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# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## T-Type, Neutral Point Clamp Module

This high-density, integrated power module combines high-performance IGBTs with rugged anti-parallel diodes for sine wave inverter applications.

### Features

- Extremely Efficient Trench IGBT with Fieldstop Technology
- Module Design Offers High Power Density
- Low Inductive Layout
- Q0PACK Package with Press-Fit Pins

### Typical Applications

- Solar Inverters
- Uninterruptable Power Supplies

### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
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#### BRIDGE IGBT

Collector-emitter voltage	$V_{CES}$	1200	V
Collector current $T_h = 80^\circ\text{C}$	$I_C$	65	A
Pulsed Collector Current, $T_{pulse}$ Limited by $T_{jmax}$	$I_{CM}$	260	A
Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Power Dissipation per IGBT $T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	$P_{total}$	146	W
Short Circuit Withstand Time $V_{GE} = 15\text{ V}, V_{CE} = 600\text{ V}, T_J \leq 150^\circ\text{C}$	$T_{SC}$	10	$\mu\text{s}$

#### NEUTRAL POINT IGBT

Collector-emitter voltage (Bridge)	$V_{CES}$	600	V
Collector current $@ T_h = 80^\circ\text{C}$	$I_C$	59	A
Pulsed Collector Current, $T_{pulse}$ Limited by $T_{jmax}$	$I_{CM}$	235	A
Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Power Dissipation per IGBT $T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	$P_{total}$	66	W
Short Circuit Withstand Time $V_{GE} = 15\text{ V}, V_{CE} = 400\text{ V}, T_J \leq 150^\circ\text{C}$	$T_{SC}$	5	$\mu\text{s}$

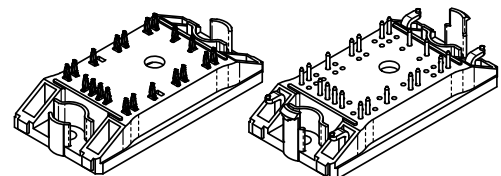
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



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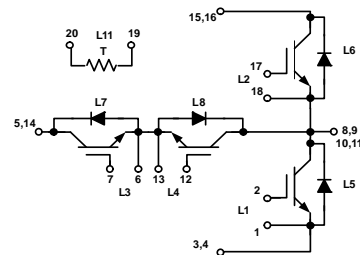
80 A, 1200 V (Bridge)  
50 A, 600 V (Neutral Point Clamp)  
T – Type Neutral Point Clamp



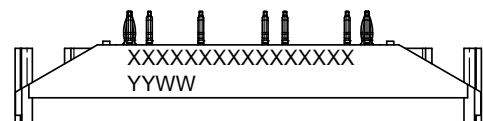
Q0PACK  
CASE 180AA

Q0PACK  
CASE 180AB

### SCHEMATIC



### MARKING DIAGRAM



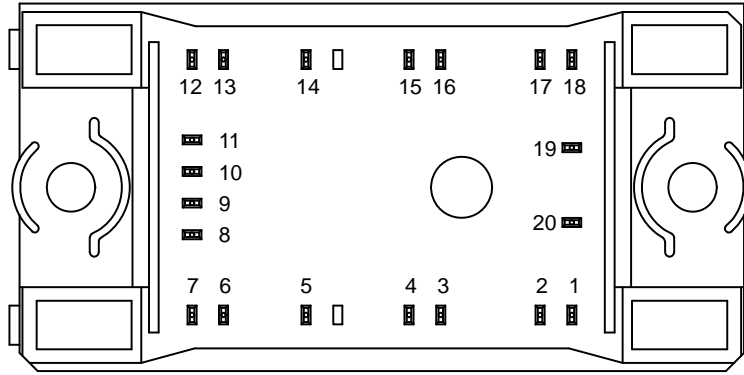
YYWW = Year and Work Week Code

### ORDERING INFORMATION

See detailed ordering and shipping information in the dimensions section on page 13 of this data sheet.

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## PIN ASSIGNMENTS



### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
<b>BRIDGE DIODE</b>			
Peak Repetitive Voltage	$V_{RRM}$	1200	V
Forward Current, DC @ $T_C = 80^\circ\text{C}$	$I_F$	41	A
Power Dissipation per Diode $T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	$P_{total}$	69	W
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I_{FSM}$	300	A
$I^2t$ – value (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I^2t$	373.5	$\text{A}^2\text{s}$

### NEUTRAL POINT DIODE

Diode peak repetitive voltage	$V_{RRM}$	600	V
Forward Current, DC @ $T_h = 80^\circ\text{C}$	$I_F$	36	A
Power Dissipation per Diode $T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	$P_{total}$	51	W
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I_{FSM}$	500	A
$I^2t$ – value (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I^2t$	1037.5	$\text{A}^2\text{s}$

### THERMAL & SAFETY CHARACTERISTICS

Rating	Symbol	Value	Unit
Maximum junction temperature range IGBT Diode	$T_J$	175 175	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-40 to 150	$^\circ\text{C}$
Operating Temperature under Switching conditions	$T_{VJOP}$	-40 to 150	$^\circ\text{C}$
Isolation test voltage, $t = 1$ min, 60 Hz	$V_{is}$	2500	Vac
Creepage distance		12.7	mm
Clearance		12.7	mm

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit	
<b>HALF BRIDGE IGBT CHARACTERISTICS</b>							
Collector-emitter saturation voltage	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 80 A, T <sub>J</sub> = 25°C V <sub>GE</sub> = 15 V, I <sub>C</sub> = 80 A, T <sub>J</sub> = 150°C	V <sub>CE(sat)</sub>	1.7	2.17 2.20	2.7	V	
Gate-emitter threshold voltage	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 1.5 mA	V <sub>GE(TH)</sub>	5.0	6.0	6.5	V	
Collector-emitter cutoff current	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 1200 V	I <sub>CES</sub>	–	–	200	μA	
Gate leakage current	V <sub>GE</sub> = 20 V, V <sub>CE</sub> = 0 V	I <sub>GES</sub>	–	–	1.2	μA	
Turn-on delay time	T <sub>J</sub> = 25°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>d(on)</sub>	–	35	–	ns	
Rise time		t <sub>r</sub>	–	28	–		
Turn-off delay time		t <sub>d(off)</sub>	–	280	–		
Fall time		t <sub>f</sub>	–	28	–		
Turn on switching loss		E <sub>on</sub>	–	0.670	–		mJ
Turn off switching loss		E <sub>off</sub>	–	1.3	–		
Turn-on delay time	T <sub>J</sub> = 150°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>d(on)</sub>	–	80	–	ns	
Rise time		t <sub>r</sub>	–	30	–		
Turn-off delay time		t <sub>d(off)</sub>	–	320	–		
Fall time		t <sub>f</sub>	–	230	–		
Turn on switching loss		E <sub>on</sub>	–	0.975	–		mJ
Turn off switching loss		E <sub>off</sub>	–	3.00	–		
Input capacitance	V <sub>CE</sub> = 20 V, V <sub>GE</sub> = 0 V, f = 10 KHz	C <sub>ies</sub>	–	19940	–	pF	
Output capacitance		C <sub>oes</sub>	–	592	–		
Reverse transfer capacitance		C <sub>res</sub>	–	383	–		
Gate charge total	V <sub>CE</sub> = 960 V, I <sub>C</sub> = 40 A, V <sub>GE</sub> = ±15 V	Q <sub>g</sub>	–	840	–	nC	
Thermal Resistance, chip-to-heatsink	Thermal grease thickness ≤ 50 μm λ = 1 W/mK	R <sub>θJH</sub>		0.65		°C/W	

## HALF BRIDGE DIODE CHARACTERISTICS

Forward voltage	V <sub>GE</sub> = 0 V, I <sub>F</sub> = 50 A, T <sub>J</sub> = 25°C V <sub>GE</sub> = 0 V, I <sub>F</sub> = 50 A, T <sub>J</sub> = 150°C	V <sub>F</sub>	–	1.81 1.90	2.4	V
Reverse recovery time	T <sub>J</sub> = 25°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>rr</sub>	–	0.12	–	μs
Reverse recovery charge		Q <sub>rr</sub>	–	4.7	–	μC
Peak reverse recovery current		I <sub>rrm</sub>	–	135	–	A
Peak rate of fall of recovery current		di/dt <sub>max</sub>	–	7200	–	A/μs
Reverse recovery energy		E <sub>rr</sub>	–	1.37	–	mJ
Reverse recovery time	T <sub>J</sub> = 150°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>rr</sub>	–	0.14	–	μs
Reverse recovery charge		Q <sub>rr</sub>	–	7.65	–	μC
Peak reverse recovery current		I <sub>rrm</sub>	–	138	–	A
Peak rate of fall of recovery current		di/dt <sub>max</sub>	–	4900	–	A/μs
Reverse recovery energy		E <sub>rr</sub>	–	2.15	–	mJ
Thermal Resistance, chip-to-heatsink	Thermal grease thickness ≤ 50 μm λ = 1 W/mK	R <sub>θJH</sub>		1.38		°C/W

## NEUTRAL POINT CLAMP IGBT CHARACTERISTICS

Collector-emitter saturation voltage	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 30 A, T <sub>J</sub> = 25°C V <sub>GE</sub> = 15 V, I <sub>C</sub> = 30 A, T <sub>J</sub> = 150°C	V <sub>CE(sat)</sub>	1.1	1.3 1.3	1.6	V
Gate-emitter threshold voltage	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 1.2 mA	V <sub>GE(TH)</sub>	5.0	5.7	6.5	V
Collector-emitter cutoff current	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 600 V	I <sub>CES</sub>	–	–	100	μA
Gate leakage current	V <sub>GE</sub> = 20 V, V <sub>CE</sub> = 0 V	I <sub>GES</sub>	–	–	0.60	μA

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>NEUTRAL POINT CLAMP IGBT CHARACTERISTICS</b>						
Turn-on delay time	T <sub>J</sub> = 25°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>d(on)</sub>	–	46	–	ns
Rise time		t <sub>r</sub>	–	16	–	
Turn-off delay time		t <sub>d(off)</sub>	–	125	–	
Fall time		t <sub>f</sub>	–	60	–	
Turn on switching loss		E <sub>on</sub>	–	0.668	–	mJ
Turn off switching loss		E <sub>off</sub>	–	0.76	–	
Turn-on delay time	T <sub>J</sub> = 150°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>d(on)</sub>	–	48	–	ns
Rise time		t <sub>r</sub>	–	22	–	
Turn-off delay time		t <sub>d(off)</sub>	–	200	–	
Fall time		t <sub>f</sub>	–	134	–	
Turn on switching loss		E <sub>on</sub>	–	1.1	–	mJ
Turn off switching loss		E <sub>off</sub>	–	2.5	–	
Input capacitance	V <sub>CE</sub> = 20 V, V <sub>GE</sub> = 0 V, f = 10 KHz	C <sub>ies</sub>	–	9900	–	pF
Output capacitance		C <sub>oes</sub>	–	270	–	
Reverse transfer capacitance		C <sub>res</sub>	–	270	–	
Gate charge total	V <sub>CE</sub> = 480 V, I <sub>C</sub> = 75 A, V <sub>GE</sub> = ±15 V	Q <sub>G</sub>	–	390	–	nC
Thermal Resistance, chip-to-heatsink	Thermal grease thickness ≤ 50 μm λ = 1 W/mK	R <sub>θJH</sub>		1.35		°C/W

## NEUTRAL POINT CLAMP DIODE CHARACTERISTICS

Forward voltage	V <sub>GE</sub> = 0 V, I <sub>F</sub> = 60 A, T <sub>J</sub> = 25°C V <sub>GE</sub> = 0 V, I <sub>F</sub> = 60 A, T <sub>J</sub> = 150°C	V <sub>F</sub>	–	1.7	2.0	V
				–	1.8	–
Reverse recovery time	T <sub>J</sub> = 25°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>rr</sub>	–	0.04	–	μs
Reverse recovery charge		Q <sub>rr</sub>	–	1.1	–	μC
Peak reverse recovery current		I <sub>rrm</sub>	–	65	–	A
Peak rate of fall of recovery current		di/dt <sub>max</sub>	–	6600	–	A/μs
Reverse recovery energy		E <sub>rr</sub>	–	0.384	–	mJ
Reverse recovery time	T <sub>J</sub> = 150°C V <sub>CE</sub> = 350 V, I <sub>C</sub> = 56 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 4 Ω	t <sub>rr</sub>	–	0.1	–	μs
Reverse recovery charge		Q <sub>rr</sub>	–	3.3	–	μC
Peak reverse recovery current		I <sub>rrm</sub>	–	68	–	A
Peak rate of fall of recovery current		di/dt <sub>max</sub>	–	1733	–	A/μs
Reverse recovery energy		E <sub>rr</sub>	–	0.74	–	mJ
Thermal Resistance, chip-to-heatsink	Thermal grease thickness ≤ 50 μm λ = 1 W/mK	R <sub>θJH</sub>		1.86		°C/W

## THERMISTOR CHARACTERISTICS

Normal resistance		R		22		kΩ
Nominal resistance	T = 100°C	R		1468		Ω
Deviation of R25		ΔR/R	–5		5	%
Power dissipation		P <sub>D</sub>		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	

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.

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## TYPICAL CHARACTERISTICS – HALF BRIDGE

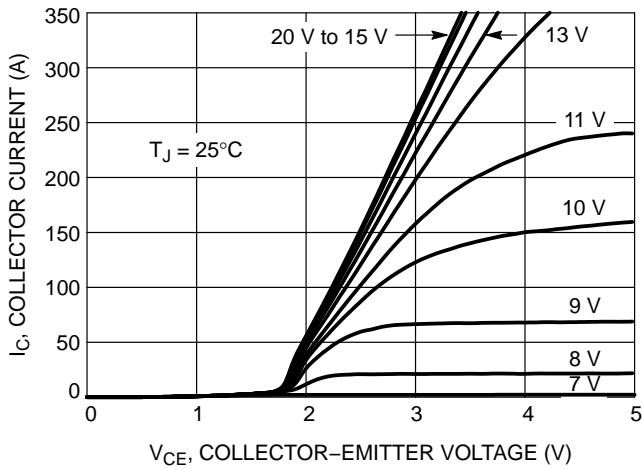


Figure 1. Output Characteristics

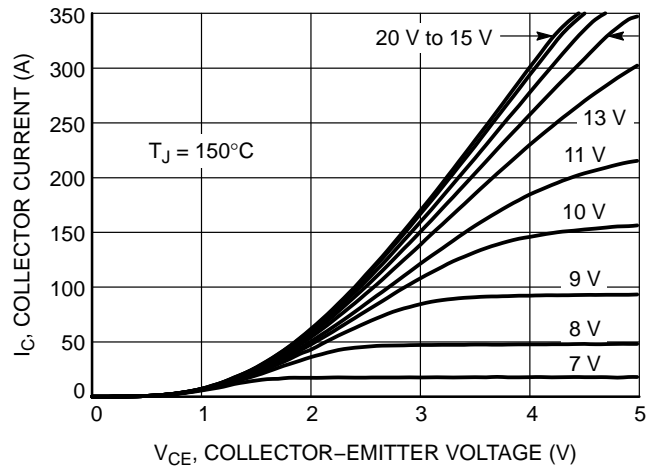


Figure 2. Output Characteristics

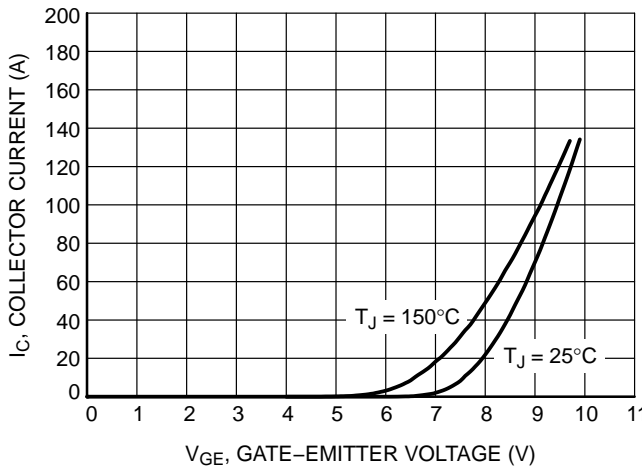


Figure 3. Typical Transfer Characteristics

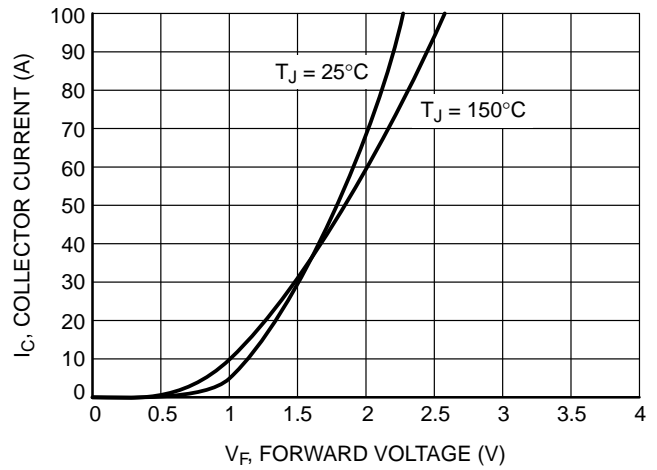


Figure 4. Diode Forward Characteristics

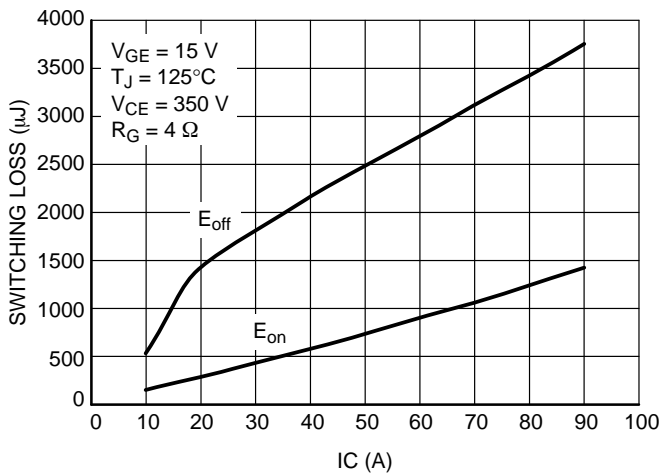


Figure 5. Typical Switching Loss vs. IC

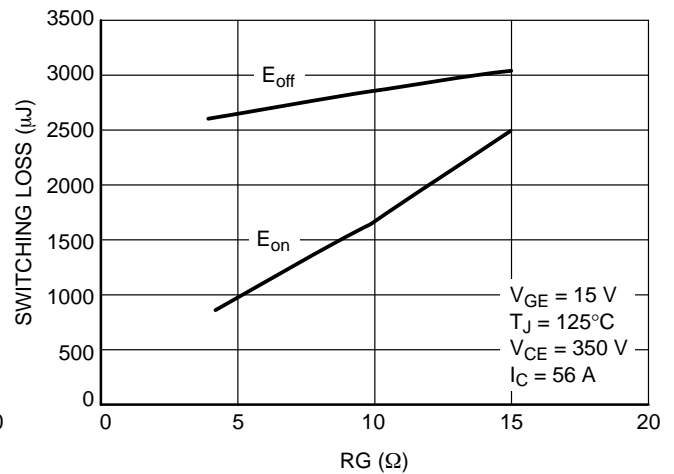


Figure 6. Typical Switching Loss vs. RG

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## TYPICAL CHARACTERISTICS – HALF BRIDGE

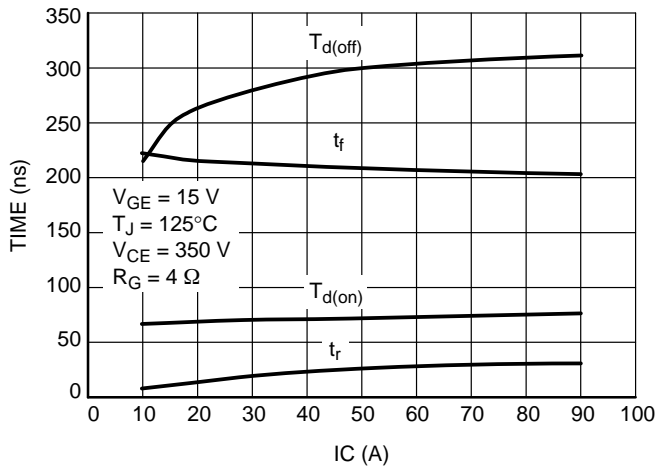


Figure 7. Typical Switching Time vs. IC

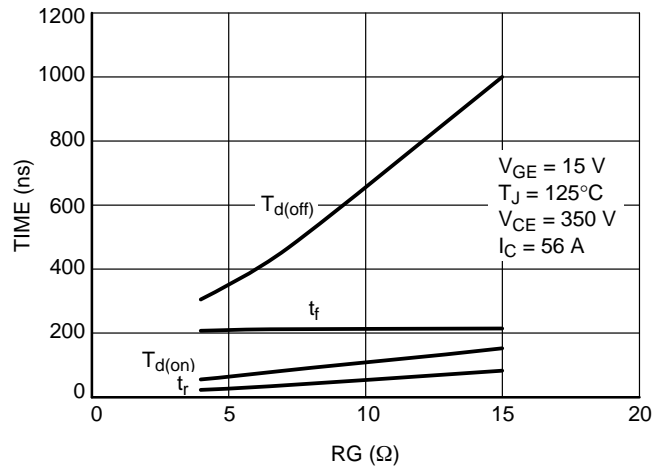


Figure 8. Typical Switching Time vs. RG

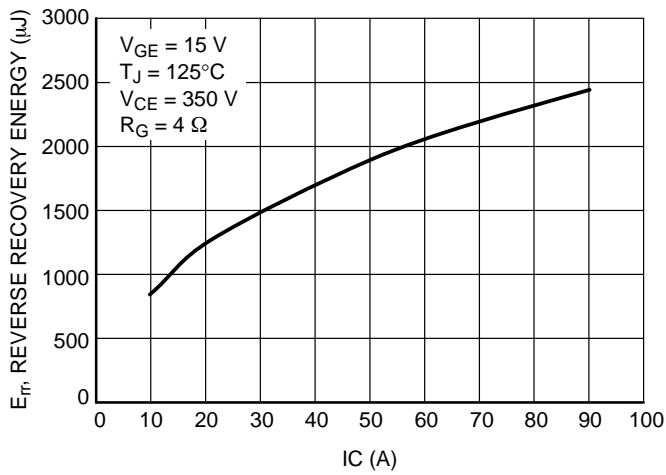


Figure 9. Typical Reverse Recovery Energy Loss vs. IC

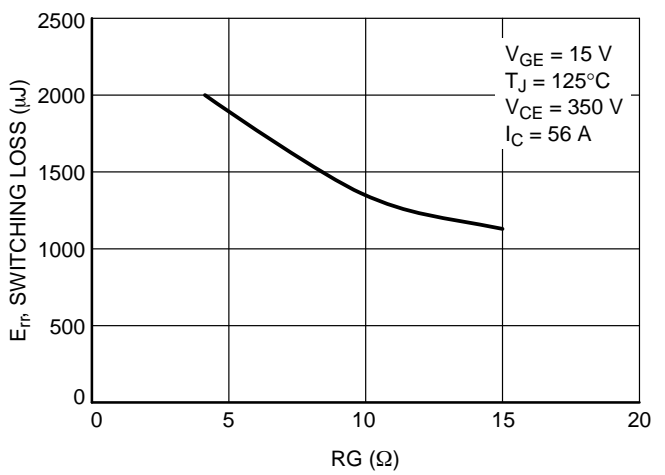


Figure 10. Typical Reverse Recovery Energy Loss vs. RG

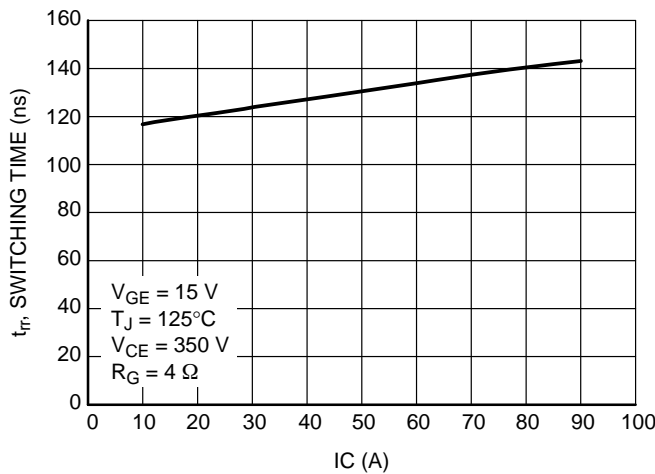


Figure 11. Typical Reverse Recovery Time vs. IC

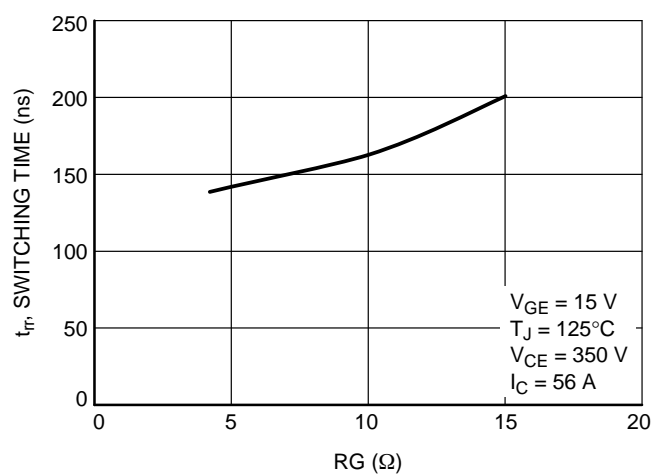


Figure 12. Typical Reverse Recovery Time vs. RG

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## TYPICAL CHARACTERISTICS – HALF BRIDGE

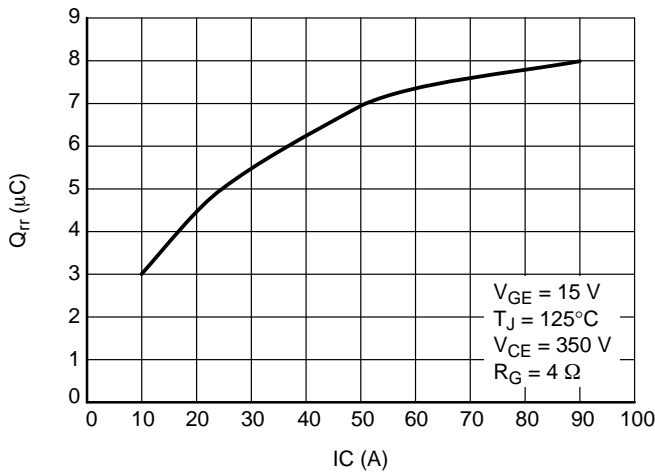


Figure 13. Typical Reverse Recovery Charge vs. IC

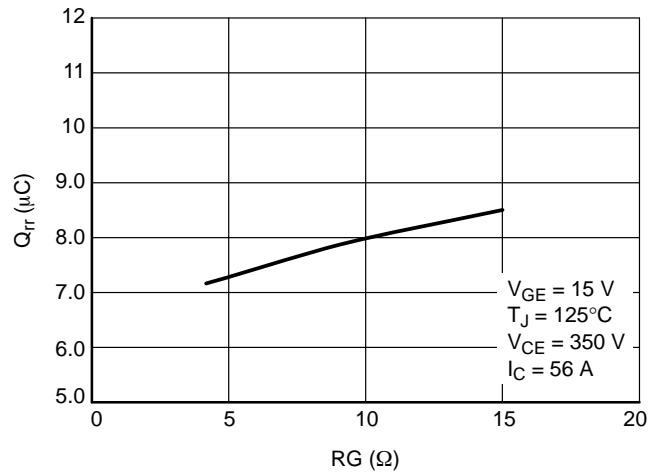


Figure 14. Typical Reverse Recovery Charge vs. RG

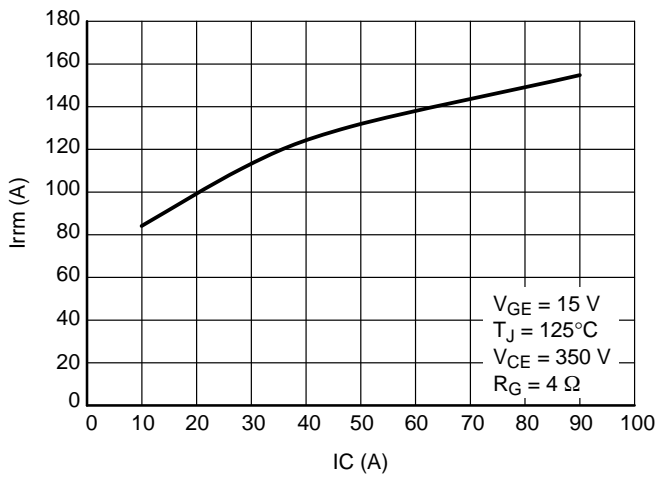


Figure 15. Typical Reverse Recovery Current vs. IC

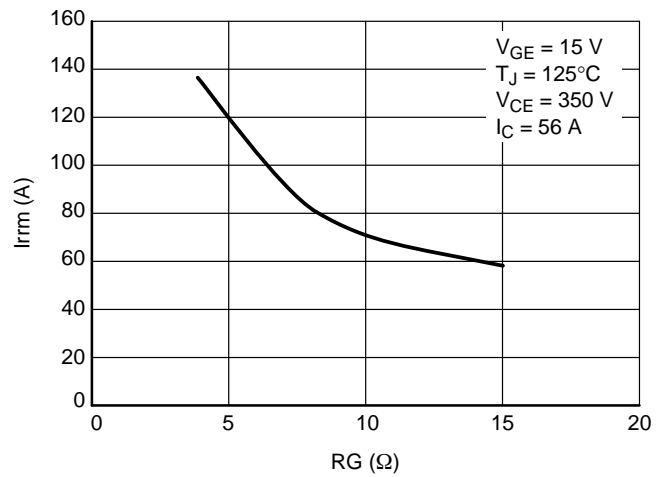


Figure 16. Typical Reverse Recovery Current vs. RG

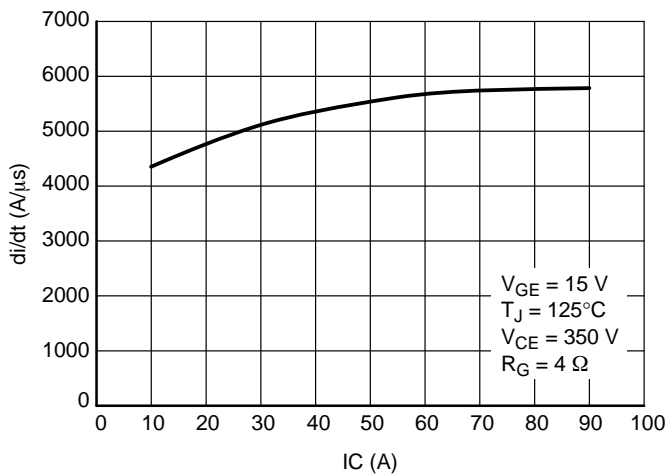


Figure 17. Typical di/dt vs. IC

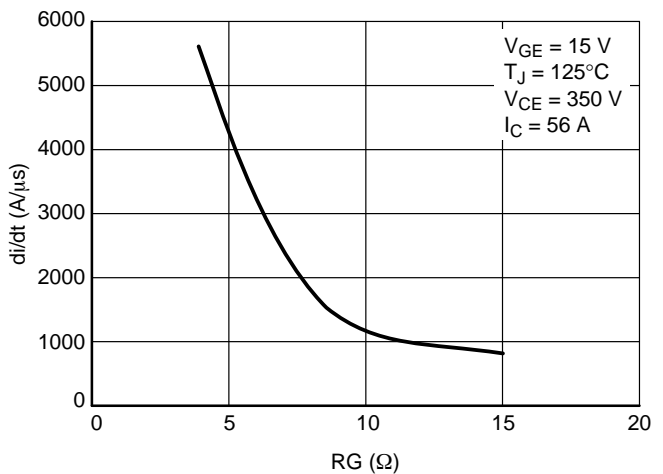


Figure 18. Typical di/dt vs. RG

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## TYPICAL CHARACTERISTICS – HALF BRIDGE

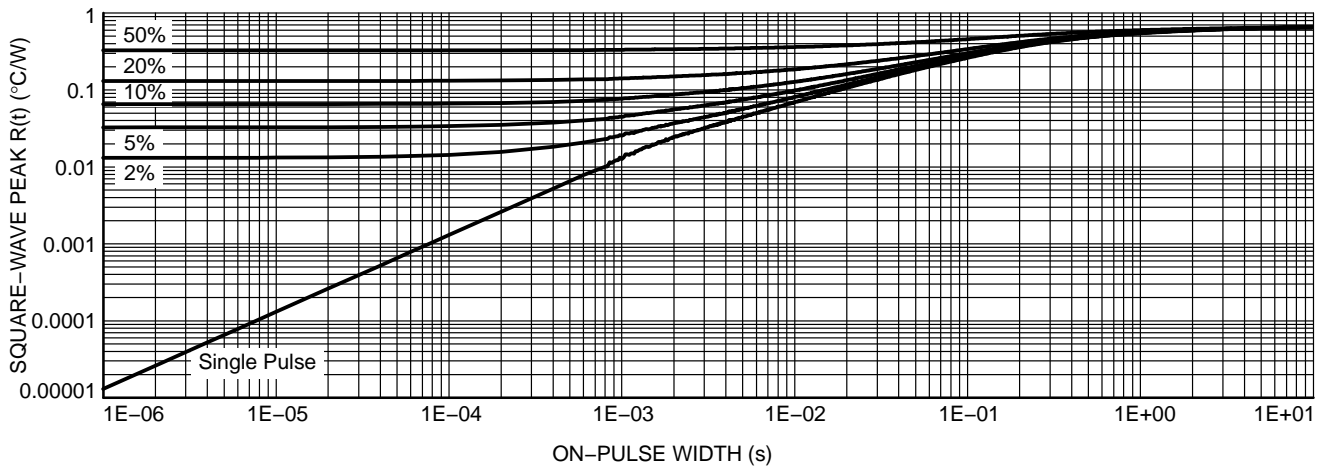


Figure 19. IGBT Transient Thermal Impedance

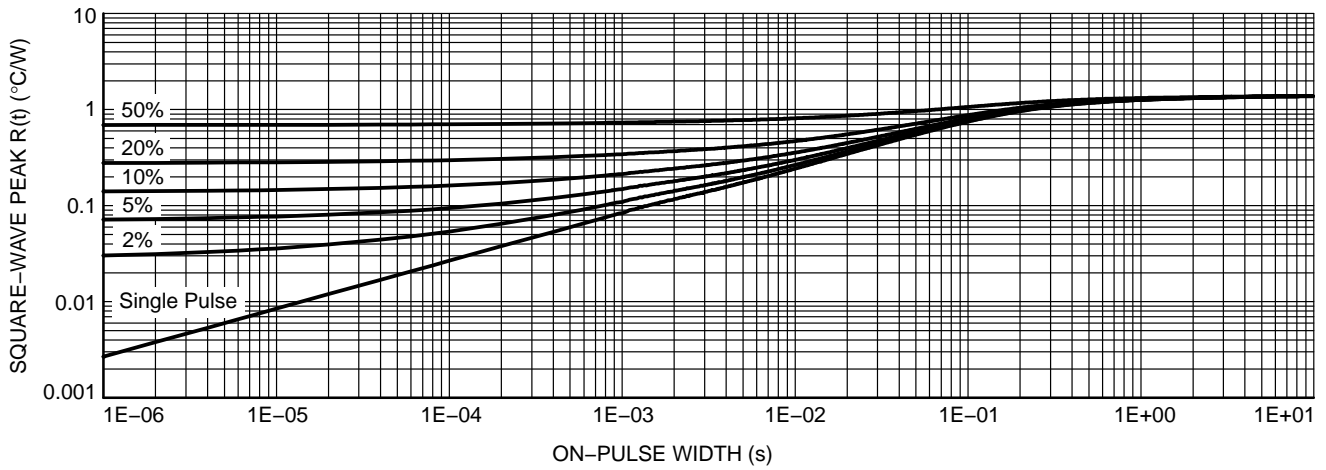


Figure 20. Diode Transient Thermal Impedance

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## TYPICAL CHARACTERISTICS – NEUTRAL POINT

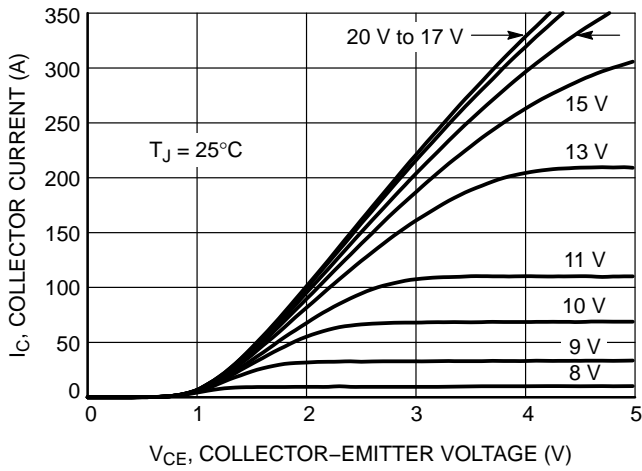


Figure 21. Output Characteristics

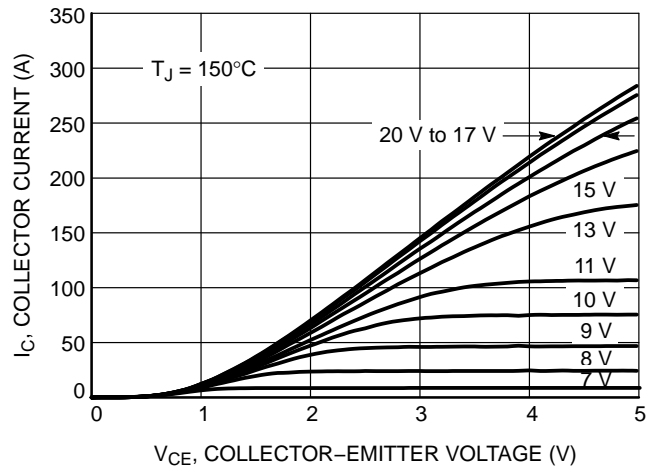


Figure 22. Output Characteristics

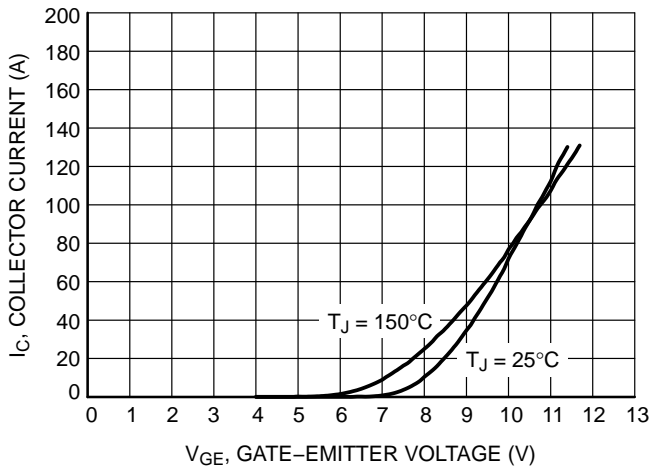


Figure 23. Typical Transfer Characteristics

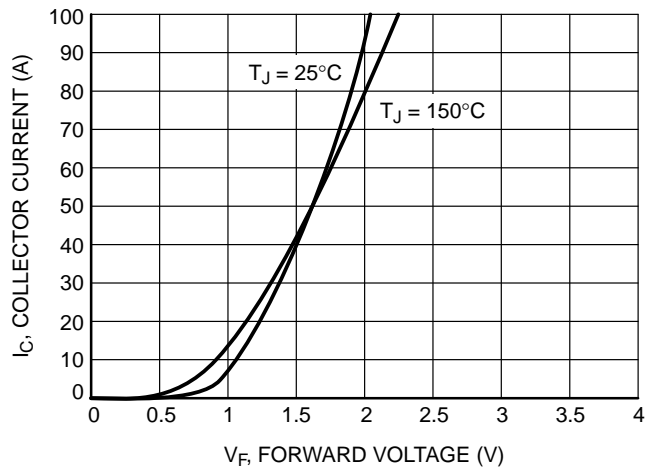


Figure 24. Diode Forward Characteristics

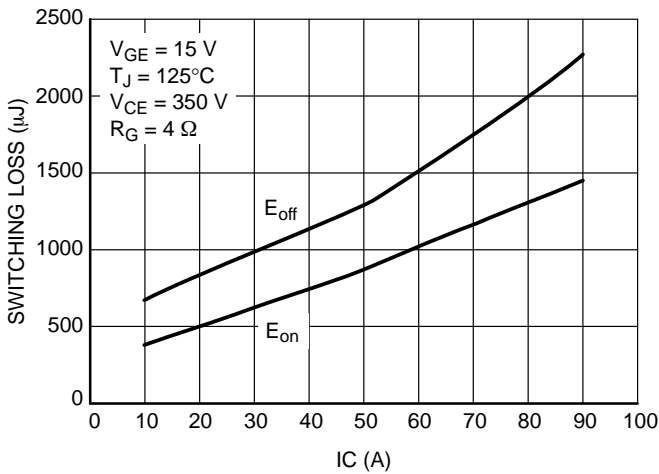


Figure 25. Typical Switching Loss vs.  $I_C$

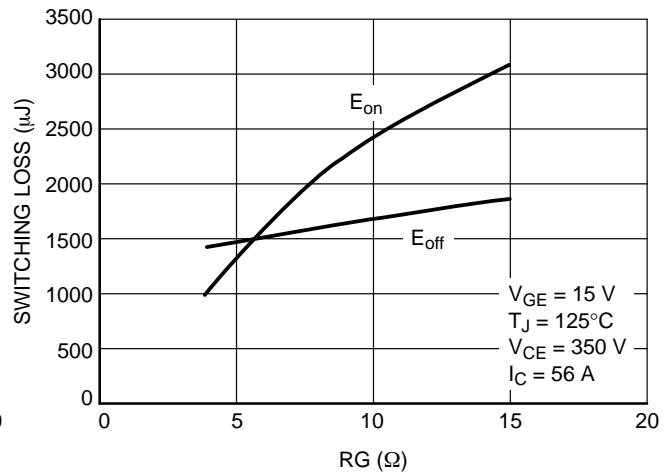


Figure 26. Typical Switching Loss vs.  $R_G$

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## TYPICAL CHARACTERISTICS – NEUTRAL POINT

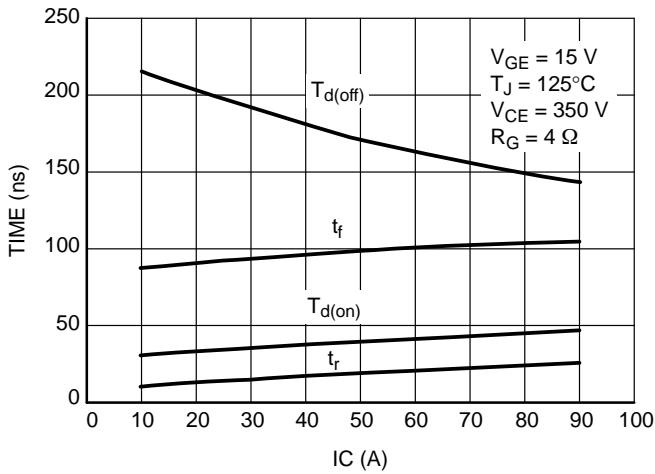


Figure 27. Typical Switching Time vs. IC

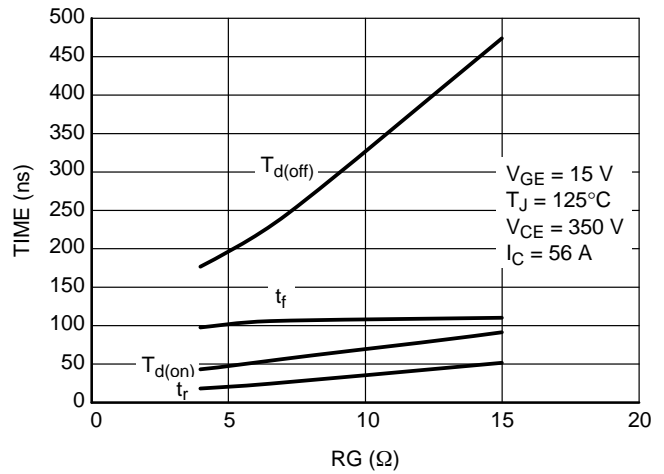


Figure 28. Typical Switching Time vs. R<sub>G</sub>

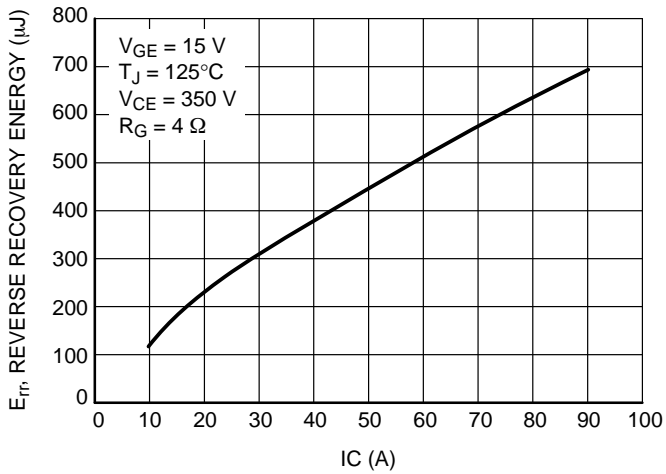


Figure 29. Typical Reverse Recovery Energy Loss vs. IC

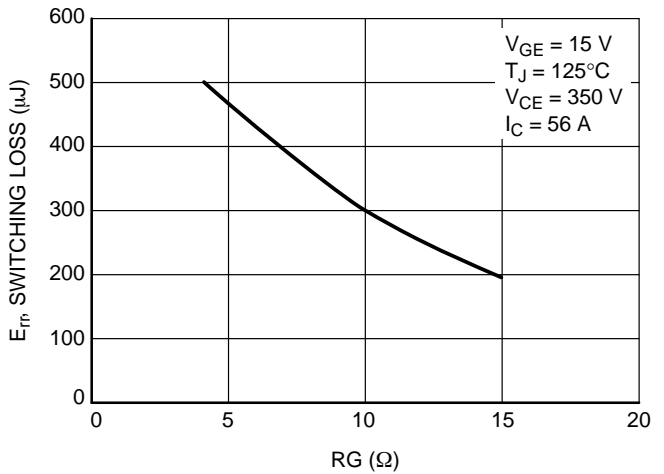


Figure 30. Typical Reverse Recovery Energy Loss vs. R<sub>G</sub>

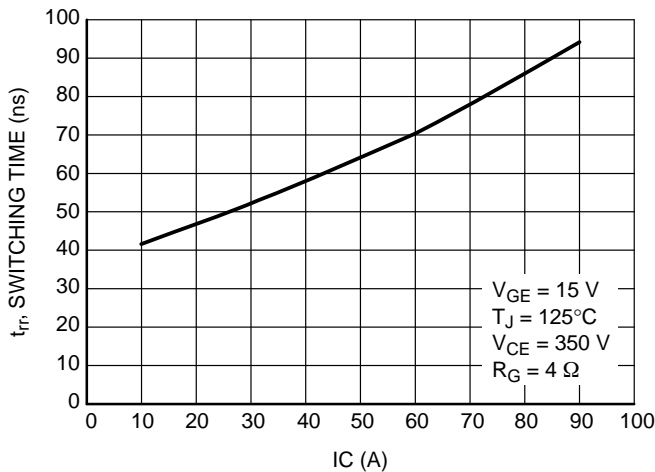


Figure 31. Typical Reverse Recovery Time vs. IC

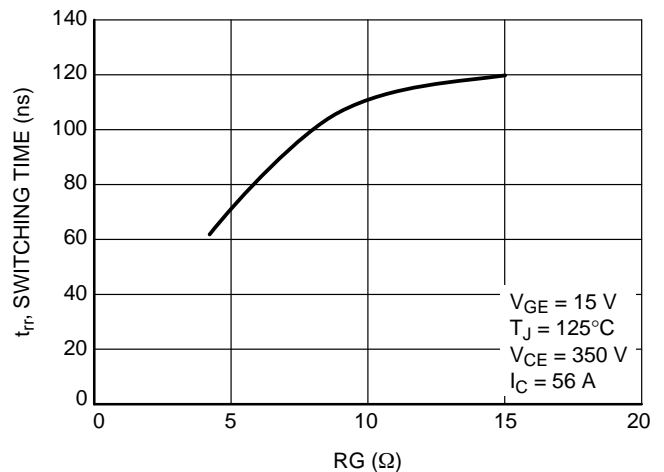
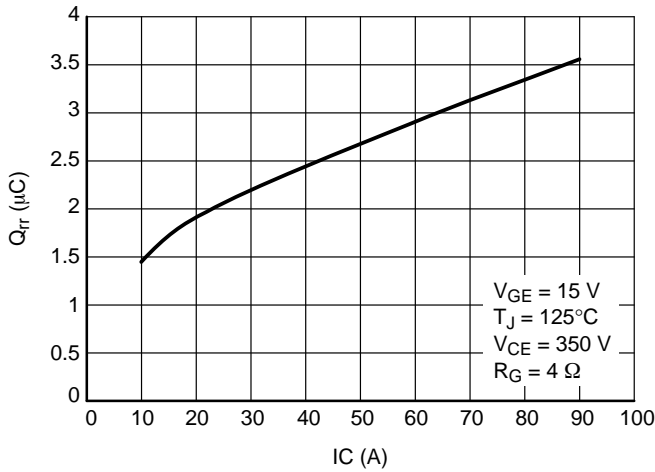


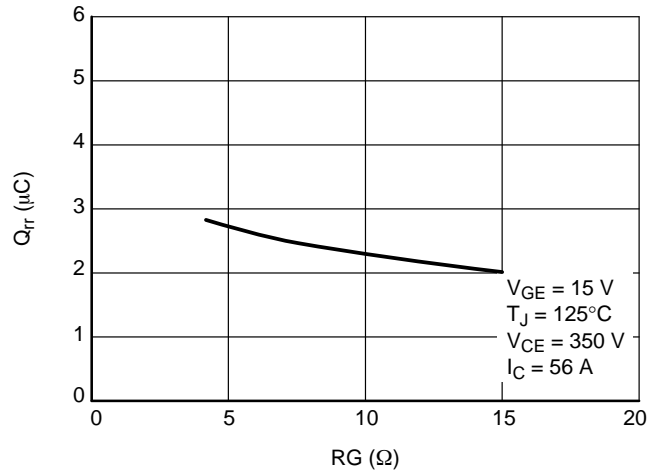
Figure 32. Typical Reverse Recovery Time vs. R<sub>G</sub>

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

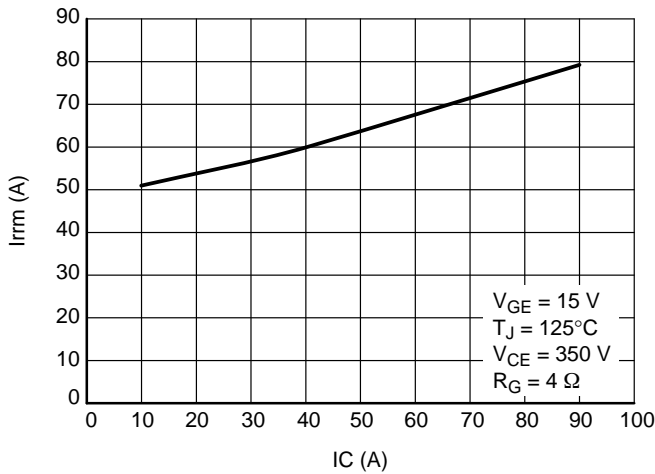
## TYPICAL CHARACTERISTICS – NEUTRAL POINT



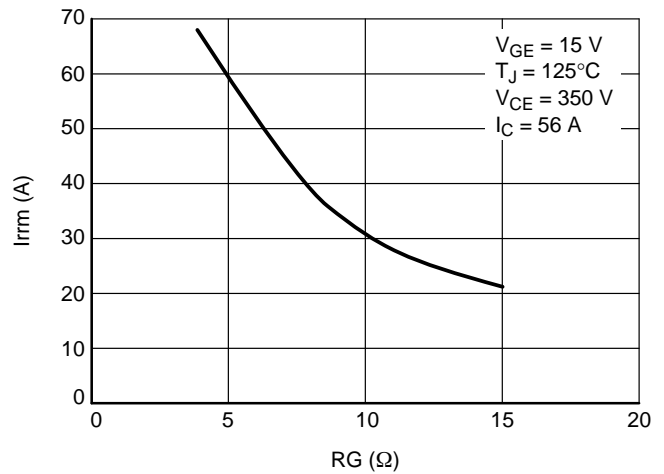
**Figure 33. Typical Reverse Recovery Charge vs. IC**



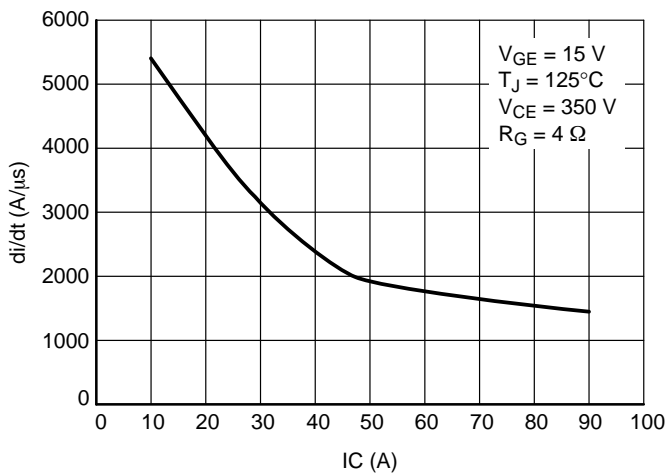
**Figure 34. Typical Reverse Recovery Charge vs. RG**



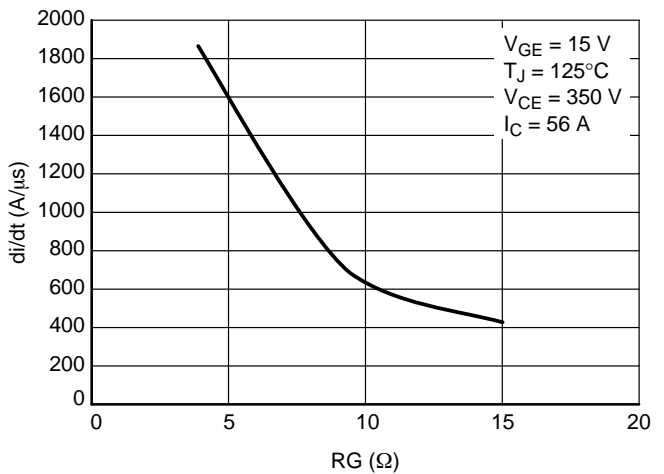
**Figure 35. Typical Reverse Recovery Current vs. IC**



**Figure 36. Typical Reverse Recovery Current vs. RG**



**Figure 37. Typical di/dt vs. IC**



**Figure 38. Typical di/dt vs. RG**

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## TYPICAL CHARACTERISTICS – NEUTRAL POINT

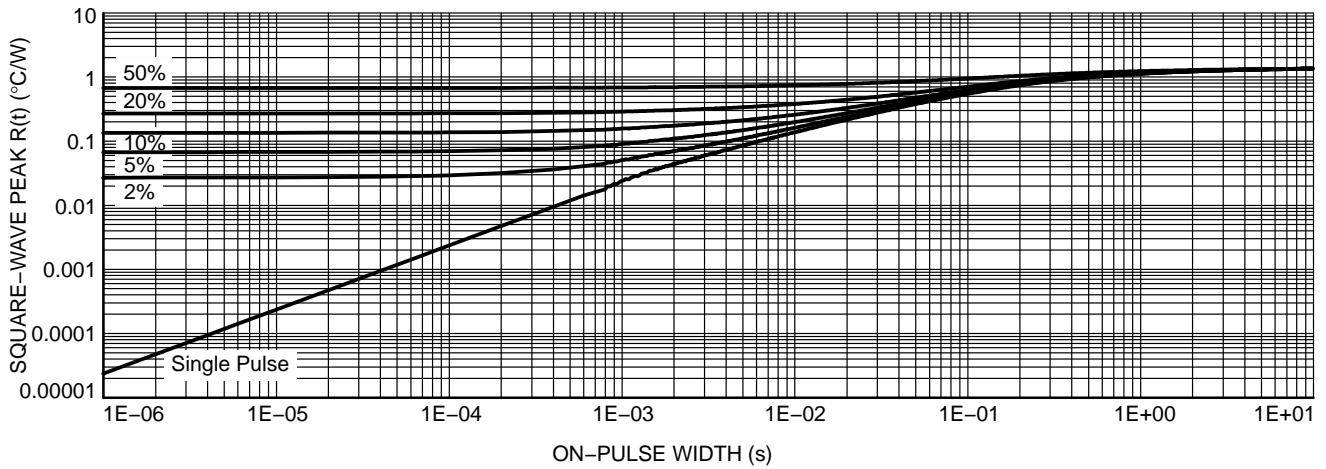


Figure 39. IGBT Transient Thermal Impedance

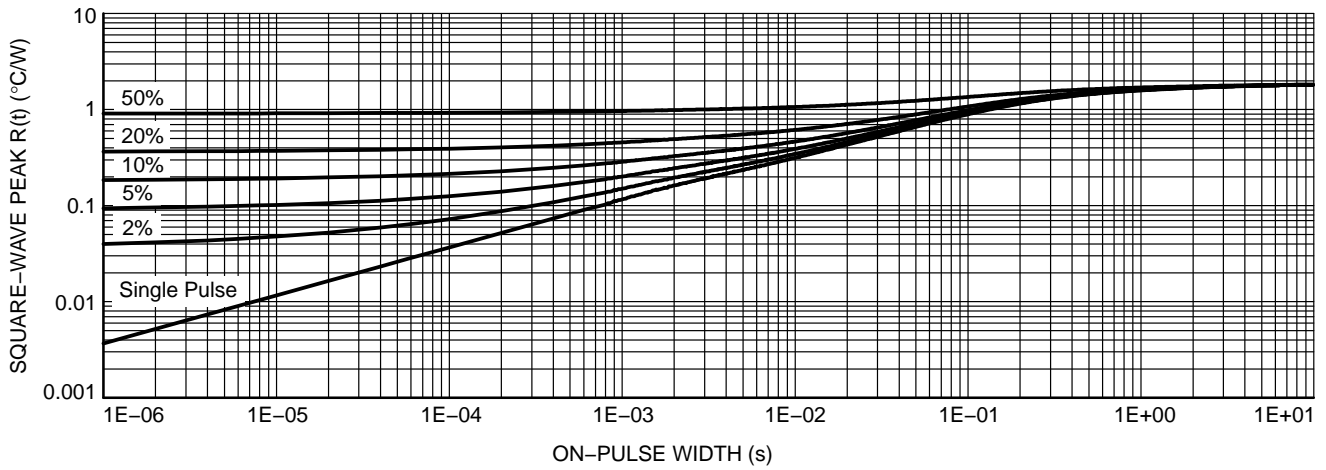


Figure 40. Diode Transient Thermal Impedance

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## THERMISTOR CHARACTERISTICS

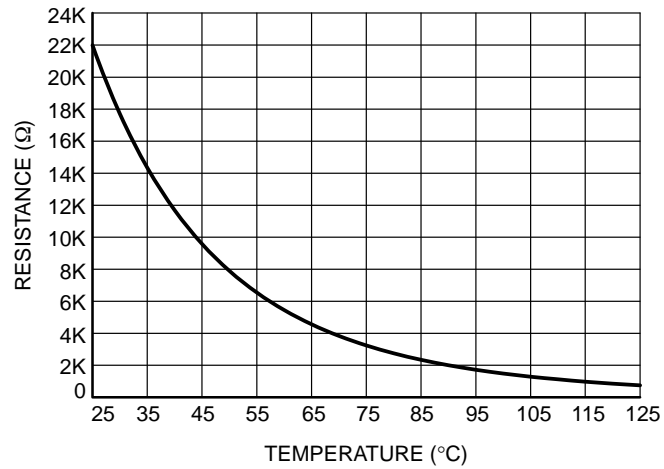


Figure 41. Thermistor Characteristics

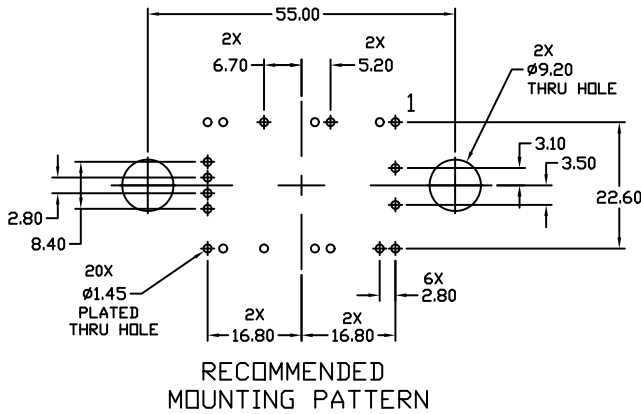
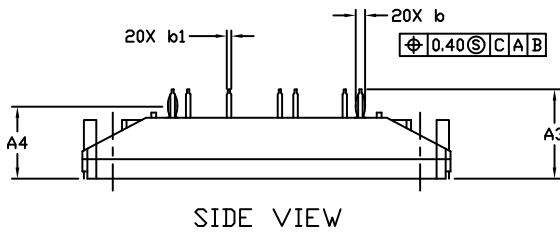
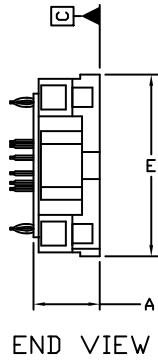
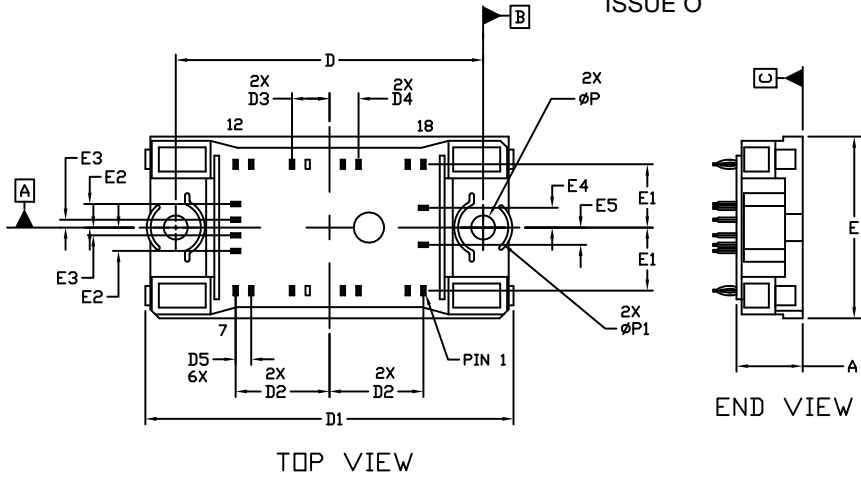
### ORDERING INFORMATION

Orderable Part Number	Package	Shipping
NXH80T120L2Q0PG (Press Fit Pin)	Q0PACK – Case 180AA (Pb-Free and Halide-Free)	24 Units / Blister Tray
NXH80T120L2Q0SG (Solder Pin)	Q0PACK – Case 180AB (Pb-Free and Halide-Free)	24 Units / Blister Tray

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## PACKAGE DIMENSIONS

PIM20, 55x32.5 / Q0PACK  
CASE 180AA  
ISSUE O



### NOTES:

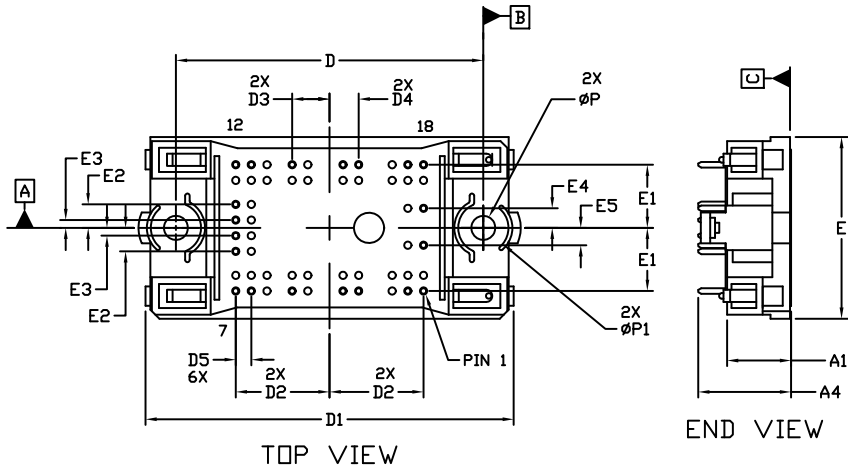
1. DIMENSIONING AND TOLERANCING PER. ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A4.

DIM	MILLIMETERS	
	MIN.	NOM.
A	11.33	12.33
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
D2	16.80 BSC	
D3	6.70 BSC	
D4	5.20 BSC	
D5	2.80 BSC	
E	32.30	32.70
E1	11.30 BSC	
E2	4.20 BSC	
E3	1.40 BSC	
E4	3.50 BSC	
E5	3.10 BSC	
P	4.10	4.50
P1	8.50	9.50

# NXH80T120L2Q0PG, NXH80T120L2Q0SG

## PACKAGE DIMENSIONS

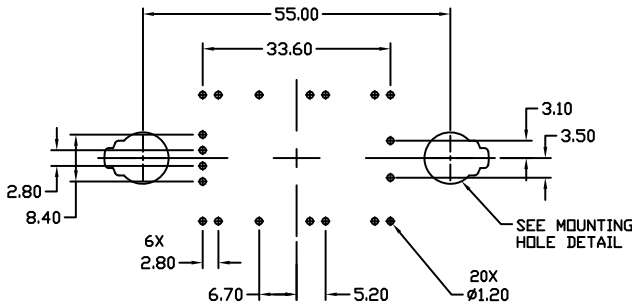
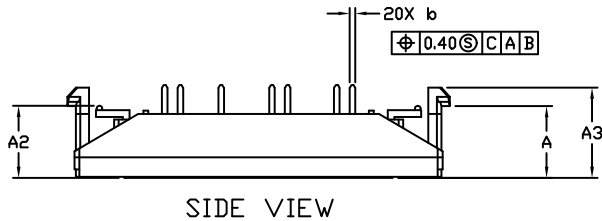
PIM20, 55x32.5 / Q0PACK  
CASE 180AB  
ISSUE O



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO THE PLATED TERMINALS AND ARE MEASURED BETWEEN 1.00 AND 3.00 FROM TERMINAL TIP.

DIM	MILLIMETERS	
	MIN.	NDM.
A	13.10	14.10
A1	10.75	11.75
A2	12.20	13.20
A3	15.45	16.45
A4	16.40	REF
b	0.95	1.05
D	54.80	55.20
D1	65.70	70.10
D2	16.80	BSC
D3	6.70	BSC
D4	5.20	BSC
D5	2.80	BSC
E	32.00	33.00
E1	11.30	BSC
E2	4.20	BSC
E3	1.40	BSC
E4	3.50	BSC
E5	3.10	BSC
P	4.10	4.50
P1	8.50	9.50



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