

N-Channel Power MOSFET 7A, 900Volts

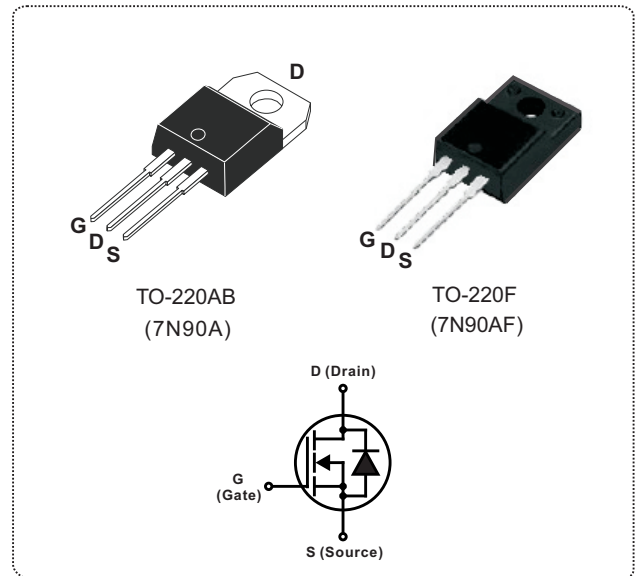
DESCRIPTION

The Nell **7N90** is a three-terminal silicon device with current conduction capability of 7A, 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

- $R_{DS(ON)} = 1.8\Omega$ @ $V_{GS} = 10V$
- Ultra low gate charge(52nC max.)
- Low reverse transfer capacitance ($C_{RSS} = 17pF$ typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature



PRODUCT SUMMARY

I_D (A)	7
V_{DSS} (V)	900
$R_{DS(ON)}$ (Ω)	1.8 @ $V_{GS} = 10V$
Q_G (nC) max.	52

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	$T_C = 25^\circ C$	7.0	A
		$T_C = 100^\circ C$	4.4	
I_{DM}	Pulsed Drain current(Note 1)		28	
I_{AR}	Avalanche current(Note 1)		7	mJ
E_{AR}	Repetitive avalanche energy(Note 1)	$I_{AR} = 7A, R_{GS} = 50\Omega, V_{GS} = 10V$	25	
E_{AS}	Single pulse avalanche energy(Note 2)	$I_{AS} = 7A, L = 30mH$	780	
dv/dt	Peak diode recovery dv/dt(Note 3)		4	V / ns
P_D	Total power dissipation	$T_C = 25^\circ C$	TO-220AB 210	W
			TO-220F 32	
	Linear derating factor above $T_C = 25^\circ C$	$T_C = 25^\circ C$	TO-220AB 1.70	$^\circ C/W$
			TO-220F 0.25	
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. $I_{AS} = 7A, L = 30mH, V_{DD} = 50V, R_{GS} = 25\Omega$, starting $T_J = 25^\circ C$.
 3. $I_{SD} \leq 7A, di/dt \leq 200A/\mu s, V_{DD} \leq V_{(BR)DSS}$, 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			0.5	°C/W
		TO-220F			3.1	
$R_{th(j-a)}$	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
ΔV _{(BR)DSS} /ΔT _J	Breakdown voltage temperature coefficient	I _D = 250μA, V _{DS} = V _{GS}			0.96		V/°C
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 =3.5A			1.5	1.8	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 =3.5A			5.7		S
◎ DYNAMIC CHARACTERISTICS							
C _{ISS}	Input capacitance	V _{DS} =25V, V _{GS} =0V, f=1MHz			1440	1880	pF
C _{OSS}	Output capacitance				140	185	
C _{RSS}	Reverse transfer capacitance				17	23	
◎ SWITCHING CHARACTERISTICS							
t _{d(ON)}	Turn-on delay time	V _{DD} =450V, V _{GS} =10V I _D =7A, R _{GS} =25Ω (Note1,2)			35	80	ns
t _r	Rise time				80	170	
t _{d(OFF)}	Turn-off delay time				95	200	
t _f	Fall time				55	120	
Q _G	Total gate charge	V _{DD} = 720V, V _{GS} =10V I _D =7A, (Note1,2)			40	52	nC
Q _{GS}	Gate to source charge				8.5		
Q _{GD}	Gate to drain charge (Miller charge)				20		

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	$I_{SD} = 7\text{A}$, $V_{GS} = 0\text{V}$			1.4	V
I_S (ISD)	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET			7	A
I_{SM}	Pulsed source current				28	
t_{rr}	Reverse recovery time	$I_{SD} = 7\text{A}$, $V_{GS} = 0\text{V}$, $dI_F/dt = 100\text{A}/\mu\text{s}$		400		ns
Q_{rr}	Reverse recovery charge			4.3		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

	7	N	90	A
Current rating, I_D				
7 = 7A				
MOSFET series				
N = N-Channel				
Voltage rating, V_{DS}				
90 = 900V				
Package type				
A = TO-220AB				
AF = TO-220F				

■ TEST CIRCUITS

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

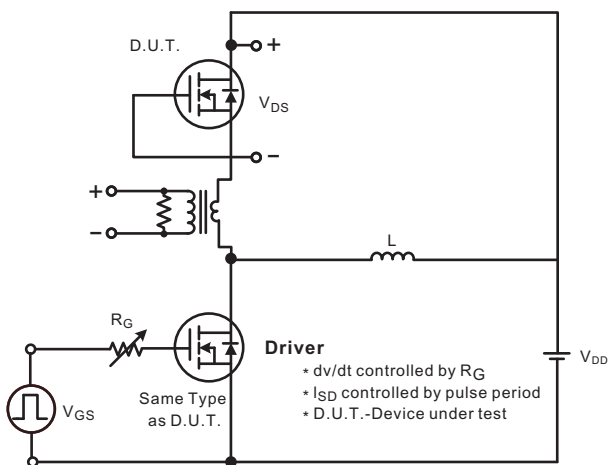
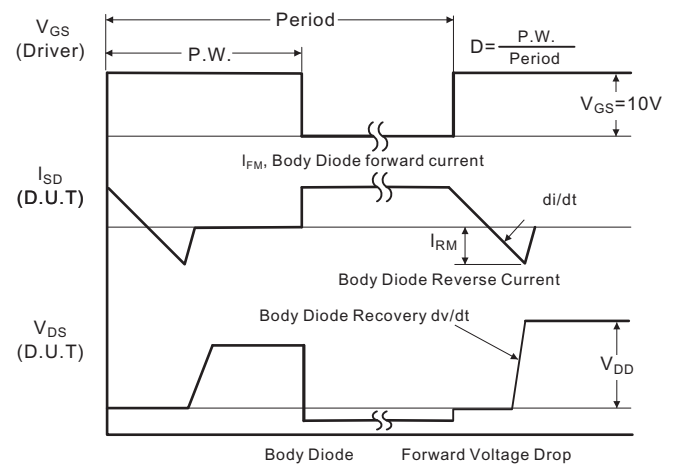
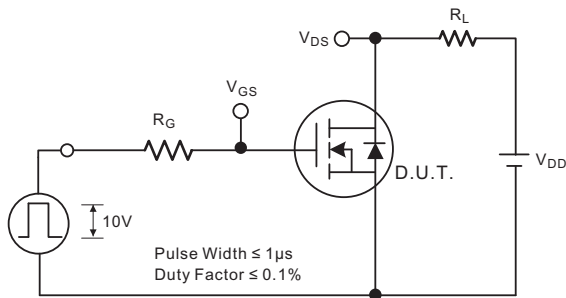
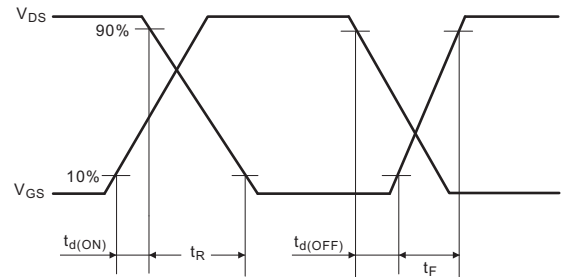
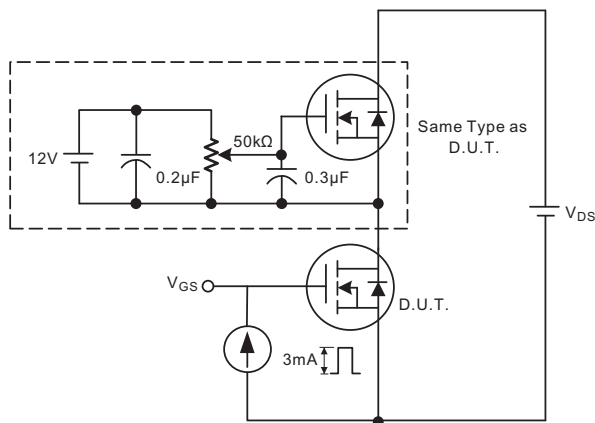
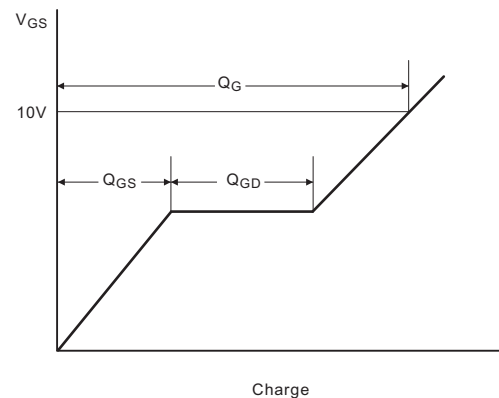
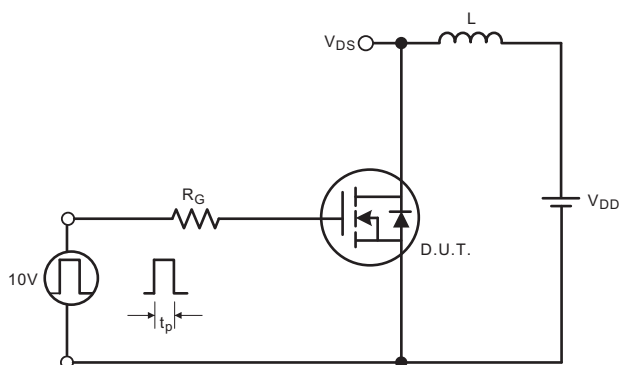
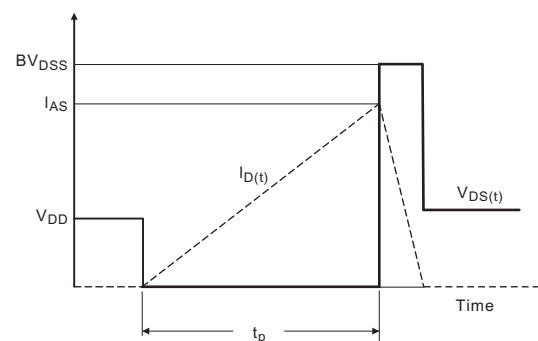


Fig.1B Peak diode recovery dv/dt waveforms



■ 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

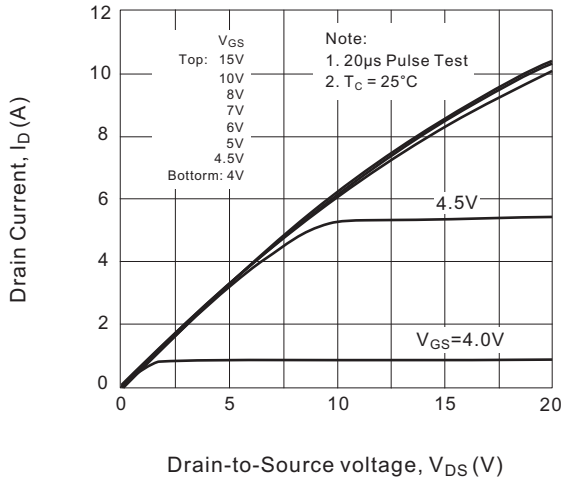


Fig.2 Typical transfer characteristics

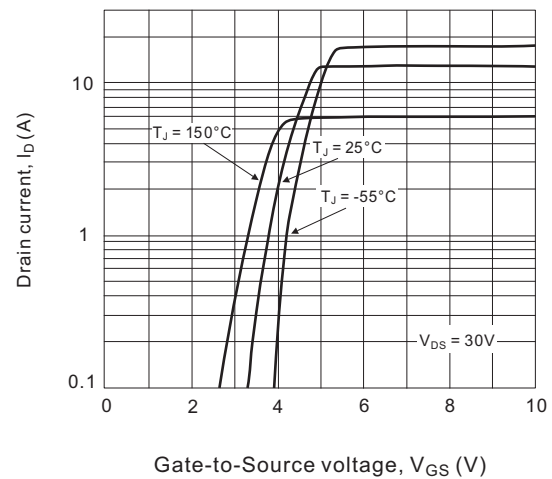


Fig.3 On-resistance vs. drain current

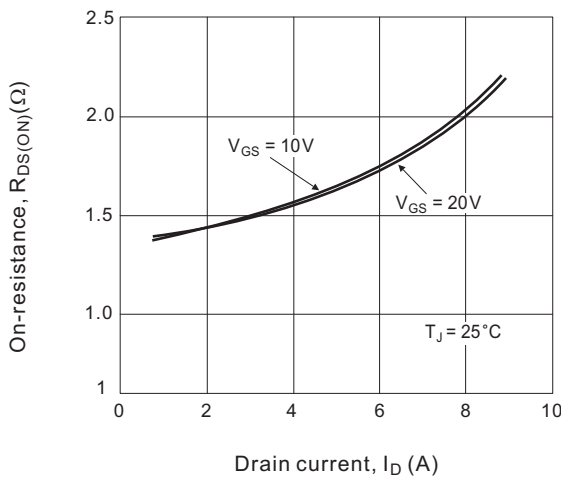


Fig.4 Typical gate charge vs. gate-source voltage

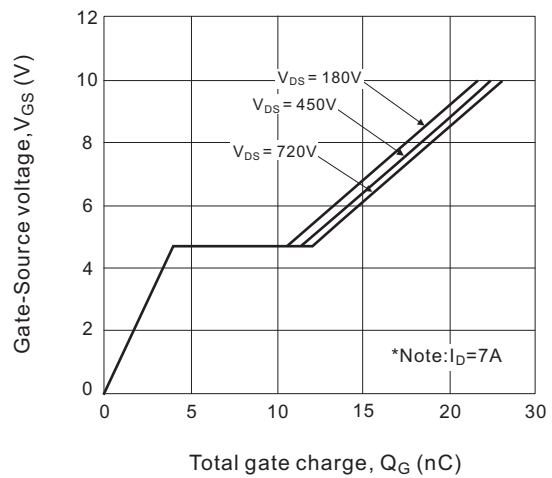


Fig.5 On-resistance variation vs. Junction temperature

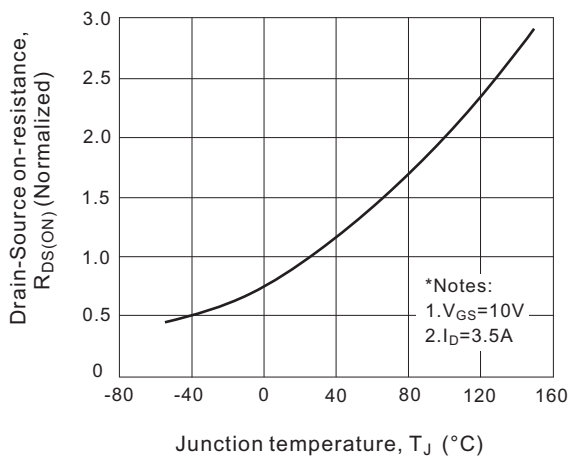
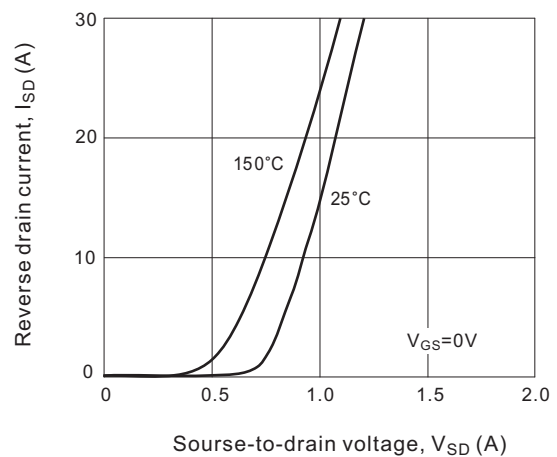


Fig.6 Source-drain diode forward voltage



■ TYPICAL CHARACTERISTICS

Fig.7 Maximum drain current vs. Case temperature

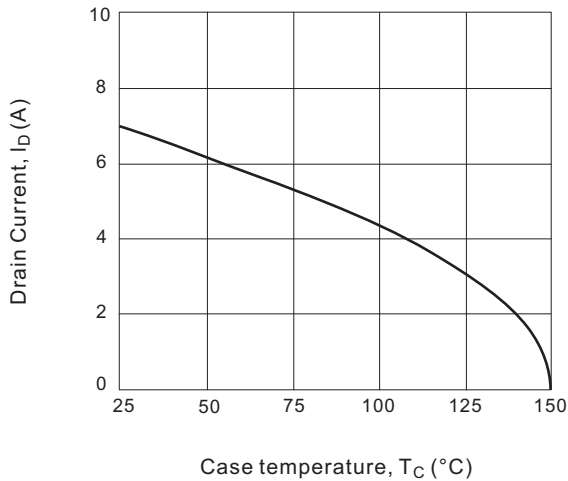


Fig.8 Junction temperature vs. $B_{VR(DSS)}$

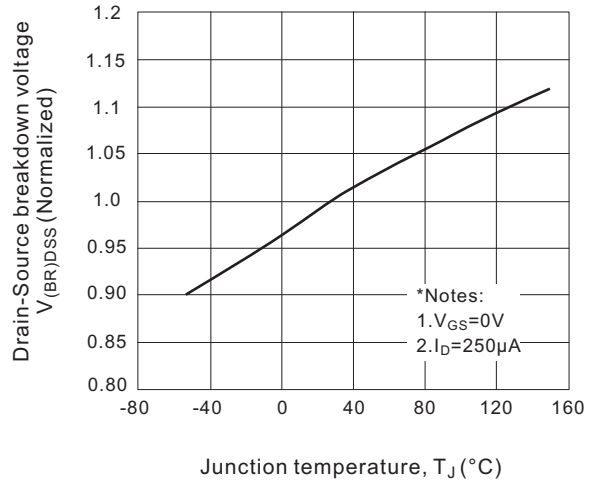


Fig.9 Typical Capacitance vs. drain-source voltage

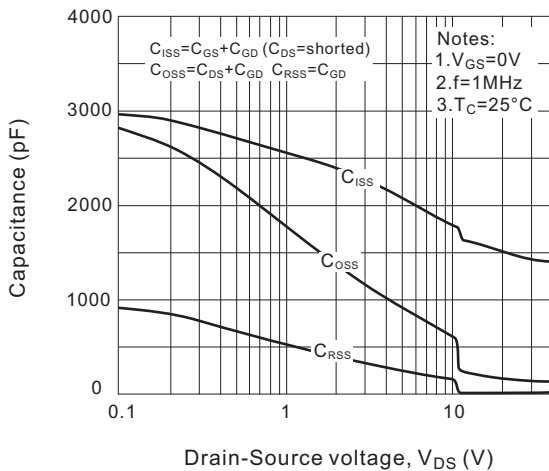


Fig.10-1 Maximum safe operating area for 7N90A

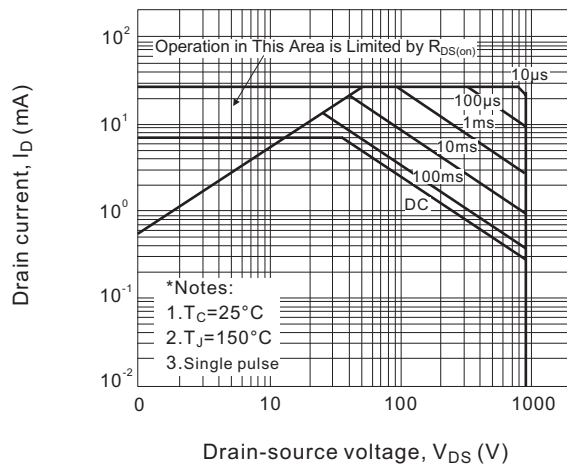
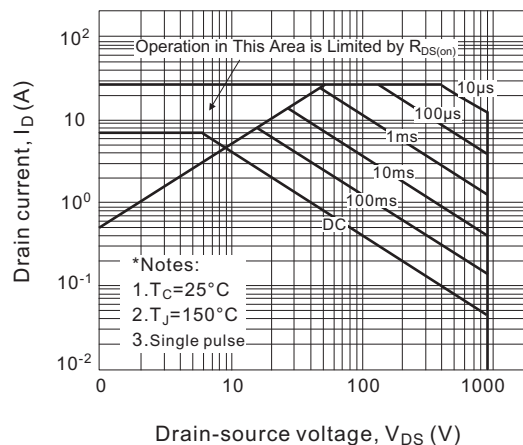


Fig.10-2 Maximum safe operating area for 7N90AF



■ TYPICAL CHARACTERISTICS

Fig.11 Normalized thermal transient impedance, junction-to-ambient for 7N90A

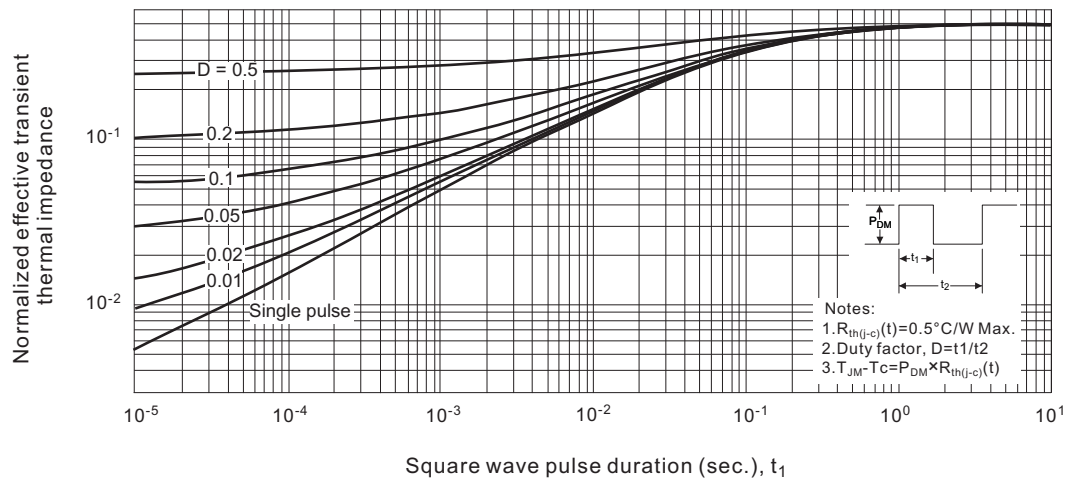
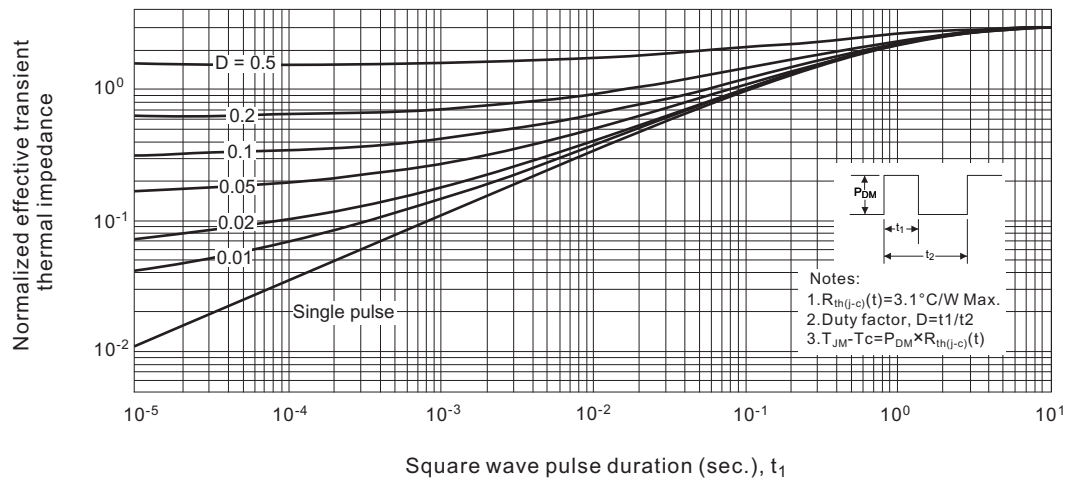
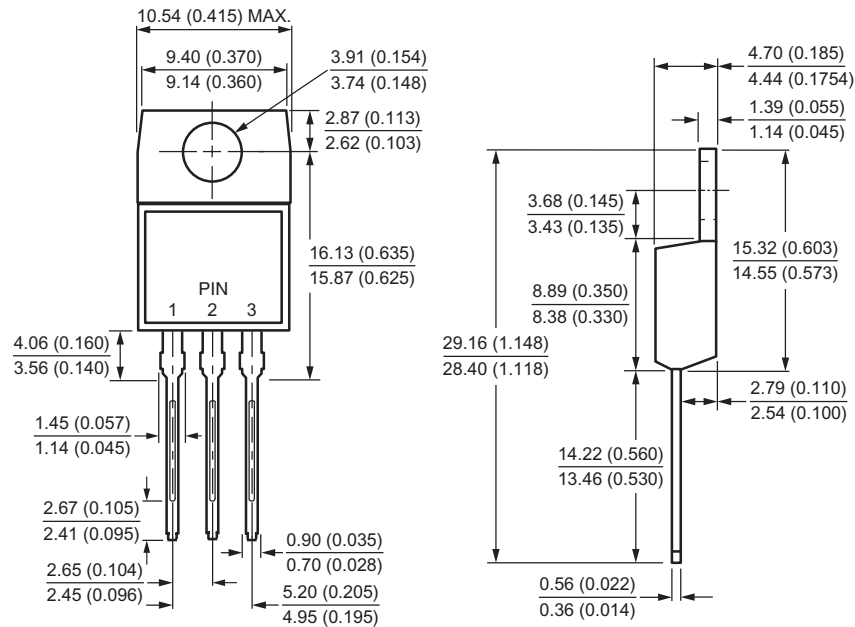
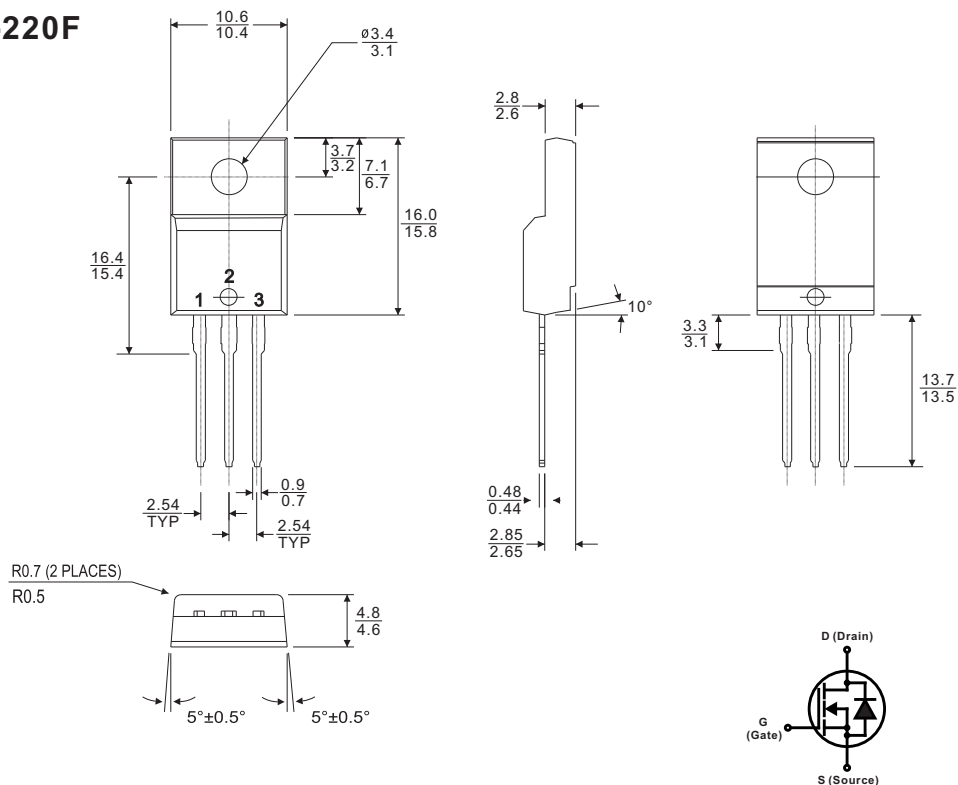


Fig.11-2 Normalized thermal transient impedance, junction-to-ambient for 7N90AF



TO-220AB

TO-220F


All dimensions in millimeters