27 mΩ, 1200 V SiC Boost Module

NXH027B120MNF2PTG

The NXH027B120MNF2PTG Silicon Boost module contains three parallel 80 mΩ, 1200 V SiC MOSFETs, five parallel 10 A, 1200 V SiC boost diodes, two parallel 150 A, 1200 V bypass diodes, one 75 A, 1200 V protection diode for the MOSFETs and an NTC thermistor. The device is packaged in an F2 package with pre−applied phase−change material and press−fit pins.

Features

- Pre−applied Phase−change Material
- Press−fit Pins
- Pin Compatible with Full Si Boost Module
- Internal 3 Ohm Gate Resistors for the SiC MOSFETs

Typical Applications

- Solar Inverter

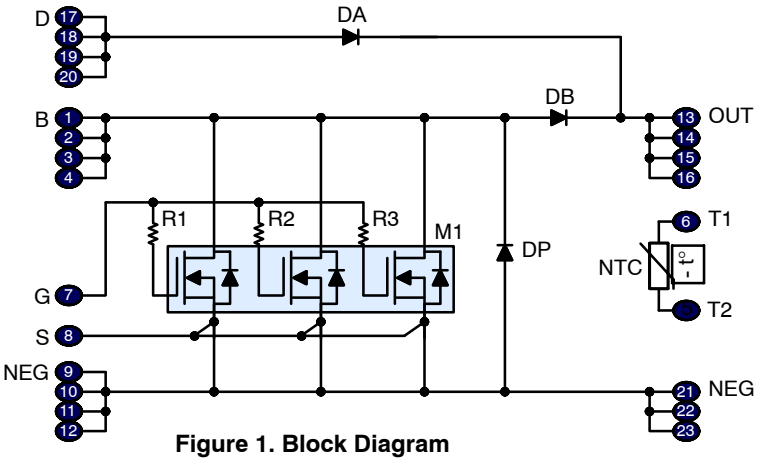
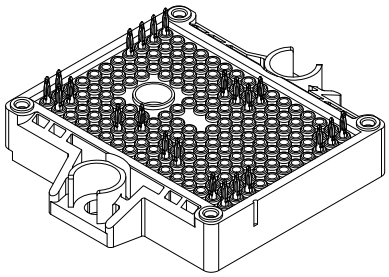
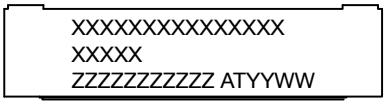


Figure 1. Block Diagram



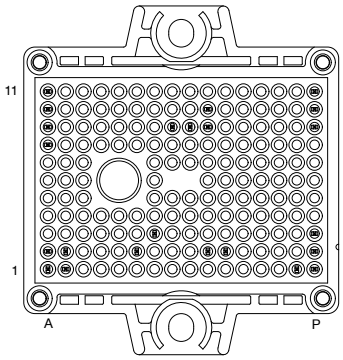
F2 BOOST
CASE MODGZ

MARKING DIAGRAM



XXXX = Specific Device Code
ZZZ = Lot ID
AT = Assembly & Test Location
YY = Year
WW = Work Week

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

Table 1. PIN FUNCTION DESCRIPTION

Pin	Name	Description
21	NEG	Power Ground
22	NEG	Power Ground
13	OUT	Output of Boost
14	OUT	Output of Boost
15	OUT	Output of Boost
16	OUT	Output of Boost
23	NEG	Power Ground
12	NEG	Power Ground
7	G	SiC MOSFET Gate
8	S	SiC MOSFET Source
17	D	Bypass Diode Anode
18	D	Bypass Diode Anode
6	T1	Thermistor connection 1
19	D	Bypass Diode Anode
20	D	Bypass Diode Anode
5	T2	Thermistor connection 2
1	B	Boost Switching Node
2	B	Boost Switching Node
3	B	Boost Switching Node
4	B	Boost Switching Node
9	NEG	Power Ground
10	NEG	Power Ground
11	NEG	Power Ground

Table 2. MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
BOOST MOSFET			
Drain−Source Voltage	V_{DSS}	1200	V
Gate−Source Voltage	V_{GSS}	−6 to +22	V
Continuous Drain Current @ T_c = 80°C (T_J = 150°C)	I_D	84	A
Maximum Power Dissipation (T_J = 150°C)	P_{tot}	134	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
BOOST DIODE			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_c = 80°C (T_J = 150°C)	I_F	85	A
Surge Forward Current, tp = 10 ms	I_{FSM}	270	A
Power Dissipation Per Diode (T_J = 150°C,T_h = 80°C)	P_{tot}	159	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
BYPASS DIODE/ PROTECTION DIODE			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_c = 80°C (T_J = 150°C)	I_F	112	A
Surge Forward Current, tp = 10 ms	I_{FSM}	400	A
Power Dissipation Per Diode (T_J = 150°C,T_h = 80°C)	P_{tot}	111	W
I^2t – value (Surge applied at rated load conditions halfwave, tp = 10 ms, T_j = 150°C)	I^2t	1600	A^2s
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
THERMAL PROPERTIES			
Storage Temperature range	T_{stg}	−40 to 125	°C
MODULE			
Isolation test voltage, @AC 1 minute	V_{iso}	2500	V_{RMS}
Mounting Torque (Note 2)	T_{MOUNT}	2.4	Nm
Creepage distance: Terminal to Heatsink		11.5	mm
Creepage distance: Terminal to Terminal		6.3	mm
Clearance distance: Terminal to Heatsink		10.0	mm
Clearance distance: Terminal to Terminal		5.0	mm

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. Recommendable value: 2 to 2.4 Nm.

Table 3. RECOMMENDED OPERATING RANGES

Rating	Symbol	Min	Max	Unit
Module Operating Junction Temperature	T_J	−40	150	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

Table 4. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
BOOST MOSFET CHARACTERISTICS						
Drain−Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	BV_{DSS}	1200	–	–	V
Drain−Source Cutoff Current	V_{GS} = 0 V, V_{DS} = 1200 V	I_{DSS}	–	–	50	μA
Drain−Source Saturation Voltage	V_{GS} = 20 V, I_D = 60 A, T_J = 25°C	$R_{DS(ON)}$	–	26.3	38	mohm
	V_{GS} = 20 V, I_D = 60 A, T_J = 150°C		–	37.9	–	
Gate−Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 13.2 mA	$V_{GS(TH)}$	1.4	3.13	4.9	V
Gate Leakage Current	V_{GS} = −6 V/20 V, V_{DS} = 0 V	I_{GSS}	−0.4	–	0.4	μA
Internal Gate Resistor		R_{gext}	–	3	–	Ω
Turn−on Delay Time	T_J = 25°C V_{DS} = 600 V, I_D = 60 A V_{GS} = 18 V/0 V, R_G = 11 Ω	$t_{d(on)}$	–	28.9	–	ns
Rise Time		t_r	–	18.2	–	
Turn−off Delay Time		$t_{d(off)}$	–	89.1	–	
Fall Time		t_f	–	32.3	–	
Turn−on Switching Loss per Pulse		E_{on}	–	848.3	–	μJ
Turn off Switching Loss per Pulse		E_{off}	–	594.7	–	
Turn−on Delay Time	T_J = 125°C V_{DS} = 600 V, I_D = 60 A V_{GS} = 18 V/0 V, R_G = 11 Ω	$t_{d(on)}$	–	24.6	–	ns
Rise Time		t_r	–	15.8	–	
Turn−off Delay Time		$t_{d(off)}$	–	99.5	–	
Fall Time		t_f	–	35.9	–	
Turn−on Switching Loss per Pulse		E_{on}	–	751.8	–	μJ
Turn off Switching Loss per Pulse		E_{off}	–	841	–	
Input Capacitance	V_{DS} = 20 V, V_{GS} = 0 V, f = 1 MHz	C_{iss}	–	3687	–	pF
Output Capacitance		C_{oss}	–	1420	–	
Reverse Transfer Capacitance		C_{rss}	–	64	–	
Total Gate Charge	V_{DS} = 600 V, I_D = 60 A, V_{GS} = 18 V/0 V	Q_g	–	135.7	–	nC
Thermal Resistance − chip−to−case		R_{thJC}	–	0.38	–	°C/W
Thermal Resistance − chip−to−heatsink	Thermal grease, λ = 2.87 W/mK	R_{thJH}	–	0.60	–	°C/W
BOOST DIODE CHARACTERISTICS						
Diode Reverse Leakage Current	V_R = 1200 V	I_R	–	–	1000	μA
Diode Forward Voltage	I_F = 50 A, T_J = 25°C	V_F	–	1.44	1.70	V
	I_F = 50 A, T_J = 150°C		–	1.95	–	
Reverse Recovery Time	T_J = 25°C V_{DS} = 600 V, I_D = 60 A V_{GS} = 18 V/0 V, R_G = 11 Ω	t_{rr}	–	18.2	–	ns
Reverse Recovery Charge		Q_{rr}	–	0.313	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	34.4	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	3814	–	A/μs
Reverse Recovery Energy		E_{rr}	–	30.7	–	μJ
Reverse Recovery Time	T_J = 125°C V_{DS} = 600 V, I_D = 60 A V_{GS} = 18 V/0 V, R_G = 11 Ω	t_{rr}	–	17.7	–	ns
Reverse Recovery Charge		Q_{rr}	–	0.324	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	36.6	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	4333	–	A/μs
Reverse Recovery Energy		E_{rr}	–	31.2	–	μJ
Thermal Resistance − chip−to−case		R_{thJC}	–	0.33	–	°C/W
Thermal Resistance − chip−to−heatsink	Thermal grease, λ = 2.87 W/mK	R_{thJH}	–	0.49	–	°C/W

Table 4. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
BYPASS DIODE CHARACTERISTICS						
Diode Reverse Leakage Current	V_R = 1200 V, T_J = 25°C	I_R	–	–	20	μA
Diode Forward Voltage	I_F = 75 A, T_J = 25°C	V_F	–	1.08	1.6	V
	I_F = 75 A, T_J = 150°C		–	0.98	–	
Thermal Resistance – chip–to–case		R_{thJC}	–	0.21	–	°C/W
Thermal Resistance – chip–to–heatsink	Thermal grease, λ = 2.87 W/mK	R_{thJH}	–	0.38	–	°C/W
PROTECTION DIODE CHARACTERISTICS						
Diode Reverse Leakage Current	V_R = 1200 V, T_J = 25°C	I_R	–	–	20	μA
Diode Forward Voltage	I_F = 75 A, T_J = 25°C	V_F	–	1.08	1.6	V
	I_F = 75 A, T_J = 150°C		–	0.98	–	
Thermal Resistance – chip–to–case		R_{thJC}	–	0.42	–	°C/W
Thermal Resistance – chip–to–heatsink	Thermal grease, λ = 2.87 W/mK	R_{thJH}	–	0.76	–	°C/W
THERMISTOR CHARACTERISTICS						
Nominal resistance	T_C = 25°C	R	–	10	–	kΩ
Nominal resistance	T_C = 100°C	R	–	936	–	Ω
Deviation of R25	T_C = 25°C	ΔR/R	–3	–	3	%
Power dissipation	T_C = 25°C	P_D	–	–	20	mW
B–value	B(25/50), tolerance ±2%	B(25/50)	–	3450	3519	K
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.

ORDERING INFORMATION

Device	Marking	Package	Shipping†
NXH027B120MNF2P2TG F2BOOST	NXH027B120MNF2P2TG	F2 BOOST Case MODGZ (Pb – Free and Halide–Free)	20 Units / Blister Tray

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

TYPICAL CHARACTERISTICS

BOOST MOSFET & MOSFET PROTECTION DIODE/ BYPASS DIODE

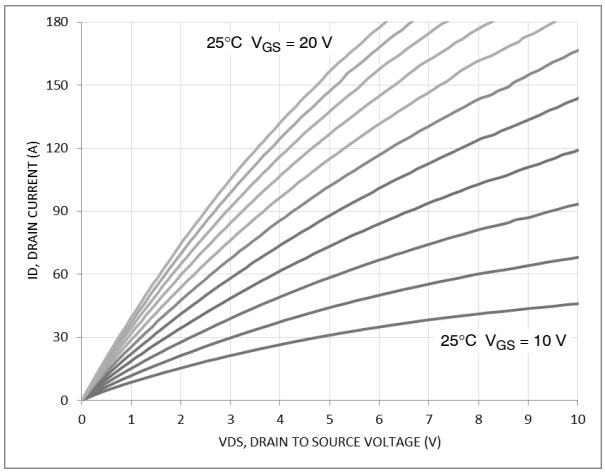


Figure 2. MOSFET Typical Output Characteristic

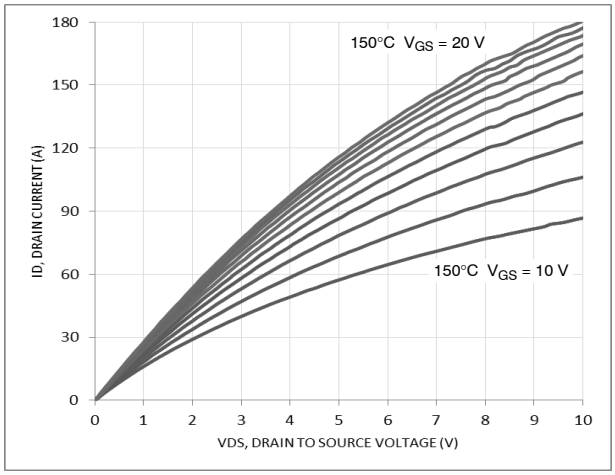


Figure 3. MOSFET Typical Output Characteristic

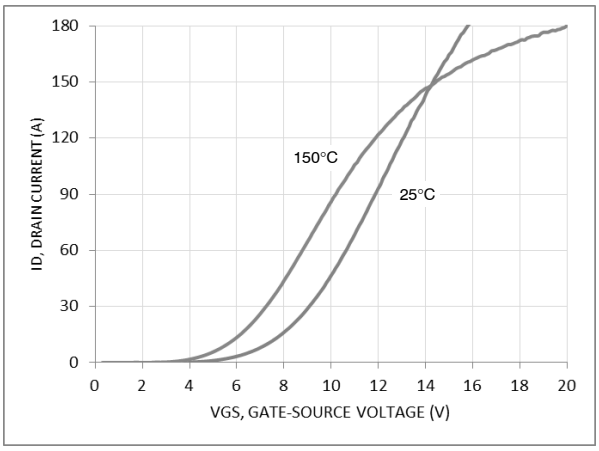


Figure 4. MOSFET Typical Transfer Characteristics

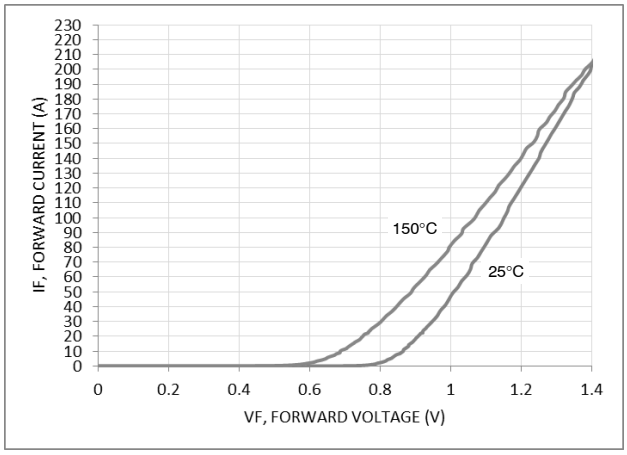


Figure 5. Diode Forward Characteristics (Protection/ Bypass)

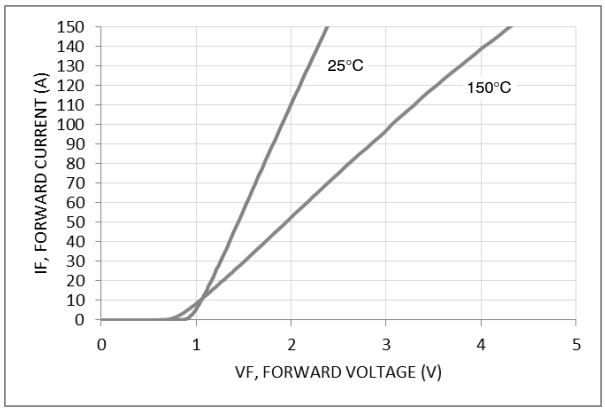


Figure 6. Diode Forward Characteristics (Boost Diode)

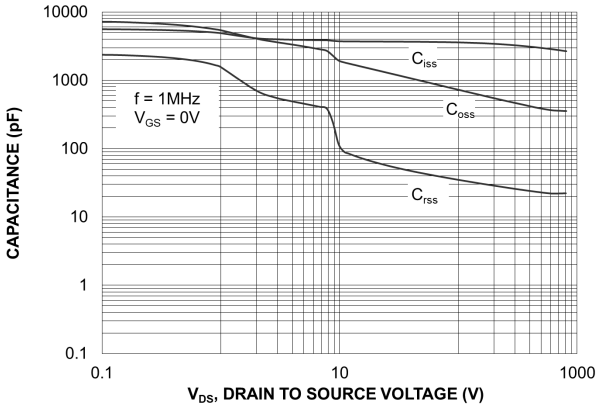


Figure 7. Capacitance vs. Drain to Source Voltage at f = 1 Mhz

TYPICAL CHARACTERISTICS (25°C UNLESS OTHERWISE NOTED)

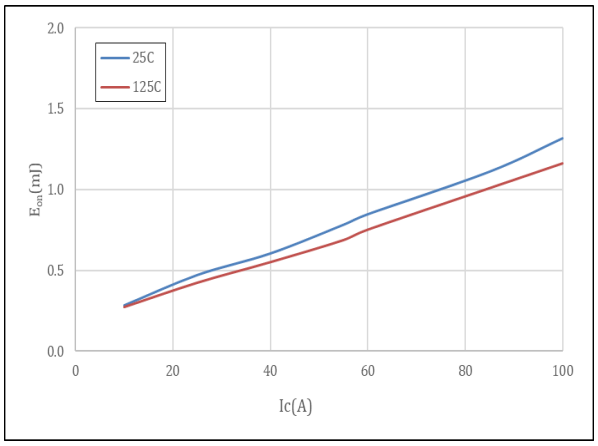


Figure 8. Typical Switching Loss Eon vs. IC

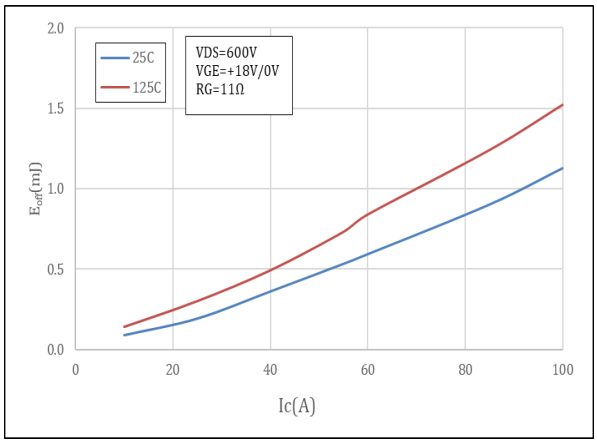


Figure 9. Typical Switching Loss Eoff vs. IC

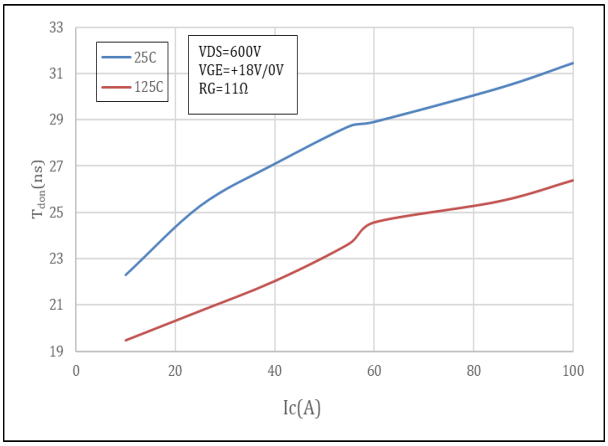


Figure 10. Typical Switching Time Tdon vs. IC

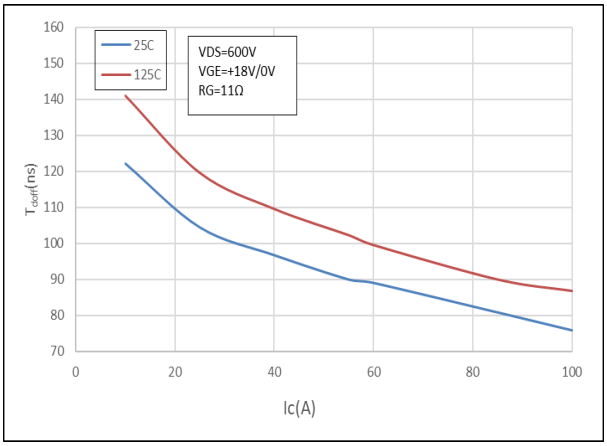


Figure 11. Typical Switching Time Tdoff vs. IC

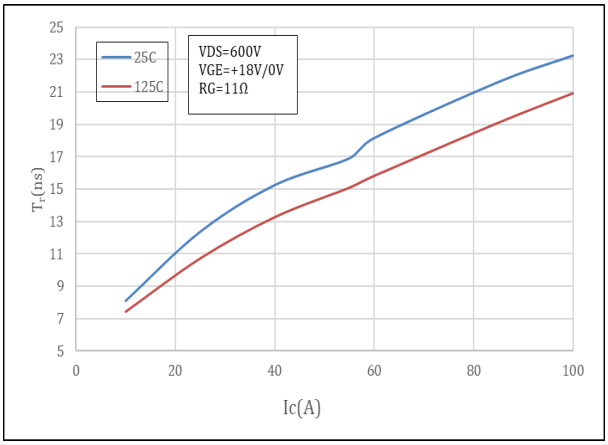


Figure 12. Typical Switching Time Trise vs. IC

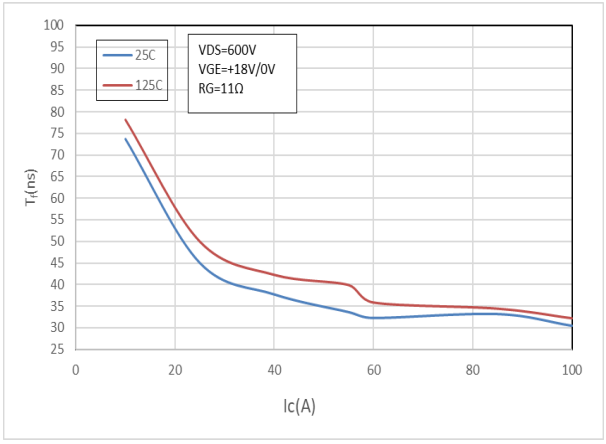


Figure 13. Typical Switching Time Tfall vs. IC

TYPICAL CHARACTERISTICS (25°C UNLESS OTHERWISE NOTED)

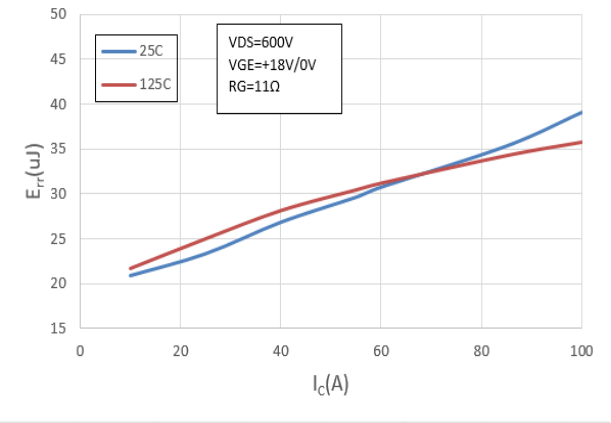


Figure 14. Typical Reverse Recovery Energy vs. IC

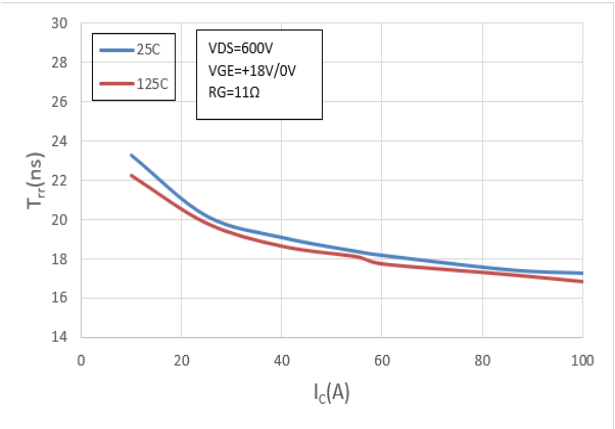


Figure 15. Typical Reverse Recovery Time vs. IC

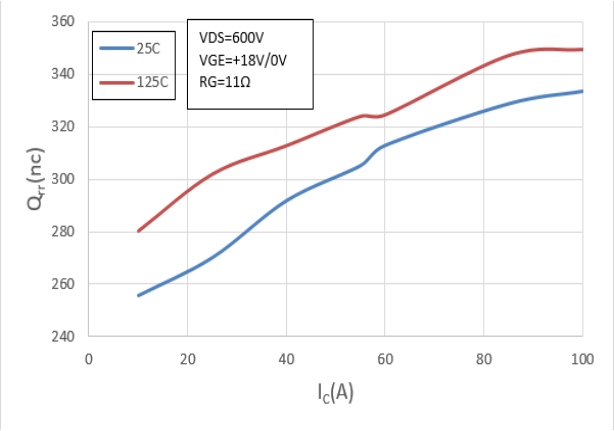


Figure 16. Typical Reverse Recovery Charge vs. IC

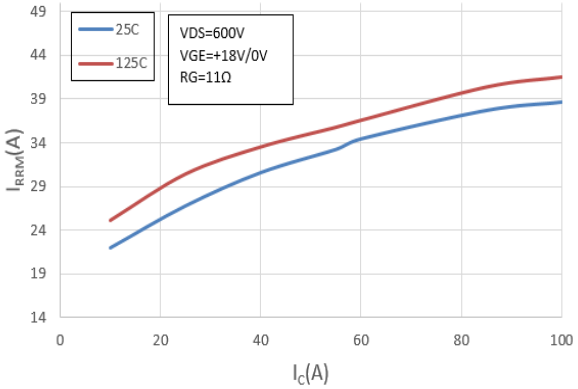


Figure 17. Typical Reverse Recovery Current vs. IC

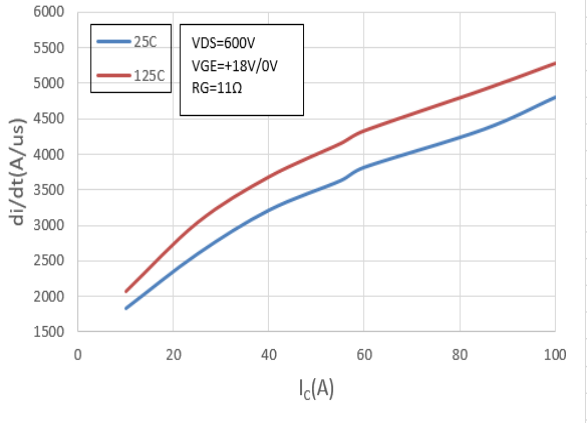


Figure 18. Typical di/dt vs. IC

TYPICAL CHARACTERISTICS (25°C UNLESS OTHERWISE NOTED)

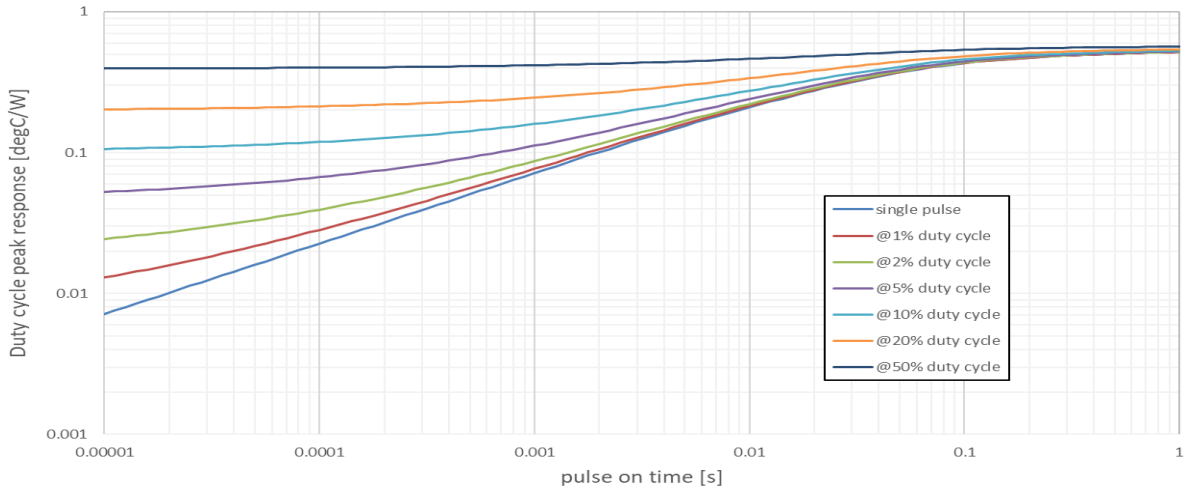


Figure 19. Boost Mosfet Junction*to*Heatsink Transient Thermal Impedance

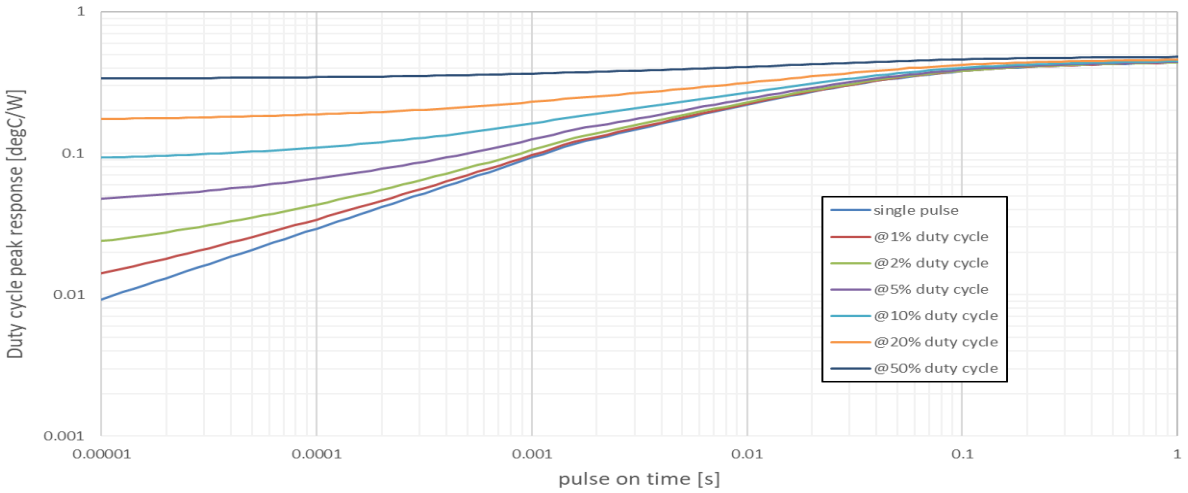


Figure 20. Boost Diode Junction*to*Heatsink Transient Thermal Impedance

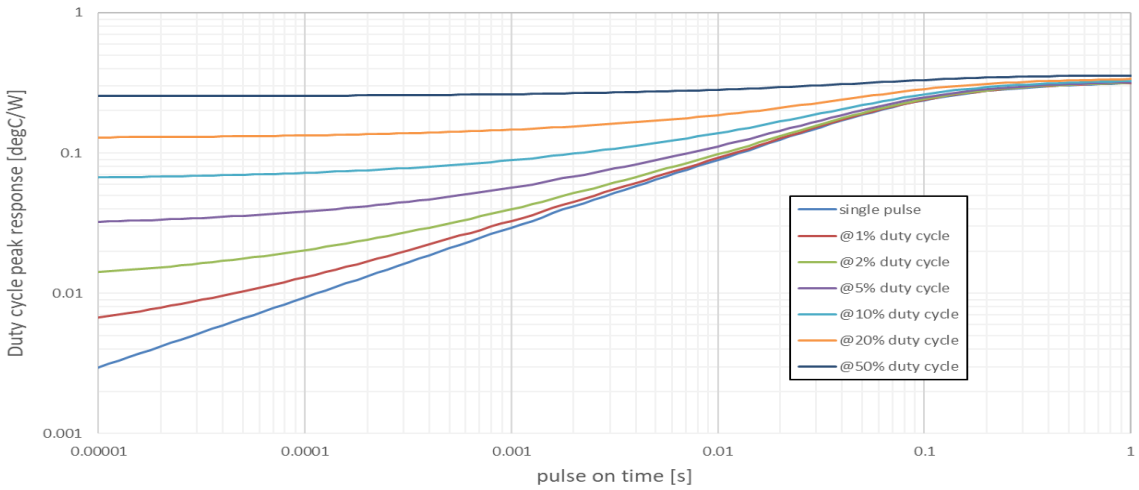
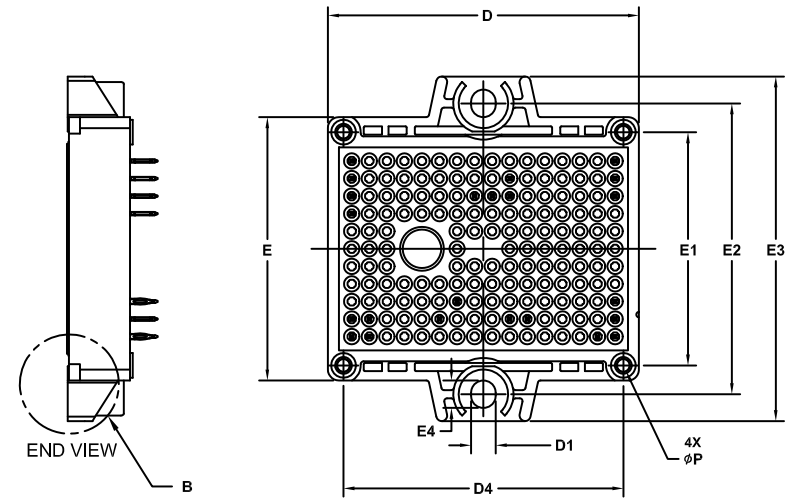


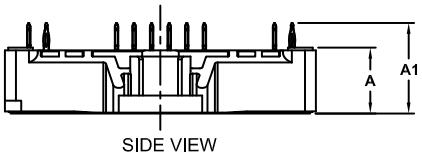
Figure 21. Bypass Diode Junction*to*Heatsink Transient Thermal Impedance

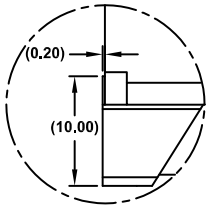
NXH027B120MNF2PTG

PACKAGE DIMENSIONS

PIM23 56.7x42.5 (PRESS FIT)
CASE MODGZ
ISSUE A

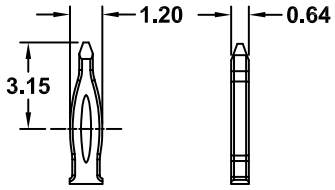






DETAIL B
SCALE N/A

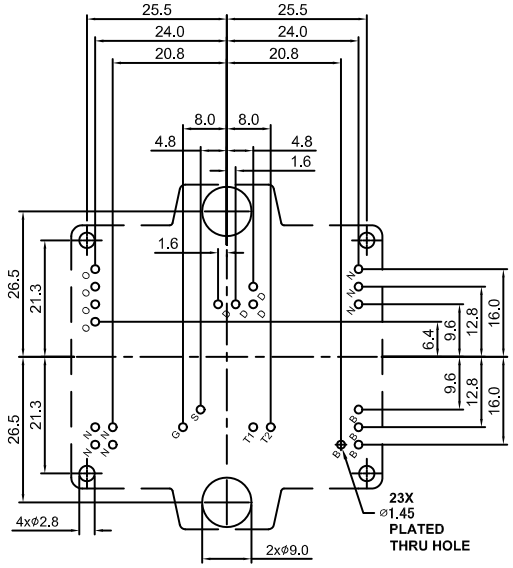
SCREW PART(BOTH SIDE)
BOTTOM SURFACE EXTRUSION



PIN DESIGN

NOTES:
1. CONTROLLING DIMENSION: MILLIMETERS

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	11.65	12.00	12.35
A1	16.00	16.50	17.00
D	56.40	56.70	57.00
D1	4.40	4.50	4.60
D4	50.85	51.00	51.15
E	47.70	48.00	48.30
E1	42.35	42.50	42.65
E2	52.90	53.00	53.10
E3	62.30	62.80	63.30
E4	4.90	5.00	5.10
P	2.20	2.30	2.40



PCB HOLE PATTERN
(View from PCB Top Layer downward to backside of PCB Layer)

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊