

N-Channel Power MOSFET (5A, 900Volts)

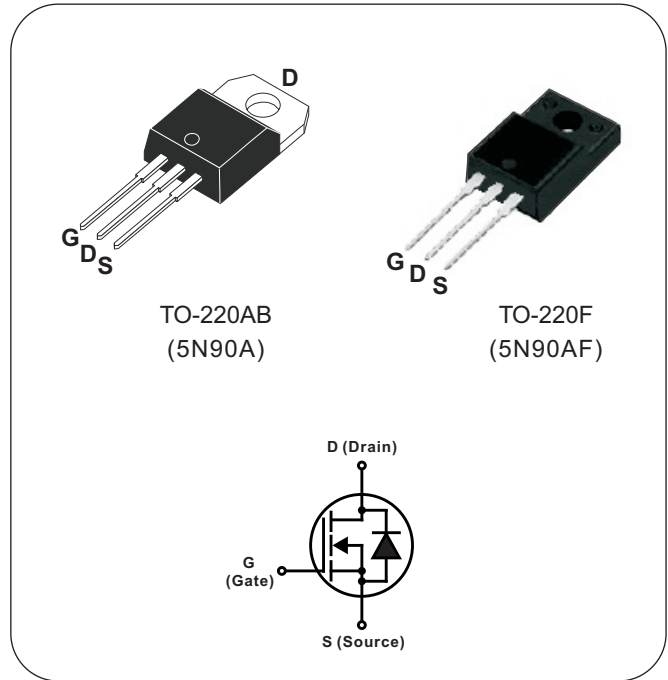
DESCRIPTION

The Nell **5N90** is a three-terminal silicon device with current conduction capability of 5A, fast switching speed, low on-state resistance, breakdown voltage rating of 900V, and max. threshold voltage of 5 volts.

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

FEATURES

- $R_{DS(ON)} = 2.80\Omega @ V_{GS} = 10V$
- Ultra low gate charge(40nC max.)
- Low reverse transfer capacitance ($C_{RSS} = 13pF$ typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature



PRODUCT SUMMARY

I_D (A)	5
V_{DSS} (V)	900
$R_{DS(ON)}$ (Ω)	2.80 @ $V_{GS} = 10V$
Q_G (nC) max.	40

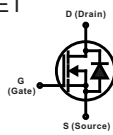
ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ C$ unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT	
V_{DSS}	Drain to Source voltage(Note 1)	$T_J=25^\circ C$ to $150^\circ C$	900	V	
V_{DGR}	Drain to Gate voltage	$R_{GS}=20K\Omega$	900		
V_{GS}	Gate to Source voltage		± 30		
I_D	Continuous Drain Current	$T_C=25^\circ C$	5	A	
		$T_C=100^\circ C$	3.1		
			12		
I_{AR}	Repetitive avalanche current (Note 1)		5	mJ	
E_{AR}	Repetitive avalanche energy(Note 1)	$I_{AR}=5A, R_{GS}=50\Omega, V_{GS}=10V$	5.1		
E_{AS}	Single pulse avalanche energy (Note 2)	$I_{AS}=5A, L=52.8mH$	660	V/ns	
dv/dt	Peak diode recovery dv/dt(Note 3)		4.0		
P_D	Total power dissipation (Derating factor above $25^\circ C$)	$T_C=25^\circ C$	TO-220AB	125	W(W / $^\circ C$)
			TO-220F	38	
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.
 2. $V_{DD}=50V, L=52.8mH, I_{AS}=5A, R_{GS}=25\Omega$, starting $T_J=25^\circ C$
 3. $I_{SD} \leq 5.4A, di/dt \leq 200A/\mu s, V_{DD} \leq V_{(BR)DSS}$, starting $T_J = 25^\circ C$.

THERMAL RESISTANCE						
SYMBOL	PARAMETER		Min.	Typ.	Max.	UNIT
$R_{th(j-c)}$	Thermal resistance, junction to case	TO-220AB			1.0	°C/W
		TO-220F			3.25	
$R_{th(j-a)}$	Thermal resistance, junction to ambient	TO-220AB			62.5	
		TO-220F			62.5	

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)							
SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
◎ OFF CHARACTERISTICS							
$V_{(BR)DSS}$	Drain to source breakdown voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	900			V	
$V_{(BR)DSS}/T_J$	Breakdown voltage temperature coefficient	$I_D = 250\mu\text{A}, V_{DS} = V_{GS}$		1.0		V/°C	
I_{DSS}	Drain to source leakage current	$V_{DS} = 900\text{V}, V_{GS} = 0\text{V}, T_C = 25^\circ\text{C}$			10	μA	
		$V_{DS} = 720\text{V}, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$			100		
I_{GSS}	Gate to source forward leakage current	$V_{GS} = 30\text{V}, V_{DS} = 0\text{V}$			100	nA	
	Gate to source reverse leakage current	$V_{GS} = -30\text{V}, V_{DS} = 0\text{V}$			-100		
◎ ON CHARACTERISTICS							
$R_{DS(ON)}$	Static drain to source on-state resistance	$V_{GS} = 10\text{V}, I_D = 2.5\text{A}$		2.25	2.8	Ω	
$V_{GS(TH)}$	Gate threshold voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3		5	V	
g_{fs}	Forward transconductance	$V_{DS} = 50\text{V}, I_D = 2.5\text{A}$ (Note 1)		4.0		S	
◎ DYNAMIC CHARACTERISTICS							
C_{ISS}	Input capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		1200	1550	pF	
C_{OSS}	Output capacitance				110		145
C_{RSS}	Reverse transfer capacitance				15		20
◎ SWITCHING CHARACTERISTICS							
$t_{d(ON)}$	Turn-on delay time	$V_{DD} = 450\text{V}, V_{GS} = 10\text{V}$ $I_D = 5\text{A}, R_{GS} = 25\Omega$ (Note 1,2)		28	65	ns	
t_r	Rise time				65		140
$t_{d(OFF)}$	Turn-off delay time				65		140
t_f	Fall time				50		110
Q_G	Total gate charge	$V_{DD} = 720\text{V}, V_{GS} = 10\text{V}$ $I_D = 5\text{A},$ (Note 1,2)		31	40	nC	
Q_{GS}	Gate to source charge				7.2		
Q_{GD}	Gate to drain charge (Miller charge)				15		

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	$I_{SD} = 5\text{A}, V_{GS} = 0\text{V}$			1.4	V
I_S (Isd)	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET 			5	A
I_{SM}	Pulsed source current				12	
t_{rr}	Reverse recovery time	$I_{SD} = 5.4\text{A}, V_{GS} = 0\text{V},$ $di_f/dt = 100\text{A}/\mu\text{s}$		610		ns
Q_{rr}	Reverse recovery charge			5.30		μC

Note: 1. Pulse test: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
2. Essentially independent of operating temperature.

ORDERING INFORMATION SCHEME

	5	N	90	A
Current rating, I_D				
5 = 5A				
MOSFET series				
N = N-Channel				
Voltage rating, V_{DS}				
90 = 900V				
Package type				
A = TO-220AB				
AF = TO-220F				

■ TEST CIRCUITS AND WAVEFORMS

Fig.1A Peak diode recovery dv/dt test circuit

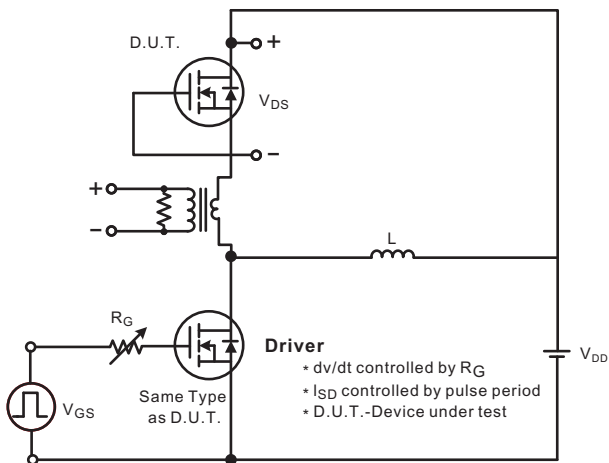
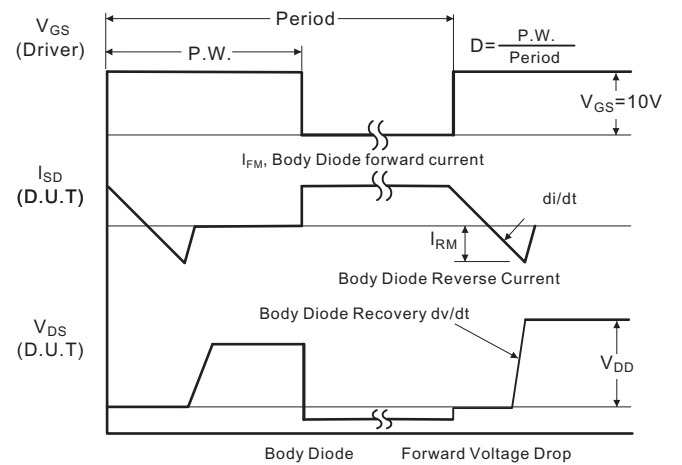


Fig.1B Peak diode recovery dv/dt waveforms



TEST CIRCUITS AND WAVEFORMS (Cont.)

Fig.2A Switching test circuit

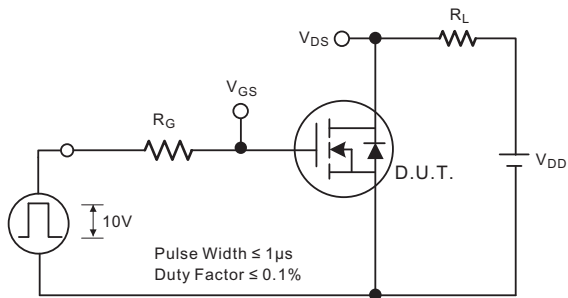


Fig.2B Switching Waveforms

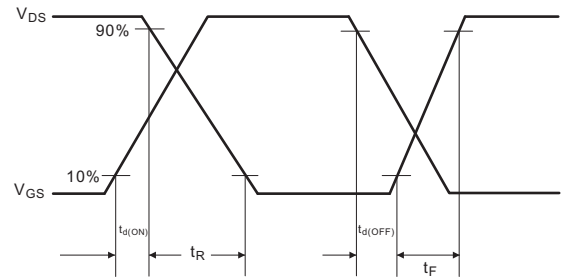


Fig.3A Gate charge test circuit

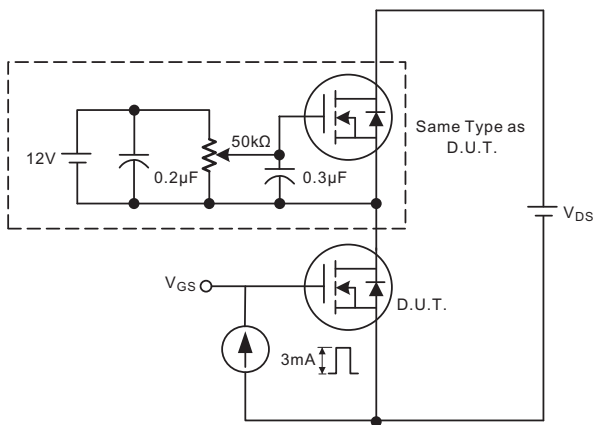


Fig.3B Gate charge waveform

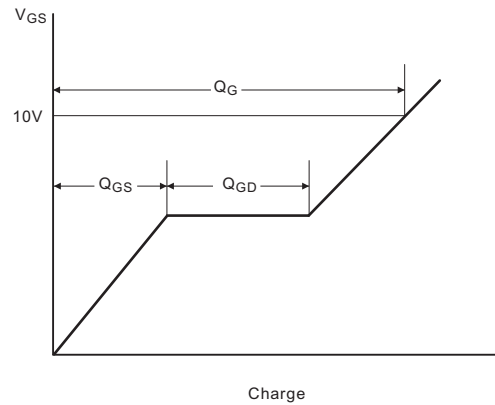


Fig.4A Unclamped Inductive switching test circuit

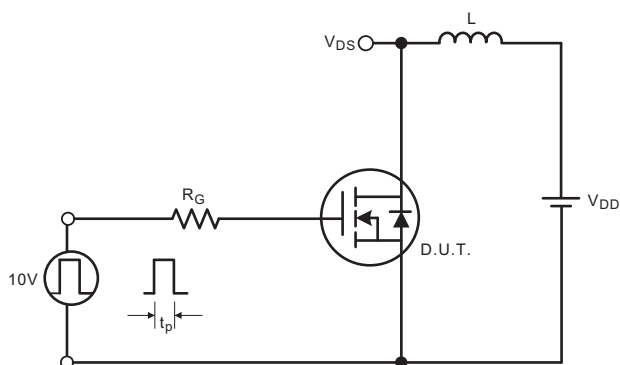
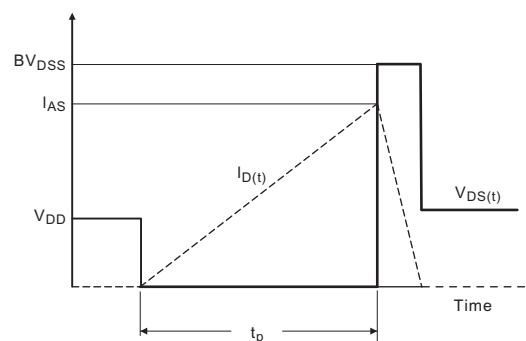


Fig.4B Unclamped Inductive switching waveforms



■ TYPICAL CHARACTERISTICS

Fig.1 On-State characteristics

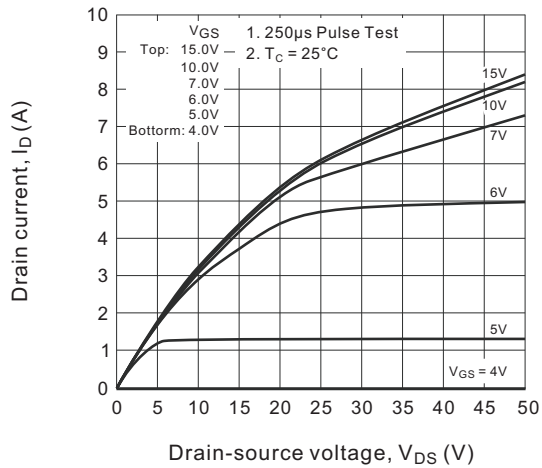


Fig.2 Transfer characteristics

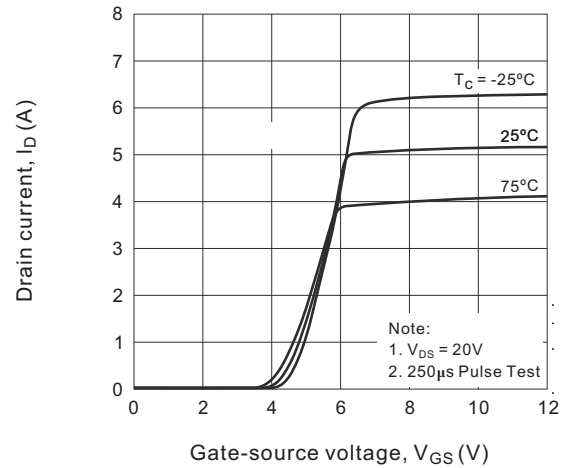


Fig.3 On-Resistance variation vs. Gate voltage

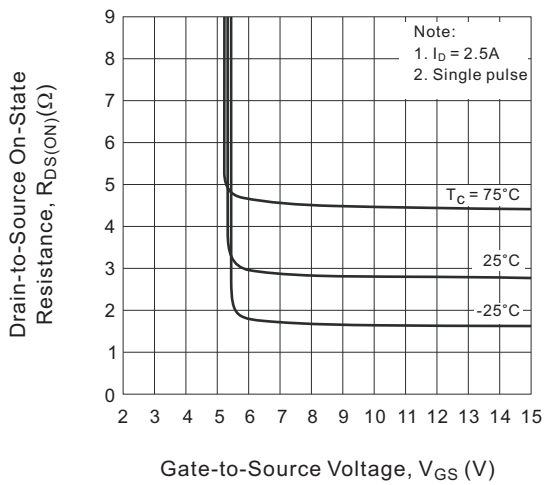


Fig.4 On-State resistance vs. Case temperature

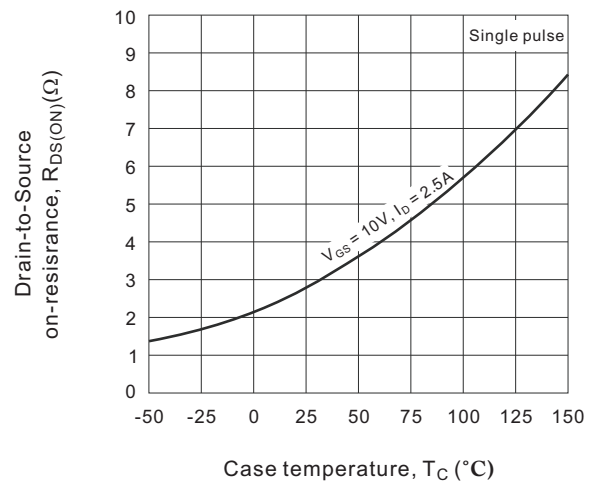


Fig.5 Typical forward transconductance

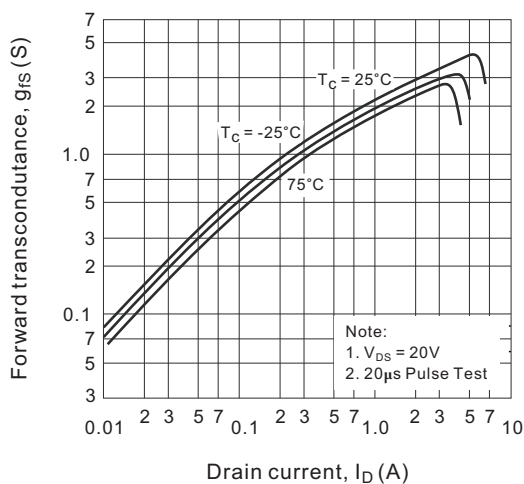


Fig.6 Typical source-drain diode forward voltage

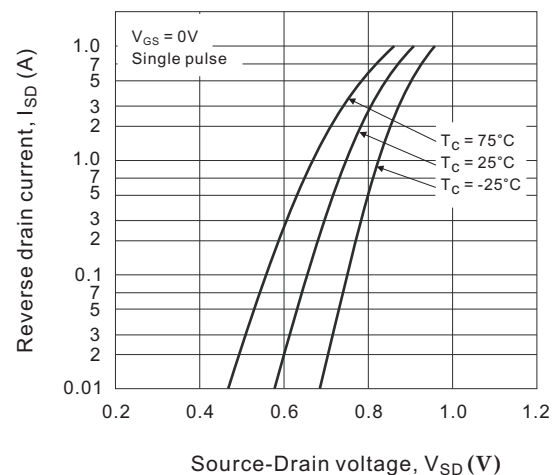


Fig.7 Switching time vs. Drain current

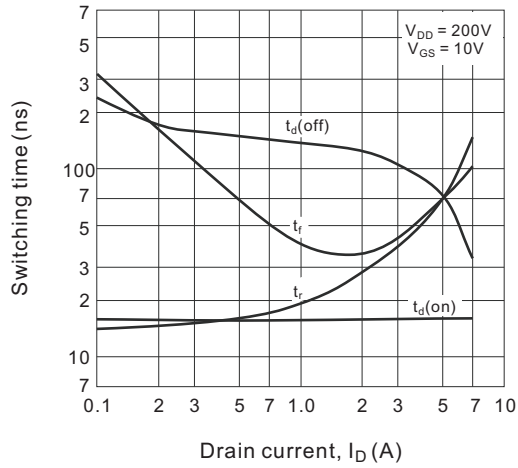


Fig.8 Typical capacitance vs. Drain-Source voltage

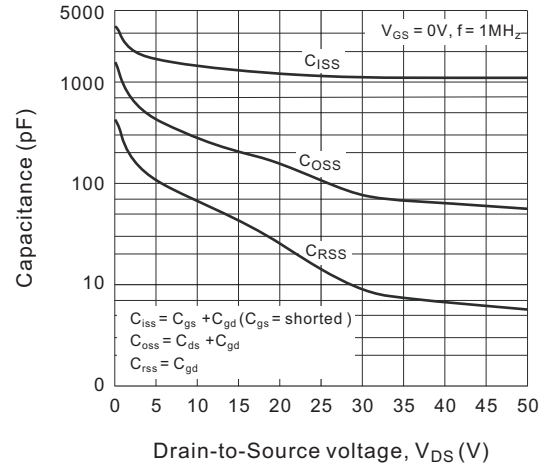


Fig.9 Typical gate charge vs. Gate-Source voltage

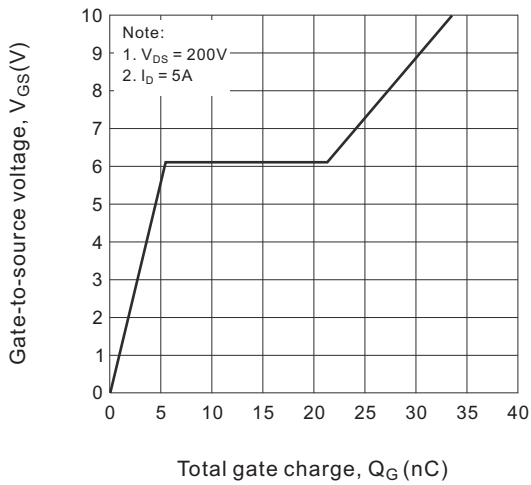


Fig.10-1 Maximum safe operating area for 5N90A

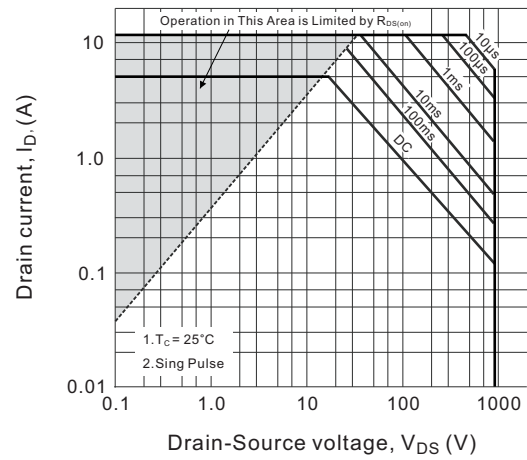


Fig.10-2 Maximum safe operating area for 5N90AF

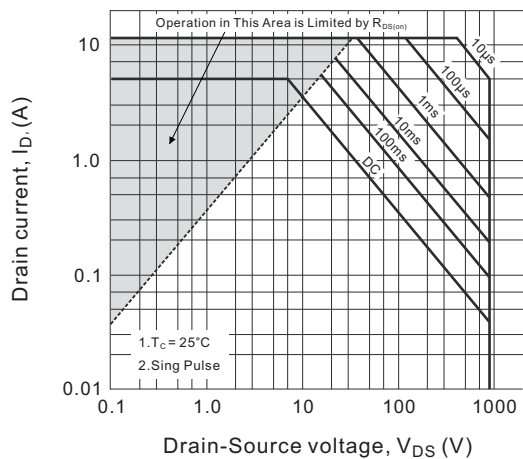


Fig.11 Power dissipation vs. Case temperature for 5N90A

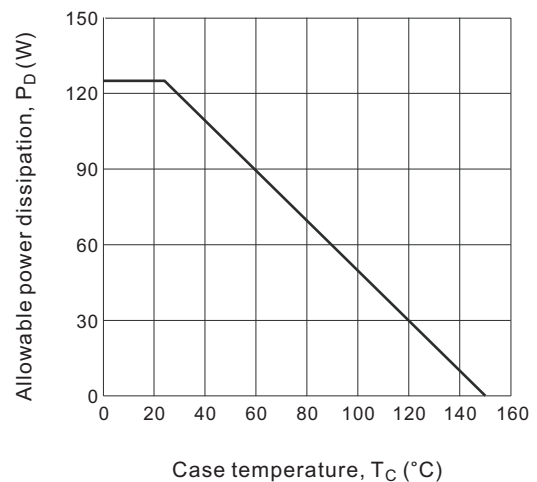


Fig.12 Power dissipation vs. Case temperature for 5N90AF

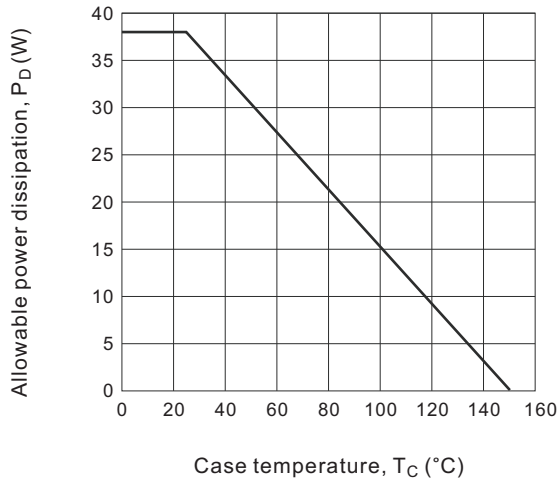


Fig.13 Avalanche energy derating factor vs. Ambient temperature

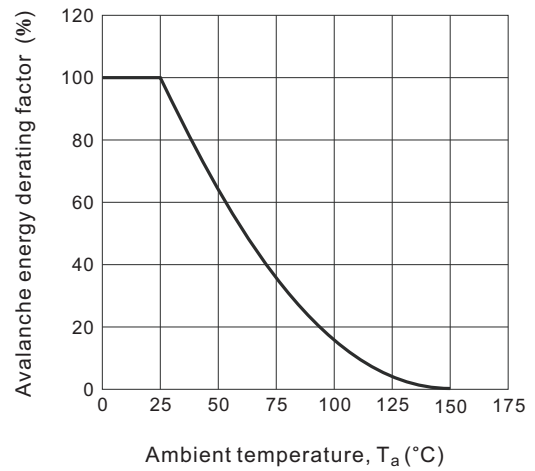


Fig.14-1 Transient thermal response curve for 5N90A

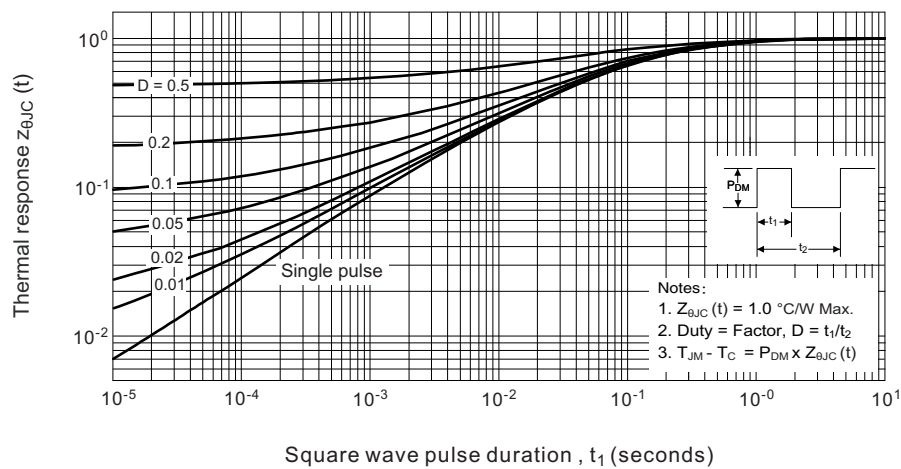
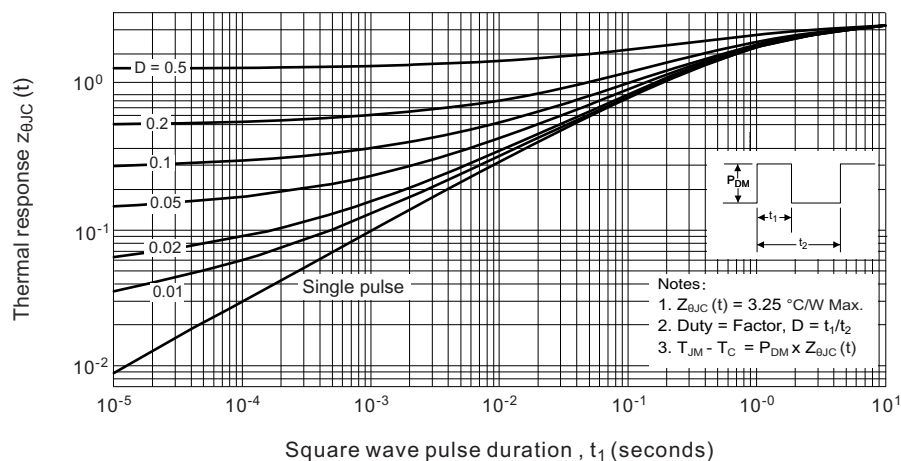
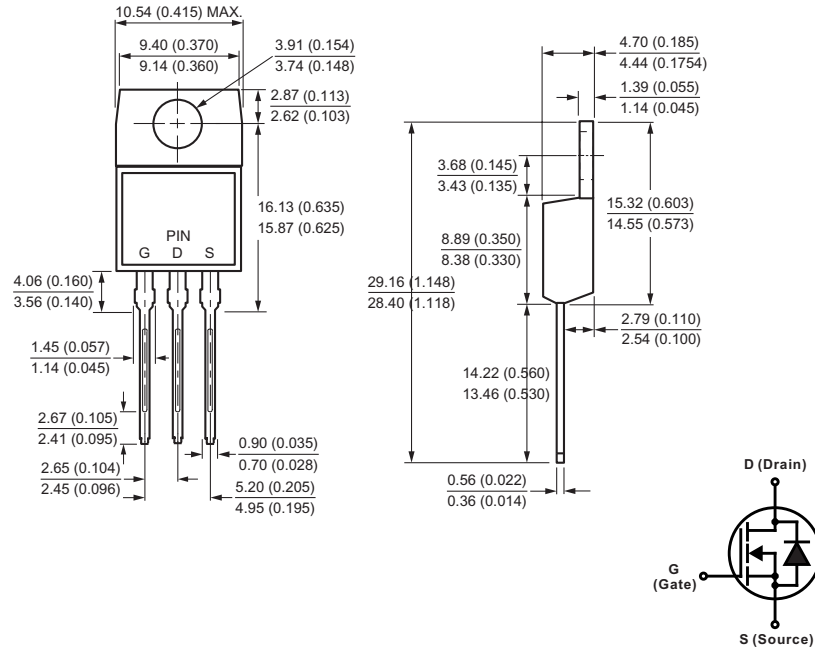


Fig.14-2 Transient thermal response curve for 5N90AF

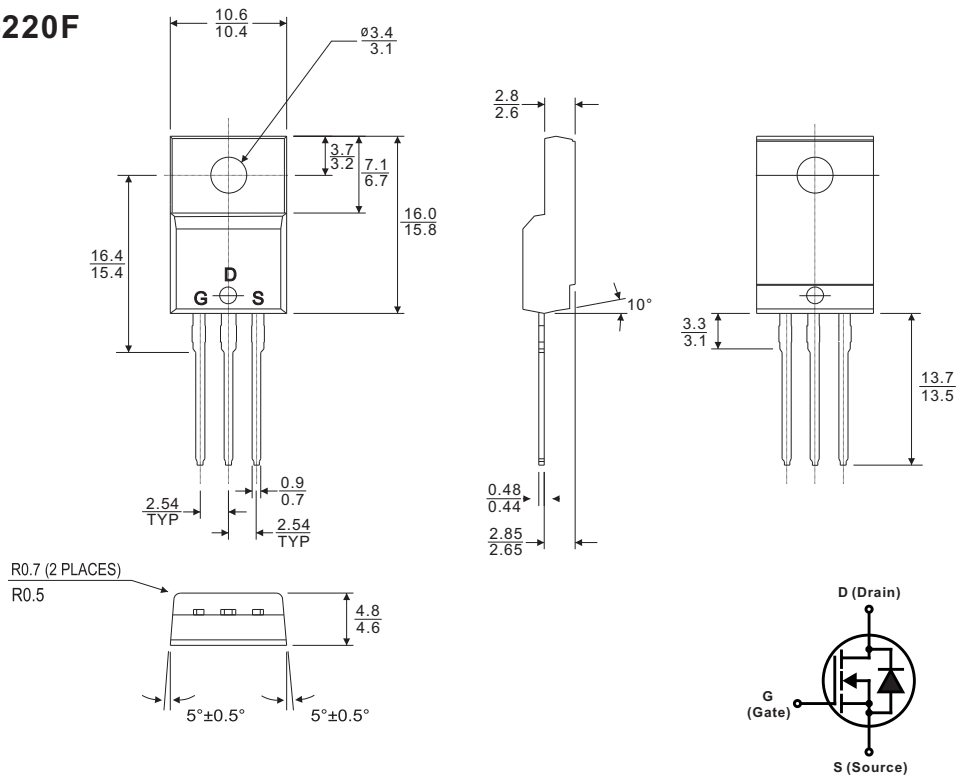


TO-220AB



All dimensions in millimeters(inches)

TO-220F



All dimensions in millimeters