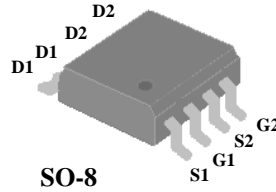




**Complementary N and P-channel
Enhancement-mode Power MOSFETs**

- Simple Drive Requirement
- Low On-resistance
- Fast Switching Performance
- RoHS-compliant, halogen-free

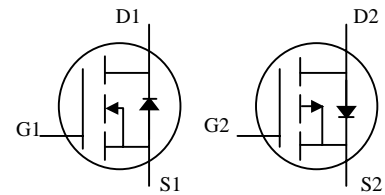


| | | |
|------|--------------|--------------|
| N-CH | BV_{DSS} | 30V |
| | $R_{DS(ON)}$ | 28m Ω |
| | I_D | 7A |
| P-CH | BV_{DSS} | -30V |
| | $R_{DS(ON)}$ | 50m Ω |
| | I_D | -5.3A |

Description

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

The AP4501GM-HF-3 is in a standard SO-8 package, which is widely used for commercial and industrial surface-mount applications, and is well suited for applications such as DC and servo motor drives.



Absolute Maximum Ratings

| Symbol | Parameter | Rating | | Units |
|---------------------------|---------------------------------------|------------|-----------|---------------|
| | | N-channel | P-channel | |
| V_{DS} | Drain-Source Voltage | 30 | -30 | V |
| V_{GS} | Gate-Source Voltage | ± 20 | ± 20 | V |
| I_D at $T_A=25^\circ C$ | Continuous Drain Current ³ | 7.0 | -5.3 | A |
| I_D at $T_A=70^\circ C$ | Continuous Drain Current ³ | 5.8 | -4.7 | A |
| I_{DM} | Pulsed Drain Current ¹ | 20 | -20 | A |
| P_D at $T_A=25^\circ C$ | Total Power Dissipation | 2.0 | | 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 ³ | 62.5 | $^\circ C/W$ |

Ordering Information

AP4501GM-HF-3TR RoHS-compliant, halogen-free SO-8, shipped on tape and reel (3000 pcs/reel)



N-channel Electrical Specifications 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 ² | $V_{GS}=10V, I_D=7A$ | - | - | 28 | m Ω |
| | | $V_{GS}=4.5V, I_D=5A$ | - | - | 42 | m Ω |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1 | - | 3 | V |
| g_{fs} | Forward Transconductance | $V_{DS}=10V, I_D=6A$ | - | 15 | - | S |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=30V, V_{GS}=0V$ | - | - | 1 | μA |
| | | $V_{DS}=24V, V_{GS}=0V, T_j=70^\circ\text{C}$ | - | - | 25 | μA |
| I_{GSS} | Gate-Source Leakage | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| Q_g | Total Gate Charge ² | $I_D=6A$ | - | 8 | 13.5 | nC |
| Q_{gs} | Gate-Source Charge | $V_{DS}=24V$ | - | 2 | - | nC |
| Q_{gd} | Gate-Drain ("Miller") Charge | $V_{GS}=4.5V$ | - | 4.5 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time ² | $V_{DS}=15V$ | - | 8 | - | ns |
| t_r | Rise Time | $I_D=1A$ | - | 5 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | $R_G=3.3\Omega, V_{GS}=10V$ | - | 19 | - | ns |
| t_f | Fall Time | $R_D=15\Omega$ | - | 5 | - | ns |
| C_{iss} | Input Capacitance | $V_{GS}=0V$ | - | 645 | 800 | pF |
| C_{oss} | Output Capacitance | $V_{DS}=25V$ | - | 150 | - | pF |
| C_{rss} | Reverse Transfer Capacitance | $f=1.0\text{MHz}$ | - | 95 | - | pF |

Source-Drain Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|----------|------------------------------------|----------------------|------|------|------|-------|
| V_{SD} | Forward On Voltage ² | $I_S=7A, V_{GS}=0V$ | - | - | 1.2 | V |
| t_{rr} | Reverse Recovery Time ² | $I_S=6A, V_{GS}=0V,$ | - | 19 | - | ns |
| Q_{rr} | Reverse Recovery Charge | $di/dt=100A/\mu s$ | - | 14 | - | 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 in² copper pad of FR4 board, $t \leq 10\text{sec}$; 135°C/W when mounted on min. copper pad.

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

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P-channel Electrical Specifications 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 ² | $V_{GS}=-10V, I_D=-5.3A$ | - | - | 50 | m Ω |
| | | $V_{GS}=-4.5V, I_D=-4.2A$ | - | - | 90 | m Ω |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -1 | - | -3 | V |
| g_{fs} | Forward Transconductance | $V_{DS}=-10V, I_D=-5A$ | - | 5 | - | S |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=-30V, V_{GS}=0V$ | - | - | -1 | μA |
| | | $V_{DS}=-24V, V_{GS}=0V, T_j=70^\circ\text{C}$ | - | - | -25 | μA |
| I_{GSS} | Gate-Source Leakage | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| Q_g | Total Gate Charge ² | $I_D=-5A$ | - | 8 | 13 | nC |
| Q_{gs} | Gate-Source Charge | $V_{DS}=-15V$ | - | 1.7 | - | nC |
| Q_{gd} | Gate-Drain ("Miller") Charge | $V_{GS}=-4.5V$ | - | 4.5 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time ² | $V_{DS}=-15V$ | - | 6.7 | - | ns |
| t_r | Rise Time | $I_D=-1A$ | - | 10 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | $R_G=3.3\Omega, V_{GS}=-10V$ | - | 21 | - | ns |
| t_f | Fall Time | $R_D=15\Omega$ | - | 10 | - | ns |
| C_{iss} | Input Capacitance | $V_{GS}=0V$ | - | 595 | 950 | pF |
| C_{oss} | Output Capacitance | $V_{DS}=-25V$ | - | 80 | - | pF |
| C_{rss} | Reverse Transfer Capacitance | $f=1.0\text{MHz}$ | - | 75 | - | pF |

Source-Drain Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|----------|------------------------------------|------------------------|------|------|------|-------|
| V_{SD} | Forward On Voltage ² | $I_S=-2.6A, V_{GS}=0V$ | - | - | -1.2 | V |
| t_{rr} | Reverse Recovery Time ² | $I_S=-5A, V_{GS}=0V,$ | - | 18 | - | 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 in² copper pad of FR4 board, $t \leq 10\text{sec}$; 135°C/W when mounted on min. copper pad.

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

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Typical N-channel Electrical Characteristics

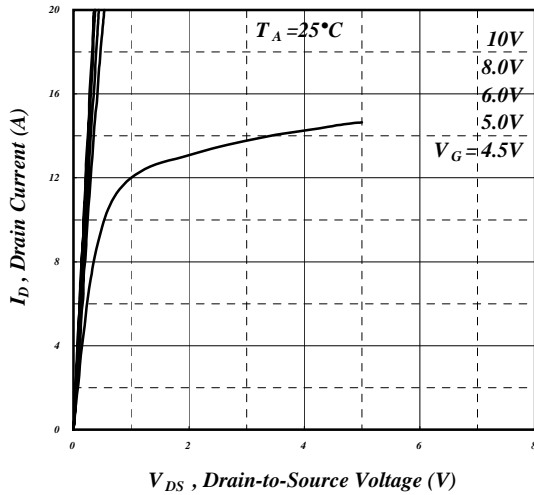


Fig 1. Typical Output Characteristics

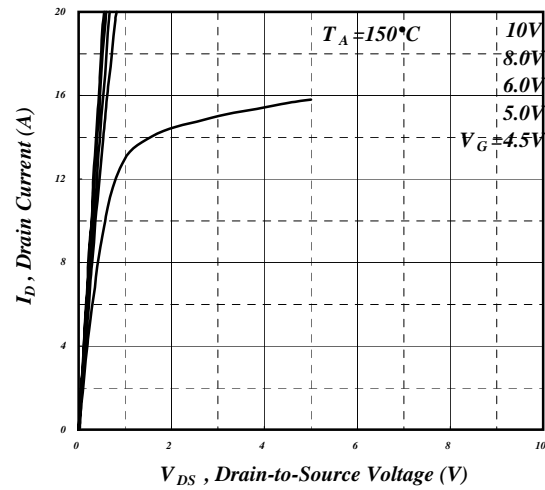


Fig 2. Typical Output Characteristics

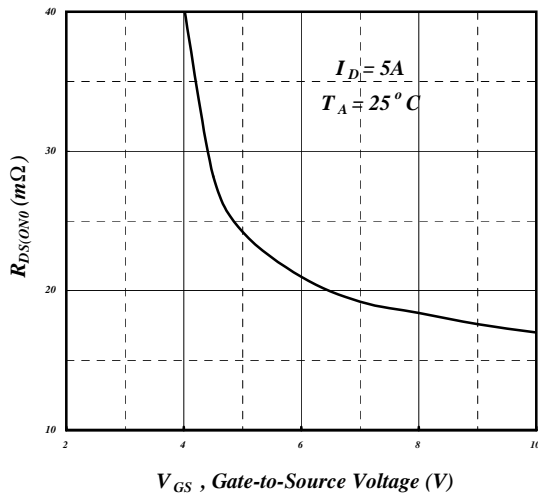


Fig 3. On-Resistance vs. Gate Voltage

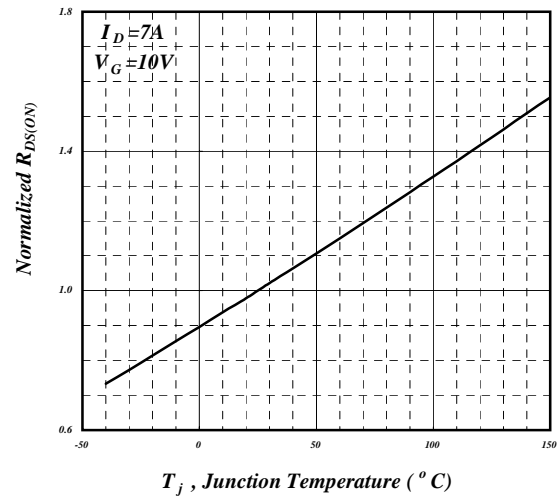


Fig 4. Normalized On-Resistance vs. Junction Temperature

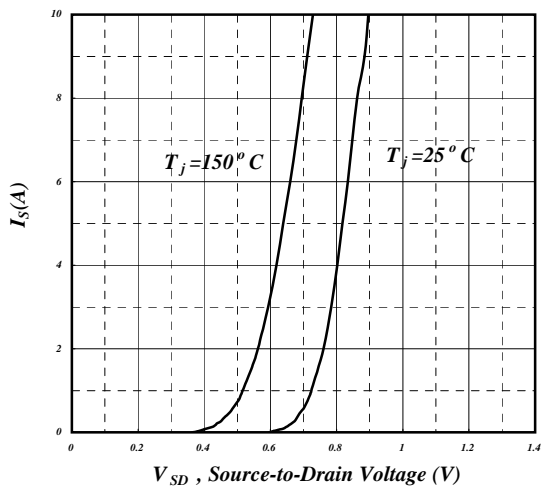


Fig 5. Forward Characteristic of Reverse Diode

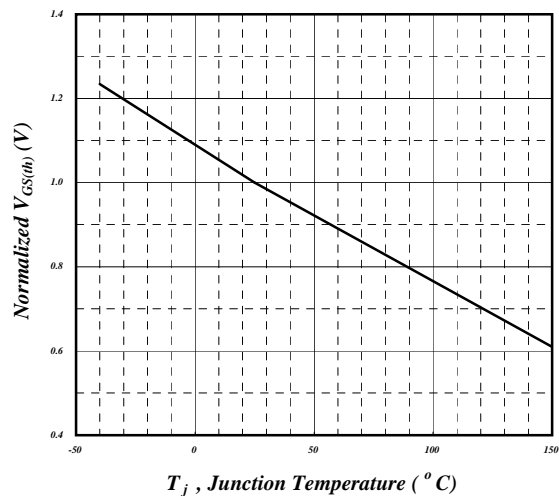


Fig 6. Gate Threshold Voltage vs. Junction Temperature



Typical N-channel Electrical Characteristics (cont.)

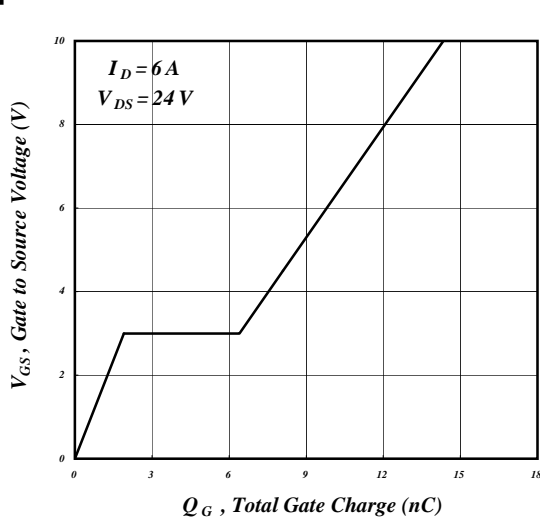


Fig 7. Gate Charge Characteristics

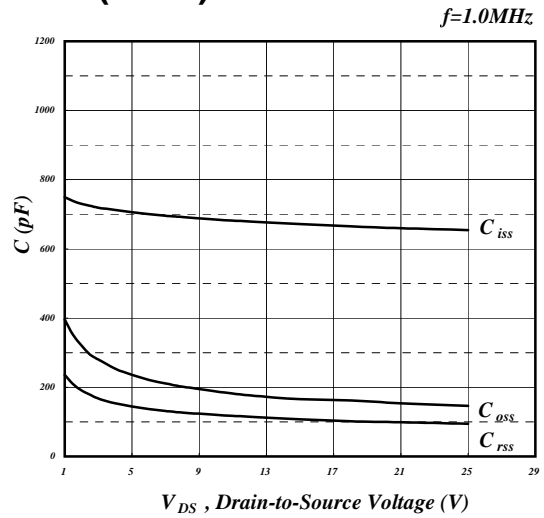


Fig 8. Typical Capacitance Characteristics

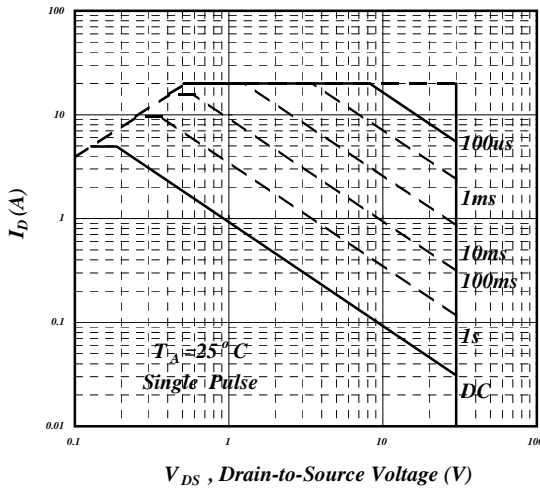


Fig 9. Maximum Safe Operating Area

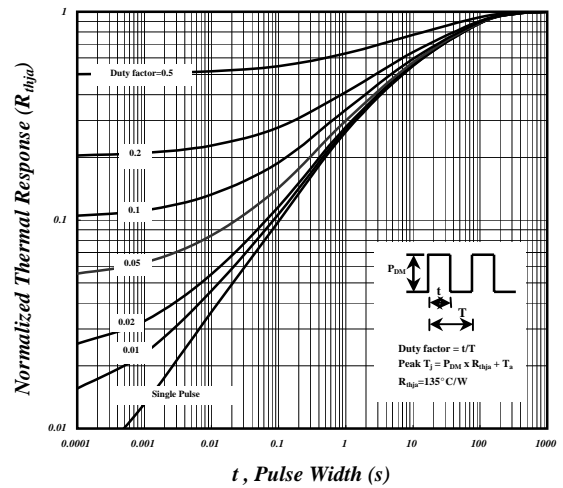


Fig 10. Effective Transient Thermal Impedance

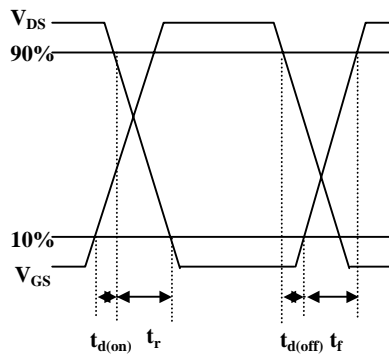


Fig 11. Switching Time Waveforms

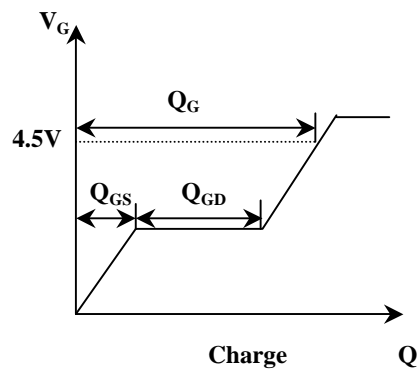
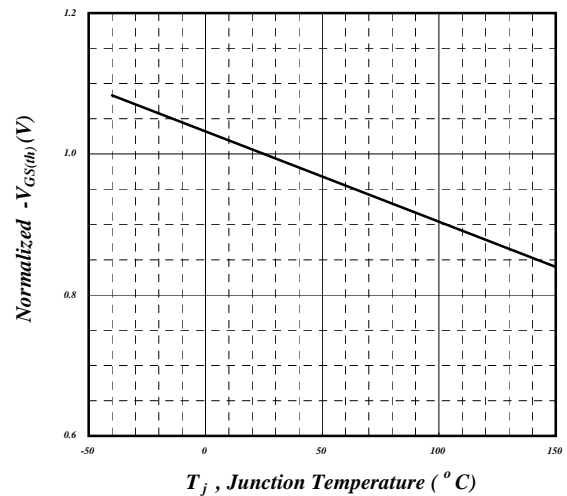
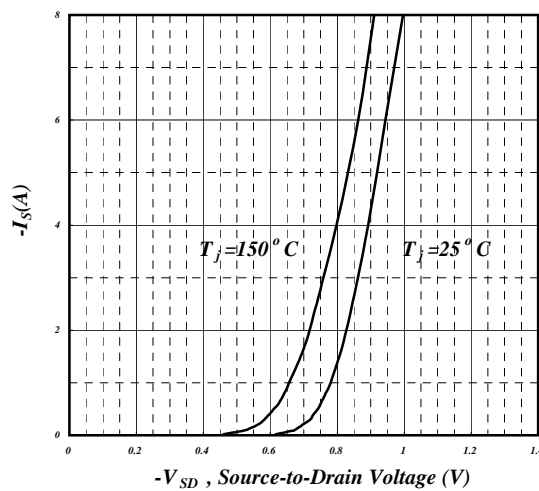
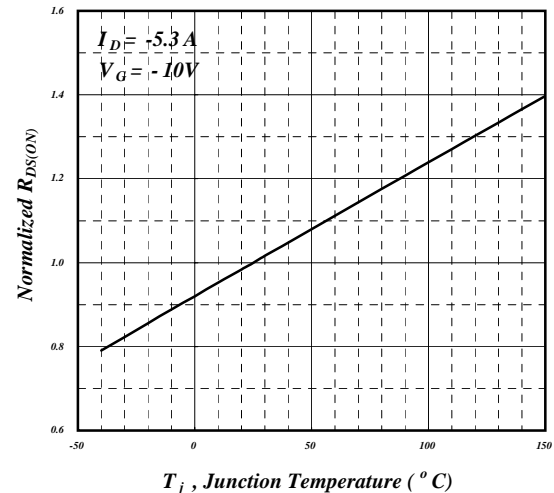
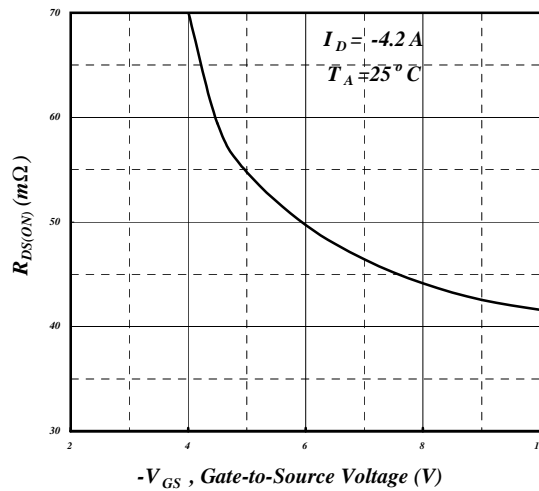
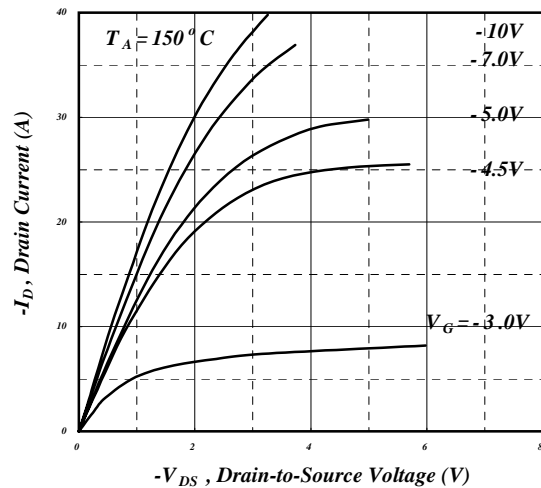
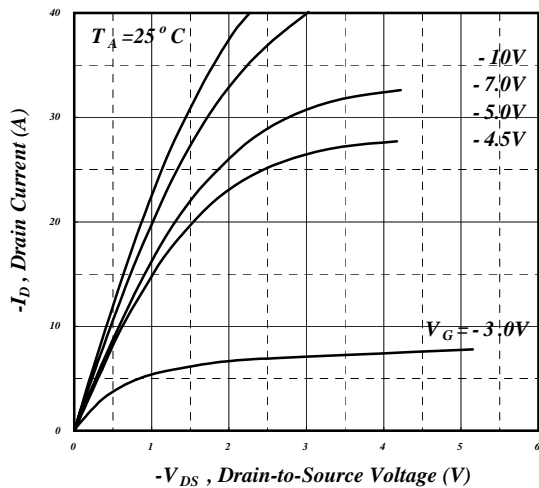


Fig 12. Gate Charge Waveform



Typical P-channel Electrical Characteristics





Typical P-channel Electrical Characteristics (cont.)

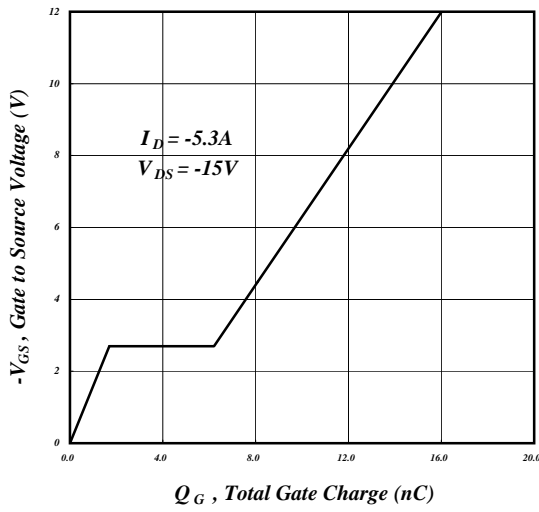


Fig 7. Gate Charge Characteristics

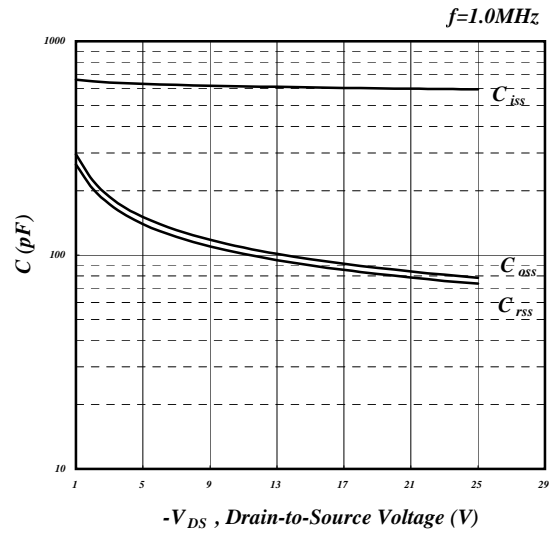


Fig 8. Typical Capacitance Characteristics

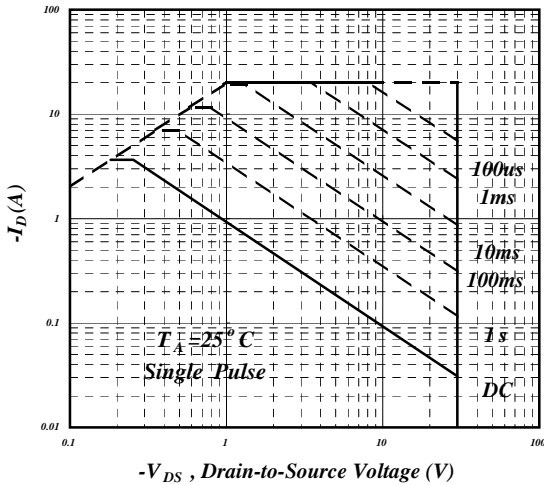


Fig 9. Maximum Safe Operating Area

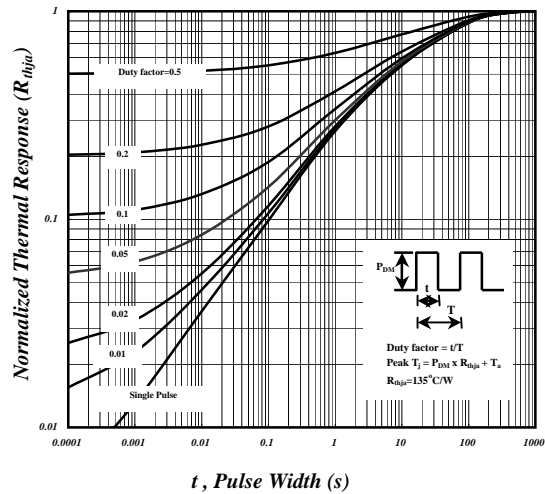


Fig 10. Effective Transient Thermal Impedance

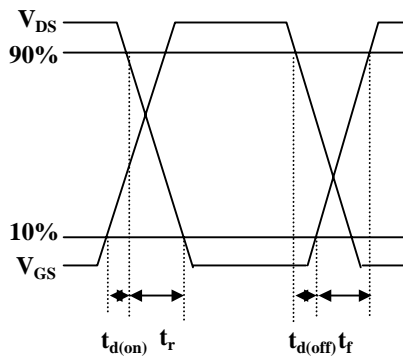


Fig 11. Switching Time Waveforms

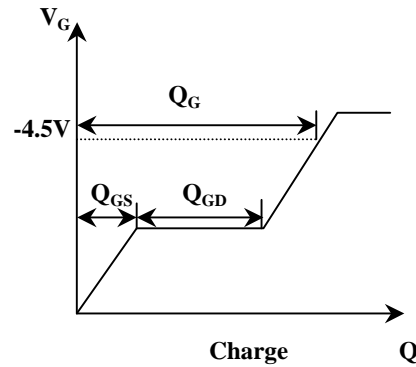
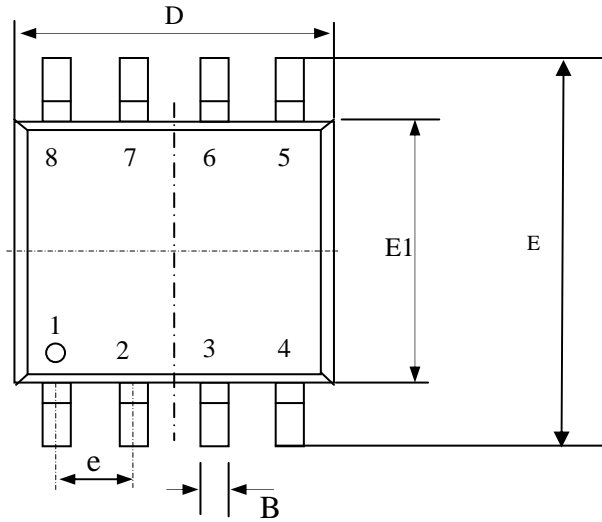


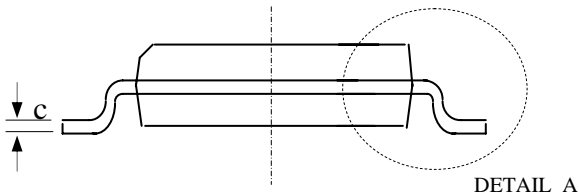
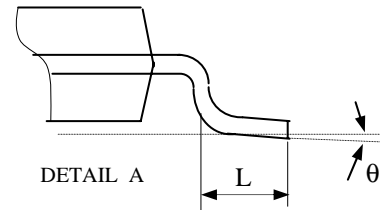
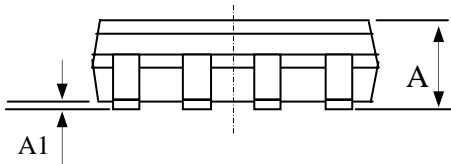
Fig 12. Gate Charge Waveform



Package Dimensions: SO-8

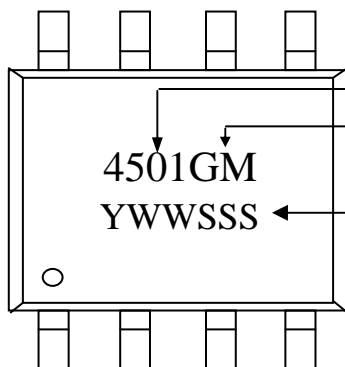


| SYMBOLS | Millimeters | | |
|----------|-------------|------|------|
| | MIN | NOM | MAX |
| A | 1.35 | 1.55 | 1.75 |
| A1 | 0.10 | 0.18 | 0.25 |
| B | 0.33 | 0.41 | 0.51 |
| C | 0.19 | 0.22 | 0.25 |
| D | 4.80 | 4.90 | 5.00 |
| E1 | 3.80 | 3.90 | 4.00 |
| E | 5.80 | 6.15 | 6.50 |
| L | 0.38 | 0.71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



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

Marking Information:



Product: AP4501
 Package:
 GM = RoHS-compliant SO-8
 Date/lot code (YWWSSS)
 Y: Last digit of the year
 WW: Work week
 SSS: Lot code sequence

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