

CY91460D series is a line of general-purpose 32-bit RISC microcontrollers designed for embedded control applications which require high-speed real-time processing, such as consumer devices and on-board vehicle systems. This series uses the FR60 CPU, which is compatible with the FR family of CPUs.

This series contains the LIN-USART and CAN controllers.

Features

FR60 CPU Core

- 32-bit RISC, load/store architecture, five-stage pipeline
- 16-bit fixed-length instructions (basic instructions)
- Instruction execution speed: 1 instruction per cycle
- Instructions including memory-to-memory transfer, bit manipulation, and barrel shift instructions: Instructions suitable for embedded applications
- Function entry/exit instructions and register data multi-load store instructions : Instructions supporting C language
- Register interlock function: Facilitating assembly-language coding
- Built-in multiplier with instruction-level support
 - Signed 32-bit multiplication: 5 cycles
 - Signed 16-bit multiplication: 3 cycles
- Interrupts (save PC/PS) : 6 cycles (16 priority levels)
- Harvard architecture enabling program access and data access to be performed simultaneously
- Instructions compatible with the FR family

Internal Peripheral Resources

- General-purpose ports : Maximum 170 ports
- DMAC (DMA Controller)
 - Maximum of 5 channels able to operate simultaneously. (External to external : 1 channel)
 - 3 transfer sources (external pin/internal peripheral/software)
 - Activation source can be selected using software.
 - Addressing mode specifies full 32-bit addresses (increment/decrement/fix)
 - Transfer mode (demand transfer/burst transfer/step transfer/block transfer)
 - Fly-by transfer support (between external I/O and memory)
 - Transfer data size selectable from 8/16/32-bit
 - Multi-byte transfer enabled (by software)
 - DMAC descriptor in I/O areas (200_H to 240_H, 1000_H to 1024_H)
- A/D converter (successive approximation type)
 - 10-bit resolution: 24 channels
 - Conversion time: minimum 1 μs
- External interrupt inputs : 14 channels
 - 8 channels shared with CAN RX or I2C pins

- Bit search module (for REALOS)
 - Function to search from the MSB (most significant bit) for the position of the first "0", "1", or changed bit in a word
- LIN-USART (full duplex double buffer): 5 channels
 - Clock synchronous/asynchronous selectable
 - Sync-break detection
 - Internal dedicated baud rate generator
- I²C bus interface (supports 400 kbps): 3 channels
 - Master/slave transmission and reception
 - Arbitration function, clock synchronization function
- CAN controller (C-CAN): 3 channels
 - Maximum transfer speed: 1 Mbps
 - 32 transmission/reception message buffers
- Stepper motor controller : 6 channels
 - 4 high current output to each channel
 - 2 synchronized PWMs per channel (8/10-bit)
- Sound generator : 1 channel
 - Tone frequency : PWM frequency divide-by-two (reload value + 1)
- Alarm comparator : 1 channel
 - Monitor external voltage
 - Generate an interrupt in case of voltage lower/higher than the defined thresholds (reference voltage)
- 16-bit PPG timer : 12 channels
- 16-bit PFM timer : 1 channel
- 16-bit reload timer: 8 channels
- 16-bit free-run timer: 8 channels (1 channel each for ICU and OCU)
- Input capture: 8 channels (operates in conjunction with the free-run timer)
- Output compare: 4 channels (operates in conjunction with the free-run timer)
- Up/Down counter: 3 channels (3*8-bit or 1*16-bit + 1*8-bit)
- Watchdog timer
- Real-time clock
- Low-power consumption modes : Sleep/stop mode function
- Supply Supervisor: Low voltage detection circuit for external V_{DD5} and internal 1.8V core voltage

- Clock supervisor
 - Monitors the sub-clock (32 kHz) and the main clock (4 MHz) , and switches to a recovery clock (CR oscillator, etc.) when the oscillations stop.
- Clock modulator
- Clock monitor
- Sub-clock calibration
 - Corrects the real-time clock timer when operating with the 32 kHz or CR oscillator
- Main oscillator stabilization timer
 - Generates an interrupt in sub-clock mode after the stabilization wait time has elapsed on the 23-bit stabilization wait time counter

- Sub-oscillator stabilization timer
 - Generates an interrupt in main clock mode after the stabilization wait time has elapsed on the 15-bit stabilization wait time counter

Package and Technology

- Package : QFP-208
- CMOS 0.18 μm technology
- Power supply range 3 V to 5 V (1.8 V internal logic provided by a step-down voltage converter)
- Operating temperature range: between -40°C and $+105^{\circ}\text{C}$

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1. Product Lineup

| Feature | CY91V460A | CY91F465DA | CY91F467DA CY91F467DB |
|---------------------------------|--------------------------------|--------------------------|--------------------------|
| Max. core frequency (CLKB) | 80MHz | 100MHz | 96MHz |
| Max. resource frequency (CLKP) | 40MHz | 50MHz | 48MHz |
| Max. external bus freq. (CLKT) | 40MHz | 50MHz | 48MHz |
| Max. CAN frequency (CLKCAN) | 20MHz | 50MHz | 48MHz |
| Max. FlexRay frequency (SCLK) | - | - | - |
| Technology | 0.35µm | 0.18µm | 0.18µm |
| Watchdog timer | yes | yes | yes |
| Watchdog timer (RC osc. based) | yes (disengageable) | yes | yes |
| Bit Search | yes | yes | yes |
| Reset input (INITX) | yes | yes | yes |
| Hardware Standby input (HSTX) | yes | no | no |
| Clock Modulator | yes | yes | yes |
| Clock Monitor | yes | yes | yes |
| Low Power Mode | yes | yes | yes |
| DMA | 5 ch | 5 ch | 5 ch |
| MAC (uDSP) | no | no | no |
| MMU/MPU | MPU (16 ch) ¹⁾ | MPU (8 ch) ¹⁾ | MPU (8 ch) ¹⁾ |
| | | | |
| Flash memory | Emulation SRAM 32bit read data | 544 KByte | 1088 KByte |
| Satellite Flash memory | - | no | no |
| Flash Protection | - | yes | yes |
| | | | |
| D-RAM | 64 KByte | 32 KByte | 32 KByte |
| ID-RAM | 64 KByte | 16 KByte | 32 KByte |
| Flash-Cache (Instruction cache) | 16 KByte | 8 KByte | 8 KByte |
| Boot-ROM / BI-ROM | 4 KByte fixed | 4 KByte | 4 KByte |
| | | | |
| RTC | 1 ch | 1 ch | 1 ch |
| Free Running Timer | 8 ch | 8 ch | 8 ch |
| ICU | 8 ch | 8 ch | 8 ch |
| OCU | 8 ch | 4 ch | 4 ch |
| Reload Timer | 8 ch | 8 ch | 8 ch |

| Feature | CY91V460A | CY91F465DA | CY91F467DA CY91F467DB |
|----------------------------------------------|------------------------------|------------------------------|------------------------------|
| PPG 16-bit | 16 ch | 12 ch | 12 ch |
| PFM 16-bit | 1 ch | 1 ch | 1 ch |
| Sound Generator | 1 ch | 1 ch | 1 ch |
| Up/Down Counter (8/16-bit) | 4 ch (8-bit) / 2 ch (16-bit) | 3 ch (8-bit) / 1 ch (16-bit) | 3 ch (8-bit) / 1 ch (16-bit) |
| | | | |
| C_CAN | 6 ch (128msg) | 3 ch (32msg) | 3 ch (32msg) |
| LIN-USART | 4 ch + 4 ch FIFO + 8 ch | 1 ch + 4 ch FIFO | 1 ch + 4 ch FIFO |
| I2C (400k) | 4 ch | 3 ch | 3 ch |
| | | | |
| FR external bus | yes (32bit addr, 32bit data) | yes (26bit addr, 32bit data) | yes (26bit addr, 32bit data) |
| | | | |
| External Interrupts | 16 ch | 14 ch | 14 ch |
| NMI Interrupts | 1 ch | - | - |
| | | | |
| SMC | 6 ch | 6 ch | 6 ch |
| LCD controller (40x4) | 1 ch | - | - |
| | | | |
| ADC (10 bit) | 32 ch | 24 ch | 24 ch |
| Alarm Comparator | 2 ch | 1 ch | 1 ch |
| | | | |
| Supply Supervisor (low voltage detection) | yes | yes | yes |
| Clock Supervisor | yes | yes | yes |
| | | | |
| Main clock oscillator | 4MHz | 4MHz | 4MHz |
| Sub clock oscillator | 32kHz | 32kHz | 32kHz |
| RC Oscillator | 100kHz | 100kHz / 2MHz | 100kHz / 2MHz |
| PLL | x 20 | x 25 | x 24 |
| | | | |
| DSU4 | yes | - | - |
| EDSU | yes (32 BP) *1 | yes (16 BP) *1 | yes (16 BP) *1 |
| | | | |
| Supply Voltage | 3V / 5V | 3V / 5V | 3V / 5V |
| Regulator | yes | yes | yes |
| Power Consumption | n.a. | < 1 W | < 1 W |
| Temperature Range (Ta) | 0..70 C | -40..105 C | -40..105 C |
| | | | |
| Package | BGA660 | QFP208 | QFP208 |

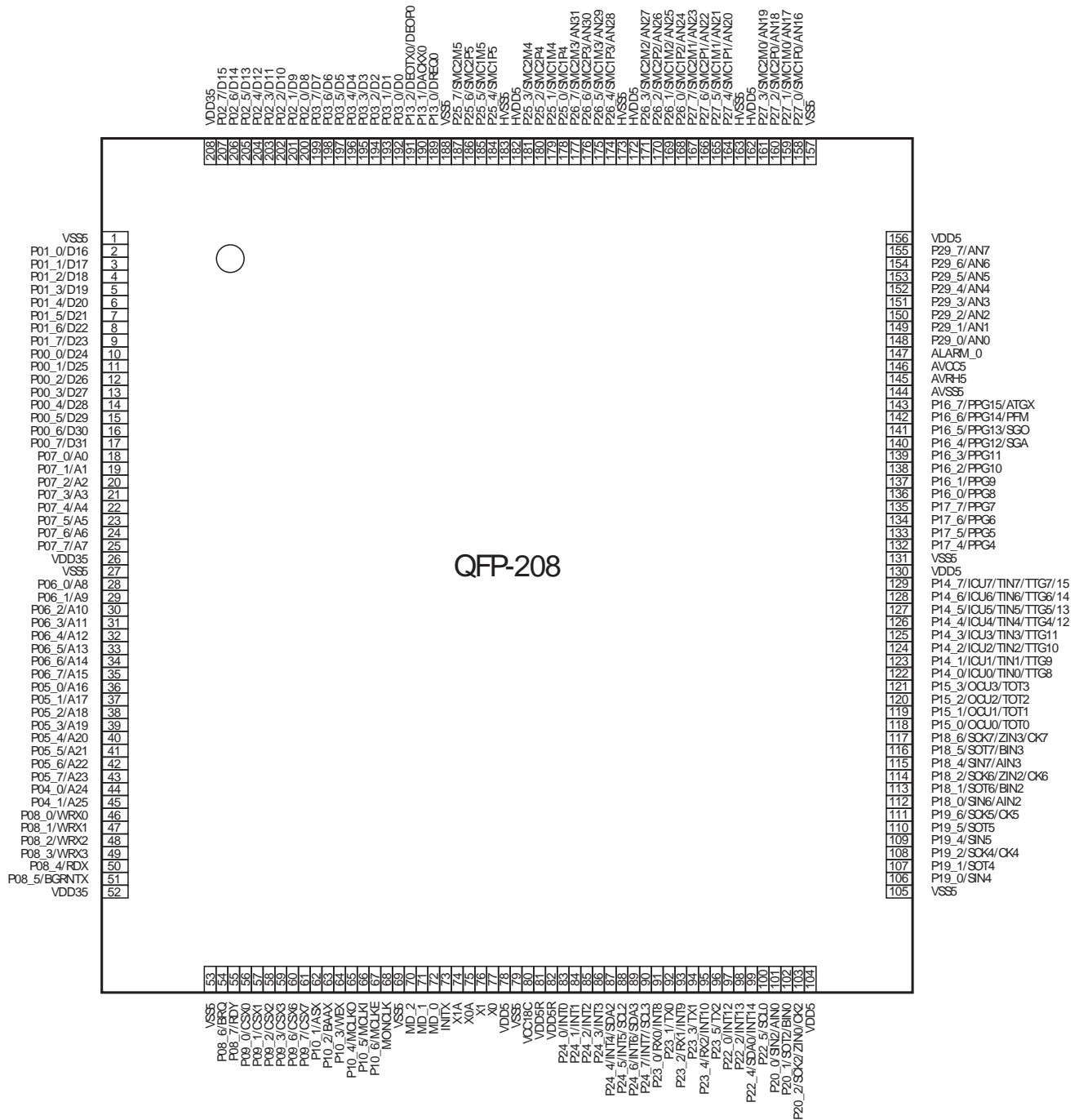
| Feature | CY91V460A | CY91F465DA | CY91F467DA CY91F467DB |
|---------------------|-----------|------------------|--------------------------|
| Power on to PLL run | < 20 ms | < 20 ms | < 20 ms |
| Flash Download Time | n.a. | < 5 sec. typical | < 6 sec typical |
| | | | |

*1 : MPU channels use EDSU breakpoint registers (shared operation between MPU and EDSU).

2. Pin Assignment

2.1 CY91F465DA, CY91F467Dx

(TOP VIEW)



(HQB208)

3. Pin Description

3.1 CY91F465DA, CY91F467Dx

| Pin No. | Pin Name | I/O | I/O Circuit Type* | Function |
|----------|----------------|-----|-------------------|------------------------------------------------------|
| 2 to 9 | P01_0 to P01_7 | I/O | A | General-purpose input/output ports |
| | D16 to D23 | | | Signal pins of external data bus (bit16 to bit23) |
| 10 to 17 | P00_0 to P00_7 | I/O | A | General-purpose input/output ports |
| | D24 to D31 | | | Signal pins of external data bus (bit24 to bit31) |
| 18 to 25 | P07_0 to P07_7 | I/O | A | General-purpose input/output ports |
| | A0 to A7 | | | Signal pins of external address bus (bit0 to bit7) |
| 28 to 35 | P06_0 to P06_7 | I/O | A | General-purpose input/output ports |
| | A8 to A15 | | | Signal pins of external address bus (bit8 to bit15) |
| 36 to 43 | P05_0 to P05_7 | I/O | A | General-purpose input/output ports |
| | A16 to A23 | | | Signal pins of external address bus (bit16 to bit23) |
| 44, 45 | P04_0, P04_1 | I/O | A | General-purpose input/output ports |
| | A24, A25 | | | Signal pins of external address bus (bit24, bit25) |
| 46 to 49 | P08_0 to P08_3 | I/O | A | General-purpose input/output ports |
| | WRX0 to WRX3 | | | External write strobe output pins |
| 50 | P08_4 | I/O | A | General-purpose input/output port |
| | RDX | | | External read strobe output pin |
| 51 | P08_5 | I/O | A | General-purpose input/output port |
| | BGRNTX | | | External bus release reception output pin |
| 54 | P08_6 | I/O | A | General-purpose input/output port |
| | BRQ | | | External bus release request input pin |
| 55 | P08_7 | I/O | A | General-purpose input/output port |
| | RDY | | | External ready input pin |
| 56 to 59 | P09_0 to P09_3 | I/O | A | General-purpose input/output ports |
| | CSX0 to CSX3 | | | Chip select output pins |
| 60, 61 | P09_6, P09_7 | I/O | A | General-purpose input/output ports |
| | CSX6, CSX7 | | | Chip select output pins |
| 62 | P10_1 | I/O | A | General-purpose input/output port |
| | ASX | | | Address strobe output pin |
| 63 | P10_2 | I/O | A | General-purpose input/output port |
| | BAAX | | | Burst address advance output pin |
| 64 | P10_3 | I/O | A | General-purpose input/output port |
| | WEX | | | Write enable output pin |
| 65 | P10_4 | I/O | A | General-purpose input/output port |
| | MCLKO | | | Clock output pin for memory |

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| Pin No. | Pin Name | I/O | I/O Circuit Type* | Function |
|----------|----------------|-----|-------------------|---------------------------------------------|
| 66 | P10_5 | I/O | A | General-purpose input/output port |
| | MCLKI | | | Clock input pin for memory |
| 67 | P10_6 | I/O | A | General-purpose input/output port |
| | MCLKE | | | Clock enable signal pin for memory |
| 68 | MONCLK | O | M | Clock monitor pin |
| 70 | MD_2 | I | G | Mode setting pins |
| 71 | MD_1 | I | G | |
| 72 | MD_0 | I | G | |
| 73 | INITX | I | H | External reset input pin |
| 74 | X1A | — | J2 | Sub clock (oscillation) output |
| 75 | X0A | — | J2 | Sub clock (oscillation) input |
| 76 | X1 | — | J1 | Clock (oscillation) output |
| 77 | X0 | — | J1 | Clock (oscillation) input |
| 83 to 86 | P24_0 to P24_3 | I/O | A | General-purpose input/output ports |
| | INT0 to INT3 | | | External interrupt input pins |
| 87 | P24_4 | I/O | C | General-purpose input/output port |
| | INT4 | | | External interrupt input pin |
| | SDA2 | | | I ² C bus DATA input/output pin |
| 88 | P24_5 | I/O | C | General-purpose input/output port |
| | INT5 | | | External interrupt input pin |
| | SCL2 | | | I ² C bus clock input/output pin |
| 89 | P24_6 | I/O | C | General-purpose input/output port |
| | INT6 | | | External interrupt input pin |
| | SDA3 | | | I ² C bus DATA input/output pin |
| 90 | P24_7 | I/O | C | General-purpose input/output port |
| | INT7 | | | External interrupt input pin |
| | SCL3 | | | I ² C bus clock input/output pin |
| 91 | P23_0 | I/O | A | General-purpose input/output port |
| | RX0 | | | RX input pin of CAN0 |
| | INT8 | | | External interrupt input pin |
| 92 | P23_1 | I/O | A | General-purpose input/output port |
| | TX0 | | | TX output pin of CAN0 |
| 93 | P23_2 | I/O | A | General-purpose input/output port |
| | RX1 | | | RX input pin of CAN1 |
| | INT9 | | | External interrupt input pin |

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| Pin No. | Pin Name | I/O | I/O Circuit Type* | Function |
|---------|----------|-----|-------------------|----------------------------------------------|
| 94 | P23_3 | I/O | A | General-purpose input/output port |
| | TX1 | | | TX output pin of CAN1 |
| 95 | P23_4 | I/O | A | General-purpose input/output port |
| | RX2 | | | RX input pin of CAN2 |
| | INT10 | | | External interrupt input pin |
| 96 | P23_5 | I/O | A | General-purpose input/output port |
| | TX2 | | | TX output pin of CAN2 |
| 97 | P22_0 | I/O | A | General-purpose input/output port |
| | INT12 | | | External interrupt input pin |
| 98 | P22_2 | I/O | A | General-purpose input/output port |
| | INT13 | | | External interrupt input pin |
| 99 | P22_4 | I/O | C | General-purpose input/output port |
| | SDA0 | | | I ² C bus data input/output pin |
| | INT14 | | | External interrupt input pin |
| 100 | P22_5 | I/O | C | General-purpose input/output port |
| | SCL0 | | | I ² C bus clock input/output pin |
| 101 | P20_0 | I/O | A | General-purpose input/output port |
| | SIN2 | | | Data input pin of USART2 |
| | AIN0 | | | Up/down counter input pin |
| 102 | P20_1 | I/O | A | General-purpose input/output port |
| | SOT2 | | | Data output pin of USART2 |
| | BIN0 | | | Up/down counter input pin |
| 103 | P20_2 | I/O | A | General-purpose input/output port |
| | SCK2 | | | Clock input/output pin of USART2 |
| | ZIN0 | | | Up/down counter input pin |
| | CK2 | | | External clock input pin of free-run timer 2 |
| 106 | P19_0 | I/O | A | General-purpose input/output port |
| | SIN4 | | | Data input pin of USART4 |
| 107 | P19_1 | I/O | A | General-purpose input/output port |
| | SOT4 | | | Data output pin of USART4 |
| 108 | P19_2 | I/O | A | General-purpose input/output port |
| | SCK4 | | | Clock input/output pin of USART4 |
| | CK4 | | | External clock input pin of free-run timer 4 |

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| Pin No. | Pin Name | I/O | I/O Circuit Type* | Function |
|------------|-----------------------------------------|-----|-------------------|----------------------------------------------|
| 109 | P19_4 | I/O | A | General-purpose input/output port |
| | SIN5 | | | Data input pin of USART5 |
| 110 | P19_5 | I/O | A | General-purpose input/output port |
| | SOT5 | | | Data output pin of USART5 |
| 111 | P19_6 | I/O | A | General-purpose input/output port |
| | SCK5 | | | Clock input/output pin of USART5 |
| | CK5 | | | External clock input pin of free-run timer 5 |
| 112 | P18_0 | I/O | A | General-purpose input/output port |
| | SIN6 | | | Data input pin of USART6 |
| | AIN2 | | | Up/down counter input pin |
| 113 | P18_1 | I/O | A | General-purpose input/output port |
| | SOT6 | | | Data output pin of USART6 |
| | BIN2 | | | Up/down counter input pin |
| 114 | P18_2 | I/O | A | General-purpose input/output port |
| | SCK6 | | | Clock input/output pin of USART6 |
| | ZIN2 | | | Up/down counter input pin |
| | CK6 | | | External clock input pin of free-run timer 6 |
| 115 | P18_4 | I/O | A | General-purpose input/output port |
| | SIN7 | | | Data input pin of USART7 |
| | AIN3 | | | Up/down counter input pin |
| 116 | P18_5 | I/O | A | General-purpose input/output port |
| | SOT7 | | | Data output pin of USART7 |
| | BIN3 | | | Up/down counter input pin |
| 117 | P18_6 | I/O | A | General-purpose input/output port |
| | SCK7 | | | Clock input/output pin of USART7 |
| | ZIN3 | | | Up/down counter input pin |
| | CK7 | | | External clock input pin of free-run timer 7 |
| 118 to 121 | P15_0 to P15_3 | I/O | A | General-purpose input/output ports |
| | OCU0 to OCU3 | | | Output compare output pins |
| | TOT0 to TOT3 | | | Reload timer output pins |
| 122 to 129 | P14_0 to P14_7 | I/O | A | General-purpose input/output ports |
| | ICU0 to ICU7 | | | Input capture input pins |
| | TIN0 to TIN7 | | | External trigger input pins of reload timer |
| | TTG8 to TTG11, TTG4/12 to TTG7/15 | | | External trigger input pins of PPG timer |

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| Pin No. | Pin Name | I/O | I/O Circuit Type* | Function |
|------------|----------------|-----|-------------------|------------------------------------------|
| 132 to 135 | P17_4 to P17_7 | I/O | A | General-purpose input/output ports |
| | PPG4 to PPG7 | | | Output pins of PPG timer |
| 136 to 139 | P16_0 to P16_3 | I/O | A | General-purpose input/output ports |
| | PPG8 to PPG11 | | | PPG timer output pins |
| 140 | P16_4 | I/O | A | General-purpose input/output port |
| | PPG12 | | | Output pin of PPG timer |
| | SGA | | | SGA output pin of sound generator |
| 141 | P16_5 | I/O | A | General-purpose input/output port |
| | PPG13 | | | Output pin of PPG timer |
| | SGO | | | SGO output pin of sound generator |
| 142 | P16_6 | I/O | A | General-purpose input/output port |
| | PPG14 | | | Output pin of PPG timer |
| | PFM | | | Pulse frequency modulator output pin |
| 143 | P16_7 | I/O | A | General-purpose input/output port |
| | PPG15 | | | PPG timer output pin |
| | ATGX | | | A/D converter external trigger input pin |
| 147 | ALARM_0 | I | N | Alarm comparator input pin |
| 148 to 155 | P29_0 to P29_7 | I/O | B | General-purpose input/output ports |
| | AN0 to AN7 | | | Analog input pins of A/D converter |
| 158 | P27_0 | I/O | F | General-purpose input/output port |
| | SMC1P0 | | | Controller output pin of Stepper motor |
| | AN16 | | | Analog input pin of A/D converter |
| 159 | P27_1 | I/O | F | General-purpose input/output port |
| | SMC1M0 | | | Controller output pin of Stepper motor |
| | AN17 | | | Analog input pin of A/D converter |
| 160 | P27_2 | I/O | F | General-purpose input/output port |
| | SMC2P0 | | | Controller output pin of Stepper motor |
| | AN18 | | | Analog input pin of A/D converter |
| 161 | P27_3 | I/O | F | General-purpose input/output port |
| | SMC2M0 | | | Controller output pin of Stepper motor |
| | AN19 | | | Analog input pin of A/D converter |
| 164 | P27_4 | I/O | F | General-purpose input/output port |
| | SMC1P1 | | | Controller output pin of Stepper motor |
| | AN20 | | | Analog input pin of A/D converter |

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| Pin No. | Pin Name | I/O | I/O Circuit Type* | Function |
|---------|----------|-----|-------------------|----------------------------------------|
| 165 | P27_5 | I/O | F | General-purpose input/output port |
| | SMC1M1 | | | Controller output pin of Stepper motor |
| | AN21 | | | Analog input pin of A/D converter |
| 166 | P27_6 | I/O | F | General-purpose input/output port |
| | SMC2P1 | | | Controller output pin of Stepper motor |
| | AN22 | | | Analog input pin of A/D converter |
| 167 | P27_7 | I/O | F | General-purpose input/output port |
| | SMC2M1 | | | Controller output pin of Stepper motor |
| | AN23 | | | Analog input pin of A/D converter |
| 168 | P26_0 | I/O | F | General-purpose input/output port |
| | SMC1P2 | | | Controller output pin of Stepper motor |
| | AN24 | | | Analog input pin of A/D converter |
| 169 | P26_1 | I/O | F | General-purpose input/output port |
| | SMC1M2 | | | Controller output pin of Stepper motor |
| | AN25 | | | Analog input pin of A/D converter |
| 170 | P26_2 | I/O | F | General-purpose input/output port |
| | SMC2P2 | | | Controller output pin of Stepper motor |
| | AN26 | | | Analog input pin of A/D converter |
| 171 | P26_3 | I/O | F | General-purpose input/output port |
| | SMC2M2 | | | Controller output pin of Stepper motor |
| | AN27 | | | Analog input pin of A/D converter |
| 174 | P26_4 | I/O | F | General-purpose input/output port |
| | SMC1P3 | | | Controller output pin of Stepper motor |
| | AN28 | | | Analog input pin of A/D converter |
| 175 | P26_5 | I/O | F | General-purpose input/output port |
| | SMC1M3 | | | Controller output pin of Stepper motor |
| | AN29 | | | Analog input pin of A/D converter |
| 176 | P26_6 | I/O | F | General-purpose input/output port |
| | SMC2P3 | | | Controller output pin of Stepper motor |
| | AN30 | | | Analog input pin of A/D converter |
| 177 | P26_7 | I/O | F | General-purpose input/output port |
| | SMC2M3 | | | Controller output pin of Stepper motor |
| | AN31 | | | Analog input pin of A/D converter |

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| Pin No. | Pin Name | I/O | I/O Circuit Type* | Function |
|------------|----------------|-----|-------------------|-------------------------------------------------------|
| 178 | P25_0 | I/O | E | General-purpose input/output port |
| | SMC1P4 | | | Controller output pin of Stepper motor |
| 179 | P25_1 | I/O | E | General-purpose input/output port |
| | SMC1M4 | | | Controller output pin of Stepper motor |
| 180 | P25_2 | I/O | E | General-purpose input/output port |
| | SMC2P4 | | | Controller output pin of Stepper motor |
| 181 | P25_3 | I/O | E | General-purpose input/output port |
| | SMC2M4 | | | Controller output pin of Stepper motor |
| 184 | P25_4 | I/O | E | General-purpose input/output port |
| | SMC1P5 | | | Controller output pin of Stepper motor |
| 185 | P25_5 | I/O | E | General-purpose input/output port |
| | SMC1M5 | | | Controller output pin of Stepper motor |
| 186 | P25_6 | I/O | E | General-purpose input/output port |
| | SMC2P5 | | | Controller output pin of Stepper motor |
| 187 | P25_7 | I/O | E | General-purpose input/output port |
| | SMC2M5 | | | Controller output pin of Stepper motor |
| 189 | P13_0 | I/O | A | General-purpose input/output port |
| | DREQ0 | | | DMA external transfer request input |
| 190 | P13_1 | I/O | A | General-purpose input/output port |
| | DACKX0 | | | DMA external transfer acknowledge output pin |
| 191 | P13_2 | I/O | A | General-purpose input/output port |
| | DEOTX0 | | | DMA external transfer EOT (End of Track) output pin |
| | DEOP0 | | | DMA external transfer EOP (End of Process) output pin |
| 192 to 199 | P03_0 to P03_7 | I/O | A | General-purpose input/output ports |
| | D0 to D7 | | | Signal pins of external data bus (bit0 to bit7) |
| 200 to 207 | P02_0 to P02_7 | I/O | A | General-purpose input/output ports |
| | D8 to D15 | | | Signal pins of external data bus (bit8 to bit15) |

* : For information about the I/O circuit type, refer to "4. I/O Circuit Types".

[Power Supply/Ground Pins]

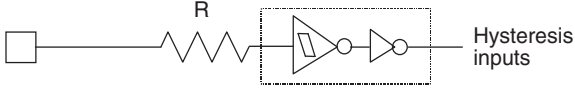
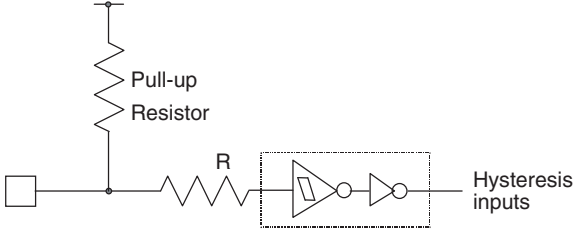
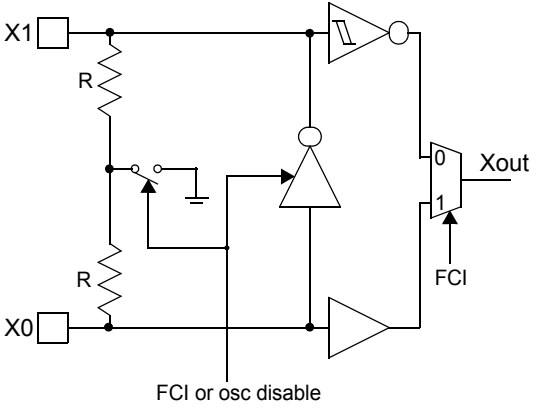
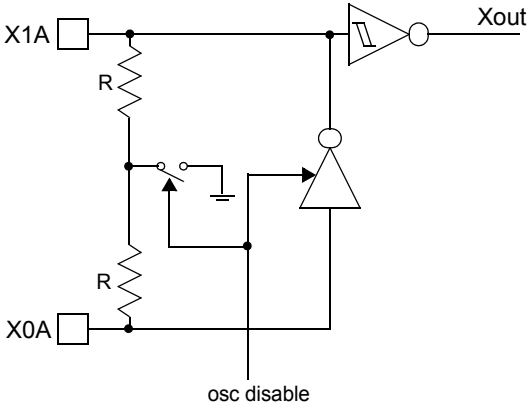
| Pin No. | Pin Name | I/O | Function |
|---------------------------------------|----------|--------|-------------------------------------------------|
| 1, 27, 53, 69, 79, 105, 131, 157, 188 | VSS5 | Supply | Ground pins |
| 163, 173, 183 | HVSS5 | | Ground pins for Stepper motor controller |
| 26, 52 | VDD35 | | Power supply pins for external data bus |
| 78, 104, 130, 156 | VDD5 | | Power supply pins |
| 162, 172, 182 | HVDD5 | | Power supply pins for Stepper motor controller |
| 81, 82 | VDD5R | | Power supply pins for internal regulator |
| 144 | AVSS5 | | Analog ground pin for A/D converter |
| 146 | AVCC5 | | Power supply pin for A/D converter |
| 145 | AVRH5 | | Reference power supply pin for A/D converter |
| 80 | VCC18C | | Capacitor connection pin for internal regulator |

4. I/O Circuit Types

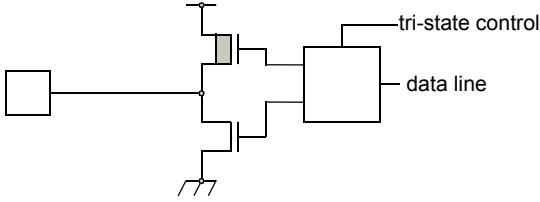
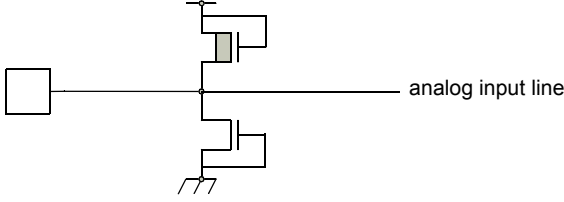
| Type | Circuit | Remarks |
|------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A | | <p>CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$) 2 different CMOS hysteresis inputs with input shutdown function Automotive input with input shutdown function TTL input with input shutdown function Programmable pull-up resistor: 50kΩ approx.</p> |
| B | | <p>CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$) 2 different CMOS hysteresis inputs with input shutdown function Automotive input with input shutdown function TTL input with input shutdown function Programmable pull-up resistor: 50kΩ approx. Analog input</p> |

| Type | Circuit | Remarks |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C | <p>pull-up control</p> <p>pull- down control</p> <p>data line</p> <p>R</p> <p>CMOS hysteresis type1</p> <p>CMOS hysteresis type2</p> <p>Automotive inputs</p> <p>TTL input</p> <p>standby control for input shutdown</p> | <p>CMOS level output ($I_{OL} = 3mA$, $I_{OH} = -3mA$)</p> <p>2 different CMOS hysteresis inputs with input shutdown function</p> <p>Automotive input with input shutdown function</p> <p>TTL input with input shutdown function</p> <p>Programmable pull-up resistor: 50kΩ approx.</p> |
| D | <p>pull-up control</p> <p>pull- down control</p> <p>data line</p> <p>R</p> <p>CMOS hysteresis type1</p> <p>CMOS hysteresis type2</p> <p>Automotive inputs</p> <p>TTL input</p> <p>standby control for input shutdown</p> <p>analog input</p> | <p>CMOS level output ($I_{OL} = 3mA$, $I_{OH} = -3mA$)</p> <p>2 different CMOS hysteresis inputs with input shutdown function</p> <p>Automotive input with input shutdown function</p> <p>TTL input with input shutdown function</p> <p>Programmable pull-up resistor: 50kΩ approx.</p> <p>Analog input</p> |

| Type | Circuit | Remarks |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E | <p>pull-up control</p> <p>driver strength control</p> <p>data line</p> <p>pull-down control</p> <p>R</p> <p>CMOS hysteresis type1</p> <p>CMOS hysteresis type2</p> <p>Automotive inputs</p> <p>TTL input</p> <p>standby control for input shutdown</p> | <p>CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$, and $I_{OL} = 30\text{mA}$, $I_{OH} = -30\text{mA}$)</p> <p>2 different CMOS hysteresis inputs with input shutdown function</p> <p>Automotive input with input shutdown function</p> <p>TTL input with input shutdown function</p> <p>Programmable pull-up resistor: 50kΩ approx.</p> |
| F | <p>pull-up control</p> <p>driver strength control</p> <p>data line</p> <p>pull-down control</p> <p>R</p> <p>CMOS hysteresis type1</p> <p>CMOS hysteresis type2</p> <p>Automotive inputs</p> <p>TTL input</p> <p>standby control for input shutdown</p> <p>analog input</p> | <p>CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$, and $I_{OL} = 30\text{mA}$, $I_{OH} = -30\text{mA}$)</p> <p>2 different CMOS hysteresis inputs with input shutdown function</p> <p>Automotive input with input shutdown function</p> <p>TTL input with input shutdown function</p> <p>Programmable pull-up resistor: 50kΩ approx.</p> <p>Analog input</p> |

| Type | Circuit | Remarks |
|------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G |  | <p>Mask ROM and EVA device: CMOS Hysteresis input pin</p> <p>Flash device: CMOS input pin 12 V withstand (for MD [2:0])</p> |
| H |  | <p>CMOS Hysteresis input pin Pull-up resistor value: 50 kΩ approx.</p> |
| J1 |  | <p>High-speed oscillation circuit:</p> <ul style="list-style-type: none"> • Programmable between oscillation mode (external crystal or resonator connected to X0/X1 pins) and Fast external Clock Input (FCI) mode (external clock connected to X0 pin) • Feedback resistor = approx. 2 * 0.5 MΩ. Feedback resistor is grounded in the center when the oscillator is disabled or in FCI mode. |
| J2 |  | <p>Low-speed oscillation circuit:</p> <ul style="list-style-type: none"> • Feedback resistor = approx. 2 * 5 MΩ. Feedback resistor is grounded in the center when the oscillator is disabled. |

| Type | Circuit | Remarks |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| K | <p>pull-up control</p> <p>driver strength control</p> <p>data line</p> <p>pull-down control</p> <p>R</p> <p>CMOS hysteresis type1</p> <p>CMOS hysteresis type2</p> <p>Automotive inputs</p> <p>TTL input</p> <p>standby control for input shutdown</p> <p>LCD SEG/COM</p> | <p>CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$)</p> <p>2 different CMOS hysteresis inputs with input shutdown function</p> <p>Automotive input with input shutdown function</p> <p>TTL input with input shutdown function</p> <p>Programmable pull-up resistor: 50kΩ approx.</p> <p>LCD SEG/COM output</p> |
| L | <p>pull-up control</p> <p>driver strength control</p> <p>data line</p> <p>pull-down control</p> <p>R</p> <p>CMOS hysteresis type1</p> <p>CMOS hysteresis type2</p> <p>Automotive inputs</p> <p>TTL input</p> <p>standby control for input shutdown</p> <p>VLCD</p> | <p>CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$)</p> <p>2 different CMOS hysteresis inputs with input shutdown function</p> <p>Automotive input with input shutdown function</p> <p>TTL input with input shutdown function</p> <p>Programmable pull-up resistor: 50kΩ approx.</p> <p>Analog input</p> <p>LCD Voltage input</p> |

| Type | Circuit | Remarks |
|------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| M |  | <p>CMOS level tri-state output $(I_{OL} = 5\text{mA}, I_{OH} = -5\text{mA})$</p> |
| N |  | <p>Analog input pin with protection</p> |

5. Handling Devices

5.1 Preventing Latch-up

Latch-up may occur in a CMOS IC if a voltage higher than (V_{DD5} , V_{DD35} or HV_{DD5}) or less than (V_{SS5} or HV_{SS5}) is applied to an input or output pin or if a voltage exceeding the rating is applied between the power supply pins and ground pins. If latch-up occurs, the power supply current increases rapidly, sometimes resulting in thermal breakdown of the device. Therefore, be very careful not to apply voltages in excess of the absolute maximum ratings.

5.2 Handling of Unused Input Pins

If unused input pins are left open, abnormal operation may result. Any unused input pins should be connected to pull-up or pull-down resistor (2K Ω to 10K Ω) or enable internal pullup or pulldown resistors (PPER/PPCR) before the input enable (PORTEN) is activated by software. The mode pins MD_x can be connected to V_{SS5} or V_{DD5} directly. Unused ALARM input pins can be connected to AV_{SS5} directly.

5.3 Power Supply Pins

In CY91460D series, devices including multiple power supply pins and ground pins are designed as follows; pins necessary to be at the same potential are interconnected internally to prevent malfunctions such as latch-up. All of the power supply pins and ground pins must be externally connected to the power supply and ground respectively in order to reduce unnecessary radiation, to prevent strobe signal malfunctions due to the ground level rising and to follow the total output current ratings. Furthermore, the power supply pins and ground pins of the CY91460D series must be connected to the current supply source via a low impedance.

It is also recommended to connect a ceramic capacitor of approximately 0.1 μ F as a bypass capacitor between power supply pin and ground pin near this device.

This series has a built-in step-down regulator. Connect a bypass capacitor of 4.7 μ F (use a X7R ceramic capacitor) to VCC18C pin for the regulator.

5.4 Crystal Oscillator Circuit

Noise in proximity to the X0 (X0A) and X1 (X1A) pins can cause the device to operate abnormally. Printed circuit boards should be designed so that the X0 (X0A) and X1 (X1A) pins, and crystal oscillator, as well as bypass capacitors connected to ground, are located near the device and ground.

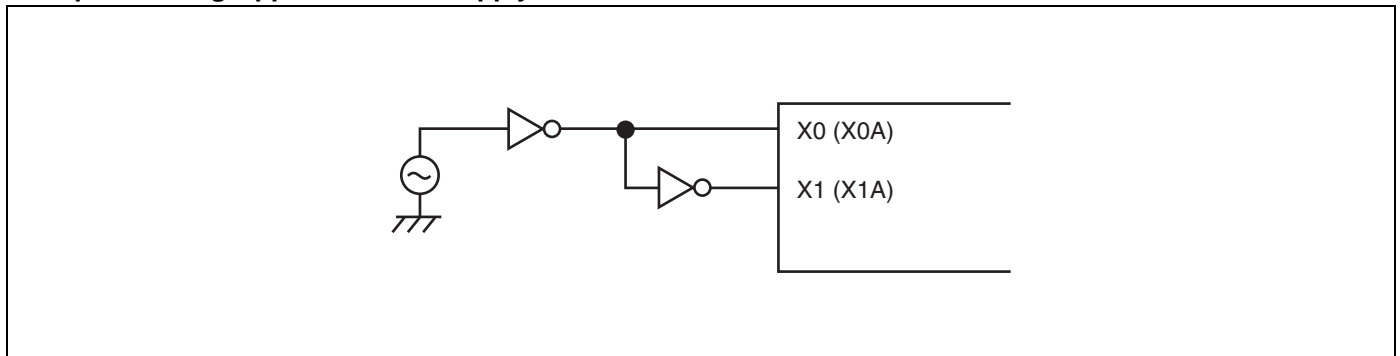
It is recommended that the printed circuit board layout be designed such that the X0 and X1 pins or X0A and X1A pins are surrounded by ground plane for the stable operation.

Please request the oscillator manufacturer to evaluate the oscillational characteristics of the crystal and this device.

5.5 Notes on Using External Clock

When using the external clock, it is necessary to simultaneously supply the X0 (X0A) and the X1 (X1A) pins. In the described combination, X1 (X1A) should be supplied with a clock signal which has the opposite phase to the X0 (X0A) pins. At X0 and X1, a frequency up to 16 MHz is possible.

Example of Using Opposite Phase Supply



5.6 Mode Pins (MD_x)

These pins should be connected directly to the power supply or ground pins. To prevent the device from entering test mode accidentally due to noise, minimize the lengths of the patterns between each mode pin and power supply pin or ground pin on the printed circuit board as possible and connect them with low impedance.

5.7 Notes on Operating in PLL Clock Mode

If the oscillator is disconnected or the clock input stops when the PLL clock is selected, the microcontroller may continue to operate at the free-running frequency of the self-oscillating circuit of the PLL. However, this self-running operation cannot be guaranteed.

5.8 Pull-up Control

The AC standard is not guaranteed in case a pull-up resistor is connected to the pin serving as an external bus pin.

5.9 Notes on PS Register

As the PS register is processed in advance by some instructions, when the debugger is being used, the exception handling may result in execution breaking in an interrupt handling routine or the displayed values of the flags in the PS register being updated.

As the microcontroller is designed to carry out reprocessing correctly upon returning from such an EIT event, the operation before and after the EIT always proceeds according to specification.

The following behavior may occur if any of the following occurs in the instruction immediately after a DIV0U/DIV0S instruction:

- (a) a user interrupt or NMI is accepted;
- (b) single-step execution is performed;
- (c) execution breaks due to a data event or from the emulator menu.
 - 1. D0 and D1 flags are updated in advance.
 - 2. An EIT handling routine (user interrupt/NMI or emulator) is executed.
 - 3. Upon returning from the EIT, the DIV0U/DIV0S instruction is executed and the D0 and D1 flags are updated to the same values as those in 1.

The following behavior occurs when an ORCCR, STILM, MOV Ri,PS instruction is executed to enable a user interrupt or NMI source while that interrupt is in the active state.

- 1. The PS register is updated in advance.
- 2. An EIT handling routine (user interrupt/NMI or emulator) is executed.
- 3. Upon returning from the EIT, the above instructions are executed and the PS register is updated to the same value as in 1.

6. Notes on Debugger

6.1 Execution of the RETI Command

If single-step execution is used in an environment where an interrupt occurs frequently, the corresponding interrupt handling routine will be executed repeatedly to the exclusion of other processing. This will prevent the main routine and the handlers for low priority level interrupts from being executed (For example, if the time-base timer interrupt is enabled, stepping over the RETI instruction will always break on the first line of the time-base timer interrupt handler).

Disable the corresponding interrupts when the corresponding interrupt handling routine no longer needs debugging.

6.2 Break Function

If the range of addresses that cause a hardware break (including event breaks) is set to the address of the current system stack pointer or to an area that contains the stack pointer, execution will break after each instruction regardless of whether the user program actually contains data access instructions.

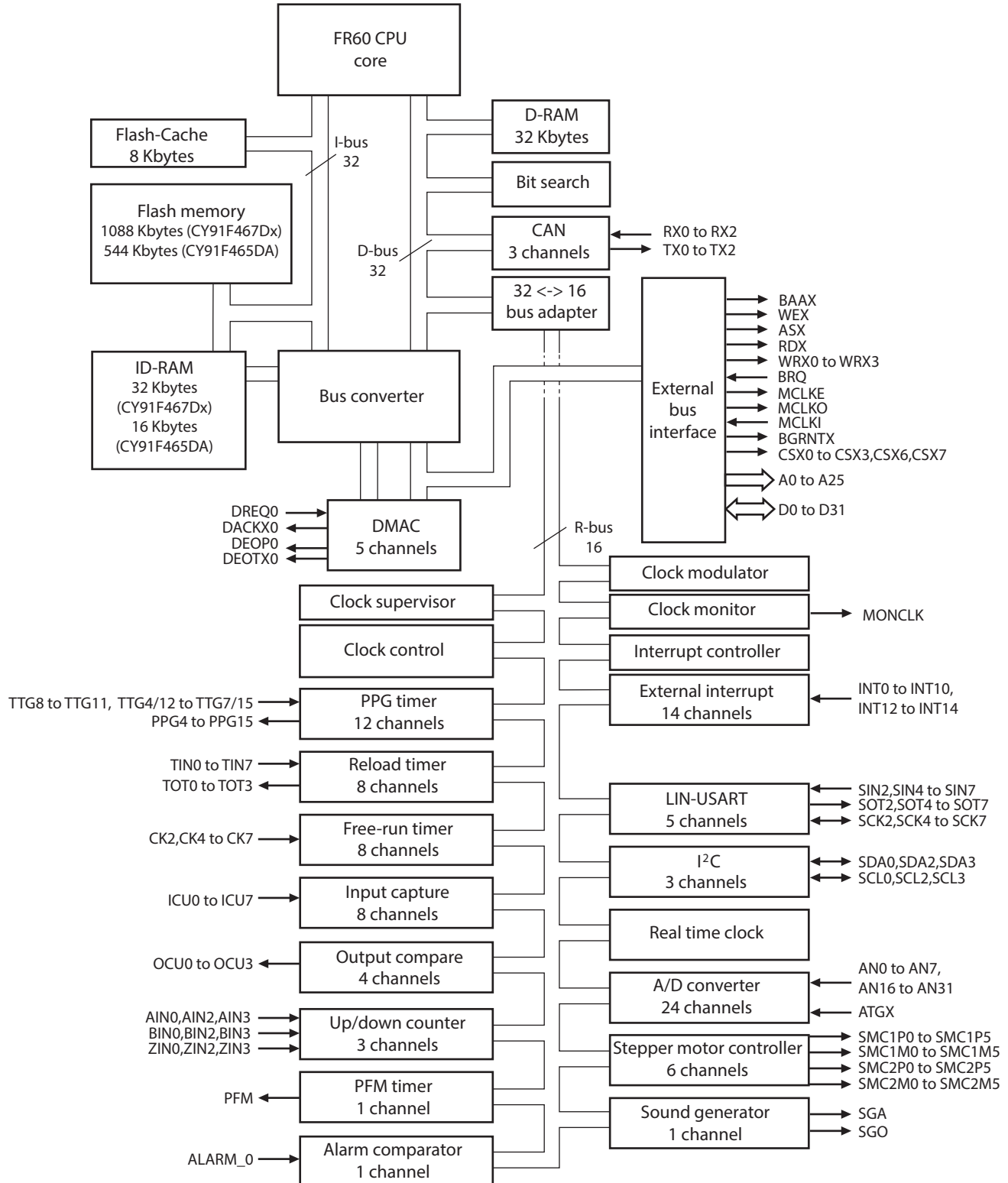
To prevent this, do not set (word) access to the area containing the address of the system stack pointer as the target of the hardware break (including an event breaks).

6.3 Operand Break

It may cause malfunctions if a stack pointer exists in the area which is set as the DSU operand break. Do not set the access to the areas containing the address of system stack pointer as a target of data event break.

7. Block Diagram

7.1 CY91F465DA, CY91F467Dx



8. CPU and Control Unit

The FR family CPU is a high performance core that is designed based on the RISC architecture with advanced instructions for embedded applications.

8.1 Features

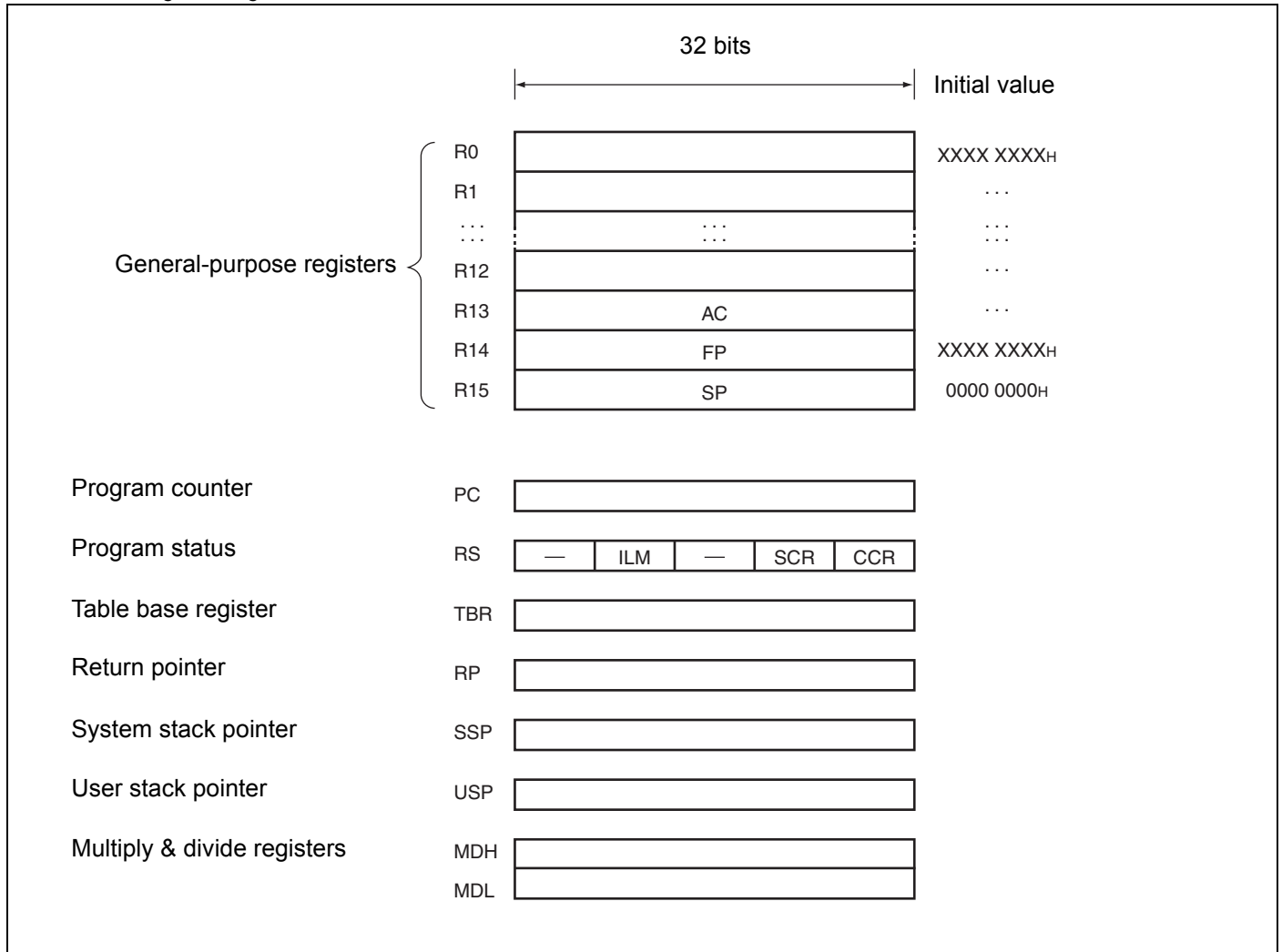
- Adoption of RISC architecture
Basic instruction: 1 instruction per cycle
- General-purpose registers: 32-bit × 16 registers
- 4 Gbytes linear memory space
- Multiplier installed
32-bit × 32-bit multiplication: 5 cycles
16-bit × 16-bit multiplication: 3 cycles
- Enhanced interrupt processing function
Quick response speed (6 cycles)
Multiple-interrupt support
Level mask function (16 levels)
- Enhanced instructions for I/O operation
Memory-to-memory transfer instruction
Bit processing instruction
Basic instruction word length: 16 bits
- Low-power consumption
Sleep mode/stop mode

8.2 Internal Architecture

- The FR family CPU uses the Harvard architecture in which the instruction bus and data bus are independent of each other.
- A 32-bit ↔ 16-bit buffer is connected to the 32-bit bus (D-bus) to provide an interface between the CPU and peripheral resources.
- A Harvard ↔ Princeton bus converter is connected to both the I-bus and D-bus to provide an interface between the CPU and the bus controller.

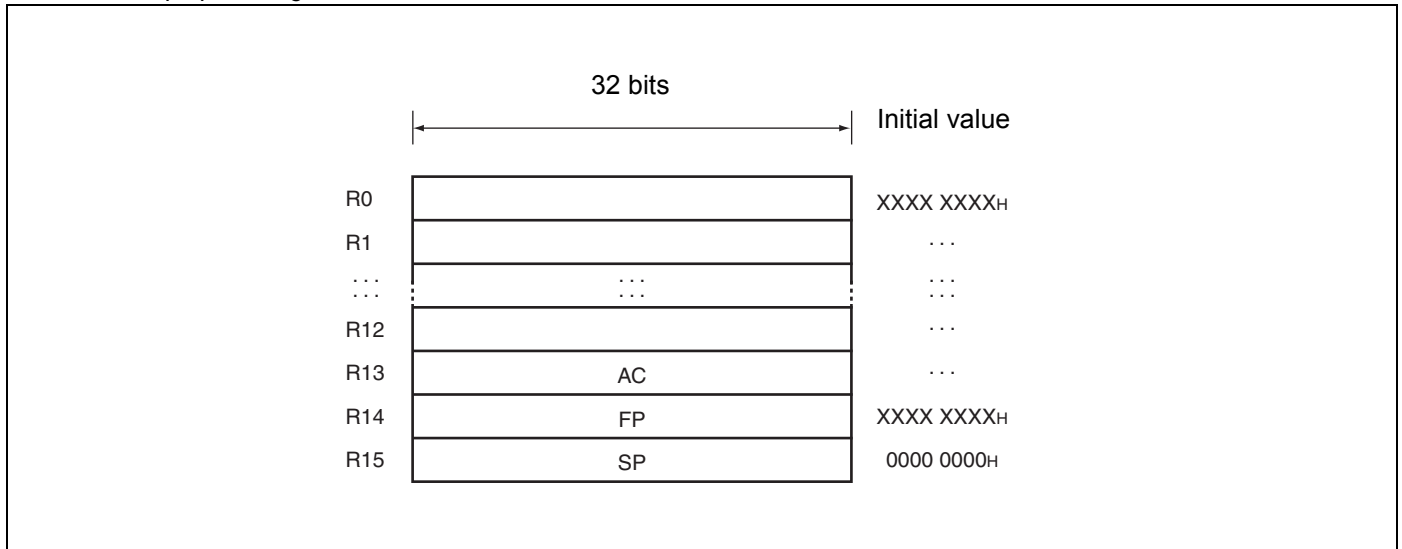
8.3 Programming Model

8.3.1 Basic Programming Model



8.4 Registers

8.4.1 General-purpose Register



Registers R0 to R15 are general-purpose registers. These registers can be used as accumulators for computation operations and as pointers for memory access.

Of the 16 registers, enhanced commands are provided for the following registers to enable their use for particular applications.

R13 : Virtual accumulator

R14 : Frame pointer

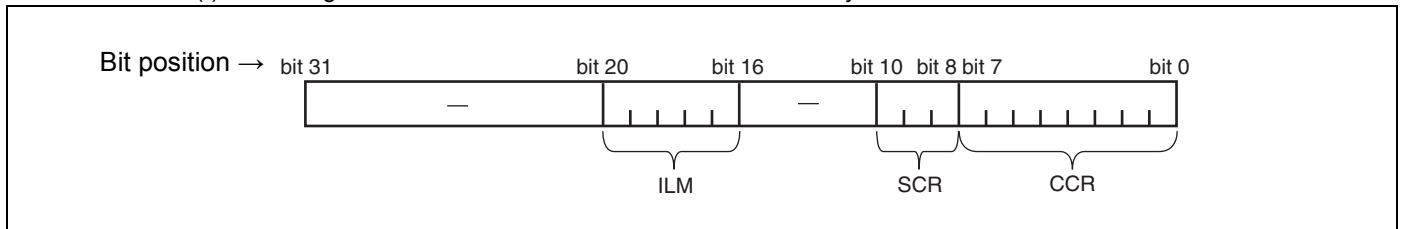
R15 : Stack pointer

Initial values at reset are undefined for R0 to R14. The value for R15 is 00000000_H (SSP value).

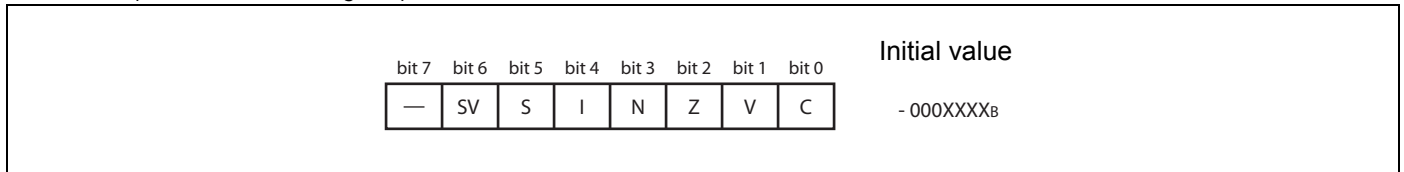
8.4.2 PS (Program Status)

This register holds the program status, and is divided into three parts, ILM, SCR, and CCR.

All undefined bits (-) in the diagram are reserved bits. The read values are always "0". Write access to these bits is invalid.

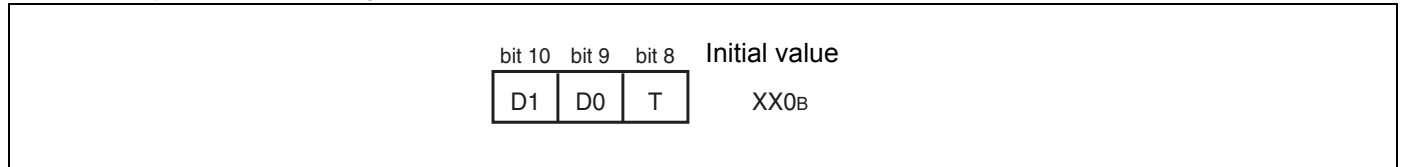


8.4.3 CCR (Condition Code Register)



- SV : Supervisor flag
- S : Stack flag
- I : Interrupt enable flag
- N : Negative enable flag
- Z : Zero flag
- V : Overflow flag
- C : Carry flag

8.4.4 SCR (System Condition Register)



Flag for step division (D1, D0)

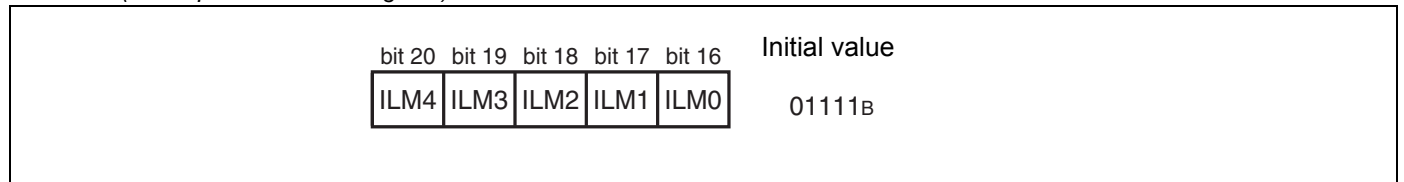
This flag stores interim data during execution of step division.

Step trace trap flag (T)

This flag indicates whether the step trace trap is enabled or disabled.

The step trace trap function is used by emulators. When an emulator is in use, it cannot be used in execution of user programs.

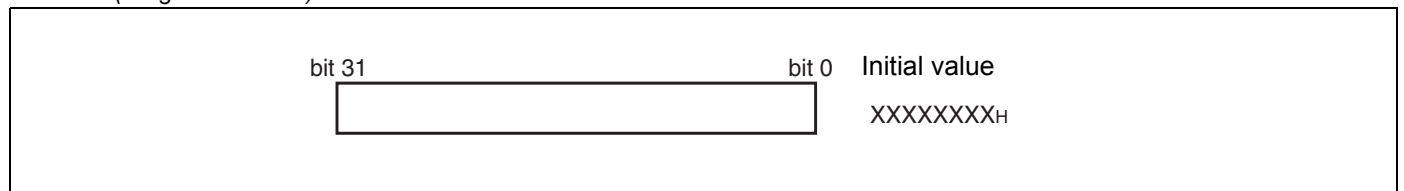
8.4.5 ILM (Interrupt Level Mask Register)



This register stores interrupt level mask values, and the values stored in ILM4 to ILM0 are used for level masking.

The register is initialized to value “01111_B” at reset.

8.4.6 PC (Program Counter)



The program counter indicates the address of the instruction that is being executed.

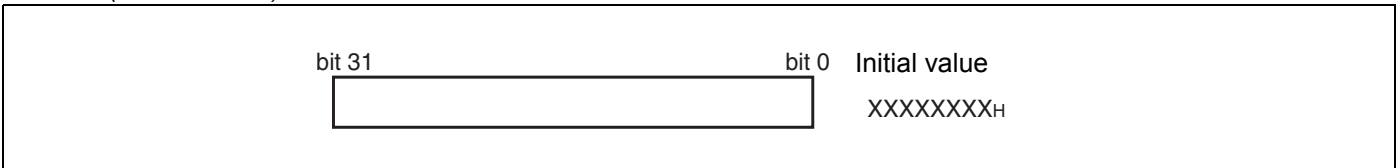
The initial value at reset is undefined.

8.4.7 TBR (Table Base Register)



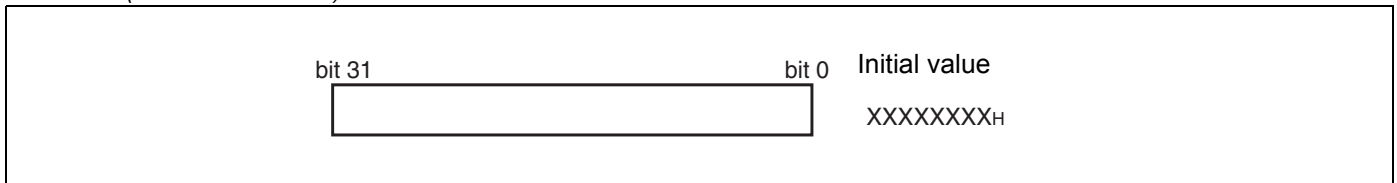
The table base register stores the starting address of the vector table used in EIT processing. The initial value at reset is 000FFC00H.

8.4.8 RP (Return Pointer)



The return pointer stores the address for return from subroutines. During execution of a CALL instruction, the PC value is transferred to this RP register. During execution of a RET instruction, the contents of the RP register are transferred to PC. The initial value at reset is undefined.

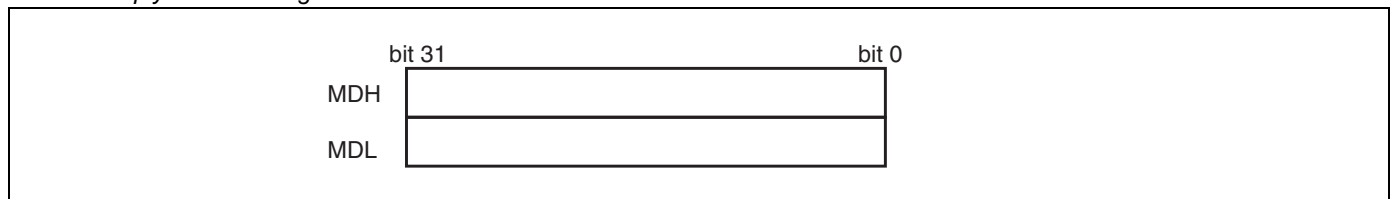
8.4.9 USP (User Stack Pointer)



The user stack pointer, when the S flag is "1", this register functions as the R15 register.

- The USP register can also be explicitly specified. The initial value at reset is undefined.
- This register cannot be used with RETI instructions.

8.4.10 Multiply & Divide Registers



These registers are for multiplication and division, and are each 32 bits in length. The initial value at reset is undefined.

9. Embedded Program/data Memory (Flash)

9.1 Flash Features

- CY91F467Dx: 1088 Kbytes (16 × 64 Kbytes + 8 × 8 Kbytes) = 8.5 Mbits
- CY91F465DA: 544 Kbytes (8 × 64 Kbytes + 4 × 8 Kbytes) = 4.25 Mbits
- Programmable wait state for read/write access
- Flash and Boot security with security vector at 0x0014:8000 - 0x0014:800F
- Boot security
- Basic specification: Same as CYM29LV400TC (except size and part of sector configuration)

9.2 Operation Modes

1. 64-bit CPU mode (available on CY91F467Dx only) :
 - CPU reads and executes programs in word (32-bit) length units.
 - Flash writing is not possible.
 - Actual Flash Memory access is performed in d-word (64-bit) length units.
2. 32-bit CPU mode :
 - CY91F465DA: CPU reads and executes programs in word (32-bit) length units.
 - CY91F467Dx: CPU reads, writes and executes programs in word (32-bit) length units.
 - Actual Flash Memory access is performed in word (32-bit) length units.
3. 16-bit CPU mode :
 - CPU reads and writes in half-word (16-bit) length units.
 - Program execution from the Flash is not possible.
 - Actual Flash Memory access is performed in half-word (16-bit) length units.

Note: The operation mode of the flash memory can be selected using a Boot-ROM function. The function start address is 0xBF60. The parameter description is given in the Hardware Manual in chapter 54.6 “Flash Access Mode Switching”.

9.3 Flash Access in CPU Mode

9.3.1 Flash Configuration

Flash Memory Map CY91F467Dx

| Address | | | | | | | | | |
|--------------------------|-------------|--------|-----------|--------|-------------|--------|-----------|--------|-------|
| 0014:FFFFh 0014:C000h | SA6 (8KB) | | | | SA7 (8KB) | | | | ROMS7 |
| 0014:BFFFh 0014:8000h | SA4 (8KB) | | | | SA5 (8KB) | | | | |
| 0014:7FFFh 0014:4000h | SA2 (8KB) | | | | SA3 (8KB) | | | | |
| 0014:3FFFh 0014:0000h | SA0 (8KB) | | | | SA1 (8KB) | | | | |
| 0013:FFFFh 0012:0000h | SA22 (64KB) | | | | SA23 (64KB) | | | | ROMS6 |
| 0011:FFFFh 0010:0000h | SA20 (64KB) | | | | SA21 (64KB) | | | | |
| 000F:FFFFh 000E:0000h | SA18 (64KB) | | | | SA19 (64KB) | | | | ROMS5 |
| 000D:FFFFh 000C:0000h | SA16 (64KB) | | | | SA17 (64KB) | | | | ROMS4 |
| 000B:FFFFh 000A:0000h | SA14 (64KB) | | | | SA15 (64KB) | | | | ROMS3 |
| 0009:FFFFh 0008:0000h | SA12 (64KB) | | | | SA13 (64KB) | | | | ROMS2 |
| 0007:FFFFh 0006:0000h | SA10 (64KB) | | | | SA11 (64KB) | | | | ROMS1 |
| 0005:FFFFh 0004:0000h | SA8 (64KB) | | | | SA9 (64KB) | | | | ROMS0 |
| | addr+0 | addr+1 | addr+2 | addr+3 | addr+4 | addr+5 | addr+6 | addr+7 | |
| 16bit read/write | dat[31:16] | | dat[15:0] | | dat[31:16] | | dat[15:0] | | |
| 32bit read/write | dat[31:0] | | | | dat[31:0] | | | | |
| 64bit read | dat[63:0] | | | | | | | | |

Flash Memory Map CY91F465DA

| Addr | | | | | | | | | |
|--------------------------|-----------------------------------|--------|-----------|--------|-------------------------------|--------|-----------|--------|-------|
| 0014:FFFFh 0014:C000h | SA6 (8KB) | | | | SA7 (8KB) | | | | ROMS7 |
| 0014:BFFFh 0014:8000h | SA4 (8KB) | | | | SA5 (8KB) | | | | |
| 0014:7FFFh 0014:4000h | SA2 (8KB) | | | | SA3 (8KB) | | | | |
| 0014:3FFFh 0014:0000h | SA0 (8KB) | | | | SA1 (8KB) | | | | |
| 0013:FFFFh 0012:0000h | SA22 (64KB) | | | | SA23 (64KB) | | | | ROMS6 |
| 0011:FFFFh 0010:0000h | SA20 (64KB) | | | | SA21 (64KB) | | | | |
| 000F:FFFFh 000E:0000h | SA18 (64KB) | | | | SA19 (64KB) | | | | ROMS5 |
| 000D:FFFFh 000C:0000h | SA16 (64KB) | | | | SA17 (64KB) | | | | ROMS4 |
| 000B:FFFFh 000A:0000h | SA14 (64KB) | | | | SA15 (64KB) | | | | ROMS3 |
| 0009:FFFFh 0008:0000h | SA12 (64KB) | | | | SA13 (64KB) | | | | ROMS2 |
| 0007:FFFFh 0006:0000h | SA10 (64KB) | | | | SA11 (64KB) | | | | ROMS1 |
| 0005:FFFFh 0004:0000h | SA8 (64KB) | | | | SA9 (64KB) | | | | ROMS0 |
| | addr+0 | addr+1 | addr+2 | addr+3 | addr+4 | addr+5 | addr+6 | addr+7 | |
| 16bit read/write | dat[31:16] | | dat[15:0] | | dat[31:16] | | dat[15:0] | | |
| 32bit read | dat[31:0] | | | | dat[31:0] | | | | |
| Legend | Memory not available in this area | | | | Memory available in this area | | | | |

9.3.2 Flash Access Timing Settings in CPU Mode

The following tables list all settings for a given maximum Core Frequency (through the setting of CLKB or maximum clock modulation) for Flash read and write access.

Flash Read Timing Settings (Synchronous Read)

| Core Clock (CLKB) | ATD | ALEH | EQ | WEXH | WTC | Remark |
|-------------------|-----|------|----|------|-----|-----------------------------|
| to 24 MHz | 0 | 0 | 0 | - | 1 | |
| to 48 MHz | 0 | 0 | 1 | - | 2 | |
| to 96 MHz | 1 | 1 | 3 | - | 4 | |
| to 100 MHz | 1 | 1 | 3 | - | 4 | not available on CY91F467Dx |

Flash Write Timing Settings (Synchronous Write)

| Core Clock (CLKB) | ATD | ALEH | EQ | WEXH | WTC | Remark |
|-------------------|-----|------|----|------|-----|-----------------------------|
| to 32 MHz | 1 | - | - | 0 | 4 | |
| to 48 MHz | 1 | - | - | 0 | 5 | |
| to 64 MHz | 1 | - | - | 0 | 6 | |
| to 96 MHz | 1 | - | - | 0 | 7 | |
| to 100 MHz | 1 | - | - | 0 | 7 | not available on CY91F467Dx |

9.3.3 Address Mapping from CPU to Parallel Programming Mode

The following tables show the calculation from CPU addresses to flash macro addresses which are used in parallel programming.

Address Mapping CY91F467Dx

| CPU Address (addr) | Condition | Flash Sectors | FA (flash address) Calculation |
|----------------------------|------------|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 14:0000h to 14:FFFFh | addr[2]==0 | SA0, SA2, SA4, SA6 (8 Kbyte) | FA := addr - addr%00:4000h + (addr%00:4000h)/2 - (addr/2)%4 + addr%4 - 05:0000h |
| 14:0000h to 14:FFFFh | addr[2]==1 | SA1, SA3, SA5, SA7 (8 Kbyte) | FA := addr - addr%00:4000h + (addr%00:4000h)/2 - (addr/2)%4 + addr%4 - 05:0000h + 00:2000h |
| 04:0000h to 13:FFFFh | addr[2]==0 | SA8, SA10, SA12, SA14, SA16, SA18, SA20, SA22 (64 Kbyte) | FA := addr - addr%02:0000 + (addr%02:0000h)/2 - (addr/2)%4 + addr%4 + 0C:0000h |
| 04:0000h to 13:FFFFh | addr[2]==1 | SA9, SA11, SA13, SA15, SA17, SA19, SA21, SA23 (64 Kbyte) | FA := addr - addr%02:0000h + (addr%02:0000h)/2 - (addr/2)%4 + addr%4 + 0C:0000h + 01:0000h |

Note: FA result is without 20:0000h offset for parallel Flash programming.

Set offset by keeping FA[21] = 1 as described in section "Parallel Flash programming mode".

Address Mapping CY91F465DA

| CPU Address (addr) | Condition | Flash Sectors | FA (flash address) Calculation |
|----------------------------|------------|--------------------------------------|--------------------------------------------------------------------------------------------------|
| 14:8000h to 14:FFFFh | addr[2]==0 | SA4, SA6 (8 Kbyte) | FA := addr - addr%00:4000h + (addr%00:4000h)/2 - (addr/2)%4 + addr%4 - 0D:0000h |
| 14:8000h to 14:FFFFh | addr[2]==1 | SA5, SA7 (8 Kbyte) | FA := addr - addr%00:4000h + (addr%00:4000h)/2 - (addr/2)%4 + addr%4 - 0D:0000h + 00:2000h |
| 08:0000h to 0F:FFFFh | addr[2]==0 | SA12, SA14, SA16, SA18 (64 Kbyte) | FA := addr - addr%02:0000 + (addr%02:0000h)/2 - (addr/2)%4 + addr%4 + 00:0000h |
| 08:0000h to 0F:FFFFh | addr[2]==1 | SA13, SA15, SA17, SA19 (64 Kbyte) | FA := addr - addr%02:0000h + (addr%02:0000h)/2 - (addr/2)%4 + addr%4 - 00:0000h + 01:0000h |

Note: FA result is without 10:0000h offset for parallel Flash programming.

Set offset by keeping FA[20] = 1 as described in section "Parallel Flash programming mode".

9.4 Parallel Flash Programming Mode

9.4.1 Flash Configuration in Parallel Flash Programming Mode

Parallel Flash Programming Mode (MD[2:0] = 111):

CY91F467Dx

| FA[21:0] | | | | | |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------|------------|----------|----------|
| 003F:FFFFh 003F:0000h | SA23 (64KB) | | | | |
| 003E:FFFFh 003E:0000h | SA22 (64KB) | | | | |
| 003D:FFFFh 003D:0000h | SA21 (64KB) | | | | |
| 003C:FFFFh 003C:0000h | SA20 (64KB) | | | | |
| 003B:FFFFh 003B:0000h | SA19 (64KB) | | | | |
| 003A:FFFFh 003A:0000h | SA18 (64KB) | | | | |
| 0039:FFFFh 0039:0000h | SA17 (64KB) | | | | |
| 0038:FFFFh 0038:0000h | SA16 (64KB) | | | | |
| 0037:FFFFh 0037:0000h | SA15 (64KB) | | | | |
| 0036:FFFFh 0036:0000h | SA14 (64KB) | | | | |
| 0035:FFFFh 0035:0000h | SA13 (64KB) | | | | |
| 0034:FFFFh 0034:0000h | SA12 (64KB) | | | | |
| 0033:FFFFh 0033:0000h | SA11 (64KB) | | | | |
| 0032:FFFFh 0032:0000h | SA10 (64KB) | | | | |
| 0031:FFFFh 0031:0000h | SA9 (64KB) | | | | |
| 0030:FFFFh 0030:0000h | SA8 (64KB) | | | | |
| 002F:FFFFh 002F:E000h | SA7 (8KB) | | | | |
| 002F:DFFFh 002F:C000h | SA6 (8KB) | | | | |
| 002F:BFFFh 002F:A000h | SA5 (8KB) | | | | |
| 002F:9FFFh 002F:8000h | SA4 (8KB) | | | | |
| 002F:7FFFh 002F:6000h | SA3 (8KB) | | | | |
| 002F:5FFFh 002F:4000h | SA2 (8KB) | | | | |
| 002F:3FFFh 002F:2000h | SA1 (8KB) | | | | |
| 002F:1FFFh 002F:0000h | SA0 (8KB) | | | | |
| 16bit write mode | <table border="1"> <tr> <th>FA[1:0]=00</th> <th>FA[1:0]=10</th> </tr> <tr> <td>DQ[15:0]</td> <td>DQ[15:0]</td> </tr> </table> | FA[1:0]=00 | FA[1:0]=10 | DQ[15:0] | DQ[15:0] |
| FA[1:0]=00 | FA[1:0]=10 | | | | |
| DQ[15:0] | DQ[15:0] | | | | |

Remark: Always keep FA[0] = 0 and FA[21] = 1

CY91F465DA

| FA[20:0] | | | | | |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------|----------|----------|
| 001F:FFFFh 001F:0000h | SA19 (64KB) | | | | |
| 001E:FFFFh 001E:0000h | SA18 (64KB) | | | | |
| 001D:FFFFh 001D:0000h | SA17 (64KB) | | | | |
| 001C:FFFFh 001C:0000h | SA16 (64KB) | | | | |
| 001B:FFFFh 001B:0000h | SA15 (64KB) | | | | |
| 001A:FFFFh 001A:0000h | SA14 (64KB) | | | | |
| 0019:FFFFh 0019:0000h | SA13 (64KB) | | | | |
| 0018:FFFFh 0018:0000h | SA12 (64KB) | | | | |
| | SA11 (64KB) | | | | |
| | SA10 (64KB) | | | | |
| | SA9 (64KB) | | | | |
| | SA8 (64KB) | | | | |
| 0017:FFFFh 0017:E000h | SA7 (8KB) | | | | |
| 0017:DFFFh 0017:C000h | SA6 (8KB) | | | | |
| 0017:BFFFh 0017:A000h | SA5 (8KB) | | | | |
| 0017:9FFFh 0017:8000h | SA4 (8KB) | | | | |
| | SA3 (8KB) | | | | |
| | SA2 (8KB) | | | | |
| | SA1 (8KB) | | | | |
| | SA0 (8KB) | | | | |
| 16bit write mode | <table border="1"> <tr> <th>FA[1:0]=00</th> <th>FA[1:0]=10</th> </tr> <tr> <td>DQ[15:0]</td> <td>DQ[15:0]</td> </tr> </table> | FA[1:0]=00 | FA[1:0]=10 | DQ[15:0] | DQ[15:0] |
| FA[1:0]=00 | FA[1:0]=10 | | | | |
| DQ[15:0] | DQ[15:0] | | | | |
| Legend | <table border="1"> <tr> <td>Memory available in this area</td> </tr> <tr> <td>Memory not available in this area</td> </tr> </table> | Memory available in this area | Memory not available in this area | | |
| Memory available in this area | | | | | |
| Memory not available in this area | | | | | |

Remark: Always keep FA[0] = 0 and FA[20] = 1

9.4.2 Pin Connections in Parallel Programming Mode

Resetting after setting the MD[2:0] pins to [111] will halt CPU functioning. At this time, the Flash memory's interface circuit enables direct control of the Flash memory unit from external pins by directly linking some of the signals to General Purpose Ports. Please see table below for signal mapping.

In this mode, the Flash memory appears to the external pins as a stand-alone unit. This mode is generally set when writing/erasing using the parallel Flash programmer. In this mode, all operations of the 8.5 Mbits Flash memory's Auto Algorithms are available.

Correspondence between CYM29LV400TC and Flash Memory Control Signals

| CYM29LV400TC External Pins | FR-CPU Mode | CY91F465DA, CY91F467Dx External Pins | | | Comment |
|----------------------------|---------------------------------------------------------|--------------------------------------|-----------------|------------|----------------------------------------------------|
| | | Flash Memory Mode | Normal Function | Pin Number | |
| — | INITX | — | INITX | 73 | |
| RESET | — | FRSTX | P09_6 | 60 | |
| — | — | MD_2 | MD_2 | 70 | Set to '1' |
| — | — | MD_1 | MD_1 | 71 | Set to '1' |
| — | — | MD_0 | MD_0 | 72 | Set to '1' |
| RY/BY | FMCS:RDY bit | RY/BYX | P09_0 | 56 | |
| BYTE | Internally fixed to 'H' | BYTEX | P09_2 | 58 | |
| WE | Internal control signal + control via interface circuit | WEX | P13_2 | 191 | |
| OE | | OEX | P13_1 | 190 | |
| CE | | CEX | P13_0 | 189 | |
| — | | ATDIN | P25_7 | 187 | Set to '0' |
| — | | EQIN | P25_6 | 186 | Set to '0' |
| — | | TESTX | P09_3 | 59 | Set to '1' |
| — | | RDYI | P09_1 | 57 | Set to '0' |
| A-1 | | Internal address bus | FA0 | P25_5 | 185 |
| A0 to A3 | FA1 to FA4 | | P27_0 to P27_3 | 158 to 161 | |
| A4 to A7 | FA5 to FA8 | | P27_4 to P27_7 | 164 to 167 | |
| A8 to A11 | FA9 to FA12 | | P26_0 to P26_3 | 168 to 171 | |
| A12 to A15 | FA13 to FA16 | | P26_4 to P26_7 | 174 to 177 | |
| A16 to A19 | FA17 to FA20 | | P25_0 to P25_3 | 178 to 181 | |
| — | FA21 | | P25_4 | 184 | Not needed on CY91F465DA; Set to '1' on CY91F467Dx |
| DQ0 to DQ7 | Internal data bus | DQ0 to DQ7 | P03_0 to P03_7 | 192 to 199 | |
| DQ8 to DQ15 | | DQ8 to DQ15 | P02_0 to P02_7 | 200 to 207 | |

9.5 Poweron Sequence in Parallel Programming Mode

The flash memory can be accessed in programming mode after a certain wait time, which is needed for Security Vector fetch:

- Minimum wait time after VDD5/VDD5R power on: 2.76 ms
- Minimum wait time after INITX rising: 1.0 ms

9.6 Flash Security

9.6.1 Vector Addresses

Two Flash Security Vectors (FSV1, FSV2) are located parallel to the Boot Security Vectors (BSV1, BSV2) controlling the protection functions of the Flash Security Module:

FSV1: 0x14:8000 BSV1: 0x14:8004
 FSV2: 0x14:8008 BSV2: 0x14:800C

9.6.2 Security Vector FSV1

The setting of the Flash Security Vector FSV1 is responsible for the read and write protection modes and the individual write protection of the 8 Kbytes sectors.

FSV1 (bit31 to bit16)

The setting of the Flash Security Vector FSV1 bits [31:16] is responsible for the read and write protection modes.

Explanation of the bits in the Flash Security Vector FSV1 [31:16]

| FSV1[31:19] | FSV1[18] Write Protection Level | FSV1[17] Write Protection | FSV1[16] Read Protection | Flash Security Mode |
|----------------|---------------------------------------|------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| set all to "0" | set to "0" | set to "0" | set to "1" | Read Protection (all device modes, except INTVEC mode MD[2:0] = "000") |
| set all to "0" | set to "0" | set to "1" | set to "0" | Write Protection (all device modes, without exception) |
| set all to "0" | set to "0" | set to "1" | set to "1" | Read Protection (all device modes, except INTVEC mode MD[2:0] = "000") and Write Protection (all device modes) |
| set all to "0" | set to "1" | set to "0" | set to "1" | Read Protection (all device modes, except INTVEC mode MD[2:0] = "000") |
| set all to "0" | set to "1" | set to "1" | set to "0" | Write Protection (all device modes, except INTVEC mode MD[2:0] = "000") |
| set all to "0" | set to "1" | set to "1" | set to "1" | Read Protection (all device modes, except INTVEC mode MD[2:0] = "000") and Write Protection (all device modes except INTVEC mode MD[2:0] = "000") |

FSV1 (bit15 to bit0)

The setting of the Flash Security Vector FSV1 bits [15:0] is responsible for the individual write protection of the 8 Kbytes sectors. It is only evaluated if write protection bit FSV1[17] is set.

Explanation of the bits in the Flash Security Vector FSV1 [15:0]

| FSV1 bit | Sector | Enable Write Protection | Disable Write Protection | Comment |
|----------|------------------|-------------------------|--------------------------|--------------------------------|
| FSV1[0] | SA0 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV1[1] | SA1 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV1[2] | SA2 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV1[3] | SA3 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV1[4] | SA4 | set to "0" | — | Write protection is mandatory! |
| FSV1[5] | SA5 | set to "0" | set to "1" | |
| FSV1[6] | SA6 | set to "0" | set to "1" | |
| FSV1[7] | SA7 | set to "0" | set to "1" | |
| FSV1[8] | — | set to "0" | set to "1" | not available |
| FSV1[9] | — | set to "0" | set to "1" | not available |
| FSV1[10] | — | set to "0" | set to "1" | not available |
| FSV1[11] | — | set to "0" | set to "1" | not available |
| FSV1[12] | — | set to "0" | set to "1" | not available |
| FSV1[13] | — | set to "0" | set to "1" | not available |
| FSV1[14] | — | set to "0" | set to "1" | not available |
| FSV1[15] | — | set to "0" | set to "1" | not available |

Note : It is mandatory to always set the sector where the Flash Security Vectors FSV1 and FSV2 are located to write protected (here sector SA4). Otherwise it is possible to overwrite the Security Vector to a setting where it is possible to either read out the Flash content or manipulate data by writing.

See section "Flash access in CPU mode" for an overview about the sector organisation of the Flash Memory.

9.6.3 Security Vector FSV2

The setting of the Flash Security Vector FSV2 bits [31:0] is responsible for the individual write protection of the 64 Kbytes sectors. It is only evaluated if write protection bit FSV1 [17] is set.

Explanation of the bits in the Flash Security Vector FSV2[31:0]

| FSV2 bit | Sector | Enable Write Protection | Disable Write Protection | Comment |
|-------------|-------------------|-------------------------|--------------------------|---------------|
| FSV2[0] | SA8 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[1] | SA9 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[2] | SA10 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[3] | SA11 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[4] | SA12 | set to "0" | set to "1" | |
| FSV2[5] | SA13 | set to "0" | set to "1" | |
| FSV2[6] | SA14 | set to "0" | set to "1" | |
| FSV2[7] | SA15 | set to "0" | set to "1" | |
| FSV2[8] | SA16 | set to "0" | set to "1" | |
| FSV2[9] | SA17 | set to "0" | set to "1" | |
| FSV2[10] | SA18 | set to "0" | set to "1" | |
| FSV2[11] | SA19 | set to "0" | set to "1" | |
| FSV2[12] | SA20 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[13] | SA21 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[14] | SA22 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[15] | SA23 (CY91F467Dx) | set to "0" | set to "1" | |
| FSV2[31:16] | — | set to "0" | set to "1" | not available |

Note : See section "Flash access in CPU mode" for an overview about the sector organisation of the Flash Memory.

10. Memory Space

The FR family has 4 Gbytes of logical address space (2^{32} addresses) available to the CPU by linear access.

Direct Addressing Area

The following address space area is used for I/O.

This area is called direct addressing area, and the address of an operand can be specified directly in an instruction.

The size of directly addressable area depends on the length of the data being accessed as shown below.

Byte data access : 000_H to 0FF_H

Half word access : 000_H to 1FF_H

Word data access : 000_H to 3FF_H

11. Memory Maps

11.1 CY91F465DA, CY91F467Dx

| | |
|-----------------------|------------------------------|
| 00000000 _H | I/O (direct addressing area) |
| 00000400 _H | I/O |
| 00001000 _H | DMA |
| 00002000 _H | |
| 00004000 _H | Flash-Cache (8 KBytes) |
| 00006000 _H | |
| 00007000 _H | Flash memory control |
| 00008000 _H | |
| 0000B000 _H | Boot ROM (4 Kbytes) |
| 0000C000 _H | CAN |
| 0000D000 _H | |
| 00028000 _H | D-RAM (0 wait, 32 Kbytes) |
| 00030000 _H | ID-RAM (32 Kbytes) |
| 00038000 _H | |
| 00040000 _H | Flash memory (1088 Kbytes) |
| 00150000 _H | |
| 00180000 _H | External bus area |
| 00500000 _H | External data bus |
| FFFFFFFF _H | |

Note: Access prohibited areas

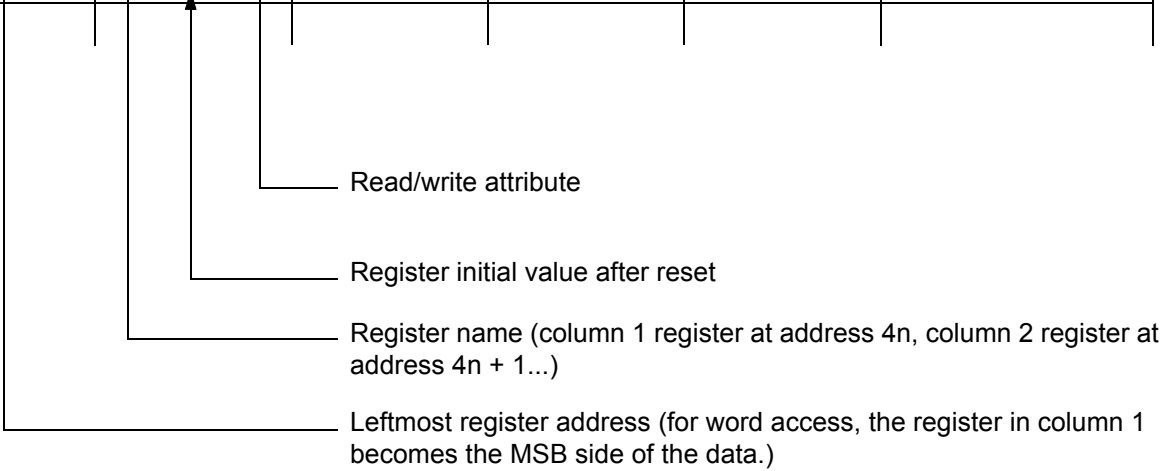
| | |
|-----------------------|------------------------------|
| 00000000 _H | I/O (direct addressing area) |
| 00000400 _H | I/O |
| 00001000 _H | DMA |
| 00002000 _H | |
| 00004000 _H | Flash-Cache (8 KBytes) |
| 00006000 _H | |
| 00007000 _H | Flash memory control |
| 00008000 _H | |
| 0000B000 _H | Boot ROM (4 Kbytes) |
| 0000C000 _H | CAN |
| 0000D000 _H | |
| 00028000 _H | D-RAM (0 wait, 32 Kbytes) |
| 00030000 _H | ID-RAM (16 Kbytes) |
| 00034000 _H | |
| 00040000 _H | External bus area |
| 00080000 _H | Flash memory (512 Kbytes) |
| 00100000 _H | External bus area |
| 00148000 _H | Flash memory (32 Kbytes) |
| 00150000 _H | |
| 00180000 _H | External bus area |
| 00500000 _H | External data bus |
| FFFFFFFF _H | |

Note: Access prohibited areas

12. I/O Map

12.1 CY91F465DA, CY91F467Dx

| Address | Register | | | | Block |
|---------------------|------------------------|------------------------|------------------------|------------------------|------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000000 _H | PDR0 [R/W] XXXXXXXX | PDR1 [R/W] XXXXXXXX | PDR2 [R/W] XXXXXXXX | PDR3 [R/W] XXXXXXXX | T-unit port data register |



Read/write attribute

Register initial value after reset

Register name (column 1 register at address 4n, column 2 register at address 4n + 1...)

Leftmost register address (for word access, the register in column 1 becomes the MSB side of the data.)

Note : Initial values of register bits are represented as follows:

- “ 1 ” : Initial value “ 1 ”
- “ 0 ” : Initial value “ 0 ”
- “ X ” : Initial value “ undefined ”
- “ - ” : No physical register at this location

Access is barred with an undefined data access attribute.

| Address | Register | | | | Block |
|------------------------------------------------|----------------------------|----------------------------------|----------------------------------|----------------------------------|--------------------------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00000 _H | PDR00 [R/W] XXXXXXXX | PDR01 [R/W] XXXXXXXX | PDR02 [R/W] XXXXXXXX | PDR03 [R/W] XXXXXXXX | R-bus Port Data Register |
| 00004 _H | PDR04 [R/W] -----XX | PDR05 [R/W] XXXXXXXX | PDR06 [R/W] XXXXXXXX | PDR07 [R/W] XXXXXXXX | |
| 00008 _H | PDR08 [R/W] XXXXXXXX | PDR09 [R/W] XX - - XXXX | PDR10 [R/W] - XXXXXX - | Reserved | |
| 0000C _H | Reserved | PDR13 [R/W] -----XXX | PDR14 [R/W] XXXXXXXX | PDR15 [R/W] ---- XXXX | |
| 00010 _H | PDR16 [R/W] XXXXXXXX | PDR17 [R/W] XXXX ---- | PDR18 [R/W] - XXX - XXX | PDR19 [R/W] - XXX - XXX | |
| 00014 _H | PDR20 [R/W] -----XXX | Reserved | PDR22 [R/W] -- XX - X - X | PDR23 [R/W] -- XXXXXX | |
| 00018 _H | PDR24 [R/W] XXXXXXXX | PDR25 [R/W] XXXXXXXX | PDR26 [R/W] XXXXXXXX | PDR27 [R/W] XXXXXXXX | |
| 0001C _H | Reserved | PDR29 [R/W] XXXXXXXX | Reserved | | |
| 00020 _H to 0002C _H | Reserved | | | | Reserved |
| 00030 _H | EIRR0 [R/W] XXXXXXXX | ENIR0 [R/W] 00000000 | ELVR0 [R/W] 00000000 00000000 | | External interrupt (INT 0 to INT 7) |
| 00034 _H | EIRR1 [R/W] XXXXXXXX | ENIR1 [R/W] 00000000 | ELVR1 [R/W] 00000000 00000000 | | External interrupt (INT 8 to INT 10, INT 12 to INT 14) |
| 00038 _H | DICR [R/W] ----- 0 | HRCL [R/W] 0 - - 11111 | Reserved | | Delay Interrupt |
| 0003C _H to 0004C _H | Reserved | | | | Reserved |
| 00050 _H | SCR02 [R/W, W] 00000000 | SMR02 [R/W, W] 00000000 | SSR02 [R/W, R] 00001000 | RDR02/TDR02 [R/W] 00000000 | LIN-USART 2 |
| 00054 _H | ESCR02 [R/W] 0000X00 | ECCR02 [R/W, R, W] -0000XX | Reserved | | |
| 00058 _H , 0005C _H | Reserved | | | | Reserved |

(Continued)

(Continued)

| Address | Register | | | | Block |
|---------------------|----------------------------------|-----------------------------------|----------------------------------|----------------------------------|-------------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000060 _H | SCR04 [R/W, W] 00000000 | SMR04 [R/W, W] 00000000 | SSR04 [R/W, R] 00001000 | RDR04/TDR04 [R/W] 00000000 | LIN-USART 4 with FIFO |
| 000064 _H | ESCR04 [R/W] 00000X00 | ECCR04 [R/W, R, W] -00000XX | FSR04 [R] --- 00000 | FCR04 [R/W] 0001 - 000 | |
| 000068 _H | SCR05 [R/W, W] 00000000 | SMR05 [R/W, W] 00000000 | SSR05 [R/W, R] 00001000 | RDR05/TDR05 [R/W] 00000000 | LIN-USART 5 with FIFO |
| 00006C _H | ESCR05 [R/W] 00000X00 | ECCR05 [R/W, R, W] -00000XX | FSR05 [R] --- 00000 | FCR05 [R/W] 0001 - 000 | |
| 000070 _H | SCR06 [R/W, W] 00000000 | SMR06 [R/W, W] 00000000 | SSR06 [R/W, R] 00001000 | RDR06/TDR06 [R/W] 00000000 | LIN-USART 6 with FIFO |
| 000074 _H | ESCR06 [R/W] 00000X00 | ECCR06 [R/W, R, W] -00000XX | FSR06 [R] --- 00000 | FCR06 [R/W] 0001 - 000 | |
| 000078 _H | SCR07 [R/W, W] 00000000 | SMR07 [R/W, W] 00000000 | SSR07 [R/W, R] 00001000 | RDR07/TDR07 [R/W] 00000000 | LIN-USART 7 with FIFO |
| 00007C _H | ESCR07 [R/W] 00000X00 | ECCR07 [R/W, R, W] -00000XX | FSR07 [R] --- 00000 | FCR07 [R/W] 0001 - 000 | |
| 000080 _H | Reserved | | | | Reserved |
| 000084 _H | BGR102 [R/W] 00000000 | BGR002 [R/W] 00000000 | Reserved | | Baud rate Generator LIN-USART 2,4 to 7 |
| 000088 _H | BGR104 [R/W] 00000000 | BGR004 [R/W] 00000000 | BGR105 [R/W] 00000000 | BGR005 [R/W] 00000000 | |
| 00008C _H | BGR106 [R/W] 00000000 | BGR006 [R/W] 00000000 | BGR107 [R/W] 00000000 | BGR007 [R/W] 00000000 | |
| 000090 _H | PWC20 [R/W] ----- XX XXXXXXXX | | PWC10 [R/W] ----- XX XXXXXXXX | | Stepper Motor 0 |
| 000094 _H | Reserved | | PWS20 [R/W] -0000000 | PWS10 [R/W] - -000000 | |
| 000098 _H | PWC21 [R/W] ----- XX XXXXXXXX | | PWC11 [R/W] ----- XX XXXXXXXX | | Stepper Motor 1 |
| 00009C _H | Reserved | | PWS21 [R/W] -0000000 | PWS11 [R/W] - -000000 | |

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| Address | Register | | | | Block |
|--------------------------------------------------|----------------------------------|--------------------------|---------------------------------|--------------------------|---------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 0000A0 _H | PWC22 [R/W] -----XX XXXXXXXX | | PWC12 [R/W] -----XX XXXXXXXX | | Stepper Motor 2 |
| 0000A4 _H | Reserved | | PWS22 [R/W] -0000000 | PWS12 [R/W] --000000 | |
| 0000A8 _H | PWC23 [R/W] -----XX XXXXXXXX | | PWC13 [R/W] -----XX XXXXXXXX | | Stepper Motor 3 |
| 0000AC _H | Reserved | | PWS23 [R/W] -0000000 | PWS13 [R/W] --000000 | |
| 0000B0 _H | PWC24 [R/W] -----XX XXXXXXXX | | PWC14 [R/W] -----XX XXXXXXXX | | Stepper Motor 4 |
| 0000B4 _H | Reserved | | PWS24 [R/W] -0000000 | PWS14 [R/W] --000000 | |
| 0000B8 _H | PWC25 [R/W] -----XX XXXXXXXX | | PWC15 [R/W] -----XX XXXXXXXX | | Stepper Motor 5 |
| 0000BC _H | Reserved | | PWS25 [R/W] -0000000 | PWS15 [R/W] --000000 | |
| 0000C0 _H | Reserved | PWC0 [R/W] -00000-- | Reserved | PWC1 [R/W] -00000-- | Stepper Motor Control 0 to 5 |
| 0000C4 _H | Reserved | PWC2 [R/W] -00000-- | Reserved | PWC3 [R/W] -00000-- | |
| 0000C8 _H | Reserved | PWC4 [R/W] -00000-- | Reserved | PWC5 [R/W] -00000-- | |
| 0000CC _H | Reserved | | | | Reserved |
| 0000D0 _H | IBCR0 [R/W] 00000000 | IBSR0 [R] 00000000 | ITBAH0 [R/W] -----00 | ITBAL0 [R/W] 00000000 | I ² C 0 |
| 0000D4 _H | ITMKH0 [R/W] 00----11 | ITMKL0 [R/W] 11111111 | ISMK0 [R/W] 01111111 | ISBA0 [R/W] -0000000 | |
| 0000D8 _H | Reserved | IDAR0 [R/W] 00000000 | ICCR0 [R/W] 00011111 | Reserved | |
| 0000DC _H to 000100 _H | Reserved | | | | Reserved |
| 000104 _H | GCN11 [R/W] 00110010 00010000 | | Reserved | GCN21 [R/W] ----0000 | PPG Control 4 to 7 |
| 000108 _H | GCN12 [R/W] 00110010 00010000 | | Reserved | GCN22 [R/W] ----0000 | PPG Control 8 to 11 |
| 000110 _H to 00012C _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|---------------------|------------------------------------|----------------------------------|------------------------------------|----------------------------------|----------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000130 _H | PTMR04 [R] 11111111 11111111 | | PCSR04 [W] XXXXXXXX XXXXXXXX | | PPG 4 |
| 000134 _H | PDUT04 [W] XXXXXXXX XXXXXXXX | | PCNH04 [R/W] 0000000 - | PCNL04 [R/W] 000000 - 0 | |
| 000138 _H | PTMR05 [R] 11111111 11111111 | | PCSR05 [W] XXXXXXXX XXXXXXXX | | PPG 5 |
| 00013C _H | PDUT05 [W] XXXXXXXX XXXXXXXX | | PCNH05 [R/W] 0000000 - | PCNL05 [R/W] 000000 - 0 | |
| 000140 _H | PTMR06 [R] 11111111 11111111 | | PCSR06 [W] XXXXXXXX XXXXXXXX | | PPG 6 |
| 000144 _H | PDUT06 [W] XXXXXXXX XXXXXXXX | | PCNH06 [R/W] 0000000 - | PCNL06 [R/W] 000000 - 0 | |
| 000148 _H | PTMR07 [R] 11111111 11111111 | | PCSR07 [W] XXXXXXXX XXXXXXXX | | PPG 7 |
| 00014C _H | PDUT07 [W] XXXXXXXX XXXXXXXX | | PCNH07 [R/W] 0000000 - | PCNL07 [R/W] 000000 - 0 | |
| 000150 _H | PTMR08 [R] 11111111 11111111 | | PCSR08 [W] XXXXXXXX XXXXXXXX | | PPG 8 |
| 000154 _H | PDUT08 [W] XXXXXXXX XXXXXXXX | | PCNH08 [R/W] 0000000 - | PCNL08 [R/W] 000000 - 0 | |
| 000158 _H | PTMR09 [R] 11111111 11111111 | | PCSR09 [W] XXXXXXXX XXXXXXXX | | PPG 9 |
| 00015C _H | PDUT09 [W] XXXXXXXX XXXXXXXX | | PCNH09 [R/W] 0000000 - | PCNL09 [R/W] 000000 - 0 | |
| 000160 _H | PTMR10 [R] 11111111 11111111 | | PCSR10 [W] XXXXXXXX XXXXXXXX | | PPG 10 |
| 000164 _H | PDUT10 [W] XXXXXXXX XXXXXXXX | | PCNH10 [R/W] 0000000 - | PCNL10 [R/W] 000000 - 0 | |
| 000168 _H | PTMR11 [R] 11111111 11111111 | | PCSR11 [W] XXXXXXXX XXXXXXXX | | PPG 11 |
| 00016C _H | PDUT11 [W] XXXXXXXX XXXXXXXX | | PCNH11 [R/W] 0000000 - | PCNL11 [R/W] 000000 - 0 | |
| 000170 _H | P0TMCSRH [R/W] - 0 - 000 - 0 | P0TMCSRL [R/W] - - - 00000 | P1TMCSRH [R/W] - 0 - 000 - 0 | P1TMCSRL [R/W] - - - 00000 | PFM |
| 000174 _H | P0TMRLR [W] XXXXXXXX XXXXXXXX | | P0TMR [R] XXXXXXXX XXXXXXXX | | |
| 000178 _H | P1TMRLR [W] XXXXXXXX XXXXXXXX | | P1TMR [R] XXXXXXXX XXXXXXXX | | |
| 00017C _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|---------------------|---------------------------------------|----------------------------|---------------------------------------|-----------------------------|----------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000180 _H | Reserved | ICS01 [R/W] 00000000 | Reserved | ICS23 [R/W] 00000000 | Input Capture 0 to 3 |
| 000184 _H | IPCP0 [R] XXXXXXXX XXXXXXXX | | IPCP1 [R] XXXXXXXX XXXXXXXX | | |
| 000188 _H | IPCP2 [R] XXXXXXXX XXXXXXXX | | IPCP3 [R] XXXXXXXX XXXXXXXX | | |
| 00018C _H | OCS01 [R/W] --- 0 -- 00 0000 -- 00 | | OCS23 [R/W] --- 0 -- 00 0000 -- 00 | | Output Compare 0 to 3 |
| 000190 _H | OCCP0 [R/W] XXXXXXXX XXXXXXXX | | OCCP1 [R/W] XXXXXXXX XXXXXXXX | | |
| 000194 _H | OCCP2 [R/W] XXXXXXXX XXXXXXXX | | OCCP3 [R/W] XXXXXXXX XXXXXXXX | | |
| 000198 _H | SGCRH [R/W] 0000 -- 00 | SGCRL [R/W] -- 0 -- 000 | SGFR [R/W, R] XXXXXXXX XXXXXXXX | | Sound Generator |
| 00019C _H | SGAR [R/W] 00000000 | Reserved | SGTR [R/W] XXXXXXXX | SGDR [R/W] XXXXXXXX | |
| 0001A0 _H | ADERH [R/W] 00000000 00000000 | | ADERL [R/W] 00000000 00000000 | | A/D Converter |
| 0001A4 | ADCS1 [R/W] 00000000 | ADCS0 [R/W] 00000000 | ADCR1 [R] 000000XX | ADCR0 [R] XXXXXXXX | |
| 0001A8 _H | ADCT1 [R/W] 00010000 | ADCT0 [R/W] 00101100 | ADSCH [R/W] --- 00000 | ADECH [R/W] --- 00000 | |
| 0001AC _H | Reserved | ACSR0 [R/W] - 11XXXX00 | Reserved | | Alarm Comparator 0 |
| 0001B0 _H | TMRLR0 [W] XXXXXXXX XXXXXXXX | | TMR0 [R] XXXXXXXX XXXXXXXX | | Reload Timer 0 |
| 0001B4 _H | Reserved | | TMCSRH0 [R/W] --- 00000 | TMCSRL0 [R/W] 0 - 000000 | |
| 0001B8 _H | TMRLR1 [W] XXXXXXXX XXXXXXXX | | TMR1 [R] XXXXXXXX XXXXXXXX | | Reload Timer 1 |
| 0001BC _H | Reserved | | TMCSRH1 [R/W] --- 00000 | TMCSRL1 [R/W] 0 - 000000 | |
| 0001C0 _H | TMRLR2 [W] XXXXXXXX XXXXXXXX | | TMR2 [R] XXXXXXXX XXXXXXXX | | Reload Timer 2 (PPG 4, PPG 5) |
| 0001C4 _H | Reserved | | TMCSRH2 [R/W] --- 00000 | TMCSRL2 [R/W] 0 - 000000 | |

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| Address | Register | | | | Block |
|---------------------|------------------------------------|-----|---------------------------------|-----------------------------|-----------------------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 0001C8 _H | TMRLR3 [W] XXXXXXXXX XXXXXXXXX | | TMR3 [R] XXXXXXXXX XXXXXXXXX | | Reload Timer 3 (PPG 6, PPG 7) |
| 0001CC _H | Reserved | | TMCSRH3 [R/W] --- 00000 | TMCSRL3 [R/W] 0 - 000000 | |
| 0001D0 _H | TMRLR4 [W] XXXXXXXXX XXXXXXXXX | | TMR4 [R] XXXXXXXXX XXXXXXXXX | | Reload Timer 4 (PPG 8, PPG 9) |
| 0001D4 _H | Reserved | | TMCSRH4 [R/W] --- 00000 | TMCSRL4 [R/W] 0 - 000000 | |
| 0001D8 _H | TMRLR5 [W] XXXXXXXXX XXXXXXXXX | | TMR5 [R] XXXXXXXXX XXXXXXXXX | | Reload Timer 5 (PPG 10, PPG 11) |
| 0001DC _H | Reserved | | TMCSRH5 [R/W] --- 00000 | TMCSRL5 [R/W] 0 - 000000 | |
| 0001E0 _H | TMRLR6 [W] XXXXXXXXX XXXXXXXXX | | TMR6 [R] XXXXXXXXX XXXXXXXXX | | Reload Timer 6 (PPG 12, PPG 13) |
| 0001E4 _H | Reserved | | TMCSRH6 [R/W] --- 00000 | TMCSRL6 [R/W] 0 - 000000 | |
| 0001E8 _H | TMRLR7 [W] XXXXXXXXX XXXXXXXXX | | TMR7 [R] XXXXXXXXX XXXXXXXXX | | Reload Timer 7 (PPG 14, PPG 15) (A/D Converter) |
| 0001EC _H | Reserved | | TMCSRH7 [R/W] --- 00000 | TMCSRL7 [R/W] 0 - 000000 | |
| 0001F0 _H | TCDT0 [R/W] XXXXXXXXX XXXXXXXXX | | Reserved | TCCS0 [R/W] 00000000 | Free Running Timer 0 (ICU 0, ICU 1) |
| 0001F4 _H | TCDT1 [R/W] XXXXXXXXX XXXXXXXXX | | Reserved | TCCS1 [R/W] 00000000 | Free Running Timer 1 (ICU 2, ICU 3) |
| 0001F8 _H | TCDT2 [R/W] XXXXXXXXX XXXXXXXXX | | Reserved | TCCS2 [R/W] 00000000 | Free Running Timer 2 (OCU 0, OCU 1) |
| 0001FC _H | TCDT3 [R/W] XXXXXXXXX XXXXXXXXX | | Reserved | TCCS3 [R/W] 00000000 | Free Running Timer 3 (OCU 2, OCU 3) |

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| Address | Register | | | | Block |
|--------------------------------------------------|-----------------------------------------------------|--------------------------|--------------------------------|-------------------------|-----------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000200 _H | DMACA0 [R/W] 00000000 0000XXXX XXXXXXXX XXXXXXXX | | | | DMAC |
| 000204 _H | DMACB0 [R/W] 00000000 00000000 XXXXXXXX XXXXXXXX | | | | |
| 000208 _H | DMACA1 [R/W] 00000000 0000XXXX XXXXXXXX XXXXXXXX | | | | |
| 00020C _H | DMACB1 [R/W] 00000000 00000000 XXXXXXXX XXXXXXXX | | | | |
| 000210 _H | DMACA2 [R/W] 00000000 0000XXXX XXXXXXXX XXXXXXXX | | | | |
| 000214 _H | DMACB2 [R/W] 00000000 00000000 XXXXXXXX XXXXXXXX | | | | |
| 000218 _H | DMACA3 [R/W] 00000000 0000XXXX XXXXXXXX XXXXXXXX | | | | |
| 00021C _H | DMACB3 [R/W] 00000000 00000000 XXXXXXXX XXXXXXXX | | | | |
| 000220 _H | DMACA4 [R/W] 00000000 0000XXXX XXXXXXXX XXXXXXXX | | | | |
| 000224 _H | DMACB4 [R/W] 00000000 00000000 XXXXXXXX XXXXXXXX | | | | |
| 000228 _H to 00023C _H | Reserved | | | | |
| 000240 _H | DMACR [R/W] 00 - - 0000 | Reserved | | | |
| 000244 _H to 0002CC _H | Reserved | | | | Reserved |
| 0002D0 _H | Reserved | ICS045 [R/W] 00000000 | Reserved | ICS67 [R/W] 00000000 | Input Capture 4 to 7 |
| 0002D4 _H | IPCP4 [R] XXXXXXXX XXXXXXXX | | IPCP5 [R] XXXXXXXX XXXXXXXX | | |
| 0002D8 _H | IPCP6 [R] XXXXXXXX XXXXXXXX | | IPCP7 [R] XXXXXXXX XXXXXXXX | | |
| 0002DC _H to 0002EC _H | Reserved | | | | Reserved |
| 0002F0 _H | TCDT4 [R/W] XXXXXXXX XXXXXXXX | | Reserved | TCCS4 [R/W] 00000000 | Free Running Timer 4 (ICU 4, ICU 5) |

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| Address | Register | | | | Block |
|--------------------------------------------------|----------------------------------|--------------------------|---------------------------------|----------------------------|-----------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 0002F4 _H | TCDT5 [R/W] XXXXXXXX XXXXXXXX | | Reserved | TCCS5 [R/W] 00000000 | Free Running Timer 5 (ICU 6, ICU 7) |
| 0002F8 _H | TCDT6 [R/W] XXXXXXXX XXXXXXXX | | Reserved | TCCS6 [R/W] 00000000 | Free Running Timer 6 |
| 0002FC _H | TCDT7 [R/W] XXXXXXXX XXXXXXXX | | Reserved | TCCS7 [R/W] 00000000 | Free Running Timer 7 |
| 000300 _H | Reserved | UDRC0 [W] 00000000 | Reserved | UDCR0 [R] 00000000 | Up/Down Counter 0 |
| 000304 _H | UDCCH0 [R/W] 00000000 | UDCCL0 [R/W] 00001000 | Reserved | UDCS0 [R/W] 00000000 | |
| 000308 _H , 00030C _H | Reserved | | | | Reserved |
| 000310 _H | UDRC3 [W] 00000000 | UDRC2 [W] 00000000 | UDCR3 [R] 00000000 | UDCR2 [R] 00000000 | Up/Down Counter 2 to 3 |
| 000314 _H | UDCCH2 [R/W] 00000000 | UDCCL2 [R/W] 00001000 | Reserved | UDCS2 [R/W] 00000000 | |
| 000318 _H | UDCCH3 [R/W] 00000000 | UDCCL3 [R/W] 00001000 | Reserved | UDCS3 [R/W] 00000000 | |
| 00031C _H | Reserved | | | | Reserved |
| 000320 _H | GCN13 [R/W] 00110010 00010000 | | Reserved | GCN23 [R/W] ---- 0000 | PPG Control 12 to 15 |
| 000324 _H to 00032C _H | Reserved | | | | Reserved |
| 000330 _H | PTMR12 [R] 11111111 11111111 | | PCSR12 [W] XXXXXXXX XXXXXXXX | | PPG 12 |
| 000334 _H | PDUT12 [W] XXXXXXXX XXXXXXXX | | PCNH12 [R/W] 0000000 - | PCNL12 [R/W] 000000 - 0 | |
| 000338 _H | PTMR13 [R] 11111111 11111111 | | PCSR13 [W] XXXXXXXX XXXXXXXX | | PPG 13 |
| 00033C _H | PDUT13 [W] XXXXXXXX XXXXXXXX | | PCNH13 [R/W] 0000000 - | PCNL13 [R/W] 000000 - 0 | |
| 000340 _H | PTMR14 [R] 11111111 11111111 | | PCSR14 [W] XXXXXXXX XXXXXXXX | | PPG 14 |
| 000344 _H | PDUT14 [W] XXXXXXXX XXXXXXXX | | PCNH14 [R/W] 0000000 - | PCNL14 [R/W] 000000 - 0 | |

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| Address | Register | | | | Block |
|--------------------------------------------------|------------------------------------------------------------------------------|--------------------------|---------------------------------|----------------------------|---------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000348 _H | PTMR15 [R] 11111111 11111111 | | PCSR15 [W] XXXXXXXX XXXXXXXX | | PPG 15 |
| 00034C _H | PDUT15 [W] XXXXXXXX XXXXXXXX | | PCNH15 [R/W] 0000000 - | PCNL15 [R/W] 000000 - 0 | |
| 000350 _H to 000364 _H | Reserved | | | | Reserved |
| 000368 _H | IBCR2 [R/W] 00000000 | IBSR2 [R] 00000000 | ITBAH2 [R/W] ----- 00 | ITBAL2 [R/W] 00000000 | I ² C 2 |
| 00036C _H | ITMKH2 [R/W] 00 ---- 11 | ITMKL2 [R/W] 11111111 | ISMK2 [R/W] 01111111 | ISBA2 [R/W] - 0000000 | |
| 000370 _H | Reserved | IDAR2 [R/W] 00000000 | ICCR2 [R/W] 00011111 | Reserved | |
| 000374 _H | IBCR3 [R/W] 00000000 | IBSR3 [R] 00000000 | ITBAH3 [R/W] ----- 00 | ITBAL3 [R/W] 00000000 | I ² C 3 |
| 000378 _H | ITMKH3 [R/W] 00 ---- 11 | ITMKL3 [R/W] 11111111 | ISMK3 [R/W] 01111111 | ISBA3 [R/W] - 0000000 | |
| 00037C _H | Reserved | IDAR3 [R/W] 00000000 | ICCR3 [R/W] 00011111 | Reserved | |
| 000380 _H to 00038C _H | Reserved | | | | Reserved |
| 000390 _H | ROMS [R] 11111111 00000000 (CY91F467Dx) 11111111 01000011 (CY91F465DA) | | Reserved | | ROM Select Register |
| 000394 _H to 0003EC _H | Reserved | | | | Reserved |
| 0003F0 _H | BSD0 [W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | Bit Search Module |
| 0003F4 _H | BSD1 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 0003F8 _H | BSDC [W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 0003FC _H | BSRR [R] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 000400 _H to 00043C _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|---------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000440 _H | ICR00 [R/W] ---11111 | ICR01 [R/W] ---11111 | ICR02 [R/W] ---11111 | ICR03 [R/W] ---11111 | Interrupt Controller |
| 000444 _H | ICR04 [R/W] ---11111 | ICR05 [R/W] ---11111 | ICR06 [R/W] ---11111 | ICR07 [R/W] ---11111 | |
| 000448 _H | ICR08 [R/W] ---11111 | ICR09 [R/W] ---11111 | ICR10 [R/W] ---11111 | ICR11 [R/W] ---11111 | |
| 00044C _H | ICR12 [R/W] ---11111 | ICR13 [R/W] ---11111 | ICR14 [R/W] ---11111 | ICR15 [R/W] ---11111 | |
| 000450 _H | ICR16 [R/W] ---11111 | ICR17 [R/W] ---11111 | ICR18 [R/W] ---11111 | ICR19 [R/W] ---11111 | |
| 000454 _H | ICR20 [R/W] ---11111 | ICR21 [R/W] ---11111 | ICR22 [R/W] ---11111 | ICR23 [R/W] ---11111 | |
| 000458 _H | ICR24 [R/W] ---11111 | ICR25 [R/W] ---11111 | ICR26 [R/W] ---11111 | ICR27 [R/W] ---11111 | |
| 00045C _H | ICR28 [R/W] ---11111 | ICR29 [R/W] ---11111 | ICR30 [R/W] ---11111 | ICR31 [R/W] ---11111 | |
| 000460 _H | ICR32 [R/W] ---11111 | ICR33 [R/W] ---11111 | ICR34 [R/W] ---11111 | ICR35 [R/W] ---11111 | |
| 000464 _H | ICR36 [R/W] ---11111 | ICR37 [R/W] ---11111 | ICR38 [R/W] ---11111 | ICR39 [R/W] ---11111 | |
| 000468 _H | ICR40 [R/W] ---11111 | ICR41 [R/W] ---11111 | ICR42 [R/W] ---11111 | ICR43 [R/W] ---11111 | |
| 00046C _H | ICR44 [R/W] ---11111 | ICR45 [R/W] ---11111 | ICR46 [R/W] ---11111 | ICR47 [R/W] ---11111 | |
| 000470 _H | ICR48 [R/W] ---11111 | ICR49 [R/W] ---11111 | ICR50 [R/W] ---11111 | ICR51 [R/W] ---11111 | |
| 000474 _H | ICR52 [R/W] ---11111 | ICR53 [R/W] ---11111 | ICR54 [R/W] ---11111 | ICR55 [R/W] ---11111 | |
| 000478 _H | ICR56 [R/W] ---11111 | ICR57 [R/W] ---11111 | ICR58 [R/W] ---11111 | ICR59 [R/W] ---11111 | |
| 00047C _H | ICR60 [R/W] ---11111 | ICR61 [R/W] ---11111 | ICR62 [R/W] ---11111 | ICR63 [R/W] ---11111 | |
| 000480 _H | RSRR [R/W] 10000000 | STCR [R/W] 00110011 | TBCR [R/W] 00XXX - 00 | CTBR [W] XXXXXXXXXX | Clock Control |
| 000484 _H | CLKR [R/W] ---- 0000 | WPR [W] XXXXXXXXXX | DIVR0 [R/W] 00000011 | DIVR1 [R/W] 00000000 | |
| 000488 _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|--------------------------------------------------|-----------------------------------|--------------------------------------------|--------------------------------------|-----------------------------|------------------------------------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00048C _H | PLLDIVM [R/W] ---- 0000 | PLLDIVN [R/W] -- 000000 | PLLDIVG [R/W] ---- 0000 | PLLMULG [W] 00000000 | PLL Interface |
| 000490 _H | PLLCTRL [R/W] ---- 0000 | Reserved | | | |
| 000494 _H | OSCC1 [R/W] ----- 010 | OSCS1 [R/W] 00001111 | OSCC2 [R/W] ----- 010 | OSCS2 [R/W] 00001111 | Main/Sub Oscillator Control |
| 000498 _H | PORTEN [R/W] ----- 00 | Reserved | | | Port Input Enable Control |
| 00049C _H | Reserved | | | | Reserved |
| 0004A0 _H | Reserved | WT CER [R/W] ----- 00 | WT CR [R/W] 00000000 000 - 00 - 0 | | Real Time Clock (Watch Timer) |
| 0004A4 _H | Reserved | WT BR [R/W] --- XXXXX XXXXXXXX XXXXXXXX | | | |
| 0004A8 _H | WT HR [R/W] --- 00000 | WT MR [R/W] -- 000000 | WT SR [R/W] -- 000000 | Reserved | |
| 0004AC _H | CSVTR [R/W] --- 00010 | CSVCR [R/W] 00011100 | CSCFG [R/W] 0X000000 | CMCFG [R/W] 00000000 | Clock- Supervisor / Selector / Monitor |
| 0004B0 _H | CUCR [R/W] ----- 0 -- 00 | | CUTD [R/W] 10000000 00000000 | | Calibration of Sub Clock |
| 0004B4 _H | CUTR1 [R] ----- 00000000 | | CUTR2 [R] 00000000 00000000 | | |
| 0004B8 _H | CMPR [R/W] -- 000010 11111101 | | Reserved | CMCR [R/W] - 001 -- 00 | Clock Modulator |
| 0004BC _H | CMT1 [R/W] 00000000 1 --- 0000 | | CMT2 [R/W] -- 000000 -- 000000 | | |
| 0004C0 _H | CANPRE [R/W] 0 --- 0000 | CANCKD [R/W] ----- 000*1 | Reserved | | CAN Clock Control |
| 0004C4 _H | LVSEL [R/W] 00000111 | LVDET [R/W] 0000 0 - 00 | HWVDE [R/W] ----- 00 | HWWD [R/W, W] 00011000 | Low Voltage Detection/Hardware Watchdog |
| 0004C8 _H | OSCRH [R/W] 000 -- 001 | OSCRL [R/W] ----- 000 | WPCRH [R/W] 00 --- 000 | WPCRL [R/W] ----- 00 | Main-/Sub-Oscillation Stabilisation Timer |
| 0004CC _H | OSCCR [R/W] ----- 0 | Reserved | REGSEL [R/W] -- 000100 | REGCTR [R/W] --- 0 -- 00 | Main- Oscillation Standby Control Main-/Sub regulator Control |
| 0004D0 _H to 00063C _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|--------------------------------------------------|---------------------------------|-------------------------|-----------------------------------|--------------------------|---------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000640 _H | ASR0 [R/W] 00000000 00000000 | | ACR0 [R/W] 1111**00 00100000*2 | | External Bus |
| 000644 _H | ASR1 [R/W] XXXXXXXX XXXXXXXX | | ACR1 [R/W] XXXXXXXX XXXXXXXX | | |
| 000648 _H | ASR2 [R/W] XXXXXXXX XXXXXXXX | | ACR2 [R/W] XXXXXXXX XXXXXXXX | | |
| 00064C _H | ASR3 [R/W] XXXXXXXX XXXXXXXX | | ACR3 [R/W] XXXXXXXX XXXXXXXX | | |
| 000650 _H | ASR4 [R/W] XXXXXXXX XXXXXXXX | | ACR4 [R/W] XXXXXXXX XXXXXXXX | | |
| 000654 _H | ASR5 [R/W] XXXXXXXX XXXXXXXX | | ACR5 [R/W] XXXXXXXX XXXXXXXX | | |
| 000658 _H | ASR6 [R/W] XXXXXXXX XXXXXXXX | | ACR6 [R/W] XXXXXXXX XXXXXXXX | | |
| 00065C _H | ASR7 [R/W] XXXXXXXX XXXXXXXX | | ACR7 [R/W] XXXXXXXX XXXXXXXX | | |
| 000660 _H | AWR0 [R/W] 01001111 11111011 | | AWR1 [R/W] XXXXXXXX XXXXXXXX | | |
| 000664 _H | AWR2 [R/W] XXXXXXXX XXXXXXXX | | AWR3 [R/W] XXXXXXXX XXXXXXXX | | |
| 000668 _H | AWR4 [R/W] XXXXXXXX XXXXXXXX | | AWR5 [R/W] XXXXXXXX XXXXXXXX | | |
| 00066C _H | AWR6 [R/W] XXXXXXXX XXXXXXXX | | AWR7 [R/W] XXXXXXXX XXXXXXXX | | |
| 000670 _H | MCRA [R/W] XXXXXXXX | MCRB [R/W] XXXXXXXX | Reserved | | |
| 000674 _H | Reserved | | | | |
| 000678 _H | IORW0 [R/W] XXXXXXXX | IORW1 [R/W] XXXXXXXX | IORW2 [R/W] XXXXXXXX | Reserved | |
| 00067C _H | Reserved | | | | |
| 000680 _H | CSER [R/W] 00000001 | CHER [R/W] 11111111 | Reserved | TCR [R/W] 0000**** *3 | |
| 000684 _H | RCRH [R/W] 00XXXXXX | RCRL [R/W] XXXX0XXX | Reserved | | |
| 000688 _H to 0007F8 _H | Reserved | | | | |
| 0007FC _H | Reserved | MODR [W] XXXXXXXX | Reserved | | Mode Register |

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| Address | Register | | | | Block |
|--------------------------------------------------|-------------------------|---------------------------|------------------------------|----------------------------|-----------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000800 _H to 000CFC _H | Reserved | | | | Reserved |
| 000D00 _H | PDRD00 [R] XXXXXXXX | PDRD01 [R] XXXXXXXX | PDRD02 [R] XXXXXXXX | PDRD03 [R] XXXXXXXX | R-bus Port Data Direct Read Register |
| 000D04 _H | PDRD04 [R] -----XX | PDRD05 [R] XXXXXXXX | PDRD06 [R] XXXXXXXX | PDRD07 [R] XXXXXXXX | |
| 000D08 _H | PDRD08 [R] XXXXXXXX | PDRD09 [R] XX -- XXXX | PDRD10 [R] - XXXXXX - | Reserved | |
| 000D0C _H | Reserved | PDRD13 [R] -----XXX | PDRD14 [R] XXXXXXXX | PDRD15 [R] ---- XXXX | |
| 000D10 _H | PDRD16 [R] XXXXXXXX | PDRD17 [R] XXXX ---- | PDRD18 [R] - XXX - XXX | PDRD19 [R] - XXX - XXX | |
| 000D14 _H | PDRD20 [R] -----XXX | Reserved | PDRD22 [R] -- XX - X - X | PDRD23 [R] -- XXXXXX | |
| 000D18 _H | PDRD24 [R] XXXXXXXX | PDRD25 [R] XXXXXXXX | PDRD26 [R] XXXXXXXX | PDRD27 [R] XXXXXXXX | |
| 000D1C _H | Reserved | PDRD29 [R] XXXXXXXX | Reserved | | |
| 000D20 _H to 000D3C _H | Reserved | | | | Reserved |
| 000D40 _H | DDR00 [R/W] 00000000 | DDR01 [R/W] 00000000 | DDR02 [R/W] 00000000 | DDR03 [R/W] 00000000 | R-bus Port Direction Register |
| 000D44 _H | DDR04 [R/W] -----00 | DDR05 [R/W] 00000000 | DDR06 [R/W] 00000000 | DDR07 [R/W] 00000000 | |
| 000D48 _H | DDR08 [R/W] 00000000 | DDR09 [R/W] 00 -- 0000 | DDR10 [R/W] - 000000 - | Reserved | |
| 000D4C _H | Reserved | DDR13 [R/W] -----000 | DDR14 [R/W] 00000000 | DDR15 [R/W] ---- 0000 | |
| 000D50 _H | DDR16 [R/W] 00000000 | DDR17 [R/W] 0000 ---- | DDR18 [R/W] - 000 - 000 | DDR19 [R/W] - 000 - 000 | |
| 000D54 _H | DDR20 [R/W] -----000 | Reserved | DDR22 [R/W] -- 00 - 0 - 0 | DDR23 [R/W] -- 000000 | |
| 000D58 _H | DDR24 [R/W] 00000000 | DDR25 [R/W] 00000000 | DDR26 [R/W] 00000000 | DDR27 [R/W] 00000000 | |
| 000D5C _H | Reserved | DDR29 [R/W] 00000000 | Reserved | | |
| 000D60 _H to 000D7C _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|--------------------------------------------------|----------------------------|----------------------------|------------------------------|------------------------------|------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000D80 _H | PFR00 [R/W] 11111111 | PFR01 [R/W] 11111111 | PFR02 [R/W] 11111111 | PFR03 [R/W] 11111111 | R-bus Port Function Register |
| 000D84 _H | PFR04 [R/W] ----- 11 | PFR05 [R/W] 11111111 | PFR06 [R/W] 11111111 | PFR07 [R/W] 11111111 | |
| 000D88 _H | PFR08 [R/W] 11111111 | PFR09 [R/W] 11 -- 1111 | PFR10 [R/W] - 111111 - | Reserved | |
| 000D8C _H | Reserved | PFR13 [R/W] ----- 000 | PFR14 [R/W] 00000000 | PFR15 [R/W] ---- 0000 | |
| 000D90 _H | PFR16 [R/W] 00000000 | PFR17 [R/W] 0000 ---- | PFR18 [R/W] - 000 - 000 | PFR19 [R/W] - 000 - 000 | |
| 000D94 _H | PFR20 [R/W] ----- 000 | Reserved | PFR22 [R/W] -- 00 - 0 - 0 | PFR23 [R/W] -- 000000 | |
| 000D98 _H | PFR24 [R/W] 00000000 | PFR25 [R/W] 00000000 | PFR26 [R/W] 00000000 | PFR27 [R/W] 00000000 | |
| 000D9C _H | Reserved | PFR29 [R/W] 00000000 | Reserved | | |
| 000DA0 _H to 000DBC _H | Reserved | | | | Reserved |
| 000DC0 _H | EPFR00 [R/W] ----- | EPFR01 [R/W] ----- | EPFR02 [R/W] ----- | EPFR03 [R/W] ----- | R-bus Extra Port Function Register |
| 000DC4 _H | EPFR04 [R/W] ----- | EPFR05 [R/W] ----- | EPFR06 [R/W] ----- | EPFR07 [R/W] ----- | |
| 000DC8 _H | EPFR08 [R/W] ----- | EPFR09 [R/W] ----- | EPFR10 [R/W] -- 00 ---- | Reserved | |
| 000DCC _H | Reserved | EPFR13 [R/W] ----- 0 -- | EPFR14 [R/W] 00000000 | EPFR15 [R/W] ---- 0000 | |
| 000DD0 _H | EPFR16 [R/W] 0000 ---- | EPFR17 [R/W] ----- | EPFR18 [R/W] - 00 -- 00 - | EPFR19 [R/W] - 0 --- 0 -- | |
| 000DD4 _H | EPFR20 [R/W] ----- 00 - | Reserved | EPFR22 [R/W] ----- | EPFR23 [R/W] ----- | |
| 000DD8 _H | EPFR24 [R/W] ----- | EPFR25 [R/W] ----- | EPFR26 [R/W] 00000000 | EPFR27 [R/W] 00000000 | |
| 000DDC _H | Reserved | EPFR29 [R/W] ----- | Reserved | | |
| 000DE0 _H to 000DFC _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|--------------------------------------------------|---------------------------|----------------------------|-------------------------------|-----------------------------|-----------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000E00 _H | PODR00 [R/W] 00000000 | PODR01 [R/W] 00000000 | PODR02 [R/W] 00000000 | PODR03 [R/W] 00000000 | R-bus Port Output Drive Select Register |
| 000E04 _H | PODR04 [R/W] ----- 00 | PODR05 [R/W] 00000000 | PODR06 [R/W] 00000000 | PODR07 [R/W] 00000000 | |
| 000E08 _H | PODR08 [R/W] 00000000 | PODR09 [R/W] 00 -- 0000 | PODR10 [R/W] - 000000 - | Reserved | |
| 000E0C _H | Reserved | PODR13 [R/W] ----- 000 | PODR14 [R/W] 00000000 | PODR15 [R/W] ---- 0000 | |
| 000E10 _H | PODR16 [R/W] 00000000 | PODR17 [R/W] 0000 ---- | PODR18 [R/W] - 000 - 000 | PODR19 [R/W] - 000 - 000 | |
| 000E14 _H | PODR20 [R/W] ----- 000 | Reserved | PODR22 [R/W] -- 00 - 0 - 0 | PODR23 [R/W] -- 000000 | |
| 000E18 _H | PODR24 [R/W] 00000000 | PODR25 [R/W] 00000000 | PODR26 [R/W] 00000000 | PODR27 [R/W] 00000000 | |
| 000E1C _H | Reserved | PODR29 [R/W] 00000000 | Reserved | | |
| 000E20 _H to 000E3C _H | Reserved | | | | Reserved |
| 000E40 _H | PILR00 [R/W] 00000000 | PILR01 [R/W] 00000000 | PILR02 [R/W] 00000000 | PILR03 [R/W] 00000000 | R-bus Port Input Level Select Register |
| 000E44 _H | PILR04 [R/W] ----- 00 | PILR05 [R/W] 00000000 | PILR06 [R/W] 00000000 | PILR07 [R/W] 00000000 | |
| 000E48 _H | PILR08 [R/W] 00000000 | PILR09 [R/W] 00 -- 0000 | PILR10 [R/W] - 000000 - | Reserved | |
| 000E4C _H | Reserved | PILR13 [R/W] ----- 000 | PILR14 [R/W] 00000000 | PILR15 [R/W] ---- 0000 | |
| 000E50 _H | PILR16 [R/W] 00000000 | PILR17 [R/W] 0000 ---- | PILR18 [R/W] - 000 - 000 | PILR19 [R/W] - 000 - 000 | |
| 000E54 _H | PILR20 [R/W] ----- 000 | Reserved | PILR22 [R/W] -- 00 - 0 - 0 | PILR23 [R/W] -- 000000 | |
| 000E58 _H | PILR24 [R/W] 00000000 | PILR25 [R/W] 00000000 | PILR26 [R/W] 00000000 | PILR27 [R/W] 00000000 | |
| 000E5C _H | Reserved | PILR29 [R/W] 00000000 | Reserved | | |
| 000E60 _H to 000E7C _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|--------------------------------------------------|----------------------------|-----------------------------|--------------------------------|------------------------------|----------------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000E80 _H | EPILR00 [R/W] 00000000 | EPILR01 [R/W] 00000000 | EPILR02 [R/W] 00000000 | EPILR03 [R/W] 00000000 | R-bus Extra Port Input Level Select Register |
| 000E84 _H | EPILR04 [R/W] ----- 00 | EPILR05 [R/W] 00000000 | EPILR06 [R/W] 00000000 | EPILR07 [R/W] 00000000 | |
| 000E88 _H | EPILR08 [R/W] 00000000 | EPILR09 [R/W] 00 -- 0000 | EPILR10 [R/W] - 000000 - | Reserved | |
| 000E8C _H | Reserved | EPILR13 [R/W] ----- 000 | EPILR14 [R/W] 00000000 | EPILR15 [R/W] ---- 0000 | |
| 000E90 _H | EPILR16 [R/W] 00000000 | EPILR17 [R/W] 0000 ---- | EPILR18 [R/W] - 000 - 000 | EPILR19 [R/W] - 000 - 000 | |
| 000E94 _H | EPILR20 [R/W] ----- 000 | Reserved | EPILR22 [R/W] -- 00 - 0 - 0 | EPILR23 [R/W] -- 000000 | |
| 000E98 _H | EPILR24 [R/W] 00000000 | EPILR25 [R/W] 00000000 | EPILR26 [R/W] 00000000 | EPILR27 [R/W] 00000000 | |
| 000E9C _H | Reserved | EPILR29 [R/W] 00000000 | Reserved | | |
| 000EA0 _H to 000EBC _H | Reserved | | | | Reserved |
| 000EC0 _H | PPER00 [R/W] 00000000 | PPER01 [R/W] 00000000 | PPER02 [R/W] 00000000 | PPER03 [R/W] 00000000 | R-bus Port Pull-Up/Down Enable Register |
| 000EC4 _H | PPER04 [R/W] ----- 00 | PPER05 [R/W] 00000000 | PPER06 [R/W] 00000000 | PPER07 [R/W] 00000000 | |
| 000EC8 _H | PPER08 [R/W] 00000000 | PPER09 [R/W] 00 -- 0000 | PPER10 [R/W] - 000000 - | Reserved | |
| 000ECC _H | Reserved | PPER13 [R/W] ----- 000 | PPER14 [R/W] 00000000 | PPER15 [R/W] ---- 0000 | |
| 000ED0 _H | PPER16 [R/W] 00000000 | PPER17 [R/W] 0000 ---- | PPER18 [R/W] - 000 - 000 | PPER19 [R/W] - 000 - 000 | |
| 000ED4 _H | PPER20 [R/W] ----- 000 | Reserved | PPER22 [R/W] -- 00 - 0 - 0 | PPER23 [R/W] -- 000000 | |
| 000ED8 _H | PPER24 [R/W] 00000000 | PPER25 [R/W] 00000000 | PPER26 [R/W] 00000000 | PPER27 [R/W] 00000000 | |
| 000EDC _H | Reserved | PPER29 [R/W] 00000000 | Reserved | | |
| 000EE0 _H to 000EFC _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|--------------------------------------------------|--------------------------------------------------------------|----------------------------|-------------------------------|-----------------------------|------------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 000F00 _H | PPCR00 [R/W] 11111111 | PPCR01 [R/W] 11111111 | PPCR02 [R/W] 11111111 | PPCR03 [R/W] 11111111 | R-bus Port Pull-Up/Down Control Register |
| 000F04 _H | PPCR04 [R/W] ----- 11 | PPCR05 [R/W] 11111111 | PPCR06 [R/W] 11111111 | PPCR07 [R/W] 11111111 | |
| 000F08 _H | PPCR08 [R/W] 11111111 | PPCR09 [R/W] 11 -- 1111 | PPCR10 [R/W] - 111111 - | Reserved | |
| 000F0C _H | Reserved | PPCR13 [R/W] ----- 111 | PPCR14 [R/W] 11111111 | PPCR15 [R/W] ---- 1111 | |
| 000F10 _H | PPCR16 [R/W] 11111111 | PPCR17 [R/W] 1111 ---- | PPCR18 [R/W] - 111 - 111 | PPCR19 [R/W] - 111 - 111 | |
| 000F14 _H | PPCR20 [R/W] ----- 111 | Reserved | PPCR22 [R/W] -- 11 - 1 - 1 | PPCR23 [R/W] -- 111111 | |
| 000F18 _H | PPCR24 [R/W] 11111111 | PPCR25 [R/W] 11111111 | PPCR26 [R/W] 11111111 | PPCR27 [R/W] 11111111 | |
| 000F1C _H | Reserved | PPCR29 [R/W] 11111111 | Reserved | | |
| 000F20 _H to 000F3C _H | Reserved | | | | Reserved |
| 001000 _H | DMASA0 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | DMAC |
| 001004 _H | DMADA0 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 001008 _H | DMASA1 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 00100C _H | DMADA1 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 001010 _H | DMASA2 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 001014 _H | DMADA2 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 001018 _H | DMASA3 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 00101C _H | DMADA3 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 001020 _H | DMASA4 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 001024 _H | DMADA4 [R/W] XXXXXXXX XXXXXXXXXXX XXXXXXXXXXX XXXXXXXXXXX | | | | |
| 001028 _H to 001FFC _H | Reserved | | | | Reserved |

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| Address | Register | | | | Block |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------------------|-------------------------|------------------------------------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00200 _H to 006FFC _H | CY91F467Dx Flash-cache size is 8 Kbytes : 004000 _H to 005FFC _H CY91F465DA Flash-cache size is 8 Kbytes : 004000 _H to 005FFC _H | | | | Flash-cache / I-RAM area |
| 007000 _H | FMCS [R/W] 01101000 | FMCR [R] --- 00000 | FCHCR [R/W] ----- 00 10000011 | | Flash Memory/ Flash-cache/ I-RAM Control Register |
| 007004 _H | FMWT [R/W] 11111111 11111111 | | FMWT2 [R] - 001 ---- | FMPS [R/W] ----- 000 | |
| 007008 _H | FMAC [R] 00000000 00000000 00000000 00000000 | | | | |
| 00700C _H | FCHA0 [R/W] ----- --- 00000 00000000 00000000 | | | | Flash-cache Non-cacheable area setting Register |
| 007010 _H | FCHA1 [R/W] ----- --- 00000 00000000 00000000 | | | | |
| 007014 _H to 007FFC _H | Reserved | | | | Reserved |
| 008000 _H to 00BFFC _H | CY91F467Dx Boot-ROM size is 4 Kbytes : 00B000 _H to 00BFFC _H CY91F465DA Boot-ROM size is 4 Kbytes : 00B000 _H to 00BFFC _H (instruction access is 1 wait cycle, data access is 1 wait cycle) | | | | Boot ROM area |
| 00C000 _H | CTRLR0 [R/W] 00000000 00000001 | | STATR0 [R/W] 00000000 00000000 | | CAN 0 Control Register |
| 00C004 _H | ERRCNT0 [R] 00000000 00000000 | | BTR0 [R/W] 00100011 00000001 | | |
| 00C008 _H | INTR0 [R] 00000000 00000000 | | TESTR0 [R/W] 00000000 X0000000 | | |
| 00C00C _H | BRPE0 [R/W] 00000000 00000000 | | Reserved | | |
| 00C010 _H | IF1CREQ0 [R/W] 00000000 00000001 | | IF1CMSK0 [R/W] 00000000 00000000 | | CAN 0 IF 1 Register |
| 00C014 _H | IF1MSK20 [R/W] 11111111 11111111 | | IF1MSK10 [R/W] 11111111 11111111 | | |
| 00C018 _H | IF1ARB20 [R/W] 00000000 00000000 | | IF1ARB10 [R/W] 00000000 00000000 | | |
| 00C01C _H | IF1MCTR0 [R/W] 00000000 00000000 | | Reserved | | |

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| Address | Register | | | | Block |
|--------------------------------------------------|-------------------------------------|-----|-------------------------------------|-----|------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00C020 _H | IF1DTA10 [R/W] 00000000 00000000 | | IF1DTA20 [R/W] 00000000 00000000 | | CAN 0 IF 1 Register |
| 00C024 _H | IF1DTB10 [R/W] 00000000 00000000 | | IF1DTB20 [R/W] 00000000 00000000 | | |
| 00C028 _H , 00C02C _H | Reserved | | | | |
| 00C030 _H | IF1DTA20 [R/W] 00000000 00000000 | | IF1DTA10 [R/W] 00000000 00000000 | | |
| 00C034 _H | IF1DTB20 [R/W] 00000000 00000000 | | IF1DTB10 [R/W] 00000000 00000000 | | |
| 00C038 _H , 00C03C _H | Reserved | | | | |
| 00C040 _H | IF2CREQ0 [R/W] 00000000 00000001 | | IF2CMSK0 [R/W] 00000000 00000000 | | CAN 0 IF 2 Register |
| 00C044 _H | IF2MSK20 [R/W] 11111111 11111111 | | IF2MSK10 [R/W] 11111111 11111111 | | |
| 00C048 _H | IF2ARB20 [R/W] 00000000 00000000 | | IF2ARB10 [R/W] 00000000 00000000 | | |
| 00C04C _H | IF2MCTR0 [R/W] 00000000 00000000 | | Reserved | | |
| 00C050 _H | IF2DTA10 [R/W] 00000000 00000000 | | IF2DTA20 [R/W] 00000000 00000000 | | |
| 00C054 _H | IF2DTB10 [R/W] 00000000 00000000 | | IF2DTB20 [R/W] 00000000 00000000 | | |
| 00C058 _H , 00C05C _H | Reserved | | | | |
| 00C060 _H | IF2DTA20 [R/W] 00000000 00000000 | | IF2DTA10 [R/W] 00000000 00000000 | | |
| 00C064 _H | IF2DTB20 [R/W] 00000000 00000000 | | IF2DTB10 [R/W] 00000000 00000000 | | |
| 00C068 _H to 00C07C _H | Reserved | | | | |

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| Address | Register | | | | Block |
|--------------------------------------------------|-------------------------------------|-----|-------------------------------------|-----|------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00C080 _H | TREQR20 [R] 00000000 00000000 | | TREQR10 [R] 00000000 00000000 | | CAN 0 Status Flags |
| 00C084 _H to 00C08C _H | Reserved | | | | |
| 00C090 _H | NEWDT20 [R] 00000000 00000000 | | NEWDT10 [R] 00000000 00000000 | | |
| 00C094 _H to 00C09C _H | Reserved | | | | |
| 00C0A0 _H | INTPND20 [R] 00000000 00000000 | | INTPND10 [R] 00000000 00000000 | | |
| 00C0A4 _H to 00C0AC _H | Reserved | | | | |
| 00C0B0 _H | MSGVAL20 [R] 00000000 00000000 | | MSGVAL10 [R] 00000000 00000000 | | |
| 00C0B4 _H to 00C0FC _H | Reserved | | | | Reserved |
| 00C100 _H | CTRLR1 [R/W] 00000000 00000001 | | STATR1 [R/W] 00000000 00000000 | | CAN 1 Control Register |
| 00C104 _H | ERRCNT1 [R] 00000000 00000000 | | BTR1 [R/W] 00100011 00000001 | | |
| 00C108 _H | INTR1 [R] 00000000 00000000 | | TESTR1 [R/W] 00000000 X0000000 | | |
| 00C10C _H | BRPE1 [R/W] 00000000 00000000 | | Reserved | | |
| 00C110 _H | IF1CREQ1 [R/W] 00000000 00000001 | | IF1CMSK1 [R/W] 00000000 00000000 | | CAN 1 IF 1 Register |
| 00C114 _H | IF1MSK21 [R/W] 11111111 11111111 | | IF1MSK11 [R/W] 11111111 11111111 | | |
| 00C118 _H | IF1ARB21 [R/W] 00000000 00000000 | | IF1ARB11 [R/W] 00000000 00000000 | | |
| 00C11C _H | IF1MCTR1 [R/W] 00000000 00000000 | | Reserved | | |
| 00C120 _H | IF1DTA11 [R/W] 00000000 00000000 | | IF1DTA21 [R/W] 00000000 00000000 | | |
| 00C124 _H | IF1DTB11 [R/W] 00000000 00000000 | | IF1DTB21 [R/W] 00000000 00000000 | | |

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| Address | Register | | | | Block |
|--------------------------------------------------|-------------------------------------|-----|-------------------------------------|-----|------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00C128 _H , 00C12C _H | Reserved | | | | CAN 1 IF 1 Register |
| 00C130 _H | IF1DTA21 [R/W] 00000000 00000000 | | IF1DTA11 [R/W] 00000000 00000000 | | |
| 00C134 _H | IF1DTB21 [R/W] 00000000 00000000 | | IF1DTB11 [R/W] 00000000 00000000 | | |
| 00C138 _H , 00C13C _H | Reserved | | | | |
| 00C140 _H | IF2CREQ1 [R/W] 00000000 00000001 | | IF2CMSK1 [R/W] 00000000 00000000 | | CAN 1 IF 2 Register |
| 00C144 _H | IF2MSK21 [R/W] 11111111 11111111 | | IF2MSK11 [R/W] 11111111 11111111 | | |
| 00C148 _H | IF2ARB21 [R/W] 00000000 00000000 | | IF2ARB11 [R/W] 00000000 00000000 | | |
| 00C14C _H | IF2MCTR1 [R/W] 00000000 00000000 | | Reserved | | |
| 00C150 _H | IF2DTA11 [R/W] 00000000 00000000 | | IF2DTA21 [R/W] 00000000 00000000 | | |
| 00C154 _H | IF2DTB11 [R/W] 00000000 00000000 | | IF2DTB21 [R/W] 00000000 00000000 | | |
| 00C158 _H , 00C15C _H | Reserved | | | | |
| 00C160 _H | IF2DTA21 [R/W] 00000000 00000000 | | IF2DTA11 [R/W] 00000000 00000000 | | |
| 00C164 _H | IF2DTB21 [R/W] 00000000 00000000 | | IF2DTB11 [R/W] 00000000 00000000 | | |
| 00C168 _H to 00C17C _H | Reserved | | | | |
| 00C180 _H | TREQR21 [R] 00000000 00000000 | | TREQR11 [R] 00000000 00000000 | | CAN 1 Status Flags |
| 00C184 _H to 00C18C _H | Reserved | | | | |
| 00C190 _H | NEWDT21 [R] 00000000 00000000 | | NEWDT11 [R] 00000000 00000000 | | |
| 00C194 _H to 00C19C _H | Reserved | | | | |

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| Address | Register | | | | Block |
|--------------------------------------------------|-------------------------------------|-----|-------------------------------------|-----|------------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00C1A0 _H | INTPND21 [R] 00000000 00000000 | | INTPND11 [R] 00000000 00000000 | | CAN 1 Status Flags |
| 00C1A4 _H to 00C1AC _H | Reserved | | | | |
| 00C1B0 _H | MSGVAL21 [R] 00000000 00000000 | | MSGVAL11 [R] 00000000 00000000 | | |
| 00C1B4 _H to 00C1FC _H | Reserved | | | | |
| 00C200 _H | CTRLR2 [R/W] 00000000 00000001 | | STATR2 [R/W] 00000000 00000000 | | CAN 2 Control Register |
| 00C204 _H | ERRCNT2 [R] 00000000 00000000 | | BTR2 [R/W] 00100011 00000001 | | |
| 00C208 _H | INTR2 [R] 00000000 00000000 | | TESTR2 [R/W] 00000000 X0000000 | | |
| 00C20C _H | BRPE2 [R/W] 00000000 00000000 | | Reserved | | |
| 00C210 _H | IF1CREQ2 [R/W] 00000000 00000001 | | IF1CMSK2 [R/W] 00000000 00000000 | | CAN 2 IF 1 Register |
| 00C214 _H | IF1MSK22 [R/W] 11111111 11111111 | | IF1MSK12 [R/W] 11111111 11111111 | | |
| 00C218 _H | IF1ARB22 [R/W] 00000000 00000000 | | IF1ARB12 [R/W] 00000000 00000000 | | |
| 00C21C _H | IF1MCTR2 [R/W] 00000000 00000000 | | Reserved | | |
| 00C220 _H | IF1DTA12 [R/W] 00000000 00000000 | | IF1DTA22 [R/W] 00000000 00000000 | | |
| 00C224 _H | IF1DTB12 [R/W] 00000000 00000000 | | IF1DTB22 [R/W] 00000000 00000000 | | |
| 00C228 _H , 00C22C _H | Reserved | | | | |
| 00C230 _H | IF1DTA22 [R/W] 00000000 00000000 | | IF1DTA12 [R/W] 00000000 00000000 | | |
| 00C234 _H | IF1DTB22 [R/W] 00000000 00000000 | | IF1DTB12 [R/W] 00000000 00000000 | | |
| 00C238 _H , 00C23C _H | Reserved | | | | |

(Continued)

(Continued)

| Address | Register | | | | Block |
|--------------------------------------------------|-------------------------------------|-----|-------------------------------------|-----|------------------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00C240 _H | IF2CREQ2 [R/W] 00000000 00000001 | | IF2CMSK2 [R/W] 00000000 00000000 | | CAN 2 IF 2 Register |
| 00C244 _H | IF2MSK22 [R/W] 11111111 11111111 | | IF2MSK12 [R/W] 11111111 11111111 | | |
| 00C248 _H | IF2ARB22 [R/W] 00000000 00000000 | | IF2ARB12 [R/W] 00000000 00000000 | | |
| 00C24C _H | IF2MCTR2 [R/W] 00000000 00000000 | | Reserved | | |
| 00C250 _H | IF2DTA12 [R/W] 00000000 00000000 | | IF2DTA22 [R/W] 00000000 00000000 | | |
| 00C254 _H | IF2DTB12 [R/W] 00000000 00000000 | | IF2DTB22 [R/W] 00000000 00000000 | | |
| 00C258 _H , 00C25C _H | Reserved | | | | |
| 00C260 _H | IF2DTA22 [R/W] 00000000 00000000 | | IF2DTA12 [R/W] 00000000 00000000 | | |
| 00C264 _H | IF2DTB22 [R/W] 00000000 00000000 | | IF2DTB12 [R/W] 00000000 00000000 | | |
| 00C268 _H to 00C27C _H | Reserved | | | | |
| 00C280 _H | TREQR22 [R] 00000000 00000000 | | TREQR12 [R] 00000000 00000000 | | CAN 2 Status Flags |
| 00C284 _H to 00C28C _H | Reserved | | | | |
| 00C290 _H | NEWDT22 [R] 00000000 00000000 | | NEWDT12 [R] 00000000 00000000 | | |
| 00C294 _H to 00C29C _H | Reserved | | | | |
| 00C2A0 _H | INTPND22 [R] 00000000 00000000 | | INTPND12 [R] 00000000 00000000 | | |
| 00C2A4 _H to 00C2AC _H | Reserved | | | | |
| 00C2B0 _H | MSGVAL22 [R] 00000000 00000000 | | MSGVAL12 [R] 00000000 00000000 | | |

(Continued)

(Continued)

| Address | Register | | | | Block |
|--------------------------------------------------|---------------------------------------------------|-----|-----|-----|------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00C2B4 _H to 00EFFC _H | Reserved | | | | Reserved |
| 00F000 _H | BCTRL [R/W] ----- 11111100 00000000 | | | | EDSU / MPU |
| 00F004 _H | BSTAT [R/W] -----000 00000000 10 -- 0000 | | | | |
| 00F008 _H | BIAC [R] ----- 00000000 00000000 | | | | |
| 00F00C _H | BOAC [R] ----- 00000000 00000000 | | | | |
| 00F010 _H | BIRQ [R/W] ----- 00000000 00000000 | | | | |
| 00F014 _H to 00F01C _H | Reserved | | | | |
| 00F020 _H | BCR0 [R/W] ----- 00000000 00000000 00000000 | | | | |
| 00F024 _H | BCR1 [R/W] ----- 00000000 00000000 00000000 | | | | |
| 00F028 _H | BCR2 [R/W] ----- 00000000 00000000 00000000 | | | | |
| 00F02C _H | BCR3 [R/W] ----- 00000000 00000000 00000000 | | | | |
| 00F030 _H to 00F07C _H | Reserved | | | | Reserved |
| 00F080 _H | BAD0 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | EDSU / MPU |
| 00F084 _H | BAD1 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F088 _H | BAD2 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F08C _H | BAD3 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F090 _H | BAD4 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F094 _H | BAD5 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F098 _H | BAD6 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |

(Continued)

| Address | Register | | | | Block |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-------------|
| | + 0 | + 1 | + 2 | + 3 | |
| 00F09C _H | BAD7 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | EDSU / MPU |
| 00F0A0 _H | BAD8 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0A4 _H | BAD9 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0A8 _H | BAD10 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0AC _H | BAD11 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0B0 _H | BAD12 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0B4 _H | BAD13 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0B8 _H | BAD14 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0BC _H | BAD15 [R/W] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX | | | | |
| 00F0C0 _H to 01FFFC _H | Reserved | | | | Reserved |
| 020000 _H to 02FFFC _H | CY91F467Dx D-RAM size is 32 Kbytes : 028000 _H to 02FFFC _H CY91F465DA D-RAM size is 32 Kbytes : 028000 _H to 02FFFC _H (data access is 0 wait cycles) | | | | D-RAM area |
| 030000 _H to 03FFFC _H | CY91F467Dx ID-RAM size is 32 Kbytes : 030000 _H to 037FFC _H CY91F465DA ID-RAM size is 16 Kbytes : 030000 _H to 033FFC _H (instruction access is 0 wait cycles, data access is 1 wait cycle) | | | | ID-RAM area |

*1 : depends on the number of available CAN channels

*2 : ACR0 [11 : 10] depends on bus width setting in Mode vector fetch information

*3 : TCR [3 : 0] INIT value = 0000, keeps value after RST

12.2 Flash Memory and External Bus Area

| 32bit Read/Write | dat[31:0] | | | | dat[31:0] | | | | Block |
|--------------------------------------------------|------------------------------------------------------|-----|-----------|-----|------------------------------------------------------|-----|-----------|-----|-------|
| 16bit Read/Write | dat[31:16] | | dat[15:0] | | dat[31:16] | | dat[15:0] | | |
| Address | Register | | | | | | | | |
| | + 0 | + 1 | + 2 | + 3 | + 4 | + 5 | + 6 | + 7 | |
| 040000 _H to 05FFF8 _H | SA8 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | SA9 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | ROMS0 |
| 060000 _H to 07FFF8 _H | SA10 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | SA11 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | ROMS1 |
| 080000 _H to 09FFF8 _H | SA12 (64KB) | | | | SA13 (64KB) | | | | ROMS2 |
| 0A0000 _H to 0BFFF8 _H | SA14 (64KB) | | | | SA15 (64KB) | | | | ROMS3 |
| 0C0000 _H to 0DFFF8 _H | SA16 (64KB) | | | | SA17 (64KB) | | | | ROMS4 |
| 0E0000 _H to 0FFFF0 _H | SA18 (64KB) | | | | SA19 (64KB) | | | | ROMS5 |
| 0FFFF8 _H | FMV [R] 06 00 00 00H | | | | FRV [R] 00 00 BF F8H | | | | |
| 100000 _H to 11FFF8 _H | SA20 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | SA21 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | ROMS6 |
| 120000 _H to 13FFF8 _H | SA22 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | SA23 (64KB, CY91F467Dx) External bus (CY91F465DA) | | | | |
| 140000 _H to 143FF8 _H | SA0 (8KB, CY91F467Dx) Reserved (CY91F465DA) | | | | SA1 (8KB, CY91F467Dx) Reserved (CY91F465DA) | | | | ROMS7 |
| 144000 _H to 147FF8 _H | SA2 (8KB, CY91F467Dx) Reserved (CY91F465DA) | | | | SA3 (8KB, CY91F467Dx) Reserved (CY91F465DA) | | | | |
| 148000 _H to 14BFF8 _H | SA4 (8KB, CY91F467Dx) | | | | SA5 (8KB, CY91F467Dx) | | | | |
| 14C000 _H to 14FFF8 _H | SA6 (8KB, CY91F467Dx) | | | | SA7 (8KB, CY91F467Dx) | | | | |
| 150000 _H to 17FFF8 _H | Reserved | | | | | | | | |

| 32bit Read/Write | dat[31:0] | | | | dat[31:0] | | | | |
|--------------------------------------------------|-------------------|-----|-----------|-----|------------|-----|-----------|-----|--------|
| 16bit Read/Write | dat[31:16] | | dat[15:0] | | dat[31:16] | | dat[15:0] | | |
| Address | Register | | | | | | | | Block |
| | + 0 | + 1 | + 2 | + 3 | + 4 | + 5 | + 6 | + 7 | |
| 180000 _H to 1BFFF8 _H | External Bus Area | | | | | | | | ROMS8 |
| 1C0000 _H to 1FFFF8 _H | | | | | | | | | ROMS9 |
| 200000 _H to 27FFF8 _H | | | | | | | | | ROMS10 |
| 280000 _H to 2FFFF8 _H | | | | | | | | | ROMS11 |
| 300000 _H to 37FFF8 _H | | | | | | | | | ROMS12 |
| 380000 _H to 3FFFF8 _H | | | | | | | | | ROMS13 |
| 400000 _H to 47FFF8 _H | | | | | | | | | ROMS14 |
| 480000 _H to 4FFFF8 _H | | | | | | | | | ROMS15 |

Notes: Write operations to address 0FFFF8_H and 0FFFFC_H are not possible. When reading these addresses, the values shown above will be read.

On CY91F465DA, write access to the flash is only possible in 16-bit mode.

13. Interrupt Vector Table

| Interrupt | Interrupt Number | | Interrupt Level *1 | | Interrupt Vector *2 | | DMA Resource Number |
|---------------------------------------------|------------------|--------------|----------------------|------------------|---------------------|------------------------|---------------------|
| | Decimal | Hexa-Decimal | Setting Register | Register Address | Offset | Default Vector Address | |
| Reset | 0 | 00 | — | — | 3FC _H | 000FFFFC _H | — |
| Mode vector | 1 | 01 | — | — | 3F8 _H | 000FFFF8 _H | — |
| System reserved | 2 | 02 | — | — | 3F4 _H | 000FFFF4 _H | — |
| System reserved | 3 | 03 | — | — | 3F0 _H | 000FFFF0 _H | — |
| System reserved | 4 | 04 | — | — | 3EC _H | 000FFFE _C | — |
| CPU supervisor mode (INT #5 instruction) *5 | 5 | 05 | — | — | 3E8 _H | 000FFFE8 _H | — |
| Memory Protection exception *5 | 6 | 06 | — | — | 3E4 _H | 000FFFE4 _H | — |
| System reserved | 7 | 07 | — | — | 3E0 _H | 000FFFE0 _H | — |
| System reserved | 8 | 08 | — | — | 3DC _H | 000FFFD _C | — |
| System reserved | 9 | 09 | — | — | 3D8 _H | 000FFFD8 _H | — |
| System reserved | 10 | 0A | — | — | 3D4 _H | 000FFFD4 _H | — |
| System reserved | 11 | 0B | — | — | 3D0 _H | 000FFFD0 _H | — |
| System reserved | 12 | 0C | — | — | 3CC _H | 000FFFC _C | — |
| System reserved | 13 | 0D | — | — | 3C8 _H | 000FFFC8 _H | — |
| Undefined instruction exception | 14 | 0E | — | — | 3C4 _H | 000FFFC4 _H | — |
| NMI request | 15 | 0F | F _H fixed | | 3C0 _H | 000FFFC0 _H | — |
| External Interrupt 0 | 16 | 10 | ICR00 | 440 _H | 3BC _H | 000FFFB _C | 0, 16 |
| External Interrupt 1 | 17 | 11 | | | 3B8 _H | 000FFFB8 _H | 1, 17 |
| External Interrupt 2 | 18 | 12 | ICR01 | 441 _H | 3B4 _H | 000FFFB4 _H | 2, 18 |
| External Interrupt 3 | 19 | 13 | | | 3B0 _H | 000FFFB0 _H | 3, 19 |
| External Interrupt 4 | 20 | 14 | ICR02 | 442 _H | 3AC _H | 000FFFA _C | 20 |
| External Interrupt 5 | 21 | 15 | | | 3A8 _H | 000FFFA8 _H | 21 |
| External Interrupt 6 | 22 | 16 | ICR03 | 443 _H | 3A4 _H | 000FFFA4 _H | 22 |
| External Interrupt 7 | 23 | 17 | | | 3A0 _H | 000FFFA0 _H | 23 |
| External Interrupt 8 | 24 | 18 | ICR04 | 444 _H | 39C _H | 000FFF9 _C | — |
| External Interrupt 9 | 25 | 19 | | | 398 _H | 000FFF98 _H | — |
| External Interrupt 10 | 26 | 1A | ICR05 | 445 _H | 394 _H | 000FFF94 _H | — |
| System reserved | 27 | 1B | | | 390 _H | 000FFF90 _H | — |
| External Interrupt 12 | 28 | 1C | ICR06 | 446 _H | 38C _H | 000FFF8 _C | — |
| External Interrupt 13 | 29 | 1D | | | 388 _H | 000FFF88 _H | — |
| External Interrupt 14 | 30 | 1E | ICR07 | 447 _H | 384 _H | 000FFF84 _H | — |
| System reserved | 31 | 1F | | | 380 _H | 000FFF80 _H | — |

(Continued)

| Interrupt | Interrupt Number | | Interrupt Level *1 | | Interrupt Vector *2 | | DMA Resource Number |
|-------------------|------------------|--------------|--------------------|------------------|---------------------|------------------------|---------------------|
| | Decimal | Hexa-Decimal | Setting Register | Register Address | Offset | Default Vector Address | |
| Reload Timer 0 | 32 | 20 | ICR08 | 448 _H | 37C _H | 000FFF7C _H | 4, 32 |
| Reload Timer 1 | 33 | 21 | | | 378 _H | 000FFF78 _H | 5, 33 |
| Reload Timer 2 | 34 | 22 | ICR09 | 449 _H | 374 _H | 000FFF74 _H | 34 |
| Reload Timer 3 | 35 | 23 | | | 370 _H | 000FFF70 _H | 35 |
| Reload Timer 4 | 36 | 24 | ICR10 | 44A _H | 36C _H | 000FFF6C _H | 36 |
| Reload Timer 5 | 37 | 25 | | | 368 _H | 000FFF68 _H | 37 |
| Reload Timer 6 | 38 | 26 | ICR11 | 44B _H | 364 _H | 000FFF64 _H | 38 |
| Reload Timer 7 | 39 | 27 | | | 360 _H | 000FFF60 _H | 39 |
| Free Run Timer 0 | 40 | 28 | ICR12 | 44C _H | 35C _H | 000FFF5C _H | 40 |
| Free Run Timer 1 | 41 | 29 | | | 358 _H | 000FFF58 _H | 41 |
| Free Run Timer 2 | 42 | 2A | ICR13 | 44D _H | 354 _H | 000FFF54 _H | 42 |
| Free Run Timer 3 | 43 | 2B | | | 350 _H | 000FFF50 _H | 43 |
| Free Run Timer 4 | 44 | 2C | ICR14 | 44E _H | 34C _H | 000FFF4C _H | 44 |
| Free Run Timer 5 | 45 | 2D | | | 348 _H | 000FFF48 _H | 45 |
| Free Run Timer 6 | 46 | 2E | ICR15 | 44F _H | 344 _H | 000FFF44 _H | 46 |
| Free Run Timer 7 | 47 | 2F | | | 340 _H | 000FFF40 _H | 47 |
| CAN 0 | 48 | 30 | ICR16 | 450 _H | 33C _H | 000FFF3C _H | — |
| CAN 1 | 49 | 31 | | | 338 _H | 000FFF38 _H | — |
| CAN 2 | 50 | 32 | ICR17 | 451 _H | 334 _H | 000FFF34 _H | — |
| System reserved | 51 | 33 | | | 330 _H | 000FFF30 _H | — |
| System reserved | 52 | 34 | ICR18 | 452 _H | 32C _H | 000FFF2C _H | — |
| System reserved | 53 | 35 | | | 328 _H | 000FFF28 _H | — |
| System reserved | 54 | 36 | ICR19 | 453 _H | 324 _H | 000FFF24 _H | 6, 48 |
| System reserved | 55 | 37 | | | 320 _H | 000FFF20 _H | 7, 49 |
| System reserved | 56 | 38 | ICR20 | 454 _H | 31C _H | 000FFF1C _H | 8, 50 |
| System reserved | 57 | 39 | | | 318 _H | 000FFF18 _H | 9, 51 |
| LIN-USART 2 RX | 58 | 3A | ICR21 | 455 _H | 314 _H | 000FFF14 _H | 52 |
| LIN-USART 2 TX | 59 | 3B | | | 310 _H | 000FFF10 _H | 53 |
| System reserved | 60 | 3C | ICR22 | 456 _H | 30C _H | 000FFF0C _H | 54 |
| System reserved | 61 | 3D | | | 308 _H | 000FFF08 _H | 55 |
| System reserved | 62 | 3E | ICR23 *3 | 457 _H | 304 _H | 000FFF04 _H | — |
| Delayed Interrupt | 63 | 3F | | | 300 _H | 000FFF00 _H | — |

(Continued)

| Interrupt | Interrupt Number | | Interrupt Level *1 | | Interrupt Vector *2 | | DMA Resource Number |
|-----------------------------------------|------------------|--------------|--------------------|---------------------|---------------------|------------------------|---------------------|
| | Decimal | Hexa-Decimal | Setting Register | Register Address | Offset | Default Vector Address | |
| System reserved *4 | 64 | 40 | (ICR24) | (458 _H) | 2FC _H | 000FFEFCH | — |
| System reserved *4 | 65 | 41 | | | 2F8 _H | 000FFEF8 _H | — |
| LIN-USART (FIFO) 4 RX | 66 | 42 | ICR25 | 459 _H | 2F4 _H | 000FFEF4 _H | 10, 56 |
| LIN-USART (FIFO) 4 TX | 67 | 43 | | | 2F0 _H | 000FFEF0 _H | 11, 57 |
| LIN-USART (FIFO) 5 RX | 68 | 44 | ICR26 | 45A _H | 2EC _H | 000FFEECH | 12, 58 |
| LIN-USART (FIFO) 5 TX | 69 | 45 | | | 2E8 _H | 000FFEE8 _H | 13, 59 |
| LIN-USART (FIFO) 6 RX | 70 | 46 | ICR27 | 45B _H | 2E4 _H | 000FFEE4 _H | 60 |
| LIN-USART (FIFO) 6 TX | 71 | 47 | | | 2E0 _H | 000FFEE0 _H | 61 |
| LIN-USART (FIFO) 7 RX | 72 | 48 | ICR28 | 45C _H | 2DC _H | 000FFEDCH | 62 |
| LIN-USART (FIFO) 7 TX | 73 | 49 | | | 2D8 _H | 000FFED8 _H | 63 |
| I ² C 0 / I ² C 2 | 74 | 4A | ICR29 | 45D _H | 2D4 _H | 000FFED4 _H | — |
| I ² C 3 | 75 | 4B | | | 2D0 _H | 000FFED0 _H | — |
| System reserved | 76 | 4C | ICR30 | 45E _H | 2CC _H | 000FFECCH | 64 |
| System reserved | 77 | 4D | | | 2C8 _H | 000FFEC8 _H | 65 |
| System reserved | 78 | 4E | ICR31 | 45F _H | 2C4 _H | 000FFEC4 _H | 66 |
| System reserved | 79 | 4F | | | 2C0 _H | 000FFEC0 _H | 67 |
| System reserved | 80 | 50 | ICR32 | 460 _H | 2BC _H | 000FFEBCH | 68 |
| System reserved | 81 | 51 | | | 2B8 _H | 000FFEB8 _H | 69 |
| System reserved | 82 | 52 | ICR33 | 461 _H | 2B4 _H | 000FFEB4 _H | 70 |
| System reserved | 83 | 53 | | | 2B0 _H | 000FFEB0 _H | 71 |
| System reserved | 84 | 54 | ICR34 | 462 _H | 2AC _H | 000FFEACH | 72 |
| System reserved | 85 | 55 | | | 2A8 _H | 000FFEA8 _H | 73 |
| System reserved | 86 | 56 | ICR35 | 463 _H | 2A4 _H | 000FFEA4 _H | 74 |
| System reserved | 87 | 57 | | | 2A0 _H | 000FFEA0 _H | 75 |
| System reserved | 88 | 58 | ICR36 | 464 _H | 29C _H | 000FFE9CH | 76 |
| System reserved | 89 | 59 | | | 298 _H | 000FFE98 _H | 77 |
| System reserved | 90 | 5A | ICR37 | 465 _H | 294 _H | 000FFE94 _H | 78 |
| System reserved | 91 | 5B | | | 290 _H | 000FFE90 _H | 79 |
| Input Capture 0 | 92 | 5C | ICR38 | 466 _H | 28C _H | 000FFE8CH | 80 |
| Input Capture 1 | 93 | 5D | | | 288 _H | 000FFE88 _H | 81 |
| Input Capture 2 | 94 | 5E | ICR39 | 467 _H | 284 _H | 000FFE84 _H | 82 |
| Input Capture 3 | 95 | 5F | | | 280 _H | 000FFE80 _H | 83 |

(Continued)

| Interrupt | Interrupt Number | | Interrupt Level *1 | | Interrupt Vector *2 | | DMA Resource Number |
|---------------------------|------------------|--------------|--------------------|------------------|---------------------|------------------------|---------------------|
| | Decimal | Hexa-Decimal | Setting Register | Register Address | Offset | Default Vector Address | |
| Input Capture 4 | 96 | 60 | ICR40 | 468 _H | 27C _H | 000FFE7C _H | 84 |
| Input Capture 5 | 97 | 61 | | | 278 _H | 000FFE78 _H | 85 |
| Input Capture 6 | 98 | 62 | ICR41 | 469 _H | 274 _H | 000FFE74 _H | 86 |
| Input Capture 7 | 99 | 63 | | | 270 _H | 000FFE70 _H | 87 |
| Output Compare 0 | 100 | 64 | ICR42 | 46A _H | 26C _H | 000FFE6C _H | 88 |
| Output Compare 1 | 101 | 65 | | | 268 _H | 000FFE68 _H | 89 |
| Output Compare 2 | 102 | 66 | ICR43 | 46B _H | 264 _H | 000FFE64 _H | 90 |
| Output Compare 3 | 103 | 67 | | | 260 _H | 000FFE60 _H | 91 |
| System reserved | 104 | 68 | ICR44 | 46C _H | 25C _H | 000FFE5C _H | 92 |
| System reserved | 105 | 69 | | | 258 _H | 000FFE58 _H | 93 |
| System reserved | 106 | 6A | ICR45 | 46D _H | 254 _H | 000FFE54 _H | 94 |
| System reserved | 107 | 6B | | | 250 _H | 000FFE50 _H | 95 |
| Sound Generator | 108 | 6C | ICR46 | 46E _H | 24C _H | 000FFE4C _H | — |
| Phase Frequency Modulator | 109 | 6D | | | 248 _H | 000FFE48 _H | — |
| System reserved | 110 | 6E | ICR47 *3 | 46F _H | 244 _H | 000FFE44 _H | — |
| System reserved | 111 | 6F | | | 240 _H | 000FFE40 _H | — |
| System reserved | 112 | 70 | ICR48 | 470 _H | 23C _H | 000FFE3C _H | 15, 96 |
| System reserved | 113 | 71 | | | 238 _H | 000FFE38 _H | 97 |
| System reserved | 114 | 72 | ICR49 | 471 _H | 234 _H | 000FFE34 _H | 98 |
| System reserved | 115 | 73 | | | 230 _H | 000FFE30 _H | 99 |
| PPG4 | 116 | 74 | ICR50 | 472 _H | 22C _H | 000FFE2C _H | 100 |
| PPG5 | 117 | 75 | | | 228 _H | 000FFE28 _H | 101 |
| PPG6 | 118 | 76 | ICR51 | 473 _H | 224 _H | 000FFE24 _H | 102 |
| PPG7 | 119 | 77 | | | 220 _H | 000FFE20 _H | 103 |
| PPG8 | 120 | 78 | ICR52 | 474 _H | 21C _H | 000FFE1C _H | 104 |
| PPG9 | 121 | 79 | | | 218 _H | 000FFE18 _H | 105 |
| PPG10 | 122 | 7A | ICR53 | 475 _H | 214 _H | 000FFE14 _H | 106 |
| PPG11 | 123 | 7B | | | 210 _H | 000FFE10 _H | 107 |
| PPG12 | 124 | 7C | ICR54 | 476 _H | 20C _H | 000FFE0C _H | 108 |
| PPG13 | 125 | 7D | | | 208 _H | 000FFE08 _H | 109 |
| PPG14 | 126 | 7E | ICR55 | 477 _H | 204 _H | 000FFE04 _H | 110 |
| PPG15 | 127 | 7F | | | 200 _H | 000FFE00 _H | 111 |

(Continued)

(Continued)

| Interrupt | Interrupt Number | | Interrupt Level *1 | | Interrupt Vector *2 | | DMA Resource Number |
|------------------------------|------------------|----------------|--------------------|------------------|-----------------------------------------|------------------------------------------------------|---------------------|
| | Decimal | Hexa-Decimal | Setting Register | Register Address | Offset | Default Vector Address | |
| Up/Down Counter 0 | 128 | 80 | ICR56 | 478 _H | 1FC _H | 000FFDFC _H | — |
| System reserved | 129 | 81 | | | 1F8 _H | 000FFDF8 _H | — |
| Up/Down Counter 2 | 130 | 82 | ICR57 | 479 _H | 1F4 _H | 000FFDF4 _H | — |
| Up/Down Counter 3 | 131 | 83 | | | 1F0 _H | 000FFDF0 _H | — |
| Real Time Clock | 132 | 84 | ICR58 | 47A _H | 1EC _H | 000FFDEC _H | — |
| Calibration Unit | 133 | 85 | | | 1E8 _H | 000FFDE8 _H | — |
| A/D Converter 0 | 134 | 86 | ICR59 | 47B _H | 1E4 _H | 000FFDE4 _H | 14, 112 |
| System reserved | 135 | 87 | | | 1E0 _H | 000FFDE0 _H | — |
| Alarm Comparator 0 | 136 | 88 | ICR60 | 47C _H | 1DC _H | 000FFDDC _H | — |
| System reserved | 137 | 89 | | | 1D8 _H | 000FFDD8 _H | — |
| Low Voltage Detection | 138 | 8A | ICR61 | 47D _H | 1D4 _H | 000FFDD4 _H | — |
| SMC Comparator 0 to 5 | 139 | 8B | | | 1D0 _H | 000FFDD0 _H | — |
| Timebase Overflow | 140 | 8C | ICR62 | 47E _H | 1CC _H | 000FFDCC _H | — |
| PLL Clock Gear | 141 | 8D | | | 1C8 _H | 000FFDC8 _H | — |
| DMA Controller | 142 | 8E | ICR63 | 47F _H | 1C4 _H | 000FFDC4 _H | — |
| Main/Sub OSC stability wait | 143 | 8F | | | 1C0 _H | 000FFDC0 _H | — |
| Security vector | 144 | 90 | — | — | 1BC _H | 000FFDBC _H | — |
| Used by the INT instruction. | 145 to 255 | 91 to FF | — | — | 1B8 _H to 000 _H | 000FFDB8 _H to 000FFC00 _H | — |

*1 : The Interrupt Control Registers (ICRs) are located in the interrupt controller and set the interrupt level for each interrupt request. An ICR is provided for each interrupt request.

*2 : The vector address for each EIT (exception, interrupt or trap) is calculated by adding the listed offset to the table base register value (TBR) . The TBR specifies the top of the EIT vector table. The addresses listed in the table are for the default TBR value (000FFC00_H) . The TBR is initialized to this value by a reset. The TBR is set to 000FFC00_H after the internal boot ROM is executed.

*3 : ICR23 and ICR47 can be exchanged by setting the REALOS compatibility bit (addr 0C03_H : IOS[0])

*4 : Used by REALOS

*5 : Memory Protection Unit (MPU) support

14. Recommended Settings

14.1 PLL and Clockgear Settings

Please note that for CY91F467Dx the core base clock frequencies are valid in the 1.8V operation mode of the Main regulator and Flash.

Recommended PLL Divider and Clockgear Settings

| PLL Input (CLK) [MHz] | Frequency Parameter | | Clockgear Parameter | | PLL Output (X) [MHz] | Core Base Clock [MHz] | Remarks |
|-----------------------|---------------------|------|---------------------|------|----------------------|-----------------------|---------|
| | DIVM | DIVN | DIVG | MULG | | | |
| 4 | 2 | 25 | 16 | 24 | 200 | 100 | *1 |
| 4 | 2 | 24 | 16 | 24 | 192 | 96 | |
| 4 | 2 | 23 | 16 | 24 | 184 | 92 | |
| 4 | 2 | 22 | 16 | 24 | 176 | 88 | |
| 4 | 2 | 21 | 16 | 20 | 168 | 84 | |
| 4 | 2 | 20 | 16 | 20 | 160 | 80 | |
| 4 | 2 | 19 | 16 | 20 | 152 | 76 | |
| 4 | 2 | 18 | 16 | 20 | 144 | 72 | |
| 4 | 2 | 17 | 16 | 16 | 136 | 68 | |
| 4 | 2 | 16 | 16 | 16 | 128 | 64 | |
| 4 | 2 | 15 | 16 | 16 | 120 | 60 | |
| 4 | 2 | 14 | 16 | 16 | 112 | 56 | |
| 4 | 2 | 13 | 16 | 12 | 104 | 52 | |
| 4 | 2 | 12 | 16 | 12 | 96 | 48 | |
| 4 | 2 | 11 | 16 | 12 | 88 | 44 | |
| 4 | 4 | 10 | 16 | 24 | 160 | 40 | |
| 4 | 4 | 9 | 16 | 24 | 144 | 36 | |
| 4 | 4 | 8 | 16 | 24 | 128 | 32 | |
| 4 | 4 | 7 | 16 | 24 | 112 | 28 | |
| 4 | 6 | 6 | 16 | 24 | 144 | 24 | |
| 4 | 8 | 5 | 16 | 28 | 160 | 20 | |
| 4 | 10 | 4 | 16 | 32 | 160 | 16 | |
| 4 | 12 | 3 | 16 | 32 | 144 | 12 | |

*1 This setting is not possible at CY91F467Dx

14.2 Clock Modulator Settings

The following table shows all possible settings for the Clock Modulator in a base clock frequency range from 32MHz up to 88MHz. The Flash access time settings need to be adjusted according to Fmax while the PLL and clockgear settings should be set according to base clock frequency.

Clock Modulator Settings, Frequency Range and Supported Supply Voltage

| Modulation Degree (k) | Random No (N) | CMPR [hex] | Baseclk [MHz] | Fmin [MHz] | Fmax [MHz] | Remarks |
|-----------------------|---------------|------------|---------------|------------|------------|---------|
| 1 | 3 | 026F | 88 | 79.5 | 98.5 | *1 |
| 1 | 3 | 026F | 84 | 76.1 | 93.8 | |
| 1 | 3 | 026F | 80 | 72.6 | 89.1 | |
| 1 | 5 | 02AE | 80 | 68.7 | 95.8 | |
| 2 | 3 | 046E | 80 | 68.7 | 95.8 | |
| 1 | 3 | 026F | 76 | 69.1 | 84.5 | |
| 1 | 5 | 02AE | 76 | 65.3 | 90.8 | |
| 1 | 7 | 02ED | 76 | 62 | 98.1 | *1 |
| 2 | 3 | 046E | 76 | 65.3 | 90.8 | |
| 3 | 3 | 066D | 76 | 62 | 98.1 | *1 |
| 1 | 3 | 026F | 72 | 65.5 | 79.9 | |
| 1 | 5 | 02AE | 72 | 62 | 85.8 | |
| 1 | 7 | 02ED | 72 | 58.8 | 92.7 | |
| 2 | 3 | 046E | 72 | 62 | 85.8 | |
| 3 | 3 | 066D | 72 | 58.8 | 92.7 | |
| 1 | 3 | 026F | 68 | 62 | 75.3 | |
| 1 | 5 | 02AE | 68 | 58.7 | 80.9 | |
| 1 | 7 | 02ED | 68 | 55.7 | 87.3 | |
| 1 | 9 | 032C | 68 | 53 | 95 | |
| 2 | 3 | 046E | 68 | 58.7 | 80.9 | |
| 2 | 5 | 04AC | 68 | 53 | 95 | |
| 3 | 3 | 066D | 68 | 55.7 | 87.3 | |
| 4 | 3 | 086C | 68 | 53 | 95 | |
| 1 | 3 | 026F | 64 | 58.5 | 70.7 | |
| 1 | 5 | 02AE | 64 | 55.3 | 75.9 | |
| 1 | 7 | 02ED | 64 | 52.5 | 82 | |
| 1 | 9 | 032C | 64 | 49.9 | 89.1 | |
| 1 | 11 | 036B | 64 | 47.6 | 97.6 | *1 |
| 2 | 3 | 046E | 64 | 55.3 | 75.9 | |
| 2 | 5 | 04AC | 64 | 49.9 | 89.1 | |

(Continued)

(Continued)

| Modulation Degree (k) | Random No (N) | CMPR [hex] | Baseclk [MHz] | Fmin [MHz] | Fmax [MHz] | Remarks |
|-----------------------|---------------|------------|---------------|------------|------------|---------|
| 3 | 3 | 066D | 64 | 52.5 | 82 | |
| 4 | 3 | 086C | 64 | 49.9 | 89.1 | |
| 5 | 3 | 0A6B | 64 | 47.6 | 97.6 | |
| 1 | 3 | 026F | 60 | 54.9 | 66.1 | |
| 1 | 5 | 02AE | 60 | 51.9 | 71 | |
| 1 | 7 | 02ED | 60 | 49.3 | 76.7 | |
| 1 | 9 | 032C | 60 | 46.9 | 83.3 | |
| 1 | 11 | 036B | 60 | 44.7 | 91.3 | |
| 2 | 3 | 046E | 60 | 51.9 | 71 | |
| 2 | 5 | 04AC | 60 | 46.9 | 83.3 | |
| 3 | 3 | 066D | 60 | 49.3 | 76.7 | |
| 4 | 3 | 086C | 60 | 46.9 | 83.3 | |
| 5 | 3 | 0A6B | 60 | 44.7 | 91.3 | |
| 1 | 3 | 026F | 56 | 51.4 | 61.6 | |
| 1 | 5 | 02AE | 56 | 48.6 | 66.1 | |
| 1 | 7 | 02ED | 56 | 46.1 | 71.4 | |
| 1 | 9 | 032C | 56 | 43.8 | 77.6 | |
| 1 | 11 | 036B | 56 | 41.8 | 84.9 | |
| 1 | 13 | 03AA | 56 | 39.9 | 93.8 | |
| 2 | 3 | 046E | 56 | 48.6 | 66.1 | |
| 2 | 5 | 04AC | 56 | 43.8 | 77.6 | |
| 2 | 7 | 04EA | 56 | 39.9 | 93.8 | |
| 3 | 3 | 066D | 56 | 46.1 | 71.4 | |
| 3 | 5 | 06AA | 56 | 39.9 | 93.8 | |
| 4 | 3 | 086C | 56 | 43.8 | 77.6 | |
| 5 | 3 | 0A6B | 56 | 41.8 | 84.9 | |
| 6 | 3 | 0C6A | 56 | 39.9 | 93.8 | |
| 1 | 3 | 026F | 52 | 47.8 | 57 | |
| 1 | 5 | 02AE | 52 | 45.2 | 61.2 | |
| 1 | 7 | 02ED | 52 | 42.9 | 66.1 | |
| 1 | 9 | 032C | 52 | 40.8 | 71.8 | |
| 1 | 11 | 036B | 52 | 38.8 | 78.6 | |
| 1 | 13 | 03AA | 52 | 37.1 | 86.8 | |
| 1 | 15 | 03E9 | 52 | 35.5 | 96.9 | *1 |
| 2 | 3 | 046E | 52 | 45.2 | 61.2 | |

(Continued)

(Continued)

| Modulation Degree (k) | Random No (N) | CMPR [hex] | Baseclk [MHz] | Fmin [MHz] | Fmax [MHz] | Remarks |
|-----------------------|---------------|------------|---------------|------------|------------|---------|
| 2 | 5 | 04AC | 52 | 40.8 | 71.8 | |
| 2 | 7 | 04EA | 52 | 37.1 | 86.8 | |
| 3 | 3 | 066D | 52 | 42.9 | 66.1 | |
| 3 | 5 | 06AA | 52 | 37.1 | 86.8 | |
| 4 | 3 | 086C | 52 | 40.8 | 71.8 | |
| 5 | 3 | 0A6B | 52 | 38.8 | 78.6 | |
| 6 | 3 | 0C6A | 52 | 37.1 | 86.8 | |
| 7 | 3 | 0E69 | 52 | 35.5 | 96.9 | *1 |
| 1 | 3 | 026F | 48 | 44.2 | 52.5 | |
| 1 | 5 | 02AE | 48 | 41.8 | 56.4 | |
| 1 | 7 | 02ED | 48 | 39.6 | 60.9 | |
| 1 | 9 | 032C | 48 | 37.7 | 66.1 | |
| 1 | 11 | 036B | 48 | 35.9 | 72.3 | |
| 1 | 13 | 03AA | 48 | 34.3 | 79.9 | |
| 1 | 15 | 03E9 | 48 | 32.8 | 89.1 | |
| 2 | 3 | 046E | 48 | 41.8 | 56.4 | |
| 2 | 5 | 04AC | 48 | 37.7 | 66.1 | |
| 2 | 7 | 04EA | 48 | 34.3 | 79.9 | |
| 3 | 3 | 066D | 48 | 39.6 | 60.9 | |
| 3 | 5 | 06AA | 48 | 34.3 | 79.9 | |
| 4 | 3 | 086C | 48 | 37.7 | 66.1 | |
| 5 | 3 | 0A6B | 48 | 35.9 | 72.3 | |
| 6 | 3 | 0C6A | 48 | 34.3 | 79.9 | |
| 7 | 3 | 0E69 | 48 | 32.8 | 89.1 | |
| 1 | 3 | 026F | 44 | 40.6 | 48.1 | |
| 1 | 5 | 02AE | 44 | 38.4 | 51.6 | |
| 1 | 7 | 02ED | 44 | 36.4 | 55.7 | |
| 1 | 9 | 032C | 44 | 34.6 | 60.4 | |
| 1 | 11 | 036B | 44 | 33 | 66.1 | |
| 1 | 13 | 03AA | 44 | 31.5 | 73 | |
| 1 | 15 | 03E9 | 44 | 30.1 | 81.4 | |
| 2 | 3 | 046E | 44 | 38.4 | 51.6 | |
| 2 | 5 | 04AC | 44 | 34.6 | 60.4 | |
| 2 | 7 | 04EA | 44 | 31.5 | 73 | |
| 2 | 9 | 0528 | 44 | 28.9 | 92.1 | |

(Continued)

(Continued)

| Modulation Degree (k) | Random No (N) | CMPR [hex] | Baseclk [MHz] | Fmin [MHz] | Fmax [MHz] | Remarks |
|-----------------------|---------------|------------|---------------|------------|------------|---------|
| 3 | 3 | 066D | 44 | 36.4 | 55.7 | |
| 3 | 5 | 06AA | 44 | 31.5 | 73 | |
| 4 | 3 | 086C | 44 | 34.6 | 60.4 | |
| 4 | 5 | 08A8 | 44 | 28.9 | 92.1 | |
| 5 | 3 | 0A6B | 44 | 33 | 66.1 | |
| 6 | 3 | 0C6A | 44 | 31.5 | 73 | |
| 7 | 3 | 0E69 | 44 | 30.1 | 81.4 | |
| 8 | 3 | 1068 | 44 | 28.9 | 92.1 | |
| 1 | 3 | 026F | 40 | 37 | 43.6 | |
| 1 | 5 | 02AE | 40 | 34.9 | 46.8 | |
| 1 | 7 | 02ED | 40 | 33.1 | 50.5 | |
| 1 | 9 | 032C | 40 | 31.5 | 54.8 | |
| 1 | 11 | 036B | 40 | 30 | 59.9 | |
| 1 | 13 | 03AA | 40 | 28.7 | 66.1 | |
| 1 | 15 | 03E9 | 40 | 27.4 | 73.7 | |
| 2 | 3 | 046E | 40 | 34.9 | 46.8 | |
| 2 | 5 | 04AC | 40 | 31.5 | 54.8 | |
| 2 | 7 | 04EA | 40 | 28.7 | 66.1 | |
| 2 | 9 | 0528 | 40 | 26.3 | 83.3 | |
| 3 | 3 | 066D | 40 | 33.1 | 50.5 | |
| 3 | 5 | 06AA | 40 | 28.7 | 66.1 | |
| 3 | 7 | 06E7 | 40 | 25.3 | 95.8 | |
| 4 | 3 | 086C | 40 | 31.5 | 54.8 | |
| 4 | 5 | 08A8 | 40 | 26.3 | 83.3 | |
| 5 | 3 | 0A6B | 40 | 30 | 59.9 | |
| 6 | 3 | 0C6A | 40 | 28.7 | 66.1 | |
| 7 | 3 | 0E69 | 40 | 27.4 | 73.7 | |
| 8 | 3 | 1068 | 40 | 26.3 | 83.3 | |
| 9 | 3 | 1267 | 40 | 25.3 | 95.8 | |
| 1 | 3 | 026F | 36 | 33.3 | 39.2 | |
| 1 | 5 | 02AE | 36 | 31.5 | 42 | |
| 1 | 7 | 02ED | 36 | 29.9 | 45.3 | |
| 1 | 9 | 032C | 36 | 28.4 | 49.2 | |
| 1 | 11 | 036B | 36 | 27.1 | 53.8 | |
| 1 | 13 | 03AA | 36 | 25.8 | 59.3 | |

(Continued)

(Continued)

| Modulation Degree (k) | Random No (N) | CMPR [hex] | Baseclk [MHz] | Fmin [MHz] | Fmax [MHz] | Remarks |
|-----------------------|---------------|------------|---------------|------------|------------|---------|
| 1 | 15 | 03E9 | 36 | 24.7 | 66.1 | |
| 2 | 3 | 046E | 36 | 31.5 | 42 | |
| 2 | 5 | 04AC | 36 | 28.4 | 49.2 | |
| 2 | 7 | 04EA | 36 | 25.8 | 59.3 | |
| 2 | 9 | 0528 | 36 | 23.7 | 74.7 | |
| 3 | 3 | 066D | 36 | 29.9 | 45.3 | |
| 3 | 5 | 06AA | 36 | 25.8 | 59.3 | |
| 3 | 7 | 06E7 | 36 | 22.8 | 85.8 | |
| 4 | 3 | 086C | 36 | 28.4 | 49.2 | |
| 4 | 5 | 08A8 | 36 | 23.7 | 74.7 | |
| 5 | 3 | 0A6B | 36 | 27.1 | 53.8 | |
| 6 | 3 | 0C6A | 36 | 25.8 | 59.3 | |
| 7 | 3 | 0E69 | 36 | 24.7 | 66.1 | |
| 8 | 3 | 1068 | 36 | 23.7 | 74.7 | |
| 9 | 3 | 1267 | 36 | 22.8 | 85.8 | |
| 1 | 3 | 026F | 32 | 29.7 | 34.7 | |
| 1 | 5 | 02AE | 32 | 28 | 37.3 | |
| 1 | 7 | 02ED | 32 | 26.6 | 40.2 | |
| 1 | 9 | 032C | 32 | 25.3 | 43.6 | |
| 1 | 11 | 036B | 32 | 24.1 | 47.7 | |
| 1 | 13 | 03AA | 32 | 23 | 52.5 | |
| 1 | 15 | 03E9 | 32 | 22 | 58.6 | |
| 2 | 3 | 046E | 32 | 28 | 37.3 | |
| 2 | 5 | 04AC | 32 | 25.3 | 43.6 | |
| 2 | 7 | 04EA | 32 | 23 | 52.5 | |
| 2 | 9 | 0528 | 32 | 21.1 | 66.1 | |
| 2 | 11 | 0566 | 32 | 19.5 | 89.1 | |
| 3 | 3 | 066D | 32 | 26.6 | 40.2 | |
| 3 | 5 | 06AA | 32 | 23 | 52.5 | |
| 3 | 7 | 06E7 | 32 | 20.3 | 75.9 | |
| 4 | 3 | 086C | 32 | 25.3 | 43.6 | |
| 4 | 5 | 08A8 | 32 | 21.1 | 66.1 | |
| 5 | 3 | 0A6B | 32 | 24.1 | 47.7 | |
| 5 | 5 | 0AA6 | 32 | 19.5 | 89.1 | |
| 6 | 3 | 0C6A | 32 | 23 | 52.5 | |

(Continued)

(Continued)

| Modulation Degree (k) | Random No (N) | CMPR [hex] | Baseclk [MHz] | Fmin [MHz] | Fmax [MHz] | Remarks |
|-----------------------|---------------|------------|---------------|------------|------------|---------|
| 7 | 3 | 0E69 | 32 | 22 | 58.6 | |
| 8 | 3 | 1068 | 32 | 21.1 | 66.1 | |
| 9 | 3 | 1267 | 32 | 20.3 | 75.9 | |
| 10 | 3 | 1466 | 32 | 19.5 | 89.1 | |

*1 : These settings are not possible at CY91F467Dx

15. Electrical Characteristics

15.1 Absolute Maximum Ratings

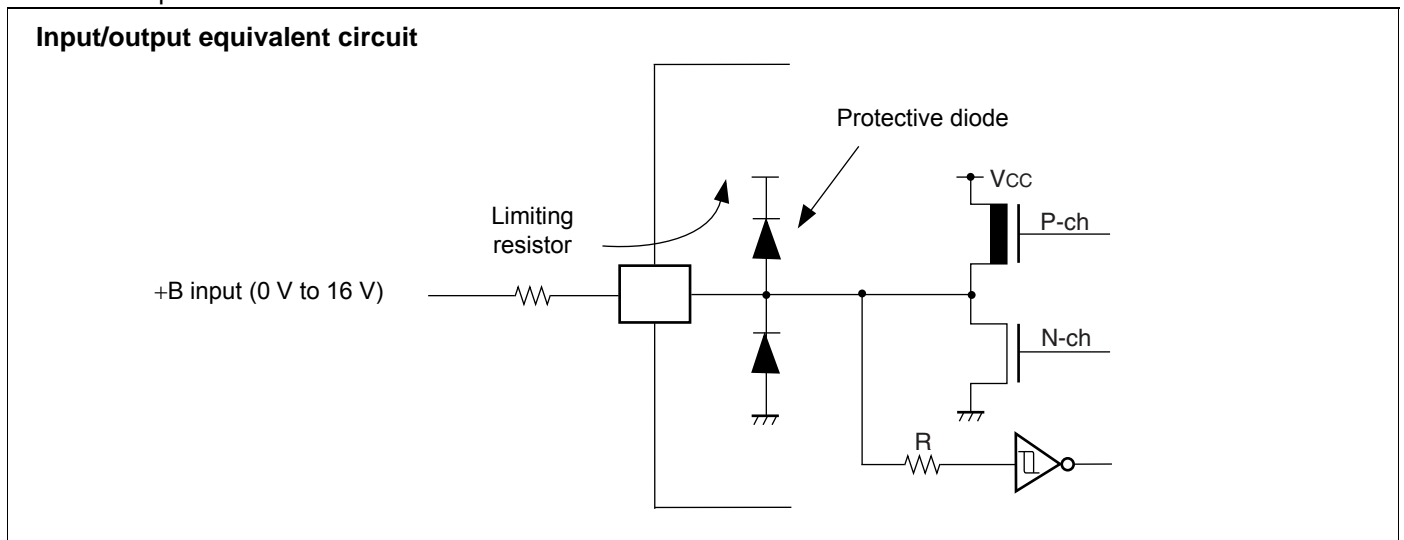
| Parameter | Symbol | Rating | | Unit | Remarks |
|------------------------------------------|-----------------------|-------------------------|-------------------------|------|---------------------------------------------------------------------------------------|
| | | Min | Max | | |
| Power supply slew rate | — | — | 50 | V/ms | |
| Power supply voltage 1*1 | V _{DD5R} | - 0.3 | + 6.0 | V | |
| Power supply voltage 2*1 | V _{DD5} | - 0.3 | + 6.0 | V | |
| Power supply voltage 3*1 | HV _{DD5} | - 0.3 | + 6.0 | V | |
| Power supply voltage 4*1 | V _{DD35} | - 0.3 | + 6.0 | V | |
| Relationship of the supply voltages | HV _{DD5} | V _{DD5} -0.3 | V _{DD5} +0.3 | V | SMC mode |
| | | V _{SS5} -0.3 | V _{DD5} +0.3 | V | General purpose port mode |
| | AV _{CC5} | V _{DD5} -0.3 | V _{DD5} +0.3 | V | At least one pin of the Ports 25 to 29 (SMC, ANn) is used as digital input or output. |
| | | V _{SS5} -0.3 | V _{DD5} +0.3 | V | All pins of the Ports 25 to 29 (SMC, ANn) follow the condition of V _{IA} |
| Analog power supply voltage*1 | AV _{CC5} | - 0.3 | + 6.0 | V | *2 |
| Analog reference power supply voltage*1 | AVRH5 | - 0.3 | + 6.0 | V | *2 |
| Input voltage 1*1 | V _{I1} | V _{SS5} - 0.3 | V _{DD5} + 0.3 | V | |
| Input voltage 2*1 | V _{I2} | V _{SS5} - 0.3 | V _{DD35} + 0.3 | V | External bus |
| Input voltage 3*1 | V _{I3} | HV _{SS5} - 0.3 | HV _{DD5} + 0.3 | V | Stepper motor controller |
| Analog pin input voltage*1 | V _{IA} | AV _{SS5} - 0.3 | AV _{CC5} + 0.3 | V | |
| Output voltage 1*1 | V _{O1} | V _{SS5} - 0.3 | V _{DD5} + 0.3 | V | |
| Output voltage 2*1 | V _{O2} | V _{SS5} - 0.3 | V _{DD35} + 0.3 | V | External bus |
| Output voltage 3*1 | V _{O3} | HV _{SS5} - 0.3 | HV _{DD5} + 0.3 | V | Stepper motor controller |
| Maximum clamp current | I _{CLAMP} | - 4.0 | + 4.0 | mA | *3 |
| Total maximum clamp current | Σ I _{CLAMP} | — | 20 | mA | *3 |
| “L” level maximum output current*4 | I _{OL} | — | 10 | mA | |
| | | — | 40 | mA | Stepper motor controller |
| “L” level average output current*5 | I _{OLAV} | — | 8 | mA | |
| | | — | 30 | mA | Stepper motor controller |
| “L” level total maximum output current | ΣI _{OL} | — | 100 | mA | |
| | | — | 360 | mA | Stepper motor controller |
| “L” level total average output current*6 | ΣI _{OLAV} | — | 50 | mA | |
| | | — | 230 | mA | Stepper motor controller |
| “H” level maximum output current*4 | I _{OH} | — | - 10 | mA | |
| | | — | - 40 | mA | Stepper motor controller |
| “H” level average output current*5 | I _{OHAV} | — | - 4 | mA | |
| | | — | - 30 | mA | Stepper motor controller |

| Parameter | Symbol | Rating | | Unit | Remarks |
|------------------------------------------|-------------------|--------|-------|------------------|------------------------------|
| | | Min | Max | | |
| “H” level total maximum output current | ΣI_{OH} | — | – 100 | mA | |
| | | — | – 360 | mA | Stepper motor controller |
| “H” level total average output current*6 | ΣI_{OHAV} | — | – 25 | mA | |
| | | — | – 230 | mA | Stepper motor controller |
| Power consumption | P_D | — | 1000 | mW | at $T_A = 105^\circ\text{C}$ |
| Operating temperature | T_A | – 40 | + 105 | $^\circ\text{C}$ | |
| Storage temperature | T_{stg} | – 55 | + 150 | $^\circ\text{C}$ | |

*1 : The parameter is based on $V_{SS5} = HV_{SS5} = AV_{SS5} = 0.0 \text{ V}$.

*2 : AV_{CC5} and $AVRH5$ must not exceed $V_{DD5} + 0.3 \text{ V}$.

- *3 :
- Use within recommended operating conditions.
 - Use with DC voltage (current).
 - +B signals are input signals that exceed the V_{DD5} voltage. +B signals should always be applied by connecting a limiting resistor or between the +B signal and the microcontroller.
 - The value of the limiting resistor should be set so that the current input to the microcontroller pin does not exceed the rated value at any time, either instantaneously or for an extended period, when the +B signal is input.
 - Note that when the microcontroller drive current is low, such as in the low power consumption modes, the +B input potential can increase the potential at the power supply pin via a protective diode, possibly affecting other devices.
 - Note that if the +B signal is input when the microcontroller is off (not fixed at 0 V), power is supplied through the +B input pin; therefore, the microcontroller may partially operate.
 - Note that if the +B signal is input at power-on, since the power is supplied through the pin, the power-on reset may not function in the power supply voltage.
 - Do not leave +B input pins open.
 - Example of recommended circuit :



- *4 : Maximum output current is defined as the value of the peak current flowing through any one of the corresponding pins.
- *5 : Average output current is defined as the value of the average current flowing through any one of the corresponding pins for a 100 ms period.
- *6 : Total average output current is defined as the value of the average current flowing through all of the corresponding pins for a 100 ms period.

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

15.2 Recommended Operating Conditions

(V_{SS5} = AV_{SS5} = 0.0 V)

| Parameter | Symbol | Value | | | Unit | Remarks |
|-------------------------------------------|-----------------------|-------|-----|-------|---------------|----------------------------------------------------------------------------------------|
| | | Min | Typ | Max | | |
| Power supply voltage | V _{DD5} | 3.0 | — | 5.5 | V | |
| | V _{DD5R} | 3.0 | — | 5.5 | V | Internal regulator |
| | V _{DD35} | 3.0 | — | 5.5 | V | External bus |
| | HV _{DD5} | 4.5 | — | 5.5 | V | Stepper motor controller |
| | | 3.0 | — | 5.5 | V | Stepper motor controller (when all pins are used as general-purpose ports) |
| AV _{CC5} | 3.0 | — | 5.5 | V | A/D converter | |
| Smoothing capacitor at VCC18C pin | C _S | — | 4.7 | — | μF | Use a X7R ceramic capacitor or a capacitor that has similar frequency characteristics. |
| Power supply slew rate | — | — | — | 50 | V/ms | |
| Operating temperature | T _A | - 40 | — | + 105 | °C | |
| Stepper motor control slew rate | — | — | 40 | — | ns | Clload = 0 pF |
| Main Oscillation stabilisation time | — | 10 | — | — | ms | |
| Look-up time PLL (4 MHz -> 16 ... 100MHz) | — | — | — | 0.6 | ms | |
| ESD Protection (Human body model) | V _{surge} | 2 | — | — | kV | R _{discharge} = 1.5kΩ C _{discharge} = 100pF |
| RC Oscillator | f _{RC100kHz} | 50 | 100 | 200 | kHz | VDD _{CORE} ≥ 1.65V |
| | f _{RC2MHz} | 1 | 2 | 4 | MHz | |

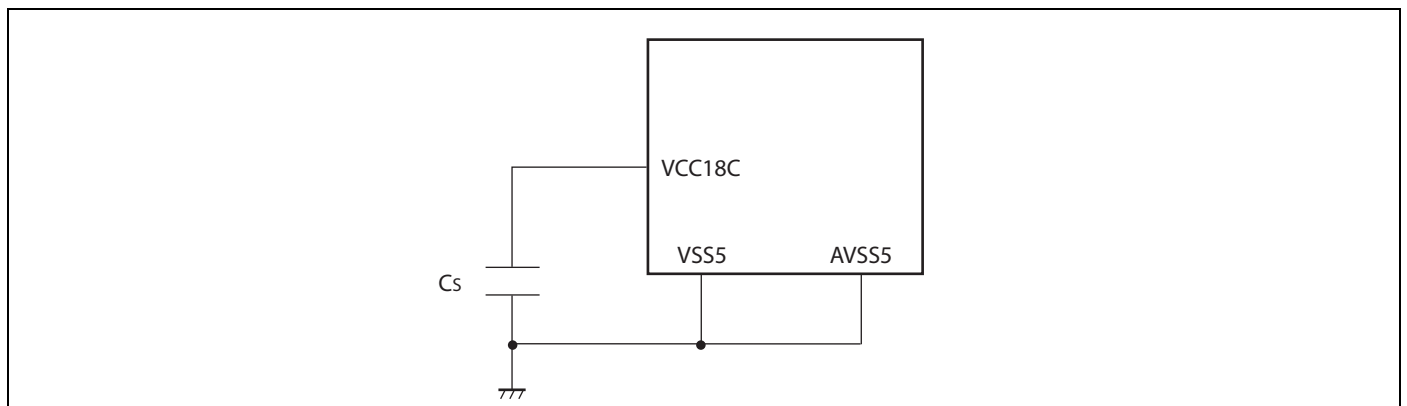
WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges.

Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet.

Users considering application outside the listed conditions are advised to contact their representatives beforehand.



15.3 DC Characteristics

Note: In the following tables, “V_{DD}” means V_{DD35} for pins of ext. bus or HV_{DD5} for SMC pins or V_{DD5} for other pins.

In the following tables, “V_{SS}” means Hv_{SS5} for ground Pins of the stepper motor and V_{SS5} for the other pins.

(V_{DD5} = AV_{CC5} = 3.0 V to 5.5 V, V_{SS5} = AV_{SS5} = 0 V, T_A = -40°C to +105°C)

| Parameter | Symbol | Pin Name | Condition | Value | | | Unit | Remarks |
|--------------------|--------------------|--------------------------------------|----------------------------------------------------------|------------------------|-----------------------|------------------------|-------------------------------------------|--------------------------------------|
| | | | | Min | Typ | Max | | |
| Input “H” voltage | V _{IH} | — | Port inputs if CMOS Hysteresis 0.8/0.2 input is selected | 0.8 × V _{DD} | — | V _{DD} + 0.3 | V | CMOS hysteresis input |
| | | — | Port inputs if CMOS Hysteresis 0.7/0.3 input is selected | 0.7 × V _{DD} | — | V _{DD} + 0.3 | V | 4.5 V ≤ V _{DD} ≤ 5.5 V |
| | | | | 0.74 × V _{DD} | — | V _{DD} + 0.3 | V | 3 V ≤ V _{DD} < 4.5 V |
| | | — | AUTOMOTIVE Hysteresis input is selected | 0.8 × V _{DD} | — | V _{DD} + 0.3 | V | |
| | — | Port inputs if TTL input is selected | 2.0 | — | V _{DD} + 0.3 | V | | |
| | V _{IHR} | INITX | — | 0.8 × V _{DD} | — | V _{DD} + 0.3 | V | INITX input pin (CMOS Hysteresis) |
| | V _{IHM} | MD_2 to MD_0 | — | V _{DD} - 0.3 | — | V _{DD} + 0.3 | V | Mode input pins |
| | V _{IHX0S} | X0, X0A | — | 2.5 | — | V _{DD} + 0.3 | V | External clock in “Oscillation mode” |
| V _{IHX0F} | X0 | — | 0.8 × V _{DD} | — | V _{DD} + 0.3 | V | External clock in “Fast Clock Input mode” | |
| Input “L” voltage | V _{IL} | — | Port inputs if CMOS Hysteresis 0.8/0.2 input is selected | V _{SS} - 0.3 | — | 0.2 × V _{DD} | V | |
| | | — | Port inputs if CMOS Hysteresis 0.7/0.3 input is selected | V _{SS} - 0.3 | — | 0.3 × V _{DD} | V | |
| | | | | V _{SS} - 0.3 | — | 0.5 × V _{DD} | V | 4.5 V ≤ V _{DD} ≤ 5.5 V |
| | | — | AUTOMOTIVE Hysteresis input is selected | V _{SS} - 0.3 | — | 0.46 × V _{DD} | V | 3 V ≤ V _{DD} < 4.5 V |
| | — | Port inputs if TTL input is selected | V _{SS} - 0.3 | — | 0.8 | V | | |
| | V _{ILR} | INITX | — | V _{SS} - 0.3 | — | 0.2 × V _{DD} | V | INITX input pin (CMOS Hysteresis) |
| | V _{ILM} | MD_2 to MD_0 | — | V _{SS} - 0.3 | — | V _{SS} + 0.3 | V | Mode input pins |
| | V _{ILXDS} | X0, X0A | — | V _{SS} - 0.3 | — | 0.5 | V | External clock in “Oscillation mode” |

$(V_{DD5} = AV_{CC5} = 3.0\text{ V to } 5.5\text{ V}, V_{SS5} = AV_{SS5} = 0\text{ V}, T_A = -40^\circ\text{C to } +105^\circ\text{C})$

| Parameter | Symbol | Pin Name | Condition | Value | | | Unit | Remarks |
|-----------------------|--------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------|-----|---------------------|------------------------------|-------------------------------------------|
| | | | | Min | Typ | Max | | |
| Input "L" voltage | V_{ILXDF} | X0 | — | $V_{SS} - 0.3$ | — | $0.2 \times V_{DD}$ | V | External clock in "Fast Clock Input mode" |
| Output "H" voltage | V_{OH2} | Normal outputs | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = -2\text{mA}$ | $V_{DD} - 0.5$ | — | — | V | Driving strength set to 2 mA |
| | | | $3.0\text{V} \leq V_{DD} \leq 4.5\text{V}, I_{OH} = -1.6\text{mA}$ | | | | | |
| | V_{OH5} | Normal outputs | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = -5\text{mA}$ | $V_{DD} - 0.5$ | — | — | V | Driving strength set to 5 mA |
| | | | $3.0\text{V} \leq V_{DD} \leq 4.5\text{V}, I_{OH} = -3\text{mA}$ | | | | | |
| V_{OH3} | I ² C outputs | $3.0\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = -3\text{mA}$ | $V_{DD} - 0.5$ | — | — | V | See note *1 | |
| V_{OH30} | High current outputs | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, T_A = -40^\circ\text{C}, I_{OH} = -40\text{mA}$ | $V_{DD} - 0.5$ | — | — | V | Driving strength set to 30mA | |
| | | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = -30\text{mA}$ | | | | | | |
| | | $3.0\text{V} \leq V_{DD} \leq 4.5\text{V}, I_{OH} = -20\text{mA}$ | | | | | | |
| Output "L" voltage | V_{OL2} | Normal outputs | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = +2\text{mA}$ | — | — | 0.4 | V | Driving strength set to 2 mA |
| | | | $3.0\text{V} \leq V_{DD} \leq 4.5\text{V}, I_{OH} = +1.6\text{mA}$ | | | | | |
| | V_{OL5} | Normal outputs | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = +5\text{mA}$ | — | — | 0.4 | V | Driving strength set to 5 mA |
| | | | $3.0\text{V} \leq V_{DD} \leq 4.5\text{V}, I_{OH} = +3\text{mA}$ | | | | | |
| V_{OL3} | I ² C outputs | $3.0\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = +3\text{mA}$ | — | — | 0.4 | V | See note *2 | |
| V_{OL30} | High current outputs | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, T_A = -40^\circ\text{C}, I_{OH} = +40\text{mA}$ | — | — | 0.5 | V | Driving strength set to 30mA | |
| | | $4.5\text{V} \leq V_{DD} \leq 5.5\text{V}, I_{OH} = +30\text{mA}$ | | | | | | |
| | | $3.0\text{V} \leq V_{DD} \leq 4.5\text{V}, I_{OH} = +20\text{mA}$ | | | | | | |
| Input leakage current | I_{IL} | Pnn _m ^{*3} | $3.0\text{V} \leq V_{DD} \leq 5.5\text{V}, V_{SS5} < V_I < V_{DD}, T_A = 25^\circ\text{C}$ | -1 | — | +1 | μA | |
| | | | $3.0\text{V} \leq V_{DD} \leq 5.5\text{V}, V_{SS5} < V_I < V_{DD}, T_A = 105^\circ\text{C}$ | -3 | — | +3 | | |

| Parameter | Symbol | Pin Name | Condition | Value | | | Unit | Remarks |
|-----------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------|-----|------|--------------------|--------------------------------|
| | | | | Min | Typ | Max | | |
| Analog input leakage current | I _{AIN} | ANn *4 | 3.0V ≤ V _{DD} ≤ 5.5V T _A =25°C | - 1 | — | + 1 | μA | |
| | | | 3.0V ≤ V _{DD} ≤ 5.5V T _A =105°C | - 3 | — | + 3 | μA | |
| Pull-up resistance | R _{UP} | Pnn _m *5 | 3.0V ≤ V _{DD} ≤ 3.6V | 40 | 100 | 160 | kΩ | |
| | | INITX | 4.5V ≤ V _{DD} ≤ 5.5V | 25 | 50 | 100 | | |
| Pull-down resistance | R _{DOWN} | Pnn _m *6 | 3.0V ≤ V _{DD} ≤ 3.6V | 40 | 100 | 180 | kΩ | |
| | | | 4.5V ≤ V _{DD} ≤ 5.5V | 25 | 50 | 100 | | |
| Input capacitance | C _{IN} | All except V _{DD5} , V _{DD5R} , V _{SS5} , AV _{CC5} , AV _{SS} , AVRH5 | f = 1 MHz | - | 5 | 15 | pF | |
| Power supply current CY91-F467Dx | I _{CC} | V _{DD5R} | CY91F467Dx: CLKB: 96 MHz CLKP: 48 MHz CLKT: 48 MHz CLKCAN: 48 MHz | — | 120 | 150 | mA | Code fetch from Flash |
| | I _{CCH} | V _{DD5R} | T _A = + 25°C | — | 30 | 150 | μA | At stop mode *7 *8 |
| | | | T _A = + 105°C | — | 400 | 2000 | μA | |
| | | | T _A = + 25°C | — | 100 | 500 | μA | RTC : 4 MHz mode *7 *8 |
| | | | T _A = + 105°C | — | 500 | 2400 | μA | |
| | | | T _A = + 25°C | — | 50 | 250 | μA | RTC : 100 kHz mode *7 *8 |
| | | | T _A = + 105°C | — | 450 | 2200 | μA | |
| | I _{LVE} | V _{DD5} | — | — | 70 | 150 | μA | External low voltage detection |
| | I _{LVI} | V _{DD5R} | — | — | 50 | 100 | μA | Internal low voltage detection |
| I _{OSC} | V _{DD5} | — | — | 250 | 500 | μA | Main clock (4 MHz) | |
| | | — | — | 20 | 40 | μA | Sub clock (32 kHz) | |

| Parameter | Symbol | Pin Name | Condition | Value | | | Unit | Remarks |
|-------------------------------------|-----------|------------|--------------------------------------------------------------------------------|-------|-----|---------------|--------------------|--------------------------------|
| | | | | Min | Typ | Max | | |
| Power supply current CY91-F465DA | I_{CC} | V_{DD5R} | CY91F465DA: CLKB: 100 MHz CLKP: 50 MHz CLKT: 50 MHz CLKCAN: 50 MHz | - | 110 | 140 | mA | Code fetch from Flash |
| | I_{CCH} | V_{DD5R} | $T_A = +25^{\circ}\text{C}$ | - | 30 | 150 | μA | At stop mode *7 |
| | | | $T_A = +105^{\circ}\text{C}$ | - | 300 | 2000 | μA | |
| | | | $T_A = +25^{\circ}\text{C}$ | - | 100 | 500 | μA | RTC : 4 MHz mode *7 |
| | | | $T_A = +105^{\circ}\text{C}$ | - | 500 | 2400 | μA | |
| | | | $T_A = +25^{\circ}\text{C}$ | - | 50 | 250 | μA | RTC : 100 kHz mode *7 |
| | | | $T_A = +105^{\circ}\text{C}$ | - | 400 | 2200 | μA | |
| | I_{LVE} | V_{DD5} | - | - | 70 | 150 | μA | External low voltage detection |
| | I_{LVI} | V_{DD5R} | - | - | 50 | 100 | μA | Internal low voltage detection |
| | I_{OSC} | V_{DD5} | - | - | 250 | 500 | μA | Main clock (4 MHz) |
| - | | | - | 20 | 40 | μA | Sub clock (32 kHz) | |

1. I2C Spec on CY91F467Dx only guaranteed for $4.5\text{ V} < V_{DD5} < 5.5\text{ V}$.
2. I2C Spec on CY91F467Dx only guaranteed for $4.5\text{ V} < V_{DD5} < 5.5\text{ V}$.
3. Pnn_m includes all GPIO pins. Analog (AN) channels and PullUp/PullDown are disabled.
4. ANn includes all pins where AN channels are enabled.
5. Pnn_m includes all GPIO pins. The pull up resistors must be enabled by PPER/PPCR setting and the pins must be in input direction.
6. Pnn_m includes all GPIO pins. The pull down resistors must be enabled by PPER/PPCR setting and the pins must be in input direction.
7. Main regulator OFF, sub regulator set to 1.2V, Low voltage detection disabled.
8. On CY91F467Dx, the I2C pin consumes typical 200 μA and maximal 400 μA when "L" level is output, even if there is no load condition. When entering the standby mode while I2C outputs "L", the above-mentioned current is added to ICCH. The I2C pins are recommended to use for port input or external interrupt in standby mode.

15.4 A/D Converter Characteristics
 $(V_{DD5} = AV_{CC5} = 3.0 \text{ V to } 5.5 \text{ V}, V_{SS5} = AV_{SS5} = 0 \text{ V}, T_A = -40^\circ\text{C to } +105^\circ\text{C})$

| Parameter | Symbol | Pin Name | Value | | | Unit | Remarks |
|---------------------------------|------------|----------|----------------|----------------|----------------|---------------|-------------------------------------------------------------------------------------|
| | | | Min | Typ | Max | | |
| Resolution | — | — | — | — | 10 | bit | |
| Total error | — | — | - 3 | — | + 3 | LSB | |
| Nonlinearity error | — | — | - 2.5 | — | + 2.5 | LSB | |
| Differential nonlinearity error | — | — | - 1.9 | — | + 1.9 | LSB | |
| Zero reading voltage | V_{OT} | ANn | AVRL - 1.5 LSB | AVRL + 0.5 LSB | AVRL + 2.5 LSB | V | |
| Full scale reading voltage | V_{FST} | ANn | AVRH - 3.5 LSB | AVRH - 1.5 LSB | AVRH + 0.5 LSB | V | |
| Compare time | T_{comp} | — | 0.6 | — | 16,500 | μs | $4.5 \text{ V} \leq AV_{CC5} \leq 5.5 \text{ V}$ |
| | | | 2.0 | — | — | μs | $3.0 \text{ V} \leq AV_{CC5} \leq 4.5 \text{ V}$ |
| Sampling time | T_{samp} | — | 0.4 | — | — | μs | $4.5 \text{ V} \leq AV_{CC5} \leq 5.5 \text{ V}$, $R_{EXT} < 2 \text{ k}\Omega$ |
| | | | 1.0 | — | — | μs | $3.0 \text{ V} \leq AV_{CC5} \leq 4.5 \text{ V}$, $R_{EXT} < 1 \text{ k}\Omega$ |
| Conversion time | T_{conv} | — | 1.0 | — | — | μs | $4.5 \text{ V} \leq AV_{CC5} \leq 5.5 \text{ V}$ |
| | | | 3.0 | — | — | μs | $3.0 \text{ V} \leq AV_{CC5} \leq 4.5 \text{ V}$ |
| Input capacitance | C_{IN} | ANn | — | — | 11 | pF | |
| Input resistance | R_{IN} | ANn | — | — | 2.6 | k Ω | $4.5 \text{ V} \leq AV_{CC5} \leq 5.5 \text{ V}$ |
| | | | — | — | 12.1 | k Ω | $3.0 \text{ V} \leq AV_{CC5} \leq 4.5 \text{ V}$ |
| Analog input leakage current | I_{AIN} | ANn | - 1 | — | + 1 | μA | $T_A = + 25^\circ\text{C}$ |
| | | | - 3 | — | + 3 | μA | $T_A = + 105^\circ\text{C}$ |
| Analog input voltage range | V_{AIN} | ANn | AVRL | — | AVRH | V | |
| Offset between input channels | — | ANn | — | — | 4 | LSB | |

(Continued)

Note : The accuracy gets worse as AVRH - AVRL becomes smaller

(Continued)

| Parameter | Symbol | Pin Name | Value | | | Unit | Remarks |
|---------------------------|----------|-------------------|------------------------|-----|------------------------|---------|-------------------------------|
| | | | Min | Typ | Max | | |
| Reference voltage range | AVRH | AVRH5 | $0.75 \times AV_{CC5}$ | — | AV_{CC5} | V | |
| | AVRL | AV _{SS5} | AV_{SS5} | — | $AV_{CC5} \times 0.25$ | V | |
| Power supply current | I_A | AV_{CC5} | — | 2.5 | 5 | mA | A/D Converter active |
| | I_{AH} | AV_{CC5} | — | — | 5 | μA | A/D Converter not operated *1 |
| Reference voltage current | I_R | AVRH5 | — | 0.7 | 1 | mA | A/D Converter active |
| | I_{RH} | AVRH5 | — | — | 5 | μA | A/D Converter not operated *2 |

*1 : Supply current at AV_{CC5} , if A/D converter and ALARM comparator are not operating, ($V_{DD5} = AV_{CC5} = AVRH = 5.0$ V)

*2 : Input current at AVRH5, if A/D converter is not operating, ($V_{DD5} = AV_{CC5} = AVRH = 5.0$ V)

Sampling Time Calculation

$$T_{\text{samp}} = (2.6 \text{ k}\Omega + R_{\text{EXT}}) \times 11 \text{ pF} \times 7; \text{ for } 4.5 \text{ V} \leq AV_{CC5} \leq 5.5 \text{ V}$$

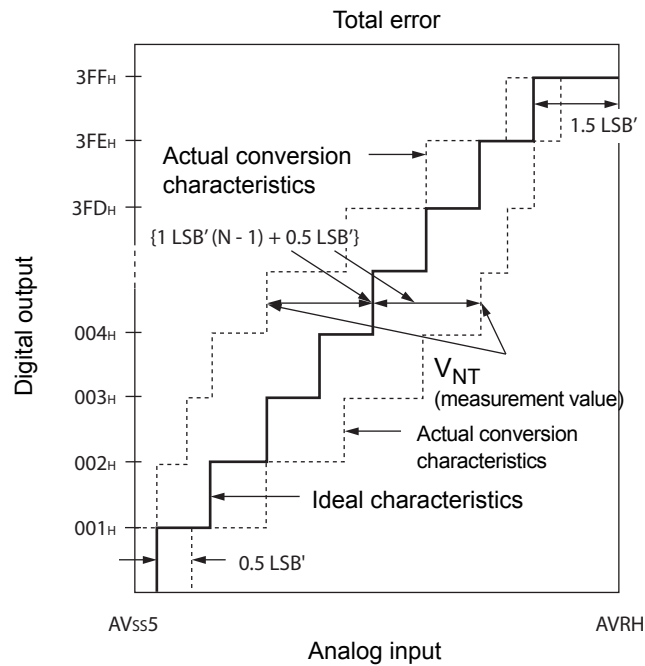
$$T_{\text{samp}} = (12.1 \text{ k}\Omega + R_{\text{EXT}}) \times 11 \text{ pF} \times 7; \text{ for } 3.0 \text{ V} \leq AV_{CC5} \leq 4.5 \text{ V}$$

Conversion Time Calculation

$$T_{\text{conv}} = T_{\text{samp}} + T_{\text{comp}}$$

Definition of A/D converter terms

- Resolution
Analog variation that is recognizable by the A/D converter.
- Nonlinearity error
Deviation between actual conversion characteristics and a straight line connecting the zero transition point (00 0000 0000_B ↔ 00 0000 0001_B) and the full scale transition point (11 1111 1110_B ↔ 11 1111 1111_B).
- Differential nonlinearity error
Deviation of the input voltage from the ideal value that is required to change the output code by 1 LSB.
- Total error
This error indicates the difference between actual and theoretical values, including the zero transition error, full scale transition error, and nonlinearity error.



$$1\text{LSB}' (\text{ideal value}) = \frac{\text{AVRH} - \text{AV}_{\text{SS5}}}{1024} \text{ [V]}$$

$$\text{Total error of digital output } N = \frac{V_{\text{NT}} - \{1 \text{LSB}' \times (N - 1) + 0.5 \text{LSB}'\}}{1 \text{LSB}'}$$

N : A/D converter digital output value

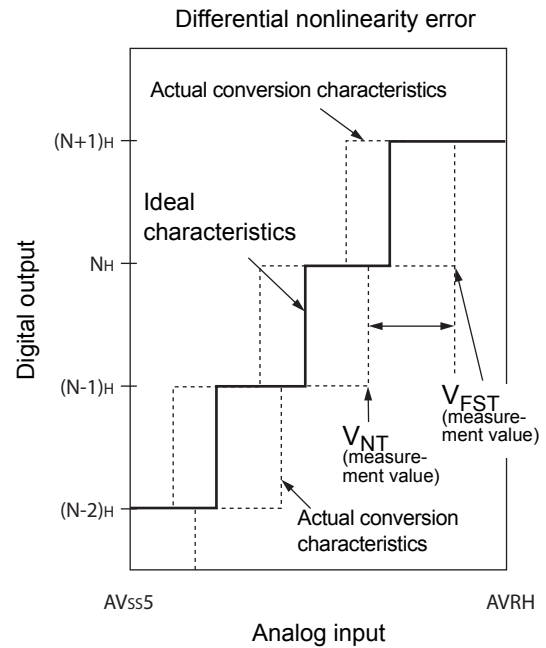
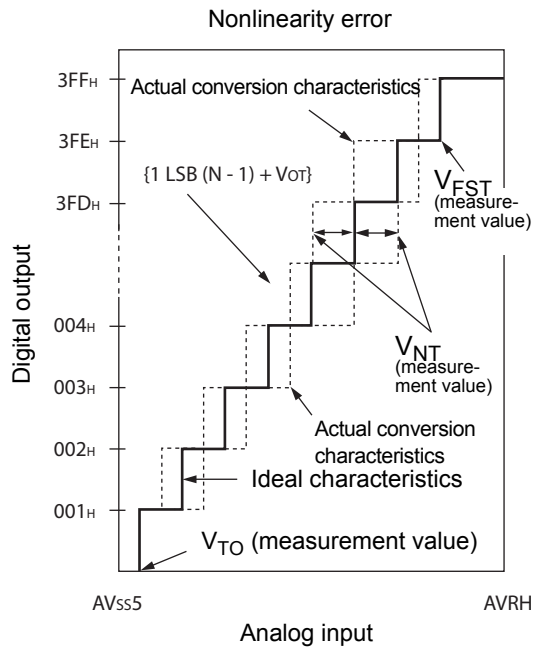
$$V_{\text{OT}}' (\text{ideal value}) = \text{AV}_{\text{SS5}} + 0.5 \text{LSB}' \text{ [V]}$$

$$V_{\text{FST}}' (\text{ideal value}) = \text{AVRH} - 1.5 \text{LSB}' \text{ [V]}$$

V_{NT} : Voltage at which the digital output changes from (N + 1)_H to N_H

(Continued)

(Continued)



$$\text{Nonlinearity error of digital output } N = \frac{V_{NT} - \{1\text{LSB} \times (N - 1) + V_{OT}\}}{1\text{LSB}} \text{ [LSB]}$$

$$\text{Differential nonlinearity error of digital output } N = \frac{V_{(N+1)T} - V_{NT}}{1\text{LSB}} - 1 \text{ [LSB]}$$

$$1\text{LSB} = \frac{V_{FST} - V_{OT}}{1022} \text{ [V]}$$

N : A/D converter digital output value

V_{OT} : Voltage at which the digital output changes from 000_H to 001_H.

V_{FST} : Voltage at which the digital output changes from 3FE_H to 3FF_H.

15.5 Alarm Comparator Characteristics

| Parameter | Symbol | Pin Name | Value | | | Unit | Remarks |
|-------------------------------|--------------|------------|-------------------------------|------------------------|-------------------------------|--------------------------------------------|----------------------------------------------------------|
| | | | Min | Typ | Max | | |
| Power supply current | I_{A5ALMF} | AV_{CC5} | — | 25 | 40 | μA | Alarm comparator enabled in fast mode (per channel) *1 |
| | I_{A5ALMS} | | — | 7 | 10 | μA | Alarm comparator enabled in normal mode (per channel) *1 |
| | I_{A5ALMH} | | — | — | 5 | μA | Alarm comparator disabled |
| ALARM pin input current | I_{ALIN} | ALARM_n | -1 | — | +1 | μA | $T_A=25^\circ C$ |
| | | | -3 | — | +3 | μA | $T_A=105^\circ C$ |
| ALARM pin input voltage range | V_{ALIN} | | 0 | — | AV_{CC5} | V | |
| Alarm upper limit voltage | V_{IAH} | | $AV_{CC5} \times 0.78$ -3% | $AV_{CC5} \times 0.78$ | $AV_{CC5} \times 0.78$ +3% | V | |
| Alarm lower limit voltage | V_{IAL} | | $AV_{CC5} \times 0.36$ -5% | $AV_{CC5} \times 0.36$ | $AV_{CC5} \times 0.36$ +5% | V | |
| Alarm hysteresis voltage | V_{IAHYS} | | 50 | — | 250 | mV | |
| Alarm input resistance | R_{IN} | | 5 | — | — | M Ω | |
| Comparison time | t_{COMPF} | | — | 0.1 | 0.2 | μs | Alarm comparator enabled in fast mode *1 |
| | t_{COMPS} | — | 1 | 2 | μs | Alarm comparator enabled in normal mode *1 | |

Note: *1 : The fast Alarm Comparator mode is enabled by setting ACSR.MD=1
Setting ACSR.MD = 0 sets the normal mode.

15.6 FLASH Memory Program/Erase Characteristics
15.6.1 CY91F465DA

 (T_A = 25°C, V_{CC} = 5.0V)

| Parameter | Value | | | Unit | Remarks |
|--------------------------------------|--------|-------|-------|-------|-----------------------------------------------|
| | Min | Typ | Max | | |
| Sector erase time | - | 0.9 | 3.6 | s | Erasure programming time not included |
| Chip erase time | - | n*0.9 | n*3.6 | s | n is the number of Flash sector of the device |
| Word (16-bit width) programming time | - | 23 | 370 | μs | System overhead time not included |
| Programme/Erase cycle | 10 000 | - | - | cycle | |
| Flash data retention time | 20 | - | - | year | *1 |

*1: This value was converted from the results of evaluating the reliability of the technology (using Arrhenius equation to convert high temperature measurements into normalized value at 85°C)

15.6.2 CY91F467Dx

 (T_A = 25°C, V_{CC} = 5.0V)

| Parameter | Value | | | Unit | Remarks |
|--------------------------------------------|--------|-------|-------|-------|-----------------------------------------------|
| | Min | Typ | Max | | |
| Sector erase time | - | 0.5 | 2.0 | s | Erasure programming time not included |
| Chip erase time | - | n*0.5 | n*2.0 | s | n is the number of Flash sector of the device |
| Word (16 or 32-bit width) programming time | - | 6 | 100 | μs | System overhead time not included |
| Programme/Erase cycle | 10 000 | - | - | cycle | |
| Flash data retention time | 20 | - | - | year | *1 |

*1: This value was converted from the results of evaluating the reliability of the technology (using Arrhenius equation to convert high temperature measurements into normalized value at 85°C)

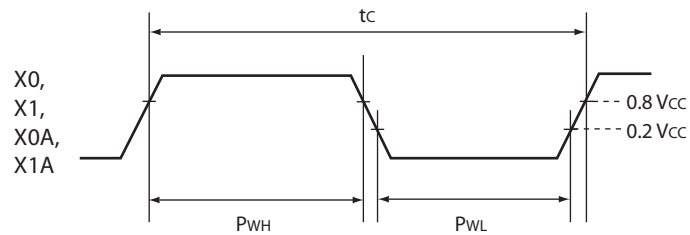
15.7 AC Characteristics

15.7.1 Clock Timing

($V_{DD5} = 3.0\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Value | | | Unit | Condition |
|-----------------|--------|------------|-------|--------|-----|------|-------------------------------------------|
| | | | Min | Typ | Max | | |
| Clock frequency | f_C | X0 X1 | 3.5 | 4 | 16 | MHz | Opposite phase external supply or crystal |
| | | X0A X1A | 32 | 32.768 | 100 | kHz | |

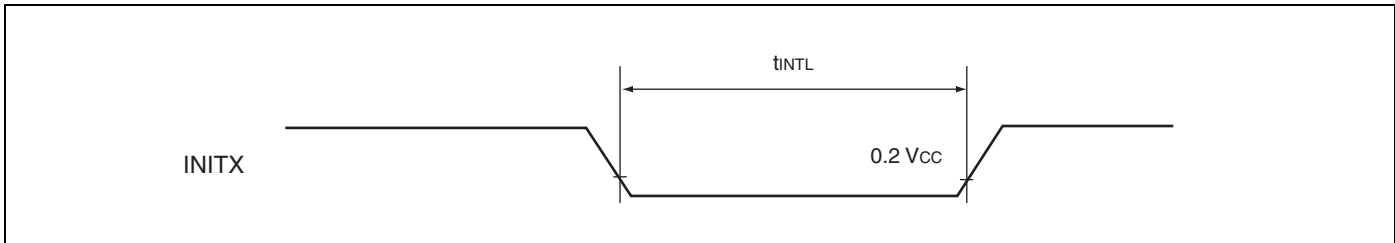
Clock Timing Condition



15.7.2 Reset Input Ratings

($V_{DD5} = 3.0\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Condition | Value | | Unit |
|-----------------------------------------|------------|----------|-----------|-------|-----|---------------|
| | | | | Min | Max | |
| INITX input time (at power-on) | t_{INTL} | INITX | — | 8 | — | ms |
| INITX input time (other than the above) | | | | 20 | — | μs |



15.7.3 LIN-USART Timings at $V_{DD5} = 3.0$ to 5.5 V

- Conditions during AC measurements
- All AC tests were measured under the following conditions:
 - - $I_{Odrive} = 5$ mA
 - - $V_{DD5} = 3.0$ V to 5.5 V, $I_{load} = 3$ mA
 - - $V_{SS5} = 0$ V
 - - $T_a = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$
 - - $C_l = 50$ pF (load capacity value of pins when testing)
 - - $V_{OL} = 0.2 \times V_{DD5}$
 - - $V_{OH} = 0.8 \times V_{DD5}$
 - - EPILR = 0, PILR = 1 (Automotive Level = worst case)

 $(V_{DD5} = 3.0$ V to 5.5 V, $V_{SS5} = AV_{SS5} = 0$ V, $T_A = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$)

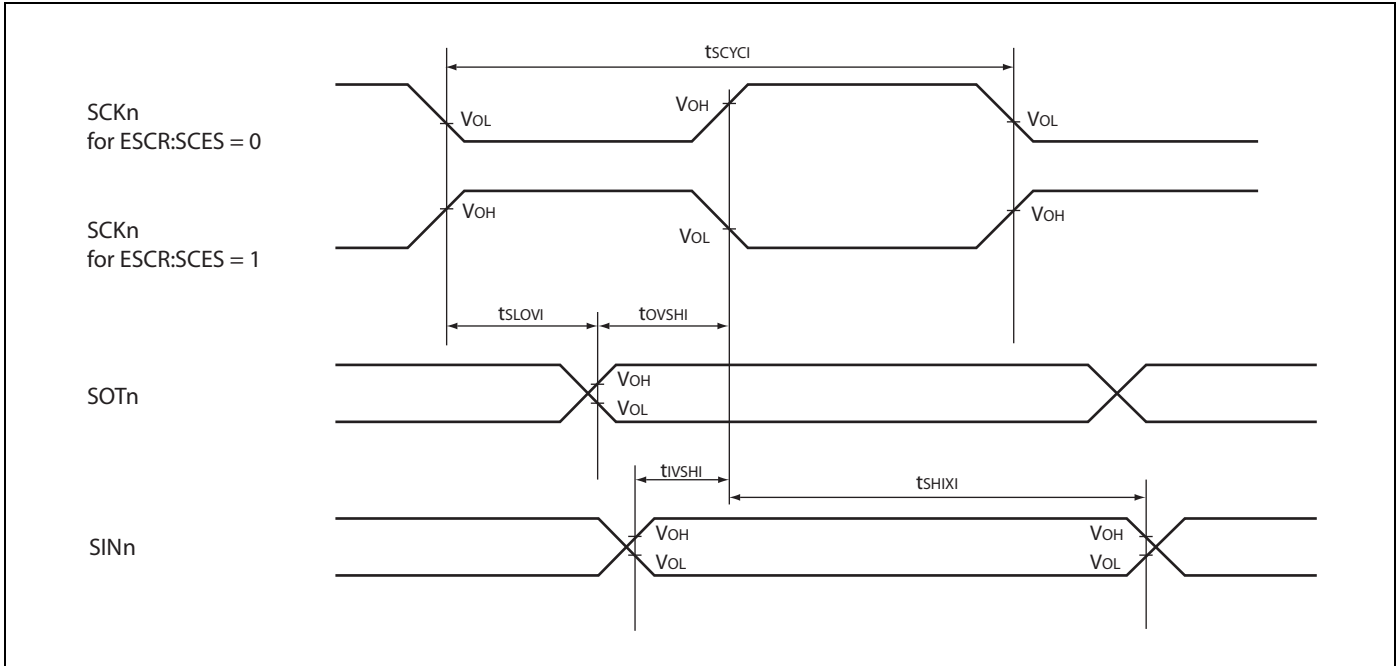
| Parameter | Symbol | Pin Name | Condition | $V_{DD5} = 3.0$ V to 4.5 V | | $V_{DD5} = 4.5$ V to 5.5 V | | Unit |
|---------------------------------------------------|-------------|--------------|----------------------------------------|------------------------------|-------------------|------------------------------|-------------------|------|
| | | | | Min | Max | Min | Max | |
| Serial clock cycle time | t_{SCYCI} | SCKn | Internal clock operation (master mode) | $4 t_{CLKP}$ | — | $4 t_{CLKP}$ | — | ns |
| SCK $\downarrow \rightarrow$ SOT delay time | t_{SLOVI} | SCKn SOTn | | - 30 | 30 | - 20 | 20 | ns |
| SOT \rightarrow SCK \downarrow delay time | t_{OVSHI} | SCKn SOTn | | $m \times t_{CLKP} - 30^*$ | — | $m \times t_{CLKP} - 20^*$ | — | ns |
| Valid SIN \rightarrow SCK \uparrow setup time | t_{IVSHI} | SCKn SINn | | $t_{CLKP} + 55$ | — | $t_{CLKP} + 45$ | — | ns |
| SCK $\uparrow \rightarrow$ valid SIN hold time | t_{SHIXI} | SCKn SINn | | 0 | — | 0 | — | ns |
| Serial clock "H" pulse width | t_{SHSLE} | SCKn | External clock operation (slave mode) | $t_{CLKP} + 10$ | — | $t_{CLKP} + 10$ | — | ns |
| Serial clock "L" pulse width | t_{SLSHE} | SCKn | | $t_{CLKP} + 10$ | — | $t_{CLKP} + 10$ | — | ns |
| SCK $\downarrow \rightarrow$ SOT delay time | t_{SLOVE} | SCKn SOTn | | — | $2 t_{CLKP} + 55$ | — | $2 t_{CLKP} + 45$ | ns |
| Valid SIN \rightarrow SCK \uparrow setup time | t_{IVSHE} | SCKn SINn | | 10 | — | 10 | — | ns |
| SCK $\uparrow \rightarrow$ valid SIN hold time | t_{SHIXE} | SCKn SINn | | $t_{CLKP} + 10$ | — | $t_{CLKP} + 10$ | — | ns |
| SCK rising time | t_{FE} | SCKn | | — | 20 | — | 20 | ns |
| SCK falling time | t_{RE} | SCKn | | — | 20 | — | 20 | ns |

* : Parameter m depends on t_{SCYCI} and can be calculated as :

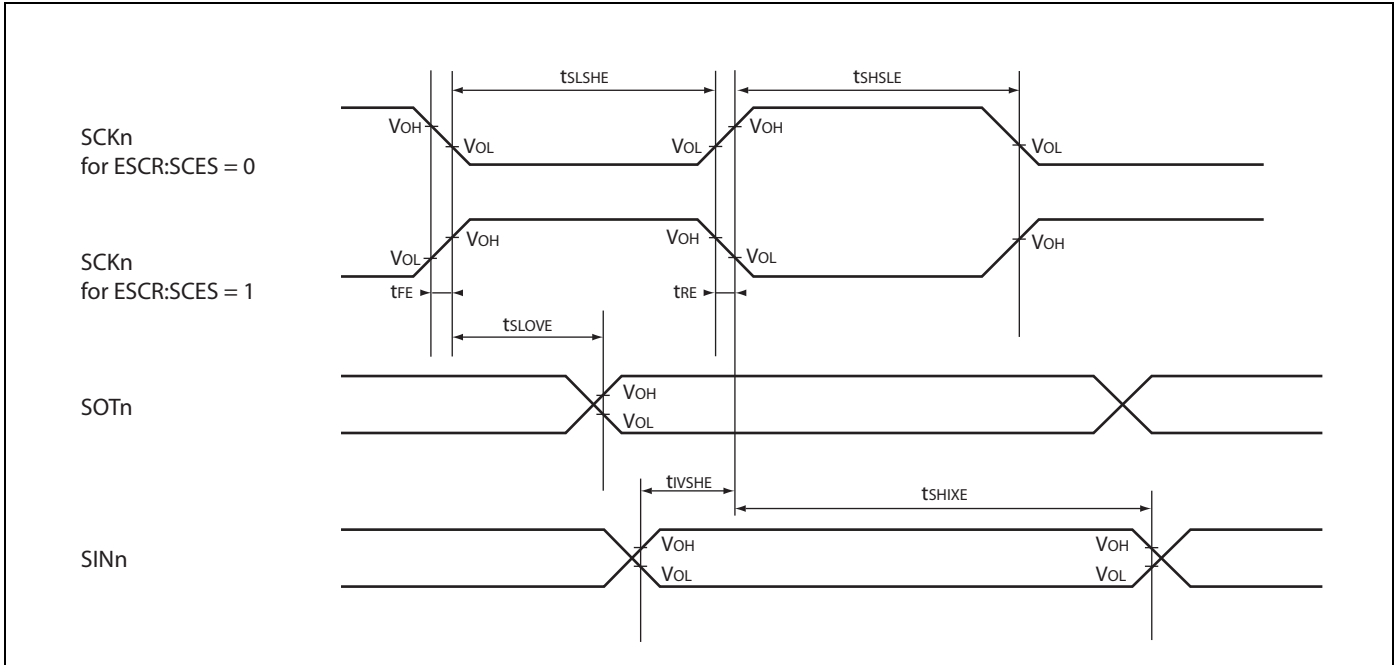
- if $t_{SCYCI} = 2 \times k \times t_{CLKP}$, then $m = k$, where k is an integer > 2
- if $t_{SCYCI} = (2 \times k + 1) \times t_{CLKP}$, then $m = k + 1$, where k is an integer > 1

Notes : • The above values are AC characteristics for CLK synchronous mode.
• t_{CLKP} is the cycle time of the peripheral clock.

Internal Clock Mode (Master Mode)



External Clock Mode (Slave Mode)



15.7.4 I²C AC Timings at V_{DD5} = 3.0 to 5.5 V

- Conditions during AC measurements

All AC tests were measured under the following conditions:

- I_{Odrive} = 3 mA
- V_{DD5} = 3.0 V to 5.5 V, I_{load} = 3 mA (V_{DD} = 4.5 V to 5.5 V for CY91F467Dx)
- V_{SS5} = 0 V
- T_a = -40°C to +105°C
- C_l = 50 pF
- VOL = 0.3 × V_{DD5}
- VOH = 0.7 × V_{DD5}
- EPILR = 0, PILR = 0 (CMOS Hysteresis 0.3 × V_{DD5}/0.7 × V_{DD5})

Fast Mode:

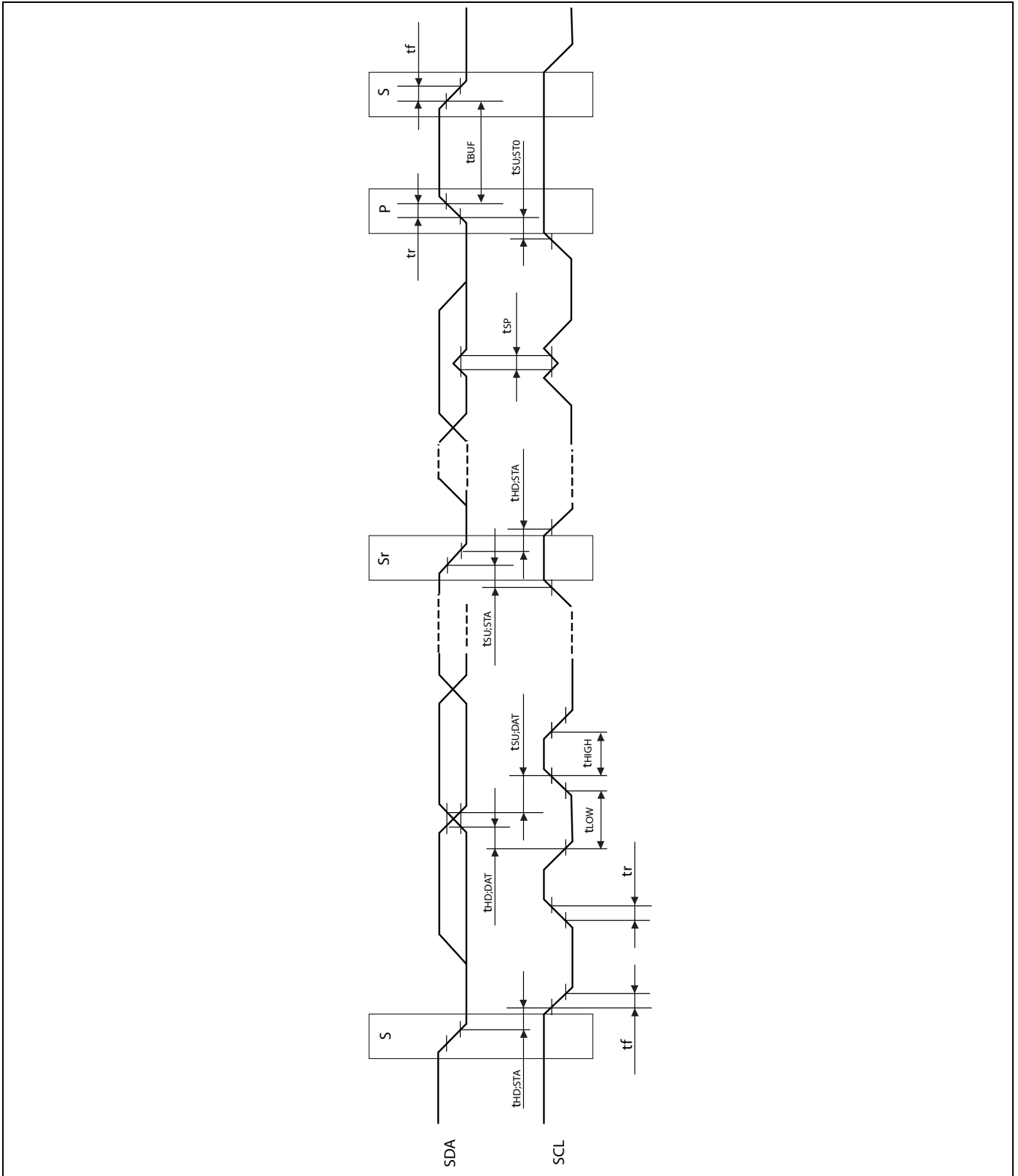
(V_{DD5} = 3.5 V to 5.5 V, V_{SS5} = AV_{SS5} = 0 V, T_A = -40°C to +105°C)

| Parameter | Symbol | Pin Name | Value | | Unit | Remark |
|---------------------------------------------------------------------------------------------|---------------------|------------|------------|------------------------------|------|--------|
| | | | Min | Max | | |
| SCL clock frequency | f _{SCL} | SCLn | 0 | 400 | kHz | |
| Hold time (repeated) START condition. After this period, the first clock pulse is generated | t _{HD;STA} | SCLn, SDAn | 0.6 | — | μs | |
| LOW period of the SCL clock | t _{LOW} | SCLn | 1.3 | — | μs | |
| HIGH period of the SCL clock | t _{HIGH} | SCLn | 0.6 | — | μs | |
| Setup time for a repeated START condition | t _{SU;STA} | SCLn, SDAn | 0.6 | — | μs | |
| Data hold time for I ² C-bus devices | t _{HD;DAT} | SCLn, SDAn | 0 | 0.9 | μs | |
| Data setup time | t _{SU;DAT} | SCLn, SDAn | 100 | — | ns | |
| Rise time of both SDA and SCL signals | t _r | SCLn, SDAn | 20 + 0.1Cb | 300 | ns | *1 |
| Fall time of both SDA and SCL signals | t _f | SCLn, SDAn | 20 + 0.1Cb | 300 | ns | *1 |
| Setup time for STOP condition | t _{SU;STO} | SCLn, SDAn | 0.6 | — | μs | |
| Bus free time between a STOP and START condition | t _{BUF} | SCLn, SDAn | 1.3 | — | μs | |
| Capacitive load for each bus line | C _b | SCLn, SDAn | — | 400 | pF | |
| Pulse width of spike suppressed by input filter | t _{SP} | SCLn, SDAn | 0 | (1..1.5) × t _{CLKP} | ns | *2 |

*1 : On CY91F467Dx only guaranteed for 4.5 V < V_{DD5} < 5.5 V.

*2 : The noise filter will suppress single spikes with a pulse width of 0ns and between (1 to 1.5) cycles of peripheral clock, depending on the phase relationship between I2C signals (SDA, SCL) and peripheral clock.

Note: t_{CLKP} is the cycle time of the peripheral clock.

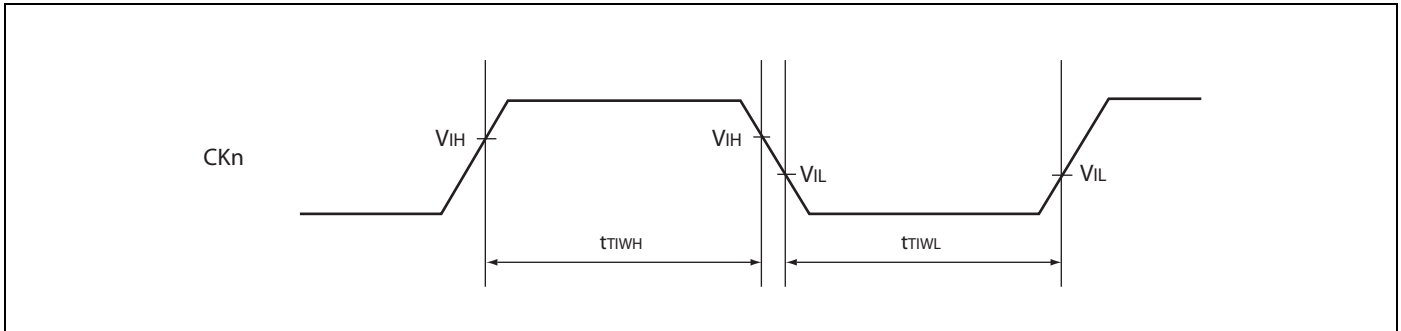


15.7.5 Free-run Timer Clock

($V_{DD5} = 3.0\text{ V to } 5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to } +105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Condition | Value | | Unit |
|-------------------|--------------------------|----------|-----------|-------------|-----|------|
| | | | | Min | Max | |
| Input pulse width | t_{TIWH} t_{TIWL} | CKn | — | $4t_{CLKP}$ | — | ns |

Note : t_{CLKP} is the cycle time of the peripheral clock.

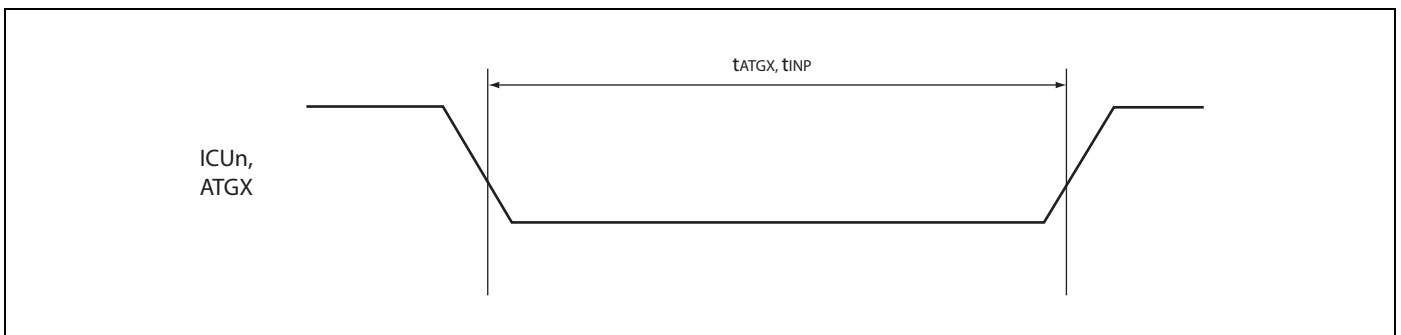


15.7.6 Trigger Input Timing

($V_{DD5} = 3.0\text{ V to } 5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to } +105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Condition | Value | | Unit |
|-----------------------------|------------|----------|-----------|-------------|-----|------|
| | | | | Min | Max | |
| Input capture input trigger | t_{INP} | ICUn | — | $5t_{CLKP}$ | — | ns |
| A/D converter trigger | t_{ATGX} | ATGX | — | $5t_{CLKP}$ | — | ns |

Note : t_{CLKP} is the cycle time of the peripheral clock.



15.7.7 External Bus AC Timings at $V_{DD35} = 4.5$ to 5.5 V

- Conditions during AC measurements

All AC tests were measured under the following conditions:

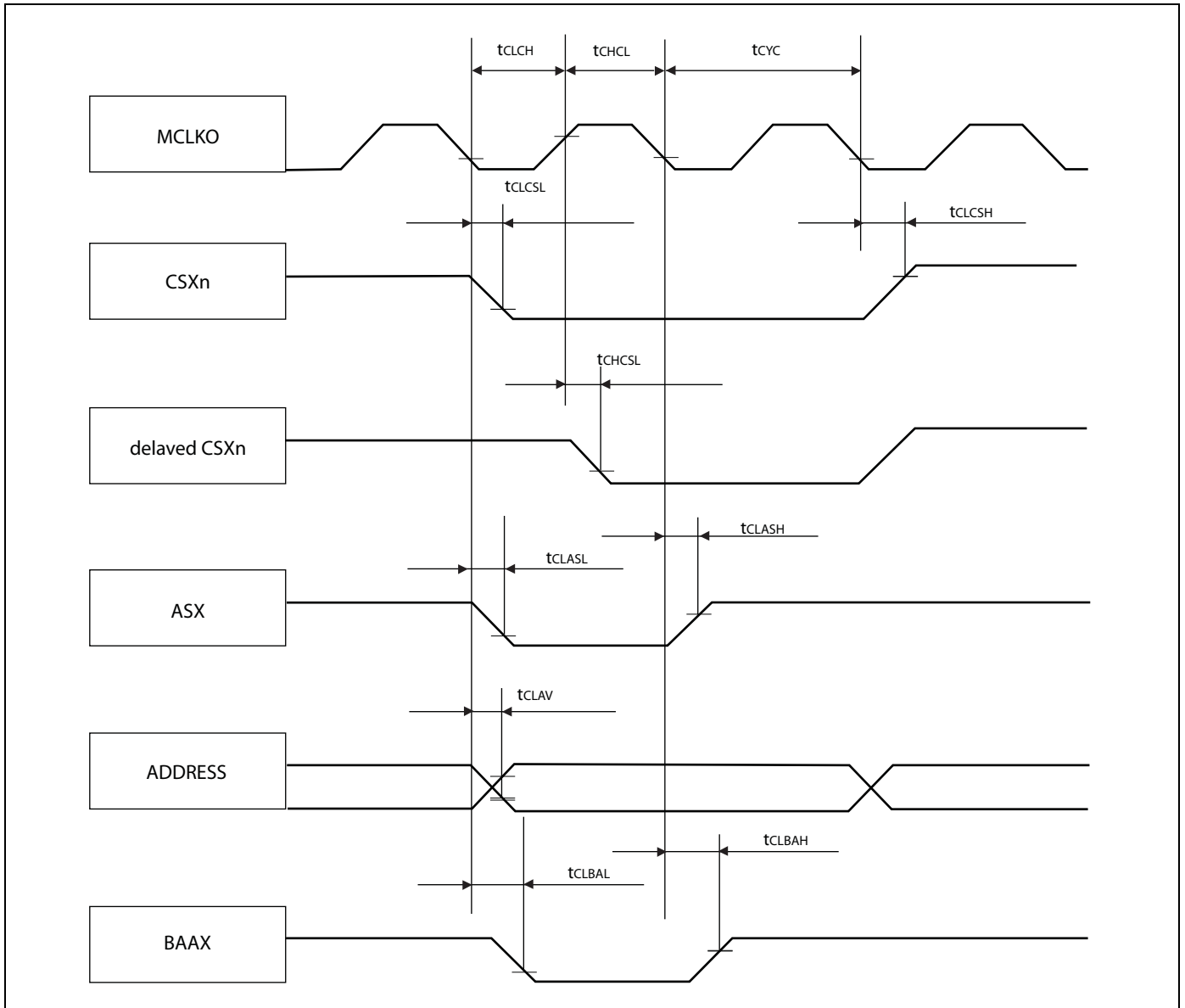
- $I_{Odrive} = 5$ mA
- $V_{DD35} = 4.5$ V to 5.5 V, $I_{load} = 5$ mA
- $V_{SS5} = 0$ V
- $T_a = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$
- $C_l = 50$ pF
- $V_{OL} = 0.2 \times V_{DD35}$
- $V_{OH} = 0.8 \times V_{DD35}$
- $EPILR = 0$, $PILR = 1$ (Automotive Level = worst case)

Basic Timing

($V_{DD35} = 4.5$ V to 5.5 V, $V_{SS5} = AV_{SS5} = 0$ V, $T_A = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$)

| Parameter | Symbol | Pin Name | Value | | Unit |
|-------------------------------------------------|-------------|--------------------|---------------------------|---------------------------|------|
| | | | Min | Max | |
| MCLKO | t_{CLCH} | MCLKO | $1/2 \times t_{CLKT} - 7$ | $1/2 \times t_{CLKT} + 7$ | ns |
| | t_{CHCL} | | $1/2 \times t_{CLKT} - 7$ | $1/2 \times t_{CLKT} + 7$ | ns |
| MCLKO ↓ to CSXn delay time | t_{CLCSL} | MCLKO CSXn | — | 9 | ns |
| | t_{CLCSH} | | — | 8 | ns |
| MCLKO ↑ to CSXn delay time (Addr → CS delay) | t_{CHCSL} | | — 5 | + 2 | ns |
| MCLKO ↓ to ASX delay time | t_{CLASL} | MCLKO ASX | — | 8 | ns |
| | t_{CLASH} | | — | 8 | ns |
| MCLKO ↓ to BAAX delay time | t_{CLBAL} | MCLKO BAAX | — | 5 | ns |
| | t_{CLBAH} | | 1 | — | ns |
| MCLKO ↓ to Address valid delay time | t_{CLAV} | MCLKO A25 to A0 | — | 11 | ns |

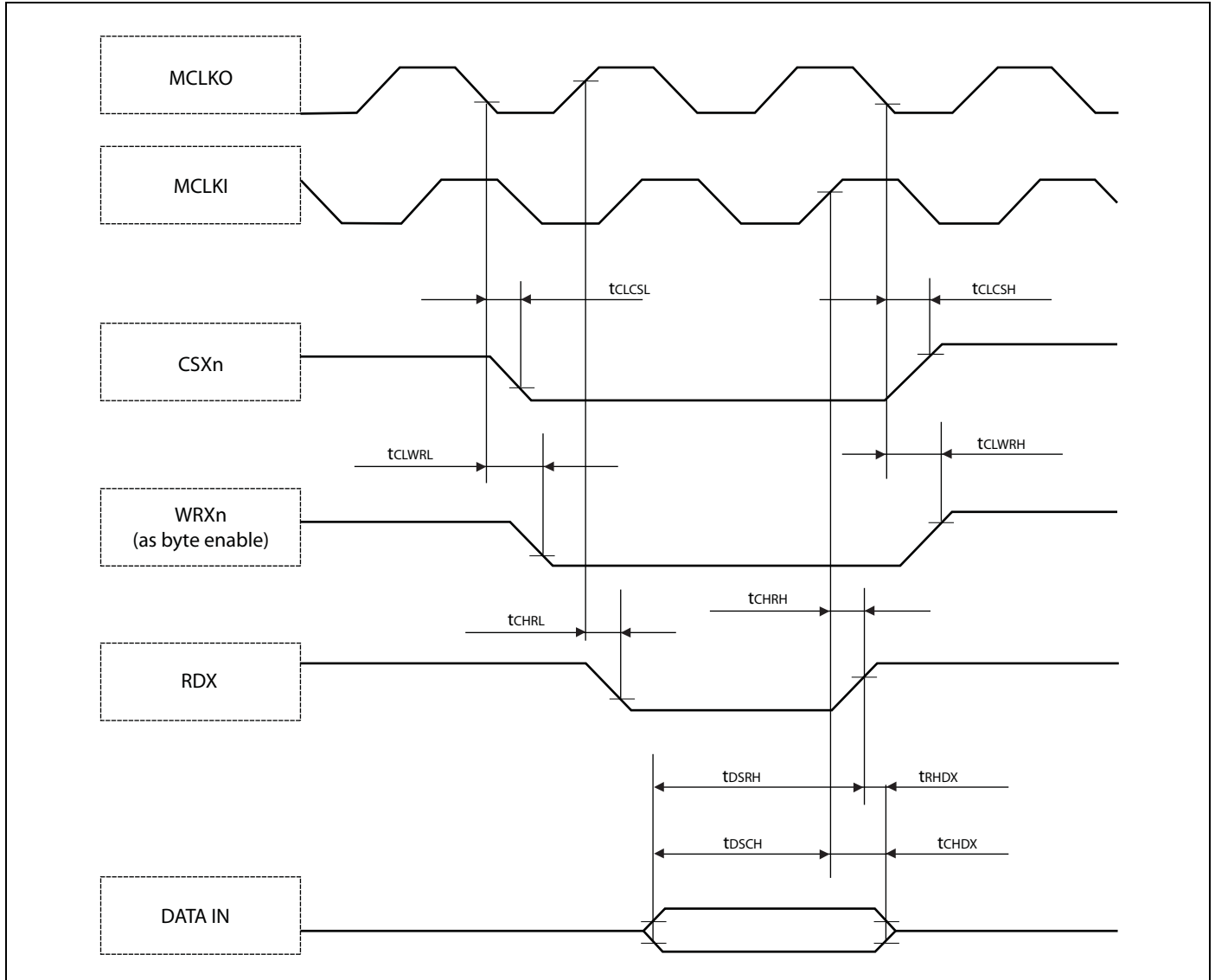
Note : t_{CLKT} is the cycle time of the external bus clock.



Synchronous/Asynchronous Read Access With External Mclki Input
(V_{DD35} = 4.5 V to 5.5 V, V_{SS5} = AV_{SS5} = 0 V, T_A = -40°C to +105°C)

| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------------------------------|--------------------|--------------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO ↑ /MCLKI ↑ to RDX delay time | t _{CHRL} | MCLKO RDX | - 5 | 2 | ns |
| | t _{CHRH} | MCLKI RDX | 8 | 16 | ns |
| Data valid to RDX ↑ setup time | t _{DSRH} | RDX D31 to D0 | 19 | — | ns |
| RDX ↑ to Data valid hold time (external MCLKI input) | t _{RHDX} | RDX D31 to D0 | 0 | — | ns |
| Data valid to MCLKI ↑ setup time | t _{DSCH} | MCLKI D31 to D0 | 3 | — | ns |
| MCLKI ↑ to Data valid hold time | t _{CHDX} | MCLKI D31 to D0 | 1 | — | ns |
| MCLKO ↓ to WRXn (as byte enable) delay time | t _{CLWRL} | MCLKO WRXn | — | 9 | ns |
| | t _{CLWRH} | | - 1 | — | ns |
| MCLKO ↓ to CSXn delay time | t _{CLCSL} | MCLKO CSXn | — | 9 | ns |
| | t _{CLCSH} | | — | 8 | ns |

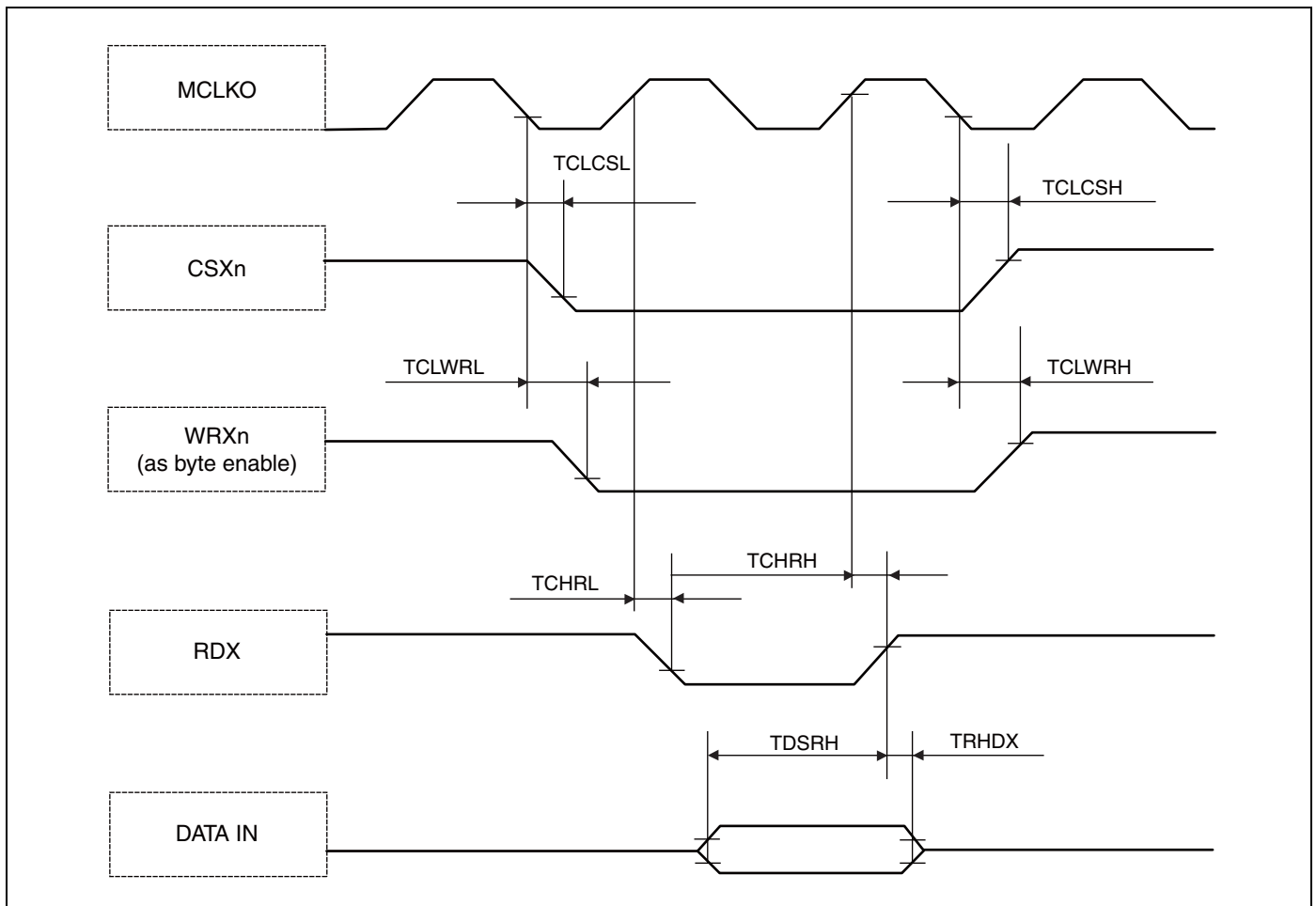
Note: The usage of the external feedback from MCLKO to MCLKI is not recommended.



Synchronous/Asynchronous Read Access with Internal MCLKO --> MCLKI Feedback

($V_{DD35} = 4.5\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

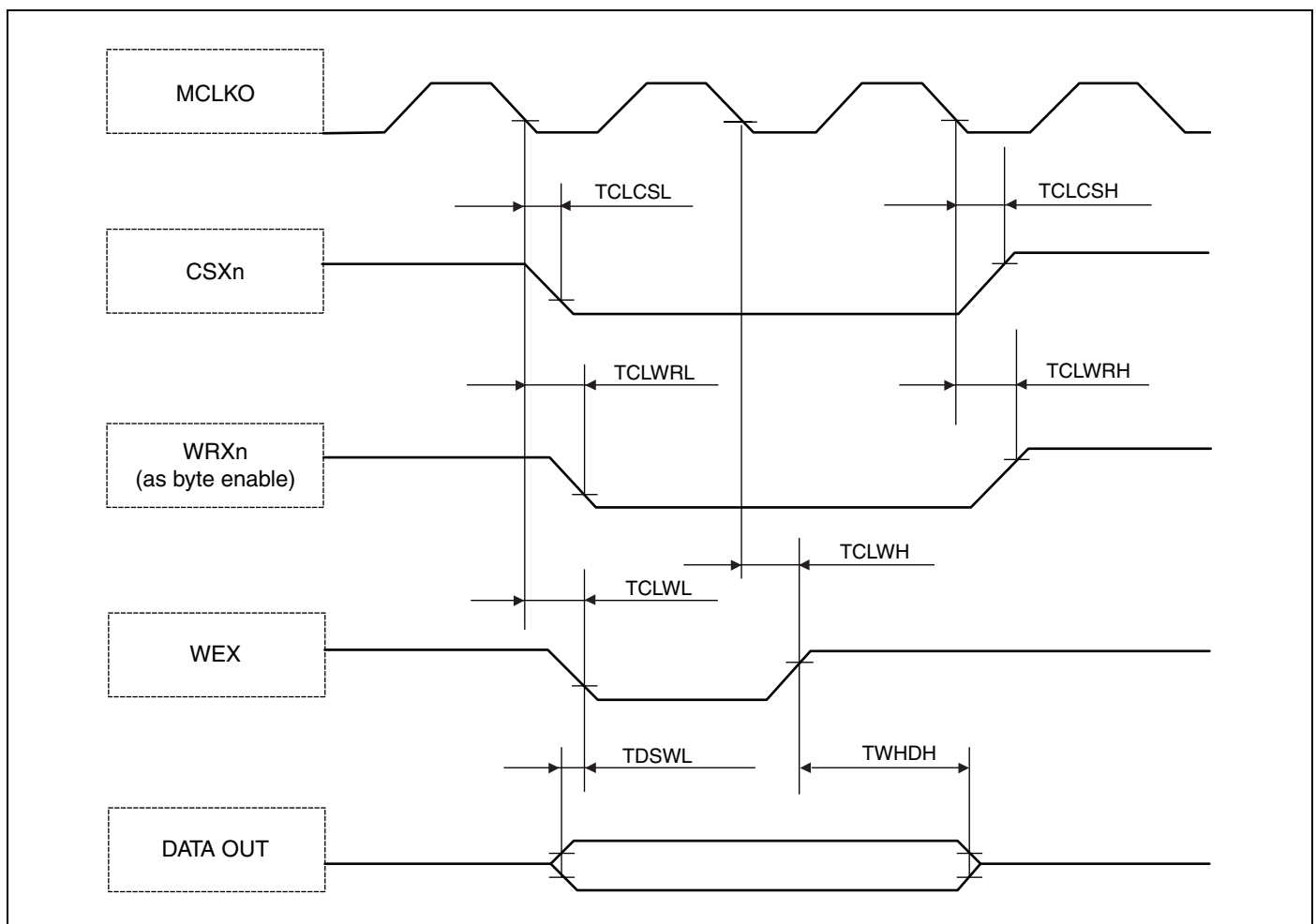
| Parameter | Symbol | Pin Name | Value | | Unit |
|----------------------------------------------------------------------------------------------|--------|------------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO \uparrow to RDX delay time | TCHRL | MCLKO RDX | - 5 | 2 | ns |
| | TCHRH | | - 5 | 2 | ns |
| Data valid to RDX \uparrow setup time | TDSRH | RDX D31 to D0 | 20 | — | ns |
| RDX \uparrow to Data valid hold time (internal MCLKO \rightarrow MCLKI / MCLKI feedback) | TRHDX | RDX D31 to D0 | 0 | — | ns |
| MCLKO \downarrow to WRXn (as byte enable) delay time | TCLWRL | MCLKO WRXn | — | 9 | ns |
| | TCLWRH | | - 1 | — | ns |
| MCLKO \downarrow to CSXn delay time | TCLCSL | MCLKO CSXn | — | 9 | ns |
| | TCLCSH | | — | 8 | ns |



Synchronous Write Access - Byte Control Type

($V_{DD35} = 4.5\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

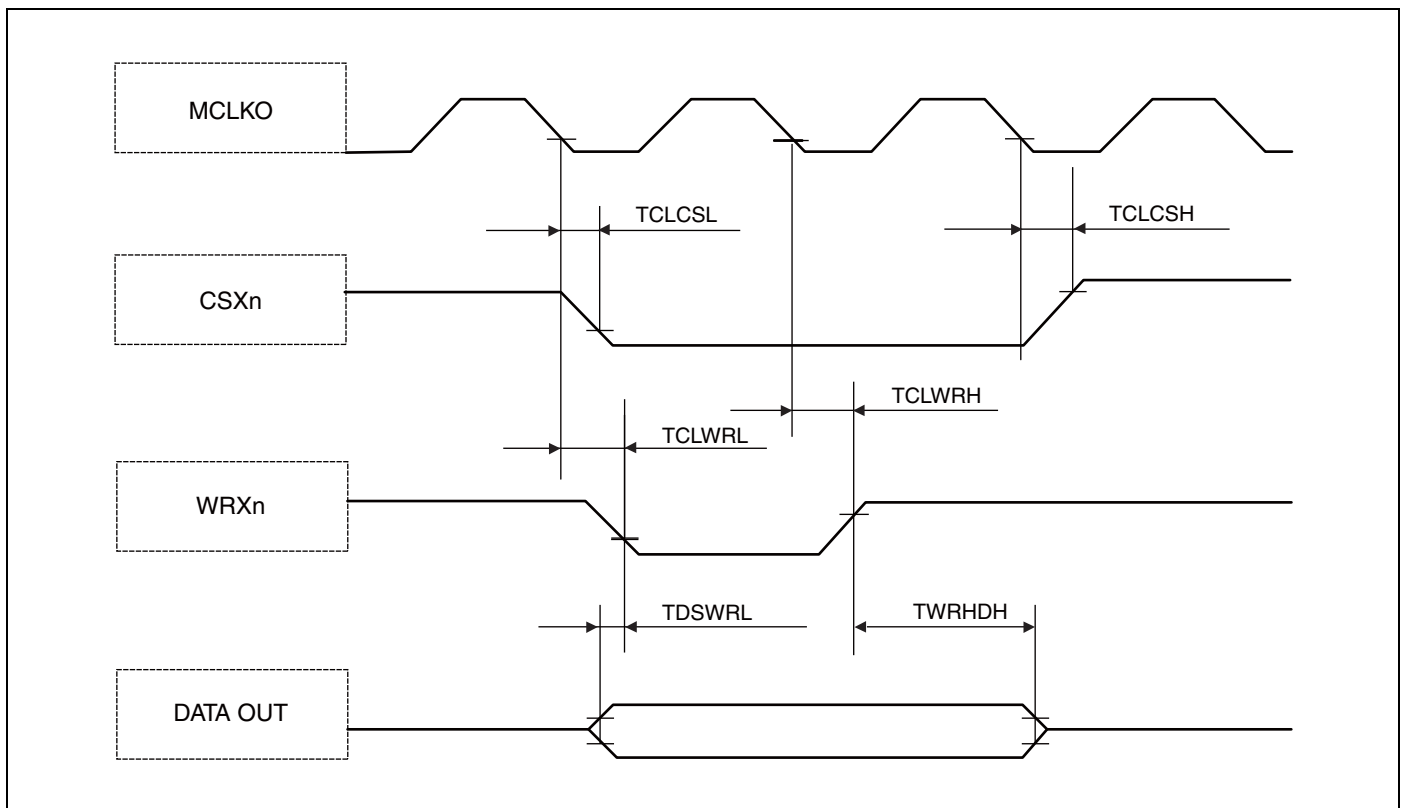
| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------------------|--------|------------------|-----------------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to WEX delay time | TCLWL | MCLKO | — | 9 | ns |
| | TCLWH | WEX | 2 | — | ns |
| Data valid to WEX ↓ setup time | TDSWL | WEX D31 to D0 | - 11 | — | ns |
| WEX ↑ to Data valid hold time | TWHDH | WEX D31 to D0 | $t_{CLKT} - 10$ | — | ns |
| MCLKO ↓ to WRXn (as byte enable) delay time | TCLWRL | MCLKO | — | 9 | ns |
| | TCLWRH | WRXn | - 1 | — | ns |
| MCLKO ↓ to CSXn delay time | TCLCSL | MCLKO | — | 9 | ns |
| | TCLCSH | CSXn | — | 8 | ns |



Synchronous Write Access - No Byte Control Type

($V_{DD35} = 4.5\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

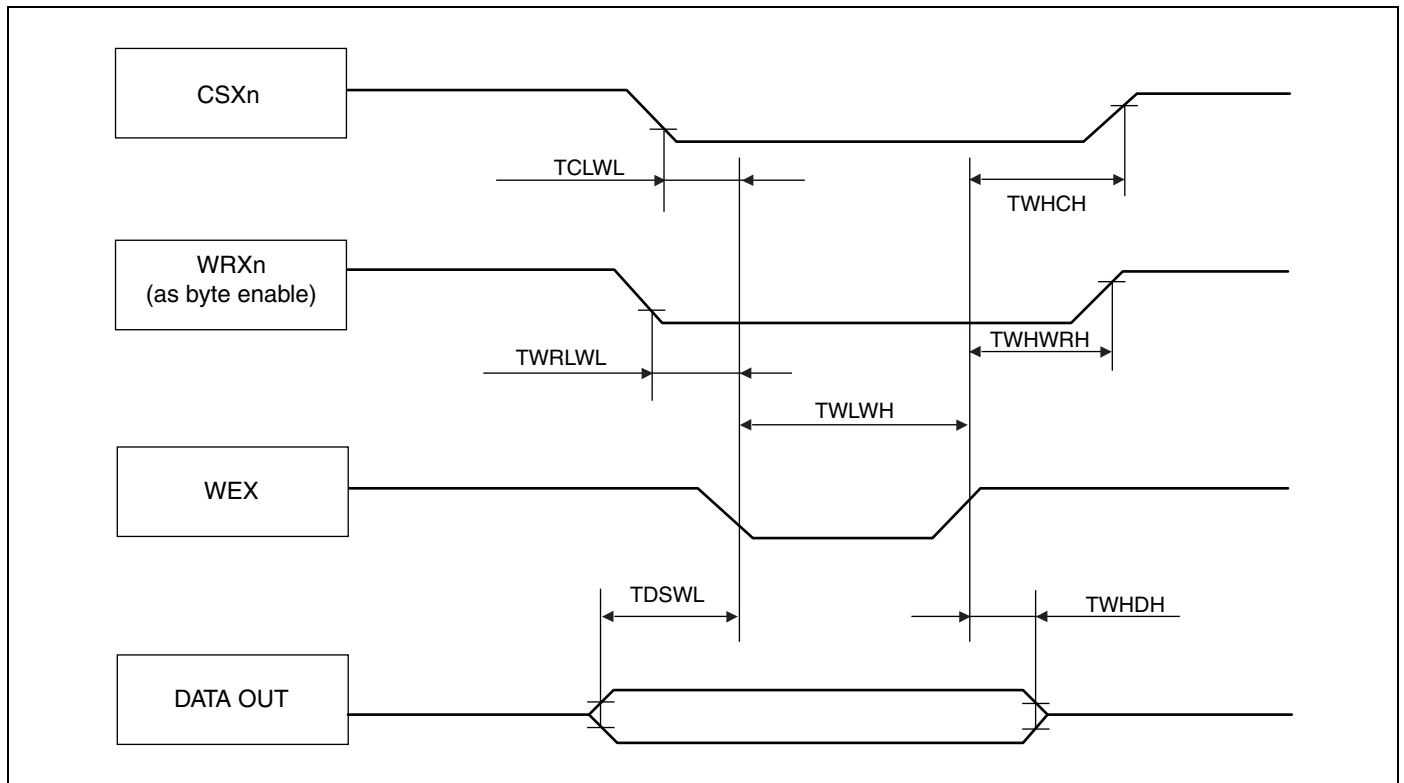
| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------|--------|-------------------|----------------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to WRXn delay time | TCLWRL | MCLKO WRXn | — | 9 | ns |
| | TCLWRH | | - 1 | — | ns |
| Data valid to WRXn ↓ setup time | TDSWRL | WRXn D31 to D0 | - 12 | — | ns |
| WRXn ↑ to Data valid hold time | TWRHDH | WRXn D31 to D0 | $t_{CLKT} - 8$ | — | ns |
| MCLKO ↓ to CSXn delay time | TCLCSL | MCLKO CSXn | — | 9 | ns |
| | TCLCSH | | — | 8 | ns |



Asynchronous Write Access - Byte Control Type

($V_{DD35} = 4.5\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

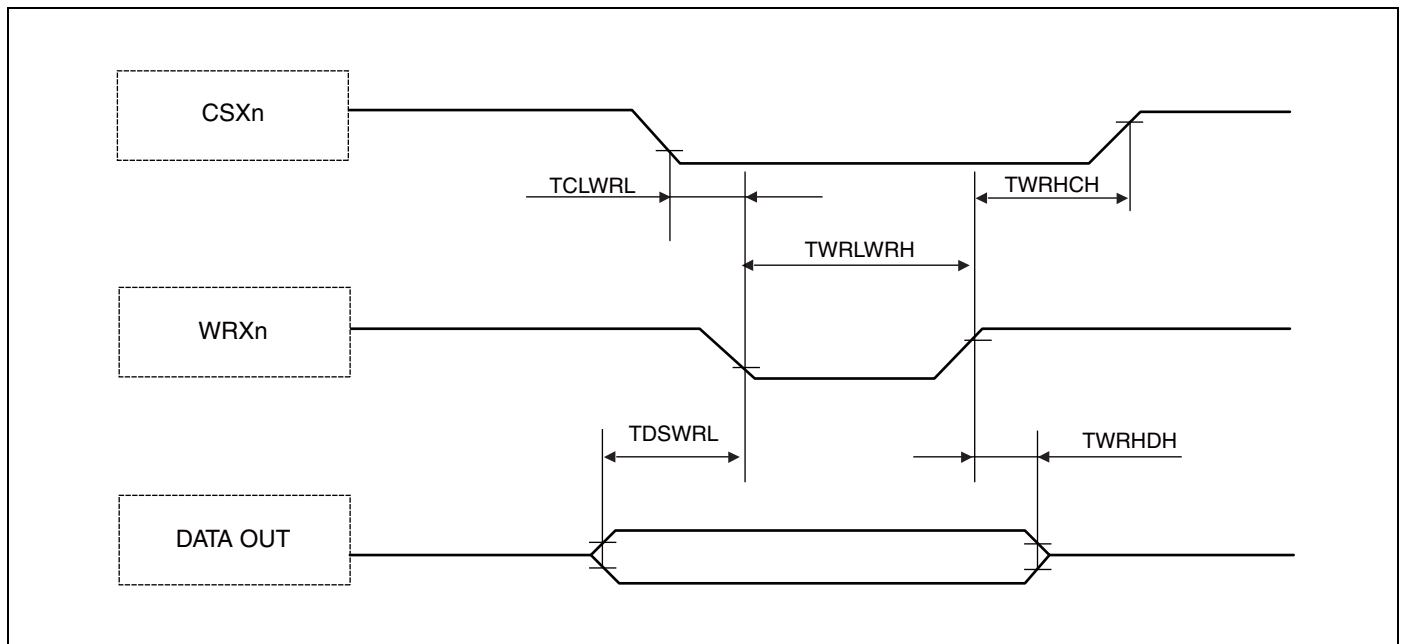
| Parameter | Symbol | Pin Name | Value | | Unit |
|--------------------------------|--------|------------------|----------------------------|---------------------------|------|
| | | | Min | Max | |
| WEX ↓ to WEX ↑ pulse width | TWLWH | WEX | $t_{CLKT} - 2$ | — | ns |
| Data valid to WEX ↓ setup time | TDSWL | WEX D31 to D0 | $1/2 \times t_{CLKT} - 13$ | — | ns |
| WEX ↑ to Data valid hold time | TWHDH | WEX D31 to D0 | $1/2 \times t_{CLKT} - 10$ | — | ns |
| WEX to WRXn delay time | TWRLWL | WEX WRXn | — | $1/2 \times t_{CLKT} + 2$ | ns |
| | TWHWRH | WRXn | $1/2 \times t_{CLKT} - 4$ | — | ns |
| WEX to CSXn delay time | TCLWL | WEX CSXn | — | $1/2 \times t_{CLKT}$ | ns |
| | TWHCH | CSXn | $1/2 \times t_{CLKT} - 5$ | — | ns |



Asynchronous Write Access - No Byte Control Type

($V_{DD35} = 4.5\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

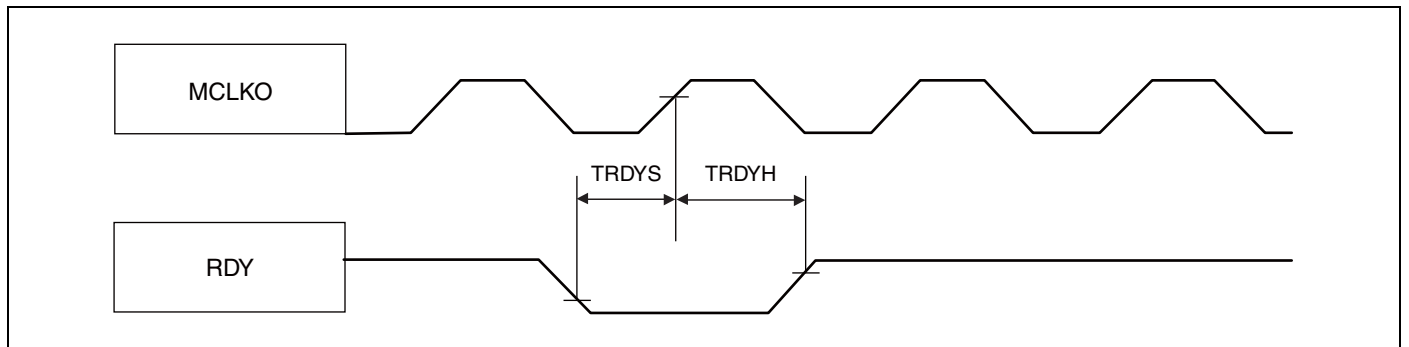
| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------|---------|-------------------|----------------------------|---------------------------|------|
| | | | Min | Max | |
| WRXn ↓ to WRXn ↑ pulse width | TWRLWRH | WRXn | $t_{CLKT} - 1$ | — | ns |
| Data valid to WRXn ↓ setup time | TDSWRL | WRXn D31 to D0 | $1/2 \times t_{CLKT} - 14$ | — | ns |
| WRXn ↑ to Data valid hold time | TWRHCH | WRXn D31 to D0 | $1/2 \times t_{CLKT} - 7$ | — | ns |
| WRXn to CSXn delay time | TCLWRL | WRXn CSXn | — | $1/2 \times t_{CLKT} - 1$ | ns |
| | TWRHCH | WRXn CSXn | $1/2 \times t_{CLKT} - 3$ | — | ns |



RDY Waitcycle Insertion

 ($V_{DD35} = 4.5 \text{ V to } 5.5 \text{ V}$, $V_{SS5} = AV_{SS5} = 0 \text{ V}$, $T_A = -40^\circ\text{C to } +105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Value | | Unit |
|----------------|--------|--------------|-------|-----|------|
| | | | Min | Max | |
| RDY setup time | TRDYS | MCLKO RDY | 21 | — | ns |
| RDY hold time | TRDYH | MCLKO RDY | 0 | — | ns |

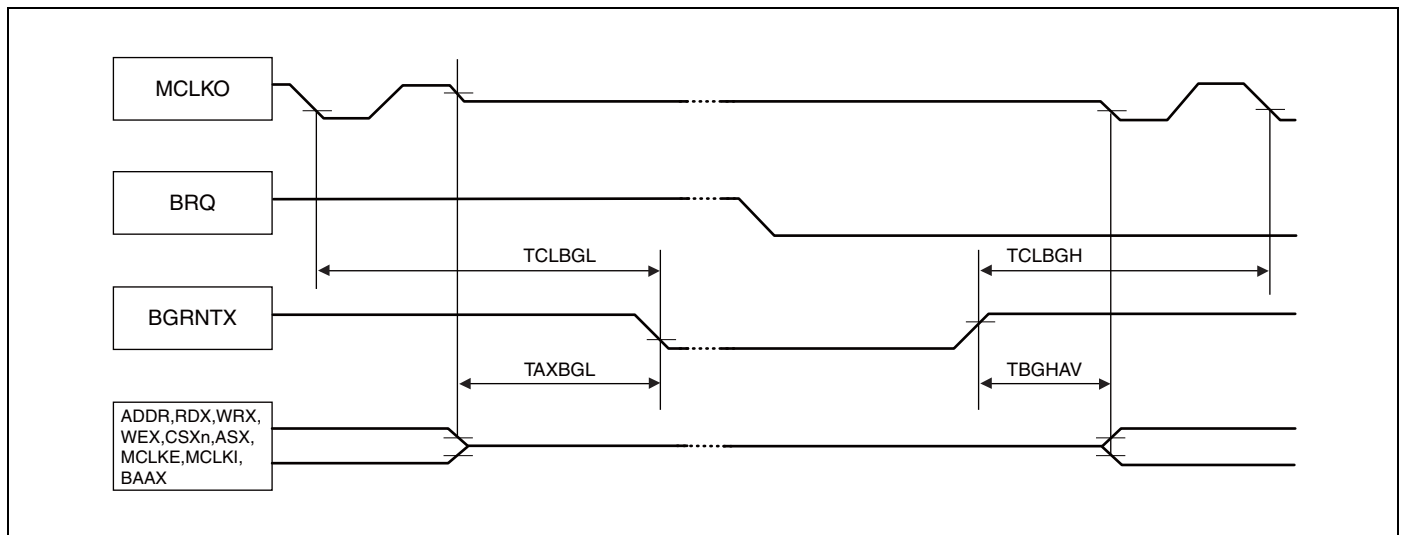


Bus Hold Timing

($V_{DD35} = 4.5\text{ V to } 5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to } +105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Value | | Unit |
|------------------------------|--------|--------------------------------------------------------------------|----------------|-------------------------|------|
| | | | Min | Max | |
| MCLKO ↓ to BGRNTX delay time | TCLBGL | MCLKO BGRNTX | — | $2 \times t_{CLKT} + 5$ | ns |
| | TCLBGH | | — | $2 \times t_{CLKT} + 2$ | ns |
| Bus HIZ to BGRNTX ↓ | TAXBGL | BGRNTX MCLK* A0 to An RDX, ASX WRXn, WEX CSXn, BAAX | $t_{CLKT} - 6$ | — | ns |
| BGRNTX ↑ to Bus drive | TBGHAV | | $t_{CLKT} + 8$ | — | ns |

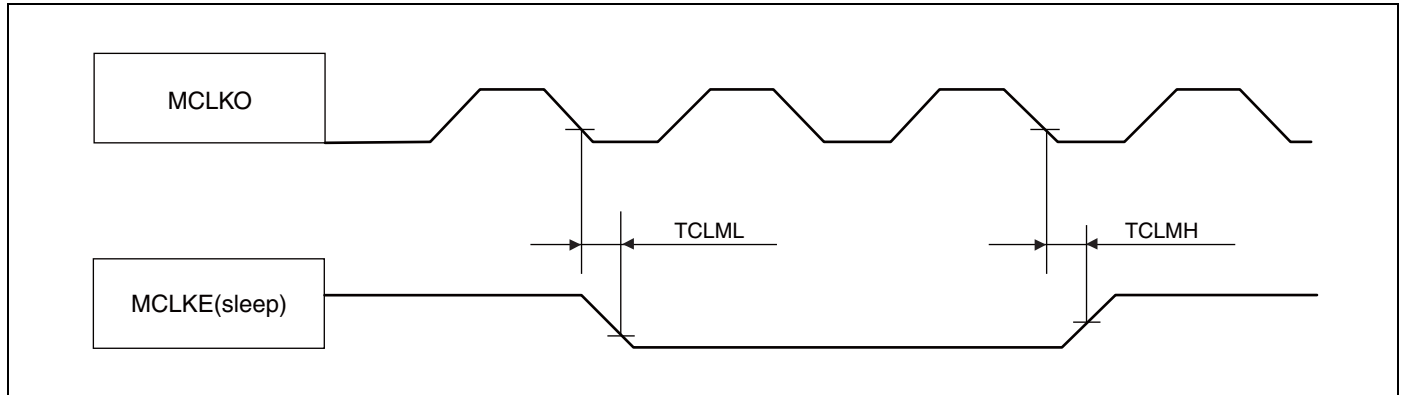
Note : BRQ must be kept High until the bus is granted (this is acknowledged by the falling edge of BGRNTX).
 It must be kept High as long as the bus shall be hold.
 After releasing the bus (BRQ set to Low) this is acknowledged by the rising edge of BGRNTX.



Clock Relationships

($V_{DD35} = 4.5\text{ V to }5.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Value | | Unit |
|----------------------------------|--------|----------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to MCLKE (in sleep mode) | TCLML | MCLKO MCLKE | — | 7 | ns |
| | TCLMH | | -1 | — | ns |

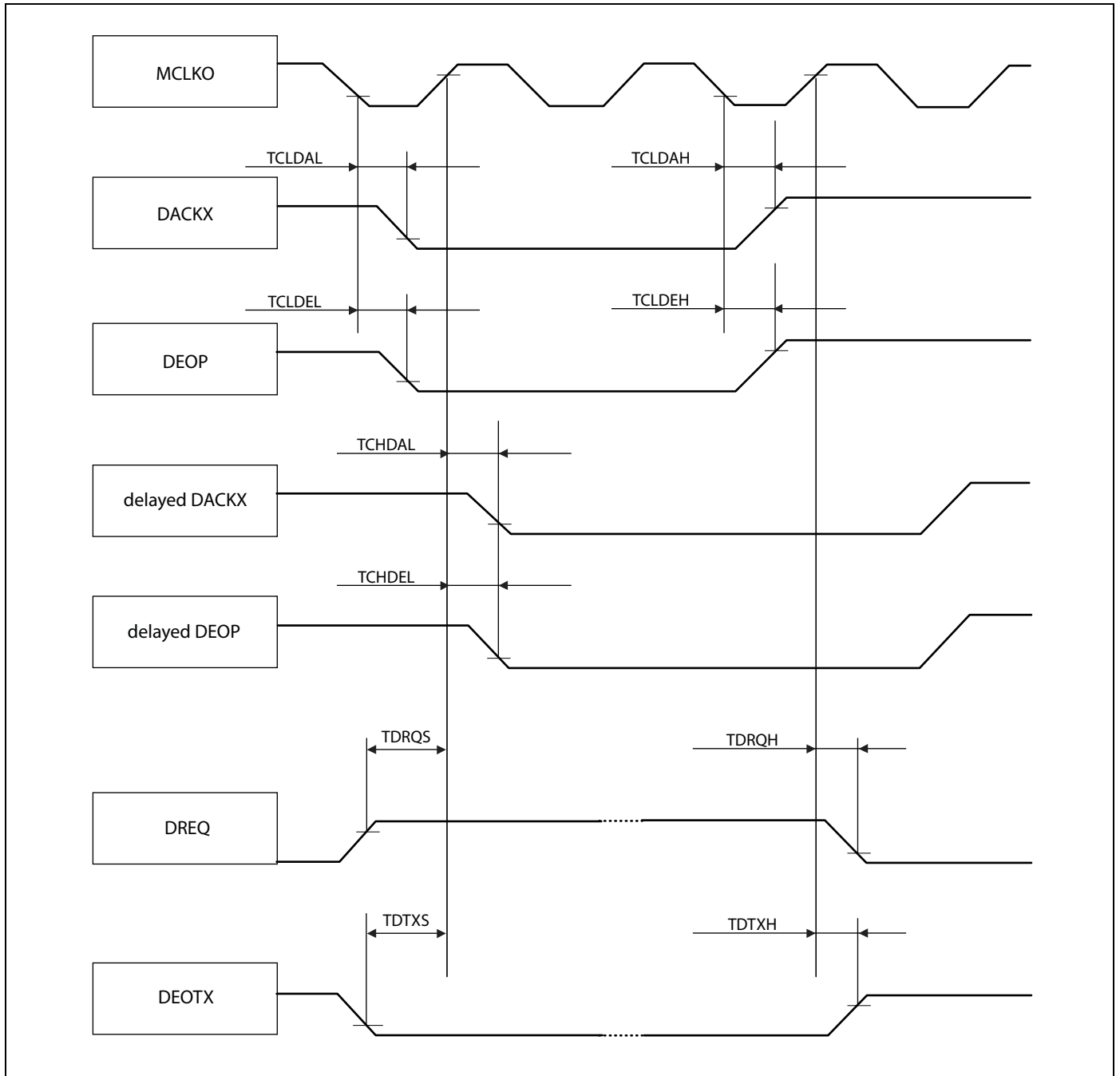


DMA Transfer

 (V_{DD35} = 4.5 V to 5.5 V, V_{SS5} = AV_{SS5} = 0 V, T_A = -40°C to +105°C)

| Parameter | Symbol | Pin Name | Value | | Unit |
|----------------------------------------------------|--------|-----------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to DACKX delay time | TCLDAL | MCLKO | — | 9 | ns |
| | TCLDAH | DACKXn | — | 6 | ns |
| MCLKO ↓ to DEOP delay time | TCLDEL | MCLKO | — | 8 | ns |
| | TCLDEH | DEOPn | — | 9 | ns |
| MCLKO ↑ to DACKX delay time (ADDR → delayed CS) | TCHDAL | MCLKO DACKXn | - 4 | 3 | ns |
| MCLKO ↑ to DEOP delay time (ADDR → delayed CS) | TCHDEL | MCLKO DEOPn | - 4 | 3 | ns |
| DREQ setup time | TDRQS | MCLKO DREQn | 23 | — | ns |
| DREQ hold time | TDRQH | MCLKO DREQn | 0 | — | ns |
| DEOTXn setup time | TDTXS | MCLKO DEOTXn | 24 | — | ns |
| DEOTXn hold time | TDTXH | MCLKO DEOTXn | 0 | — | ns |

Note : DREQ and DEOTX must be applied for at least $5 \times t_{CLKT}$ to ensure that they are really sampled and evaluated.
Under best case conditions (DMA not busy) only setup and hold times are required.



15.7.8 External Bus AC Timings at $V_{DD35} = 3.0$ to 4.5 V

- Conditions during AC measurements

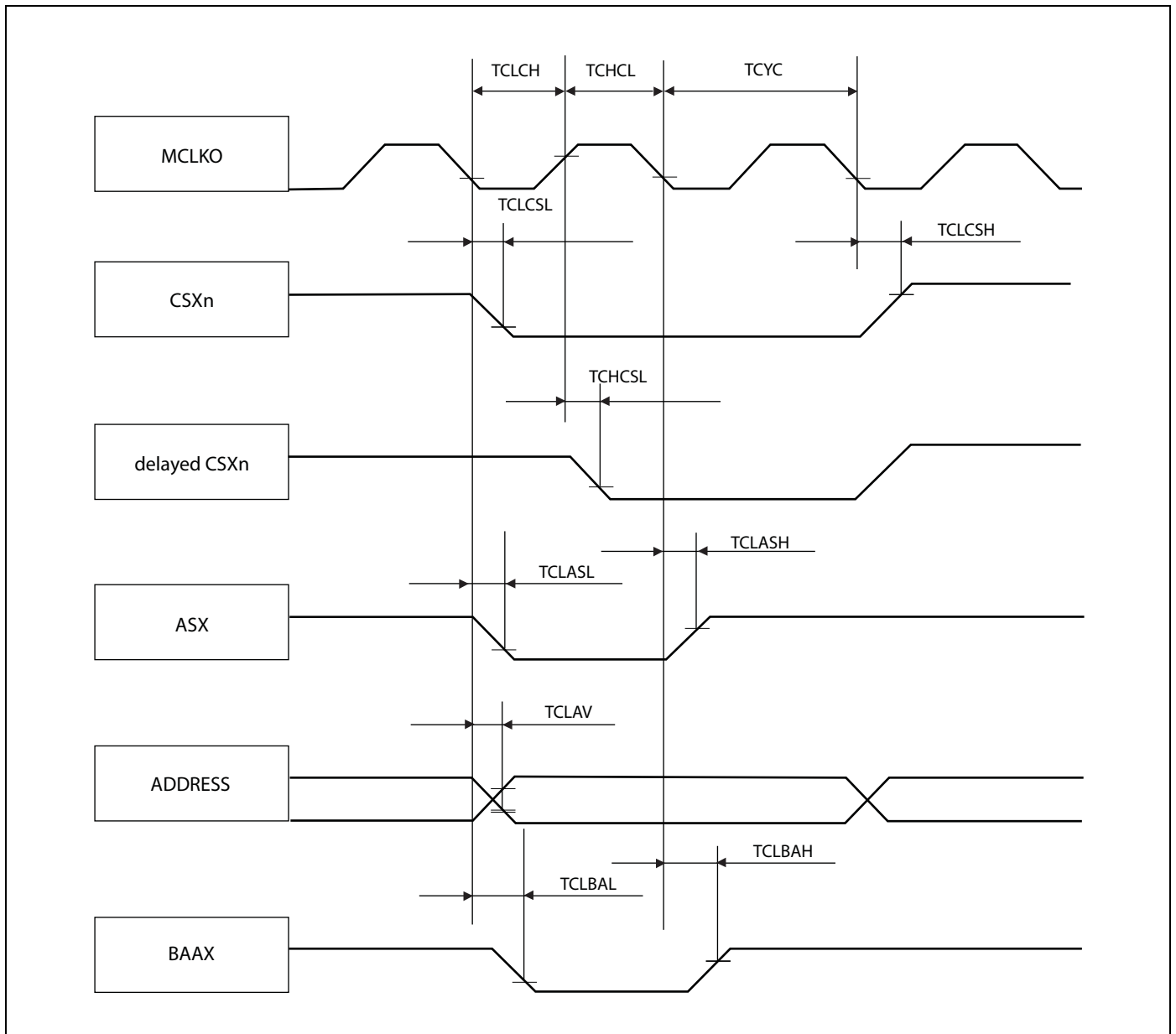
All AC tests were measured under the following conditions:

- $I_{Odrive} = 5$ mA
- $V_{DD35} = 3.0$ V to 4.5 V, $I_{load} = 3$ mA
- $V_{SS5} = 0$ V
- $T_a = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$
- $C_l = 50$ pF
- $V_{OL} = 0.2 \times V_{DD35}$
- $V_{OH} = 0.8 \times V_{DD35}$
- $EPILR = 0$, $PILR = 1$ (Automotive Level = worst case)

Basic Timing

($V_{DD35} = 3.0$ V to 4.5 V, $V_{SS5} = AV_{SS5} = 0$ V, $T_A = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$)

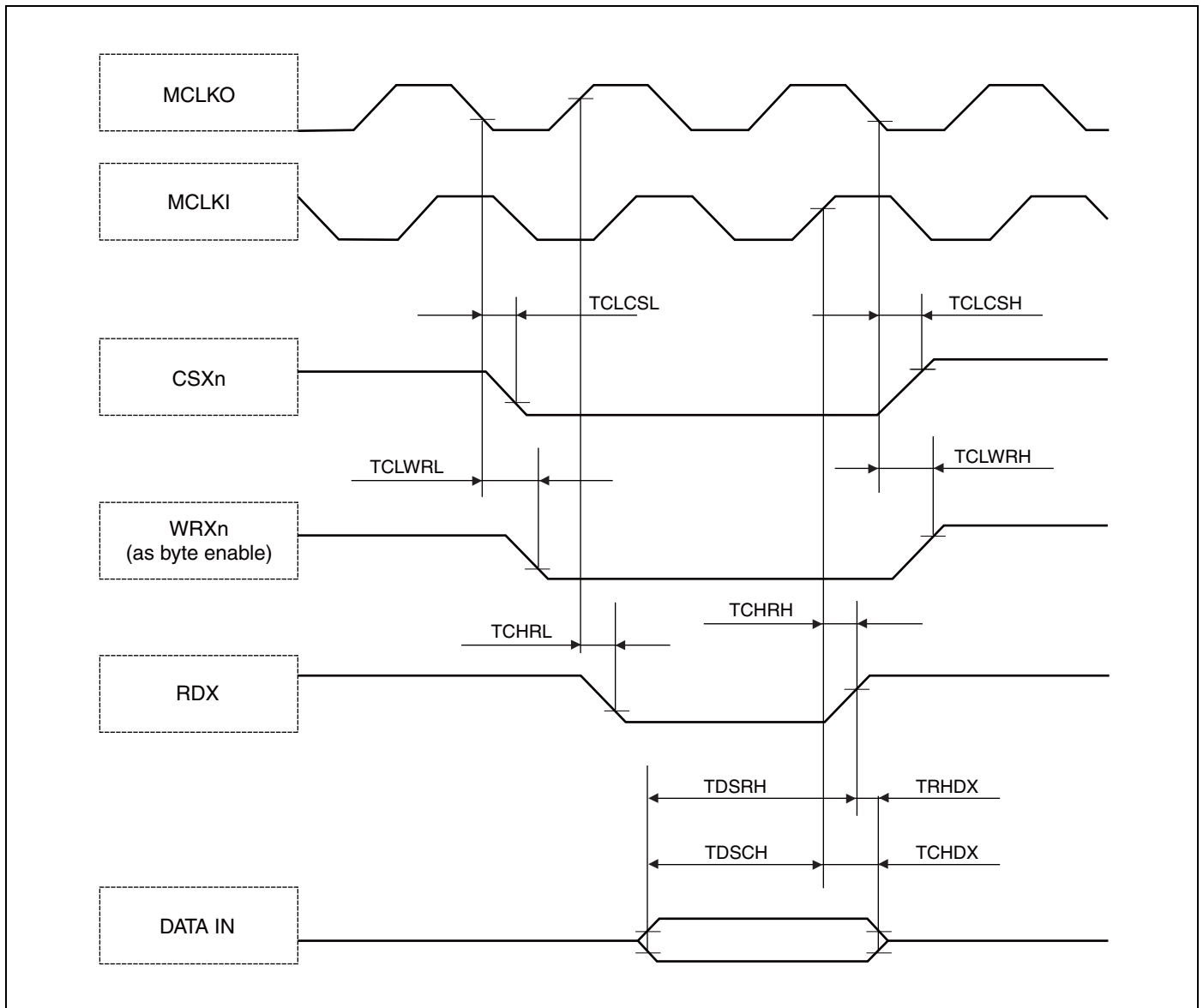
| Parameter | Symbol | Pin Name | Value | | Unit |
|-------------------------------------------------|--------|--------------------|----------------------------|----------------------------|------|
| | | | Min | Max | |
| MCLKO | TCLCH | MCLKO | $1/2 \times t_{CLKT} - 13$ | $1/2 \times t_{CLKT} + 13$ | ns |
| | TCHCL | | $1/2 \times t_{CLKT} - 13$ | $1/2 \times t_{CLKT} + 13$ | ns |
| MCLKO ↓ to CSXn delay time | TCLCSL | MCLKO CSXn | — | 6 | ns |
| | TCLCSH | | — | 7 | ns |
| MCLKO ↑ to CSXn delay time (Addr → CS delay) | TCHCSL | | - 11 | 0 | ns |
| MCLKO ↓ to ASX delay time | TCLASL | MCLKO ASX | — | 6 | ns |
| | TCLASH | — | 9 | ns | |
| MCLKO ↓ to BAAX delay time | TCLBAL | MCLKO BAAX | — | 3 | ns |
| | TCLBAH | 1 | — | ns | |
| MCLKO ↓ to Address valid delay time | TCLAV | MCLKO A25 to A0 | — | 13 | ns |



Synchronous/Asynchronous Read Access With External Mclki Input
(V_{DD35} = 3.0 V to 4.5 V, V_{SS5} = AV_{SS5} = 0 V, T_A = -40°C to +105°C)

| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------------------------------|--------|--------------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO ↑/MCLKI ↑ to RDX delay time | TCHRL | MCLKO RDX | -12 | 0 | ns |
| | TCHRH | MCLKI RDX | 12 | 26 | ns |
| Data valid to RDX ↑ setup time | TDSRH | RDX D31 to D0 | 28 | — | ns |
| RDX ↑ to Data valid hold time (external MCLKI input) | TRHDX | RDX D31 to D0 | 0 | — | ns |
| Data valid to MCLKI ↑ setup time | TDSCH | MCLKI D31 to D0 | 3 | — | ns |
| MCLKI ↑ to Data valid hold time | TCHDX | MCLKI D31 to D0 | 1 | — | ns |
| MCLKO ↓ to WRXn (as byte enable) delay time | TCLWRL | MCLKO WRXn | — | 6 | ns |
| | TCLWRH | | 0 | — | ns |
| MCLKO ↓ to CSXn delay time | TCLCSL | MCLKO CSXn | — | 6 | ns |
| | TCLCSH | | — | 7 | ns |

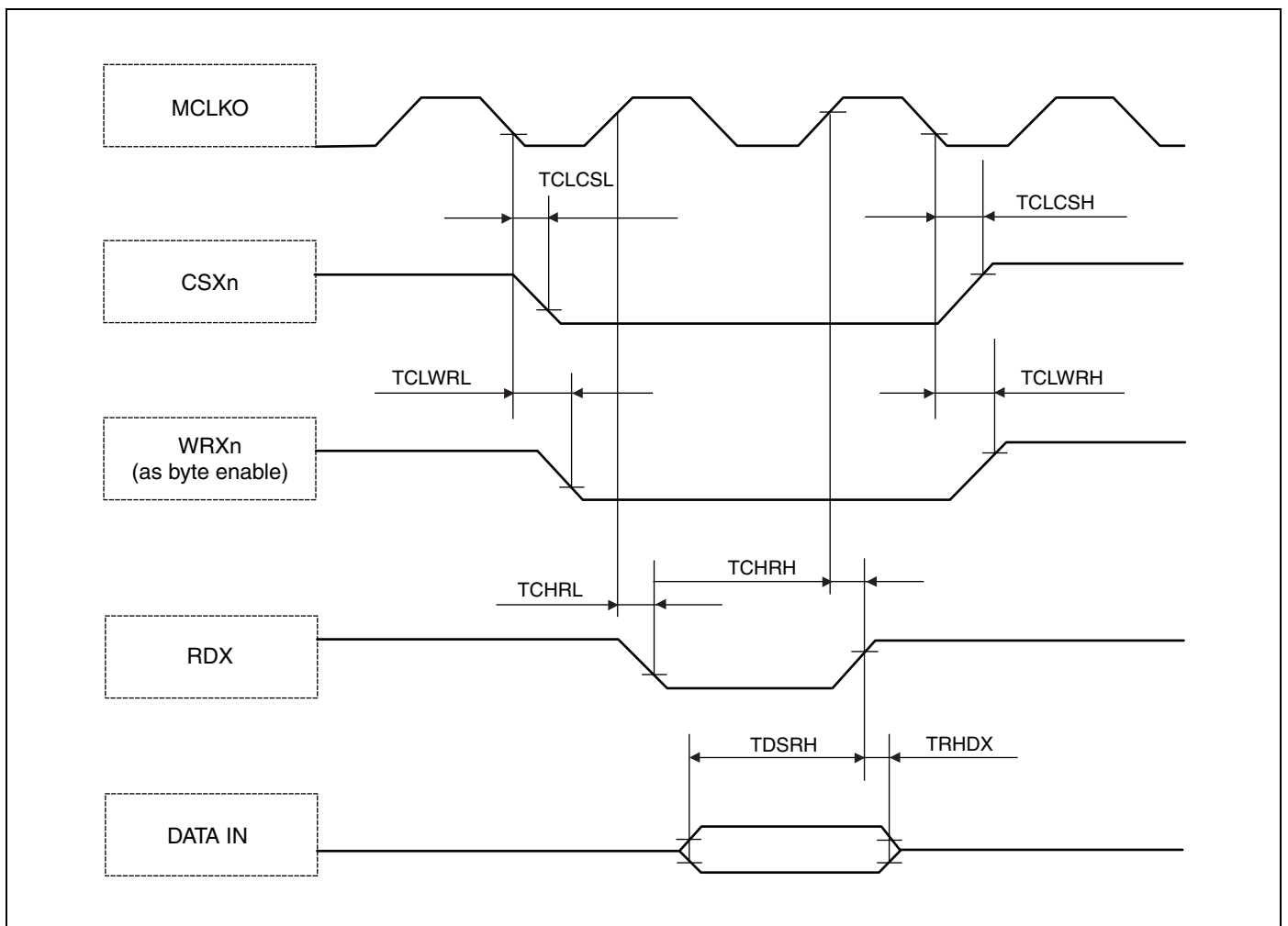
Note: The usage of the external feedback from MCLKO to MCLKI is not recommended.



Synchronous/Asynchronous Read Access with Internal MCLKO --> MCLKI Feedback

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

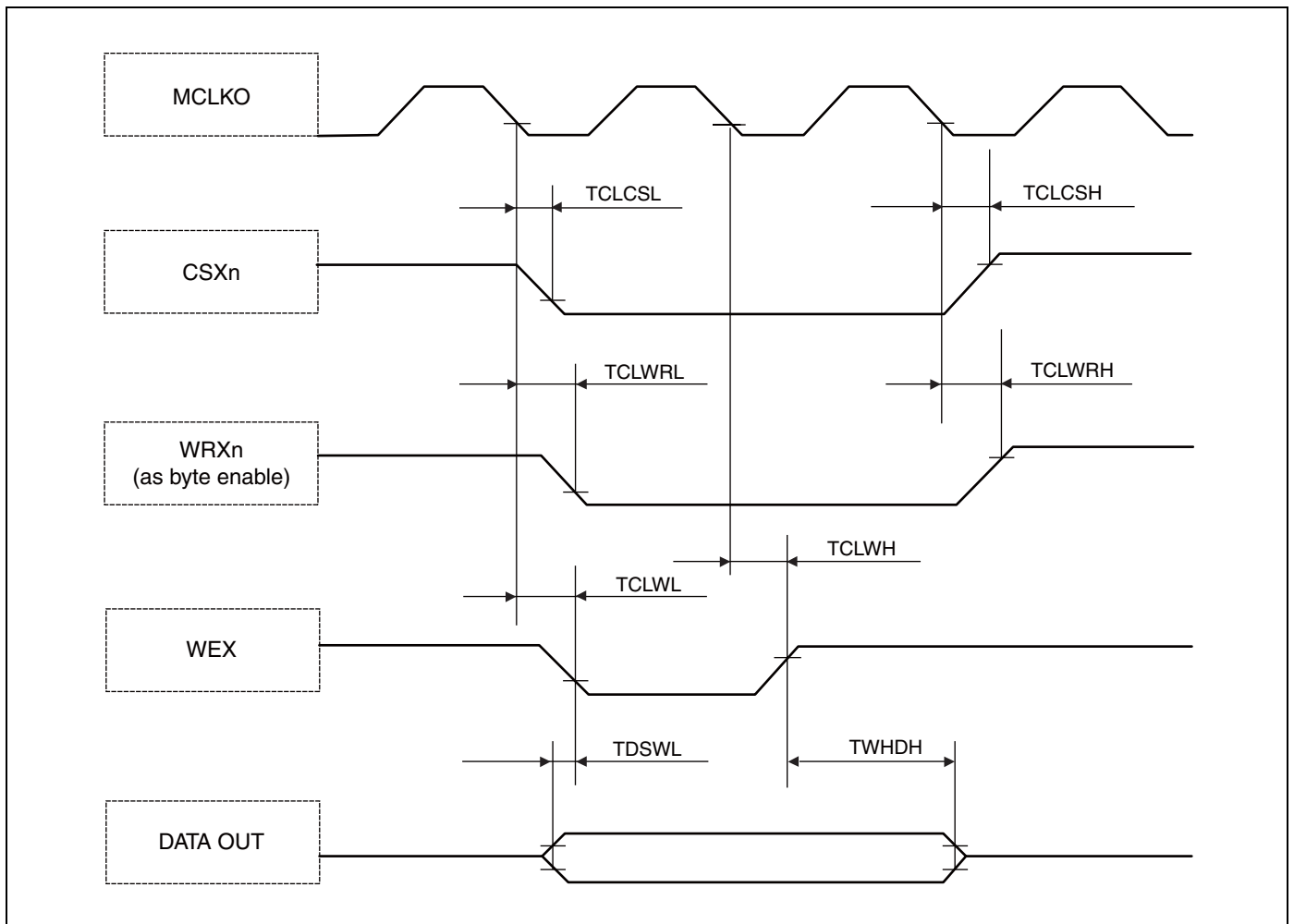
| Parameter | Symbol | Pin Name | Value | | Unit |
|----------------------------------------------------------------------------------------------|--------|------------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO \uparrow to RDX delay time | TCHRL | MCLKO RDX | - 12 | 0 | ns |
| | TCHRH | | - 9 | 1 | ns |
| Data valid to RDX \uparrow setup time | TDSRH | RDX D31 to D0 | 29 | — | ns |
| RDX \uparrow to Data valid hold time (internal MCLKO \rightarrow MCLKI / MCLKI feedback) | TRHDX | RDX D31 to D0 | 0 | — | ns |
| MCLKO \downarrow to WRXn (as byte enable) delay time | TCLWRL | MCLKO WRXn | — | 6 | ns |
| | TCLWRH | | 0 | — | ns |
| MCLKO \downarrow to CSXn delay time | TCLCSL | MCLKO CSXn | — | 6 | ns |
| | TCLCSH | | — | 7 | ns |



Synchronous Write Access - Byte Control Type

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

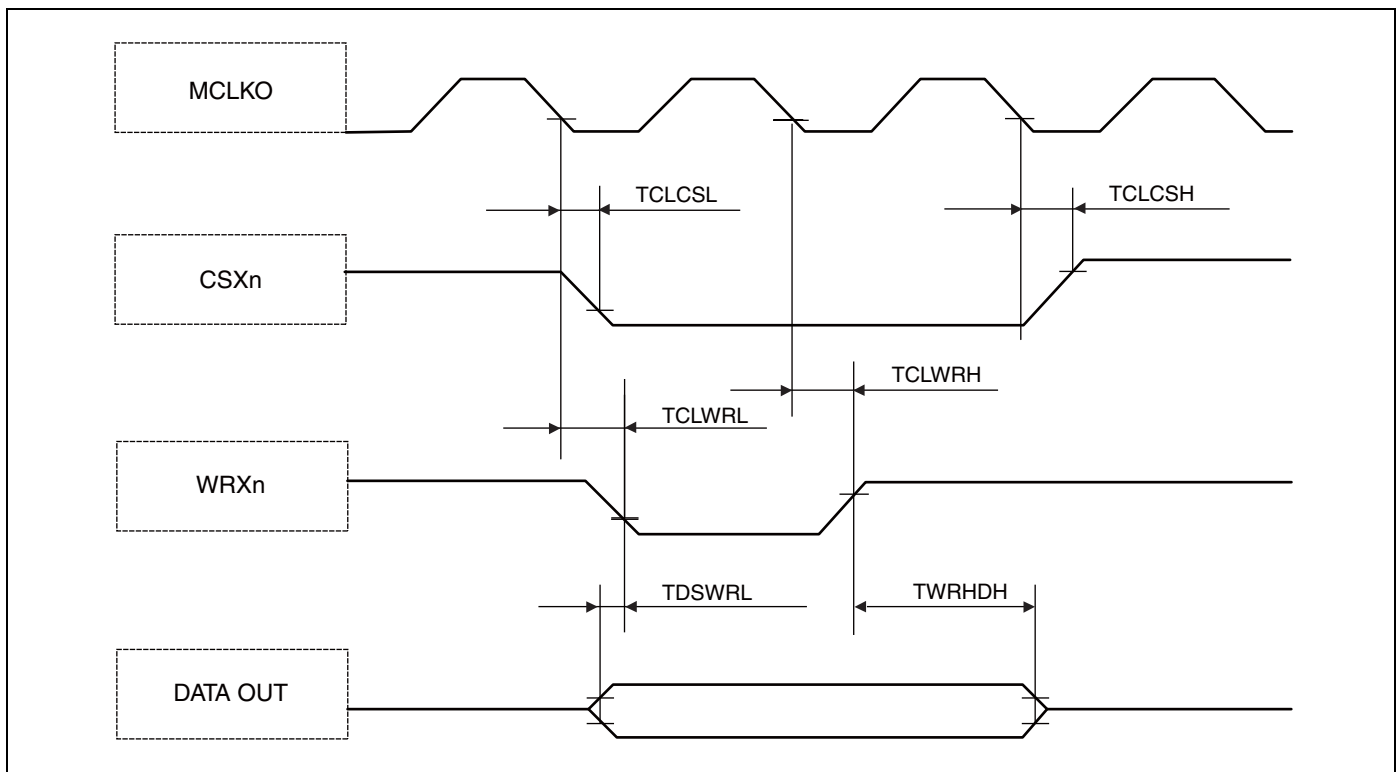
| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------------------|--------|------------------|-----------------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to WEX delay time | TCLWL | MCLKO | — | 7 | ns |
| | TCLWH | WEX | 1 | — | ns |
| Data valid to WEX ↓ setup time | TDSWL | WEX D31 to D0 | -20 | — | ns |
| WEX ↑ to Data valid hold time | TWHDH | WEX D31 to D0 | $t_{CLKT} - 19$ | — | ns |
| MCLKO ↓ to WRXn (as byte enable) delay time | TCLWRL | MCLKO | — | 6 | ns |
| | TCLWRH | WRXn | 0 | — | ns |
| MCLKO ↓ to CSXn delay time | TCLCSL | MCLKO | — | 6 | ns |
| | TCLCSH | CSXn | — | 7 | ns |



Synchronous Write Access - No Byte Control Type

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

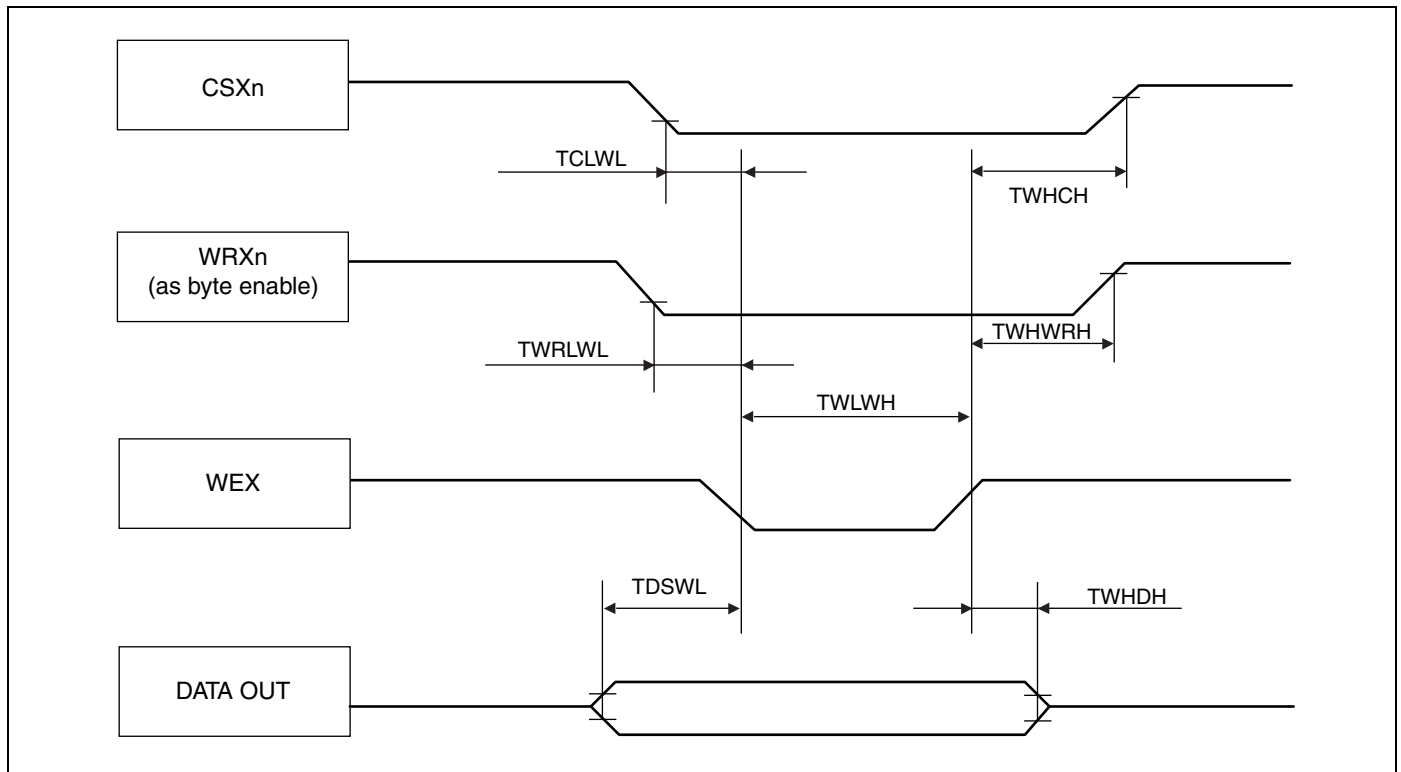
| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------|--------|-------------------|-----------------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to WRXn delay time | TCLWRL | MCLKO WRXn | — | 6 | ns |
| | TCLWRH | | 0 | — | ns |
| Data valid to WRXn ↓ setup time | TDSWRL | WRXn D31 to D0 | - 20 | — | ns |
| WRXn ↑ to Data valid hold time | TWRHDH | WRXn D31 to D0 | $t_{CLKT} - 14$ | — | ns |
| MCLKO ↓ to CSXn delay time | TCLCSL | MCLKO CSXn | — | 6 | ns |
| | TCLCSH | | — | 7 | ns |



Asynchronous Write Access - Byte Control Type

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

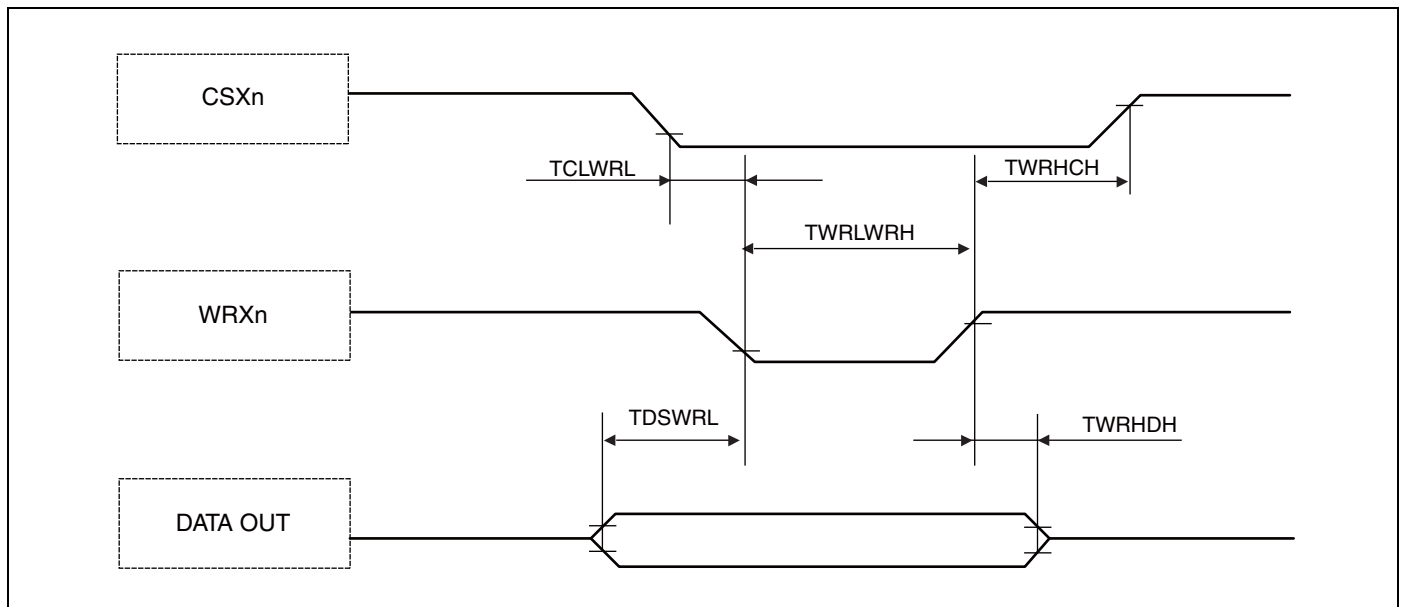
| Parameter | Symbol | Pin Name | Value | | Unit |
|--------------------------------|--------|------------------|----------------------------|---------------------------|------|
| | | | Min | Max | |
| WEX ↓ to WEX ↑ pulse width | TWLWH | WEX | $t_{CLKT} - 2$ | — | ns |
| Data valid to WEX ↓ setup time | TDSWL | WEX D31 to D0 | $1/2 \times t_{CLKT} - 20$ | — | ns |
| WEX ↑ to Data valid hold time | TWHDH | WEX D31 to D0 | $1/2 \times t_{CLKT} - 20$ | — | ns |
| WEX to WRXn delay time | TWRLWL | WEX WRXn | — | $1/2 \times t_{CLKT} + 3$ | ns |
| | TWHWRH | WEX WRXn | $1/2 \times t_{CLKT} - 7$ | — | ns |
| WEX to CSXn delay time | TCLWL | WEX CSXn | — | $1/2 \times t_{CLKT} - 1$ | ns |
| | TWHCH | WEX CSXn | $1/2 \times t_{CLKT} - 4$ | — | ns |



Asynchronous Write Access - No Byte Control Type

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

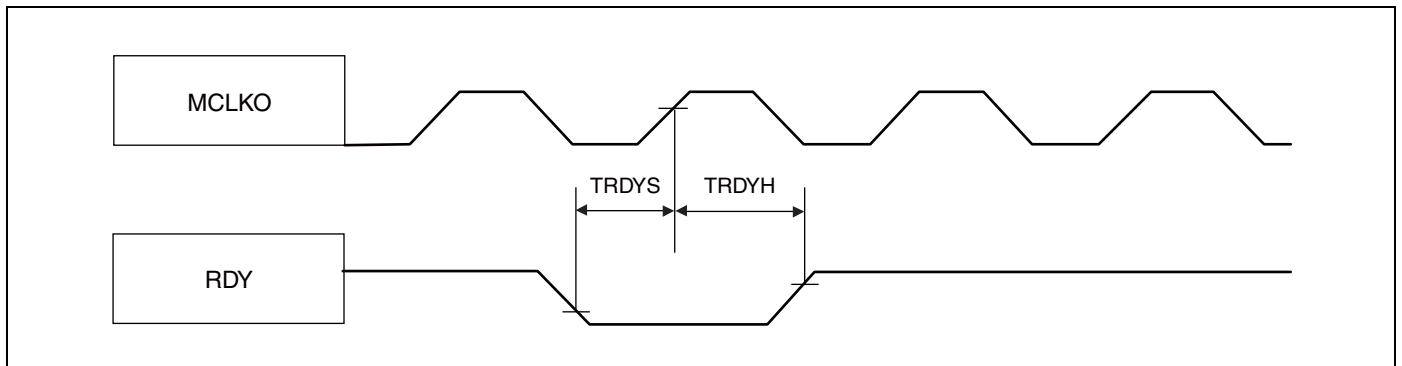
| Parameter | Symbol | Pin Name | Value | | Unit |
|---------------------------------|---------|-------------------|----------------------------|---------------------------|------|
| | | | Min | Max | |
| WRXn ↓ to WRXn ↑ pulse width | TWRLWRH | WRXn | $t_{CLKT} - 2$ | — | ns |
| Data valid to WRXn ↓ setup time | TDSWRL | WRXn D31 to D0 | $1/2 \times t_{CLKT} - 21$ | — | ns |
| WRXn ↑ to Data valid hold time | TWRHDH | WRXn D31 to D0 | $1/2 \times t_{CLKT} - 18$ | — | ns |
| WRXn to CSXn delay time | TCLWRL | WRXn CSXn | — | $1/2 \times t_{CLKT} - 1$ | ns |
| | TWRHCH | WRXn CSXn | $1/2 \times t_{CLKT} - 4$ | — | ns |



RDY Waitcycle Insertion

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Value | | Unit |
|----------------|--------|--------------|-------|-----|------|
| | | | Min | Max | |
| RDY setup time | TRDYS | MCLKO RDY | 37 | — | ns |
| RDY hold time | TRDYH | MCLKO RDY | 0 | — | ns |

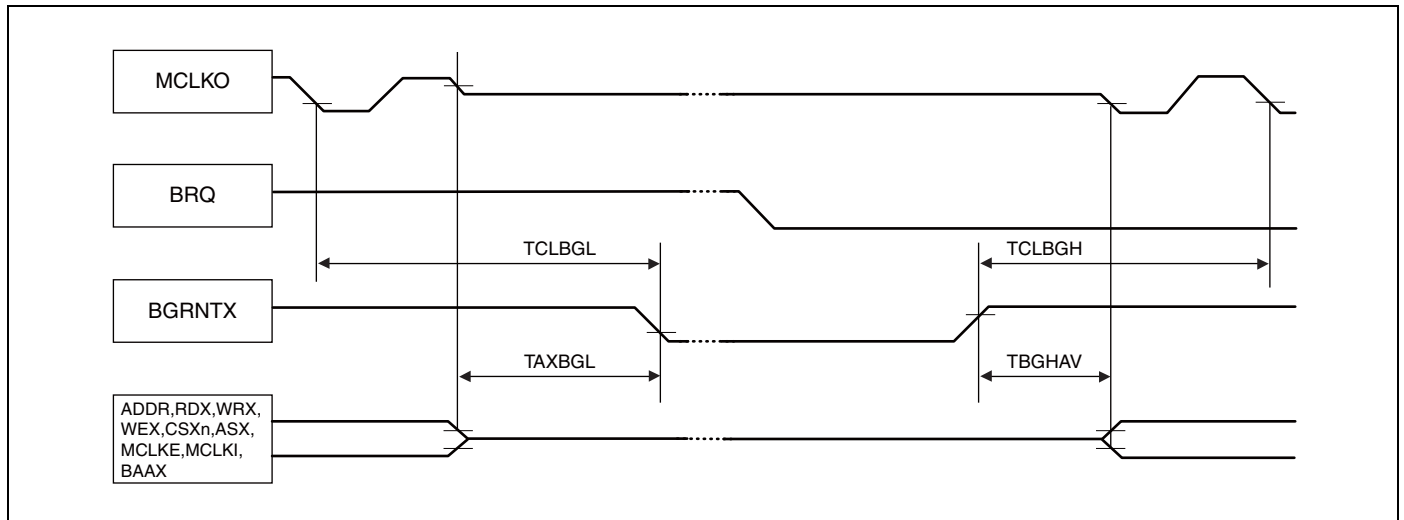


Bus Hold Timing

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Value | | Unit |
|------------------------------|--------|--------------------------------------------------------------------|----------------|--------------------------|------|
| | | | Min | Max | |
| MCLKO ↓ to BGRNTX delay time | TCLBGL | MCLKO BGRNTX | — | $2 \times t_{CLKT} + 16$ | ns |
| | TCLBGH | | — | $2 \times t_{CLKT} + 3$ | ns |
| Bus HIZ to BGRNTX ↓ | TAXBGL | BGRNTX MCLK* A0 to An RDX, ASX WRXn, WEX CSXn, BAAX | $t_{CLKT} + 1$ | — | ns |
| BGRNTX ↑ to Bus drive | TBGHAV | | $t_{CLKT} + 1$ | — | ns |

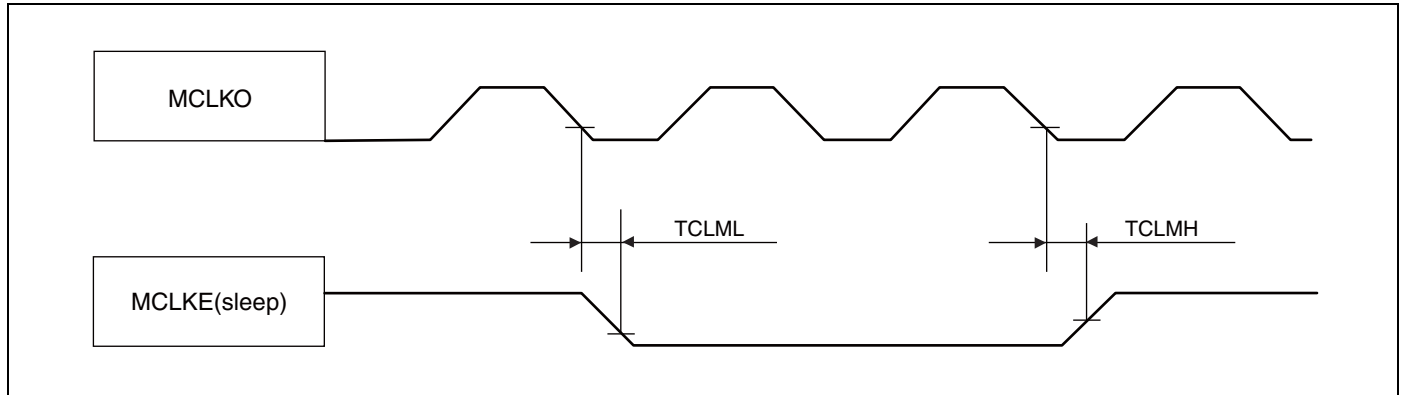
Note : BRQ must be kept High until the bus is granted (this is acknowledged by the falling edge of BGRNTX).
 It must be kept High as long as the bus shall be hold.
 After releasing the bus (BRQ set to Low) this is acknowledged by the rising edge of BGRNTX.



Clock Relationships

($V_{DD35} = 3.0\text{ V to }4.5\text{ V}$, $V_{SS5} = AV_{SS5} = 0\text{ V}$, $T_A = -40^\circ\text{C to }+105^\circ\text{C}$)

| Parameter | Symbol | Pin Name | Value | | Unit |
|-------------------------------------|--------|-------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to MCLKE (in sleep mode) | TCLML | MCLKO MCLKE | — | 3 | ns |
| | TCLMH | | 0 | — | ns |

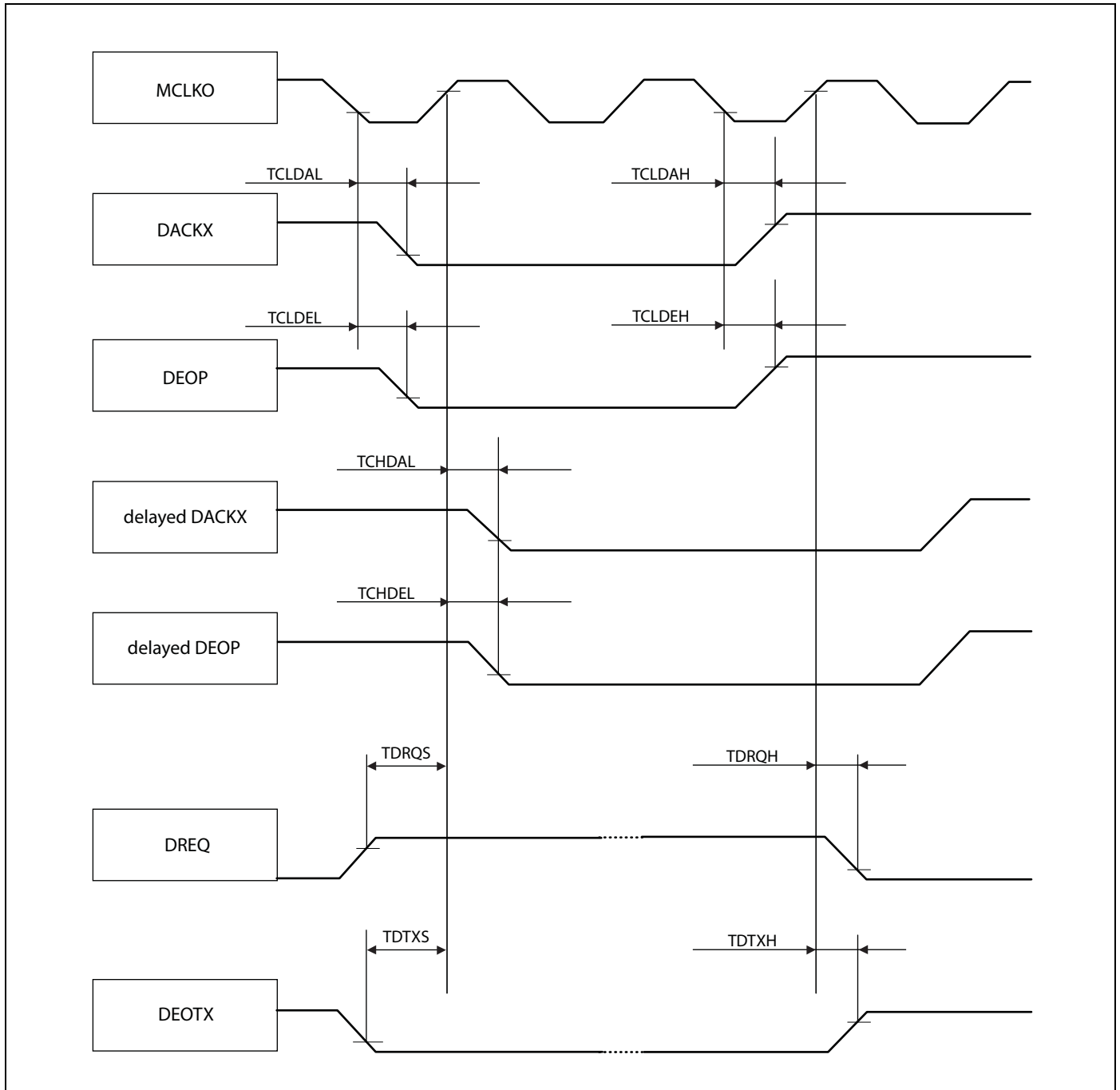


DMA Transfer

 (V_{DD35} = 3.0 V to 4.5 V, V_{SS5} = AV_{SS5} = 0 V, T_A = -40°C to +105°C)

| Parameter | Symbol | Pin Name | Value | | Unit |
|----------------------------------------------------|--------|-----------------|-------|-----|------|
| | | | Min | Max | |
| MCLKO ↓ to DACKX delay time | TCLDAL | MCLKO DACKXn | — | 7 | ns |
| | TCLDAH | | — | 8 | ns |
| MCLKO ↓ to DEOP delay time | TCLDEL | MCLKO DEOPn | — | 7 | ns |
| | TCLDEH | | — | 11 | ns |
| MCLKO ↑ to DACKX delay time (ADDR → delayed CS) | TCHDAL | MCLKO DACKXn | - 10 | 2 | ns |
| MCLKO ↑ to DEOP delay time (ADDR → delayed CS) | TCHDEL | MCLKO DEOPn | - 10 | 1 | ns |
| DREQ setup time | TDRQS | MCLKO DREQn | 38 | — | ns |
| DREQ hold time | TDRQH | MCLKO DREQn | 0 | — | ns |
| DEOTXn setup time | TDTXS | MCLKO DEOTXn | 39 | — | ns |
| DEOTXn hold time | TDTXH | MCLKO DEOTXn | 0 | — | ns |

Note : DREQ and DEOTX must be applied for at least $5 \times t_{CLKT}$ to ensure that they are really sampled and evaluated.
Under best case conditions (DMA not busy) only setup and hold times are required.

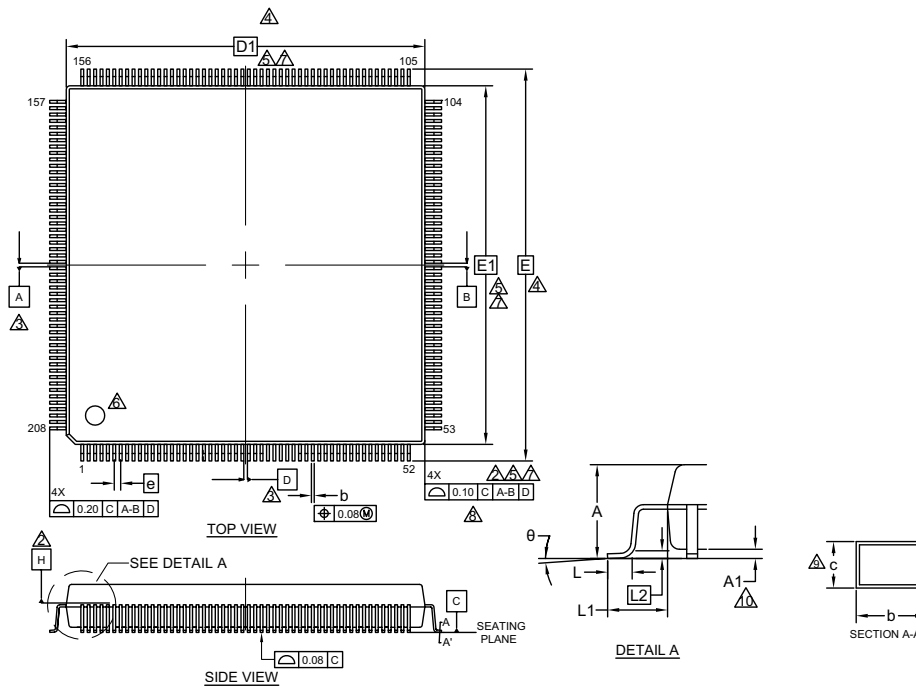


16. Ordering Information

| Part Number | Package | Remarks |
|------------------------|---------------------------------|---------|
| CY91F467DAPFVS-GS-UJE2 | 208-pin plastic QFP (HQB208) | |
| CY91F467DBPFVS-GS-UJE2 | | |
| CY91F467DAPVSR-GS-UJE2 | | |
| CY91F467DBPVSR-GS-UJE2 | | |

17. Package Dimension

| Package Type | Package Code |
|--------------|--------------|
| QFP 208-pin | HQB208 |



| SYMBOL | DIMENSIONS | | |
|--------|------------|------|------|
| | MIN. | NOM. | MAX. |
| A | — | — | 3.95 |
| A1 | 0.25 | — | 0.50 |
| b | 0.17 | 0.22 | 0.27 |
| c | 0.09 | — | 0.20 |
| D | 30.60 BSC | | |
| D1 | 28.00 BSC | | |
| e | 0.50 BSC | | |
| E | 30.60 BSC | | |
| E1 | 28.00 BSC | | |
| θ | 0° | — | 8° |
| L | 0.45 | 0.60 | 0.75 |
| L1 | 1.30 REF | | |
| L2 | 0.25 BSC | | |

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS.
 - DATUM PLANE H IS LOCATED AT THE BOTTOM OF THE MOLD PARTING LINE COINCIDENT WITH WHERE THE LEAD EXITS THE BODY.
 - DATUMS A-B AND D TO BE DETERMINED AT DATUM PLANE H.
 - TO BE DETERMINED AT SEATING PLANE C.
 - DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25mm PRE SIDE. DIMENSIONS D1 AND E1 INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H.
 - DETAILS OF PIN 1 IDENTIFIER ARE OPTIONAL BUT MUST BE LOCATED WITHIN THE ZONE INDICATED.
 - REGARDLESS OF THE RELATIVE SIZE OF THE UPPER AND LOWER BODY SECTIONS. DIMENSIONS D1 AND E1 ARE DETERMINED AT THE LARGEST FEATURE OF THE BODY EXCLUSIVE OF MOLD FLASH AND GATE BURRS. BUT INCLUDING ANY MISMATCH BETWEEN THE UPPER AND LOWER SECTIONS OF THE MOLDER BODY.
 - DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. THE DAMBAR PROTRUSION (⊗) SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED b MAXIMUM BY MORE THAN 0.08mm. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE LEAD FOOT.
 - THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10mm AND 0.25mm FROM THE LEAD TIP.
 - A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.

PACKAGE OUTLINE, 208 LEAD QFP, 28.00X28.00X3.95 MM HQB208 REV. **

002-18454 **

18. Revision History

Spanion Publication Number: DS07-16612-2E

| Version | Date | Remark |
|---------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.0 | 2007-09-04 | Initial version |
| 2.1 | 2007-10-08 | Revision history table added Fixed PDF generation problem before section "AD converter characteristics" Absolute maximum ratings: Smoothing capacitor size at VCC18C changed to "typ 4.7uF" Output voltage 2 is max. V_{DD35} Recommended operating conditions: Power supply slew rate fixed Exchanged the sequence of device names into "MB91F465DA, MB91F467DA" where they appear on one line |
| 2.2 | 2007-10-16 | Moved revision history to the end of file Features: Added Clock Monitor Corrected VCC18C pin number in table "Power supply/Ground pins" pg.14 Electrical characteristics: Added section 7.FLASH memory program/erase characteristics |
| 2.3 | 2007-10-22 | DC characterisitcs: Corrected I_{CC-H} in STOP + RTC 100kHz mode and I_{LV} (lcc of low volt detection) max. value |
| 2.4 | 2007-10-25 | FLASH memory program/erase characteristics: Typo fixed in note *1 Recommended operating conditions: Corrected text for smoothing capacitor at VCC18C pin Naming inconsistency AVSS / AVSS5 fixed Features: added Up/Down counter Product lineup: fixed number of interrupt channels Handling devices: changed the notes about external clock supply and removed section "Single phase clock supply" Clock timing: removed "Single phase clock supply" from freq. table |
| 2.5 | 2008-1-11 | DC characterisitcs: $I_{LL} = +/- 3 \mu A$ at 105 deg.C IO CIRCUIT TYPE: Corrected oscillator pin block diagrams ELECTRICAL CHARACTERISTICS: re-arranged section sequence Fixed typos in ALARM comparator spec. Added MB91F467DB (called F467Dx if the text item is for bot revisions) Corrected IO-MAP according to latest proofread on F460G series Various corrections after proofread by FJ |
| 2.6 | 2008-02-04 | Added MEMO and DISCLAIMER |
| 2.7 | 2008-02-18 | AC-Characteristics: Replaced "rising"/"falling" with arrow-up/arrow-down |

| Version | Date | Remark |
|---------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.8 | 2008-06-20 | <p>Corrected missing bullets on PDF pages 2+3 Pin Assignment, Block Diagram: Corrected naming and assignments of TTG inputs, SGO and DACKX0 Notes on PS register: Re-formatted for better understanding ADC Characteristics: Offset between ADC channels is max. 4 LSB DC Characteristics: Added I_{LVI} (I_{CC} of internal low voltage detection), renamed I_{LV} into I_{LVE} (for external low voltage detection) AC Characteristics for external bus: Added notes that the usage of external feedback MCLKO --> MCLKI is not recommended. Flash parallel programming mode: Added notes about the pins to be set fix-0 / fix-1 (MD_2:0,...) Added section about the wait times after power on Flash operation modes: Added note about the BootROM fuction entry address for operation mode switch. Package Dimension: Updated package drawing All pages: Corrected typos and formatting bugs found by FJ proofread</p> |
| 2.9 | 2008-06-30 | EMBEDDED PROGRAM/DATA MEMORY (FLASH): Corrected "The operation mode of the flash memory ..." instead of "of the MCU" |
| 2.10 | 2008-08-04 | <p>Resources,Product lineup: Added Supply Supervisor (Low voltage detection) DC Characteristics: Updated pull-up/pull-down resistance values, updated and re-numbered the table footnotes</p> |
| 2.11 | 2008-08-18 | <p>Interrupt Vector Table: corrected the footnotes Flash Security: Corrected the sector assignments of FSV1/FSV2 bits Electrical Characteristics: removed the note that analog input/output pins cannot accept +B signal input. Ordering information: updated the part numbers All pages: Kilobytes are now written with "K"</p> |

NOTE: Please see "Document History" about later revised information.

19. Major Changes

| Page | Section | Change Results | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|---------|---------------------|---------------------------------------|-----------------|---------------------|-----------------|--------------------|-----------------|--------------------|-------------------|-------------|---------|---------|------------------------|---------------------------------|--|------------------------|--|------------------------|--|------------------------|--|
| Rev.*B | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | Marketing Part Numbers changed from an MB prefix to a CY prefix for all of these products. | | | | | | | | | | | | | | | | | | | | | | | | | |
| P7,P132 ,P133 | 2. Pin Assignment 16. Ordering Information 17. Package Dimension | Package description modified to JEDEC description. FPT-208P-M04 → (HQB208) | | | | | | | | | | | | | | | | | | | | | | | | |
| P132 | 16. Ordering Information | <p>Revised Marketing Part Numbers as follows:</p> <p>Before)</p> <table border="1"> <thead> <tr> <th>Part number</th> <th>Package</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>MB91F467DAPFVS-GSE2</td> <td rowspan="4">208-pin plastic QFP (FPT-208P-M04)</td> <td>not recommended</td> </tr> <tr> <td>MB91F467DBPFVS-GSE2</td> <td>not recommended</td> </tr> <tr> <td>MB91F467DAPVS-GSE2</td> <td>not recommended</td> </tr> <tr> <td>MB91F467DBPVS-GSE2</td> <td>Lead-free package</td> </tr> </tbody> </table> <p>After)</p> <table border="1"> <thead> <tr> <th>Part number</th> <th>Package</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>CY91F467DAPFVS-GS-UJE2</td> <td rowspan="4">208-pin plastic QFP (HQB208)</td> <td></td> </tr> <tr> <td>CY91F467DBPFVS-GS-UJE2</td> <td></td> </tr> <tr> <td>CY91F467DAPVSR-GS-UJE2</td> <td></td> </tr> <tr> <td>CY91F467DBPVSR-GS-UJE2</td> <td></td> </tr> </tbody> </table> | Part number | Package | Remarks | MB91F467DAPFVS-GSE2 | 208-pin plastic QFP (FPT-208P-M04) | not recommended | MB91F467DBPFVS-GSE2 | not recommended | MB91F467DAPVS-GSE2 | not recommended | MB91F467DBPVS-GSE2 | Lead-free package | Part number | Package | Remarks | CY91F467DAPFVS-GS-UJE2 | 208-pin plastic QFP (HQB208) | | CY91F467DBPFVS-GS-UJE2 | | CY91F467DAPVSR-GS-UJE2 | | CY91F467DBPVSR-GS-UJE2 | |
| Part number | Package | Remarks | | | | | | | | | | | | | | | | | | | | | | | | |
| MB91F467DAPFVS-GSE2 | 208-pin plastic QFP (FPT-208P-M04) | not recommended | | | | | | | | | | | | | | | | | | | | | | | | |
| MB91F467DBPFVS-GSE2 | | not recommended | | | | | | | | | | | | | | | | | | | | | | | | |
| MB91F467DAPVS-GSE2 | | not recommended | | | | | | | | | | | | | | | | | | | | | | | | |
| MB91F467DBPVS-GSE2 | | Lead-free package | | | | | | | | | | | | | | | | | | | | | | | | |
| Part number | Package | Remarks | | | | | | | | | | | | | | | | | | | | | | | | |
| CY91F467DAPFVS-GS-UJE2 | 208-pin plastic QFP (HQB208) | | | | | | | | | | | | | | | | | | | | | | | | | |
| CY91F467DBPFVS-GS-UJE2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CY91F467DAPVSR-GS-UJE2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CY91F467DBPVSR-GS-UJE2 | | | | | | | | | | | | | | | | | | | | | | | | | | |

Document History

| Document Title: CY91460D Series FR60 32-bit Microcontroller Document Number: 002-04613 | | | | |
|-------------------------------------------------------------------------------------------|---------|-----------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Revision | ECN | Orig. of Change | Submission Date | Description of Change |
| ** | — | AKIH | 08/21/2009 | Migrated to Cypress and assigned document number 002-04613. No change to document contents or format. |
| *A | 5207167 | AKIH | 04/06/2016 | Updated to Cypress format. |
| *B | 5969904 | MIYH | 11/17/2017 | Revised the following items: Marketing Part Numbers changed from an MB prefix to a CY prefix for all of these products. Pin Assignment Ordering Information Package Dimension For details, please see 19. Major Changes. |

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