Q2BOOST Module

NXH400B100H4Q2F2SG, NXH400B100H4Q2F2PG

The NXH400B100H4Q2F2xG is a power module containing two channel flying capacitor boost. The integrated field stop trench IGBTs and Si/SiC Diodes provide lower conduction losses and switching losses, enabling designers to achieve high efficiency and superior reliability.

Features

- Flying Capacitor Boost Module
- 1000 V Field Stop 4 IGBTs and 1200 V SiC Diodes
- Low Inductive Layout
- Solder Pins
- Thermistor
- This is a Pb−Free Device

Typical Applications

- Solar Inverter
- Energy Storage System

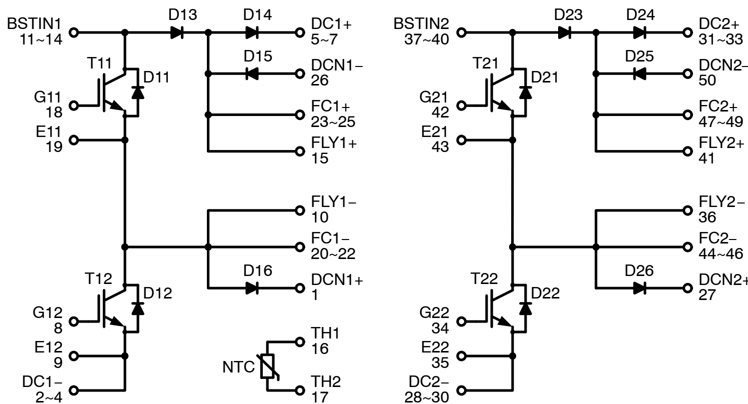
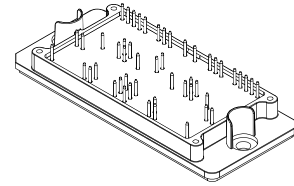
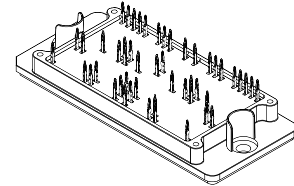


Figure 1. NXH400B100H4Q2F2xG Schematic Diagram

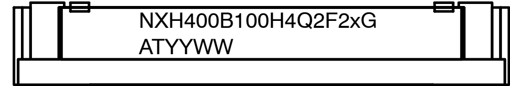


PIM50, 93x47 (SOLDER PIN)
CASE 180HN



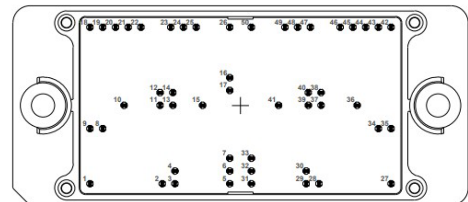
PIM50, 93x47 (1.2MM PRESSFIT PIN)
CASE 180BB

MARKING DIAGRAM



NXH400B100H4Q2F2xG	= Specific 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 13 of this data sheet.

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Table 1. ABSOLUTE MAXIMUM RATINGS (T_J = 25°C unless otherwise noted) (Note 1)

Rating	Symbol	Value	Unit
IGBT (T11, T12, T21, T22)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate−Emitter Voltage Positive Transient Gate – Emitter Voltage (tpulse = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Continuous Collector Current @ T_c = 80 °C (T_J = 175°C)	I_C	164	A
Pulsed Collector Current (T_J = 175°C) @ Tpulse = 1 ms	$I_{C(Pulse)}$	492	A
Maximum Power Dissipation (T_J = 175°C, T_h = 80°C)	P_{tot}	396	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum Junction Temperature (Note 2)	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	78	A
Repetitive Peak Forward Current (T_J = 175°C) @ Tpulse = 1 ms	I_{FRM}	234	A
Maximum Power Dissipation (T_J = 175°C, T_h = 80°C)	P_{tot}	129	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum 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	71	A
Repetitive Peak Forward Current (T_J = 175°C) @ Tpulse = 1 ms	I_{FRM}	213	A
Maximum Power Dissipation (T_J = 175°C, T_h = 80°C)	P_{tot}	245	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum Junction Temperature	T_{JMAX}	175	°C
AUXILIARY DIODE (D15, D25)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_c = 80 °C (T_J = 175°C)	I_F	32	A
Repetitive Peak Forward Current (T_J = 175°C) @ Tpulse = 1 ms	I_{FRM}	96	A
Maximum Power Dissipation (T_J = 175°C, T_h = 80°C)	P_{tot}	90	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum Junction Temperature	T_{JMAX}	175	°C
AUXILIARY DIODE (D16, D26)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_c = 80 °C (T_J = 175°C)	I_F	59	A
Repetitive Peak Forward Current (T_J = 175°C) @ Tpulse = 1 ms	I_{FRM}	177	A
Maximum Power Dissipation (T_J= 175°C, T_h = 80°C)	P_{tot}	152	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum 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.

1. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.
2. Qualification at 175°C per discrete TO247

Table 2. THERMAL AND INSULATION PROPERTIES (T_J = 25°C unless otherwise noted) (Note 3)

Rating	Symbol	Value	Unit
THERMAL PROPERTIES			
Operating Temperature under Switching Condition	T_{VJOP}	−40 to 150	°C
Storage Temperature Range	T_{stg}	−40 to 125	°C
INSULATION PROPERTIES			
Isolation Test Voltage, t = 1 s, 50 Hz	V_{is}	4000	V_{RMS}
Creepage Distance		12.7	mm
Comparative Tracking Index	CTI	>600	

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

Table 3. ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Note 4)

Rating	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T11, T12, T21, T22)						
Collector−Emitter Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	$V_{(BR)CES}$	1000	1150	–	V
Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	10	μA
Collector−Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 200 A, T_J = 25°C	$V_{CE(sat)}$	–	1.88	2.3	V
	V_{GE} = 15 V, I_C = 200 A, T_J = 175°C		–	2.4	–	
Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 200 mA	$V_{GE(TH)}$	3.8	4.82	6.6	V
Gate Leakage Current	V_{GE} = ±20 V, V_{CE} = 0 V	I_{GES}	–	–	1	μA
Internal Gate Resistor		R_G	–	3	–	Ω
Turn−On Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 50 A V_{GE} = −9 V, 15 V, R_{Gon} = 9 Ω, R_{Goff} = 25 Ω	$t_{d(on)}$	–	119.75	–	ns
Rise Time		t_r	–	30.08	–	
Turn−Off Delay Time		$t_{d(off)}$	–	614.57	–	
Fall Time		t_f	–	26.85	–	
Turn On Switching Loss		E_{on}	–	860	–	μJ
Turn Off Switching Loss		E_{off}	–	1500	–	
Turn−On Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 50 A V_{GE} = −9 V, 15 V, R_{Gon} = 9 Ω, R_{Goff} = 25 Ω	$t_{d(on)}$	–	119.97	–	ns
Rise Time		t_r	–	32.09	–	
Turn−Off Delay Time		$t_{d(off)}$	–	706.72	–	
Fall Time		t_f	–	40.22	–	
Turn On Switching Loss		E_{on}	–	1120	–	μJ
Turn Off Switching Loss		E_{off}	–	2750	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	–	12687.7	–	pF
Output Capacitance		C_{oes}	–	418.0	–	
Reverse Transfer Capacitance		C_{res}	–	73.9	–	
Gate Charge	V_{CE} = 600 V, I_C = 40 A, V_{GE} = −15 V~15 V	Q_g	–	680	–	nC
Thermal Resistance − Chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.87 W/mK	R_{thJH}	–	0.430	–	K/W
Thermal Resistance − chip−to−case		R_{thJC}	–	0.240	–	K/W
IGBT INVERSE DIODE (D11, D12, D21, D22)						
Diode Forward Voltage	I_F = 50 A, T_J = 25°C	V_F	–	1.14	1.5	V
	I_F = 50 A, T_J = 175°C		–	1.03	–	
Thermal Resistance − Chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.87 W/mK	R_{thJH}	–	0.739	–	K/W
Thermal Resistance − Chip−to−case		R_{thJC}	–	0.594	–	K/W

Table 3. ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Note 4) (continued)

Rating	Test Conditions	Symbol	Min	Typ	Max	Unit
BOOST SILICON CARBIDE SCHOTTKY DIODE (D13, D14, D23, D24)						
Diode Forward Voltage	I_F = 60 A, T_J = 25°C	V_F	–	1.48	1.8	V
	I_F = 60 A, T_J = 175°C		–	2.14	–	
Reverse Recovery Time	T_J = 25°C V_{CE} = 600 V, I_C = 50 A V_{GE} = –9 V, 15 V, R_{Gon} = 9 Ω	t_{rr}	–	28.14	–	ns
Reverse Recovery Charge		Q_{rr}	–	304.98	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	18.8	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	1389.12	–	A/μs
Reverse Recovery Energy		E_{rr}	–	105.08	–	μJ
Reverse Recovery Time	T_J = 125°C V_{CE} = 600 V, I_C = 50 A V_{GE} = –9 V, 15 V, R_{Gon} = 9 Ω	t_{rr}	–	45.73	–	ns
Reverse Recovery Charge		Q_{rr}	–	583.95	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	24.08	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	1236	–	A/μs
Reverse Recovery Energy		E_{rr}	–	216.04	–	μJ
Thermal Resistance – Chip–to–heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.87 W/mK	R_{thJH}	–	0.532	–	K/W
Thermal Resistance – Chip–to–case		R_{thJC}	–	0.387	–	K/W
AUXILIARY DIODE (D15, D25)						
Diode Forward Voltage	I_F = 30 A, T_J = 25°C	V_F	–	2.3	2.9	V
	I_F = 30 A, T_J = 175°C		–	2.1	–	
Thermal Resistance – Chip–to–heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	1.187	–	K/W
Thermal Resistance – Chip–to–case		R_{thJC}	–	1.058	–	K/W
AUXILIARY 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 = 175°C		–	2.19	–	
Thermal Resistance – Chip–to–heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	0.746	–	K/W
Thermal Resistance – Chip–to–case		R_{thJC}	–	0.627	–	K/W
THERMISTOR CHARACTERISTICS						
Nominal Resistance	T = 25°C	R_{25}	–	5	–	kΩ
Nominal Resistance	T = 100°C	R_{100}	–	490.6	–	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%		–	3435	–	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.

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

TYPICAL CHARACTERISTICS – T11||D13, T12||D14, T21||D23, T22||D24

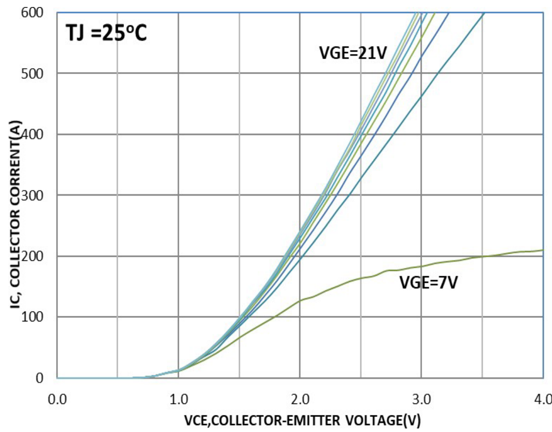


Figure 2. Typical Output Characteristics

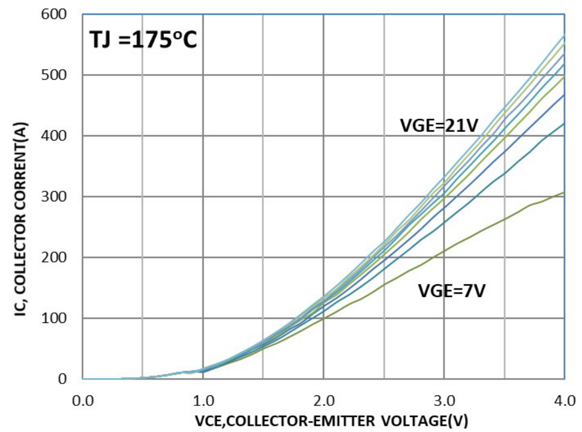


Figure 3. Typical Output Characteristics

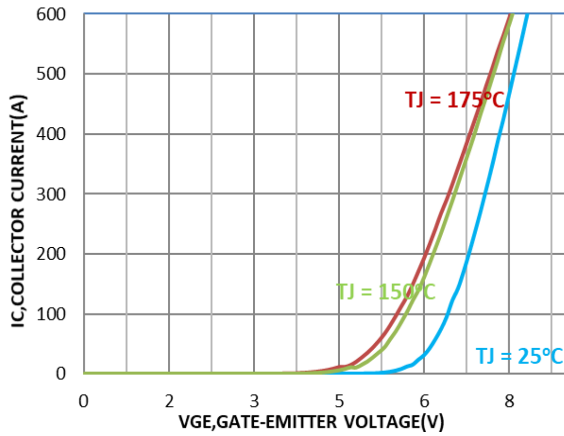


Figure 4. Transfer Characteristics

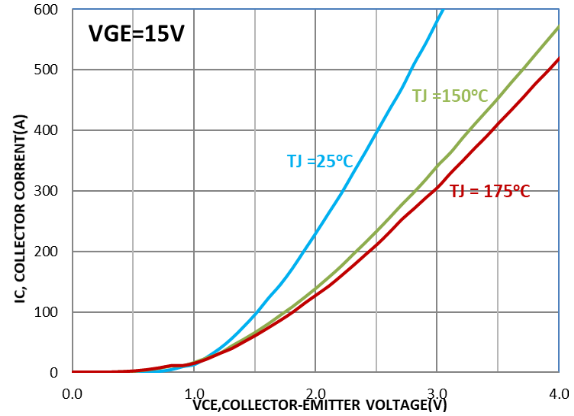


Figure 5. Saturation Voltage Characteristics

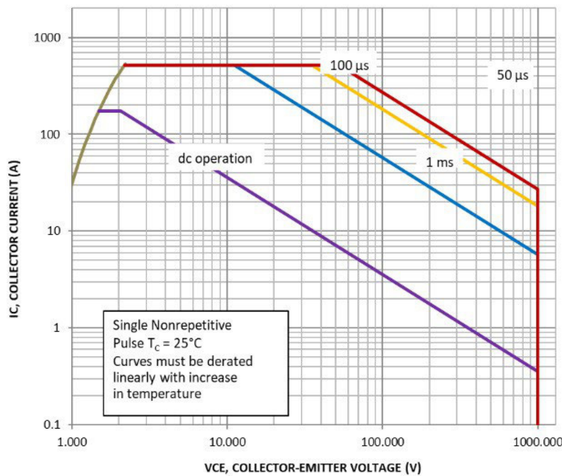


Figure 6. FBSOA

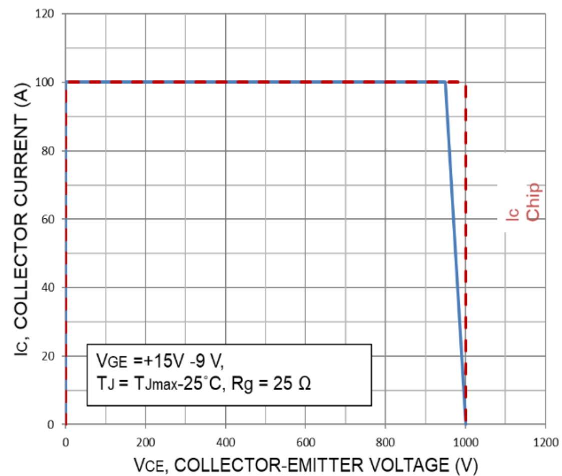


Figure 7. RBSOA

TYPICAL CHARACTERISTICS – T11||D13, T12||D14, T21||D23, T22||D24 (CONTINUED)

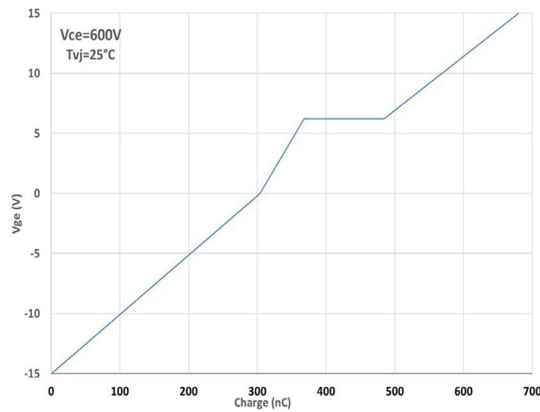


Figure 8. Gate Voltage vs. Gate Charge

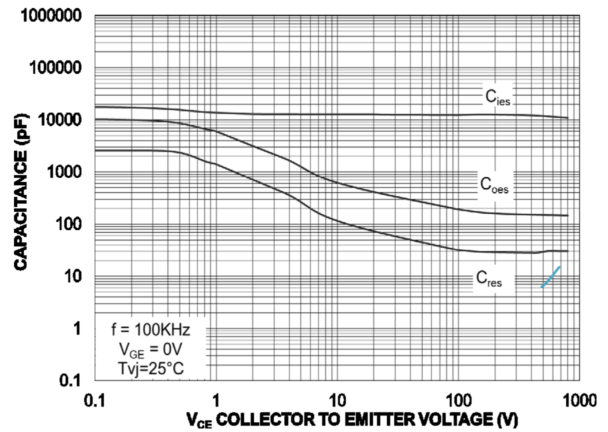


Figure 9. Capacitance

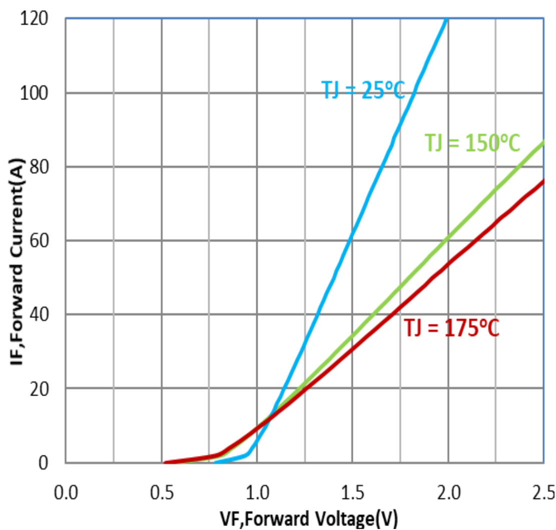


Figure 10. Diode Forward Characteristics

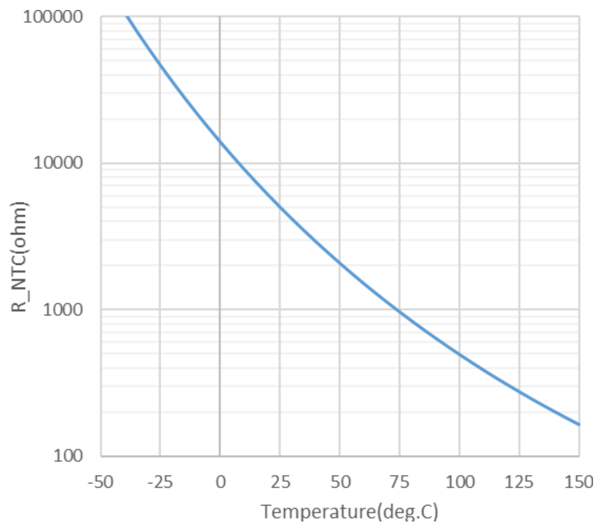


Figure 11. Temperature vs. NTC Value

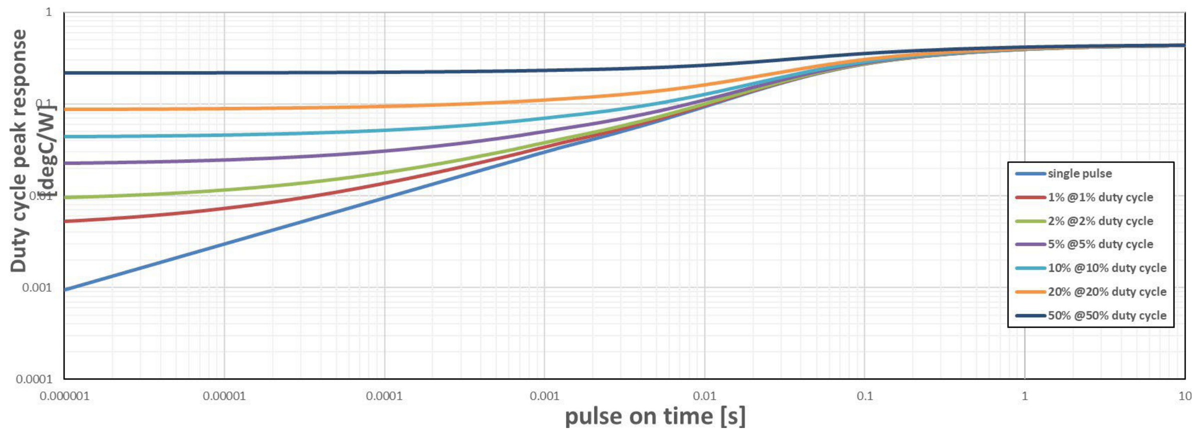


Figure 12. Transient Thermal Impedance (IGBT Rthjh)

TYPICAL CHARACTERISTICS – T11||D13, T12||D14, T21||D23, T22||D24 (CONTINUED)

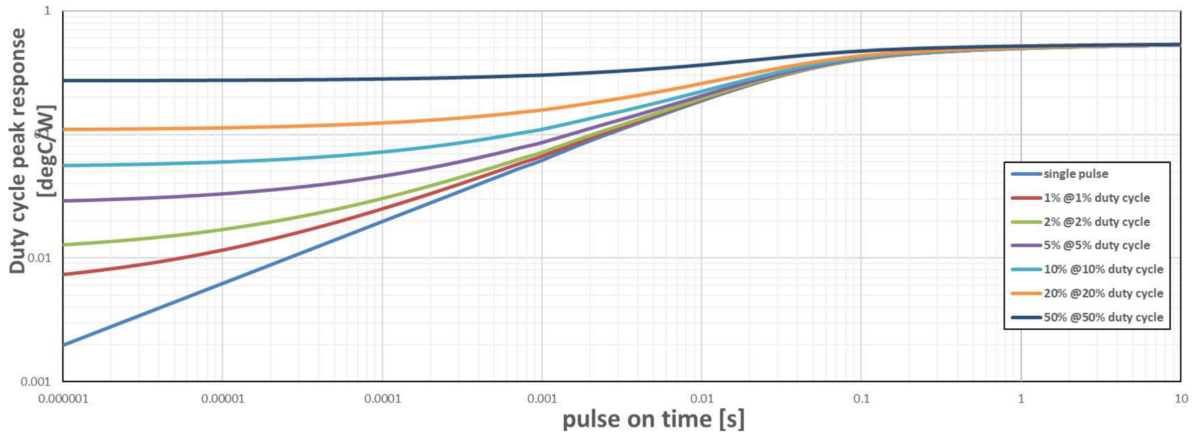


Figure 13. Transient Thermal Impedance (DIODE Rthjh)

TYPICAL CHARACTERISTICS – D11, D12, D21, D22 DIODE

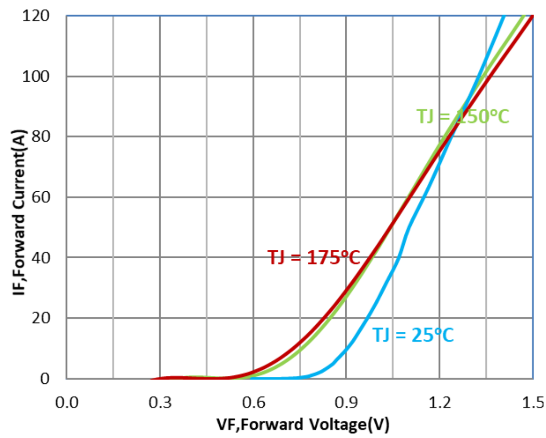


Figure 14. Diode Forward Characteristics

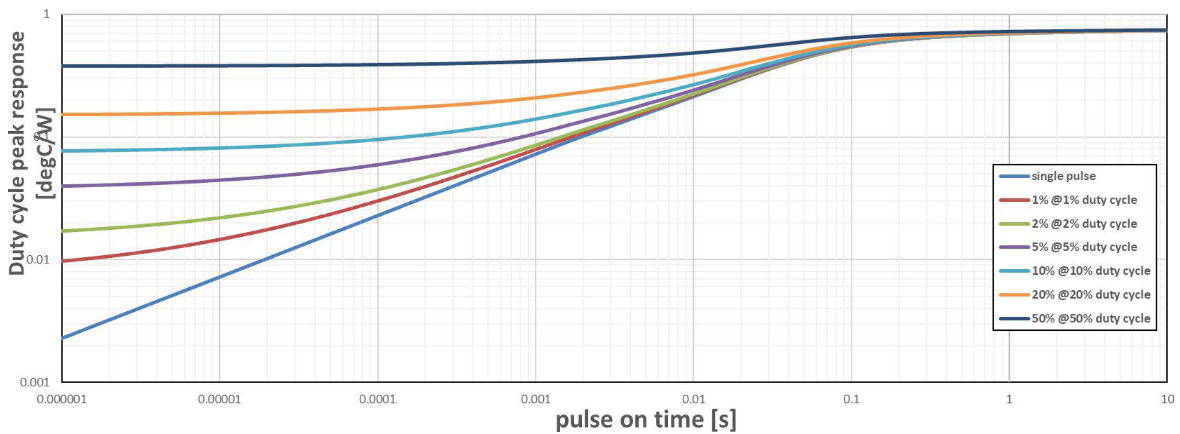


Figure 15. Transient Thermal Impedance (Rthjh)

TYPICAL CHARACTERISTICS – D15, D25 DIODE

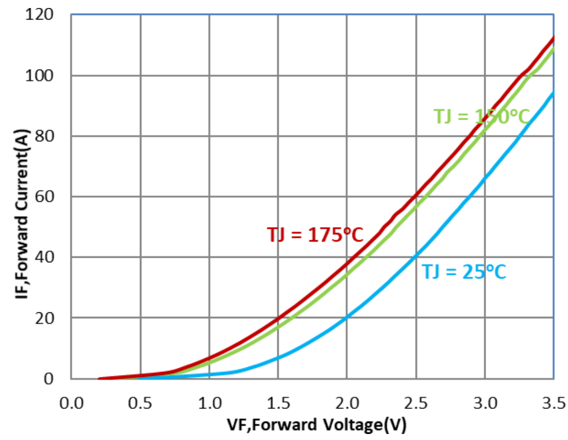


Figure 16. Diode Forward Characteristics

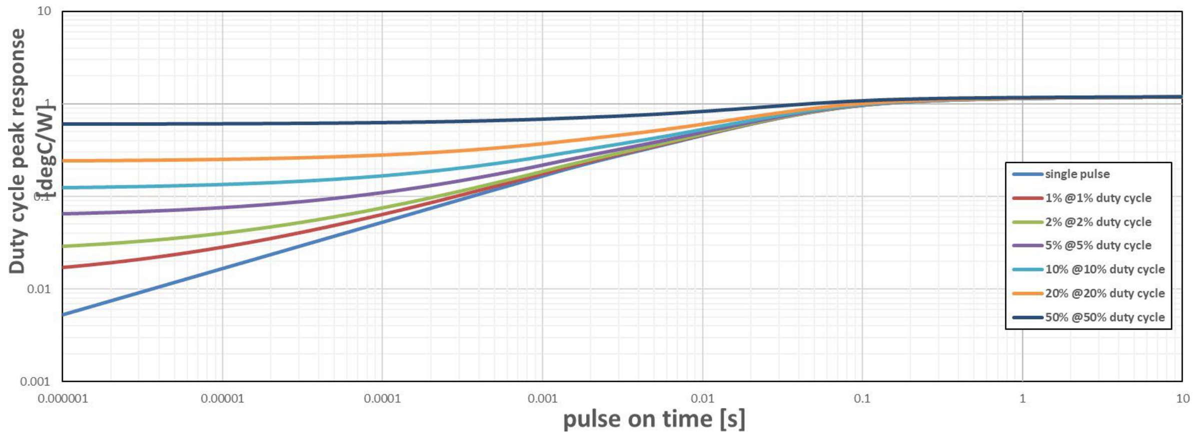


Figure 17. Transient Thermal Impedance (Rthjh)

TYPICAL CHARACTERISTICS – D16, D26 DIODE

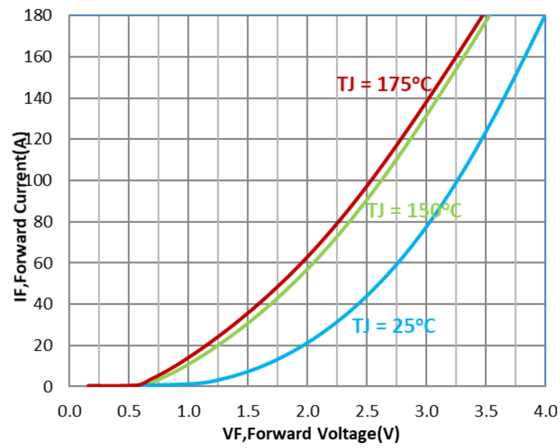


Figure 18. Diode Forward Characteristics

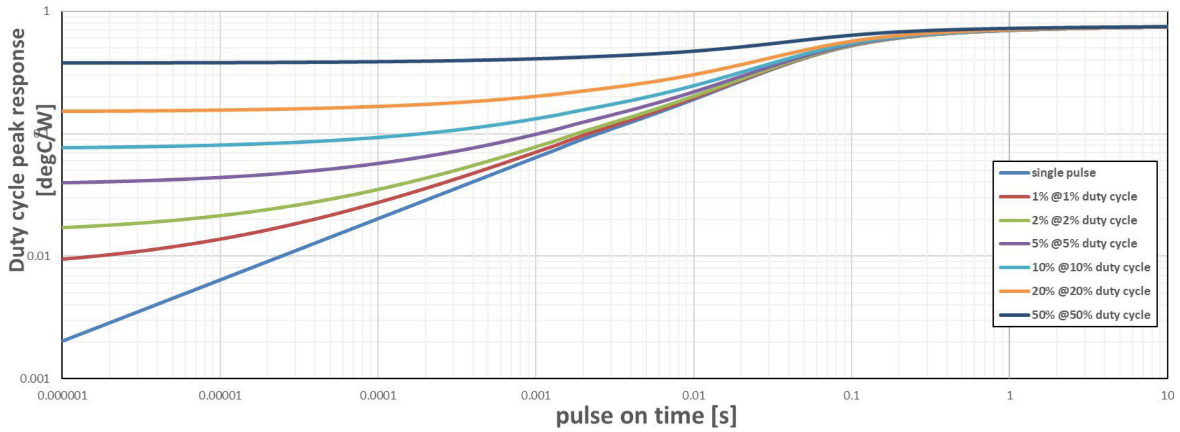


Figure 19. Transient Thermal Impedance (Rthjh)

TYPICAL CHARACTERISTICS – T11||D13, T12||D14, T21||D23, T22||D24

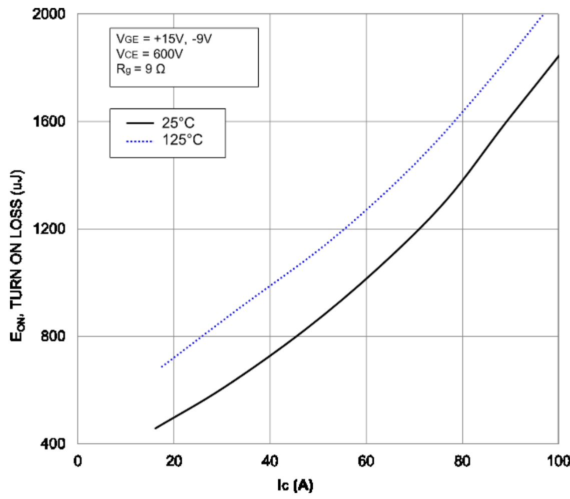


Figure 20. Typical Turn On Loss vs. I_C

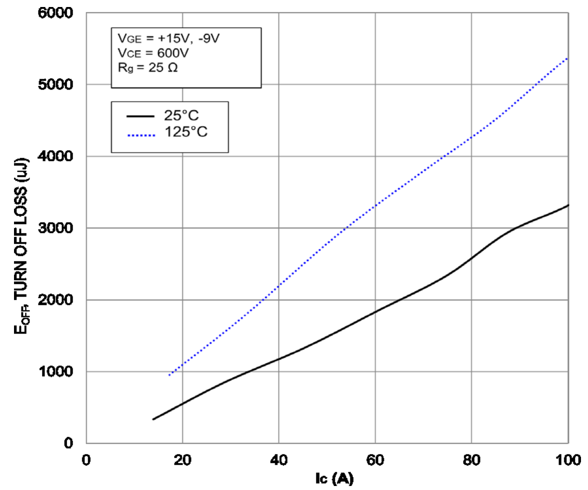


Figure 21. Typical Turn Off Loss vs. I_C

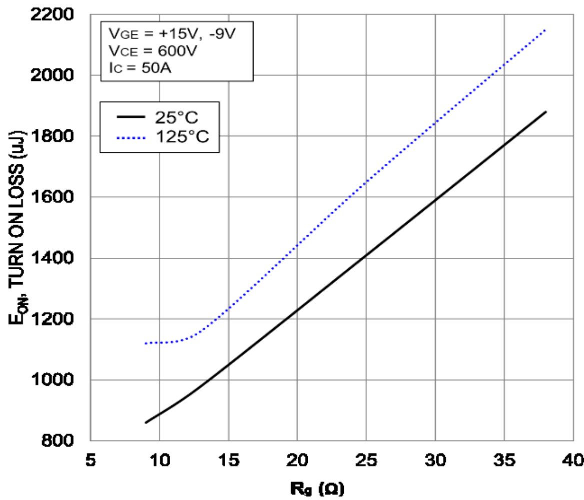


Figure 22. Typical Turn On Loss vs. R_g

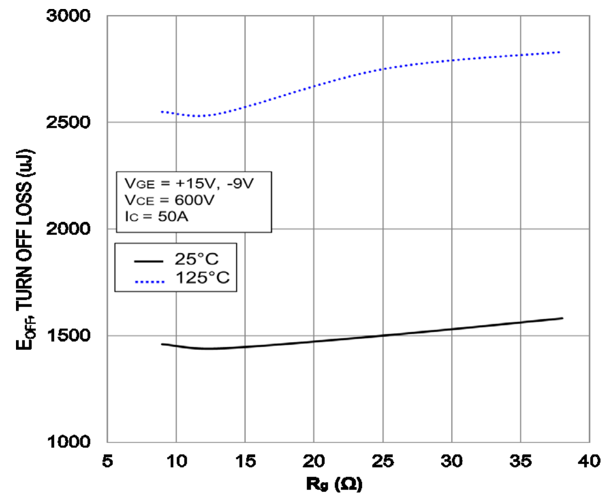


Figure 23. Typical Turn Off Loss vs. R_g

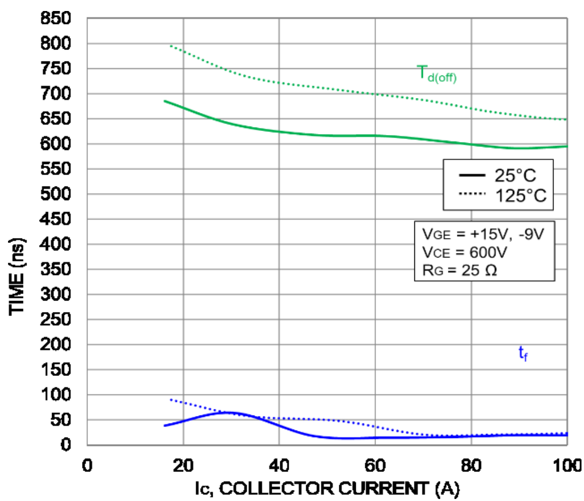


Figure 24. Typical Turn−Off Switching Time vs. I_C

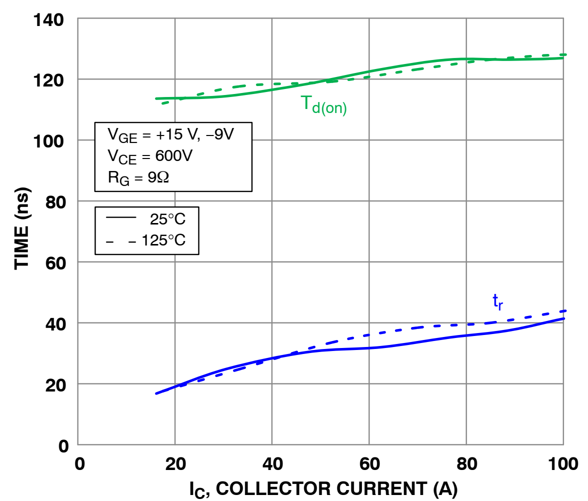


Figure 25. Typical Turn−On Switching Time vs. I_C

TYPICAL CHARACTERISTICS – T11||D13, T12||D14, T21||D23, T22||D24 (CONTINUED)

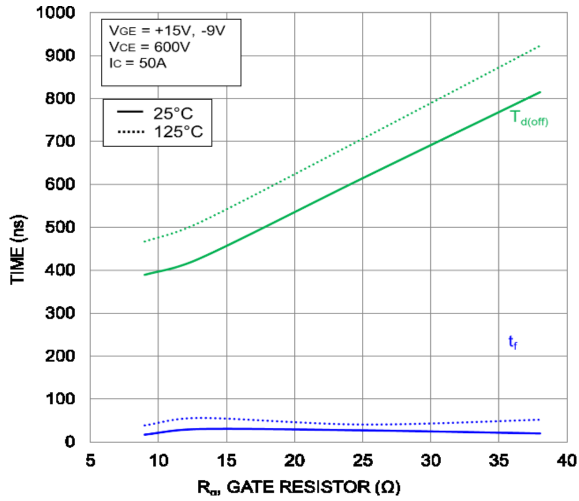


Figure 26. Typical Turn–Off Switching Time vs. R_g

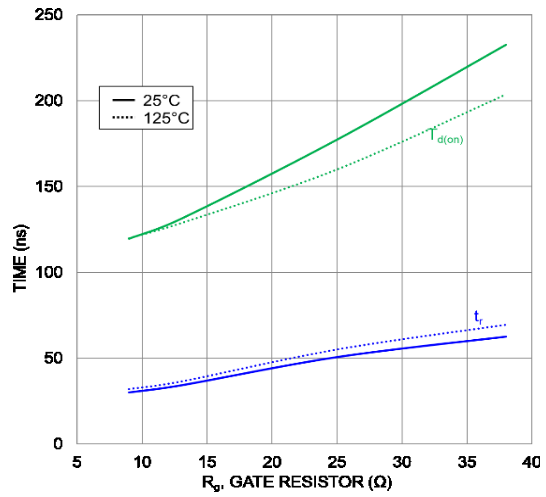


Figure 27. Typical Turn–On Switching Time vs. R_g

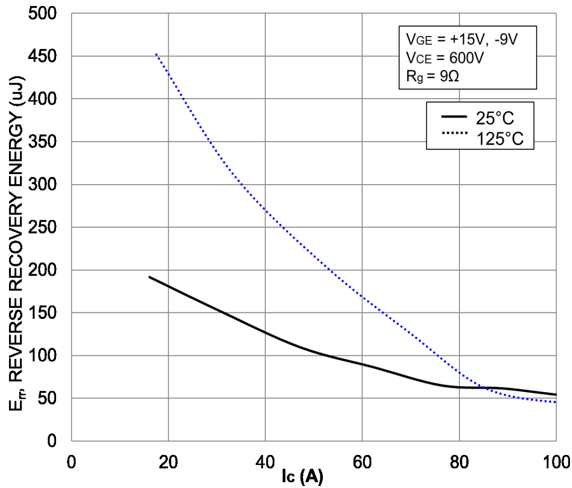


Figure 28. Typical Reverse Recovery Energy Loss vs. I_C

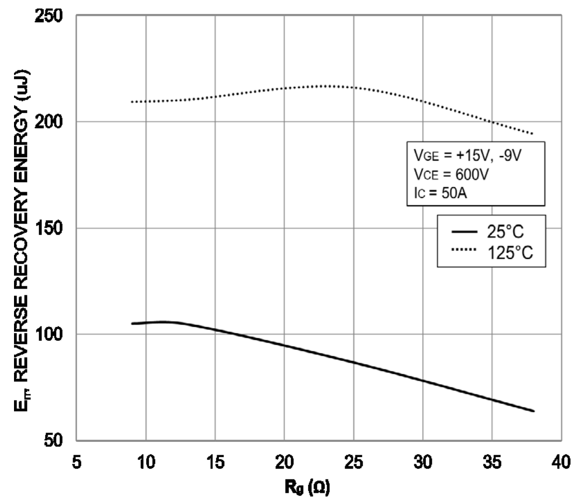


Figure 29. Typical Reverse Recovery Energy Loss vs. R_g

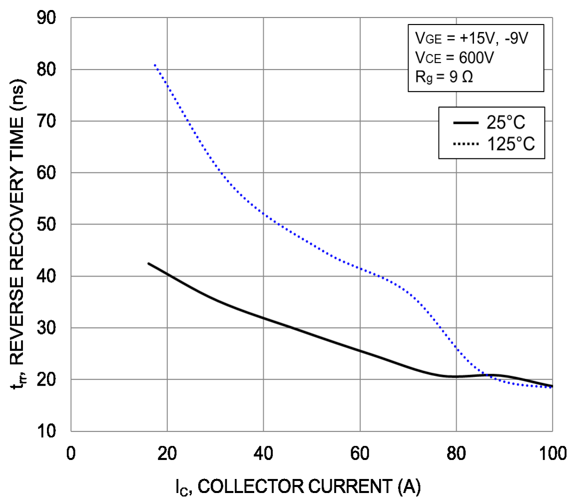


Figure 30. Typical Reverse Recovery Time vs. I_C

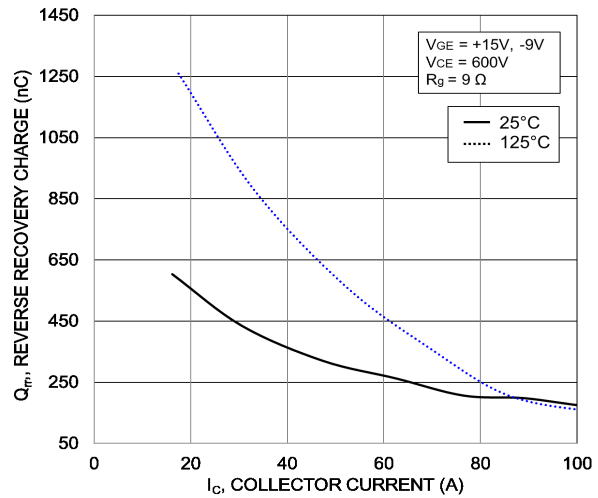


Figure 31. Typical Reverse Recovery Time vs. I_C

TYPICAL CHARACTERISTICS – T11||D13, T12||D14, T21||D23, T22||D24 (CONTINUED)

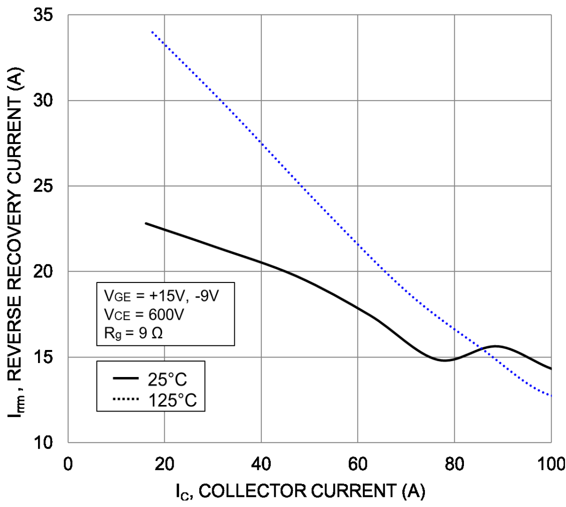


Figure 32. Typical Reverse Recovery Current vs. I_C

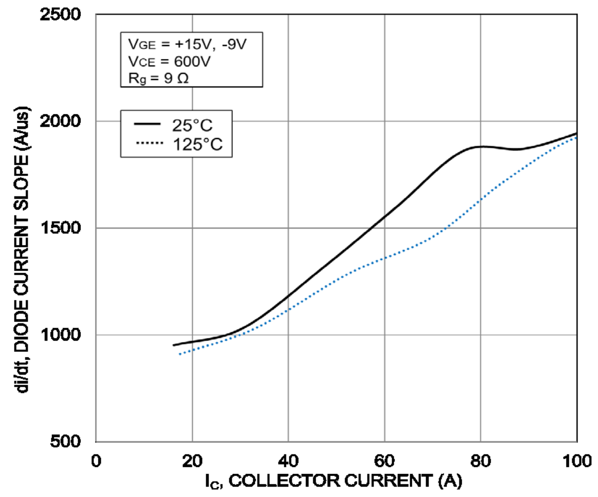


Figure 33. Typical di/dt vs. I_C

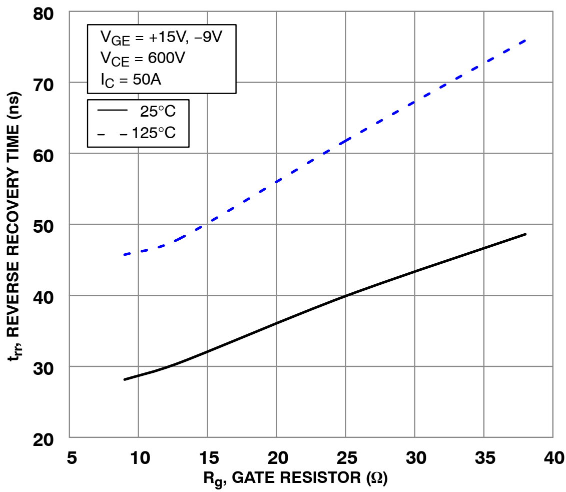


Figure 34. Typical Reverse Recovery Time vs. R_g

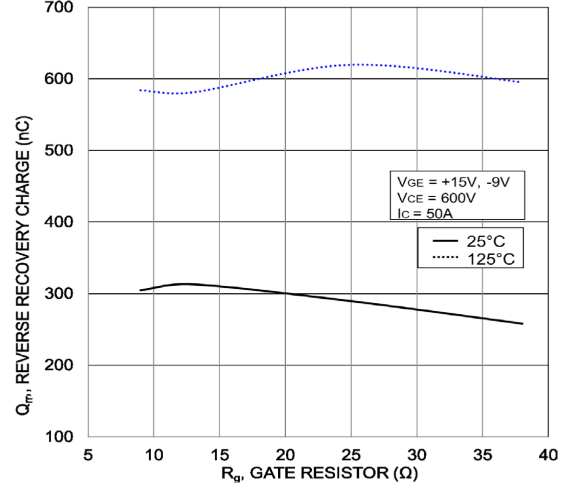


Figure 35. Typical Reverse Recovery Charge vs. R_g

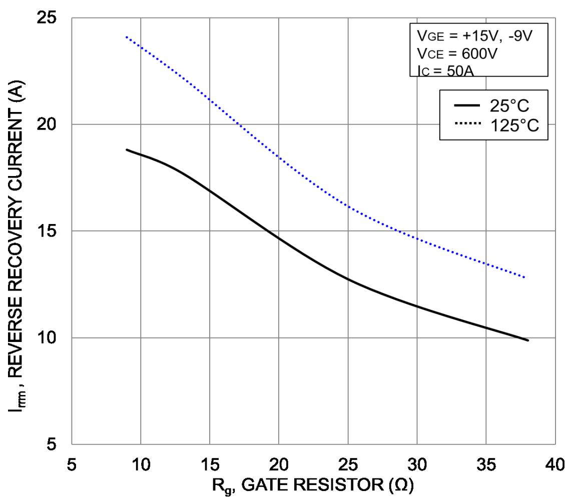


Figure 36. Typical Reverse Recovery Peak Current vs. R_g

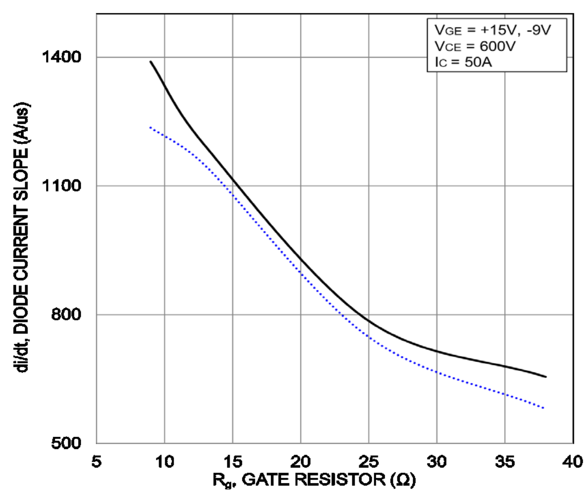
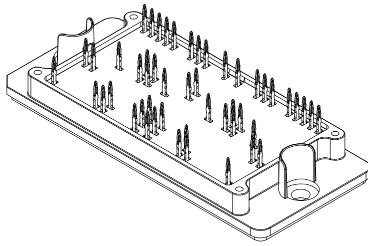


Figure 37. Typical di/dt vs. R_g

ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH400B100H4Q2F2SG	NXH400B100H4Q2F2SG	Q2BOOST − PIM50 (Pb−Free and Halide−Free Solder Pins)	12 Units / Blister Tray
NXH400B100H4Q2F2PG	NXH400B100H4Q2F2PG	Q2BOOST − PIM50 (Pb−Free and Halide−Free Press−fit Pins)	12 Units / Blister Tray



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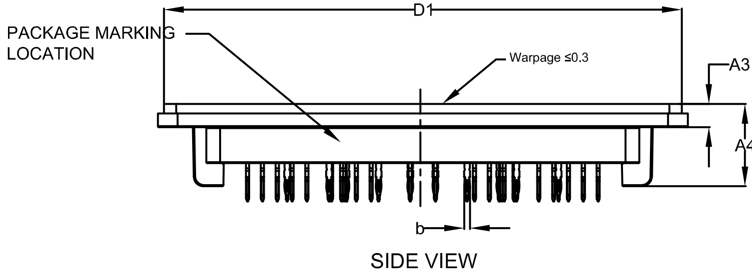
ISSUE B

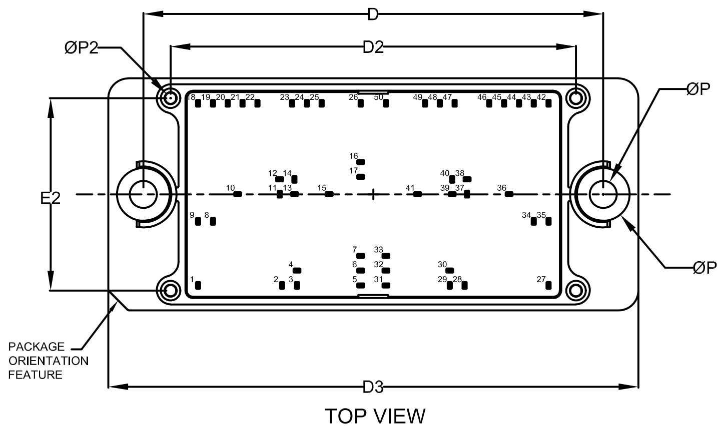
DATE 15 SEP 2023



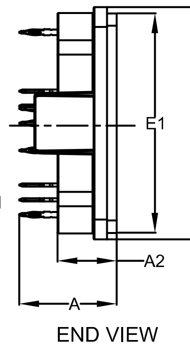
SIDE VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009
2. CONTROLLING DIMENSION : MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A1
4. PIN POSITION TOLERANCE IS ± 0.4mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES
6. PRESS FIT PIN



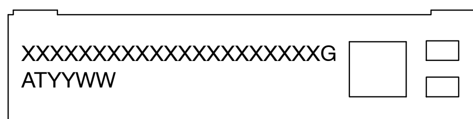
TOP VIEW



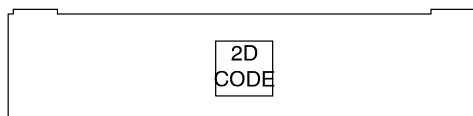
END VIEW

DIM	MILLIMETERS MIN.	NOM.	MAX.
A	19.36	19.76	20.16
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
D	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.20	47.00	47.80
E1	44.10	44.40	44.70
E2	38.80	39.00	39.20
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20

GENERIC
MARKING DIAGRAM*



FRONTSIDE MARKING



BACKSIDE MARKING

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

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present. Some products may not follow the Generic Marking.

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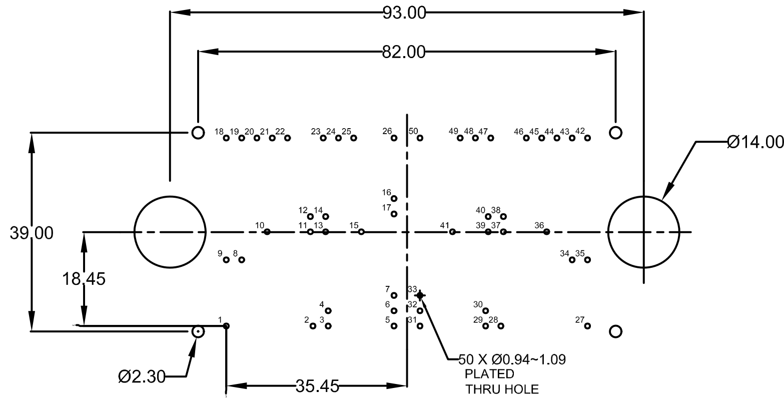
CASE 180BB
ISSUE B

DATE 15 SEP 2023



RECOMMENDED
MOUNTING PATTERN

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

NOTE 4

MOUNTING HOLE POSITION					
Pin #	X	Y	Pin #	X	Y
1	0	0	26	32.9	36.9
2	17	0	27	70.9	0
3	20	0	28	53.9	0
4	20	3	29	50.9	0
5	32.9	0	30	50.9	3
6	32.9	3	31	38	0
7	32.9	6	32	38	3
8	3	13	33	38	6
9	0	13	34	67.9	13
10	8	18.5	35	70.9	13
11	16.5	18.5	36	62.9	18.5
12	16.5	21.5	37	54.4	18.5
13	19.5	18.5	38	54.4	21.5
14	19.5	21.5	39	51.4	18.5
15	26.5	18.5	40	51.4	21.5
16	32.9	25	41	44.4	18.5
17	32.9	22	42	70.9	36.9
18	0	36.9	43	67.9	36.9
19	3	36.9	44	64.9	36.9
20	6	36.9	45	61.9	36.9
21	9	36.9	46	58.9	36.9
22	12	36.9	47	51.9	36.9
23	19	36.9	48	48.9	36.9
24	22	36.9	49	45.9	36.9
25	25	36.9	50	38	36.9

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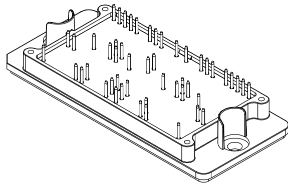

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CASE 180HN
ISSUE A

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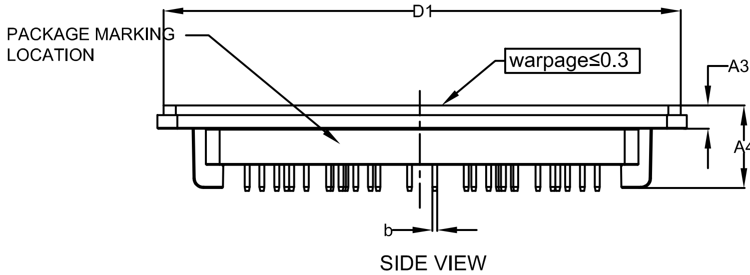
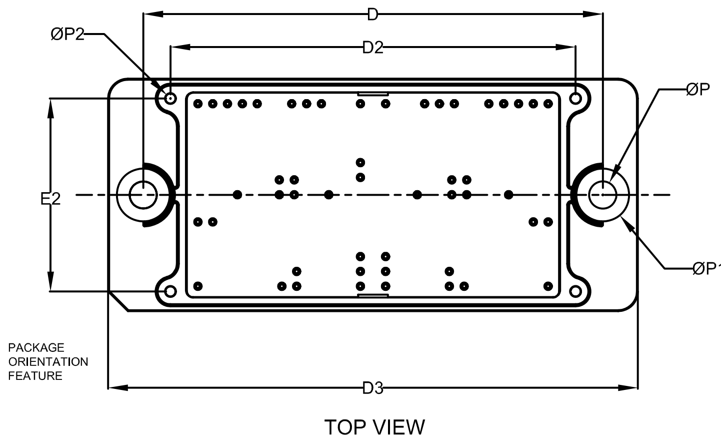


SIDE VIEW

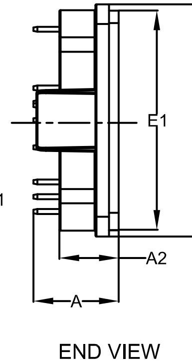
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009
2. CONTROLLING DIMENSION : MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A1
4. PIN POSITION TOLERANCE IS ± 0.4mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES
6. SOLDER PIN

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	16.90	17.30	17.70
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	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	38.80	39.00	39.20
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20

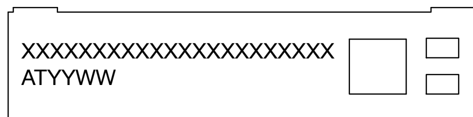


TOP VIEW

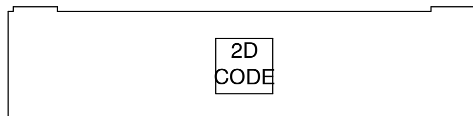


END VIEW

GENERIC MARKING DIAGRAM*



FRONTSIDE MARKING



BACKSIDE MARKING

XXXXX = Specific Device Code
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present. Some products may not follow the Generic Marking.

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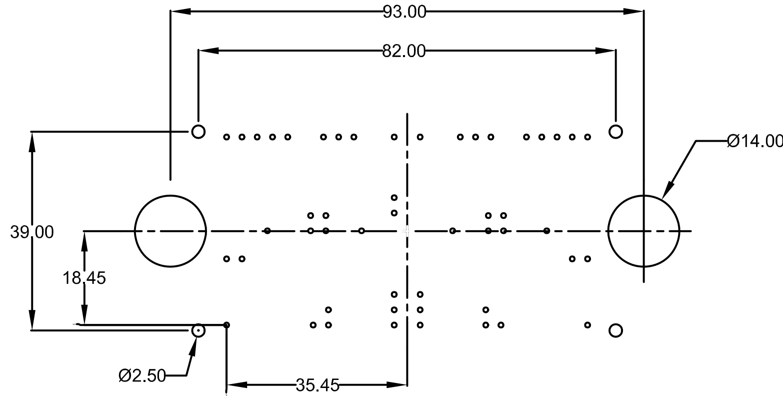

RECOMMENDED
MOUNTING PATTERN

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

Pin position

Pin #	X	Y	Function		Pin #	X	Y	Function
1	0	0	DCN1+		26	32.9	36.9	DCN1-
2	17	0	DC1-		27	70.9	0	DCN2+
3	20	0	DC1-		28	53.9	0	DC2-
4	20	3	DC1-		29	50.9	0	DC2-
5	32.9	0	DC1+		30	50.9	3	DC2-
6	32.9	3	DC1+		31	38	0	DC2+
7	32.9	6	DC1+		32	38	3	DC2+
8	3	13	G12		33	38	6	DC2+
9	0	13	E12		34	67.9	13	G22
10	8	18.5	FLY1-		35	70.9	13	E22
11	16.5	18.5	BSTIN1		36	62.9	18.5	FLY2-
12	16.5	21.5	BSTIN1		37	54.4	18.5	BSTIN2
13	19.5	18.5	BSTIN1		38	54.4	21.5	BSTIN2
14	19.5	21.5	BSTIN1		39	51.4	18.5	BSTIN2
15	26.5	18.5	FLY1+		40	51.4	21.5	BSTIN2
16	32.9	25	TH1		41	44.4	18.5	FLY2+
17	32.9	22	TH2		42	70.9	36.9	G21
18	0	36.9	G11		43	67.9	36.9	E21
19	3	36.9	E11		44	64.9	36.9	FC2-
20	6	36.9	FC1-		45	61.9	36.9	FC2-
21	9	36.9	FC1-		46	58.9	36.9	FC2-
22	12	36.9	FC1-		47	51.9	36.9	FC2+
23	19	36.9	FC1+		48	48.9	36.9	FC2+
24	22	36.9	FC1+		49	45.9	36.9	FC2+
25	25	36.9	FC1+		50	38	36.9	DCN2-

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