

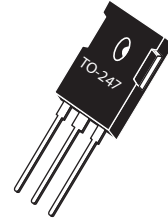
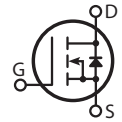
Silicon Carbide N-Channel Power MOSFET

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


APT5SM170B


Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain Source Voltage	1700	V
I_D	Continuous Drain Current @ $T_c = 25^\circ\text{C}$	5	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	3.5	
I_{DM}	Pulsed Drain Current ^①	10	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ $T_c = 25^\circ\text{C}$	63	W
	Linear Derating Factor	0.42	W/°C

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance			2.4	°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	$V_{GS} = 0V, I_D = 100\mu\text{A}$	1700			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to $25^\circ\text{C}, I_D = 100\mu\text{A}$		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	$V_{GS} = V_{DS}, I_D = 500\mu\text{A}$	1.8	3.2		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient				-6.8	
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
APT5SM170B

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		
E_{off}	Turn-Off Switching Energy		30			
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 850V$ $V_{GS} = 0/20V$ $I_D = 2A$ $R_G = 2.5\ \Omega$ ③ $L = 115\ \mu\text{H}$ $T_c = 150^\circ\text{C}$		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		
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.

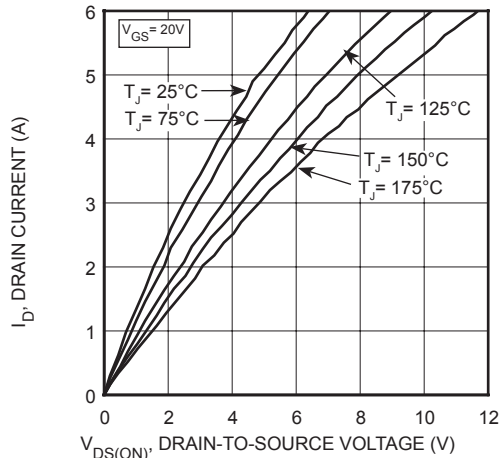


Figure 1, Output Characteristics

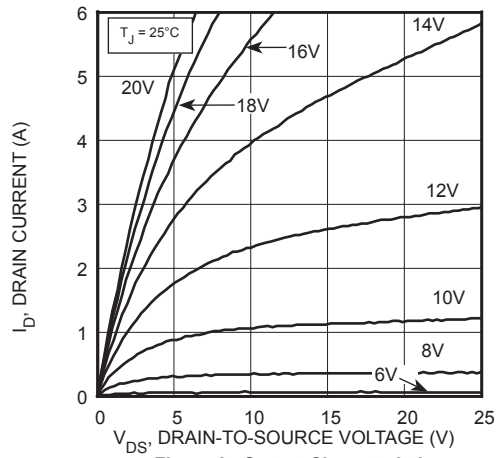


Figure 2, Output Characteristics

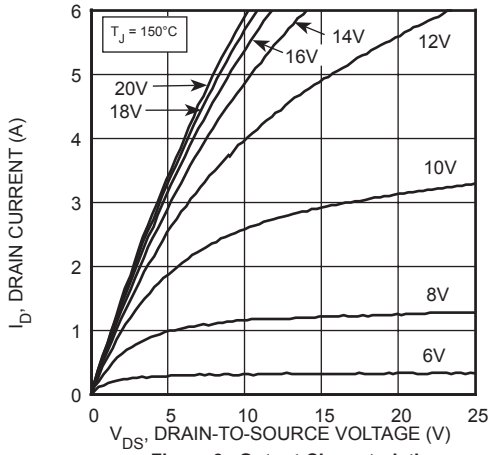


Figure 3, Output Characteristics

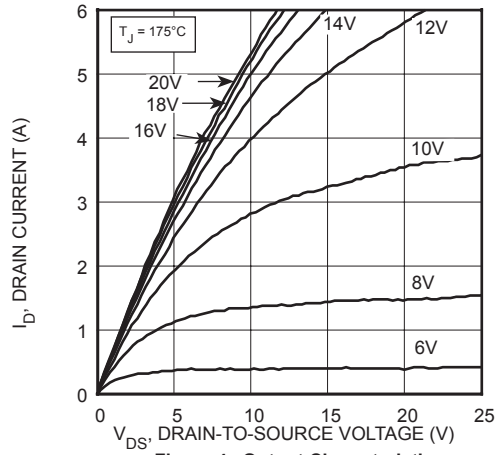


Figure 4, Output Characteristics

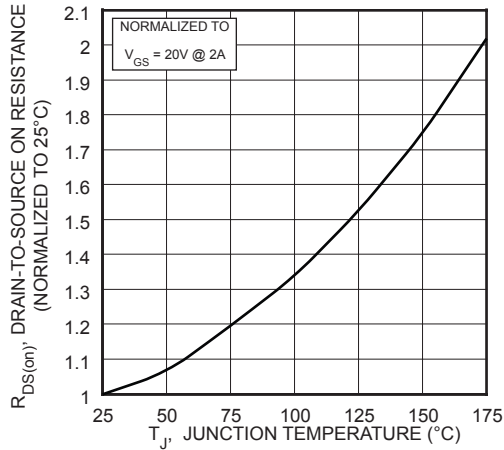


Figure 5, $R_{DS(on)}$ vs Junction Temperature

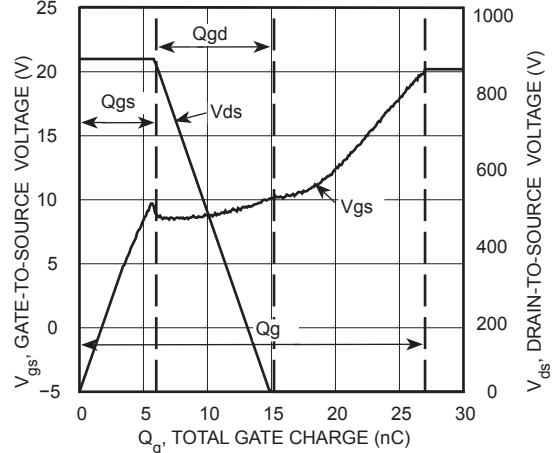


Figure 6, Gate Charge vs Gate-to-Source Voltage

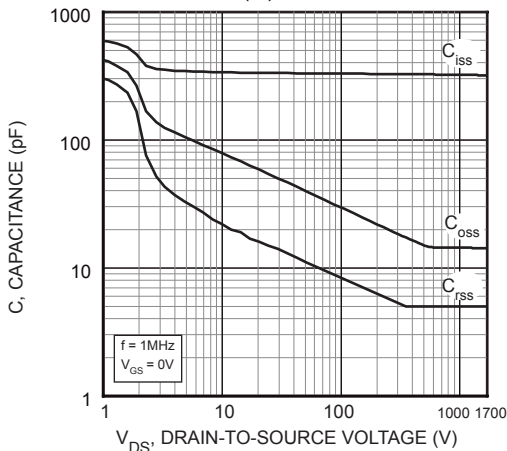


Figure 7, Capacitance vs Drain-to-Source Voltage

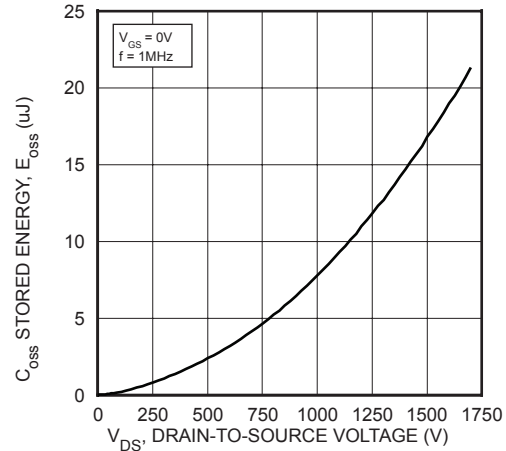


Figure 8, Typical Output Capacitance Stored Energy, E_{oss}

TYPICAL PERFORMANCE CURVES

APT5SM170B

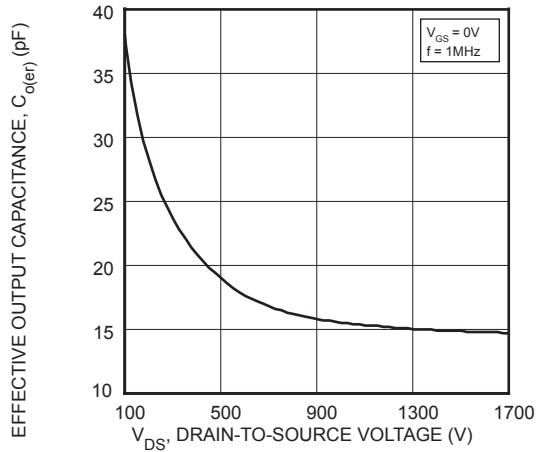


Figure 9, Effective Output Capacitance, $C_{oe(r)}$

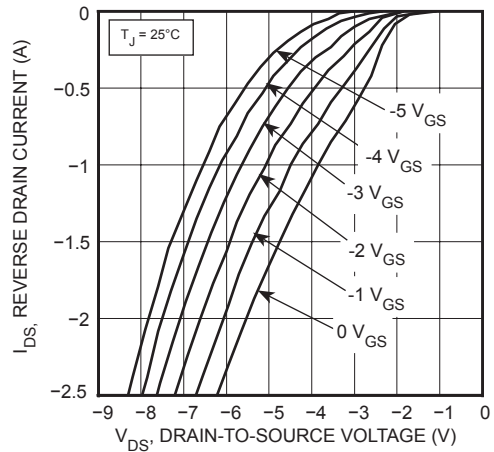


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

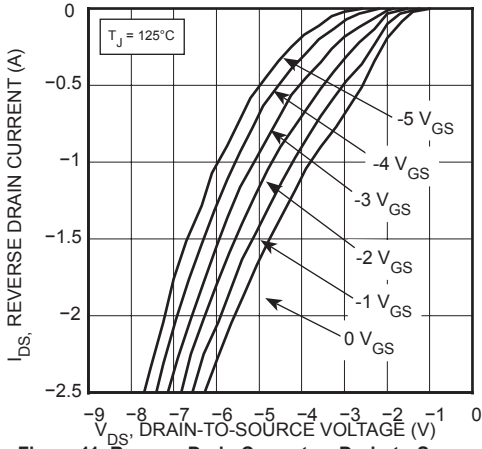


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

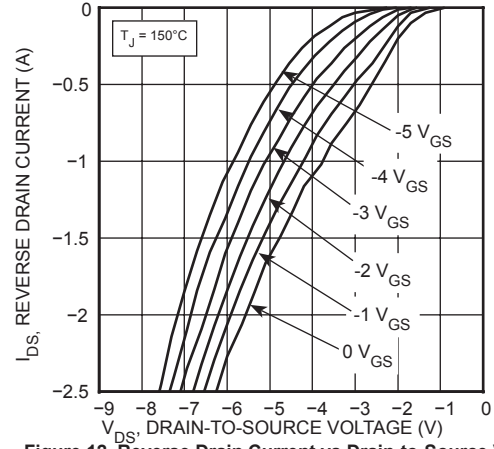


Figure 12, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

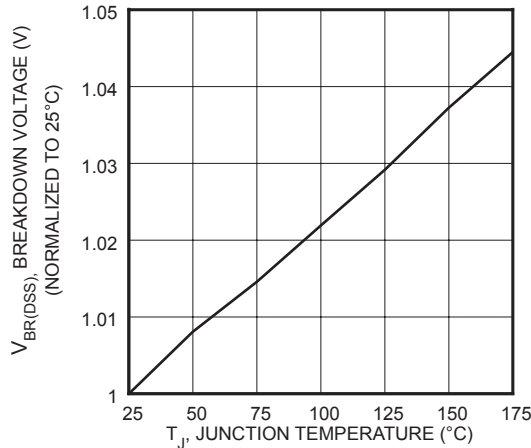


Figure 13, Breakdown Voltage vs Temperature

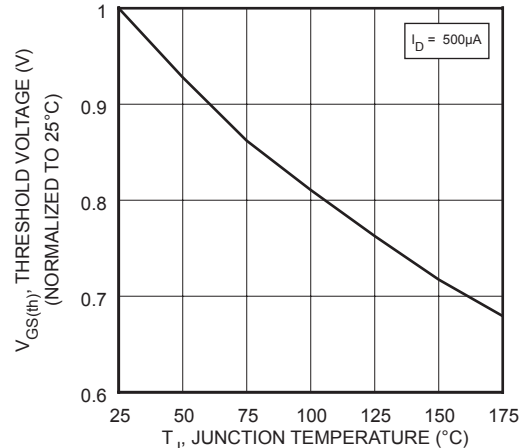


Figure 14, Threshold Voltage vs Temperature

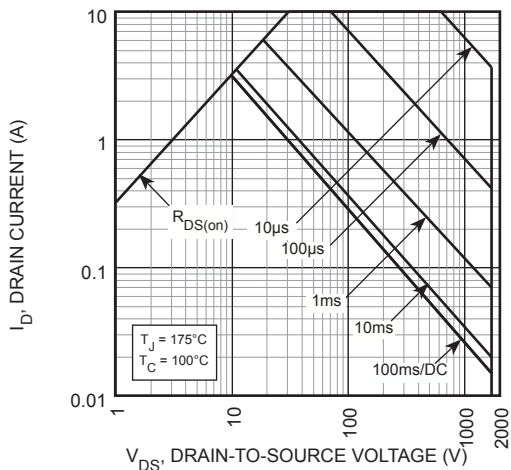
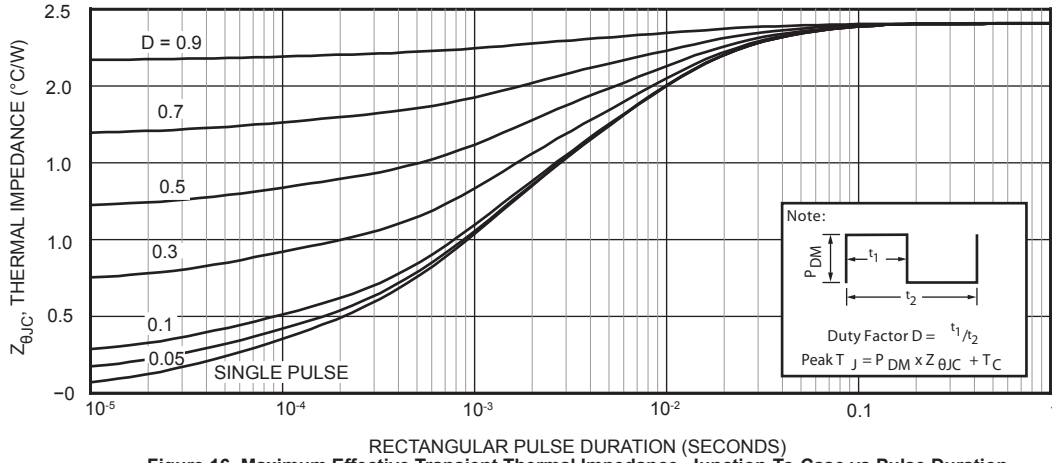
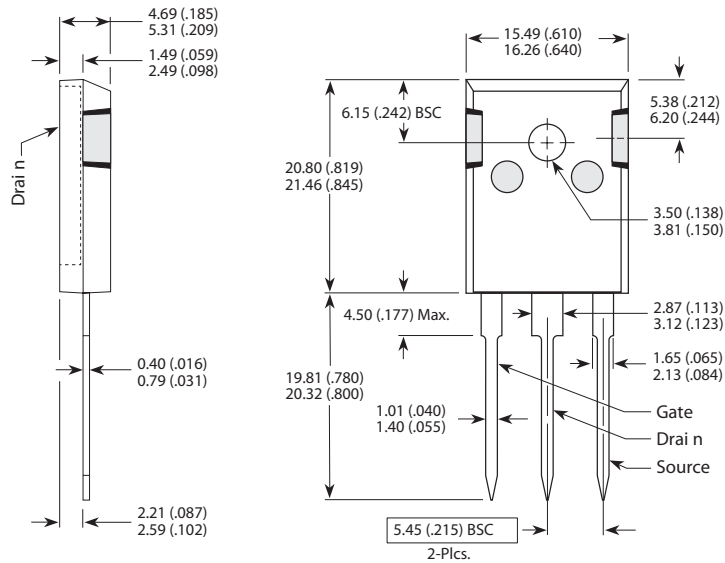


Figure 15, Forward Safe Operating Area



TO-247 (B) Package Outline



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