

F2HALFBR Module

Product Preview

NXH006P120MNF2PTG

The NXH006P120MNF2 is a power module containing an 6 mΩ /1200 V SiC MOSFET half-bridge and a thermistor in an F2 package.

Features

- 6 mΩ /1200 V SiC MOSFET Half-bridge
- Thermistor
- Options with Pre-applied Thermal Interface Material (TIM) and without Pre-applied TIM
- Options with Solderable Pins and Press-fit Pins
- These Devices are Pb-Free, Halide Free and are RoHS Compliant

Typical Applications

- Solar Inverter
- Uninterruptible Power Supplies
- Electric Vehicle Charging Stations
- Industrial Power

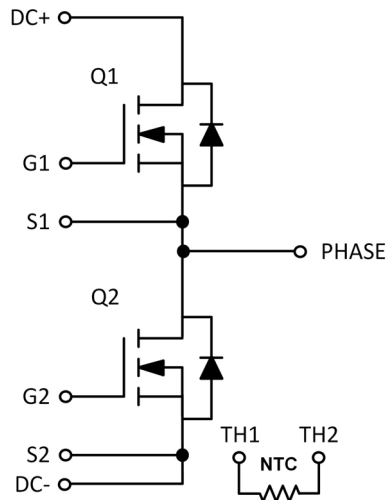


Figure 1. NXH006P120MNF2 Schematic Diagram

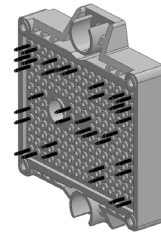
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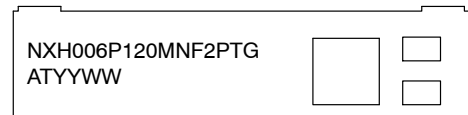
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PACKAGE PICTURE



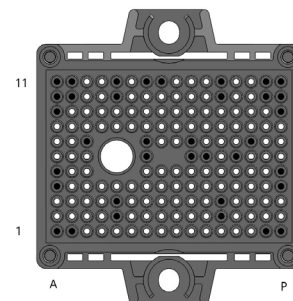
PIM36 56.7x42.5 (PRESS FIT)
CASE 180BY

MARKING DIAGRAM



XXXXX = Specific Device Code
AT = Assembly & Test Site Code
YWW = Year and Work Week Code

PIN CONNECTIONS



See Pin Function Description for pin names

ORDERING INFORMATION

See detailed ordering and shipping information on page 4 of this data sheet.

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PIN FUNCTION DESCRIPTION

Pin	Name	Description
A1	S1	Q1 Kelvin Emitter (High side switch)
A4	DC+	DC Positive Bus connection
A5	DC+	DC Positive Bus connection
A9	PHASE	Center point of half bridge
A10	PHASE	Center point of half bridge
A11	PHASE	Center point of half bridge
B1	G1	Q1 Gate (High side switch)
B10	PHASE	Center point of half bridge
B11	PHASE	Center point of half bridge
C7	DC-	DC Negative Bus connection
E2	DC+	DC Positive Bus connection
E3	DC+	DC Positive Bus connection
E10	S2	Q2 Kelvin Emitter (Low side switch)
E11	G2	Q2 Gate (Low side switch)
G6	DC-	DC Negative Bus connection
G7	DC-	DC Negative Bus connection
G11	TH1	Thermistor Connection 1
H11	TH2	Thermistor Connection 2
J6	DC-	DC Negative Bus connection
J7	DC-	DC Negative Bus connection
K6	DC-	DC Negative Bus connection
L2	DC+	DC Positive Bus connection
L3	DC+	DC Positive Bus connection
L10	S2	Q2 Kelvin Emitter (Low side switch)
L11	G2	Q2 Gate (Low side switch)
M6	DC-	DC Negative Bus connection
N7	DC-	DC Negative Bus connection
O1	G1	Q1 Gate (High side switch)
O10	PHASE	Center point of half bridge
O11	PHASE	Center point of half bridge
P1	S1	Q1 Kelvin Emitter (High side switch)
P4	DC+	DC Positive Bus connection
P5	DC+	DC Positive Bus connection
P9	PHASE	Center point of half bridge
P10	PHASE	Center point of half bridge
P11	PHASE	Center point of half bridge

NXH006P120MNF2PTG

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
SiC MOSFET			
Drain-Source Voltage	V_{DSS}	1200	V
Gate-Source Voltage	V_{GS}	+25/-15	V
Continuous Drain Current @ $T_c = 80^\circ\text{C}$ ($T_J = 175^\circ\text{C}$)	I_D	304	A
Pulsed Drain Current ($T_J = 175^\circ\text{C}$)	I_{Dpulse}	912	A
Maximum Power Dissipation ($T_J = 175^\circ\text{C}$)	P_{tot}	950	W
Short Circuit Withstand Time @ $V_{GE} = 15\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J \leq 150^\circ\text{C}$	T_{sc}	2.0	μs
Minimum Operating Junction Temperature	T_{JMIN}	-40	$^\circ\text{C}$
Maximum Operating Junction Temperature	T_{JMAX}	175	$^\circ\text{C}$

THERMAL PROPERTIES

Storage Temperature range	T_{stg}	-40 to 150	$^\circ\text{C}$
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INSULATION PROPERTIES

Isolation test voltage, $t = 1\text{ sec}$, 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

Rating	Symbol	Min	Max	Unit
Module Operating Junction Temperature	T_J	-40	175	$^\circ\text{C}$

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

$T_J = 25^\circ\text{C}$ unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_D = 800\ \mu\text{A}$	$V_{(BR)DSS}$	1200	-	-	V
Zero Gate Voltage Drain Current	$V_{GS} = 0\text{ V}$, $V_{DS} = 1200\text{ V}$	I_{DSS}	-	-	300	μA
Drain-Source On Resistance	$V_{GS} = 20\text{ V}$, $I_D = 200\text{ A}$, $T_J = 25^\circ\text{C}$	$R_{DS(ON)}$	-	5.48	7.2	m Ω
	$V_{GS} = 20\text{ V}$, $I_D = 200\text{ A}$, $T_J = 125^\circ\text{C}$		-	6.52	-	
	$V_{GS} = 20\text{ V}$, $I_D = 200\text{ A}$, $T_J = 150^\circ\text{C}$		-	7.28	-	
Gate-Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 80\text{ mA}$	$V_{GS(TH)}$	1.8	2.83	4.3	V
Gate Leakage Current	$V_{GS} = -10\text{ V} / 20\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	-1000	-	1000	nA
Forward Transconductance	$V_{DS} = 10\text{ V}$, $I_D = 200\text{ A}$	g_{FS}		14		S
Internal Gate Resistance		R_G		-		Ω
Input Capacitance	$V_{DS} = 800\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$	C_{ISS}	-	6687	-	pF
Reverse Transfer Capacitance		C_{RSS}	-	49	-	
Output Capacitance		C_{OSS}	-	1092	-	
C_{OSS} Stored Energy	$V_{DS} = 0\text{ V}$ to 800 V , $V_{GS} = 0\text{ V}$.	E_{OSS}	-	349	-	μJ
Total Gate Charge	$V_{DS} = 800\text{ V}$, $V_{GS} = 20\text{ V}$, $I_D = 200\text{ A}$	$Q_{G(TOTAL)}$	-	847	-	nC
Gate-Source Charge		Q_{GS}	-	231	-	nC
Gate-Drain Charge		Q_{GD}	-	195	-	nC

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ELECTRICAL CHARACTERISTICS (continued)

T_J = 25 °C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Turn-on Delay Time	T _J = 25°C V _{DS} = 600 V, I _D = 200 A V _{GS} = -5 V / 20 V, R _G = 1.8 Ω	t _{d(on)}	–	54	–	ns
Rise Time		t _r	–	21	–	
Turn-off Delay Time		t _{d(off)}	–	174	–	
Fall Time		t _f	–	22	–	
Turn-on Switching Loss per Pulse		E _{ON}	–	2.1	–	mJ
Turn off Switching Loss per Pulse		E _{OFF}	–	2.75	–	
Turn-on Delay Time	T _J = 150°C V _{DS} = 600 V, I _D = 200 A V _{GS} = -5 V / 20 V, R _G = 1.8 Ω	t _{d(on)}	–	48	–	ns
Rise Time		t _r	–	19	–	
Turn-off Delay Time		t _{d(off)}	–	196	–	
Fall Time		t _f	–	22	–	
Turn-on Switching Loss per Pulse		E _{ON}	–	2.3	–	mJ
Turn off Switching Loss per Pulse		E _{OFF}	–	2.93	–	
Diode Forward Voltage	I _D = 200 A, T _J = 25 °C	V _{SD}	–	4.0	6	V
	I _D = 200 A, T _J = 150 °C		–	3.6	–	
Thermal Resistance – chip-to-case	Thermal grease, Thickness = 2 Mil +2%, A = 2.8 W/mK	R _{thJC}	–	0.10	–	°C/W
Thermal Resistance – chip-to-heatsink		R _{thJH}	–	0.21	–	°C/W

Thermistor Characteristics

Nominal resistance	T = 25°C	R ₂₅	–	5	–	kΩ
Nominal resistance	T = 100°C	R ₁₀₀	–	457	–	Ω
Deviation of R25		ΔR/R	-3	–	3	%
Power dissipation		P _D	–	50	–	mW
Power dissipation constant			–	5	–	mW/K
B-value	B(25/50), tolerance ±3%		–	3375	–	K
B-value	B(25/100), tolerance ±3%		–	3455	–	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
NXH006P120MNF2PTG	NXH006P120MNF2PTG	F2HALFBR: Case 180BY Press-fit Pins with pre-applied thermal interface material (TIM) (Pb-Free / Halide Free)	20 Units / Blister Tray

NXH006P120MNF2PTG

TYPICAL CHARACTERISTICS HALFBRIDGE MOSFET

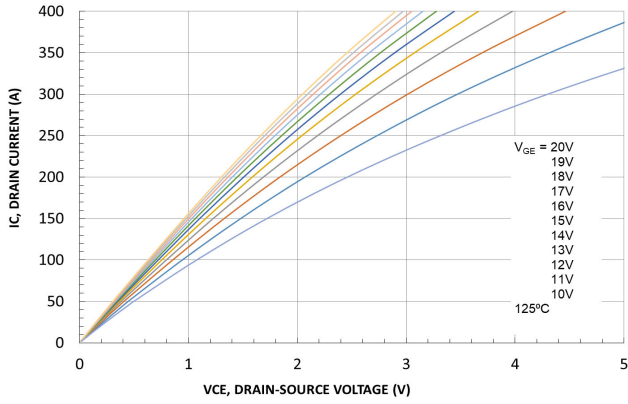


Figure 2. MOSFET Typical Output Characteristic at 125°C

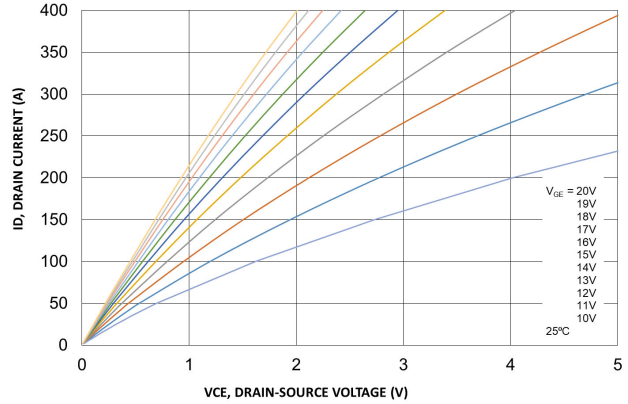


Figure 3. MOSFET Typical Output Characteristic at 25°C

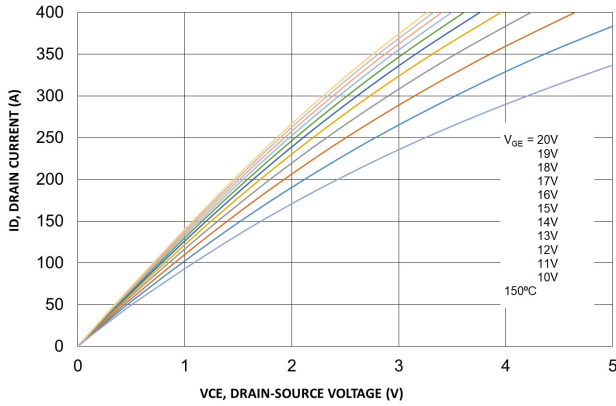


Figure 4. MOSFET Typical Output Characteristic at 150°C

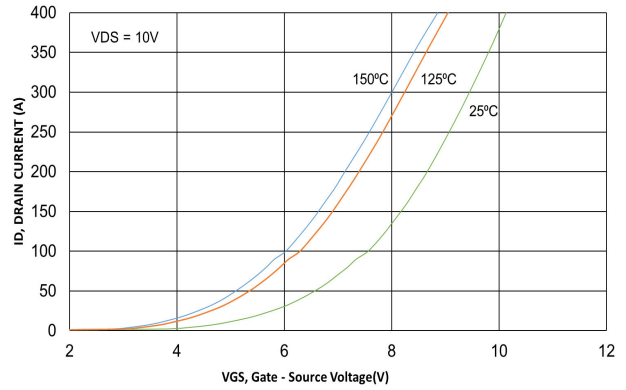


Figure 5. MOSFET Typical Transfer Characteristic

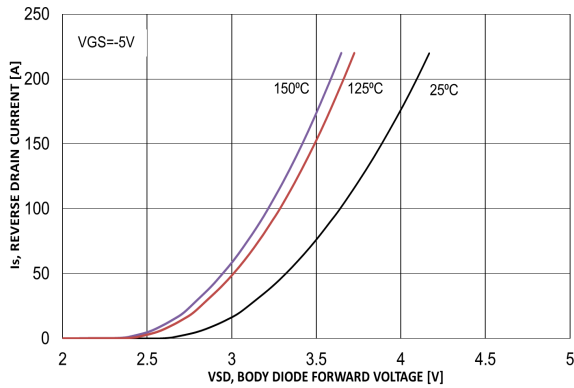


Figure 6. Body Diode Forward Characteristic

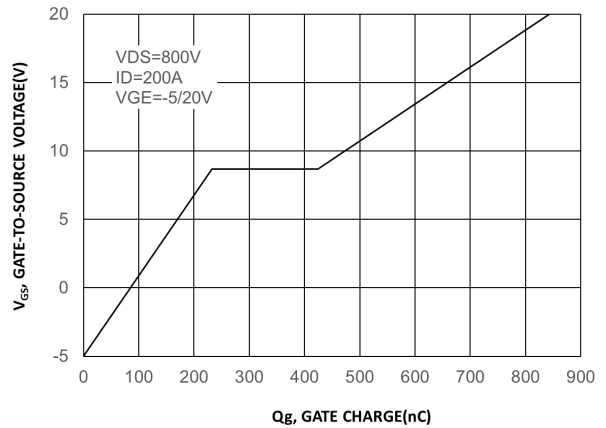


Figure 7. Gate-to-Source Voltage vs. Total Charge

NXH006P120MNF2PTG

TYPICAL CHARACTERISTICS

(25°C unless otherwise noted)

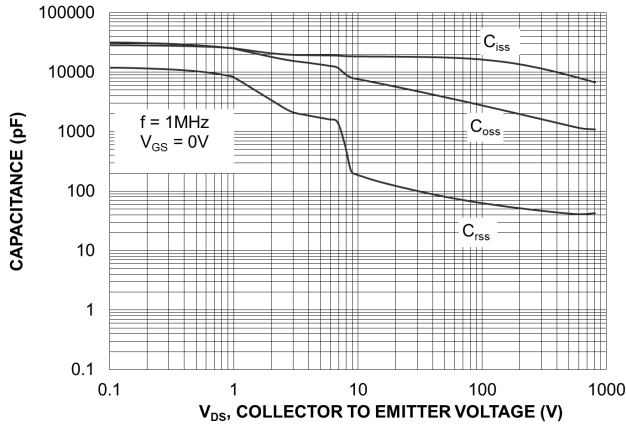


Figure 8. Capacitance vs. Drain-to-Source Voltage

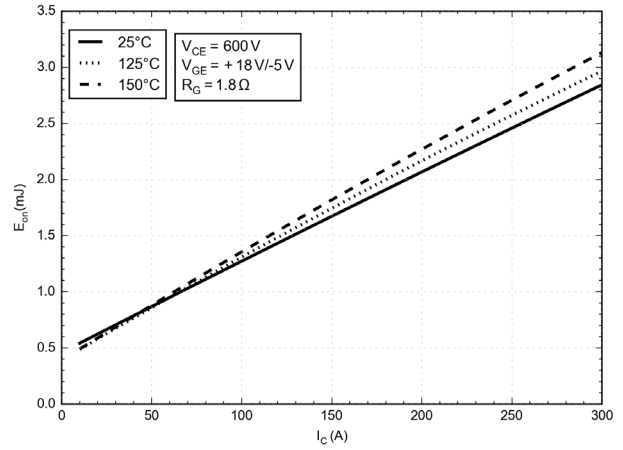


Figure 9. Typical Switching Loss E_{on} vs. I_C

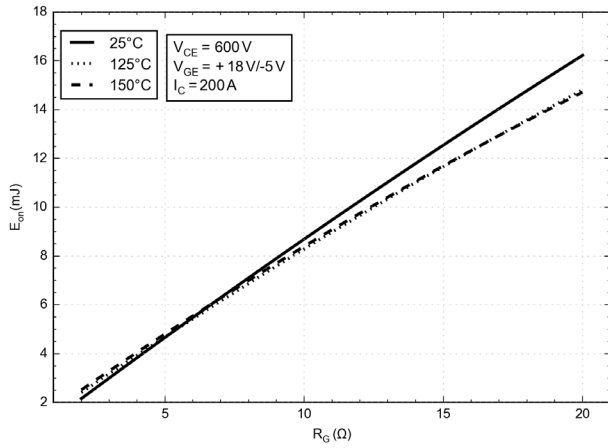


Figure 10. Typical Switching Loss E_{on} vs. R_g

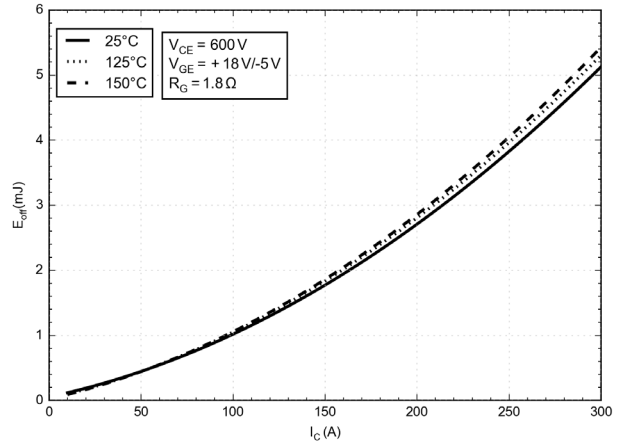


Figure 11. Typical Switching Loss E_{off} vs. I_C

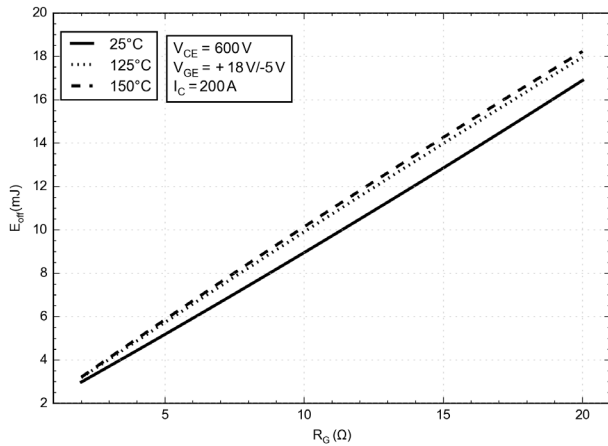


Figure 12. Typical Switching Loss E_{off} vs. R_g

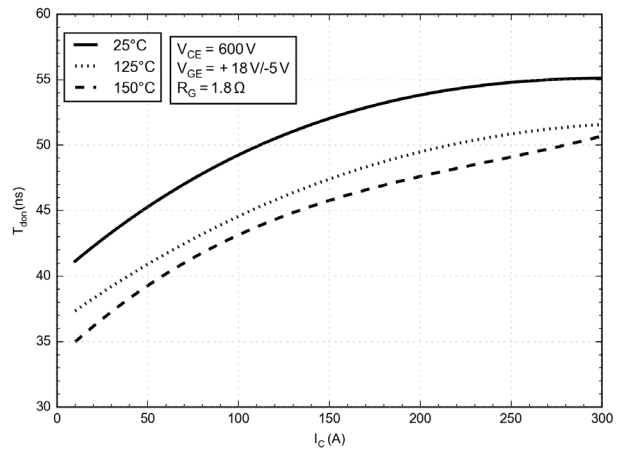


Figure 13. Typical Switching Loss T_{don} vs. I_C

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TYPICAL CHARACTERISTICS

(25°C unless otherwise noted)

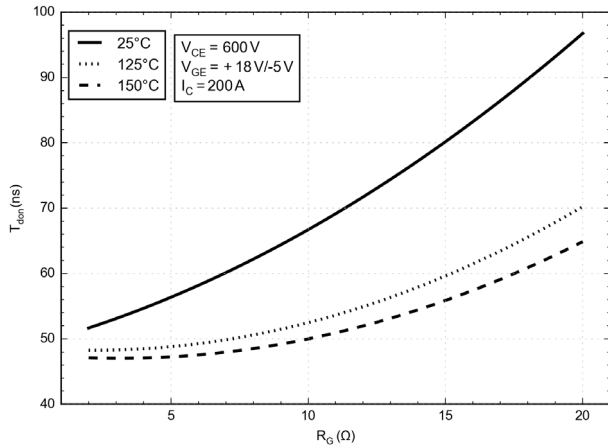


Figure 14. Typical Switching Loss T_{don} vs. R_g

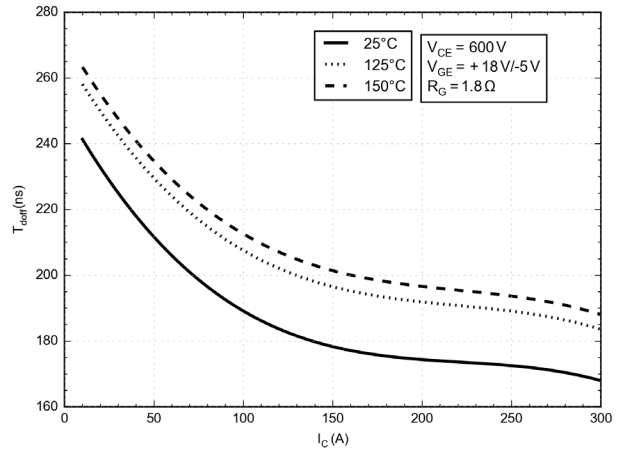


Figure 15. Typical Switching Loss T_{doff} vs. I_C

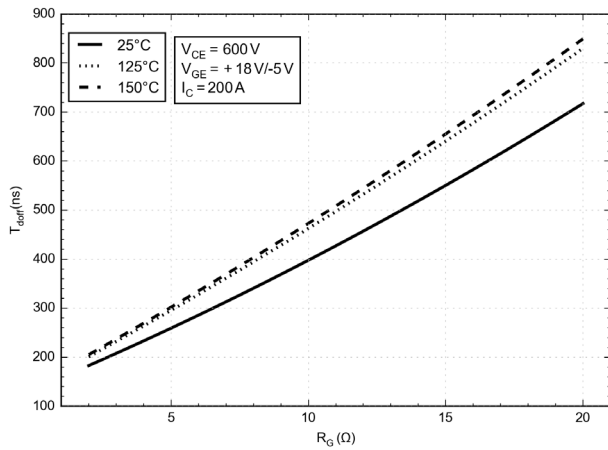


Figure 16. Typical Switching Loss T_{doff} vs. R_g

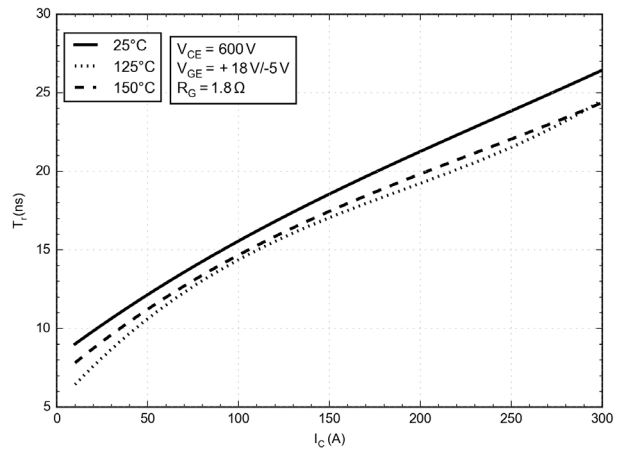


Figure 17. Typical Switching Loss T_r vs. I_C

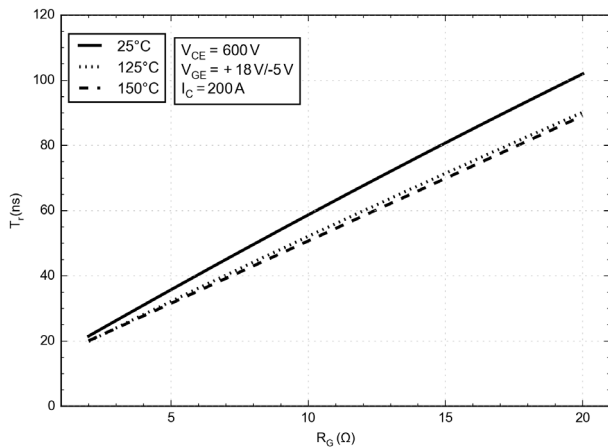


Figure 18. Typical Switching Loss T_r vs. R_g

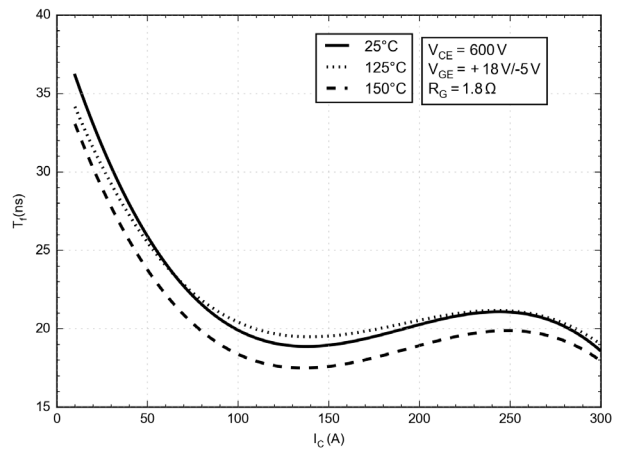


Figure 19. Typical Switching Loss T_f vs. I_C

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TYPICAL CHARACTERISTICS

(25°C unless otherwise noted)

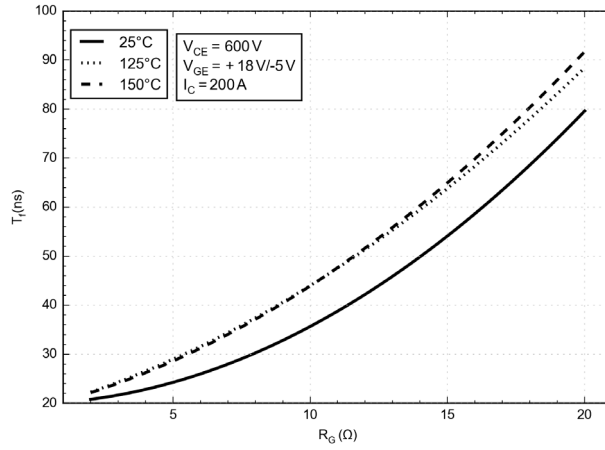


Figure 20. Typical Switching Loss Tf vs. Rg

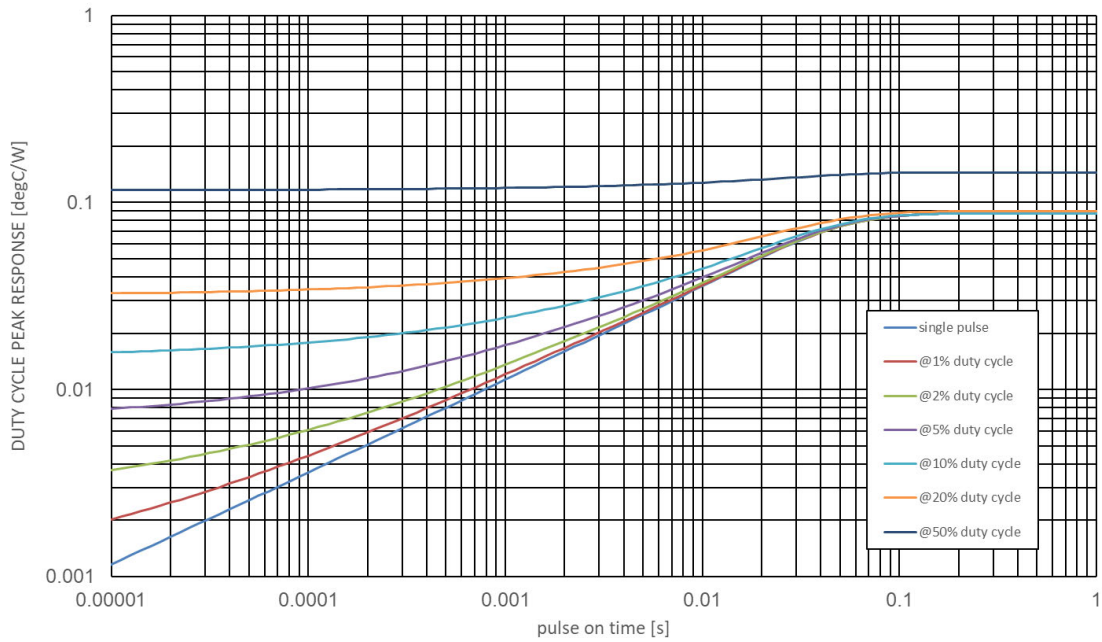


Figure 21. MOSFET Junction-to-Case Transient Thermal Impedance

MECHANICAL CASE OUTLINE

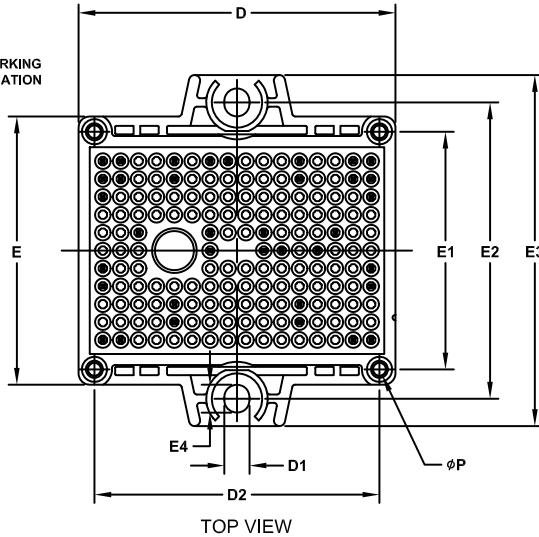
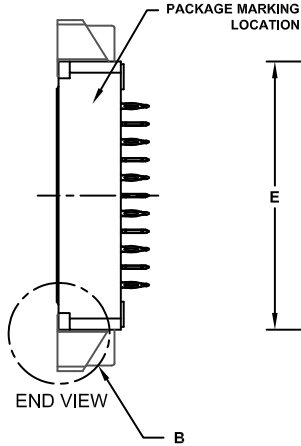
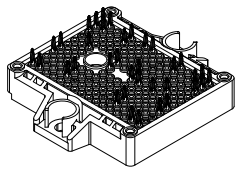
PACKAGE DIMENSIONS

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PIM36 56.7x42.5 (PRESS FIT) CASE 180BY ISSUE B

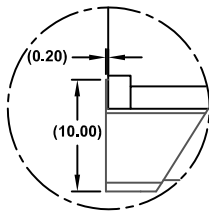
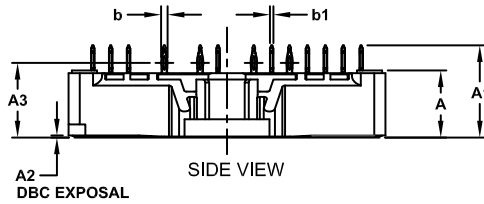
DATE 28 JAN 2021



NOTES:

1. CONTROLLING DIMENSION: MILLIMETERS
2. PIN POSITION TOLERANCE IS $\pm 0.4\text{mm}$

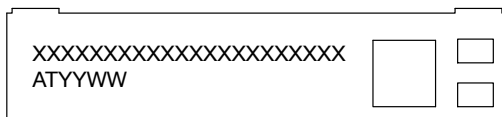
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	11.65	12.00	12.35
A1	16.00	16.50	17.00
A2	0.00	0.35	0.60
A3	12.85	13.35	13.85
b	1.15	1.20	1.25
b1	0.59	0.64	0.69
D	56.40	56.70	57.00
D1	4.40	4.50	4.60
D2	50.85	51.00	51.15
E	47.70	48.00	48.30
E1	42.35	42.50	42.65
E2	52.90	53.00	53.10
E3	62.30	62.80	63.30
E4	4.90	5.00	5.10
P	2.20	2.30	2.40



DETAIL B
SCALE N/A

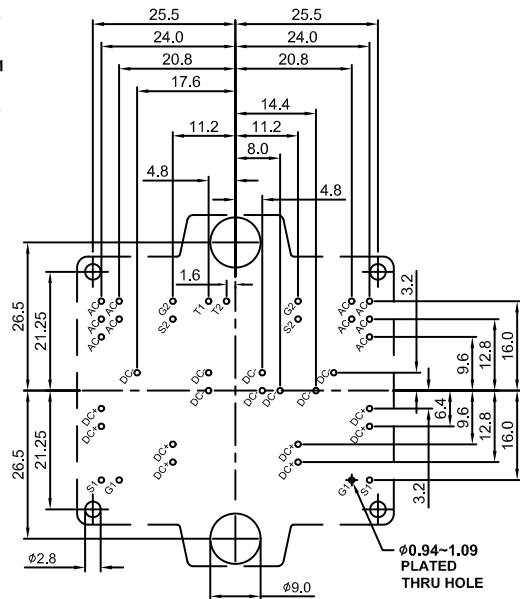
SCREW PART (BOTH SIDE)
BOTTOM SURFACE EXTRUSION

GENERIC MARKING DIAGRAM*



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 "μ", may or may not be present. Some products may not follow the Generic Marking.



RECOMMENDED MOUNTING PATTERN

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