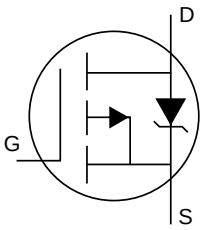
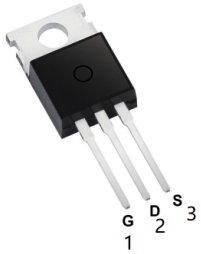
## Description

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.




## Features

- $V_{DS}$ (V) =-55V
- $I_D$ = -12A ($V_{GS}$ = -10V)
- $R_{DS(ON)}$ < 170mΩ ($V_{GS}$ = -10V)



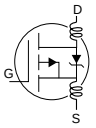

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ -10V | -12 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ -10V | -8.5 | |
| $I_{DM}$ | Pulsed Drain Current ① | -48 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 45 | W |
| | Linear Derating Factor | 0.30 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy② | 96 | mJ |
| $I_{AR}$ | Avalanche Current① | -7.2 | A |
| $E_{AR}$ | Repetitive Avalanche Energy① | 4.5 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | -5.0 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 175 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case ) | |
| | Mounting torque, 6-32 or M3 screw | 10 lbf•in (1.1N•m) | |

## Thermal Resistance

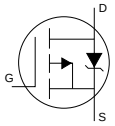
| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | | 3.3 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | | |
| $R_{\theta JA}$ | Junction-to-Ambient | | 62 | |

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | -55 | | | V | $V_{GS}$ = 0V, $I_D$ = -250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | | -0.05 | | V/°C | Reference to 25°C, $I_D$ = -1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | | | 175 | mΩ | $V_{GS}$ = -10V, $I_D$ = -7.2A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | -2.0 | | -4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA |
| $g_{fs}$ | Forward Transconductance | 2.5 | | | S | $V_{DS}$ = -25V, $I_D$ = -7.2A |
| $I_{DSS}$ | Drain-to-Source Leakage Current | | | -25 | μA | $V_{DS}$ = -55V, $V_{GS}$ = 0V |
| | | | | -250 | | $V_{DS}$ = -44V, $V_{GS}$ = 0V, $T_J$ = 150°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | | | 100 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | | | -100 | | $V_{GS}$ = -20V |
| $Q_g$ | Total Gate Charge | | | 19 | nC | $I_D$ = -7.2A |
| $Q_{gs}$ | Gate-to-Source Charge | | | 5.1 | | $V_{DS}$ = -44V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | | | 10 | | $V_{GS}$ = -10V, See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | | 13 | | ns | $V_{DD}$ = -28V |
| $t_r$ | Rise Time | | 55 | | | $I_D$ = -7.2A |
| $t_{d(off)}$ | Turn-Off Delay Time | | 23 | | | $R_G$ = 24Ω |
| $t_f$ | Fall Time | | 37 | | | $R_D$ = 3.7Ω, See Fig. 10 ④ |
| $L_D$ | Internal Drain Inductance | | 4.5 | | nH | Between lead, 6mm (0.25in.) from package and center of die contact |
| $L_S$ | Internal Source Inductance | | 7.5 | | | |
| $C_{iss}$ | Input Capacitance | | 350 | | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | | 170 | | | $V_{DS}$ = -25V |
| $C_{rss}$ | Reverse Transfer Capacitance | | 92 | | | $f$ = 1.0MHz, See Fig. 5 |




## Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | | | -12 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | | | -48 | | |
| $V_{SD}$ | Diode Forward Voltage | | | -1.6 | V | $T_J$ = 25°C, $I_S$ = -7.2A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | | 47 | 71 | ns | $T_J$ = 25°C, $I_F$ = -7.2A |
| $Q_{rr}$ | Reverse RecoveryCharge | | 84 | 130 | μC | di/dt = -100A/μs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$+$L_D$) | | | | |




**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )

② Starting $T_J$ = 25°C, L = 3.7mH $R_G$ = 25Ω, $I_{AS}$ = -7.2A. (See Figure 12)

③ $I_{SD}$ ≤ -7.2A, di/dt ≤ -280A/μs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_J$ ≤ 175°C

④ Pulse width ≤ 300μs; duty cycle ≤ 2%.

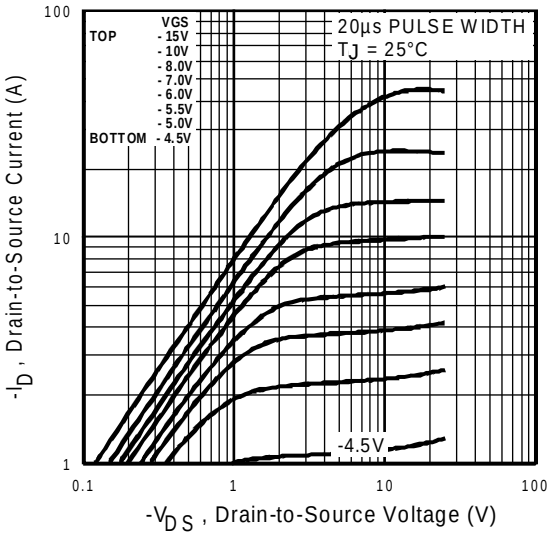



**Fig 1.** Typical Output Characteristics,

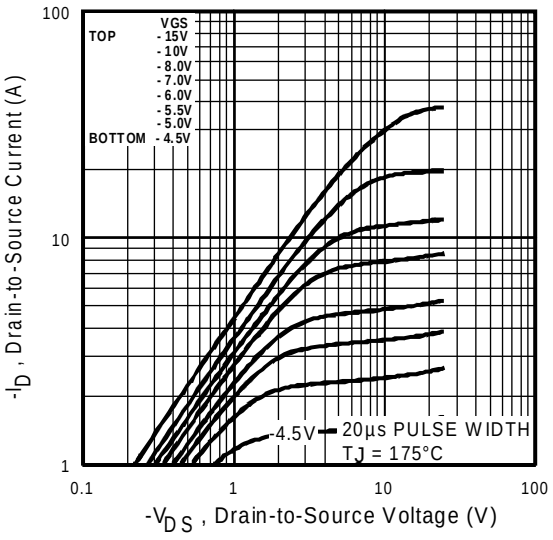



**Fig 2.** Typical Output Characteristics,

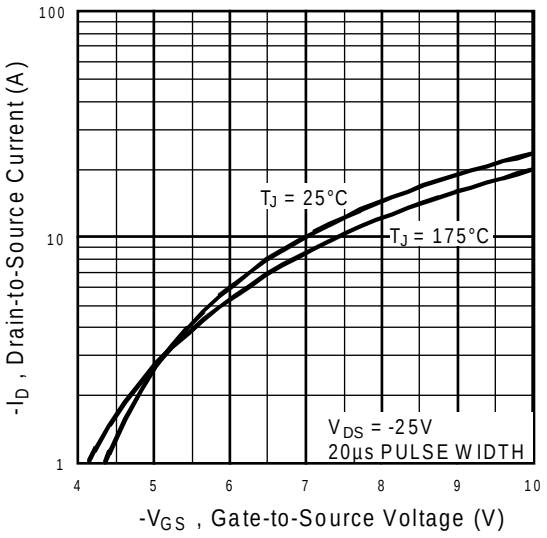



**Fig 3.** Typical Transfer Characteristics

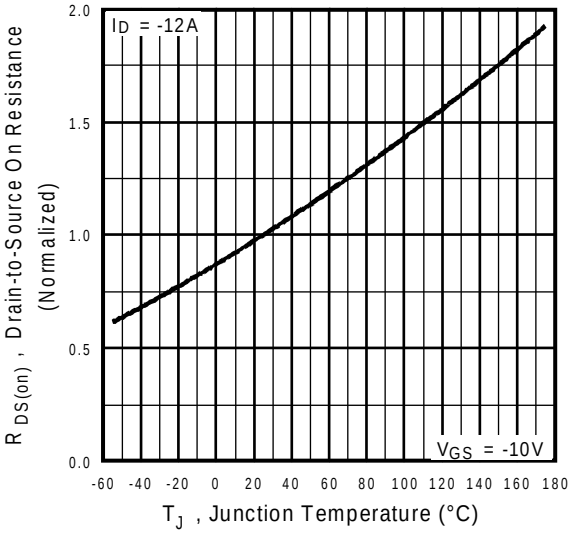



**Fig 4.** Normalized On-Resistance
Vs. Temperature

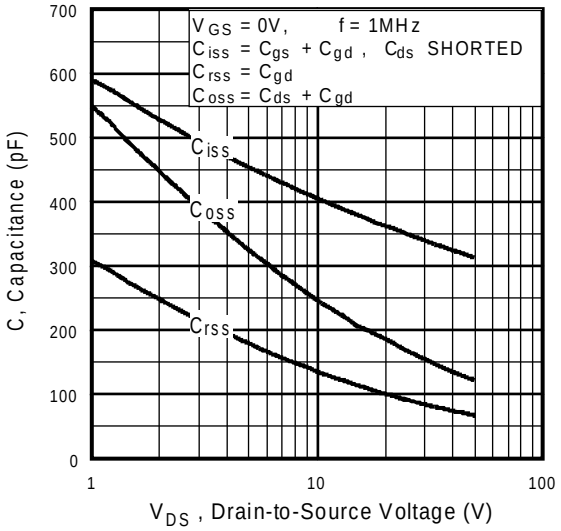



**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

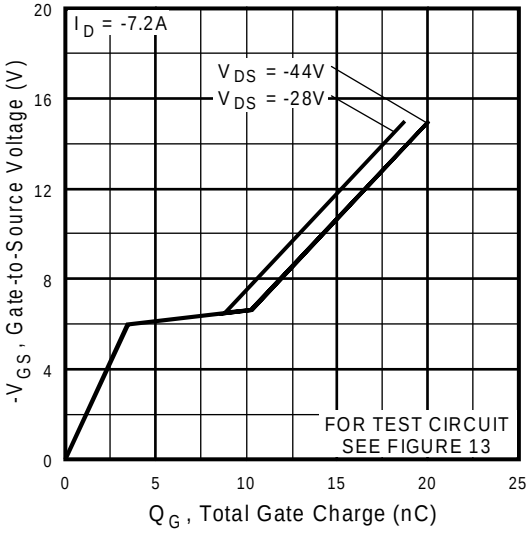



**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage

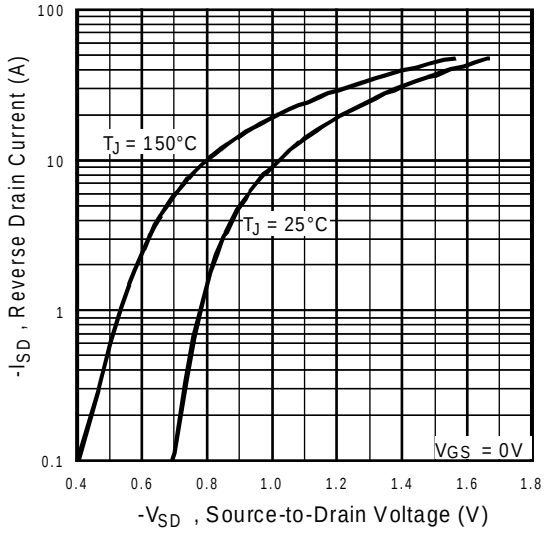



**Fig 7.** Typical Source-Drain Diode Forward Voltage

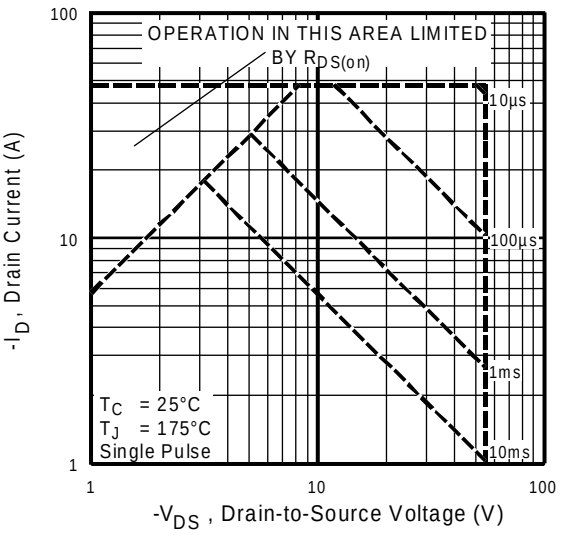



**Fig 8.** Maximum Safe Operating Area

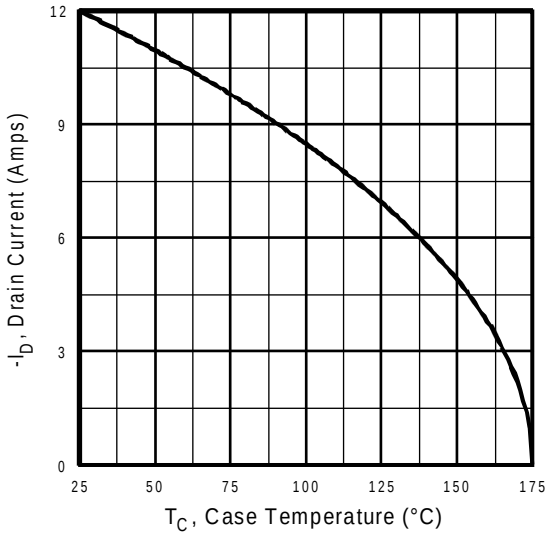



**Fig 9.** Maximum Drain Current Vs. Case Temperature

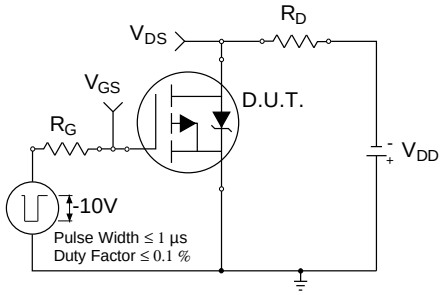



**Fig 10a.** Switching Time Test Circuit

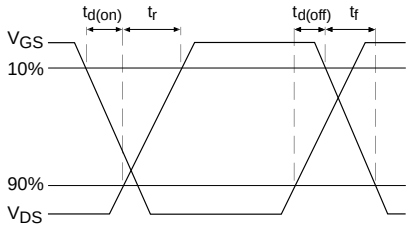



**Fig 10b.** Switching Time Waveforms

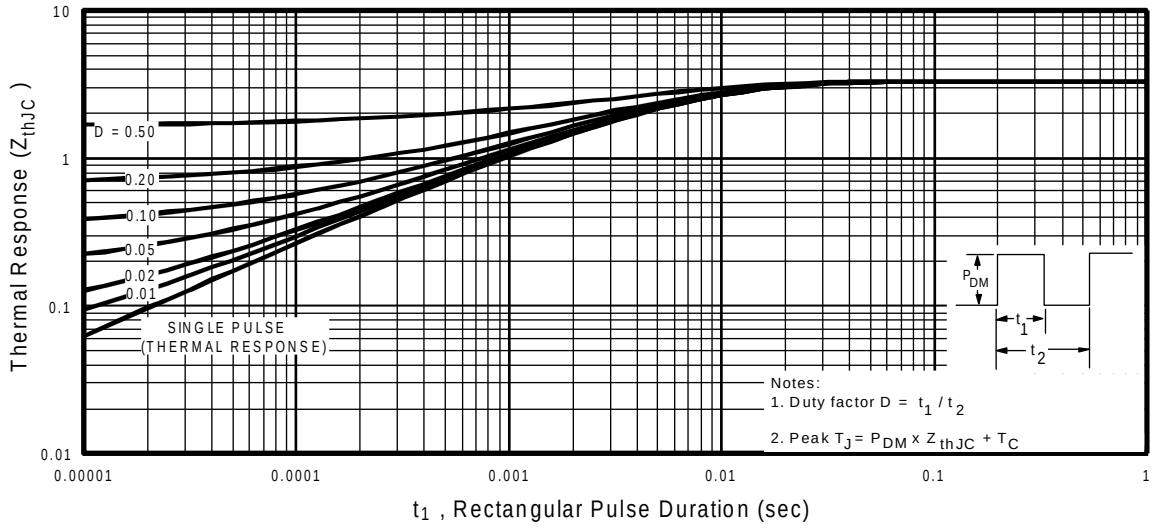



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

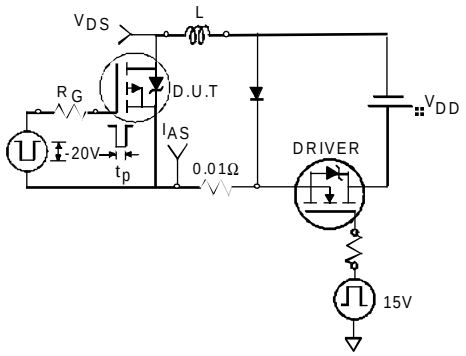



**Fig 12a.** Unclamped Inductive Test Circuit

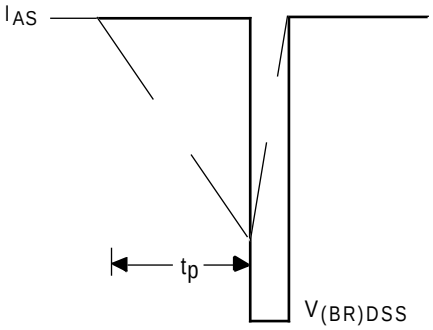



**Fig 12b.** Unclamped Inductive Waveforms

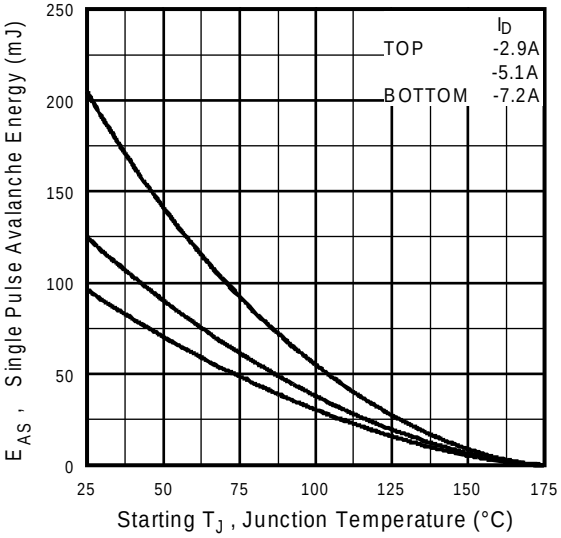



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

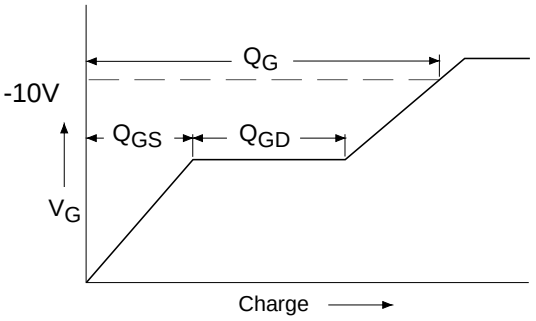



**Fig 13a.** Basic Gate Charge Waveform

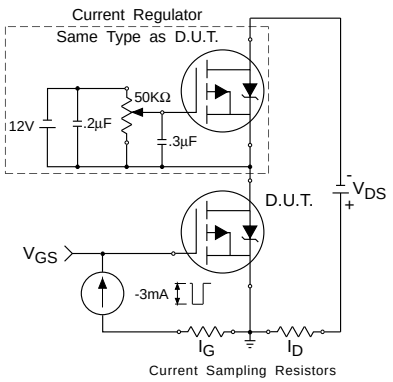
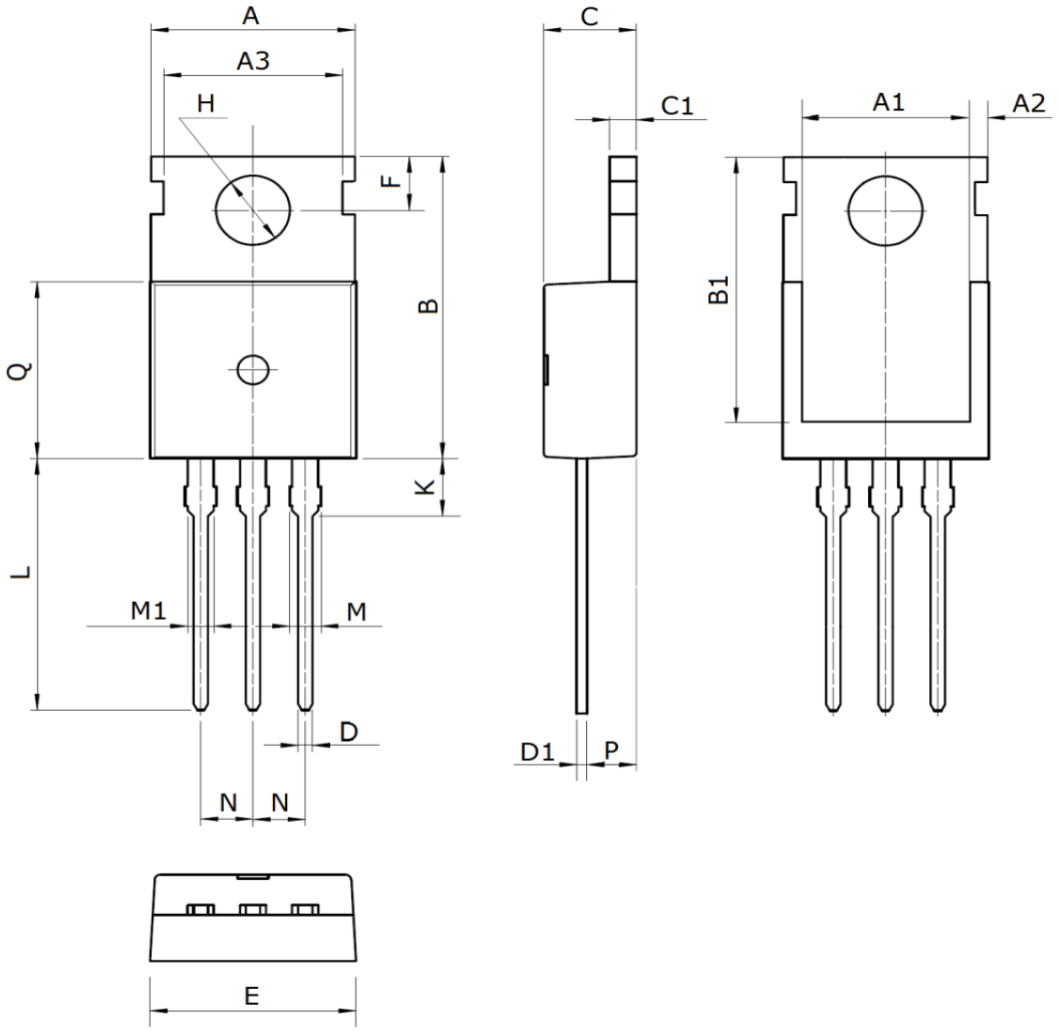


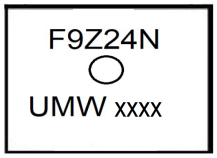

**Fig 13b.** Gate Charge Test Circuit

## Package Mechanical Data TO-220




| Symbol | Dimensions （mm） | Symbol | Dimensions (mm) | Symbol | Dimensions (mm) |
|---|---|---|---|---|---|
| A | 10.0±0.3 | C1 | 1.3±0.2 | L | 13.2±0.4 |
| A1 | 8.0±0.2 | D | 0.8±0.2 | M | 1.38±0.1 |
| A2 | 0.94±0.1 | D1 | 0.5±0.1 | M1 | 1.28±0.1 |
| A3 | 8.7±0.1 | E | 10.0±0.3 | N | 2.54(typ) |
| B | 15.6±0.4 | F | **2.8±0.1** | P | 2.4±0.3 |
| B1 | **13.2±0.2** | H | 3.6±0.1 | Q | **9.15±0.25** |
| C | **4.5±0.2** | K | 3.1±0.2 | | |

## Marking




## Ordering information

| Order code | Package | Baseqty | Deliverymode |
|---|---|---|---|
| UMW IRF9Z24N | TO-220 | 1000 | Tube and box |

单击下面可查看定价，库存，交付和生命周期等信息

>>UMW(友台半导体)