

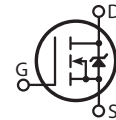
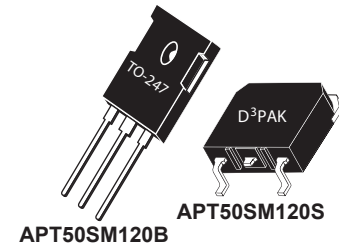
Silicon Carbide Power MOSFET

FEATURES

- Fast switching with low EMI/RFI
- Low Switching Energy
- Low $R_{DS(on)}$ Temperature Coefficient For Improved Efficiency
- Low gate charge
- Short Circuit Withstand Rated
- 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
I_D	Continuous Drain Current @ $T_c = 25^\circ\text{C}$	47	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	40	
I_{DM}	Pulsed Drain Current ^①	100	
V_{GS}	Gate-Source Voltage	-10 to +25	V
SCWT	Short Circuit Withstand Time: $V_{DD} = 960\text{V}$, $V_{GS} = 20\text{V}$, $T_c = 25^\circ\text{C}$	4.5	μs
P_D	Total Power Dissipation @ $T_c = 25^\circ\text{C}$	273	W
	Linear Derating Factor	1.82	W/ $^\circ\text{C}$

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.55	$^\circ\text{C}/\text{W}$
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55		175	$^\circ\text{C}$
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	$V_{GS} = 0\text{V}$, $I_D = 1\text{mA}$	1200			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to 25°C , $I_D = 1\text{mA}$		0.250		V/ $^\circ\text{C}$
$R_{DS(on)}$	Drain-Source On Resistance ^②	$V_{GS} = 20\text{V}$, $I_D = 20\text{A}$		50	65	mΩ
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 1\text{mA}$	1.7	2.4		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient			-6.4		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{V}$ $V_{GS} = 0\text{V}$	$T_J = 25^\circ\text{C}$	10	100	μA
			$T_J = 125^\circ\text{C}$		500	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +20\text{V} / -10\text{V}$			± 100	nA
ESR	Equivalent Series Resistance	$f = 1\text{MHz}$, 25mV, Drain Short		1.27		Ω

Dynamic Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DD} = 1000V$ $f = 1MHz$		3460		pF
C_{rss}	Reverse Transfer Capacitance			21		
C_{oss}	Output Capacitance			117		
Q_g	Total Gate Charge	$V_{GS} = 0/20V$ $V_{DD} = 800V$ $I_D = 20A$		166		nC
Q_{gs}	Gate-Source Charge			66		
Q_{gd}	Gate-Drain Charge			29		
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 800V$ $V_{GS} = 20V$ $I_D = 20A$ $R_G = 0.7 \Omega$ ③ $L = 115 \mu H$ $T_c = 25^\circ C$		11		ns
t_r	Current Rise Time			9		
$t_{d(off)}$	Turn-Off Delay Time			55		
t_f	Current Fall Time			29		
E_{on2}	Turn-On Switching Energy ④			408		
E_{off}	Turn-Off Switching Energy		143			
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 800V$ $V_{GS} = 20V$ $I_D = 20A$ $R_G = 0.7 \Omega$ ③ $L = 115 \mu H$ $T_c = 150^\circ C$		8		ns
t_r	Current Rise Time			8		
$t_{d(off)}$	Turn-Off Delay Time			64		
t_f	Current Fall Time			32		
E_{on2}	Turn-On Switching Energy ④			386		
E_{off}	Turn-Off Switching Energy		164			

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	$I_{SD} = 20A, T_J = 25^\circ C, V_{GS} = 0V$		3.91		V
t_{rr}	Reverse Recovery Time	$I_{SD} = 20A, V_{DD} = 800V$ $di/dt = 100A/\mu s, T_J = 25^\circ C$		120		ns
Q_{rr}	Reverse Recovery Charge			90		nC
I_{rrm}	Reverse Recovery Current			1.9		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 gate resistance including internal gate driver impedance (MIC4452).

④ Free wheeling diode APT10SCD120B.

TYPICAL PERFORMANCE CURVES

APT50SM120B_S

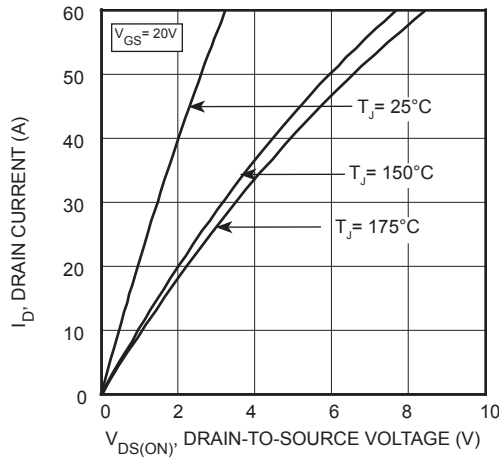


Figure 1, Output Characteristics

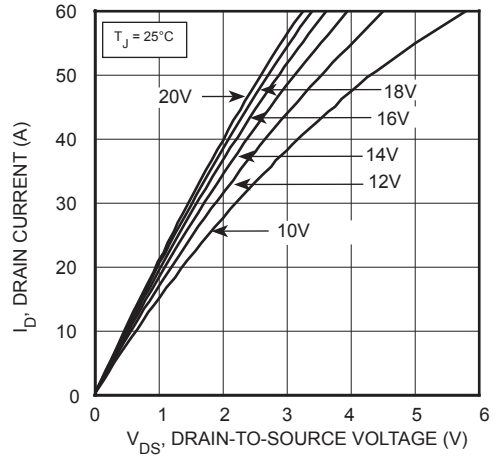


Figure 2, Output Characteristics

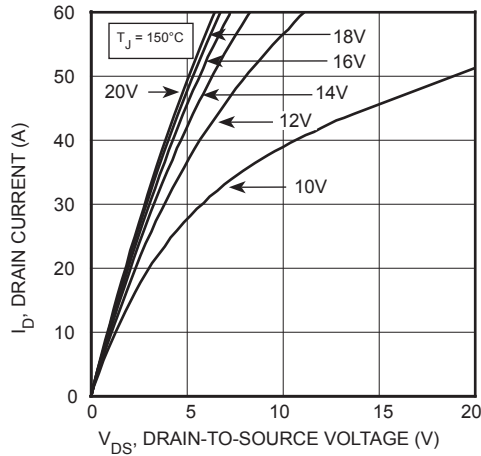


Figure 3, Output Characteristics

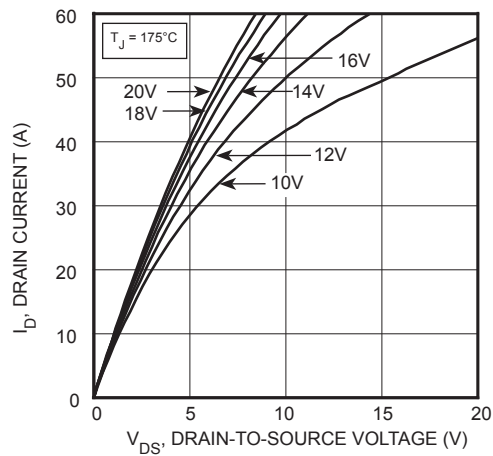


Figure 4, Output Characteristics

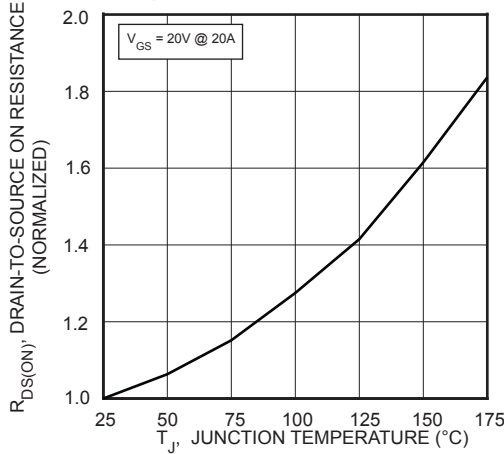


Figure 5, $R_{DS(ON)}$ vs Junction Temperature

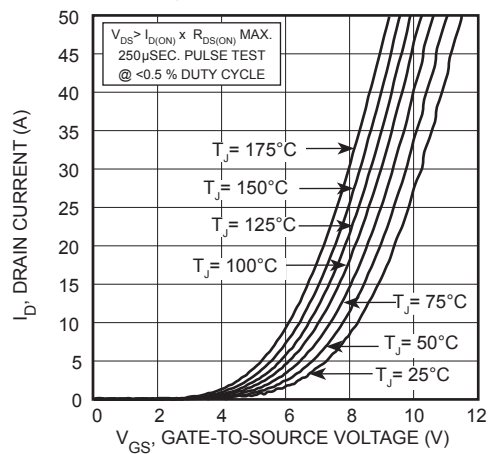


Figure 6, Transfer Characteristics

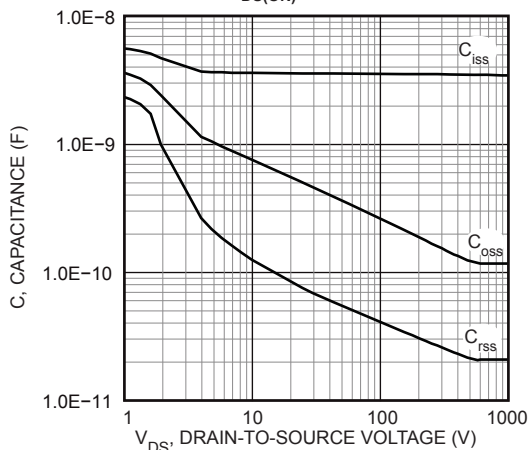


Figure 7, Capacitance vs Drain-to-Source Voltage

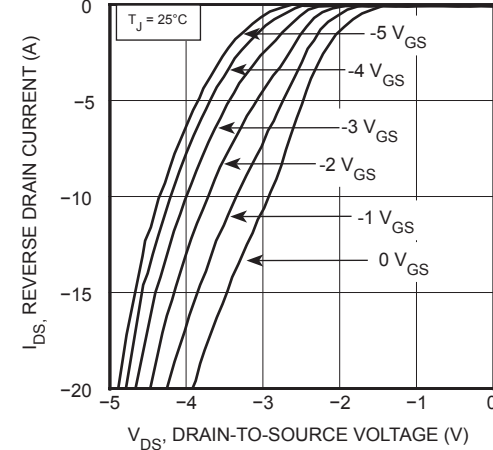


Figure 8, Reverse Drain Current vs Drain-to-Source Voltage

TYPICAL PERFORMANCE CURVES

APT50SM120B_S

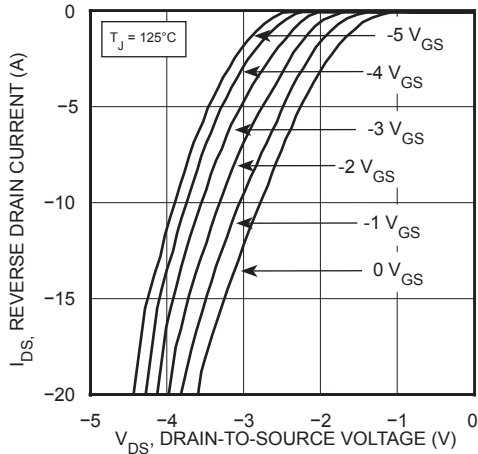


Figure 9, Reverse Drain Current vs Drain-to-Source Voltage

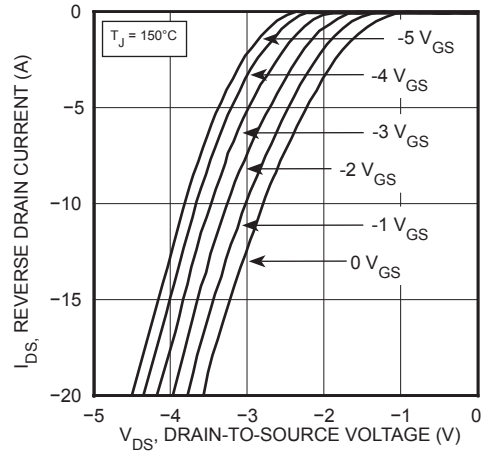


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage

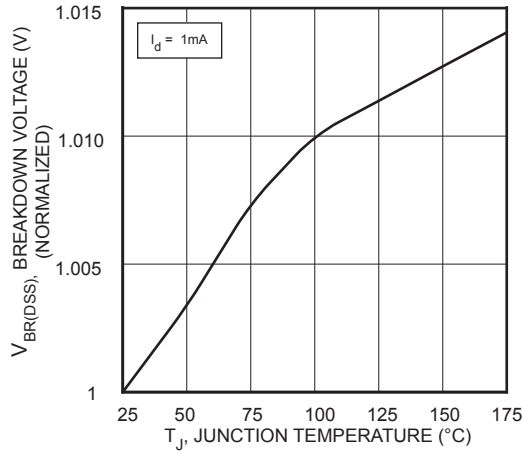


Figure 11, Breakdown Voltage vs Temperature

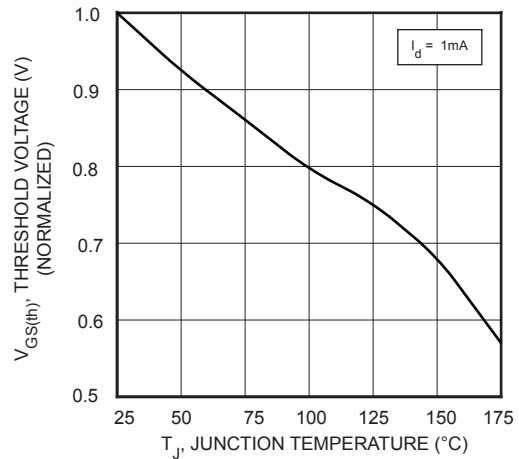


Figure 12, Threshold Voltage vs Temperature

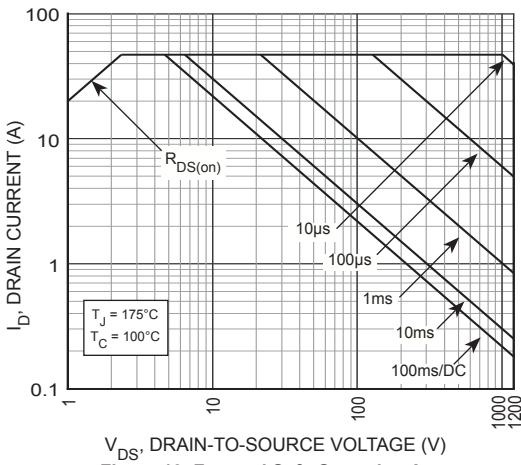


Figure 13, Forward Safe Operating Area

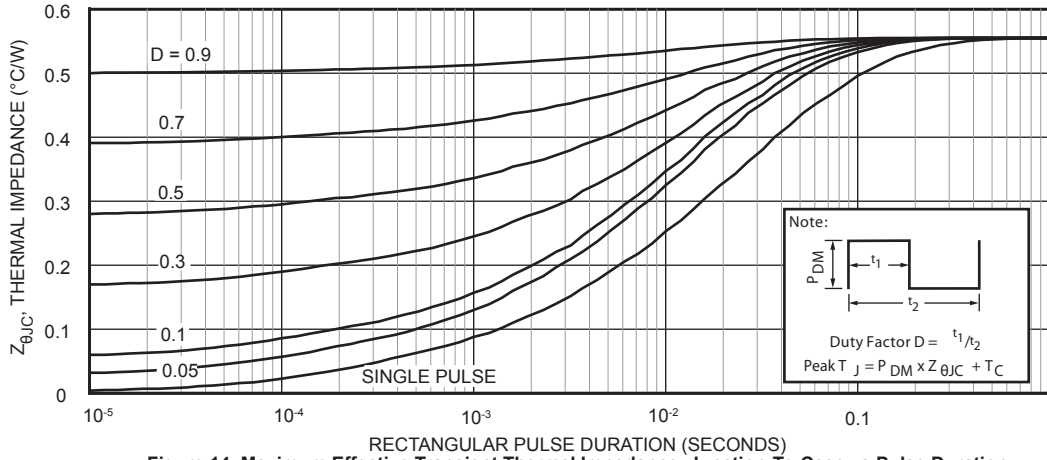
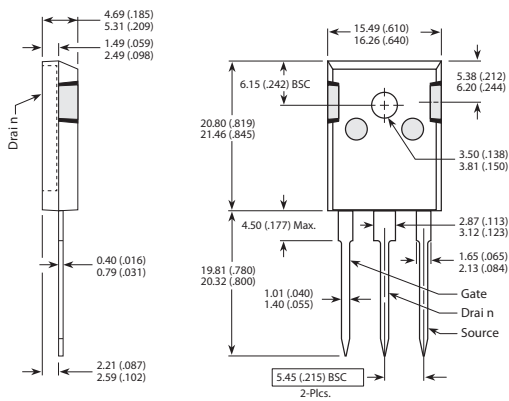


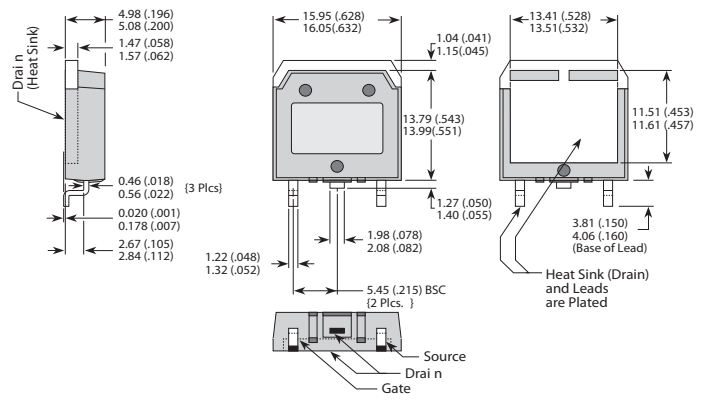
Figure 14, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline

(e1) SAC: Tin, Silver, Copper



D³PAK (S) Package Outline



Dimensions in Millimeters (Inches)

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