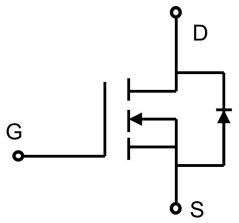
## 16A, 500V N-CHANNEL MOSFET





### GENERAL DESCRIPTION

This power mosfet is an N-channel enhancement mode power MOS field effect transistor which is produced using Hi-semicon proprietary F-CellTM structure VDMOS technology. The improved planar stripe cell and the improved guard ring terminal have been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.
These devices are widely used in AC-DC power suppliers, DC-DC converters and H-bridge PWM motor drivers.

### Features

- ◆VDS(V)=500V,ID=16A
- ◆$R_{DS(ON)}$
  TYP:265mΩ@$V_{GS}$=10V $I_D$=8A
  MAX:350mΩ

### Applications

- ◆Power faction correction (PFC)
- ◆Switched mode power supplies (SMPS)
- ◆Uninterruptible power supply (UPS)
- ◆LED lighting power

### ORDERING INFORMATION

| Part No. | Package | Marking | Material | Packing |
|---|---|---|---|---|
| SFF16N50 | TO-220F-3L | SFF16N50 | Pb Free | Tube |

## ABSOLUTE MAXIMUM RATINGS ($T_J$=25°C unless otherwise noted)

| Characteristics | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 500 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Drain Current | $T_C$ = 25°C | $I_D$ | 16 | A |
| | $T_C$ = 100°C | | 10.8 | |
| Drain Current Pulsed(Note 1) | | $I_{DM}$ | 64 | A |
| Power Dissipation($T_C$=25°C) | | $P_D$ | 42 | W |
| -Derate above 25°C | | | 0.36 | W/°C |
| Single Pulsed Avalanche Energy (Note 2) | | $E_{AS}$ | 511 | mJ |
| Operation Junction Temperature Range | | $T_J$ | -55～+150 | °C |
| Storage Temperature Range | | $T_{stg}$ | -55～+150 | °C |
| Maximum lead temperature for soldering purposes,1/8" from case for 5 seconds | | TL | 300 | ℃ |

## THERMAL CHARACTERISTICS

| Characteristics | Symbol | MAX | Unit |
|---|---|---|---|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 3.75 | °C/W |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain -Source Breakdown Voltage | $B_{VDSS}$ | $V_{GS}$=0V, $I_D$=250μA | 500 | 550 | -- | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=500V, $V_{GS}$=0V | -- | -- | 100 | nA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=30V, $V_{DS}$=0V | -- | -- | 100 | nA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=-30V, $V_{DS}$=0V | -- | -- | -100 | nA |
| **On Characteristics** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$= $V_{DS}$, $I_D$=250μA | 2 | 3.1 | 4.0 | V |
| Static Drain- Source On State Resistance | $R_{DS(on)}$ | $V_{GS}$=10V, $I_D$=8A | -- | 265 | 350 | mΩ |
| | | $V_{GS}$=10V, $I_D$=1A | -- | 260 | 350 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| Gate Resistance | Rg | $V_{GS}$=0V; f=1.0MHZ | 1 | 2.8 | 10 | Ω |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=25V | -- | 2800 | -- | pF |
| Output Capacitance | $C_{oss}$ | $V_{GS}$=0V | -- | 247.8 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | f=1.0MHZ | -- | 5.7 | -- | pF |
| **Switching Characteristics** | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=250V | -- | 32 | -- | ns |
| Turn-on Rise Time | $t_r$ | $R_G$=10Ω; $I_D$=8A | -- | 71.3 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | (Note 3.4) | -- | 72 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 53.6 | -- | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total Gate Charge | $Q_g$ | $V_{DS}$=500V, $I_D$=16A | -- | 56.5 | -- | nc |
| Gate-Source Charge | $Q_{gs}$ | $V_{GS}$=10V | -- | 11.5 | -- | |
| Gate-Drain Charge | $Q_{gd}$ | (Note 3.4) | -- | 20.3 | -- | |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Continuous Source Current | $I_S$ | Integral Reverse P-N Junction Diode in the MOSFET | -- | -- | 16 | A |
| Pulsed Source Current | $I_{SM}$ | | -- | -- | 64 | |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=20A,$V_{GS}$=0V | -- | 0.79 | 1.2 | V |
| Reverse Recovery Time | $T_{rr}$ | $I_F$=20A,$V_R$=520V, dIF/dt=100A/μS | -- | 566 | -- | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | -- | 233 | -- | μC |

1.Pluse width limited by maximum junction temperature

2.L=10mH, $I_{AS}$=10A, $V_{DD}$=80V, $V_G$=10V, $R_G$=25Ω, starting $T_J$=25°C

3.Pulse Test: Pulse width ≤300μs, Duty cycle≤2%

4.Essentially independent of operating temperature

## Typical Performance Characteristics

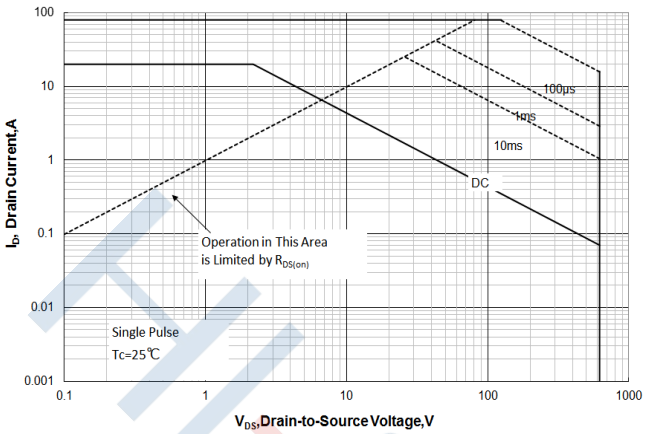



Figure 1 Maximum Forward Bias Safe Operating Area

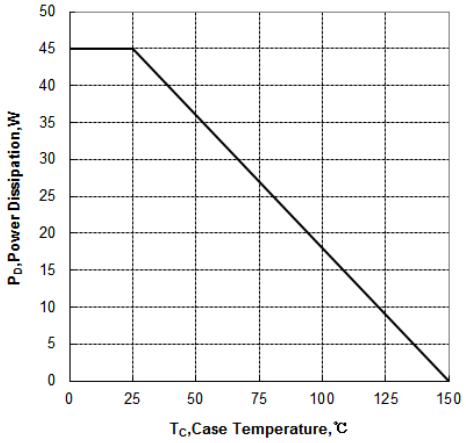



Figure 2 Maximum Power dissipation vs Case Temperature

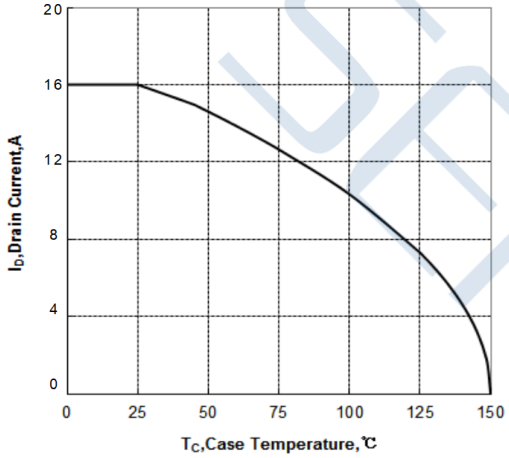



Figure 3 Maximum Continuous Drain Current vs Case Temperature

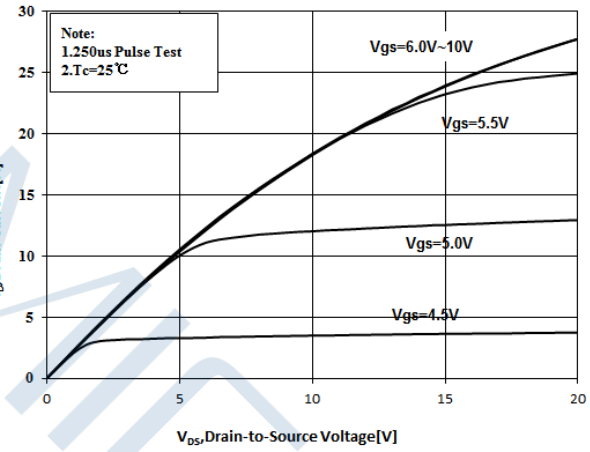



Figure 4 Typical Output Characteristics

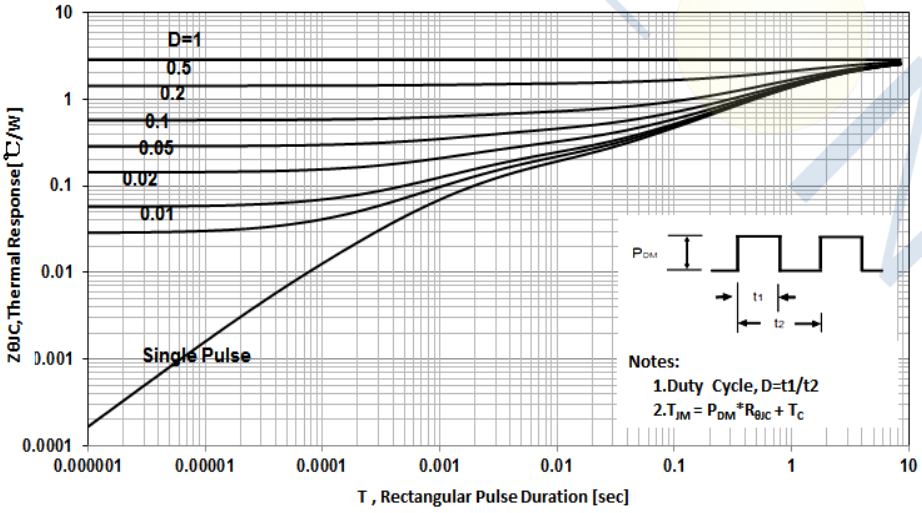



Figure 5 Maximum Effective Thermal Impedance , Junction to Case

## Typical Performance Characteristics

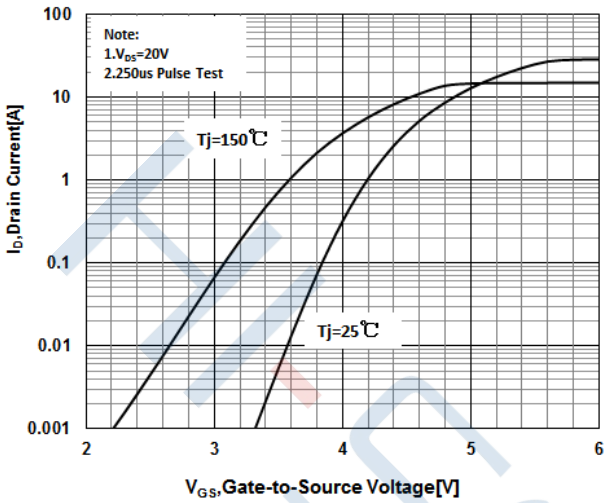



Figure 6 Typical Transfer Characteristics

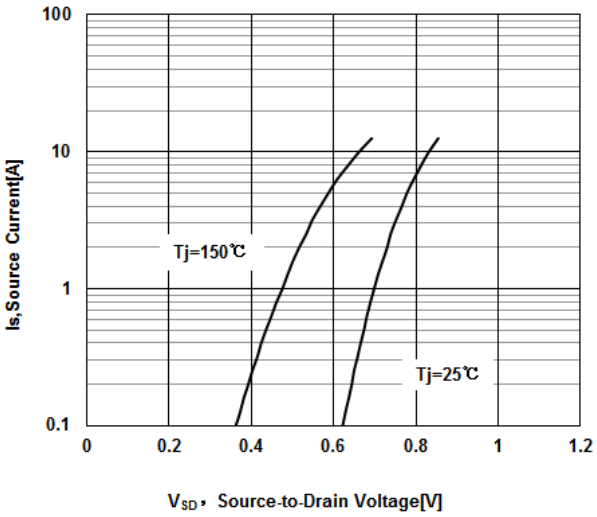



Figure 7 Typical Body Diode Transfer Characteristics

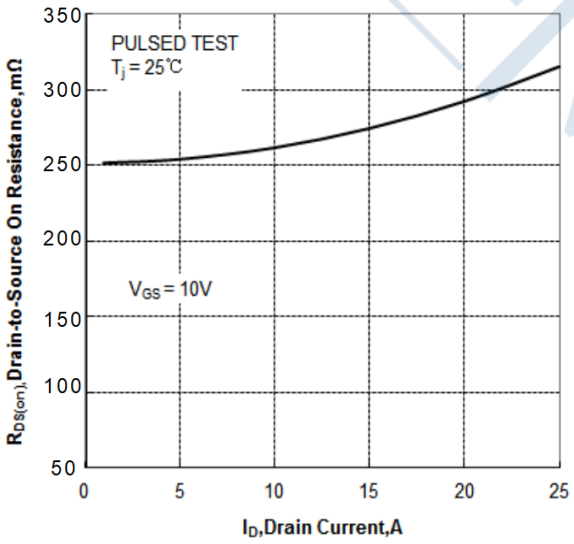



Figure 8 Typical Drain to Source ON Resistance vs Drain Current

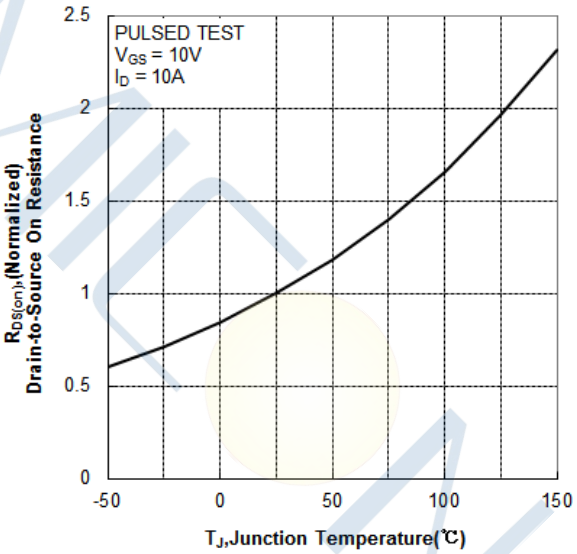



Figure 9 Typical Drian to Source on Resistance vs Junction Temperature

## Typical Performance Characteristics

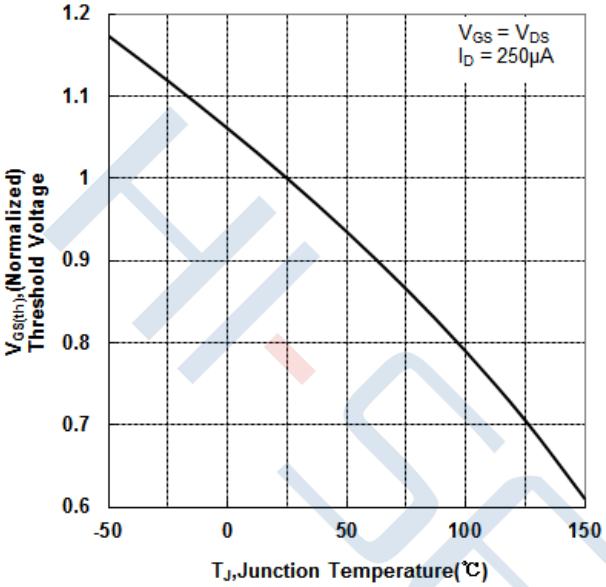



Figure 10 Typical Theshold Voltage vs Junction Temperature

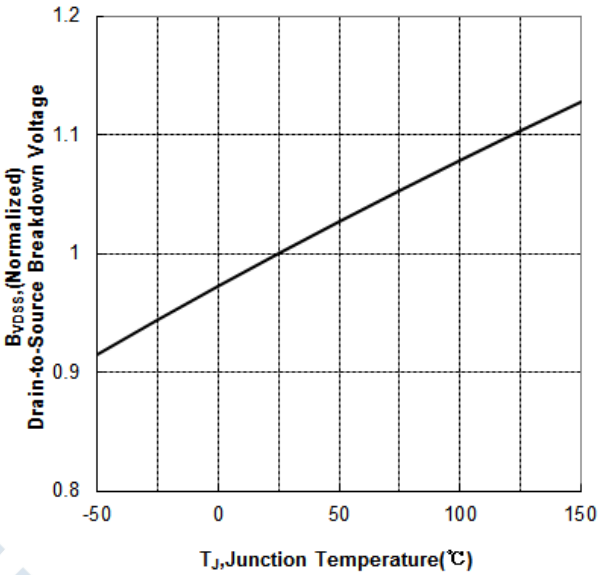



Figure 11 Typical Breakdown Voltage vs Junction Temperature

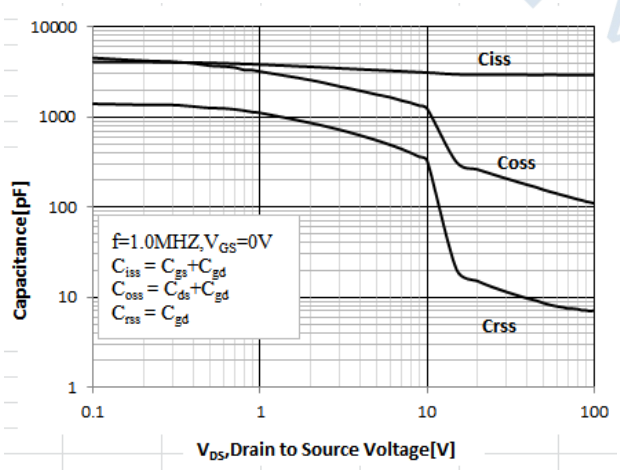



Figure 12 Typical Capacitance vs Drain to Source Voltage

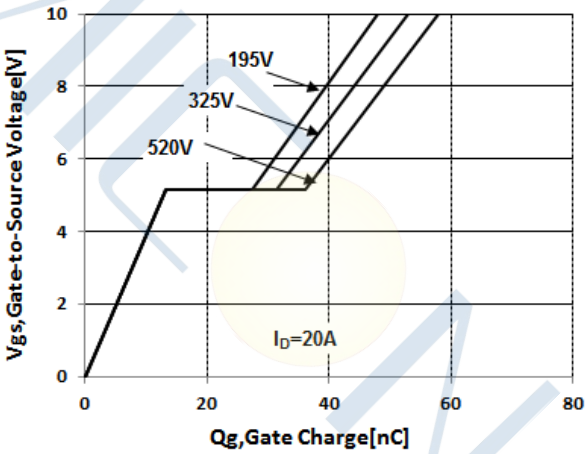
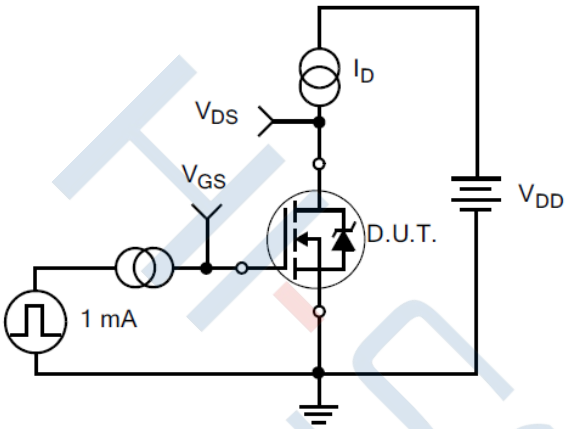
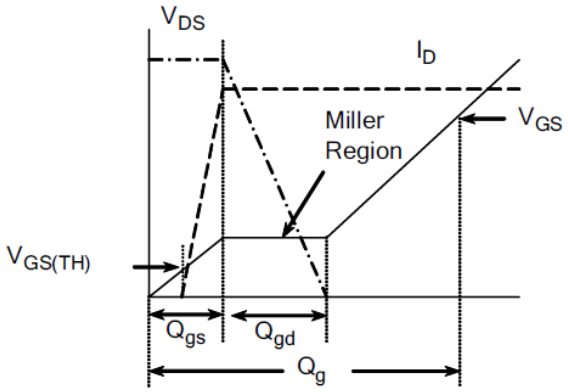



Figure 13 Typical Gate Charge vs Gate to Source Voltage

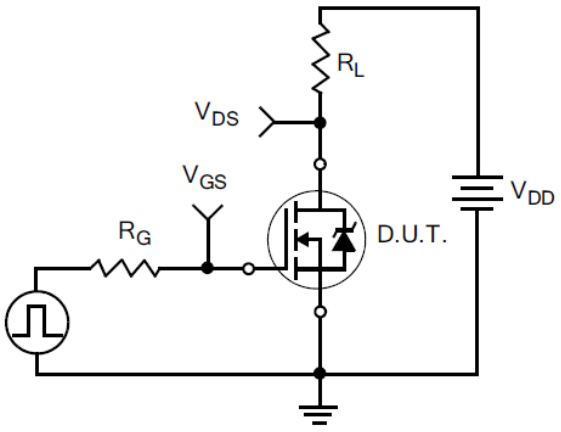
## Test Circuit



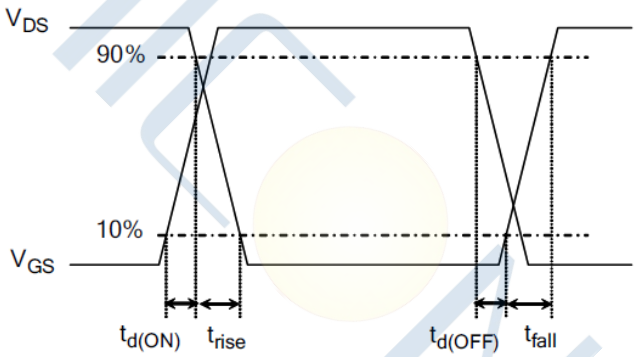

Gate Charge Test Circuit




Gate Charge Waveform

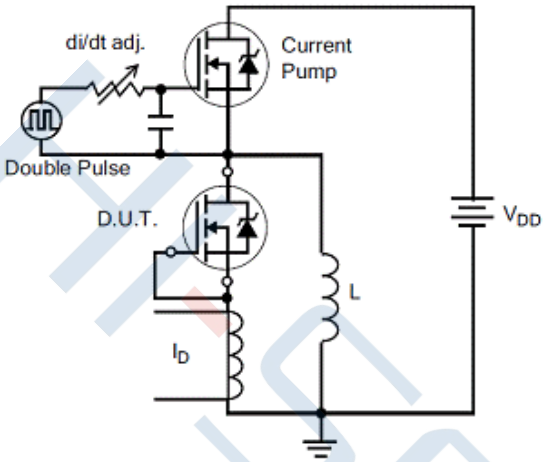



Resistive Switching Test Circuit

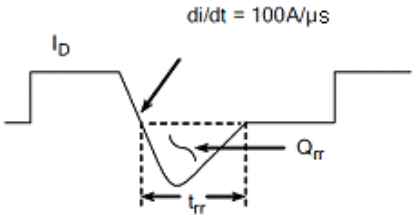



Resistive Switching Waveforms

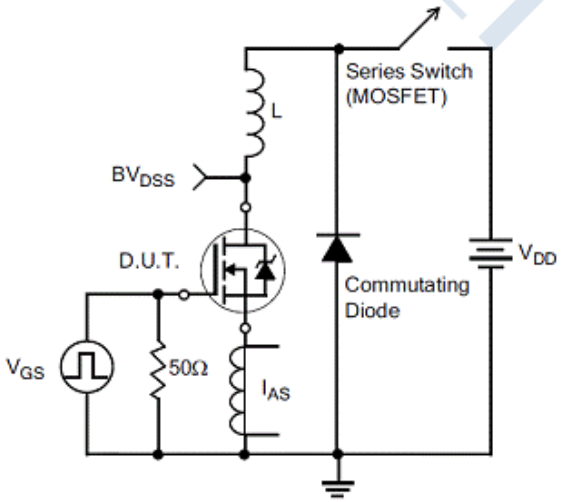
## Test Circuit



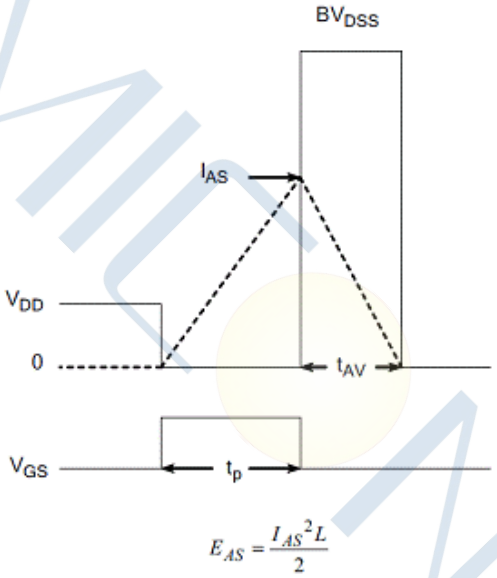

. Diode Reverse Recovery Test Circuit




. Diode Reverse Recovery Waveform

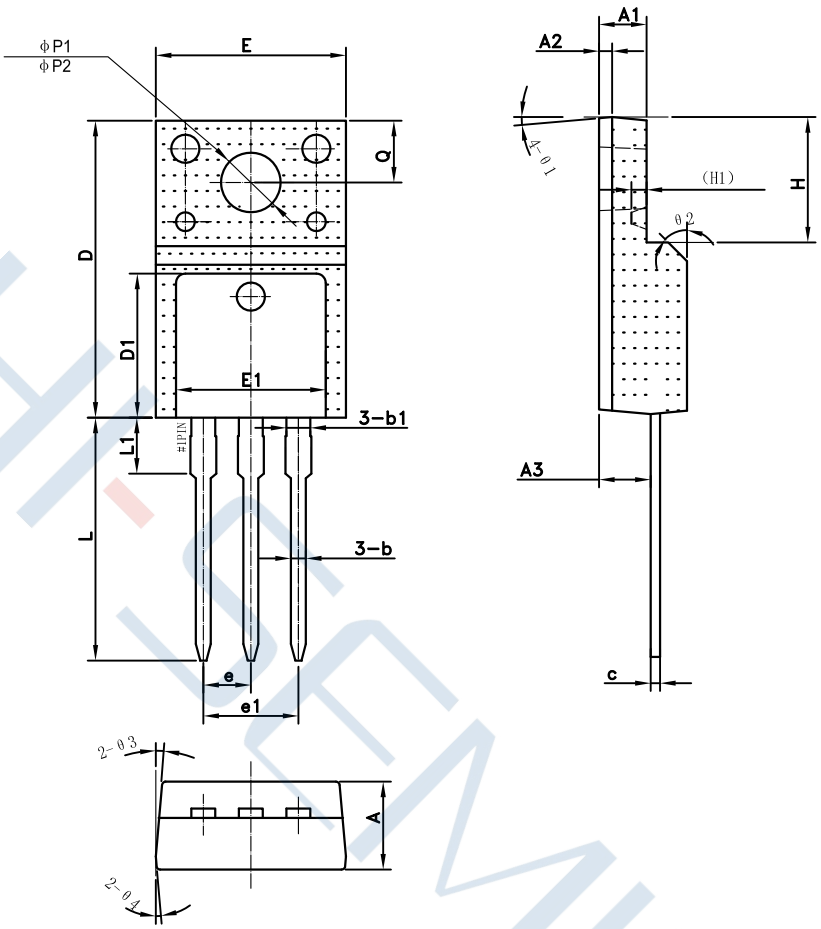



Unclamped Inductive Switching Test Circuit




. Unclamped Inductive Switching Waveforms

## Package Dimensions of TO 220F-3L




| Symbol | Mechanical Dimension/mm | | |
|---|---|---|---|
| | Min | Typ | Max |
| A | 4.50 | 4.70 | 4.90 |
| A1 | 2.44 | 2.54 | 2.64 |
| A2 | 0.60 | 0.70 | 0.80 |
| A3 | 2.56 | 2.76 | 2.96 |
| b | 0.70 | 0.80 | 0.95 |
| b1 | | 1.28 | |
| c | 0.45 | 0.50 | 0.65 |
| D | 15.67 | 15.87 | 16.07 |
| D1 | | 7.70 | |
| E | 9.96 | 10.16 | 10.36 |
| E1 | | 8.00 | |
| e | | 2.54 | |
| e1 | | 5.08 | |
| H | 6.50 | 6.70 | 6.90 |
| (H1) | | (0.81) | |
| L | 12.48 | 12.98 | 13.20 |
| L1 | | 2.93 | |
| ϕP1 | 2.98 | 3.18 | 3.38 |
| ϕP2 | 3.20 | 3.40 | 3.60 |
| Q | 3.10 | 3.30 | 3.50 |
| θ1 | | 5° | |
| θ2 | | 45° | |
| θ3 | | 5° | |
| θ4 | | 5° | |

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