



## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$ | $I_D$ |
|---------------|-----------------|-------|
| 60V           | 13.5mΩ@10V      | 10A   |
|               | 16.5mΩ@4.5V     |       |

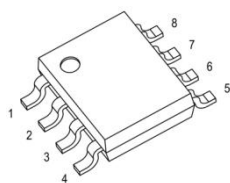
## Feature

- Fast Switching
- Extremely low switching loss
- Excellent Rdson and Low Gate Charge

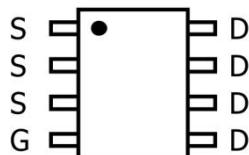
## Application

- Power Management
- Switched mode power supply

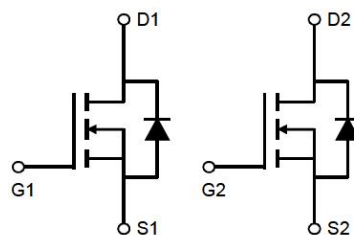
## Package



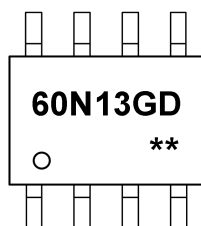
SOP-8L



## Circuit diagram



## Marking



60N13GD      =Device Code  
\*\*                =Week Code

**Absolute maximum ratings (Ta=25°C unless otherwise noted)**

| Parameter                                         | Symbol          | Value      | Unit |
|---------------------------------------------------|-----------------|------------|------|
| Drain-source voltage                              | $V_{DS}$        | 60         | V    |
| Gate-source voltage                               | $V_{GS}$        | $\pm 20$   | V    |
| Continuous drain current <sup>1)</sup> , TC=25 °C | $I_D$           | 10         | A    |
| Pulsed drain current <sup>2)</sup> , TC=25 °C     | $I_{DM}$        | 40         | A    |
| Power dissipation <sup>3)</sup>                   | $P_D$           | 3.5        | W    |
| Single pulsed avalanche energy <sup>4)</sup>      | $E_{AS}$        | 95         | mJ   |
| Thermal resistance, junction-Ambient              | $R_{\theta JA}$ | 37.8       | °C/W |
| Operation and storage temperature                 | $T_{stg}, T_j$  | -55 to 150 | °C   |

**Electrical characteristics (Ta=25 °C, unless otherwise noted)**

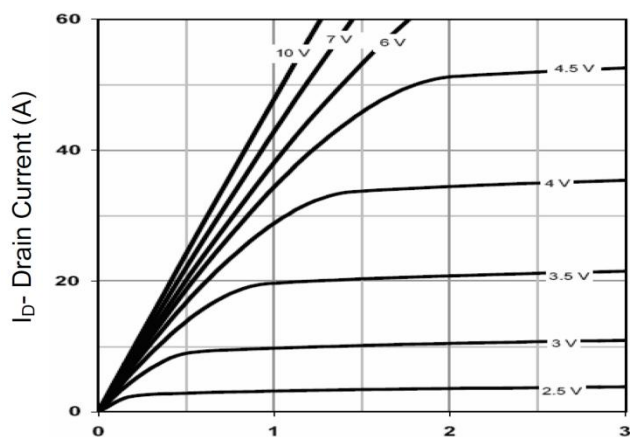
| Parameter                        | Symbol            | Test condition                        | Min. | Typ. | Max. | Unit |
|----------------------------------|-------------------|---------------------------------------|------|------|------|------|
| Static Characteristics           |                   |                                       |      |      |      |      |
| Drain-source breakdown voltage   | BV <sub>DSS</sub> | VGS=0 V, ID=250 μA                    | 60   |      |      | V    |
| Gate-source leakage current      | IGSS              | VGS=±20 V                             |      |      | ±100 | nA   |
| Drain-source leakage current     | IDSS              | VDS=48 V, VGS=0 V                     |      |      | 1    | μA   |
| Gate threshold voltage           | VGS(th)           | VDS=VGS, ID=250 μA                    | 1    | 1.8  | 2.5  | V    |
| Drain-source on-state resistance | RDS(ON)           | VGS=10 V, ID=8 A                      |      | 13.5 | 17   | mΩ   |
|                                  |                   | VGS=4.5 V, ID=8 A                     |      | 16.5 | 21   |      |
| Dynamic Characteristics          |                   |                                       |      |      |      |      |
| Input capacitance                | Ciss              | VGS=0 V, VDS=25V, f=1MHz              |      | 980  |      | pF   |
| Output capacitance               | Coss              |                                       |      | 240  |      |      |
| Reverse transfer capacitance     | Crss              |                                       |      | 9.5  |      |      |
| Total gate charge                | Qg                | VGS=10 V, VDS=30 V, ID=10 A           |      | 22   |      | nC   |
| Gate-source charge               | Qgs               |                                       |      | 5    |      |      |
| Gate-drain charge                | Qgd               |                                       |      | 4.2  |      |      |
| Switching Characteristics        |                   |                                       |      |      |      |      |
| Turn-on delay time               | td(on)            | VGS=10 V, VDS=30 V, RG=1.6 Ω, ID=10 A |      | 12   |      | ns   |
| Rise time                        | tr                |                                       |      | 18   |      |      |
| Turn-off delay time              | td(off)           |                                       |      | 19   |      |      |
| Fall time                        | tf                |                                       |      | 5    |      |      |
| Body Diode Characteristics       |                   |                                       |      |      |      |      |
| Diode forward voltage            | VSD               | IS=1 A, VGS=0 V                       |      |      | 1.2  | V    |

**Note:**

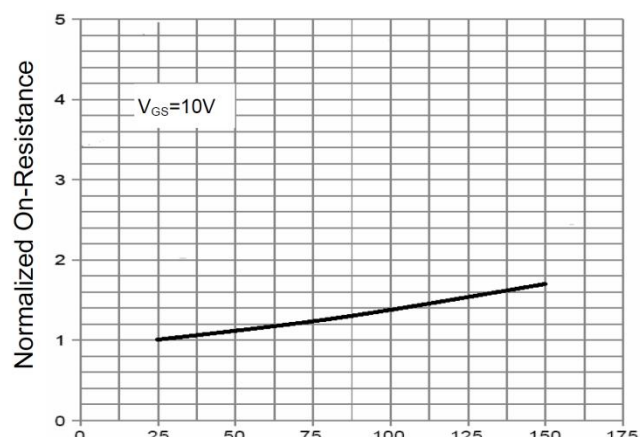
1. Calculated continuous current based on maximum allowable junction temperature.
2. Repetitive rating; pulse width limited by max. junction temperature.
3.  $P_D$  is based on max. junction temperature, using junction-case thermal resistance.
4.  $V_{DD}=30\text{ V}, V_{GS}=10\text{ V}, L=0.5\text{ mH}$ , starting  $T_j=25\text{ }^\circ\text{C}$ .



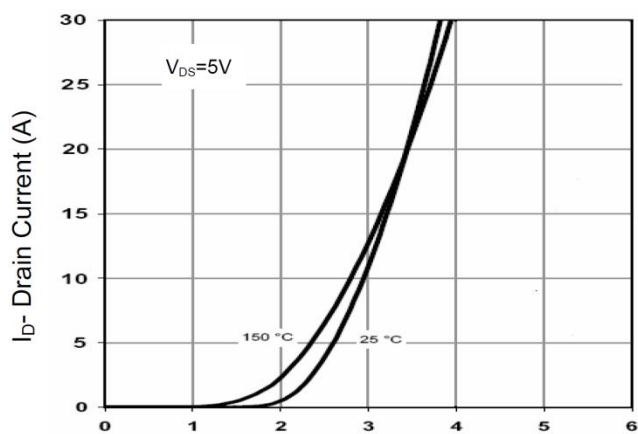
Typical Characteristics



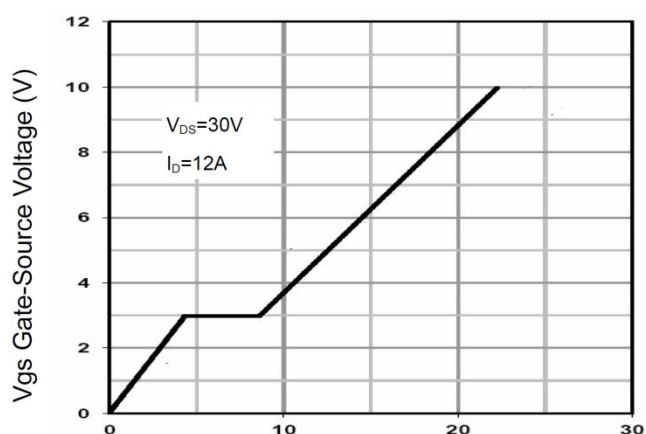
$V_{DS}$  Drain-Source Voltage (V)  
Output Characteristics



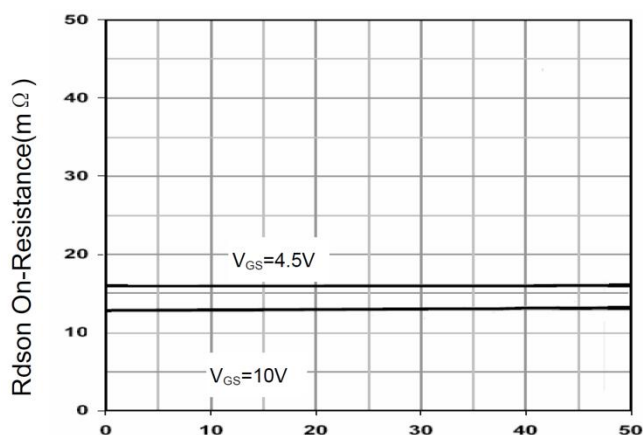
$T_J$ -Junction Temperature ( $^{\circ}C$ )  
 $R_{DS(on)}$ -Junction Temperature



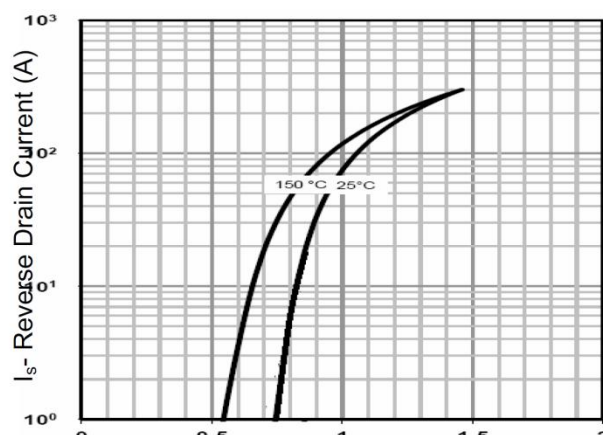
$V_{GS}$  Gate-Source Voltage (V)  
Transfer Characteristics



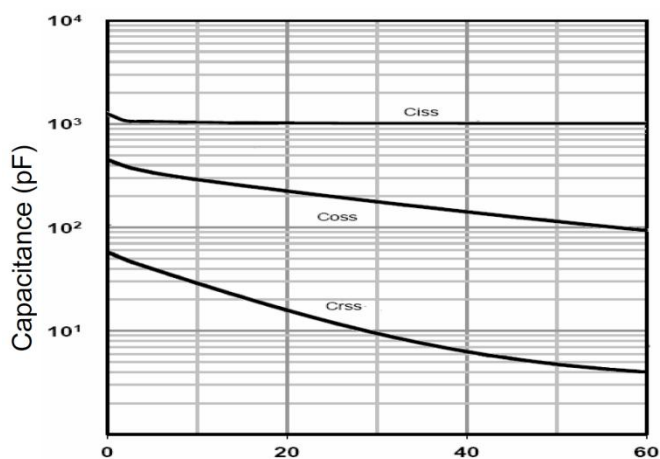
$Q_g$  Gate Charge (nC)  
Gate Charge



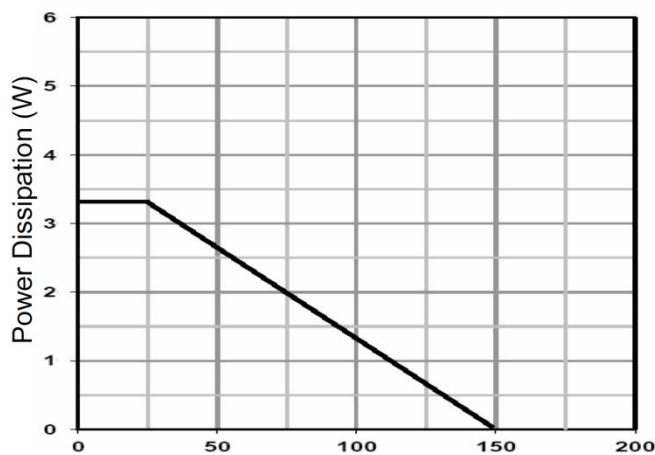
$I_D$  Drain Current (A)  
 $R_{DS(on)}$  - Drain Current



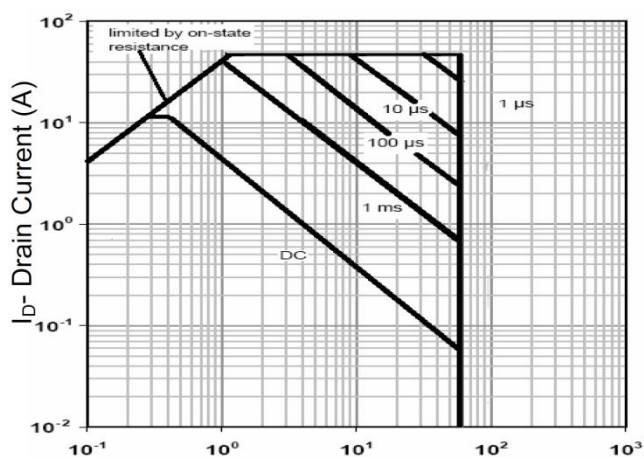
$V_{SD}$  Source-Drain Voltage (V)  
Source- Drain Diode Forward



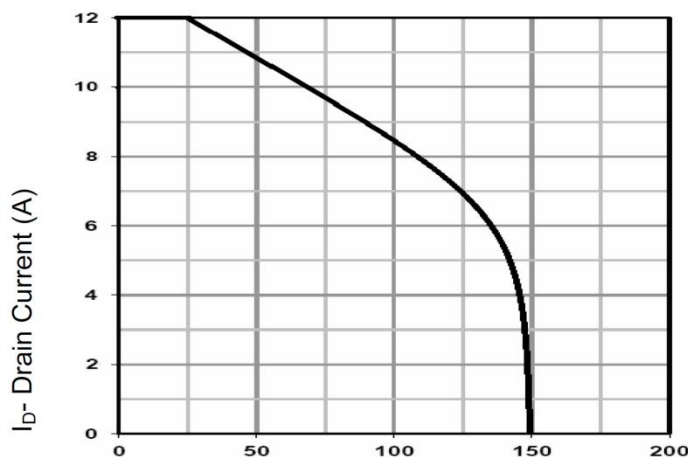
$V_{ds}$  Drain-Source Voltage (V)  
**Capacitance vs  $V_{ds}$**



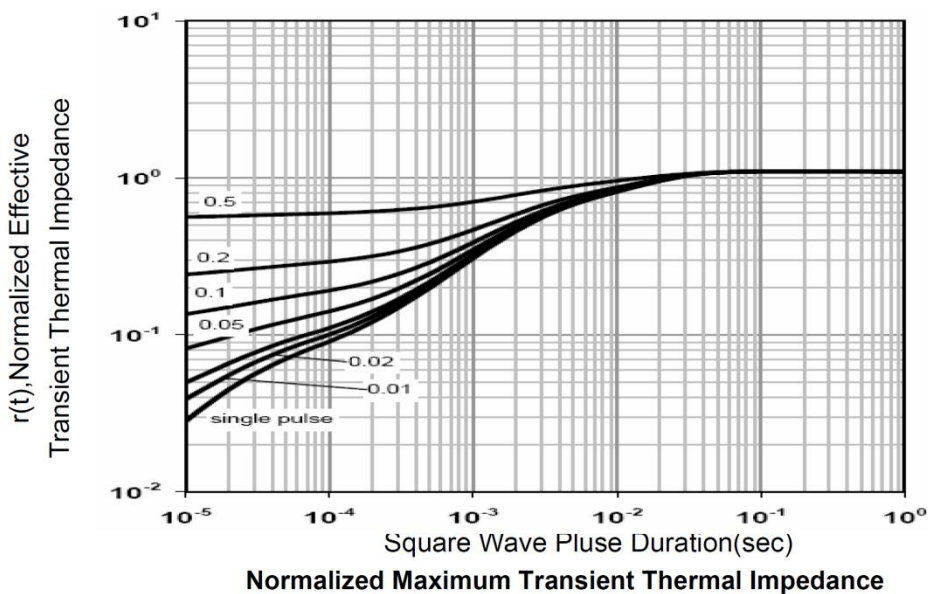
$T_J$ -Junction Temperature( $^{\circ}C$ )  
**Power De-rating**



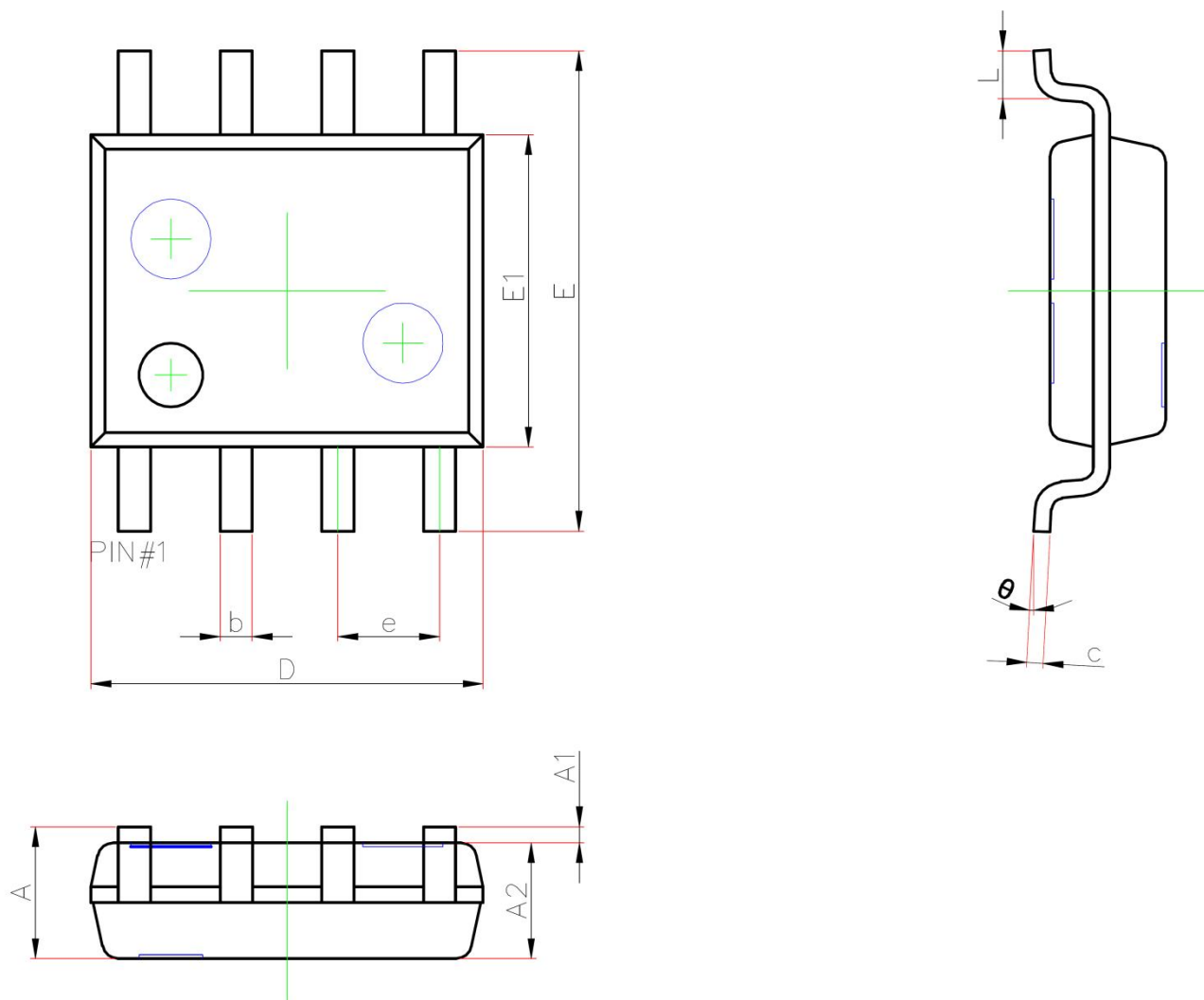
$V_{ds}$  Drain-Source Voltage (V)  
**Safe Operation Area**



$T_J$ -Junction Temperature ( $^{\circ}C$ )  
**Current De-rating**



**SOP-8 Package Information**



| Symbol   | Dimensions In Millimeters |      |
|----------|---------------------------|------|
|          | Min.                      | Max. |
| A        | 1.35                      | 1.75 |
| A1       | 0.10                      | 0.25 |
| A2       | 1.35                      | 1.55 |
| b        | 0.33                      | 0.51 |
| c        | 0.17                      | 0.25 |
| D        | 4.80                      | 5.00 |
| e        | 1.27 REF.                 |      |
| E        | 5.80                      | 6.20 |
| E1       | 3.80                      | 4.00 |
| L        | 0.40                      | 1.27 |
| $\theta$ | 0°                        | 8°   |