

Flying Capacitor BOOST Module

Product Preview

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

The NXH500B100H7Q2F2SHG/PHG is a power module in Q2 package containing two channel flying capacitor boost. The integrated field stop trench IGBTs and Si/SiC Diodes provide lower conduction and switching losses, enabling designers to achieve high efficiency, high power density and superior reliability.

Features

- Flying Capacitor Boost Module
- 1000 V Field Stop 7 IGBTs and 1200 V SiC Diodes
- Low Inductive Layout
- Solder Pins and Press Fit Pins
- Integrated NTC Thermistor
- These Devices are Pb-Free, Halide Free and are RoHS Compliant

Typical Applications

- Solar Inverter
- Energy Storage System

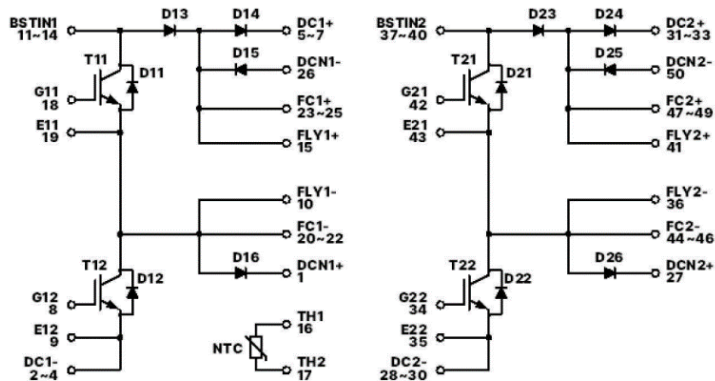
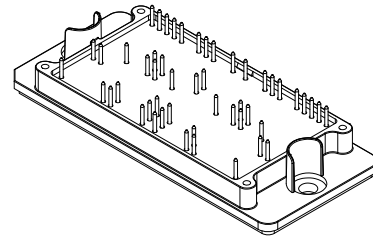
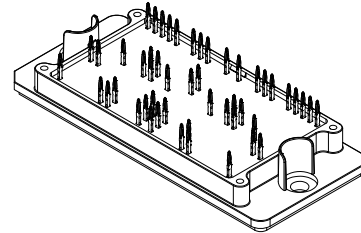


Figure 1. NXH500B100H7Q2F2SHG/PHG Schematic Diagram

This document contains information on a product under development. onsemi reserves the right to change or discontinue this product without notice.

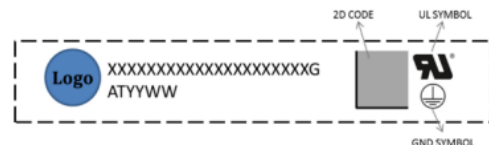


PIM50 93.00x47.00x12.00 (SOLDER PIN)
CASE 180CU



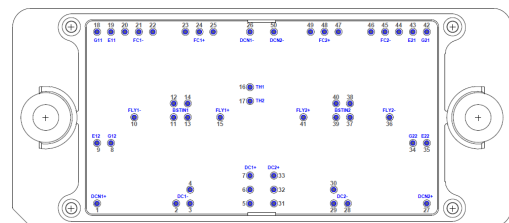
PIM50 93.00x47.00x12.00 (PRESS FIT PIN)
CASE 180HZ

MARKING DIAGRAM



XXXXX = Device Code
G = Pb-Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

PIN CONNECTIONS



ORDERING INFORMATION

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

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

MODULE CHARACTERISTICS

Rating	Symbol	Value	Unit
Operating Temperature under Switching Condition	T_{VJOP}	-40 to 150	°C
Storage Temperature Range	T_{stg}	-40 to 125	°C
Isolation Test Voltage, $t = 2$ s, 50 Hz (Note 1)	V_{is}	4800	V_{RMS}
Stray Inductance	L_s CE	15	nH
Terminal Connection Torque (M5, Screw) Torque	M	3 to 5	Nm
Weight	G	176	g
Comparative Tracking Index	CTI	>600	

1. 4800 VAC_{RMS} for 2 second duration is equivalent to 4000 VAC_{RMS} for 1 minute duration.

MAXIMUM RATINGS ($T_J = 25$ °C unless otherwise noted)

Parameter	Symbol	Value	Unit
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IGBT (T11, T12, T21, T22)

Collector-Emitter Voltage	V_{CES}	1000	V
Gate-Emitter Voltage Positive Transient Gate-Emitter Voltage ($T_{pulse} = 5$ μ s, $D < 0.10$)	V_{GE}	± 20 30	V
Continuous Collector Current @ $T_C = 80$ °C ($T_J = 175$ °C)	I_C	210	A
Pulsed Peak Collector Current @ $T_C = 80$ °C ($T_J = 175$ °C), $T_{pulse} = 1$ ms	$I_{C(Pulse)}$	630	A
Power Dissipation ($T_J = 175$ °C, $T_C = 80$ °C)	P_{tot}	503	W
Minimum Operating Junction Temperature	T_{JMIN}	-40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

IGBT INVERSE DIODE (D11, D12, D21, D22)

Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current @ $T_C = 80$ °C ($T_J = 175$ °C)	I_F	97	A
Repetitive Peak Forward Current ($T_J = 175$ °C), $T_{pulse} = 1$ ms	I_{FRM}	291	A
Maximum Power Dissipation @ $T_C = 80$ °C ($T_J = 175$ °C)	P_{tot}	171	W
Minimum Operating Junction Temperature	T_{JMIN}	-40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

BOOST SILICON CARBIDE SCHOTTKY DIODE (D13, D14, D23, D24)

Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ $T_C = 80$ °C ($T_J = 175$ °C)	I_F	155	A
Repetitive Peak Forward Current ($T_J = 175$ °C), $T_{pulse} = 1$ ms	I_{FRM}	465	A
Maximum Power Dissipation @ $T_C = 80$ °C ($T_J = 175$ °C)	P_{tot}	352	W
Minimum Operating Junction Temperature	T_{JMIN}	-40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

START-UP DIODE (D15, D25)

Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ $T_C = 80$ °C ($T_J = 175$ °C)	I_F	34	A
Repetitive Peak Forward Current ($T_J = 175$ °C), $T_{pulse} = 1$ ms	I_{FRM}	102	A
Maximum Power Dissipation @ $T_C = 80$ °C ($T_J = 175$ °C)	P_{tot}	88	W
Minimum Operating Junction Temperature	T_{JMIN}	-40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

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MAXIMUM RATINGS (T_J = 25 °C unless otherwise noted) (continued)

Parameter	Symbol	Value	Unit
START-UP DIODE (D16, D26)			
Peak Repetitive Reverse Voltage	V _{RRM}	1200	V
Continuous Forward Current @ T _C = 80 °C (T _J = 175 °C)	I _F	78	A
Repetitive Peak Forward Current (T _J = 175 °C), T _{pulse} = 1 ms	I _{FRM}	234	A
Maximum Power Dissipation @ T _C = 80 °C (T _J = 175 °C)	P _{tot}	203	W
Minimum Operating Junction Temperature	T _{JMIN}	-40	°C
Maximum Operating Junction Temperature	T _{JMAX}	175	°C

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.

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

ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T11, T12, T21, T22)						
Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = 1000 V	I _{CES}	–	–	500	μA
Collector-Emitter Saturation Voltage	V _{GE} = 15 V, I _C = 240 A, T _C = 25 °C	V _{CE(SAT)}	–	1.7	2.3	V
	V _{GE} = 15 V, I _C = 240 A, T _C = 150 °C		–	2.1	–	
Gate-Emitter Threshold Voltage	V _{GE} = V _{CE} , I _C = 240 mA	V _{GE(TH)}	4.0	5.7	6.9	V
Gate Leakage Current	V _{GE} = ±20 V, V _{CE} = 0 V	I _{GES}	–	–	1	μA
Internal Gate Resistor		R _g	–	1.5	–	Ω
Turn-off Safe Operating Area	V _{CC} < 800V, R _{G, off} ≥ 30 Ω, T _{vj} < 150 °C		–	200	–	A
Turn-On Delay Time	T _J = 25 °C V _{CE} = 600 V, I _C = 100 A V _{GE} = -9 V, +15 V, R _{G, on} = 7 Ω, R _{G, off} = 22 Ω	t _{d(on)}	–	132	–	ns
Rise Time		t _r	–	30	–	
Turn-Off Delay Time		t _{d(off)}	–	400	–	
Fall Time		t _f	–	29	–	
Turn On Switching Loss		E _{on}	–	1070	–	μJ
Turn Off Switching Loss		E _{off}	–	3500	–	
Turn-On Delay Time	T _J = 125 °C V _{CE} = 600 V, I _C = 100 A V _{GE} = -9 V, +15 V, R _{G, on} = 7 Ω, R _{G, off} = 22 Ω	t _{d(on)}	–	127	–	ns
Rise Time		t _r	–	33	–	
Turn-Off Delay Time		t _{d(off)}	–	460	–	
Fall Time		t _f	–	40	–	
Turn On Switching Loss		E _{on}	–	1280	–	μJ
Turn Off Switching Loss		E _{off}	–	5000	–	
Input Capacitance	V _{CE} = 20 V, V _{GE} = 0 V, f = 100 kHz	C _{ies}	–	18488	–	pF
Output Capacitance		C _{oes}	–	797	–	
Reverse Transfer Capacitance		C _{res}	–	116	–	
Gate Charge	V _{CE} = 600 V, V _{GE} = -15/+20 V, I _C = 40 A	Q _g	–	1094	–	nC
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R _{thJH}	–	0.309	–	K/W
Thermal Resistance – Chip-to-case		R _{thJC}	–	0.197	–	K/W

IGBT INVERSE DIODE (D11, D12, D21, D22)

Diode Forward Voltage	I _F = 50 A, T _J = 25 °C	V _F	–	1.15	1.5	V
	I _F = 50 A, T _J = 150 °C		–	1.0	–	
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R _{thJH}	–	0.670	–	K/W
		R _{thJC}	–	0.562	–	K/W

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ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise noted) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
BOOST SILICON CARBIDE SCHOTTKY DIODE (D13, D14, D23, D24)						
Diode Forward Voltage	I _F = 120 A, T _J = 25 °C	V _F	–	1.45	1.7	V
	I _F = 120 A, T _J = 150 °C		–	1.75	–	
Reverse Recovery Time	T _J = 25 °C V _R = 600 V, I _C = 100 A V _{GE} = -9 V, 15 V, R _{G, on} = 7 Ω	t _{rr}	–	25.5	–	ns
Reverse Recovery Charge		Q _{rr}	–	575	–	nC
Peak Reverse Recovery Current		I _{RRM}	–	33	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	2800	–	A/μs
Reverse Recovery Energy		E _{rr}	–	270	–	μJ
Reverse Recovery Time		t _{rr}	–	26	–	ns
Reverse Recovery Charge	T _J = 125 °C V _R = 600 V, I _C = 100 A V _{GE} = -9 V, 15 V, R _{G, on} = 7 Ω	Q _{rr}	–	615	–	nC
Peak Reverse Recovery Current		I _{RRM}	–	36	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	2550	–	A/μs
Reverse Recovery Energy		E _{rr}	–	279	–	μJ
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R _{thJH}	–	0.416	–	K/W
Thermal Resistance – Chip-to-case		R _{thJC}	–	0.288	–	K/W

START-UP DIODE (D15, D25)

Diode Forward Voltage	I _F = 30 A, T _J = 25 °C	V _F	–	2.2	2.9	V
	I _F = 30 A, T _J = 150 °C		–	1.5	–	
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R _{thJH}	–	1.225	–	K/W
Thermal Resistance – Chip-to-case		R _{thJC}	–	1.085	–	K/W

START-UP DIODE (D16, D26)

Diode Forward Voltage	I _F = 75 A, T _J = 25 °C	V _F	–	2.87	3.5	V
	I _F = 75 A, T _J = 150 °C		–	2.19	–	
Thermal Resistance – Chip-to-heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R _{thJH}	–	0.61	–	K/W
Thermal Resistance – Chip-to-case		R _{thJC}	–	0.47	–	K/W

THERMISTOR CHARACTERISTICS

Nominal Resistance	T = 25 °C	R ₂₅	–	5	–	kΩ
Nominal Resistance	T = 100 °C	R ₁₀₀	–	492.2	–	Ω
Deviation of R25		ΔR/R	-1	–	1	%
Power Dissipation		P _D	–	5	–	mW
Power Dissipation Constant			–	1.3	–	mW/K
B-value	B(25/85), tolerance ±1%		–	3430	–	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.

ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH500B100H7Q2F2SHG	NXH500B100H7Q2F2SHG	Q2 – PIM50 93x47 (SOLDER PIN) (Pb-Free / Halide Free)	12 Units / Blister Tray
NXH500B100H7Q2F2PHG	NXH500B100H7Q2F2PHG	Q2 – PIM50 93x47 (PRESS FIT PIN) (Pb-Free / Halide Free)	12 Units / Blister Tray

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

TYPICAL CHARACTERISTIC – T11, T12, T21, T22 (IGBT)

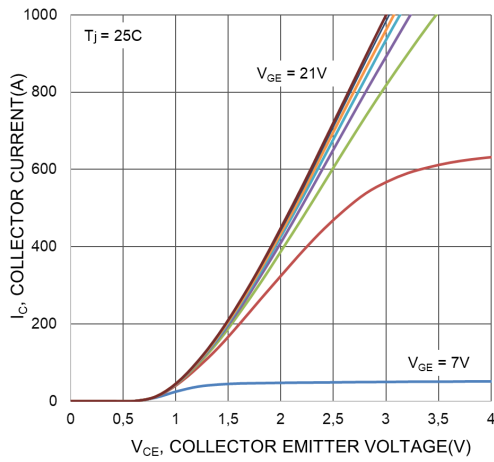


Figure 2. Typical Output Characteristics – IGBT

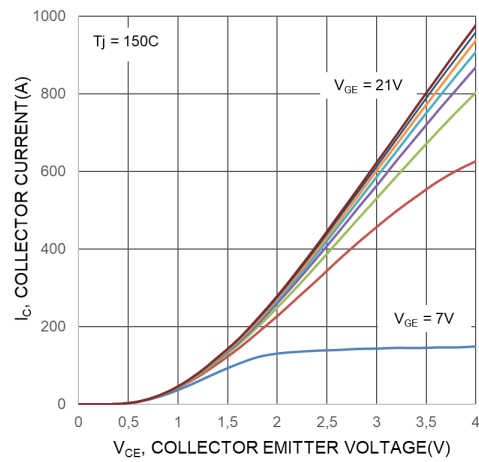


Figure 3. Typical Output Characteristics – IGBT

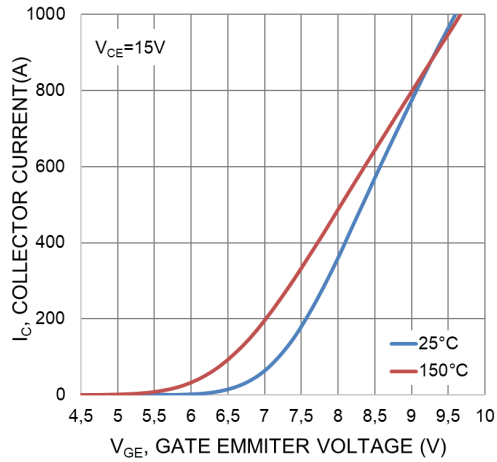


Figure 4. Transfer Characteristics – IGBT

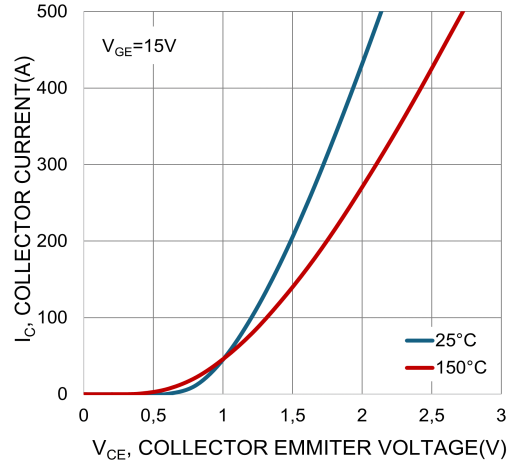


Figure 5. Saturation Voltage Characteristic – IGBT

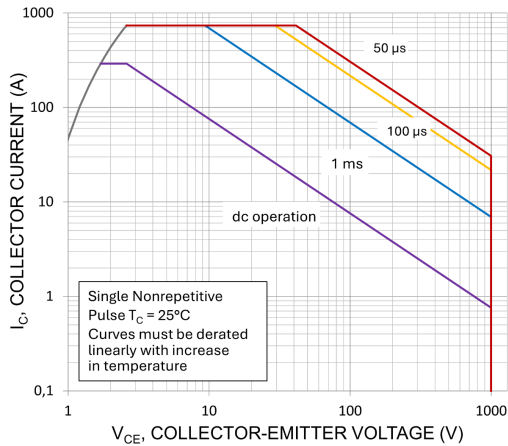


Figure 6. FBSOA

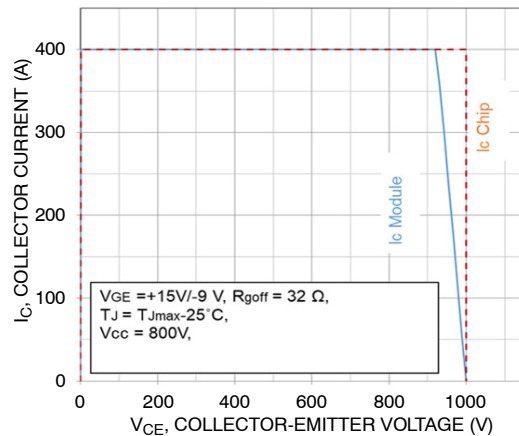


Figure 7. RBSOA

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

TYPICAL CHARACTERISTIC – T11, T12, T21, T22 (IGBT) (continued)

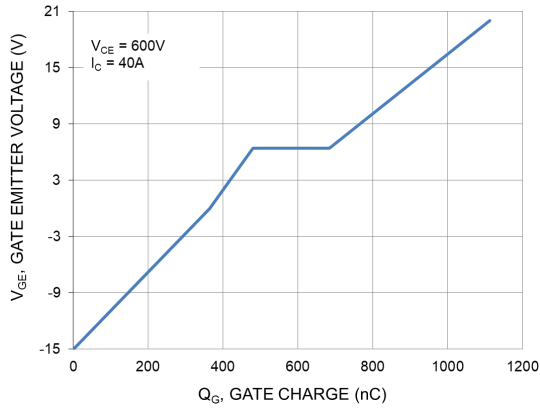


Figure 8. Gate Voltage vs. Gate Charge

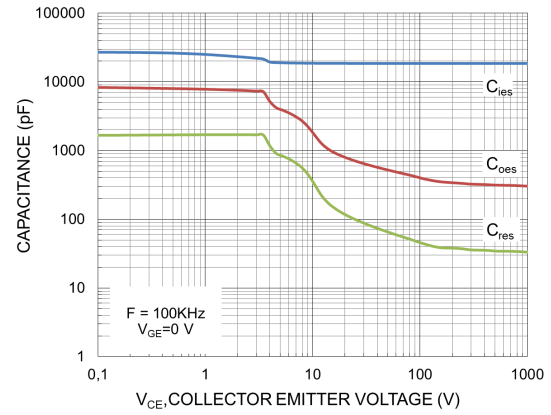


Figure 9. Capacitance vs. V_{CE}

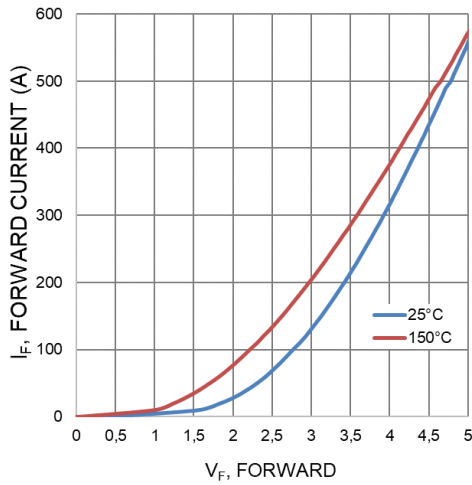


Figure 10. Start-up Diode Forward Characteristics

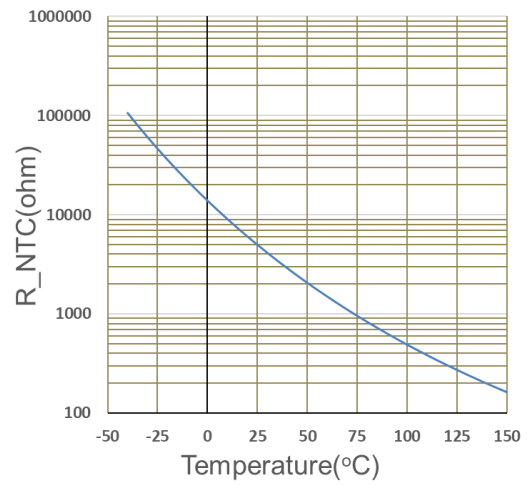


Figure 11. Thermistor Characteristic

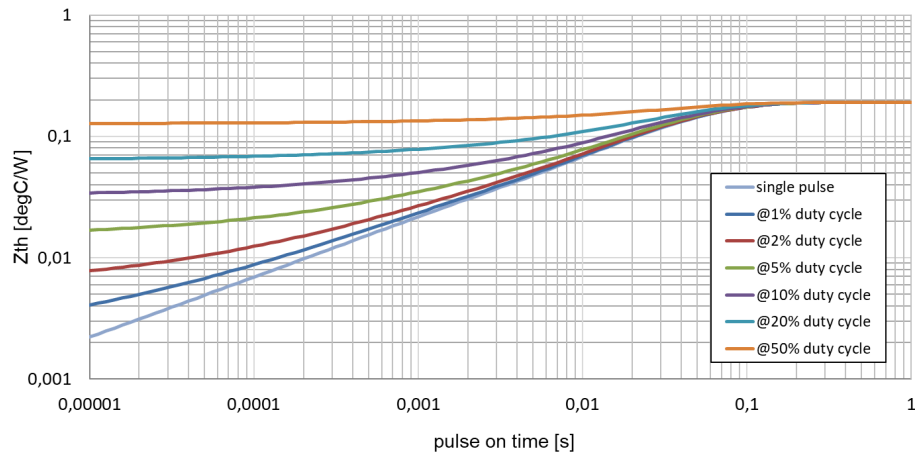


Figure 12. Transient Thermal Impedance (IGBT Z_{thjc})

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

TYPICAL CHARACTERISTIC – D11, D12, D21, D22 (INVERSE DIODE)

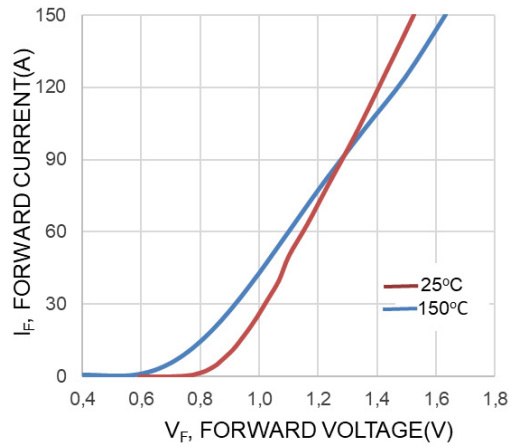


Figure 13. Inverse Diode Forward Characteristics

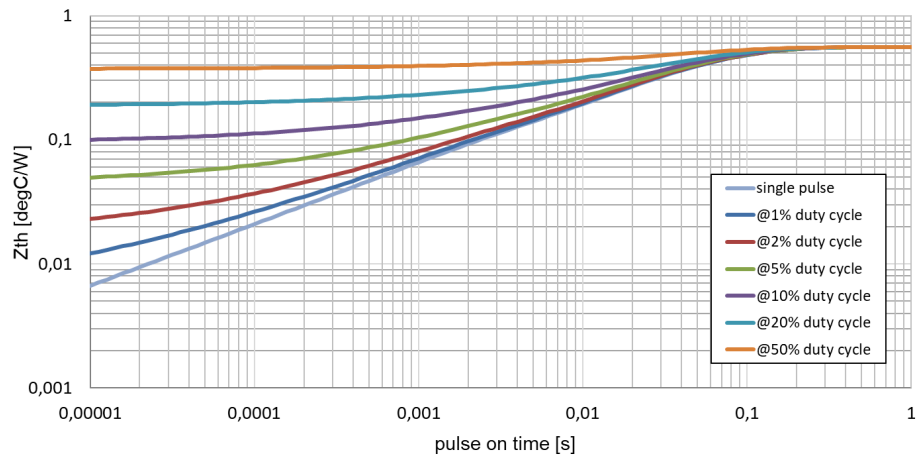


Figure 14. Transient Thermal Impedance (Inverse Diode Z_{thjc})

TYPICAL CHARACTERISTIC – D13, D14, D23, D24 (SiC SCHOTTKY DIODE)

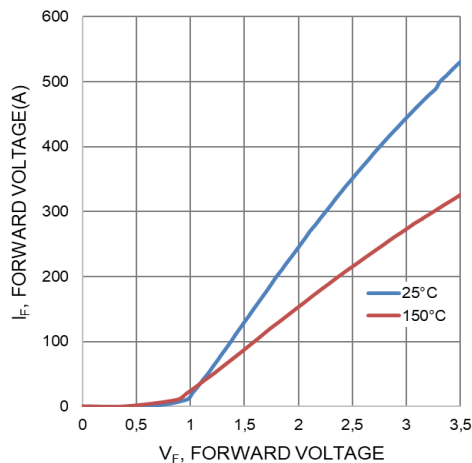


Figure 15. SiC Schottky Diode Forward Characteristics

TYPICAL CHARACTERISTIC – D13, D14, D23, D24 (SiC SCHOTTKY DIODE) (continued)

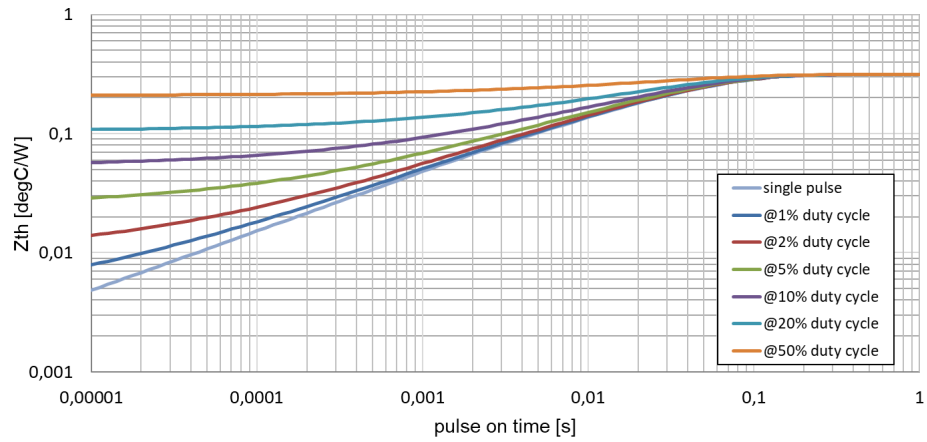


Figure 16. Transient Thermal Impedance (SiC Schottky Diode Z_{thjc})

TYPICAL CHARACTERISTIC – D15, D25 (START-UP DIODE)

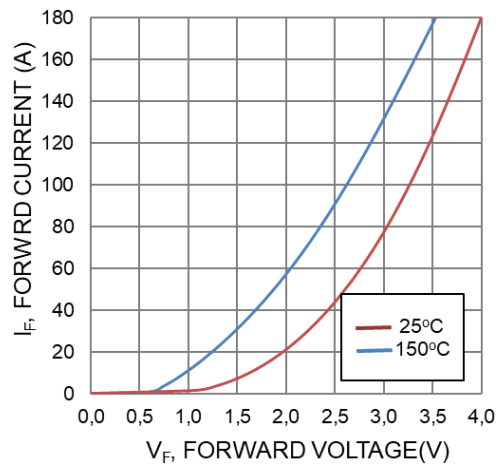


Figure 17. Start-up Diode Forward Characteristics

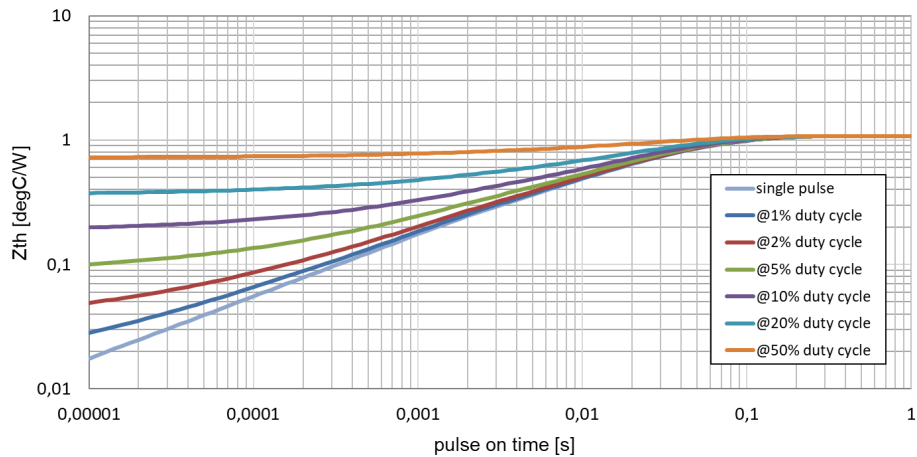


Figure 18. Transient Thermal Impedance (Start-up Diode Z_{thjc})

TYPICAL CHARACTERISTICS – D16, D26 DIODE

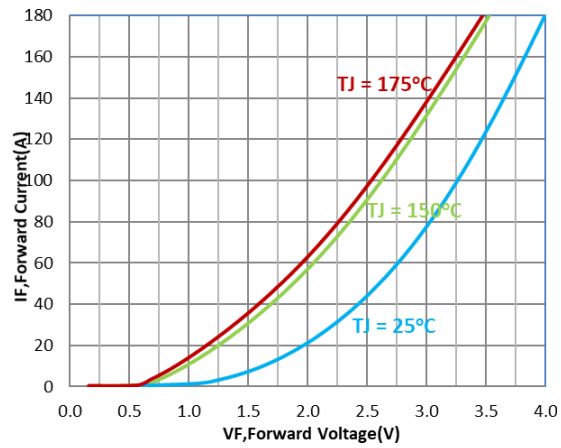


Figure 19. Diode Forward Characteristics

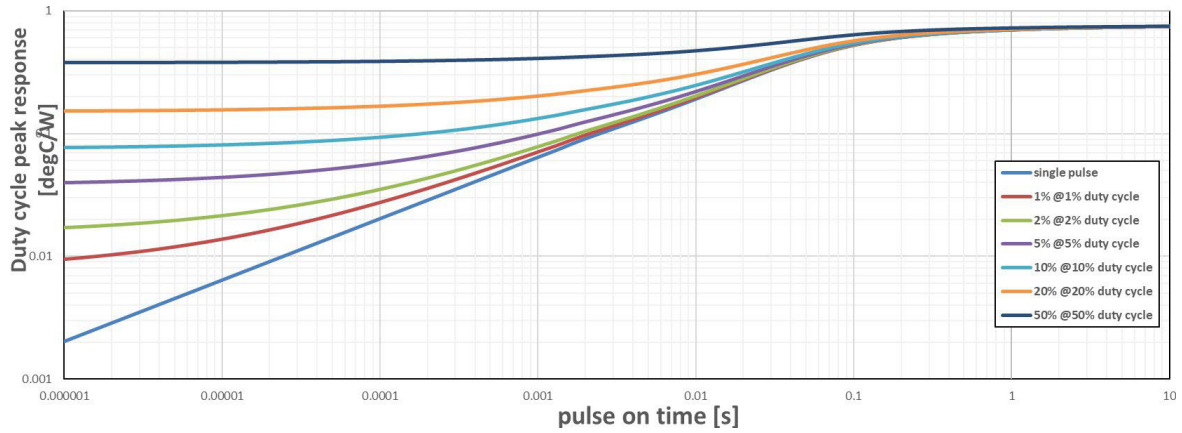


Figure 20. Transient Thermal Impedance (R_{thjh})

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

TYPICAL CHARACTERISTICS – T11, T12, T21, T22 (IGBT)

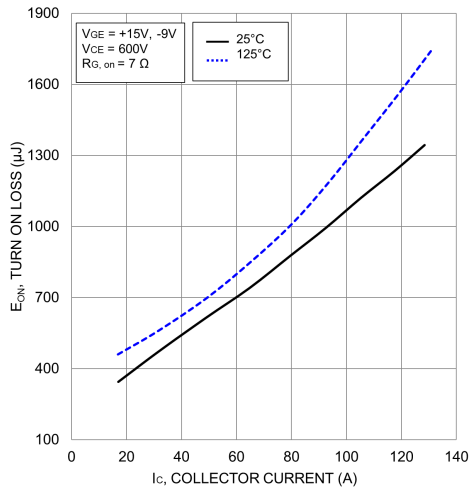


Figure 21. Typical Turn On Loss vs. I_C

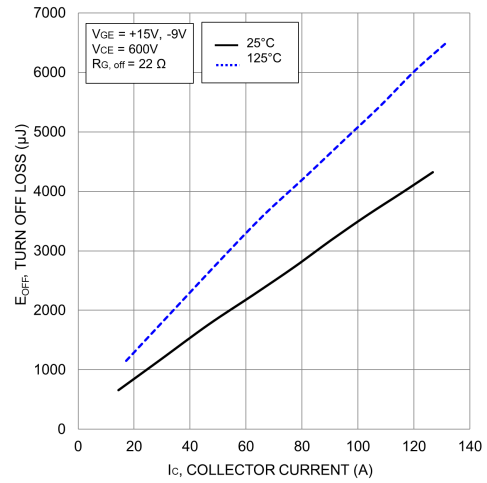


Figure 22. Typical Turn Off Loss vs. I_C

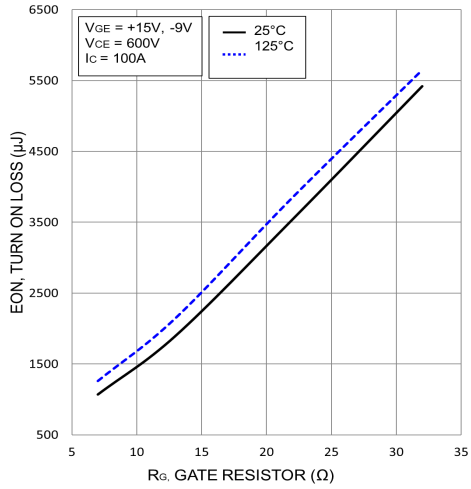


Figure 23. Typical Turn On Loss vs. R_G

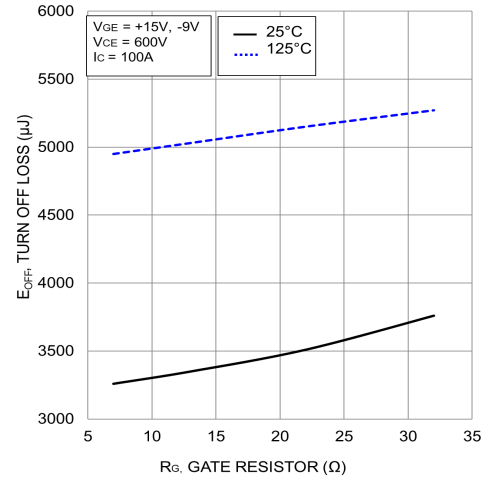


Figure 24. Typical Turn Off Loss vs. R_G

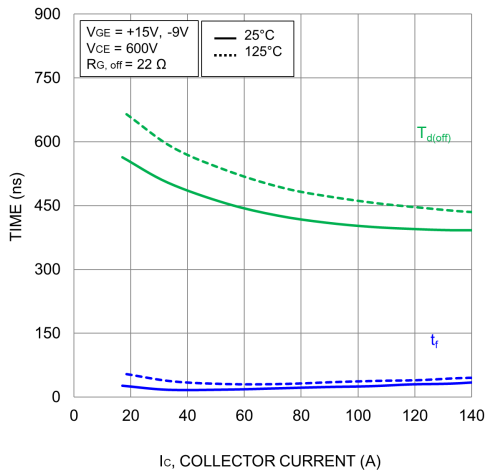


Figure 25. Typical Turn-Off Switching Time vs. I_C

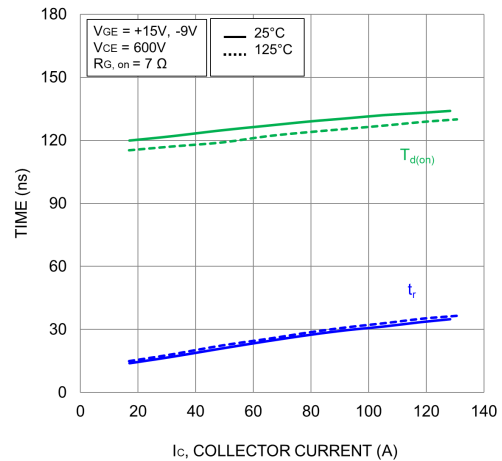


Figure 26. Typical Turn-On Switching Time vs. I_C

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

TYPICAL CHARACTERISTICS – T11, T12, T21, T22 (IGBT) (continued)

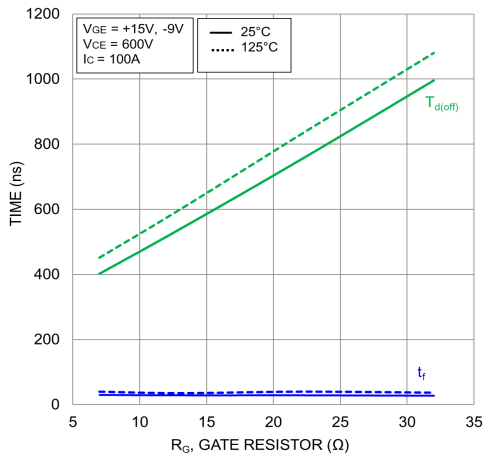


Figure 27. Typical Turn-Off Switching Time vs. R_G

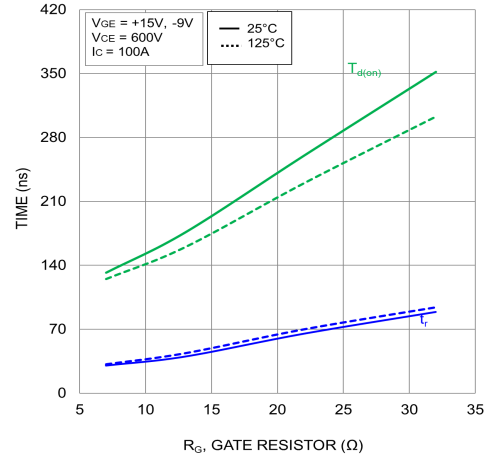


Figure 28. Typical Turn-On Switching Time vs. R_G

TYPICAL CHARACTERISTICS – SiC SCHOTTKY DIODE (D13, D14, D23, D24)

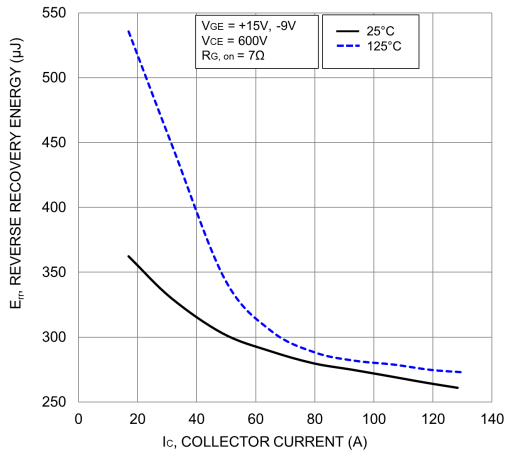


Figure 29. Typical Reverse Recovery Energy Loss vs. I_C

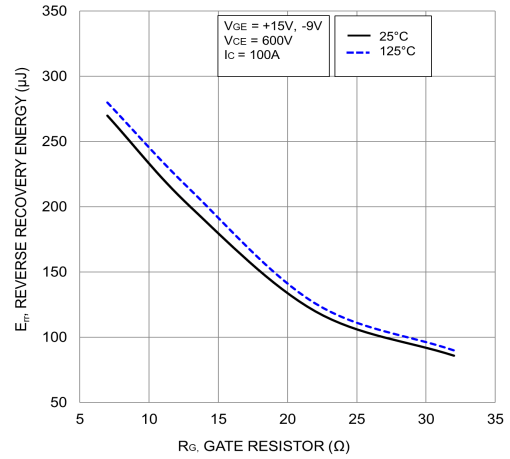


Figure 30. Typical Reverse Recovery Energy Loss vs. R_G

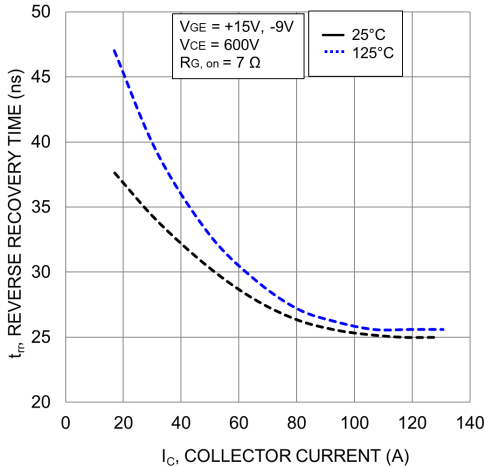


Figure 31. Typical Reverse Recovery Time vs. I_C

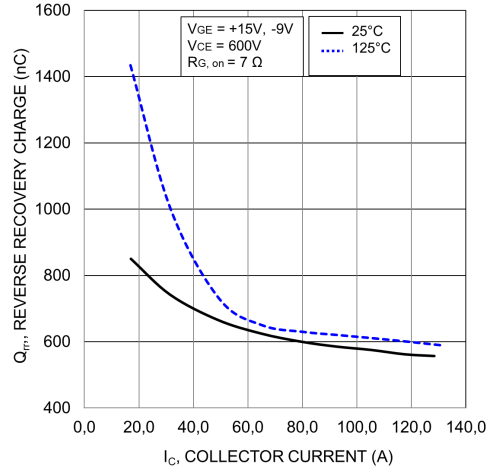


Figure 32. Typical Reverse Recovery Charge vs. I_C

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

TYPICAL CHARACTERISTICS – SiC SCHOTTKY DIODE (D13, D14, D23, D24) (continued)

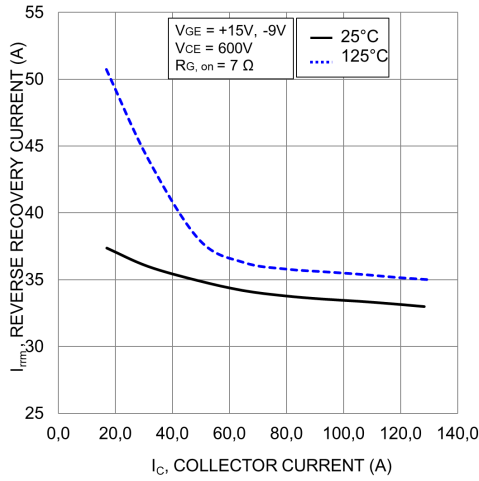


Figure 33. Typical Reverse Recovery Current vs. I_C

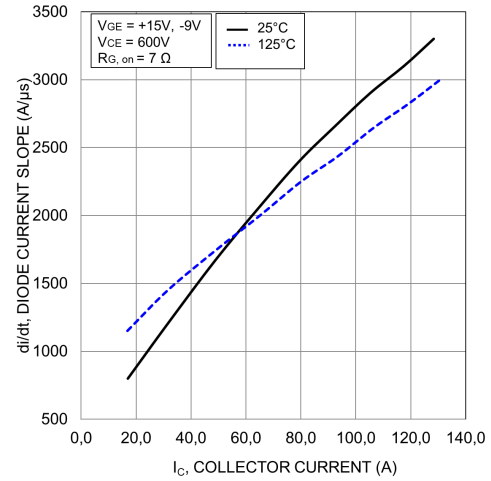


Figure 34. Typical Diode Current Slope vs. I_C

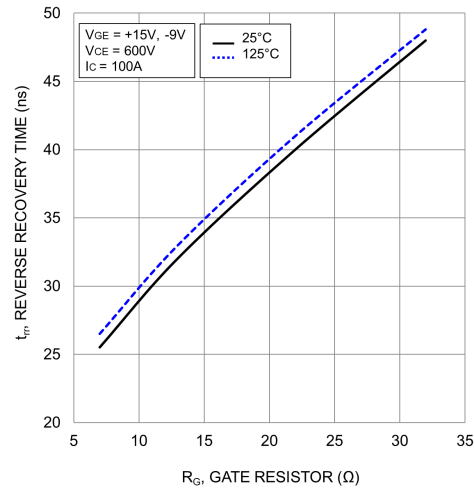


Figure 35. Typical Reverse Recovery Time vs. R_G

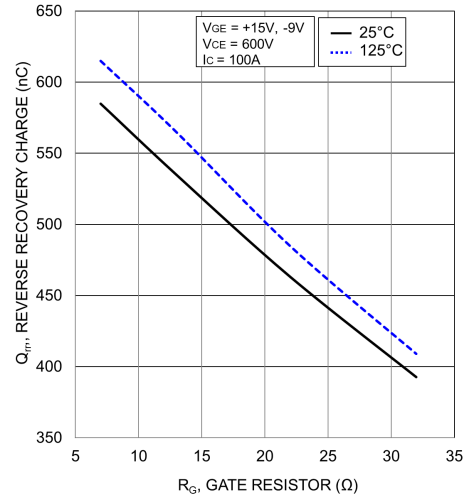


Figure 36. Typical Reverse Recovery Charge vs. R_G

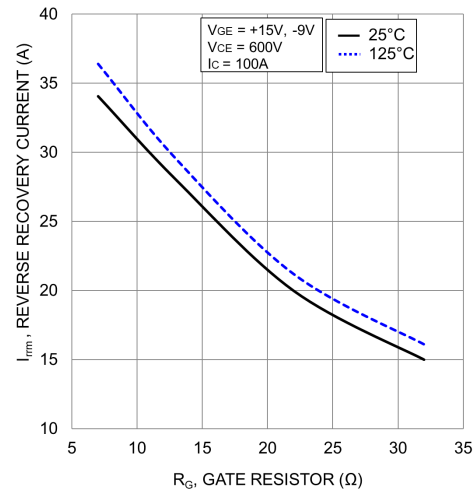


Figure 37. Typical Reverse Recovery Current vs. R_G

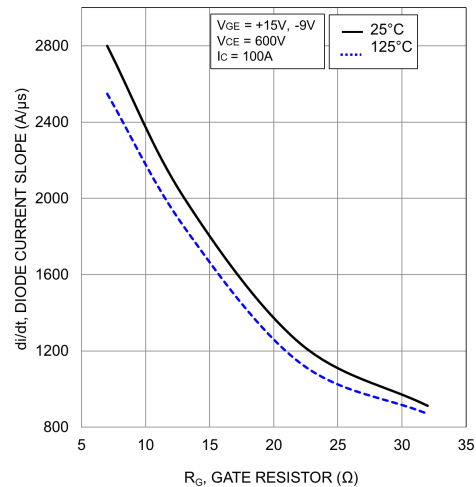


Figure 38. Typical Diode Current Slope vs. R_G

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

REVISION HISTORY

Revision	Description of Changes	Date
P3	Figure 7. RBSOA updated.	6/20/2025

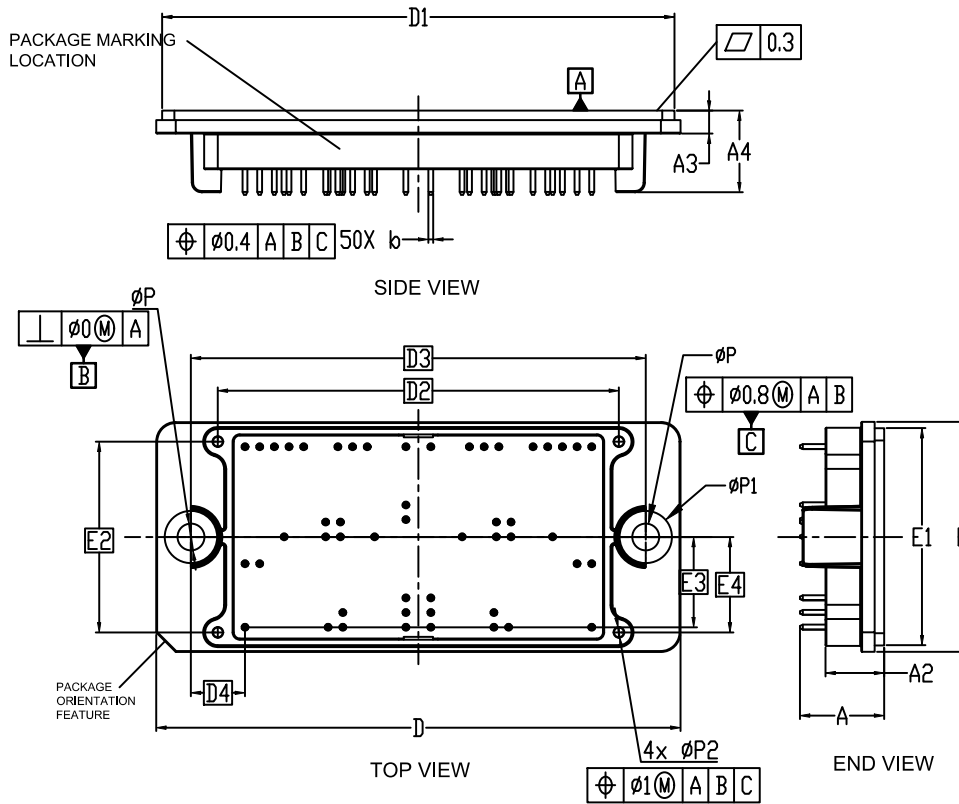
NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

PACKAGE DIMENSIONS

PIM50 93.00x47.00x12.00
CASE 180CU
ISSUE O

NOTES:

1. Dimensioning and tolerancing conform to ASME Y14.5
2. All dimensions are in millimeters.
3. Dimensions b and b1 apply to the plated terminals and are measured at dimension A1
4. Pin position tolerance is $\pm 0.4\text{mm}$
5. Package marking is located on the side opposite the package orientation feature.
6. The pins are Gold plated solder pin



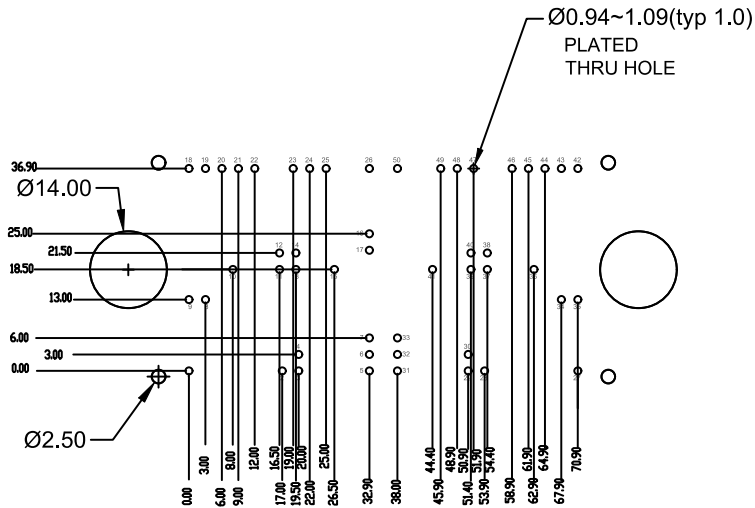
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	16.80	17.20	17.60
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	0.95	1.00	1.05
D	106.90	107.20	107.50
D1	104.45	104.75	105.05
D2	82.00 BSC		
D3	93.00 BSC		
D4	11.05 BSC		
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	39.00 BSC		
E3	18.45 BSC		
E4	19.50 BSC		
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

PIM50 93.00x47.00x12.00

CASE 180CU

ISSUE 0



RECOMMENDED
MOUNTING PATTERN

* For additional Information on our Pb-Free strategy and soldering details, please download the Onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

Pin table					
pin	X	Y	Pin	X	Y
1	0	0	26	32.90	36.90
2	17	0	27	70.90	0
3	20	0	28	53.90	0
4	20	3	29	50.90	0
5	32.90	0	30	50.90	3
6	32.90	3	31	38	0
7	32.90	6	32	38	3
8	3	13	33	38	6
9	0	13	34	67.90	13
10	8	18.50	35	70.90	13
11	16.50	18.50	36	62.90	18.50
12	16.50	21.50	37	54.40	18.50
13	19.50	21.50	38	54.40	21.50
14	19.50	18.50	39	51.40	18.50
15	26.50	18.50	40	51.40	21.50
16	32.90	25.00	41	44.40	18.50
17	32.90	22	42	70.90	36.90
18	0	36.90	43	67.90	36.90
19	3	36.90	44	64.90	36.90
20	6	36.90	45	61.90	36.90
21	9	36.90	46	58.90	36.90
22	12	36.90	47	51.90	36.90
23	19	36.90	48	48.90	36.90
24	22	36.90	49	45.90	36.90
25	25	36.90	50	38	36.90

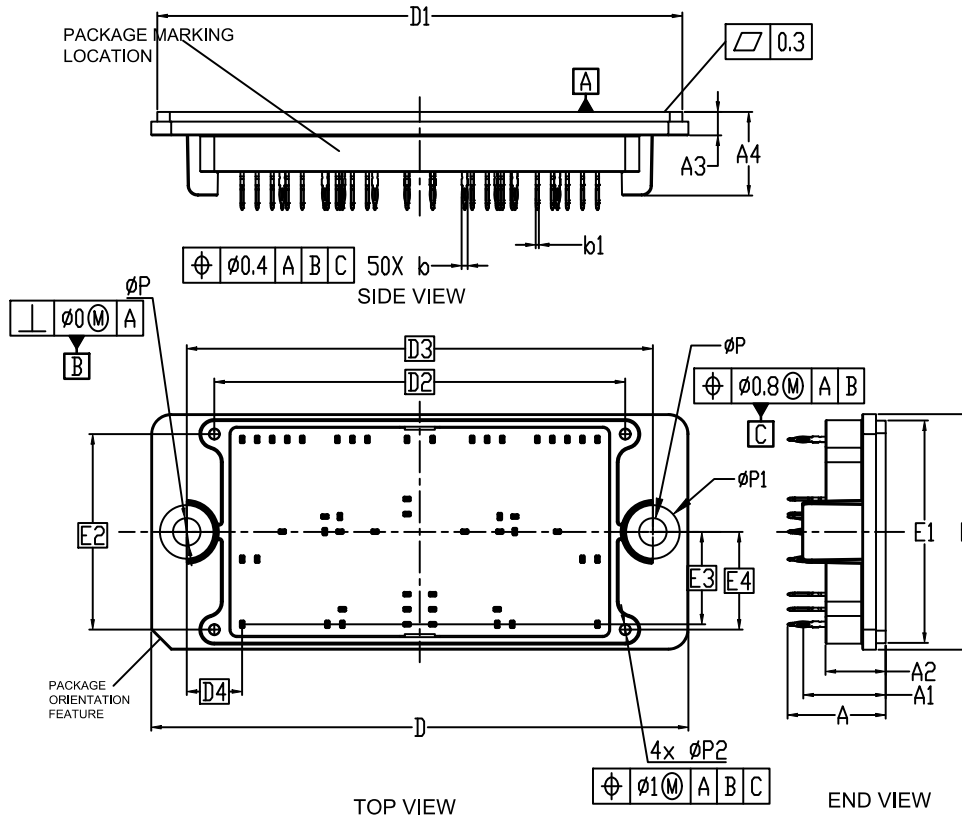
NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

PACKAGE DIMENSIONS

PIM50 93.00x47.00x12.00
CASE 180HZ
ISSUE O

NOTES:

1. Dimensioning and tolerancing conform to ASME Y14.5
2. All dimensions are in millimeters.
3. Dimensions b and b1 apply to the plated terminals and are measured at dimension A1
4. Pin position tolerance is $\pm 0.4\text{mm}$
5. Package marking is located on the side opposite the package orientation feature.
6. The pins are Sn plated press fit pin.



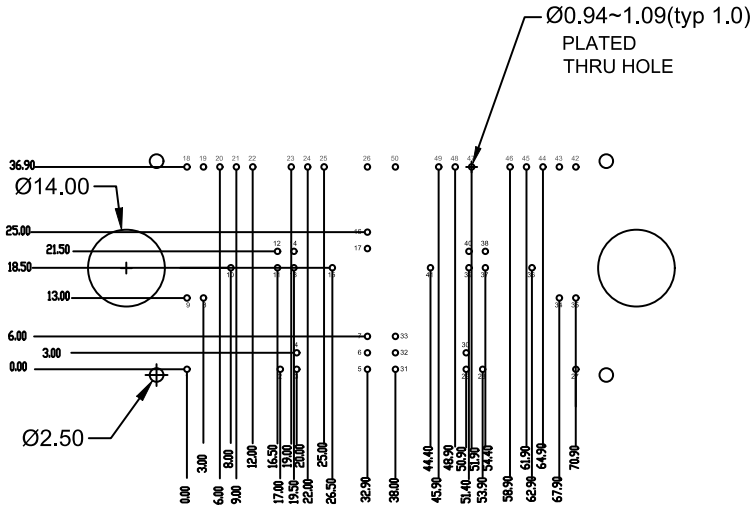
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	19.20	19.60	20.00
A1	16.25	16.45	16.65
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	1.15	1.20	1.25
b1	0.59	0.64	0.69
D	106.90	107.20	107.50
D1	104.45	104.75	105.05
D2	82.00 BSC		
D3	93.00 BSC		
D4	11.05 BSC		
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	39.00 BSC		
E3	18.45 BSC		
E4	19.50 BSC		
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20

NXH500B100H7Q2F2SHG, NXH500B100H7Q2F2PHG

PIM50 93.00x47.00x12.00

CASE 180HZ

ISSUE O



RECOMMENDED
MOUNTING PATTERN

* For additional Information on our Pb-Free strategy and soldering details, please download the Onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

Pin table					
pin	X	Y	Pin	X	Y
1	0	0	26	32.90	36.90
2	17	0	27	70.90	0
3	20	0	28	53.90	0
4	20	3	29	50.90	0
5	32.90	0	30	50.90	3
6	32.90	3	31	38	0
7	32.90	6	32	38	3
8	3	13	33	38	6
9	0	13	34	67.90	13
10	8	18.50	35	70.90	13
11	16.50	18.50	36	62.90	18.50
12	16.50	21.50	37	54.40	18.50
13	19.50	21.50	38	54.40	21.50
14	19.50	18.50	39	51.40	18.50
15	26.50	18.50	40	51.40	21.50
16	32.90	25.00	41	44.40	18.50
17	32.90	22	42	70.90	36.90
18	0	36.90	43	67.90	36.90
19	3	36.90	44	64.90	36.90
20	6	36.90	45	61.90	36.90
21	9	36.90	46	58.90	36.90
22	12	36.90	47	51.90	36.90
23	19	36.90	48	48.90	36.90
24	22	36.90	49	45.90	36.90
25	25	36.90	50	38	36.90

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