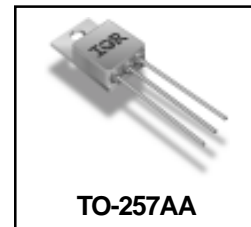


**RADIATION HARDENED
 POWER MOSFET
 THRU-HOLE (TO-257AA)**

**IRHY57034CM
 60V, N-CHANNEL
 R5 TECHNOLOGY**

Product Summary

Part Number	Radiation Level	RDS(on)	ID
IRHY57034CM	100K Rads (Si)	0.04Ω	18A*
IRHY53034CM	300K Rads (Si)	0.04Ω	18A*
IRHY54034CM	600K Rads (Si)	0.04Ω	18A*
IRHY58034CM	1000K Rads (Si)	0.048Ω	18A*



International Rectifier's R5™ technology provides high performance power MOSFETs for space applications. These devices have been characterized for Single Event Effects (SEE) with useful performance up to an LET of 80 (MeV/(mg/cm²)). The combination of low RDS(on) and low gate charge reduces the power losses in switching applications such as DC to DC converters and motor control. These devices retain all of the well established advantages of MOSFETs such as voltage control, fast switching, ease of paralleling and temperature stability of electrical parameters.

Features:

- Single Event Effect (SEE) Hardened
- Ultra Low RDS(on)
- Low Total Gate Charge
- Proton Tolerant
- Simple Drive Requirements
- Ease of Paralleling
- Hermetically Sealed
- Ceramic Package
- Light Weight

Absolute Maximum Ratings

Pre-Irradiation

	Parameter		Units
ID @ VGS = 12V, TC = 25°C	Continuous Drain Current	18*	A
ID @ VGS = 12V, TC = 100°C	Continuous Drain Current	18*	
IDM	Pulsed Drain Current ①	72	
PD @ TC = 25°C	Max. Power Dissipation	75	W
	Linear Derating Factor	0.6	W/°C
VGS	Gate-to-Source Voltage	±20	V
EAS	Single Pulse Avalanche Energy ②	110	mJ
IAR	Avalanche Current ①	18	A
EAR	Repetitive Avalanche Energy ①	7.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③	10	V/ns
TJ	Operating Junction	-55 to 150	°C
TSTG	Storage Temperature Range		
	Lead Temperature	300 (0.063in./1.6mm from case for 10sec)	
	Weight	4.3 (Typical)	g

* Current is limited by internal wire diameter
 For footnotes refer to the last page

Electrical Characteristics @ T_j = 25°C (Unless Otherwise Specified)

	Parameter	Min	Typ	Max	Units	Test Conditions
B _V DSS	Drain-to-Source Breakdown Voltage	60	—	—	V	V _{GS} = 0V, I _D = 1.0mA
ΔB _V DSS/ΔT _J	Temperature Coefficient of Breakdown Voltage	—	0.057	—	V/°C	Reference to 25°C, I _D = 1.0mA
R _{DS(on)}	Static Drain-to-Source On-State Resistance	—	—	0.04	Ω	V _{GS} = 12V, I _D = 18A ④
V _{GS(th)}	Gate Threshold Voltage	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 1.0mA
g _{fs}	Forward Transconductance	16	—	—	S (r _θ)	V _{DS} > 15V, I _{DS} = 18A ④
I _{DSS}	Zero Gate Voltage Drain Current	—	—	10	μA	V _{DS} =48V, V _{GS} =0V
		—	—	25		V _{DS} = 48V, V _{GS} = 0V, T _J = 125°C
I _{GSS}	Gate-to-Source Leakage Forward	—	—	100	nA	V _{GS} = 20V
I _{GSS}	Gate-to-Source Leakage Reverse	—	—	-100		V _{GS} = -20V
Q _g	Total Gate Charge	—	—	45	nC	V _{GS} = 12V, I _D = 18A
Q _{gs}	Gate-to-Source Charge	—	—	10		V _{DS} = 30V
Q _{gd}	Gate-to-Drain ('Miller') Charge	—	—	15		
t _{d(on)}	Turn-On Delay Time	—	—	25	ns	V _{DD} = 30V, I _D = 18A, V _{GS} = 12V, R _G = 7.5Ω
t _r	Rise Time	—	—	100		
t _{d(off)}	Turn-Off Delay Time	—	—	35		
t _f	Fall Time	—	—	30		
L _S + L _D	Total Inductance	—	6.8	—	nH	Measured from drain lead (6mm/ 0.25in. from package) to source lead (6mm/0.25in. from package)
C _{iss}	Input Capacitance	—	1152	—	pF	V _{GS} = 0V, V _{DS} = 25V f = 1.0MHz
C _{oss}	Output Capacitance	—	535	—		
C _{rss}	Reverse Transfer Capacitance	—	42	—		

Source-Drain Diode Ratings and Characteristics

	Parameter	Min	Typ	Max	Units	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	18*	A	T _j = 25°C, I _S = 18A, V _{GS} = 0V ④
I _{SM}	Pulse Source Current (Body Diode) ①	—	—	72		
V _{SD}	Diode Forward Voltage	—	—	1.2	V	T _j = 25°C, I _F = 18A, di/dt ≥ 100A/μs
t _{rr}	Reverse Recovery Time	—	—	99	ns	V _{DD} ≤ 25V ④
Q _{RR}	Reverse Recovery Charge	—	—	322	nC	
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by L _S + L _D .				

* Current is limited by internal wire diameter

Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R _{thJC}	Junction-to-Case	—	—	1.67	°C/W	
R _{thJA}	Junction-to-Ambient	—	—	80		

Note: Corresponding Spice and Saber models are available on the G&S Website.

For footnotes refer to the last page

Radiation Characteristics

IRHY57034CM

International Rectifier Radiation Hardened MOSFETs are tested to verify their radiation hardness capability. The hardness assurance program at International Rectifier is comprised of two radiation environments. Every manufacturing lot is tested for total ionizing dose (per notes 5 and 6) using the TO-3 package. Both pre- and post-irradiation performance are tested and specified using the same drive circuitry and test conditions in order to provide a direct comparison.

Table 1. Electrical Characteristics @ Tj = 25°C, Post Total Dose Irradiation ⑤⑥

	Parameter	Up to 600K Rads(Si) ¹		1000K Rads (Si) ²		Units	Test Conditions
		Min	Max	Min	Max		
BV _{DSS}	Drain-to-Source Breakdown Voltage	60	—	60	—	V	V _{GS} = 0V, I _D = 1.0mA
V _{GS(th)}	Gate Threshold Voltage	2.0	4.0	1.5	4.0		V _{GS} = V _{DS} , I _D = 1.0mA
I _{GSS}	Gate-to-Source Leakage Forward	—	100	—	100	nA	V _{GS} = 20V
I _{GSS}	Gate-to-Source Leakage Reverse	—	-100	—	-100		V _{GS} = -20 V
I _{DSS}	Zero Gate Voltage Drain Current	—	10	—	10	μA	V _{DS} =48V, V _{GS} =0V
R _{DS(on)}	Static Drain-to-Source ④ On-State Resistance (TO-3)	—	0.044	—	0.053	Ω	V _{GS} = 12V, I _D = 18A
R _{DS(on)}	Static Drain-to-Source ④ On-State Resistance (TO-257AA)	—	0.04	—	0.048	Ω	V _{GS} = 12V, I _D = 18A
V _{SD}	Diode Forward Voltage ④	—	1.2	—	1.2	V	V _{GS} = 0V, I _S = 18A

1. Part numbers IRHY57034CM, IRHY53034CM and IRHY54034CM

2. Part number IRHY58034CM

International Rectifier radiation hardened MOSFETs have been characterized in heavy ion environment for Single Event Effects (SEE). Single Event Effects characterization is illustrated in Fig. a and Table 2.

Table 2. Single Event Effect Safe Operating Area

Ion	LET MeV/(mg/cm ²)	Energy (MeV)	Range (μm)	V _{DS} (V)				
				@ V _{GS} =0V	@ V _{GS} =-5V	@ V _{GS} =-10V	@ V _{GS} =-15V	@ V _{GS} =-20V
Kr	39.2	300	37.4	60	60	60	52	34
Xe	63.3	300	29.2	46	46	35	25	15
Au	86.6	2068	106	35	35	27	20	14

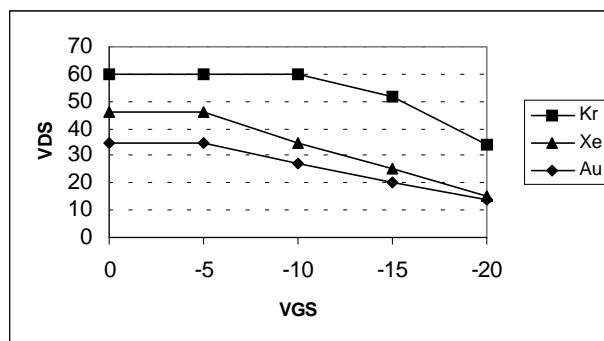


Fig a. Single Event Effect, Safe Operating Area

For footnotes refer to the last page

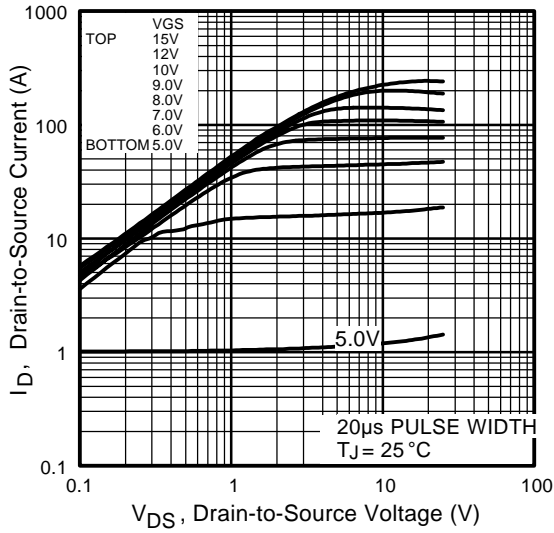


Fig 1. Typical Output Characteristics

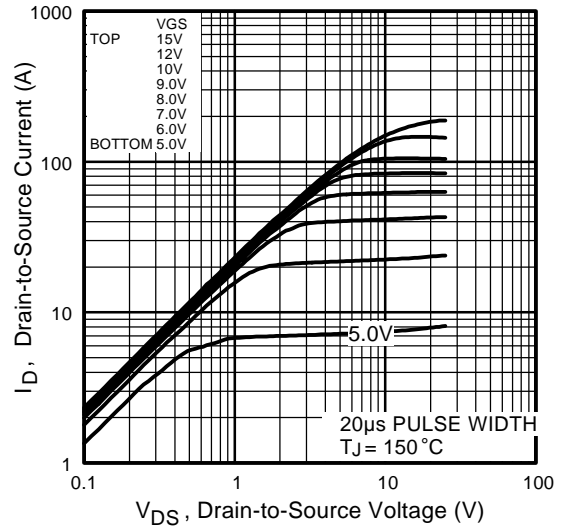


Fig 2. Typical Output Characteristics

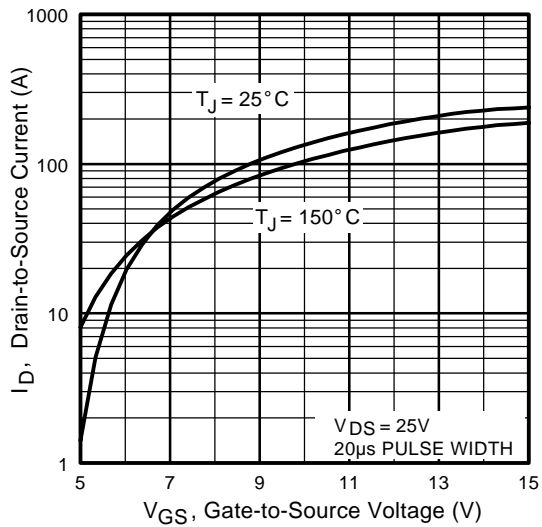


Fig 3. Typical Transfer Characteristics

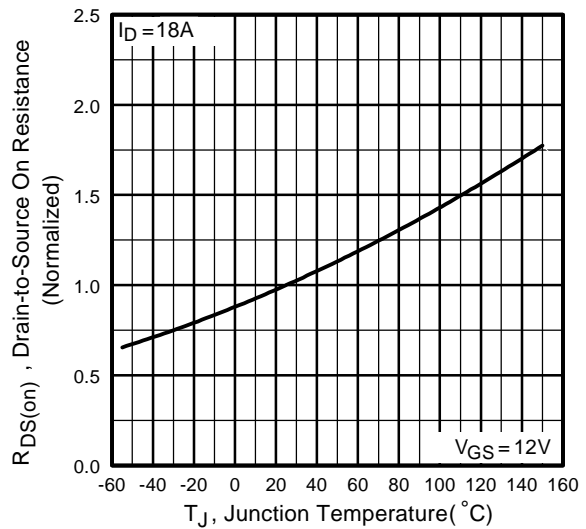


Fig 4. Normalized On-Resistance Vs. Temperature

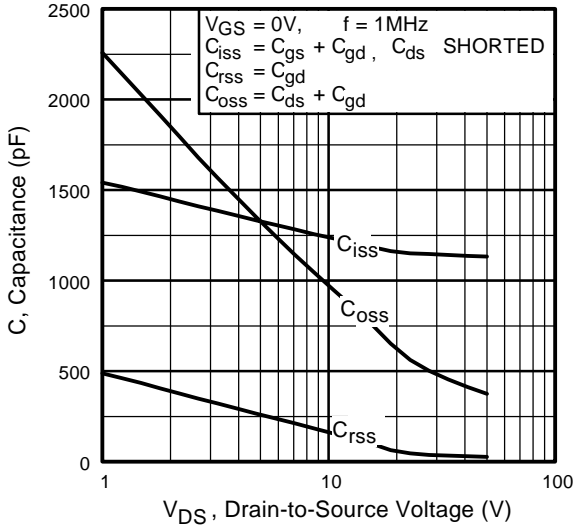


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

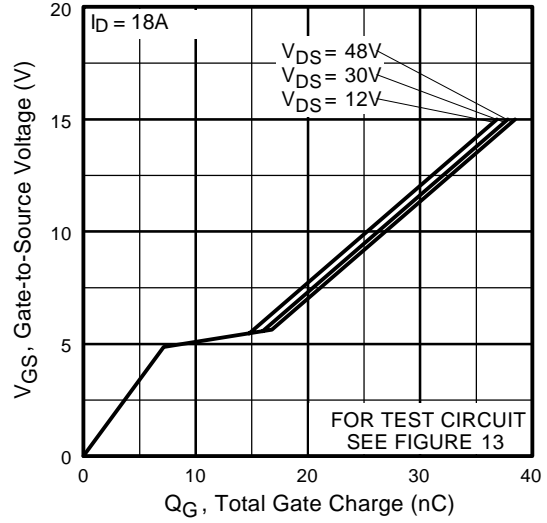


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

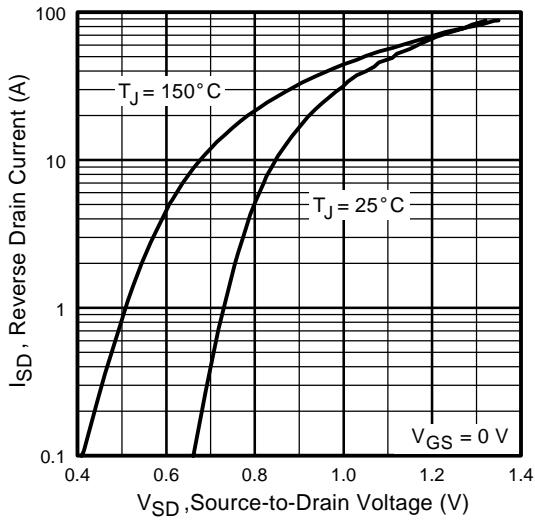


Fig 7. Typical Source-Drain Diode Forward Voltage

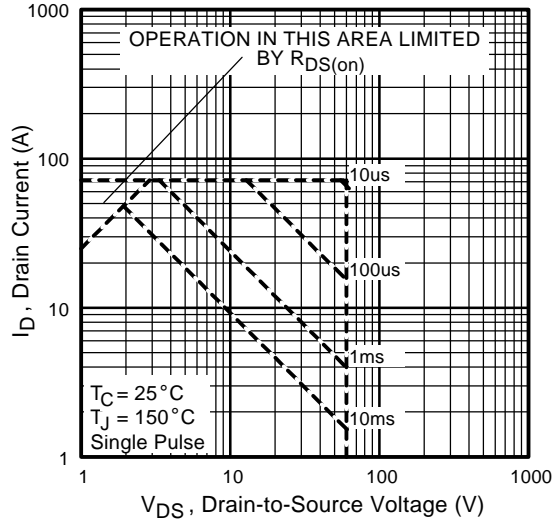


Fig 8. Maximum Safe Operating Area

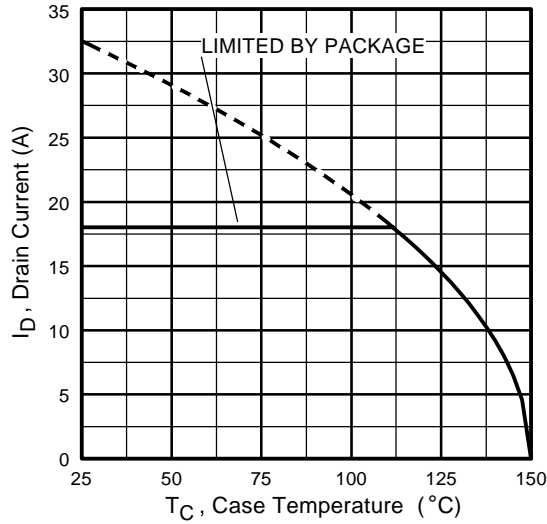


Fig 9. Maximum Drain Current Vs. Case Temperature

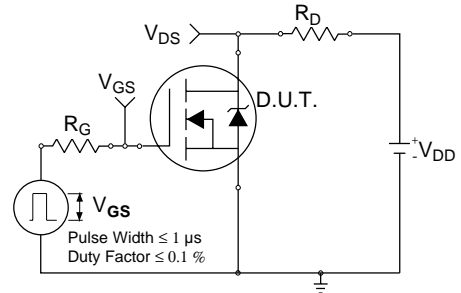


Fig 10a. Switching Time Test Circuit

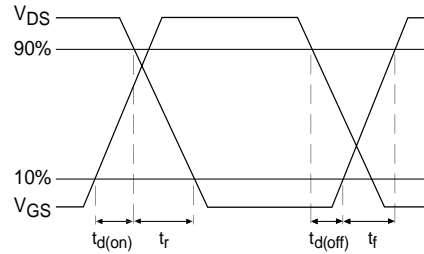


Fig 10b. Switching Time Waveforms

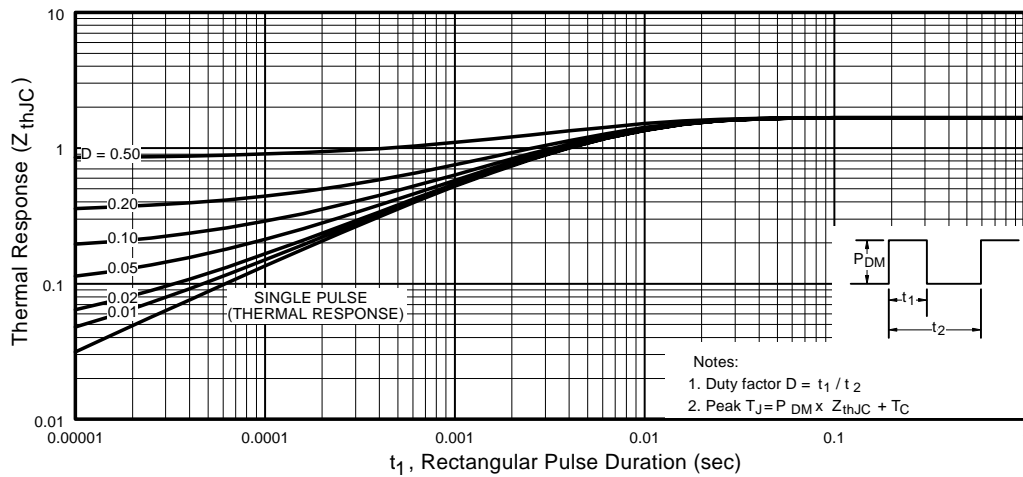


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

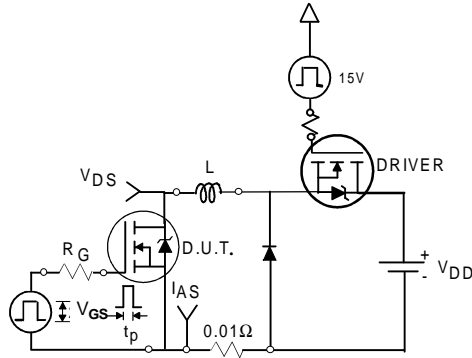


Fig 12a. Unclamped Inductive Test Circuit

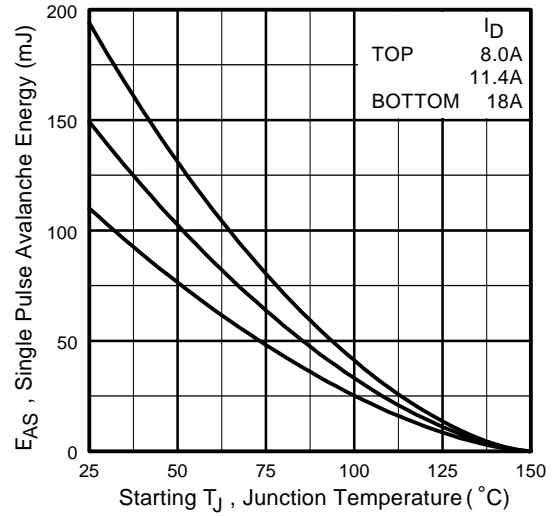


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

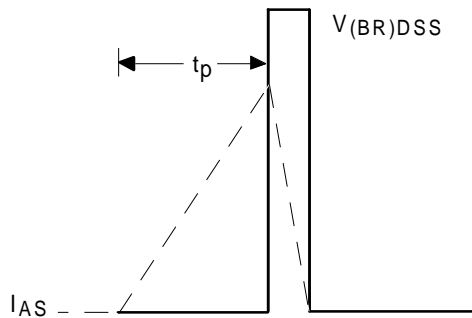


Fig 12b. Unclamped Inductive Waveforms

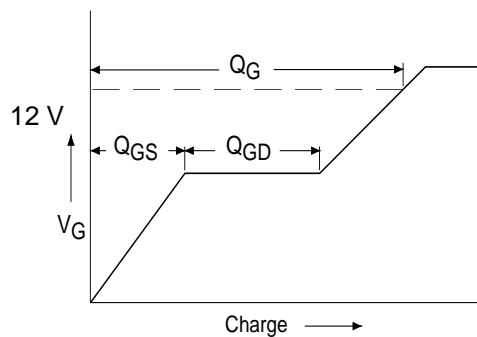


Fig 13a. Basic Gate Charge Waveform

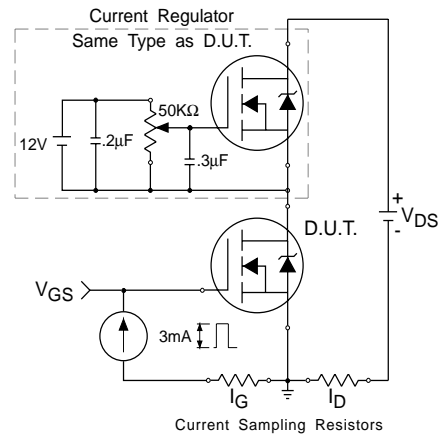
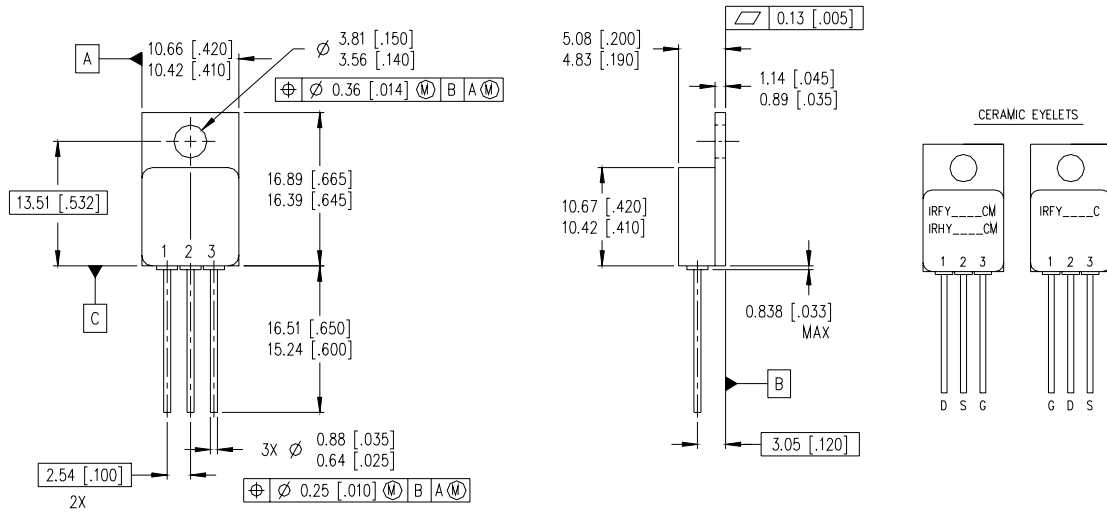


Fig 13b. Gate Charge Test Circuit

Footnotes:

- ① Repetitive Rating; Pulse width limited by maximum junction temperature.
- ② $V_{DD} = 50V$, starting $T_J = 25^\circ C$, $L = 0.7\text{ mH}$
Peak $I_L = 18A$, $V_{GS} = 12V$
- ③ $ISD \leq 18A$, $di/dt \leq 234A/\mu s$,
 $V_{DD} \leq 60V$, $T_J \leq 150^\circ C$
- ④ Pulse width $\leq 300\ \mu s$; Duty Cycle $\leq 2\%$
- ⑤ **Total Dose Irradiation with V_{GS} Bias.**
12 volt V_{GS} applied and $V_{DS} = 0$ during irradiation per MIL-STD-750, method 1019, condition A.
- ⑥ **Total Dose Irradiation with V_{DS} Bias.**
48 volt V_{DS} applied and $V_{GS} = 0$ during irradiation per MIL-STD-750, method 1019, condition A.

Case Outline and Dimensions — TO-257AA



NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-257AA.

LEGEND

- D - DRAIN
- S - SOURCE
- G - GATE

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