

Description

The DGD1503 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 DGD1503's high side to switch to 250V in a bootstrap operation.

The DGD1503 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. DGD1503 has a fixed internal deadtime of 430ns (typical).

The DGD1503 is offered in the SO-8 package and operates over an extended -40°C to +125°C temperature range.

Applications

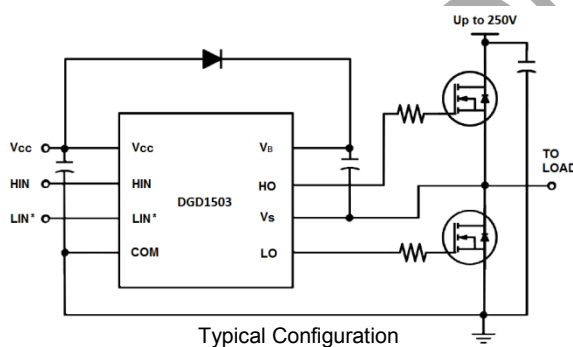
- DC-DC Converters
- DC-AC Inverters
- AC-DC Power Supplies
- Motor Controls
- Class D Power Amplifiers

Features

- Floating High-Side Driver In Bootstrap Operation to 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 (HIN and LIN*) 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)**
- **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 Ⓜ3
- Weight: 0.075 grams (Approximate)

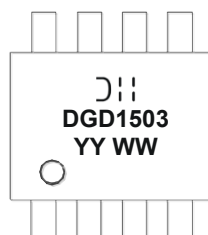


Ordering Information (Note 4)

| Product | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|--------------|---------|--------------------|-----------------|-------------------|
| DGD1503S8-13 | DGD1503 | 13 | 12 | 2500 |

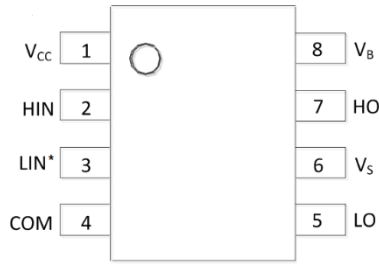
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen-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

Marking Information



☽|| = Manufacturer's marking
 DGD1503 = Product Type Marking Code
 YY = Year (ex: 19 = 2019)
 WW = Week (01 - 53)

Pin Diagrams

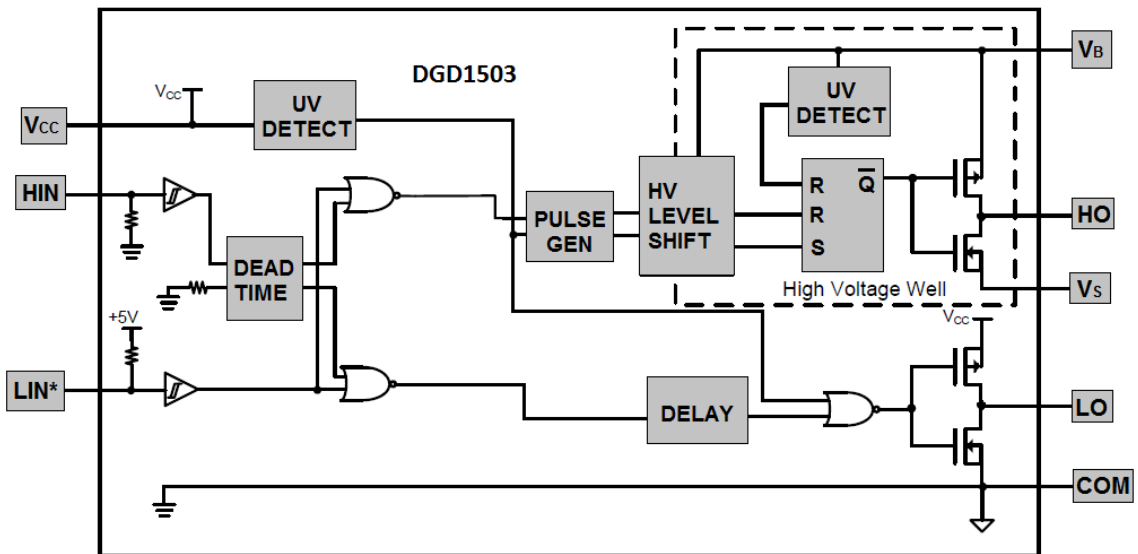


Top view: SO-8

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 +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 (HIN and LIN*) | V _{IN} | -0.3 to V _{CC} +0.3 | V |

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

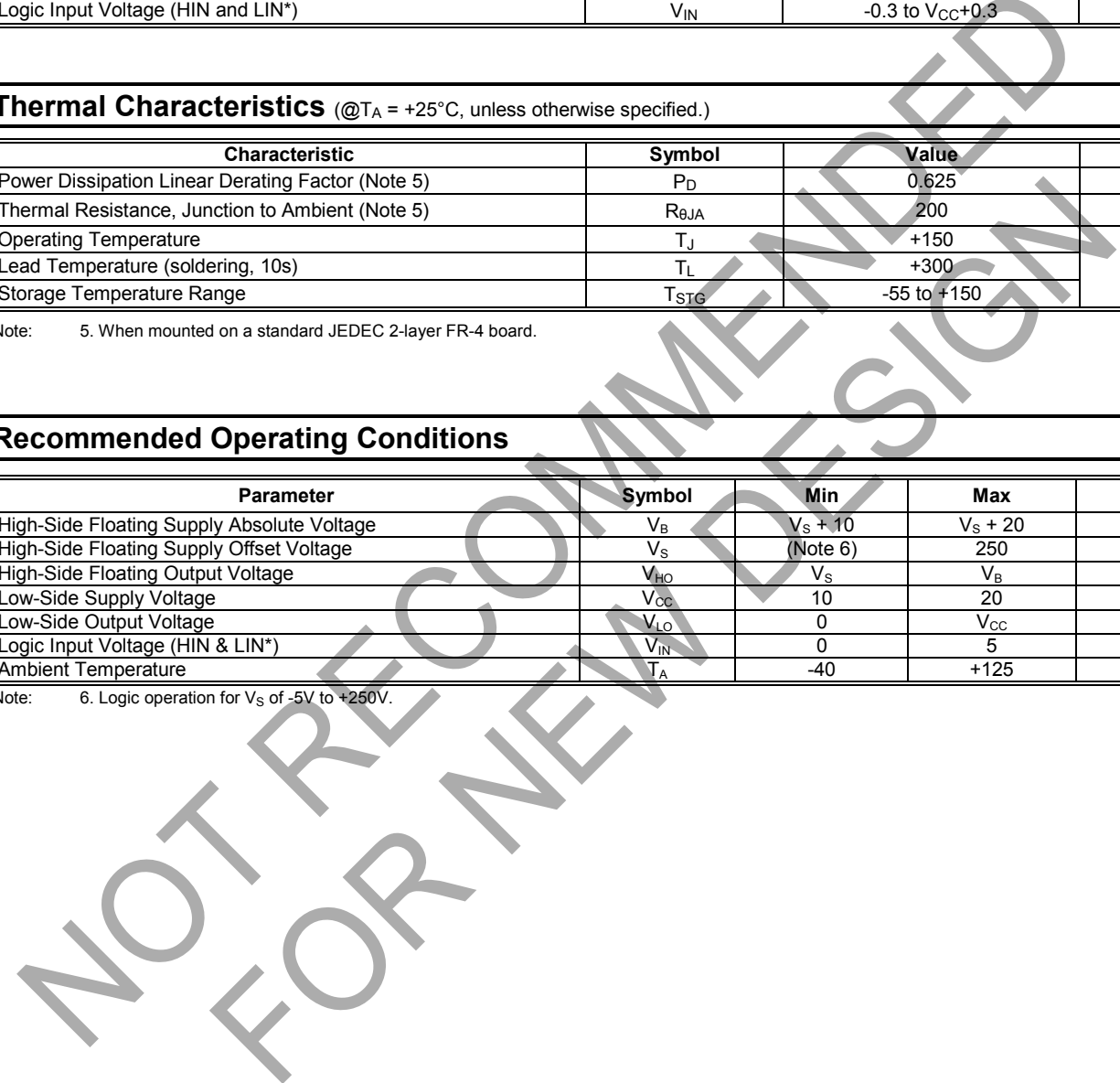
| Characteristic | Symbol | Value | Unit |
|---|------------------|-------------|------|
| Power Dissipation Linear Derating Factor (Note 5) | P _D | 0.625 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | R _{θJA} | 200 | °C/W |
| Operating Temperature | T _J | +150 | °C |
| Lead Temperature (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 Supply Voltage | V _{CC} | 10 | 20 | V |
| Low-Side Output Voltage | V _{LO} | 0 | V _{CC} | V |
| Logic Input Voltage (HIN & LIN*) | V _{IN} | 0 | 5 | V |
| Ambient Temperature | T _A | -40 | +125 | °C |

Note: 6. Logic operation for V_S of -5V to +250V.



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) & Logic "0" (LIN*) Input Voltage | V_{IH} | 2.5 | – | – | V | $V_{CC} = 10V$ to 20V |
| Logic "0" (HIN) & Logic "1" (LIN*) 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 | 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+} | 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 | $V_O = 0V$, $PW \leq 10\mu s$ |
| Output Low Short Circuit Pulsed Current | I_{O-} | 270 | 600 | – | mA | $V_O = 15V$, $PW \leq 10\mu s$ |

Note: 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 860ns.

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 | $V_S = 250V$ |
| Delay Matching, HO & 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

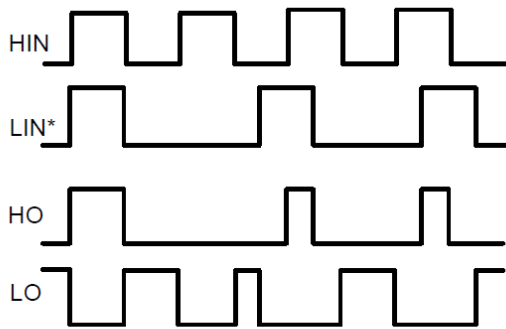


Figure 1. Input / Output Timing Diagram

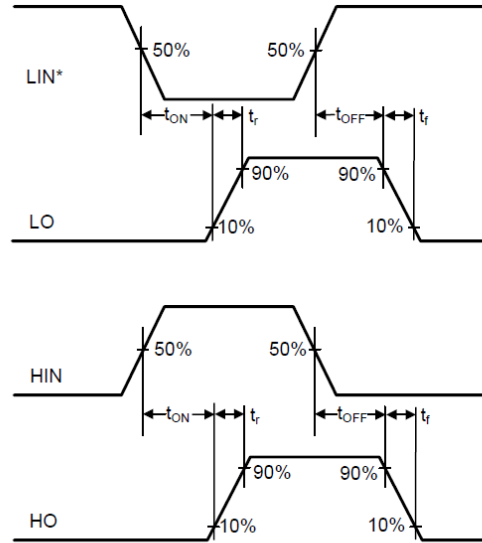


Figure 2. Switching Time Waveform Definitions

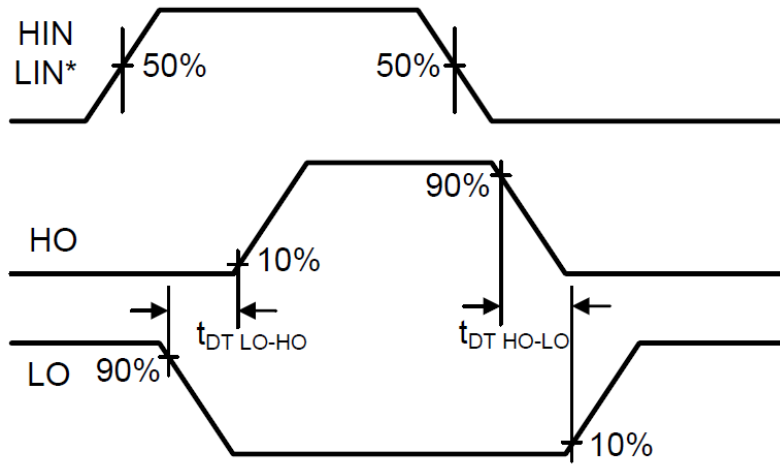


Figure 3. Deadtime Waveform Definitions

Typical Performance Characteristics ($V_{CC}=15V$, $T_A = +25^\circ C$, unless otherwise specified.)

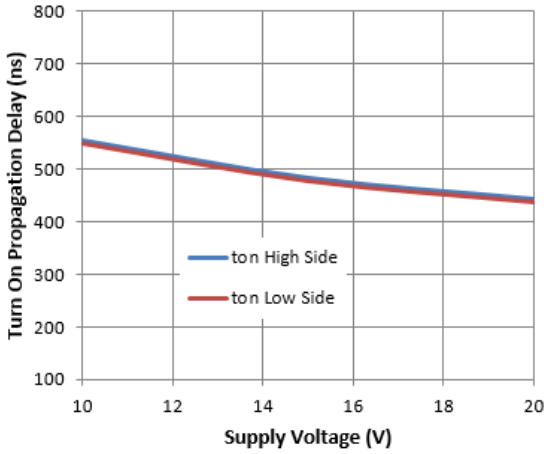


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

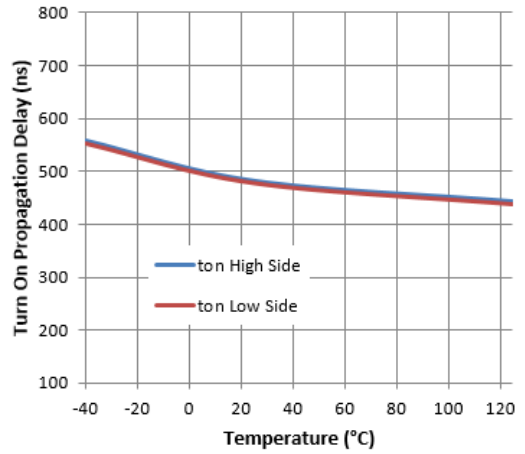


Figure 5. Turn-on Propagation Delay vs. Temperature

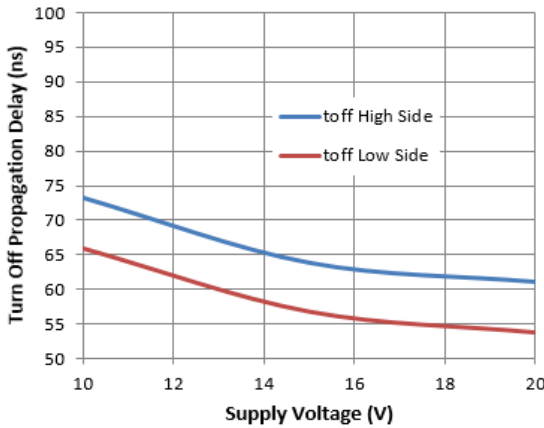


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

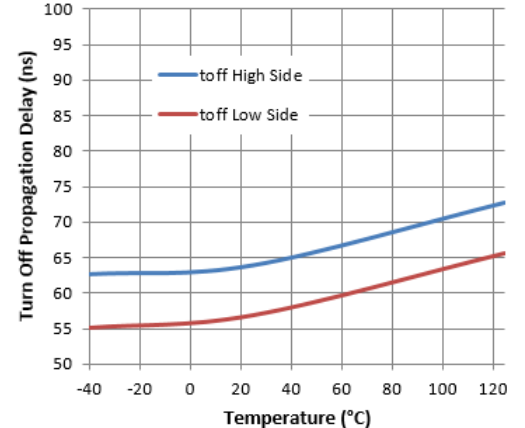


Figure 7. Turn-off Propagation Delay vs. Temperature

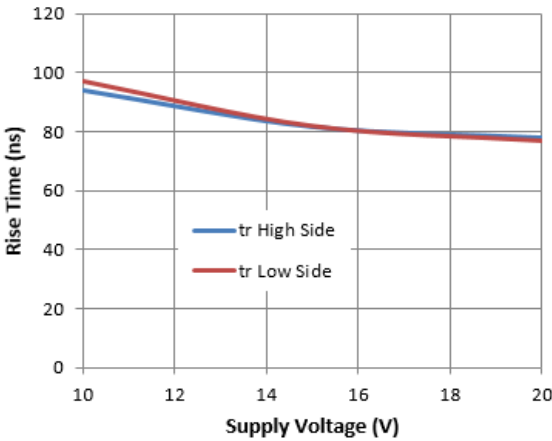


Figure 8. Rise Time vs. Supply Voltage

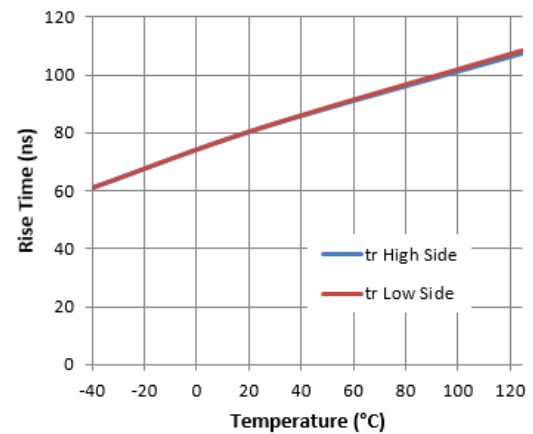


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

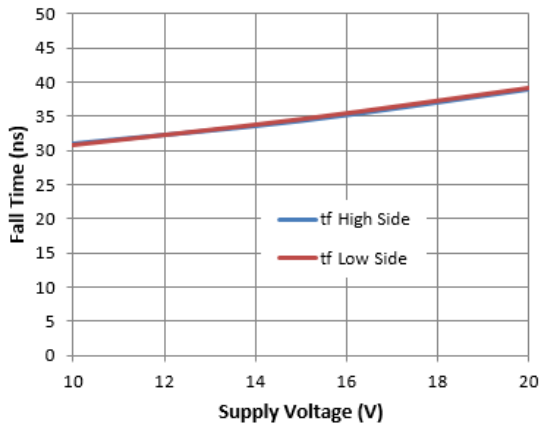


Figure 10. Fall Time vs. Supply Voltage

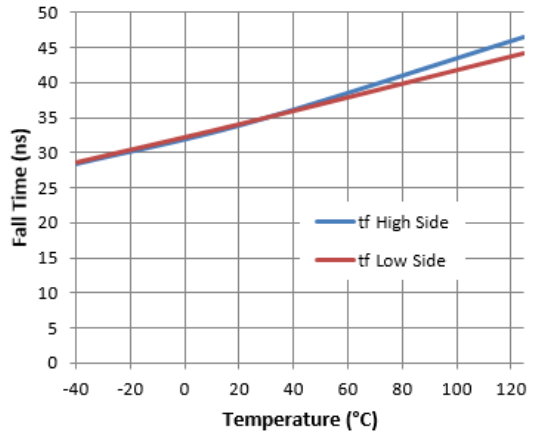


Figure 11. Fall Time vs. Temperature

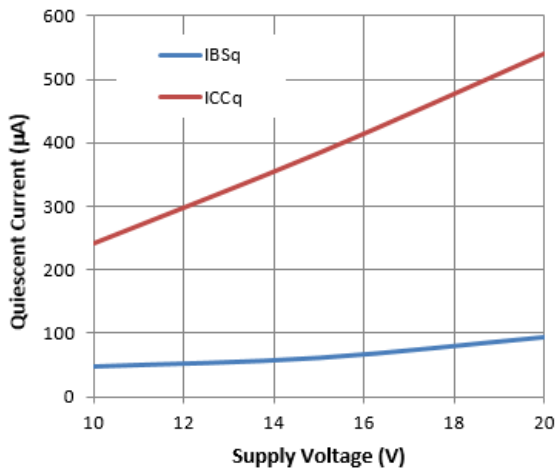


Figure 12. Quiescent Current vs. Supply Voltage

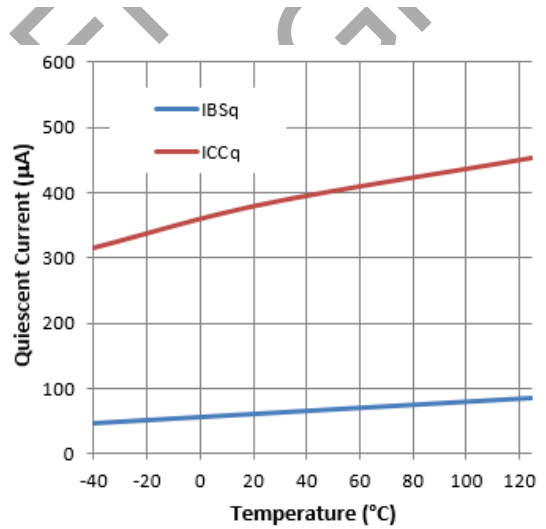


Figure 13. Quiescent Current vs. Temperature

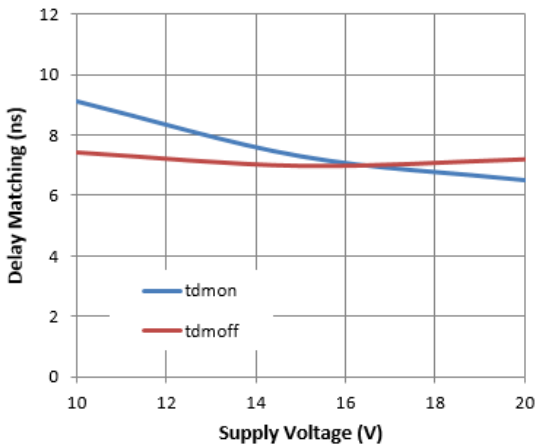


Figure 14. Delay Matching vs. Supply Voltage

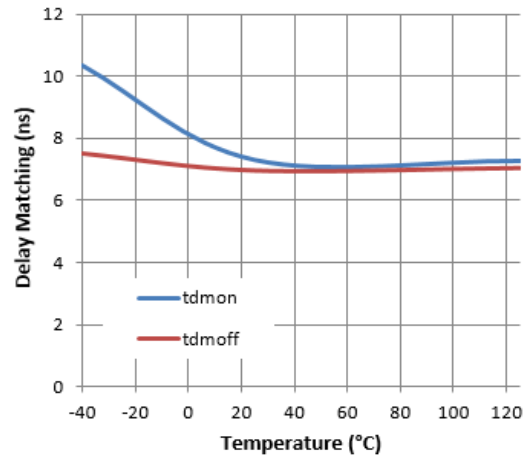


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (cont.)

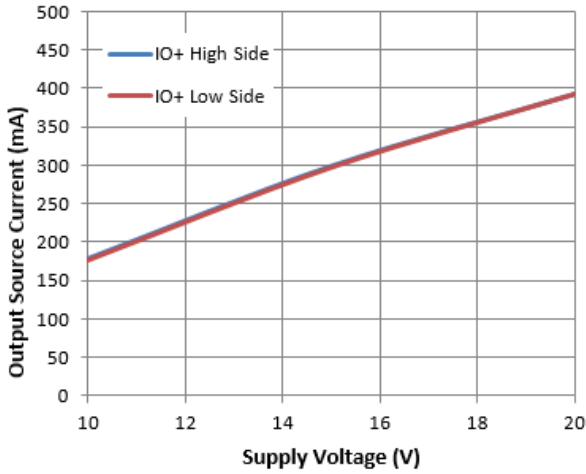


Figure 16. Output Source Current vs. Supply Voltage

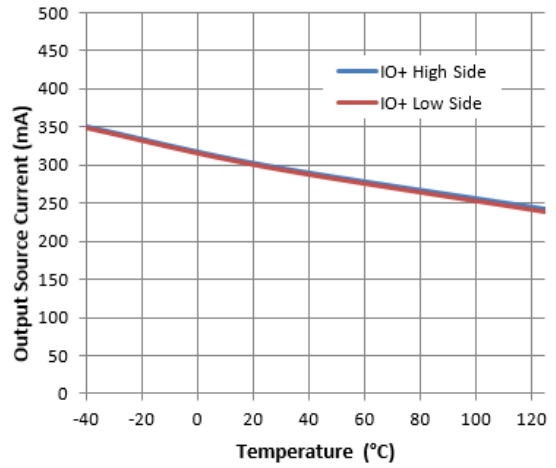


Figure 17. Output Source Current vs. Temperature

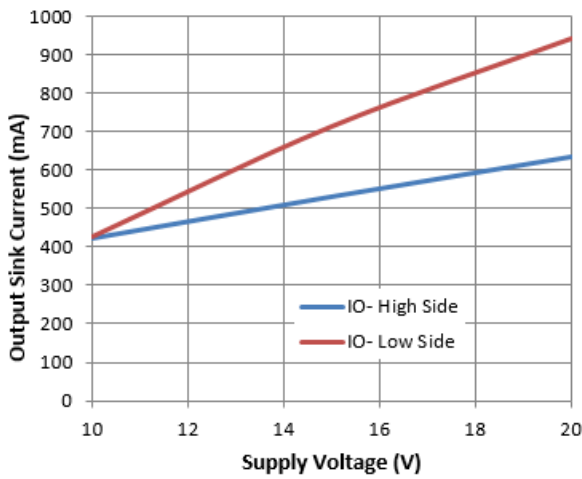


Figure 18. Output Sink Current vs. Supply Voltage

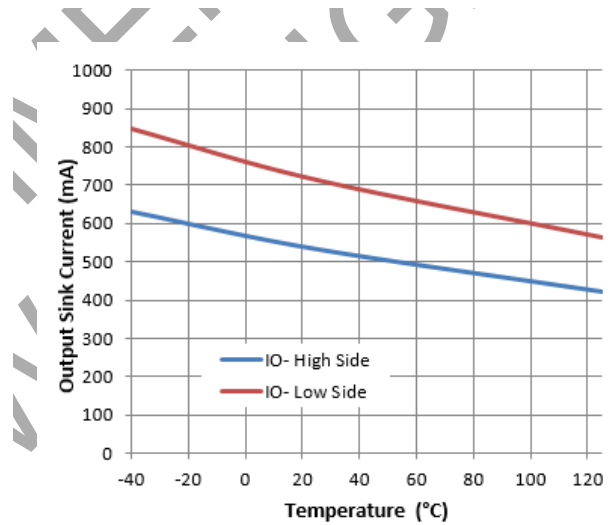


Figure 19. Output Sink Current vs. Temperature

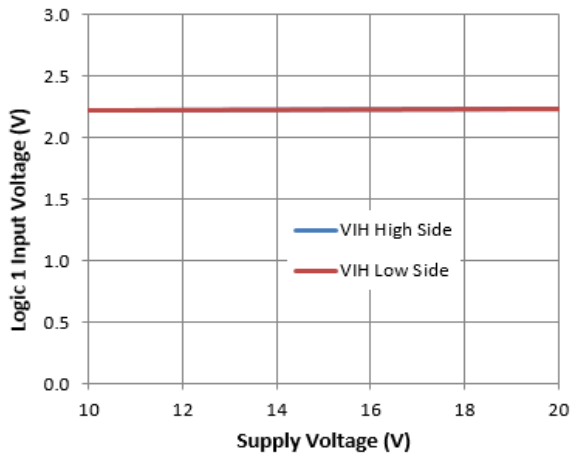


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

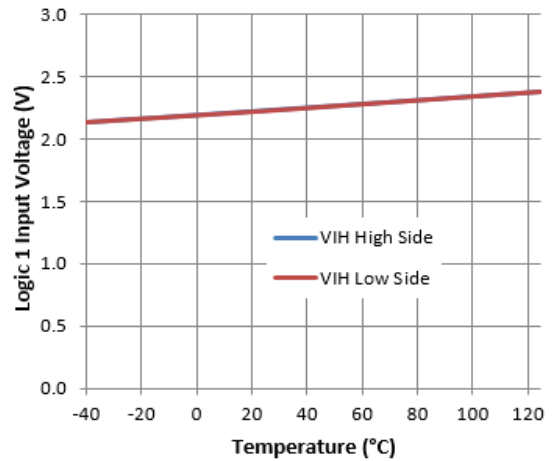


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (cont.)

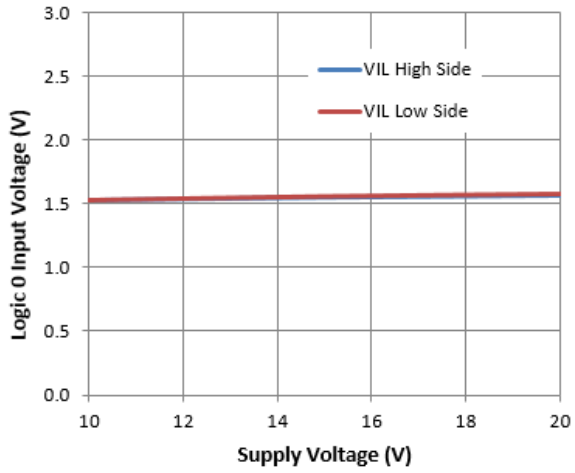


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

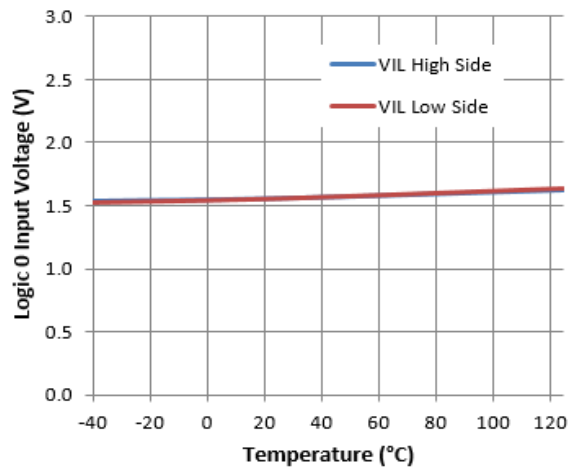


Figure 23. Logic 0 Input Voltage vs. Temperature

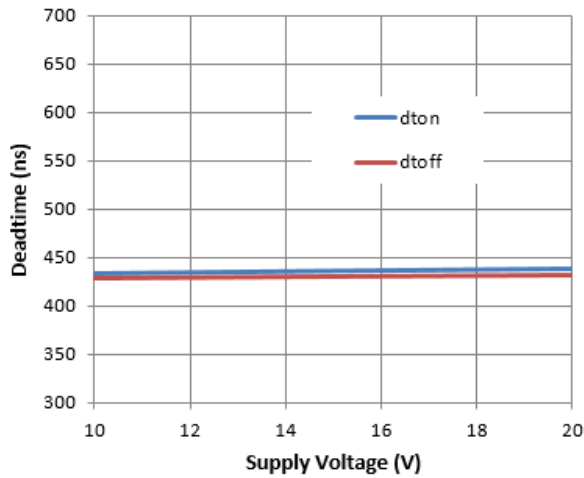


Figure 24. Deadtime vs. Supply Voltage

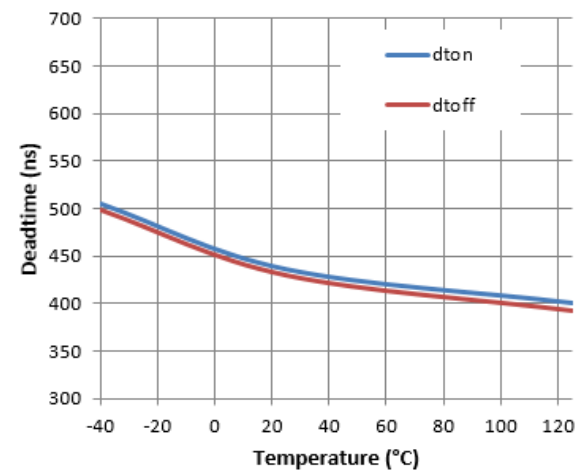


Figure 25. Deadtime vs. Temperature

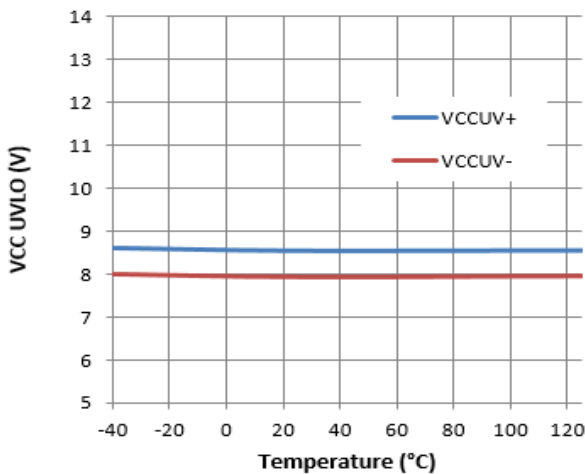


Figure 26. VCC UVLO vs. Temperature

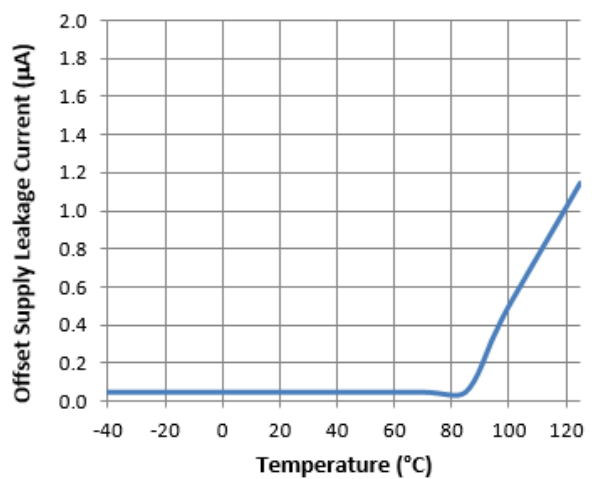
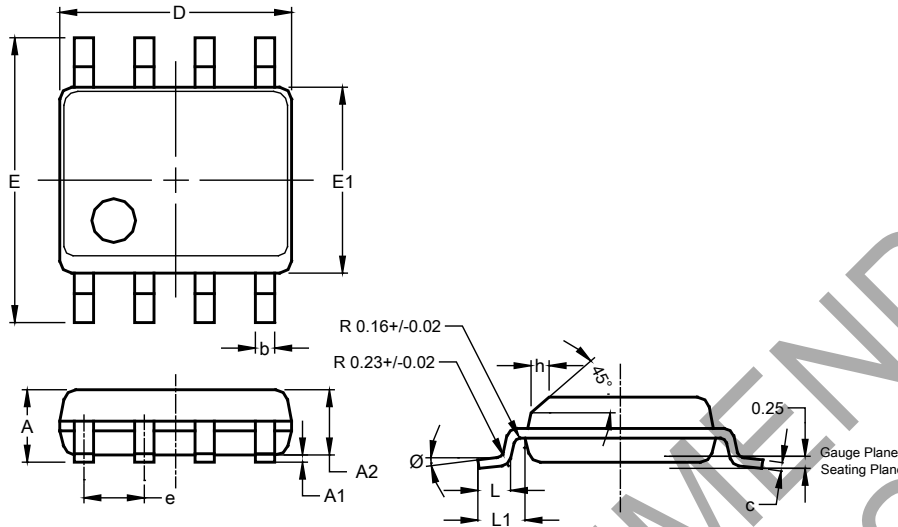


Figure 27. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

SO-8 (Type TH)

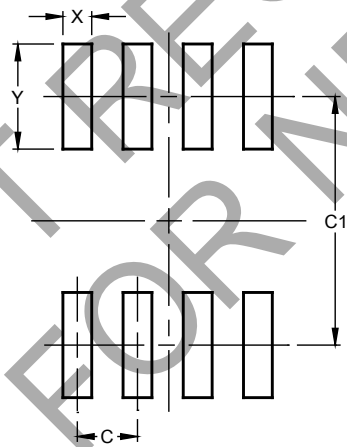


| SO-8 (Type TH) | | | |
|----------------------|-------|-------|------|
| Dim | Min | Max | Typ |
| A | 1.35 | 1.75 | -- |
| A1 | 0.10 | 0.25 | -- |
| A2 | -- | -- | 1.45 |
| b | 0.35 | 0.51 | -- |
| c | 0.190 | 0.248 | -- |
| D | 4.80 | 5.00 | 4.90 |
| E | 5.80 | 6.20 | 6.00 |
| E1 | 3.80 | 4.00 | 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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