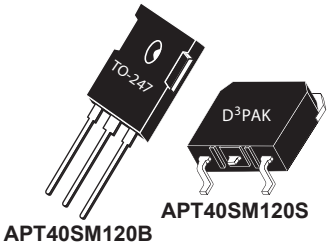
APT40SM120B
APT40SM120S

1200V, 40A, 80mΩ

Silicon Carbide Power MOSFET



APT40SM120B APT40SM120S

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°C	41	A
	Continuous Drain Current @ T_C = 100°C	34	
I_{DM}	Pulsed Drain Current ①	100	
V_{GS}	Gate-Source Voltage	-10 to +25	V
SCWT	Short Circuit Withstand Time: V_{DD} = 960V, V_{GS} = 20V, T_C=25°C	8	µs
P_D	Total Power Dissipation @ T_C = 25°C	273	W
	Linear Derating Factor	1.82	W/°C

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.55	°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 = 1mA		1200			V
$\Delta V_{BR(DSS)}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	Reference to 25°C, I_D = 1mA			0.250		V/°C
$R_{DS(on)}$	Drain-Source On Resistance ②	V_{GS} = 20V, I_D = 20A			80	100	mΩ
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 1mA		1.7	3.0		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient				-5.8		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200V, V_{GS} = 0V	T_J = 25°C		1	100	µA
			T_J = 125°C			500	
I_{GSS}	Gate-Source Leakage Current	V_{GS} = +20V / -10V				±100	nA
ESR	Equivalent Series Resistance	f = 1MHz, 25mV, Drain Short			1.29		Ω

Dynamic Characteristics T_J = 25°C unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DD} = 1000V f = 1MHz		2560		pF
C_{rss}	Reverse Transfer Capacitance			21		
C_{oss}	Output Capacitance			122		
Q_g	Total Gate Charge	V_{GS} = 0/20V V_{DD} = 800V I_D = 20A		130		nC
Q_{gs}	Gate-Source Charge			58		
Q_{gd}	Gate-Drain Charge			27		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 800V V_{GS} = 20V I_D = 20A R_G = 0.7 Ω ③ L = 115 µH T_c = 25°C		11		ns
t_r	Current Rise Time			8		
$t_{d(off)}$	Turn-Off Delay Time			39		
t_f	Current Fall Time			27		
E_{on2}	Turn-On Switching Energy④			438		µJ
E_{off}	Turn-Off Switching Energy			130		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 800V V_{GS} = 20V I_D = 20A R_G = 0.7 Ω ③ L = 115 µH T_c = 150°C		9		ns
t_r	Current Rise Time			8		
$t_{d(off)}$	Turn-Off Delay Time			46		
t_f	Current Fall Time			29		
E_{on2}	Turn-On Switching Energy④			404		µJ
E_{off}	Turn-Off Switching Energy			139		

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} = 20A, T_J = 25°C, V_{GS} = 0V		3.85		V
t_{rr}	Reverse Recovery Time	I_{SD} = 20A, V_{DD} = 800V dI/dt = 100A/µs, T_J = 25°C		140		ns
Q_{rr}	Reverse Recovery Charge			115		nC
I_{rrm}	Reverse Recovery Current			2.0		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 gate resistance including internal gate driver impedance (MIC4452).

④ Free wheeling diode APT10SCD120B.

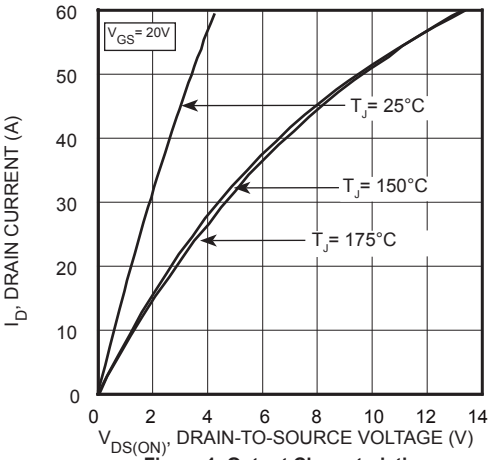


Figure 1, Output Characteristics

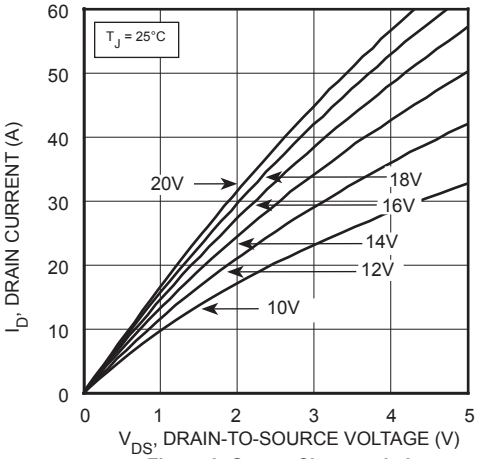


Figure 2, Output Characteristics

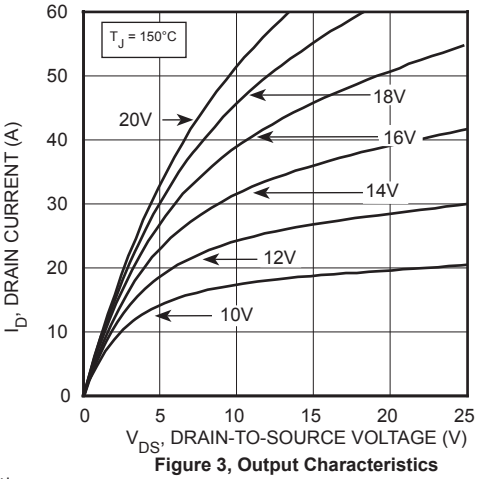


Figure 3, Output Characteristics

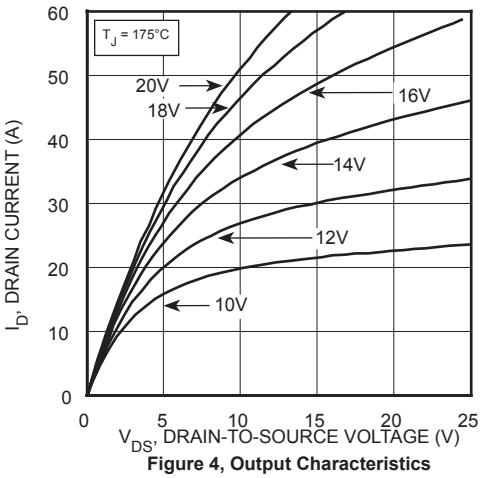


Figure 4, Output Characteristics

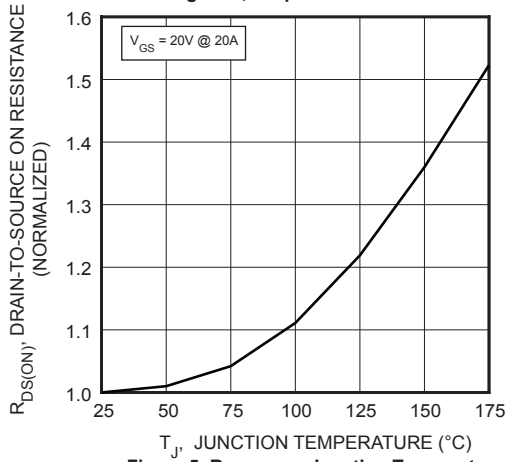


Figure 5, $R_{DS(ON)}$ vs Junction Temperature

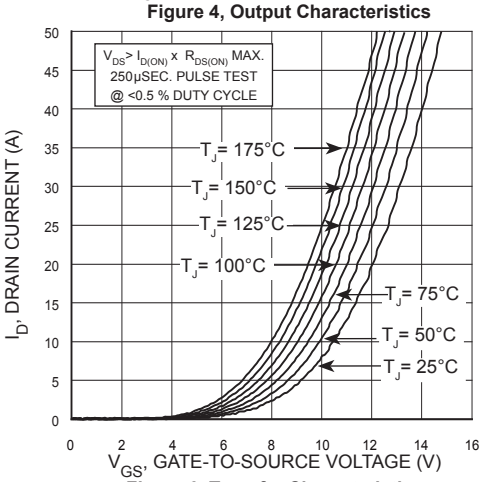


Figure 6, Transfer Characteristics

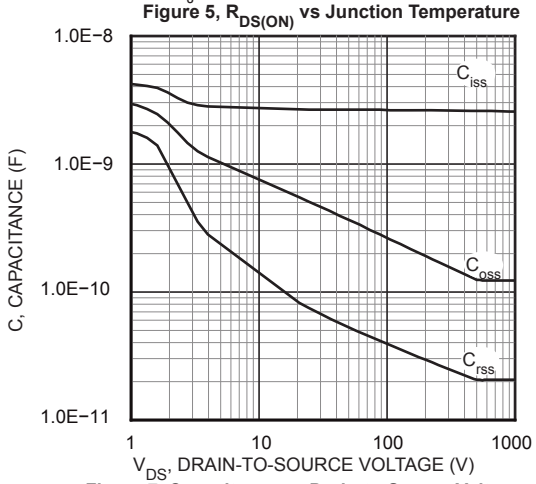


Figure 7, Capacitance vs Drain-to-Source Voltage

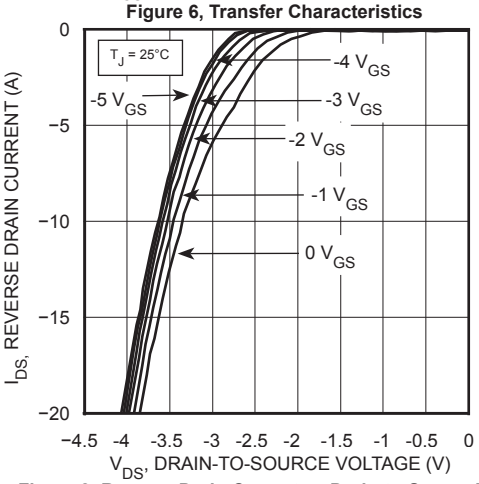


Figure 8, Reverse Drain Current vs Drain-to-Source Voltage

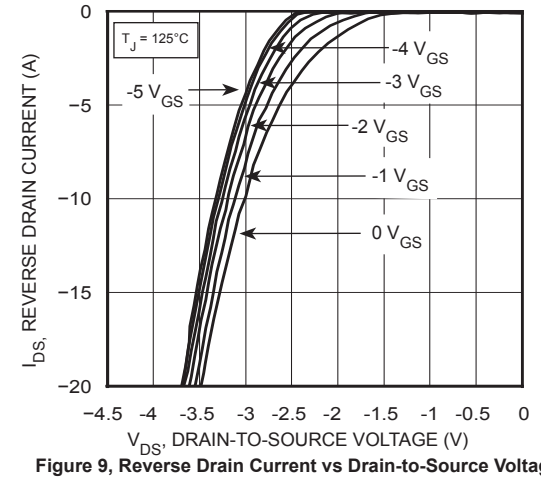


Figure 9, Reverse Drain Current vs Drain-to-Source Voltage

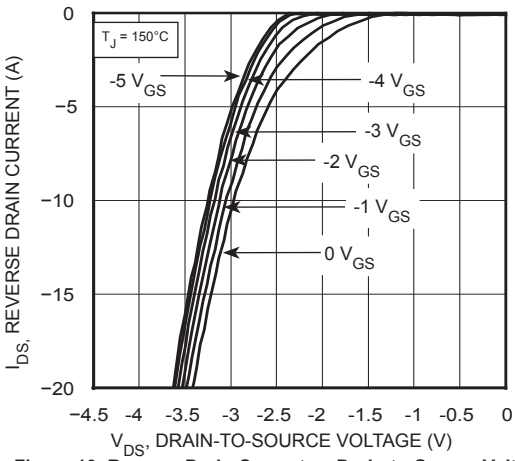


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage

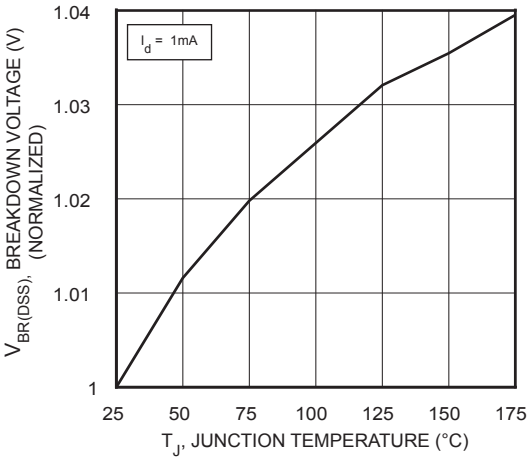


Figure 11, Breakdown Voltage vs Temperature

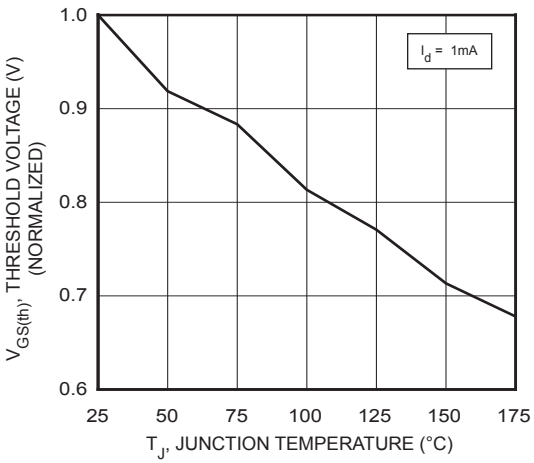


Figure 12, Threshold Voltage vs Temperature

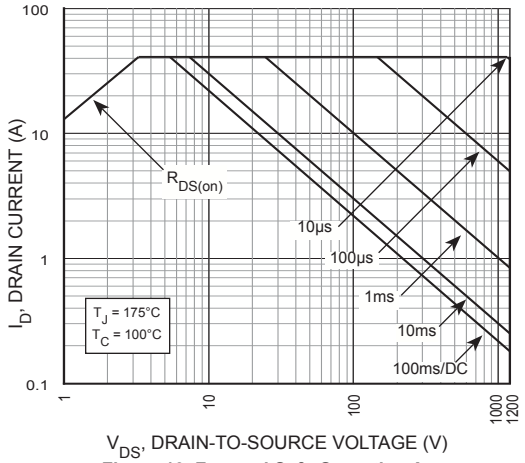


Figure 13, Forward Safe Operating Area

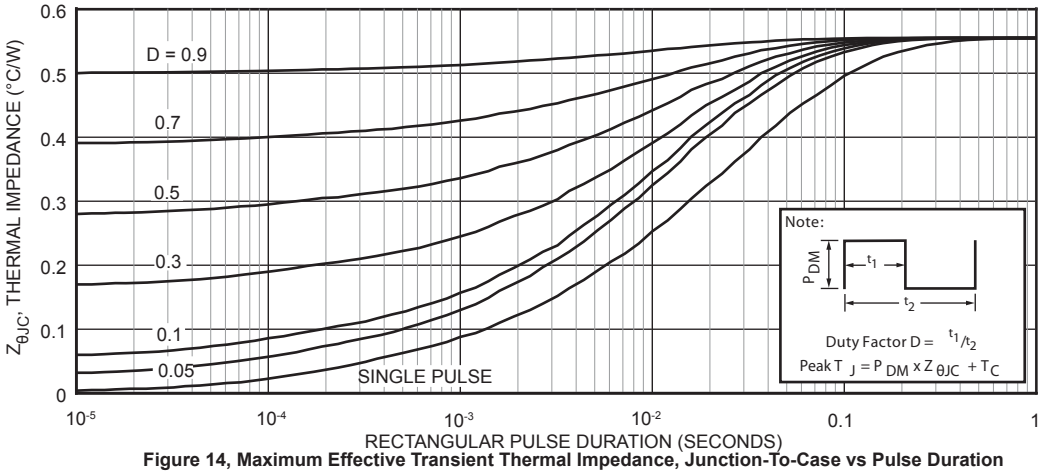
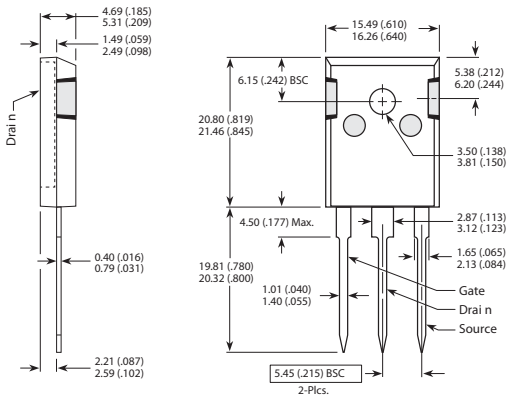


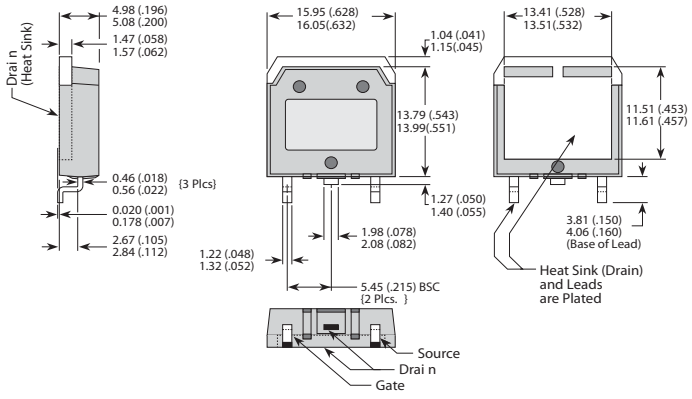
Figure 14, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline

e1 SAC: Tin, Silver, Copper



D³PAK (S) Package Outline



Dimensions in Millimeters (Inches)

Disclaimer:

050-7698 Rev A 4-2014