

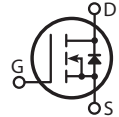
Silicon Carbide N-Channel Power MOSFET

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 @ $T_c = 25^\circ\text{C}$	49	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	34	
I_{DM}	Pulsed Drain Current ^①	154	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ $T_c = 25^\circ\text{C}$	165	W
	Linear Derating Factor	1.1	W/°C

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance		0.63	0.91	°C/W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55		175	°C
Torque	Mounting Torque (SOT-227 Package), 6-32 or M3 screw			10	in·lbf
				1.1	N·m
W_T	Package Weight		1.03		oz
			29.2		g

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	$V_{GS} = 20V, I_D = 32.5A$		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

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

APT70SM70J

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	$V_{GS} = 0/20V$ $V_{DD} = 466V$ $I_D = 32.5A$		125		nC
Q_{gs}	Gate-Source Charge			21		
Q_{gd}	Gate-Drain Charge			35		
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 466V$ $V_{GS} = 0/20V$ $I_D = 32.5A$ $R_G = 3.0\ \Omega$ ③ $L = 115\ \mu\text{H}$ $T_c = 25^\circ\text{C}$ Freewheeling Diode = APT20SCE65B		12		ns
t_r	Current Rise Time			14		
$t_{d(off)}$	Turn-Off Delay Time			33		
t_f	Current Fall Time			23		
E_{on2}	Turn-On Switching Energy			645		
E_{off}	Turn-Off Switching Energy		170			
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 466V$ $V_{GS} = 0/20V$ $I_D = 32.5A$ $R_G = 3.0\ \Omega$ ③ $L = 115\ \mu\text{H}$ $T_c = 150^\circ\text{C}$ Freewheeling Diode = APT20SCE65B		10		ns
t_r	Current Rise Time			13		
$t_{d(off)}$	Turn-Off Delay Time			37		
t_f	Current Fall Time			27		
E_{on2}	Turn-On Switching Energy			540		
E_{off}	Turn-Off Switching Energy		225			

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	$I_{SD} = 32.5A, V_{GS} = 0V$		4.25		V
T_{rr}	Reverse Recovery Time	$I_{SD} = 32.5A, V_{DD} = 466V$ $di/dt = -1000A/\mu\text{s}$		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

APT70SM70J

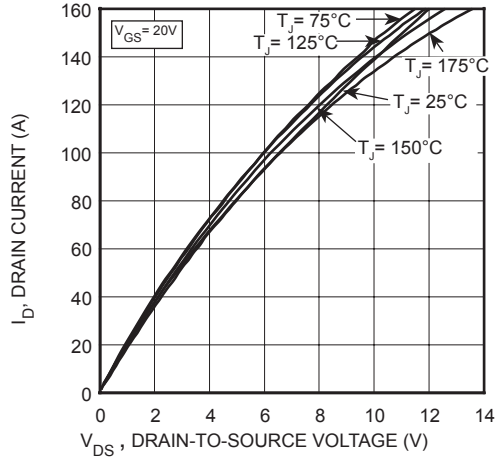


Figure 1, Output Characteristics

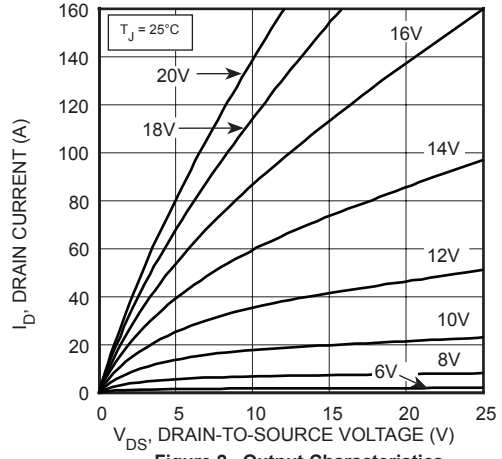


Figure 2, Output Characteristics

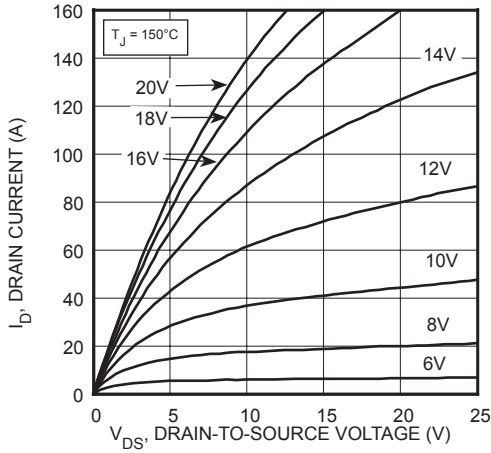


Figure 3, Output Characteristics

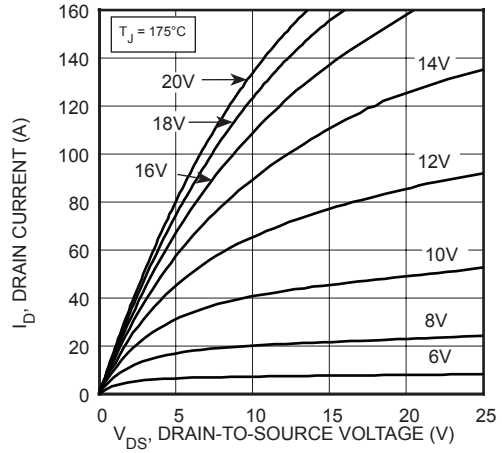


Figure 4, Output Characteristics

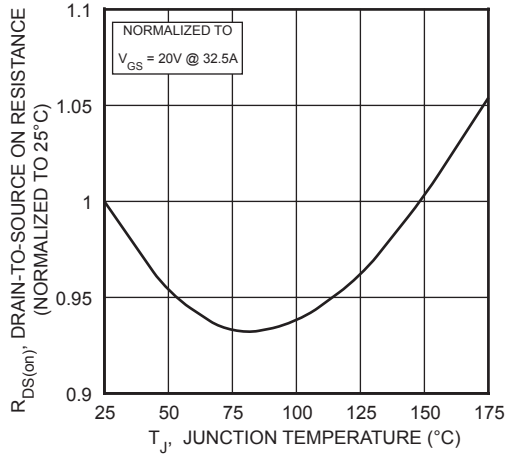


Figure 5, $R_{DS(on)}$ vs Junction Temperature

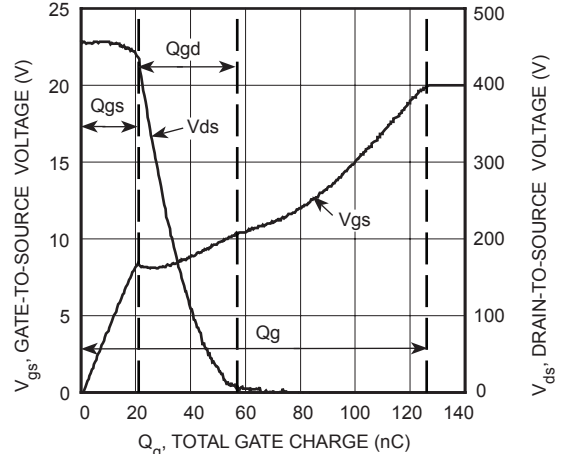


Figure 6, Gate Charge vs Gate-to-Source Voltage

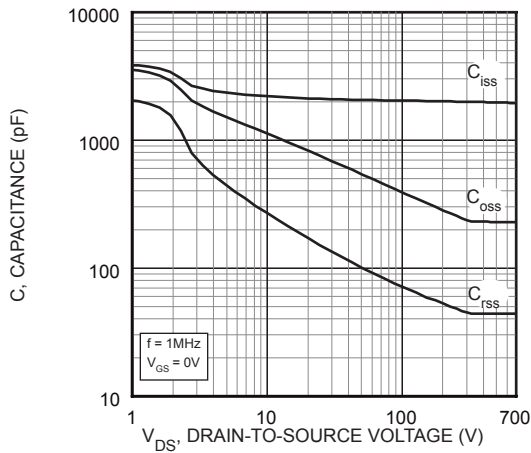


Figure 7, Capacitance vs Drain-to-Source Voltage

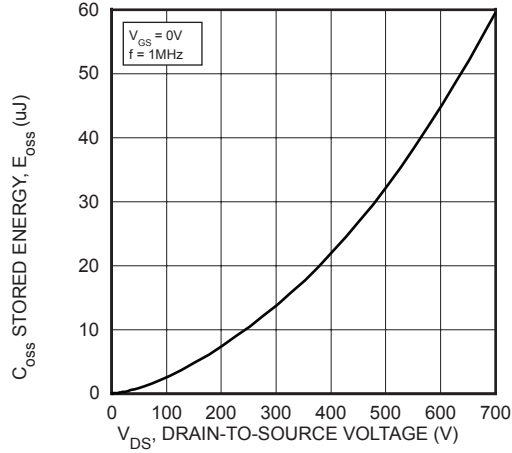


Figure 8, Typical Output Capacitance Stored Energy, E_{oss}

TYPICAL PERFORMANCE CURVES

APT70SM70J

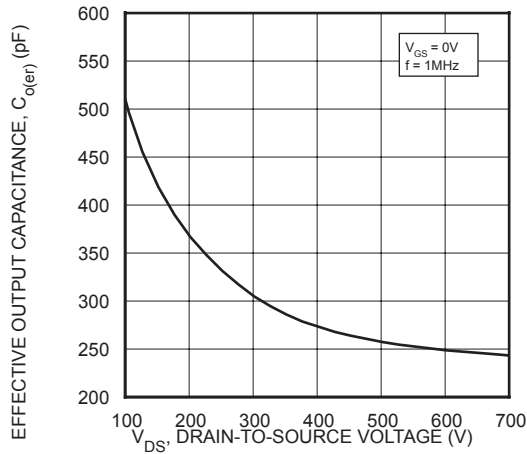


Figure 9, Effective Output Capacitance, $C_{oe(r)}$

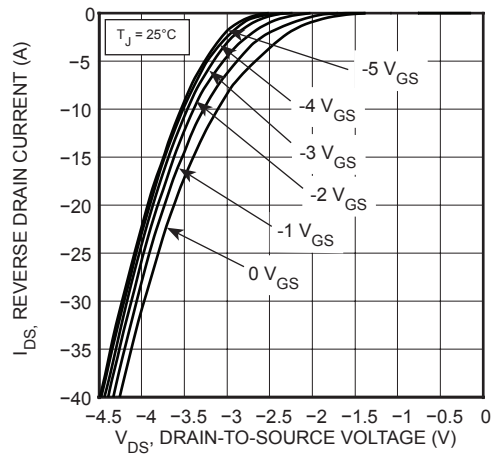


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

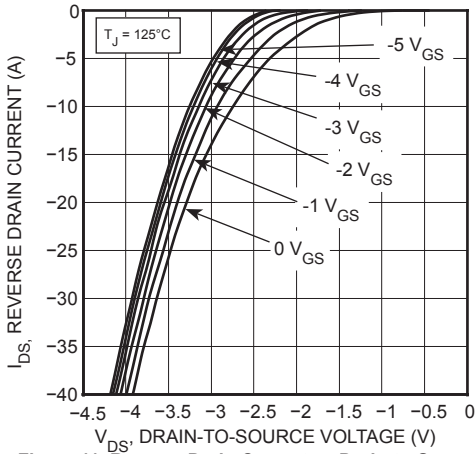


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

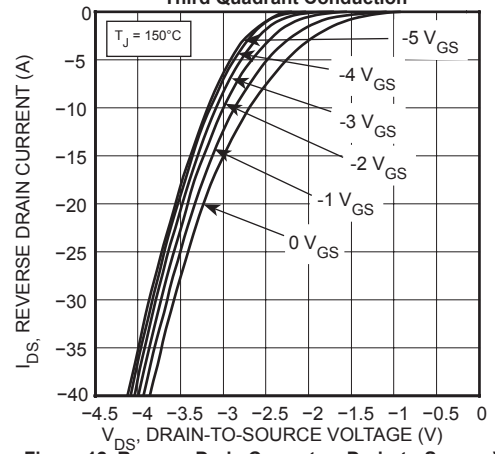


Figure 12, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

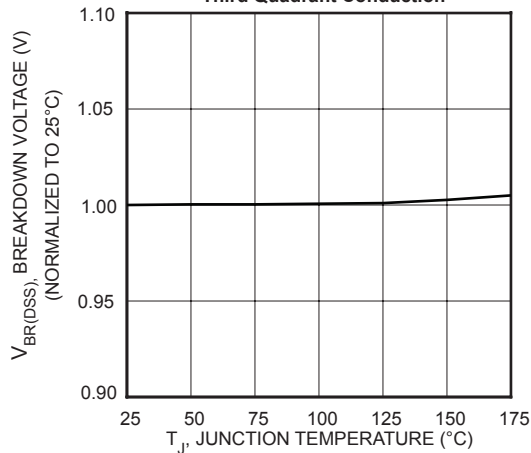


Figure 13, Breakdown Voltage vs Temperature

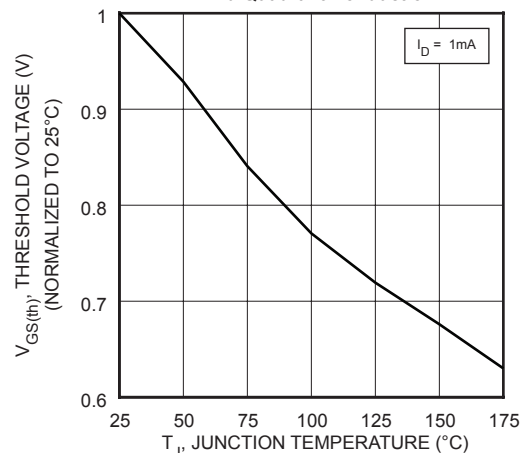


Figure 14, Threshold Voltage vs Temperature

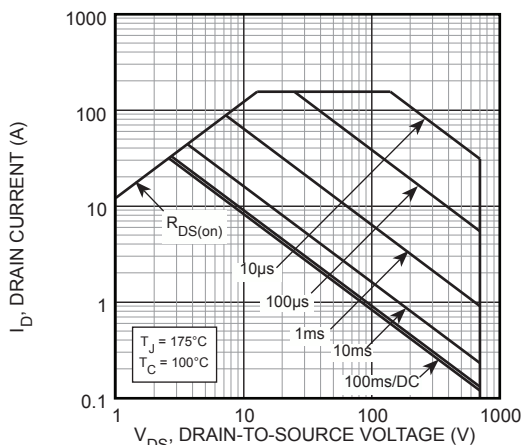
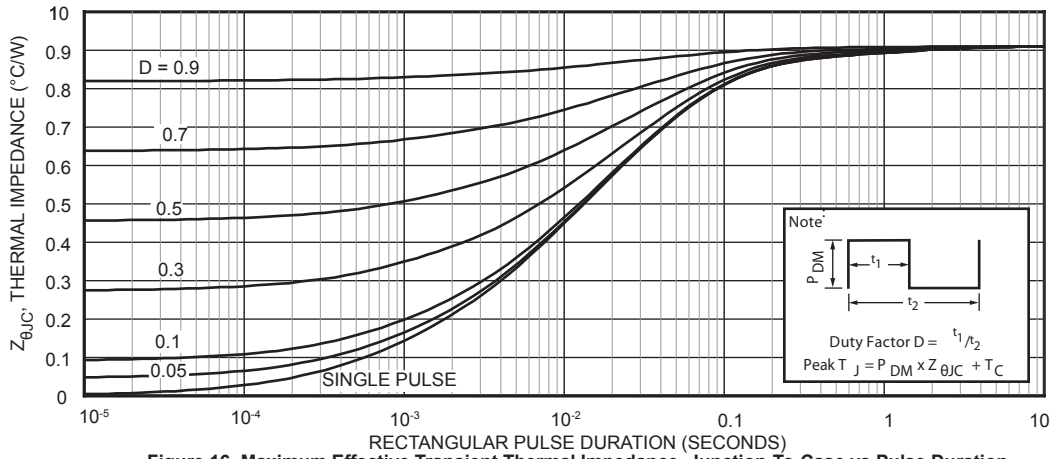
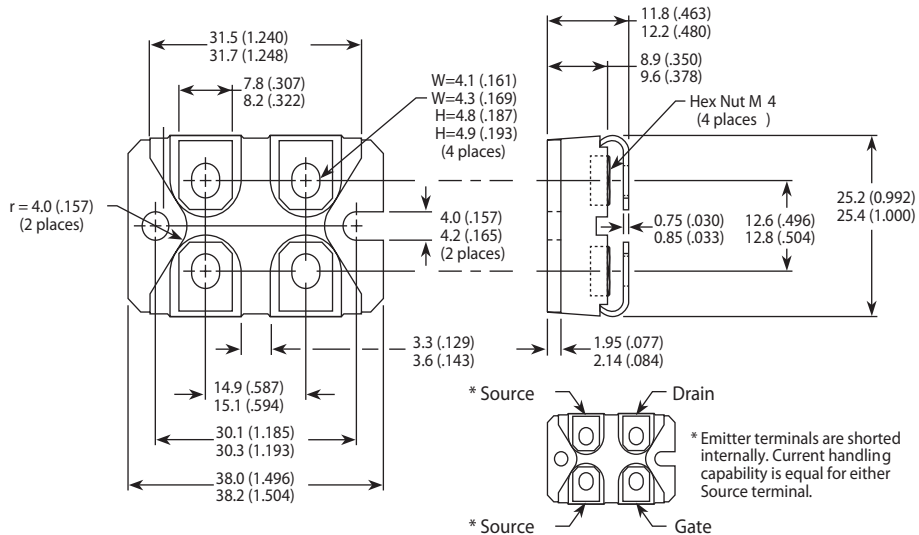


Figure 15, Forward Safe Operating Area



SOT-227 (ISOTOP®) Package Outline



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