

N-Channel Power MOSFET 6A, 900Volts

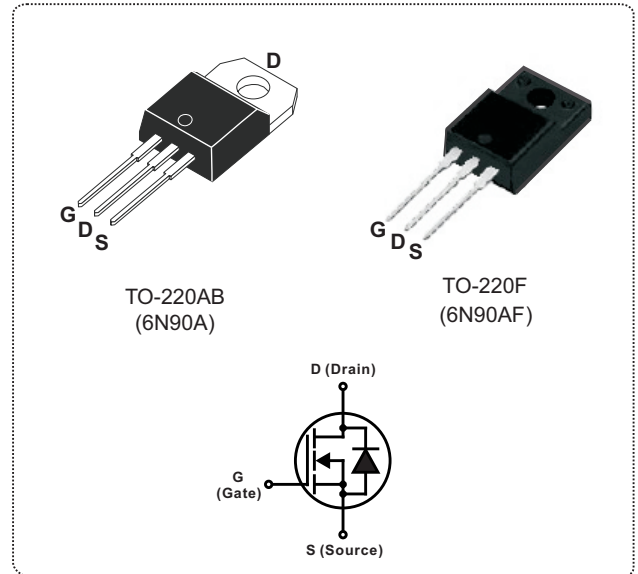
DESCRIPTION

The Nell **6N90** is a three-terminal silicon device with current conduction capability of 6A, 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

- $R_{DS(ON)} = 2.3\Omega @ V_{GS} = 10V$
- Ultra low gate charge(40nC max.)
- Low reverse transfer capacitance ($C_{RSS} = 11pF$ typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature



PRODUCT SUMMARY

I_D (A)	6
V_{DSS} (V)	900
$R_{DS(ON)}$ (Ω)	2.3 @ $V_{GS} = 10V$
Q_G (nC) max.	40

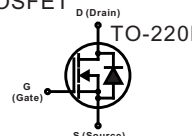
ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ C$ unless otherwise specified)

SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT	
V_{DSS}	Drain to Source voltage	$T_J = 25^\circ C$ 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	$T_C = 25^\circ C$	6	A	
		$T_C = 100^\circ C$	3.8		
I_{DM}	Pulsed Drain current(Note 1)		24		
I_{AR}	Avalanche current(Note 1)		6		
E_{AR}	Repetitive avalanche energy(Note 1)	$I_{AR} = 6A, R_{GS} = 50\Omega, V_{GS} = 10V$	16.7	mJ	
E_{AS}	Single pulse avalanche energy(Note 2)	$I_{AS} = 6A, L = 34mH$	650		
dv/dt	Peak diode recovery dv/dt(Note 3)		4.5	V / ns	
P_D	Total power dissipation	$T_C = 25^\circ C$	TO-220AB	167	W
			TO-220F	56	
	Linear derating factor above $T_C = 25^\circ C$	$T_C = 25^\circ C$	TO-220AB	1.43	$^\circ C/W$
			TO-220F	0.48	
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. $I_{AS} = 6A, L = 34mH, V_{DD} = 50V, R_{GS} = 25\Omega$, starting $T_J = 25^\circ C$.
 3. $I_{SD} \leq 6A, di/dt \leq 200A/\mu s, V_{DD} \leq V_{(BR)DSS}$, starting $T_J = 25^\circ C$.

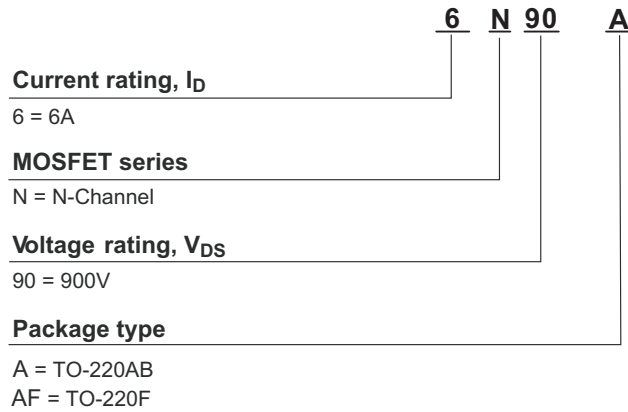
THERMAL RESISTANCE						
SYMBOL	PARAMETER		MIN.	TYP.	MAX.	UNIT
$R_{th(j-c)}$	Thermal resistance, junction to case	TO-220AB			0.75	°C/W
		TO-220F			2.25	
$R_{th(j-a)}$	Thermal resistance, junction to ambient	TO-220AB			62.5	
		TO-220F			62.5	

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
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown voltage temperature coefficient	$I_D = 250\mu\text{A}, V_{DS} = V_{GS}$		1.07		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	$V_{GS} = 10\text{V}, I_D = 3\text{A}$		1.95	2.3	Ω
$V_{GS(TH)}$	Gate threshold voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3		5	V
g_{FS}	Forward transconductance	$V_{DS} = 50\text{V}, I_D = 3\text{A}$		5.5		S
◎ DYNAMIC CHARACTERISTICS						
C_{ISS}	Input capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		1360	1770	pF
C_{OSS}	Output capacitance			110	145	
C_{RSS}	Reverse transfer capacitance			11	15	
◎ SWITCHING CHARACTERISTICS						
$t_{d(ON)}$	Turn-on delay time	$V_{DD} = 450\text{V}, V_{GS} = 10\text{V}$ $I_D = 6\text{A}, R_{GS} = 25\Omega$ (Note 1,2)		35	80	ns
t_r	Rise time			90	190	
$t_{d(OFF)}$	Turn-off delay time			55	120	
t_f	Fall time			60	130	
Q_G	Total gate charge	$V_{DD} = 720\text{V}, V_{GS} = 10\text{V}$ $I_D = 6\text{A},$ (Note 1,2)		30	40	nC
Q_{GS}	Gate to source charge			9.0		
Q_{GD}	Gate to drain charge (Miller charge)			12		

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	$I_{SD} = 6\text{A}, V_{GS} = 0\text{V}$			1.4	V
I_S (I_{SD})	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET 			6	A
I_{SM}	Pulsed source current				24	
t_{rr}	Reverse recovery time	$I_{SD} = 6\text{A}, V_{GS} = 0\text{V},$ $dI_F/dt = 100\text{A}/\mu\text{s}$		630		ns
Q_{rr}	Reverse recovery charge			6.9		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



TEST CIRCUITS

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

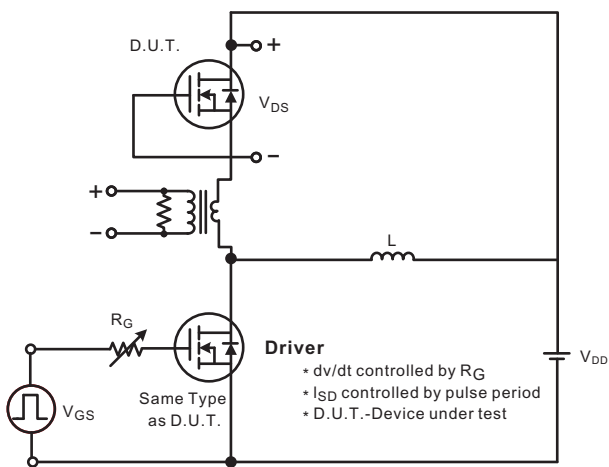
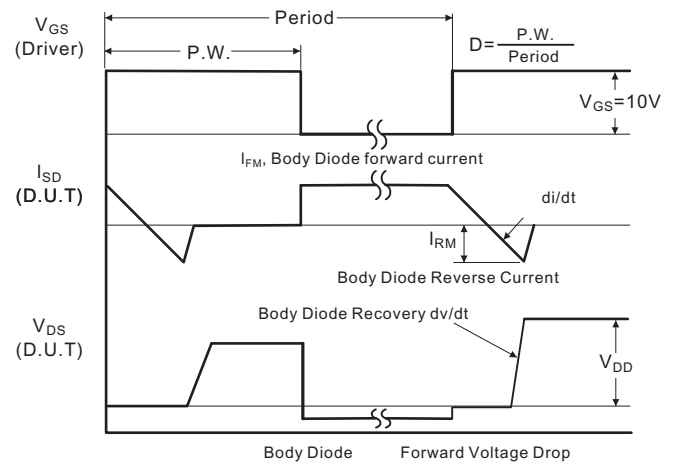


Fig.1B Peak diode recovery dv/dt waveforms



■ TEST CIRCUIT(Cont.)

Fig.2A Switching test circuit

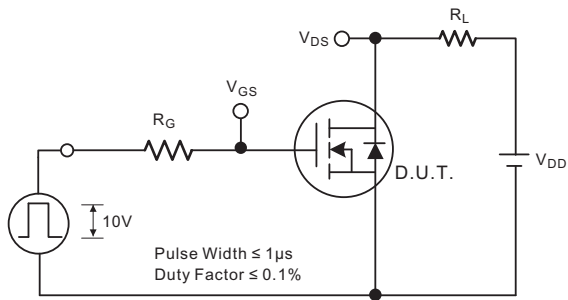


Fig.2B Switching Waveforms

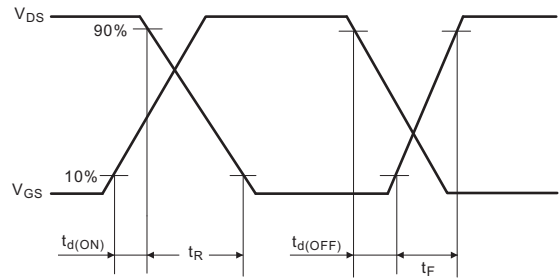


Fig.3A Gate charge test circuit

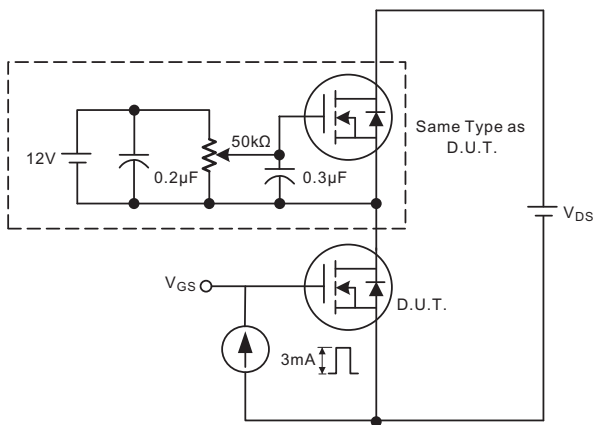


Fig.3B Gate charge waveform

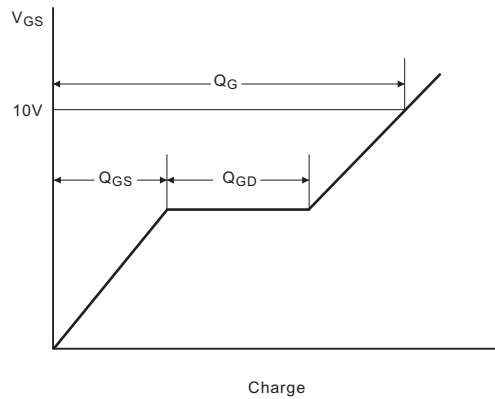


Fig.4A Unclamped Inductive switching test circuit

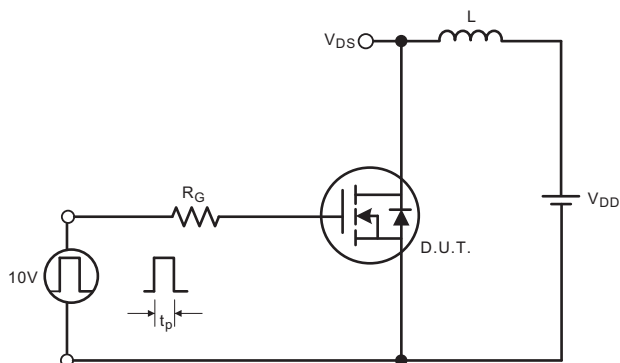
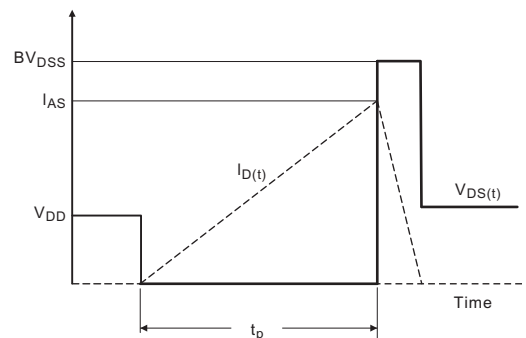


Fig.4B Unclamped Inductive switching waveforms



■ TYPICAL CHARACTERISTICS

Fig.1 Typical output characteristics

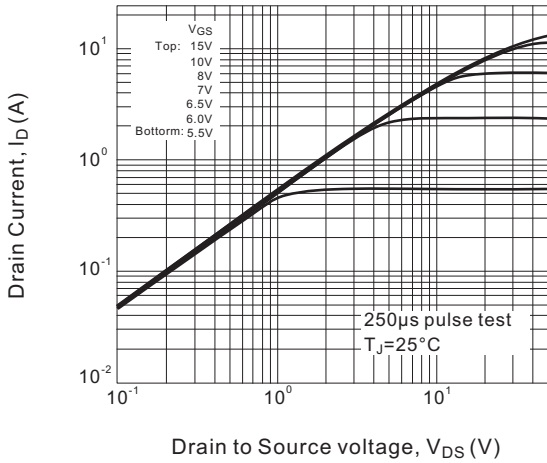


Fig.2 Typical transfer characteristics

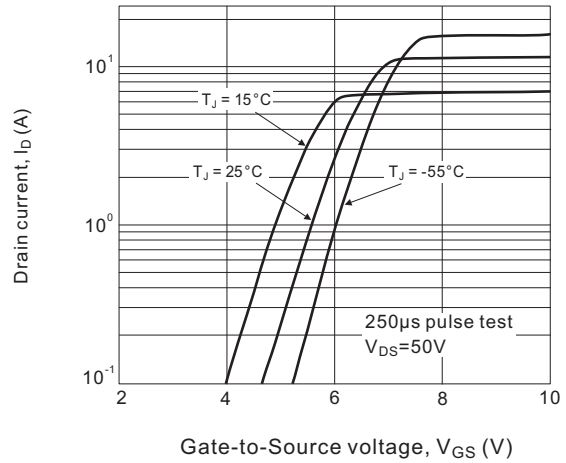


Fig.3 On-resistance variation vs. drain current and gate voltage

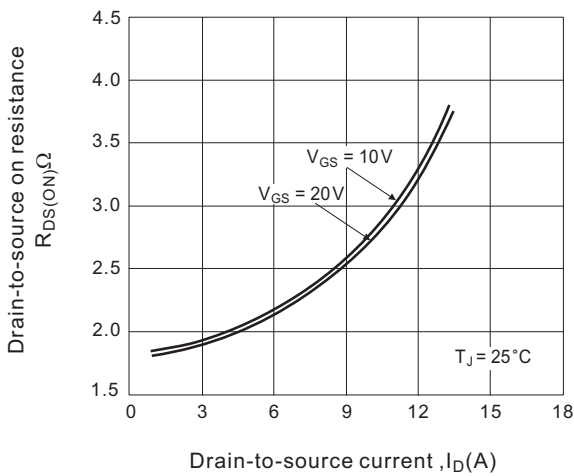


Fig.4 Body diode forward voltage variation with source current and temperature

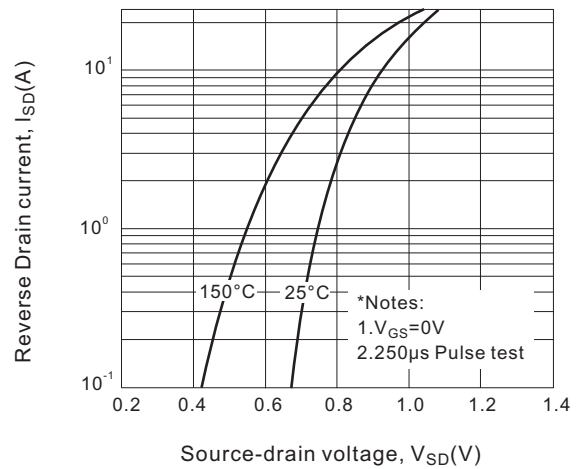


Fig.5 Typical capacitance characteristics

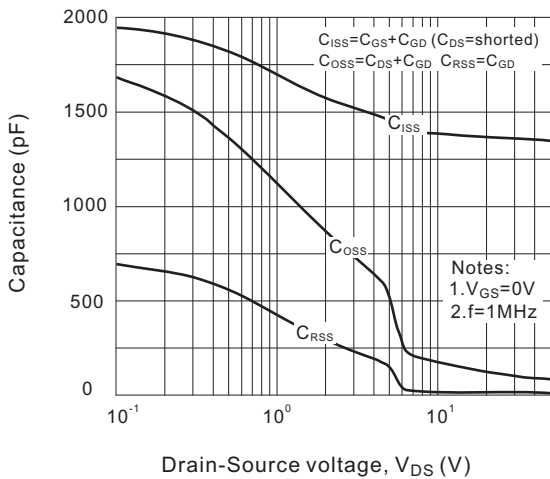


Fig.6 Typical gate charge characteristics

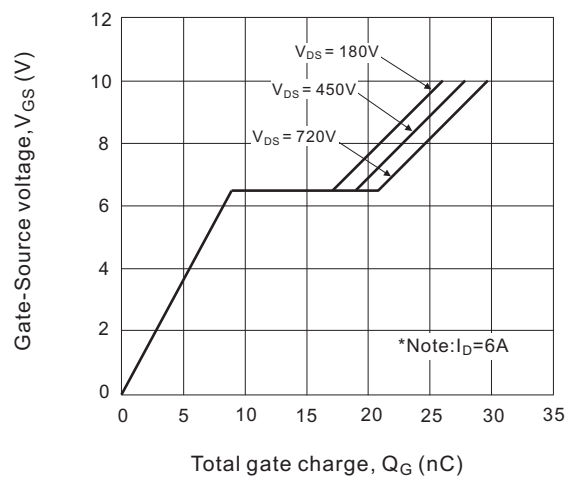


Fig.7 Breakdown voltage variation vs. Junction temperature

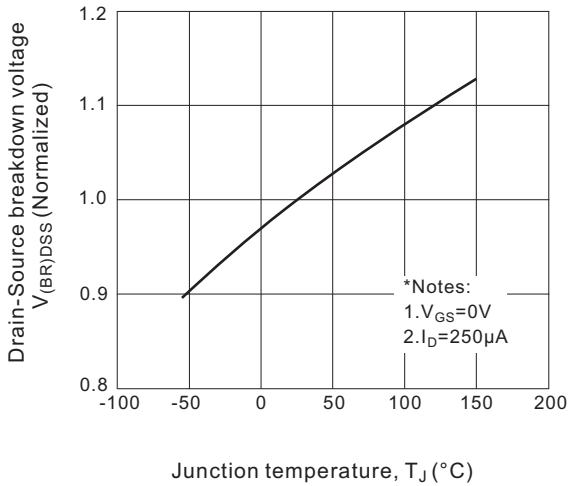


Fig.8 On-resistance variation vs. Junction temperature

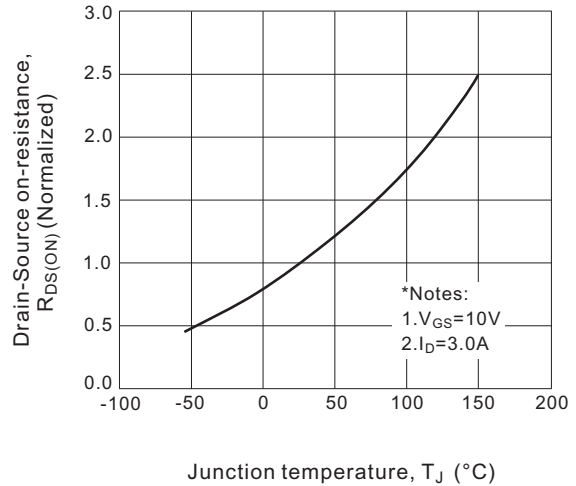


Fig.9 Maximum safe operating area for 6N90A

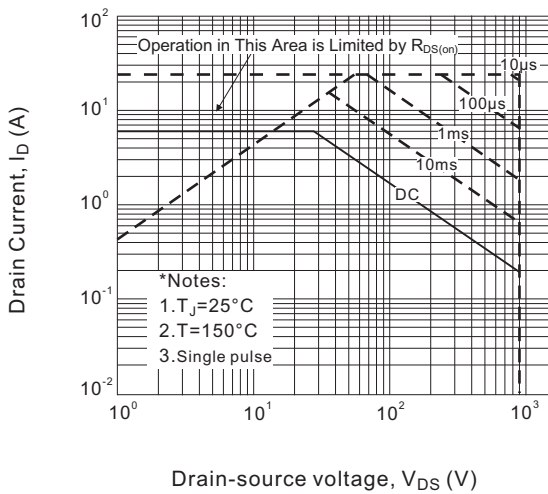


Fig.9-2 Maximum safe operating area for 6N90AF

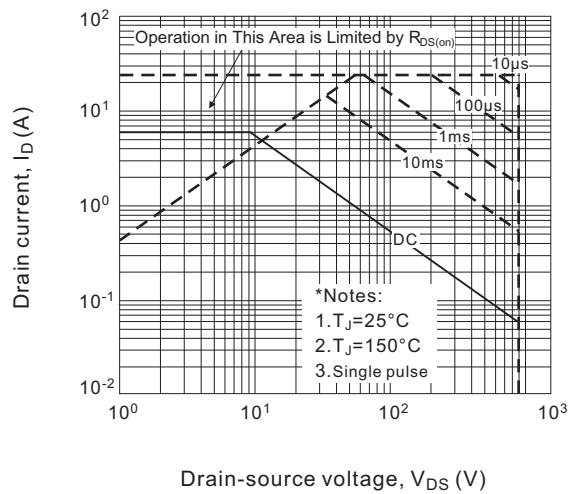


Fig.10 Maximum drain current vs. Case temperature

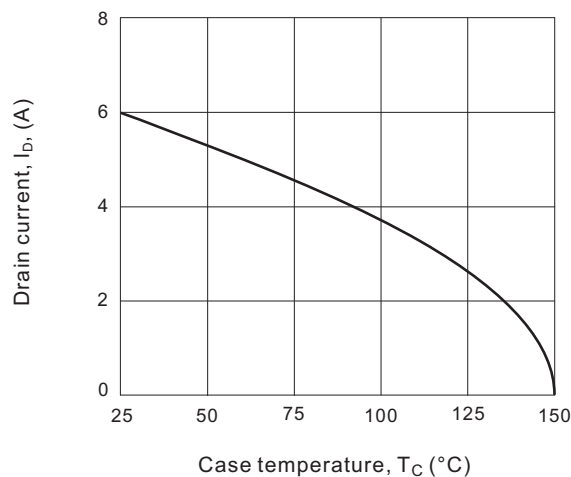


Fig.11 Transient thermal response curve for 6N90A

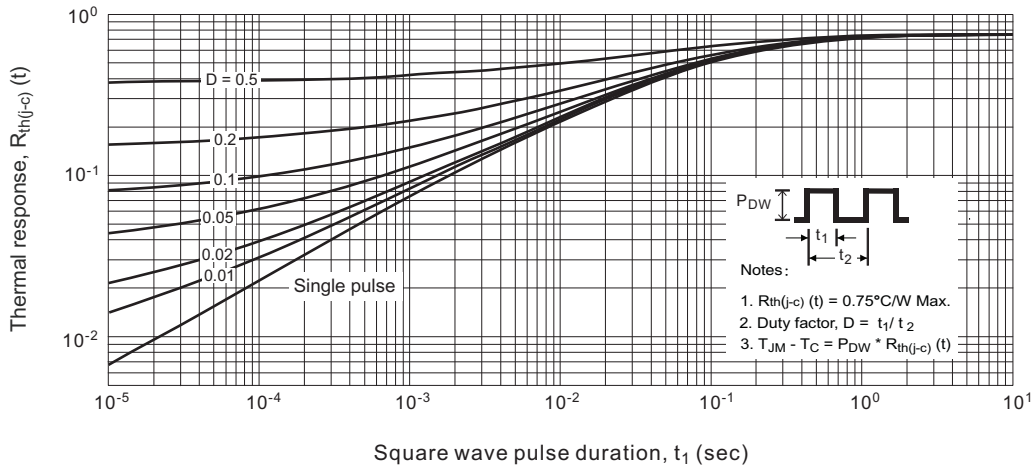
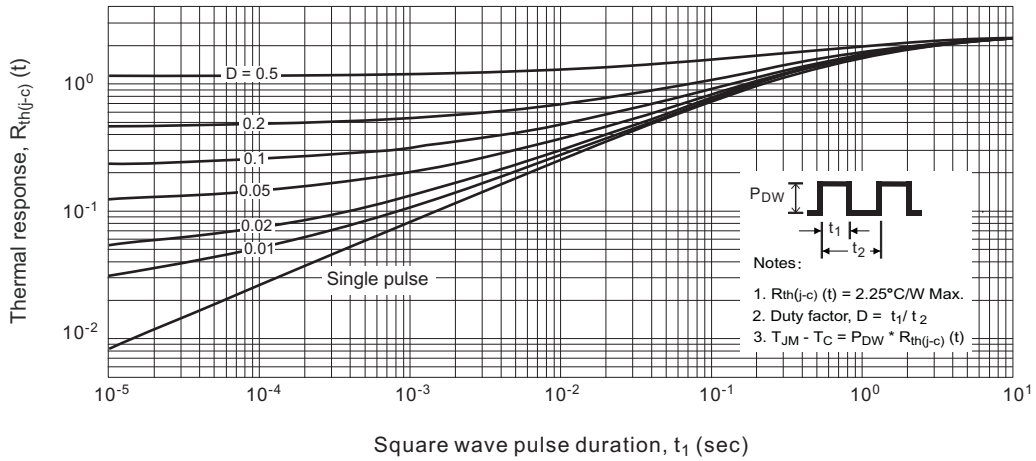
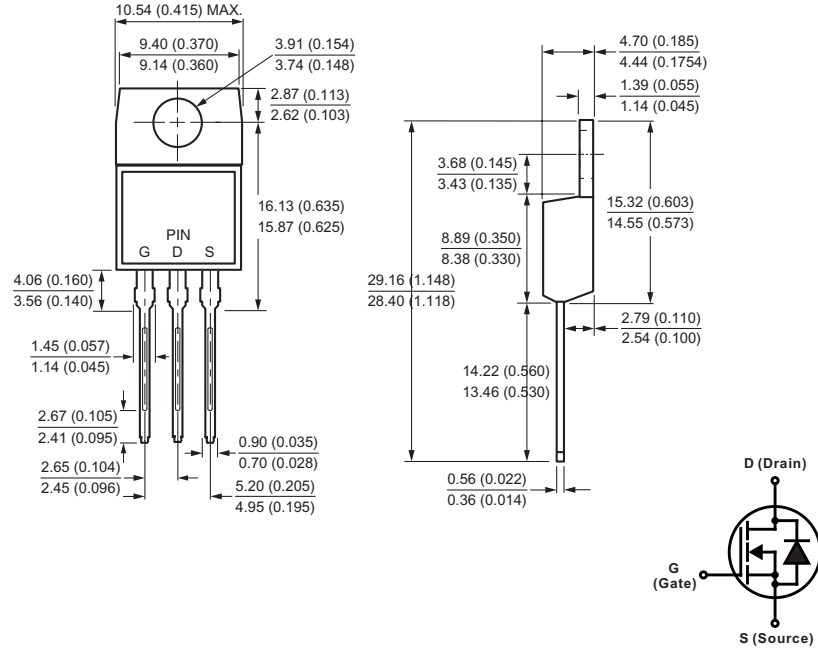


Fig.12 Transient thermal response curve for 6N90AF

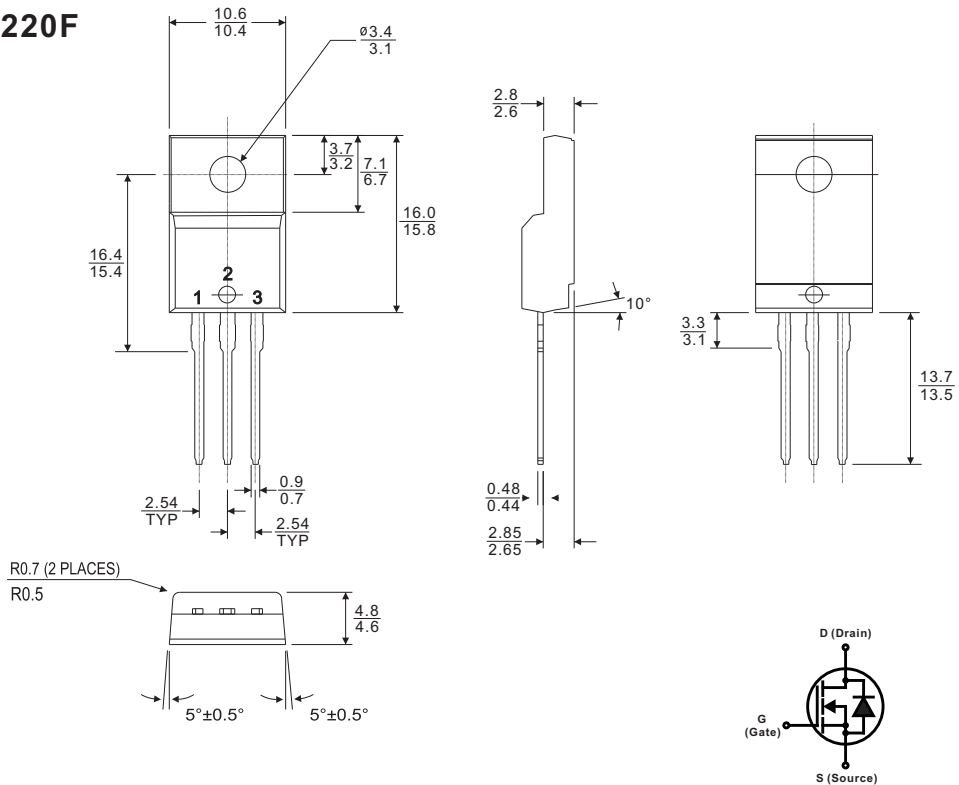


TO-220AB



All dimensions in millimeters(inches)

TO-220F



All dimensions in millimeters