

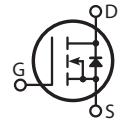
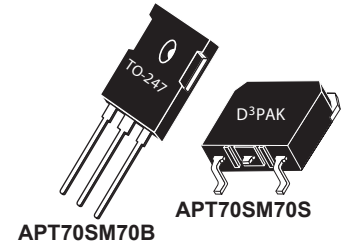
Silicon Carbide N-Channel Power MOSFET

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 @ $T_c = 25^\circ\text{C}$	70	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	50	
I_{DM}	Pulsed Drain Current ^①	165	
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 ^②	$V_{GS} = 20V, I_D = 40A$		53	60	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
 $T_J = 25^\circ\text{C}$ unless otherwise specified
APT70SM70B_S

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DD} = 700V$ $f = 1\text{MHz}$		1950		pF
C_{rss}	Reverse Transfer Capacitance			50		
C_{oss}	Output Capacitance			230		
E_{oss}	Output Capacitance Stored Energy	$V_{GS} = 0V, V_{DD} = 700V$ $f = 1\text{MHz}$		60		μJ
$C_{o(er)}$	Effective Output Capacitance			245		pF
Q_g	Total Gate Charge	$V_{GS} = 0/20V$ $V_{DD} = 466V$ $I_D = 40A$		125		nC
Q_{gs}	Gate-Source Charge			21		
Q_{gd}	Gate-Drain Charge			35		
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 466V$ $V_{GS} = 0/20V$ $I_D = 40A$ $R_G = 3.0\ \Omega$ ③ $L = 115\ \mu\text{H}$ $T_c = 25^\circ\text{C}$ Freewheeling Diode = APT20SCE65B		11		ns
t_r	Current Rise Time			11		
$t_{d(off)}$	Turn-Off Delay Time			34		
t_f	Current Fall Time			21		
E_{on2}	Turn-On Switching Energy			460		
E_{off}	Turn-Off Switching Energy		205			
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 466V$ $V_{GS} = 0/20V$ $I_D = 40A$ $R_G = 3.0\ \Omega$ ③ $L = 115\ \mu\text{H}$ $T_c = 150^\circ\text{C}$ Freewheeling Diode = APT20SCE65B		9		ns
t_r	Current Rise Time			11		
$t_{d(off)}$	Turn-Off Delay Time			40		
t_f	Current Fall Time			25		
E_{on2}	Turn-On Switching Energy			425		
E_{off}	Turn-Off Switching Energy		335			

Source-Drain Diode Characteristics
 $T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	$I_{SD} = 40A, V_{GS} = 0V$		4.25		V
T_{rr}	Reverse Recovery Time	$I_{SD} = 40A, V_{DD} = 466V$ $di/dt = -1000A/\mu\text{s}$		45		ns
Q_{rr}	Reverse Recovery Charge			250		nC
I_{rrm}	Reverse Recovery Current			10		A

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.

TYPICAL PERFORMANCE CURVES

APT70SM70B_S

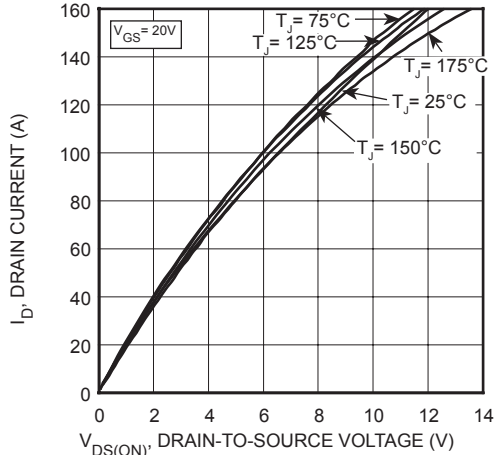


Figure 1, Output Characteristics

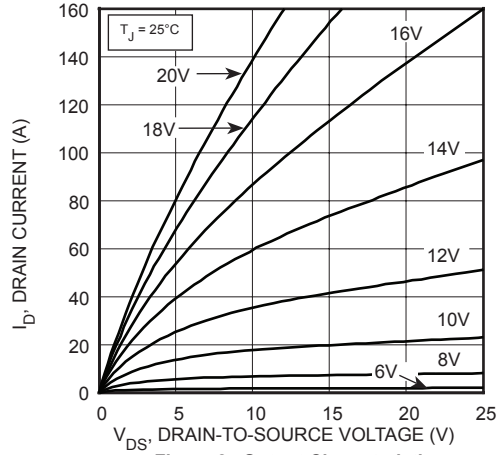


Figure 2, Output Characteristics

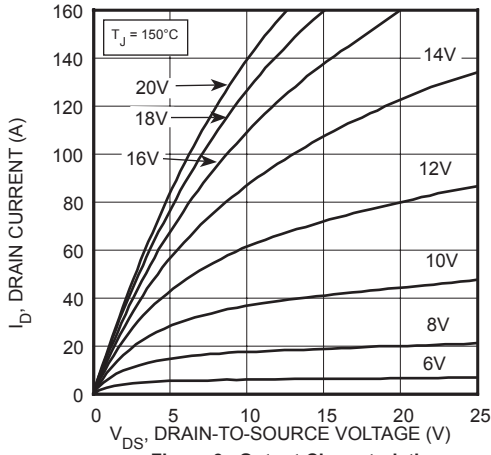


Figure 3, Output Characteristics

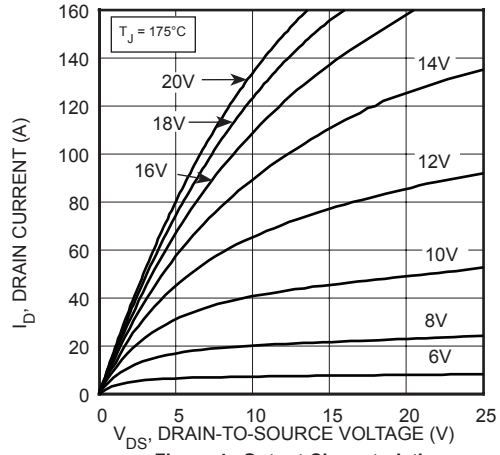


Figure 4, Output Characteristics

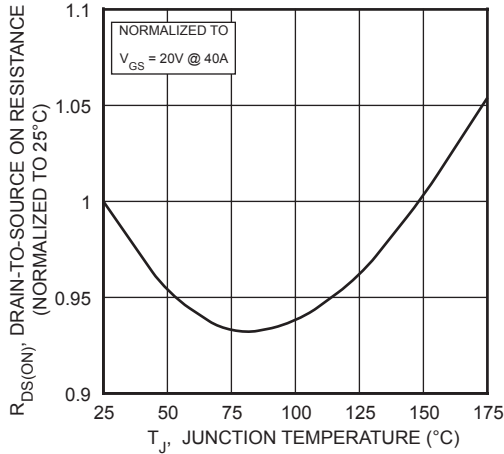


Figure 5, $R_{DS(ON)}$ vs Junction Temperature

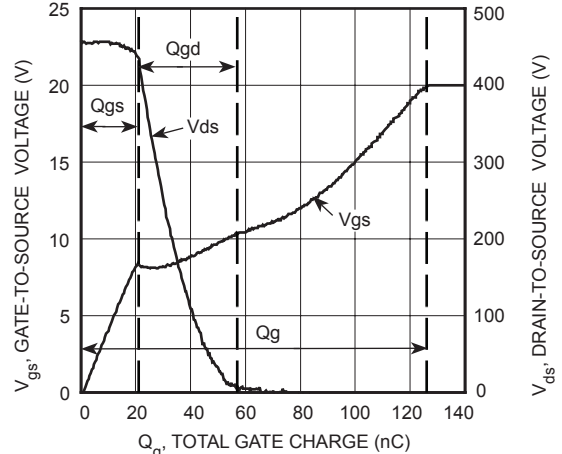


Figure 6, Gate Charge vs Gate-to-Source Voltage

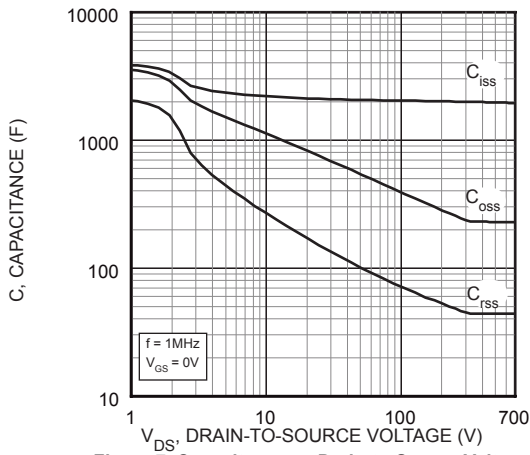


Figure 7, Capacitance vs Drain-to-Source Voltage

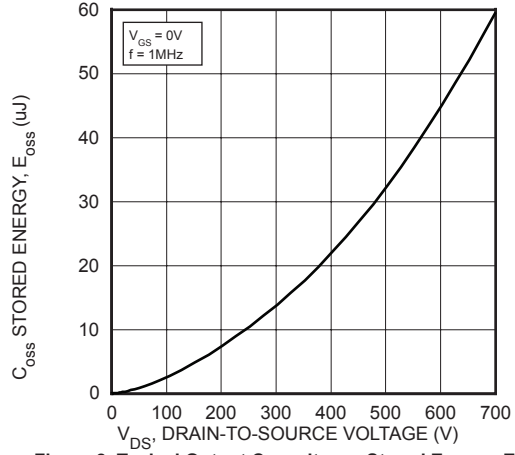


Figure 8, Typical Output Capacitance Stored Energy, E_{oss}

TYPICAL PERFORMANCE CURVES

APT70SM70B_S

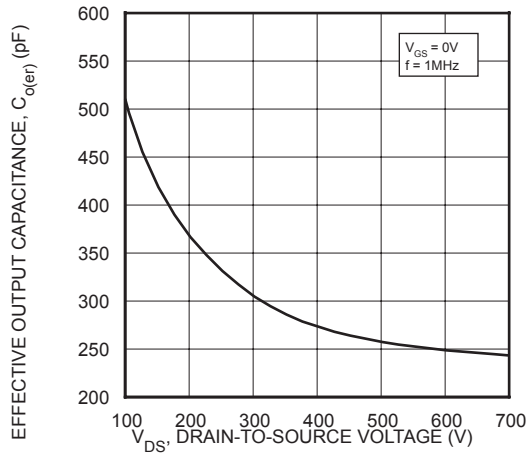


Figure 9, Effective Output Capacitance, $C_{oe(r)}$

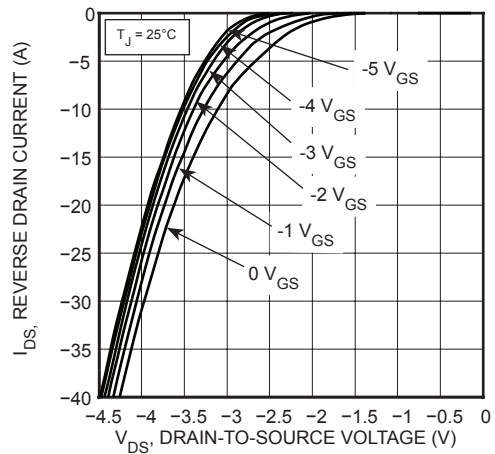


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

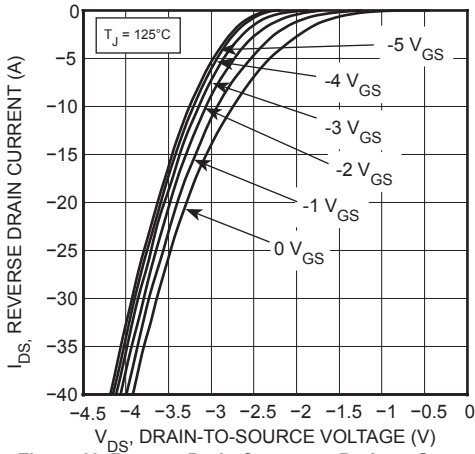


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

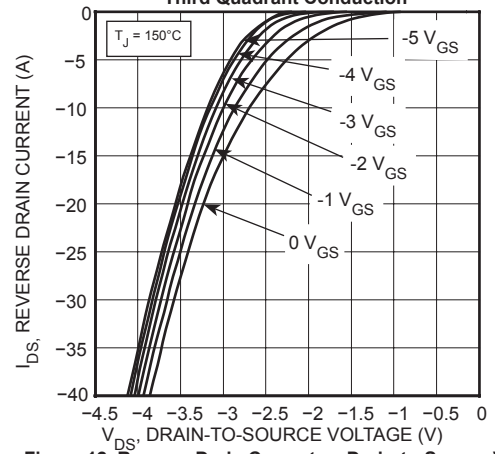


Figure 12, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

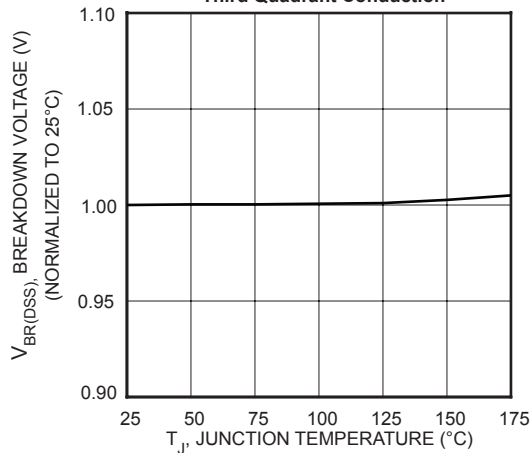


Figure 13, Breakdown Voltage vs Temperature

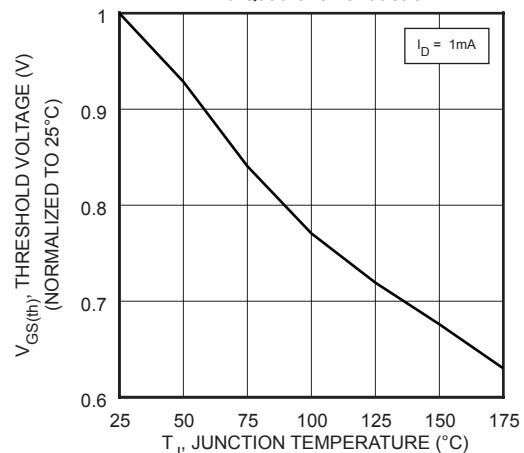


Figure 14, Threshold Voltage vs Temperature

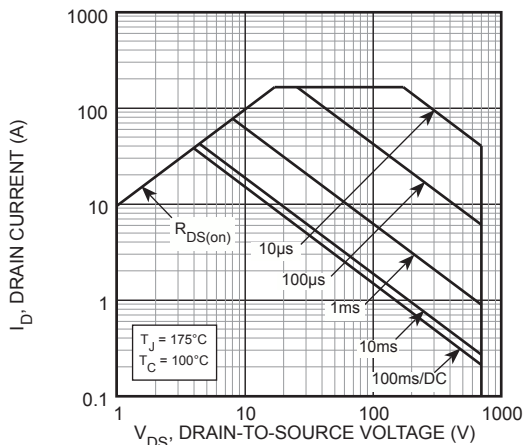


Figure 15, Forward Safe Operating Area

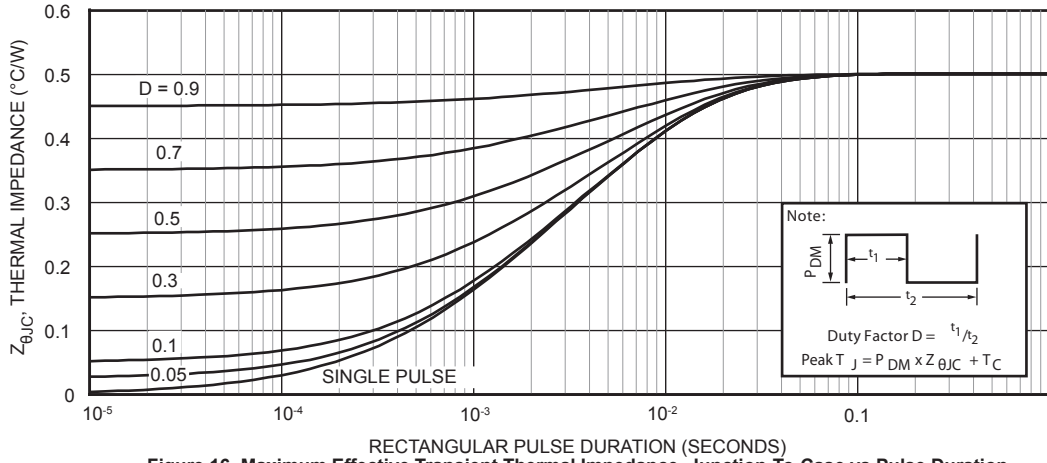
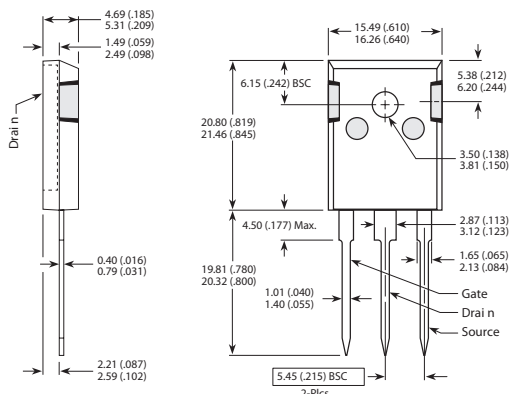
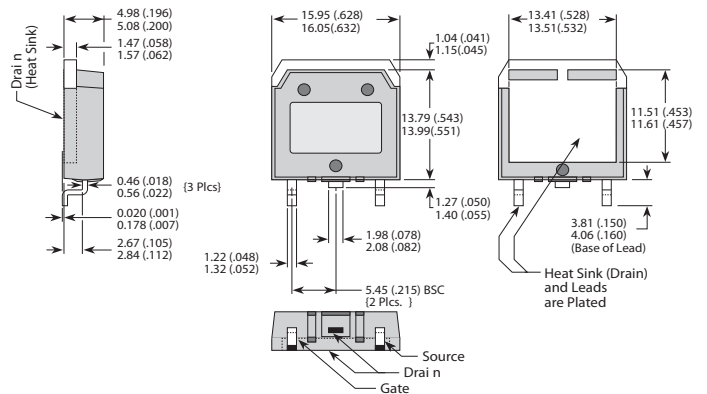


Figure 16, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline



D³PAK (S) Package Outline



Dimensions in Millimeters (Inches)

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