NCV8452

Self Protected High Side Driver with Temperature Shutdown and Current Limit

The NCV8452 is a fully protected High−Side driver that can be used to switch a wide variety of loads, such as bulbs, solenoids and other activators. The device is internally protected from an overload condition by an active current limit and thermal shutdown.

Features

- Short Circuit Protection
- Thermal Shutdown with Automatic Restart
- CMOS (3 V/5 V) Compatible Control Input
- Overvoltage Protection and Shutdown
- Output Voltage Clamp for Inductive Switching
- Under Voltage Shutdown
- Loss of Ground Protection
- ESD Protection
- Reverse Battery Protection (with external resistor)
- Very Low Standby Current
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- Switch a Variety of Resistive, Inductive and Capacitive Loads
- Can Replace Electromechanical Relays and Discrete Circuits
- Automotive / Industrial

PRODUCT SUMMARY

Symbol	Characteristics	Value	Unit
V_{OV}	Overvoltage Protection	41	V
V_D	Operation Voltage	5 – 34	V
R_{ON}	On−State Resistance	200	mΩ
I_{ILIM}	Output Current Limit	1.0	A

ON Semiconductor®

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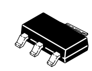
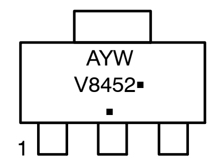
MARKING DIAGRAM



SOT−223 (TO−261) CASE 318E



V8452 = Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 12 of this data sheet.

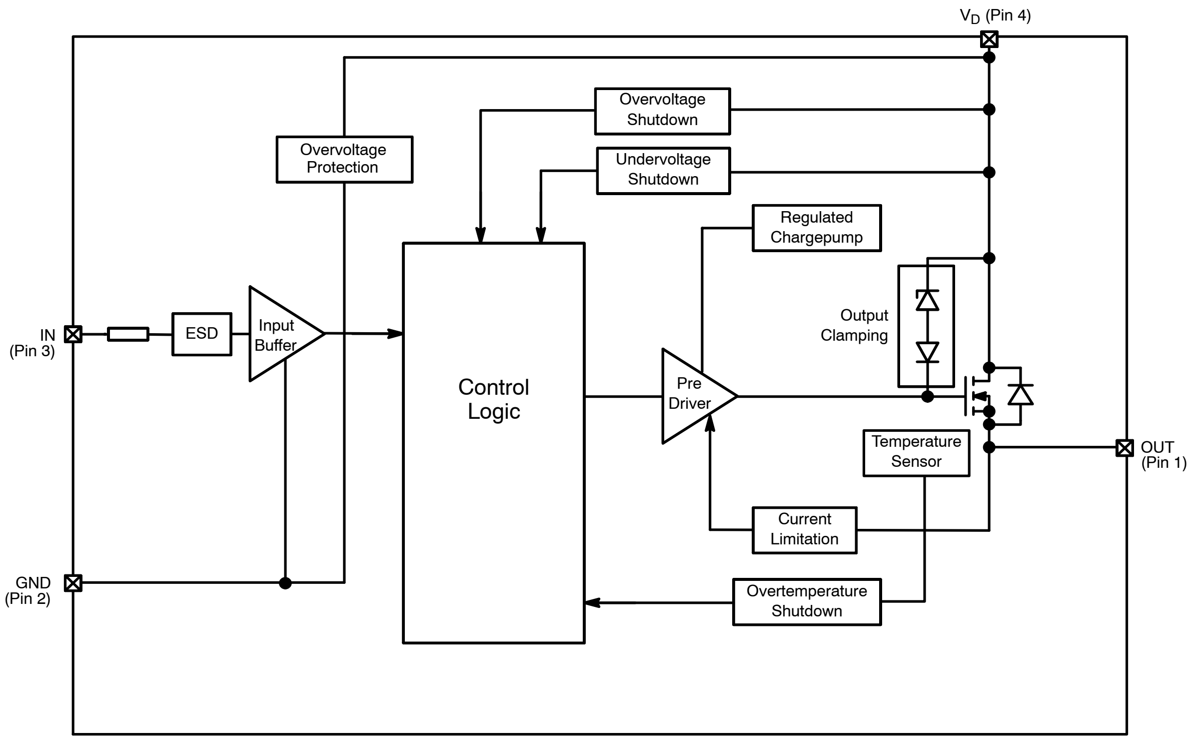


Figure 1. Block Diagram

PACKAGE PIN DESCRIPTION

Pin #	Symbol	Description
1	OUT	Output
2	GND	Ground
3	IN	Logic Level Input
4	V_D	Supply Voltage

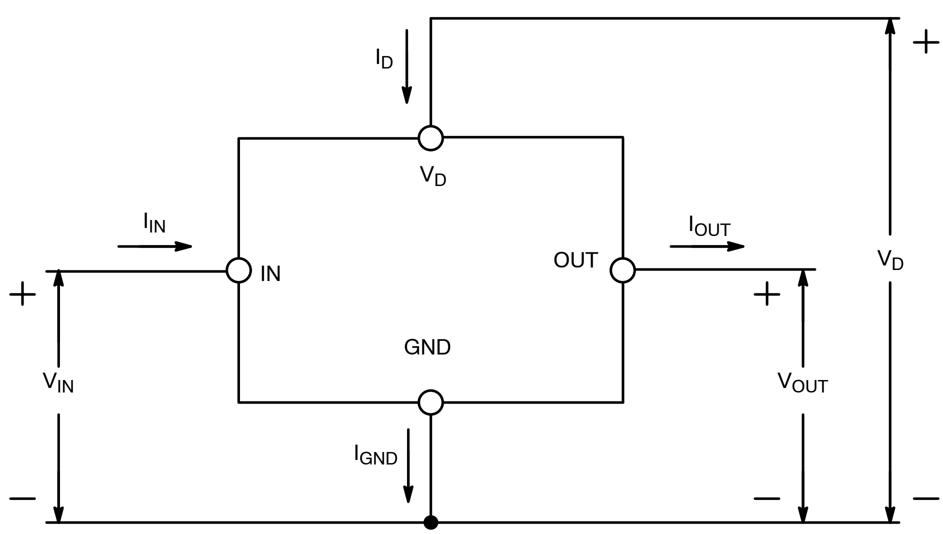


Figure 2. Voltage and Current Definition

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Supply Voltage	V_D	40	V
Peak Transient Input Voltage (Load Dump 37.5 V, V_D = 13.5 V, ISO7637−2 pulse5) (Note 1)	V_{peak}	51	V
Input Voltage	V_{IN}	−5 to V_D	V
Input Current	I_{IN}	±5	mA
Output Current	I_{OUT}	Internally Limited	A
Power Dissipation @T_A = 25°C (Note 3) @T_A = 25°C (Note 4)	P_D	 1.19 1.76	W
Electrostatic Discharge (Note 1) (HBM Model 100 pF / 1500 Ω) Input Output V_D		 ±1 ±5 ±5	kV
Single Pulse Inductive Load Switch Off Energy (Note 1) (L = 4.55 H, V_D = 13.5 V; I_L = 0.5 A, T_{Jstart} = 25°C)	E_{AS}	0.8	J
Operating Junction Temperature	T_J	−40 to +150	°C
Storage Temperature	$T_{storage}$	−55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Not subjected to production testing
2. Reverse Output current has to be limited by the load to stay within absolute maximum ratings and thermal performance.
3. Minimum pad.
4. 1 in square pad size, FR−4, 1 oz Cu.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max Value	Unit
Thermal Resistance (Note 5) Junction−to−Soldering Point Junction−to−Ambient (Note 6) Junction−to−Ambient (Note 7)	 R_{thJS} R_{thJA} R_{thJA}	 10 105 71	 °C/W °C/W °C/W

5. Reverse Output current has to be limited by the load to stay within absolute maximum ratings and thermal performance.
6. Minimum pad.
7. 1 in square pad size, FR−4, 1 oz Cu.

ELECTRICAL CHARACTERISTICS (V_D = 13.5 V; −40°C < T_J < 150°C unless otherwise specified)

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Operating Supply Voltage	V_D		5	–	34	V
Undervoltage Shutdown	V_{UV}		2.5		5.5	V
Undervoltage Restart	$V_{UV(res)}$				6.0	V
Undervoltage Hysteresis	$V_{UV(hyst)}$			0.3		
Overvoltage Shutdown	V_{OV}		34		42	V
Overvoltage Restart	$V_{OV(res)}$		33			
On−state Resistance	R_{ON}	I_{OUT} = 0.5 A, V_{IN} = 5 V, T_J = 25°C I_{OUT} = 0.5 A, V_{IN} = 5 V, T_J = 150°C		160 –	200 400	mΩ
Standby Current	$I_{D(off)}$	V_{IN} = V_{OUT} = 0 V		12	25	μA
Active Ground Current	$I_{GND(on)}$	V_{IN} = 5 V		1	1.8	mA
Output Leakage Current	$I_{OUT(off)}$	V_{IN} = 0 V			2	μA
INPUT CHARACTERISTICS						
Input Voltage − Low	$V_{IN(low)}$				0.8	V
Input Voltage − High	$V_{IN(high)}$		2.2			V
Off State Input Current	$I_{IN(off)}$	V_{IN} = 0.7 V			10	μA
On State Input Current	$I_{IN(on)}$	V_{IN} = 5.0 V			10	μA
Input Threshold Hysteresis	$V_{IN(hyst)}$			0.3		V
Input Resistance	R_I		1.5	2.8	3.5	kΩ
SWITCHING CHARACTERISTICS						
Turn−On Time	t_{on}	to 90% V_{OUT}, R_L = 24 Ω		60	120	μs
Turn−Off Time	t_{off}	to 10% V_{OUT}, R_L = 24 Ω		60	120	μs
Slew Rate On	dV_{OUT}/dt_{on}	10% to 30% V_{OUT}, R_L = 24 Ω		1	4	V / μs
Slew Rate Off	dV_{OUT}/dt_{off}	70% to 40% V_{OUT}, R_L = 24 Ω		1	4	V / μs
REVERSE BATTERY (Note 8)						
Reverse Battery	$-V_D$	Requires a 150 Ω Resistor in GND Connection			32	V
Forward Voltage	V_F	T_J = 150°C		0.6		V
PROTECTION FUNCTIONS (Note 9)						
Temperature Shutdown (Note 8)	TSD		150	175	200	°C
Temperature Shutdown Hysteresis (Note 8)	$TSD_{(hyst)}$			10		°C
Overvoltage Protection	V_{OV}	I_D = 4 mA	41			V
Switch Off Output Clamp Voltage	V_{CLAMP}	I_D = 4 mA, V_{IN} = 0 V	V_D − 41	V_D − 47		V
Output Current Limit Initial Peak	I_{LIM}	V_D = 20 V, T_J = 25°C T_J = −40°C to150°C	 1.0	1.8 –	 3	A

8. Not subjected to production testing
9. To ensure long term reliability under heavy overload or short circuit conditions, protection and related diagnostic signals must be used together with a proper hardware/software strategy. If the devices operates under abnormal conditions this hardware/software solutions must limit the duration and number of activation cycles.

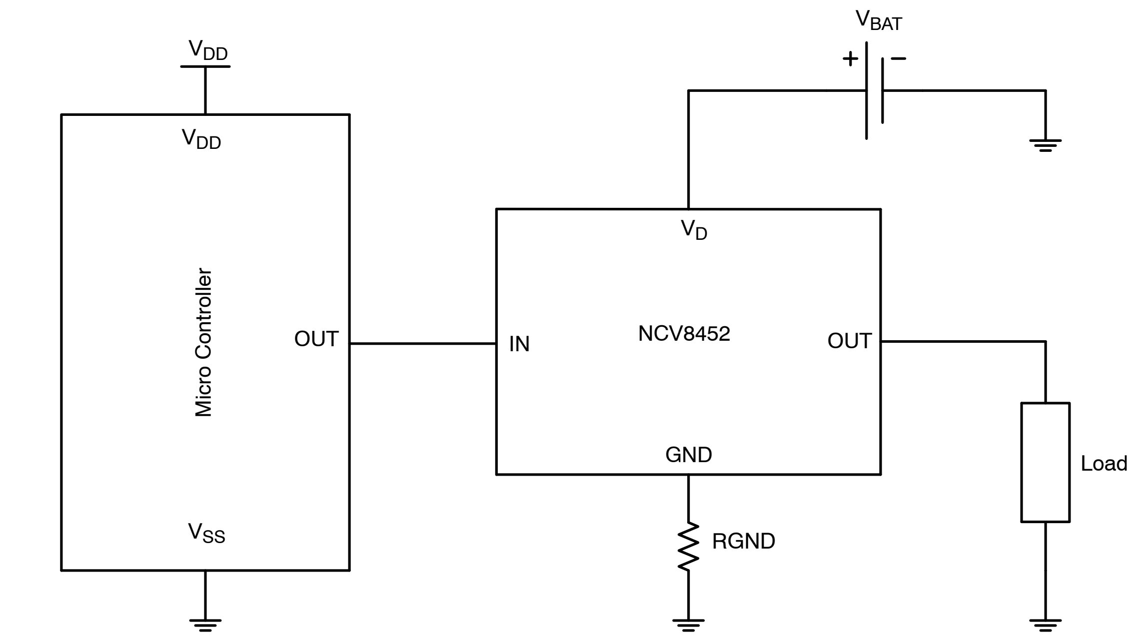


Figure 3. Application Diagram

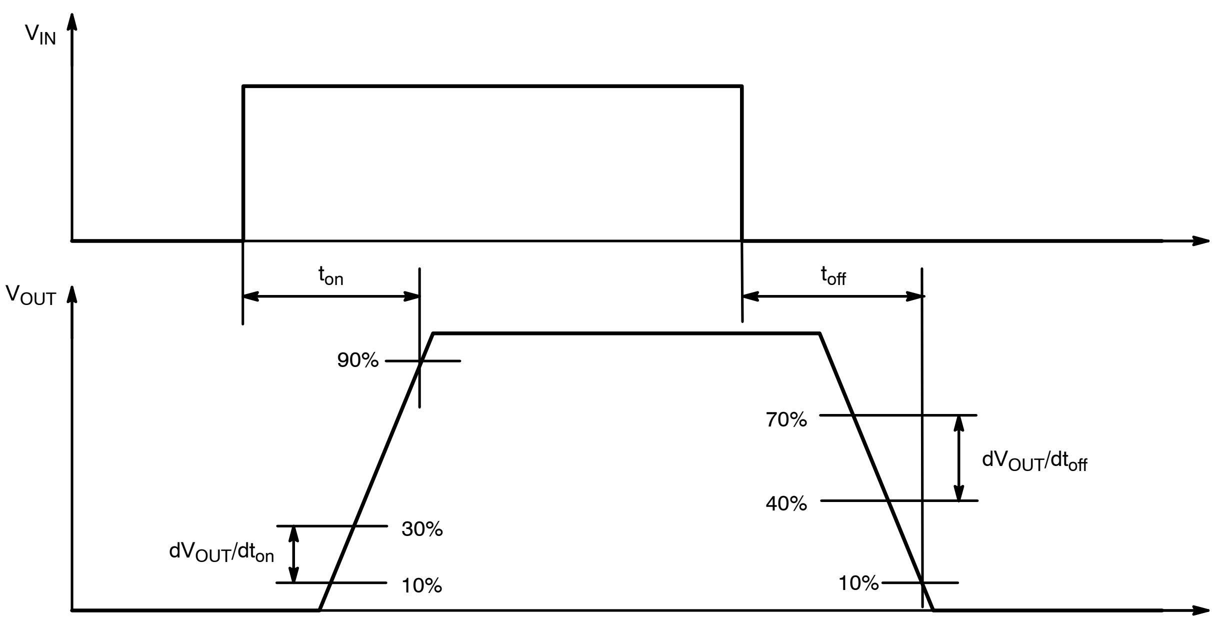


Figure 4. Resistive Load Switching Waveform

TYPICAL CHARACTERISTIC CURVES

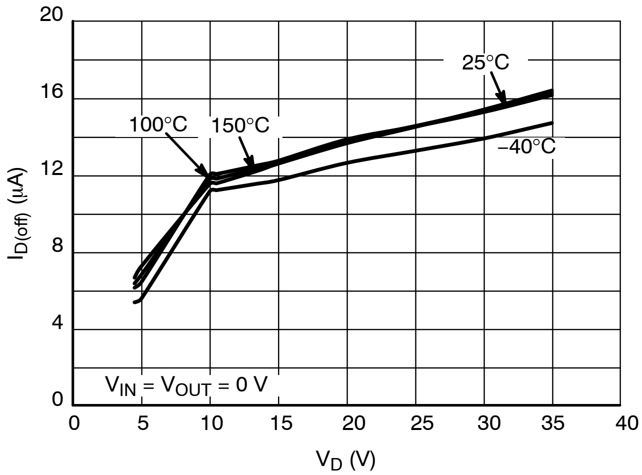


Figure 5. Standby Current vs. Supply Voltage

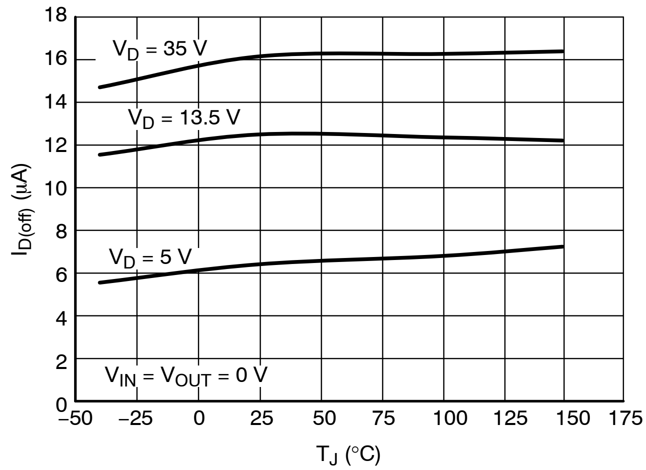


Figure 6. Standby Current vs. Junction Temperature

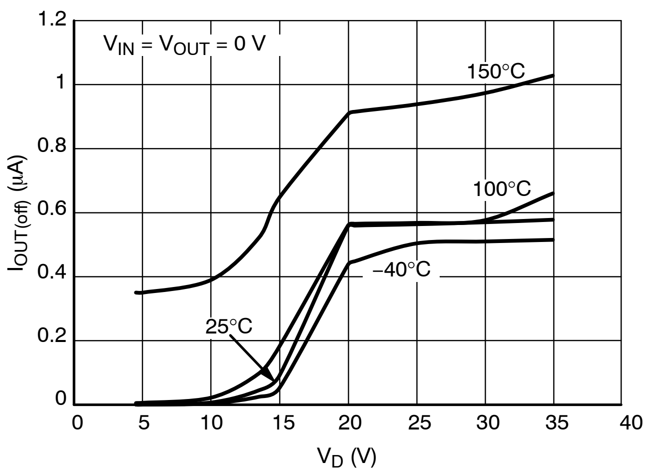


Figure 7. Output Leakage Current vs. Supply Voltage

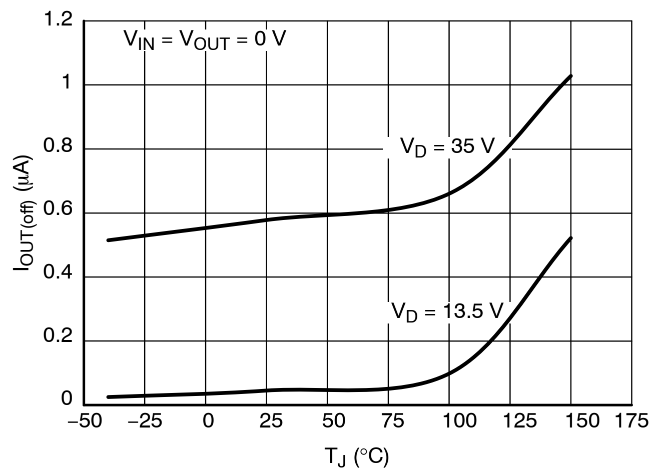


Figure 8. Output Leakage Current vs. Junction Temperature

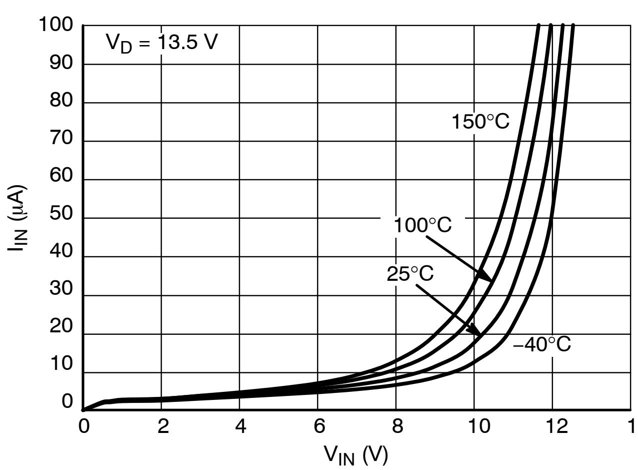


Figure 9. Input Current vs. Input Voltage

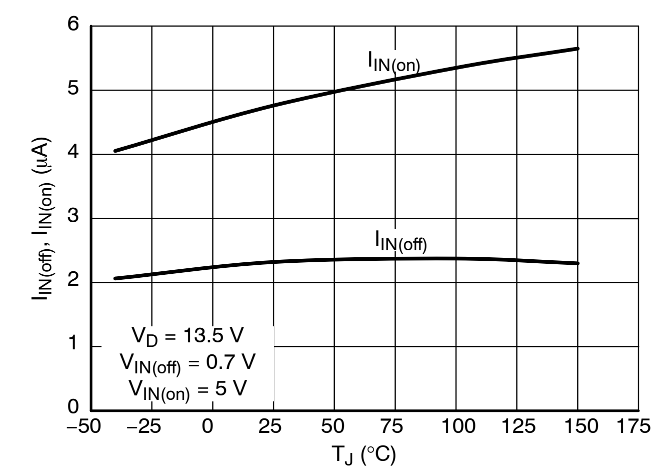


Figure 10. Input Current vs. Junction Temperature

TYPICAL CHARACTERISTIC CURVES

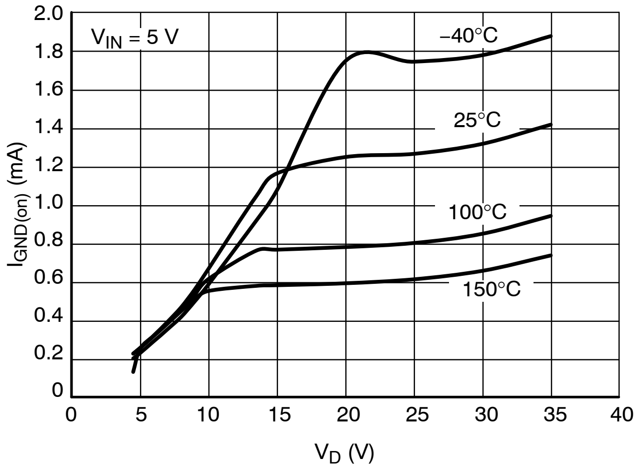


Figure 11. Active Ground Current vs. Supply Voltage

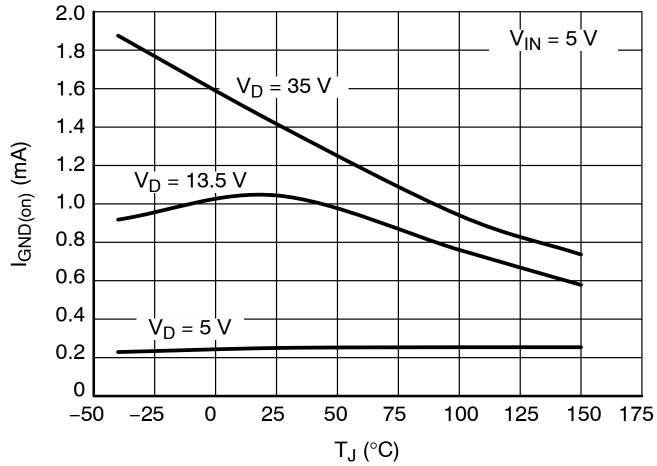


Figure 12. Active Ground Current vs. Junction Temperature

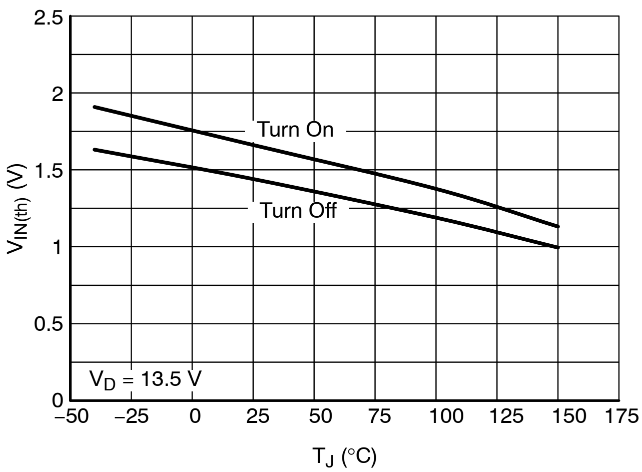


Figure 13. Input Threshold Voltage vs. Junction Temperature

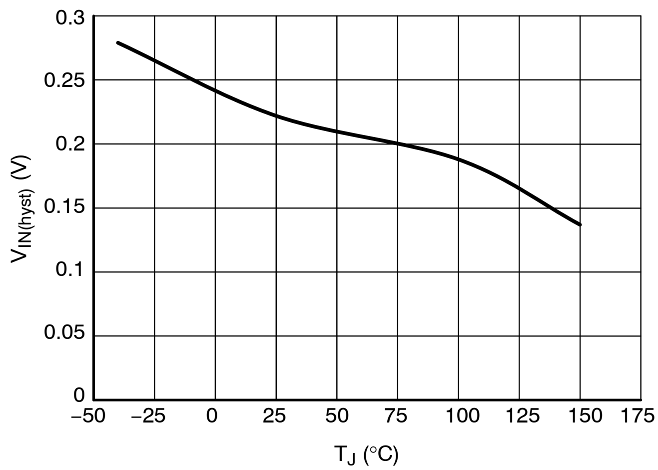


Figure 14. Input Threshold Hysteresis vs. Junction Temperature

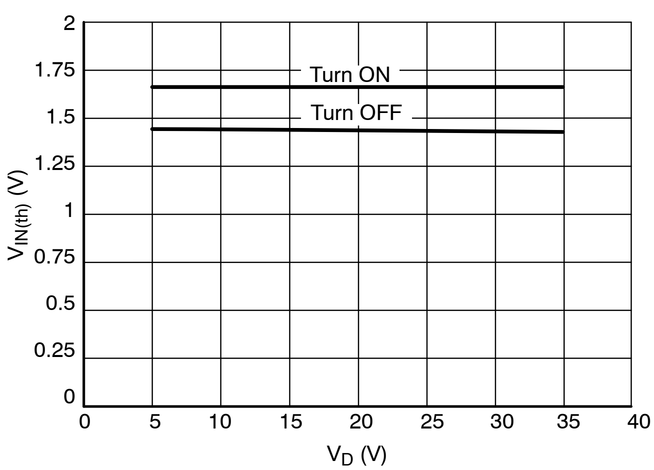


Figure 15. Input Threshold Voltage vs. Supply Voltage

TYPICAL CHARACTERISTIC CURVES

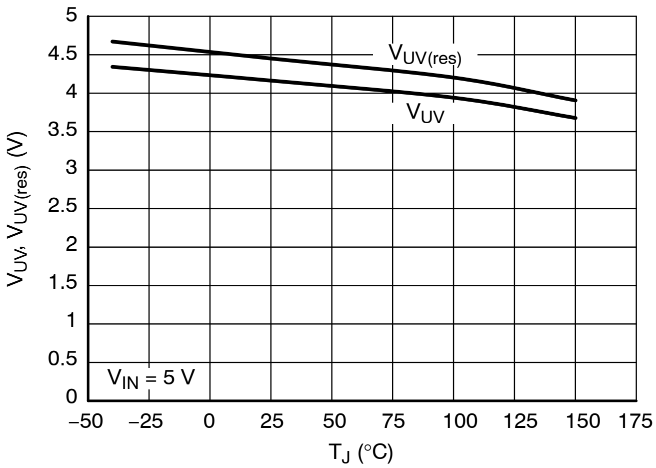


Figure 16. Under Voltage Shutdown and Restart vs. Junction Temperature

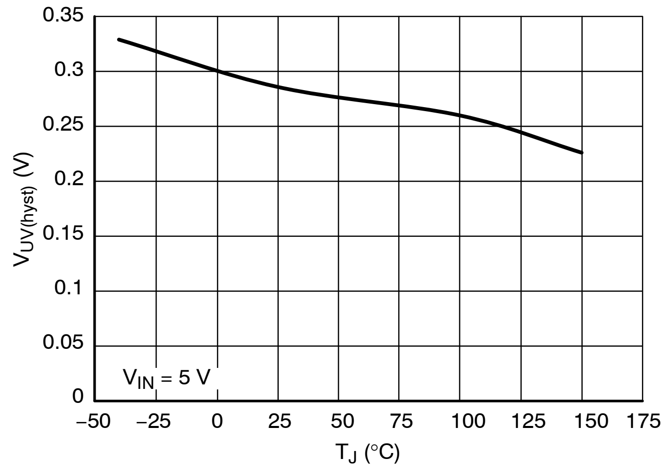


Figure 17. Under Voltage Shutdown Hysteresis vs. Junction Temperature

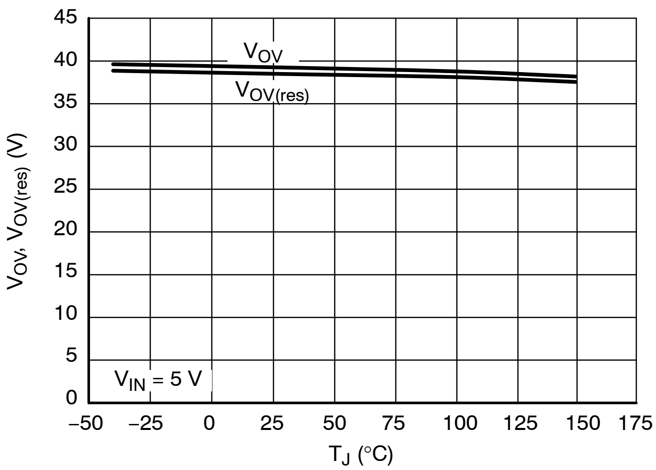


Figure 18. Over Voltage Shutdown vs. Junction Temperature

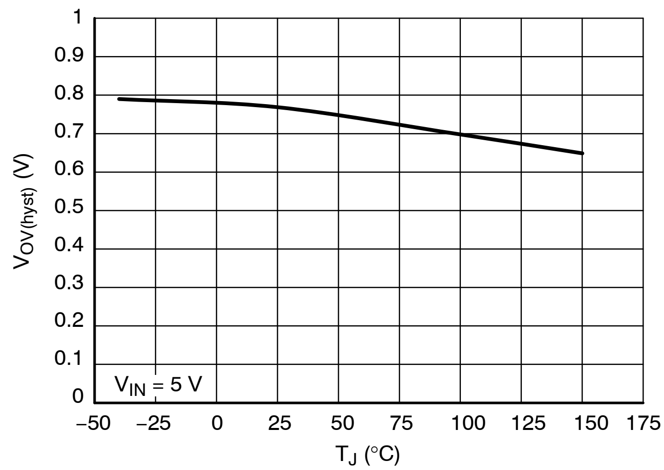


Figure 19. Over Voltage Shutdown Hysteresis vs. Junction Temperature

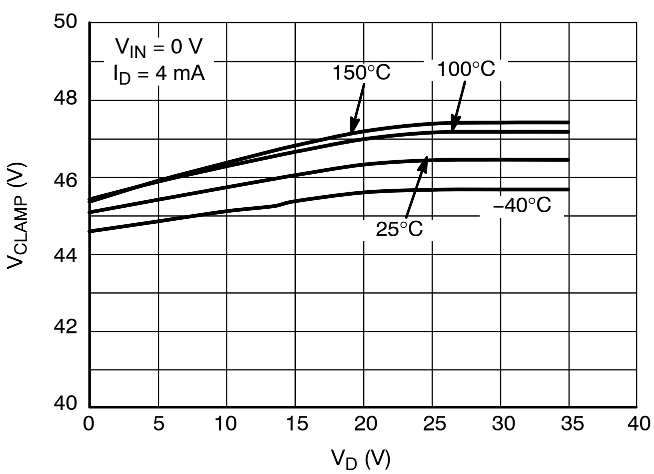


Figure 20. Output Clamp Voltage vs. Supply Voltage

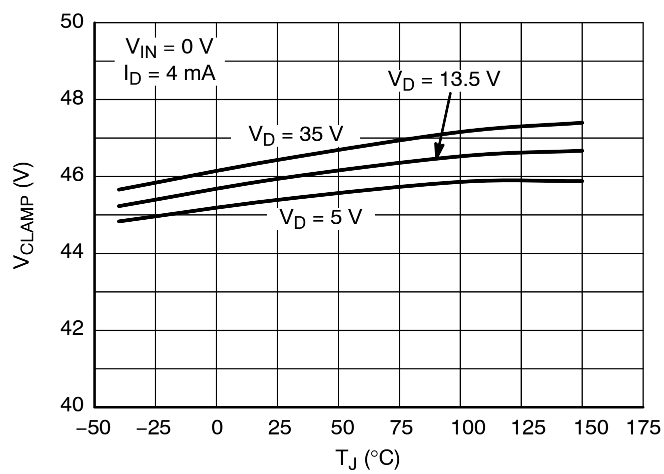


Figure 21. Output Clamp Voltage vs. Junction Temperature

TYPICAL CHARACTERISTIC CURVES

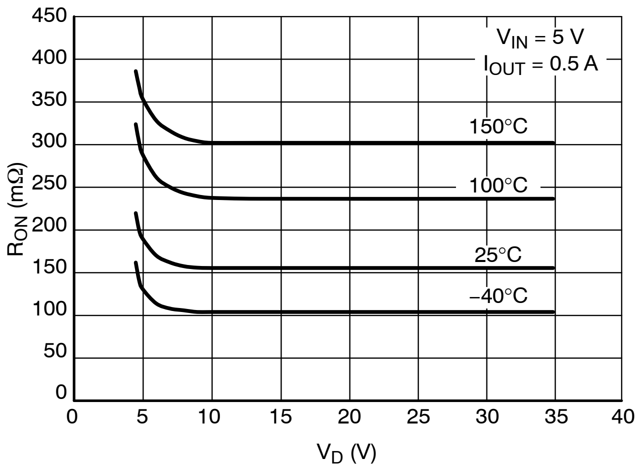


Figure 22. On−state Resistance vs. Supply Voltage

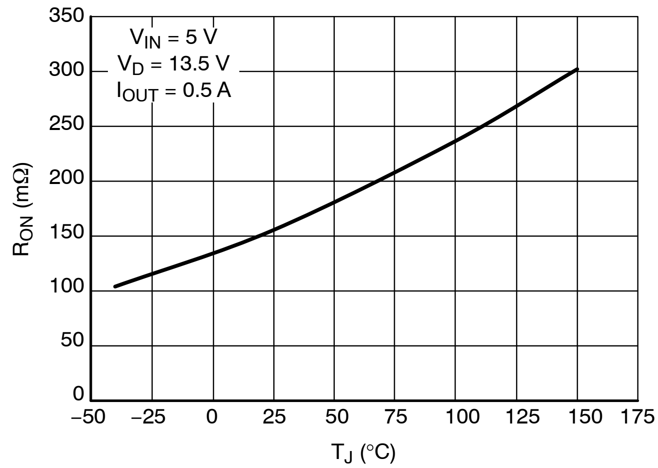


Figure 23. On−state Resistance vs. Junction Temperature

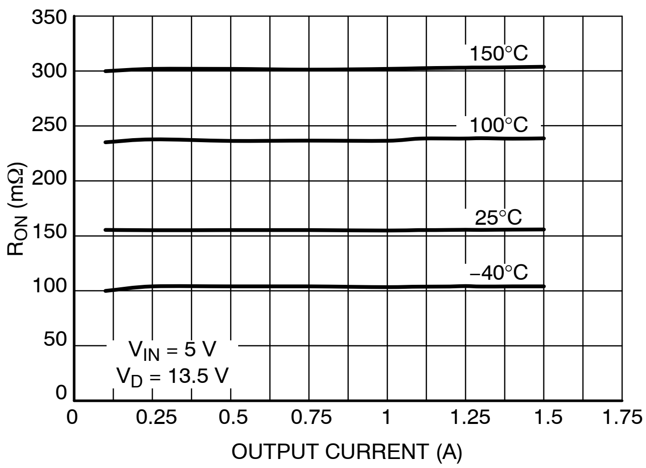


Figure 24. On−state Resistance vs. Output Current

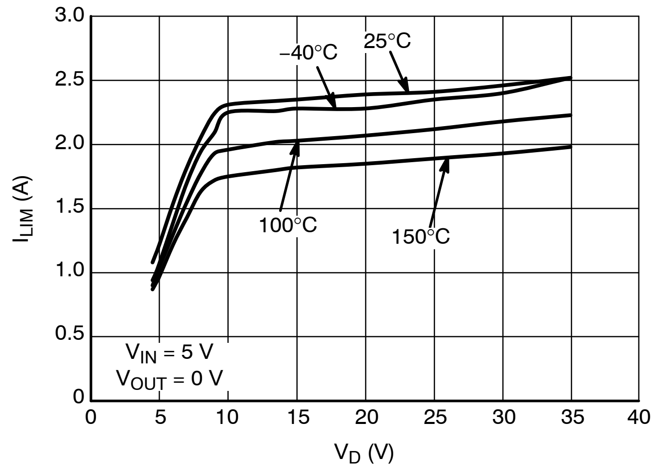


Figure 25. Current Limit vs. Supply Voltage

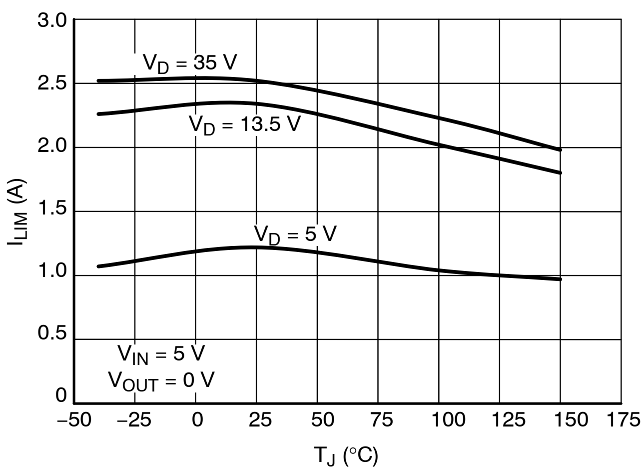


Figure 26. Current Limit vs. Junction Temperature

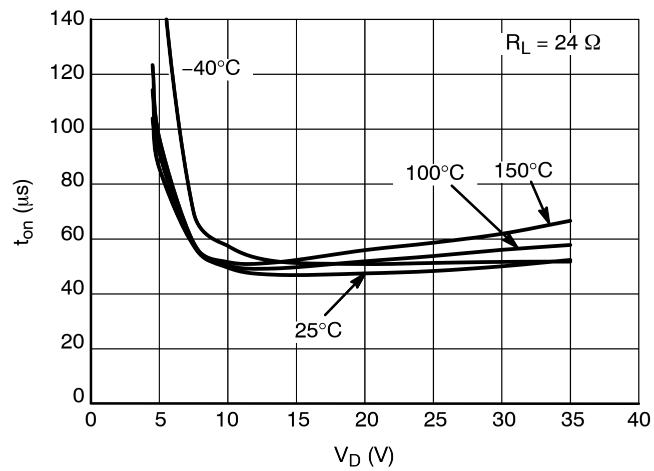


Figure 27. Turn−On Time vs. Supply Voltage

TYPICAL CHARACTERISTIC CURVES

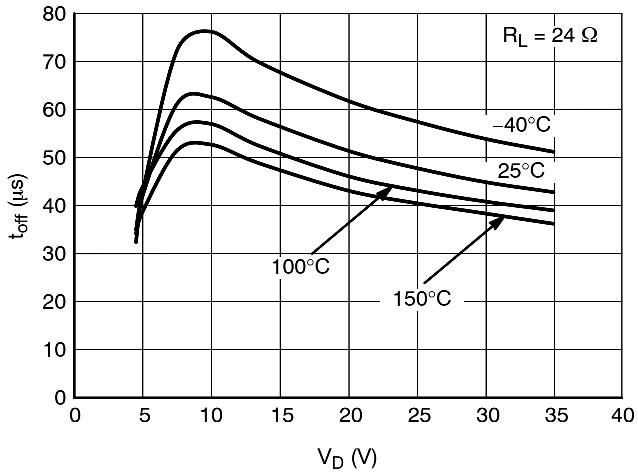


Figure 28. Turn−Off Time vs. Supply Voltage

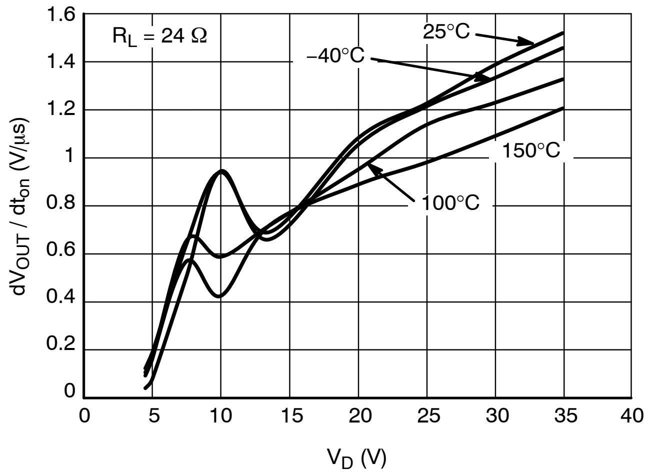


Figure 29. Slew Rate On vs. Supply Voltage

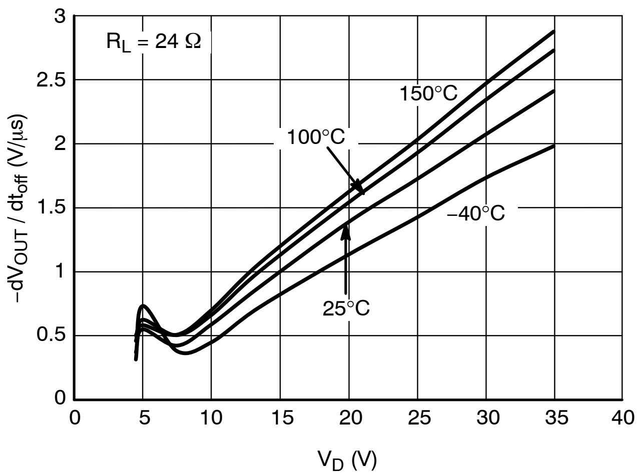


Figure 30. Slew Rate Off vs. Supply Voltage

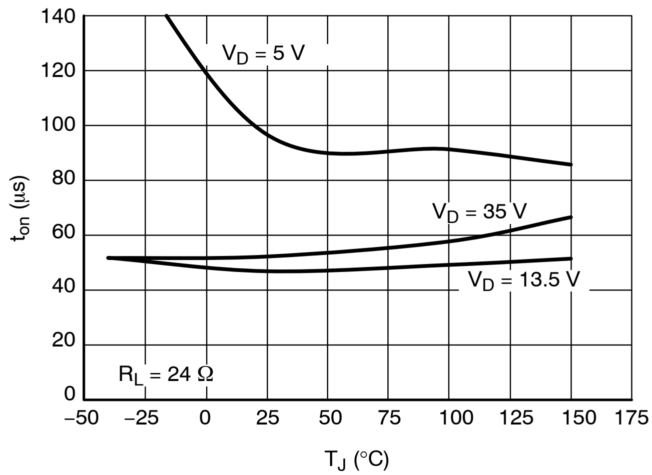


Figure 31. Turn−On vs. Junction Temperature

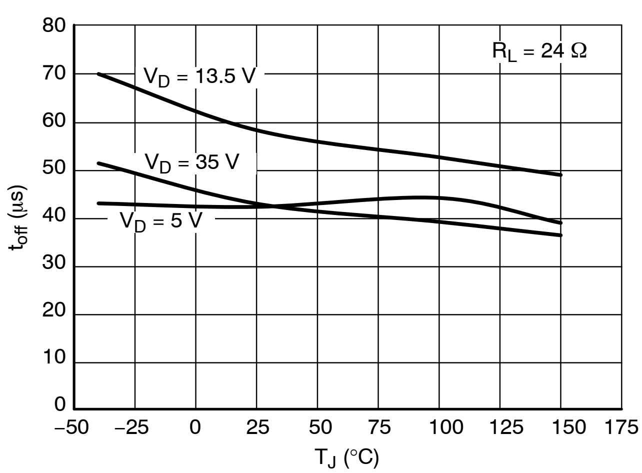


Figure 32. Turn−Off Time vs. Junction Temperature

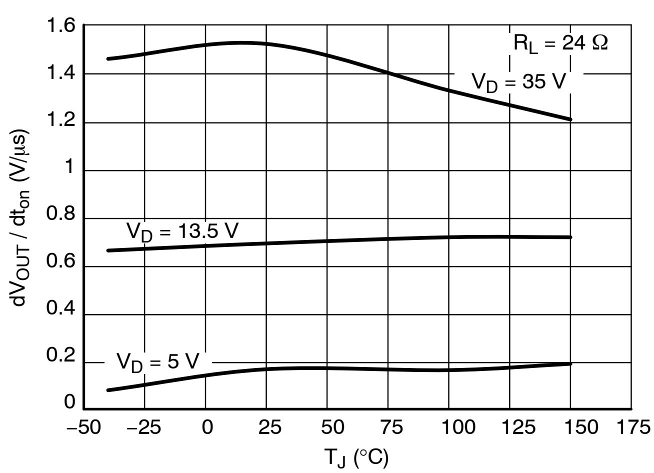


Figure 33. Slew Rate On vs. Junction Temperature

TYPICAL CHARACTERISTIC CURVES

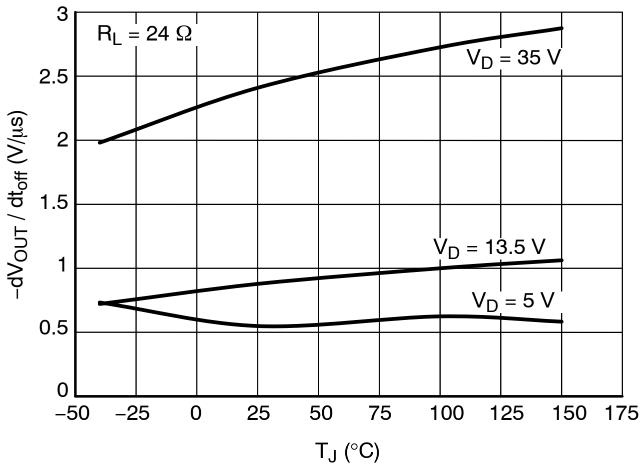


Figure 34. Slew Rate Off vs. Junction Temperature

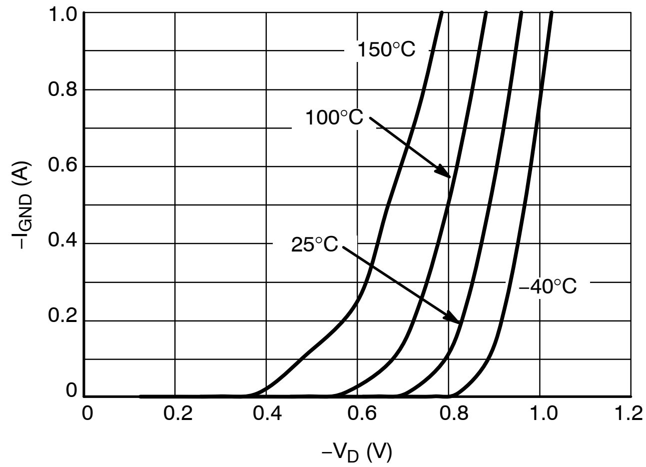


Figure 35. Supply−to−Ground Reverse Characteristics

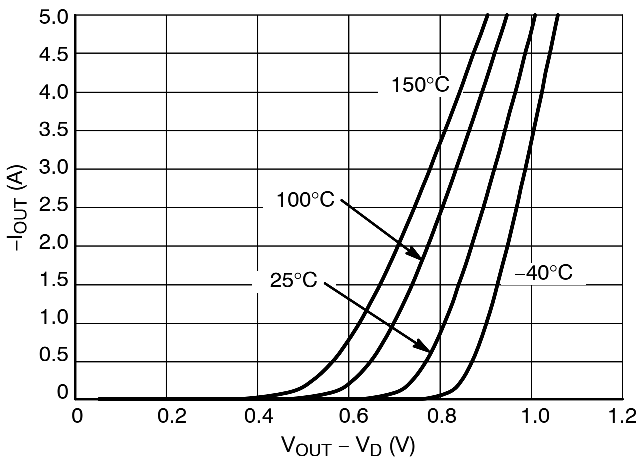


Figure 36. Power FET Body Forward Characteristics

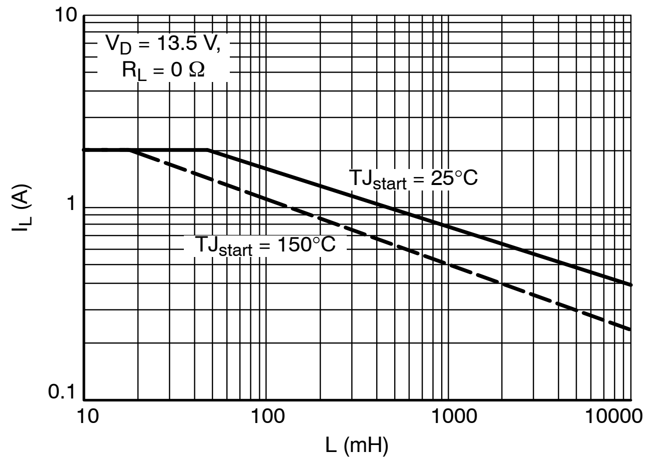


Figure 37. Single Pulse Maximum Switch Off Current vs. Load Inductance

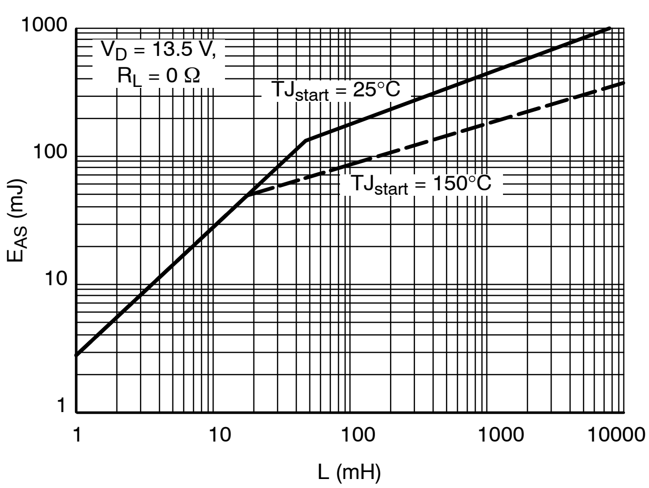


Figure 38. Single Pulse Maximum Switch Off Energy vs. Load Inductance

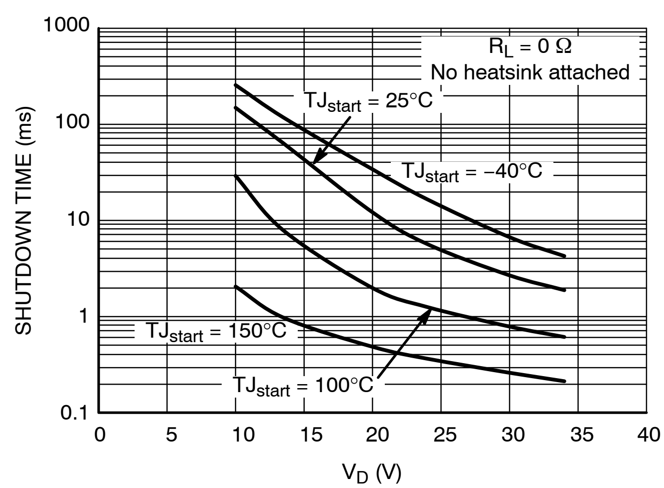


Figure 39. Initial Short−Circuit Shutdown Time vs. Supply Voltage

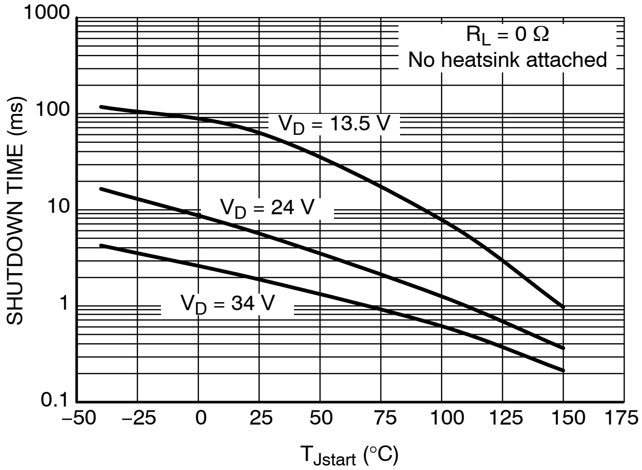


Figure 40. Initial Short−Circuit Shutdown Time vs. Starting Junction Temperature

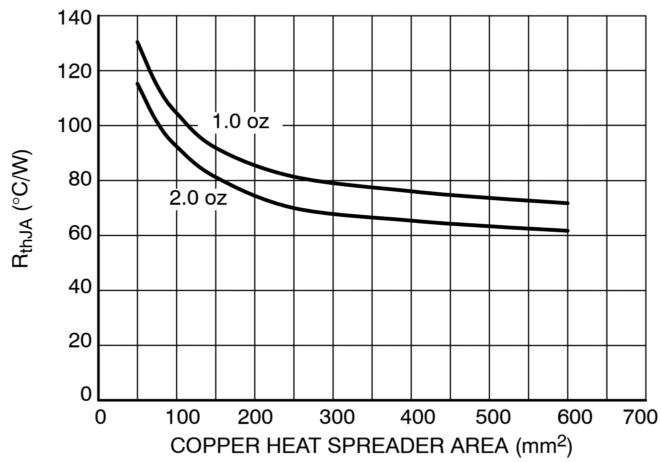


Figure 41. Junction−to−Ambient Thermal Resistance vs. Copper Area

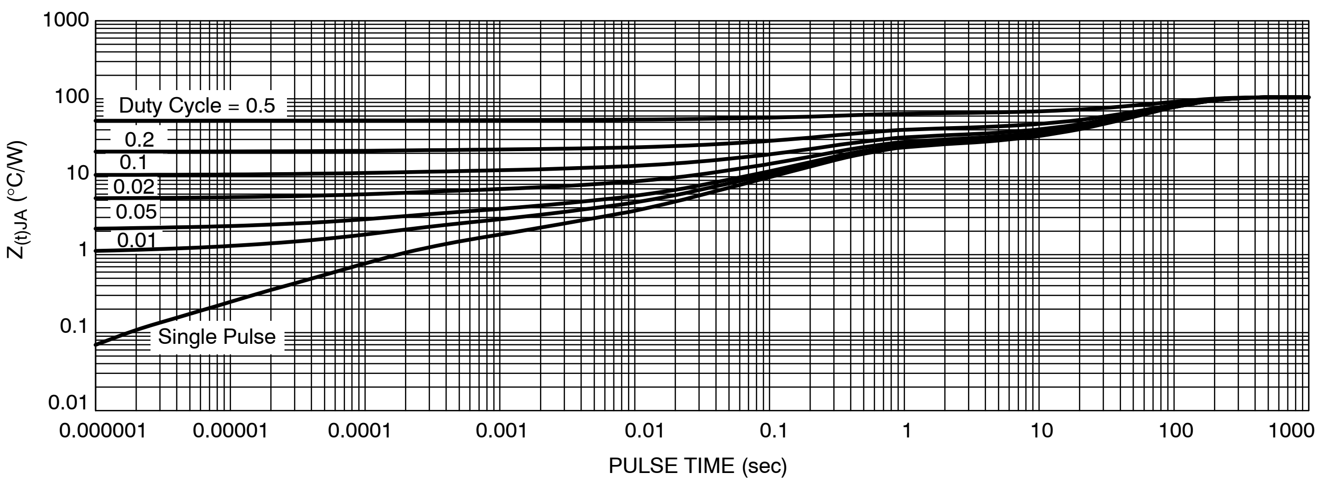
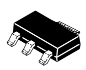


Figure 42. Junction−to−Ambient Transient Thermal Impedance (minimum pad size)

ORDERING INFORMATION

Device	Package	Shipping†
NCV8452STT1G	SOT−223 (Pb−Free)	1000 / Tape & Reel
NCV8452STT3G	SOT−223 (Pb−Free)	4000 / Tape & Reel

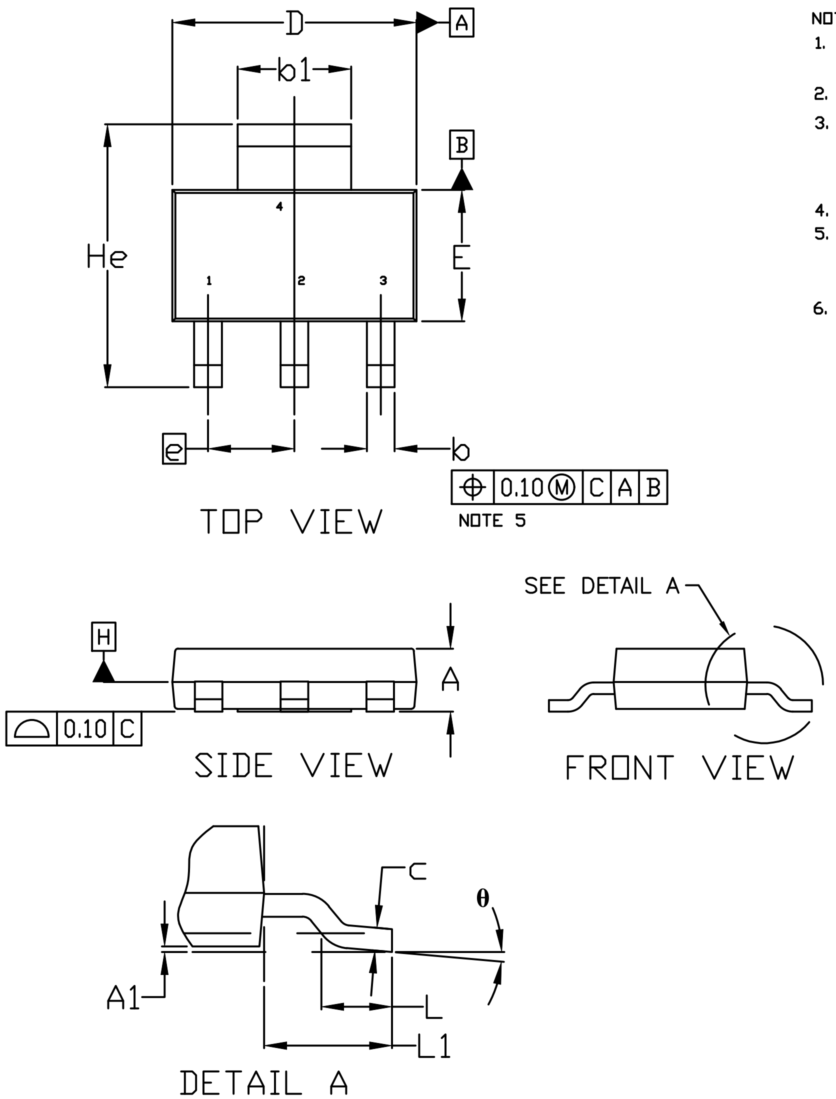
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



SCALE 1:1

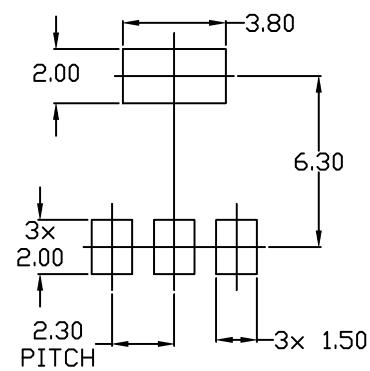
SOT−223 (TO−261)
CASE 318E−04
ISSUE R

DATE 02 OCT 2018



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.200MM PER SIDE.
4. DATUMS A AND B ARE DETERMINED AT DATUM H.
5. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
6. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	1.50	1.63	1.75
A1	0.02	0.06	0.10
b	0.60	0.75	0.89
b1	2.90	3.06	3.20
c	0.24	0.29	0.35
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	2.30 BSC		
L	0.20	---	---
L1	1.50	1.75	2.00
He	6.70	7.00	7.30
θ	0°	---	10°



RECOMMENDED MOUNTING FOOTPRINT

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DESCRIPTION:	**SOT−223 (TO−261)**	**PAGE 1 OF 2**

SOT−223 (TO−261)
CASE 318E−04
ISSUE R

DATE 02 OCT 2018

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. ANODE
2. CATHODE
3. NC
4. CATHODE

STYLE 3:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 4:
PIN 1. SOURCE
2. DRAIN
3. GATE
4. DRAIN

STYLE 5:
PIN 1. DRAIN
2. GATE
3. SOURCE
4. GATE

STYLE 6:
PIN 1. RETURN
2. INPUT
3. OUTPUT
4. INPUT

STYLE 7:
PIN 1. ANODE 1
2. CATHODE
3. ANODE 2
4. CATHODE

STYLE 8:
CANCELLED

STYLE 9:
PIN 1. INPUT
2. GROUND
3. LOGIC
4. GROUND

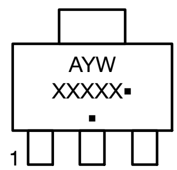
STYLE 10:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 11:
PIN 1. MT 1
2. MT 2
3. GATE
4. MT 2

STYLE 12:
PIN 1. INPUT
2. OUTPUT
3. NC
4. OUTPUT

STYLE 13:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

GENERIC
MARKING DIAGRAM*



A	=	Assembly Location
Y	=	Year
W	=	Work Week
XXXXX	=	Specific Device Code
▪	=	Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

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