

INTEGRATED RELAY, INDUCTIVE LOAD DRIVER

Description and Applications

The DRDC3105 is an integrated solid-state DC relay driver that can switch inductive loads. It provides a robust driver interface by acting as a buffer stage between sensitive logic circuits and that of 3V to 6V DC inductive relay coils. With a low input drive current requirement, the DRDC3105 only has slight loading on the input circuitry and it will provide good transient isolation between output and input channels. The output switch is guaranteed by design to go open-circuit and fall into the off-state condition when input drive is lost or disconnected.

In the industry standard SOT23 and SOT26, the DRDC3105 comes as a single or dual die which can replace three to six individual discrete components within a single integrated package, including a Zener across the output. The Zener will clamp at 6.6V to sink inductive currents to ground which will reduce EMI noise in the system. By integrating the Zener, the DRDC3105 eliminates the need for an external free-wheeling diode and allows the driving of inductive loads such as relays, solenoids, incandescent lamps, and small DC motors in:

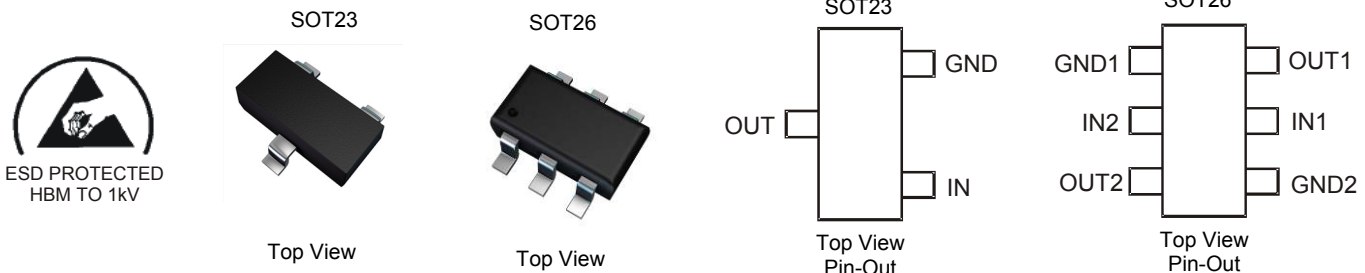
- Automotive: 5.0 V Driven Relays, Lamp Drivers, Motor Controls
- Telecom equipment: Modems, DSL, Cable (EMTA), Line Cards, IP-PBX, Analog Terminal Adaptors, End User Telecom Equipment
- Desktop Computers, Printers, Photocopiers
- LCD & Plasma TVs, Set Top Boxes
- Consumer Appliances, White Goods, Automated Door Control
- Industrial Equipment Inc. Process Control, ATE equipment
- Solar Inverters

Features and Benefits

- Inductive load driver capable of driving 3 to 6V DC coils
- Optimized to switch inductive loads from supply of 3 to 5V with the capability to drive coils up to 2.5W from a 5V rail
- Fully integrated into a single SOT23 or dual SOT26 package to minimize footprint area and reduce number of components
- Includes Zener across output to reduce EMI noise
- Internal low saturation BJT to reduce power dissipation in driving high currents into the coil
- Output guaranteed to be in off-state condition during no input
- Near – Zero quiescent supply current in off-state condition with minimal leakage
- Rugged design and inherently robust by using solid-state BJT technology integrated into a single die
- **ESD Protected up to 1kV on Human Body Model (HBM)**
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Mechanical Data

- Case: SOT23 & SOT26
- Case material: "Green" plastic molding compound (Note 2)
- UL Flammability 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: SOT23 = 0.008 grams (Approximate)
SOT26 = 0.018 grams (Approximate)

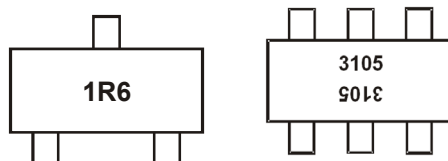


Ordering Information (Note 4)

Product	Package	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DRDC3105F-7	SOT23	1R6	7	8	3,000
DRDC3105E6-7	SOT26	3105	7	8	3,000

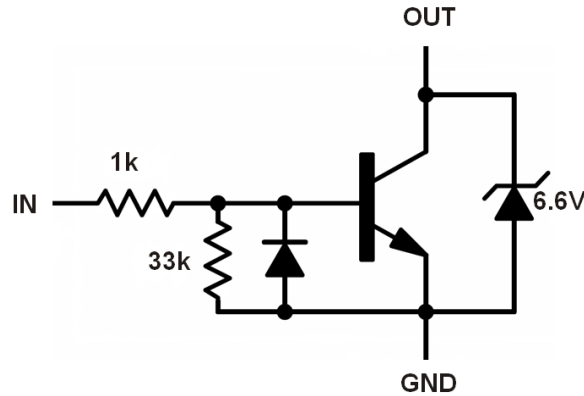
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen and Antimony free, "Green" and Lead-Free.
 3. Halogen and Antimony free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



1R6 = SOT23, Product Type Marking Code
3105 = SOT26, Product Type Marking Code

Internal Device Schematic



Maximum Ratings (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Limit	Unit
Supply Voltage	V_{CC}	6.0	V
Input Voltage (Forward)	$V_{IN(FWD)}$	6.0	V
Input Voltage (Reverse)	$V_{IN(REV)}$	-0.5	V
Output Sink Continuous Current	I_O	500	mA
Repetitive Pulse Zener Energy Limit (Duty Cycle 0.01%)	E_{zpk}	50	mJ

Thermal Characteristics for DRDC3105F (SOT23) (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation	P_D	(Note 5)	310
		(Note 6)	350
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	(Note 5)	403
		(Note 6)	357
Thermal Resistance, Junction to Leads	$R_{\theta JL}$	350	$^\circ\text{C/W}$
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

Thermal Characteristics for DRDC3105E6 (SOT26) (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation Linear Derating Factor	P_D	(Note 7 & 9)	0.9
		(Note 7 & 10)	7.2
		(Note 8 & 10)	1.1
		(Note 8 & 10)	8.8
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	(Note 7 & 9)	1.7
		(Note 7 & 10)	13.6
		(Note 8 & 10)	139
Thermal Resistance, Junction to Leads	$R_{\theta JL}$	113	$^\circ\text{C/W}$
Thermal Resistance, Junction to Leads	$R_{\theta JL}$	(Note 11)	73
		(Note 11)	100
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

- Notes:
- For a device mounted on minimum recommended pad layout 1oz weight copper that is on a single-sided FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
 - Same as Note 5, except the device is mounted on 15mm X 15mm 1oz copper.
 - Same as Note 5, except the device is mounted on 25mm X 25mm 1oz copper.
 - Same as Note 7, except the device is measured at < 5sec
 - For a device with one active die.
 - For a device with two die running at equal power.
 - Thermal resistance from junction to solder-point (at the end of the "OUT" lead).

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Output Zener Breakdown Voltage	BV _(out) BV _(-out)	6.2 -	6.6 0.67	7.0 -	V	@ I _T = 10 mA Pulse
Output Leakage Current @ 0 Input Voltage	I _{OO}	— —	— —	0.1 30	μA	V _O = 5.5 V, T _A = +25°C V _O = 5.5 V, T _A = +85°C
“ON” state input voltage (Note 13)	V _{in(on)}	—	0.99	1.5	V	I _O = 100 mA, V _O = 150mV
“OFF” State Input Voltage (Note 14)	V _{in(off)}	400	540	—	mV	I _O = 100 μA, V _O = 4.9V
ON CHARACTERISTICS						
Input Bias Current (H _{FE} Limited)	I _{in}	—	0.7	1.6	mA	I _O = 250 mA, V _O = 0.25V
Output Saturation Voltage	V _{O(sat)}	—	125	160	mV	I _O = 250 mA, I _{in} = 1.5 mA
Output Sink Current – Continuous	I _{O(on)}	250	430	—	mA	V _{CE} = 0.25 V, I _{in} = 1.5 mA
SWITCHING CHARACTERISTICS (Refer to Figure 1)						
Propagation Delay Times:						
High to Low Propagation Delay; (5.0V 74HC04)	t _{PHL}	—	20.4	—	ns	—
Low to High Propagation Delay; (5.0V 74HC04)	t _{PLH}	—	1.43	—	μs	
High to Low Propagation Delay; 13 (3.0V 74HC04)	t _{PHL}	—	32.2	—	ns	—
Low to High Propagation Delay; 13 (3.0V 74HC04)	t _{PLH}	—	760	—	ns	
High to Low Propagation Delay; 14 (5.0V 74LS04)	t _{PHL}	—	25.3	—	ns	—
Low to High Propagation Delay; 14 (5.0V 74LS04)	t _{PLH}	—	2.57	—	μs	
Transition Times:						
Fall Time; (5.0V 74HC04)	t _f	—	12.5	—	ns	—
Rise Time; (5.0V 74HC04)	t _r	—	411	—	ns	
Fall Time; 13 (3.0V 74HC04)	t _f	—	21.1	—	ns	—
Rise Time; 13 (3.0V 74HC04)	t _r	—	220	—	ns	
Fall Time; 14 (5.0V 74LS04)	t _f	—	15.1	—	ns	—
Rise Time; 14 (5.0V 74LS04)	t _r	—	849	—	ns	

Notes: 13. The device is guaranteed to be in “ON” state with V_{in(ON)} above 1.5V
14. The device is guaranteed to be in “OFF” state with V_{in(OFF)} below 400mV

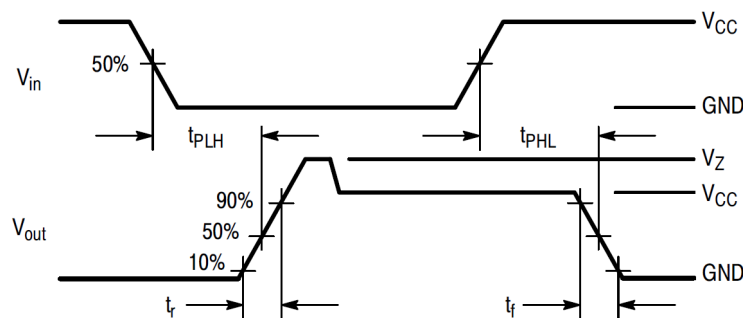


Figure 1. Switching Waveforms

Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

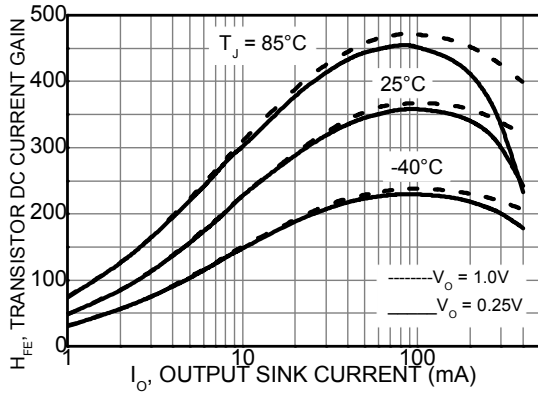


Figure 2. Transistor DC Current Gain

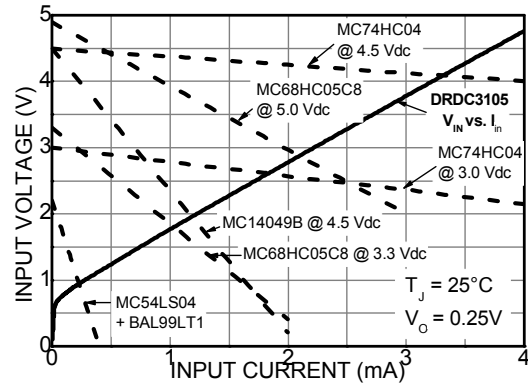


Figure 3. Input V-I Requirement Compared to Possible Source Logic Outputs

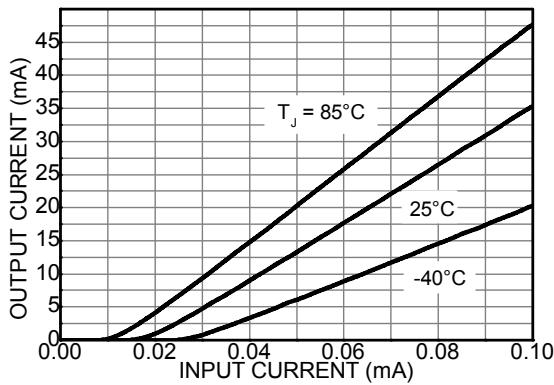


Figure 4. Threshold Effects

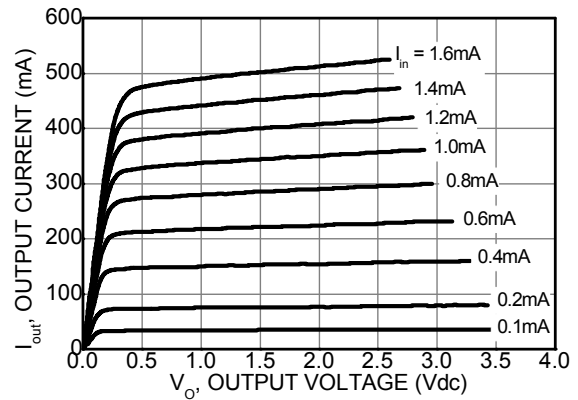


Figure 5. Transistor Output V-I Characteristic

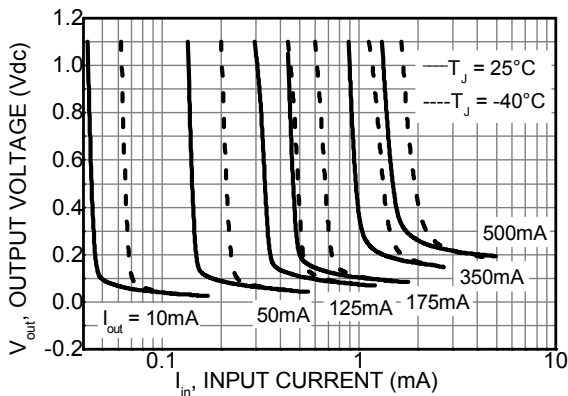


Figure 6. Output Saturation Voltage versus I_{out}/I_{in}

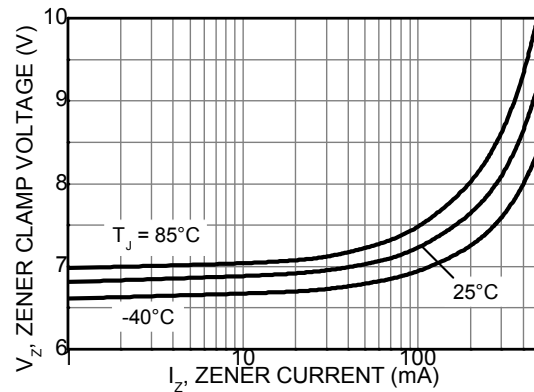


Figure 7. Zener Clamp Voltage versus Zener Current

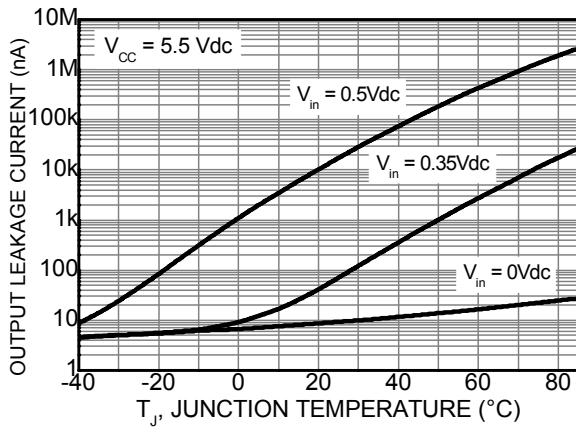


Figure 8. Output Leakage Current versus Temperature

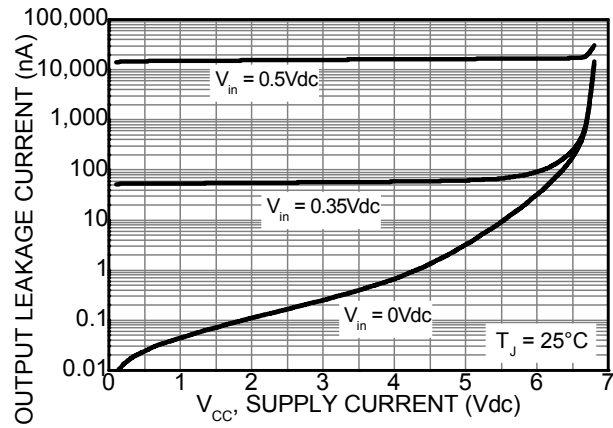


Figure 9. Output Leakage Current versus Supply Voltage

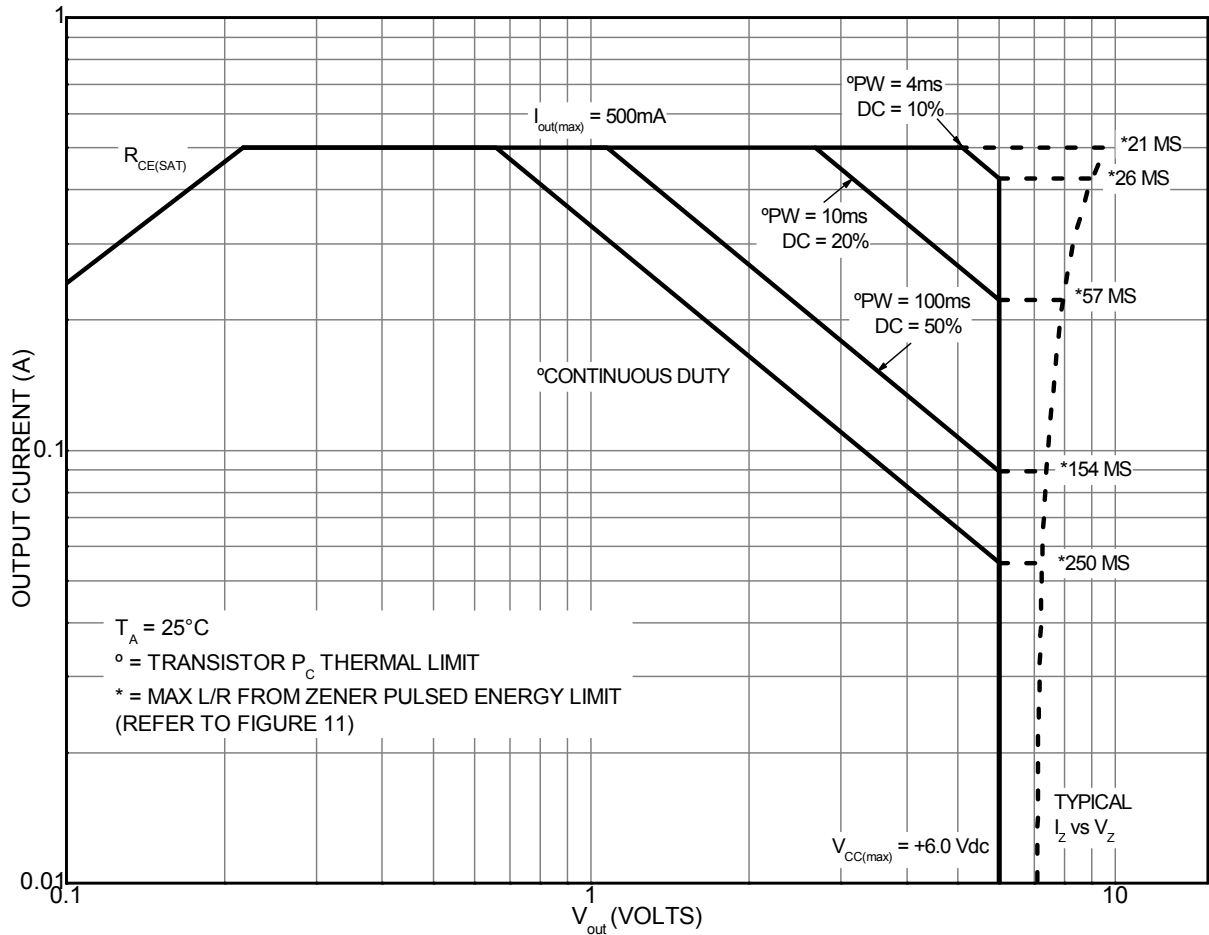


Figure 10. Safe Operating Area

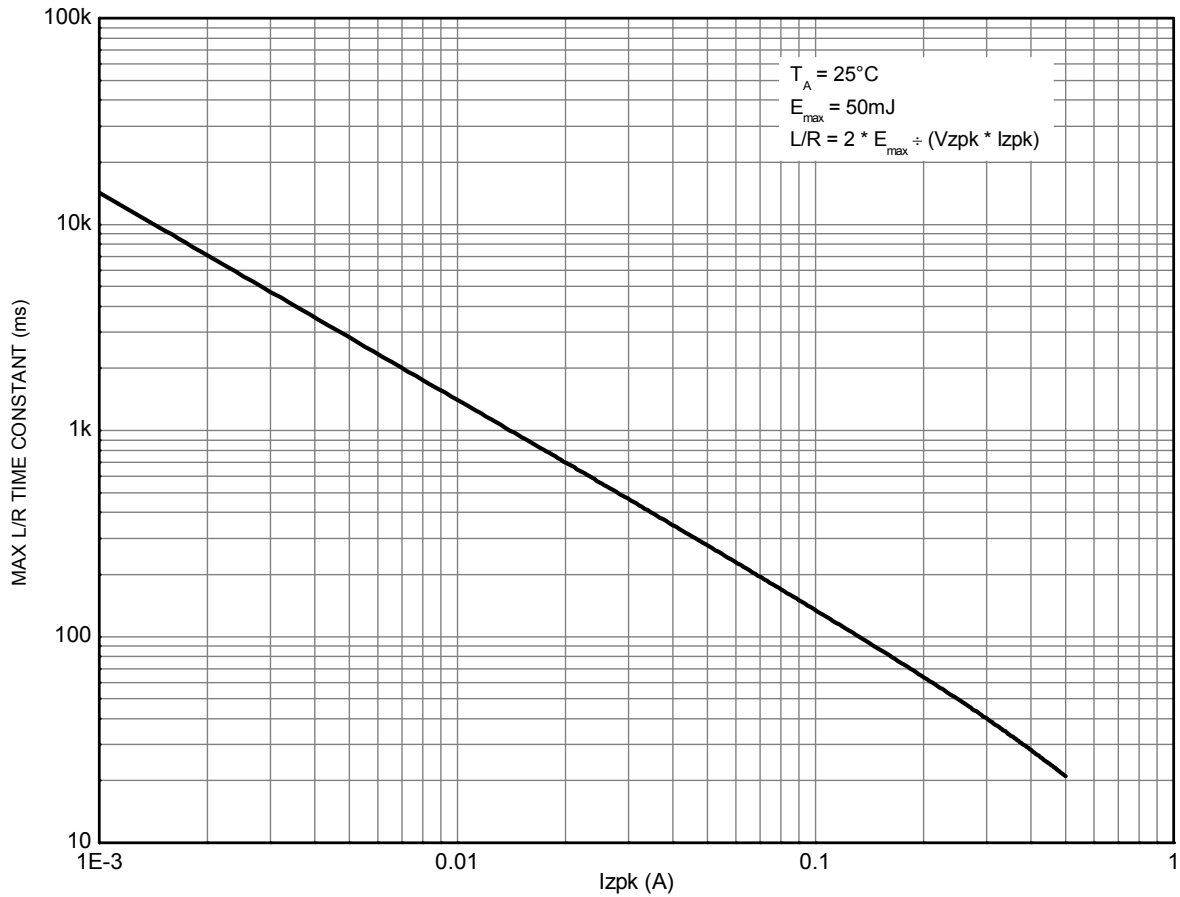


Figure 11. Zener Repetitive Pulse Energy Limit on L/R Time Constant

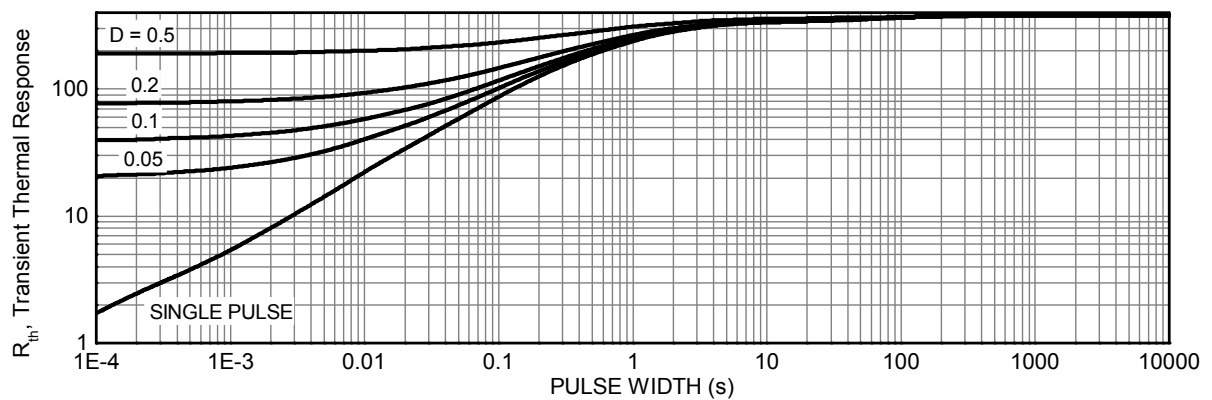
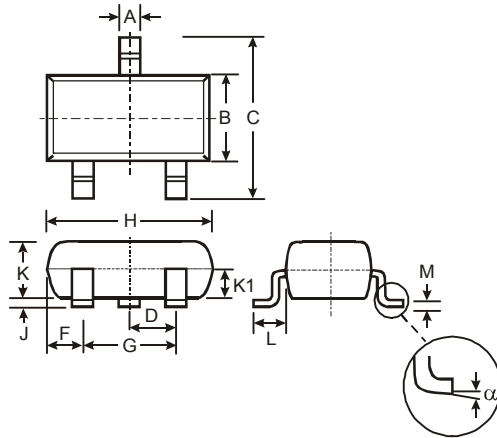


Figure 12. Transient Thermal Response

Package Outline Dimensions

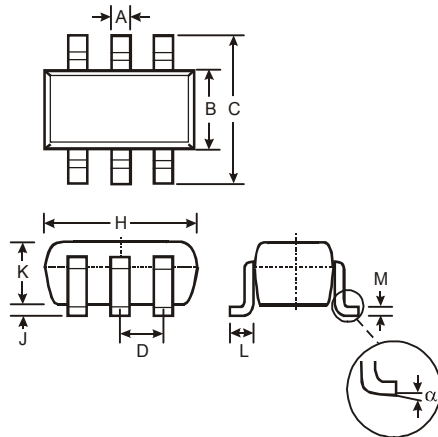
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

Package Type: SOT23



SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.903	1.10	1.00
K1	-	-	0.400
L	0.45	0.61	0.55
M	0.085	0.18	0.11
α	0°	8°	-
All Dimensions in mm			

Package Type: SOT26

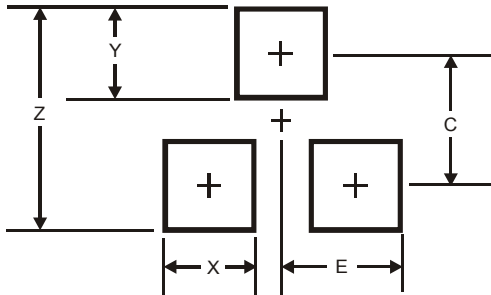


SOT26			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	—	—	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
α	0°	8°	—
All Dimensions in mm			

Suggested Pad Layout

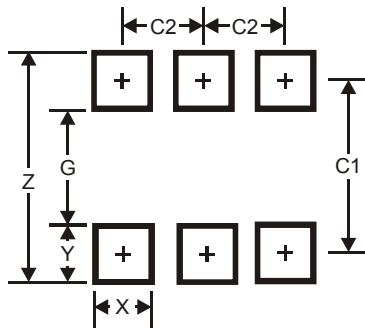
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

Package Type: SOT23



Dimensions	Value (in mm)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

Package Type: SOT26



Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

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