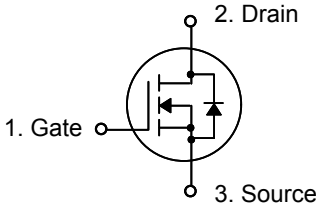
Pb Free Plating Product

# IRFP250MPbF

ThinkiSemi 200V,30A N-Channel Planar Process Power MOSFETs

## Features

- $R_{DS(on)}$ (Max 0.075Ω)@$V_{GS}$=10V
- Gate Charge (Max 123nC)
- Improved dv/dt Capability
- High ruggedness
- 100% Avalanche Tested




**$BV_{DSS}$ = 200V**

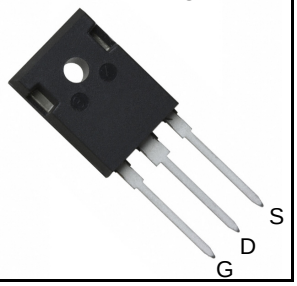
**$R_{DS(ON)}$ = 0.075 ohm**

**$I_D$ = 30A**

## General Description

This N-channel enhancement mode field-effect power transistor using THINKI Semiconductor advanced planar stripe, DMOS technology intended for off-line switch mode power supply.
Also, especially designed to minimize rds(on) and high rugged avalanche characteristics. The TO-247AD pkg is well suited for adaptor power unit and small power inverter application.

**THINKI-TO-247AD**




**Absolute Maximum Ratings**

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 30 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 21 | |
| $I_{DM}$ | Pulsed Drain Current ①⑤ | 120 | |
| $P_D$ @$T_C$ = 25°C | Maximum Power Dissipation | 214 | W |
| | Linear Derating Factor | 1.4 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ②⑤ | 315 | mJ |
| $I_{AR}$ | Avalanche Current ①⑤ | 30 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | 21 | mJ |
| dv/dt | Peak Diode Recovery dv/dt③⑤ | 8.6 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 175 | °C |
| | Soldering Temperature, for 10 seconds (1.6mm from case) | 300 | |
| | Mounting torque, 6-32 or M3 screw | 10 lbf•in (1.1N•m) | |

**Thermal Resistance**

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | — | 0.7 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 40 | |

**Electrical characteristics @ $T_J$ = 25°C (unless otherwise specified)**

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 200 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | 0.26 | —— | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | —— | —— | 0.075 | Ω | $V_{GS}$ = 10V, $I_D$ = 18A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | —— | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| gfs | Forward Trans conductance | 17 | —— | —— | S | $V_{DS}$ = 50V, $I_D$ = 18A④ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | 25 | μA | $V_{DS}$ = 200V, $V_{GS}$ = 0V |
| | | —— | —— | 250 | | $V_{DS}$ = 160V,$V_{GS}$ = 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 |

**Dynamic Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)**

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | —— | —— | 123 | nC | $I_D$ = 18A |
| $Q_{gs}$ | Gate-to-Source Charge | —— | —— | 21 | | $V_{DS}$ = 160V |
| $Q_{gd}$ | Gate-to-Drain Charge | —— | —— | 57 | | $V_{GS}$ = 10V, See Fig.6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 14 | | ns | $V_{DD}$ = 100V |
| $t_r$ | Rise Time | —— | 43 | —— | | $I_D$ = 18A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 41 | —— | | $R_G$= 3.9Ω |
| $t_f$ | Fall Time | —— | 33 | —— | | $R_D$= 5.5Ω , See Fig.10④ |
| $L_D$ | Internal Drain Inductance | —— | 5.0 | —— | nH | Between lead, 6mm (0.25in.) from package and center of die contact |
| $L_S$ | Internal Source Inductance | —— | 13 | —— | | |
| $C_{iss}$ | Input Capacitance | —— | 2159 | —— | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 315 | —— | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 83 | —— | | $f$ = 1.0MHz, See Fig.5 |

**Diode Characteristics**

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | —— | —— | 30 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | —— | —— | 120 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | 1.3 | V | $T_J$ = 25°C,$I_S$ = 18A,$V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | —— | 186 | 279 | ns | $T_J$ = 25°C ,$I_F$ = 18A |
| $Q_{rr}$ | Reverse Recovery Charge | —— | 1.3 | 2.0 | μC | di/dt = 100A/μs ④ |

**Notes:**

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

② Starting $T_J$ = 25°C, L = 1.9mH, $R_G$ = 25Ω, $I_{AS}$ = 18A.(See fig. 12).

③ $I_{SD}$ ≤ 18A, di/dt ≤ 374A/μs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_J$ ≤ 175°C.

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

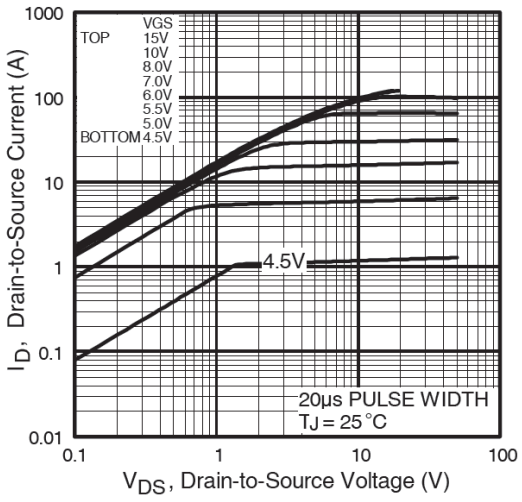



**Fig. 1** Typical Output Characteristics

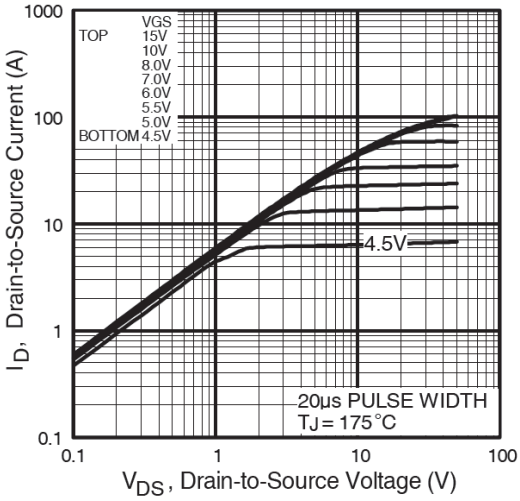



**Fig. 2** Typical Output Characteristics

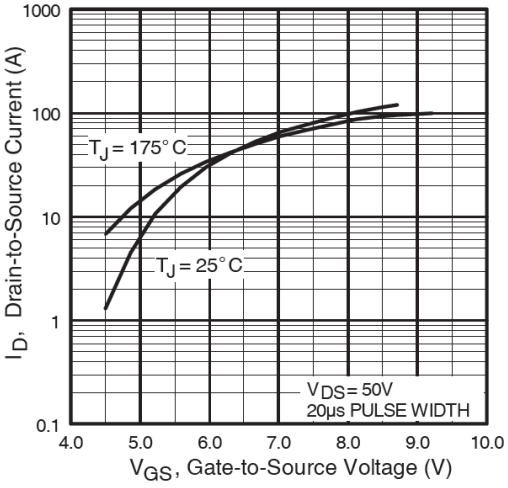



**Fig. 3** Typical Transfer Characteristics

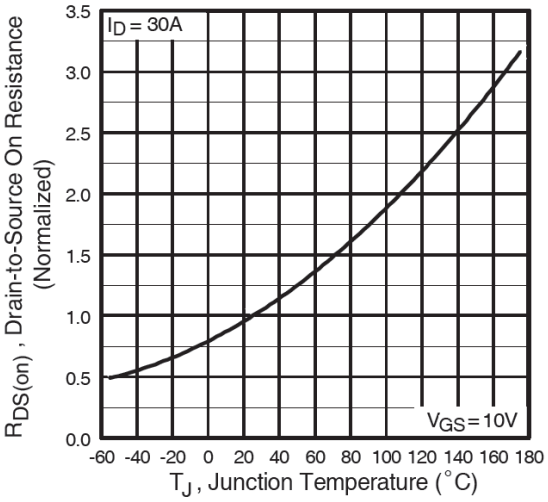



**Fig. 4** Normalized On-Resistance vs. Temperature

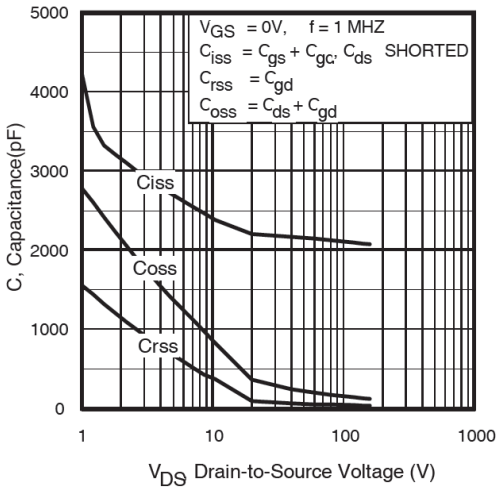



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

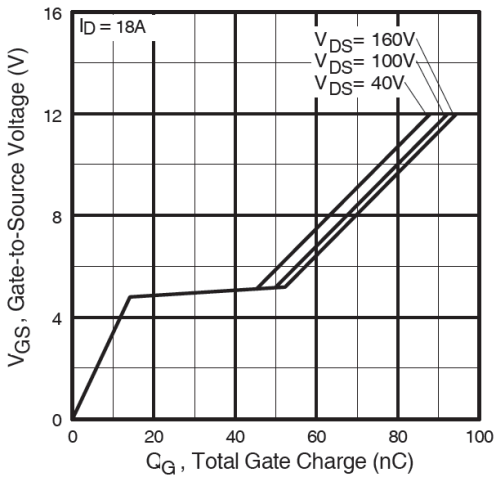



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

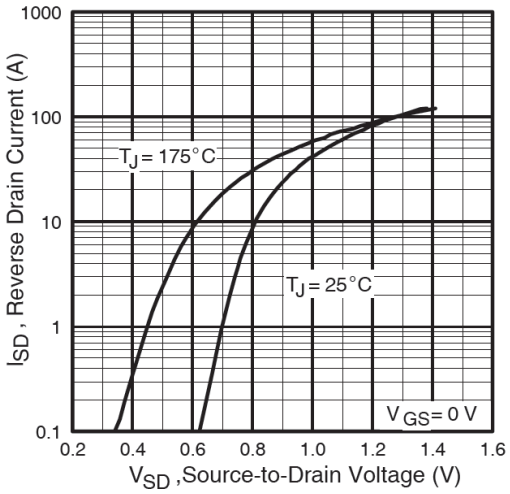



**Fig. 7** Typical Source-to-Drain Diode Forward Voltage

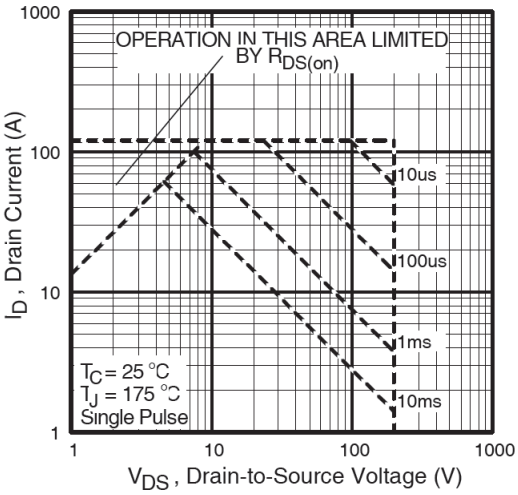



**Fig 8.** Maximum Safe Operating Area

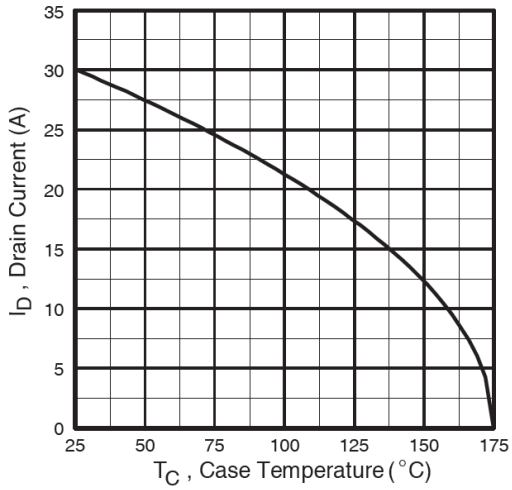



**Fig 9.** Maximum Drain Current vs. Case Temperature

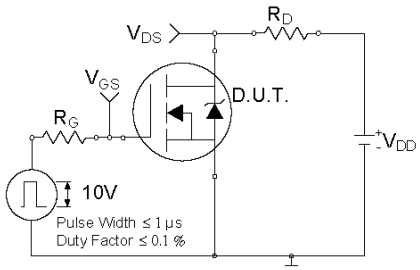



**Fig 10a.** Switching Time Test Circuit

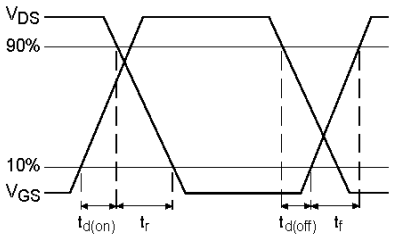



**Fig 10a.** Switching Time Waveforms

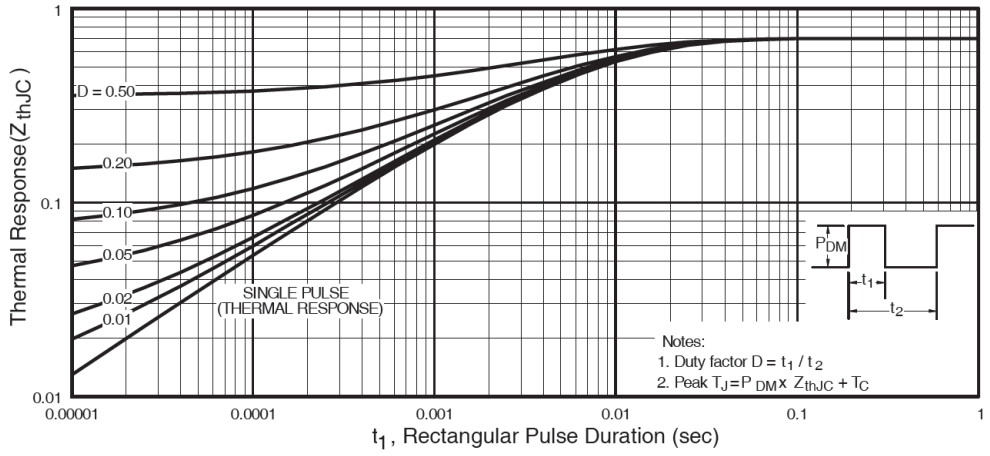



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

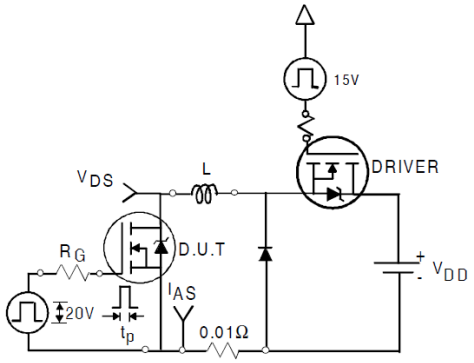



**Fig. 12a.** Unclamped Inductive Test Circuit

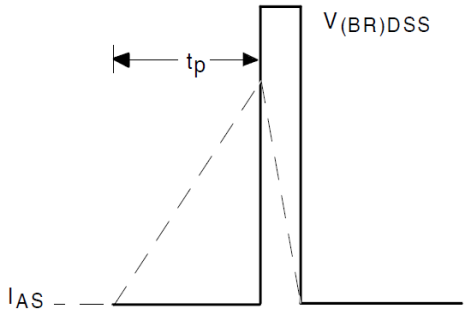



**Fig. 12b.** Unclamped Inductive Waveforms

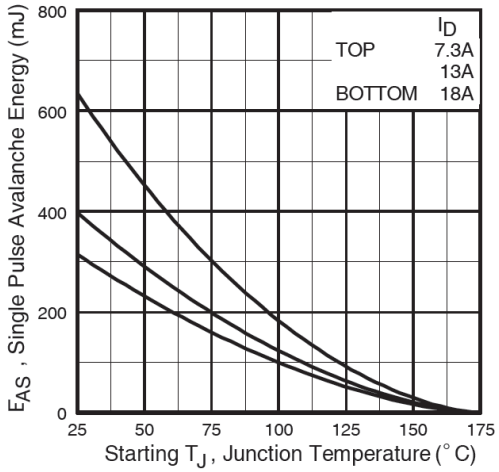



**Fig 12c.** Maximum Avalanche Energy vs. Drain Current

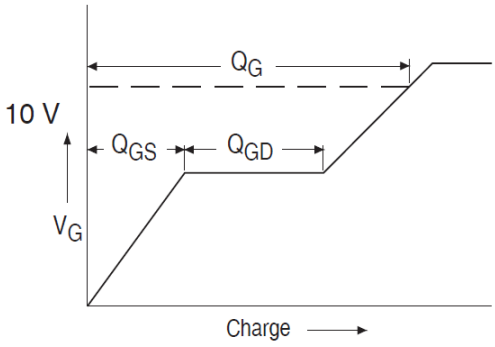



**Fig 13a.** Basic Gate Charge Waveform

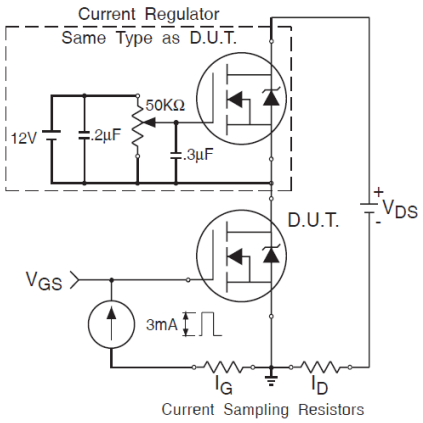



**Fig 13b.** Gate Charge Test Circuit

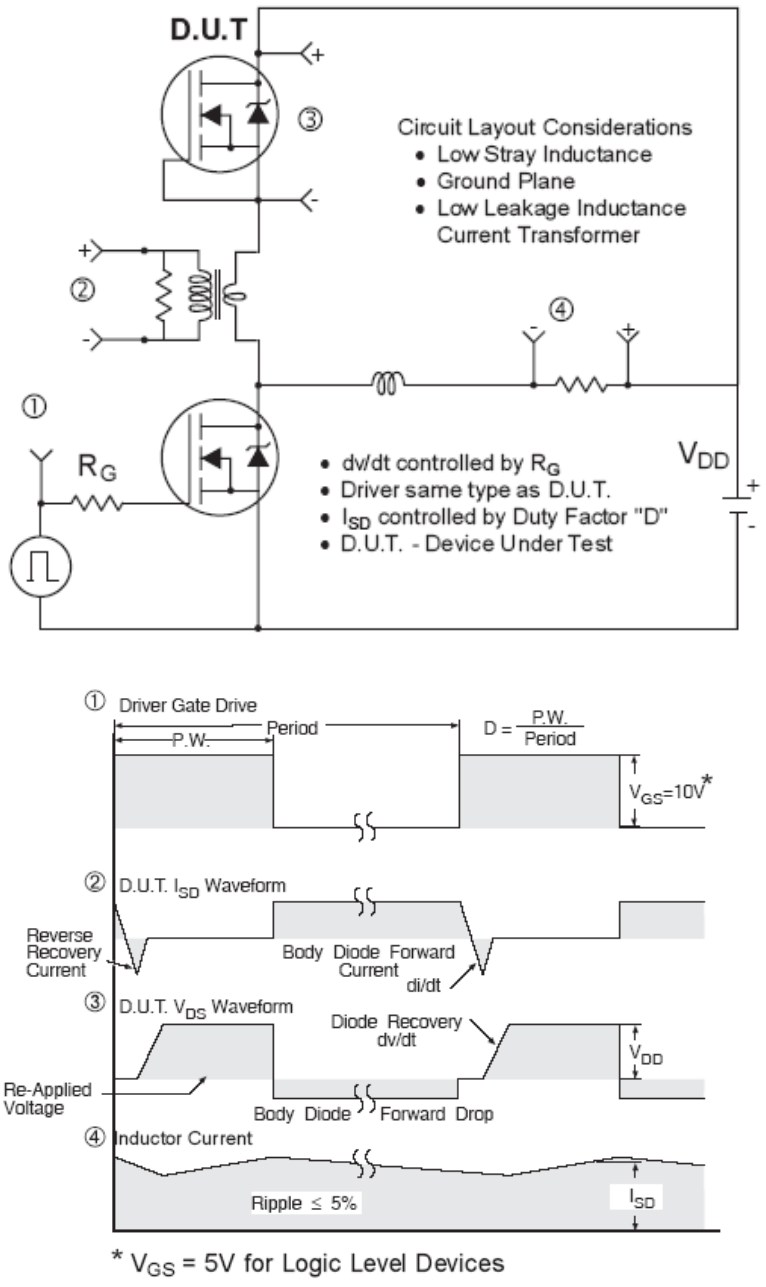
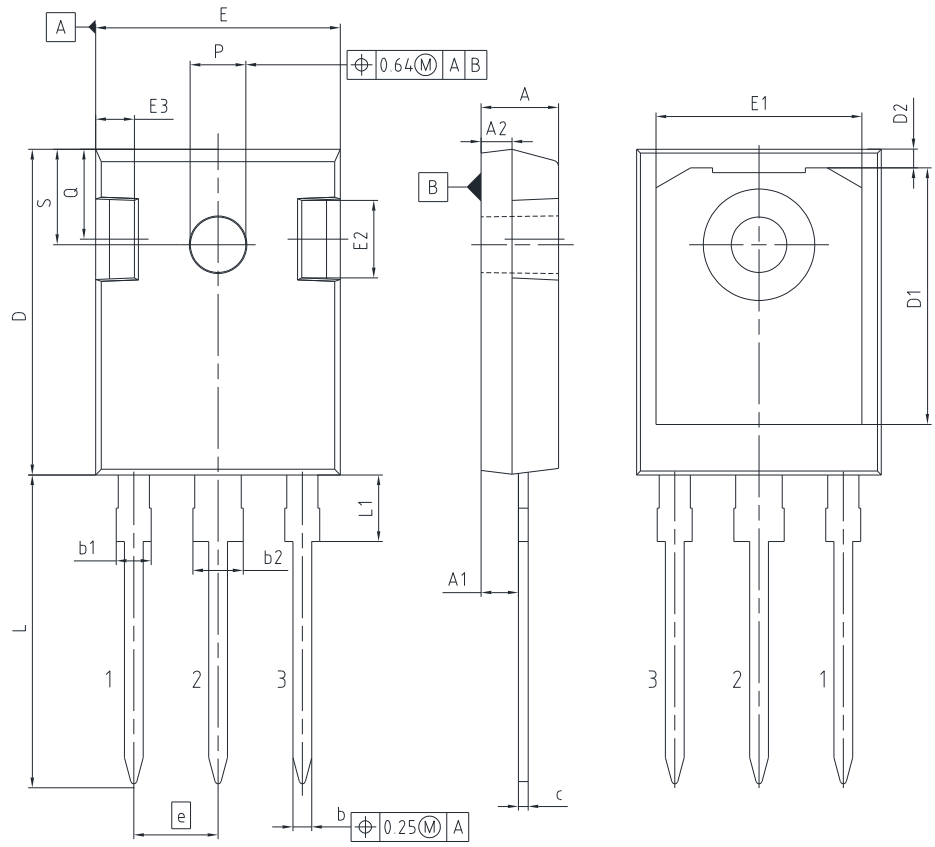



**Fig 14.** Peak Diode Recovery dv/dt Test Circuit for N-Channel IR MOSFET™

## THINKI TO-247AD MECHANICAL DATA




| DIMENSIONS | MILLIMETERS | |
|---|---|---|
| | MIN. | MAX. |
| **A** | 4.70 | 5.30 |
| **A1** | 2.20 | 2.60 |
| **A2** | 1.50 | 2.50 |
| **b** | 1.00 | 1.40 |
| **b1** | 1.60 | 2.41 |
| **b2** | 2.57 | 3.43 |
| **c** | 0.38 | 0.89 |
| **D** | 20.70 | 21.50 |
| **D1** | 13.08 | 17.65 |
| **D2** | 0.51 | 1.35 |
| **E** | 15.50 | 16.30 |
| **E1** | 12.38 | 14.15 |
| **E2** | 3.40 | 5.10 |
| **E3** | 1.00 | 2.60 |
| **e** | 5.44 | |
| **L** | 19.80 | 20.40 |
| **L1** | 3.85 | 4.50 |
| **P** | 3.50 | 3.70 |
| **Q** | 5.35 | 6.25 |
| **S** | 6.04 | 6.30 |