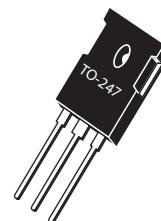## Silicon Carbide N-Channel Power MOSFET

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°C	5	A
	Continuous Drain Current @ T_C = 100°C	3.5	
I_{DM}	Pulsed Drain Current①	10	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ T_C = 25°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		1.75	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°C unless otherwise specified

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 100µA		1700			V
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to 25°C, I_D = 100µA			0.68		V/°C
$R_{DS(on)}$	Drain-Source On Resistance②	V_{GS} = 20V, I_D = 2A			0.8	1.2	Ω
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}$, I_D = 500µA		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°C			100	µA
			T_J = 150°C			250	
I_{GSS}	Gate-Source Leakage Current	V_{GS} = +20V / -10V				±100	nA
ESR	Equivalent Series Resistance	f = 1MHz, 25mV, Drain Short			1.30		Ω

050-7722   Rev B 8-2015

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DD} = 1000V f = 1MHz		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 = 1MHz		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 Ω ③ L = 115 µH T_c = 25°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 Ω ③ L = 115 µH T_c = 150°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°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/µs		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 < 380µs, duty cycle < 2%.

③ R_G is total external gate resistance not including internal gate driver impedance.
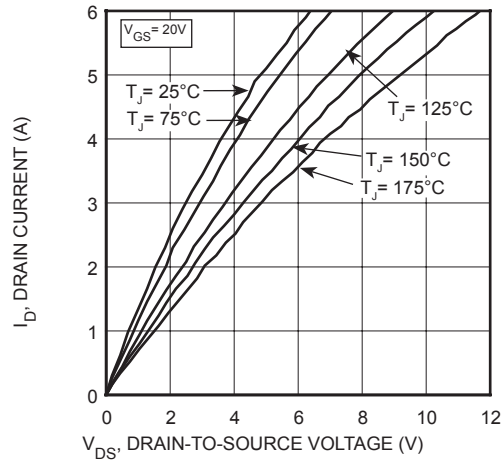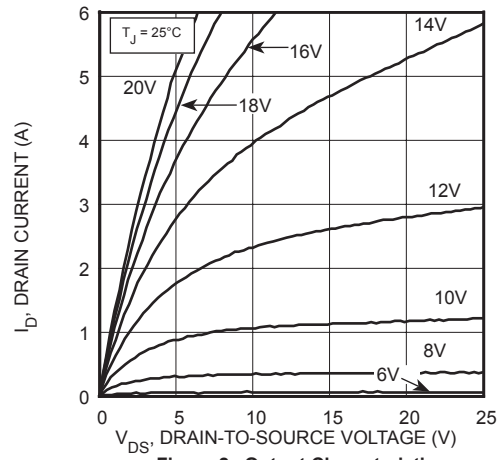
Figure 1, Output Characteristics
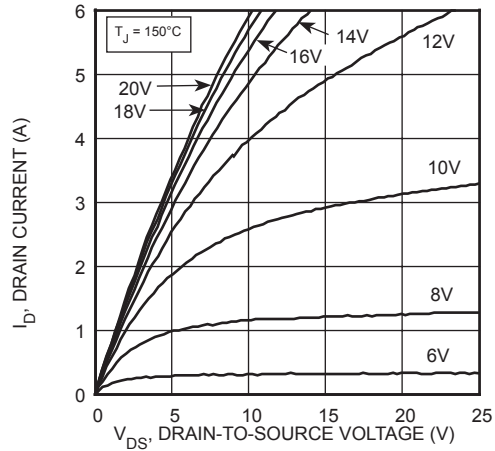
Figure 2, Output Characteristics
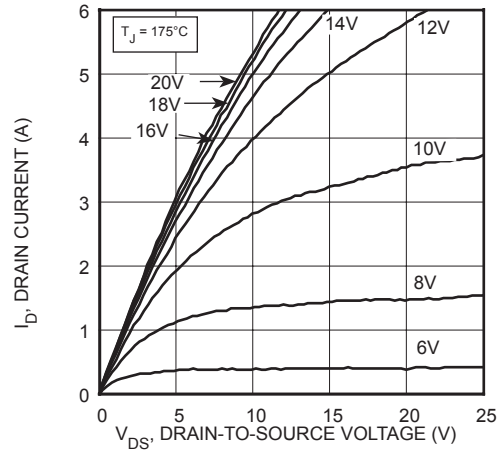
Figure 3, Output Characteristics

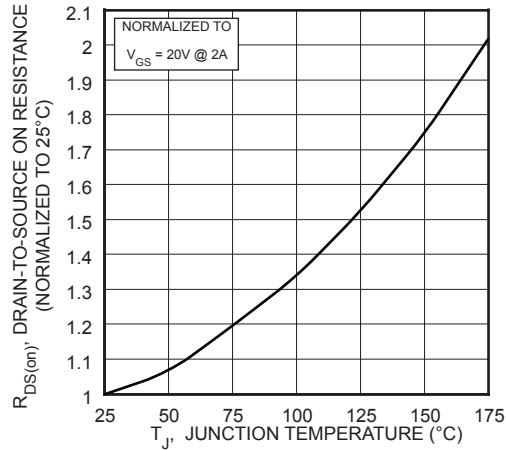**Figure 4, Output Characteristics**

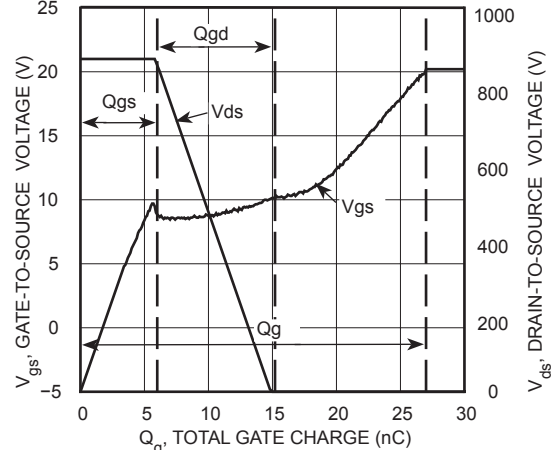**Figure 5, $R_{DS(on)}$ vs Junction Temperature**

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

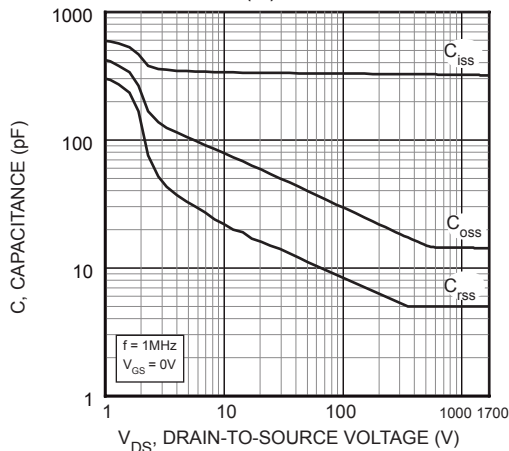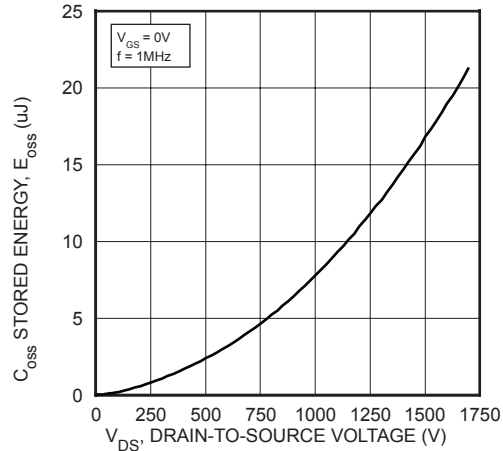**Figure 7, Capacitance vs Drain-to-Source Voltage**

Figure 8, Typical Output Capacitance Stored Energy, E_{oss}
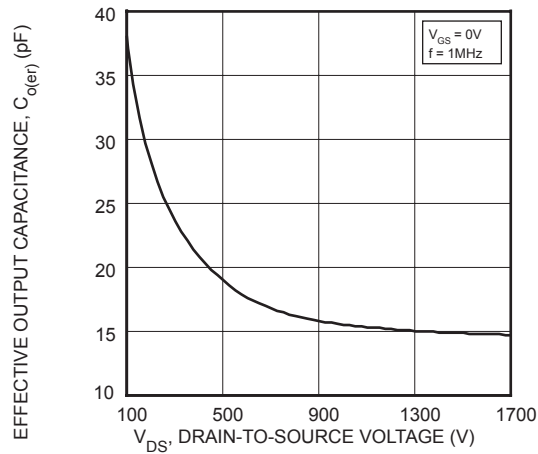
Figure 9, Effective Output Capacitance, C$_{o(er)}$
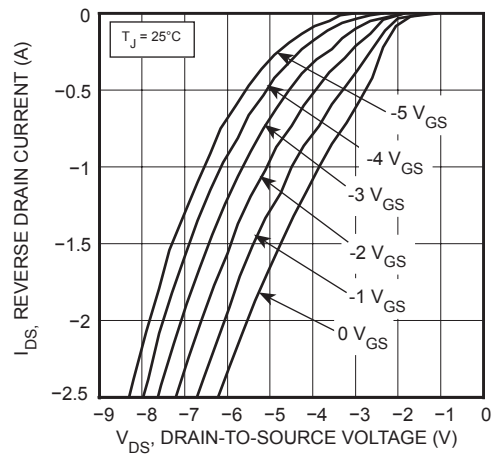
Figure 10, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction
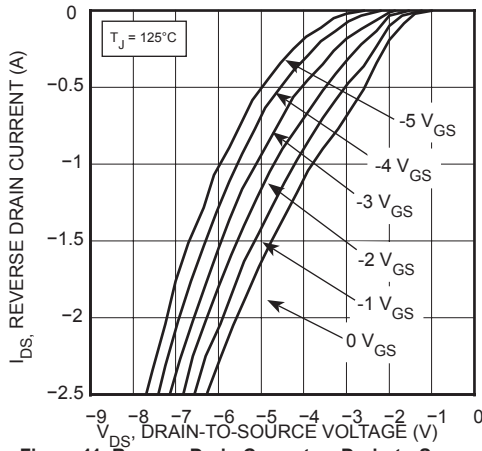
Figure 11, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction
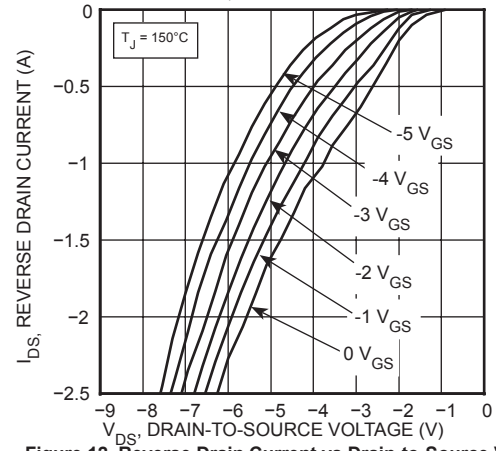
Figure 12, Reverse Drain Current vs Drain-to-Source Voltage
Third Quadrant Conduction
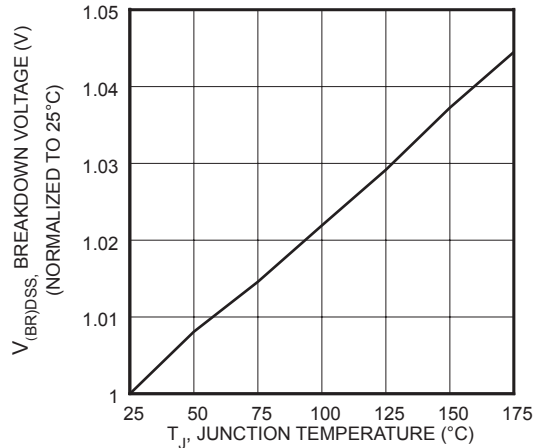
Figure 13, Breakdown Voltage vs Temperature
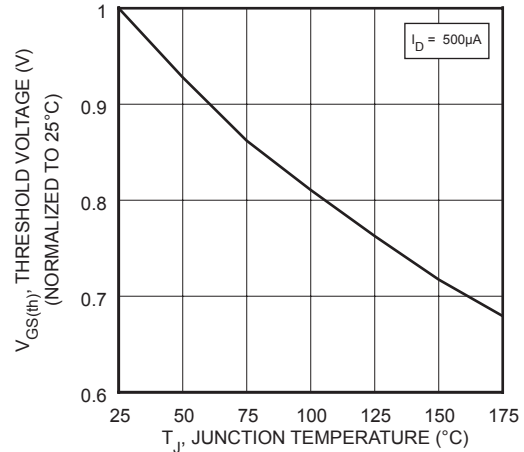
Figure 14, Threshold Voltage vs Temperature
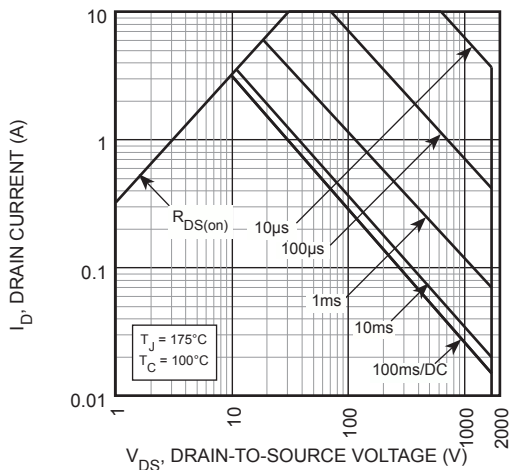
Figure 15, Forward Safe Operating Area
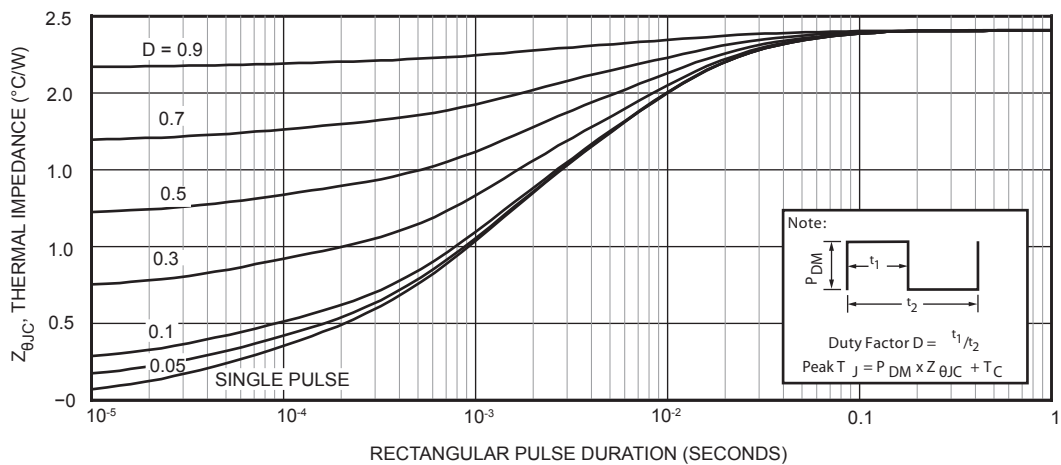
Figure 16, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline

Dimensions in Millimeters (Inches)

050-7722 Rev B 8-2015

Disclaimer: