

## 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

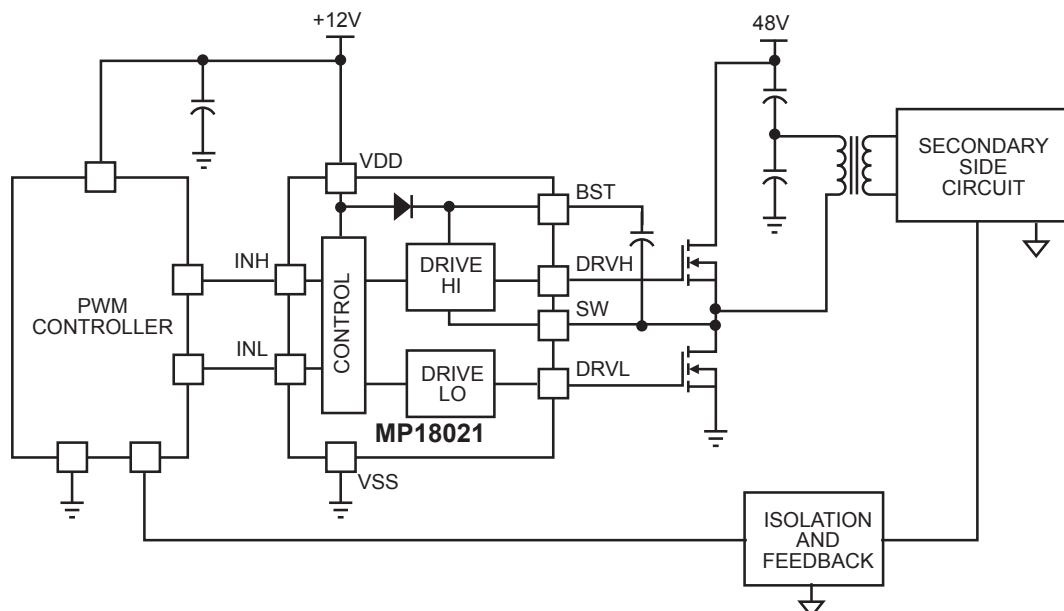
## APPLICATIONS

- 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

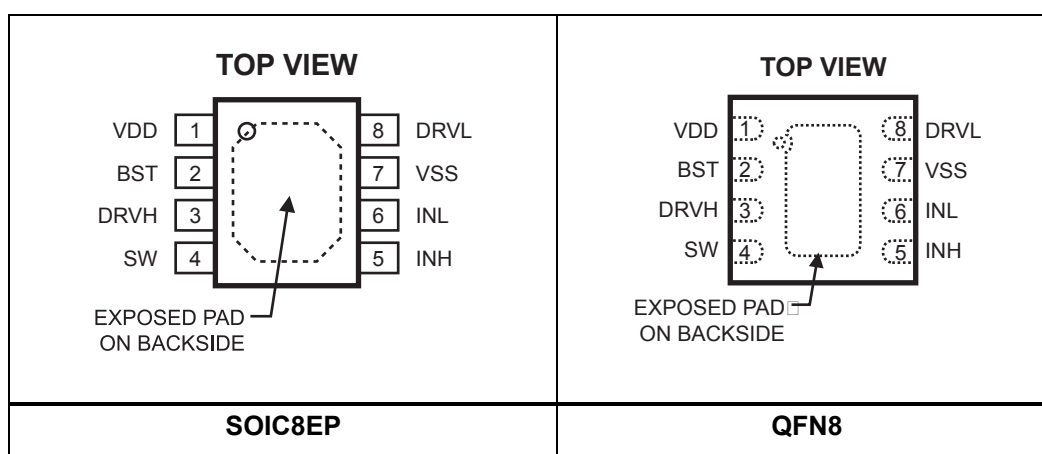
\* For Tape & Reel, add suffix -Z (e.g. MP18021HN-Z);

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>

	θ <sub>JA</sub>	θ <sub>JC</sub>
SOIC8 (Exposed Pad)	48	10... °C/W
QFN8 (3x3)	50	12... °C/W

### 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 θ<sub>JA</sub>, 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>)/θ<sub>JA</sub>. 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
Supply Currents						
VDD quiescent current	I <sub>DDQ</sub>	INL=INH=0		100	150	μA
VDD operating current	I <sub>DDO</sub>	fsw=500kHz		2.8	3.5	mA
Floating driver quiescent current	I <sub>BSTQ</sub>	INL=INH=0		60	90	μA
Floating driver operating current	I <sub>BSTO</sub>	fsw=500kHz		2.1	3	mA
Leakage Current	I <sub>LK</sub>	BST=SW=100V		0.05	1	μA
Inputs						
INL/INH High				2	2.4	V
INL/INH Low			1	1.4		V
INL/INH internal pull-down resistance	R <sub>IN</sub>			185		kΩ
Under Voltage Protection						
VDD rising threshold	V <sub>DDR</sub>		7.7	8.1	8.5	V
VDD hysteresis	V <sub>DDH</sub>			0.5		V
(BST-SW) rising threshold	V <sub>BSTR</sub>		6.7	7.1	7.5	V
(BST-SW) hysteresis	V <sub>BSTH</sub>			0.55		V
Bootstrap Diode						
Bootstrap diode VF @ 100uA	V <sub>F1</sub>			0.5		V
Bootstrap diode VF @ 100mA	V <sub>F2</sub>			0.9		V
Bootstrap diode dynamic R	R <sub>D</sub>	@ 100mA		2.5		Ω
Low Side Gate Driver						
Low level output voltage	V <sub>OLL</sub>	I <sub>O</sub> =100mA		0.15	0.22	V
High level output voltage to rail	V <sub>OHL</sub>	I <sub>O</sub> =-100mA		0.45	0.6	V
Peak pull-up current	I <sub>OHL</sub>	V <sub>DRV<sub>L</sub></sub> =0V, V <sub>DD</sub> =12V		1.5		A
		V <sub>DRV<sub>L</sub></sub> =0V, V <sub>DD</sub> =16V		2.5		A
Peak pull-down current	I <sub>OLL</sub>	V <sub>DRV<sub>L</sub></sub> =V <sub>DD</sub> =12V		2.5		A
		V <sub>DRV<sub>L</sub></sub> =V <sub>DD</sub> =16V		3.5		A
Floating Gate Driver						
Low level output voltage	V <sub>OLH</sub>	I <sub>O</sub> =100mA		0.15	0.22	V
High level output voltage to rail	V <sub>OHH</sub>	I <sub>O</sub> =-100mA		0.45	0.6	V
Peak pull-up current	I <sub>OHH</sub>	V <sub>DRV<sub>H</sub></sub> =0V, V <sub>DD</sub> =12V		1.5		A
		V <sub>DRV<sub>H</sub></sub> =0V, V <sub>DD</sub> =16V		2.5		A
Peak pull-down current	I <sub>OLH</sub>	V <sub>DRV<sub>H</sub></sub> =V <sub>DD</sub> =12V		2.5		A
		V <sub>DRV<sub>H</sub></sub> =V <sub>DD</sub> =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	$T_{PW}$				$50^{(5)}$	ns
Bootstrap diode turn-on or turn- off time	$T_{BS}$			$10^{(5)}$		ns
<b>Over Temperature Protection<sup>(5)</sup></b>						
OTP entry threshold				160		$^{\circ}C$
OTP recovery threshold				140		
OTP hysteresis				20		

**Note:**

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

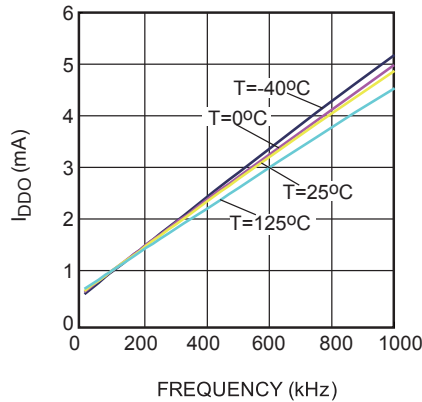
## PIN FUNCTIONS

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.

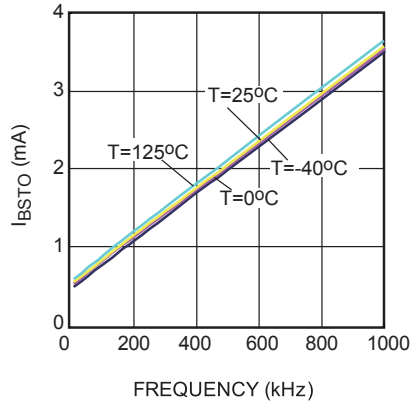
## TYPICAL PERFORMANCE CHARACTERISTICS

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

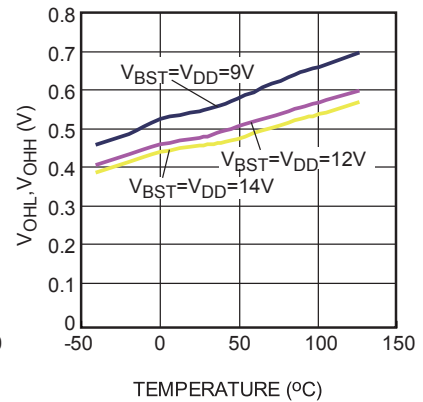
**$I_{DDO}$  Operation Current vs. Frequency**



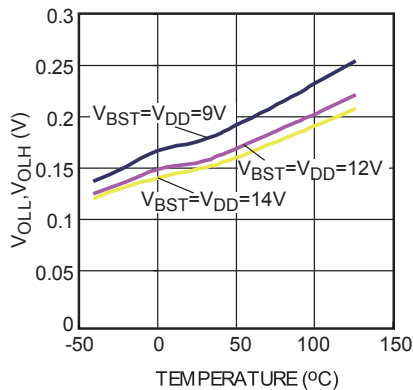
**$I_{BSTO}$  Operation Current vs. Frequency**



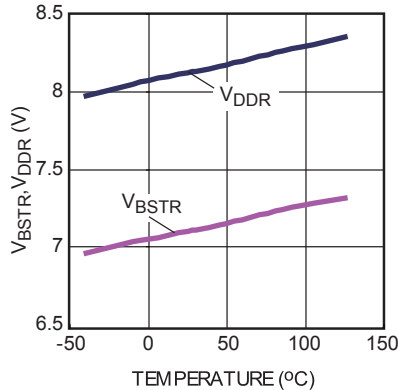
**High Level Output Voltage vs. Temperature**



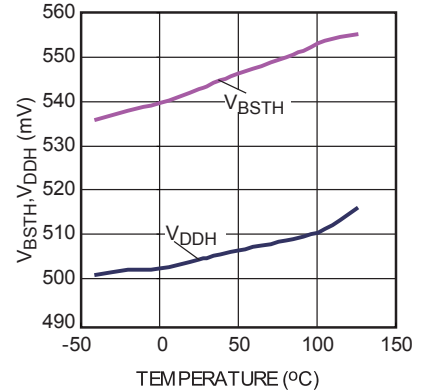
**Low Level Output Voltage vs. Temperature**



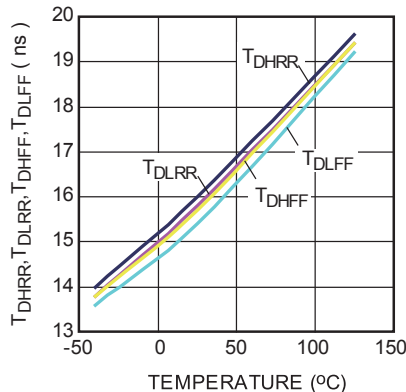
**Undervoltage Lockout Threshold vs. Temperature**



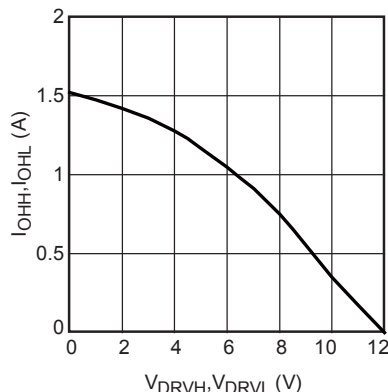
**Undervoltage Lockout Hysteresis vs. Temperature**



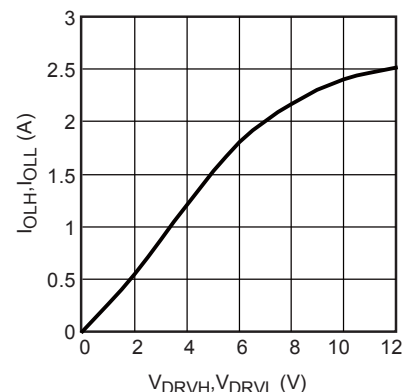
**Propagation Delay vs. Temperature**



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



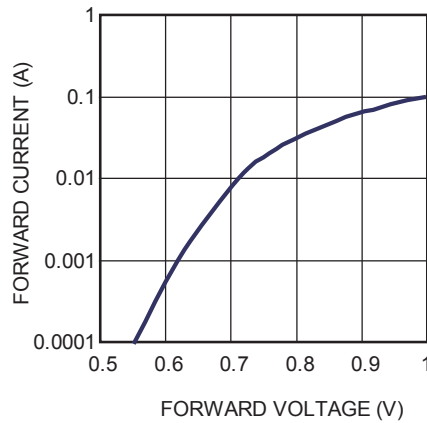
**Peak Pull-down Current vs. Output Voltage**



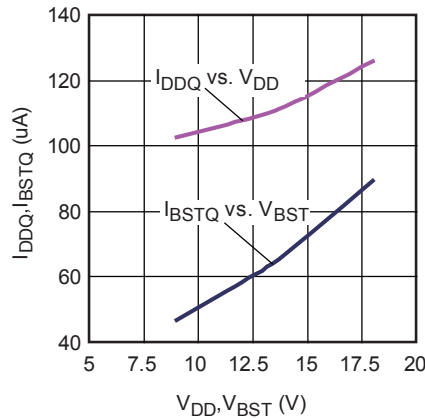
## TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

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

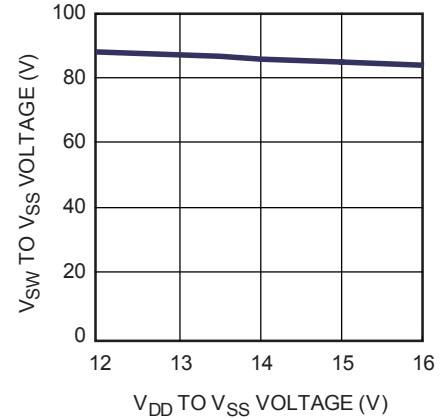
**Bootstrap Diode I-V Characteristics**



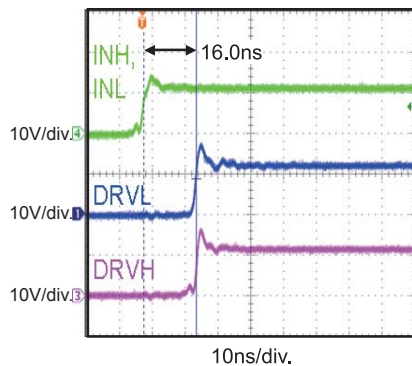
**Quiescent Current vs. Voltage**



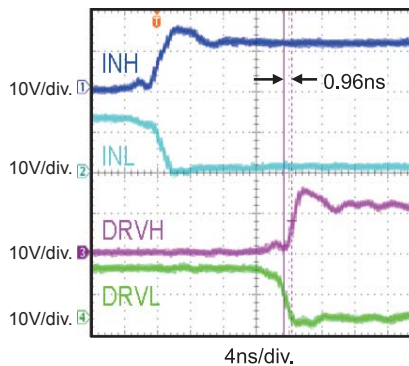
**Maximum  $V_{SW}$  Voltage vs.  $V_{DD}$  Voltage**



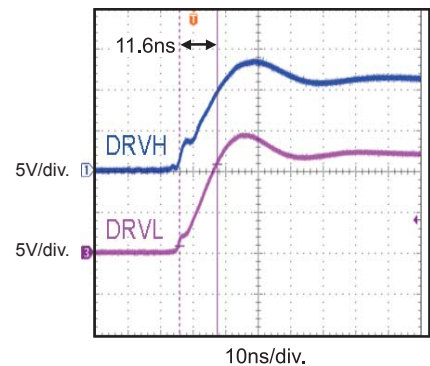
**Turn-on Propagation Delay**



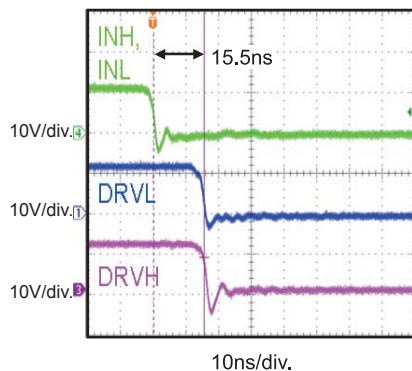
**Gate Drive Matching  $T_{MOFF}$**



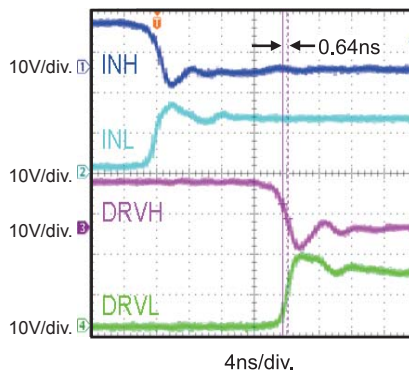
**Drive Rise Time (1nF Load)**



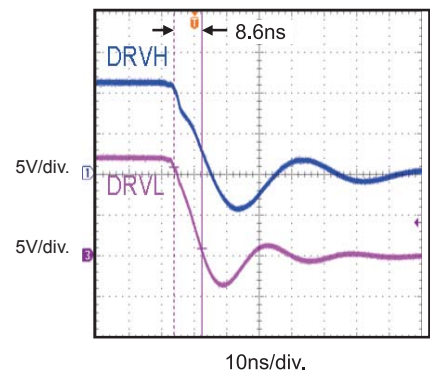
**Turn-off Propagation Delay**



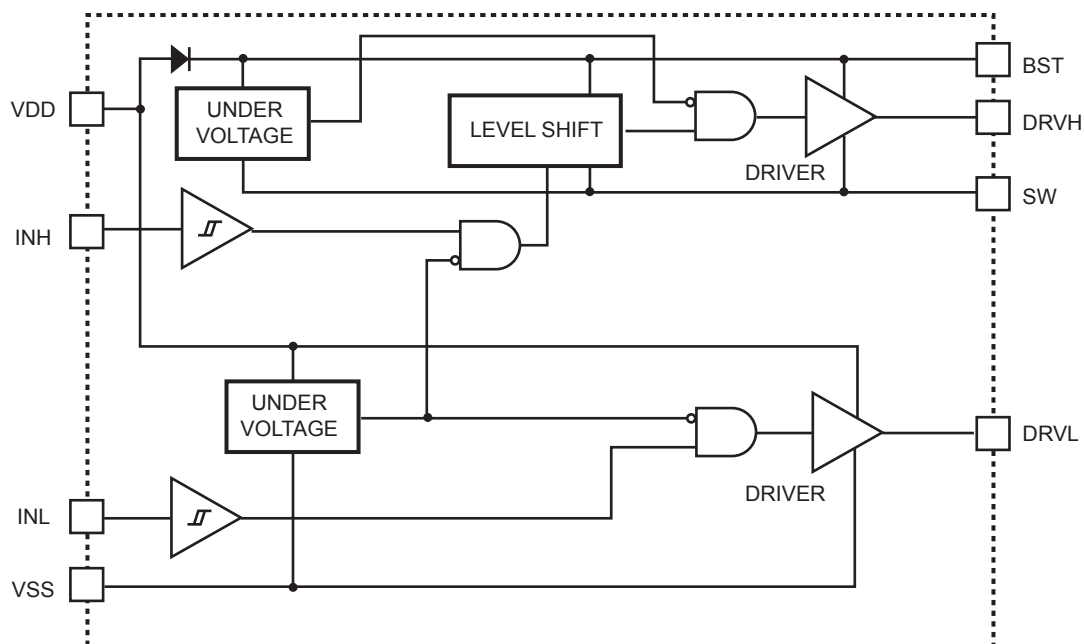
**Gate Drive Matching  $T_{MON}$**



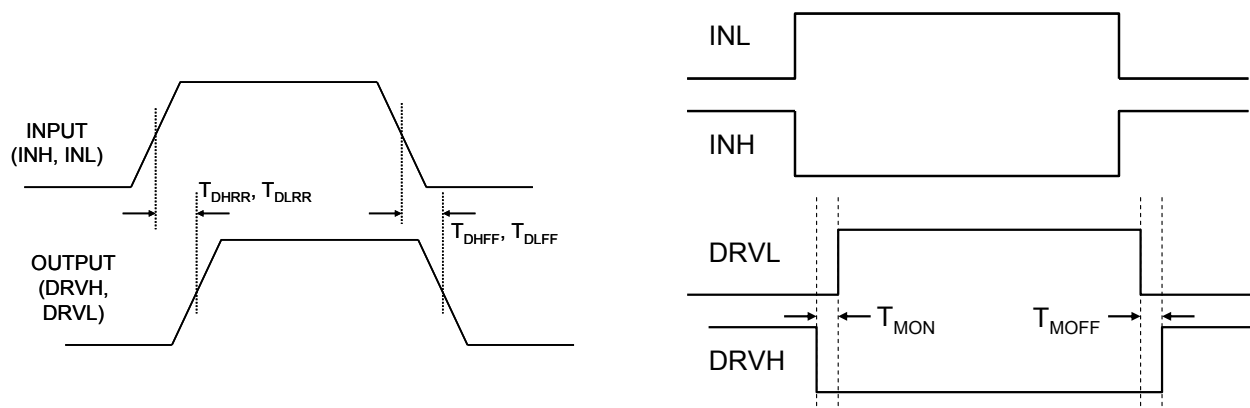
**Drive Fall Time (1nF Load)**



## BLOCK DIAGRAM



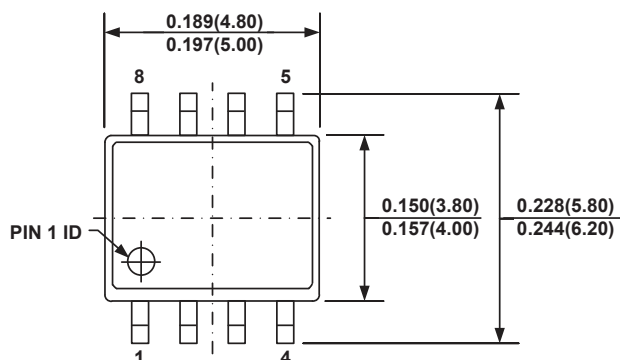
**Figure 1—Function Block Diagram**



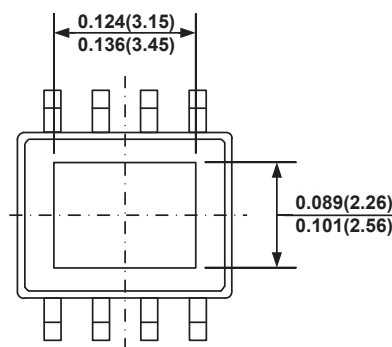
**Figure 2—Timing Diagram**

## PACKAGE INFORMATION

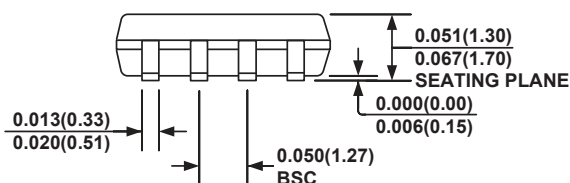
### SOIC8 (EXPOSED PAD)



**TOP VIEW**

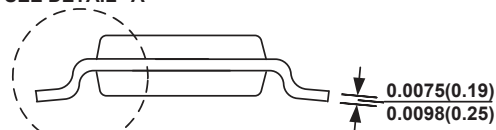


**BOTTOM VIEW**

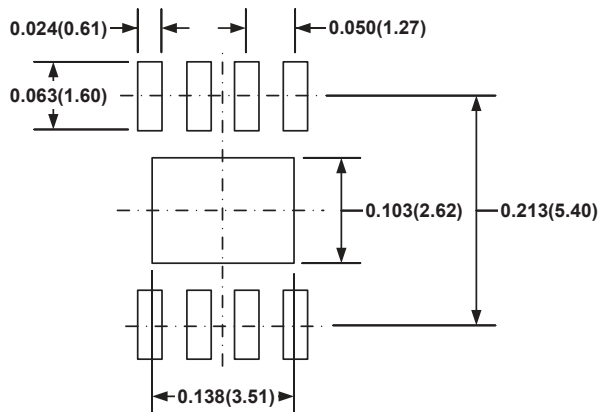


**FRONT VIEW**

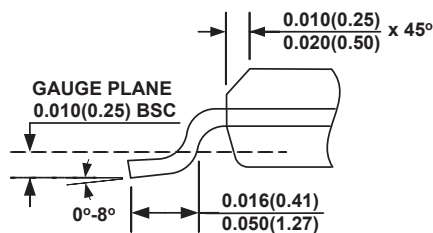
SEE DETAIL "A"



**SIDE VIEW**



**RECOMMENDED LAND PATTERN**

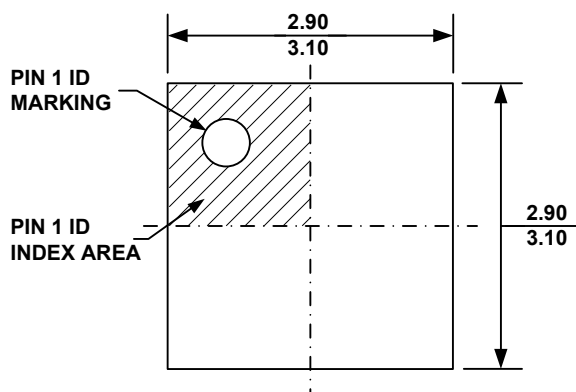


**DETAIL "A"**

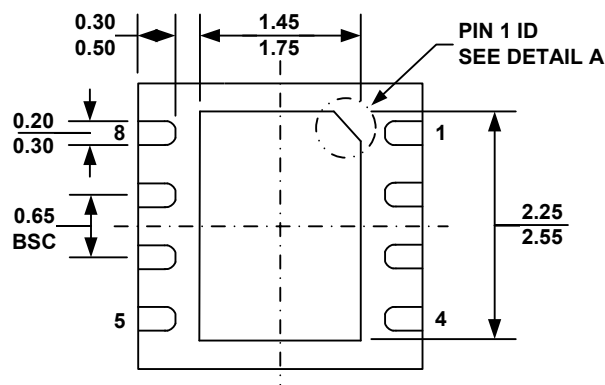
#### NOTE:

- 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.

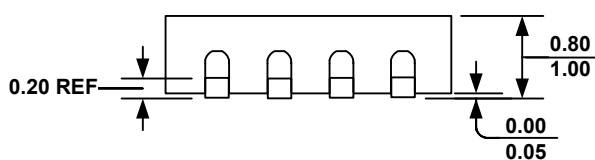
**QFN8 (3mm×3mm)**



**TOP VIEW**

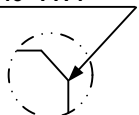


**BOTTOM VIEW**

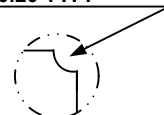


**SIDE VIEW**

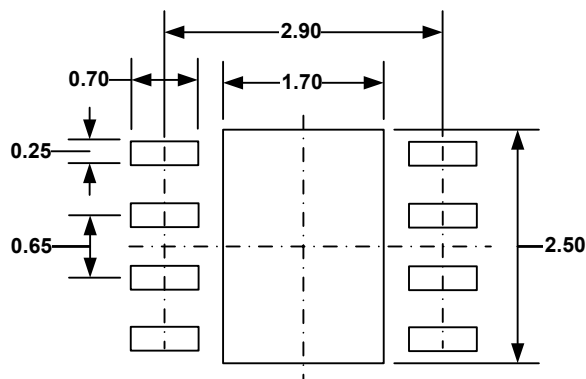
**PIN 1 ID OPTION A**  
0.30x45° TYP.



**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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