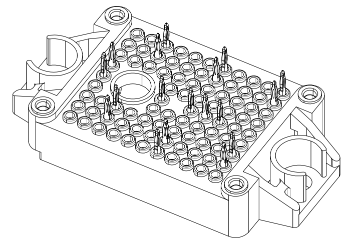
F1-2 PACK SiC MOSFET Module

Product Preview

NXH010P90MNF1PTG, NXH010P90MNF1PG

The NXH010P120MNF1 is a power module containing an 10 mΩ/900 V SiC MOSFET half bridge and a thermistor in an F1 package.



PIM18 33.8x42.5 (PRESS FIT)
CASE 180BW

Features

- 10 mΩ/900 V SiC MOSFET Half Bridge
- Thermistor
- Options with Pre−applied Thermal Interface Material (TIM) and without Pre−applied TIM
- Press−fit Pins

Typical Applications

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

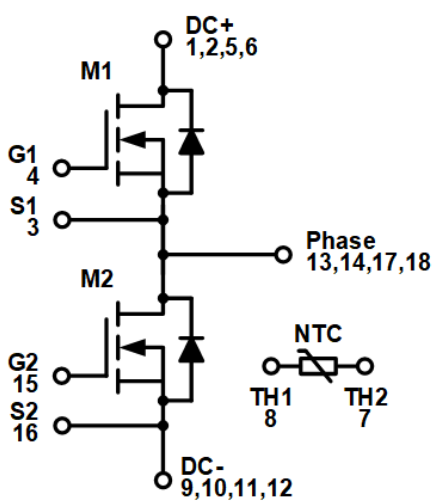
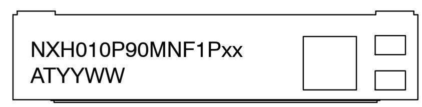


Figure 1. NXH010P90MNF1 Schematic Diagram

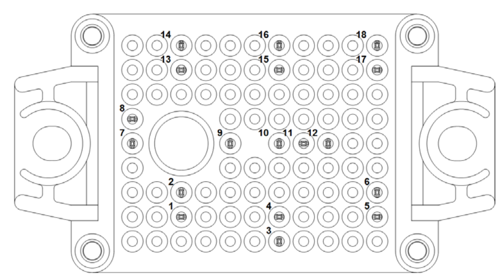
This document contains information on a product under development. **onsemi** reserves the right to change or discontinue this product without notice.

MARKING DIAGRAM



NXH010P90MNF1PTG	= Specific Device Code
NXH010P90MNF1PG	= Specific Device Code
AT	= Assembly & Test Site Code
YYWW	= 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.

March, 2022 − Rev. P2

PIN FUNCTION DESCRIPTION

Pin	Name	Description
1	DC+	DC Positive Bus connection
2	DC+	DC Positive Bus connection
3	S1	Q1 Kelvin Emitter (High side switch)
4	G1	Q1 Gate (High side switch)
5	DC+	DC Positive Bus connection
6	DC+	DC Positive Bus connection
7	TH2	Thermistor Connection 2
8	TH1	Thermistor Connection 1
9	DC−	DC Negative Bus connection
10	DC−	DC Negative Bus connection
11	DC−	DC Negative Bus connection
12	DC−	DC Negative Bus connection
13	PHASE	Center point of half bridge
14	PHASE	Center point of half bridge
15	G2	Q2 Gate (Low side switch)
16	S2	Q2 Kelvin Emitter (High side switch)
17	PHASE	Center point of half bridge
18	PHASE	Center point of half bridge

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
SiC MOSFET			
Drain−Source Voltage	V_{DSS}	900	V
Gate−Source Voltage	V_{GS}	+18/−8	V
Continuous Drain Current @ T_C = 80°C (T_J = 175°C)	I_D	154	A
Pulsed Drain Current (T_J = 175°C)	I_{Dpulse}	308	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	328	W
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 s, 60 Hz	V_{is}	4800	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	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.

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 = 400 μA	$V_{(BR)DSS}$	900	–	–	V
Zero Gate Voltage Drain Current	V_{GS} = 0 V, V_{DS} = 900 V	I_{DSS}	–	–	200	μA
Drain−Source On Resistance	V_{GS} = 15 V, I_D = 100 A, T_J = 25°C	$R_{DS(ON)}$	–	10.03	14	mΩ
	V_{GS} = 15 V, I_D = 100 A, T_J = 125°C		–	10.08	–	
	V_{GS} = 15 V, I_D = 100 A, T_J = 150°C		–	11.61	–	
Gate−Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 40 mA	$V_{GS(TH)}$	1.8	2.74	4.3	V
Gate Leakage Current	V_{GS} = −5/15 V, V_{DS} = 0 V	I_{GSS}	−500	–	500	nA
Internal Gate Resistance		R_G		0.8		Ω
Input Capacitance	V_{DS} = 450 V, V_{GS} = 0 V, f = 1 MHz	C_{ISS}	–	7007	–	pF
Reverse Transfer Capacitance		C_{RSS}	–	44	–	
Output Capacitance		C_{OSS}	–	665	–	
C_{OSS} Stored Energy	V_{DS} = 0 V to 800 V, V_{GS} = 0 V	E_{OSS}	–	251	–	μJ
Total Gate Charge	V_{DS} = 720 V, V_{GS} = −15/15 V, I_D = 100 A	$Q_{G(TOTAL)}$	–	546.4	–	nC
Gate−Source Charge		Q_{GS}	–	105.45	–	nC
Gate−Drain Charge		Q_{GD}	–	122.7	–	nC
Turn−on Delay Time	T_J = 25°C V_{DS} = 600 V, I_D = 100 A V_{GS} = −5 V/18 V, R_G = 1.5 Ω	$t_{d(on)}$	–	61.2	–	ns
Rise Time		t_r	–	16.5	–	
Turn−off Delay Time		$t_{d(off)}$	–	148	–	
Fall Time		t_f	–	11.9	–	
Turn−on Switching Loss per Pulse		E_{ON}	–	0.65	–	mJ
Turn off Switching Loss per Pulse		E_{OFF}	–	1.18	–	
Turn−on Delay Time	T_J = 150°C V_{DS} = 600 V, I_D = 100 A V_{GS} = −5 V/18 V , R_G = 1.5 Ω	$t_{d(on)}$	–	58.4	–	ns
Rise Time		t_r	–	15.6	–	
Turn−off Delay Time		$t_{d(off)}$	–	164	–	
Fall Time		t_f	–	13.1	–	
Turn−on Switching Loss per Pulse		E_{ON}	–	0.71	–	mJ
Turn off Switching Loss per Pulse		E_{OFF}	–	1.23	–	
Diode Forward Voltage	I_D = 100 A, T_J = 25°C	V_{SD}	–	4.47	6	V
	I_D = 100 A, T_J = 150°C		–	3.92	–	
Reverse Recovery Time	T_J = 25°C V_{DS} = 600 V, I_D = 100 A V_{GS} = −5 V/18 V, R_G = 1.5 Ω	t_{rr}	–	19.4	–	ns
Reverse Recovery Charge		Q_{rr}	–	821	–	nC
Peak Reverse Recovery Current		I_{RRM}	–	64.2	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	8995	–	A/μs
Reverse Recovery Energy		E_{rr}	–	400	–	μJ
Reverse Recovery Time	T_J = 150°C V_{DS} = 450 V, I_D = 100 A V_{GS} = −5 V/18 V , R_G = 1.8 Ω	t_{rr}	–	25	–	ns
Reverse Recovery Charge		Q_{rr}	–	1709	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	108	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	13319	–	A/μs
Reverse Recovery Energy		E_{rr}	–	875	–	μJ
Thermal Resistance − chip−to−case	M1, M2	R_{thJC}	–	0.29	–	°C/W
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness = 2 Mil _2%, A = 2.8 W/mK	R_{thJH}	–	0.46	–	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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

ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH010P90MNF1PG	NXH010P90MNF1PG	F1−2PACK: Case 180BW Press−fit Pins (Pb − Free and Halide − Free)	28 Units / Blister Tray
NXH010P90MNF1PTG	NXH010P90MNF1PTG	F1−2PACK: Case 180BW Press−fit Pins with pre − applied thermal interface material (TIM) (Pb − Free and Halide − Free)	28 Units / Blister Tray

TYPICAL CHARACTERISTICS

SiC MOSFET (M1/M2)

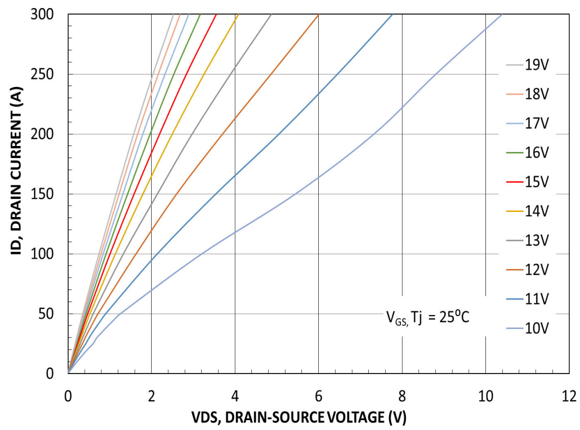


Figure 2. MOSFET Typical Output Characteristics

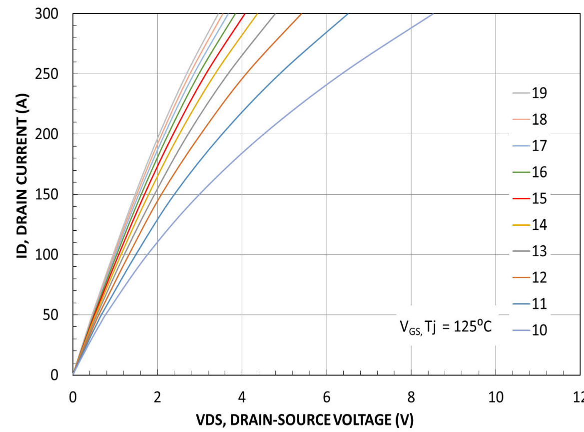


Figure 3. MOSFET Typical Output Characteristics

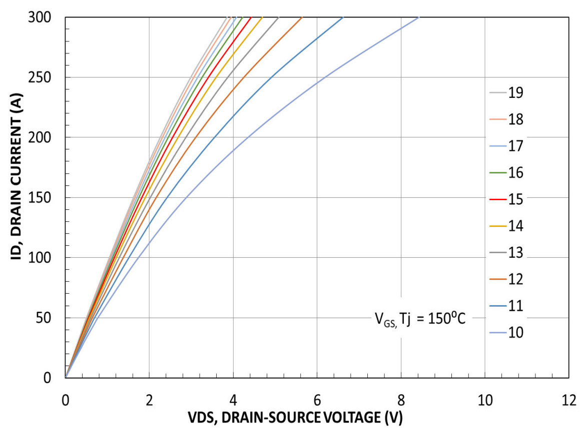


Figure 4. MOSFET Typical Output Characteristics

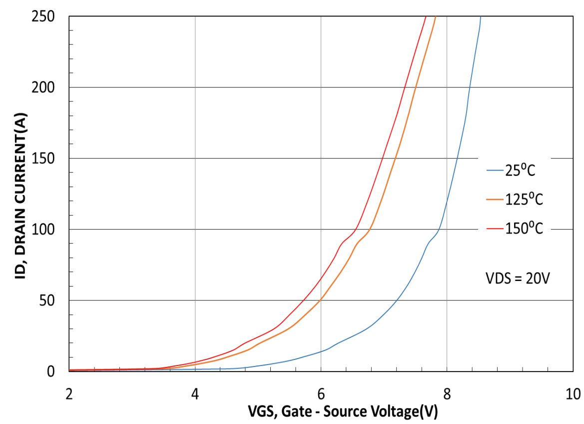


Figure 5. MOSFET Typical Transfer Characteristics

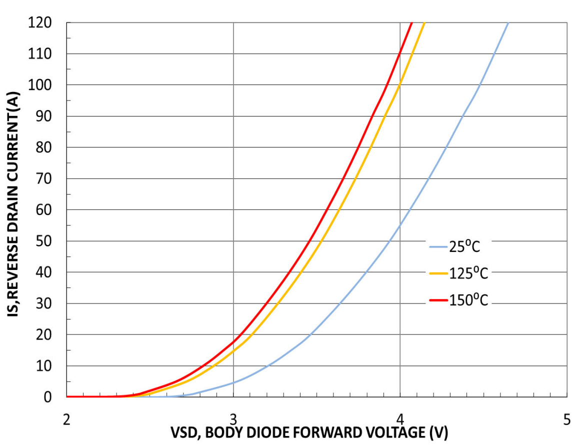


Figure 6. Body Diode Forward Characteristics

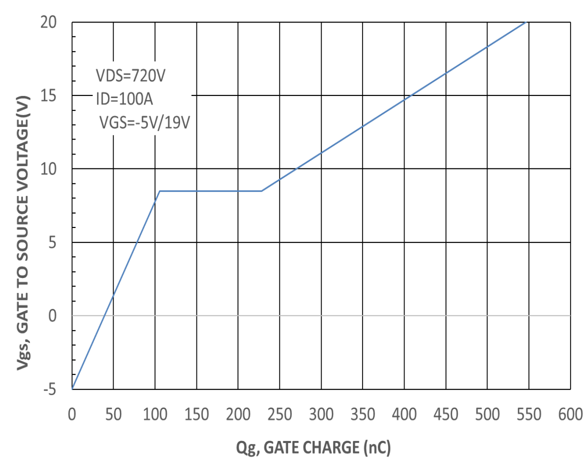


Figure 7. Gate−to−Source Voltage vs. Total Charge

TYPICAL CHARACTERISTICS

SiC MOSFET (M1/M2)

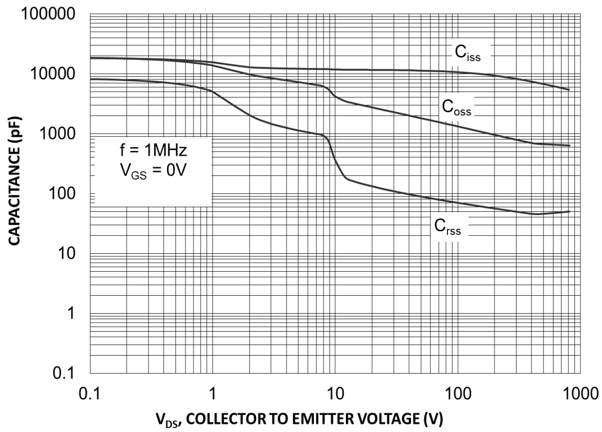


Figure 8. Capacitance vs. Drain−to−Source Voltage

TYPICAL CHARACTERISTICS

M1/M2 MOSFET SWITCHING CHARACTERISTICS

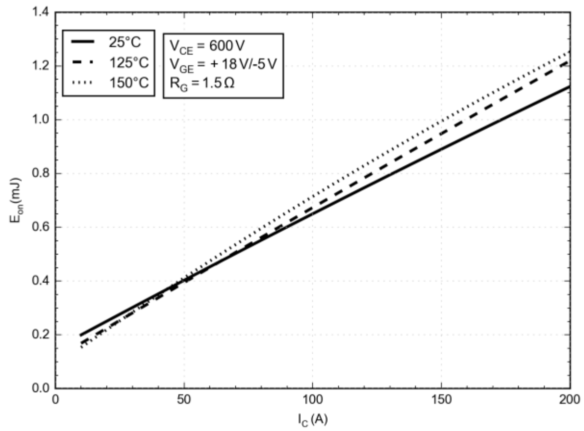


Figure 9. Typical Switching Loss Eon vs. IC

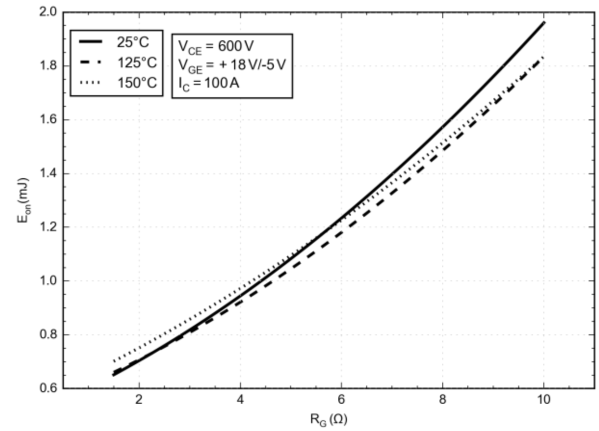


Figure 10. Typical Switching Loss Eon vs. R_G

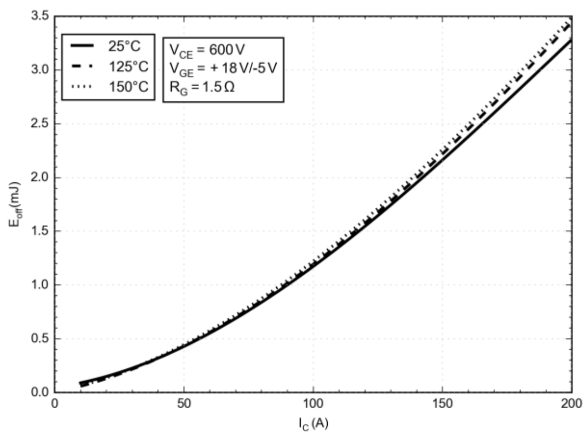


Figure 11. Typical Switching Loss Eoff vs. IC

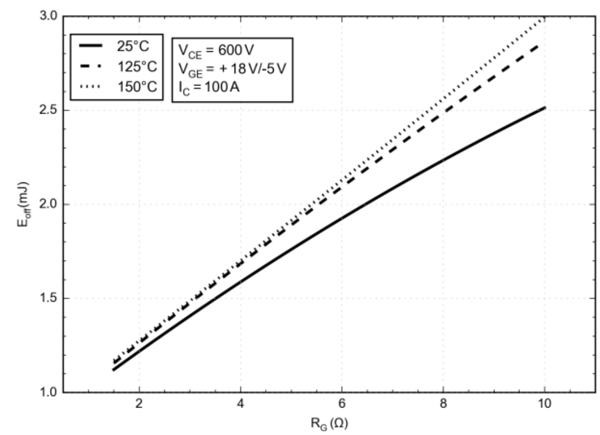


Figure 12. Typical Switching Loss Eoff vs. R_G

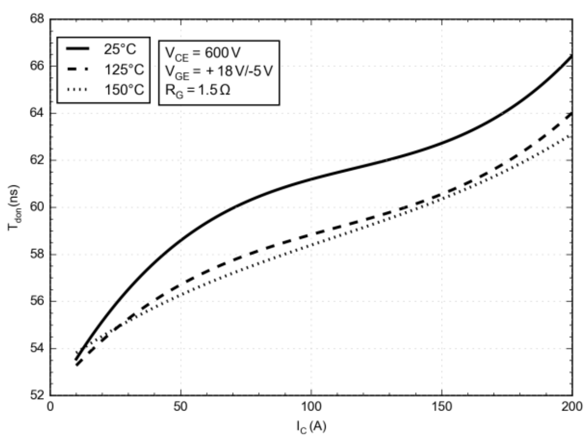


Figure 13. Typical Turn−On Switching Tdon vs. IC

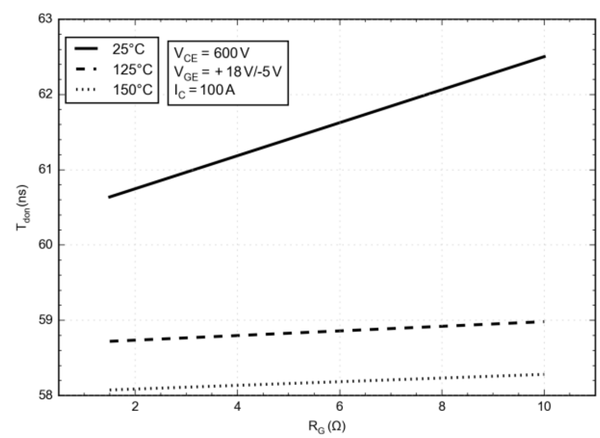


Figure 14. Typical Turn−On Switching Tdon vs. R_G

TYPICAL CHARACTERISTICS

M1/M2 MOSFET SWITCHING CHARACTERISTICS

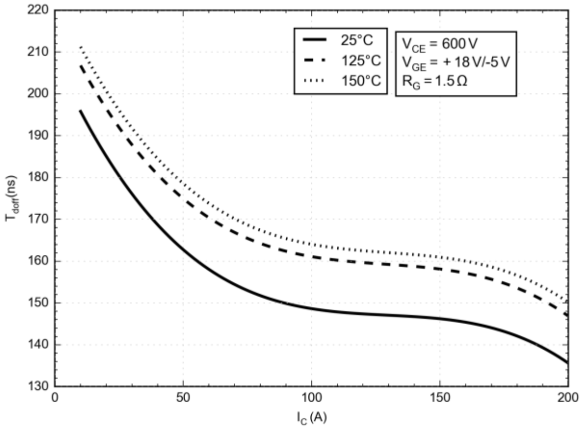


Figure 15. Typical Turn−off Switching Tdoff vs. IC

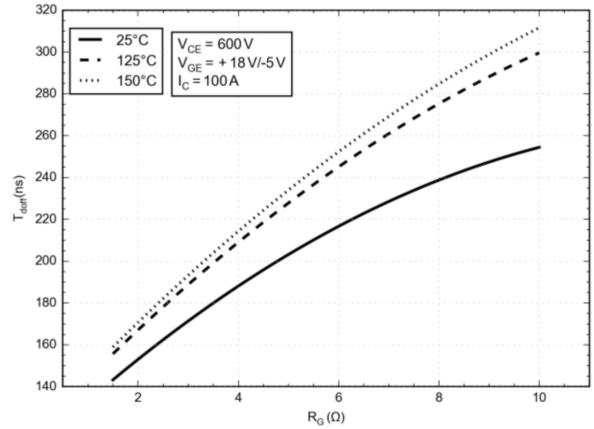


Figure 16. Typical Turn−off Switching Tdoff vs. R_G

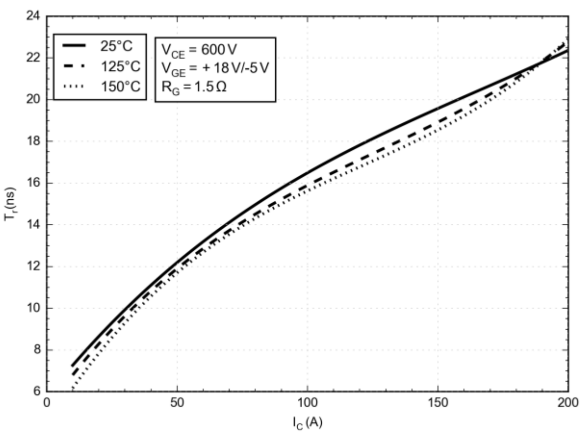


Figure 17. Typical Turn−On Switching Tr vs. IC

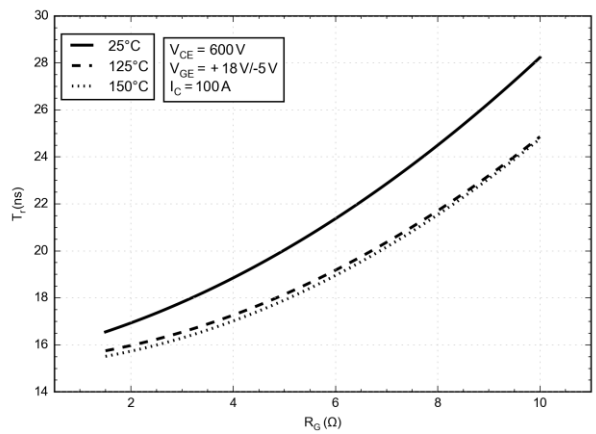


Figure 18. Typical Turn−On Switching Tr vs. R_G

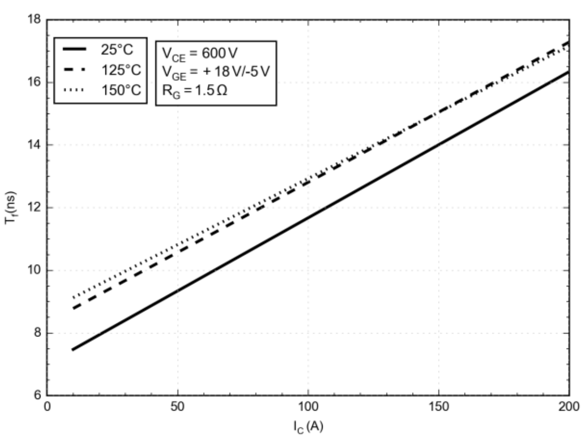


Figure 19. Typical Turn−Off Switching Tf vs. IC

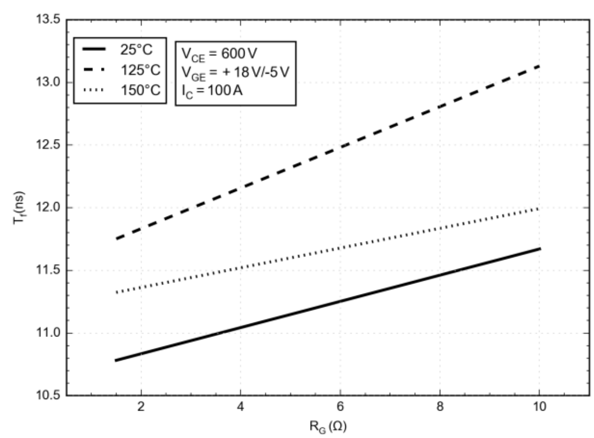


Figure 20. Typical Turn−Off Switching Tf vs. R_G

TYPICAL CHARACTERISTICS

M1/M2 MOSFET SWITCHING CHARACTERISTICS

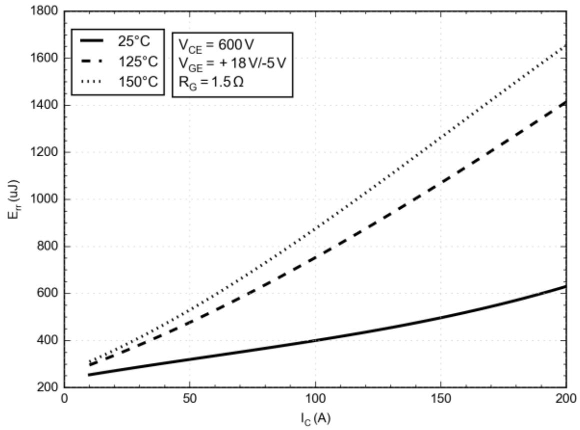


Figure 21. Typical Reverse Recovery Energy vs. IC

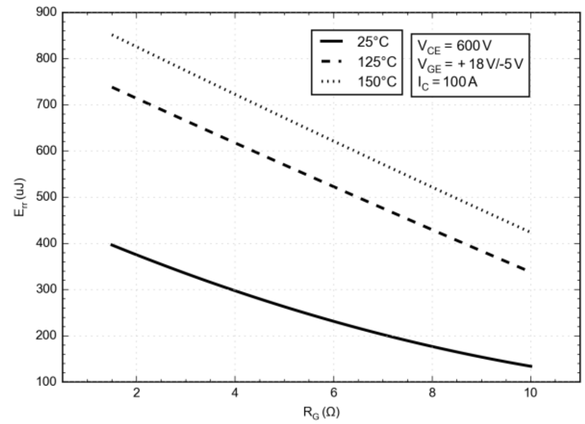


Figure 22. Typical Reverse Recovery Energy vs. R_G

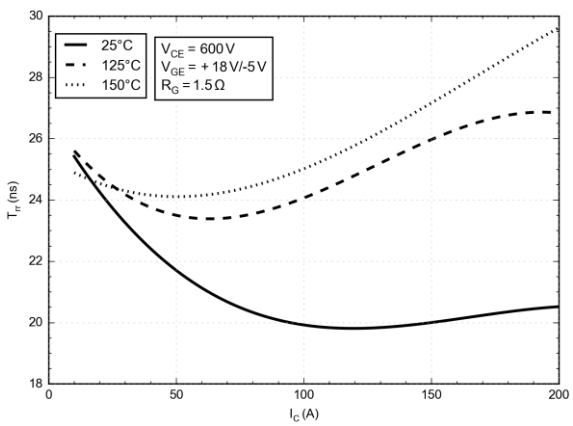


Figure 23. Typical Reverse Recovery Time vs. IC

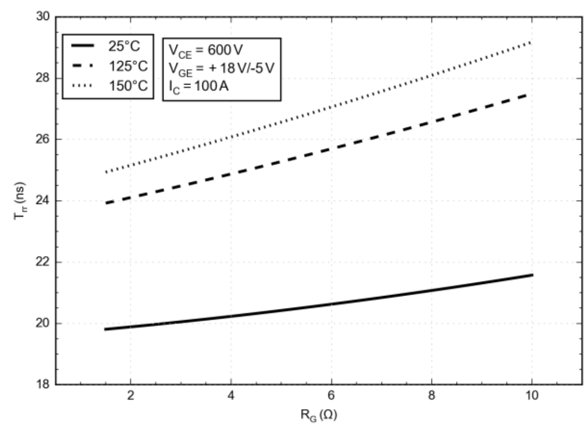


Figure 24. Typical Reverse Recovery Time vs. R_G

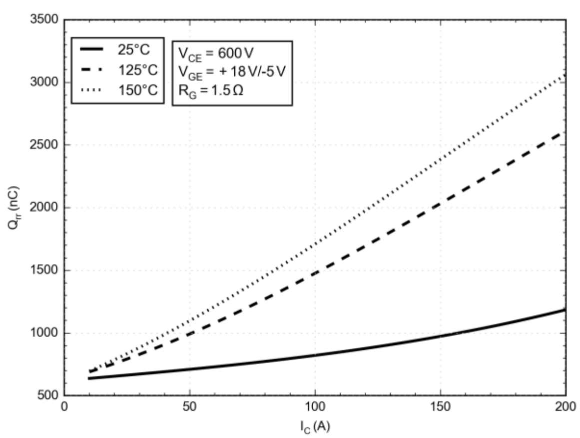


Figure 25. Typical Reverse Recovery Charge vs. IC

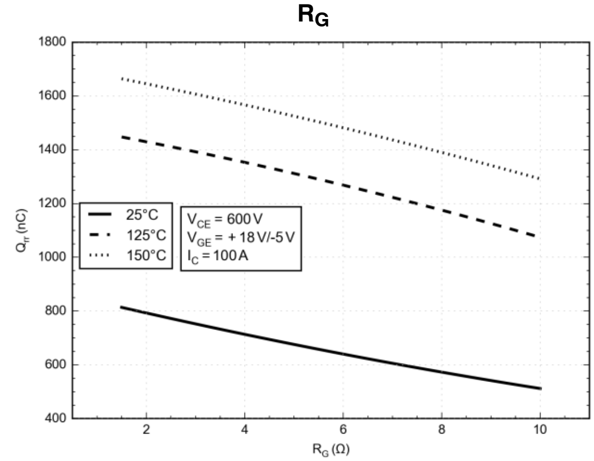


Figure 26. Typical Reverse Recovery Charge vs. R_G

TYPICAL CHARACTERISTICS

M1/M2 MOSFET SWITCHING CHARACTERISTICS

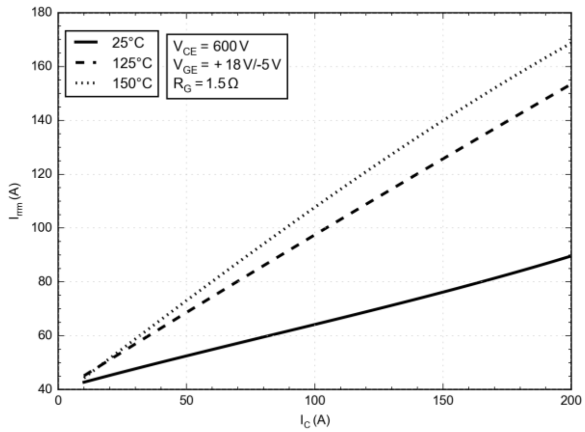


Figure 27. Typical Reverse Recovery Current vs. IC

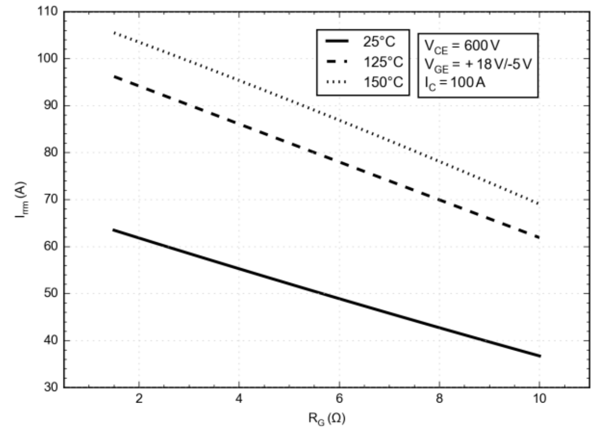


Figure 28. Typical Reverse Recovery Current vs. R_G

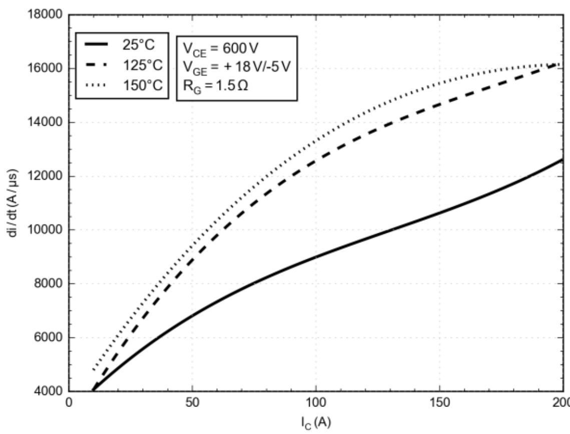


Figure 29. Typical di/dt vs. IC

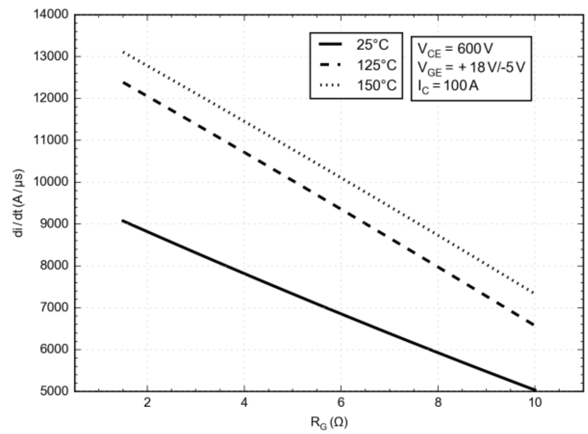


Figure 30. Typical di/dt vs. R_G

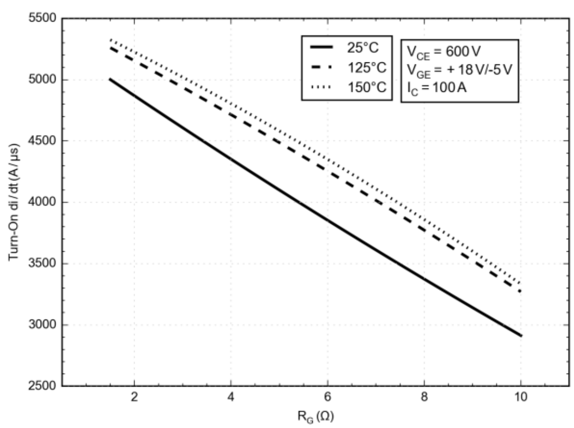


Figure 31. di/dt ON vs IC

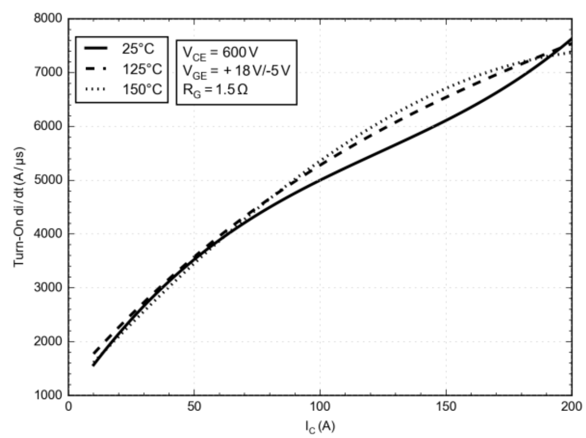


Figure 32. di/dt ON vs. R_G

TYPICAL CHARACTERISTICS

M1/M2 MOSFET SWITCHING CHARACTERISTICS

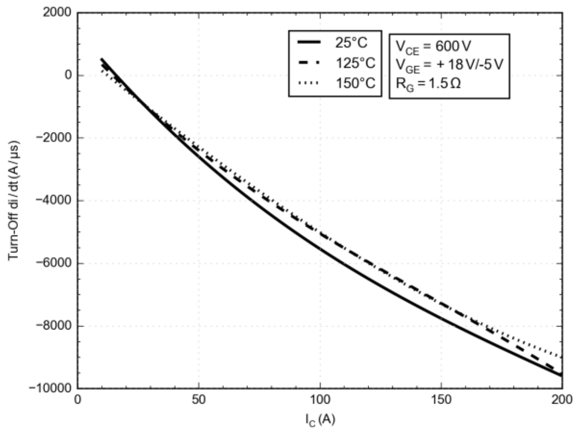


Figure 33. di/dt OFF vs IC

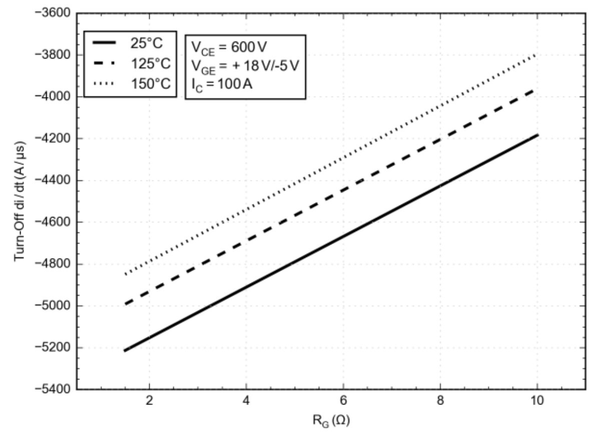


Figure 34. di/dt OFF vs. R_G

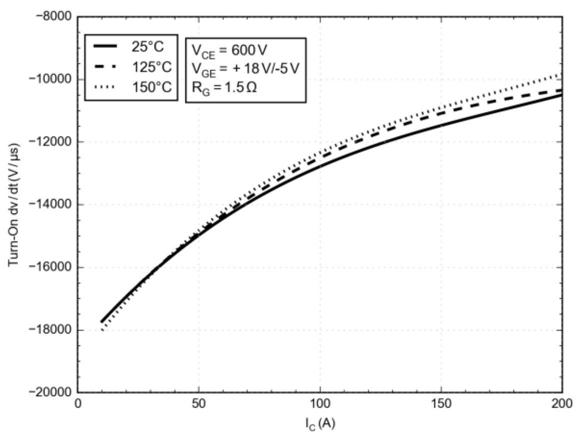


Figure 35. dv/dt ON vs IC

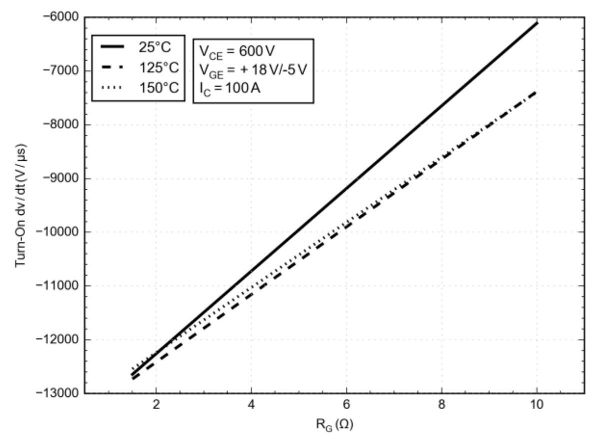


Figure 36. dv/dt ON vs. R_G

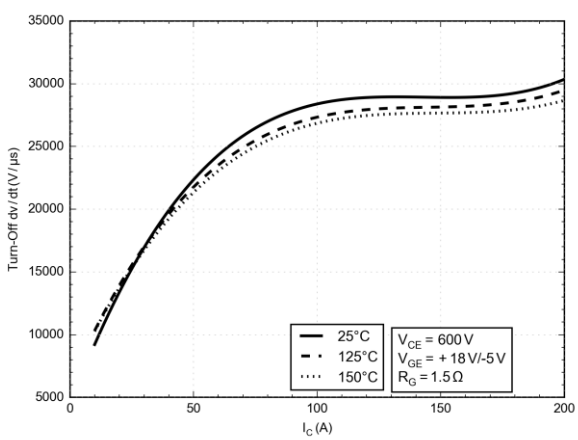


Figure 37. dv/dt OFF vs IC

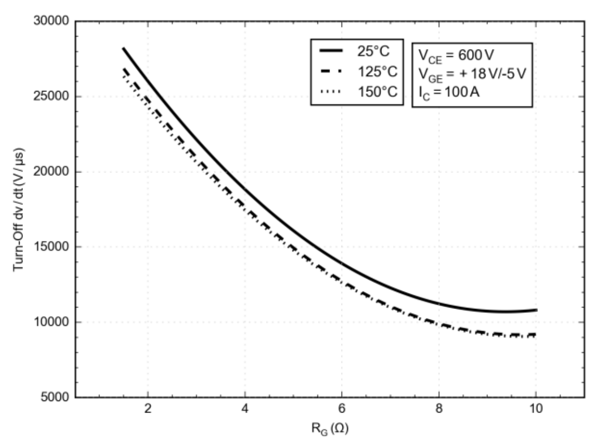


Figure 38. dv/dt OFF vs. R_G

TYPICAL CHARACTERISTICS

SiC MOSFET (M1/M2)

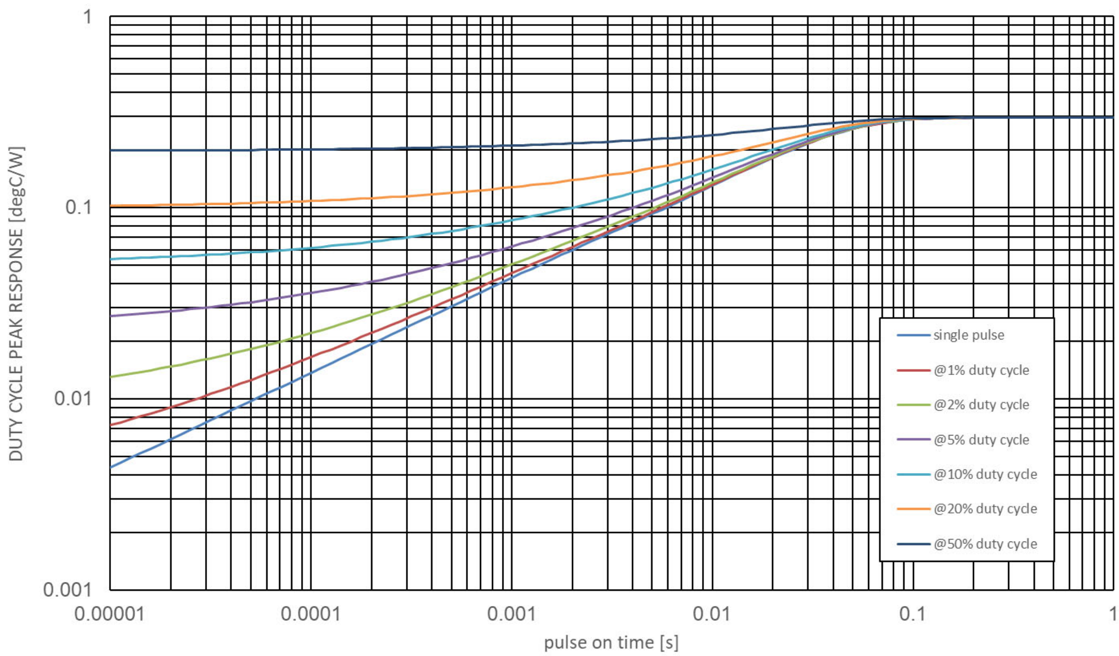


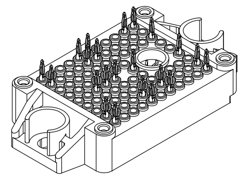
Figure 39. SiC Mosfet Junction−to−Case Transient Thermal Impedance

Table 1. FOSTER NETWORKS – M1, M2

Foster Element #	M1		M2	
	Rth (K/W)	Cth (Ws/K)	Rth (K/W)	Cth (Ws/K)
1	0.018018	0.006761	0.017423	0.006288
2	0.00725	0.110732	0.008856	0.083472
3	0.007012	0.219934	0.007085	0.218085
4	0.034121	0.121787	0.035241	0.119517
5	0.227927	0.132429	0.233897	0.129036

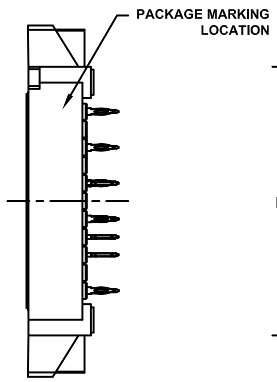
Table 2. CAUER NETWORKS – M1, M2

Cauer Element #	M1		M2	
	Rth (K/W)	Cth (Ws/K)	Rth (K/W)	Cth (Ws/K)
1	0.025529	0.005642	0.026977	0.005357
2	0.050904	0.03348	0.070046	0.034112
3	0.066724	0.042125	0.094049	0.071939
4	0.058571	0.063408	0.040991	0.068148
5	0.092598	0.079724	0.064984	0.039596

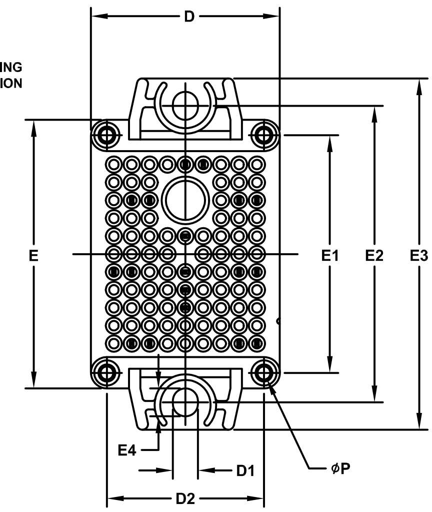


PIM18 33.8x42.5 (PRESS FIT)
CASE 180BW
ISSUE B

DATE 30 APR 2021



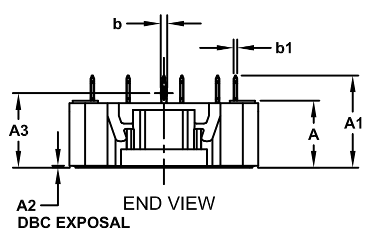
SIDE VIEW



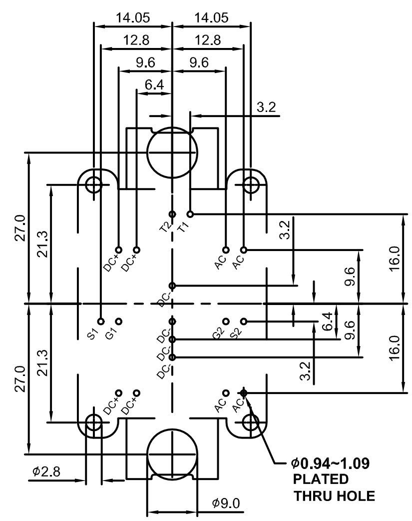
TOP VIEW

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	33.50	33.80	34.10
D1	4.40	4.50	4.60
D2	27.95	28.10	28.25
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

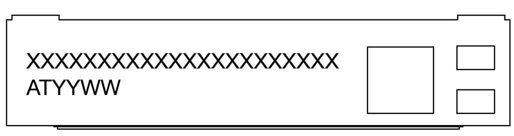


END VIEW



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:	98AON19723H	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	PIM18 33.8x42.5 (PRESS FIT)	PAGE 1 OF 1