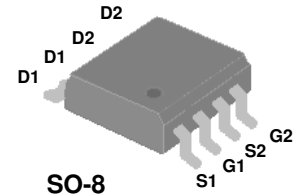
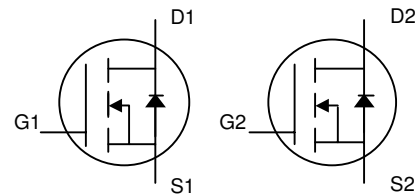




**Dual N-channel Enhancement-mode Power MOSFETs**

- Simple Drive Requirement**
- Low On-resistance**
- Fast Switching Performance**
- RoHS-compliant, halogen-free SO-8 package**

|              |              |
|--------------|--------------|
| $BV_{DSS}$   | 30V          |
| $R_{DS(ON)}$ | 26m $\Omega$ |
| $I_D$        | 6.8A         |



**Description**

Advanced Power MOSFETs from APEC provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The AP4228GM-HF-3 is in the popular SO-8 surface-mount package and is well-suited for use in low-voltage DC/DC conversion and general load-switching applications.

**Absolute Maximum Ratings**

| Symbol                    | Parameter                             | Rating     | Units         |
|---------------------------|---------------------------------------|------------|---------------|
| $V_{DS}$                  | Drain-Source Voltage                  | 30         | V             |
| $V_{GS}$                  | Gate-Source Voltage                   | $\pm 20$   | V             |
| $I_D$ at $T_A=25^\circ C$ | Continuous Drain Current <sup>3</sup> | 6.8        | A             |
| $I_D$ at $T_A=70^\circ C$ | Continuous Drain Current <sup>3</sup> | 5.5        | A             |
| $I_{DM}$                  | Pulsed Drain Current <sup>1</sup>     | 40         | A             |
| $P_D$ at $T_A=25^\circ C$ | Total Power Dissipation               | 2          | W             |
|                           | Linear Derating Factor                | 0.016      | W/ $^\circ C$ |
| $T_{STG}$                 | Storage Temperature Range             | -55 to 150 | $^\circ C$    |
| $T_J$                     | Operating Junction Temperature Range  | -55 to 150 | $^\circ C$    |

**Thermal Data**

| Symbol | Parameter   | Value | Unit         |
|--------|---|-------|--------------|
| Rthj-a | Maximum Thermal Resistance, Junction-ambient <sup>3</sup> | 62.5  | $^\circ C/W$ |

**Ordering Information**

**AP4228GM-HF-3TR** RoHS-compliant halogen-free SO-8, shipped on tape and reel, 3000pcs/reel



**Electrical Characteristics at  $T_j = 25^\circ\text{C}$  (unless otherwise specified)**

| Symbol       | Parameter                                      | Test Conditions                               | Min. | Typ. | Max.      | Units      |
|--------------|--|---|------|------|-----------|------------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage                 | $V_{GS}=0V, I_D=250\mu A$                     | 30   | -    | -         | V          |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=10V, I_D=6A$                          | -    | -    | 26        | m $\Omega$ |
|              |  | $V_{GS}=4.5V, I_D=4A$                         | -    | -    | 40        | m $\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage                         | $V_{DS}=V_{GS}, I_D=250\mu A$                 | 1    | -    | 3         | V          |
| $g_{fs}$     | Forward Transconductance                       | $V_{DS}=10V, I_D=6A$                          | -    | 6    | -         | S          |
| $I_{DSS}$    | Drain-Source Leakage Current                   | $V_{DS}=30V, V_{GS}=0V$                       | -    | -    | 1         | $\mu A$    |
|              |  | $V_{DS}=24V, V_{GS}=0V, T_j=70^\circ\text{C}$ | -    | -    | 25        | $\mu A$    |
| $I_{GSS}$    | Gate-Source Leakage                            | $V_{GS} = \pm 20V, V_{DS}=0V$                 | -    | -    | $\pm 100$ | nA         |
| $Q_g$        | Total Gate Charge <sup>2</sup>                 | $I_D=6A$                                      | -    | 7.7  | 12        | nC         |
| $Q_{gs}$     | Gate-Source Charge                             | $V_{DS}=15V$                                  | -    | 1.4  | -         | nC         |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge                   | $V_{GS}=4.5V$                                 | -    | 4.1  | -         | nC         |
| $t_{d(on)}$  | Turn-on Delay Time <sup>2</sup>                | $V_{DS}=20V$                                  | -    | 5    | -         | ns         |
| $t_r$        | Rise Time                                      | $I_D=1A$                                      | -    | 8    | -         | ns         |
| $t_{d(off)}$ | Turn-off Delay Time                            | $R_G=3.3\Omega, V_{GS}=10V$                   | -    | 18.5 | -         | ns         |
| $t_f$        | Fall Time                                      | $R_D=20\Omega$                                | -    | 9    | -         | ns         |
| $C_{iss}$    | Input Capacitance                              | $V_{GS}=0V$                                   | -    | 485  | 770       | pF         |
| $C_{oss}$    | Output Capacitance                             | $V_{DS}=25V$                                  | -    | 80   | -         | pF         |
| $C_{rss}$    | Reverse Transfer Capacitance                   | $f=1.0\text{MHz}$                             | -    | 75   | -         | pF         |
| $R_g$        | Gate Resistance                                | $f=1.0\text{MHz}$                             | -    | 1.4  | 2.1       | $\Omega$   |

**Source-Drain Diode**

| Symbol   | Parameter                          | Test Conditions       | Min. | Typ. | Max. | Units |
|----------|------------------------------------|-----------------------|------|------|------|-------|
| $V_{SD}$ | Forward On Voltage <sup>2</sup>    | $I_S=2.1A, V_{GS}=0V$ | -    | -    | 1.2  | V     |
| $t_{rr}$ | Reverse Recovery Time <sup>2</sup> | $I_S=6A, V_{GS}=0V,$  | -    | 19   | -    | ns    |
| $Q_{rr}$ | Reverse Recovery Charge            | $di/dt=100A/\mu s$    | -    | 11   | -    | nC    |

**Notes:**

1. Pulse width limited by maximum junction temperature.
2. Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. Surface-mounted on 1 in<sup>2</sup> copper pad of FR4 board; 135 °C/W when mounted on minimum copper pad.

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

USE OF THIS PRODUCT AS A CRITICAL COMPONENT IN LIFE SUPPORT OR OTHER SIMILAR SYSTEMS IS NOT AUTHORIZED.

APEC DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

APEC RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN.

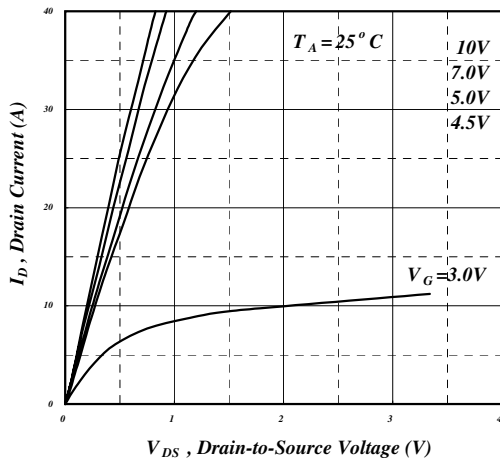


Fig 1. Typical Output Characteristics

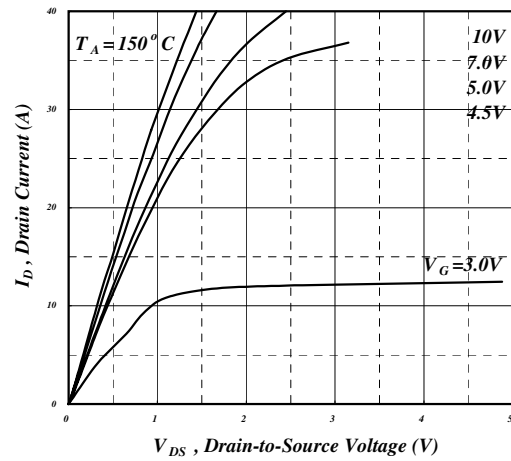


Fig 2. Typical Output Characteristics

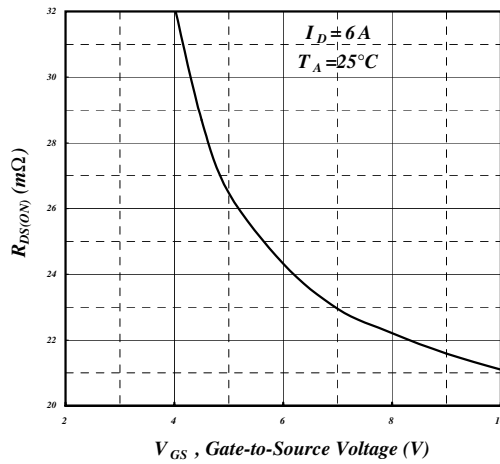


Fig 3. On-Resistance vs. Gate Voltage

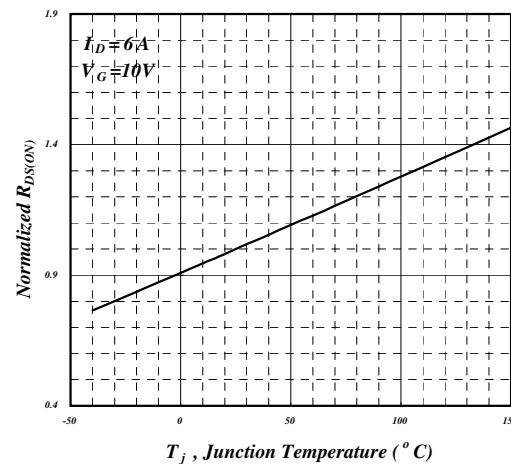


Fig 4. Normalized On-Resistance vs. Junction Temperature

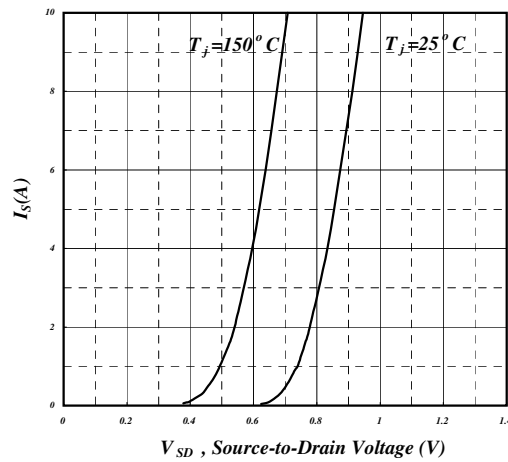


Fig 5. Forward Characteristic of Reverse Diode

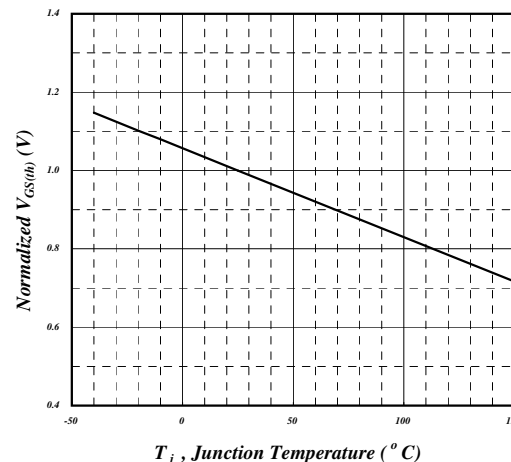


Fig 6. Gate Threshold Voltage vs. Junction Temperature

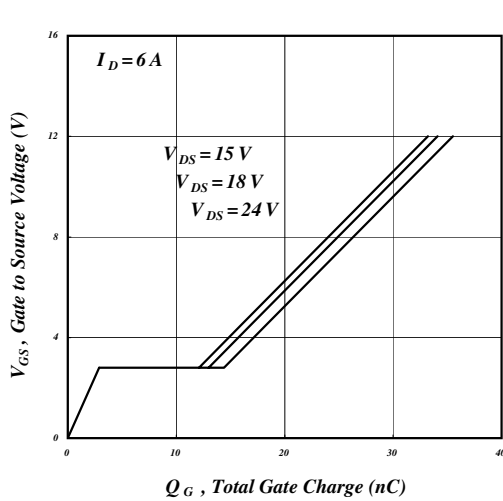


Fig 7. Gate Charge Characteristics

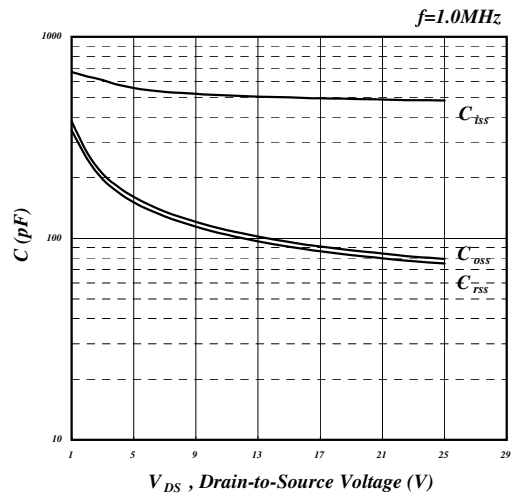


Fig 8. Typical Capacitance Characteristics

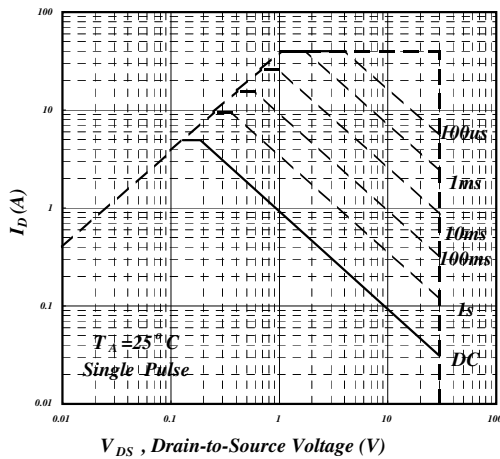


Fig 9. Maximum Safe Operating Area

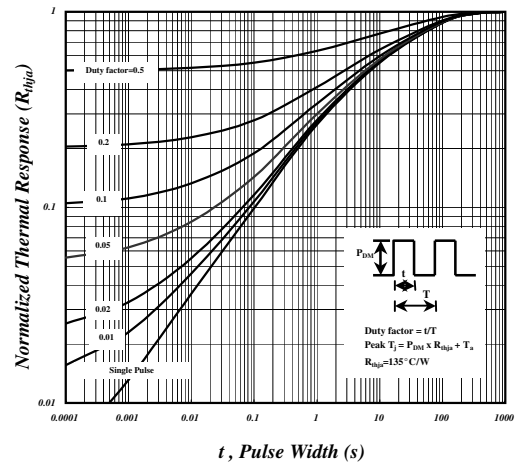


Fig 10. Effective Transient Thermal Impedance

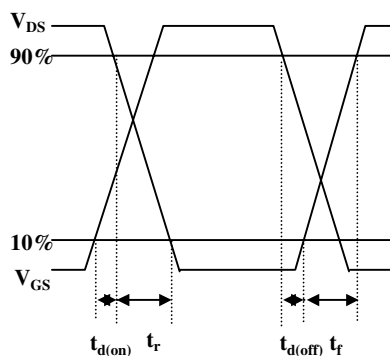


Fig 11. Switching Time Waveform

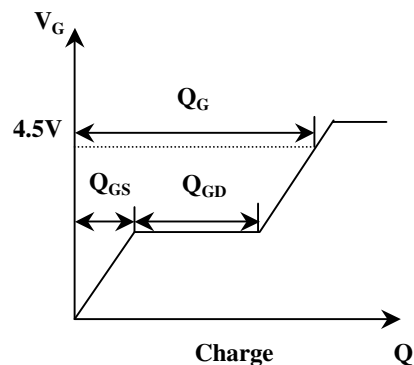
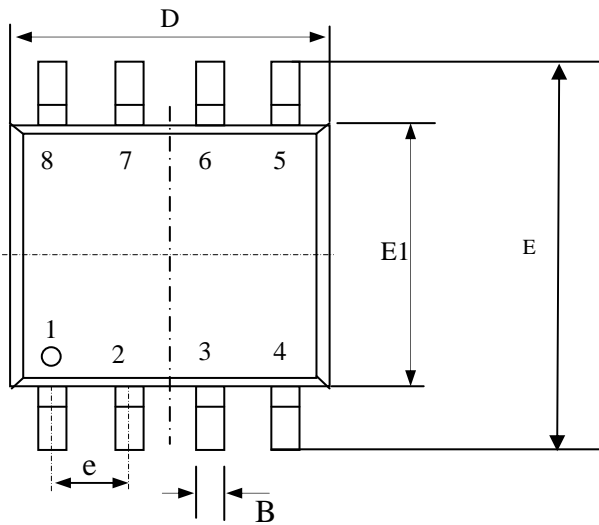


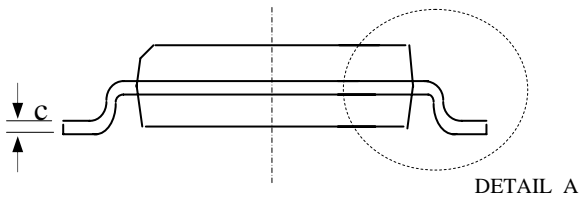
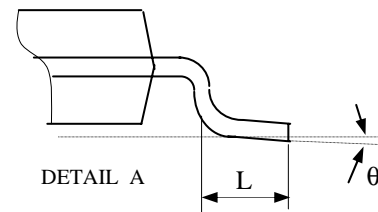
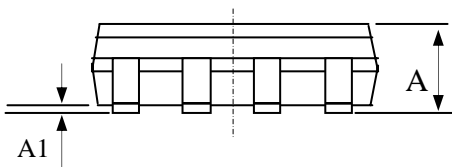
Fig 12. Gate Charge Waveform



**Package Dimensions: SO-8**

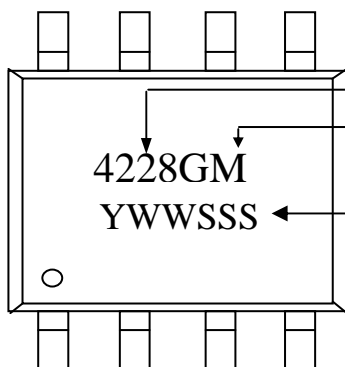


| SYMBOLS  | Millimeters |      |      |
|----------|-------------|------|------|
|          | MIN         | NOM  | MAX  |
| A        | 1.35        | 1.55 | 1.75 |
| A1       | 0.10        | 0.18 | 0.25 |
| B        | 0.33        | 0.41 | 0.51 |
| C        | 0.19        | 0.22 | 0.25 |
| D        | 4.80        | 4.90 | 5.00 |
| E1       | 3.80        | 3.90 | 4.00 |
| E        | 5.80        | 6.15 | 6.50 |
| L        | 0.38        | 0.71 | 1.27 |
| $\theta$ | 0           | 4.00 | 8.00 |
| e        | 1.27 TYP    |      |      |



1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

**Marking Information: SO-8**



- Product: AP4228
- Package:  
GM = RoHS-compliant halogen-free SO-8
- Date/lot code (YWWSSS)  
Y: Last digit of the year  
WW: Work week  
SSS: Lot code sequence