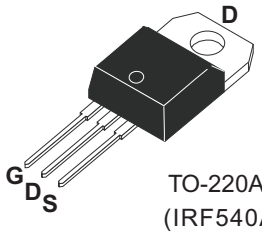
N-Channel Power MOSFET
(28A, 100Volts)

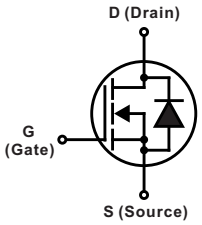
DESCRIPTION

The Nell **IRF540** are N-Channel enhancement mode silicon gate power field effect transistors. They are designed, tested and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation.

They are designed as an extremely efficient and reliable device for use in a wide variety of applications such as switching regulators. convertors,UPS, switching mode power supplies and drivers for high power bipolar switching transistors requiring high speed and low gate drive power. These transistors can be operated directly from integrated circuits.



TO-220AB
(IRF540A)



FEATURES

- $R_{DS(ON)}$ = 0.077Ω @ V_{GS} = 10V
- Ultra low gate charge(72nC Max.)
- Low reverse transfer capacitance (C_{RSS} = 120pF typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 175°C operation temperature

PRODUCT SUMMARY	
I_D (A)	28
V_{DSS} (V)	100
$R_{DS(ON)}$ (Ω)	0.077 @ V_{GS} = 10V
Q_G(nC) max.	72

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

SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT
V_{DSS}	Drain to Source voltage(Note 1)		100	V
V_{DGR}	Drain to Gate voltage	R_{GS}=20KΩ	100	
V_{GS}	Gate to Source voltage		±20	
I_D	Continuous Drain Current	V_{GS}=10V, T_C=25°C	28	A
		V_{GS}=10V, T_C=100°C	20	
I_{DM}	Pulsed Drain current(Note 1)		110	
I_{AR}	Avalanche current(Note 1)		28	
E_{AR}	Repetitive avalanche energy(Note 1)	I_{AR}=28A, R_{GS}=50Ω, V_{GS}=10V	15	mJ
E_{AS}	Single pulse avalanche energy(Note 2)	I_{AS}=28A, L=440μH	230	mJ
dv/dt	Peak diode recovery dv/dt(Note 3)		5.5	V /ns
P_D	Total power dissipation	T_C=25°C	150	W
	Derating factor above 25°C		1.20	W /°C
T_J	Operation junction temperature		-55 to 175	°C
T_{STG}	Storage temperature		-55 to 175	
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.V_{DD} ≤ 25V, L=440μH, I_{AS}=28A, R_G=25Ω, starting T_J =25°C
3.I_{SD} ≤ 28A, di/dt ≤ 170A/μs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 175°C.

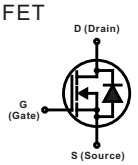
THERMAL RESISTANCE

SYMBOL	PARAMETER	Min.	Typ.	Max.	UNIT
$R_{th(j-c)}$	Thermal resistance, junction to case			1.00	°C/W
$R_{th(c-s)}$	Thermal resistance, case to heatsink		0.50		
$R_{th(j-a)}$	Thermal resistance, junction to ambient			62	

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	V_{GS} = 0V, I_D = 250μA		100			V
$V_{(BR)DSS}/\ T_J$	Breakdown voltage temperature coefficient	I_D = 1mA, referenced to 25°C			0.13		V/°C
I_{DSS}	Drain to source leakage current	V_{DS}=100V, V_{GS}=0V	T_C = 25°C			25.0	μA
		V_{DS}=80V, V_{GS}=0V	T_C=125°C			250	
I_{GSS}	Gate to source forward leakage current	V_{GS} = 20V, V_{DS} = 0V				100	nA
	Gate to source reverse leakage current	V_{GS} = -20V, V_{DS} = 0V				-100	
$R_{DS(ON)}$	Static drain to source on-state resistance	V_{GS} = 10V, I_D = 17A (Note 1)				0.077	Ω
$V_{GS(TH)}$	Gate threshold voltage	V_{GS}=V_{DS}, I_D=250μA		2.0		4.0	V
g_{fS}	Forward transconductance	V_{DS}=50V, I_D=17A		8.7			S
◎ DYNAMIC							
C_{ISS}	Input capacitance	V_{DS} = 25V, V_{GS} = 0V, f =1MHz			1700		pF
C_{OSS}	Output capacitance				560		
C_{RSS}	Reverse transfer capacitance				120		
$t_{d(ON)}$	Turn-on delay time	V_{DD} = 50V, I_D = 17A,R_D = 2.9Ω, V_{GS} = 10V, R_G=9.1Ω (Note 1)			11		ns
t_r	Rise time				44		
$t_{d(OFF)}$	Turn-off delay time				53		
t_f	Fall time				43		
Q_G	Total gate charge	V_{DS} = 80V, V_{GS} = 10V, I_D = 17A				72	nC
Q_{GS}	Gate to source charge					11	
Q_{GD}	Gate to drain charge (Miller charge)					32	
L_D	Internal drain inductance	Between lead, 6mm from package and center of die			4.5		nH
L_S	Internal source inductance				7.5		

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} = 28A, V_{GS} = 0V			2.5	V
$I_S(I_{SD})$	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET			28	A
I_{SM}	Pulsed source current				110	
t_{rr}	Reverse recovery time	I_{SD} = 17A, V_{GS} = 0V, dI_F/dt = 100A/μs		180	360	ns
Q_{rr}	Reverse recovery charge			1.3	2.8	μC
t_{ON}	Forward turn-on time	Intrinsic turn-on time is negligible (turn-on is domonated by LS+LD)				

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

ORDERING INFORMATION SCHEME

IRF 540 A

MOSFET series

N-Channel, IRF series

Current & Voltage rating, I_D & V_{DS}

28A / 100V

Package type

A = TO-220AB

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

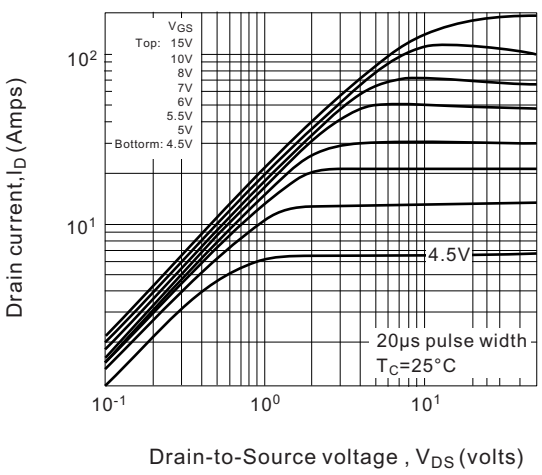


Fig.2 Typical transfer characteristics

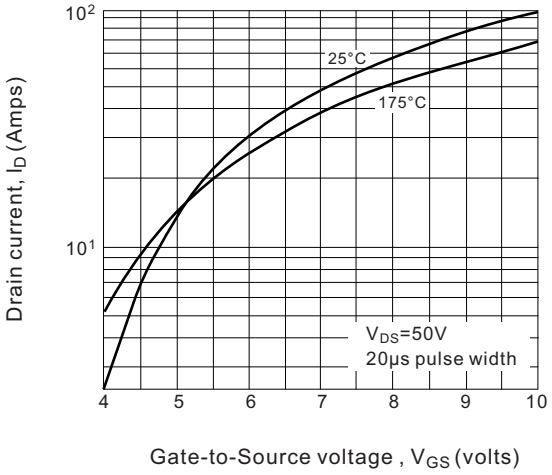


Fig.3 Typical output characteristics, T_C=175°C

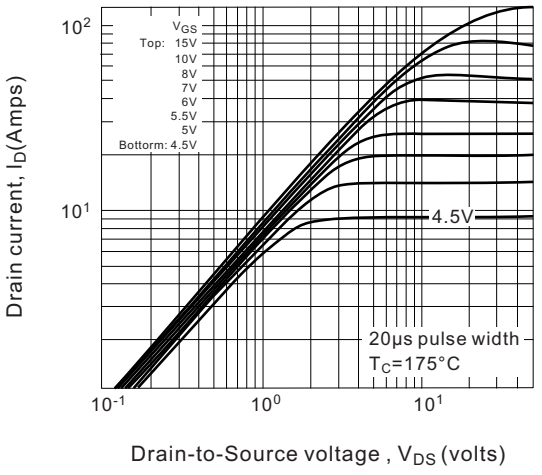


Fig.4 Normalized On-Resistance vs. Temperature

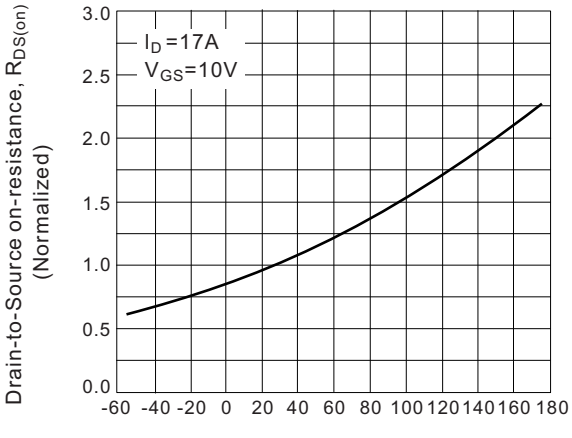


Fig.5 Typical capacitance vs. Drain-to-Source voltage

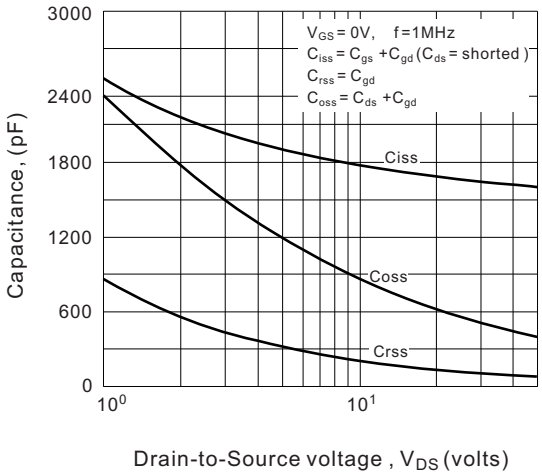


Fig.6 Typical source-drain diode forward voltage

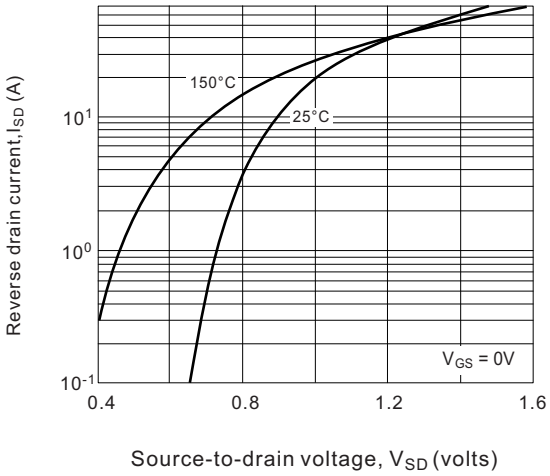


Fig.7 Typical gate charge vs. gate-to-source voltage

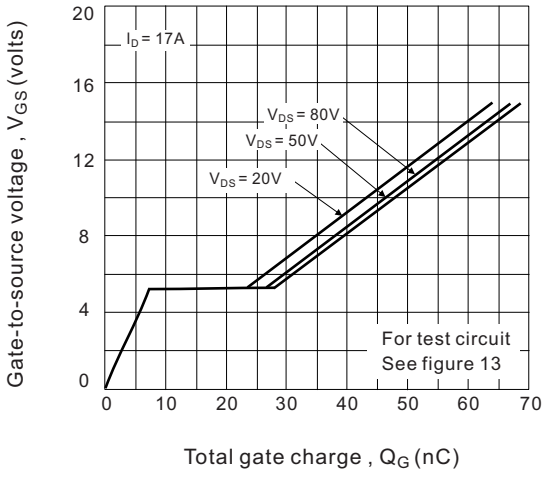


Fig.8 Maximum safe operating area

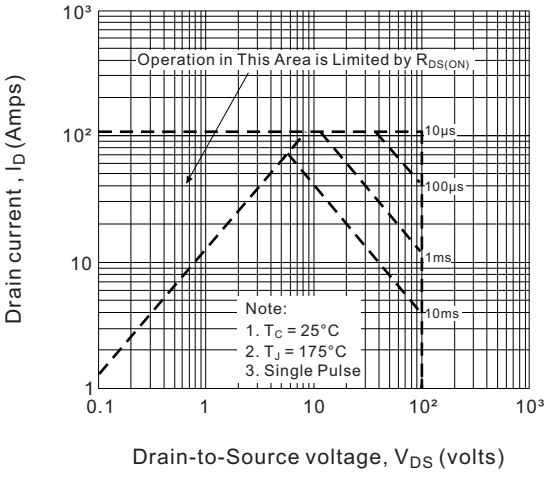


Fig.9 Maximum drain current vs. Case temperature

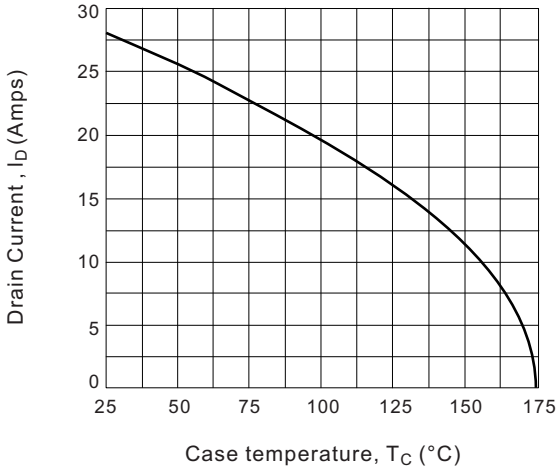


Fig.10 Maximum effective transient thermal impedance, Junction-to-Case

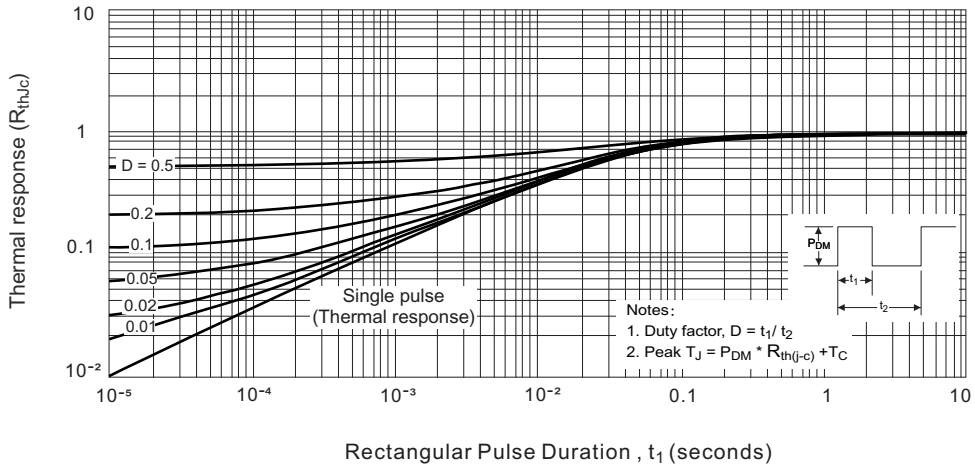


Fig.11a. Switching time test circuit

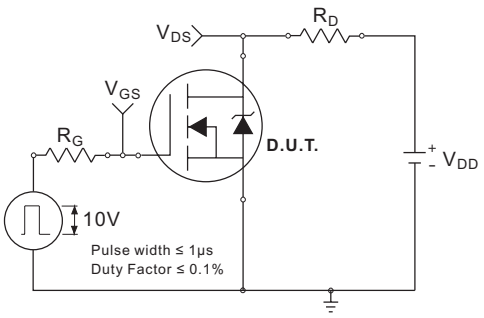


Fig.11b. Switching time waveforms

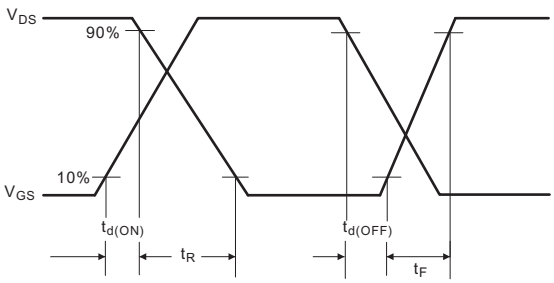
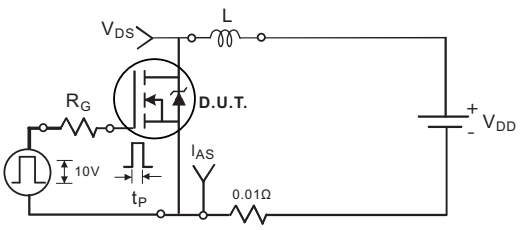


Fig.12a. Unclamped Inductive test circuit



Vary t_p to obtain required I_{AS}

Fig.12b. Unclamped Inductive waveforms

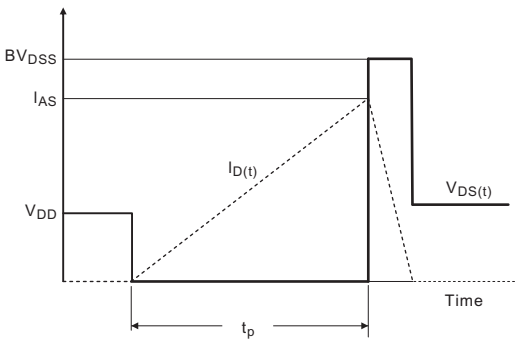


Fig.12c. Maximum avalanche energy vs. Drain current

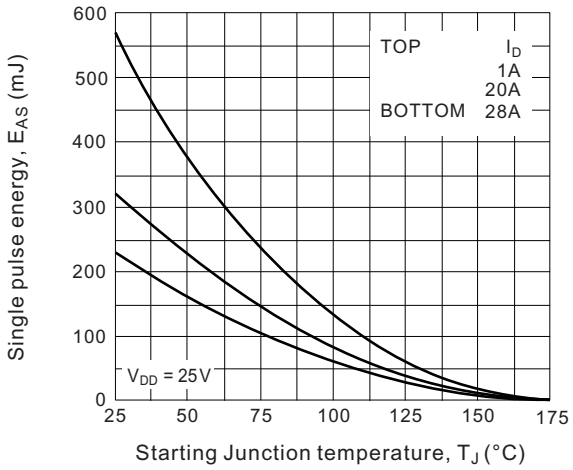


Fig.13a. Basic gate charge waveform

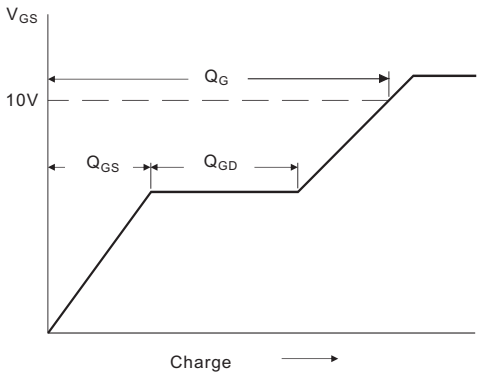


Fig.13b. Gate charge test circuit

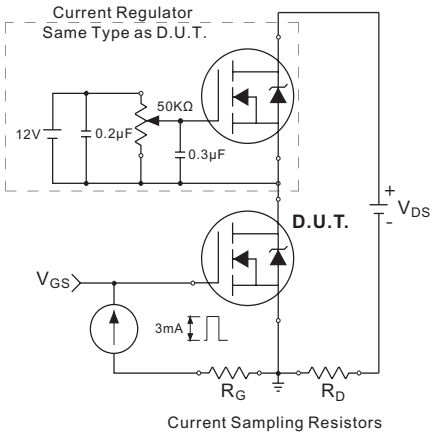
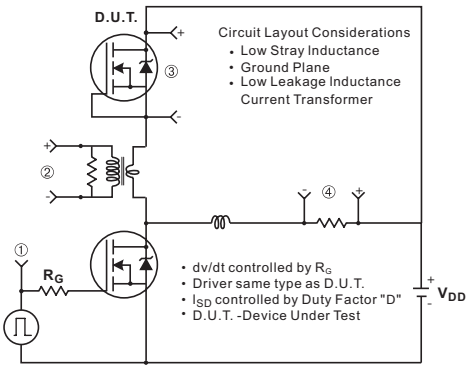
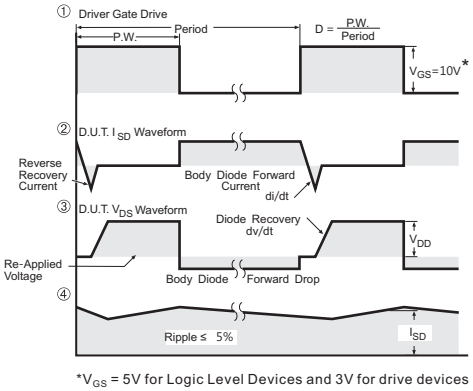


Fig.14 Peak diode recovery dv/dt test circuit for N-Channel MOSFET

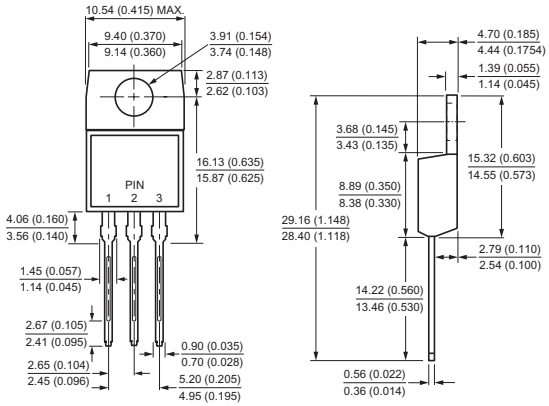




*V_{GS} = 5V for Logic Level Devices and 3V for drive devices

Case Style

TO-220AB



All dimensions in millimeters(inches)