

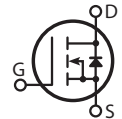
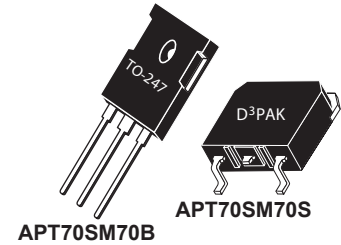
## Silicon Carbide N-Channel Power MOSFET

### FEATURES

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

### TYPICAL APPLICATIONS

- PFC and other boost converter
- Buck converter
- Two switch forward (asymmetrical bridge)
- Single switch forward
- Flyback
- Inverters



### Maximum Ratings

Symbol	Parameter	Ratings	Unit
$V_{DSS}$	Drain Source Voltage	700	V
$I_D$	Continuous Drain Current @ $T_c = 25^\circ\text{C}$	65	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	46	
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	154	
$V_{GS}$	Gate-Source Voltage	-10 to +25	V
$P_D$	Total Power Dissipation @ $T_c = 25^\circ\text{C}$	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
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55		175	°C
$T_L$	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

### Static Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{BR(DSS)}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 1mA$	700			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to $25^\circ\text{C}, I_D = 1mA$		0.027		V/°C
$R_{DS(on)}$	Drain-Source On Resistance <sup>②</sup>	$V_{GS} = 20V, I_D = 32.5A$		53	70	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			-4.69		mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 700V$ $V_{GS} = 0V$	$T_J = 25^\circ\text{C}$		100	μA
			$T_J = 150^\circ\text{C}$		250	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS} = +20V / -10V$			±100	nA
ESR	Equivalent Series Resistance	$f = 1MHz, 25mV, \text{Drain Short}$		1.12		Ω

**Dynamic Characteristics**
**T<sub>J</sub> = 25°C unless otherwise specified**
**APT70SM70B\_S**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V, V <sub>DD</sub> = 700V f = 1MHz		1950		pF
C <sub>riss</sub>	Reverse Transfer Capacitance			50		
C <sub>oss</sub>	Output Capacitance			230		
E <sub>oss</sub>	Output Capacitance Stored Energy	V <sub>GS</sub> = 0V, V <sub>DD</sub> = 700V f = 1MHz		60		μJ
C <sub>o(er)</sub>	Effective Output Capacitance			245		pF
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> = 0/20V V <sub>DD</sub> = 466V I <sub>D</sub> = 32.5A		125		nC
Q <sub>gs</sub>	Gate-Source Charge			21		
Q <sub>gd</sub>	Gate-Drain Charge			35		
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 466V V <sub>GS</sub> = 0/20V I <sub>D</sub> = 32.5A R <sub>G</sub> = 3.0 Ω <sup>③</sup> L = 115 μH T <sub>c</sub> = 25°C Freewheeling Diode = APT20SCE65B		11		ns
t <sub>r</sub>	Current Rise Time			11		
t <sub>d(off)</sub>	Turn-Off Delay Time			34		
t <sub>f</sub>	Current Fall Time			21		
E <sub>on2</sub>	Turn-On Switching Energy			460		
E <sub>off</sub>	Turn-Off Switching Energy		205			
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 466V V <sub>GS</sub> = 0/20V I <sub>D</sub> = 32.5A R <sub>G</sub> = 3.0 Ω <sup>③</sup> L = 115 μH T <sub>c</sub> = 150°C Freewheeling Diode = APT20SCE65B		9		ns
t <sub>r</sub>	Current Rise Time			11		
t <sub>d(off)</sub>	Turn-Off Delay Time			40		
t <sub>f</sub>	Current Fall Time			25		
E <sub>on2</sub>	Turn-On Switching Energy			425		
E <sub>off</sub>	Turn-Off Switching Energy		335			

**Source-Drain Diode Characteristics**
**T<sub>J</sub> = 25°C unless otherwise specified**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V <sub>SD</sub>	Diode Forward Voltage	I <sub>SD</sub> = 32.5A, V <sub>GS</sub> = 0V		4.25		V
T <sub>rr</sub>	Reverse Recovery Time	I <sub>SD</sub> = 32.5A, V <sub>DD</sub> = 466V di/dt = -1000A/μs		45		ns
Q <sub>rr</sub>	Reverse Recovery Charge			250		nC
I <sub>rrm</sub>	Reverse Recovery Current			10		A

① Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature.

② Pulse test: Pulse Width < 380μs, duty cycle < 2%.

③ R<sub>G</sub> is total external gate resistance not including internal gate driver impedance.

TYPICAL PERFORMANCE CURVES

APT70SM70B\_S

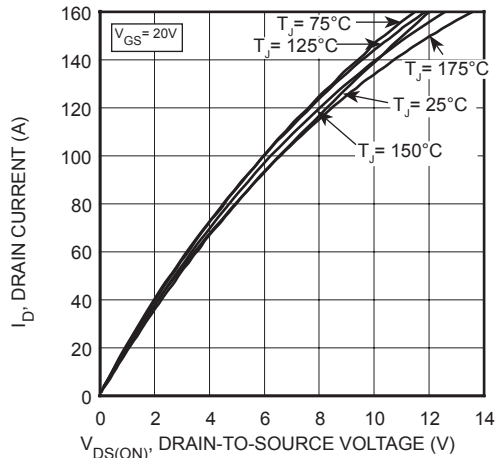


Figure 1, Output Characteristics

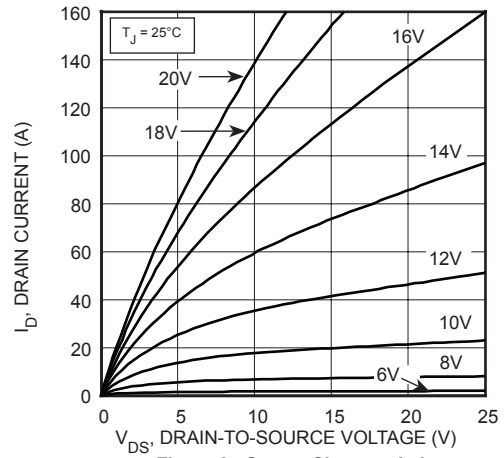


Figure 2, Output Characteristics

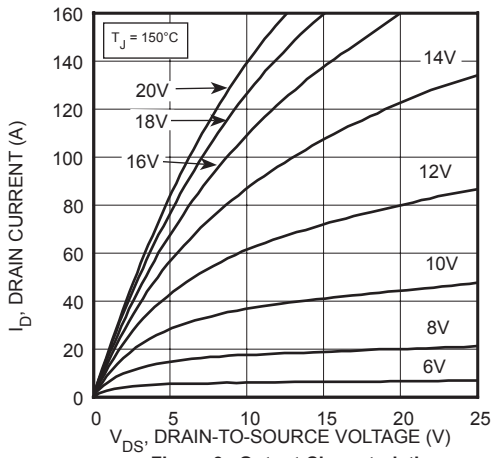


Figure 3, Output Characteristics

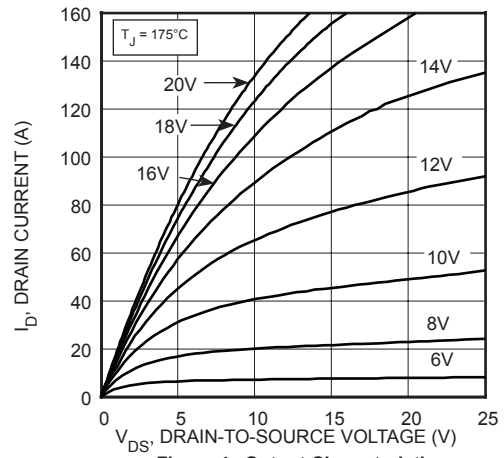


Figure 4, Output Characteristics

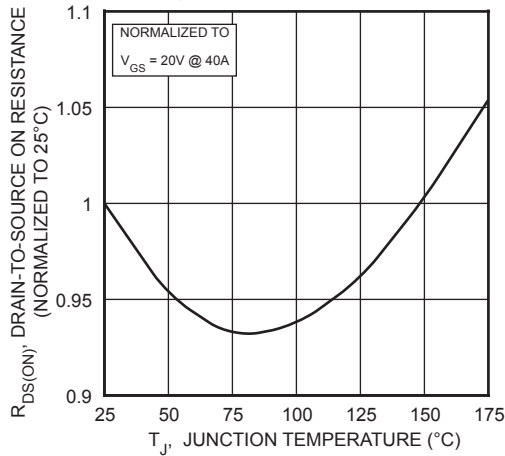


Figure 5,  $R_{DS(ON)}$  vs Junction Temperature

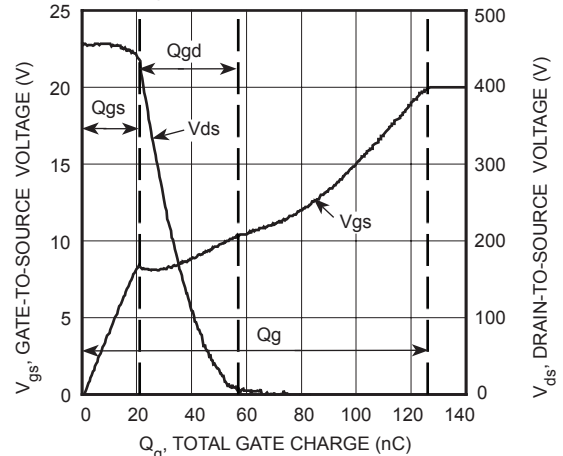


Figure 6, Gate Charge vs Gate-to-Source Voltage

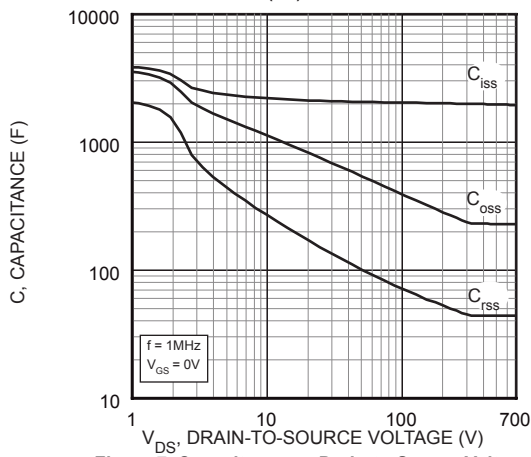


Figure 7, Capacitance vs Drain-to-Source Voltage

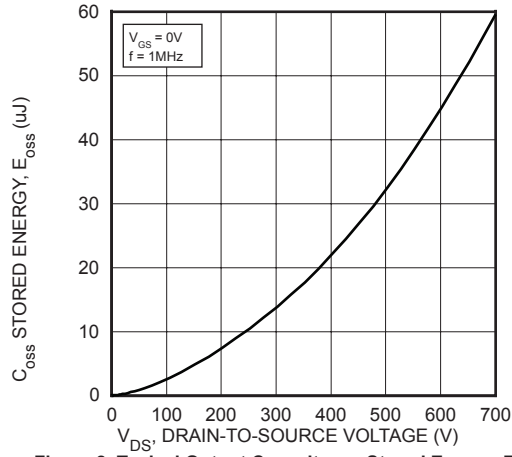


Figure 8, Typical Output Capacitance Stored Energy,  $E_{oss}$

TYPICAL PERFORMANCE CURVES

APT70SM70B\_S

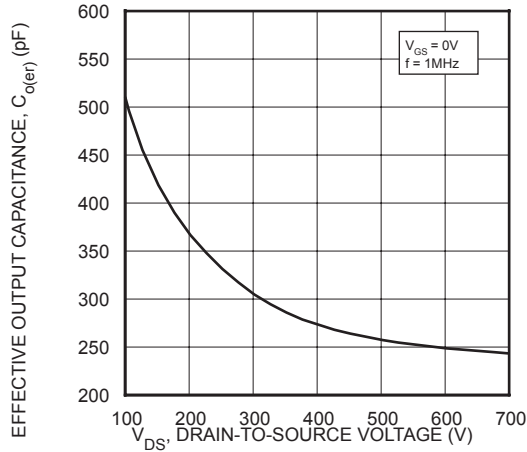


Figure 9, Effective Output Capacitance,  $C_{oe(r)}$

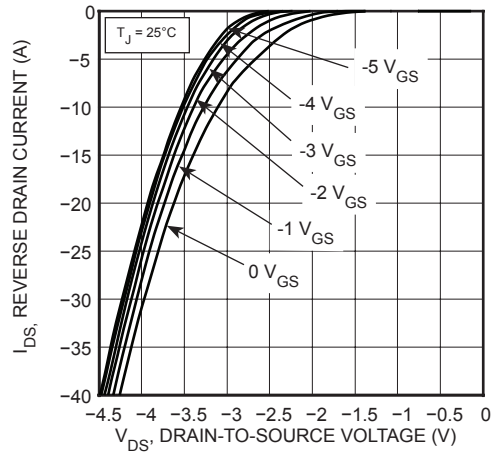


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

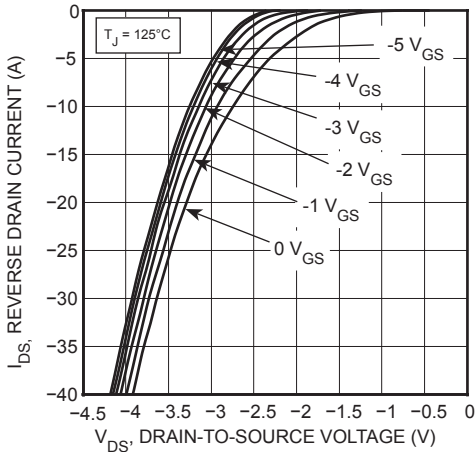


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

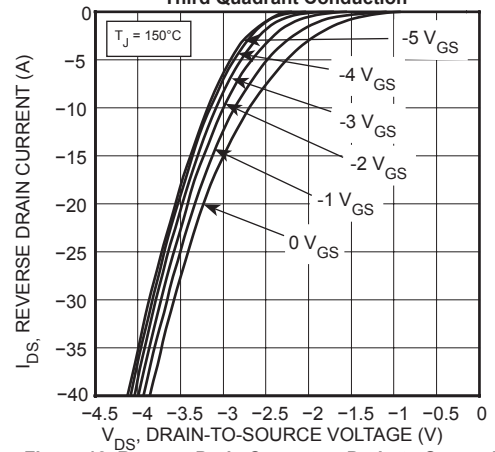


Figure 12, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

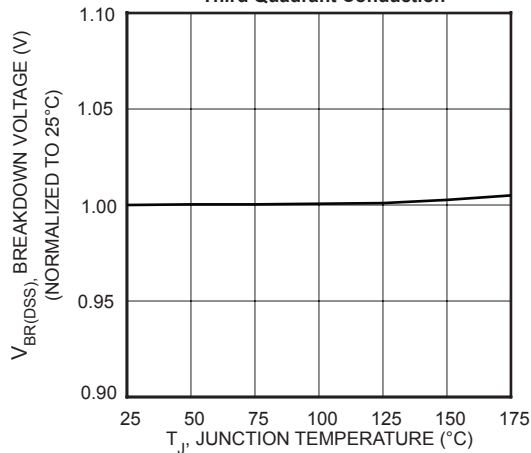


Figure 13, Breakdown Voltage vs Temperature

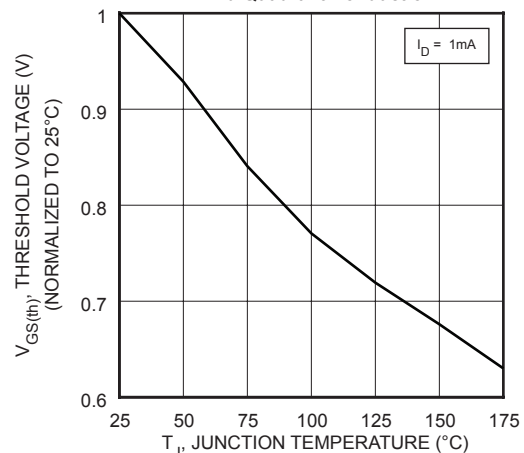


Figure 14, Threshold Voltage vs Temperature

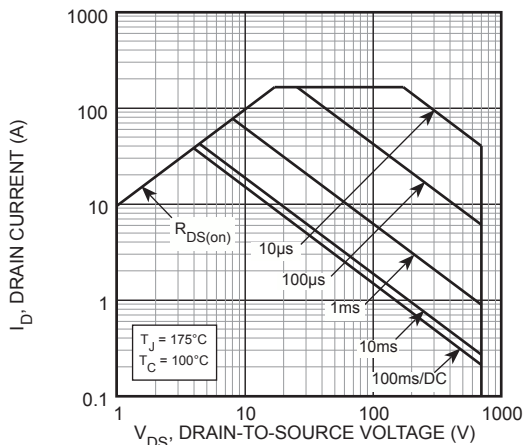
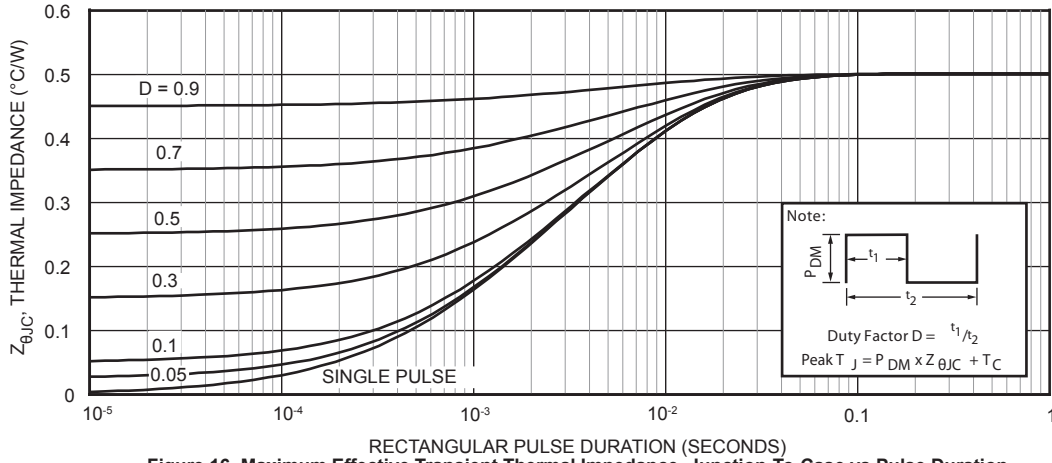
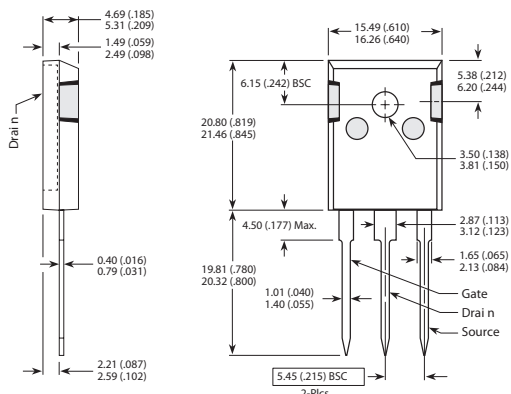


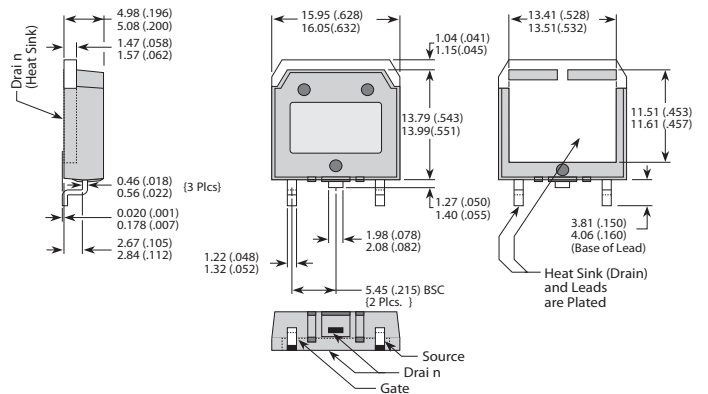
Figure 15, Forward Safe Operating Area



**TO-247 (B) Package Outline**



**D<sup>3</sup>PAK (S) Package Outline**



Dimensions in Millimeters (Inches)

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