

PRODUCT CHARACTERISTICS

VDSS	500
$R_{DS(on)max}(V_{GS}=10V)$	0.45Ω
Qg@type	43nC
ID	13A

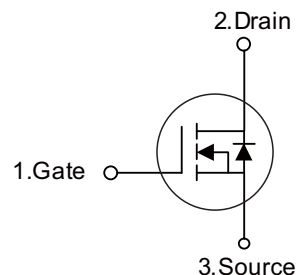
APPLICATIONS

- High efficiency switch mode power supplies
- Electronic ballasts
- LED power supply

FEATURES

- * $R_{DS(ON)} \leq 0.45\Omega @ V_{GS}=10V$
- * High Switching Speed
- * 100% Avalanche Tested

Symbol



TO-220



TO-220F

ORDER INFORMATION

Order codes		Package	Packing
Halogen-Free	Halogen		
N/A	MOT13N50F	TO-220F	50 pieces/Tube
N/A	MOT13N50A	TO-220	50 pieces/Tube

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V _{DSS}	500	V
Gate-Source Voltage		V _{GSS}	±30	V
Continuous Drain Current		I _D	13	A
Pulsed Drain Current (Note 2)		I _{DM}	52	A
Avalanche Current (Note 2)		I _{AR}	13	A
Single Pulsed Avalanche Energy (Note 3)		E _{AS}	860	mJ
Repetitive Avalanche Energy (Note 2)		E _{AR}	19.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation (T _C =25°C)	TO-220	P _D	195	W
	TO-220F		48	W
Junction Temperature		T _J	+150	°C
Storage Temperature		T _{STG}	-55~+150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating : Pulse width limited by maximum junction temperature

3. $L = 6.0$, $I_{AS} = 13A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 13A$, $di/dt \leq 200A/\mu s$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ ELECTRICAL CHARACTERISTICS ($T_C=25^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	500			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 500V, V_{GS} = 0V$			1	μA
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = 30V, V_{DS} = 0V$			100	nA
		$V_{GS} = -30V, V_{DS} = 0V$			-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS} / \Delta T_J$	$I_D = 250\mu A$ Referenced to 25°C		0.5		V/°C
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 6.5A$		0.39	0.45	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1.0MHz$		1580	2055	pF
Output Capacitance	C_{OSS}			180	235	pF
Reverse Transfer Capacitance	C_{RSS}			20	25	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=250V, I_D=13A$ $R_G=25\Omega$ (Note 1,2)		25	60	nS
Turn-On Rise Time	t_R			100	210	nS
Turn-Off Delay Time	$t_{D(OFF)}$			130	270	nS
Turn-Off Fall Time	t_F			100	210	nS
Total Gate Charge	Q_G	$V_{DS}=400V, I_D=13A, V_{GS}=10V$ (Note 1, 2)		43	56	nC
Gate-Source Charge	Q_{GS}			7.5		nC
Gate-Drain Charge	Q_{GD}			18.5		nC

■ ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0V, I_S = 13A$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				13	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				52	A
Reverse Recovery Time	t_{RR}	$V_{GS} = 0V, I_S = 13A,$		410		nS
Reverse Recovery Charge	Q_{RR}	$dI_F / dt = 100A/\mu s$ (Note 1)		4.5		μC

Notes: 1. Pulse Test : Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$

2. Essentially independent of operating ambient temperature

TEST CIRCUITS AND WAVEFORMS

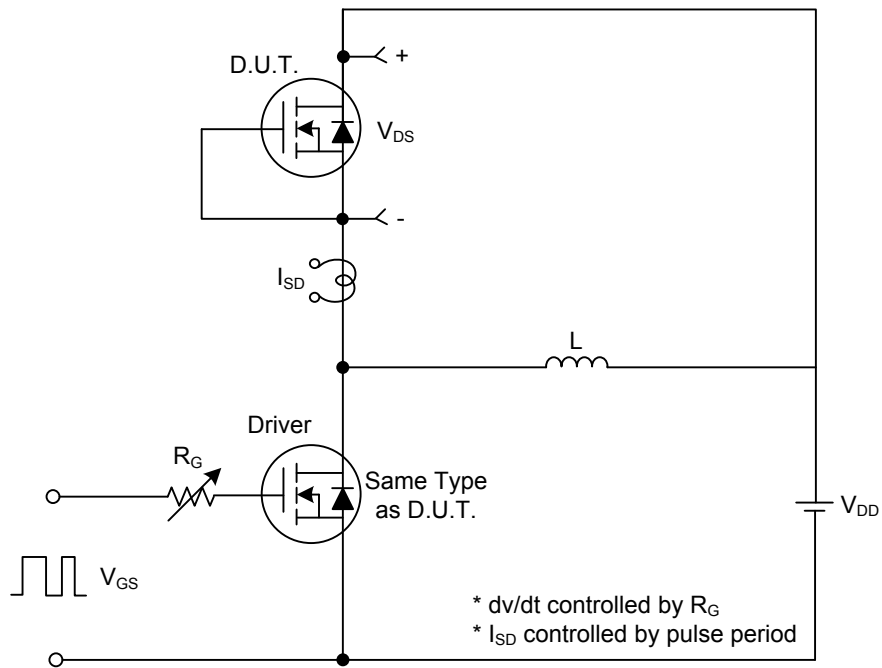


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

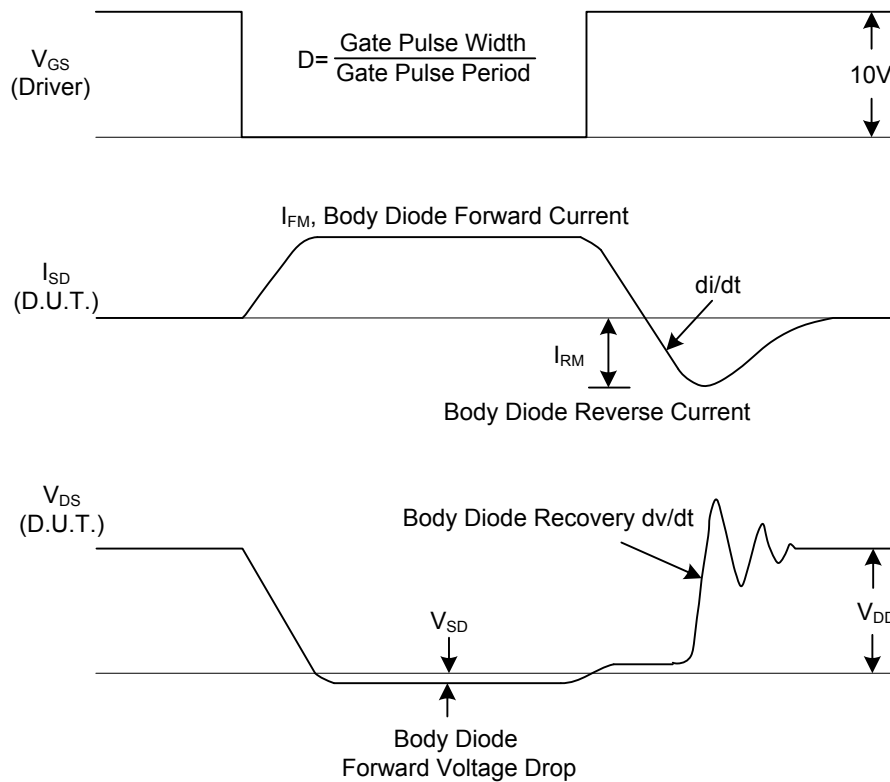


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS(Cont.)

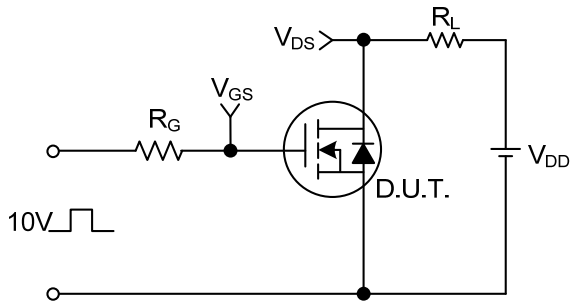


Fig. 2A Switching Test Circuit

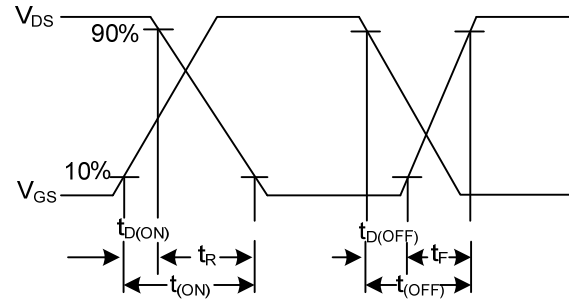


Fig.2B Switching Waveforms

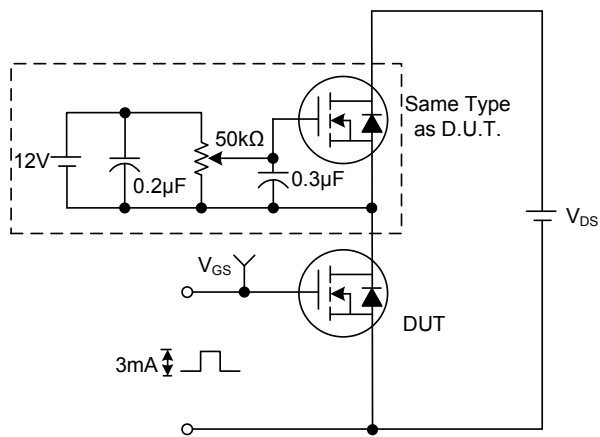


Fig. 3A Gate Charge Test Circuit

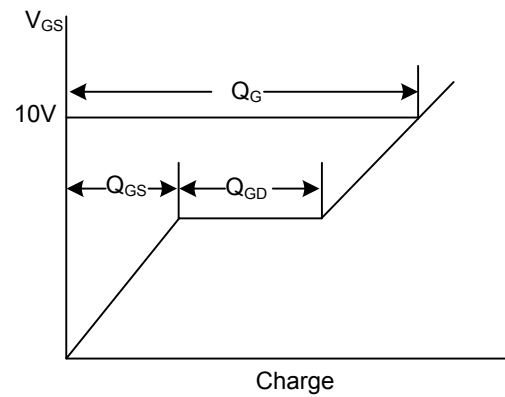


Fig. 3B Gate Charge Waveform

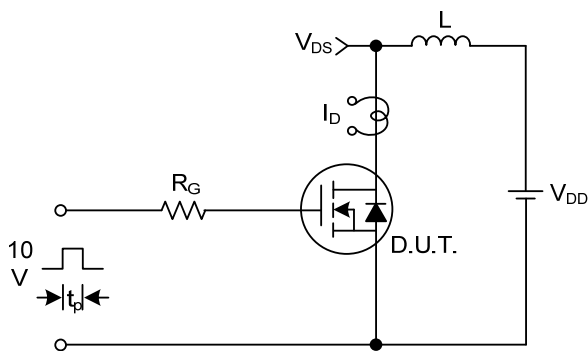


Fig. 4A Unclamped Inductive Switching Test Circuit

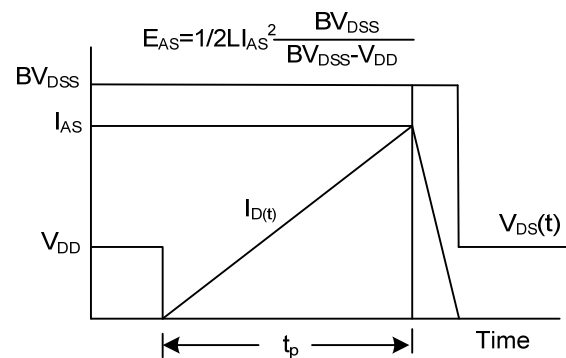


Fig. 4B Unclamped Inductive Switching Waveforms

Technical drawing of a mechanical part, showing three views: front view, top view, and side view. Dimensions are given in millimeters (mm) with tolerances.

Front View Dimensions:

- Overall width: 10.06 ± 0.15
- Overall height: 15.87 ± 0.15
- Top flange width: 7.00 ± 0.15
- Top flange thickness: 3.30
- Central circular feature diameter: $3 - \phi 1.50 \pm 0.15$
- Central circular feature position from top edge: 1.80 ± 0.1
- Central circular feature position from bottom edge: 1.80 ± 0.1
- Bottom flange width: 8.0
- Bottom flange thickness: 4.90
- Bottom flange radius: $R0.5$
- Bottom flange position from top edge: 6.10 ± 0.1
- Bottom flange position from bottom edge: 12.93 ± 0.3
- Bottom flange width: $3 - 1.38 \pm 0.1$
- Bottom flange thickness: 0.80
- Bottom flange position from top edge: (6.47)
- Bottom flange position from bottom edge: (9.75)
- Bottom flange width: 2.54
- Bottom flange thickness: 2.54
- Bottom flange position from top edge: (3.18)

Top View Dimensions:

- Overall width: 10.06 ± 0.15
- Overall height: 15.87 ± 0.15
- Top flange width: 7.00 ± 0.15
- Top flange thickness: 3.30
- Central circular feature diameter: $3 - \phi 1.50 \pm 0.15$
- Central circular feature position from top edge: 1.80 ± 0.1
- Central circular feature position from bottom edge: 1.80 ± 0.1
- Bottom flange width: 8.0
- Bottom flange thickness: 4.90
- Bottom flange radius: $R0.5$
- Bottom flange position from top edge: 6.10 ± 0.1
- Bottom flange position from bottom edge: 12.93 ± 0.3
- Bottom flange width: $3 - 1.38 \pm 0.1$
- Bottom flange thickness: 0.80
- Bottom flange position from top edge: (6.47)
- Bottom flange position from bottom edge: (9.75)
- Bottom flange width: 2.54
- Bottom flange thickness: 2.54
- Bottom flange position from top edge: (3.18)

Side View Dimensions:

- Overall width: 10.06 ± 0.15
- Overall height: 15.87 ± 0.15
- Top flange width: 7.00 ± 0.15
- Top flange thickness: 3.30
- Central circular feature diameter: $3 - \phi 1.50 \pm 0.15$
- Central circular feature position from top edge: 1.80 ± 0.1
- Central circular feature position from bottom edge: 1.80 ± 0.1
- Bottom flange width: 8.0
- Bottom flange thickness: 4.90
- Bottom flange radius: $R0.5$
- Bottom flange position from top edge: 6.10 ± 0.1
- Bottom flange position from bottom edge: 12.93 ± 0.3
- Bottom flange width: $3 - 1.38 \pm 0.1$
- Bottom flange thickness: 0.80
- Bottom flange position from top edge: (6.47)
- Bottom flange position from bottom edge: (9.75)
- Bottom flange width: 2.54
- Bottom flange thickness: 2.54
- Bottom flange position from top edge: (3.18)

■ TO-220-3L PACKAGE OUTLINE DIMENSIONS

