DATA SHEET
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Flying Capacitor BOOST Module

Product Preview

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

The NXH500B100H7Q2F2SHG/PHG is a power module in Q2 package containing two channel flying capacitor boost. The integrated field stop trench IGBTs and Si/SiC Diodes provide lower conduction and switching losses, enabling designers to achieve high efficiency, high power density and superior reliability.

Features

- Flying Capacitor Boost Module
- 1000 V Field Stop 7 IGBTs and 1200 V SiC Diodes
- Low Inductive Layout
- Solder Pins and Press Fit Pins
- Integrated NTC Thermistor
- These Devices are Pb−Free, Halide Free and are RoHS Compliant

Typical Applications

- Solar Inverter
- Energy Storage System

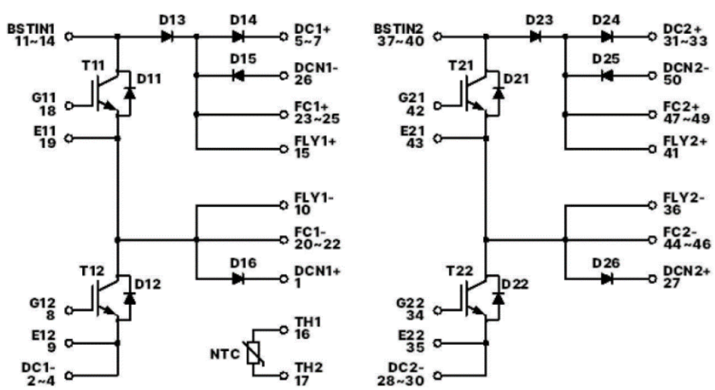
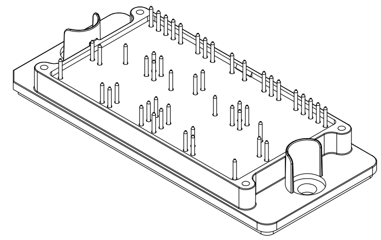
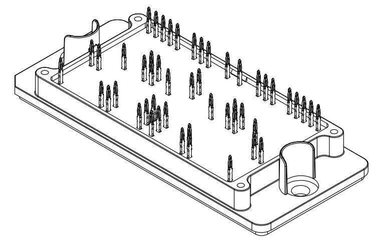


Figure 1. NXH500B100H7Q2F2SHG/PHG Schematic Diagram

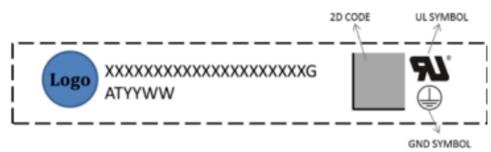


PIM50 93.00x47.00x12.00 (SOLDER PIN)
CASE 180CU



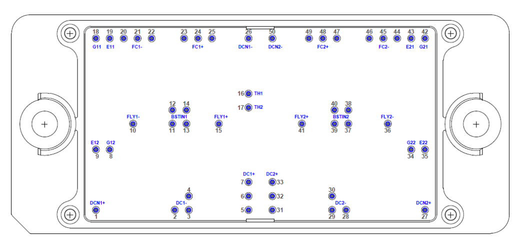
PIM50 93.00x47.00x12.00 (PRESS FIT PIN)
CASE 180HZ

MARKING DIAGRAM



XXXXX = Device Code
G = Pb−Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 4 of this data sheet.

This document contains information on a product under development. **onsemi** reserves the right to change or discontinue this product without notice.

MODULE CHARACTERISTICS

Rating	Symbol	Value	Unit
Operating Temperature under Switching Condition	T_{VJOP}	−40 to 150	°C
Storage Temperature Range	T_{stg}	−40 to 125	°C
Isolation Test Voltage, t = 2 s, 50 Hz (Note 1)	V_{is}	4800	V_{RMS}
Stray Inductance	$L_{s\ CE}$	15	nH
Terminal Connection Torque (M5, Screw) Torque	M	3 to 5	Nm
Weight	G	176	g
Comparative Tracking Index	CTI	>600	

1. 4800 VAC_{RMS} for 2 second duration is equivalent to 4000 VAC_{RMS} for 1 minute duration.

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
IGBT (T11, T12, T21, T22)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate−Emitter Voltage Positive Transient Gate−Emitter Voltage (T_{pulse} = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Continuous Collector Current @ T_C = 80°C (T_J = 175°C)	I_C	210	A
Pulsed Peak Collector Current @ T_C = 80°C (T_J = 175°C), T_{pulse} = 1 ms	$I_{C(Pulse)}$	630	A
Power Dissipation (T_J = 175°C, T_C = 80°C)	P_{tot}	503	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
IGBT INVERSE DIODE (D11, D12, D21, D22)			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current @ T_C = 80°C (T_J = 175°C)	I_F	97	A
Repetitive Peak Forward Current (T_J = 175°C), T_{pulse} = 1 ms	I_{FRM}	291	A
Maximum Power Dissipation @ T_C = 80°C (T_J = 175°C)	P_{tot}	171	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
BOOST SILICON CARBIDE SCHOTTKY DIODE (D13, D14, D23, D24)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_C = 80°C (T_J = 175°C)	I_F	155	A
Repetitive Peak Forward Current (T_J = 175°C), T_{pulse} = 1 ms	I_{FRM}	465	A
Maximum Power Dissipation @ T_C = 80°C (T_J = 175°C)	P_{tot}	352	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
START−UP DIODE (D15, D25)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_C = 80°C (T_J = 175°C)	I_F	34	A
Repetitive Peak Forward Current (T_J = 175°C), T_{pulse} = 1 ms	I_{FRM}	102	A
Maximum Power Dissipation @ T_C = 80°C (T_J = 175°C)	P_{tot}	88	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted) (continued)

Parameter	Symbol	Value	Unit
START−UP DIODE (D16, D26)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_C = 80°C (T_J = 175°C)	I_F	78	A
Repetitive Peak Forward Current (T_J = 175°C), T_{pulse} = 1 ms	I_{FRM}	234	A
Maximum Power Dissipation @ T_C = 80°C (T_J = 175°C)	P_{tot}	203	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°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.

2. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T11, T12, T21, T22)						
Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	500	μA
Collector−Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 240 A, T_C = 25°C	$V_{CE(SAT)}$	–	1.7	2.3	V
	V_{GE} = 15 V, I_C = 240 A, T_C = 150°C		–	2.1	–	
Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 240 mA	$V_{GE(TH)}$	4.0	5.7	6.9	V
Gate Leakage Current	V_{GE} = ±20 V, V_{CE} = 0 V	I_{GES}	–	–	1	μA
Internal Gate Resistor		R_g	–	1.5	–	Ω
Turn−off Safe Operating Area	V_{CC} < 800V, $R_{G, off}$ ≥ 30 Ω, T_{vj} < 150°C		–	200	–	A
Turn−On Delay Time	T_j = 25°C V_{CE} = 600 V, I_C = 100 A V_{GE} = −9 V, +15 V, $R_{G, on}$ = 7 Ω, $R_{G, off}$ = 22 Ω	$t_{d(on)}$	–	132	–	ns
Rise Time		t_r	–	30	–	
Turn−Off Delay Time		$t_{d(off)}$	–	400	–	
Fall Time		t_f	–	29	–	
Turn On Switching Loss		E_{on}	–	1070	–	μJ
Turn Off Switching Loss		E_{off}	–	3500	–	
Turn−On Delay Time	T_j = 125°C V_{CE} = 600 V, I_C = 100 A V_{GE} = −9 V, +15 V, $R_{G, on}$ = 7 Ω, $R_{G, off}$ = 22 Ω	$t_{d(on)}$	–	127	–	ns
Rise Time		t_r	–	33	–	
Turn−Off Delay Time		$t_{d(off)}$	–	460	–	
Fall Time		t_f	–	40	–	
Turn On Switching Loss		E_{on}	–	1280	–	μJ
Turn Off Switching Loss		E_{off}	–	5000	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 100 kHz	C_{ies}	–	18488	–	pF
Output Capacitance		C_{oes}	–	797	–	
Reverse Transfer Capacitance		C_{res}	–	116	–	
Gate Charge	V_{CE} = 600 V, V_{GE} = −15/+20 V, I_C = 40 A	Q_g	–	1094	–	nC
Thermal Resistance − Chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.309	–	K/W
Thermal Resistance − Chip−to−case		R_{thJC}	–	0.197	–	K/W
IGBT INVERSE DIODE (D11, D12, D21, D22)						
Diode Forward Voltage	I_F = 50 A, T_J = 25°C	V_F	–	1.15	1.5	V
	I_F = 50 A, T_J = 150°C		–	1.0	–	
Thermal Resistance − Chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.670	–	K/W
		R_{thJC}	–	0.562	–	K/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
BOOST SILICON CARBIDE SCHOTTKY DIODE (D13, D14, D23, D24)						
Diode Forward Voltage	I_F = 120 A, T_J = 25°C	V_F	–	1.45	1.7	V
	I_F = 120 A, T_J = 150°C		–	1.75	–	
Reverse Recovery Time	T_J = 25°C V_R = 600 V, I_C = 100 A V_{GE} = −9 V, 15 V, $R_{G, on}$ = 7 Ω	t_{rr}	–	25.5	–	ns
Reverse Recovery Charge		Q_{rr}	–	575	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	33	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	2800	–	A/μs
Reverse Recovery Energy		E_{rr}	–	270	–	μJ
Reverse Recovery Time	T_J = 125°C V_R = 600 V, I_C = 100 A V_{GE} = −9 V, 15 V, $R_{G, on}$ = 7 Ω	t_{rr}	–	26	–	ns
Reverse Recovery Charge		Q_{rr}	–	615	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	36	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	2550	–	A/μs
Reverse Recovery Energy		E_{rr}	–	279	–	μJ
Thermal Resistance − Chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.416	–	K/W
Thermal Resistance − Chip−to−case		R_{thJC}	–	0.288	–	K/W
START−UP DIODE (D15, D25)						
Diode Forward Voltage	I_F = 30 A, T_J = 25°C	V_F	–	2.2	2.9	V
	I_F = 30 A, T_J = 150°C		–	1.5	–	
Thermal Resistance − Chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	1.225	–	K/W
Thermal Resistance − Chip−to−case		R_{thJC}	–	1.085	–	K/W
START−UP DIODE (D16, D26)						
Diode Forward Voltage	I_F = 75 A, T_J = 25°C	V_F	–	2.87	3.5	V
	I_F = 75 A, T_J = 150°C		–	2.19	–	
Thermal Resistance − Chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.61	–	K/W
Thermal Resistance − Chip−to−case		R_{thJC}	–	0.47	–	K/W
THERMISTOR CHARACTERISTICS						
Nominal Resistance	T = 25°C	R_{25}	–	5	–	kΩ
Nominal Resistance	T = 100°C	R_{100}	–	492.2	–	Ω
Deviation of R25		ΔR/R	−1	–	1	%
Power Dissipation		P_D	–	5	–	mW
Power Dissipation Constant			–	1.3	–	mW/K
B−value	B(25/85), tolerance ±1%		–	3430	–	K

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH500B100H7Q2F2SHG	NXH500B100H7Q2F2SHG	Q2 − PIM50 93x47 (SOLDER PIN) (Pb−Free / Halide Free)	12 Units / Blister Tray
NXH500B100H7Q2F2PHG	NXH500B100H7Q2F2PHG	Q2 − PIM50 93x47 (PRESS FIT PIN) (Pb−Free / Halide Free)	12 Units / Blister Tray

TYPICAL CHARACTERISTIC – T11, T12, T21, T22 (IGBT)

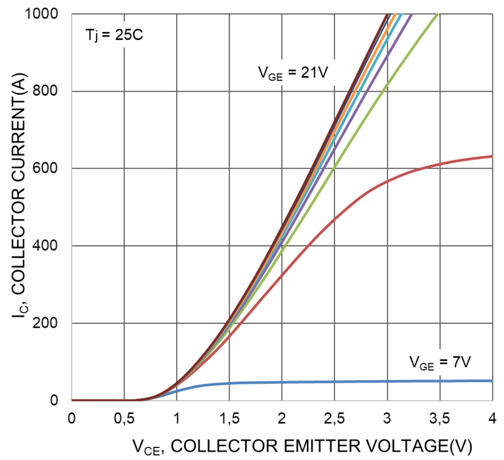


Figure 2. Typical Output Characteristics – IGBT

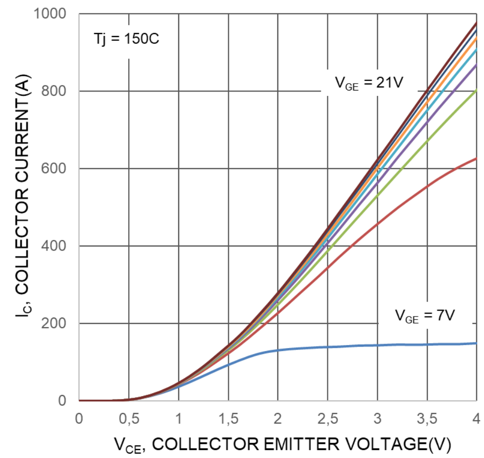


Figure 3. Typical Output Characteristics – IGBT

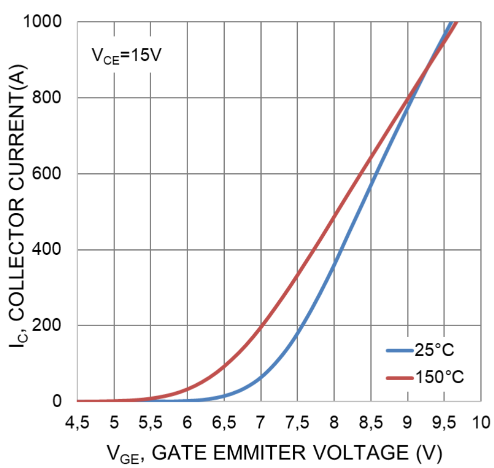


Figure 4. Transfer Characteristics – IGBT

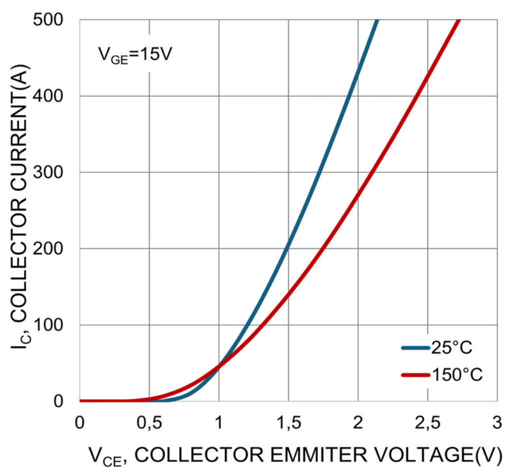


Figure 5. Saturation Voltage Characteristic – IGBT

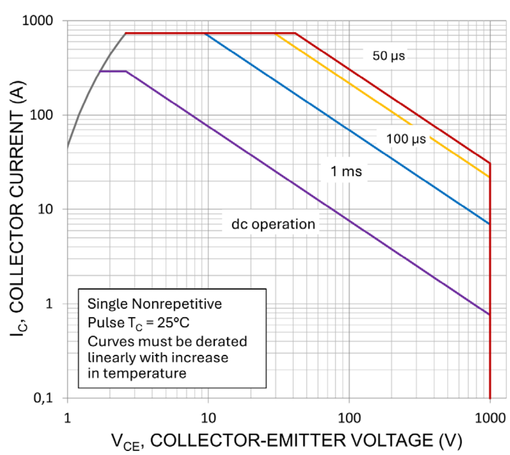


Figure 6. FBSOA

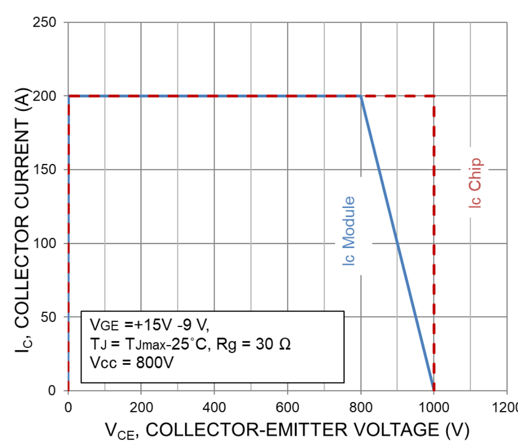


Figure 7. RBSOA

TYPICAL CHARACTERISTIC – T11, T12, T21, T22 (IGBT) (CONTINUED)

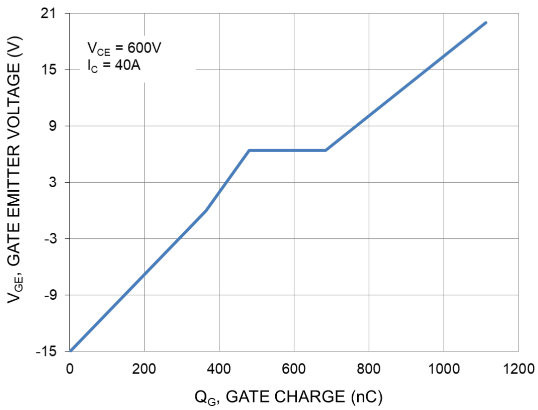


Figure 8. Gate Voltage vs. Gate Charge

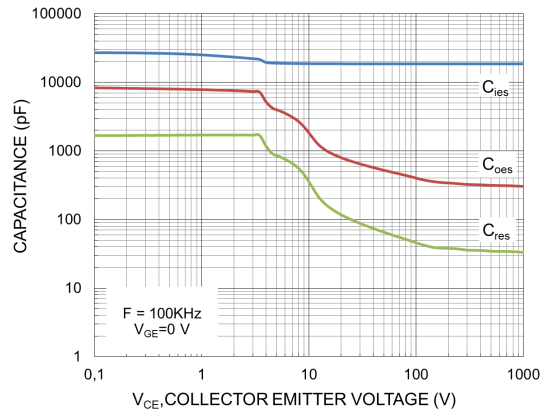


Figure 9. Capacitance vs. V_{CE}

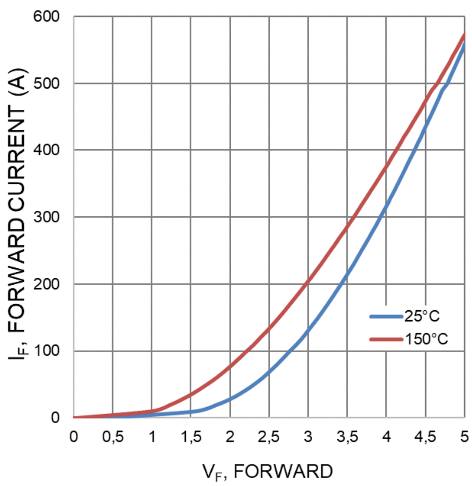


Figure 10. Start−up Diode Forward Characteristics

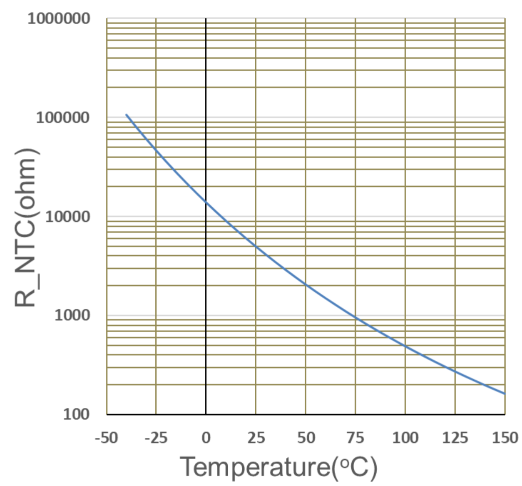


Figure 11. Thermistor Characteristic

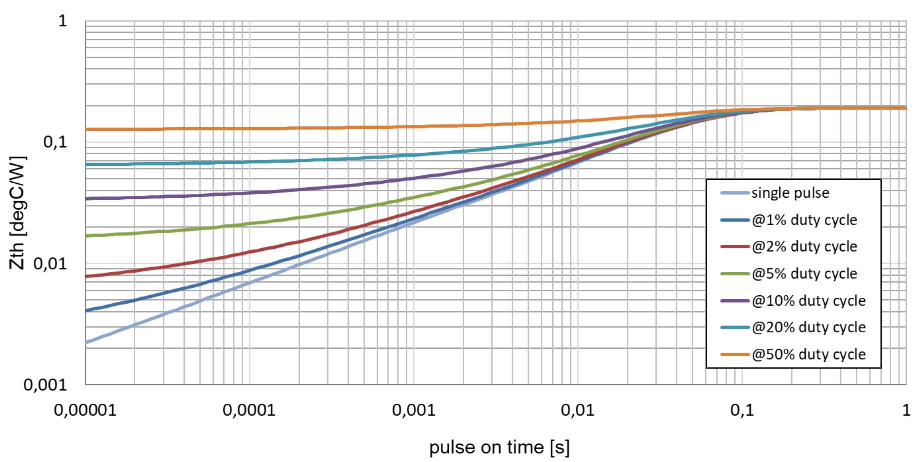


Figure 12. Transient Thermal Impedance (IGBT Zthjc)

TYPICAL CHARACTERISTIC – D11, D12, D21, D22 (INVERSE DIODE)

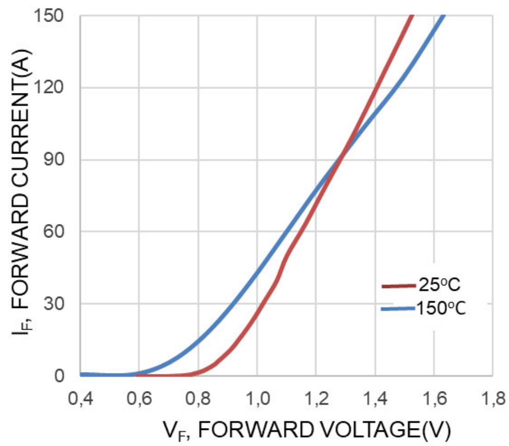


Figure 13. Inverse Diode Forward Characteristics

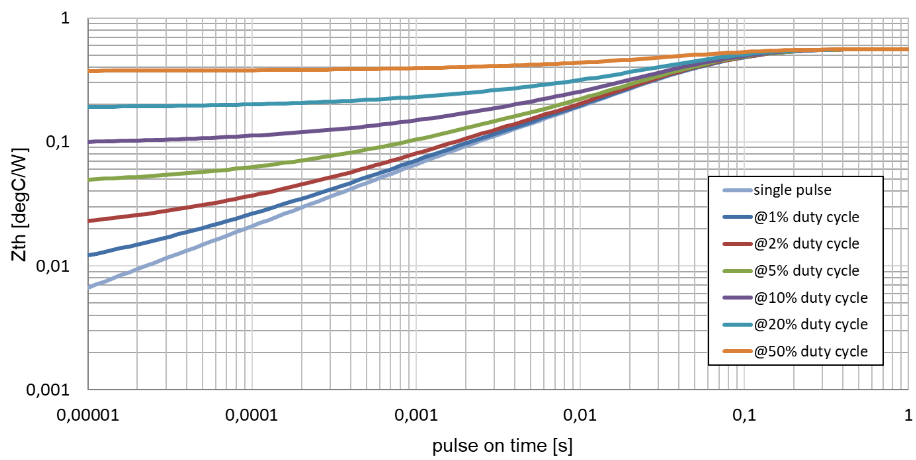


Figure 14. Transient Thermal Impedance (Inverse Diode Zthjc)

TYPICAL CHARACTERISTIC – D13, D14, D23, D24 (SiC SCHOTTKY DIODE)

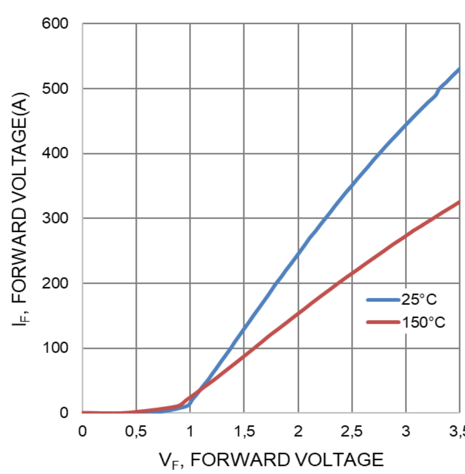


Figure 15. SiC Schottky Diode Forward Characteristics

TYPICAL CHARACTERISTIC – D13, D14, D23, D24 (SiC SCHOTTKY DIODE) (CONTINUED)

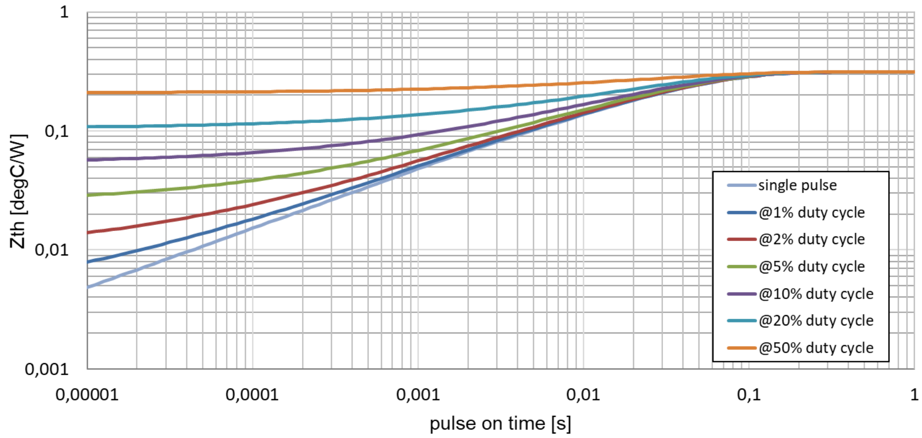


Figure 16. Transient Thermal Impedance (SiC Schottky Diode Zthjc)

TYPICAL CHARACTERISTIC – D15, D25 (START–UP DIODE)

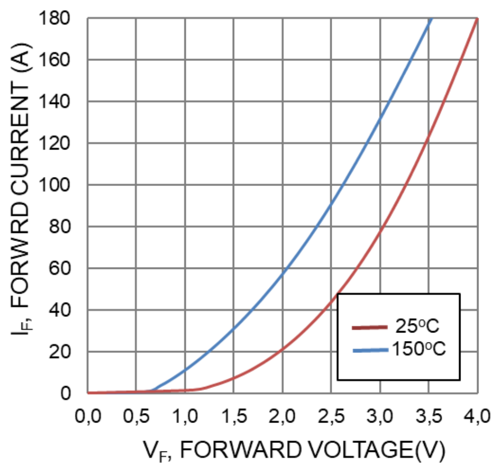


Figure 17. Start–up Diode Forward Characteristics

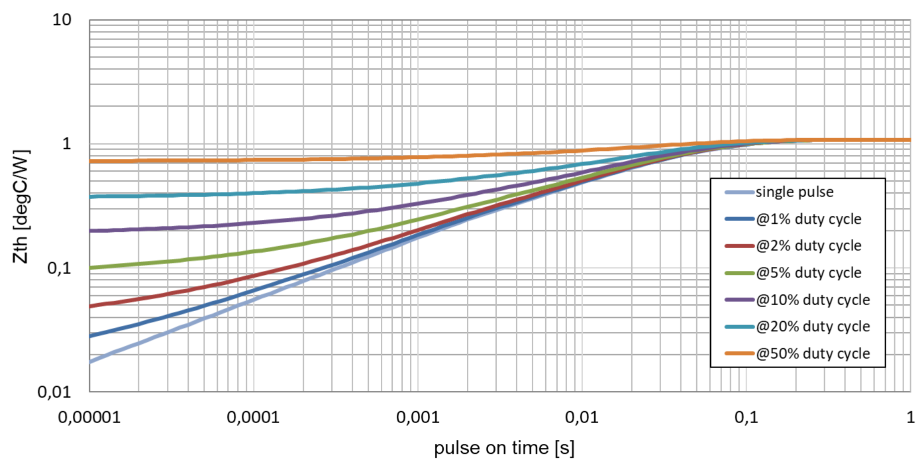


Figure 18. Transient Thermal Impedance (Start–up Diode Zthjc)

TYPICAL CHARACTERISTICS – D16, D26 DIODE

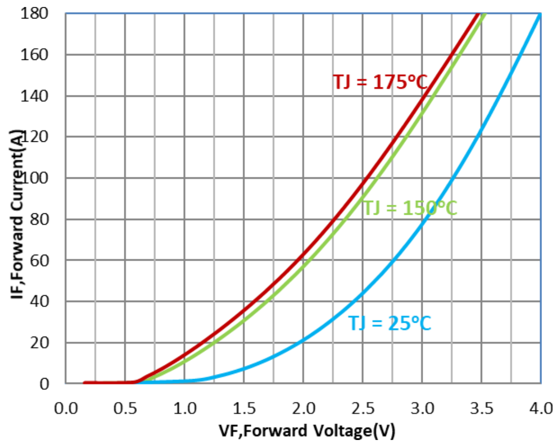


Figure 19. Diode Forward Characteristics

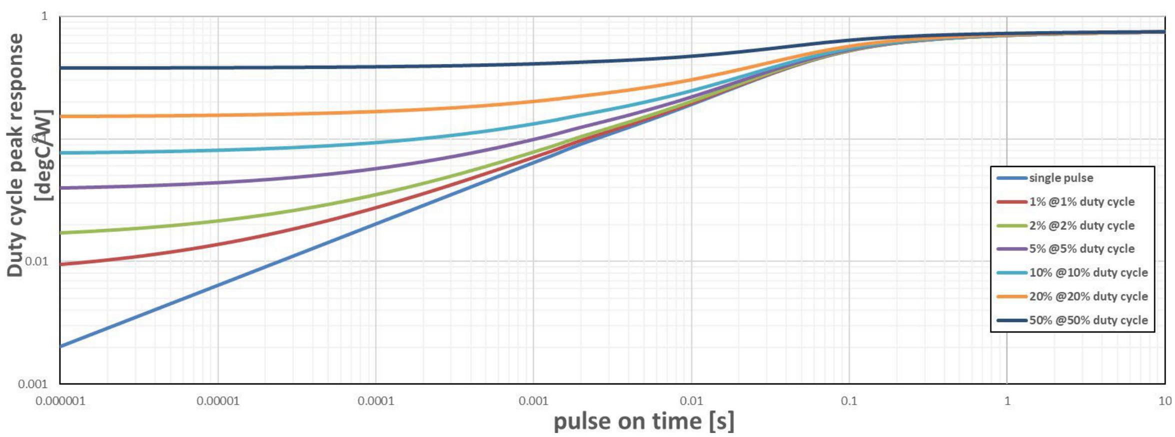


Figure 20. Transient Thermal Impedance (Rthjh)

TYPICAL CHARACTERISTICS – T11, T12, T21, T22 (IGBT)

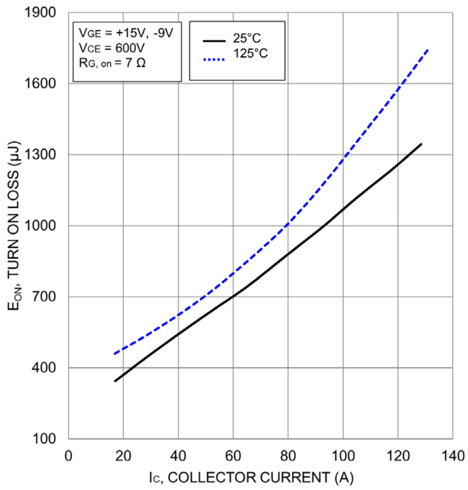


Figure 21. Typical Turn On Loss vs. I_C

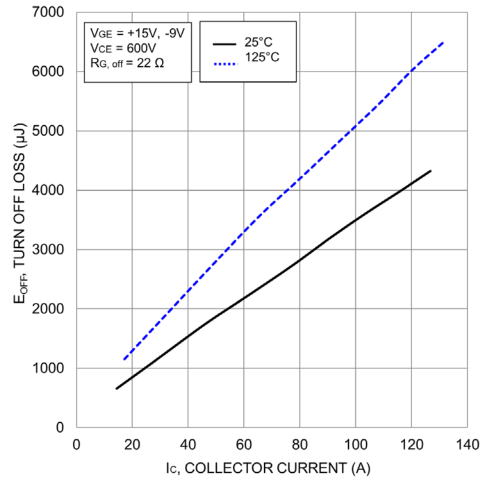


Figure 22. Typical Turn Off Loss vs. I_C

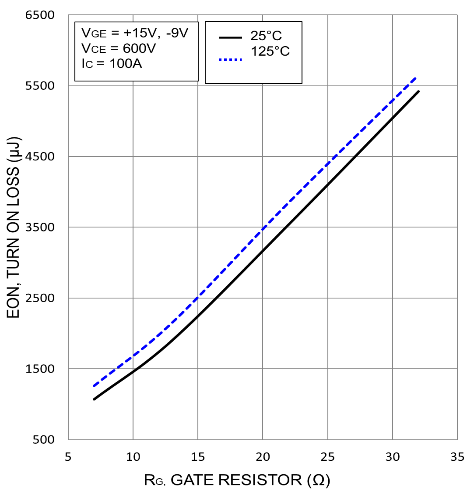


Figure 23. Typical Turn On Loss vs. R_G

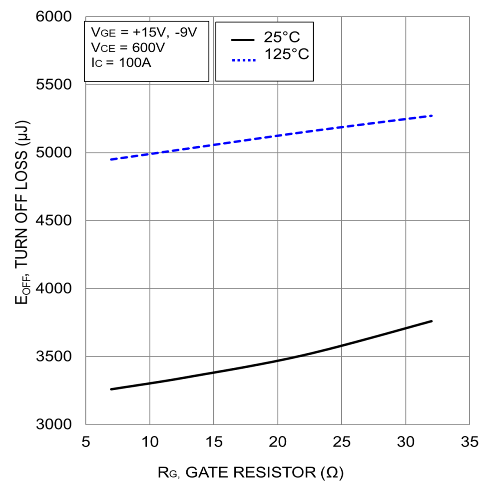


Figure 24. Typical Turn Off Loss vs. R_G

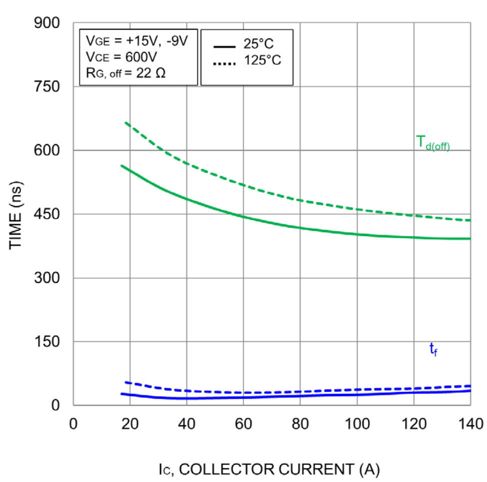


Figure 25. Typical Turn−Off Switching Time vs. I_C

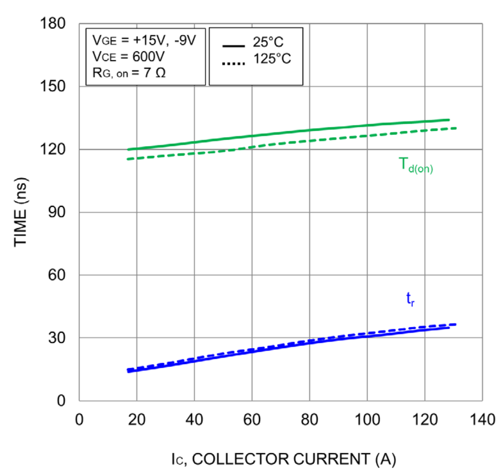


Figure 26. Typical Turn−On Switching Time vs. I_C

TYPICAL CHARACTERISTICS – T11, T12, T21, T22 (IGBT) (CONTINUED)

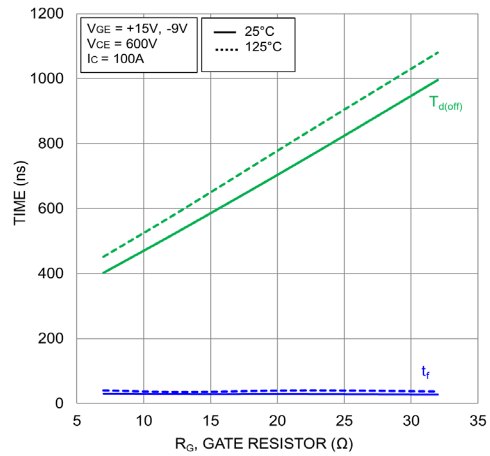


Figure 27. Typical Turn−Off Switching Time vs. R_G

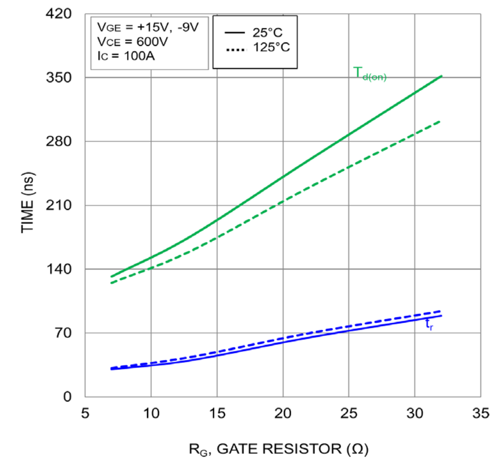


Figure 28. Typical Turn−On Switching Time vs. R_G

TYPICAL CHARACTERISTICS – SiC SCHOTTKY DIODE (D13, D14, D23, D24)

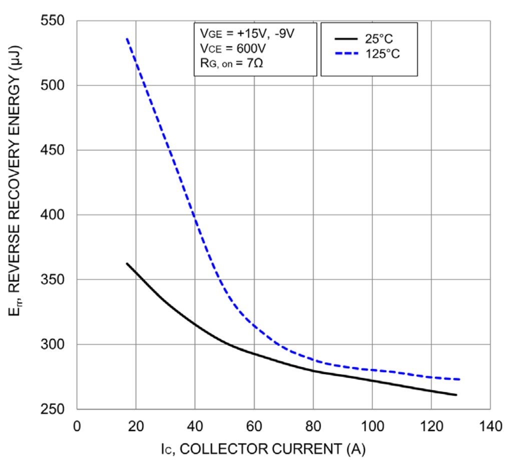


Figure 29. Typical Reverse Recovery Energy Loss vs. I_C

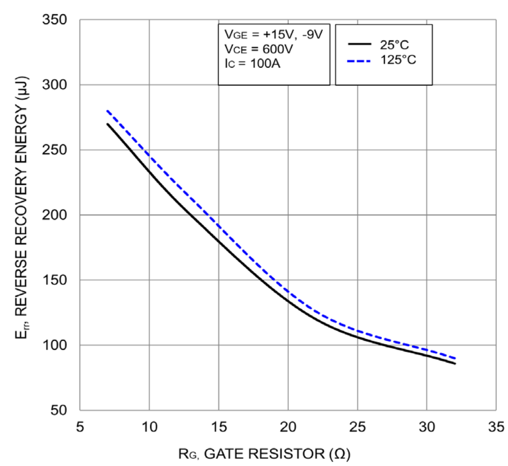


Figure 30. Typical Reverse Recovery Energy Loss vs. R_G

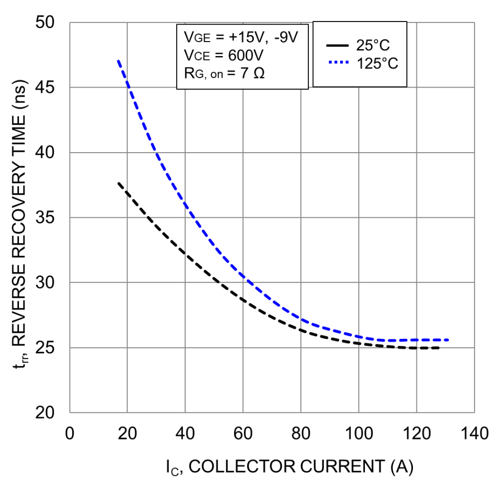


Figure 31. Typical Reverse Recovery Time vs. I_C

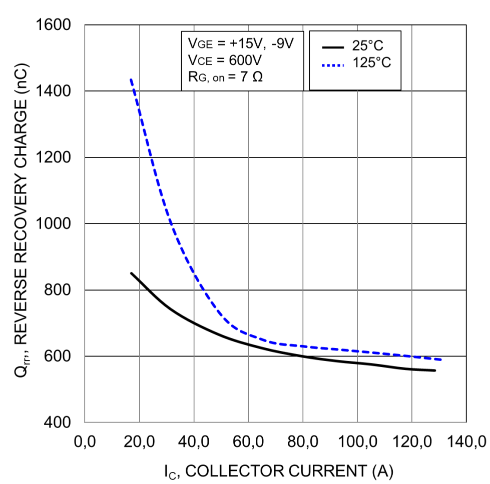


Figure 32. Typical Reverse Recovery Charge vs. I_C

TYPICAL CHARACTERISTICS – SiC SCHOTTKY DIODE (D13, D14, D23, D24) (CONTINUED)

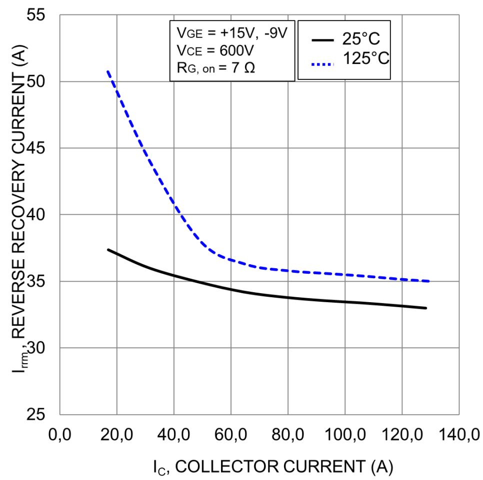


Figure 33. Typical Reverse Recovery Current vs. I_C

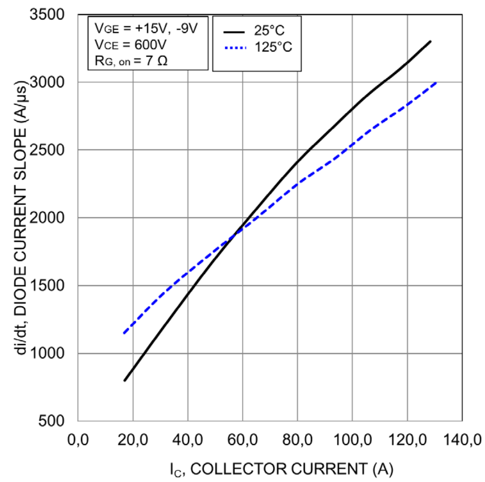


Figure 34. Typical Diode Current Slope vs. I_C

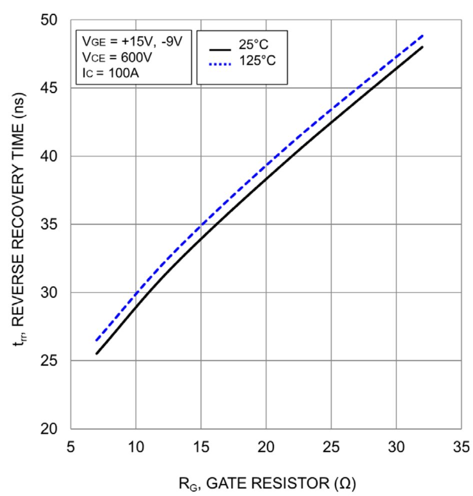


Figure 35. Typical Reverse Recovery Time vs. R_G

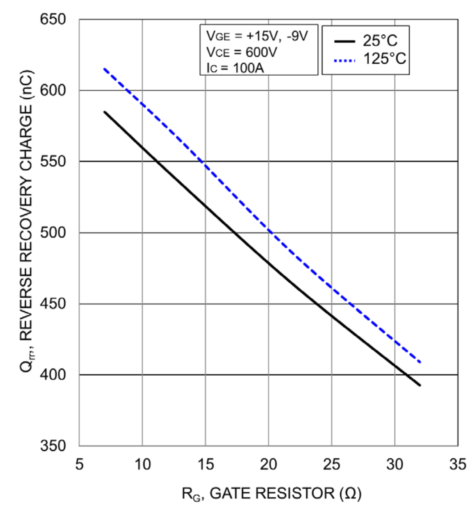


Figure 36. Typical Reverse Recovery Charge vs. R_G

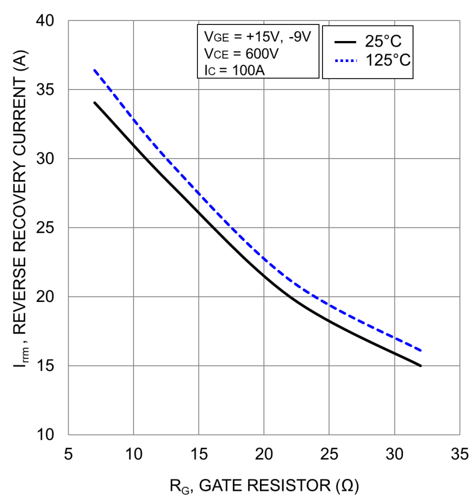


Figure 37. Typical Reverse Recovery Current vs. R_G

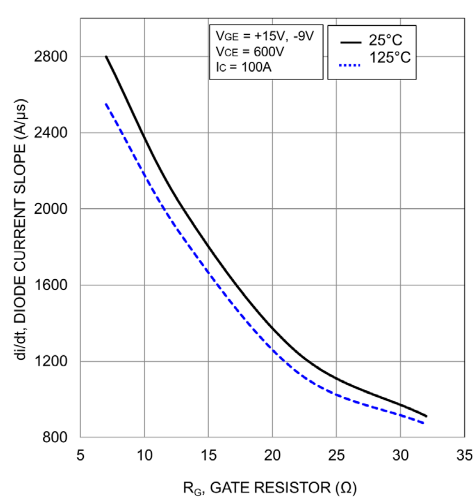


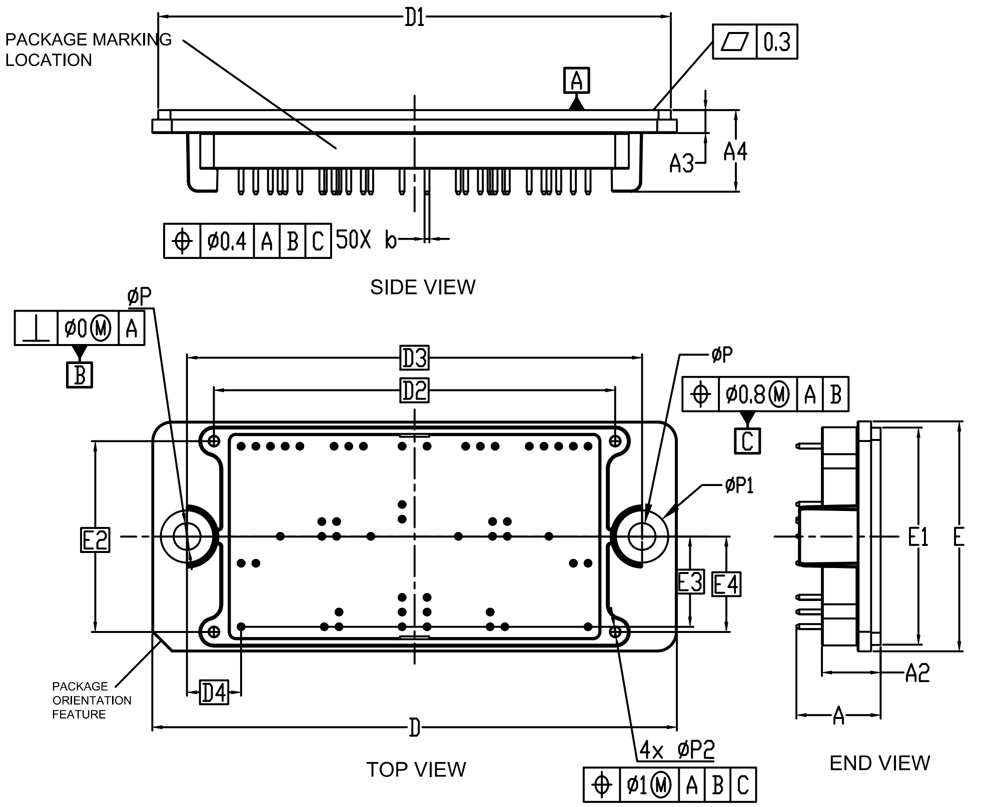
Figure 38. Typical Diode Current Slope vs. R_G

PACKAGE DIMENSIONS

PIM50 93.00x47.00x12.00
CASE 180CU
ISSUE O

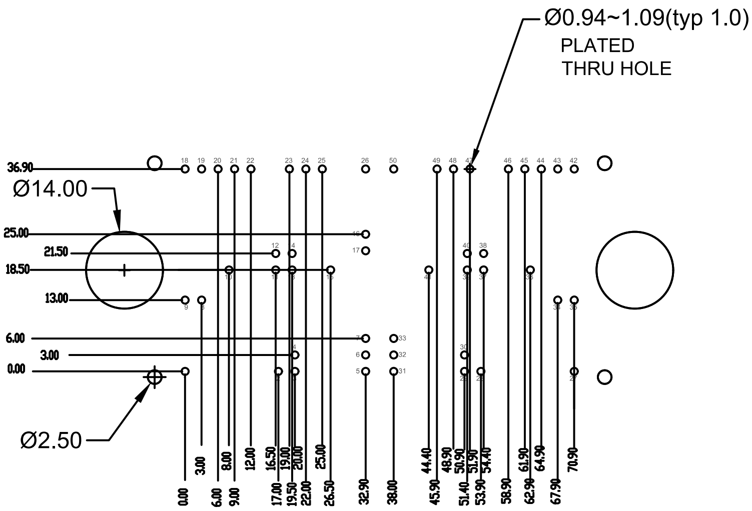
NOTES:

1. Dimensioning and tolerancing conform to ASME Y14.5
2. All dimensions are in millimeters.
3. Dimensions b and b1 apply to the plated terminals and are measured at dimension A1
4. Pin position tolerance is ± 0.4mm
5. Package marking is located on the side opposite the package orientation feature.
6. The pins are Gold plated solder pin



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	16.80	17.20	17.60
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	0.95	1.00	1.05
D	106.90	107.20	107.50
D1	104.45	104.75	105.05
D2	82.00 BSC		
D3	93.00 BSC		
D4	11.05 BSC		
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	39.00 BSC		
E3	18.45 BSC		
E4	19.50 BSC		
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20

PIM50 93.00x47.00x12.00
CASE 180CU
ISSUE O



RECOMMENDED
MOUNTING PATTERN

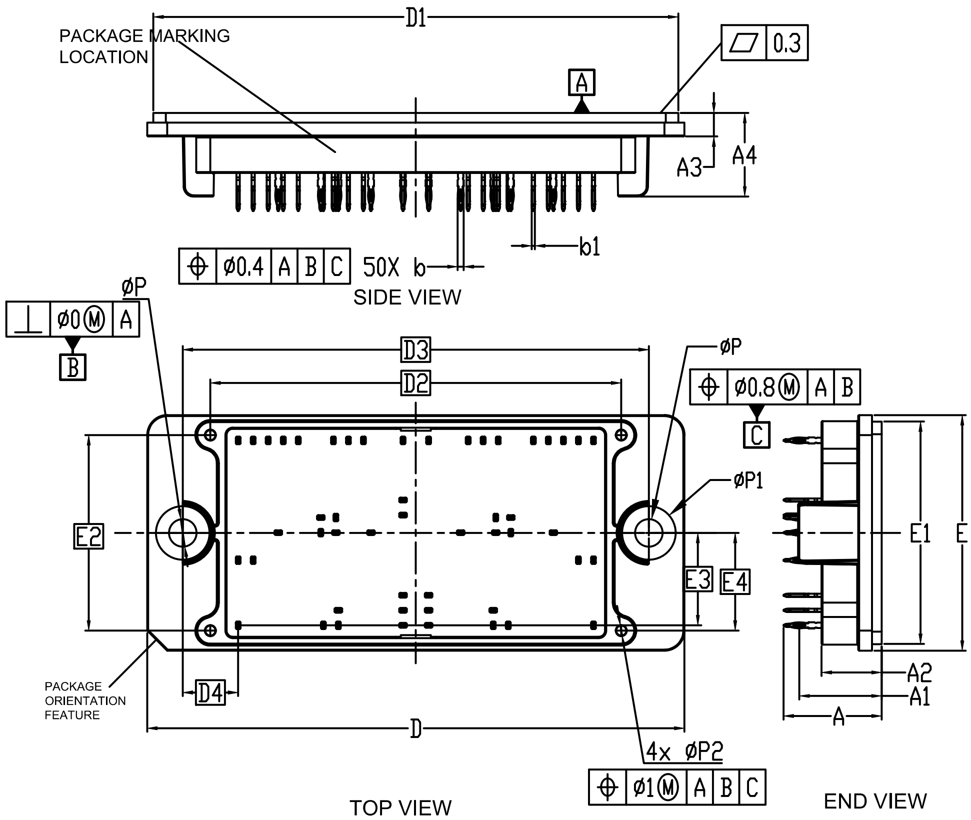
* For additional Information on our Pb−Free strategy and soldering details, please download the Onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

Pin table					
pin	X	Y	Pin	X	Y
1	0	0	26	32.90	36.90
2	17	0	27	70.90	0
3	20	0	28	53.90	0
4	20	3	29	50.90	0
5	32.90	0	30	50.90	3
6	32.90	3	31	38	0
7	32.90	6	32	38	3
8	3	13	33	38	6
9	0	13	34	67.90	13
10	8	18.50	35	70.90	13
11	16.50	18.50	36	62.90	18.50
12	16.50	21.50	37	54.40	18.50
13	19.50	21.50	38	54.40	21.50
14	19.50	18.50	39	51.40	18.50
15	26.50	18.50	40	51.40	21.50
16	32.90	25.00	41	44.40	18.50
17	32.90	22	42	70.90	36.90
18	0	36.90	43	67.90	36.90
19	3	36.90	44	64.90	36.90
20	6	36.90	45	61.90	36.90
21	9	36.90	46	58.90	36.90
22	12	36.90	47	51.90	36.90
23	19	36.90	48	48.90	36.90
24	22	36.90	49	45.90	36.90
25	25	36.90	50	38	36.90

PACKAGE DIMENSIONS

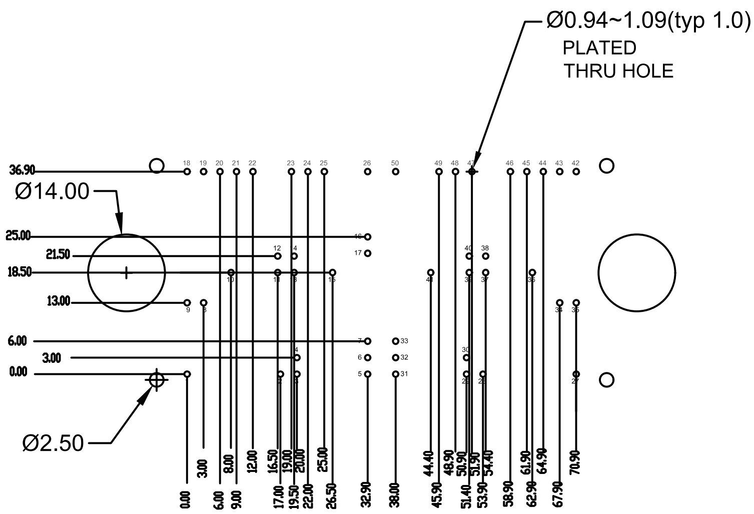
PIM50 93.00x47.00x12.00
CASE 180HZ
ISSUE O

NOTES:
1. Dimensioning and tolerancing conform to ASME Y14.5
2. All dimensions are in millimeters.
3. Dimensions b and b1 apply to the plated terminals and are measured at dimension A1
4. Pin position tolerance is ± 0.4mm
5. Package marking is located on the side opposite the package orientation feature.
6. The pins are Sn plated press fit pin.



DIM	MILLIMETERS MIN.	NOM.	MAX.
A	19.20	19.60	20.00
A1	16.25	16.45	16.65
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	1.15	1.20	1.25
b1	0.59	0.64	0.69
D	106.90	107.20	107.50
D1	104.45	104.75	105.05
D2		82.00 BSC	
D3		93.00 BSC	
D4		11.05 BSC	
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2		39.00 BSC	
E3		18.45 BSC	
E4		19.50 BSC	
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20

PIM50 93.00x47.00x12.00
CASE 180HZ
ISSUE O



RECOMMENDED
MOUNTING PATTERN

* For additional Information on our Pb−Free strategy and soldering details, please download the Onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

Pin table					
pin	X	Y	Pin	X	Y
1	0	0	26	32.90	36.90
2	17	0	27	70.90	0
3	20	0	28	53.90	0
4	20	3	29	50.90	0
5	32.90	0	30	50.90	3
6	32.90	3	31	38	0
7	32.90	6	32	38	3
8	3	13	33	38	6
9	0	13	34	67.90	13
10	8	18.50	35	70.90	13
11	16.50	18.50	36	62.90	18.50
12	16.50	21.50	37	54.40	18.50
13	19.50	21.50	38	54.40	21.50
14	19.50	18.50	39	51.40	18.50
15	26.50	18.50	40	51.40	21.50
16	32.90	25.00	41	44.40	18.50
17	32.90	22	42	70.90	36.90
18	0	36.90	43	67.90	36.90
19	3	36.90	44	64.90	36.90
20	6	36.90	45	61.90	36.90
21	9	36.90	46	58.90	36.90
22	12	36.90	47	51.90	36.90
23	19	36.90	48	48.90	36.90
24	22	36.90	49	45.90	36.90
25	25	36.90	50	38	36.90

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