

600V/4.5A N-Channel MOSFET

General Description

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

Features

- $V_{DSS}=600V$, $I_D=4.5A$;
- Low Drain-Source ON Resistance:
 $R_{DS(ON)} = 2.5 \Omega @ V_{GS}=10V$
- $Q_g(\text{typ.})=17nC$
- RoHS Compliant

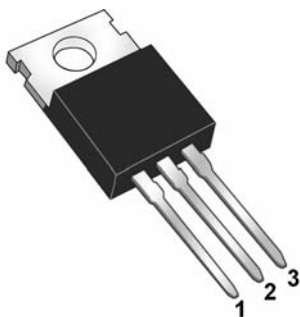


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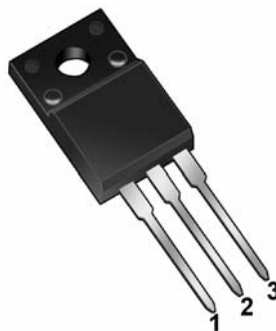


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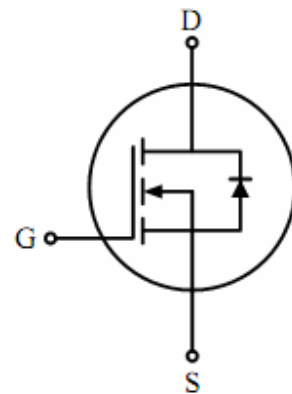
Pin Configuration



1: Gate 2: Drain 3: Source
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600V/4.5A N-Channel MOSFET

MSK4D5N60T/F

Absolute Maximum Ratings ($T_C=25^\circ\text{C}$ unless otherwise specified, Note)

Symbol	Description		MSK4D5N60T	MSK4D5N60F	Unit
V_{DSS}	Drain-Source Voltage		600		V
V_{GSS}	Gate-Source Voltage		± 30		V
I_D	Drain Current	@ T _c =25°C (note 1)	4.5		A
		@ T _c =100°C (note 1)	2.8		
I_{DP}	Drain Current - Pulsed (note 2)		18		
E_{AS}	Single Pulsed Avalanche Energy (note 3)		260		mJ
E_{AR}	Repetitive Avalanche Energy (note 2)		10.6		mJ
dv/dt	Peak Diode Recovery dv/dt (note 4)		4.5		V/nS
P_D	Power Dissipation	T _c =25°C	106	36	W
		Derate above 25°C	0.85	0.29	W/°C
R_{θJC}	Thermal Resistance (Junction-to-Case)		1.18	3.47	°C/ W
R_{θCS}	Thermal Resistance (Case-to-Sink)		0.5	-	°C/ W
R_{θJA}	Thermal Resistance (Junction-to-Ambient)		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=25mH, I_s=4.5A, V_{DD}=50V, R_G=25Ω, Starting T_J=25°C.
 4. I_s≤4.5A, dI/dt≤200A/μS, V_{DD}≤BV_{DSS}, Starting T_J=25°C.

Electrical Characteristics ($T_{\text{Ambient}}=25^\circ\text{C}$ 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
ΔV_{(BR)DSS/ΔT_J}	Breakdown Voltage Temperature Coefficient	-	0.6	-	V/°C	I _D =250μA, Referenced to 25°C
I_{DSS}	Zero Gate Voltage Drain Current	-	-	10	uA	V _D =600V, V _{GS} =0V
I_{GSS}	Gate-Source Leakage Current	-	-	±100	nA	V _{GS} =±30V, V _D =0V

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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	-	2.2	2.5	Ω	V _{GS} =10V, I _D =2.25A

Dynamic Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
C_{iss}	Input Capacitance	-	655	850	pF	V _{DS} =25V, V _{GS} =0V, f=1MHz
C_{oss}	Output Capacitance	-	66	86		
C_{rss}	Reverse Transfer Capacitance	-	8	11		

Switching Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
t_{D(on)}	Turn-On Delay Time	-	15	35	ns	V _{DD} =300V, R _L =67Ω, R _G =25Ω(note 5,6)
t_r	Turn-On Rise Time	-	35	80		
t_{D(off)}	Turn-Off Delay Time	-	70	150		
t_f	Turn-Off Fall Time	-	80	170		
Q_g	Total Gate Charge	-	17	21	nC	V _{DS} =480V, I _D =4.5A, V _{GS} =10V (note 5,6)
Q_{gs}	Gate-Source Charge	-	3	-		
Q_{gd}	Gate-Drain Charge	-	7.3	-		

Drain-Source Diode Characteristics and Maximum Ratings

Symbol	Description	Min.	Typ.	Max.	Unit	Conditions
I_S	Continuous Source-Drain Diode Current	-	-	4.5	A	V _{GS} < V _{GS(th)}
I_{sp}	Pulsed Source-Drain Diode Current	-	-	18		
V_{sd}	Source-Drain Diode Forward Voltage	-	-	1.5	V	I _S =4.5A, V _{GS} =0V
t_{rr}	Reverse Recovery Time	-	350	-	ns	I _S =4.5A, V _{GS} =0V
Q_{rr}	Reverse Recovered Charge	-	2.7	-	μC	dI _S /dt=100A/μs

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

6. Essentially independent of operating temperature.

Typical Characteristics Curves

Fig.1- I_D vs. V_{DS}

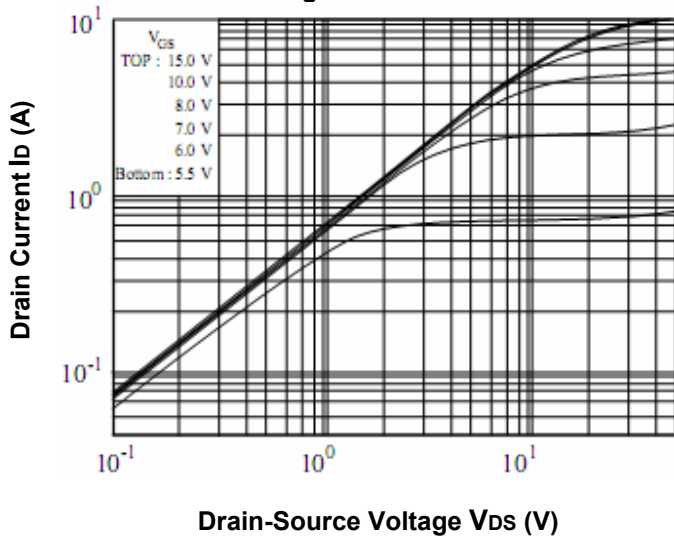


Fig.2- I_D vs. V_{GS}

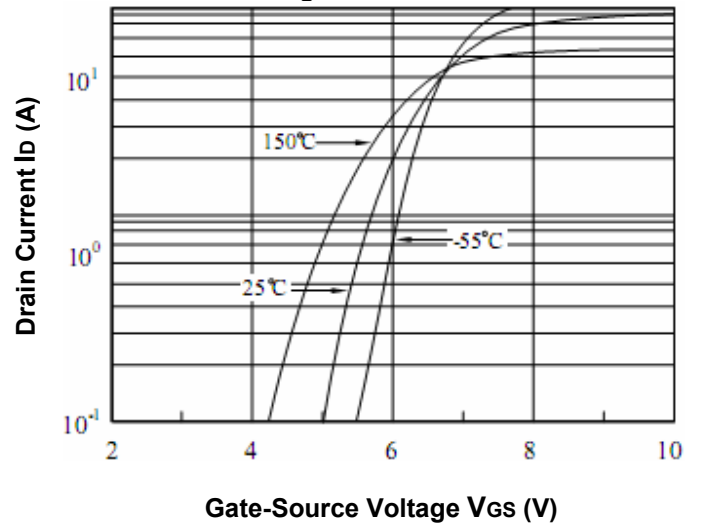


Fig.3- BV_{DSS} vs. T_J

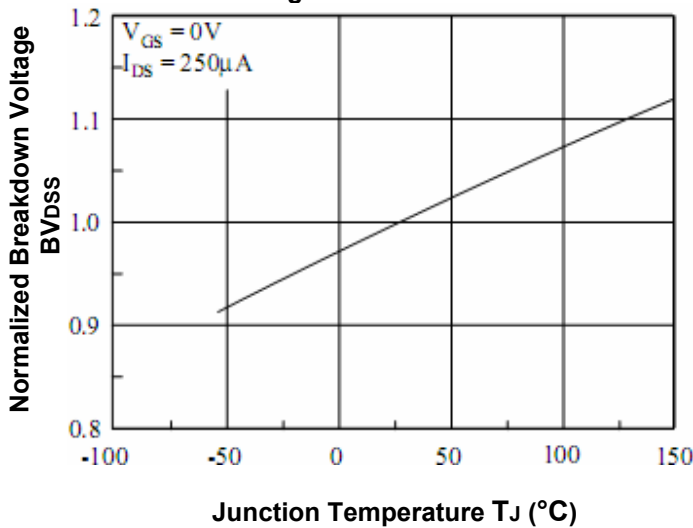
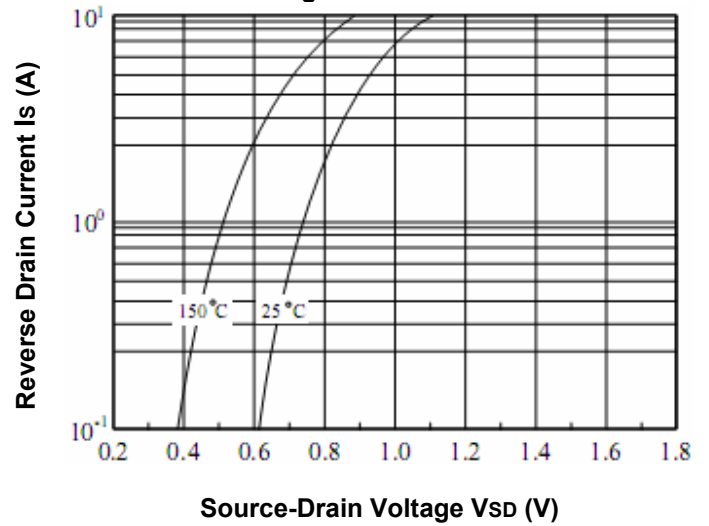


Fig.4- I_S vs. V_{SD}



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

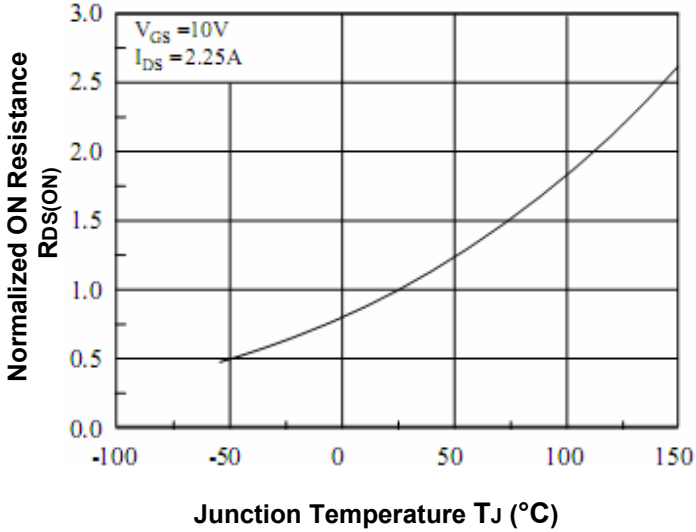


Fig.6- R_{DS(ON)} vs. I_D

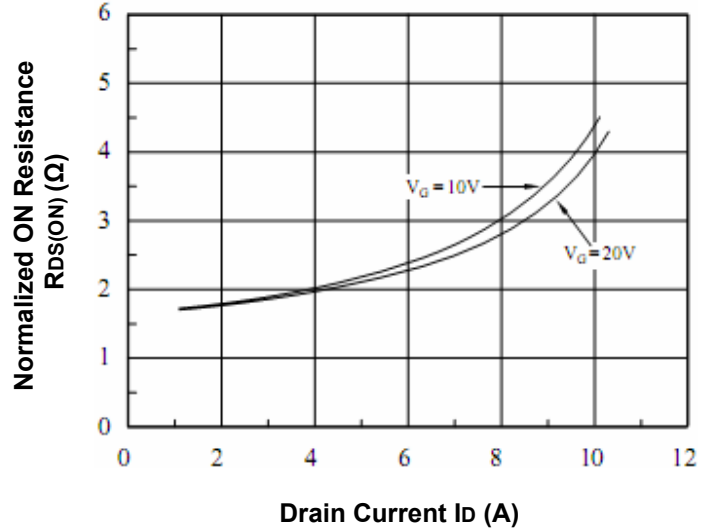


Fig.7- I_D vs. T_J

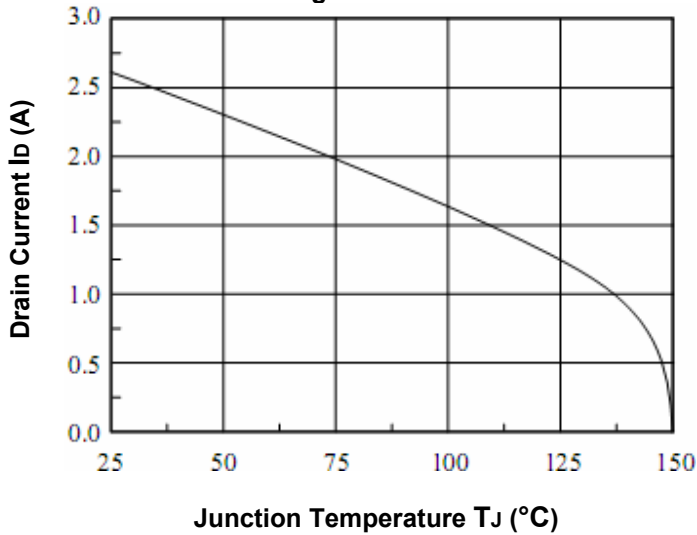
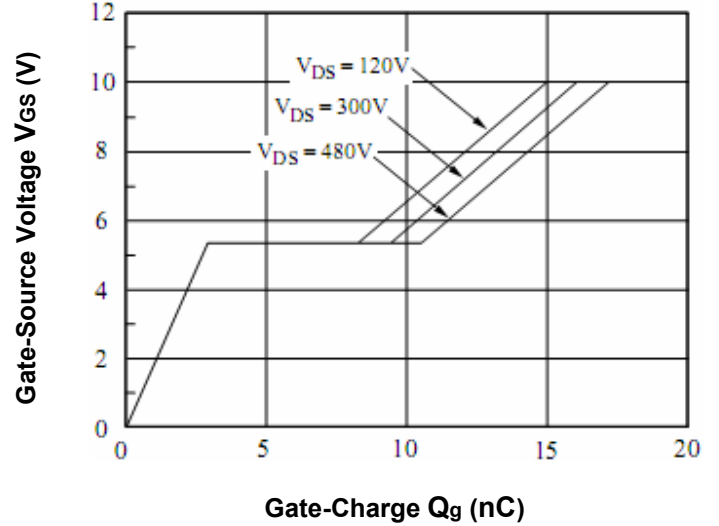


Fig.8- Q_g vs. V_{GS}



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Fig.9- C vs. V_{DS}

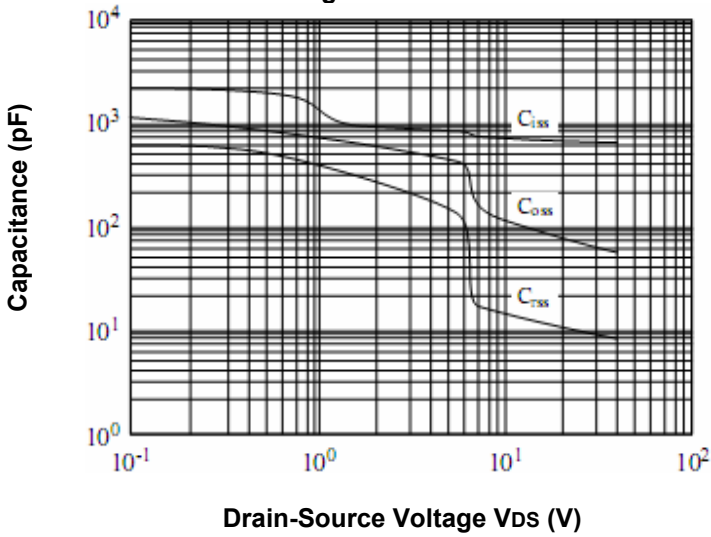


Fig.10- Safe Operation Area (MSK4D5N60T)

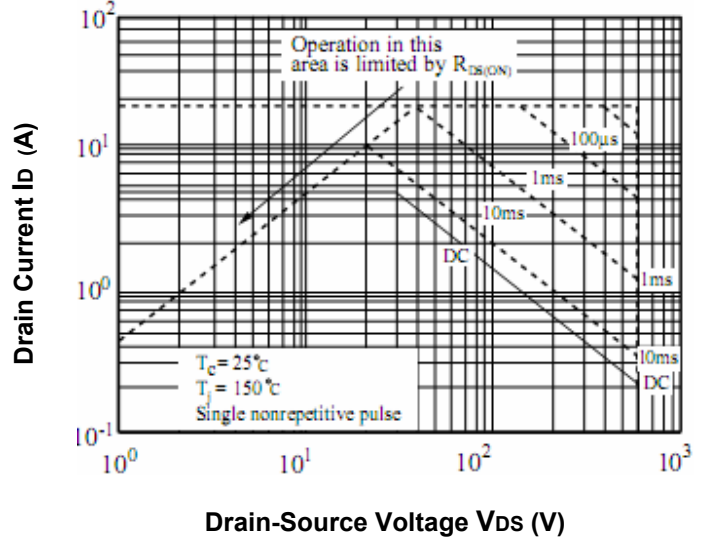


Fig.11- Safe Operation Area (MSK4D5N60F)

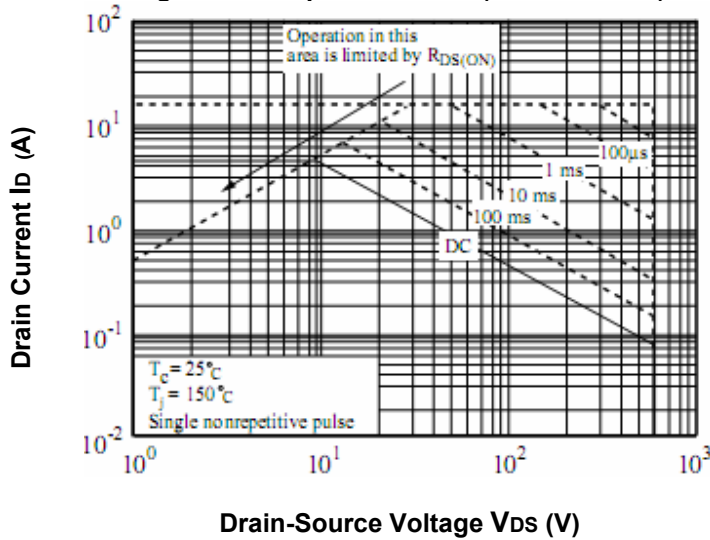


Fig.12- Transient Thermal Response Curve
(MSK4D5N60T)

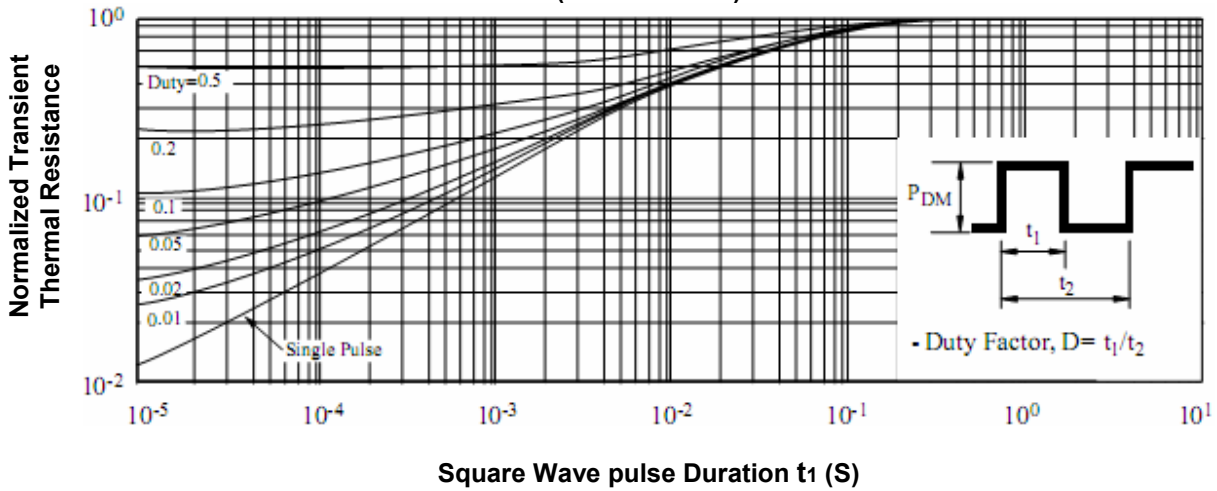
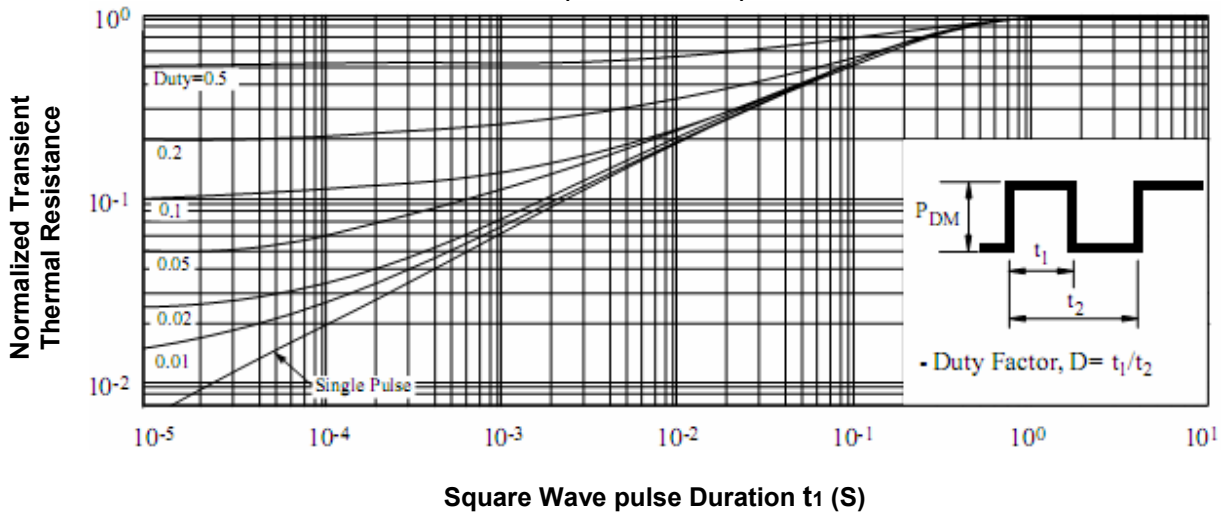


Fig.13- Transient Thermal Response Curve
(MSK4D5N60F)



Test Circuit and Waveform

Fig.14-Gate Charge

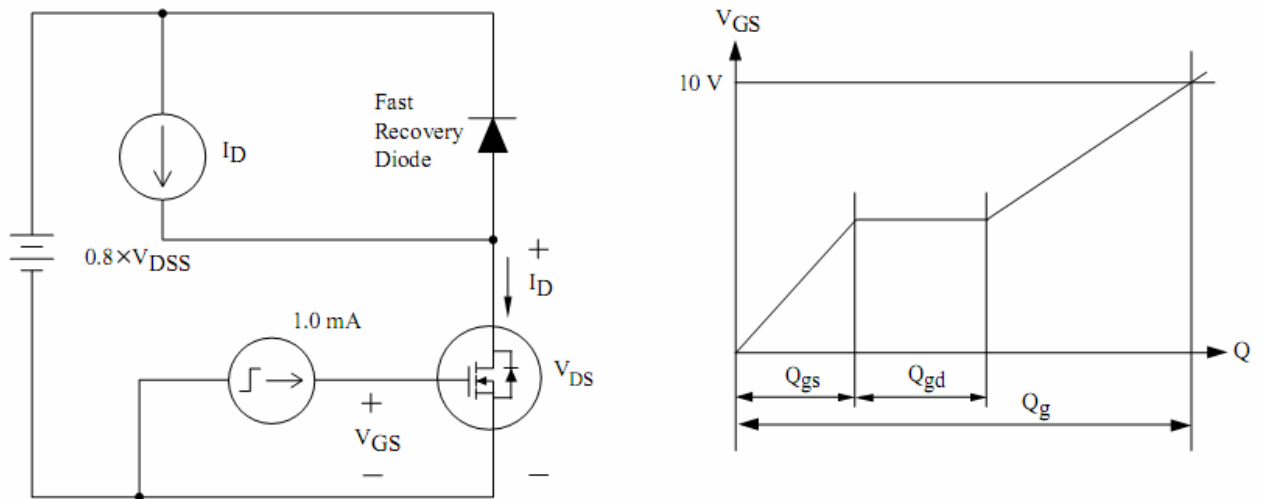


Fig.15- Single Pulsed Avalanche Energy

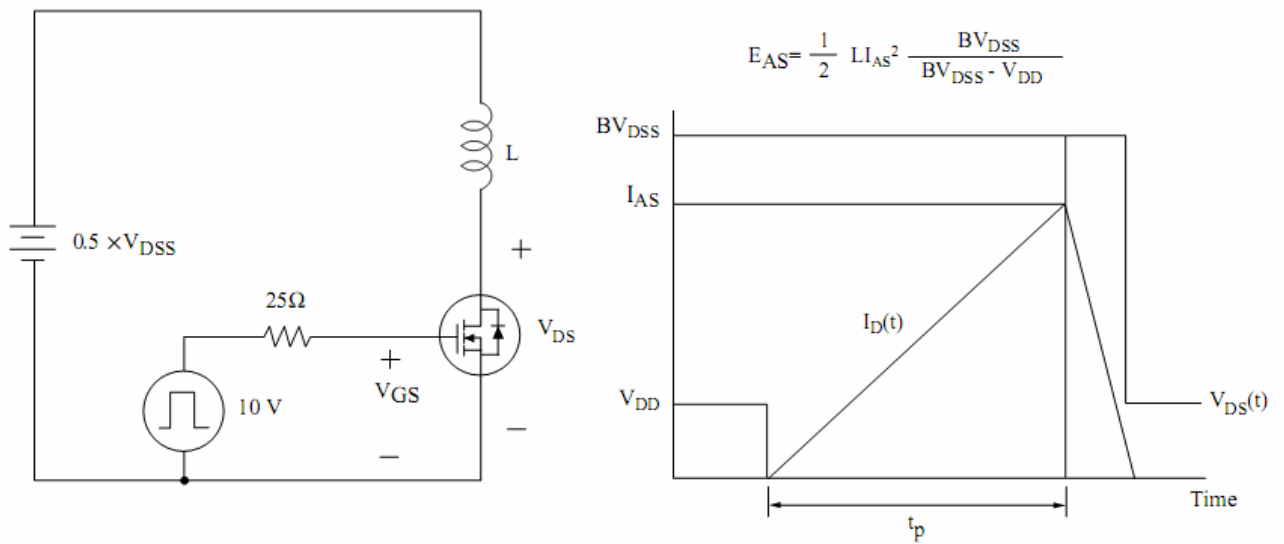


Fig.16-Resistive Load Switching

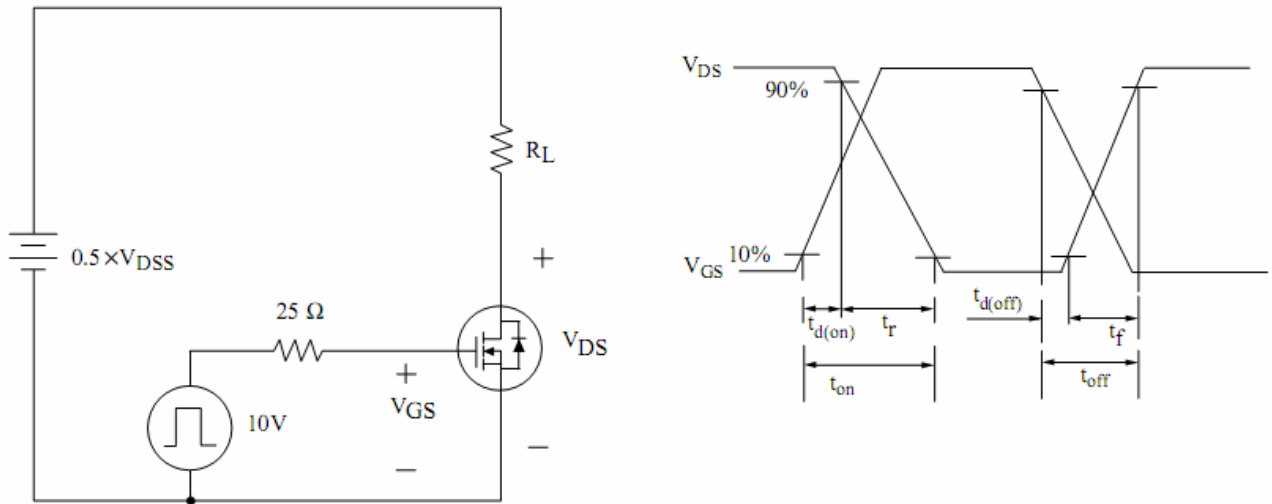
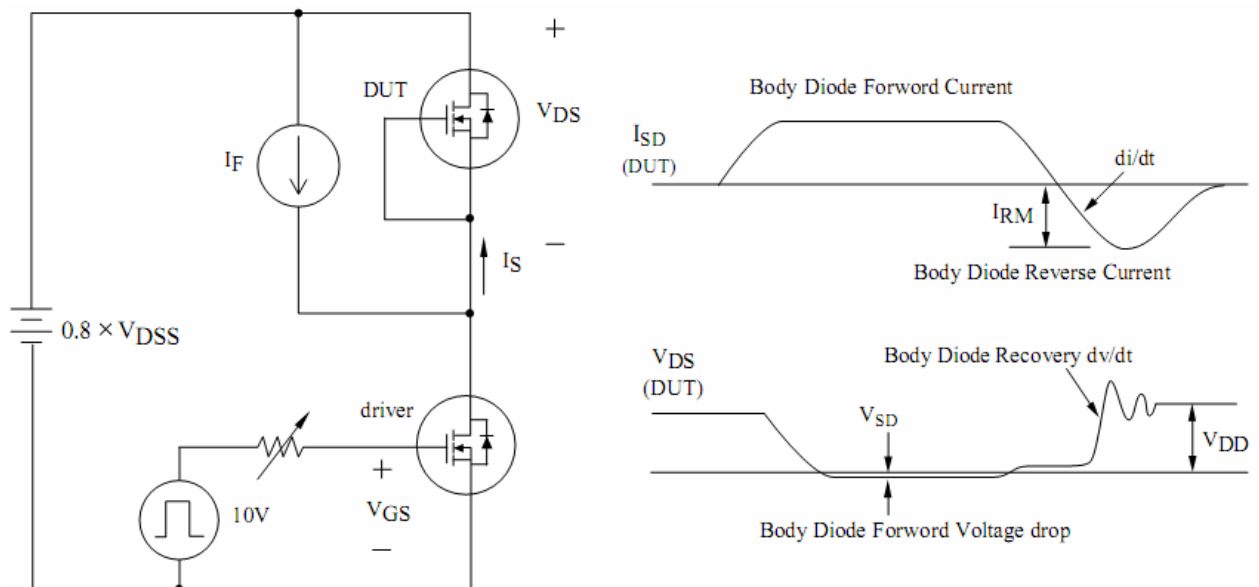


Fig.17-Source - Drain Diode Reverse Recovery and dv /dt

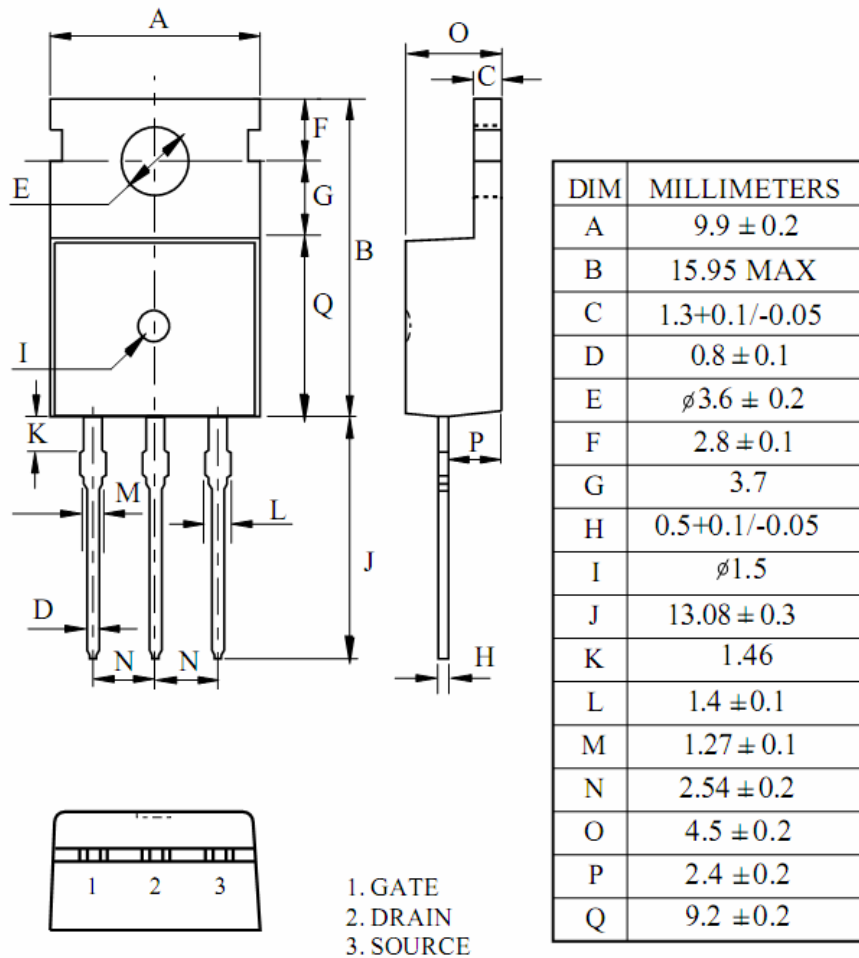


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Dimensions in mm

MSK4D5N60T

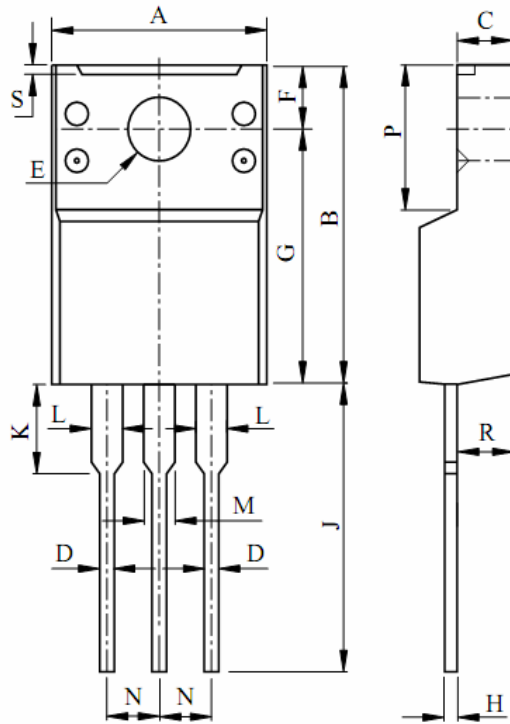


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DIM	MILLIMETERS
A	10.0±0.3
B	15.0±0.3
C	2.70±0.3
D	0.76+0.09/-0.05
E	Φ3.2±0.2
F	3.0±0.3
G	12.0±0.3
H	0.5+0.1/-0.05
J	13.6±0.5
K	3.7±0.2
L	1.2+0.25/-0.1
M	1.5+0.25/-0.1
N	2.54±0.1
P	6.8±0.1
Q	4.5±0.2
R	2.6±0.2
S	0.5 Typ

1. GATE
2. DRAIN
3. SOURCE

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