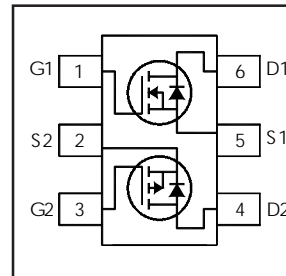


# IRF5851PbF

HEXFET® Power MOSFET

- Ultra Low On-Resistance
- Dual N and P Channel MOSFET
- Surface Mount
- Available in Tape & Reel
- Low Gate Charge
- Lead-Free

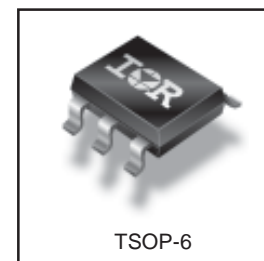


	N-Ch	P-Ch
$V_{DS}$	20V	-20V
$R_{DS(on)}$	0.090 $\Omega$	0.135 $\Omega$

## Description

These N and P channel MOSFETs from International Rectifier utilize advanced processing techniques to achieve the extremely low on-resistance per silicon area. This benefit provides the designer with an extremely efficient device for use in battery and load management applications.

This Dual TSOP-6 package is ideal for applications where printed circuit board space is at a premium and where maximum functionality is required. With two die per package, the IRF5851 can provide the functionality of two SOT-23 packages in a smaller footprint. Its unique thermal design and  $R_{DS(on)}$  reduction enables an increase in current-handling capability.



## Absolute Maximum Ratings

	Parameter	Max.		Units
		N-Channel	P-Channel	
$V_{DS}$	Drain-to-Source Voltage	20	-20	A
$I_D @ T_A = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	2.7	-2.2	
$I_D @ T_A = 70^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	2.2	-1.7	
$I_{DM}$	Pulsed Drain Current ①	11	-9.0	
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation ③	0.96		W
$P_D @ T_A = 70^\circ\text{C}$	Power Dissipation ③	0.62		
	Linear Derating Factor	7.7		mW/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 12$		V
$T_J, T_{STG}$	Junction and Storage Temperature Range	-55 to + 150		°C

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient ③	—	130	°C/W

# IRF5851PbF

International  
IR Rectifier

## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

Parameter	Description		Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage		20	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
			-20	—	—		V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient		—	0.016	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
			—	-0.011	—		Reference to 25°C, I <sub>D</sub> = -1mA
R <sub>DS(ON)</sub>	Static Drain-to-Source On-Resistance		—	—	0.090	Ω	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 2.7A ②
			—	—	0.120		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 2.2A ②
			—	—	0.135		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -2.2A ②
			—	—	0.220		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -1.7A ②
V <sub>GS(th)</sub>	Gate Threshold Voltage		0.60	—	1.25	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
			-0.45	—	-1.2		V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
g <sub>fs</sub>	Forward Transconductance		5.2	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 2.7A ②
			3.5	—	—		V <sub>DS</sub> = -10V, I <sub>D</sub> = -2.2A ②
I <sub>DSS</sub>	Drain-to-Source Leakage Current		—	—	1.0	μA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
			—	—	-1.0		V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V
			—	—	25		V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 70°C
			—	—	-25		V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 70°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage		—	—	±100		V <sub>GS</sub> = ±12V
Q <sub>g</sub>	Total Gate Charge		—	4.0	6.0		N-Channel I <sub>D</sub> = 2.7A, V <sub>DS</sub> = 10V, V <sub>GS</sub> = 4.5V ②
			—	3.6	5.4		
Q <sub>gs</sub>	Gate-to-Source Charge		—	0.95	—	nC	P-Channel I <sub>D</sub> = -2.2A, V <sub>DS</sub> = -10V, V <sub>GS</sub> = -4.5V ②
			—	0.66	—		
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge		—	0.83	—		N-Channel V <sub>DD</sub> = 10V, I <sub>D</sub> = 1.0A, R <sub>G</sub> = 6.2Ω, V <sub>GS</sub> = 4.5V ②
			—	5.7	—		
t <sub>d(on)</sub>	Turn-On Delay Time		—	6.6	—		P-Channel V <sub>DD</sub> = -10V, I <sub>D</sub> = -1.0A, R <sub>G</sub> = 6.0Ω, V <sub>GS</sub> = -4.5V ②
			—	8.3	—		
t <sub>r</sub>	Rise Time		—	1.2	—	ns	
			—	14	—		
t <sub>d(off)</sub>	Turn-Off Delay Time		—	15	—		
			—	31	—		
t <sub>f</sub>	Fall Time		—	2.4	—		
			—	28	—		
C <sub>iss</sub>	Input Capacitance		—	400	—	pF	N-Channel V <sub>GS</sub> = 0V, V <sub>DS</sub> = 15V, f = 1.0MHz
			—	320	—		
C <sub>oss</sub>	Output Capacitance		—	48	—		P-Channel V <sub>GS</sub> = 0V, V <sub>DS</sub> = -15V, f = 1.0MHz
			—	56	—		
C <sub>rss</sub>	Reverse Transfer Capacitance		—	32	—		
			—	40	—		

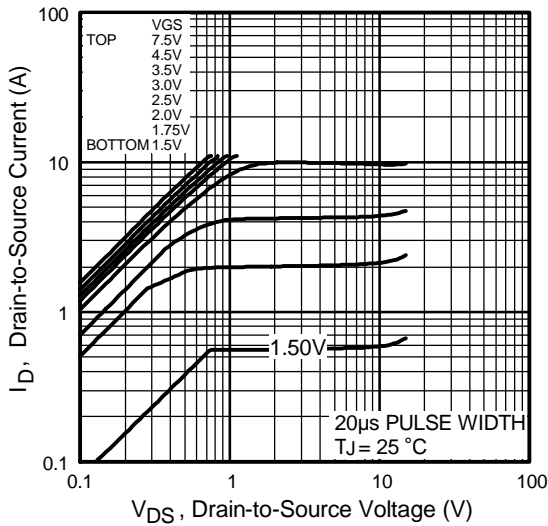
## Source-Drain Ratings and Characteristics

Parameter	Description		Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)		—	—	0.96	A	
			—	—	-0.96		
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①		—	—	11		
			—	—	-9.0		
V <sub>SD</sub>	Diode Forward Voltage		—	—	1.2	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 0.96A, V <sub>GS</sub> = 0V ②
			—	—	-1.2		T <sub>J</sub> = 25°C, I <sub>S</sub> = -0.96A, V <sub>GS</sub> = 0V ②
t <sub>rr</sub>	Reverse Recovery Time		—	25	38	ns	N-Channel T <sub>J</sub> = 25°C, I <sub>F</sub> = 0.96A, di/dt = 100A/μs
			—	23	35		
Q <sub>rr</sub>	Reverse Recovery Charge		—	6.5	9.8	nC	P-Channel T <sub>J</sub> = 25°C, I <sub>F</sub> = -0.96A, di/dt = -100A/μs ②
			—	7.7	12		

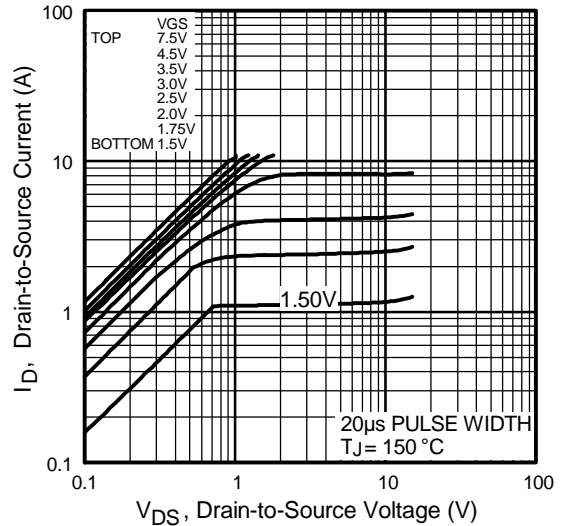
### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 10 & 26 )  
 ② Pulse width ≤ 400μs; duty cycle ≤ 2%.

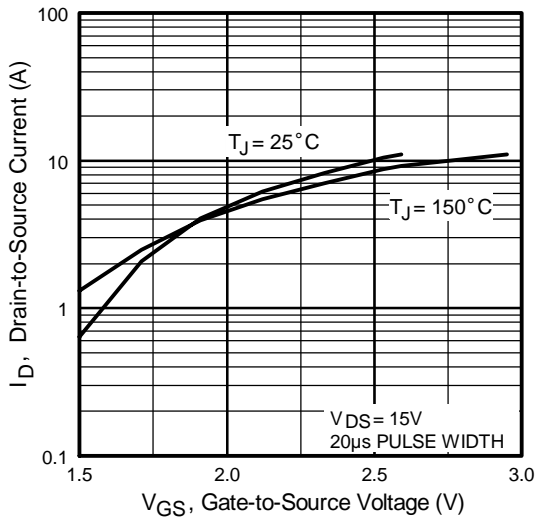
- ③ Surface mounted on FR-4 board, t ≤ 10sec.



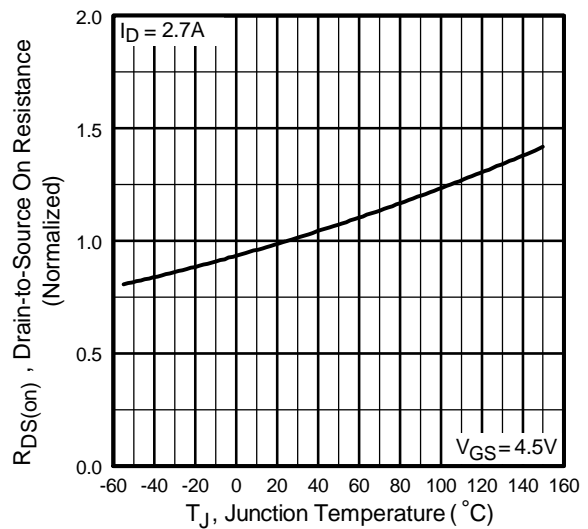
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



**Fig 3.** Typical Transfer Characteristics

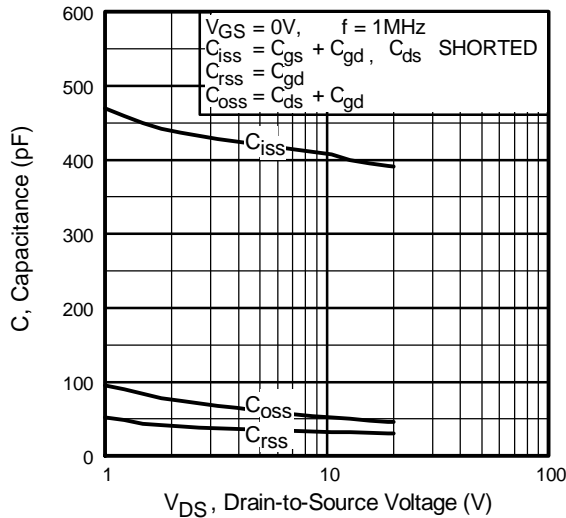


**Fig 4.** Normalized On-Resistance Vs. Temperature

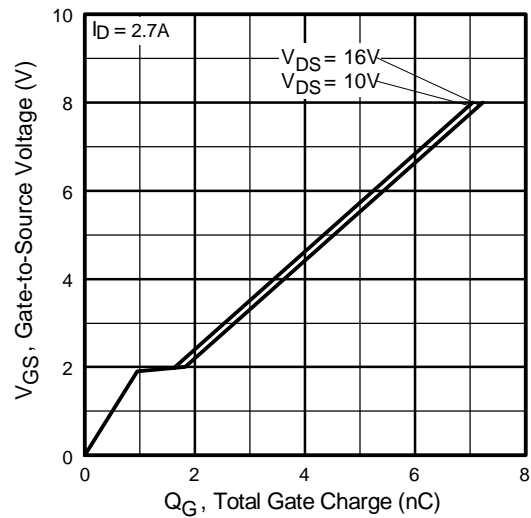
# IRF5851PbF

N-Channel

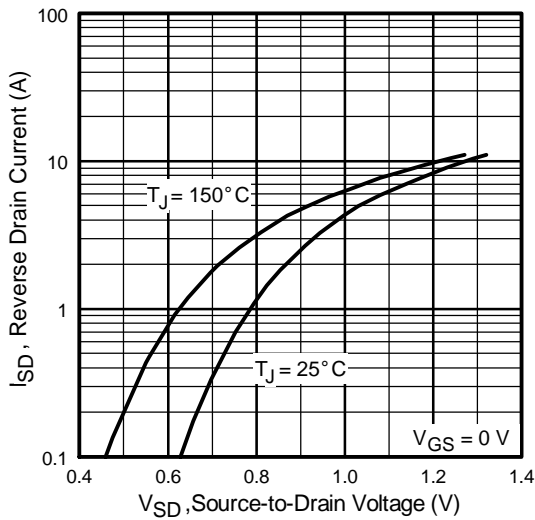
International  
IR Rectifier



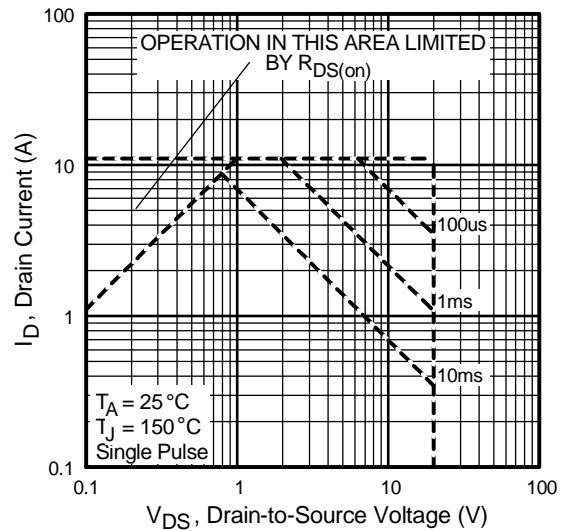
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



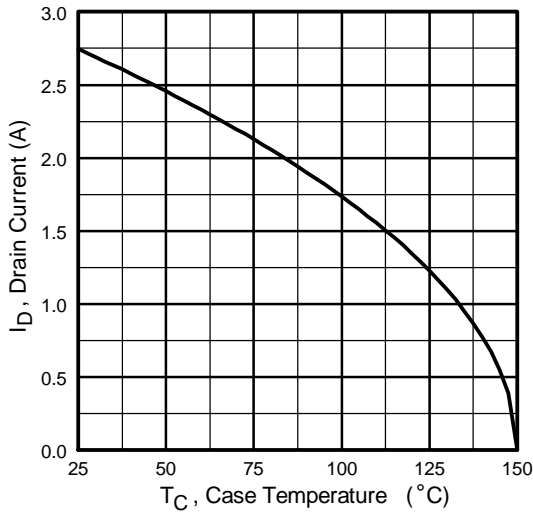
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



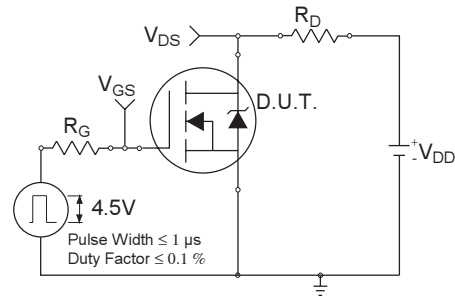
**Fig 7.** Typical Source-Drain Diode Forward Voltage



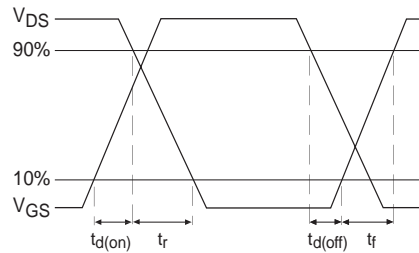
**Fig 8.** Maximum Safe Operating Area



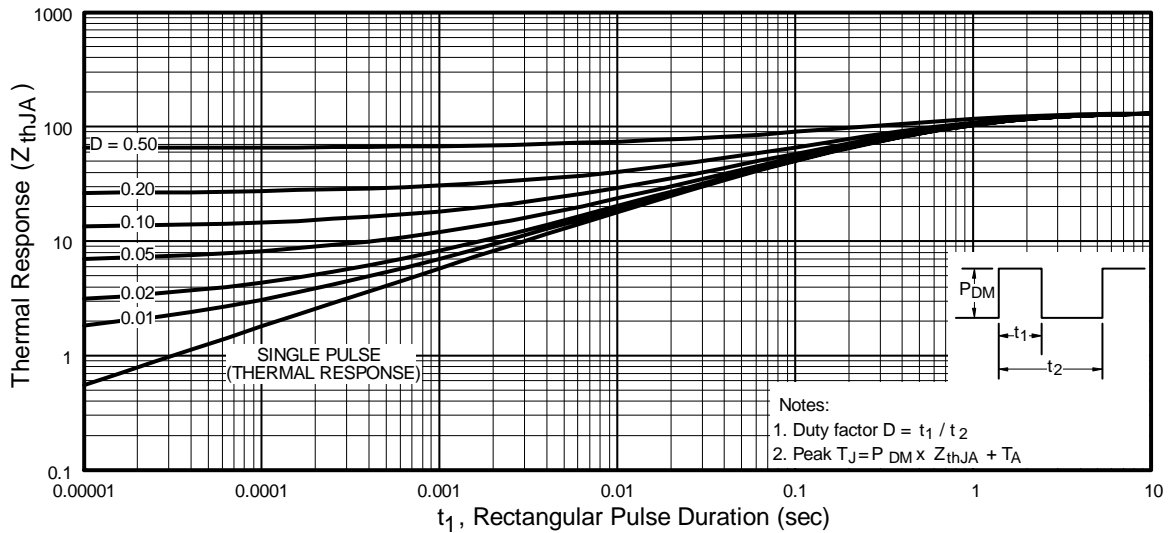
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



**Fig 10b.** Switching Time Waveforms

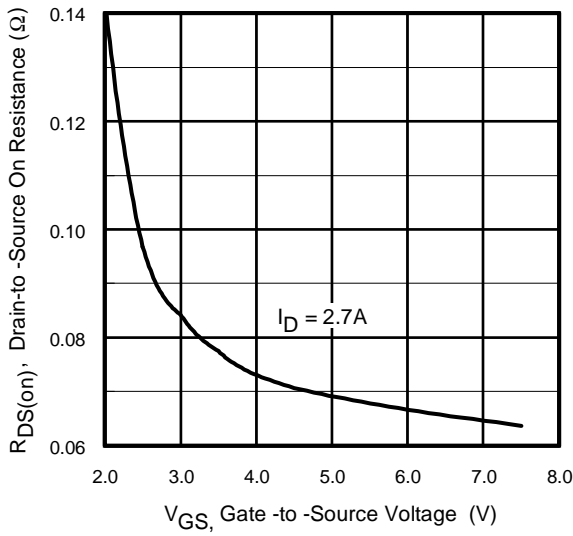


**Fig 10.** Typical Effective Transient Thermal Impedance, Junction-to-Ambient

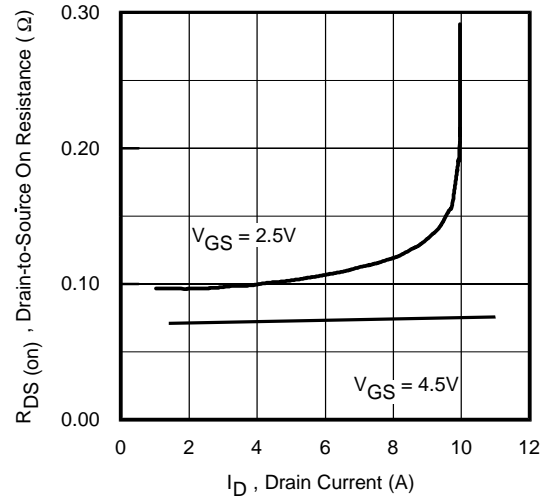
# IRF5851PbF

N-Channel

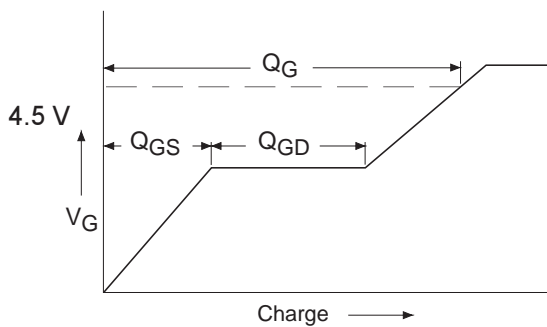
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**IR** Rectifier



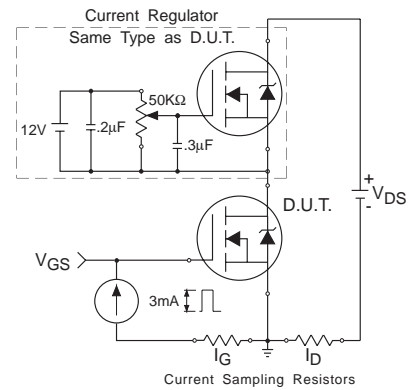
**Fig 11.** Typical On-Resistance Vs. Gate Voltage



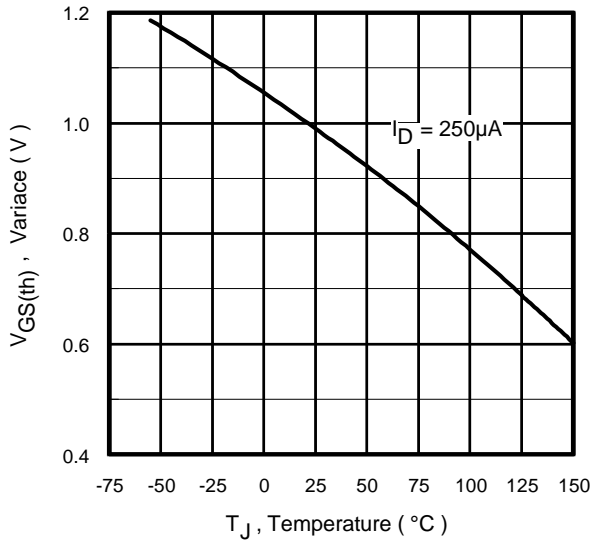
**Fig 12.** Typical On-Resistance Vs. Drain Current



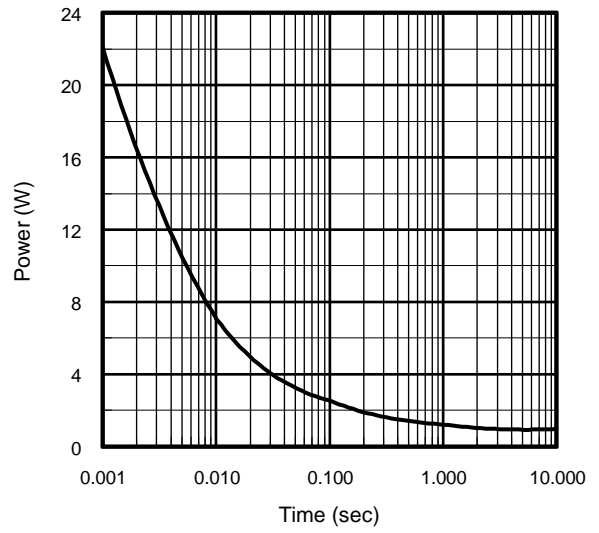
**Fig 13a.** Basic Gate Charge Waveform



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



**Fig 14.** Threshold Voltage Vs. Temperature

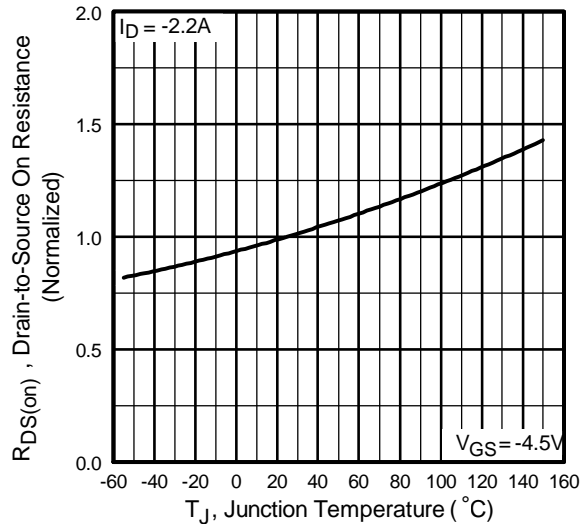
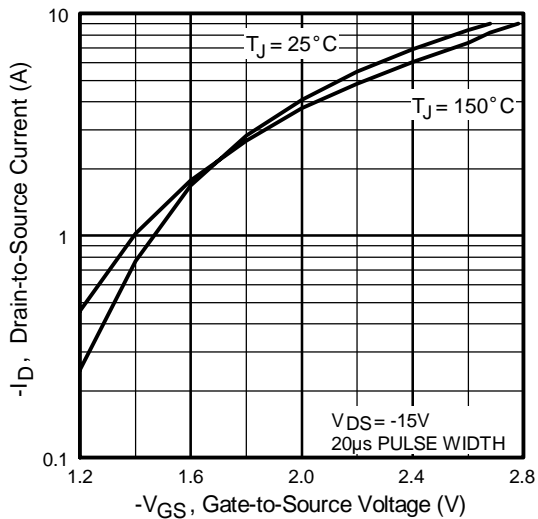
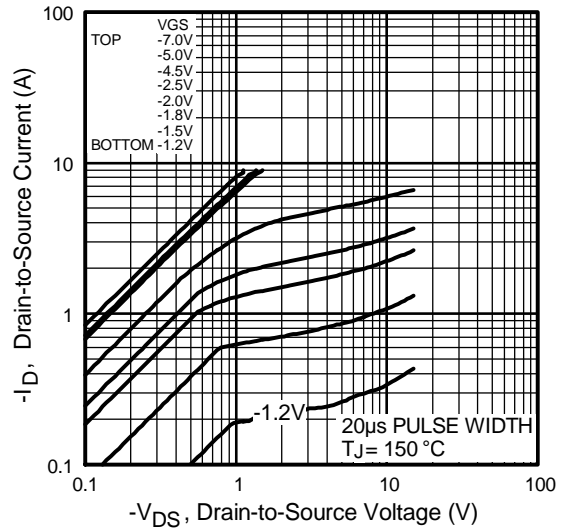
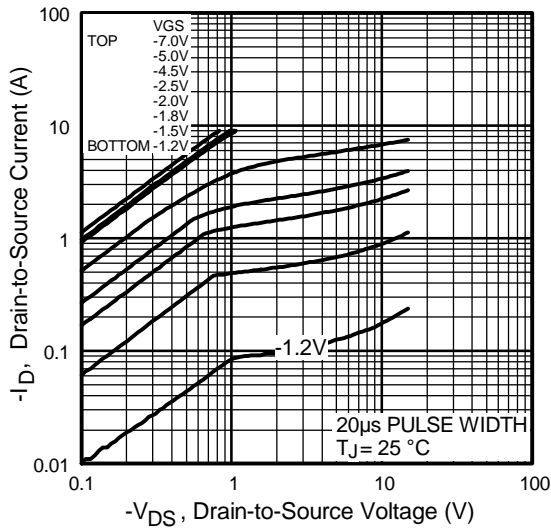


**Fig 15.** Typical Power Vs. Time

# IRF5851PbF

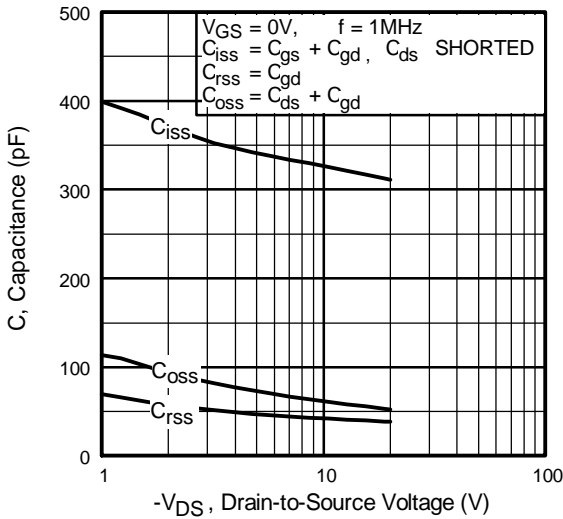
P-Channel

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**IR** Rectifier

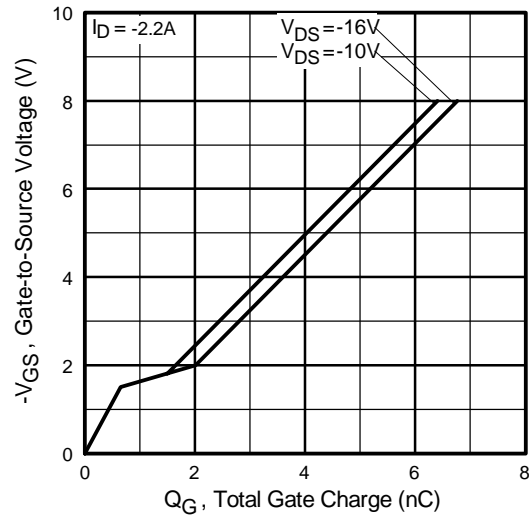




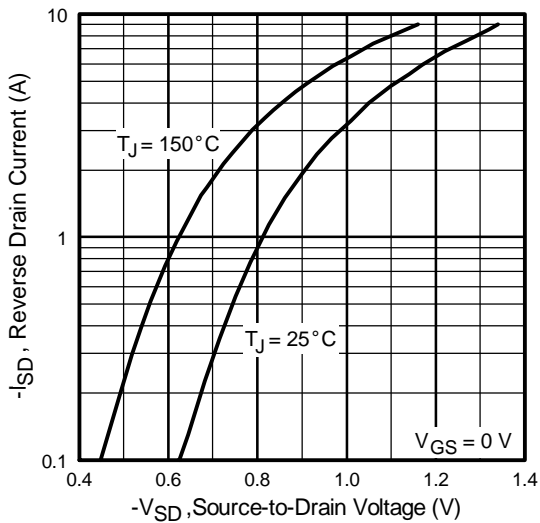
## P-Channel



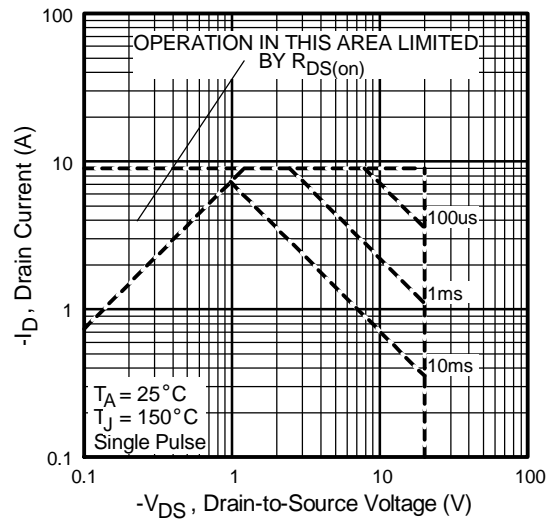
**Fig 20.** Typical Capacitance Vs. Drain-to-Source Voltage



**Fig 21.** Typical Gate Charge Vs. Gate-to-Source Voltage



**Fig 22.** Typical Source-Drain Diode Forward Voltage

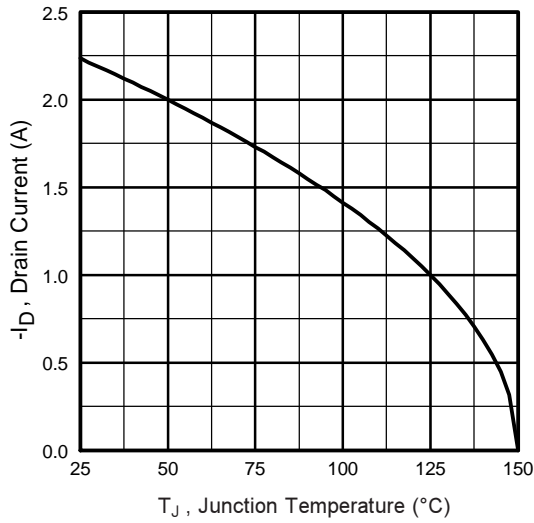


**Fig 23.** Maximum Safe Operating Area

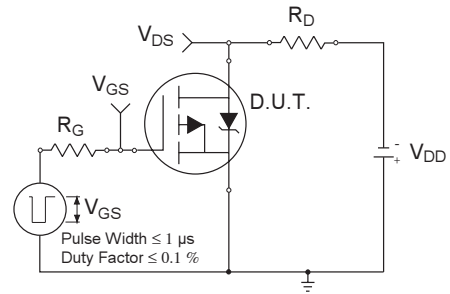
# IRF5851PbF

P-Channel

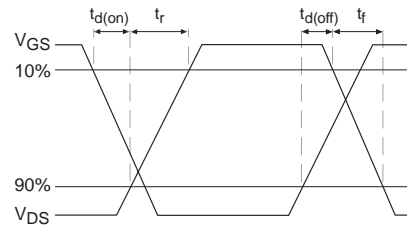
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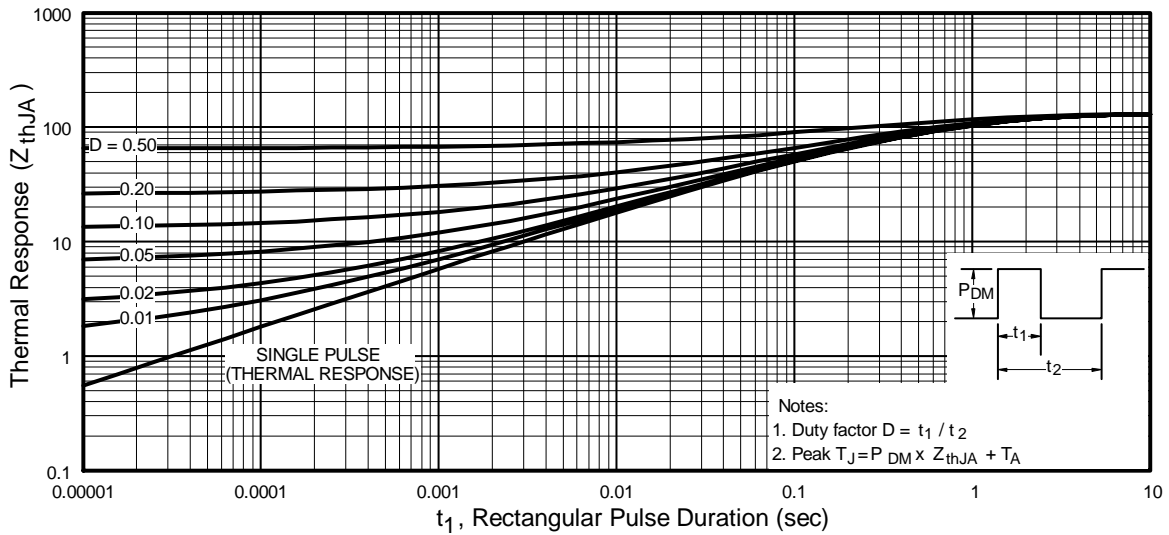
**Fig 24.** Maximum Drain Current Vs. Junction Temperature



**Fig 25a.** Switching Time Test Circuit



**Fig 25b.** Switching Time Waveforms



**Fig 26.** Typical Effective Transient Thermal Impedance, Junction-to-Ambient

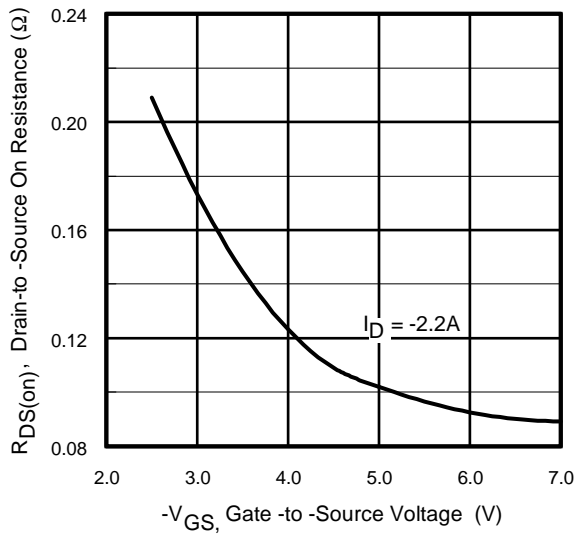


Fig 27. Typical On-Resistance Vs. Gate Voltage

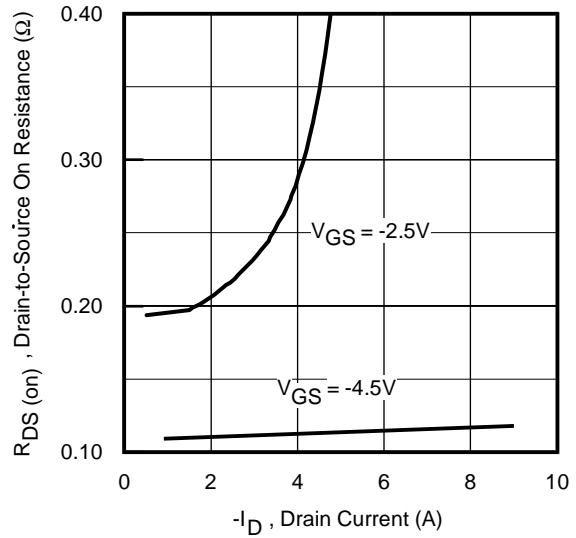


Fig 28. Typical On-Resistance Vs. Drain Current

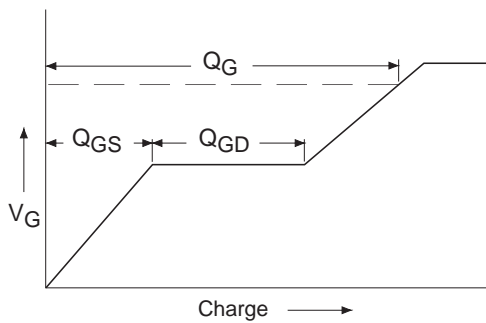


Fig 29a. Basic Gate Charge Waveform

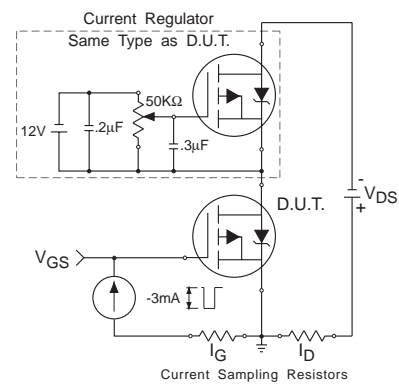
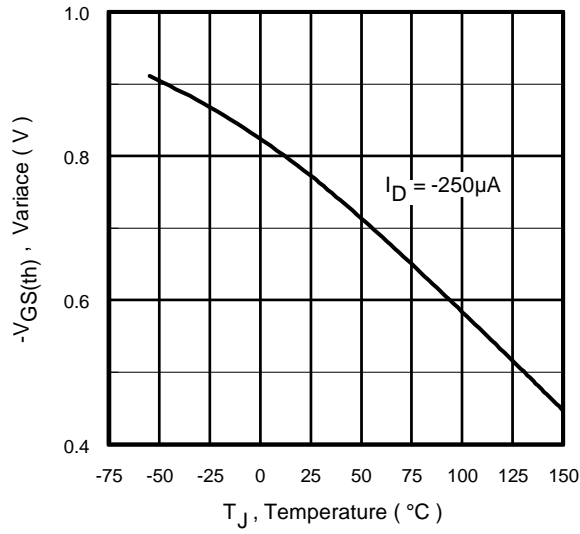


Fig 29b. Gate Charge Test Circuit

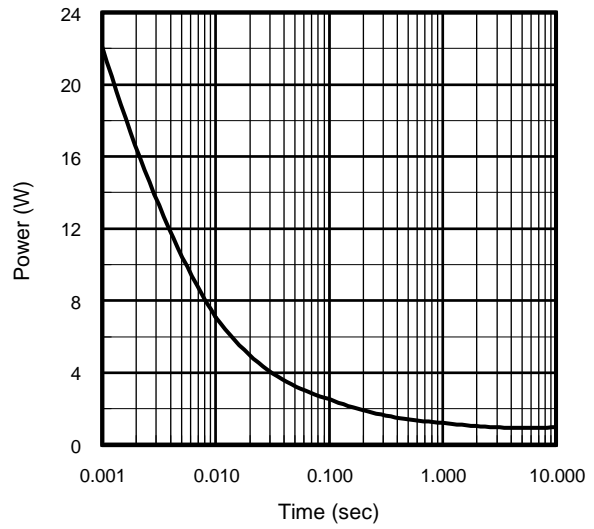
# IRF5851PbF

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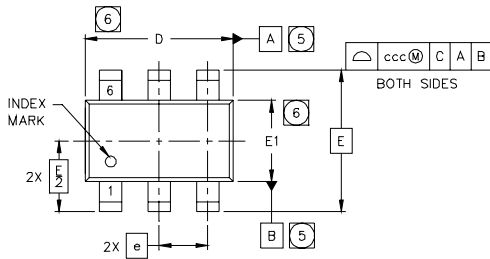


**Fig 30.** Threshold Voltage Vs. Temperature

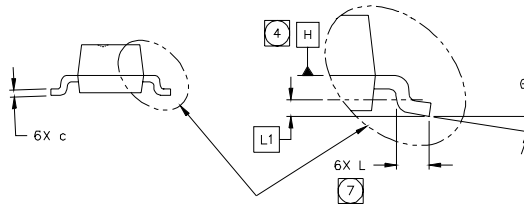
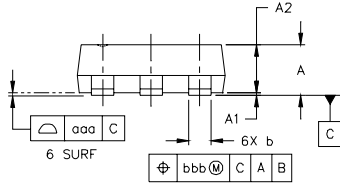


**Fig 31.** Typical Power Vs. Time

## TSOP-6 Package Outline

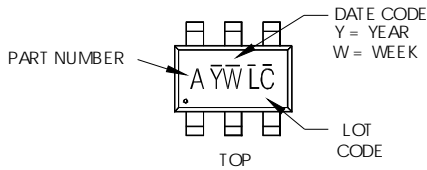


SYMBOL	MO-193AA DIMENSIONS					
	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.10	---	---	.0433
A1	0.01	---	0.10	.0004	---	.0039
A2	0.80	0.90	1.00	.0315	.0354	.0393
b	0.25	---	0.50	.0099	---	.0196
c	0.10	---	0.26	.004	---	.010
D	2.90	3.00	3.10	.115	.118	.122
E	2.75 BSC			.108 BSC		
E1	1.30	1.50	1.70	.052	.059	.066
e	1.00 BSC			.039 BSC		
L	0.20	0.40	0.60	.0079	.0157	.0236
L1	0.30 BSC			.0118 BSC		
θ	0°	---	8°	0°	---	8°
aaa	0.10			.004		
bbb	0.15			.006		
ccc	0.25			.010		



## TSOP-6 Part Marking Information

W = (1-26) IF PRECEDED BY LAST DIGIT OF CALENDAR YEAR



PART NUMBER CODE REFERENCE:

- A = SI3443DV
- B = IRF5800
- C = IRF5850
- D = IRF5851
- E = IRF5852
- F = IRF5801
- I = IRF5805
- J = IRF5806
- K = IRF5810
- L = IRF5804
- M = IRF5803
- N = IRF5802

Note: A line above the work week (as shown here) indicates Lead-Free.

YEAR	Y	WORK WEEK	W
2001	1	01	A
2002	2	02	B
2003	3	03	C
2004	4	04	D
2005	5		
2006	6		
2007	7		
2008	8		
2009	9		
2010	0	24	X
		25	Y
		26	Z

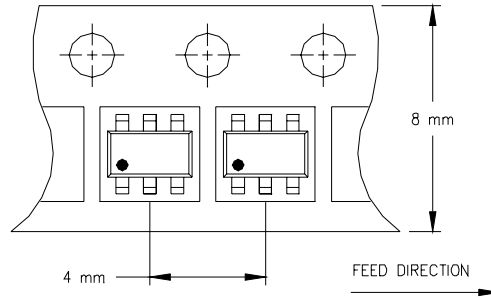
W = (27-52) IF PRECEDED BY A LETTER

YEAR	Y	WORK WEEK	W
2001	A	27	A
2002	B	28	B
2003	C	29	C
2004	D	30	D
2005	E		
2006	F		
2007	G		
2008	H		
2009	J		
2010	K	50	X
		51	Y
		52	Z

# IRF5851PbF

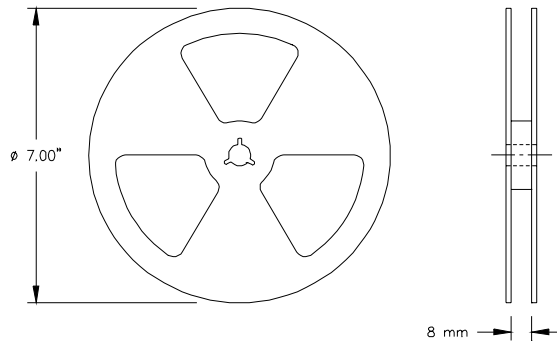
International  
**IR** Rectifier

## TSOP-6 Tape & Reel Information



NOTES:

1. OUTLINE CONFORMS TO EIA-481 & EIA-541.



NOTES:

1. OUTLINE CONFORMS TO EIA-481 & EIA-541.

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Consumer market.  
Qualifications Standards can be found on IR's Web site.

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
TAC Fax: (310) 252-7903  
Visit us at [www.irf.com](http://www.irf.com) for sales contact information.08/05