chanhvinh.com

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

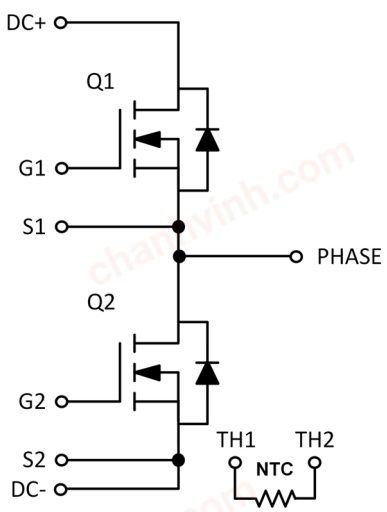


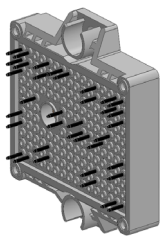
Figure 1. NXH006P120MNF2 Schematic Diagram

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

ON Semiconductor®

www.onsemi.com

PACKAGE PICTURE



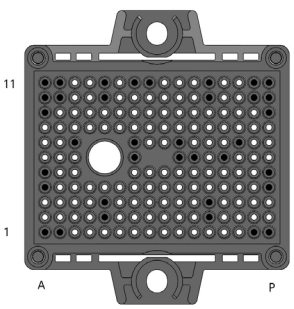
PIM36 56.7x42.5 (PRESS FIT)
CASE 180BY

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.

© Semiconductor Components Industries, LLC, 2019

chanhvinh.com

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

chanhvinh.com

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°C (T_J = 175°C)	I_D	304	A
Pulsed Drain Current (T_J = 175°C)	I_{Dpulse}	912	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	950	W
Short Circuit Withstand Time @ V_{GE} = 15 V, V_{CE} = 600 V, $T_J \leq$ 150°C	T_{sc}	2.0	μs
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
THERMAL PROPERTIES			
Storage Temperature range	T_{stg}	−40 to 150	°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

Rating	Symbol	Min	Max	Unit
Module Operating Junction Temperature	T_J	−40	175	°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 noted

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

chanhvinh.com

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

chanhvinh.com

TYPICAL CHARACTERISTICS

HALFBRIDGE MOSFET

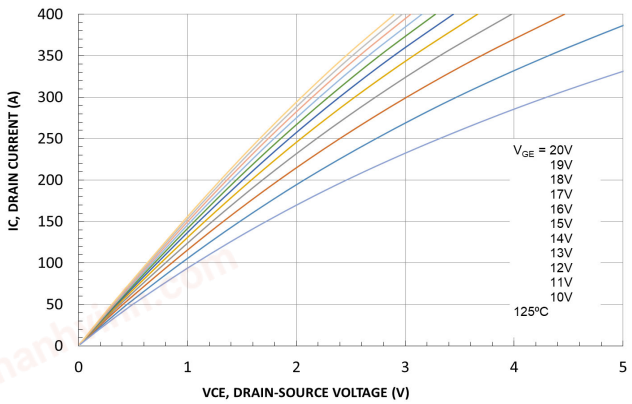


Figure 2. MOSFET Typical Output Characteristic at 125°C

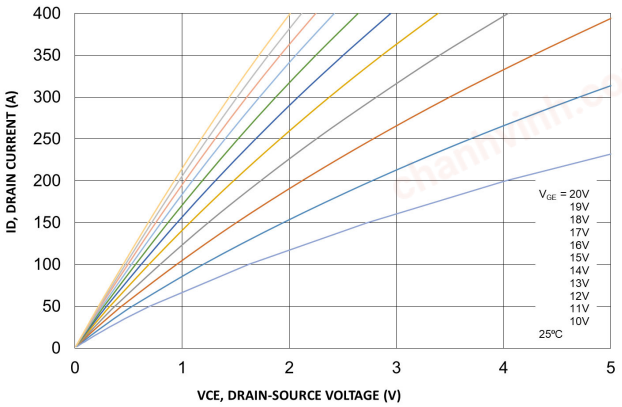


Figure 3. MOSFET Typical Output Characteristic

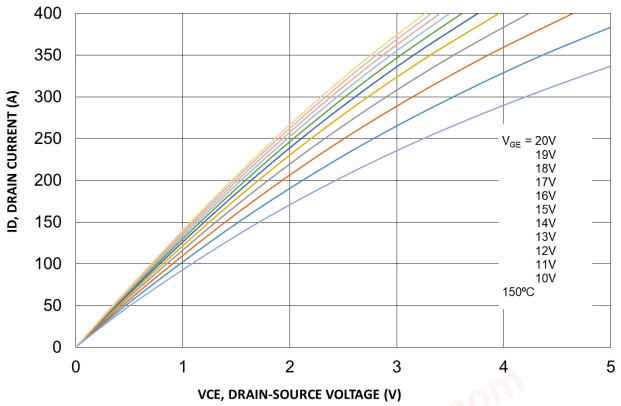


Figure 4. MOSFET Typical Output Characteristic

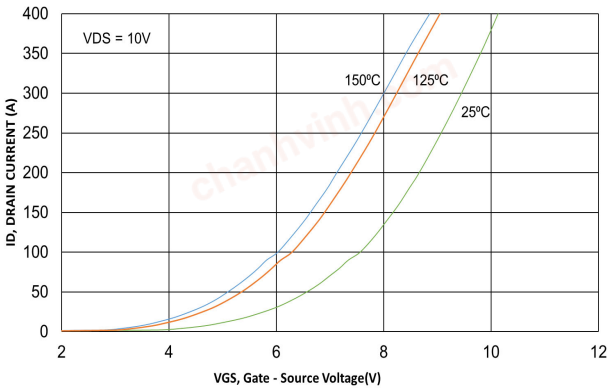


Figure 5. MOSFET Typical Transfer Characteristic

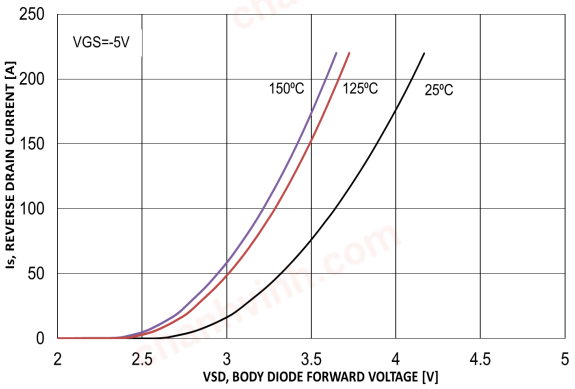


Figure 6. Body Diode Forward Characteristic

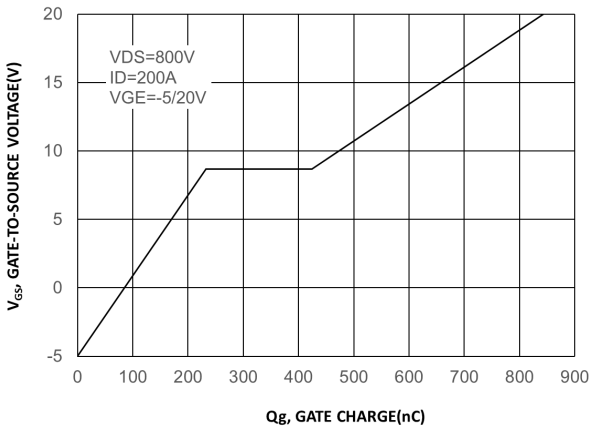


Figure 7. Gate−to−Source Voltage vs. Total Charge

chanhvinh.com

TYPICAL CHARACTERISTICS

(25°C unless otherwise noted)

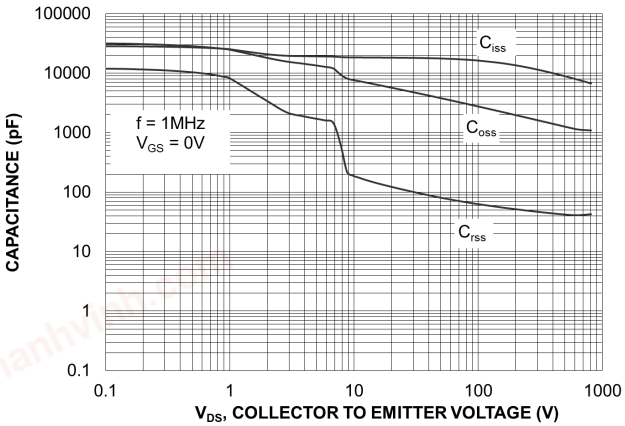


Figure 8. Capacitance vs. Drain−to−Source Voltage

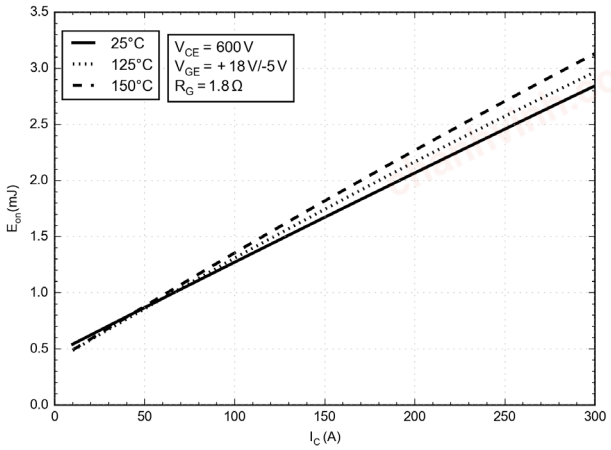


Figure 9. Typical Switching Loss Eon vs. IC

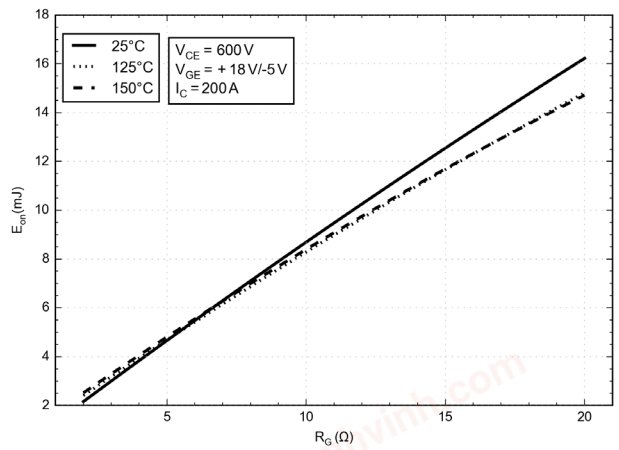


Figure 10. Typical Switching Loss Eon vs. Rg

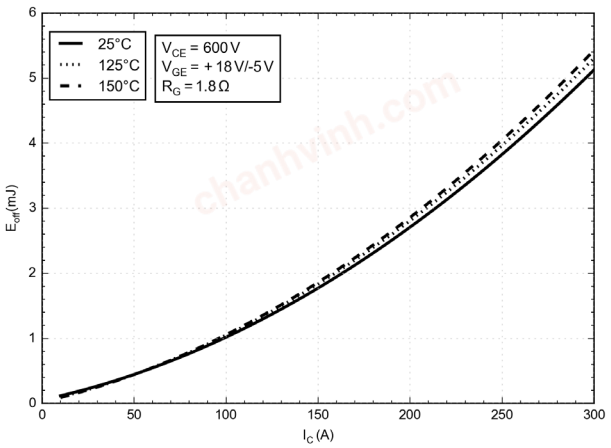


Figure 11. Typical Switching Loss Eoff vs. IC

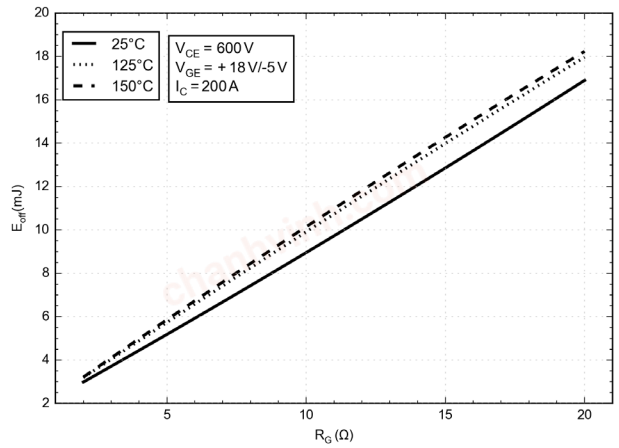


Figure 12. Typical Switching Loss Eoff vs. Rg

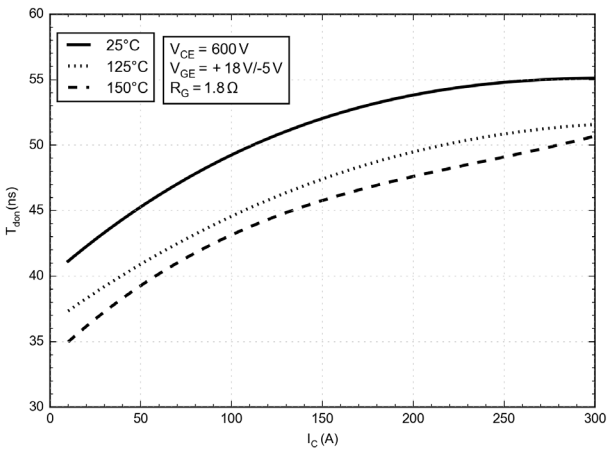


Figure 13. Typical Switching Loss Tdon vs. IC

chanhvinh.com

TYPICAL CHARACTERISTICS

(25°C unless otherwise noted)

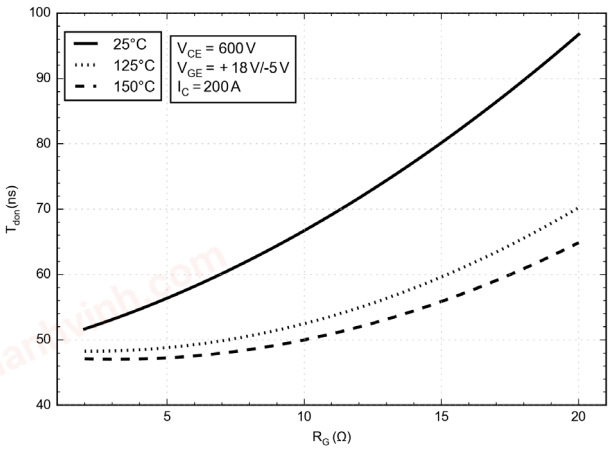


Figure 14. Typical Switching Loss Tdon vs. Rg

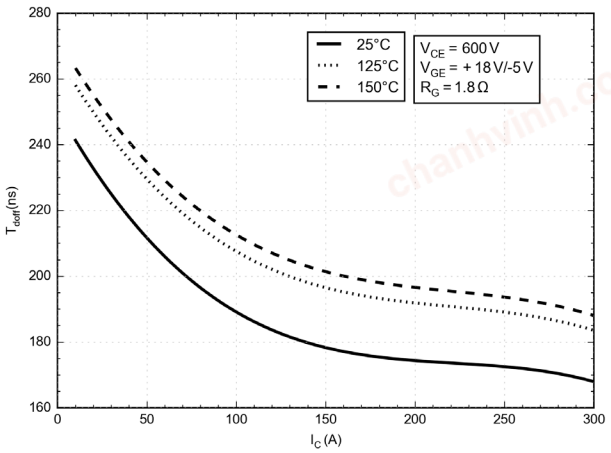


Figure 15. Typical Switching Loss Tdoff vs. IC

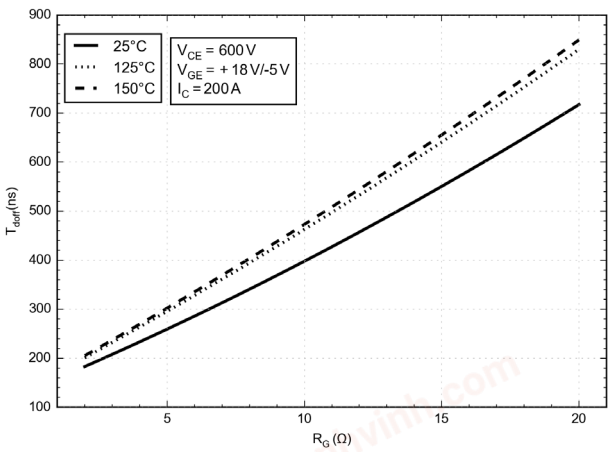


Figure 16. Typical Switching Loss Tdoff vs. Rg

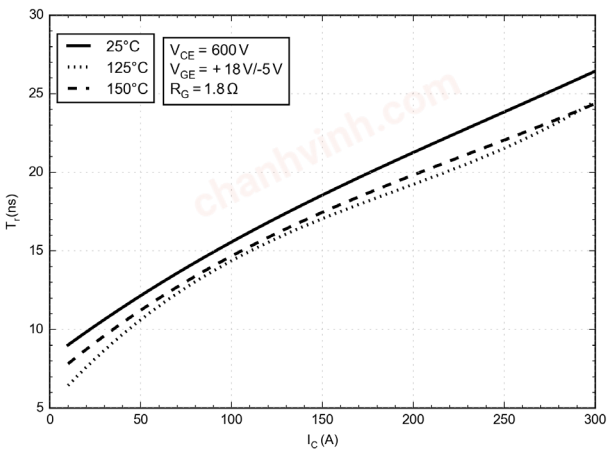


Figure 17. Typical Switching Loss Tr vs. IC

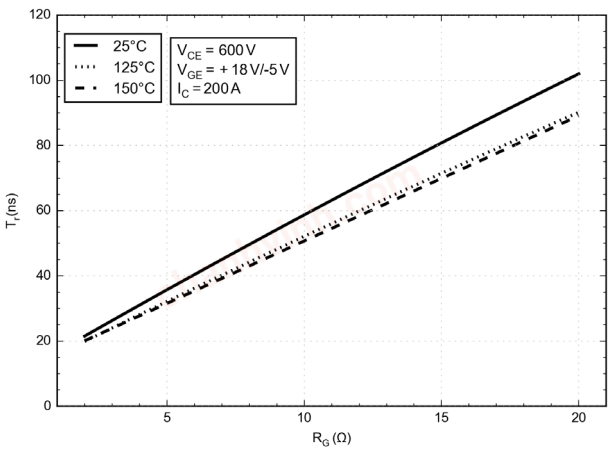


Figure 18. Typical Switching Loss Tr vs. Rg

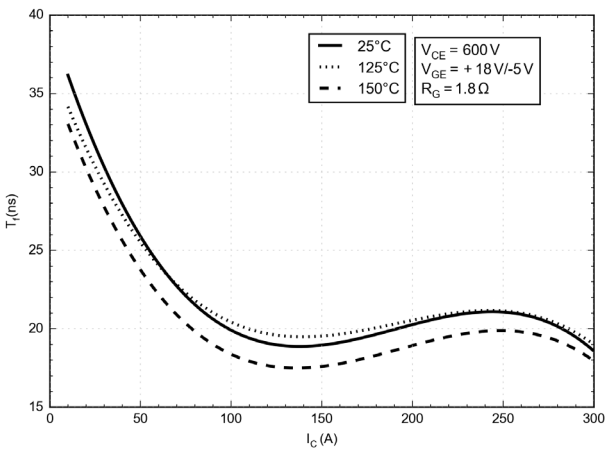


Figure 19. Typical Switching Loss Tf vs. IC

chanhvinh.com

TYPICAL CHARACTERISTICS

(25°C unless otherwise noted)

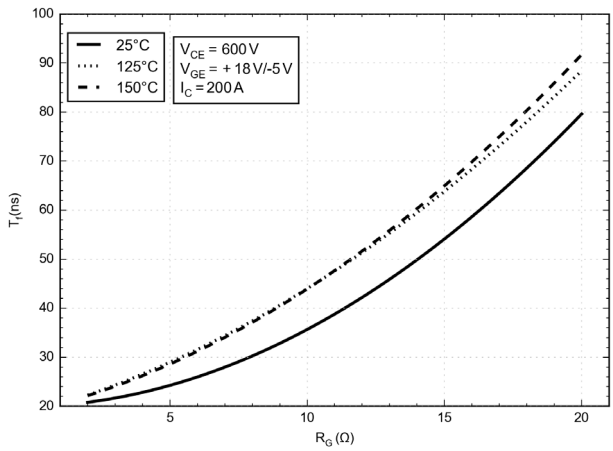


Figure 20. Typical Switching Loss Tf vs. Rg

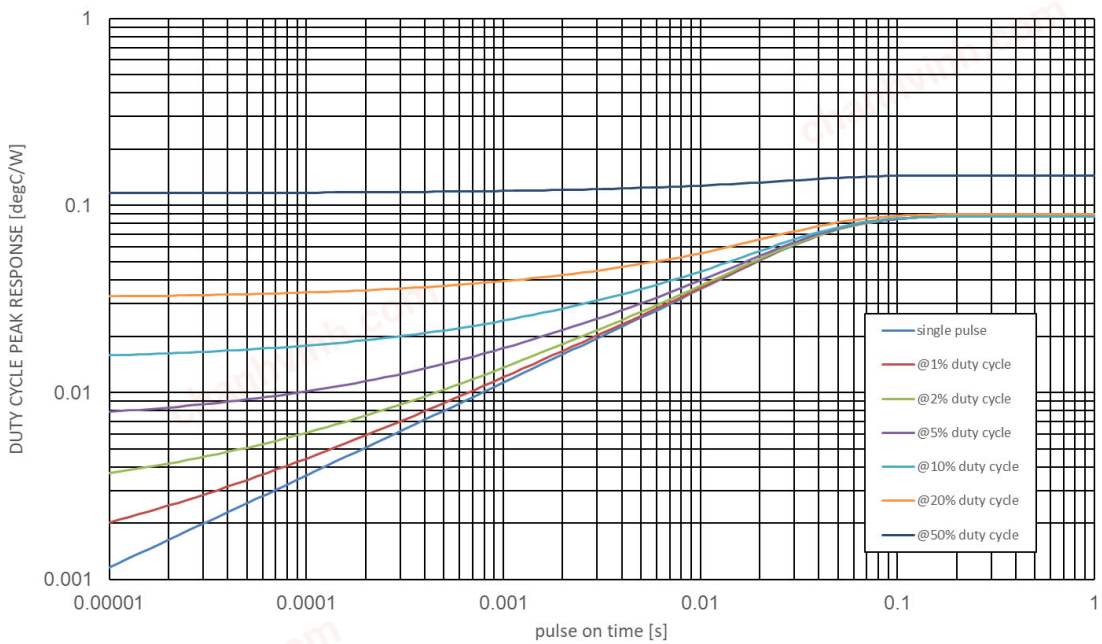


Figure 21. MOSFET Junction−to−Case Transient Thermal Impedance

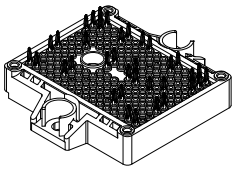
chanhvinh.com

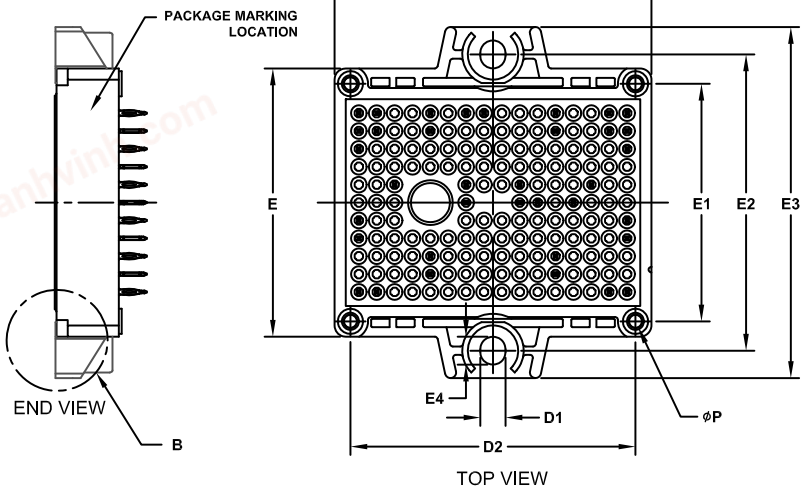
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

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

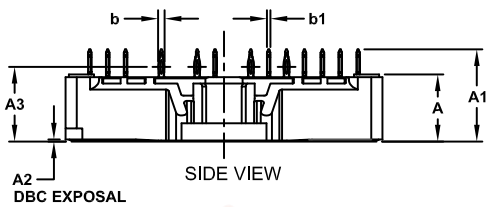
DATE 28 JAN 2021

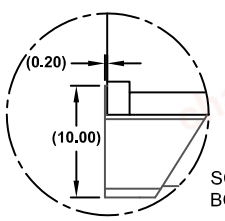




NOTES:
1. CONTROLLING DIMENSION: MILLIMETERS
2. PIN POSITION TOLERANCE IS ± 0.4mm

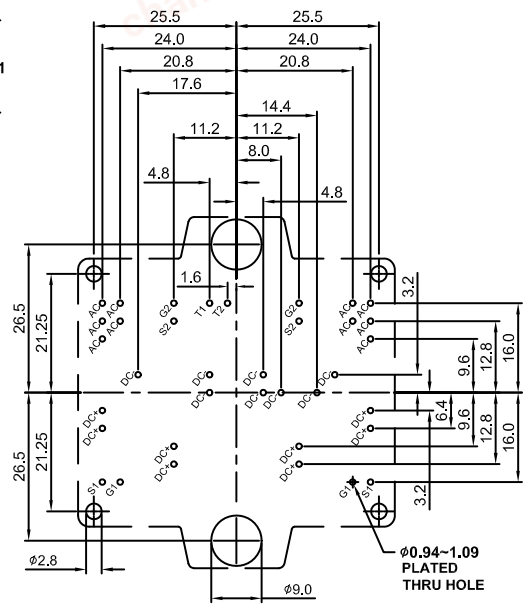
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	11.65	12.00	12.35
A1	16.00	16.50	17.00
A2	0.00	0.35	0.60
A3	12.85	13.35	13.85
b	1.15	1.20	1.25
b1	0.59	0.64	0.69
D	56.40	56.70	57.00
D1	4.40	4.50	4.60
D2	50.85	51.00	51.15
E	47.70	48.00	48.30
E1	42.35	42.50	42.65
E2	52.90	53.00	53.10
E3	62.30	62.80	63.30
E4	4.90	5.00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





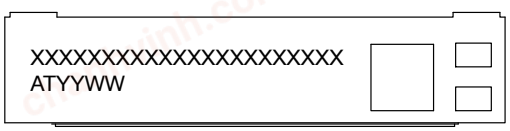
SCREW PART(BOTH SIDE)
BOTTOM SURFACE EXTRUSION

DETAIL B
SCALE N/A



RECOMMENDED MOUNTING PATTERN

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 “▪”, may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	**98AON19725H**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.	
DESCRIPTION:	**PIM36 56.7x42.5 (PRESS FIT)**		**PAGE 1 OF 1**

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

© Semiconductor Components Industries, LLC, 2018

chanhvinh.com

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

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

ON Semiconductor 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

◊