Description

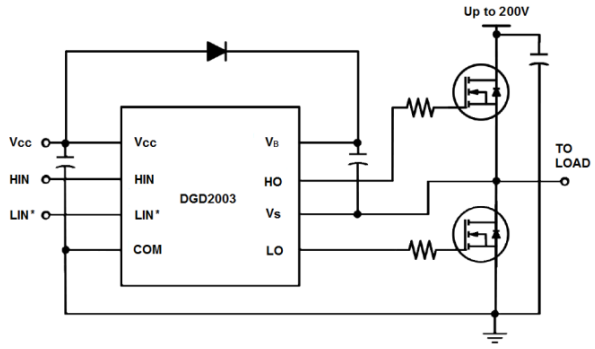
The DGD2003 is a high-voltage / high-speed gate driver capable of driving N-channel MOSFETs in a half-bridge configuration. High voltage processing techniques enable the DGD2003's high side to switch to 200V in a bootstrap operation.

The DGD2003 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. The DGD2003 has a fixed internal deadtime of 420ns (typical).

The DGD2003 is offered in the SO-8 package and operates over an extended -40°C to +125°C temperature range.

Applications

- Battery Power Tools and Appliances
- Light Electric Vehicles (LEV)
- Inverters



Typical Configuration

Features

- Floating High-Side Driver in Bootstrap Operation to 200V
- Drives Two N-Channel MOSFETs in a Half-Bridge Configuration
- 290mA Source/600mA Sink Output Current Capability
- Outputs Tolerant to Negative Transients
- Internal Dead Time of 420ns 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 High-Side and Low-Side Drivers
- 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

- Case: SO-8 (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 Plated Leads. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.075 grams (Approximate)

SO-8

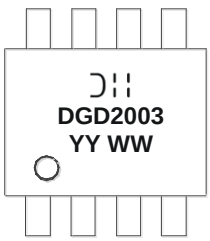
Top View

Ordering Information (Note 4)

Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
DGD2003S8-13	DGD2003	13	12	2,500

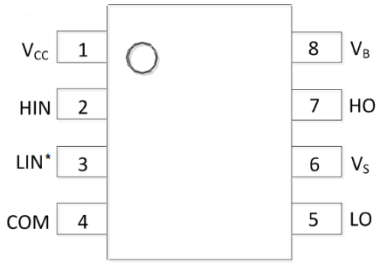
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- 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



= Manufacturer's Marking
DGD2003 = Product Type Marking Code
YY = Year (ex: 19 = 2019)
WW = Week (01 to 53)

Pin Diagrams

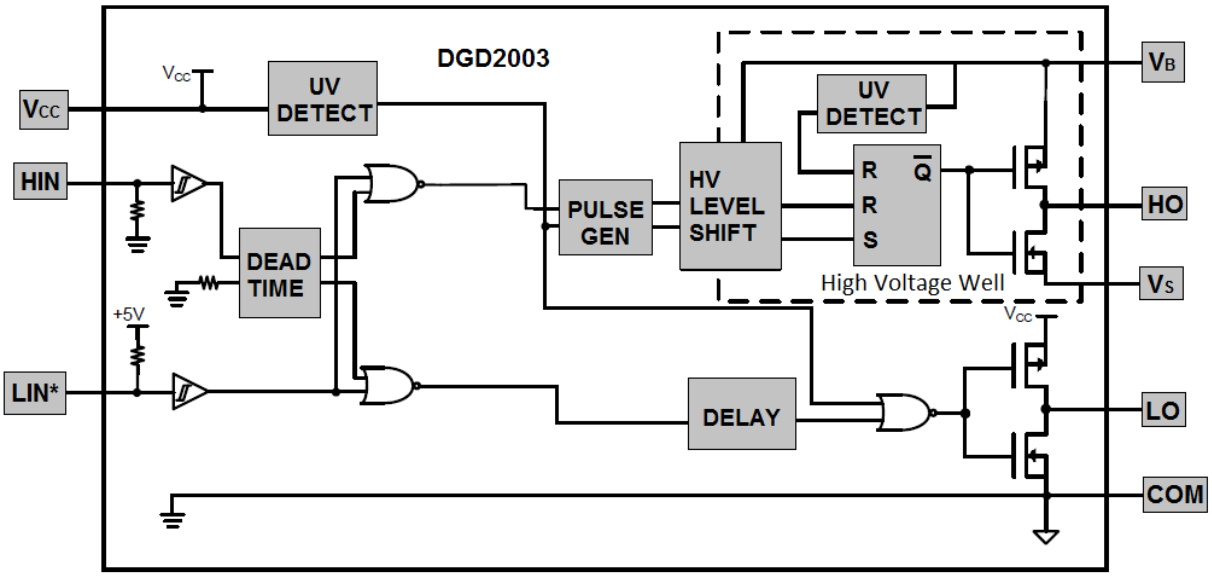


Top View: SO-8

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	COM	Low-Side and Logic Return
5	LO	Low-Side Gate Drive Output
6	V_S	High-Side Floating Supply Return
7	HO	High-Side Gate Drive Output
8	V_B	High-Side Floating Supply

Functional Block Diagram



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

Characteristic	Symbol	Value	Unit
High-Side Floating Supply Voltage	V_B	-0.3 to +224	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	0.625	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	200	°C/W
Operating Temperature	T_J	+150	°C
Lead Temperature (Soldering, 10s)	T_L	+300	
Storage Temperature Range	T_{STG}	-55 to +150	

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)	200	V
High Side Floating Output Voltage	V_{HO}	V_S	V_B	V
Low Side 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

Notes: 5. When mounted on a standard JEDEC 2-layer FR-4 board.
6. Logic operation for V_S of -5V to +200V.

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) and Logic "0" (LIN*) Input Voltage (Note 8)	V_{IH}	2.5	—	—	V	V_{CC} = 10V to 20V
Logic "0" (HIN) and Logic "1" (LIN*) Input Voltage (Note 8)	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 = 200V
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	µA	HIN = 0V, LIN* = 5V
V_{CC} Supply Undervoltage Positive Going Threshold	V_{CCUV+}	8.0	8.9	9.8	V	—
V_{CC} Supply Undervoltage Negative Going Threshold	V_{CCUV-}	7.4	8.2	9.0	V	—
V_{BS} Supply Undervoltage Positive Going Threshold	V_{BSUV+}	4.5	5.5	6.5	V	—
V_{BS} Supply Undervoltage Negative Going Threshold	V_{BSUV-}	4.2	5.2	6.2	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

Notes: 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.

8. For optimal operation, it is recommended that the input pulses (HIN and LIN*) should have a minimum amplitude of 2.5V with a minimum pulse width of 840ns.

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 = 200V
Delay Matching, HO and 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: $t_{DT\ LO-HO}$ and $t_{DT\ HO-LO}$	t_{DT}	300	420	650	ns	—

Timing Waveforms

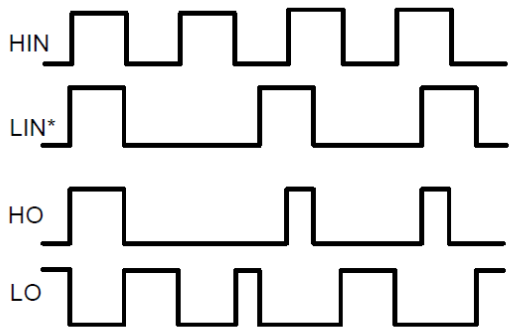


Figure 1. Input / Output Timing Diagram

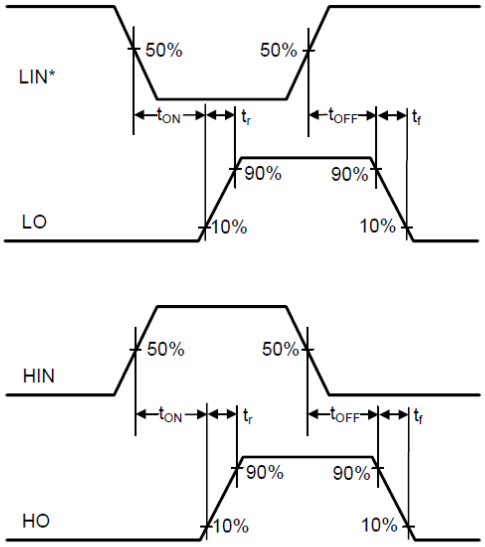


Figure 2. Switching Time Waveform Definitions

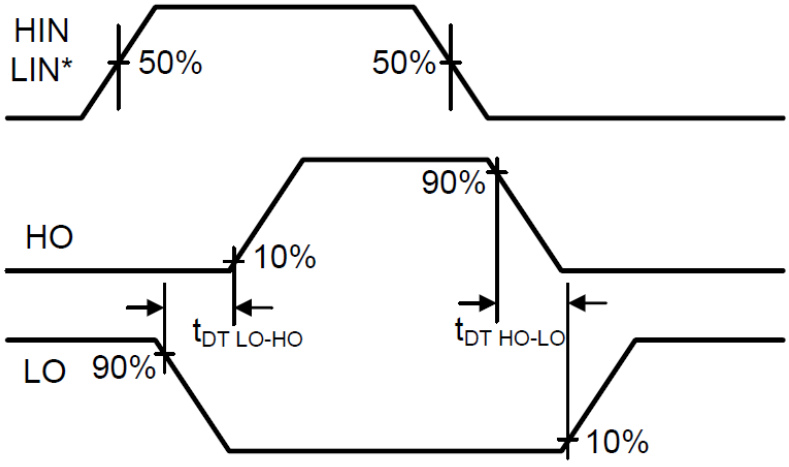


Figure 3. Deadtime Waveform Definitions

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

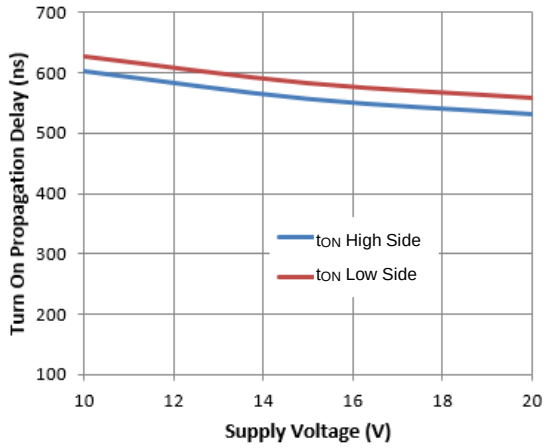


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

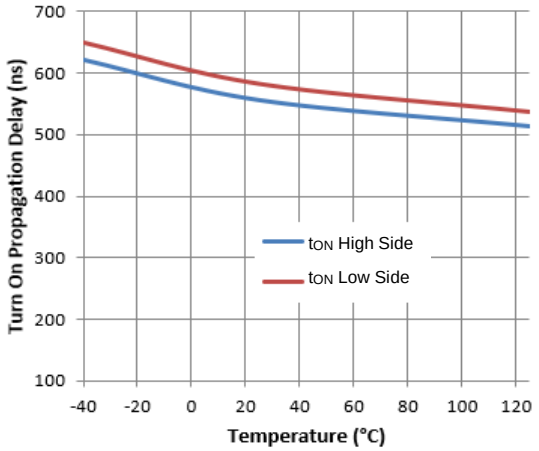


Figure 5. Turn-on Propagation Delay vs. Temperature

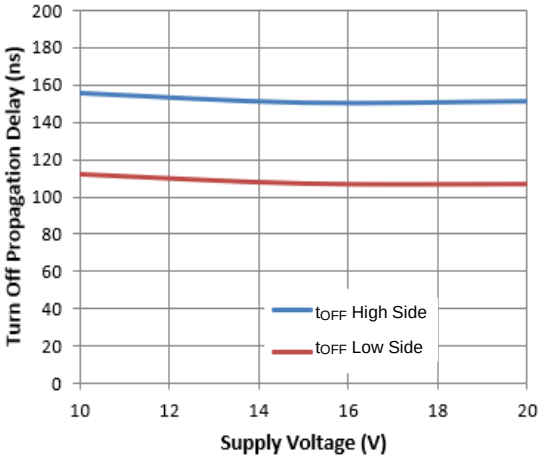


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

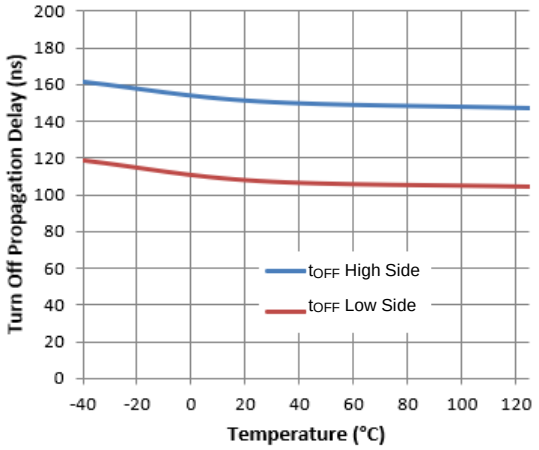


Figure 7. Turn-off Propagation Delay vs. Temperature

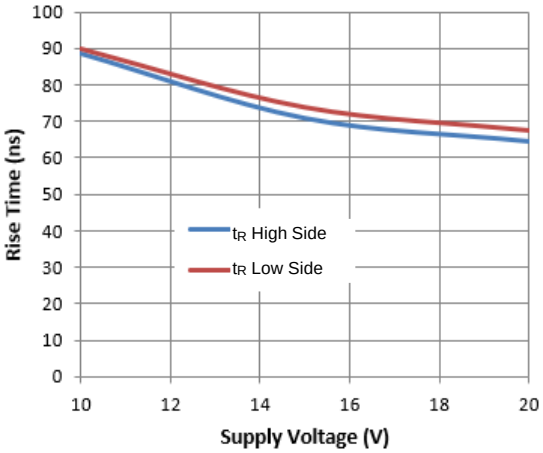


Figure 8. Rise Time vs. Supply Voltage

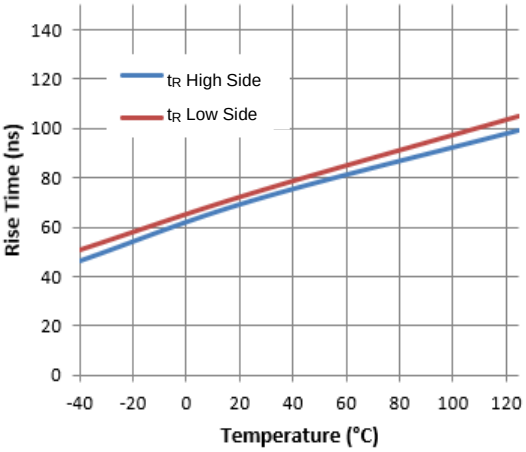


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

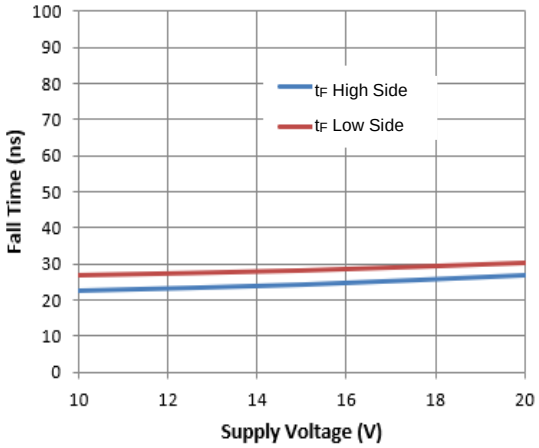


Figure 10. Fall Time vs. Supply Voltage

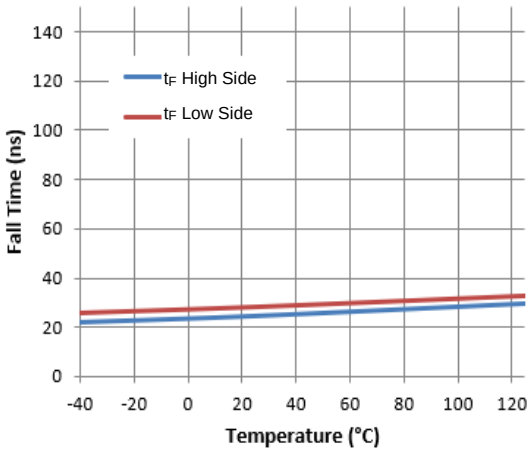


Figure 11. Fall Time vs. Temperature

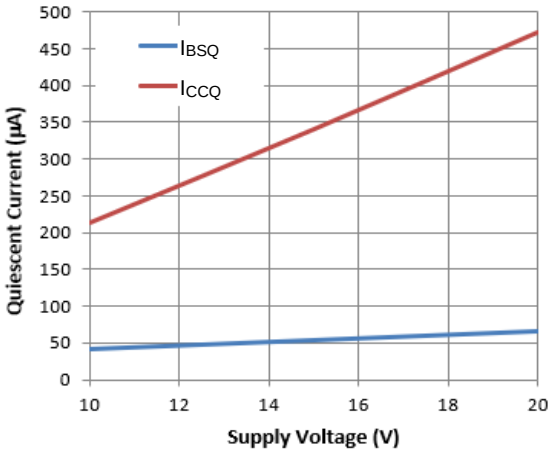


Figure 12. Quiescent Current vs. Supply Voltage

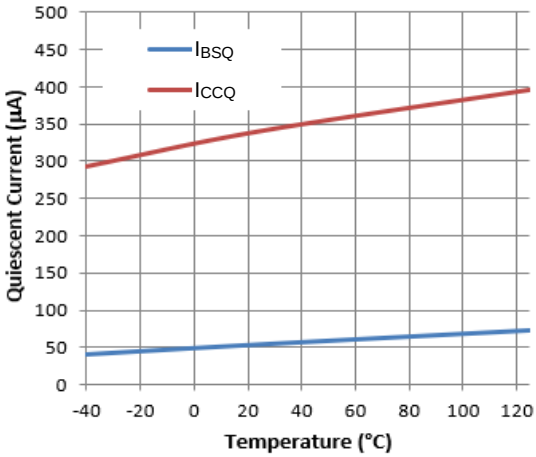


Figure 13. Quiescent Current vs. Temperature

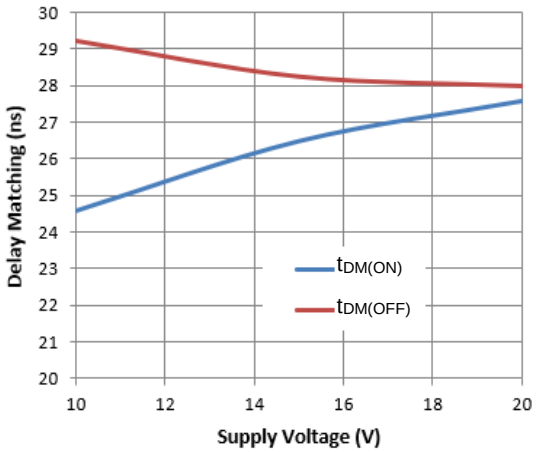


Figure 14. Delay Matching vs. Supply Voltage

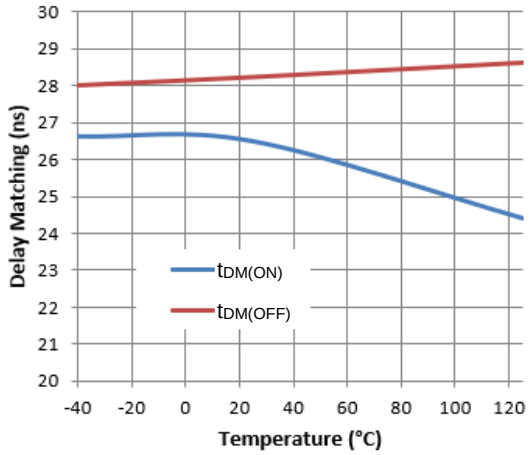


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (continued)

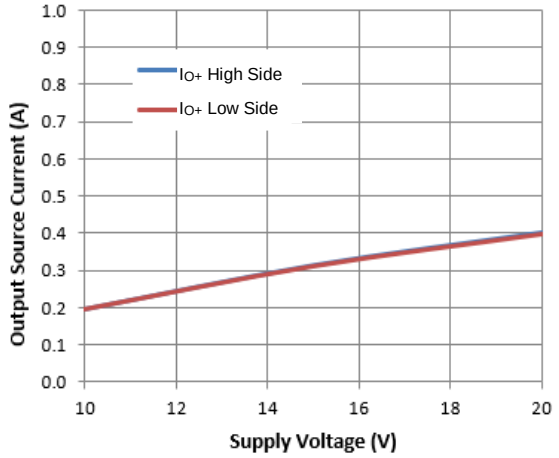


Figure 16. Output Source Current vs. Supply Voltage

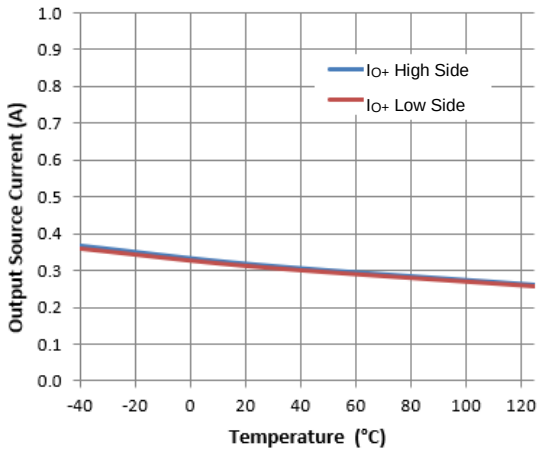


Figure 17. Output Source Current vs. Temperature

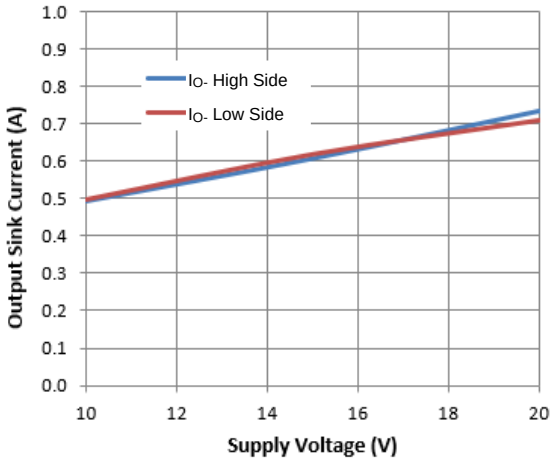


Figure 18. Output Sink Current vs. Supply Voltage

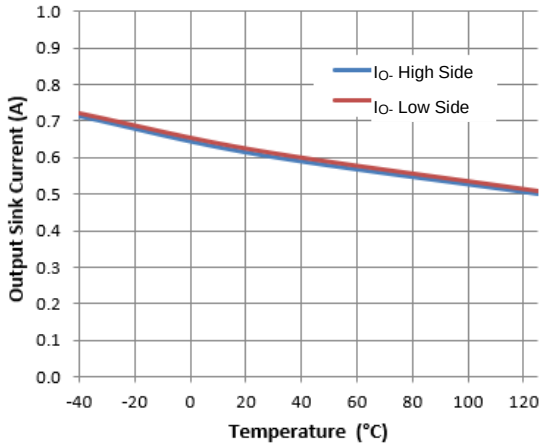


Figure 19. Output Sink Current vs. Temperature

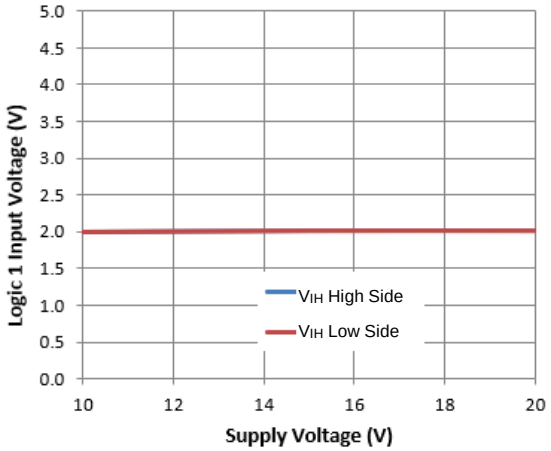


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

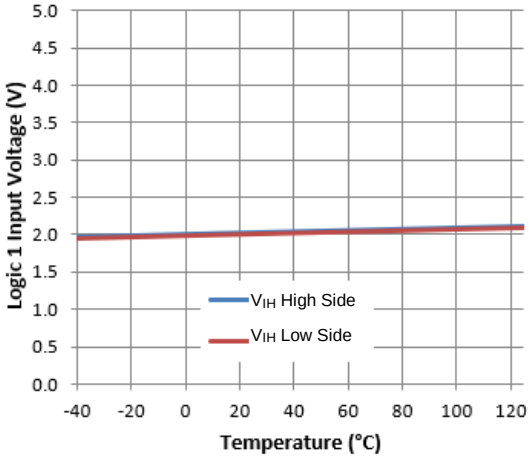


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (continued)

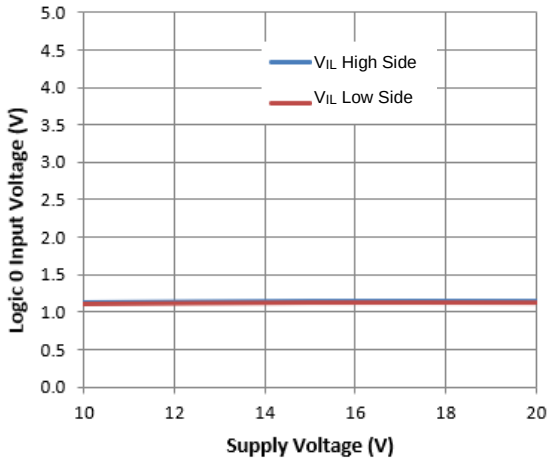


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

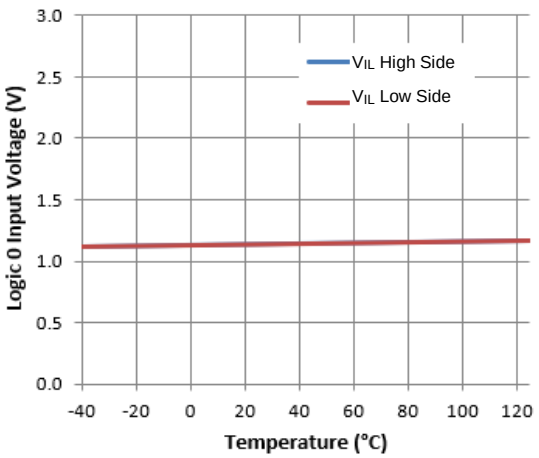


Figure 23. Logic 0 Input Voltage vs. Temperature

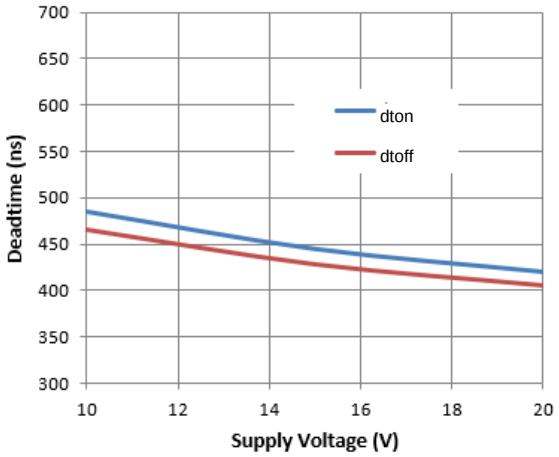


Figure 24. Deadtime vs. Supply Voltage

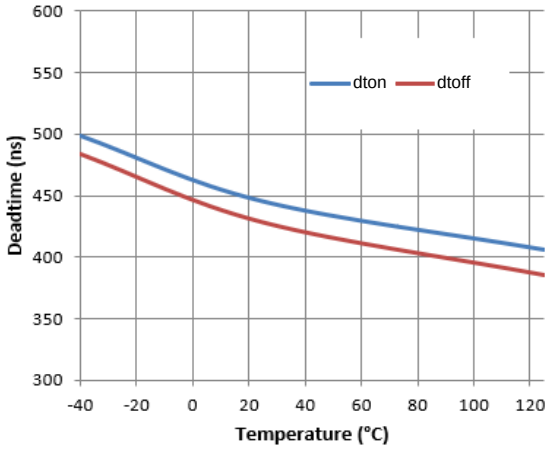


Figure 25. Deadtime vs. Temperature

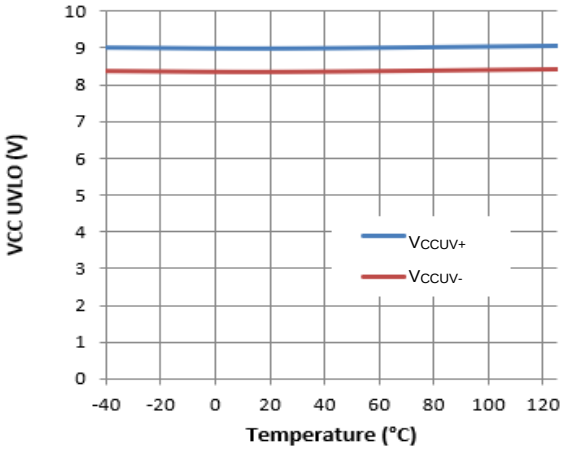


Figure 26. VCC UVLO vs. Temperature

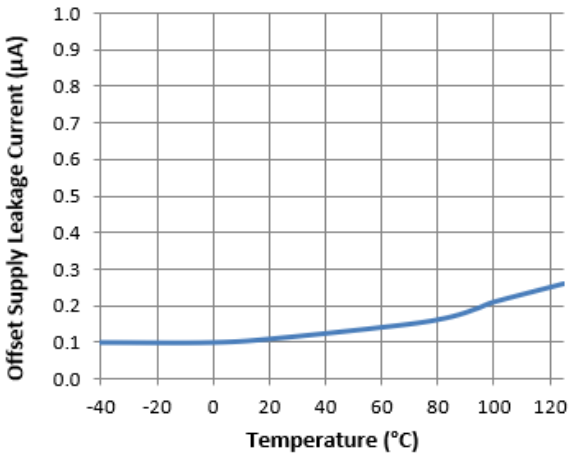
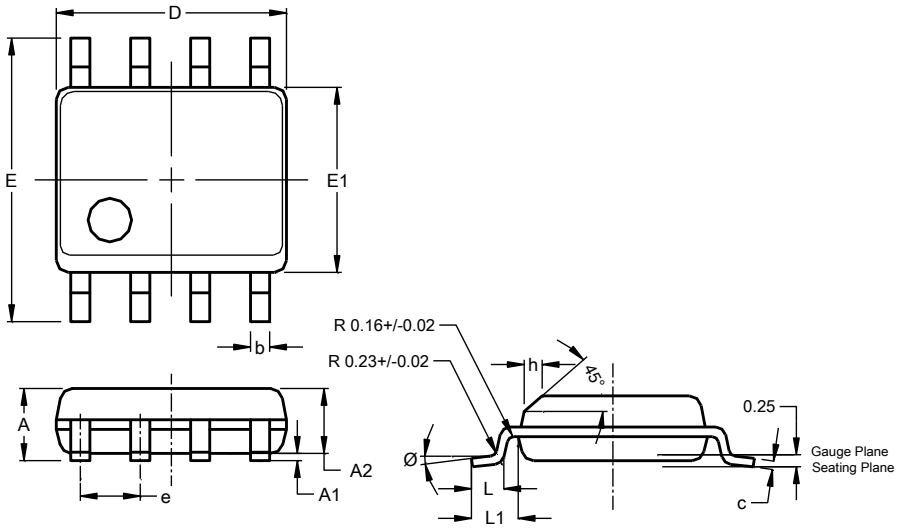


Figure 27. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

SO-8 (Type TH)

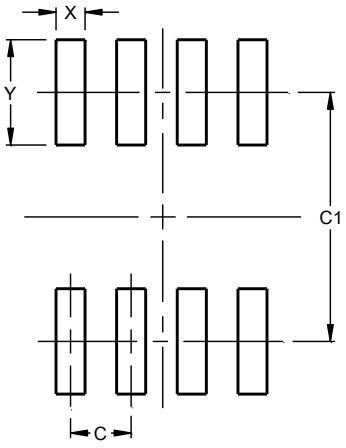


SO-8 (Type TH)			
Dim	**Min**	**Max**	**Typ**
A	1.35	1.75	--
A1	0.10	0.25	--
A2	--	--	1.45
b	0.35	0.51	--
c	0.190	0.248	--
D	4.80	5.00	4.90
E	5.80	6.20	6.00
E1	3.80	4.00	3.90
e	--	--	1.27
h	0.25	0.50	--
L	0.41	1.27	--
L1	--	--	1.04
Ø	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

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

SO-8 (Type TH)



Dimensions	Value (in mm)
C	1.27
C1	5.20
X	0.60
Y	2.20

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.

IMPORTANT NOTICE

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel. Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes Incorporated.

LIFE SUPPORT

Diodes Incorporated products are specifically not authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Diodes Incorporated. As used herein:

A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or

2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

www.diodes.com