

## DESCRIPTION

The APM9945KC is the N-Channel logic enhancement mode power field effect transistor, is produced using high cell density advanced trench technology.

This high density process is especially tailored to minimize on-state resistance. These devices are particularly suited for low voltage application, notebook computer power management and other battery powered circuits.

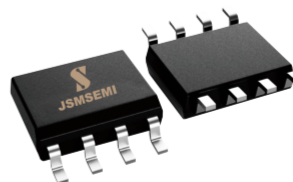
## FEATURE

- ◆ 60V/6.3A,  $R_{DS(ON)}=30m\Omega$  (typ.)@VGS= 10V
- ◆ 60V/5.0A,  $R_{DS(ON)}=37m\Omega$  (typ.)@VGS= 4.5V
- ◆ Super high design for extremely low  $R_{DS(ON)}$
- ◆ Exceptional on-resistance and Maximum DC current capability
- ◆ Full RoHS compliance
- ◆ SOP8 package design

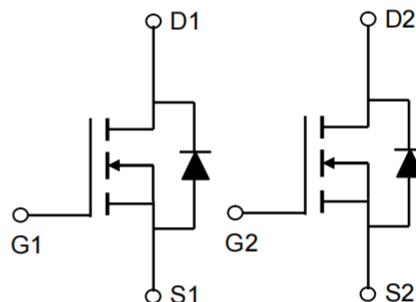
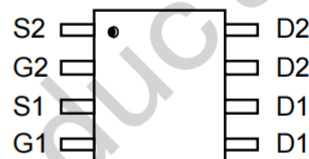
## APPLICATIONS

- ◆ Power Management
- ◆ Portable Equipment
- ◆ DC/DC Converter
- ◆ Load Switch
- ◆ DSC
- ◆ LCD Display inverter

## PIN CONFIGURATION



Top View



## ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ Unless otherwise noted )

| Parameter                              | Symbol                 | Maximum    | Units            |
|----------------------------------------|------------------------|------------|------------------|
| Drain-Source Voltage                   | $V_{DS}$               | 60         | V                |
| Gate-Source Voltage                    | $V_{GS}$               | $\pm 20$   | V                |
| Continuous Drain Current <sup>A</sup>  | $T_A=25^\circ\text{C}$ | 6.3        | A                |
|                                        | $T_A=70^\circ\text{C}$ | 5          |                  |
| Pulsed Drain Current <sup>B</sup>      | $I_{DM}$               | 40         |                  |
| Power Dissipation                      | $T_A=25^\circ\text{C}$ | 2          | W                |
|                                        | $T_A=70^\circ\text{C}$ | 1.28       |                  |
| Junction and Storage Temperature Range | $T_J, T_{STG}$         | -55 to 150 | $^\circ\text{C}$ |

| Thermal Characteristics                  |              |                 |     |      |                    |
|------------------------------------------|--------------|-----------------|-----|------|--------------------|
| Parameter                                |              | Symbol          | Typ | Max  | Units              |
| Maximum Junction-to-Ambient <sup>A</sup> | $t \leq 10s$ | $R_{\theta JA}$ | 50  | 62.5 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient <sup>A</sup> | Steady-State |                 | 73  | 110  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Lead <sup>C</sup>    | Steady-State | $R_{\theta JL}$ | 31  | 40   | $^\circ\text{C/W}$ |

**Note:** Absolute maximum ratings are those values beyond which the device could be permanently damaged.  
Absolute maximum ratings are stress rating only and functional device operation is not implied

**ELECTRICAL CHARACTERISTICS** ( $T_A=25^\circ\text{C}$  Unless otherwise noted)

| Symbol               | Parameter                       | Condition                                                                                    | Min | Typ  | Max  | Unit |
|----------------------|---------------------------------|----------------------------------------------------------------------------------------------|-----|------|------|------|
| Static Parameters    |                                 |                                                                                              |     |      |      |      |
| V <sub>(BR)DSS</sub> | Drain-Source Breakdown Voltage  | V <sub>GS</sub> =0V, I <sub>D</sub> = 250uA                                                  | 60  |      |      | V    |
| V <sub>GS(th)</sub>  | Gate Threshold Voltage          | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = 250uA                                    | 1.0 | 1.8  | 3.0  | V    |
| I <sub>GSS</sub>     | Gate Leakage Current            | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                                   |     |      | ±100 | nA   |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current | V <sub>DS</sub> = 48V, V <sub>GS</sub> =0                                                    |     |      | 1    | uA   |
|                      |                                 | V <sub>DS</sub> = 48V, V <sub>GS</sub> =0<br>T <sub>J</sub> =55°C                            |     |      | 5    |      |
| R <sub>DS(ON)</sub>  | Drain-Source On-Resistance      | V <sub>GS</sub> = 10V, I <sub>D</sub> = 6.3A                                                 |     | 30   | 45   | mΩ   |
|                      |                                 | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 5.0A                                                |     | 37   | 55   |      |
| Source-Drain Diode   |                                 |                                                                                              |     |      |      |      |
| V <sub>SD</sub>      | Diode Forward Voltage           | I <sub>S</sub> = 1.0A, V <sub>GS</sub> =0V                                                   |     | 0.8  | 1.3  | V    |
| Dynamic Parameters   |                                 |                                                                                              |     |      |      |      |
| Q <sub>g</sub>       | Total Gate Charge               | V <sub>DS</sub> = 30V<br>V <sub>GS</sub> = 10V<br>I <sub>D</sub> = 5.0A                      |     | 15.6 | 16   | nC   |
| Q <sub>gs</sub>      | Gate-Source Charge              |                                                                                              |     | 1.3  |      |      |
| Q <sub>gd</sub>      | Gate-Drain Charge               |                                                                                              |     | 4.5  |      |      |
| C <sub>iss</sub>     | Input Capacitance               | V <sub>DS</sub> = 25V<br>V <sub>GS</sub> =0V<br>f=1MHz                                       |     | 520  |      | pF   |
| C <sub>oss</sub>     | Output Capacitance              |                                                                                              |     | 105  |      |      |
| C <sub>rss</sub>     | Reverse Transfer Capacitance    |                                                                                              |     | 60   |      |      |
| T <sub>d(on)</sub>   | Turn-On Time                    | V <sub>DS</sub> = 30V<br>I <sub>D</sub> = 1A<br>V <sub>GEN</sub> = 10V<br>R <sub>G</sub> =6Ω |     | 8    | 16   | nS   |
| T <sub>r</sub>       |                                 |                                                                                              |     | 6    | 12   |      |
| T <sub>d(off)</sub>  | Turn-Off Time                   |                                                                                              |     | 25   | 46   |      |
| T <sub>f</sub>       |                                 |                                                                                              |     | 4    | 8    |      |

Note: 1. Pulse test: pulse width $\leq 300\mu\text{s}$ , duty cycle $\leq 2\%$

2. Static parameters are based on package level with recommended wire bonding

■ **TYPICAL CHARACTERISTICS** (25°C Unless Note)

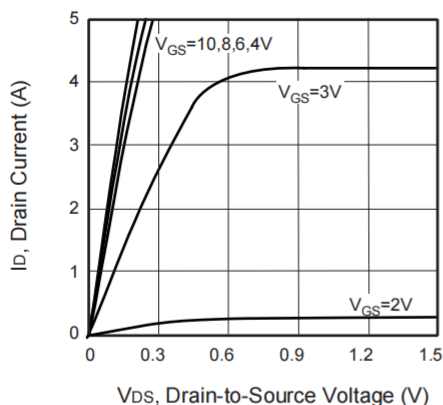


Figure 1. Output Characteristics

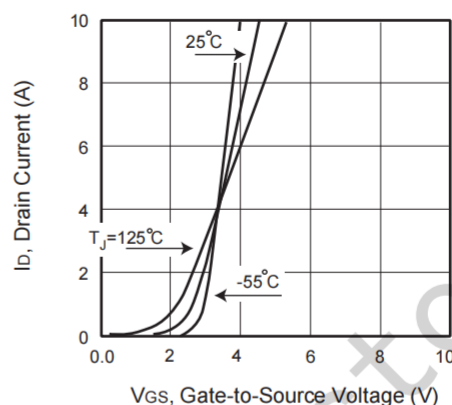


Figure 2. Transfer Characteristics

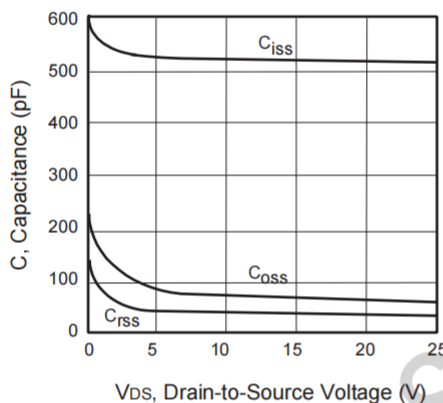


Figure 3. Capacitance

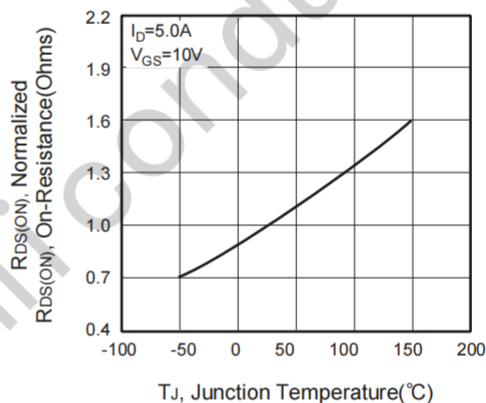


Figure 4. On-Resistance Variation with Temperature

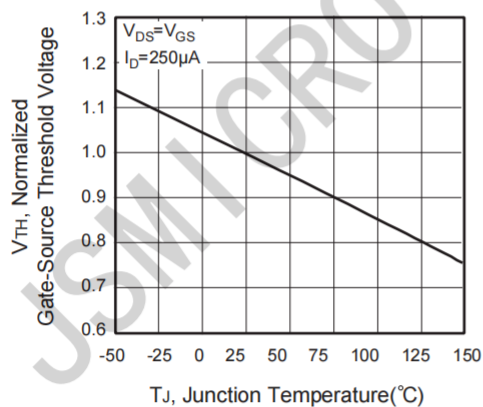


Figure 5. Gate Threshold Variation with Temperature

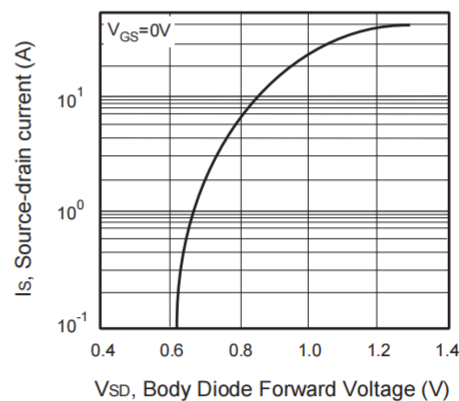


Figure 6. Body Diode Forward Voltage Variation with Source Current

■ **TYPICAL CHARACTERISTICS** (continuous)

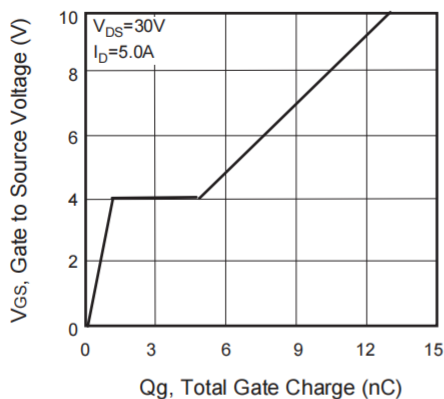


Figure 7. Gate Charge

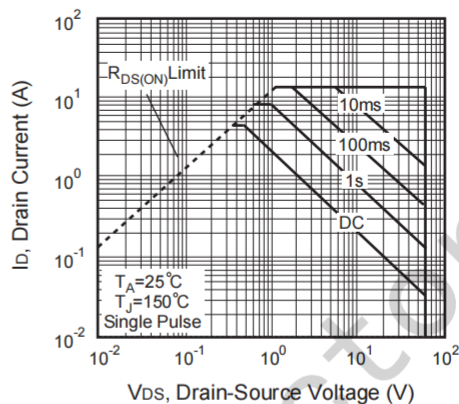


Figure 8. Maximum Safe Operating Area

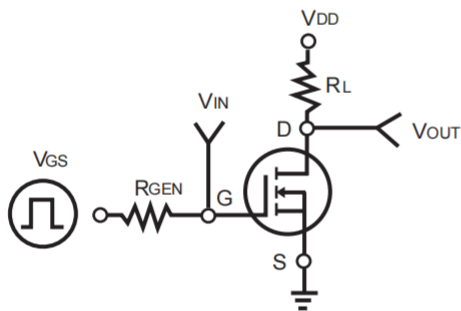


Figure 9. Switching Test Circuit

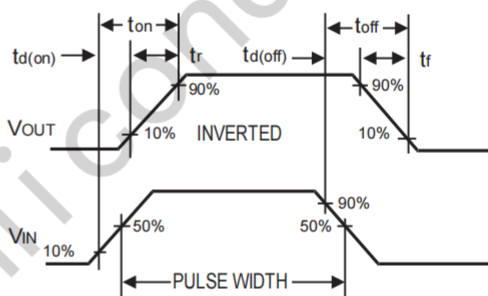


Figure 10. Switching Waveforms

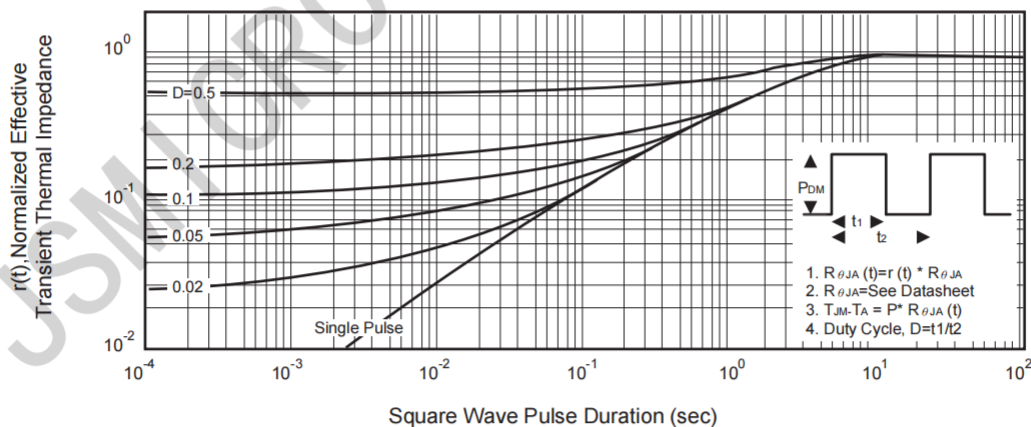
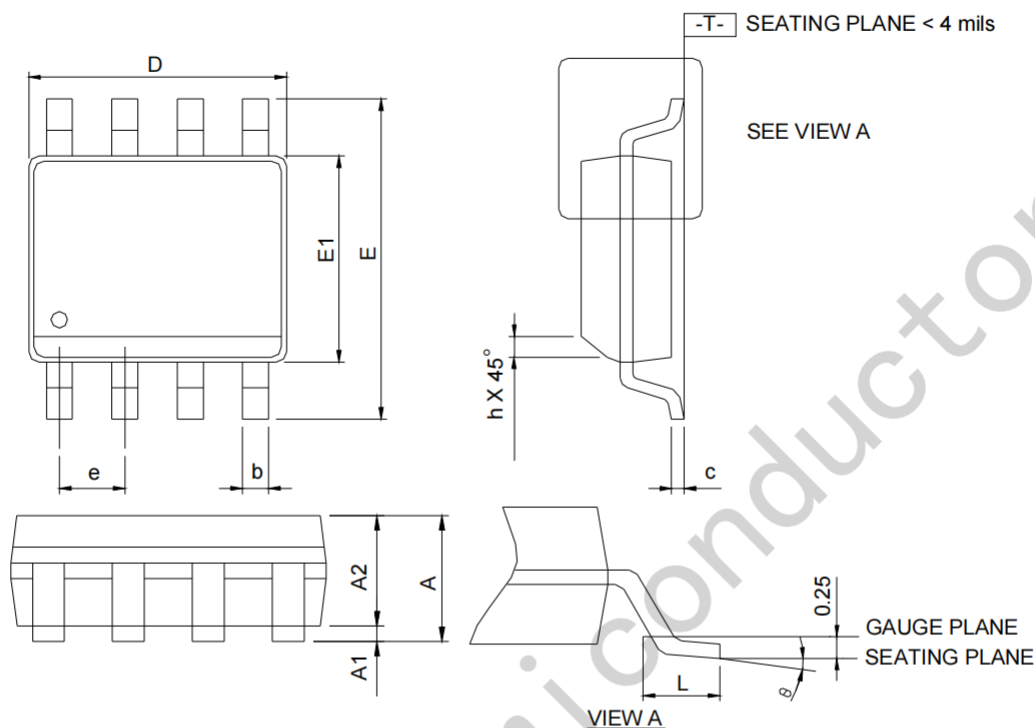


Figure 11. Normalized Thermal Transient Impedance Curve

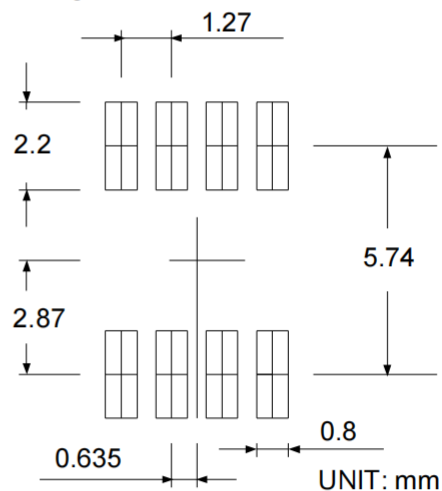
## Package Information

SOP-8



| SYMBOL | SOP-8       |      |           |       |
|--------|-------------|------|-----------|-------|
|        | MILLIMETERS |      | INCHES    |       |
|        | MIN.        | MAX. | MIN.      | MAX.  |
| A      | -           | 1.75 | -         | 0.069 |
| A1     | 0.10        | 0.25 | 0.004     | 0.010 |
| A2     | 1.25        | -    | 0.049     | -     |
| b      | 0.31        | 0.51 | 0.012     | 0.020 |
| c      | 0.17        | 0.25 | 0.007     | 0.010 |
| D      | 4.80        | 5.00 | 0.189     | 0.197 |
| E      | 5.80        | 6.20 | 0.228     | 0.244 |
| E1     | 3.80        | 4.00 | 0.150     | 0.157 |
| e      | 1.27 BSC    |      | 0.050 BSC |       |
| h      | 0.25        | 0.50 | 0.010     | 0.020 |
| L      | 0.40        | 1.27 | 0.016     | 0.050 |
| θ      | 0°          | 8°   | 0°        | 8°    |

### RECOMMENDED LAND PATTERN



Note: 1. Follow JEDEC MS-012 AA.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.

3. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.