

### DESCRIPTION

The MP18021 is a high frequency, 100V half bridge N-channel power MOSFET driver. Its low side and high side driver channels are independently controlled and matched with less than 5ns in time delay. Under voltage lock-out on both high side and low side supplies force their outputs low in case of insufficient supply. The integrated bootstrap diode reduces external component count.

### FEATURES

- Drives N-channel MOSFET half bridge
- 100V  $V_{BST}$  voltage range
- On-chip bootstrap diode
- Typical 16ns propagation delay time
- Less than 5ns gate drive matching
- Drive 1nF load with 12ns/9ns rise/fall times with 12V VDD
- TTL compatible input
- Less than 150 $\mu$ A quiescent current
- UVLO for both high side and low side
- In SOIC8 EPAD and 3 $\times$ 3mm QFN8 Packages

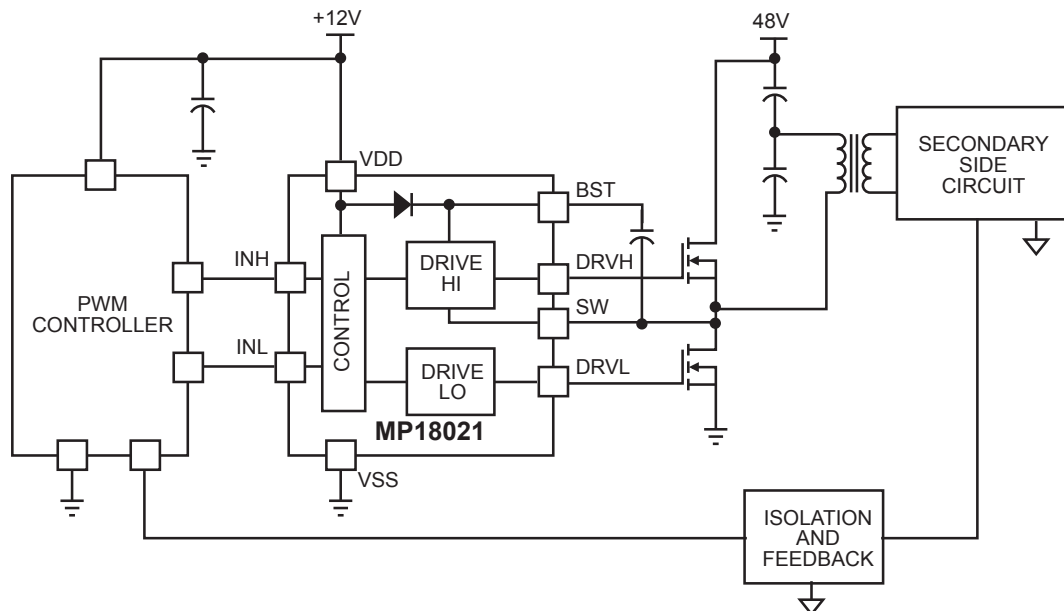
### APPLICATIONS

- Telecom half bridge power supplies
- Avionics DC-DC converters
- Two-switch forward converters
- Active clamp forward converters

All MPS parts are lead-free, halogen free, and adhere to the RoHS directive. For MPS green status, please visit MPS website under Quality Assurance.

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### TYPICAL APPLICATION

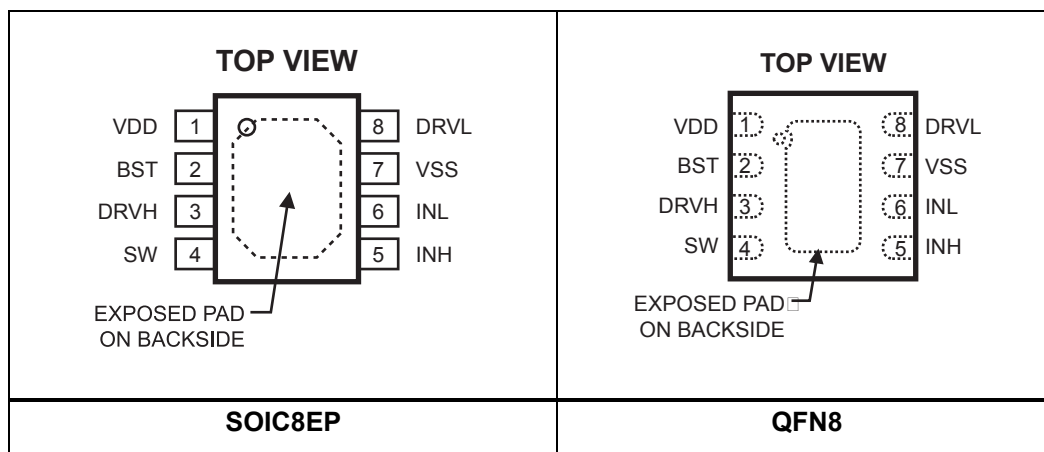


### ORDERING INFORMATION

Part Number*	Package	Top Marking	Free Air Temperature (T <sub>A</sub> )
MP18021HN	SOIC8EP	MP18021HN	-40°C to + 125°C
MP18021HQ	QFN8 (3x 3mm)	ABN	-40°C to + 125°C

\* For Tape & Reel, add suffix -Z (e.g. MP18021HN-Z);  
 For RoHS compliant packaging, add suffix -LF; (e.g. MP18021HN-LF-Z)  
 For Tape & Reel, add suffix -Z (e.g. MP18021HQ-Z);  
 For RoHS compliant packaging, add suffix -LF; (e.g. MP18021HQ-LF-Z)

### PACKAGE REFERENCE



### ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

Supply Voltage (V <sub>DD</sub> )	-0.3V to +18V
SW Voltage (V <sub>SW</sub> )	-5.0V to 100V
BST Voltage (V <sub>BST</sub> )	-0.3V to 100V
BST to SW	-0.3V to +18V
DRVH to SW	-0.3V to +18V
All Other Pins	-0.3V to (V <sub>DD</sub> +0.3V)
Continuous Power Dissipation (T <sub>A</sub> = +25°C) <sup>(2)</sup>	
SOIC8 (Exposed Pad)	2.6W
QFN8 (3x3)	2.5W
Junction Temperature	150°C
Lead Temperature	260°C
Storage Temperature	-65°C to +150°C

### Recommended Operating Conditions <sup>(3)</sup>

Supply Voltage V <sub>DD</sub>	+9.0V to 16.0V
SW Voltage (V <sub>SW</sub> )	-1.0V to 100V-V <sub>DD</sub>
SW slew rate	<50V/nsec
Operating Junct. Temp (T <sub>J</sub> )	-40°C to +125°C

### Thermal Resistance <sup>(4)</sup>

	$\theta_{JA}$	$\theta_{JC}$
SOIC8 (Exposed Pad)	48	10
QFN8 (3x3)	50	12

#### Notes:

- Exceeding these ratings may damage the device.
- The maximum allowable power dissipation is a function of the maximum junction temperature T<sub>J</sub>(MAX), the junction-to-ambient thermal resistance  $\theta_{JA}$ , and the ambient temperature T<sub>A</sub>. The maximum allowable continuous power dissipation at any ambient temperature is calculated by P<sub>D</sub>(MAX)=(T<sub>J</sub>(MAX)-T<sub>A</sub>)/ $\theta_{JA}$ . Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.
- The device is not guaranteed to function outside of its operating conditions.
- Measured on JESD51-7, 4-layer PCB.

## ELECTRICAL CHARACTERISTICS

$V_{DD} = V_{BST} - V_{SW} = 12V$ ,  $V_{SS} = V_{SW} = 0V$ , No load at DRVH and DRVL,  $T_A = +25^\circ C$ , unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
<b>Supply Currents</b>						
VDD quiescent current	$I_{DDQ}$	INL=INH=0		100	150	$\mu A$
VDD operating current	$I_{DDO}$	fsw=500kHz		2.8	3.5	mA
Floating driver quiescent current	$I_{BSTQ}$	INL=INH=0		60	90	$\mu A$
Floating driver operating current	$I_{BSTO}$	fsw=500kHz		2.1	3	mA
Leakage Current	$I_{LK}$	BST=SW=100V		0.05	1	$\mu A$
<b>Inputs</b>						
INL/INH High				2	2.4	V
INL/INH Low			1	1.4		V
INL/INH internal pull-down resistance	$R_{IN}$			185		k $\Omega$
<b>Under Voltage Protection</b>						
VDD rising threshold	$V_{DDR}$		7.7	8.1	8.5	V
VDD hysteresis	$V_{DDH}$			0.5		V
(BST-SW) rising threshold	$V_{BSTR}$		6.7	7.1	7.5	V
(BST-SW) hysteresis	$V_{BSTH}$			0.55		V
<b>Bootstrap Diode</b>						
Bootstrap diode VF @ 100uA	$V_{F1}$			0.5		V
Bootstrap diode VF @ 100mA	$V_{F2}$			0.9		V
Bootstrap diode dynamic R	$R_D$	@ 100mA		2.5		$\Omega$
<b>Low Side Gate Driver</b>						
Low level output voltage	$V_{OLL}$	$I_O = 100mA$		0.15	0.22	V
High level output voltage to rail	$V_{OHL}$	$I_O = -100mA$		0.45	0.6	V
Peak pull-up current	$I_{OHL}$	$V_{DRVL} = 0V, V_{DD} = 12V$		1.5		A
		$V_{DRVL} = 0V, V_{DD} = 16V$		2.5		A
Peak pull-down current	$I_{OLL}$	$V_{DRVL} = V_{DD} = 12V$		2.5		A
		$V_{DRVL} = V_{DD} = 16V$		3.5		A
<b>Floating Gate Driver</b>						
Low level output voltage	$V_{OLH}$	$I_O = 100mA$		0.15	0.22	V
High level output voltage to rail	$V_{OHH}$	$I_O = -100mA$		0.45	0.6	V
Peak pull-up current	$I_{OHH}$	$V_{DRVH} = 0V, V_{DD} = 12V$		1.5		A
		$V_{DRVH} = 0V, V_{DD} = 16V$		2.5		A
Peak pull-down current	$I_{OLH}$	$V_{DRVH} = V_{DD} = 12V$		2.5		A
		$V_{DRVH} = V_{DD} = 16V$		3.5		A

**ELECTRICAL CHARACTERISTICS (continued)**

$V_{DD} = V_{BST} - V_{SW} = 12V$ ,  $V_{SS} = V_{SW} = 0V$ , No load at DRVH and DRVL,  $T_A = +25^\circ C$ , unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
<b>Switching Spec. --- Low Side Gate Driver</b>						
Turn-off propagation delay INL falling to DRVL falling	$T_{DLFF}$			16		ns
Turn-on propagation delay INL rising to DRVL rising	$T_{DLRR}$			16		
DRVL rise time		$C_L = 1nF$		12		ns
DRVL fall time		$C_L = 1nF$		9		ns
<b>Switching Spec. --- Floating Gate Driver</b>						
Turn-off propagation delay INL falling to DRVH falling	$T_{DHFF}$			16		ns
Turn-on propagation delay INL rising to DRVH rising	$T_{DHRR}$			16		ns
DRVH rise time		$C_L = 1nF$		12		ns
DRVH fall time		$C_L = 1nF$		9		ns
<b>Switching Spec. --- Matching</b>						
Floating driver turn-off to low side drive turn-on	$T_{MON}$			1	5	ns
Low side driver turn-off to floating driver turn-on	$T_{MOFF}$			1	5	ns
Minimum input pulse width that changes the output	$T_{PW}$				50 <sup>(5)</sup>	ns
Bootstrap diode turn-on or turn- off time	$T_{BS}$			10 <sup>(5)</sup>		ns
<b>Over Temperature Protection<sup>(5)</sup></b>						
OTP entry threshold				160		°C
OTP recovery threshold				140		
OTP hysteresis				20		

**Note:**

5) Derived from bench characterization. Not tested in production.

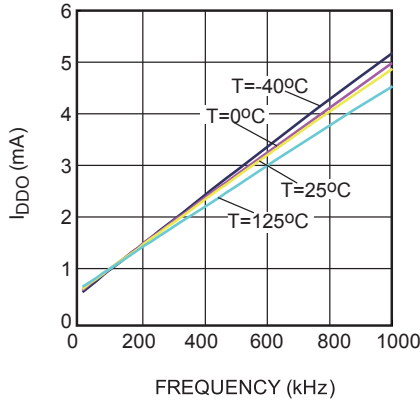
## PIN FUNCTIONS

Pin #	Name	Description
1	VDD	Supply input. This pin supplies power to all the internal circuitry. A decoupling capacitor to ground must be placed close to this pin to ensure stable and clean supply.
2	BST	Bootstrap. This is the positive power supply for the internal floating high-side MOSFET driver. Connect a bypass capacitor between this pin and SW pin.
3	DRVH	Floating driver output.
4	SW	Switching node.
5	INH	Control signal input for the floating driver.
6	INL	Control signal input for the low side driver.
7	VSS, Exposed Pad	Chip ground. Connect to Exposed pad to VSS for proper thermal operation.
8	DRVL	Low side driver output.

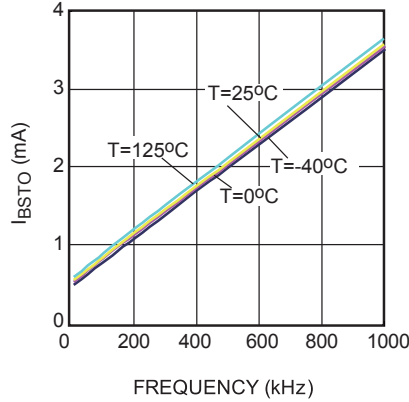
## TYPICAL PERFORMANCE CHARACTERISTICS

$V_{DD} = 12V$ ,  $V_{SS} = V_{SW} = 0V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.

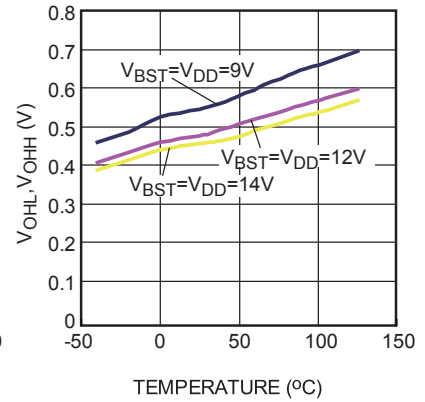
**$I_{DDO}$  Operation Current vs. Frequency**



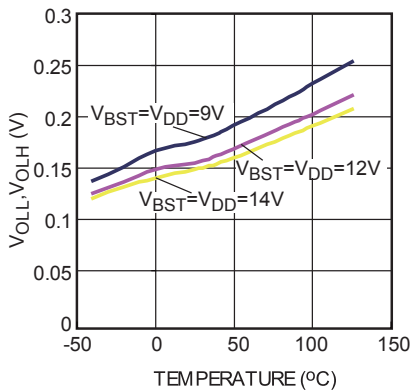
**$I_{BSTO}$  Operation Current vs. Frequency**



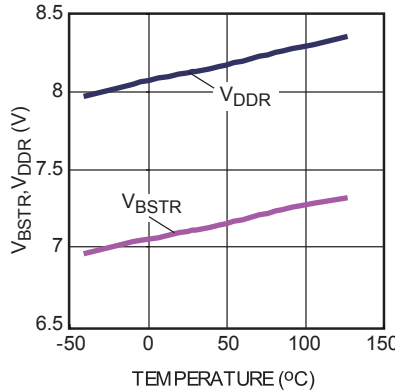
**High Level Output Voltage vs. Temperature**



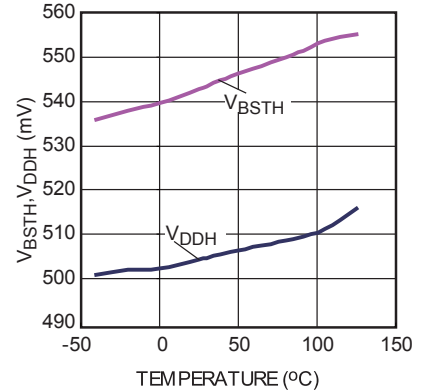
**Low Level Output Voltage vs. Temperature**



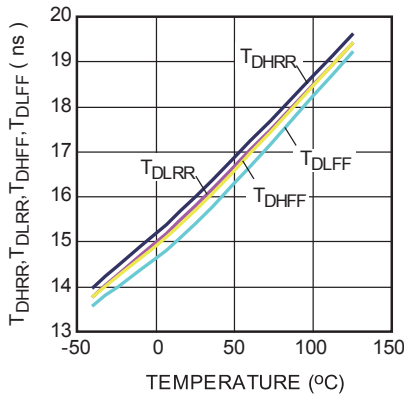
**Undervoltage Lockout Threshold vs. Temperature**



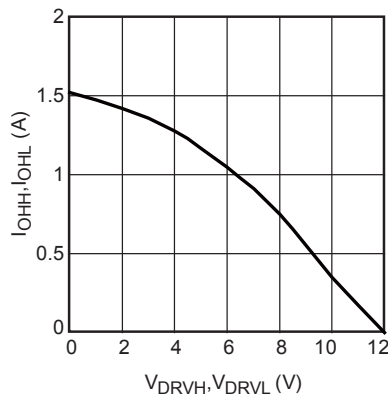
**Undervoltage Lockout Hysteresis vs. Temperature**



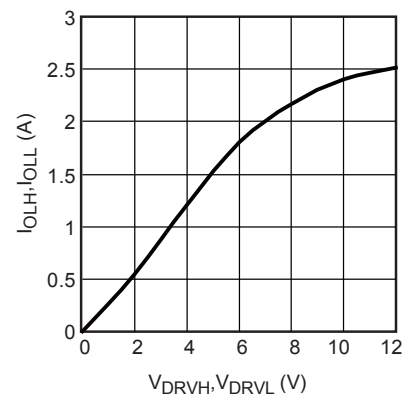
**Propagation Delay vs. Temperature**



**Peak Pull-up Current vs. Output Voltage**



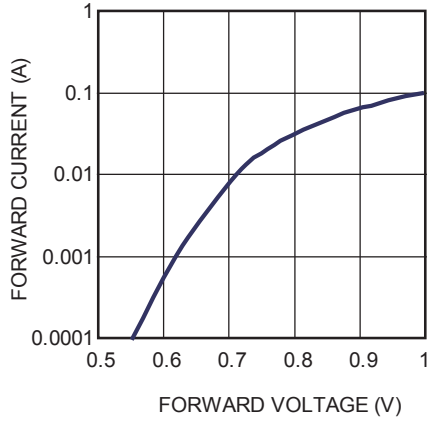
**Peak Pull-down Current vs. Output Voltage**



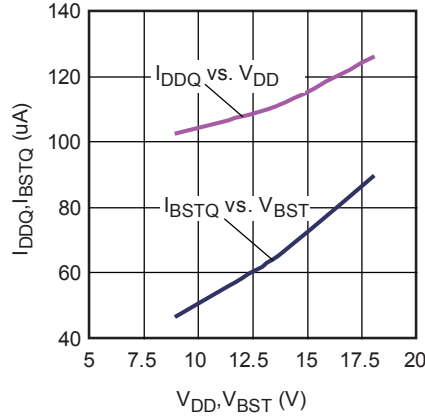
**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

$V_{DD} = 12V$ ,  $V_{SS} = V_{SW} = 0V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.

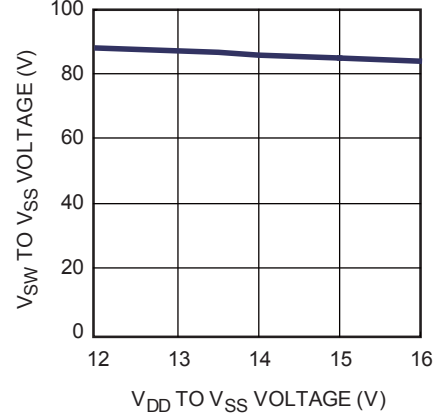
**Bootstrap Diode I-V Characteristics**



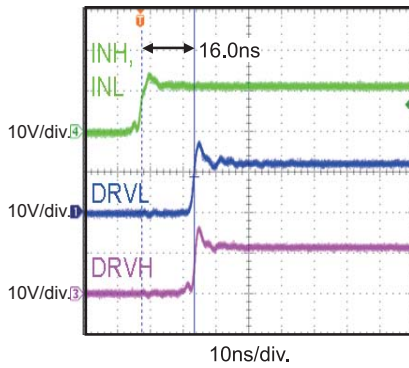
**Quiescent Current vs. Voltage**



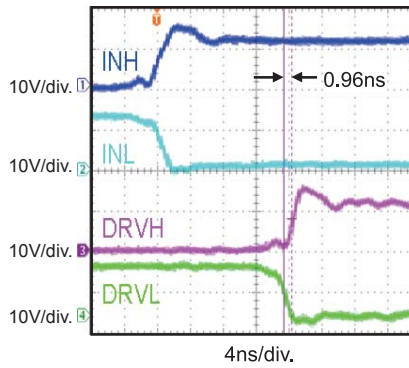
**Maximum VSW Voltage vs. VDD Voltage**



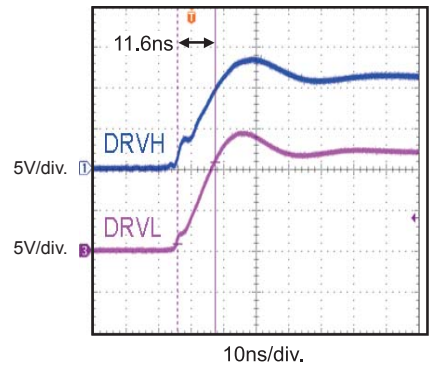
**Turn-on Propagation Delay**



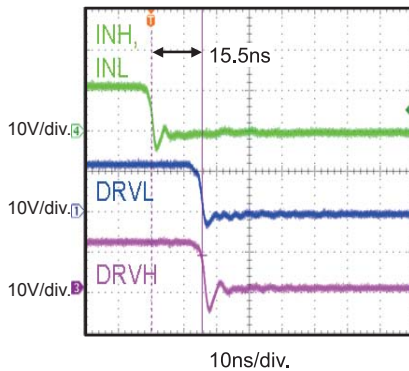
**Gate Drive Matching TMOFF**



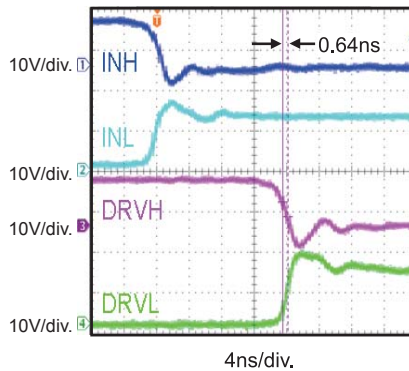
**Drive Rise Time (1nF Load)**



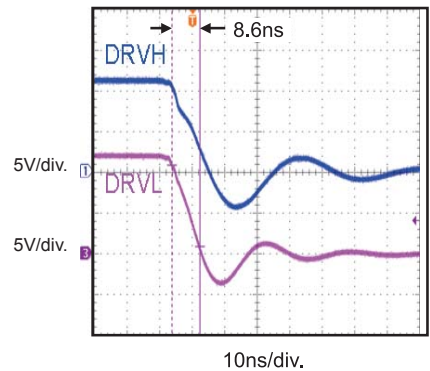
**Turn-off Propagation Delay**



**Gate Drive Matching TMON**



**Drive Fall Time (1nF Load)**



BLOCK DIAGRAM

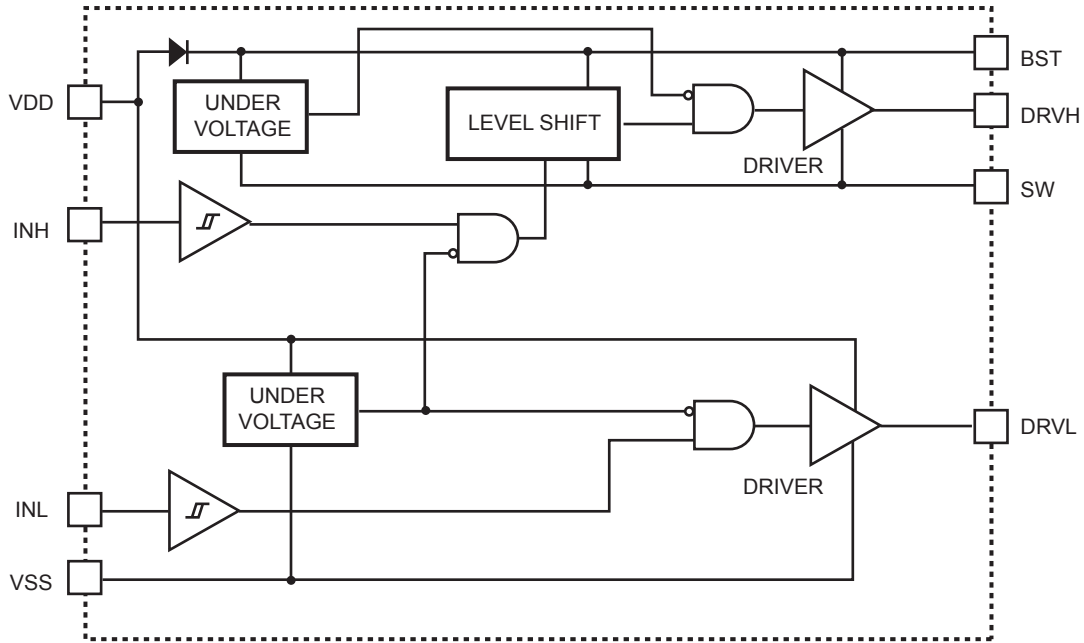


Figure 1—Function Block Diagram

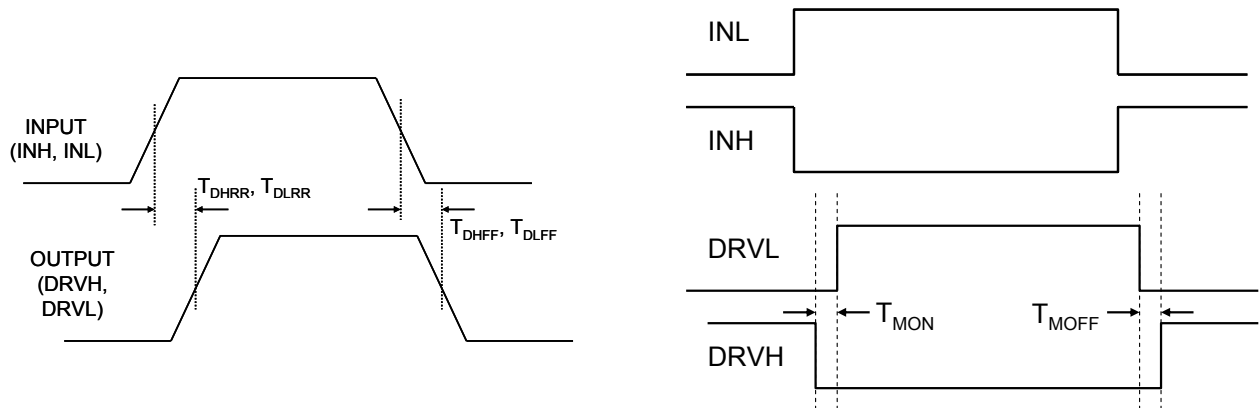
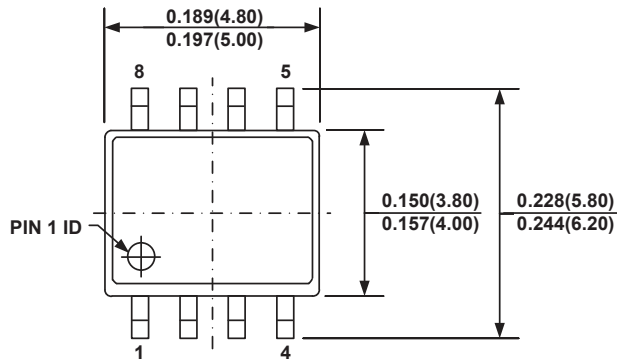
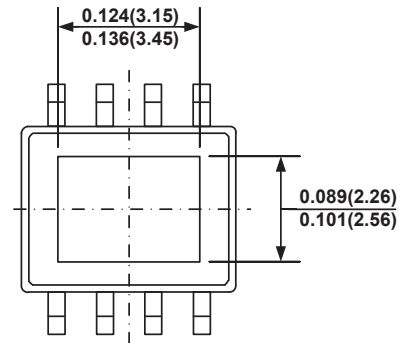
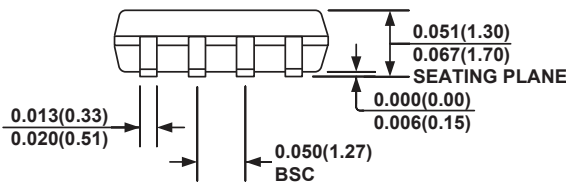
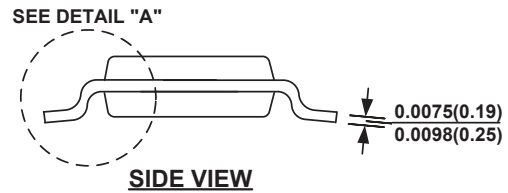
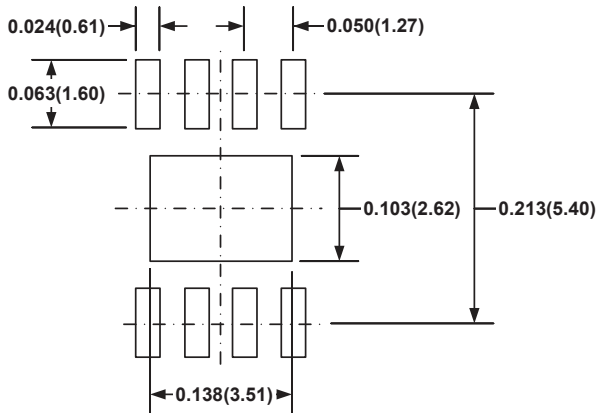
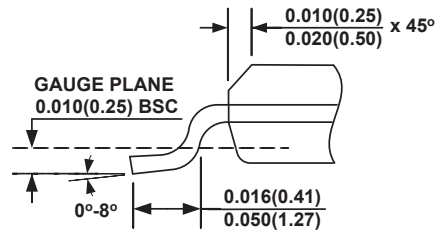
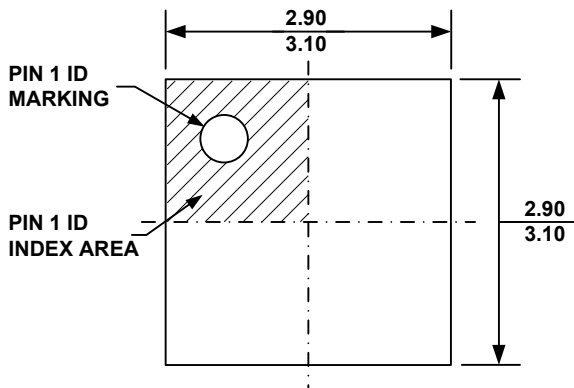
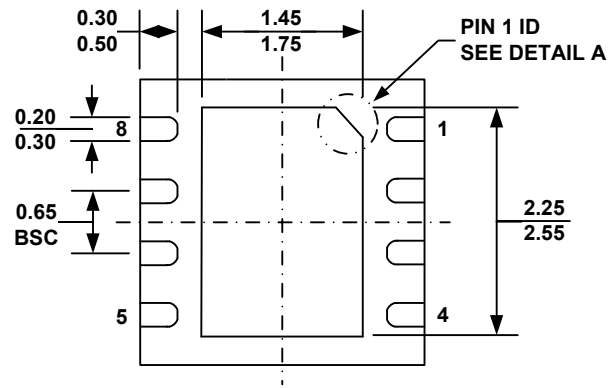
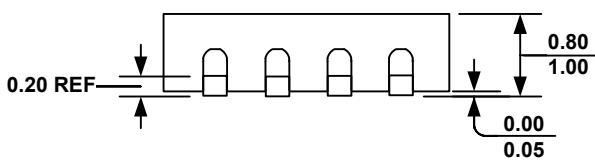
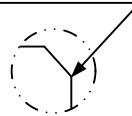
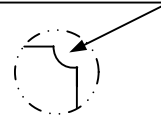
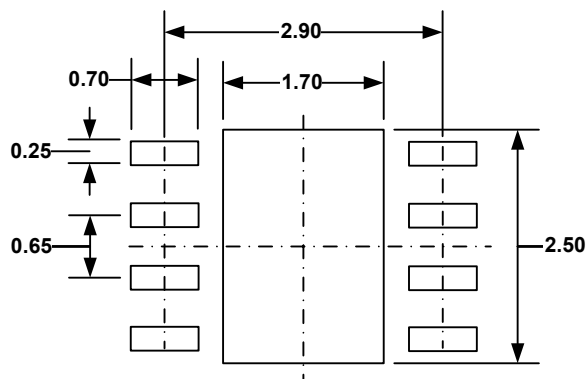


Figure 2—Timing Diagram



**PACKAGE INFORMATION**
**SOIC8 (EXPOSED PAD)**

**TOP VIEW**

**BOTTOM VIEW**

**FRONT VIEW**

**SIDE VIEW**

**RECOMMENDED LAND PATTERN**

**DETAIL "A"**
**NOTE:**

- 1) CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
- 2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
- 3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
- 4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
- 5) DRAWING CONFORMS TO JEDEC MS-012, VARIATION BA.
- 6) DRAWING IS NOT TO SCALE.

**QFN8 (3mm×3mm)**

**TOP VIEW**

**BOTTOM VIEW**

**SIDE VIEW**
**PIN 1 ID OPTION A  
0.30x45° TYP.**

**PIN 1 ID OPTION B  
R0.20 TYP.**

**DETAIL A**

**RECOMMENDED LAND PATTERN**
**NOTE:**

- 1) ALL DIMENSIONS ARE IN MILLIMETERS.
- 2) EXPOSED PADDLE SIZE DOES NOT INCLUDE MOLD FLASH.
- 3) LEAD COPLANARITY SHALL BE 0.10 MILLIMETER MAX.
- 4) DRAWING CONFORMS TO JEDEC MO-229, VARIATION VEEC-2.
- 5) DRAWING IS NOT TO SCALE.

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