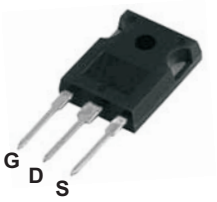
N-Channel Power MOSFET
22A, 600Volts

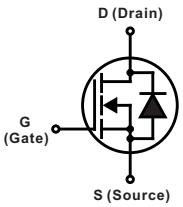
DESCRIPTION

The Nell **IRF22N60** is a three-terminal silicon device with current conduction capability of 22A, fast switching speed, low on-state resistance, breakdown voltage rating of 600V, and max. threshold voltage of 5 volts.

They are designed for use in applications such as switched mode power supplies, DC to DC converters, motor control circuits, UPS and general purpose switching applications.



TO-247AB
(IRF22N60C)



FEATURES

- $R_{DS(ON)}$ = 0.28Ω @ V_{GS} = 10V
- Ultra low gate charge(150nC Max.)
- Low reverse transfer capacitance (C_{RSS} = 36pF typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature

PRODUCT SUMMARY	
I_D (A)	22
V_{DSS} (V)	600
$R_{DS(ON)}$ (Ω)	0.28 @ V_{GS} = 10V
Q_G(nC) max.	150

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT
V_{DSS}	Drain to Source voltage	T_J=25°C to 150°C	600	
V_{DGR}	Drain to Gate voltage	R_{GS}=20KΩ	600	V
V_{GS}	Gate to Source voltage		±30	
I_D	Continuous Drain Current (V_{GS}=10V)	T_C=25°C	22	A
		T_C=100°C	14	
I_{DM}	Pulsed Drain current(Note 1)		88	
I_{AR}	Avalanche current(Note 1)		22	
E_{AR}	Repetitive avalanche energy(Note 1)	I_{AR}=22A, R_{GS}=50Ω, V_{GS}=10V	37	mJ
E_{AS}	Single pulse avalanche energy(Note 2)	I_{AS}=22A, L=1.5mH	380	
dv/dt	Peak diode recovery dv/dt(Note 3)		18	V /ns
P_D	Total power dissipation	T_C=25°C	370	W
	Derate above 25°C		2.9	W /°C
T_J	Operation junction temperature		-55 to 150	
T_{STG}	Storage temperature		-55 to 150	°C
T_L	Maximum soldering temperature, for 10 seconds	1.6mm from case	300	
	Mounting torque, #6-32 or M3 screw		10 (1.1)	lbf·in (N·m)

Note: 1.Repetitive rating: pulse width limited by junction temperature.
2.I_{AS}=22A, L=1.5mH, V_{DD}=50V, R_G=25Ω, starting T_J=25°C.
3.I_{SD} ≤ 22A, di/dt ≤ 540A/μs, V_{DD} ≤ $V_{(BR)DSS}$, starting T_J < 150°C.

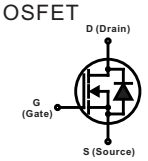
THERMAL RESISTANCE

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
$R_{th(j-c)}$	Thermal resistance, junction to case			0.34	°C/W
$R_{th(c-s)}$	Thermal resistance, case to heat sink		0.24		
$R_{th(j-a)}$	Thermal resistance, junction to ambient			40	

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
◎ STATIC						
$V_{(BR)DSS}$	Drain to source breakdown voltage	I_D = 250μA, V_{GS} = 0V	600			V
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown voltage temperature coefficient	I_D = 1mA, V_{DS} = V_{GS}		0.30		V/°C
I_{DSS}	Drain to source leakage current	V_{DS}=600V, V_{GS}=0V, T_C = 25°C			50	μA
		V_{DS}=480V, V_{GS}=0V, T_C=125°C			250	
I_{GSS}	Gate to source forward leakage current	V_{GS} = 30V, V_{DS} = 0V			100	nA
	Gate to source reverse leakage current	V_{GS} = -30V, V_{DS} = 0V			-100	
$R_{DS(ON)}$	Static drain to source on-state resistance	I_D = 13A, V_{GS} = 10V		0.24	0.28	Ω
$V_{GS(TH)}$	Gate threshold voltage	V_{GS}=V_{DS}, I_D=250μA	3.0		5.0	V
g_{fs}	Forward transconductance	V_{DS} = 50V, I_D = 13A	11			S
◎ DYNAMIC						
C_{ISS}	Input capacitance	V_{DS} = 25V, V_{GS} = 0V, f =1MHz		3570		pF
C_{OSS}	Output capacitance			350		
C_{RSS}	Reverse transfer capacitance			36		
$t_{d(ON)}$	Turn-on delay time	V_{DD} = 300V, V_{GS} = 10V I_D = 22A, R_G = 6.2Ω, R_D = 3.2Ω (Note1,2)		26		ns
t_r	Rise time			99		
$t_{d(OFF)}$	Turn-off delay time			48		
t_f	Fall time			37		
Q_G	Total gate charge	V_{DD} = 480V, V_{GS} = 10V I_D = 22A, (Note1,2)			150	nC
Q_{GS}	Gate to source charge				45	
Q_{GD}	Gate to drain charge (Miller charge)				76	

SOURCE TO DRAIN DIODE RATINGS AND CHARACTERISTICS (T_C = 25°C unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{SD}	Diode forward voltage	I_{SD} = 22A, V_{GS} = 0V			1.5	V
Is (I_{SD})	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET			22	A
I_{SM}	Pulsed source current				88	
t_{rr}	Reverse recovery time, T_J=25°C	I_{SD} = 22A, V_{GS} = 0V, dI_F/dt = 100A/μs		590	890	ns
	Reverse recovery time, T_J=125°C			670	1010	
Q_{rr}	Reverse recovery charge, T_J=25°C			7.2	11	μC
	Reverse recovery charge, T_J=125°C			8.5	13	
I_{RRM}	Reverse recovery current			26	39	A
t_{qd}	Forward turn-on time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Note: 1. Pulse test: Pulse width ≤ 300μs, duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

ORDERING INFORMATION SCHEME

IRF 22N60 C

MOSFET series

N-Channel,IRF series

Current and Voltage rating, I_D & V_{DS}

22A / 600V

Package type

C = TO-247AB

■ TYPICAL CHARACTERISTICS

Fig.1 Typical output characteristics, T_C=25°C

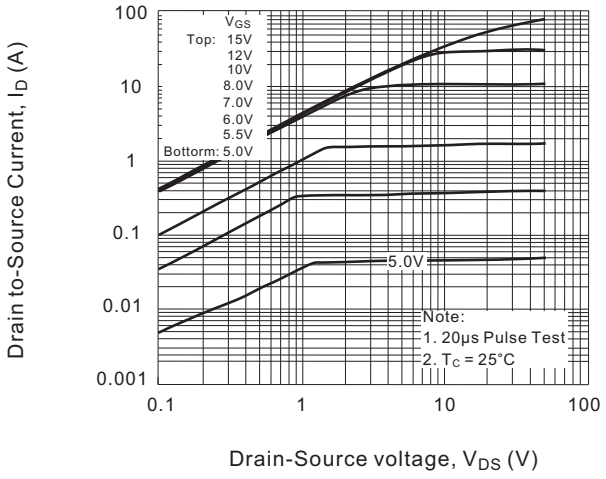


Fig.2 Typical output characteristics, T_C=150°C

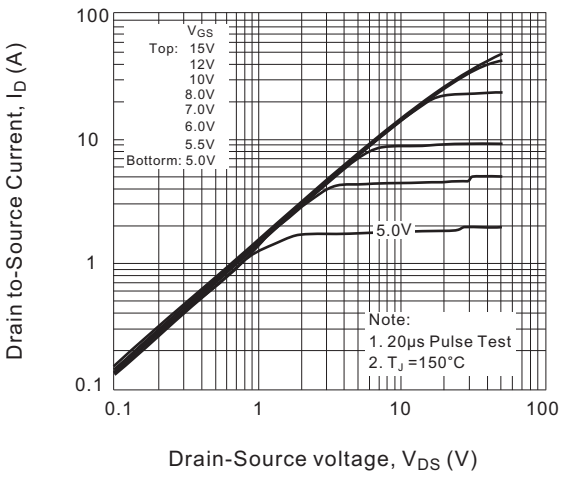


Fig.3 Typical transfer characteristics

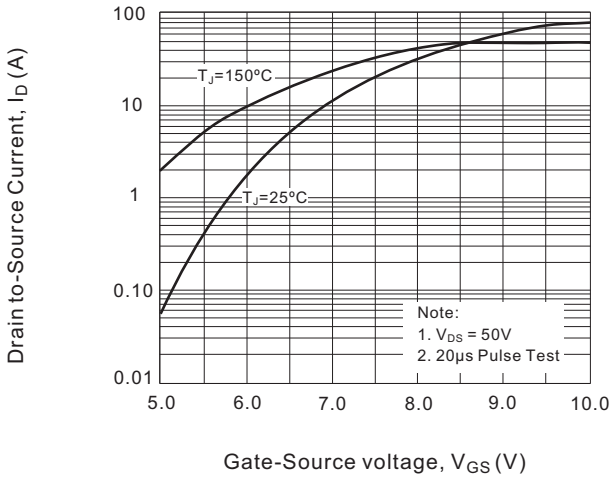


Fig.4 Normalized On-Resistance vs. Temperature

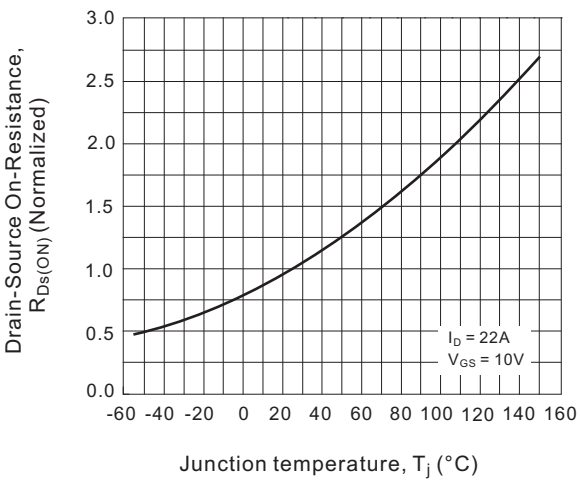


Fig.5 Typical capacitance vs. Drain-to-Source voltage

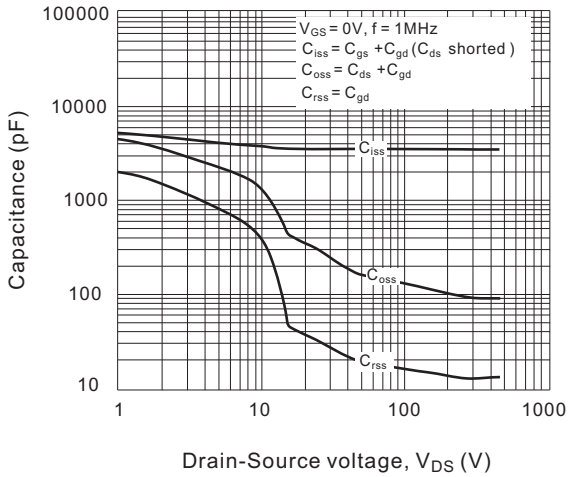


Fig.6 Typical gate charge vs. gate-to-source voltage

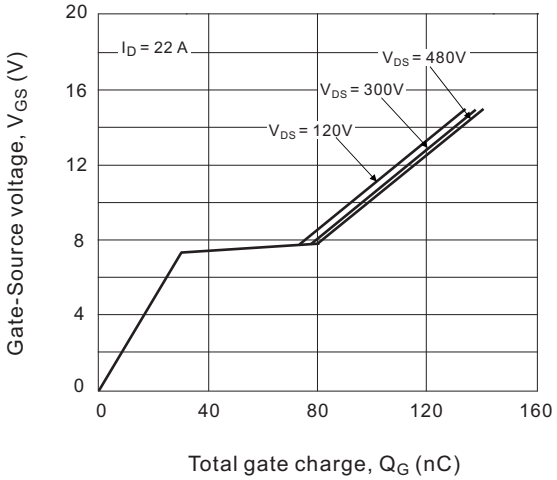


Fig.7 Typical source-drain diode forward voltage

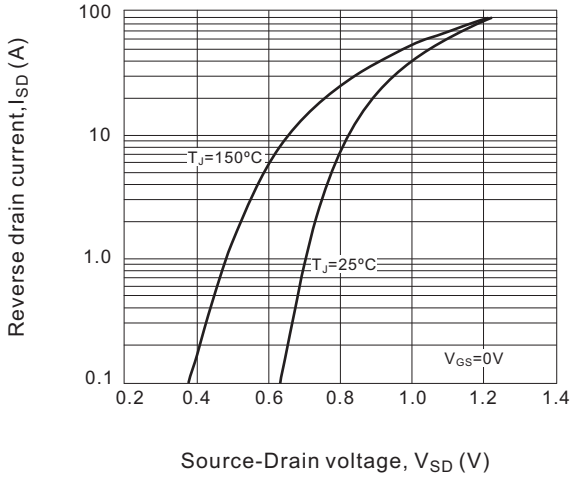


Fig.8 Maximum safe operating area

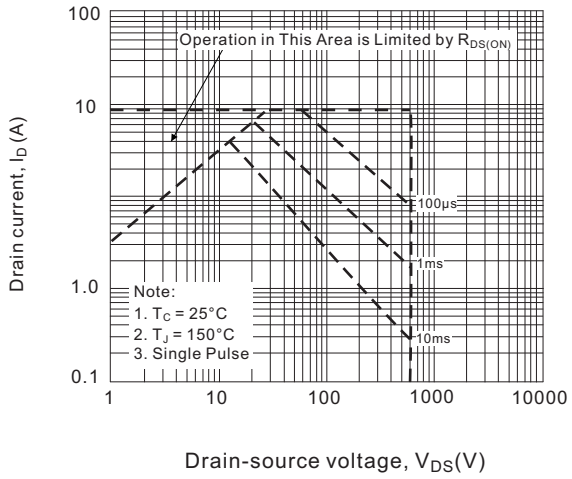


Fig.9 Maximum drain current vs. Case temperature

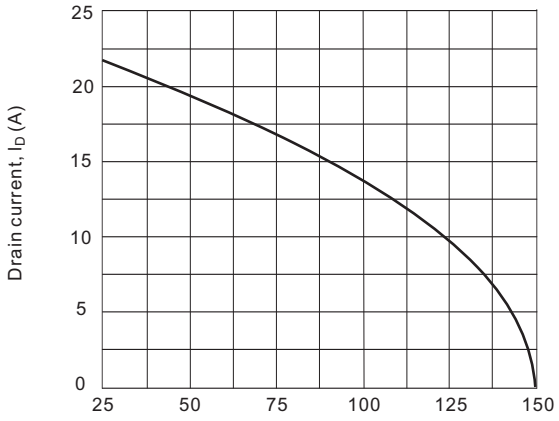


Fig.10 Maximum effective transient thermal impedance, Junction-to-Case

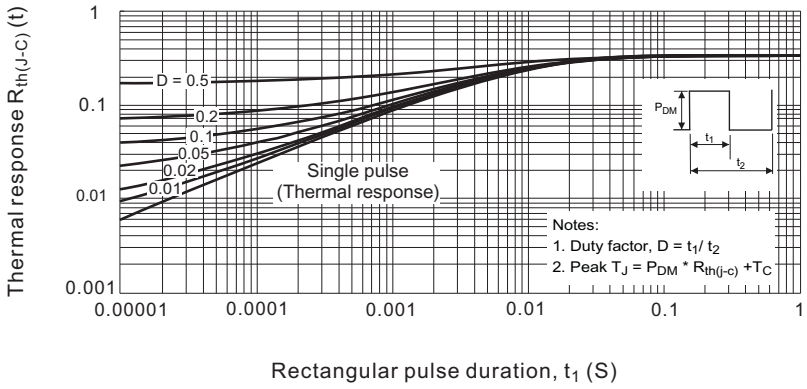


Fig.11a. Switching time test circuit

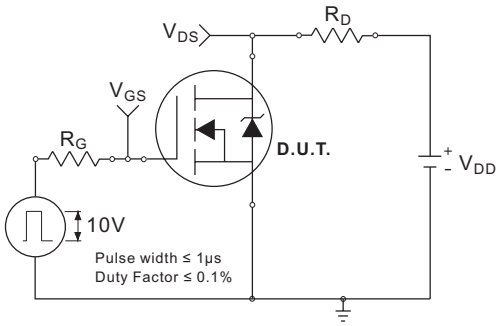


Fig.11b. Switching time waveforms

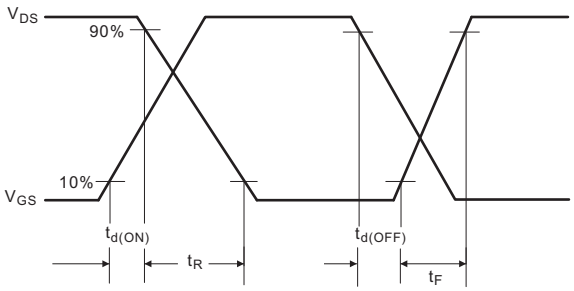
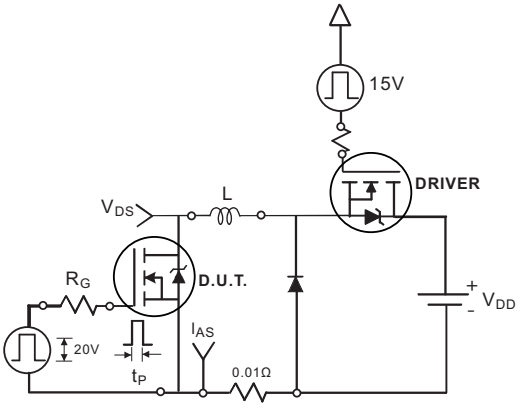


Fig.12a. Unclamped Inductive test circuit



Vary t_p to obtain required I_{AS}

Fig.12b. Unclamped Inductive waveforms

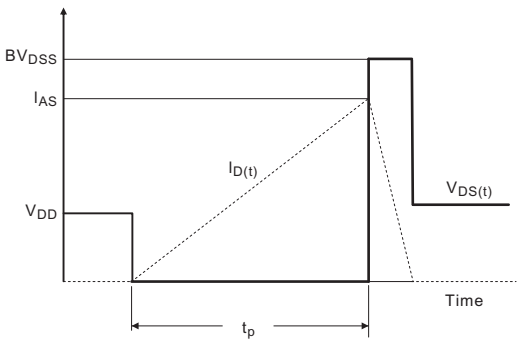


Fig.12c. Maximum avalanche energy vs. Drain current

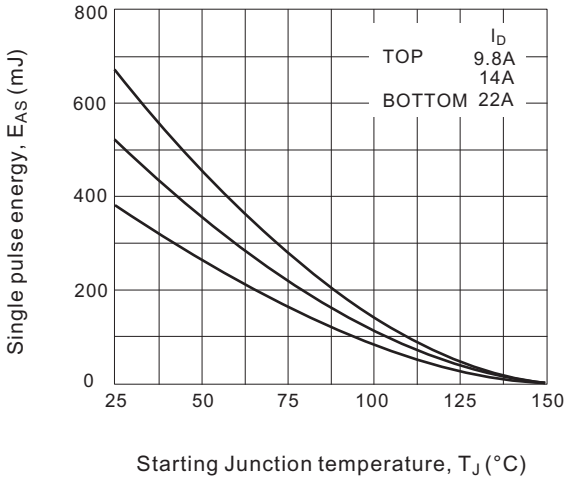


Fig.13a. Basic gate charge waveform

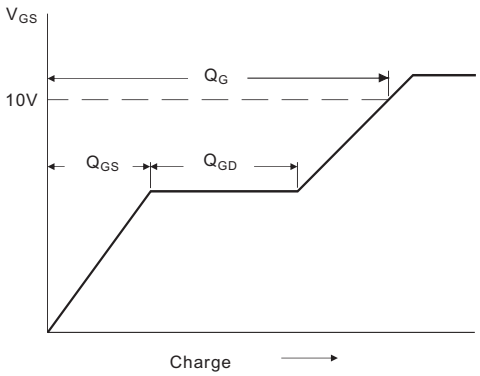


Fig.13b. Gate charge test circuit

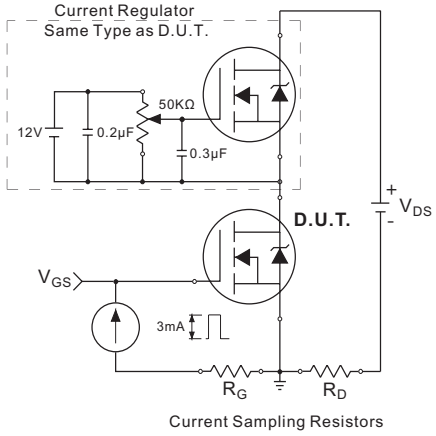
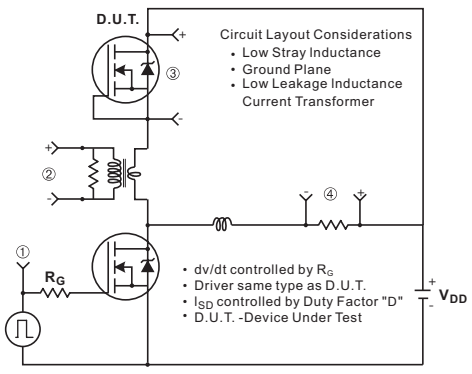
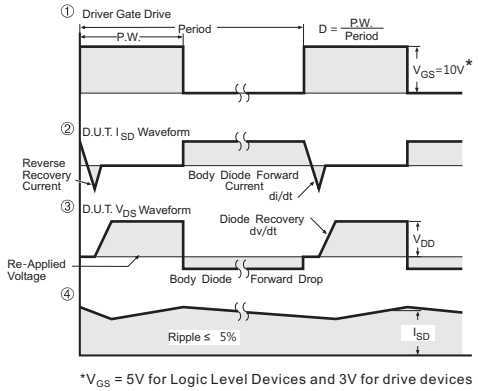


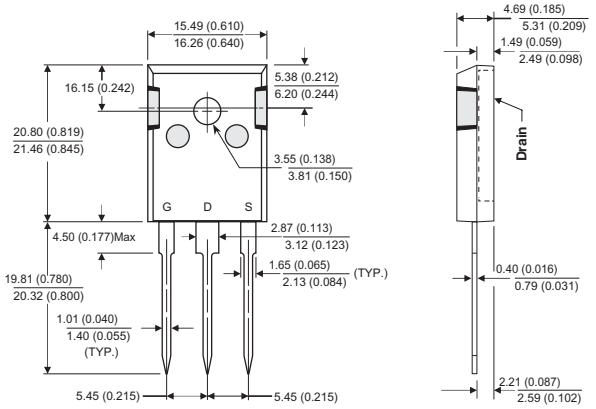
Fig.14 Peak diode recovery dv/dt test circuit for N-Channel MOSFET





*V_{GS} = 5V for Logic Level Devices and 3V for drive devices

TO-247AB



All dimensions in millimeters(inches)