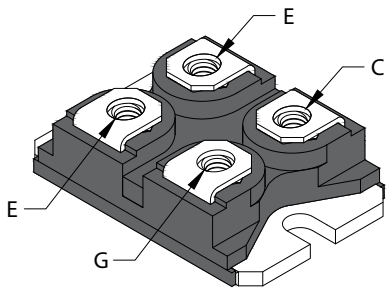
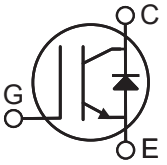
1200 V, 140 A Fast Field-Stop IGBT 7 with SiC Diode

APT140GH120JSC50

Product Overview

1200 V, 140 A Fast Field-Stop IGBT with co-packaged anti-parallel SiC diode, SOT-227





G—Gate
C—Collector, Diode Cathode
E—Emitter, Diode Anode

Table 1. Ordering Information

Catalog Part Number (CPN)	Package	Packing Media	Qualification
APT140GH120JSC50	SOT-227	Tube	Industrial

Features

- Low conduction loss and saturation voltage
- Fast switching
- Low gate charge
- Ultrafast tail current shutoff
- No reverse recovery
- Reverse-bias safe operating area (RBSOA) rated
- Easy to parallel
- RoHS compliant
- Zero E_{on} switching loss from co-packaged, anti-parallel diode
- Isolated voltage to 2500 V, UL certified file E145592

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1. Device Specifications: IGBT

This section shows the specifications of this device.

1.1. Absolute Maximum Ratings

The following table shows the absolute maximum ratings of this device. T_C = 25 °C unless otherwise specified.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{CES}	Collector-emitter voltage	1200	V
V_{GE}	Gate-emitter voltage	±20	
I_{C1}	Continuous collector current (T_C = 25 °C)	190	A
I_{C2}	Continuous collector current (T_C = 100 °C)	115	
I_{CM}	Pulsed collector current[1] (T_C = 175 °C)	560	
RBSOA	Reverse-bias safe operating area (T_J = 175 °C)	560	A
P_D	Total power dissipation	536	W

Note:

1. Repetitive rating: Pulse width and case temperature are limited by the maximum junction temperature.

1.2. Thermal and Mechanical Characteristics

The following table shows the thermal and mechanical characteristics of this device.

Table 1-2. Thermal and Mechanical Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Unit
$R_{\Theta JC}$	Junction-to-case thermal resistance (IGBT)			0.28	°C/W
$R_{\Theta JC}$	Junction-to-case thermal resistance (diode)			0.56	
T_J, T_{STG}	Operating and storage junction temperature	–40		175	°C
$V_{ISOLATION}$	RMS voltage (50 Hz–60 Hz sinusoidal waveform from terminals to mounting base for 1 minute)	2500			V
τ_M	Mounting torque, M3 screw for heat sink attachment (requires 2, not included)		0.8		N·m
τ_T	Terminal screw torque, M4 screw (4 included)			1.1	
Wt	Package weight		29.2		g

1.3. Electrical Performance

The following table shows the static characteristics of this device. T_C = 25 °C unless otherwise specified.

Table 1-3. Static Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 2.24 mA	4.7	5.5	6.2	V
$V_{CE(on)}$	Collector-emitter on voltage	V_{GE} = 15 V, I_C = 140 A		1.7	2.15	
		V_{GE} = 15 V, I_C = 140 A, T_J = 175 °C		2.0		
I_{CES}	Collector cut-off current[1]	V_{CE} = 1200 V, V_{GE} = 0 V			140	µA
		V_{CE} = 1200 V, V_{GE} = 0 V, T_J = 175 °C		17750		
I_{GES}	Gate-emitter leakage current	V_{GE} = ±20 V			±100	nA

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Note:

1. I_{CES} includes both IGBT and diode leakages.

The following table shows the dynamic characteristics of this device. T_C = 25 °C unless otherwise specified.

Table 1-4. Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{GE} = 0 V, V_{CE} = 25 V, ƒ = 200 kHz		18460		pF
C_{res}	Reverse transfer capacitance			110		
C_{oes}	Output capacitance			251		
V_{GEP}	Gate-to-emitter plateau voltage	V_{GE} = 15 V, V_{CE} = 600 V, I_C = 140 A		7.5		V
Q_G	Total gate charge[1]			1005		nC
Q_{GE}	Gate-emitter charge			129		
Q_{GC}	Gate-collector ("Miller") charge			361		
RBSOA	Reverse-bias safe operating area	T_J = 175 °C, R_G = 23 Ω, V_{GE} = 15 V, V_{CE} = 800 V, L = 100 µH	560			A
$t_{d(on)}$	Turn-on delay time	V_{CC} = 800 V, V_{GE} =15 V, I_C = 140 A, R_G = 5 Ω, T_J = 25 °C		58		ns
t_r	Current rise time			100		
$t_{d(off)}$	Turn-off delay time			540		
t_f	Current fall time			82		
E_{on}	Turn-on switching energy[2]			13030		µJ
E_{off}	Turn-off switching energy[3]			6935		
$t_{d(on)}$	Turn-on delay time	V_{CC} = 800 V, V_{GE} = 15 V, I_C = 140 A, R_G = 5 Ω, T_J = 125 °C		58		ns
t_r	Current rise time			100		
$t_{d(off)}$	Turn-off delay time			587		
t_f	Current fall time			81		
E_{on}	Turn-on switching energy[2]			12570		µJ
E_{off}	Turn-off switching energy[3]			8257		

Notes:

1. See MIL-STD-750 Method 3471.
2. E_{on} is the clamped inductive turn-on-energy of this device; there is no contribution to E_{on} from the SiC diode. (See Figure 1-19, Figure 1-20.)
3. E_{off} is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1. (See Figure 1-19, Figure 1-21.)

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1.4. Typical Performance Curves

Data for performance curves are characterized, not 100% tested.

Figure 1-1. Output Characteristics

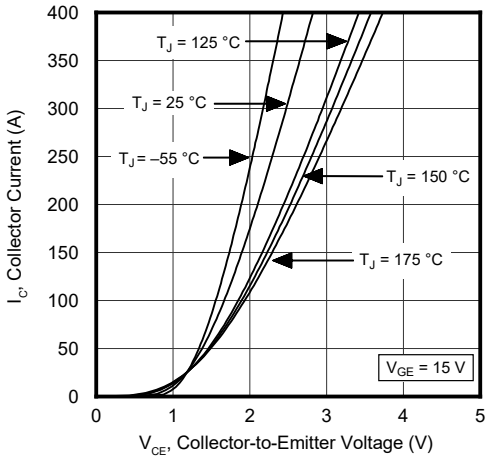


Figure 1-2. Transfer Characteristics

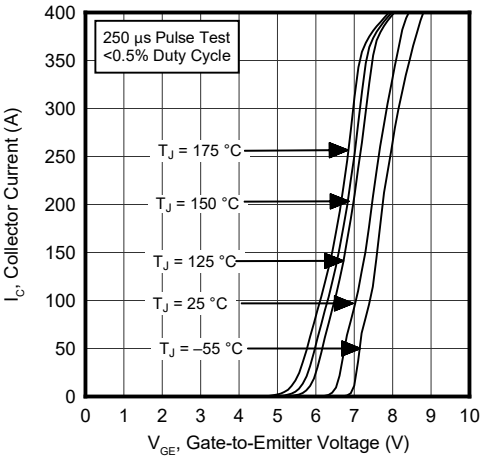


Figure 1-3. Gate Charge

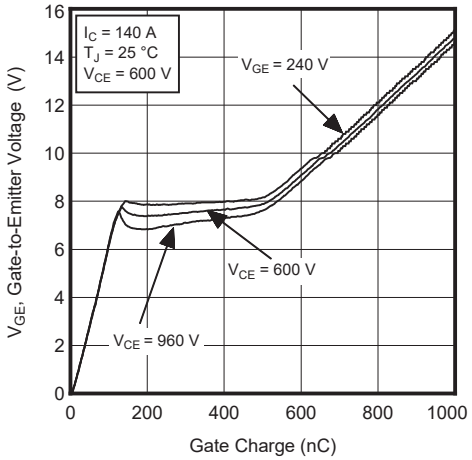
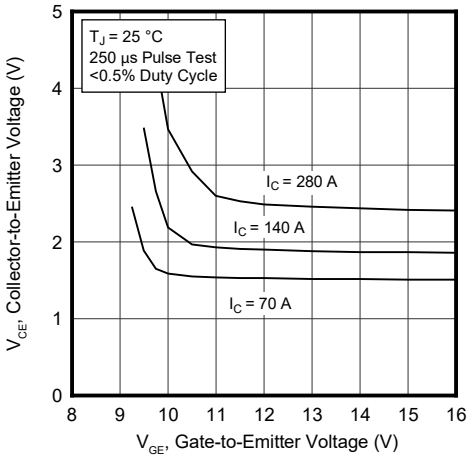


Figure 1-4. On-State Voltage vs. Gate-to-Emitter Voltage



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Figure 1-5. On-State Voltage vs. Junction Temperature

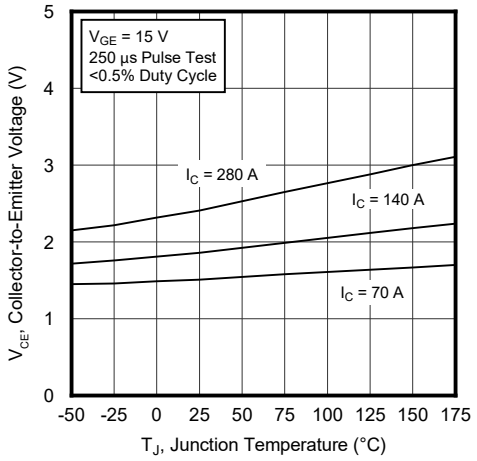


Figure 1-6. DC Collector Current vs. Case Temperature

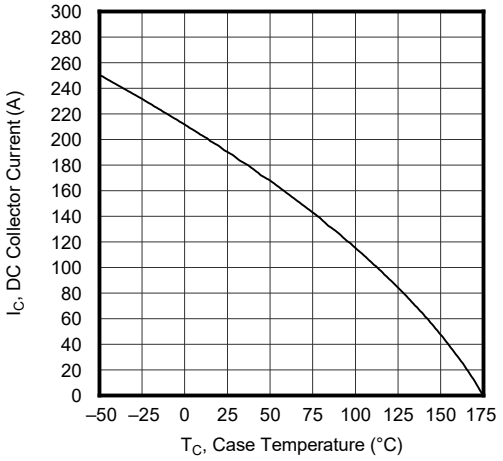


Figure 1-7. Turn-On Delay Time vs. Collector Current

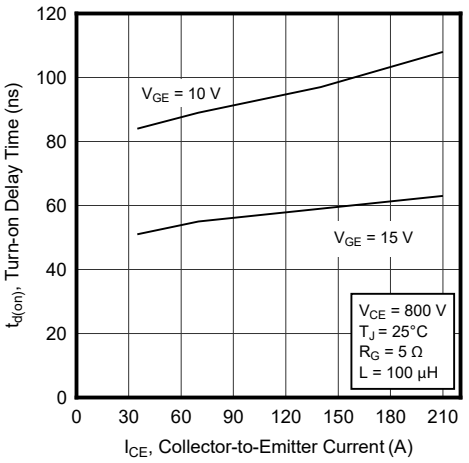


Figure 1-8. Turn-Off Delay Time vs. Collector Current

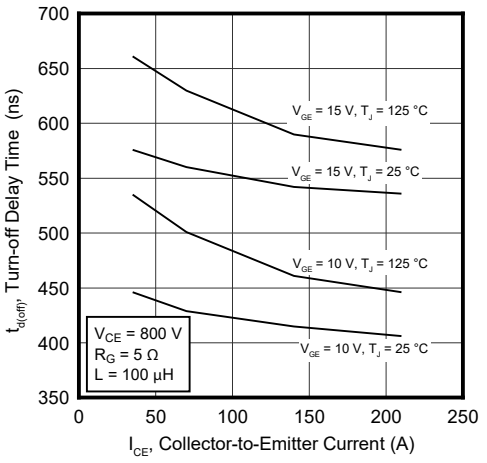


Figure 1-9. Current Rise Time vs. Collector Current

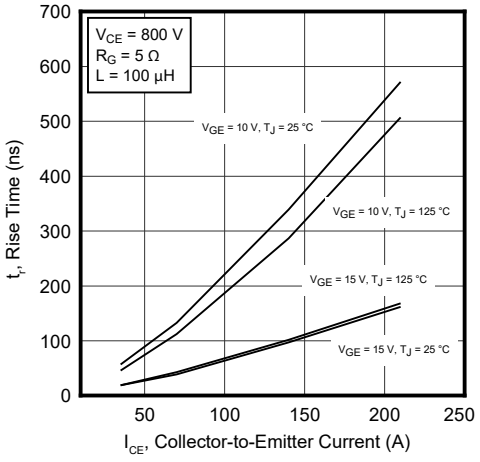
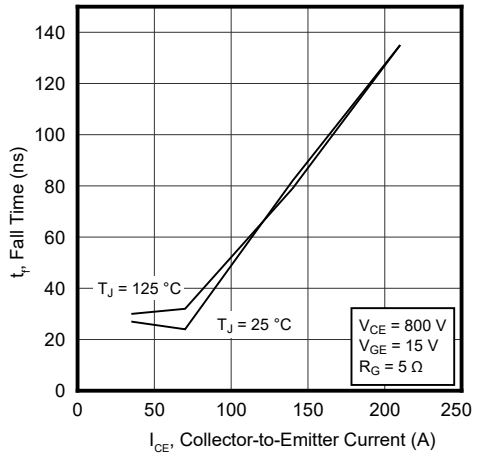


Figure 1-10. Current Fall Time vs. Collector Current



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Figure 1-11. Turn-On Energy Loss vs. Collector Current

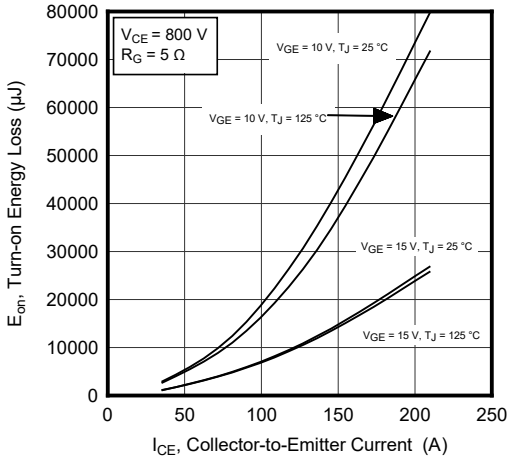


Figure 1-12. Turn-Off Energy Loss vs. Collector Current

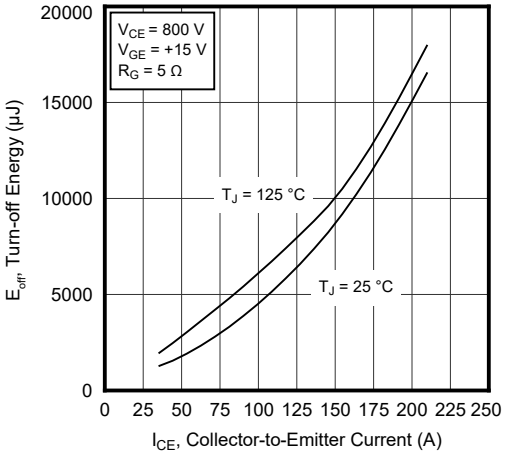


Figure 1-13. Switching Energy Losses vs. Gate Resistance

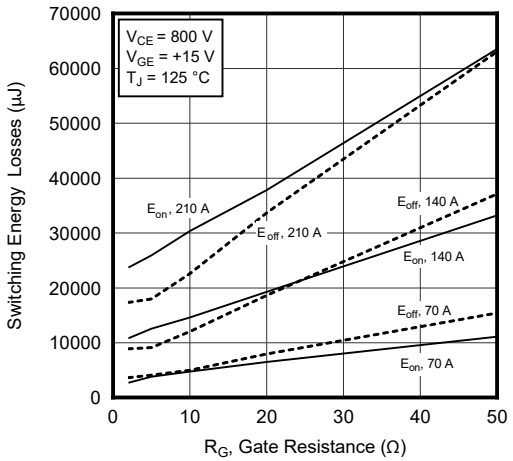


Figure 1-14. Switching Energy Losses vs. Junction Temperature

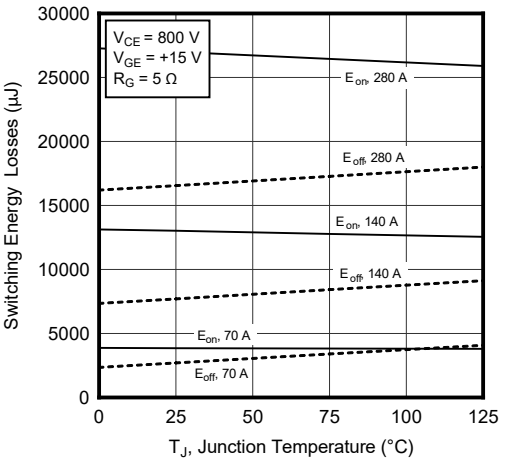


Figure 1-15. Capacitance vs. Collector-To-Emitter Voltage

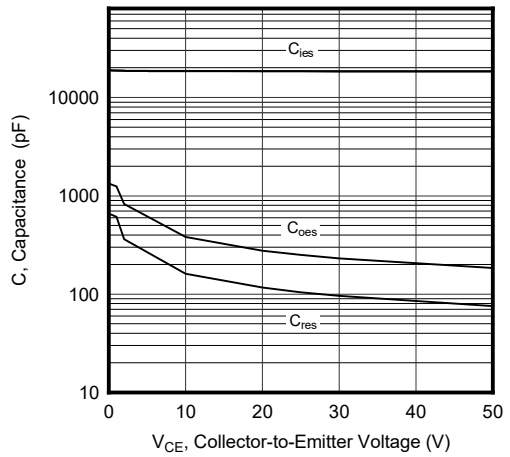
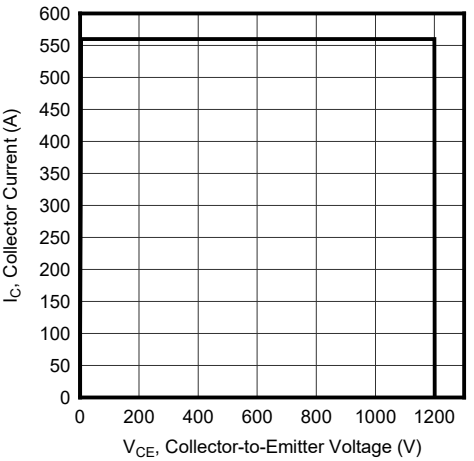


Figure 1-16. Reverse-bias Safe Operating Area



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Figure 1-17. Maximum Transient Thermal Impedance

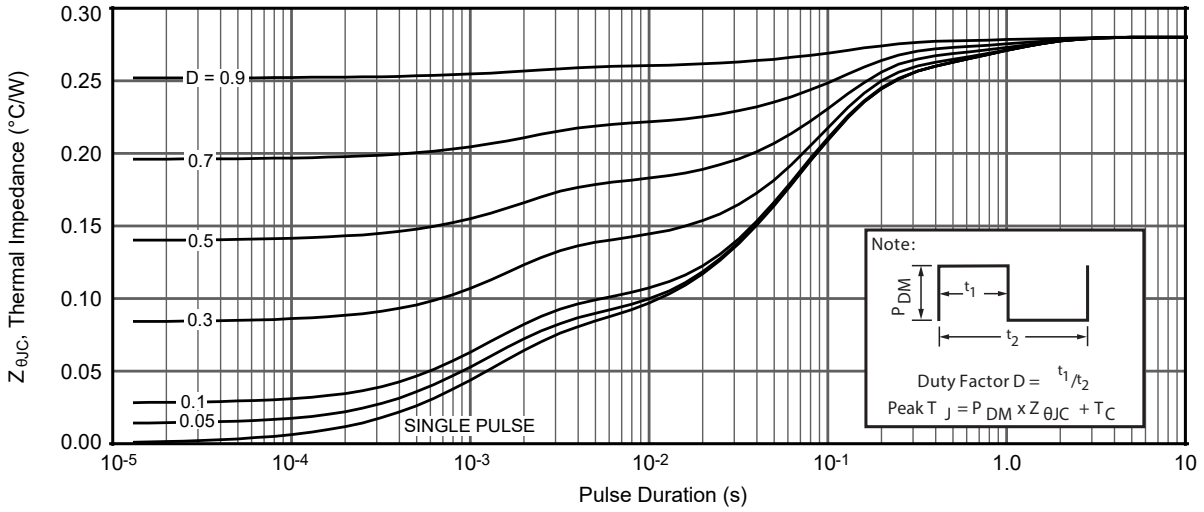


Figure 1-18. Transient Thermal Impedance Model

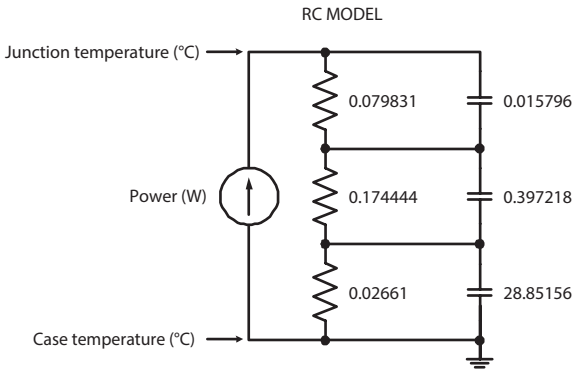


Figure 1-19. Inductive Switching Test Circuit

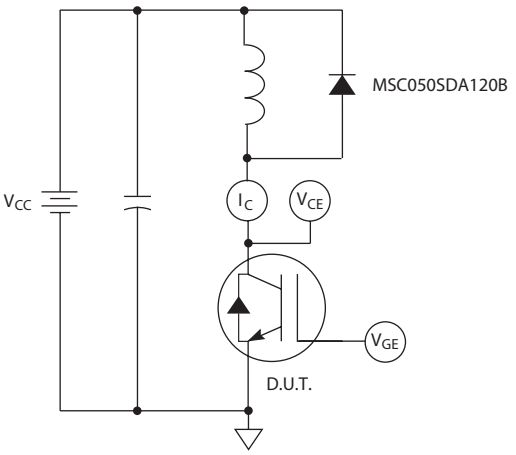
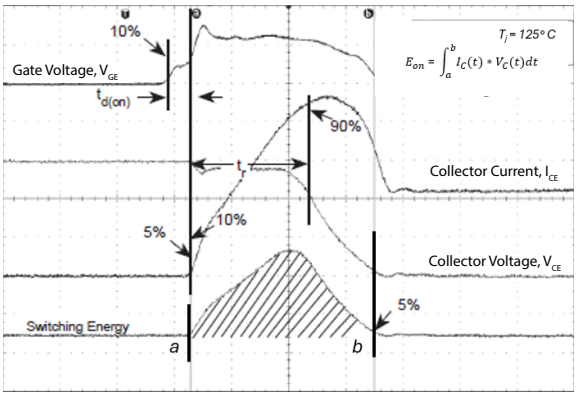
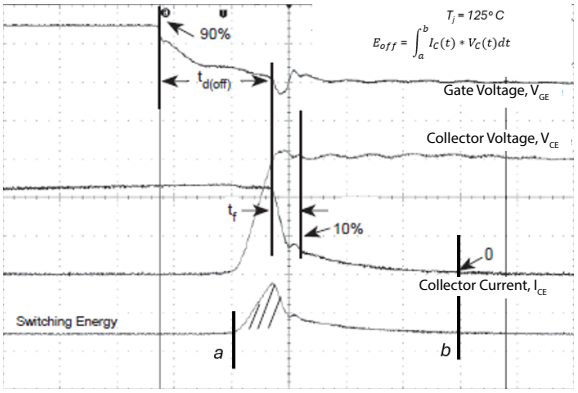


Figure 1-20. Turn-on Switching Waveform and Definitions



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Figure 1-21. Turn-off Switching Waveform and Definitions



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2. Device Specifications: Zero-Recovery SiC Anti-Parallel Diode

This section shows the specifications of the co-packaged, anti-parallel diode.

2.1. Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the anti-parallel diode. T_C = 25 °C unless otherwise specified.

Table 2-1. Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
I_F	Maximum DC forward current (T_C = 25 °C)	83	A
	Maximum DC forward current (T_C = 110 °C)	49	
	Maximum DC forward current (T_C = 135 °C)	36	
I_{FRM}	Repetitive peak forward surge current (t_P = 8.3 ms, half sine wave)	154	
I_{FSM}	Non-repetitive forward surge current (t_P = 8.3 ms, half sine wave)	290	
P_{TOT}	Total power dissipation (T_C = 25 °C)	268	W
	Total power dissipation (T_C = 110 °C)	116	

2.2. Electrical Performance

The following table shows the static characteristics of the anti-parallel diode.

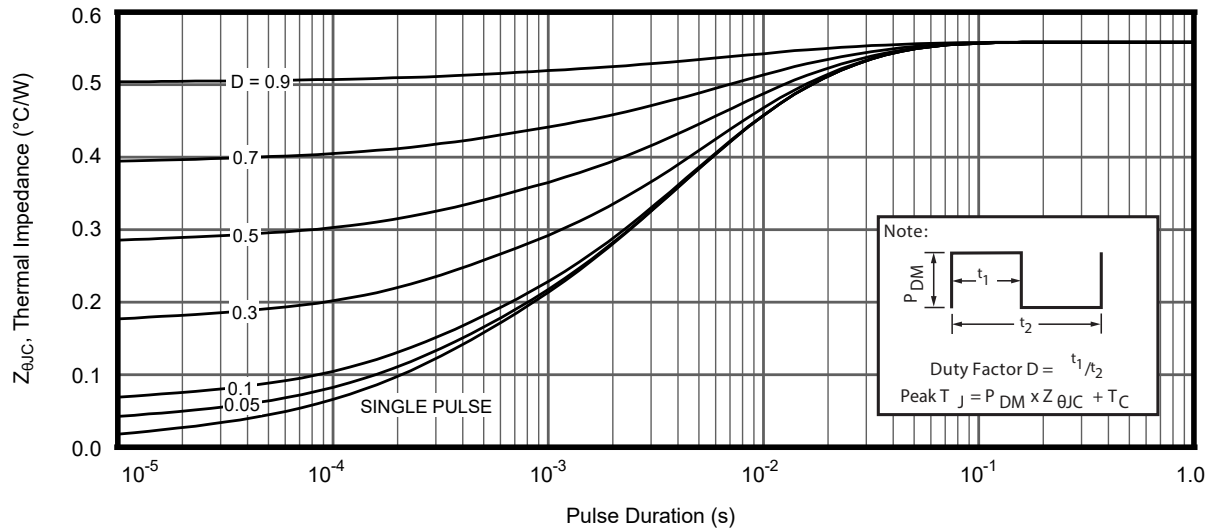
Table 2-2. Static Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_F	Forward voltage	I_F = 50 A, T_J = 25 °C		1.5	1.8	V
		I_F = 50 A, T_J = 175 °C		2.1		

2.3. Typical Performance Curves

Data for performance curves are characterized, not 100% tested.

Figure 2-1. Maximum Transient Thermal Impedance



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Figure 2-2. Forward Current vs. Forward Voltage

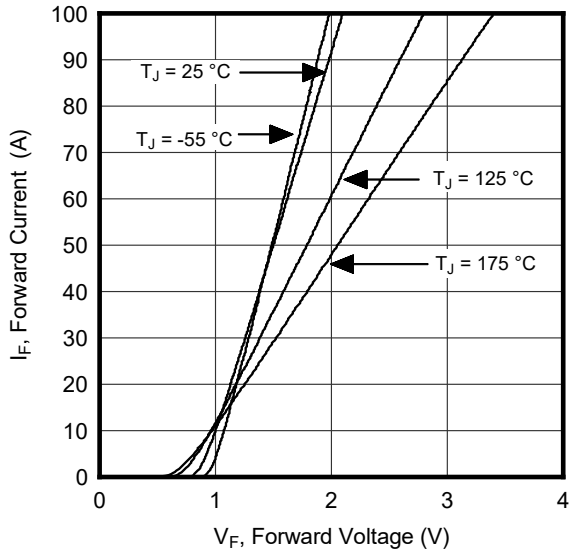


Figure 2-3. Max. Forward Current vs. Case Temp.

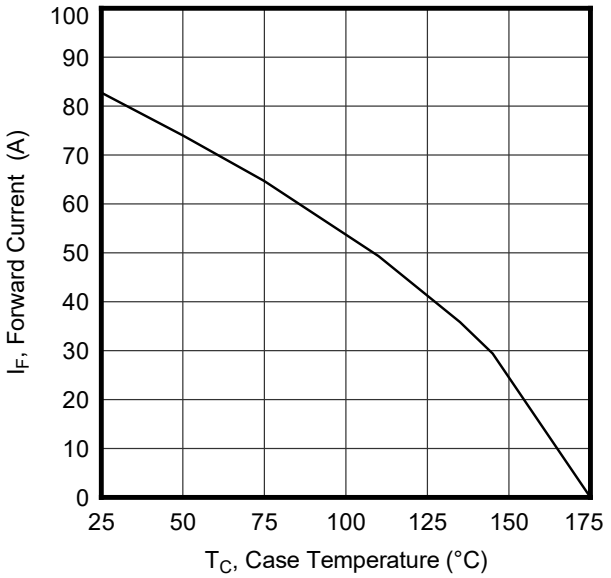


Figure 2-4. Max. Power Dissipation vs. Case Temp.

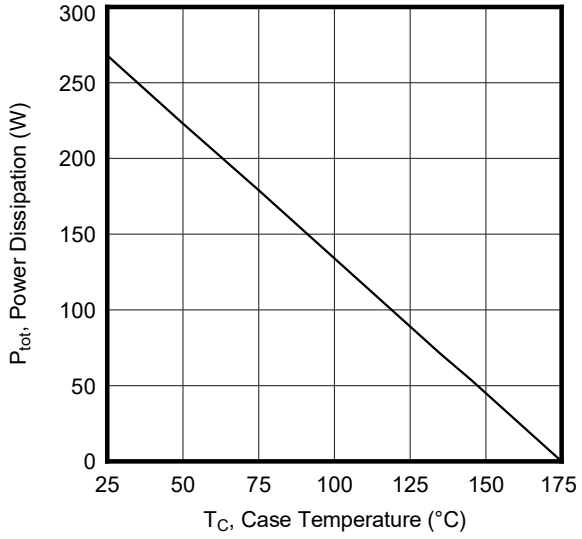
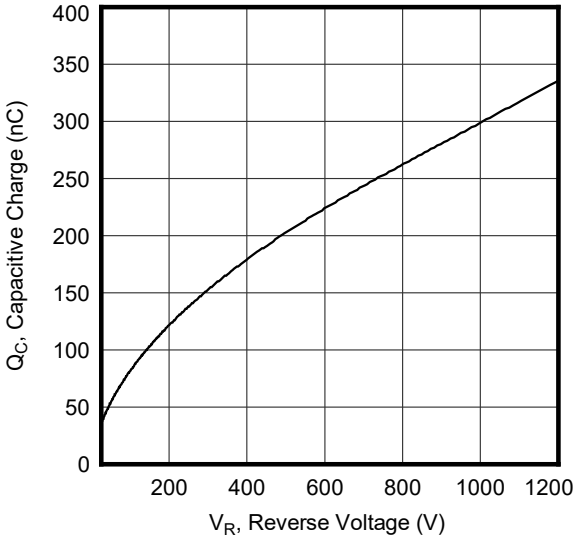


Figure 2-5. Total Capacitive Charge vs. Reverse Voltage



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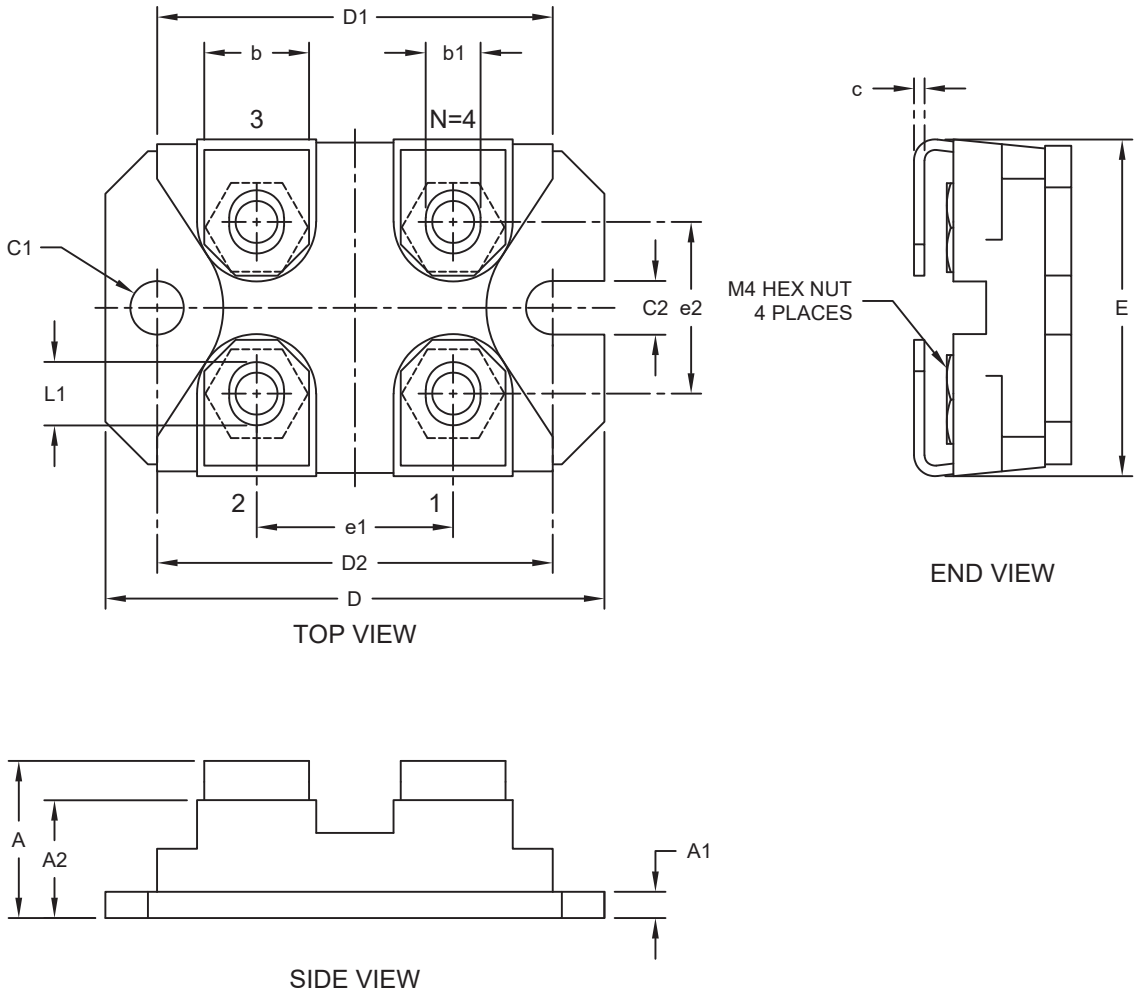
3. Package Specification

This section shows the package specification of this device.

3.1. Package Outline Drawing

The following figure illustrates the SOT-227 package outline of this device.

Figure 3-1. Package Outline Drawing



The following table shows the SOT-227 dimensions and should be used in conjunction with the package outline drawing.

Table 3-1. SOT-227 Dimensions

Dimension Limits		Dimensions (millimeters)	
		Min.	Max.
Number of terminals	N	4	
Terminal pitch	e1	14.9	15.1
Terminal pitch	e2	12.6	12.8
Overall height	A	11.8	12.2
Base plate thickness	A1	1.95	2.14

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Table 3-1. SOT-227 Dimensions (continued)

Dimension Limits		Dimensions (millimeters)	
		Min.	Max.
Molded package thickness	A2	8.9	9.6
Overall length	D	38.0	38.2
Molded package length	D1	31.5	31.7
Mounting centers	D2	30.1	30.3
Overall width	E	25.2	25.4
Terminal width	b	7.8	8.2
Terminal thickness	c	0.75	0.85
Terminal slot width	b1	4.1	4.3
Terminal slot length	L1	4.8	4.9
Mounting hole diameter	C1	4.0	4.2
Mounting slot width	C2	4.0	4.2

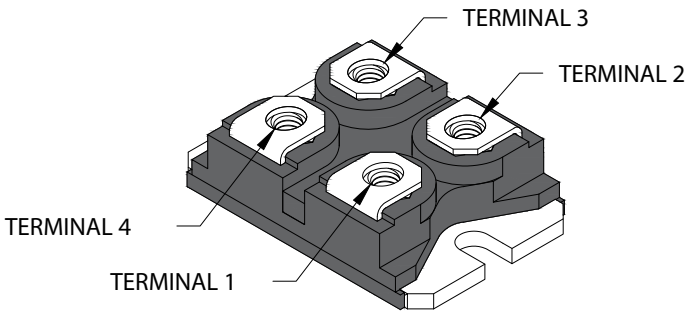
Note:

1. Dimensioning and tolerancing per ASME Y14.5M.

3.2. Terminal Pinout

The following figure illustrates the terminal pinout of this device.

Figure 3-2. Terminal Pinout



The following table shows the electrical signal terminal pinout of this device.

Table 3-2. Electrical Signal Terminal Pinout

Terminal	Definition
TERMINAL 1	Gate
TERMINAL 2	Collector, Diode Cathode
TERMINAL 3	Emitter, Diode Anode
TERMINAL 4	Emitter, Diode Anode

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4. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Table 4-1. Revision History

Revision	Date	Description
A	02/2026	Document created.

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ISBN: 979-8-3371-2788-0

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