chanhvinh.com

PD - 96433A

International
IOR Rectifier

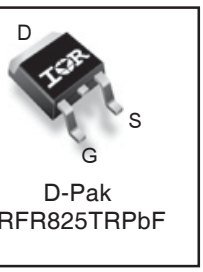
# IRFR825TRPbF

HEXFET® Power MOSFET

## Applications

- Zero Voltage Switching SMPS
- Uninterruptible Power Supplies
- Motor Control applications

| $V_{DSS}$ | $R_{DS(on)}$ typ. | Trr typ. | $I_D$ |
|---|---|---|---|
| 500V | 1.05Ω | 92ns | 6.0A |




D-Pak
IRFR825TRPbF

## Features and Benefits

- Fast body diode eliminates the need for external diodes in ZVS applications.
- Lower Gate charge results in simpler drive requirements.
- Higher Gate voltage threshold offers improved noise immunity.

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 6.0 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 3.9 | |
| $I_{DM}$ | Pulsed Drain Current ① | 24 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 119 | W |
| | Linear Derating Factor | 1.0 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| dv/dt | Peak Diode Recovery dv/dt ③ | 9.9 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case ) | |

## Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 6.0 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | — | — | 24 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.2 | V | $T_J$ = 25°C, $I_S$ = 6.0A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | — | 92 | 138 | ns | $T_J$ = 25°C, $I_F$ = 6.0A |
| | | — | 152 | 228 | | $T_J$ = 125°C, di/dt = 100A/µs ④ |
| $Q_{rr}$ | Reverse Recovery Charge | — | 167 | 251 | nC | $T_J$ = 25°C, $I_S$ = 6.0A, $V_{GS}$ = 0V ④ |
| | | — | 292 | 438 | | $T_J$ = 125°C, di/dt = 100A/µs ④ |
| $I_{RRM}$ | Reverse Recovery Current | — | 3.6 | 5.4 | A | $T_J$ = 25°C, $I_S$ = 6.0A, $V_{GS}$ = 0V di/dt = 100A/µs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

Notes ① through ⑦ are on page 2

chanhvinh.com



## Static @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 500 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.33 | — | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 1.05 | 1.3 | Ω | $V_{GS}$ = 10V, $I_D$ = 3.7A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 3.0 | — | 5.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | 25 | µA | $V_{DS}$ = 500V, $V_{GS}$ = 0V |
| | | — | — | 2.0 | mA | $V_{DS}$ = 400V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS}$ = -20V |

## Dynamic @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| gfs | Forward Transconductance | 7.5 | — | — | S | $V_{DS}$ = 50V, $I_D$ = 3.7A |
| $Q_g$ | Total Gate Charge | — | — | 34 | nC | $I_D$ = 6.0A |
| $Q_{gs}$ | Gate-to-Source Charge | — | — | 11 | | $V_{DS}$ = 400V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | — | — | 14 | | $V_{GS}$ = 10V, See Fig.14a &14b ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 8.5 | — | ns | $V_{DD}$ = 250V |
| $t_r$ | Rise Time | — | 25 | — | | $I_D$ = 6.0A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 30 | — | | $R_G$ =7.5Ω |
| $t_f$ | Fall Time | — | 20 | — | | $V_{GS}$ = 10V, See Fig. 15a & 15b ④ |
| $C_{iss}$ | Input Capacitance | — | 1346 | — | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | — | 76 | — | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 15 | — | | $f$ = 1.0KHz, See Fig. 5 |
| $C_{oss}$ | Output Capacitance | — | 1231 | — | | $V_{GS}$ = 0V, $V_{DS}$ = 1.0V, $f$ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | — | 25 | — | | $V_{GS}$ = 0V, $V_{DS}$ = 400V, $f$ = 1.0MHz |
| $C_{oss}$ eff. | Effective Output Capacitance | — | 51 | — | | $V_{GS}$ = 0V,$V_{DS}$ = 0V to 400V ⑤ |
| $C_{oss}$ eff. (ER) | Effective Output Capacitance (Energy Related) | — | 43 | — | | |

## Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy② | — | 178 | mJ |
| $I_{AR}$ | Avalanche Current ① | — | 3 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | — | 11.9 | mJ |

## Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case⑥ | — | 1.05 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mount) ⑦ | — | 50 | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 110 | |

**Notes:**

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

② Starting $T_J$ = 25°C, L = 40mH, $R_G$ = 25Ω,$I_{AS}$ = 3.0A. (See Figure 13).

③ $I_{SD}$ = 6.0A, di/dt ≤ 416A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$,$T_J$ ≤ 150°C.

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

⑤ $C_{oss}$ eff. is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$. $C_{oss}$ eff.(ER) is a fixed capacitance that stores the same energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.

⑥ $R_\theta$ is measured at $T_J$ approximately 90°C

⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniquea refer to applocation note # AN- 994 echniques refer to application note #AN-994.

chanhvinh.com



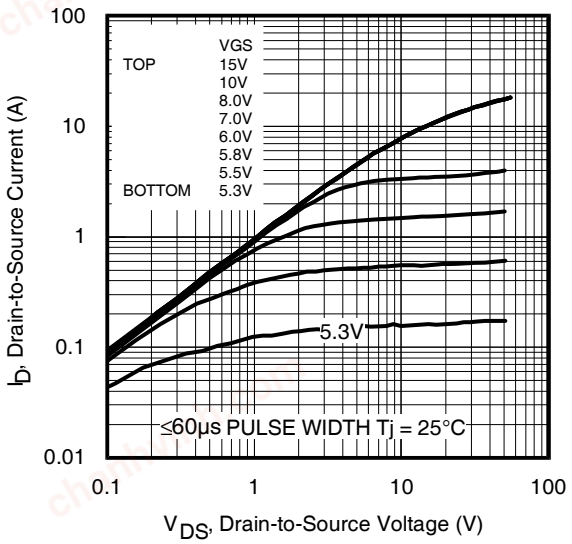



**Fig 1.** Typical Output Characteristics

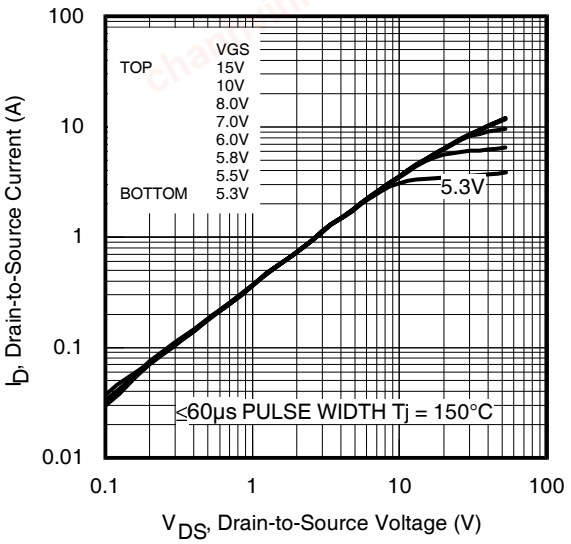



**Fig 2.** Typical Output Characteristics

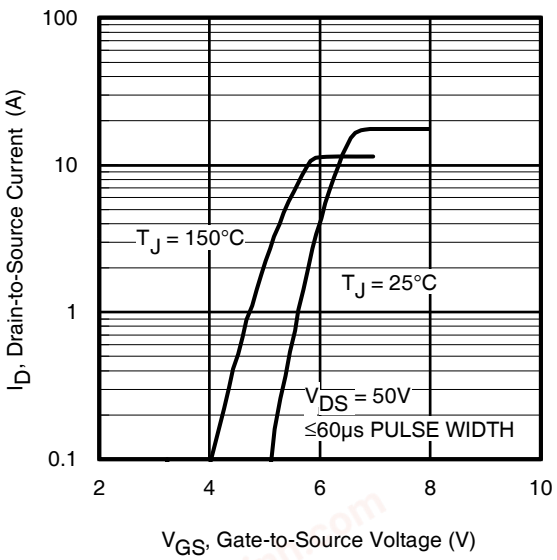



**Fig 3.** Typical Transfer Characteristics

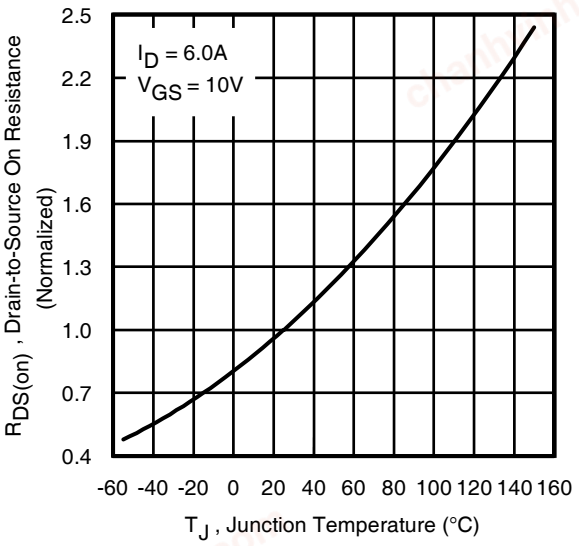



**Fig 4.** Normalized On-Resistance Vs. Temperature

chanhvinh.com



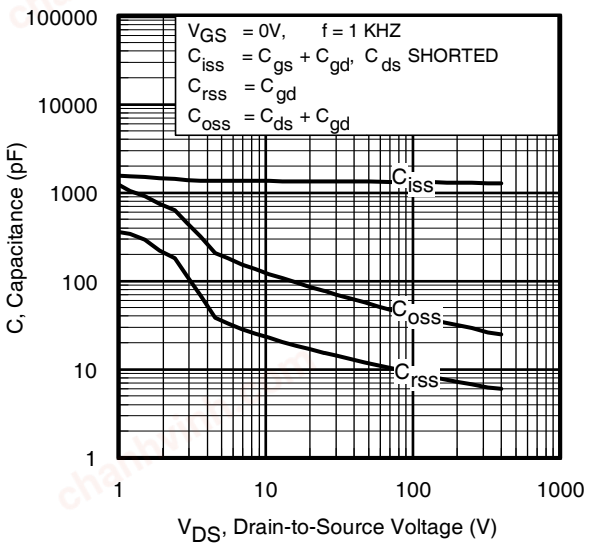



**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

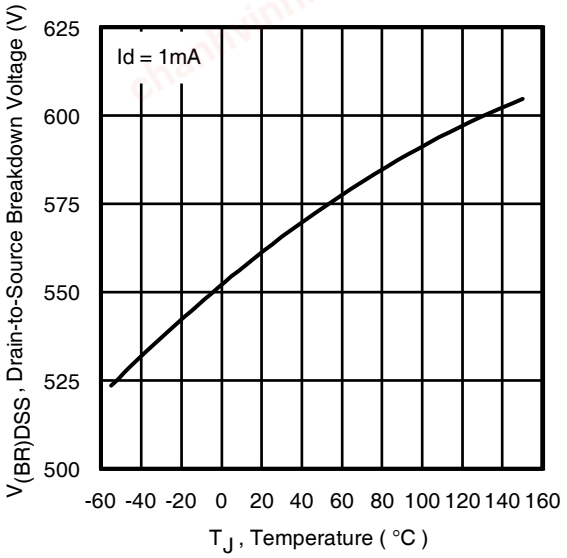
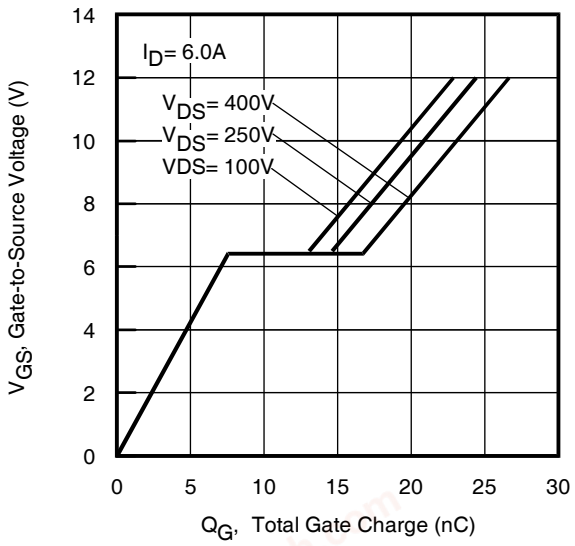
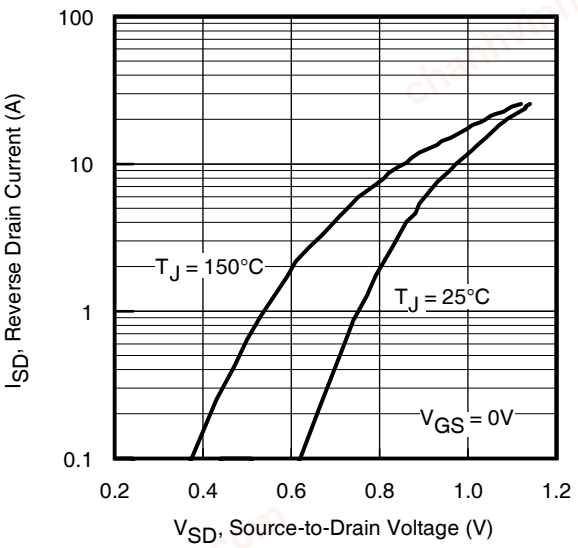



**Fig 6.** Typ. Breadown Voltage vs. Temperature



chanhvinh.com



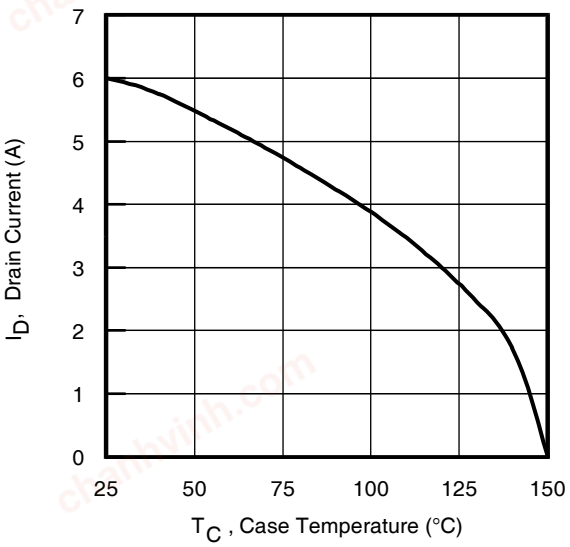



**Fig 9.** Maximum Drain Current Vs. Case Temperature

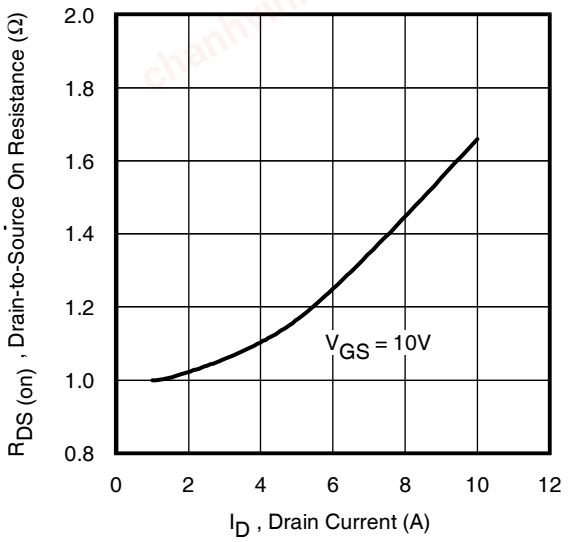



**Fig 9.** Typical Rdson Vs. Drain Current

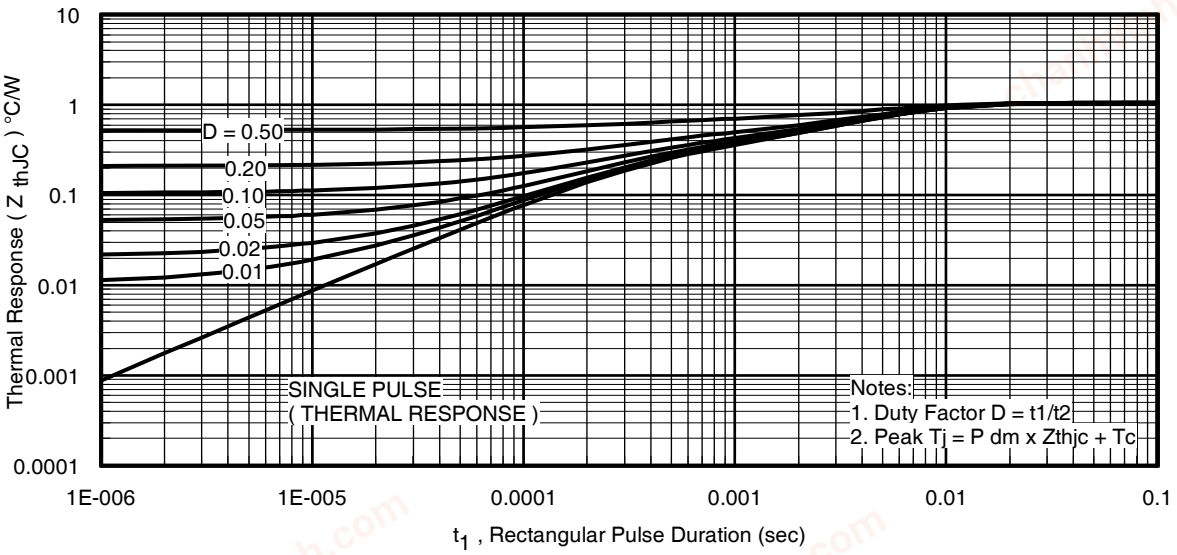



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

chanhvinh.com



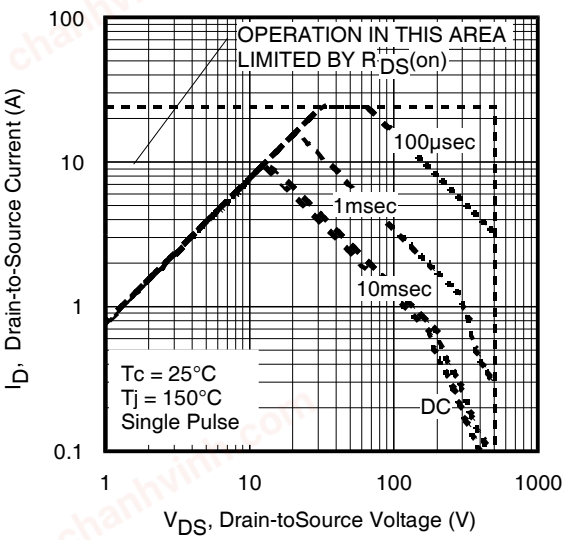



**Fig 12.** Maximum Safe Operating Area

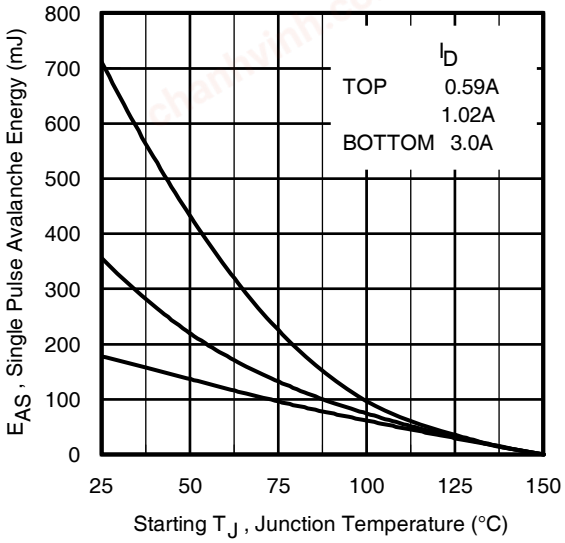



**Fig 13.** Maximum Avalanche Energy vs. Drain Current

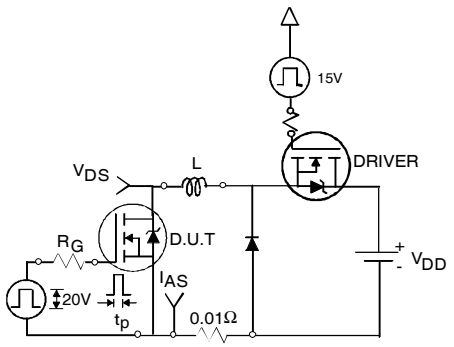



**Fig 13a.** Unclamped Inductive Test Circuit

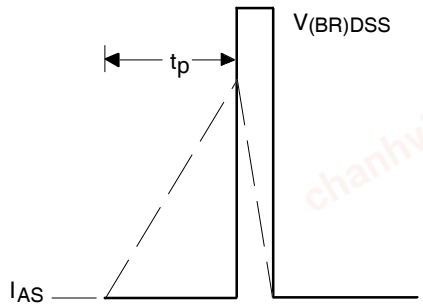



**Fig 13b.** Unclamped Inductive Waveforms

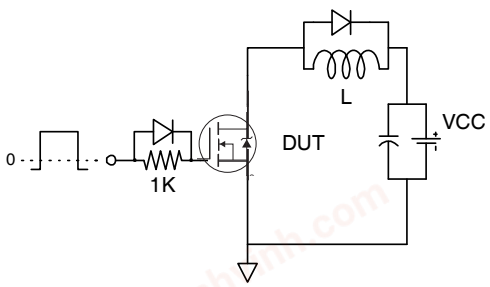



**Fig 14a.** Gate Charge Test Circuit

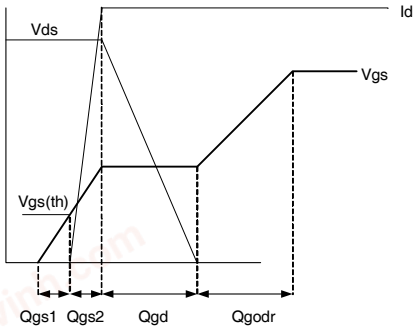



**Fig 14b.** Gate Charge Waveform

chanhvinh.com



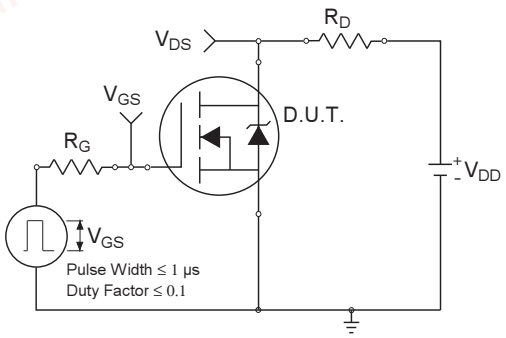



**Fig 15a.** Switching Time Test Circuit

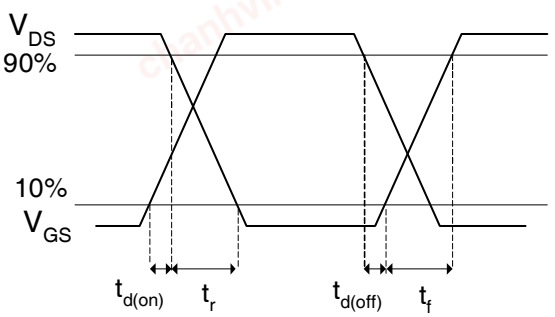
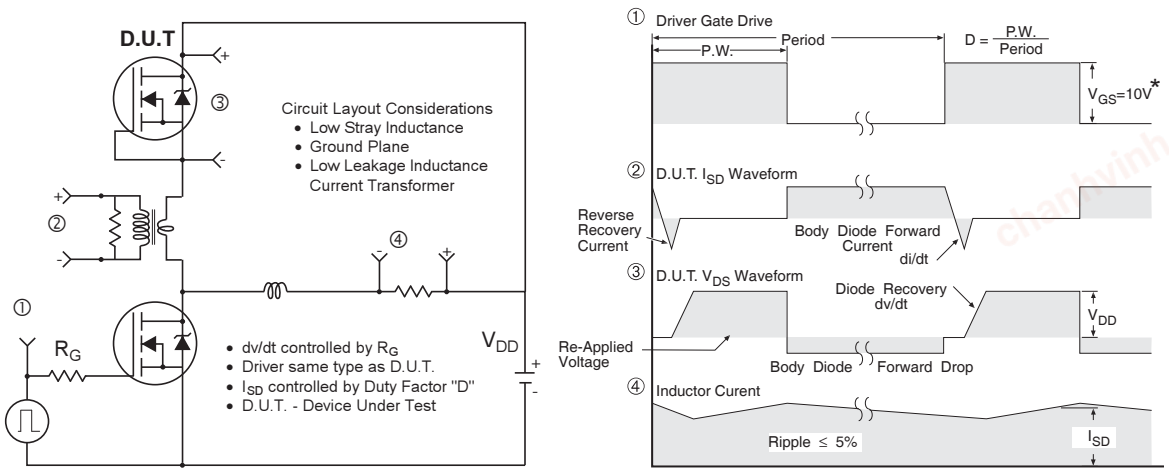



**Fig 15b.** Switching Time Waveforms




* $V_{GS}$ = 5V for Logic Level Devices

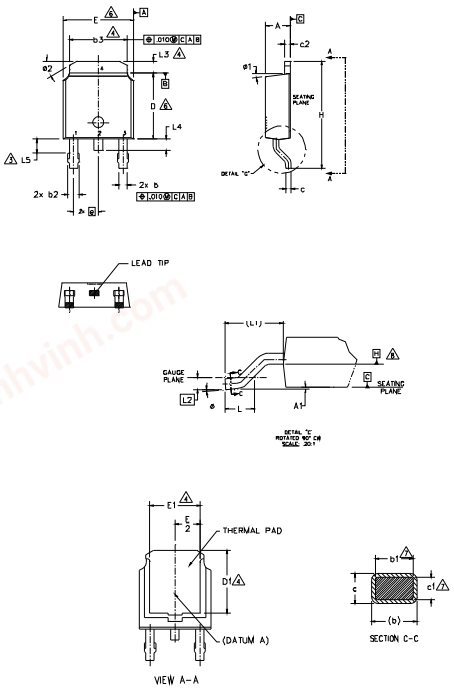
**Fig 16.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

chanhvinh.com



## D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)




NOTES:
1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS].
3.- LEAD DIMENSION UNCONTROLLED IN L5.
4.- DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
5.- SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
6.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
7.- DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.
8.- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 2.18 | 2.39 | .086 | .094 | |
| A1 | – | 0.13 | – | .005 | |
| b | 0.64 | 0.89 | .025 | .035 | |
| b1 | 0.65 | 0.79 | .025 | .031 | 7 |
| b2 | 0.76 | 1.14 | .030 | .045 | |
| b3 | 4.95 | 5.46 | .195 | .215 | 4 |
| c | 0.46 | 0.61 | .018 | .024 | |
| c1 | 0.41 | 0.56 | .016 | .022 | 7 |
| c2 | 0.46 | 0.89 | .018 | .035 | |
| D | 5.97 | 6.22 | .235 | .245 | 6 |
| D1 | 5.21 | – | .205 | – | 4 |
| E | 6.35 | 6.73 | .250 | .265 | 6 |
| E1 | 4.32 | – | 170 | – | 4 |
| e | 2.29 BSC | | .090 BSC | | |
| H | 9.40 | 10.41 | .370 | .410 | |
| L | 1.40 | 1.78 | .055 | .070 | |
| L1 | 2.74 BSC | | .108 REF. | | |
| L2 | 0.51 BSC | | .020 BSC | | |
| L3 | 0.89 | 1.27 | .035 | .050 | 4 |
| L4 | – | 1.02 | – | .040 | |
| L5 | 1.14 | 1.52 | .045 | .060 | 3 |
| ø | 0° | 10° | 0° | 10° | |
| ø1 | 0° | 15° | 0° | 15° | |
| ø2 | 25° | 35° | 25° | 35° | |

LEAD ASSIGNMENTS

HEXFET

1.- GATE
2.- DRAIN
3.- SOURCE
4.- DRAIN

IGBT & CoPAK

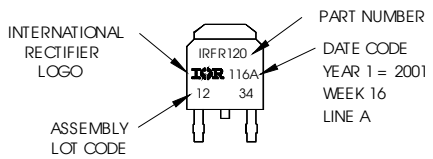
1.- GATE
2.- COLLECTOR
3.- EMITTER
4.- COLLECTOR

## D-Pak (TO-252AA) Part Marking Information

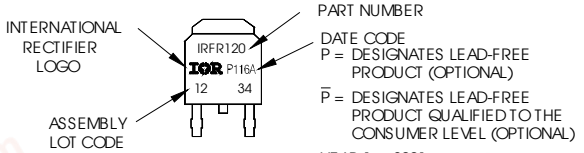
EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW 16, 2001
IN THE ASSEMBLY LINE "A"

Note: "P" in assembly line position indicates "Lead-Free"

"P̄" in assembly line position indicates "Lead-Free" qualification to the consumer-level




OR



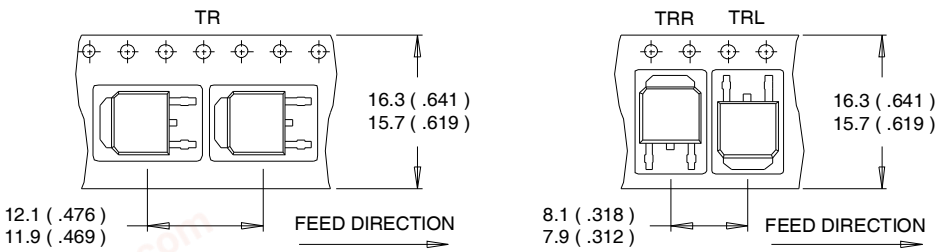

**Note: For the most current drawing please refer to IR website at http://www.irf.com/package/**

chanhvinh.com

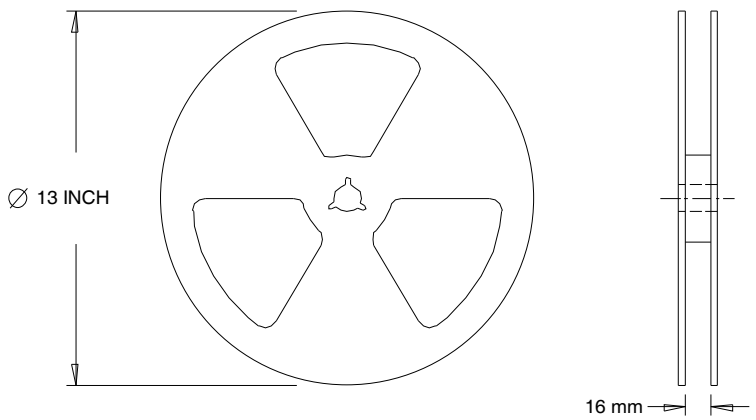


## D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)




NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS ( INCHES ).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.




NOTES :
1. OUTLINE CONFORMS TO EIA-481.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

**IR WORLD HEADQUARTERS:** 101N.Sepulveda Blvd, El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.12/2012