# SOP-8 Plastic-Encapsulate MOSFETS

**TF4611**

## N and P-Channel Enhancement Mode Power MOSFET

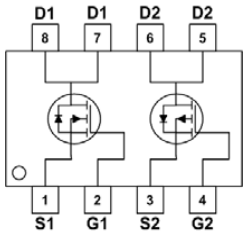
### Description

The TF4611 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.

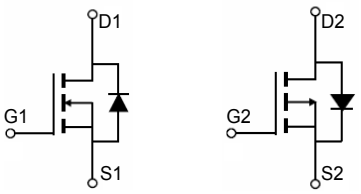
### General Features

- **N-Channel**
  $V_{DS}$ = 60V,$I_D$ =6.3A
  $R_{DSON\ (typ)}$= 25mΩ @ $V_{GS}$=10V
  $R_{DSON\ (typ)}$= 32mΩ @ $V_{GS}$=4.5V
- **P-Channel**
  $V_{DS}$ = -60V,$I_D$ = -6.0A
  $R_{DSON\ (typ)}$= 69mΩ @ $V_{GS}$=-10V
  $R_{DSON\ (typ)}$= 85mΩ @ $V_{GS}$=-4.5V
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

**SOP-8L**

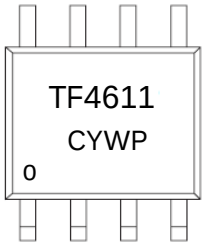



**Schematic diagram**




**N-channel** **P-channel**

**Marking and pin assignment**




**Y :year code W :week code**

## Absolute Maximum Ratings ($T_A$=25℃unless otherwise noted)

| Parameter | | Symbol | N-Channel | P-Channel | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 60 | -60 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | ±20 | V |
| Continuous Drain Current | $T_A$=25℃ | $I_D$ | 6.3 | -6.0 | A |
| Pulsed Drain Current (Note 1) | | $I_{DM}$ | 40 | -30 | A |
| Maximum Power Dissipation | $T_A$=25℃ | $P_D$ | 1.0 | 1.0 | W |
| Operating Junction and Storage Temperature Range | | $T_J$,$T_{STG}$ | -55 To 150 | -55 To 150 | ℃ |

## Thermal Characteristic

| | | | | |
|---|---|---|---|---|
| Thermal Resistance,Junction-to-Ambient (Note2) | $R_{\theta JA}$ | N-Ch | 62.5 | ℃/W |
| Thermal Resistance,Junction-to-Ambient (Note2) | $R_{\theta JA}$ | P-Ch | 64.5 | ℃/W |

## N-CH Electrical Characteristics ($T_A$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 60 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=60V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1.0 | 1.6 | 2.3 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=6.3A | - | 25 | 30 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=5.0A | - | 32 | 38 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=5V,$I_D$=6A | 15 | - | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=25V,$V_{GS}$=0V, F=1.0MHz | - | 1035 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 65.0 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 60.0 | - | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=30V, $I_D$=6.0A $V_{GS}$=10V,$R_G$=3.0Ω | - | 7.00 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 20.0 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 16.0 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 23.0 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=30V,$I_D$=6A, $V_{GS}$=10V | - | 25.0 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 4.50 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 6.50 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=2A | - | 0.76 | 1.0 | V |

**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- Channel Typical Electrical and Thermal Characteristics (Curves)

Figure 1: Output Characteristics

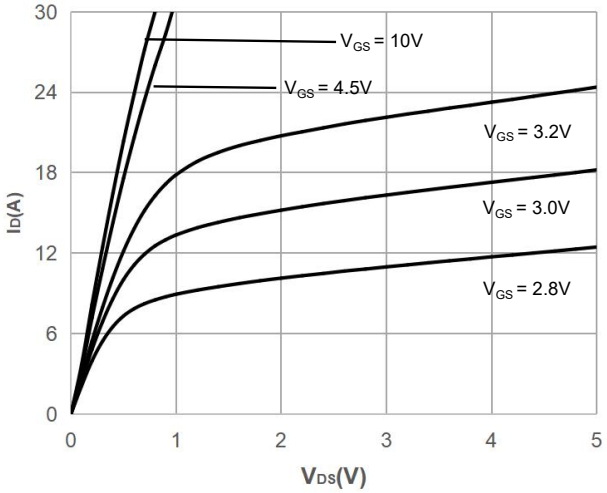



Figure 2: Typical Transfer Characteristics

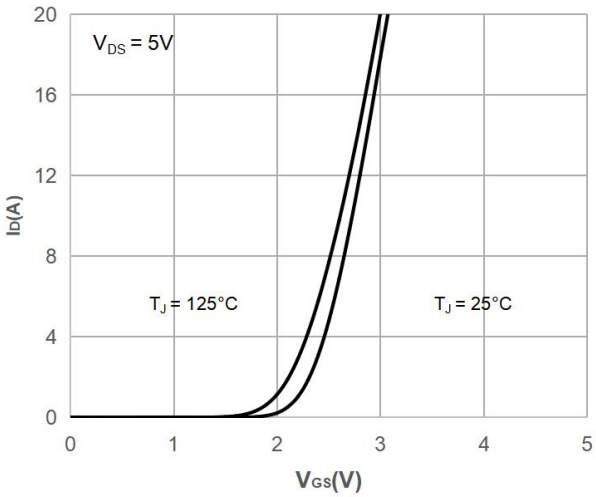



Figure 3: On-resistance vs. Drain Current

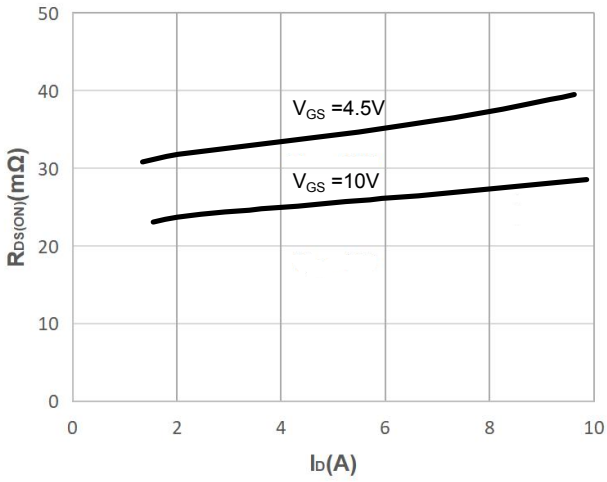



Figure 4: Body Diode Characteristics

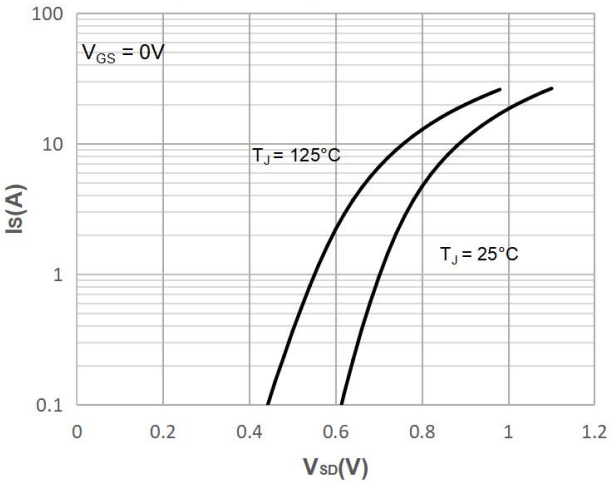



Figure 5: Gate Charge Characteristics

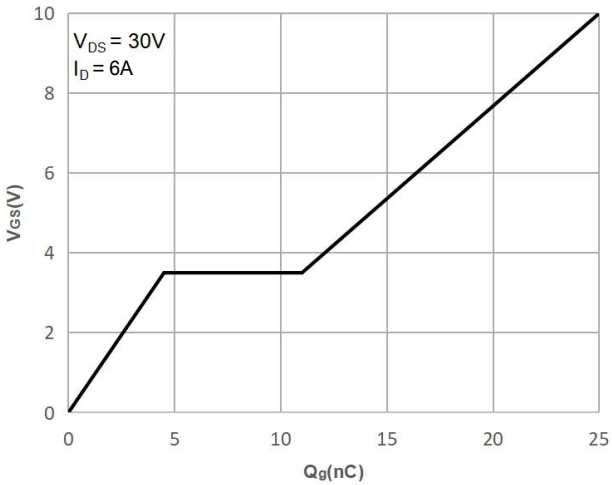
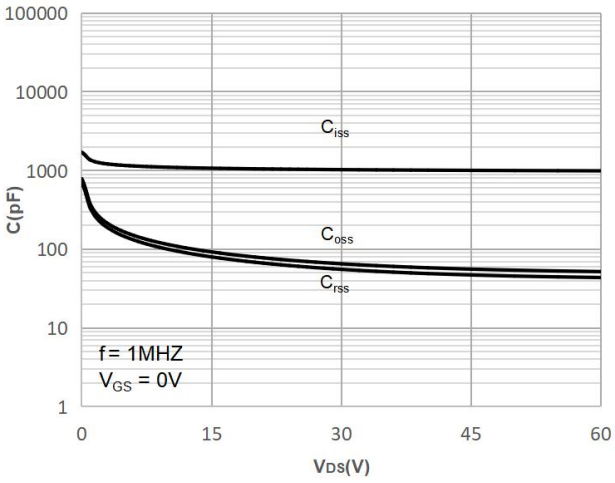



Figure 6: Capacitance Characteristics



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

Figure 7: Normalized Breakdown voltage vs. Junction Temperature

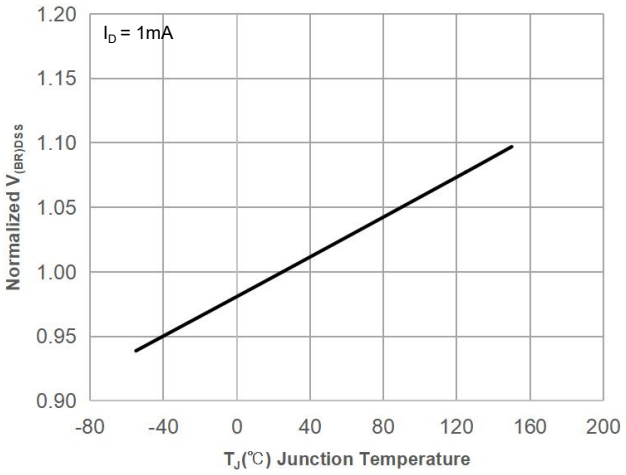



Figure 8: Normalized on Resistance vs. Junction Temperature

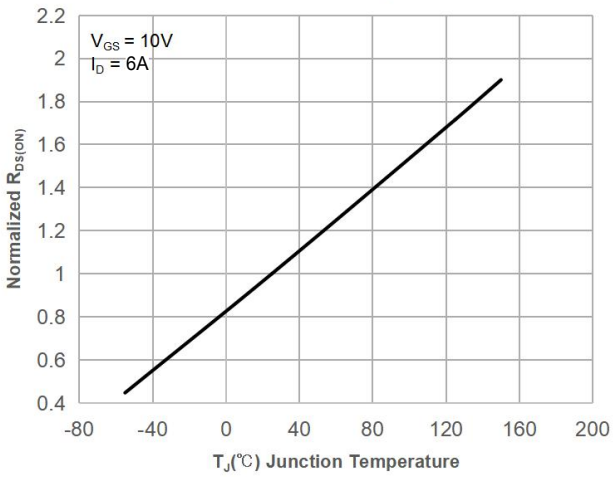



Figure 9: Maximum Safe Operating Area

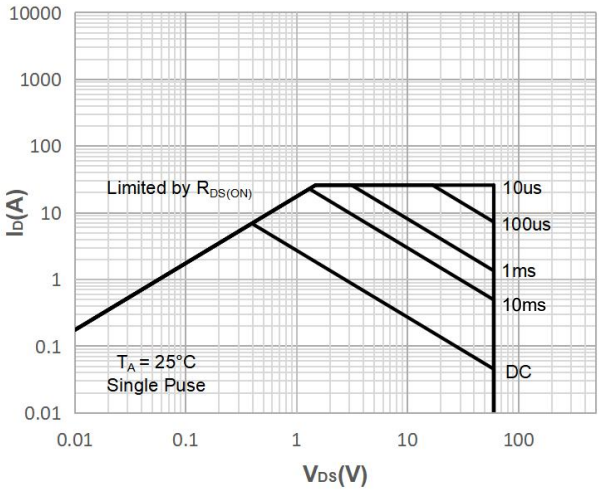



Figure 10: Maximum Continuous Drian Current vs. Case Temperature

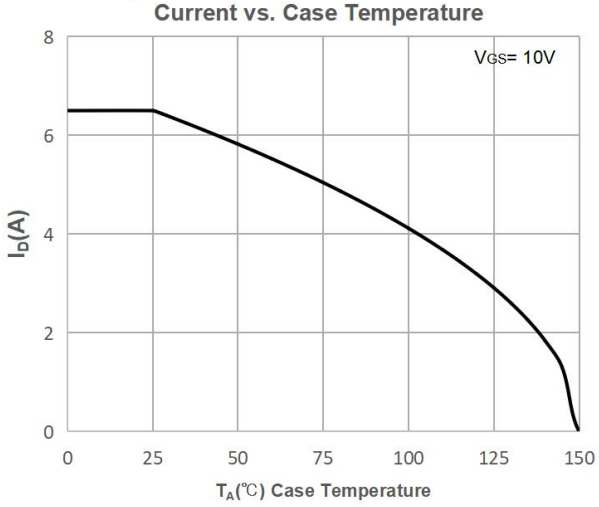



Figure 11: Normalized Maximum Transient Thermal Impedance

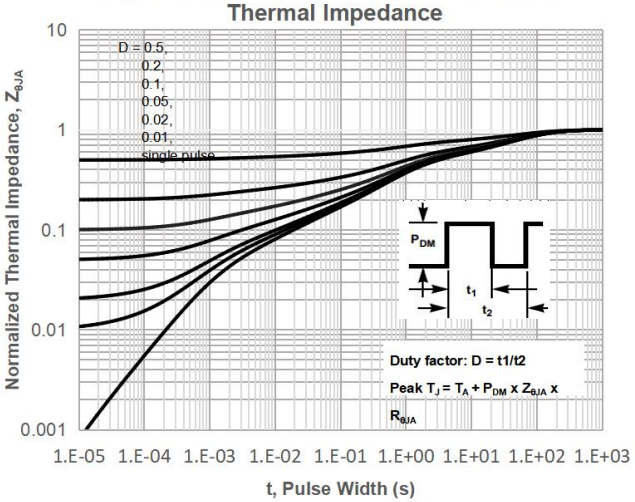
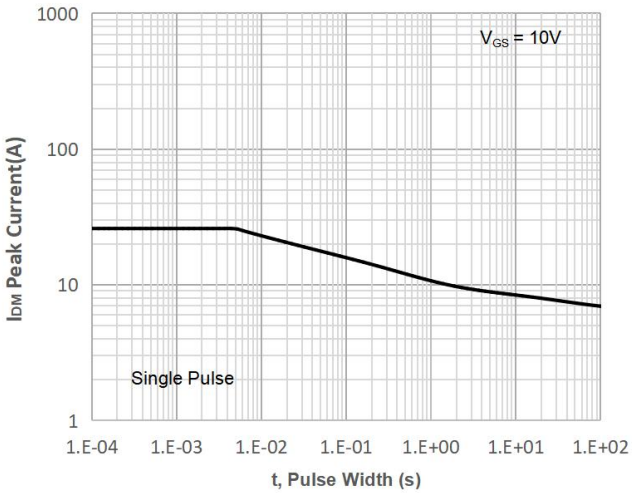



Figure 12: Peak Current Capacity



## P-CH Electrical Characteristics ($T_A$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=-250μA | -60 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-60V,$V_{GS}$=0V | - | - | -1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=-250μA | -1.1 | -1.8 | -2.5 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-6.0A<br>$V_{GS}$=-4.5V, $I_D$=-5.0A | -<br>- | 69<br>85 | 85<br>110 | mΩ<br>mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-5V,$I_D$=-7.0A | 15 | - | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=-20V,$V_{GS}$=0V, F=1.0MHz | - | 1450 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 48.0 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 35.0 | - | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-30V, $R_L$=7Ω<br>$V_{GS}$=-10V,$R_G$=10Ω | - | 9.70 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 5.50 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 29.0 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 6.00 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-20V,$I_D$=-6.0A<br>$V_{GS}$=-10V | - | 23.7 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 2.10 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 7.20 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=-2.0A | - | 0.79 | -1.0 | V |

**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

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

**Figure 1. Output Characteristics**

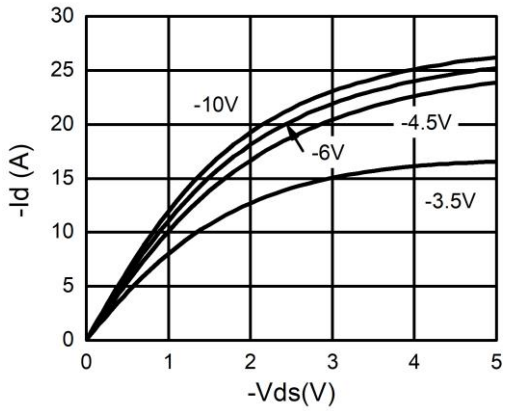



**Figure 2. Transfer Characteristics**

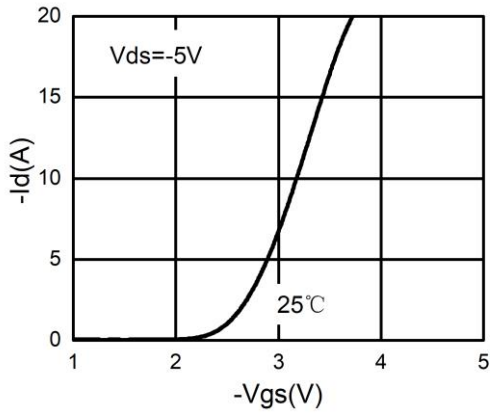



**Figure 3. Power Dissipation**

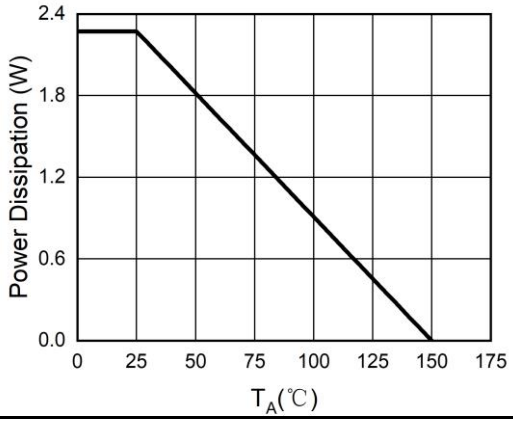



**Figure 4. Drain Current**

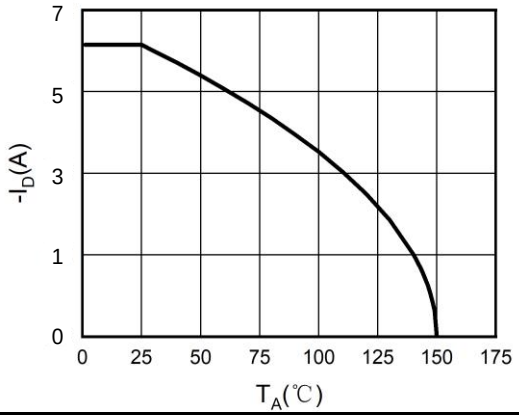



**Figure 5. $BV_{DSS}$ vs Junction Temperature**

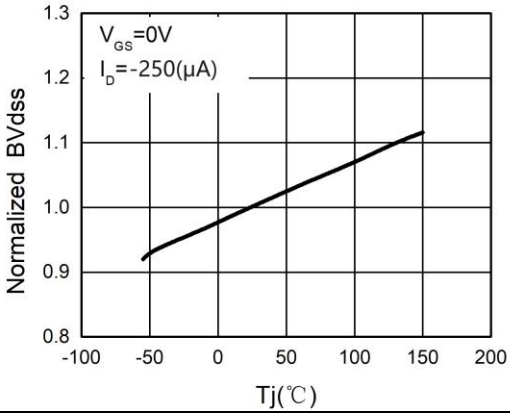
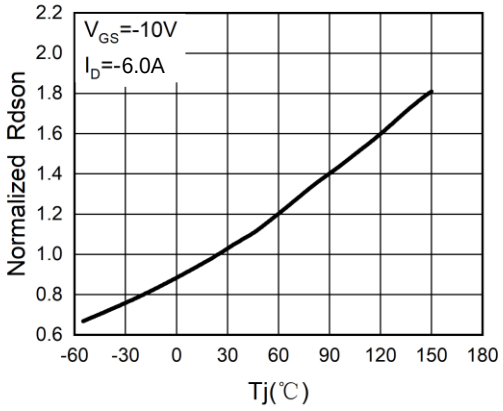



**Figure 6. $R_{DS(ON)}$ vs Junction Temperature**



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

**Figure 7. Gate Charge Waveforms**

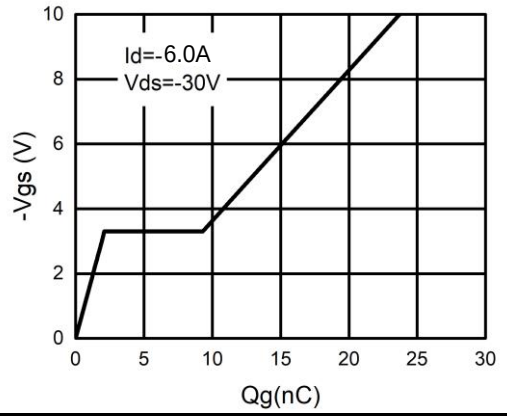



**Figure 8. Capacitance**

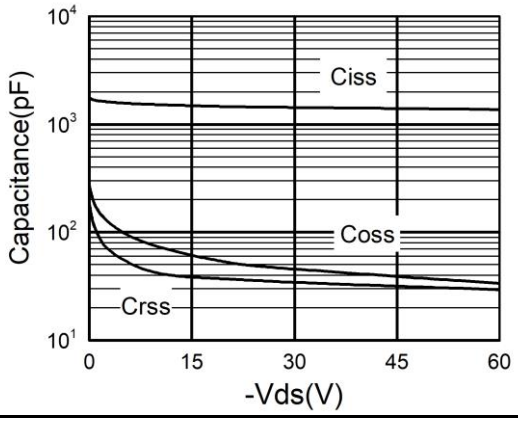



**Figure 9. Body-Diode Characteristics**

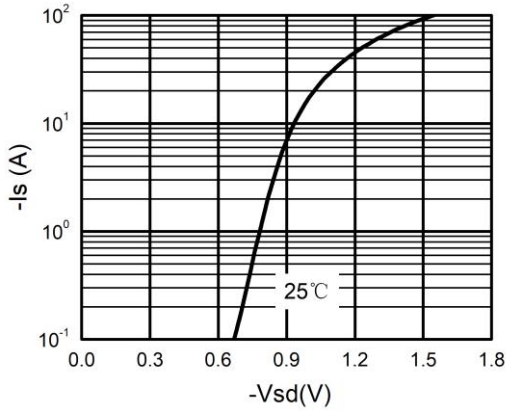
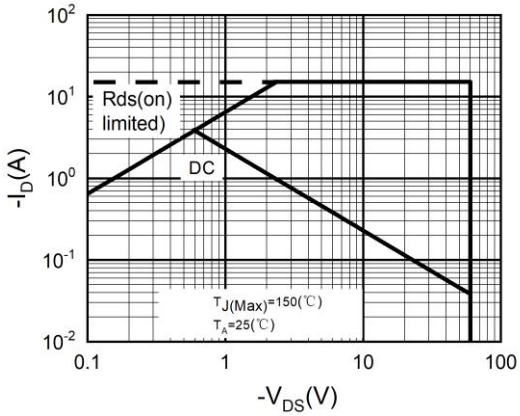


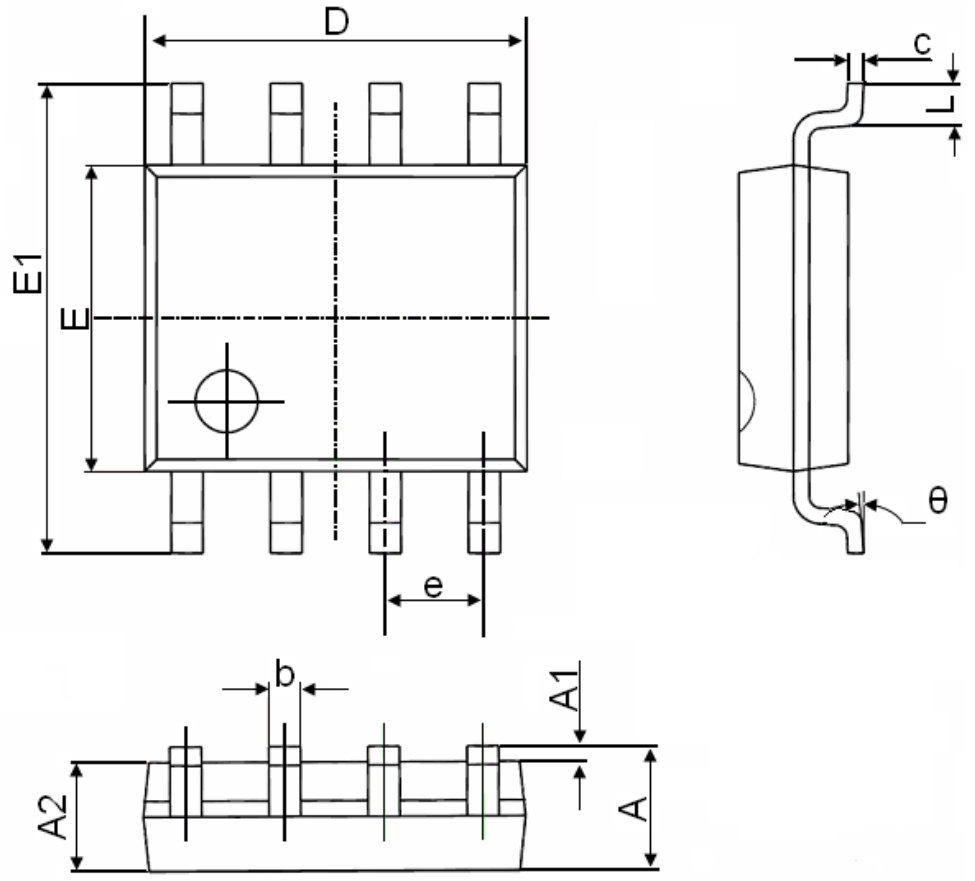

**Figure 10. Maximum Safe Operating Area**



# SOP-8 Plastic-Encapsulate MOSFETS

## *TF4611*

### 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° |