

Description

A proprietary structure is used in achieving ultra-low $V_{CE(sat)}$ performance and reduced operating temperature. This has the benefit of reducing thermal management requirements and increasing long-term reliability.

Features

- $BV_{CEO} > 60V$
- 5.5A Continuous Collector Current
- Low Saturation Voltage $V_{CE(sat)} < 45mV @ 1A$
- High Current $R_{CE(sat)} Typ = 24m\Omega$
- h_{FE} Characterized Up to 6A
- 2W Power Dissipation
- Fast Switching with Short Storage Time
- Sidewall Tin Plating for Wettable Flanks in AOI
- **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@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

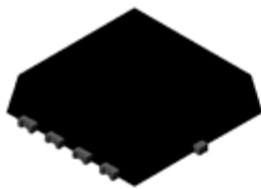
Mechanical Data

- Package: PowerDI[®]3333-8
- 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
- Weight: 0.03 grams (Approximate)

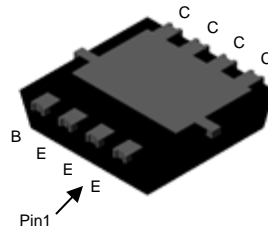
Applications

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

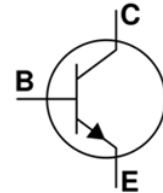
PowerDI3333-8 (SWP) (Type UX)



Top View



Bottom View



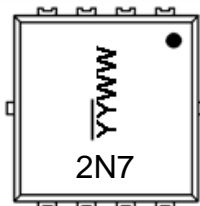
Device Symbol

Ordering Information (Note 4)

Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
DXTN69060CFG-7	PowerDI3333-8 (SWP) (Type UX)	2N7	7	12	2,000	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



2N7= Product Type Marking Code
 YYWW = Date Code Marking
 YY = Last Two Digits of Year (ex: 24 = 2024)
 WW = Week Code (01 to 53)

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

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	80	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	7	V
Continuous Collector Current (note 5)	I_C	3.5	A
Continuous Collector Current (note 6)	I_C	5.5	A
Peak Pulse Current	I_{CM}	12	A
Base Current	I_B	1	A

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

Characteristic	Symbol	Value	Unit
Power Dissipation Linear Derating Factor	P_D	2	W mW/ $^{\circ}\text{C}$
		16	
		1.35	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	10.8	$^{\circ}\text{C}/\text{W}$
		0.9	
		7.2	
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	62.5	$^{\circ}\text{C}/\text{W}$
		92	
		139	
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^{\circ}\text{C}$

- 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

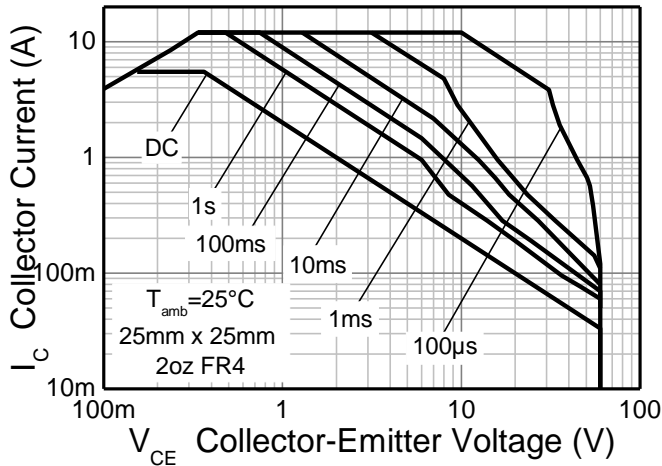


Fig 1. Safe Operating Area

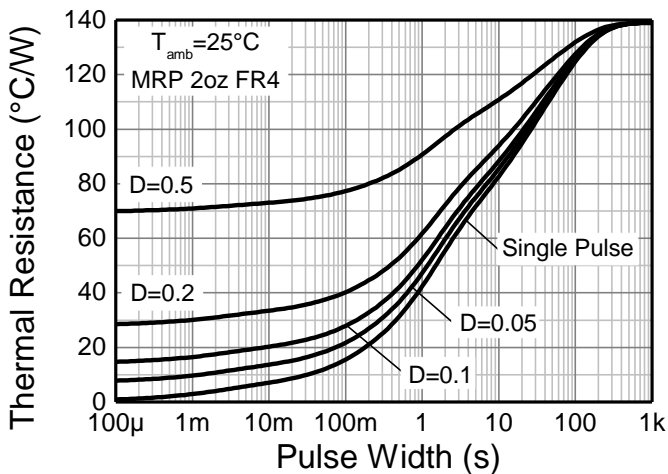


Fig 2. Transient Thermal Impedance

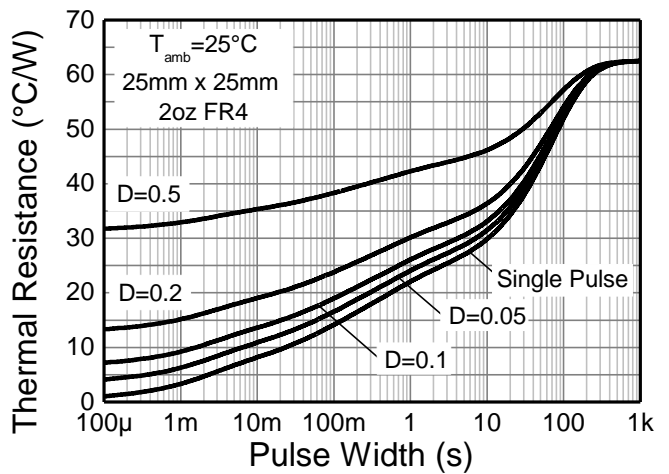


Fig 3. Transient Thermal Impedance

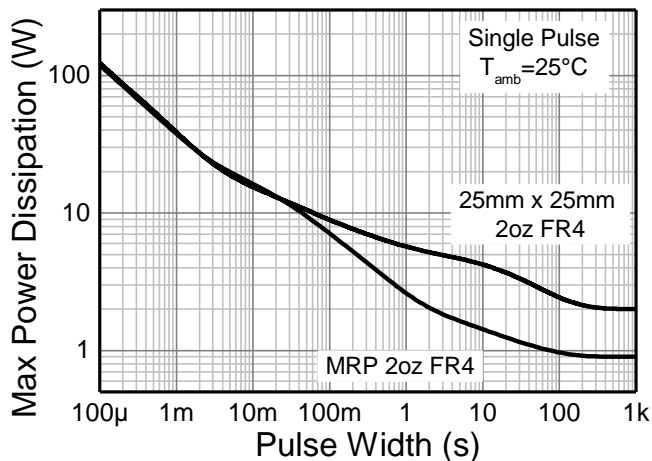


Fig 4. Pulse Power Dissipation

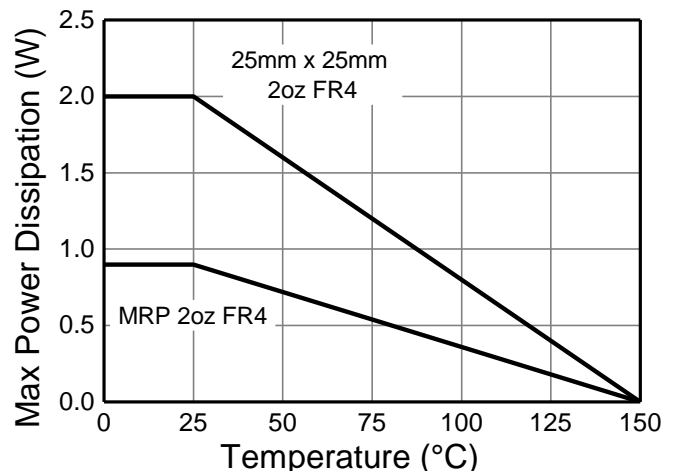


Fig 5. Derating Curve

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage	BV _{CBO}	80	—	—	V	I _C = 100μA
Collector-Emitter Breakdown Voltage (Base Open) (Note 10)	BV _{CEO}	60	—	—	V	I _C = 10mA
Emitter-Base Breakdown Voltage	BV _{EBO}	7	—	—	V	I _E = 100μA
Collector-Base Cutoff Current	I _{CBO}	—	—	100 0.5	nA μA	V _{CB} = 80V V _{CB} = 80V, T _A = +100°C
Emitter-Base Cutoff Current	I _{EBO}	—	—	100	nA	V _{EB} = 6V
ON CHARACTERISTICS (Note 10)						
Static Forward Current Transfer Ratio	h _{FE}	250 200 80	360 325 170	475 — —	—	I _C = 100mA, V _{CE} = 2V I _C = 2A, V _{CE} = 2V I _C = 6A, V _{CE} = 2V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	—	30 70 70 135 170	45 95 100 170 220	mV	I _C = 1A, I _B = 100mA I _C = 1A, I _B = 10mA I _C = 2A, I _B = 40mA I _C = 5.5A, I _B = 550mA I _C = 5.5A, I _B = 150mA
Base-Emitter Saturation Voltage	V _{BE(sat)}	—	1,050 890	1,150	mV	I _C = 5.5A, I _B = 550mA I _C = 5.5A, I _B = 150mA
Base-Emitter On Voltage	V _{BE(on)}	—	760	900	mV	I _C = 5.5A, V _{CE} = 2V
SWITCHING CHARACTERISTICS						
Transition Frequency	f _T	—	200	—	MHz	I _C = 100mA, V _{CE} = 10V, f = 100MHz
Input Capacitance	C _{ibo}	—	380	—	pF	V _{EB} = 0.5V, f = 1MHz
Output Capacitance	C _{obo}	—	23	—	pF	V _{CB} = 10V, f = 1MHz
Delay Time	t _d	—	81	—	ns	V _{CC} = 24V, I _C = 750mA, I _{B1} = -I _{B2} = 15mA. See Fig 6.
Rise Time	t _r	—	64	—	ns	
Storage Time	t _s	—	640	—	ns	
Fall Time	t _f	—	78	—	ns	
Delay Time	t _d	—	87	—	ns	
Rise Time	t _r	—	117	—	ns	V _{CC} = 48V, I _C = 750mA, I _{B1} = -I _{B2} = 15mA. See Fig 6.
Storage Time	t _s	—	510	—	ns	
Fall Time	t _f	—	101	—	ns	

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

Timing Waveform

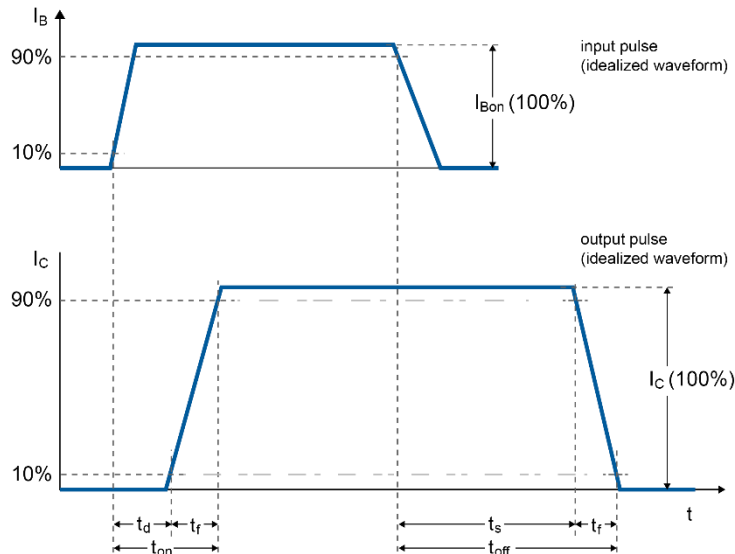


Fig 6. Timing Waveform

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

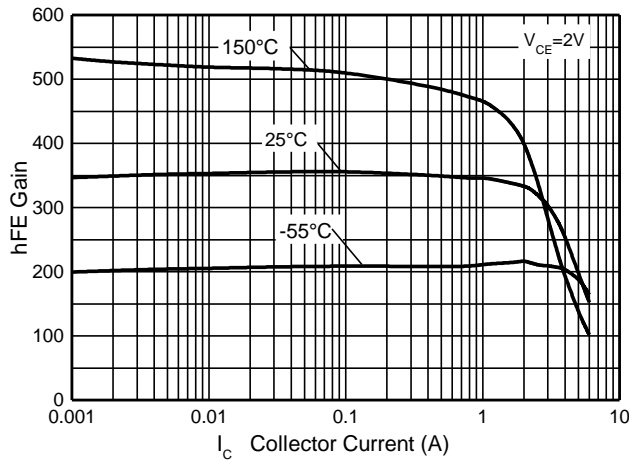


Fig. 7 $hFE \ v \ I_C$

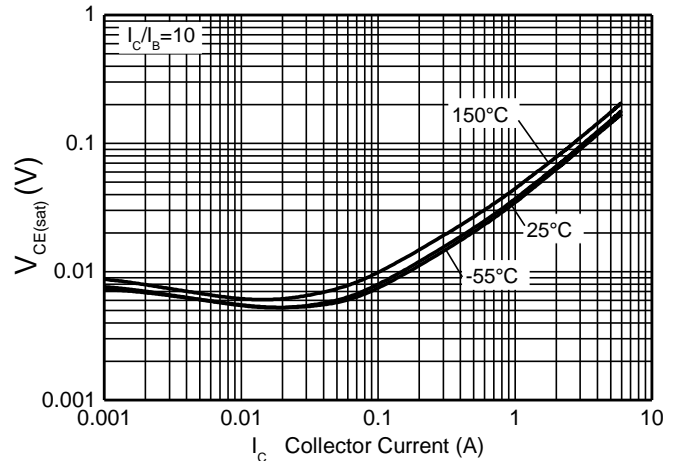


Fig. 8 $V_{CE(sat)} \ v \ I_C$

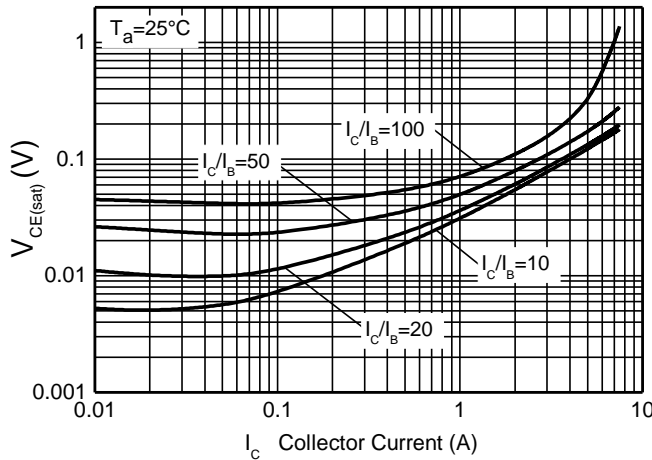


Fig. 9 $V_{CE(sat)} \ v \ I_C$

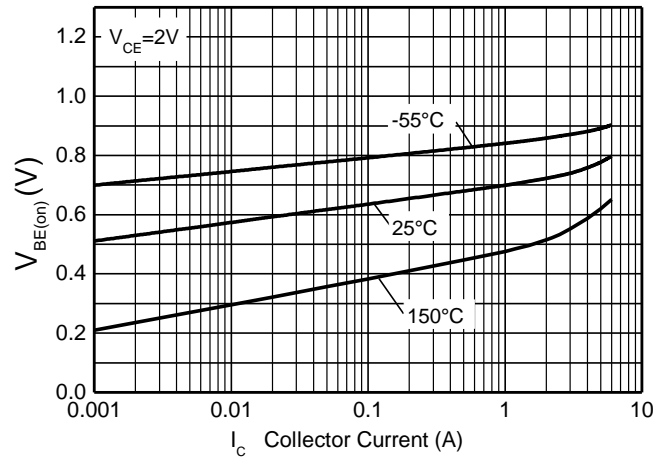


Fig. 10 $V_{BE(on)} \ v \ I_C$

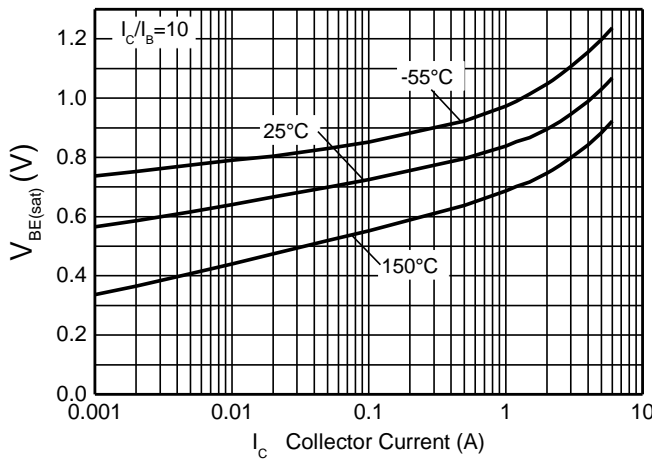


Fig. 11 $V_{BE(sat)} \ v \ I_C$

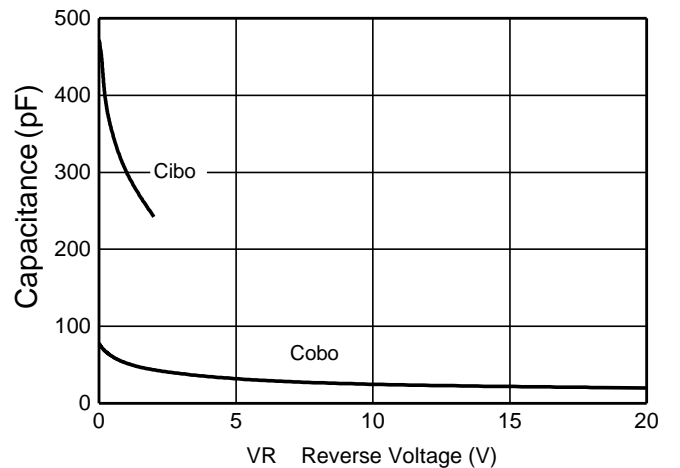


Fig. 12 Typical Junction Capacitance

Application Notes

Figure 13 shows the DXTN69060CFG 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.

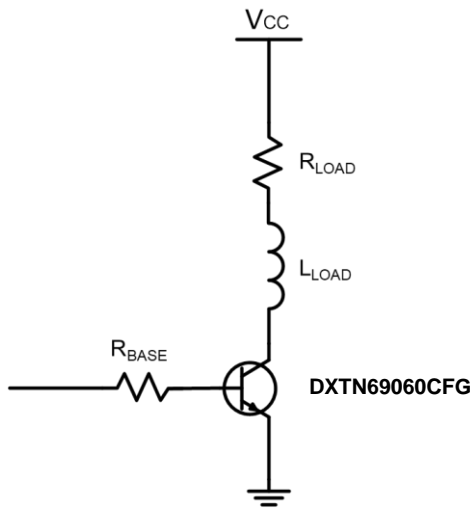


Fig. 13 DXTN69060CFG in a low-side switch configuration

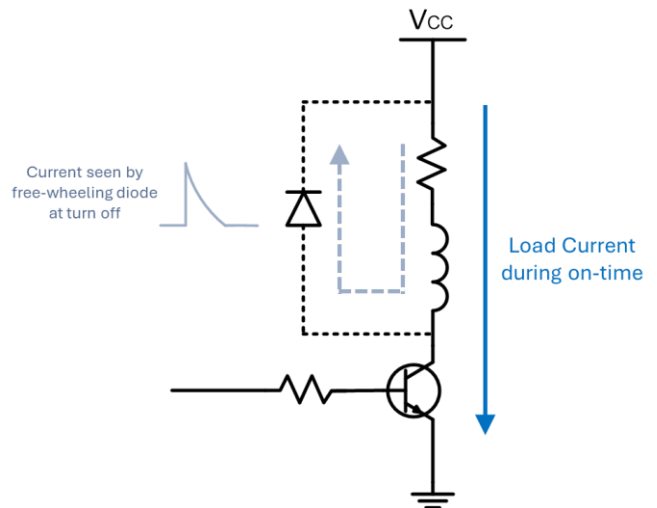


Fig. 14 Additional free-wheeling diode across inductive load for voltage spikes suppression

The appropriate free-wheeling diode should have:

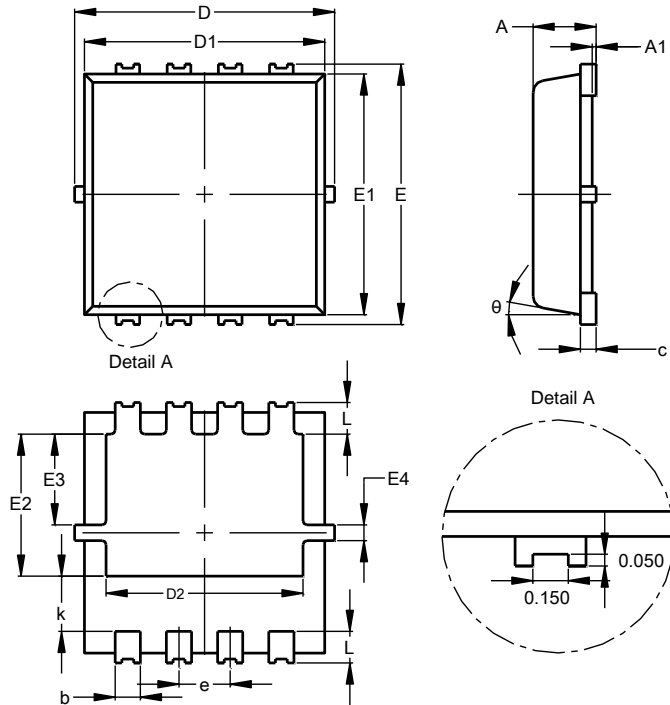
- An Average Rectified Output Current (I_O) rating of at least twice the full Load Current
- A Working Peak Reverse Voltage (V_{RWM}) equal to the voltage applied to the load (minimum) or twice its value (recommended)

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 (Note 11)

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

PowerDI3333-8 (SWP) (Type UX)



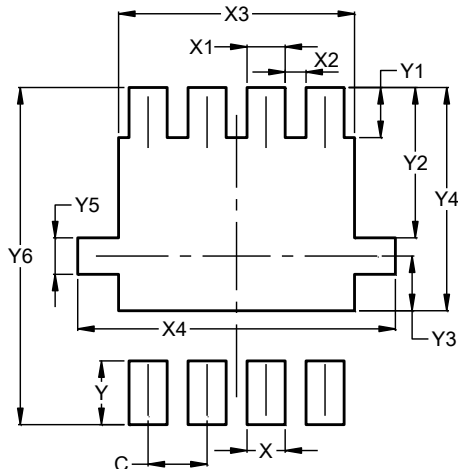
PowerDI3333-8 (SWP) (Type UX)			
Dim	Min	Max	Typ
A	0.75	0.85	0.80
A1	0.00	0.05	--
b	0.25	0.40	0.32
c	0.10	0.25	0.15
D	3.20	3.40	3.30
D1	2.95	3.15	3.05
D2	2.30	2.70	2.50
E	3.20	3.40	3.30
E1	2.95	3.15	3.05
E2	1.60	2.00	1.80
E3	0.95	1.35	1.15
E4	0.10	0.30	0.20
e	--	--	0.65
k	0.50	0.90	0.70
L	0.30	0.50	0.40
θ	0°	12°	10°
All Dimensions in mm			

Note: 11. Side wall tin plated package for wettable flanks in AOI.

Suggested Pad Layout

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

PowerDI3333-8 (SWP) (Type UX)



Dimensions	Value (in mm)
C	0.650
X	0.420
X1	0.420
X2	0.230
X3	2.600
X4	3.500
Y	0.700
Y1	0.550
Y2	1.650
Y3	0.600
Y4	2.450
Y5	0.400
Y6	3.700

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