

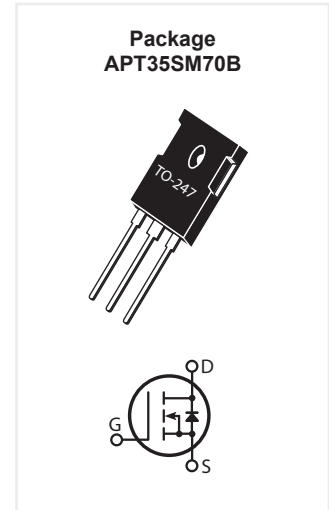
# APT35SM70B

700V, 35A, 125mΩ

## Silicon Carbide N-Channel Power MOSFET

### 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 on-resistance virtually independent on the ambient temperature
- Low capacitances and low gate charge
- Fast switching speed due to low internal gate resistance (ESR)
- Stable operation at high junction temperature,  $T_j(\text{max}) = +175\text{C}$
- 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
$V_{\text{DSS}}$	Drain Source Voltage	700	V
$I_{\text{D}}$	Continuous Drain Current @ $T_c = 25^\circ\text{C}$	35	A
	Continuous Drain Current @ $T_c = 100^\circ\text{C}$	25	
$I_{\text{DM}}$	Pulsed Drain Current <sup>①</sup>	80	
$V_{\text{GS}}$	Gate-Source Voltage	-10 to +25	V
$P_{\text{D}}$	Total Power Dissipation @ $T_c = 25^\circ\text{C}$	176	W
	Linear Derating Factor	1.18	W/°C

### THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta\text{JC}}$	Junction to Case Thermal Resistance		0.75	0.85	°C/W
$T_j$	Operating Junction Temperature	-55		175	°C
$T_{\text{stg}}$	Storage Junction Temperature Range	-55		150	
$T_L$	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

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## STATIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 1mA$	700			V
$R_{DS(on)}$	Drain-Source On Resistance <sup>2</sup>	$V_{GS} = 20V, I_D = 10A$		125	145	m $\Omega$
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1mA$	1.7	2.5		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold Voltage Temperature Coefficient			-5.5		mV/ $^{\circ}C$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 700V$ $V_{GS} = 0V$		$T_J = 25^{\circ}C$	100	$\mu A$
				$T_J = 150^{\circ}C$	250	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS} = +20V / -10V$			$\pm 100$	nA
ESR	Equivalent Series Resistance	$f = 1MHz, 25mV, \text{Drain Short}$		2.2		$\Omega$

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

## DYNAMIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit		
$C_{iss}$	Input Capacitance	$V_{GS} = 0V, V_{DD} = 700V$ $f = 1MHz$		1035		pF		
$C_{rss}$	Reverse Transfer Capacitance		26					
$C_{oss}$	Output Capacitance		127					
$Q_g$	Total Gate Charge	$V_{GS} = 0/20V$		67		nC		
$Q_{gs}$	Gate-Source Charge	$V_{DD} = 466V$		11				
$Q_{gd}$	Gate-Drain Charge	$I_D = 10A$		19				
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 466V$ $V_{GS} = 0/20V$ $I_D = 10A$ $R_G = 3.0 \Omega$ <sup>③</sup> $L = 115 \mu H$ $T_c = 25^{\circ}C$ Freewheeling Diode = APT10SCE65B		8		ns		
$t_r$	Current Rise Time			4				
$t_{d(off)}$	Turn-Off Delay Time			24				
$t_f$	Current Fall Time			18				
$E_{on2}$	Turn-On Switching Energy <sup>④</sup>				71		$\mu J$	
$E_{off}$	Turn-Off Switching Energy				23			
$t_{d(on)}$	Turn-On Delay Time		$V_{DD} = 466V$ $V_{GS} = 0/20V$ $I_D = 10A$ $R_G = 3.0 \Omega$ <sup>③</sup> $L = 115 \mu H$ $T_c = 150^{\circ}C$ Freewheeling Diode = APT10SCE65B		7			ns
$t_r$	Current Rise Time				4			
$t_{d(off)}$	Turn-Off Delay Time			27				
$t_f$	Current Fall Time			19				
$E_{on2}$	Turn-On Switching Energy <sup>④</sup>				67		$\mu J$	
$E_{off}$	Turn-Off Switching Energy				28			

### Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{SD}$	Diode Forward Voltage	$I_{SD} = 10A, V_{GS} = 0V$		4.25		V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 10A, V_{DD} = 466V$ $di/dt = -1000A/\mu s$		35		ns
$Q_{rr}$	Reverse Recovery Charge			115		nC
$I_{rrm}$	Reverse Recovery Current			6.6		A

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

- ① Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature  
 ② Pulse test: Pulse Width < 380 $\mu s$ , duty cycle < 2%.  
 ③  $R_G$  is total gate resistance including internal gate driver impedance.  
 ④  $E_{on2}$  includes energy of APT10SCE65B free wheeling diode.

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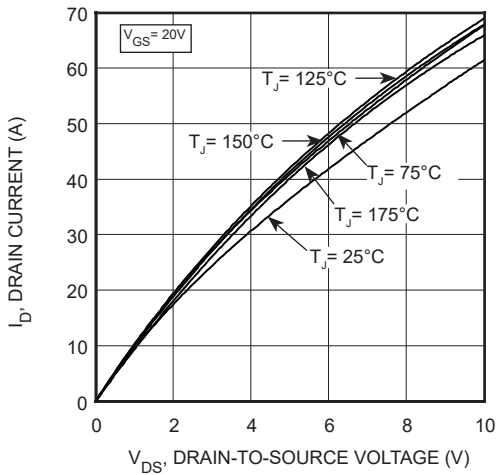


Figure 1, Output Characteristics

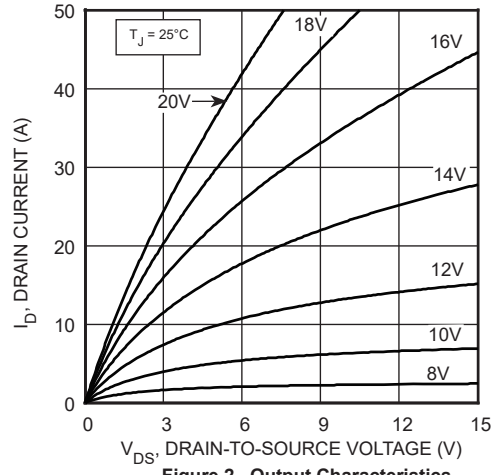


Figure 2, Output Characteristics

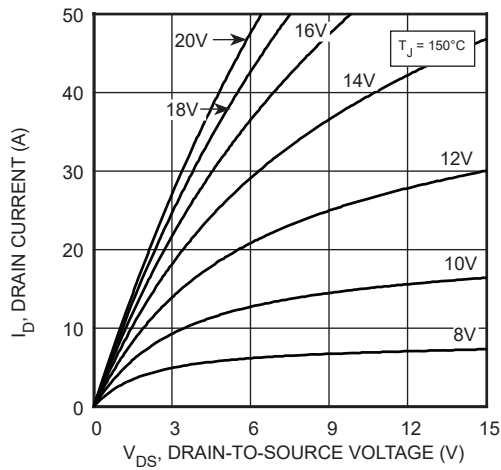


Figure 3, Output Characteristics

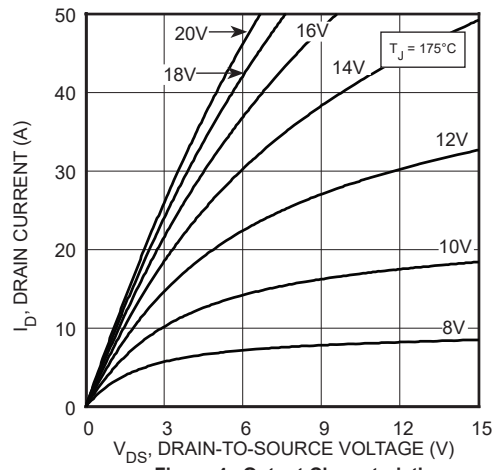


Figure 4, Output Characteristics

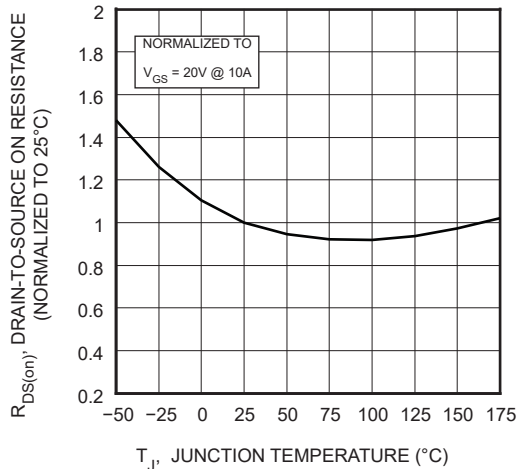


Figure 5,  $R_{DS(on)}$  vs Junction Temperature

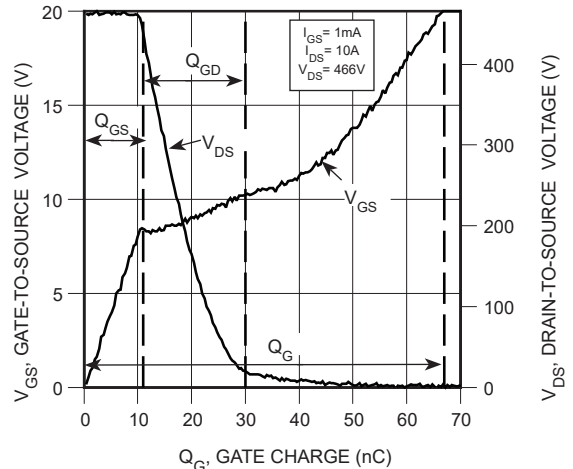


Figure 6, Gate Charge Characteristics

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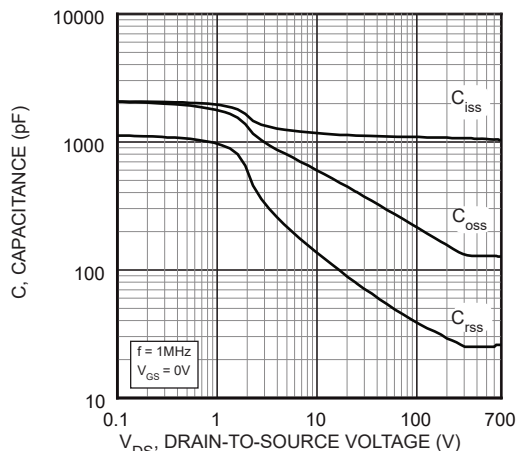


Figure 7, Capacitance vs Drain-to-Source Voltage

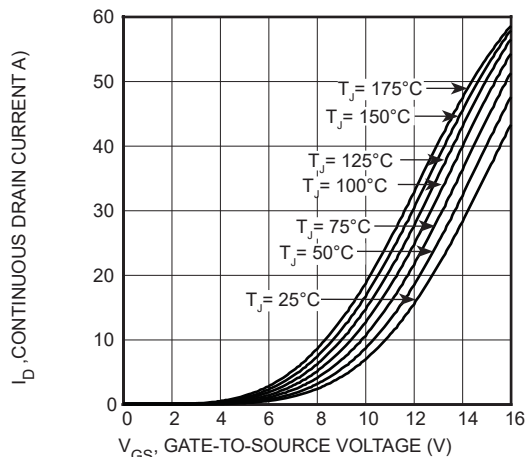


Figure 8, Output Characteristics  $I_D$  vs  $V_{GS}$  Temperature

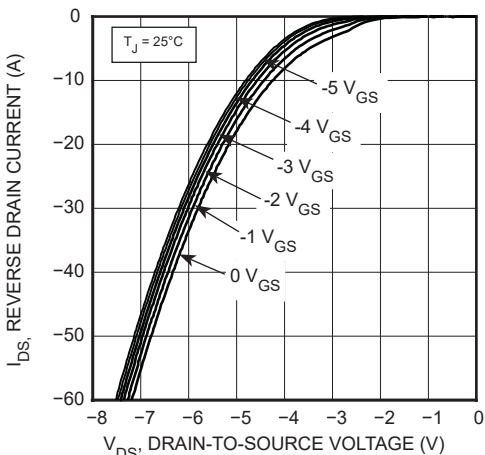


Figure 9, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

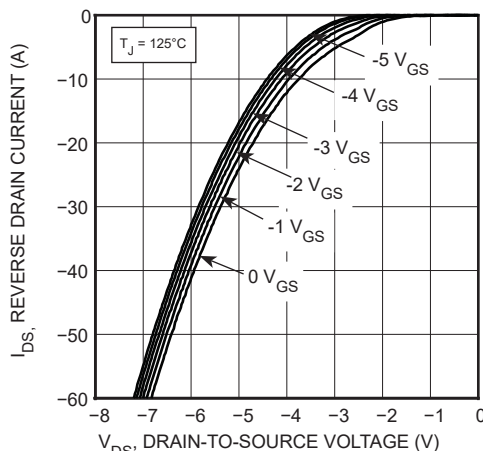


Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

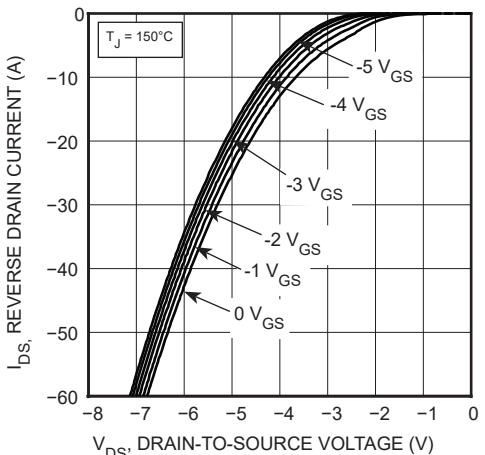


Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction

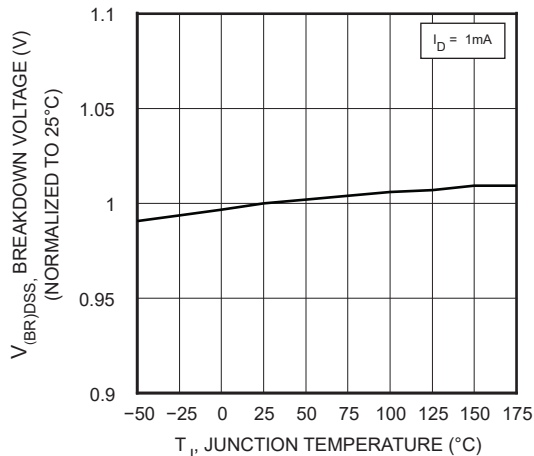


Figure 12, Breakdown Voltage vs Temperature

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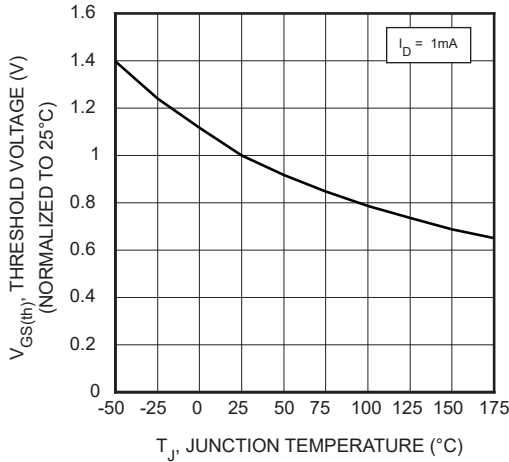


Figure 13, Threshold Voltage vs Temperature

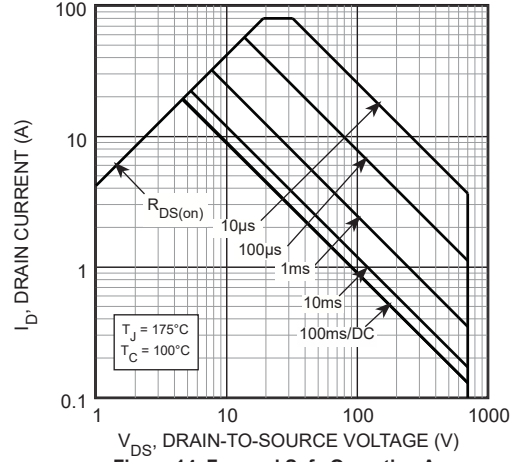


Figure 14, Forward Safe Operating Area

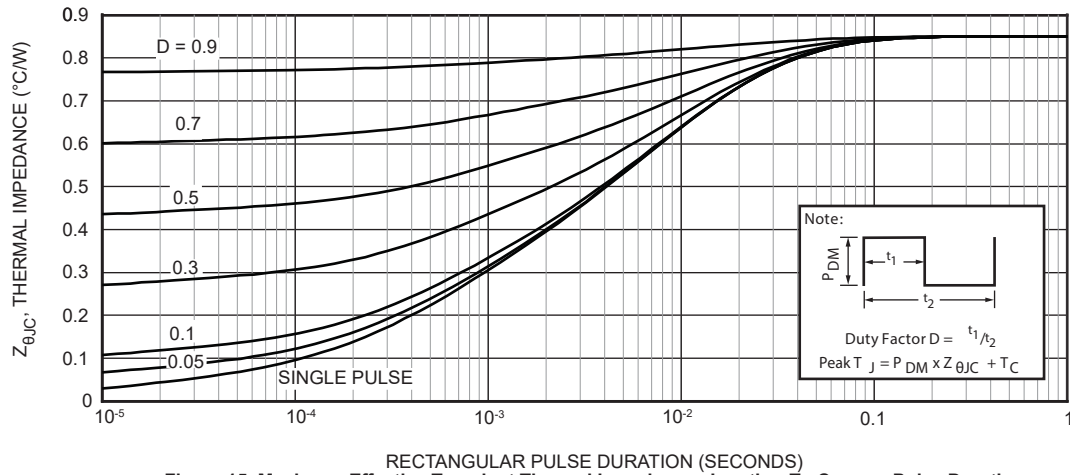
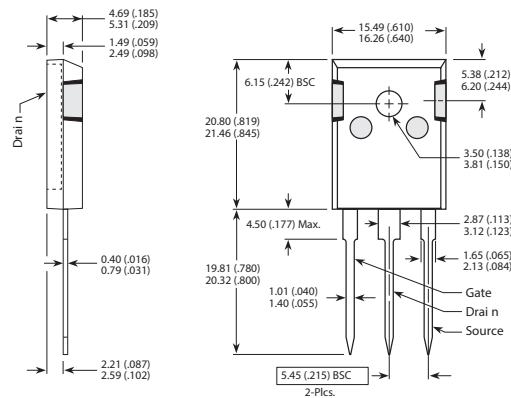


Figure 15, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

## TO-247 (B) Package Outline



Dimensions in Millimeters (Inches)

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