

# SNXH80T120L2Q0P2G

## Q0PACK Module

The SNXH80T120L2Q0P2G is a power module containing a T-type neutral point clamped (NPC) three level inverter stage. The integrated field stop trench IGBTs and fast recovery diodes are providing lower conduction loss and switching losses. It enables designers to achieve high efficiency and superior reliability.

### Features

- Low Switching Loss
- Low  $V_{CESAT}$
- Compact 65.9 mm x 32.5 mm x 12 mm Package
- Thermistor
- Press-fit Pins

### Typical Applications

- Solar Inverter
- Uninterruptable Power Supplies

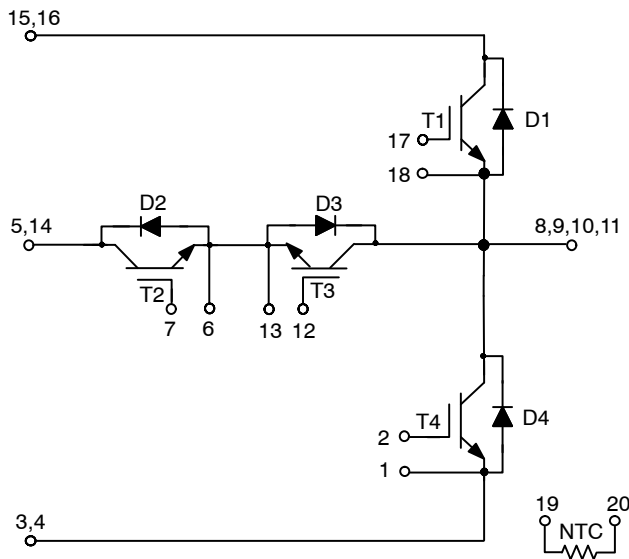
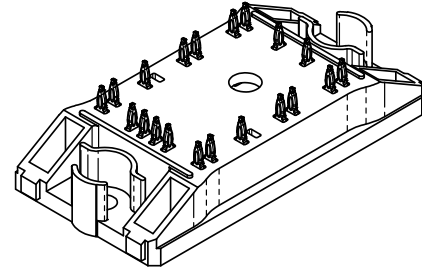


Figure 1. Schematic Diagram



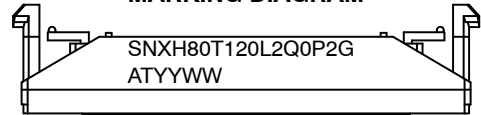
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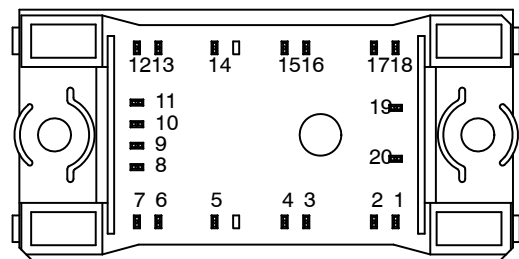
Q0PACK  
CASE 180AA

### MARKING DIAGRAM



SNXH80T120L2Q0P2G = Specific Device Code  
 YYWW = Year and Work Week Code  
 A = Assembly Site Code  
 T = Test Site Code  
 G = Pb-free Package

### PIN ASSIGNMENTS



### ORDERING INFORMATION

See detailed ordering and shipping information in the dimensions section on page 15 of this data sheet.

# SNXH80T120L2Q0P2G

**Table 1. MAXIMUM RATINGS**

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 @ $T_h = 80^\circ\text{C}$	$I_C$	67	A
Pulsed Collector Current	$I_{Cpulse}$	201	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$	$P_{tot}$	158	W
Short Circuit Withstand Time @ $V_{GE} = 15\text{ V}, V_{CE} = 600\text{ V}, T_J \leq 175^\circ\text{C}$	$T_{sc}$	5	$\mu\text{s}$
Maximum Junction Temperature	$T_{JMAX}$	175	$^\circ\text{C}$
<b>NEUTRAL POINT IGBT</b>			
Collector–Emitter Voltage	$V_{CES}$	650	V
Gate–Emitter Voltage	$V_{GE}$	$\pm 20$	V
Continuous Collector Current @ $T_h = 80^\circ\text{C}$	$I_C$	49	A
Pulsed Collector Current	$I_{Cpulse}$	147	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$	$P_{tot}$	86	W
Short Circuit Withstand Time @ $V_{GE} = 15\text{ V}, V_{CE} = 400\text{ V}, T_J \leq 175^\circ\text{C}$	$T_{sc}$	5	$\mu\text{s}$
Maximum Junction Temperature	$T_{JMAX}$	175	$^\circ\text{C}$
<b>HALF BRIDGE DIODE</b>			
Peak Repetitive Reverse Voltage	$V_{RRM}$	1200	V
Continuous Forward Current @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$I_F$	28	A
Repetitive Peak Forward Current ( $T_J = 175^\circ\text{C}$ , $t_p$ limited by $T_{Jmax}$ )	$I_{FRM}$	84	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$P_{tot}$	73	W
Maximum Operating Junction Temperature	$T_{JMAX}$	175	$^\circ\text{C}$
<b>NEUTRAL POINT DIODE</b>			
Peak Repetitive Reverse Voltage	$V_{RRM}$	650	V
Continuous Forward Current @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$I_F$	33	A
Repetitive Peak Forward Current ( $T_J = 175^\circ\text{C}$ , $t_p$ limited by $T_{Jmax}$ )	$I_{FRM}$	99	A
Maximum Power Dissipation @ $T_h = 80^\circ\text{C}$ ( $T_J = 175^\circ\text{C}$ )	$P_{tot}$	63	W
Maximum Operating Junction Temperature	$T_{JMAX}$	175	$^\circ\text{C}$
<b>THERMAL PROPERTIES</b>			
Storage Temperature range	$T_{stg}$	-40 to 125	$^\circ\text{C}$
<b>INSULATION PROPERTIES</b>			
Isolation test voltage, $t = 1\text{ sec}, 60\text{ Hz}$	$V_{is}$	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 Temperature under Switching Condition	$T_{VJOP}$	-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	$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 25^\circ\text{C}$	$V_{CE(sat)}$	–	2.05	2.85	V	
	$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 150^\circ\text{C}$		–	2.10	–		
Gate–Emitter Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1.5\text{ mA}$	$V_{GE(TH)}$	4.5	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	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{d(on)}$	–	61	–	ns	
Rise Time		$t_r$	–	28	–		
Turn-off Delay Time		$t_{d(off)}$	–	205	–		
Fall Time		$t_f$	–	41	–		
Turn-on Switching Loss per Pulse		$E_{on}$	–	550	–		$\mu\text{J}$
Turn off Switching Loss per Pulse		$E_{off}$	–	1100	–		
Turn-on Delay Time	$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{d(on)}$	–	58	–	ns	
Rise Time		$t_r$	–	30	–		
Turn-off Delay Time		$t_{d(off)}$	–	230	–		
Fall Time		$t_f$	–	63	–		
Turn-on Switching Loss per Pulse		$E_{on}$	–	720	–		$\mu\text{J}$
Turn off Switching Loss per Pulse		$E_{off}$	–	1700	–		
Input Capacitance	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 10\text{ kHz}$	$C_{ies}$	–	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 = $76\ \mu\text{m} \pm 2\%$ , $\lambda = 2.9\text{ W/mK}$	$R_{thJH}$	–	0.60	–	$^\circ\text{C/W}$	

### NEUTRAL POINT DIODE CHARACTERISTICS

Diode Forward Voltage	$I_F = 60\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	–	1.7	2.2	V
	$I_F = 60\text{ A}, T_J = 150^\circ\text{C}$		–	1.6	–	
Reverse Recovery Time	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{rr}$	–	39	–	ns
Reverse Recovery Charge		$Q_{rr}$	–	1.1	–	$\mu\text{C}$
Peak Reverse Recovery Current		$I_{RRM}$	–	48	–	A
Peak Rate of Fall of Recovery Current		$di/dt$	–	3400	–	$\text{A}/\mu\text{s}$
Reverse Recovery Energy		$E_{rr}$	–	400	–	$\mu\text{J}$
Reverse Recovery Time		$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{rr}$	–	78	–
Reverse Recovery Charge	$Q_{rr}$		–	2.0	–	$\mu\text{C}$
Peak Reverse Recovery Current	$I_{RRM}$		–	59	–	A
Peak Rate of Fall of Recovery Current	$di/dt$		–	1600	–	$\text{A}/\mu\text{s}$
Reverse Recovery Energy	$E_{rr}$		–	550	–	$\mu\text{J}$
Thermal Resistance – chip-to–heatsink	Thermal grease, Thickness = $76\ \mu\text{m} \pm 2\%$ , $\lambda = 2.9\text{ W/mK}$		$R_{thJH}$	–	1.50	–

### NEUTRAL POINT IGBT CHARACTERISTICS

Collector–Emitter Cutoff Current	$V_{GE} = 0\text{ V}, V_{CE} = 650\text{ V}$	$I_{CES}$	–	–	200	$\mu\text{A}$
Collector–Emitter Saturation Voltage	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 25^\circ\text{C}$	$V_{CE(sat)}$	–	1.40	1.75	V
	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 150^\circ\text{C}$		–	1.50	–	
Gate–Emitter Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1.2\text{ mA}$	$V_{GE(TH)}$	4.5	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	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{d(on)}$	–	30	–	ns
Rise Time		$t_r$	–	19	–	
Turn-off Delay Time		$t_{d(off)}$	–	110	–	
Fall Time		$t_f$	–	23	–	
Turn-on Switching Loss per Pulse		$E_{on}$	–	480	–	$\mu\text{J}$
Turn off Switching Loss per Pulse		$E_{off}$	–	800	–	
Turn-on Delay Time	$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{d(on)}$	–	32	–	ns
Rise Time		$t_r$	–	18	–	
Turn-off Delay Time		$t_{d(off)}$	–	120	–	
Fall Time		$t_f$	–	35	–	
Turn-on Switching Loss per Pulse		$E_{on}$	–	880	–	$\mu\text{J}$
Turn off Switching Loss per Pulse		$E_{off}$	–	1100	–	
Input Capacitance	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 10\text{ kHz}$	$C_{ies}$	–	9400	–	$\text{pF}$
Output Capacitance		$C_{oes}$	–	280	–	
Reverse Transfer Capacitance		$C_{res}$	–	250	–	
Total Gate Charge	$V_{CE} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = +15\text{ V}$	$Q_g$	–	790	–	nC
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness = $76\ \mu\text{m} \pm 2\%$ , $\lambda = 2.9\text{ W/mK}$	$R_{thJH}$	–	1.10	–	$^\circ\text{C/W}$

### HALF BRIDGE DIODE CHARACTERISTICS

Diode Forward Voltage	$I_F = 40\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	–	2.11	3.10	V
	$I_F = 40\text{ A}, T_J = 150^\circ\text{C}$		–	1.50	–	
Reverse recovery time	$T_J = 25^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{rr}$	–	45	–	ns
Reverse recovery charge		$Q_{rr}$	–	2.7	–	$\mu\text{C}$
Peak reverse recovery current		$I_{RRM}$	–	110	–	A
Peak rate of fall of recovery current		$di/dt$	–	7100	–	$\text{A}/\mu\text{s}$
Reverse recovery energy		$E_{rr}$	–	1000	–	$\mu\text{J}$
Reverse recovery time		$T_J = 125^\circ\text{C}$ $V_{CE} = 350\text{ V}, I_C = 60\text{ A}$ $V_{GE} = \pm 15\text{ V}, R_G = 4.7\ \Omega$	$t_{rr}$	–	185	–
Reverse recovery charge	$Q_{rr}$		–	6	–	$\mu\text{C}$
Peak reverse recovery current	$I_{RRM}$		–	150	–	A
Peak rate of fall of recovery current	$di/dt$		–	5900	–	$\text{A}/\mu\text{s}$
Reverse recovery energy	$E_{rr}$		–	1900	–	$\mu\text{J}$
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness = $76\ \mu\text{m} \pm 2\%$ , $\lambda = 2.9\text{ W/mK}$		$R_{thJH}$	–	1.30	–

### THERMISTOR CHARACTERISTICS

Nominal resistance	$T = 25^\circ\text{C}$	$R_{25}$	–	22	–	$\text{k}\Omega$
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	–	$\text{mW/K}$
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 (T1, T4) and Neutral Point Diode (D2, D3)

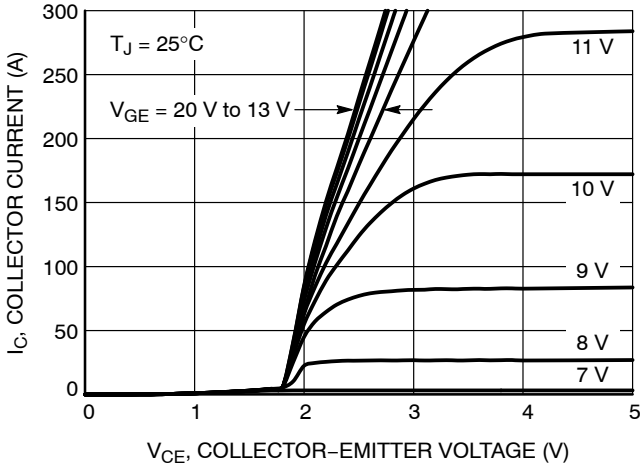


Figure 2. Typical Output Characteristics

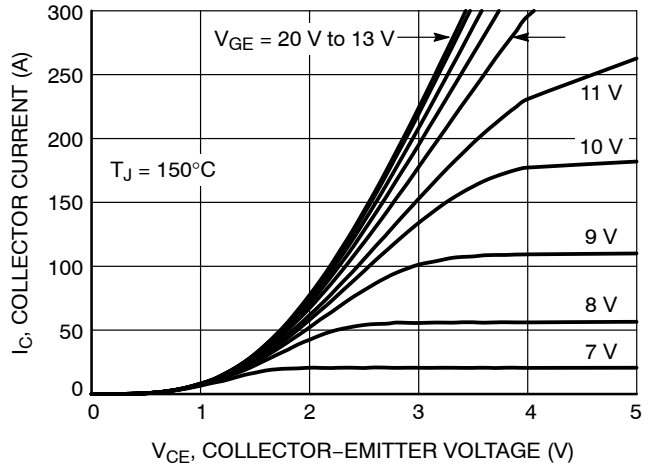


Figure 3. Typical Output Characteristics

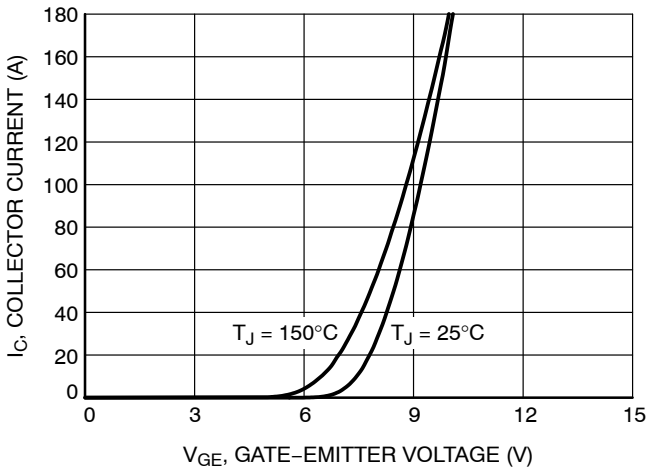


Figure 4. Typical Transfer Characteristics

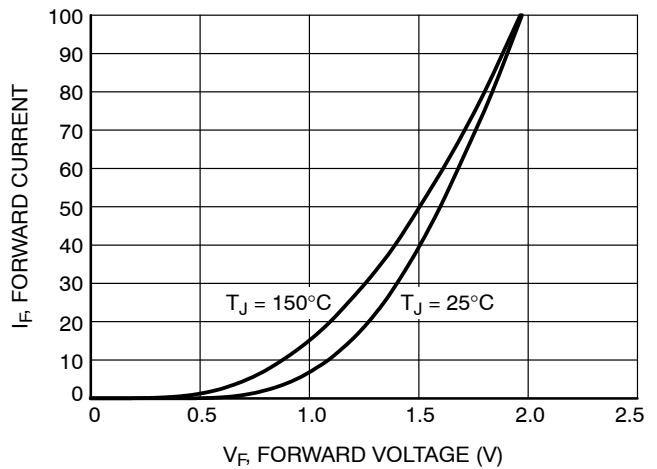


Figure 5. Diode Forward Characteristics

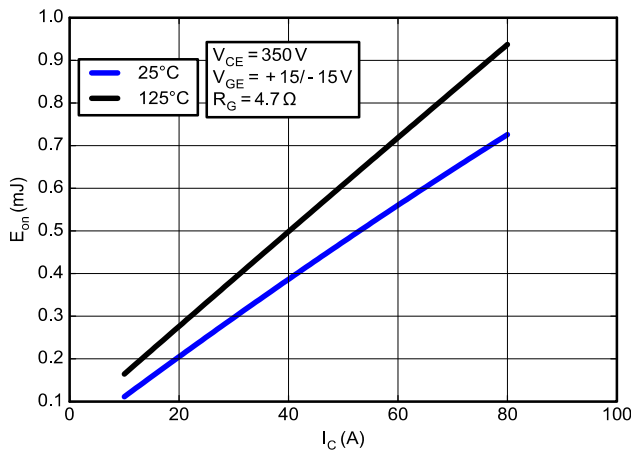


Figure 6. Typical Turn On Loss vs. IC

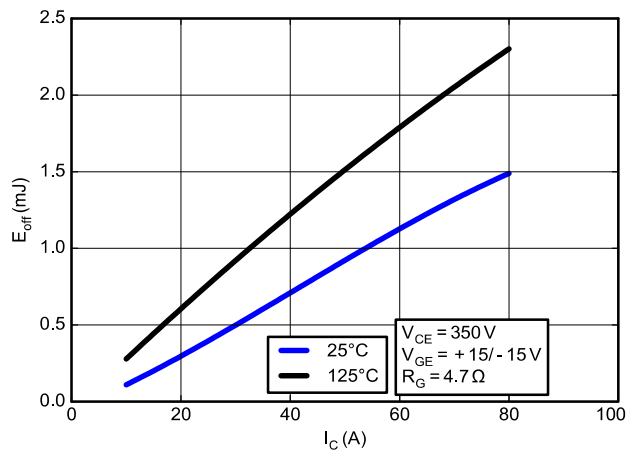


Figure 7. Typical Turn Off Loss vs. IC

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## TYPICAL CHARACTERISTICS – Half Bridge IGBT (T1, T4) and Neutral Point Diode (D2, D3)

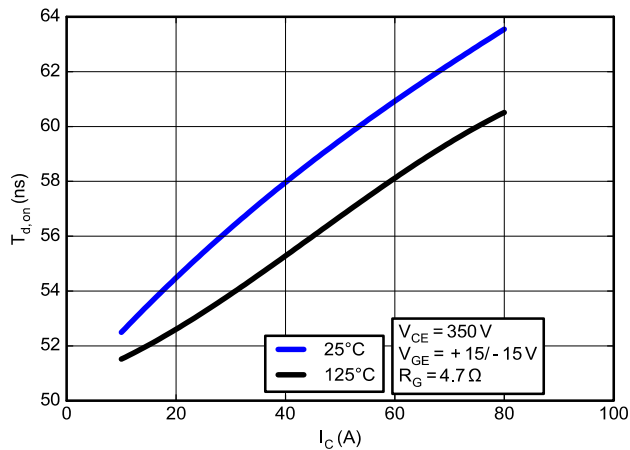


Figure 8. Typical On Switching Times vs. IC

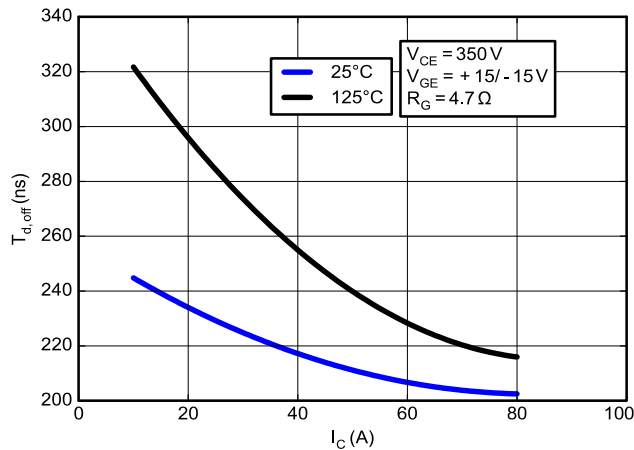


Figure 9. Typical Off Switching Times vs. IC

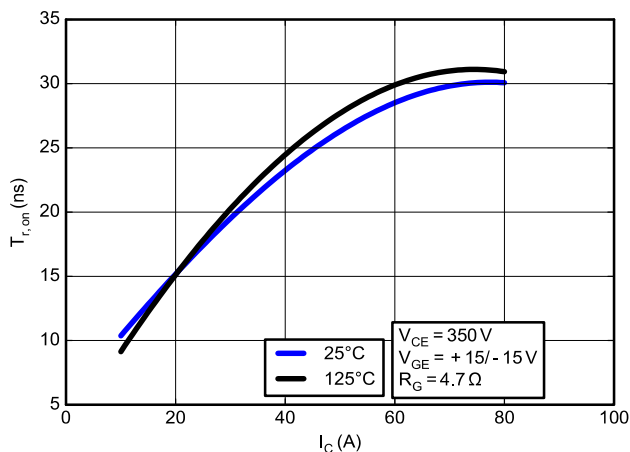


Figure 10. Typical On Rise Times vs. IC

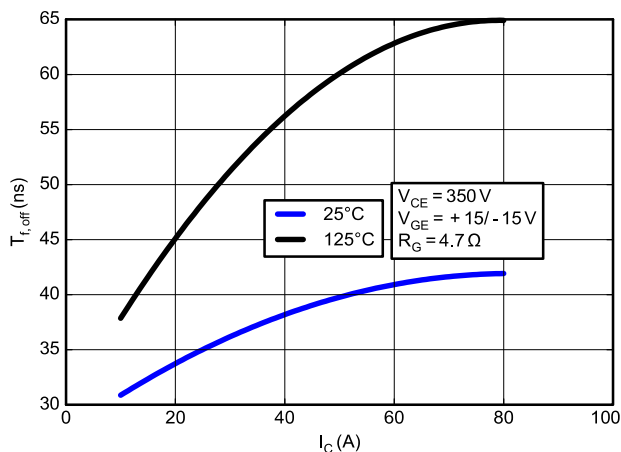


Figure 11. Typical Off Fall Times vs. IC

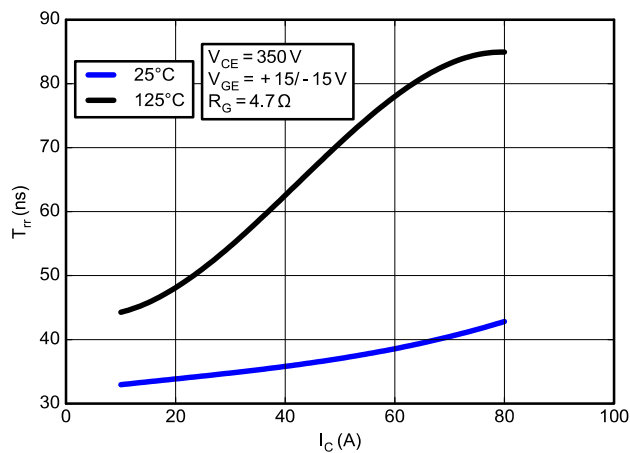


Figure 12. Typical Reverse Recovery Time vs. IC

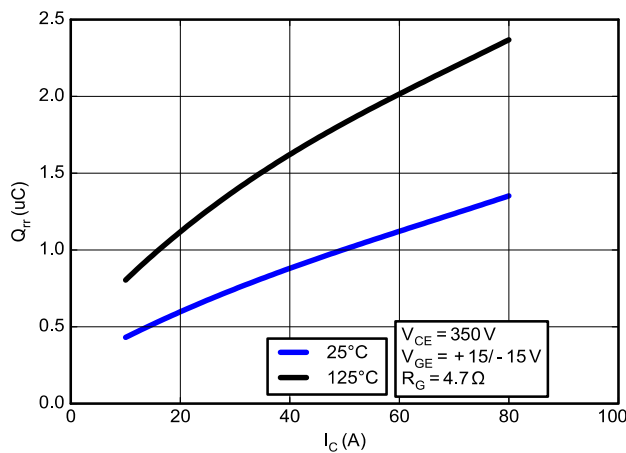


Figure 13. Typical Reverse Recovery Charge vs. IC

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## TYPICAL CHARACTERISTICS – Half Bridge IGBT (T1, T4) and Neutral Point Diode (D2, D3)

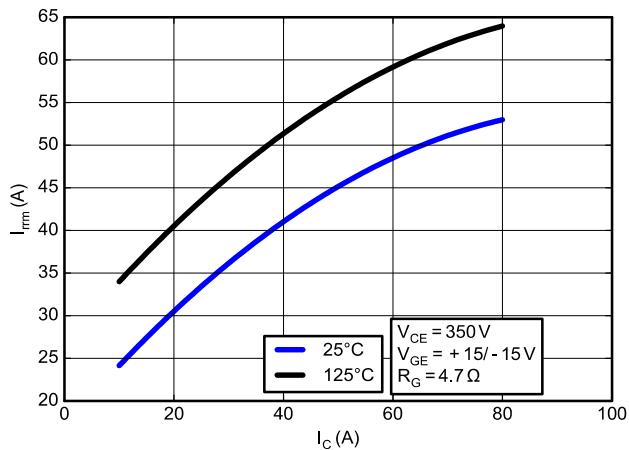


Figure 14. Typical Reverse Recovery Peak Current vs.  $I_C$

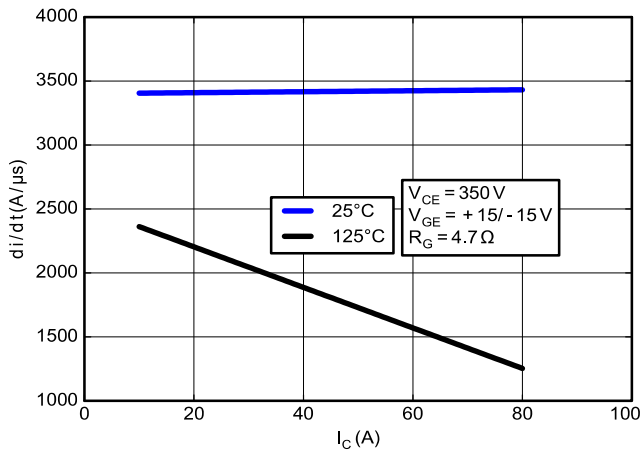


Figure 15. Typical Diode Current Slope vs.  $I_C$

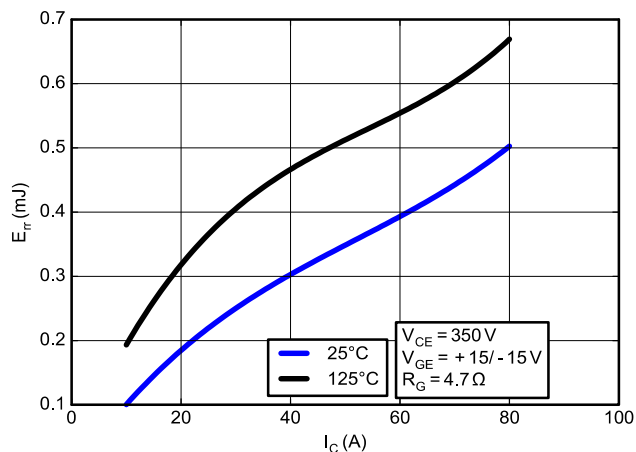


Figure 16. Typical Reverse Recovery Energy vs.  $I_C$

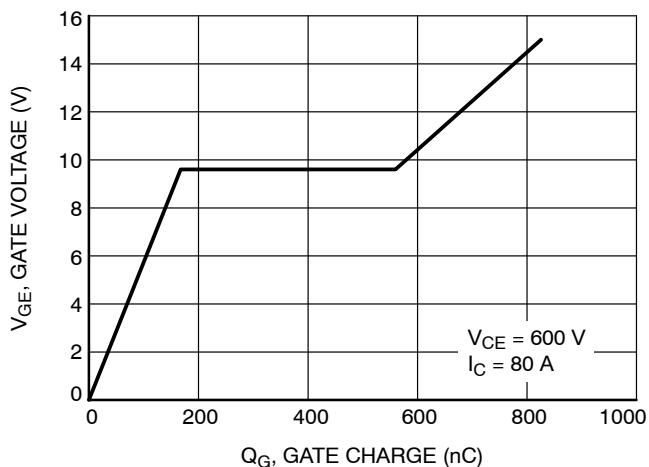


Figure 17. Gate Voltage vs. Gate Charge

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## TYPICAL CHARACTERISTICS – Half Bridge IGBT (T1, T4) and Neutral Point Diode (D2, D3)

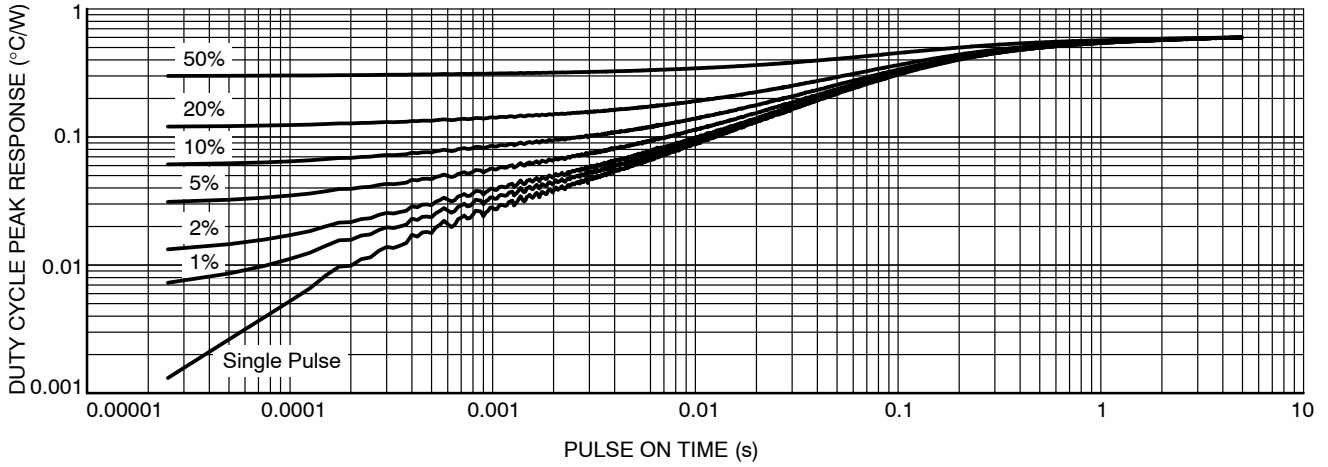


Figure 18. IGBT Transient Thermal Impedance

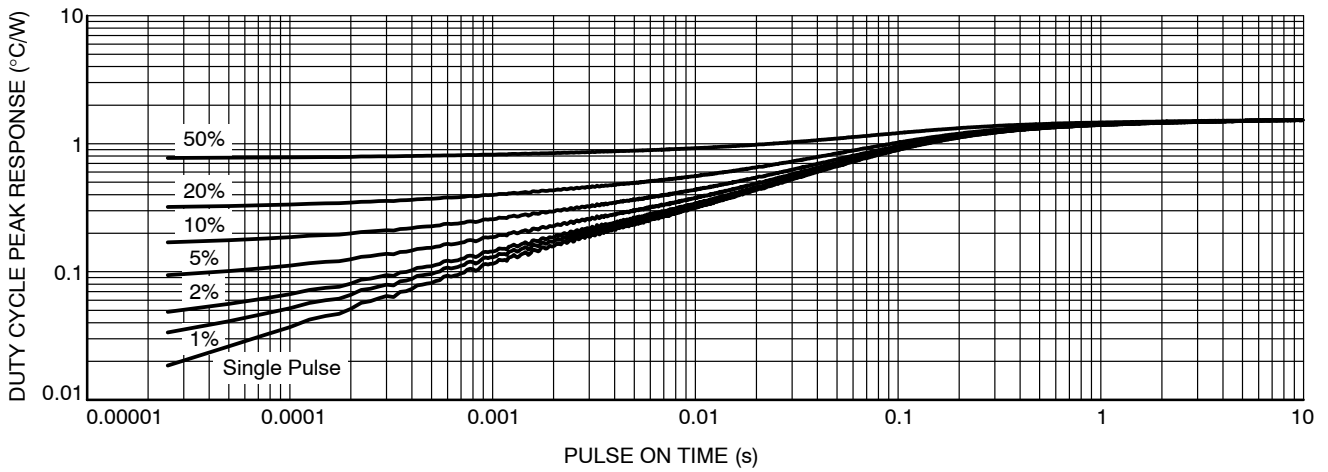


Figure 19. Diode Transient Thermal Impedance

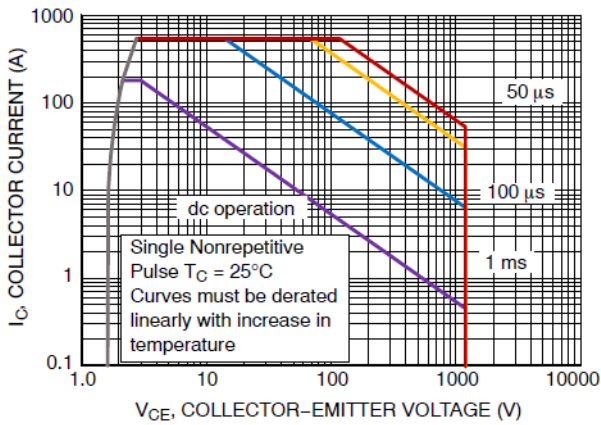


Figure 20. T1 & T4 FBSOA

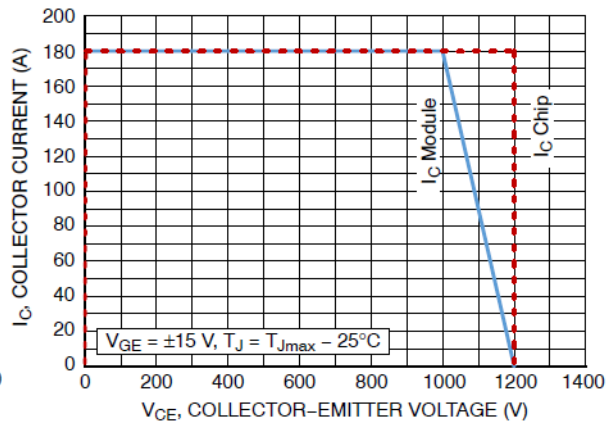


Figure 21. T1 & T4 RBSOA



# SNXH80T120L2Q0P2G

## TYPICAL CHARACTERISTICS – Neutral Point IGBT (T2, T3) and Half Bridge Diode (D1, D4)

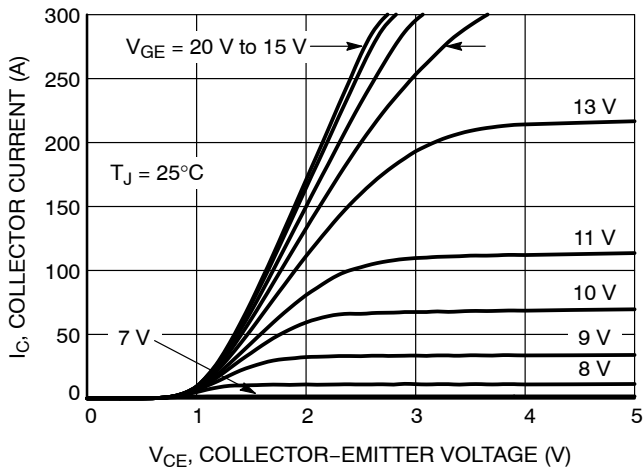


Figure 22. Typical Output Characteristics

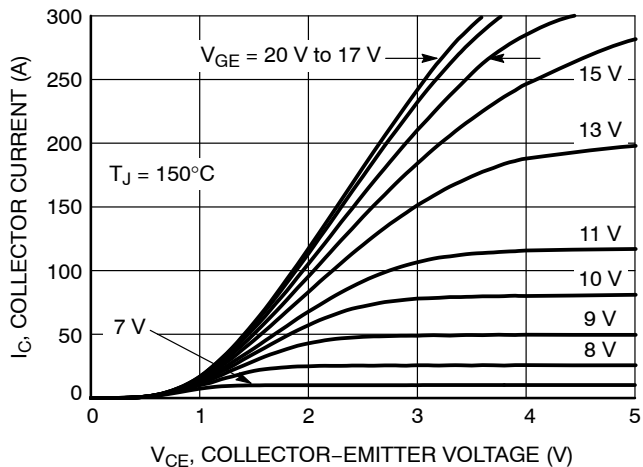


Figure 23. Typical Output Characteristics

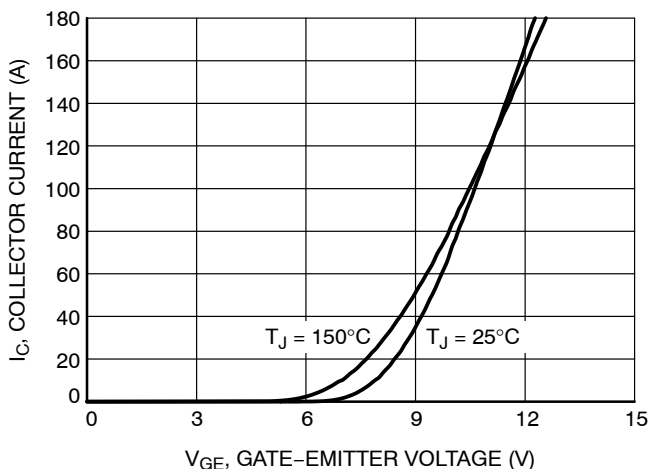


Figure 24. Typical Transfer Characteristics

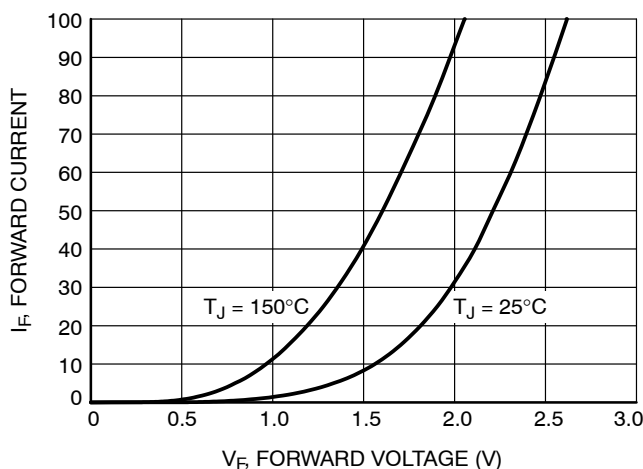


Figure 25. Diode Forward Characteristics

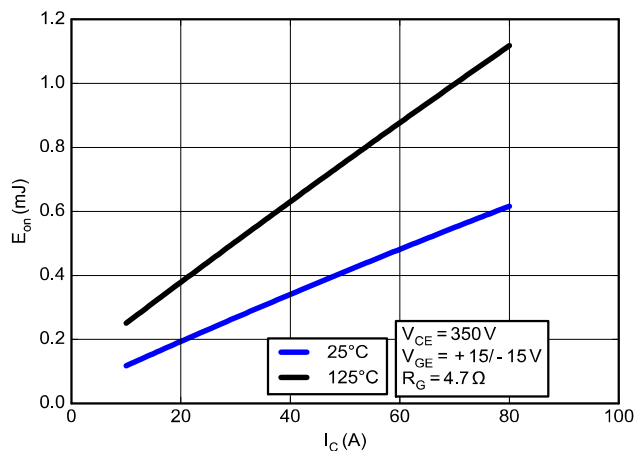


Figure 26. Typical Turn On Loss vs. IC

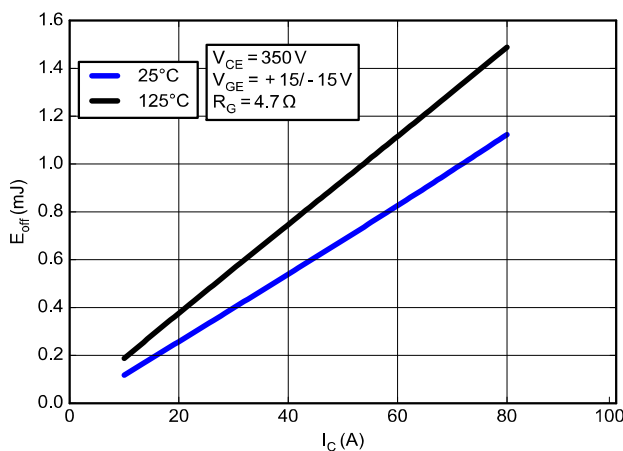


Figure 27. Typical Turn Off Loss vs. IC

# SNXH80T120L2Q0P2G

## TYPICAL CHARACTERISTICS – Neutral Point IGBT (T2, T3) and Half Bridge Diode (D1, D4)

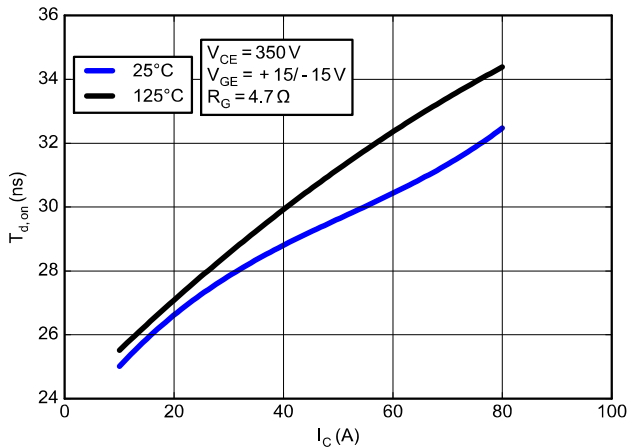


Figure 28. Typical On Switching Times vs. IC

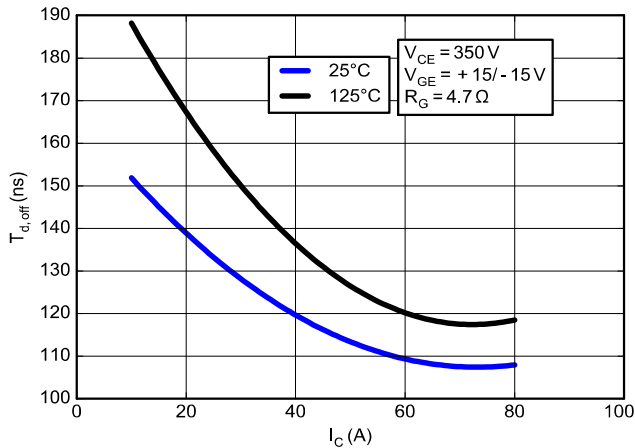


Figure 29. Typical Off Switching Times vs. IC

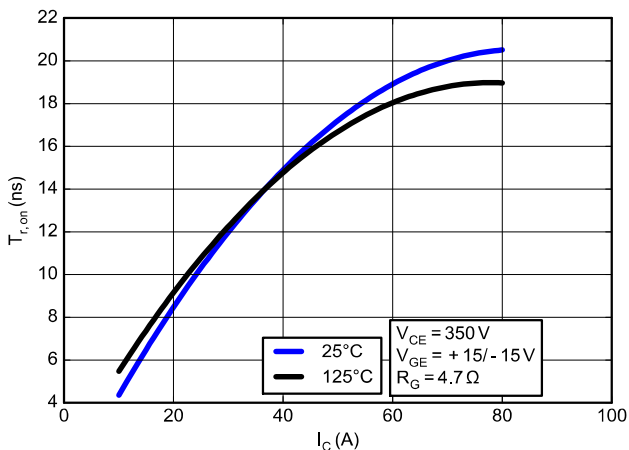


Figure 30. Typical On Rise Times vs. IC

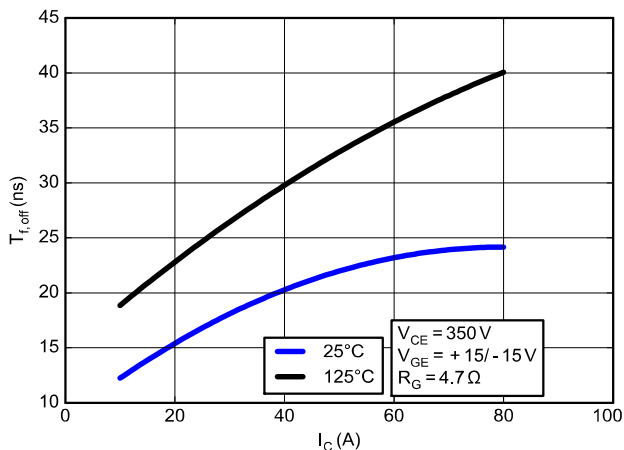


Figure 31. Typical Off Fall Times vs. IC

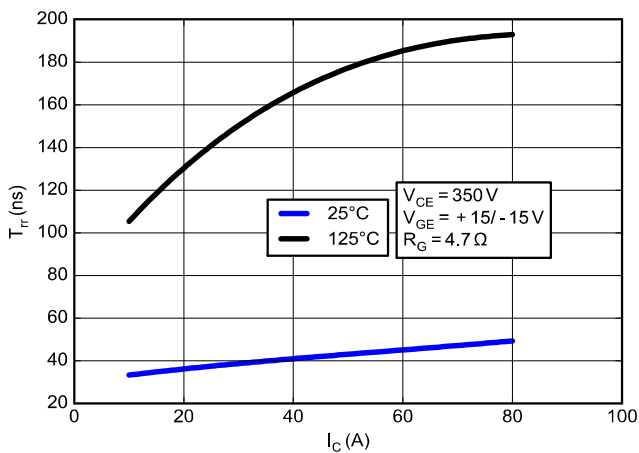


Figure 32. Typical Reverse Recovery Time vs. IC

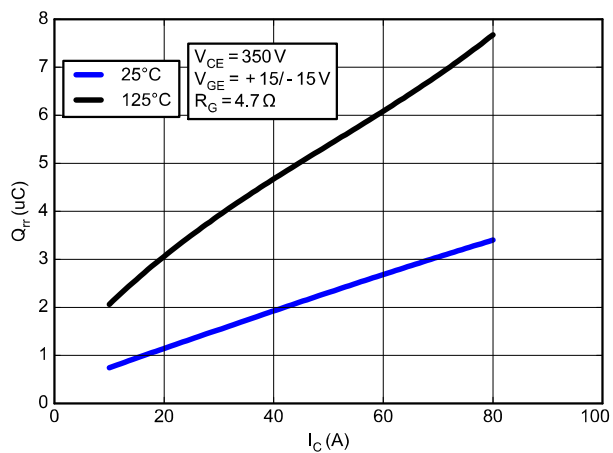


Figure 33. Typical Reverse Recovery Charge vs. IC

# SNXH80T120L2Q0P2G

## TYPICAL CHARACTERISTICS – Neutral Point IGBT (T2, T3) and Half Bridge Diode (D1, D4)

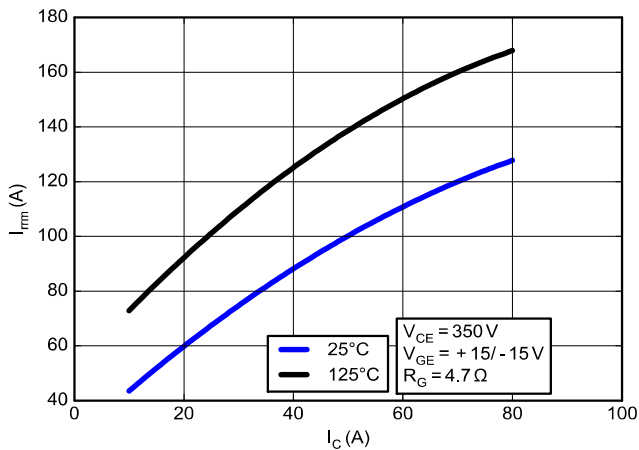


Figure 34. Typical Reverse Recovery Peak Current vs.  $I_C$

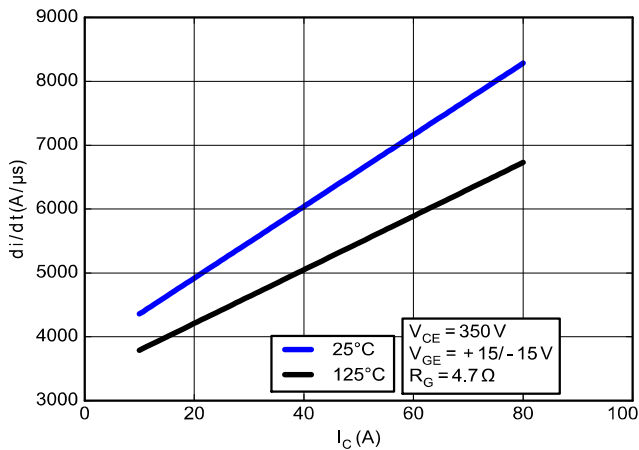


Figure 35. Typical Diode Current Slope vs.  $I_C$

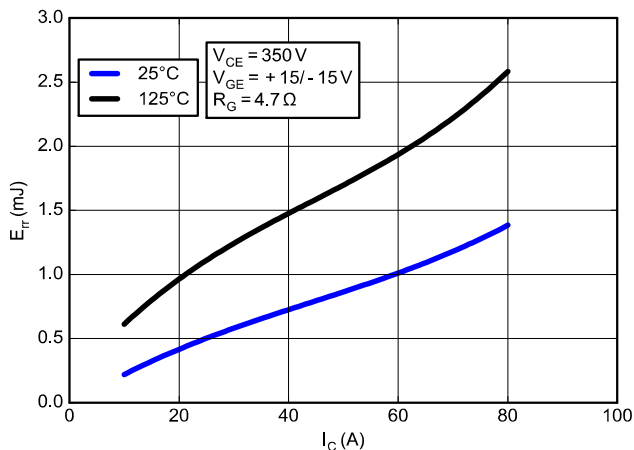


Figure 36. Typical Reverse Recovery Energy vs.  $I_C$

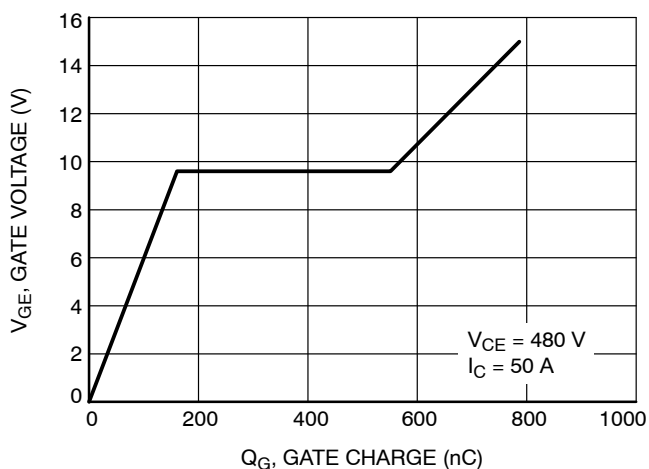


Figure 37. Gate Voltage vs. Gate Charge

# SNXH80T120L2Q0P2G

## TYPICAL CHARACTERISTICS – Neutral Point IGBT (T2, T3) and Half Bridge Diode (D1, D4)

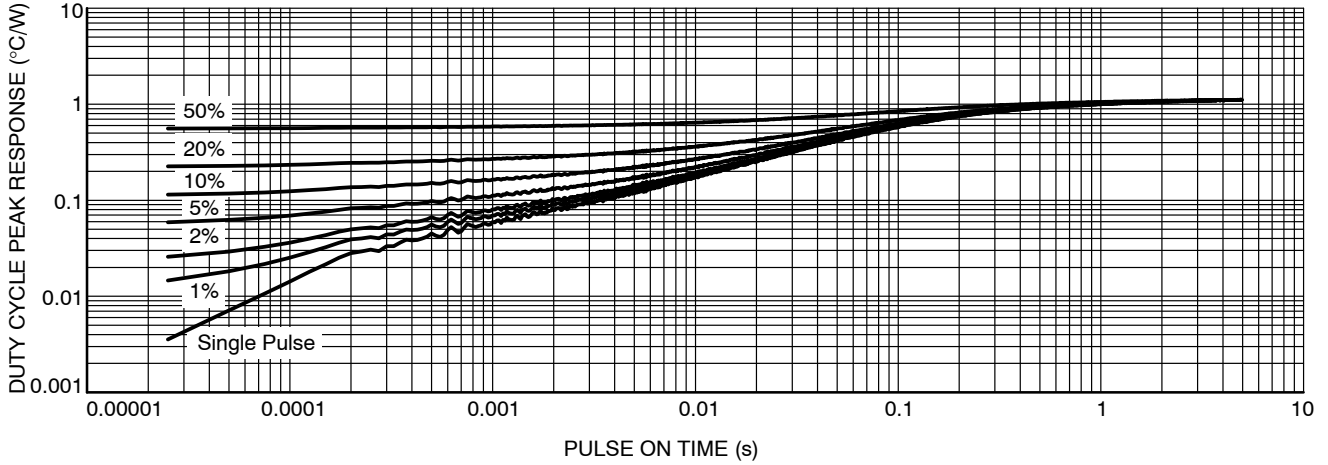


Figure 38. IGBT Transient Thermal Impedance

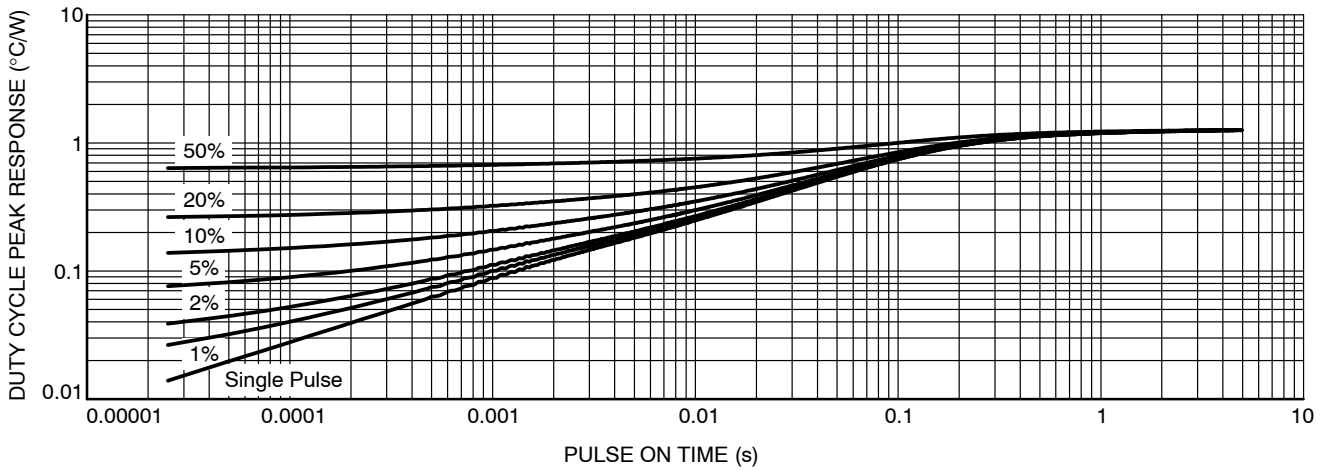


Figure 39. Diode Transient Thermal Impedance

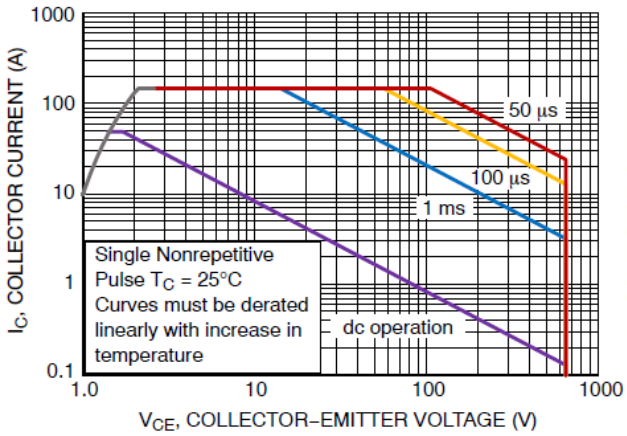


Figure 40. T2 & T3 FBSOA

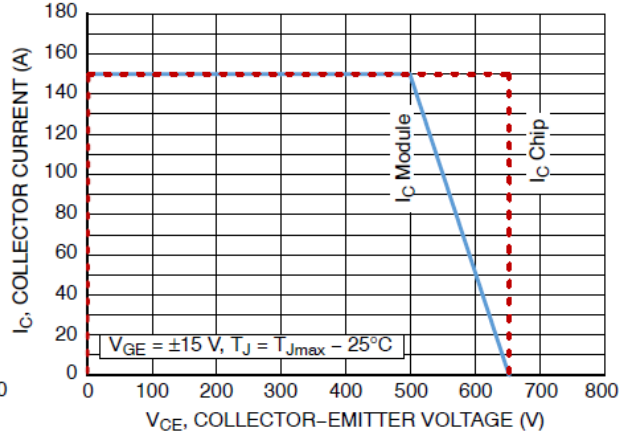
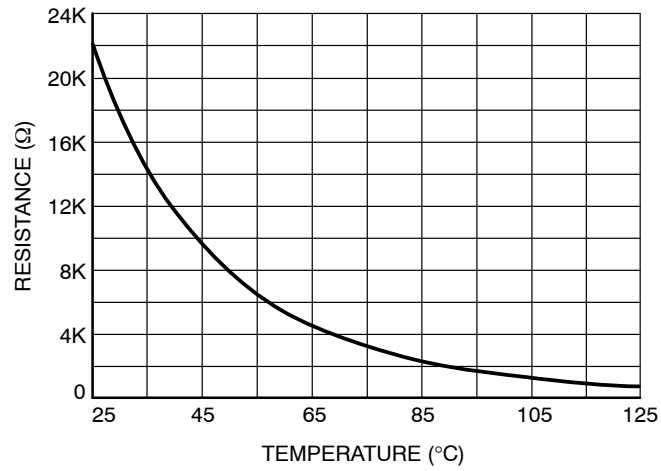


Figure 41. T2 & T3 RBSOA

# SNXH80T120L2Q0P2G

## TYPICAL CHARACTERISTICS - Thermistor

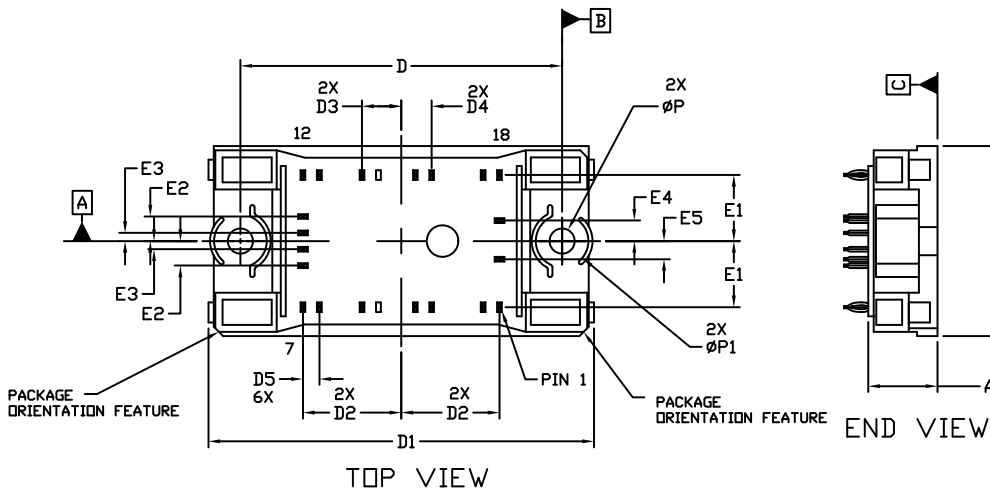


**Figure 42. Thermistor Characteristics**

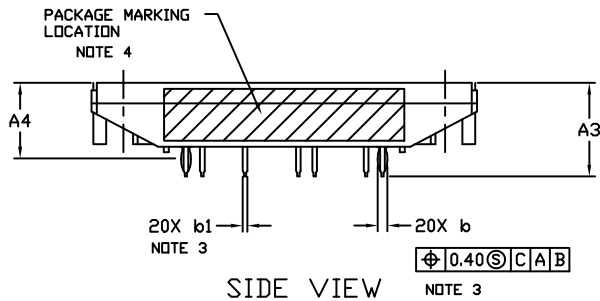
# SNXH80T120L2Q0P2G

## PACKAGE DIMENSIONS

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

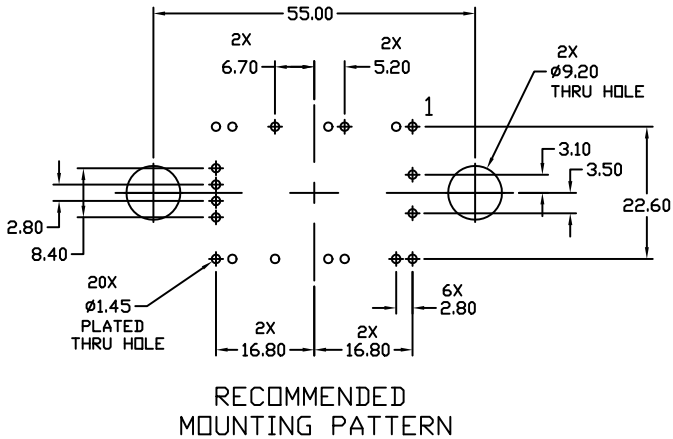


DIM	MILLIMETERS		
	MIN.	NDM.	MAX.
A	11.33	11.83	12.33
A3	15.50	16.00	16.50
A4	12.88 BSC		
b	1.61	1.66	1.71
b1	0.75	0.80	0.85
D	54.80	55.00	55.20
D1	65.70	67.90	70.10
D2	16.80 BSC		
D3	6.70 BSC		
D4	5.20 BSC		
D5	2.80 BSC		
E	32.30	32.50	32.70
E1	11.30 BSC		
E2	4.20 BSC		
E3	1.40 BSC		
E4	3.50 BSC		
E5	3.10 BSC		
P	4.10	4.30	4.50
P1	8.50	9.00	9.50



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. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES.



# SNXH80T120L2Q0P2G

## ORDERING INFORMATION

Orderable Part Number	Marking	Pin Type	Package	Shipping
SNXH80T120L2Q0P2G	SNXH80T120L2Q0P2G	Press-fit Pins	Case 180AA (Pb-Free and Halide-Free)	24 Units / Blister Tray

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