

1.0 Amps, 600/650 Volts N-CHANNEL MOSFET

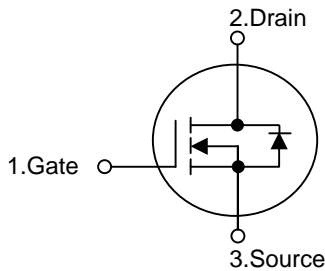
DESCRIPTION

1N60 1N65 is a high voltage MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} = 11.5\Omega @ V_{GS} = 10V$.
- * Ultra Low gate charge (typical 5.0nC)
- * Low reverse transfer capacitance ($C_{RSS} =$ typical 3.0 pF)
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

SYMBOL

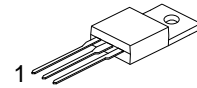


ORDERING INFORMATION

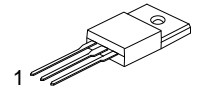
Ordering Number	Package	Pin Assignment		
		1	2	3
1N60	TO-220	G	D	S
	ITO-220/TO-220F	G	D	S
1N65	TO-251/IPAK	G	D	S
	TO-252/DPAK	G	D	S

Note: Pin Assignment: G: Gate D: Drain S: Source

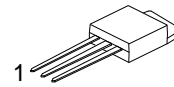
Part No.	Package	Packing
1N6*-TU	TO-251	75pcs / Tube
1N6*-TR	TO-252	2.5Kpcs / 13" Reel
1N6*-TU	TO-252	75pcs / Tube
1N6*-TU	TO-220	50pcs / Tube
1N6*-TU	ITO-220/TO-220F	50pcs / Tube
1N6*-TU	TO-262	50pcs / Tube
1N6*-TU	TO-263	50pcs / Tube
1N6*-TR	TO-263	800pcs / 13" Reel



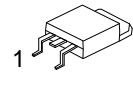
TO-220



ITO-220/TO-220F



TO-251/IPAK



TO-252/DPAK

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	1N60	V_{DSS}	600	V
	1N65		650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note 1)		I_{AR}	1.0	A
Continuous Drain Current		I_D	1.0	A
Pulsed Drain Current (Note 1)		I_{DM}	4.8	A
Avalanche Energy	Single Pulsed (Note 2)	E_{AS}	50	mJ
	Repetitive (Note 1)	E_{AR}	4.0	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation	TO-251/IPAK	P_D	28	W
	TO-252/DPAK		28	W
	TO-220		40	W
	TO-220F		21	W
	TO-92($T_a=25^\circ\text{C}$)		1	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Operating Temperature		T_{OPR}	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

Note: 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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction-to-Ambient	TO-251/IPAK	θ_{JA}	110	$^\circ\text{C/W}$
	TO-252/DPAK		110	
	TO-220		62.5	
	TO-220F		62.5	
	TO-92		140	
Junction-to-Case	TO-251/IPAK	θ_{Jc}	4.53	$^\circ\text{C/W}$
	TO-252/DPAK		4.53	
	TO-220		3.13	
	TO-220F		5.95	

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	1N60	$V_{GS}=0V, I_D=250\mu A$	600			V
	1N65		650			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=600V, V_{GS}=0V$			10	μA
Gate-Source Leakage Current	Forward	$V_{GS}=30V, V_{DS}=0V$ $V_{GS}=-30V, V_{DS}=0V$			100	nA
	Reverse				-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$		0.4		$^\circ\text{C}^{-1}$
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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=0.5A$		9.3	11.5	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1\text{MHz}$		120	150	pF
Output Capacitance	C_{OSS}			20	25	pF
Reverse Transfer Capacitance	C_{RSS}			3.0	4.0	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=300V, I_D=1.0A, R_G=50\Omega$ (Note 4,5)		5	20	ns
Turn-On Rise Time	t_R			25	60	ns
Turn-Off Delay Time	$t_{D(OFF)}$			7	25	ns
Turn-Off Fall Time	t_F			25	60	ns
Total Gate Charge	Q_G	$V_{DS}=480V, V_{GS}=10V, I_D=1.0A$ (Note 4,5)		5.0	6.0	nC
Gate-Source Charge	Q_{GS}			1.0		nC
Gate-Drain Charge	Q_{GD}			2.6		nC
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=1.0A$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				1.2	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				4.8	A
Reverse Recovery Time	t_{RR}	$V_{GS}=0V, I_S=1.0A$		160		ns
Reverse Recovery Charge	Q_{RR}	$di_F/dt=100A/\mu s$ (Note1)		0.3		μC

- Note:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
 2. $L = 60\text{mH}, I_{AS} = 1A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
 3. $I_{SD} \leq 1.0A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
 4. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
 5. Essentially Independent of Operating Temperature

■ TEST CIRCUITS AND WAVEFORMS

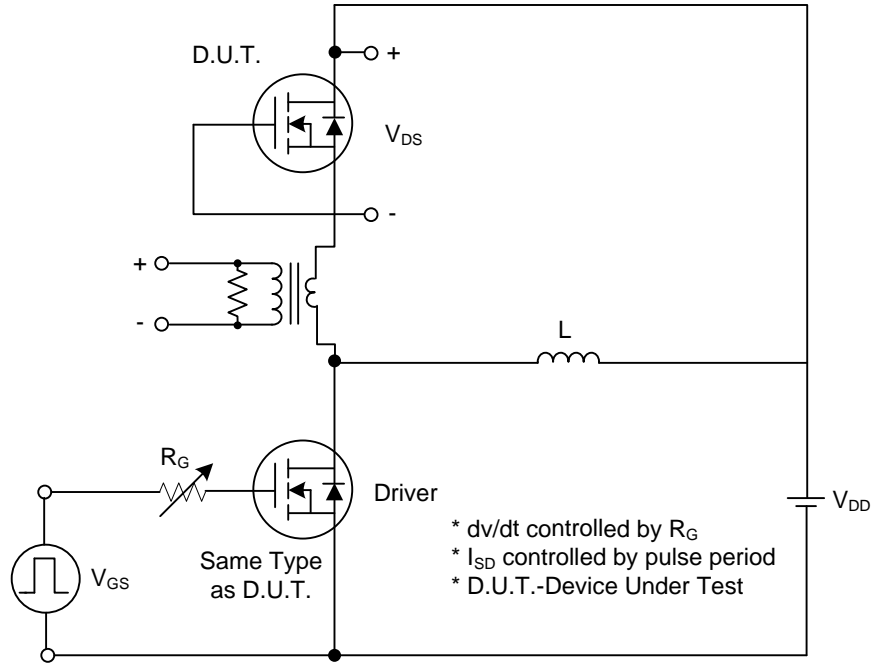


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

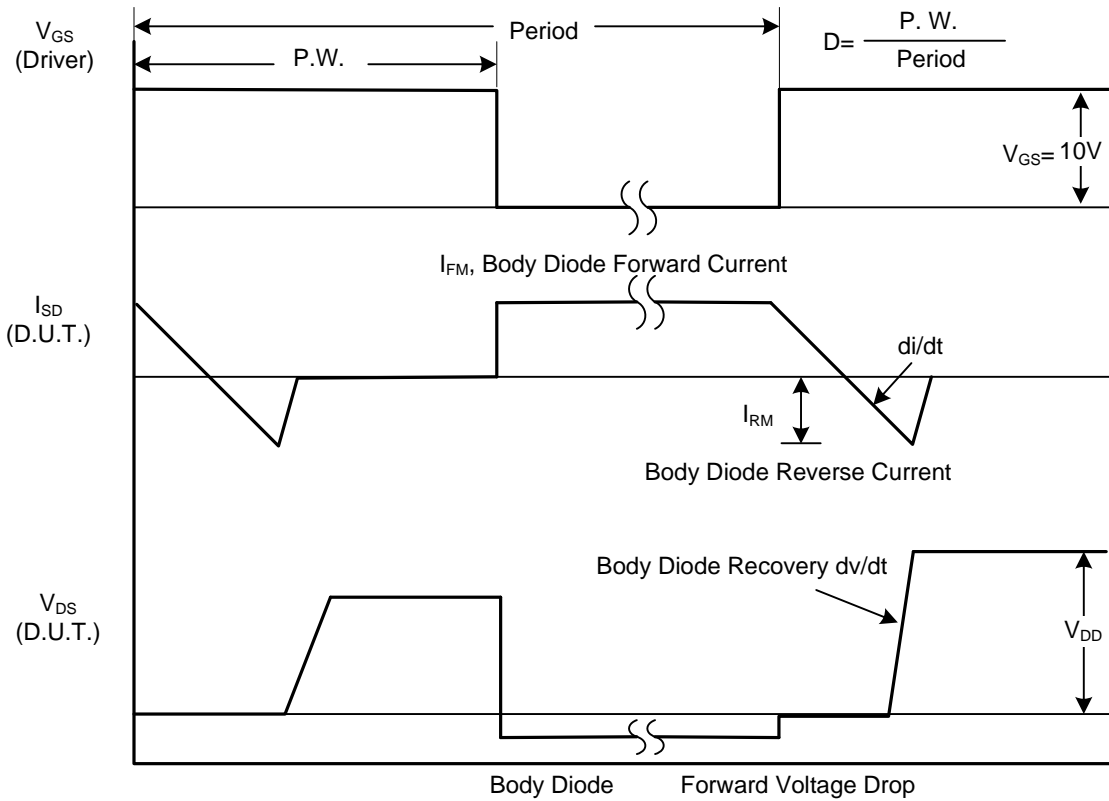


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

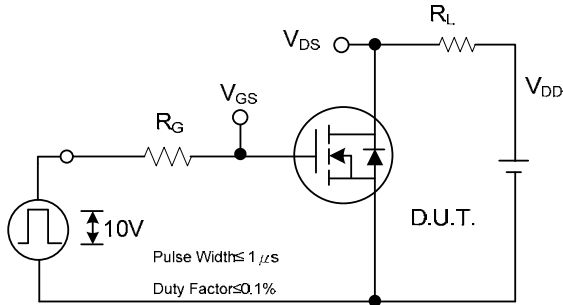


Fig. 2A Switching Test Circuit

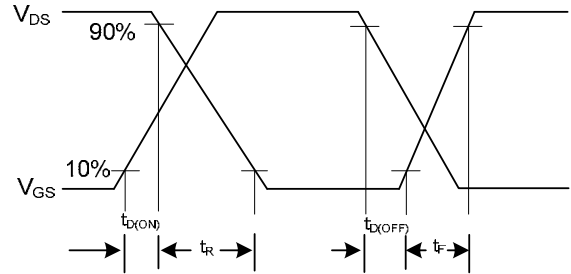


Fig. 2B Switching Waveforms

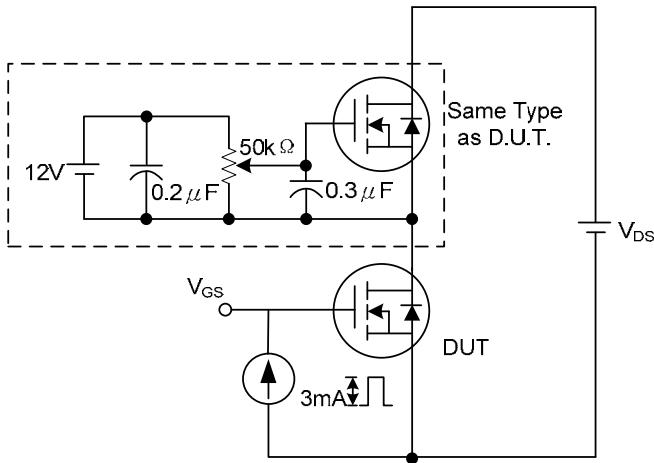


Fig. 3A Gate Charge Test Circuit

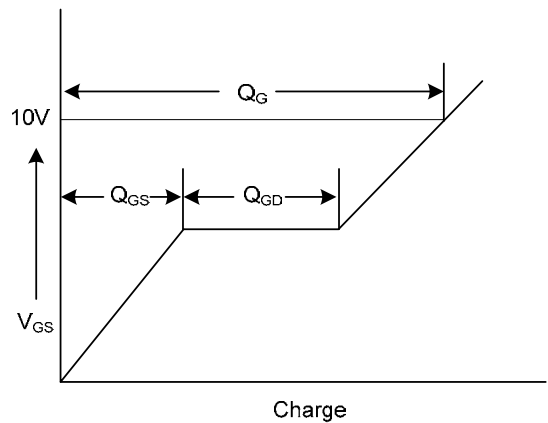


Fig. 3B Gate Charge Waveform

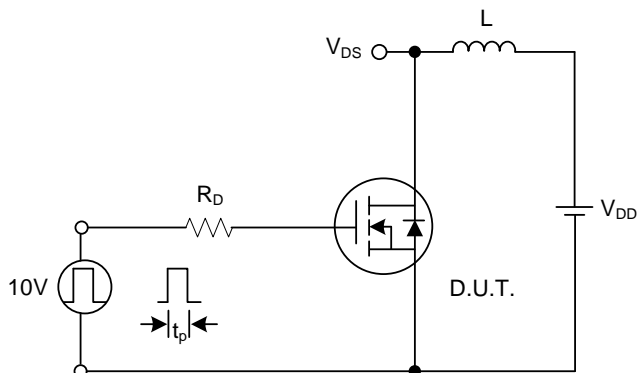


Fig. 4A Unclamped Inductive Switching Test Circuit

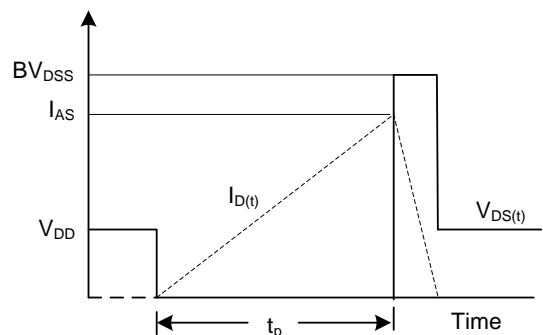


Fig. 4B Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

