

### Product Summary

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

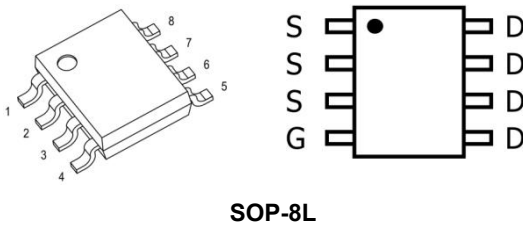
### Feature

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

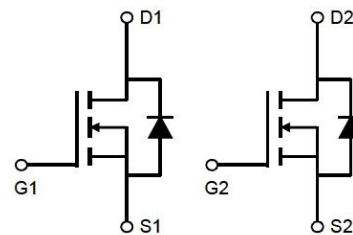
### Application

- Power Management
- Switched mode power supply

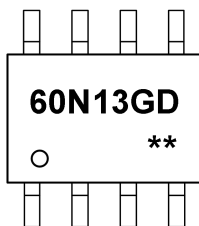
### Package



### 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	$V_{GS}$	±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)**

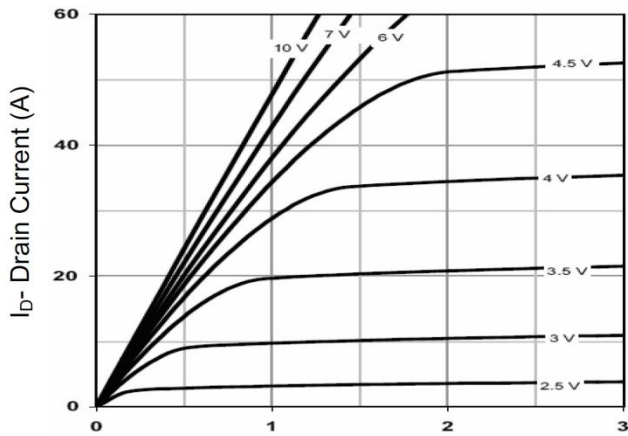
Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$	60			V
Gate-source leakage current	$I_{GSS}$	$V_{GS}=\pm 20\text{ V}$			±100	nA
Drain-source leakage current	$I_{DSS}$	$V_{DS}=48\text{ V}, V_{GS}=0\text{ V}$			1	μA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\ \mu\text{A}$	1	1.8	2.5	V
Drain-source on-state resistance	$R_{DS(ON)}$	$V_{GS}=10\text{ V}, I_D=8\text{ A}$		13.5	17	mΩ
		$V_{GS}=4.5\text{ V}, I_D=8\text{ A}$		16.5	21	
<b>Dynamic Characteristics</b>						
Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V}, f=1\text{ MHz}$		980		pF
Output capacitance	$C_{oss}$			240		
Reverse transfer capacitance	$C_{rss}$			9.5		
Total gate charge	$Q_g$	$V_{GS}=10\text{ V}, V_{DS}=30\text{ V}, I_D=10\text{ A}$		22		nC
Gate-source charge	$Q_{gs}$			5		
Gate-drain charge	$Q_{gd}$			4.2		
<b>Switching Characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{GS}=10\text{ V}, V_{DS}=30\text{ V}, R_G=1.6\ \Omega, I_D=10\text{ A}$		12		ns
Rise time	$t_r$			18		
Turn-off delay time	$t_{d(off)}$			19		
Fall time	$t_f$			5		
<b>Body Diode Characteristics</b>						
Diode forward voltage	$V_{SD}$	$I_S=1\text{ A}, V_{GS}=0\text{ V}$			1.2	V

**Note:**

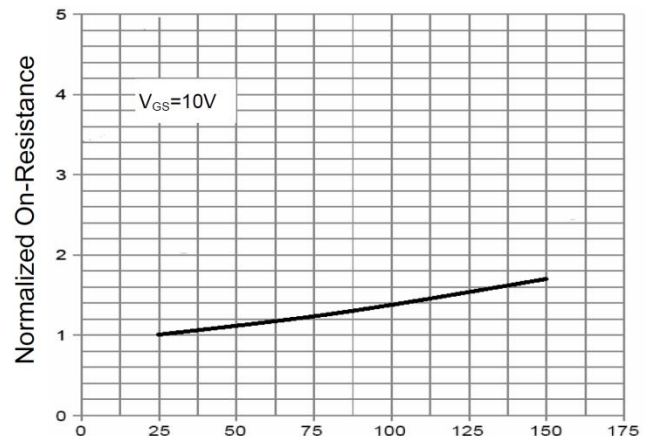
1. Calculated continuous current based on maximum allowable junction temperature.
2. Repetitive rating; pulse width limited by max. junction temperature.
3.  $P_D$  is based on max. junction temperature, using junction-case thermal resistance.
4.  $V_{DD}=30\text{ V}, V_{GS}=10\text{ V}, L=0.5\text{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



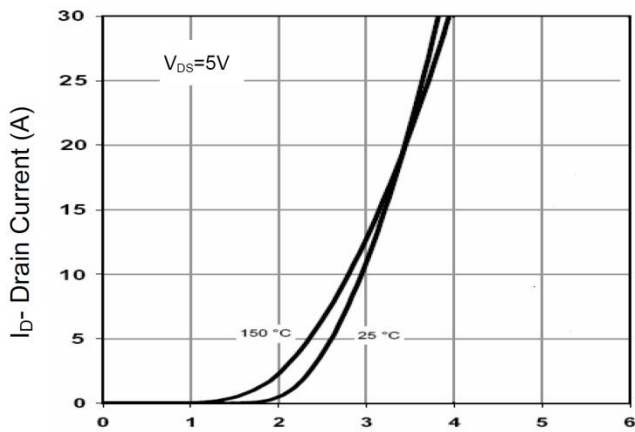
Typical Characteristics



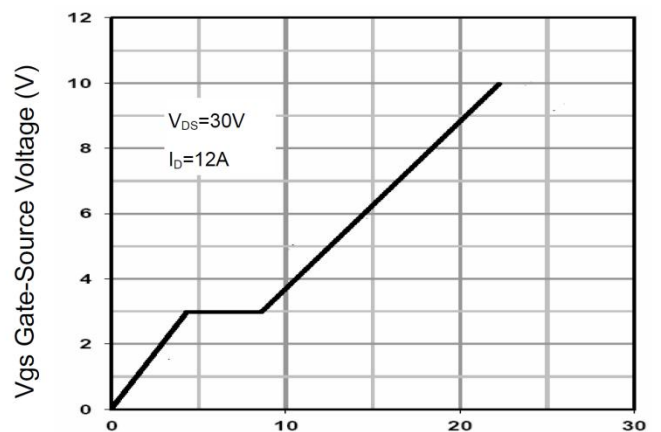
$V_{DS}$  Drain-Source Voltage (V)  
Output Characteristics



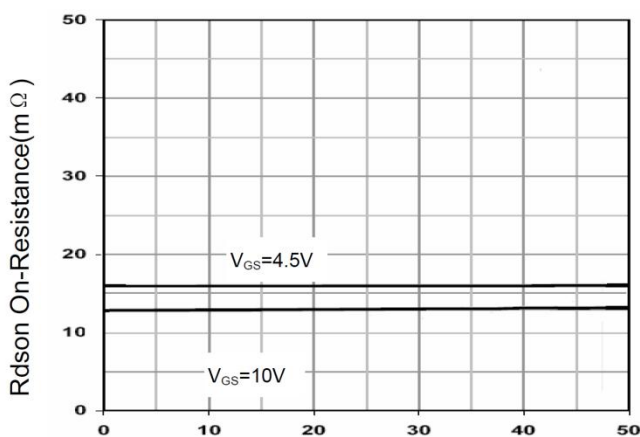
$T_J$ -Junction Temperature ( $^{\circ}C$ )  
 $R_{dson}$ -Junction Temperature



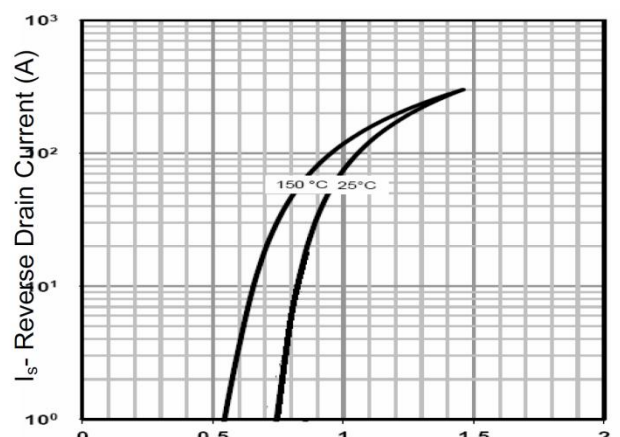
$V_{GS}$  Gate-Source Voltage (V)  
Transfer Characteristics



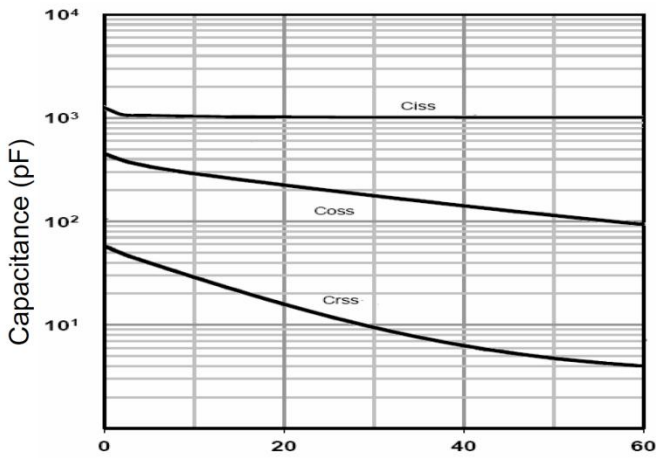
$Q_g$  Gate Charge (nC)  
Gate Charge



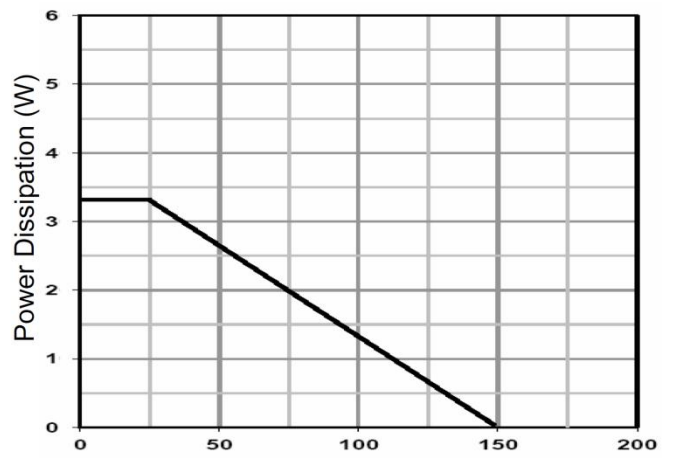
$I_D$ - Drain Current (A)  
 $R_{dson}$ - Drain Current



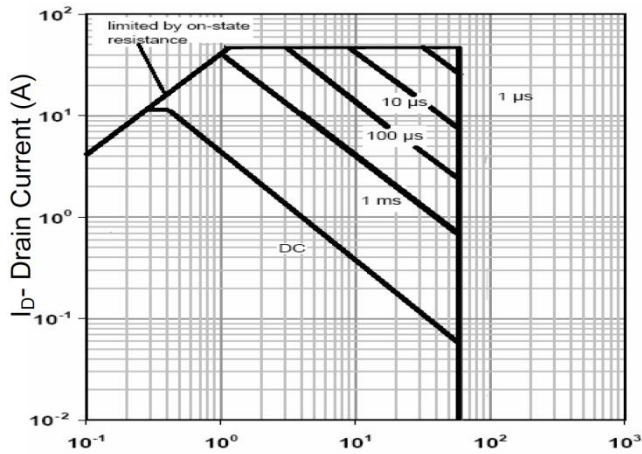
$V_{SD}$  Source-Drain Voltage (V)  
Source- Drain Diode Forward



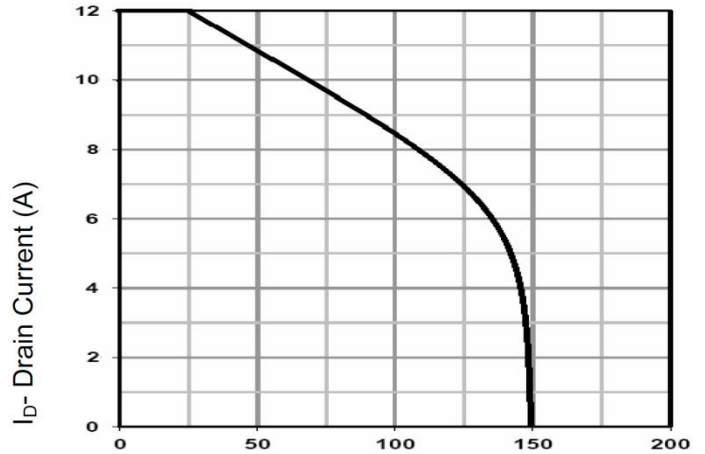
V<sub>ds</sub> Drain-Source Voltage (V)  
Capacitance vs V<sub>ds</sub>



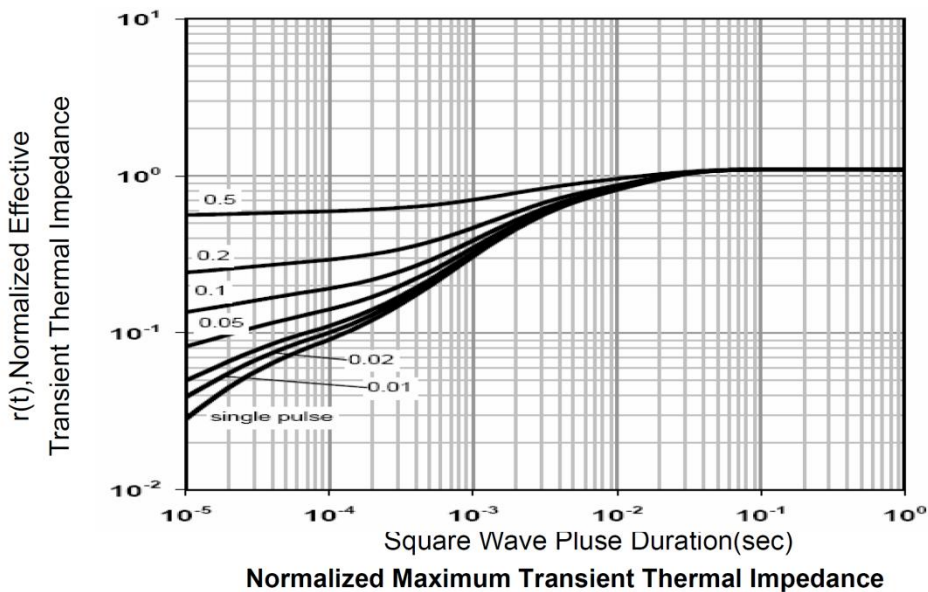
T<sub>J</sub>-Junction Temperature(°C)  
Power De-rating

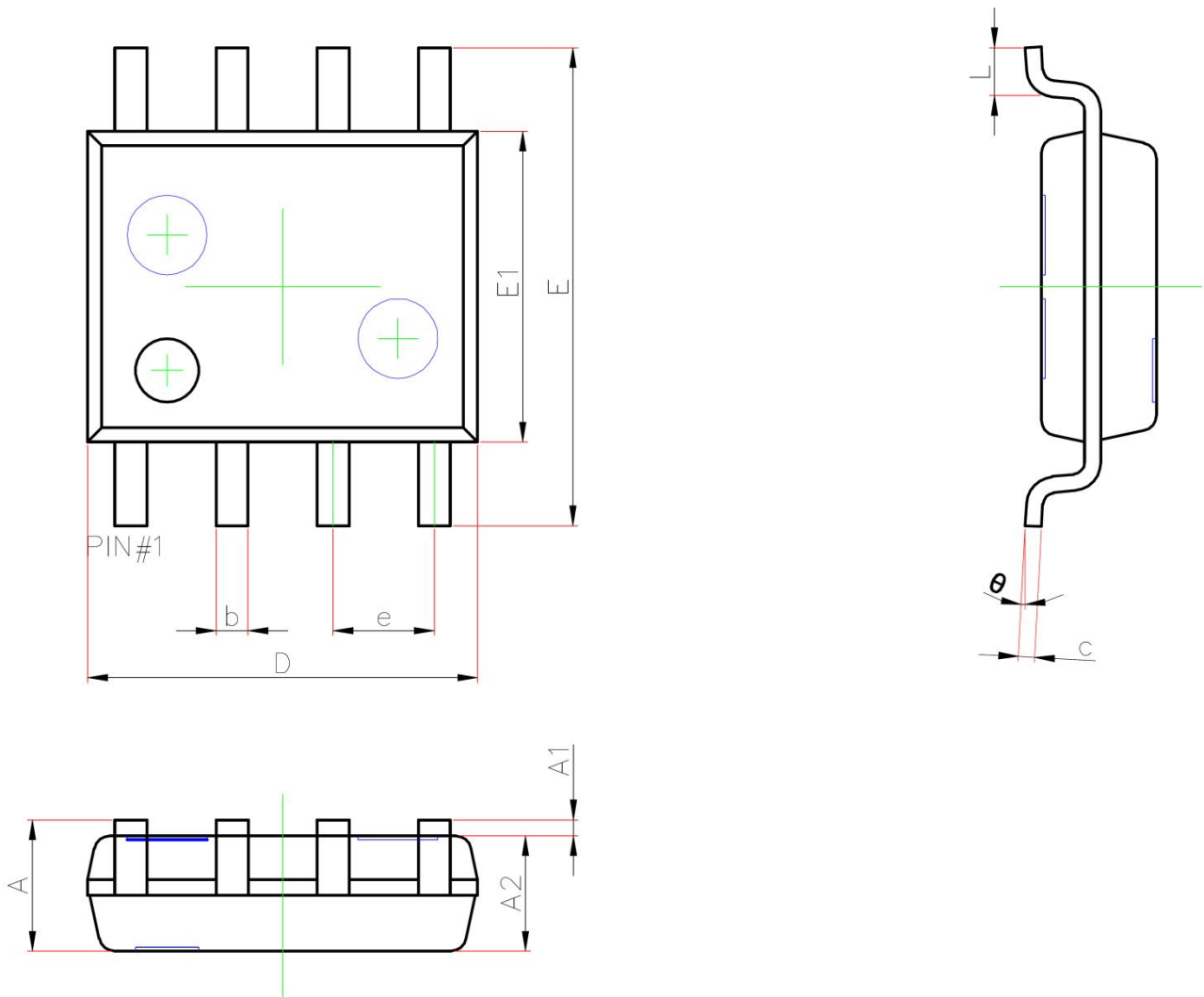


V<sub>ds</sub> Drain-Source Voltage (V)  
Safe Operation Area



T<sub>J</sub>-Junction Temperature (°C)  
Current De-rating





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°

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