


Silicon Carbide N-Channel Power MOSFET

FEATURES

- 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


APT5SM170S


Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain Source Voltage	1700	V
I_D	Continuous Drain Current @ $T_c = 25^\circ\text{C}$	4.6	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	3.3	
I_{DM}	Pulsed Drain Current ^①	9.2	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ $T_c = 25^\circ\text{C}$	52	W
	Linear Derating Factor	0.35	W/°C

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance		2.4	2.9	°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	

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	$V_{GS} = 0V, I_D = 100\mu A$	1700			V
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to $25^\circ\text{C}, I_D = 100\mu A$		0.68		V/°C
$R_{DS(on)}$	Drain-Source On Resistance ^②	$V_{GS} = 20V, I_D = 2A$		0.8	1.2	Ω
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 500\mu A$	1.8	3.2		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient			-6.8		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1700V, V_{GS} = 0V, T_J = 25^\circ\text{C}$			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	$f = 1\text{MHz}, 25\text{mV}, \text{Drain Short}$		1.30		Ω

Dynamic Characteristics
 $T_J = 25^\circ\text{C}$ unless otherwise specified
APT5SM170S

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DD} = 1000V$ $f = 1\text{MHz}$		325		pF
C_{rss}	Reverse Transfer Capacitance			5		
C_{oss}	Output Capacitance			15		
E_{oss}	Output Capacitance Stored Energy	$V_{GS} = 0V, V_{DD} = 1000V$ $f = 1\text{MHz}$		8		μJ
$C_{o(er)}$	Effective Output Capacitance			16		pF
Q_g	Total Gate Charge	$V_{GS} = -5/20V$ $V_{DD} = 850V$ $I_D = 2A$		29		nC
Q_{gs}	Gate-Source Charge			7		
Q_{gd}	Gate-Drain Charge			9		
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 850V$ $V_{GS} = 0/20V$ $I_D = 2A$ $R_G = 2.5\ \Omega$ ③ $L = 115\ \mu\text{H}$ $T_c = 25^\circ\text{C}$		4		ns
t_r	Current Rise Time			1		
$t_{d(off)}$	Turn-Off Delay Time			7		
t_f	Current Fall Time			95		
E_{on2}	Turn-On Switching Energy			90		μJ
E_{off}	Turn-Off Switching Energy			30		
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 850$ $V_{GS} = 0/20V$ $I_D = 2A$ $R_G = 2.5\ \Omega$ ③ $L = 115\ \mu\text{H}$ $T_c = 150^\circ\text{C}$		3		ns
t_r	Current Rise Time			1		
$t_{d(off)}$	Turn-Off Delay Time			8		
t_f	Current Fall Time			95		
E_{on2}	Turn-On Switching Energy			90		μJ
E_{off}	Turn-Off Switching Energy			32		

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	$I_{SD} = 1A, V_{GS} = 0V$		3.7		V
T_{rr}	Reverse Recovery Time	$I_{SD} = 2A, V_{DD} = 850V$ $di/dt = -1200A/\mu\text{s}$		30		ns
Q_{rr}	Reverse Recovery Charge			55		nC
I_{rrm}	Reverse Recovery Current			-3.5		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.

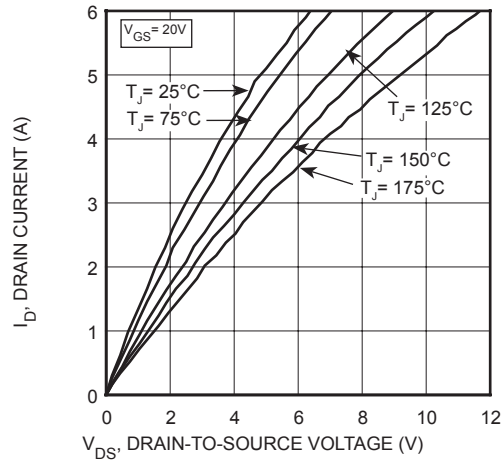


Figure 1, Output Characteristics

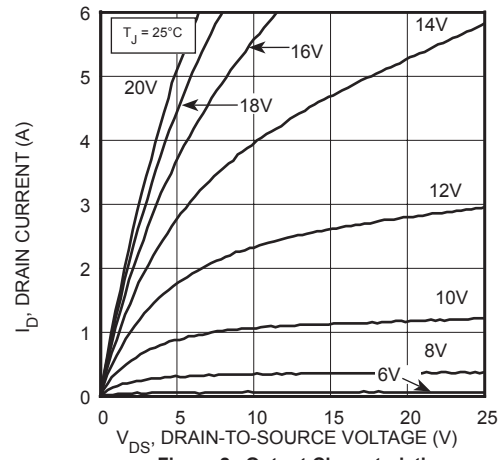


Figure 2, Output Characteristics

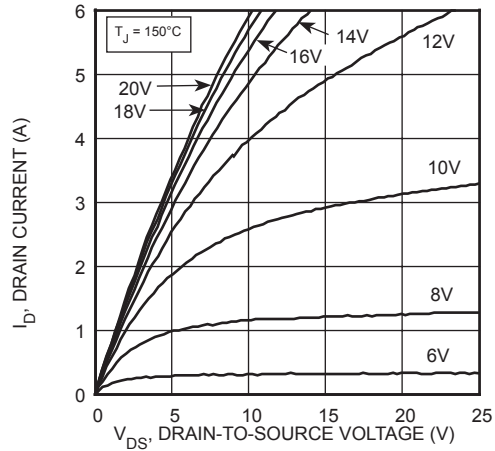


Figure 3, Output Characteristics

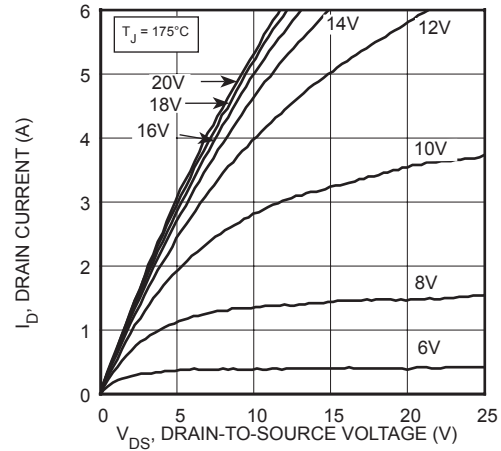


Figure 4, Output Characteristics

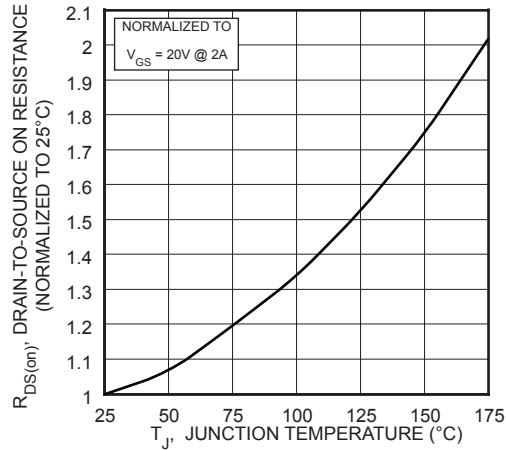
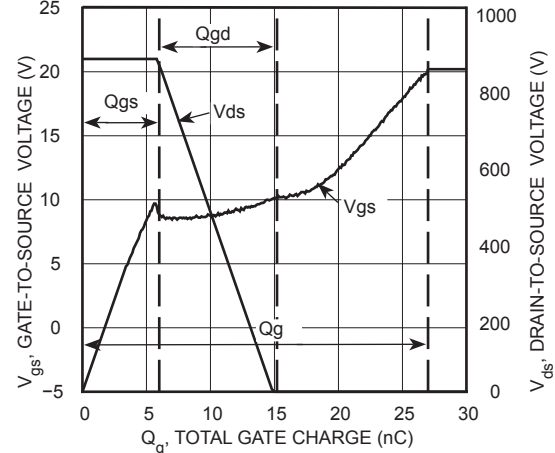
Figure 5, $R_{DS(on)}$ vs Junction Temperature

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

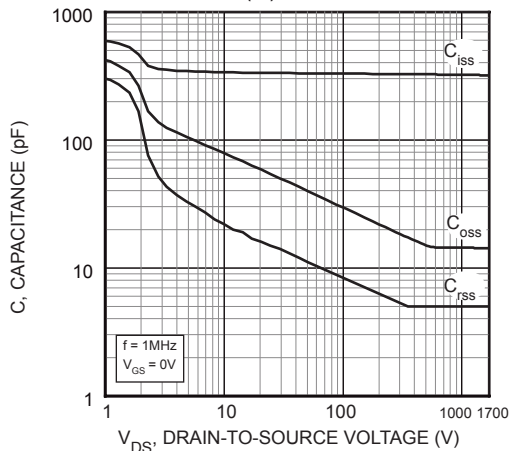
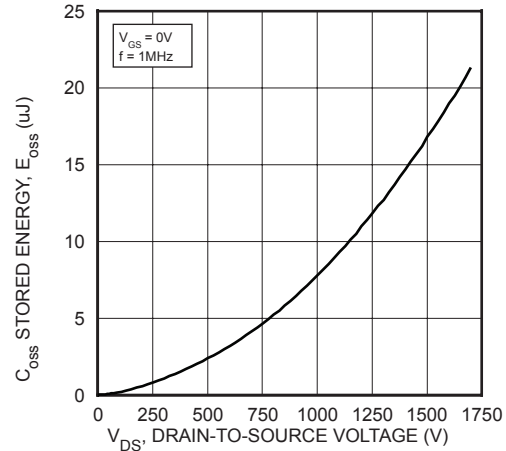


Figure 7, Capacitance vs Drain-to-Source Voltage

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

TYPICAL PERFORMANCE CURVES

APT5SM170S

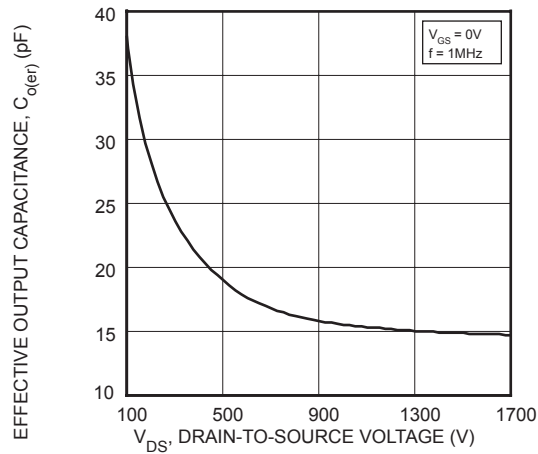


Figure 9, Effective Output Capacitance, C_{oe}

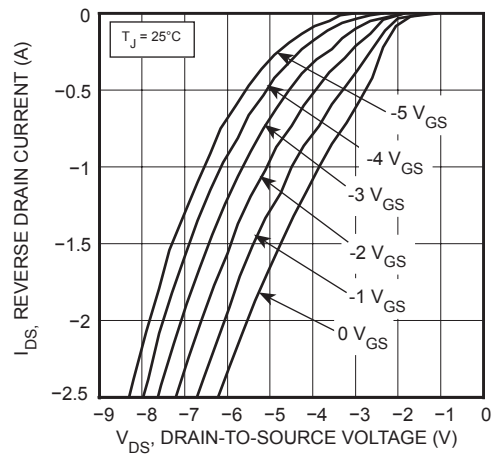


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

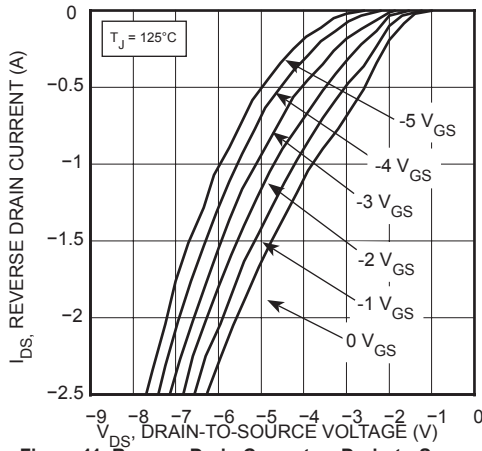


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

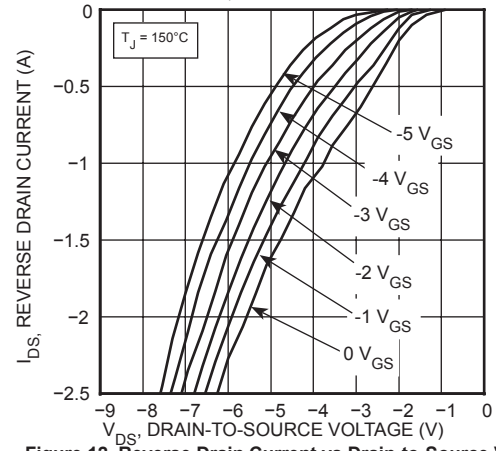


Figure 12, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction

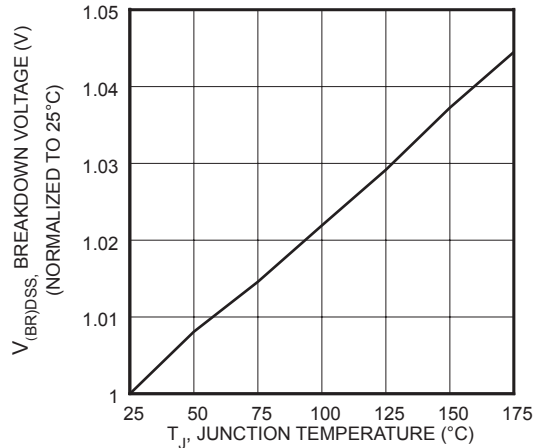


Figure 13, Breakdown Voltage vs Temperature

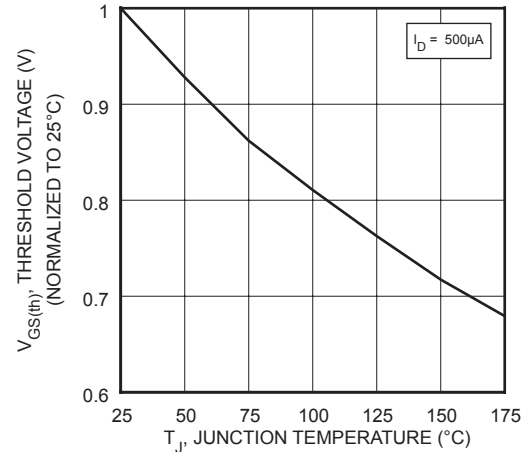


Figure 14, Threshold Voltage vs Temperature

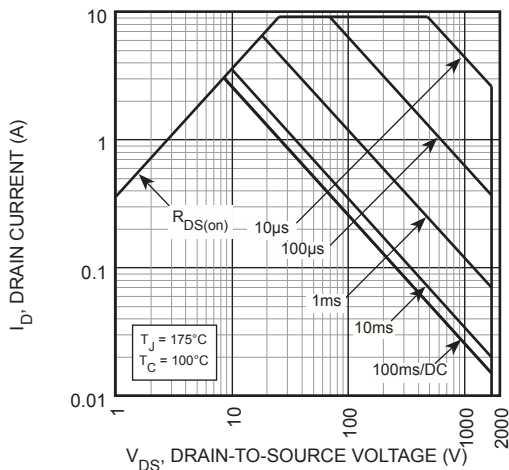


Figure 15, Forward Safe Operating Area

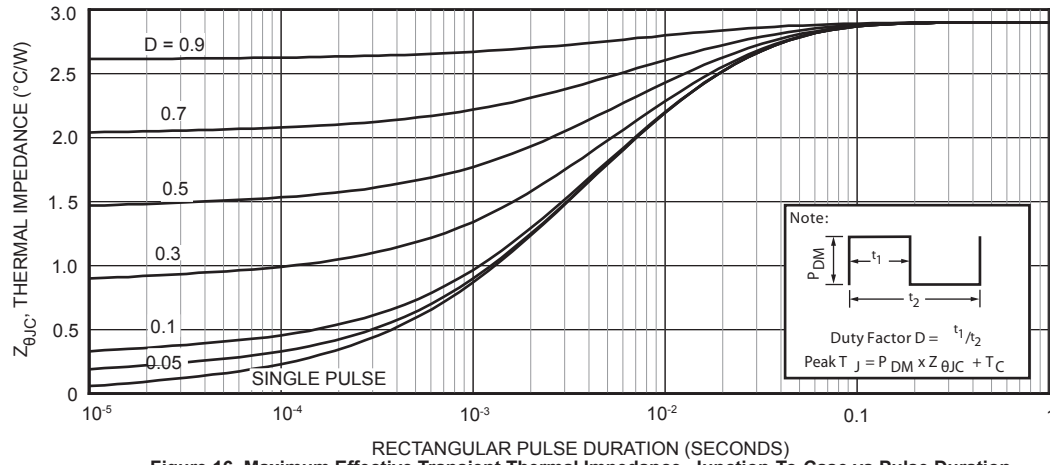
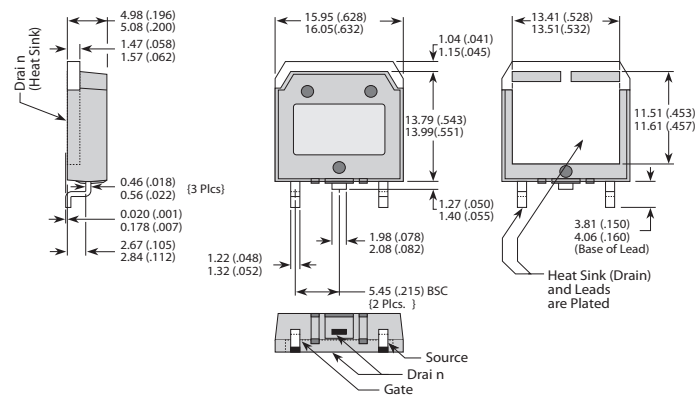


Figure 16, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

D³PAK (S) Package Outline



Dimensions in Millimeters (Inches)

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