

IRFF110

PD-90423E

Repetitive Avalanche and dv/dt Rated Power MOSFET Thru-Hole (TO-205AF / TO-39) 100V, 3.5A, N-channel

Features

- Repetitive avalanche ratings
- Dynamic dv/dt rating
- Hermetically sealed
- Simple drive requirements
- ESD rating: Class 1A per MIL-STD-750, Method 1020

Product Summary

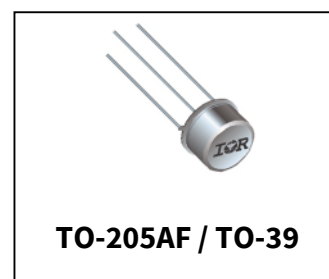
- BV_{DSS} : 100V
- I_D : 3.5A
- $R_{DS(on),max}$: 0.6Ω
- $Q_{G,max}$: 8.1nC

Potential Applications

- DC-DC converter
- Motor drives

Product Validation

Qualified according to MIL-PRF-19500 for space applications



Description

HEXFET POWER MOSFET technology is the key to IR HiRel's advanced line of power MOSFET transistors. The efficient geometry and unique processing of this latest "State of the Art" design achieves: very low on-state resistance combined with high trans conductance; superior reverse energy and diode recovery dv/dt capability. The HEXFET transistors also feature all of the well-established advantages of MOSFETs such as voltage control, very fast switching and temperature stability of the electrical parameters. They are well suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high energy pulse circuits.

Ordering Information

Table 1 Ordering options

Part number	Package	Screening Level
IRFF110	TO-205AF / TO-39	COTS
2N6782	TO-205AF / TO-39	COTS
JANTX2N6782	TO-205AF / TO-39	JANTX
JANTXV2N6782	TO-205AF / TO-39	JANTXV

IRFF110

Power MOSFET Thru-Hole (TO-205AF / TO-39)

Table of contents

Table of contents

Features	1
Potential Applications.....	1
Product Validation.....	1
Description	1
Table of contents.....	2
1 Absolute Maximum Ratings	3
2 Device Characteristics	4
2.1 Electrical Characteristics	4
2.2 Source-Drain Diode Ratings and Characteristics	5
2.3 Thermal Characteristics	5
3 Electrical Characteristics Curves.....	6
4 Test Circuits	9
5 Package Outline	10
Revision history.....	11

Absolute Maximum Ratings

1 Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
$I_{D1} @ V_{GS} = 10V, T_C = 25^{\circ}C$	Continuous Drain Current	3.5	A
$I_{D2} @ V_{GS} = 10V, T_C = 100^{\circ}C$	Continuous Drain Current	2.25	A
$I_{DM} @ T_C = 25^{\circ}C$	Pulsed Drain Current ¹	14	A
$P_D @ T_C = 25^{\circ}C$	Maximum Power Dissipation	15	W
	Linear Derating Factor	0.12	W/ $^{\circ}C$
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ²	68	mJ
I_{AR}	Avalanche Current ¹	3.5	A
E_{AR}	Repetitive Avalanche Energy ¹	1.5	mJ
dv/dt	Peak Diode Reverse Recovery ³	5.5	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	$^{\circ}C$
	Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)	
	Weight	0.98 (Typical)	g

¹ Repetitive Rating; Pulse width limited by maximum junction temperature.² $V_{DD} = 25V$, starting $T_J = 25^{\circ}C$, $L = 11.1mH$, Peak $I_L = 3.5A$ ³ $I_{SD} \leq 3.5A$, $di/dt \leq 75A/\mu s$, $V_{DD} \leq 100V$, $T_J \leq 150^{\circ}C$

Device Characteristics

2 Device Characteristics

2.1 Electrical Characteristics

Table 3 Static and Dynamic Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (Unless Otherwise Specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	100	—	—	V	$V_{GS} = 0V, I_D = 1.0mA$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.10	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1.0mA$
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	—	0.60	Ω	$V_{GS} = 10V, I_{D2} = 2.25A^1$
		—	—	0.61		$V_{GS} = 10V, I_{D2} = 3.5A^1$
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
G_{fs}	Forward Transconductance	0.8	—	—	S	$V_{DS} = 15V, I_{D2} = 2.25A^1$
I_{DSS}	Zero Gate Voltage Drain Current	—	—	25	μA	$V_{DS} = 80V, V_{GS} = 0V$
		—	—	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	—	—	8.1	nC	$I_{D1} = 3.5A$
Q_{GS}	Gate-to-Source Charge	—	—	1.7		$V_{DS} = 50V$
Q_{GD}	Gate-to-Drain ('Miller') Charge	—	—	4.5		$V_{GS} = 10V$
$t_{d(on)}$	Turn-On Delay Time	—	—	15	ns	$I_{D1} = 3.5A^{**}$ $V_{DD} = 50V$ $R_G = 7.5\Omega$ $V_{GS} = 10V$
t_r	Rise Time	—	—	25		
$t_{d(off)}$	Turn-Off Delay Time	—	—	25		
t_f	Fall Time	—	—	20		
$L_s + L_D$	Total Inductance	—	7.0	—	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 pin
C_{iss}	Input Capacitance	—	180	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0MHz$
C_{oss}	Output Capacitance	—	82	—		
C_{rss}	Reverse Transfer Capacitance	—	15	—		

** Switching speed maximum limits are based on manufacturing test equipment and capability.

¹ Pulse width $\leq 300 \mu s$; Duty Cycle $\leq 2\%$

Device Characteristics

2.2 Source-Drain Diode Ratings and Characteristics

Table 4 Source-Drain Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	3.5	A	
I _{SM}	Pulsed Source Current (Body Diode) ¹	—	—	14	A	
V _{SD}	Diode Forward Voltage	—	—	1.5	V	T _J = 25°C, I _S = 3.5A, V _{GS} = 0V ²
t _{rr}	Reverse Recovery Time	—	—	180	ns	T _J = 25°C, I _F = 3.5A, V _{DD} ≤ 50V di/dt = 100A/μs
Q _{rr}	Reverse Recovery Charge	—	1.3	—	μC	
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L _S +L _D)				

2.3 Thermal Characteristics

Table 5 Thermal Resistance

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case	—	—	8.33	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient (Typical socket mount)	—	—	175	

¹ Repetitive Rating; Pulse width limited by maximum junction temperature.² Pulse width $\leq 300\ \mu\text{s}$; Duty Cycle $\leq 2\%$

IRFF110

Power MOSFET Thru-Hole (TO-205AF / TO-39)

Electrical Characteristics Curves

3 Electrical Characteristics Curves

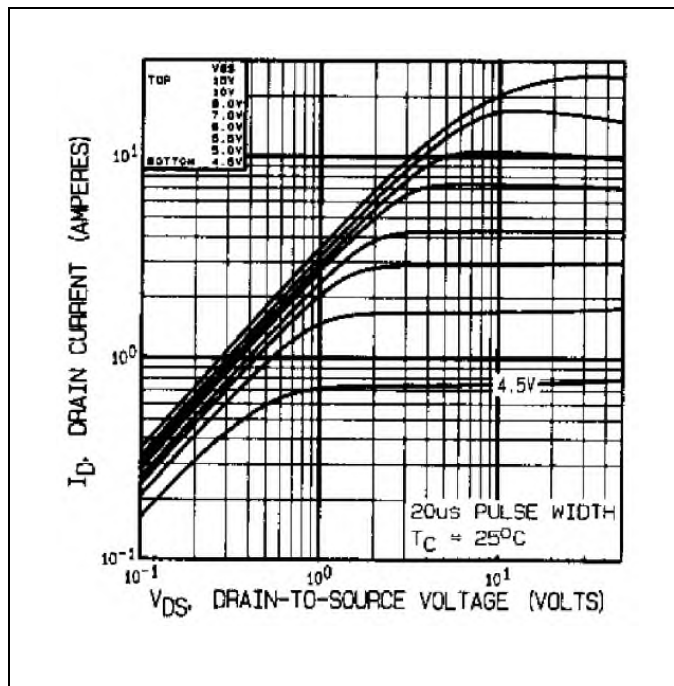


Figure 1 Typical Output Characteristics

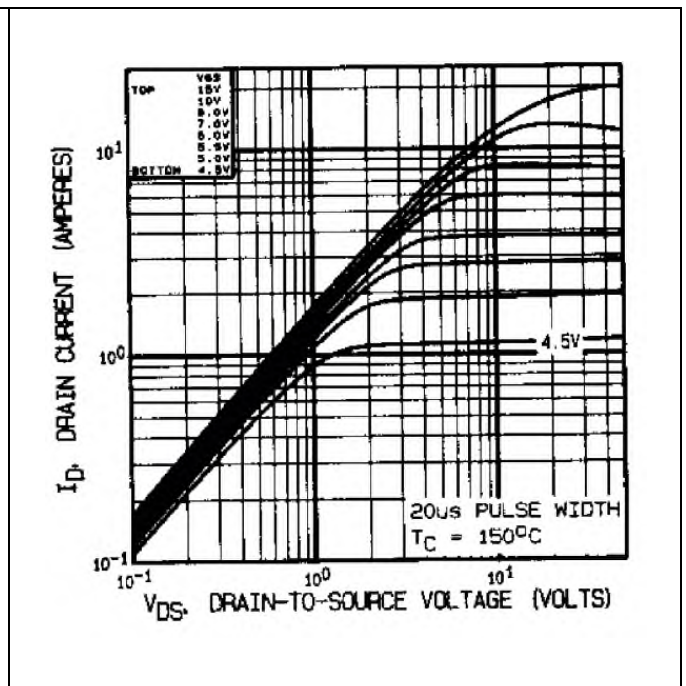


Figure 2 Typical Output Characteristics

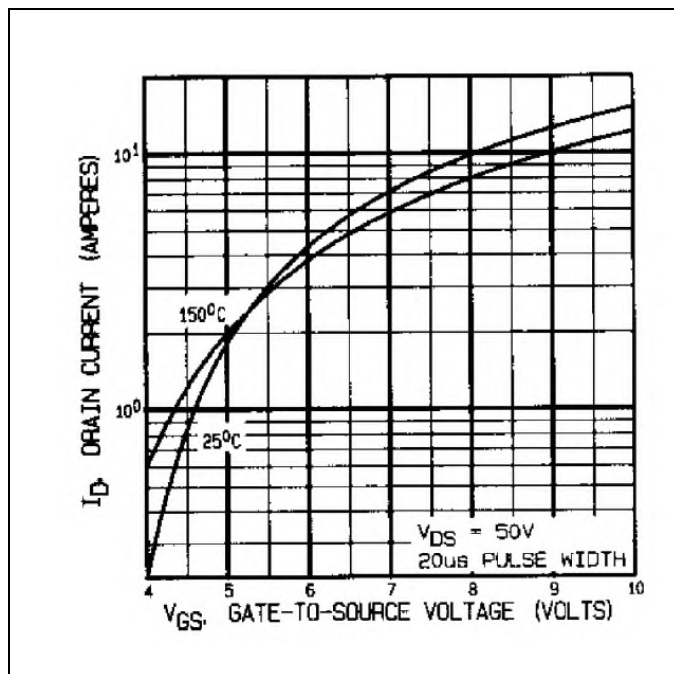


Figure 3 Typical Transfer Characteristics

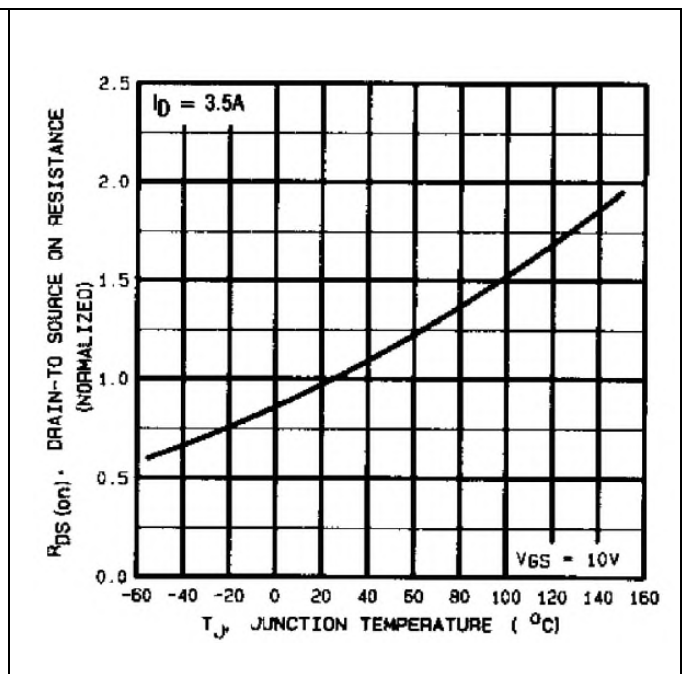


Figure 4 Normalized On-Resistance Vs. Temperature

IRFF110

Power MOSFET Thru-Hole (TO-205AF / TO-39)

Electrical Characteristics Curves

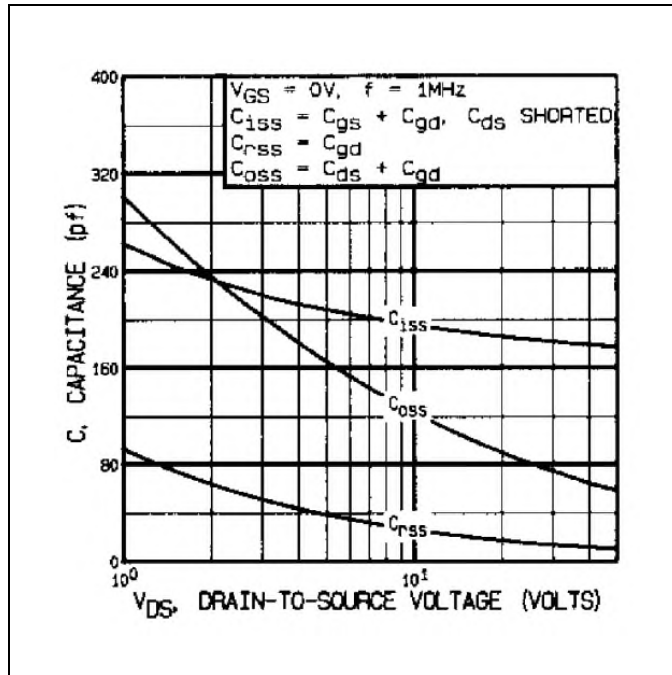


Figure 5 Typical Capacitance Vs. Drain-to-Source Voltage

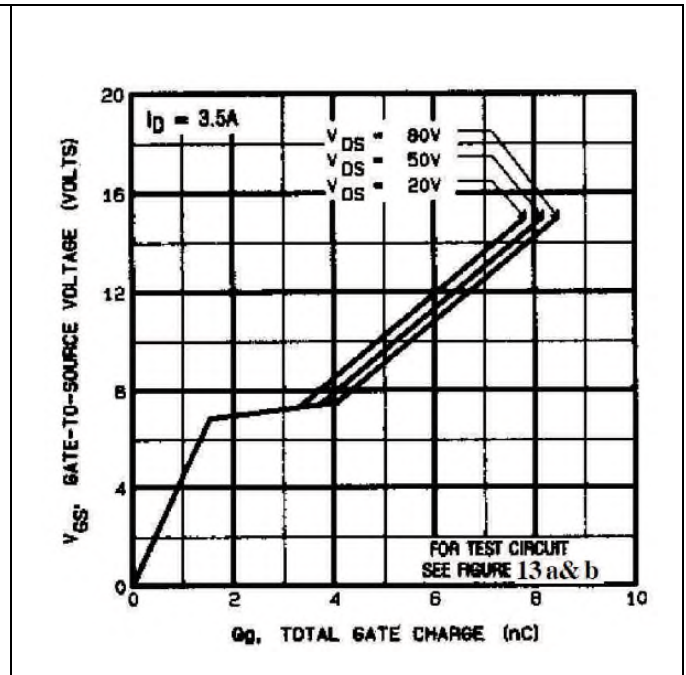


Figure 6 Typical Gate Charge Vs. Gate-to-Source Voltage

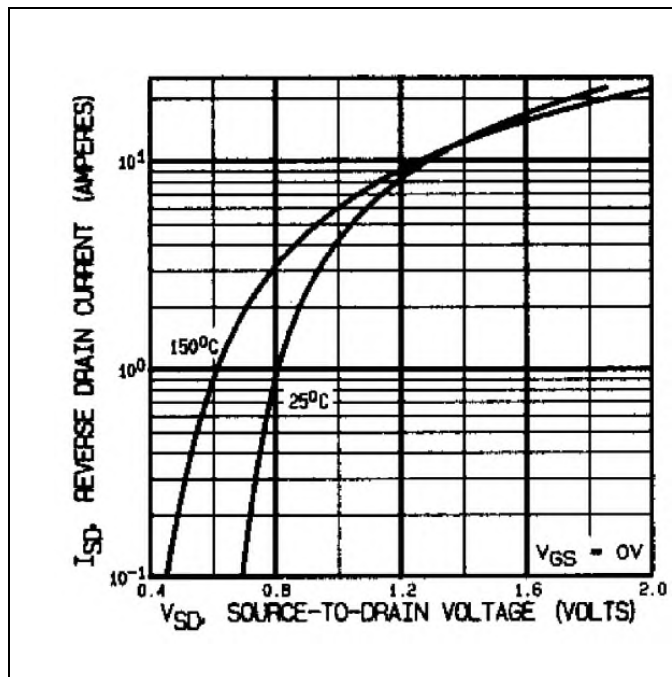


Figure 7 Typical Source-Drain Diode Forward Voltage

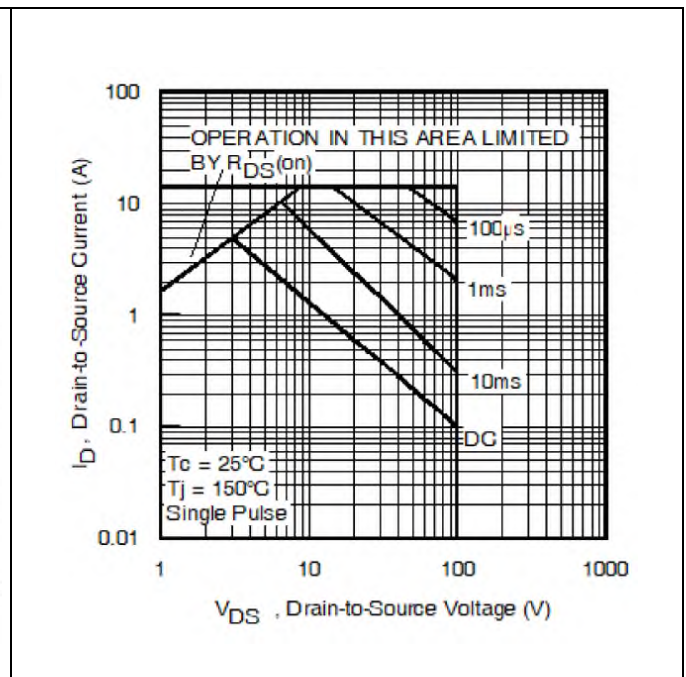


Figure 8 Maximum Safe Operating Area

IRFF110

Power MOSFET Thru-Hole (TO-205AF / TO-39)

Electrical Characteristics Curves

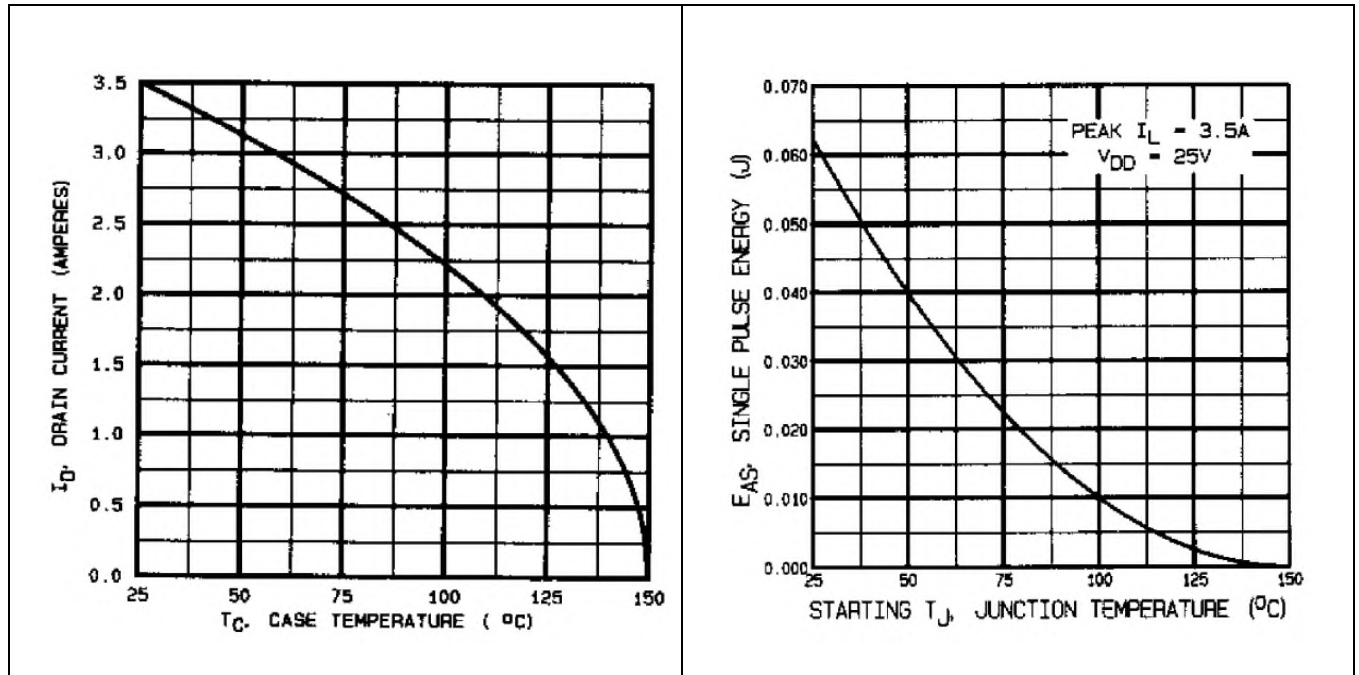


Figure 9 Maximum Drain Current Vs. Case Temperature

Figure 10 Maximum Avalanche Energy Vs. Junction Temperature

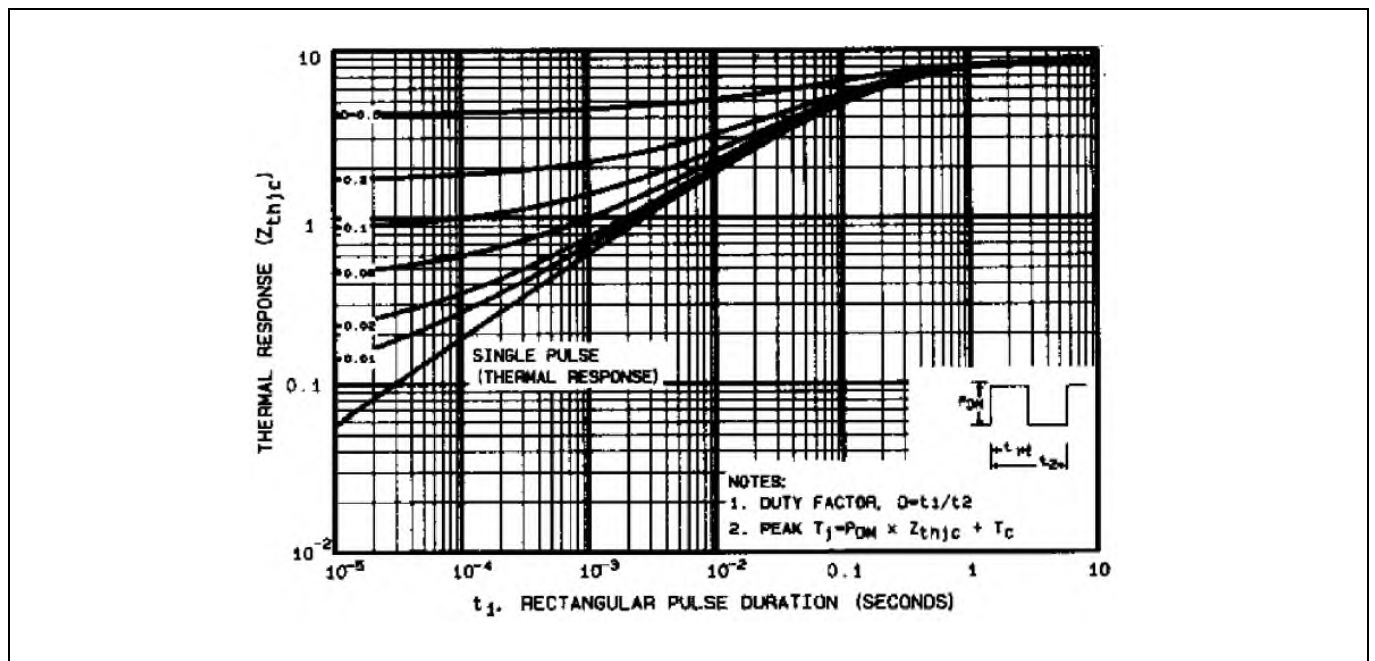


Figure 11 Maximum Effective Transient Thermal Impedance, Junction-to-Case

IRFF110

Power MOSFET Thru-Hole (TO-205AF / TO-39)

Test Circuits

4 Test Circuits

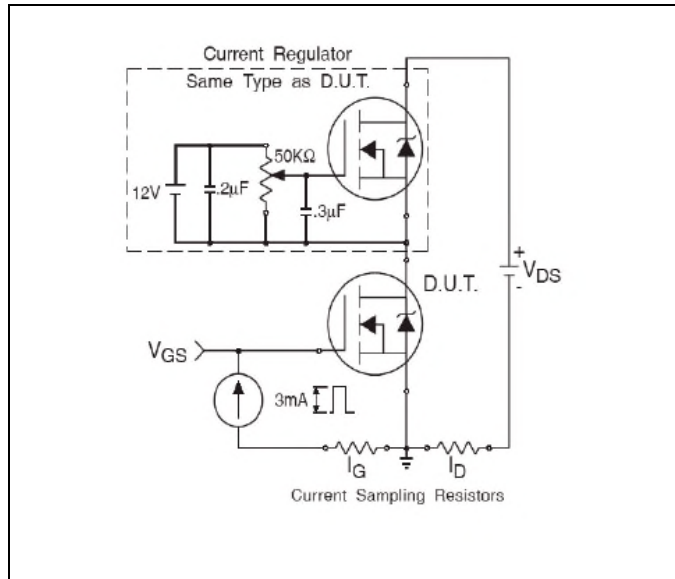


Figure 12 Gate Charge Test Circuit

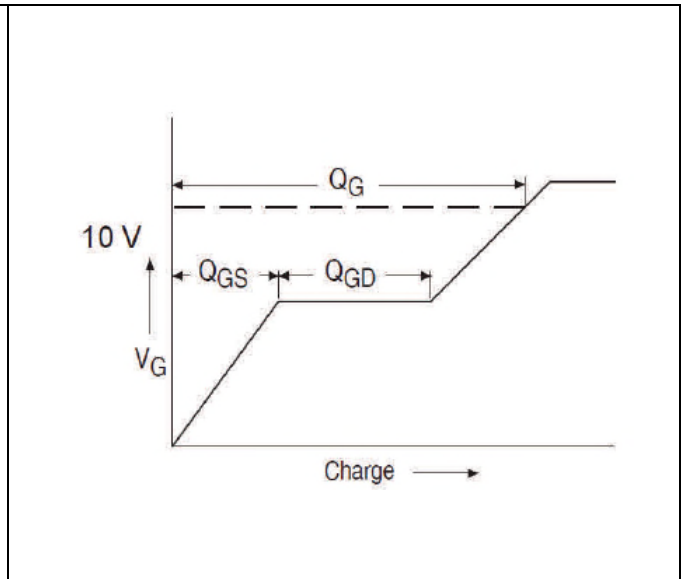


Figure 13 Gate Charge Waveform

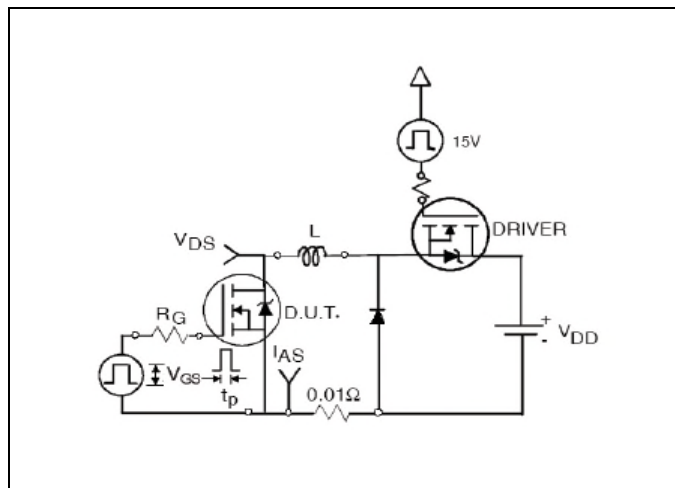


Figure 14 Unclamped Inductive Test Circuit

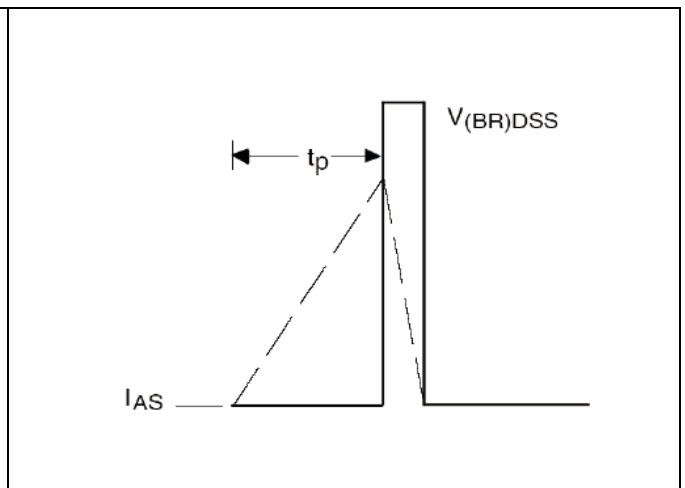


Figure 15 Unclamped Inductive Waveform

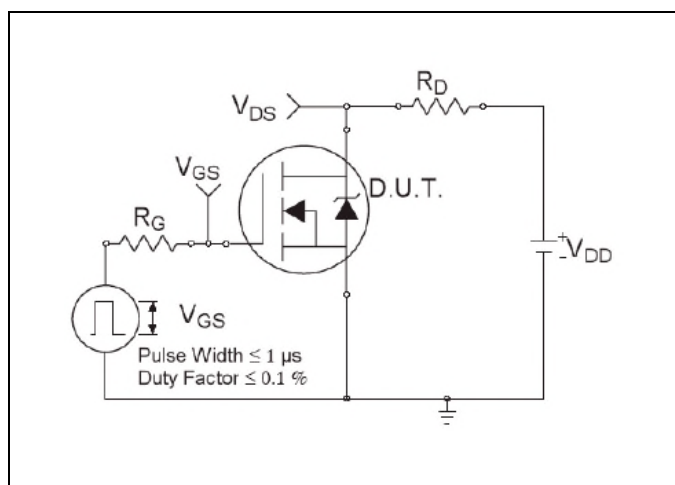


Figure 16 Switching Time Test Circuit

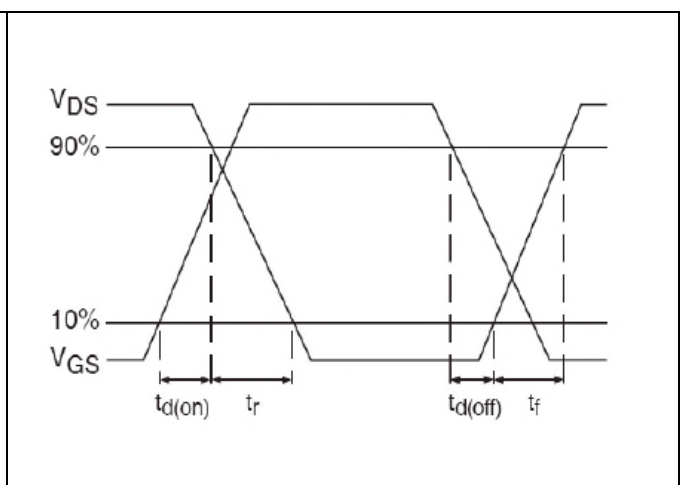


Figure 17 Switching Time Waveforms

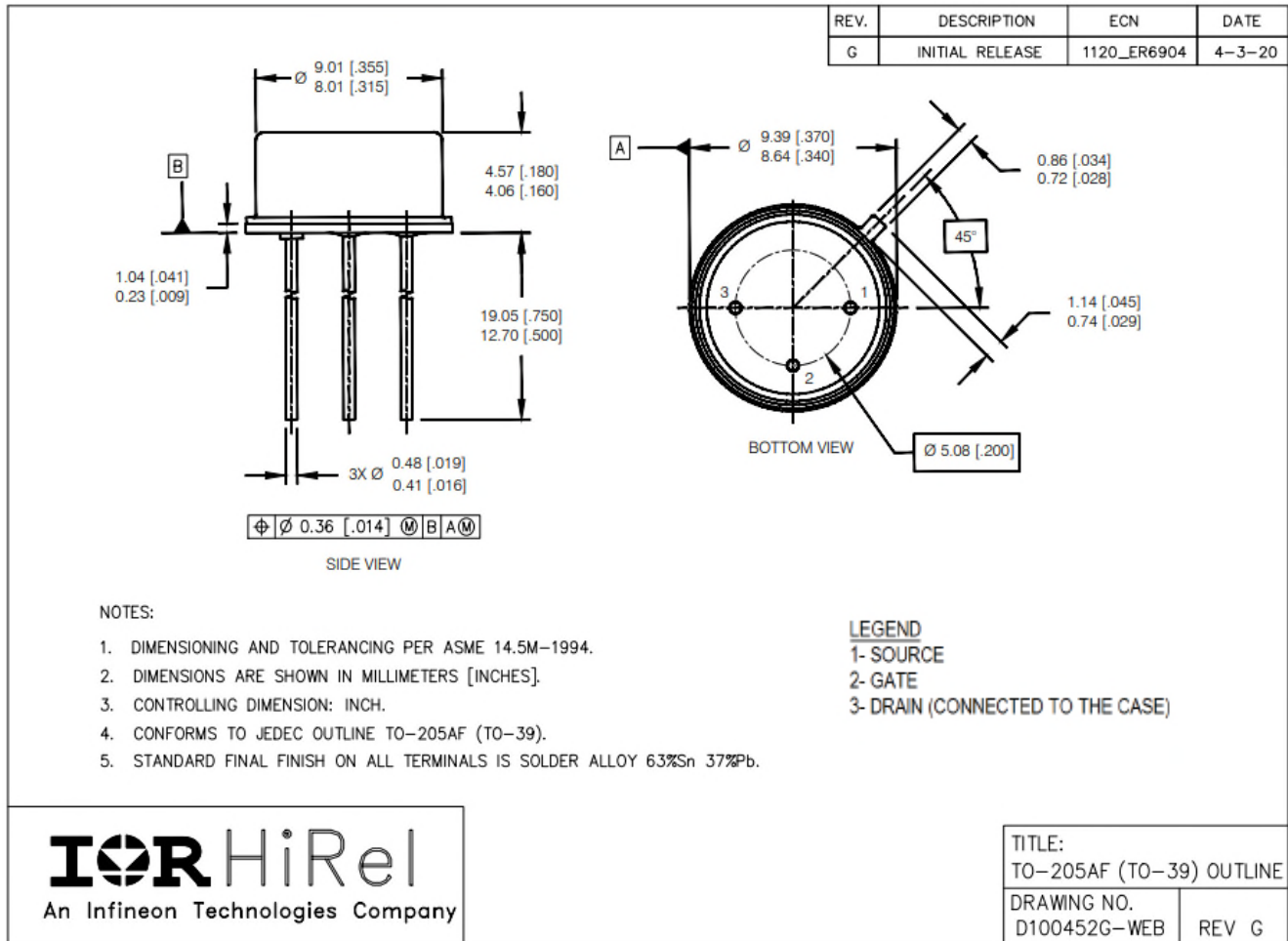
IRFF110

Power MOSFET Thru-Hole (TO-205AF / TO-39)

Package Outline

5 Package Outline

Note: For the most updated package outline, please see the website: [TO-205AF / TO-39](https://www.infineon.com/products/power/mosfet/to-205af-to-39)



Revision history**Revision history**

Document version	Date of release	Description of changes
	01/26/2001	Datasheet (PD-90423C)
Rev D	12/04/2018	Updated based on ECN-1120_06255
Rev E	01/16/2023	Updated based on ECN-1120_09384

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2023-01-16

Published by

**International Rectifier HiRel Products,
Inc.**

**An Infineon Technologies company
El Segundo, California 90245 USA**

**© 2023 Infineon Technologies AG.
All Rights Reserved.**

**Do you have a question about this
document?**

Email: erratum@infineon.com

Document reference

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest International Rectifier HiRel Products, Inc., an Infineon Technologies company, office.

International Rectifier HiRel Components may only be used in life-support devices or systems with the expressed written approval of International Rectifier HiRel Products, Inc., an Infineon Technologies company, if failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety and effectiveness of that device or system.

Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.