Microsemi
POWER PRODUCTS GROUP

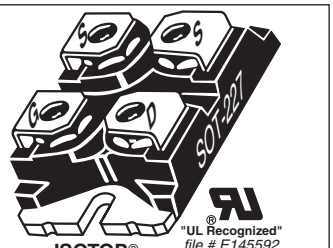
Power MOS 8™ Cooler!

# APT80F60J

**600V, 84A, 0.055Ω Max, $t_{rr}$ ≤ 370ns**

## N-Channel FREDFET

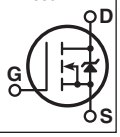
Power MOS 8™ is a high speed, high voltage N-channel switch-mode power MOSFET. A proprietary planar stripe design yields excellent reliability and manufacturability. Low switching loss is achieved with low input capacitance and ultra low $C_{rss}$ "Miller" capacitance. The intrinsic gate resistance and capacitance of the poly-silicon gate structure help control slew rates during switching, resulting in low EMI and reliable paralleling, even when switching at very high frequency. Reliability in flyback, boost, forward, and other circuits is enhanced by the high avalanche energy capability.




"UL Recognized" file # E145592

**ISOTOP®**
**APT80F60J**

Single die FREDFET




## FEATURES

- **Fast switching with low EMI/RFI**
- **Low $R_{DS(on)}$**
- **Ultra low $C_{rss}$ for improved noise immunity**
- **Low gate charge**
- **Avalanche energy rated**
- **RoHS compliant**

## TYPICAL APPLICATIONS

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

### Absolute Maximum Ratings

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $I_D$ | Continuous Drain Current @ $T_C$ = 25°C | 84 | A |
| | Continuous Drain Current @ $T_C$ = 100°C | 52 | |
| $I_{DM}$ | Pulsed Drain Current ① | 447 | |
| $V_{GS}$ | Gate-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 3352 | mJ |
| $I_{AR}$ | Avalanche Current, Repetitive or Non-Repetitive | 60 | A |

### Thermal and Mechanical Characteristics

| Symbol | Characteristic | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $P_D$ | Total Power Dissipation @ $T_C$ = 25°C | | | 961 | W |
| $R_{\theta JC}$ | Junction to Case Thermal Resistance | | | 0.13 | °C/W |
| $R_{\theta CS}$ | Case to Sink Thermal Resistance, Flat, Greased Surface | | 0.15 | | |
| $T_J$,$T_{STG}$ | Operating and Storage Junction Temperature Range | -55 | | 150 | °C |
| $V_{Isolation}$ | RMS Voltage (50-60hHz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.) | 2500 | | | V |
| $W_T$ | Package Weight | | 1.03 | | oz |
| | | | 29.2 | | g |
| Torque | Terminals and Mounting Screws. | | | 10 | in·lbf |
| | | | | 1.1 | N·m |



050-8175 Rev B 5-2009

## Static Characteristics $T_J$ = 25°C unless otherwise specified APT80M60J

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{BR(DSS)}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250µA | 600 | | | V |
| $\Delta V_{BR(DSS)}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | Reference to 25°C, $I_D$ = 250µA | | 0.60 | | V/°C |
| $R_{DS(on)}$ | Drain-Source On Resistance③ | $V_{GS}$ = 10V, $I_D$ = 60A | | 0.042 | 0.055 | Ω |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 2.5mA | 2.5 | 4 | 5 | V |
| $\Delta V_{GS(th)}/\Delta T_J$ | Threshold Voltage Temperature Coefficient | | | -10 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 600V, $V_{GS}$ = 0V, $T_J$ = 25°C | | | 250 | µA |
| | | $V_{DS}$ = 600V, $V_{GS}$ = 0V, $T_J$ = 125°C | | | 1000 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$ = ±30V | | | ±100 | nA |

## Dynamic Characteristics $T_J$ = 25°C unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ | Forward Transconductance | $V_{DS}$ = 50V, $I_D$ = 60A | | 117 | | S |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 25V f = 1MHz | | 23994 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 245 | | |
| $C_{oss}$ | Output Capacitance | | | 2201 | | |
| $C_{o(cr)}$ ④ | Effective Output Capacitance, Charge Related | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 400V | | 1170 | | |
| $C_{o(er)}$ ⑤ | Effective Output Capacitance, Energy Related | | | 606 | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0 to 10V, $I_D$ = 60A, $V_{DS}$ = 300V | | 598 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 128 | | |
| $Q_{gd}$ | Gate-Drain Charge | | | 251 | | |
| $t_{d(on)}$ | Turn-On Delay Time | **Resistive Switching** $V_{DD}$ = 400V, $I_D$ = 60A, $R_G$ = 2.2Ω⑥, $V_{GG}$ = 15V | | 134 | | ns |
| $t_r$ | Current Rise Time | | | 156 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 408 | | |
| $t_f$ | Current Fall Time | | | 123 | | |

## Source-Drain Diode Characteristics

| Symbol | Parameter | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | MOSFET symbol showing the integral reverse p-n junction diode (body diode)   | | | | 84 | A |
| $I_{SM}$ | Pulsed Source Current (Body Diode)① | | | | | 447 | |
| $V_{SD}$ | Diode Forward Voltage | $I_{SD}$ = 60A, $T_J$ = 25°C, $V_{GS}$ = 0V | | | | 0.8 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 60A③, $V_{DD}$ = 100V, $di_{SD}/dt$ = 100A/µs | $T_J$ = 25°C | | | 370 | ns |
| | | | $T_J$ = 125°C | | | 690 | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_J$ = 25°C | | 2.6 | | µC |
| | | | $T_J$ = 125°C | | 7.0 | | |
| $I_{rrm}$ | Reverse Recovery Current | | $T_J$ = 25°C | | 14.5 | | A |
| | | | $T_J$ = 125°C | | 20 | | |
| dv/dt | Peak Recovery dv/dt | $I_{SD}$ ≤ 60A, di/dt ≤1000A/µs, $V_{DD}$ = 400V, $T_J$ = 125°C | | | | 25 | V/ns |

1 Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature.

2 Starting at $T_J$ = 25°C, L = 2.08mH, $R_G$ = 2.2Ω, $I_{AS}$ = 60A.

3 Pulse test: Pulse Width < 380µs, duty cycle < 2%.

4 $C_{o(cr)}$ is defined as a fixed capacitance with the same stored charge as $C_{OSS}$ with $V_{DS}$ = 67% of $V_{(BR)DSS}$.

5 $C_{o(er)}$ is defined as a fixed capacitance with the same stored energy as $C_{OSS}$ with $V_{DS}$ = 67% of $V_{(BR)DSS}$. To calculate $C_{o(cr)}$ for any value of $V_{DS}$ less than $V_{(BR)DSS,}$ use this equation: $C_{o(er)}$ = -3.14E-7/$V_{DS}$^2 + 7.31E-8/$V_{DS}$ + 2.09E-10.

6 $R_G$ is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)

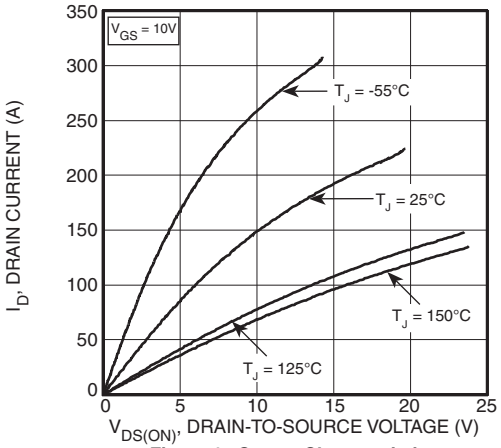



**Figure 1, Output Characteristics**

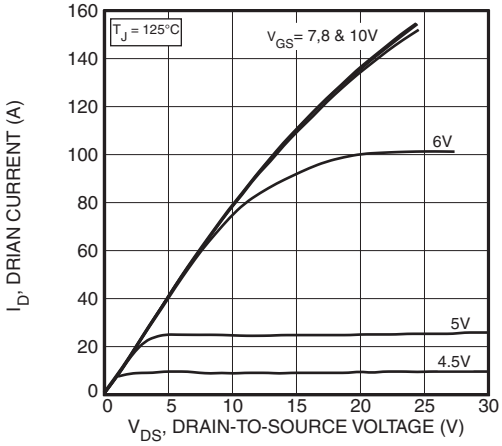



**Figure 2, Output Characteristics**

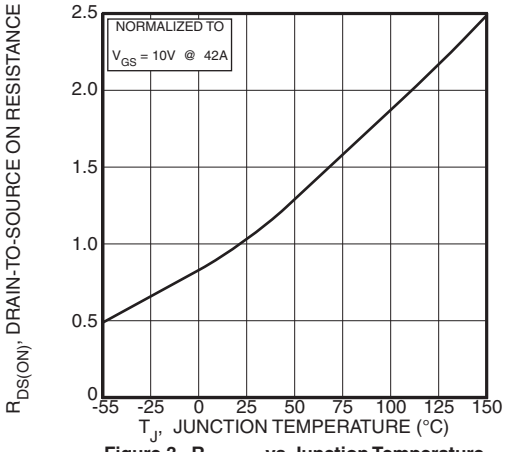



**Figure 3, $R_{DS(ON)}$ vs Junction Temperature**

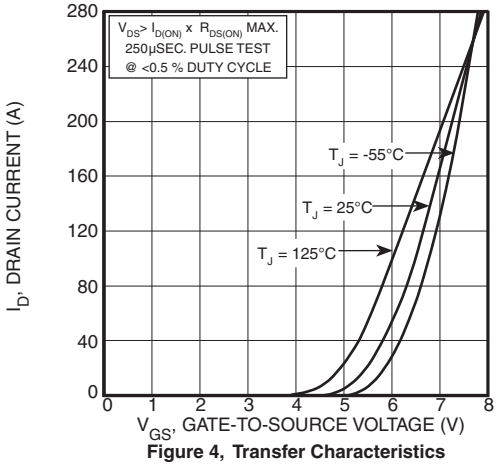



**Figure 4, Transfer Characteristics**

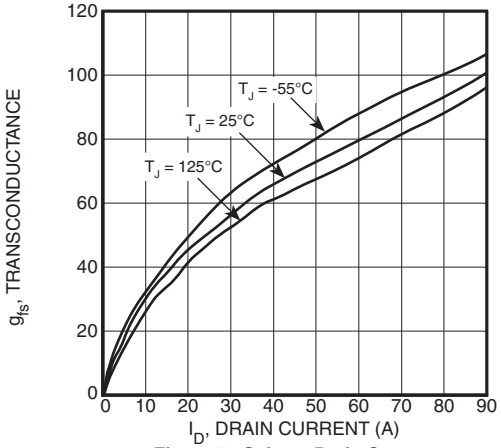



**Figure 5, Gain vs Drain Current**

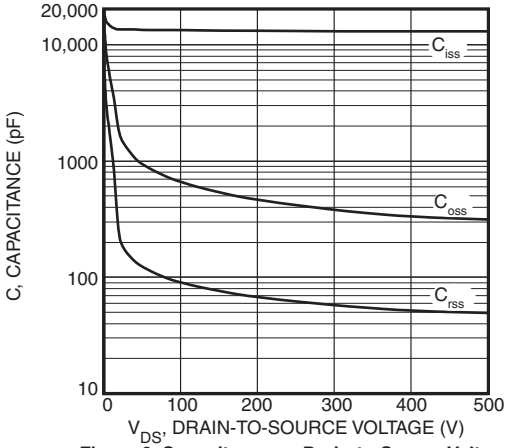



**Figure 6, Capacitance vs Drain-to-Source Voltage**

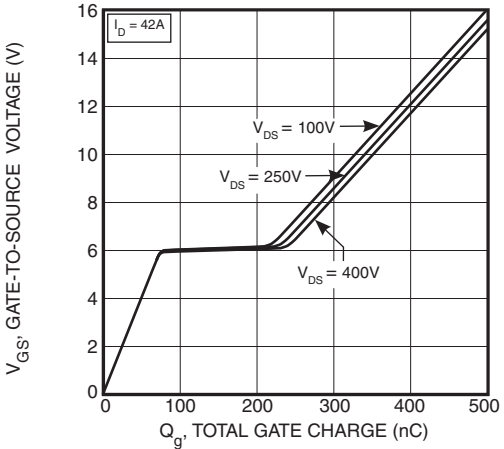



**Figure 7, Gate Charge vs Gate-to-Source Voltage**

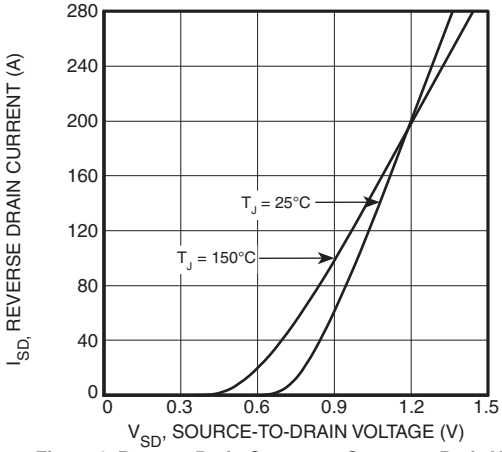



**Figure 8, Reverse Drain Current vs Source-to-Drain Voltage**

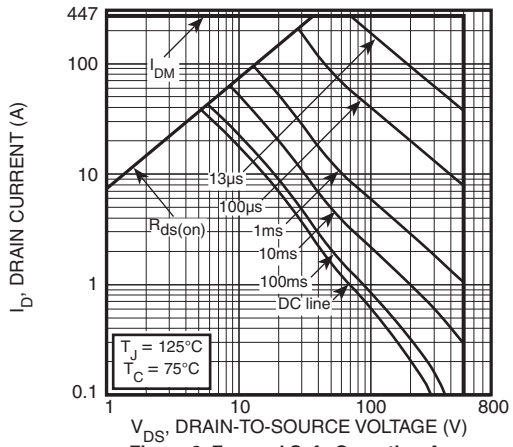



**Figure 9, Forward Safe Operating Area**

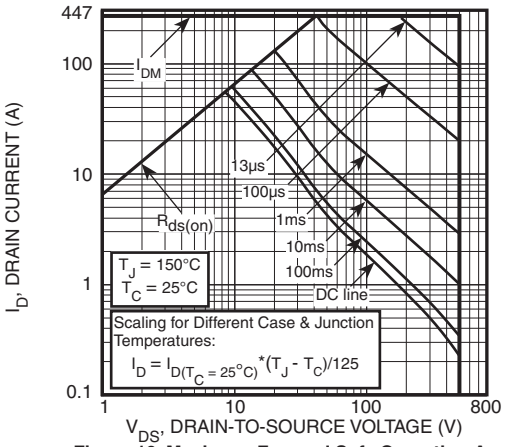



**Figure 10, Maximum Forward Safe Operating Area**

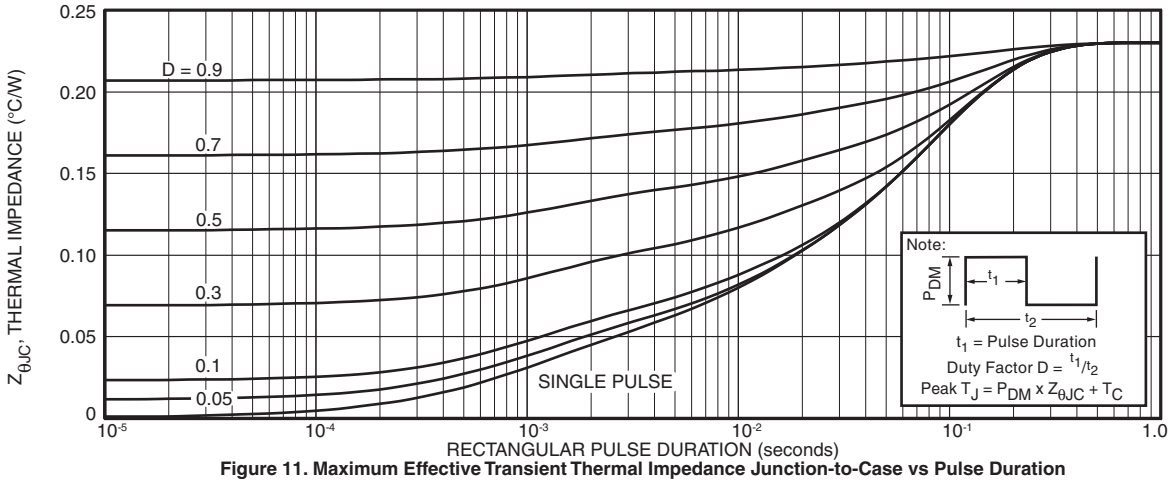
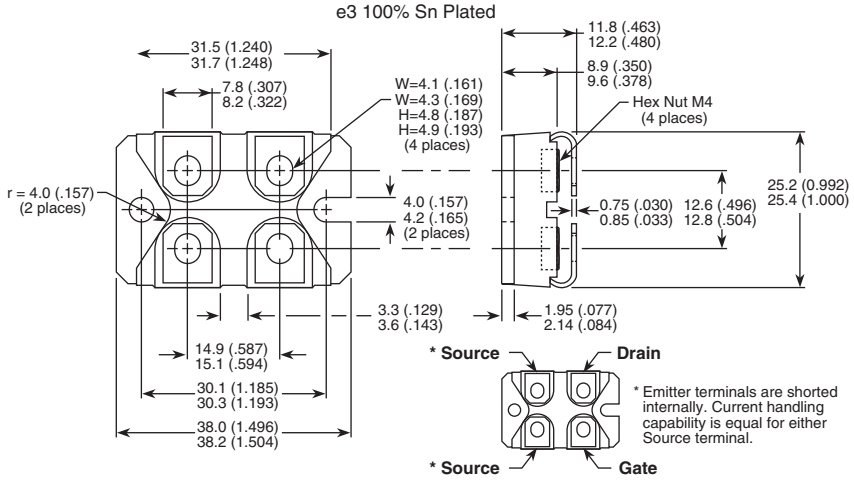



**Figure 11. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration**

## SOT-227 (ISOTOP®) Package Outline

e3 100% Sn Plated




Dimensions in Millimeters and (Inches)