

**REPETITIVE AVALANCHE AND  $dv/dt$  RATED  
HEXFET® TRANSISTOR**

**IRFE310  
JANTX2N6786U  
JANTXV2N6786U  
[REF:MIL-PRF-19500/556]  
N-CHANNEL**

**400V, 3.6 $\Omega$ , HEXFET**

The leadless chip carrier (LCC) package represents the logical next step in the continual evolution of surface mount technology. The LCC provides designers the extra flexibility they need to increase circuit board density. International Rectifier has engineered the LCC package to meet the specific needs of the power market by increasing the size of the bottom source pad, thereby enhancing the thermal and electrical performance. The lid of the package is grounded to the source to reduce RF interference. HEXFET transistors also feature all of the well-established advantages of MOSFETs, such as voltage control, very fast switching, ease of paralleling and electrical parameter temperature stability. They are well-suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high-energy pulse circuits, and virtually any application where high reliability is required.

**Product Summary**

Part Number	BV <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRFE310	400V	3.6 $\Omega$	1.25A

**Features:**

- Hermetically Sealed
- Simple Drive Requirements
- Ease of Paralleling
- Small footprint
- Surface Mount
- Lightweight

**Absolute Maximum Ratings**


	Parameter	IRFE310, JANTX-, JANTXV-, 2N6786U	Units
I <sub>D</sub> @ V <sub>GS</sub> = 10V, T <sub>C</sub> = 25°C	Continuous Drain Current	1.25	A
I <sub>D</sub> @ V <sub>GS</sub> = 10V, T <sub>C</sub> = 100°C	Continuous Drain Current	0.80	
I <sub>DM</sub>	Pulsed Drain Current ①	5.5	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Max. Power Dissipation	15	W
	Linear Derating Factor	0.12	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	±20	V
EAS	Single Pulse Avalanche Energy ②	34	mJ
dv/dt	Peak Diode Recovery dv/dt ③	2.8	V/ns
T <sub>J</sub>	Operating Junction	-55 to 150	°C
T <sub>STG</sub>	Storage Temperature Range		
	Surface Temperature	300 ( for 5 seconds)	
	Weight	0.42 (typical)	g

## IRFE310, JANTX-, JANTXV-, 2N6786U Devices

### Electrical Characteristics @ T<sub>j</sub> = 25°C (Unless Otherwise Specified)

	Parameter	Min	Typ	Max	Units	Test Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	400	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 1.0mA
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Temperature Coefficient of Breakdown Voltage	—	0.37	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1.0mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-State Resistance	—	—	3.6		V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.8A ④
		—	—	3.7		V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.25A
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	—	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
g <sub>fs</sub>	Forward Transconductance	0.87	—	—	S (r <sub>S</sub> )	V <sub>DS</sub> > 15V, I <sub>DS</sub> = 0.8A ④
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	—	—	25	μA	V <sub>DS</sub> = 0.8 x Max Rating, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 0.8 x Max Rating, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Leakage Forward	—	—	100	nA	V <sub>GS</sub> = 20V
I <sub>GSS</sub>	Gate-to-Source Leakage Reverse	—	—	-100		V <sub>GS</sub> = -20V
Q <sub>g</sub>	Total Gate Charge	—	—	8.4	nC	V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.25A
Q <sub>gs</sub>	Gate-to-Source Charge	—	—	1.6		V <sub>DS</sub> = Max Rating x 0.5
Q <sub>gd</sub>	Gate-to-Drain ('Miller') Charge	—	—	5.0		
t <sub>d(on)</sub>	Turn-On Delay Time	—	—	15	ns	V <sub>DD</sub> = 15V, I <sub>D</sub> = 1.25A, R <sub>G</sub> = 7.5Ω
t <sub>r</sub>	Rise Time	—	—	20		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	—	35		
t <sub>f</sub>	Fall Time	—	—	30		
L <sub>D</sub>	Internal Drain Inductance	—	5.0	—	nH	Measured from drain lead, 6mm (0.25 in) from package to center of die.
L <sub>S</sub>	Internal Source Inductance	—	15	—		Measured from source lead, 6mm (0.25 in) from package to source bonding pad.
C <sub>iss</sub>	Input Capacitance	—	190	—	pF	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	65	—		
C <sub>rss</sub>	Reverse Transfer Capacitance	—	24	—		

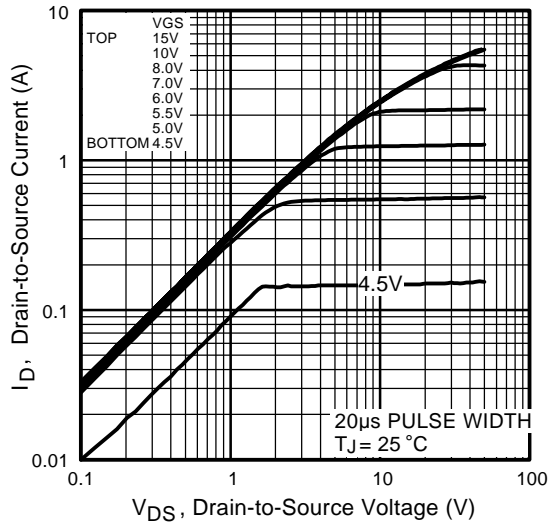
### Source-Drain Diode Ratings and Characteristics

	Parameter	Min	Typ	Max	Units	Test Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	1.25	A	Modified MOSFET symbol showing the integral reverse p-n junction rectifier. 
I <sub>SM</sub>	Pulse Source Current (Body Diode) ①	—	—	5.5		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.4	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 1.25A, V <sub>GS</sub> = 0V ④
t <sub>rr</sub>	Reverse Recovery Time	—	—	540	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 1.25A, di/dt ≤ 100A/μs V <sub>DD</sub> ≤ 50V ④
Q <sub>RR</sub>	Reverse Recovery Charge	—	—	4.5	μC	
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by L <sub>S</sub> + L <sub>D</sub> .				

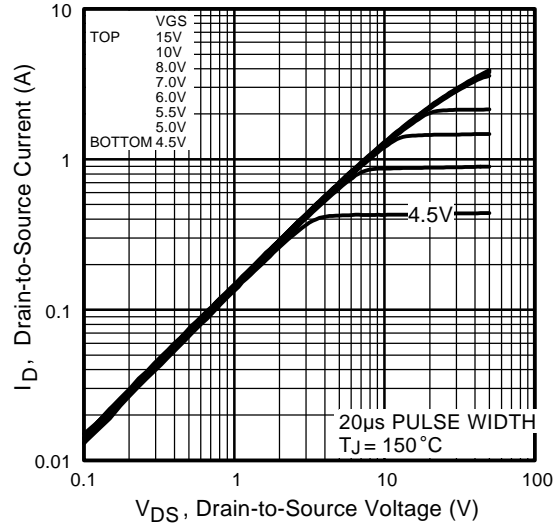
### Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R <sub>thJC</sub>	Junction-to-Case	—	—	8.3	°C/W	
R <sub>thJ-PCB</sub>	Junction-to-PC board	—	—	27		soldered to a copper-clad PC board

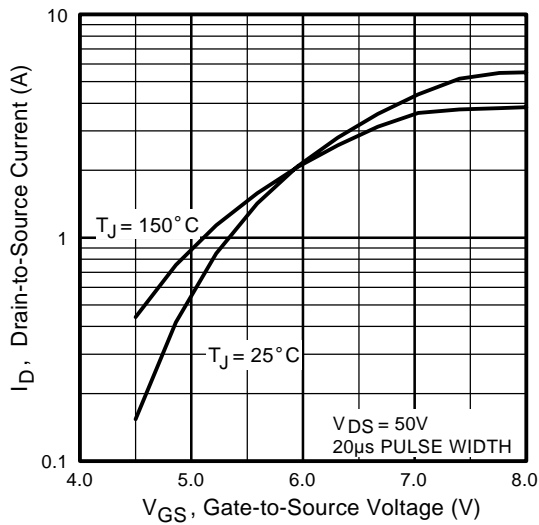
## IRFE310, JANTX-, JANTXV-, 2N6786U Devices



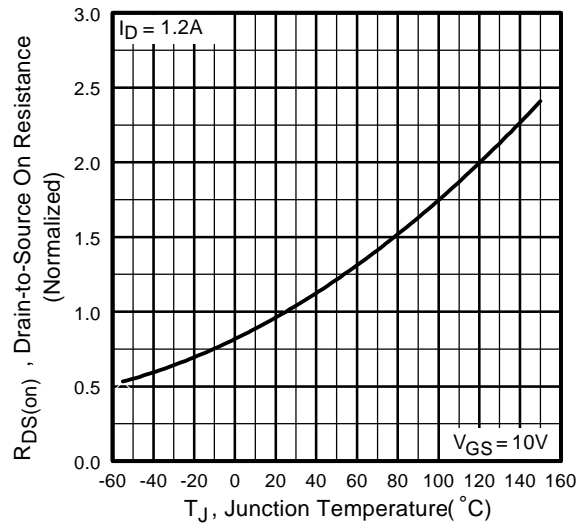
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

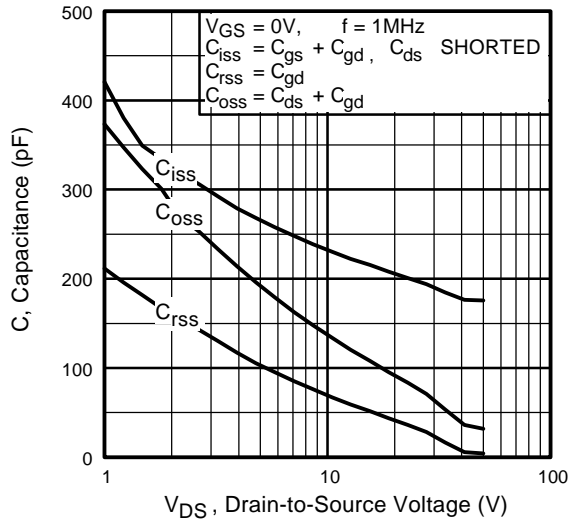


**Fig 3.** Typical Transfer Characteristics

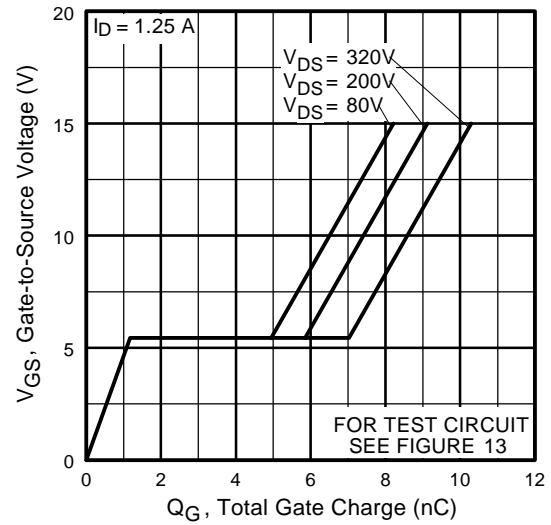


**Fig 4.** Normalized On-Resistance Vs. Temperature

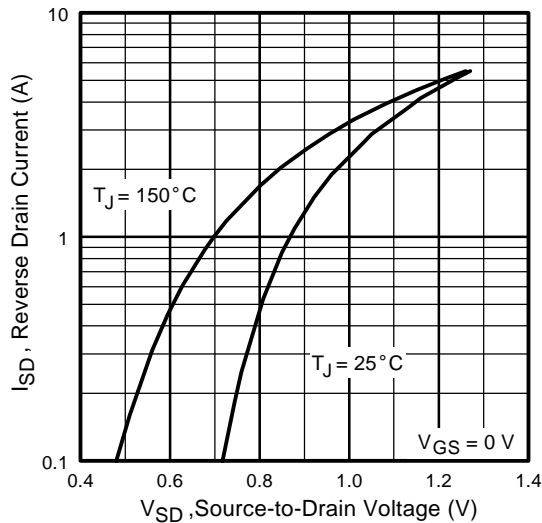
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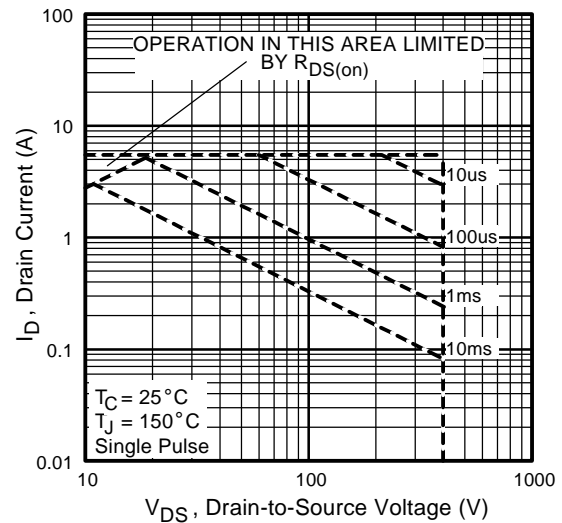
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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

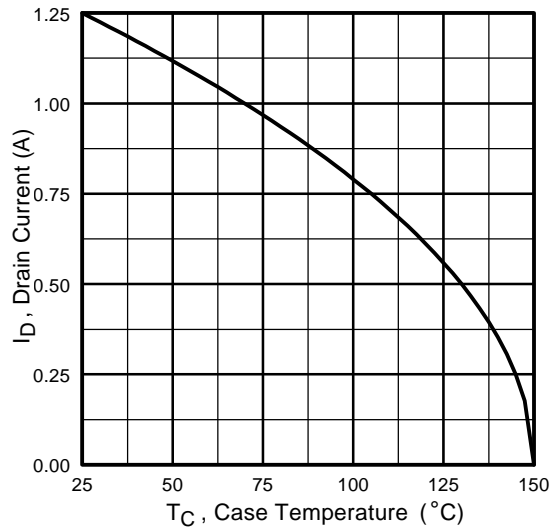


**Fig 7.** Typical Source-Drain Diode Forward Voltage

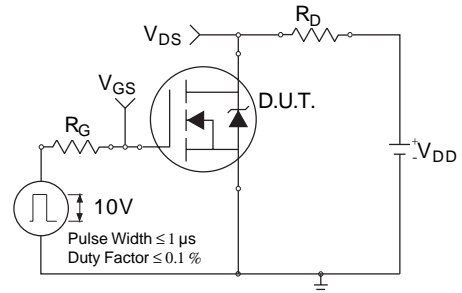


**Fig 8.** Maximum Safe Operating Area

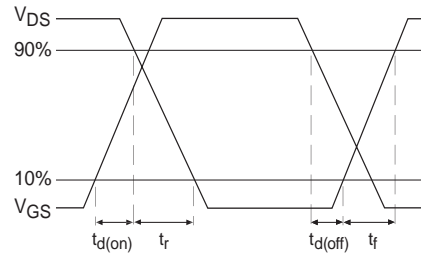
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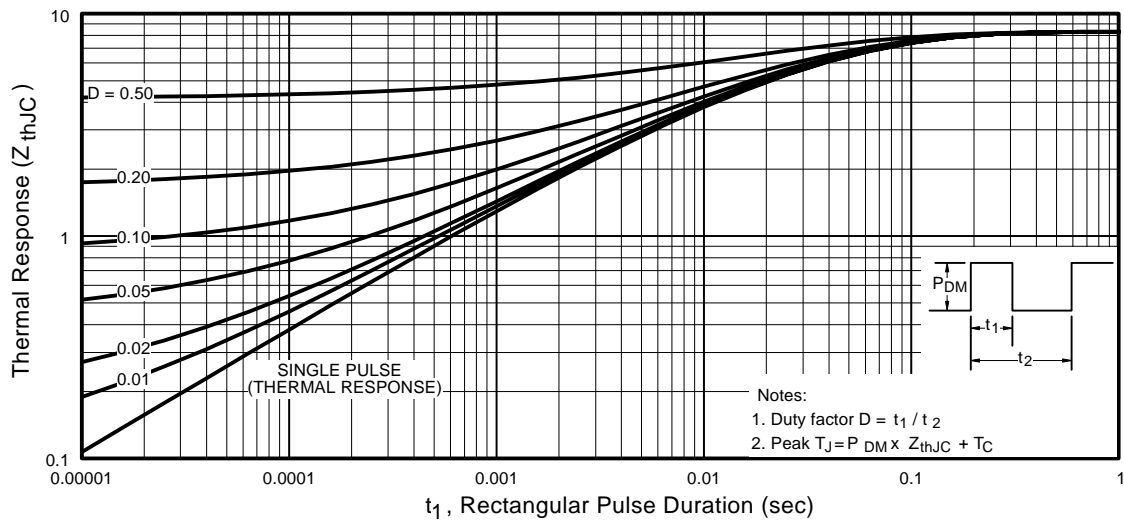
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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

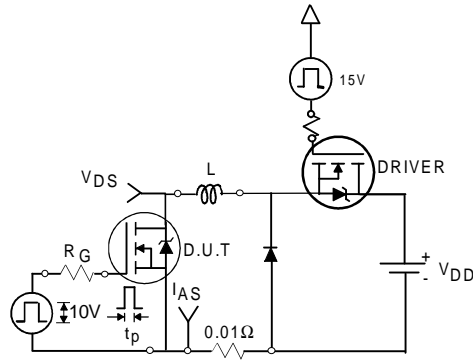


**Fig 10b.** Switching Time Waveforms

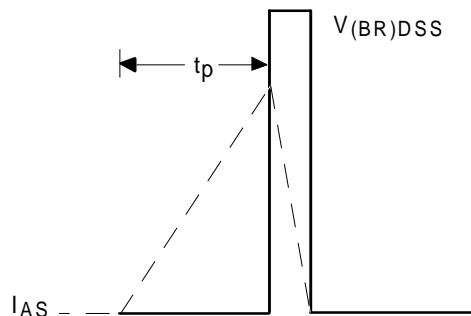


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

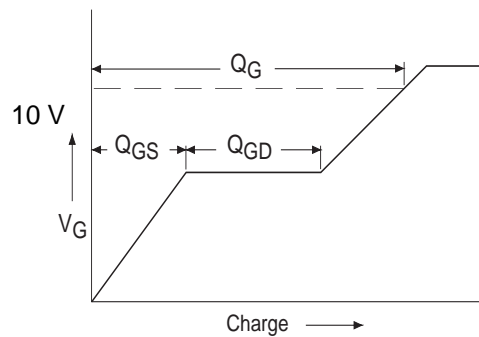
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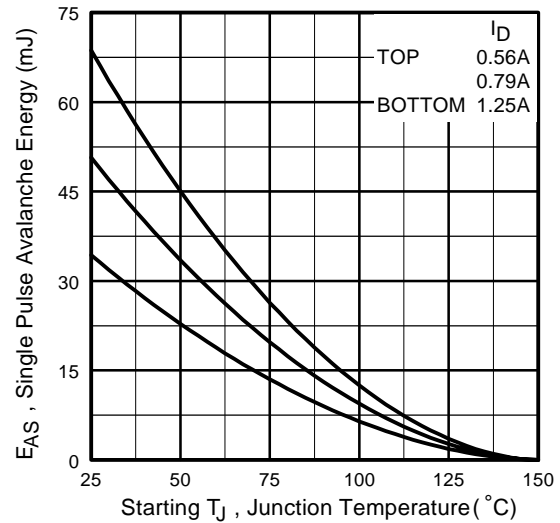
**Fig 12a.** Unclamped Inductive Test Circuit



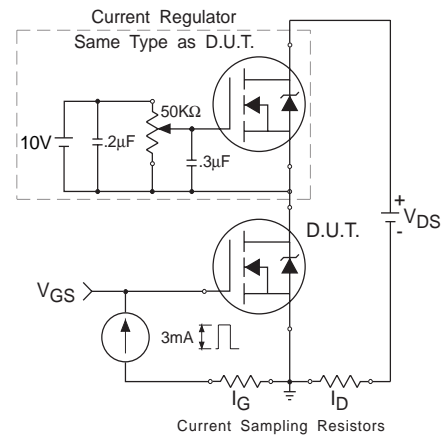
**Fig 12b.** Unclamped Inductive Waveforms



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



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



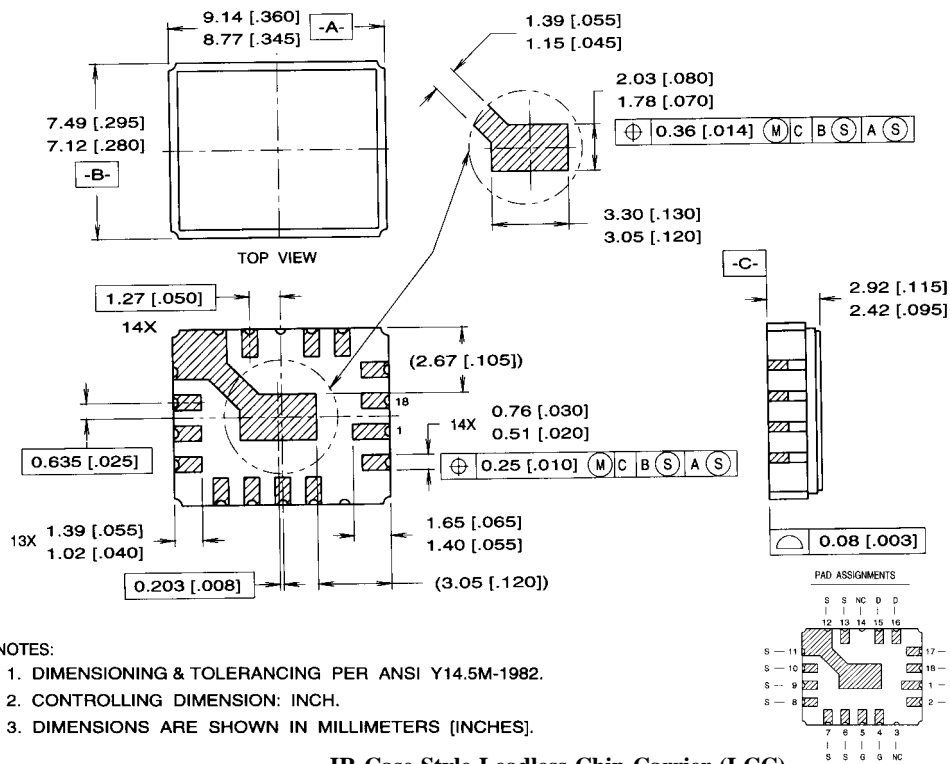
**Fig 13b.** Gate Charge Test Circuit

## IRFE310, JANTX-, JANTXV-, 2N6786U Devices

### Notes:

- ① Repetitive Rating; Pulse width limited by maximum junction temperature.  
Refer to current HEXFET reliability report.
- ② @  $V_{DD} = 50\text{ V}$ , Starting  $T_J = 25^\circ\text{C}$ ,  
 $EAS = [0.5 * L * (I_L^2)]$   
Peak  $I_L = 1.25\text{ A}$ ,  $V_{GS} = 10\text{ V}$ ,  $25 \leq R_G \leq 200\Omega$
- ③  $I_{SD} \leq 1.25\text{ A}$ ,  $di/dt \leq 180\text{ A}/\mu\text{s}$ ,  
 $V_{DD} \leq BV_{DSS}$ ,  $T_J \leq 150^\circ\text{C}$ , Suggested  $R_G = 50\Omega$
- ④ Pulse width  $\leq 300\text{ }\mu\text{s}$ ; Duty Cycle  $\leq 2\%$

## Case Outline and Dimensions — Leadless Chip Carrier (LCC) Package



### NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

### IR Case Style Leadless Chip Carrier (LCC)

International  
**IR** Rectifier

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**IR CANADA:** 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200

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