

N-Channel Power MOSFET 7A, 900Volts

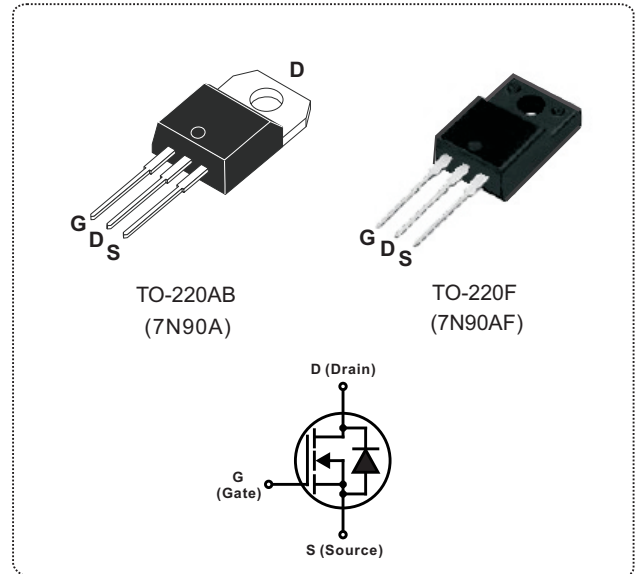
DESCRIPTION

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 | | |
| E_{AR} | Repetitive avalanche energy(Note 1) | $I_{AR} = 7A, R_{GS} = 50\Omega, V_{GS} = 10V$ | 25 | mJ | |
| 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) | |

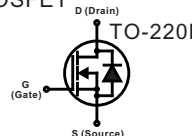
Note: 1. Repetitive rating: pulse width limited by junction temperature.
 2. $I_{AS} = 7A, L = 30mH, V_{DD} = 50V, R_{GS} = 25\Omega$, starting $T_J = 25^\circ C$.
 3. $I_{SD} \leq 7A, di/dt \leq 200A/\mu s, V_{DD} \leq V_{(BR)DSS}$, starting $T_J = 25^\circ C$.

| 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)

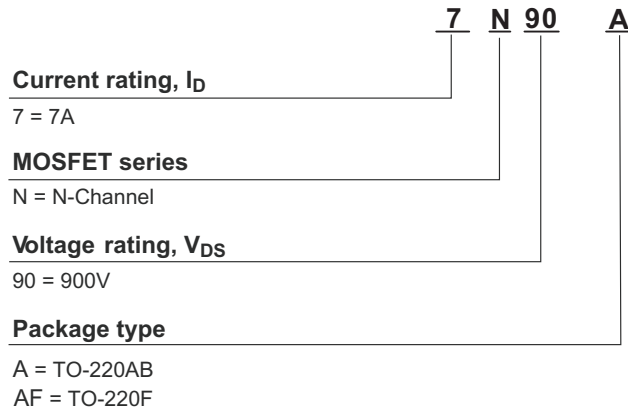
| SYMBOL | PARAMETER | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------------------|--|--|------|------|------|------|-----|
| ◎ OFF CHARACTERISTICS | | | | | | | |
| V _{(BR)DSS} | Drain to source breakdown voltage | I _D = 250μA, V _{GS} = 0V | 900 | | | V | |
| ΔV _{(BR)DSS/ΔT_J} | 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 (Note 1,2) | | 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, (Note 1,2) | | 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°C unless otherwise specified)

| SYMBOL | PARAMETER | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------|------------------------------------|--|------|------|------|------|
| V _{SD} | Diode forward voltage | I _{SD} = 7A, V _{GS} = 0V | | | 1.4 | V |
| I _S (I _{SD}) | 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} = 7A, V _{GS} = 0V, | | 400 | | ns |
| Q _{rr} | Reverse recovery charge | dI _F /dt = 100A/μs | | 4.3 | | μC |

Note: 1. Pulse test: Pulse width ≤ 300μs, duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

ORDERING INFORMATION SCHEME



■ TEST CIRCUITS

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

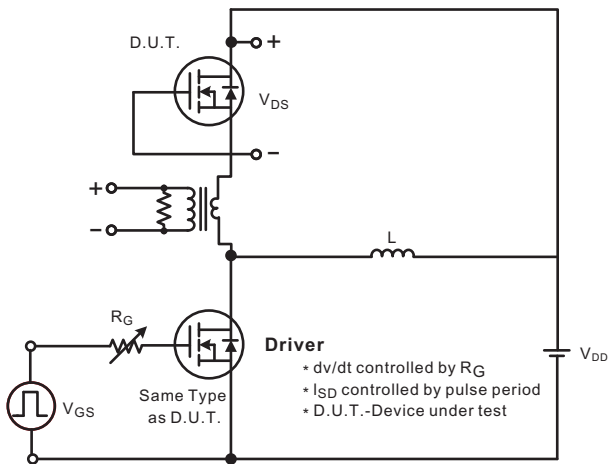
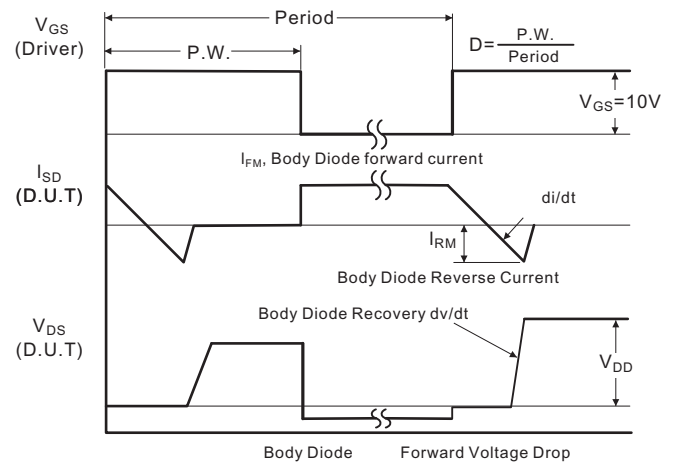


Fig.1B Peak diode recovery dv/dt waveforms



TEST CIRCUIT(Cont.)

Fig.2A Switching test circuit

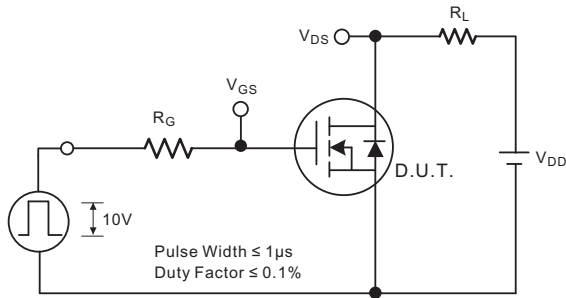


Fig.2B Switching Waveforms

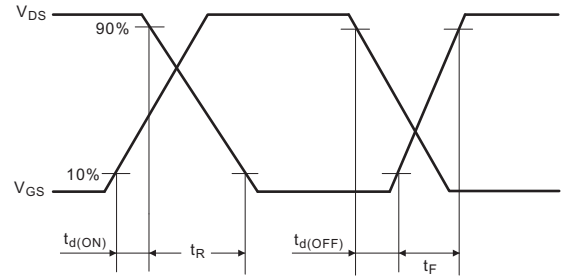


Fig.3A Gate charge test circuit

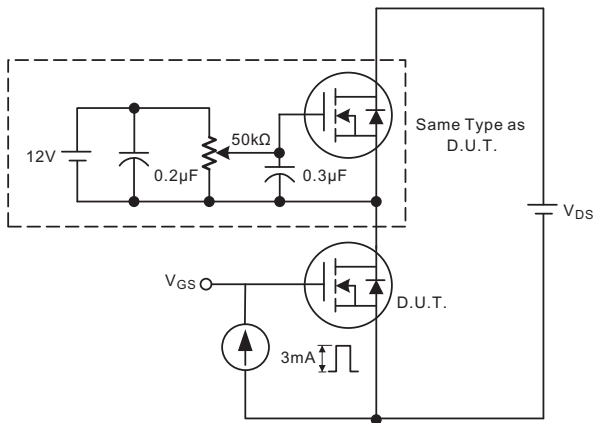


Fig.3B Gate charge waveform

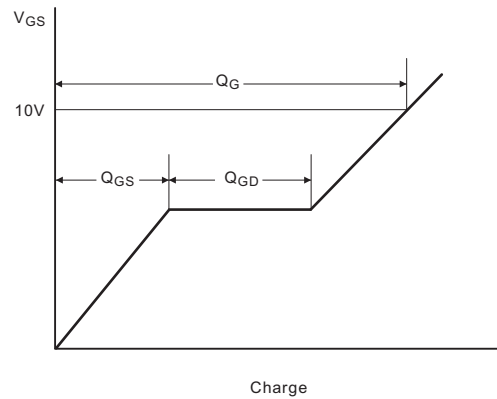


Fig.4A Unclamped Inductive switching test circuit

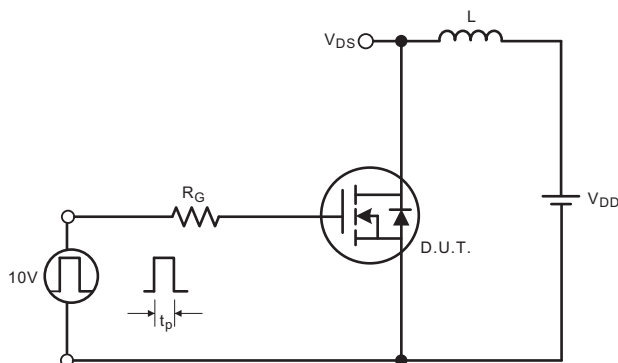
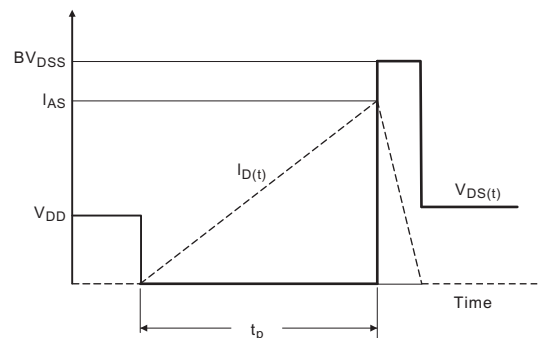


Fig.4B Unclamped Inductive switching waveforms



■ TYPICAL CHARACTERISTICS

Fig.1 Typical output characteristics

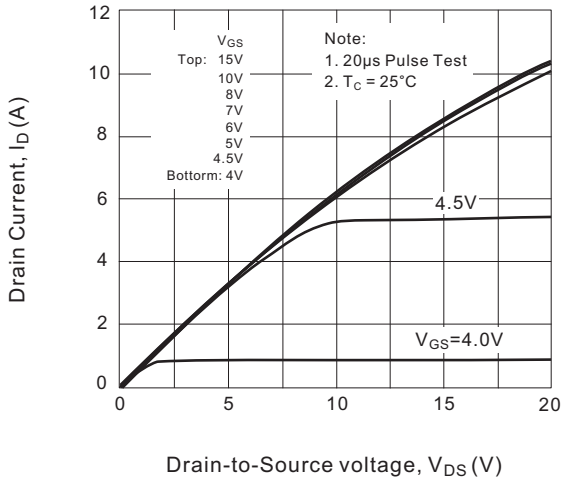


Fig.2 Typical transfer characteristics

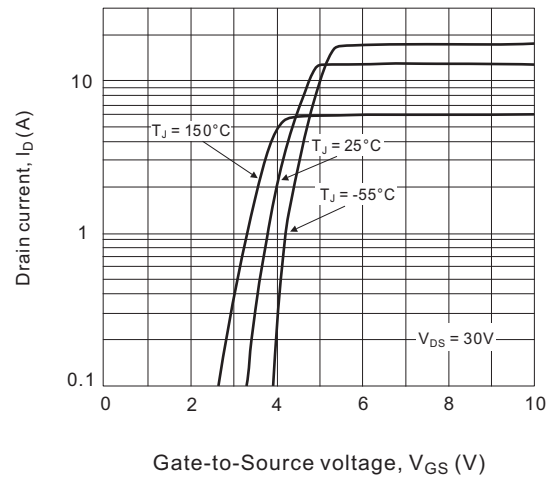


Fig.3 On-resistance vs. drain current

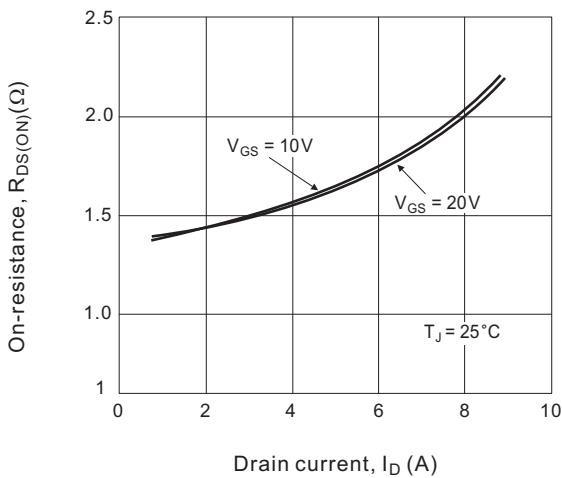


Fig.4 Typical gate charge vs. gate-source voltage

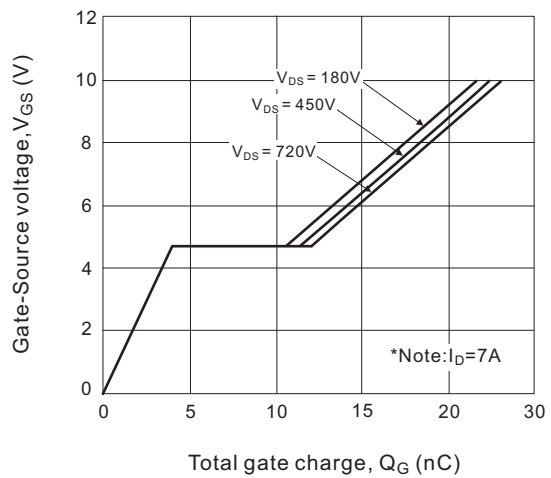


Fig.5 On-resistance variation vs. Junction temperature

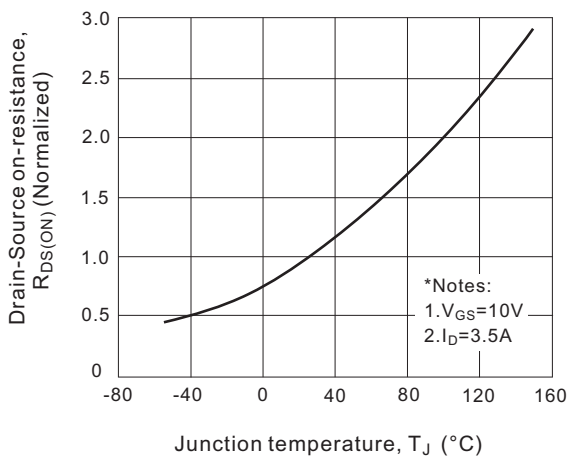
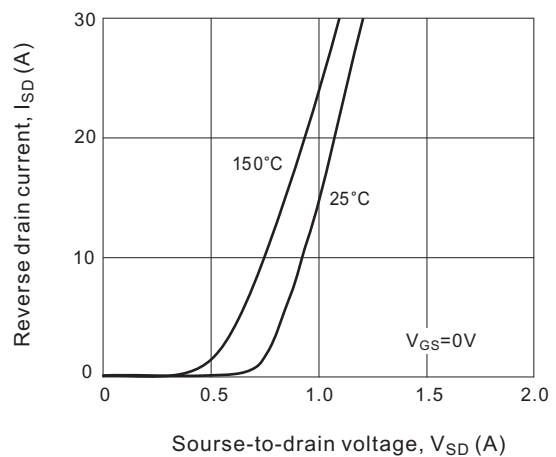


Fig.6 Source-drain diode forward voltage



■ TYPICAL CHARACTERISTICS

Fig.7 Maximum drain current vs. Case temperature

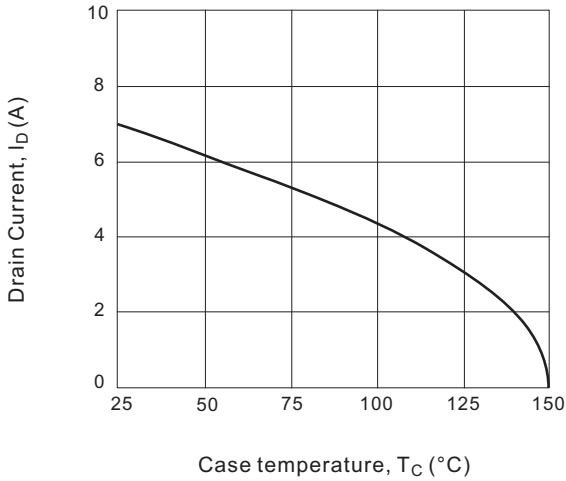


Fig.8 Junction temperature vs. $B_{VR(DSS)}$

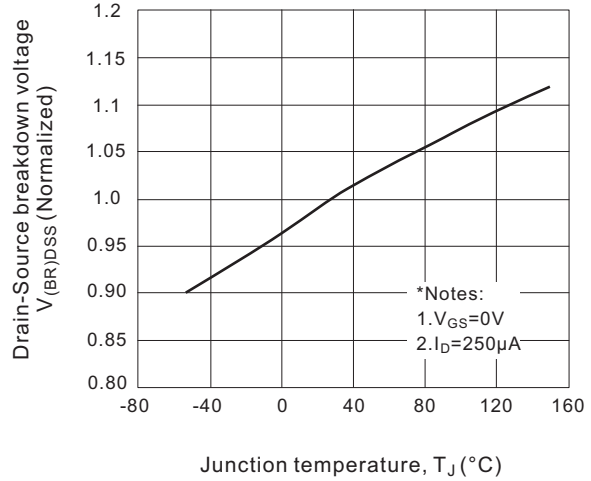


Fig.9 Typical Capacitance vs. drain-source voltage

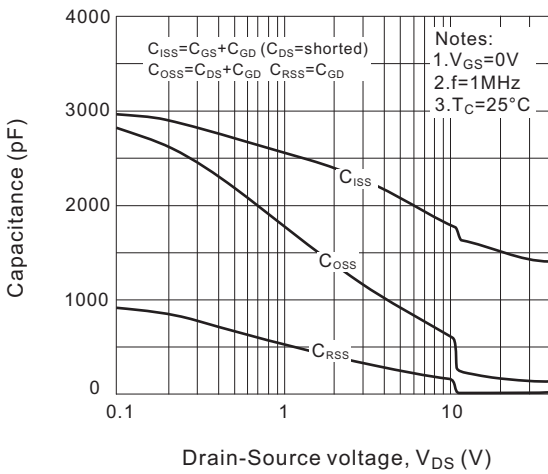


Fig.10-1 Maximum safe operating area for 7N90A

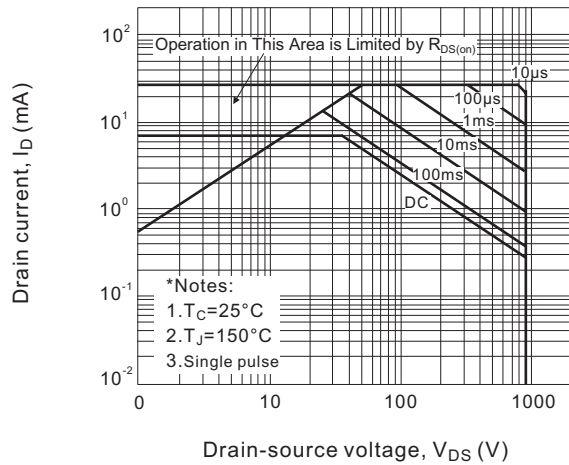
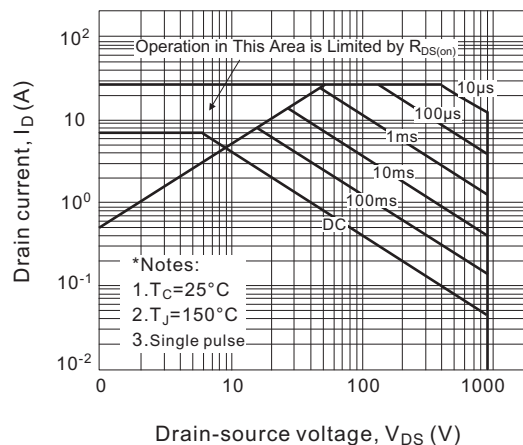


Fig.10-2 Maximum safe operating area for 7N90AF



■ **TYPICAL CHARACTERISTICS**

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

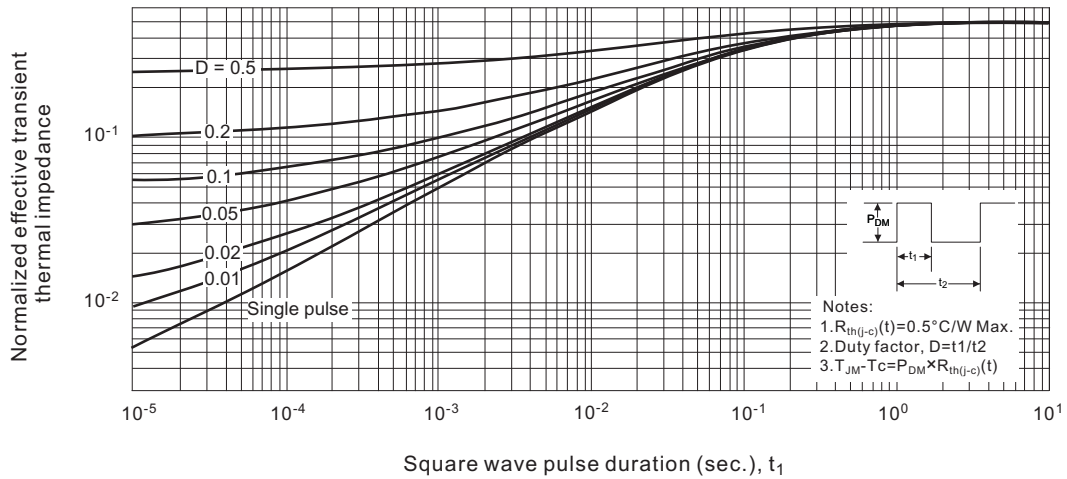
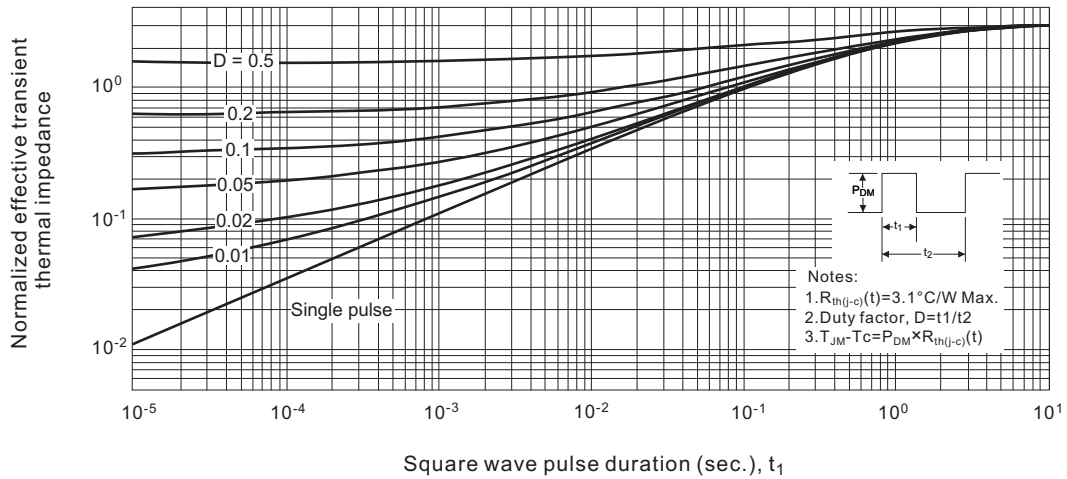
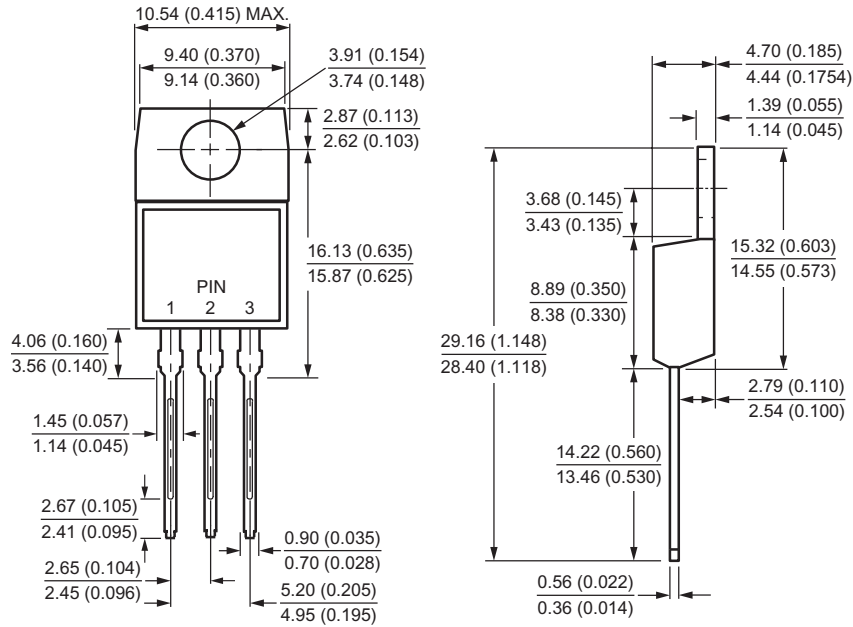


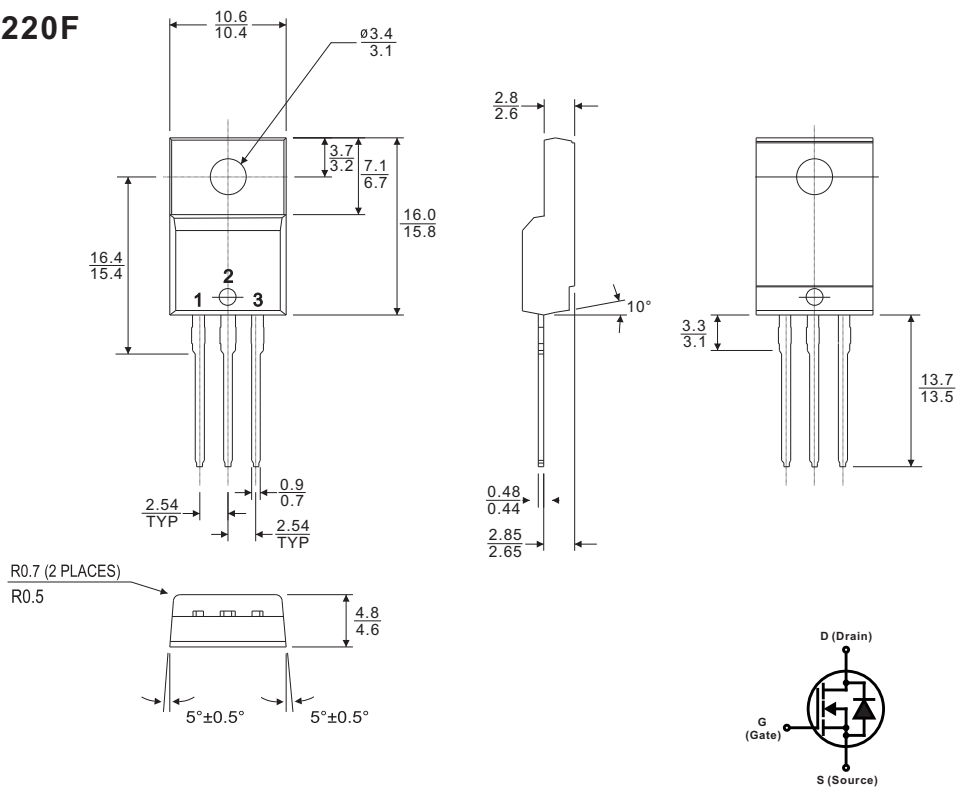
Fig.11-2 Normalized thermal transient impedance, junction-to-ambient for 7N90AF



TO-220AB



TO-220F



All dimensions in millimeters