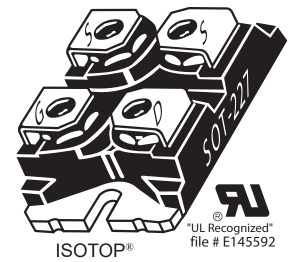
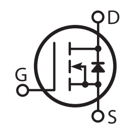
APT40SM120J

1200V, 32A, 80mΩ

Silicon Carbide N-Channel Power MOSFET

Package
APT40SM120J





DESCRIPTION

Silicon carbide (SiC) power MOSFET product line from Microsemi increase your performance over silicon MOSFET and silicon IGBT solutions while lowering your total cost of ownership for high-voltage applications.

FEATURES / TYPICAL APPLICATIONS

SiC MOSFET Features:

- Low capacitances and low gate charge
- Fast switching speed due to low internal gate resistance (ESR)
- Stable operation at high junction temperature, Tj(max) = +175C
- Fast and reliable body diode
- Superior avalanche ruggedness

SiC MOSFET Benefits:

- High efficiency to enable lighter/compact system
- Simple to drive and easy to parallel
- Improved thermal capabilities and lower switching losses
- Eliminates the need of external Free Wheeling Diode
- Lower system cost of ownership

Applications:

- PV inverter, converter and industrial motor drives
- Smart grid transmission & distribution
- Induction heating, and welding
- H/EV powertrain and EV charger
- Power supply and distribution

MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain Source Voltage	1200	V
I_D	Continuous Drain Current @ T_C = 25°C	32	A
	Continuous Drain Current @ T_C = 100°C	22	
I_{DM}	Pulsed Drain Current①	99	
V_{GS}	Gate-Source Voltage	-10 to +25	V
P_D	Total Power Dissipation @ T_C = 25°C	165	W
	Linear Derating Factor	1.1	W/°C

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.91	°C/W
T_j	Operating Junction Temperature	-55		175	°C
T_{stg}	Storage Junction Temperature Range	-55		150	
W_T	Package Weight			1.03	oz
Torque	Mounting Torque (SOT-227 Package), 6-32 or M3 screw		5	10	in·lbf
			.56	1.13	N·m

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STATIC CHARACTERISTICS

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 1mA		1200			V
$R_{DS(on)}$	Drain-Source On Resistance②	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				-4.8		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200V, V_{GS} = 0V	T_J = 25°C			100	µA
			T_J = 125°C			500	
I_{GSS}	Gate-Source Leakage Current	V_{GS} = +20V / -10V				±100	nA

T_J = 25°C unless otherwise specified

DYNAMIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DD} = 1000V, f = 1MHz		2085		pF
C_{rss}	Reverse Transfer Capacitance			25		
C_{oss}	Output Capacitance			115		
Q_g	Total Gate Charge	V_{GS} = 0/20V, V_{DD}= 800V, I_D = 20A		130		nC
Q_{gs}	Gate-Source Charge			19		
Q_{gd}	Gate-Drain Charge			35		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 800V, V_{GS} = 0/20V, I_D = 20A, R_G = 0.7 Ω③, L = 115 µH, T_c = 25°C, Freewheeling Diode = APT10SCE120B		10		ns
t_r	Current Rise Time			6		
$t_{d(off)}$	Turn-Off Delay Time			32		
t_f	Current Fall Time			16		
E_{on2}	Turn-On Switching Energy④			225		µJ
E_{off}	Turn-Off Switching Energy			50		
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 800V, V_{GS} = 0/20V, I_D = 20A, R_G = 0.7 Ω ③, L = 115 µH, T_c = 150°C, Freewheeling Diode = APT10SCE120B		8		ns
t_r	Current Rise Time			6		
$t_{d(off)}$	Turn-Off Delay Time			36		
t_f	Current Fall Time			17		
E_{on2}	Turn-On Switching Energy④			225		µJ
E_{off}	Turn-Off Switching Energy			60		
ESR	Equivalent Series Resistance	f = 1MHz, 25mV, Drain Short		1.2		Ω
SCWT	Short Circuit Withstand Time	V_{DS} = 960V, V_{GS} = 20V, T_C = 25°C		5		µS
E_{AS}	Avalanche Energy, Single Pulse	V_{DS} = 145V, V_{GS} = 20V, I_D = 20A, T_C = 25°C		2500		mJ

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	I_{SD} = 20A, V_{GS} = 0V		3.8		V
t_{rr}	Reverse Recovery Time	I_{SD} = 20A, V_{DD} = 800V, dI/dt = -1000A/µs		90		ns
Q_{rr}	Reverse Recovery Charge			265		nC
I_{rrm}	Reverse Recovery Current			7.8		A

T_J = 25°C unless otherwise specified

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.
④ E_{on2} includes energy of APT10SCD120B free wheeling diode.

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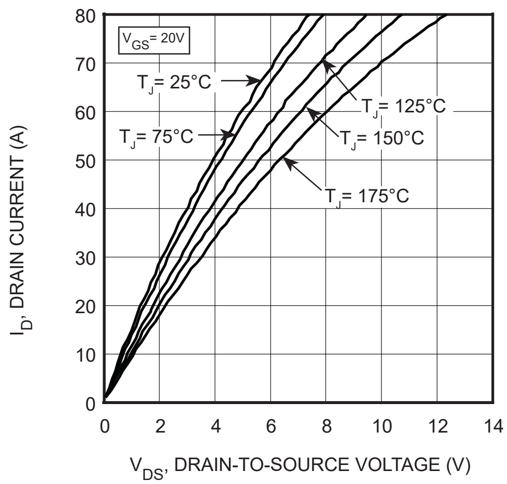

Figure 1, Output Characteristics

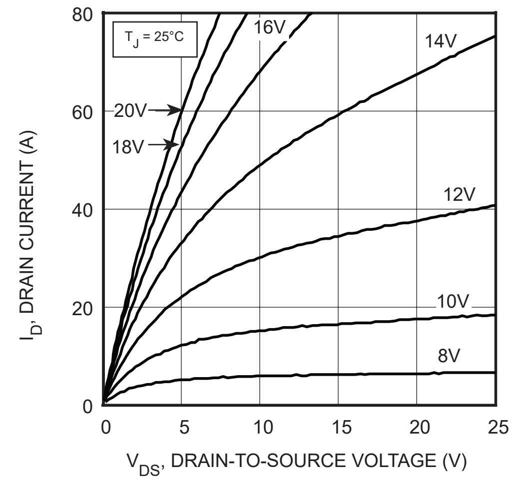

Figure 2, Output Characteristics

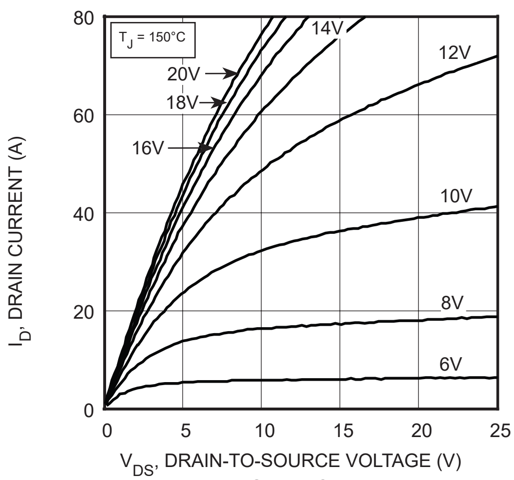

Figure 3, Output Characteristics

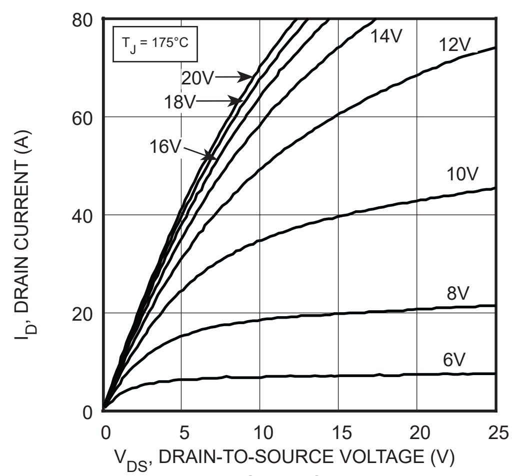

Figure 4, Output Characteristics

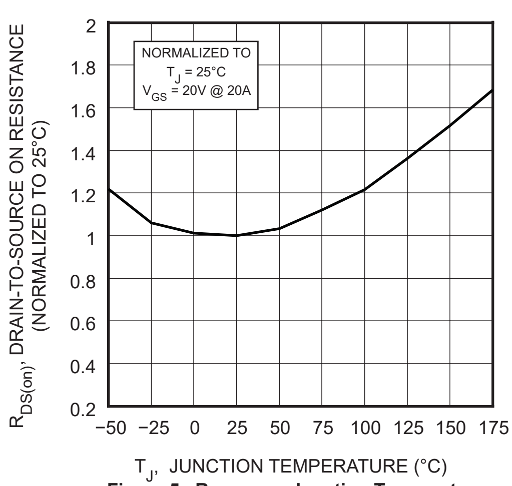

Figure 5, $R_{DS(on)}$ vs Junction Temperature

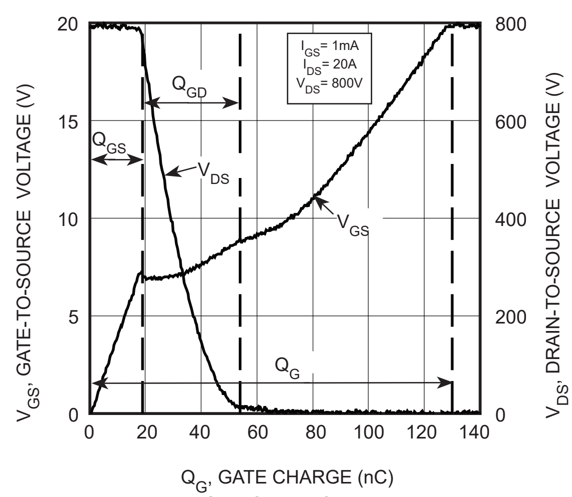

Figure 6, Gate Charge Characteristics

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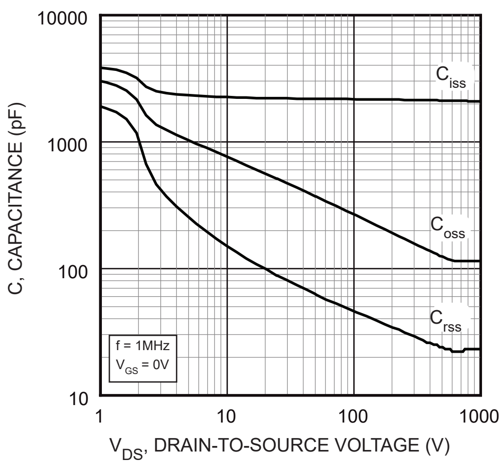

Figure 7, Capacitance vs Drain-to-Source Voltage

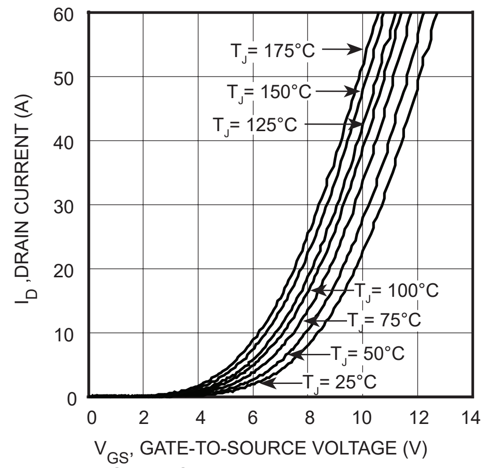

Figure 8, Output Characteristics I_D vs V_{GS} Temperature

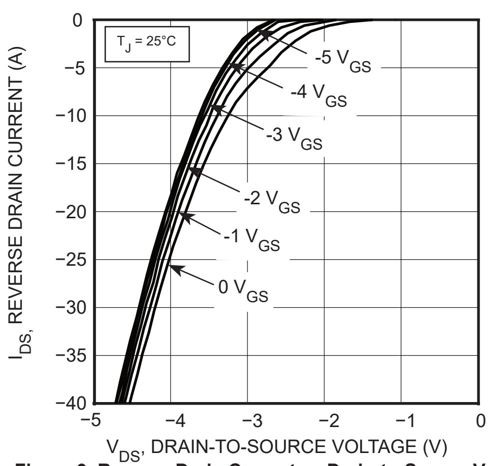

Figure 9, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

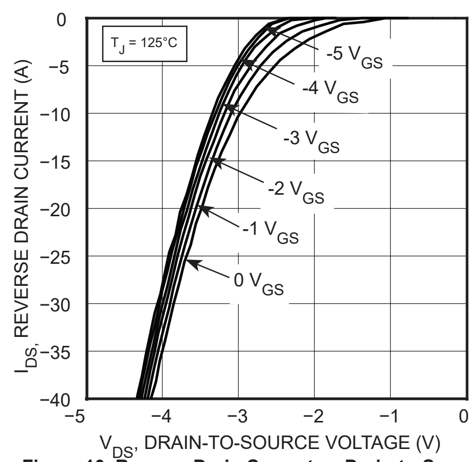

Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

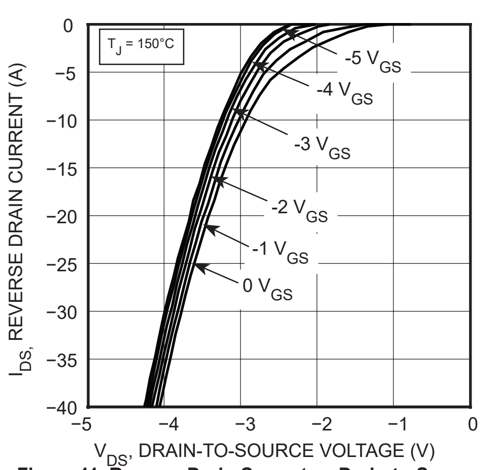

Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

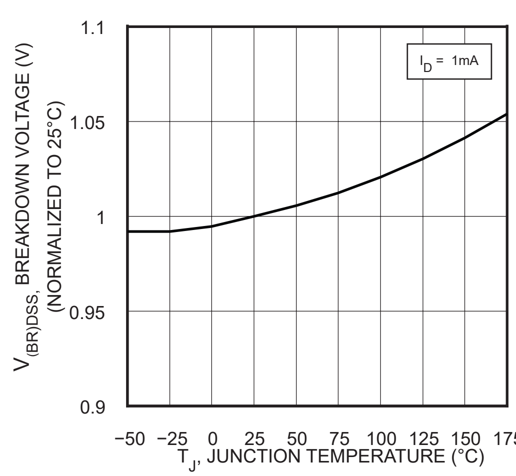

Figure 12, Breakdown Voltage vs Temperature

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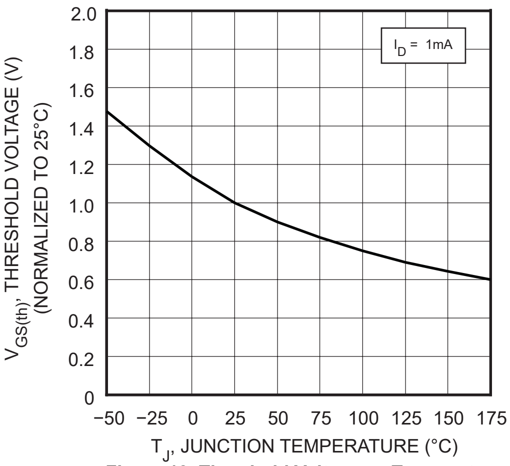


Figure 13, Threshold Voltage vs Temperature

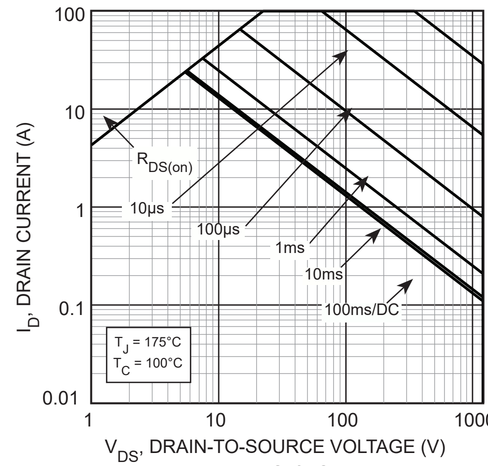


Figure 14, Forward Safe Operating Area

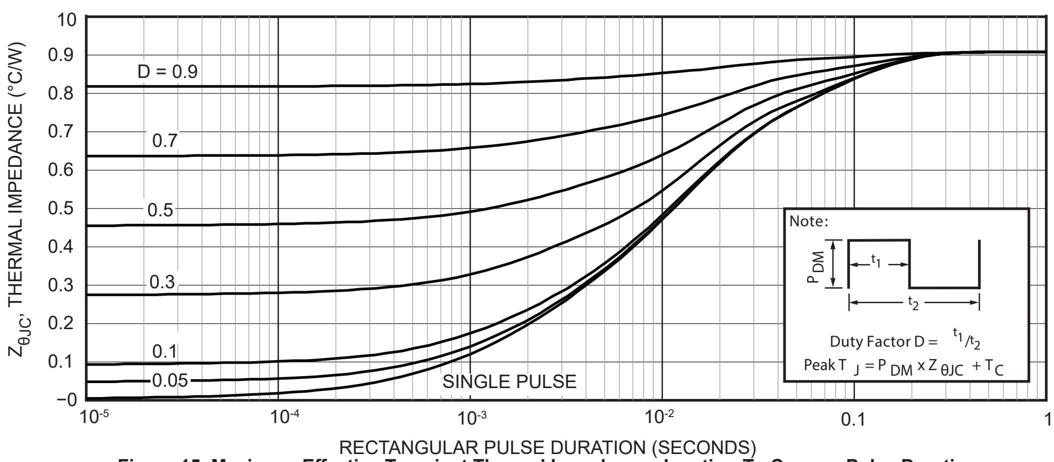
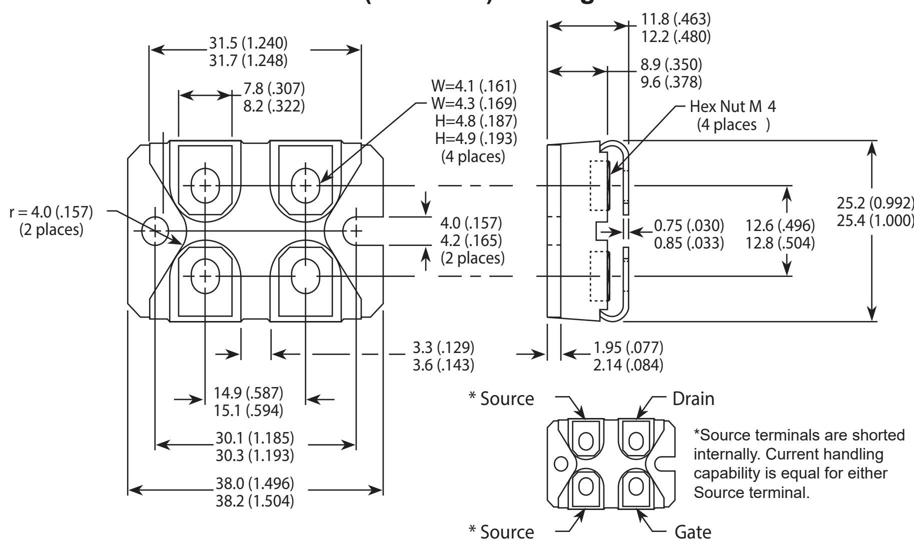


Figure 15, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters (Inches)

Microsemi

Power Matters.™

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