HALF-BRIDGE GATE DRIVER IN SO-8

Description

The DGD2304 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 DGD2304's high side to switch to 600V in a bootstrap operation.

The DGD2304 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. An internal deadtime of 100ns protects high-voltage MOSFETs from shoot-through.

The DGD2304 is offered in the SO-8 package and operates over an extended -40°C to +125°C temperature range.

Applications

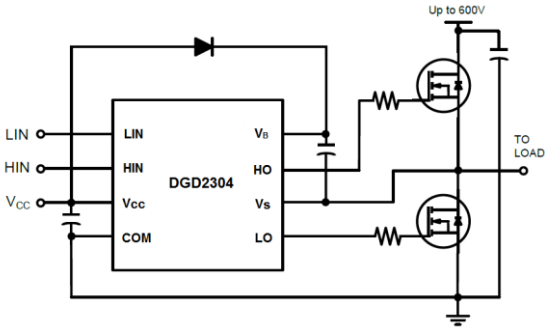
- DC-DC Converters
- DC-AC Inverters
- AC-DC Power Supplies
- Motor Controls
- Class D Power Amplifiers

Features

- Floating High-Side Driver in Bootstrap Operation to 600V
- 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 Logic and Dead Time (100ns) to Protect MOSFETs
- Logic Input (HIN and LIN) 3.3V Capability
- Schmitt Triggered Logic Inputs with Internal Pull Down
- Undervoltage Lockout for High 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
- 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)



Typical Configuration

SO-8

Top View

Ordering Information (Note 4)

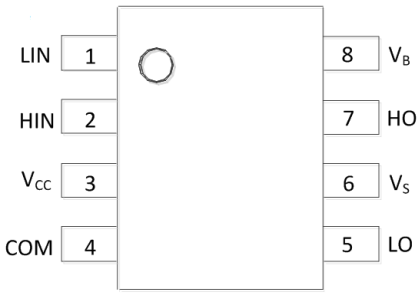
Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
DGD2304S8-13	DGD2304	13	12	2,500

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

DGD2304 = Manufacturer's Marking
DGD2304 = Product Type Marking Code
YY = Year (ex: 20 = 2020)
WW or WW– = Week (01 to 53)

Pin Diagrams

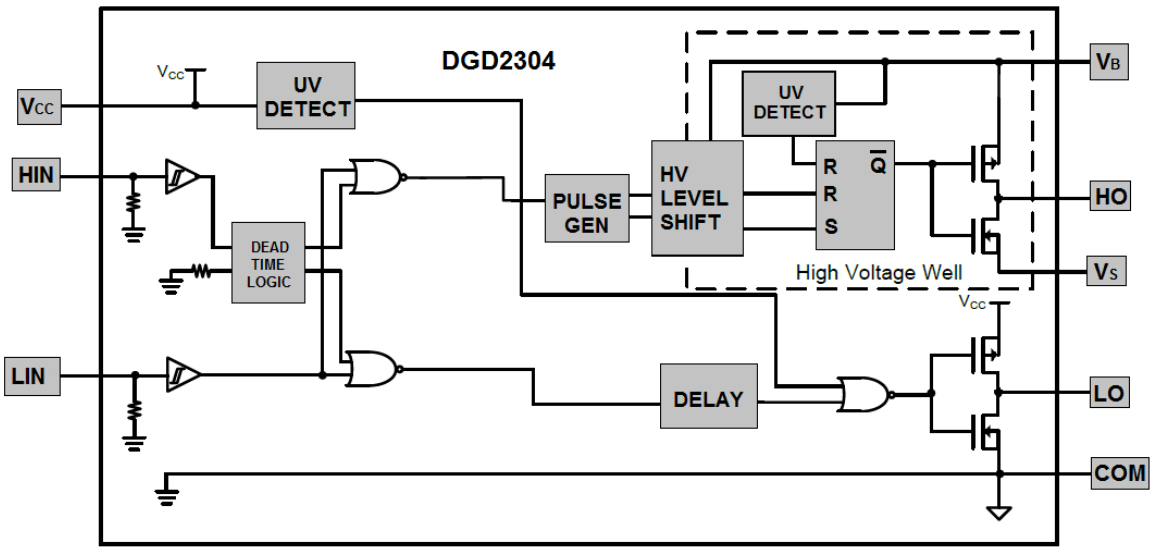


Top View: SO-8

Pin Descriptions

Pin Number	Pin Name	Function
1	LIN	Logic input for Low-Side Gate Driver Output in Phase with LO
2	HIN	Logic Input for High-Side Gate Driver Output in Phase with HO
3	V_{CC}	Low Side and Logic Fixed Supply
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 +624	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 and Logic 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}	V_{SS}-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	1.25	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	55	°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)	600	V
High-Side Floating Output Voltage	V_{HO}	V_S	V_B	V
Low-Side and Logic Fixed Supply Voltage	V_{CC}	10	20	V
Low-Side Output Voltage	V_{LO}	0	V_{CC}	V
Logic Input Voltage	V_{IN}	0	5	V
Ambient Temperature	T_A	-40	+125	°C

Note: 6. Logic operation for V_S of -5V to +600V. 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	Conditions
Logic "1" Input Voltage	V_{IH}	2.3	—	—	V	V_{CC} = 10V to 20V
Logic "0" Input Voltage	V_{IL}	—	—	0.7	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 = 600V
Quiescent V_{BS} Supply Current	I_{BSQ}	20	60	150	µA	V_{IN} = 0V or 5V
Quiescent V_{CC} Supply Current	I_{CCQ}	50	260	400	µA	V_{IN} = 0V or 5V
Logic "1" Input Bias Current	I_{IN+}	—	5.0	40	µA	V_{IN} = 5V
Logic "0" Input Bias Current	I_{IN-}	—	1.0	5.0	µA	V_{IN} = 0V
V_{BS} Supply Under-Voltage Positive Going Threshold	V_{BSUV+}	7.7	8.7	9.7	V	—
V_{BS} Supply Under-Voltage Negative Going Threshold	V_{BSUV-}	7.0	8.0	9.0	V	—
V_{CC} Supply Under-Voltage Positive Going Threshold	V_{CCUV+}	7.7	8.7	9.7	V	—
V_{CC} Supply Under-Voltage Negative Going Threshold	V_{CCUV-}	7.0	8.0	9.0	V	—
Output High Short Circuit Pulsed Current	I_{O+}	60	290	—	mA	V_O = 0V, P_W ≤ 10µs
Output Low Short Circuit Pulsed Current	I_{O-}	130	600	—	mA	V_O = 15V, P_W ≤ 10µs

Note: 7. The V_{IN} and I_{IN} parameters are referenced to COM and are applicable to the two logic pins: HIN and LIN. The V_O and I_O parameters are referenced to COM and 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}	—	95	210	ns	V_S = 0V
Turn-Off Propagation Delay	t_{OFF}	—	100	210	ns	V_S = 0V or 600V
Delay Matching, HO and LO Turn-On / Turn-Off	$t_{DM\ ON}$	—	—	50	ns	—
Turn-On Rise Time	t_r	—	70	120	ns	—
Turn-Off Fall Time	t_f	—	35	60	ns	—
Deadtime: $t_{DT\ LO-HO}$ and $t_{DT\ HO-LO}$	t_{DT}	80	100	190	ns	—

Timing Waveforms

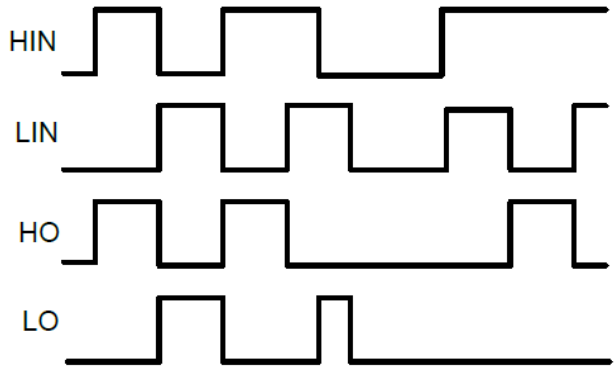


Figure 1. Input / Output Timing Diagram

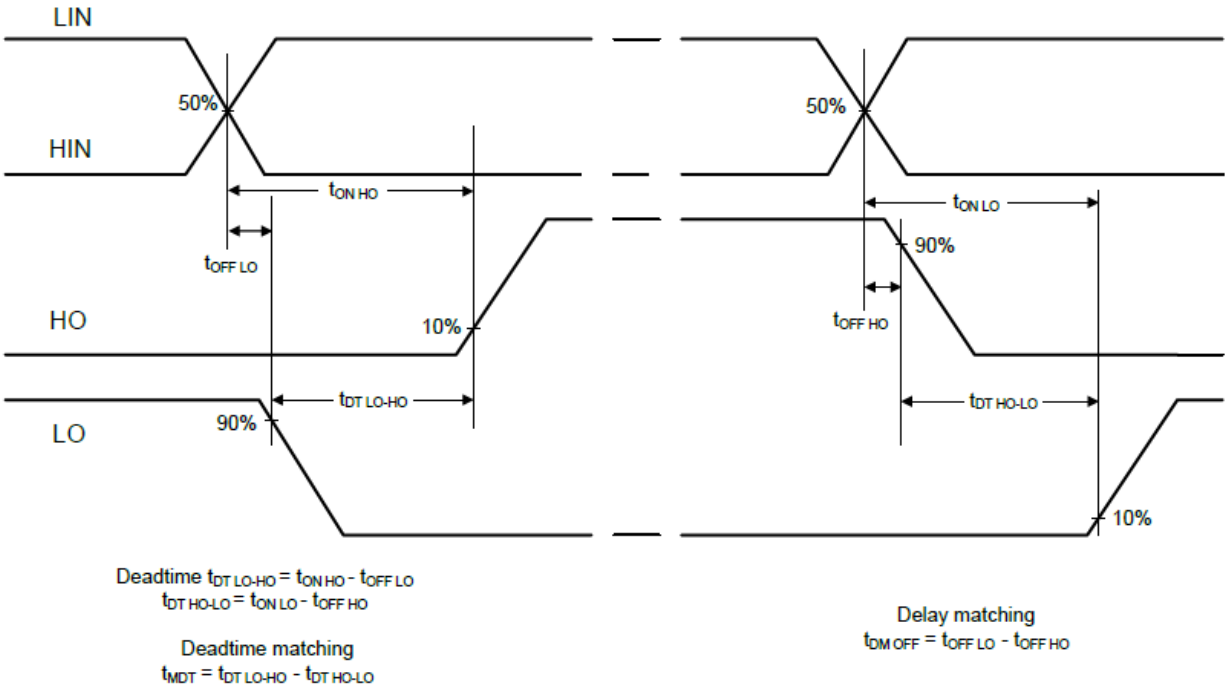


Figure 2. Switching Time Waveform Definition

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

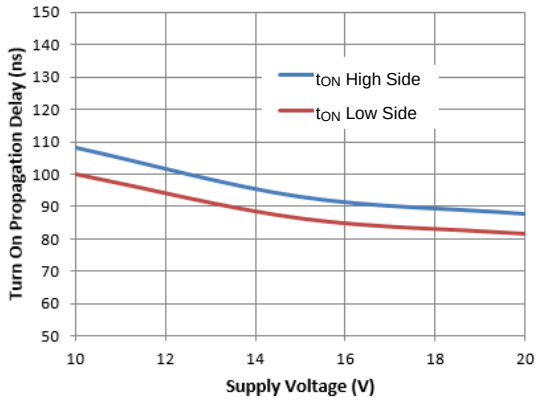


Figure 3. Turn-on Propagation Delay vs. Supply Voltage

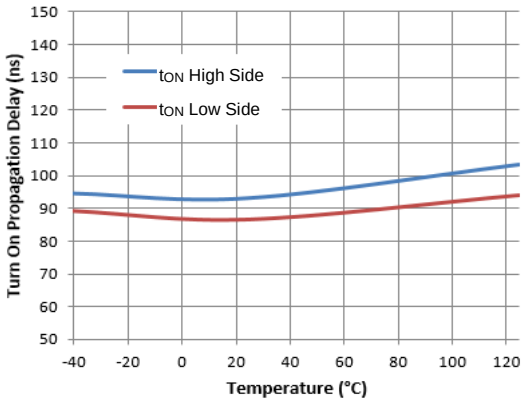


Figure 4. Turn-on Propagation Delay vs. Temperature

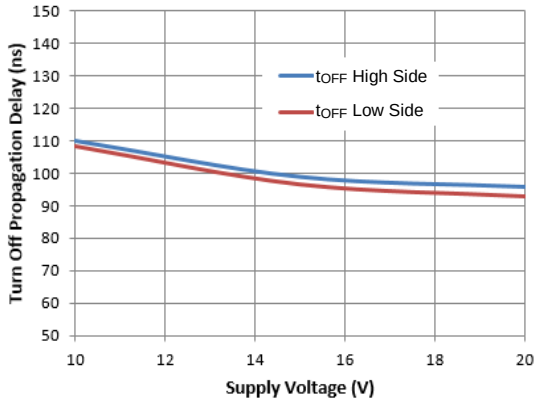


Figure 5. Turn-off Propagation Delay vs. Supply Voltage

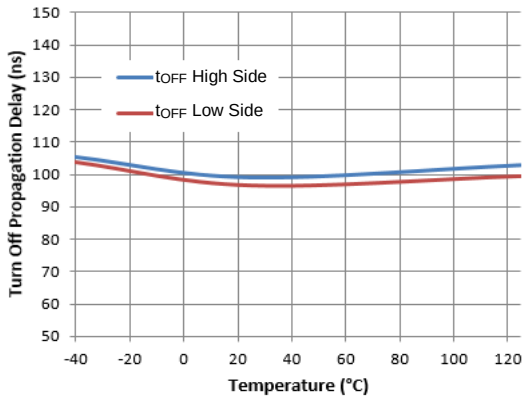


Figure 6. Turn-off Propagation Delay vs. Temperature

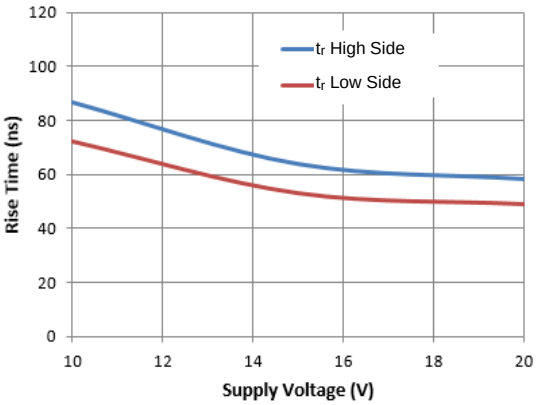


Figure 7. Rise Time vs. Supply Voltage

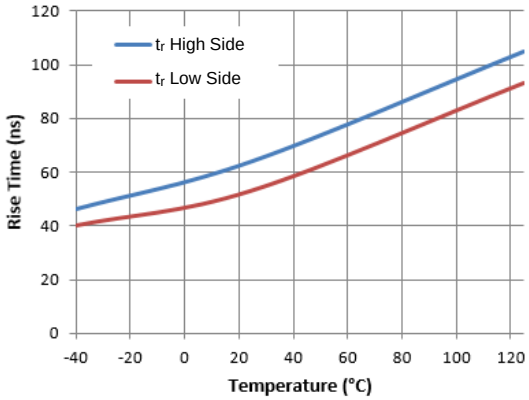


Figure 8. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

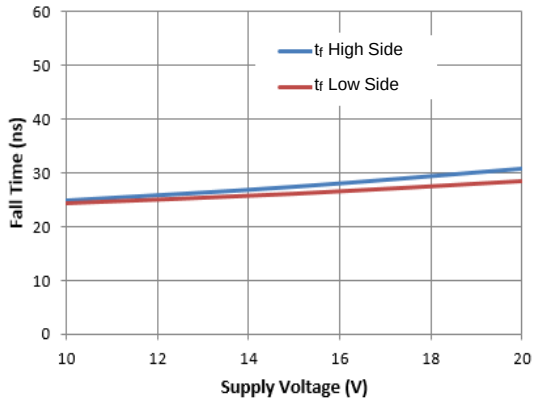


Figure 9. Fall Time vs. Supply Voltage

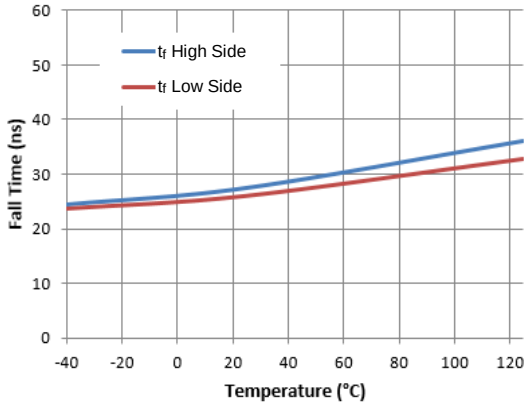


Figure 10. Fall Time vs. Temperature

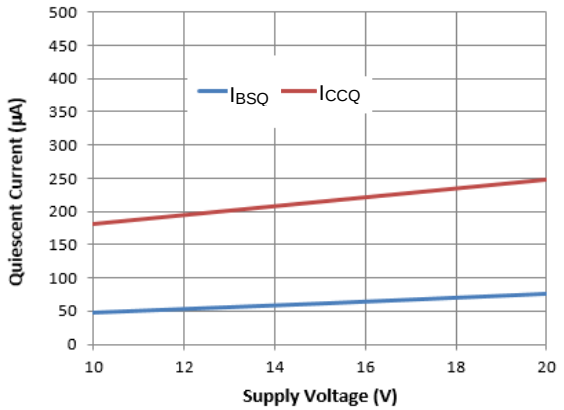


Figure 11. Quiescent Current vs. Supply Voltage

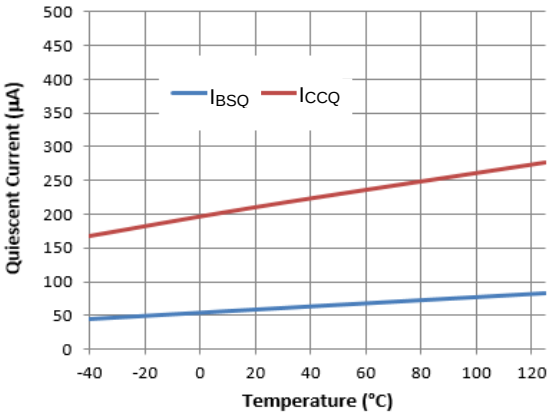


Figure 12. Quiescent Current vs. Temperature

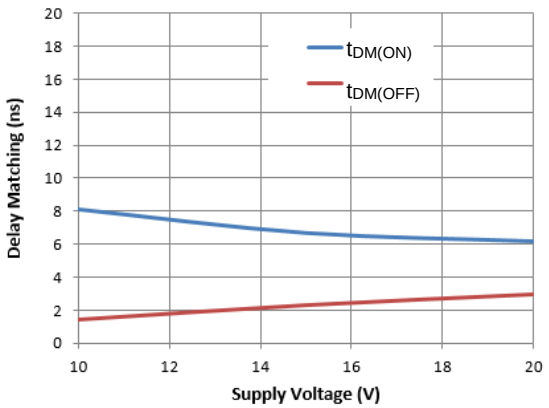


Figure 13. Delay Matching vs. Supply Voltage

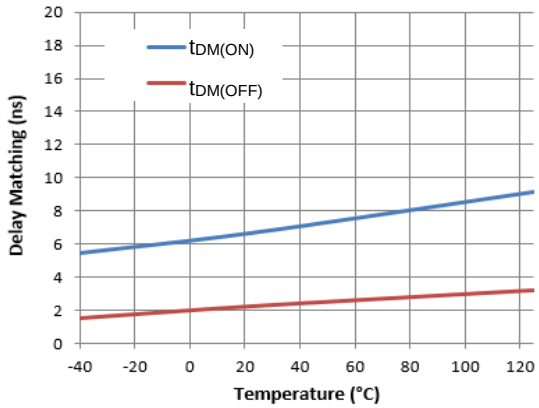


Figure 14. Delay Matching vs. Temperature

Typical Performance Characteristics (continued)

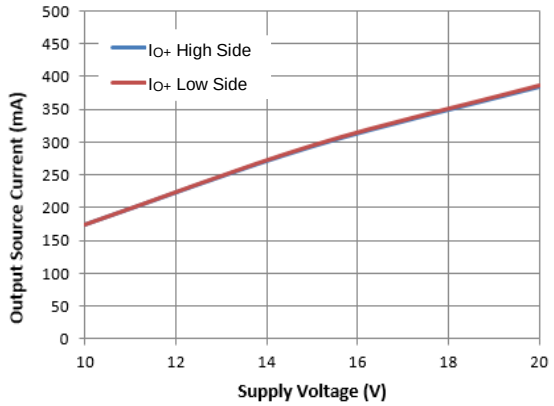


Figure 15. Output Source Current vs. Supply Voltage

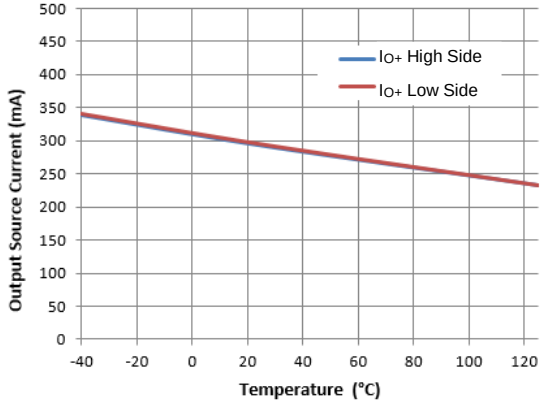


Figure 16. Output Source Current vs. Temperature

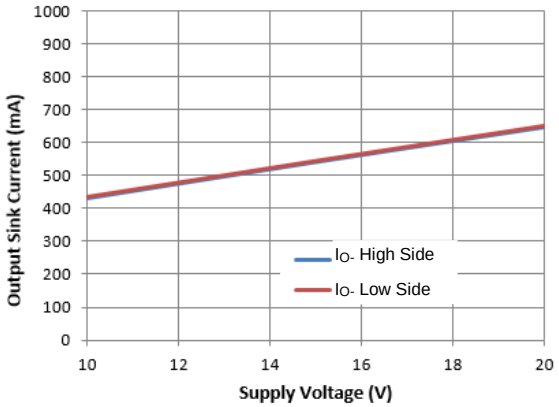


Figure 17. Output Sink Current vs. Supply Voltage

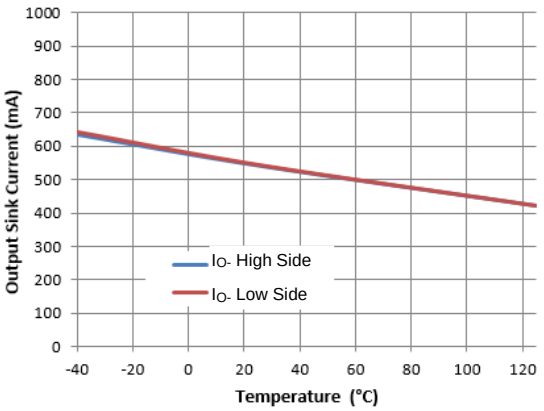


Figure 18. Output Sink Current vs. Temperature

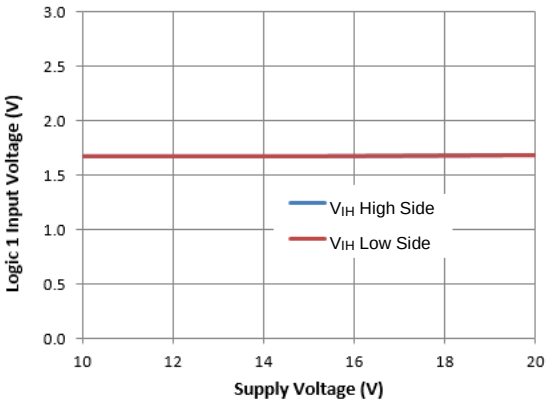


Figure 19. Logic 1 Input Voltage vs. Supply Voltage

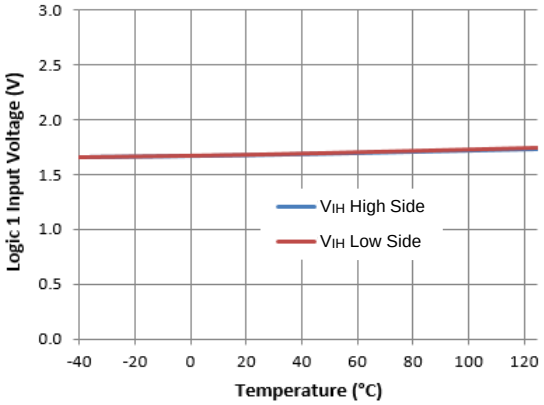


Figure 20. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (continued)

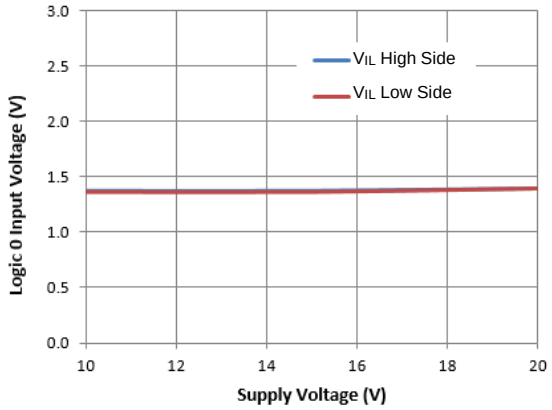


Figure 21. Logic 0 Input Voltage vs. Supply Voltage

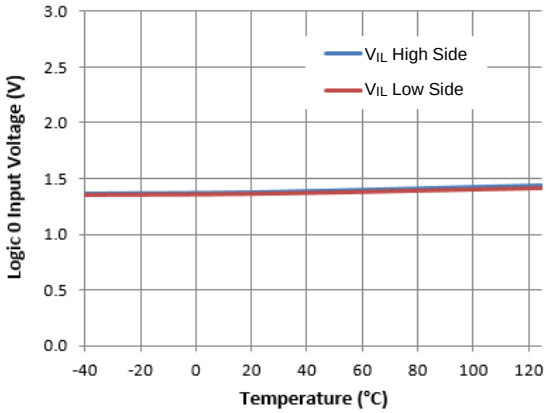


Figure 22. Logic 0 Input Voltage vs. Temperature

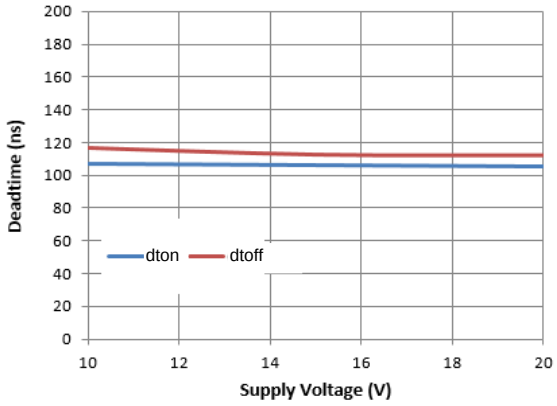


Figure 23. Deadtime vs. Supply Voltage

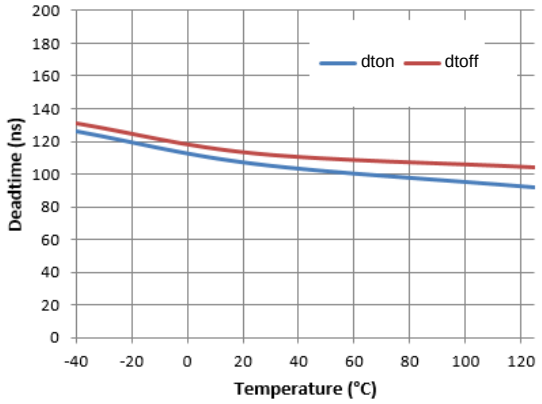


Figure 24. Deadtime vs. Temperature

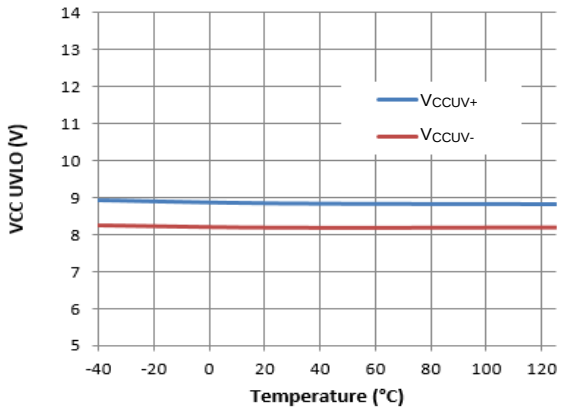


Figure 25. VCC UVLO vs. Temperature

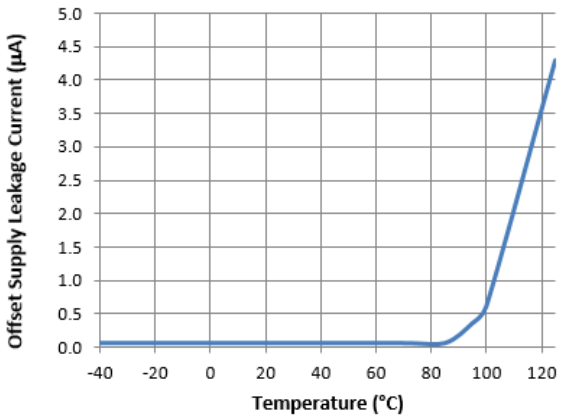
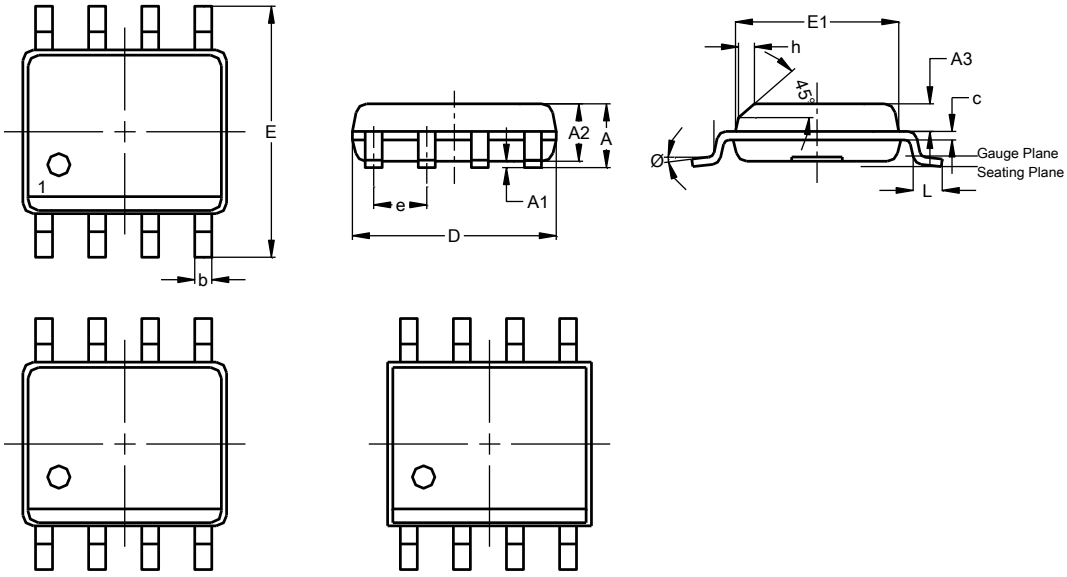


Figure 26. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

SO-8 (Standard)



OPTION A
(TOP VIEW)

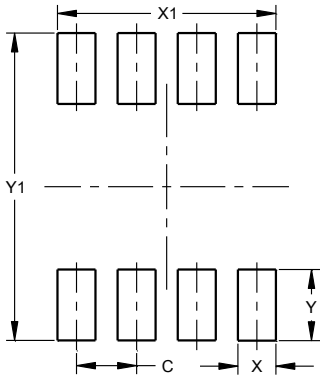
OPTION B
(TOP VIEW)

SO-8 (Standard)			
Dim	**Min**	**Max**	**Typ**
A	--	1.75	--
A1	0.10	0.25	--
A2	1.25	1.65	--
A3	0.50	0.70	--
b	0.30	0.51	--
c	0.15	0.25	--
D	4.80	5.00	--
E	5.80	6.20	6.00
E1	3.80	4.00	--
e	--	--	1.27
h	0.25	0.50	--
L	0.45	0.82	--
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 (Standard)



Dimensions	Value (in mm)
C	1.27
X	0.802
X1	4.612
Y	1.505
Y1	6.50

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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