

## Description

A proprietary structure is used in achieving ultra-low V<sub>CE(sat)</sub> performance and reduced operating temperature. This has the benefit of reducing thermal management requirements and increasing long-term reliability.

## Features

- BV<sub>CEO</sub> > 60V
- 5.5A Continuous Collector Current
- Low Saturation Voltage V<sub>CE(sat)</sub> < 45mV @ 1A
- High Current R<sub>CE(sat)</sub> Typ = 25mΩ
- h<sub>FE</sub> Characterized Up to 6A
- 2W Power Dissipation
- Fast Switching with Short Storage Time
- **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-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

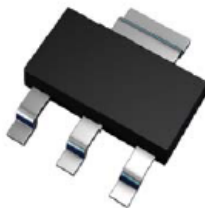
## Mechanical Data

- Package: SOT223
- Package Material: Molded Plastic. "Green" Molding Compound UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Solderable per MIL-STD-202, Method 208 Ⓔ③
- Weight: 0.112 grams (Approximate)

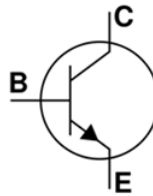
## Applications

- Medium-power DC-DC converters
- High-side/low-side switches
- Linear voltage regulation

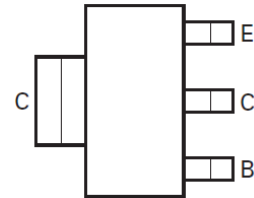
SOT223



Top View



Device Symbol



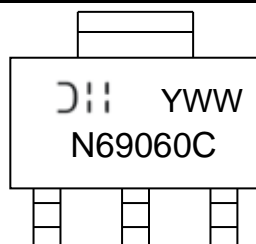
Top View  
Pin-Out

## Ordering Information (Note 4)

Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
DXTN69060CE-7	SOT223	N69060C	7	12	1,000	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



N69060C = Product Type Marking Code  
 YWW = Date Code Marking  
 Y or  $\bar{Y}$  = Last Digit of Year (ex: 4 = 2024)  
 WW = Week Code (01 to 53)

**Absolute Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CBO</sub>	80	V
Collector-Emitter Voltage	V <sub>CEO</sub>	60	V
Emitter-Base Voltage	V <sub>EBO</sub>	7	V
Continuous Collector Current	I <sub>C</sub>	5.5	A
Peak Pulse Current	I <sub>CM</sub>	12	A
Base Current	I <sub>B</sub>	1	A

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation Linear Derating Factor	P <sub>D</sub>	2	W mW/°C
		16	
		1.6	
		12.8	
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	1	°C/W
		8	
		62.5	
		78	
Thermal Resistance, Junction to Lead	R <sub>θJL</sub>	125	°C/W
		21	
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

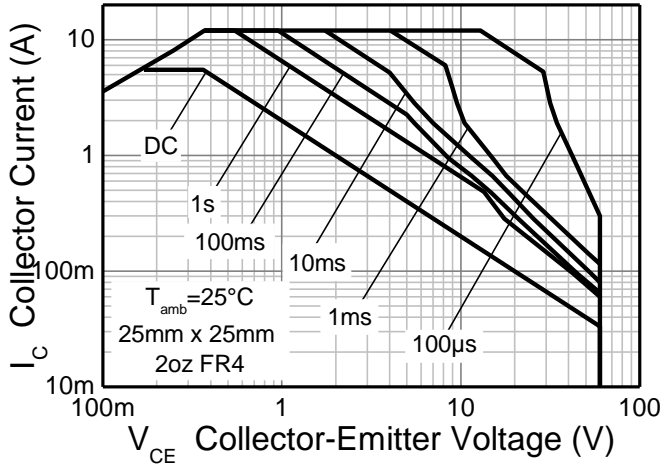
- Notes:
5. For a device mounted with the exposed collector pad on 25mm x 25mm 2oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
  6. Same as Note 5, except the device is mounted on 15mm x 15mm 2oz copper.
  7. Same as Note 5, except the device is mounted on minimum recommended pad layout.
  8. Thermal resistance from junction to solder-point (at the end of the collector lead).

**ESD Ratings** (Note 9)

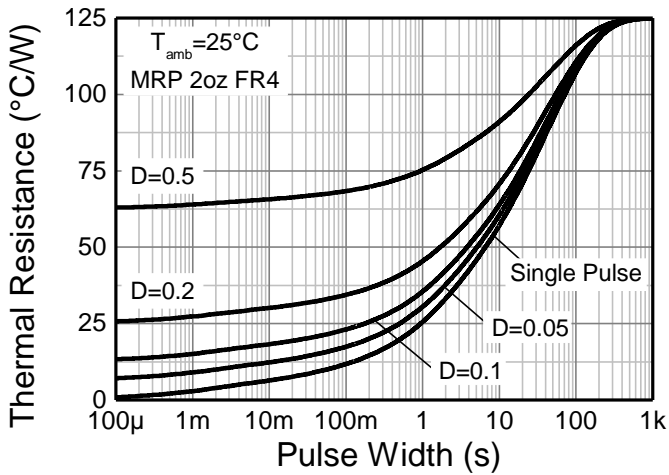
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C
Electrostatic Discharge – Charged Device Model	ESD CDM	1,000	V	IV

- Note: 9. Refer to JEDEC specification JESD22-A114, JESD22-A115 and JESD22-C101.

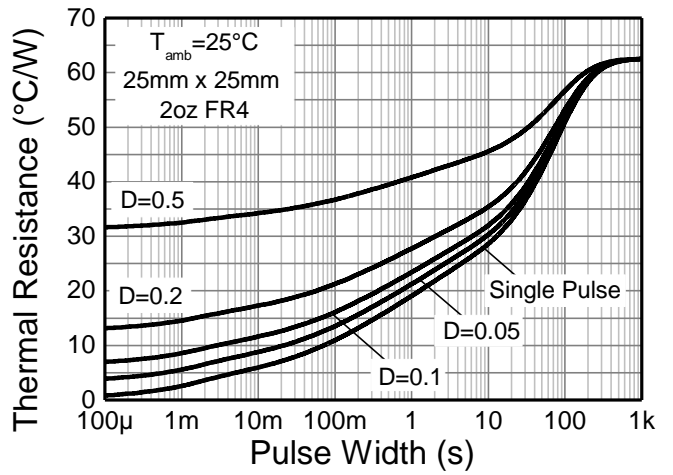
**Thermal Characteristics and Derating Information**



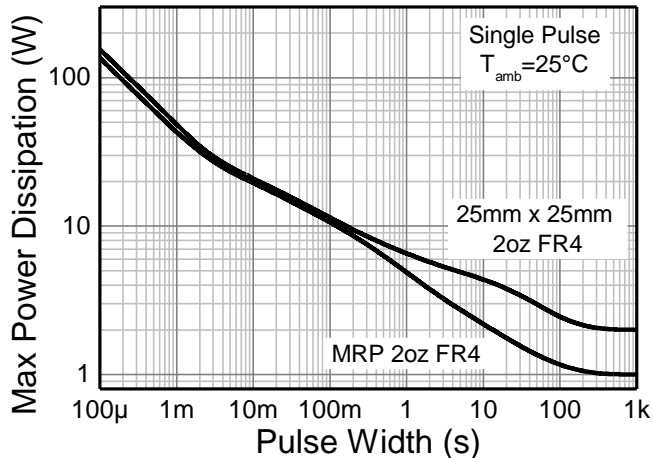
**Fig 1. Safe Operating Area**



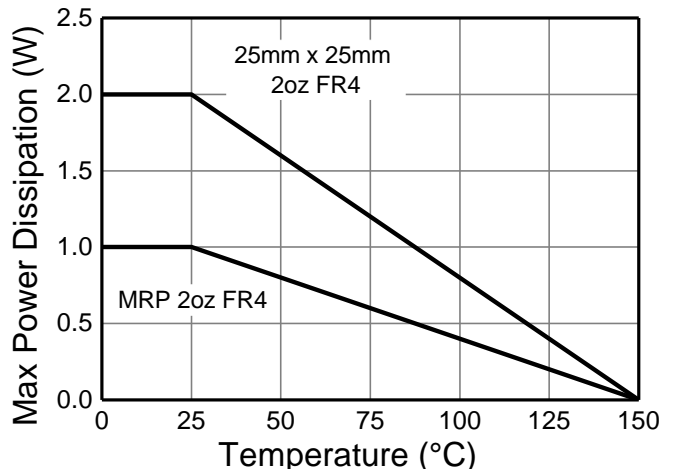
**Fig 2. Transient Thermal Impedance**



**Fig 3. Transient Thermal Impedance**



**Fig 4. Pulse Power Dissipation**



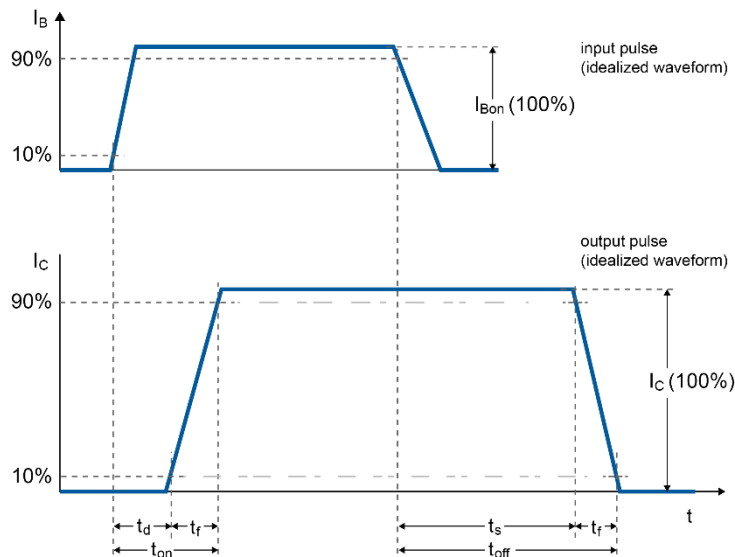
**Fig 5. Derating Curve**

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Collector-Base Breakdown Voltage	BV <sub>CBO</sub>	80	—	—	V	I <sub>C</sub> = 100μA
Collector-Emitter Breakdown Voltage (Base Open) (Note 10)	BV <sub>CEO</sub>	60	—	—	V	I <sub>C</sub> = 10mA
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	7	—	—	V	I <sub>E</sub> = 100μA
Collector-Base Cutoff Current	I <sub>CBO</sub>	—	—	100 0.5	nA μA	V <sub>CB</sub> = 80V V <sub>CB</sub> = 80V, T <sub>A</sub> = +100°C
Emitter-Base Cutoff Current	I <sub>EBO</sub>	—	—	100	nA	V <sub>EB</sub> = 6V
<b>ON CHARACTERISTICS (Note 10)</b>						
Static Forward Current Transfer Ratio	h <sub>FE</sub>	250 200 80	370 330 170	475 — —	—	I <sub>C</sub> = 100mA, V <sub>CE</sub> = 2V I <sub>C</sub> = 2A, V <sub>CE</sub> = 2V I <sub>C</sub> = 6A, V <sub>CE</sub> = 2V
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	—	32 70 80 140 180	45 95 110 180 230	mV	I <sub>C</sub> = 1A, I <sub>B</sub> = 100mA I <sub>C</sub> = 1A, I <sub>B</sub> = 10mA I <sub>C</sub> = 2A, I <sub>B</sub> = 40mA I <sub>C</sub> = 5.5A, I <sub>B</sub> = 550mA I <sub>C</sub> = 5.5A, I <sub>B</sub> = 150mA
Base-Emitter Saturation Voltage	V <sub>BE(sat)</sub>	—	1,050 890	1,150	mV	I <sub>C</sub> = 5.5A, I <sub>B</sub> = 550mA I <sub>C</sub> = 5.5A, I <sub>B</sub> = 150mA
Base-Emitter On Voltage	V <sub>BE(on)</sub>	—	830	900	mV	I <sub>C</sub> = 5.5A, V <sub>CE</sub> = 2V
<b>SWITCHING CHARACTERISTICS</b>						
Transition Frequency	f <sub>T</sub>	—	200	—	MHz	I <sub>C</sub> = 100mA, V <sub>CE</sub> = 10V, f = 100MHz
Input Capacitance	C <sub>ibo</sub>	—	380	—	pF	V <sub>EB</sub> = 0.5V, f = 1MHz
Output Capacitance	C <sub>obo</sub>	—	23	—	pF	V <sub>CB</sub> = 10V, f = 1MHz
Delay Time	t <sub>d</sub>	—	81	—	ns	V <sub>CC</sub> = 24V, I <sub>C</sub> = 750mA, I <sub>B1</sub> = -I <sub>B2</sub> = 15mA. See Fig 6.
Rise Time	t <sub>r</sub>	—	64	—	ns	
Storage Time	t <sub>s</sub>	—	640	—	ns	
Fall Time	t <sub>f</sub>	—	78	—	ns	
Delay Time	t <sub>d</sub>	—	87	—	ns	
Rise Time	t <sub>r</sub>	—	117	—	ns	V <sub>CC</sub> = 48V, I <sub>C</sub> = 750mA, I <sub>B1</sub> = -I <sub>B2</sub> = 15mA See Fig 6.
Storage Time	t <sub>s</sub>	—	510	—	ns	
Fall Time	t <sub>f</sub>	—	101	—	ns	

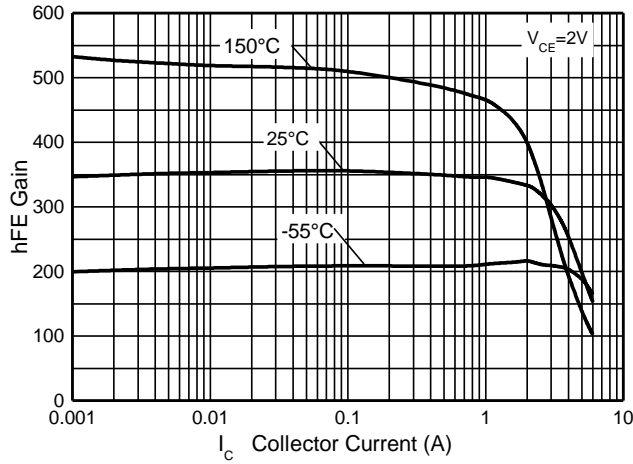
Note: 10. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%

**Timing Waveform**

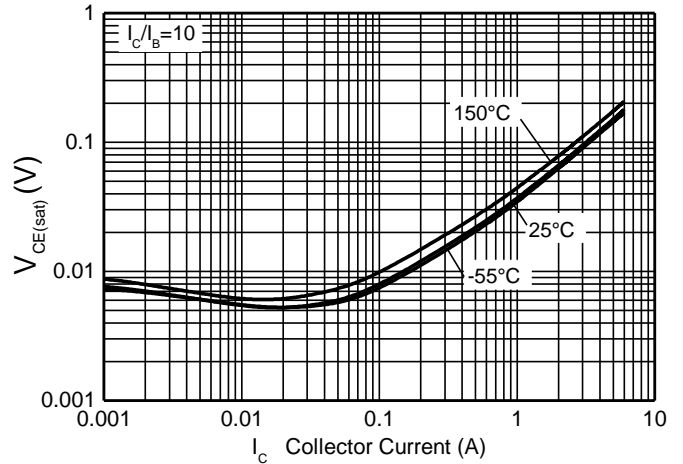


**Fig 6. Timing Waveform**

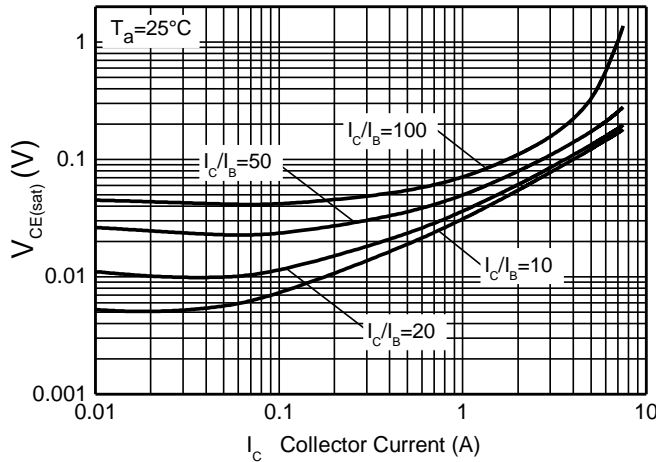
**Typical Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)



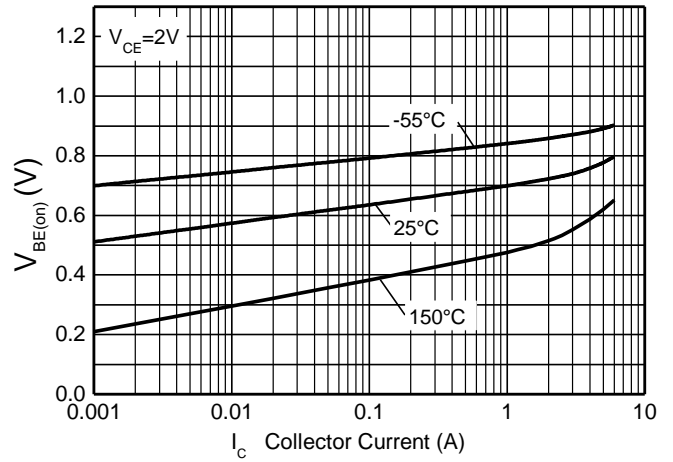
**Fig. 7** hFE v I<sub>C</sub>



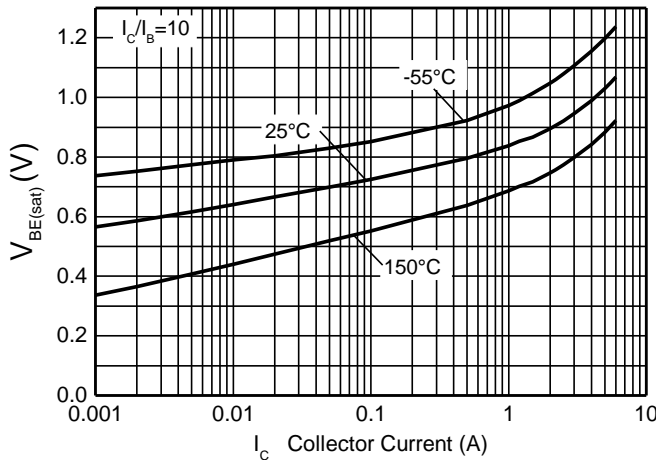
**Fig. 8** V<sub>CE(sat)</sub> v I<sub>C</sub>



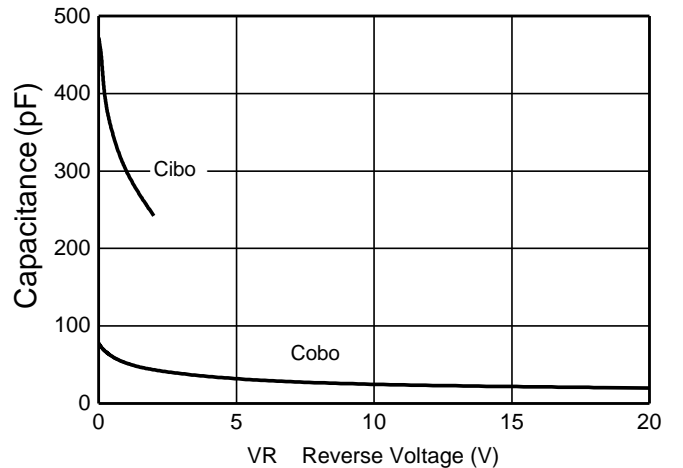
**Fig. 9** V<sub>CE(sat)</sub> v I<sub>C</sub>



**Fig. 10** V<sub>BE(on)</sub> v I<sub>C</sub>



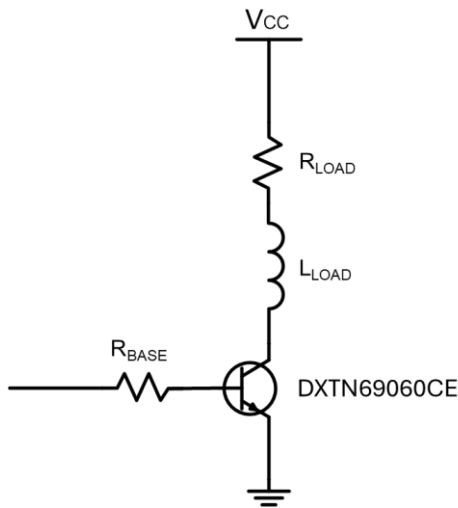
**Fig. 11** V<sub>BE(sat)</sub> v I<sub>C</sub>



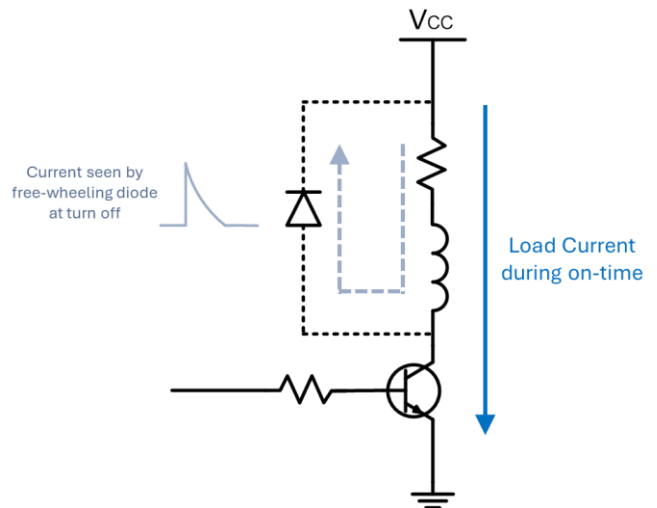
**Fig. 12** Typical Junction Capacitance

## Application Notes

Figure 13 shows the DXTN69060CE as a low-side switch. When driving high-current inductive loads, it is recommended to apply appropriate protective measures to manage the kick-back voltage that builds up due to the collapse of the inductor's magnetic field after a switch-off event. The voltage spikes that originate this way can potentially overstress the device above its Maximum Ratings. During evaluation, ensure that the Collector-Emitter Voltage stays below  $V_{CE0}$  rating of 60V. An easy way to suppress induced voltage spikes is to place an additional free-wheeling diode in parallel with the load as shown in Figure 14.



**Fig. 13** DXTN69060CE in a low-side switch configuration



**Fig. 14** Additional free-wheeling diode across inductive load for voltage spikes suppression

The appropriate free-wheeling diode should have:

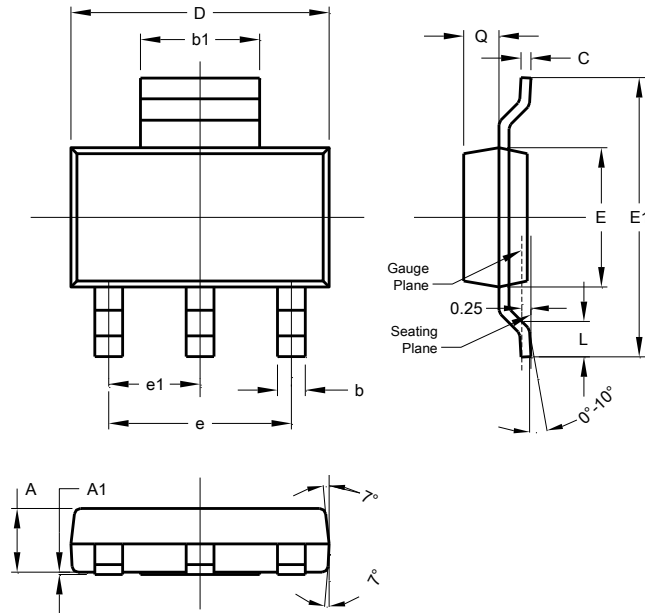
- An Average Rectified Output Current ( $I_O$ ) rating of at least twice the full Load Current
- A Working Peak Reverse Voltage ( $V_{RWM}$ ) equal to the voltage applied to the load (minimum) or twice its value (recommended)

For example, in the figures above,  $V_{CC} = 24V$  and  $I_{LOAD} = 3A$ . The PDS760 Schottky Barrier Rectifier with  $I_O=7A$  and  $V_{RWM}=60V$  will protect the transistor from turn-off inductive voltage spikes and ensure a safe system operation.

**Package Outline Dimensions**

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

**SOT223**

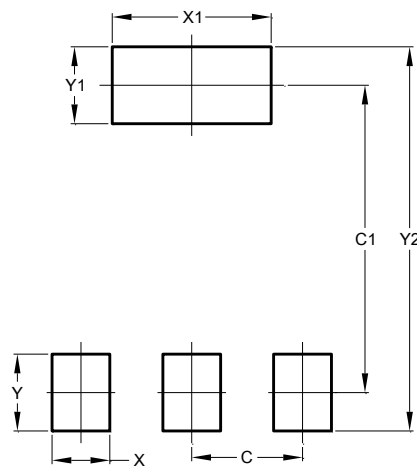


SOT223			
Dim	Min	Max	Typ
A	1.55	1.65	1.60
A1	0.010	0.15	0.05
b	0.60	0.80	0.70
b1	2.90	3.10	3.00
C	0.20	0.30	0.25
D	6.45	6.55	6.50
E	3.45	3.55	3.50
E1	6.90	7.10	7.00
e	-	-	4.60
e1	-	-	2.30
L	0.85	1.05	0.95
Q	0.84	0.94	0.89
<b>All Dimensions in mm</b>			

**Suggested Pad Layout**

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

**SOT223**



Dimensions	Value (in mm)
C	2.30
C1	6.40
X	1.20
X1	3.30
Y	1.60
Y1	1.60
Y2	8.00

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