30V HIGH FREQUENCY HALF-BRIDGE GATE DRIVER WITH ADAPTIVE DEADTIME IN DFN3030-8

Description

The DGD28225 is a high-frequency gate driver with an internal bootstrap diode capable of driving N-channel MOSFETs in a half-bridge configuration. the floating high-side driver is rated up to 30V in a bootstrap configuration.

System efficiency in the half-bridge is greatly improved with adaptive deadtime, 19ns rise and fall times, and 22ns propagation delays. UVLO for the high- and low-side protects the MOSFET during a loss of supply.

Fast and well-matched propagation delays and rise and fall times allow for a higher switching frequency, which enables a smaller, more compact power switching design using smaller associated components. To minimize component footprint, an internal boostrap diode is included.

The DGD28225 is packaged in a space-saving U-DFN3030-8 package. The device's operating temperature extends from -40°C to +125°C.

Features

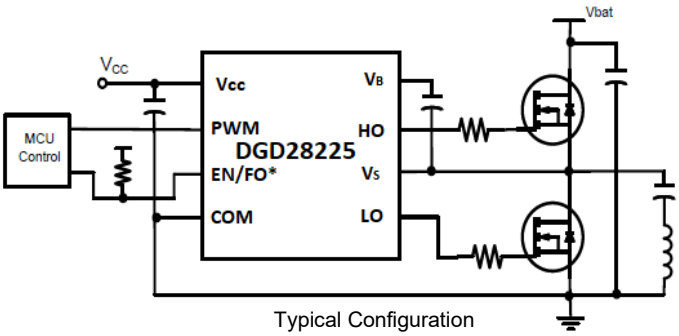
- 30V Floating High-Side Driver
- Drives Two N-Channel MOSFETs in a Half-Bridge Configuration
- Adaptive Deadtime of 22ns typical
- 1.5A Source / 1.5A Sink Output Current Capability for High Side
- 1.5A Source / 2.4A Sink Output Current Capability for Low Side
- Internal Bootstrap Diode
- V_{CC} Undervoltage Lockout
- Propagation Delay Typical of 22ns
- Fast Rise and Fall times of 19ns Typical
- Wide V_{CC} Operating Voltage 4.5V to 6V
- Extended Temperature Range: -40°C to +125°C
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q101, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Applications

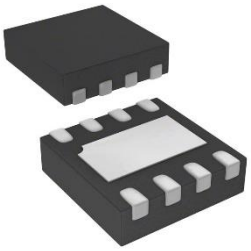
- Multi-phase DC-to-DC converters with digital control
- Synchronous rectification for isolated point of load
- Wireless charging transmitter

Mechanical Data

- Package: U-DFN3030-8
- Package Material: Molded Plastic. "Green" Molding Compound UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Finish Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.017 grams (Approximate)



Typical Configuration



U-DFN3030-8

Ordering Information (Note 4)

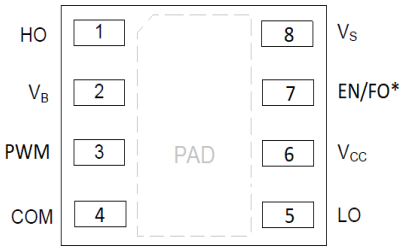
Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
DGD28225FN-7	U-DFN3030-8	DGD28225B	7	8	3,000	Reel

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

DGD28225B = Product Type Marking Code
YY = Year (ex: 25 = 2025)
WW = Week (01 to 53)

Pin Diagrams

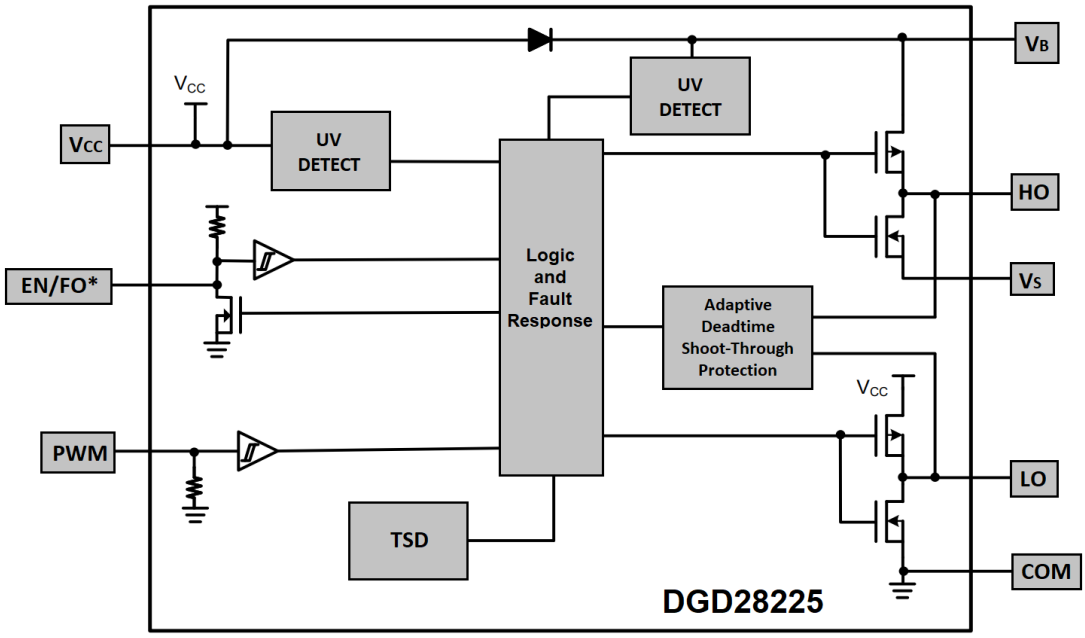


Top view: U-DFN3030-8

Pin Descriptions

Pin Number	Pin Name	Function
1	HO	High-Side Gate Drive Output
2	V_B	High-Side Floating Supply
3	PWM	Control Input
4	COM	Low-Side and Logic Return
5	LO	Low-Side Gate Drive Output
6	V_{CC}	Low-Side and Logic Supply
7	EN/FO*	Enable/Fault Output. Enable: IC is disabled with EN = L. Fault Output: FO* is L when the IC is in UVLO or Thermal Shutdown.
8	V_S	High-Side Floating Supply Return
PAD	Substrate	Connect to COM on PCB

Functional Block Diagram



Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
High-Side Positive Supply Voltage	V_B	-0.3 to +40	V
High-Side Negative Supply Voltage	V_S	V_B -6.5 to V_B+0.3	V
High-Side Output Voltage	V_{HO}	V_S-0.3 to V_B+0.3	V
Offset Supply Voltage Transient	dV_S / dt	50	V/ns
Logic and Low-Side Fixed Supply Voltage	V_{CC}	-0.3 to +6.5	V
Low-Side Output Voltage	V_{LO}	-0.3 to V_{CC}+0.3	V
Logic Input Voltage (PWM and EN)	V_{IN}	-0.3 to V_{CC}+0.3	V

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation Linear Derating Factor (Note 5)	P_D	0.97	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	131	°C/W
Thermal Resistance, Junction to Case (Note 5)	$R_{\theta JC}$	26	°C/W
Operating Temperature	T_J	-40 to +150	°C
Lead Temperature (soldering, 10s)	T_L	+300	
Storage Temperature Range	T_{STG}	-55 to +150	

Note: 5. For a device mounted on the minimum recommended pad layout of 2oz copper on a single-sided 1.6mm FR4 PCB; device is measured under still-air conditions whilst operating in steady-state condition.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
High-Side Floating Supply	V_B	V_S + 4.5	V_S + 6	V
High-Side Floating Supply Offset Voltage	V_S	Note 6	30 (Note 7)	V
High-Side Floating Output Voltage	V_{HO}	V_S	V_B	V
Logic and Low-Side Fixed Supply Voltage	V_{CC}	4.5	6	V
Low-Side Output Voltage	V_{LO}	0	V_{CC}	V
Logic Input Voltage (PWM and EN)	V_{IN}	0	5	V
Ambient Temperature	T_A	-40	+125	°C

Notes: 6. Logic operation for V_S of -5V to +30V.
7. Provided V_B doesn't exceed absolute maximum rating of 40V.

DC Electrical Characteristics (V_{CC} = V_{BS} = 5.0V, @T_A = 25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
PWM Input Rising Threshold	V_{PWMH}	–	1.7	2.4	V	–
PWM Input Falling Threshold	V_{PWML}	0.7	0.9	–	V	–
EN Input Rising Threshold	V_{ENH}	–	1.7	2.4	V	–
EN Input Falling Threshold	V_{ENL}	0.7	0.9	–	V	–
Offset Supply Leakage Current	I_{LK}	–	–	50	μA	V_B = V_S = 30V
PWM Input Bias Current	I_{PWM}	–	80	150	μA	V_{PWM} = 5V
		–	0	–	μA	V_{PWM} = 0V
V_{CC} Input Bias Current (includes I_{BS})	I_{CCQ}	–	420	650	μA	V_{EN} = 0 or 5V, PMW = 0V
		–	100	260		V_{EN} = 0 or 5V, PMW = 0V
V_{CC} Supply Under-Voltage Positive Going Threshold	V_{CCUV+}	3.0	3.4	3.8	V	–
V_{CC} Supply Under-Voltage Negative Going Threshold	V_{CCUV-}	2.3	2.7	3.6	V	–
Fault Output at Low Vcc	V_{FO}	–	–	0.2	V	V_{CC} = 2.5V
Forward Voltage of Bootstrap Diode	V_F	–	1.2	–	V	I_F = 100mA
		–	0.6	–	V	I_F = 100μA
Thermal Shutdown Rising Threshold	T_{SDH}	–	160	–	◦C	–
Thermal Shutdown Falling Threshold	T_{SDL}	–	140	–	◦C	–
High-Side						
Source Resistance	R_{HSO}	–	1.3	2	Ω	I_{HO} = 500mA
Output Source Current	I_{HO+}	–	1.5	–	A	V_{HO} = 0V
Sink Resistance	R_{HSI}	–	0.9	2	Ω	I_{HO} = -500mA
Output Sink Current	I_{HO-}	–	1.5	–	A	V_{HO} = V_{CC}
Low-Side						
Source Resistance	R_{LSO}	–	1.3	2	Ω	I_{LO} = 500mA
Output Source Current	I_{LO+}	–	1.5	–	A	V_{LO} = 0V
Sink Resistance	R_{LSI}	–	0.6	1	Ω	I_{LO} = -500mA
Output Sink Current	I_{LO-}	–	2.4	–	A	V_{LO} = V_{CC}

AC Electrical Characteristics (V_{CC} = V_{BS} = 5.0V, @T_A = 25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-on Propagation Delay, HO	t_{ON}	–	54	–	ns	C_L = 3nF
Turn-on Propagation Delay, LO		–	65	–	ns	
Turn-off Propagation Delay, HO and LO	t_{OFF}	–	22	–	ns	
Turn-on Rise Time, HO and LO	t_R	–	17	–	ns	
Turn-off Fall Time, HO	t_F	–	19	–	ns	
Turn-off Fall time, LO		–	14	–	ns	
Adaptive Deadtime	t_{ADT}	–	22	–	ns	
Minimum Pulse Width	t_{P-MIN}	–	30	–	ns	C_L = 3nF, V_{PWM} = 5V

Timing Waveforms

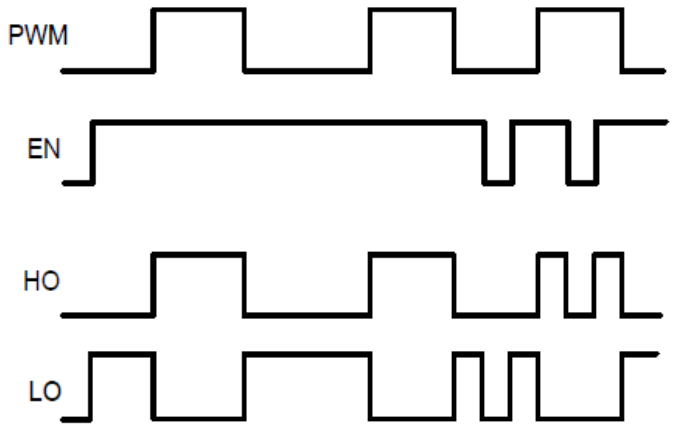


Figure 1. Input / Output Timing Diagram

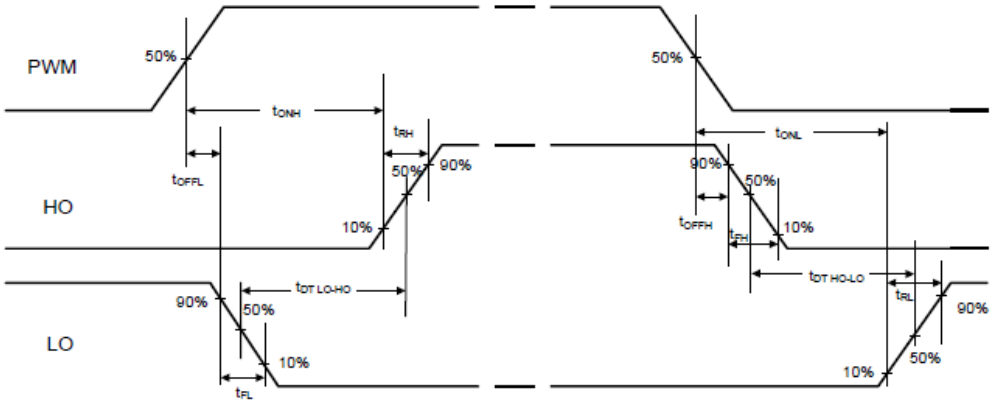


Figure 2. Switching Time Waveform Definitions

Typical Performance Characteristics (@T_A = +25°C, unless otherwise specified.)

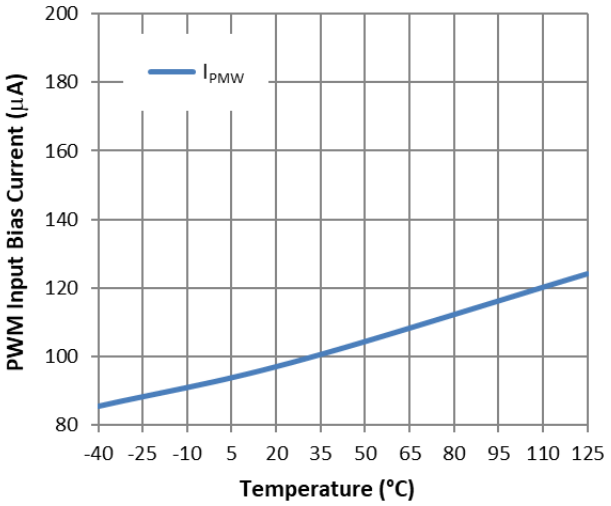


Figure 3. PWM Input Bias Current vs. Temperature

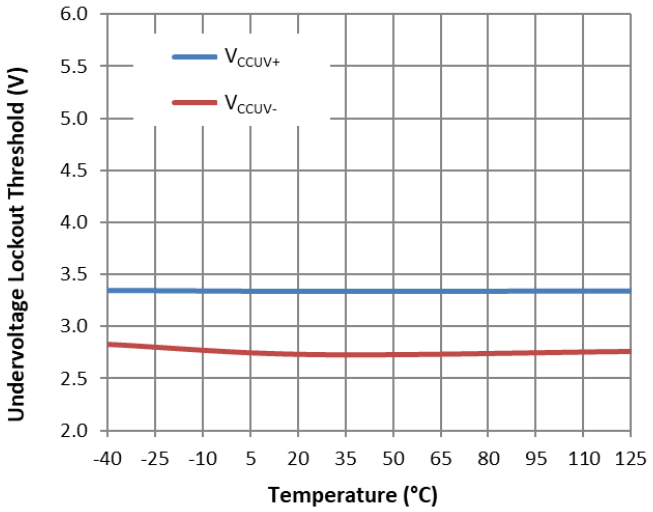


Figure 4. Undervoltage Lockout Threshold vs. Temperature

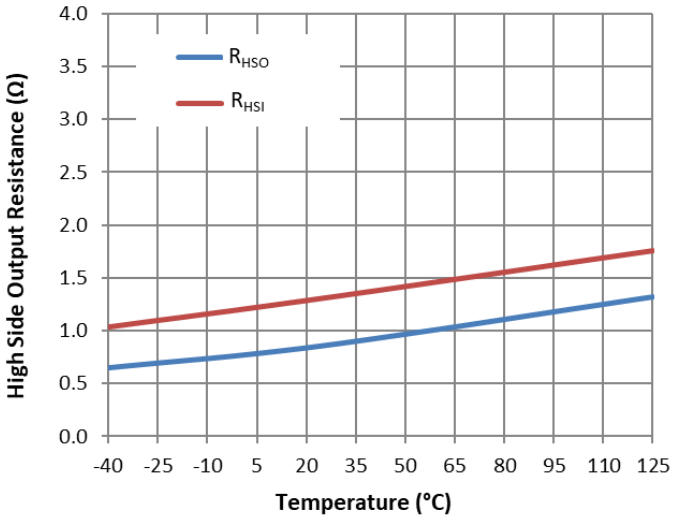


Figure 5. High Side Output Resistance vs. Temperature

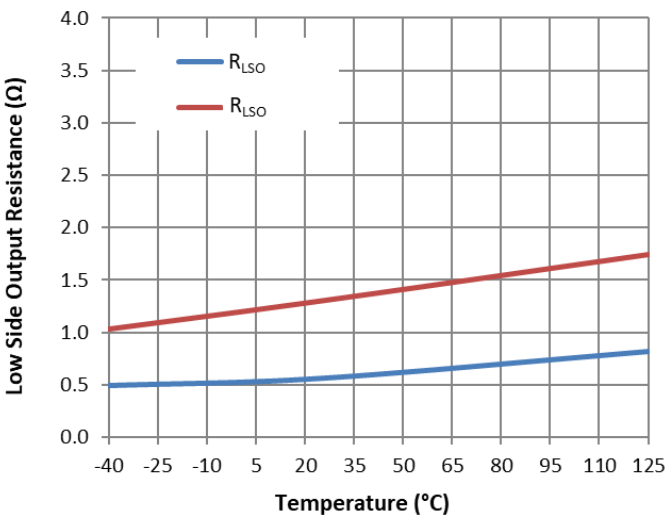


Figure 6. Low Side Output Resistance vs. Temperature

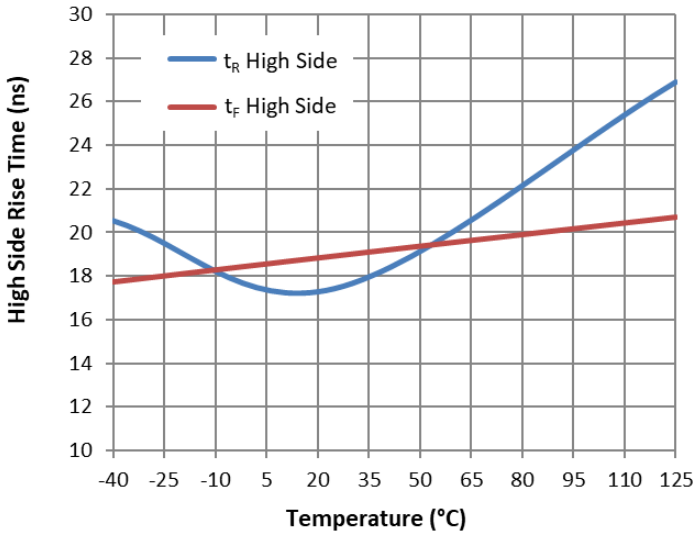


Figure 7. High Side Rise Time vs. Temperature

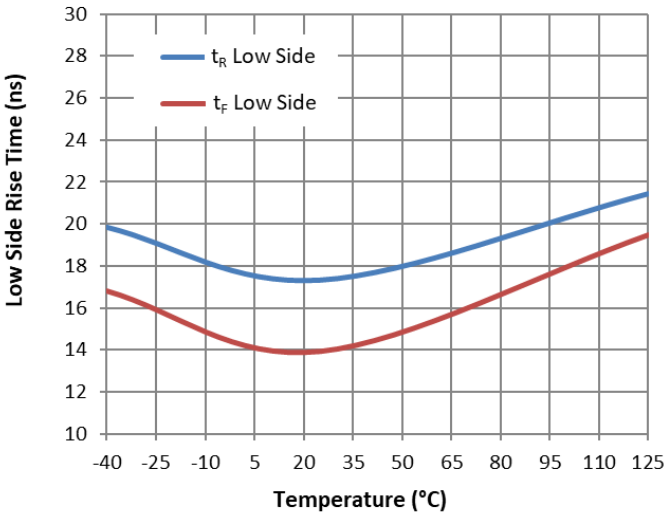


Figure 8. Low Side Rise Time vs. Temperature

Typical Performance Characteristics (@T_A = +25°C, unless otherwise specified.)

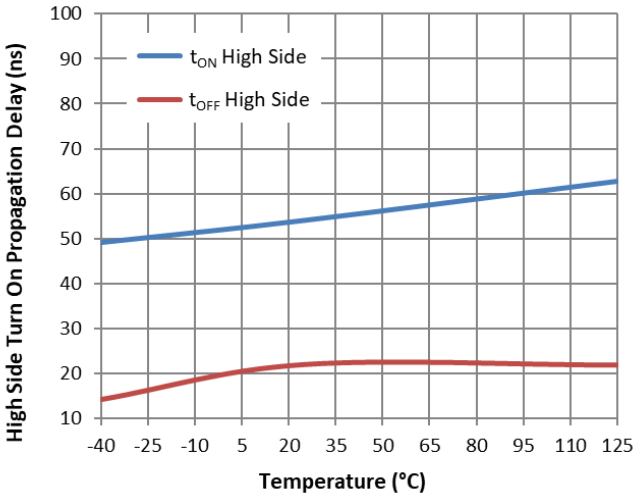


Figure 9. High Side Turn On Propagation Delay vs. Temperature

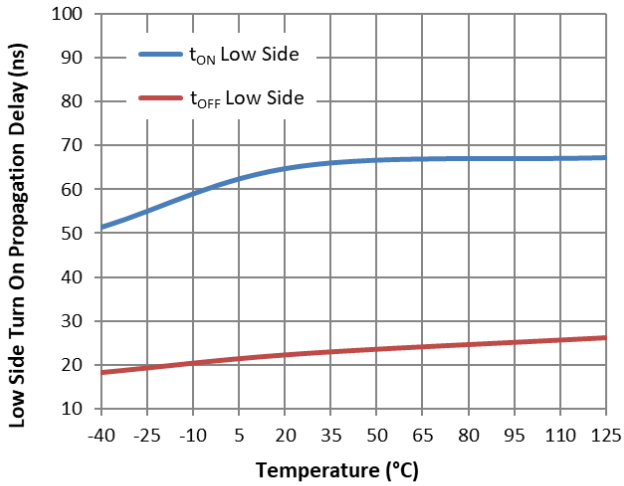
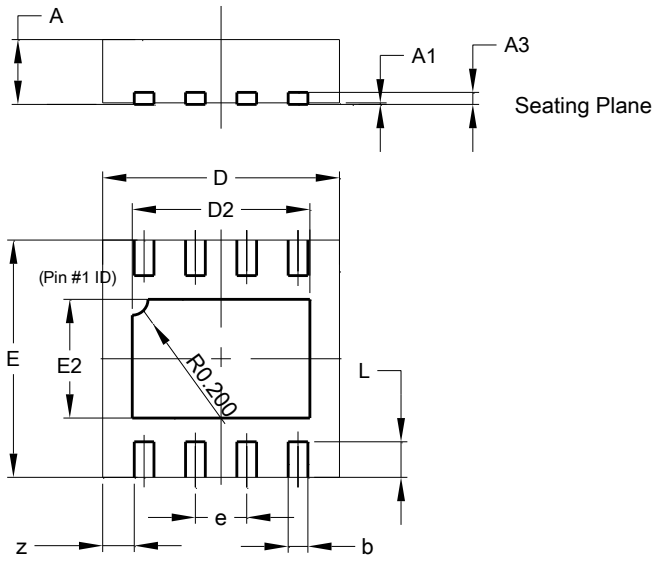


Figure 10. Low Side Turn On Propagation Delay vs. Temperature

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

U-DFN3030-8

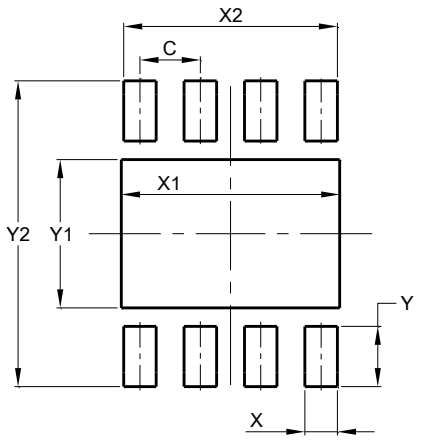


U-DFN3030-8			
Dim	**Min**	**Max**	**Typ**
A	0.57	0.63	0.60
A1	0.00	0.05	0.02
A3	-	-	0.15
b	0.20	0.30	0.25
D	2.95	3.05	3.00
D2	2.15	2.35	2.25
E	2.95	3.05	3.00
E2	1.40	1.60	1.50
e	-	-	0.65
L	0.30	0.60	0.45
z	-	-	0.40
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

U-DFN3030-8



Dimensions	Value (in mm)
C	0.650
X	0.350
X1	2.350
X2	2.300
Y	0.650
Y1	1.600
Y2	3.300

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