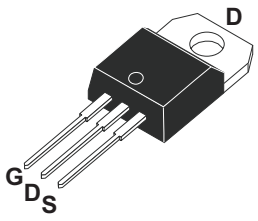
N-Channel Power MOSFET
(5A, 900Volts)

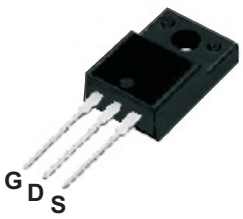
DESCRIPTION

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.

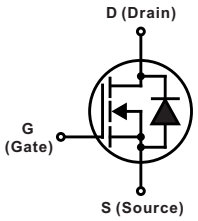
They are designed for use in applications such as switched mode power supplies, DC to DC converters, **PWM** motor controls, bridge circuits and general purpose switching applications.



TO-220AB
(5N90A)



TO-220F
(5N90AF)



FEATURES

- $R_{DS(ON)}$ = 2.80Ω @ 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°C unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS		VALUE	UNIT
V_{DSS}	Drain to Source voltage(Note 1)	T_J=25°C to 150°C		900	V
V_{DGR}	Drain to Gate voltage	R_{GS}=20KΩ		900	
V_{GS}	Gate to Source voltage			±30	
I_D	Continuous Drain Current	T_C=25°C		5	A
		T_C=100°C		3.1	
I_{DM}	Pulsed Drain current (Note 1)			12	
I_{AR}	Repetitive avalanche current (Note 1)			5	
E_{AR}	Repetitive avalanche energy(Note 1)	I_{AR}=5A, R_{GS}=50Ω, V_{GS}=10V		5.1	mJ
E_{AS}	Single pulse avalanche energy (Note 2)	I_{AS}=5A, L=52.8mH		660	
dv/dt	Peak diode recovery dv/dt(Note 3)			4.0	V /ns
P_D	Total power dissipation (Derating factor above 25°C)	T_C=25°C	TO-220AB	125	W(W /°C)
			TO-220F	38	
T_J	Operation junction temperature			-55 to 150	°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}=25Ω,starting T_J=25°C
3.I_{SD} ≤ 5.4A, di/dt ≤ 200A/μs, V_{DD} ≤ $V_{(BR)DSS}$, starting T_J = 25°C.

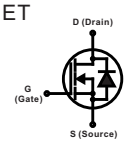
THERMAL RESISTANCE

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°C unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
◎ OFF CHARACTERISTICS							
$V_{(BR)DSS}$	Drain to source breakdown voltage	I_D = 250μA, V_{GS} = 0V		900			V
$V_{(BR)DSS}/\ T_J$	Breakdown voltage temperature coefficient	I_D = 250μA, V_{DS} =V_{GS}			1.0		V/ºC
I_{DSS}	Drain to source leakage current	V_{DS}=900V, V_{GS}=0V	T_C=25°C			10	μA
		V_{DS}=720V, V_{GS}=0V	T_C=125°C			100	
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	
◎ ON CHARACTERISTICS							
$R_{DS(ON)}$	Static drain to source on-state resistance	V_{GS}=10V, I_D=2.5A			2.25	2.8	Ω
$V_{GS(TH)}$	Gate threshold voltage	V_{GS}=V_{DS}, I_D=250μA		3		5	V
g_{fs}	Forward transconductance	V_{DS}=50V, I_D=2.5A (Note 1)			4.0		S
◎ DYNAMIC CHARACTERISTICS							
C_{ISS}	Input capacitance	V_{DS}=25V, V_{GS}=0V, f=1MHz			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}=450V, V_{GS}=10V I_D=5A, R_{GS}=25Ω (Note1,2)			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}= 720V, V_{GS}=10V I_D=5A, (Note1,2)			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°C unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{SD}	Diode forward voltage	I_{SD} = 5A, V_{GS} = 0V			1.4	V
Is (I_{SD})	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} = 5.4A, V_{GS} = 0V, dI_F/dt = 100A/μs		610		ns
Q_{rr}	Reverse recovery charge			5.30		μC

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

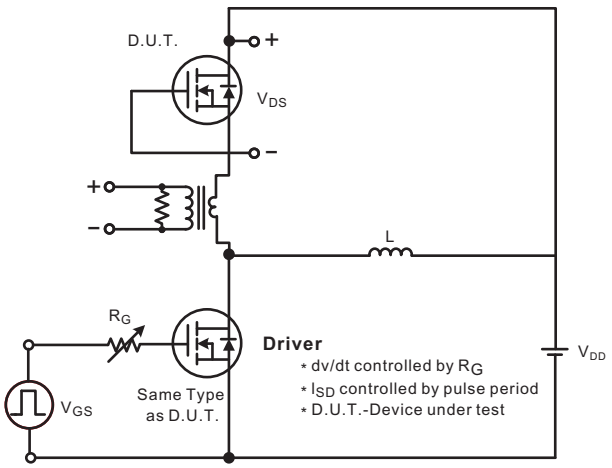
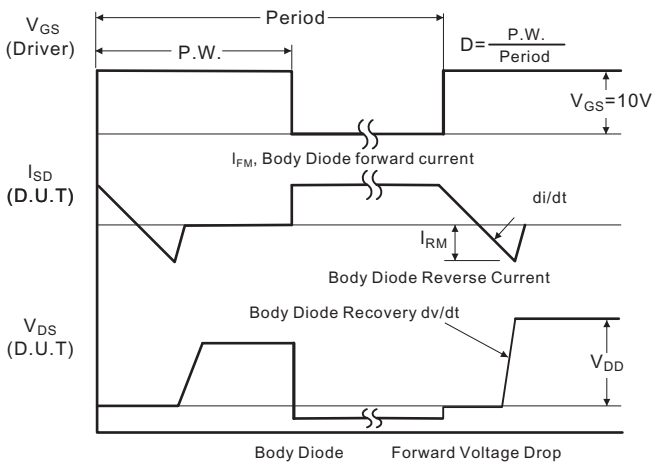


Fig.1B Peak diode recovery dv/dt waveforms



■ TEST CIRCUITS AND WAVEFORMS(Cont.)

Fig.2A Switching test circuit

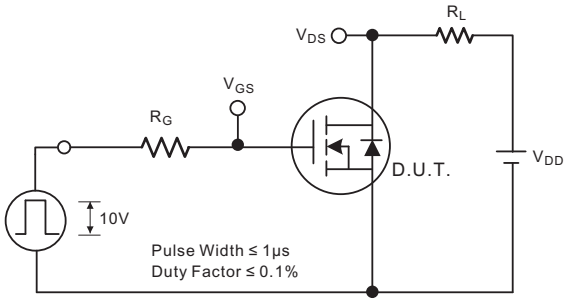


Fig.2B Switching Waveforms

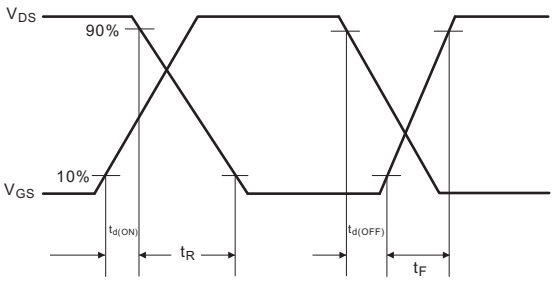


Fig.3A Gate charge test circuit

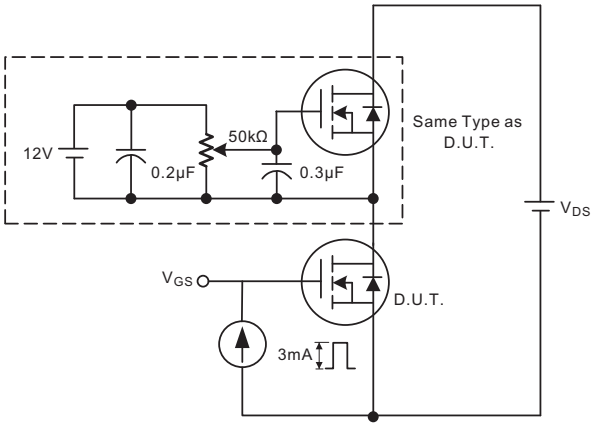


Fig.3B Gate charge waveform

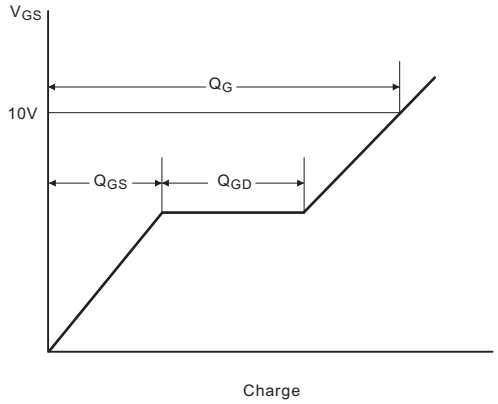


Fig.4A Unclamped Inductive switching test circuit

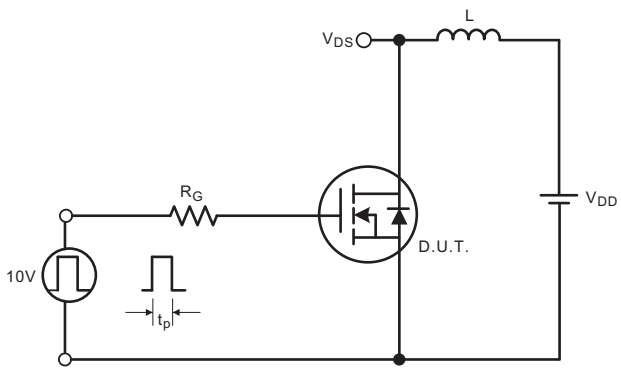
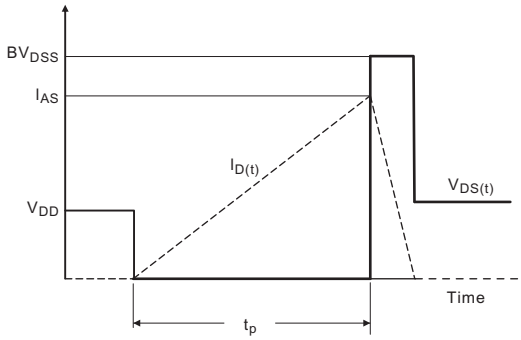


Fig.4B Unclamped Inductive switching waveforms



■ TYPICAL CHARACTERISTICS

Fig.1 On-State characteristics

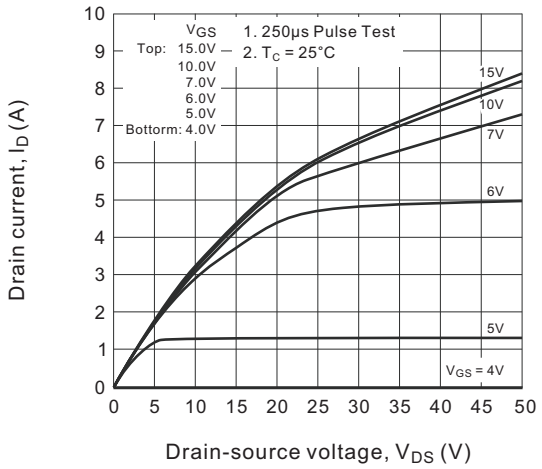


Fig.2 Transfer characteristics

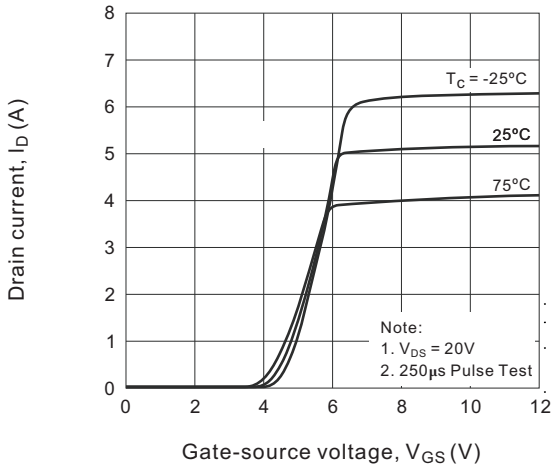


Fig.3 On-Resistance variation vs. Gate voltage

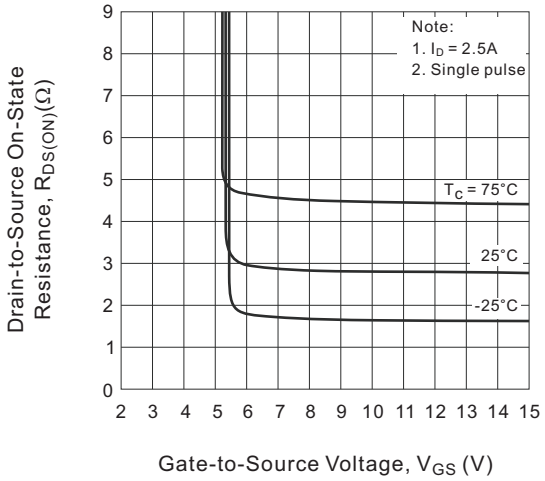


Fig.4 On-State resistance vs. Case temperature

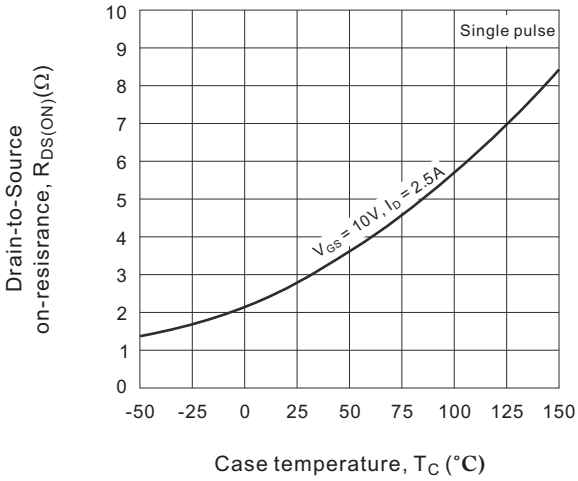


Fig.5 Typical forward transcondutance

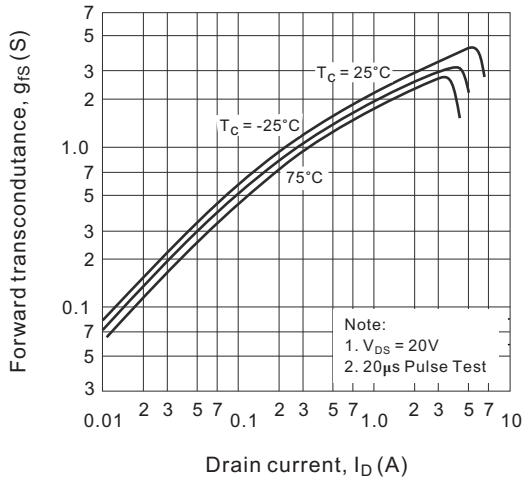


Fig.6 Typical source-drain diode forward voltage

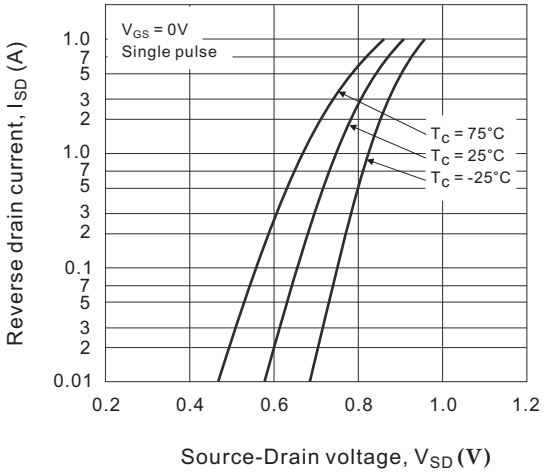


Fig.7 Switching time vs. Drain current

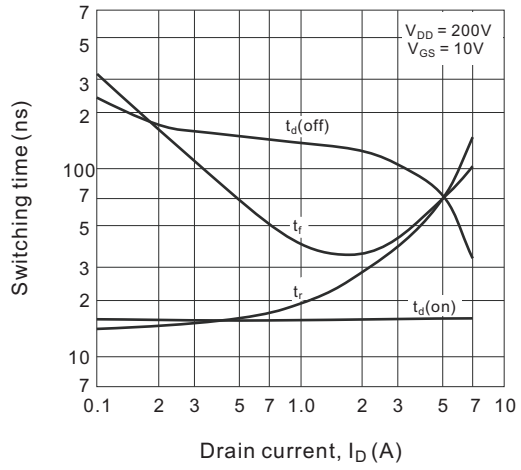


Fig.8 Typical capacitance vs. Drain-Source voltage

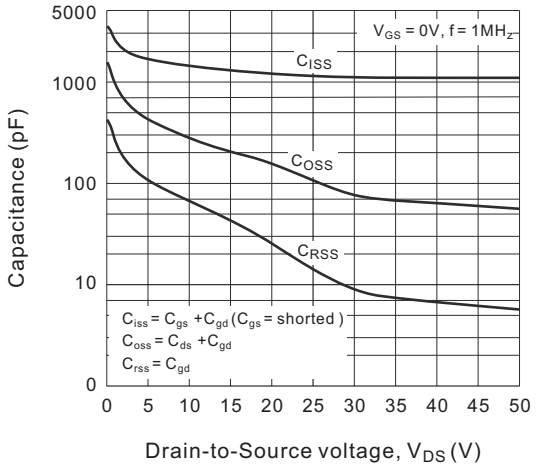


Fig.9 Typical gate charge vs. Gate-Source voltage

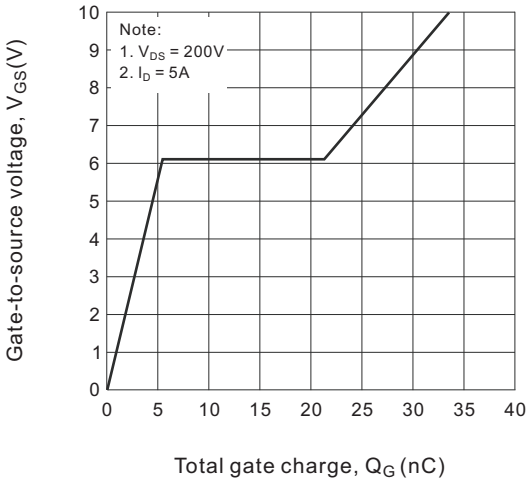


Fig.10-1 Maximum safe operating area for 5N90A

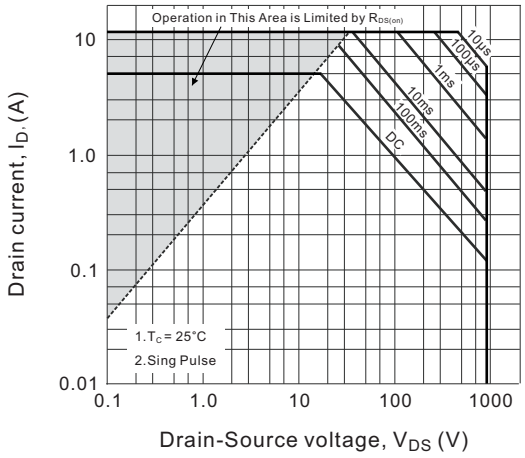


Fig.10-2 Maximum safe operating area for 5N90AF

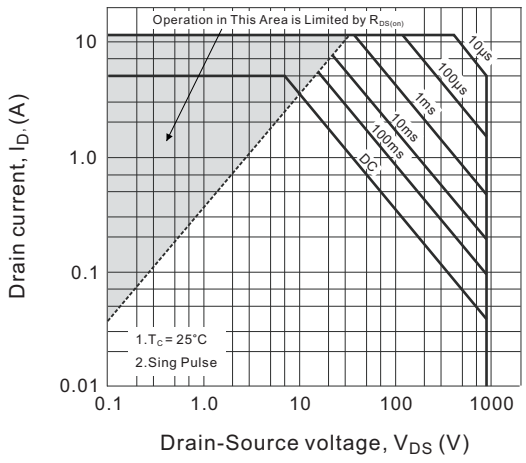


Fig.11 Power dissipation vs. Case tempeature for 5N90A

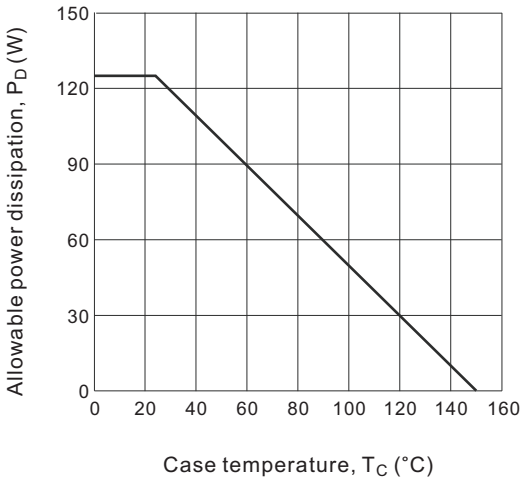


Fig.12 Power dissipation vs. Case temperature for 5N90AF

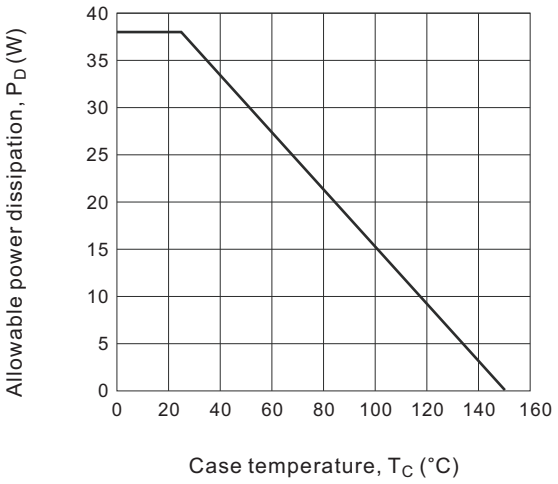


Fig.13 Avalanche energy derating factor vs. Ambient temperature

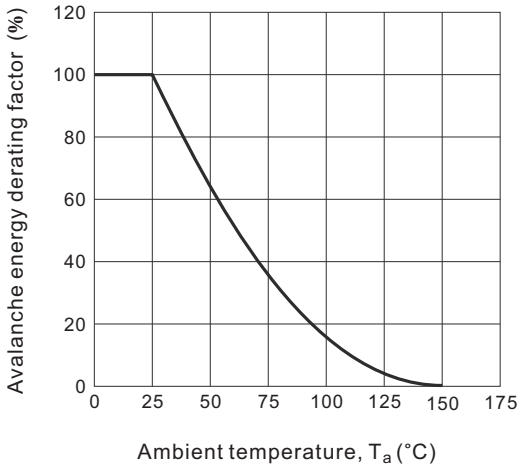


Fig.14-1 Transient thermal response curve for 5N90A

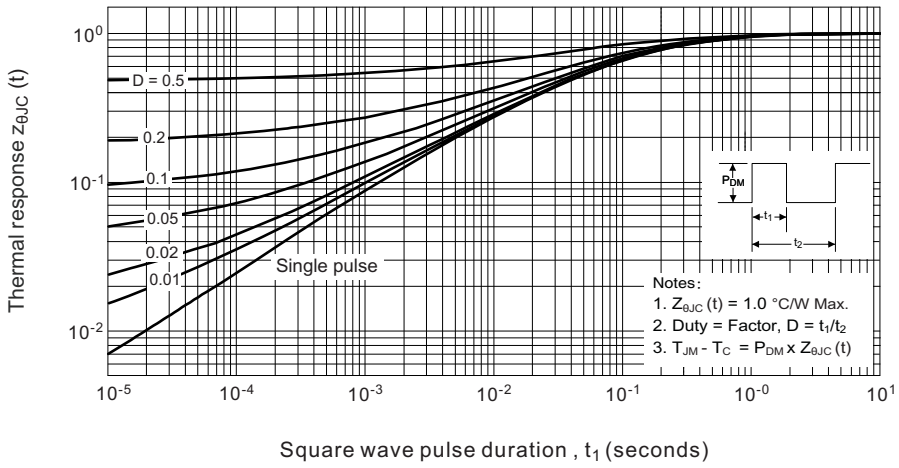
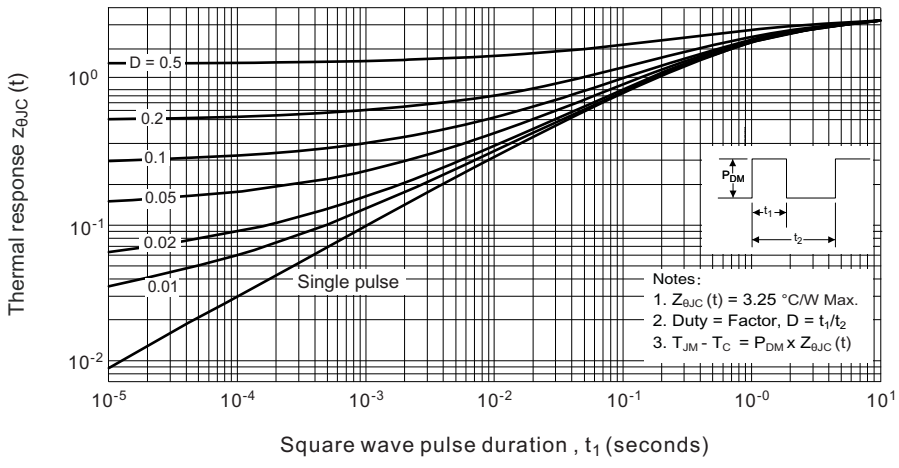
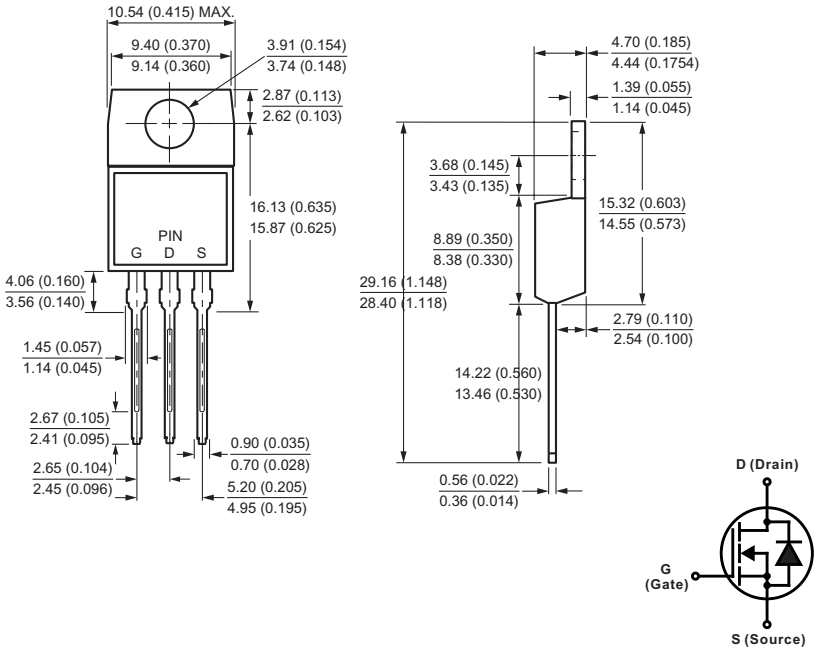


Fig.14-2 Transient thermal response curve for 5N90AF

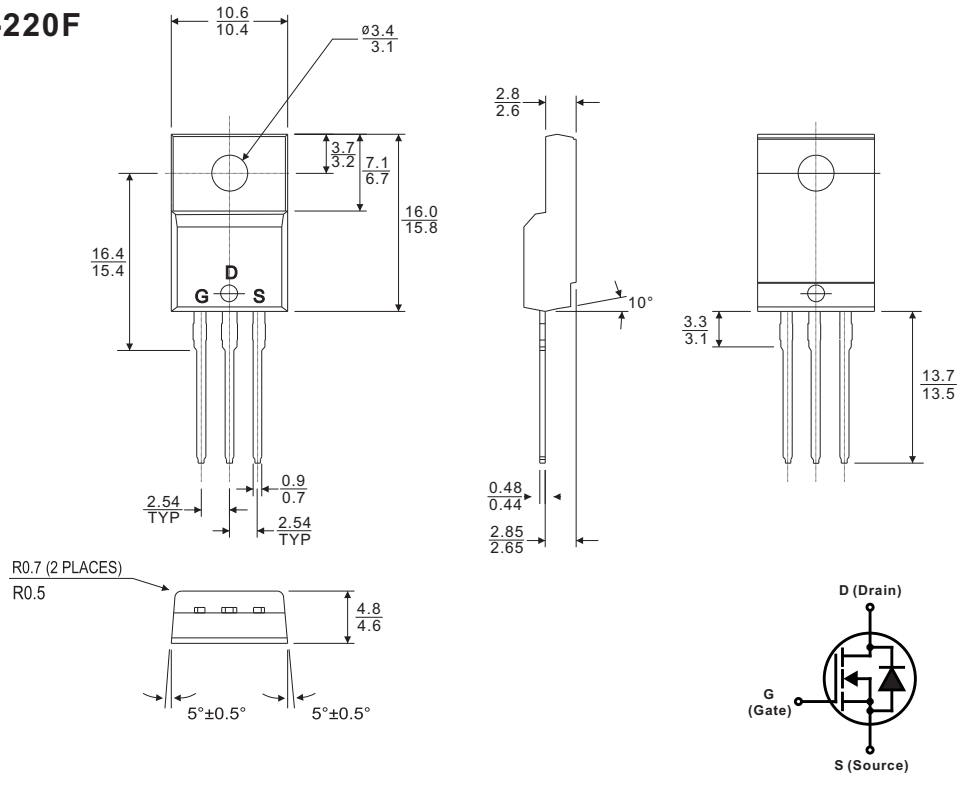


TO-220AB



All dimensions in millimeters(inches)

TO-220F



All dimensions in millimeters