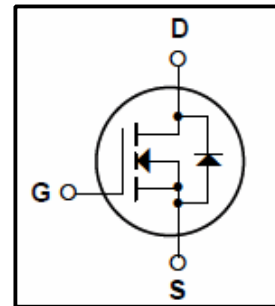## *Silicon N-Channel MOSFET*





TO220

## Features

■ 2A,600V, $R_{DS(on)}$(Max 5Ω)@$V_{GS}$=10V

■ Ultra-low Gate Charge(Typical 15nC)

■ Fast Switching Capability

■ 100%Avalanche Tested

■ 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 mode power supply.
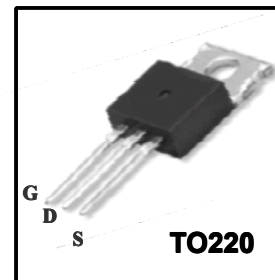
## Absolute Maximum Ratings

| Symbol | Parameter | | Value | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain Source Voltage | | 600 | V |
| $I_D$ | Continuous Drain Current(@Tc=25℃) | | 2.0 | A |
| | Continuous Drain Current(@Tc=100℃) | | 1.3 | A |
| $I_{DM}$ | Drain Current Pulsed | (Note1) | 6 | A |
| $V_{GS}$ | Gate to Source Voltage | | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 120 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy | (Note 1) | 5.4 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 5.5 | V/ns |
| $P_D$ | Total Power Dissipation(@Tc=25℃) | | 54 | W |
| | Derating Factor above 25℃ | | 0.43 | W/℃ |
| $T_{J,}$ $T_{stg}$ | Junction and Storage Temperature | | -55~150 | ℃ |
| $T_L$ | Maximum lead Temperature for soldering purposes | | 300 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Value | | | Units |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| $R_{QJC}$ | Thermal Resistance, Junction-to-Case | - | - | 2.3 | ℃/W |
| $R_{QCS}$ | Thermal Resistance, Case-to-Sink | 0.5 | - | - | ℃/W |
| $R_{QJA}$ | Thermal Resistance, Junction-to-Ambient | - | - | 62.5 | ℃/W |

T02-2

## Electrical Characteristics (Tc = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±30 V, $V_{DS}$ = 0 V | - | - | ±100 | nA |
| Gate−source breakdown voltage | | $V_{(BR)GSS}$ | $I_G$ = ±10 µA, $V_{DS}$ = 0 V | ±30 | - | - | V |
| Drain cut−off current | | $I_{DSS}$ | $V_{DS}$ = 600 V, $V_{GS}$ = 0 V | - | - | 10 | µA |
| | | | $V_{DS}$ = 480 V, Tc = 125°C | - | - | 100 | µA |
| Drain−source breakdown voltage | | $V_{(BR)DSS}$ | $I_D$ = 250 µA, $V_{GS}$ = 0 V | 600 | - | - | V |
| Break Voltage Temperature Coefficient | | $\Delta BV_{DSS}/\Delta T_J$ | $I_D$=250µA, Referenced to 25°C | - | 0.65 | - | V/°C |
| Gate threshold voltage | | $V_{GS(th)}$ | $V_{DS}$ = 10 V, $I_D$ =250 µA | 2 | - | 4 | V |
| Drain−source ON resistance | | $R_{DS(ON)}$ | $V_{GS}$ = 10 V, $I_D$ =1A | - | 4.2 | 5 | Ω |
| Forward Transconductance | | gfs | $V_{DS}$ = 50 V, $I_D$ =1A | - | 2.05 | - | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = 25 V, | - | 380 | 490 | pF |
| Reverse transfer capacitance | | $C_{rss}$ | $V_{GS}$ = 0 V, | - | 7.6 | 9.9 | |
| Output capacitance | | $C_{oss}$ | f = 1 MHz | - | 35 | 49 | |
| Switching time | Rise time | $t_r$ | $V_{DD}$ =300 V, | - | 15 | 42 | ns |
| | Turn−on time | $t_{on}$ | $I_D$ = 2 A | - | 50 | 108 | |
| | Fall time | $t_f$ | $R_G$=25 Ω | - | 40 | 89 | |
| | Turn−off time | $t_{off}$ | (Note4,5) | - | 40 | 89 | |
| Total gate charge (gate−source plus gate−drain) | | $Q_g$ | $V_{DD}$ = 320 V, $V_{GS}$ = 10 V, | - | 15 | 19 | nC |
| Gate−source charge | | $Q_{gs}$ | $I_D$ = 2 A | - | 1.7 | - | |
| Gate−drain ("miller") Charge | | $Q_{gd}$ | (Note4,5) | - | 7.2 | - | |

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

| Characteristics | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|
| Continuous drain reverse current | $I_{DR}$ | - | - | - | 2 | A |
| Pulse drain reverse current | $I_{DRP}$ | - | - | - | 6 | A |
| Forward voltage (diode) | $V_{DSF}$ | $I_{DR}$ = 2 A, $V_{GS}$ = 0 V | - | - | 1.4 | V |
| Reverse recovery time | $t_{rr}$ | $I_{DR}$ = 2 A, $V_{GS}$ = 0 V, | - | 200 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | $dI_{DR}$ / dt = 100 A / µs | - | 1.3 | - | µC |

Note 1.Repeativity rating :pulse width limited by junction temperature
2.L=0.5mH,$I_{AS}$=2.0A,$V_{DD}$=50V,$R_G$=0Ω,Starting $T_J$=25°C
3.$I_{SD}$≤2.0A,di/dt≤200A/us, $V_{DD}$<$BV_{DSS}$,STARTING TJ=25°C
4.Pulse Test: Pulse Width≤300us,Duty Cycle≤2%
5.Essentially independent of operating temperature.
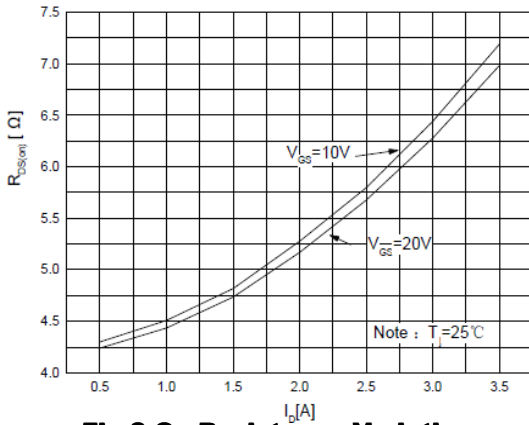
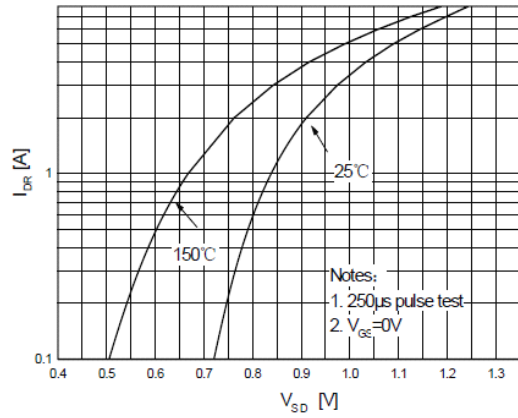This transistor is an electrostatic sensitive device

Please handle with caution

*Steady, keep you advance*
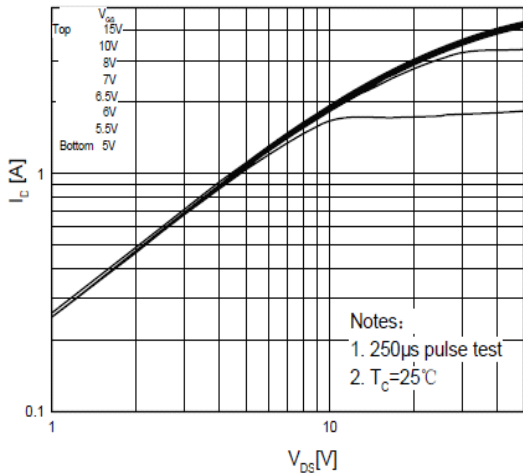
Fig. 1 On-State Characteristics
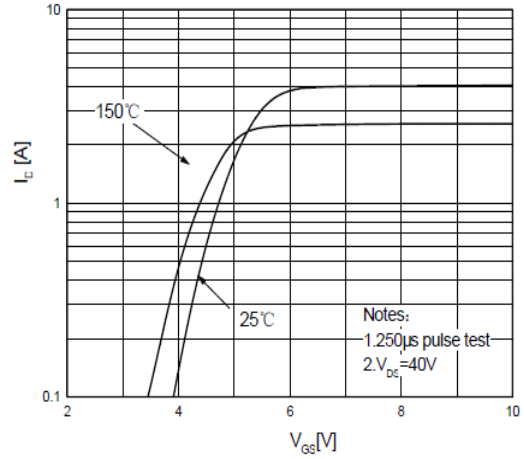


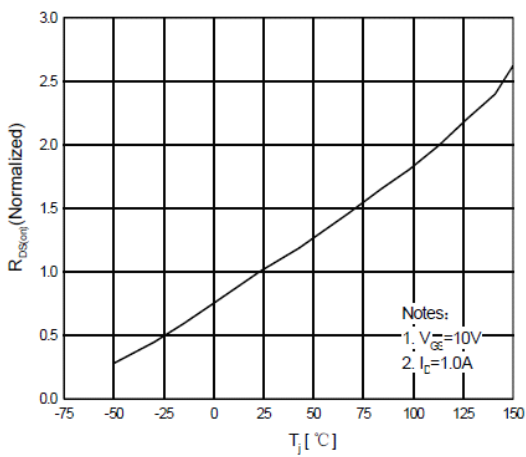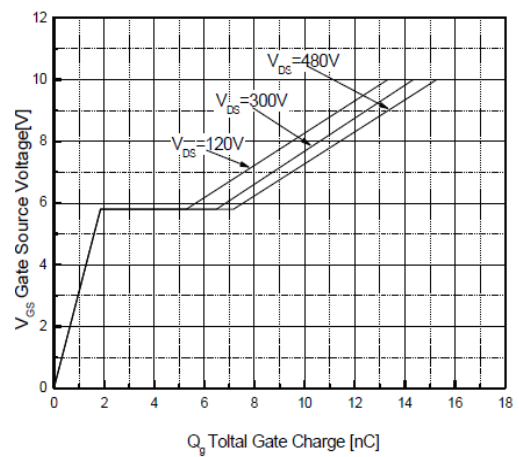Fig.2 Transfer Current Characteristics



Fig.3 On-Resistance Variation vs
Drain Current

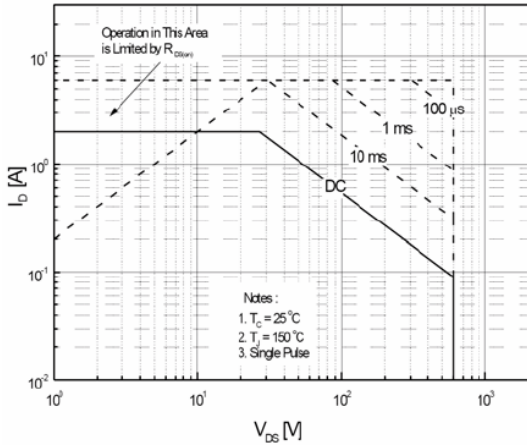

Fig.4 Body Diode Forward Voltage Variation
vs. Source Current and Temperature



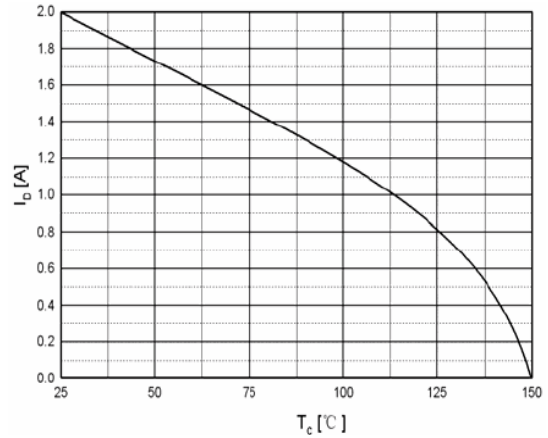Fig.5 On-Resistance Variation vs
Junction Temperature



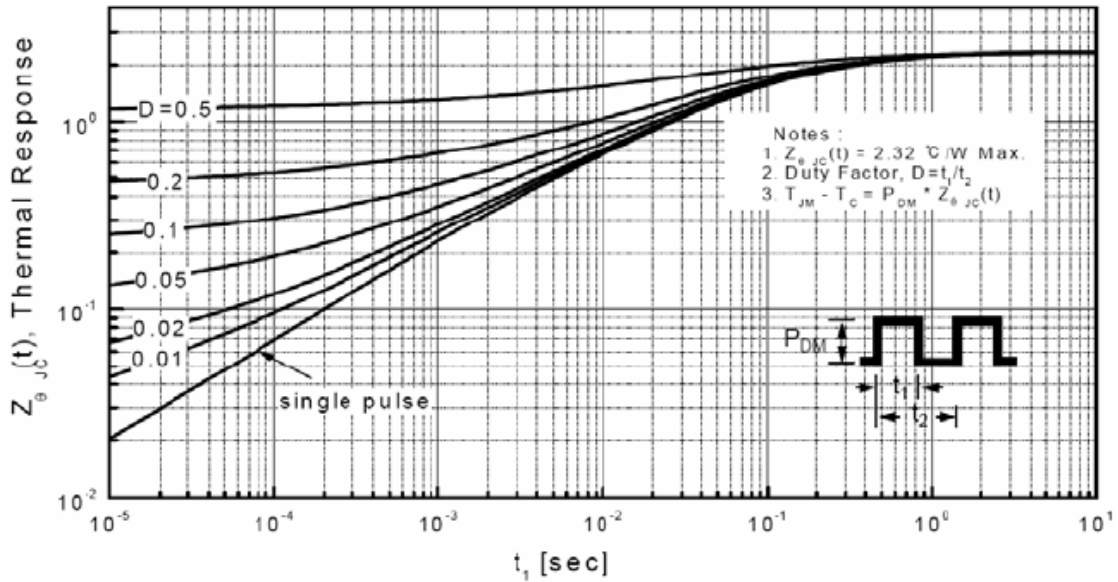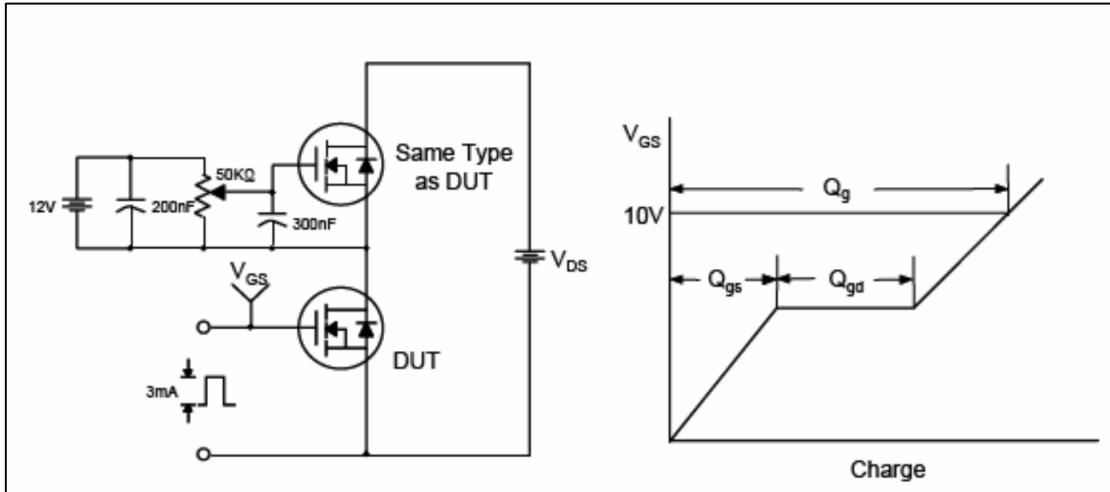Fig.6 Gate Charge Characteristics

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Fig.7 Maximum Safe Operation Area



Fig.8 Maximum Drain Current vs Case Temperature



Fig.9 Transient Thermal Response Curve

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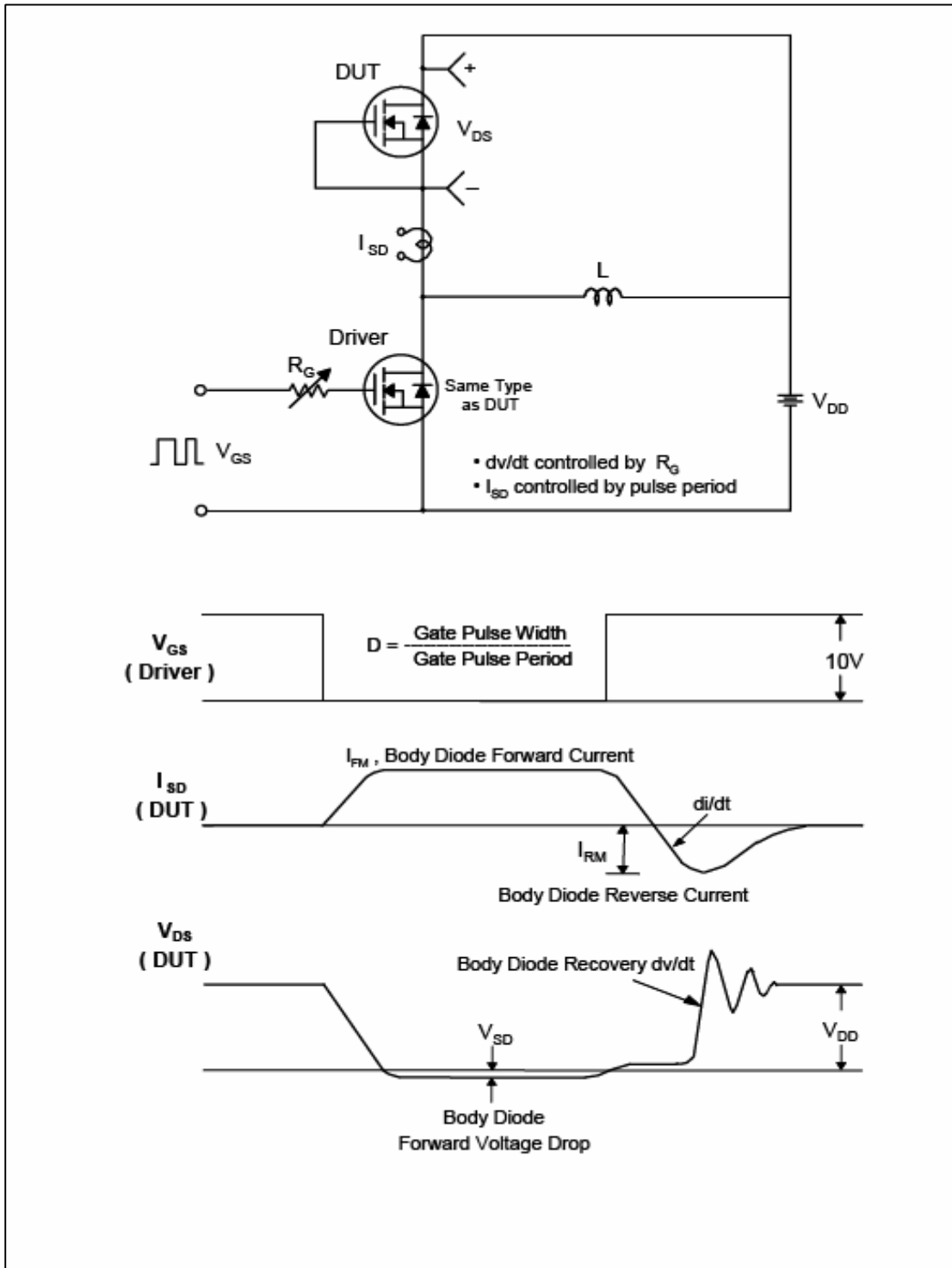
Fig.10 Gate Test Circuit & Waveform
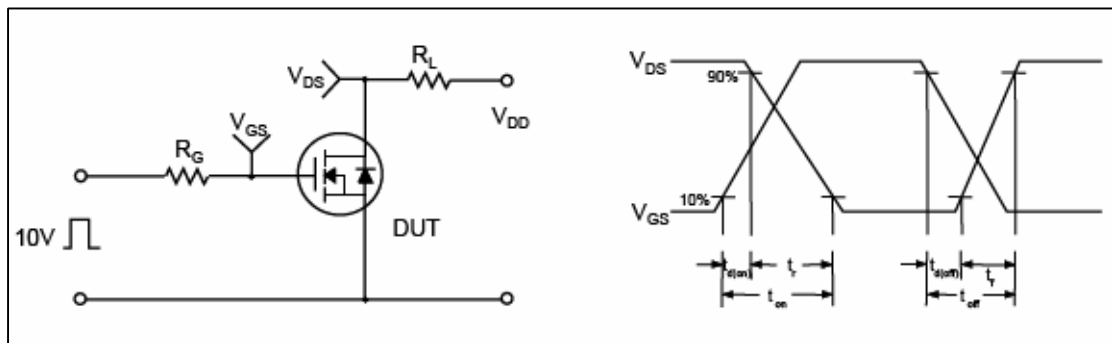


Fig.11 Resistive Switching Test Circuit & Waveform



$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
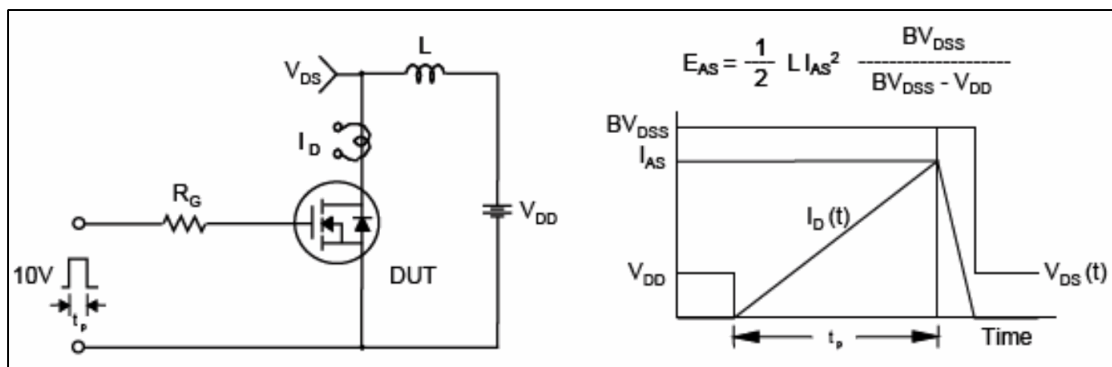
Fig.12 Unclamped Inductive Switching Test Circuit & Waveform

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

## TO-220  Package Dimension



Unit: mm

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