Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
60V	13mΩ@10V	50A

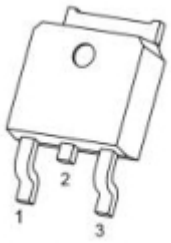
Feature

- V_{DS} =60V,I_D =50A
- $R_{DS(ON)}$ <20mΩ @ V_{GS}=10V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high EAS
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

Applications

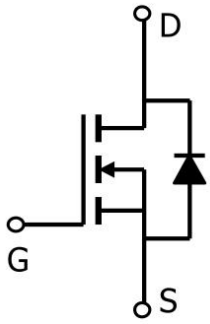
- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

Package

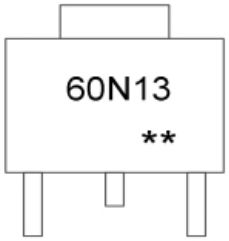


TO-252-2L(G:1 D:2 S:3)

Circuit diagram



Marking



60N13 : Product 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	I_D	50	A
Drain Current-Continuous (T_C=100℃)	$I_{D\ (100°C)}$	35.4	A
Pulsed Drain Current (T_C=25℃)	I_{DM}	200	A
Maximum Power Dissipation	P_D	85	W
Derating facto		0.57	W /°C
Single pulse avalanche energy (Note 5)	E_{AS}	300	mJ
Thermal Resistance,Junction-to-Case(Note 2)	$R_{\theta JC}$	1.8	°C/W
Operating Junction and Storage Temperature Range	$T_{STG,,}$ T_J	-55 to 150	°C

Electrical characteristics

(T_A=25℃, unless otherwise noted)

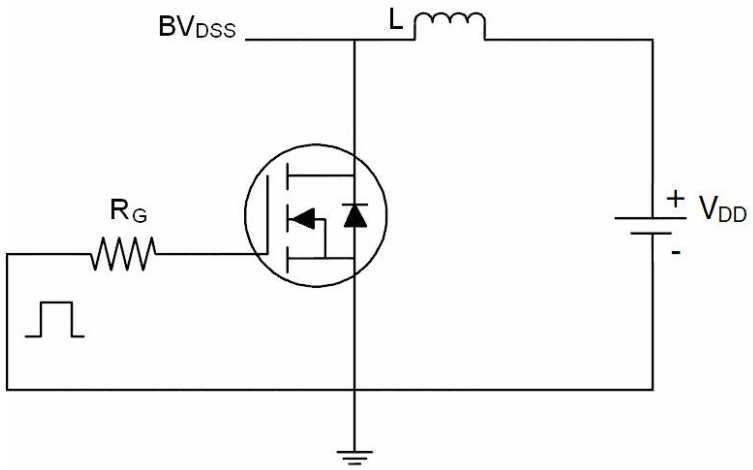
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	$BV_{(BR)DSS}$	V_{GS} = 0V, I_D =250μA	60			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} =60V, V_{GS} = 0V			1	uA
Gate-Body Leakage Current	I_{GSS}	V_{GS} =±20V, V_{DS} = 0V			±100	uA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} =V_{GS}, I_D =250μA	1.2	1.8	2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} =10V, I_D =20A		13	20	mΩ
		V_{GS} =4.5V, I_D =20A		17	25	
Forward Transconductance	g_{FS}	V_{DS}=5V, I_D=20A	18			S
Dynamic Characteristics (Note 4)						
Input capacitance	C_{iss}	V_{DS}=30V, V_{GS}=0V, f=1MHz		2050		pF
Output capacitance	C_{oss}			158		
Reverse transfer capacitance	C_{rss}			120		
Switching Characteristics(Note 4)						
Turn-on Delay Time	$T_{d(on)}$	V_{DD}=30V,R_G =6.7Ω V_{GS}=10V,, I_D =3Ω		7.4		nS
Turn-on Rise Time	T_r			5.1		
Turn-Off Delay Time	$T_{d(off)}$			28.2		
Turn-Off Fall Time	t_f			5.5		
Total Gate Charge	Q_g	V_{DS}=30V , I_D =20A , V_{GS}=10V,		50		pF
Gate-Source Charge	Q_{gs}			6		
Gate-Drain Charge	Q_{gd}			15		
Drain-Source Body Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	V_{GS}=0V ,I_S=20A			1.2	V
Diode Forward Current (Note 2)	I_S				50	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F =20A di/dt = 100A/μs(Note3)		28		nS
Reverse Recovery Charge	Q_{rr}			40		nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Note：

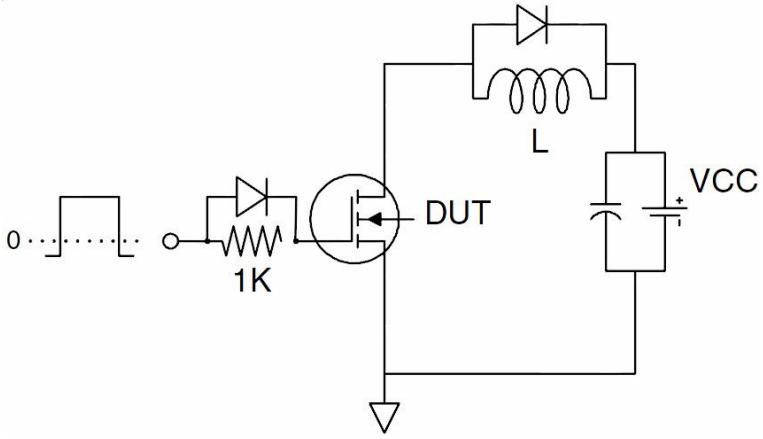
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition : T_j=25℃,V_{DD}=30V,V_G=10V,L=0.5mH,Rg=25Ω

Test Circuits

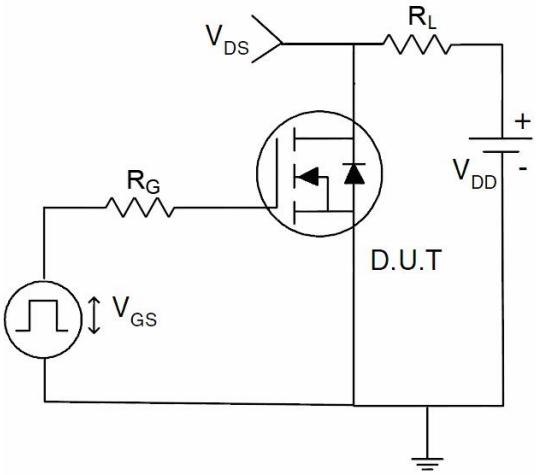
- EAS Test Circuits



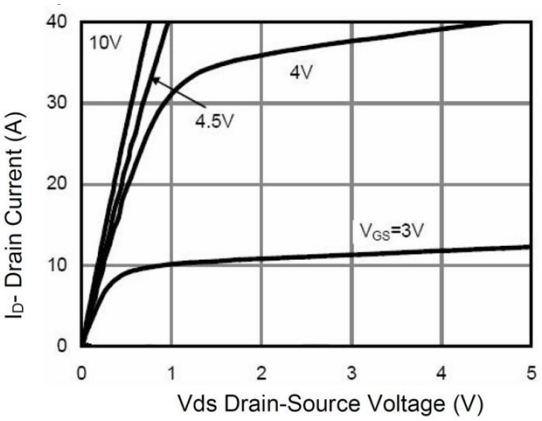
- Gate Charge Test Circuit



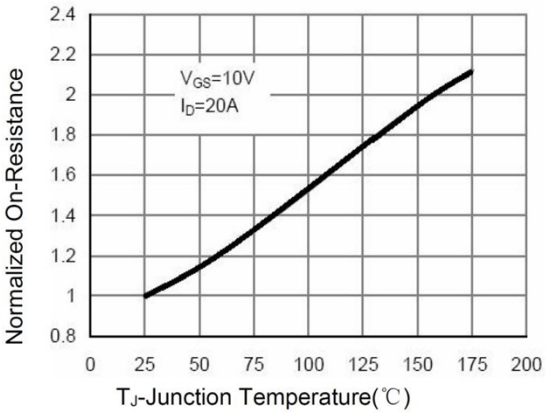
- Switch Time Test Circuit



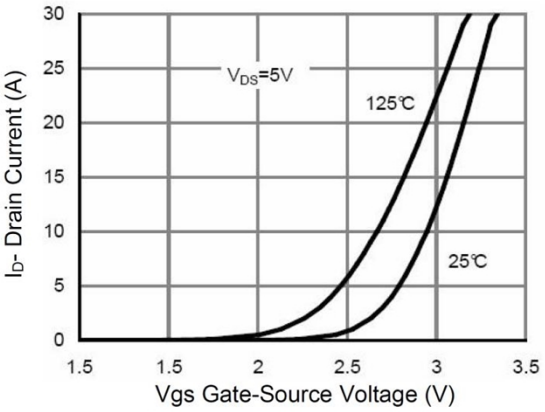
Typical Characteristics



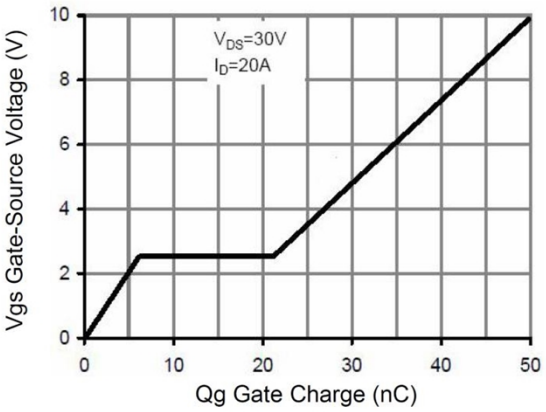
Output Characteristics



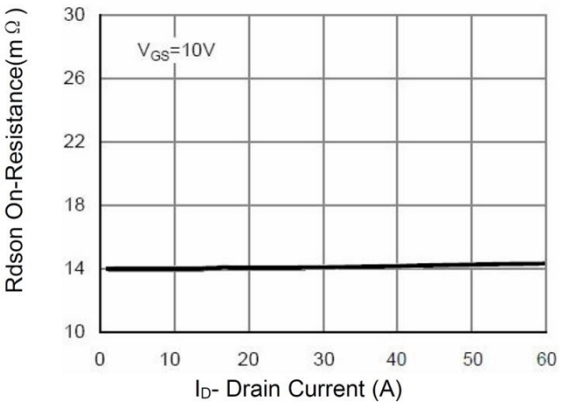
Rdson-Junction Temperature



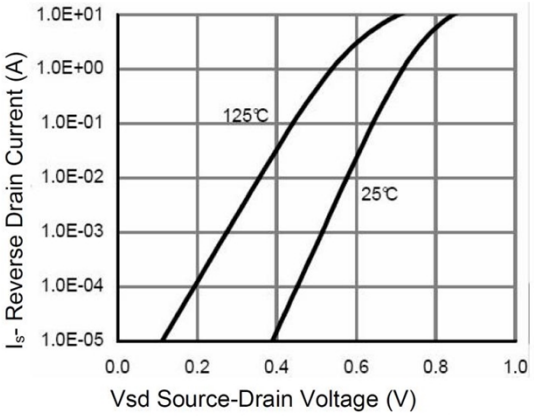
Transfer Characteristics



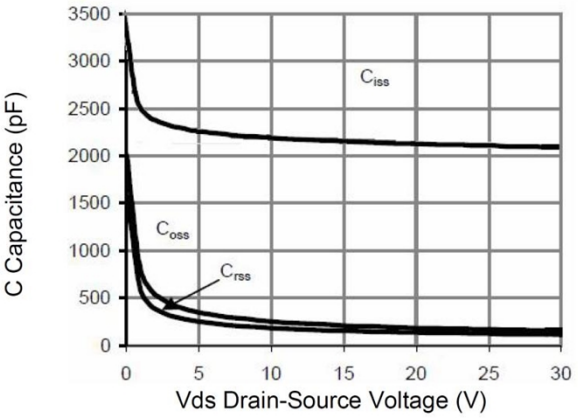
Gate Charge



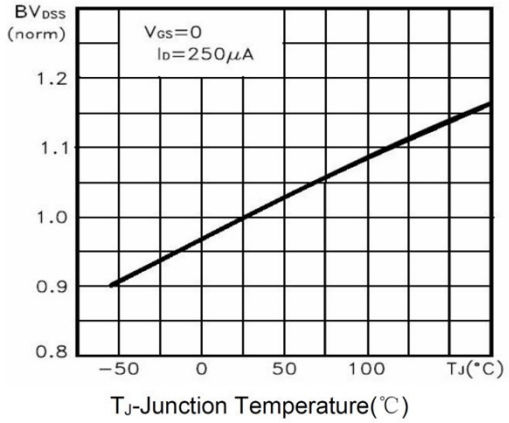
Rdson- Drain Current



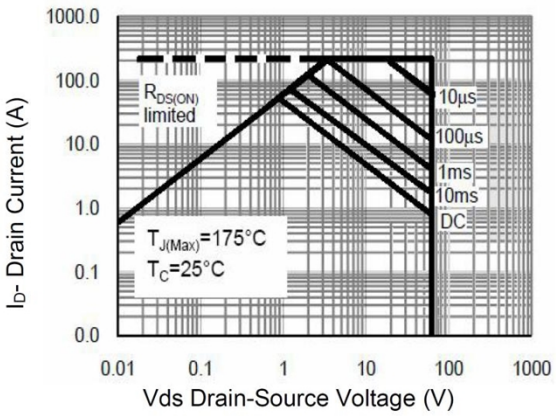
Source- Drain Diode Forward



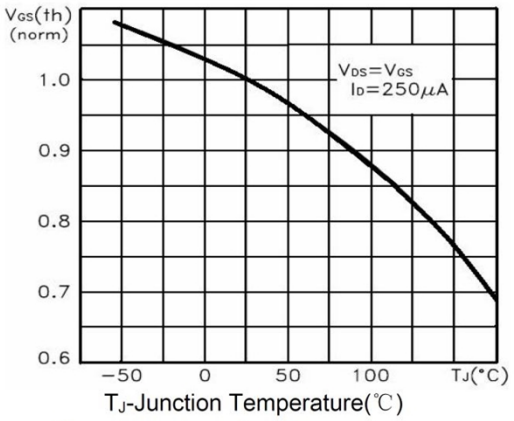
Capacitance vs Vds



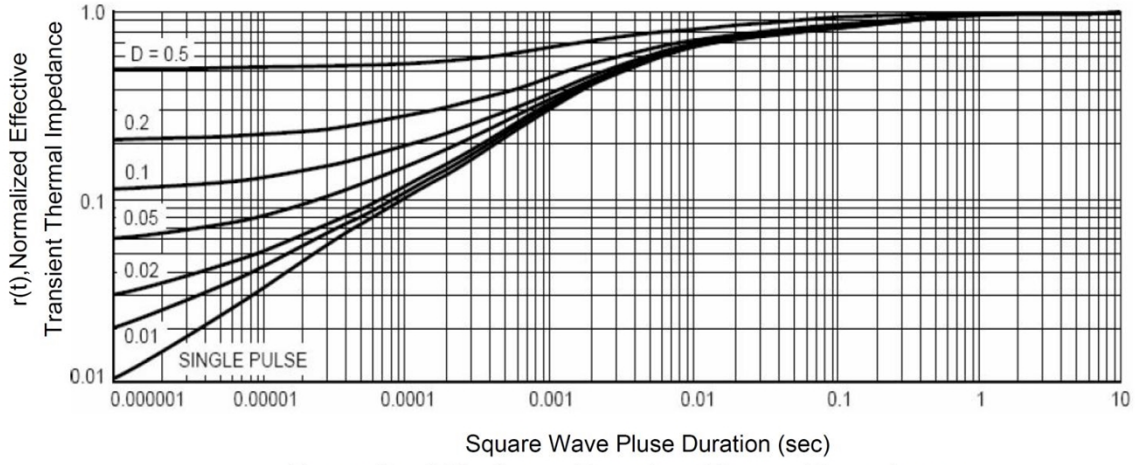
BV_{DSS} vs Junction Temperature



Safe Operation Area

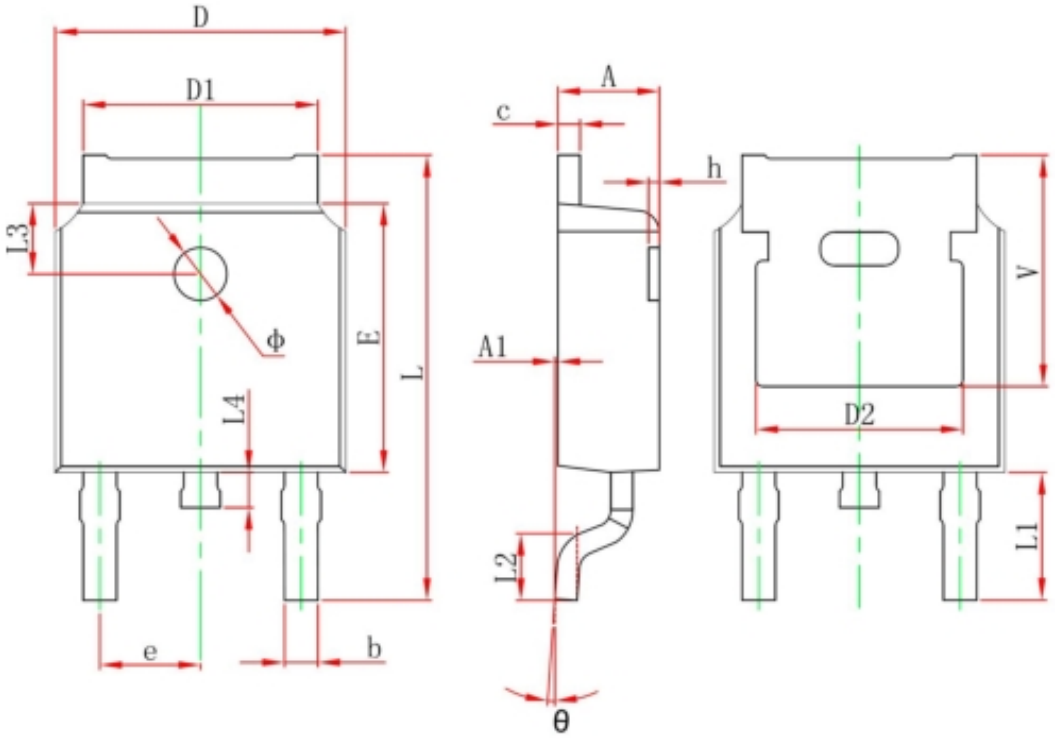


$V_{GS(th)}$ vs Junction Temperature



Normalized Maximum Transient Thermal Impedance

TO-252 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 REF.		0.211 REF.	