

Nell High Power Products

N-Channel Power MOSFET 20A, 500Volts

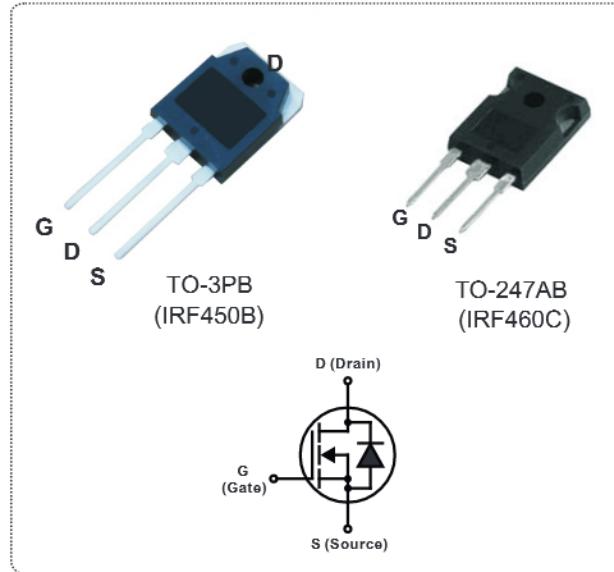
DESCRIPTION

The Nell **IRF460** is a three-terminal silicon device with current conduction capability of 20A, fast switching speed, low on-state resistance, breakdown voltage rating of 500V, and max. threshold voltage of 4 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.

FEATURES

- $R_{DS(ON)} = 0.27\Omega @ V_{GS} = 10V$
- Ultra low gate charge(210nC Max.)
- Low reverse transfer capacitance ($C_{RSS} = 350pF$ typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature



PRODUCT SUMMARY

I_D (A)	20
V_{DSS} (V)	500
$R_{DS(ON)}$ (Ω)	0.27 @ $V_{GS} = 10V$
Q_G (nC) max.	210

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

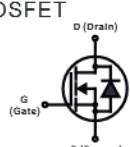
SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT
V_{DSS}	Drain to Source voltage	$T_J=25^\circ C$ to $150^\circ C$	500	V
V_{DGR}	Drain to Gate voltage	$R_{GS}=20K\Omega$	500	
V_{GS}	Gate to Source voltage		± 20	
I_D	Continuous Drain Current ($V_{GS}=10V$)	$T_C=25^\circ C$	20	A
		$T_C=100^\circ C$	13	
I_{DM}	Pulsed Drain current(Note 1)		80	A
I_{AR}	Avalanche current(Note 1)		20	
E_{AR}	Repetitive avalanche energy(Note 1)	$I_{AR}=20A, R_{GS}=50\Omega, V_{GS}=10V$	28	mJ
E_{AS}	Single pulse avalanche energy(Note 2)	$I_{AS}=20A, L=4.3mH$	960	
dv/dt	Peak diode recovery dv/dt (Note 3)		3.5	V / ns
P_D	Total power dissipation	$T_C=25^\circ C$	280	W
	Derate above $25^\circ C$		2.2	W / $^\circ C$
T_J	Operation junction temperature		-55 to 150	$^\circ C$
T_{STG}	Storage temperature		-55 to 150	
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.

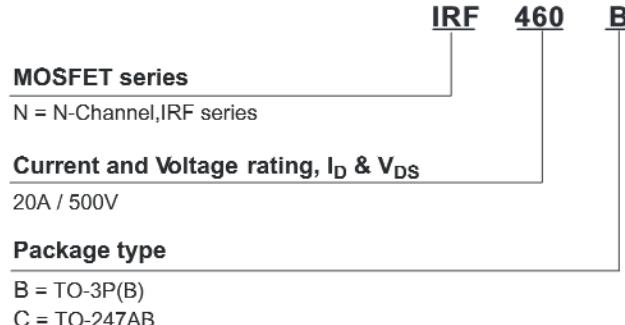
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THERMAL RESISTANCE						
SYMBOL	PARAMETER			MIN.	TYP.	MAX.
$R_{th(j-c)}$	Thermal resistance, junction to case				0.45	$^{\circ}\text{C}/\text{W}$
$R_{th(c-s)}$	Thermal resistance, case to heat sink			0.24		
$R_{th(j-a)}$	Thermal resistance, junction to ambient				40	

ELECTRICAL CHARACTERISTICS ($T_C = 25^{\circ}\text{C}$ unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
◎ STATIC						
$V_{(\text{BR})DSS}$	Drain to source breakdown voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	500			V
$\Delta V_{(\text{BR})DSS}/\Delta T_J$	Breakdown voltage temperature coefficient	$I_D = 1\text{mA}, V_{DS} = V_{GS}$		0.63		$^{\circ}\text{C}/\text{C}$
I_{DSS}	Drain to source leakage current	$V_{DS} = 500\text{V}, V_{GS} = 0\text{V}$	$T_C = 25^{\circ}\text{C}$		25.0	μA
		$V_{DS} = 400\text{V}, V_{GS} = 0\text{V}$	$T_C = 125^{\circ}\text{C}$		250	
I_{GSS}	Gate to source forward leakage current	$V_{GS} = 20\text{V}, V_{DS} = 0\text{V}$			100	nA
	Gate to source reverse leakage current	$V_{GS} = -20\text{V}, V_{DS} = 0\text{V}$			-100	
$R_{DS(\text{ON})}$	Static drain to source on-state resistance	$I_D = 12\text{A}, V_{GS} = 10\text{V}$			0.27	Ω
$V_{GS(\text{TH})}$	Gate threshold voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.0		4.0	V
g_{fs}	Forward transconductance	$V_{DS} = 50\text{V}, I_D = 12\text{A}$	13			S
◎ DYNAMIC						
C_{iss}	Input capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		4200		pF
C_{oss}	Output capacitance			870		
C_{rss}	Reverse transfer capacitance			350		
$t_{d(\text{ON})}$	Turn-on delay time	$V_{DD} = 250\text{V}, V_{GS} = 10\text{V}$ $I_D = 20\text{A}, R_G = 4.3\Omega, R_D = 13\Omega$ (Note 1,2)		18		ns
t_r	Rise time			59		
$t_{d(\text{OFF})}$	Turn-off delay time			110		
t_f	Fall time			58		
Q_G	Total gate charge	$V_{DD} = 400\text{V}, V_{GS} = 10\text{V}$ $I_D = 20\text{A}, (\text{Note 1,2})$			210	nC
Q_{GS}	Gate to source charge				29	
Q_{GD}	Gate to drain charge (Miller charge)				110	
L_D	Internal drain inductance			5		nH
L_S	Internal source inductance	Between lead, 6mm(0.25") from package and center of die contact		13		

SOURCE TO DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_C = 25^{\circ}\text{C}$ unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{SD}	Diode forward voltage	$I_{SD} = 20\text{A}, V_{GS} = 0\text{V}$			1.8	V
$I_s (I_{SD})$	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET 			20	A
I_{SM}	Pulsed source current				80	
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{A}, V_{GS} = 0\text{V}, dI_F/dt = 100\text{A}/\mu\text{s}$		570	860	ns
Q_{rr}	Reverse recovery charge			5.7	8.6	μC

ORDERING INFORMATION SCHEME



■ TYPICAL CHARACTERISTICS

Fig.1 Typical output characteristics, $T_c=25^\circ\text{C}$

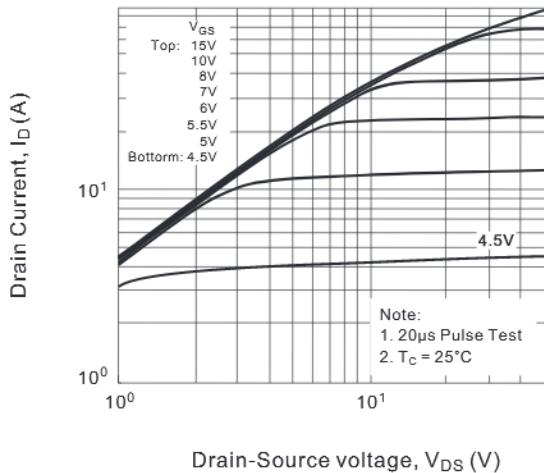


Fig.2 Typical transfer characteristics

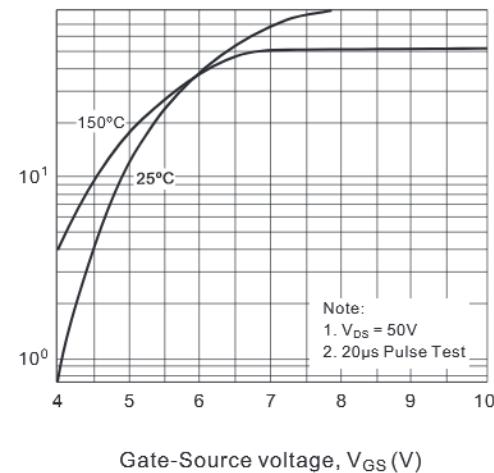


Fig.3 Typical output characteristics, $T_c=150^\circ\text{C}$

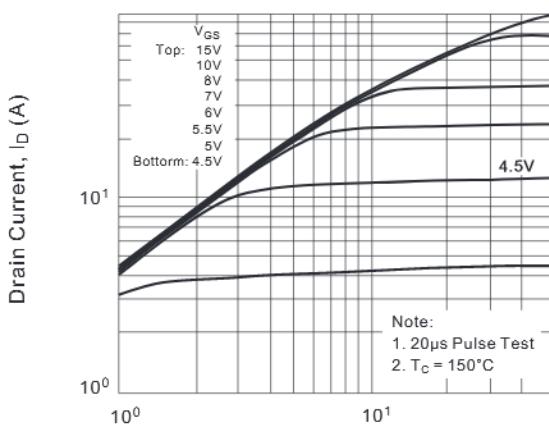


Fig.4 Normalized On-Resistance vs. Temperature

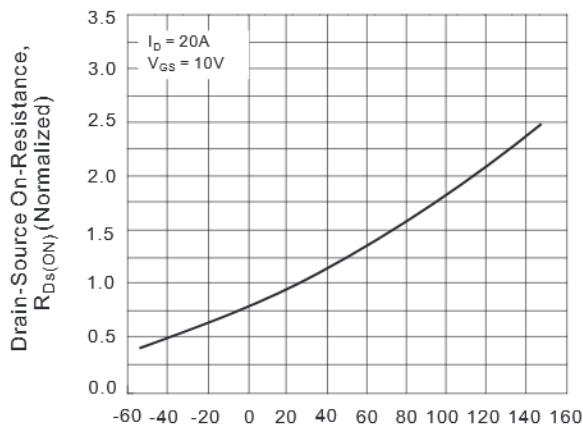


Fig.5 Typical capacitance vs. Drain-to-Source voltage

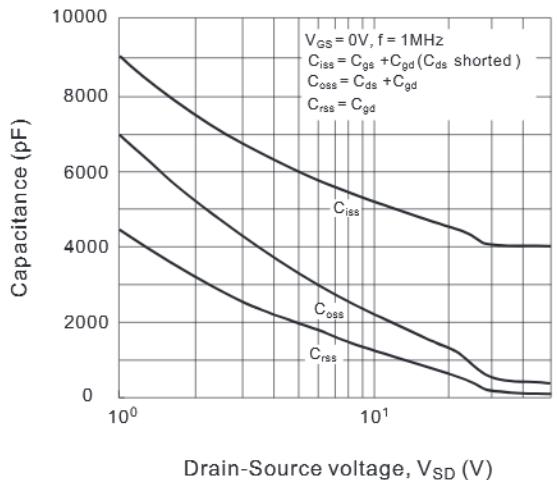


Fig.6 Typical source-drain diode forward voltage

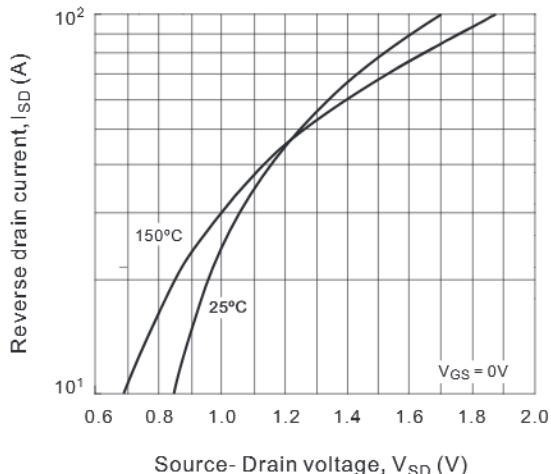


Fig.7 Typical gate charge vs. gate-to-source voltage

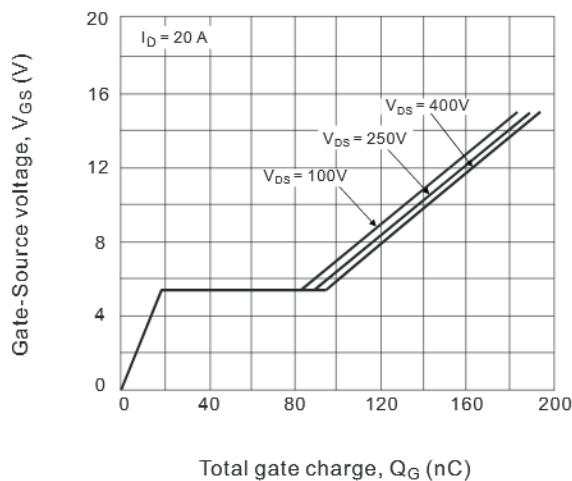


Fig.8 Maximum safe operating area

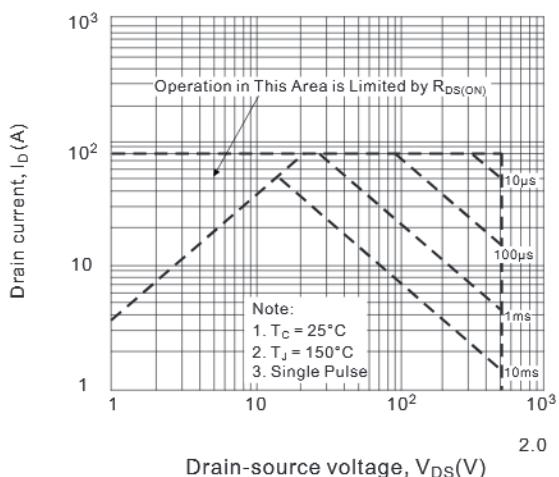


Fig.9 Maximum drain current vs. Case temperature

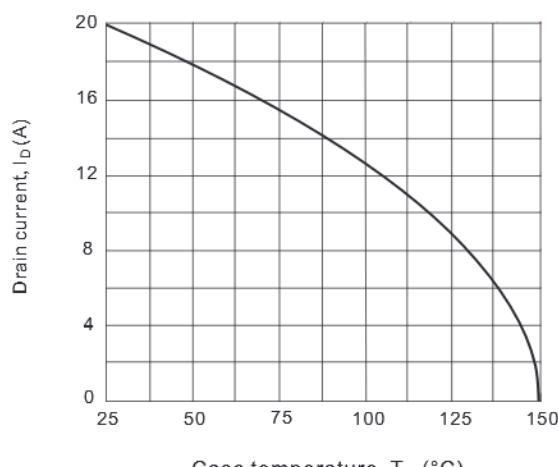


Fig.10 Maximum effective transient thermal impedance, Junction-to-Case

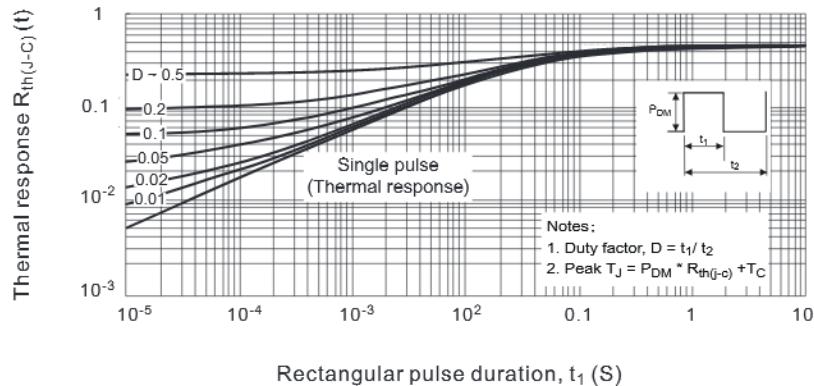


Fig.11a. Switching time test circuit

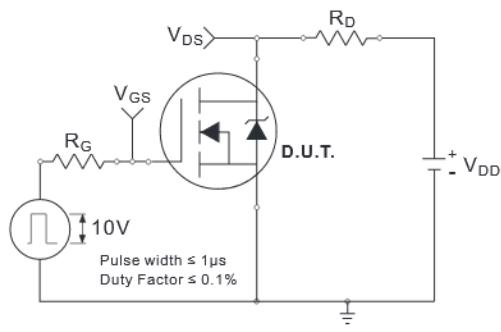


Fig.11b. Switching time waveforms

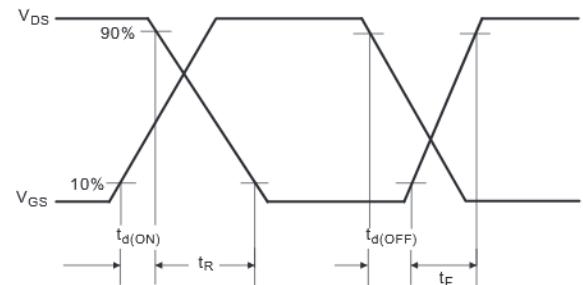


Fig.12a. Unclamped Inductive test circuit

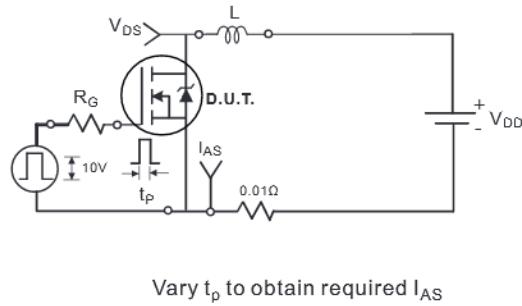
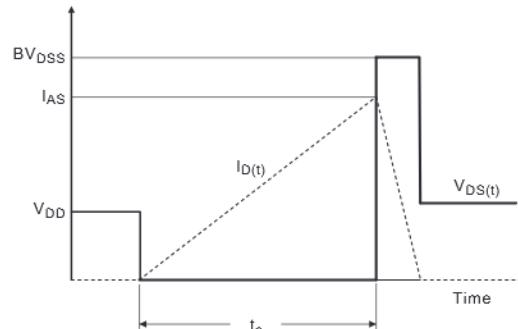


Fig.12b. Unclamped Inductive waveforms



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

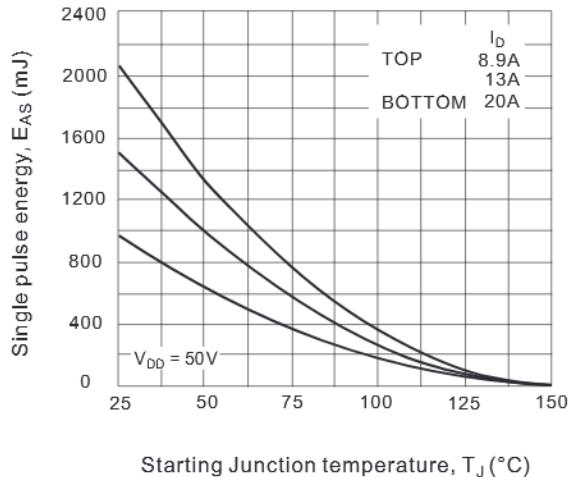


Fig.13a. Basic gate charge waveform

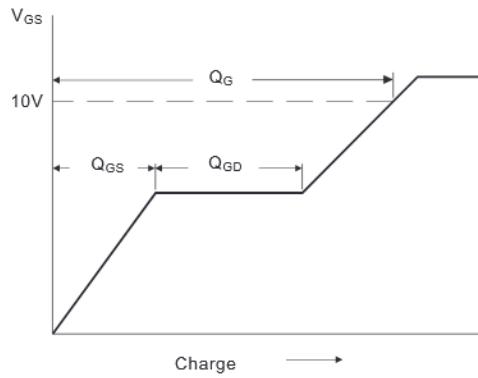


Fig.13b. Gate charge test circuit

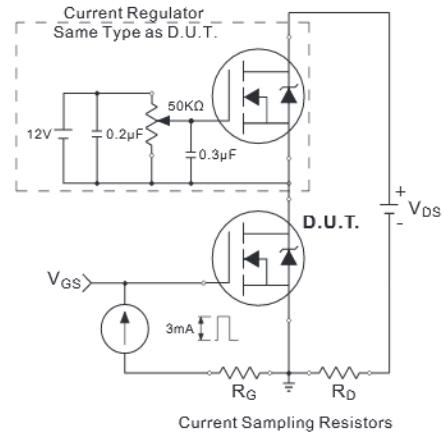
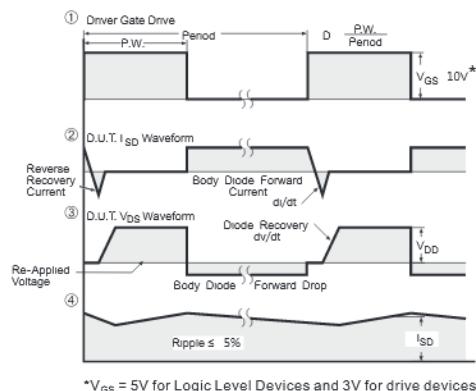
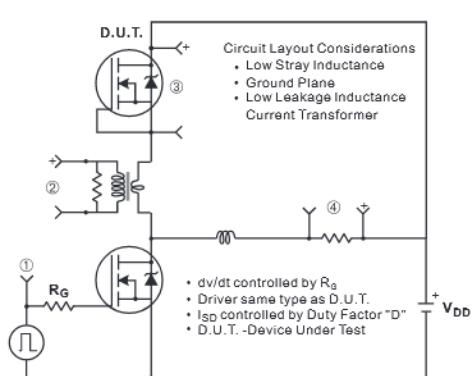
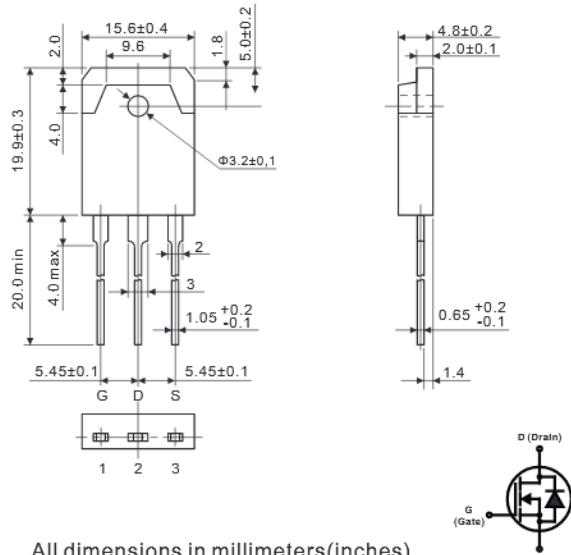


Fig.14 Peak diode recovery dv/dt test circuit for N-Channel MOSFET



TO-3PB

TO-247AB
