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# NXH80T120L2Q0S1G

## T-Type NPC Power Module

1200 V, 55 A IGBT, 600 V, 50 A IGBT

The NXH80T120L2Q0S1G is a power module containing a T-type neutral point clamped (NPC) three level inverter consisting of two 55 A/1200 V half-bridge IGBTs with 40 A/1200 V half-bridge diodes and two 50 A/600 V NP IGBTs with two 50 A/600 V NP diodes. The module also contains an on-board thermistor.

### Features

- T-type NPC Module with 55 A/1200 V and 50 A/600 V IGBTs
- HB IGBT Specifications:  $V_{CE(SAT)} = 2.5 \text{ V}$ ,  $E_{SW} = 1000 \mu\text{J}$
- NP IGBT Specifications:  $V_{CE(SAT)} = 1.5 \text{ V}$ ,  $E_{SW} = 880 \mu\text{J}$
- Solder Pins
- Thermistor

### Typical Applications

- Solar Inverter
- Uninterruptible Power Supplies

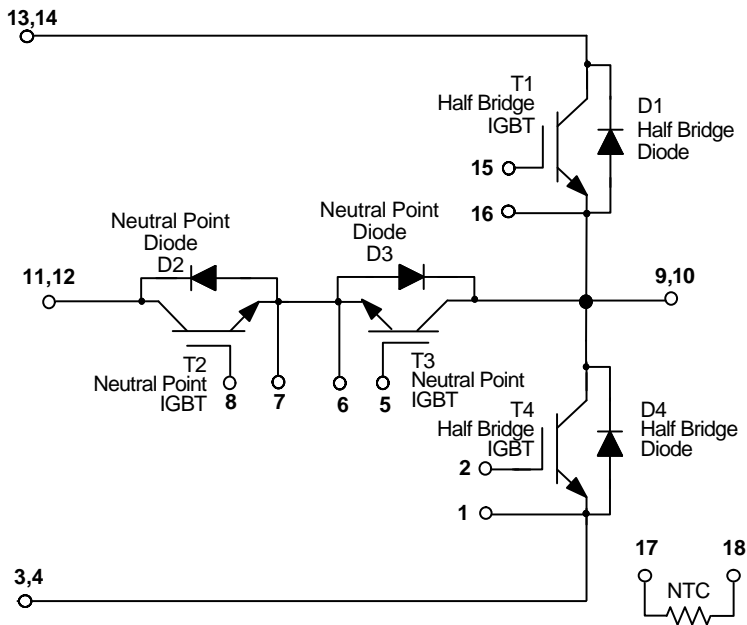
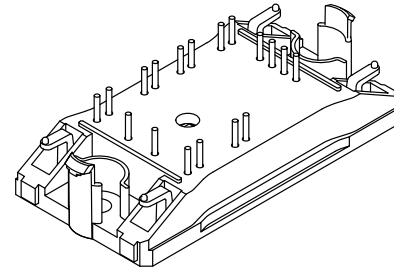


Figure 1. NXH80T120L2Q0S1G Schematic Diagram



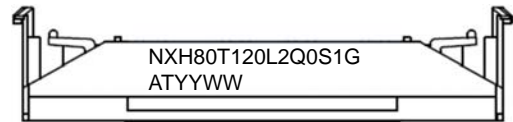
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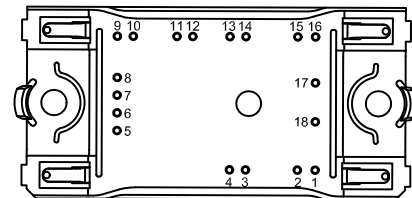
Q0PACK  
CASE 180AH

### MARKING DIAGRAM



NXH80T120L2Q0S1G = Device Code  
YYWW = Year and Work Week Code  
A = Assembly Site Code  
T = Test Site Code  
G = Pb-Free Package

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information in the dimensions section on page 11 of this data sheet.

# NXH80T120L2Q0S1G

**Table 1. ABSOLUTE MAXIMUM RATINGS** (Note 1)  $T_J = 25^\circ\text{C}$  unless otherwise noted

Rating	Symbol	Value	Unit
<b>HALF BRIDGE IGBT</b>			
Collector–Emitter Voltage	$V_{CES}$	1200	V
Gate–Emitter Voltage	$V_{GE}$	$\pm 20$	V
Continuous Collector Current @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$I_C$	57	A
Pulsed Collector Current ( $T_J = 175^\circ\text{C}$ )	$I_{Cpulse}$	171	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$P_{tot}$	125	W
Short Circuit Withstand Time @ $V_{GE} = 15\text{ V}$ , $V_{CE} = 600\text{ V}$ , $T_J \leq 150^\circ\text{C}$	$T_{sc}$	5	$\mu\text{s}$
Minimum Operating Junction Temperature	$T_{JMIN}$	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	$T_{JMAX}$	150	$^\circ\text{C}$
<b>NEUTRAL POINT IGBT</b>			
Collector–Emitter Voltage	$V_{CES}$	600	V
Gate–Emitter Voltage	$V_{GE}$	$\pm 20$	V
Continuous Collector Current @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$I_C$	52	A
Pulsed Collector Current ( $T_J = 175^\circ\text{C}$ )	$I_{Cpulse}$	156	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$P_{tot}$	95	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	$\mu\text{s}$
Minimum Operating Junction Temperature	$T_{JMIN}$	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	$T_{JMAX}$	150	$^\circ\text{C}$
<b>HALF BRIDGE DIODE</b>			
Peak Repetitive Reverse Voltage	$V_{RRM}$	1200	V
Continuous Forward Current @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$I_F$	25	A
Repetitive Peak Forward Current ( $T_J = 175^\circ\text{C}$ , $t_p$ limited by $T_{Jmax}$ )	$I_{FRM}$	70	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$P_{tot}$	54	W
Minimum Operating Junction Temperature	$T_{JMIN}$	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	$T_{JMAX}$	150	$^\circ\text{C}$
<b>NEUTRAL POINT DIODE</b>			
Peak Repetitive Reverse Voltage	$V_{RRM}$	600	V
Continuous Forward Current @ $T_h = 80^\circ\text{C}$ . ( $T_J = 175^\circ\text{C}$ )	$I_F$	31	A
Repetitive Peak Forward Current ( $T_J = 175^\circ\text{C}$ , $t_p$ limited by $T_{Jmax}$ )	$I_{FRM}$	85	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$P_{tot}$	53	W
Minimum Operating Junction Temperature	$T_{JMIN}$	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	$T_{JMAX}$	150	$^\circ\text{C}$
<b>THERMAL PROPERTIES</b>			
Storage Temperature range	$T_{stg}$	-40 to 125	$^\circ\text{C}$
<b>INSULATION PROPERTIES</b>			
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.

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

**Table 2. RECOMMENDED OPERATING RANGES**

Rating	Symbol	Min	Max	Unit
Module Operating Junction Temperature	$T_J$	-40	( $T_{Jmax}-25$ )	$^\circ\text{C}$

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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**Table 3. ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit	
<b>HALF BRIDGE IGBT CHARACTERISTICS</b>							
Collector–Emitter Cutoff Current	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$	$I_{CES}$	–	–	300	$\mu\text{A}$	
Collector–Emitter Saturation Voltage	$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 25^\circ\text{C}$	$V_{CE(sat)}$	–	2.50	2.85	V	
	$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 150^\circ\text{C}$		–	2.15	–		
Gate–Emitter Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1.5\text{ mA}$	$V_{GE(TH)}$	–	5.45	6.4	V	
Gate Leakage Current	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	–	–	300	nA	
Turn–on Delay Time	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{d(on)}$	–	37	–	ns	
Rise Time		$t_r$	–	23	–		
Turn–off Delay Time		$t_{d(off)}$	–	190	–		
Fall Time		$t_f$	–	30	–		
Turn–on Switching Loss per Pulse		$E_{on}$	–	320	–		$\mu\text{J}$
Turn–off Switching Loss per Pulse		$E_{off}$	–	680	–		
Turn–on Delay Time	$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{d(on)}$	–	30	–	ns	
Rise Time		$t_r$	–	25	–		
Turn–off Delay Time		$t_{d(off)}$	–	230	–		
Fall Time		$t_f$	–	90	–		
Turn–on Switching Loss per Pulse		$E_{on}$	–	500	–		$\mu\text{J}$
Turn–off Switching Loss per Pulse		$E_{off}$	–	1300	–		
Input Capacitance	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 10\text{ kHz}$	$C_{ies}$	–	19400	–	pF	
Output Capacitance		$C_{oes}$	–	400	–		
Reverse Transfer Capacitance		$C_{res}$	–	340	–		
Total Gate Charge	$V_{CE} = 600\text{ V}, I_C = 80\text{ A}, V_{GE} = 15\text{ V}$	$Q_g$	–	800	–	nC	
Thermal Resistance – chip–to–heatsink	Thermal grease, Thickness = 100 $\mu\text{m}$ , $\lambda = 0.84\text{ W/mK}$	$R_{thJH}$	–	0.76	–	$^\circ\text{C/W}$	

### NEUTRAL POINT DIODE CHARACTERISTICS

Diode Forward Voltage	$I_F = 50\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	–	2.60	2.85	V
	$I_F = 50\text{ A}, T_J = 150^\circ\text{C}$		–	2.0	–	
Reverse Recovery Time	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{rr}$	–	30	–	ns
Reverse Recovery Charge		$Q_{rr}$	–	305	–	$\mu\text{C}$
Peak Reverse Recovery Current		$I_{RRM}$	–	22	–	A
Peak Rate of Fall of Recovery Current		$di/dt$	–	1870	–	$\text{A}/\mu\text{s}$
Reverse Recovery Energy		$E_{rr}$	–	77	–	$\mu\text{J}$
Reverse Recovery Time		$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{rr}$	–	34	–
Reverse Recovery Charge	$Q_{rr}$		–	910	–	nC
Peak Reverse Recovery Current	$I_{RRM}$		–	50	–	A
Peak Rate of Fall of Recovery Current	$di/dt$		–	4200	–	$\text{A}/\mu\text{s}$
Reverse Recovery Energy	$E_{rr}$		–	200	–	$\mu\text{J}$
Thermal Resistance – chip–to–heatsink	Thermal grease, Thickness = 100 $\mu\text{m}$ , $\lambda = 0.84\text{ W/mK}$		$R_{thJH}$	–	1.80	–

### NEUTRAL POINT IGBT CHARACTERISTICS

Collector–Emitter Cutoff Current	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	$I_{CES}$	–	–	200	$\mu\text{A}$
Collector–Emitter Saturation Voltage	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 25^\circ\text{C}$	$V_{CE(sat)}$	–	1.50	1.75	V
	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 150^\circ\text{C}$		–	1.60	–	
Gate–Emitter Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1.2\text{ mA}$	$V_{GE(TH)}$	–	5.45	6.4	V
Gate Leakage Current	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	–	–	200	nA

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**Table 3. ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>NEUTRAL POINT IGBT CHARACTERISTICS</b>						
Turn-on Delay Time	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{d(on)}$	–	23	–	ns
Rise Time		$t_r$	–	17	–	
Turn-off Delay Time		$t_{d(off)}$	–	108	–	
Fall Time		$t_f$	–	31	–	$\mu\text{J}$
Turn-on Switching Loss per Pulse		$E_{on}$	–	360	–	
Turn-off Switching Loss per Pulse		$E_{off}$	–	520	–	
Turn-on Delay Time	$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{d(on)}$	–	27	–	ns
Rise Time		$t_r$	–	17	–	
Turn-off Delay Time		$t_{d(off)}$	–	130	–	
Fall Time		$t_f$	–	75	–	$\mu\text{J}$
Turn-on Switching Loss per Pulse		$E_{on}$	–	535	–	
Turn-off Switching Loss per Pulse		$E_{off}$	–	865	–	
Input Capacitance	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 10\text{ kHz}$	$C_{ies}$	–	9400	–	$\mu\text{F}$
Output Capacitance		$C_{oes}$	–	280	–	
Reverse Transfer Capacitance		$C_{res}$	–	250	–	
Total Gate Charge	$V_{CE} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	$Q_g$	–	395	–	nC
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness < 100 $\mu\text{m}$ , $\lambda = 0.84\text{ W/mK}$	$R_{thJH}$	–	1.00	–	$^\circ\text{C/W}$

### HALF BRIDGE DIODE CHARACTERISTICS

Diode Forward Voltage	$I_F = 40\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	–	2.65	3.45	V
	$I_F = 40\text{ A}, T_J = 150^\circ\text{C}$		–	2.15	–	
Reverse Recovery Time	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{rr}$	–	38	–	ns
Reverse Recovery Charge		$Q_{rr}$	–	853	–	nC
Peak Reverse Recovery Current		$I_{RRM}$	–	43	–	A
Peak Rate of Fall of Recovery Current		$di/dt$	–	2600	–	A/ $\mu\text{s}$
Reverse Recovery Energy		$E_{rr}$	–	200	–	$\mu\text{J}$
Reverse Recovery Time		$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 40\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4\ \Omega$	$t_{rr}$	–	300	–
Reverse Recovery Charge	$Q_{rr}$		–	2550	–	nC
Peak Reverse Recovery Current	$I_{RRM}$		–	57	–	A
Peak Rate of Fall of Recovery Current	$di/dt$		–	2340	–	A/ $\mu\text{s}$
Reverse Recovery Energy	$E_{rr}$		–	390	–	$\mu\text{J}$
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness < 100 $\mu\text{m}$ , $\lambda = 0.84\text{ W/mK}$		$R_{thJH}$	–	1.76	–

### THERMISTOR CHARACTERISTICS

Nominal resistance		$R_{25}$	–	22	–	k $\Omega$
Nominal resistance	$T = 100^\circ\text{C}$	$R_{100}$	–	1486	–	$\Omega$
Deviation of R25		$\Delta R/R$	–5		5	%
Power dissipation		$P_D$	–	200	–	mW
Power dissipation constant			–	2	–	mW/K
B-value	B(25/50), tolerance $\pm 3\%$		–	3950	–	K
B-value	B(25/100), tolerance $\pm 3\%$		–	3998	–	K

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

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## TYPICAL CHARACTERISTICS – Half Bridge IGBT and Neutral Point Diode

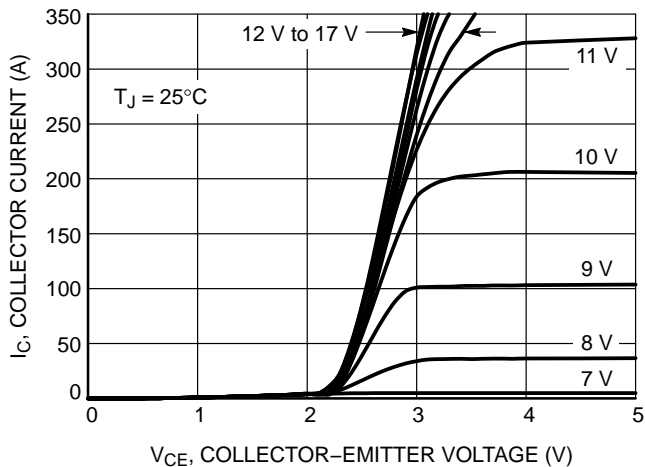


Figure 1. IGBT Typical Output Characteristics

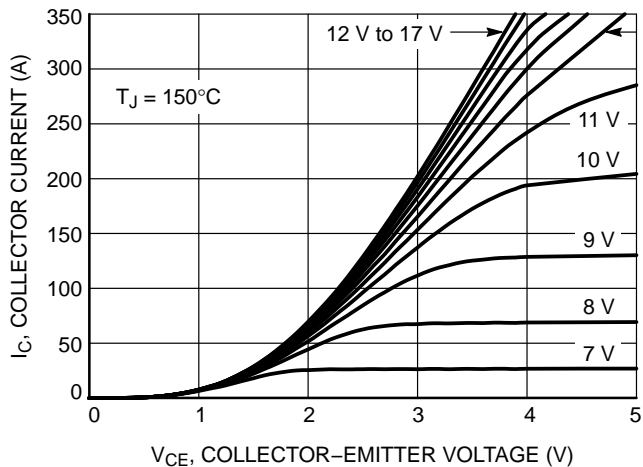


Figure 2. IGBT Typical Output Characteristics

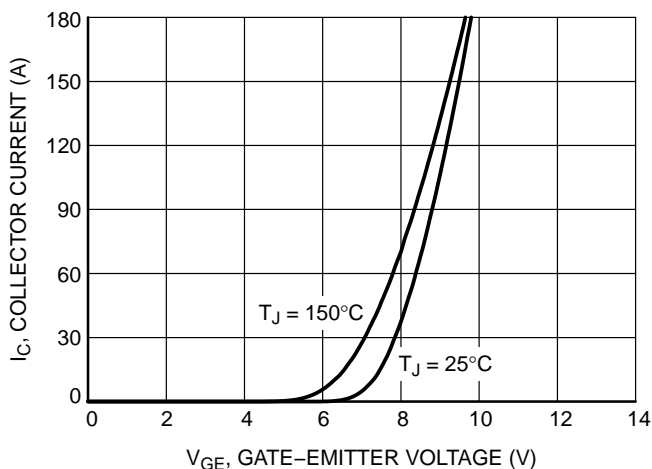


Figure 3. IGBT Typical Transfer Characteristics

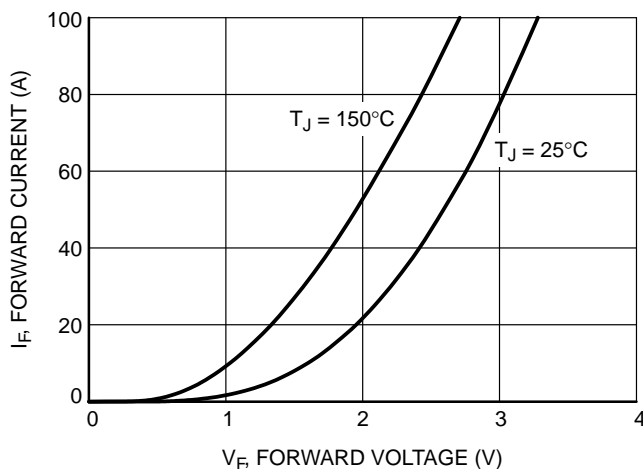


Figure 4. Diode Forward Characteristics

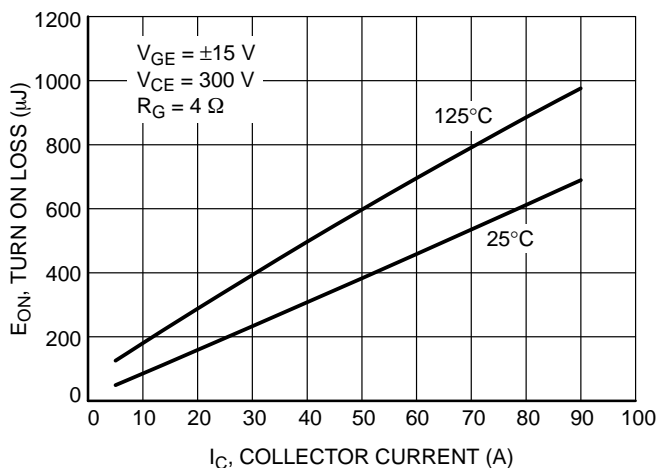


Figure 5. Typical Turn On Loss vs. IC

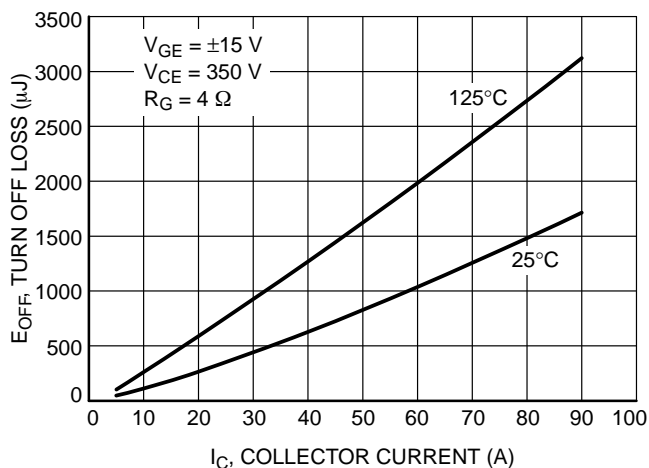


Figure 6. Typical Turn Off Loss vs. IC

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## TYPICAL CHARACTERISTICS – Half Bridge IGBT and Neutral Point Diode

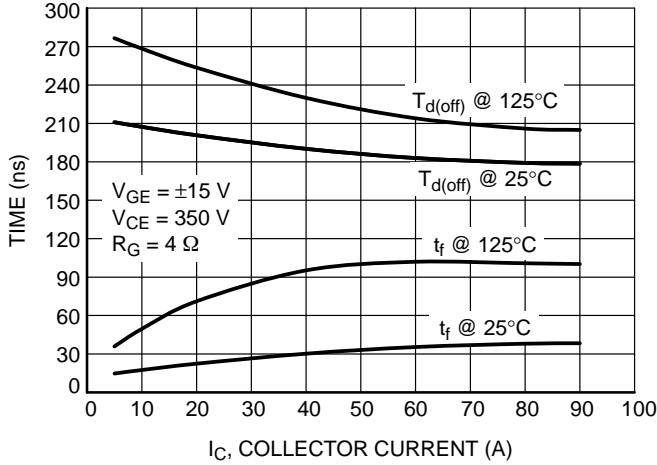


Figure 7. Typical Switching Times vs. IC

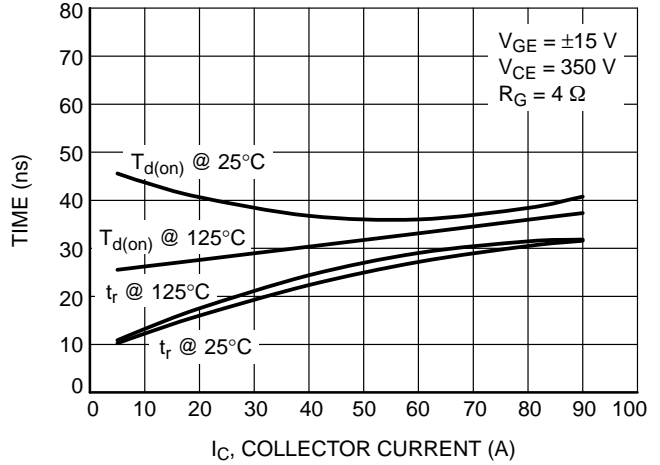


Figure 8. Typical Switching Times vs. IC

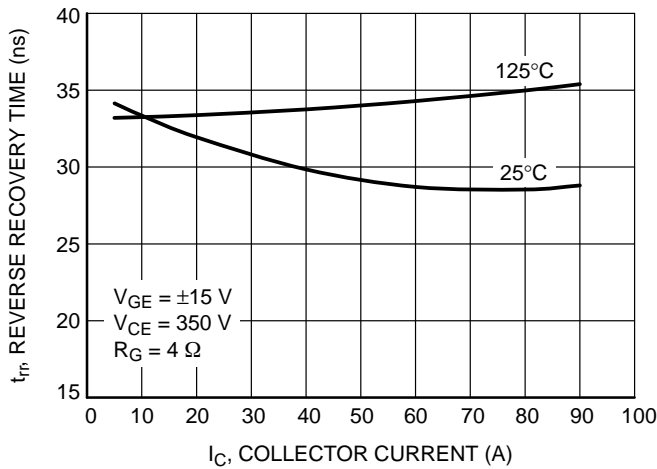


Figure 9. Typical Reverse Recovery Time vs. IC

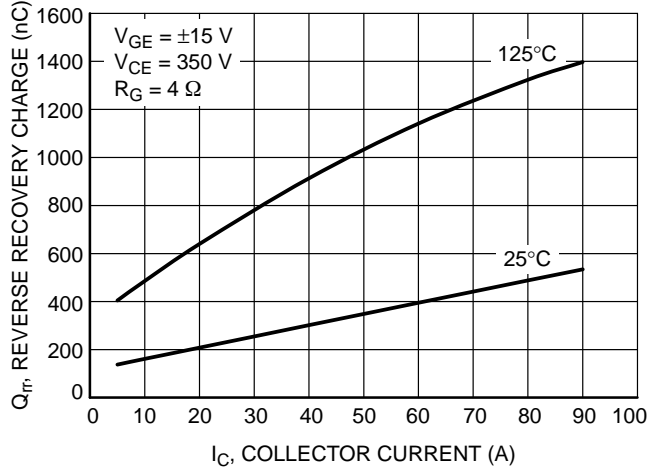


Figure 10. Typical Reverse Recovery Charge vs. IC

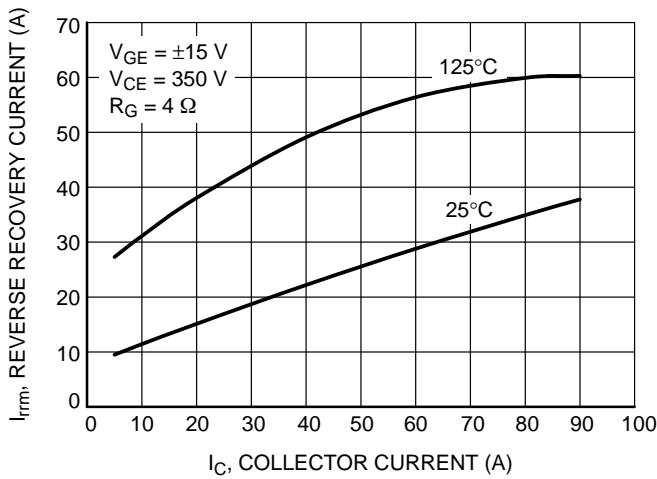


Figure 11. Typical Reverse Recovery Peak Current vs. IC

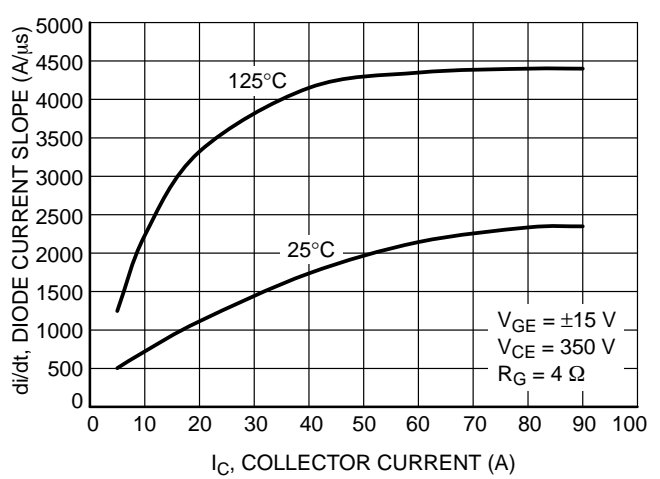
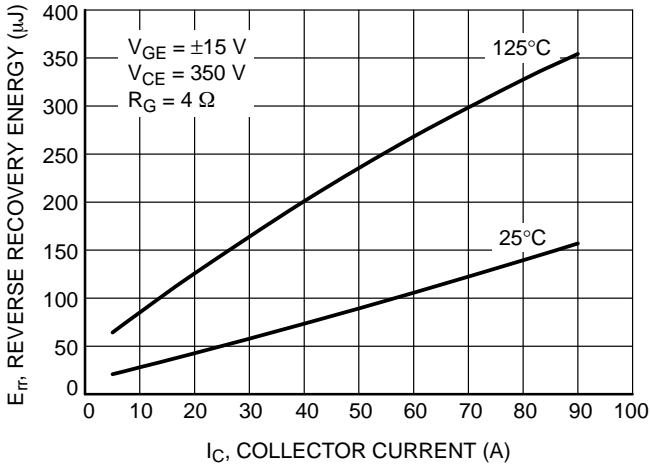


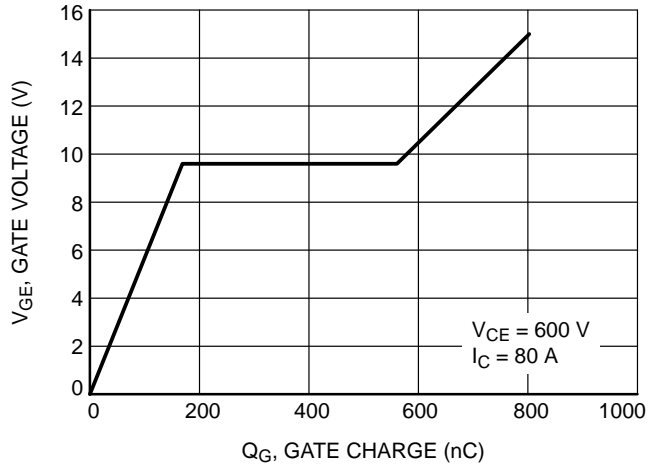
Figure 12. Typical Diode Current Slope vs. IC

# NXH80T120L2Q0S1G

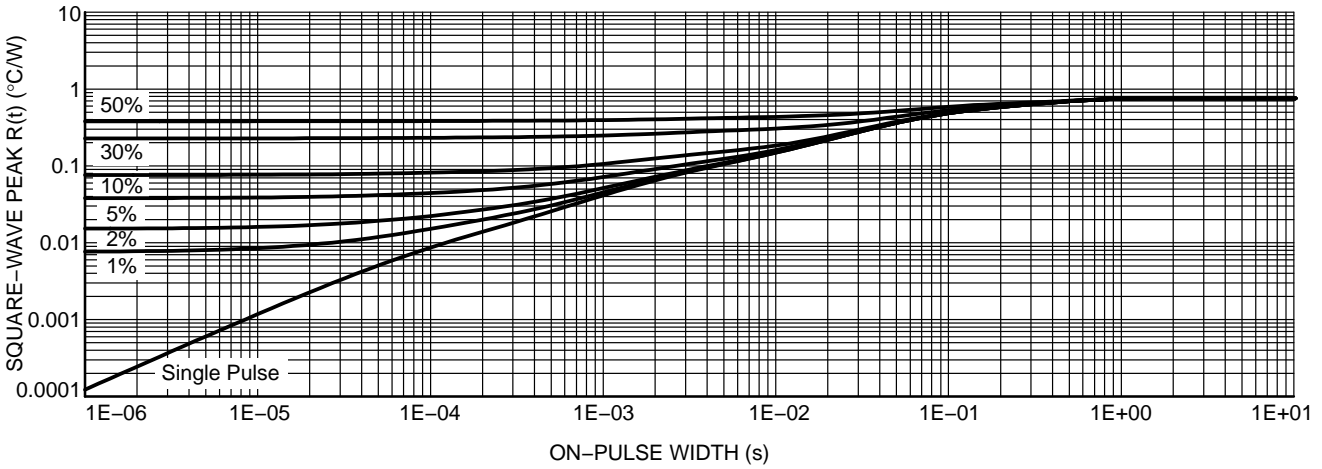
## TYPICAL CHARACTERISTICS – Half Bridge IGBT and Neutral Point Diode



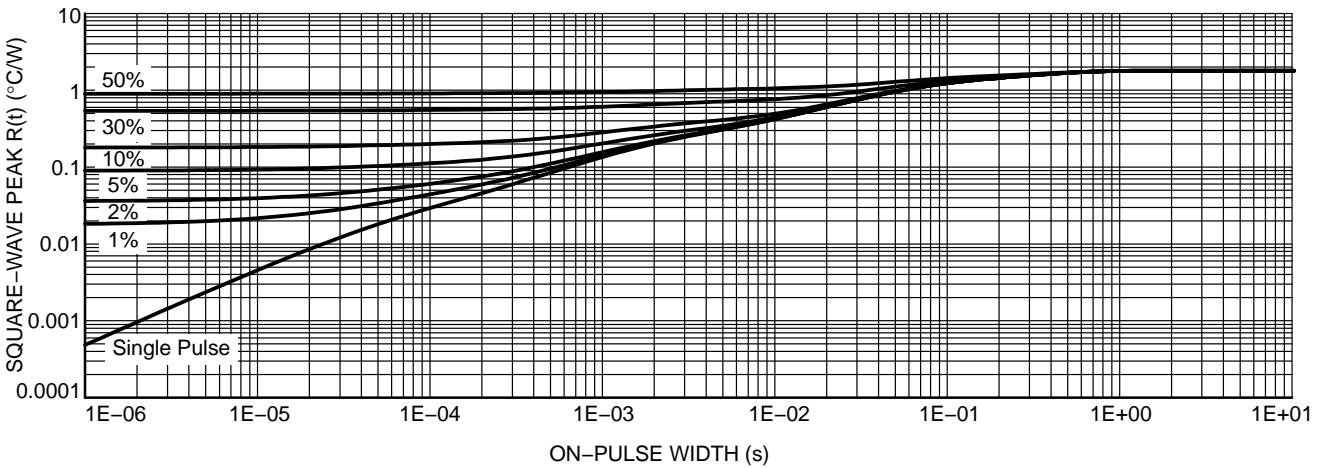
**Figure 13. Typical Reverse Recovery Time vs.  $I_C$**



**Figure 14. Gate Voltage vs. Gate Charge**



**Figure 15. IGBT Transient Thermal Impedance**



**Figure 16. Diode Transient Thermal Impedance**



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## TYPICAL CHARACTERISTICS – Neutral Point IGBT and Half Bridge Diode

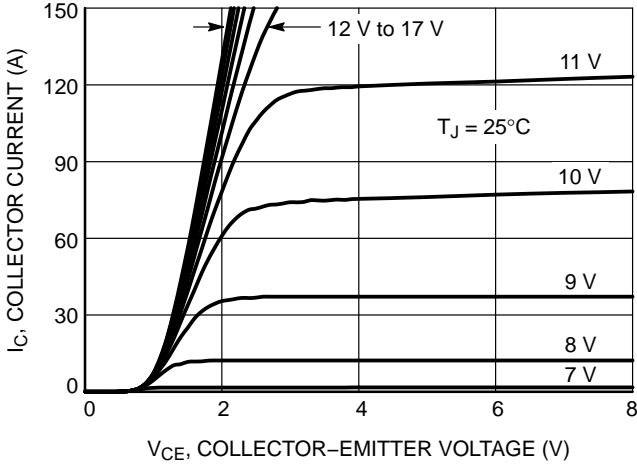


Figure 17. IGBT Typical Output Characteristics

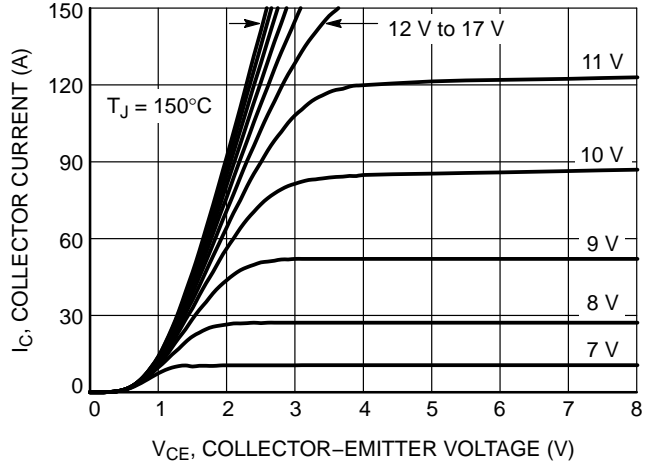


Figure 18. IGBT Typical Output Characteristics

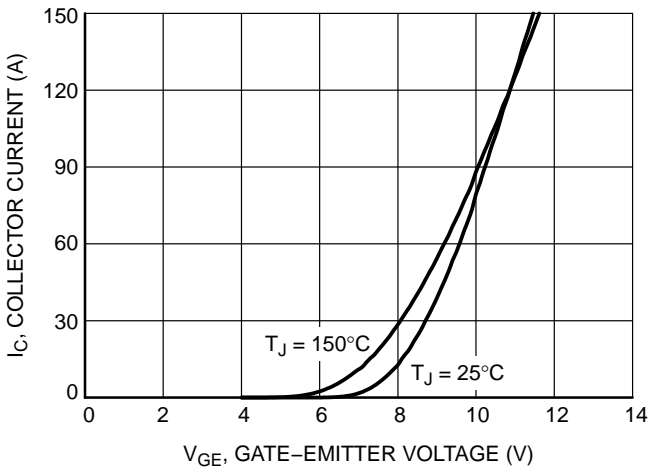


Figure 19. IGBT Typical Transfer Characteristics

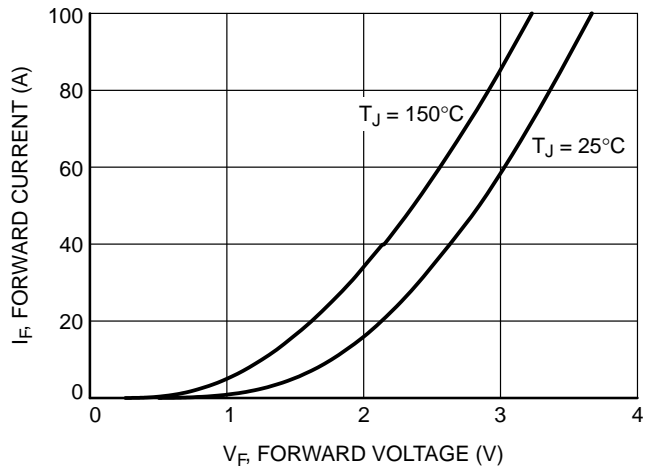


Figure 20. Diode Forward Characteristic

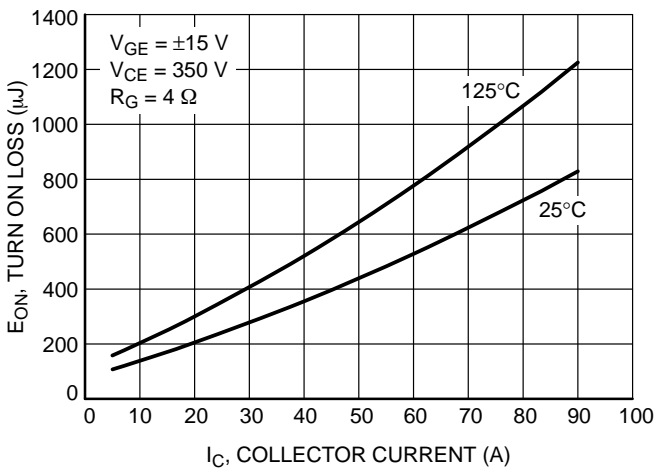


Figure 21. Typical Turn On Loss vs. IC

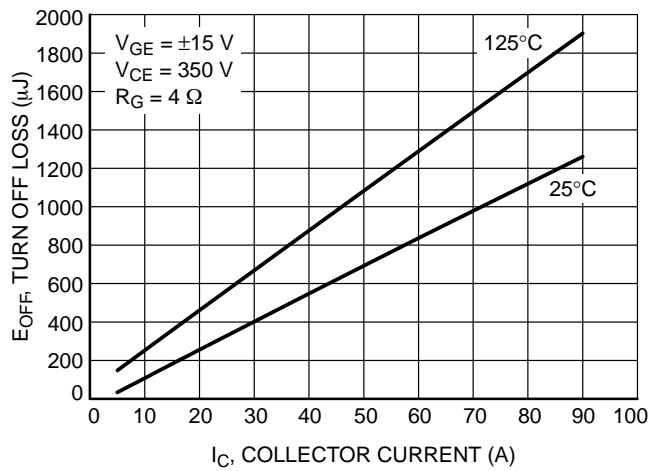


Figure 22. Typical Turn Off Loss vs. IC

# NXH80T120L2Q0S1G

## TYPICAL CHARACTERISTICS – Neutral Point IGBT and Half Bridge Diode

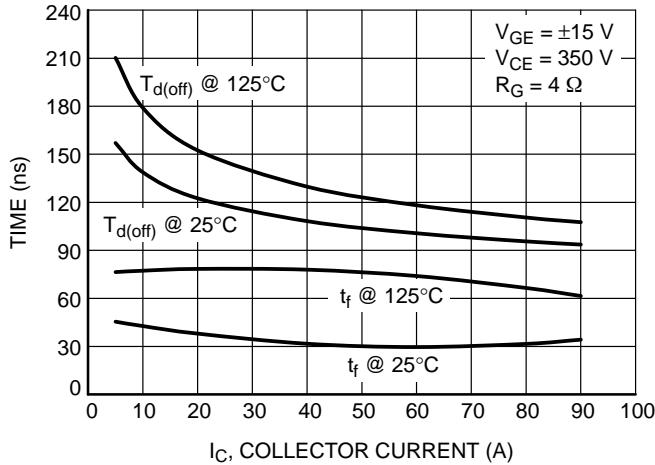


Figure 23. Typical Switching Times vs.  $I_C$

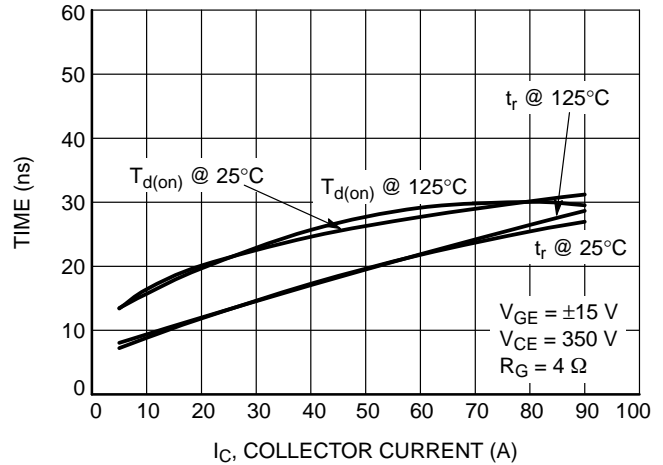


Figure 24. Typical Switching Times vs.  $I_C$

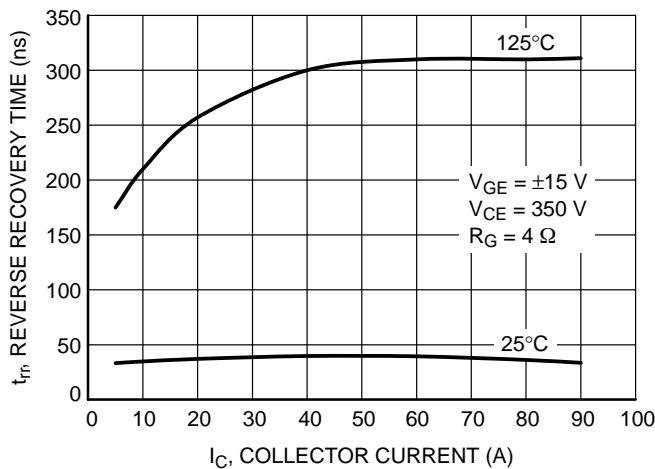


Figure 25. Typical Reverse Recovery Time vs.  $I_C$

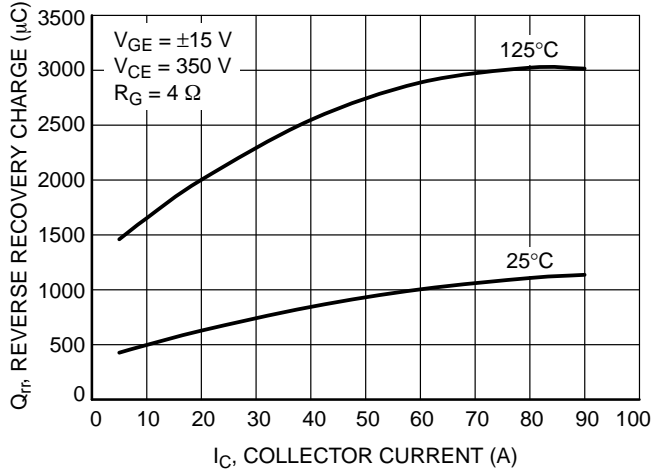


Figure 26. Typical Reverse Recovery Charge vs.  $I_C$

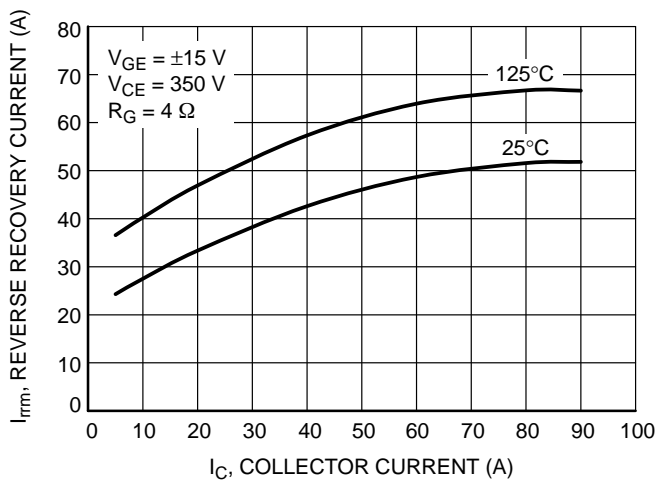


Figure 27. Typical Reverse Recovery Peak Current vs.  $I_C$

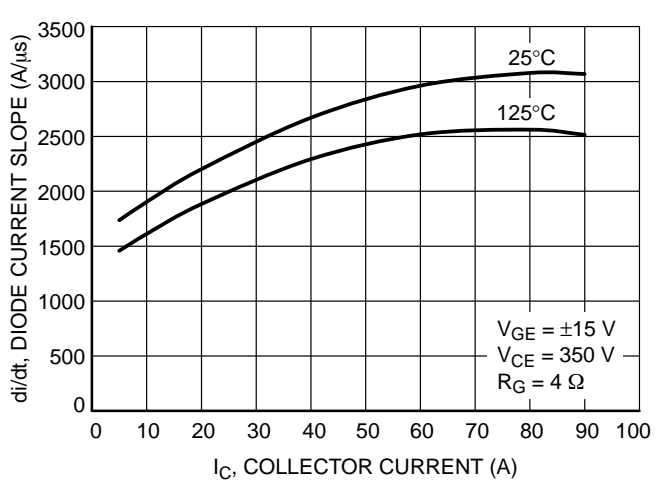
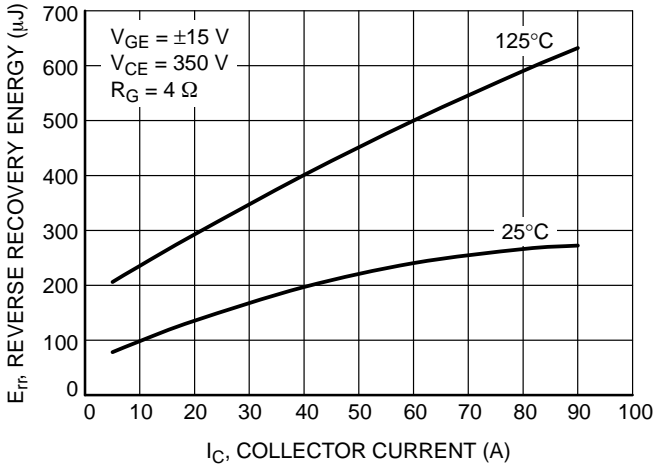


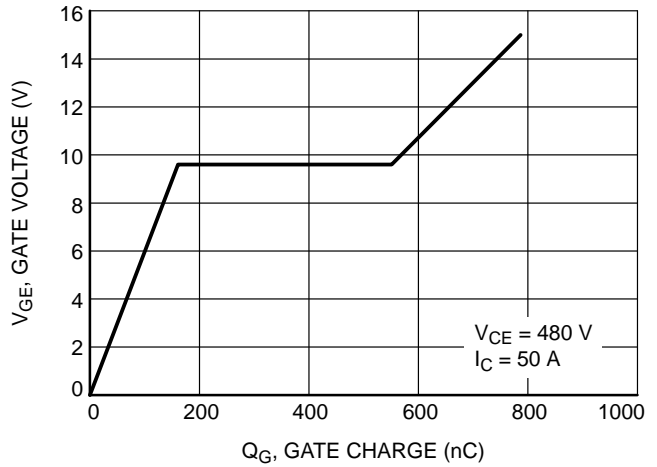
Figure 28. Typical Diode Current Slope vs.  $I_C$

# NXH80T120L2Q0S1G

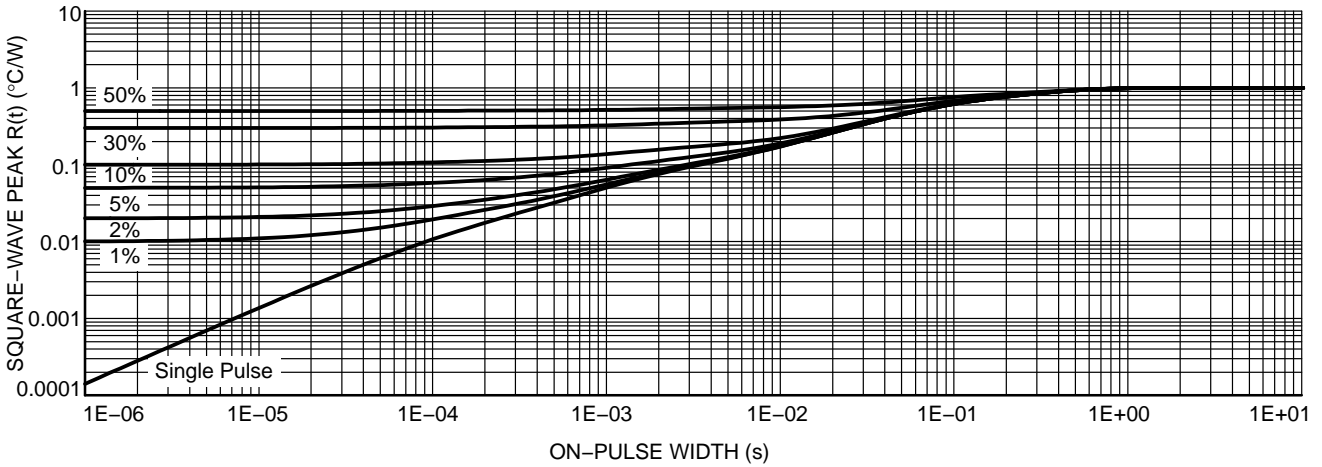
## TYPICAL CHARACTERISTICS – Neutral Point IGBT and Half Bridge Diode



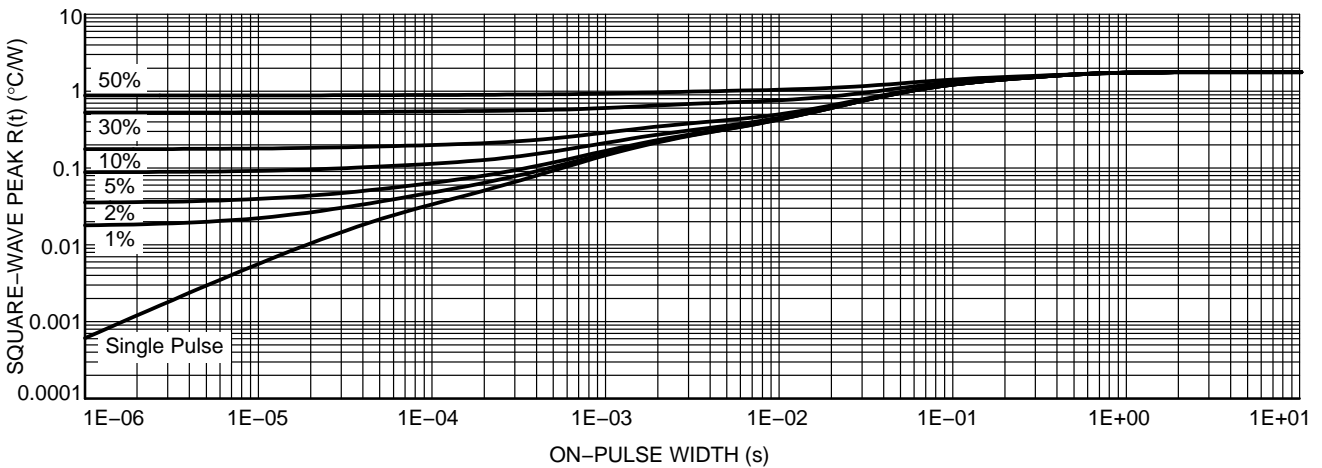
**Figure 29. Typical Reverse Recovery Energy vs.  $I_C$**



**Figure 30. Gate Voltage vs. Gate Charge**



**Figure 31. IGBT Transient Thermal Impedance**



**Figure 32. Diode Transient Thermal Impedance**

# NXH80T120L2Q0S1G

## TYPICAL CHARACTERISTICS – Thermistor

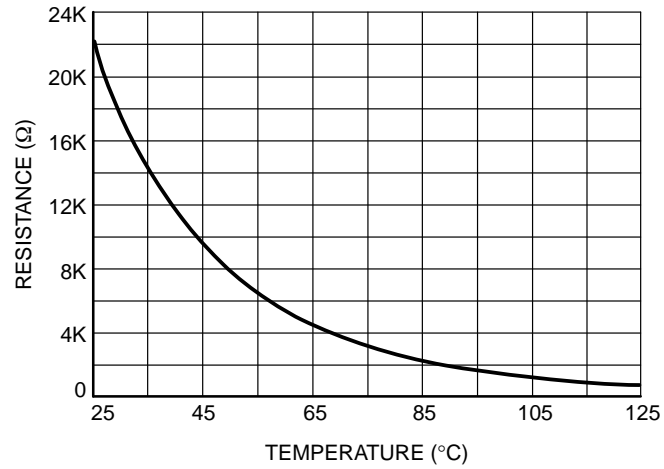


Figure 33. Thermistor Characteristics

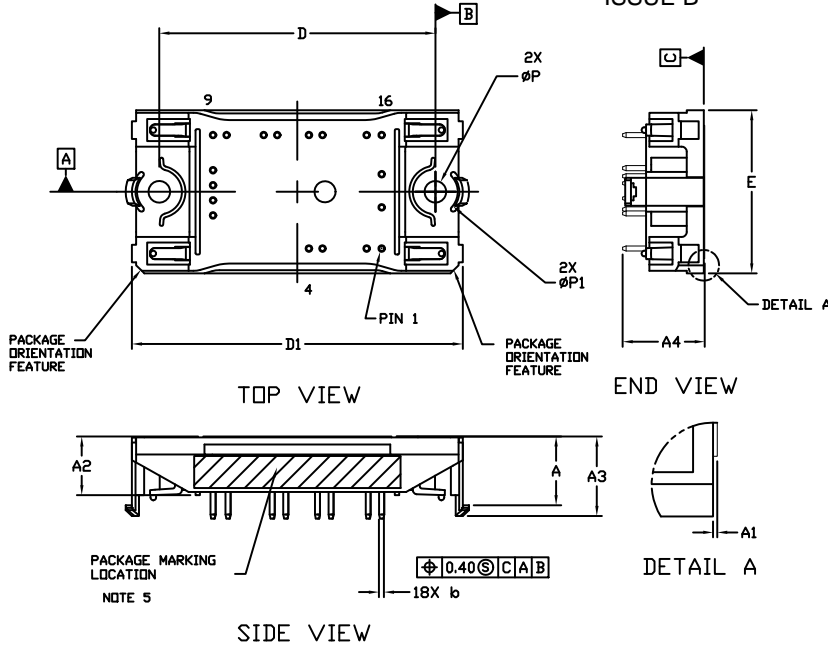
### ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH80T120L2Q0S1G Q0PACK	NXH80T120L2Q0S1G	Q0PACK – Case 180AH (Pb-Free and Halide-Free)	24 Units / Blister Tray

# NXH80T120L2Q0S1G

## PACKAGE DIMENSIONS

PIM18, 55x32.5 / Q0PACK  
CASE 180AH  
ISSUE B



### NOTES:

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

DIM	MILLIMETERS	
	MIN.	NOM.
A	13.50	13.90
A1	0.10	0.30
A2	11.50	11.90
A3	15.65	16.05
A4	16.35	REF
b	0.95	1.05
D	54.80	55.20
D1	65.60	66.20
E	32.20	32.80
P	4.20	4.40
P1	8.90	9.10

### MOUNTING HOLE POSITION

NOTE 4

PIN	PIN POSITION		PIN	PIN POSITION		PIN	PIN POSITION		PIN	PIN POSITION	
	X	Y		X	Y		X	Y		X	Y
1	16.80	11.30	10	-14.10	-10.70	1	16.80	-11.30	10	-14.10	10.70
2	13.80	11.30	11	-6.70	-10.70	2	13.80	-11.30	11	-6.70	10.70
3	5.00	11.30	12	-4.00	-10.70	3	5.00	-11.30	12	-4.00	10.70
4	2.30	11.30	13	2.30	-10.70	4	2.30	-11.30	13	2.30	10.70
5	-16.80	4.70	14	5.00	-10.70	5	-16.80	-4.70	14	5.00	10.70
6	-16.80	1.70	15	13.80	-10.70	6	-16.80	-1.70	15	13.80	10.70
7	-16.80	-1.30	16	16.80	-10.70	7	-16.80	1.30	16	16.80	10.70
8	-16.80	-4.30	17	16.80	-3.50	8	-16.80	4.30	17	16.80	3.50
9	-16.80	-10.70	18	16.80	3.10	9	-16.80	10.70	18	16.80	-3.10

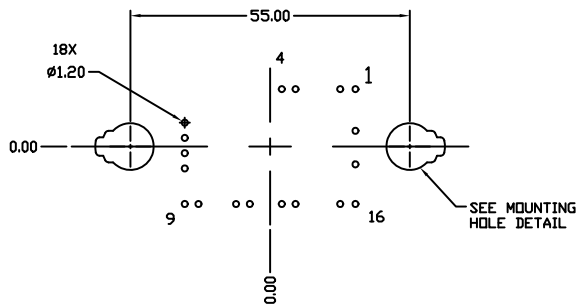
# NXH80T120L2Q0S1G

## PACKAGE DIMENSIONS

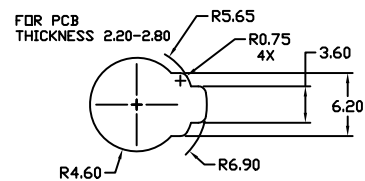
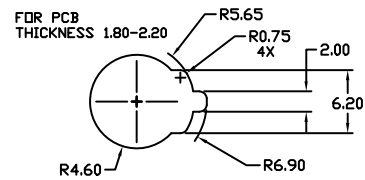
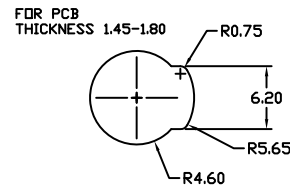
PIM18, 55x32.5 / Q0PACK  
CASE 180AH  
ISSUE O

### MOUNTING HOLE POSITION

PIN	PIN POSITION		PIN	PIN POSITION	
	X	Y		X	Y
1	16.80	11.30	10	-14.10	-10.70
2	13.80	11.30	11	-6.70	-10.70
3	5.00	11.30	12	-4.00	-10.70
4	2.30	11.30	13	2.30	-10.70
5	-16.80	4.70	14	5.00	-10.70
6	-16.80	1.70	15	13.80	-10.70
7	-16.80	-1.30	16	16.80	-10.70
8	-16.80	-4.30	17	16.80	-3.50
9	-16.80	-10.70	18	16.80	3.10



RECOMMENDED MOUNTING PATTERN



MOUNTING HOLE DETAIL

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