



## 9.5 Amps, 650 Volts N-CHANNEL POWER MOSFET

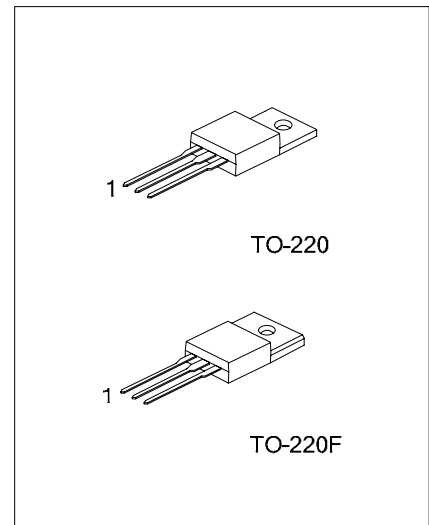
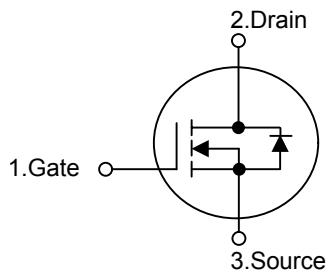
### ■ DESCRIPTION

The YR10N60 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.

### ■ FEATURES

- \* 9.5A, 650V,  $R_{DS(ON)}=1.2 \Omega @ V_{GS}=10V$
- \* Low gate charge ( typical 44 nC)
- \* Low Crss ( typical 18 pF)
- \* Fast switching
- \* 100% avalanche tested
- \* Improved dv/dt capability

### ■ SYMBOL



\*Pb-free plating product number:10N60

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	10N60	$V_{DSS}$	600	V
	10N65		650	V
Gate-Source Voltage		$V_{GSS}$	$\pm 20$	V
Avalanche Current (Note 1)		$I_{AR}$	9.5	A
Continuous Drain Current	$T_C = 25^\circ\text{C}$	$I_D$	9.5	A
	$T_C = 100^\circ\text{C}$		3.3	
Pulsed Drain Current (Note 1)		$I_{DM}$	38	A
Avalanche Energy	Single Pulsed (Note 2)	$E_{AS}$	700	mJ
	Repetitive (Note 1)	$E_{AR}$	15.6	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation		$P_D$	156	W
Junction Temperature		$T_J$	+150	
Operating Temperature		$T_{OPR}$	-55 ~ +150	
Storage Temperature		$T_{STG}$	-55 ~ +150	

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction-to-Ambient	$\theta_{JA}$	62.5	$^\circ\text{C/W}$
Junction-to-Case	$\theta_{JC}$	0.8	$^\circ\text{C/W}$

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	10N60	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu\text{A}$	600		V
	10N65	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu\text{A}$	650		V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$			1	$\mu\text{A}$
Gate-Source Leakage Current	Forward	$I_{GSS}$	$V_{GS} = 20V, V_{DS} = 0V$		100	nA
	Reverse		$V_{GS} = -20V, V_{DS} = 0V$		-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$		0.7		$V/^\circ\text{C}$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 4.75A$		0.95	1.2	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V, f=1.0\text{MHz}$		1570	2040	pF
Output Capacitance	$C_{OSS}$			166	215	pF
Reverse Transfer Capacitance	$C_{RSS}$			18	24	pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=300V, I_D=9.5A, R_\theta=25^\circ\Omega$ (Note 4, 5)		23	55	ns
Turn-On Rise Time	$t_R$			69	150	ns
Turn-Off Delay Time	$t_{D(OFF)}$			144	300	ns
Turn-Off Fall Time	$t_F$			77	165	ns
Total Gate Charge	$Q_G$			44	57	nC
Gate-Source Charge	$Q_{GS}$	$V_{DS}=480V, I_D=9.5A, V_{GS}=10V$ (Note 4, 5)		6.7		nC
Gate-Drain Charge	$Q_{GD}$			18.5		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 9.5\text{ A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				10	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				38	A
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 9.5\text{ A},$		420		ns
Reverse Recovery Charge	$Q_{RR}$	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)		4.2		$\mu\text{C}$

- Note: 1. Repetitive Rating: Pulse width limited by maximum junction temperature  
 2.  $L = 14.2\text{ mH}, I_{AS} = 9.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$  Starting  $T_J = 25^\circ\text{C}$   
 3.  $I_{SD} \leq 9.5\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$   
 4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$   
 5. Essentially independent of operating temperature



■ TEST CIRCUITS AND WAVEFORMS (Cont.)

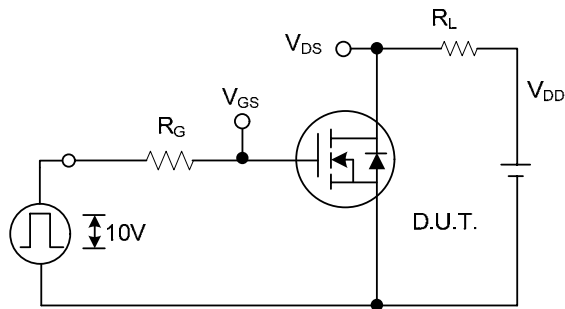


Fig. 2A Switching Test Circuit

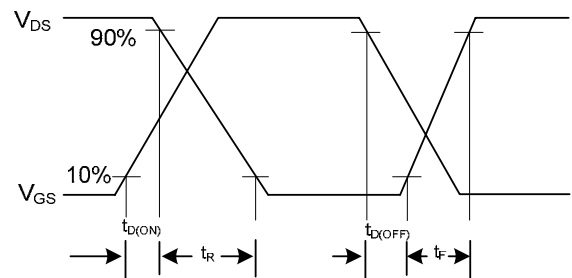


Fig. 2B Switching Waveforms

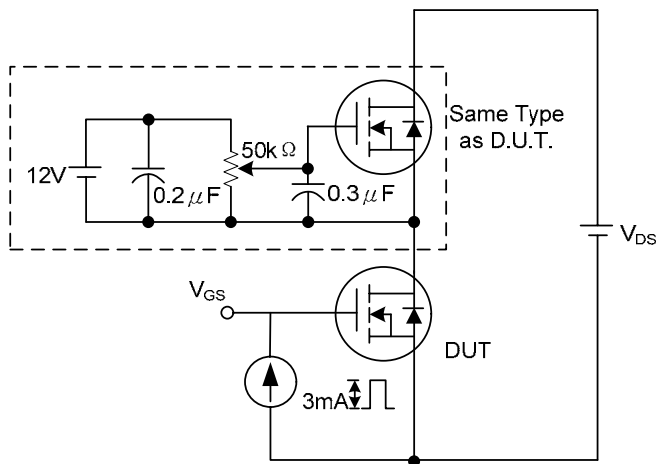


Fig. 3A Gate Charge Test Circuit

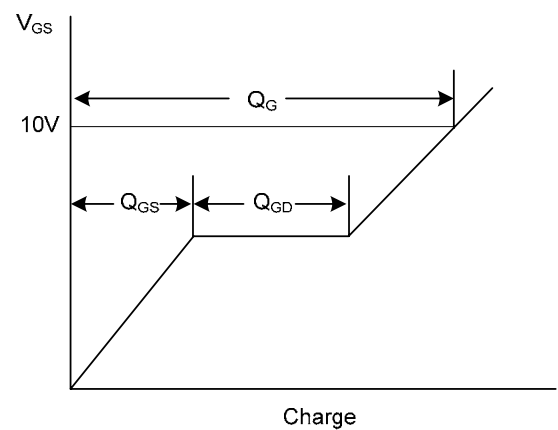


Fig. 3B Gate Charge Waveform

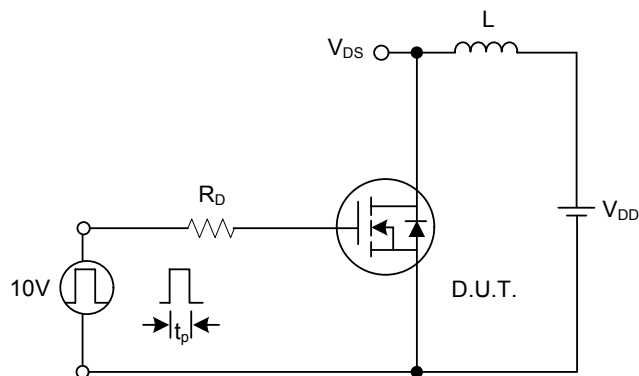


Fig. 4A Unclamped Inductive Switching Test Circuit

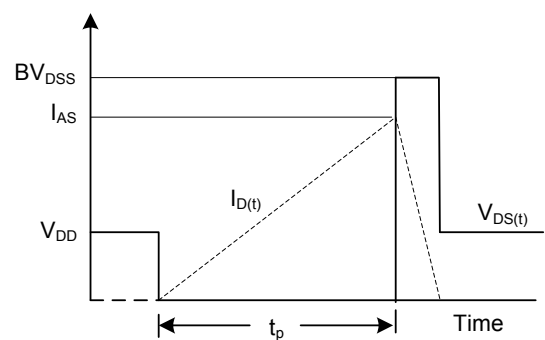
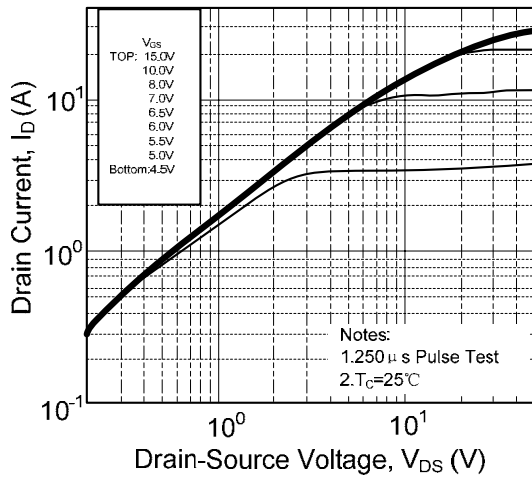


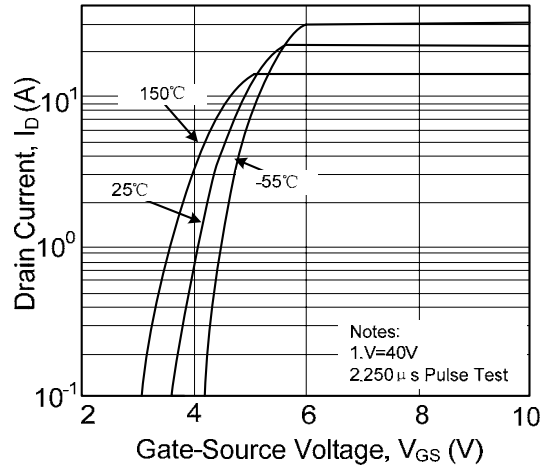
Fig. 4B Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

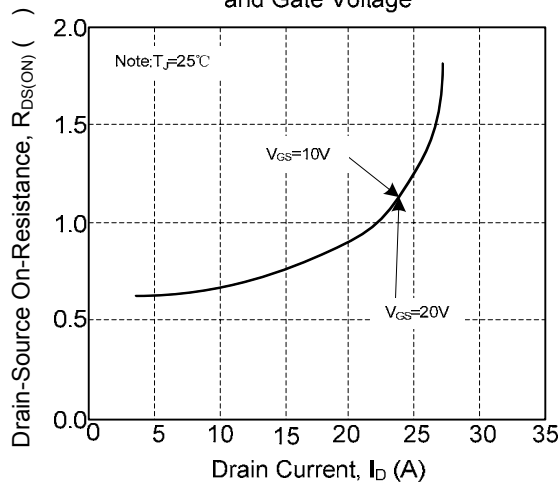
On-Region Characteristics



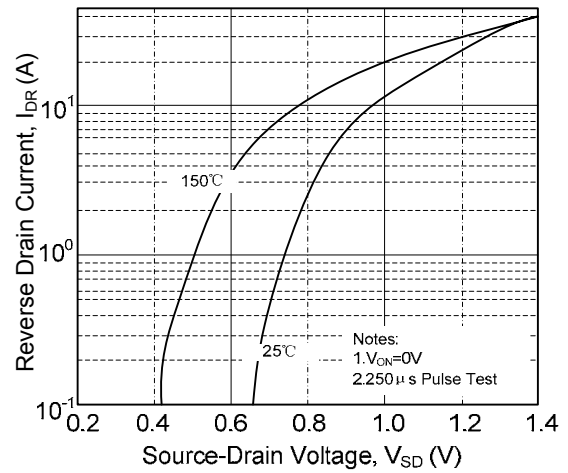
Transfer Characteristics



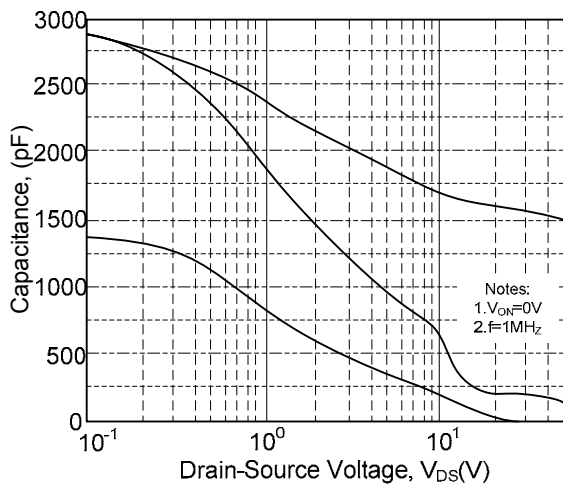
On-Resistance Variation vs. Drain Current and Gate Voltage



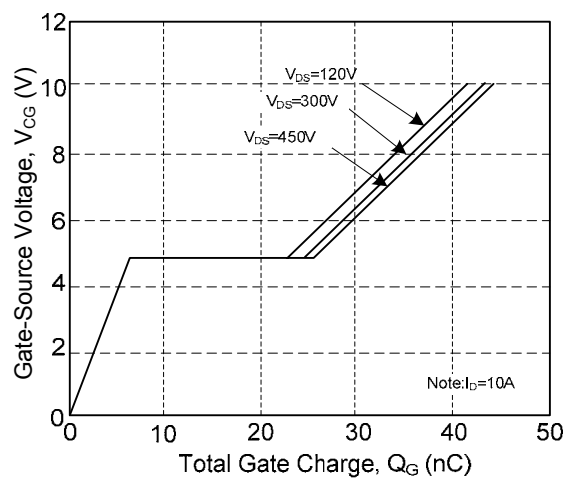
Body Diode Forward Voltage Variation with Source Current and Temperature



Capacitance Characteristics

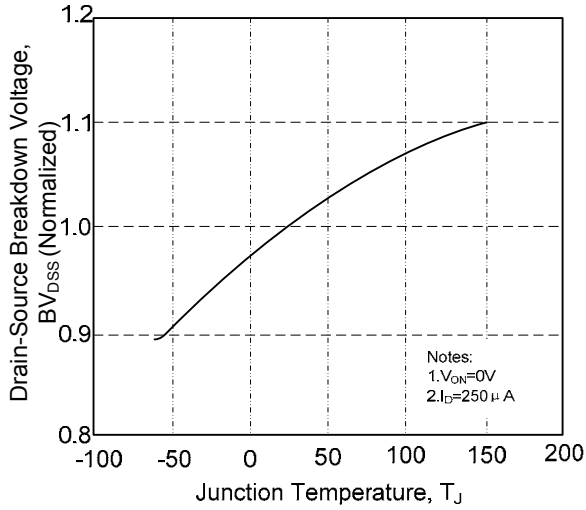


Gate Charge Characteristics

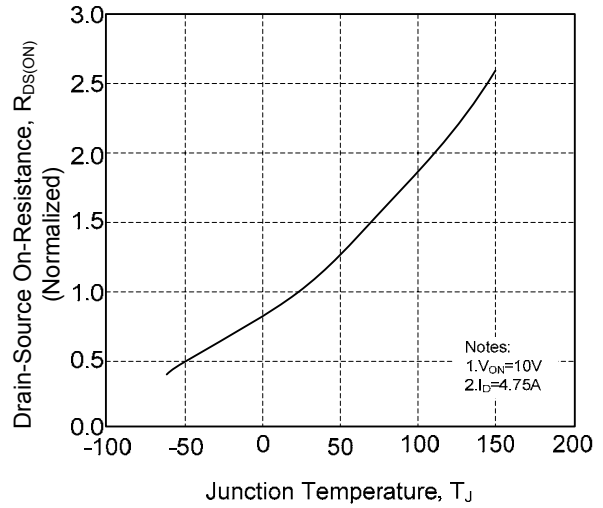


■ TYPICAL CHARACTERISTICS(Cont.)

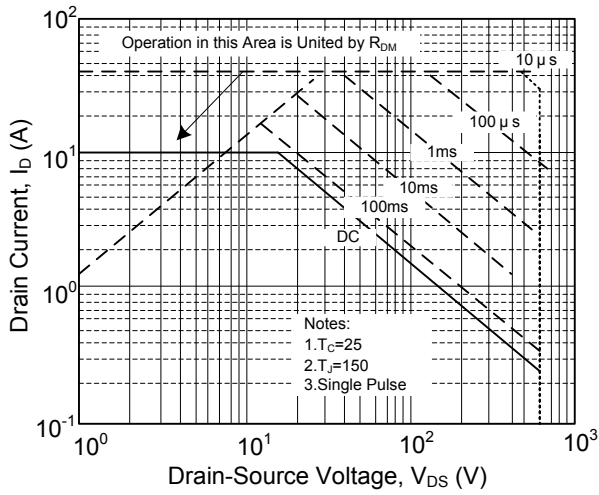
Breakdown Voltage Variation vs. Temperature



On-Resistance Variation vs. Temperature



Maximum Safe Operating Area



Maximum Drain Current vs. Case Temperature

