



# MPQ18021HN-A

100V, 2.5A, High-Frequency,  
Half-Bridge Gate Driver  
AEC-Q100 Qualified

## DESCRIPTION

The MPQ18021HN-A is a high-frequency, 100V, half-bridge, N-channel power MOSFET driver. Its low-side and high-side driver channels are controlled independently and matched with a time delay of less than 5ns. Under-voltage lockout (UVLO) on both the high-side and low-side supplies force their outputs low in the case of an insufficient supply. The integrated bootstrap diode reduces the external component count.

The MPQ18021HN-A is available in a cost-effective SOIC-8E package.

## FEATURES

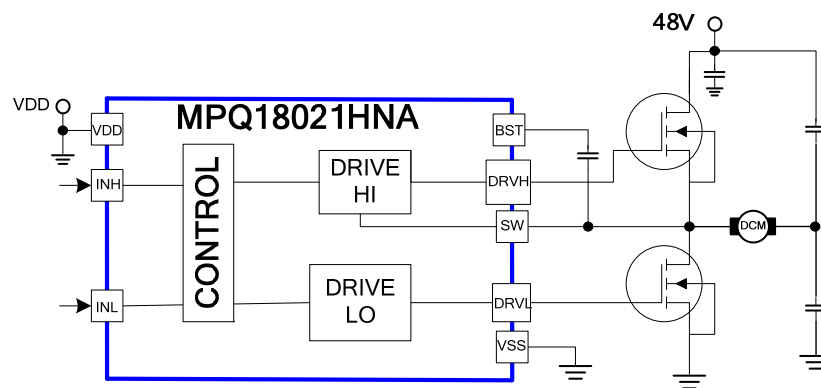
- Guaranteed Industrial / Automotive Temperature Range Limits
- Drives N-Channel MOSFET Half-Bridge
- 100V  $V_{BST}$  Voltage Range
- On-Chip Bootstrap Diode
- Typical 16ns Propagation Delay Time
- Less than 5ns Gate Drive Matching
- Drives 1nf Load with 12ns/9ns Rise/Fall Times with 12V VDD
- TTL-Compatible Input
- Less than 160 $\mu$ A Quiescent Current
- UVLO for both High-Side and Low-Side
- Available in a SOIC-8E Package
- Available in AEC-Q100 Qualified Grade 1

## APPLICATIONS

- Car DC/DC Power Systems
- Half Bridge Motor Drivers

All MPS parts are lead-free, halogen-free, and adhere to the RoHS directive. For MPS green status, please visit the MPS website under Quality Assurance. "MPS", the MPS logo, and "Simple, Easy Solutions" are trademarks of Monolithic Power Systems, Inc. or its subsidiaries.

## TYPICAL APPLICATION



### ORDERING INFORMATION

Part Number	Package	Top Marking
MPQ18021HN-A-AEC1	SOIC-8E	See Below

\* For Tape & Reel, add suffix -Z (e.g. MPQ18021HN-A-AEC1-Z).

### TOP MARKING

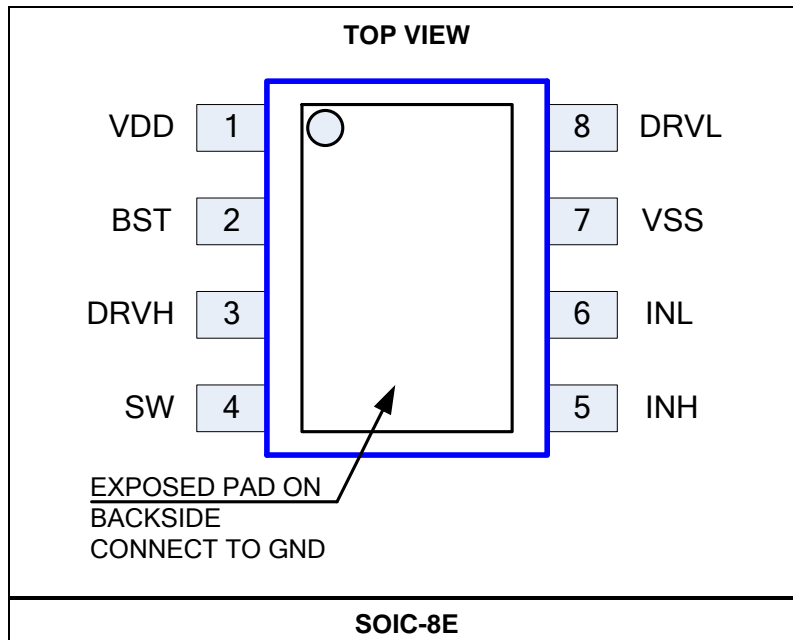
**MP18021A**

**LLLLLLLL**

**MPSYWW**

MP18021A: Part number  
 LLLLLLLL: Lot number  
 MPS: MPS prefix  
 Y: Year code  
 WW: Week code

### PACKAGE REFERENCE



## PIN FUNCTIONS

Pin #	Name	Description
1	VDD	<b>Supply input.</b> VDD supplies power to all of the internal circuitries. Place a decoupling capacitor to ground close to VDD to ensure a stable and clean supply.
2	BST	<b>Bootstrap.</b> BST is the positive power supply for the internal floating high-side MOSFET driver. Connect a bypass capacitor between BST and SW.
3	DRVH	<b>Floating high-side driver output.</b>
4	SW	<b>Switching node.</b>
5	INH	<b>Control signal input for the floating driver.</b>
6	INL	<b>Control signal input for the low-side driver.</b>
7	VSS	<b>Chip ground.</b> Connect the exposed pad to VSS for proper thermal operation.
Exposed Pad		
8	DRVL	<b>Low-side driver output.</b>

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

Supply voltage ( $V_{DD}$ )	-0.3V to +18V
SW voltage ( $V_{HS}$ )	-5.0V to +110V
BST voltage ( $V_{HB}$ )	-0.3V to +110V
BST to SW	-0.3V to +18V
DRVH to SW	-0.3V to (BST - SW) + 0.3V
DRVL to VSS	-0.3V to (VDD + 0.3V)
All other pins	-0.3V to (VDD + 0.3V)
CDM rating (AEC-Q100-011C1)	
All pins	Class C6
HBM rating (AEC-Q100-002)	
BST, DRVH	Class H1B
SW	Class H1C
Other pins	Class H2
Continuous power dissipation ( $T_A = 25^\circ\text{C}$ ) <sup>(2)</sup>	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 ( $V_{DD}$ )	9.0V to 16V
SW voltage ( $V_{HS}$ )	-1.0V to +100V - VDD
SW slew rate	<50V/ns
Operation junction temp. ( $T_J$ )	-40°C to +125°C

Thermal Resistance <sup>(4)</sup>	$\theta_{JA}$	$\theta_{JC}$
SOIC-8E	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  $T_J(\text{MAX})$ , the junction-to-ambient thermal resistance  $\theta_{JA}$ , and the ambient temperature  $T_A$ . The maximum allowable continuous power dissipation at any ambient temperature is calculated by  $P_D(\text{MAX}) = (T_J(\text{MAX}) - T_A) / \theta_{JA}$ . Exceeding the maximum allowable power dissipation produces an excessive die temperature, causing the regulator to 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,  $T_J = -40^{\circ}C$  to  $+125^{\circ}C$ , typical values tested at  $T_J = +25^{\circ}C$ , unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
<b>Supply Currents</b>						
VDD quiescent current	$I_{DDQ}$	INH = INL = 0		120	160	$\mu A$
VDD operating current	$I_{DDO}$	$f_{sw} = 500kHz$		2.8	3.5	mA
Floating driver quiescent current	$I_{BSTQ}$	INH = INL = 0		70	100	$\mu A$
Floating driver operating current	$I_{BSTO}$	$f_{sw} = 500kHz$		2.1	3	mA
Leakage current	$I_{LK}$	HB = SW = 100V		0.05	2.5	$\mu A$
<b>Inputs</b>						
INL/INH high				2.2	2.6	V
INL/INH low			1	1.5		V
INL/INH internal pull-down resistance	$R_{IN}$			185		k $\Omega$
<b>Under-Voltage Protection (UVP)</b>						
VDD rising threshold	$V_{DDR}$		7.4	8.1	8.9	V
VDD hysteresis	$V_{DDH}$			0.5		V
(BST-SW) rising threshold	$V_{BSTR}$		6.5	7.1	7.7	V
(BST-SW) hysteresis	$V_{BSTH}$			0.55		V
<b>Bootstrap Diode</b>						
Bootstrap diode VF @ 100 $\mu A$	$V_{F1}$			0.5		V
Bootstrap diode VF @ 100mA	$V_{F2}$			1		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	0.32	V
High-level output voltage to rail	$V_{OHL}$	$I_o = -100mA$		0.45	1	V
Peak pull-up current <sup>(5)</sup>	$I_{OHL}$	$V_{LO} = 0V, V_{DD} = 12V$		1.5		A
		$V_{LO} = 0V, V_{DD} = 16V$		2.5		A
Peak pull-down current <sup>(5)</sup>	$I_{OLL}$	$V_{LO} = V_{DD} = 12V$		2.5		A
		$V_{LO} = V_{DD} = 16V$		3.5		A
<b>Floating Gate Driver</b>						
Low-level output voltage	$V_{OLH}$	$I_o = 100mA$		0.15	0.32	V
High-level output voltage to rail	$V_{OHH}$	$I_o = -100mA$		0.45	1	V
Peak pull-up current <sup>(5)</sup>	$I_{OHH}$	$V_{HO} = 0V, V_{DD} = 12V$		1.5		A
		$V_{HO} = 0V, V_{DD} = 16V$		2.5		A
Peak pull-down current <sup>(5)</sup>	$I_{OLH}$	$V_{HO} = V_{DD} = 12V$		2.5		A
		$V_{HO} = V_{DD} = 16V$		3.5		A
Switching spec – low-side gate driver						
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

## ELECTRICAL CHARACTERISTICS (continued)

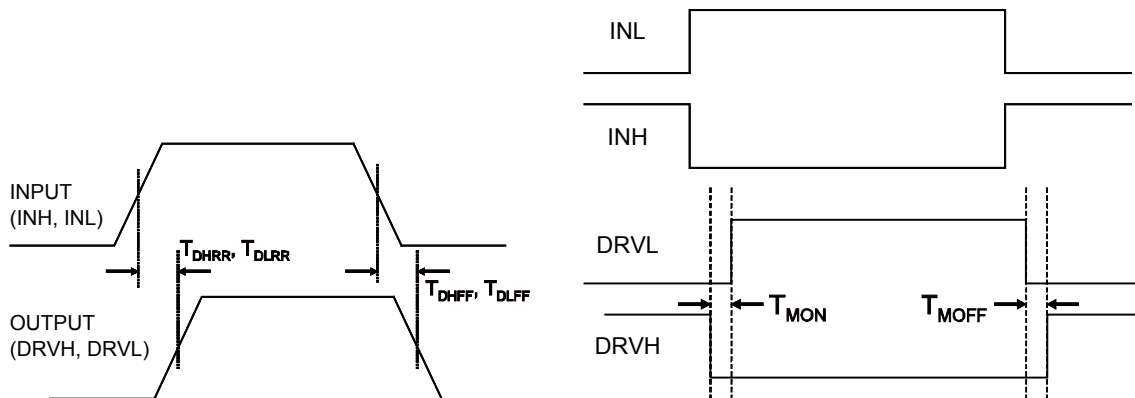
$V_{DD} = V_{BST} - V_{SW} = 12V$ ,  $V_{SS} = V_{SW} = 0V$ , no load at DRVH and DRVL,  $T_J = -40^{\circ}C$  to  $+125^{\circ}C$ , typical values tested at  $T_J = +25^{\circ}C$ , unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
<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 <sup>(5)</sup>	$T_{MON}$			1	5	ns
Low-side driver turn-off to floating driver turn-on <sup>(5)</sup>	$T_{MOFF}$			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
Thermal shutdown <sup>(5)</sup>				170		$^{\circ}C$
Thermal shutdown hysteresis <sup>(5)</sup>				25		$^{\circ}C$

**NOTE:**

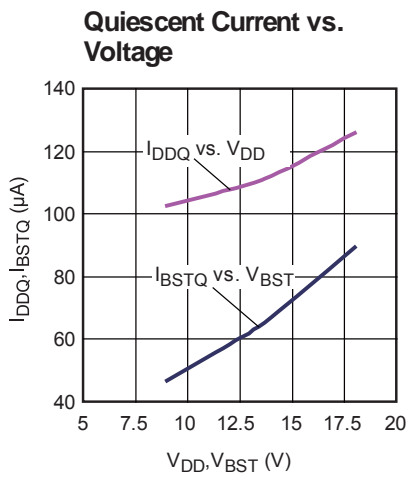
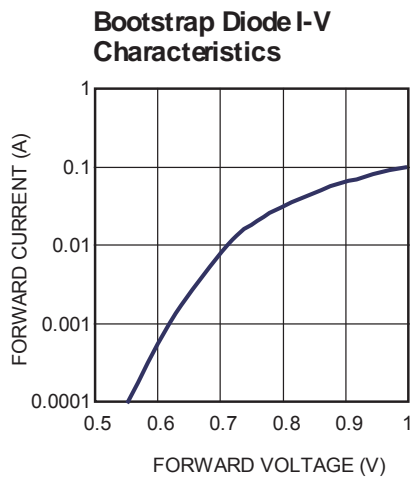
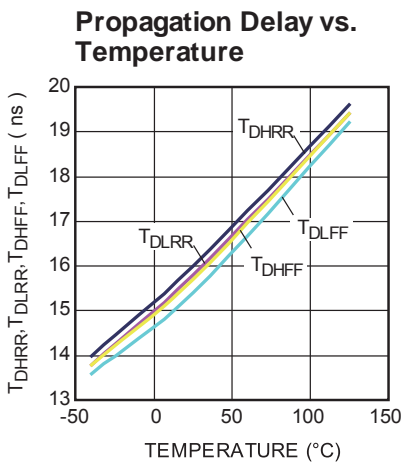
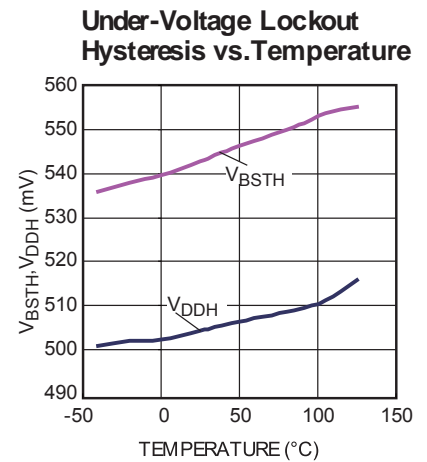
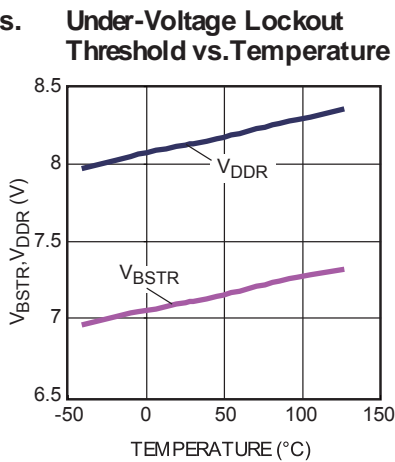
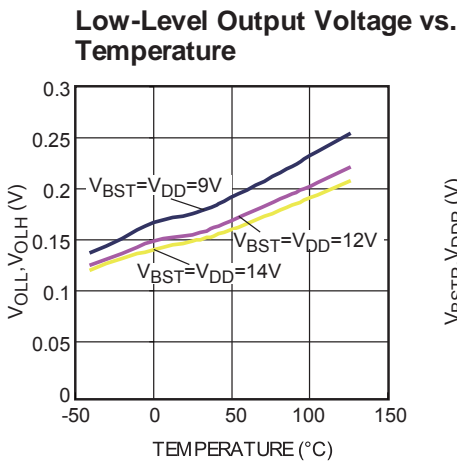
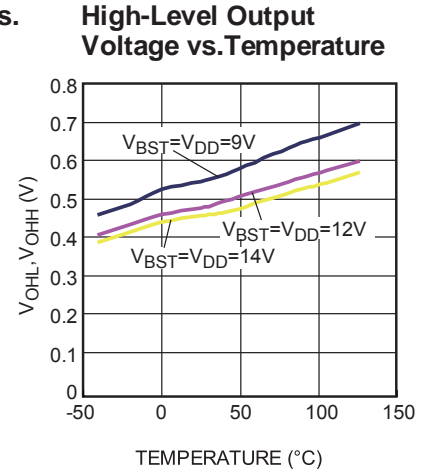
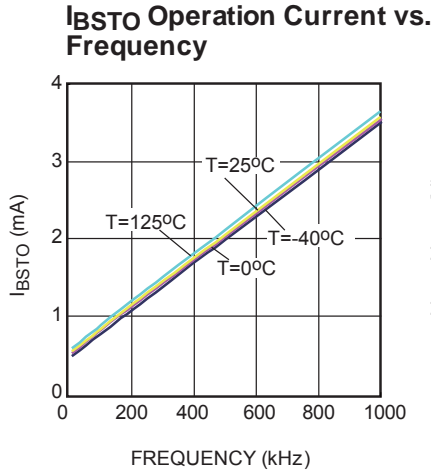
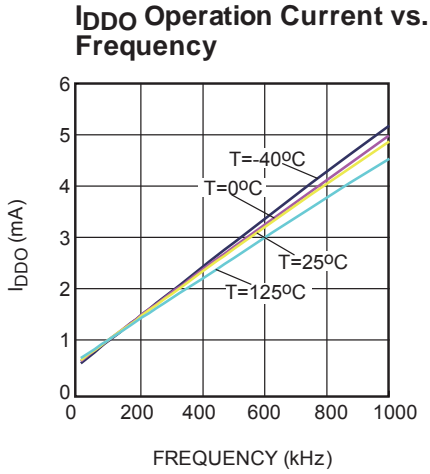
5) Guaranteed by design.

## TIMING DIAGRAM



## TYPICAL PERFORMANCE CHARACTERISTICS

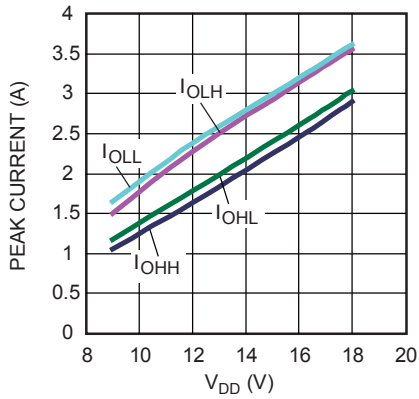
$V_{DD} = 12V$ ,  $V_{SS} = V_{SW} = 0V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.



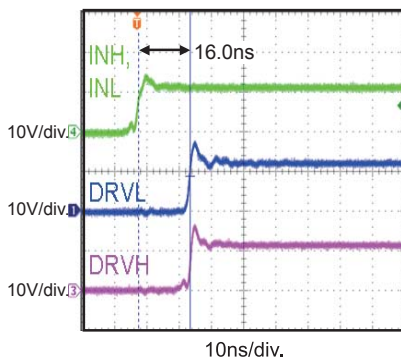
### TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

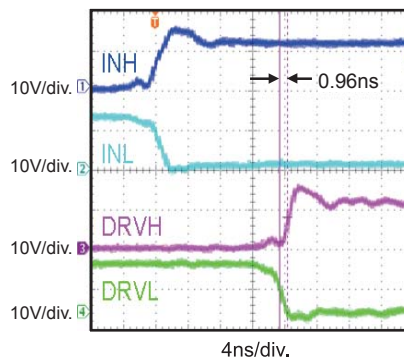
Peak Current vs.  $V_{DD}$  Voltage



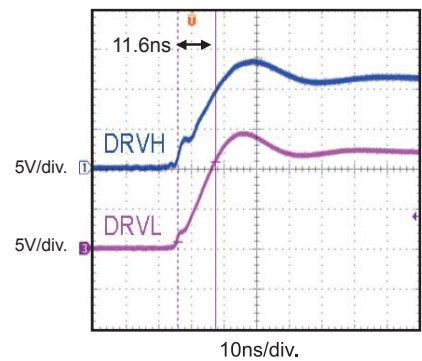
Turn-On Propagation Delay



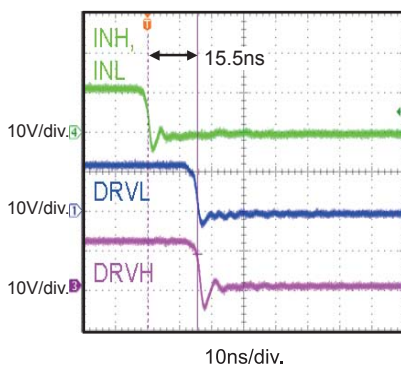
Gate Drive Matching  $T_{MOFF}$



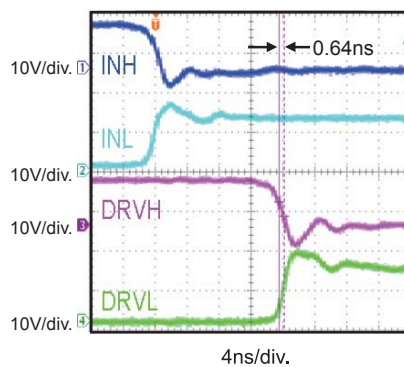
Drive Rise Time (1nF Load)



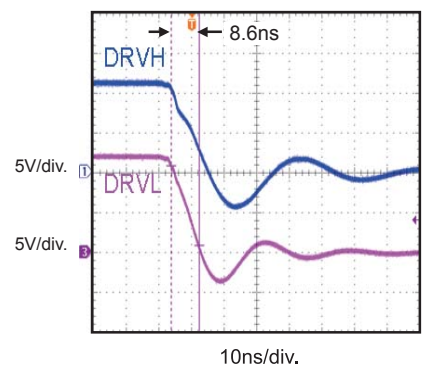
Turn-Off Propagation Delay



Gate Drive Matching  $T_{MON}$



Drive Fall Time (1nF Load)



### BLOCK DIAGRAM

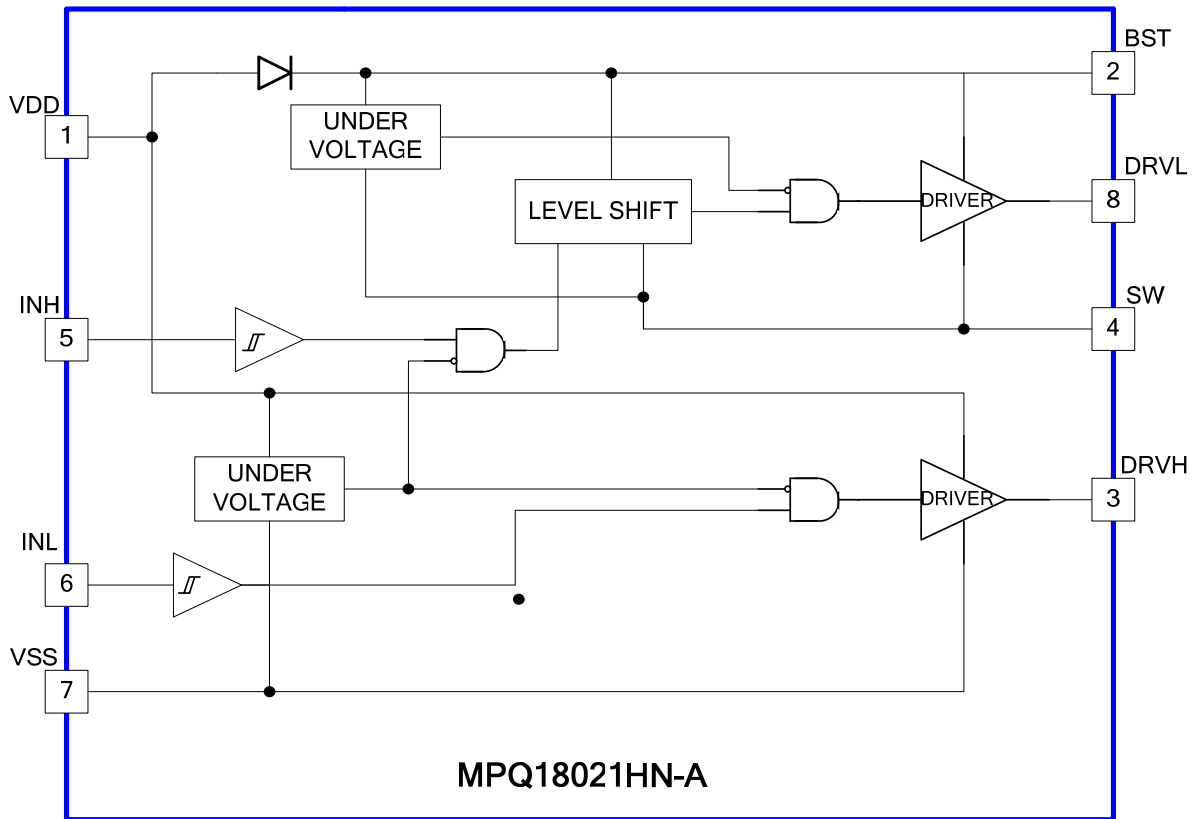


Figure 1: Functional Block Diagram



## APPLICATION

The input signals of INH and INL can be controlled independently. If both INH and INL are controlling the high-side MOSFET (HS-FET) and low-side MOSFET (LS-FET) of the same bridge, shoot through can be prevented by setting a sufficient dead time between INH and INL low, and vice versa (see Figure 2). Dead time is defined as the time interval between INH low and INL low.

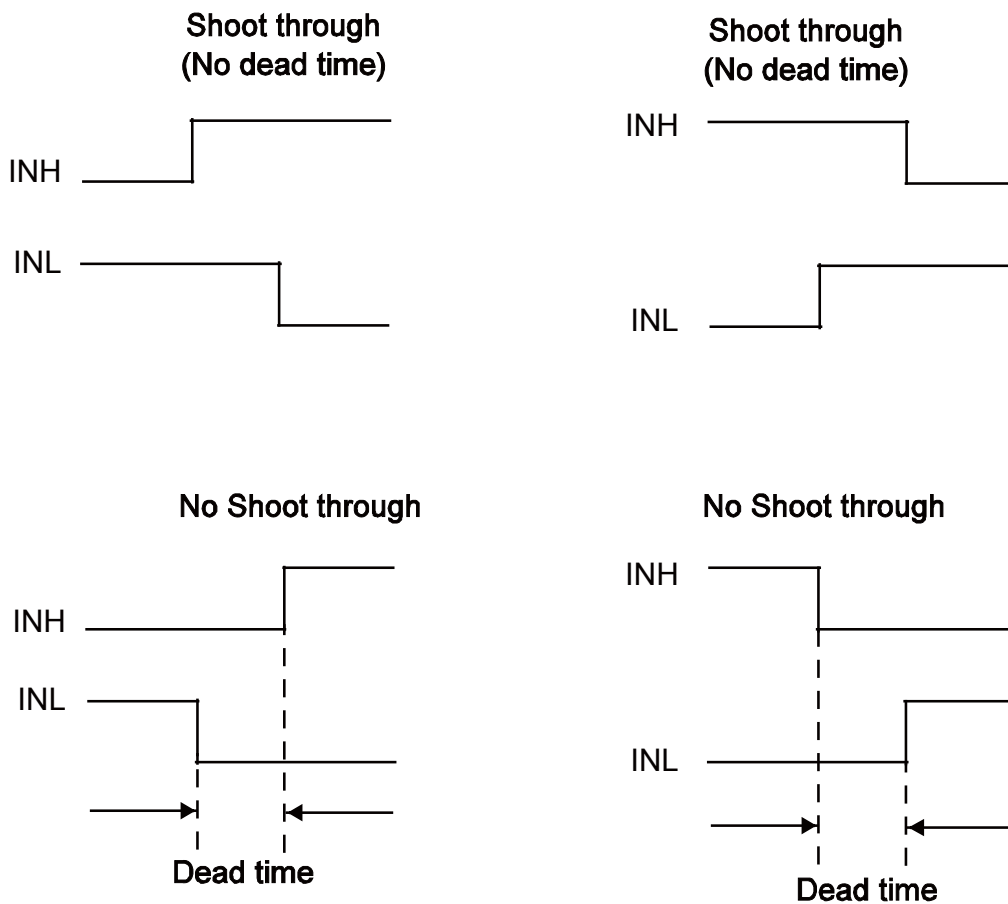


Figure 2: Shoot-Through Timing Diagram

## REFERENCE DESIGN CIRCUITS

### Half-Bridge Converter

In the half-bridge converter topology, the MOSFETs are driven alternately with some dead time. Therefore, INH and INL are driven

with alternating signals from the pulse-width modulation (PWM) controller. The input voltage can rise as high as 100V in this application (see Figure 3 through Figure 5).

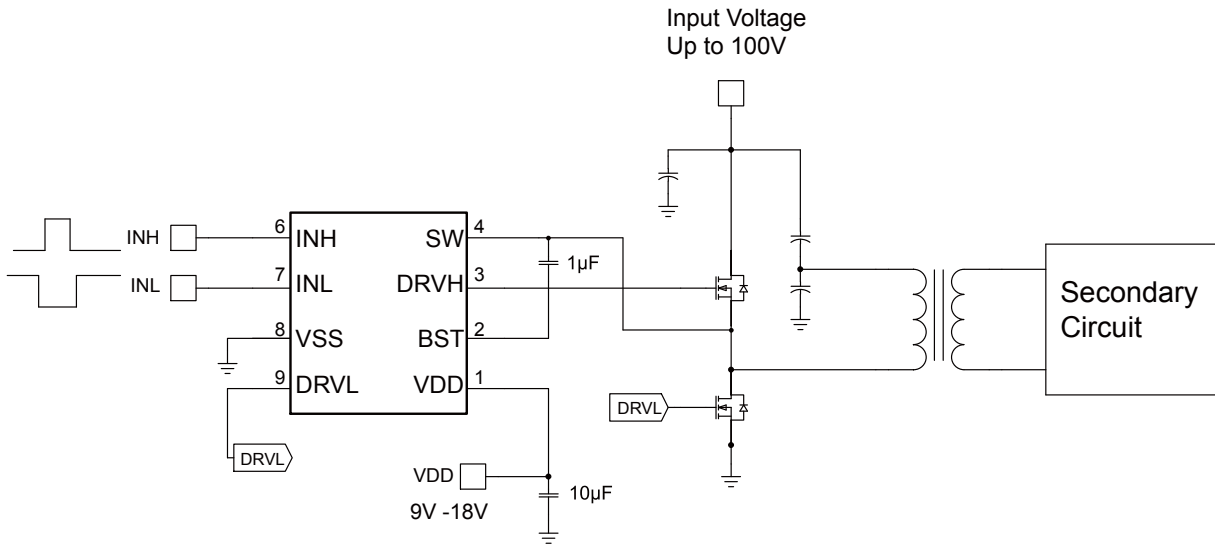


Figure 3: Half-Bridge Converter

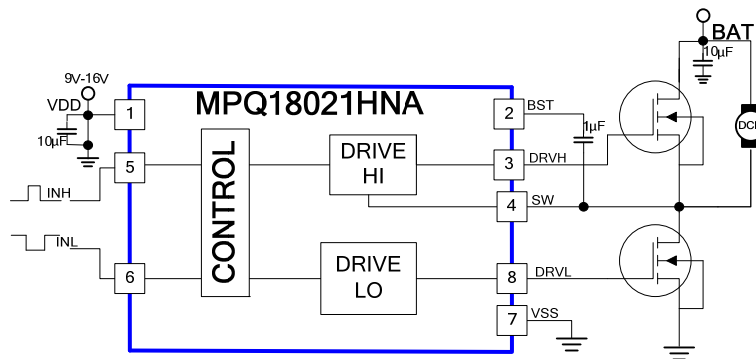


Figure 4: Half-Bridge for Unidirectional Motor

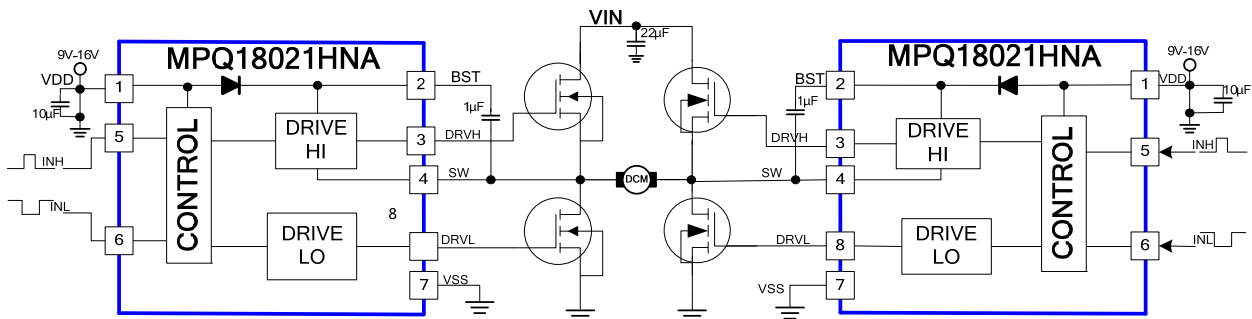
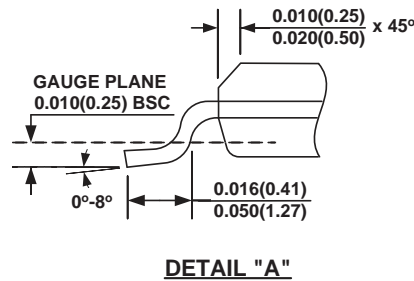
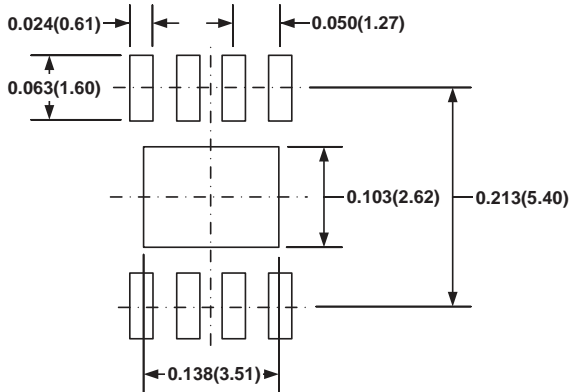
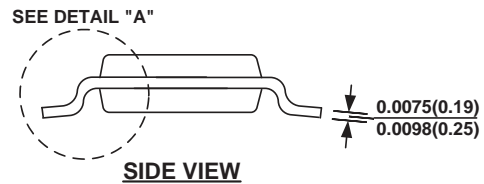
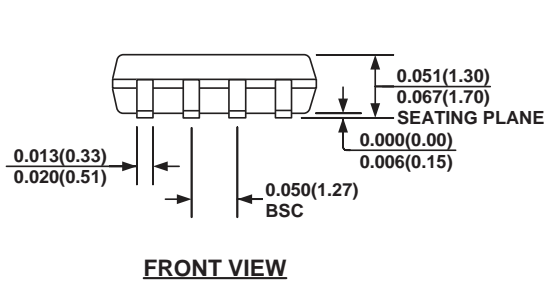
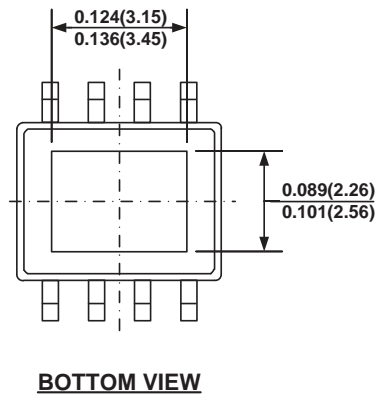
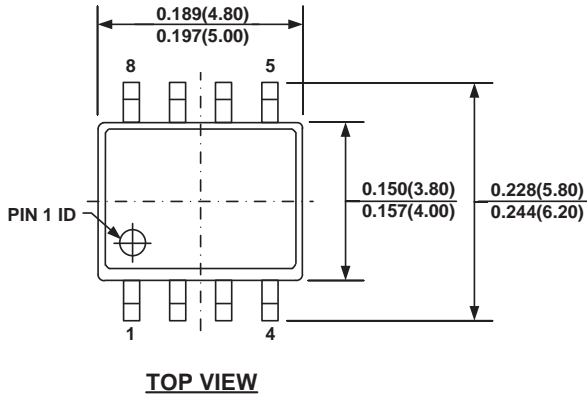


Figure 5: 2x MPQ18021HNA for One Bidirectional DC Motor

## PACKAGE INFORMATION

### SOIC-8E



#### 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.

**NOTICE:** The information in this document is subject to change without notice. Users should warrant and guarantee that third party Intellectual Property rights are not infringed upon when integrating MPS products into any application. MPS will not assume any legal responsibility for any said applications.

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for [Gate Drivers](#) category:*

*Click to view products by [Monolithic Power Systems](#) manufacturer:*

Other Similar products are found below :

[89076GBEST](#) [00053P0231](#) [56956](#) [57.404.7355.5](#) [LT4936](#) [57.904.0755.0](#) [5882900001](#) [00600P0005](#) [00-9050-LRPP](#) [00-9090-RDPP](#)  
[5951900000](#) [01-1003W-10/32-15](#) [0131700000](#) [00-2240](#) [LTP70N06](#) [LVP640](#) [5J0-1000LG-SIL](#) [LY1D-2-5S-AC120](#) [LY2-US-AC240](#) [LY3-](#)  
[UA-DC24](#) [00576P0020](#) [00600P0010](#) [LZN4-UA-DC12](#) [LZNQ2M-US-DC5](#) [LZNQ2-US-DC12](#) [LZP40N10](#) [00-8196-RDPP](#) [00-8274-RDPP](#)  
[00-8275-RDNP](#) [00-8609-RDPP](#) [00-8722-RDPP](#) [00-8728-WHPP](#) [00-8869-RDPP](#) [00-9051-RDPP](#) [00-9091-LRPP](#) [00-9291-RDPP](#) [0207100000](#)  
[0207400000](#) [01312](#) [0134220000](#) [60713816](#) [M15730061](#) [61161-90](#) [61278-0020](#) [6131-204-23149P](#) [6131-205-17149P](#) [6131-209-15149P](#)  
[6131-218-17149P](#) [6131-220-21149P](#) [6131-260-2358P](#)