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HALF- BRIDGE GATE DRIVER IN SO-14

Description

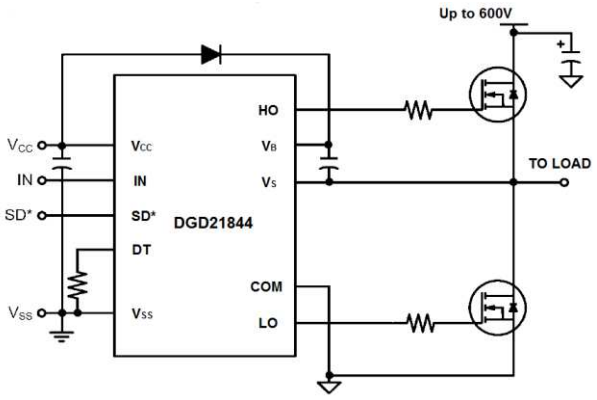
The DGD21844 is a high voltage / high speed gate driver capable of driving N-Channel MOSFETs and IGBTs in a half bridge configuration. High voltage processing techniques enable the DGD21844's high-side to switch to 600V in a bootstrap operation.

The DGD21844 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) for easy interfacing with controlling devices. The driver outputs feature high pulse current buffers designed for minimum driver cross conduction. Programmable deadtime, by an external resistor, provides more system level flexibility.

The DGD21844 is offered in SO-14 (Type TH) package, the operating temperature extends from -40°C to +125°C.

Applications

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



Typical Configuration

Features

- Floating High-side Driver in Bootstrap Operation to 600V
- Drives Two N-Channel MOSFETs or IGBTs in Half Bridge Configuration
- 1.4A Source / 1.8A Sink Output Current Capability
- Outputs Tolerant to Negative Transients
- Programmable Dead Time to Protect MOSFETs
- Wide Low-side Gate Driver and Logic Supply: 10V to 20V
- Wide Logic Supply Voltage Offset Voltage:-5V to 5V
- Logic Input (IN and SD*) 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)**

Mechanical Data

- Case: SO-14 (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: 0.142 grams (Approximate)

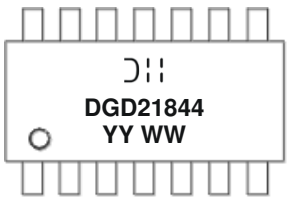
SO-14 (Type TH)
Top View

Ordering Information (Note 4)

Product	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
DGD21844S14-13	DGD21844	13	16	2,500

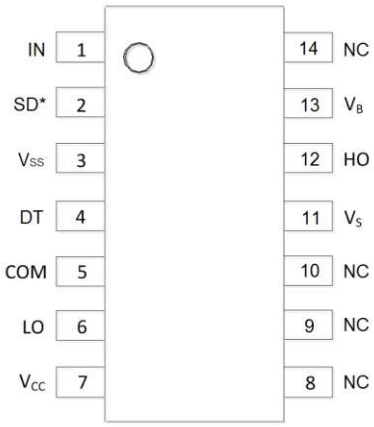
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "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
DGD21844 = Product Type Marking Code
YY = Year (ex: 16 = 2016)
WW = Week (01 to 53)

Pin Diagrams

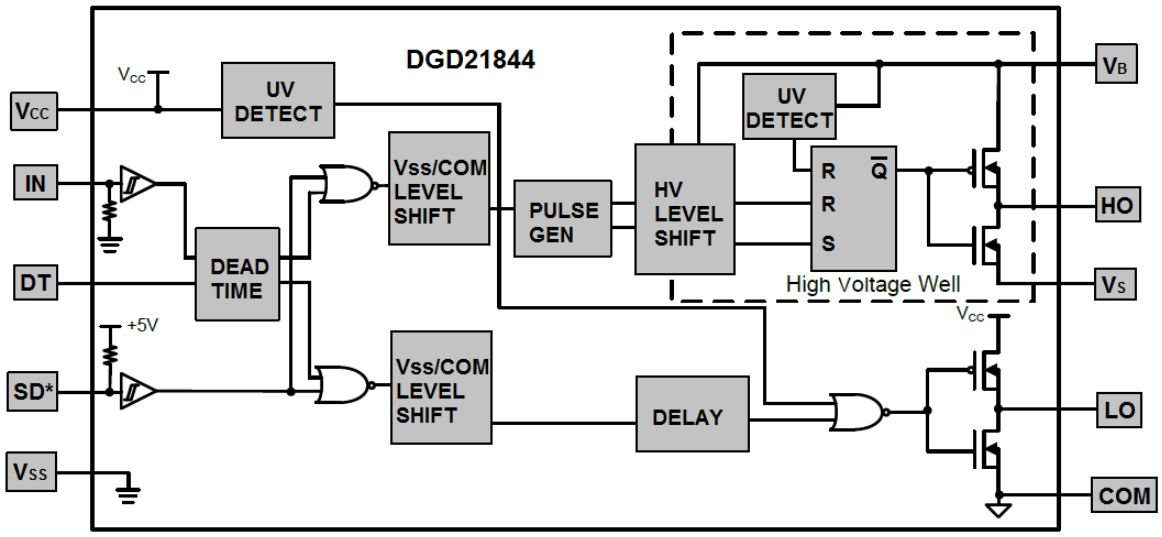


Top View SO-14 (Type TH)

Pin Descriptions

Pin Number	Pin Name	Function
1	IN	Logic input for high-side and low-side gate driver outputs (HO and LO), in phase with HO (Referenced to V_{SS})
2	SD*	Logic input for shutdown (Referenced to V_{SS}), enabled low
3	V_{SS}	Logic ground
4	DT	Programmable deadtime lead (Referenced to V_{SS})
5	COM	Low-side return
6	LO	Low-side gate drive output
7	V_{CC}	Low-side and logic fixed supply
8,9,10,14	NC	No Connect (No Internal Connection)
11	V_S	High-side floating supply return
12	HO	High-side gate drive output
13	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
Programmable Dead Time Pin Voltage	V_{DT}	V_{SS}-0.3 to V_{CC}+0.3	V
Logic and 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 Supply Offset Voltage	V_{SS}	V_{CC}-24 to V_{CC}+0.3	V
Logic Input Voltage (IN and SD*)	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	1.0	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	120	°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
Logic and 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}	V_{SS}	5	V
Programmable Dead Time Pin Voltage	V_{DT}	V_{SS}	V_{CC}	V
Logic Ground	V_{SS}	-5	5	V
Ambient Temperature	T_A	-40	+125	°C

Note: 6. Logic operation for V_S = -5V to +600V. Logic state held for V_S of -5V to -V_{BS}.

DC Electrical Characteristics (V_{BIAS} (V_{CC}, V_{BS}) = 15V, V_{SS} = COM, @T_A = +25°C, unless otherwise specified.) (Note 7)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic "1" Input Voltage for HO & Logic "0" for LO	V_{IH}	2.5	–	–	V	V_{CC} = 10V to 20V
Logic "0" Input Voltage for HO & Logic "1" for LO	V_{IL}	–	–	0.8	V	V_{CC} = 10V to 20V
SD* Input Positive Going Threshold	V_{SDTH+}	2.5	–	–	V	V_{CC} = 10V to 20V
SD* Input Negative Going Threshold	V_{SDTH-}	–	–	0.8	V	V_{CC} = 10V to 20V
High Level Output Voltage, V_{BIAS} - V_O	V_{OH}	–	–	1.4	V	I_O = 0mA
Low Level Output Voltage, V_O	V_{OL}	–	–	0.2	V	I_O = 20mA
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}	0.4	1.0	1.8	mA	V_{IN} = 0V or 5V
Logic "1" Input Bias Current	I_{IN+}	–	25	60	µA	IN = 5V, SD* = 0V
Logic "0" Input Bias Current	I_{IN-}	–	–	1.0	µA	IN = 0V, SD* = 5V
V_{BS} Supply Under-voltage Positive Going Threshold	V_{BSUV+}	8.0	8.9	9.8	V	–
V_{BS} Supply Under-voltage Negative Going Threshold	V_{BSUV-}	7.4	8.2	9.0	V	–
V_{CC} Supply Under-voltage Positive Going Threshold	V_{CCUV+}	8.0	8.9	9.8	V	–
V_{CC} Supply Under-Voltage Negative Going Threshold	V_{CCUV-}	7.4	8.2	9.0	V	–
Output High Short Circuit Pulsed Current	I_{O+}	1.4	1.9	–	A	V_O = 0V, PW ≤ 10µs
Output Low Short Circuit Pulsed Current	I_{O-}	1.7	2.3	–	A	V_O = 15V, PW ≤ 10µs

Note: 7. The V_{IN} and I_{IN} parameters are referenced to V_{SS} and are applicable to the two logic input pins: IN and SD*. 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, V_{SS} = COM, C_L = 1000pF, @T_A = +25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-on Propagation Delay	t_{ON}	–	680	900	ns	V_S = 0V
Turn-off Propagation Delay	t_{OFF}	–	270	400	ns	V_S = 0V or 600V
Shut-down Propagation Delay	t_{SD}	–	180	270	ns	–
Delay Matching, HO & LO Turn-on	t_{DMON}	–	–	90	ns	–
Delay Matching, HO & LO Turn-off	t_{DMOFF}	–	–	40	ns	–
Turn-on Rise Time	t_R	–	40	60	ns	V_S = 0V
Turn-off Fall Time	t_F	–	20	35	ns	V_S = 0V
Deadtime: $t_{DT\ LO\text{-}HO}$ & $t_{DT\ HO\text{-}LO}$	t_{DT}	280	400	520	ns	R_{DT} = 0Ω
		4	5	6	µs	R_{DT} = 200KΩ
Deatime Matching = $t_{DT\ LO\text{-}HO}$ - $t_{DT\ HO\text{-}LO}$	t_{MDT}	–	0	50	ns	R_{DT} = 0Ω
		–	0	600	ns	R_{DT} = 200KΩ

Timing Waveforms

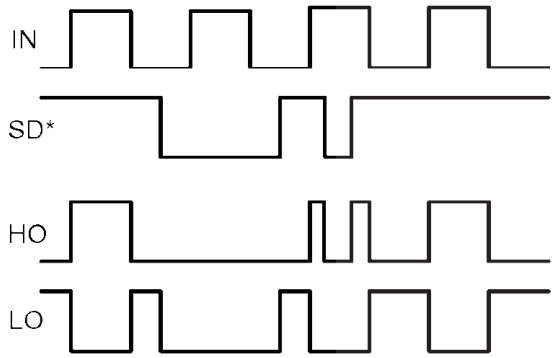


Figure 1. Input / Output Timing Diagram

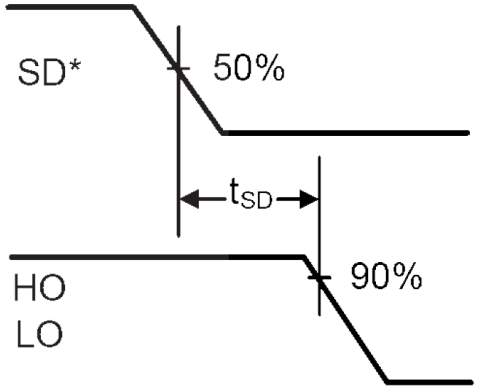
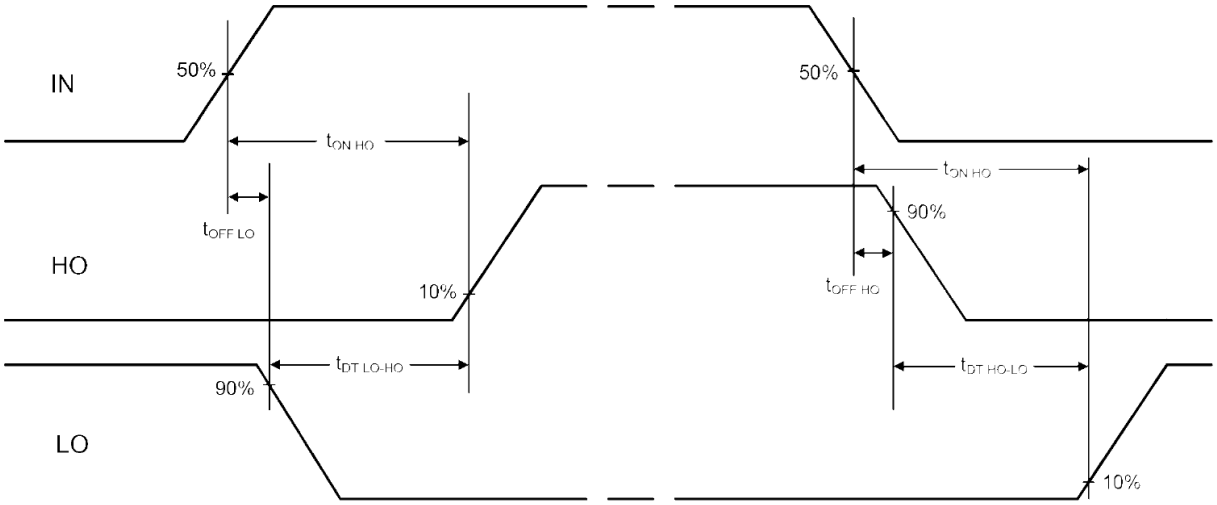


Figure 2. Shutdown Waveform Definitions



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

$t_{DM\ OFF} = t_{OFF\ LO} - t_{OFFT\ HO}$

Figure 3. Switching Time Waveform Definitions

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

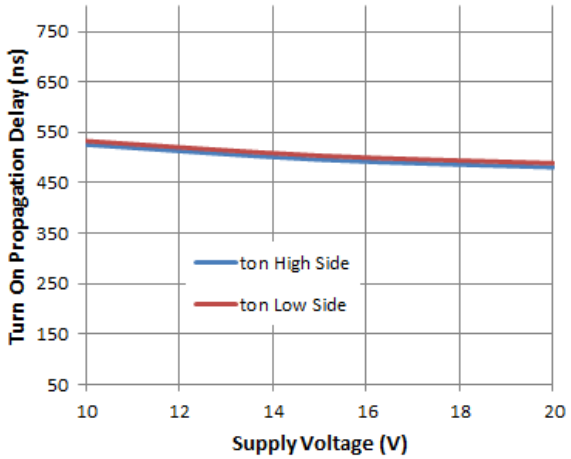


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

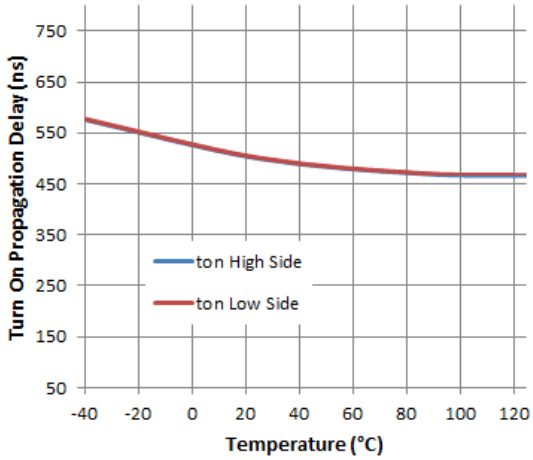


Figure 5. Turn-on Propagation Delay vs. Temperature

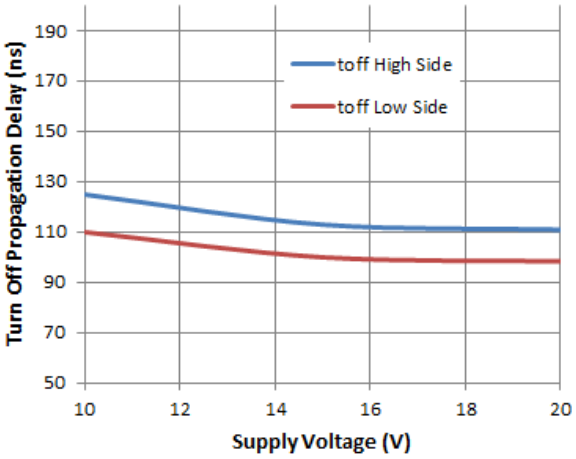


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

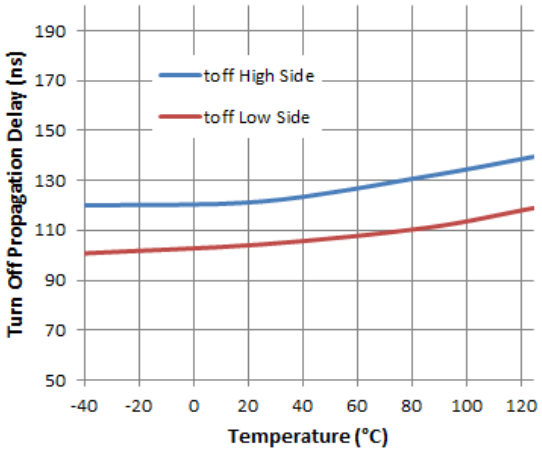


Figure 7. Turn-off Propagation Delay vs. Temperature

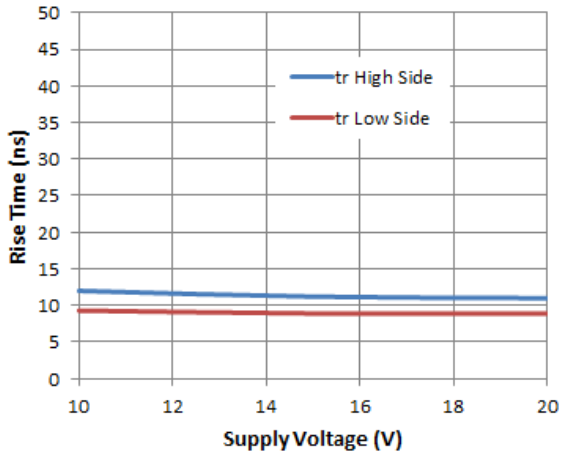


Figure 8. Rise Time vs. Supply Voltage

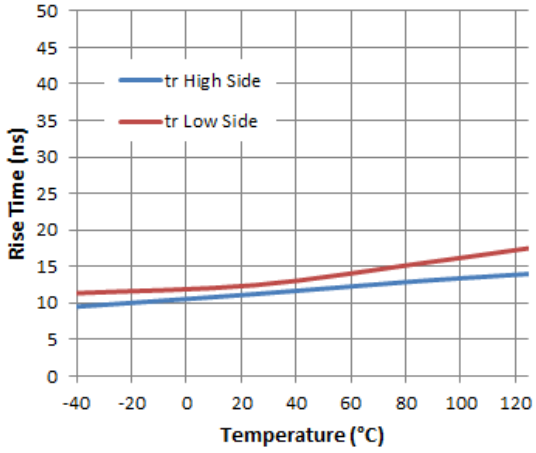


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (Cont.)

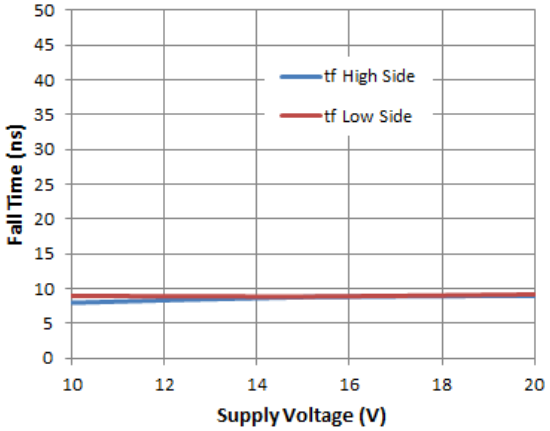


Figure 10. Fall Time vs. Supply Voltage

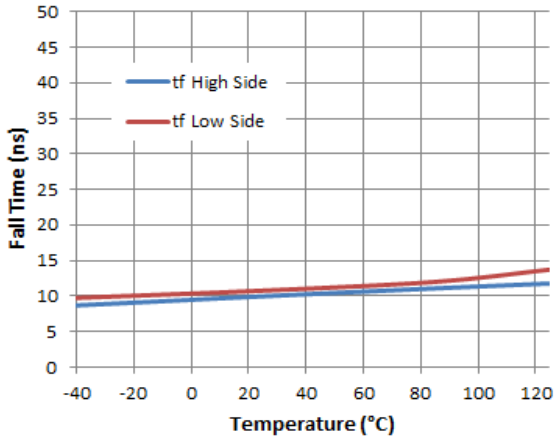


Figure 11. Fall Time vs. Temperature

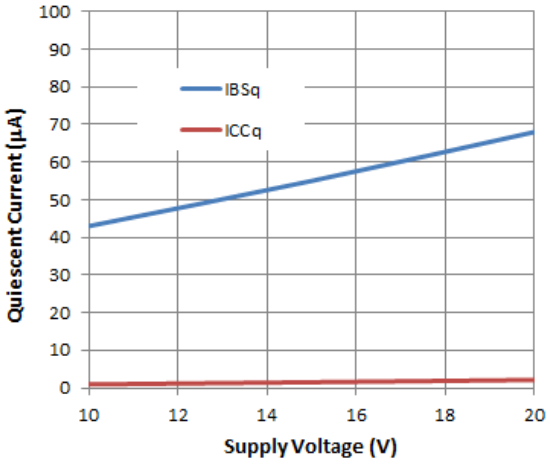


Figure 12. Quiescent Current vs. Supply Voltage

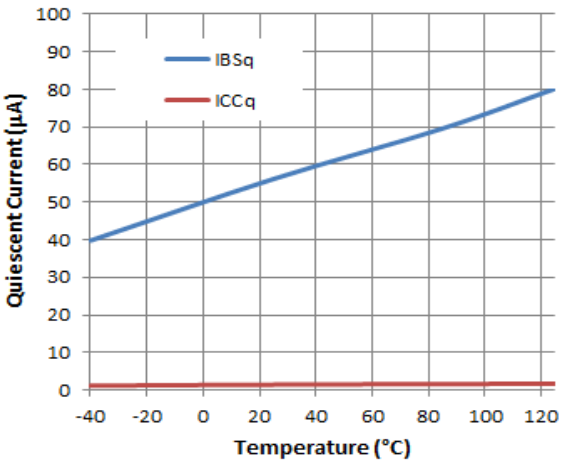


Figure 13. Quiescent Current vs. Temperature

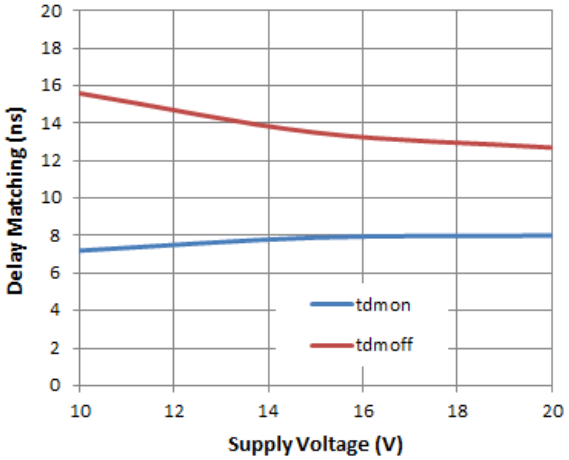


Figure 14. Delay Matching vs. Supply Voltage

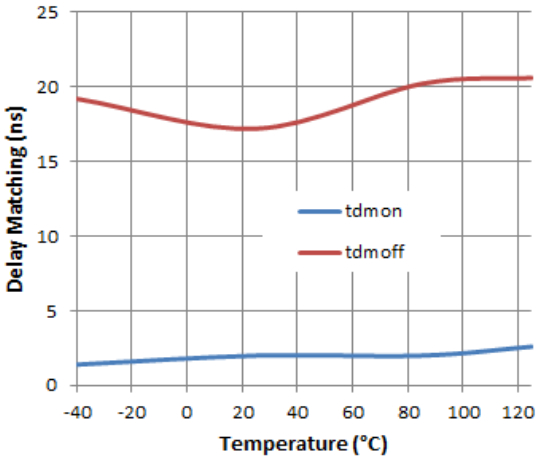


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (Cont.)

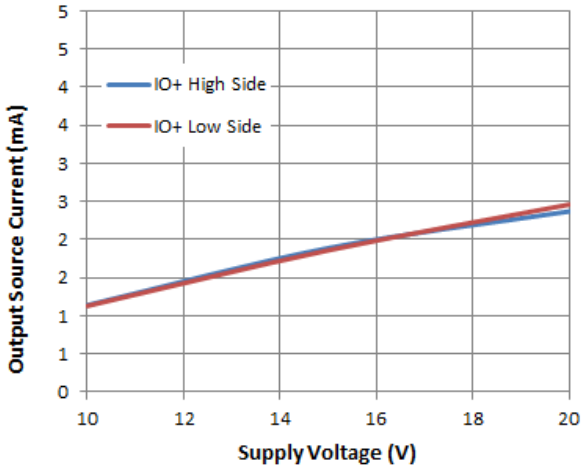


Figure 16. Output Source Current vs. Supply Voltage

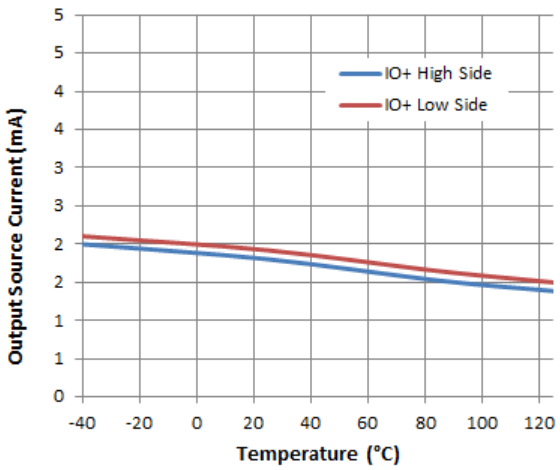


Figure 17. Output Source Current vs. Temperature

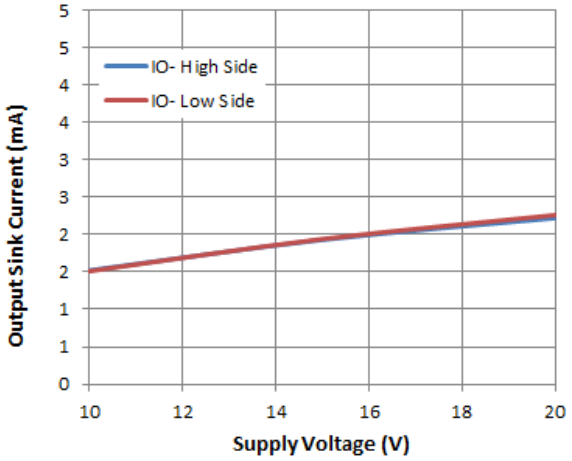


Figure 18. Output Sink Current vs. Supply Voltage

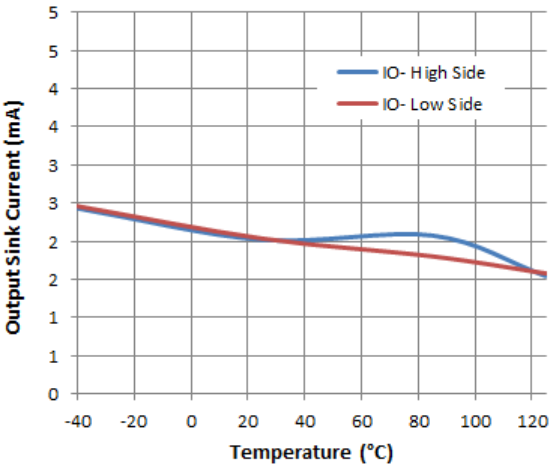


Figure 19. Output Sink Current vs. Temperature

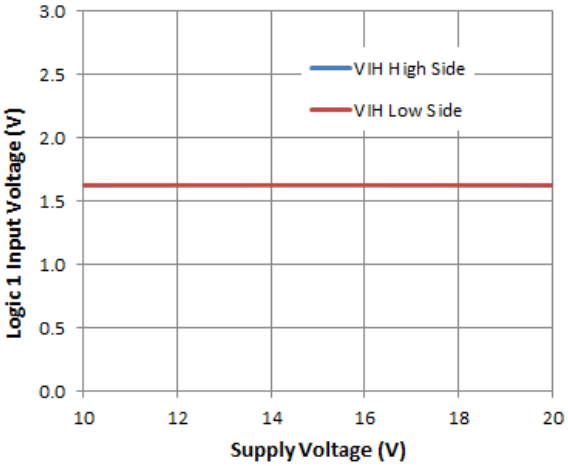


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

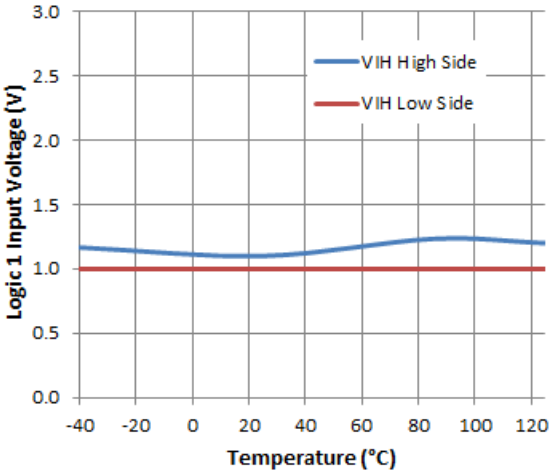


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (Cont.)

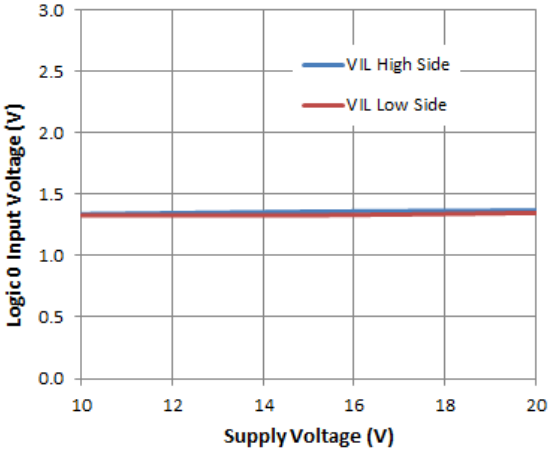


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

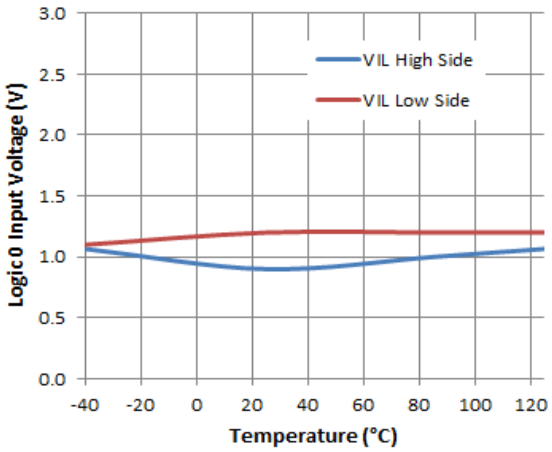


Figure 23. Logic 0 Input Voltage vs. Temperature

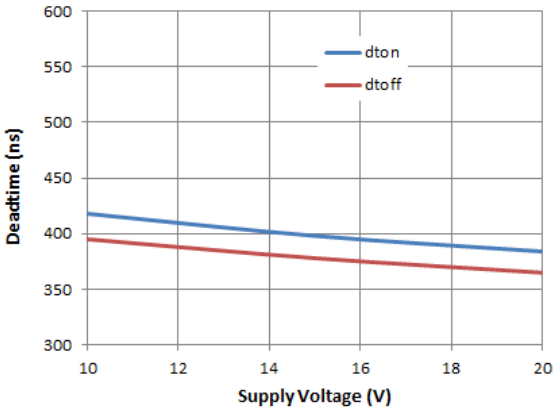


Figure 24. Deadtime vs. Supply Voltage

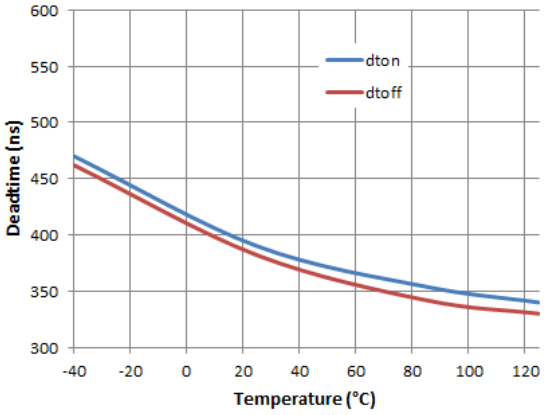


Figure 25. Deadtime vs. Temperature

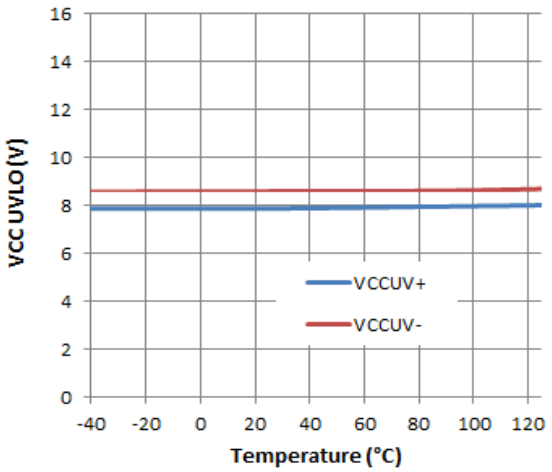


Figure 26. VCC UVLO vs. Temperature

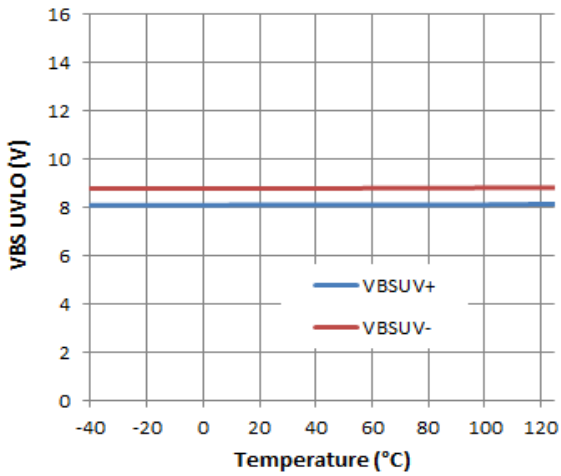


Figure 27. VBS UVLO vs. Temperature

Typical Performance Characteristics (Cont.)

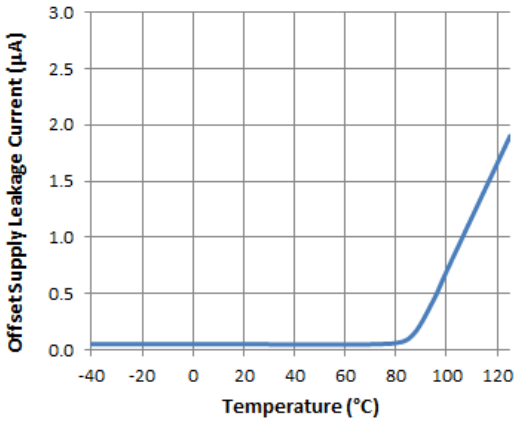
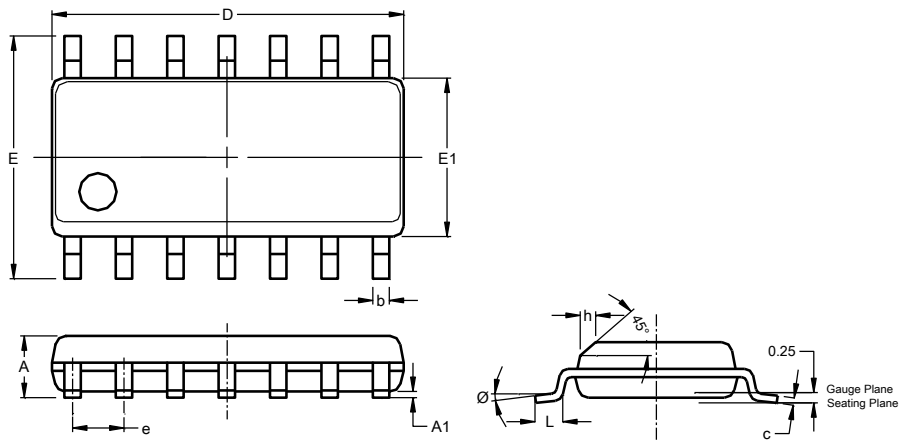


Figure 28. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

SO-14 (Type TH)

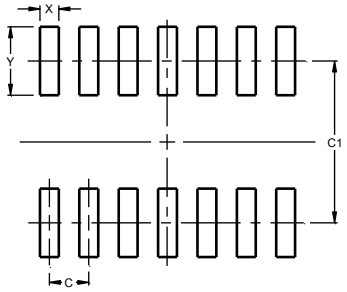


SO-14 (Type TH)			
Dim	**Min**	**Max**	**Typ**
A	1.55	1.73	--
A1	0.10	0.25	--
b	0.35	0.51	--
c	0.190	0.248	--
D	8.56	8.74	8.61
E	5.84	6.20	6.00
E1	3.81	3.99	3.94
e	--	--	1.27
h	--	--	0.33
L	0.41	0.89	--
Ø	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

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

SO-14 (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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