July 2005

SemiHow
Know-How for Semiconductor

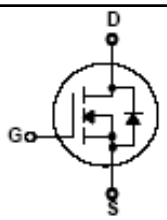
# HFS7N80
## 800V N-Channel MOSFET

$BV_{DSS}$ = 800 V
$R_{DS(on)\ typ}$ = 1.55 Ω
$I_D$ = 7.0 A

**TO-220F**




**1.Gate 2. Drain 3. Source**




## FEATURES

- ❑ Originative New Design
- ❑ Superior Avalanche Rugged Technology
- ❑ Robust Gate Oxide Technology
- ❑ Very Low Intrinsic Capacitances
- ❑ Excellent Switching Characteristics
- ❑ Unrivalled Gate Charge : 35 nC (Typ.)
- ❑ Extended Safe Operating Area
- ❑ Lower $R_{DS(ON)}$ : 1.55 Ω (Typ.) @$V_{GS}$=10V
- ❑ 100% Avalanche Tested

## Absolute Maximum Ratings

$T_C$=25℃ unless otherwise specified

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 800 | V |
| $I_D$ | Drain Current – Continuous ($T_C$ = 25℃) | 7.0* | A |
| | Drain Current – Continuous ($T_C$ = 100℃) | 4.4* | A |
| $I_{DM}$ | Drain Current – Pulsed (Note 1) | 28* | A |
| $V_{GS}$ | Gate-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | 580 | mJ |
| $I_{AR}$ | Avalanche Current (Note 1) | 7.0 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | 16.7 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 5.5 | V/ns |
| $P_D$ | Power Dissipation ($T_C$ = 25℃) | 56 | W |
| | – Derate above 25℃ | 0.44 | W/℃ |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | -55 to +150 | ℃ |
| $T_L$ | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | 300 | ℃ |

* Drain current limited by maximum junction temperature

## Thermal Resistance Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | -- | 2.25 | ℃/W |
| $R_{\theta JA}$ | Junction-to-Ambient | -- | 62.5 | |

## Electrical Characteristics $T_C$=25 °C unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **On Characteristics** | | | | | | |
| $V_{GS}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA | 2.5 | -- | 4.5 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V, $I_D$ = 3.5 A | -- | 1.55 | 1.9 | Ω |
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 μA | 800 | -- | -- | V |
| $\Delta BV_{DSS}$ /$\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to25℃ | -- | 0.93 | -- | V/℃ |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 800 V, $V_{GS}$ = 0 V | -- | -- | 1 | μA |
| | | $V_{DS}$ = 640 V, $T_C$ = 125℃ | -- | -- | 10 | μA |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS}$ = 30 V, $V_{DS}$ = 0 V | -- | -- | 100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS}$ = -30 V, $V_{DS}$ = 0 V | -- | -- | -100 | nA |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 MHz | -- | 1500 | 1950 | pF |
| $C_{oss}$ | Output Capacitance | | -- | 120 | 155 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 18 | 24 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Time | $V_{DS}$ = 400 V, $I_D$ = 7.0 A, $R_G$ = 25 Ω (Note 4,5) | -- | 40 | 80 | ns |
| $t_r$ | Turn-On Rise Time | | -- | 120 | 240 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 60 | 120 | ns |
| $t_f$ | Turn-Off Fall Time | | -- | 70 | 140 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 640V, $I_D$ = 7.0 A, $V_{GS}$ = 10 V (Note 4,5) | -- | 35 | 45 | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 10 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 13 | -- | nC |
| **Source-Drain Diode Maximum Ratings and Characteristics** | | | | | | |
| $I_S$ | Continuous Source-Drain Diode Forward Current | | -- | -- | 7.0 | A |
| $I_{SM}$ | Pulsed Source-Drain Diode Forward Current | | -- | -- | 28 | |
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $I_S$ = 7.0 A, $V_{GS}$ = 0 V | -- | -- | 1.4 | V |
| trr | Reverse Recovery Time | $I_S$ = 7.0 A, $V_{GS}$ = 0 V $di_F/dt$ = 100 A/μs (Note 4) | -- | 780 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 9.0 | -- | μC |

**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L=22.2mH, $I_{AS}$=7.0A, $V_{DD}$=50V, $R_G$=25Ω, Starting $T_J$=25°C
3. $I_{SD}$≤7.0A, di/dt≤200A/μs, $V_{DD}$≤$BV_{DSS}$ , Starting $T_J$=25 °C
4. Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature

## Typical Characteristics

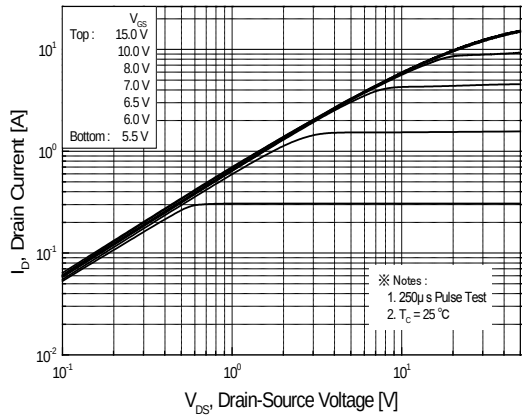



**Figure 1. On Region Characteristics**

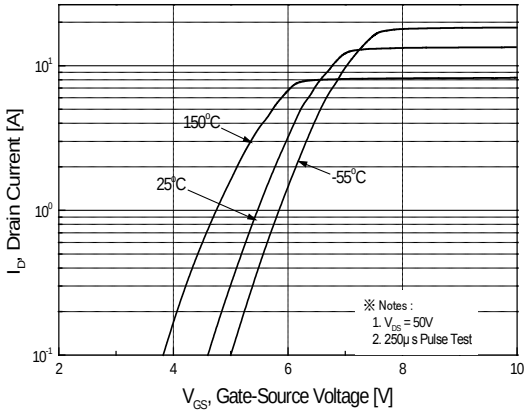



**Figure 2. Transfer Characteristics**

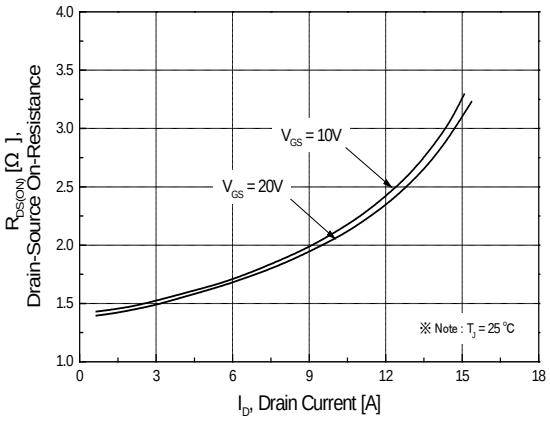



**Figure 3. On Resistance Variation vs Drain Current and Gate Voltage**

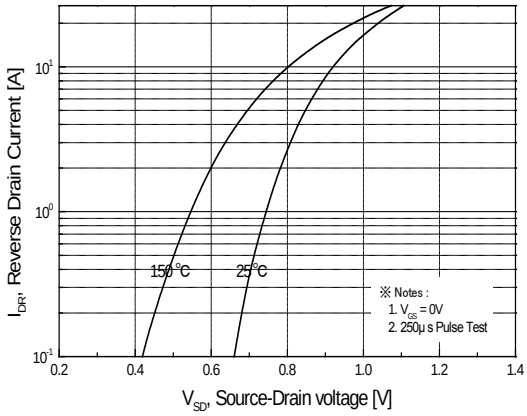



**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

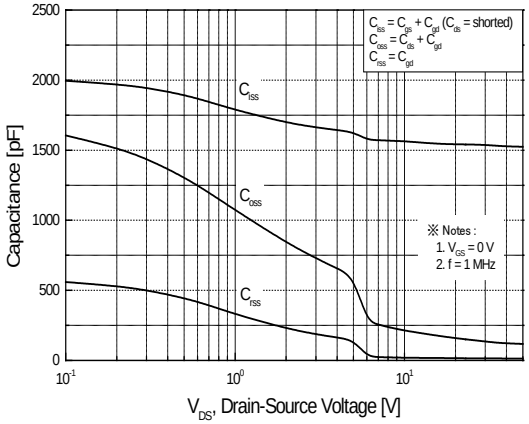



**Figure 5. Capacitance Characteristics**

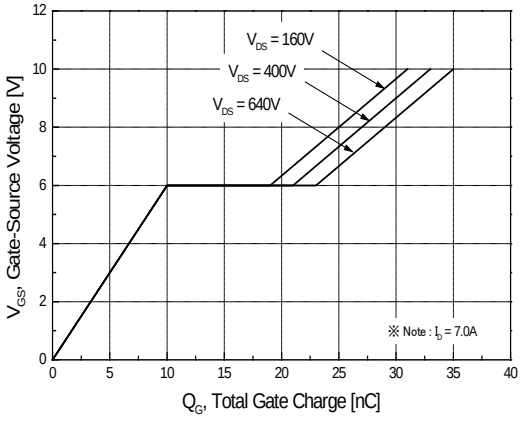



**Figure 6. Gate Charge Characteristics**

## Typical Characteristics (continued)

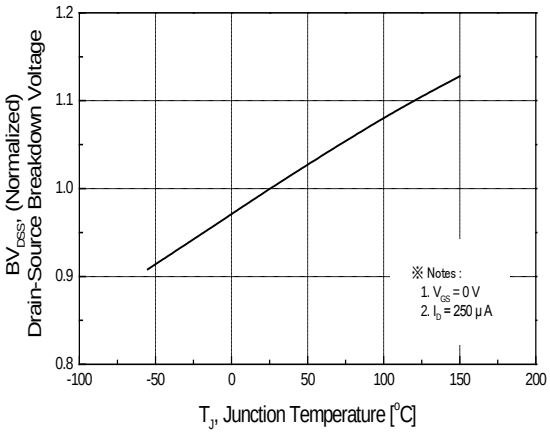



**Figure 7. Breakdown Voltage Variation vs Temperature**

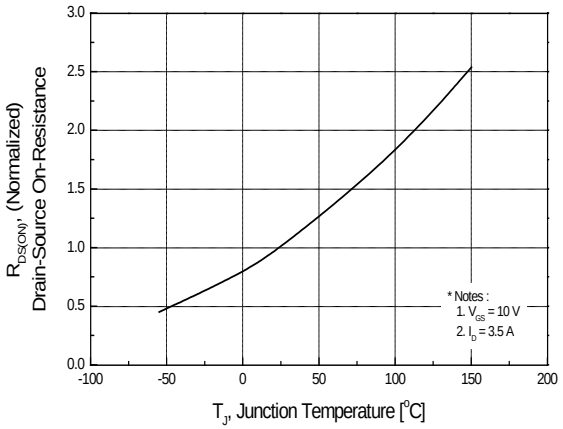



**Figure 8. On-Resistance Variation vs Temperature**

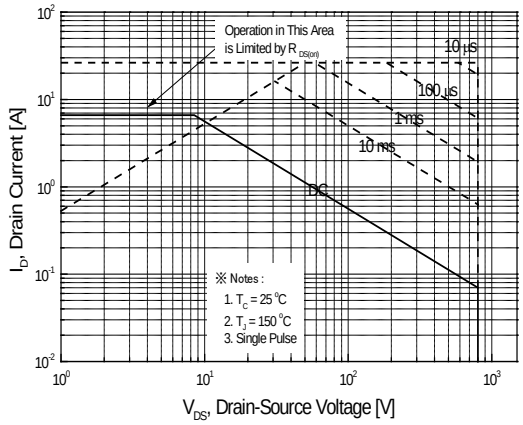



**Figure 9. Maximum Safe Operating Area**

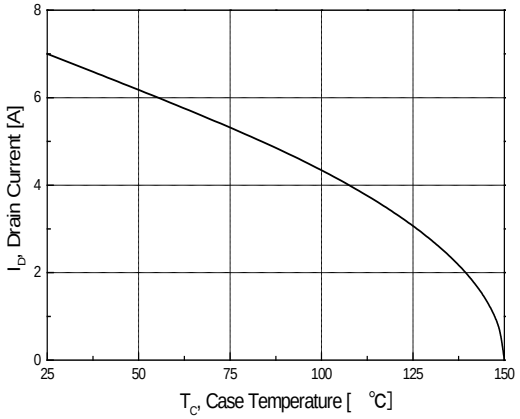



**Figure 10. Maximum Drain Current vs Case Temperature**

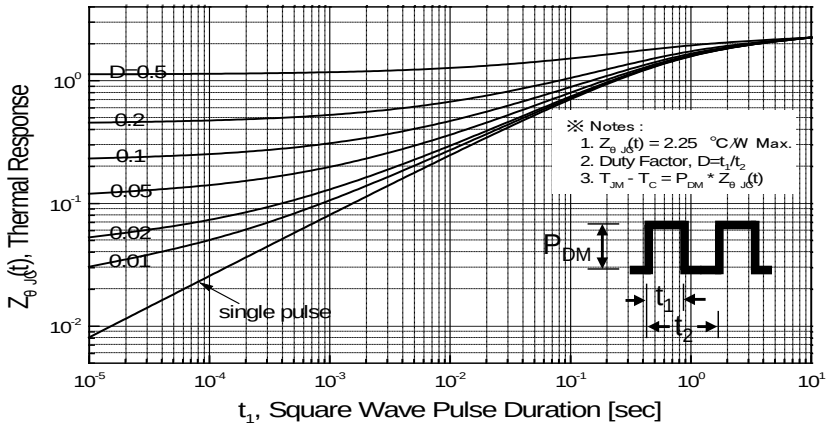



**Figure 11. Transient Thermal Response Curve**

**Fig 12. Gate Charge Test Circuit & Waveform**

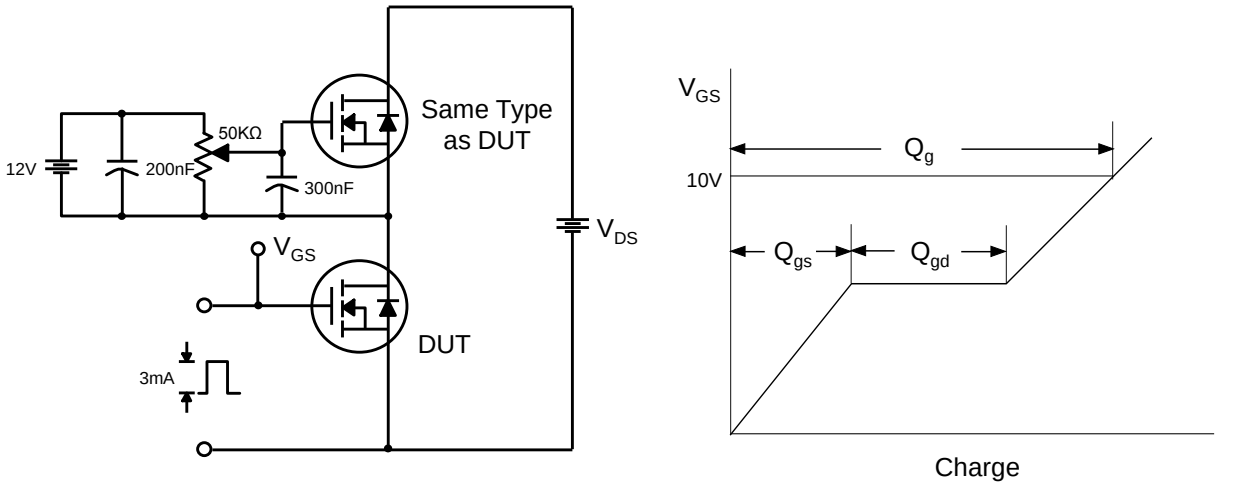



**Fig 13. Resistive Switching Test Circuit & Waveforms**

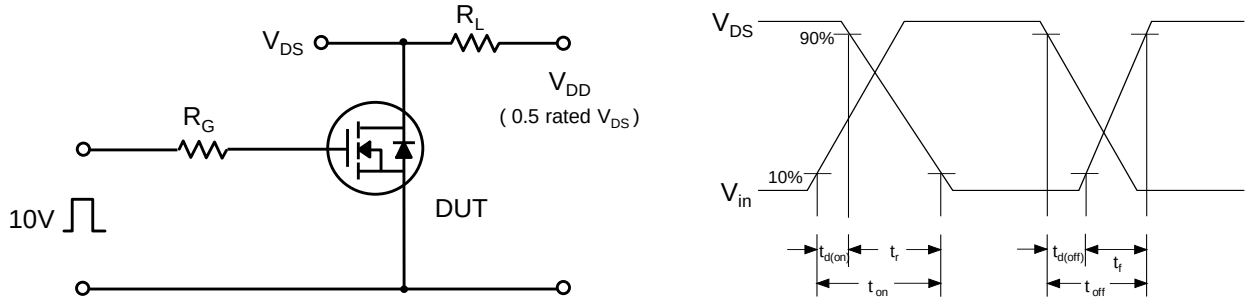



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

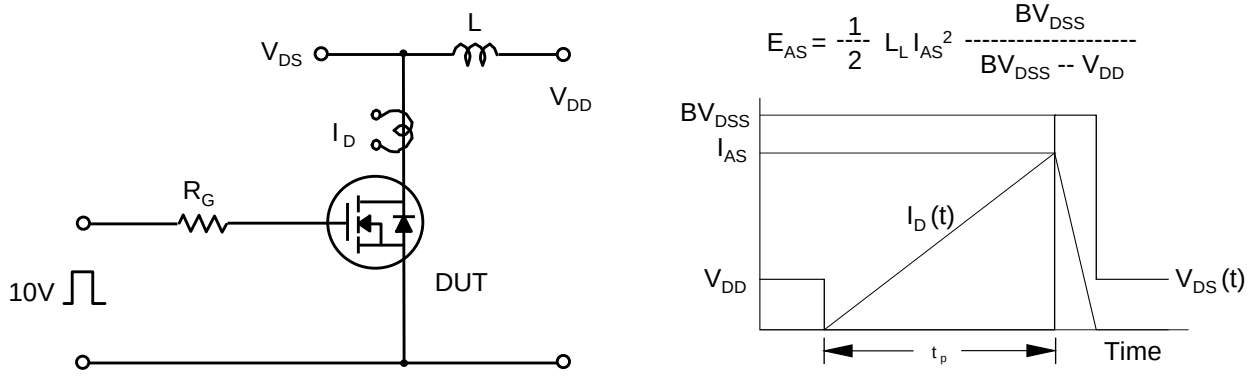
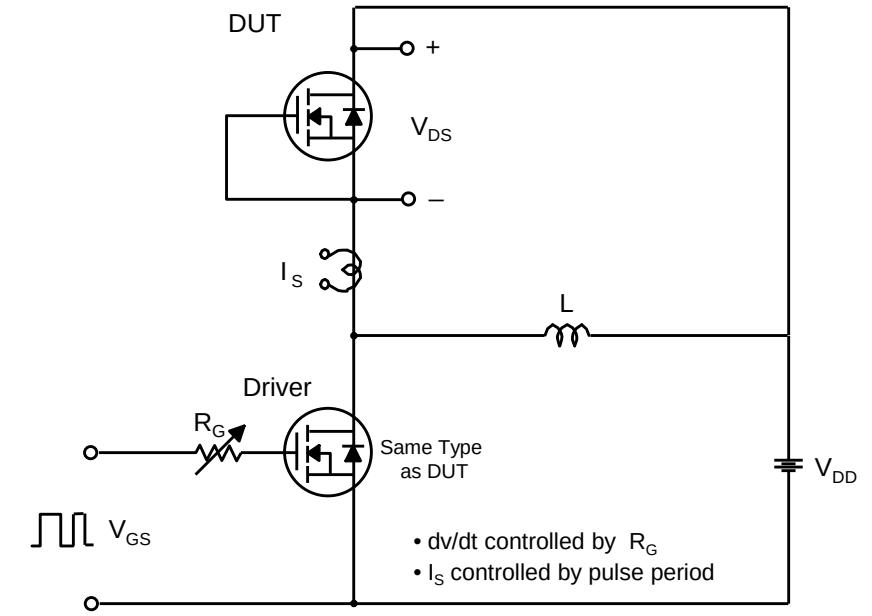
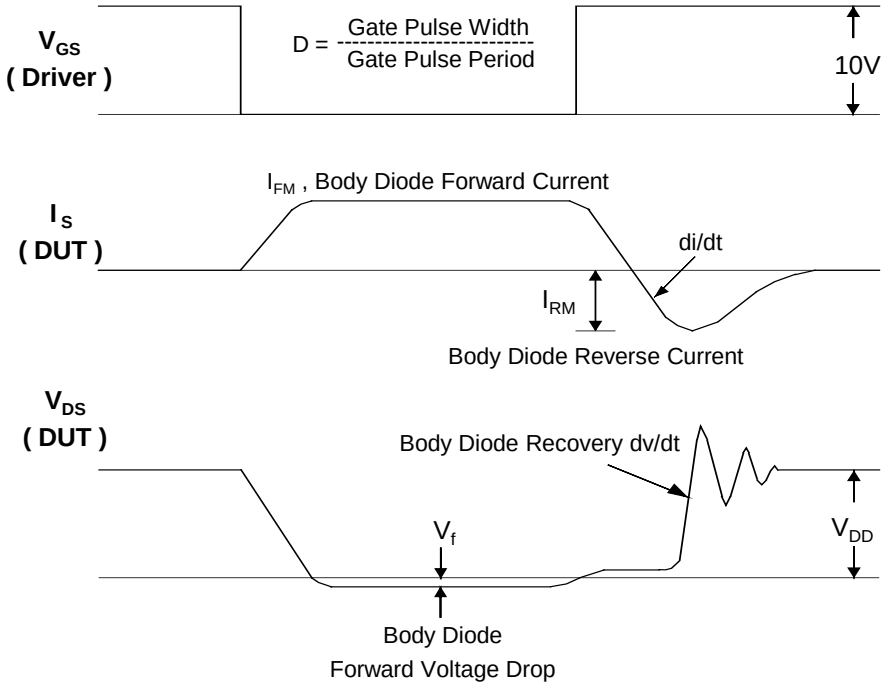


**Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**



## Package Dimension

# TO-220F

