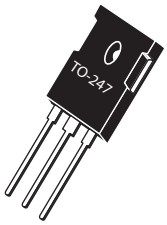
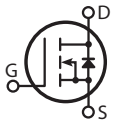
# APT130SM70B

**700V, 110A, 35mΩ**

Package
APT130SM70B




## 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, 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 | 700 | V |
| $I_D$ | Continuous Drain Current @ $T_C$ = 25°C | 110 | A |
| | Continuous Drain Current @ $T_C$ = 100°C | 78 | |
| $I_{DM}$ | Pulsed Drain Current① | 262 | |
| $V_{GS}$ | Gate-Source Voltage | -10 to +25 | V |
| $P_D$ | Total Power Dissipation @ $T_C$ = 25°C | 556 | W |
| | Linear Derating Factor | 3.7 | W/°C |

## THERMAL AND MECHANICAL CHARACTERISTICS

| Symbol | Characteristic | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction to Case Thermal Resistance | | 0.22 | 0.27 | °C/W |
| $T_J$ | Operating Junction Temperature | -55 | | 175 | °C |
| $T_{stg}$ | 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 Resistance② | $V_{GS}$ = 20V, $I_D$ = 60A | | | 35 | 45 | mΩ |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 1mA | | 1.7 | 2.4 | | V |
| $\Delta V_{GS(th)}/\Delta T_J$ | Threshold Voltage Temperature Coefficient | | | | -5.10 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 700V, $V_{GS}$ = 0V | $T_J$ = 25°C | | | 100 | µA |
| | | | $T_J$ = 150°C | | | 250 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$ = +20V / -10V | | | | ±100 | nA |
| ESR | Equivalent Series Resistance | f = 1MHz, 25mV, Drain Short | | | 0.46 | | Ω |

**$T_J$ = 25°C unless otherwise specified**

## DYNAMIC CHARACTERISTICS

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DD}$ = 700V<br>f = 1MHz | | 3950 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 50 | | |
| $C_{oss}$ | Output Capacitance | | | 465 | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0/20V<br>$V_{DD}$= 466V<br>$I_D$ = 60A | | 220 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 42 | | |
| $Q_{gd}$ | Gate-Drain Charge | | | 61 | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 466V<br>$V_{GS}$ = 0/20V<br>$I_D$ = 60A<br>$R_G$ = 3.0Ω③<br>L = 115 µH<br>$T_c$ = 25°C<br>Freewheeling Diode = APT20SCE65B | | 17 | | ns |
| $t_r$ | Current Rise Time | | | 15 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 36 | | |
| $t_f$ | Current Fall Time | | | 19 | | |
| $E_{on2}$ | Turn-On Switching Energy④ | | | 1060 | | µJ |
| $E_{off}$ | Turn-Off Switching Energy | | | 305 | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 466V<br>$V_{GS}$ = 0/20V<br>$I_D$ = 60A<br>$R_G$ = 3.0 Ω ③<br>L = 115 µH<br>$T_c$ = 150°C<br>Freewheeling Diode = APT20SCE65B | | 16 | | ns |
| $t_r$ | Current Rise Time | | | 15 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 39 | | |
| $t_f$ | Current Fall Time | | | 21 | | |
| $E_{on2}$ | Turn-On Switching Energy④ | | | 965 | | µJ |
| $E_{off}$ | Turn-Off Switching Energy | | | 345 | | |

**Source-Drain Diode Characteristics**

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | $I_{SD}$ = 60A, $V_{GS}$ = 0V | | 3.85 | | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 60A, $V_{DD}$ = 466V<br>dI/dt = -1000A/µs | | 68 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 570 | | nC |
| $I_{rrm}$ | Reverse Recovery Current | | | 15.3 | | 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 APT20SCE65B free wheeling diode.

# APT130SM70B

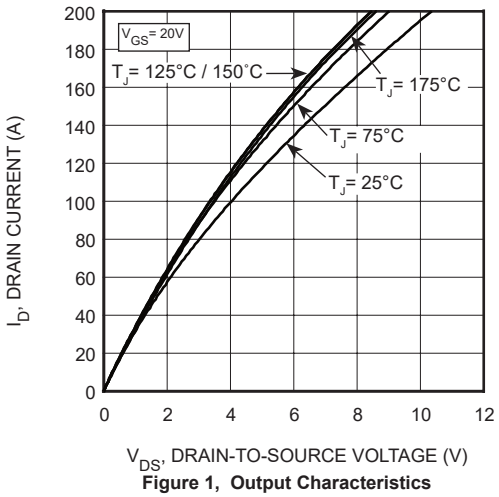


**Figure 1, Output Characteristics**

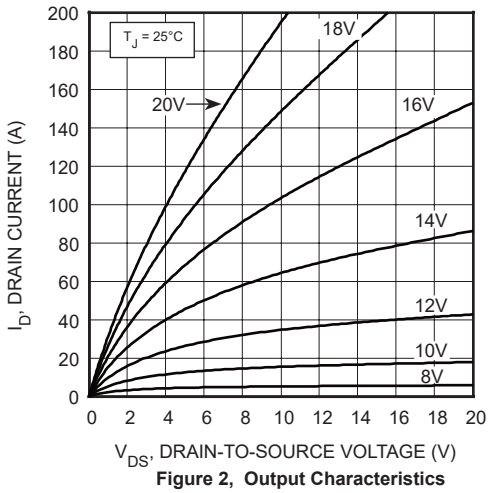


**Figure 2, Output Characteristics**

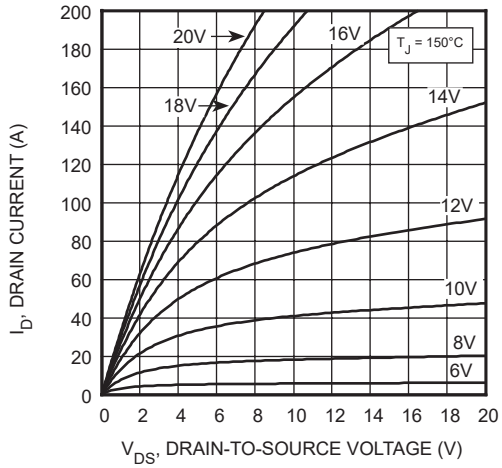


**Figure 3, Output Characteristics**

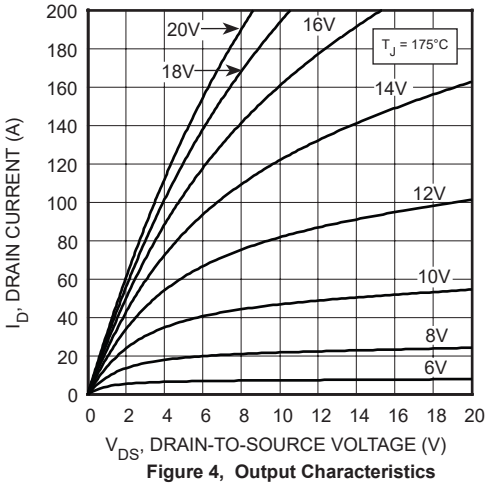


**Figure 4, Output Characteristics**

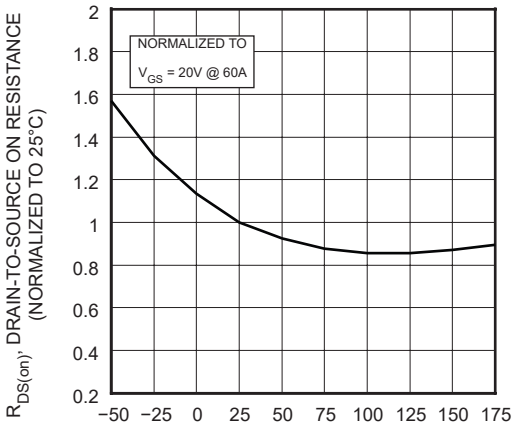


**Figure 5, $R_{DS(on)}$ vs Junction Temperature**

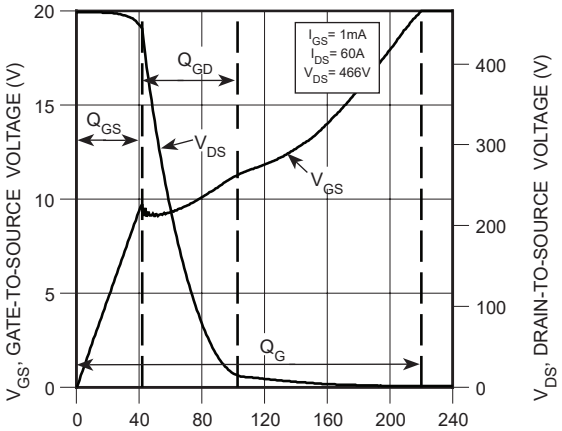


**Figure 6, Gate Charge Characteristics**

# APT130SM70B

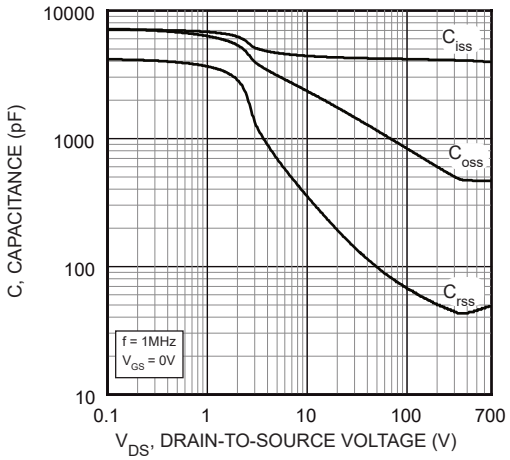


**Figure 7, Capacitance vs Drain-to-Source Voltage**

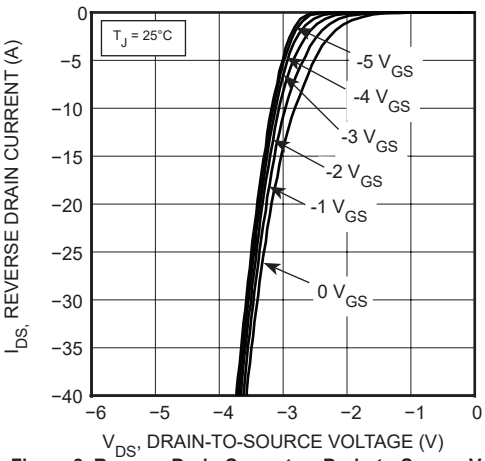


**Figure 8, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction**

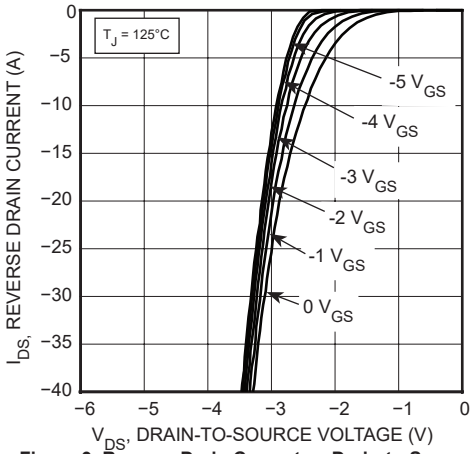


**Figure 9, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction**

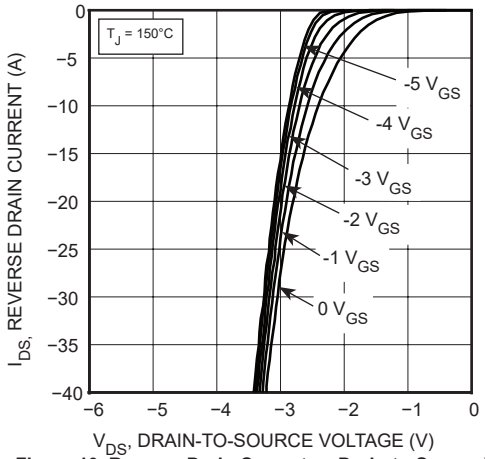


**Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction**

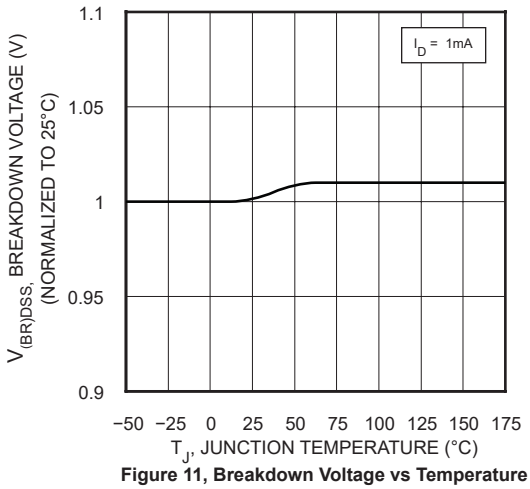


**Figure 11, Breakdown Voltage vs Temperature**

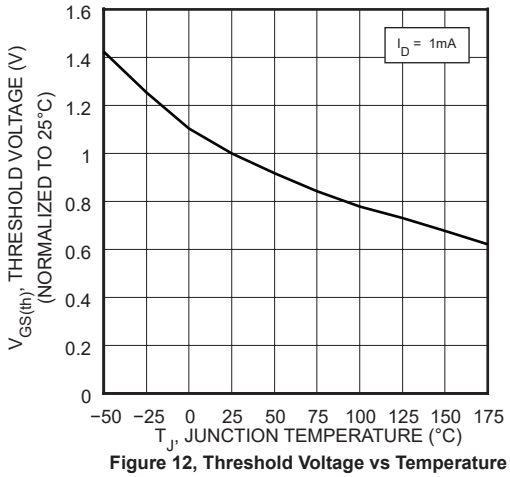


**Figure 12, Threshold Voltage vs Temperature**

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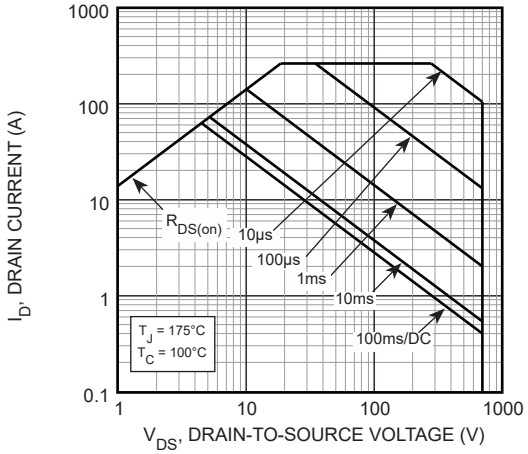



**Figure 13, Forward Safe Operating Area**

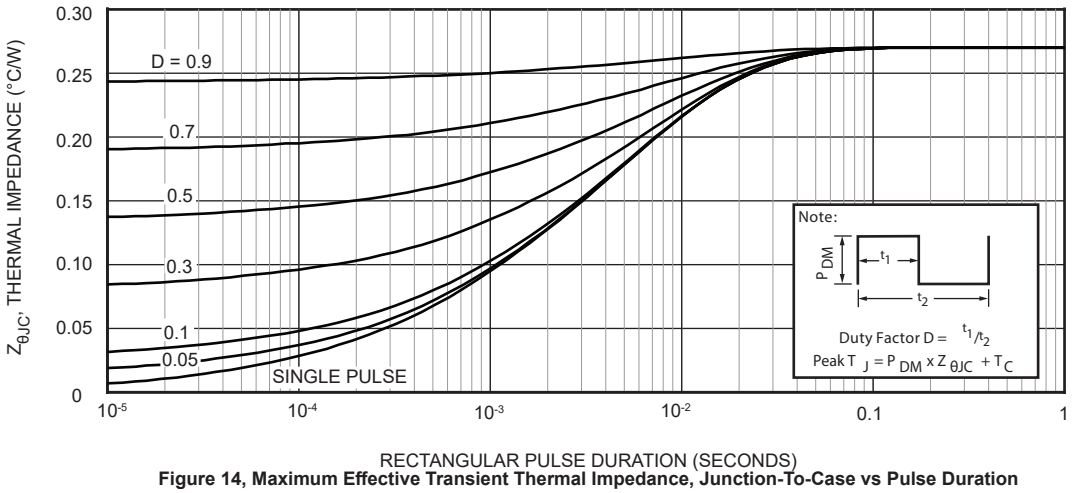
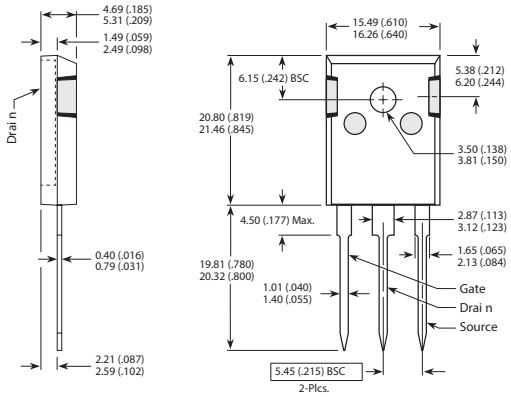



**Figure 14, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration**

## TO-247 (B) Package Outline




**Dimensions in Millimeters (Inches)**

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