# Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$ | $I_D$ |
|:---:|:---:|:---:|
| -60V | 11mΩ@-10V | -90A |
| | 14mΩ@-4.5V | |

## Feature

- High switching speed
- Improved dv/dt capability
- Low Gate Charge
- Low reverse transfer capacitance

## Application

- Load Switches, Adaptor Switch
- Notebook PCs

## Package
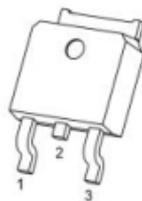


TO-263(G:1 D:2 S:3)

## Circuit diagram
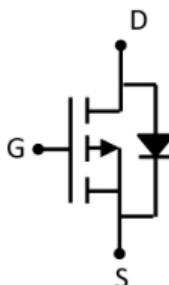
## Marking
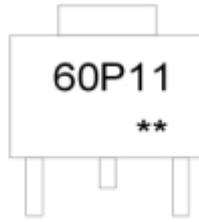


60P11    =Device Code
**        =Week Code

## Absolute maximum ratings

($T_a$=25℃ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | -60 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous（Tc=25℃） | $I_D$ | -90 | A |
| Pulsed Drain Current | $I_{DM}$ | -360 | A |
| Single pulse avalanche energy | $E_{AS}$ | 361 | mJ |
| Maximum Power Dissipation（Tc=25℃） | $P_D$ | 150 | W |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.83 | ℃/W |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55~+150 | ℃ |

# Electrical characteristics

($T_A$=25℃, unless otherwise noted)

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | BV$_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ =-250μA | -60 | | | V |
| Zero Gate Voltage Drain Current | I$_{DSS}$ | $V_{DS}$ =-48V, $V_{GS}$ = 0V | | | -1 | uA |
| Gate-Source Leakage | I$_{GSS}$ | $V_{GS}$ =±20V, $V_{DS}$ =0V | | | ±100 | uA |
| Gate-Source Threshold Voltage | V$_{GS(th)}$ | $V_{DS}$ =$V_{GS}$, $I_D$ =-250μA | -1 | -1.5 | -2.5 | V |
| Drain-Source On-Resistance | R$_{DS(on)}$ | $V_{GS}$ =-10V, $I_D$ =-20A | | 11 | 14 | mΩ |
| | | $V_{GS}$ =-4.5V, $I_D$ =-20A | | 14 | 18.5 | |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | C$_{iss}$ | $V_{DS}$=-30V, $V_{GS}$=0V, f=1MHz | | 7700 | | pF |
| Output Capacitance | C$_{oss}$ | | | 489 | | |
| Reverse Transfer Capacitance | C$_{rss}$ | | | 364 | | |
| **Switching Characteristics** | | | | | | |
| Turn-on Delay Time | T$_{d(on)}$ | $V_{DD}$ =-30V, $R_L$=4.7Ω, $V_{GEN}$=-10V, $R_{GEN}$=3Ω | | 9.8 | | nS |
| Turn-on Rise Time | T$_r$ | | | 6.1 | | |
| Turn-off Delay Time | T$_{d(off)}$ | | | 44 | | |
| Turn-off Fall Time | T$_f$ | | | 12.7 | | |
| Total Gate Charge | Q$_g$ | $V_{DS}$=-30V, $V_{GS}$=-10V, $I_D$=-20A | | 85.5 | 55 | nC |
| Gate-Source Charge | Q$_{gs}$ | | | 12.1 | | |
| Gate-Drain Charge | Q$_{gd}$ | | | 23.2 | | |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage | V$_{SD}$ | $I_{SD}$=-1A,$V_{GS}$=0V | | | -1.2 | V |

**Notes:**

1. E$_{AS}$ condition: $T_j$=25℃,$V_{DD}$=-30V,$V_G$=-10V,L=0.5mH,Rg=25Ω

## Typical Characteristics
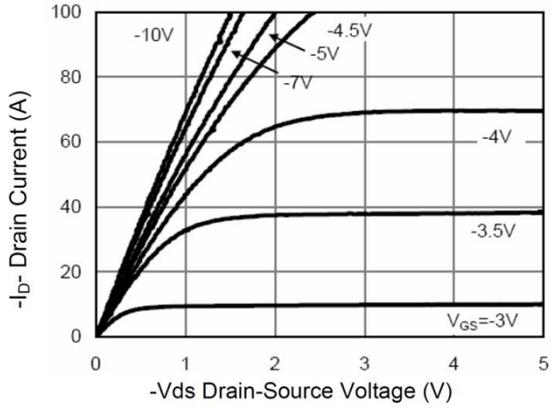


**Output Characteristics**
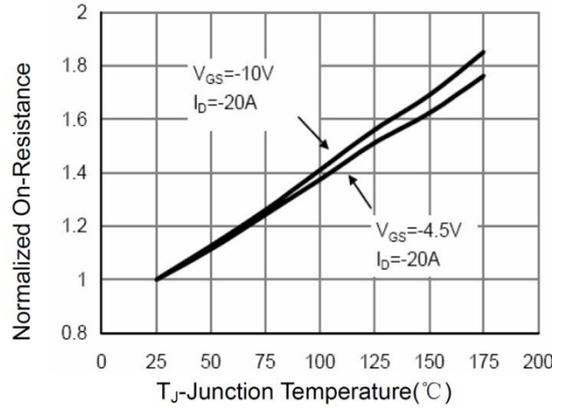


**Rdson-Junction Temperature**
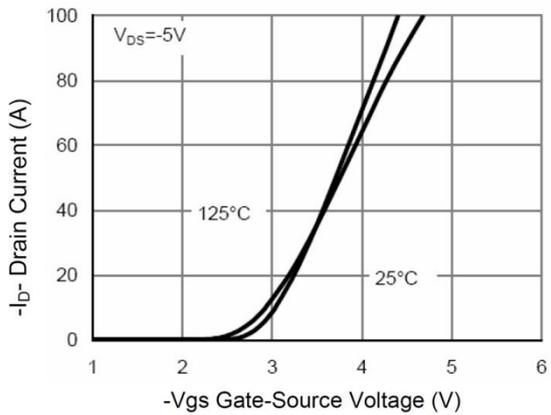


**Transfer Characteristics**
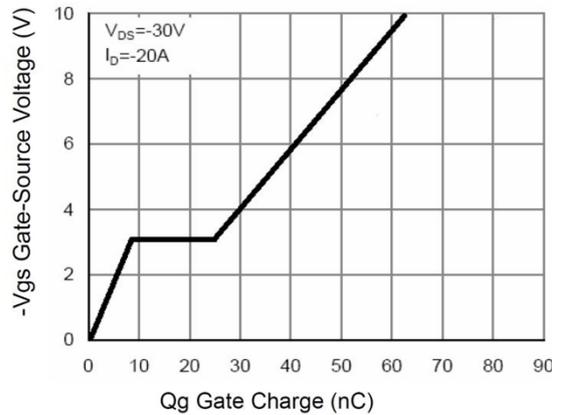


**Gate Charge**
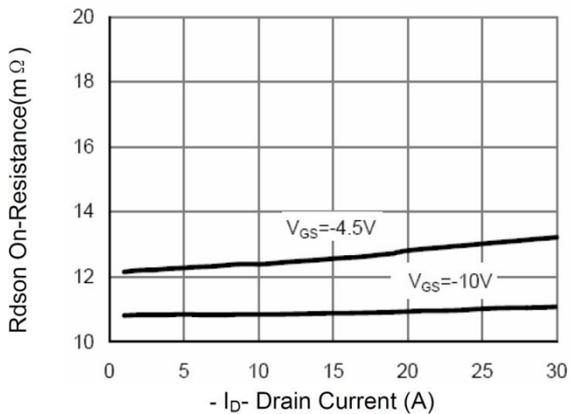


**Rdson- Drain Current**
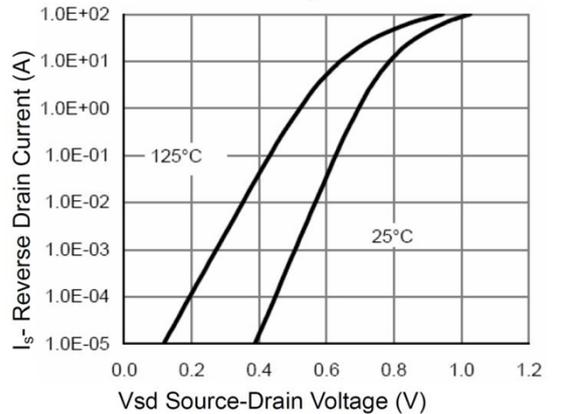


**Source- Drain Diode Forward**

**Capacitance vs Vds**



**BV_DSS vs Junction Temperature**



**Safe Operation Area**



**ID Current Derating vs Junction Temperature**



**Normalized Maximum Transient Thermal Impedance**
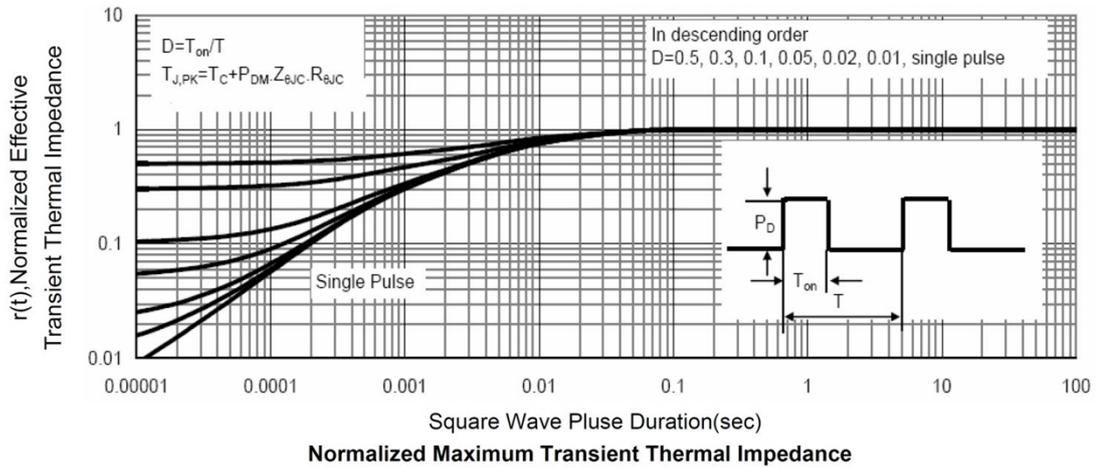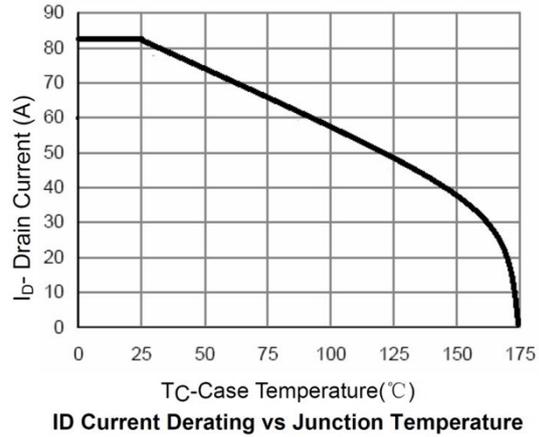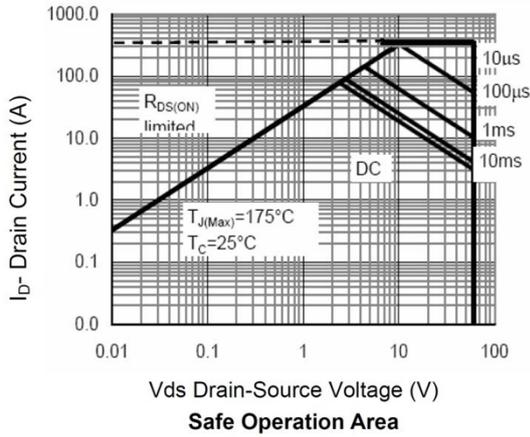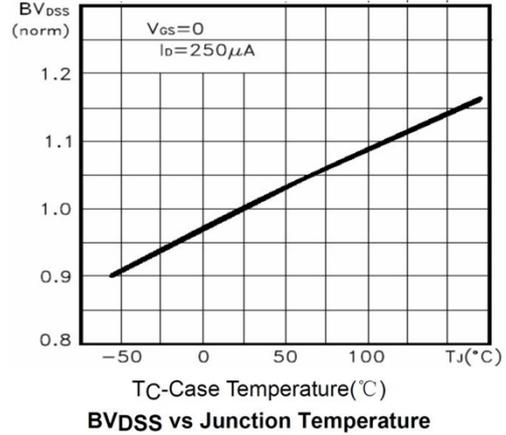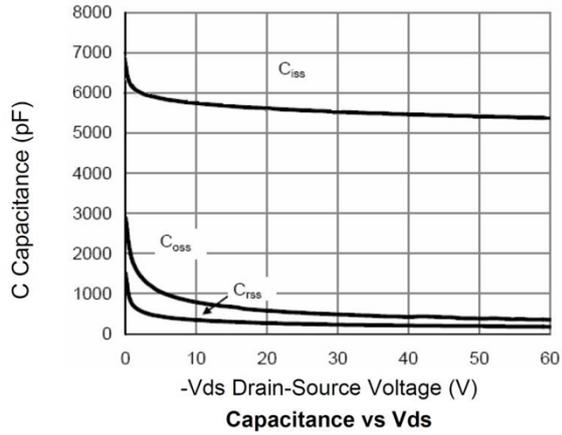
## TO-263 Package Information
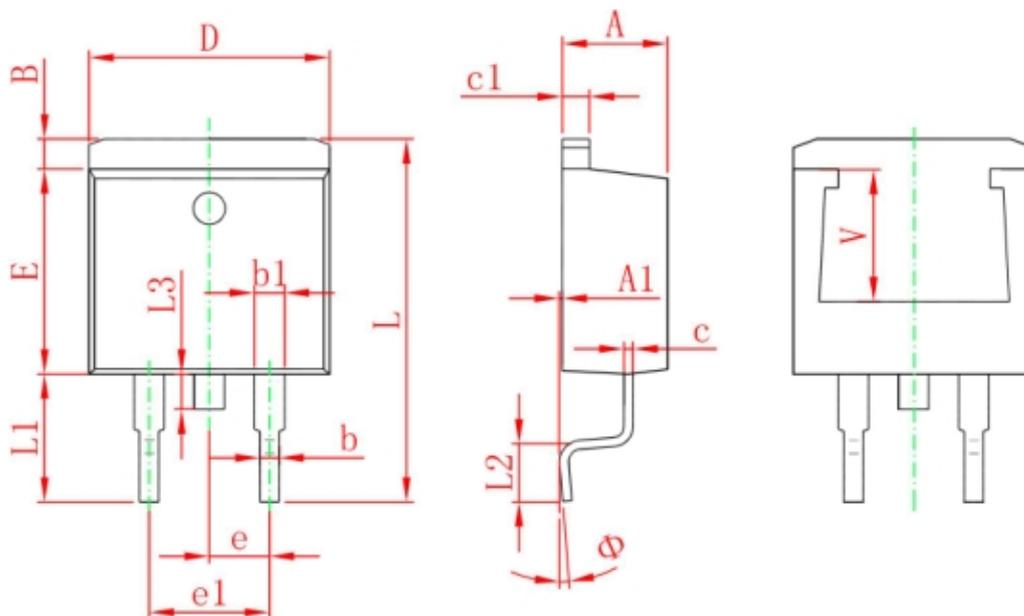


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.470 | 4.670 | 0.176 | 0.184 |
| A1 | 0.000 | 0.150 | 0.000 | 0.006 |
| B | 1.120 | 1.420 | 0.044 | 0.056 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 1.370 | 0.046 | 0.054 |
| c | 0.310 | 0.530 | 0.012 | 0.021 |
| c1 | 1.170 | 1.370 | 0.046 | 0.054 |
| D | 10.010 | 10.310 | 0.394 | 0.406 |
| E | 8.500 | 8.900 | 0.335 | 0.350 |
| e | 2.540 TYP. | | 0.100 TYP. | |
| e1 | 4.980 | 5.180 | 0.196 | 0.204 |
| L | 14.940 | 15.500 | 0.588 | 0.610 |
| L1 | 4.950 | 5.450 | 0.195 | 0.215 |
| L2 | 2.340 | 2.740 | 0.092 | 0.108 |
| L3 | 1.300 | 1.700 | 0.051 | 0.067 |
| Φ | 0° | 8° | 0° | 8° |
| V | 5.600 REF. | | 0.220 REF. | |