Si/SiC Hybrid Modules – EliteSiC, 3 Channel Flying Capacitor Boost 1000 V, 100 A IGBT, 1200 V, 30 A SiC Diode, Q2 Package

NXH300B100H4Q2F2, NXH300B100H4Q2F2SG-R

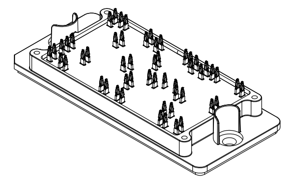
This high−density, integrated power module combines high−performance IGBTs with 1200 V SiC diode.

Features

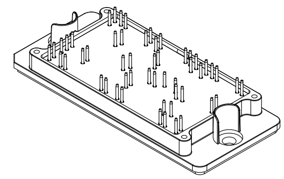
- Extremely Efficient Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- Module Design Offers High Power Density
- Low Inductive Layout
- 3−channel in Q2BOOST Package
- These are Pb−Free Devices

Typical Applications

- Solar Inverter
- Uninterruptible Power Supplies

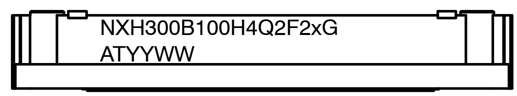


PIM53, 93x47 (PRESSFIT)
CASE 180CB



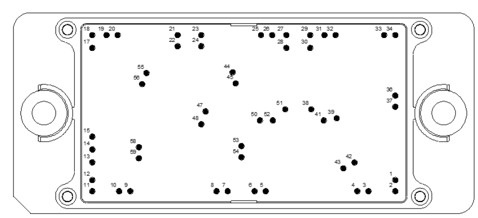
PIM53, 93x47 (SOLDER PIN)
CASE 180CC

MARKING DIAGRAM



NXH300B100H4Q2F2x = Specific Device Code (x = P, S)
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

PIN CONNECTION



ORDERING INFORMATION

See detailed ordering and shipping information on page 11 of this data sheet.

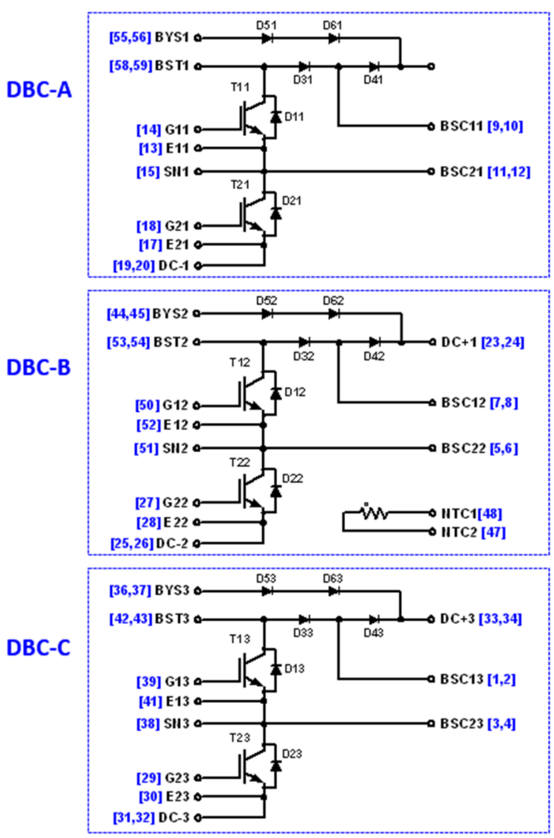


Figure 1. NXH300B100H4Q2F2PG/SG/SG−R Schematic Diagram

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

Symbol	Parameter	Value	Unit
IGBT (T11, T21, T12, T22, T13, T23)			
V_{CES}	Collector−Emitter voltage	1000	V
V_{GE}	Gate−Emitter Voltage Positive transient gate−emitter voltage (Tpulse = 5 μs, D < 0.10)	±20 30	V
I_C	Continuous Collector Current (@ V_{GE} = 20 V, T_C = 80°C)	73	A
$I_{C(Pulse)}$	Pulsed Peak Collector Current @ T_C = 80°C (T_J = 150°C)	219	A
P_{tot}	Power Dissipation (T_J = 150°C, T_C = 80°C)	194	W
T_{JMIN}	Minimum Operating Junction Temperature	−40	°C
T_{JMAX}	Maximum Operating Junction Temperature	175	°C
IGBT INVERSE DIODE (D11, D21, D12, D22, D13, D23) AND BYPASS DIODE (D51, D61, D52, D62, D53, D63)			
V_{RRM}	Peak Repetitive Reverse Voltage	1600	V
I_F	Continuous Forward Current @ T_C = 80°C	36	A
I_{FRM}	Repetitive Peak Forward Current (T_J = 150°C, T_J limited by T_{Jmax})	108	A
P_{tot}	Maximum Power Dissipation @ T_C = 80°C (T_J = 150°C)	79	W
T_{JMIN}	Minimum Operating Junction Temperature	−40	°C
T_{JMAX}	Maximum Operating Junction Temperature	150	°C
BOOST SILICON CARBIDE SCHOTTKY DIODE (D31, D41, D32, D42, D33, D43)			
V_{RRM}	Peak Repetitive Reverse Voltage	1200	V
I_F	Continuous Forward Current @ T_C = 80°C	36	A
I_{FRM}	Repetitive Peak Forward Current (T_J = 150°C, T_J limited by T_{Jmax})	108	A
P_{tot}	Maximum Power Dissipation @ T_C = 80°C (T_J = 150°C)	104	W
T_{JMIN}	Minimum Operating Junction Temperature	−40	°C
T_{JMAX}	Maximum Operating Junction Temperature	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.

THERMAL AND INSULATION PROPERTIES (Note 1) (T_J = 25°C unless otherwise noted)

Symbol	Rating	Value	Unit
THERMAL PROPERTIES			
T_{VJOP}	Operating Temperature under Switching Condition	−40 to 150	°C
T_{stg}	Storage Temperature Range	−40 to 125	°C
INSULATION PROPERTIES			
V_{is}	Isolation Test Voltage, t = 2 sec, 50 Hz (Note 3)	4000	V_{RMS}
	Creepage Distance	12.7	mm
CTI	Comparative Tracking Index	>600	

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.
3. 4000 VAC_{RMS} for 1 second duration is equivalent to 3333 VAC_{RMS} for 1 minute duration.

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
IGBT (T11, T21, T12, T22, T13, T23)						
$V_{(BR)CES}$	Collector−Emitter Breakdown Voltage	V_{GE} = 0 V, I_C =1 mA	1000	1118	–	V
$V_{CE(SAT)}$	Collector−Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 100 A, T_C = 25°C	–	1.80	2.25	V
		V_{GE} = 15 V, I_C = 100 A, T_C = 150°C	–	2.03	–	
$V_{GE(TH)}$	Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 100 mA	4.1	5.08	5.9	V
I_{CES}	Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	–	–	800	μA
I_{GES}	Gate Leakage Current	V_{GE} = ±20 V, V_{CE} = 0 V	–	–	±400	nA
r_g	Internal Gate Resistor		–	5	–	Ω
$t_{d(on)}$	Turn−On Delay Time	T_j = 25°C V_{CE} = 600 V, I_C = 50 A V_{GE} = −9 V, +15 V, R_G = 6 Ω	–	95	–	ns
t_r	Rise Time		–	15.42	–	
$t_{d(off)}$	Turn−Off Delay Time		–	267	–	
t_f	Fall time		–	59	–	
E_{on}	Turn on switching loss		–	1030	–	μJ
E_{off}	Turn off switching loss		–	1200	–	
$t_{d(on)}$	Turn−On Delay Time	T_j = 125°C V_{CE} = 600 V, I_C = 50 A V_{GE} = −9 V, +15 V, R_G = 6 Ω	–	97	–	ns
t_r	Rise Time		–	18	–	
$t_{d(off)}$	Turn−Off Delay Time		–	314	–	
t_f	Fall time		–	93	–	
E_{on}	Turn on switching loss		–	1260	–	μJ
E_{off}	Turn off switching loss		–	2140	–	
C_{ies}	Input capacitance	V_{CE} =20 V, V_{GE} = 0 V, f = 1 MHz	–	6323	–	pF
C_{oes}	Output capacitance		–	241	–	
C_{res}	Reverse transfer capacitance		–	34	–	
Q_g	Gate Charge	V_{CE} = 600 V, V_{GE} = −15/+15 V, I_C = 75 A	–	340	–	nC
R_{thJH}	Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	–	0.66	–	K/W
R_{thJC}	Thermal Resistance − chip−to−case		–	0.48	–	K/W
IGBT INVERSE DIODE (D11, D21, D12, D22, D13, D23) AND BYPASS DIODE (D51, D61, D52, D62, D53, D63)						
V_F	Diode Forward Voltage	I_F = 30 A, T_J = 25°C	–	1.04	1.7	V
		I_F = 30 A, T_J = 150°C	–	0.94	–	
R_{thJH}	Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	–	1.04	–	K/W
BOOST SILICON CARBIDE SCHOTTKY DIODE (D31, D41, D32, D42, D33, D43)						
I_R	Diode Reverse Leakage Current	V_R = 1200 V, T_J = 25°C	–	–	600	μA
V_F	Diode Forward Voltage	I_F = 30 A, T_J = 25°C	–	1.42	1.7	V
		I_F = 30 A, T_J = 150°C	–	1.85	–	
t_{rr}	Reverse Recovery Time	T_J = 25°C V_{DS} = 600 V, I_C = 50 A V_{GE} = −9 V, 15 V, R_G = 1 Ω	–	15	–	ns
Q_{rr}	Reverse Recovery Charge		–	128	–	nC
I_{RRM}	Peak Reverse Recovery Current		–	13	–	A
di/dt	Peak Rate of Fall of Recovery Current		–	4200	–	A/μs
E_{rr}	Reverse Recovery Energy		–	16	–	μJ

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
BOOST SILICON CARBIDE SCHOTTKY DIODE (D31, D41, D32, D42, D33, D43)						
t_{rr}	Reverse Recovery Time	T_J = 125°C V_{DS} = 600 V, I_C = 50 A V_{GE} = −9 V, 15 V, R_G = 1 Ω	–	19	–	ns
Q_{rr}	Reverse Recovery Charge		–	175	–	nC
I_{RRM}	Peak Reverse Recovery Current		–	17	–	A
di/dt	Peak Rate of Fall of Recovery Current		–	3153	–	A/μs
E_{rr}	Reverse Recovery Energy		–	18	–	μJ
R_{thJH}	Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	–	0.85	–	K/W
R_{thJC}	Thermal Resistance − chip−to−case		–	0.73	–	K/W
THERMISTOR CHARACTERISTICS						
R_{25}	Nominal resistance		–	22	–	kΩ
R_{100}	Nominal resistance	T = 100°C	–	1486	–	Ω
ΔR/R	Deviation of R25		−5	–	5	%
P_D	Power dissipation		–	200	–	mW
	Power dissipation constant		–	2	–	mW/K
	B−value	B (25/50), tolerance ±3%	–	3950	–	K
	B−value	B (25/100), tolerance ±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.

TYPICAL CHARACTERISTICS − IGBT, INVERSE & BYPASS DIODE AND BOOST DIODE

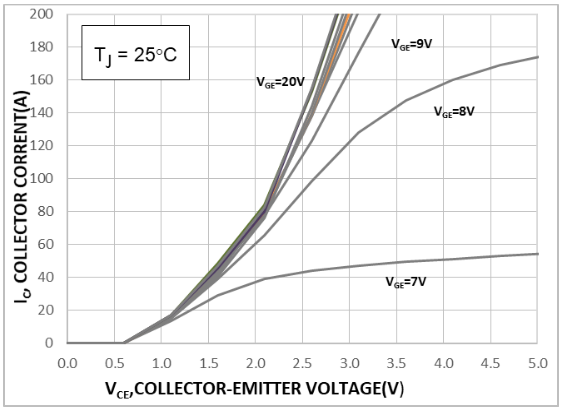


Figure 2. Typical Output Characteristics

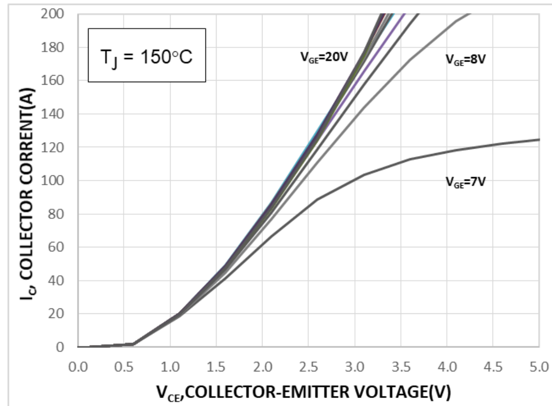


Figure 3. Typical Output Characteristics

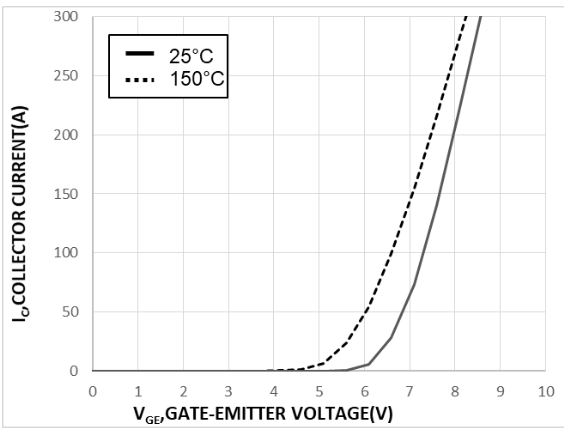


Figure 4. Transfer Characteristics

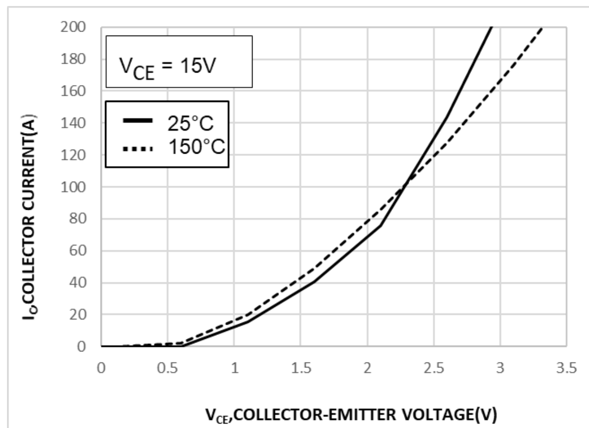


Figure 5. Typical Saturation Voltage Characteristics

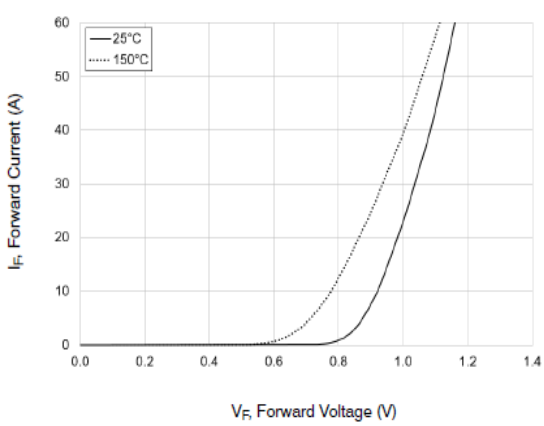


Figure 6. Inverse Diode Forward Characteristics

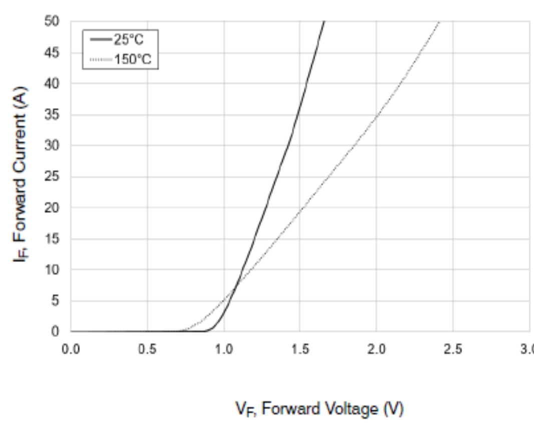


Figure 7. Boost Diode Forward Characteristics

TYPICAL CHARACTERISTICS – IGBT, INVERSE & BYPASS DIODE AND BOOST DIODE (CONTINUED)

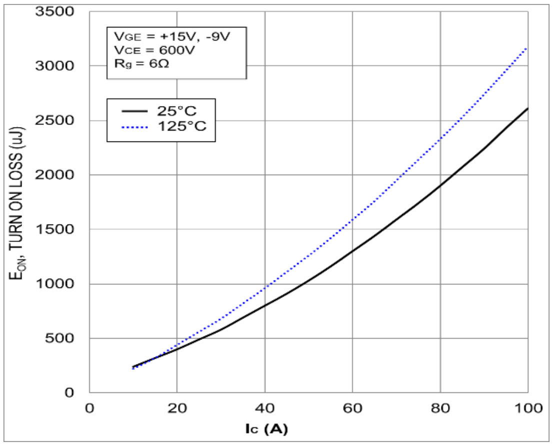


Figure 8. Typical Turn On Loss vs. I_C

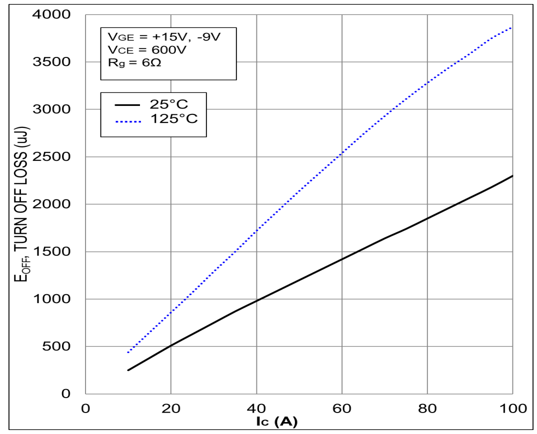


Figure 9. Typical Turn Off Loss vs. I_C

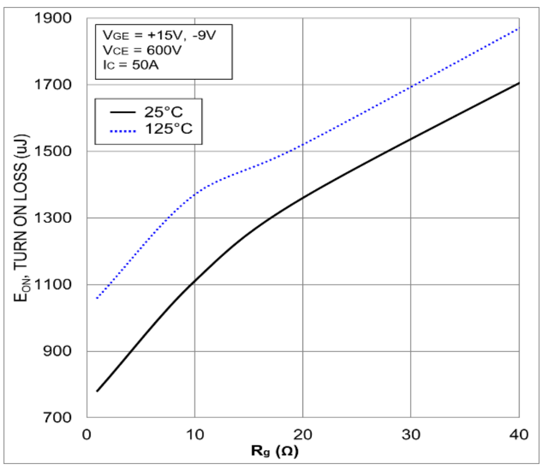


Figure 10. Typical Turn On Loss vs. R_g

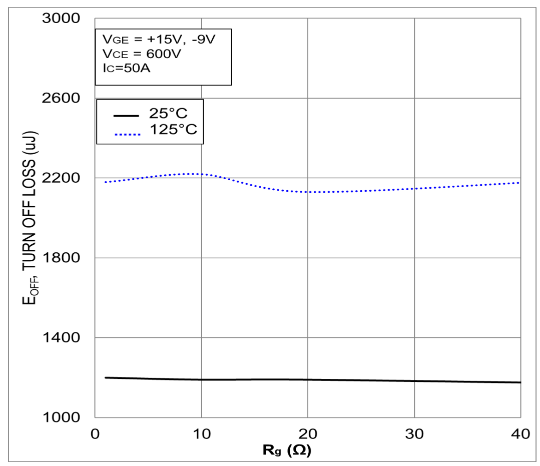


Figure 11. Typical Turn Off Loss vs. R_g

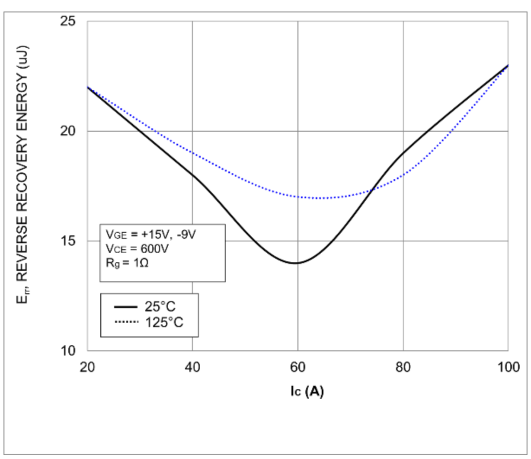


Figure 12. Typical Reverse Recovery Energy Loss vs. I_C

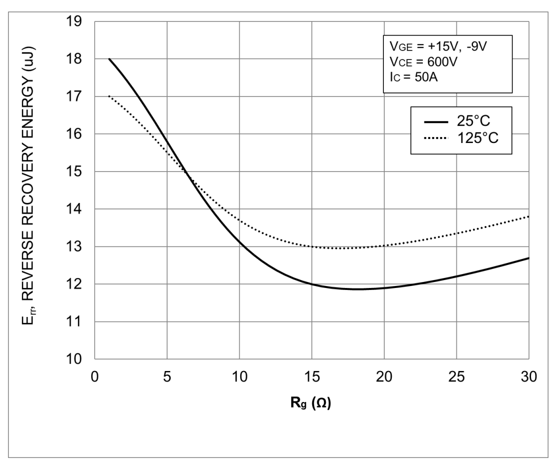


Figure 13. Typical Reverse Recovery Energy Loss vs. R_g

TYPICAL CHARACTERISTICS – IGBT, INVERSE & BYPASS DIODE AND BOOST DIODE (CONTINUED)

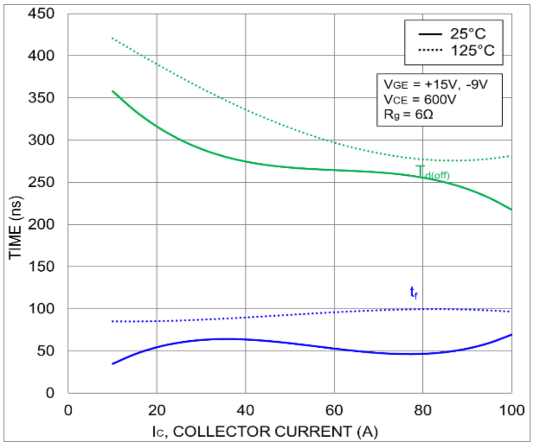


Figure 14. Typical Turn−Off Switching Time vs. I_C

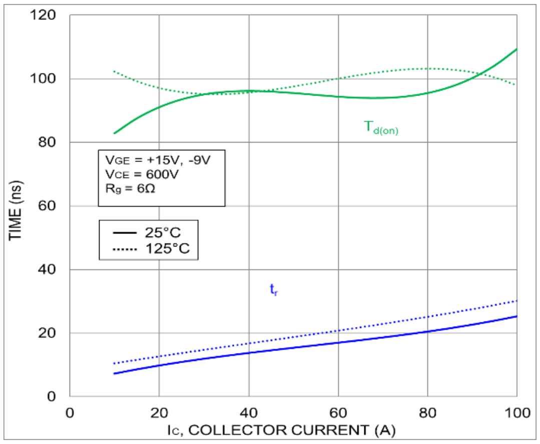


Figure 15. Typical Turn−On Switching Time vs. I_C

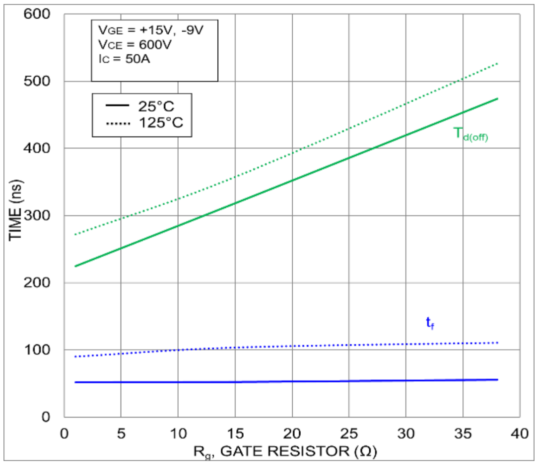


Figure 16. Typical Turn−Off Switching Time vs. Rg

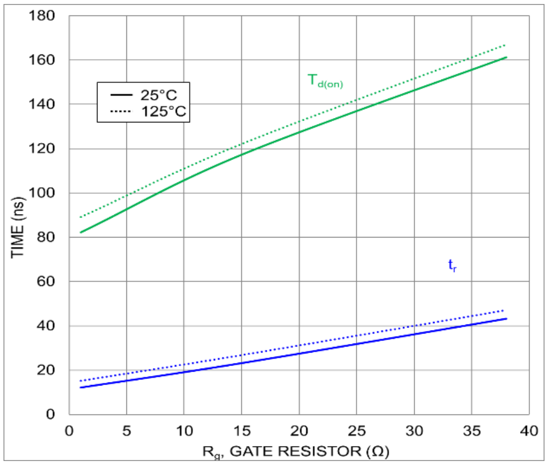


Figure 17. Typical Turn−On Switching Time vs. Rg

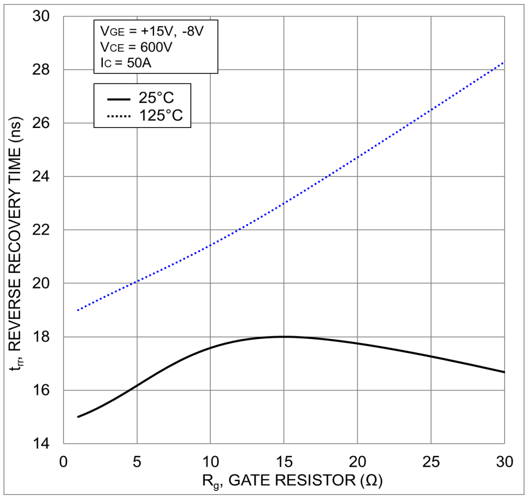


Figure 18. Typical Reverse Recovery Time vs. Rg

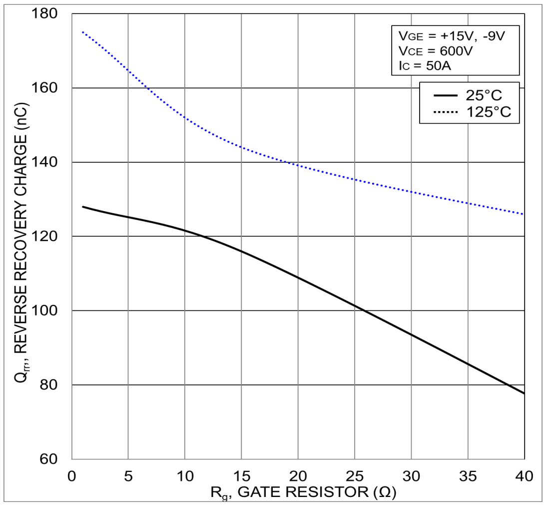


Figure 19. Typical Reverse Recovery Charge vs. Rg

TYPICAL CHARACTERISTICS − IGBT, INVERSE & BYPASS DIODE AND BOOST DIODE (CONTINUED)

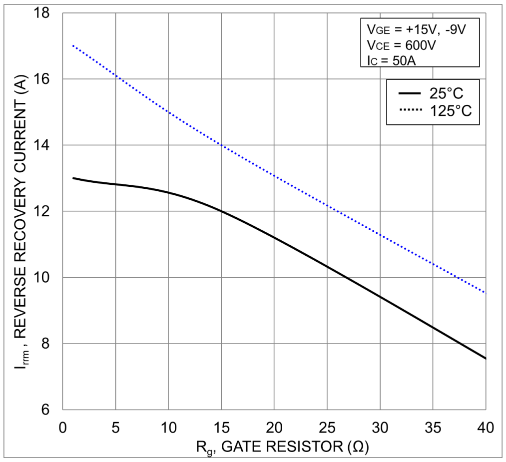


Figure 20. Typical Reverse Recovery Peak Current vs. R_g

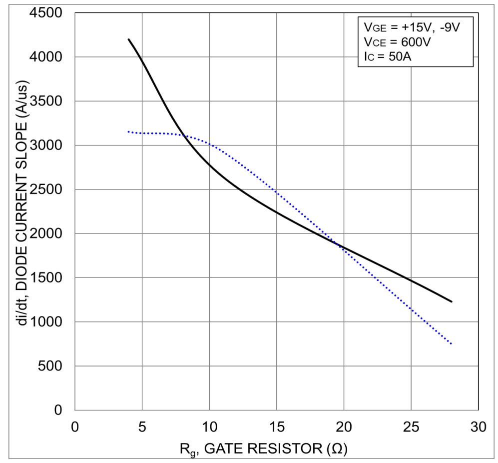


Figure 21. Typical di/dt vs. R_g

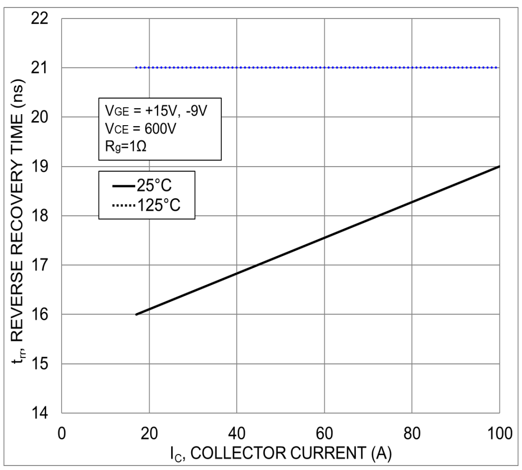


Figure 22. Typical Reverse Recovery Time vs. I_C

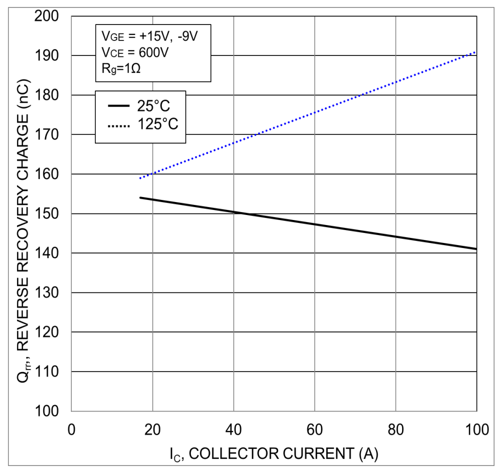


Figure 23. Typical Reverse Recovery Charge vs. I_C

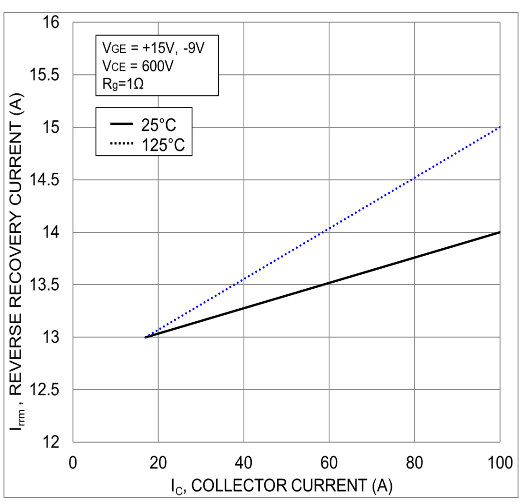


Figure 24. Typical Reverse Recovery Current vs. I_C

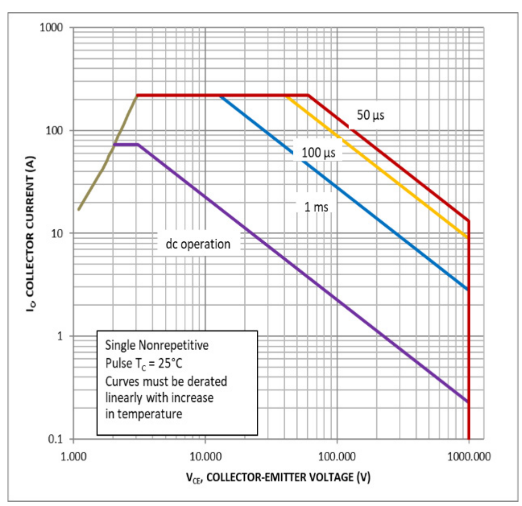


Figure 25. FBSOA

TYPICAL CHARACTERISTICS − IGBT, INVERSE & BYPASS DIODE AND BOOST DIODE (CONTINUED)

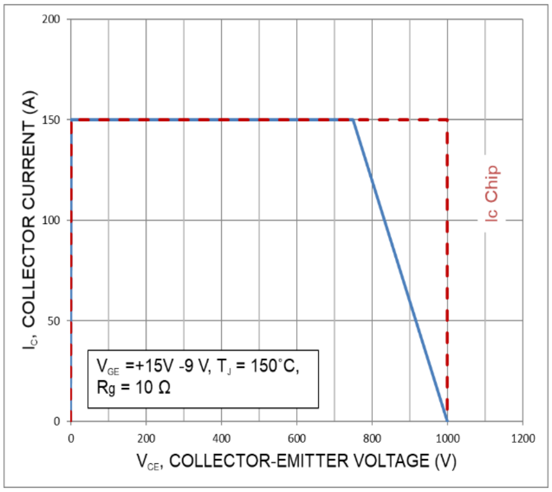


Figure 26. RBSOA

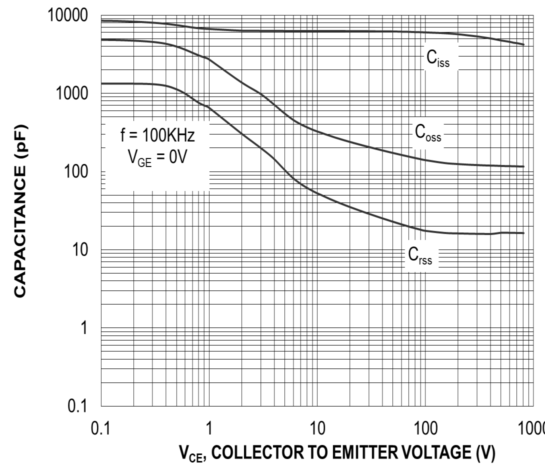


Figure 27. Capacitance Charge

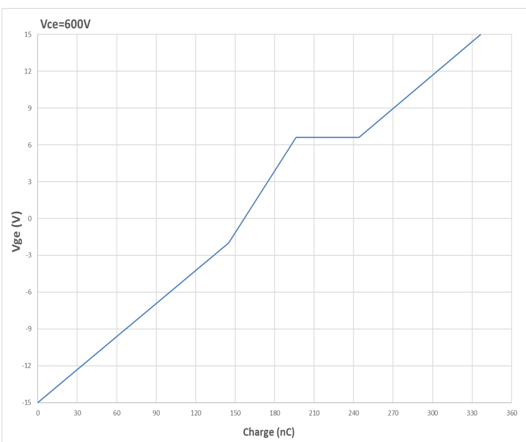


Figure 28. Gate Voltage vs. Gate Charge

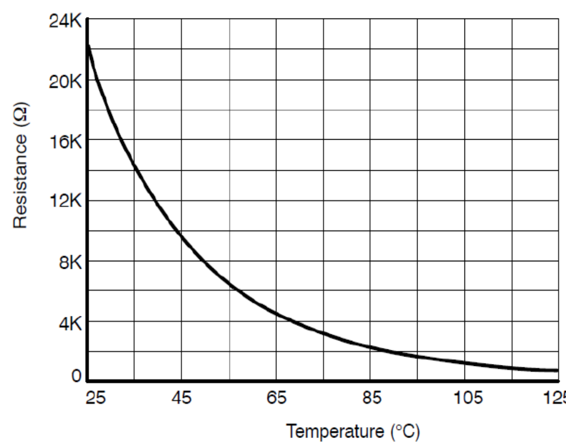


Figure 29. NTC Characteristics

TYPICAL CHARACTERISTICS − IGBT, INVERSE & BYPASS DIODE AND BOOST DIODE (CONTINUED)

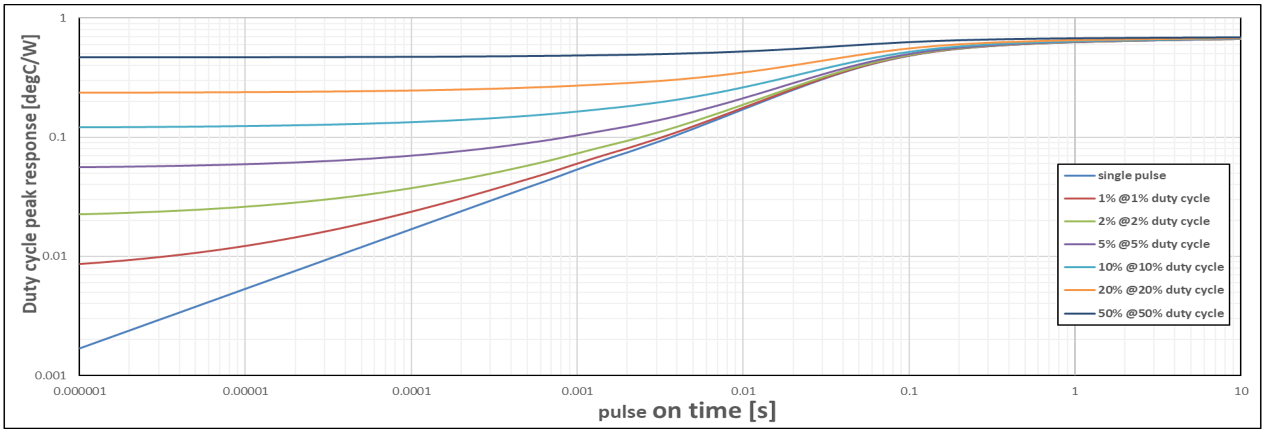


Figure 30. Transient Thermal Impedance (IGBT)

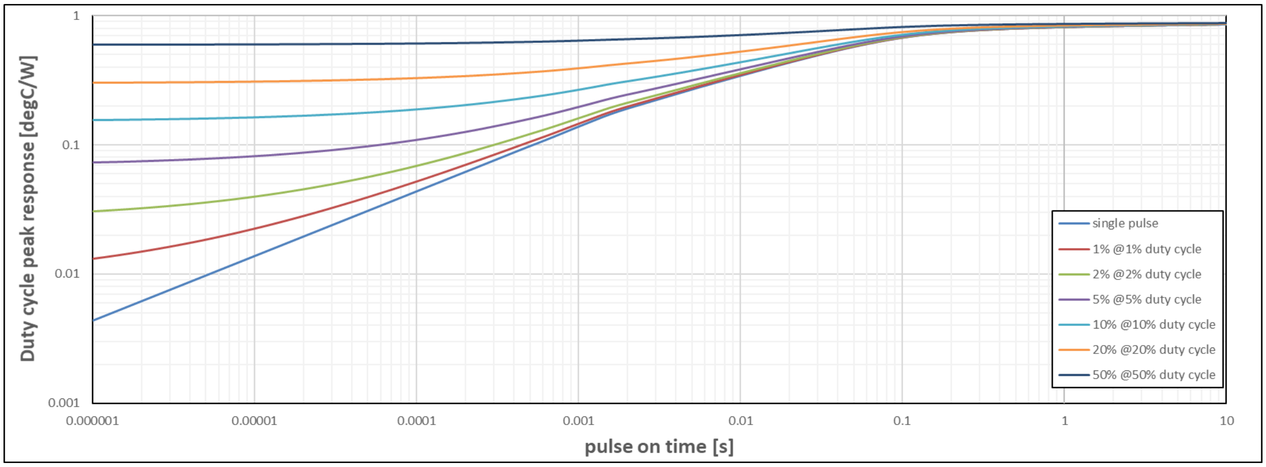


Figure 31. Transient Thermal Impedance (BOOST DIODE)

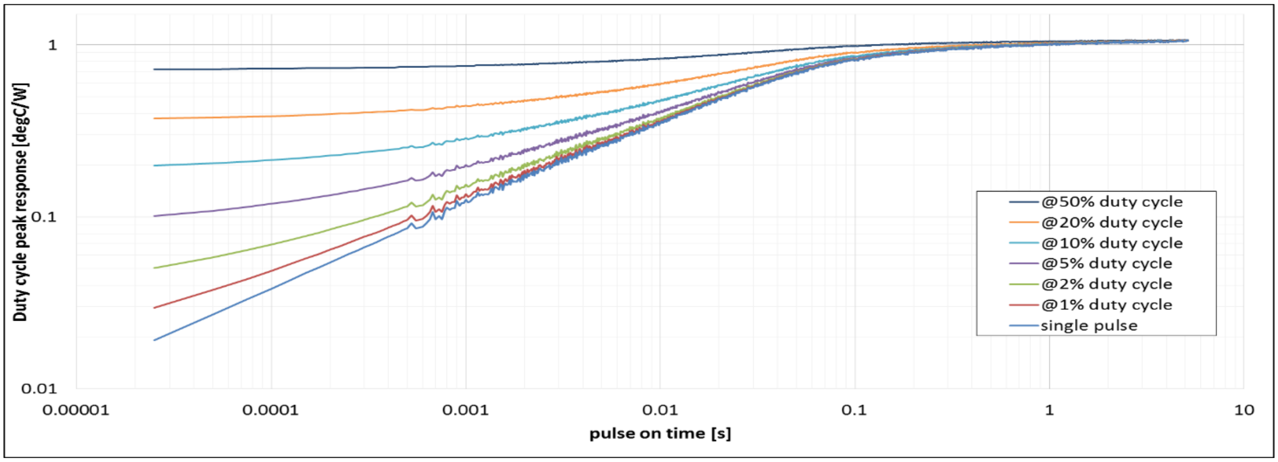
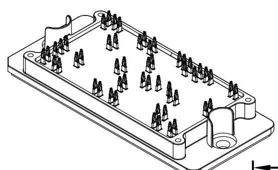


Figure 32. Transient Thermal Impedance (INVERSE&BYPASS DIODE)

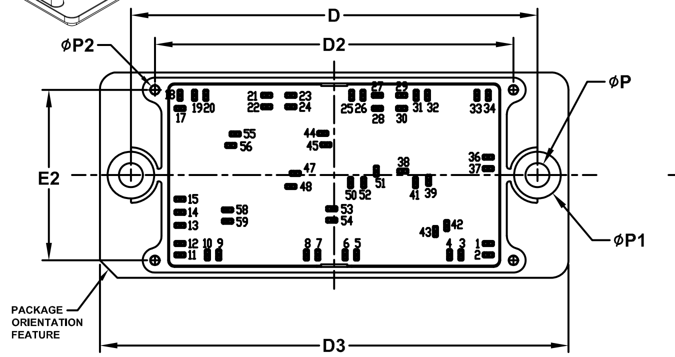
ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH300B100H4Q2F2PG PRESS FIT PINS	NXH300B100H4Q2F2PG	Q2BOOST − PIM53, 93x47 (PRESSFIT) (Pb−Free and Halide−Free Press Fit Pins)	12 Units / Blister Tray
NXH300B100H4Q2F2SG, NXH300B100H4Q2F2SG−R SOLDER PINS	NXH300B100H4Q2F2SG, NXH300B100H4Q2F2SG−R	Q2BOOST − PIM53, 93x47 (SOLDER PIN) (Pb−Free and Halide−Free Solder Pins)	12 Units / Blister Tray

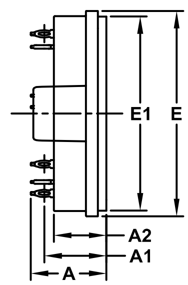


PIM53, 93x47 (PRESSFIT)
CASE 180CB
ISSUE O

DATE 30 APR 2020

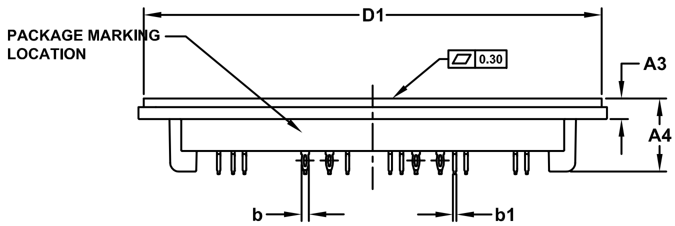


TOP VIEW



END VIEW

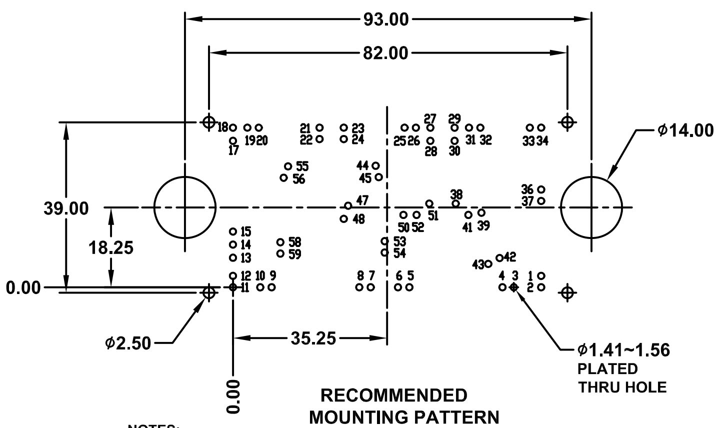
DIM	MILLIMETERS MIN.	NOM.	MAX.
A	16.90	17.30	17.70
A1	13.97	14.18	14.39
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	1.61	1.66	1.71
b1	0.75	0.80	0.85
D	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	38.80	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



SIDE VIEW

NOTE 4

PIN	PIN POSITION X	Y	PIN	PIN POSITION X	Y
1	70.50	2.60	29	50.70	36.50
2	70.50	0.00	30	50.70	33.50
3	64.25	0.00	31	54.00	36.50
4	61.65	0.00	32	56.60	36.50
5	40.35	0.00	33	67.90	36.50
6	37.75	0.00	34	70.50	36.50
7	31.50	0.00	36	70.50	22.35
8	28.90	0.00	37	70.50	19.75
9	8.85	0.00	38	50.95	19.15
10	6.25	0.00	39	56.85	17.05
11	0.00	0.00	41	53.85	16.55
12	0.00	2.60	42	61.00	6.70
13	0.00	6.75	43	58.40	5.35
14	0.00	9.75	44	32.65	27.80
15	0.00	12.75	45	33.35	25.20
17	0.00	33.50	47	26.35	18.65
18	0.00	36.50	48	25.35	15.65
19	3.30	36.50	50	39.00	16.55
20	5.90	36.50	51	44.90	19.15
21	19.80	36.50	52	42.00	16.55
22	19.80	33.90	53	34.70	10.55
23	25.35	36.50	54	34.70	7.95
24	25.35	33.90	55	12.60	27.65
25	39.25	36.50	56	11.60	25.05
26	41.85	36.50	58	10.85	10.30
27	45.15	36.50	59	10.85	7.70
28	45.15	33.50			

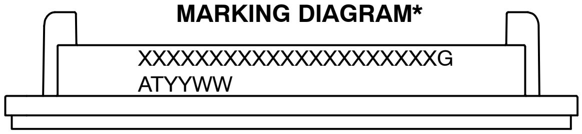


RECOMMENDED
MOUNTING PATTERN

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

GENERIC
MARKING DIAGRAM*



XXXXX = Specific Device Code
G = Pb−Free Package
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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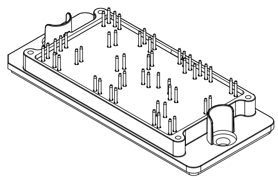
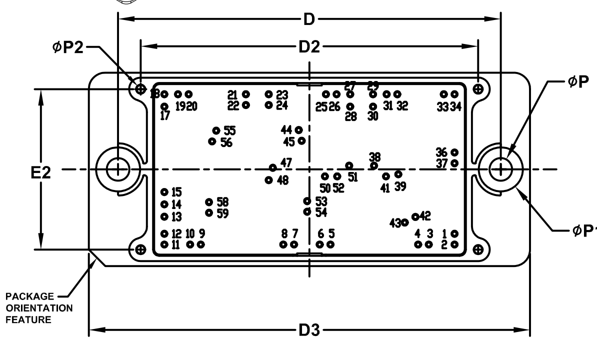


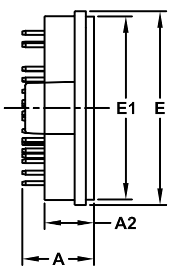
PIM53, 93x47 (SOLDER PIN)

CASE 180CC
ISSUE O

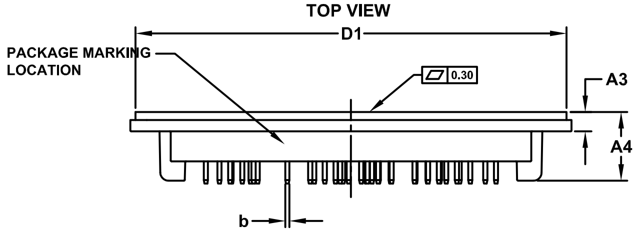
DATE 04 MAY 2020



TOP VIEW



END VIEW



SIDE VIEW

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	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
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NOTE 4

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13	0.00	6.75	43	58.40	5.35
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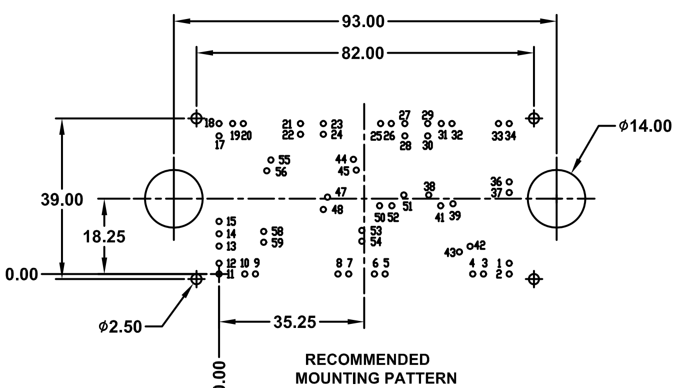
17	0.00	33.50	47	26.35	18.65
18	0.00	36.50	48	25.35	15.65
19	3.30	36.50	50	39.00	16.55
20	5.90	36.50	51	44.90	19.15
21	19.80	36.50	52	42.00	16.55
22	19.80	33.90	53	34.70	10.55
23	25.35	36.50	54	34.70	7.95
24	25.35	33.90	55	12.60	27.65
25	39.25	36.50	56	11.60	25.05
26	41.85	36.50	58	10.85	10.30
27	45.15	36.50	59	10.85	7.70
28	45.15	33.50			



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.

NOTES:

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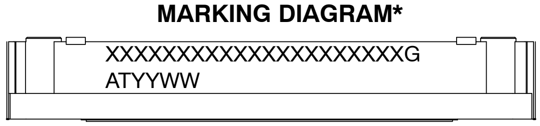
GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
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*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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DESCRIPTION:	PIM53 93X47 (SOLDER PIN)	PAGE 1 OF 1

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