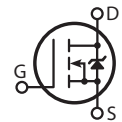


## N-Channel FREDFET

POWER MOS 8® is a high speed, high voltage N-channel switch-mode power MOSFET. This 'FREDFET' version has a drain-source (body) diode that has been optimized for high reliability in ZVS phase shifted bridge and other circuits through reduced  $t_{rr}$ , soft recovery, and high recovery  $dv/dt$  capability. Low gate charge, high gain, and a greatly reduced ratio of  $C_{rss}/C_{iss}$  result in excellent noise immunity and low switching loss. The intrinsic gate resistance and capacitance of the poly-silicon gate structure help control  $di/dt$  during switching, resulting in low EMI and reliable paralleling, even when switching at very high frequency.



IS OTO P\*  
APT29F80J



Single die FREDFET

### FEATURES

- Fast switching with low EMI
- Low  $t_{rr}$  for high reliability
- Ultra low  $C_{rss}$  for improved noise immunity
- Low gate charge
- Avalanche energy rated
- RoHS compliant 

### TYPICAL APPLICATIONS

- ZVS phase shifted and other full full bridge
- Half bridge
- PFC and other boost converter
- Buck converter
- Single and two switch forward
- Flyback

### Absolute Maximum Ratings

| Symbol   | Parameter                                       | Ratings | Unit |
|----------|-------------------------------------------------|---------|------|
| $I_D$    | Continuous Drain Current @ $T_C = 25^\circ C$   | 31      | A    |
|          | Continuous Drain Current @ $T_C = 100^\circ C$  | 19      |      |
| $I_{DM}$ | Pulsed Drain Current <sup>1</sup>               | 173     |      |
| $V_{GS}$ | Gate-Source Voltage                             | ±30     | V    |
| $E_{AS}$ | Single Pulse Avalanche Energy <sup>2</sup>      | 1979    | mJ   |
| $I_{AR}$ | Avalanche Current, Repetitive or Non-Repetitive | 24      | A    |

### Thermal and Mechanical Characteristics

| Symbol          | Characteristic                                                                       | Min  | Typ  | Max  | Unit         |
|-----------------|--------------------------------------------------------------------------------------|------|------|------|--------------|
| $P_D$           | Total Power Dissipation @ $T_C = 25^\circ C$                                         |      |      | 543  | W            |
| $R_{\theta JC}$ | Junction to Case Thermal Resistance                                                  |      |      | 0.23 | $^\circ C/W$ |
| $R_{\theta CS}$ | Case to Sink Thermal Resistance, Flat, Greased Surface                               |      | 0.15 |      |              |
| $T_J, T_{STG}$  | Operating and Storage Junction Temperature Range                                     | -55  |      | 150  | $^\circ C$   |
| $V_{Isolation}$ | RMS Voltage (50-60Hz 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          |

## Static Characteristics

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

APT29F80J

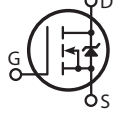
| Symbol                          | Parameter                                 | Test Conditions                                           | Min | Typ  | Max       | Unit                   |
|---------------------------------|-------------------------------------------|-----------------------------------------------------------|-----|------|-----------|------------------------|
| $V_{BR(DSS)}$                   | Drain-Source Breakdown Voltage            | $V_{GS} = 0V, I_D = 250\mu A$                             | 800 |      |           | V                      |
| $\Delta V_{BR(DSS)}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | Reference to $25^{\circ}\text{C}$ , $I_D = 250\mu A$      |     | 1.41 |           | V/ $^{\circ}\text{C}$  |
| $R_{DS(on)}$                    | Drain-Source On Resistance <sup>③</sup>   | $V_{GS} = 10V, I_D = 24A$                                 |     | 0.19 | 0.21      | $\Omega$               |
| $V_{GS(th)}$                    | 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/ $^{\circ}\text{C}$ |
| $I_{DSS}$                       | Zero Gate Voltage Drain Current           | $V_{DS} = 800V$<br>$V_{GS} = 0V$                          |     |      | 250       | $\mu A$                |
|                                 |                                           | $T_J = 25^{\circ}\text{C}$<br>$T_J = 125^{\circ}\text{C}$ |     |      | 1000      |                        |
| $I_{GSS}$                       | Gate-Source Leakage Current               | $V_{GS} = \pm 30V$                                        |     |      | $\pm 100$ | nA                     |

## Dynamic Characteristics

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

| Symbol        | Parameter                                    | Test Conditions                                                                                 | Min | Typ  | Max | Unit |
|---------------|----------------------------------------------|-------------------------------------------------------------------------------------------------|-----|------|-----|------|
| $g_{fs}$      | Forward Transconductance                     | $V_{DS} = 50V, I_D = 24A$                                                                       |     | 43   |     | S    |
| $C_{iss}$     | Input Capacitance                            | $V_{GS} = 0V, V_{DS} = 25V$<br>$f = 1MHz$                                                       |     | 9326 |     | pF   |
| $C_{rss}$     | Reverse Transfer Capacitance                 |                                                                                                 |     | 159  |     |      |
| $C_{oss}$     | Output Capacitance                           |                                                                                                 |     | 927  |     |      |
| $C_{o(cr)}^4$ | Effective Output Capacitance, Charge Related | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 533V$                                                     |     | 438  |     |      |
| $C_{o(er)}^5$ | Effective Output Capacitance, Energy Related |                                                                                                 |     | 217  |     |      |
| $Q_g$         | Total Gate Charge                            | $V_{GS} = 0 \text{ to } 10V, I_D = 24A,$<br>$V_{DS} = 400V$                                     |     | 303  |     | nC   |
| $Q_{gs}$      | Gate-Source Charge                           |                                                                                                 |     | 51   |     |      |
| $Q_{gd}$      | Gate-Drain Charge                            |                                                                                                 |     | 155  |     |      |
| $t_{d(on)}$   | Turn-On Delay Time                           | Resistive Switching<br>$V_{DD} = 533V, I_D = 24A$<br>$R_G = 2.2\Omega^{\text{⑥}}, V_{GG} = 15V$ |     | 53   |     | ns   |
| $t_r$         | Current Rise Time                            |                                                                                                 |     | 76   |     |      |
| $t_{d(off)}$  | Turn-Off Delay Time                          |                                                                                                 |     | 231  |     |      |
| $t_f$         | Current Fall Time                            |                                                                                                 |     | 67   |     |      |

## 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)<br> |                             |      | 31  | A       |
| $I_{SM}$  | Pulsed Source Current (Body Diode) <sup>①</sup> |                                                                                                                                                                    |                             |      | 173 |         |
| $V_{SD}$  | Diode Forward Voltage                           | $I_{SD} = 24A, T_J = 25^{\circ}\text{C}, V_{GS} = 0V$                                                                                                              |                             |      | 1.0 | V       |
| $t_{rr}$  | Reverse Recovery Time                           | $I_{SD} = 24A^3$<br>$di_{SD}/dt = 100A/\mu s$                                                                                                                      | $T_J = 25^{\circ}\text{C}$  |      | 370 | ns      |
|           |                                                 |                                                                                                                                                                    | $T_J = 125^{\circ}\text{C}$ |      | 710 |         |
| $Q_{rr}$  | Reverse Recovery Charge                         |                                                                                                                                                                    | $T_J = 25^{\circ}\text{C}$  | 1.91 |     | $\mu C$ |
|           |                                                 |                                                                                                                                                                    | $T_J = 125^{\circ}\text{C}$ | 5.18 |     |         |
| $I_{rrm}$ | Reverse Recovery Current                        |                                                                                                                                                                    | $T_J = 25^{\circ}\text{C}$  | 12   |     | A       |
|           |                                                 |                                                                                                                                                                    | $T_J = 125^{\circ}\text{C}$ | 18   |     |         |
| $dv/dt$   | Peak Recovery $dv/dt$                           | $I_{SD} \leq 24A, di/dt \leq 1000A/\mu s, V_{DD} = 100V,$<br>$T_J = 125^{\circ}\text{C}$                                                                           |                             |      | 25  | V/ns    |

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

② Starting at  $T_J = 25^{\circ}\text{C}$ ,  $L = 6.9mH$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 24A$ .③ Pulse test: Pulse Width  $< 380\mu s$ , 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  $C_{o(er)}$  for any value of  $V_{DS}$  less than  $V_{(BR)DSS}$ , use this equation:  $C_{o(er)} = -8.27E-7/V_{DS}^2 + 1.01E-7/V_{DS} + 1.43E-10$ .⑥  $R_G$  is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

## Typical Performance Curves

APT29F80J

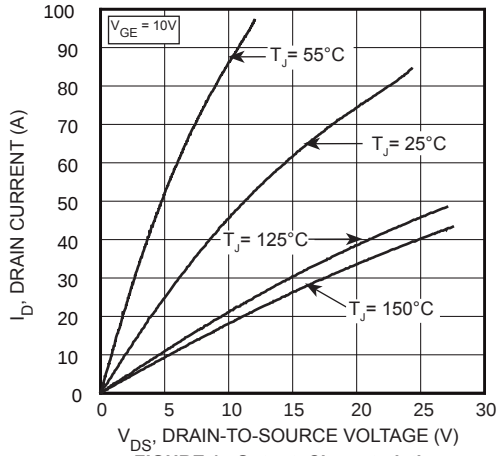


FIGURE 1, Output Characteristics

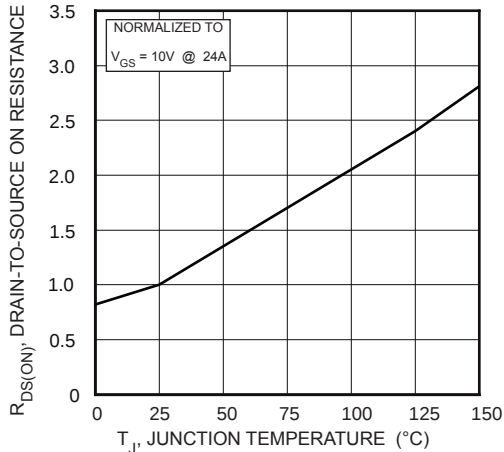


FIGURE 3,  $R_{DS(ON)}$  vs Junction Temperature

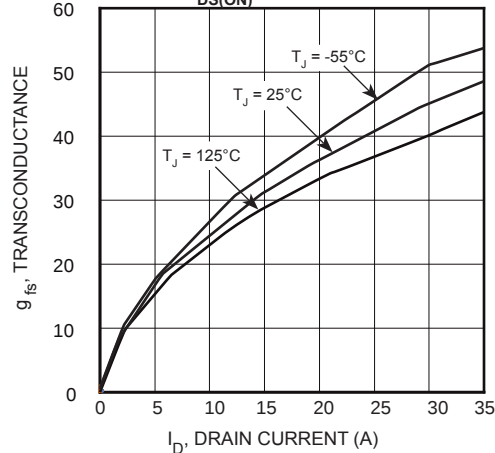


FIGURE 5, Gain vs Drain Current

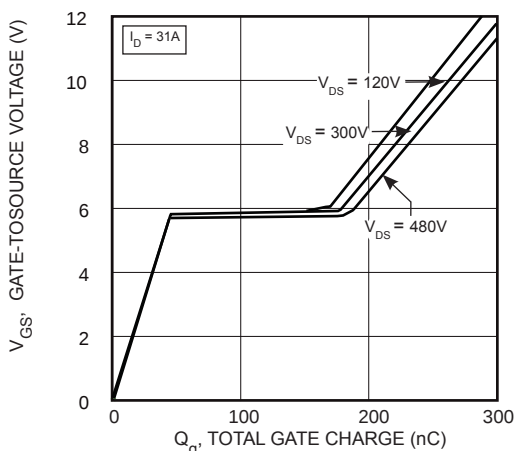


FIGURE 7, Gate Charge vs Gate-to-Source Voltage

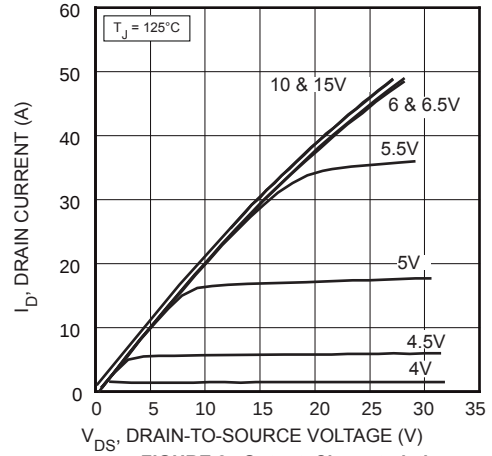


FIGURE 2, Output Characteristics

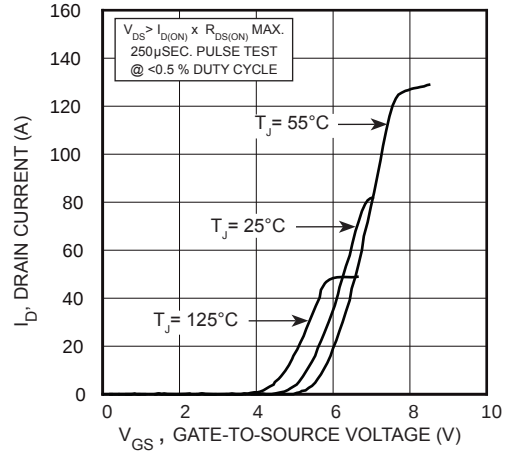


FIGURE 4, Transfer Characteristics

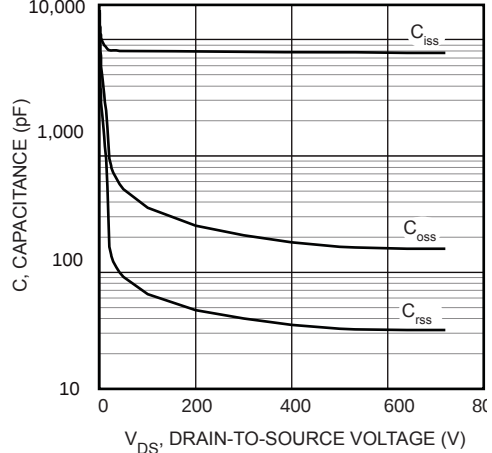


FIGURE 6, CAPACITANCE VS DRAIN-TO-SOURCE VOLTAGE

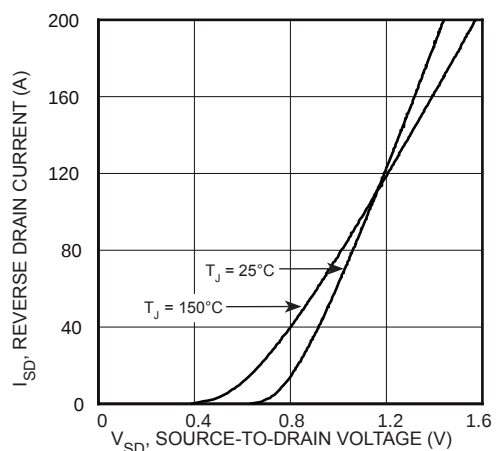
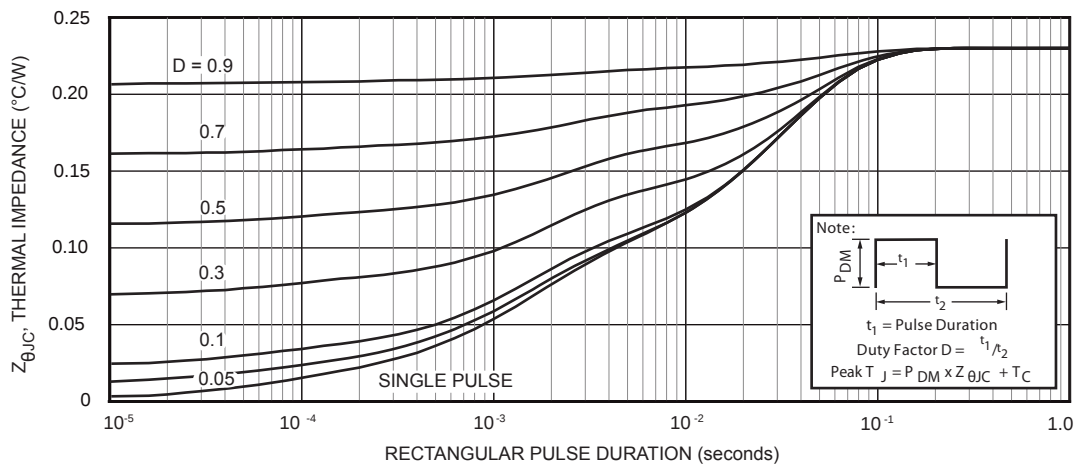
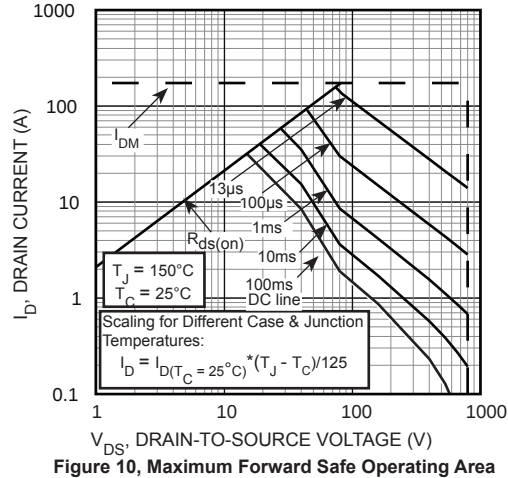
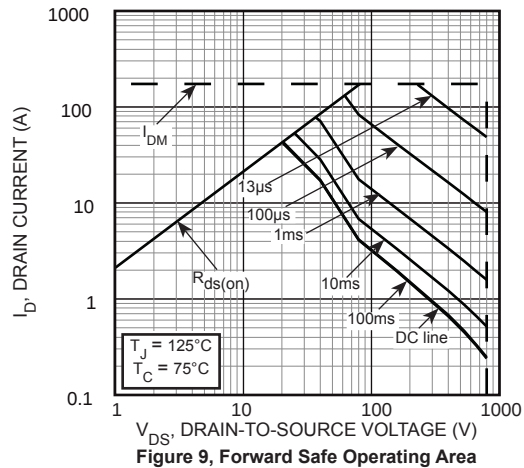
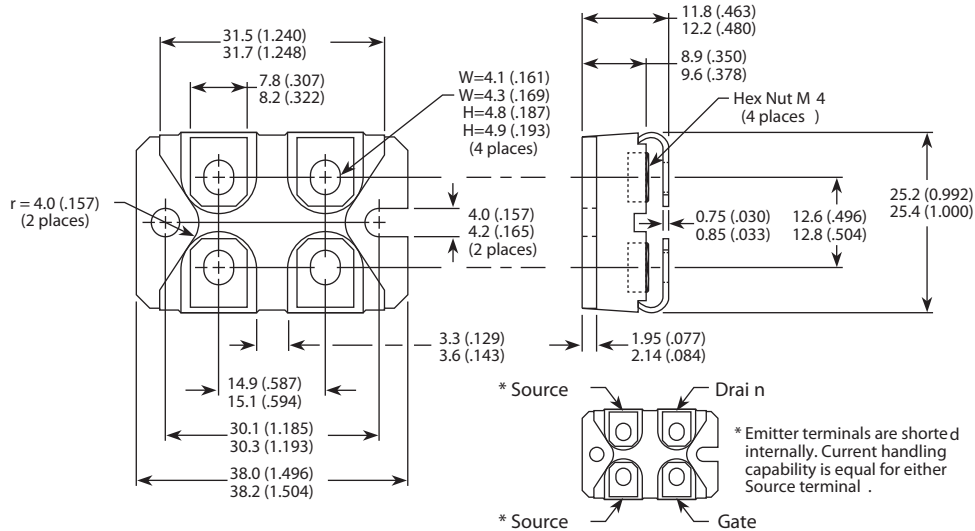


FIGURE 8, Reverse Drain Current vs Source-to-Drain Voltage



### SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)