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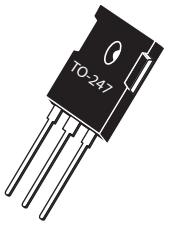
APT70SM70B

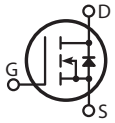
PRELIMINARY

700V, 58A, 75mΩ

Silicon Carbide N-Channel Power MOSFET

Package APT70SM70B





DESCRIPTION

Silicon carbide power MOSFET solutions with Microsemi-proprietary passivation technology provides maximum SiC benefits over silicon MOSFET solutions that include higher energy conversion efficiency with 10x higher breakdown field resistance resulting in lower RDS(on); lower switching losses due to temperature-independent switching behavior for stable high temperature performance and 2x higher electron saturation; improved system cooling with 3x higher band gap energy to operate at higher junction temperatures; and higher current capabilities with 3x higher thermal conductivity for higher power density. Faster switching frequencies combined with the above characteristics provide higher efficiency, lower power losses for power topologies that lower total cost of ownership with higher reliability and efficiency, lower passive and system costs, and smaller heat sinks.

FEATURES / TYPICAL APPLICATIONS

- Ultra Low sensitivity of $R_{DS(on)}$ to temperature
- Fast switchingwith low EMI/RFI
- Low Switching Energy
- Low $R_{DS(on)}$ Temperature Coefficient For Improved Efficiency
- Ultra Low Gate Resistance
- RoHS compliant

- PFC and other boost converter
- Buck Converter
- Two Switch forward (asymmetrical)
- Single Switch forward
- Flyback
- Inverters

MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain Source Voltage	700	V
I_D	Continuous Drain Current @ T_C = 25°C	58	A
	Continuous Drain Current @ T_C = 100°C	41	
I_{DM}	Pulsed Drain Current①	137	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ T_C = 25°C	300	W
	Linear Derating Factor	2.0	W/°C

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance		0.35	0.5	°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 = 30A			75	90	mΩ
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 1mA		1.7	2.5		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient				-4.9		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			0.97		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		1935		pF
C_{rss}	Reverse Transfer Capacitance			45		
C_{oss}	Output Capacitance			240		
Q_g	Total Gate Charge	V_{GS} = 0/20V V_{DD}= 466V I_D = 30A		120		nC
Q_{gs}	Gate-Source Charge			20		
Q_{gd}	Gate-Drain Charge			34		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 466V V_{GS} = 0/20V I_D = 30A R_G = 3.0 Ω③ L = 115 μH T_c = 25°C Freewheeling Diode = APT10SCE65B		11		ns
t_r	Current Rise Time			9		
$t_{d(off)}$	Turn-Off Delay Time			34		
t_f	Current Fall Time			20		
E_{on2}	Turn-On Switching Energy④			291		μJ
E_{off}	Turn-Off Switching Energy			122		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 466V V_{GS} = 0/20V I_D = 30A R_G = 3.0 Ω ③ L = 115 μH T_c = 150°C Freewheeling Diode = APT10SCE65B		10		ns
t_r	Current Rise Time			9		
$t_{d(off)}$	Turn-Off Delay Time			37		
t_f	Current Fall Time			24		
E_{on2}	Turn-On Switching Energy④			257		μJ
E_{off}	Turn-Off Switching Energy			135		

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	I_{SD} = 30A, V_{GS} = 0V		4.45		V
t_{rr}	Reverse Recovery Time	I_{SD} = 30A, V_{DD} = 466V dI/dt = -1000A/μs		66		ns
Q_{rr}	Reverse Recovery Charge			320		nC
I_{rrm}	Reverse Recovery Current			10		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 including internal gate driver impedance.
④ E_{on2} includes energy of APT10SCE65B free wheeling diode.

APT70SM70B

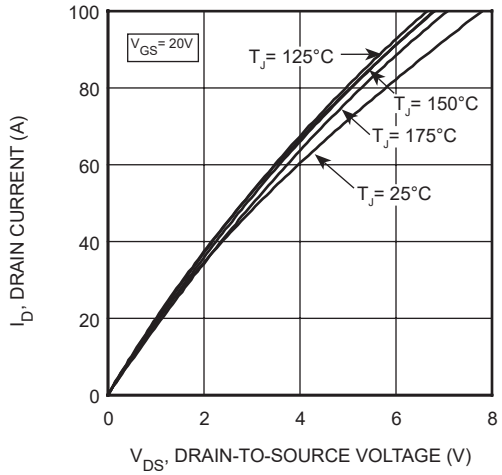


Figure 1, Output Characteristics

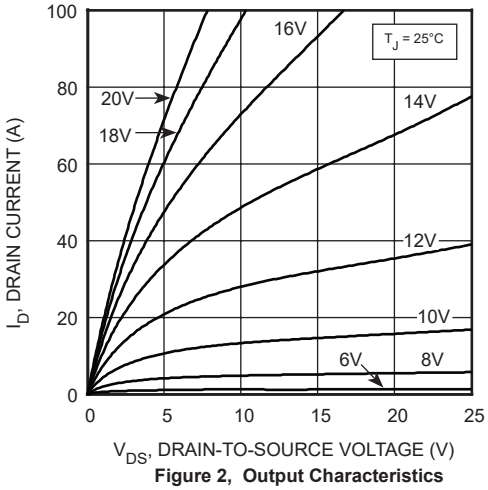


Figure 2, Output Characteristics

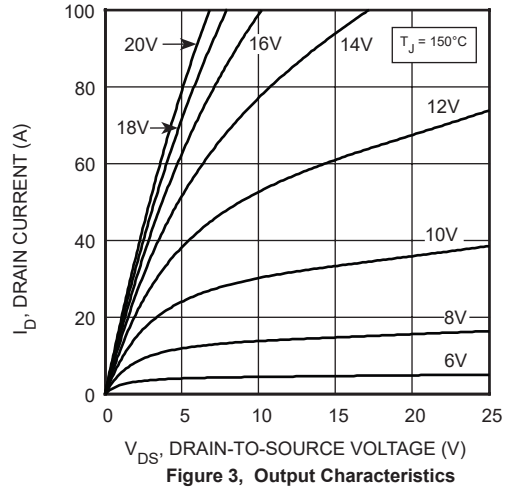


Figure 3, Output Characteristics

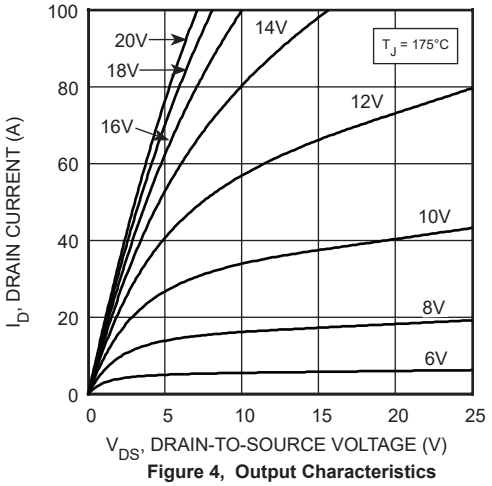


Figure 4, Output Characteristics

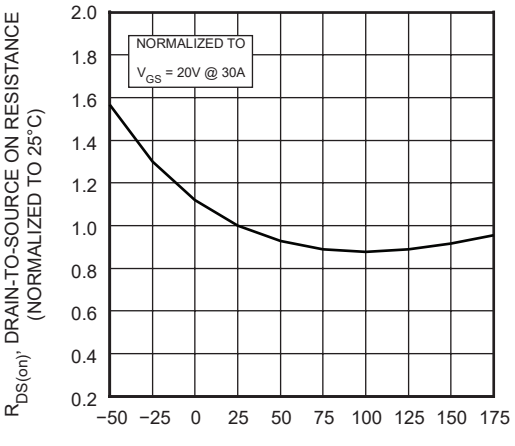


Figure 5, $R_{DS(on)}$ vs Junction Temperature

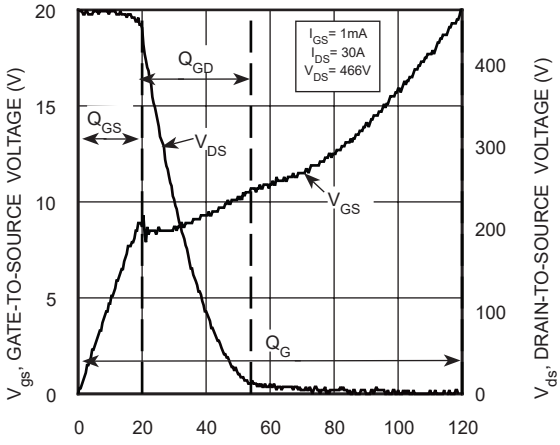


Figure 6, Gate Charge Characteristics

APT70SM70B

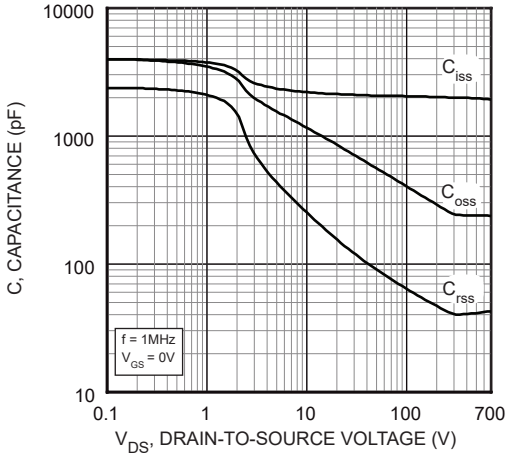


Figure 7, Capacitance vs Drain-to-Source Voltage

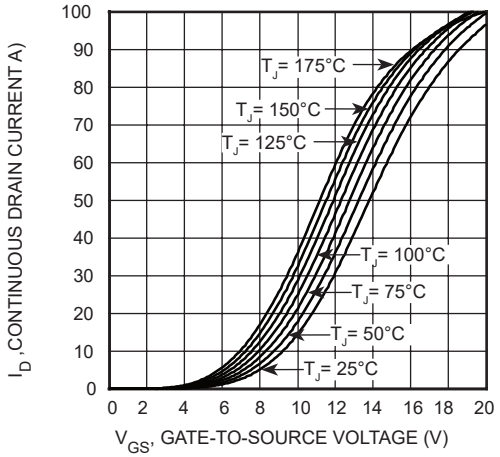


Figure 8, Output Characteristics I_D vs V_{GS} Temperature

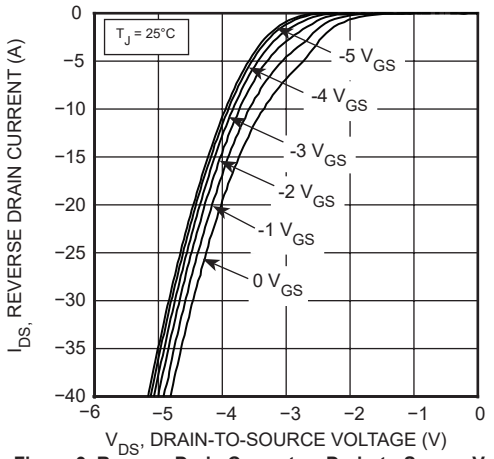


Figure 9, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

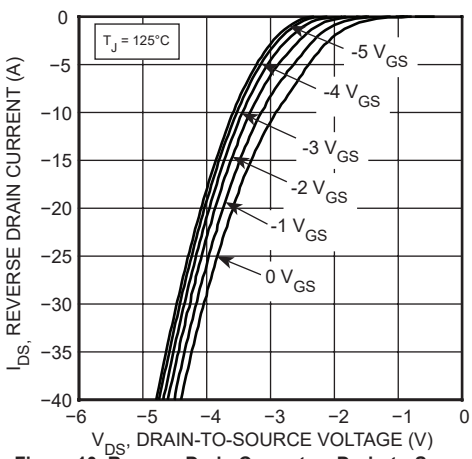


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

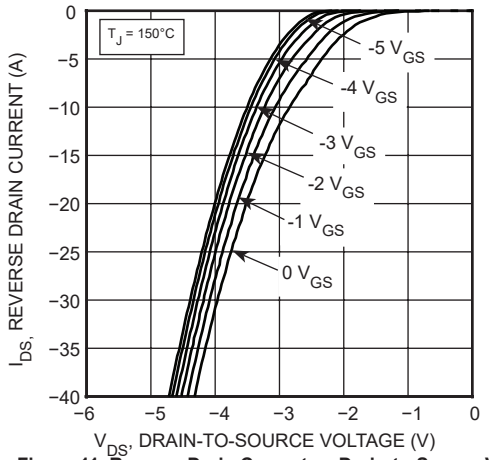


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

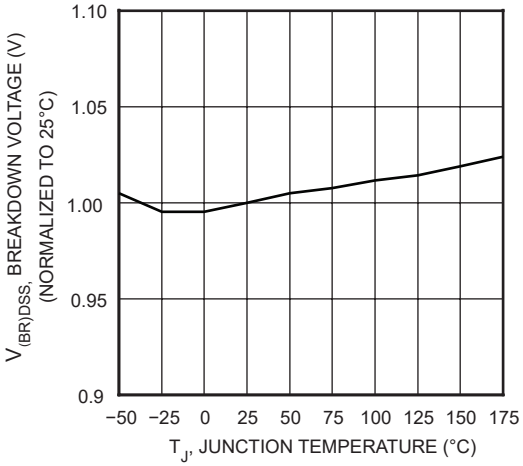


Figure 12, Breakdown Voltage vs Temperature

APT70SM70B

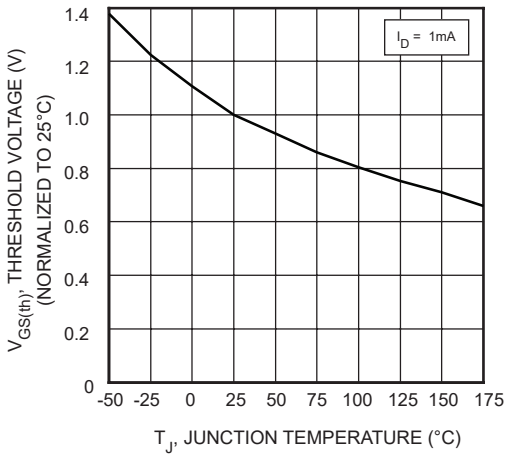


Figure 13, Threshold Voltage vs Temperature

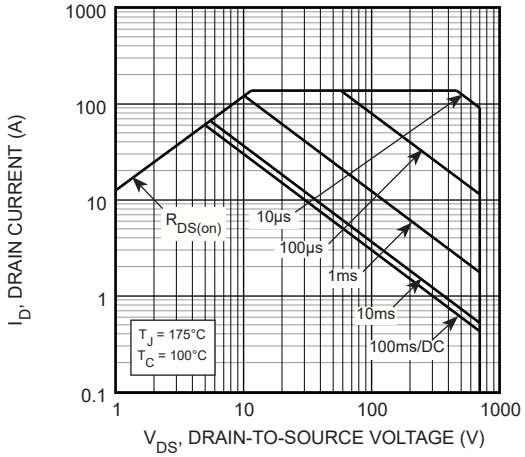


Figure 14, Forward Safe Operating Area

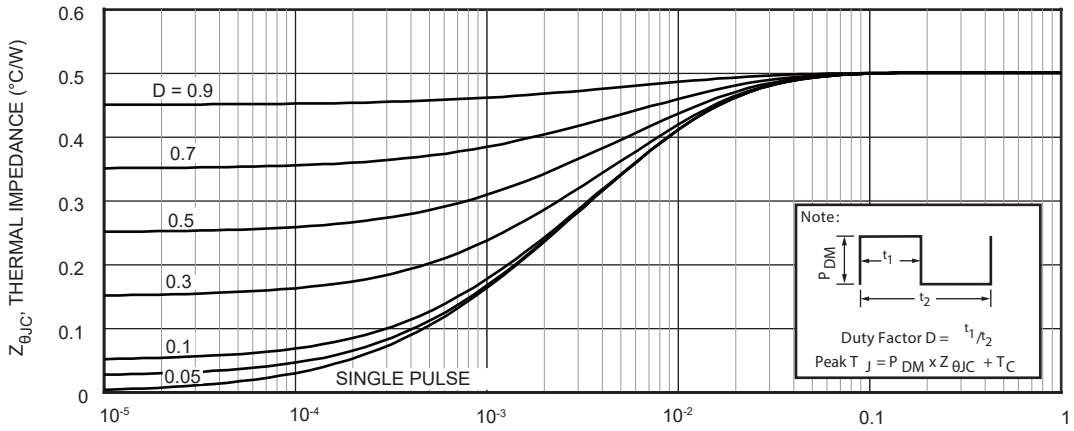
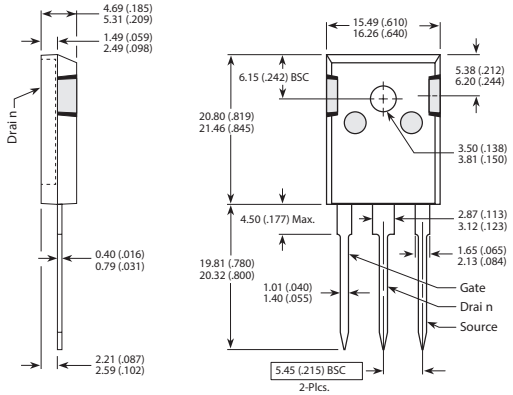


Figure 15, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline



Dimensions in Millimeters (Inches)

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