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# IRFR214B / IRFU214B

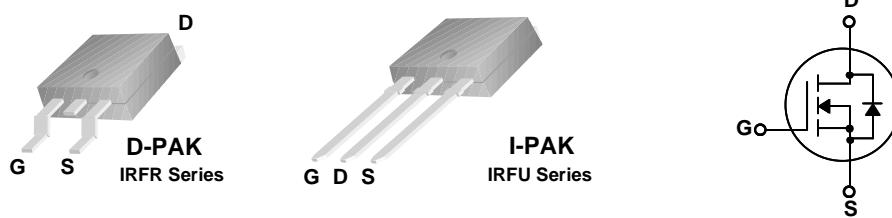
## 250V N-Channel MOSFET

### General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar, DMOS technology. This advanced technology has 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 well suited for high efficiency switching DC/DC converters and switch mode power supplies.

### Features

- 2.2A, 250V,  $R_{DS(on)} = 2.0\Omega$  @  $V_{GS} = 10$  V
- Low gate charge ( typical 8.1 nC)
- Low  $C_{RSS}$  ( typical 7.5 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



### Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	IRFR214B / IRFU214B	Units
$V_{DSS}$	Drain-Source Voltage	250	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	2.2	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	1.4	A
$I_{DM}$	Drain Current - Pulsed	(Note 1)	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	mJ
$I_{AR}$	Avalanche Current	(Note 1)	A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	V/ns
$P_D$	Power Dissipation ( $T_A = 25^\circ\text{C}$ ) *	2.5	W
	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	25	W
	- Derate above $25^\circ\text{C}$	0.2	W/ $^\circ\text{C}$
$T_J, T_{stg}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	5.08	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	50	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	110	$^\circ\text{C}/\text{W}$

\* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics

$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$	250	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.26	--	$\text{V}/^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 250 \text{ V}$ , $V_{\text{GS}} = 0 \text{ V}$	--	--	10	$\mu\text{A}$
		$V_{\text{DS}} = 200 \text{ V}$ , $T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{\text{GSSF}}$	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 30 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	100	nA
$I_{\text{GSSR}}$	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -30 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	-100	nA

## On Characteristics

$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_D = 250 \mu\text{A}$	2.0	--	4.0	V
$R_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10 \text{ V}$ , $I_D = 1.1 \text{ A}$	--	1.49	2.0	$\Omega$
$g_{\text{FS}}$	Forward Transconductance	$V_{\text{DS}} = 40 \text{ V}$ , $I_D = 1.1 \text{ A}$ (Note 4)	--	2.4	--	S

## Dynamic Characteristics

$C_{\text{iss}}$	Input Capacitance	$V_{\text{DS}} = 25 \text{ V}$ , $V_{\text{GS}} = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$	--	210	275	pF
$C_{\text{oss}}$	Output Capacitance		--	35	45	pF
$C_{\text{rss}}$	Reverse Transfer Capacitance		--	7.5	10	pF

## Switching Characteristics

$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{\text{DD}} = 125 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $R_G = 25 \Omega$	--	6.0	22	ns
$t_r$	Turn-On Rise Time		--	30	70	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		--	25	60	ns
$t_f$	Turn-Off Fall Time		--	30	70	ns
$Q_g$	Total Gate Charge	$V_{\text{DS}} = 200 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $V_{\text{GS}} = 10 \text{ V}$	--	8.1	10.5	nC
$Q_{\text{gs}}$	Gate-Source Charge		--	1.4	--	nC
$Q_{\text{gd}}$	Gate-Drain Charge		--	3.5	--	nC

## Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	2.2	A	
$I_{\text{SM}}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	8.5	A	
$V_{\text{SD}}$	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0 \text{ V}$ , $I_S = 2.2 \text{ A}$	--	--	1.5	V
$t_{\text{rr}}$	Reverse Recovery Time	$V_{\text{GS}} = 0 \text{ V}$ , $I_S = 2.8 \text{ A}$ , $dI_F / dt = 100 \text{ A}/\mu\text{s}$	--	130	--	ns
$Q_{\text{rr}}$	Reverse Recovery Charge		--	0.49	--	$\mu\text{C}$

### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 14.9\text{mH}$ ,  $I_{\text{AS}} = 2.2\text{A}$ ,  $V_{\text{DD}} = 50\text{V}$ ,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{\text{SD}} \leq 2.8\text{A}$ ,  $dI/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{\text{DD}} \leq \text{BV}_{\text{DSS}}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## Typical Characteristics

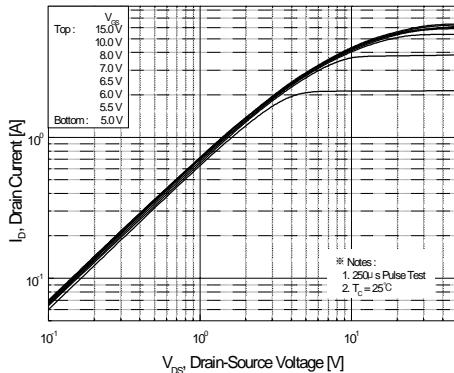


Figure 1. On-Region Characteristics

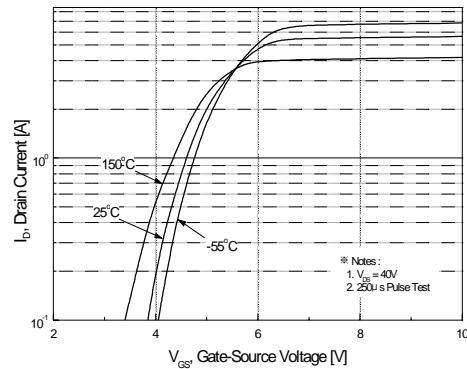


Figure 2. Transfer Characteristics

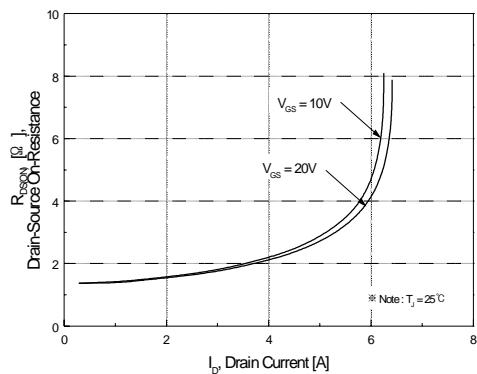


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

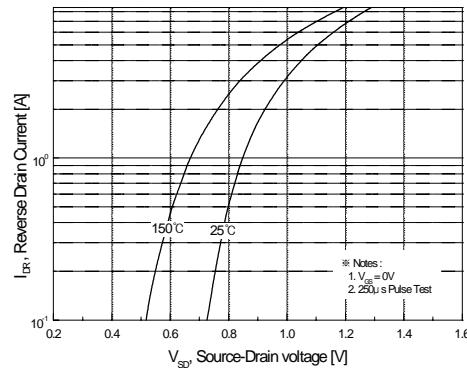


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

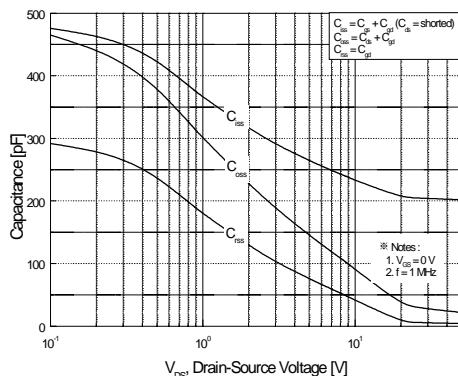


Figure 5. Capacitance Characteristics

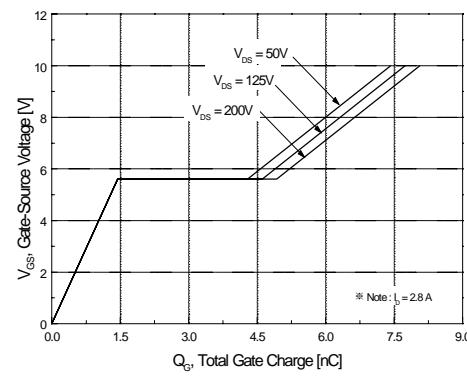
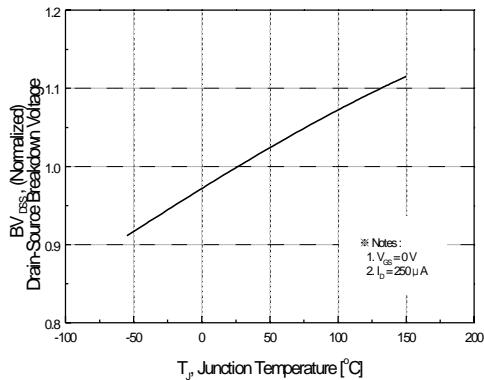
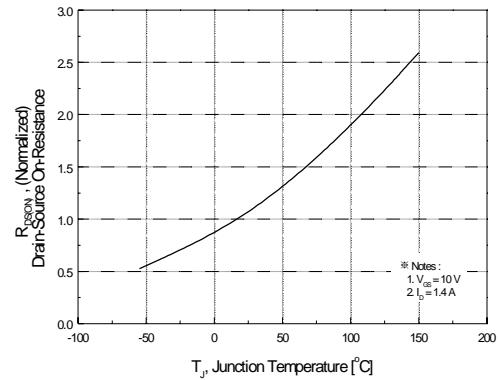


Figure 6. Gate Charge Characteristics

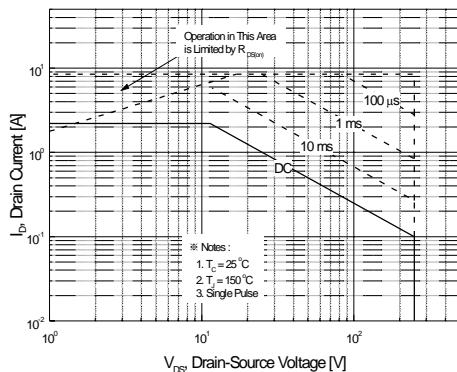
**Typical Characteristics** (Continued)



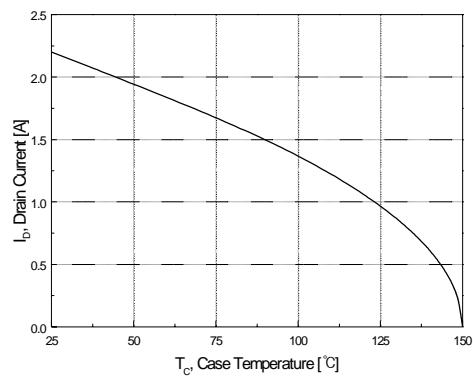
**Figure 7. Breakdown Voltage Variation vs Temperature**



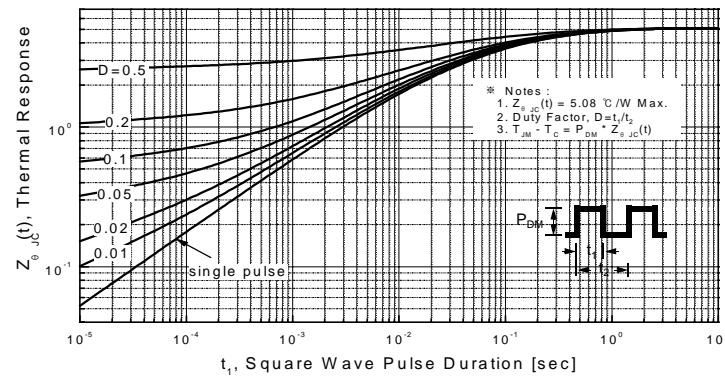
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9. Maximum Safe Operating Area**

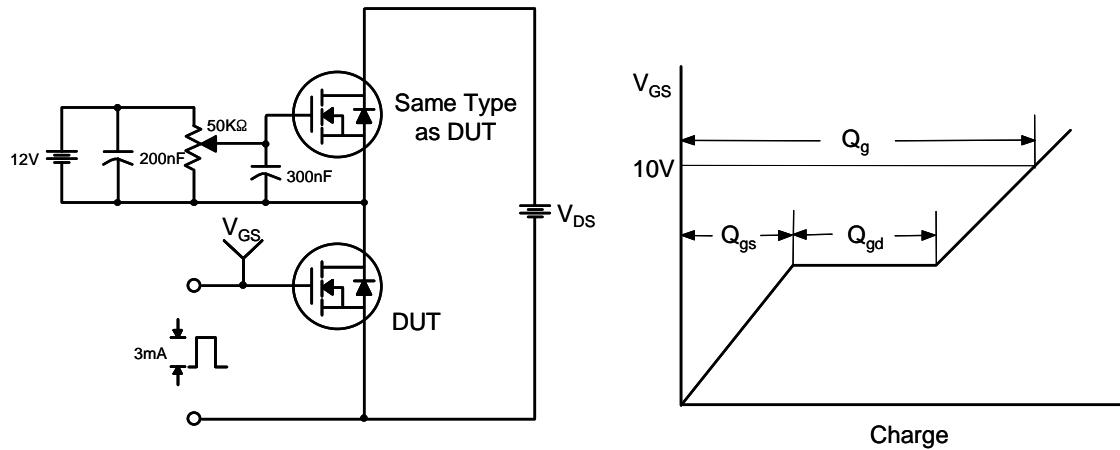


**Figure 10. Maximum Drain Current vs Case Temperature**

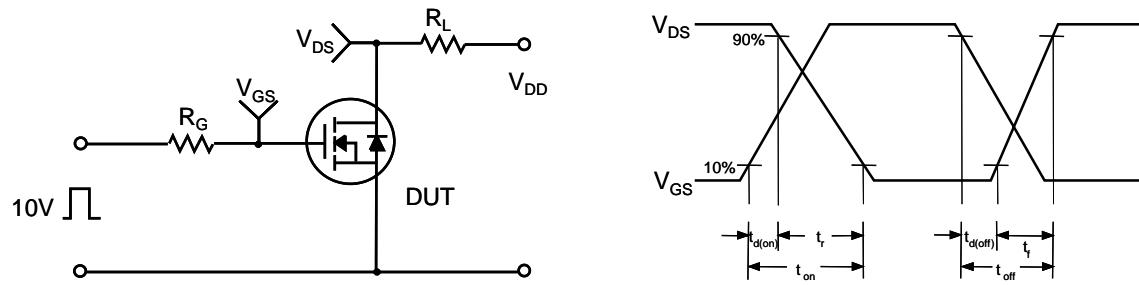


**Figure 11. Transient Thermal Response Curve**

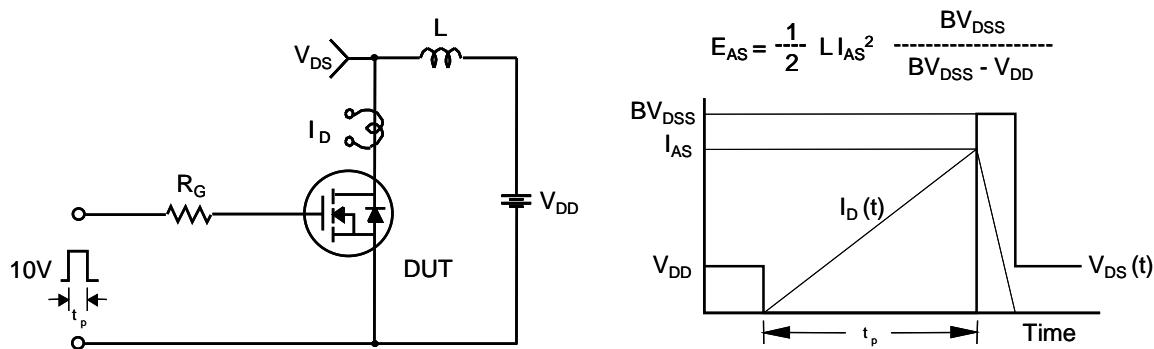
Gate Charge Test Circuit & Waveform

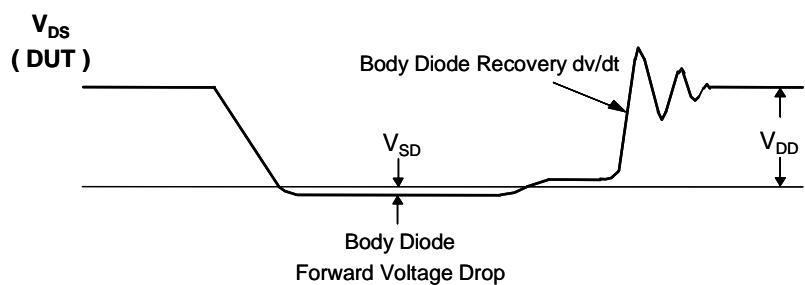
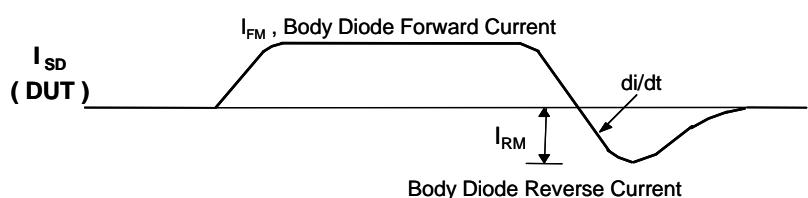
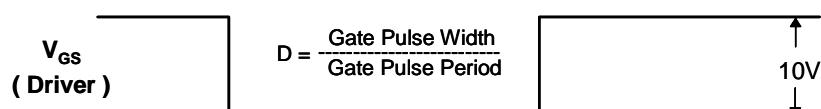
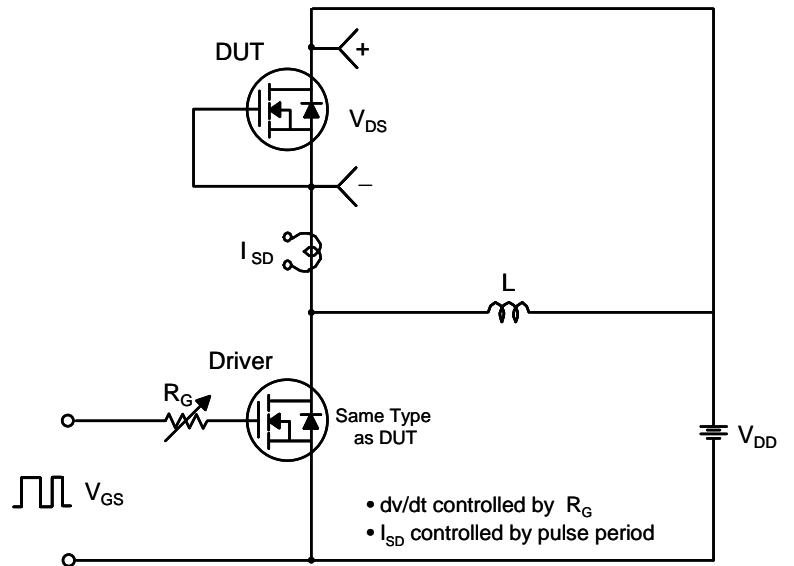


Resistive Switching Test Circuit & Waveforms



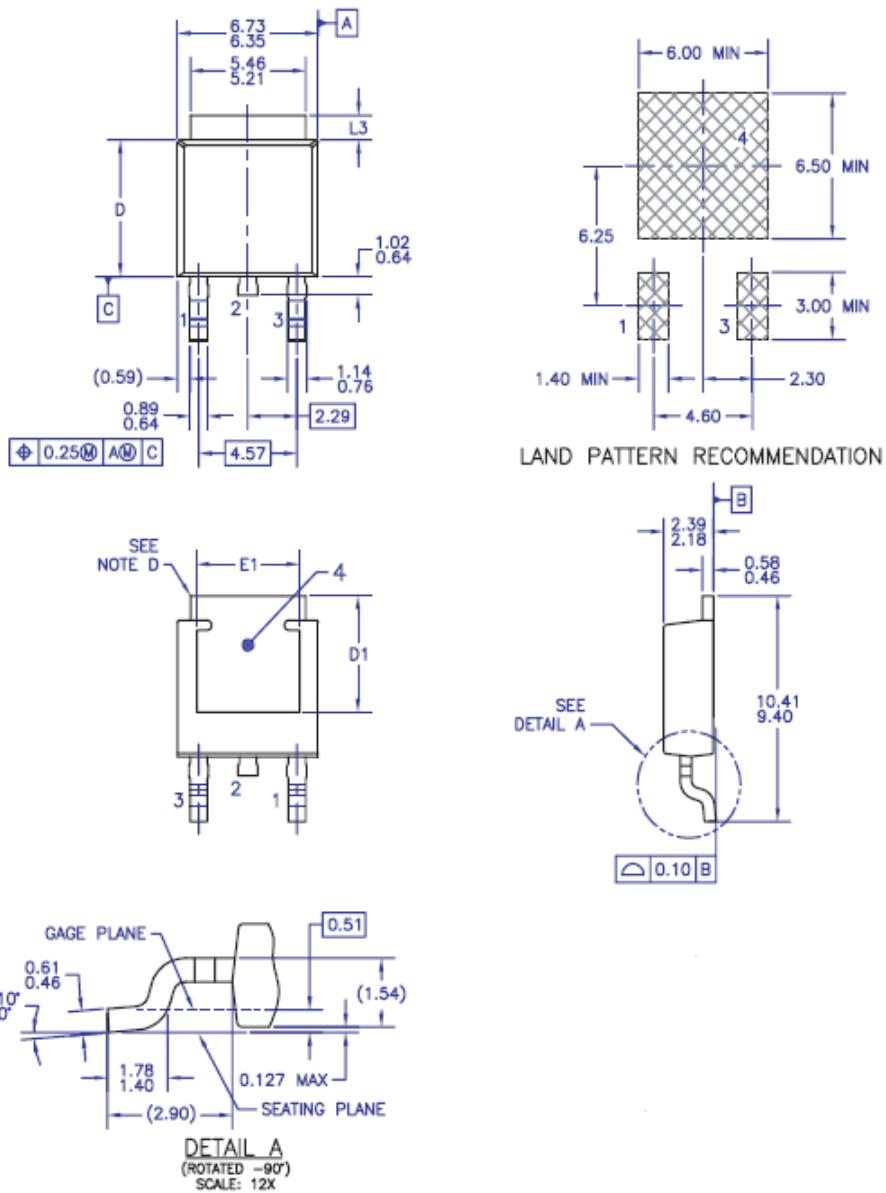
Unclamped Inductive Switching Test Circuit & Waveforms



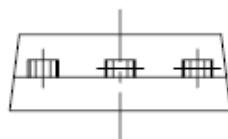
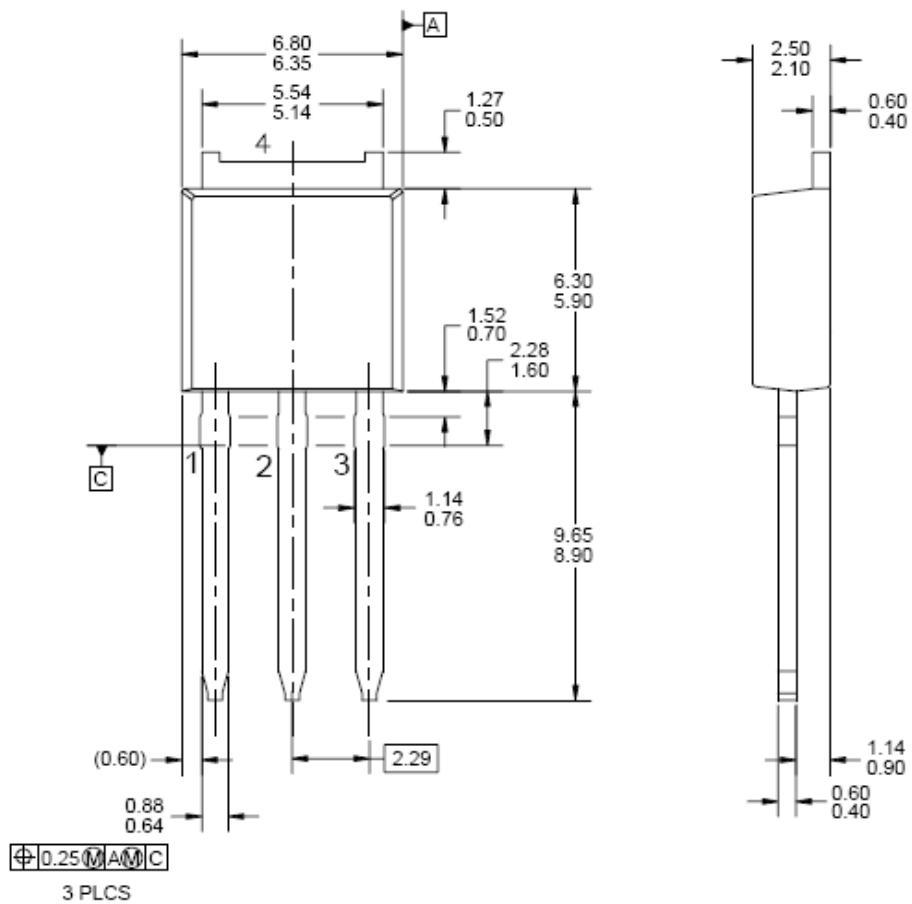
Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions

## D - PAK



### Dimensions in Millimeters

**Mechanical Dimensions****I - PAK**

Dimensions in Millimeters

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