POWER MOS 7® MOSFET

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 $R_{DS(on)}$ 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
- Lower Miller Capacitance
- Lower Gate Charge, $Q_g$
- Increased Power Dissipation
- Easier To Drive
- Popular SOT-227 Package

MAXIMUM RATINGS

All Ratings: $T_C = 25°C$ unless otherwise specified.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>APT20M20JLL</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DSS}$</td>
<td>Drain-Source Voltage</td>
<td>200</td>
<td>Volts</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Continuous Drain Current @ $T_C = 25°C$</td>
<td>104</td>
<td>Amps</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Pulsed Drain Current</td>
<td>416</td>
<td></td>
</tr>
<tr>
<td>$V_{GS}$</td>
<td>Gate-Source Voltage Continuous</td>
<td>±30</td>
<td>Volts</td>
</tr>
<tr>
<td>$V_{GSM}$</td>
<td>Gate-Source Voltage Transient</td>
<td>±40</td>
<td></td>
</tr>
<tr>
<td>$P_D$</td>
<td>Total Power Dissipation @ $T_C = 25°C$</td>
<td>463</td>
<td>Watts</td>
</tr>
<tr>
<td></td>
<td>Linear Derating Factor</td>
<td>3.70</td>
<td>W/°C</td>
</tr>
<tr>
<td>$T_J,T_{STG}$</td>
<td>Operating and Storage Junction Temperature Range</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_L$</td>
<td>Lead Temperature: 0.063” from Case for 10 Sec.</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>$I_{AR}$</td>
<td>Avalanche Current (Repetitive and Non-Repetitive)</td>
<td>100</td>
<td>Amps</td>
</tr>
<tr>
<td>$E_{AR}$</td>
<td>Repetitive Avalanche Energy</td>
<td>50</td>
<td>mJ</td>
</tr>
<tr>
<td>$E_{AS}$</td>
<td>Single Pulse Avalanche Energy</td>
<td>2500</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>$BVDSS$</td>
<td>Drain-Source Breakdown Voltage ($V_{GS} = 0V$, $I_D = 250µA$)</td>
<td>200</td>
<td></td>
<td></td>
<td>Volts</td>
</tr>
<tr>
<td>$R_{DS(on)}$</td>
<td>Drain-Source On-State Resistance ($V_{GS} = 10V$, $I_D = 52A$)</td>
<td>0.020</td>
<td>Ohms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{DS}$</td>
<td>Zero Gate Voltage Drain Current ($V_{DS} = 200V$, $V_{GS} = 0V$)</td>
<td>100</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zero Gate Voltage Drain Current ($V_{DS} = 160V$, $V_{GS} = 0V$, $T_C = 125°C$)</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{GSS}$</td>
<td>Gate-Source Leakage Current ($V_{GS} = ±30V$, $V_{DS} = 0V$)</td>
<td>±100</td>
<td>nA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{GS(th)}$</td>
<td>Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = 2.5mA$)</td>
<td>3</td>
<td>5</td>
<td>Volts</td>
<td></td>
</tr>
</tbody>
</table>

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

### Symbol | Characteristic | Test Conditions | MIN | TYP | MAX | UNIT
--- | --- | --- | --- | --- | --- | ---
C_{gs} | Input Capacitance | V_{GS} = 0V, V_{DS} = 25V | 6850 | | | pF
C_{oss} | Output Capacitance | | 2180 | | | pF
C_{rss} | Reverse Transfer Capacitance | f = 1 MHz | 95 | | | nF
Q_{g} | Total Gate Charge □ | V_{GS} = 10V, V_{DD} = 100V | 110 | | | nC
Q_{gs} | Gate-Source Charge | I_{b} = 104A @ 25°C | 43 | | | µC
Q_{gd} | Gate-Drain ("Miller") Charge | | 47 | | | µC
\( t_{d(on)} \) | Turn-on Delay Time | RESISTIVE SWITCHING | 13 | | | ns
\( t_{r} \) | Rise Time | | 40 | | | ns
\( t_{d(off)} \) | Turn-off Delay Time | INDUCTIVE SWITCHING @ 25°C | 26 | | | ns
\( t_{f} \) | Fall Time | INDUCTIVE SWITCHING @ 125°C | 2 | | | ns
E_{on} | Turn-on Switching Energy □ | V_{DD} = 130V, V_{GS} = 15V | 465 | | | µJ
E_{off} | Turn-off Switching Energy | | 455 | | | µJ
E_{on} | Turn-on Switching Energy □ | V_{DD} = 130V, V_{GS} = 15V | 920 | | | µJ
E_{off} | Turn-off Switching Energy | | 915 | | | µJ

### SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol | Characteristic / Test Conditions | MIN | TYP | MAX | UNIT
--- | --- | --- | --- | --- | ---
I_{S} | Continuous Source Current (Body Diode) | 104 | | | Amps
I_{SM} | Pulsed Source Current □ (Body Diode) | 416 | | | Amps
V_{SD} | Diode Forward Voltage □ (V_{GS} = 0V, I_{S} = -I_{D104A}) | 1.3 | | | Volts
t_{rr} | Reverse Recovery Time (I_{S} = -I_{D104A}, dI_{S}/dt = 100A/µs) | 284 | | | ns
Q_{rr} | Reverse Recovery Charge (I_{S} = -I_{D104A}, dI_{S}/dt = 100A/µs) | 3.06 | | | µC
dv/dt | Peak Diode Recovery \( dv/dt \) □ | 5 | | | V/ns

### THERMAL CHARACTERISTICS

| Symbol | Characteristic | MIN | TYP | MAX | UNIT
--- | --- | --- | --- | --- | ---
R_{JUC} | Junction to Case | 0.27 | | | °C/W
R_{JUA} | Junction to Ambient | 40 | | | °C/W

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 \( T_{J} = +25°C, L = 0.46mH, R_{G} = 25Ω, \) Peak \( I_{C} = 104A \)
5 \( dv/dt \) numbers reflect the limitations of the test circuit rather than the device itself. \( I_{S} \leq -I_{D75A} \), \( dv/dt \leq 700A/µs \), \( V_{R} \leq V_{DSS} \), \( T_{J} \leq 150°C \)
6 Eon includes diode reverse recovery. See figures 18, 20.

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

**FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL**

**FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS**

**FIGURE 4, TRANSFER CHARACTERISTICS**

**FIGURE 5, R_DS(ON) vs DRAIN CURRENT**

**FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE**

**FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE**

**FIGURE 8, R_DS(ON) vs TEMPERATURE**

**FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE**
**FIGURE 10, MAXIMUM SAFE OPERATING AREA**

- $V_{DS}$, DRAIN-TO-SOURCE VOLTAGE (VOLTS)
- $Q_g$, TOTAL GATE CHARGE (nC)

**FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE**

- $C_{iss}$, SOURCE-DRAIN DIODE FORWARD VOLTAGE

**FIGURE 12, GATE CHARGE vs GATE-TO-SOURCE VOLTAGE**

- $V_{GS}$, GATE-TO-SOURCE VOLTAGE (VOLTS)

**FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE**

- $I_D$, DRAIN CURRENT (AMPERES)

**FIGURE 14, DELAY TIMES vs CURRENT**

- $I_D (A)$

**FIGURE 15, RISE AND FALL TIMES vs CURRENT**

- $I_D (A)$

**FIGURE 16, SWITCHING ENERGY vs CURRENT**

- $I_D (A)$

**FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE**
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

* Source terminals are shorted internally. Current handling capability is equal for either Source terminal.