Lead-free Green

100V HALF-BRIDGE GATE DRIVER IN W-DFN3030-10

Description

The DIODES™ DGD0503 is a high-voltage, high-speed gate driver capable of driving N-channel MOSFETs and IGBTs in a half-bridge configuration. High voltage processing techniques enable the DGD0503's high side to switch to 100V in a bootstrap operation.

The DGD0503 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with controlling devices. The driver output features high pulse current buffers designed for minimum driver cross conduction. DGD0503 has a fixed internal deadtime of 430ns (typical).

The DGD0503 is offered in the W-DFN3030-10 (Type TH) package and operates over an extended -40°C to +125°C temperature range.

Features

- Floating High-Side Driver in Bootstrap Operation to 100V
- Drives Two N-Channel MOSFETs or IGBTs in a Half-Bridge Configuration
- 290mA Source/600mA Sink Output Current Capability
- Outputs Tolerant to Negative Transients
- Internal Dead Time of 430ns to Protect MOSFETs
- Wide Low-Side Gate Driver Supply Voltage: 10V to 20V
- Logic Input (HIN and LIN*) 3.3V Capability
- Schmitt Triggered Logic Inputs
- Undervoltage Lockout for V_{CC} (Logic and Low-Side Supply)
- 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-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.**
  https://www.diodes.com/quality/product-definitions/

Applications

- DC-DC converters
- DC-AC inverters
- AC-DC power supplies
- Motor controls
- Class-D power amplifiers
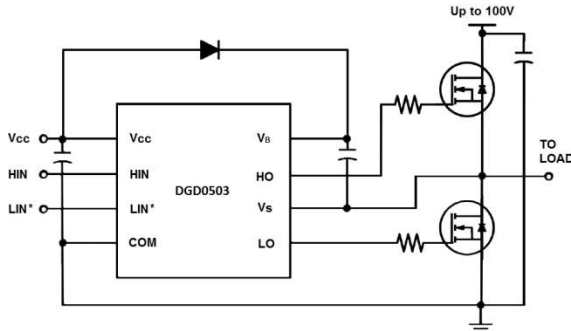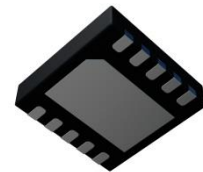
Mechanical Data

- Package: W-DFN3030-10
- 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 ⓔ3
- Weight: 0.017 grams (Approximate)

Typical Configuration

Top View   Bottom View

W-DFN3030-10 (Type TH)

Ordering Information (Note 4)

Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
DGD0503FN-7	W-DFN3030-10 (Type TH)	DGD0503	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.
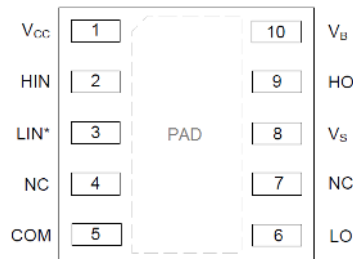4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

YYWW
DGD0503

+

DGD0503 = Product Type Marking Code
YY = Year (ex: 23 = 2023)
WW = Week (01 to 53)

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Pin Diagrams

(Top View)

W-DFN3030-10 (Type TH)

Pin Descriptions

Pin Number	Pin Name	Function
1	V_{CC}	Logic and Low-Side Supply
2	HIN	Logic Input for High-Side Gate Driver Output in Phase with HO
3	LIN*	Logic Input for Low-Side Gate Driver Output out of Phase with LO
4, 7	NC	No Connection (No Internal Connection)
5	COM	Low-Side and Logic Return
6	LO	Low-Side Gate Drive Output
8	V_S	High-Side Floating Supply Return
9	HO	High-Side Gate Drive Output
10	V_B	High-Side Floating Supply
PAD	Substrate	Connect to COM on PCB

Functional Block Diagram

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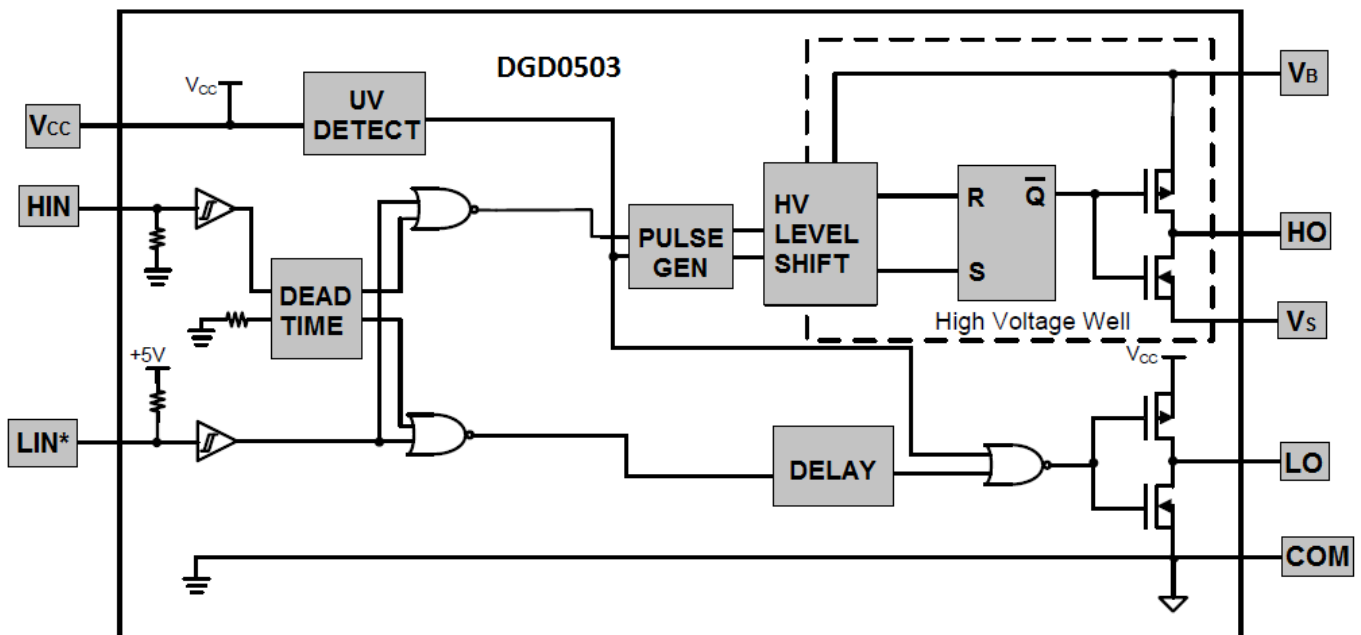
Absolute Maximum Ratings (@T$_A$ = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
High-Side Floating Supply Voltage	V$_B$	-0.3 to +124	V
High-Side Floating Supply Offset Voltage	V$_S$	V$_B$ – 24 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
Low-Side Fixed Supply Voltage	V$_{CC}$	-0.3 to +24	V
Low-Side Output Voltage	V$_{LO}$	-0.3 to V$_{CC}$ + 0.3	V
Logic Input Voltage (HIN and LIN*)	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$_{θJA}$	64	°C/W
Thermal Resistance, Junction to Case (Note 5)	R$_{θJC}$	42	°C/W
Operating Temperature	T$_J$	+150	
Lead Temperature (Soldering, 10s)	T$_L$	+300	°C
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 Absolute Voltage	V$_B$	V$_S$ + 10	V$_S$ + 20	V
High-Side Floating Supply Offset Voltage	V$_S$	(Note 6)	100	V
High-Side Floating Output Voltage	V$_{HO}$	V$_S$	V$_B$	V
Low-Side Fixed Supply Voltage	V$_{CC}$	10	20	V
Low-Side Output Voltage	V$_{LO}$	0	V$_{CC}$	V
Logic-Input Voltage (HIN and LIN*)	V$_{IN}$	0	5	V
Ambient Temperature	T$_A$	-40	+125	°C

Note: 6. Logic operation for V$_S$ of -5V to +100V.

DC Electrical Characteristics (V$_{BIAS}$ (V$_{CC}$, V$_{BS}$) = 15V, @T$_A$ = +25°C, unless otherwise specified.) (Note 7)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic "1" (HIN) & Logic "0" (LIN*) Input Voltage	V$_{IH}$	2.5	—	—	V	V$_{CC}$ = 10V to 20V
Logic "0" (HIN) & Logic "1" (LIN*) Input Voltage	V$_{IL}$	—	—	0.8	V	V$_{CC}$ = 10V to 20V
High-Level Output Voltage, V$_{BIAS}$ – V$_O$	V$_{OH}$	—	0.05	0.2	V	I$_O$ = 2mA
Low-Level Output Voltage, V$_O$	V$_{OL}$	—	0.02	0.1	V	I$_O$ = 2mA
Offset Supply Leakage Current	I$_{LK}$	—	—	50	µA	V$_B$ = V$_S$ = 100V
Quiescent V$_{BS}$ Supply Current	I$_{BSQ}$	—	60	100	µA	V$_{IN}$ = 0V or 5V
Quiescent V$_{CC}$ Supply Current	I$_{CCQ}$	—	350	500	µA	V$_{IN}$ = 0V or 5V
Logic "1" Input Bias Current	I$_{IN+}$	—	3	10	µA	HIN = 5V, LIN* = 0V
Logic "0" Input Bias Current	I$_{IN-}$	—	—	5.0	µA	HIN = 0V, LIN* = 5V
V$_{CC}$ Supply Undervoltage Positive Going Threshold	V$_{CCUV+}$	7.4	8.5	9.6	V	—
V$_{CC}$ Supply Undervoltage Negative Going Threshold	V$_{CCUV-}$	7.1	7.8	8.8	V	—
V$_{BS}$ Supply Undervoltage Positive Going Threshold	V$_{BSUV+}$	5.5	6.5	7.5	V	—
V$_{BS}$ Supply Undervoltage Negative Going Threshold	V$_{BSUV-}$	5.3	6.3	7.3	V	—
Output High Short-Circuit Pulsed Current	I$_{O+}$	130	290	—	mA	V$_O$ = 0V, PW ≤ 10µs
Output Low Short-Circuit Pulsed Current	I$_{O-}$	270	600	—	mA	V$_O$ = 15V, PW ≤ 10µs

Note: 7. The V$_{IN}$ and I$_{IN}$ parameters are applicable to the two logic pins: HIN and LIN*. The V$_O$ and I$_O$ parameters are applicable to the respective output pins: HO and LO.

AC Electrical Characteristics (V$_{BIAS}$ (V$_{CC}$, V$_{BS}$) = 15V, C$_L$ = 1000pF, @T$_A$ = +25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-On Propagation Delay	t$_{ON}$	—	680	820	ns	V$_S$ = 0V
Turn-Off Propagation Delay	t$_{OFF}$	—	150	220	ns	V$_S$ = 100V
Delay Matching, HO & LO Turn-On/Turn-Off	t$_{DM}$	—	—	60	ns	—
Turn-On Rise Time	t$_R$	—	70	170	ns	V$_S$ = 0V
Turn-Off Fall Time	t$_F$	—	35	90	ns	V$_S$ = 0V
Deadtime: t$_{DT\ LO-HO}$ & t$_{DT\ HO-LO}$	t$_{DT}$	300	430	550	ns	—

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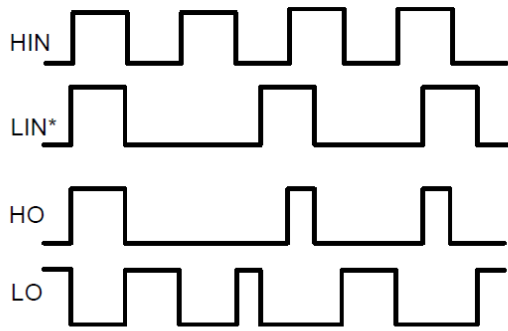
Timing Waveforms

Figure 1. Input / Output Timing Diagram
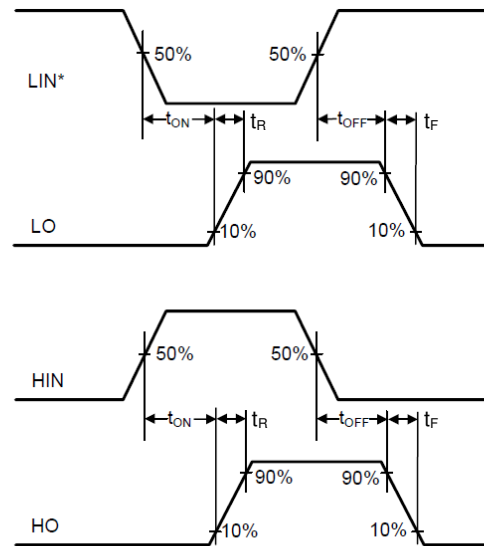

Figure 2. Switching Time Waveform Definitions
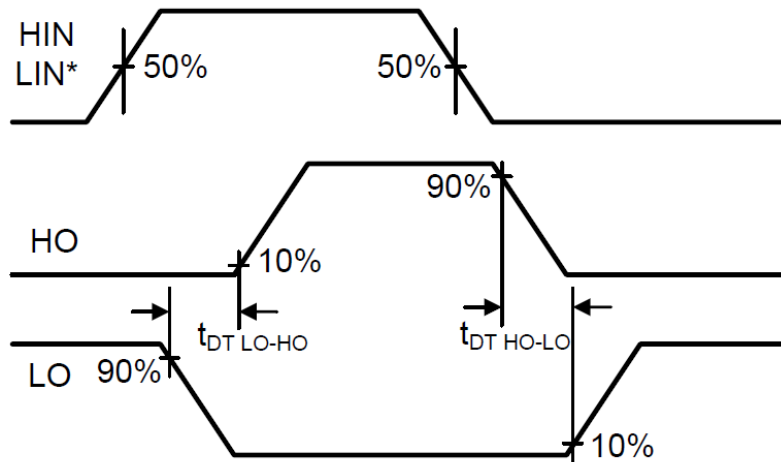

Figure 3. Deadtime Waveform Definitions

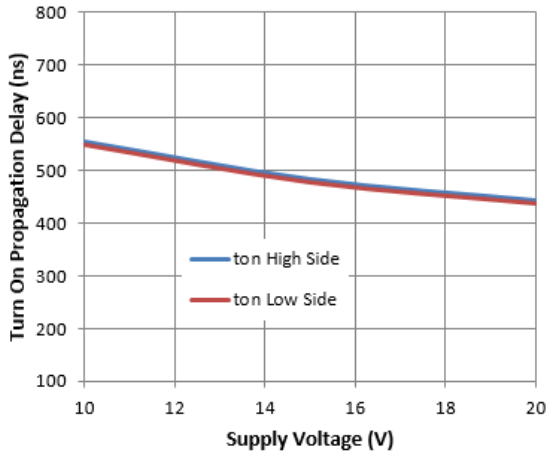## Typical Performance Characteristics (@T$_A$ = +25°C, unless otherwise specified.)

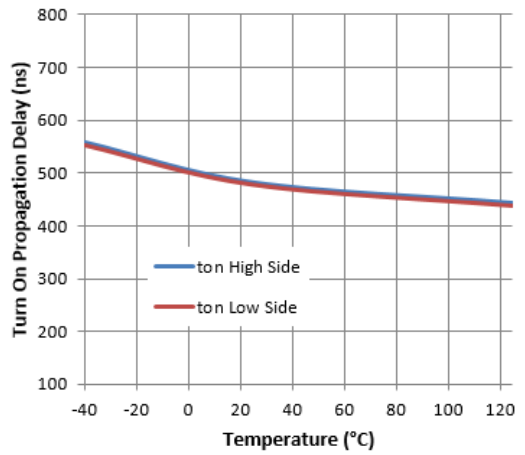**Figure 4.** Turn-on Propagation Delay vs. Supply Voltage

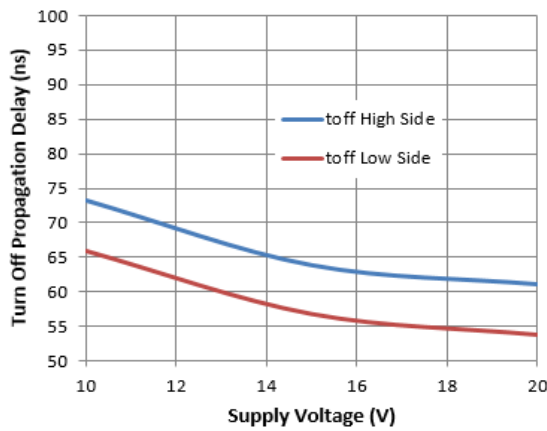**Figure 5.** Turn-on Propagation Delay vs. Temperature

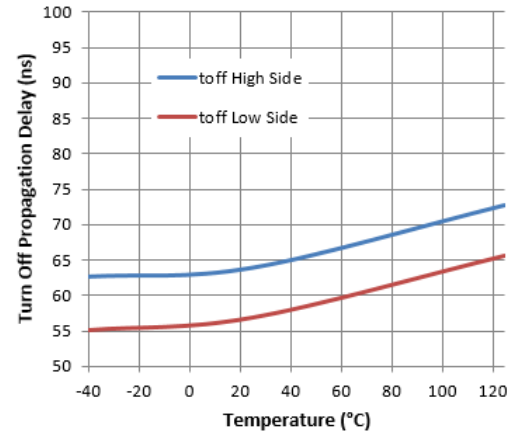**Figure 6.** Turn-off Propagation Delay vs. Supply Voltage
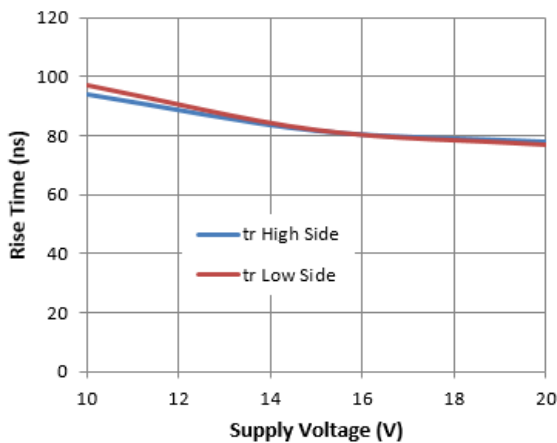
Figure 7. Turn-off Propagation Delay vs. Temperature

Figure 8. Rise Time vs. Supply Voltage
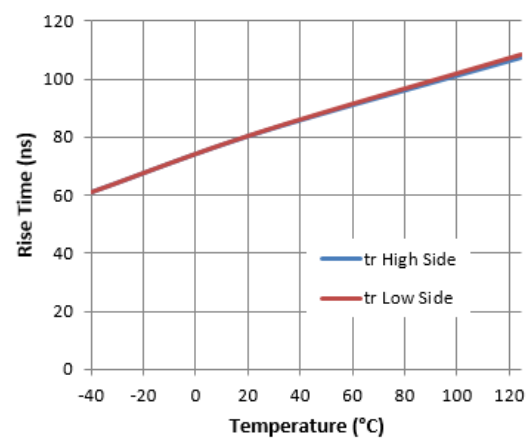
Figure 9. Rise Time vs. Temperature

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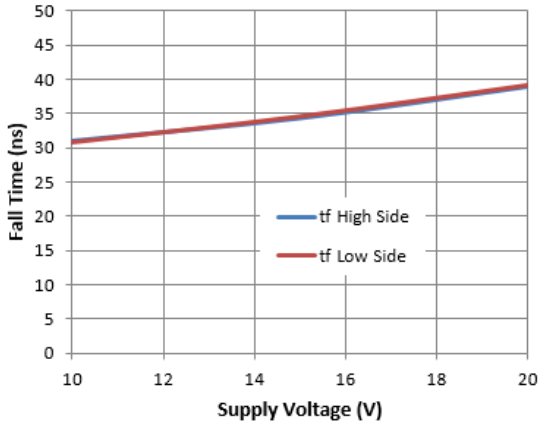
Figure 10. Fall Time vs. Supply Voltage
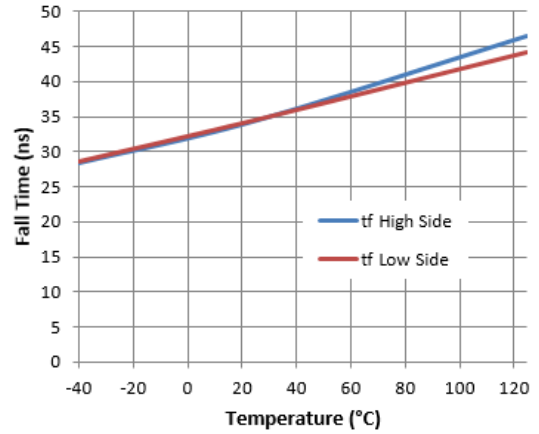
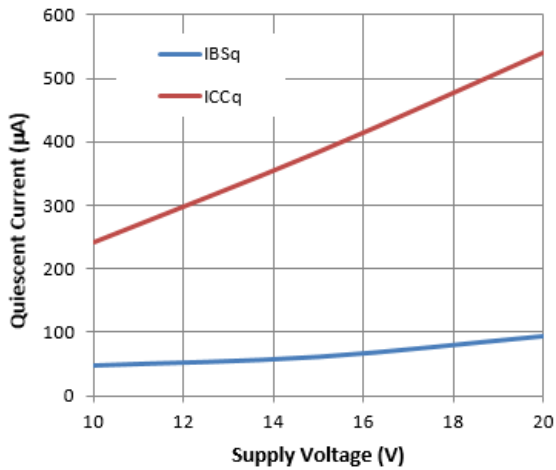**Figure 11.** Fall Time vs. Temperature

Figure 12. Quiescent Current vs. Supply Voltage

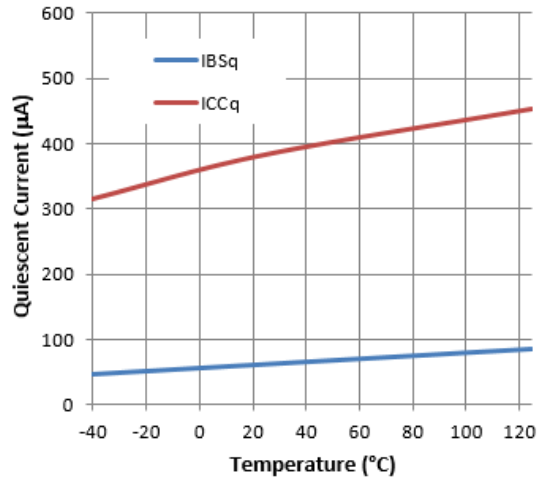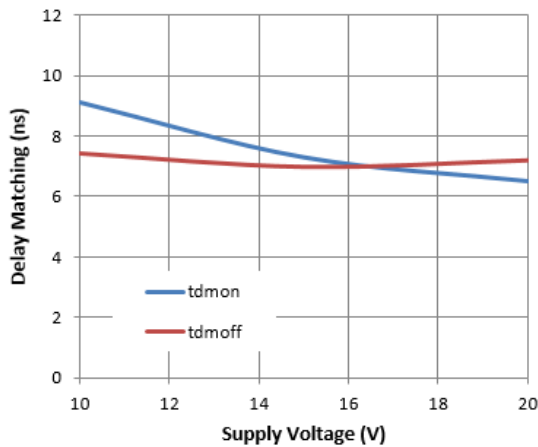**Figure 13.** Quiescent Current vs. Temperature
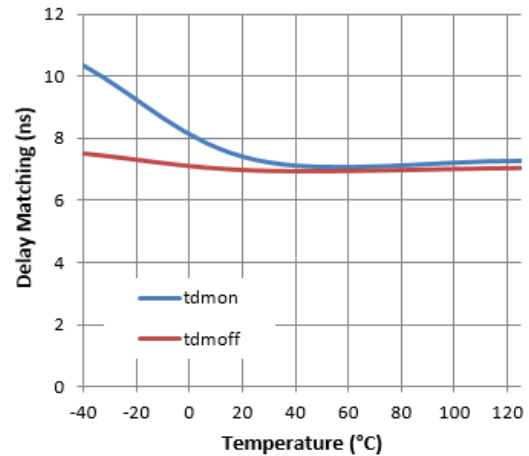

Figure 14. Delay Matching vs. Supply Voltage

Figure 15. Delay Matching vs. Temperature

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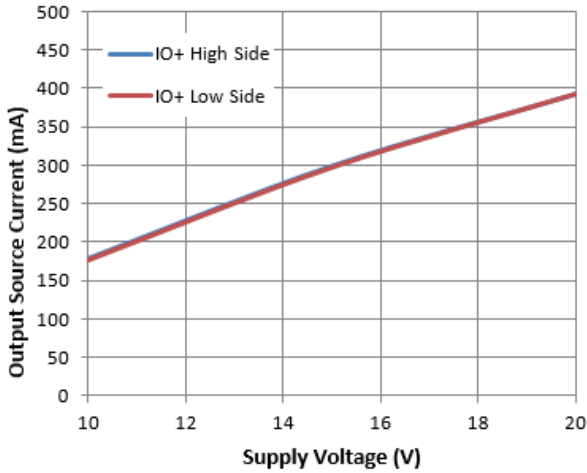

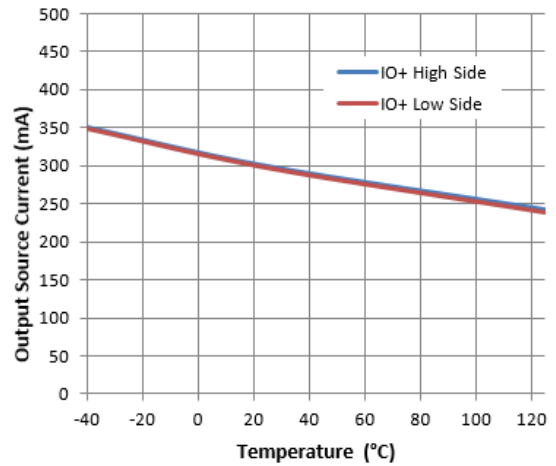**Figure 16.** Output Source Current vs. Supply Voltage

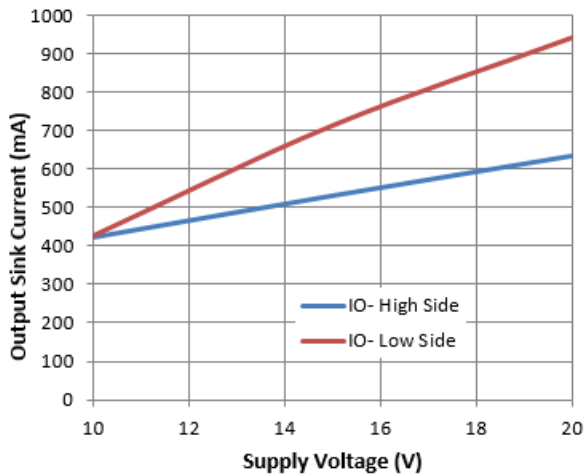**Figure 17.** Output Source Current vs. Temperature
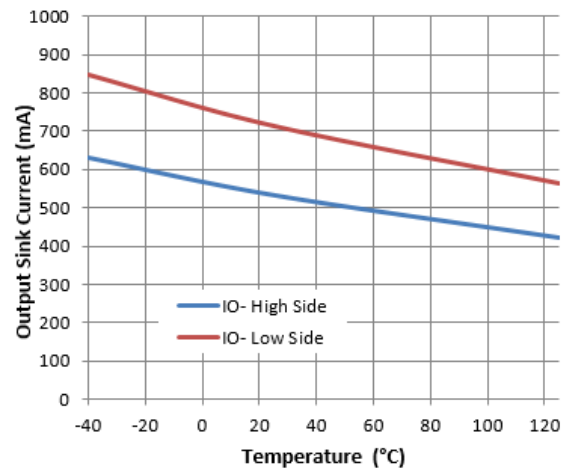

Figure 18. Output Sink Current vs. Supply Voltage
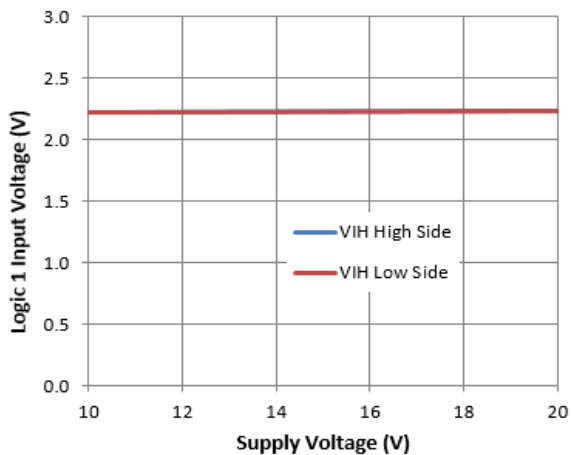

Figure 19. Output Sink Current vs. Temperature

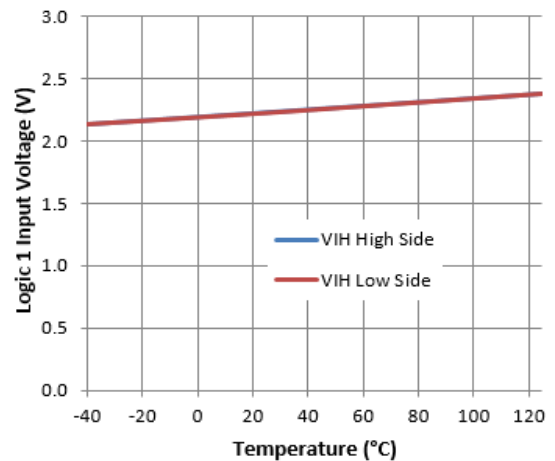**Figure 20.** Logic 1 Input Voltage vs. Supply Voltage

Figure 21. Logic 1 Input Voltage vs. Temperature

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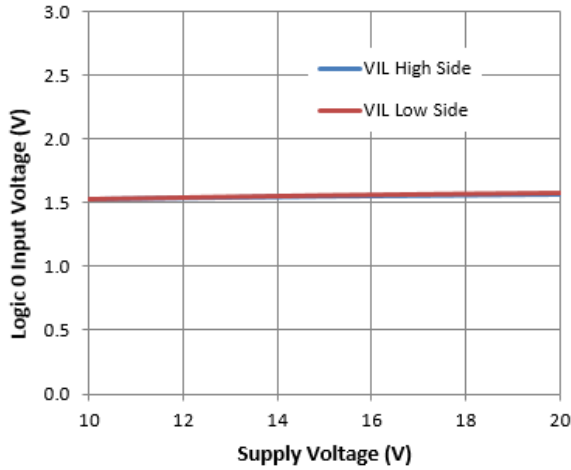

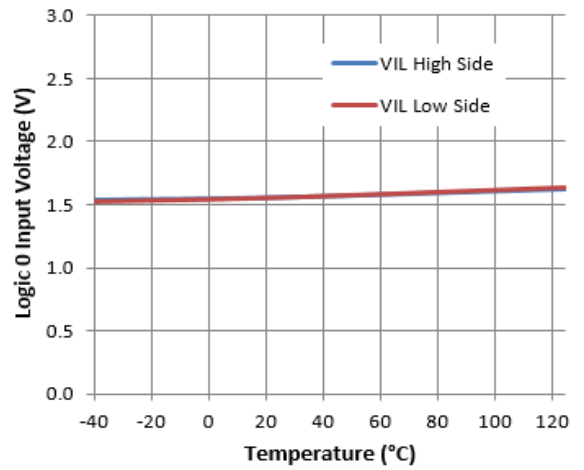Figure 22. Logic 0 Input Voltage vs. Supply Voltage

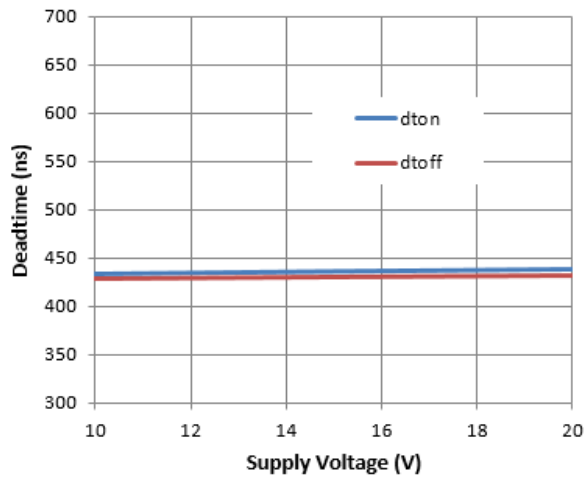Figure 23. Logic 0 Input Voltage vs. Temperature

Figure 24. Deadtime vs. Supply Voltage
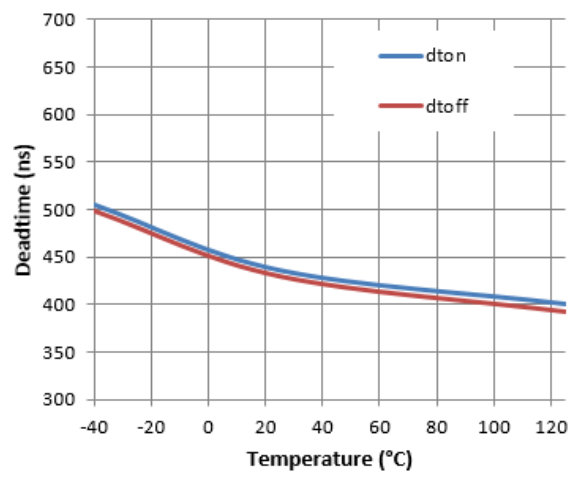

Figure 25. Deadtime vs. Temperature

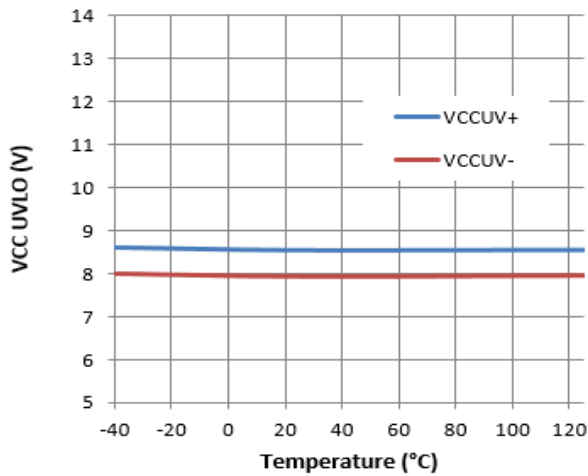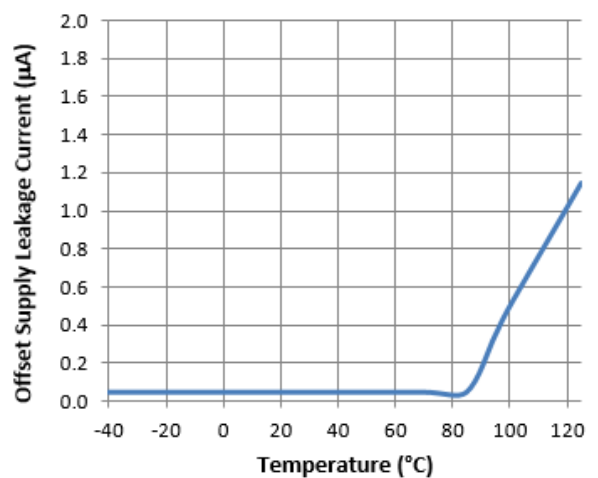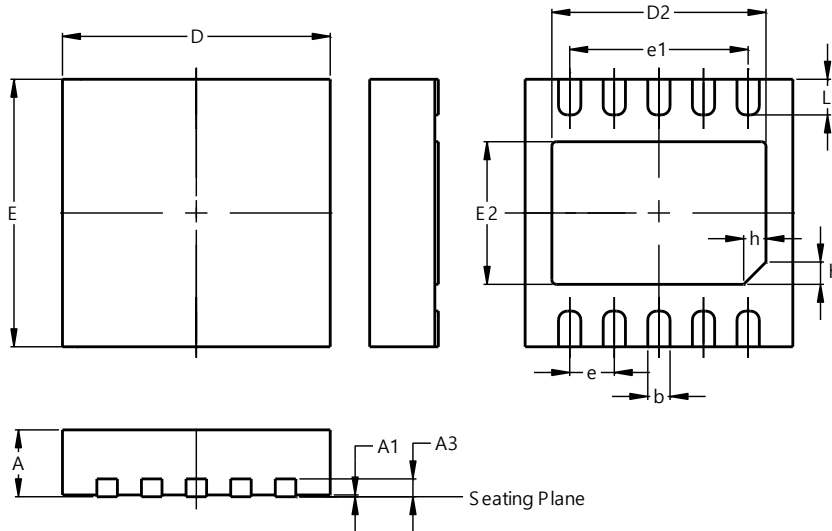Figure 26. VCC UVLO vs. Temperature

Figure 27. Offset Supply Leakage Current vs. Temperature

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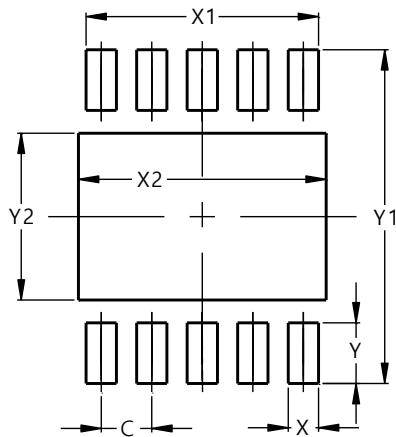
Dimensions	Value (in mm)
C	0.500
X	0.300
X1	2.300
X2	2.600
Y	0.600
Y1	3.300
Y2	1.650

Note: For high voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device Terminals and PCB tracking.

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