

SNXH160B120L2Q0PG

Q0BOOST Module (IGBT Option)

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

Features

- Extremely Efficient Trench with Fieldstop Technology
- Fast Switching SiC Diode
- Module Design Offers High Power Density
- Low Inductive Layout
- Q0BOOST Package with Press-Fit Pins
- This is a Pb-Free Device

Typical Applications

- Solar Inverters
- Uninterruptable Power Supplies

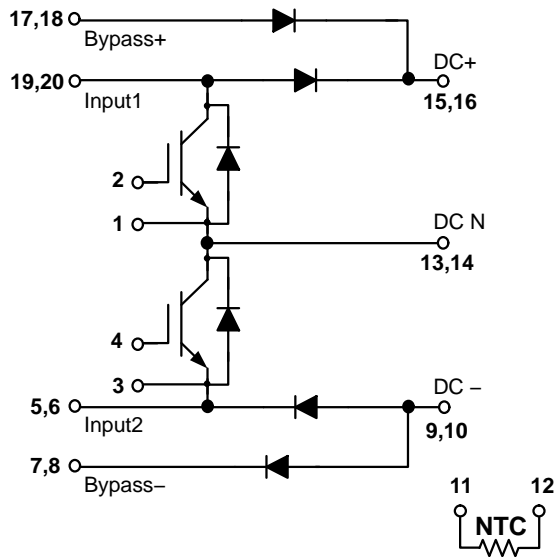


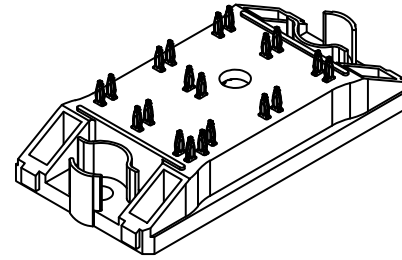
Figure 1. SNXH160B120L2Q0PG Schematic Diagram

This document contains information on some products that are still under development. ON Semiconductor reserves the right to change or discontinue these products without notice.



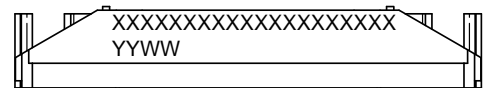
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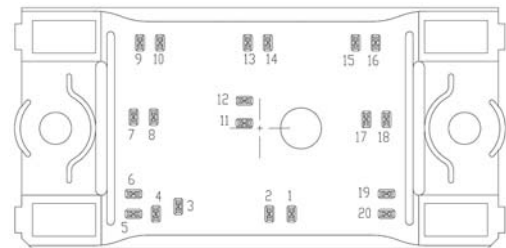
Q0BOOST
CASE 180AF

DEVICE MARKING



XXXXX = Specific Device Code
YYWW = Year and Work Week Code

PIN CONNECTIONS



ORDERING INFORMATION

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

SNXH160B120L2Q0PG

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
BYPASS DIODE (Note 1)			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current, $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	I_F	52	A
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	420	A
Power Dissipation Per Diode $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	P_{tot}	56	W
Maximum Junction Temperature	T_J	150	$^\circ\text{C}$

INPUT BOOST IGBT

Collector-emitter voltage	V_{CES}	1200	V
Continuous Collector current, $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	I_C	75	A
Pulsed collector current, T_{pulse} limited by T_{jmax}	I_{Cpulse}	300	A
Power Dissipation Per IGBT $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	P_{tot}	167	W
Gate-emitter voltage	V_{GE}	± 20	V
Short Circuit Withstand Time $V_{GE} = 15\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J \leq 150^\circ\text{C}$	T_{sc}	10	μs
Maximum Junction Temperature	T_J	175	$^\circ\text{C}$

INPUT BOOST DIODE

Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current, $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	I_F	40	A
Power Dissipation Per Diode $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	P_{tot}	90	W
Maximum Junction Temperature	T_J	175	$^\circ\text{C}$

INPUT BOOST IGBT INVERSE DIODE (Note 1)

Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current, $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	I_F	30	A
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	185	A
Power Dissipation Per Diode $T_J = T_{Jmax}$, $T_h = 80^\circ\text{C}$	P_{tot}	40	W
Maximum Junction Temperature	T_J	150	$^\circ\text{C}$

THERMAL PROPERTIES

Operating Temperature under switching condition	$T_{VJ OP}$	-40 to $(T_{jmax}-25)$	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-40 to 125	$^\circ\text{C}$

INSULATION PROPERTIES

Isolation test voltage, $t = 1\text{ sec}$, 60 Hz	V_{is}	3000	V_{RMS}
Creepage distance		12.7	mm

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.

- T_{Jmax} rated as per die supplier datasheet and reliability testing completed as per die supplier spec.

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ELECTRICAL CHARACTERISTICS

(T_J = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
BYPASS DIODE						
Forward voltage	I _F = 35 A, T _J = 25°C I _F = 35 A, T _J = 125°C	V _F	– –	1.06 0.97	1.65 –	V
Reverse leakage current	V _R = 1600 V, T _J = 25°C V _R = 1600 V, T _J = 125°C	I _R	– –	– –	100 1100	μA
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness = 3 Mil ± 2%, λ = 2.9 W/mK	R _{thJH}	–	1.25	–	K/W

INPUT BOOST IGBT

Collector-emitter saturation voltage	V _{GE} = 15 V, I _C = 80 A, T _J = 25°C V _{GE} = 15 V, I _C = 80 A, T _J = 150°C	V _{CE(sat)}	– –	2.15 2.28	2.7 –	V	
Gate-emitter threshold voltage	V _{GE} = V _{CE} , I _C = 3 mA	V _{GE(TH)}	5.0	5.78	6.5	V	
Collector-emitter cutoff current	V _{GE} = 0 V, V _{CE} = 1200 V	I _{CES}	–	–	400	μA	
Gate leakage current	V _{GE} = 20 V, V _{CE} = 0 V	I _{GES}	–	–	400	nA	
Turn-on delay time	T _J = 25°C V _{CE} = 600 V, I _C = 40 A V _{GE} = ±15 V, R _G = 5 Ω	t _{d(on)}	–	53	–	ns	
Rise time		t _r	–	27	–		
Turn-off delay time		t _{d(off)}	–	188	–		
Fall time		t _f	–	74	–		
Turn on switching loss		E _{on}	–	700	–		μJ
Turn off switching loss		E _{off}	–	1350	–		
Turn-on delay time	T _J = 125°C V _{CE} = 600 V, I _C = 40 A V _{GE} = ±15 V, R _G = 5 Ω	t _{d(on)}	–	49	–	ns	
Rise time		t _r	–	31	–		
Turn-off delay time		t _{d(off)}	–	210	–		
Fall time		t _f	–	149	–		
Turn on switching loss		E _{on}	–	772	–		μJ
Turn off switching loss		E _{off}	–	2700	–		
Input capacitance	V _{CE} = 25 V, V _{GE} = 0 V, f = 10 kHz	C _{ies}	–	16740	–	pF	
Output capacitance		C _{oes}	–	344	–		
Reverse transfer capacitance		C _{res}	–	276	–		
Gate charge total	V _{CE} = 600 V, I _C = 80 A, V _{GE} = 15 V	Q _g	–	660	–	nC	
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness = 3 Mil ± 2%, λ = 2.9 W/mK	R _{thJH}	–	0.568	–	K/W	

INPUT BOOST IGBT INVERSE DIODE

Forward voltage	I _F = 18 A, T _J = 25°C I _F = 18 A, T _J = 125°C	V _F	– –	1.095 1.035	1.6 –	V
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness = 3 Mil ± 2%, λ = 2.9 W/mK	R _{thJH}	–	1.76	–	K/W

INPUT BOOST DIODE

Forward voltage	I _F = 30 A, T _J = 25°C I _F = 30 A, T _J = 150°C	V _F	– –	1.42 1.85	2.0 –	V
Reverse leakage current	V _R = 1200 V	I _R	–	–	750	μA

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ELECTRICAL CHARACTERISTICS

($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
INPUT BOOST DIODE						
Reverse recovery time	$T_J = 25^\circ\text{C}$ $V_R = 600\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 5\ \Omega$	t_{rr}	–	31	–	ns
Reverse recovery charge		Q_{rr}	–	261	–	μC
Peak reverse recovery current		I_{RRM}	–	11.8	–	A
Peak rate of fall of recovery current		di/dt	–	255	–	$\text{A}/\mu\text{s}$
Reverse recovery energy		E_{rr}	–	45	–	μJ
Reverse recovery time	$T_J = 125^\circ\text{C}$ $V_R = 600\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 5\ \Omega$	t_{rr}	–	37	–	ns
Reverse recovery charge		Q_{rr}	–	351	–	μC
Peak reverse recovery current		I_{RRM}	–	12.4	–	A
Peak rate of fall of recovery current		di/dt	–	250	–	$\text{A}/\mu\text{s}$
Reverse recovery energy		E_{rr}	–	50	–	μJ
Thermal Resistance – chip-to–heatsink	Thermal grease, Thickness = 3 Mil \pm 2%, $\lambda = 2.9\text{ W/mK}$	R_{thJH}	–	1.04	–	K/W

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.

THERMISTOR CHARACTERISTICS

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Nominal resistance		R		22		$\text{k}\Omega$
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/K
B–value	$B(25/50)$, tol $\pm 3\%$				3950	K
B–value	$B(25/100)$, tol $\pm 3\%$				3998	K
NTC reference					B	

ORDERING INFORMATION

Device	Marking	Package	Shipping	Comment
SNXH160B120L2Q0PG GenII–Q0BOOST (IGBT Option) Press–fit Pin	SNXH160B120L2Q0PG	Q0BOOST – Case 180AF (Pb–Free and Halide–Free)	24 Units / Blister Tray	With ROHM SiC Diode
SNXH160B120L2Q0PG–N GenII–Q0BOOST (IGBT Option) Press–fit Pin (In Development)	SNXH160B120L2Q0PG–N	Q0BOOST – Case 180AF (Pb–Free and Halide–Free)	24 Units / Blister Tray	With ON Semiconductor SiC Diode

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TYPICAL CHARACTERISTICS – BOOST IGBT & BOOST DIODE

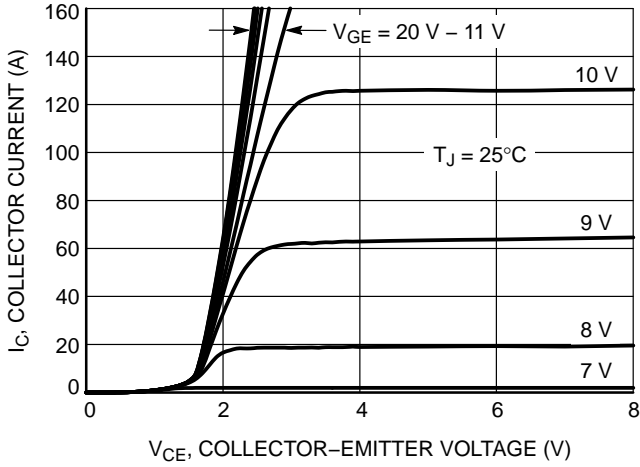


Figure 2. IGBT Typical Output Characteristics

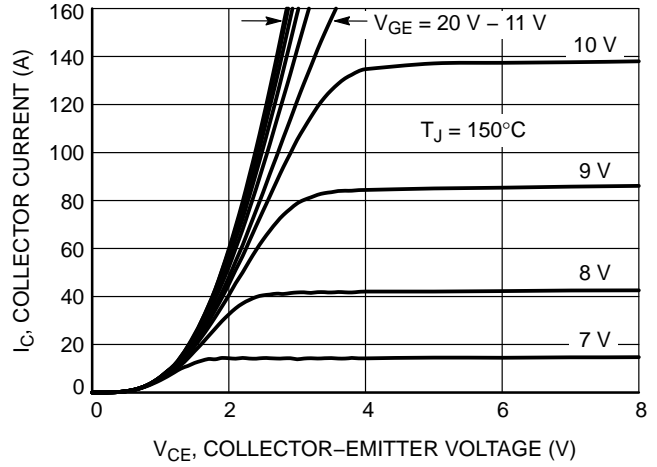


Figure 3. IGBT Typical Output Characteristics

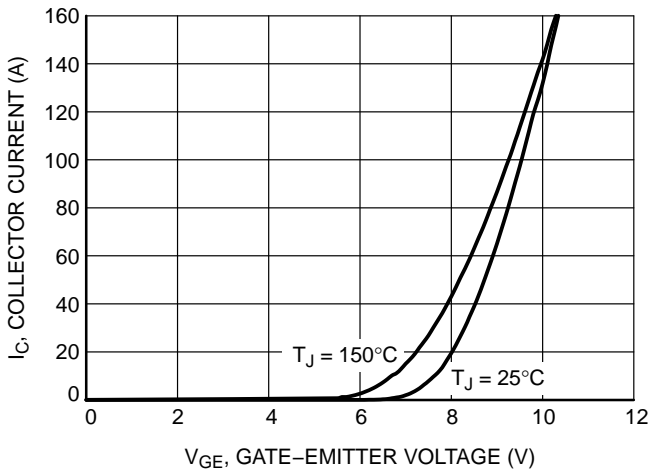


Figure 4. IGBT Typical Transfer Characteristics

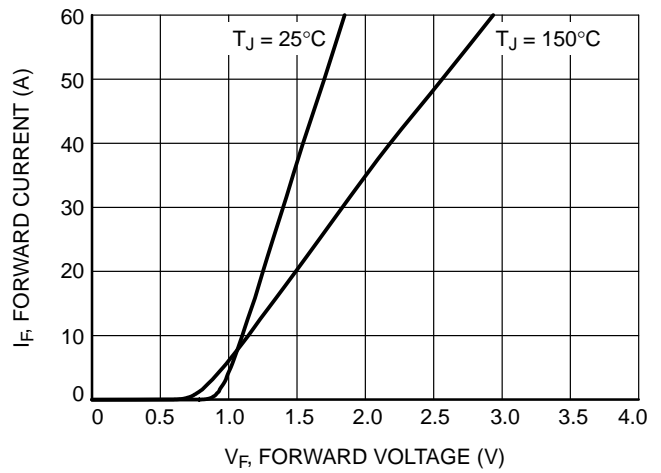


Figure 5. Diode Typical Forward Characteristics

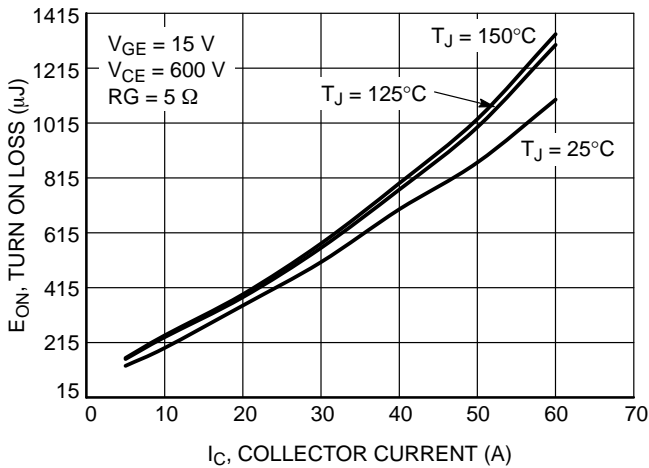


Figure 6. Typical Turn On Loss vs. I_C

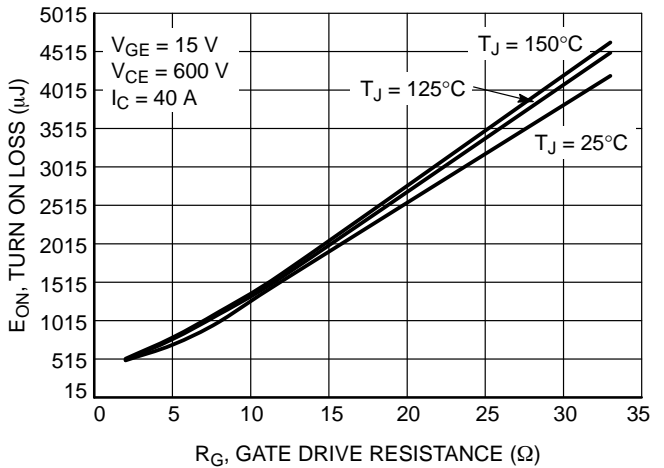


Figure 7. Typical Turn On Loss vs. R_G

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TYPICAL CHARACTERISTICS – BOOST IGBT & BOOST DIODE

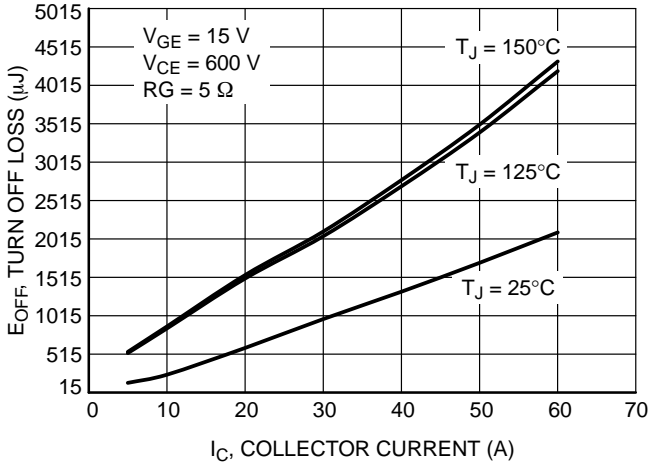


Figure 8. Typical Turn Off Loss vs. I_C

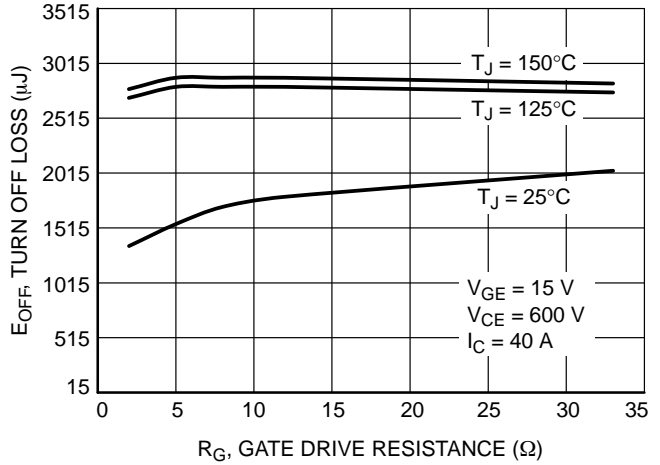


Figure 9. Typical Turn Off Loss vs. R_G

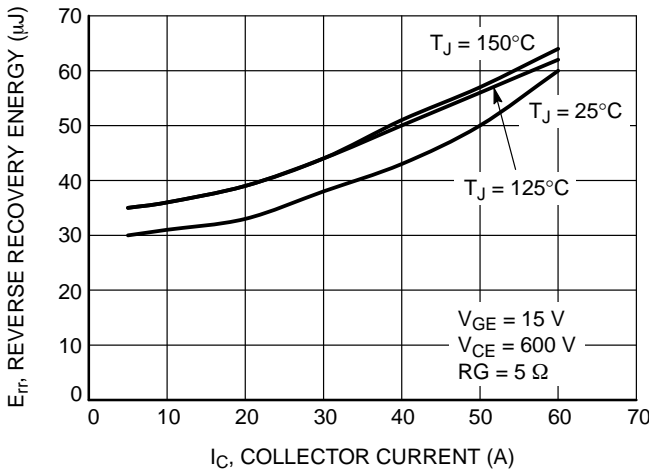


Figure 10. Typical Reverse Recovery Energy vs. I_C

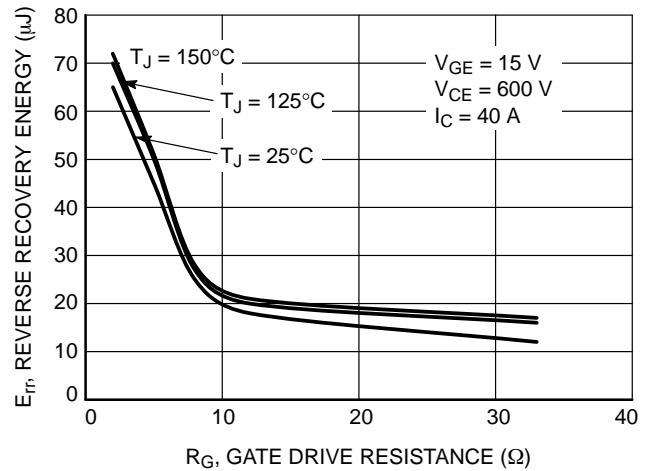


Figure 11. Typical Reverse Recovery Energy vs. R_G

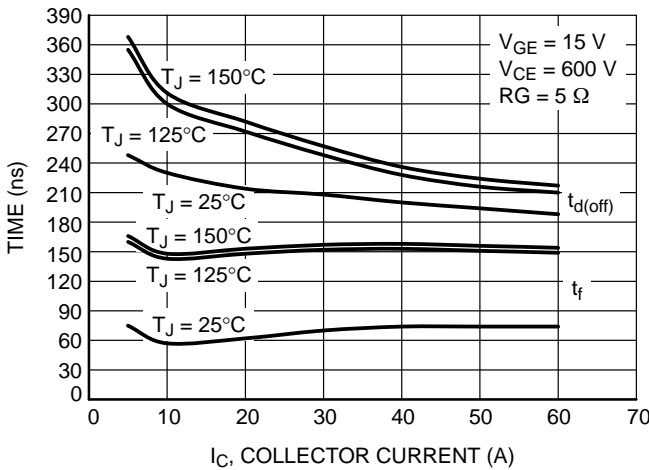


Figure 12. Typical Switching Times vs. I_C

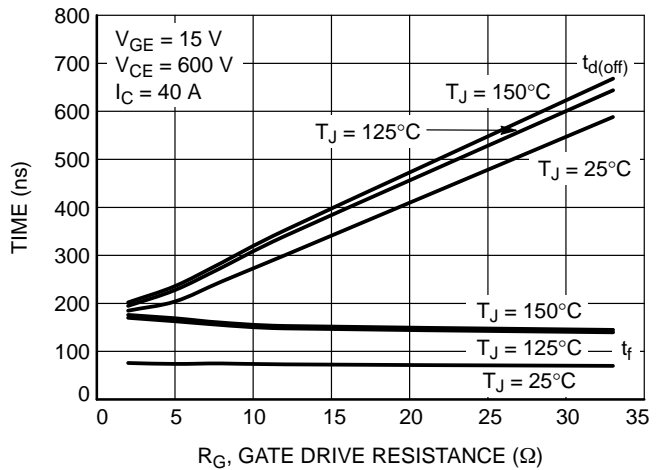


Figure 13. Typical Switching Times vs. R_G

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TYPICAL CHARACTERISTICS – BOOST IGBT & BOOST DIODE

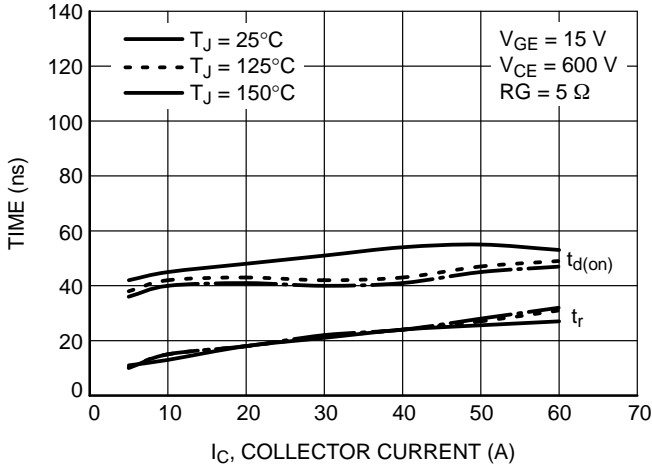


Figure 14. Typical Switching Times vs. I_C

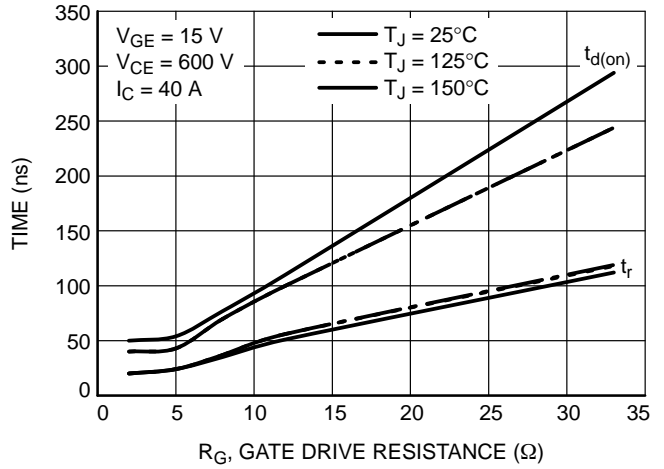


Figure 15. Typical Switching Times vs. R_G

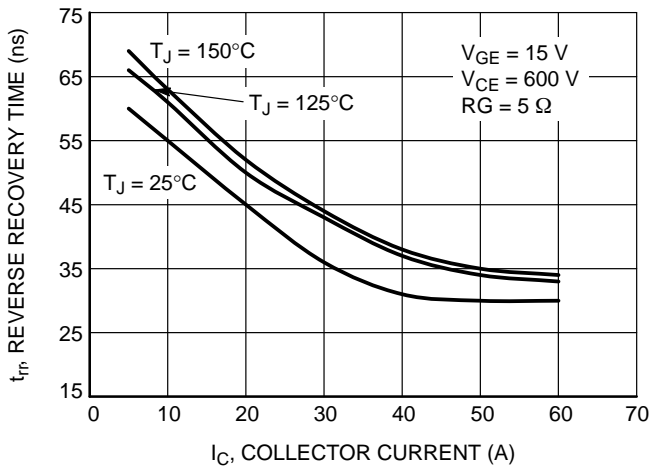


Figure 16. Typical Reverse Recovery Time vs. I_C

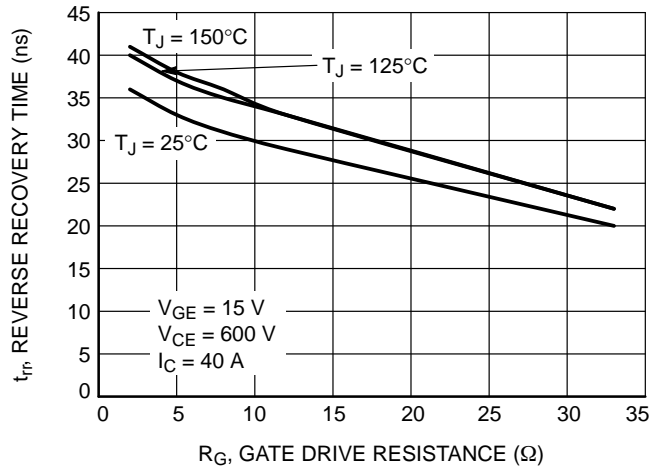


Figure 17. Typical Reverse Recovery Time vs. R_G

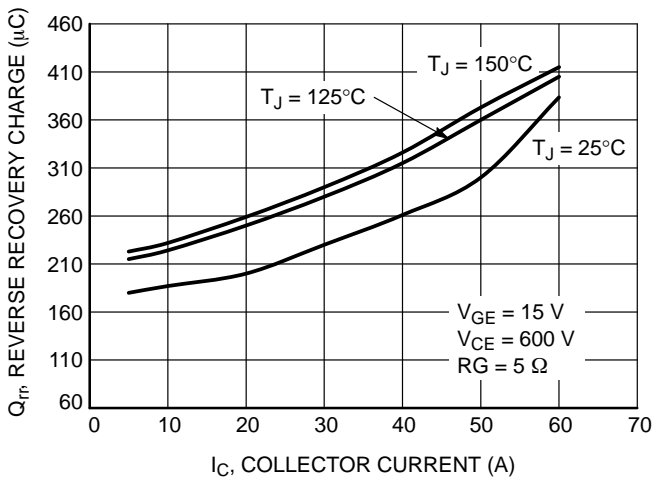


Figure 18. Typical Reverse Recovery Charge vs. I_C

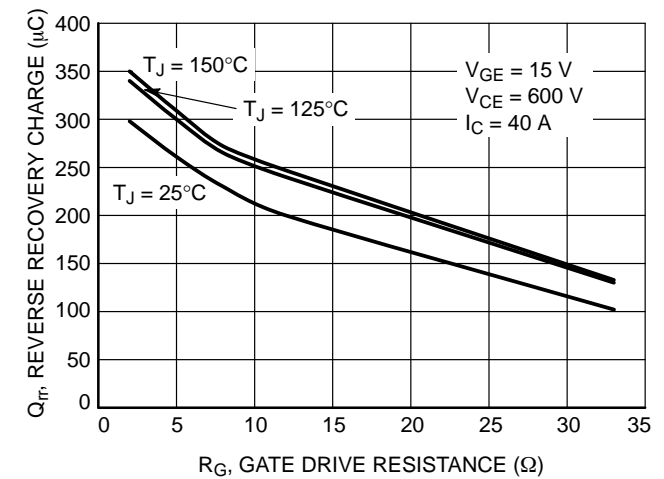


Figure 19. Typical Reverse Recovery Charge vs. R_G

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TYPICAL CHARACTERISTICS – BOOST IGBT & BOOST DIODE

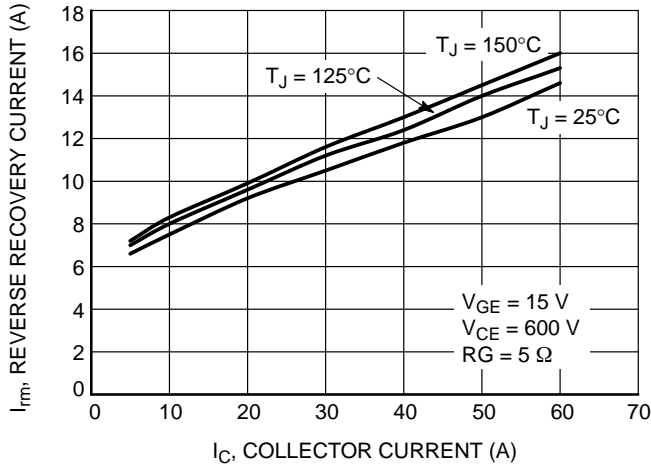


Figure 20. Typical Reverse Recovery Peak Current vs. I_C

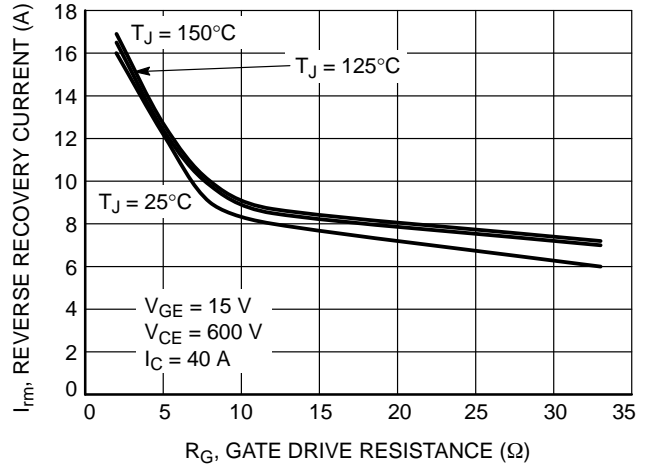


Figure 21. Typical Reverse Recovery Peak Current vs. R_G

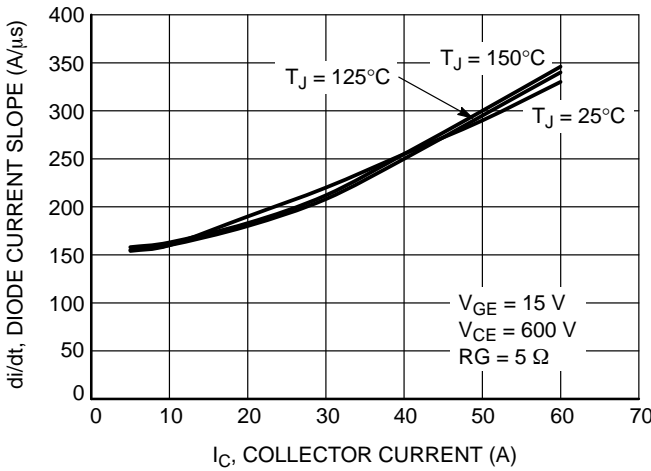


Figure 22. Typical Diode Current Slope vs. I_C

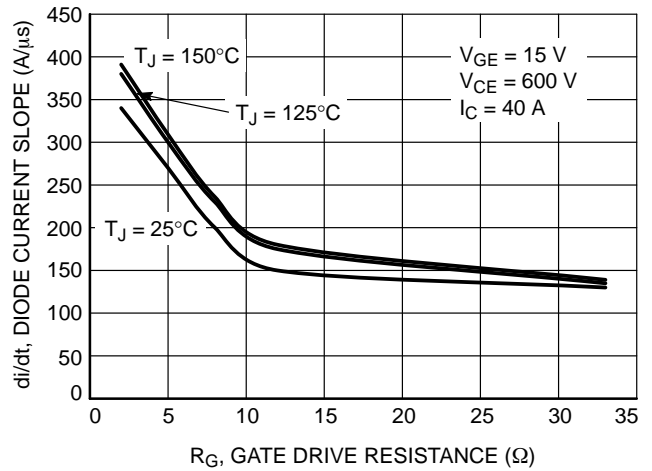


Figure 23. Typical Diode Current Slope vs. R_G

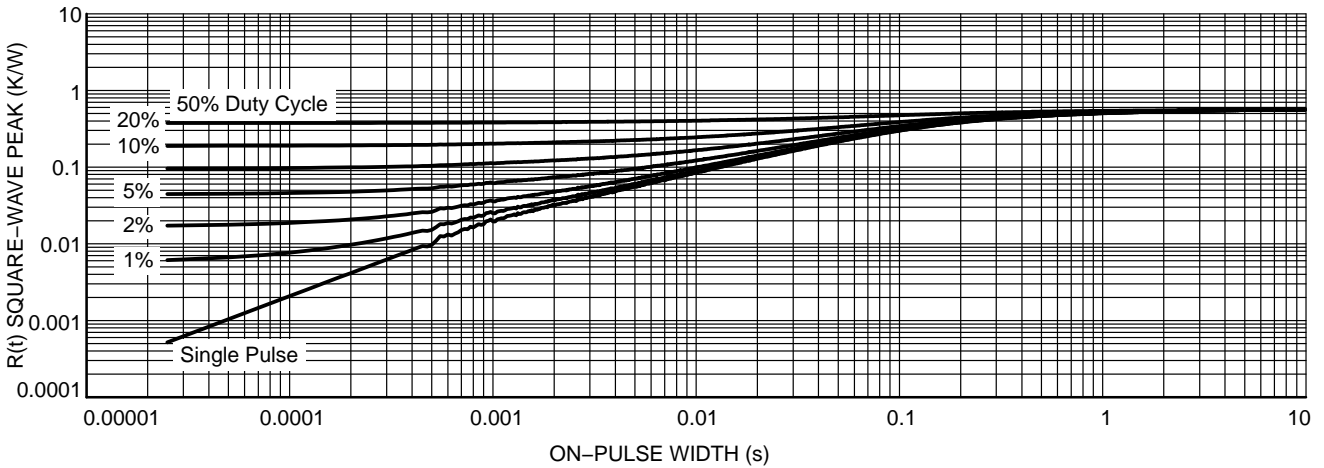


Figure 24. IGBT Transient Thermal Resistance

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TYPICAL CHARACTERISTICS – BOOST IGBT & BOOST DIODE

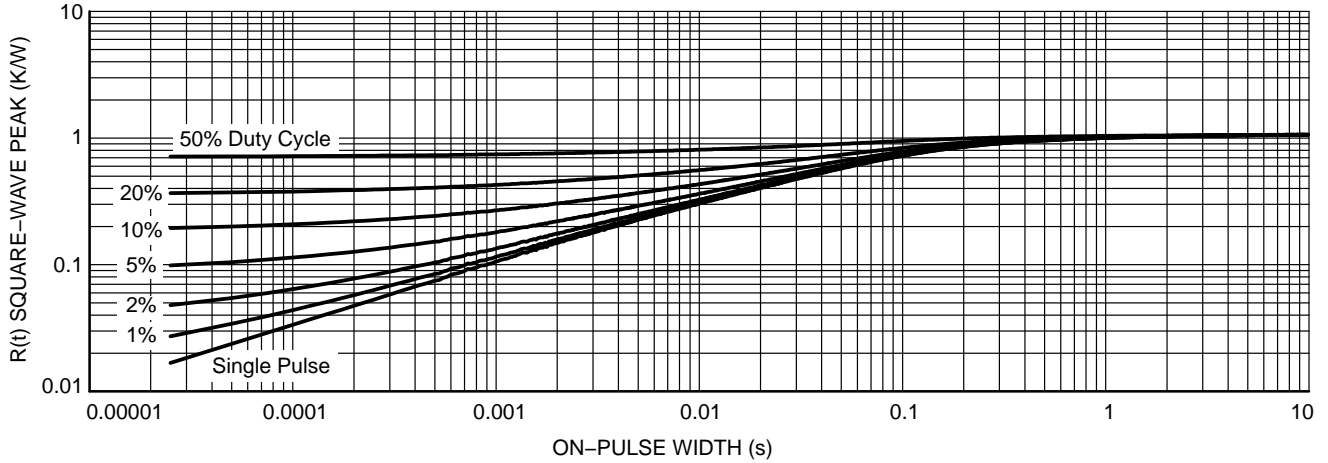


Figure 25. Diode Transient Thermal Impedance

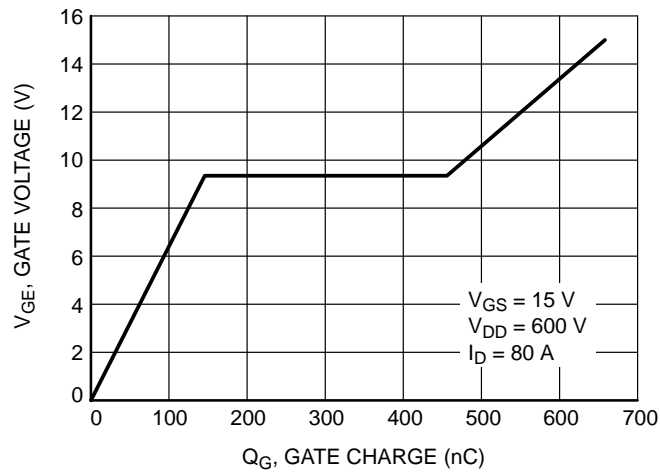


Figure 26. IGBT Gate Voltage vs. Gate Charge

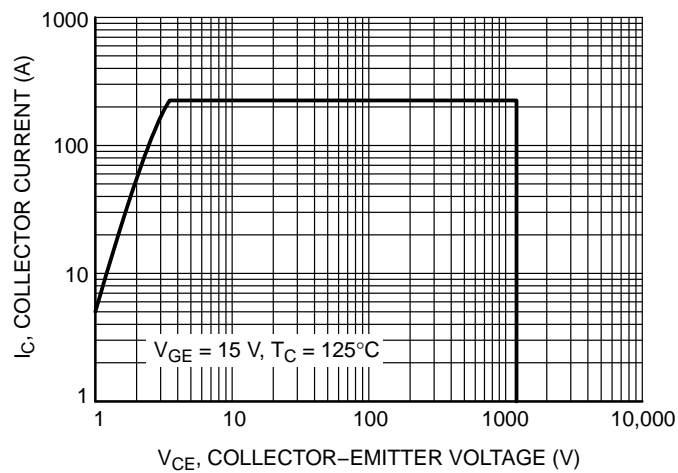


Figure 27. Safe Operating Area

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TYPICAL CHARACTERISTICS – IGBT INVERSE DIODE

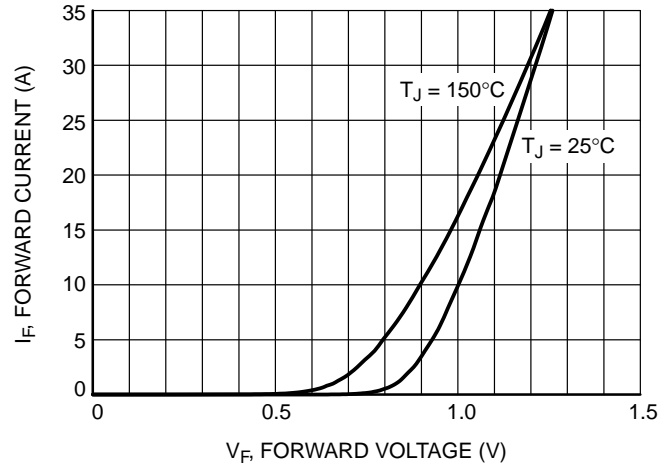


Figure 28. Diode Typical Forward Characteristics

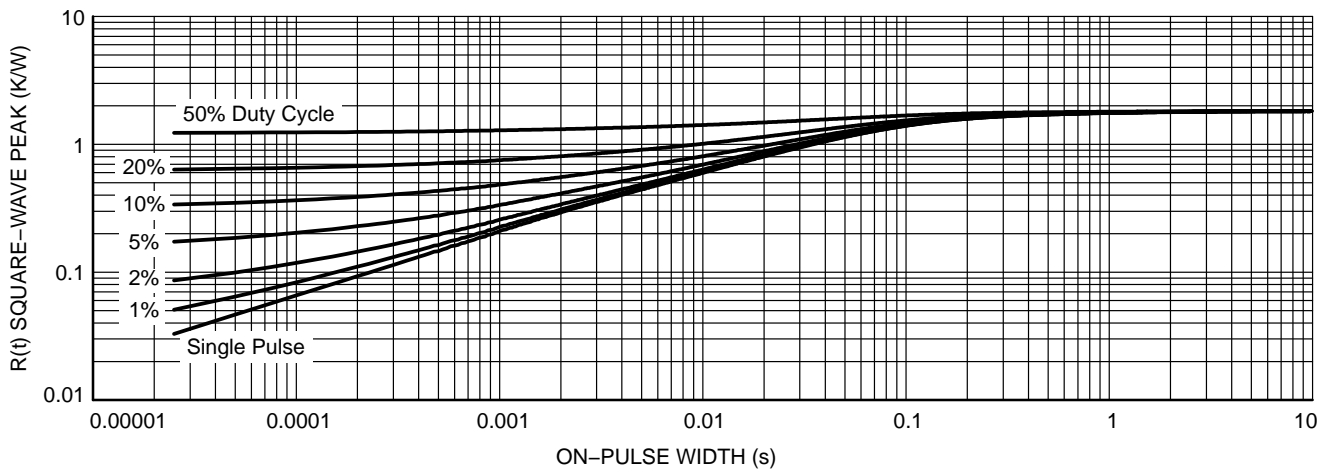


Figure 29. Diode Transient Thermal Impedance

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TYPICAL CHARACTERISTICS – BYPASS DIODE

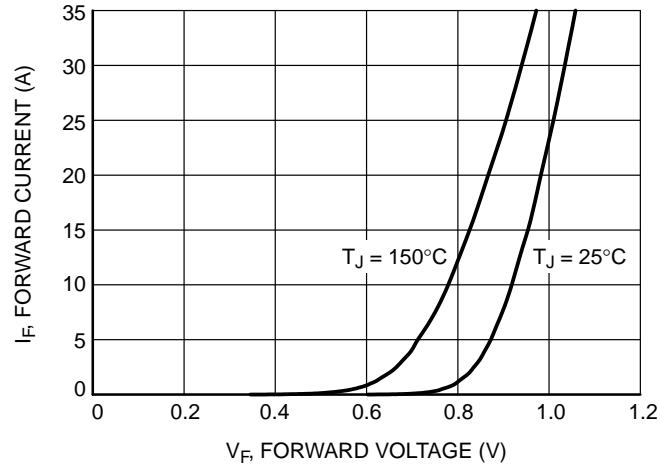


Figure 30. Diode Typical Forward Characteristics

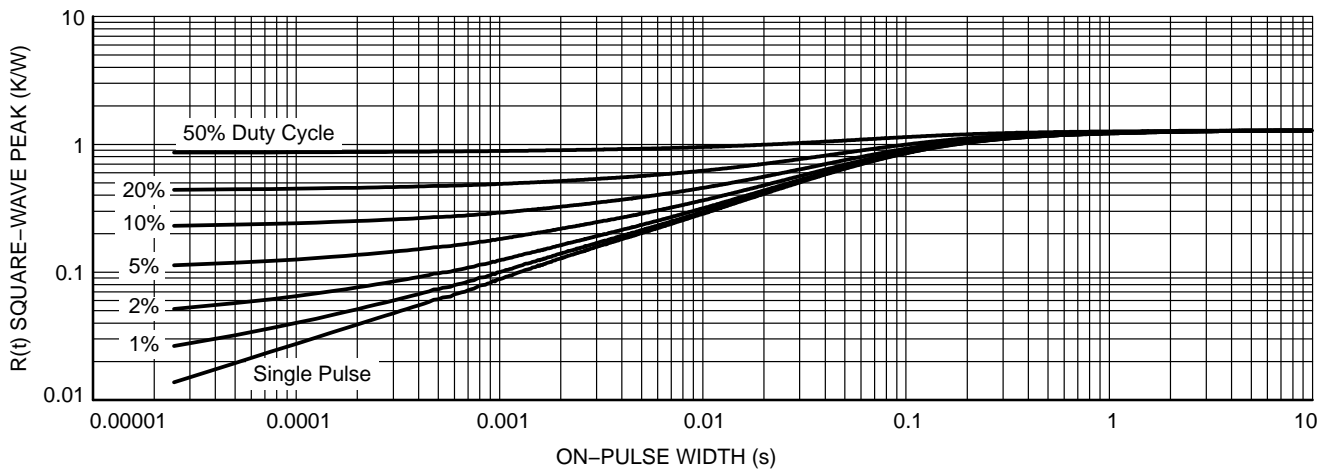


Figure 31. Diode Transient Thermal Impedance

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TYPICAL CHARACTERISTICS - THERMISTOR

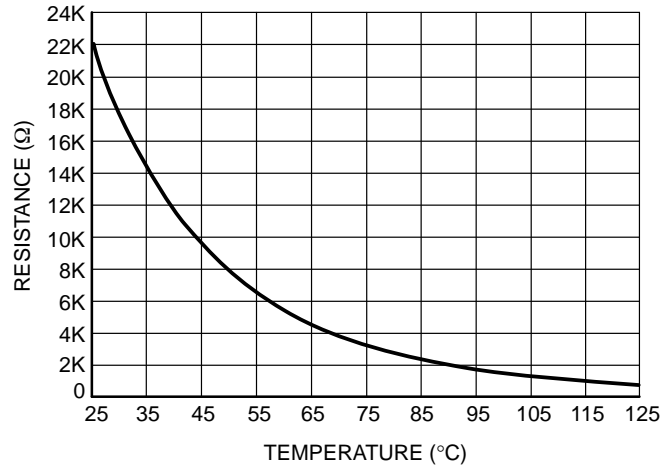


Figure 32. Thermistor Characteristics

SWITCHING WAVEFORMS AND DEFINITIONS – BOOST IGBT & BOOST DIODE

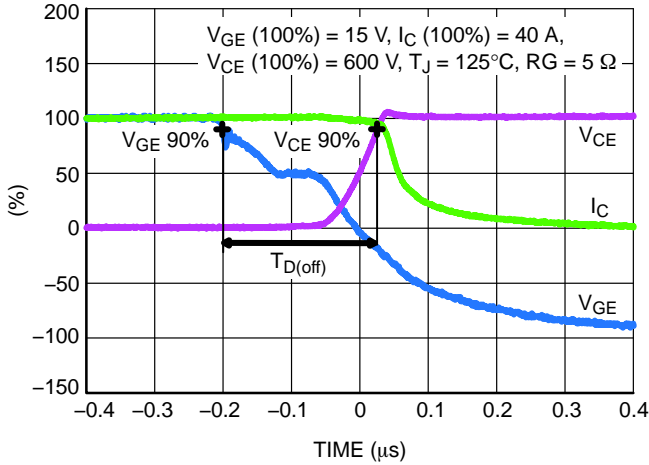


Figure 33. Turn-off Switching Waveforms and Definition of $T_{D(off)}$

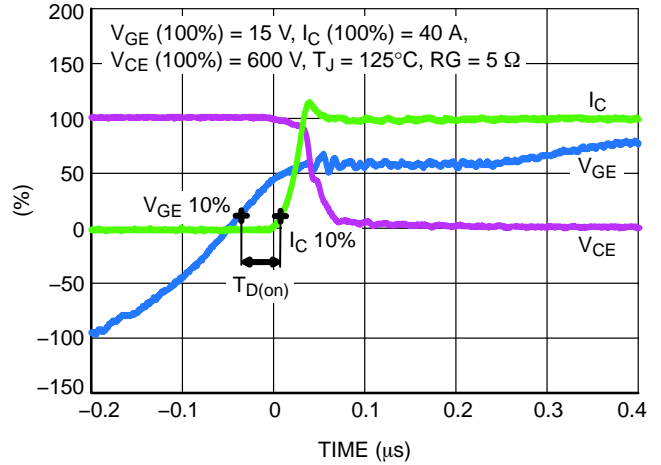


Figure 34. Turn-on Switching Waveforms and Definition of $T_{D(on)}$

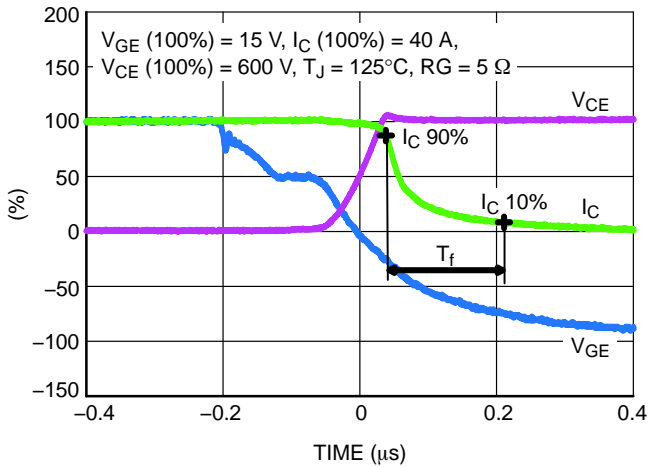


Figure 35. Turn-off Switching Waveforms and Definition of T_f

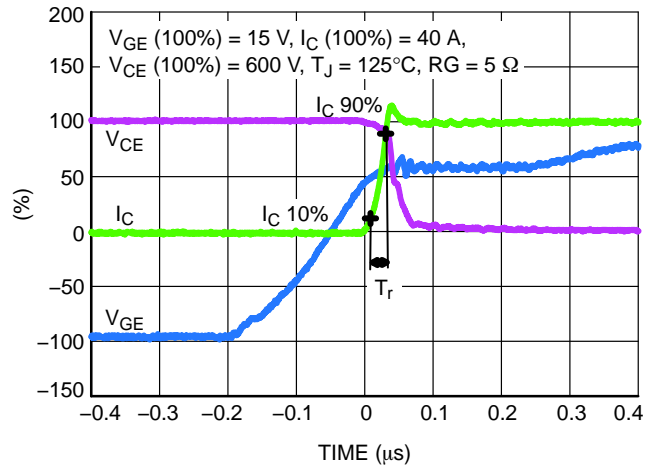


Figure 36. Turn-on Switching Waveforms and Definition of T_r

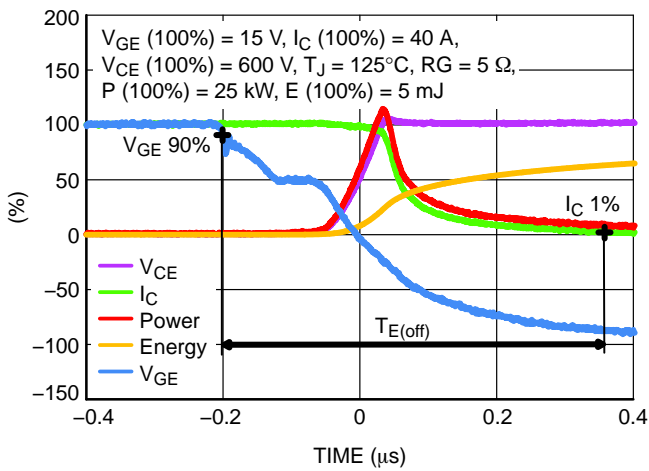


Figure 37. Turn-off Switching Waveforms and Definition of $T_{E(off)}$

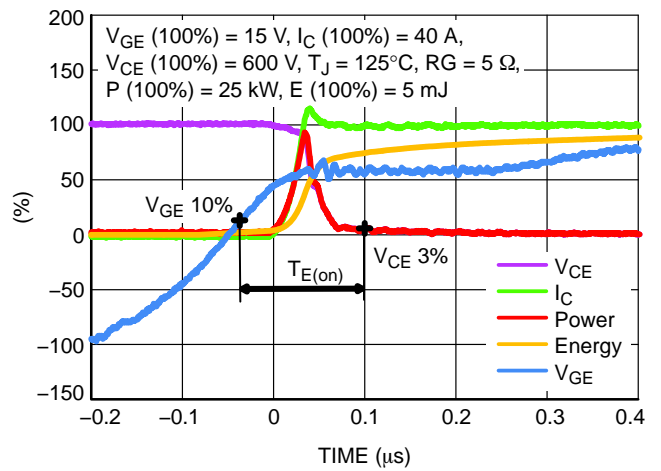


Figure 38. Turn-on Switching Waveforms and Definition of $T_{E(on)}$

SWITCHING WAVEFORMS AND DEFINITIONS – BOOST IGBT & BOOST DIODE

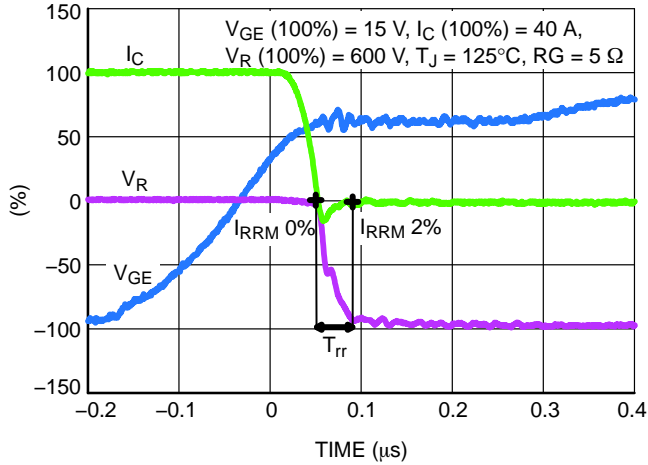


Figure 39. Turn-off Switching Waveforms and Definition of T_{rr}

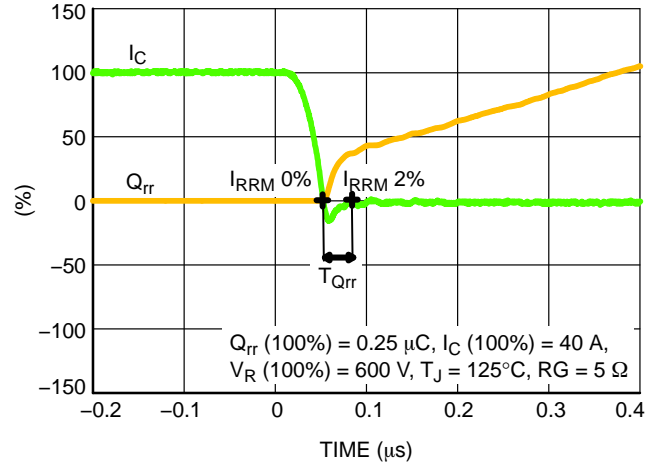


Figure 40. Turn-off Switching Waveforms and Definition of T_{Qrr}

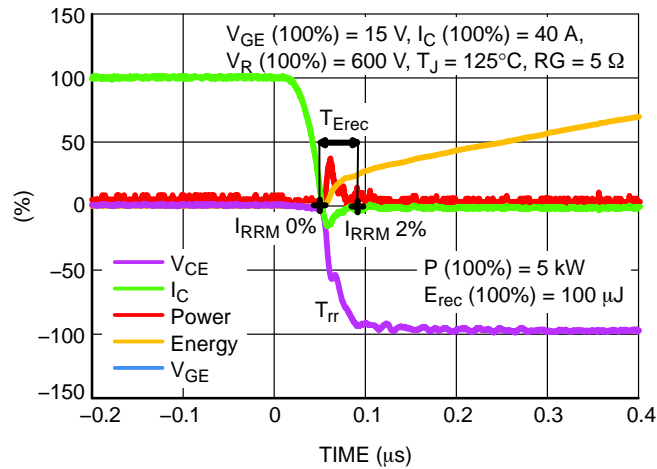
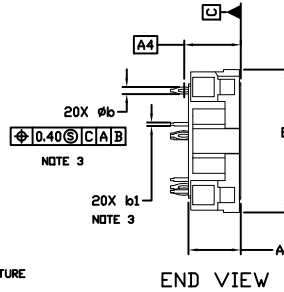
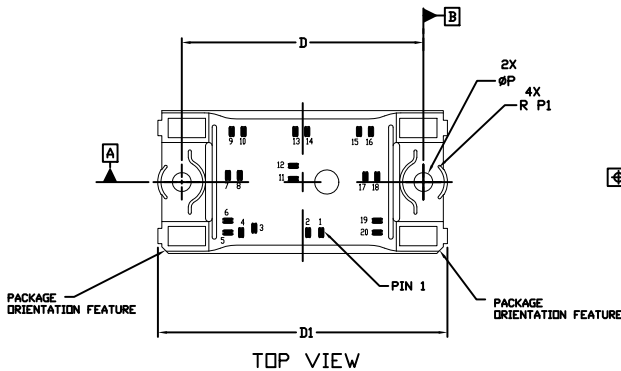


Figure 41. Turn-off Switching Waveforms and Definition of T_{Erec}

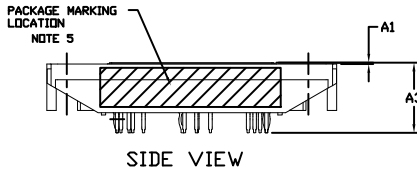
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PACKAGE DIMENSIONS

PIM20, 55x32.5 / Q0BOOST
CASE 180AF
ISSUE O

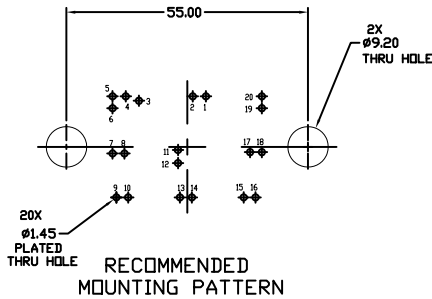


DIM	MILLIMETERS	
	MIN.	NDM.
A	11.70	12.10
A1	0.00	0.60
A3	15.50	16.50
A4	12.88	BSC
b	1.61	1.71
b1	0.75	0.85
D	54.80	55.20
D1	65.70	70.10
E	32.30	32.70
P	4.10	4.50
P1	4.55	4.95



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 THE 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	
	X	Y		X	Y
1	4.25	-11.50	11	-2.10	0.70
2	1.25	-11.50	12	-2.10	3.70
3	-11.00	-10.50	13	-1.65	11.50
4	-14.00	-11.50	14	1.05	11.50
5	-17.00	-11.50	15	12.85	11.50
6	-17.00	-8.80	16	15.55	11.50
7	-17.00	1.50	17	14.30	1.20
8	-14.30	1.50	18	17.00	1.20
9	-16.15	11.50	19	17.00	-8.80
10	-13.45	11.50	20	17.00	-11.50

MOUNTING HOLE POSITIONS

PIN	HOLE POSITION		PIN	HOLE POSITION	
	X	Y		X	Y
1	4.25	11.50	11	-2.10	-0.70
2	1.25	11.50	12	-2.10	-3.70
3	-11.00	10.50	13	-1.65	-11.50
4	-14.00	11.50	14	1.05	-11.50
5	-17.00	11.50	15	12.85	-11.50
6	-17.00	8.80	16	15.55	-11.50
7	-17.00	-1.50	17	14.30	-1.20
8	-14.30	-1.50	18	17.00	-1.20
9	-16.15	-11.50	19	17.00	8.80
10	-13.45	-11.50	20	17.00	11.50

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