

APT5SM170B

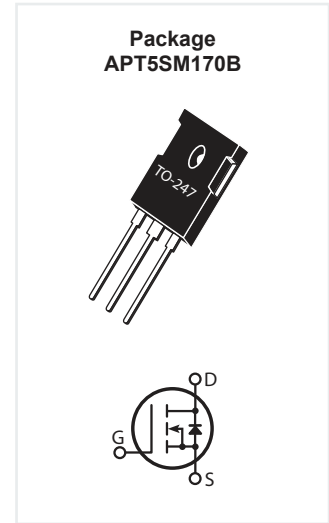
PRELIMINARY

1700V, 5A, 0.95Ω

Silicon Carbide N-Channel Power MOSFET

DESCRIPTION

Silicon carbide (SiC) power MOSFET product line from Microsemi increase your performance over silicon MOSFET and silicon IGBT solutions while lowering your total cost of ownership for high-voltage applications.



FEATURES / TYPICAL APPLICATIONS

SiC MOSFET Features:

- Low capacitances and low gate charge
- Fast switching speed due to low internal gate resistance (ESR)
- Stable operation at high junction temperature, $T_j(\text{max}) = +175\text{C}$
- Fast and reliable body diode

SiC MOSFET Benefits:

- High efficiency to enable lighter/compact system
- Simple to drive and easy to parallel
- Improved thermal capabilities and lower switching losses
- Eliminates the need of external Free Wheeling Diode
- Lower system cost of ownership

Applications:

- PV inverter, converter and industrial motor drives
- Smart grid transmission & distribution
- Induction heating, and welding
- H/EV powertrain and EV charger
- Power supply and distribution

MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain Source Voltage	1700	V
I_D	Continuous Drain Current @ $T_c = 25^\circ\text{C}$	5	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	3.5	
I_{DM}	Pulsed Drain Current ^①	8	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ $T_c = 25^\circ\text{C}$	65	W
	Linear Derating Factor	0.43	W/°C

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance		1.7	2.3	°C/W
T_j	Operating Junction Temperature	-55		175	°C
T_{stg}	Storage Junction Temperature Range	-55		150	
T_L	Soldering Temperature for 10 Seconds (1.6mm from case)			260	
Torque	Mounting Torque (TO-247 Package), 6-32 or M3 screw			10	in·lbf
				1.1	N·m

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STATIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 100\mu A$	1700			V
$R_{DS(on)}$	Drain-Source On Resistance ^②	$V_{GS} = 20V, I_D = 2.5A$		950	1250	m Ω
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 0.5mA$	1.8	3.2		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient			-7.6		mV/ $^{\circ}C$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1700V$ $V_{GS} = 0V$			100	μA
		$T_J = 25^{\circ}C$ $T_J = 150^{\circ}C$			250	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +20V / -10V$			± 100	nA

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

DYNAMIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DS} = 1000V$ $f = 1MHz$		249		pF
C_{rss}	Reverse Transfer Capacitance			3		
C_{oss}	Output Capacitance			15		
Q_g	Total Gate Charge	$V_{GS} = 0/20V$		21		nC
Q_{gs}	Gate-Source Charge	$V_{DS} = 850V$		5		
Q_{gd}	Gate-Drain Charge	$I_D = 2.5A$		8		
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 850V$ $V_{GS} = 0/20V$ $I_D = 2.5A$ $R_G = 2.5\Omega$ ^③ $L = 115\mu H$ $T_c = 25^{\circ}C$		4		ns
t_r	Current Rise Time			2		
$t_{d(off)}$	Turn-Off Delay Time			7		
t_f	Current Fall Time			4		
E_{on2}	Turn-On Switching Energy ^④				82	
E_{off}	Turn-Off Switching Energy			37	μJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 850V$ $V_{GS} = 0/20V$ $I_D = 2.5A$ $R_G = 2.5\Omega$ ^③ $L = 115\mu H$ $T_c = 150^{\circ}C$		3		ns
t_r	Current Rise Time			2		
$t_{d(off)}$	Turn-Off Delay Time			8		
t_f	Current Fall Time			5		
E_{on2}	Turn-On Switching Energy ^④				87	
E_{off}	Turn-Off Switching Energy			39	μJ	
ESR	Equivalent Series Resistance	$f = 1MHz, 25mV, \text{Drain Short}$		1.43		Ω

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	$I_{SD} = 2.5A, V_{GS} = 0V$		4		V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2.5A, V_{DD} = 850V$ $di/dt = -1000A/\mu s$		14		ns
Q_{rr}	Reverse Recovery Charge				24	nC
I_{rrm}	Reverse Recovery Current				3.6	A

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

- ① Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature
 ② Pulse test: Pulse Width < 380 μs , duty cycle < 2%.
 ③ R_G is total external gate resistance not including internal gate driver impedance.
 ④ E_{on2} includes energy of free wheeling diode.

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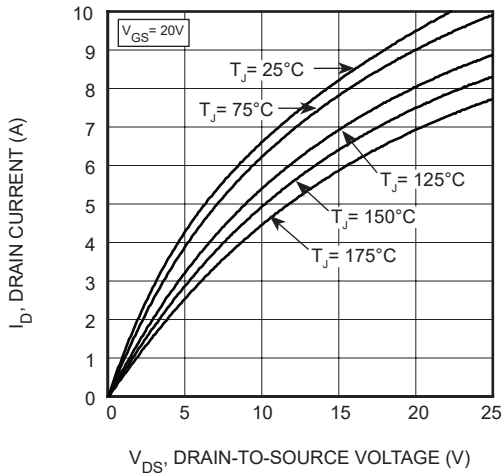


Figure 1, Output Characteristics

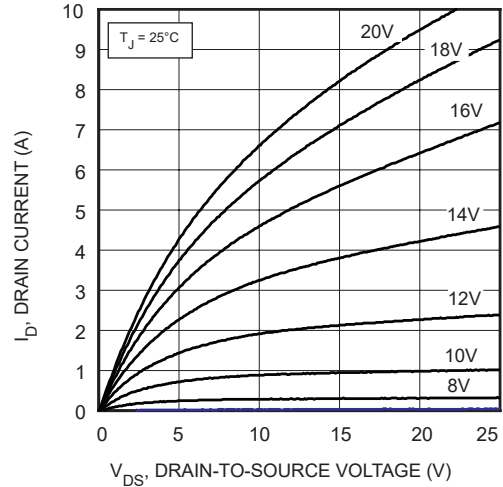


Figure 2, Output Characteristics

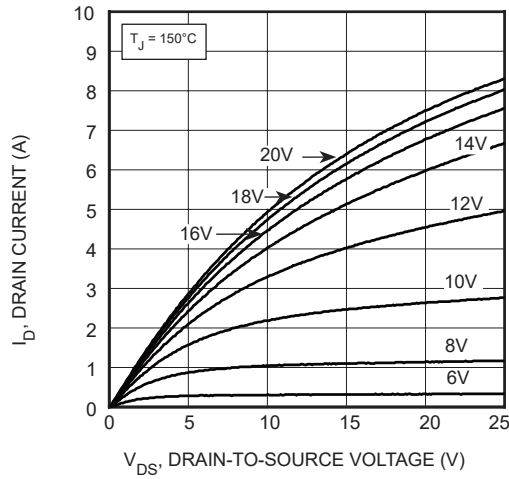


Figure 3, Output Characteristics

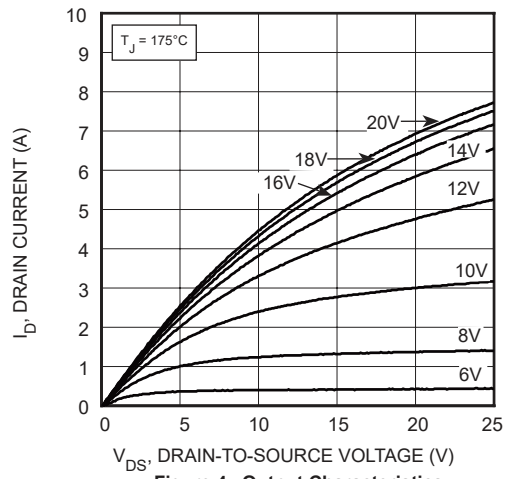


Figure 4, Output Characteristics

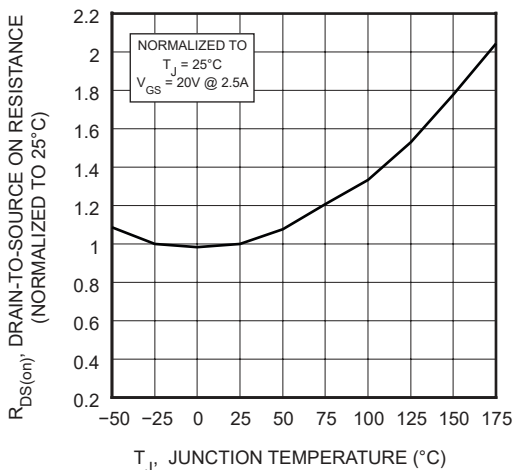


Figure 5, $R_{DS(on)}$ vs Junction Temperature

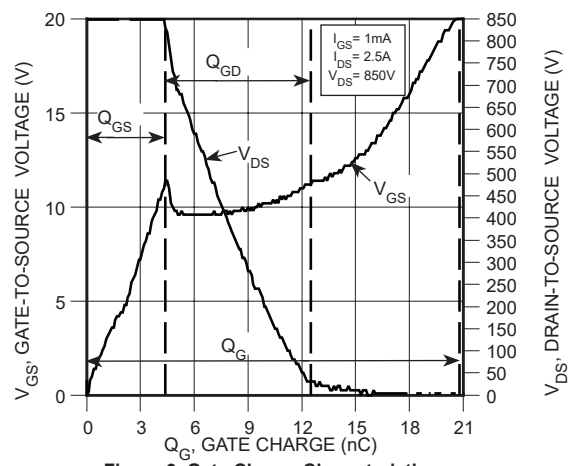


Figure 6, Gate Charge Characteristics

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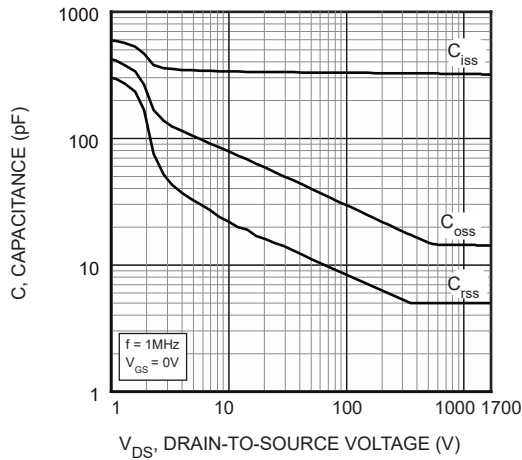


Figure 7, Capacitance vs Drain-to-Source Voltage

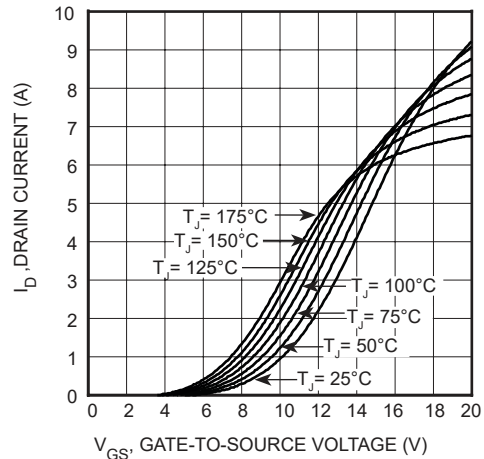


Figure 8, Output Characteristics I_D vs V_{GS} Temperature

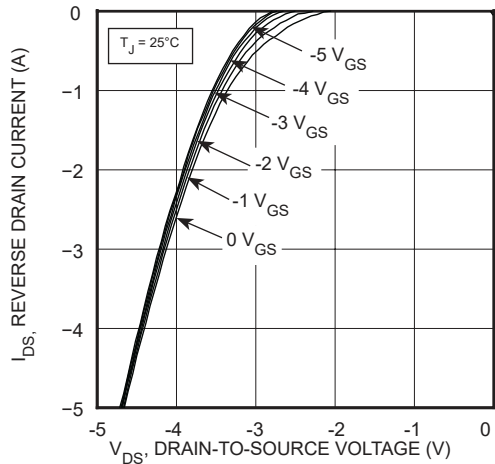


Figure 9, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

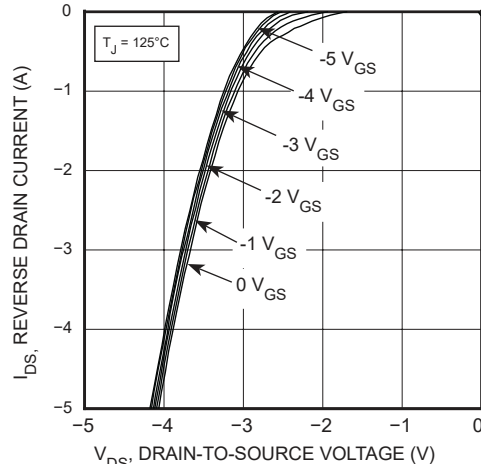


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

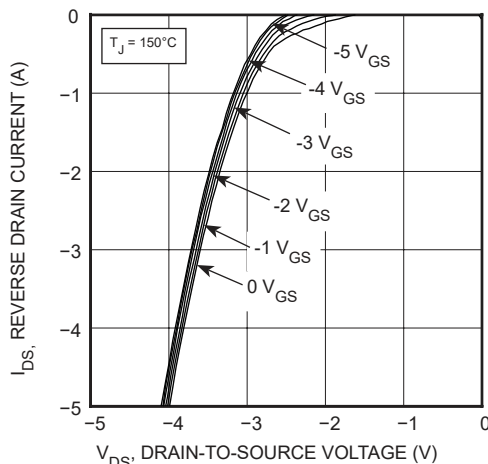


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

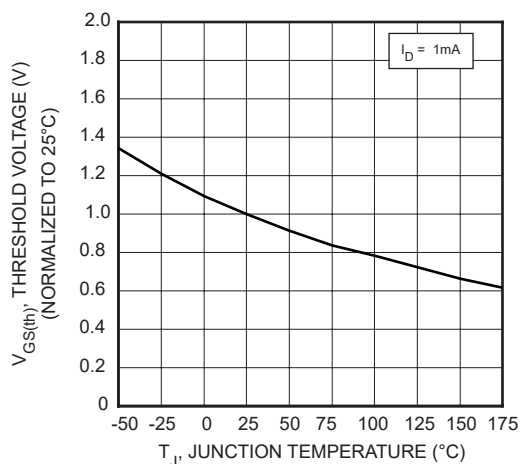


Figure 12, Threshold Voltage vs Temperature

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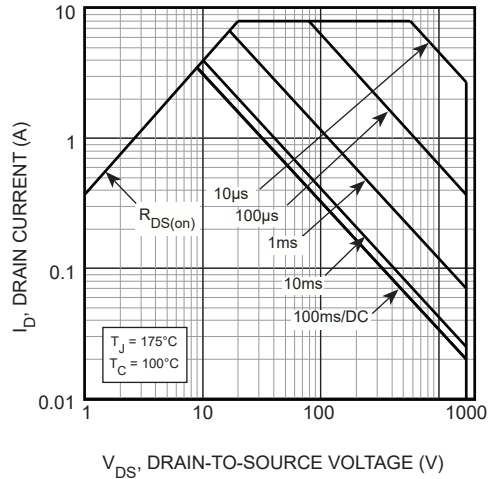


Figure 13, Forward Safe Operating Area

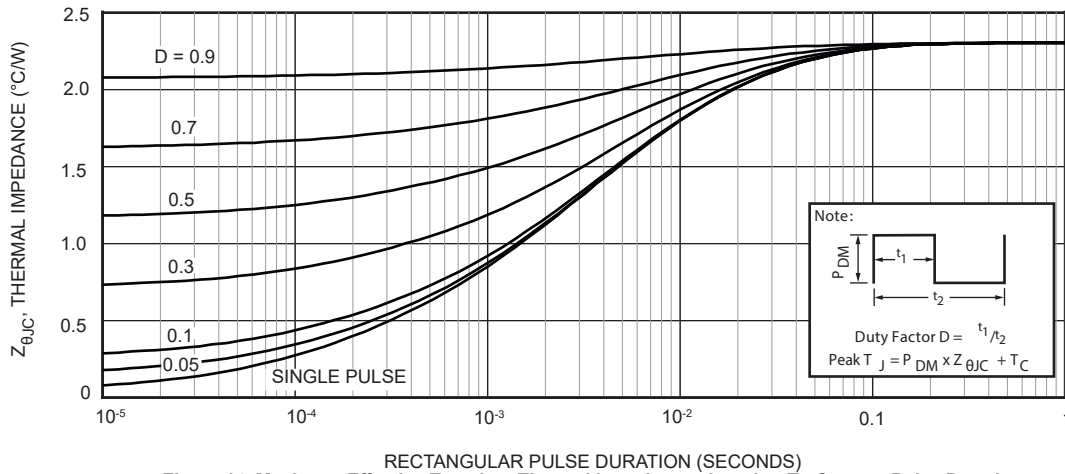
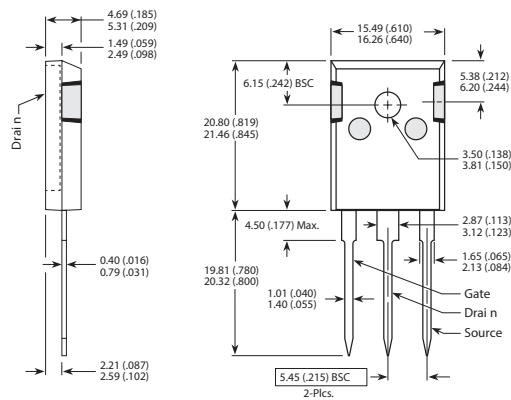


Figure 14, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline



Dimensions in Millimeters (Inches)

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