# APT5SM170S

**1700V, 4.6A, 0.8Ω**

## Silicon Carbide N-Channel Power MOSFET

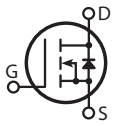
### FEATURES

- Fast switching with low EMI/RFI
- Low Switching Energy
- Low $R_{DS(on)}$ Temperature Coefficient For Improved Efficiency
- Ultra Low Gate Resistance
- RoHS compliant

### TYPICAL APPLICATIONS

- PFC and other boost converter
- Buck converter
- Two switch forward (asymmetrical bridge)
- Single switch forward
- Flyback
- Inverters


APT5SM170S




### Maximum Ratings

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $V_{DSS}$ | Drain Source Voltage | 1700 | V |
| $I_D$ | Continuous Drain Current @ $T_C$ = 25°C | 4.6 | A |
| | Continuous Drain Current @ $T_C$ = 100°C | 3.3 | |
| $I_{DM}$ | Pulsed Drain Current① | 9.2 | |
| $V_{GS}$ | Gate-Source Voltage | -10 to +25 | V |
| $P_D$ | Total Power Dissipation @ $T_C$ = 25°C | 52 | W |
| | Linear Derating Factor | 0.35 | W/°C |

### Thermal and Mechanical Characteristics

| Symbol | Characteristic | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction to Case Thermal Resistance | | 2.4 | 2.9 | °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 | |

### 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, $I_D$ = 100µA | | 1700 | | | V |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | Reference to 25°C, $I_D$ = 100µA | | | 0.68 | | V/°C |
| $R_{DS(on)}$ | Drain-Source On Resistance② | $V_{GS}$ = 20V, $I_D$ = 2A | | | 0.8 | 1.2 | Ω |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 500µA | | 1.8 | 3.2 | | V |
| $\Delta V_{GS(th)}/\Delta T_J$ | Threshold Voltage Temperature Coefficient | | | | -6.8 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 1700V, $V_{GS}$ = 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 | | | 1.30 | | Ω |

**Dynamic Characteristics** $T_J$ = 25°C unless otherwise specified **APT5SM170S**

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DD}$ = 1000V f = 1MHz | | 325 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 5 | | |
| $C_{oss}$ | Output Capacitance | | | 15 | | |
| $E_{oss}$ | Output Capacitance Stored Energy | $V_{GS}$ = 0V, $V_{DD}$ = 1000V f = 1MHz | | 8 | | µJ |
| $C_{o(er)}$ | Effective Output Capacitance | | | 16 | | pF |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = -5/20V $V_{DD}$= 850V $I_D$ = 2A | | 29 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 7 | | |
| $Q_{gd}$ | Gate-Drain Charge | | | 9 | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 850V $V_{GS}$ = 0/20V $I_D$ = 2A $R_G$ = 2.5 Ω ③ L = 115 µH $T_c$ = 25°C | | 4 | | ns |
| $t_r$ | Current Rise Time | | | 1 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 7 | | |
| $t_f$ | Current Fall Time | | | 95 | | |
| $E_{on2}$ | Turn-On Switching Energy | | | 90 | | µJ |
| $E_{off}$ | Turn-Off Switching Energy | | | 30 | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 850 $V_{GS}$ = 0/20V $I_D$ = 2A $R_G$ = 2.5 Ω ③ L = 115 µH $T_c$ = 150°C | | 3 | | ns |
| $t_r$ | Current Rise Time | | | 1 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 8 | | |
| $t_f$ | Current Fall Time | | | 95 | | |
| $E_{on2}$ | Turn-On Switching Energy | | | 90 | | µJ |
| $E_{off}$ | Turn-Off Switching Energy | | | 32 | | |

**Source-Drain Diode Characteristics** $T_J$ = 25°C unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | $I_{SD}$ = 1A, $V_{GS}$ = 0V | | 3.7 | | V |
| $T_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 2A, $V_{DD}$ = 850V dI/dt = -1200A/µs | | 30 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 55 | | nC |
| $I_{rrm}$ | Reverse Recovery Current | | | -3.5 | | 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 external gate resistance not including internal gate driver impedance.

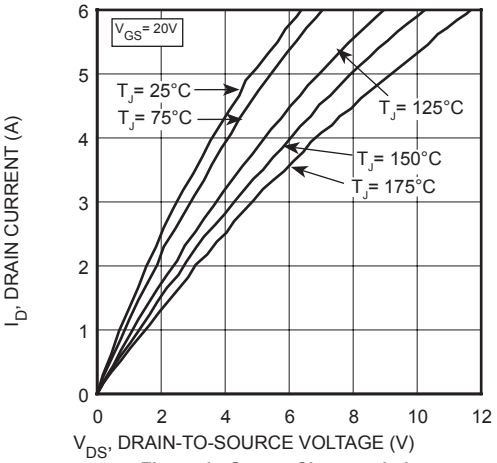



**Figure 1, Output Characteristics**

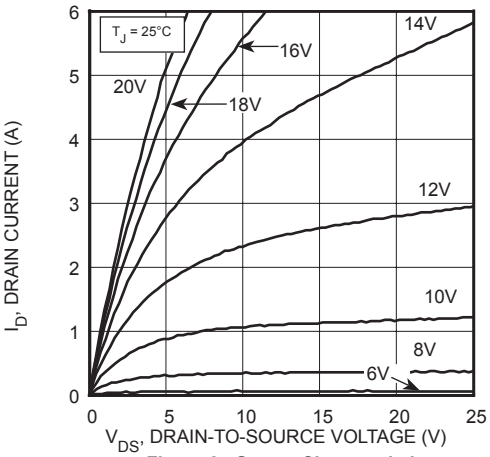



**Figure 2, Output Characteristics**

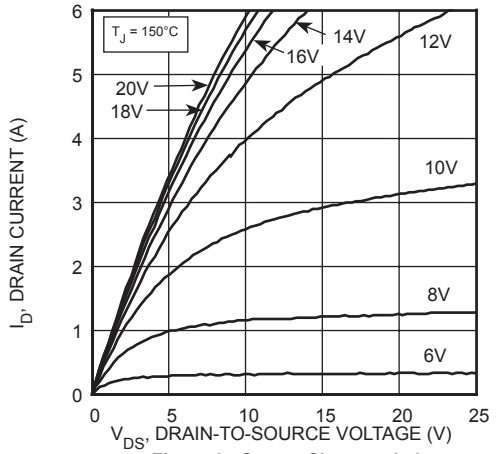



**Figure 3, Output Characteristics**

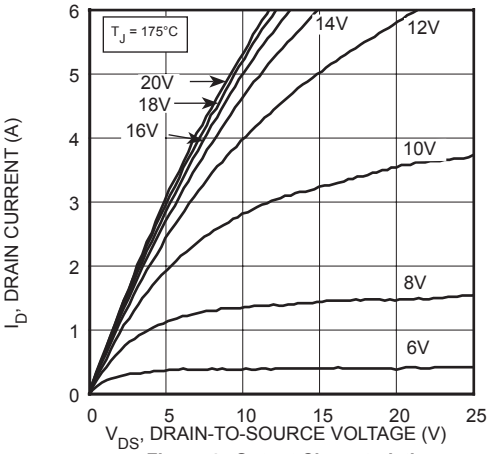



**Figure 4, Output Characteristics**

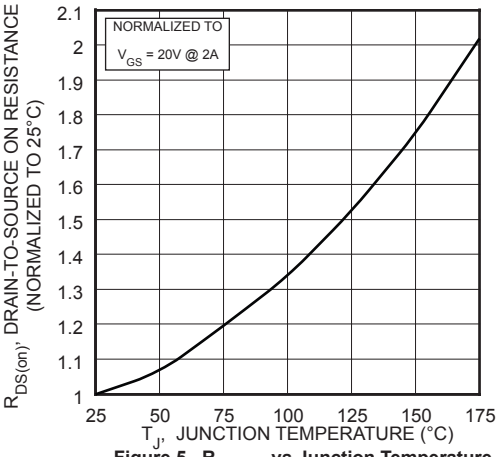



**Figure 5, $R_{DS(on)}$ vs Junction Temperature**

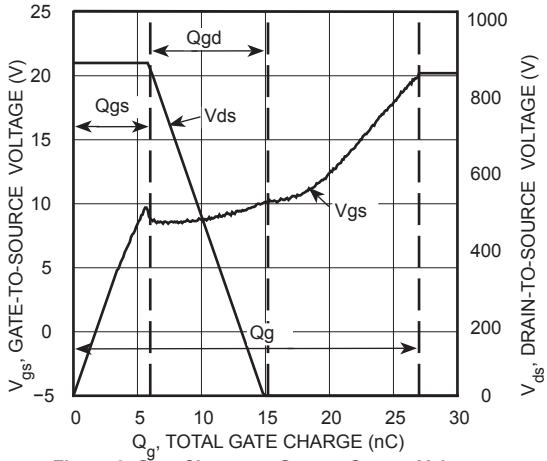



**Figure 6, Gate Charge vs Gate-to-Source Voltage**

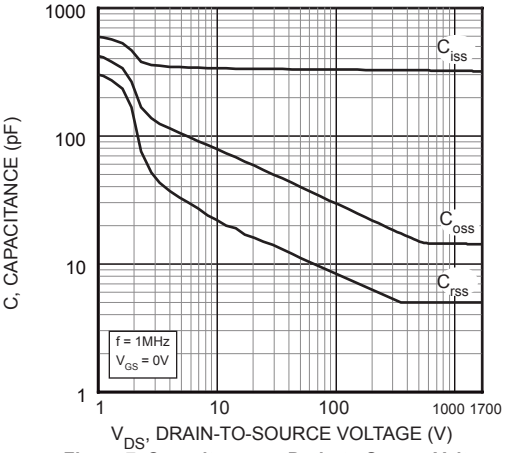



**Figure 7, Capacitance vs Drain-to-Source Voltage**

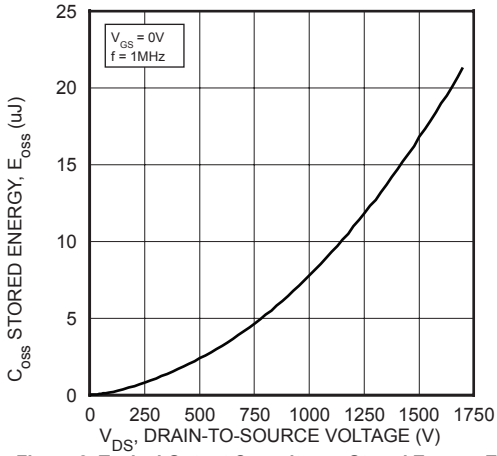



**Figure 8, Typical Output Capacitance Stored Energy, $E_{oss}$**

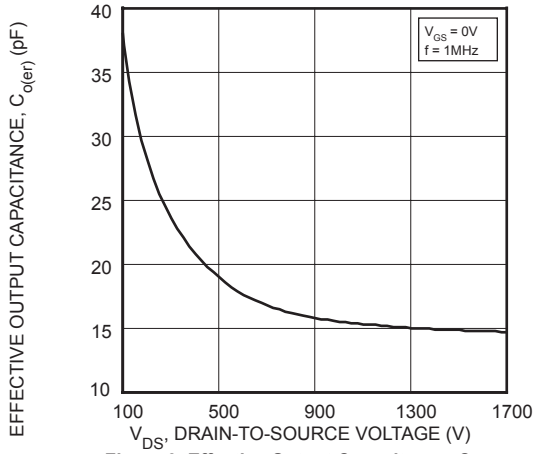



**Figure 9, Effective Output Capacitance, $C_{o(er)}$**

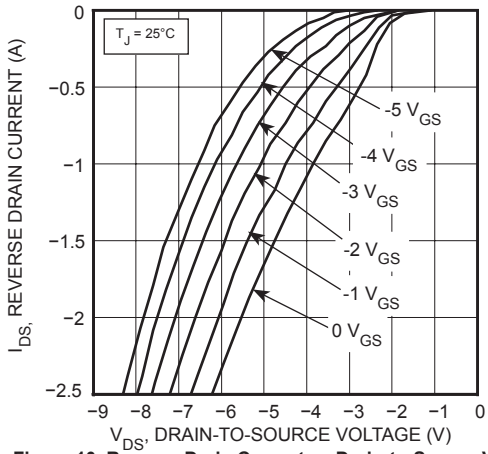



**Figure 10, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction**

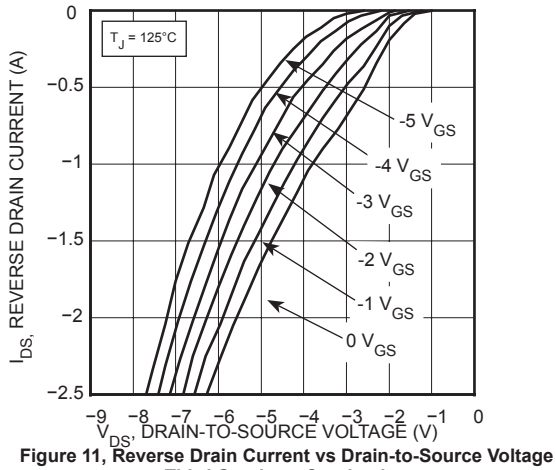



**Figure 11, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction**

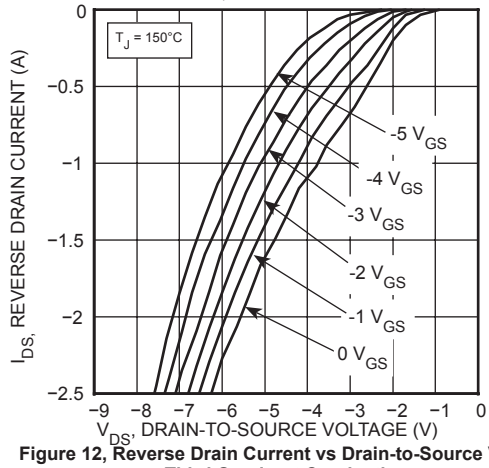



**Figure 12, Reverse Drain Current vs Drain-to-Source Voltage Third Quadrant Conduction**

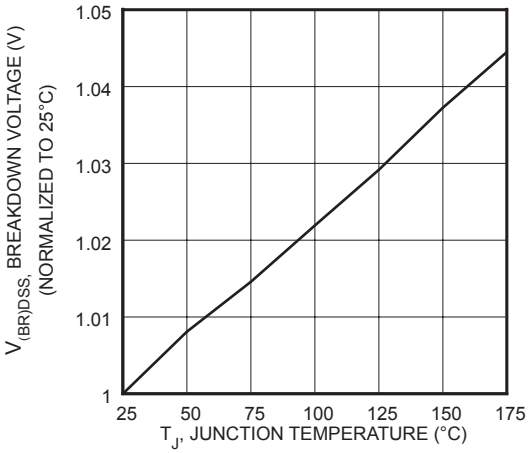



**Figure 13, Breakdown Voltage vs Temperature**

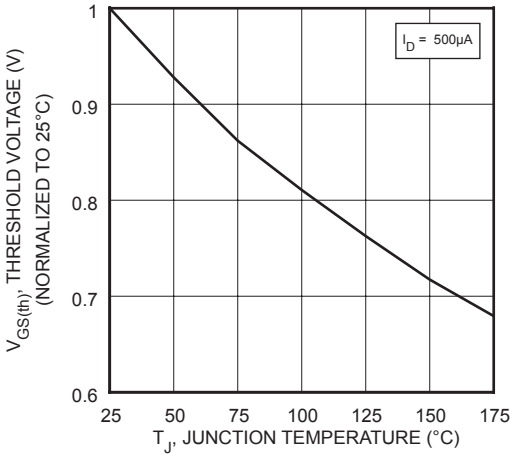



**Figure 14, Threshold Voltage vs Temperature**

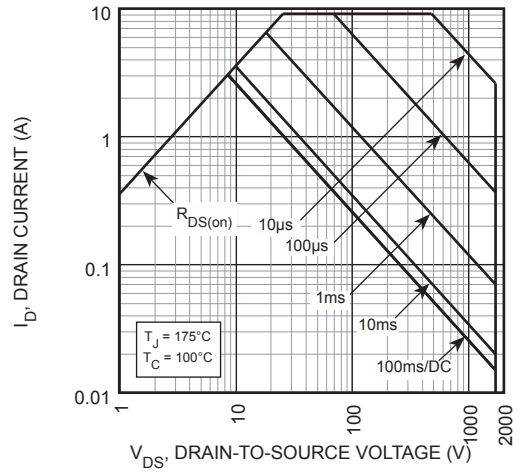



**Figure 15, Forward Safe Operating Area**

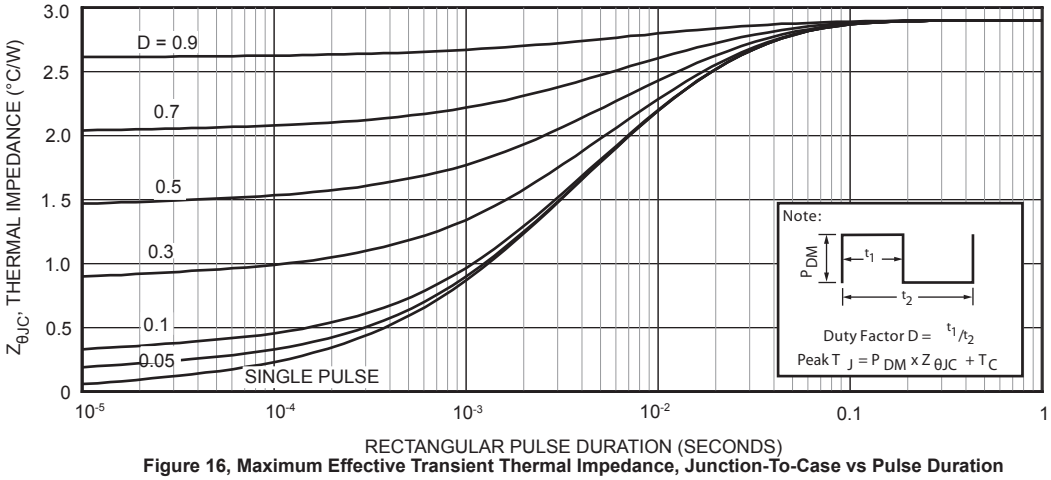
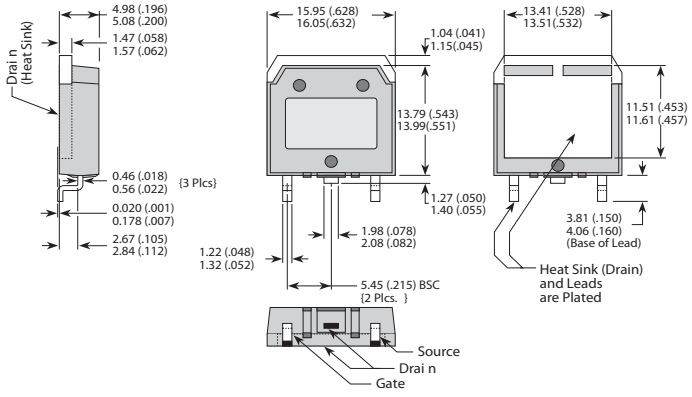



**Figure 16, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration**

## D³PAK (S) Package Outline




**Dimensions in Millimeters (Inches)**

## Disclaimer:



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