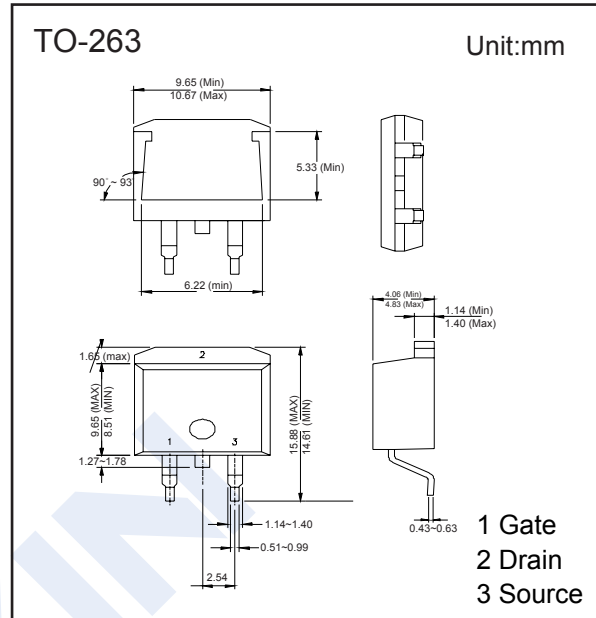# N-Channel MOSFET
IRF540NS (KRF540NS)

■ Features

● $V_{DS(V)}$ = 100V

● I_D = 33 A (V_{GS} = 10V)

● $R_{DS(ON)}$ < 44mΩ (V_{GS} = 10V)

● Fast Switching

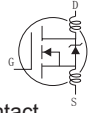TO-263 Unit:mm

1 Gate
2 Drain
3 Source
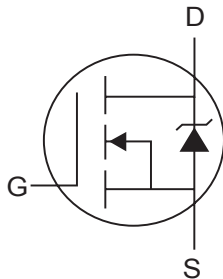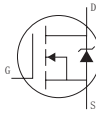
■ Absolute Maximum Ratings Ta = 25℃

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DS}	100	V
Gate-Source Voltage		V_{GS}	±20	
Continuous Drain Current	Ta=25℃	I_D	33	A
	Ta=70℃		23	
Pulsed Drain Current		I_{DM}	110	
Avalanche Current		I_{AR}	16	A
Repetitive Avalanche Energy		E_{AR}	13	mJ
Peak Diode Recovery dv/dt		dv/dt	7	V/ns
Power Dissipation	Tc=25℃	P_D	130	W
Linear Derating Factor			0.87	W/℃
Thermal Resistance.Junction- to-Ambient		R_{thJA}	40	℃/W
Thermal Resistance.Junction- to-Case		R_{thJC}	1.15	
Junction Temperature		T_J	175	℃
Storage Temperature Range		T_{stg}	-55 to 175	

N-Channel MOSFET
IRF540NS (KRF540NS)

■ Electrical Characteristics Ta = 25℃

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{DSS}	I_D=250μA, V_{GS}=0V	100			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=100V, V_{GS}=0V			25	uA
		V_{DS}=80V, V_{GS}=0V, T_J=150℃			250	
Gate-Body Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=±20V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	2		4	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=16A (Note.1)			44	mΩ
Forward Transconductance	g_{FS}	V_{DS}=50V, I_D=16A (Note.1)	21			S
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz		1960		pF
Output Capacitance	C_{oss}			250		
Reverse Transfer Capacitance	C_{rss}			40		
Total Gate Charge	Q_g	V_{GS}=10V, V_{DS}=80V, I_D=16A (Note.1)			71	nC
Gate Source Charge	Q_{gs}				14	
Gate Drain Charge	Q_{gd}				21	
Turn-On DelayTime	$t_{d(on)}$	V_{GS}=10V, V_{DS}=50V, I_D=16A, R_G=5.1Ω (Note.1)		11		ns
Turn-On Rise Time	t_r			35		
Turn-Off DelayTime	$t_{d(off)}$			39		
Turn-Off Fall Time	t_f			35		
Body Diode Reverse Recovery Time	t_{rr}	I_F= 16A, dI/dt= 100A/μs, T_J = 25°C		115	170	
Body Diode Reverse Recovery Charge	Q_{rr}			505	760	nC
Internal Drain Inductance	L_D	Between lead, 6mm (0.25in.) from package and center of die contact		4.5		nH
Internal Source Inductance	L_S			7.5		
Single Pulse Avalanche Energy	E_{AS}	I_{AS} = 16A, L = 1.5mH			185	mJ
Maximum Body-Diode Continuous Current	I_S	MOSFET symbol showing the integral reverse p-n junction diode.			33	A
Pulsed Source Current	I_{SM}				110	
Diode Forward Voltage	V_{SD}	I_S=16A, V_{GS}=0V, T_J = 25°C			1.2	V

Note.1: Pulse width ≤ 400µs; duty cycle ≤ 2%.

N-Channel MOSFET
IRF540NS (KRF540NS)

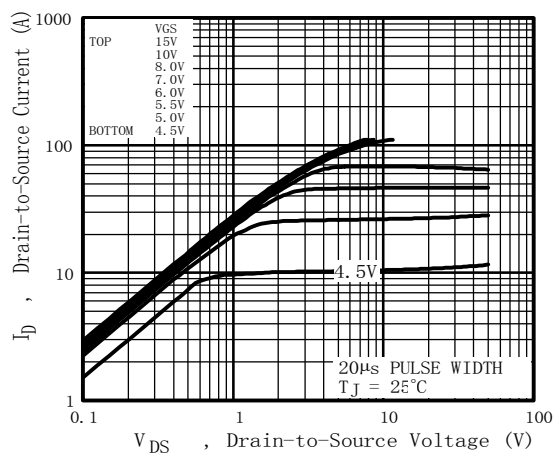■ Typical Characterisitics

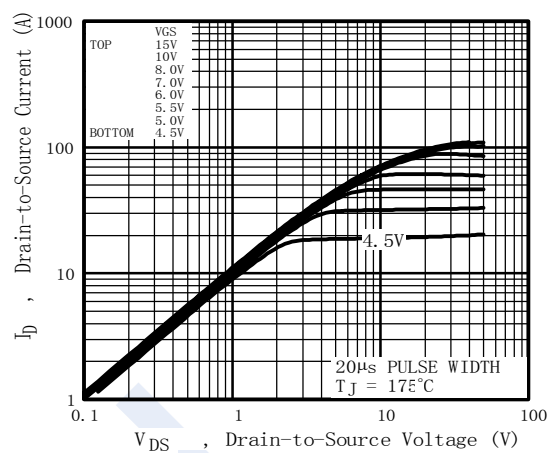Fig 1. Typical Output Characteristics
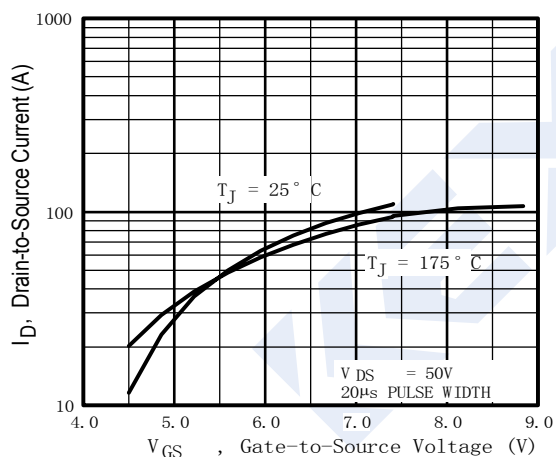

Fig 2. Typical Output Characteristics

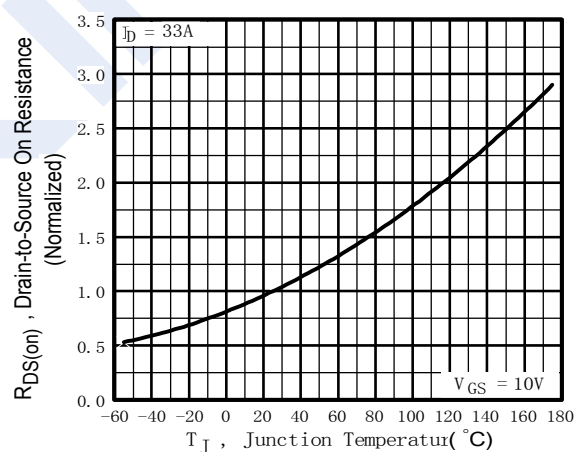Fig 3. Typical Transfer Characteristics
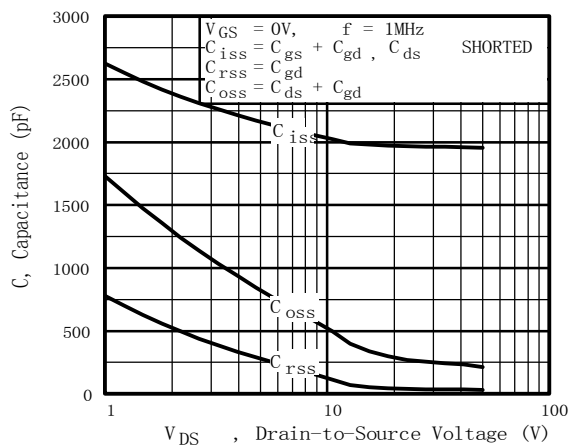

Fig 4. Normalized On-Resistance Vs. Temperature

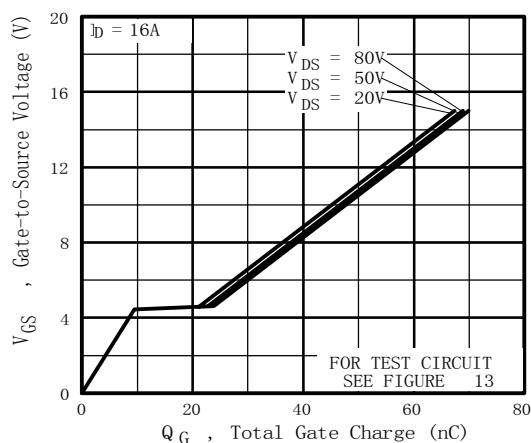
Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

N-Channel MOSFET
IRF540NS (KRF540NS)

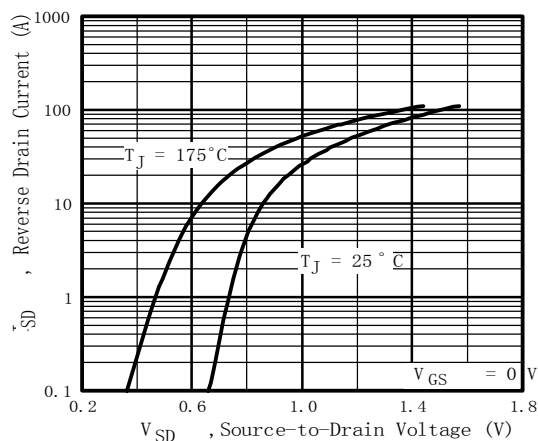■ Typical Characterisitics

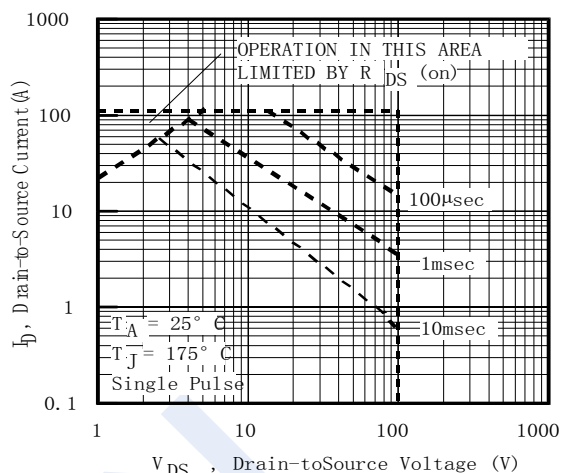Fig 7. Typical Source-Drain Diode
Forward Voltage

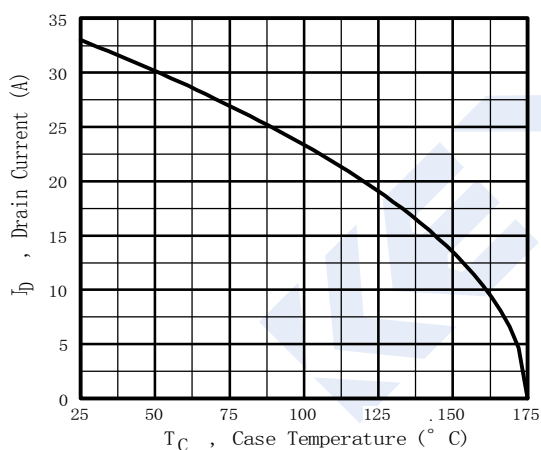Fig 8. Maximum Safe Operating Area

Fig 9. Maximum Drain Current Vs.
Case Temperature

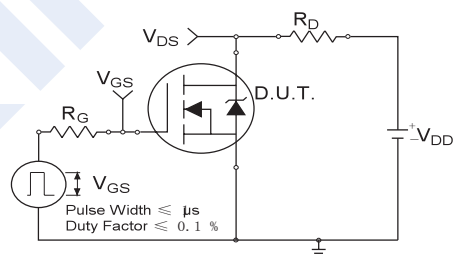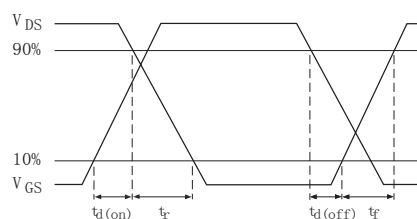Fig 10a. Switching Time Test Circuit

Fig 10b. Switching Time Waveforms

Notes:
1. Duty factor $D = t_1 / t_2$
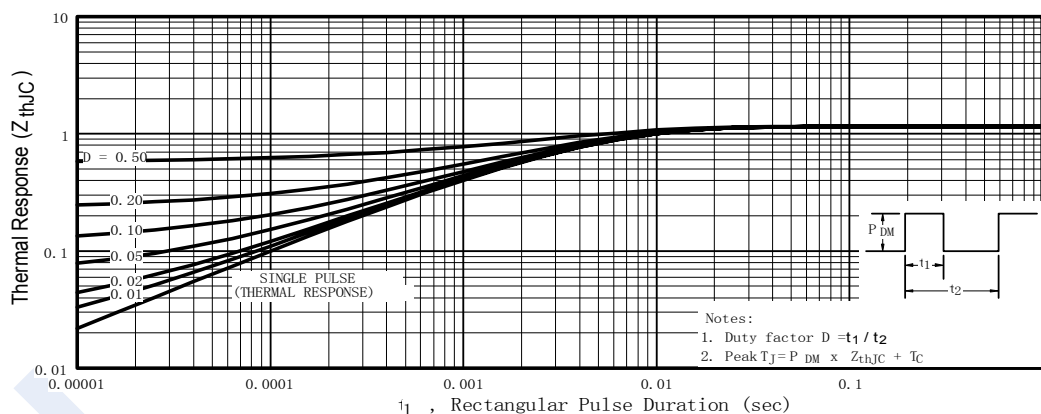2. Peak $T_J = P_{DM} \times Z_{thJC} + T_C$

Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

N-Channel MOSFET
IRF540NS (KRF540NS)

■ Typical Characterisitics

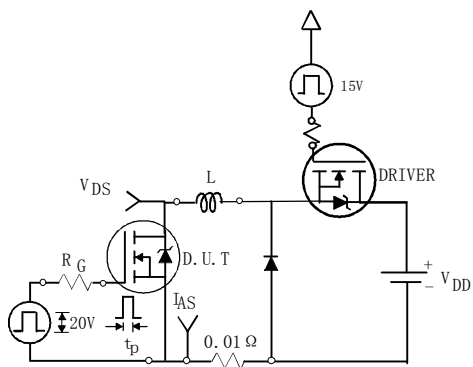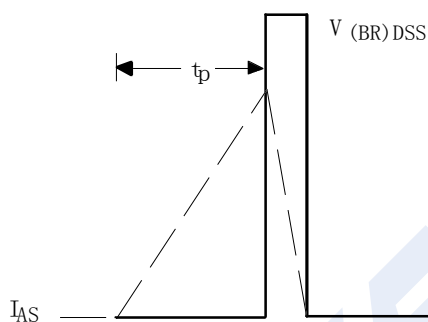**Fig 12a.** Unclamped Inductive Test Circuit
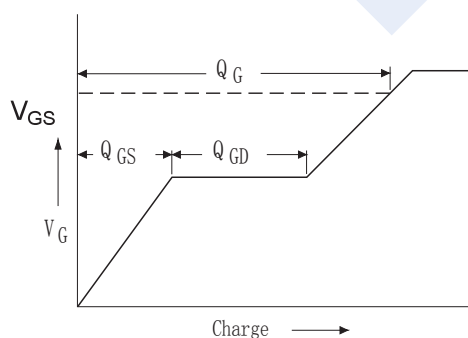

Fig 12b. Unclamped Inductive Waveforms

I_D
TOP   6.5A
          11.3A
BOTTOM   16A

Fig 12c. Maximum Avalanche Energy Vs. Drain Current
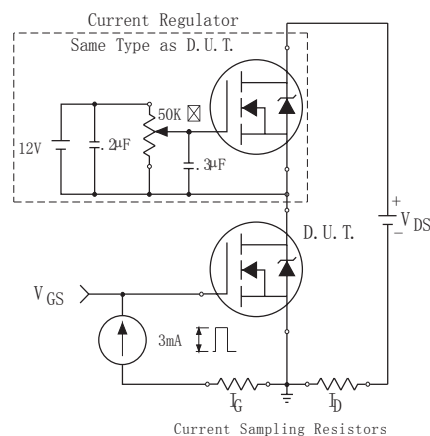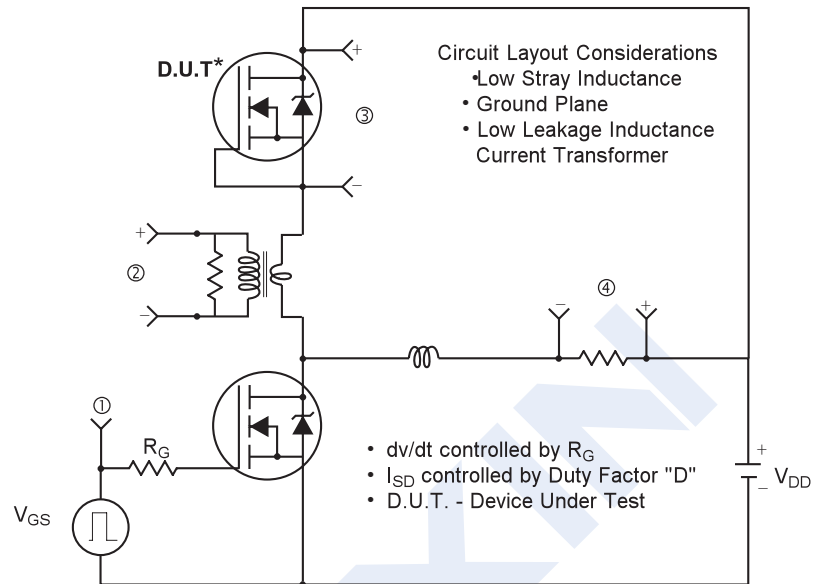

Fig 13a. Basic Gate Charge Waveform

Fig 13b. Gate Charge Test Circuit

N-Channel MOSFET
IRF540NS (KRF540NS)

■ Typical Characterisitics

Peak Diode Recovery dv/dt Test Circuit

D.U.T*

Circuit Layout Considerations
• Low Stray Inductance
• Ground Plane
• Low Leakage Inductance
  Current Transformer

③

②

④

①

R_G

V_{GS}

• dv/dt controlled by R_G
• I_{SD} controlled by Duty Factor "D"
• D.U.T. - Device Under Test

V_{DD}

* Reverse Polarity of D.U.T for P-Channel

① Driver Gate Drive

Period

P. W.

$D = \dfrac{P.W.}{Period}$

$[V_{GS} =10V]$ ***

② D.U.T. I_{SD} Waveform

Reverse
Recovery
Current

Body Diode Forward
Current
di/dt

③ D.U.T. V_{DS} Waveform

Diode Recovery
dv/dt

$[V_{DD}]$

Re-Applied
Voltage

Body Diode Forward Drop

④ Inductor Curent

Ripple ≤5%

$[I_{SD}]$
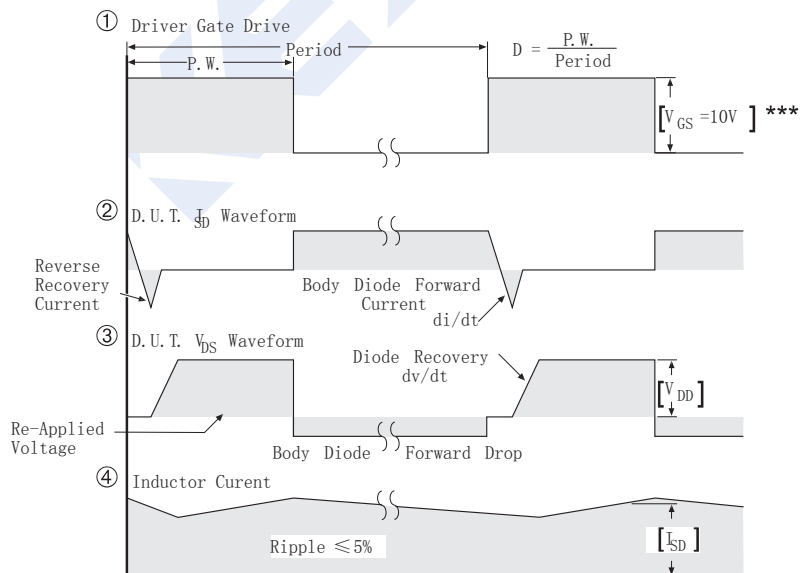
*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices

Fig 14. For N-channel HEXFET® power MOSFETs

KEXIN