

SNXH150B120H3Q2F2PG-N

Q2BOOST Module

This high-density, integrated power module combines high-performance IGBTs with rugged anti-parallel diodes.

Features

- Extremely Efficient Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- Module Design Offers High Power Density
- Low Inductive Layout
- Q2BOOST Package with Press-Fit Pins
- 1200 V SiC Diode

Typical Applications

- Solar Inverters
- UPS Systems

Table 1. MAXIMUM RATINGS

Rating	Symbol	Value	Unit
IGBT (T1, T2, T3)			
Collector-emitter Voltage	V_{CES}	1200	V
Collector Current @ $T_h = 80^\circ\text{C}$ (per IGBT)	I_C	80	A
Pulsed Collector Current, T_{pulse} Limited by $T_{J\text{max}}$	I_{CM}	309	A
Power Dissipation per IGBT $T_J = T_{J\text{max}}$, $T_h = 80^\circ\text{C}$	P_{tot}	279	W
Gate-emitter Voltage Positive transient gate-emitter voltage	V_{GE}	± 20 30	V
Short Circuit Withstand Time (Note 1) $V_{GE} = 15\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J \leq 150^\circ\text{C}$	T_{SC}	10	μs
Maximum Junction Temperature	T_J	175	$^\circ\text{C}$

IGBT INVERSE DIODE (D1, D2, D3)

Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Forward Current, DC @ $T_h = 80^\circ\text{C}$ (per Diode)	I_F	45	A
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	520	A
Power Dissipation per Diode $T_J = T_{J\text{max}}$, $T_h = 80^\circ\text{C}$	P_{tot}	76	W
I_{2t} ($T_J = 150^\circ\text{C}$, 10 ms sin 180 $^\circ\text{C}$)	I_{2t}	610	A_2S
Maximum Junction Temperature	T_J	150	$^\circ\text{C}$

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.

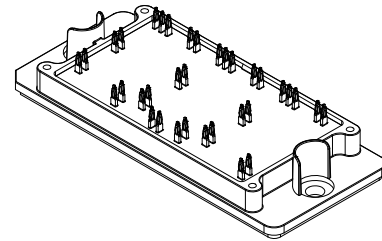
1. Rating subject to change with characterization data.

Final value to be published in final data sheet.



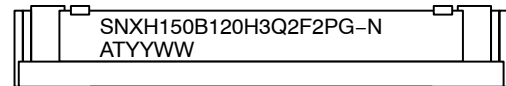
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Q2BOOST MODULE
CASE 180AL

MARKING DIAGRAM



SNXH150B120H3Q2F2P = Specific Device Code
N = SiC Source
G = Pb-Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

ORDERING INFORMATION

Device	Package	Shipping
SNXH150B120H3Q2F2PG-N	Q2BOOST (Pb-Free)	12 Units / Blister Tray

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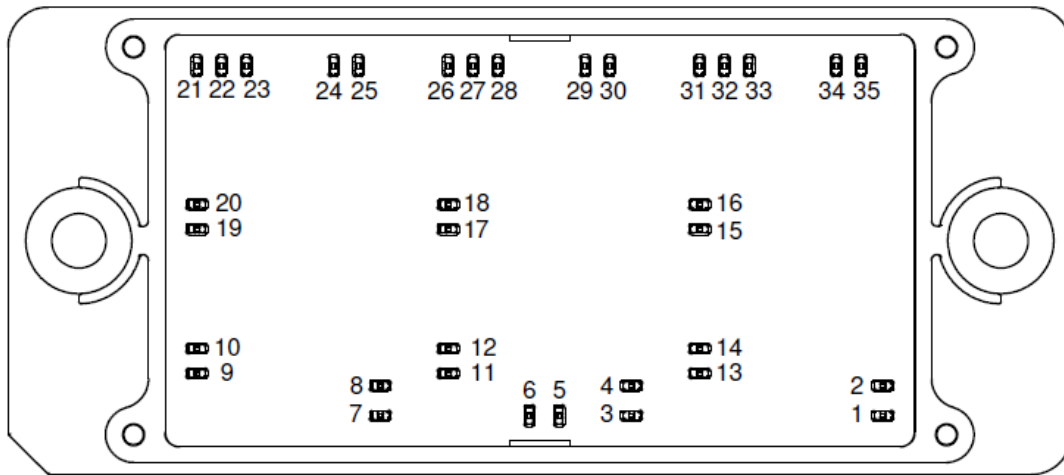


Figure 1. Pin Layout Q2BOOST

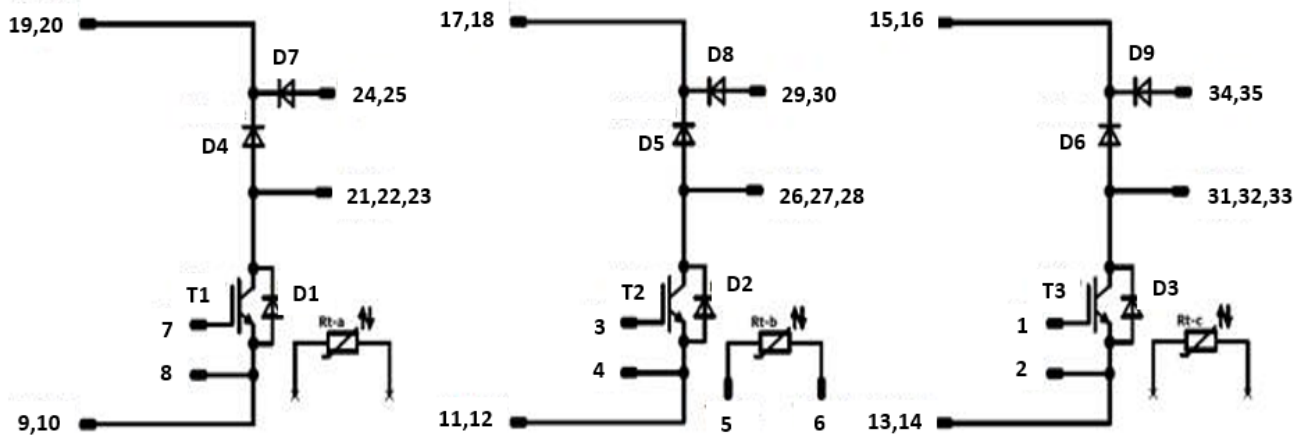


Figure 2. Schematic of Q2BOOST

Table 2. ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
SILICON CARBIDE SCHOTTKY DIODE (D4, D5, D6)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Forward Current, DC @ $T_h = 80^\circ\text{C}$ (per Diode)	I_F	30	A
Power Dissipation per Diode $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	P_{tot}	94	W
Maximum Junction Temperature	T_J	175	$^\circ\text{C}$
BYPASS (D7, D8, D9)			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Forward Current, DC @ $T_h = 80^\circ\text{C}$ (per Diode)	I_F	50	A
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	635	A
Power Dissipation per Diode $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	P_{tot}	127	W
Maximum Junction Temperature	T_J	150	$^\circ\text{C}$

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.

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Table 3. THERMAL PROPERTIES

Parameter	Symbol	Value	Unit
Operating Temperature under Switching Condition	$T_{VJ\text{ OP}}$	-40 to $(T_{J\text{ max}} - 25)$	°C
Storage Temperature Range	T_{stg}	-40 to +125	°C

Table 4. INSULATION PROPERTIES

Parameter	Symbol	Value	Unit
Isolation Test Voltage, $t = 1\text{ s}$, 50/60 Hz	V_{is}	3000	V_{RMS}
Creepage Distance		12.7	mm

Table 5. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T1, T2, T3)						
Collector-emitter Breakdown Voltage	$V_{\text{GE}} = 0\text{ V}$, $I_C = 1\text{ mA}$	$V_{(\text{BR})\text{CES}}$	1200	—	—	V
Collector-emitter Saturation Voltage	$V_{\text{GE}} = 15\text{ V}$, $I_C = 80\text{ A}$, $T_J = 25^\circ\text{C}$ $V_{\text{GE}} = 15\text{ V}$, $I_C = 80\text{ A}$, $T_J = 150^\circ\text{C}$	$V_{\text{CE(sat)}}$	—	2.2 2.11	2.5	V
Gate-emitter Threshold Voltage	$V_{\text{GE}} = V_{\text{CE}}$, $I_C = 2\text{ mA}$	$V_{\text{GE(TH)}}$	4.5	5.5	6.5	V
Collector-emitter Cutoff Current	$V_{\text{GE}} = 0\text{ V}$, $V_{\text{CE}} = 1200\text{ V}$	I_{CES}	—	—	400	μA
Gate Leakage Current	$V_{\text{GE}} = 20\text{ V}$, $V_{\text{CE}} = 0\text{ V}$	I_{GES}	—	—	800	nA
Turn-on Delay Time	$T_J = 25^\circ\text{C}$ $V_{\text{CE}} = 800\text{ V}$, $I_C = 40\text{ A}$ $V_{\text{GE}} = +15\text{ V}$, -8 V , $R_G = 4\ \Omega$	$t_{\text{d(on)}}$	—	47	—	ns
Rise Time		t_r	—	24	—	
Turn-off Delay Time		$t_{\text{d(off)}}$	—	264	—	
Fall Time		t_f	—	32	—	
Turn On Switching Loss		E_{on}	—	1126	—	μJ
Turn Off Switching Loss		E_{off}	—	1300	—	
Turn-on Delay Time	$T_J = 125^\circ\text{C}$ $V_{\text{CE}} = 800\text{ V}$, $I_C = 40\text{ A}$ $V_{\text{GE}} = +15\text{ V}$, -8 V , $R_G = 4\ \Omega$	$t_{\text{d(on)}}$	—	45	—	ns
Rise Time		t_r	—	23	—	
Turn-off Delay Time		$t_{\text{d(off)}}$	—	298	—	
Fall Time		t_f	—	112	—	
Turn On Switching Loss		E_{on}	—	1201	—	μJ
Turn Off Switching Loss		E_{off}	—	2700	—	
Input Capacitance	$V_{\text{CE}} = 20\text{ V}$, $V_{\text{GE}} = 0\text{ V}$, $f = 10\text{ kHz}$	C_{ies}	—	19137	—	pF
Output Capacitance		C_{oes}	—	446	—	
Reverse Transfer Capacitance		C_{res}	—	371	—	
Gate Charge Total	$V_{\text{CE}} = 600\text{ V}$, $I_C = 80\text{ A}$, $V_{\text{GE}} = 15\text{ V}$	Q_g	—	832	—	nC
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2 Mil $\pm 2\%$, $\lambda = 1\text{ W/mK}$	R_{thJH}	—	0.341	—	°C/W

IGBT INVERSE DIODE (D1, D2, D3)

Forward Voltage	$I_F = 45\text{ A}$, $T_J = 25^\circ\text{C}$ $I_F = 45\text{ A}$, $T_J = 150^\circ\text{C}$	V_F	— —	1.23 1.17	2.0 —	V
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2 Mil $\pm 2\%$, $\lambda = 1\text{ W/mK}$	R_{thJH}	—	0.924	—	°C/W

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Table 5. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SILICON CARBIDE SCHOTTKY DIODE (D4, D5, D6)						
Forward Voltage	$I_F = 30\text{ A}$, $T_J = 25^\circ\text{C}$ $I_F = 30\text{ A}$, $T_J = 150^\circ\text{C}$	V_F	— —	1.4 1.93	1.8 —	V
Reverse Recovery Time	$T_J = 25^\circ\text{C}$ $V_{CE} = 800\text{ V}$, $I_C = 40\text{ A}$ $V_{GE} = +15\text{ V}$, -8 V ; $R_G = 4\ \Omega$, Gate driver NCD5701C	t_{rr}	—	18	—	ns
Reverse Recovery Charge		Q_{rr}	—	143	—	nC
Peak Reverse Recovery Current		I_{RRM}	—	14.5	—	A
Peak Rate of Fall of Recovery Current		di/dt	—	1598	—	A/ μs
Reverse Recovery Energy		E_{rr}	—	101	—	μJ
Reverse Recovery Time	$T_J = 125^\circ\text{C}$ $V_{CE} = 800\text{ V}$, $I_C = 40\text{ A}$ $V_{GE} = +15\text{ V}$, -8 V ; $R_G = 4\ \Omega$, Gate driver NCD5701C	t_{rr}	—	20	—	ns
Reverse Recovery Charge		Q_{rr}	—	157	—	nC
Peak Reverse Recovery Current		I_{RRM}	—	14.2	—	A
Peak Rate of Fall of Recovery Current		di/dt	—	1593	—	A/ μs
Reverse Recovery Energy		E_{rr}	—	102	—	μJ
Reverse Leakage Current	$V_R = 1200\text{ V}$	I_r	—	—	600	μA
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2 Mil $\pm 2\%$, $\lambda = 1\text{ W/mK}$	R_{thJH}	—	0.742	—	$^\circ\text{C/W}$
BYPASS DIODE (D7, D8, D9)						
Forward Voltage	$I_F = 75\text{ A}$, $T_J = 25^\circ\text{C}$ $I_F = 75\text{ A}$, $T_J = 150^\circ\text{C}$	V_F	— —	1.11 1.06	1.5 —	V
Reverse Leakage Current	$V_R = 1600\text{ V}$	I_r	—	10	50	μA
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2 Mil $\pm 2\%$, $\lambda = 1\text{ W/mK}$	R_{thJH}	—	0.550	—	$^\circ\text{C/W}$
THERMISTOR CHARACTERISTICS						
Nominal Resistance		R	—	22	—	k Ω
Nominal Resistance	$T = 100^\circ\text{C}$	R	—	1468	—	Ω
Deviation of R25		DR/R	–5	—	5	%
Power Dissipation		P_D	—	200	—	mW
Power Dissipation Constant			—	2	—	mW/ $^\circ\text{C}$
B-value	B(25/50), tol $\pm 3\%$		—	—	3982	$^\circ\text{C}$
B-value	B(25/100), tol $\pm 3\%$		—	—	3998	$^\circ\text{C}$
NTC Reference			—	—	B	

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.

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TYPICAL CHARACTERISTICS – IGBT (T1, T2, T3) AND SILICON CARBIDE SCHOTTKY DIODE (D4, D5, D6)

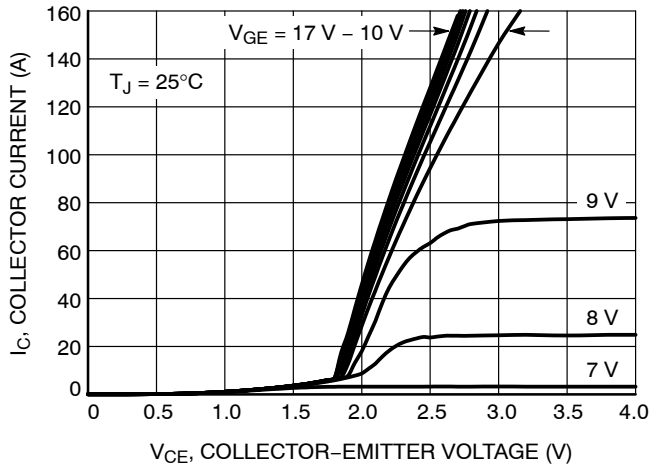


Figure 1. Typical Output Characteristics

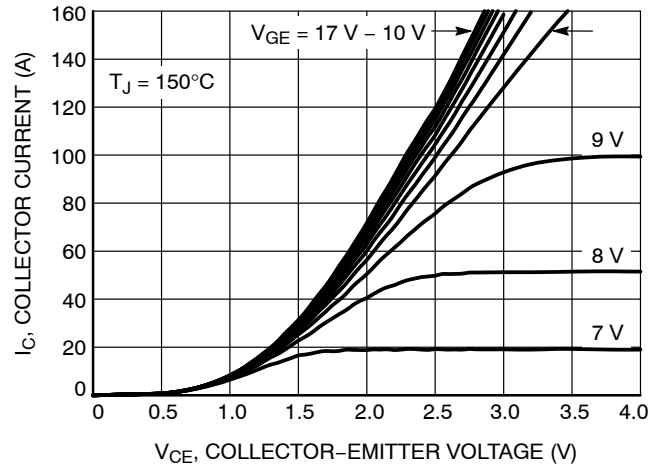


Figure 2. Typical Output Characteristics

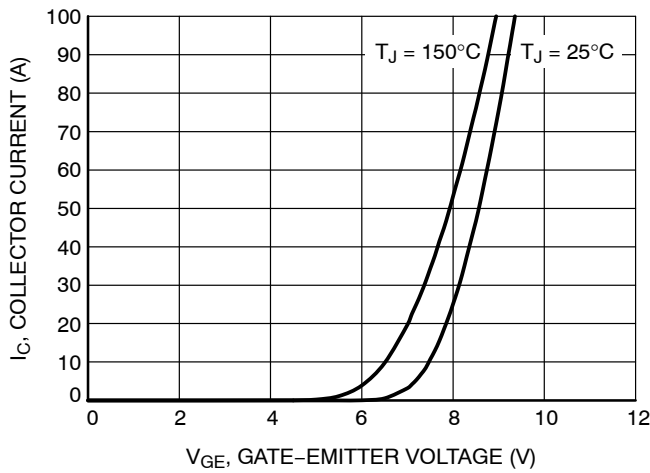


Figure 3. Typical Transfer Characteristics

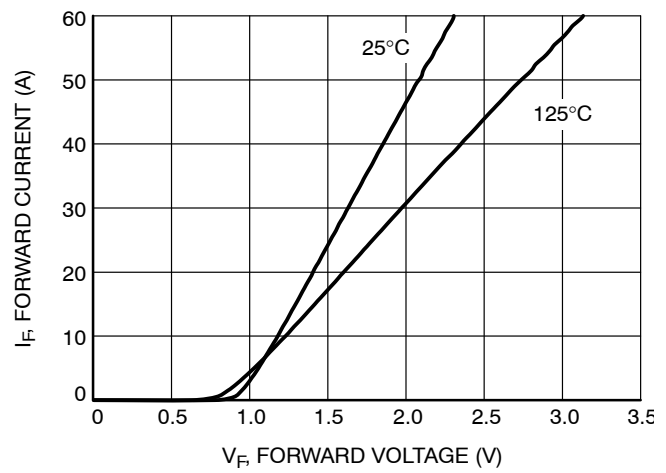


Figure 4. SIC Diode Forward Characteristics

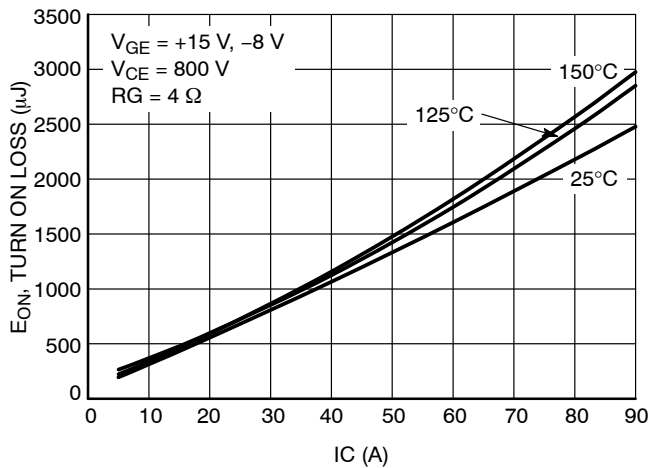


Figure 5. Typical Turn ON Loss vs. I_C

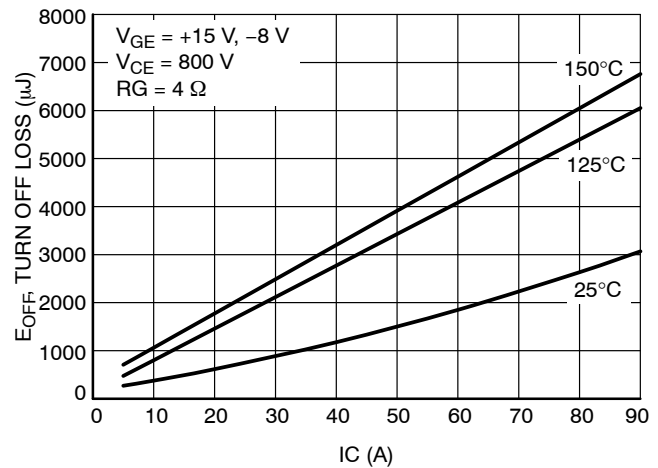


Figure 6. Typical Turn OFF Loss vs. I_C

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TYPICAL CHARACTERISTICS – IGBT (T1, T2, T3) AND SILICON CARBIDE SCHOTTKY DIODE (D4, D5, D6)

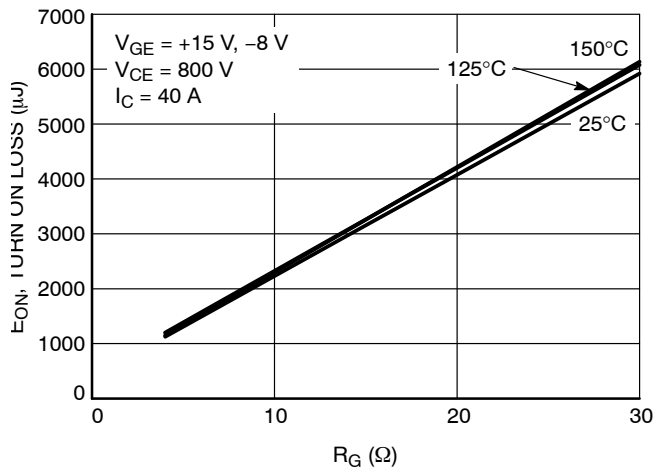


Figure 7. Typical Turn ON Loss vs. R_G

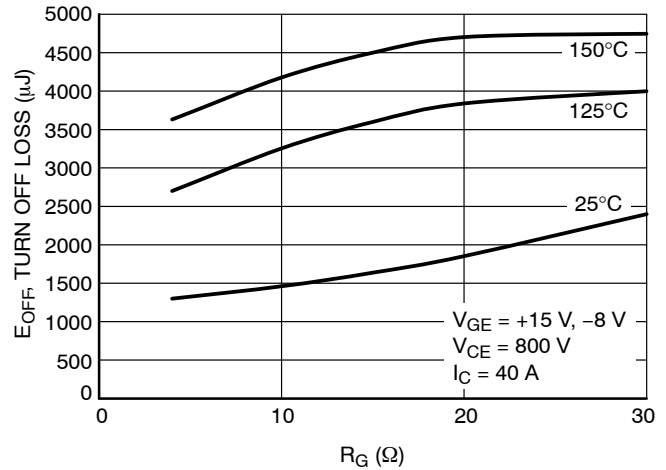


Figure 8. Typical Turn OFF Loss vs. R_G

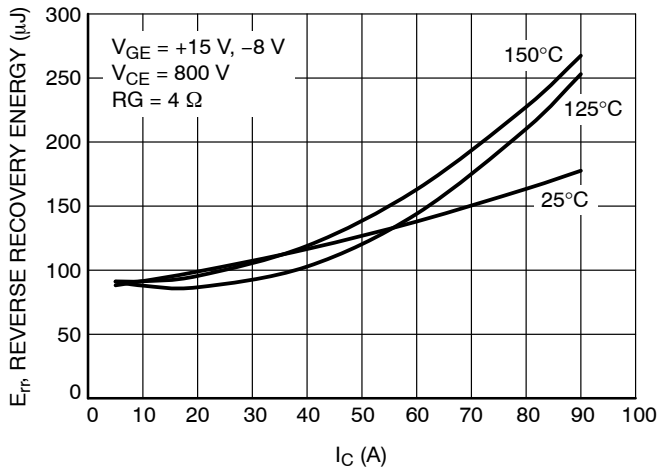


Figure 9. Typical Reverse Recovery Energy Loss vs. I_C

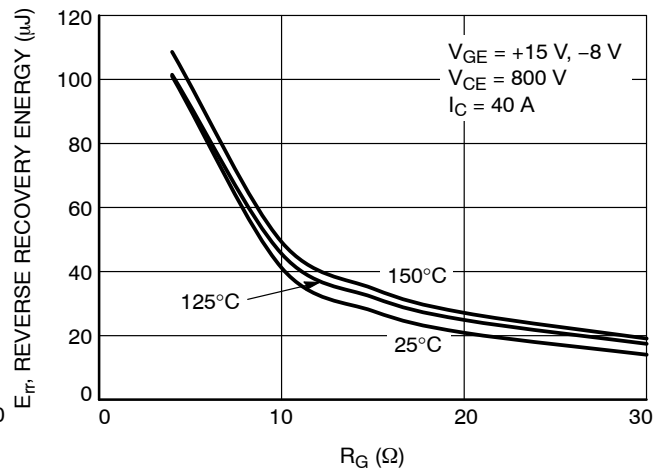


Figure 10. Typical Reverse Recovery Energy Loss vs. R_G

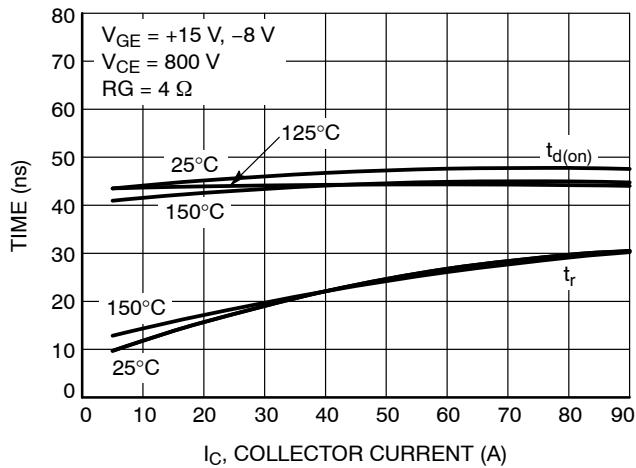


Figure 11. Typical Turn-On Switching Time vs. I_C

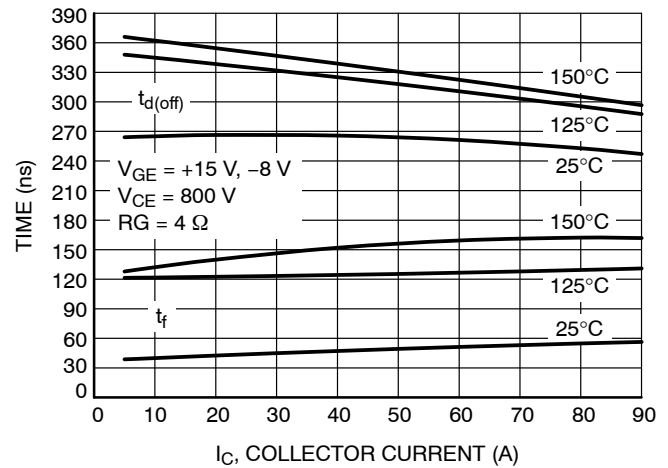


Figure 12. Typical Turn-Off Switching Time vs. I_C

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TYPICAL CHARACTERISTICS – IGBT (T1, T2, T3) AND SILICON CARBIDE SCHOTTKY DIODE (D4, D5, D6)

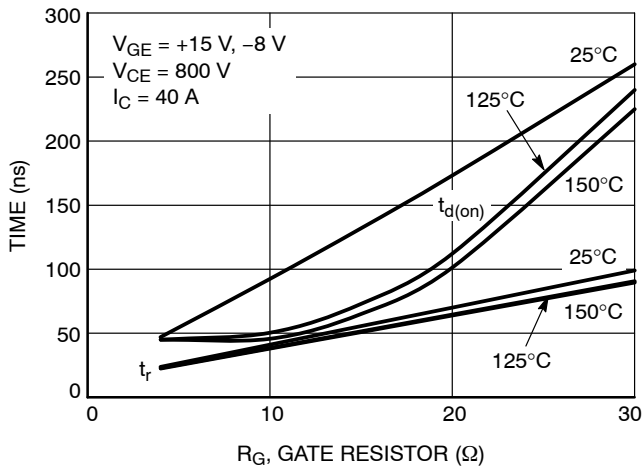


Figure 13. Typical Turn-On Switching Time vs. R_G

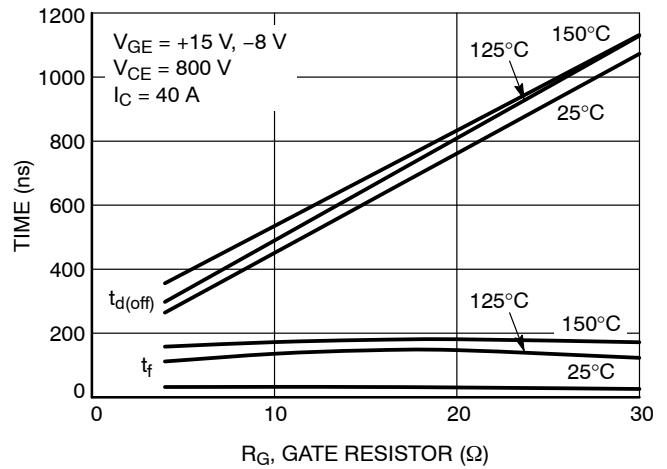


Figure 14. Typical Turn-Off Switching Time vs. R_G

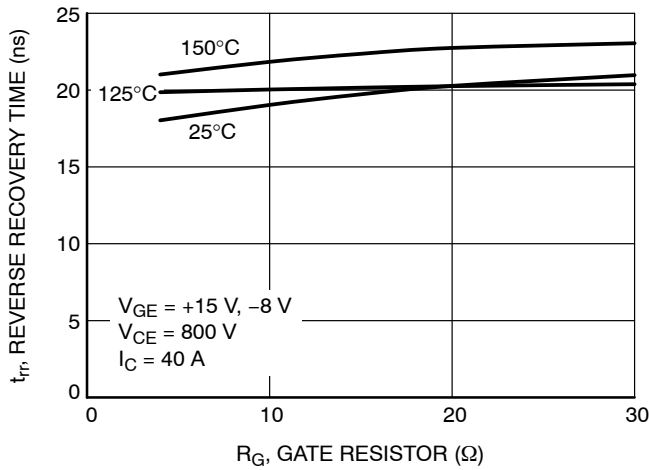


Figure 15. Typical Reverse Recovery Time vs. R_G

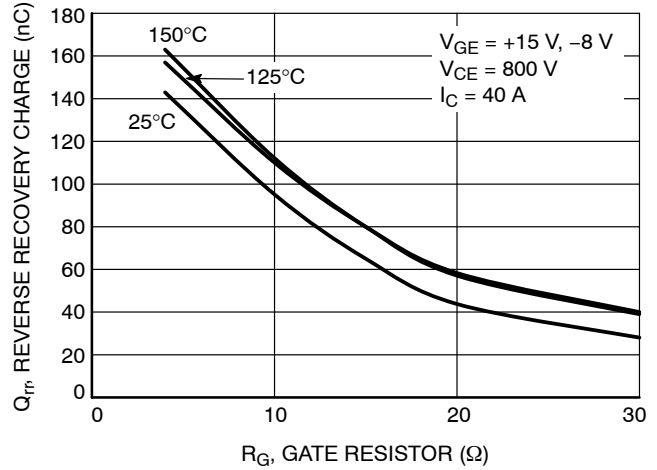


Figure 16. Typical Reverse Recovery Charge vs. R_G

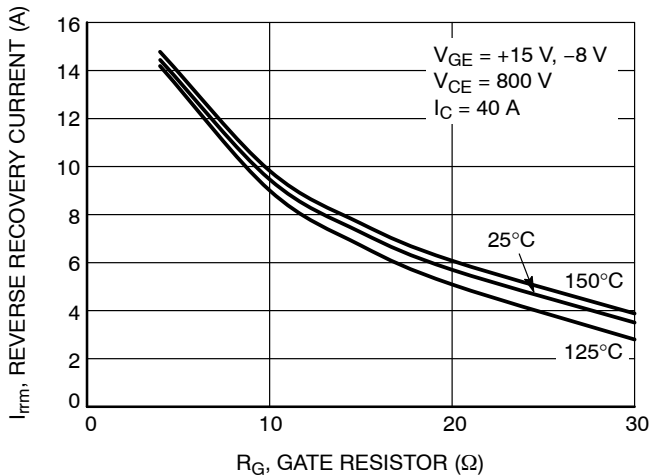


Figure 17. Typical Reverse Recovery Peak Current vs. R_G

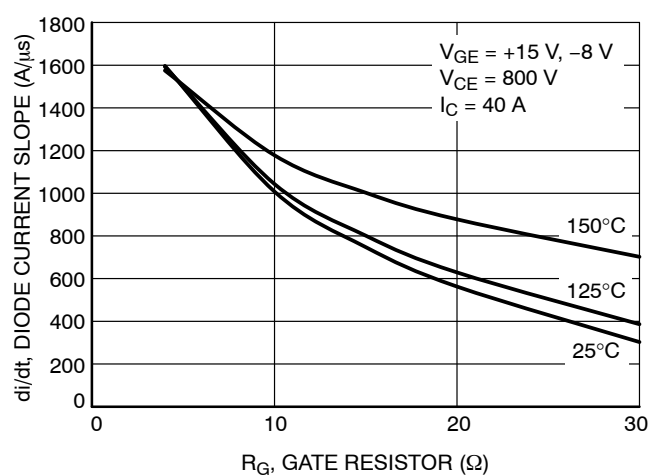


Figure 18. Typical di/dt vs. R_G

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TYPICAL CHARACTERISTICS – IGBT (T1, T2, T3) AND SILICON CARBIDE SCHOTTKY DIODE (D4, D5, D6)

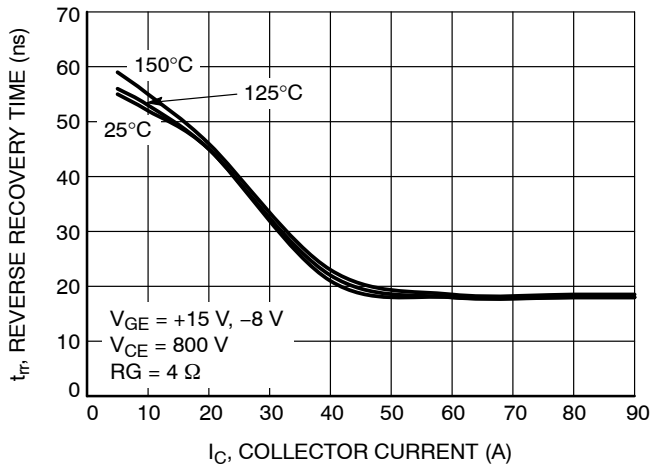


Figure 19. Typical Reverse Recovery Time vs. I_C

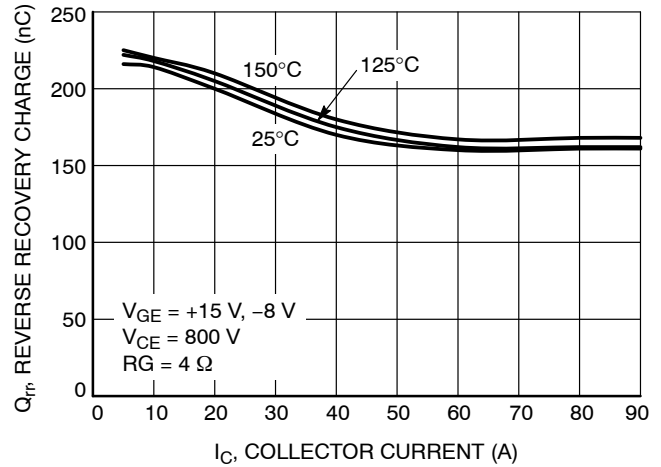


Figure 20. Typical Reverse Recovery Charge vs. I_C

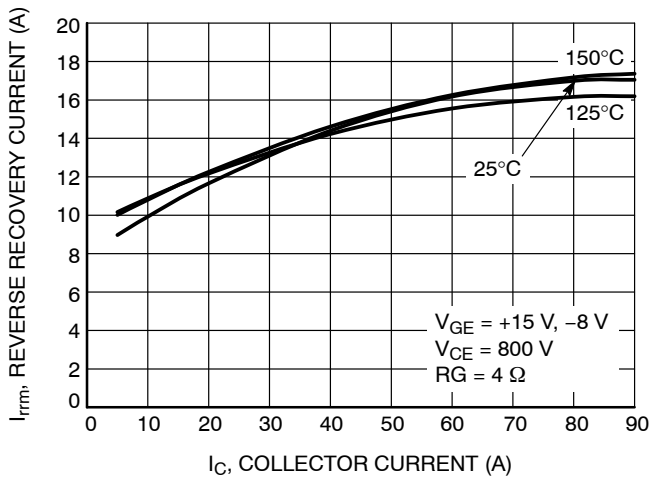


Figure 21. Typical Reverse Recovery Peak Current vs. I_C

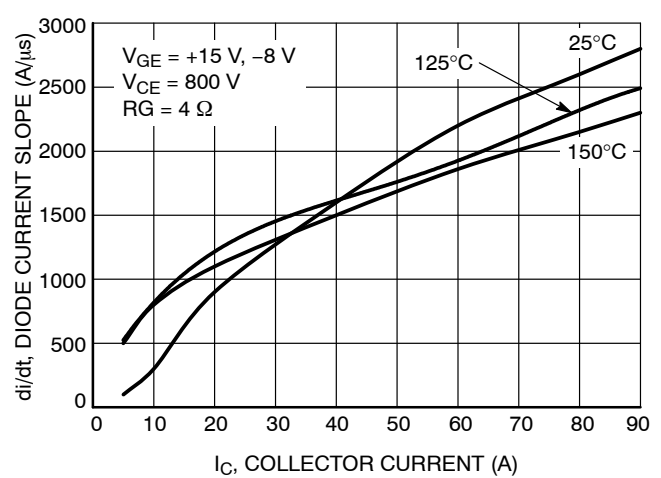


Figure 22. Typical di/dt vs. I_C

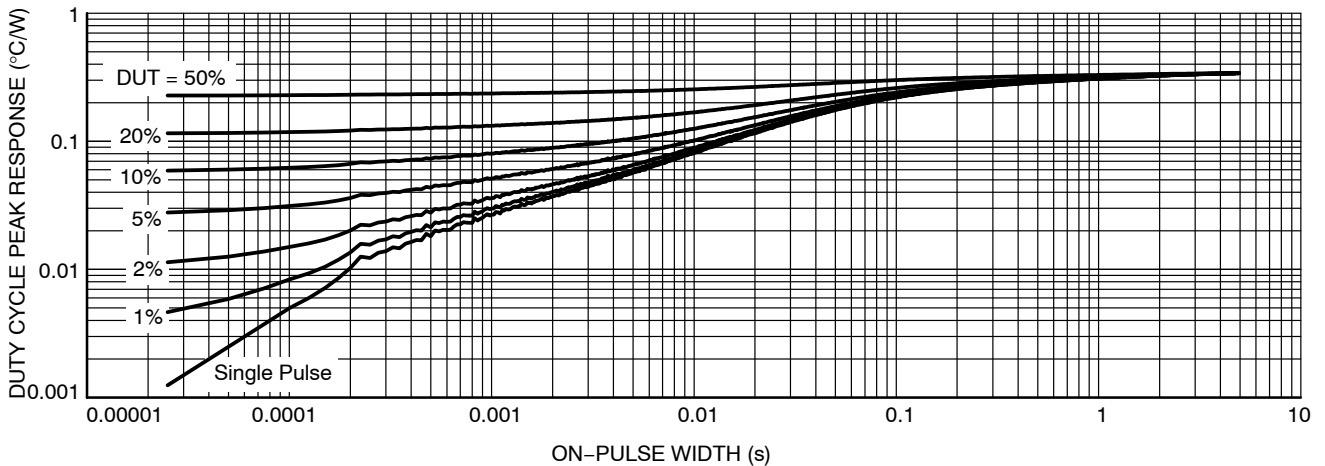


Figure 23. Transient Thermal Impedance (IGBT)

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TYPICAL CHARACTERISTICS – IGBT (T1, T2, T3) AND SILICON CARBIDE SCHOTTKY DIODE (D4, D5, D6)

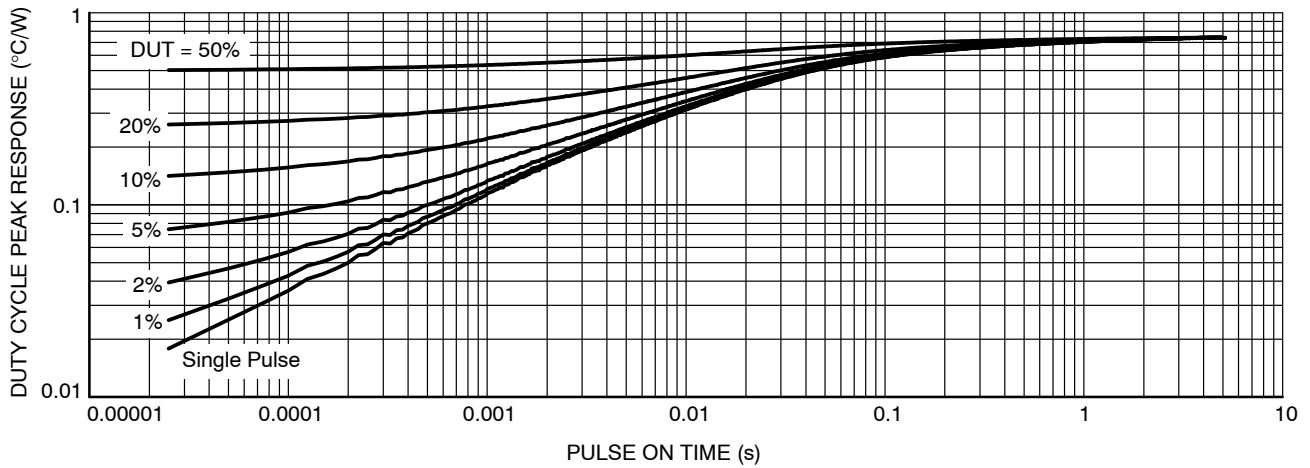


Figure 24. Transient Thermal Impedance (SILICON CARBIDE DIODE)

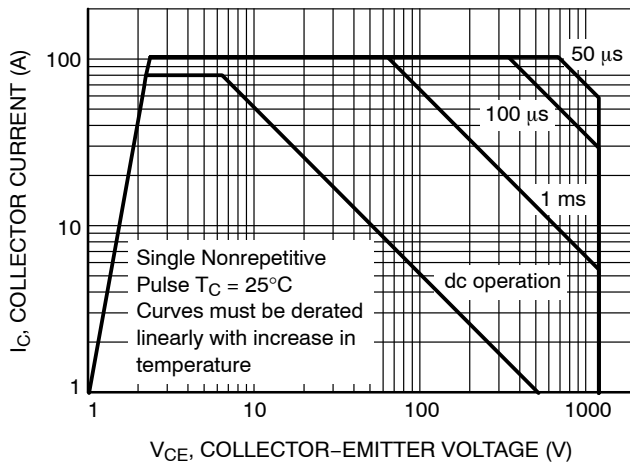


Figure 25. Safe Operating Area

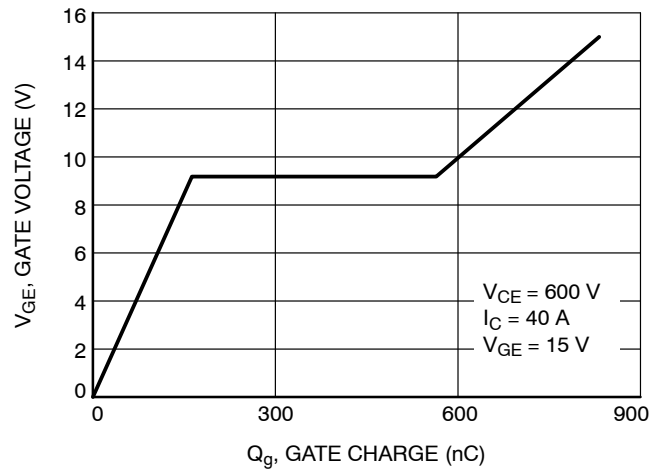


Figure 26. Gate Voltage vs. Gate Charge

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TYPICAL CHARACTERISTICS – IGBT INVERSE DIODE (D1, D2, D3)

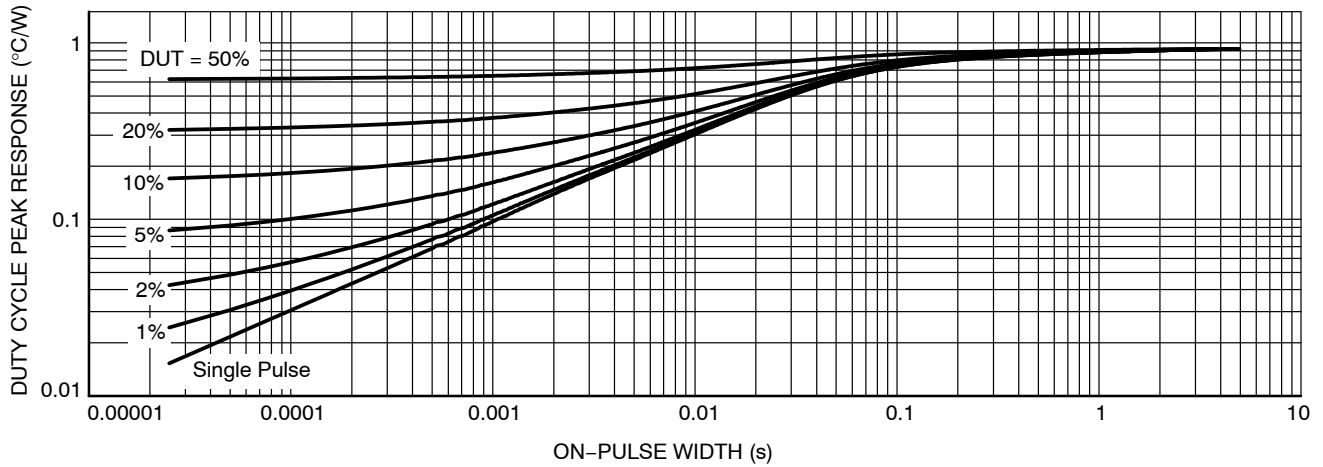


Figure 27. Transient Thermal Impedance (IGBT INVERSE DIODE)

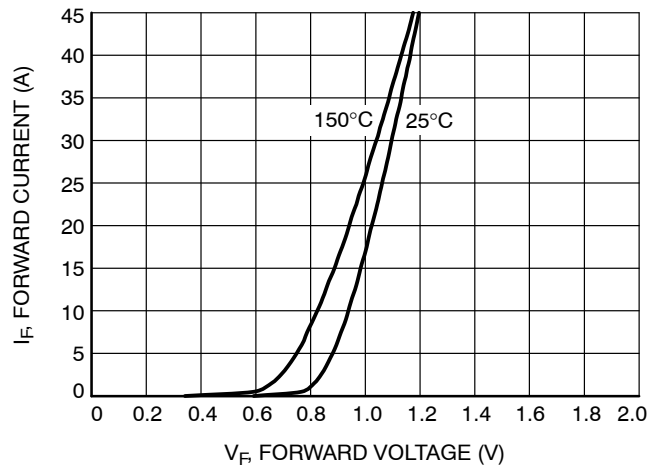


Figure 28. Diode Forward Characteristics

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TYPICAL CHARACTERISTICS – BYPASS DIODE (D7, D8, D9)

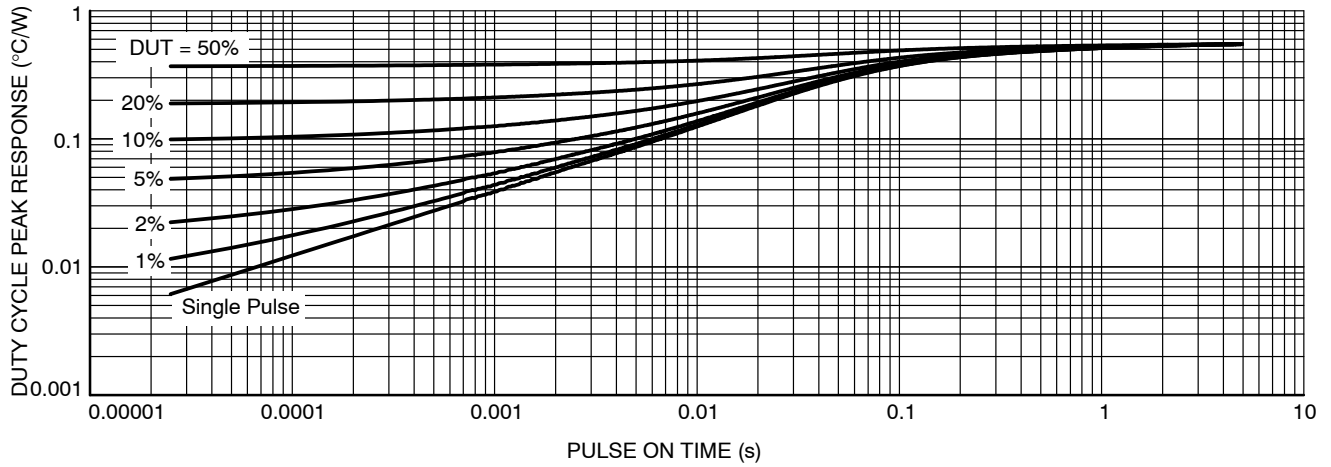


Figure 29. Transient Thermal Impedance (BYPASS DIODE)

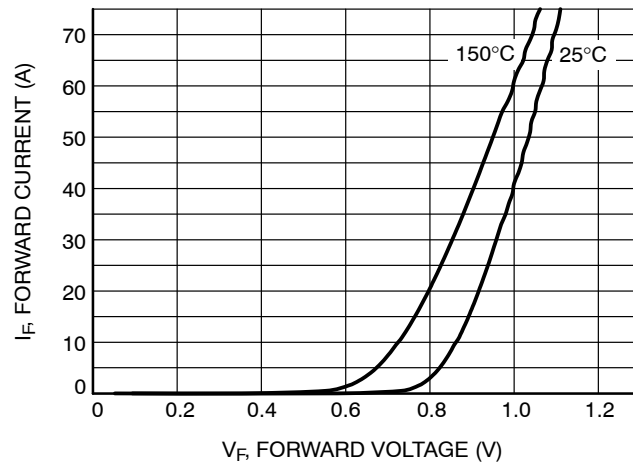


Figure 30. Bypass Diode Forward Characteristics

TYPICAL CHARACTERISTICS – T1/T2/T3 IGBT COMUTATES D4/D5/D6 DIODE

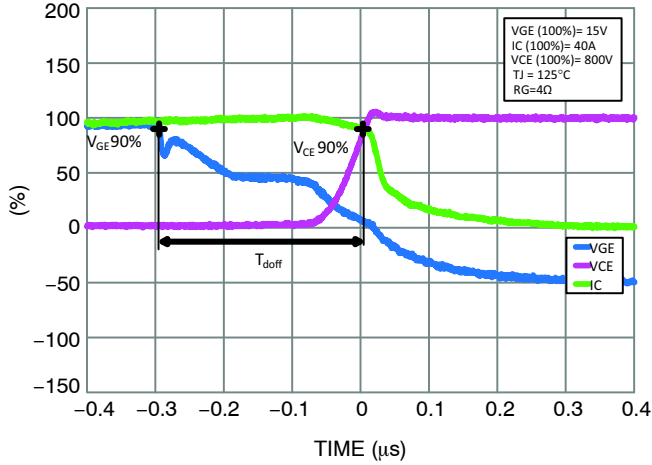


Figure 31. Turn-Off Switching of $T_{D(off)}$

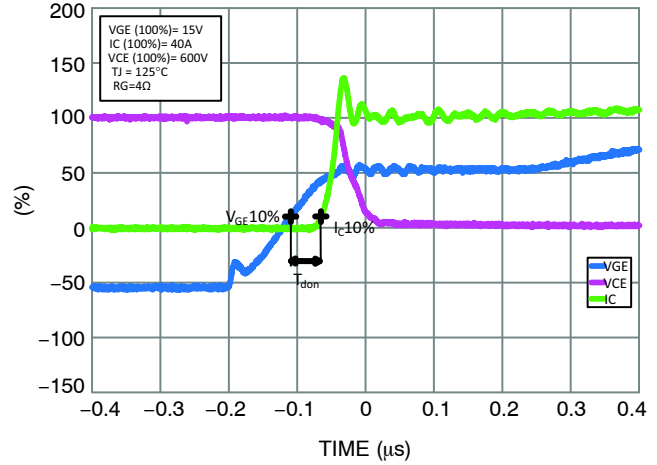


Figure 32. Turn-On Switching of $T_{D(on)}$

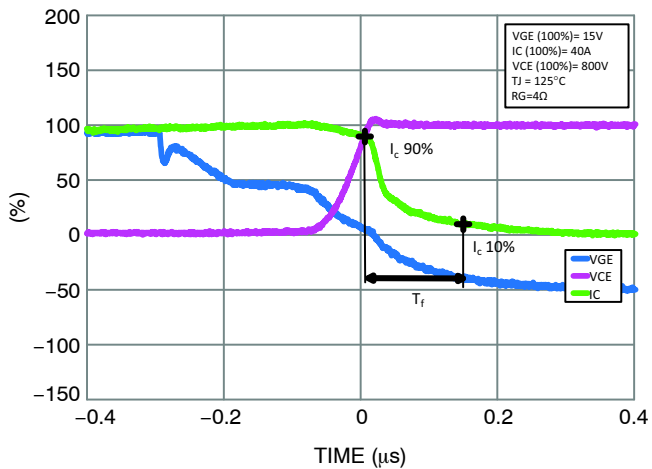


Figure 33. Turn-off Switching of T_f

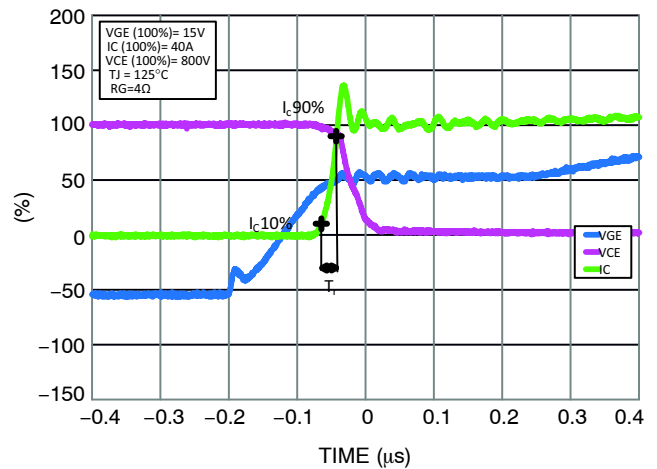


Figure 34. Turn-on Switching of T_r

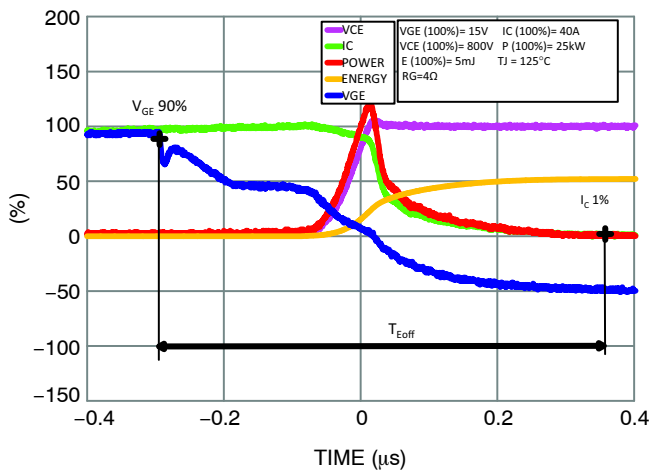


Figure 35. Turn-off Switching of $T_{E(off)}$

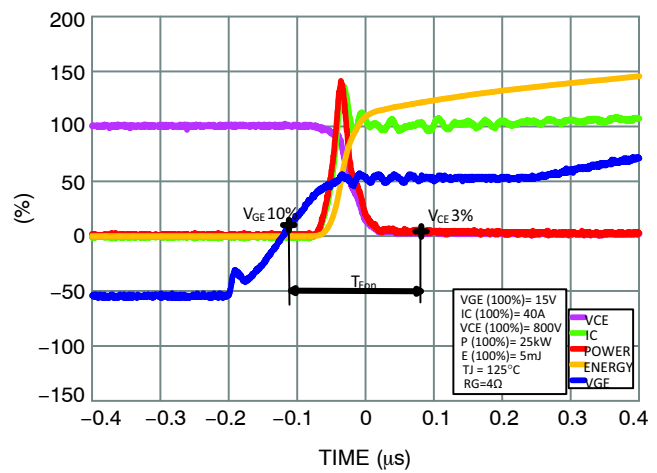


Figure 36. Turn-on Switching of $T_{E(on)}$

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TYPICAL CHARACTERISTICS – T1/T2/T3 IGBT COMMUTATES D4/D5/D6 DIODE

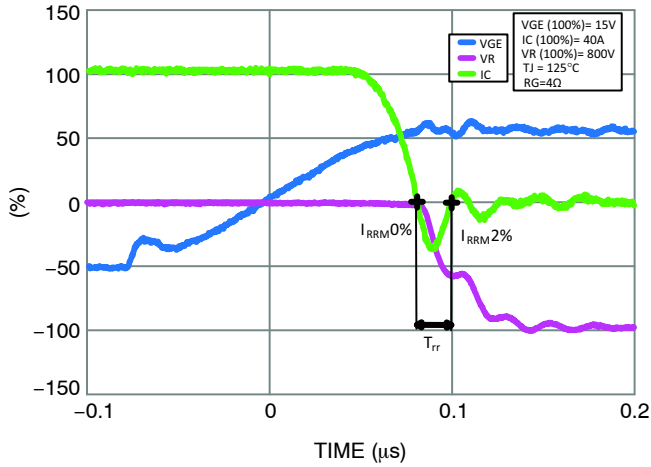


Figure 37. Turn-off Switching of T_{rr}

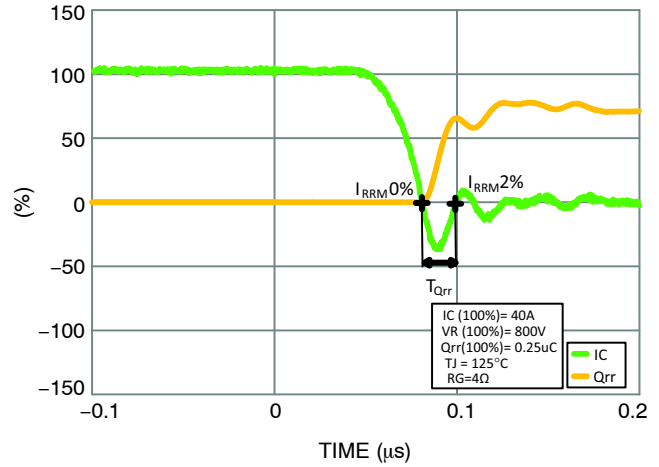


Figure 38. Turn-off Switching of T_{Qrr}

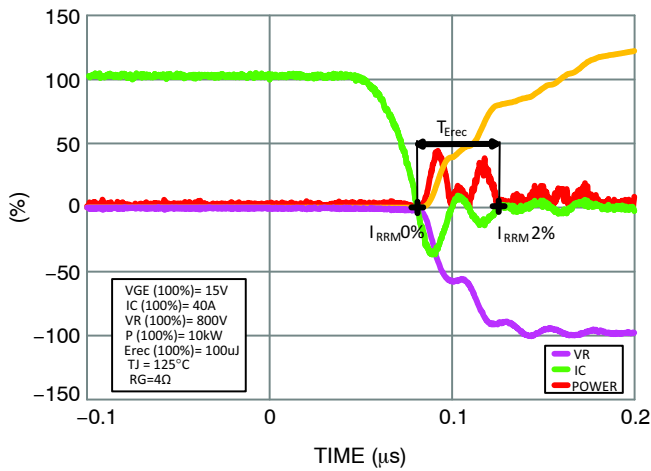


Figure 39. Turn-off Switching of T_{erec}

MECHANICAL CASE OUTLINE

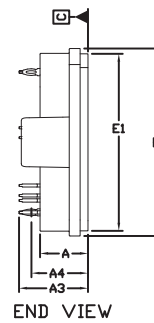
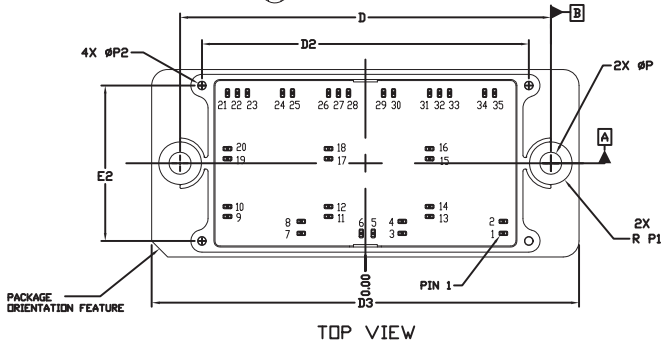
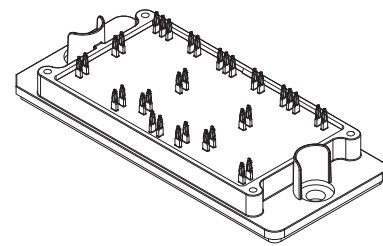
PACKAGE DIMENSIONS

ON Semiconductor®

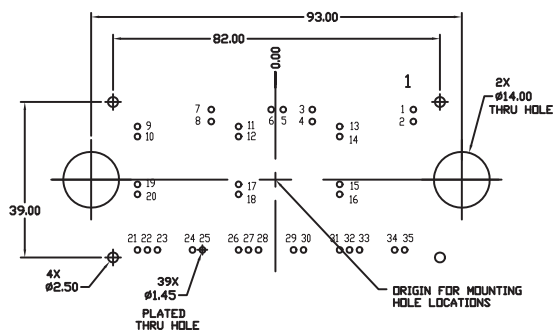
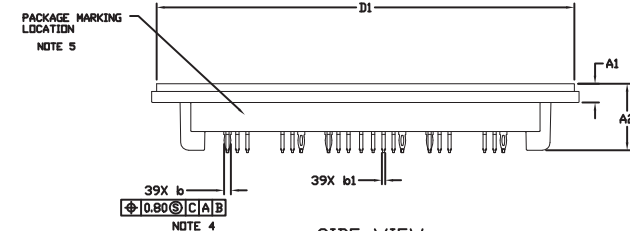
ON

PIM35, 93x47 (PRESS FIT) CASE 180AL ISSUE C

DATE 12 JUN 2018



DIM	MILLIMETERS		
	MIN.	TYP.	MAX.
A	11.70	12.00	12.30
A1	4.40	4.70	5.00
A2	16.40	16.70	17.00
A3	16.90	17.30	17.70
A4	13.97	14.18	14.39
b	1.61	1.66	1.71
b1	0.75	0.80	0.85
D	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	38.80	39.00	39.20
P	5.40	5.50	5.60
P1	5.05	5.35	5.65
P2	2.00	2.20	2.40



RECOMMENDED
MOUNTING PATTERN

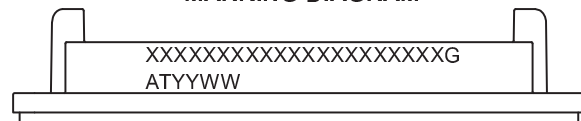
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A4.
4. POSITION OF THE CENTER OF THE TERMINALS IS DETERMINED FROM DATUM B THE CENTER OF DIMENSION D, X DIRECTION, AND FROM DATUM A, Y DIRECTION. POSITIONAL TOLERANCE, AS NOTED IN DRAWING, APPLIES TO EACH TERMINAL IN BOTH DIRECTIONS.
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES.

NOTE 4

PIN	PIN POSITION		PIN	PIN POSITION		PIN	MOUNTING HOLE POSITION		PIN	MOUNTING HOLE POSITION	
	X	Y		X	Y		X	Y		X	Y
1	34.60	-17.60	19	-34.60	1.15	1	34.60	17.60	19	-34.60	-1.15
2	34.60	-14.60	20	-34.60	3.65	2	34.60	14.60	20	-34.60	-3.65
3	9.25	-17.60	21	-34.60	17.60	3	9.25	17.60	21	-34.60	-17.60
4	9.25	-14.60	22	-32.10	17.60	4	9.25	14.60	22	-32.10	-17.60
5	1.95	-17.60	23	-29.60	17.60	5	1.95	17.60	23	-29.60	-17.60
6	-1.05	-17.60	24	-20.80	17.60	6	-1.05	17.60	24	-20.80	-17.60
7	-16.10	-17.60	25	-18.30	17.60	7	-16.10	17.60	25	-18.30	-17.60
8	-16.10	-14.60	26	-9.25	17.60	8	-16.10	14.60	26	-9.25	-17.60
9	-34.60	-13.35	27	-6.75	17.60	9	-34.60	13.35	27	-6.75	-17.60
10	-34.60	-10.85	28	-4.25	17.60	10	-34.60	10.85	28	-4.25	-17.60
11	-9.25	-13.35	29	4.55	17.60	11	-9.25	13.35	29	4.55	-17.60
12	-9.25	-10.85	30	7.05	17.60	12	-9.25	10.85	30	7.05	-17.60
13	16.10	-13.35	31	16.10	17.60	13	16.10	13.35	31	16.10	-17.60
14	16.10	-10.85	32	18.60	17.60	14	16.10	10.85	32	18.60	-17.60
15	16.10	1.15	33	21.10	17.60	15	16.10	-1.15	33	21.10	-17.60
16	16.10	3.65	34	29.90	17.60	16	16.10	-3.65	34	29.90	-17.60
17	-9.25	1.15	35	32.40	17.60	17	-9.25	-1.15	35	32.40	-17.60
18	-9.25	3.65				18	-9.25	-3.65			

GENERIC MARKING DIAGRAM*



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

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

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DESCRIPTION:	PIM35 93X47 (PRESS FIT)	PAGE 1 OF 2

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