

## N and P-Channel Enhancement Mode Power MOSFET

### Description

The HM4611C uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

### General Features

#### ● N-Channel

$$V_{DS} = 60V, I_D = 9A$$

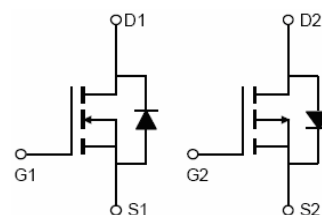
$$R_{DS(ON)} < 18m\Omega @ V_{GS}=10V$$

#### ● P-Channel

$$V_{DS} = -60V, I_D = -9A$$

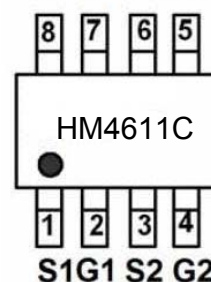
$$R_{DS(ON)} < 32m\Omega @ V_{GS}=-10V$$

- High power and current handling capability
- Lead free product is acquired
- Surface mount package



Schematic diagram

D1 D1 D2 D2



Marking and pin assignment



SOP-8 top view

### Package Marking and Ordering Information

| Device Marking | Device  | Device Package | Reel Size | Tape width | Quantity   |
|----------------|---------|----------------|-----------|------------|------------|
| HM4611C        | HM4611C | SOP-8          | Ø330mm    | 12mm       | 2500 units |

### Absolute Maximum Ratings ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter  | Symbol         | N-Channel  | P-Channel  | Unit             |
|--|----------------|------------|------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$       | 60         | -60        | V                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | $\pm 20$   | V                |
| Continuous Drain Current                         | $I_D$          | 9          | -9         | A                |
|  |                | 6.3        | -6.3       |                  |
| Pulsed Drain Current <sup>(Note 1)</sup>         | $I_{DM}$       | 27         | -27        | A                |
| Maximum Power Dissipation                        | $P_D$          | 2.0        | 2.0        | W                |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | -55 To 150 | $^\circ\text{C}$ |

### Thermal Characteristic

|  |                 |      |      |                    |
|--|-----------------|------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note2)</sup> | $R_{\theta JA}$ | N-Ch | 62.5 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient <sup>(Note2)</sup> | $R_{\theta JA}$ | P-Ch | 62.5 | $^\circ\text{C/W}$ |

**N-CH Electrical Characteristics (T<sub>A</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  | 60  | -    | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =60V, 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                                 | 1.2 | 1.8  | 2.2  | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =9A   | -   | 12   | 18   | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =9A  | 15  | -    | -    | 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                                   | -   | 500  | -    | PF   |
| Output Capacitance                            | C <sub>oss</sub>    |  | -   | 60   | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |  | -   | 25   | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |  |     |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =30V, R <sub>L</sub> =4.7Ω<br>V <sub>GS</sub> =10V, R <sub>GEN</sub> =3Ω | -   | 5    | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |  | -   | 2.6  | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |  | -   | 16.1 | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |  | -   | 2.3  | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =15V, I <sub>D</sub> =9A,<br>V <sub>GS</sub> =10V                        | -   | 25   | -    | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |  | -   | 4.5  | -    | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |  | -   | 6.5  | -    | 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> =9A  | -   | 0.8  | 1.2  | V    |

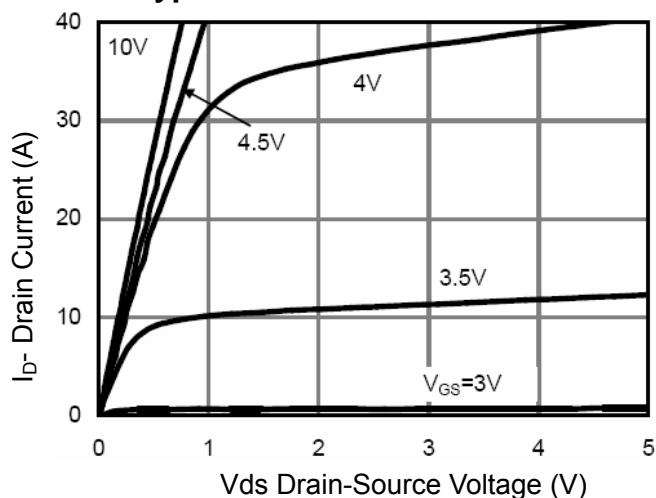
## P-CH Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| 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   | -60  | -    | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =-60V, 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                                  | -2.0 | -2.6 | -3.5 | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-5A   | -    | 25   | 32   | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =-15V, I <sub>D</sub> =-5A   | 16   | -    | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |  |      |      |      |      |
| Input Capacitance                             | C <sub>iss</sub>    | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                    | -    | 1450 | -    | PF   |
| Output Capacitance                            | C <sub>OSS</sub>    |  | -    | 145  | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rSS</sub>    |  | -    | 110  | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |  |      |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =-30V, ,R <sub>L</sub> =30Ω<br>V <sub>GS</sub> =-10V, R <sub>GEN</sub> =6Ω | -    | 8    | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |  | -    | 9    | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |  | -    | 65   | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |  | -    | 30   | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =-30V, I <sub>D</sub> =-5A,<br>V <sub>GS</sub> =-10V                       | -    | 26   | -    | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |  | -    | 4.5  | -    | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |  | -    | 7    | -    | 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> =-9A   | -    | -    | -1.2 | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |  | -    | -    | -9   | A    |

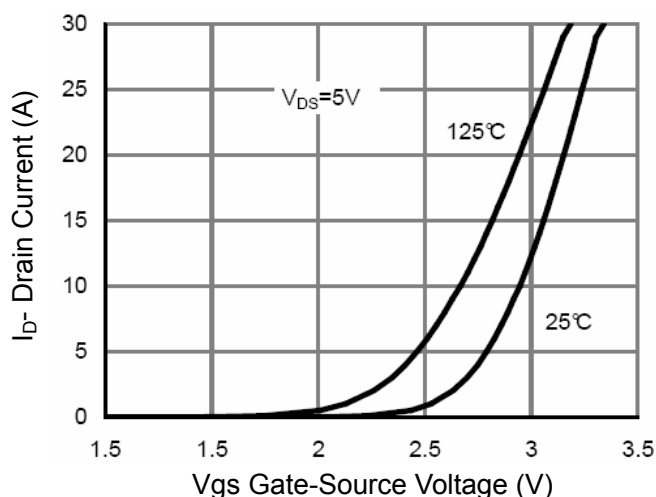
### Notes:

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

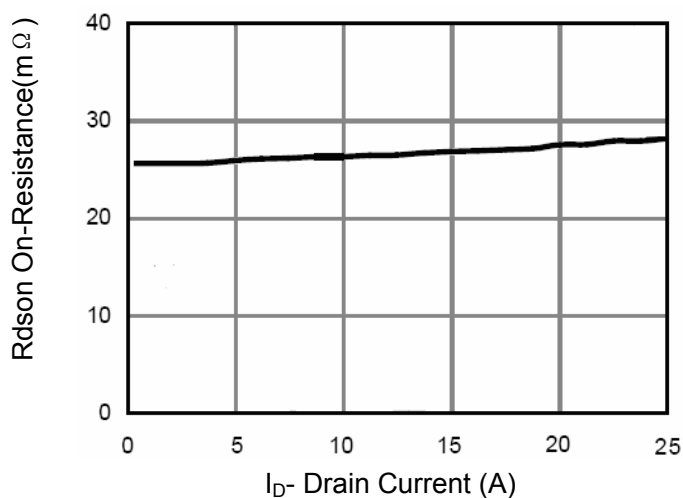
## N-CH Typical Electrical and Thermal Characteristics (Curves)



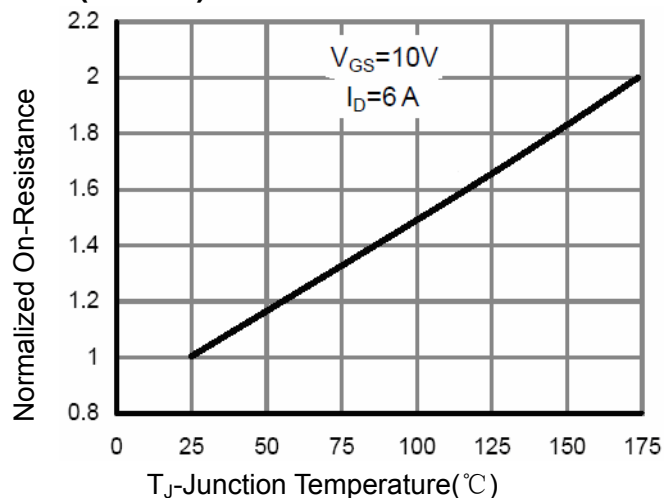
**Figure 1 Output Characteristics**



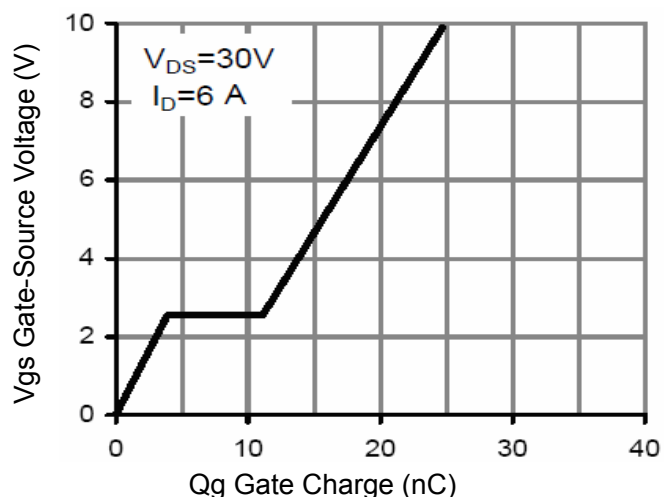
**Figure 2 Transfer Characteristics**



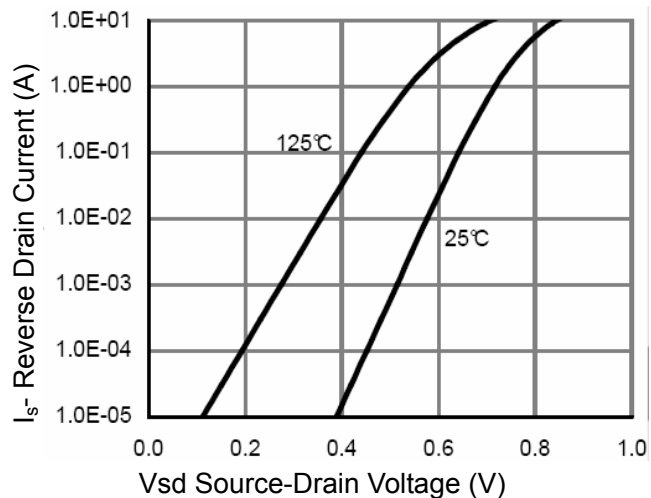
**Figure 3 Rdson- Drain Current**



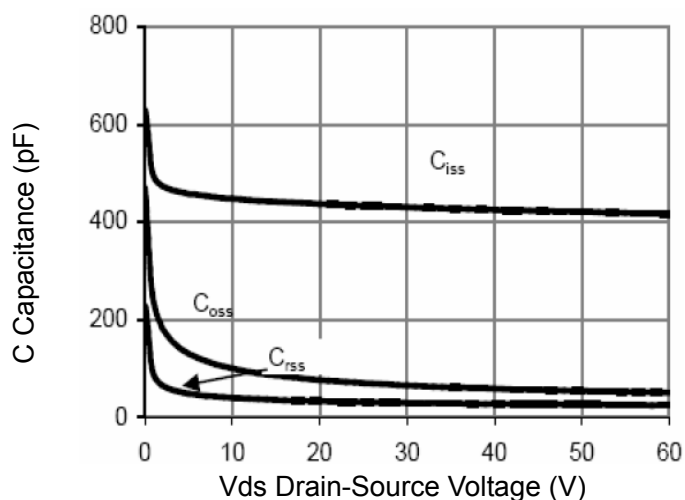
**Figure 4 Rdson-Junction Temperature**



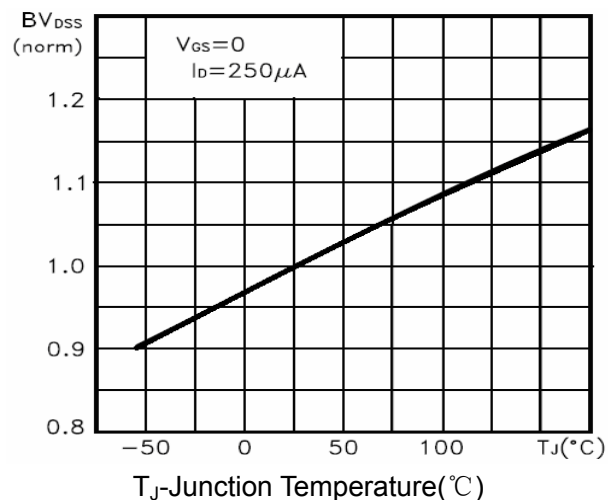
**Figure 5 Gate Charge**



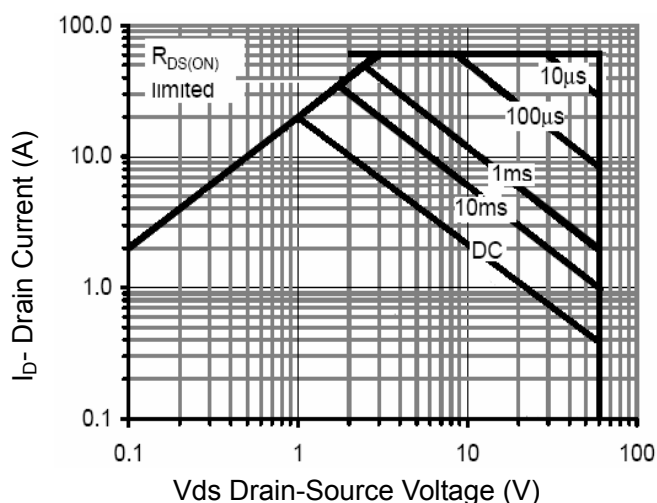
**Figure 6 Source- Drain Diode Forward**



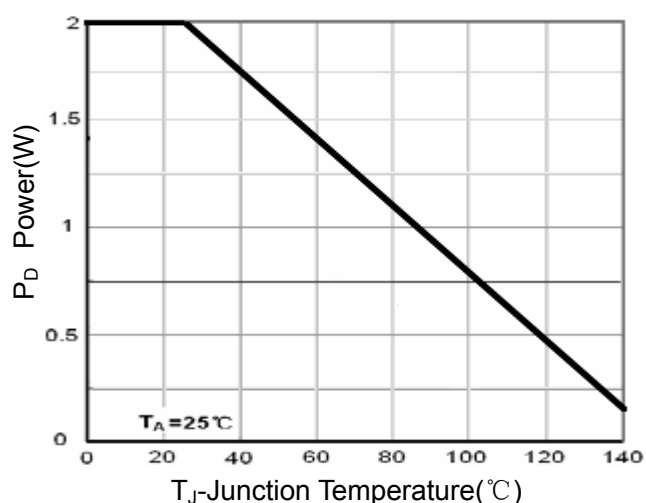
**Figure 7 Capacitance vs Vds**



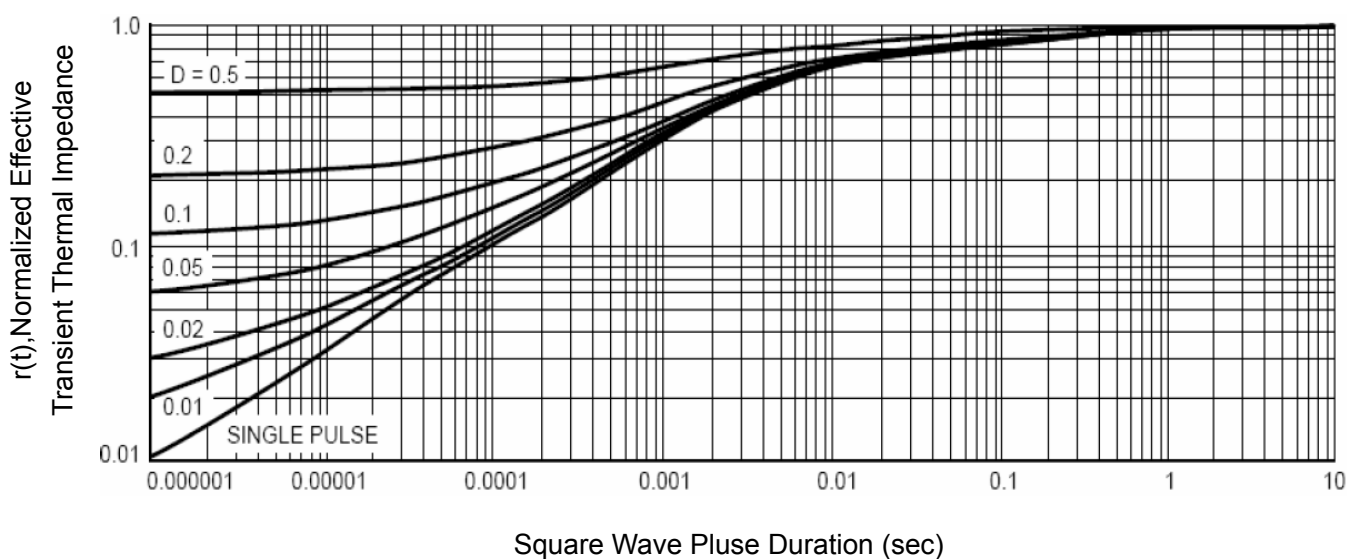
**Figure 9  $BV_{DSS}$  vs Junction Temperature**



**Figure 8 Safe Operation Area**

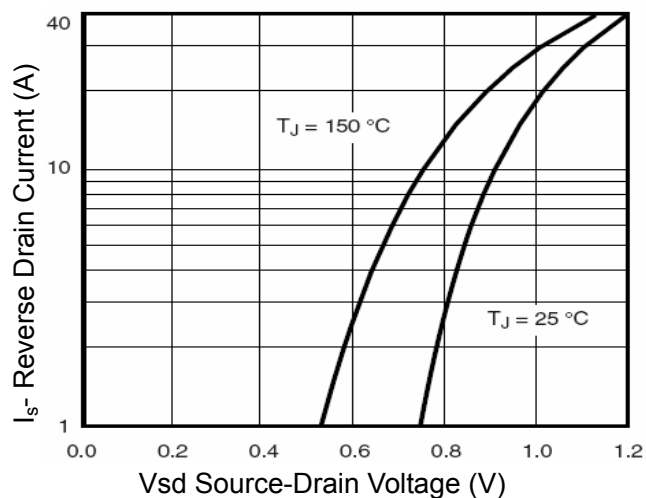
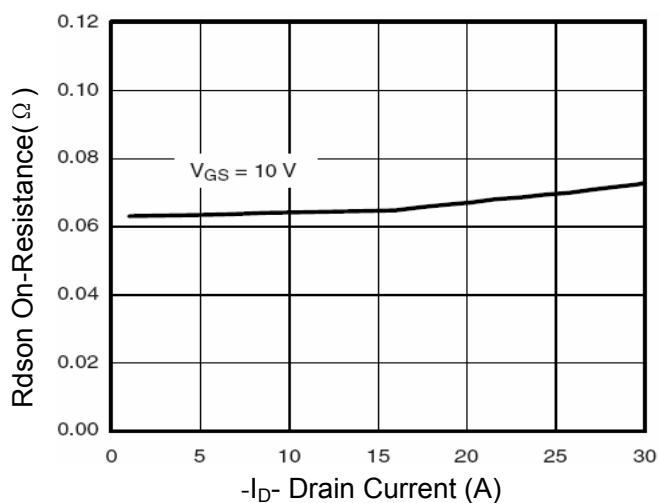
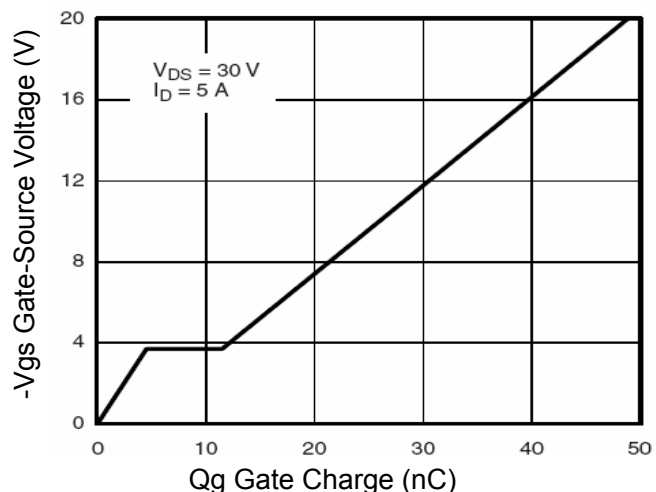
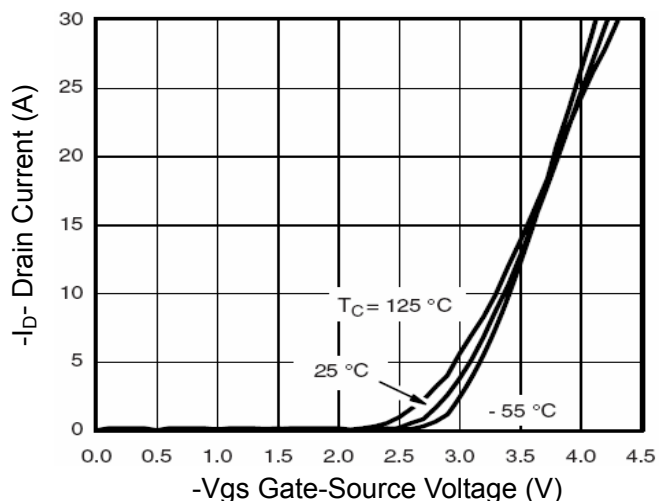
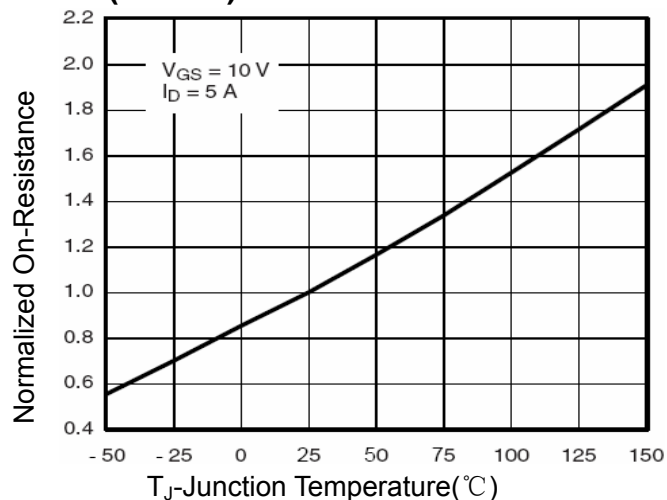
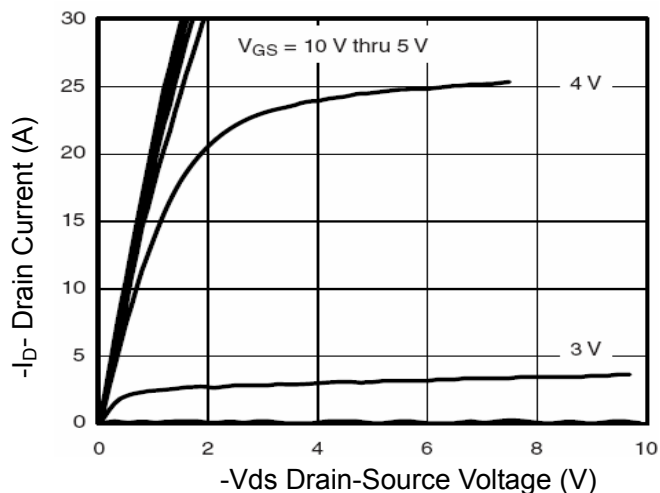


**Figure 10 Power Dissipation**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

# P-CH Typical Electrical and Thermal Characteristics (Curves)



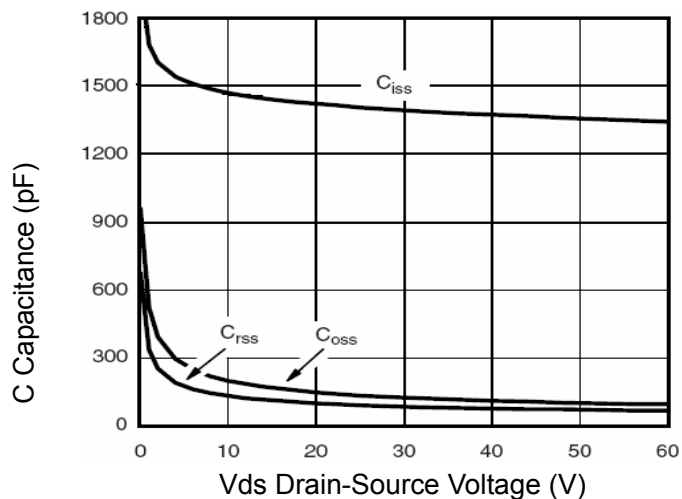


Figure 7 Capacitance vs Vds

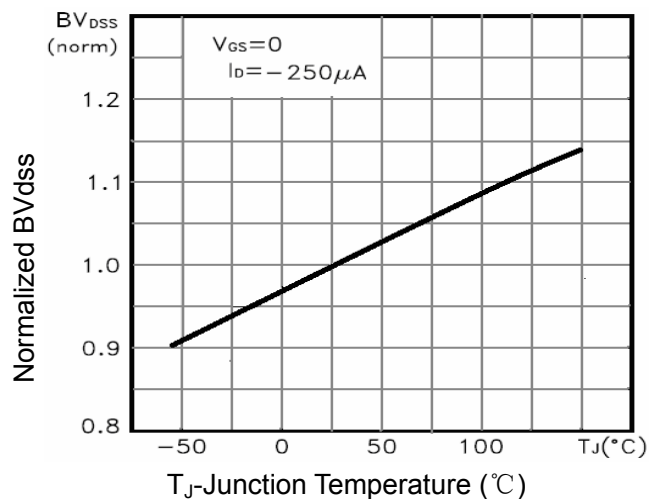


Figure 9  $BV_{DSS}$  vs Junction Temperature

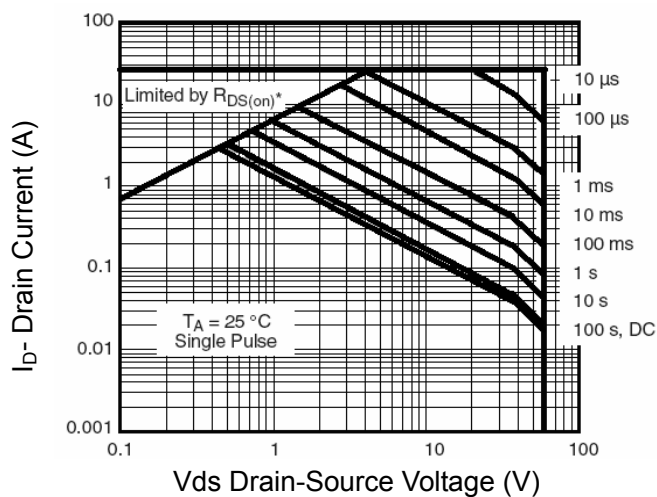


Figure 8 Safe Operation Area

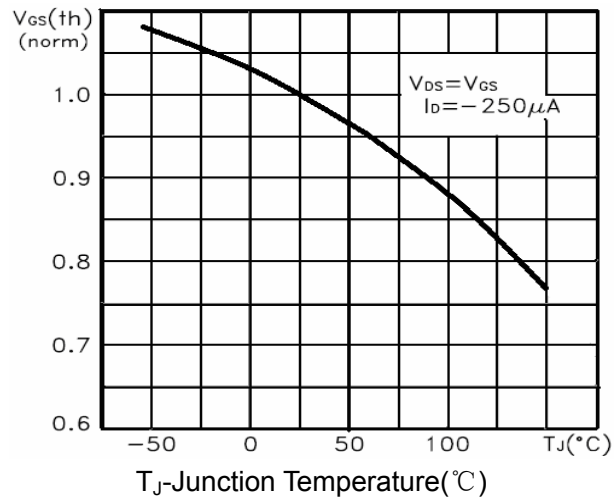


Figure 10  $V_{GS(th)}$  vs Junction Temperature

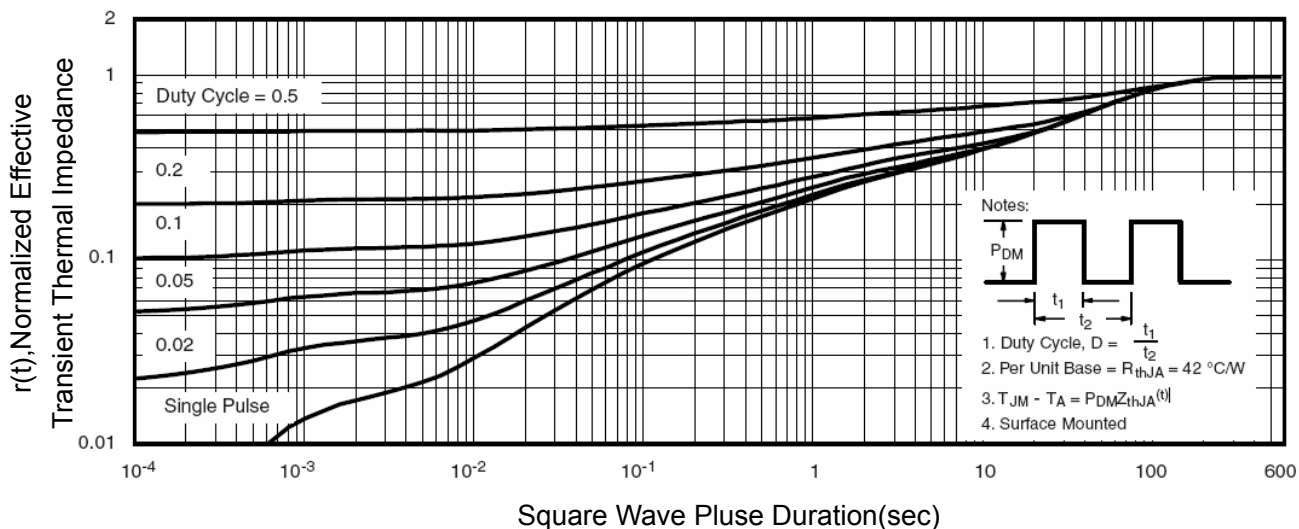
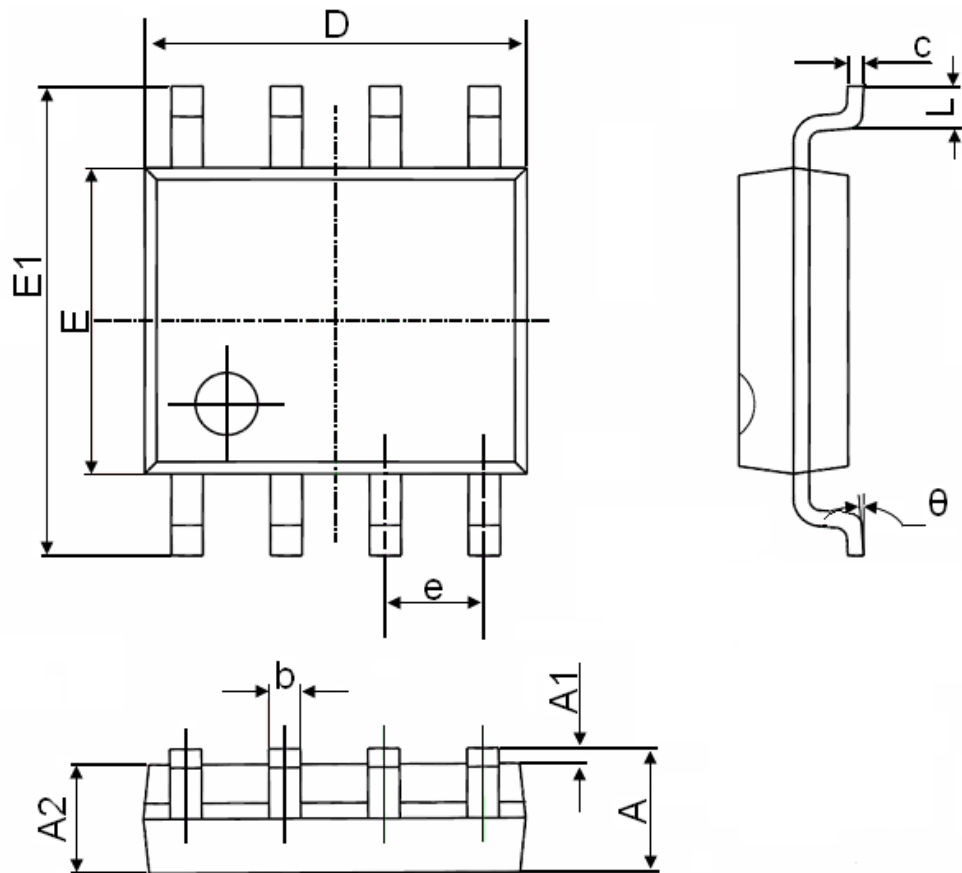


Figure 11 Normalized Maximum Transient Thermal Impedance

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°    |



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