Q2BOOST Module

SNXH225B95H3Q2F2PG-N1

This high−density, integrated power module combines high−performance IGBTs with rugged anti−parallel diodes.

Features

- Low Switching Loss Reduces System Power Dissipation
- Module Design Offers High Power Density
- Low Inductive Layout
- Q2BOOST Package with Press−Fit Pins
- 1200 V SiC Diode

Typical Applications

- Solar Inverters
- UPS Systems

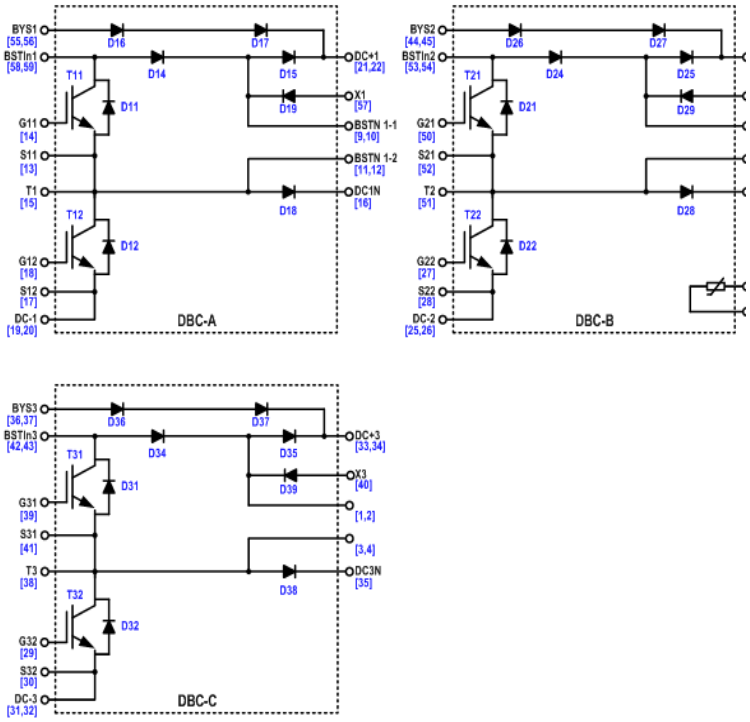

Figure 1. Schematic of Q2BOOST

ON Semiconductor®

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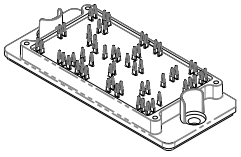
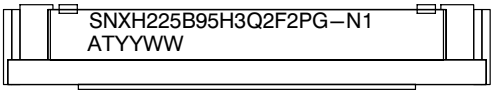


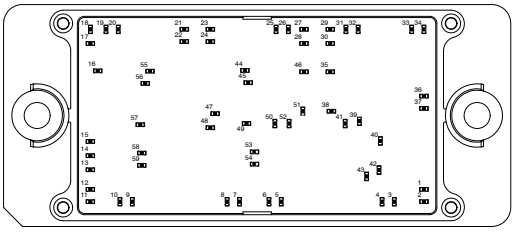
Q2BOOST MODULE
CASE 180AV

MARKING DIAGRAM



G = Pb−Free Package
AT = Assembly & Test Site Code
YYWW = Year & Work Week Code

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
SNXH225B95H3Q2F2-PG−N1	Q2BOOST (Pb−Free)	12 Units / Blister Tray

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
IGBT (T11, T21, T31, T12, T22, T32)			
Collector−emitter Voltage	V_{CES}	950	V
Collector Current @ T_h = 80°C	I_C	65	A
Pulsed Collector Current, T_{pulse} =1 ms	I_{CM}	195	A
Power Dissipation per IGBT $T_J = T_{Jmax}$ T_h = 80°C	P_{tot}	136	W
Gate−emitter Voltage Positive transient gate−emitter voltage (Tpulse = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Maximum Junction Temperature	T_J	175	°C
IGBT INVERSE DIODE (D11, D12, D21, D22, D31, D32)			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Forward Current, DC @ T_h = 80°C	I_F	53	A
Repetitive Peak Forward Current, Tpulse = 1 ms	I_{FSM}	450	A
Power Dissipation per Diode $T_J = T_{Jmax}$, T_h = 80°C	P_{tot}	67	W
Maximum Junction Temperature	T_J	150	°C
DIODE (D16+D17, D26+ D27, D36+D37)			
Peak Repetitive Reverse Voltage	V_{RRM}	2000	V
Forward Current, DC @ T_h = 80°C	I_F	49	A
Nonrepetitive Peak Surge Current, Tp = 8.3 ms, T_J = 25°C	I_{FSM}	480	A
Power Dissipation per Diode $T_J = T_{Jmax}$, T_h = 80°C	P_{tot}	134	W
Maximum Junction Temperature	T_J	150	°C
SILICON CARBIDE SCHOTTKY DIODE (D14, D15, D24, D25, D34, D45)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Forward Current, DC @ T_h = 80°C	I_F	28	A
Repetitive Peak Forward Current, Tpulse = 1 ms	I_{FRM}	84	A
Power Dissipation per Diode $T_J = T_{Jmax}$, T_h = 80°C	P_{tot}	89	W
Maximum Junction Temperature	T_J	175	°C
DIODE (D18, D19, D28, D29, D38, D39)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Forward Current, DC @ T_h = 80°C	I_F	21	A
Repetitive Peak Forward Current, Tpulse = 1 ms	I_{FRM}	63	A
Power Dissipation per Diode $T_J = T_{Jmax}$, T_h = 80°C	P_{tot}	52	W
Maximum Junction Temperature	T_J	150	°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.

THERMAL PROPERTIES

Parameter	Symbol	Value	Unit
Operating Temperature under Switching Condition	$T_{VJ\ OP}$	−40 to (T_{Jmax} − 25)	°C
Storage Temperature Range	T_{stg}	−40 to +125	°C

INSULATION PROPERTIES

Parameter	Symbol	Value	Unit
Isolation Test Voltage, t = 1 s, 50/60 Hz	V_{is}	3400	V_{RMS}
Creepage Distance		12.7	mm
Comparative tracking index	CTI	> 600	

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T11, T12, T21, T22, T31, T32)						
Collector−emitter Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	$V_{(BR)CES}$	950	–	–	V
Collector−emitter Saturation Voltage	V_{GE} = 15 V, I_C = 75 A, T_J = 25°C V_{GE} = 15 V, I_C = 75A, T_J = 150°C	$V_{CE(sat)}$	– –	1.80 2.10	2.3 –	V
Gate−emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 75 mA	$V_{GE(TH)}$	4.1	4.65	5.7	V
Collector−emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 950 V	I_{CES}	–	–	300	μA
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	400	nA
Turn−on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 40 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	$t_{d(on)}$	–	33	–	ns
Rise Time		t_r	–	15	–	
Turn−off Delay Time		$t_{d(off)}$	–	185	–	
Fall Time		t_f	–	62	–	
Turn On Switching Loss		E_{on}	–	0.38	–	mJ
Turn Off Switching Loss		E_{off}	–	0.98	–	
Turn−on Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 40 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	$t_{d(on)}$	–	35	–	ns
Rise Time		t_r	–	18	–	
Turn−off Delay Time		$t_{d(off)}$	–	230	–	
Fall Time		t_f	–	130	–	
Turn On Switching Loss		E_{on}	–	0.57	–	mJ
Turn Off Switching Loss		E_{off}	–	1.4	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 10 kHz	C_{ies}	–	4773	–	pF
Output Capacitance		C_{oes}	–	121	–	
Reverse Transfer Capacitance		C_{res}	–	27	–	
Gate Charge Total	V_{CE} = 600 V, I_C = 20 A, V_{GE} = 15 V	Q_g	–	143	–	nC
Thermal Resistance − Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.706	Ω	°C/W
IGBT INVERSE DIODE (D11, D12, D21, D22, D31, D32)						
Forward Voltage	I_F = 30 A, T_J = 25°C I_F = 30 A, T_J = 150°C	V_F	– –	1.0 0.93	1.5 –	V
Thermal Resistance − Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	Ω	1.038	Ω	°C/W
DIODE (D16+D17, D26+D27, D36+D37)						
Forward Voltage	I_F = 45 A, T_J = 25°C I_F = 45 A, T_J = 150°C	V_F	– –	2.27 2.17	2.75 –	V
Reverse Leakage Current	V_R = 2000 V	I_r	–	–	100	μA
Thermal Resistance − Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 Ω/μK	R_{thJH}	–	0.523	–	°C/W

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
SIC DIODE (D14, D15, D24, D25, D34, D35)						
Forward Voltage	I_F = 20 A, T_J = 25°C I_F = 20 A, T_J = 150°C	V_F	– –	1.4 2.0	1.7 –	V
Reverse Leakage Current	V_R = 1200 V	Ir	–	–	600	μA
Thermal Resistance – Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	1.070	–	°C/W
DIODE (D18, D19, D28, D29, D38, D39)						
Forward Voltage	I_F = 30 A, T_J = 25°C I_F = 30 A, T_J = 150°C	V_F	– –	2.50 2.25	3.0 –	V
Reverse Leakage Current	V_R = 1200 V	I_r	–	–	600	μA
Thermal Resistance – Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	1.347	–	°C/W
THERMISTOR CHARACTERISTICS						
Nominal Resistance	T = 25°C	R25	–	22	–	kΩ
Nominal Resistance	T = 100°C	R100	–	1468	–	Ω
Deviation of R100		DR/R	–5	–	5	%
Power Dissipation		P_D	–	200	–	mW
Power Dissipation Constant			–	2	–	mW/°C
B−value	B(25/50), tol ±3%		–	–	3950	°C
B−value	B(25/100), tol ±3%		–	–	3998	°C
NTC Reference			–	–	B	

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
(T11/D11, T12/D12, T21/D21, T22/D22, T31/D31, T32/D32)

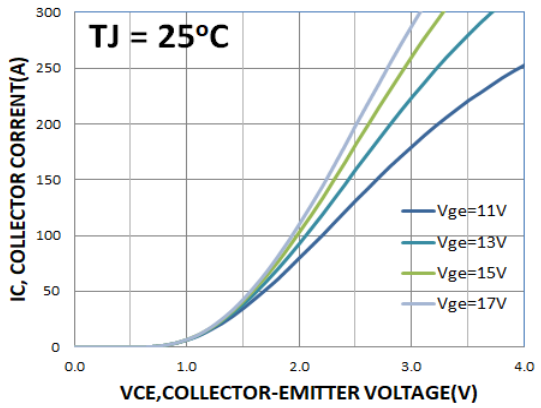


Figure 2. Typical Output Characteristics

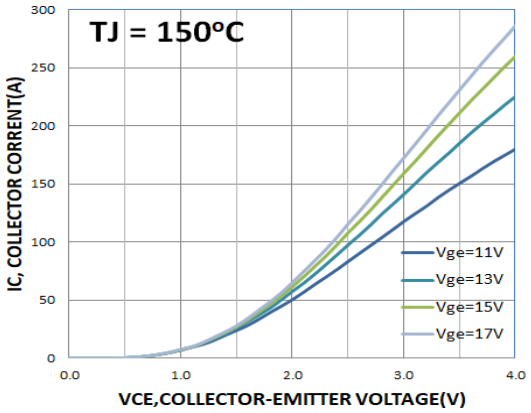


Figure 3. Typical Output Characteristics

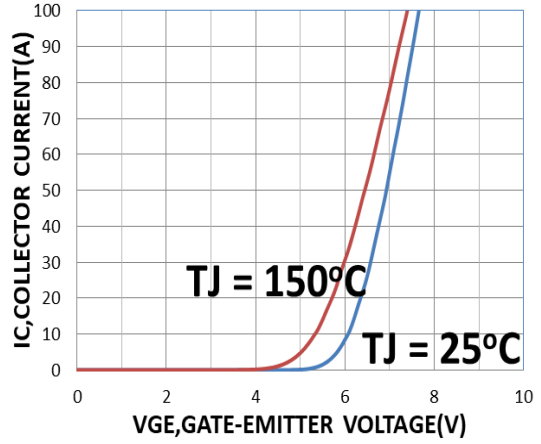


Figure 4. Typical Transfer Characteristics

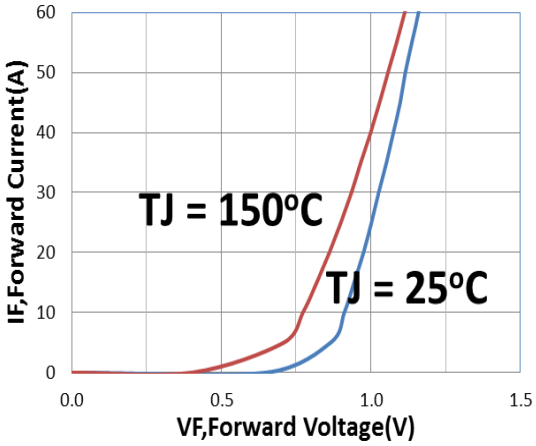


Figure 5. Diode Forward Characteristics

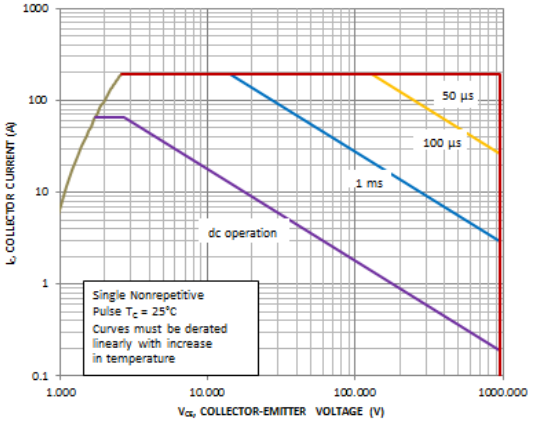


Figure 6. FBSOA

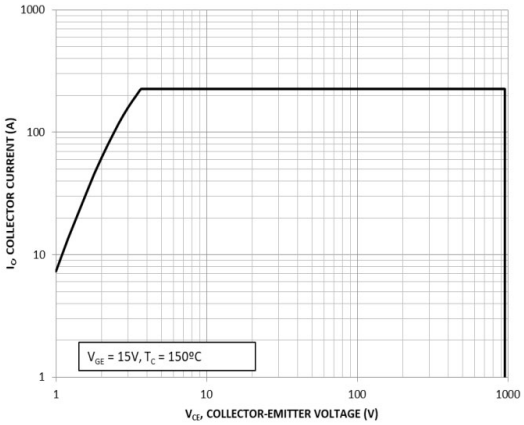


Figure 7. RBSOA

TYPICAL CHARACTERISTICS (Continued)
(T11/D11, T12/D12, T21/D21, T22/D22, T31/D31, T32/D32)

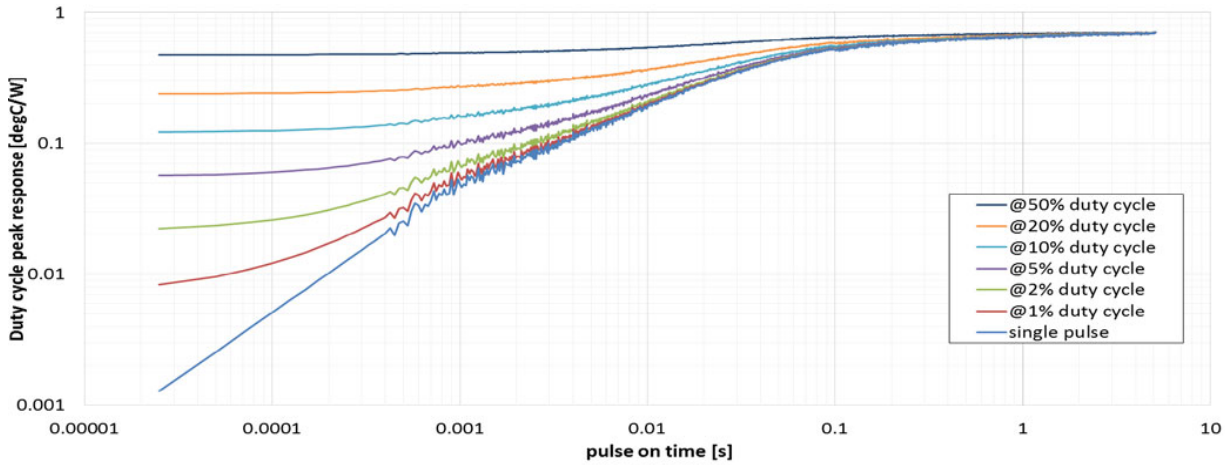


Figure 8. Transient Thermal Impedance (T11, T12, T21, T22, T31, T32)

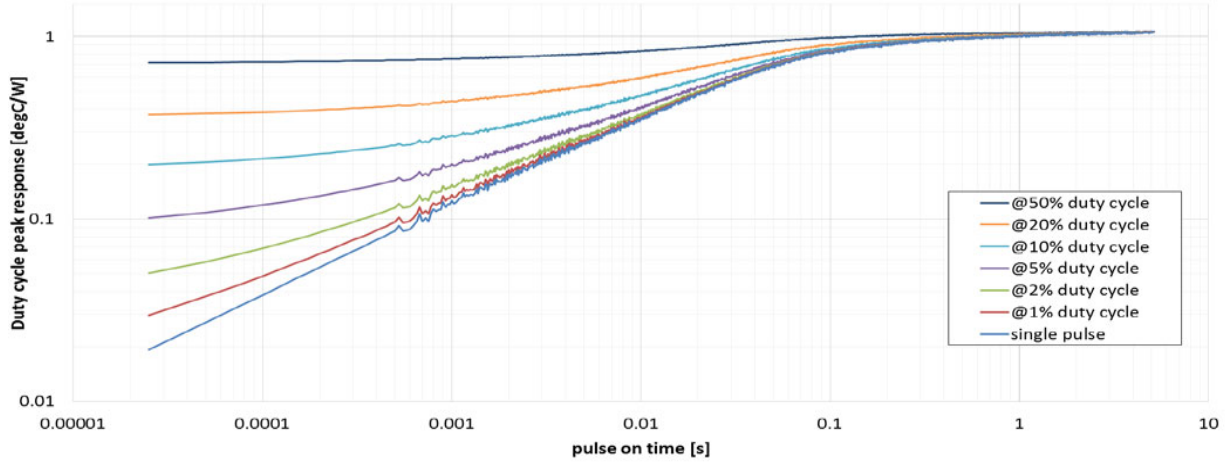


Figure 9. Transient Thermal Impedance (D11, D12, D21, D22, D31, D32)

TYPICAL CHARACTERISTICS
(D16+D17, D26+D27, D36 +D37)

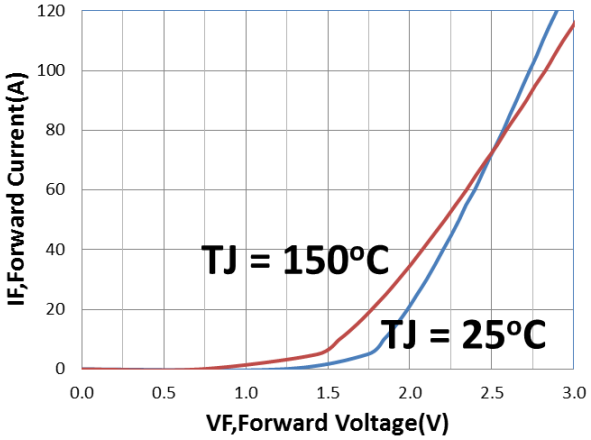


Figure 10. Diode Forward Characteristics

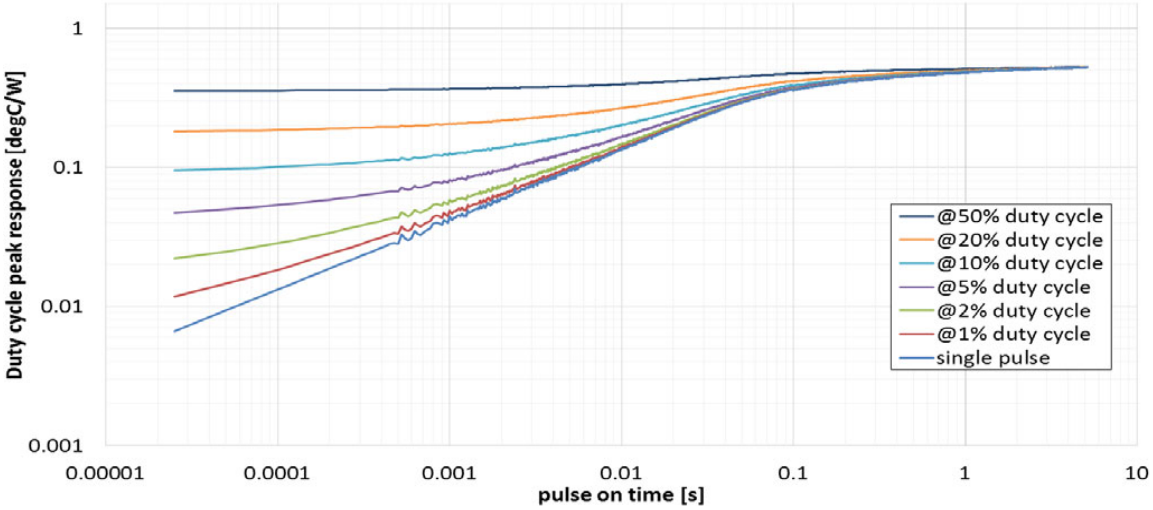


Figure 11. Transient Thermal Impedance

TYPICAL CHARACTERISTICS
(D18, D19, D28, D29, D38, D39)

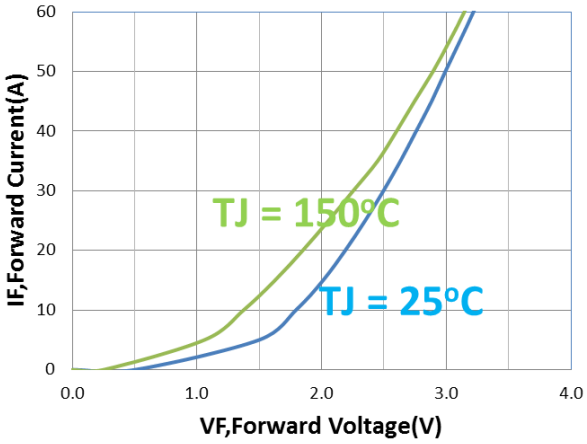


Figure 12. Diode Forward Characteristics

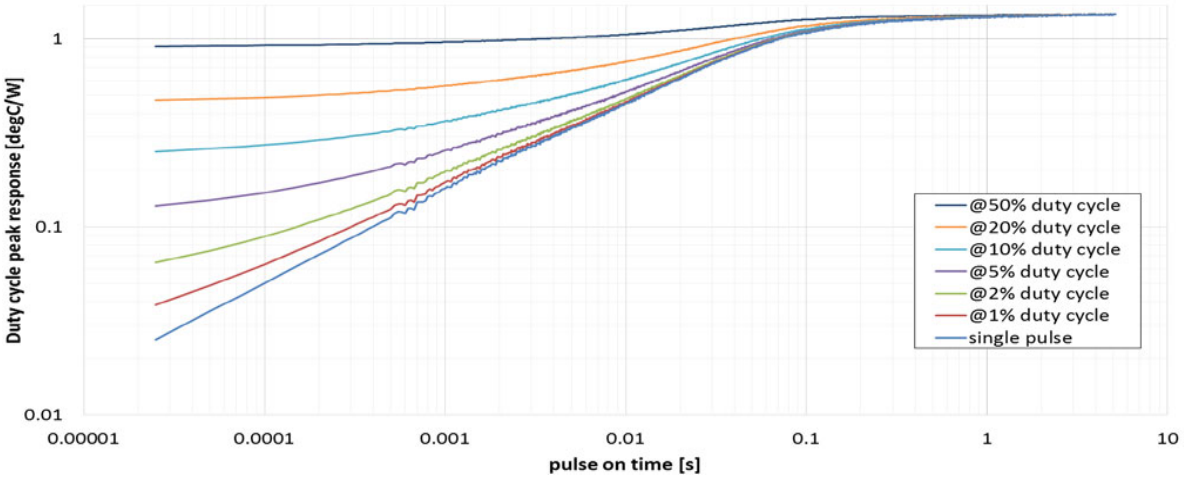


Figure 13. Transient Thermal Impedance

TYPICAL CHARACTERISTICS
(D14, D15, D24, D25, D34, D35)

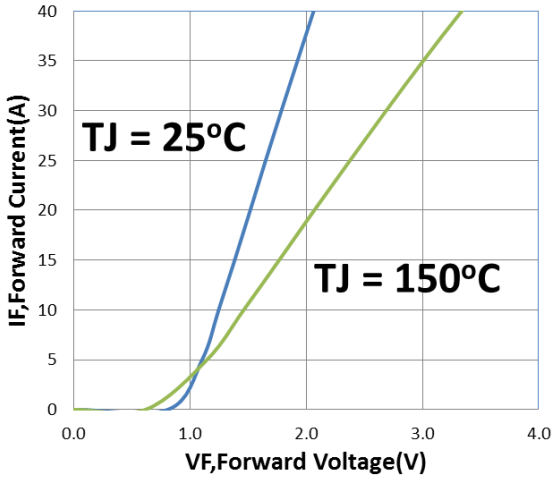


Figure 14. Diode Forward Characteristics

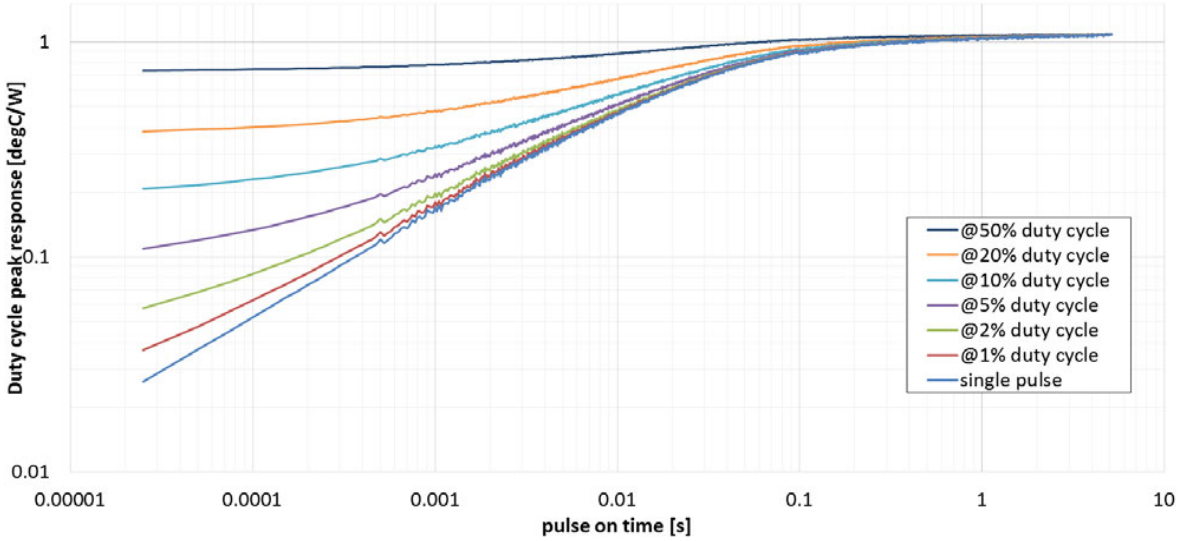


Figure 15. Transient Thermal Impedance

TYPICAL SWITCHING CHARACTERISTICS – IGBT (T11&T12, T21&T22, T31&T32) AND BOOST SIC DIODE (D14, D24, D34)

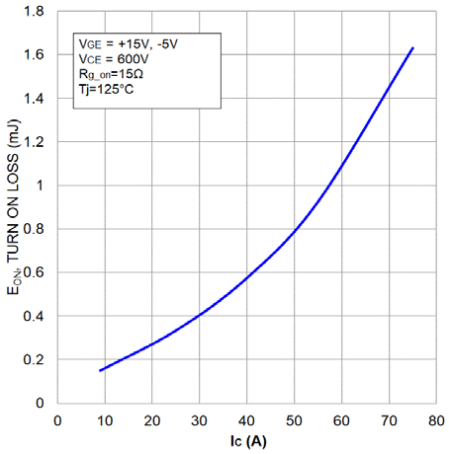


Figure 16. Typical Turn ON Loss vs. IC

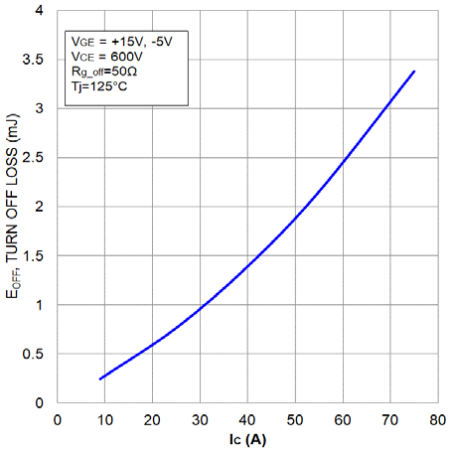


Figure 17. Typical Turn OFF Loss vs. IC

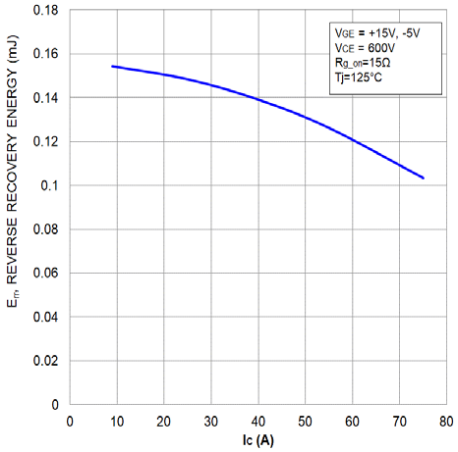
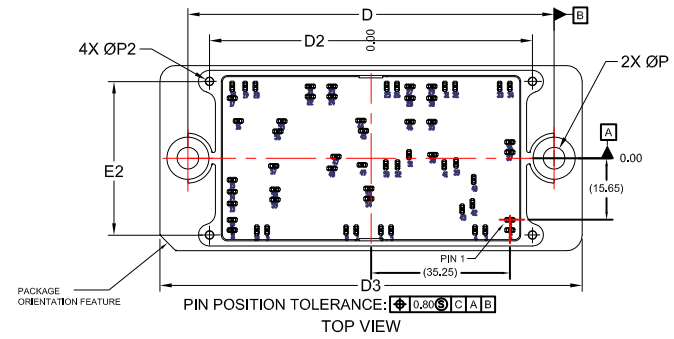
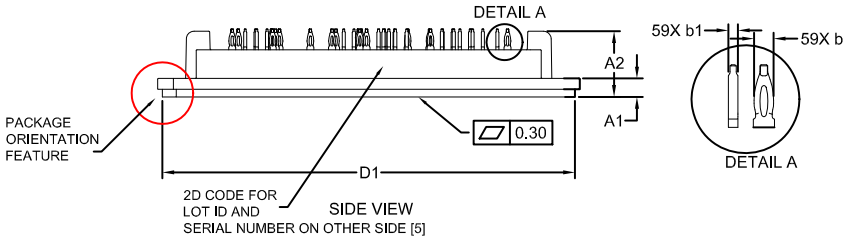


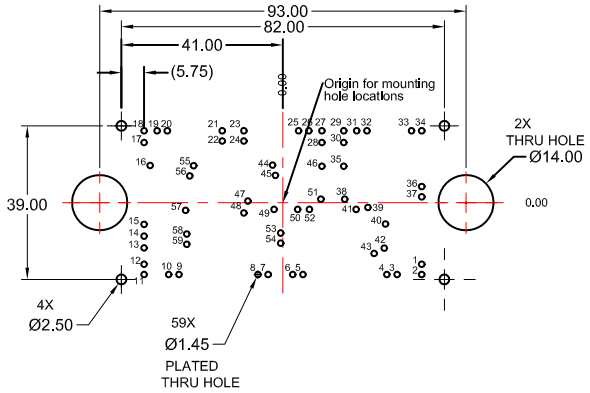
Figure 18. Typical Reverse Recovery Energy Loss vs. IC

PACKAGE DIMENSIONS

PIM59, 93x47 (PRESS FIT)
CASE 180AV
ISSUE C







RECOMMENDED MOUNTING PATTERN

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	11.70	12.00	12.30
A1	4.40	4.70	5.00
A2	16.40	16.70	17.00
A3	16.90	17.30	17.70
A4	13.97	14.18	14.39
A5	4.90	5.30	5.70
b	1.630	1.645	1.665
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	39.10
P	5.40	5.50	5.60
P1	5.05	5.35	5.65
P2	1.80	2.00	2.20

NOTE 4

MOUNTING HOLE POSITION					
PIN	X	Y	PIN	X	Y
1	35.25	-15.65	31	18.75	18.254
2	35.25	-18.25	32	21.35	18.25
3	29.0	-18.25	33	32.65	18.25
4	26.4	-18.25	34	35.25	18.25
5	5.10	-18.25	35	15.45	9.25
6	2.5	-18.25	36	35.25	4.10
7	-3.75	-18.25	37	35.25	1.50
8	-6.35	-18.25	38	15.70	0.90
9	-26.4	-18.25	39	21.60	-1.20
10	-29.0	-18.25	40	26.05	-5.40
11	-35.25	-18.25	41	18.60	-1.70
12	-35.25	-15.65	42	25.75	-11.55
13	-35.25	-11.50	43	23.15	-12.90
14	-35.25	-8.50	44	-2.60	9.55
15	-35.25	-5.50	45	-1.90	6.95
16	-33.70	9.45	46	9.90	9.25
17	-35.25	15.25	47	-8.90	0.40
18	-35.25	18.25	48	-9.90	-2.60
19	-31.95	18.25	49	-2.25	-1.70
20	-29.35	18.25	50	3.75	-1.70
21	-15.40	18.25	51	9.65	0.90
22	-15.40	15.65	52	6.75	-1.70
23	-9.90	18.25	53	-0.55	-7.70
24	-9.90	15.65	54	-0.55	-10.30
25	4.0	18.25	55	-22.65	9.40
26	6.60	18.25	56	-23.65	6.80
27	9.90	18.25	57	-24.70	-1.95
28	9.90	15.25	58	-24.40	-7.95
29	15.45	18.25	59	-24.40	-10.55
30	15.45	15.25			

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A4.
4. POSITION OF THE CENTER OF THE TERMINALS IS DETERMINED FROM DATUM B THE CENTER OF DIMENSION D, X DIRECTION, AND FROM DATUM A, Y DIRECTION. POSITIONAL TOLERANCE, AS NOTED IN DRAWING, APPLIES TO EACH TERMINAL IN BOTH DIRECTIONS.
5. PACKAGE MARKING IS LOCATED ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES.
6. MOUNTING RECOMMENDATION IS SHOWN AS VIEWED FROM THE PCB TOP LAYER LOOKING DOWN TO SUBSEQUENT LAYERS.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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