

## N&P-Channel V Complementary MOSFET

### Description

The HM607K uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

#### N channel

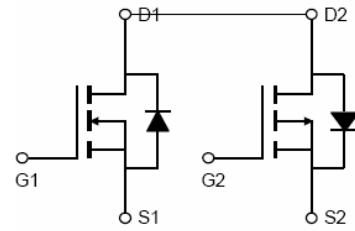
- $V_{DS} = 30V, I_D = 35A$   
 $R_{DS(ON)} < 7m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = 4.5V$

#### p channel

- $V_{DS} = -30V, I_D = -25A$   
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = -10V$   
 $R_{DS(ON)} < 25m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

- H-bridge
- Inverters



Schematic diagram



Marking and pin assignment

**100% UIS TESTED!**

**100%  $\Delta V_d$ s TESTED!**

### Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|--------|----------------|-----------|------------|----------|
| HM607K         | HM607K | TO-252-4L      | -         | -          | -        |

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Parameter                                        | Symbol         | N-Channel  | P-Channel | Unit       |
|--------------------------------------------------|----------------|------------|-----------|------------|
| Drain-Source Voltage                             | $V_{DS}$       | 30         | -30       | V          |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | $\pm 20$  | V          |
| Continuous Drain Current                         | $I_D$          | 35         | -25       | A          |
|                                                  |                | 24.5       | -17.5     |            |
| Pulsed Drain Current <sup>(Note 1)</sup>         | $I_{DM}$       | 105        | -75       | A          |
| Maximum Power Dissipation                        | $P_D$          | 21         |           | W          |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 175 |           | $^\circ C$ |

### Thermal Characteristic

|                                                          |                 |   |              |
|----------------------------------------------------------|-----------------|---|--------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 7 | $^\circ C/W$ |
|----------------------------------------------------------|-----------------|---|--------------|

**N-Channel Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)**

| Parameter                                     | Symbol              | Condition                                                                             | Min | Typ | Max  | Unit |
|-----------------------------------------------|---------------------|---------------------------------------------------------------------------------------|-----|-----|------|------|
| Off Characteristics                           |                     |                                                                                       |     |     |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                             | 30  | -   | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =30V,V <sub>GS</sub> =0V                                              | -   | -   | 1    | μA   |
| Gate-Body Leakage Current                     | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V                                             | -   | -   | ±100 | nA   |
| On Characteristics <sup>(Note 3)</sup>        |                     |                                                                                       |     |     |      |      |
| Gate Threshold Voltage                        | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                               | 1.0 | 1.5 | 2.5  | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =7A                                              | -   | 5.5 | 7    | mΩ   |
|                                               |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A                                             | -   | 7.8 | 12   | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =10V,I <sub>D</sub> =7A                                               | -   | 29  | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                       |     |     |      |      |
| Input Capacitance                             | C <sub>iss</sub>    | V <sub>DS</sub> =15V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 450 | -    | PF   |
| Output Capacitance                            | C <sub>oss</sub>    |                                                                                       | -   | 150 | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |                                                                                       | -   | 90  | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                       |     |     |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =15V ,R <sub>L</sub> =2.5Ω<br>V <sub>GS</sub> =10V,R <sub>G</sub> =3Ω | -   | 5   | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                       | -   | 12  | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                       | -   | 19  | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                       | -   | 6   | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =15V,I <sub>D</sub> =6A,<br>V <sub>GS</sub> =10V                      | -   | 9.5 |      | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                       | -   | 2.0 |      | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                       | -   | 1.9 |      | nC   |
| Drain-Source Diode Characteristics            |                     |                                                                                       |     |     |      |      |
| Diode Forward Voltage <sup>(Note 3)</sup>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V,I <sub>S</sub> =35A                                               | -   |     | 1.2  | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |                                                                                       | -   | -   | 35   | A    |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=30V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω

N-Channel Typical Electrical and Thermal Characteristics (Curves)

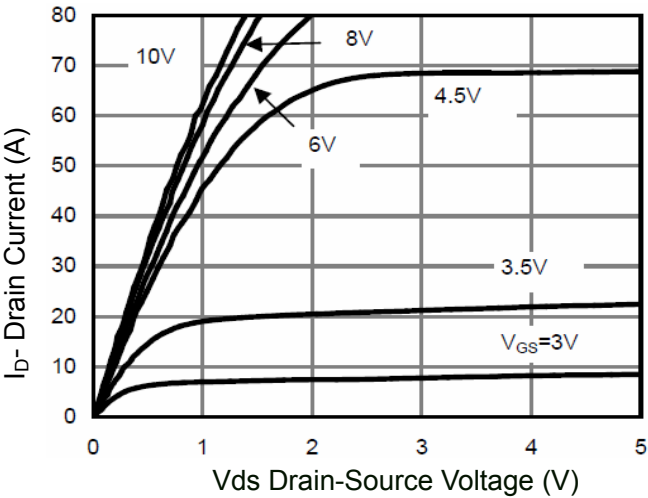


Figure 1 Output Characteristics

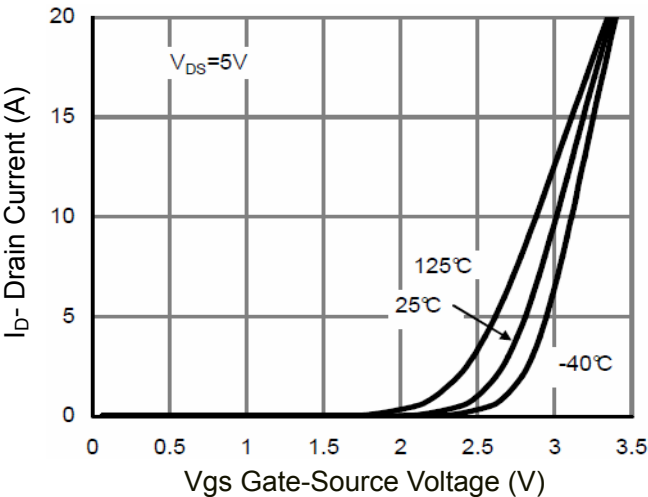


Figure 2 Transfer Characteristics

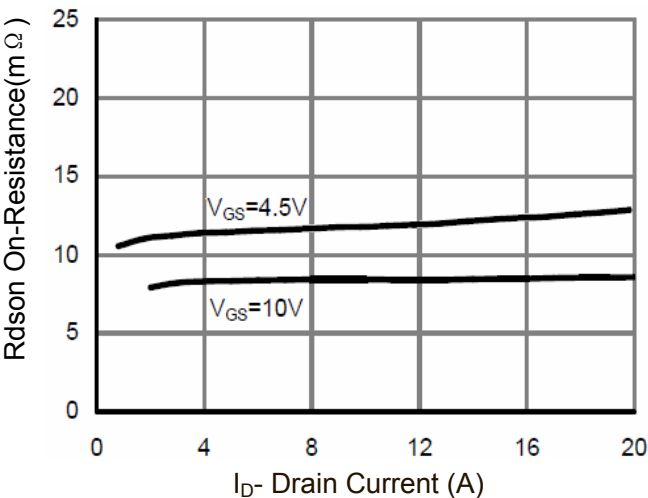


Figure 3  $R_{DS(on)}$ - Drain Current

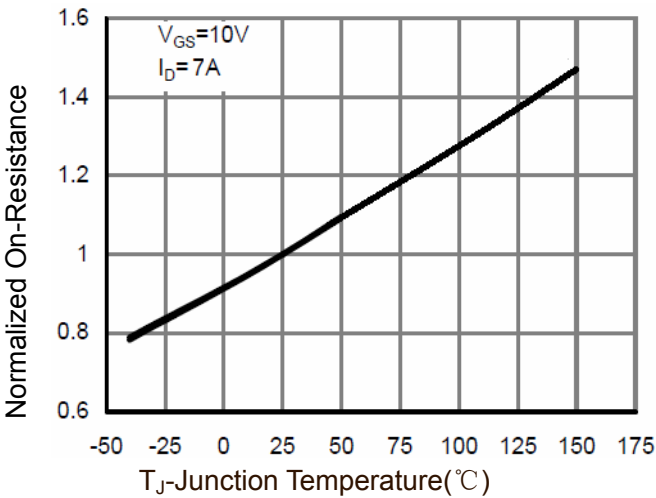


Figure 4  $R_{DS(on)}$ -Junction Temperature

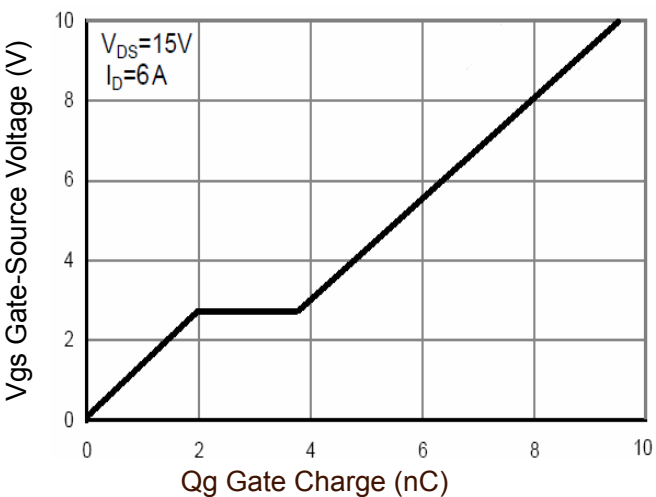


Figure 5 Gate Charge

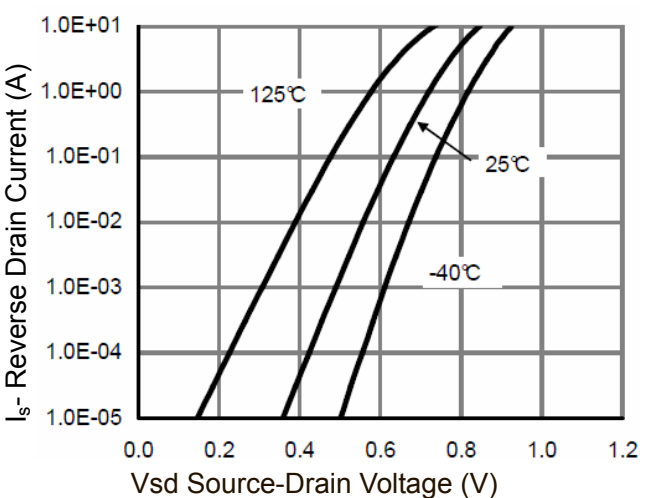


Figure 6 Source- Drain Diode Forward

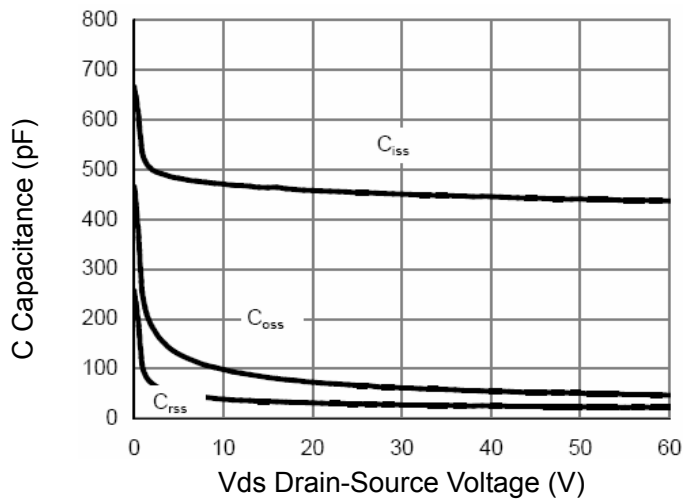


Figure 7 Capacitance vs Vds

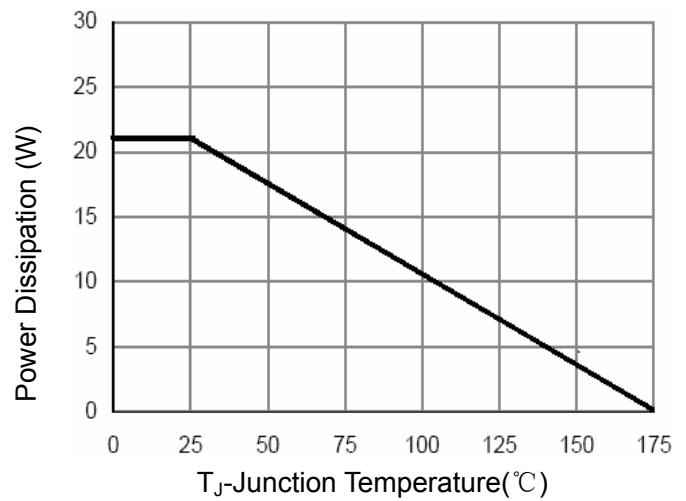


Figure 9 Power De-rating

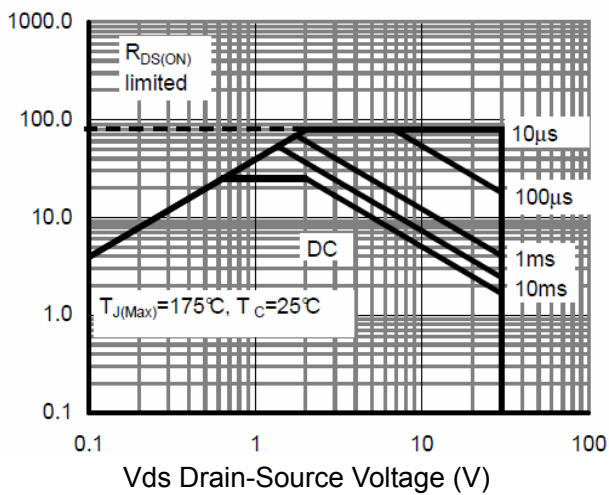


Figure 8 Safe Operation Area

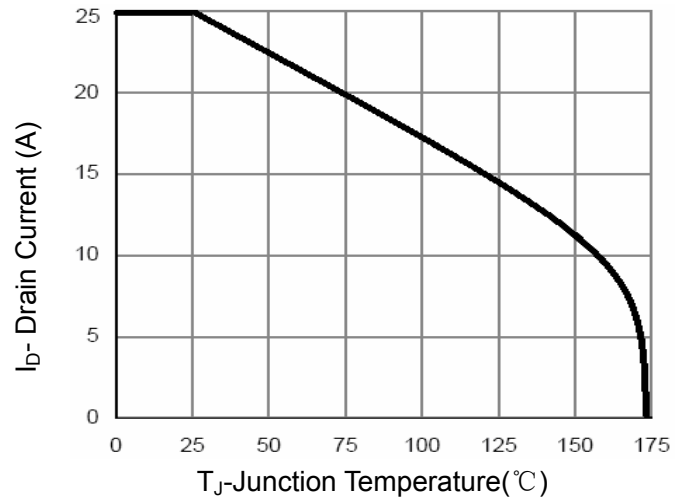


Figure 10 Current De-rating

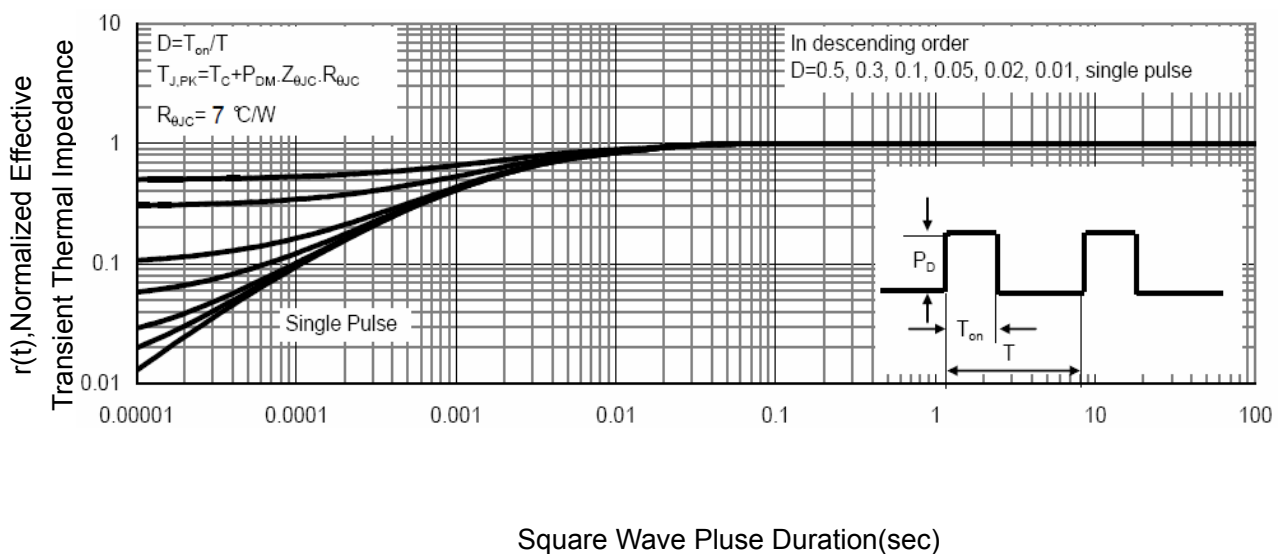


Figure 11 Normalized Maximum Transient Thermal Impedance

**P-Channel Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)**

| Parameter                                     | Symbol              | Condition                                                                                | Min  | Typ  | Max  | Unit |
|-----------------------------------------------|---------------------|------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics                           |                     |                                                                                          |      |      |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =-250μA                                               | -30  | -    | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V                                               | -    | -    | -1   | μA   |
| Gate-Body Leakage Current                     | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                               | -    | -    | ±100 | nA   |
| On Characteristics <sup>(Note 3)</sup>        |                     |                                                                                          |      |      |      |      |
| Gate Threshold Voltage                        | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                | -1.0 | -1.5 | -2.4 | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-6A                                               | -    | 15   | 18   | mΩ   |
|                                               |                     | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A                                              |      | 20   | 25   |      |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =-5V, I <sub>D</sub> =-6A                                                | -    | 15   | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                          |      |      |      |      |
| Input Capacitance                             | C <sub>Iss</sub>    | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                  | -    | 920  | -    | PF   |
| Output Capacitance                            | C <sub>OSS</sub>    |                                                                                          | -    | 140  | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rSS</sub>    |                                                                                          | -    | 90   | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                          |      |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =-15V ,R <sub>L</sub> =2.5Ω<br>V <sub>GS</sub> =-10V, R <sub>G</sub> =3Ω | -    | 8    | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                          | -    | 30   | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                          | -    | 22   | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                          | -    | 26   | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =-15V, I <sub>D</sub> =-6A,<br>V <sub>GS</sub> =-10V                     | -    | 16.2 |      | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                          | -    | 2.9  |      | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                          | -    | 3.6  |      | nC   |
| Drain-Source Diode Characteristics            |                     |                                                                                          |      |      |      |      |
| Diode Forward Voltage <sup>(Note 3)</sup>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =-6A                                                 | -    |      | -1.2 | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |                                                                                          | -    | -    | -25  | A    |
| Reverse Recovery Time                         | t <sub>rr</sub>     | TJ = 25°C, IF =-6A                                                                       | -    | 23   | -    | nS   |
| Reverse Recovery Charge                       | Q <sub>rr</sub>     | di/dt = 100A/μs <sup>(Note3)</sup>                                                       | -    | 14   | -    | nC   |

P-Channel Typical Electrical and Thermal Characteristics (Curves)

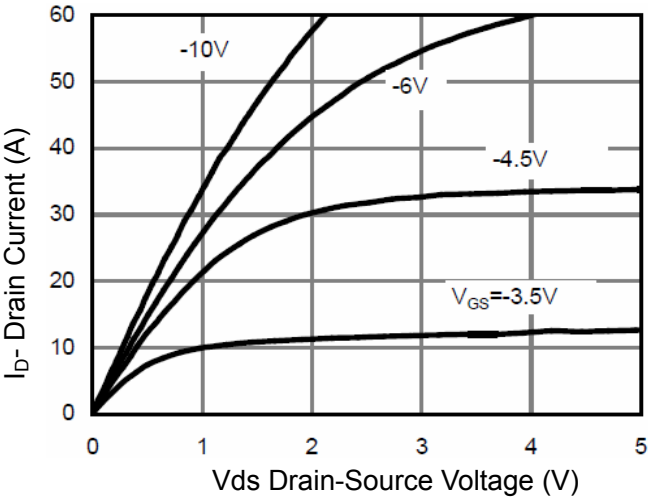


Figure 1 Output Characteristics

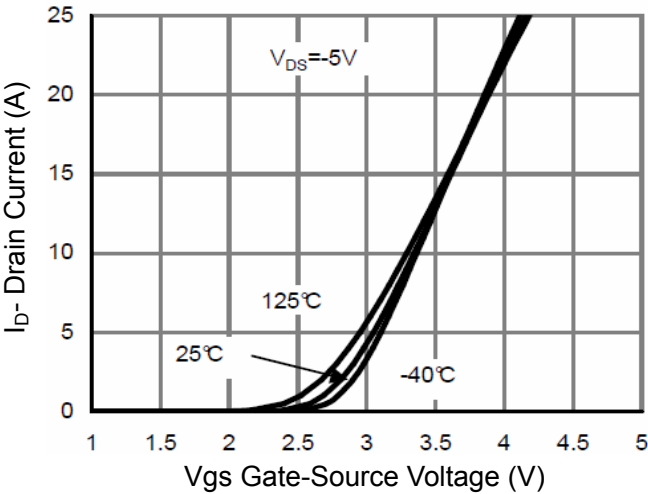


Figure 2 Transfer Characteristics

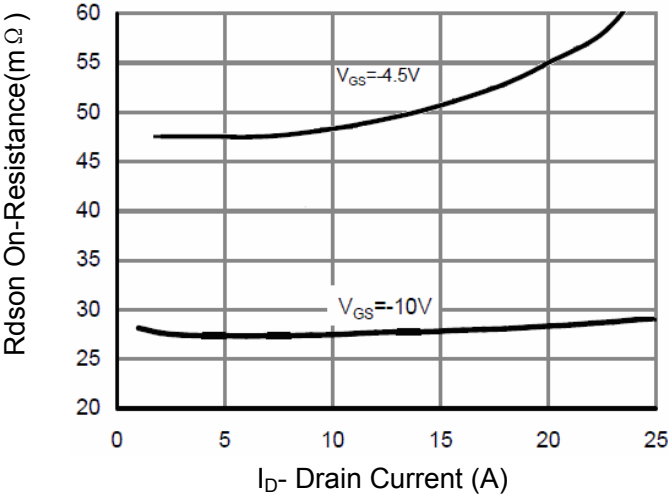


Figure 3 Rdson- Drain Current

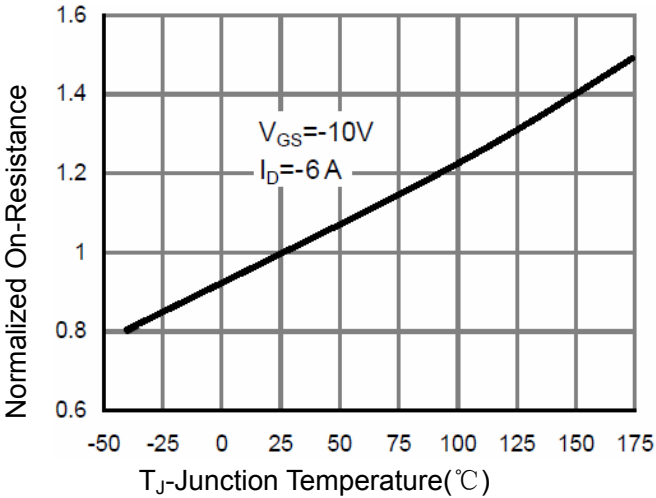


Figure 4 Rdson-Junction Temperature

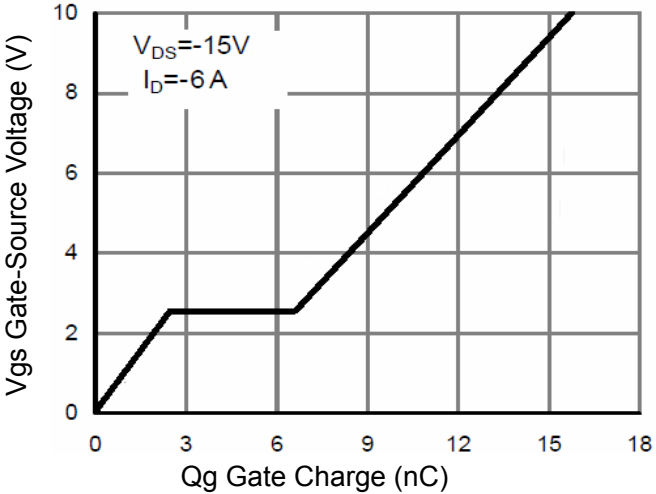


Figure 5 Gate Charge

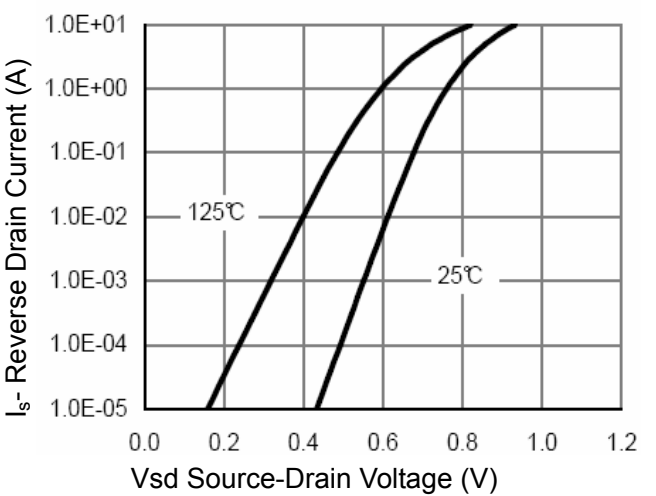


Figure 6 Source- Drain Diode Forward

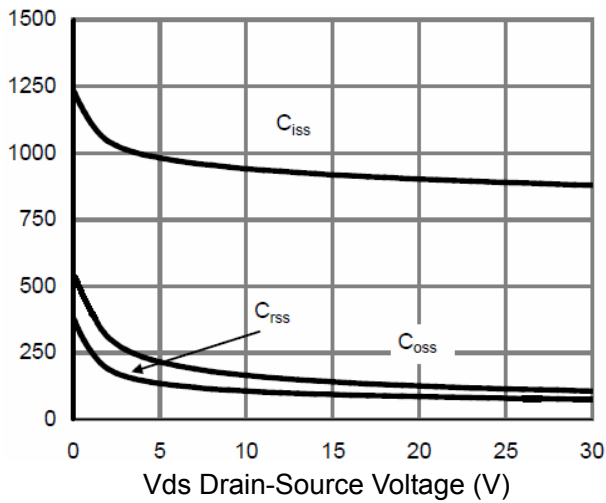


Figure 7 Capacitance vs Vds

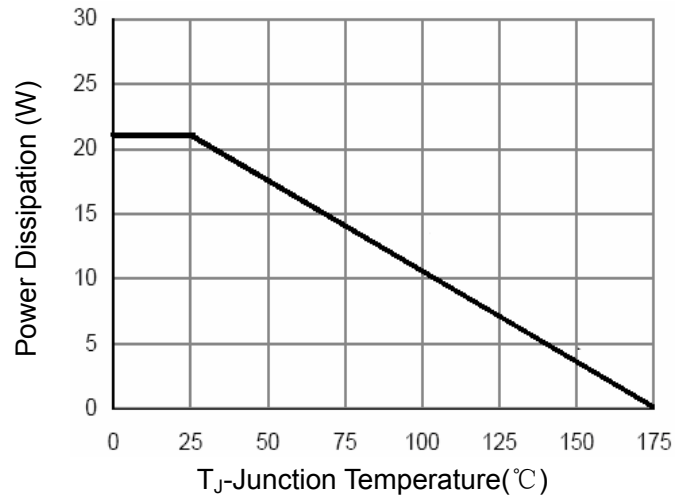


Figure 9 Power De-rating

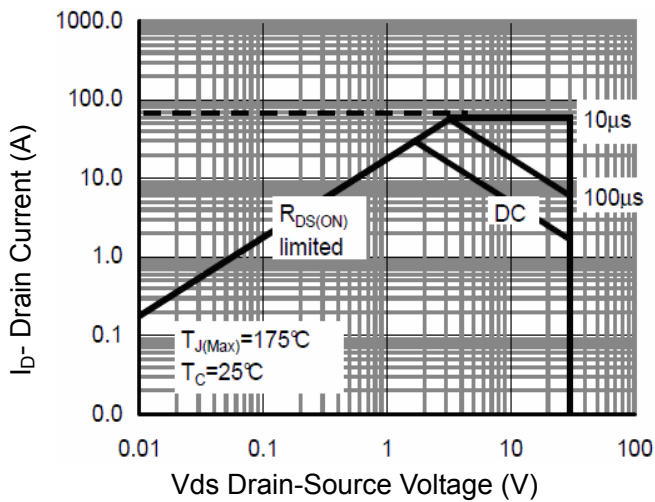


Figure 8 Safe Operation Area

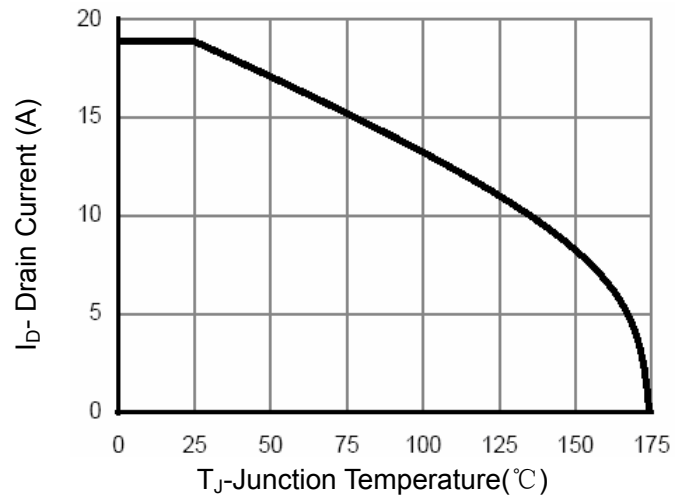


Figure 10 Current De-rating

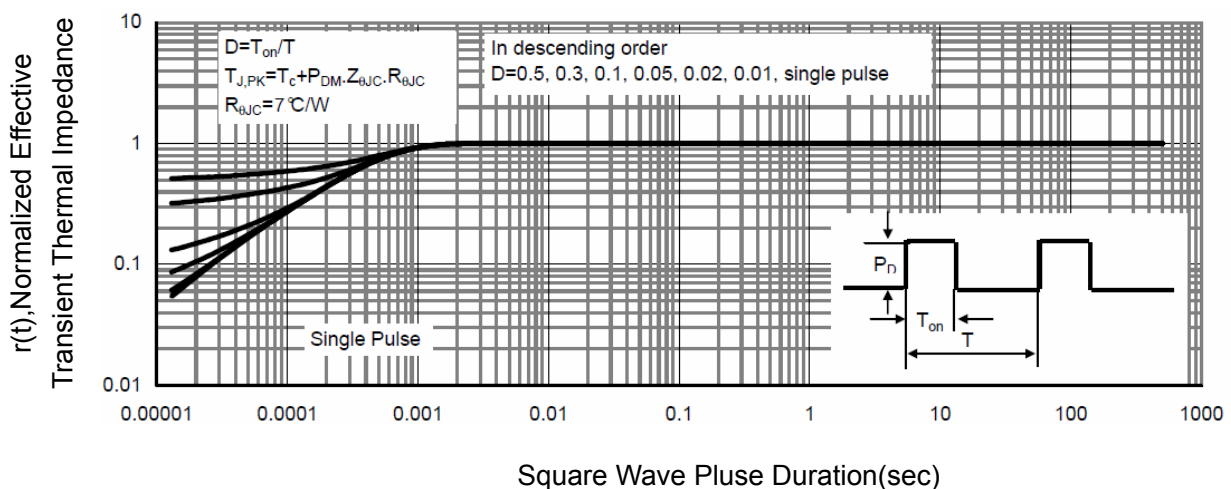
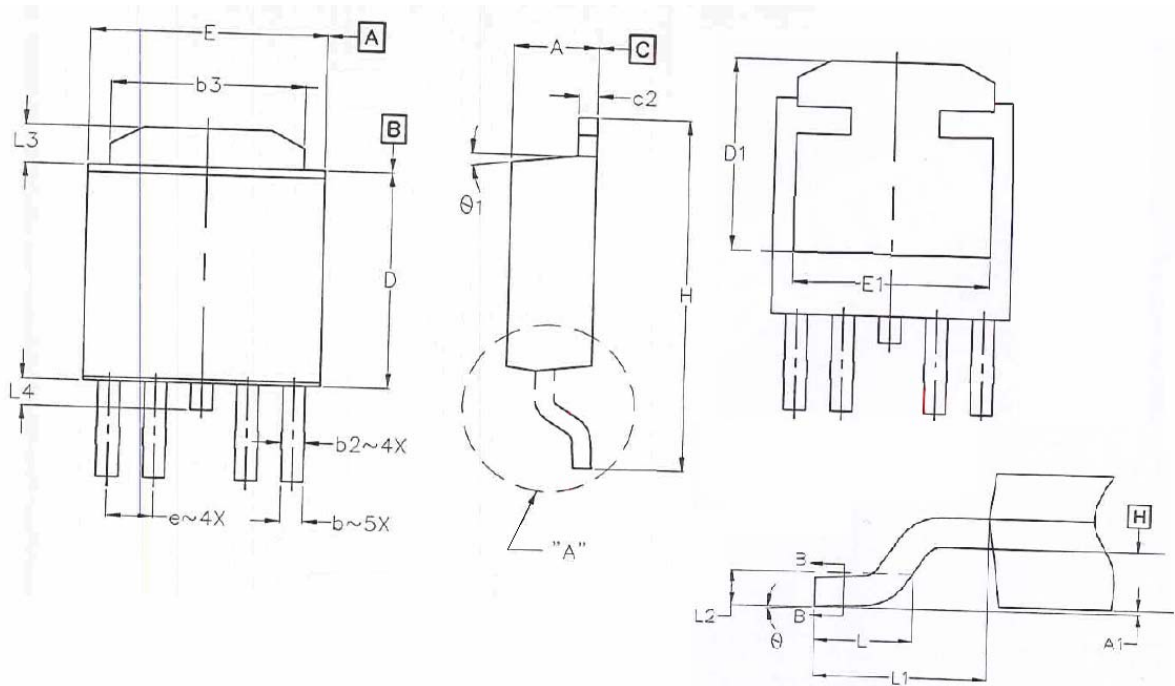


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252-4L Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 2.184                     | 2.387  | 0.086                | 0.094 |
| A1     | -                         | 0.127  | -                    | 0.094 |
| b      | 0.508                     | 0.711  | 0.020                | 0.028 |
| b1     | 0.508                     | 0.660  | 0.020                | 0.026 |
| b2     | 0.610                     | 0.787  | 0.024                | 0.031 |
| b3     | 4.953                     | 5.461  | 0.195                | 0.215 |
| c      | 0.460                     | 0.610  | 0.018                | 0.024 |
| c1     | 0.410                     | 0.559  | 0.016                | 0.022 |
| C2     | 0.460                     | 12.950 | 0.498                | 0.510 |
| D      | 4.980                     | 5.180  | 0.196                | 0.204 |
| D1     | 2.650                     | 2.950  | 0.104                | 0.116 |
| E      | 7.900                     | 8.100  | 0.311                | 0.319 |
| E1     | 0.000                     | 0.300  | 0.000                | 0.012 |
| e      | 12.900                    | 13.400 | 0.508                | 0.528 |
| H      | 2.850                     | 3.250  | 0.112                | 0.128 |
| L      | 1.397                     | 1.778  | 0.055                | 0.070 |
| L1     | 2.743                     | BSC    | 0.108                | BSC   |
| L2     | 0.508                     | BSC    | 0.020                | BSC   |
| L3     | 0.889                     | 1.270  | 0.035                | 0.050 |
| L4     | -                         | 1.015  | -                    | 0.040 |
| θ      | 0°                        | 10°    | 0°                   | 10°   |
| θ 1    | 0°                        | 15°    | 0°                   | 15°   |