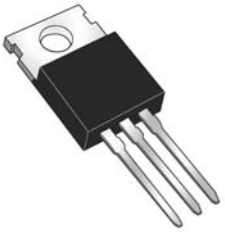
600V/2.0A N-Channel MOSFET

General Description

- Fast switching time
- Low on resistance, low gate charge
- Excellent avalanche characteristics
- Suitable for switching mode power supplies



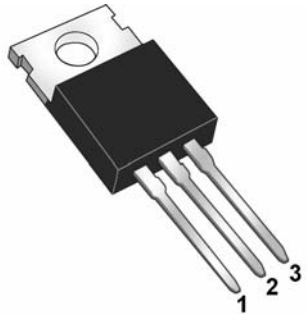
TO-220

Features

- V_{DSS}=600V, I_D=2.0A;
- Low Drain-Source ON Resistance: $R_{DS(ON)}$ =5.0 Ω @ V_{GS}=10V
- Qg(typ.)=10.9nC
- RoHS Compliant

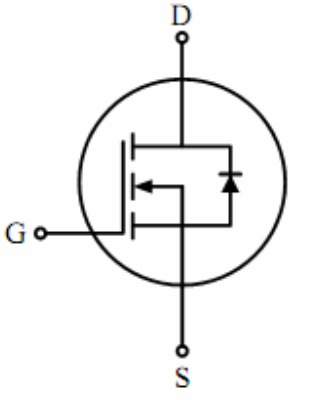
TO-220F

Pin Configuration



1: Gate 2: Drain 3: Source
TO-220

1: Gate 2: Drain 3: Source
TO-220F



Absolute Maximum Ratings *(T_C=25ºC unless otherwise specified, Note)*

Symbol	Description		MSK2N60T	MSK2N60F	Unit
V_{DSS}	Drain-Source Voltage		600		V
V_{GSS}	Gate-Source Voltage		± 30		V
I_D	Drain Current	@ Tc=25ºC (note 1)	2.0		A
		@ Tc=100ºC (note 1)	1.2		
I_{DP}	Drain Current - Pulsed (note 2)		8.0		
E_{AS}	Single Pulsed Avalanche Energy (note 3)		120		mJ
E_{AR}	Repetitive Avalanche Energy (note 2)		5.4		mJ
dv/dt	Peak Diode Recovery dv/dt (note 4)		5.5		V/nS
P_D	Power Dissipation	Tc=25ºC	54	23	W
		Derate above 25ºC	0.43	0.18	W/°C
$R_{\theta JC}$	Thermal Resistance (Junction-to-Case)		2.32	5.5	°C/ W
$R_{\theta CS}$	Thermal Resistance (Case-to-Sink)		0.5	-	°C/ W
$R_{\theta JA}$	Thermal Resistance (Junction-to-Ambient)		62.5	62.5	°C/ W
T_J	Junction Temperature		+150		°C
T_{STG}	Storage Temperature Range		-55 to +150		°C

Note: 1. Drain current limited by maximum junction temperature.

2. Repetitive rating: Pulse width limited by junction temperature.

3. L=36.9mH, I_S=2.0A, V_{DD}=50V, R_G=25Ω, Starting Tj=25°C.

4. $I_S \leqslant$2.0A, dI/dt$\leqslant$300A/μS, $V_{DD} \leqslant BV_{DSS}$, Starting Tj=25°C.

Electrical Characteristics *(T Ambient=25ºC unless noted otherwise)*

Off Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	600	-	-	V	V_{GS}=0V, I_D=250μA
$\Delta V_{(BR)DSS}/\Delta T_j$	Breakdown Voltage Temperature Coefficient	-	0.65	-	V/°C	I_D=250μA, Referenced to 25ºC
I_{DSS}	Zero Gate Voltage Drain Current	-	-	10	uA	V_{DS}=600V, V_{GS}=0V
I_{GSS}	Gate-Source Leakage Current	-	-	±100	nA	V_{GS}=±30V, V_{DS}=0V

On Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
$V_{GS(th)}$	Gate Threshold Voltage	2.0	-	4.0	V	V_{DS}=V_{GS}, I_D=250μA
$R_{DS(ON)}$	Drain-Source ON Resistance	-	3.8	5.0	Ω	V_{GS}=10V, I_D=1.0A

Dynamic Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
C_{iss}	Input Capacitance	-	388	504	pF	V_{DS}=25V, V_{GS}=0V, f=1MHz
C_{oss}	Output Capacitance	-	46	59.4		
C_{rss}	Reverse Transfer Capacitance	-	6.5	8.5		

Switching Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
$t_{D(on)}$	Turn-On Delay Time	-	-	28	ns	V_{DD}=300V, R_L=150Ω, R_G=25Ω(note 5,6)
t_r	Turn-On Rise Time	-	-	60		
$t_{D(off)}$	Turn-Off Delay Time	-	-	58		
t_f	Turn-Off Fall Time	-	-	66		
Q_g	Total Gate Charge	-	10.9	12.0	nC	V_{DS}=480V, I_D=2.0A, V_{GS}=10V (note 5,6)
Q_{gs}	Gate-Source Charge	-	1.7	3.0		
Q_{gd}	Gate-Drain Charge	-	5.0	5.5		

Drain-Source Diode Characteristics and Maximum Ratings

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
Is	Continuous Source-Drain Diode Current	-	-	2.0	A	V_{GS}< $V_{GS(th)}$
Isp	Pulsed Source-Drain Diode Current	-	-	8.0		
Vsd	Source-Drain Diode Forward Voltage	-	-	1.5	V	I_S=2.0A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	-	300	-	ns	I_S=2.0A,V_{GS}=0V dIS//dt=100A/us
Q_{rr}	Reverse Recovered Charge	-	1.55	-	uC	

Note: 5. Pulse test: Pulse width ≤300us, Duty cycle≤2%.

6. Essentially independent of operating temperature.

Typical Characteristics Curves

Fig.1- I_D vs. V_{DS}

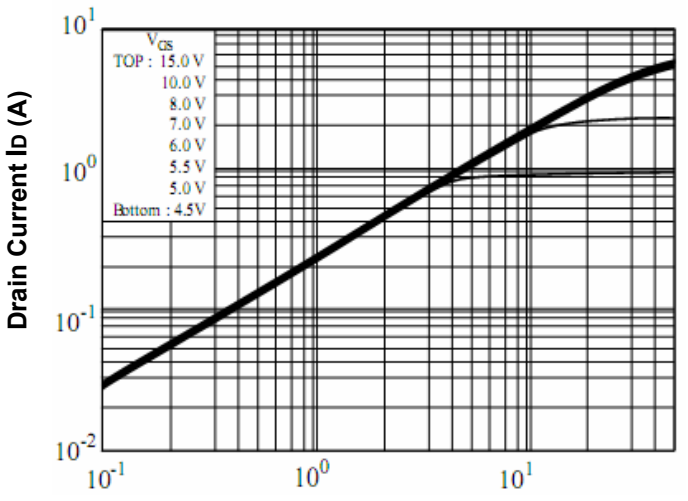


Fig.2- I_D vs. V_{GS}

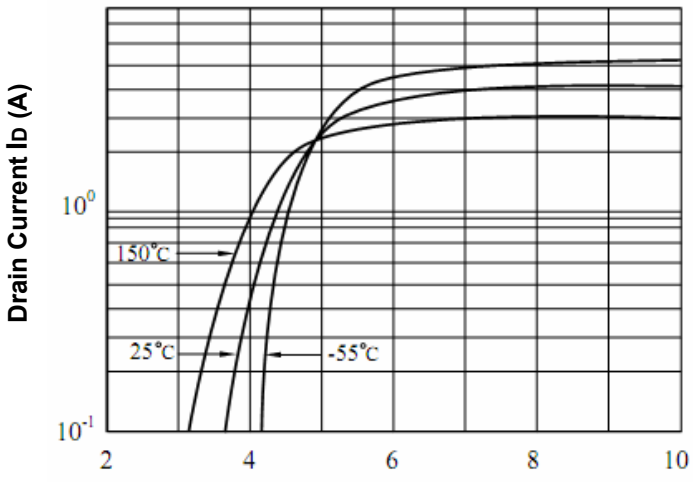


Fig.3- BV_{DSS} vs. T_J

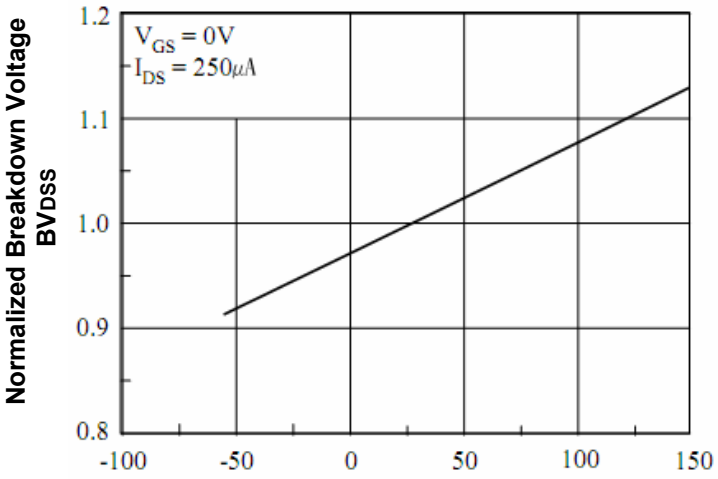


Fig.4- I_S vs. V_{SD}

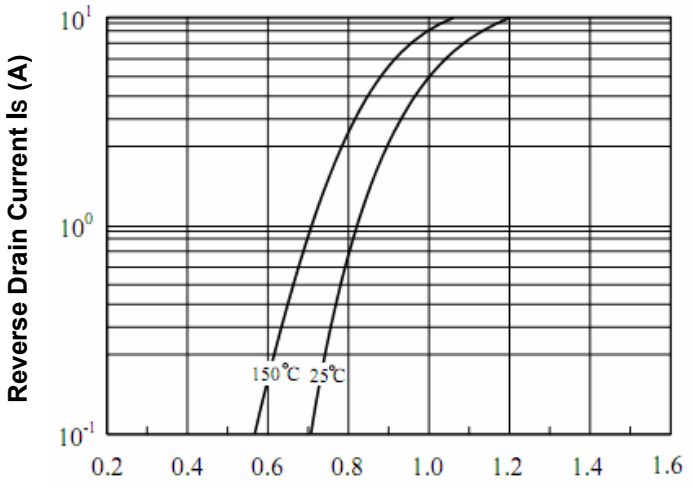


Fig.5- $R_{DS(ON)}$ vs. T_J

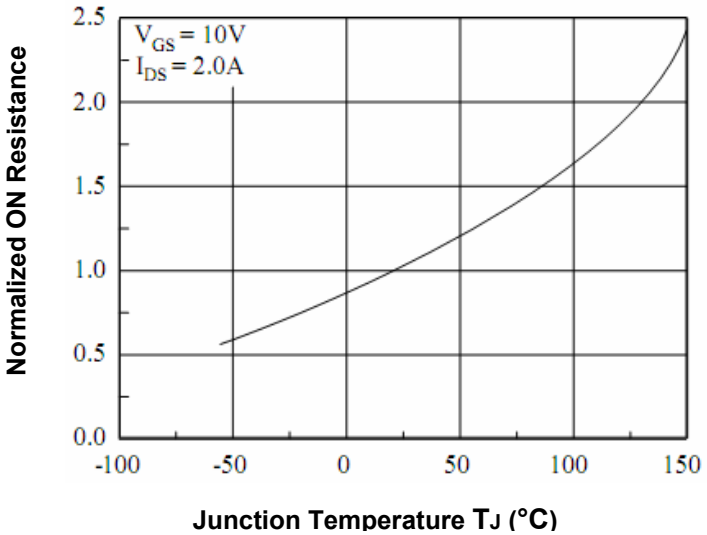


Fig.6- $R_{DS(ON)}$ vs. I_D

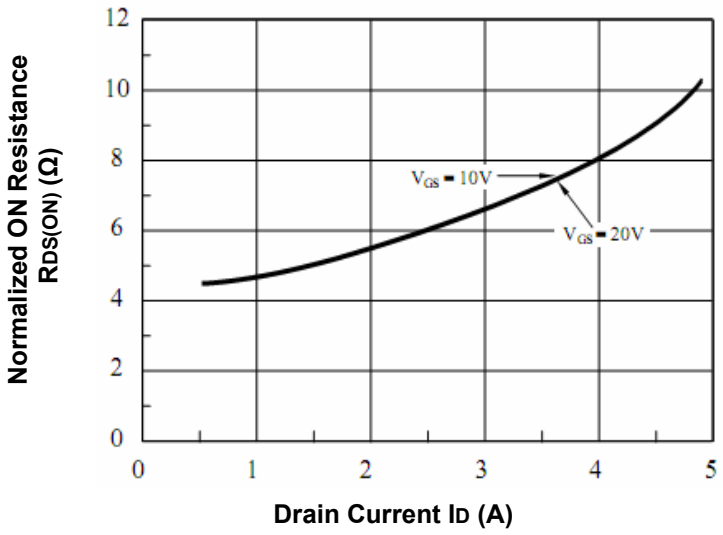


Fig.7- I_D vs. T_J

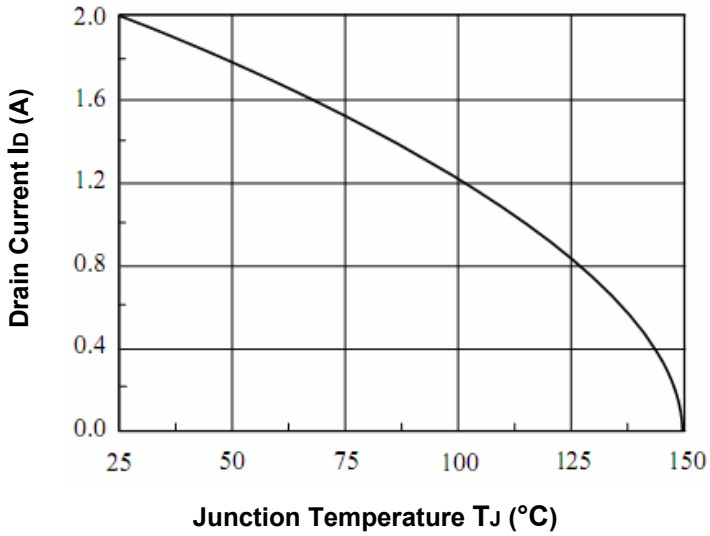


Fig.8- Q_g vs. V_{GS}

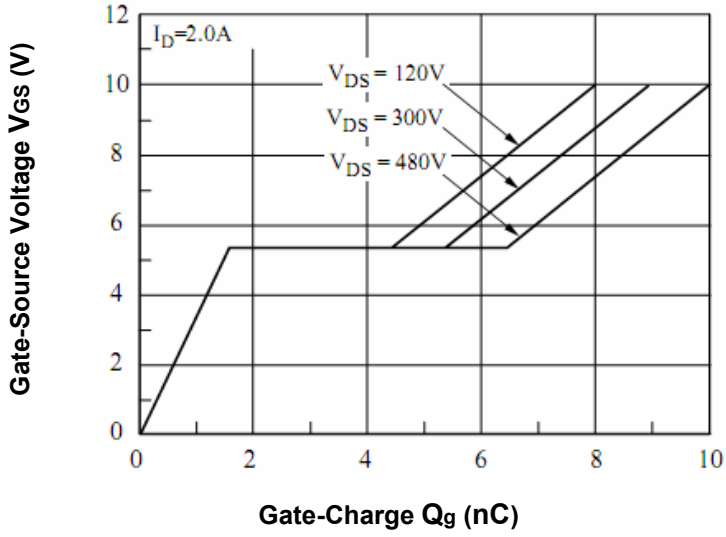


Fig.9- C vs. V_{DS}

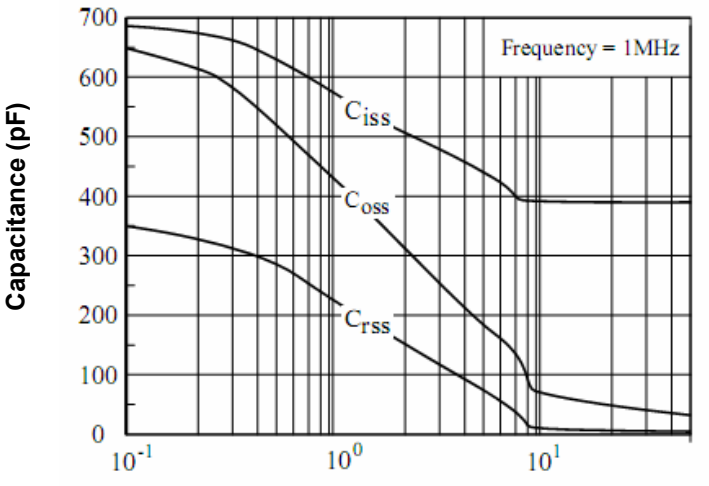


Fig.10- Safe Operation Area
MSK2N60T

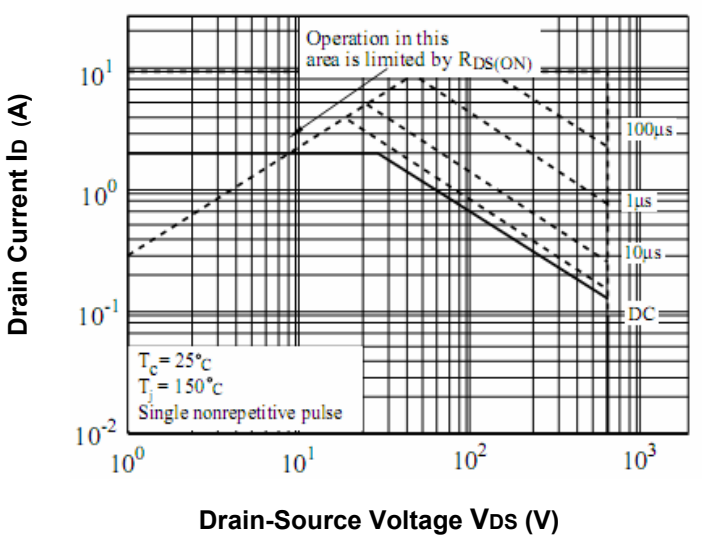


Fig.11- Safe Operation Area
MSK2N60F

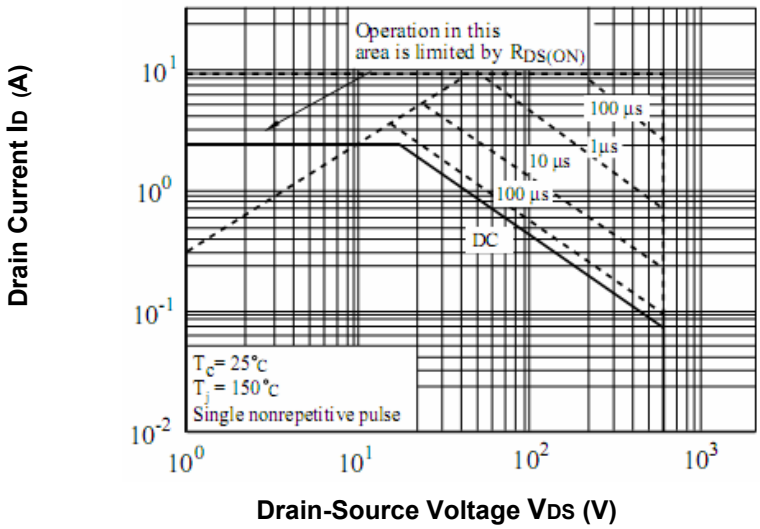


Fig.12- Transient Thermal Response Curve
MSK2N60T

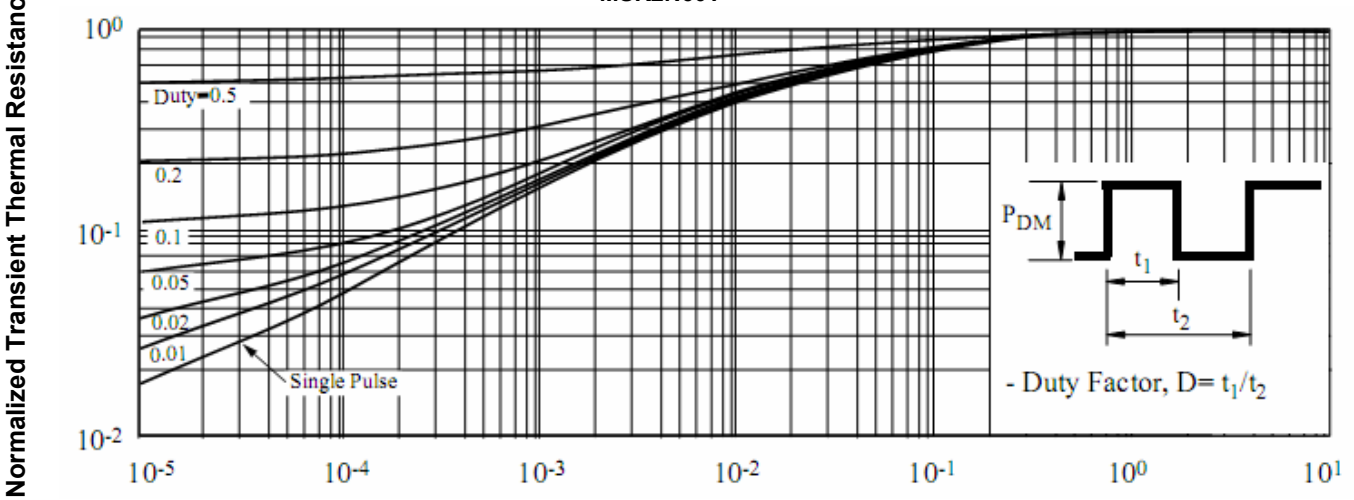
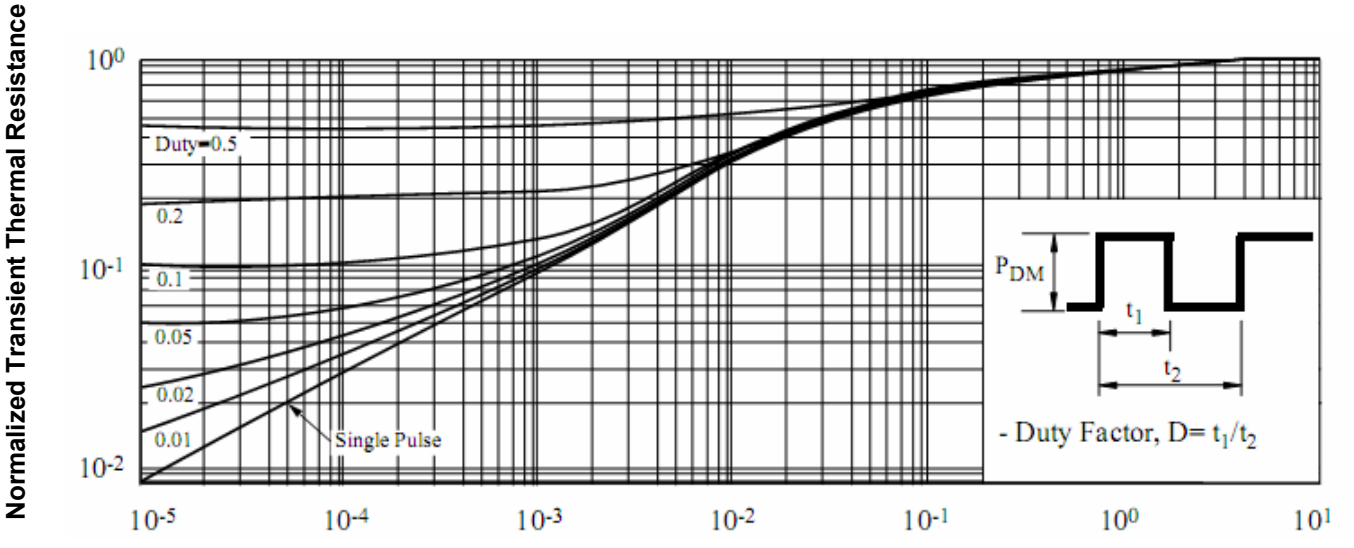


Fig.13- Transient Thermal Response Curve
MSK2N60F



Test Circuit and Waveform

Fig.14-Gate Charge

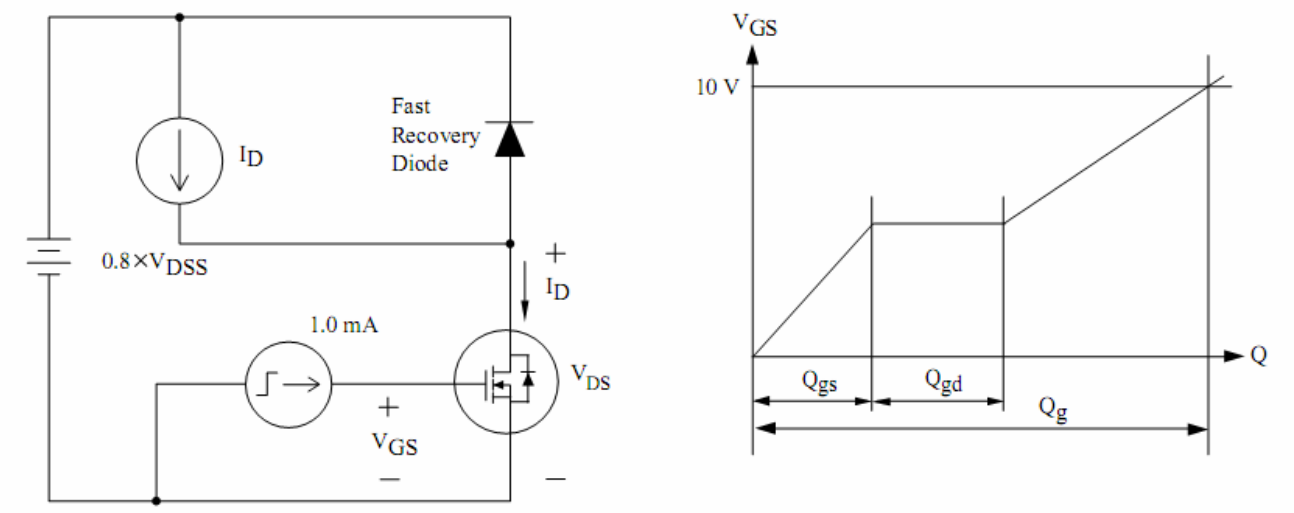


Fig.15- Single Pulsed Avalanche Energy

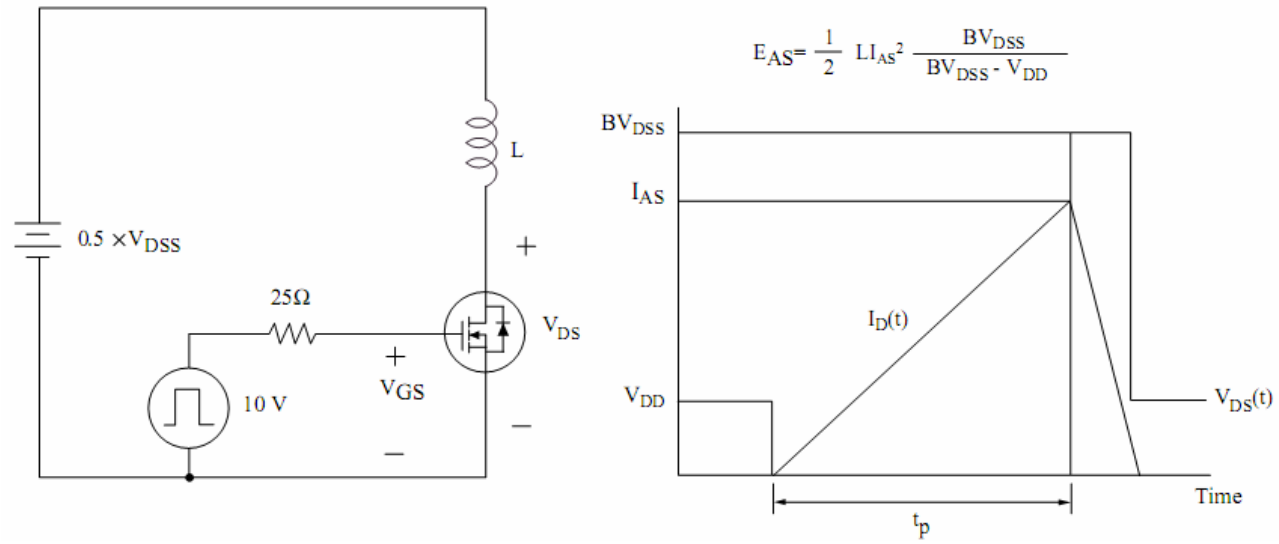


Fig.16-Resistive Load Switching

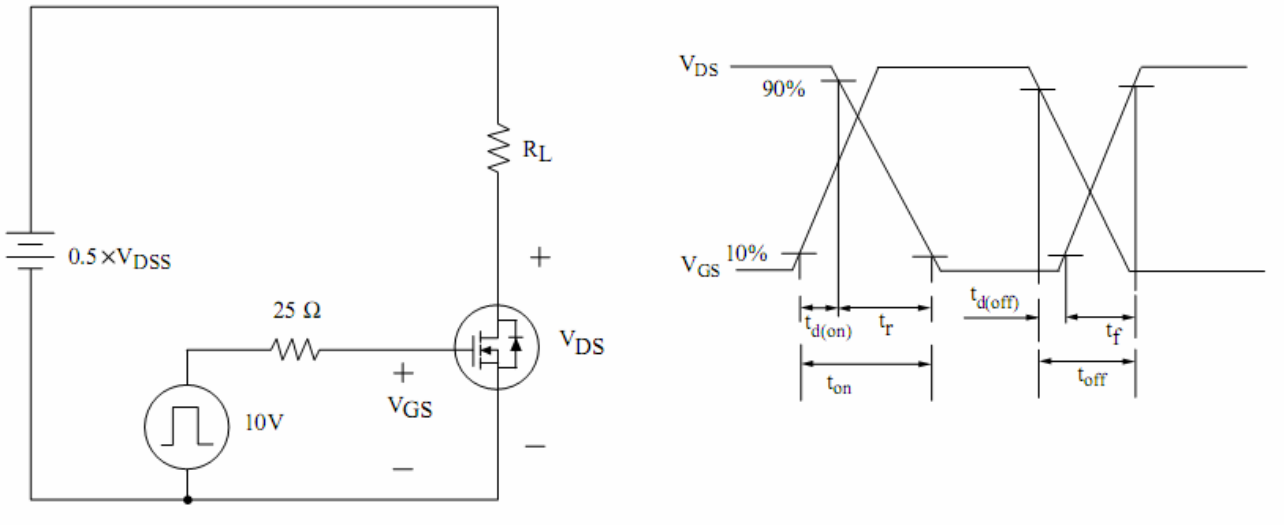
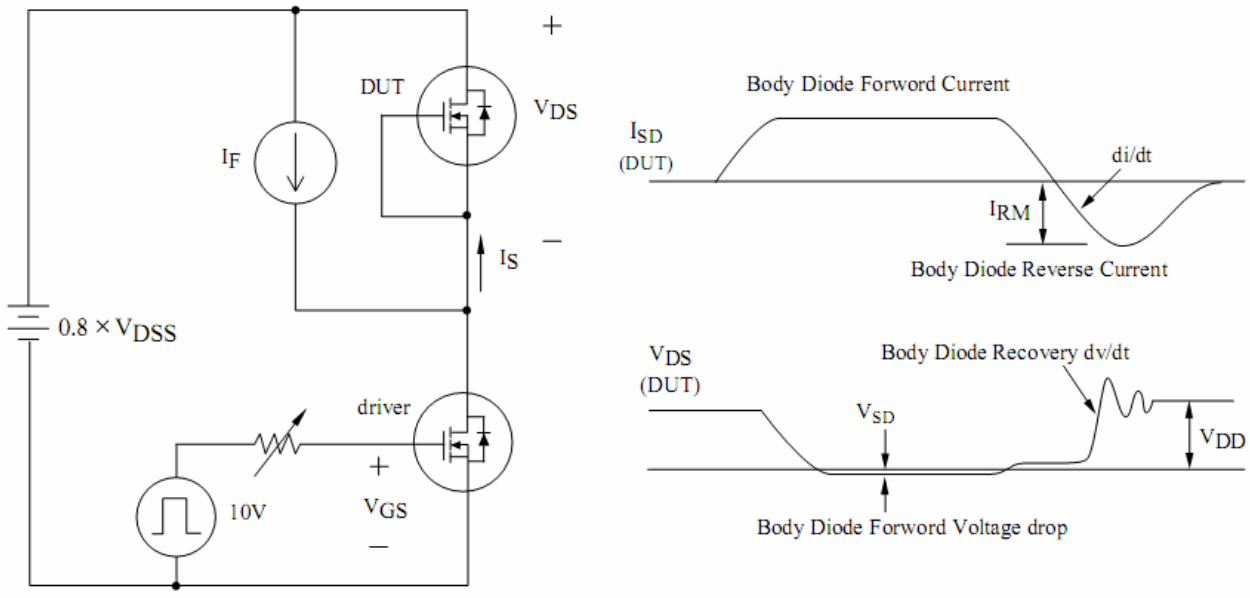
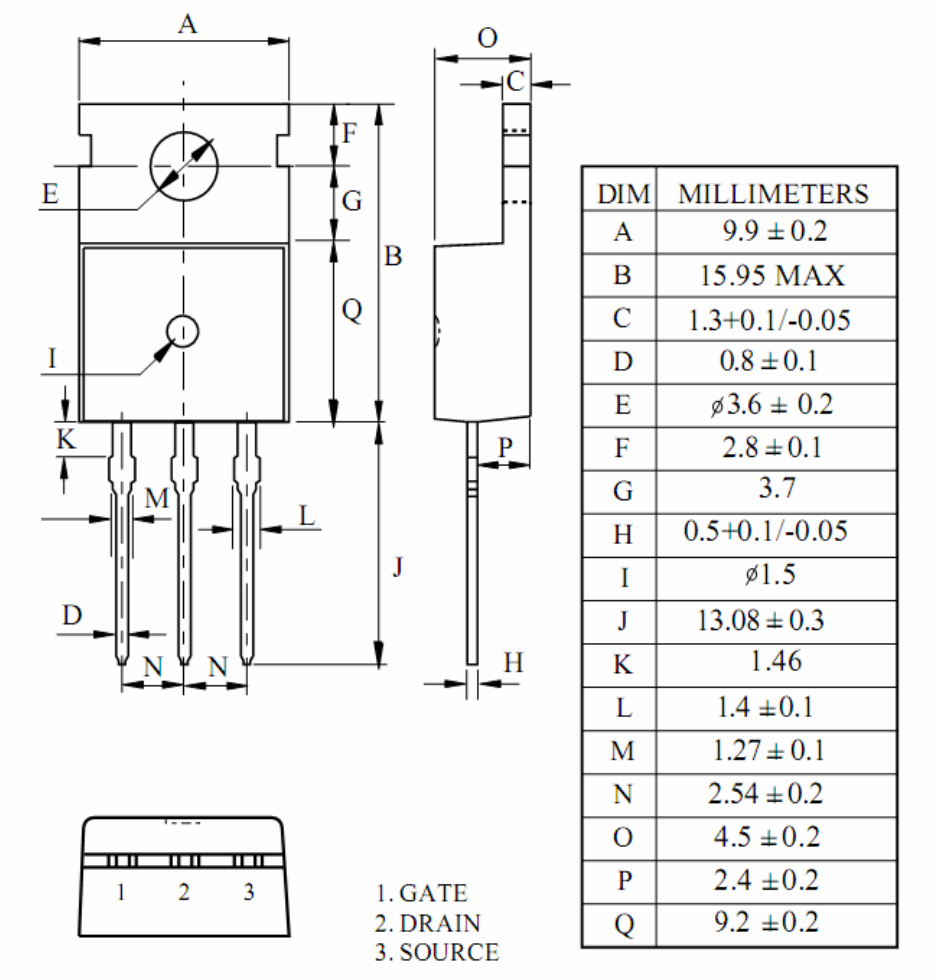


Fig.17-Source - Drain Diode Reverse Recovery and dv /dt



Dimensions in mm

MSK2N60T



DIM	MILLIMETERS
A	9.9 ± 0.2
B	15.95 MAX
C	1.3+0.1/-0.05
D	0.8 ± 0.1
E	ø3.6 ± 0.2
F	2.8 ± 0.1
G	3.7
H	0.5+0.1/-0.05
I	ø1.5
J	13.08 ± 0.3
K	1.46
L	1.4 ± 0.1
M	1.27 ± 0.1
N	2.54 ± 0.2
O	4.5 ± 0.2
P	2.4 ± 0.2
Q	9.2 ± 0.2

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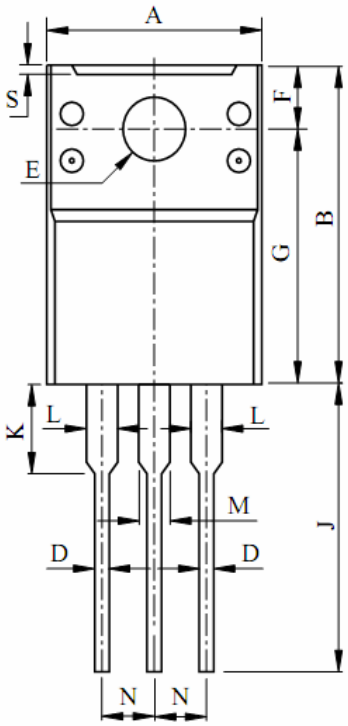

DIM	MILLIMETERS
A	10.0±0.3
B	15.0±0.3
C	2.70±0.3
D	0.76+0.09/-0.05
E	Φ3.2±0.2
F	3.0±0.3
G	12.0±0.3
H	0.5+0.1/-0.05
J	13.6±0.5
K	3.7±0.2
L	1.2+0.25/-0.1
M	1.5+0.25/-0.1
N	2.54±0.1
P	6.8±0.1
Q	4.5±0.2
R	2.6±0.2
S	0.5 Typ

1. GATE
2. DRAIN
3. SOURCE

TO-220F

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