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

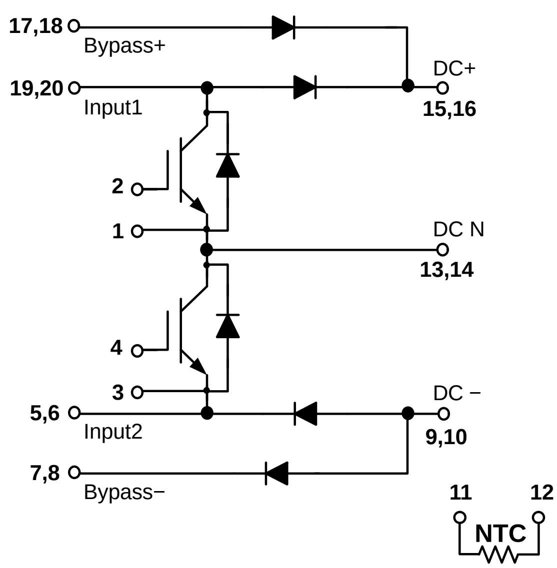
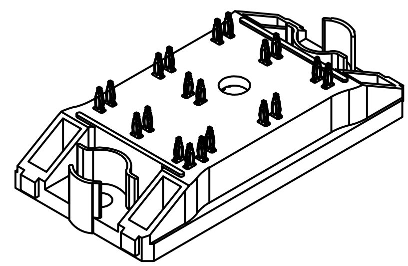


Figure 1. SNXH160B120L2Q0PG Schematic Diagram

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.

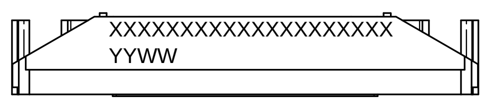
ON Semiconductor®

www.onsemi.com



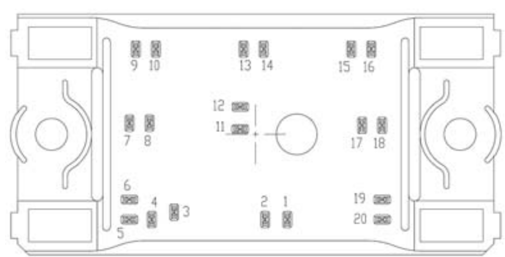
Q0BOOST
CASE 180AF

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.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
BYPASS DIODE (Note 1)			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current, $T_J = T_{Jmax}$, $T_h = 80°C$	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 $T_J = T_{Jmax}$, $T_h = 80°C$	P_{tot}	56	W
Maximum Junction Temperature	T_J	150	°C
INPUT BOOST IGBT			
Collector−emitter voltage	V_{CES}	1200	V
Continuous Collector current, $T_J = T_{Jmax}$, $T_h = 80°C$	I_C	75	A
Pulsed collector current, T_{pulse} limited by T_{jmax}	I_{Cpulse}	300	A
Power Dissipation Per IGBT $T_J = T_{Jmax}$, $T_h = 80°C$	P_{tot}	167	W
Gate−emitter voltage	V_{GE}	±20	V
Short Circuit Withstand Time $V_{GE} = 15$ V, $V_{CE} = 600$ V, $T_J \leq 150°C$	T_{sc}	10	µs
Maximum Junction Temperature	T_J	175	°C
INPUT BOOST DIODE			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current, $T_J = T_{Jmax}$, $T_h = 80°C$	I_F	40	A
Power Dissipation Per Diode $T_J = T_{Jmax}$, $T_h = 80°C$	P_{tot}	90	W
Maximum Junction Temperature	T_J	175	°C
INPUT BOOST IGBT INVERSE DIODE (Note 1)			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current, $T_J = T_{Jmax}$, $T_h = 80°C$	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 $T_J = T_{Jmax}$, $T_h = 80°C$	P_{tot}	40	W
Maximum Junction Temperature	T_J	150	°C
THERMAL PROPERTIES			
Operating Temperature under switching condition	$T_{VJ\ OP}$	−40 to (T_{jmax}−25)	°C
Storage Temperature Range	T_{stg}	−40 to 125	°C
INSULATION PROPERTIES			
Isolation test voltage, t = 1 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.

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

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, VGE = 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, IC = 80 A, VGE = 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

ELECTRICAL CHARACTERISTICS

(T_J = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
INPUT BOOST DIODE						
Reverse recovery time	T_J = 25°C V_R = 600 V, I_C = 40 A V_{GE} = ±15 V, R_G = 5 Ω	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	–	A/μs
Reverse recovery energy		E_{rr}	–	45	–	μJ
Reverse recovery time	T_J = 125°C V_R = 600 V, I_C = 40 A V_{GE} = ±15 V, R_G = 5 Ω	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	–	A/μs
Reverse recovery energy		E_{rr}	–	50	–	μJ
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness = 3 Mil ± 2%, λ = 2.9 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		kΩ
Nominal resistance	T = 100°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 ±3%				3950	K
B−value	B(25/100), tol ±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

TYPICAL CHARACTERISTICS − BOOST IGBT & BOOST DIODE

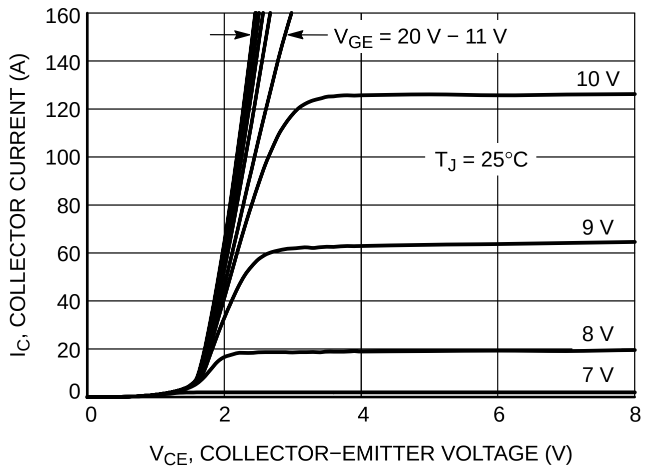


Figure 2. IGBT Typical Output Characteristics

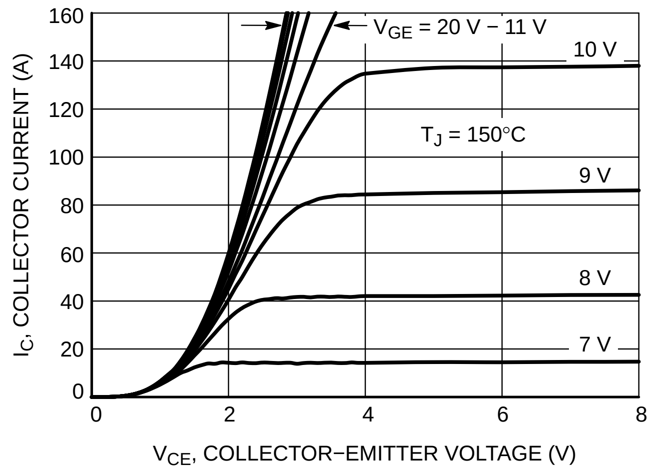


Figure 3. IGBT Typical Output Characteristics

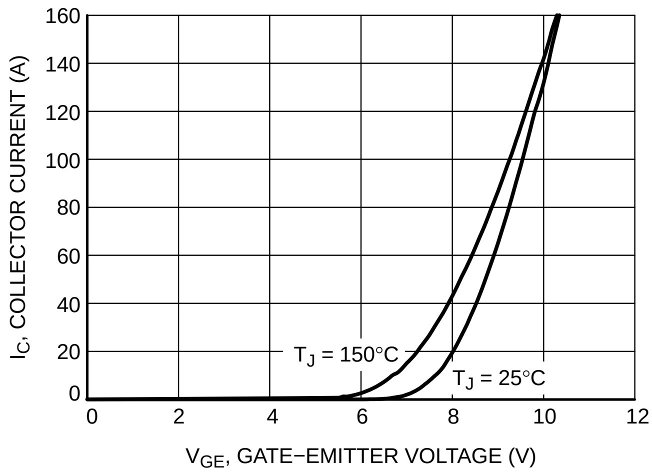


Figure 4. IGBT Typical Transfer Characteristics

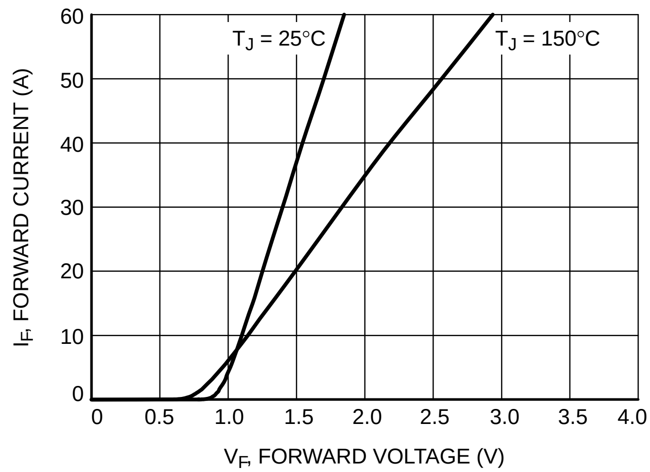


Figure 5. Diode Typical Forward Characteristics

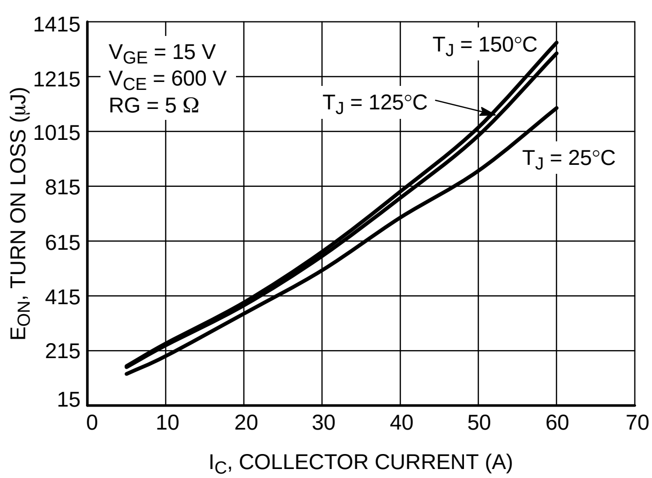


Figure 6. Typical Turn On Loss vs. I_C

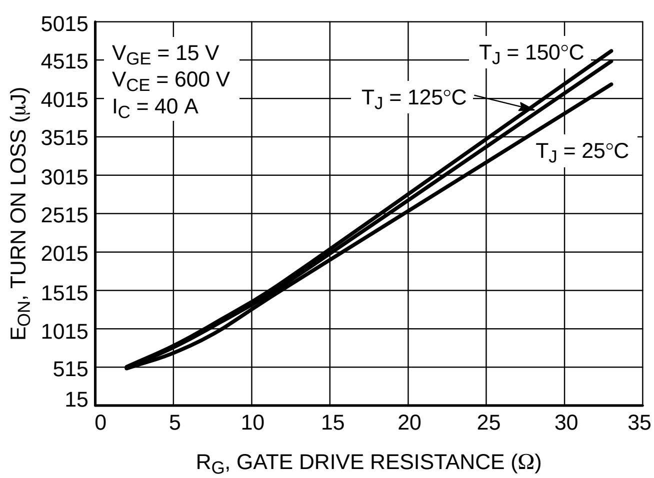


Figure 7. Typical Turn On Loss vs. R_G

TYPICAL CHARACTERISTICS − BOOST IGBT & BOOST DIODE

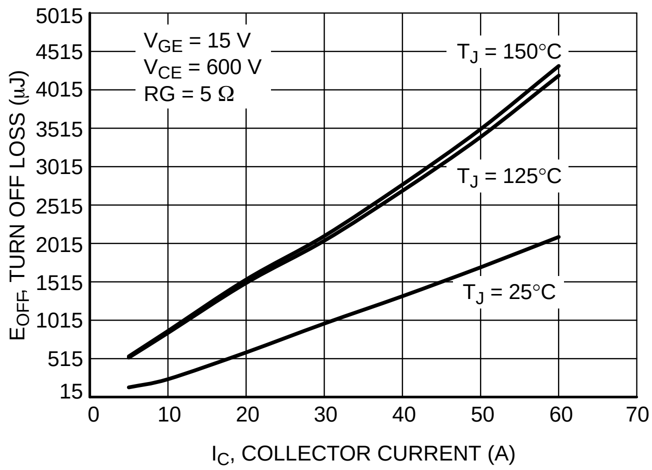


Figure 8. Typical Turn Off Loss vs. I_C

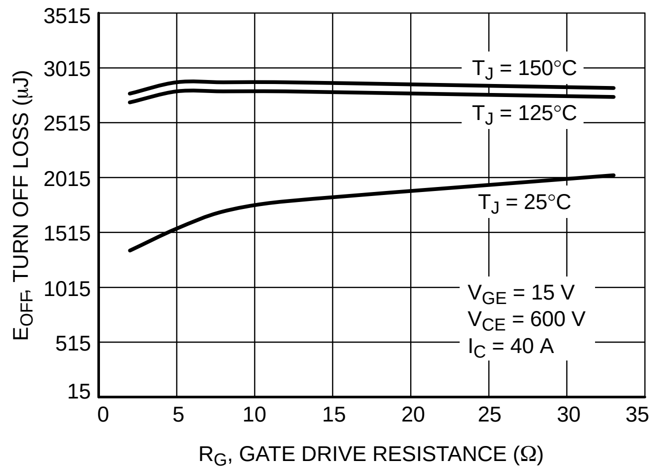


Figure 9. Typical Turn Off Loss vs. R_G

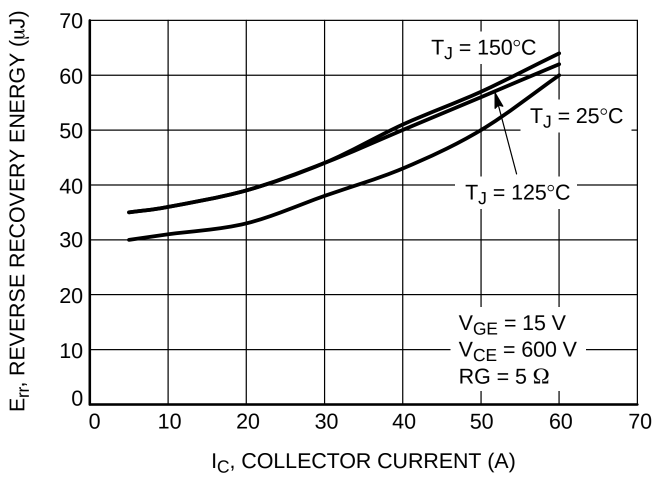


Figure 10. Typical Reverse Recovery Energy vs. IC

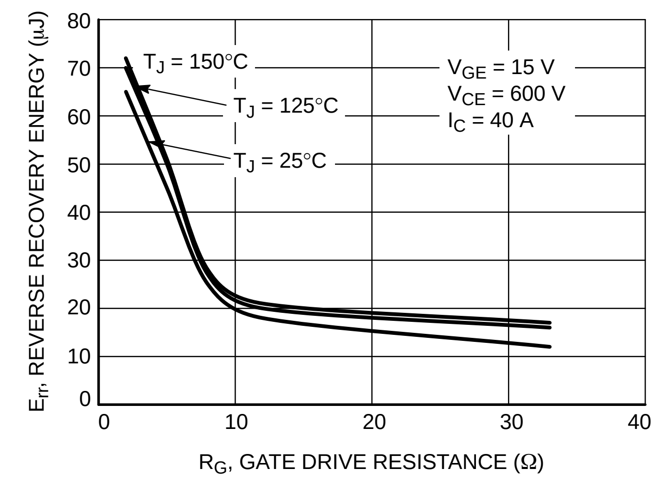


Figure 11. Typical Reverse Recovery Energy vs. R_G

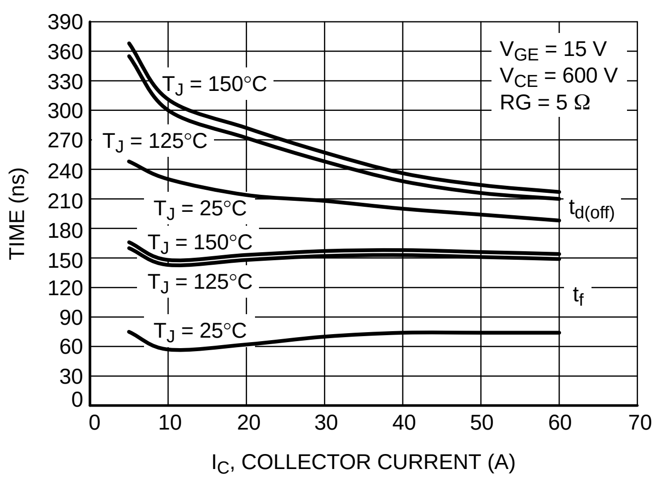


Figure 12. Typical Switching Times vs. I_C

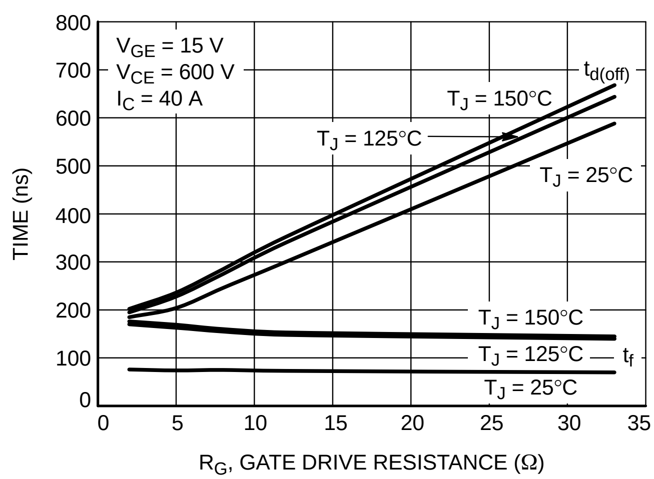


Figure 13. Typical Switching Times vs. R_G

TYPICAL CHARACTERISTICS − BOOST IGBT & BOOST DIODE

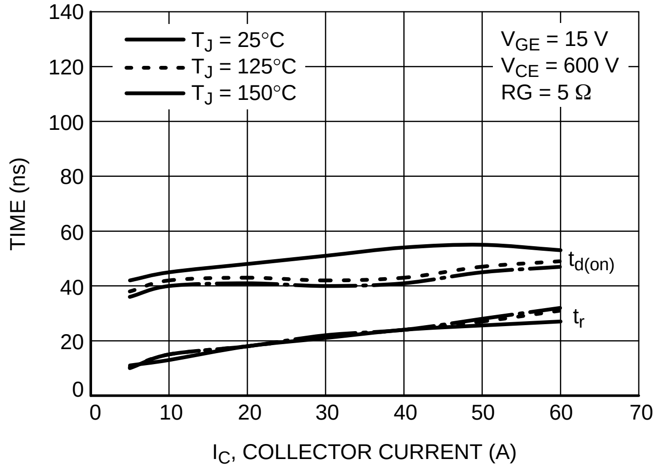


Figure 14. Typical Switching Times vs. I_C

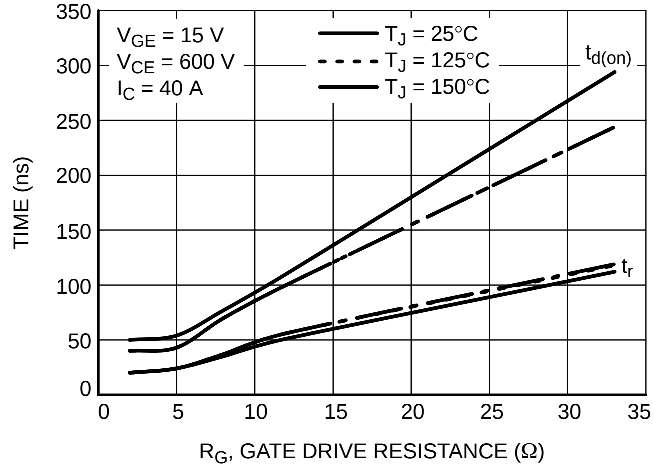


Figure 15. Typical Switching Times vs. R_G

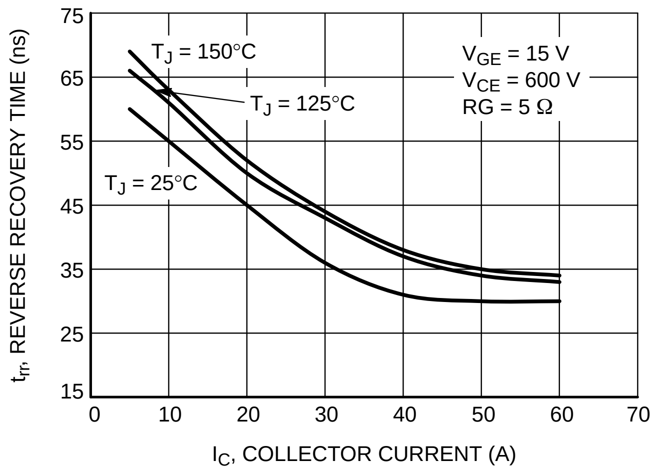


Figure 16. Typical Reverse Recovery Time vs. IC

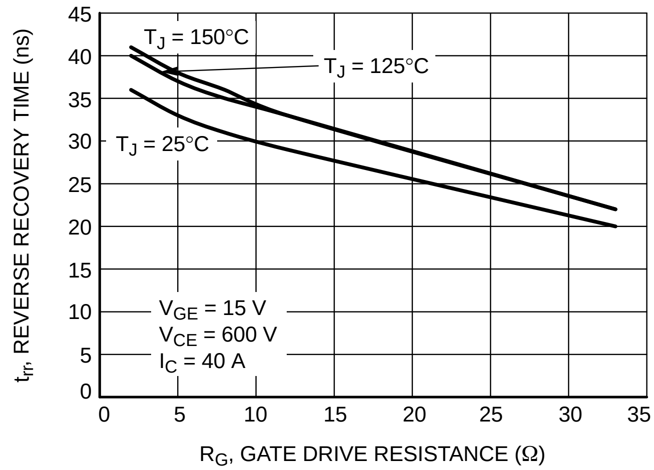


Figure 17. Typical Reverse Recovery Time vs. R_G

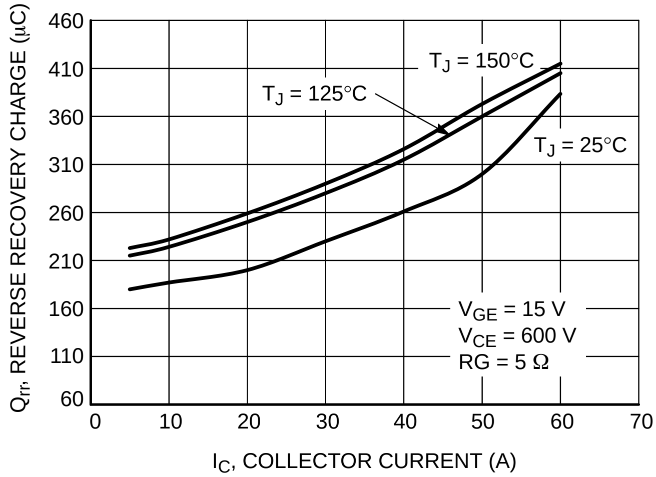


Figure 18. Typical Reverse Recovery Charge vs. I_C

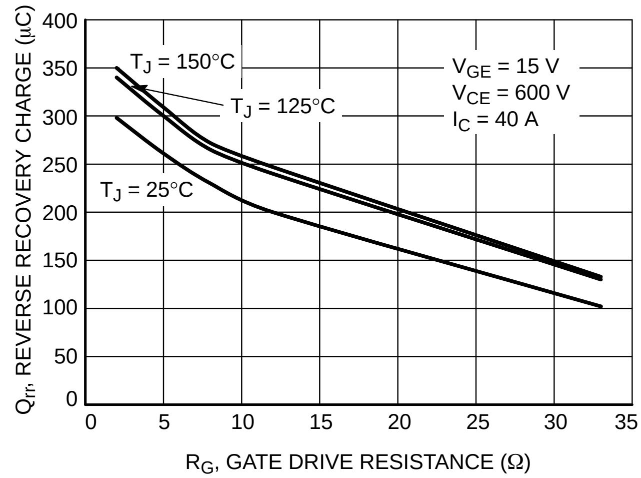


Figure 19. Typical Reverse Recovery Charge vs. R_G

TYPICAL CHARACTERISTICS − BOOST IGBT & BOOST DIODE

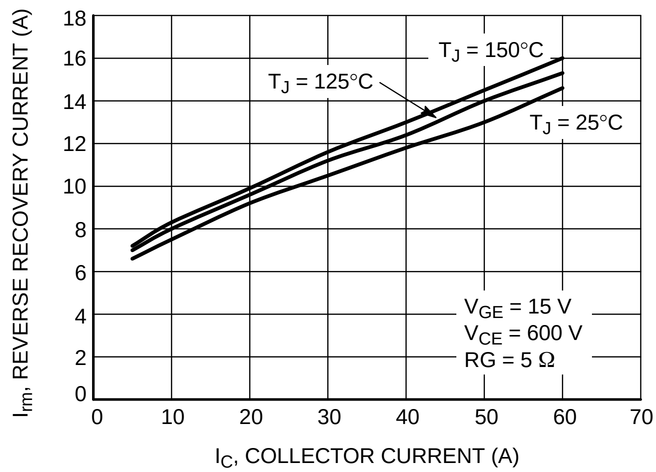


Figure 20. Typical Reverse Recovery Peak Current vs. I_C

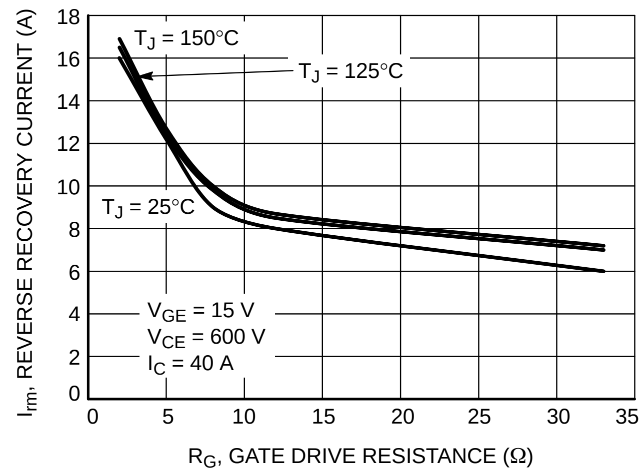


Figure 21. Typical Reverse Recovery Peak Current vs. R_G

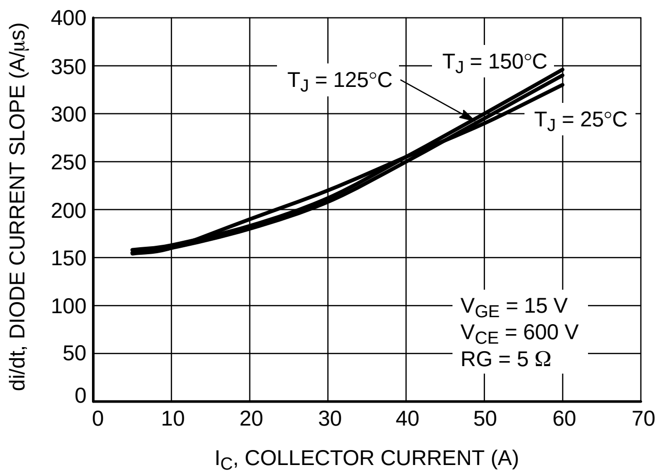


Figure 22. Typical Diode Current Slope vs. IC

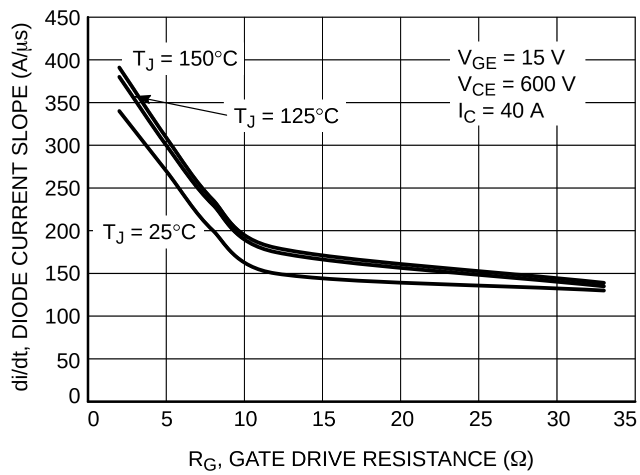


Figure 23. Typical Diode Current Slope vs. R_G

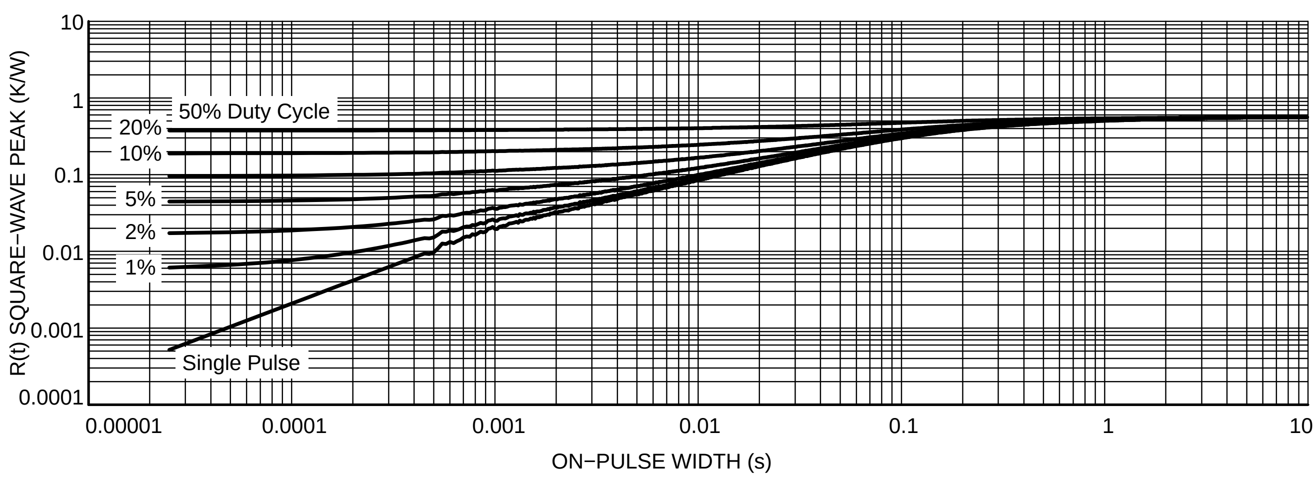


Figure 24. IGBT Transient Thermal Resistance

TYPICAL CHARACTERISTICS − BOOST IGBT & BOOST DIODE

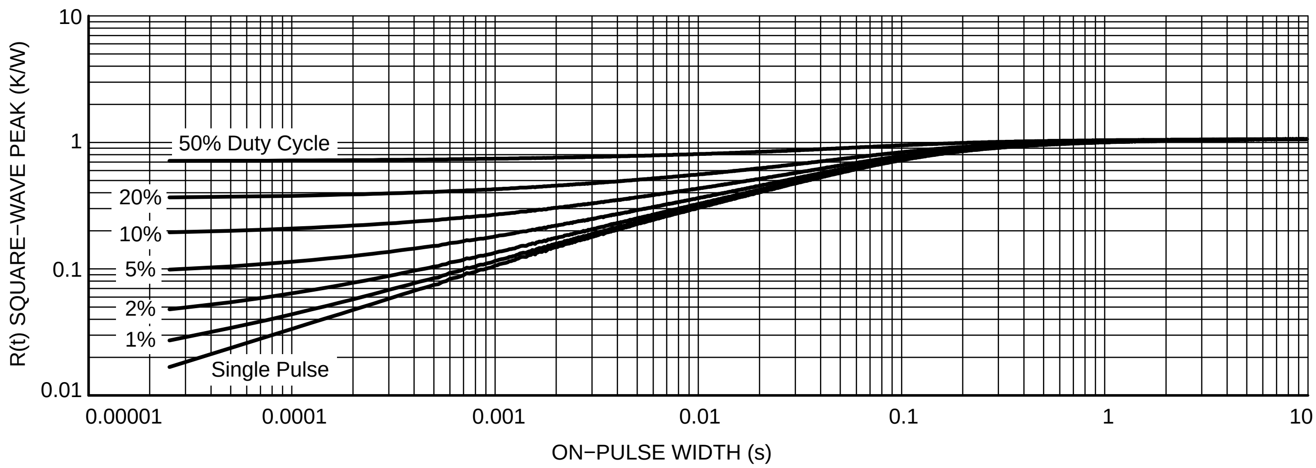


Figure 25. Diode Transient Thermal Impedance

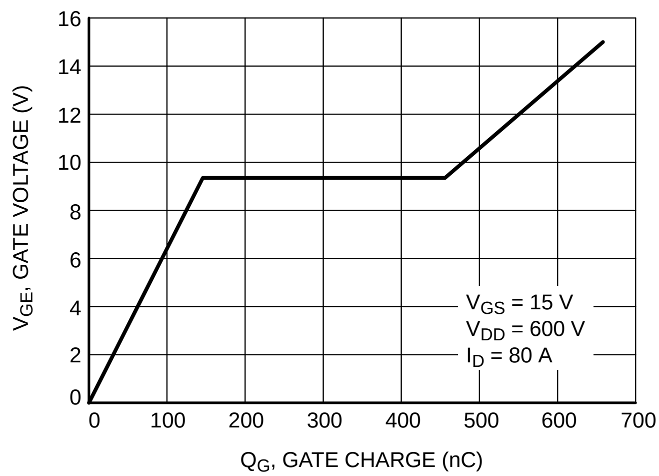


Figure 26. IGBT Gate Voltage vs. Gate Charge

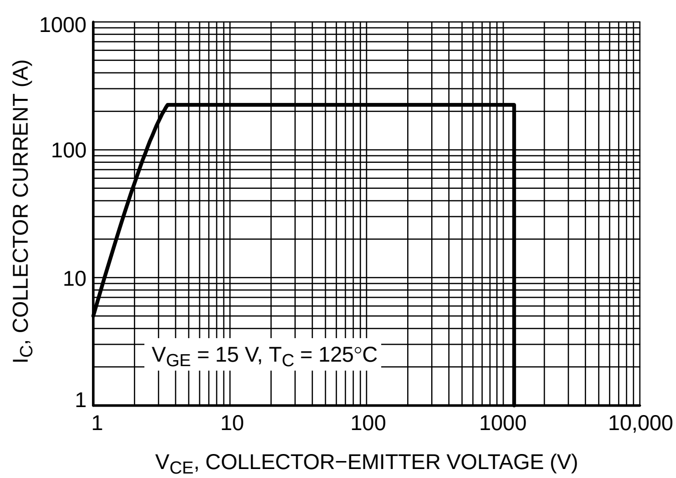


Figure 27. Safe Operating Area

TYPICAL CHARACTERISTICS − IGBT INVERSE DIODE

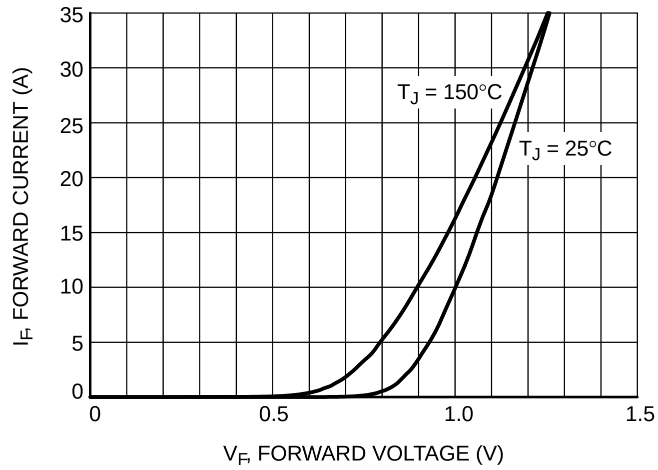


Figure 28. Diode Typical Forward Characteristics

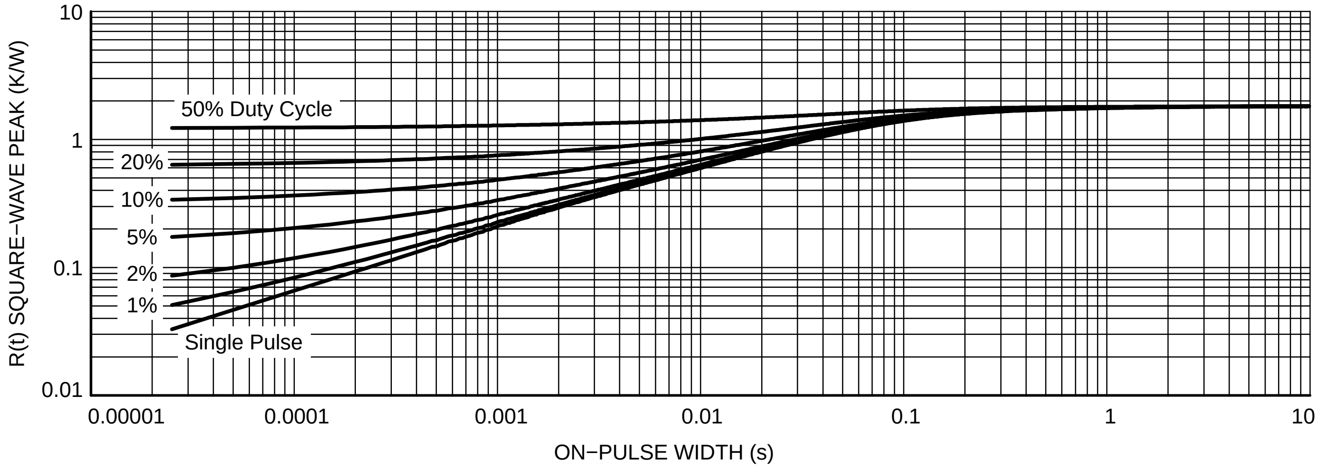


Figure 29. Diode Transient Thermal Impedance

TYPICAL CHARACTERISTICS − BYPASS DIODE

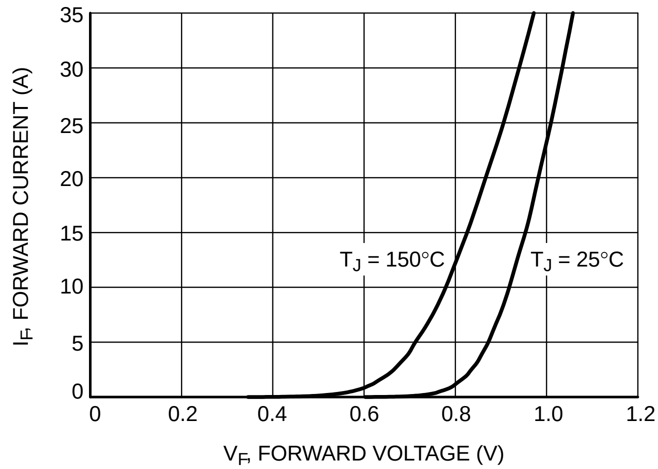


Figure 30. Diode Typical Forward Characteristics

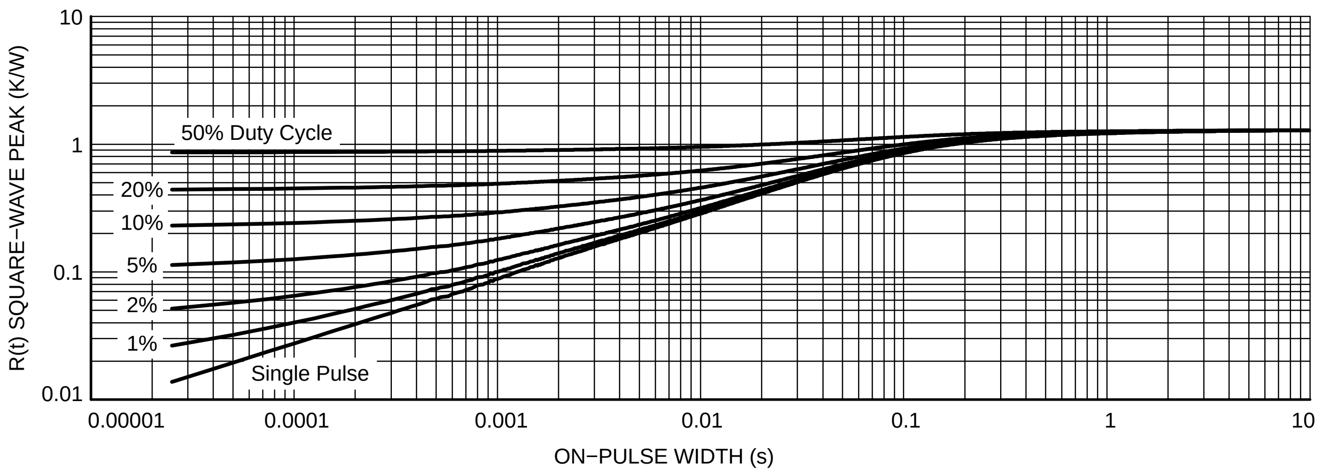


Figure 31. Diode Transient Thermal Impedance

TYPICAL CHARACTERISTICS − THERMISTOR

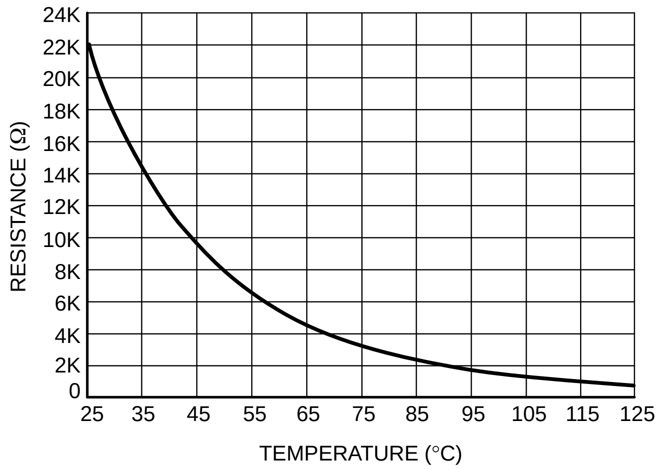


Figure 32. Thermistor Characteristics

SWITCHING WAVEFORMS AND DEFINITIONS − BOOST IGBT & BOOST DIODE

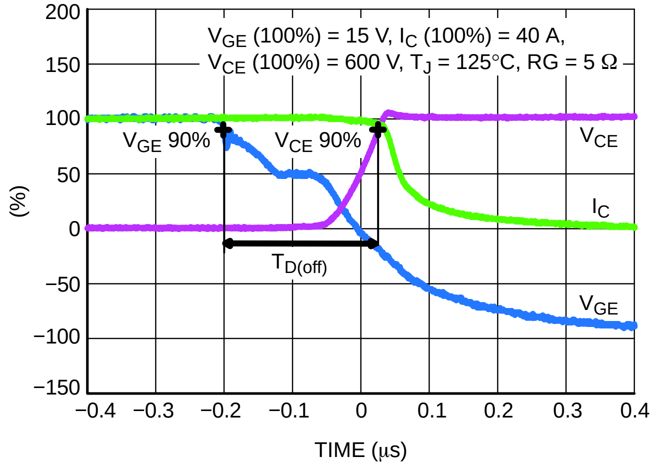


Figure 33. Turn−off Switching Waveforms and Definition of $T_{D(off)}$

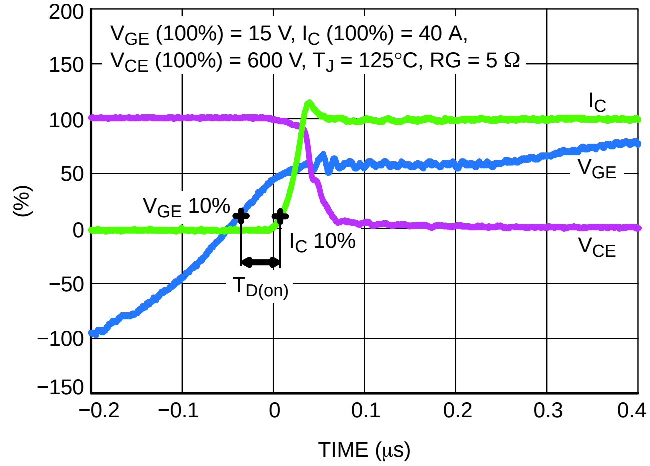


Figure 34. Turn−on Switching Waveforms and Definition of $T_{D(on)}$

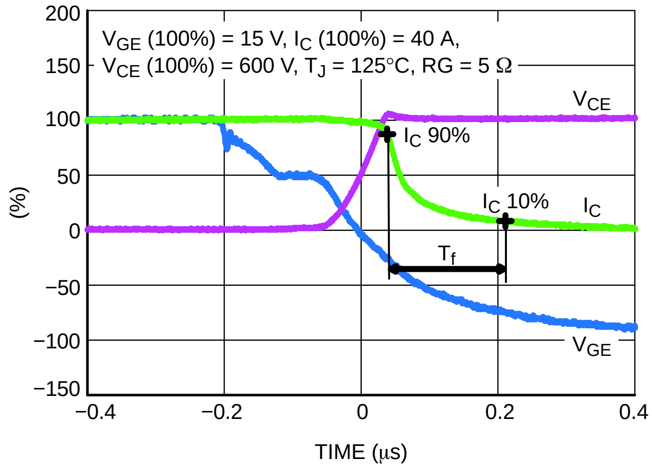


Figure 35. Turn−off Switching Waveforms and Definition of T_f

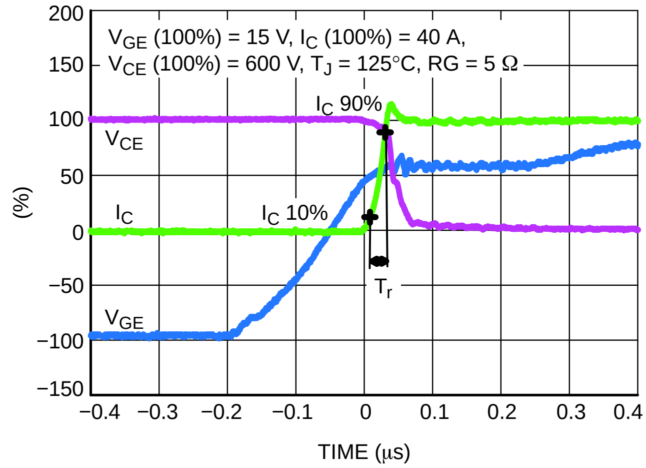


Figure 36. Turn−on Switching Waveforms and Definition of T_r

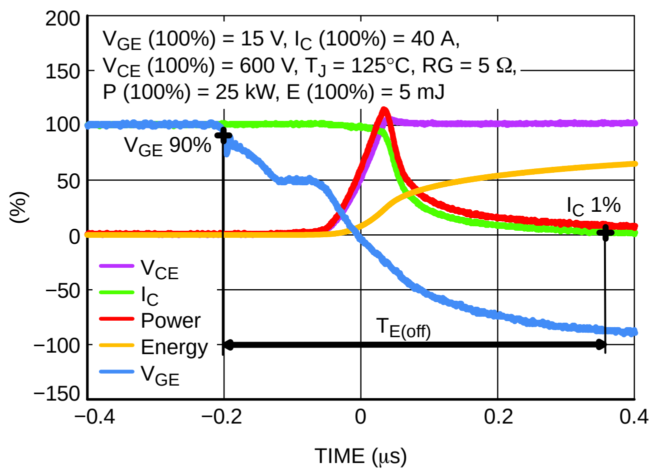


Figure 37. Turn−off Switching Waveforms and Definition of $T_{E(off)}$

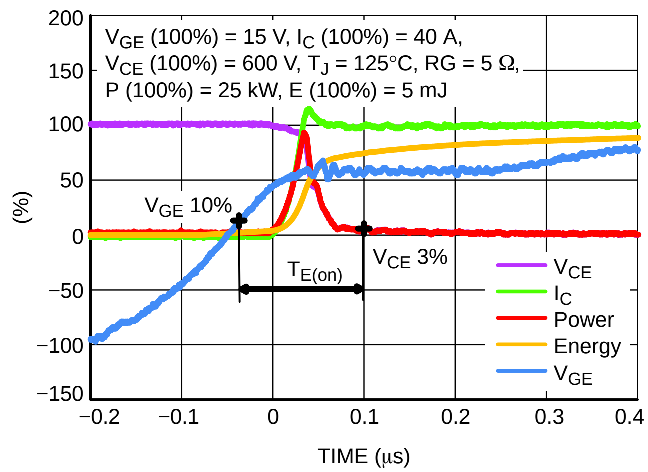


Figure 38. Turn−on Switching Waveforms and Definition of $T_{E(on)}$

SWITCHING WAVEFORMS AND DEFINITIONS − BOOST IGBT & BOOST DIODE

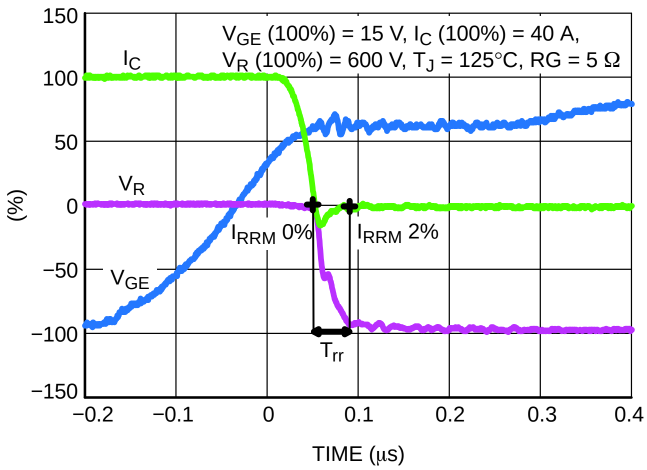


Figure 39. Turn−off Switching Waveforms and Definition of T_{rr}

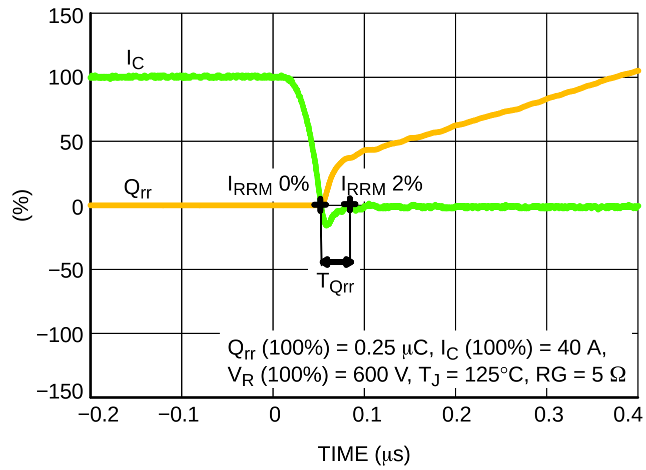


Figure 40. Turn−off Switching Waveforms and Definition of T_{Qrr}

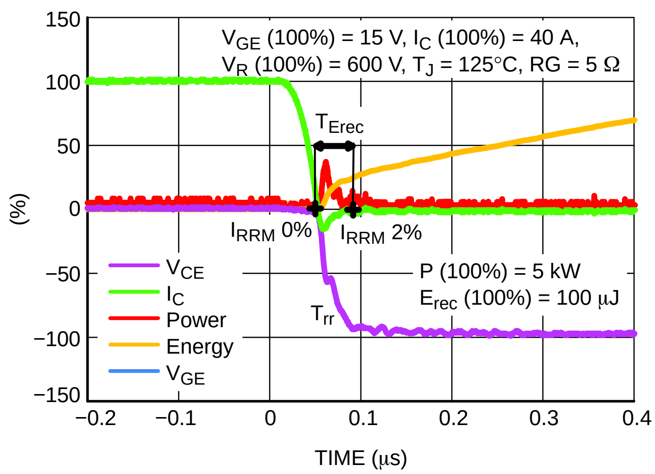
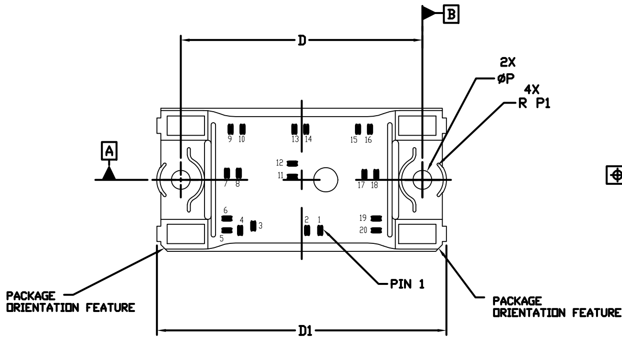


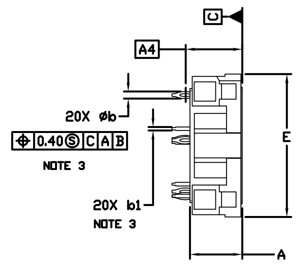
Figure 41. Turn−off Switching Waveforms and Definition of T_{Erec}

PACKAGE DIMENSIONS

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

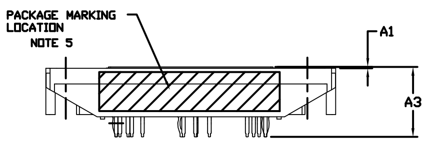


TOP VIEW



END VIEW

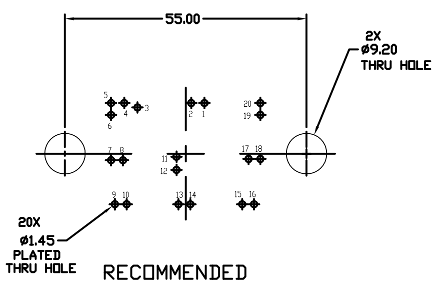
DIM	MILLIMETERS	
	MIN.	NOM.
A	11.70	12.10
A1	0.00	0.60
A3	15.50	16.50
A4	12.88 BSC	
b	1.61	1.71
b1	0.75	0.85
D	54.80	55.20
D1	65.70	70.10
E	32.30	32.70
P	4.10	4.50
P1	4.55	4.95



SIDE VIEW

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.



RECOMMENDED MOUNTING PATTERN

NOTE 4

PIN	PIN POSITION X	PIN POSITION Y	PIN	PIN POSITION X	PIN POSITION 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 X	HOLE POSITION Y	PIN	HOLE POSITION X	HOLE POSITION 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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative