HALF-BRIDGE GATE DRIVER IN SO-8

Description

The DGD1504 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 DGD1504's high side to switch to 250V in a bootstrap operation.

The DGD1504 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with controlling devices. The driver outputs feature high-pulse current buffers designed for minimum driver cross conduction. The DGD1504 has a fixed internal deadtime of 430ns (typical).

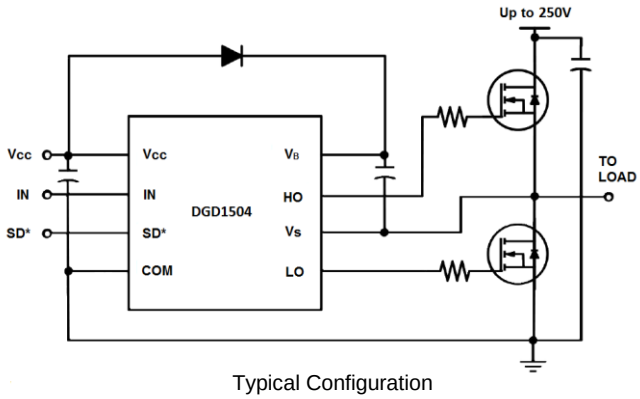
The DGD1504 is offered in the SO-8 (Type TH) package and operates over an extended -40°C to +125°C temperature range.

Features

- Floating High-Side Driver in Bootstrap Operation to 250V
- 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 (IN and SD*) 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)**

Applications

- DC-DC Converters
- DC-AC Inverters
- AC-DC Power Supplies
- Motor Controls
- Class D Power Amplifiers



Typical Configuration

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: 0.074 grams (Approximate)

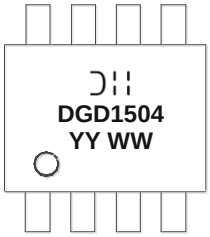
SO-8 (Type TH)
Top View

Ordering Information (Note 4)

Product	Marking	Reel Size (inch)	Tape Width (mm)	Quantity per Reel
DGD1504S8-13	DGD1504	13	12	2,500

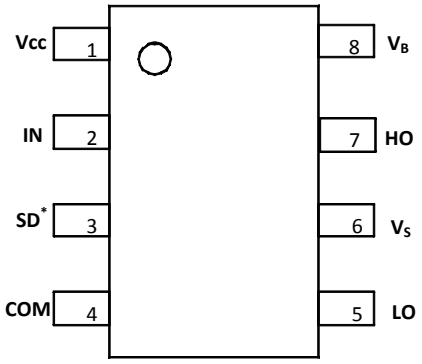
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free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

Marking Information



⊐¦¦	= Manufacturer's Marking
DGD1504	= Product Type Marking Code
YY	= Year (ex: 16 = 2016)
WW	= Week (01 to 53)

Pin Diagrams

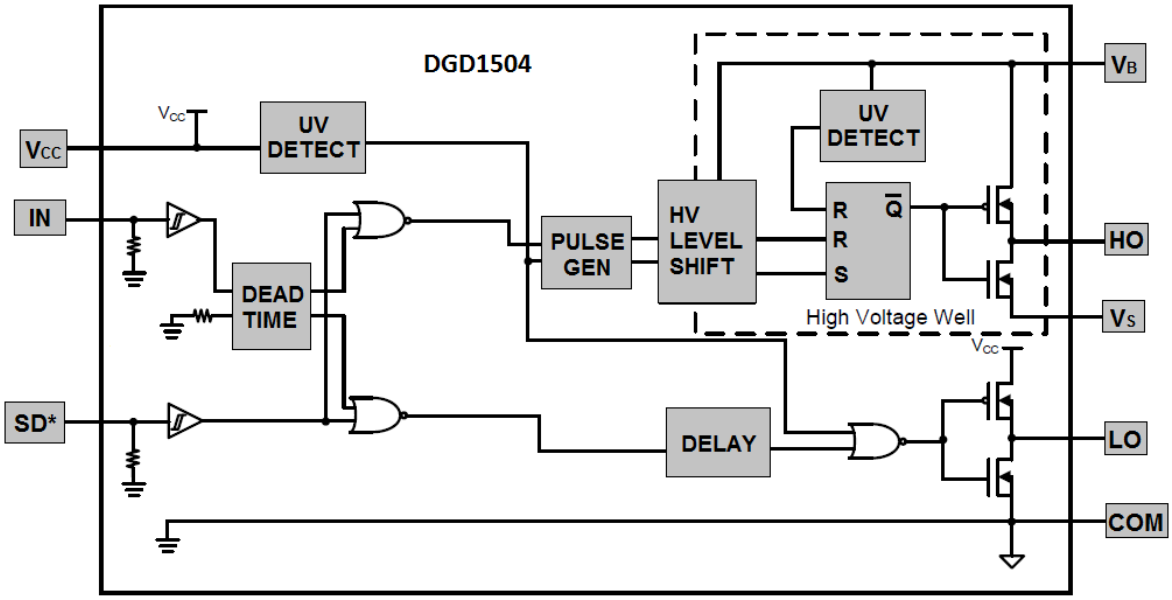


Top View: SO-8 (Type TH)

Pin Descriptions

Pin Number	Pin Name	Function
1	V_{CC}	Logic and Low Side Supply
2	IN	Logic Input for High-Side and Low-Side Gate Driver Outputs (HO and LO), in Phase with HO
3	SD*	Logic input for Shutdown, Enabled Low
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 +274	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 (IN and SD*)	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	

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)	250	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 (IN and SD*)	V_{IN}	0	5	V
Ambient Temperature	T_A	-40	+125	°C

Note: 6. Logic operation for V_S of -5V to +250V. Logic state held for V_S of -5V to -V_{BS}.

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	Condition
Logic "1" (IN) & Logic "0" (SD*) Input Voltage	V_{IH}	2.5	–	–	V	V_{CC} = 10V to 20V
Logic "0" (IN) & Logic "1" (SD*) 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 = 250V
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+}	–	3.0	10	µA	V_{IN} = 5V, SD* = 0V
Logic "0" Input Bias Current	I_{IN-}	–	–	5.0	µA	V_{IN} = 0V, SD* = 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: IN and SD*. 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	Condition
Turn-on Propagation Delay	t_{ON}	–	680	820	ns	V_S = 0V
Turn-off Propagation Delay	t_{OFF}	–	150	220	ns	V_S = 250V
Shutdown Propagation Delay	t_{SD}	–	160	220	ns	–
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: $t_{DT\ LO-HO}$ & $t_{DT\ HO-LO}$	t_{DT}	300	430	550	ns	–

Timing Waveforms

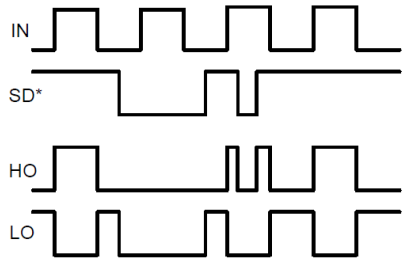


Figure 1. Input / Output Timing Diagram

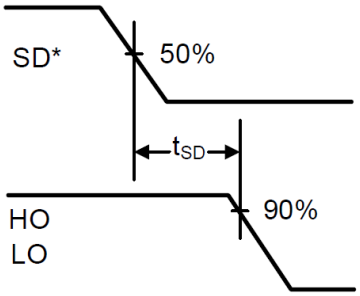
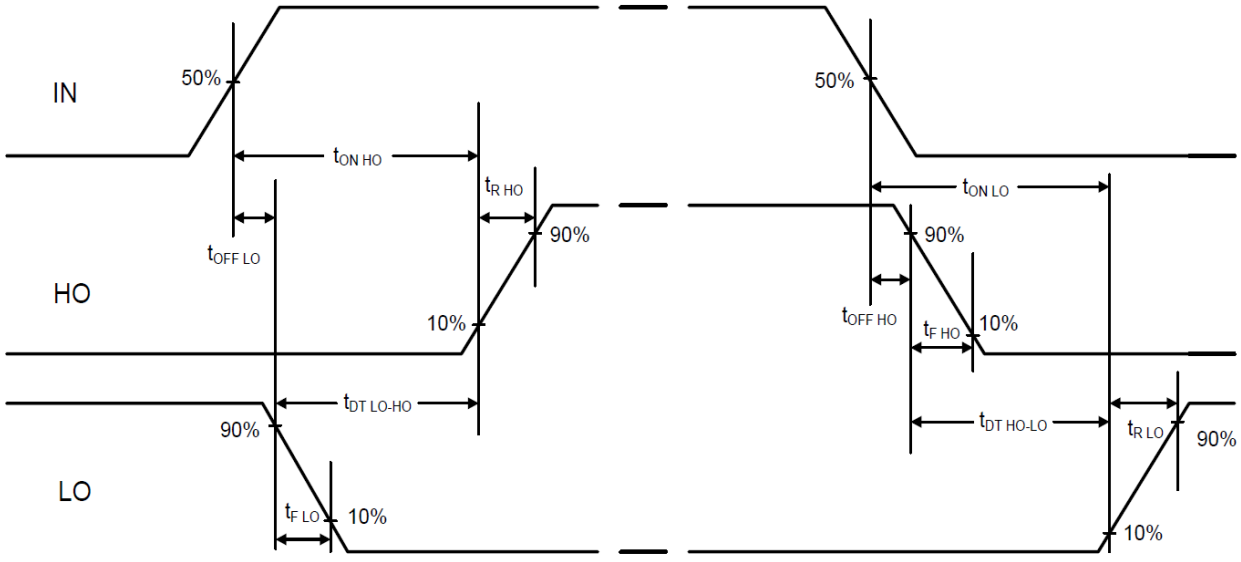


Figure 2. Shutdown Waveform Definition



Deadtime $t_{DT\ LO-HO} = t_{ON\ HO} - t_{OFF\ LO}$
$t_{DT\ HO-LO} = t_{ON\ LO} - t_{OFF\ HO}$

Deadtime matching
$t_{MDT} = t_{DT\ LO-HO} - t_{DT\ HO-LO}$

Delay matching
$t_{DM\ OFF} = t_{OFF\ LO} - t_{OFF\ HO}$
$t_{DM\ ON} = t_{ON\ LO} - t_{ON\ HO}$

Figure 3. Switching Time Waveform Definitions

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

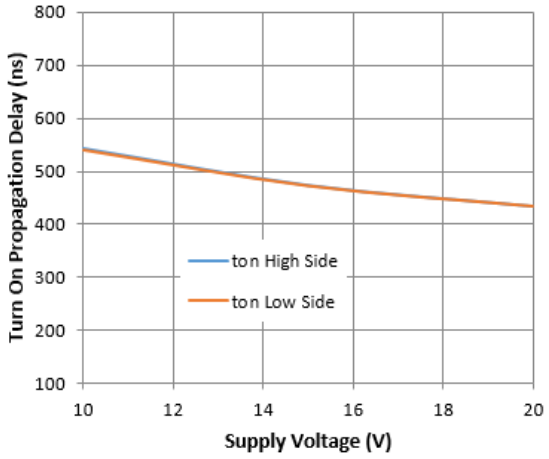


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

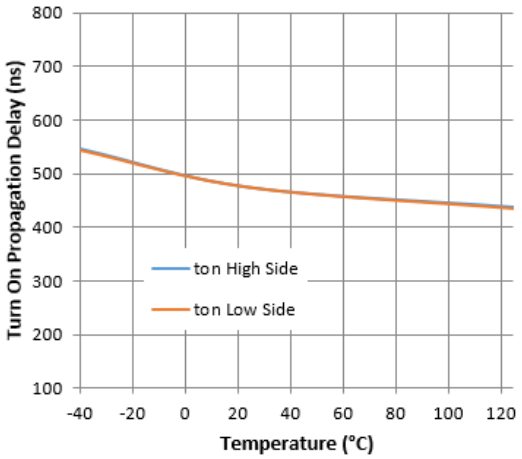


Figure 5. Turn-on Propagation Delay vs. Temperature

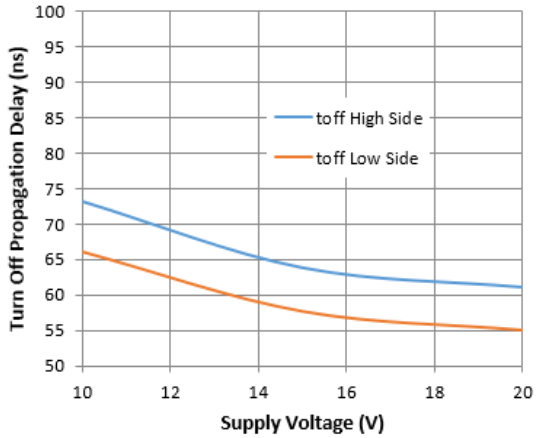


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

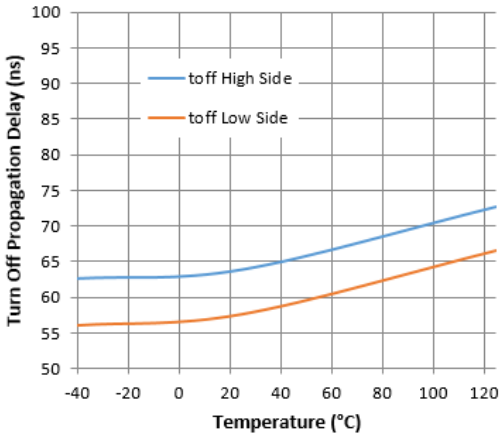


Figure 7. Turn-off Propagation Delay vs. Temperature

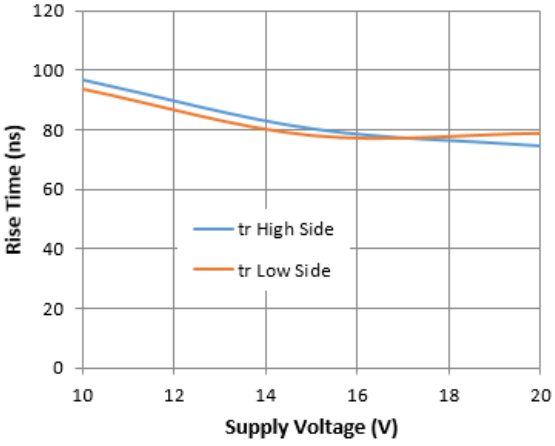


Figure 8. Rise Time vs. Supply Voltage

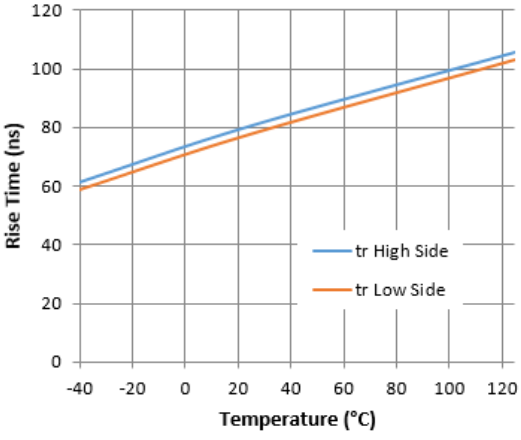


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (Cont.)

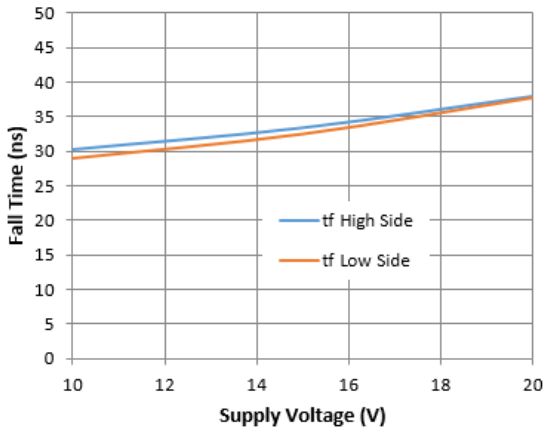


Figure 10. Fall Time vs. Supply Voltage

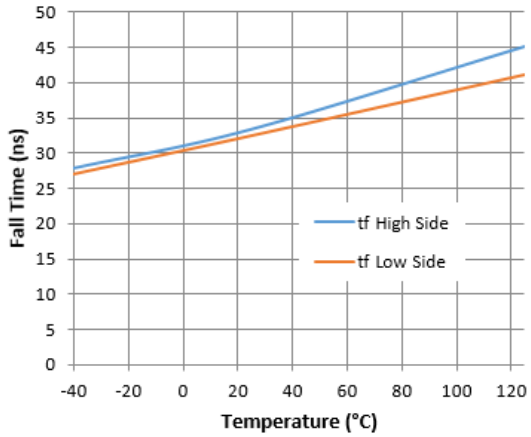


Figure 11. Fall Time vs. Temperature

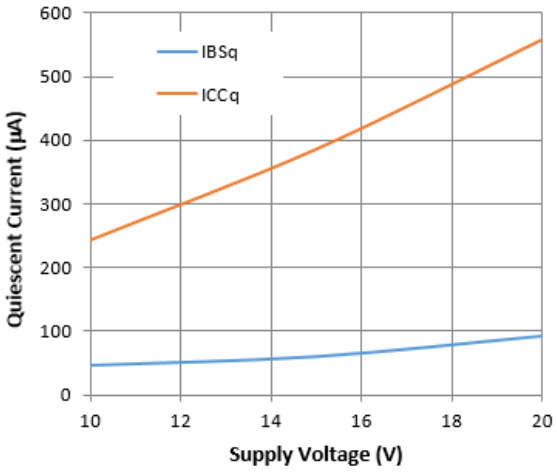


Figure 12. Quiescent Current vs. Supply Voltage

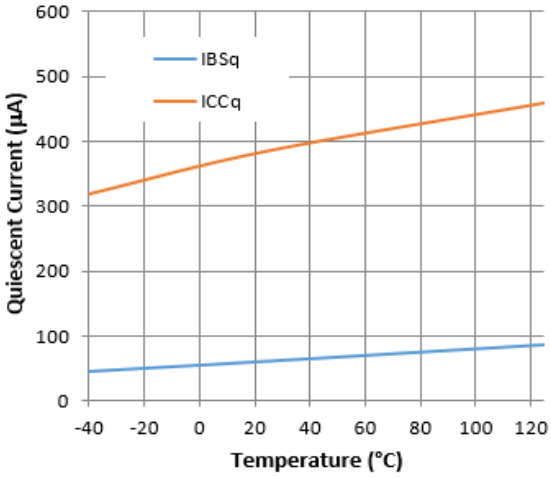


Figure 13. Quiescent Current vs. Temperature

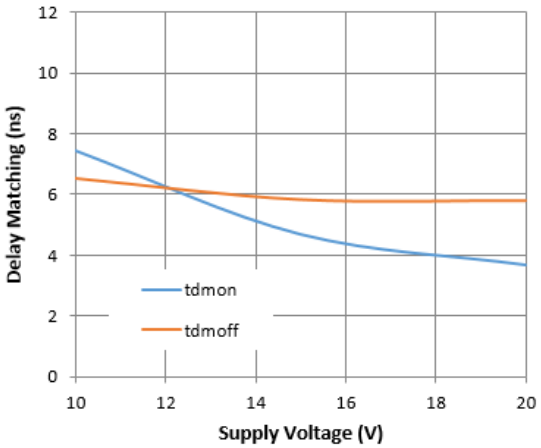


Figure 14. Delay Matching vs. Supply Voltage

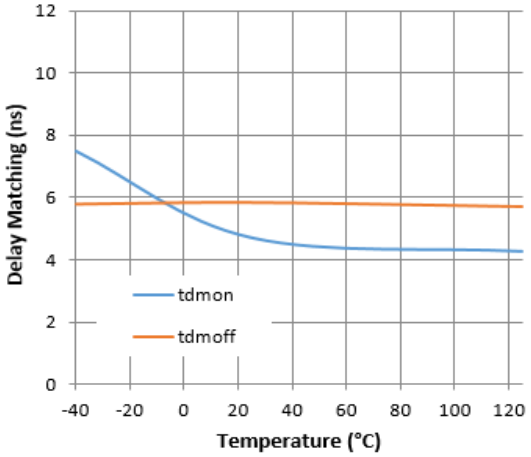


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (Cont.)

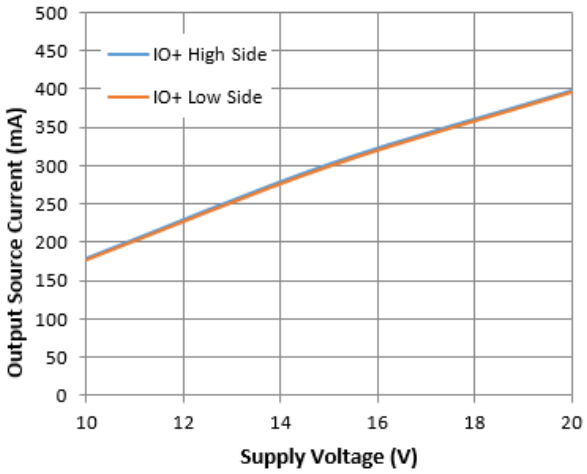


Figure 16. Output Source Current vs. Supply Voltage

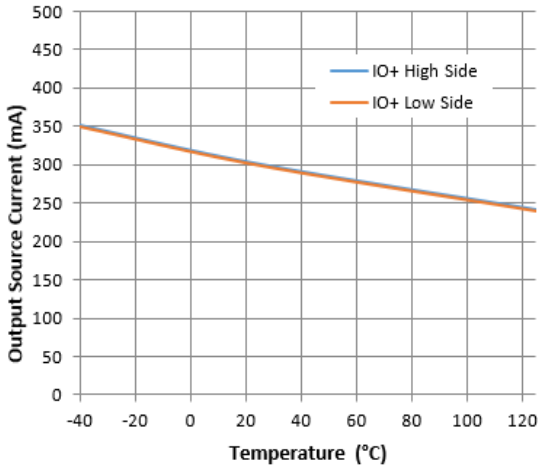


Figure 17. Output Source Current vs. Temperature

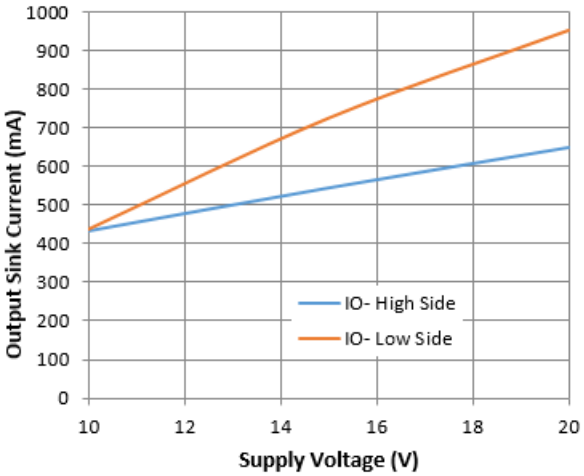


Figure 18. Output Sink Current vs. Supply Voltage

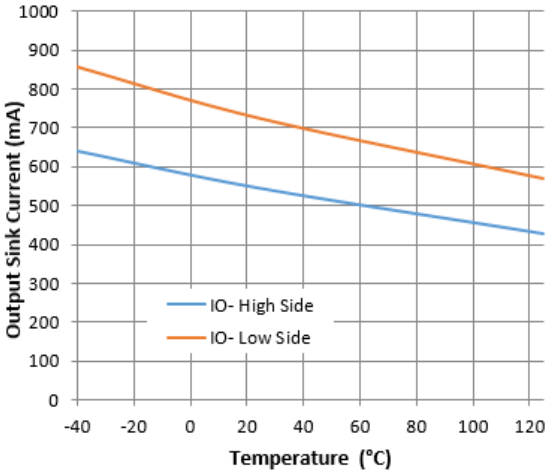


Figure 19. Output Sink Current vs. Temperature

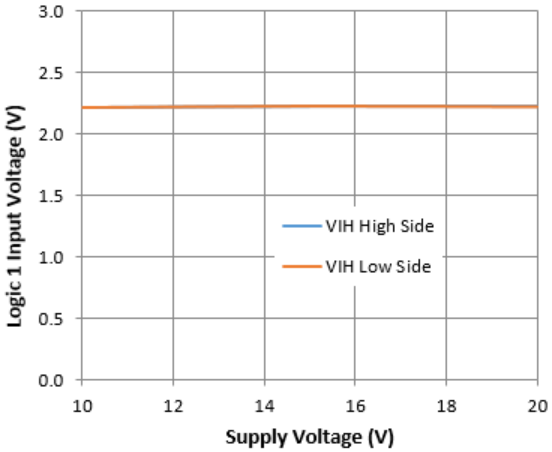


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

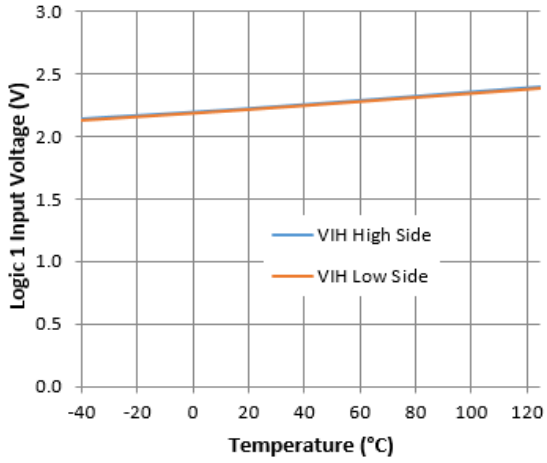


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (Cont.)

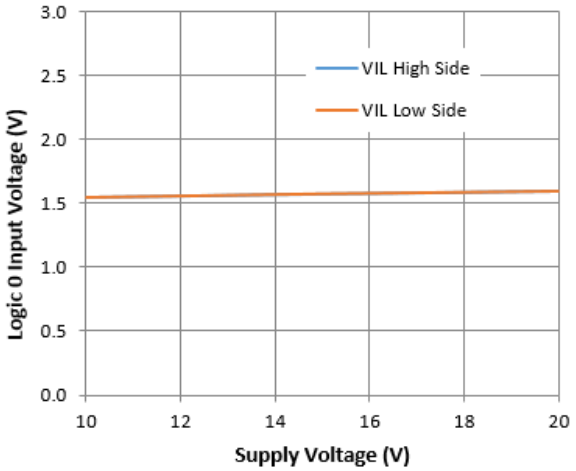


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

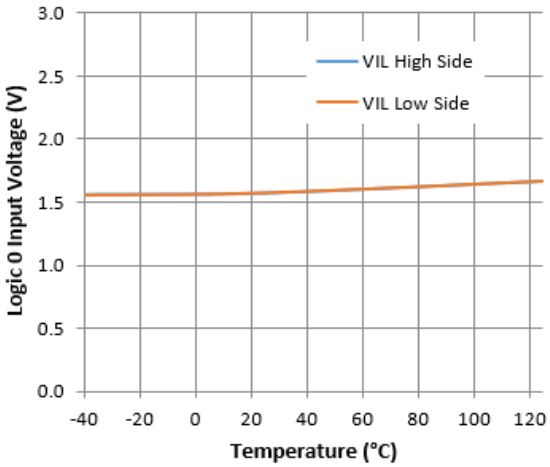


Figure 23. Logic 0 Input Voltage vs. Temperature

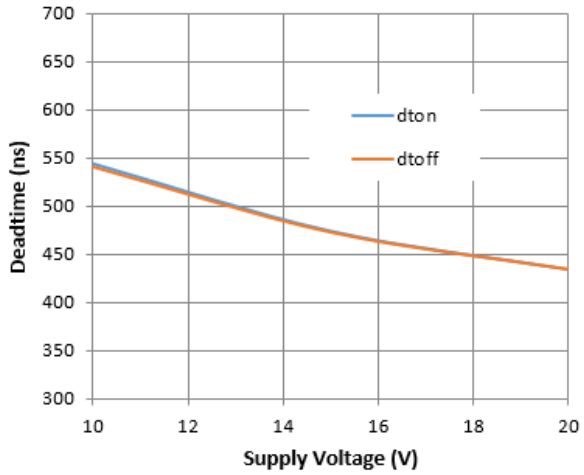


Figure 24. Deadtime vs. Supply Voltage

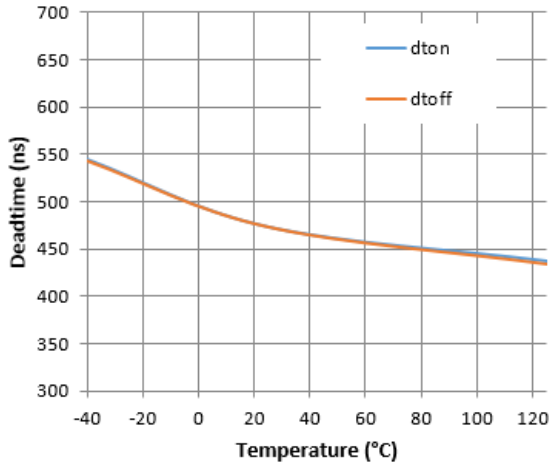


Figure 25. Deadtime vs. Temperature

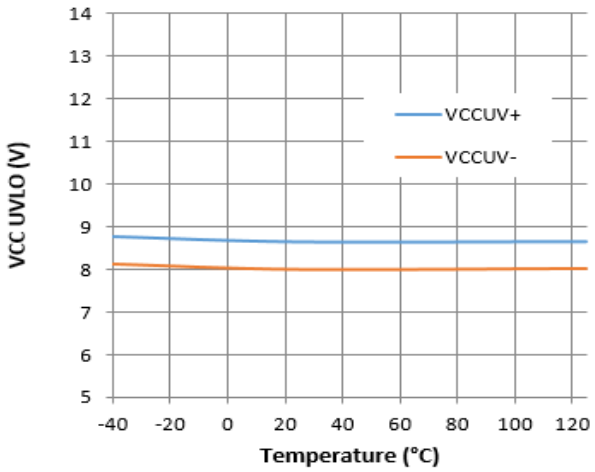


Figure 26. VCC UVLO vs. Temperature

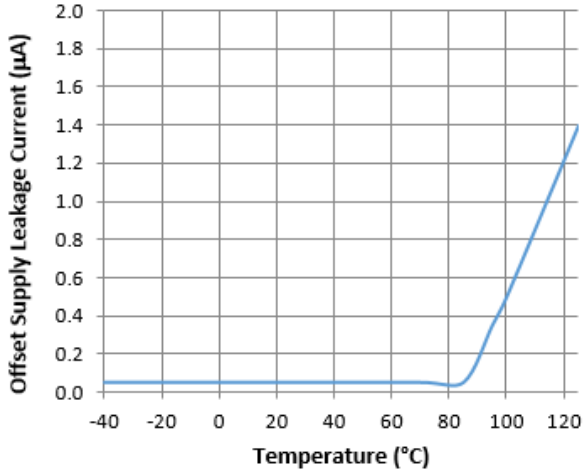
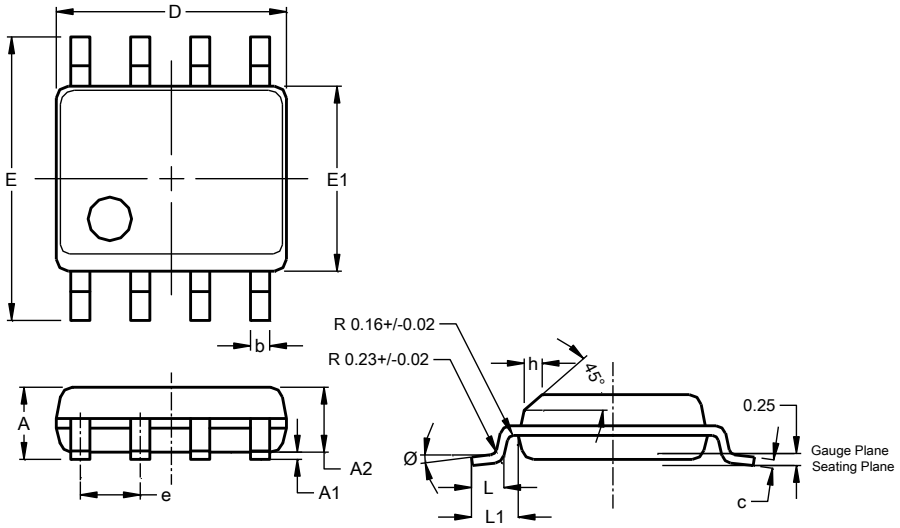


Figure 27. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

SO-8 (Type TH)

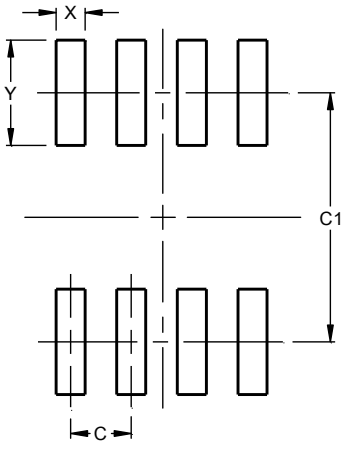


SO-8 (Type TH)			
Dim	**Min**	**Max**	**Typ**
A	1.35	1.75	--
A1	0.10	0.25	--
A2	--	--	1.45
b	0.35	0.51	--
c	0.190	0.248	--
D	4.80	5.00	4.90
E	5.80	6.20	6.00
E1	3.80	4.00	3.90
e	--	--	1.27
h	0.25	0.50	--
L	0.41	1.27	--
L1	--	--	1.04
Ø	0°	8°	--
All Dimensions in mm			

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.

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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.

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