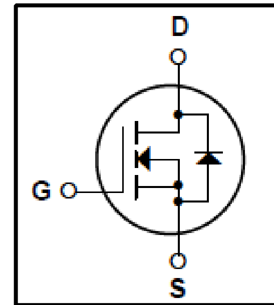
# Silicon N-Channel MOSFET

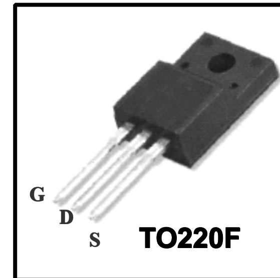
## Features

- 12A, 600V,$R_{DS(on)}$(Max 0.65Ω)@$V_{GS}$=10V
- Ultra-low Gate Charge(Typical 39nC)
- Fast Switching Capability
- 100%Avalanche Tested
- Isolation Voltage ( $V_{ISO}$ = 4000V AC )
- Maximum Junction Temperature Range(150℃)




## General Description

This Power MOSFET is produced using Winsemi's advanced planar stripe, VDMOS technology. This latest technology has been especially designed to minimize on-state resistance, have a high rugged avalanche characteristics. This devices is specially well suited for high efficiency switch model power supplies, power factor correction and half bridge and full bridge resonant topology line a Electronic lamp ballast.




## Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain Source Voltage | 600 | V |
| $I_D$ | Continuous Drain Current(@Tc=25℃) | 12* | A |
| | Continuous Drain Current(@Tc=100℃) | 7.6* | A |
| $I_{DM}$ | Drain Current Pulsed (Note1) | 48* | A |
| $V_{GS}$ | Gate to Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | 880 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | 25 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | V/ns |
| $P_D$ | Total Power Dissipation(@Tc=25℃) | 51 | W |
| | Derating Factor above 25℃ | 0.41 | W/℃ |
| $T_J$, $T_{stg}$ | Junction and Storage Temperature | -55~150 | ℃ |
| $T_L$ | Maximum lead Temperature for soldering purposes | 300 | ℃ |

*Drain current limited by maximum junction temperature

## Thermal Characteristics

| Symbol | Parameter | Value | | | Units |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| $R_{QJC}$ | Thermal Resistance, Junction-to-Case | - | - | 2.45 | ℃/W |
| $R_{QCS}$ | Thermal Resistance, Case to Sink | - | 0.5 | - | ℃/W |
| $R_{QJA}$ | Thermal Resistance, Junction-to-Ambient | - | - | 62.5 | ℃/W |



Copyright@WinSemi Semiconductor Co.,Ltd.,All rights reserved.

## Electrical Characteristics (Tc = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±30 V, VDS = 0 V | - | - | ±100 | nA |
| Gate−source breakdown voltage | | $V_{(BR)GSS}$ | $I_G$ = ±10 μA, VDS = 0 V | ±30 | - | - | V |
| Drain cut−off current | | $I_{DSS}$ | $V_{DS}$ = 600 V, VGS = 0 V | - | - | 1 | μA |
| Drain−source breakdown voltage | | $V_{(BR)DSS}$ | $I_D$ = 250 μA, VGS = 0 V | 600 | - | - | V |
| Break Voltage Temperature Coefficient | | $\Delta BV_{DSS}/\Delta T_J$ | $I_D$=250μA, Referenced to 25℃ | - | 0.5 | - | V/℃ |
| Gate threshold voltage | | $V_{GS(th)}$ | $V_{DS}$ = 10 V, ID =250 μA | 3 | - | 4.5 | V |
| Drain−source ON resistance | | $R_{DS(ON)}$ | $V_{GS}$ = 10 V, ID =6.0A | - | - | 0.65 | Ω |
| Forward Transconductance | | gfs | $V_{DS}$ = 50 V, ID =6.0A | - | 15 | | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = 25 V, | - | 1790 | 2355 | pF |
| Reverse transfer capacitance | | $C_{rss}$ | $V_{GS}$ = 0 V, | - | 175 | 232 | |
| Output capacitance | | $C_{oss}$ | f = 1 MHz | - | 23 | 31 | |
| Switching time | Turn−on Rise time | $t_r$ | $V_{DD}$ =300 V, | - | 133 | 175 | ns |
| | Turn−on Delay time | $t_{on}$ | $I_D$ =12 A | - | 80 | 100 | |
| | Turn−off Fall time | $t_f$ | $R_G$=9.1 Ω | - | 100 | 160 | |
| | Turn−off Delay time | $t_{off}$ | $R_D$=31 Ω (Note4,5) | - | 233 | 310 | |
| Total gate charge (gate−source plus gate−drain) | | Qg | $V_{DD}$ = 400 V, | - | 39 | 52 | nC |
| Gate−source charge | | Qgs | $V_{GS}$ = 10 V, | - | 8.5 | - | |
| Gate−drain (“miller”) Charge | | Qgd | $I_D$ =1 A (Note4,5) | - | 19 | - | |

## Source−Drain Ratings and Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|
| Continuous drain reverse current | $I_{DR}$ | - | - | - | 12 | A |
| Pulse drain reverse current | $I_{DRP}$ | - | - | - | 48 | A |
| Forward voltage (diode) | $V_{DSF}$ | $I_{DR}$ = 12 A, VGS = 0 V | - | - | 1.4 | V |
| Reverse recovery time | $t_{rr}$ | $I_{DR}$ = 12 A, VGS = 0 V, | - | 418 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | $dI_{DR}$ / dt = 100 A / μs | - | 4.85 | - | μC |

Note 1.Repeativity rating :pulse width limited by junction temperature

2.L=11.2mH,$I_{AS}$=12A,$V_{DD}$=50V,$R_G$=25Ω,Starting $T_J$=25℃

3.$I_{SD}$≤12A,di/dt≤300A/us, $V_{DD}$<$BV_{DSS}$,STARTING TJ=25℃

4.Pulse Test: Pulse Width≤300us,Duty Cycle≤2%

5.Essentially independent of operating temperature.

This transistor is an electrostatic sensitive device

Please handle with caution



Copyright @ WinSemi Semiconductor Co., Ltd., All rights reserved.

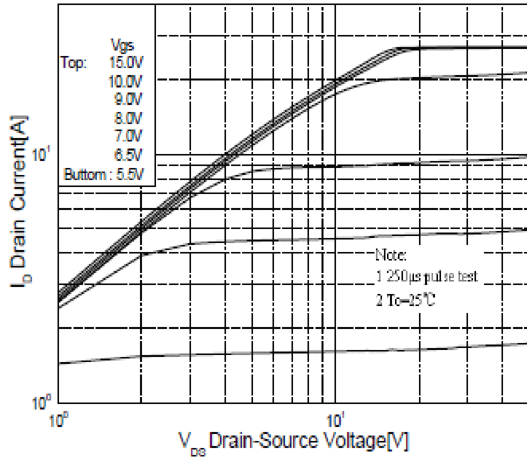



**Fig. 1 On-State Characteristics**

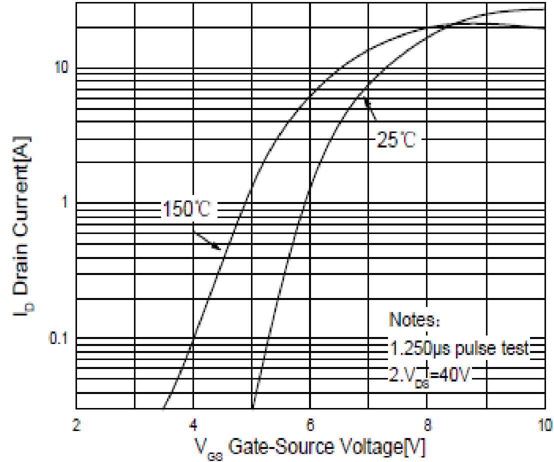



**Fig.2 Transfer Characteristics**

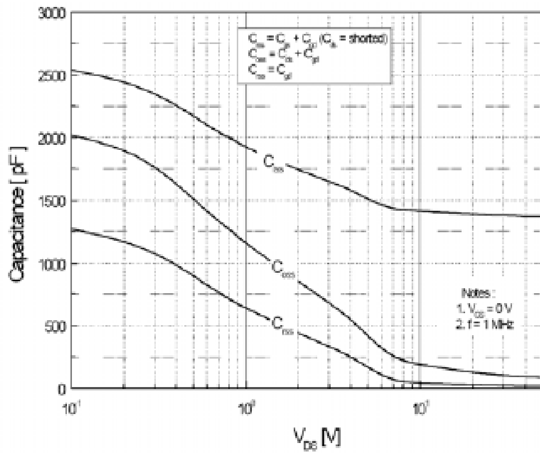



**Fig.3 Capacitance Variation vs Drain Voltage**

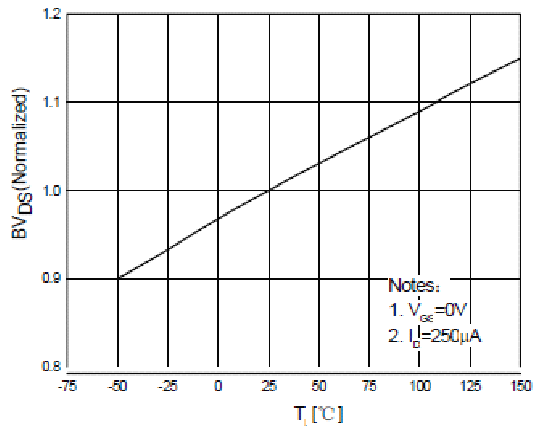



**Fig.4 Breakdown Voltage Variation vs Temperature**

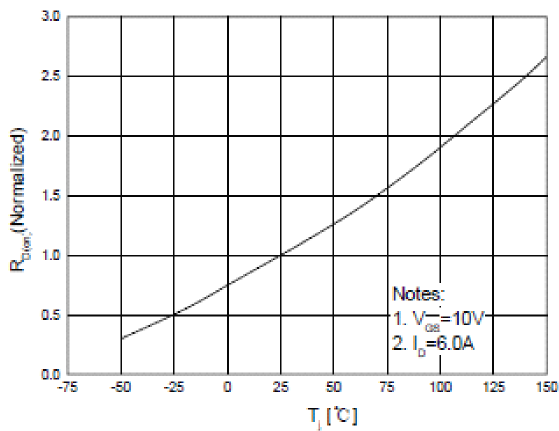



**Fig.5 On-Resistance Variation vs Junction Temperature**

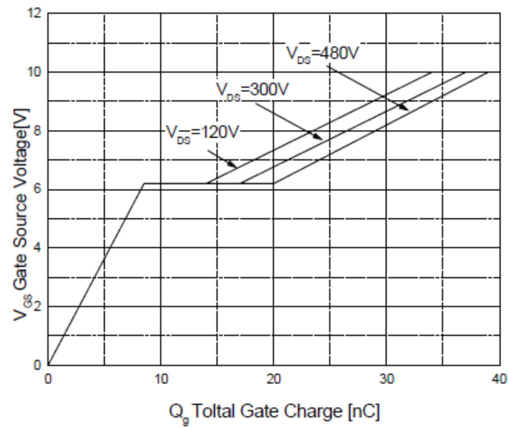



**Fig.6 Gate Charge Characteristics**



Copyright @ WinSemi Semiconductor Co., Ltd., All rights reserved.

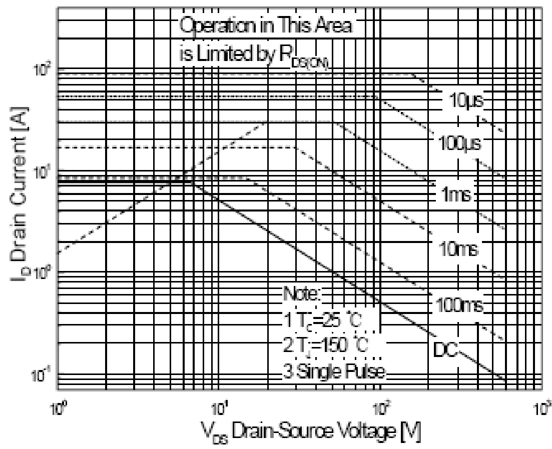



**Fig.7 Maximum Safe Operation Area**

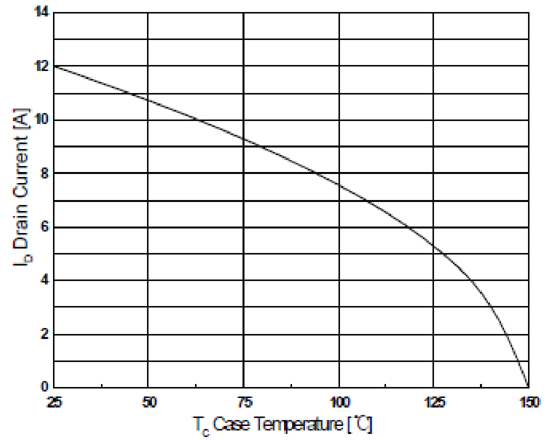



**Fig.8 Maximum Drain Current vs Case Temperature**

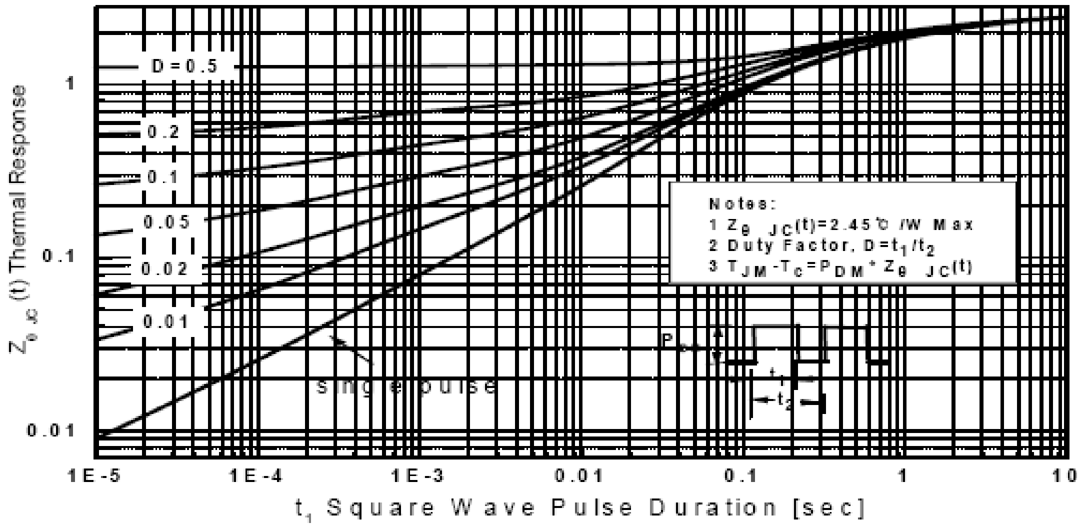
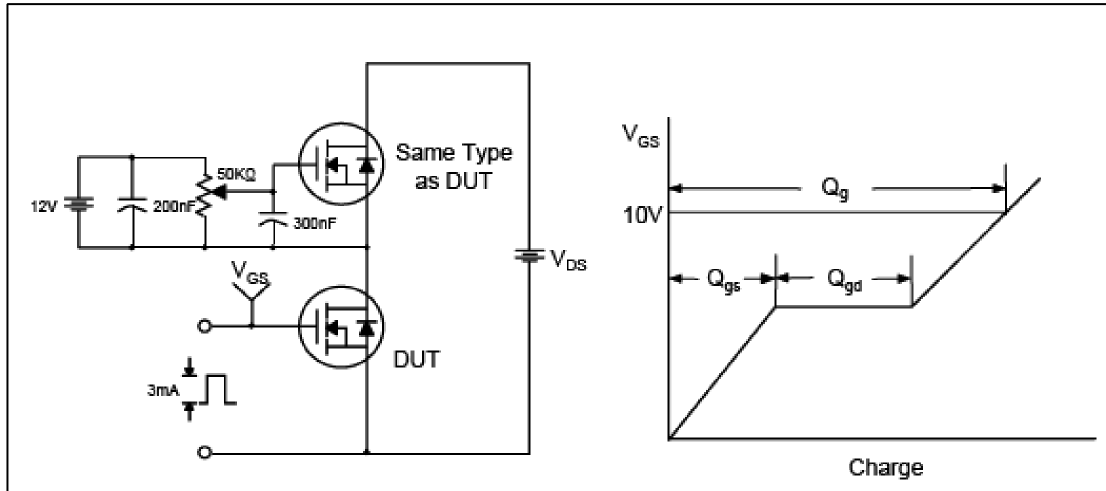



**Fig.9 Transient Thermal Response Curve**



Copyright @ WinSemi Semiconductor Co., Ltd., All rights reserved.



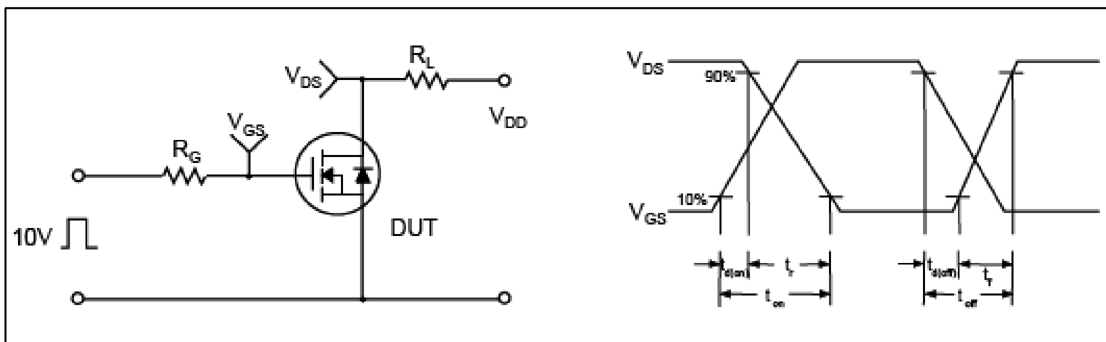




**Fig.11 Resistive Switching Test Circuit & Waveform**

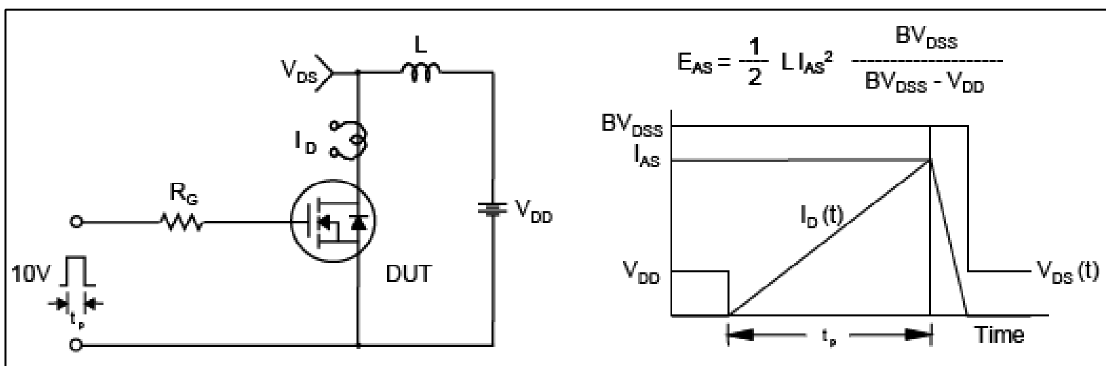



**Fig.12 Unclamped Inductive Switching Test Circuit & Waveform**



Copyright @ WinSemi Semiconductor Co., Ltd., All rights reserved.

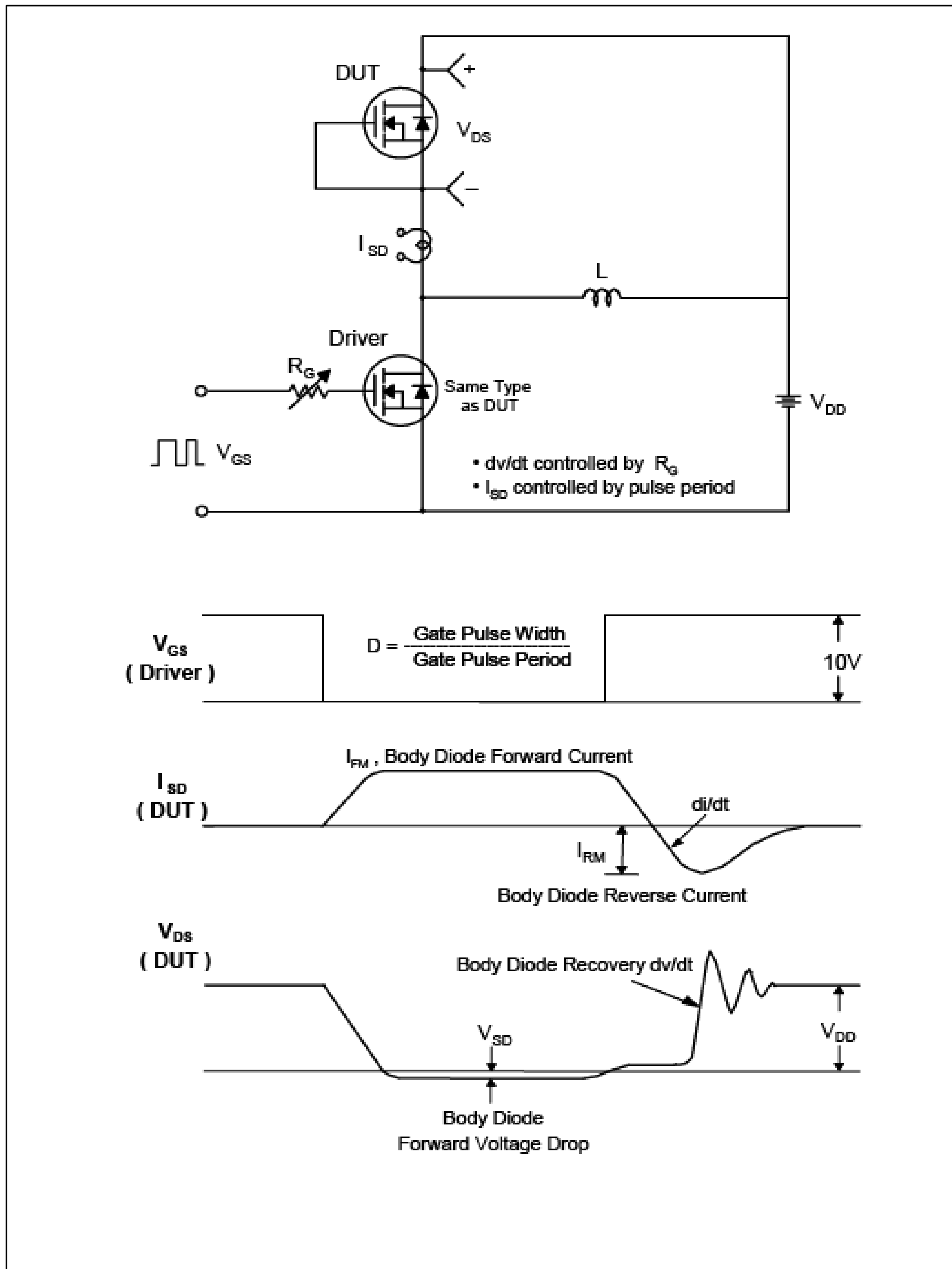
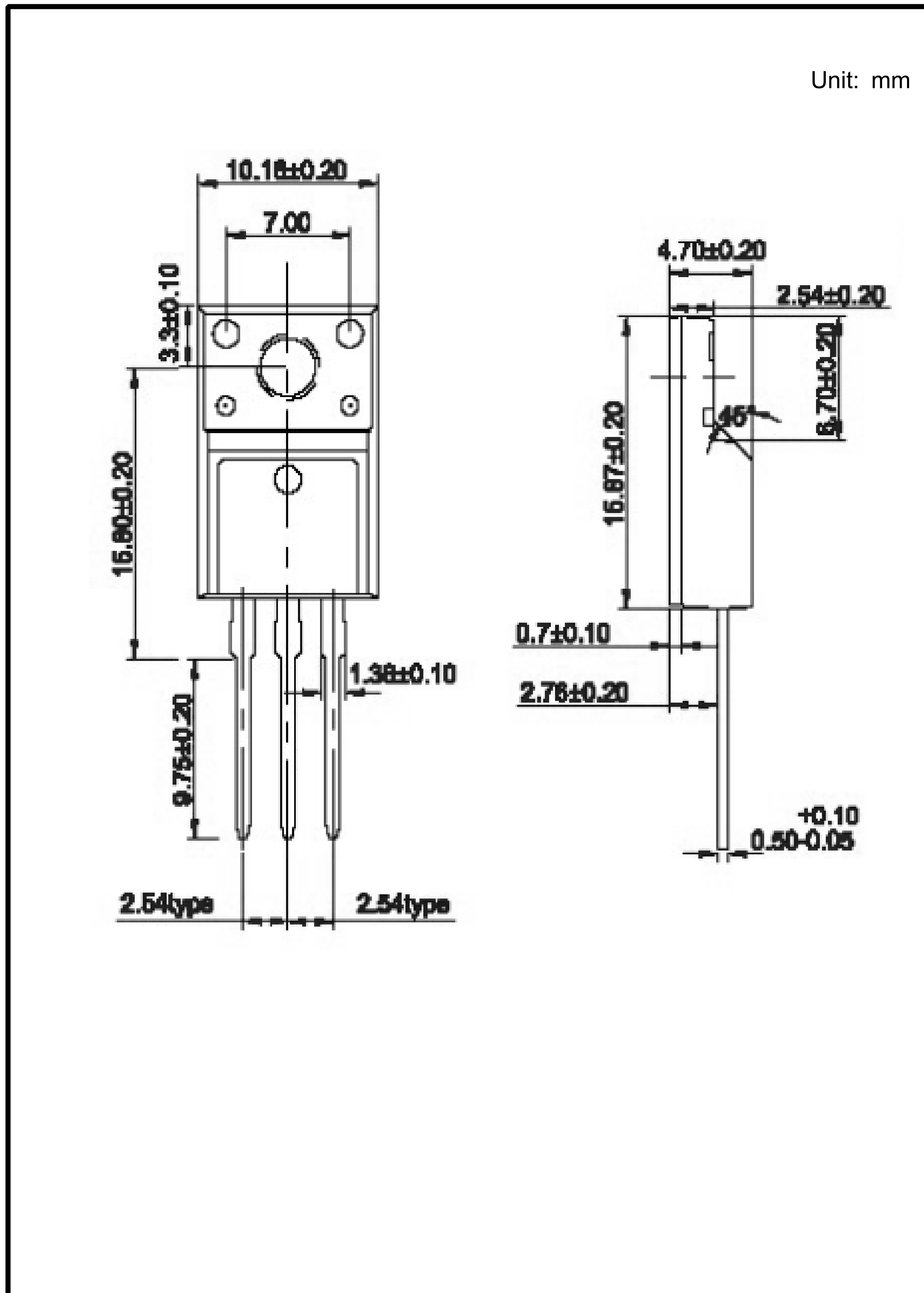



**Fig.13 Peak Diode Recovery dv/dt Test Circuit & Waveform**



Copyright @ WinSemi Semiconductor Co., Ltd., All rights reserved.

## TO-220F Package Dimension






Copyright @ WinSemi Semiconductor Co., Ltd., All rights reserved.