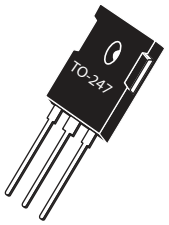
APT5SM170B

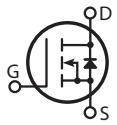
PRELIMINARY

1700V, 5A, 0.95Ω

Silicon Carbide N-Channel Power MOSFET

Package APT5SM170B





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, Tj(max) = +175C
- 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°C	5	A
	Continuous Drain Current @ T_C = 100°C	3.5	
I_{DM}	Pulsed Drain Current①	8	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ T_C = 25°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 = 100µA		1700			V
$R_{DS(on)}$	Drain-Source On Resistance②	V_{GS} = 20V, I_D = 2.5A			950	1250	mΩ
$V_{GS(th)}$	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/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1700V, V_{GS} = 0V	T_J = 25°C			100	µA
			T_J = 150°C			250	
I_{GSS}	Gate-Source Leakage Current	V_{GS} = +20V / -10V				±100	nA

T_J = 25°C unless otherwise specified

DYNAMIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{GS} = 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 V_{DS}= 850V I_D = 2.5A		21		nC
Q_{gs}	Gate-Source Charge			5		
Q_{gd}	Gate-Drain Charge			8		
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 850V V_{GS} = 0/20V I_D = 2.5A R_G = 2.5Ω ③ L = 115 µH T_c = 25°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 Energy④			82		µJ
E_{off}	Turn-Off Switching Energy			37		
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 850V V_{GS} = 0/20V I_D = 2.5A R_G = 2.5 Ω ③ L = 115 µH T_c = 150°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 Energy④			87		µJ
E_{off}	Turn-Off Switching Energy			39		
ESR	Equivalent Series Resistance	f = 1MHz, 25mV, 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/µs		14		ns
Q_{rr}	Reverse Recovery Charge			24		nC
I_{rrm}	Reverse Recovery Current			3.6		A

T_J = 25°C unless otherwise specified

① Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature
② Pulse test: Pulse Width < 380µs, 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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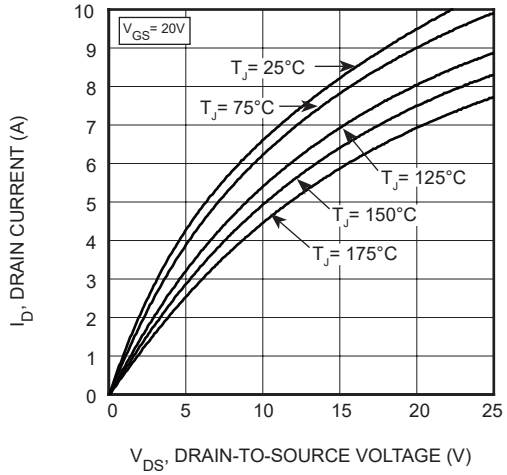

Figure 1, Output Characteristics

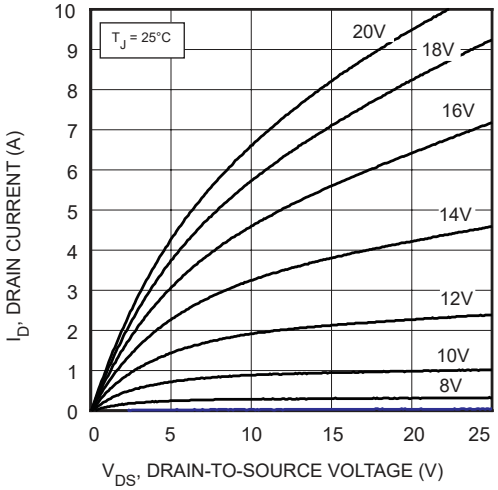

Figure 2, Output Characteristics

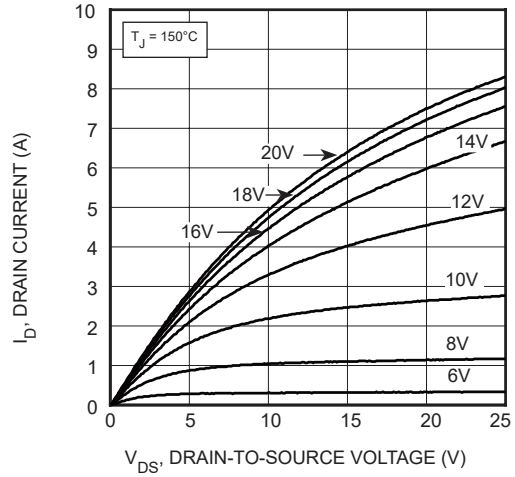

Figure 3, Output Characteristics

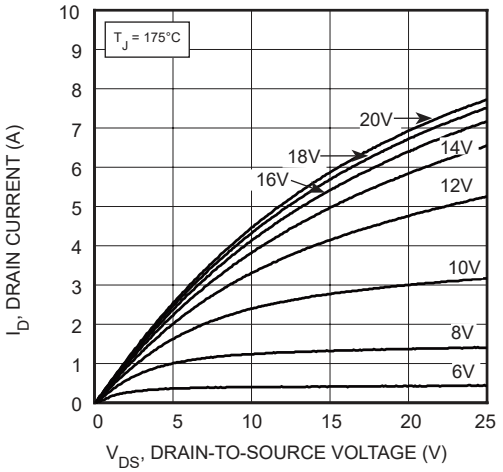

Figure 4, Output Characteristics

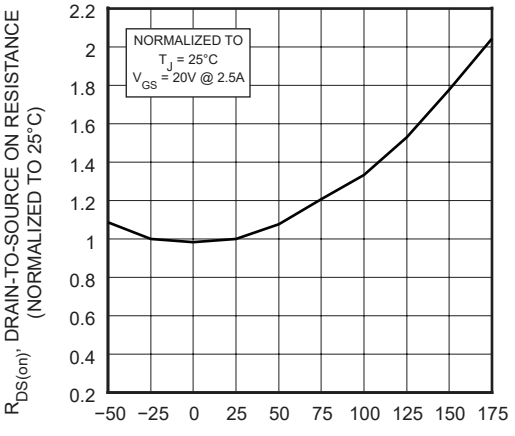

Figure 5, $R_{DS(on)}$ vs Junction Temperature

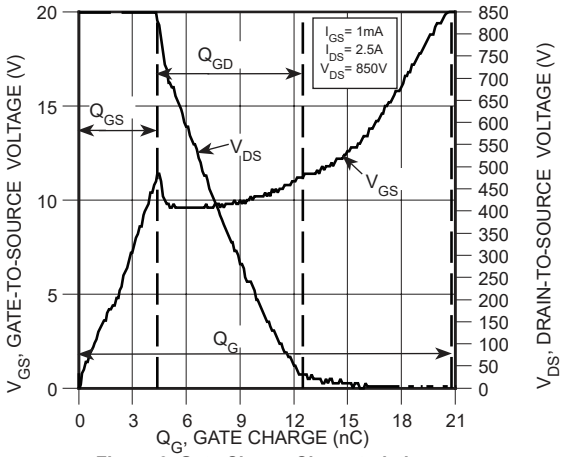

Figure 6, Gate Charge Characteristics

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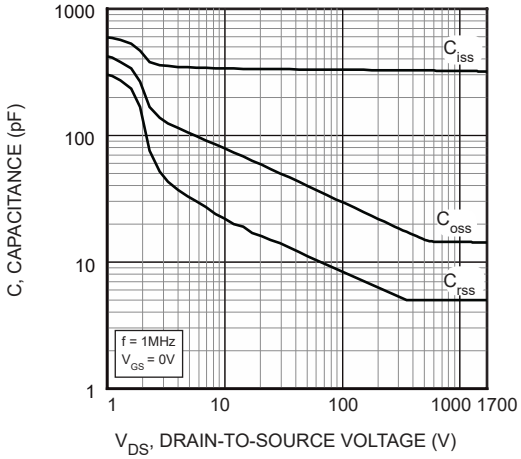

Figure 7, Capacitance vs Drain-to-Source Voltage

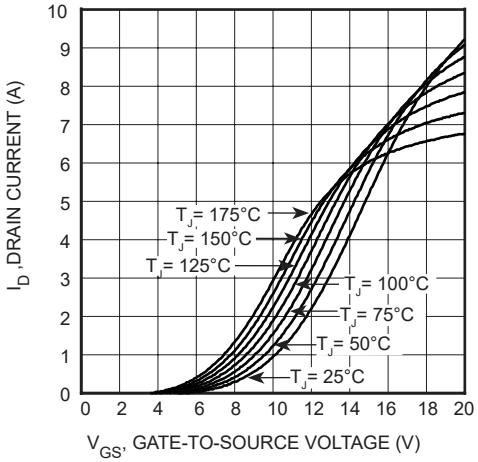

Figure 8, Output Characteristics I_D vs V_{GS} Temperature

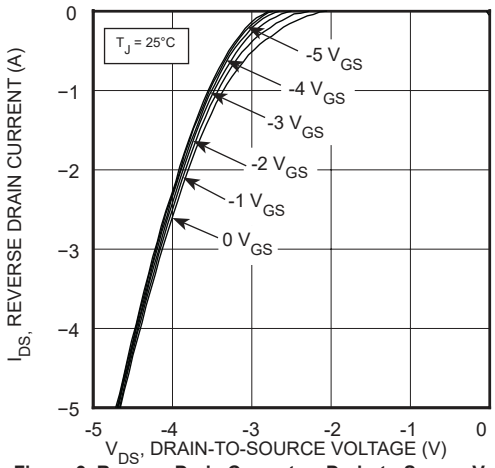

Figure 9, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

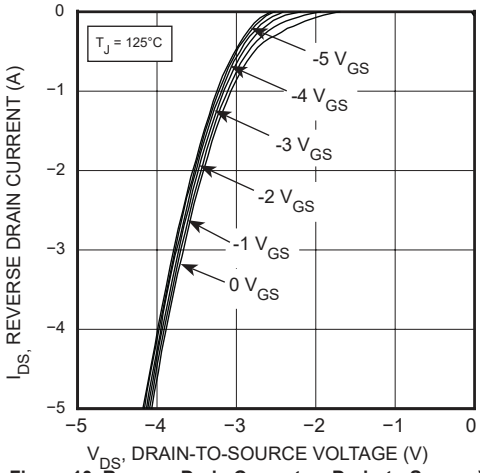

Figure 10, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

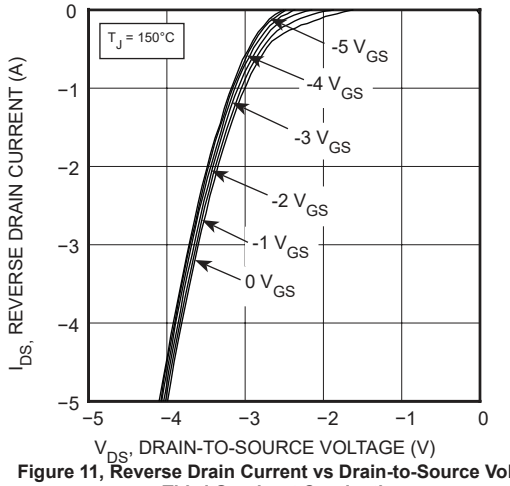

Figure 11, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

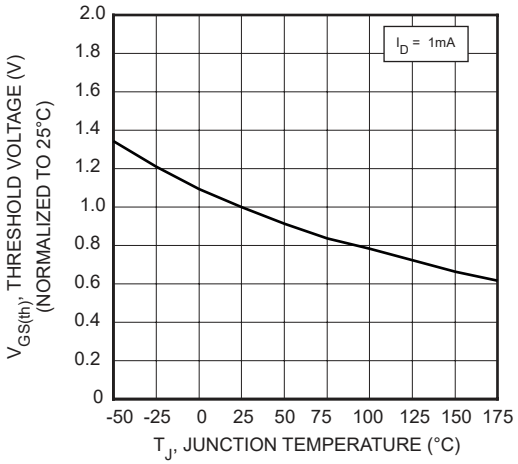

Figure 12, Threshold Voltage vs Temperature

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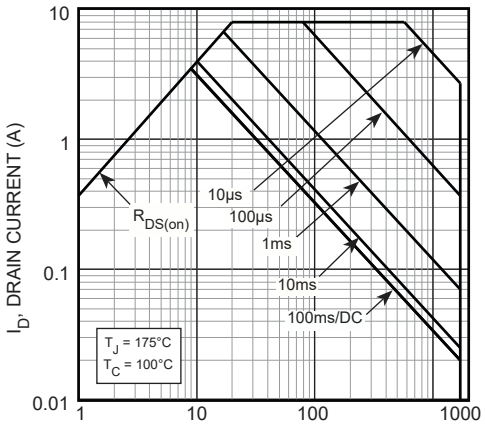


Figure 13, Forward Safe Operating Area

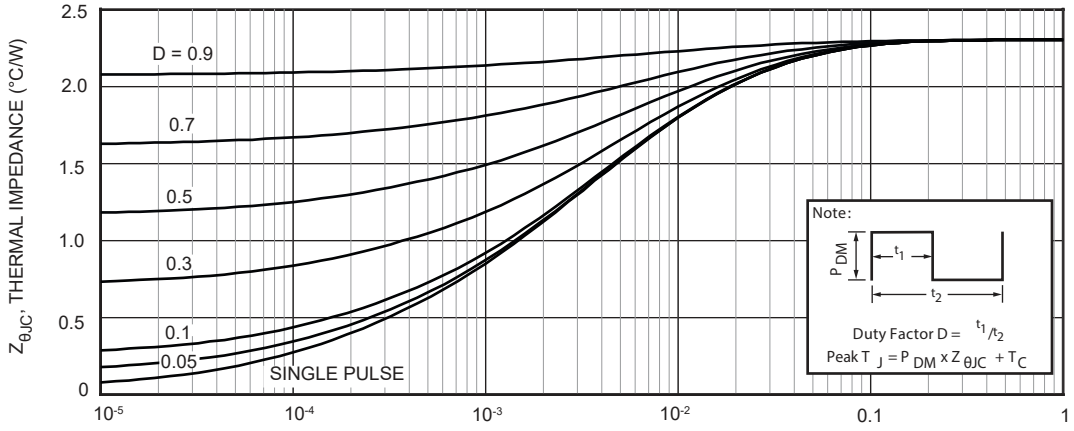
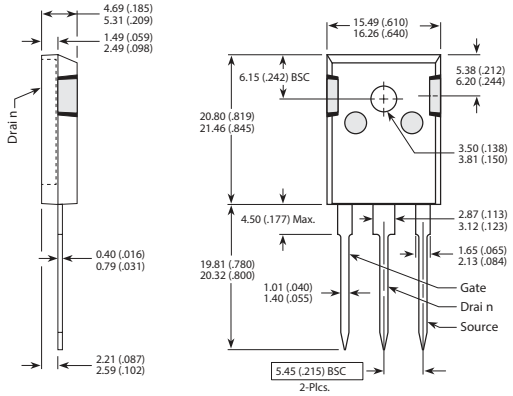


Figure 14, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline



Dimensions in Millimeters (Inches)

Microsemi Corporate Headquarters
One Enterprise, Aliso Viejo, CA 92656 USA
Within the USA: +1 (800) 713-4113
Outside the USA: +1 (949) 380-6100
Sales: +1 (949) 380-6136
Fax: +1 (949) 215-4996
email: sales.support@microsemi.com
www.microsemi.com

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