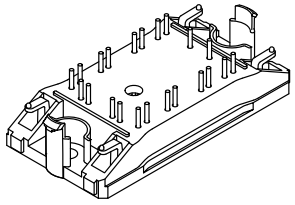
Silicon Carbide (SiC) Module – EliteSiC, 80 mohm SiC M1 MOSFET, 1200 V + 20 A, 1200 V SiC Diode, Two Channel Full SiC Boost, Q0 Package

Product Preview

NXH80B120MNQ0SNG



Q0BOOST
CASE 180AJ
SOLDER PINS

The NXH80B120MNQ0SNG is a power module containing a dual boost stage. The integrated SiC MOSFETs and SiC Diodes provide lower conduction losses and switching losses, enabling designers to achieve high efficiency and superior reliability.

Features

- 1200 V 80 mΩ SiC MOSFETs
- Low Reverse Recovery and Fast Switching SiC Diodes
- 1600 V Bypass and Anti−parallel Diodes
- Low Inductive Layout
- Solderable Pins
- Thermistor
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- Solar Inverters
- Uninterruptable Power Supplies

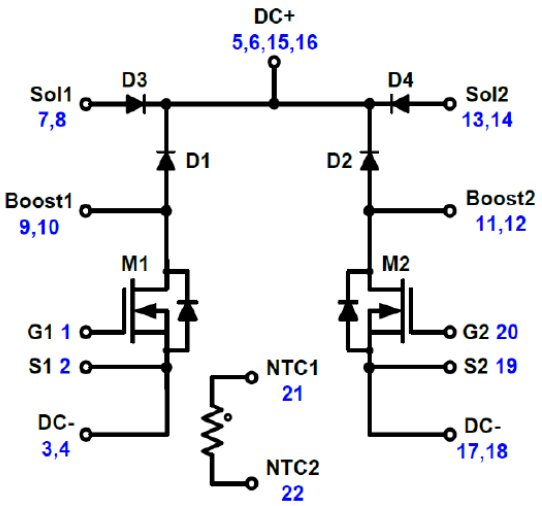
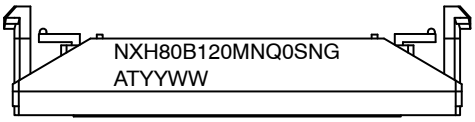


Figure 1. NXH80B120MNQ0SNG Schematic Diagram

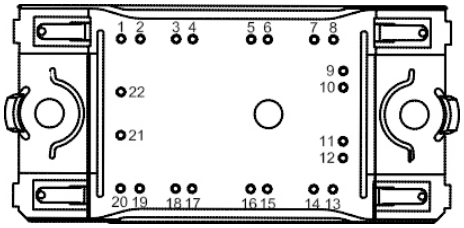
This document contains information on a product under development. **onsemi** reserves the right to change or discontinue this product without notice.

MARKING DIAGRAM



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 4 of this data sheet.

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

Rating	Symbol	Value	Unit
BOOST MOSFET			
Drain−Source Voltage	V_{DS}	1200	V
Gate−Source Voltage	V_{GS}	−15/+25	V
Continuous Drain Current (@ V_{GS} = 20 V, T_C = 80°C)	I_D	23	A
Pulsed Drain Current @ T_C = 80°C (T_J = 175°C)	$I_{D(Pulse)}$	69	A
Maximum Power Dissipation @ T_C = 80°C	P_{tot}	69	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
BOOST DIODE			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_C = 80°C	I_F	31	A
Surge Forward Current (60 Hz single half−sine wave)	I_{FSM}	93	A
Maximum Power Dissipation @ T_C = 80°C (T_J = 175°C)	P_{tot}	97	W
I^2t − value (60 Hz single half−sine wave)	I^2t	19	A^2s
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
BYPASS DIODE			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current @ T_C = 80°C (T_J = 150°C)	I_F	44	A
Repetitive Peak Forward Current (T_C = 80°C, t_p limited by T_{Jmax})	I_{FRM}	132	A
Power Dissipation Per Diode @ T_C = 80°C (T_J = 150°C)	P_{tot}	63	W
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
INSULATION PROPERTIES			
Isolation test voltage, t = 1 sec, 60 Hz	V_{is}	3000	V_{RMS}
Creepage distance		12.7	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.

RECOMMENDED OPERATING RANGES

Parameter	Symbol	Min	Max	Unit
Module Operating Junction Temperature	T_J	−40	(T_{JMAX} − 25)	°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.

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
BOOST MOSFET CHARACTERISTICS						
Zero Gate Voltage Drain Current	V_{GS} = 0 V, V_{DS} = 1200 V, T_J = 25°C	I_{DSS}	–	–	100	μA
Static Drain−to−Source On Resistance	V_{GS} = 20 V, I_D = 20 A, T_J = 25°C	$R_{DS(on)}$	–	80	110	mΩ
	V_{GS} = 20 V, I_D = 20 A, T_J = 150°C		–	114	162	
Gate−Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 5 mA	$V_{GS(th)}$	1.8	2.0	4.3	V
Gate−Source Leakage Current	V_{GS} = 25 V, V_{DS} = 0 V	I_{GSS}	–	–	1	μA
Turn−on Delay Time	T_J = 25°C V_{DS} = 700 V, V_{GS} = 20 V, −5 V I_D = 30 A, R_G = 4.7 Ω	$t_{d(on)}$	–	13.4	–	ns
Rise Time		t_r	–	3.6	–	
Turn−off Delay Time		$t_{d(off)}$	–	27.6	–	
Fall Time		t_f	–	10.3	–	
Turn−on Switching Loss per Pulse		E_{on}	–	166	–	μJ
Turn−off Switching Loss per Pulse		E_{off}	–	49.2	–	
Turn−on Delay Time	T_J = 125°C V_{DS} = 700 V, V_{GS} = 20 V, −5 V I_D = 30 A, R_G = 4.7 Ω	$t_{d(on)}$	–	13.7	–	ns
Rise Time		t_r	–	3.5	–	
Turn−off Delay Time		$t_{d(off)}$	–	29.56	–	
Fall Time		t_f	–	10.36	–	
Turn−on Switching Loss per Pulse		E_{on}	–	154	–	μJ
Turn−off Switching Loss per Pulse		E_{off}	–	46.65	–	
Input Capacitance	V_{DS} = 800 V, V_{GS} = 0 V, f = 1 MHz	C_{iss}	–	1038.7	–	pF
Output Capacitance		C_{oss}	–	95.5	–	
Reverse Transfer Capacitance		C_{rss}	–	10.9	–	
Total Gate Charge	V_{DS} = 600 V, I_D = 20 A, V_{GS} = 20 V, −5 V	Q_g	–	74.72	–	nC
Thermal Resistance − chip−to−case	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJC}	–	1.37	–	K/W
Thermal Resistance − chip−to−heatsink		R_{thJH}	–	1.94	–	K/W
BOOST DIODE CHARACTERISTICS						
Diode Reverse Leakage Current	V_R = 1200 V	I_R	–	–	300	μA
Diode Forward Voltage	I_F = 20 A, T_J = 25°C	V_F	–	1.49	1.7	V
	I_F = 20 A, T_J = 150°C		–	2.17	–	
Reverse Recovery Time	T_J = 25°C V_{DS} = 700 V, V_{GS} = 20 V, −5 V I_D = 30 A, R_G = 4.7 Ω	t_{rr}	–	12	–	ns
Reverse Recovery Charge		Q_{rr}	–	159	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	21.2	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	7240	–	A/μs
Reverse Recovery Energy		E_{rr}	–	70	–	μJ
Reverse Recovery Time	T_J = 125°C V_{DS} = 700 V, V_{GS} = 20 V, −5 V I_D = 30 A, R_G = 4.7 Ω	t_{rr}	–	11.7	–	ns
Reverse Recovery Charge		Q_{rr}	–	153	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	23.8	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	8068	–	A/μs
Reverse Recovery Energy		E_{rr}	–	66.3	–	μJ

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
BOOST DIODE CHARACTERISTICS						
Thermal Resistance – chip–to–case	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJC}	–	0.98	–	K/W
Thermal Resistance – chip–to–heatsink		R_{thJH}	–	1.33	–	K/W
BYPASS DIODE CHARACTERISTICS						
Diode Reverse Leakage Current	V_R = 1600 V, T_J = 25°C	I_R	–	–	100	μA
Diode Forward Voltage	I_F = 30 A, T_J = 25°C	V_F	–	1.04	1.4	V
	I_F = 30 A, T_J = 150°C		–	0.94	–	
Thermal Resistance – chip–to–case	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJC}	–	1.12	–	K/W
Thermal Resistance – chip–to–heatsink		R_{thJH}	–	1.56	–	K/W
THERMISTOR CHARACTERISTICS						
Nominal resistance		R_{25}	–	22	–	kΩ
Nominal resistance	T = 100°C	R_{100}	–	1486	–	Ω
Deviation of R25		ΔR/R	–5	–	5	%
Power dissipation		P_D	–	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.

ORDERING INFORMATION

Part Number	Marking	Package	Shipping
NXH80B120MNQ0SNG	NXH80B120MNQ0SNG	Q0BOOST – Case 180AJ (Pb–Free and Halide–Free Solder Pins)	24 Units / Blister Tray

TYPICAL CHARACTERISTICS – MOSFET, BOOST DIODE AND BYPASS DIODE

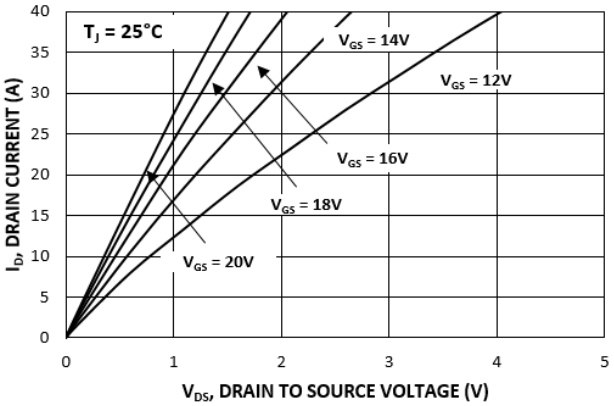


Figure 2. MOSFET On Region Characteristics

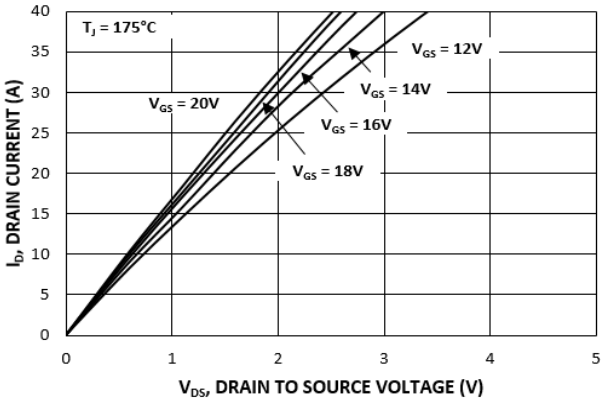


Figure 3. MOSFET On Region Characteristics

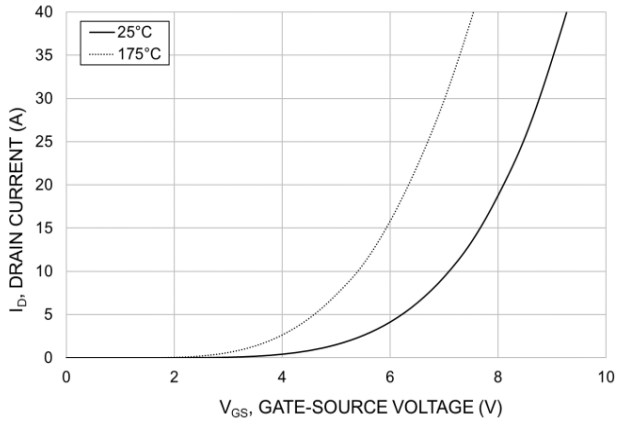


Figure 4. MOSFET Transfer Characteristics

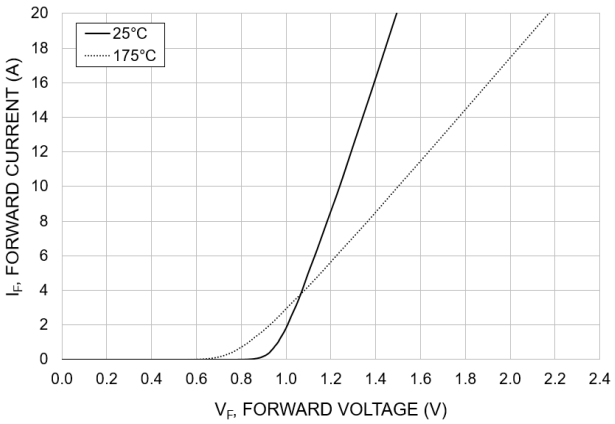


Figure 5. Boost Diode Forward Characteristics

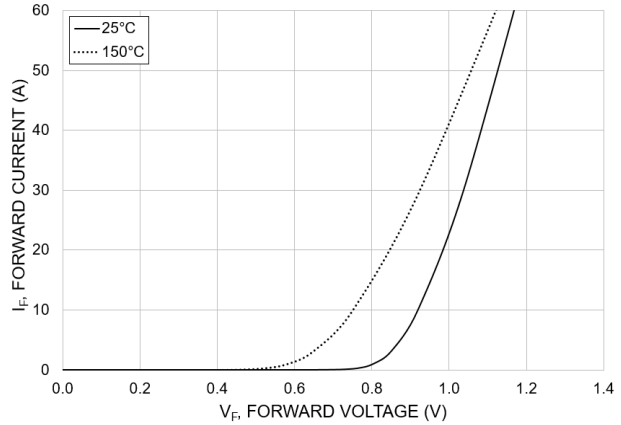


Figure 6. Bypass Diode Forward Characteristics

TYPICAL SWITCHING CHARACTERISTICS – MOSFET

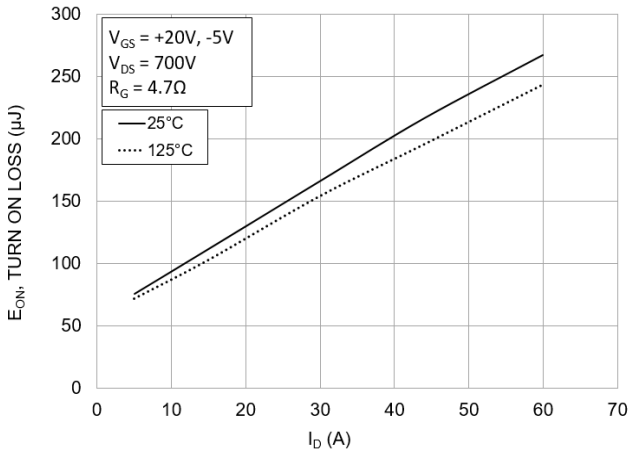


Figure 7. Typical Turn On Loss vs. I_D

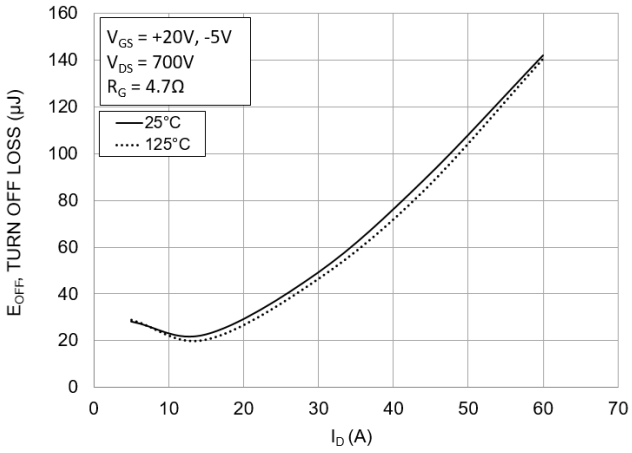


Figure 8. Typical Turn Off Loss vs. I_D

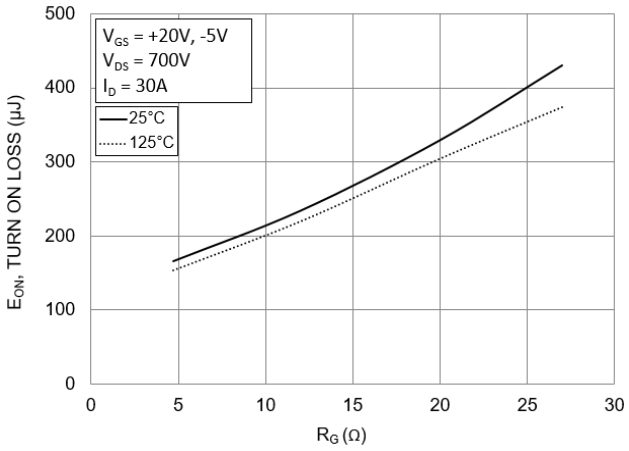


Figure 9. Typical Turn On Loss vs. R_G

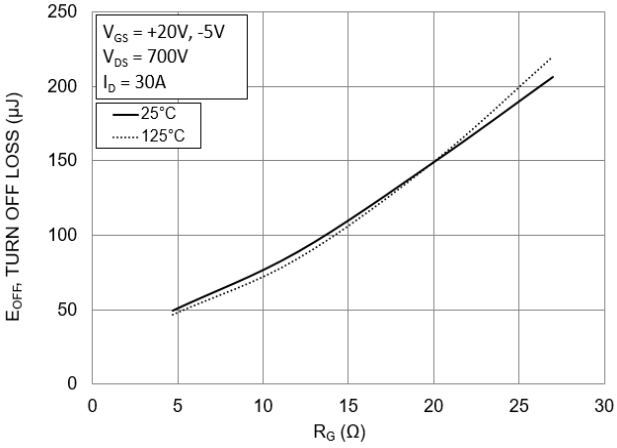


Figure 10. Typical Turn Off Loss vs. R_G

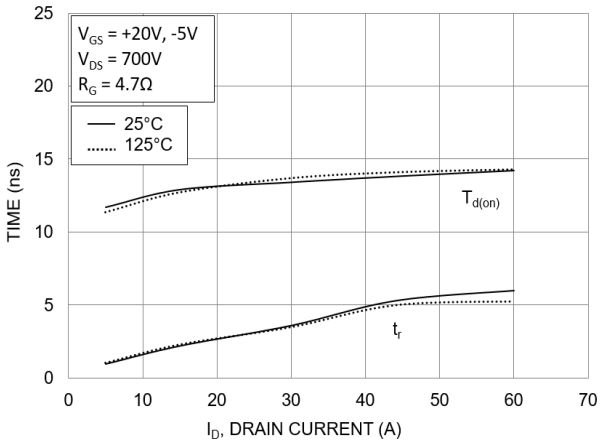


Figure 11. Typical Turn On Switching Time vs. I_D

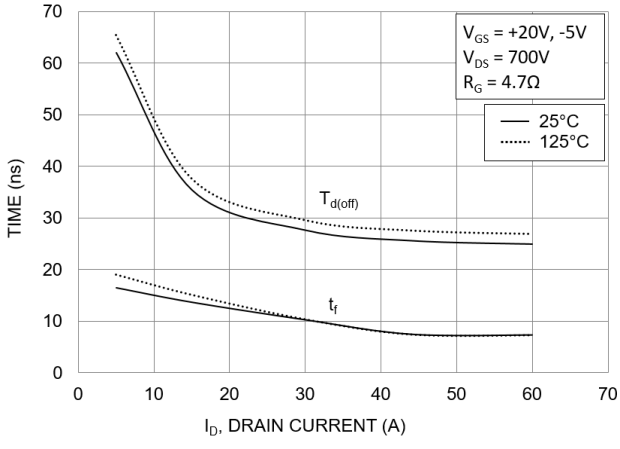


Figure 12. Typical Turn Off Switching Time vs. I_D

TYPICAL CHARACTERISTICS – MOSFET

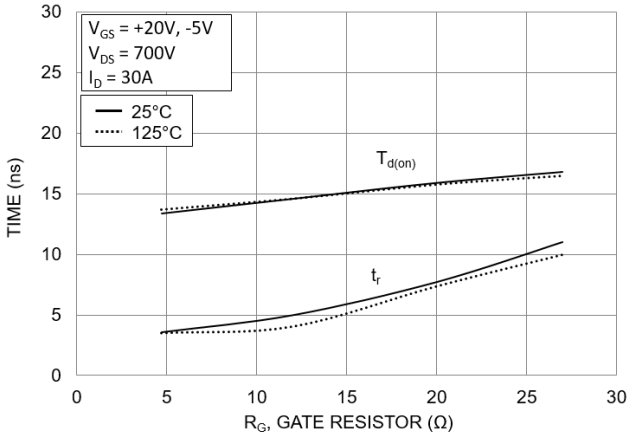


Figure 13. Typical Turn On Switching Time vs. R_G

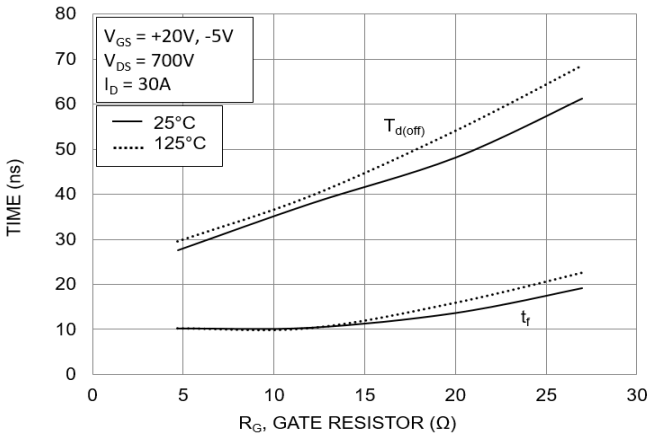


Figure 14. Typical Turn Off Switching Time vs. R_G

TYPICAL CHARACTERISTICS – BOOST DIODE

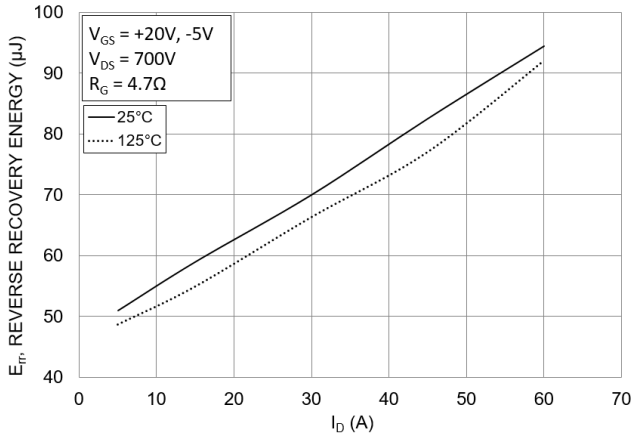


Figure 15. Typical Reverse Recovery Energy Loss vs. I_D

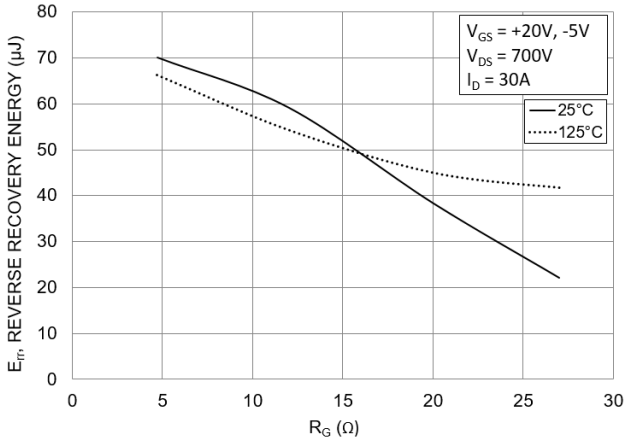


Figure 16. Typical Reverse Recovery Energy Loss vs. R_G

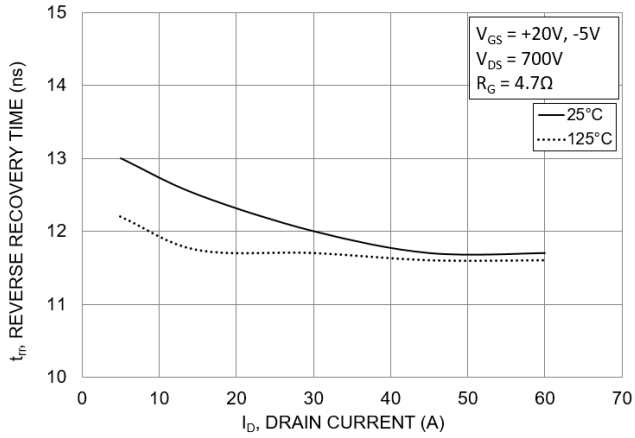


Figure 17. Typical Reverse Recovery Time vs. I_D

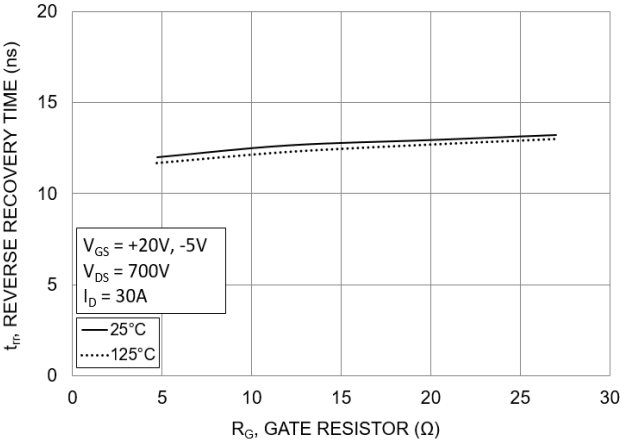


Figure 18. Typical Reverse Recovery Time vs. R_G

TYPICAL SWITCHING CHARACTERISTICS – BOOST DIODE

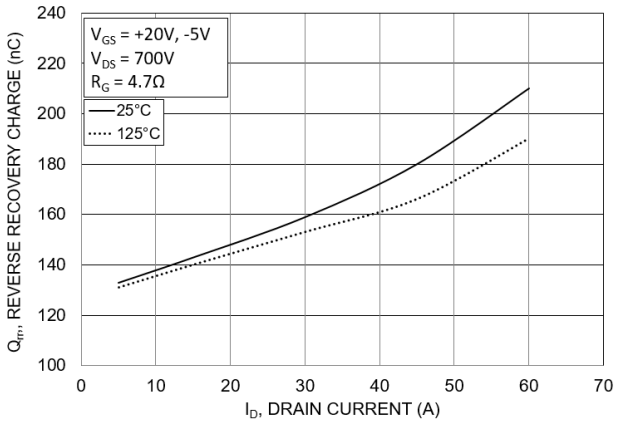


Figure 19. Typical Reverse Recovery Charge vs. I_D

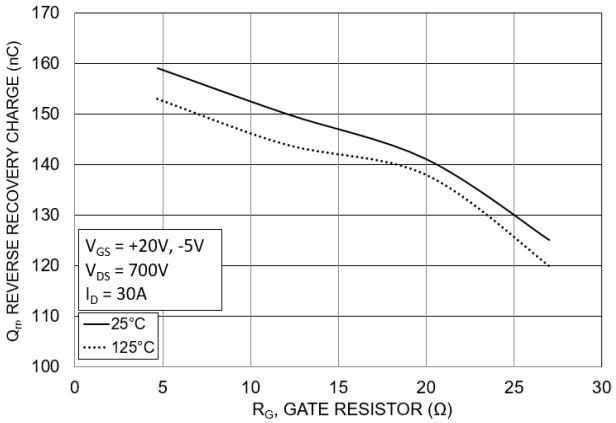


Figure 20. Typical Reverse Recovery Charge vs. R_G

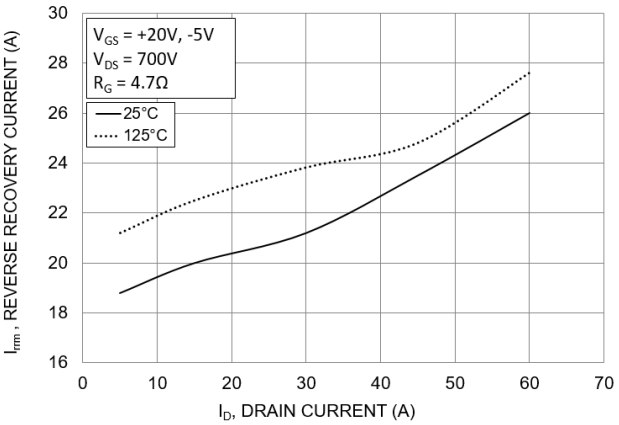


Figure 21. Typical Reverse Recovery Peak Current vs. I_D

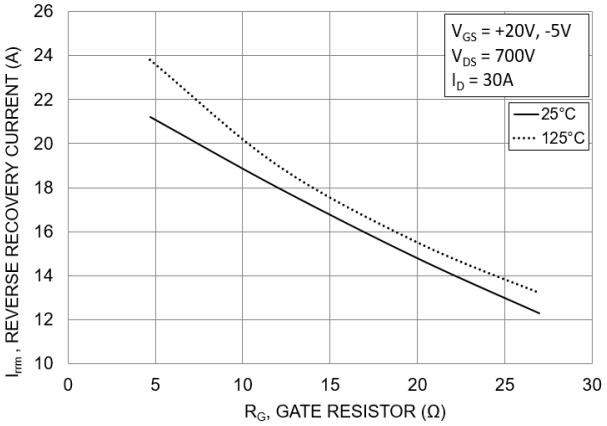


Figure 22. Typical Reverse Recovery Peak Current vs. R_G

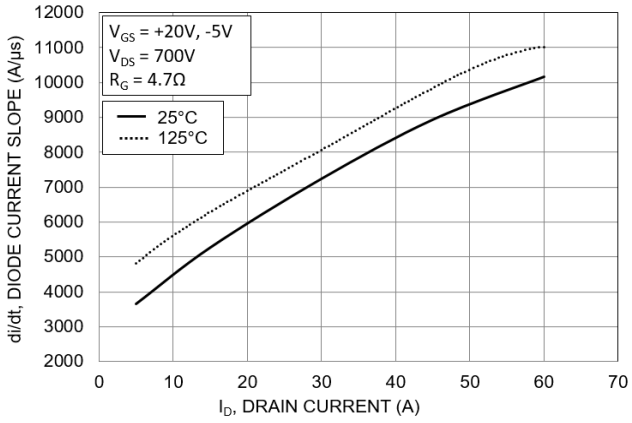


Figure 23. Typical di/dt vs. I_D

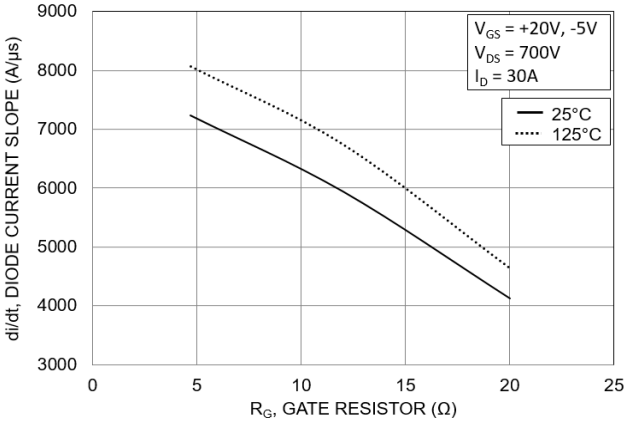


Figure 24. Typical di/dt vs. R_G

TRANSIENT THERMAL IMPEDANCE – MOSFET, BOOST DIODE AND BYPASS DIODE

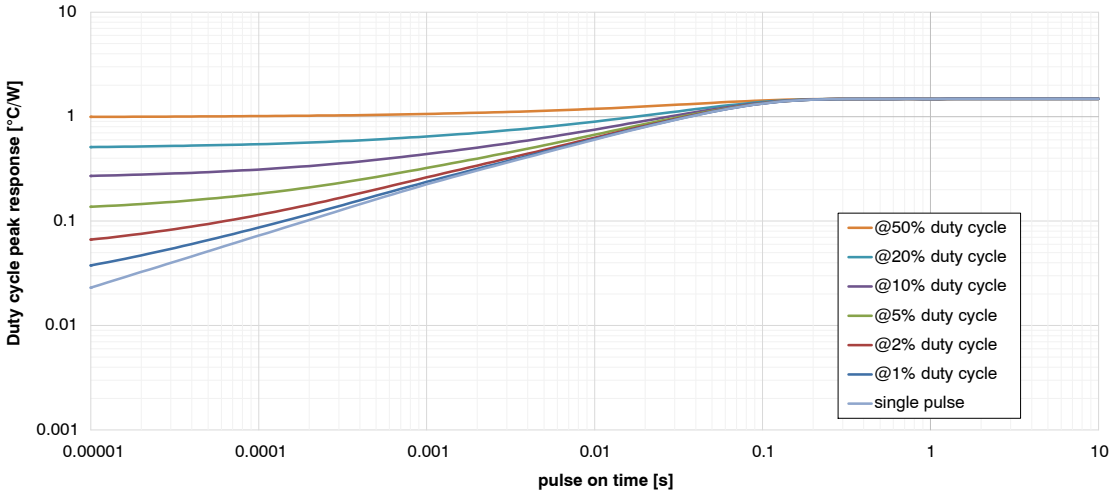


Figure 25. MOSFET Transient Thermal Impedance

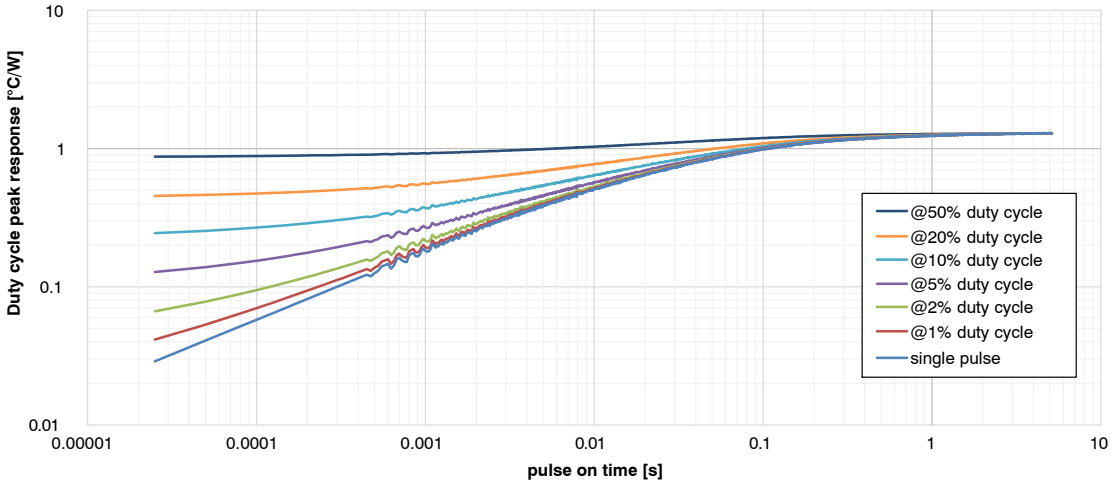


Figure 26. Boost Diode Transient Thermal Impedance

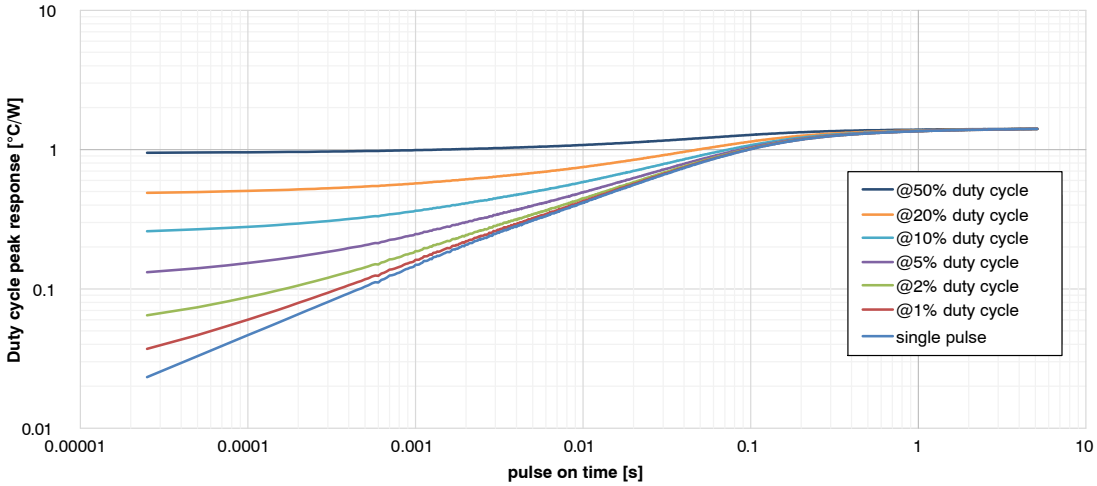


Figure 27. Bypass Diode Transient Thermal Impedance

GATE CHARGE, CAPACITANCE CHARGE, SOA AND THERMISTOR CHARACTERISTICS

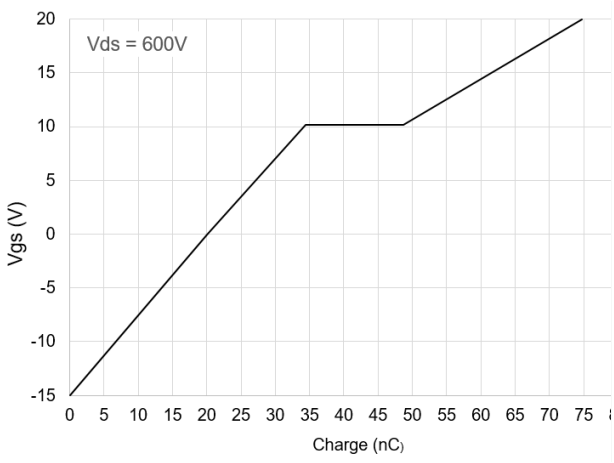


Figure 28. Gate Voltage vs. Gate Charge

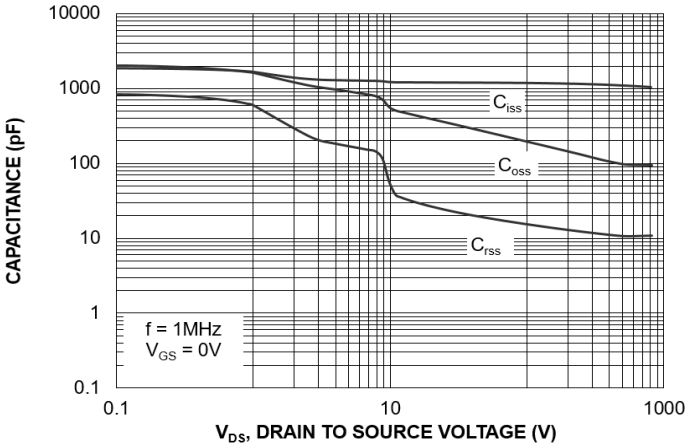


Figure 29. Capacitance Charge

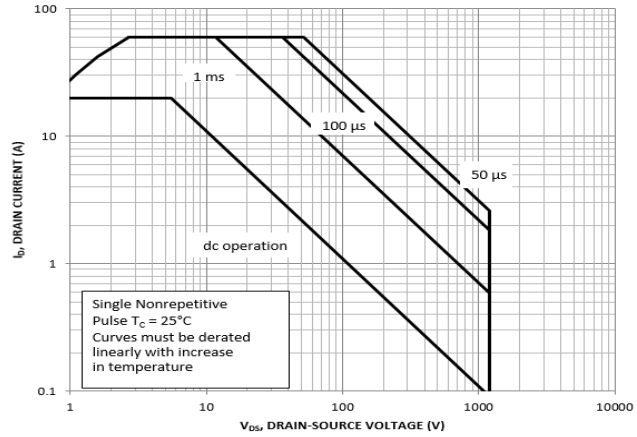


Figure 30. FBSOA

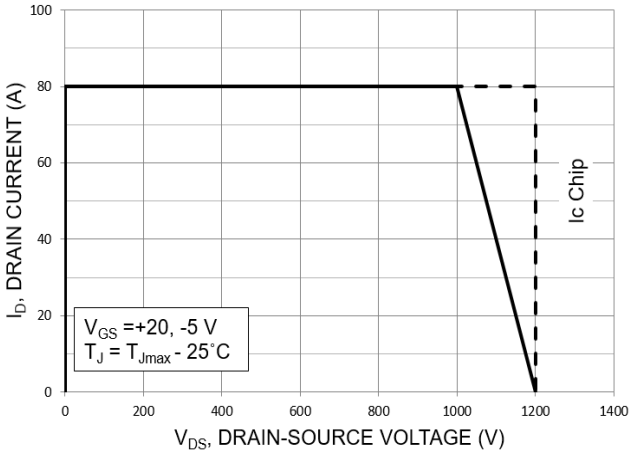


Figure 31. RBSOA

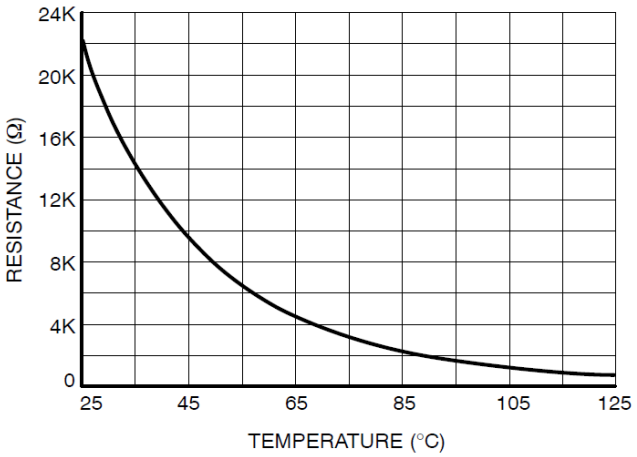
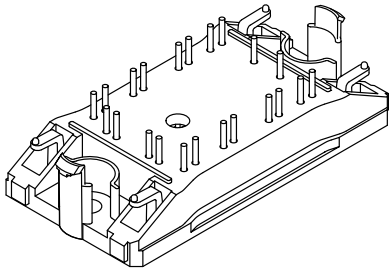
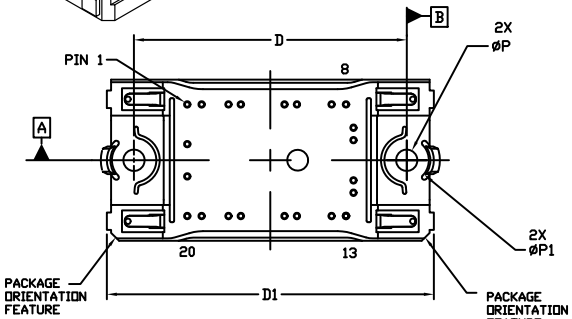


Figure 32. Thermistor Characteristics

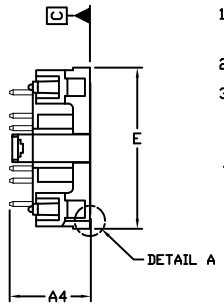
PIM22, 55x32.5 / Q0BOOST
CASE 180AJ
ISSUE B

DATE 08 NOV 2017





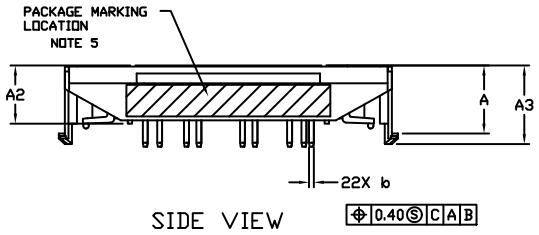
TOP VIEW



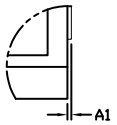
END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER. ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO THE PLATED TERMINALS AND IS MEASURED BETWEEN 1.00 AND 3.00 FROM THE TERMINAL TIP.
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 AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES.



SIDE VIEW



DETAIL A

DIM	MILLIMETERS	
	MIN.	NOM.
A	13.50	13.90
A1	0.10	0.30
A2	11.50	11.90
A3	15.65	16.05
A4	16.35 REF	
b	0.95	1.05
D	54.80	55.20
D1	65.60	66.20
E	32.20	32.80
P	4.20	4.40
P1	8.90	9.10

MOUNTING HOLE POSITION

NOTE 4

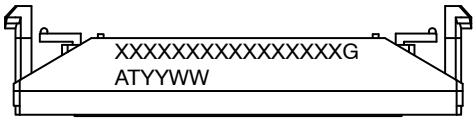
PIN	HOLE POSITION	
	X	Y
1	-16.75	-11.25
2	-13.85	-11.25
3	-8.45	-11.25
4	-5.95	-11.25
5	2.85	-11.25
6	5.35	-11.25
7	12.35	-11.25
8	15.25	-11.25
9	16.75	-6.55
10	16.75	-4.05
11	16.75	4.05

PIN	PIN POSITION	
	X	Y
12	16.75	6.55
13	15.25	11.25
14	12.35	11.25
15	5.35	11.25
16	2.85	11.25
17	-5.95	11.25
18	-8.45	11.25
19	-13.85	11.25
20	-16.75	11.25
21	-16.75	3.25
22	-16.75	-3.25

PIN	PIN POSITION	
	X	Y
1	-16.75	11.25
2	-13.85	11.25
3	-8.45	11.25
4	-5.95	11.25
5	2.85	11.25
6	5.35	11.25
7	12.35	11.25
8	15.25	11.25
9	16.75	6.55
10	16.75	4.05
11	16.75	-4.05

PIN	PIN POSITION	
	X	Y
12	16.75	-6.55
13	15.25	-11.25
14	12.35	-11.25
15	5.35	-11.25
16	2.85	-11.25
17	-5.95	-11.25
18	-8.45	-11.25
19	-13.85	-11.25
20	-16.75	-11.25
21	-16.75	-3.25
22	-16.75	3.25

GENERIC
MARKING DIAGRAM*



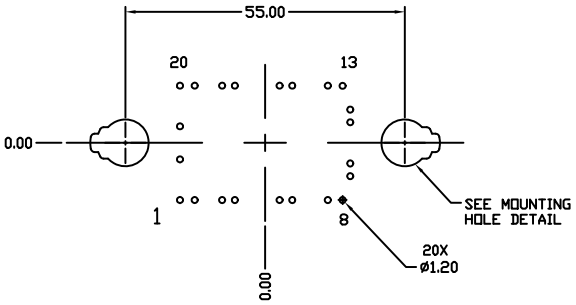
XXXXX = Specific Device Code
G = Pb−Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

*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.

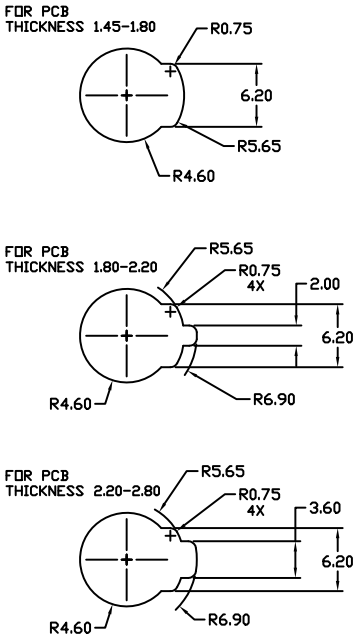
DOCUMENT NUMBER:	98AON63481G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	PIM22 55X32.5 / Q0BOOST (SOLDER PIN)	PAGE 1 OF 2

PIM22, 55x32.5 / Q0BOOST
CASE 180AJ
ISSUE B

DATE 08 NOV 2017



RECOMMENDED
MOUNTING PATTERN



MOUNTING HOLE DETAIL

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DESCRIPTION:	**PIM22 55X32.5 / Q0BOOST (SOLDER PIN)**		**PAGE 2 OF 2**

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