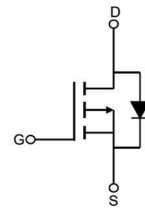


AP4409S

P-Channel Enhancement Mosfet

Feature

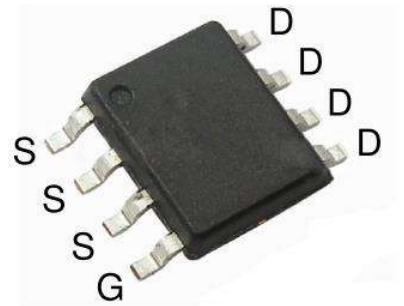
- -40V,-12A
 $R_{DS(ON)} < 14m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 20m\Omega @ V_{GS} = -4.5V$
- Advanced Trench Technology
- Lead free product is acquired



Schematic diagram

Application

- PWM applications
- Load Switch
- Power management



SOP-8

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity (PCS) |
|----------------|---------|----------------|-----------|------------|----------------|
| 4409S | AP4409S | SOP-8 | 13 inch | - | 4000 |

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|-----------------|-----------|---------------------------|
| Drain-Source Voltage | V_{DS} | -40 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current ($T_a = 25^\circ\text{C}$) | I_D | -12 | A |
| Continuous Drain Current ($T_a = 100^\circ\text{C}$) | I_D | -8.5 | A |
| Pulsed Drain Current ⁽¹⁾ | I_{DM} | -26 | A |
| Singel Pulsed Avalanche Energy ⁽²⁾ | E_{AS} | 146 | mJ |
| Power Dissipation | P_D | 2.5 | W |
| Thermal Resistance from Junction to Case ⁽⁴⁾ | $R_{\theta JC}$ | 16 | $^\circ\text{C}/\text{W}$ |
| Junction Temperature | T_J | 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{STG} | -55~ +150 | $^\circ\text{C}$ |

MOSFET ELECTRICAL CHARACTERISTICS($T_a=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---------------|---|------|------|-----------|------------|
| Static Characteristics | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -250\mu A$ | -40 | - | - | V |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = -40V, V_{GS} = 0V$ | - | - | -1 | μA |
| Gate-body leakage current | I_{GSS} | $V_{GS} = \pm 20V, V_{DS} = 0V$ | - | - | ± 100 | nA |
| Gate threshold voltage ⁽³⁾ | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\mu A$ | -1.0 | -1.6 | -2.5 | V |
| Drain-source on-resistance ⁽³⁾ | $R_{DS(on)}$ | $V_{GS} = -10V, I_D = -10A$ | - | 12 | 14 | m Ω |
| | | $V_{GS} = -4.5V, I_D = -8A$ | - | 17.5 | 20 | |
| Dynamic characteristics | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = -15V, V_{GS} = 0V, f = 1MHz$ | - | 3500 | - | pF |
| Output Capacitance | C_{oss} | | - | 323 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 222 | - | |
| Switching characteristics | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = -15V, I_D = -1A,$ $V_{GS} = -10V, R_G = 3.3\Omega$ | - | 40 | - | ns |
| Turn-on rise time | t_r | | - | 35 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 10 | - | |
| Turn-off fall time | t_f | | - | 9.6 | - | |
| Total Gate Charge | Q_g | $V_{DS} = -20V, I_D = -6A,$ $V_{GS} = -4.5V$ | - | 28 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 7.7 | - | |
| Gate-Drain Charge | Q_{gd} | | - | 7.5 | - | |
| Source-Drain Diode characteristics | | | | | | |
| Diode Forward voltage ⁽³⁾ | V_{DS} | $V_{GS} = 0V, I_S = -1A$ | - | - | -1.2 | V |
| Diode Forward current ⁽⁴⁾ | I_S | | - | - | -12 | A |

Notes:

1. Repetitive Rating: pulse width limited by maximum junction temperature
2. EAS Condition: $T_J = 25^{\circ}\text{C}, V_{DD} = -25V, R_G = 25\Omega, L = 0.1\text{mH}, I_{AS} = -54A$
3. Pulse Test: pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
4. Surface Mounted on FR4 Board, $t \leq 10\text{ sec}$

Typical Characteristics

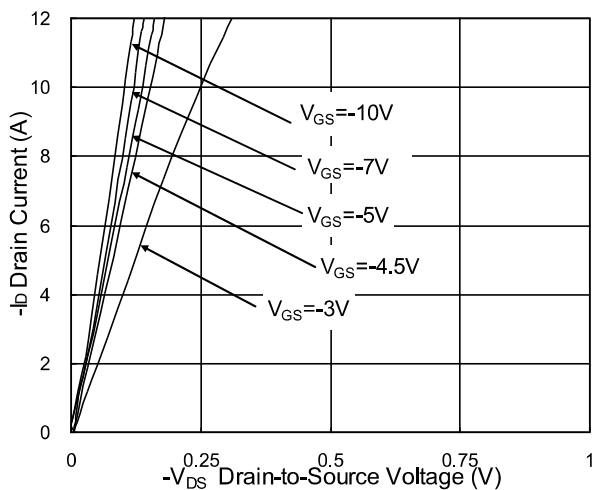


Fig.1 Typical Output Characteristics

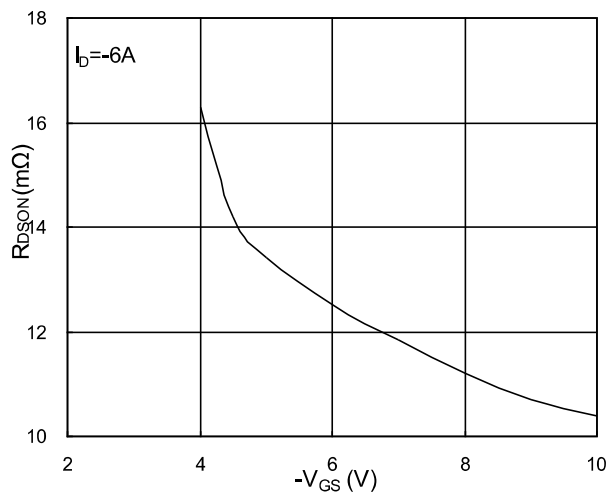


Fig.2 On-Resistance v.s Gate-Source

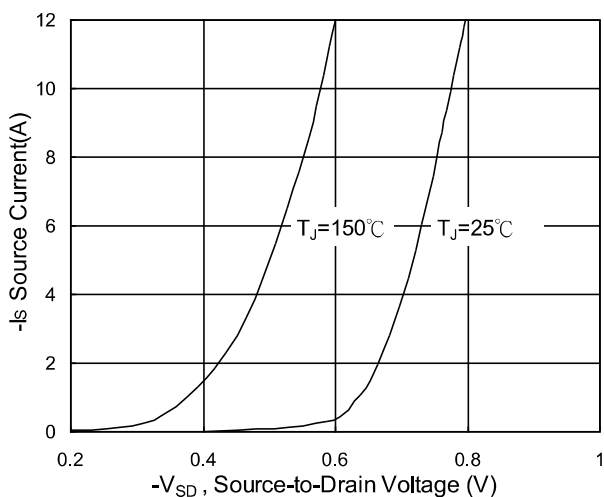


Fig.3 Forward Characteristics Of Reverse

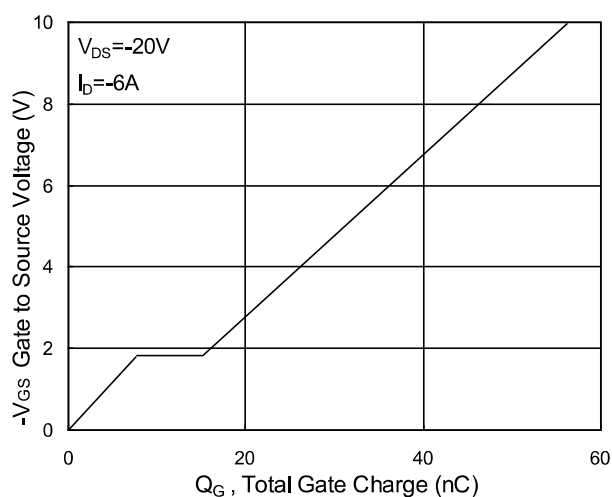


Fig.4 Gate-Charge Characteristics

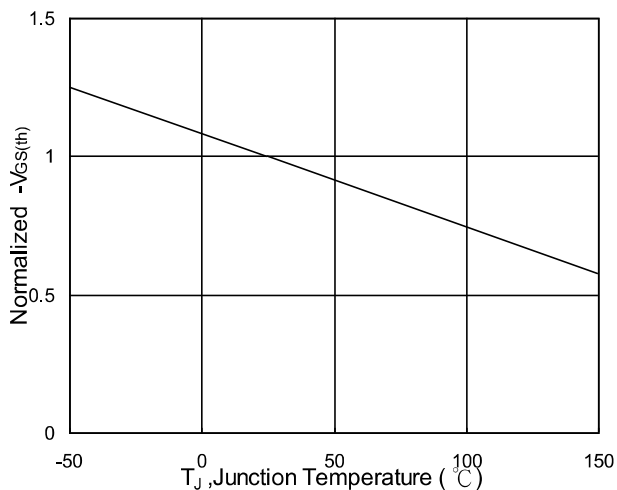


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

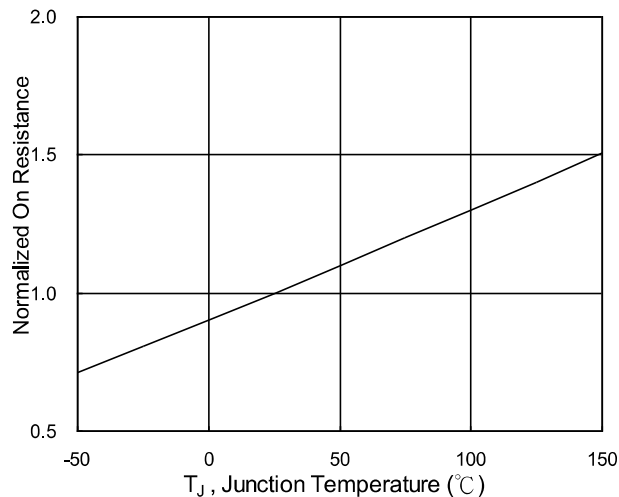


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

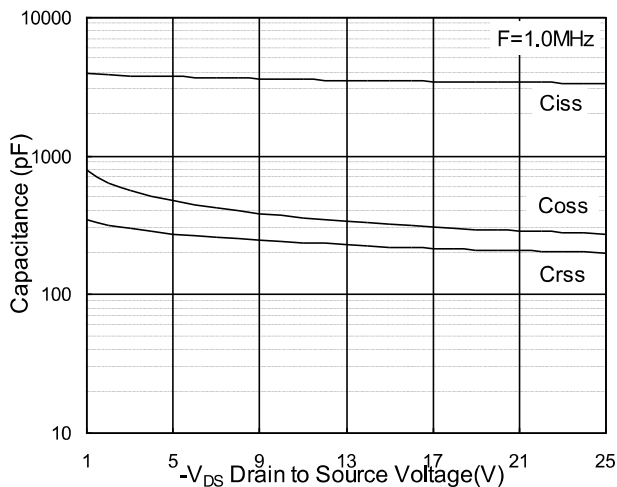


Fig.7 Capacitance

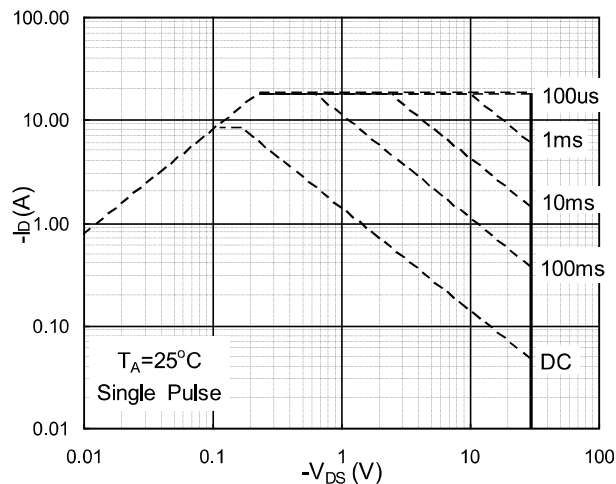


Fig.8 Safe Operating Area

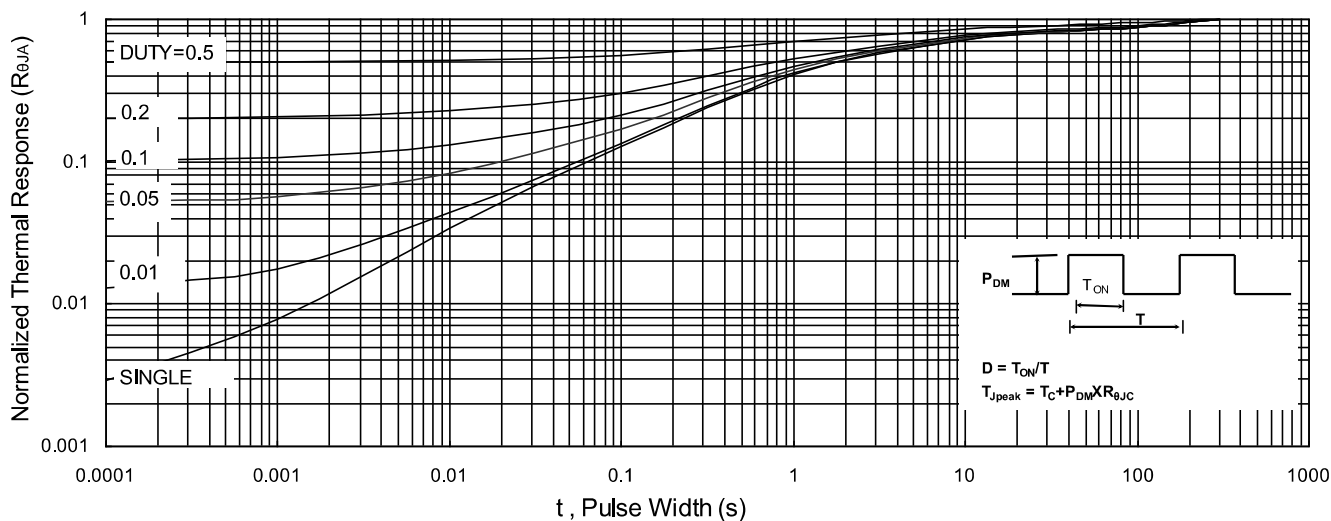


Fig.9 Normalized Maximum Transient Thermal Impedance

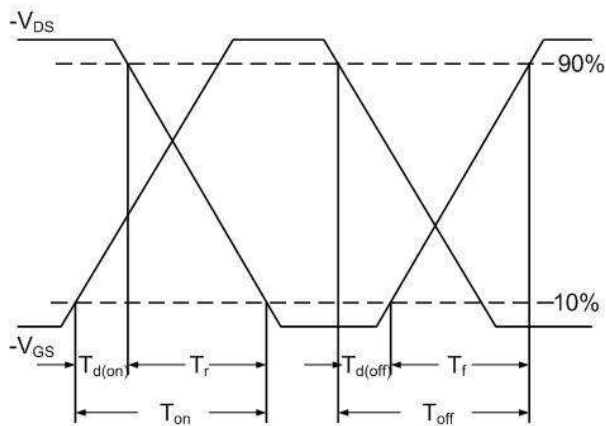


Fig.10 Switching Time Waveform

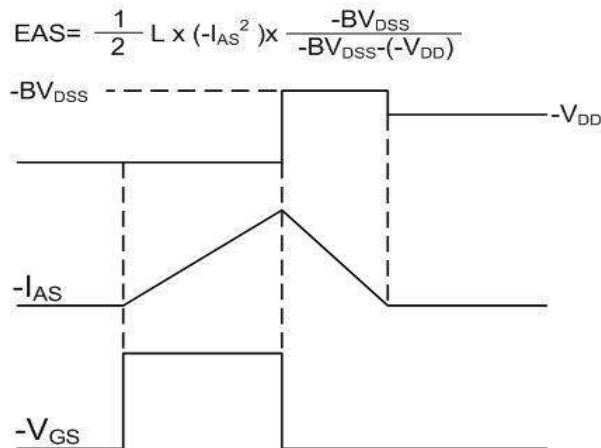
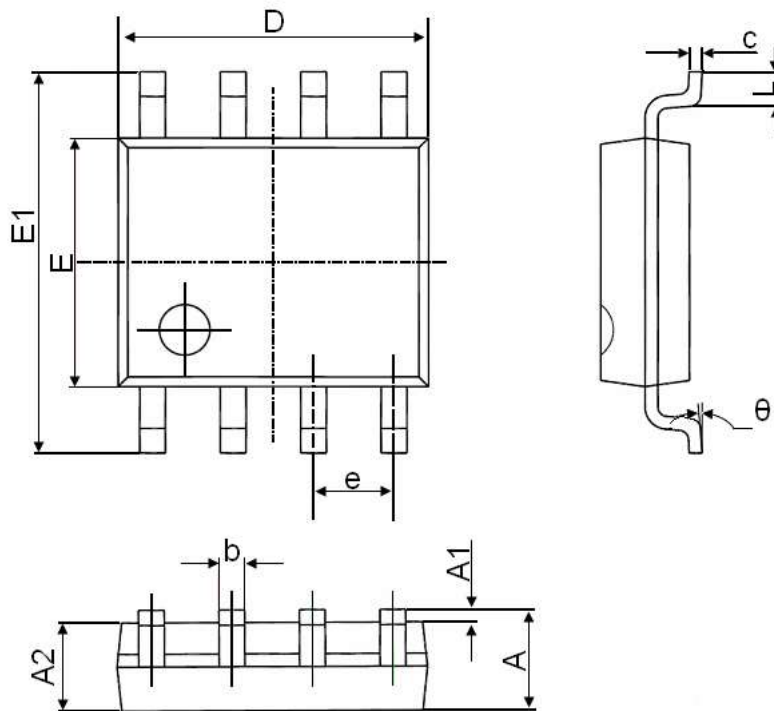


Fig.11 Unclamped Inductive Waveform

SOP-8 Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |