POWER MOS 7® FREDFET

Power MOS 7® is a new generation of low loss, high voltage, N-Channel enhancement mode power MOSFETS. Both conduction and switching losses are addressed with Power MOS 7® by significantly lowering $R_{\text{DS(on)}}$ and $Q_g$. Power MOS 7® combines lower conduction and switching losses along with exceptionally fast switching speeds inherent with APT’s patented metal gate structure.

- Lower Input Capacitance
- Increased Power Dissipation
- Lower Miller Capacitance
- Easier To Drive
- Lower Gate Charge, $Q_g$
- Popular SOT-227 Package
- FAST RECOVERY BODY DIODE

MAXIMUM RATINGS

All Ratings: $T_C = 25^\circ\text{C}$ unless otherwise specified.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>APT12031JLL</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{DSS}}$</td>
<td>Drain-Source Voltage</td>
<td>1200</td>
<td>Volts</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Continuous Drain Current @ $T_C = 25^\circ\text{C}$</td>
<td>30</td>
<td>Amps</td>
</tr>
<tr>
<td>$I_{\text{DM}}$</td>
<td>Pulsed Drain Current $\dagger$</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{GS}}$</td>
<td>Gate-Source Voltage Continuous</td>
<td>±30</td>
<td>Volts</td>
</tr>
<tr>
<td>$V_{\text{GSM}}$</td>
<td>Gate-Source Voltage Transient</td>
<td>±40</td>
<td></td>
</tr>
<tr>
<td>$P_D$</td>
<td>Total Power Dissipation @ $T_C = 25^\circ\text{C}$</td>
<td>690</td>
<td>Watts</td>
</tr>
<tr>
<td>Linear Derating Factor</td>
<td>5.52</td>
<td>$\text{W/}^\circ\text{C}$</td>
<td></td>
</tr>
<tr>
<td>$T_J, T_{\text{STG}}$</td>
<td>Operating and Storage Junction Temperature Range</td>
<td>-55 to 150</td>
<td>$^\circ\text{C}$</td>
</tr>
<tr>
<td>$T_L$</td>
<td>Lead Temperature: 0.063&quot; from Case for 10 Sec.</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>$I_{\text{AR}}$</td>
<td>Avalanche Current $\dagger$ (Repetitive and Non-Repetitive)</td>
<td>30</td>
<td>Amps</td>
</tr>
<tr>
<td>$E_{\text{AR}}$</td>
<td>Repetitive Avalanche Energy $\dagger$</td>
<td>50</td>
<td>$\text{mJ}$</td>
</tr>
<tr>
<td>$E_{\text{AS}}$</td>
<td>Single Pulse Avalanche Energy $\dagger$</td>
<td>3600</td>
<td></td>
</tr>
</tbody>
</table>

STATIC ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Characteristic / Test Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$BV_{\text{DSS}}$</td>
<td>Drain-Source Breakdown Voltage $(V_{\text{GS}} = 0\text{V}, I_D = 250\mu\text{A})$</td>
<td>1200</td>
<td></td>
<td></td>
<td>Volts</td>
</tr>
<tr>
<td>$R_{\text{DS(on)}}$</td>
<td>Drain-Source On-State Resistance $\dagger$ $(V_{\text{GS}} = 10\text{V}, 15\text{A})$</td>
<td>0.33</td>
<td></td>
<td></td>
<td>Ohms</td>
</tr>
<tr>
<td>$I_{\text{DSS}}$</td>
<td>Zero Gate Voltage Drain Current $(V_{\text{DS}} = 1200\text{V}, V_{\text{GS}} = 0\text{V})$</td>
<td>250</td>
<td></td>
<td></td>
<td>$\mu\text{A}$</td>
</tr>
<tr>
<td></td>
<td>Zero Gate Voltage Drain Current $(V_{\text{DS}} = 960\text{V}, V_{\text{GS}} = 0\text{V}, T_C = 125^\circ\text{C})$</td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{\text{GSS}}$</td>
<td>Gate-Source Leakage Current $(V_{\text{GS}} = \pm 30\text{V}, V_{\text{DS}} = 0\text{V})$</td>
<td>±100</td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>$V_{\text{GS(th)}}$</td>
<td>Gate Threshold Voltage $(V_{\text{DS}} = V_{\text{GS}}, I_D = 5\text{mA})$</td>
<td>3</td>
<td>5</td>
<td></td>
<td>Volts</td>
</tr>
</tbody>
</table>

CAUTION: These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

APT Website - http://www.advancedpower.com
## Dynamic Characteristics

### Symbol | Characteristic | Test Conditions | MIN | TYP | MAX | UNIT |
--- | --- | --- | --- | --- | --- | --- |
$C_{iss}$ | Input Capacitance | $V_{GS} = 0V$, $V_{DS} = 25V$, $f = 1$ MHz | | | | |
$C_{oss}$ | Output Capacitance | | | | | |
$C_{rss}$ | Reverse Transfer Capacitance | | | | | |
$Q_g$ | Total Gate Charge \(^\circ\) | $V_{GS} = 10V$, $V_{DD} = 600V$, $I_b = 30A @ 25°C$ | 9480 | 1460 | | pF |
$Q_{gs}$ | Gate-Source Charge | | 365 | 45 | nC |
$Q_{gd}$ | Gate-Drain ("Miller") Charge | | 235 | | |
$t_{d(on)}$ | Turn-on Delay Time | | | 23 | ns |
$t_{r}$ | Rise Time | | | 16 | |
$t_{d(\text{off})}$ | Turn-off Delay Time | | | 79 | |
$t_{f}$ | Fall Time | | | 30 | |
$E_{on}$ | Turn-on Switching Energy \(^\circ\) | $V_{DD} = 800V$, $V_{GS} = 15V$, $I_b = 30A$, $R_G = 5\Omega$ | 1760 | 1241 | | µJ |
$E_{off}$ | Turn-off Switching Energy | | | | |
$E_{on}$ | Turn-on Switching Energy \(^\circ\) | | | 1557 | |
$E_{off}$ | Turn-off Switching Energy | | | | |

### Source-Drain Diode Ratings and Characteristics

| Symbol | Characteristic / Test Conditions | MIN | TYP | MAX | UNIT |
--- | --- | --- | --- | --- | --- |
$I_S$ | Continuous Source Current (Body Diode) | | 30 | | Amps |
$I_{SM}$ | Pulsed Source Current \(^\circ\) (Body Diode) | | 120 | | |
$V_{SD}$ | Diode Forward Voltage \(^\circ\) ($V_{GS} = 0V$, $I_S = -30A$) | | 1.3 | | Volts |
$dv/dt$ | Peak Diode Recovery $dv/dt \circ$ | | 18 | | V/ns |
$t_{rr}$ | Reverse Recovery Time | $T_J = 25°C$, $T_J = 125°C$ | 300 | 600 | ns |
$Q_{rr}$ | Reverse Recovery Charge | $T_J = 25°C$, $T_J = 125°C$ | 1.8 | 7.4 | µC |
$I_{RRM}$ | Peak Recovery Current | $T_J = 25°C$, $T_J = 125°C$ | 16 | 30 | Amps |

### Thermal Characteristics

| Symbol | Characteristic | MIN | TYP | MAX | UNIT |
--- | --- | --- | --- | --- | --- |
$R_{JUC}$ | Junction to Case | | 0.18 | | °C/W |
$R_{JJA}$ | Junction to Ambient | | 40 | | |

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**Note:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Pulse Test: Pulse width < 380 μs, Duty Cycle < 2%
3. See MIL-STD-750 Method 3471
4. Starting $T_J = +25°C$, $L = 8.0mH$, $R_G = 25Ω$, Peak $I_L = 30A$
5. $dv/dt$ numbers reflect the limitations of the test circuit rather than the device itself. $I_S \leq -30A$, $dv/dt \leq 700A/\mu s$, $V_{Rs} \leq V_{DS}$, $T_J \leq 150°C$
6. $E_{on}$ includes diode reverse recovery. See figures 18, 20.

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APT reserves the right to change, without notice, the specifications and information contained herein.
Typical Performance Curves

RC MODEL

Junction temp C  0.0375  0.0554F

Power (watts)  0.142  0.751F

Case temperature C

FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

VGS = 10V

VGS = 20V

VGS = 15 & 10V

VGS = 10V

FIGURE 4, TRANSFER CHARACTERISTICS

FIGURE 5, RDS(ON) vs DRAIN CURRENT

FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

FIGURE 8, ON-RESISTANCE vs TEMPERATURE

FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE
Typical Performance Curves

Figure 18, Turn-on Switching Waveforms and Definitions

Figure 19, Turn-off Switching Waveforms and Definitions

Figure 20, Inductive Switching Test Circuit

SOT-227 (ISOTOP®) Package Outline

Dimensions in Millimeters and (Inches)