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# Advanced Power Electronics Corp.

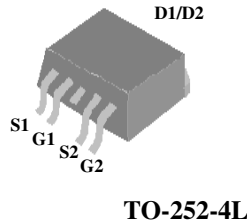
AP4525GEH-A

RoHS-compliant Product

N AND P-CHANNEL ENHANCEMENT

MODE POWER MOSFET

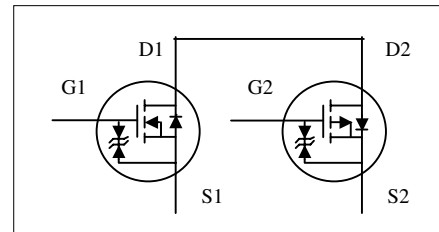
- ▼ Simple Drive Requirement
- ▼ Good Thermal Performance
- ▼ Fast Switching Performance



|      |              |              |
|------|--------------|--------------|
| N-CH | $BV_{DSS}$   | 40V          |
|      | $R_{DS(ON)}$ | 26m $\Omega$ |
|      | $I_D$        | 8.3A         |
| P-CH | $BV_{DSS}$   | -40V         |
|      | $R_{DS(ON)}$ | 40m $\Omega$ |
|      | $I_D$        | -7A          |

## Description

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



## Absolute Maximum Ratings

| Symbol                     | Parameter                             | Rating     |           | Units               |
|----------------------------|---------------------------------------|------------|-----------|---------------------|
|                            |                                       | N-channel  | P-channel |                     |
| $V_{DS}$                   | Drain-Source Voltage                  | 40         | -40       | V                   |
| $V_{GS}$                   | Gate-Source Voltage                   | $\pm 16$   | $\pm 16$  | V                   |
| $I_D@T_A=25^\circ\text{C}$ | Continuous Drain Current <sup>3</sup> | 8.3        | -7.0      | A                   |
| $I_D@T_A=70^\circ\text{C}$ | Continuous Drain Current <sup>3</sup> | 6.6        | -5.6      | A                   |
| $I_{DM}$                   | Pulsed Drain Current <sup>1</sup>     | 50         | -50       | A                   |
| $P_D@T_A=25^\circ\text{C}$ | Total Power Dissipation               | 3.125      |           | W                   |
|                            | Linear Derating Factor                | 0.025      |           | W/ $^\circ\text{C}$ |
| $T_{STG}$                  | Storage Temperature Range             | -55 to 150 |           | $^\circ\text{C}$    |
| $T_J$                      | Operating Junction Temperature Range  | -55 to 150 |           | $^\circ\text{C}$    |

## Thermal Data

| Symbol | Parameter                                             | Value | Unit                      |
|--------|-------------------------------------------------------|-------|---------------------------|
| Rthj-c | Thermal Resistance Junction-case Max.                 | 8     | $^\circ\text{C}/\text{W}$ |
| Rthj-a | Thermal Resistance Junction-ambient <sup>3</sup> Max. | 40    | $^\circ\text{C}/\text{W}$ |



## AP4525GEH-A

### N-CH Electrical Characteristics@ $T_j=25^{\circ}\text{C}$ (unless otherwise specified)

| Symbol                       | Parameter                                                 | Test Conditions                               | Min. | Typ. | Max.     | Units                |
|------------------------------|-----------------------------------------------------------|-----------------------------------------------|------|------|----------|----------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage                            | $V_{GS}=0V, I_D=250\mu A$                     | 40   | -    | -        | V                    |
| $\Delta BV_{DSS}/\Delta T_j$ | Breakdown Voltage Temperature Coefficient                 | Reference to $25^{\circ}\text{C}$ , $I_D=1mA$ | -    | 0.03 | -        | $V/^{\circ}\text{C}$ |
| $R_{DS(ON)}$                 | Static Drain-Source On-Resistance <sup>2</sup>            | $V_{GS}=10V, I_D=6A$                          | -    | -    | 26       | $m\Omega$            |
|                              |                                                           | $V_{GS}=4.5V, I_D=4A$                         | -    | -    | 32       | $m\Omega$            |
| $V_{GS(th)}$                 | 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 ( $T_j=25^{\circ}\text{C}$ ) | $V_{DS}=40V, V_{GS}=0V$                       | -    | -    | 1        | $\mu A$              |
|                              | Drain-Source Leakage Current ( $T_j=70^{\circ}\text{C}$ ) | $V_{DS}=32V, V_{GS}=0V$                       | -    | -    | 25       | $\mu A$              |
| $I_{GSS}$                    | Gate-Source Leakage                                       | $V_{GS}=\pm 16V$                              | -    | -    | $\pm 30$ | $\mu A$              |
| $Q_g$                        | Total Gate Charge <sup>2</sup>                            | $I_D=6A$                                      | -    | 9    | 14       | nC                   |
| $Q_{gs}$                     | Gate-Source Charge                                        | $V_{DS}=20V$                                  | -    | 1.5  | -        | nC                   |
| $Q_{gd}$                     | Gate-Drain ("Miller") Charge                              | $V_{GS}=4.5V$                                 | -    | 4    | -        | nC                   |
| $t_{d(on)}$                  | Turn-on Delay Time <sup>2</sup>                           | $V_{DS}=20V$                                  | -    | 7    | -        | ns                   |
| $t_r$                        | Rise Time                                                 | $I_D=6A$                                      | -    | 20   | -        | ns                   |
| $t_{d(off)}$                 | Turn-off Delay Time                                       | $R_G=3\Omega, V_{GS}=10V$                     | -    | 20   | -        | ns                   |
| $t_f$                        | Fall Time                                                 | $R_D=3.3\Omega$                               | -    | 4    | -        | ns                   |
| $C_{iss}$                    | Input Capacitance                                         | $V_{GS}=0V$                                   | -    | 580  | 930      | pF                   |
| $C_{oss}$                    | Output Capacitance                                        | $V_{DS}=25V$                                  | -    | 100  | -        | pF                   |
| $C_{rss}$                    | Reverse Transfer Capacitance                              | $f=1.0MHz$                                    | -    | 70   | -        | pF                   |
| $R_g$                        | Gate Resistance                                           | $f=1.0MHz$                                    | -    | 2    | 3        | $\Omega$             |

### Source-Drain Diode

| Symbol   | Parameter                          | Test Conditions      | Min. | Typ. | Max. | Units |
|----------|------------------------------------|----------------------|------|------|------|-------|
| $V_{SD}$ | Forward On Voltage <sup>2</sup>    | $I_S=15A, V_{GS}=0V$ | -    | -    | 1.3  | V     |
| $t_{rr}$ | Reverse Recovery Time <sup>2</sup> | $I_S=6A, V_{GS}=0V$  | -    | 20   | -    | ns    |
| $Q_{rr}$ | Reverse Recovery Charge            | $dI/dt=100A/\mu s$   | -    | 15   | -    | nC    |

**P-CH Electrical Characteristics@T<sub>j</sub>=25°C(unless otherwise specified)**

| Symbol                       | Parameter                                           | Test Conditions                                           | Min. | Typ.  | Max. | Units |
|------------------------------|-----------------------------------------------------|-----------------------------------------------------------|------|-------|------|-------|
| BV <sub>DSS</sub>            | Drain-Source Breakdown Voltage                      | V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA               | -40  | -     | -    | V     |
| $\Delta BV_{DSS}/\Delta T_j$ | Breakdown Voltage Temperature Coefficient           | Reference to 25°C, I <sub>D</sub> =-1mA                   | -    | -0.03 | -    | V/°C  |
| R <sub>DS(ON)</sub>          | Static Drain-Source On-Resistance <sup>2</sup>      | V <sub>GS</sub> =-10V, I <sub>D</sub> =-5A                | -    | -     | 40   | mΩ    |
|                              |                                                     | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A               | -    | -     | 60   | mΩ    |
| V <sub>GS(th)</sub>          | Gate Threshold Voltage                              | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250uA | -0.8 | -     | -2.5 | V     |
| g <sub>fs</sub>              | Forward Transconductance                            | V <sub>DS</sub> =-10V, I <sub>D</sub> =-5A                | -    | 5     | -    | S     |
| I <sub>DSS</sub>             | Drain-Source Leakage Current (T <sub>j</sub> =25°C) | V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V                | -    | -     | -1   | uA    |
|                              | Drain-Source Leakage Current (T <sub>j</sub> =70°C) | V <sub>DS</sub> =-32V, V <sub>GS</sub> =0V                | -    | -     | -25  | uA    |
| I <sub>GSS</sub>             | Gate-Source Leakage                                 | V <sub>GS</sub> =±16V                                     | -    | -     | ±30  | uA    |
| Q <sub>g</sub>               | Total Gate Charge <sup>2</sup>                      | I <sub>D</sub> =-5A                                       | -    | 9     | 24   | nC    |
| Q <sub>gs</sub>              | Gate-Source Charge                                  | V <sub>DS</sub> =-20V                                     | -    | 2     | -    | nC    |
| Q <sub>gd</sub>              | Gate-Drain ("Miller") Charge                        | V <sub>GS</sub> =-4.5V                                    | -    | 5     | -    | nC    |
| t <sub>d(on)</sub>           | Turn-on Delay Time <sup>2</sup>                     | V <sub>DS</sub> =-20V                                     | -    | 8.5   | -    | ns    |
| t <sub>r</sub>               | Rise Time                                           | I <sub>D</sub> =-5A                                       | -    | 15    | -    | ns    |
| t <sub>d(off)</sub>          | Turn-off Delay Time                                 | R <sub>G</sub> =3Ω, V <sub>GS</sub> =-10V                 | -    | 27    | -    | ns    |
| t <sub>f</sub>               | Fall Time                                           | R <sub>D</sub> =4Ω                                        | -    | 25    | -    | ns    |
| C <sub>iss</sub>             | Input Capacitance                                   | V <sub>GS</sub> =0V                                       | -    | 760   | 1220 | pF    |
| C <sub>oss</sub>             | Output Capacitance                                  | V <sub>DS</sub> =-25V                                     | -    | 150   | -    | pF    |
| C <sub>rss</sub>             | Reverse Transfer Capacitance                        | f=1.0MHz                                                  | -    | 105   | -    | pF    |
| R <sub>g</sub>               | Gate Resistance                                     | f=1.0MHz                                                  | -    | 6     | 9    | Ω     |

**Source-Drain Diode**

| Symbol          | Parameter                          | Test Conditions                           | Min. | Typ. | Max. | Units |
|-----------------|------------------------------------|-------------------------------------------|------|------|------|-------|
| V <sub>SD</sub> | Forward On Voltage <sup>2</sup>    | I <sub>S</sub> =-12A, V <sub>GS</sub> =0V | -    | -    | -1.3 | V     |
| t <sub>rr</sub> | Reverse Recovery Time <sup>2</sup> | I <sub>S</sub> =-5A, V <sub>GS</sub> =0V  | -    | 20   | -    | ns    |
| Q <sub>rr</sub> | Reverse Recovery Charge            | dI/dt=-100A/μs                            | -    | 16   | -    | nC    |

**Notes:**

- 1.Pulse width limited by Max. junction temperature.
- 2.Pulse test.
- 3.N-CH , P-CH are same , mounted on 2oz FR4 board t ≤ 10s.

THIS PRODUCT IS AN ELECTROSTATIC SENSITIVE, PLEASE HANDLE WITH CAUTION.

THIS PRODUCT HAS BEEN QUALIFIED FOR CONSUMER MARKET. APPLICATIONS OR USES AS CRITERIAL COMPONENT IN LIFE SUPPORT DEVICE OR SYSTEM ARE NOT AUTHORIZED.



# AP4525GEH-A

## N-Channel

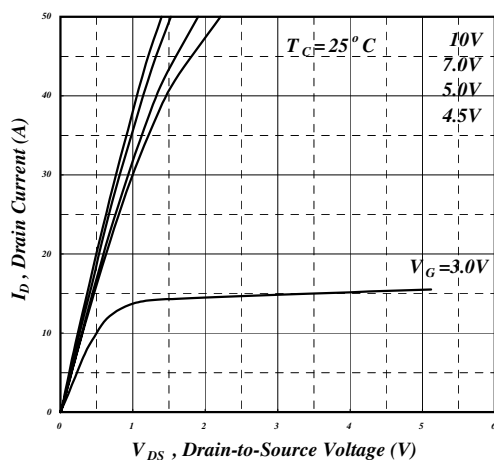


Fig 1. Typical Output Characteristics

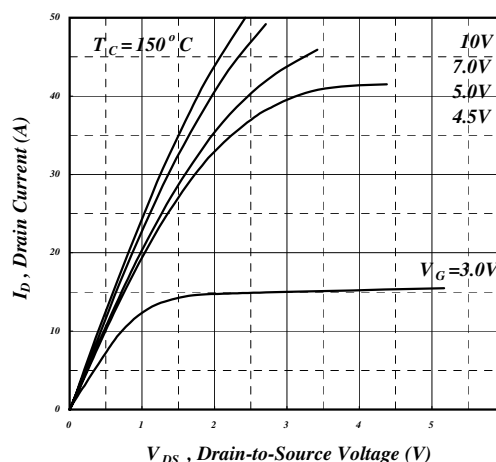


Fig 2. Typical Output Characteristics

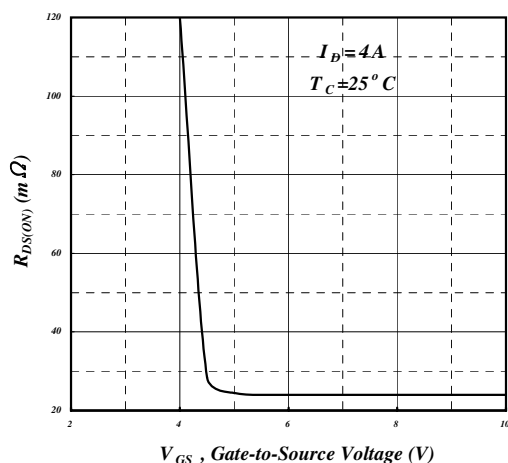


Fig 3. On-Resistance v.s. Gate Voltage

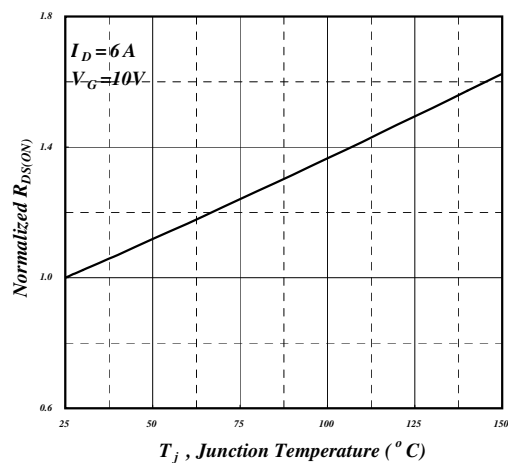


Fig 4. Normalized On-Resistance v.s. Junction Temperature

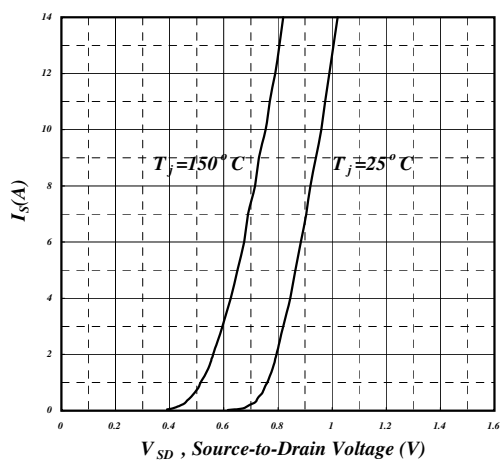


Fig 5. Forward Characteristic of Reverse Diode

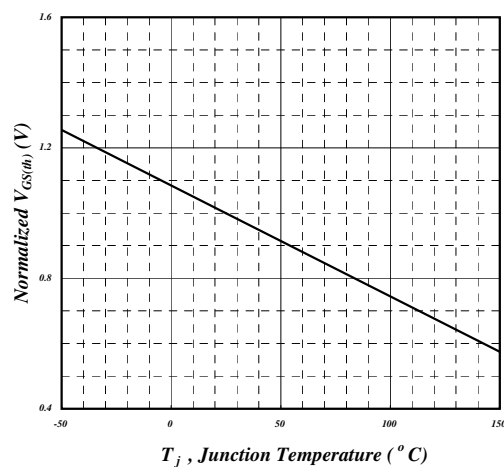


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



## N-Channel

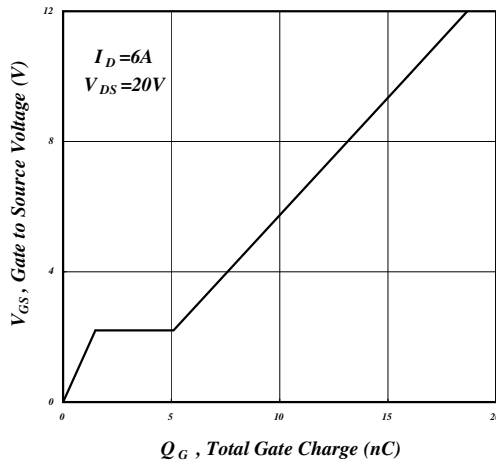


Fig 7. Gate Charge Characteristics

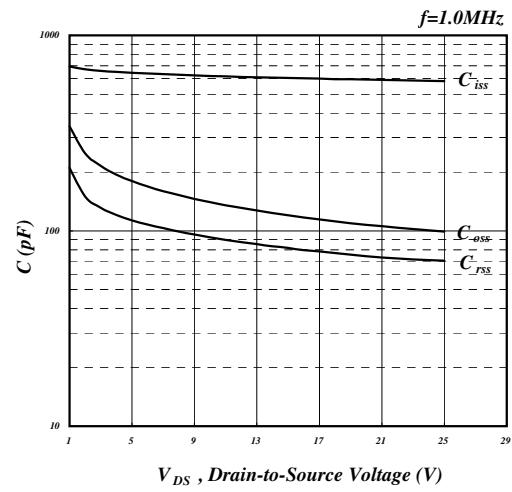


Fig 8. Typical Capacitance Characteristics

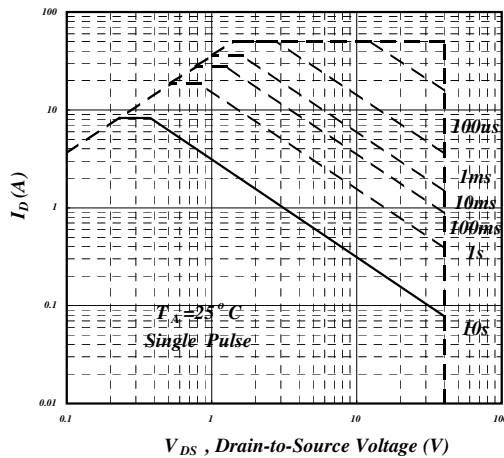


Fig 9. Maximum Safe Operating Area

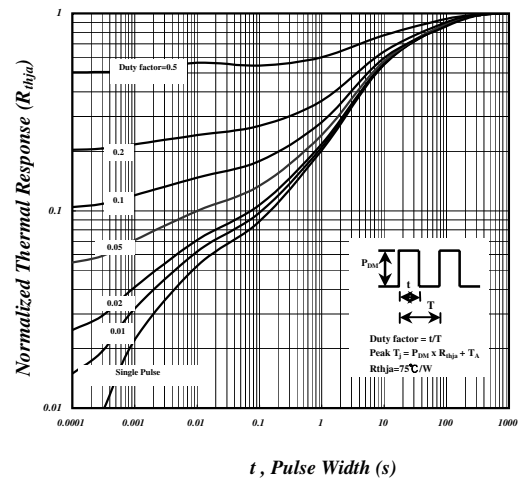


Fig 10. Effective Transient Thermal Impedance

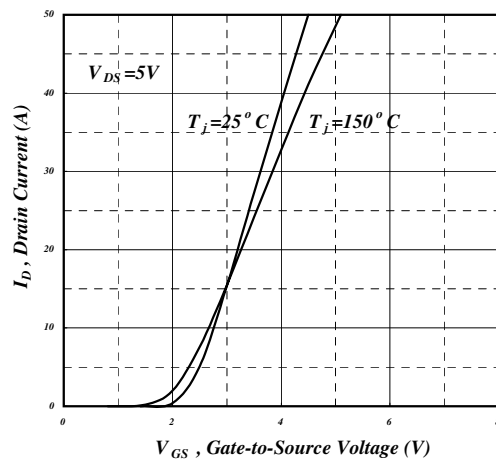


Fig 11. Transfer Characteristics

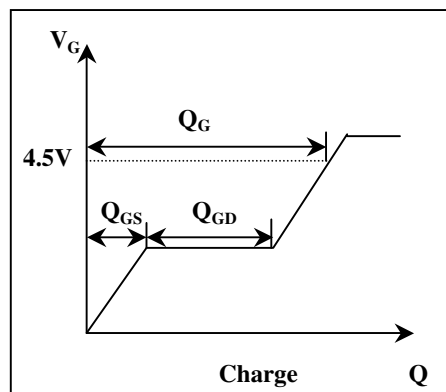


Fig 12. Gate Charge Waveform



# AP4525GEH-A

## P-Channel

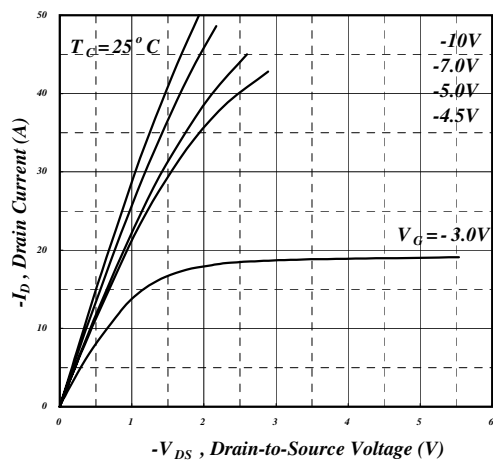


Fig 1. Typical Output Characteristics

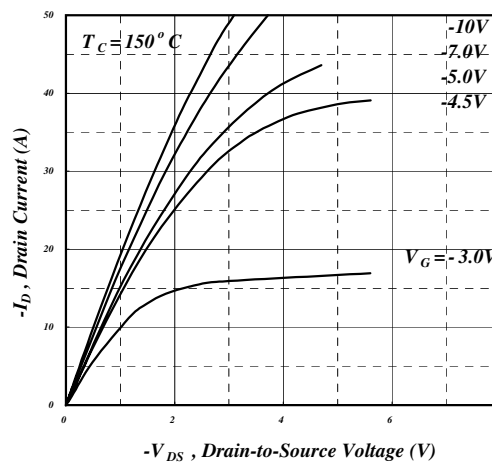


Fig 2. Typical Output Characteristics

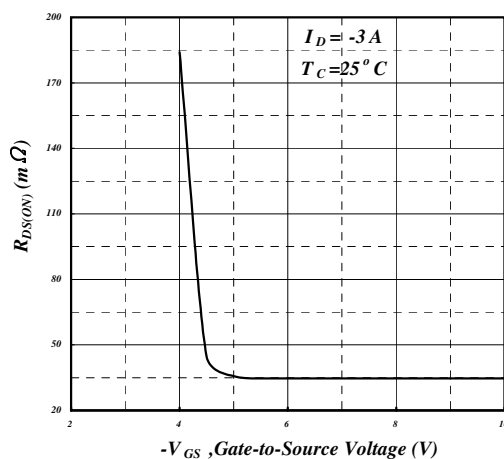


Fig 3. On-Resistance v.s. Gate Voltage

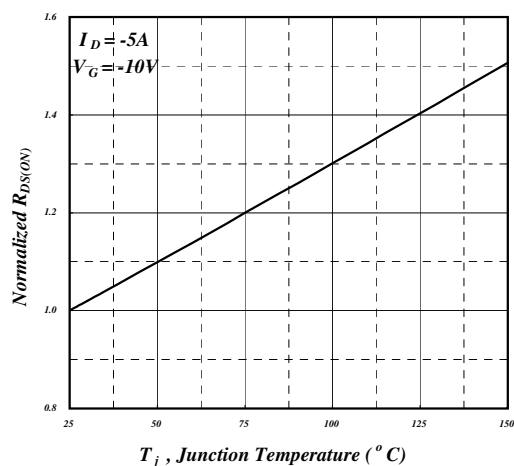


Fig 4. Normalized On-Resistance v.s. Junction Temperature

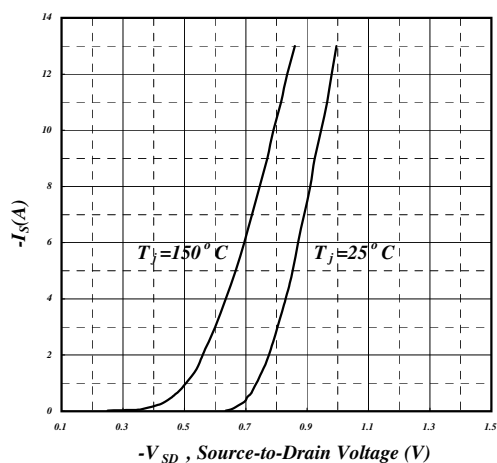


Fig 5. Forward Characteristic of Reverse Diode

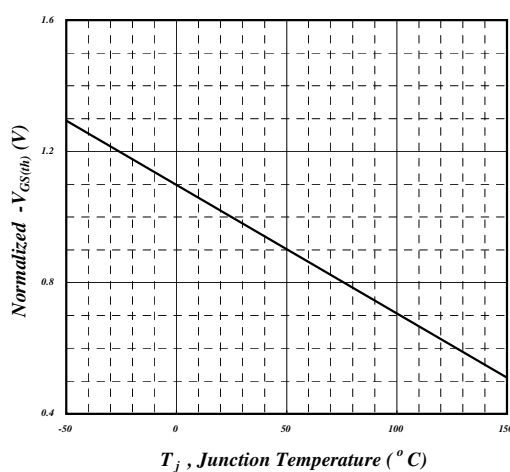


Fig 6. Gate Threshold Voltage v.s. Junction Temperature



P-Channel

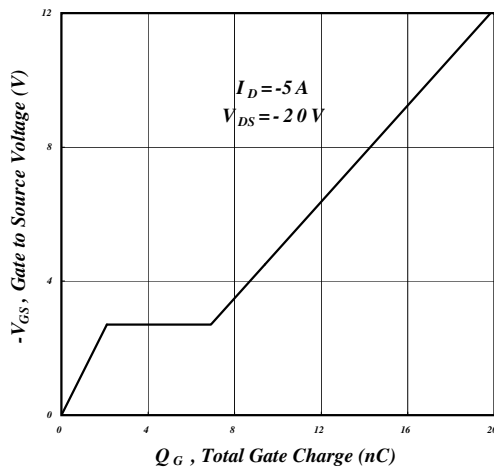


Fig 7. Gate Charge Characteristics

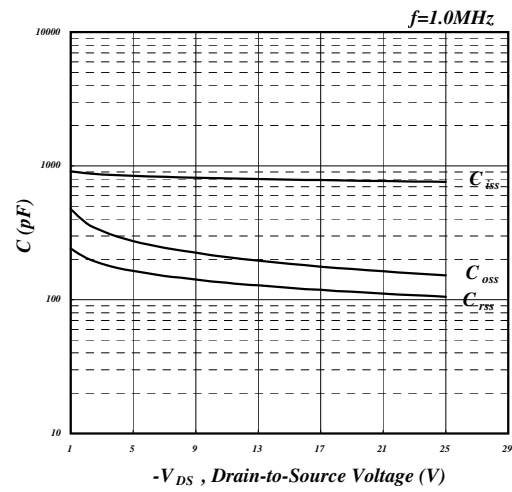


Fig 8. Typical Capacitance Characteristics

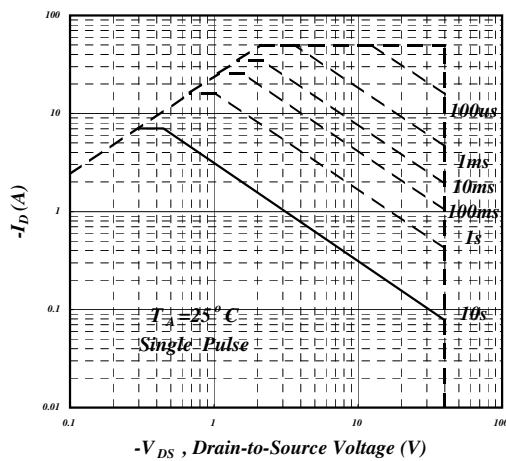


Fig 9. Maximum Safe Operating Area

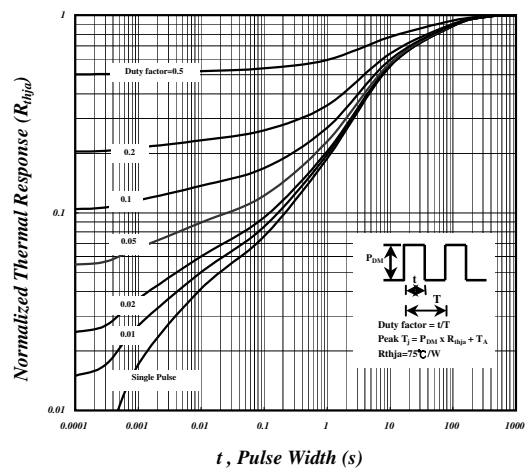


Fig 10. Effective Transient Thermal Impedance

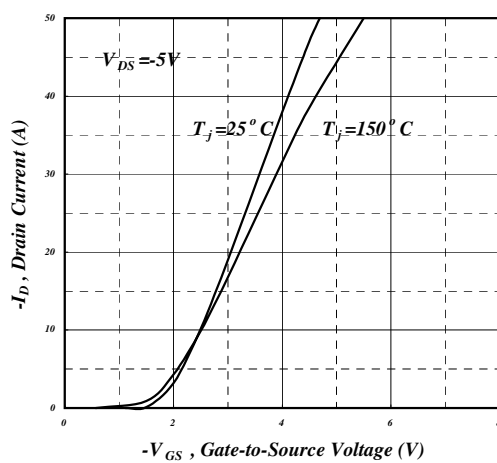


Fig 11. Transfer Characteristics

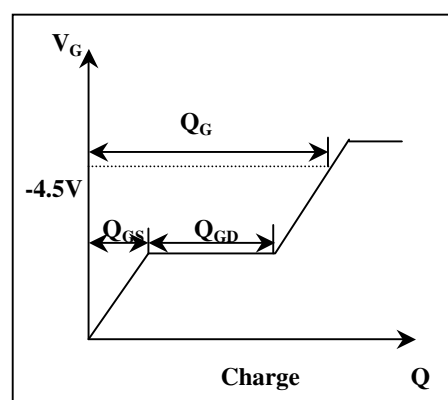
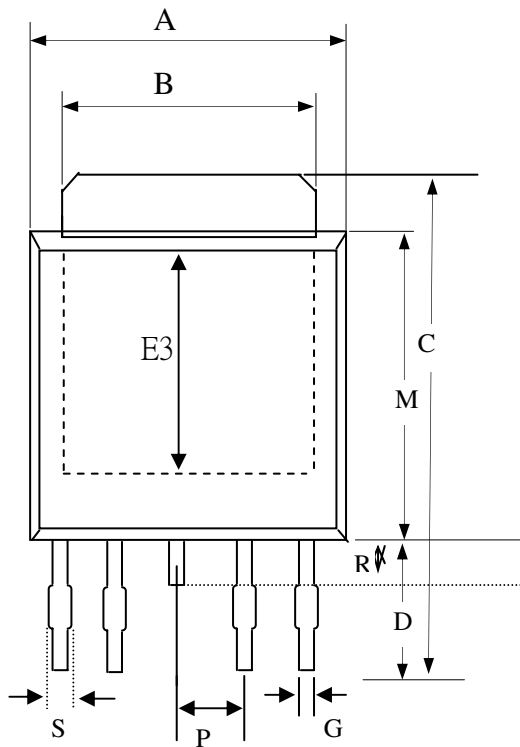


Fig 12. Gate Charge Waveform





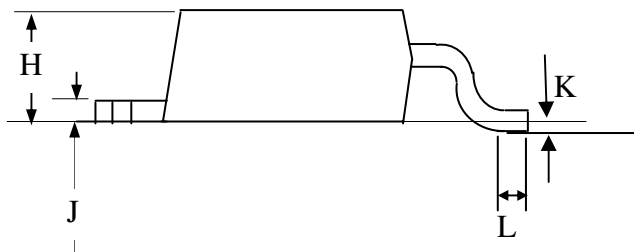
## Package Outline : TO-252(4L)



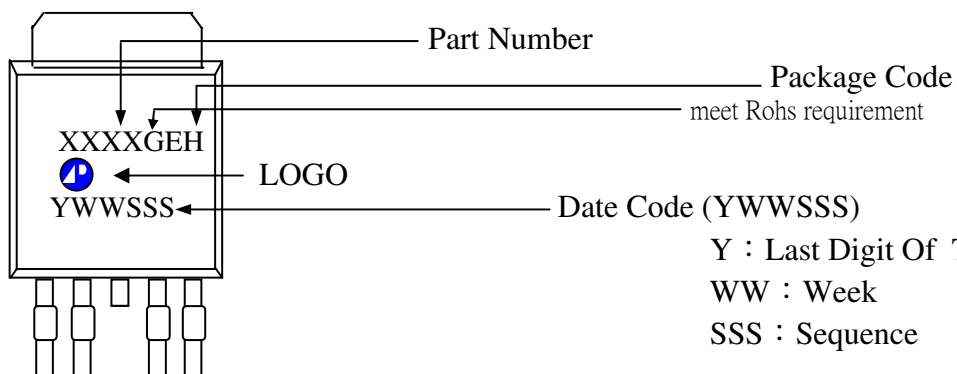
| SYMBOLS | Millimeters |       |       |
|---------|-------------|-------|-------|
|         | MIN         | NOM   | MAX   |
| A       | 6.40        | 6.6   | 6.80  |
| B       | 5.2         | 5.35  | 5.50  |
| C       | 9.40        | 9.80  | 10.20 |
| D       | 2.40        | 2.70  | 3.00  |
| P       | 1.27 REF.   |       |       |
| S       | 0.50        | 0.65  | 0.80  |
| E3      | 3.50        | 4.00  | 4.50  |
| R       | 0.80        | 1.00  | 1.20  |
| G       | 0.40        | 0.50  | 0.60  |
| H       | 2.20        | 2.30  | 2.40  |
| J       | 0.45        | 0.50  | 0.55  |
| K       | 0.00        | 0.075 | 0.15  |
| L       | 0.90        | 1.20  | 1.50  |
| M       | 5.40        | 5.60  | 5.80  |

1.All Dimensions Are in Millimeters.

2.Dimension Does Not Include Mold Protrusions.



## Part Marking Information & Packing : TO-252(4L)



Y : Last Digit Of The Year

WW : Week

SSS : Sequence