



## 4.5 Amps, 650 Volts N-CHANNEL MOSFET

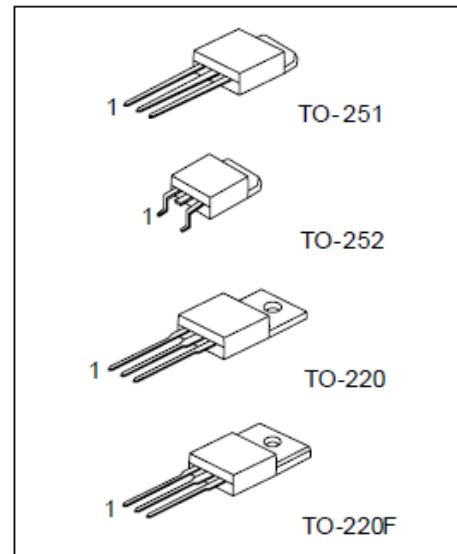
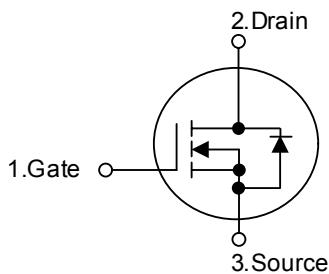
### ■ DESCRIPTION

The YR 5N65 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

- \*  $R_{DS(ON)} = 2.8\Omega @ V_{GS} = 10V$
- \* Ultra low gate charge ( typical 15 nC )
- \* Low reverse transfer Capacitance (  $C_{RSS} =$  typical 6.5 pF )
- \* Fast switching capability
- \* Avalanche energy Specified
- \* Improved dv/dt capability, high ruggedness

### ■ SYMBOL



■ ABSOLUTE MAXIMUM RATING ( $T_C = 25$  unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	650	V
Gate-Source Voltage		$V_{GSS}$	$\pm 20$	V
Avalanche Current (Note 1)		$I_{AR}$	4.5	A
Continuous Drain Current	$T_C = 25$	$I_D$	4.5	A
	$T_C = 100$		2.6	A
Pulsed Drain Current (Note 1)		$I_{DM}$	18	A
Avalanche Energy, Single Pulsed (Note 2)		$E_{AS}$	210	mJ
Avalanche Energy, Repetitive Limited by $T_{J(MAX)}$		$E_{AR}$	10	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation	$T_C = 25$	$P_D$	100	W
	Derate above 25		0.8	W/
Junction Temperature		$T_J$	+150	
Operating and Storage Temperature		$T_{STG}$	-55 ~ +150	

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		$\theta_{JA}$	62.5	$^{\circ}\text{C/W}$
Junction-to-Case		$\theta_{JC}$	1.25	$^{\circ}\text{C/W}$
Case-to-Sink		$\theta_{CS}$	0.5	$^{\circ}\text{C/W}$

■ ELECTRICAL CHARACTERISTICS ( $T_C = 25$  unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Off Characteristics</b>							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650			V
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$			1	$\mu A$
			$V_{DS} = 520V, T_C = 125$			10	$\mu A$
Breakdown Voltage Temperature Coefficient		$BV_{DSS}/T_J$	$I_D = 250\mu A$ , Referenced to 25		0.6		V/
Gate-Body Leakage Current	Forward	$I_{GSS}$	$V_{GS} = 20V, V_{DS} = 0V$			100	nA
	Reverse		$V_{GS} = -20V, V_{DS} = 0V$			-100	nA
<b>On Characteristics</b>							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.0	V
Static Drain-Source On-Resistance		$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 2.25A$		2.4	2.8	$\Omega$
Forward Transconductance		$g_{FS}$	$V_{DS} = 40V, I_D = 2.25A$ (Note 4)		4.7		S
<b>Dynamic Characteristics</b>							
Input Capacitance		$C_{ISS}$	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$		515	670	pF
Output Capacitance		$C_{OSS}$			55	72	pF
Reverse Transfer Capacitance		$C_{RSS}$			6.5	8.5	pF
<b>Switching Characteristics</b>							
Turn-On	Delay Time	$t_{D(ON)}$	$V_{DD} = 300V, I_D = 4.5 A,$ $R_G = 25\Omega$ (Note 4, 5)		10	30	ns
	Rise Time	$t_R$			42	90	ns
Turn-Off	Delay Time	$t_{D(OFF)}$			38	85	ns
	Fall Time	$t_F$			46	100	ns
Total Gate Charge		$Q_G$	$V_{DS} = 480 V, I_D = 4.5A,$ $V_{GS} = 10 V$ (Note 4, 5)		15	19	nC
Gate-Source Charge		$Q_{GS}$			2.5		nC
Gate-Drain Charge		$Q_{GD}$			6.6		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	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 4.5\text{ A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				4.5	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				18	A
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 4.5\text{ A},$		300		ns
Reverse Recovery Charge	$Q_{RR}$	$dI_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)		2.2		$\mu\text{C}$

Note 1. Repetitive Rating : Pulse width limited by  $T_J$

2.  $L = 18.9\text{mH}, I_{AS} = 4.5\text{ A}, V_{DD} = 50\text{V}, R_G = 25\ \Omega$ , Starting  $T_J = 25$

3.  $I_{SD} \leq 4.5\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25$

4. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$

5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

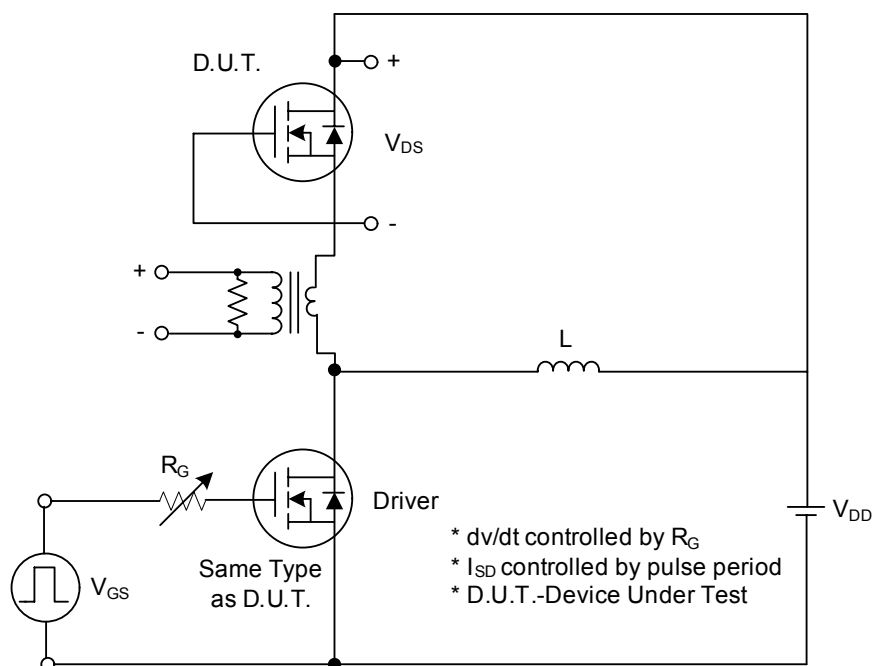


Fig. 1A Peak Diode Recovery  $dv/dt$  Test Circuit

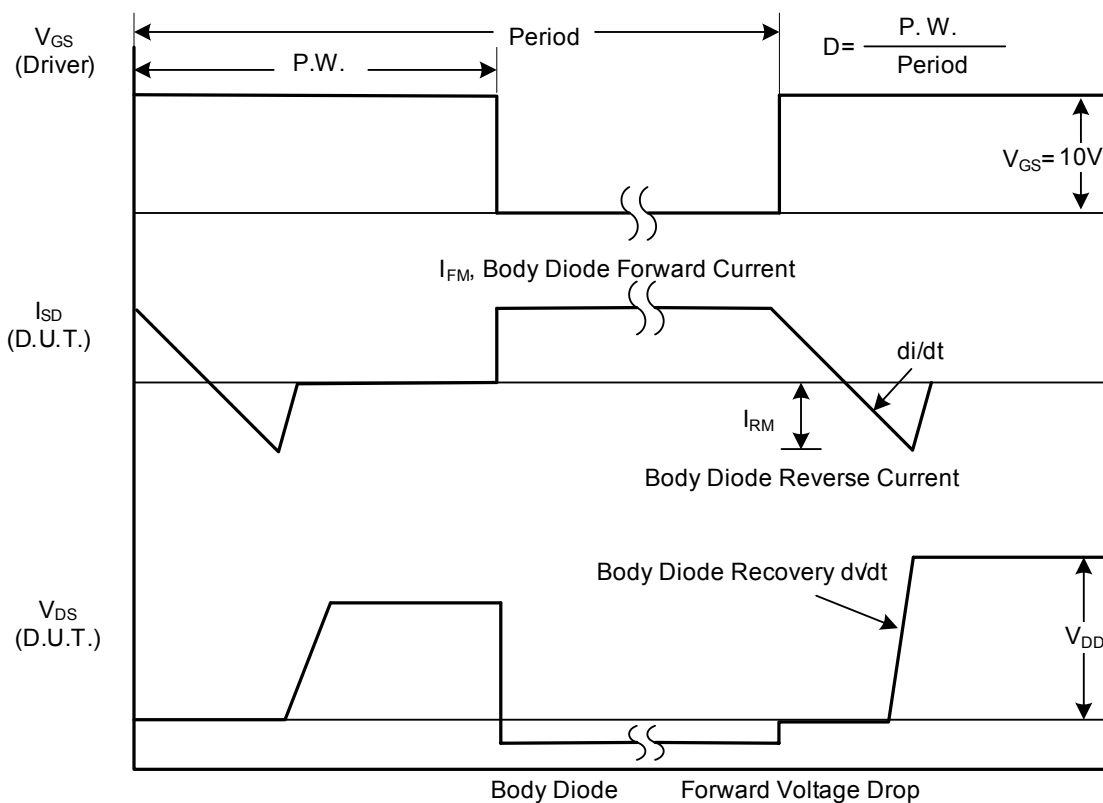


Fig. 1B Peak Diode Recovery  $dv/dt$  Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

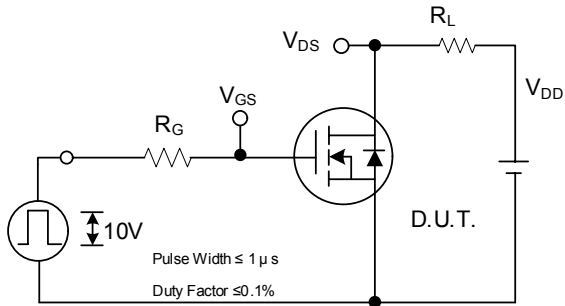


Fig. 2A Switching Test Circuit

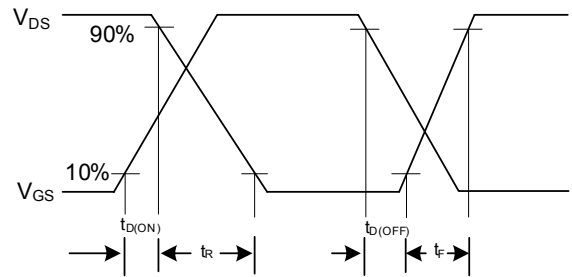


Fig. 2B Switching Waveforms

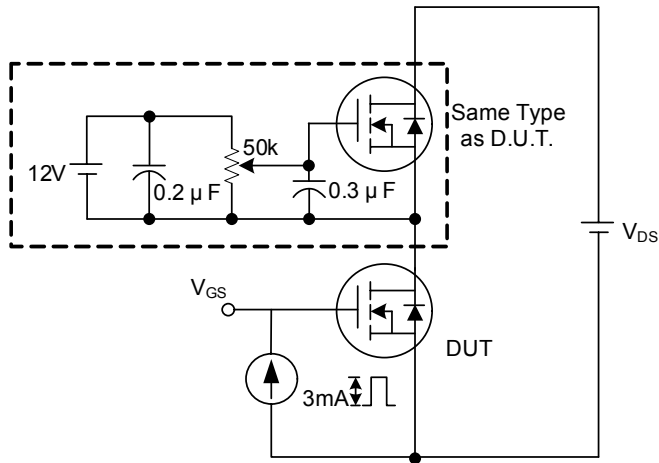


Fig. 3A Gate Charge Test Circuit

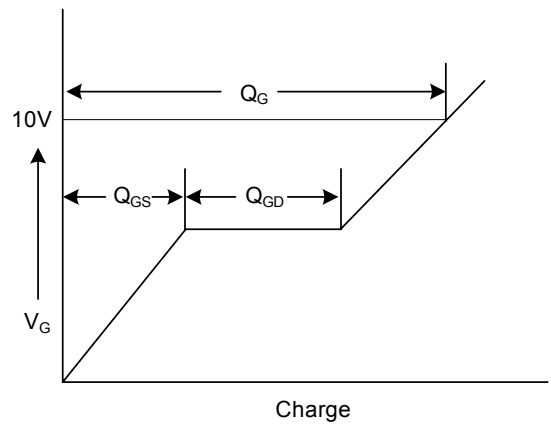


Fig. 3B Gate Charge Waveform

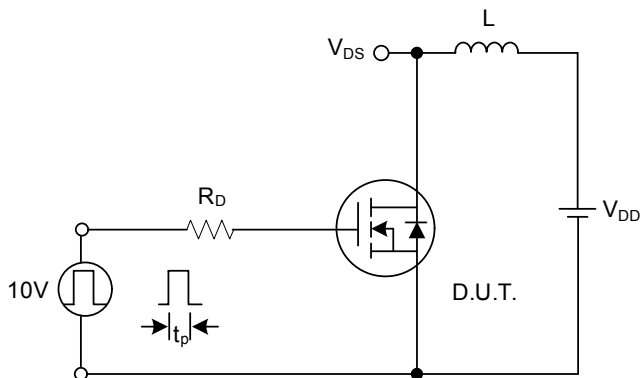


Fig. 4A Unclamped Inductive Switching Test Circuit

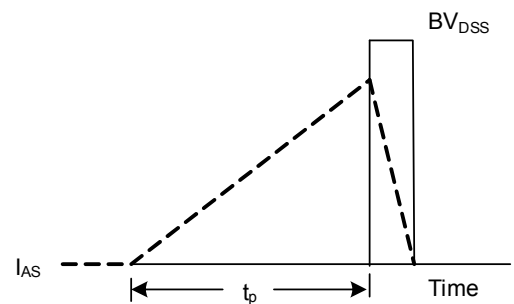


Fig. 4B Unclamped Inductive Switching Waveforms

## TYPICAL CHARACTERISTICS

