HIGH FREQUENCY HIGH-SIDE AND LOW-SIDE GATE DRIVER IN DFN3030-10

Description

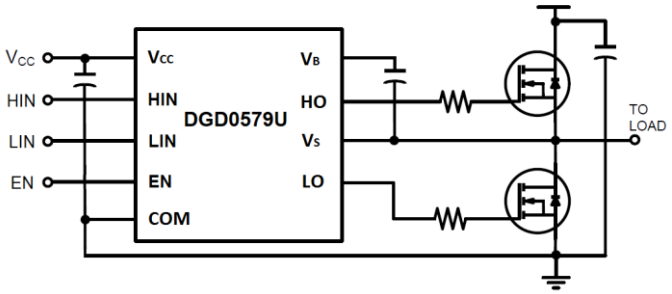
The DGD0579U is a high-frequency high-side and low-side gate driver with internal Bootstrap Diode capable of driving N-channel MOSFETs in a half-bridge configuration. The floating high-side driver is rated up to 100V in a bootstrap configuration.

The DGD0579U logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with MCUs. A UVLO for high-side and low-side will protect MOSFETs with loss of supply. Cross conduction prevention logic also protects MOSFETs by preventing the HO and LO being on at the same time.

Fast and well-matched propagation delays allow a higher switching frequency, enabling a smaller, more compact power switching design, using smaller associated components. To minimize space, an internal bootstrap diode is included and the DGD0579U is offered in the W-DFN3030-10 package and operates over an extended -40°C to +125°C temperature range.

Applications

- DC-DC Converters
- Motor Controls
- Battery Powered Hand Tools
- Class D Power Amplifiers



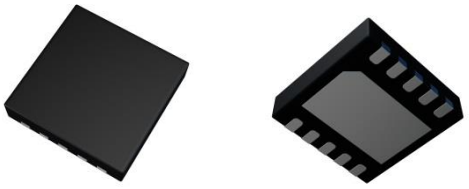
Typical Configuration

Features

- 100V Floating High-Side Driver
- Drives Two N-Channel MOSFETs in A Half-Bridge Configuration
- 1.5A Source / 2.5A Sink Output Current Capability
- Internal Bootstrap Diode
- Undervoltage Lockout for High-Side and Low-Side Drivers
- Delay Matching Maxmimum of 10ns
- Propagation Delay Typical of 60ns
- Logic Input (HIN, LIN and EN) 3.3V Capability
- Ultra Low Standby Currents (<1µA)
- 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-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.**
  https://www.diodes.com/quality/product-definitions/

Mechanical Data

- Package: W-DFN3030-10 (Type TH)
- Package Material: Molded Plastic. "Green" Molding Compound UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 3 per J-STD-020
- Terminals: Finish – Matte Tin Finish Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.017 grams (Approximate)



Top View Bottom View

W-DFN3030-10

Ordering Information (Note 4)

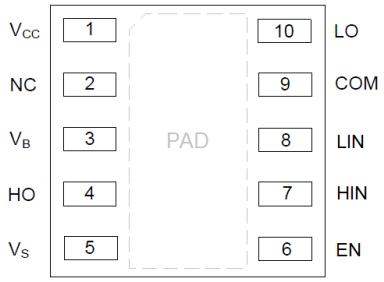
Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
				Qty.	Carrier
DGD0579UFN-7	DGD0579U	7	8	3,000	Reel

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

DGD0579U = Product Type Marking Code
YY = Year (ex: 21 = 2021)
WW = Week (01 to 53)

Pin Diagrams

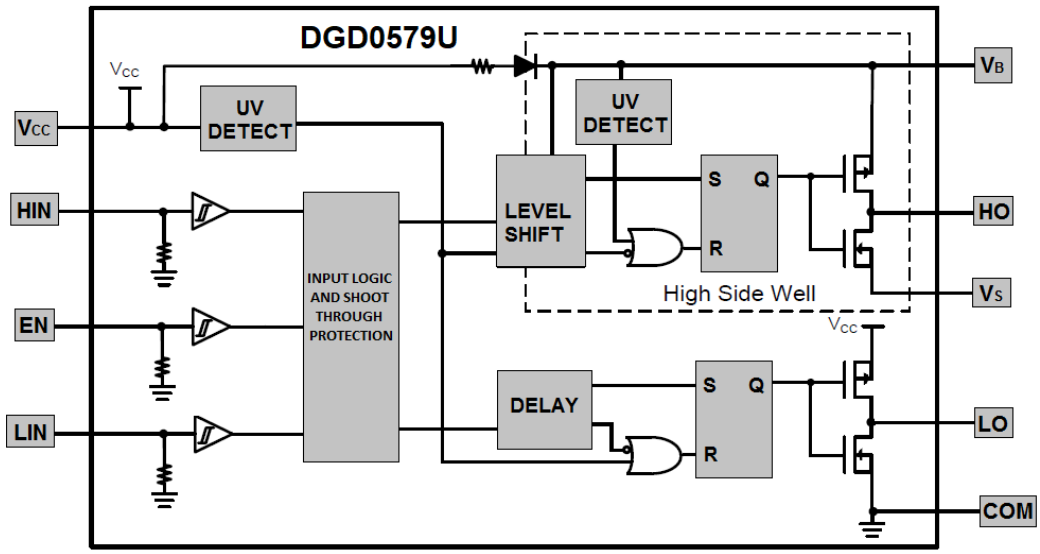


Top view: W-DFN3030-10

Pin Descriptions

Pin Number	Pin Name	Function
1	V_{CC}	Low-Side and Logic Supply
2	NC	No Connect (No Internal Connection)
3	V_B	High-Side Floating Supply
4	HO	High-Side Gate Drive Output
5	V_S	High-Side Floating Supply Return
6	EN	Logic Input Enable, A Logic Low Turns Off Gate Driver
7	HIN	Logic Input for High-Side Gate Driver, in Phase with HO
8	LIN	Logic Input for Low-Side Gate Driver, in Phase with LO
9	COM	Low-Side and Logic Return
10	LO	Low-Side Gate Drive Output
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 Floating Positive Supply Voltage	V_B	-0.3 to +120	V
High-Side Floating Negative Supply Voltage	V_S	V_B-20 to V_B+0.3	V
High-Side Floating 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 +20	V
Low-Side Output Voltage	V_{LO}	-0.3 to V_{CC}+0.3	V
Logic Input Voltage (HIN, LIN 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	0.4	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	64	°C/W
Thermal Resistance, Junction to Case (Note 5)	$R_{\theta JC}$	42	°C/W
Operating Temperature	T_J	+150	°C
Lead Temperature (soldering, 10s)	T_L	+300	
Storage Temperature Range	T_{STG}	-55 to +150	

Note: 5. When mounted on a standard JEDEC 2-layer FR-4 board.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
High-Side Floating Supply	V_B	V_S + 5.8	V_S + 18	V
High-Side Floating Supply Offset Voltage	V_S	(Note 6)	100 (Note 7)	V
High-Side Floating Output Voltage	V_{HO}	V_S	V_B	V
Logic and Low Side Fixed Supply Voltage	V_{CC}	6.5	18	V
Low-Side Output Voltage	V_{LO}	0	V_{CC}	V
Logic Input Voltage (HIN, LIN and EN)	V_{IN}	0	5	V
Ambient Temperature	T_A	-40	+125	°C

Notes: 6. Logic operation for V_S of -5V to +100V.
7. Provided V_B doesn't exceed absolute maximum rating of 120V.

DC Electrical Characteristics (V_{CC} = V_{BS} = 12V, COM = V_S = 0V, @T_A = +25°C, unless otherwise specified.) (Note 8)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic "1" Input Voltage (HIN, LIN)	V_{IH}	2.5	—	—	V	—
Logic "0" Input Voltage (HIN, LIN)	V_{IL}	—	—	0.8	V	—
Enable Logic "1" Input Voltage (EN)	V_{EIH}	1.6	—	—	V	—
Enable Logic "0" Input Voltage (EN)	V_{EIL}	—	—	0.5	V	—
Input Voltage Hysteresis	V_{INHYS}	—	0.7	—	V	—
High Level Output Voltage, V_{BIAS} - V_O	V_{OH}	—	0.05	0.3	V	I_{O+} = 10mA
Low Level Output Voltage, V_O	V_{OL}	—	0.02	0.1	V	I_{O-} = 10mA
Offset Supply Leakage Current	I_{LK}	—	0.1	1	µA	V_B = V_S = 100V
V_{CC} Shutdown Supply Current	I_{CCSD}	—	0	1	µA	V_{IN} = 0V or 5V, V_{EN} = 0V
V_{CC} Quiescent Supply Current	I_{CCQ}	—	80	150	µA	V_{IN} = 0V or 5V
V_{CC} Operating Supply Current	I_{CCOP}	—	8.2	—	mA	fs = 500kHz, C_L = 1nF
V_{BS} Quiescent Supply Current	I_{BSQ}	—	50	100	µA	V_{IN} = 0V or 5V
V_{BS} Operating Supply Current	I_{BSOP}	—	8.0	—	mA	fs = 500kHz, C_L = 1nF
Logic "1" Input Bias Current	I_{IN+}	—	—	50	µA	V_{IN} = 5V
Logic "0" Input Bias Current	I_{IN-}	—	—	5	µA	V_{IN} = 0V
V_{BS} Supply Undervoltage Positive Going Threshold	V_{BSUV+}	3.8	4.9	5.8	V	—
V_{BS} Supply Undervoltage Negative Going Threshold	V_{BSUV-}	3.3	4.5	5.3	V	—
V_{CC} Supply Undervoltage Positive Going Threshold	V_{CCUV+}	4.0	5.2	6.0	V	—
V_{CC} Supply Undervoltage Negative Going Threshold	V_{CCUV-}	3.5	4.7	5.5	V	—
Output High Short Circuit Pulsed Current	I_{O+}	1.0	1.5	—	A	V_O = 0V, PW ≤ 10µs
Output Low Short Circuit Pulsed Current	I_{O-}	1.5	2.5	—	A	V_O = 15V, PW ≤ 10µs
Forward Voltage of Bootstrap Diode	V_{F1}	—	0.6	0.75	V	I_F = 100µA
Forward Voltage of Bootstrap Diode	V_{F2}	—	1.4	1.75	V	I_F = 100mA

Note: 8. The V_{IN} and I_{IN} parameters are applicable to the logic pins: HIN, LIN and EN. The V_O and I_O parameters are applicable to the respective output pins: HO and LO.

AC Electrical Characteristics (V_{CC} = V_{BS} = 12V, COM = V_S = 0V, C_L = 1000pF, @T_A = +25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-on Propagation Delay	t_{ON}	—	65	—	ns	—
Turn-off Propagation Delay	t_{OFF}	—	58	—	ns	V_S = 100V
Delay Matching, HO & LO turn-on	t_{DM}	—	—	10	ns	—
Turn-on Rise Time	t_r	—	19	—	ns	—
Turn-off Fall Time	t_f	—	15	—	ns	—

Timing Waveforms

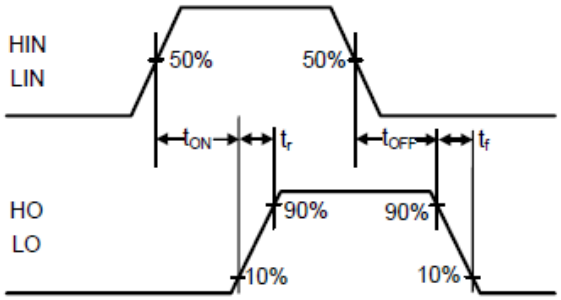


Figure 1. Switching Time Waveform Definitions

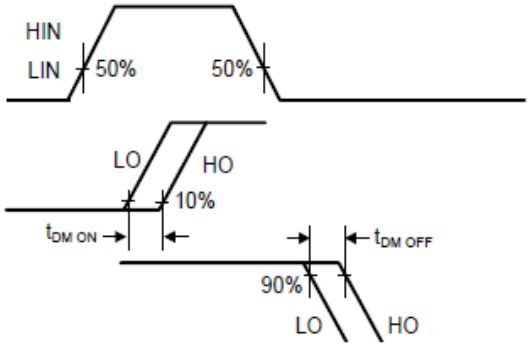


Figure 2. Delay Matching Waveform Definitions

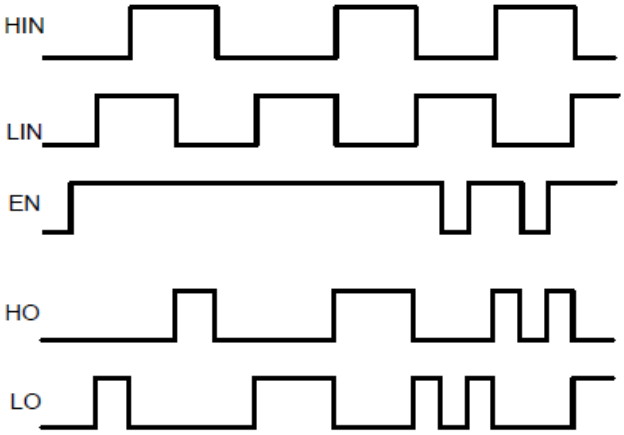


Figure 3. Input / Output Timing Diagram

Typical Performance Characteristics (V_{CC} = 15V, @T_A = +25°C, unless otherwise specified.)

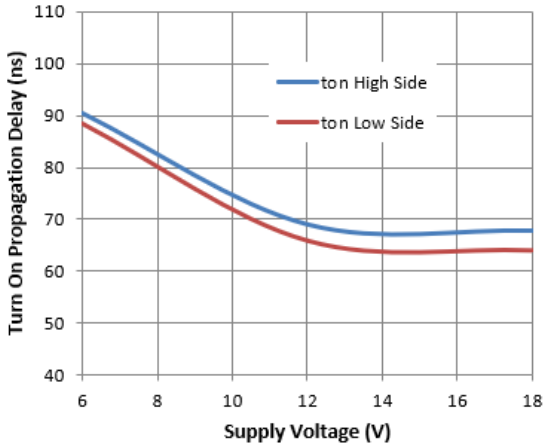


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

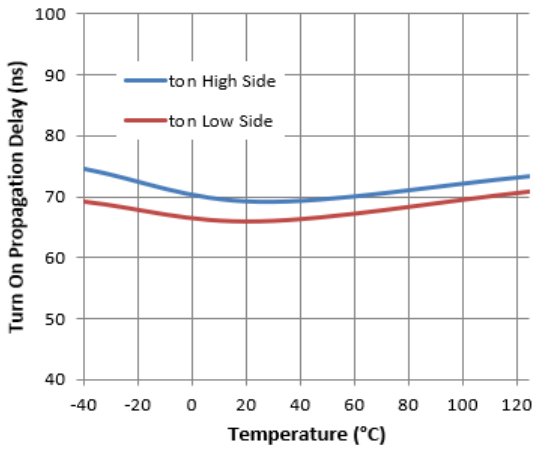


Figure 5. Turn-on Propagation Delay vs. Temperature

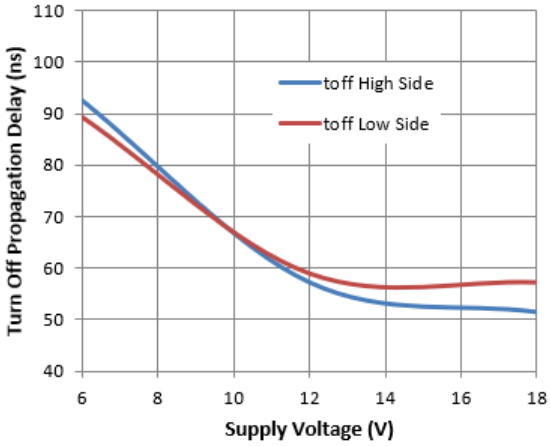


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

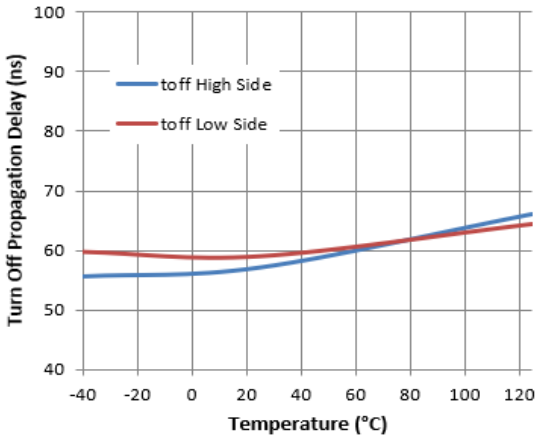


Figure 7. Turn-off Propagation Delay vs. Temperature

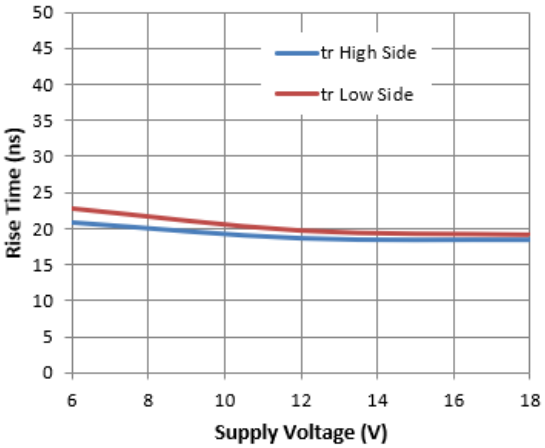


Figure 8. Rise Time vs. Supply Voltage

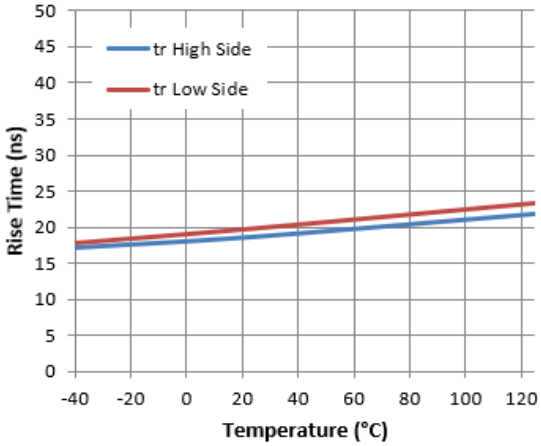


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

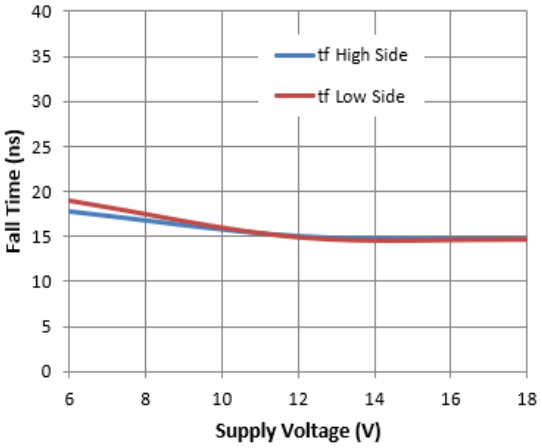


Figure 10. Fall Time vs. Supply Voltage

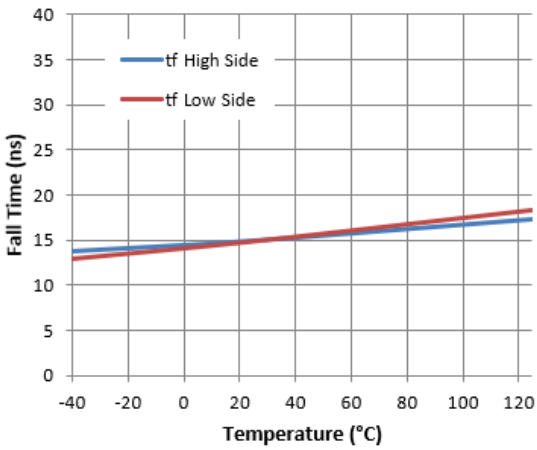


Figure 11. Fall Time vs. Temperature

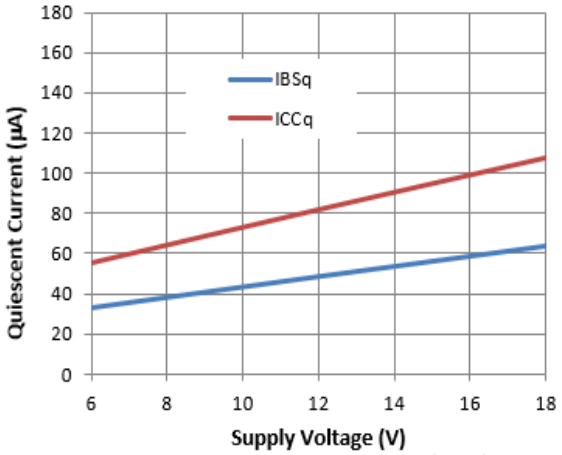


Figure 12. Quiescent Current vs. Supply Voltage

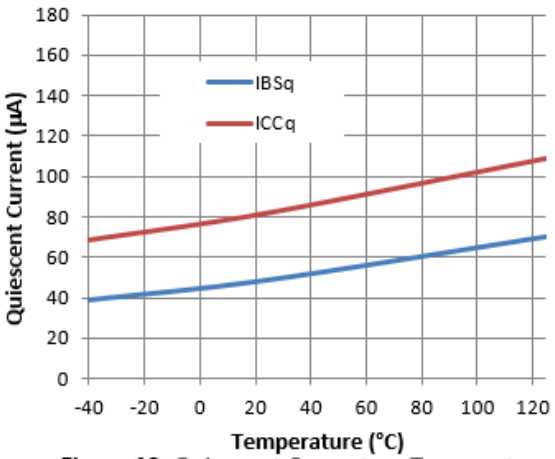


Figure 13. Quiescent Current vs. Temperature

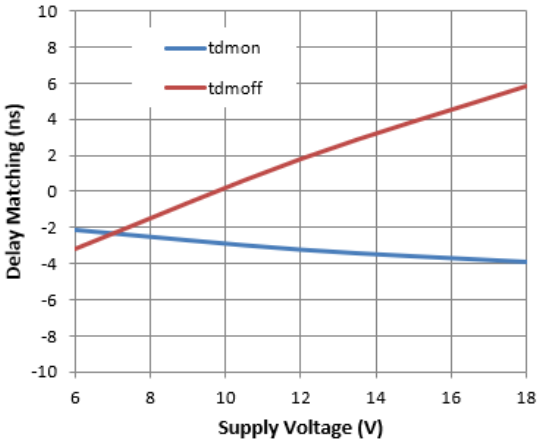


Figure 14. Delay Matching vs. Supply Voltage

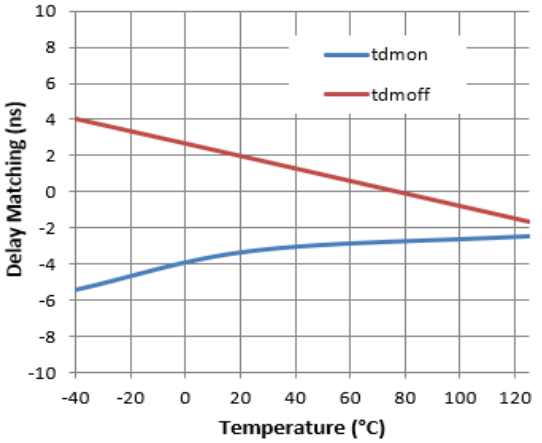


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (continued)

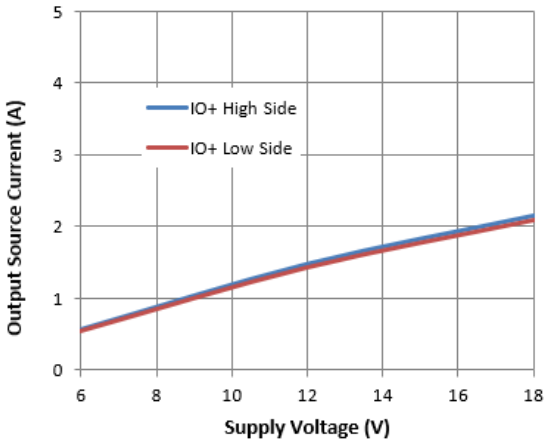


Figure 16. Output Source Current vs. Supply Voltage

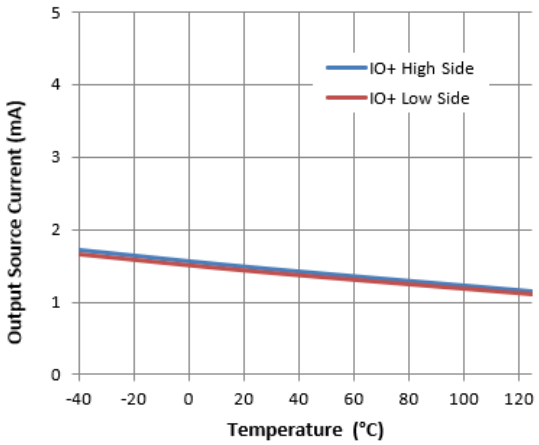


Figure 17. Output Source Current vs. Temperature

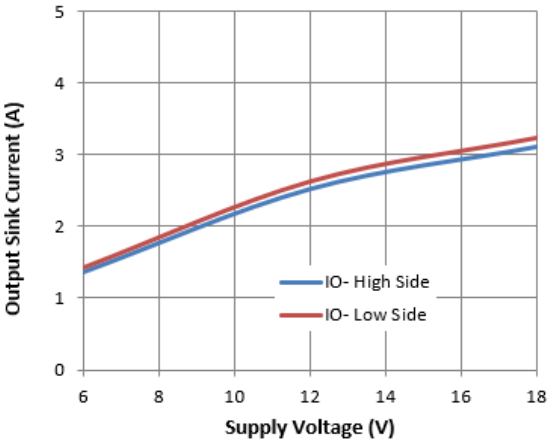


Figure 18. Output Sink Current vs. Supply Voltage

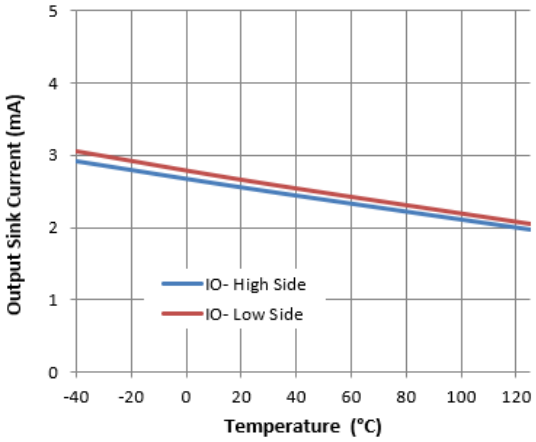


Figure 19. Output Sink Current vs. Temperature

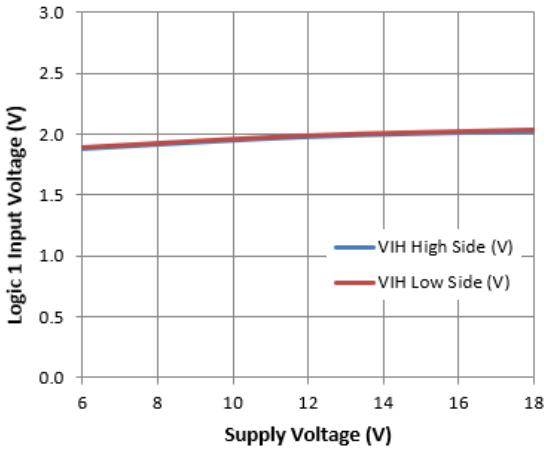


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

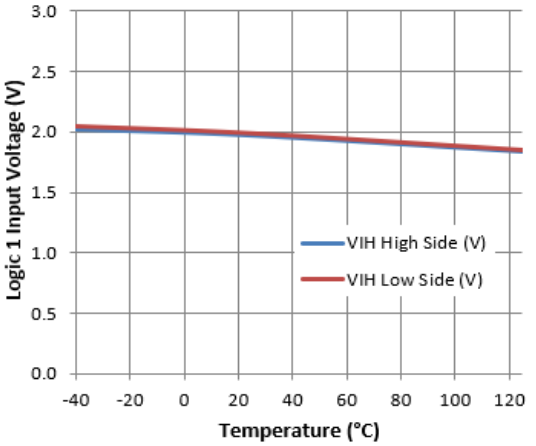


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (continued)

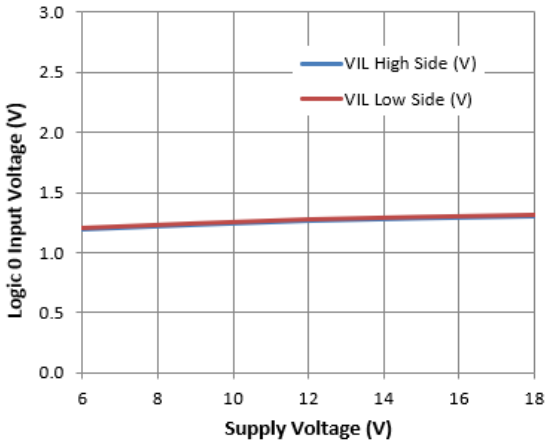


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

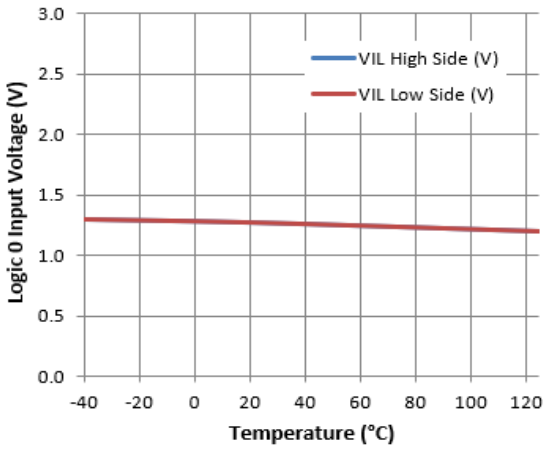


Figure 23. Logic 0 Input Voltage vs. Temperature

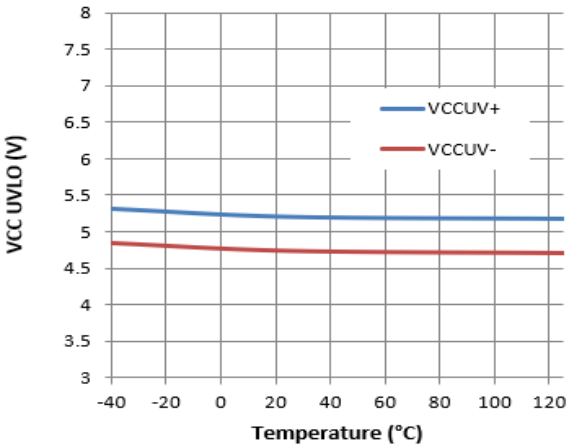


Figure 24. VCC UVLO vs. Temperature

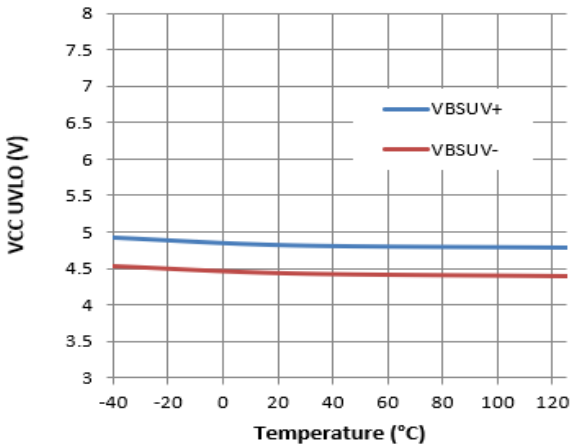


Figure 25. VBS UVLO vs. Temperature

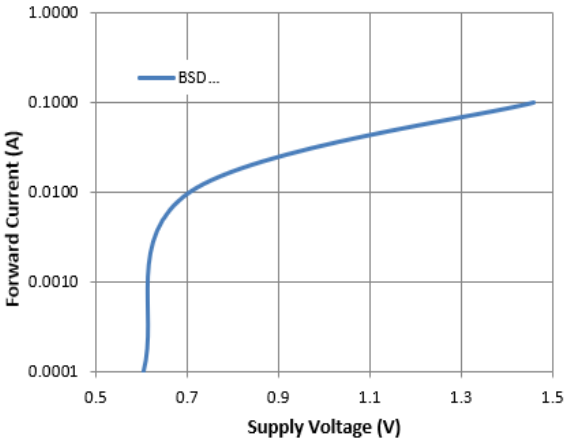


Figure 26. Bootstrap Diode I-V Characteristics

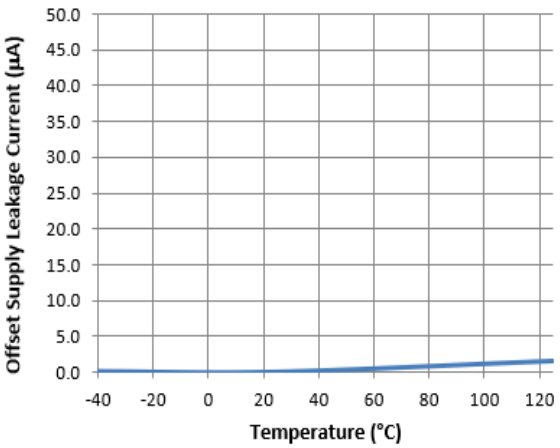
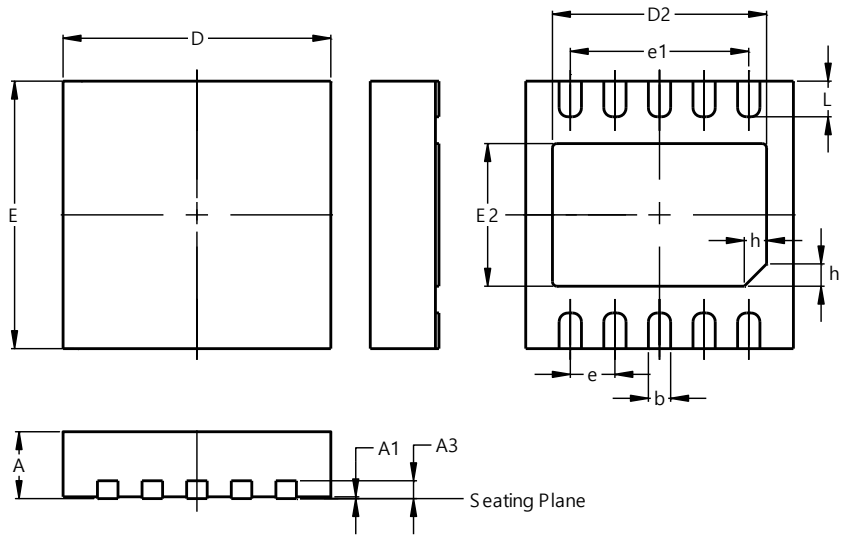


Figure 27. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

W-DFN3030-10 (Type TH)

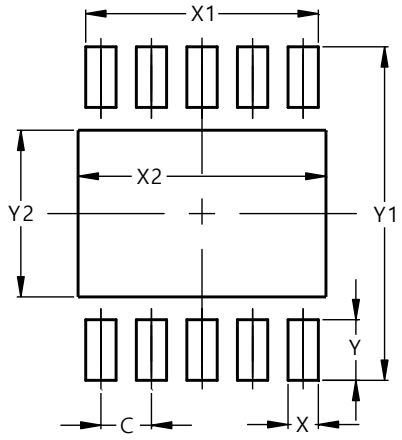


W-DFN3030-10 (Type TH)			
Dim	**Min**	**Max**	**Typ**
A	0.70	0.80	0.75
A1	--	0.05	0.02
A3	0.18	0.25	0.20
b	0.18	0.30	0.25
D	2.90	3.10	3.00
D2	2.40	2.60	2.50
e	0.50BSC		
e1	2.00BSC		
E	2.90	3.10	3.00
E2	1.45	1.65	1.55
h	0.20	0.30	0.25
L	0.30	0.50	0.40
All Dimensions in mm			

Suggested Pad Layout

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

W-DFN3030-10 (Type TH)



Dimensions	Value (in mm)
C	0.500
X	0.300
X1	2.300
X2	2.600
Y	0.600
Y1	3.300
Y2	1.650

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