

## POWER MOSFET THRU-HOLE (TO-254AA)

## 100V, P-CHANNEL HEXFET MOSFET TECHNOLOGY

### Product Summary

Part Number	$R_{DS(on)}$	$I_D$
IRF5M5210	0.07 $\Omega$	-34A



### Description

Fifth Generation HEXFET power MOSFETs from IR HiRel utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon unit area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient device for use in a wide variety of applications.

These devices are well-suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high-energy pulse circuits.

### Features

- Low  $R_{DS(on)}$
- Avalanche Energy Ratings
- Dynamic dv/dt Rating
- Simple Drive Requirements
- Hermetically Sealed
- Light Weight

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$I_{D1} @ V_{GS} = -10V, T_C = 25^\circ C$	Continuous Drain Current	-34	A
$I_{D2} @ V_{GS} = -10V, T_C = 100^\circ C$	Continuous Drain Current	-21	
$I_{DM} @ T_C = 25^\circ C$	Pulsed Drain Current ①	-136	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	125	W
	Linear Derating Factor	1.0	W/ $^\circ C$
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy ②	520	mJ
$I_{AR}$	Avalanche Current ①	-21	A
$E_{AR}$	Repetitive Avalanche Energy ①	12.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-3.4	V/ns
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	$^\circ C$
	Lead Temperature	300 (0.063 in. /1.6 mm from case for 10s)	
	Weight	9.3 (Typical)	

For Footnotes refer to the page 2.

**Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (Unless Otherwise Specified)**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	-100	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.12	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = -1.0\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	—	0.07	$\Omega$	$V_{GS} = -10V, I_{D2} = -21A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	-2.0	—	-4.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
$G_{fs}$	Forward Transconductance	10	—	—	S	$V_{DS} = -15V, I_{D2} = -21A$ ④
$I_{DSS}$	Zero Gate Voltage Drain Current	—	—	-25	$\mu A$	$V_{DS} = -100V, V_{GS} = 0V$
		—	—	-250		$V_{DS} = -80V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Leakage Forward	—	—	-100	nA	$V_{GS} = -20V$
	Gate-to-Source Leakage Reverse	—	—	100		$V_{GS} = 20V$
$Q_G$	Total Gate Charge	—	—	180	nC	$I_{D2} = -21A$
$Q_{GS}$	Gate-to-Source Charge	—	—	25		$V_{DS} = -80V$
$Q_{GD}$	Gate-to-Drain ('Miller') Charge	—	—	100		$V_{GS} = -10V$
$t_{d(on)}$	Turn-On Delay Time	—	—	28	ns	$V_{DD} = -50V$
$t_r$	Rise Time	—	—	150		$I_{D2} = -21A$
$t_{d(off)}$	Turn-Off Delay Time	—	—	100		$R_G = 2.5\Omega$
$t_f$	Fall Time	—	—	120		$V_{GS} = -10V$
$L_S + L_D$	Total Inductance	—	6.8	—	nH	Measured from Drain lead (6mm / 0.25 in from package) to Source lead (6mm/ 0.25 in from package) with Source wire internally bonded from Source pin to Drain pad
$C_{iss}$	Input Capacitance	—	2730	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	824	—		$V_{DS} = -25V$
$C_{riss}$	Reverse Transfer Capacitance	—	465	—		$f = 1.0\text{MHz}$

**Source-Drain Diode Ratings and Characteristics**

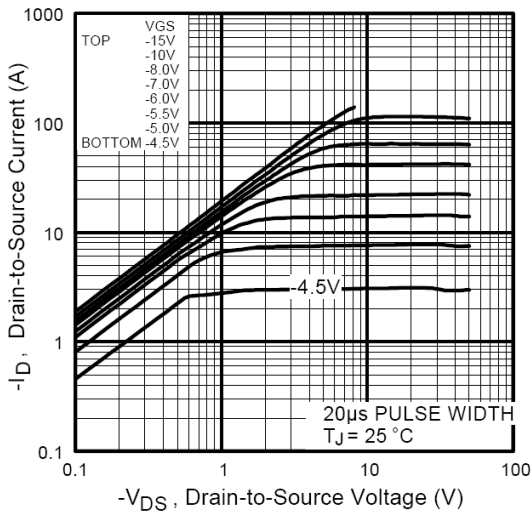
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	-34	A	
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	-136		
$V_{SD}$	Diode Forward Voltage	—	—	-1.6	V	$T_J = 25^\circ\text{C}, I_S = -21A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	—	260	ns	$T_J = 25^\circ\text{C}, I_F = -21A, V_{DD} \leq -30V$
$Q_{rr}$	Reverse Recovery Charge	—	—	1.8	$\mu\text{C}$	$di/dt = 100A/\mu\text{s}$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

**Thermal Resistance**

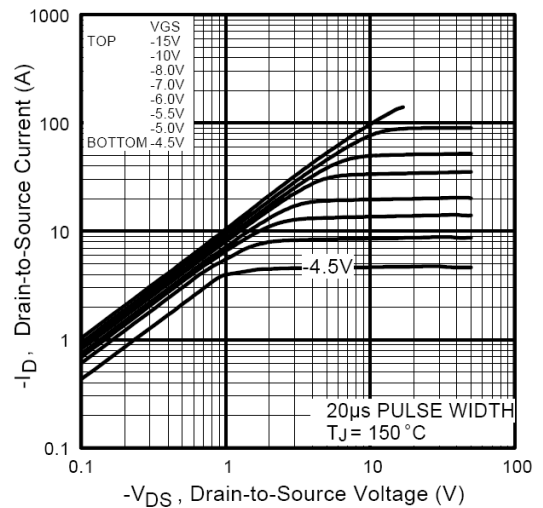
Symbol	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	1.0	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case -to-Sink	—	0.21	—	
$R_{\theta JA}$	Junction-to-Ambient (Typical socket mount)	—	—	48	

**Footnotes:**

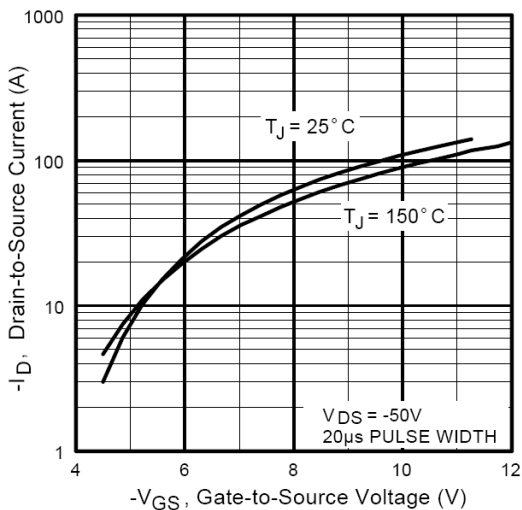
- ① Repetitive Rating; Pulse width limited by maximum junction temperature.
- ②  $V_{DD} = -25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 2.4\text{mH}$ , Peak  $I_L = -21A$ ,  $V_{GS} = -10V, R_G = 25\Omega$ .
- ③  $I_{SD} \leq -21A$ ,  $di/dt \leq -400A/\mu\text{s}$ ,  $V_{DD} \leq -100V$ ,  $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300 \mu\text{s}$ ; Duty Cycle  $\leq 2\%$ .



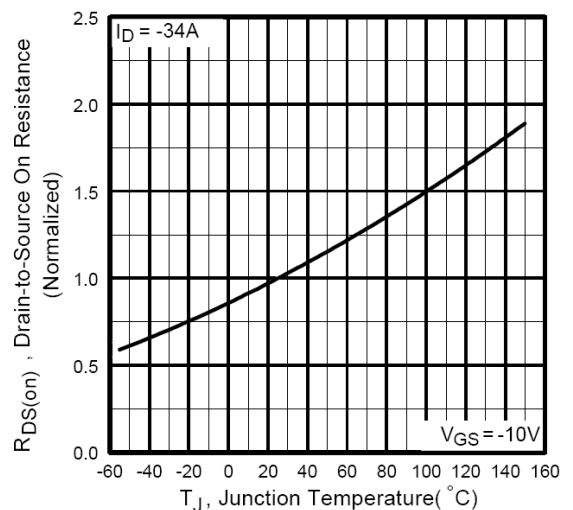
**Fig 1. Typical Output Characteristics**



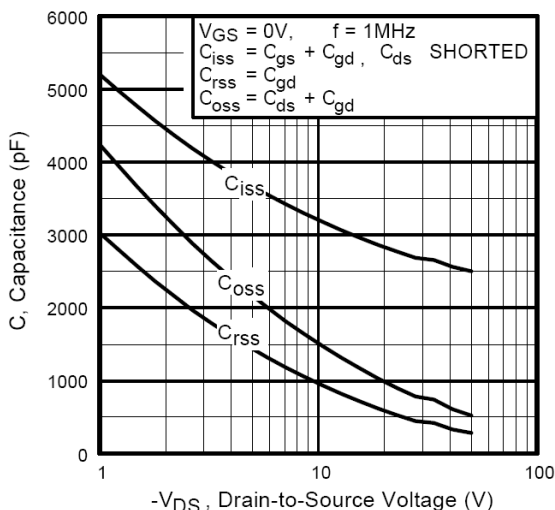
**Fig 2. Typical Output Characteristics**



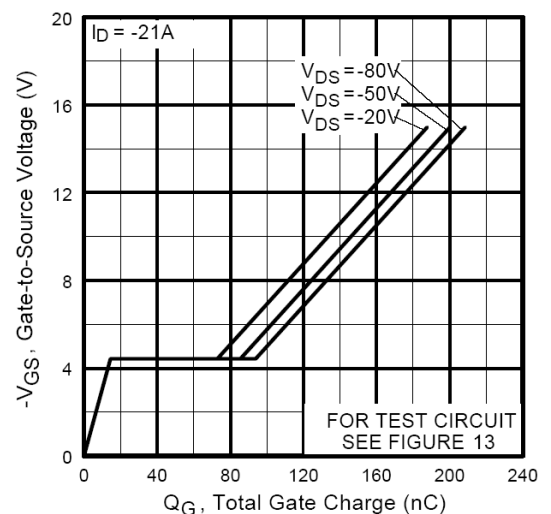
**Fig 3. Typical Transfer Characteristics**



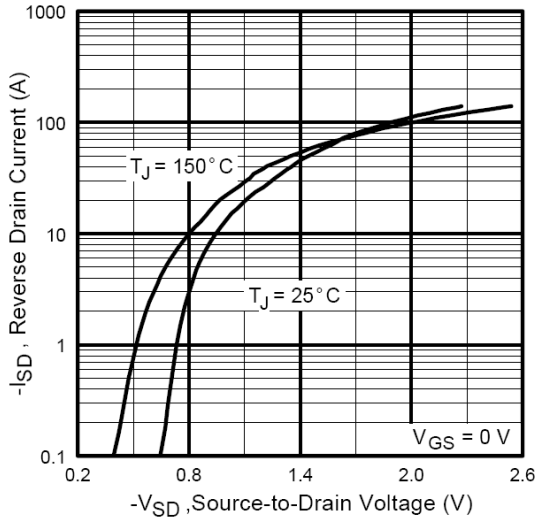
**Fig 4. Normalized On-Resistance Vs. Temperature**



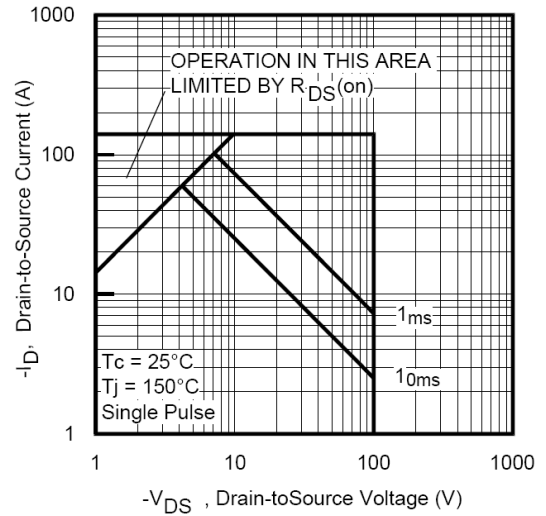
**Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage**



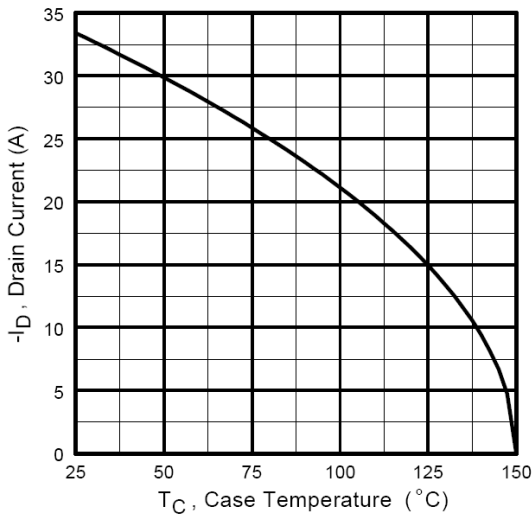
**Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage**



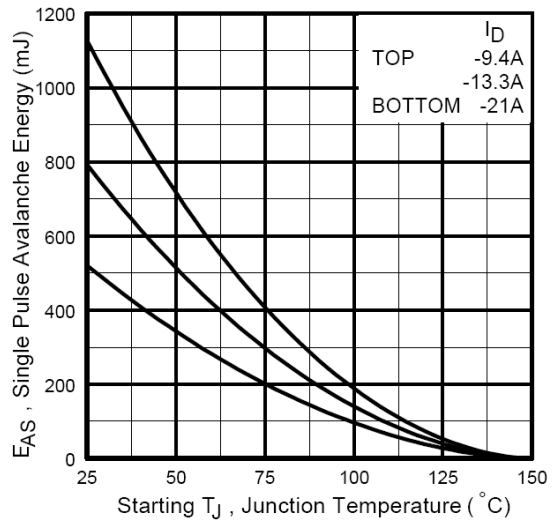
**Fig 7.** Typical Source-Drain Diode Forward Voltage



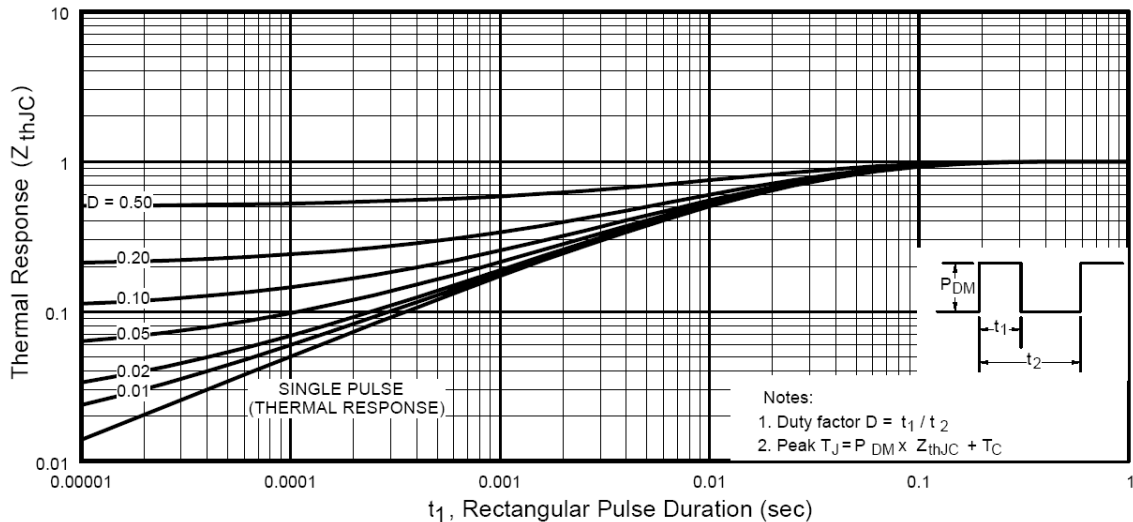
**Fig 8.** Maximum Safe Operating Area



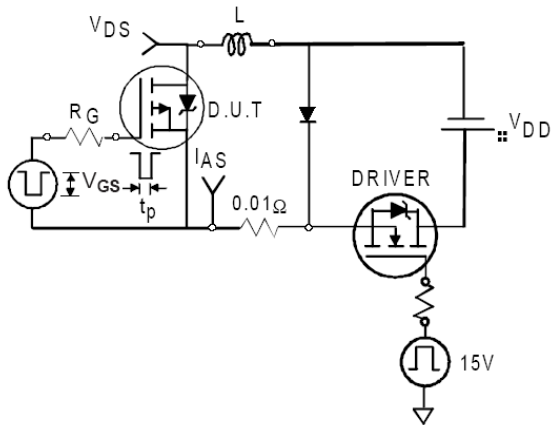
**Fig 9.** Maximum Drain Current Vs. Case Temperature



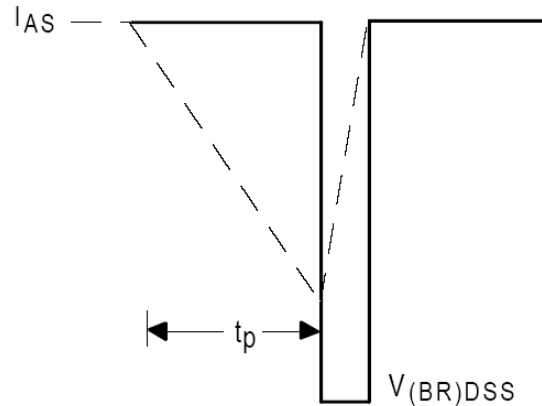
**Fig 10.** Maximum Avalanche Energy Vs. Drain Current



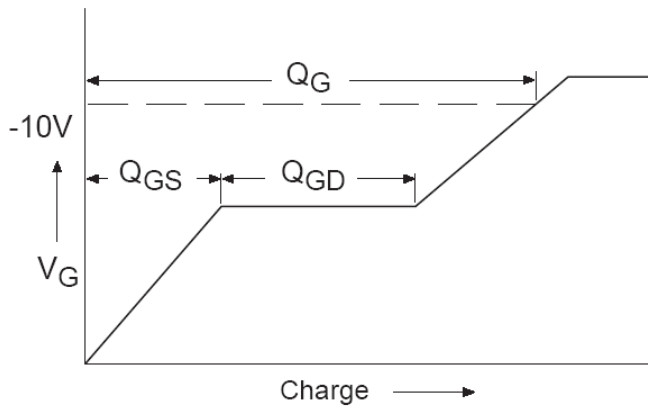
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



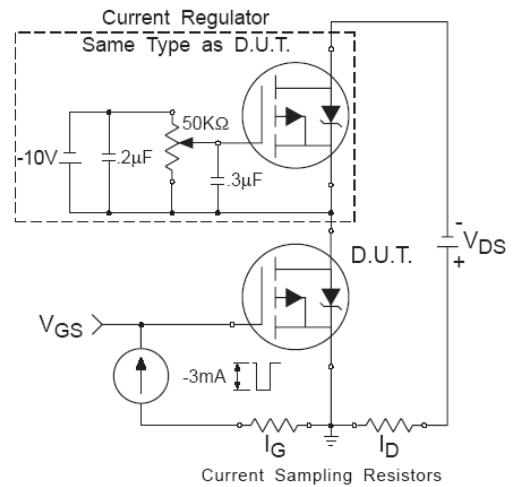
**Fig 12a.** Unclamped Inductive Test Circuit



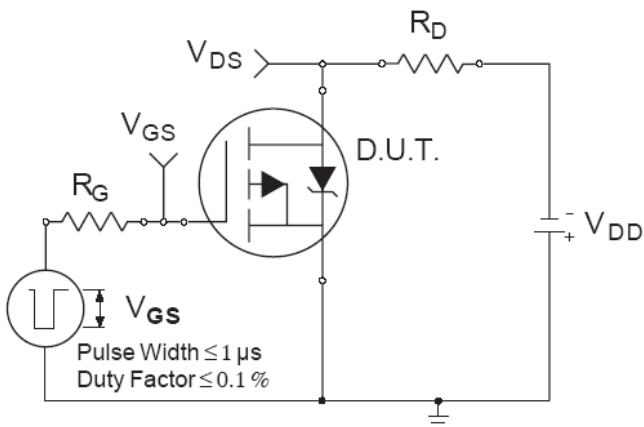
**Fig 12b.** Unclamped Inductive Waveforms



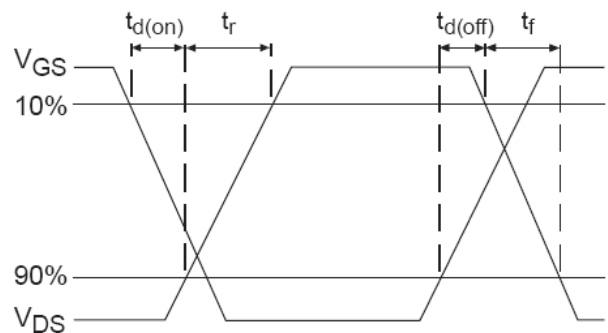
**Fig 13a.** Basic Gate Charge Waveform



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



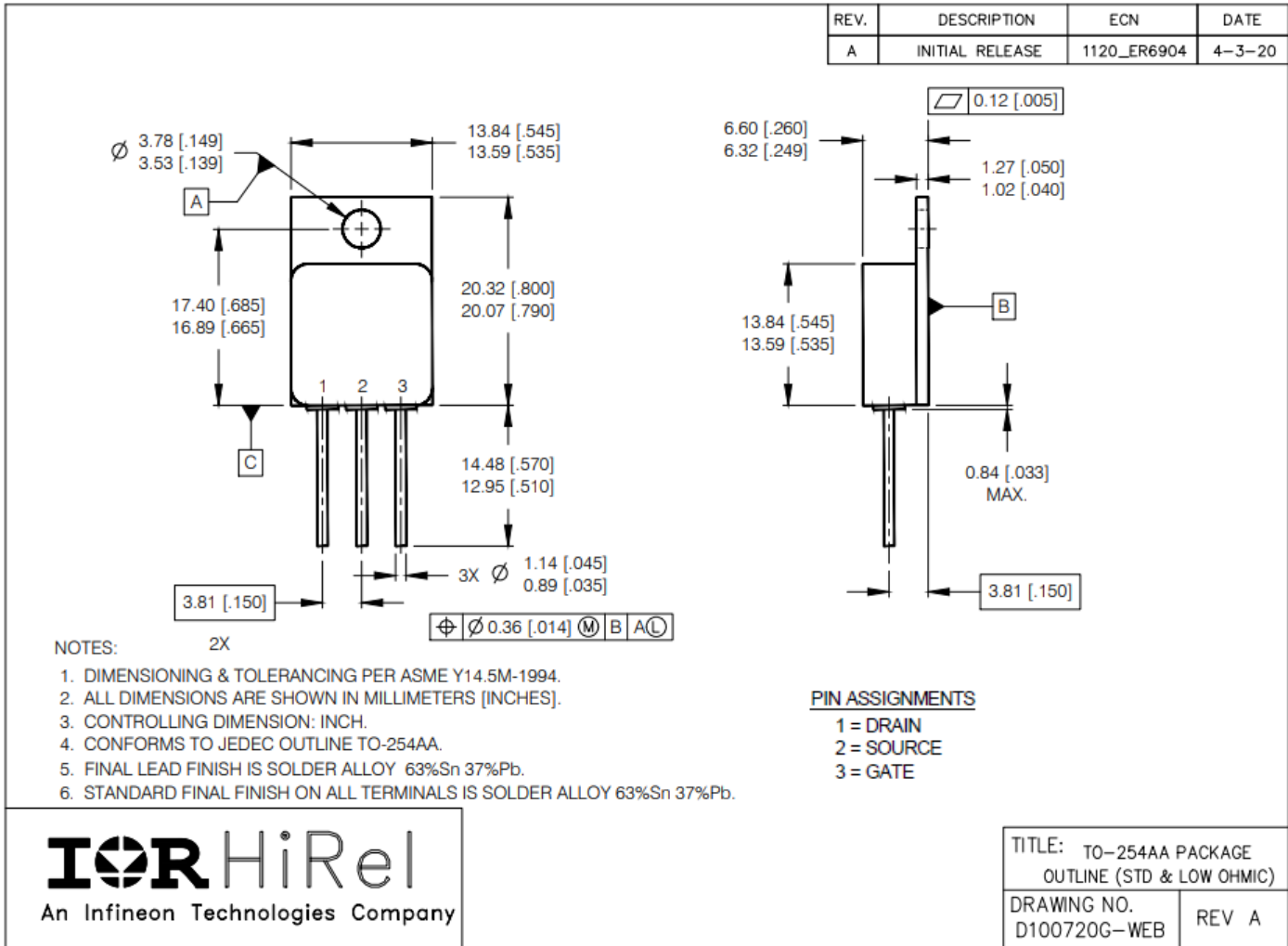
**Fig 14a.** Switching Time Test Circuit



**Fig 14b.** Switching Time Waveforms

Note: For the most updated package outline, please see the website: [TO-254AA](http://TO-254AA)

**Case Outline and Dimensions - Low-Ohmic TO-254AA**



**BERYLLIA WARNING PER MIL-PRF-19500**

Package containing beryllia shall not be ground, sandblasted, machined, or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.

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