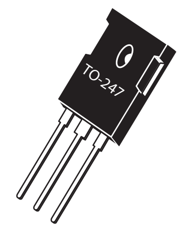
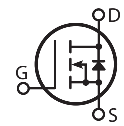
APT130SM70B

700V, 110A, 35mΩ

Silicon Carbide N-Channel Power MOSFET

Package
APT130SM70B





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 on-resistance virtually independent on the ambient temperature
- 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
- Superior avalanche ruggedness

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	700	V
I_D	Continuous Drain Current @ T_C = 25°C	110	A
	Continuous Drain Current @ T_C = 100°C	78	
I_{DM}	Pulsed Drain Current①	262	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ T_C = 25°C	556	W
	Linear Derating Factor	3.7	W/°C

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance		0.22	0.27	°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 = 1mA		700			V
$R_{DS(on)}$	Drain-Source On Resistance②	V_{GS} = 20V, I_D = 60A			35	45	mΩ
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 1mA		1.7	2.4		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient				-5.10		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 700V 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
ESR	Equivalent Series Resistance	f = 1MHz, 25mV, Drain Short			0.46		Ω

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_{DD} = 700V f = 1MHz		3950		pF
C_{rss}	Reverse Transfer Capacitance			50		
C_{oss}	Output Capacitance			465		
Q_g	Total Gate Charge	V_{GS} = 0/20V V_{DD}= 466V I_D = 60A		220		nC
Q_{gs}	Gate-Source Charge			42		
Q_{gd}	Gate-Drain Charge			61		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 466V V_{GS} = 0/20V I_D = 60A R_G = 3.0Ω③ L = 115 µH T_c = 25°C Freewheeling Diode = APT20SCE65B		17		ns
t_r	Current Rise Time			15		
$t_{d(off)}$	Turn-Off Delay Time			36		
t_f	Current Fall Time			19		
E_{on2}	Turn-On Switching Energy④			1060		µJ
E_{off}	Turn-Off Switching Energy			305		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 466V V_{GS} = 0/20V I_D = 60A R_G = 3.0 Ω ③ L = 115 µH T_c = 150°C Freewheeling Diode = APT20SCE65B		16		ns
t_r	Current Rise Time			15		
$t_{d(off)}$	Turn-Off Delay Time			39		
t_f	Current Fall Time			21		
E_{on2}	Turn-On Switching Energy④			965		µJ
E_{off}	Turn-Off Switching Energy			345		

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	I_{SD} = 60A, V_{GS} = 0V		3.85		V
t_{rr}	Reverse Recovery Time	I_{SD} = 60A, V_{DD} = 466V dI/dt = -1000A/µs		68		ns
Q_{rr}	Reverse Recovery Charge			570		nC
I_{rrm}	Reverse Recovery Current			15.3		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 gate resistance including internal gate driver impedance.
④ E_{on2} includes energy of APT20SCE65B free wheeling diode.

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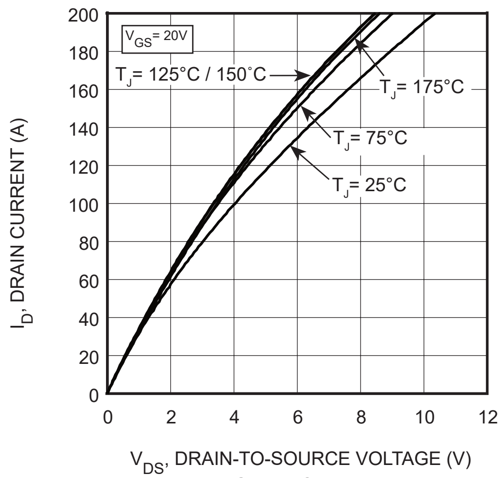

Figure 1, Output Characteristics

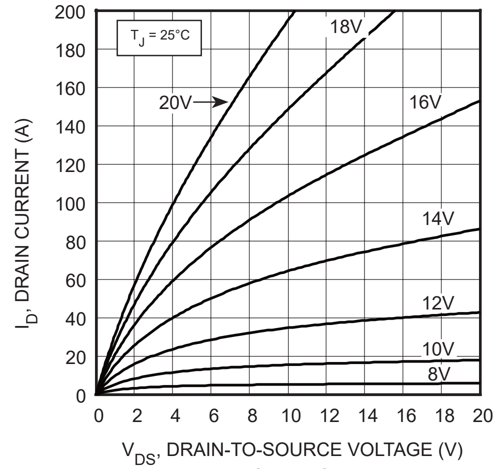

Figure 2, Output Characteristics

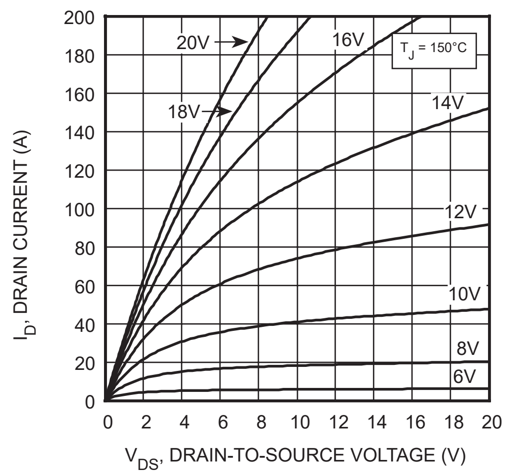

Figure 3, Output Characteristics

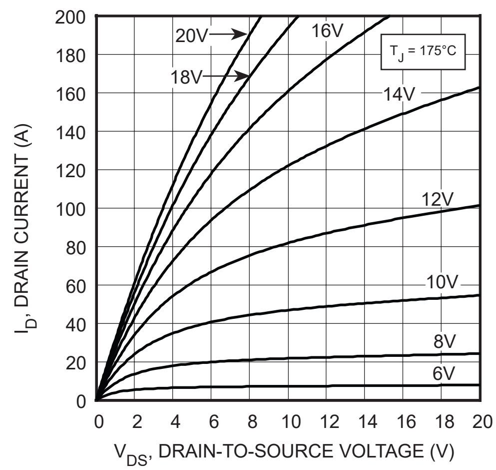

Figure 4, Output Characteristics

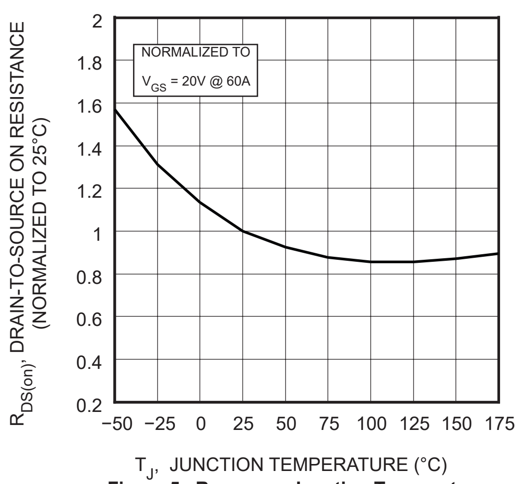

Figure 5, $R_{DS(on)}$ vs Junction Temperature

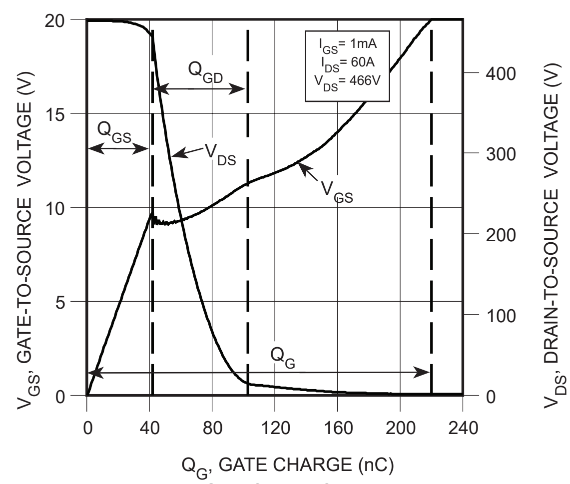

Figure 6, Gate Charge Characteristics

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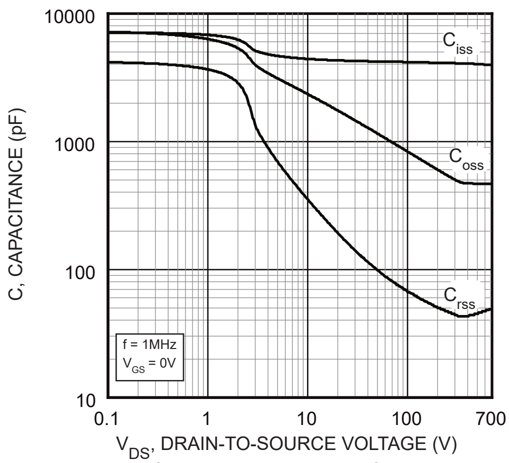

Figure 7, Capacitance vs Drain-to-Source Voltage

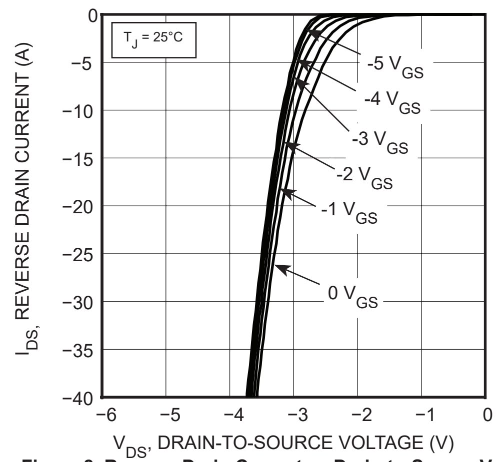

Figure 8, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

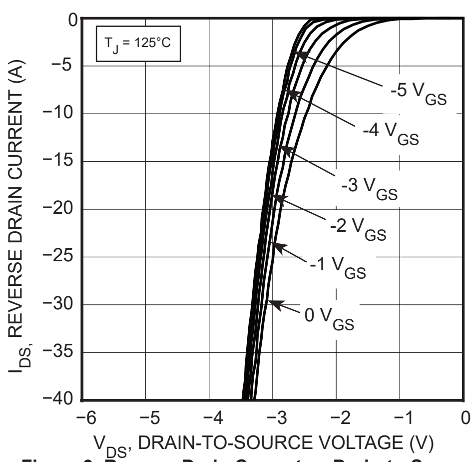

Figure 9, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

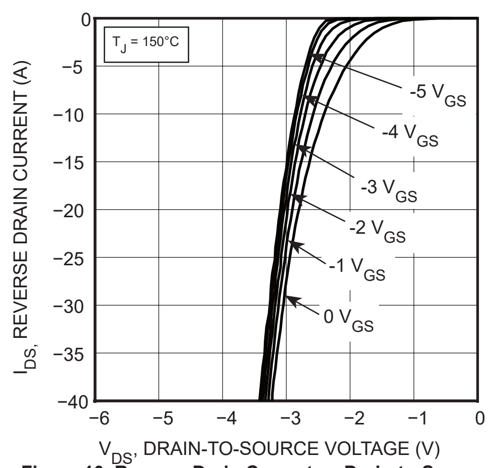

Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

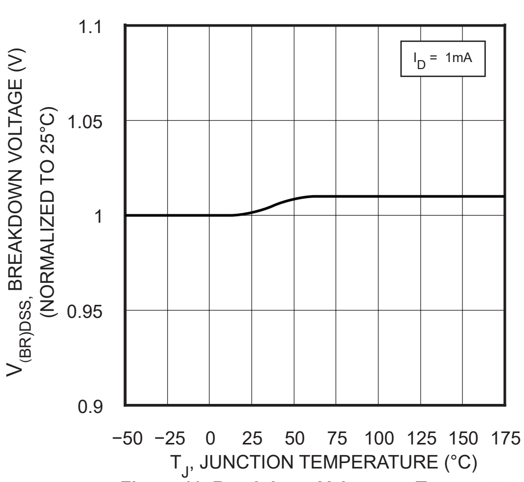

Figure 11, Breakdown Voltage vs Temperature

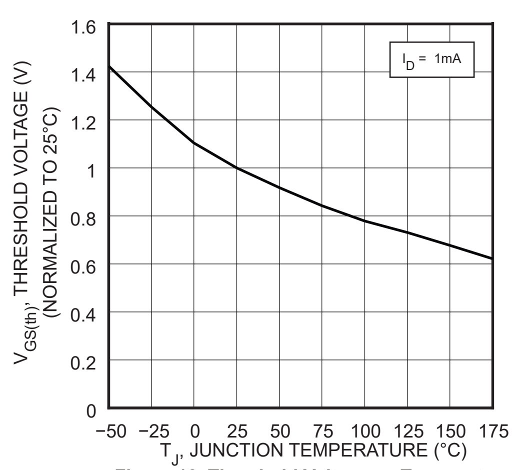

Figure 12, Threshold Voltage vs Temperature

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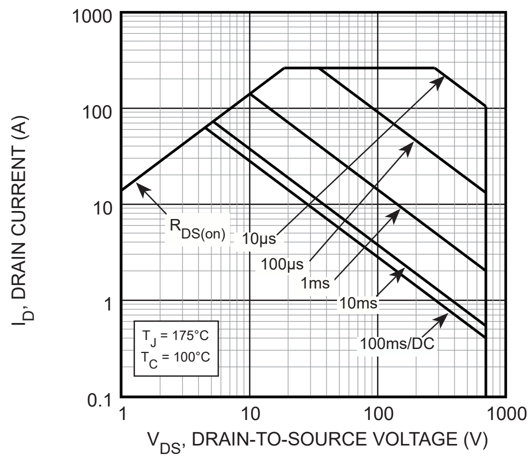


Figure 13, Forward Safe Operating Area

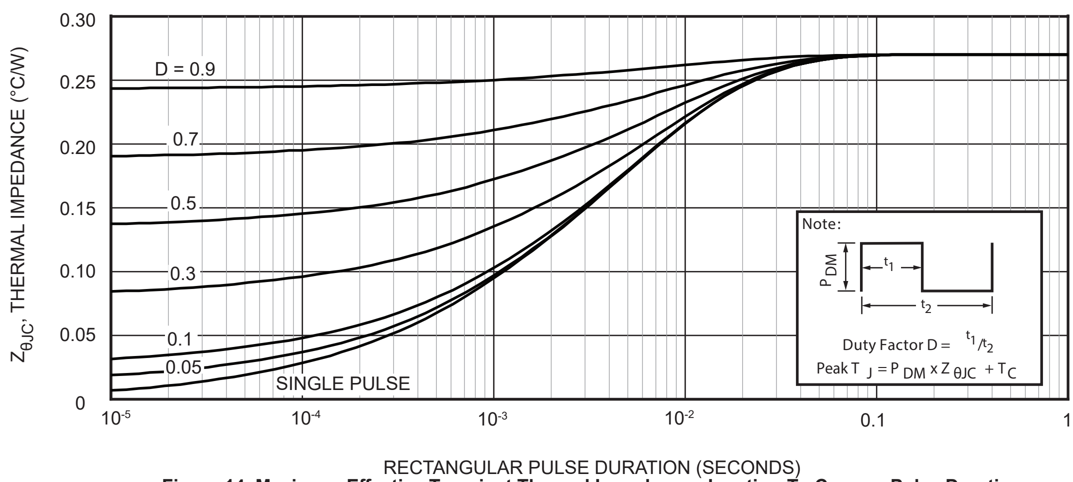
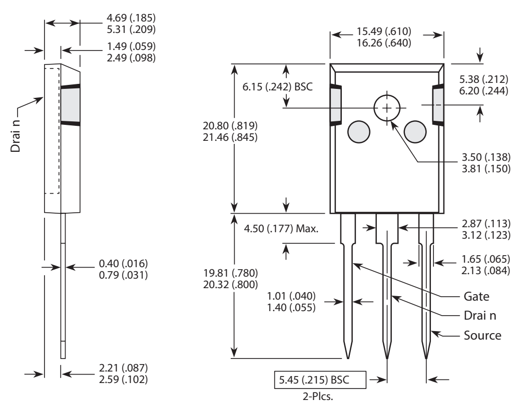


Figure 14, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline



Dimensions in Millimeters (Inches)

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Power Matters.™

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