

## Programmable System Clock Chip for ATI RS/RD690 - K8™ based Systems

### Recommended Application:

ATI RS/RD690 systems using AMD K8 processors & SB600 Southbridge

### Output Features:

- 2 - pairs of CPU pairs
- 8 - pairs of SRC pairs
- 4 - pairs of ATIG pairs
- 1 - HyperTransport 66MHz clock seed
- 2 - 48MHz USB clock
- 3 - 14.318MHz Reference clock

### Key Specifications:

- CPU outputs cycle-to-cycle jitter < 85ps
- SRC outputs cycle-to-cycle jitter < 125ps
- ATIG outputs cycle-to-cycle jitter < 125ps
- +/- 300ppm frequency accuracy on CPU, SRC & ATIG clocks

### Features/Benefits:

- 3 - Programmable Clock Request pins for SRC and ATIG clocks
- ATIGCLKs are programmable for frequency
- Spread Spectrum for EMI reduction
- Outputs may be disabled via SMBus
- External crystal load capacitors for maximum frequency accuracy

### Functionality

FS2	FS1	FS0	CPU MHz	HTT MHz	SRC MHz	ATIG MHz	USB MHz
0	0	0	Hi-Z	Hi-Z	100.00	100.00	48.00
0	0	1	X / 2	X / 3	100.00	100.00	48.00
0	1	0	230.00	76.67	100.00	100.00	48.00
0	1	1	240.00	80.00	100.00	100.00	48.00
1	0	0	100.00	66.66	100.00	100.00	48.00
1	0	1	133.33	66.66	100.00	100.00	48.00
1	1	0	166.67	66.66	100.00	100.00	48.00
1	1	1	200.00	66.66	100.00	100.00	48.00

### Power Groups

Pin Number		Description
VDD	GND	
5	8	USB_48 outputs
14,23,28,44	15,22,29,45	SRCCLK outputs
39	38	ATIGCLK differential outputs
50	49	Analog, PLL
54	53	CPUCLK8 differential outputs
60	58	HTTCLK output
2	1	REF outputs

### Pin Configuration

GNDREF	1	64	FS0/REF0
VDDREF	2	63	FS1/REF1
X1	3	62	FS2/REF2
X2	4	61	PD**
VDD48	5	60	VDDHTT
48MHz_0	6	59	HTTCLK0
48MHz_1	7	58	GNDHTT
GND48	8	57	*CLKREQA#
SMBCLK	9	56	CPUCLK8T0
SMBDAT	10	55	CPUCLK8C0
RESET_IN#	11	54	VDDCPU
SRCCCLK7	12	53	GNDCPU
SRCCCLK7	13	52	CPUCLK8T1
VDDSRC	14	51	CPUCLK8C1
GNDSRC	15	50	VDDA
SRCCCLK6	16	49	GND A
SRCCCLK6	17	48	IREF
SRCCCLK5	18	47	SRCCCLKT0
SRCCCLK5	19	46	SRCCCLKC0
SRCCCLK4	20	45	GNDSRC
SRCCCLK4	21	44	VDDSRC
GNDSRC	22	43	SRCCCLKT1
VDDSRC	23	42	SRCCCLKC1
SRCCCLK3	24	41	ATIGCLKT0
SRCCCLK3	25	40	ATIGCLKC0
SRCCCLK2	26	39	VDDATIG
SRCCCLK2	27	38	GNDATIG
VDDSRC	28	37	ATIGCLKT1
GNDSRC	29	36	ATIGCLKC1
ATIGCLKT3	30	35	ATIGCLKT2
ATIGCLKC3	31	34	ATIGCLKC2
*CLKREQB#	32	33	*CLKREQC#

ICS 951462

### 64-TSSOP

\* Internal Pull-Up Resistor

\*\* Internal Pull-Down Resistor

**Pin Description**

PIN #	PIN NAME	TYPE	DESCRIPTION
1	GNDREF	PWR	Ground pin for the REF outputs.
2	VDDREF	PWR	Ref, XTAL power supply, nominal 3.3V
3	X1	IN	Crystal input, Nominally 14.318MHz.
4	X2	OUT	Crystal output, Nominally 14.318MHz
5	VDD48	PWR	Power pin for the 48MHz output.3.3V
6	48MHz_0	OUT	48MHz clock output.
7	48MHz_1	OUT	48MHz clock output.
8	GND48	PWR	Ground pin for the 48MHz outputs
9	SMBCLK	IN	Clock pin of SMBUS circuitry, 5V tolerant
10	SMBDAT	I/O	Data pin of SMBUS circuitry, 5V tolerant
11	RESET_IN#	IN	Real time active low input. When active, SMBus is reset to power up default.
12	SRCCLKT7	OUT	True clock of differential SRC clock pair.
13	SRCCLKC7	OUT	Complement clock of differential SRC clock pair.
14	VDDSRC	PWR	Supply for SRC clocks, 3.3V nominal
15	GNDSRC	PWR	Ground pin for the SRC outputs
16	SRCCLKT6	OUT	True clock of differential SRC clock pair.
17	SRCCLKC6	OUT	Complement clock of differential SRC clock pair.
18	SRCCLKT5	OUT	True clock of differential SRC clock pair.
19	SRCCLKC5	OUT	Complement clock of differential SRC clock pair.
20	SRCCLKT4	OUT	True clock of differential SRC clock pair.
21	SRCCLKC4	OUT	Complement clock of differential SRC clock pair.
22	GNDSRC	PWR	Ground pin for the SRC outputs
23	VDDSRC	PWR	Supply for SRC clocks, 3.3V nominal
24	SRCCLKT3	OUT	True clock of differential SRC clock pair.
25	SRCCLKC3	OUT	Complement clock of differential SRC clock pair.
26	SRCCLKT2	OUT	True clock of differential SRC clock pair.
27	SRCCLKC2	OUT	Complement clock of differential SRC clock pair.
28	VDDSRC	PWR	Supply for SRC clocks, 3.3V nominal
29	GNDSRC	PWR	Ground pin for the SRC outputs
30	ATIGCLKT3	OUT	True clock of differential ATIGCLK clock pair.
31	ATIGCLKC3	OUT	Complementary clock of differential ATIGCLK clock pair.
32	*CLKREQB#	IN	Output enable for PCI Express (SRC) outputs. SMBus selects which outputs are controlled. 0 = enabled, 1 = tri-stated

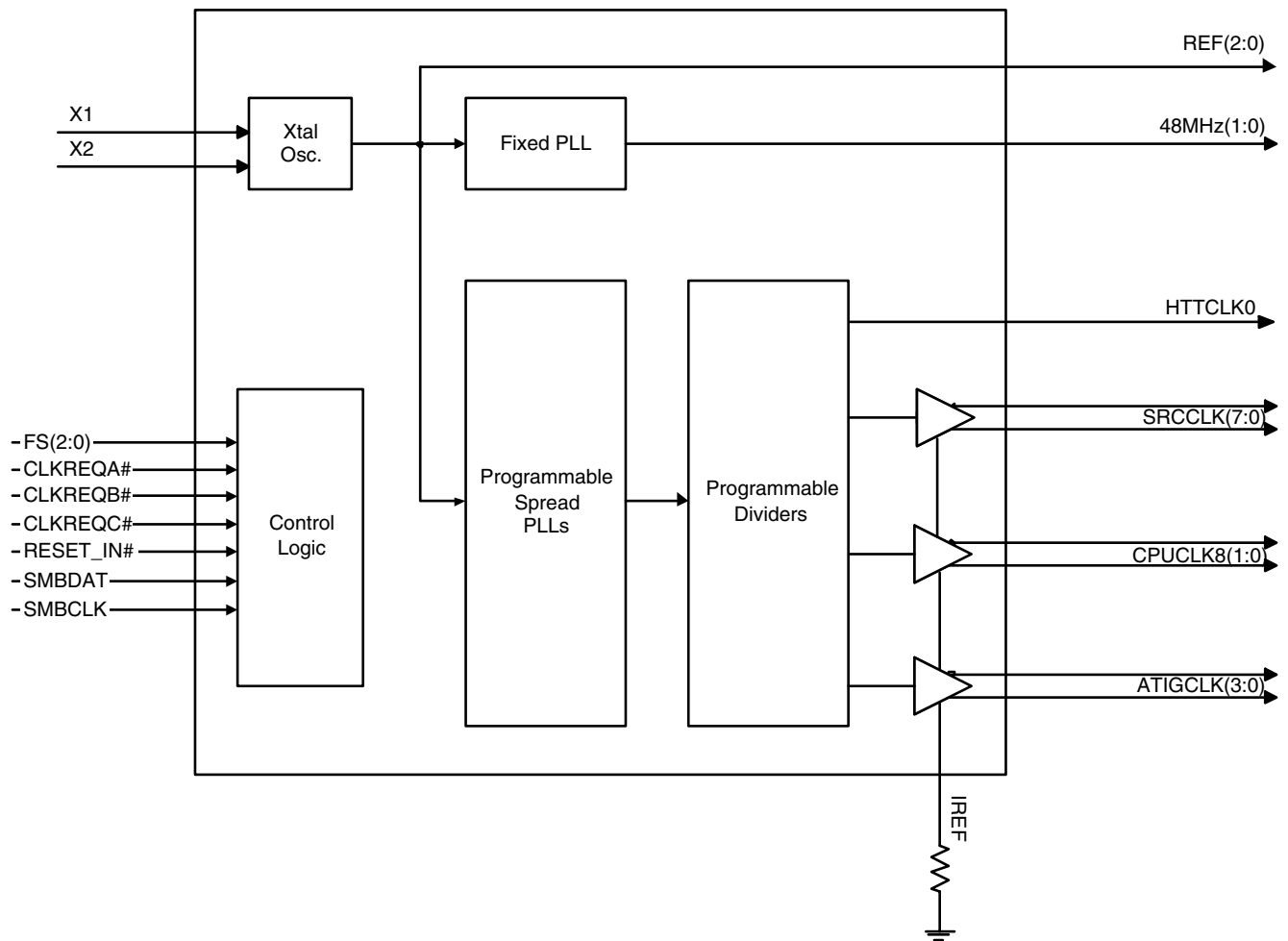
**Pin Description (Continued)**

PIN #	PIN NAME	TYPE	DESCRIPTION
33	*CLKREQC#	IN	Output enable for PCI Express (SRC) outputs. SMBus selects which outputs are controlled. 0 = enabled, 1 = tri-stated
34	ATIGCLKC2	OUT	Complementary clock of differential ATIGCLK clock pair.
35	ATIGCLKT2	OUT	True clock of differential ATIGCLK clock pair.
36	ATIGCLKC1	OUT	Complementary clock of differential ATIGCLK clock pair.
37	ATIGCLKT1	OUT	True clock of differential ATIGCLK clock pair.
38	GNDATIG	PWR	Ground for ATIG clocks
39	VDDATIG	PWR	Power supply ATIG clocks, nominal 3.3V
40	ATIGCLKC0	OUT	Complementary clock of differential ATIGCLK clock pair.
41	ATIGCLKT0	OUT	True clock of differential ATIGCLK clock pair.
42	SRCCLKC1	OUT	Complement clock of differential push-pull SRC clock pair.
43	SRCCLKT1	OUT	True clock of differential SRC clock pair.
44	VDDSRC	PWR	Supply for SRC clocks, 3.3V nominal
45	GNDSRC	PWR	Ground pin for the SRC outputs
46	SRCCLKC0	OUT	Complement clock of differential SRC clock pair.
47	SRCCLKT0	OUT	True clock of differential SRC clock pair.
48	IREF	OUT	This pin establishes the reference current for the differential current-mode output pairs. This pin requires a fixed precision resistor tied to ground in order to establish the appropriate current. 475 ohms is the standard value.
49	GND A	PWR	Ground pin for the PLL core.
50	VDD A	PWR	3.3V power for the PLL core.
51	CPUCLK8C1	OUT	Complementary clock of differential 3.3V push-pull K8 pair.
52	CPUCLK8T1	OUT	True clock of differential 3.3V push-pull K8 pair.
53	GND CPU	PWR	Ground pin for the CPU outputs
54	VDD CPU	PWR	Supply for CPU clocks, 3.3V nominal
55	CPUCLK8C0	OUT	Complementary clock of differential 3.3V push-pull K8 pair.
56	CPUCLK8T0	OUT	True clock of differential 3.3V push-pull K8 pair.
57	*CLKREQA#	IN	Output enable for PCI Express (SRC) outputs. SMBus selects which outputs are controlled. 0 = enabled, 1 = tri-stated
58	GNDHTT	PWR	Ground pin for the HTT outputs
59	HTTCLK0	OUT	3.3V Hyper Transport output
60	VDDHTT	PWR	Supply for HTT clocks, nominal 3.3V.
61	PD**	IN	Asynchronous active high input pin used to power down the device. The internal clocks are disabled and the VCO is stopped.
62	FS2/REF2	I/O	Frequency select latch input pin / 14.318 MHz reference clock.
63	FS1/REF1	I/O	Frequency select latch input pin / 14.318 MHz reference clock.
64	FS0/REF0	I/O	Frequency select latch input pin / 14.318 MHz reference clock.

**General Description**

The **ICS951462** is a main clock synthesizer chip that provides all clocks required for ATI RS/RD690-based systems. An SMBus interface allows full control of the device.

**Block Diagram**



**Table1: CPU and HTT Frequency Selection Table**

Byte 0					CPUCLK (2:0) (MHz)	HTT (MHz)	Spread %	Overclock %
Bit4	Bit3	Bit2	Bit1	Bit0				
CPU SS_EN	CPU FS3	CPU FS2	CPU FS1	CPU FS0				
0	0	0	0	0	Hi-Z	Hi-Z	None	
0	0	0	0	1	X / 2	X / 3	None	
0	0	0	1	0	230.00	76.67	None	<b>15%</b>
0	0	0	1	1	240.00	80.00	None	<b>20%</b>
0	0	1	0	0	100.00	66.67	None	<b>0%</b>
0	0	1	0	1	133.33	66.67	None	
0	0	1	1	0	166.67	66.67	None	
0	0	1	1	1	200.00	66.67	None	
0	1	0	0	0	250.00	83.33	None	<b>25%</b>
0	1	0	0	1	260.00	86.67	None	<b>30%</b>
0	1	0	1	0	270.00	90.00	None	<b>35%</b>
0	1	0	1	1	280.00	93.33	None	<b>40%</b>
0	1	1	0	0	102.00	68.00	None	<b>2%</b>
0	1	1	0	1	136.00	68.00	None	
0	1	1	1	0	170.00	68.00	None	
0	1	1	1	1	204.00	68.00	None	
1	0	0	0	0	210.00	70.00	-0.5%	<b>5%</b>
1	0	0	0	1	220.00	73.33	-0.5%	<b>10%</b>
1	0	0	1	0	230.00	76.67	-0.5%	<b>15%</b>
1	0	0	1	1	240.00	80.00	-0.5%	<b>20%</b>
1	0	1	0	0	100.00	66.67	-0.5%	<b>0%</b>
1	0	1	0	1	133.33	66.67	-0.5%	
1	0	1	1	0	166.67	66.67	-0.5%	
1	0	1	1	1	200.00	66.67	-0.5%	
1	1	0	0	0	250.00	83.33	-0.5%	<b>25%</b>
1	1	0	0	1	260.00	86.67	-0.5%	<b>30%</b>
1	1	0	1	0	270.00	90.00	-0.5%	<b>35%</b>
1	1	0	1	1	280.00	93.33	-0.5%	<b>40%</b>
1	1	1	0	0	102.00	68.00	-0.5%	<b>2%</b>
1	1	1	0	1	136.00	68.00	-0.5%	
1	1	1	1	0	170.00	68.00	-0.5%	
1	1	1	1	1	204.00	68.00	-0.5%	



Table2: SRC Frequency Selection Table

Byte 0 Bit 5	Byte 5				SRC(7:0) (MHz)	Spread %	SRC OverClock %
	SRC SS_EN	SRC FS3	SRC FS2	SRC FS1			
0	0	0	0	0	100.00	0	0%
0	0	0	0	1	101.00	0	1%
0	0	0	1	0	102.00	0	2%
0	0	0	1	1	103.00	0	3%
0	0	1	0	0	104.00	0	4%
0	0	1	0	1	105.00	0	5%
0	0	1	1	0	106.00	0	6%
0	0	1	1	1	107.00	0	7%
0	1	0	0	0	100.00	0	0%
0	1	0	0	1	101.00	0	1%
0	1	0	1	0	102.00	0	2%
0	1	0	1	1	103.00	0	3%
0	1	1	0	0	104.00	0	4%
0	1	1	0	1	105.00	0	5%
0	1	1	1	0	106.00	0	6%
0	1	1	1	1	107.00	0	7%
1	0	0	0	0	100.00	-0.25%	0%
1	0	0	0	1	101.00	-0.25%	1%
1	0	0	1	0	102.00	-0.25%	2%
1	0	0	1	1	103.00	-0.25%	3%
1	0	1	0	0	104.00	-0.25%	4%
1	0	1	0	1	105.00	-0.25%	5%
1	0	1	1	0	106.00	-0.25%	6%
1	0	1	1	1	107.00	-0.25%	7%
1	1	0	0	0	100.00	-0.5%	0%
1	1	0	0	1	101.00	-0.5%	1%
1	1	0	1	0	102.00	-0.5%	2%
1	1	0	1	1	103.00	-0.5%	3%
1	1	1	0	0	104.00	-0.5%	4%
1	1	1	0	1	105.00	-0.5%	5%
1	1	1	1	0	106.00	-0.5%	6%
1	1	1	1	1	107.00	-0.5%	7%



Table3: ATIG Frequency Selection Table

Byte 0 Bit 6	Byte 9				ATIG(2:0) (MHz)	Spread %	ATIG OverClock %
	Bit3	Bit2	Bit1	Bit0			
ATIG SS_EN	ATIG FS3	ATIG FS2	ATIG FS1	ATIG FS0			
0	0	0	0	0	100.00	0	0%
0	0	0	0	1	105.00	0	5%
0	0	0	1	0	110.00	0	10%
0	0	0	1	1	115.00	0	15%
0	0	1	0	0	120.00	0	20%
0	0	1	0	1	125.00	0	25%
0	0	1	1	0	130.00	0	30%
0	0	1	1	1	135.00	0	35%
0	1	0	0	0	100.00	0	0%
0	1	0	0	1	105.00	0	5%
0	1	0	1	0	110.00	0	10%
0	1	0	1	1	115.00	0	15%
0	1	1	0	0	120.00	0	20%
0	1	1	0	1	125.00	0	25%
0	1	1	1	0	130.00	0	30%
0	1	1	1	1	135.00	0	35%
1	0	0	0	0	100.00	-0.25%	0%
1	0	0	0	1	105.00	-0.25%	5%
1	0	0	1	0	110.00	-0.25%	10%
1	0	0	1	1	115.00	-0.25%	15%
1	0	1	0	0	120.00	-0.25%	20%
1	0	1	0	1	125.00	-0.25%	25%
1	0	1	1	0	130.00	-0.25%	30%
1	0	1	1	1	135.00	-0.25%	35%
1	1	0	0	0	100.00	-0.5%	0%
1	1	0	0	1	105.00	-0.5%	5%
1	1	0	1	0	110.00	-0.5%	10%
1	1	0	1	1	115.00	-0.5%	15%
1	1	1	0	0	120.00	-0.5%	20%
1	1	1	0	1	125.00	-0.5%	25%
1	1	1	1	0	130.00	-0.5%	30%
1	1	1	1	1	135.00	-0.5%	35%



**Table 4: CPU Divider Ratios**

<b>B19b(7:4)</b>		<b>Divider (3:2)</b>							
<b>Divider (1:0)</b>	<b>Bit</b>	<b>00</b>		<b>01</b>		<b>10</b>		<b>11</b>	<b>MSB</b>
	00	0000	2	0100	4	1000	8	1100	16
	01	0001	3	0101	6	1001	12	1101	24
	10	0010	5	0110	10	1010	20	1110	40
	11	0011	15	0111	30	1011	60	1111	120
<b>LSB</b>	Address	Div	Address		Address	Div	Address	Div	

**Table 5: HTT Divider Ratios**

<b>B20b(3:0)</b>		<b>Divider (3:2)</b>							
<b>Divider (1:0)</b>	<b>Bit</b>	<b>00</b>		<b>01</b>		<b>10</b>		<b>11</b>	<b>MSB</b>
	00	0000	4	0100	8	1000	16	1100	32
	01	0001	3	0101	6	1001	12	1101	24
	10	0010	5	0110	10	1010	20	1110	40
	11	0011	15	0111	30	1011	60	1111	120
<b>LSB</b>	Address	Div	Address		Address	Div	Address	Div	

**Table 6: ATIG Divider Ratios**

<b>B19b(3:0)</b>		<b>Divider (3:2)</b>							
<b>Divider (1:0)</b>	<b>Bit</b>	<b>00</b>		<b>01</b>		<b>10</b>		<b>11</b>	<b>MSB</b>
	00	0000	2	0100	4	1000	8	1100	16
	01	0001	3	0101	6	1001	12	1101	24
	10	0010	5	0110	10	1010	20	1110	40
	11	0011	7	0111	14	1011	28	1111	56
<b>LSB</b>	Address	Div	Address		Address	Div	Address	Div	



## General SMBus serial interface information for the ICS951462

### How to Write:

- Controller (host) sends a start bit.
- Controller (host) sends the write address D2<sub>(H)</sub>
- ICS clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- ICS clock will **acknowledge**
- Controller (host) sends the data byte count = X
- ICS clock will **acknowledge**
- Controller (host) starts sending **Byte N through Byte N + X - 1**  
(see Note 2)
- ICS clock will **acknowledge** each byte **one at a time**
- Controller (host) sends a Stop bit

### How to Read:

- Controller (host) will send start bit.
- Controller (host) sends the write address D2<sub>(H)</sub>
- ICS clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- ICS clock will **acknowledge**
- Controller (host) will send a separate start bit.
- Controller (host) sends the read address D3<sub>(H)</sub>
- ICS clock will **acknowledge**
- ICS clock will send the data byte count = X
- ICS clock sends **Byte N + X - 1**
- ICS clock sends **Byte 0 through byte X (if X<sub>(H)</sub> was written to byte 8)**.
- Controller (host) will need to acknowledge each byte
- Controller (host) will send a not acknowledge bit
- Controller (host) will send a stop bit

Index Block Write Operation		
Controller (Host)		ICS (Slave/Receiver)
T	starT bit	
Slave Address D2 <sub>(H)</sub>		
WR	WRite	
		ACK
Beginning Byte = N		
		ACK
Data Byte Count = X		
		ACK
Beginning Byte N	X Byte	
○		ACK
○		○
○		○
Byte N + X - 1		○
		ACK
P	stoP bit	

Index Block Read Operation		
Controller (Host)		ICS (Slave/Receiver)
T	starT bit	
Slave Address D2 <sub>(H)</sub>		
WR	WRite	
		ACK
Beginning Byte = N		
		ACK
RT	Repeat starT	
Slave Address D3 <sub>(H)</sub>		
RD	ReaD	
		ACK
		Data Byte Count = X
ACK		
ACK		Beginning Byte N
○		○
○		○
○		○
		Byte N + X - 1
N	Not acknowledge	
P	stoP bit	

**SMBus Table: Spread Spectrum Enable and CPU Frequency Select Register**

Byte 0	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	FS Source	Latched Input or SMBus Frequency Select	RW	Latched Inputs	SMBus	0
Bit 6	-	ATIG_SS_EN	ATIG Spread Spectrum Enable	RW	Disable	Enable	0
Bit 5	-	SRC_SS_EN	SRC Spread Spectrum Enable	RW	Disable	Enable	0
Bit 4	-	CPU_SS_EN	CPU Spread Spectrum Enable	RW	Disable	Enable	0
Bit 3	-	CPU FS3	CPU Freq Select Bit 3	RW	See Table 1: CPU Frequency Selection Table		0
Bit 2	-	CPU FS2	CPU Freq Select Bit 2	RW			Latch
Bit 1	-	CPU FS1	CPU Freq Select Bit 1	RW			Latch
Bit 0	-	CPU FS0	CPU Freq Select Bit 0	RW			Latch

Note: Each Spread Spectrum Enable bit is independent from the other.

Bit(6:4) must all set to "1" in order to enable spread for CPU, SRC and ATIG clocks.

**SMBus Table: Output Control Register**

Byte 1	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	7	48MHz_1	48MHz_1 Output Enable	RW	Disable	Enable	1
Bit 6	6	48MHz_0	48MHz_0 Output Enable	RW	Disable	Enable	1
Bit 5	62	REF2	REF2 Output Enable	RW	Disable	Enable	1
Bit 4	63	REF1	REF1 Output Enable	RW	Disable	Enable	1
Bit 3	64	REF0	REF0 Output Enable	RW	Disable	Enable	1
Bit 2	59	HTTCLK0	HTTCLK0 Output Enable	RW	Disable	Enable	1
Bit 1	52,51	CPUCLK1	CPUCLK1 Output Enable	RW	Disable	Enable	1
Bit 0	56,55	CPUCLK0	CPUCLK0 Output Enable	RW	Disable	Enable	1

**SMBus Table: ATIGCLK and CLKREQB# Output Control Register**

Byte 2	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	30,31	ATIGCLK3	ATIGCLK3 Output Enable	RW	Disable	Enable	1
Bit 6	35,34	ATIGCLK2	ATIGCLK2 Output Enable	RW	Disable	Enable	1
Bit 5	37,36	ATIGCLK1	ATIGCLK1 Output Enable	RW	Disable	Enable	1
Bit 4	41,40	ATIGCLK0	ATIGCLK0 Output Enable	RW	Disable	Enable	1
Bit 3	20,21	REQBSRC4	CLKREQB# Controls SRC4	RW	Does not control	Controls	0
Bit 2	24,25	REQBSRC3	CLKREQB# Controls SRC3	RW	Does not control	Controls	0
Bit 1	26,27	REQBSRC2	CLKREQB# Controls SRC2	RW	Does not control	Controls	0
Bit 0	30,31	REQBATIG3	CLKREQB# Controls ATIG3	RW	Does not control	Controls	0

**SMBus Table: SRCCLK Output Control Register**

Byte 3	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	12,13	SRCCLK7	Master Output control. Enables or disables output, regardless of CLKREQ# inputs.	RW	Disable	Enable	1
Bit 6	16,17	SRCCLK6		RW	Disable	Enable	1
Bit 5	18,19	SRCCLK5		RW	Disable	Enable	1
Bit 4	20,21	SRCCLK4		RW	Disable	Enable	1
Bit 3	24,25	SRCCLK3		RW	Disable	Enable	1
Bit 2	26,27	SRCCLK2		RW	Disable	Enable	1
Bit 1	43,42	SRCCLK1		RW	Disable	Enable	1
Bit 0	47,46	SRCCLK0		RW	Disable	Enable	1

**SMBus Table: CLKREQA# and CLKREQC# Output Control Register**

Byte 4	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	12,13	REQASRC7	CLKREQA# Controls SRC7	RW	Does not control	Controls	0
Bit 6	16,17	REQASRC6	CLKREQA# Controls SRC6	RW	Does not control	Controls	0
Bit 5	18,19	REQASRC5	CLKREQA# Controls SRC5	RW	Does not control	Controls	0
Bit 4	43,42	REQCSRC1	CLKREQC# Controls SRC1	RW	Does not control	Controls	0
Bit 3	35,34	REQCATIG2	CLKREQC# Controls ATIG2	RW	Does not control	Controls	0
Bit 2	37,36	REQCATIG1	CLKREQC# Controls ATIG1	RW	Does not control	Controls	0
Bit 1	41,40	REQCATIG0	CLKREQC# Controls ATIG0	RW	Does not control	Controls	0
Bit 0	47,46	REQCSRC0	CLKREQC# Controls SRC0	RW	Does not control	Controls	0

**SMBus Table: CPU Stop Control and SRC Frequency Select Register**

Byte 5	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7			Reserved				0
Bit 6			Reserved				0
Bit 5			Reserved				0
Bit 4	SRC, ATIG	Differential Output Disable Mode	Hi-Z or Driven when disable	RW	Driven	Hi-Z	0
Bit 3	-	SRC FS3	SRC Freq Select Bit 3	RW	See Table 2: SRC Frequency Selection Table		0
Bit 2	-	SRC FS2	SRC Freq Select Bit 2	RW			0
Bit 1	-	SRC FS1	SRC Freq Select Bit 1	RW			0
Bit 0	-	SRC FS0	SRC Freq Select Bit 0	RW			0

**SMBus Table: Device ID Register**

Byte 6	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	Device ID7 (MSB)	DEVICE ID	R	-	-	0
Bit 6	-	Device ID6		R	-	-	1
Bit 5	-	Device ID5		R	-	-	1
Bit 4	-	Device ID4		R	-	-	0
Bit 3	-	Device ID3		R	-	-	0
Bit 2	-	Device ID2		R	-	-	0
Bit 1	-	Device ID1		R	-	-	1
Bit 0	-	Device ID0 (LSB)		R	-	-	0

**SMBus Table: Revision and Vendor ID Register**

Byte 7	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	RID3	REVISION ID	R	-	-	0
Bit 6	-	RID2		R	-	-	0
Bit 5	-	RID1		R	-	-	0
Bit 4	-	RID0		R	-	-	1
Bit 3	-	VID3	VENDOR ID	R	-	-	0
Bit 2	-	VID2		R	-	-	0
Bit 1	-	VID1		R	-	-	0
Bit 0	-	VID0		R	-	-	1

**SMBus Table: Byte Count Register**

Byte 8	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	BC7	Byte Count Programming b(7:0)	RW	Writing to this register will configure how many bytes will be read back, default is 9 bytes.		0
Bit 6	-	BC6		RW			0
Bit 5	-	BC5		RW			0
Bit 4	-	BC4		RW			0
Bit 3	-	BC3		RW			1
Bit 2	-	BC2		RW			0
Bit 1	-	BC1		RW			0
Bit 0	-	BC0		RW			1

**SMBus Table: REF2, 48MHz Output Strength Control and ATIG Frequency Select Register**

Byte 9	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	62	REF2Str	REF2 Strength Control	RW	1X	2X	1
Bit 6	7	48MHz_1Str	48MHz_1 Strength Control	RW	1X	2X	1
Bit 5	6	48MHz_0Str	48MHz_0 Strength Control	RW	1X	2X	1
Bit 4	Reserved						0
Bit 3	-	ATIG FS3	ATIG Freq Select Bit 3	RW	See Table 3: ATIG Frequency Selection Table		0
Bit 2	-	ATIG FS2	ATIG Freq Select Bit 2	RW			0
Bit 1	-	ATIG FS1	ATIG Freq Select Bit 1	RW			0
Bit 0	-	ATIG FS0	ATIG Freq Select Bit 0	RW			0

**SMBus Table: PLLs M/N Programming Enable and REF1, REF0 Output Strength Control Register**

Byte 10	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	M/N_EN	PLLs M/N Programming Enable	RW	Disable	Enable	0
Bit 6	63	REF1Str	REF1 Strength Control	RW	1X	2X	1
Bit 5	64	REF0Str	REF0 Strength Control	RW	1X	2X	1
Bit 4	Reserved						0
Bit 3	Reserved						0
Bit 2	Reserved						0
Bit 1	Reserved						0
Bit 0	Reserved						0

**SMBus Table: CPU PLL VCO Frequency Control Register**

Byte 11	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	N Div8	N Divider Prog bit 8	RW	The decimal representation of M and N Divider in Byte 11 and 12 will configure the VCO frequency. Default at power up = latch-in or Byte 0 Rom table. VCO Frequency = $14.318 \times [\text{NDiv}(9:0)+8] / [\text{MDiv}(5:0)+2]$		X
Bit 6	-	N Div 9	N Divider Prog bit 9	RW			X
Bit 5	-	M Div5	M Divider Programming bits	RW			X
Bit 4	-	M Div4		RW			X
Bit 3	-	M Div3		RW			X
Bit 2	-	M Div2		RW			X
Bit 1	-	M Div1		RW			X
Bit 0	-	M Div0		RW			X

**SMBus Table: CPU PLL VCO Frequency Control Register**

Byte 12	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	N Div7	N Divider Programming b(7:0)	RW	The decimal representation of M and N Divider in Byte 11 and 12 will configure the VCO frequency. Default at power up = latch-in or Byte 0 Rom table. VCO Frequency = $14.318 \times [\text{NDiv}(9:0)+8] / [\text{MDiv}(5:0)+2]$		X
Bit 6	-	N Div6		RW			X
Bit 5	-	N Div5		RW			X
Bit 4	-	N Div4		RW			X
Bit 3	-	N Div3		RW			X
Bit 2	-	N Div2		RW			X
Bit 1	-	N Div1		RW			X
Bit 0	-	N Div0		RW			X

**SMBus Table: CPU PLL Spread Spectrum Control Register**

Byte 13	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	SSP7	Spread Spectrum Programming b(7:0)	RW	These Spread Spectrum bits in Byte 13 and 14 will program the spread percentage. It is recommended to use ICS Spread % table for spread programming.		X
Bit 6	-	SSP6		RW			X
Bit 5	-	SSP5		RW			X
Bit 4	-	SSP4		RW			X
Bit 3	-	SSP3		RW			X
Bit 2	-	SSP2		RW			X
Bit 1	-	SSP1		RW			X
Bit 0	-	SSP0		RW			X

**SMBus Table: CPU PLL Spread Spectrum Control Register**

Byte 14	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-		Reserved				0
Bit 6	-	SSP14	Spread Spectrum Programming b(14:8)	RW	These Spread Spectrum bits in Byte 13 and 14 will program the spread percentage. It is recommended to use ICS Spread % table for spread programming.		X
Bit 5	-	SSP13		RW			X
Bit 4	-	SSP12		RW			X
Bit 3	-	SSP11		RW			X
Bit 2	-	SSP10		RW			X
Bit 1	-	SSP9		RW			X
Bit 0	-	SSP8		RW			X

**SMBus Table: ATIG PLL VCO Frequency Control Register**

Byte 15	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	N Div8	N Divider Prog bit 8	RW	The decimal representation of M and N Divier in Byte 17 and 18 will configure the VCO frequency. Default at power up = Byte 0 Rom table. VCO Frequency = 14.318 x [NDiv(9:0)+8] / [MDiv(5:0)+2]		X
Bit 6	-	N Div9	N Divider Prog bit 9	RW			X
Bit 5	-	M Div5	M Divider Programming bits	RW			X
Bit 4	-	M Div4		RW			X
Bit 3	-	M Div3		RW			X
Bit 2	-	M Div2		RW			X
Bit 1	-	M Div1		RW			X
Bit 0	-	M Div0		RW			X

**SMBus Table: ATIG PLL VCO Frequency Control Register**

Byte 16	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	N Div7	N Divider Programming b(7:0)	RW	The decimal representation of M and N Divier in Byte 17 and 18 will configure the VCO frequency. Default at power up = Byte 0 Rom table. VCO Frequency = 14.318 x [NDiv(9:0)+8] / [MDiv(5:0)+2]		X
Bit 6	-	N Div6		RW			X
Bit 5	-	N Div5		RW			X
Bit 4	-	N Div4		RW			X
Bit 3	-	N Div3		RW			X
Bit 2	-	N Div2		RW			X
Bit 1	-	N Div1		RW			X
Bit 0	-	N Div0		RW			X

**SMBus Table: ATIG PLL Spread Spectrum Control Register**

Byte 17	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	SSP7	Spread Spectrum Programming b(7:0)	RW	These Spread Spectrum bits in Byte 19 and 20 will program the spread percentage. It is recommended to use ICS Spread % table for spread programming.		X
Bit 6	-	SSP6		RW			X
Bit 5	-	SSP5		RW			X
Bit 4	-	SSP4		RW			X
Bit 3	-	SSP3		RW			X
Bit 2	-	SSP2		RW			X
Bit 1	-	SSP1		RW			X
Bit 0	-	SSP0		RW			X

**SMBus Table: ATIG PLL Spread Spectrum Control Register**

Byte 18	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7			Reserved				0
Bit 6	-	SSP14	Spread Spectrum Programming b(14:8)	RW	These Spread Spectrum bits in Byte 19 and 20 will program the spread percentage. It is recommended to use ICS Spread % table for spread programming.		X
Bit 5	-	SSP13		RW		X	
Bit 4	-	SSP12		RW		X	
Bit 3	-	SSP11		RW		X	
Bit 2	-	SSP10		RW		X	
Bit 1	-	SSP9		RW		X	
Bit 0	-	SSP8		RW		X	

**SMBus Table: CPU and ATIG Divider Ratio Programming Bits Select Register**

Byte 19	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7	-	CPU_Div3	CPU_Divider Ratio Programming Bits	RW	See Table 4: CPU Divider Ratios		X
Bit 6	-	CPU_Div2		RW		X	
Bit 5	-	CPU_Div1		RW		X	
Bit 4	-	CPU_Div0		RW		X	
Bit 3	-	ATIG_Div3	ATIG_Divider Ratio Programming Bits	RW	See Table 5: ATIG Divider Ratios		X
Bit 2	-	ATIG_Div2		RW		X	
Bit 1	-	ATIG_Div1		RW		X	
Bit 0	-	ATIG_Div0		RW		X	

**SMBus Table: HTT Divider Ratio Programming Bits Select Register**

Byte 20	Pin #	Name	Control Function	Type	0	1	PWD
Bit 7			Reserved				0
Bit 6			Reserved				0
Bit 5			Reserved				0
Bit 4			Reserved				0
Bit 3	-	HTT_Div3	HTT_Divider Ratio Programming Bits	RW	See Table 6: HTT Divider Ratios		X
Bit 2	-	HTT_Div2		RW		X	
Bit 1	-	HTT_Div1		RW		X	
Bit 0	-	HTT_Div0		RW		X	

**Absolute Maximum Rating** (Above which useful life may be impaired)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	Notes
3.3V Core Supply Voltage	VDD_A	-			V <sub>DD</sub> + 0.5V	V	1
3.3V Logic Input Supply Voltage	VDD_In	-	GND - 0.5		V <sub>DD</sub> + 0.5V	V	1
Storage Temperature	T <sub>s</sub>	-	-65		150	°C	1
Ambient Operating Temp	T <sub>ambient</sub>	-	0		70	°C	1
Max Junction Temp	T <sub>J</sub>	V <sub>DD</sub> MAX, 70°C			130	°C	1
Case Temperature	T <sub>case</sub>	-			115	°C	1
Input ESD protection HBM	ESD prot	-	2000			V	1

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

**Electrical Characteristics - Input/Supply/Common Output Parameters**

PARAMETER	SYMBOL	CONDITIONS*	MIN	TYP	MAX	UNITS	Notes
Input High Voltage	V <sub>IH</sub>	3.3 V +/-5%	2		V <sub>DD</sub> + 0.3	V	1
Input Low Voltage	V <sub>IL</sub>	3.3 V +/-5%	V <sub>SS</sub> - 0.3		0.8	V	1
Input High Current	I <sub>IH</sub>	V <sub>IN</sub> = V <sub>DD</sub>	-5		5	uA	1
Input Low Current	I <sub>IL1</sub>	V <sub>IN</sub> = 0 V; Inputs with no pull-up resistors	-5			uA	1
	I <sub>IL2</sub>	V <sub>IN</sub> = 0 V; Inputs with pull-up resistors	-200			uA	1
Low Threshold Input-High Voltage	V <sub>IH_FS</sub>	3.3 V +/-5%	0.7		V <sub>DD</sub> + 0.3	V	1
Low Threshold Input-Low Voltage	V <sub>IL_FS</sub>	3.3 V +/-5%	V <sub>SS</sub> - 0.3		0.35	V	1
Operating Current	I <sub>DD3.3OP</sub>	all outputs driven			400	mA	1
Powerdown Current	I <sub>DD3.3PD</sub>	all diff pairs driven			70	mA	1
		all differential pairs tri-stated			12	mA	1
Input Frequency	F <sub>i</sub>	V <sub>DD</sub> = 3.3 V		14.31818		MHz	2
Pin Inductance	L <sub>pin</sub>				7	nH	1
Input Capacitance	C <sub>IN</sub>	Logic Inputs			5	pF	1
	C <sub>OUT</sub>	Output pin capacitance			6	pF	1
	C <sub>INX</sub>	X1 & X2 pins			5	pF	1
Clk Stabilization	T <sub>STAB</sub>	From VDD Power-Up or de-assertion of PD to 1st clock			1.8	ms	1
Modulation Frequency		Triangular Modulation	30		33	kHz	1
Tdrive_PD		CPU output enable after PD de-assertion			300	us	1
Tfall_PD		PD fall time of			5	ns	1
Trise_PD		PD rise time of			5	ns	1
SMBus Voltage	V <sub>DD</sub>		2.7		5.5	V	1
Low-level Output Voltage	V <sub>OL</sub>	@ I <sub>PULLUP</sub>			0.4	V	1
Current sinking at V <sub>OL</sub> = 0.4 V	I <sub>PULLUP</sub>		4			mA	1
SMBCLK/SMBDAT Clock/Data Rise Time	T <sub>RI2C</sub>	(Max VIL - 0.15) to (Min VIH + 0.15)			1000	ns	1
SMBCLK/SMBDAT Clock/Data Fall Time	T <sub>FI2C</sub>	(Min VIH + 0.15) to (Max VIL - 0.15)			300	ns	1

\*TA = 0 - 70°C; Supply Voltage VDD = 3.3 V +/-5%

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup> Input frequency should be measured at the REF pin and tuned to ideal 14.31818MHz to meet ppm frequency accuracy on PLL outputs.

## Electrical Characteristics - K8 Push Pull Differential Pair

$T_A = 0 - 70^\circ\text{C}$ ;  $V_{DD} = 3.3\text{ V} \pm 5\%$ ;  $C_L = \text{AMD64 Processor Test Load}$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Rising Edge Rate	$\delta V/\delta t$	Measured at the AMD64 processor's test load. 0 V +/- 400 mV (differential measurement)	2		10	V/ns	1
Falling Edge Rate	$\delta V/\delta t$		2		10	V/ns	1
Differential Voltage	$V_{DIFF}$	Measured at the AMD64 processor's test load. (single-ended measurement)	0.4	1.25	2.3	V	1
Change in $V_{DIFF\_DC}$ Magnitude	$\Delta V_{DIFF}$		-150		150	mV	1
Common Mode Voltage	$V_{CM}$		1.05	1.25	1.45	V	1
Change in Common Mode Voltage	$\Delta V_{CM}$		-200		200	mV	1
Jitter, Cycle to cycle	$t_{jyc-cyc}$	Measurement from differential waveform. Maximum difference of cycle time between 2 adjacent cycles.	0	50	85	ps	1
Jitter, Accumulated	$t_{ja}$	Measured using the JIT2 software package with a Tek 7404 scope. TIE (Time Interval Error) measurement technique: Sample resolution = 50 ps, Sample Duration = 10 $\mu\text{s}$	-1000		1000		1,2,3
Duty Cycle	$d_{I3}$	Measurement from differential waveform	45		53	%	1
Output Impedance	$R_{ON}$	Average value during switching transition. Used for determining series termination value.	15	35	55	$\Omega$	1
Group Skew	$t_{src-skew}$	Measurement from differential waveform			50	ps	1

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup>All accumulated jitter specifications are guaranteed assuming that REF is at 14.31818MHz

<sup>3</sup>Spread Spectrum is off



**Electrical Characteristics - HTTCLK Clock**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	Notes
Long Accuracy	ppm	see Tperiod min-max values	-300		300	ppm	1,2
PCI33 Clock period	T <sub>period</sub>	33.33MHz output nominal	29.9910		30.0090	ns	2
		33.33MHz output spread	29.9910		30.1598	ns	2
HTT66 Clock period	T <sub>period</sub>	66.67MHz output nominal	14.9955		15.0045	ns	2
		66.67MHz output spread	14.9955		15.0799	ns	2
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1 mA	2.4			V	1
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 1 mA			0.55	V	1
Output High Current	I <sub>OH</sub>	V <sub>OH</sub> @ MIN = 1.0 V	-33			mA	1
		V <sub>OH</sub> @ MAX = 3.135 V			-33	mA	1
Output Low Current	I <sub>OL</sub>	V <sub>OL</sub> @ MIN = 1.95 V	30			mA	1
		V <sub>OL</sub> @ MAX = 0.4 V			38	mA	1
Edge Rate	ΔV/Δt	Rising edge rate	1		4	V/ns	1
Edge Rate	ΔV/Δt	Falling edge rate	1		4	V/ns	1
Rise Time	t <sub>r1</sub>	V <sub>OL</sub> = 0.4 V, V <sub>OH</sub> = 2.4 V	0.5		2	ns	1
Fall Time	t <sub>f1</sub>	V <sub>OH</sub> = 2.4 V, V <sub>OL</sub> = 0.4 V	0.5		2	ns	1
Duty Cycle	d <sub>t1</sub>	V <sub>T</sub> = 1.5 V	45		55	%	1
Jitter, Cycle to cycle	t <sub>jcc-cyc</sub>	V <sub>T</sub> = 1.5 V			180	ps	1

\*T<sub>A</sub> = 0 - 70°C; VDD=3.3V +/-5%; C<sub>L</sub> = 30 pF (unless otherwise specified)

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup>All Long Term Accuracy and Clock Period specifications are guaranteed with the assumption that REF is at 14.31818MHz

**Electrical Characteristics - SRC/ATIG 0.7V Current Mode Differential Pair**

PARAMETER	SYMBOL	CONDITIONS*	MIN	TYP	MAX	UNITS	Notes
Current Source Output Impedance	Z <sub>o</sub>	V <sub>O</sub> = V <sub>x</sub>	3000			Ω	1
Voltage High	VHigh	Statistical measurement on single ended signal	660		850	mV	1,3
Voltage Low	VLow		-150		150	mV	1,3
Max Voltage	V <sub>ovs</sub>	Measurement on single ended signal using absolute value.			1150	mV	1
Min Voltage	V <sub>uds</sub>		-300			mV	1
Crossing Voltage (abs)	V <sub>x(abs)</sub>		250		550	mV	1
Crossing Voltage (var)	d-V <sub>x</sub>	Variation of crossing over all edges			140	mV	1
Long Accuracy	ppm	see Tperiod min-max values	-300		300	ppm	1,2
Average period	Tperiod	100.00MHz nominal	9.9970		10.0030	ns	2
		100.00MHz spread	9.9970		10.0533	ns	2
Absolute min period	T <sub>absmin</sub>	100.00MHz nominal/spread	9.8720			ns	1,2
Rise Time	t <sub>r</sub>	V <sub>OL</sub> = 0.175V, V <sub>OH</sub> = 0.525V	175		700	ps	1
Fall Time	t <sub>f</sub>	V <sub>OH</sub> = 0.525V V <sub>OL</sub> = 0.175V	175		700	ps	1
Rise Time Variation	d-t <sub>r</sub>	V <sub>OL</sub> = 0.175V, V <sub>OH</sub> = 0.525V			125	ps	1
Fall Time Variation	d-t <sub>f</sub>	V <sub>OH</sub> = 0.525V V <sub>OL</sub> = 0.175V			125	ps	1
Duty Cycle	d <sub>t3</sub>	Measurement from differential waveform	45		55	%	1
Skew	t <sub>sk3</sub>	V <sub>T</sub> = 50%			100	ps	1
Jitter, Cycle to cycle	t <sub>jcc-cyc</sub>	Measurement from differential waveform			125	ps	1

\*T<sub>A</sub> = 0 - 70°C; V<sub>DD</sub> = 3.3 V +/-5%; C<sub>L</sub> = 2pF, R<sub>S</sub> = 33.2Ω, R<sub>P</sub> = 49.9Ω, I<sub>REF</sub> = 475Ω

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup>All Long Term Accuracy and Clock Period specifications are guaranteed assuming that REFOUT is at 14.31818MHz

<sup>3</sup>I<sub>REF</sub> = V<sub>DD</sub>/(3xR<sub>P</sub>). For R<sub>P</sub> = 475Ω (1%), I<sub>REF</sub> = 2.32mA. I<sub>OH</sub> = 6 x I<sub>REF</sub> and V<sub>OH</sub> = 0.7V @ Z<sub>O</sub> = 50Ω.

**Electrical Characteristics - USB - 48MHz**

PARAMETER	SYMBOL	CONDITIONS*	MIN	TYP	MAX	UNITS	NOTES
Long Accuracy	ppm	see Tperiod min-max values	-100		100	ppm	1,2
Clock period	T <sub>period</sub>	48.00MHz output nominal	20.8229		20.8344	ns	2
Clock Low Time	T <sub>low</sub>	Measure from < 0.6V	9.3750		11.4580	ns	2
Clock High Time	T <sub>high</sub>	Measure from > 2.0V	9.3750		11.4580	ns	2
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1 mA	2.4			V	1
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 1 mA			0.55	V	1
Output High Current	I <sub>OH</sub>	V <sub>OH</sub> @MIN = 1.0 V	-33			mA	1
		V <sub>OH</sub> @MAX = 3.135 V			-33	mA	1
Output Low Current	I <sub>OL</sub>	V <sub>OL</sub> @ MIN = 1.95 V	30			mA	1
		V <sub>OL</sub> @ MAX = 0.4 V			38	mA	1
Rise Time	t <sub>r USB</sub>	V <sub>OL</sub> = 0.4 V, V <sub>OH</sub> = 2.4 V	0.5		1.5	ns	1
Fall Time	t <sub>f USB</sub>	V <sub>OH</sub> = 2.4 V, V <sub>OL</sub> = 0.4 V	0.5		1.5	ns	1
Duty Cycle	d <sub>tt</sub>	V <sub>T</sub> = 1.5 V	45		55	%	1
Group Skew	t <sub>skew</sub>	V <sub>T</sub> = 1.5 V			100	ps	1
Jitter, Cycle to cycle	t <sub>jyc-cyc</sub>	V <sub>T</sub> = 1.5 V			130	ps	1,2

\*TA = 0 - 70°C; Supply Voltage VDD = 3.3 V +/-5%, CL = 5 pF with Rs = 22Ω (unless otherwise specified)

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup>ICS recommended and/or chipset vendor layout guidelines must be followed to meet this specification

**Electrical Characteristics - REF-14.318MHz**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	Notes
Long Accuracy	ppm	see Tperiod min-max values	-300		300	ppm	1,2
Clock period	T <sub>period</sub>	14.318MHz output nominal	69.8270		69.8550	ns	2
Clock Low Time	T <sub>low</sub>	Measure from < 0.6V	30.9290		37.9130	ns	2
Clock High Time	T <sub>high</sub>	Measure from > 2.0V	30.9290		37.9130	ns	2
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1 mA	2.4			V	1
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 1 mA			0.4	V	1
Output High Current	I <sub>OH</sub>	V <sub>OH</sub> @MIN = 1.0 V,	-29			mA	1
		V <sub>OH</sub> @MAX = 3.135 V			-23	mA	1
Output Low Current	I <sub>OL</sub>	V <sub>OL</sub> @ MIN = 1.95 V,	29			mA	1
		V <sub>OL</sub> @ MAX = 0.4 V			27	mA	1
Rise Time	t <sub>r1</sub>	V <sub>OL</sub> = 0.4 V, V <sub>OH</sub> = 2.4 V			1.5	ns	1
Fall Time	t <sub>f1</sub>	V <sub>OH</sub> = 2.4 V, V <sub>OL</sub> = 0.4 V			1.5	ns	1
Skew	t <sub>sk1</sub>	V <sub>T</sub> = 1.5 V			100	ps	1
Duty Cycle	d <sub>tt</sub>	V <sub>T</sub> = 1.5 V	44	53	56	%	1
Jitter	t <sub>jyc-cyc</sub>	V <sub>T</sub> = 1.5 V		200	300	ps	1

\*TA = 0 - 70°C; Supply Voltage VDD = 3.3 V +/-5%, CL = 5 pF with Rs = 22Ω (unless otherwise specified)

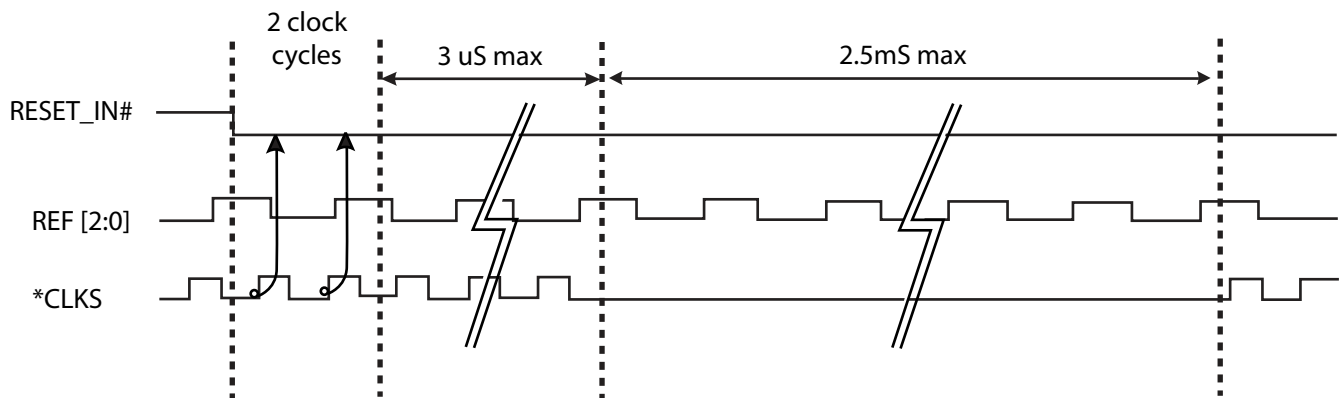
<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup> All Long Term Accuracy and Clock Period specifications are guaranteed assuming that REFOUT is at 14.31818MHz

**RESET\_IN# - Assertion (transition from '1' to '0')**

Asserting RESET\_IN pin stops all the outputs including CPU, SRC, ATIG, PCI and USB with the REF[2:0] running. The pin is a Schmitt trigger input with debouncing. After it is triggered, REF clocks will wait for two clock cycle to ensure the RESET\_IN is asserted. Then, it will take 3uS for the clocks to stop without glitches. The clock chip will be power down and re-power up, and SMBus will be reloaded. It will take no more than 2.5mS for the clocks to come out with correct frequencies and no glitches.

**\*\* Deassertion of RESET\_IN# (transition from '0' to '1') has NO effect on the clocks.**

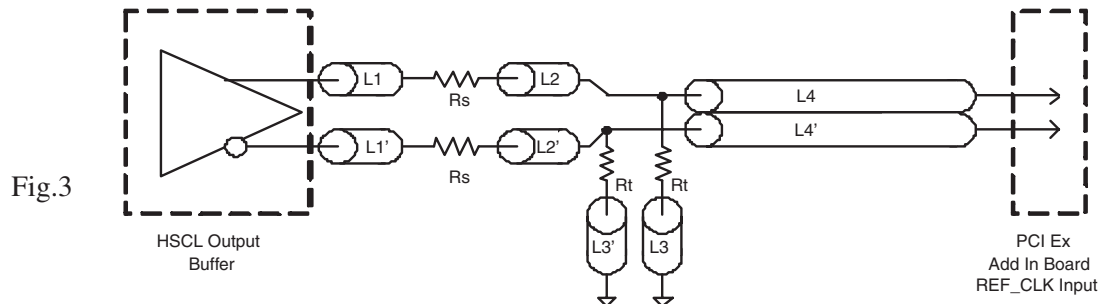
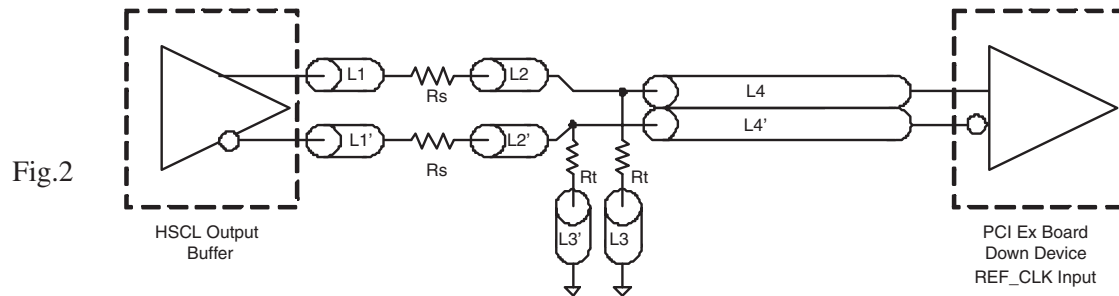
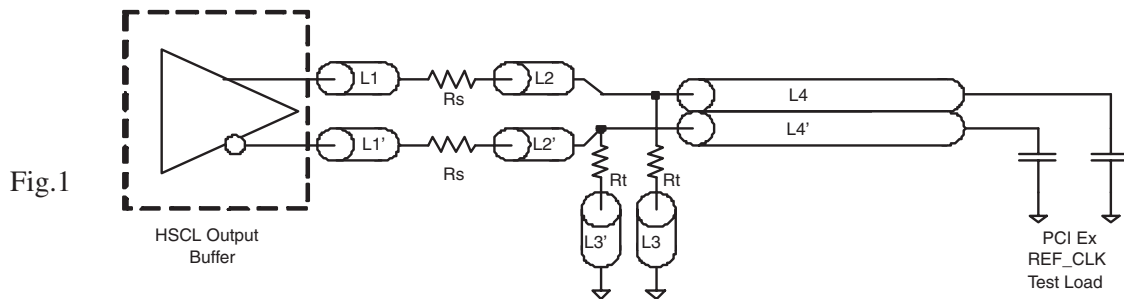


## SRC Routing Information

SRC Reference Clock			
Common Recommendations for Differential Routing	Dimension or Value	Unit	Figure
L1 length, Route as non-coupled 50 ohm trace.	0.5 max	inch	2, 3
L2 length, Route as non-coupled 50 ohm trace.	0.2 max	inch	2, 3
L3 length, Route as non-coupled 50 ohm trace.	0.2 max	inch	2, 3
$R_s$	33	ohm	2, 3
$R_t$	49.9	ohm	2, 3

Down Device Differential Routing	Dimension or Value	Unit	Figure
L4 length, Route as coupled <b>microstrip</b> 100 ohm differential trace.	2 min to 16 max	inch	2
L4 length, Route as coupled <b>stripline</b> 100 ohm differential trace.	1.8 min to 14.4 max	inch	2

Differential Routing to PCI Express Connector	Dimension or Value	Unit	Figure
L4 length, Route as coupled <b>microstrip</b> 100 ohm differential trace.	0.25 to 14 max	inch	3
L4 length, Route as coupled <b>stripline</b> 100 ohm differential trace.	0.225 min to 12.6 max	inch	3

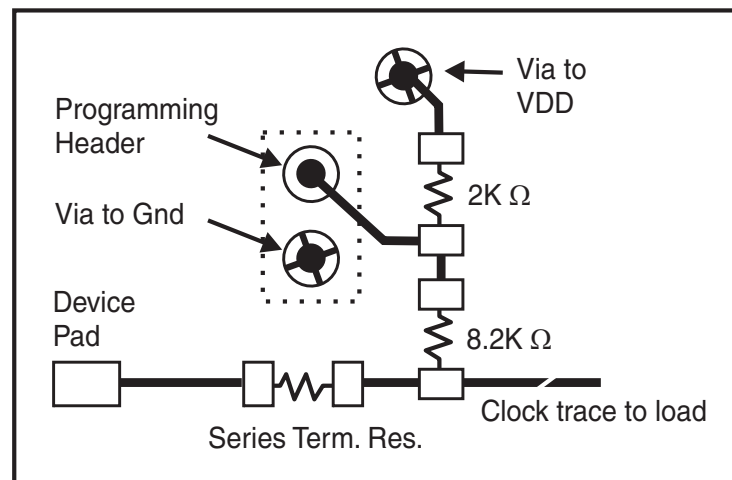


## Shared Pin Operation - Input/Output Pins

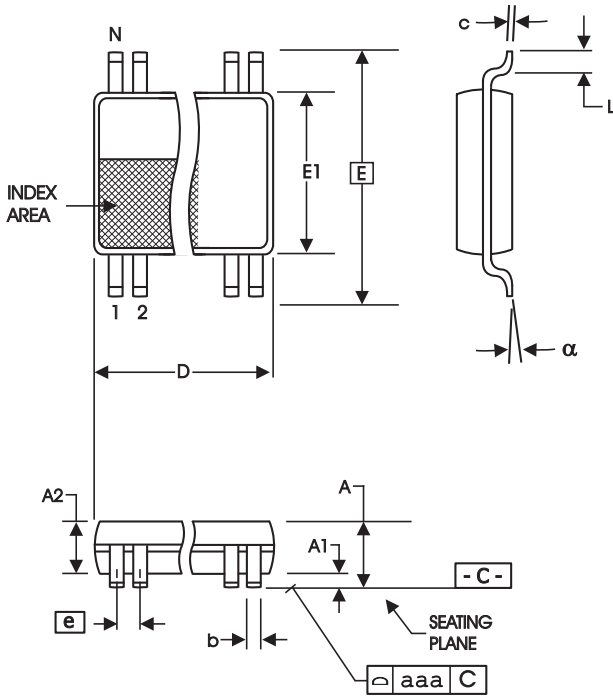
The I/O pins designated by (input/output) on the **ICS951462** serve as dual signal functions to the device. During initial power-up, they act as input pins. The logic level (voltage) that is present on these pins at this time is read and stored into a 5-bit internal data latch. At the end of Power-On reset, (see AC characteristics for timing values), the device changes the mode of operations for these pins to an output function. In this mode the pins produce the specified buffered clocks to external loads.

To program (load) the internal configuration register for these pins, a resistor is connected to either the VDD (logic 1) power supply or the GND (logic 0) voltage potential. A 10 Kiloohm (10K) resistor is used to provide both the solid CMOS programming voltage needed during the power-up programming period and to provide an insignificant load on the output clock during the subsequent operating period. Figure 1 shows a means of implementing this function when a switch or 2 pin header is used. With no jumper is installed

the pin will be pulled high. With the jumper in place the pin will be pulled low. If programmability is not necessary, than only a single resistor is necessary. The programming resistors should be located close to the series termination resistor to minimize the current loop area. It is more important to locate the series termination resistor close to the driver than the programming resistor.



**Fig. 1**



**6.10 mm. Body, 0.50 mm. Pitch TSSOP  
(240 mil) (20 mil)**

SYMBOL	In Millimeters COMMON DIMENSIONS		In Inches COMMON DIMENSIONS	
	MIN	MAX	MIN	MAX
A	--	1.20	--	.047
A1	0.05	0.15	.002	.006
A2	0.80	1.05	.032	.041
b	0.17	0.27	.007	.011
c	0.09	0.20	.0035	.008
D	SEE VARIATIONS		SEE VARIATIONS	
E	8.10 BASIC		0.319 BASIC	
E1	6.00	6.20	.236	.244
e	0.50 BASIC		0.020 BASIC	
L	0.45	0.75	.018	.030
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°
aaa	--	0.10	--	.004

**VARIATIONS**

N	D mm.		D (inch)	
	MIN	MAX	MIN	MAX
64	16.90	17.10	.665	.673

Reference Doc.: JEDEC Publication 95, MO-153

10-0039

## Ordering Information

**951462yGLFT**

Example:

**XXXX y G LFT**

- XXXX — Designation for tape and reel packaging
- y — Lead Free, RoHS Compliant (Optional)
- G — Package Type  
G = TSSOP
- LFT — Revision Designator (will not correlate with datasheet revision)
- XXXX — Device Type (consists of 3 to 7 digit numbers)

## Revision History

Rev.	Issue Date	Description	Page #
0.0	4/7/2005	Initial Release	-
0.1	4/15/2005	Added Timing Diagram	19
0.2	6/6/2005	1. SMBus Byte 5 bits[6:5] are changed from CPU_STOP Enable to RESERVED. 2. Updated LF Ordering Information from "Annealed Lead Free" to "RoHS Compliant".	11, 22
0.3	6/8/2005	Updated Timing Diagram.	19
0.4	9/9/2005	1. Updated all description: Changed RS680 to RS580. 2. Updated Pin Description: Pin 11 and 57. 3. Updated Block Diagram: Took out CPU_STOP#. 4. Updated Electrical Characteristics: i. Input/Supply/Common Output Parameters: Took out Operating Supply Current. ii. USB: Updated Rise and Fall Time. iii. REF: Updated Rise and Fall Time. 5. Updated LF Ordering Information.	1, 2,3, 4, 15,18,  22
0.5	9/22/2005	1. Updated Output Features.	1
0.6	2/8/2006	Updated pin description pin 30/31 and 42/43	2-3
A	3/22/2006	1. Updated REF and USB cycle to cycle jitter specs to tentative SB600 requirements. 2. Updated CPU skew and jitter numbers 3. Updated SRC and ATIG skew and jitter numbers 4. Move Data sheet to Preliminary	17, 18
B	5/26/2006	1. Updated REF and USB rise/fall time specs to tentative SB600 requirements.	18
C	7/25/2006	Updated Reference to CLKREQB# on Byte 4 to CLKREQA#.	11
D	9/15/2006	Updated Recommended Application.	1, 4
E	12/5/2006	1. Updated Table 3 description. 2. Updated SMBus Pin# association.	7, 10-11
F	12/12/2006	1. Updated REF duty cycle to 56/44%.	18
G	1/30/2007	1. Updated REF Rise/Fall time spec	18
H	3/5/2007	1. Updated pinout and pin description for pin #61	1, 3
I	5/23/2007	Added Max Junction Temperature.	15
J	3/16/2009	Changed Cycle-to-cycle Jitter spec from 85 to 125ps.	17