

Description

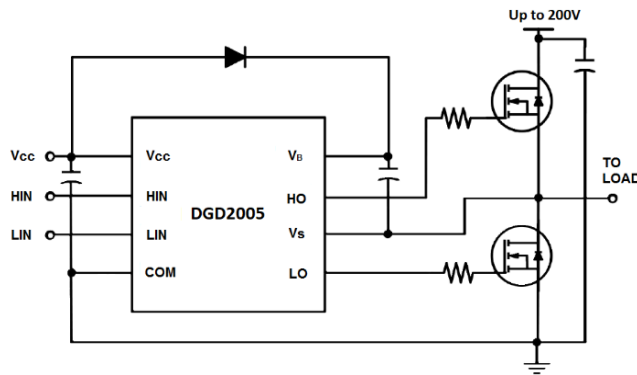
The DGD2005 is a mid-voltage/high-speed gate driver capable of driving N-channel MOSFETs in a half-bridge configuration. High-voltage processing techniques enable the DGD2005's high-side to switch to 200V in a bootstrap operation. The 30ns (maximum) propagation delay matching between the high-side and low-side drivers allows high-frequency switching.

The DGD2005 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 low-side gate driver and logic share a common ground.

The DGD2005 is available in a space saving SO-8 package and operates over an extended -40°C to +125°C temperature range.

Applications

- Battery Power Tools and Appliances
- Light Electric Vehicles (LEV)
- Inverters



Typical Configuration

Features

- Floating High-Side Driver in Bootstrap Operation to 200V
- Drives Two N-Channel MOSFETs in Half Bridge Configuration
- 290mA Source/600mA Sink Output Current Capability
- Outputs Tolerant to Negative Transients
- Wide Logic and Low-Side Gate Driver Supply Voltage: 10V to 20V
- Logic Input (HIN and LIN) 3.3V Capability
- Schmitt Triggered Logic Inputs with Internal Pull Down
- Delay Matching of 30ns Maximum
- Undervoltage Lockout for High-Side 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](mailto:contact_us) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

Mechanical Data

- Case: SO-8 (Standard)
- 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)



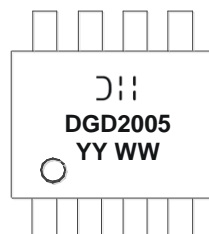
SO-8
Top View


Ordering Information (Note 4)

| Part Number | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|--------------|---------|--------------------|-----------------|-------------------|
| DGD2005S8-13 | DGD2005 | 13 | 12 | 2500 |

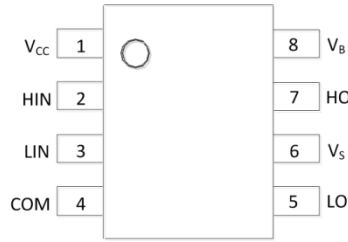
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen-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

Marking Information



 = Manufacturer's Marking
 DGD2005 = Product Type Marking Code
 YY = Year (ex: 21 = 2021)
 WW = Week (01 to 53)

Pin Diagrams

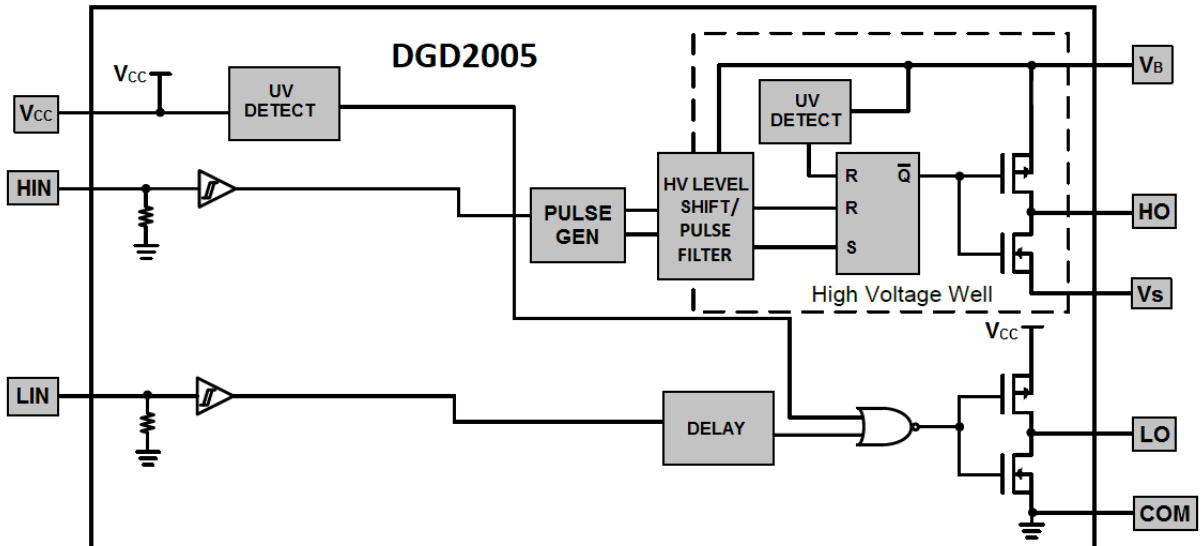


Top View: SO-8

Pin Descriptions

| Pin Number | Pin Name | Function |
|------------|----------|--|
| 1 | Vcc | Low-Side and Logic Fixed 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, in Phase with LO |
| 4 | COM | Low-Side Return |
| 5 | LO | Low-Side Gate Drive Output |
| 6 | Vs | High-Side Floating Supply Return |
| 7 | HO | High-Side Gate Drive Output |
| 8 | Vb | 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 +224 | 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} | -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) | 200 | 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 +200V.

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} | 2.5 | — | — | V | — |
| Logic "0" Input Voltage | V_{IL} | — | — | 0.6 | V | — |
| 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 | $V_B = V_S = 200V$ |
| 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-} | — | — | 2.0 | μA | $V_{IN} = 0V$ |
| V_{BS} Supply Undervoltage Positive Going Threshold | V_{BSUV+} | 8.0 | 8.9 | 9.8 | V | — |
| V_{BS} Supply Undervoltage Negative Going Threshold | V_{BSUV-} | 7.4 | 8.2 | 9.0 | V | — |
| V_{CC} Supply Undervoltage Positive Going Threshold | V_{CCUV+} | 8.0 | 8.9 | 9.8 | V | — |
| V_{CC} Supply Undervoltage Negative Going Threshold | V_{CCUV-} | 7.4 | 8.2 | 9.0 | V | — |
| Undervoltage Lockout Hysteresis | V_{UVLOH} | 0.3 | 0.7 | — | V | — |
| Output High Short Circuit Pulsed Current | I_{O+} | 130 | 290 | — | mA | $V_O = 0V$, $V_{IN} = \text{Logic "1"}$, $PW \leq 10\mu s$ |
| Output Low Short Circuit Pulsed Current | I_{O-} | 270 | 600 | — | mA | $V_O = 15V$, $V_{IN} = \text{Logic "0"}$, $PW \leq 10\mu s$ |

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} | — | 100 | 300 | ns | $V_S = 0V$ |
| Turn-Off Propagation Delay | t_{OFF} | — | 100 | 280 | ns | $V_S = 0V$ or 200V |
| Delay Matching | t_{DM} | — | — | 30 | ns | — |
| Turn-On Rise Time | t_R | — | 90 | 220 | ns | $V_S = 0V$ |
| Turn-Off Fall Time | t_F | — | 30 | 80 | ns | $V_S = 0V$ |

Timing Waveforms

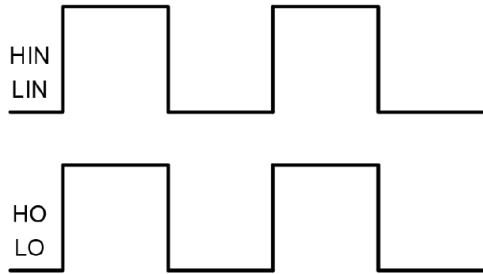


Figure 1. Input / Output Timing Diagram

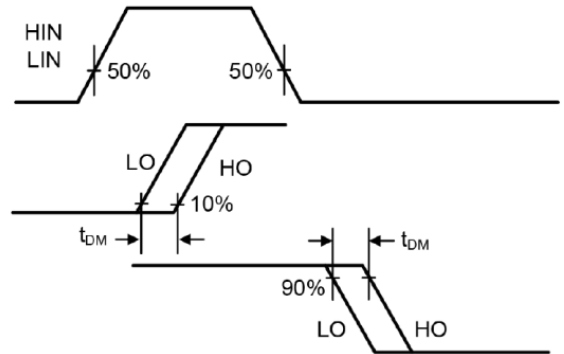


Figure 2. Delay Matching Waveform Definitions

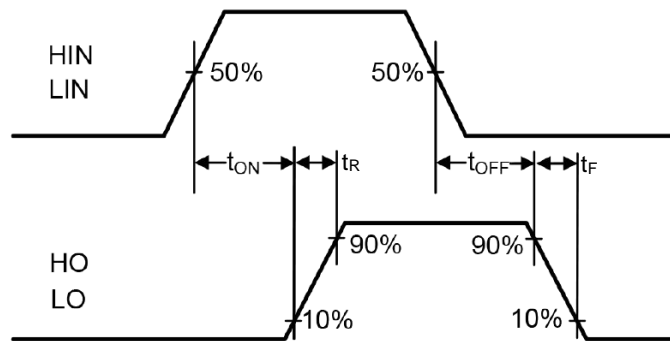


Figure 3. Switching Time Waveform Definitions

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

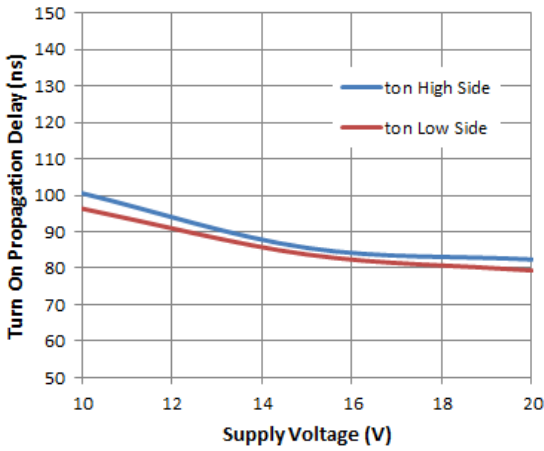


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

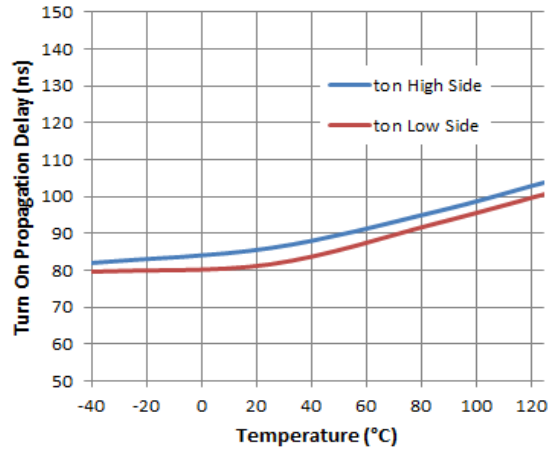


Figure 5. Turn-on Propagation Delay vs. Temperature

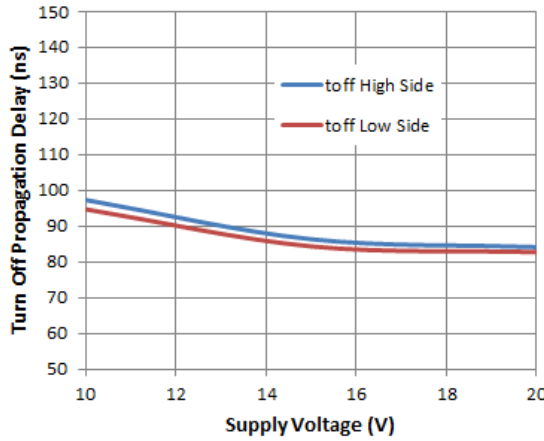


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

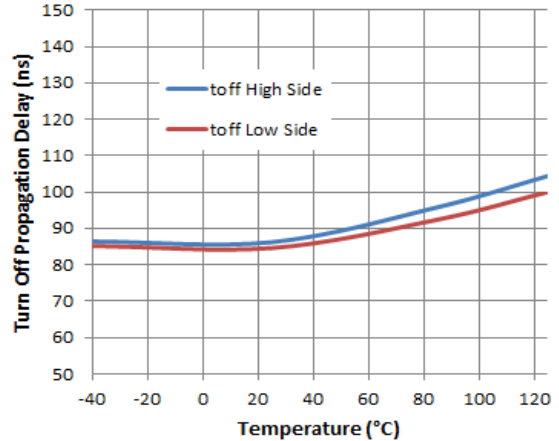


Figure 7. Turn-off Propagation Delay vs. Temperature

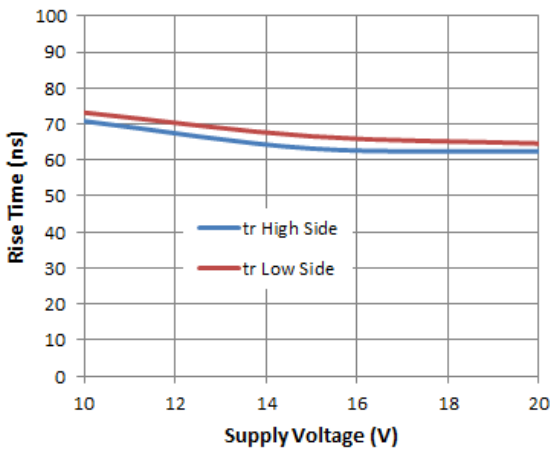


Figure 8. Rise Time vs. Supply Voltage

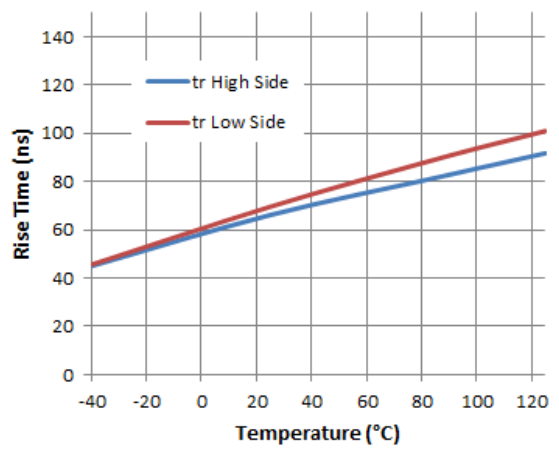


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

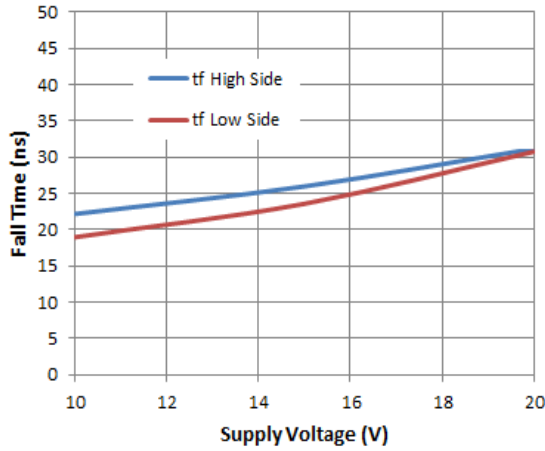


Figure 10. Fall Time vs. Supply Voltage

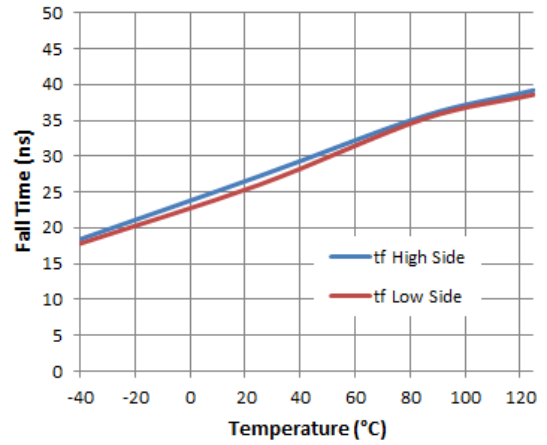


Figure 11. Fall Time vs. Temperature

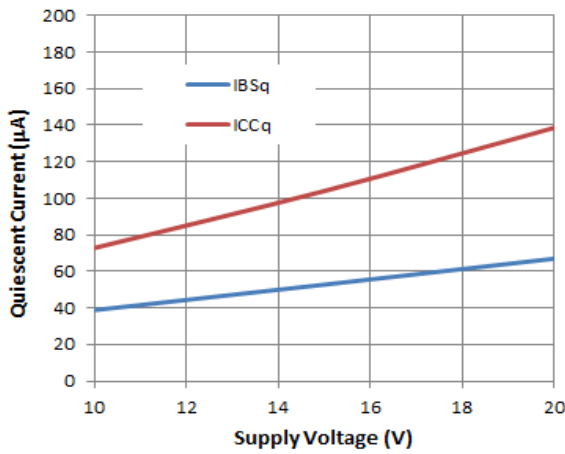


Figure 12. Quiescent Current vs. Supply Voltage

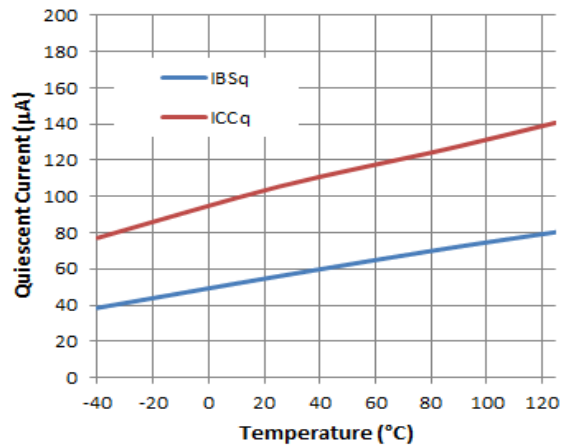


Figure 13. Quiescent Current vs. Temperature

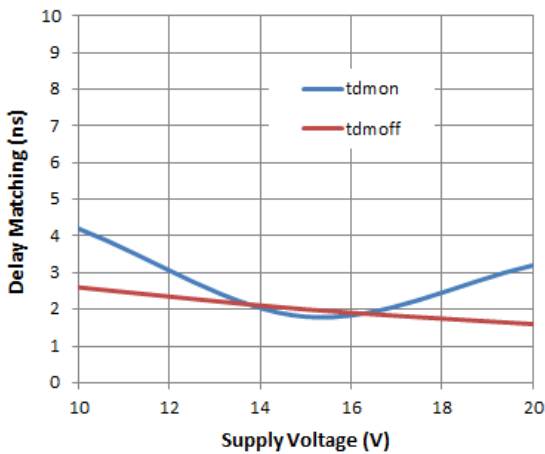


Figure 14. Delay Matching vs. Supply Voltage

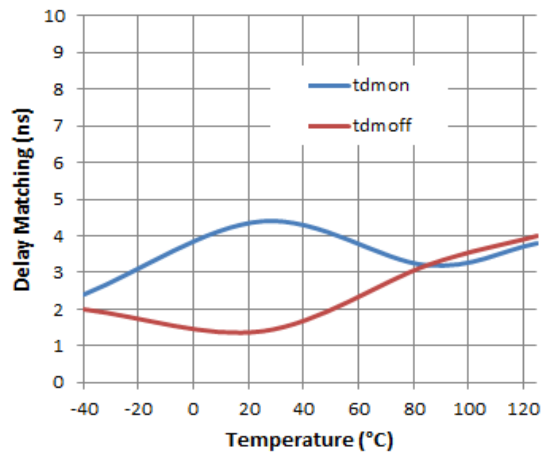


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (continued)

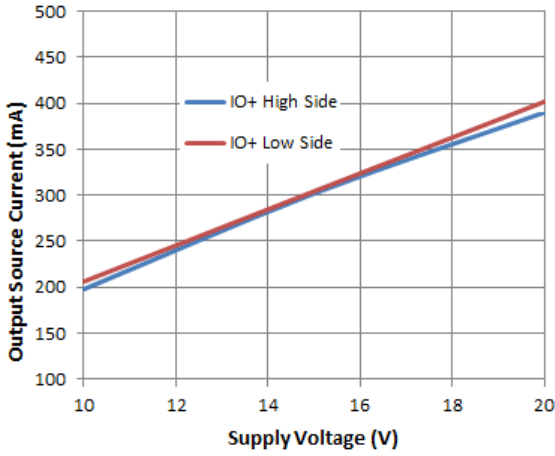


Figure 16. Output Source Current vs. Supply Voltage

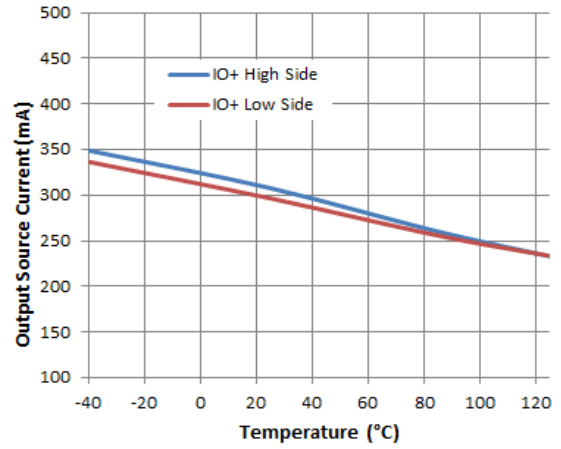


Figure 17. Output Source Current vs. Temperature

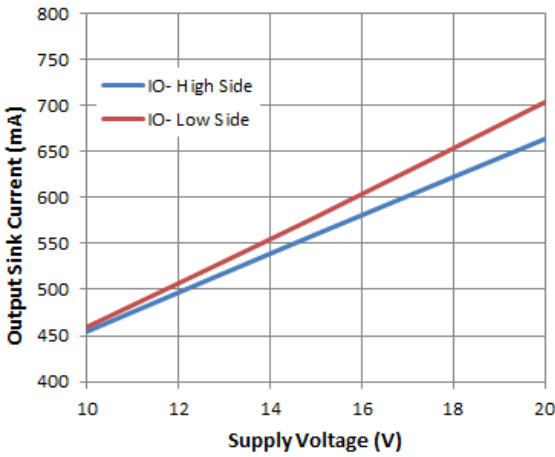


Figure 18. Output Sink Current vs. Supply Voltage

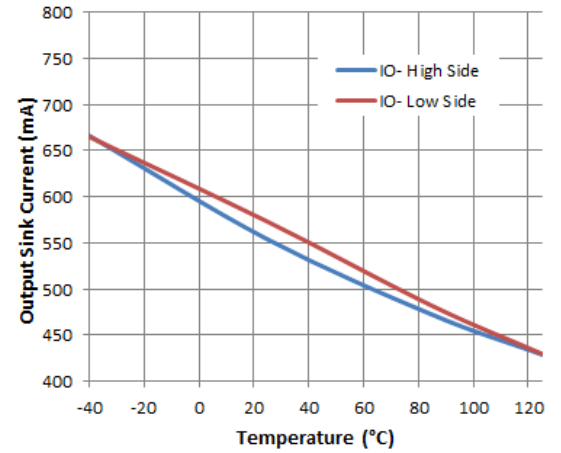


Figure 19. Output Sink Current vs. Temperature

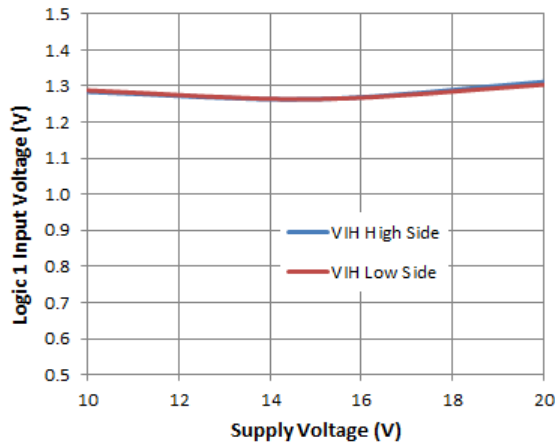


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

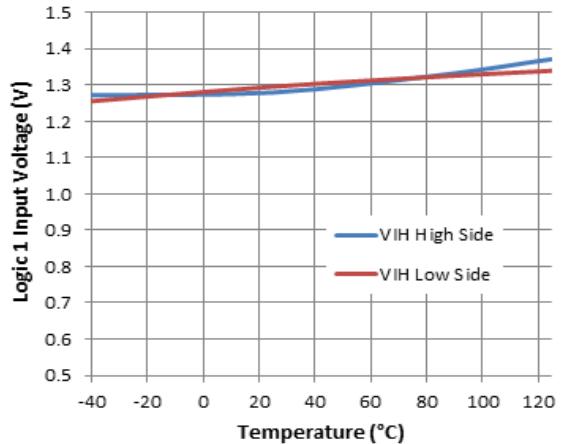


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (continued)

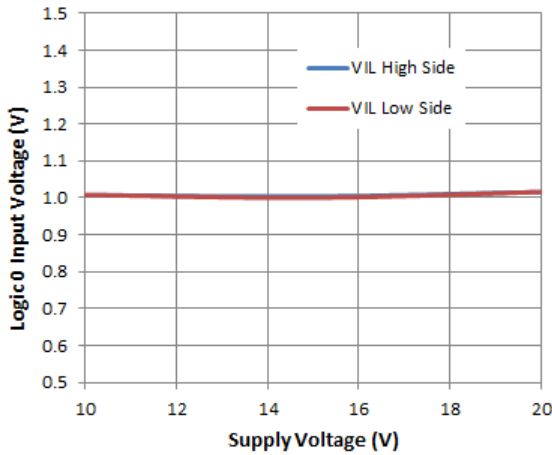


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

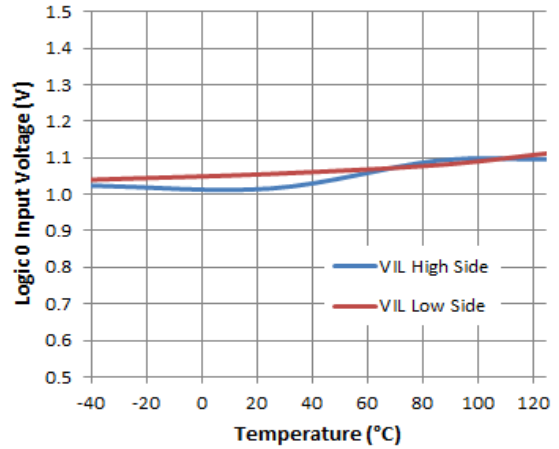


Figure 23. Logic 0 Input Voltage vs. Temperature

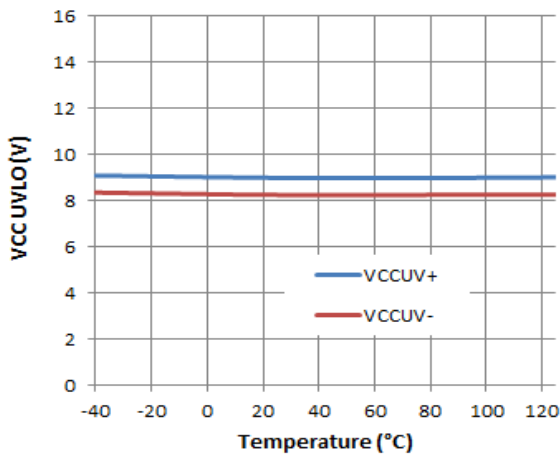


Figure 24. VCC UVLO vs. Temperature

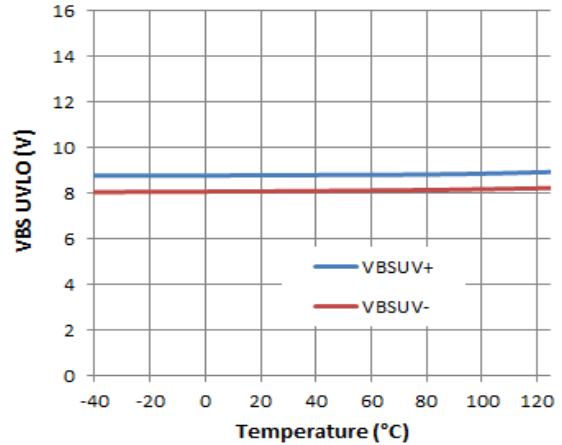


Figure 25. VBS UVLO vs. Temperature

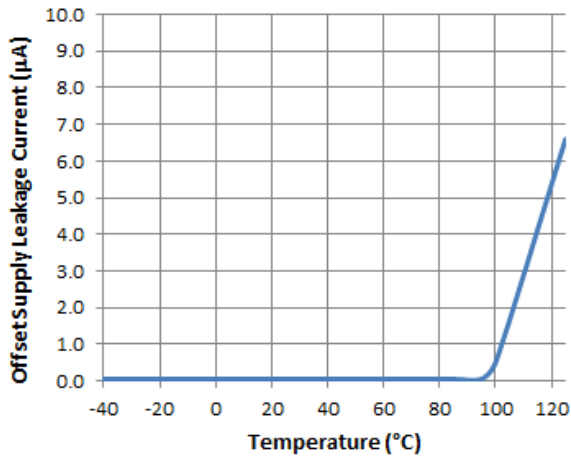
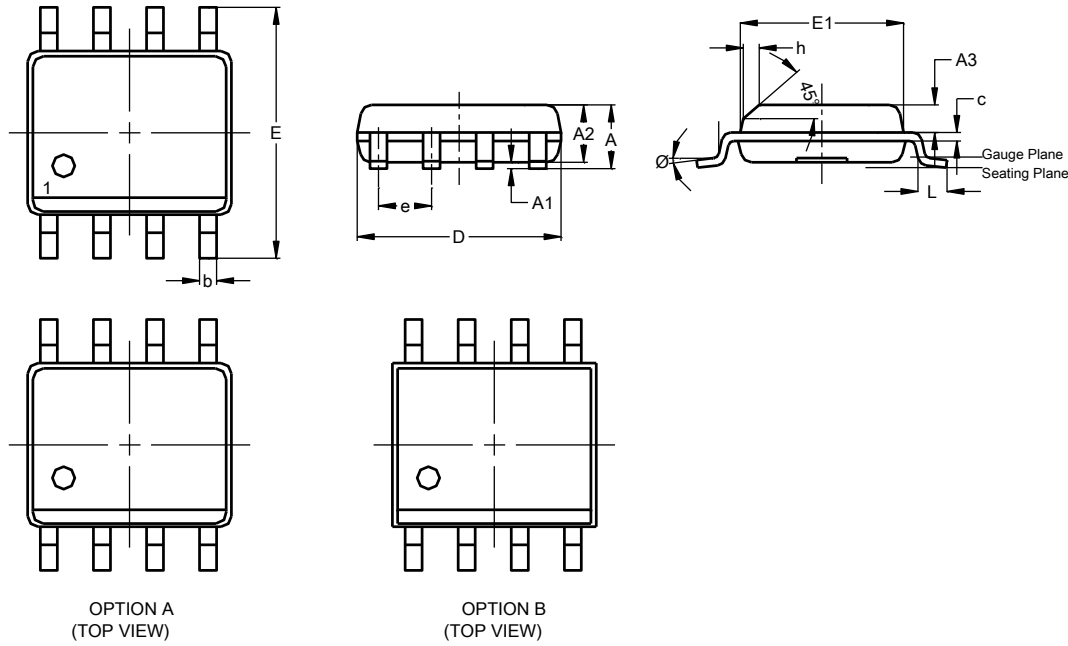


Figure 26. Offset Supply Leakage Current vs. Temperature

Package Outline Dimensions

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

SO-8 (Standard)

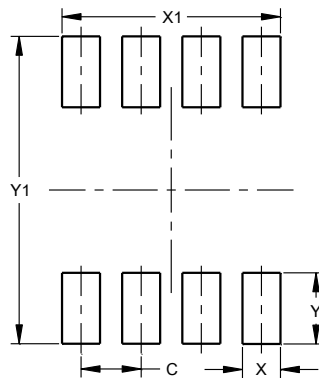


| SO-8 (Standard) | | | |
|----------------------|------|------|------|
| Dim | Min | Max | Typ |
| A | -- | 1.75 | -- |
| A1 | 0.10 | 0.25 | -- |
| A2 | 1.25 | 1.65 | -- |
| A3 | 0.50 | 0.70 | -- |
| b | 0.30 | 0.51 | -- |
| c | 0.15 | 0.25 | -- |
| D | 4.80 | 5.00 | -- |
| E | 5.80 | 6.20 | 6.00 |
| 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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