

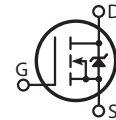
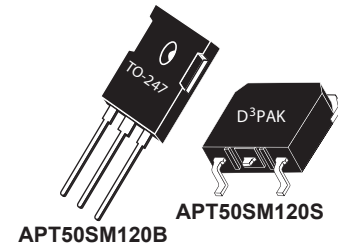
Silicon Carbide Power MOSFET

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/°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

$T_J = 25^\circ\text{C}$ 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/°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/°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

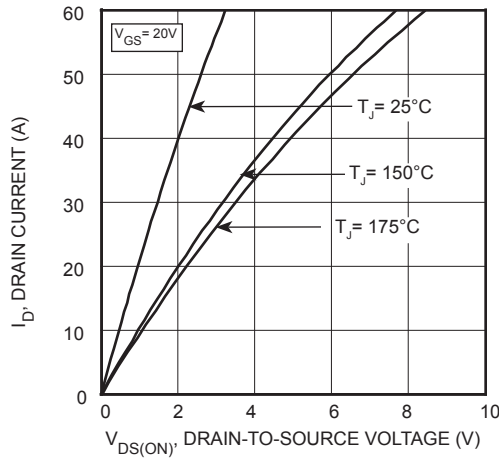


Figure 1, Output Characteristics

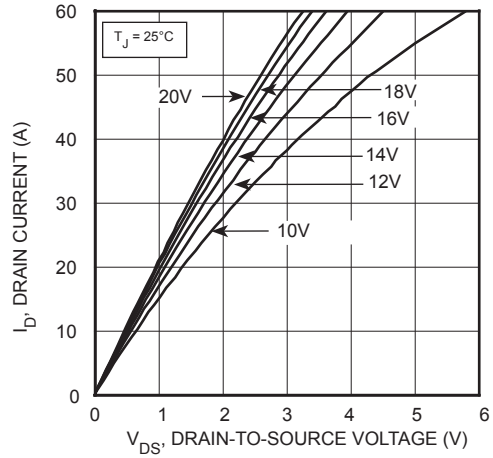


Figure 2, Output Characteristics

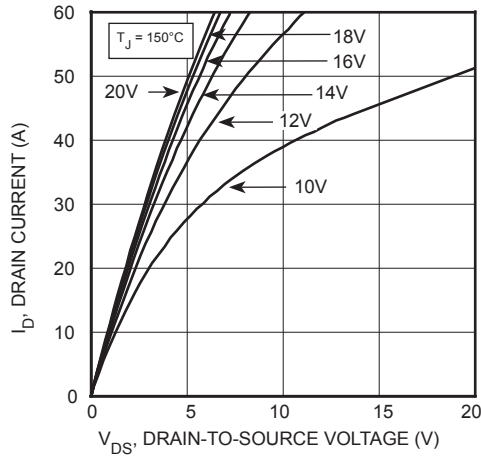


Figure 3, Output Characteristics

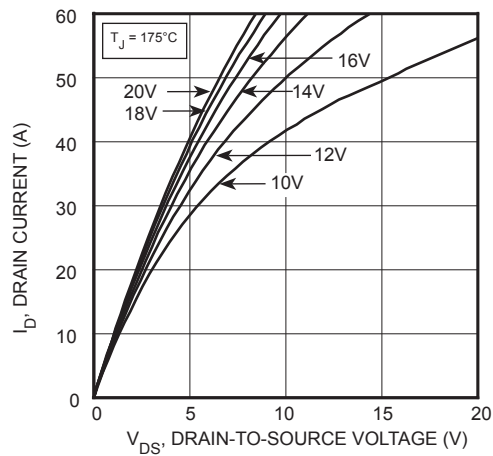


Figure 4, Output Characteristics

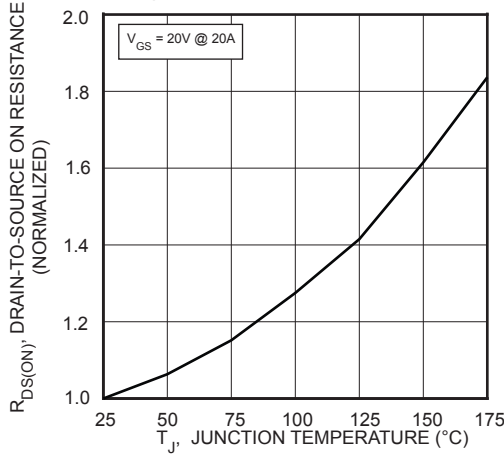


Figure 5, $R_{DS(ON)}$ vs Junction Temperature

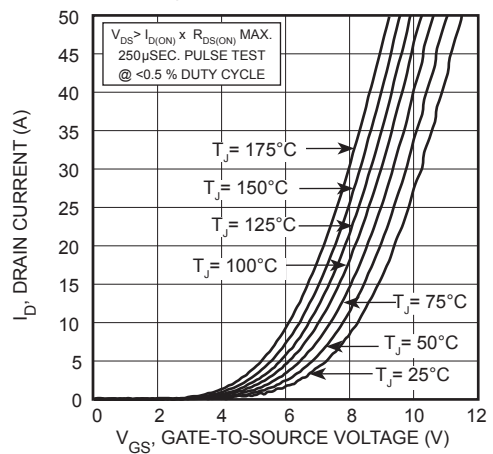


Figure 6, Transfer Characteristics

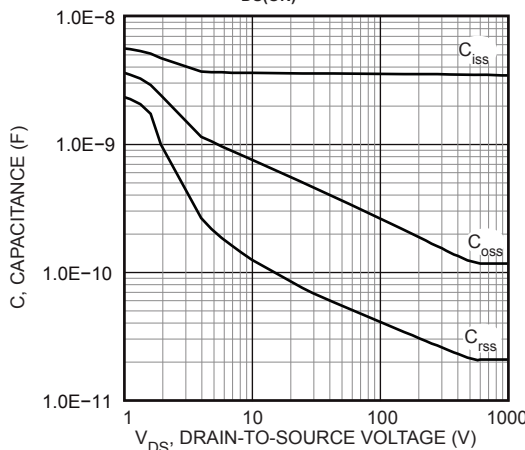


Figure 7, Capacitance vs Drain-to-Source Voltage

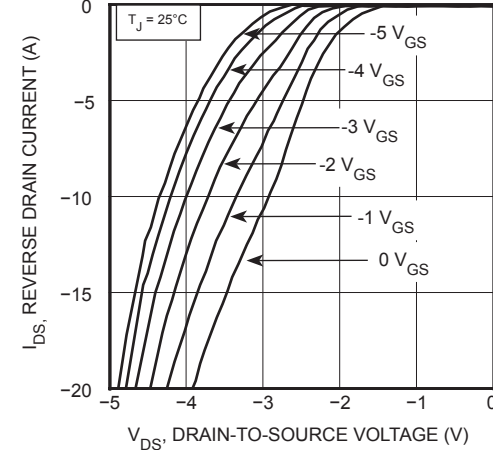


Figure 8, Reverse Drain Current vs Drain-to-Source Voltage

TYPICAL PERFORMANCE CURVES

APT50SM120B_S

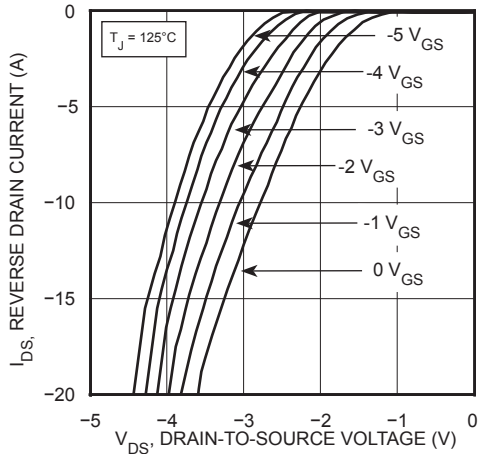


Figure 9, Reverse Drain Current vs Drain-to-Source Voltage

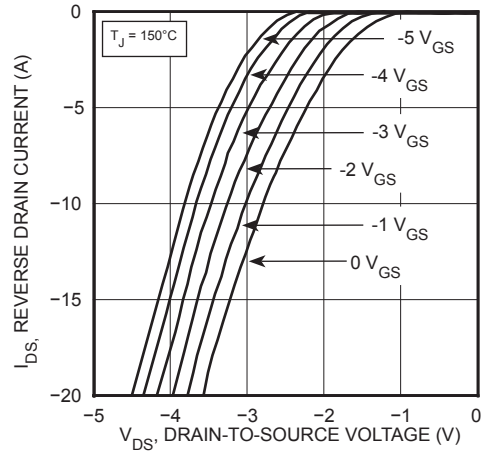


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage

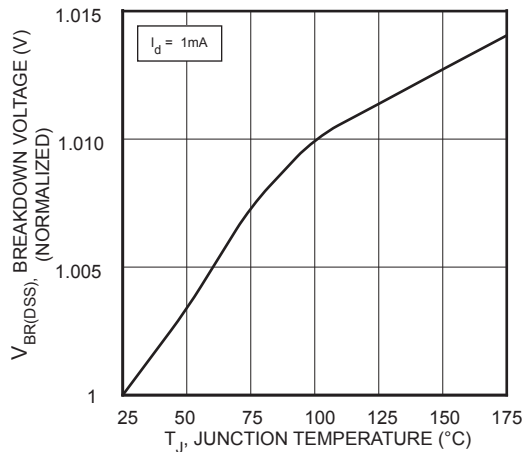


Figure 11, Breakdown Voltage vs Temperature

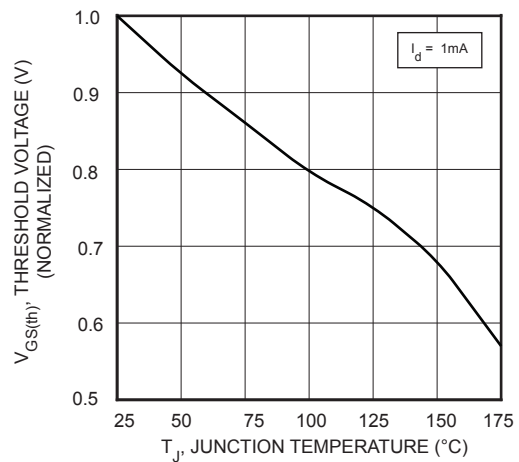


Figure 12, Threshold Voltage vs Temperature

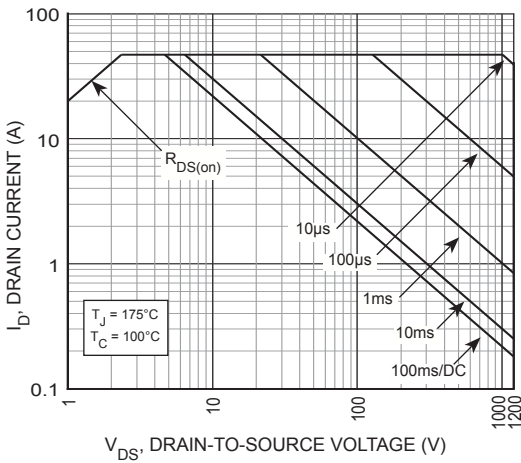


Figure 13, Forward Safe Operating Area

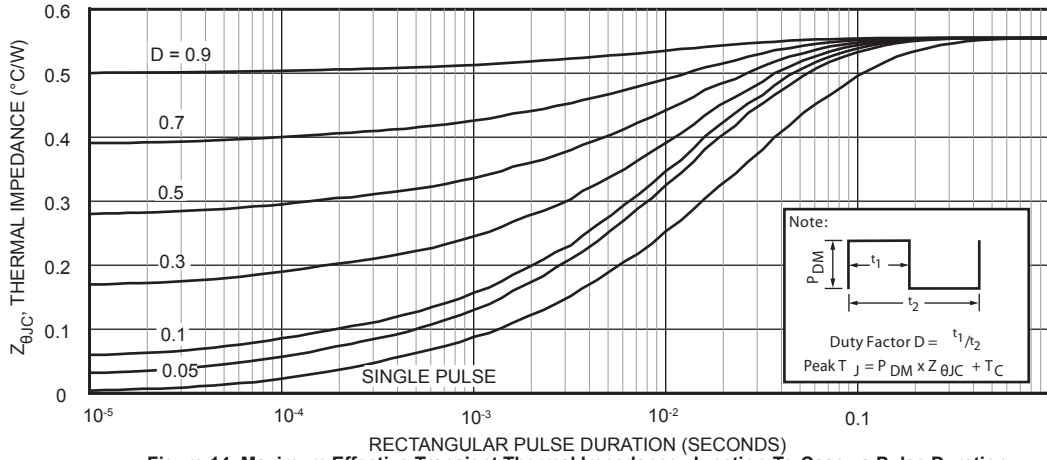
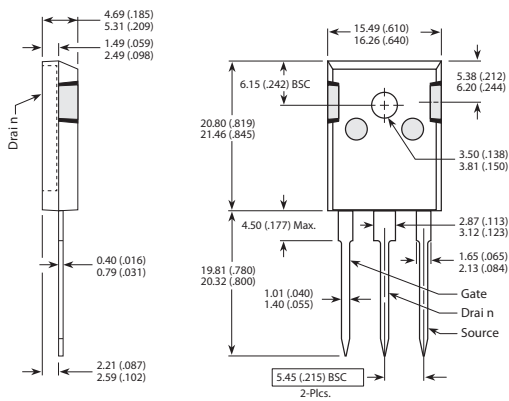


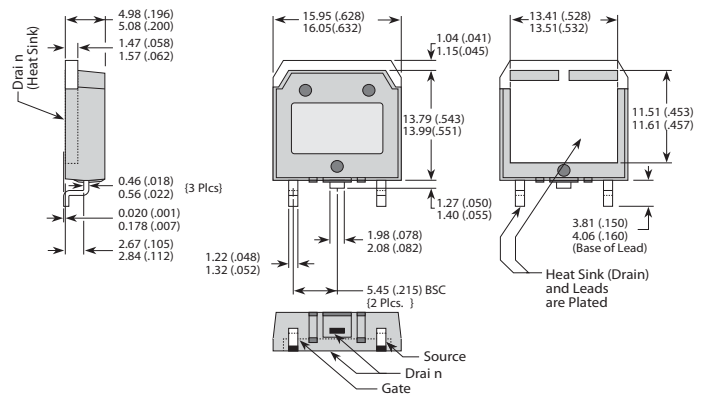
Figure 14, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

TO-247 (B) Package Outline

(e1) SAC: Tin, Silver, Copper



D³PAK (S) Package Outline



Dimensions in Millimeters (Inches)

Disclaimer:

The information contained in the document (unless it is publicly available on the Web without access restrictions) is PROPRIETARY AND CONFIDENTIAL information of Microsemi and cannot be copied, published, uploaded, posted, transmitted, distributed or disclosed or used without the express duly signed written consent of Microsemi. If the recipient of this document has entered into a disclosure agreement with Microsemi, then the terms of such Agreement will also apply. This document and the information contained herein may not be modified, by any person other than authorized personnel of Microsemi. No license under any patent, copyright, trade secret or other intellectual property right is granted to or conferred upon you by disclosure or delivery of the information, either expressly, by implication, inducement, estoppels or otherwise. Any license under such intellectual property rights must be approved by Microsemi in writing signed by an officer of Microsemi.

Microsemi reserves the right to change the configuration, functionality and performance of its products at anytime without any notice. This product has been subject to limited testing and should not be used in conjunction with life-support or other mission-critical equipment or applications. Microsemi assumes no liability whatsoever, and Microsemi disclaims any express or implied warranty, relating to sale and/or use of Microsemi products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Any performance specifications believed to be reliable but are not verified and customer or user must conduct and complete all performance and other testing of this product as well as any user or customer's final application. User or customer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the customer's and user's responsibility to independently determine suitability of any Microsemi product and to test and verify the same. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the User. Microsemi specifically disclaims any liability of any kind including for consequential, incidental and punitive damages as well as lost profit. The product is subject to other terms and conditions which can be located on the web at <http://www.microsemi.com/terms-a-conditions>.