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

The DGD0507 is a high-frequency gate driver capable of driving N-channel MOSFETs. The floating high-side driver can switch to 50V in a bootstrap configuration.

The DGD0507 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with MCUs. UVLO for high-side and low-side will protect a MOSFET with loss of supply. To protect MOSFETs, cross conduction prevention logic prevents the HO and LO outputs from 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. The DGD0507 is offered in the W-DFN3030-10 (Type TH) package and operates over an extended -40°C to +125°C temperature range.

Applications

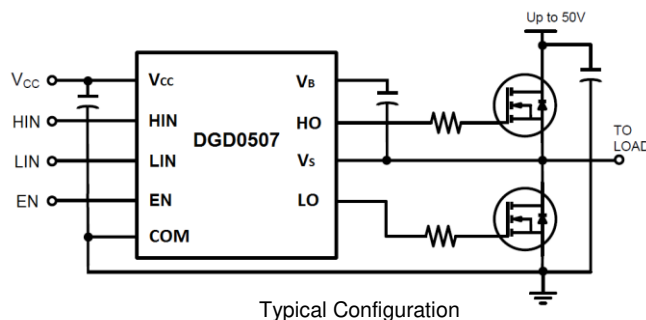
- DC-DC Converters
- Motor Controls
- Battery Powered Hand Tools
- eCig Devices
- Class D Power Amplifiers

Features

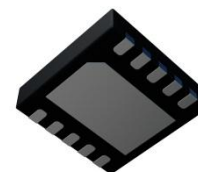
- Floating high-side driver in bootstrap operation to 50V
- Drives two N-channel MOSFETs in a half-bridge configuration
- 1.5A source / 2.5A sink output current capability
- Internal bootstrap diode included
- Undervoltage lockout for high-side and low-side drivers
- Delay matching a typical of 5ns
- Propagation delay a typical of 35ns
- Logic input (HIN, LIN and EN) 3.3V capability
- Ultra low standby currents (<math>< \mu\text{A}</math>)
- 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)**

Mechanical Data

- Case: W-DFN3030-10 (Type TH)
- Case 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
- Weight: 0.017 grams (Approximate)



Top View



Bottom View

W-DFN3030-10 (Type TH)

Ordering Information (Note 4)

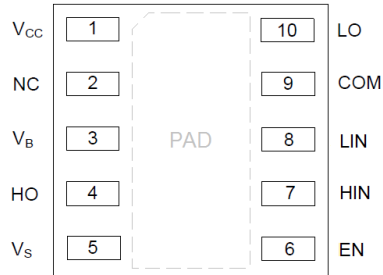
Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DGD0507FN-7	DGD0507	7	8	3,000

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html 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 <math>< 900\text{ppm}</math> bromine, <math>< 900\text{ppm}</math> chlorine (<math>< 1500\text{ppm}</math> total Br + Cl) and <math>< 1000\text{ppm}</math> antimony compounds.
 4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

Marking Information


DGD0507 = Product Type Marking Code
 YY = Year (ex: 17 = 2017)
 WW = Week (01 - 53)

Pin Diagrams

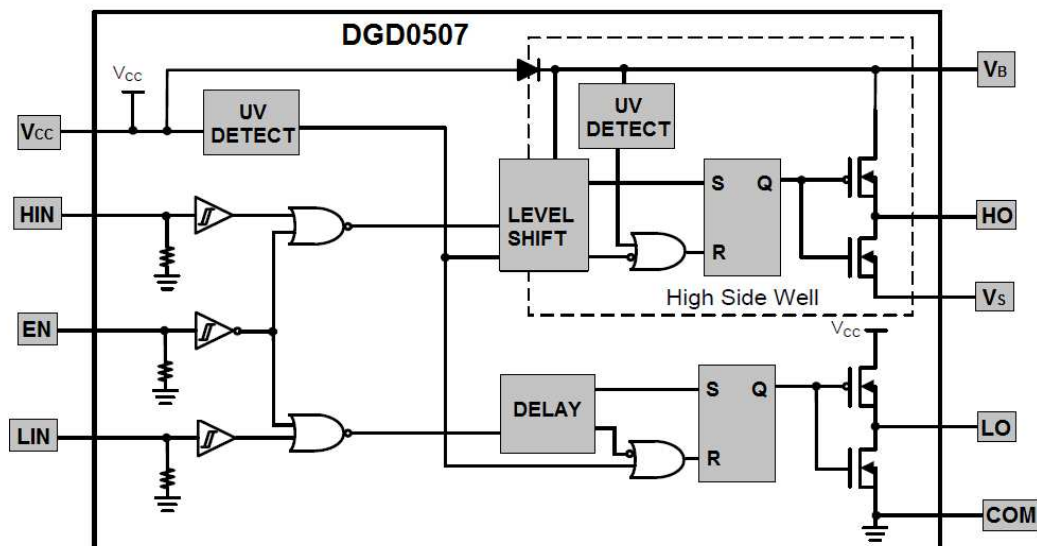


Top view: W-DFN3030-10 (Type TH)

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 +50	V
High-Side Floating Negative Supply Voltage	V _S	V _B -14 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 +15	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 15	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 _{θJA}	64	°C/W
Thermal Resistance, Junction to Case (Note 5)	R _{θJC}	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 + 8	V _S + 14	V
High-Side Floating Supply Offset Voltage	V _S	(Note 6)	40	V
High-Side Floating Output Voltage	V _{HO}	V _S	V _B	V
Logic and Low Side Fixed Supply Voltage	V _{CC}	8	14	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

Note: 6. Logic operation for V_S of -5V to +50V. Logic state held for V_S of -5V to -V_{BS}.

DC Electrical Characteristics ($V_{CC} = V_{BS} = 12V$, $COM = V_S = 0V$, $@T_A = +25^\circ C$, unless otherwise specified.) (Note 7)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic "1" Input Voltage	V_{IH}	2.5	–	–	V	–
Logic "0" Input Voltage	V_{IL}	–	–	1.0	V	–
Enable Logic "1" Input Voltage	V_{ENIH}	1.5	–	–	V	–
Enable Logic "0" Input Voltage	V_{ENIL}	–	–	0.7	V	–
Input Voltage Hysteresis	V_{INHYS}	–	0.6	–	V	–
Enable Input Voltage Hysteresis	$V_{ENINHYS}$	–	0.1	–	V	–
High Level Output Voltage, $V_{BIAS} - V_O$	V_{OH}	–	0.45	0.6	V	$I_{O+} = 100mA$
Low Level Output Voltage, V_O	V_{OL}	–	0.15	0.22	V	$I_{O-} = 100mA$
Offset Supply Leakage Current	I_{LK}	–	10	50	μA	$V_B = V_S = 50V$
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}	100	150	200	μA	$V_{IN} = 0V$ or $5V$
V_{CC} Operating Supply Current	I_{CCOP}	–	3.0	5.0	mA	$f_s = 500kHz$
V_{BS} Quiescent Supply Current	I_{BSQ}	–	62	100	μA	$V_{IN} = 0V$ or $5V$
V_{BS} Operating Supply Current	I_{BSOP}	–	2.8	3.0	mA	$f_s = 500kHz$
Logic "1" Input Bias Current	I_{IN+}	–	–	50	μA	$V_{IN} = 5V$
Logic "0" Input Bias Current	I_{IN-}	–	–	5	μA	$V_{IN} = 0V$
Enable Logic "1" Input Bias Current	I_{ENIN+}	–	43	60	μA	$V_{IN} = 5V$
Enable Logic "0" Input Bias Current	I_{ENIN-}	–	0	5	μA	$V_{IN} = 0V$
V_{BS} Supply Undervoltage Positive Going Threshold	V_{BSUV+}	6.0	6.9	7.8	V	–
V_{BS} Supply Undervoltage Negative Going Threshold	V_{BSUV-}	5.7	6.6	7.5	V	–
V_{CC} Supply Undervoltage Positive Going Threshold	V_{CCUV+}	6.0	6.9	7.8	V	–
V_{CC} Supply Undervoltage Negative Going Threshold	V_{CCUV-}	5.7	6.6	7.5	V	–
Output High Short Circuit Pulsed Current	I_{O+}	0.9	1.4	–	A	$V_O = 0V$, $PW \leq 10\mu s$
Output Low Short Circuit Pulsed Current	I_{O-}	1.5	2.2	–	A	$V_O = 15V$, $PW \leq 10\mu s$
Forward Voltage of Bootstrap Diode	V_{F1}	–	0.3	–	V	$I_F = 100\mu A$
Forward Voltage of Bootstrap Diode	V_{F2}	–	0.8	–	V	$I_F = 100mA$

Note: 7. The V_{IN} and I_{IN} parameters are applicable to the two 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 ($V_{CC} = V_{BS} = 12V$, $COM = V_S = 0V$, $C_L = 1000pF$, $@T_A = +25^\circ C$, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-on Propagation Delay	t_{ON}	–	20	35	ns	–
Turn-off Propagation Delay	t_{OFF}	–	23	35	ns	$V_S = 50V$
Delay Matching, HO & LO turn-on	t_{DM}	–	–	5	ns	–
Turn-on Rise Time	t_r	–	17	35	ns	–
Turn-off Fall Time	t_f	–	13	25	ns	–

Timing Waveforms

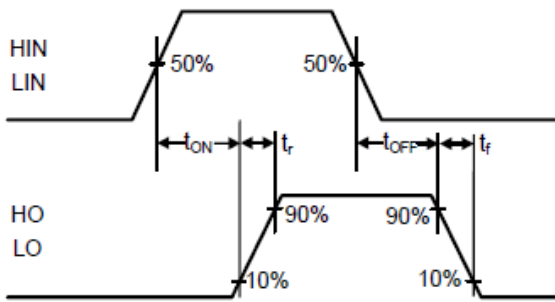


Figure 1. Switching Time Waveform Definitions

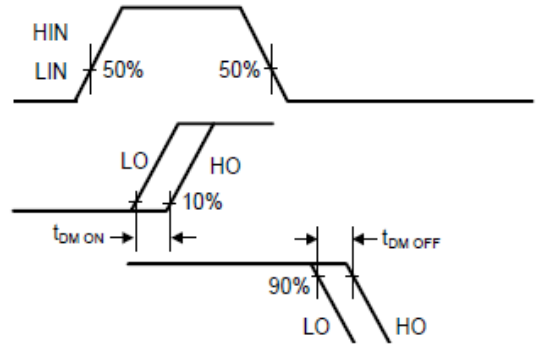


Figure 2. Delay Matching Waveform Definitions

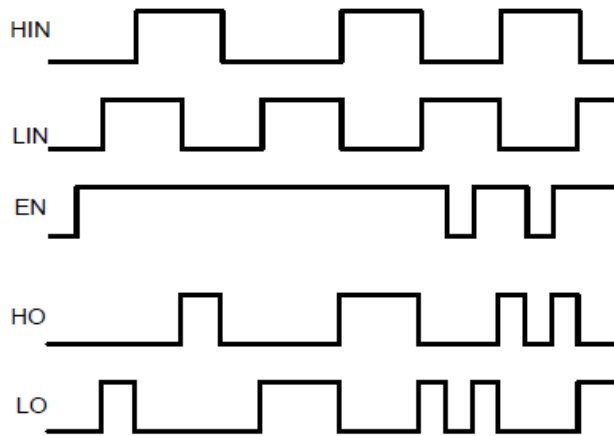


Figure 3. Input / Output Timing Diagram

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

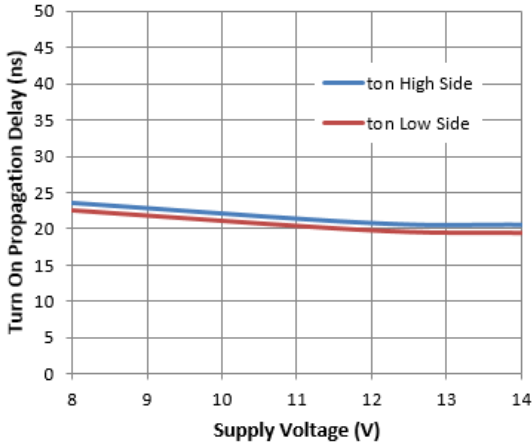


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

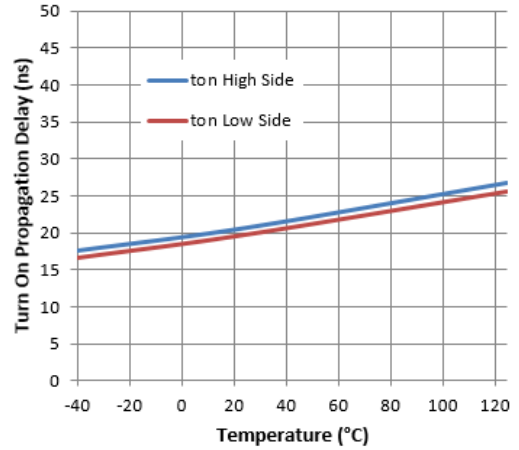


Figure 5. Turn-on Propagation Delay vs. Temperature

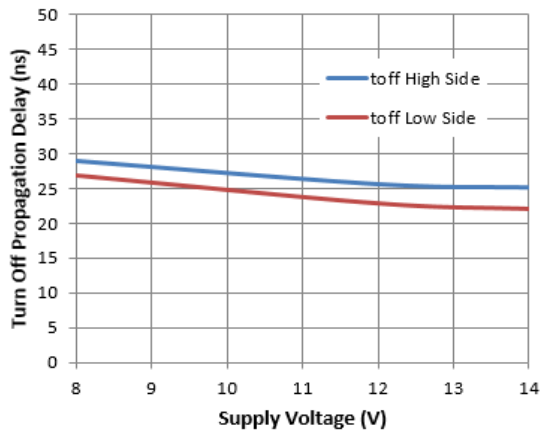


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

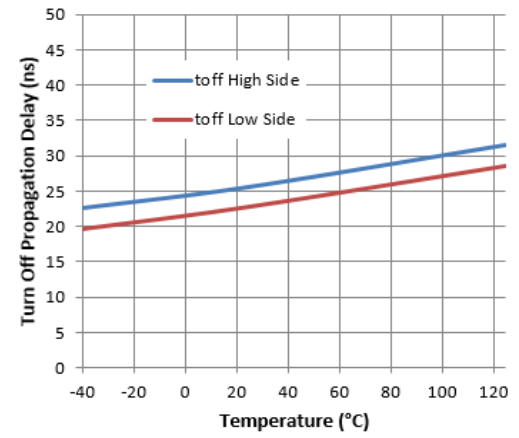


Figure 7. Turn-off Propagation Delay vs. Temperature

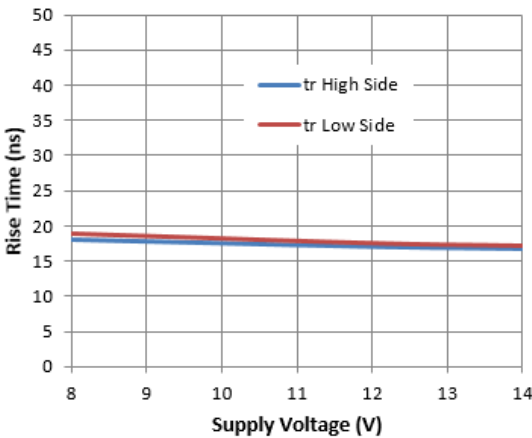


Figure 8. Rise Time vs. Supply Voltage

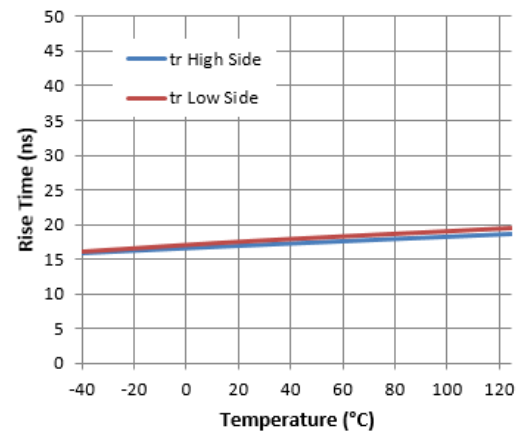


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

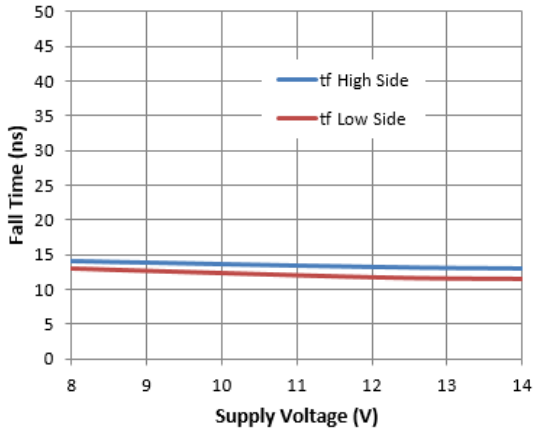


Figure 10. Fall Time vs. Supply Voltage

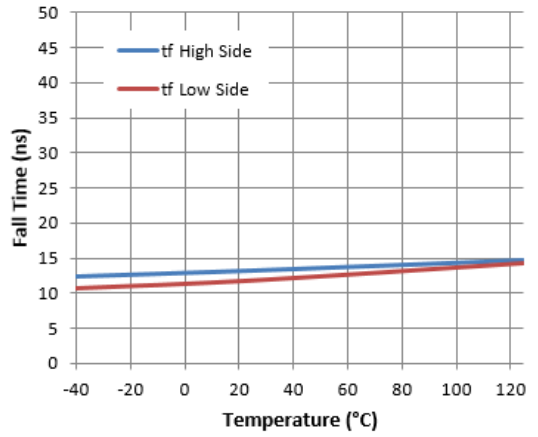


Figure 11. Fall Time vs. Temperature

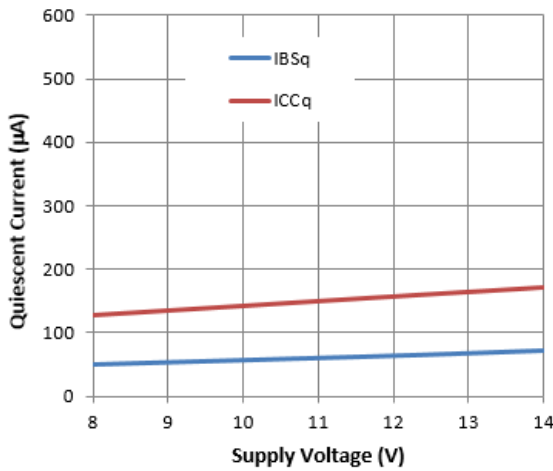


Figure 12. Quiescent Current vs. Supply Voltage

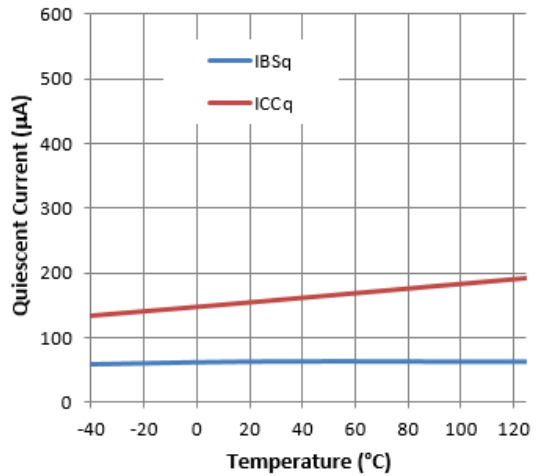


Figure 13. Quiescent Current vs. Temperature

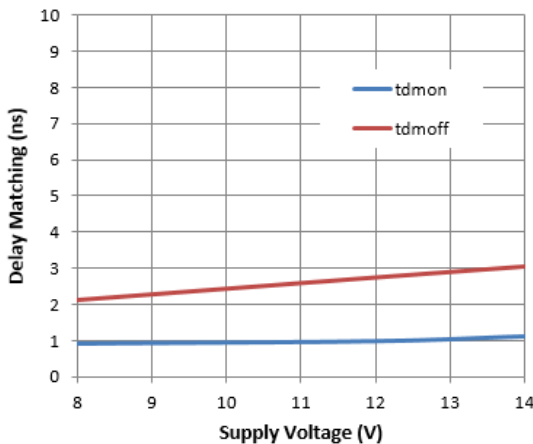


Figure 14. Delay Matching vs. Supply Voltage

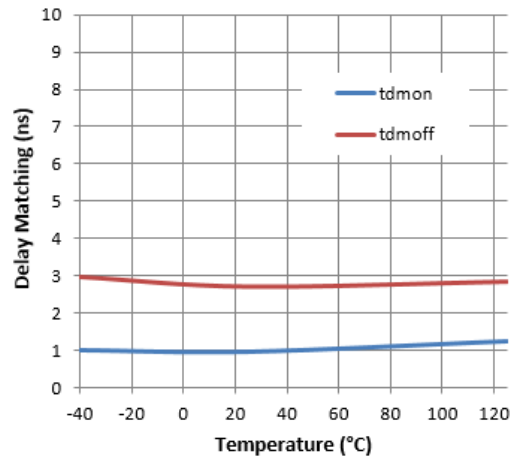


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (cont.)

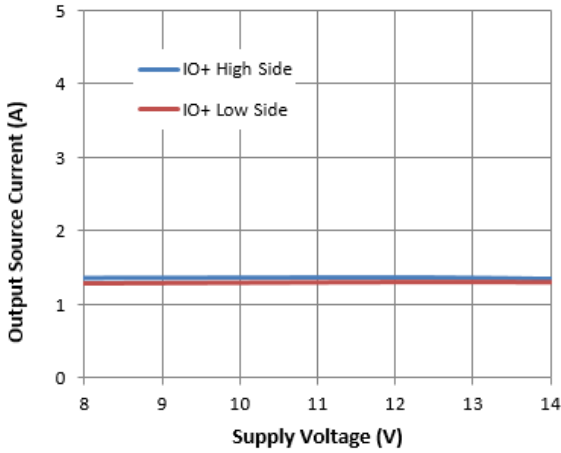


Figure 16. Output Source Current vs. Supply Voltage

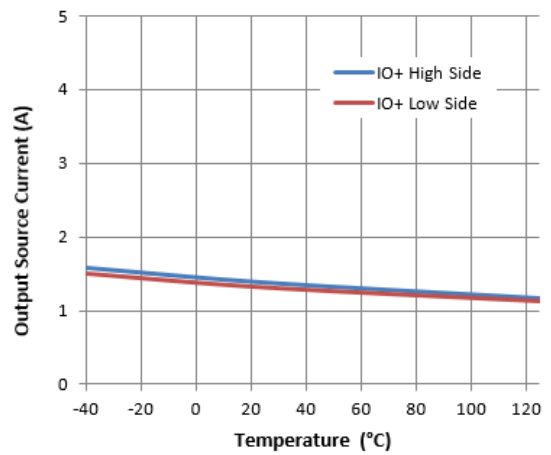


Figure 17. Output Source Current vs. Temperature

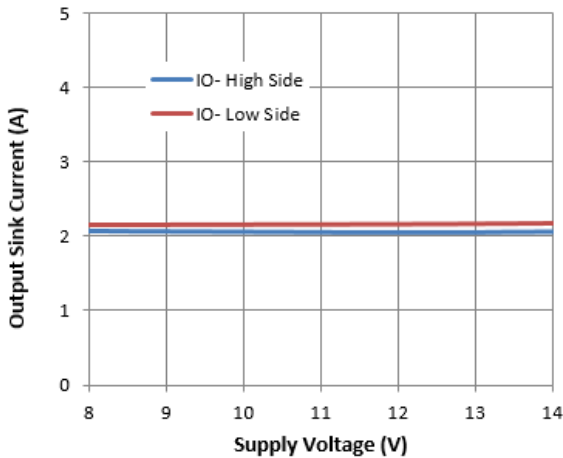


Figure 18. Output Sink Current vs. Supply Voltage

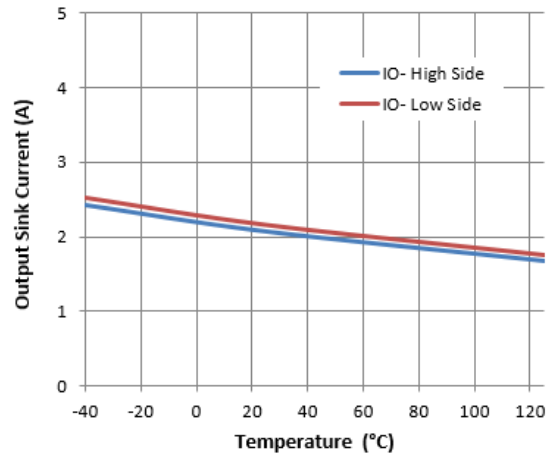


Figure 19. Output Sink Current vs. Temperature

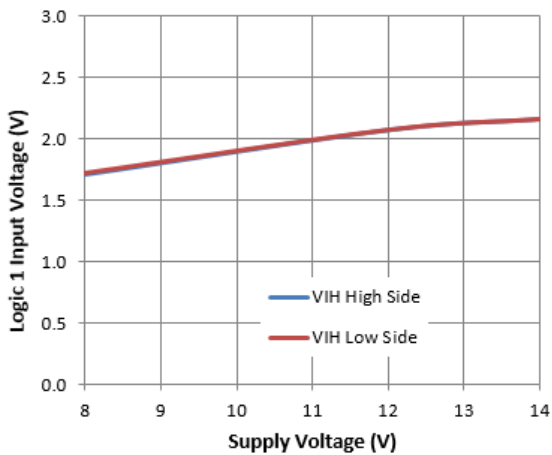


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

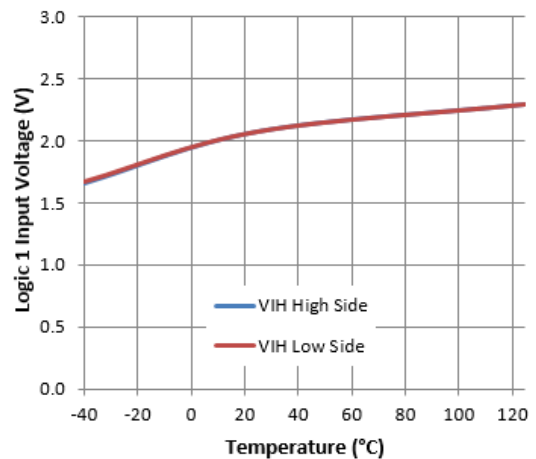


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (cont.)

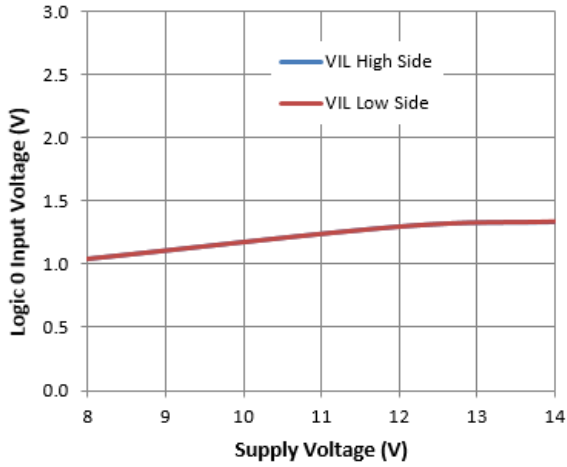


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

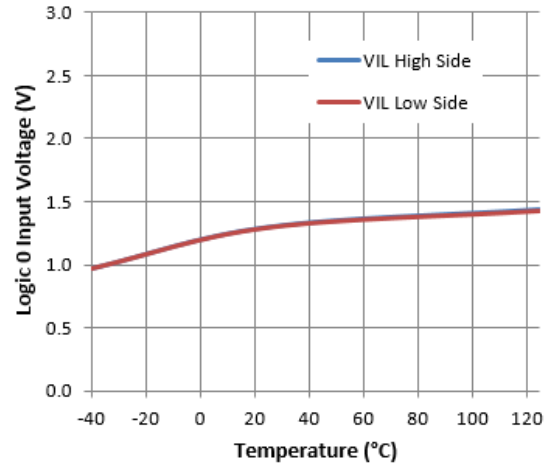


Figure 23. Logic 0 Input Voltage vs. Temperature

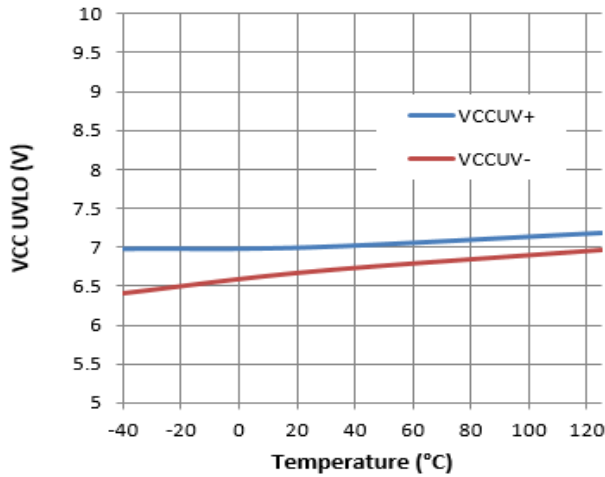


Figure 24. VCC UVLO vs. Temperature

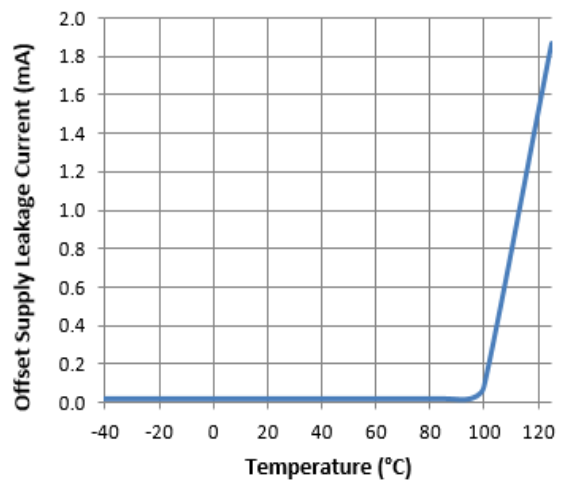
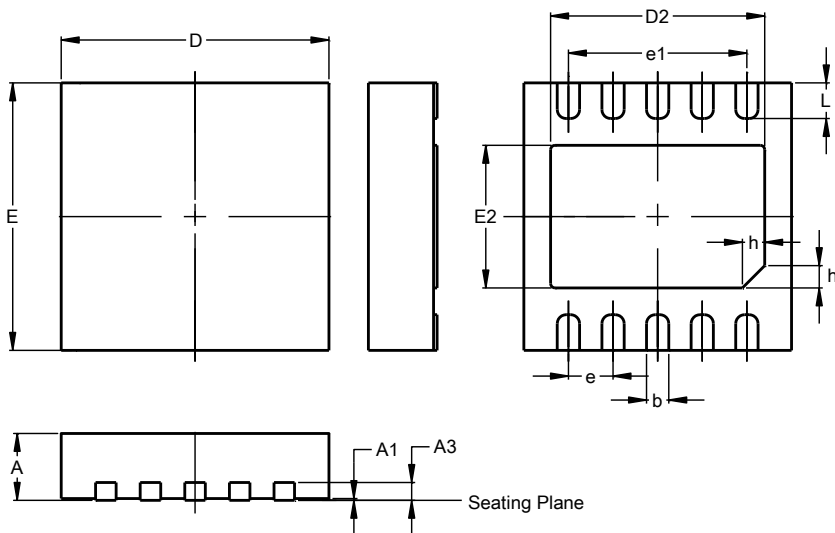


Figure 25. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

W-DFN3030-10 (Type TH)

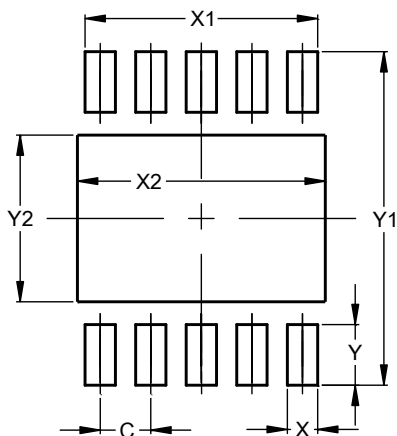


W-DFN3030-10 (Type TH)			
Dim	Min	Max	Typ
A	0.70	0.80	0.75
A1	--	0.05	0.02
A3	0.18	0.25	0.20
b	0.18	0.30	0.25
D	2.90	3.10	3.00
D2	2.40	2.60	2.50
e	0.50BSC		
e1	2.00BSC		
E	2.90	3.10	3.00
E2	1.45	1.65	1.55
h	0.20	0.30	0.25
L	0.30	0.50	0.40
All Dimensions in mm			

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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