DATA SHEET
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Si/SiC Hybrid Module – EliteSiC™, 3 Channel Flying Capacitor Boost 1000 V, 200 A IGBT, 1200 V, 60 A SiC Diode, Q2 Package

NXH600B100H4Q2F2S1G, SNXH600B100H4Q2F2S1G-S

The NXH600B100H4Q2S1G is a Si/SiC Hybrid three channel flying capacitor boost module. Each channel contains two 1000 V, 200 A IGBTs, and two 1200 V, 60 A SiC diodes. The module contains an NTC thermistor.

Features

- 3−channel Boost in Q2 Package
- Extremely Efficient Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- Module Design Offers High Power Density
- Low Inductive Layout

Typical Applications

- Solar Inverters
- Uninterruptible Power Supplies Systems

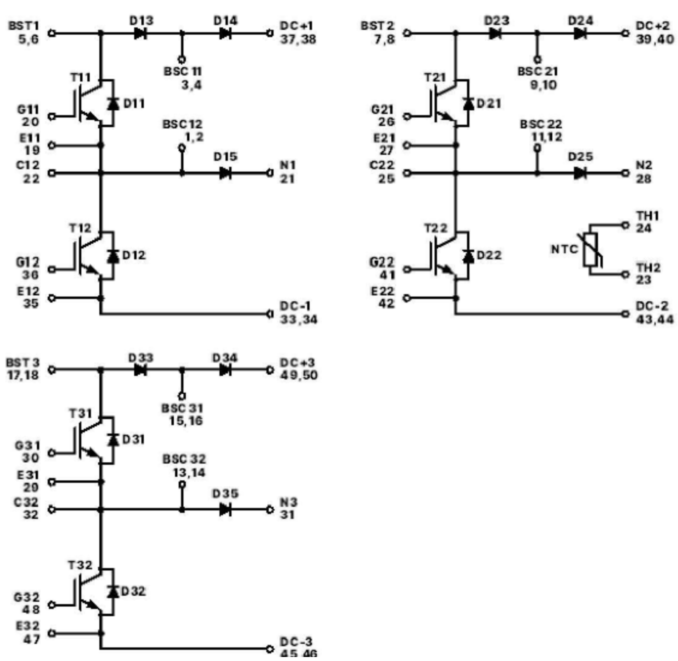
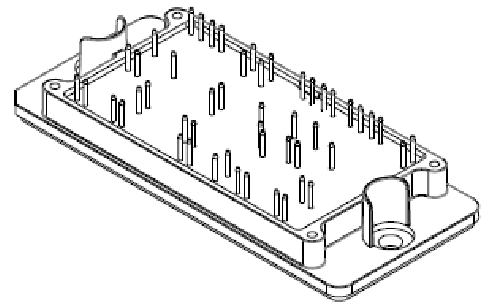
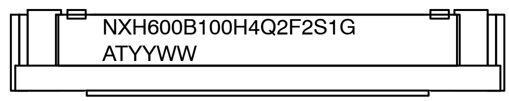


Figure 1. NXH600B100H4Q2F2S1G Schematic Diagram



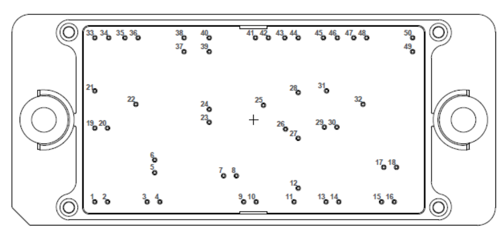
PIM56, 93x47 (SOLDER PIN)
CASE 180BK

MARKING DIAGRAM



NXH600B100H4Q2F2S1G = 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 in the package dimensions section on page 4 of this data sheet.

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

Rating	Symbol	Value	Unit
IGBT (T11, T12, T21, T22, T31, T32)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate−Emitter Voltage Positive Transient Gate−Emitter Voltage (t_{pulse} = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Continuous Collector Current @ T_C = 80°C	I_C	173	A
Pulsed Peak Collector Current @ T_C = 80°C (T_J = 175°C)	$I_{C(Pulse)}$	519	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	422	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum Junction Temperature (Note 2)	T_{JMAX}	175	°C
IGBT INVERSE DIODE (D11, D12, D21, D22, D31, D32)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_C = 80°C	I_F	66	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	98	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	101	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum Junction Temperature	T_{JMAX}	175	°C
SILICON CARBIDE SCHOTTKY DIODE (D13, D14, D23, D24, D33, D34)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_C = 80°C	I_F	63	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	189	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	204	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum Junction Temperature	T_{JMAX}	175	°C
START−UP DIODE (D15, D25, D35)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_C = 80°C	I_F	35	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	105	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	84	W
Minimum Junction Temperature	T_{JMIN}	−40	°C
Maximum Junction Temperature	T_{JMAX}	175	°C
THERMAL AND INSULATION PROPERTIES			
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 sec, 50 Hz	V_{is}	4000	V_{RMS}
Creepage distance		12.7	mm
Comparative tracking index	CTI	>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.

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T11, T12, T21, T22, T31, T32) CHARACTERISTICS						
Collector−Emitter Breakdown Voltage	V_{GE} = 0 V, I_C = 2 mA	$V_{(BR)CES}$	1000	1150	–	V
Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	20	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 = 150°C		–	2.4	–	
Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 200 mA	$V_{GE(TH)}$	4	4.98	6	V
Gate Leakage Current	V_{GE} = ±20 V, V_{CE} = 0 V	I_{GES}	–	–	350	nA
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 per Pulse		E_{on}	–	860	–	μJ
Turn off Switching Loss per Pulse		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 per Pulse		E_{on}	–	1120	–	μJ
Turn off Switching Loss per Pulse		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	–	
Total 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}	–	0.420	–	K/W
Thermal Resistance − chip−to−case		R_{thJC}	–	0.225	–	K/W
IGBT INVERSE DIODE (D11, D12, D21, D22, D31, D32) CHARACTERISTICS						
Diode Forward Voltage	I_F = 50 A, T_J = 25°C	V_F	–	1.15	1.5	V
	I_F = 50 A, T_J = 175°C		–	1.08	–	
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.87 W/mK	R_{thJH}	–	0.956	–	K/W
Thermal Resistance − chip−to−case		R_{thJC}	–	0.800	–	K/W
DIODES (D13, D14, D23, D24, D33, D34) CHARACTERISTICS						
Diode Forward Voltage	I_F = 60 A, T_J = 25°C	V_F	–	1.51	2.2	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

Table 2. ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
DIODES (D13, D14, D23, D24, D33, D34) CHARACTERISTICS						
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}	–	0.599	–	K/W
Thermal Resistance − chip−to−case		R_{thJC}	–	0.466	–	K/W
START−UP DIODE (D15, D25, D35) CHARACTERISTICS						
Diode Forward Voltage	I_F = 30 A, T_J = 25°C	V_F	–	2.25	3.2	V
	I_F = 30 A, T_J = 175°C		–	1.8	–	
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.87 W/mK	R_{thJH}	–	1.309	–	K/W
Thermal Resistance − chip−to−case		R_{thJC}	–	1.133	–	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.

ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH600B100H4Q2F2S1G	NXH600B100H4Q2F2S1G	Q2BOOST, Case 180BK (Pb−Free and Halide−Free Solder Pins)	12 Units / Blister Tray
SNXH600B100H4Q2F2S1G−S	SNXH600B100H4Q2F2S1G−S	Q2BOOST, Case 180BK (Pb−Free and Halide−Free Solder Pins)	12 Units / Blister Tray

TYPICAL CHARACTERISTICS − T11||D13, T12||D14, T21||D23, T22||D24, T31||D33, T32||D34

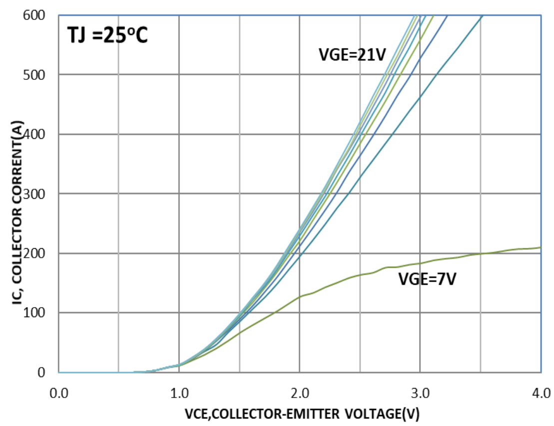


Figure 2. Typical Output Characteristics

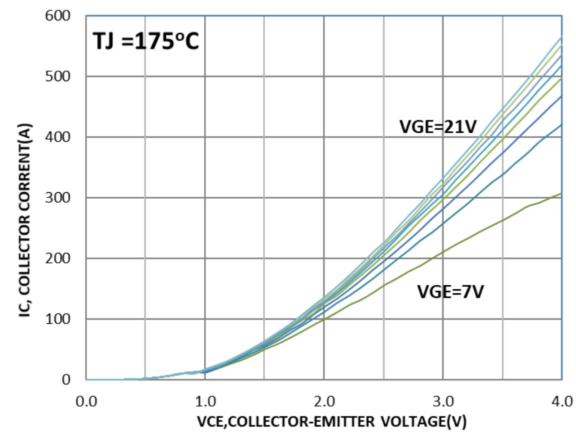


Figure 3. Typical Output Characteristics

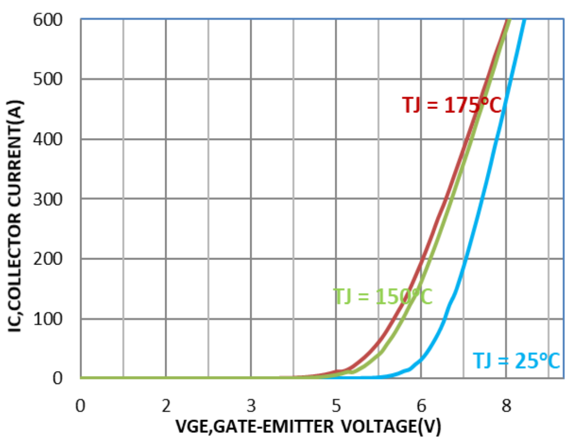


Figure 4. Transfer Characteristics

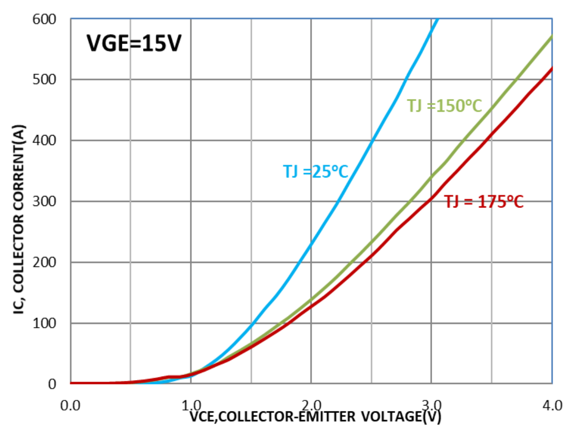


Figure 5. Saturation Voltage Characteristic

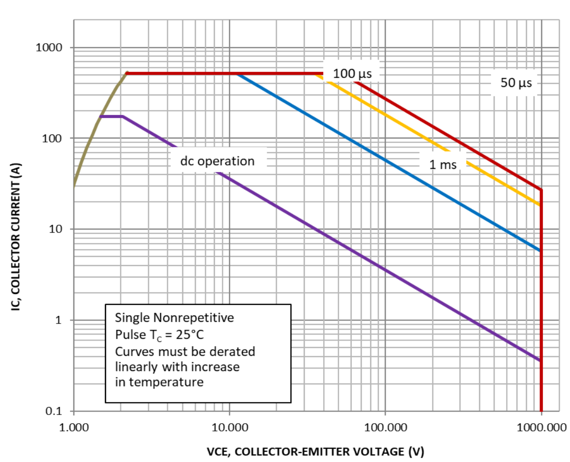


Figure 6. FBSOA

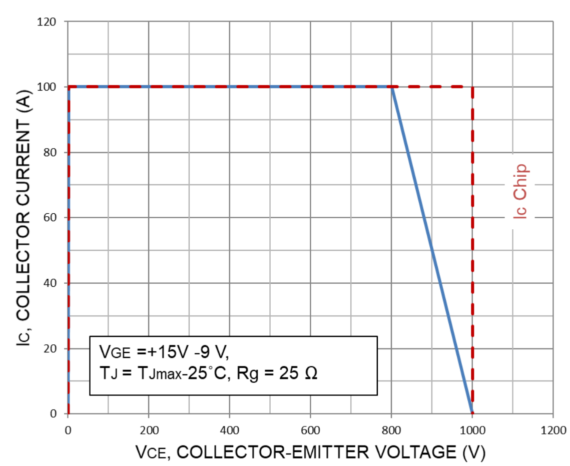


Figure 7. RBSOA

TYPICAL CHARACTERISTICS − T11||D13, T12||D14, T21||D23, T22||D24, T31||D33, T32||D34 (CONTINUED)

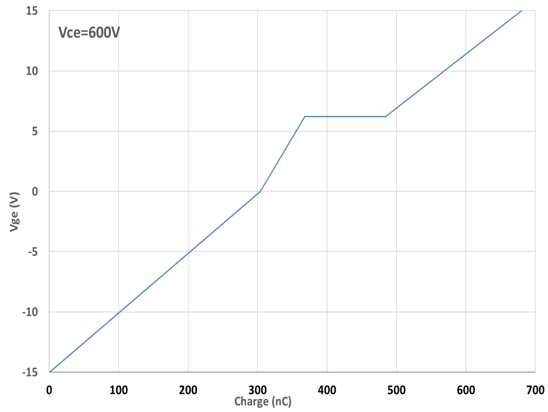


Figure 8. Gate Voltage vs. Gate Charge

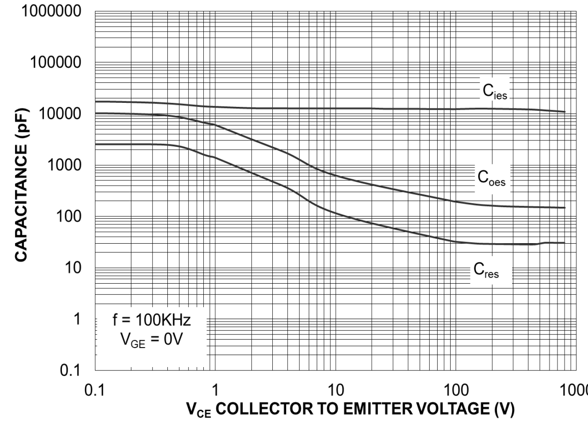


Figure 9. Capacitance

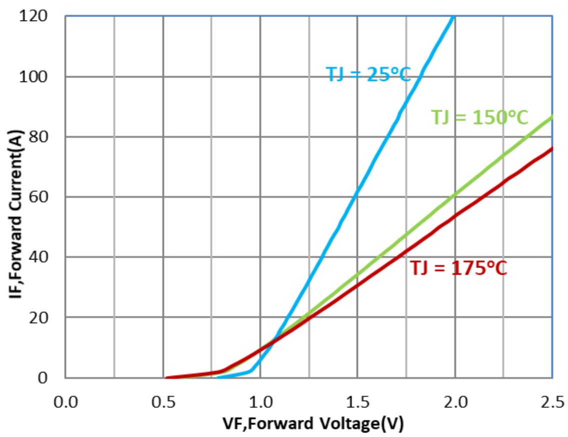


Figure 10. Diode Forward Characteristics

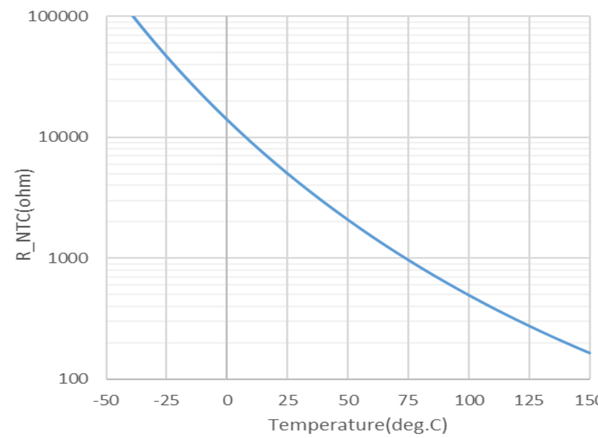


Figure 11. Temperature vs. NTC Value

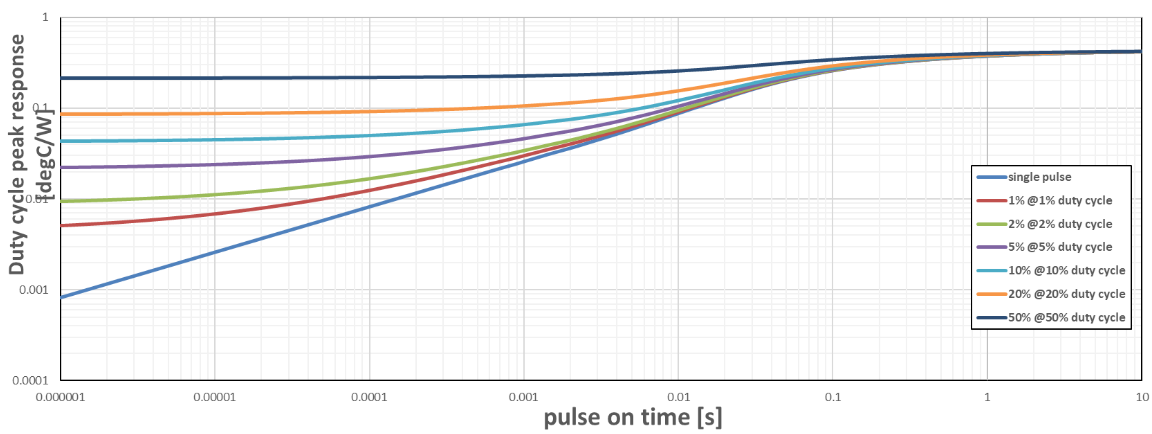


Figure 12. Transient Thermal Impedance (IGBT Rthjc)

TYPICAL CHARACTERISTICS – T11||D13, T12||D14, T21||D23, T22||D24, T31||D33, T32||D34 (CONTINUED)

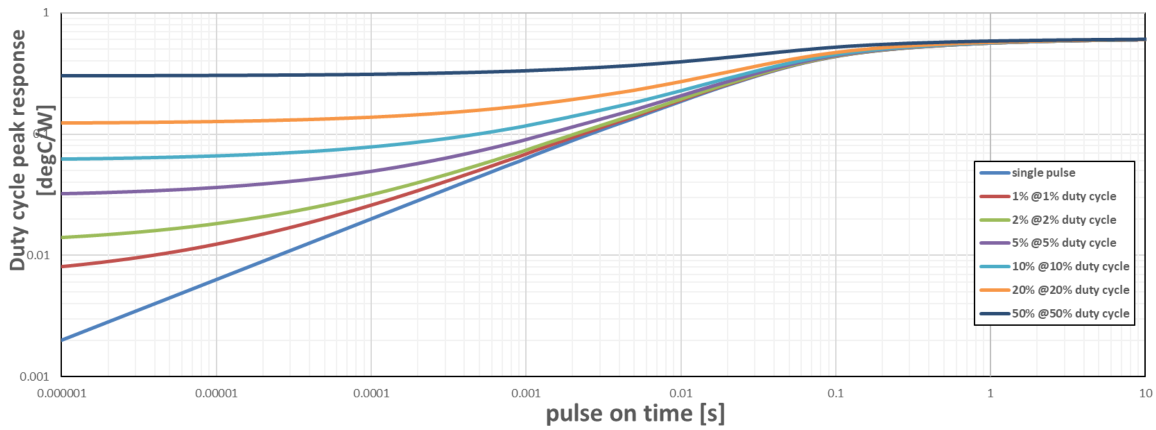


Figure 13. Transient Thermal Impedance (DIODE Rthjc)

TYPICAL CHARACTERISTICS – D11, D12, D21, D22, D31, D32 DIODE

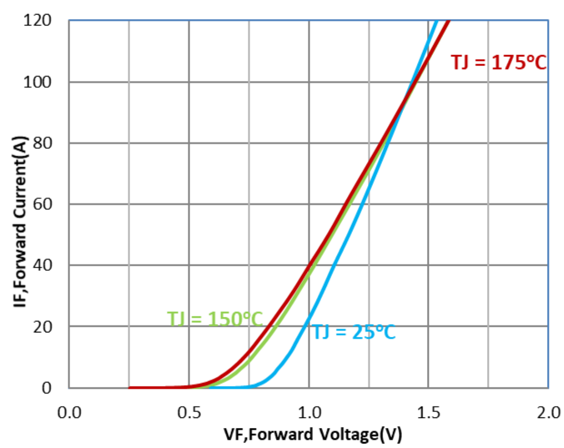


Figure 14. Diode Forward Characteristics

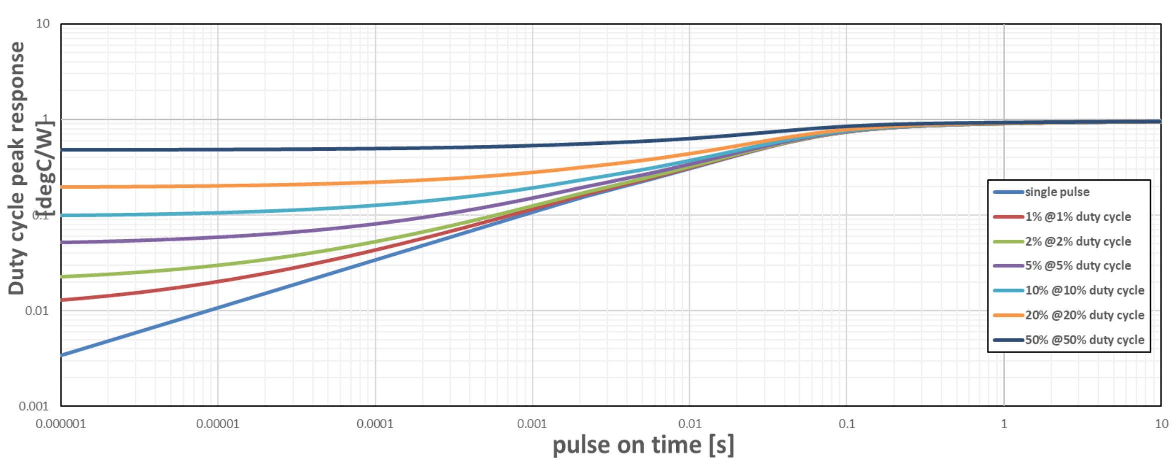


Figure 15. Transient Thermal Impedance (Rthjc)

TYPICAL CHARACTERISTICS − D15, D25, D35 DIODE

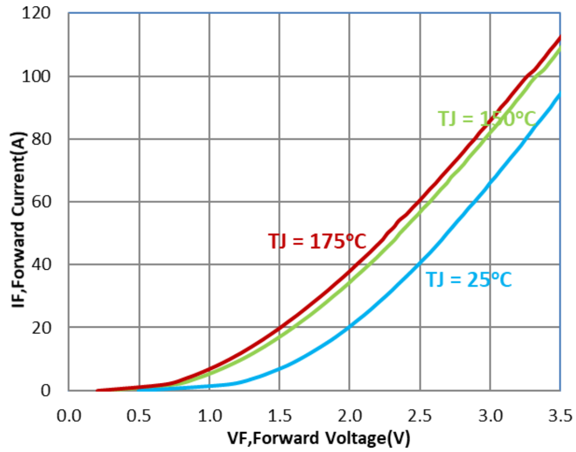


Figure 16. Diode Forward Characteristics

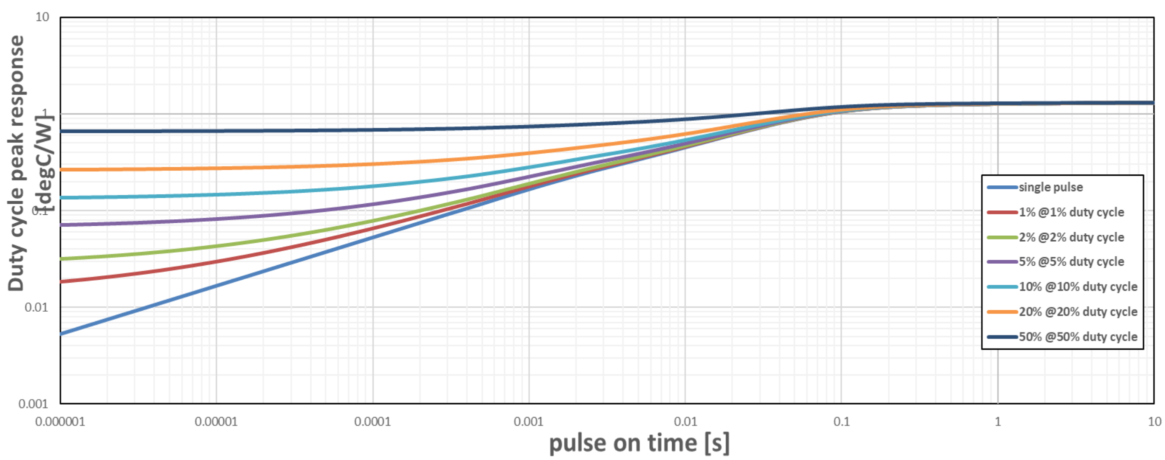


Figure 17. Transient Thermal Impedance (Rthjc)

TYPICAL CHARACTERISTICS − T11||D13, T12||D14, T21||D23, T22||D24, T31||D33, T32||D34

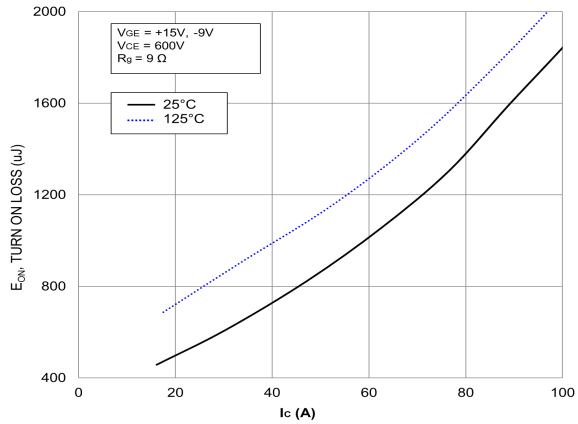


Figure 18. Typical Turn On Loss vs. I_C

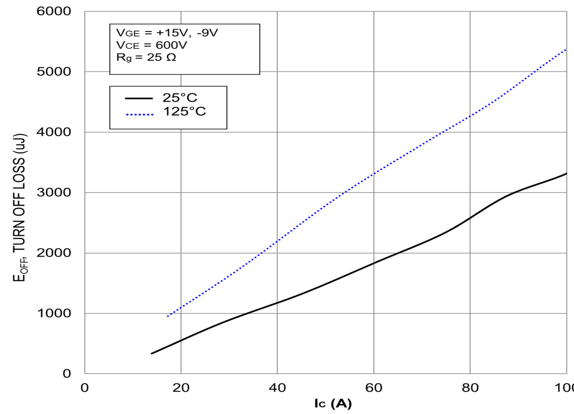


Figure 19. Typical Turn Off Loss vs. I_C

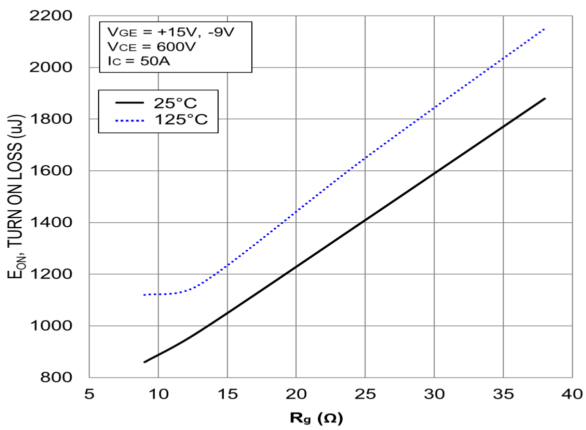


Figure 20. Typical Turn On Loss vs. R_g

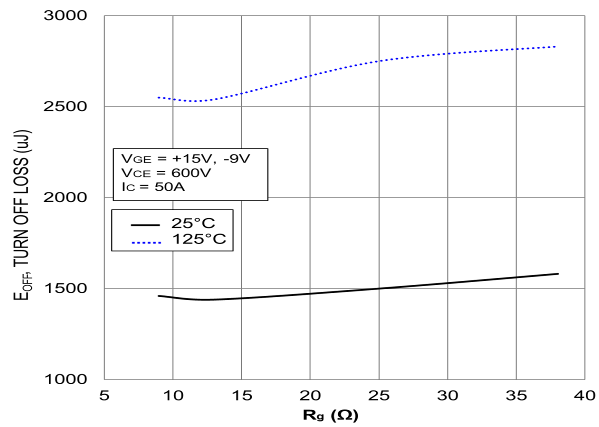


Figure 21. Typical Turn Off Loss vs. R_g

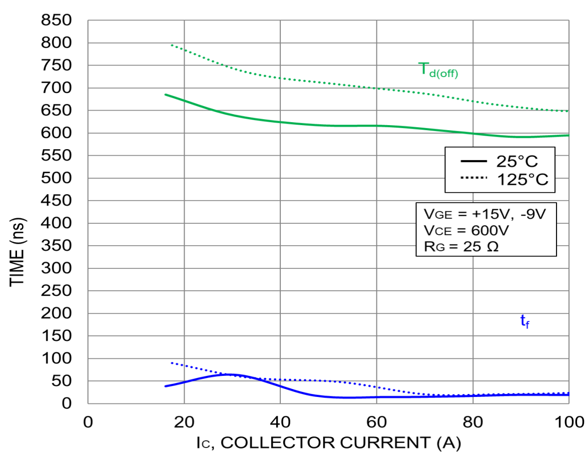


Figure 22. Typical Turn−Off Switching Time vs. I_C

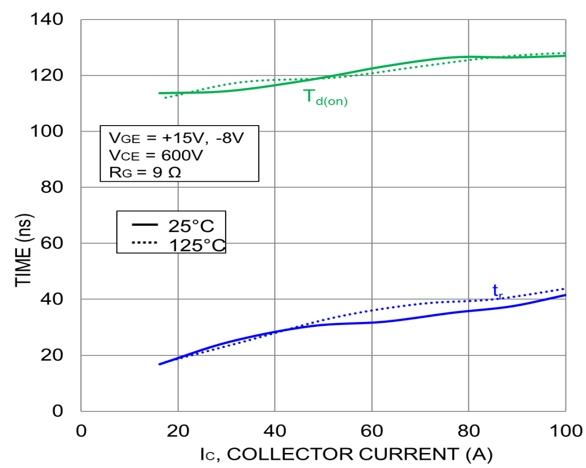


Figure 23. Typical Turn−On Switching Time vs. I_C

TYPICAL CHARACTERISTICS − T11||D13, T12||D14, T21||D23, T22||D24, T31||D33, T32||D34 (continued)

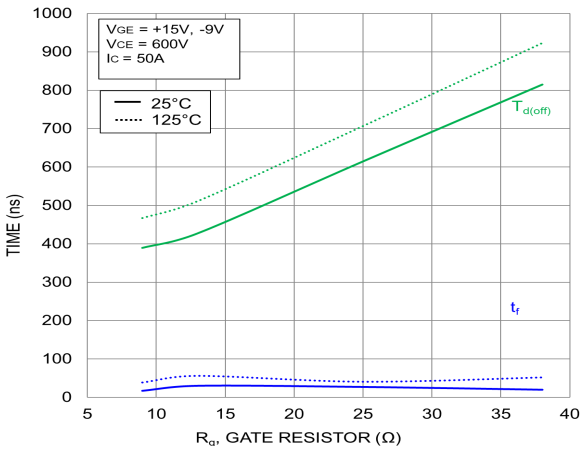


Figure 24. Typical Turn−Off Switching Time vs. R_g

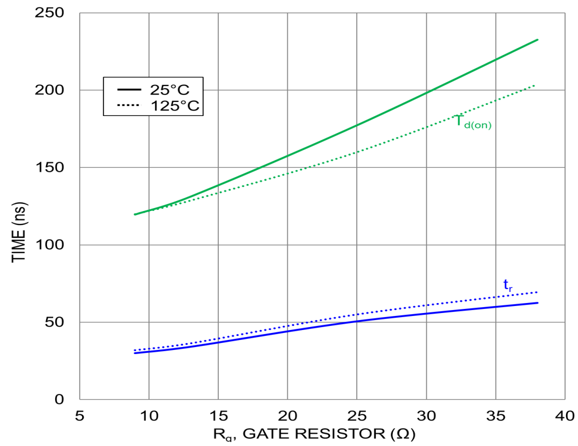


Figure 25. Typical Turn−On Switching Time vs. R_g

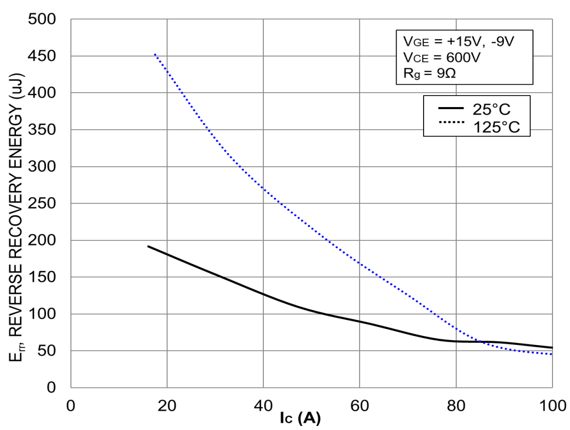


Figure 26. Typical Reverse Recovery Energy Loss vs. I_C

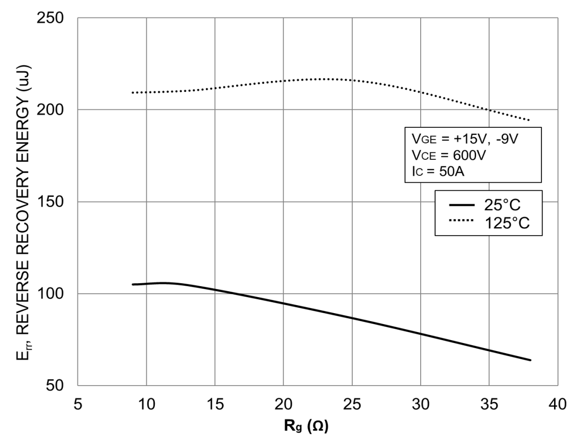


Figure 27. Typical Reverse Recovery Energy Loss vs. R_g

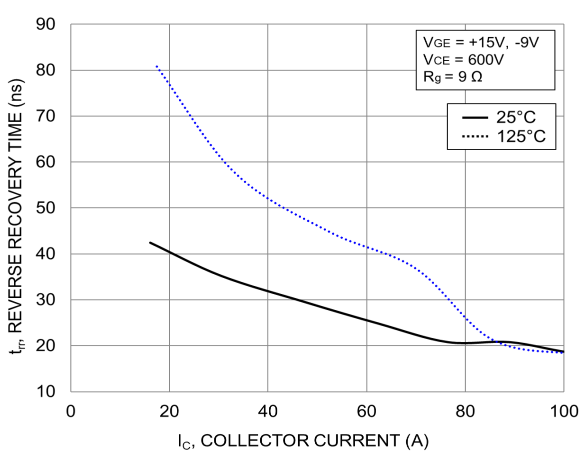


Figure 28. Typical Reverse Recovery Time vs. I_C

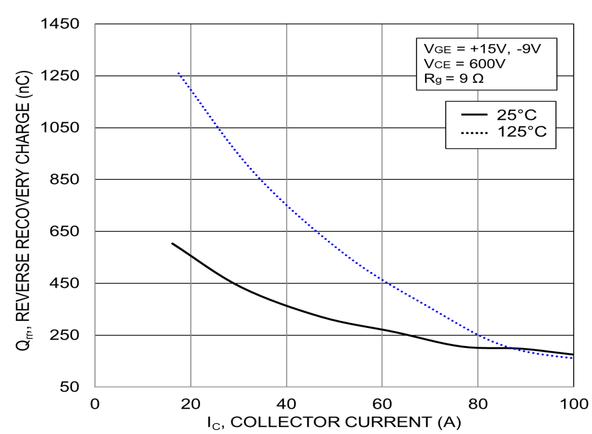


Figure 29. Typical Reverse Recovery Charge vs. I_C

TYPICAL CHARACTERISTICS − T11||D13, T12||D14, T21||D23, T22||D24, T31||D33, T32||D34 (continued)

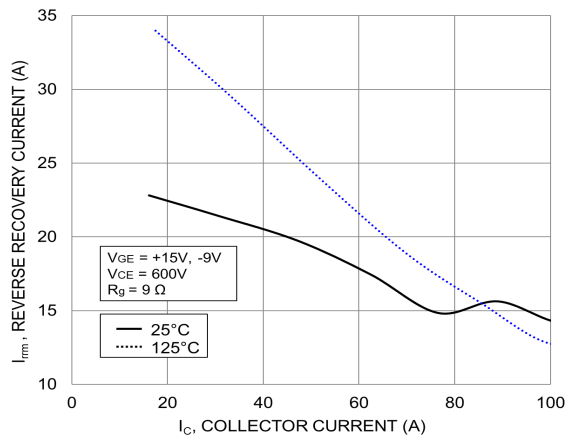


Figure 30. Typical Reverse Recovery Current vs. I_C

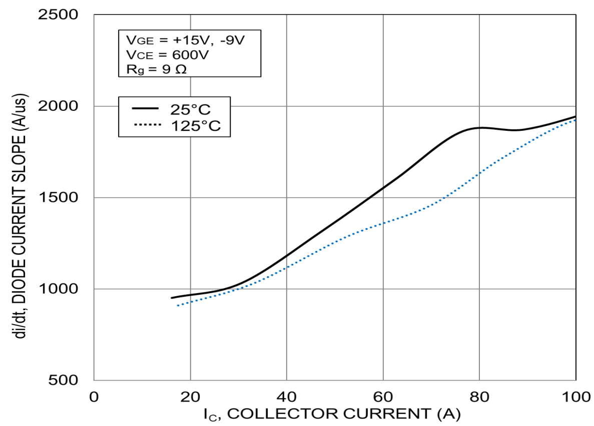


Figure 31. Typical di/dt vs. I_C

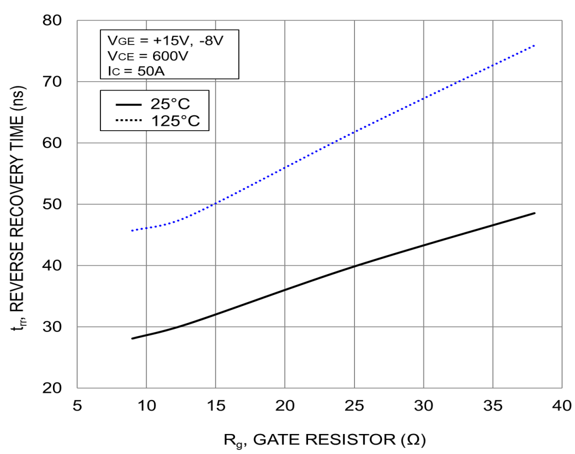


Figure 32. Typical Reverse Recovery Time vs. R_g

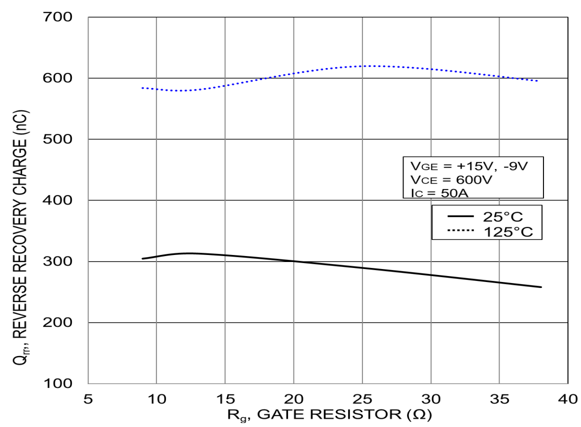


Figure 33. Typical Reverse Recovery Charge vs. R_g

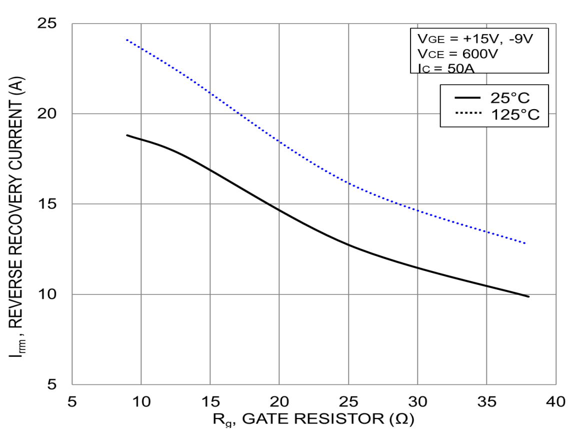


Figure 34. Typical Reverse Recovery Peak Current vs. R_g

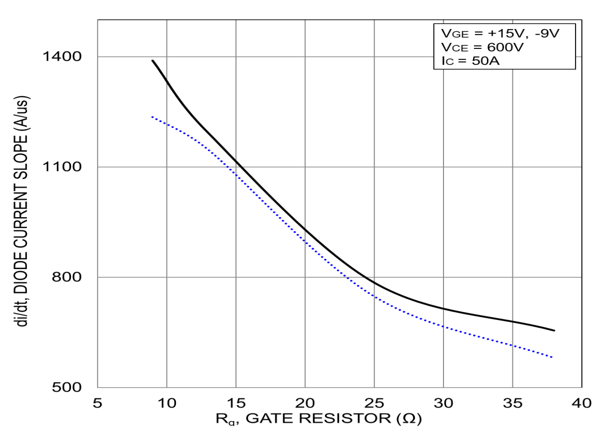
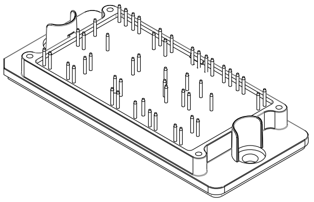


Figure 35. Typical di/dt vs. R_g



PIM56, 93x47 (SOLDER PIN)

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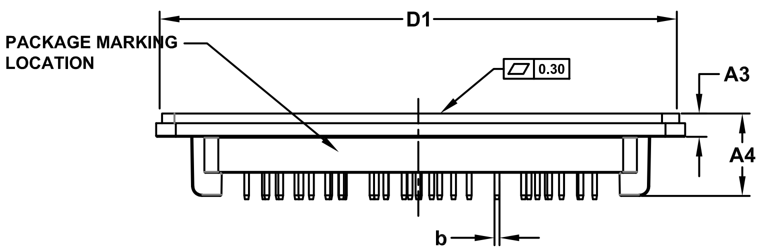
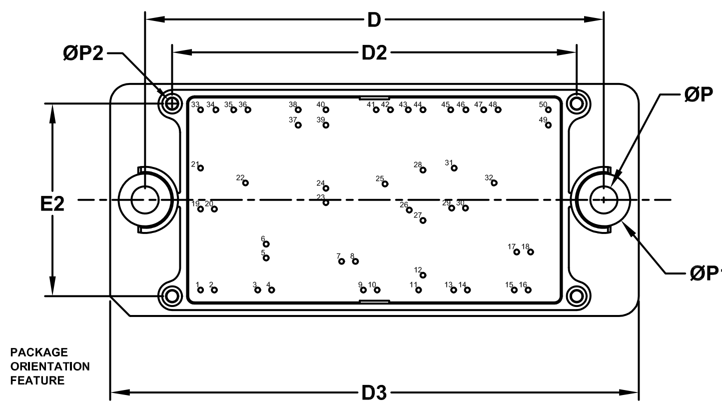


SIDE VIEW

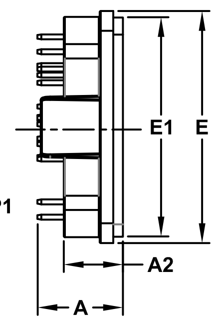
NOTES:

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

	MILLIMETERS		
DIM	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
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20



TOP VIEW



END VIEW

NOTE 4

Pin #	X	Y	Function	Pin #	X	Y	Function
1	0	0	BSC12	26	42.3	16.2	G21
2	2.8	0	BSC12	27	45.1	14.1	E21
3	11.6	0	BSC11	28	45.1	24.3	N2
4	14.4	0	BSC11	29	50.9	16.6	E31
5	13.3	6.5	BST1	30	53.7	16.6	G31
6	13.3	9.3	BST1	31	51.4	24.7	N3
7	28.6	5.8	BST2	32	59.5	21.7	C32
8	31.4	5.8	BST2	33	0	36.5	DC-1
9	33	0	BSC21	34	3.1	36.5	DC-1
10	35.8	0	BSC21	35	6.7	36.5	E12
11	44.2	0	BSC22	36	9.6	36.5	G12
12	45.1	3	BSC22	37	19.8	33.4	DC+1
13	51.3	0	BSC32	38	19.8	36.5	DC+1
14	54.1	0	BSC32	39	25.4	33.4	DC+2
15	63.6	0	BSC31	40	25.4	36.5	DC+2
16	66.4	0	BSC31	41	35.6	36.5	G22
17	64.1	7.7	BST3	42	38.5	36.5	E22
18	66.9	7.7	BST3	43	42.1	36.5	DC-2
19	0	16.4	E11	44	45.1	36.5	DC-2
20	2.8	16.4	G11	45	50.7	36.5	DC-3
21	0	24.7	N1	46	53.8	36.5	DC-3
22	9.1	21.7	C12	47	57.4	36.5	E32
23	25.4	17.7	TH2	48	60.3	36.5	G32
24	25.4	20.6	TH1	49	70.5	33.4	DC+3
25	37.4	21.5	C22	50	70.5	36.5	DC+3

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PIM56, 93x47 (SOLDER PIN)
CASE 180BK
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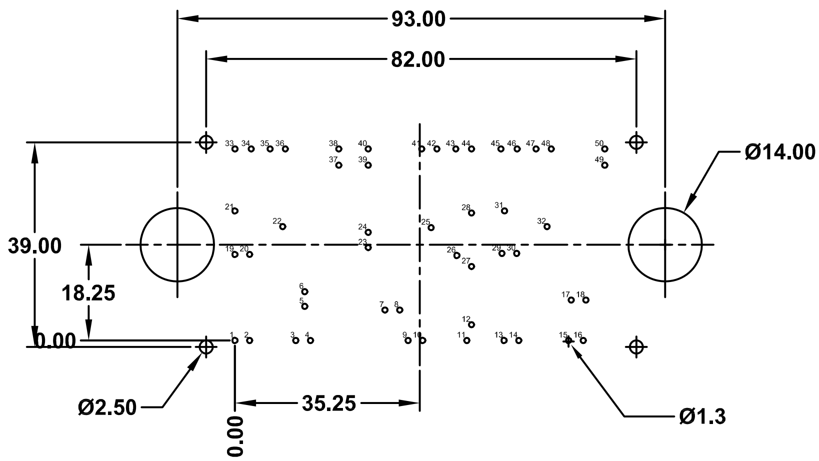
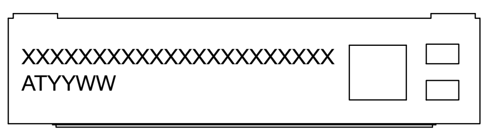


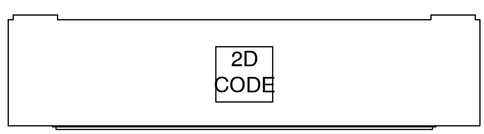
RECOMMENDED MOUNTING PATTERN

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

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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