



ESD



TVS



TSS



MOV



GDT



PLED

MS13N50P/F
Product specification

Description

The MS13N50P/F can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-220/ TO-220F, which accords with the RoHS standard

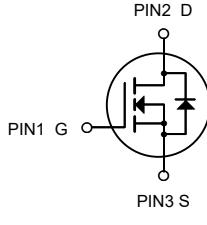
General Features

- $V_{DS}=500V, I_D=13A$
- $R_{DS(ON)} < 0.48\Omega @ V_{GS}=10V$

Application

- Power switch circuit of adaptor and charger

Reference News

PACKAGE OUTLINE		N-Channel MOSFET	Marking	
		 PIN1 G PIN2 D PIN3 S	MSKSEMI 13N50 MS ***	MSKSEMI 13N50 MS ***
TO-220	TO-220F		MS13N50P	MS13N50F

Note : ****Representative production cycle

Absolute Maximum Ratings@ $T_j=25^\circ C$ (unless otherwise specified)

Symbol	Parameter	13N50P	13N50F	Unit
V_{DSS}	Drain-to-Source Voltage	500		V
V_{GSS}	Gate-to-Source Voltage	± 30		
I_D	Continuous Drain Current	13		A
I_{DM}	Pulsed Drain Current at $V_{GS}=10V$	52		
E_{AS}	Single Pulse Avalanche Energy	900		mJ
P_D	Power Dissipation	195	48	W
	Derating Factor above $25^\circ C$	1.56	0.38	W/ $^\circ C$
T_L T_{PAK}	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	300 260		$^\circ C$
T_j & T_{STG}	Operating and Storage Temperature Range	-55 to 150		
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.64	2.6	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	100	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	500	--	--	V	$\text{V}_{\text{GS}}=0\text{V}$, $\text{I}_D=250\text{uA}$
I_{DSS}	Drain-to-Source Leakage Current	--	--	1	uA	$\text{V}_{\text{DS}}=500\text{V}$, $\text{V}_{\text{GS}}=0\text{V}$
		--	--	100		$\text{V}_{\text{DS}}=400\text{V}$, $\text{V}_{\text{GS}}=0\text{V}$, $T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Leakage Current	--	--	+100	nA	$\text{V}_{\text{GS}}=30\text{V}$, $\text{V}_{\text{DS}}=0\text{V}$
		--	--	-100		$\text{V}_{\text{GS}}=-30\text{V}$, $\text{V}_{\text{DS}}=0\text{V}$
$\text{R}_{\text{DS(ON)}}$	Static Drain-to-Source On-Resistance	--	0.40	0.48	Ω	$\text{V}_{\text{GS}}=10\text{V}$, $\text{I}_D=6.5\text{A}$
$\text{V}_{\text{GS(TH)}}$	Gate Threshold Voltage	2.0	--	4.0	V	$\text{V}_{\text{DS}}=\text{V}_{\text{GS}}$, $\text{I}_D=250\text{uA}$
g_{fs}	Forward Transconductance	--	15	--	S	$\text{V}_{\text{DS}}=30\text{V}$, $\text{I}_D=13\text{A}$
C_{iss}	Input Capacitance	--	2150	--	pF	$\text{V}_{\text{GS}}=0\text{V}$, $\text{V}_{\text{DS}}=25\text{V}$, $f=1.0\text{MHz}$
C_{rss}	Reverse Transfer Capacitance	--	23	--		
C_{oss}	Output Capacitance	--	210	--		
Q_{g}	Total Gate Charge	--	45	--	nC	$\text{V}_{\text{DD}}=250\text{V}$, $\text{I}_D=13\text{A}$, $\text{V}_{\text{GS}}=0$ to 10V
Q_{gs}	Gate-to-Source Charge	--	10	--		
Q_{gd}	Gate-to-Drain (Miller) Charge	--	18	--		
$\text{t}_{\text{d(ON)}}$	Turn-on Delay Time	--	15	--	ns	$\text{V}_{\text{DD}}=250\text{V}$, $\text{I}_D=13\text{A}$, $\text{V}_{\text{GS}}=10\text{V}$ $\text{R}_g=6.1\ \Omega$
t_{rise}	Rise Time	--	25	--		
$\text{t}_{\text{d(OFF)}}$	Turn-Off Delay Time	--	45	--		
t_{fall}	Fall Time	--	35	--		
I_{SD}	Continuous Source Current ^[2]	--	--	13	A	Integral pn-diode in MOSFET
I_{SM}	Pulsed Source Current ^[2]	--	--	52		
V_{SD}	Diode Forward Voltage	--	--	1.5	V	$\text{I}_s=13\text{A}$, $\text{V}_{\text{GS}}=0\text{V}$
t_{rr}	Reverse Recovery Time	--			ns	$\text{V}_{\text{GS}}=0\text{V}$ $\text{I}_f=13\text{A}$, $\text{di}/\text{dt}=100\text{A}/\mu\text{s}$
Q_{rr}	Reverse Recovery Charge	--	4.0	--		

Note:

[1] $T_J=+25^\circ\text{C}$ to $+150^\circ\text{C}$

[2] Pulse width $\leq 380\mu\text{s}$; duty cycle $\leq 2\%$.

Typical Characteristics(Cont.)

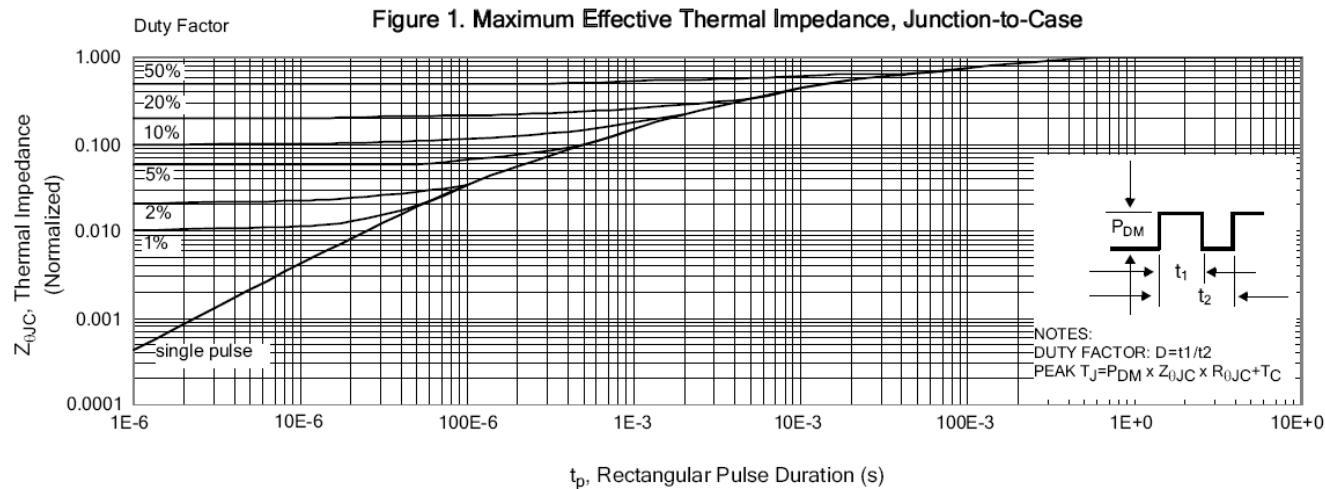


Figure 2. Maximum Power Dissipation vs Case Temperature

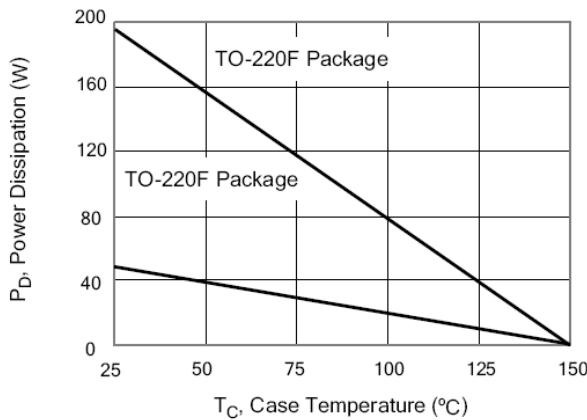


Figure 4. Typical Output Characteristics

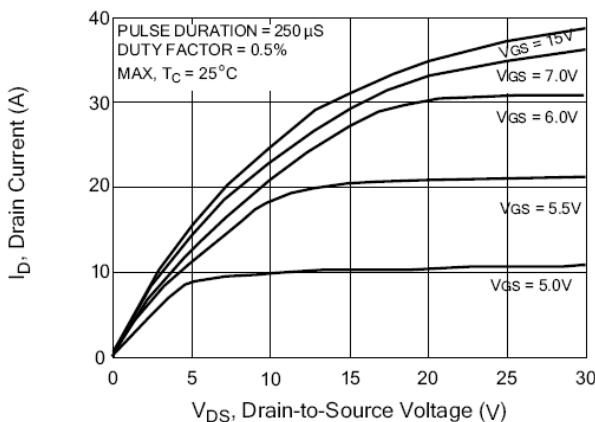


Figure 3. Maximum Continuous Drain Current vs Case Temperature

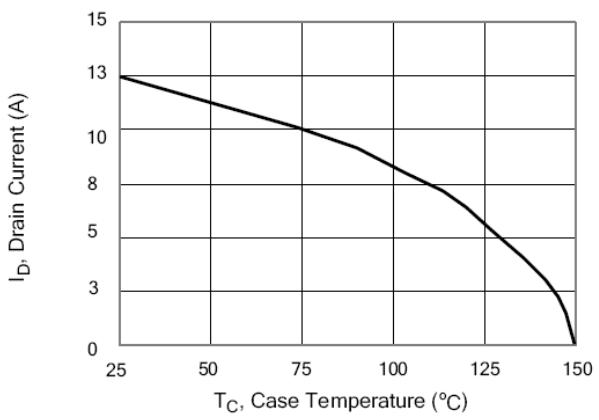
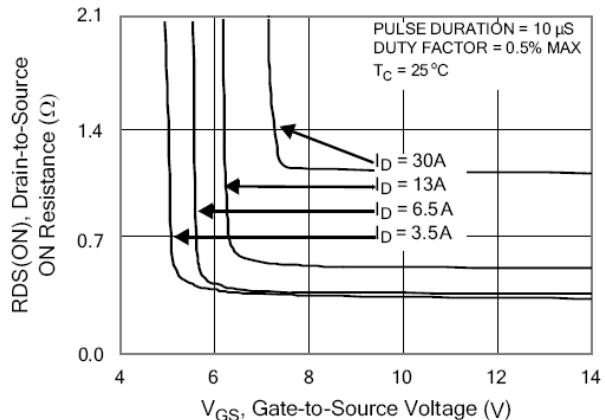


Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current



Typical Characteristics(Cont.)

Figure 6. Maximum Peak Current Capability

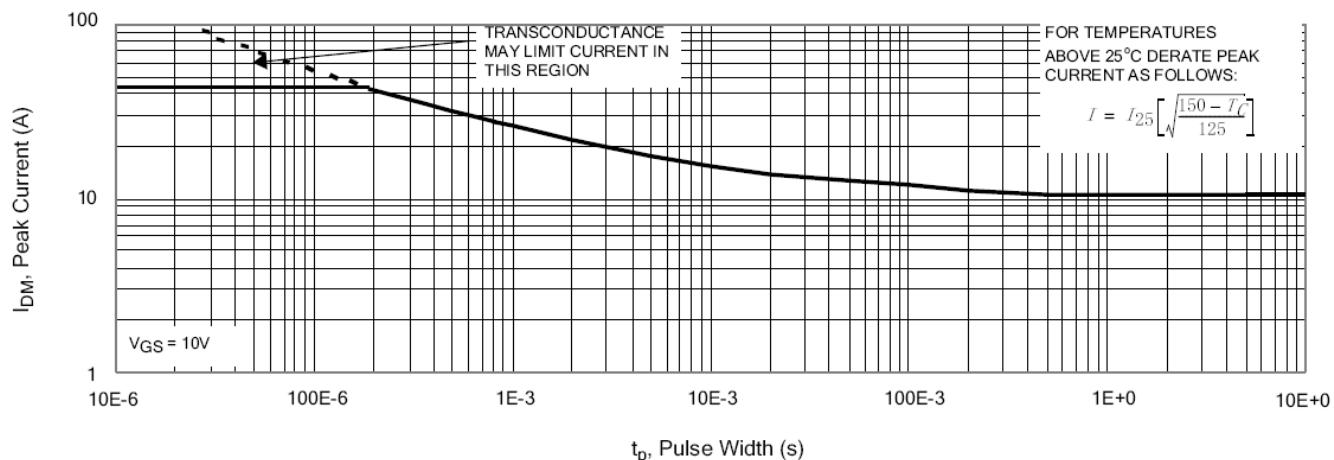


Figure 7. Typical Transfer Characteristics

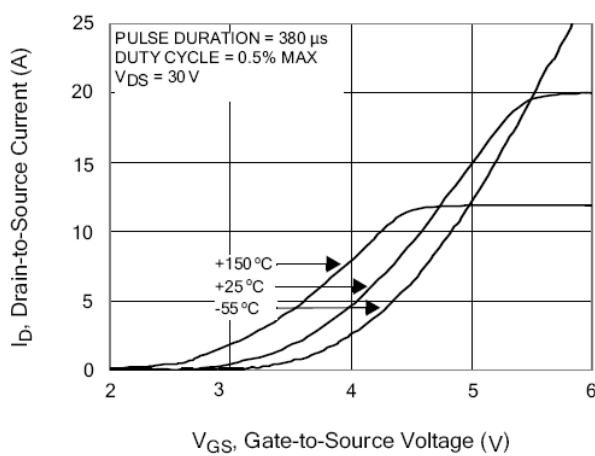


Figure 8. Unclamped Inductive Switching Capability

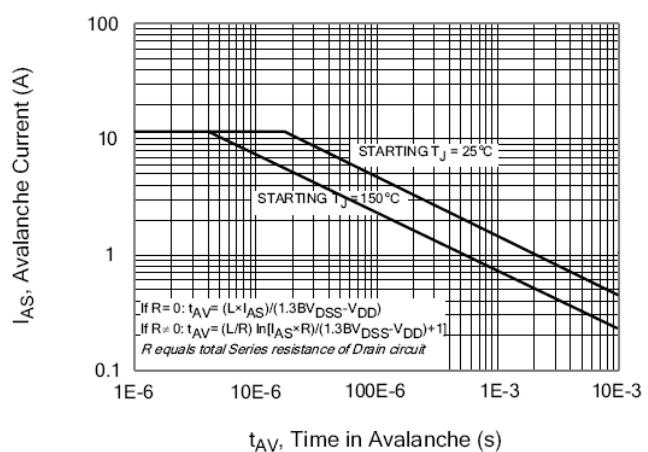


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

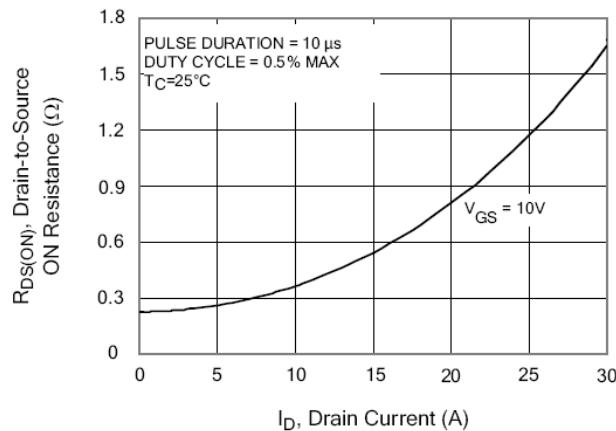
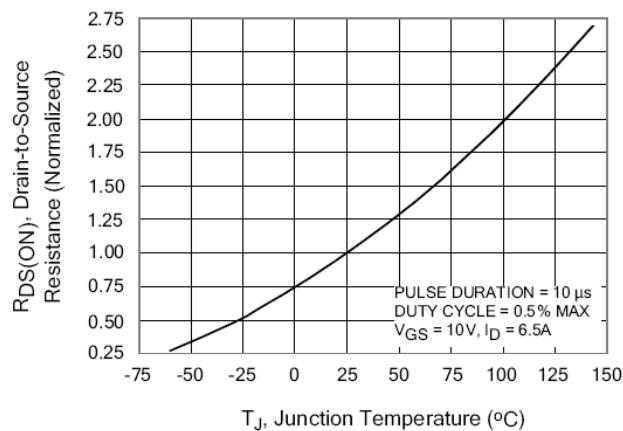


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature



Typical Characteristics(Cont.)

Figure 11. Typical Breakdown Voltage vs Junction Temperature

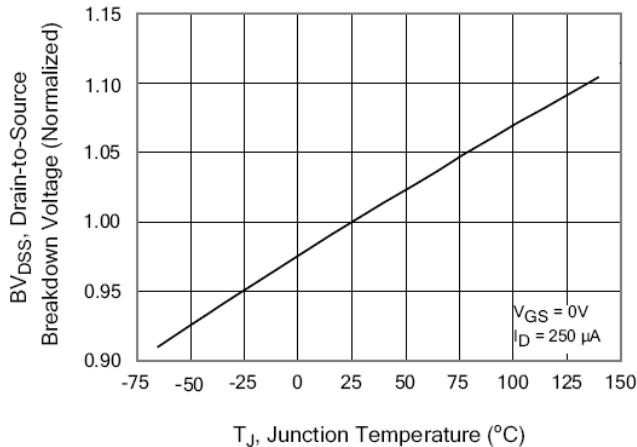


Figure 13. Maximum Forward Bias Safe Operating Area

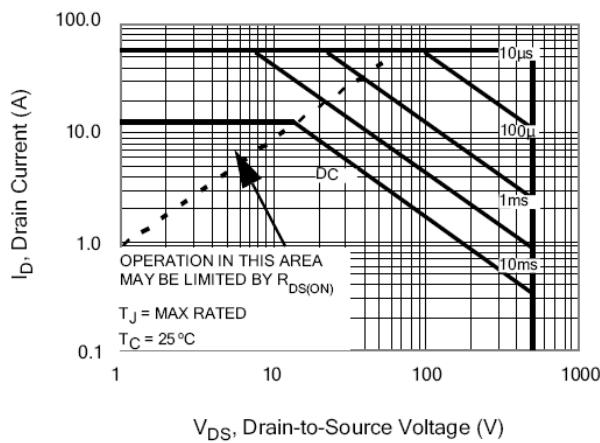


Figure 15. Typical Gate Charge vs Gate-to-Source Voltage

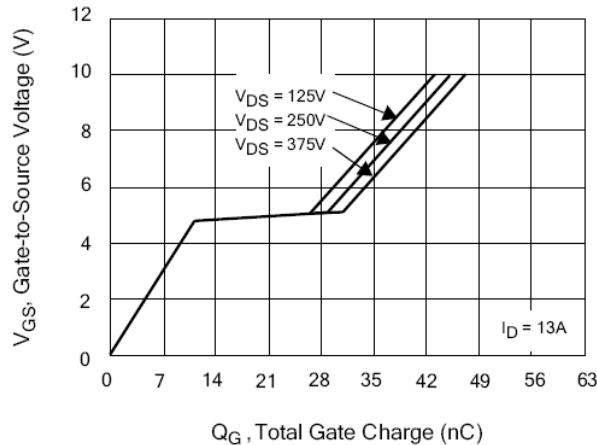


Figure 12. Typical Threshold Voltage vs Junction Temperature

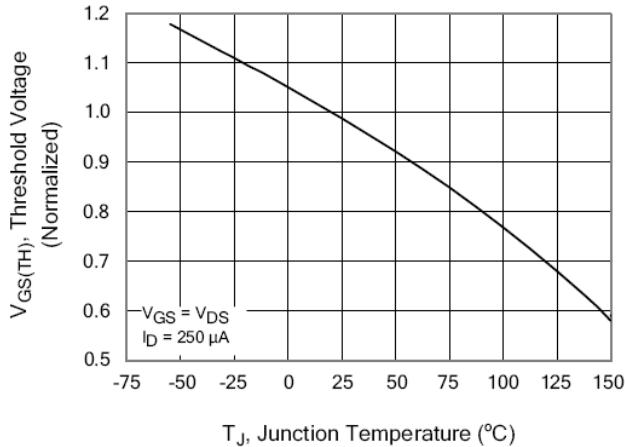


Figure 14. Typical Capacitance vs Drain-to-Source Voltage

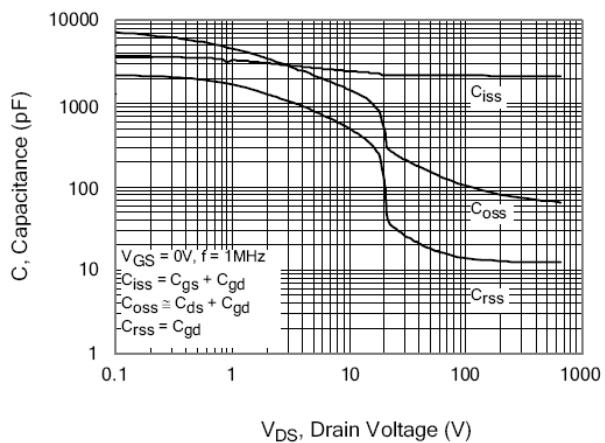
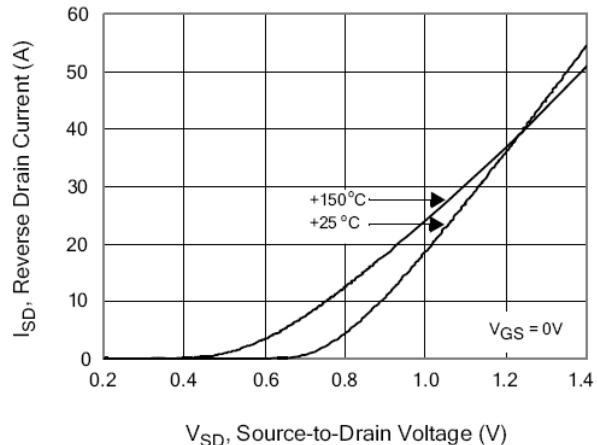


Figure 16. Typical Body Diode Transfer Characteristics



Test Circuits and Waveforms

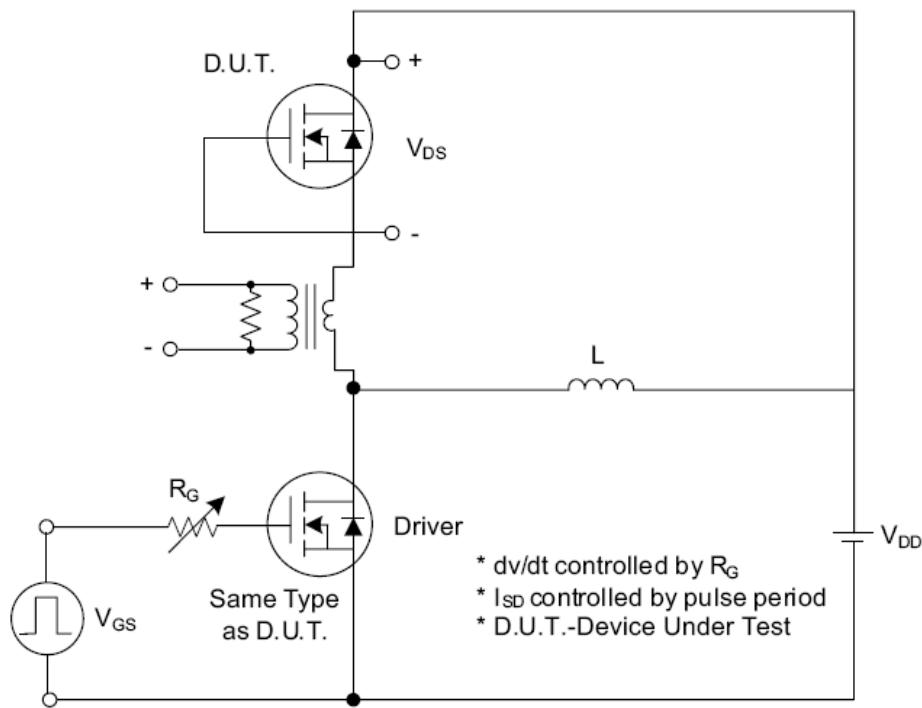


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

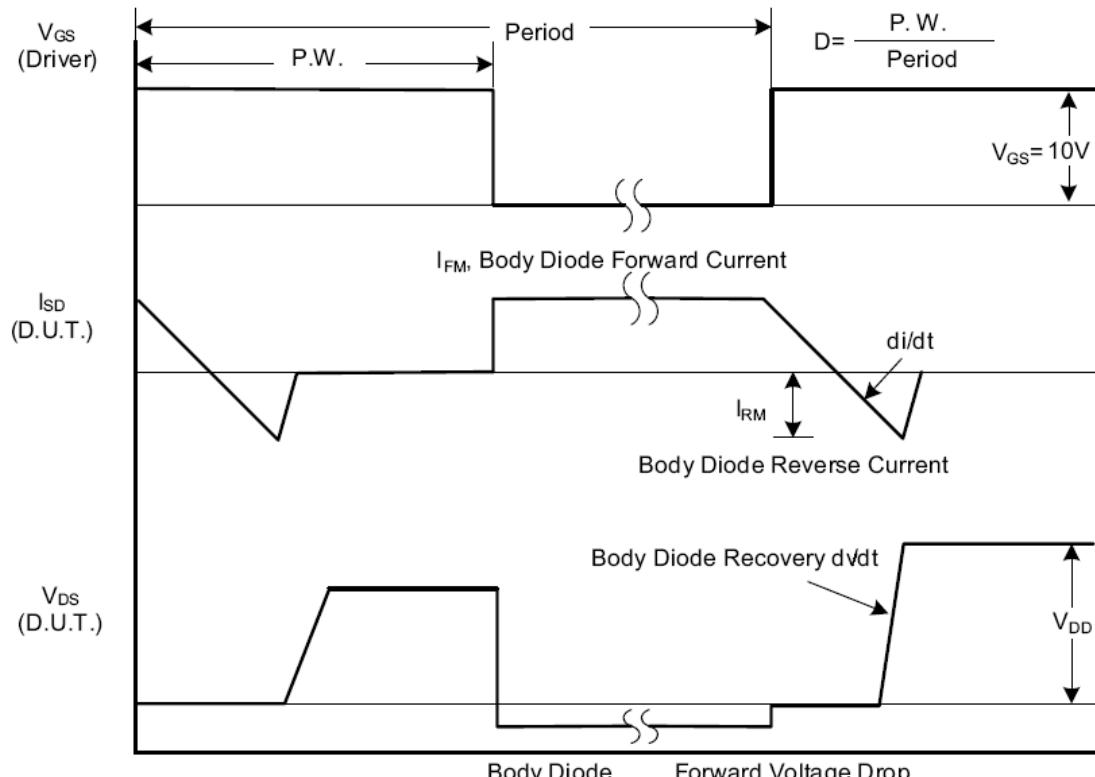


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

Test Circuits and Waveforms (Cont.)

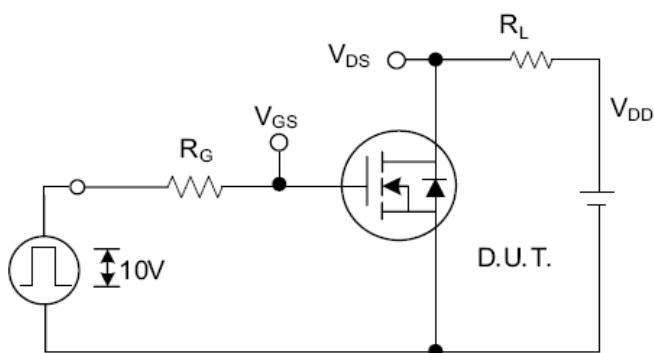


Fig. 2.1 Switching Test Circuit

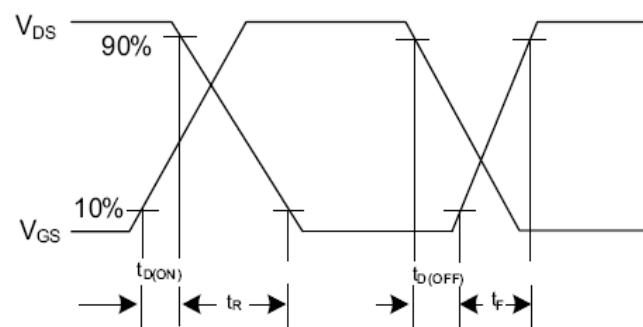


Fig. 2.2 Switching Waveforms

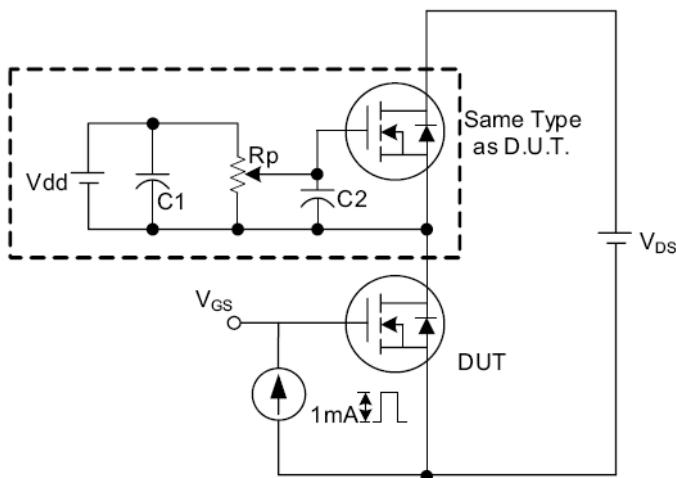


Fig. 3.1 Gate Charge Test Circuit

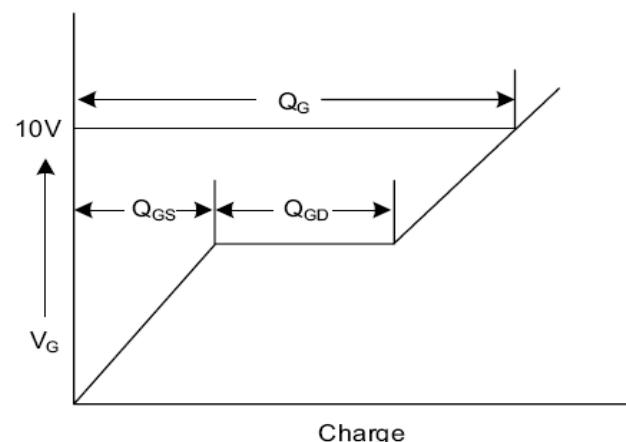


Fig. 3.2 Gate Charge Waveform

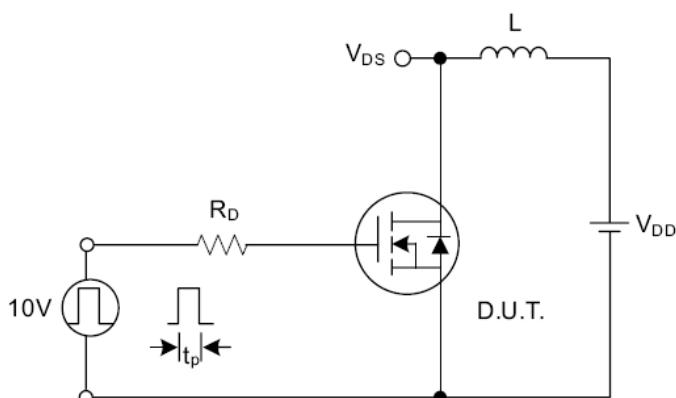


Fig. 4.1 Unclamped Inductive Switching Test Circuit

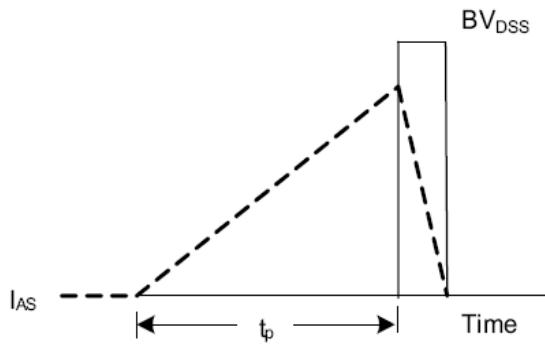
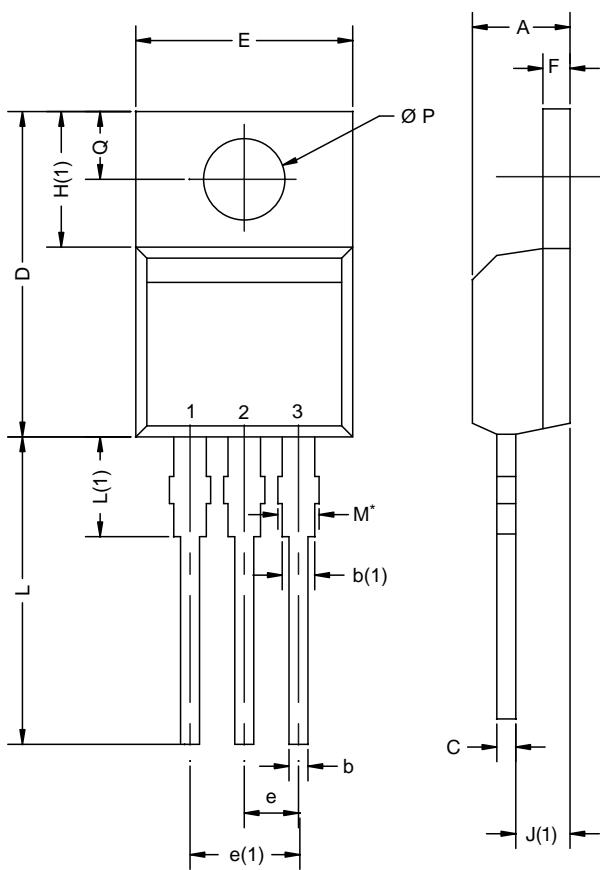


Fig. 4.2 Unclamped Inductive Switching Waveforms

Package Dimension TO-220



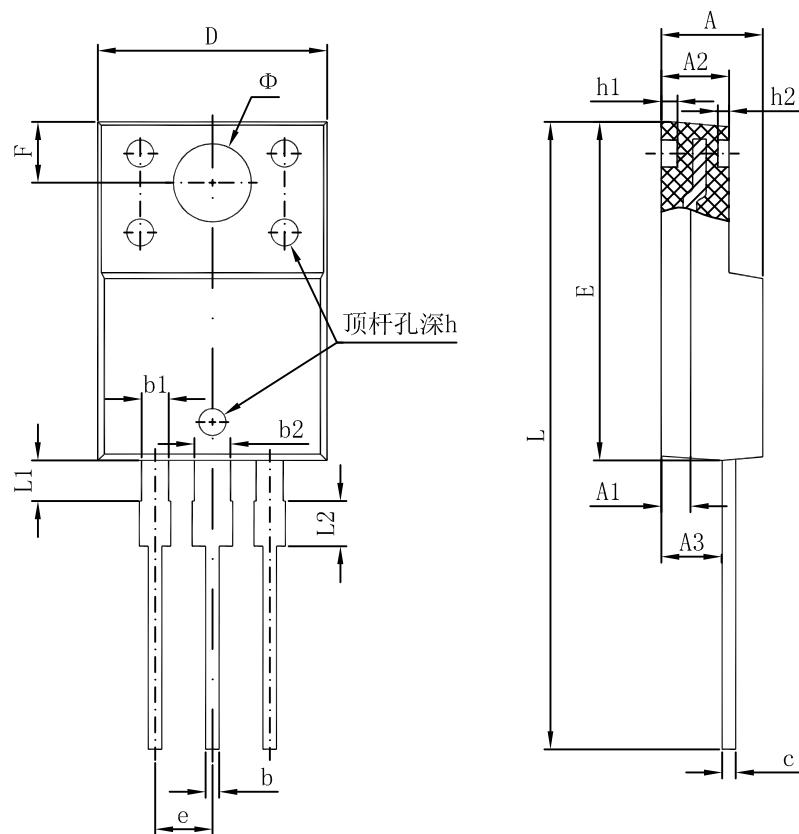
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

REEL SPECIFICATION

P/N	PKG	QTY
MS13N50P	TO-220	1 tube of 50pcs/1 box of 1000pcs

Package Dimension TO-220F


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.300	REF.	0.051	REF.
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.500	0.750	0.020	0.030
b1	1.100	1.350	0.043	0.053
b2	1.500	1.750	0.059	0.069
c	0.500	0.750	0.020	0.030
D	9.960	10.360	0.392	0.408
E	14.800	15.200	0.583	0.598
e	2.540 TYP.		0.100 TYP.	
F	2.700 REF.		0.106 REF.	
Φ	3.500 REF.		0.138 REF.	
h	0.000	0.300	0.000	0.012
h1	0.800 REF.		0.031 REF.	
h2	0.500 REF.		0.020 REF.	
L	28.000	28.400	1.102	1.118
L1	1.700	1.900	0.067	0.075
L2	1.900	2.100	0.075	0.083

REEL SPECIFICATION

P/N	PKG	QTY
MS13N50F	TO-220F	1 tube of 50pcs/1 box of 1000pcs

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