DIODES INCORPORATED

Lead-free Green

HIGH-SIDE AND LOW-SIDE GATE DRIVER IN SO-14 (Type TH)

Description

The DGD21064 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 DGD21064's high-side to switch to 600V in a bootstrap operation.

The DGD21064 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 DGD21064 is available in a SO-14 package and operates over an extended -40°C to +125°C temperature range.

Features

- Floating High-Side Driver in Bootstrap Operation to 600V
- Drives Two N-Channel MOSFETs or IGBTs in Half Bridge Configuation
- Outputs Tolerant to Negative Transients
- Wide Logic and Low-Side Gate Driver Supply Voltage: 10V to 20V
- Wide Logic Supply Voltage Offset Voltage: -5V to 5V
- 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)**

Applications

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

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 ⓔ3
- Weight: 0.142 grams (Approximate)
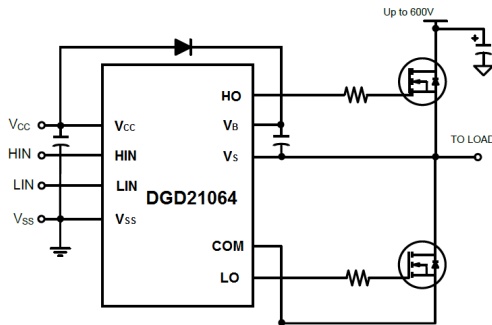
Typical Configuration

SO-14

Top View

Ordering Information (Note 4)

Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
DGD21064S14-13	DGD21064	13	16	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.
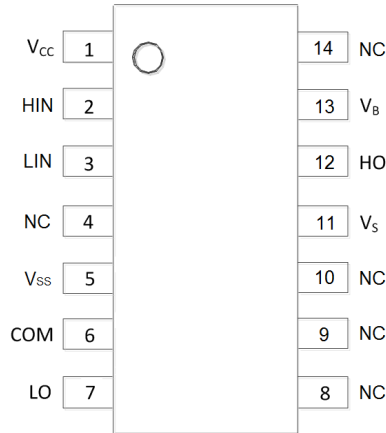4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information
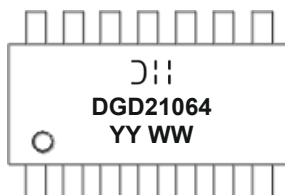
DGD21064
YY WW

Ɔ¦¦ = Manufacturer's Marking
DGD21064 = Product Type Marking Code
YY = Year (ex: 19 = 2019)
WW = Week (01 to 53)

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Pin Diagrams

```
         ┌──────────────┐
V_CC  1 ─┤  ○           ├─ 14  NC
HIN   2 ─┤              ├─ 13  V_B
LIN   3 ─┤              ├─ 12  HO
NC    4 ─┤              ├─ 11  V_S
V_SS  5 ─┤              ├─ 10  NC
COM   6 ─┤              ├─ 9   NC
LO    7 ─┤              ├─ 8   NC
         └──────────────┘
```

Top View: SO-14

Pin Descriptions

Pin Number	Pin Name	Function
1	V_{CC}	Low-side and logic fixed supply
2	HIN	Logic input for high-side gate driver output, in phase with HO (Referenced to V_{SS})
3	LIN	Logic input for low-side gate driver output, in phase with LO (Referenced to V_{SS})
4,8,9,10,14	NC	No connect (No Internal Connection)
5	V_{SS}	Logic ground
6	COM	Low-side return
7	LO	Low-side gate drive output
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

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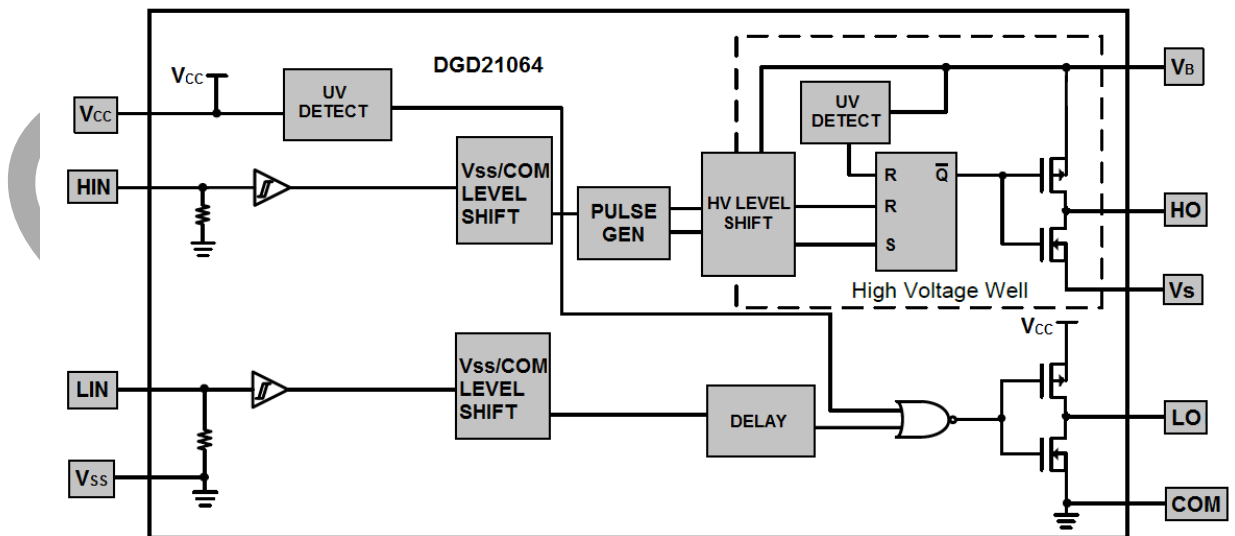
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Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
High-Side Floating Supply Voltage	V_B	-0.3 to +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 Supply Offset Voltage	V_{SS}	V_{SS}-24 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	1.0	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	120	°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)	600	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}	COM	V_{CC}	V
Logic Input Voltage (HIN and LIN)	V_{IN}	V_{SS}	5	V
Logic Ground	V_{SS}	-5	5	V
Ambient Temperature	T_A	-40	+125	°C

Note: 6. Logic operation for V_S of -5V to +600V.

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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	Condition
Logic "1" Input Voltage (Note 8)	V$_{IH}$	2.5	–	–	V	V$_{CC}$ = 10V to 20V
Logic "0" Input Voltage (Note 8)	V$_{IL}$	–	–	0.6	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	75	130	µA	V$_{IN}$ = 0V or 5V
Quiescent V$_{CC}$ Supply Current	I$_{CCQ}$	60	120	180	µA	V$_{IN}$ = 0V or 5V
Logic "1" Input Bias Current	I$_{IN+}$	–	5.0	20	µA	V$_{IN}$ = 5V
Logic "0" Input Bias Current	I$_{IN-}$	–	–	5.0	µA	V$_{IN}$ = 0V
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	–
Hysterisis	V$_{CCUVH}$	0.3	0.7	–	V	–
	V$_{BSUVH}$	0.3	0.7	–	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 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.
8. For optimal operation, it is recommended that the input pulses (HIN and LIN) should have an minimum amplitude of 2.5V with a minimum pulse width of 440ns.

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

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Turn-On Propagation Delay	t$_{ON}$	–	220	300	ns	V$_S$ = 0V
Turn-Off Propagation Delay	t$_{OFF}$	–	200	280	ns	V$_S$ = 0V or 600V
Delay Matching	t$_{DM}$	–	–	30	ns	–
Turn-On Rise Time	t$_R$	–	100	220	ns	V$_S$ = 0V
Turn-Off Fall Time	t$_F$	–	35	80	ns	V$_S$ = 0V

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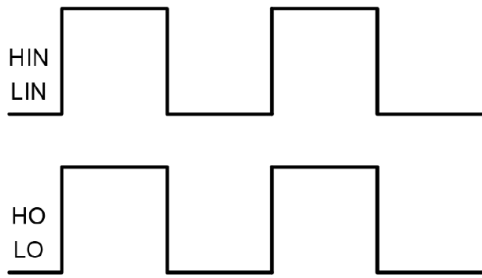
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Timing Waveforms

Figure 1. Input / Output Timing Diagram
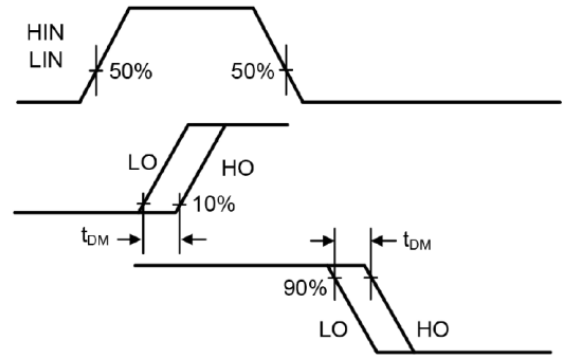
Figure 2. Delay Matching Waveform Definitions
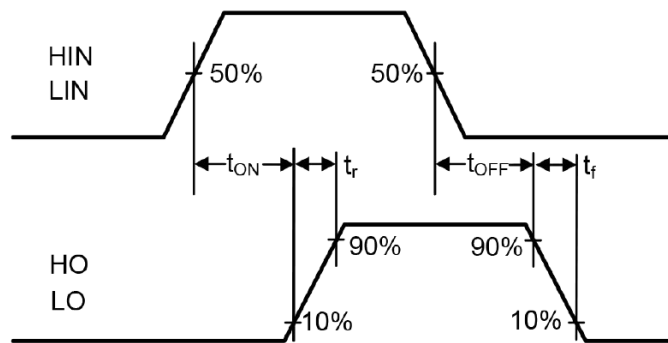
Figure 3. Switching Time Waveform Definitions

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Typical Performance Characteristics (V_CC=15V, @T_A = +25°C, unless otherwise specified.)
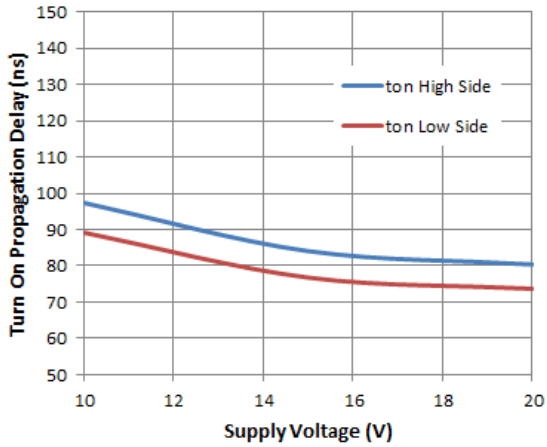
Figure 4. Turn-on Propagation Delay vs. Supply Voltage
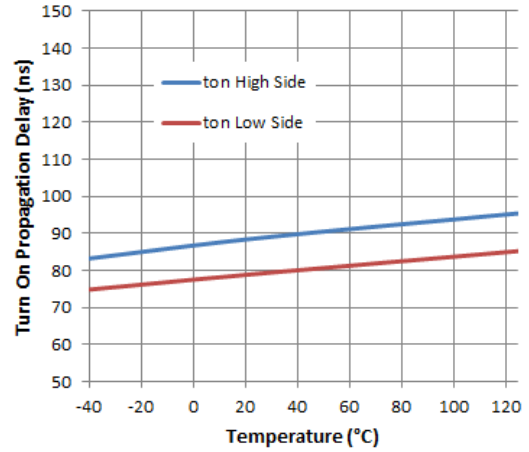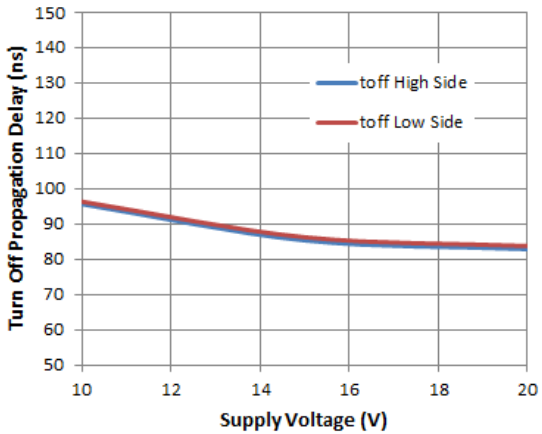

Figure 5. Turn-on Propagation Delay vs. Temperature

Figure 6. Turn-off Propagation Delay vs. Supply Voltage
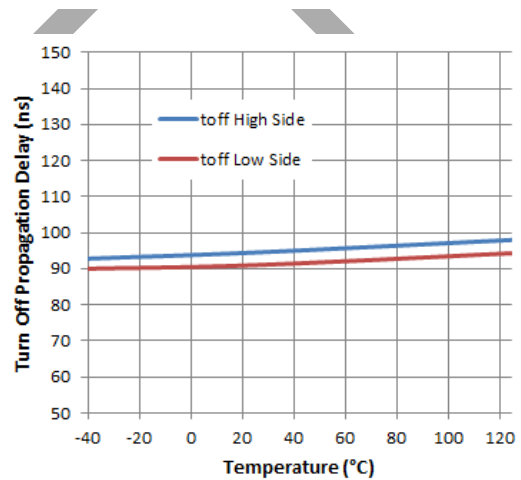
Figure 7. Turn-off Propagation Delay vs. Temperature
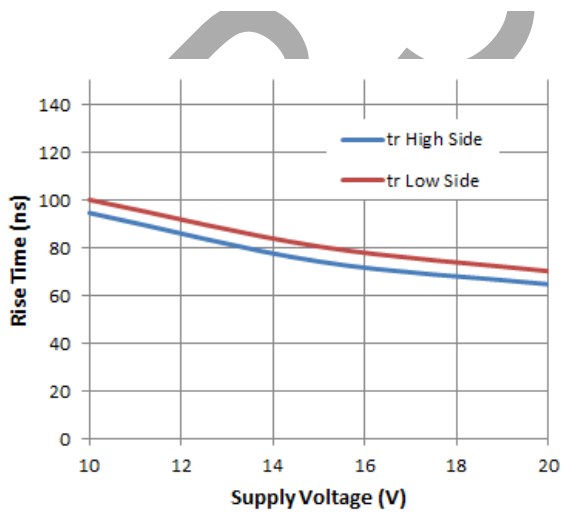
Figure 8. Rise Time vs. Supply Voltage
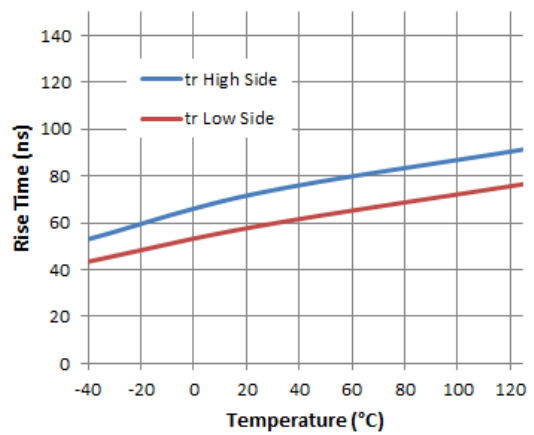
Figure 9. Rise Time vs. Temperature

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Typical Performance Characteristics (continued)
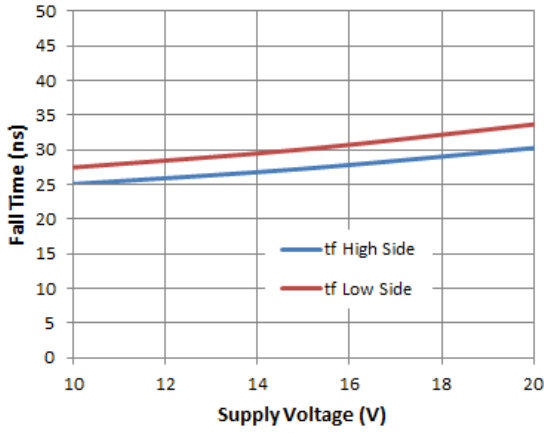
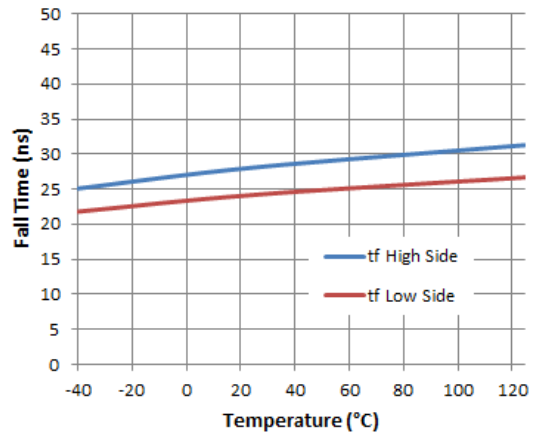Figure 10. Fall Time vs. Supply Voltage
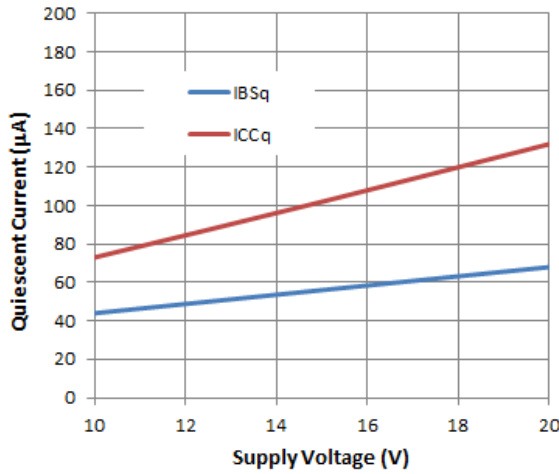

Figure 11. Fall Time vs. Temperature
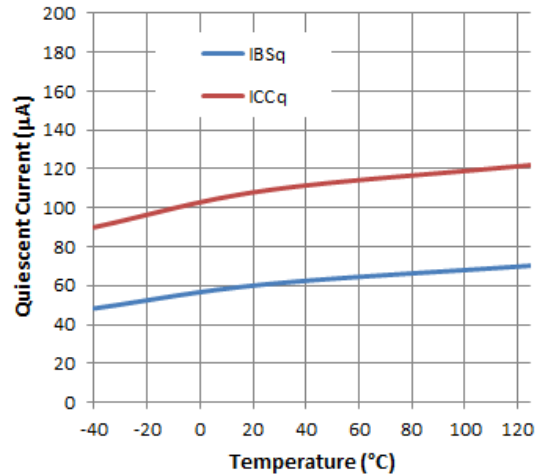

Figure 12. Quiescent Current vs. Supply Voltage
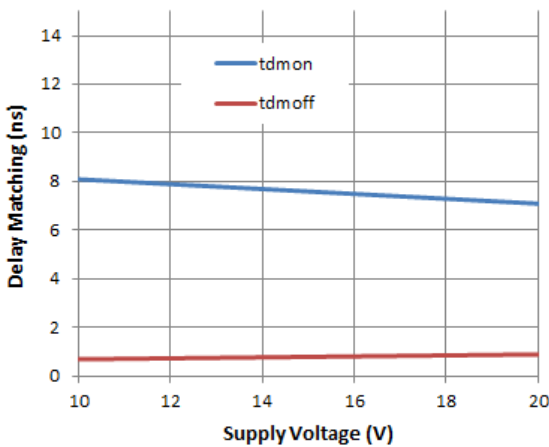

Figure 13. Quiescent Current vs. Temperature

Figure 14. Delay Matching vs. Supply Voltage

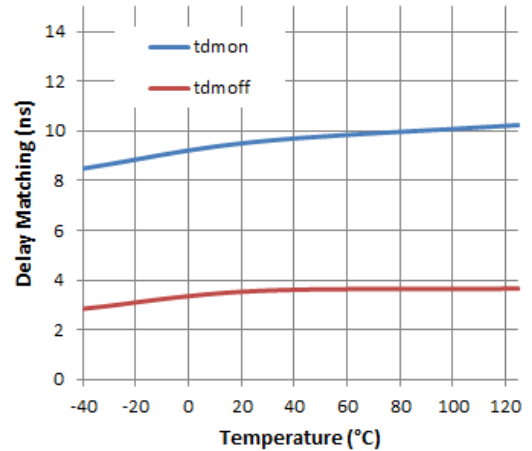
Figure 15. Delay Matching vs. Temperature

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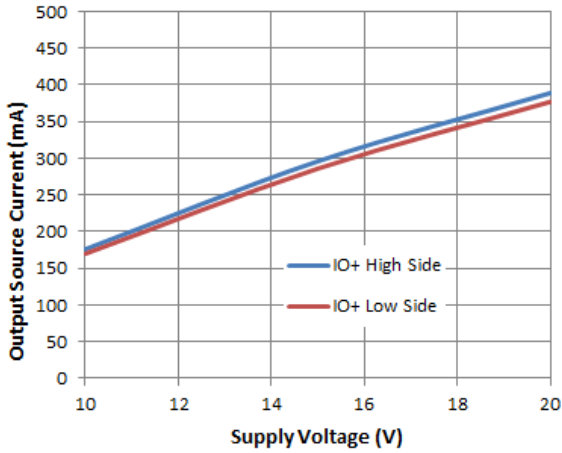## Typical Performance Characteristics (continued)

Figure 16. Output Source Current vs. Supply Voltage
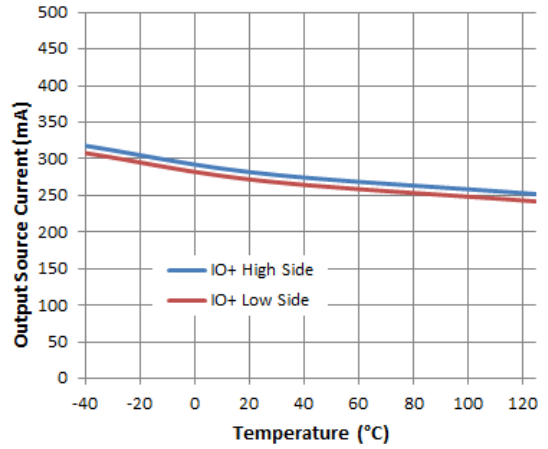

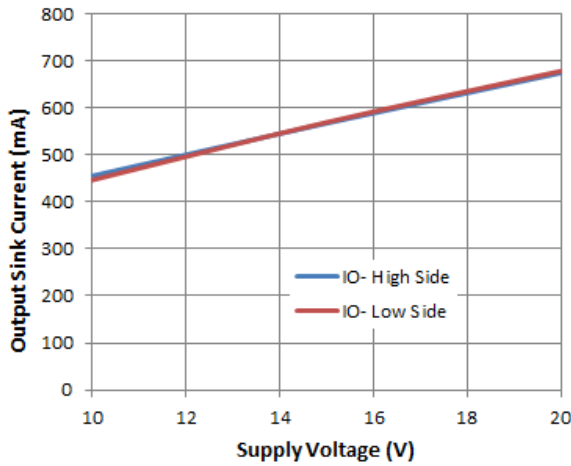Figure 17. Output Source Current vs. Temperature

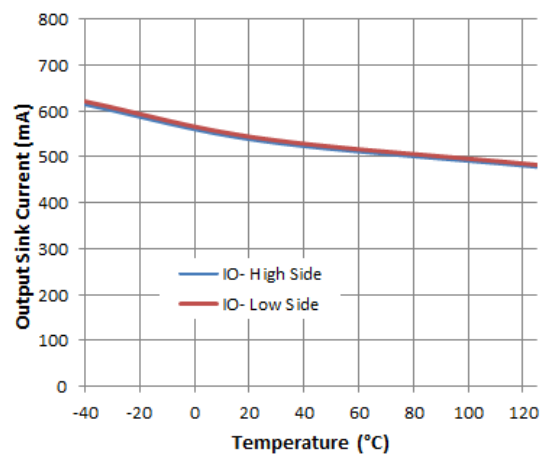Figure 18. Output Sink Current vs. Supply Voltage

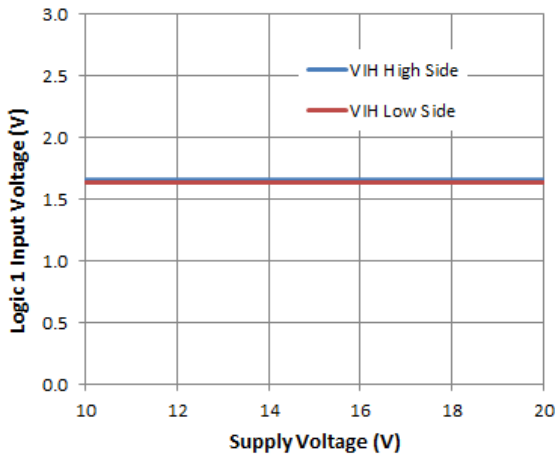Figure 19. Output Sink Current vs. Temperature

Figure 20. Logic 1 Input Voltage vs. Supply Voltage
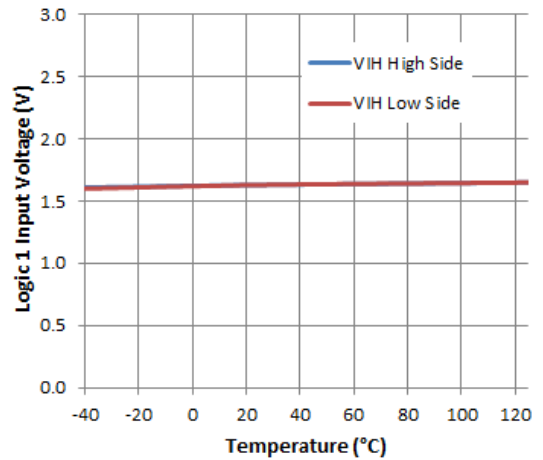
Figure 21. Logic 1 Input Voltage vs. Temperature

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Typical Performance Characteristics (continued)

Figure 22. Logic 0 Input Voltage vs. Supply Voltage

Figure 23. Logic 0 Input Voltage vs. Temperature

Figure 24. VCC UVLO vs. Temperature

Figure 25. VBS UVLO vs. Temperature

Figure 26. Offset Supply Leakage Current vs. Temperature

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Package Outline Dimensions

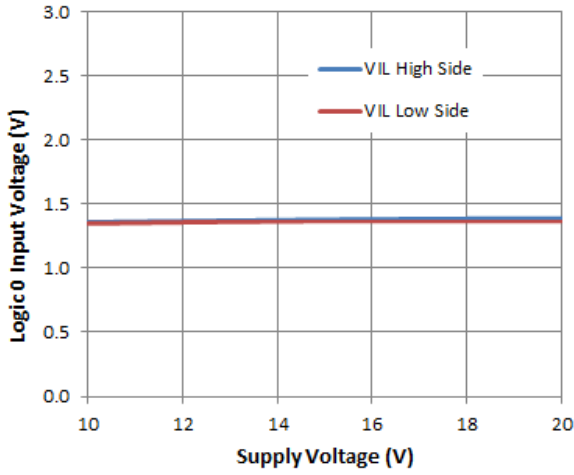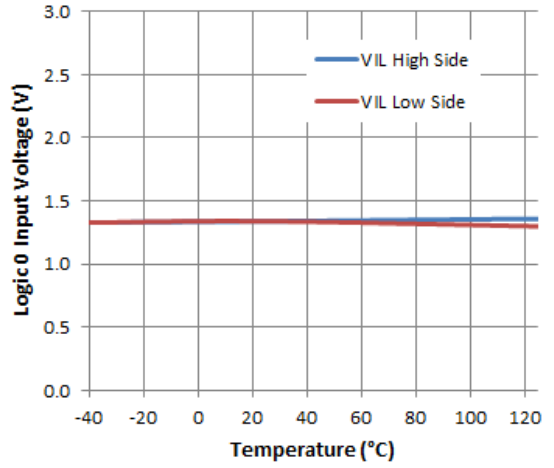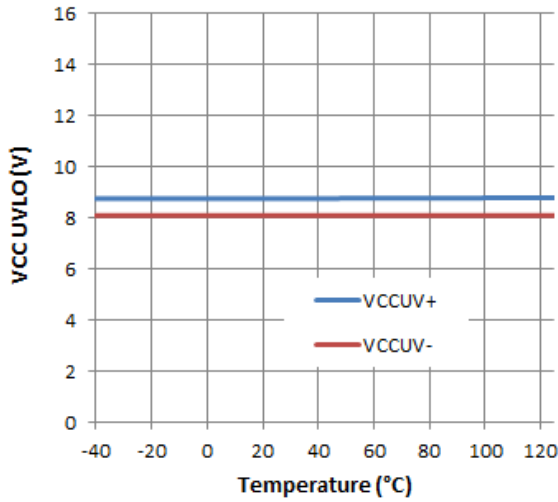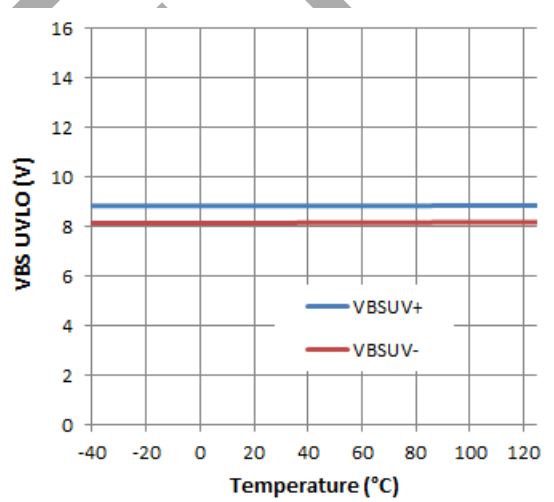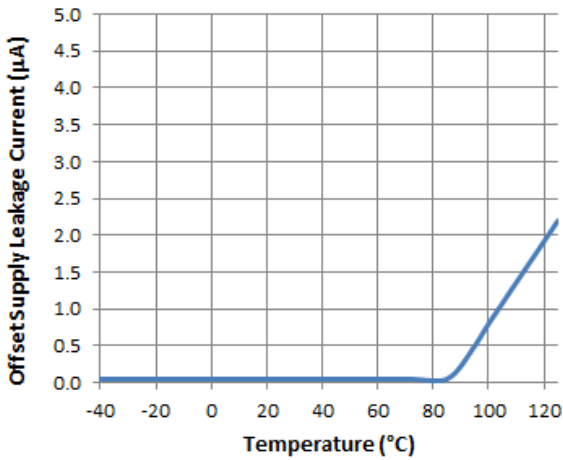Please see http://www.diodes.com/package-outlines.html for the latest version.
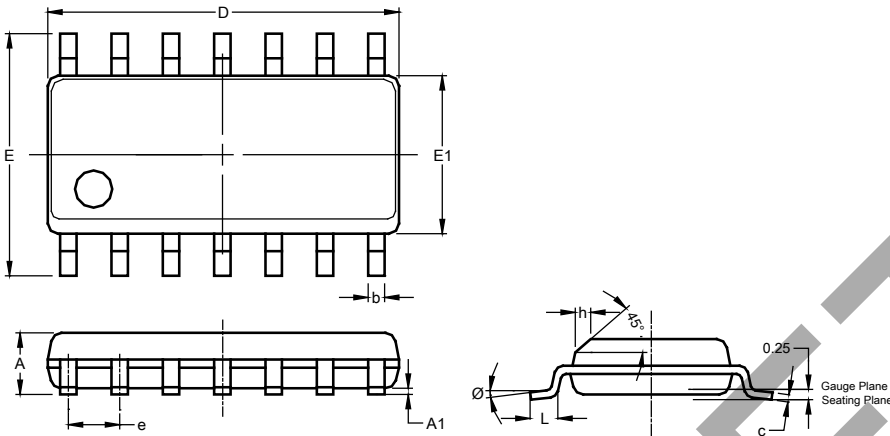
SO-14 (Type TH)

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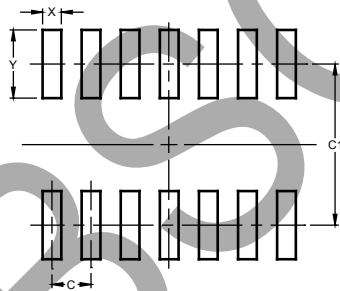
Dimensions	Value (in mm)
C	1.27
C1	5.20
X	0.60
Y	2.20

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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