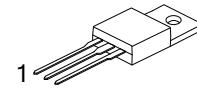


12N60 12N65

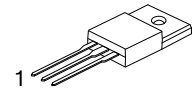
Power MOSFET

12 Amps, 600/650 Volts

N-CHANNEL POWER MOSFET



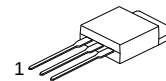
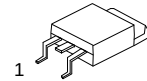
TO-220



ITO-220/TO-220F

DESCRIPTION

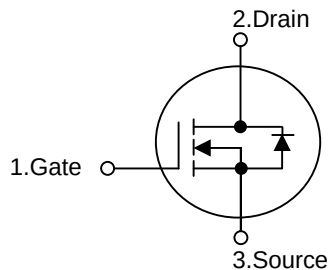
12N60 12N65 is a high voltage and high current power MOSFET, designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

TO-262/I²PAKTO-263/D²PAK

FEATURES

- * 12A, 600V, $R_{DS(ON)} = 0.73\Omega @ V_{GS} = 10V$
- * Low gate charge (typical 44 nC)
- * Low C_{rss} (typical 18 pF)
- * Fast switching
- * 100% avalanche tested
- * Improved dv/dt capability

SYMBOL



ORDERING INFORMATION

Ordering Number	Package	Pin Assignment		
		1	2	3
12N60	TO-220	G	D	S
	ITO-220/TO-220F	G	D	S
12N65	TO-262/I ² PAK	G	D	S
	TO-263/D ² PAK	G	D	S

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

Part No.	Package	Packing
12N6*-TU	TO-220	50pcs / Tube
12N6*-TU	ITO-220/TO-220F	50pcs / Tube
12N6*-TU	TO-262	50pcs / Tube
12N6*-TU	TO-263	50pcs / Tube
12N6*-TR	TO-263	800pcs / 13" Reel

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	12N60	V_{DS}	600	V
	12N65		650	V
Gate-Source Voltage		V_{GS}	± 30	V
Avalanche Current (Note 2)		I_{AR}	10	A
Drain Current	Continuous	I_D	12	A
	Pulsed (Note 2)	I_{DM}	48.0	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	790	mJ
	Repetitive (Note 2)	E_{AR}	15.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-263/TO-262	P_D ($T_C = 25^\circ\text{C}$)	225	W
	TO-220F		51	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Ambient Operating Temperature		T_{OPR}	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

- 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 T_J
 3. $L=7.3\text{mH}$, $I_S=10\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
 4. $I_{SD}\leq 9.5\text{A}$, $di/dt\leq 200\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction-to-Ambient	TO-262/I ² PAK	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-263/D ² PAK		62.5	
	TO-220		62.5	
	ITO-220/TO-220F		62.5	
Junction-to-Case	TO-262/I ² PAK	θ_{JC}	0.85	$^\circ\text{C}/\text{W}$
	TO-263/D ² PAK		0.85	
	TO-220		0.85	
	ITO-220/TO-220F		2.60	

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

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	10N60	BV _{DSS}	V _{GS} = 0V, I _D = 250μA	600			V
	10N65			650			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			1	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30V, V _{DS} = 0V			100	nA
	Reverse		V _{GS} = -30V, V _{DS} = 0V			-100	nA
Breakdown Voltage Temperature Coefficient		△BV _{DSS} /△T _J	I _D = 250 μA, Referenced to 25°C		0.7		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250μA	2.0		4.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} = 10V, I _D =6A		0.6	0.8	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V,f =1MHz		1480		pF
Output Capacitance		C _{OSS}			200		pF
Reverse Transfer Capacitance		C _{RSS}			25		pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D (ON)}	V _{DD} =300V, I _D =10A, R _G =25Ω (Note 1, 2)		30	55	ns
Turn-On Rise Time		t _R			115	150	ns
Turn-Off Delay Time		t _{D(OFF)}			95	300	ns
Turn-Off Fall Time		t _F			85	165	ns
Total Gate Charge		Q _G	V _{DS} =480V, V _{GS} =10V, I _D =10A (Note 1, 2)		42	57	nC
Gate-Source Charge		Q _{GS}			8.6		nC
Gate-Drain Charge		Q _{GD}			21		nC
DRAIN-SOURCE DIODE CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} = 0 V, I _{SD} = 10 A			1.4	V
Continuous Drain-Source Current		I _{SD}				12	A
Pulsed Drain-Source Current		I _{SM}				48	A
Reverse Recovery Time		t _{RR}	V _{GS} = 0 V, I _{SD} = 10A,		570		ns
Reverse Recovery Charge		Q _{RR}	di/dt = 100 A/μs (Note1)		5.5		μC

Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$
2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

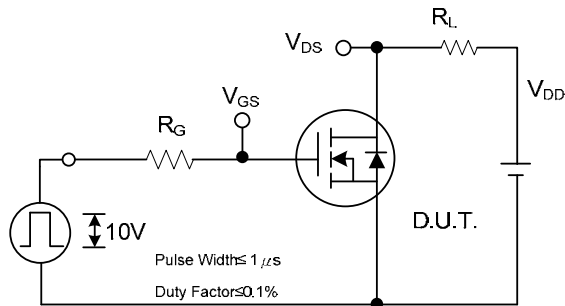


Fig. 2A Switching Test Circuit

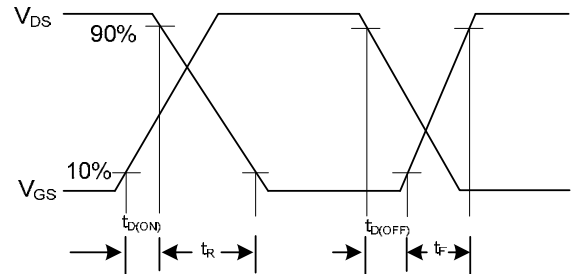


Fig. 2B Switching Waveforms

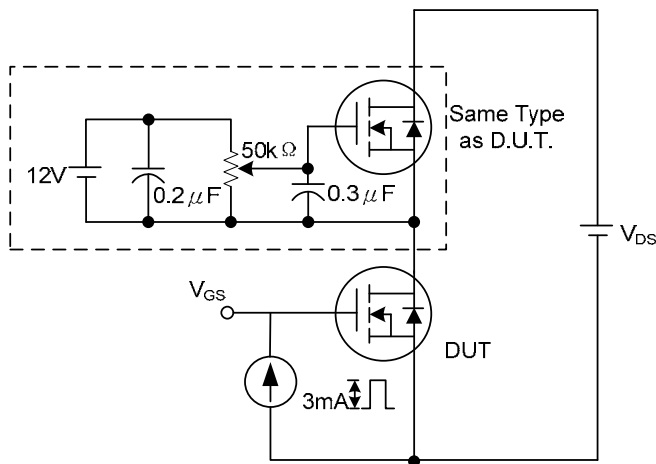


Fig. 3A Gate Charge Test Circuit

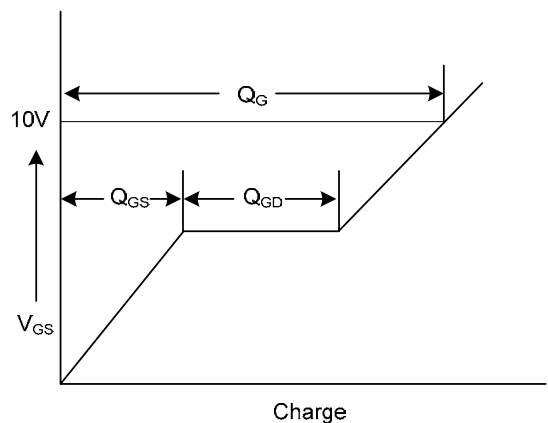


Fig. 3B Gate Charge Waveform

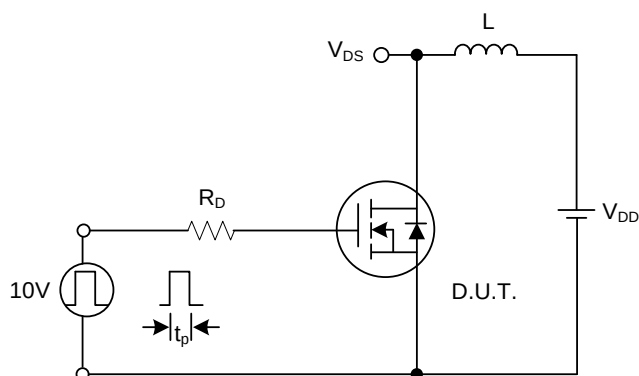


Fig. 4A Unclamped Inductive Switching Test Circuit

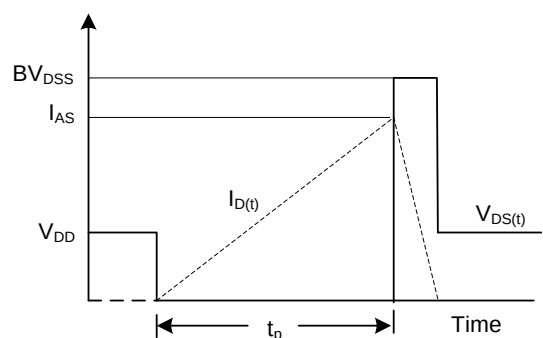
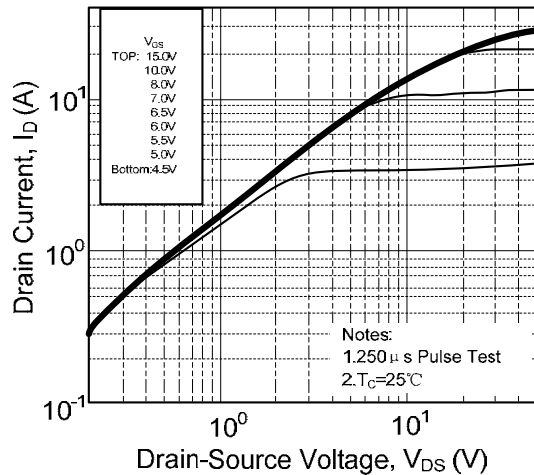


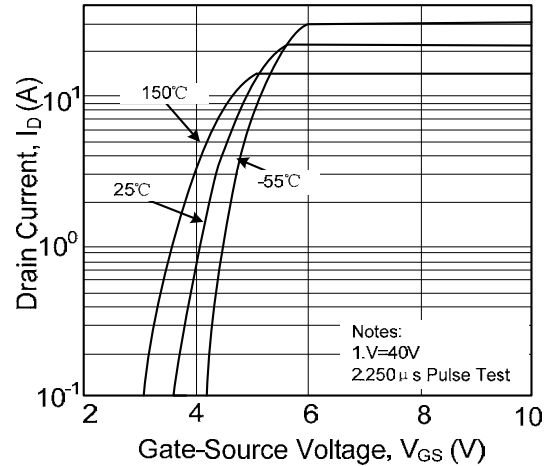
Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

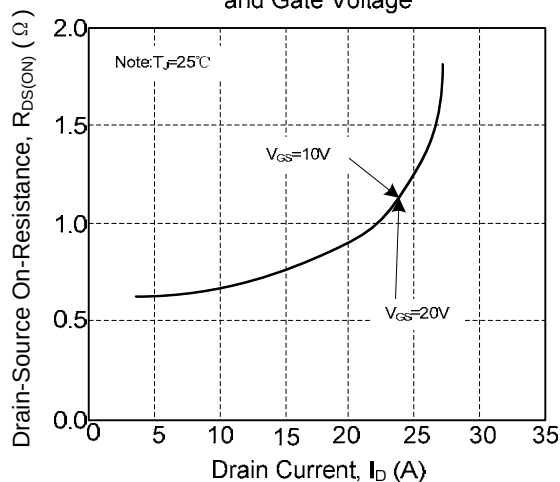
On-Region Characteristics



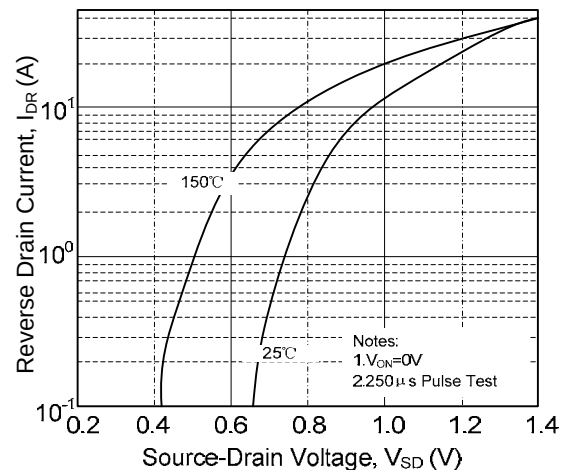
Transfer Characteristics



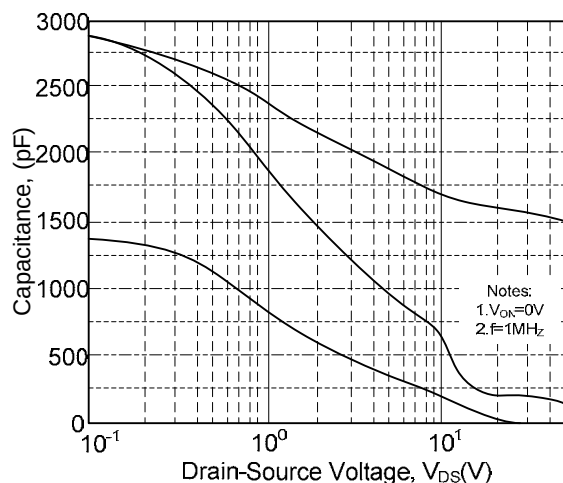
On-Resistance Variation vs. Drain Current and Gate Voltage



Body Diode Forward Voltage Variation with Source Current and Temperature



Capacitance Characteristics



Gate Charge Characteristics

