AUTOMOTIVE LOW SIDE SINGLE GATE DRIVER WITH LDO

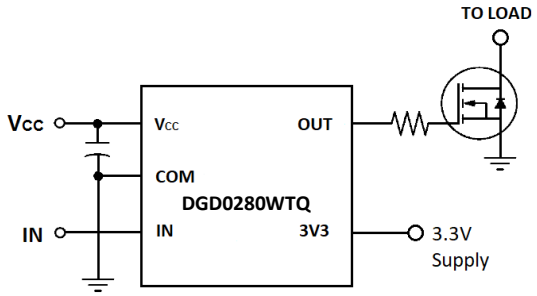
Description

The DIODES™ DGD0280WTQ, low-side MOSFET and IGBT driver is capable of driving 2.8A of peak current. The DGD280WTQ logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with MCUs. Internal undervoltage lockout (UVLO) protects the MOSFET with loss of supply by turning off the output when VCC falls below operating range. Fast and well matched propagation delays allow high-speed operation, enabling a smaller, more compact power-switching design using smaller associated components.

The DGD0280WTQ has an integrated LDO that outputs 3.3V at ±1% tolerance with the ability to supply 15mA. The DIODES™ DGD0280 provides a non-inverted output. The DGD0280WTQ comes in a space-saving TSOT25 package and operates over an extended -40°C to +125°C temperature range.

Applications

- DC-DC converters
- Line drivers
- Motor controls
- Switch mode power supplies



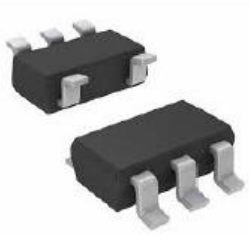
Typical Configuration

Features

- Efficient Low Cost Solution for Driving MOSFETs and IGBTs
- Integrated LDO (3.3V, 15mA Output)
- 3.3V LDO at 1% Accuracy at +25°C
- Wide Supply Voltage Operating Range: 4.5V to 18V
- 2.5A Source / 2.8A Sink Output Current Capability
- Undervoltage Lockout for Vcc Supply
- Fast Propagation Delay (35ns Typ)
- Fast Rise and Fall Times (20ns Typ)
- Logic Input (IN) 3.3V Capability
- 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)**
- **The DGD0280WTQ is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
  https://www.diodes.com/quality/product-definitions/

Mechanical Data

- Package: TSOT25
- Package Material: Molded Plastic. "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish—Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.016 grams (Approximate)



TSOT25

Ordering Information (Note 4)

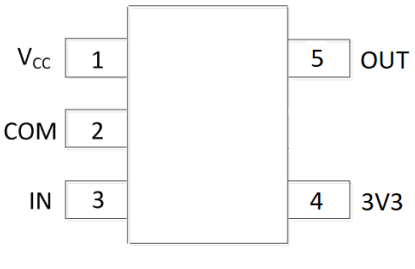
Part Number	Package	Marking Code	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
DGD0280WTQ-7	TSOT25	D0280	7	8	3000	Reel

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

D0280 = Product Type Marking Code
YY = Year (ex: 22 = 2022)
WW or WW – = Week (01 to 53)

Pin Diagrams

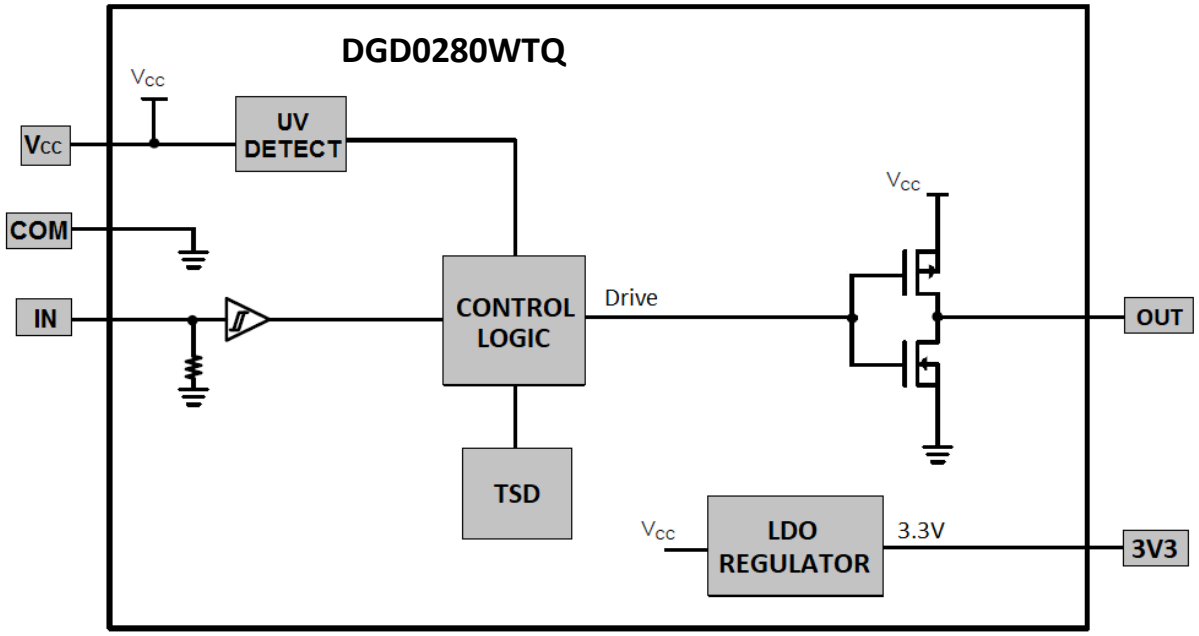


Top View TSOT25

Pin Descriptions

Pin Number	Pin Name	Function
1	Vcc	Supply Input
2	COM	Supply Return
3	IN	Logic Input, In Phase with OUT
4	3V3	LDO Regulator 3.3V Ouput
5	OUT	Gate Drive Output

Functional Block Diagram



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

Characteristic	Symbol	Value	Unit
Low-Side Fixed Supply Voltage	V_{CC}	-0.3 to +22	V
Output Voltage (OUT)	V_{OUT}	-0.3 to V_{CC}+0.3	V
Logic Input Voltage (IN)	V_{IN}	-5 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	0.89	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\Theta JA}$	117	°C/W
Thermal Resistance, Junction to Case (Note 5)	$R_{\Theta JC}$	12.5	°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 with minimum recommended pad layout.

ESD Ratings (Note 6)

Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	2000	V	2
Electrostatic Discharge – Charged Device Model	ESD CDM	1000	V	IV

Note: 6. Refer to JEDEC specification JESD22-A114 and JESD22-C101.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	4.5	18	V
Output Voltage (OUT)	V_{OUT}	0	V_{CC}	V
Logic Input Voltage (IN)	V_{IN}	0	5	V
Ambient Temperature	T_A	-40	+125	°C

DC Electrical Characteristics (V_{CC} = 12V, @T_A = +25°C, unless otherwise specified.) (Note 7)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic “1” Input Voltage	V_{IH}	2.0	—	—	V	—
Logic “0” Input Voltage	V_{IL}	—	—	0.8	V	—
Input Hysteresis	V_{IN_HYS}	—	0.5	—	V	—
Logic “1” Input Bias Current	I_{IN+}	—	7.5	20	µA	V_{IN} = 3V
Logic “0” Input Bias Current	I_{IN-}	—	—	1	µA	V_{IN} = 0V
Quiescent V_{CC} Supply Current	I_{CCQ}	—	—	250	µA	Inputs Open
Operating V_{CC} Supply Current	I_{CCO}	—	1.5	—	mA	fs = 100kHz C_L = 1000pF
		—	12.5	—		fs = 1MHz C_L = 1000pF
V_{CC} Supply Undervoltage Positive Going Threshold	V_{CCUV+}	4.5	4.75	5.0	V	—
V_{CC} Supply Undervoltage Negative Going Threshold	V_{CCUV-}	4.2	4.5	4.8	V	—
Output High Short-Circuit Pulsed Current	I_{O+}	—	2.5	—	A	V_O = 0V, PW ≤ 10µs
Output Low Short-Circuit Pulsed Current	I_{O-}	—	2.8	—	A	V_O = 15V, PW ≤ 10µs
LDO Output Voltage	V_{LDO}	3.267	3.3	3.333	V	I_{OUT} = 10mA
LDO Line Regulation	V_{LDO_LINE}	—	21	38	mV	V_{CC} = 5V to 18V, I_{OUT} = 10mA
LDO Load Regulation	V_{LDO_LOAD}	—	—	10	mV	V_{CC} = 12V, I_{OUT} = 0.1mA to 10mA
Maximum LDO Current	I_{LDO_MAX}	—	15	—	mA	RL = 220Ω
LDO Current Limit	I_{LDO_LIM}	20	68	—	mA	RL = 0Ω
Thermal Shutdown Turn On	TSD_{ON}	—	150	—	°C	—
Thermal Shutdown Turn Off	TSD_{OFF}	—	125	—	°C	—

Note: 7. The V_{IN} and I_{IN} parameters are applicable to the logic input pin: IN. The V_O and I_O parameters are applicable to the output pin: OUT.

AC Electrical Characteristics (V_{CC} = 12V, @T_A = +25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-on Rise Time	t_r	—	20	35	ns	C_L = 1000pF
Turn-off Fall Time	t_f	—	15	35	ns	C_L = 1000pF
Turn-on Propagation Delay	t_{ON}	20	35	50	ns	—
Turn-off Propagation Delay	t_{OFF}	15	30	50	ns	—

Timing Waveforms

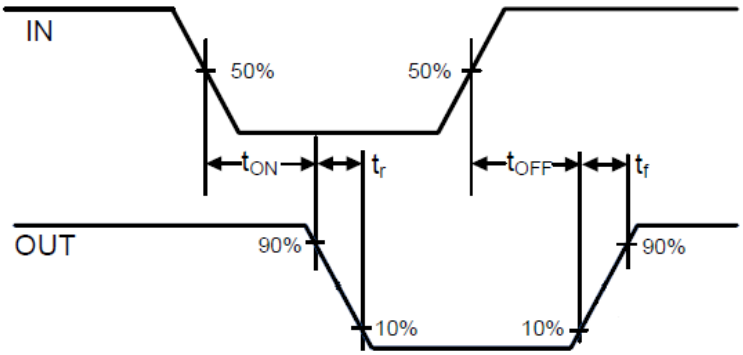


Figure 1. Switching Time Waveform Definitions

Typical Performance Characteristics (V_{CC} = 12V, @T_A = +25°C, unless otherwise specified.)

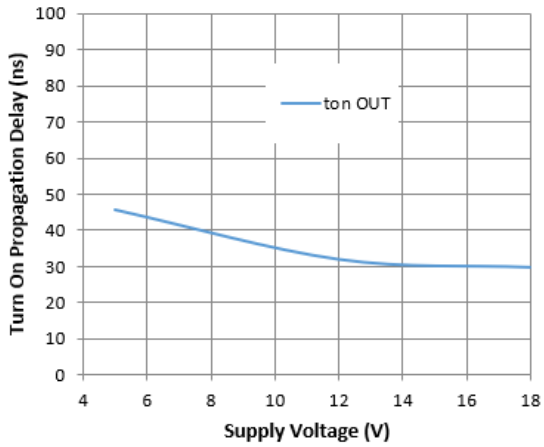


Figure 2. Turn-on Propagation Delay vs. Supply Voltage

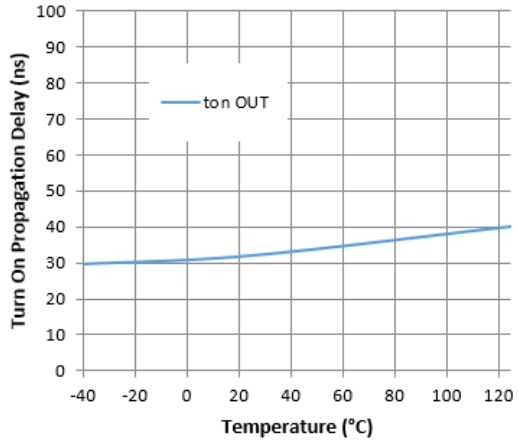


Figure 3. Turn-on Propagation Delay vs. Temperature

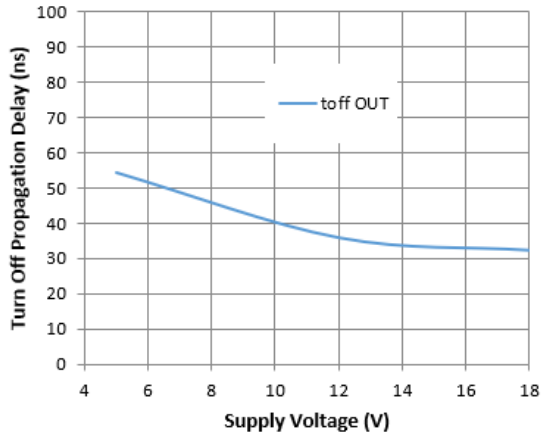


Figure 4. Turn-off Propagation Delay vs. Supply Voltage

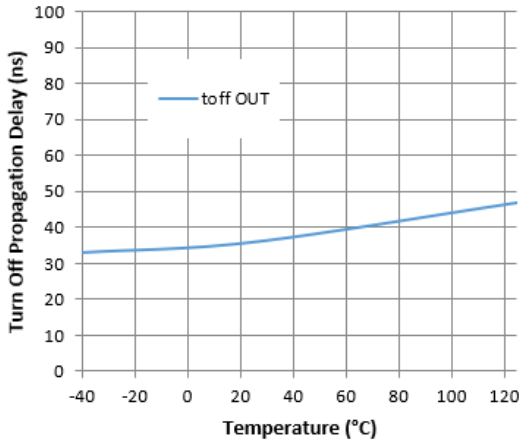


Figure 5. Turn-off Propagation Delay vs. Temperature

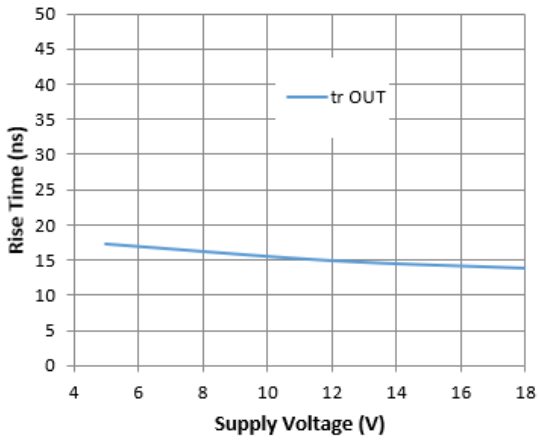


Figure 6. Rise Time vs. Supply Voltage

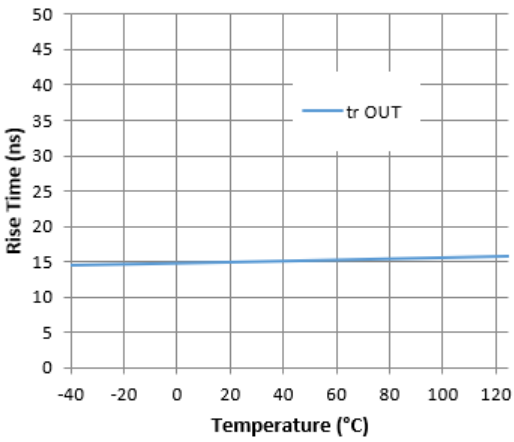


Figure 7. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

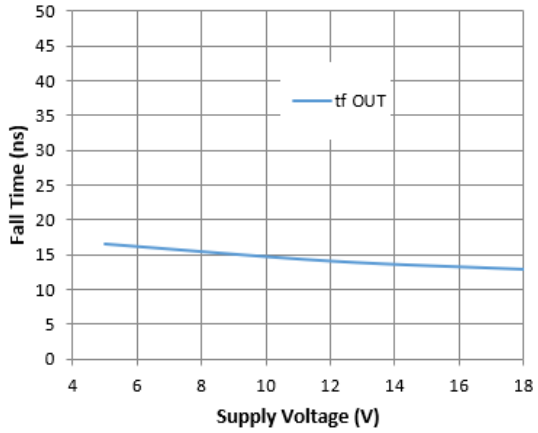


Figure 8. Fall Time vs. Supply Voltage

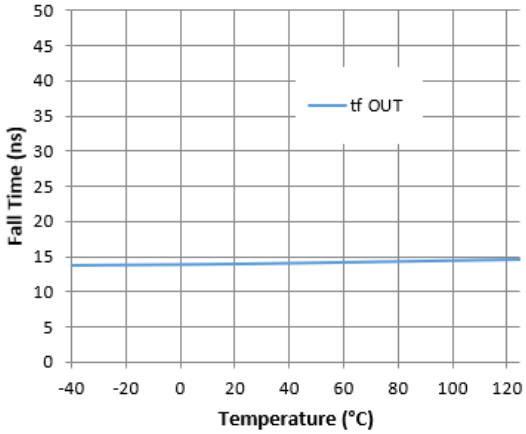


Figure 9. Fall Time vs. Temperature

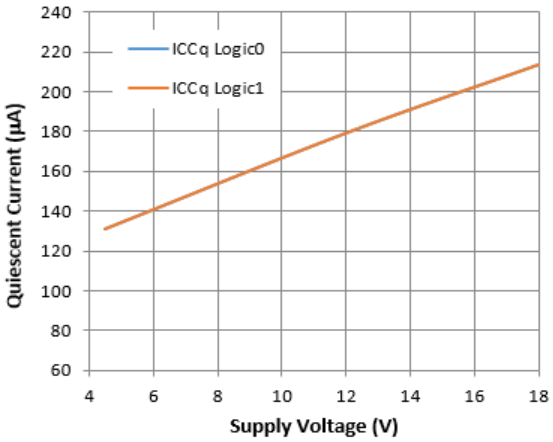


Figure 10. Quiescent Current vs. Supply Voltage

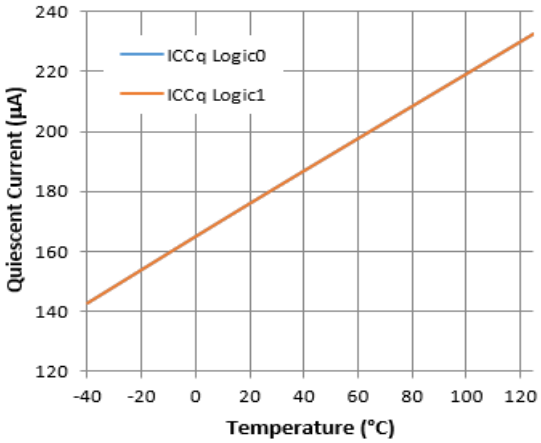


Figure 11. Quiescent Current vs. Temperature

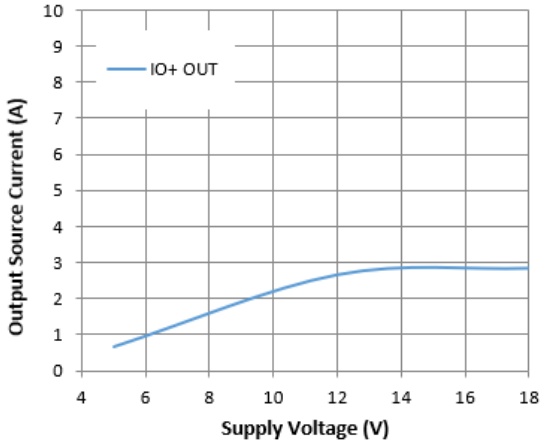


Figure 12. Output Source Current vs. Supply Voltage

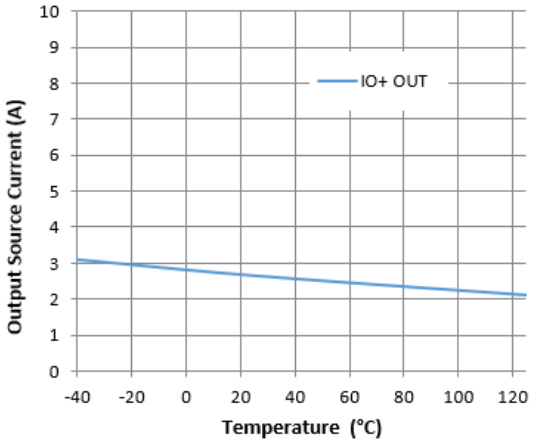


Figure 13. Output Source Current vs. Temperature

Typical Performance Characteristics (continued)

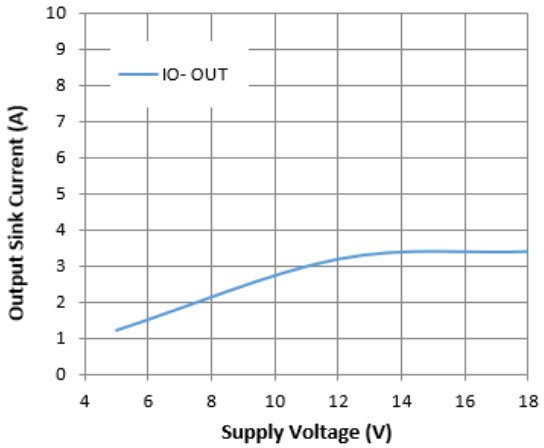


Figure 14. Output Sink Current vs. Supply Voltage

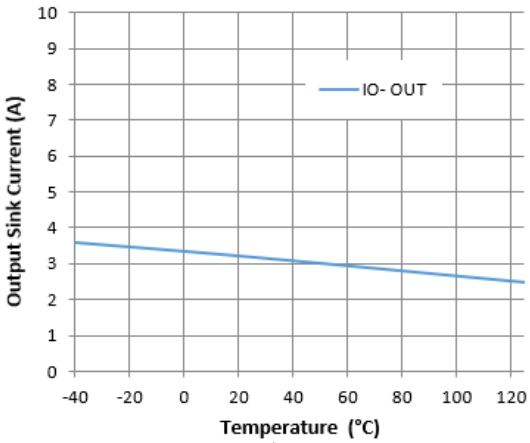


Figure 15. Output Sink Current vs. Temperature

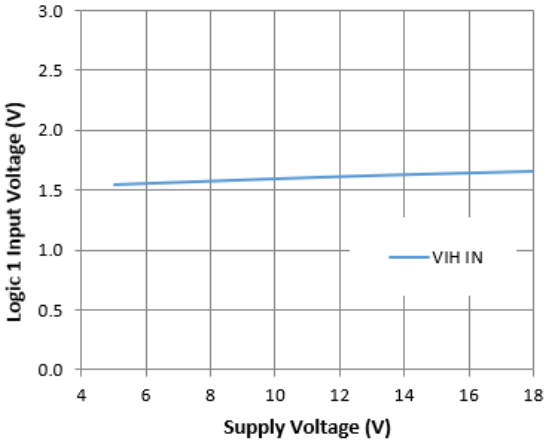


Figure 16. Logic 1 Input Voltage vs. Supply Voltage

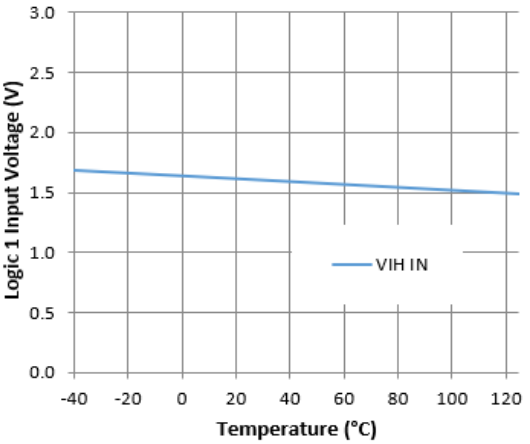


Figure 17. Logic 1 Input Voltage vs. Temperature

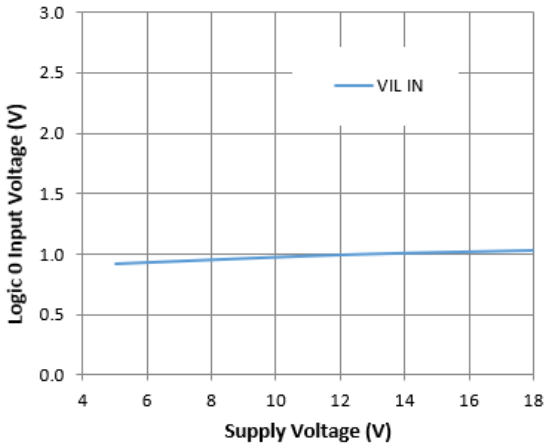


Figure 18. Logic 0 Input Voltage vs. Supply Voltage

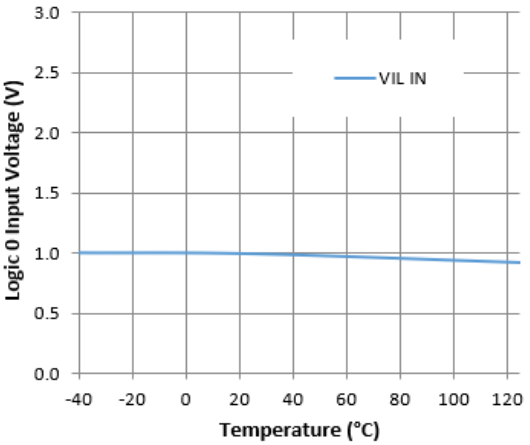


Figure 19. Logic 0 Input Voltage vs. Temperature

Typical Performance Characteristics (continued)

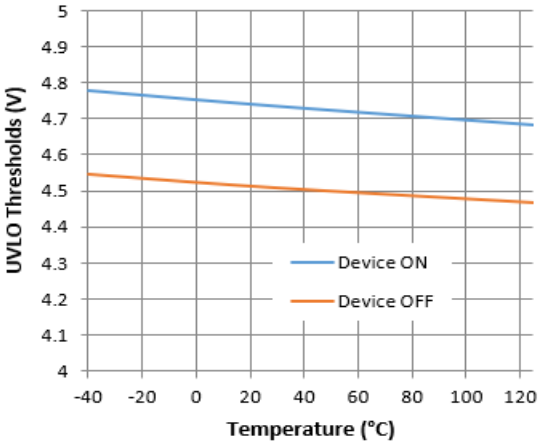


Figure 20. UVLO Thresholds vs. Temperature

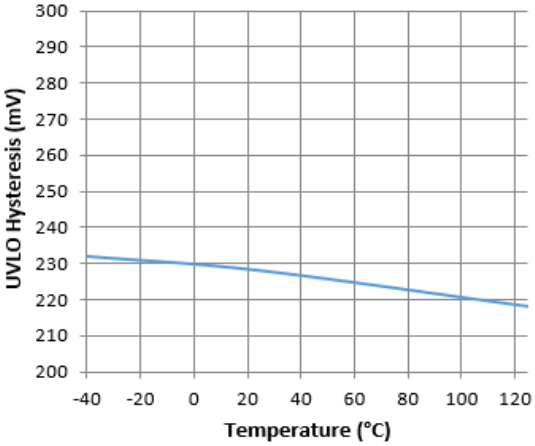
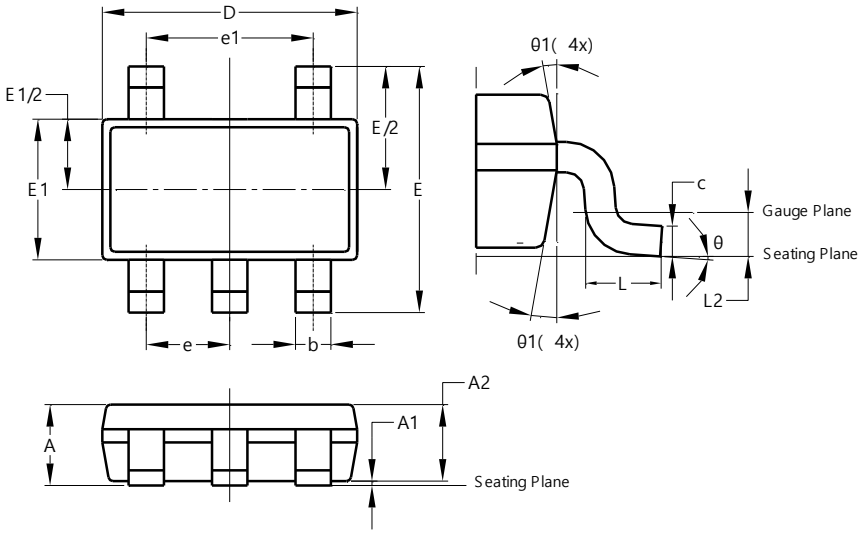


Figure 21. UVLO Hysteresis vs. Temperature

Package Outline Dimensions

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

TSOT25

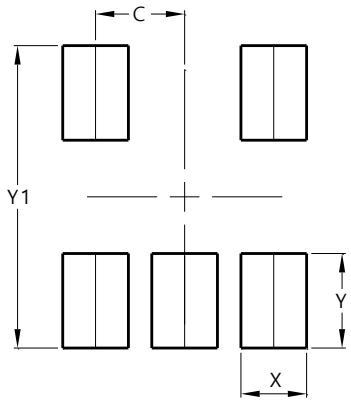


TSOT25			
Dim	**Min**	**Max**	**Typ**
A	—	1.00	—
A1	0.01	0.10	—
A2	0.84	0.90	—
b	0.30	0.45	—
c	0.12	0.20	—
D	—	—	2.90
E	—	—	2.80
E1	—	—	1.60
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	0.50	—
L2	0.25 BSC		
θ	0°	8°	4°
θ1	4°	12°	—
All Dimensions in mm			

Suggested Pad Layout

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

TSOT25



Dimensions	Value (in mm)
C	0.950
X	0.700
Y	1.000
Y1	3.199

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