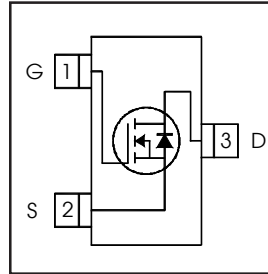


# IRLML0040TRPbF

HEXFET® Power MOSFET

$V_{DSS}$	<b>40</b>	<b>V</b>
$V_{GS\ Max}$	<b>± 16</b>	<b>V</b>
$R_{DS(on)\ max}$ (@ $V_{GS} = 10V$ )	<b>56</b>	<b>mΩ</b>
$R_{DS(on)\ max}$ (@ $V_{GS} = 4.5V$ )	<b>78</b>	<b>mΩ</b>



## Application(s)

- Load/ System Switch
- DC Motor Drive

## Features and Benefits

### Features

Low $R_{DS(on)}$ ( $\leq 56m\Omega$ )
Industry-standard pinout
Compatible with existing Surface Mount Techniques
RoHS compliant containing no lead, no bromide and no halogen
MSL1, Consumer qualification

results in  
⇒

### Benefits

Lower switching losses
Multi-vendor compatibility
Easier manufacturing
Environmentally friendly
Increased reliability

## Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
$V_{DS}$	Drain-Source Voltage	40	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	3.6	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	2.9	
$I_{DM}$	Pulsed Drain Current	15	
$P_D @ T_A = 25^\circ C$	Maximum Power Dissipation	1.3	W
$P_D @ T_A = 70^\circ C$	Maximum Power Dissipation	0.8	
	Linear Derating Factor	0.01	
$V_{GS}$	Gate-to-Source Voltage	± 16	V
$T_J, T_{STG}$	Junction and Storage Temperature Range	-55 to + 150	°C

## Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient ③	—	100	°C/W
$R_{\theta JA}$	Junction-to-Ambient ( $t < 10s$ ) ④	—	99	

### ORDERING INFORMATION:

See detailed ordering and shipping information on the last page of this data sheet.

Notes ① through ④ are on page 10  
www.irf.com

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.04	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	44	56	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3.6A ②
		—	62	78		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 2.9A ②
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.0	1.8	2.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 25μA
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	100	nA	V <sub>GS</sub> = 16V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -16V
R <sub>G</sub>	Internal Gate Resistance	—	1.1	—	Ω	
g <sub>fs</sub>	Forward Transconductance	6.2	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 3.6A
Q <sub>g</sub>	Total Gate Charge	—	2.6	3.9	nC	I <sub>D</sub> = 3.6A
Q <sub>gs</sub>	Gate-to-Source Charge	—	0.7	—		V <sub>DS</sub> = 20V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	1.4	—		V <sub>GS</sub> = 4.5V ②
t <sub>d(on)</sub>	Turn-On Delay Time	—	5.1	—	ns	V <sub>DD</sub> = 20V
t <sub>r</sub>	Rise Time	—	5.4	—		I <sub>D</sub> = 1.0A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	6.4	—		R <sub>G</sub> = 6.8 Ω
t <sub>f</sub>	Fall Time	—	4.3	—		V <sub>GS</sub> = 4.5V
C <sub>iss</sub>	Input Capacitance	—	266	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	49	—		V <sub>DS</sub> = 25V
C <sub>riss</sub>	Reverse Transfer Capacitance	—	29	—		f = 1.0MHz

## Source - Drain Ratings and Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	1.3	A	MOSFET symbol showing the integral reverse p-n junction diode.
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	15		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.2	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 1.3A, V <sub>GS</sub> = 0V ②
t <sub>rr</sub>	Reverse Recovery Time	—	10	—	ns	T <sub>J</sub> = 25°C, V <sub>R</sub> = 32V, I <sub>F</sub> = 1.3 A
Q <sub>rr</sub>	Reverse Recovery Charge	—	9.3	—	nC	di/dt = 100A/μs ②

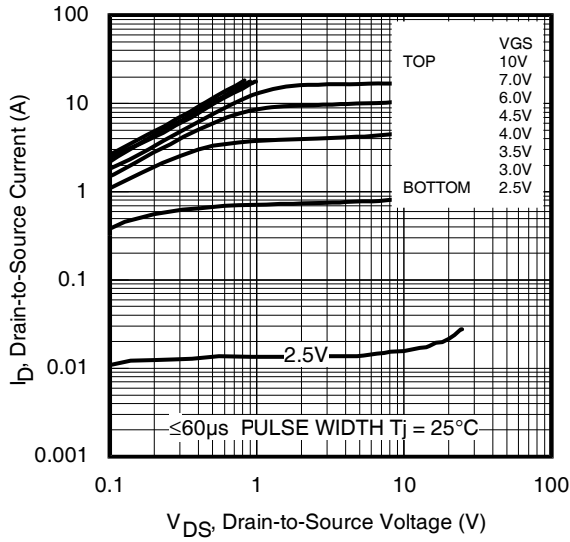


Fig 1. Typical Output Characteristics

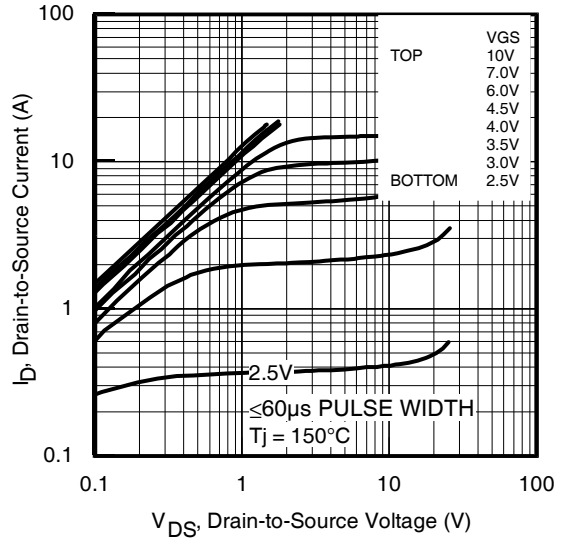


Fig 2. Typical Output Characteristics

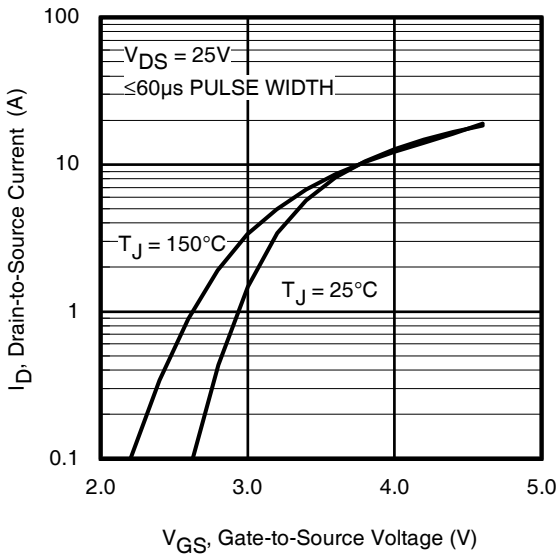


Fig 3. Typical Transfer Characteristics

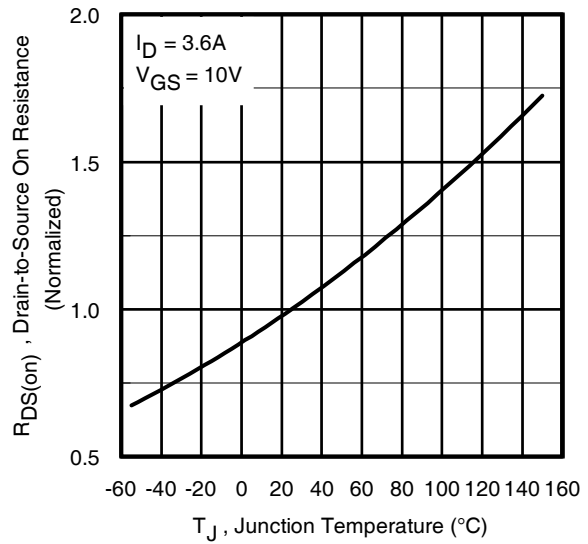
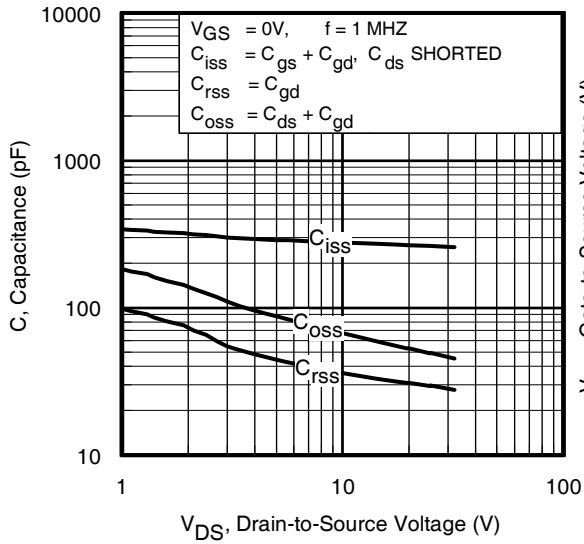
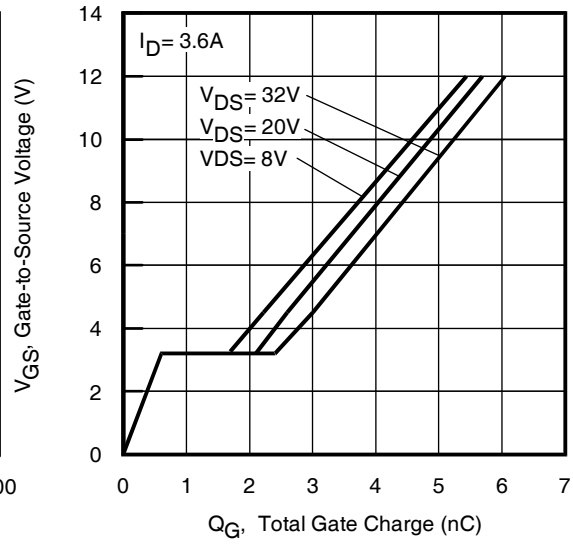


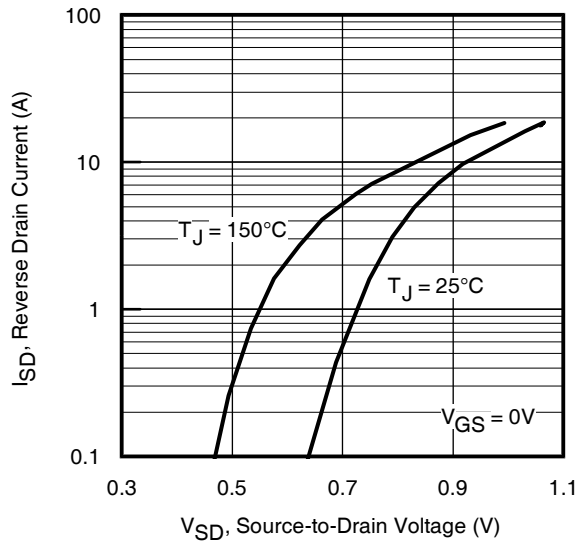
Fig 4. Normalized On-Resistance Vs. Temperature



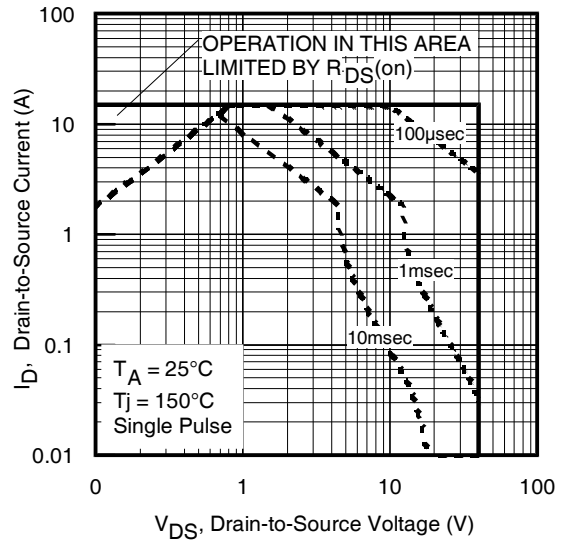
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



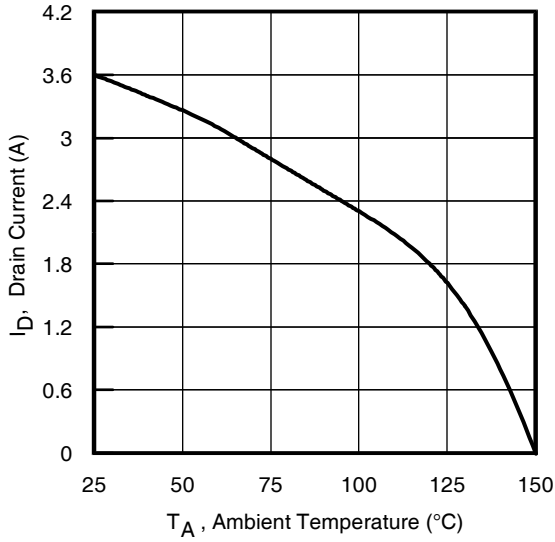
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



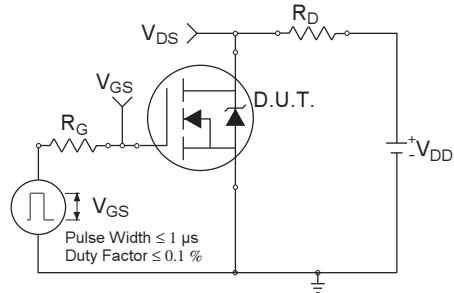
**Fig 7.** Typical Source-Drain Diode Forward Voltage



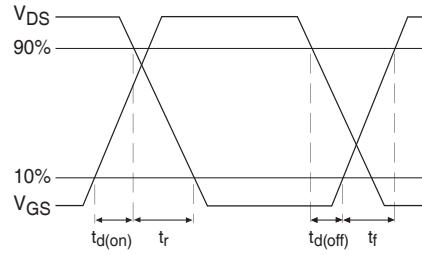
**Fig 8.** Maximum Safe Operating Area



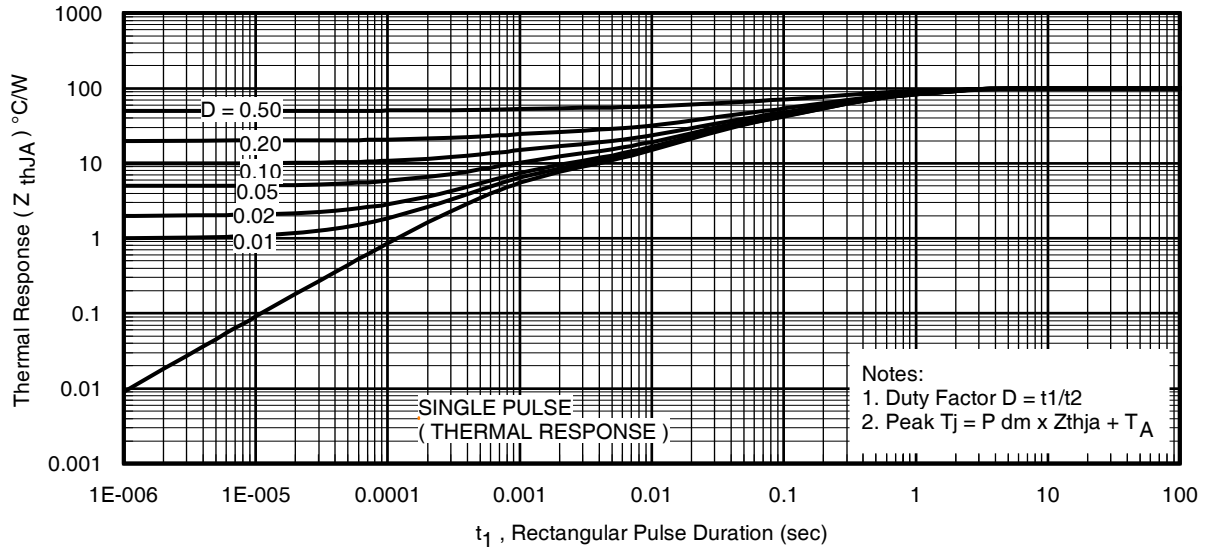
**Fig 9.** Maximum Drain Current Vs. Ambient Temperature



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



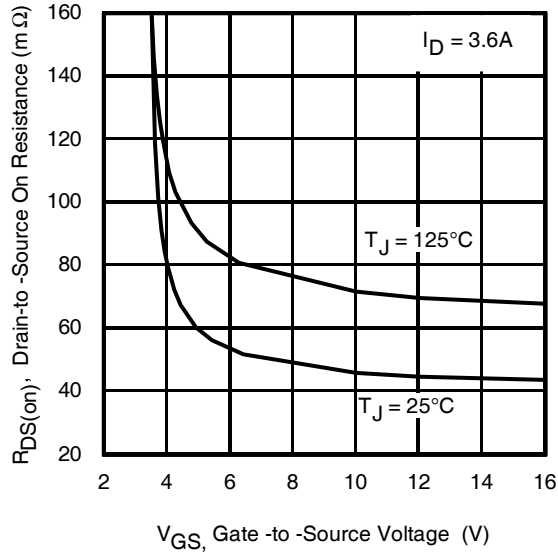
**Fig 10b.** Switching Time Waveforms



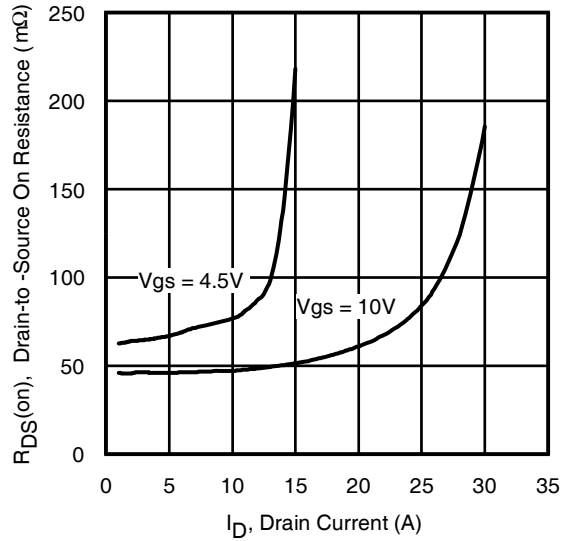
**Fig 11.** Typical Effective Transient Thermal Impedance, Junction-to-Ambient

# IRLML0040TRPbF

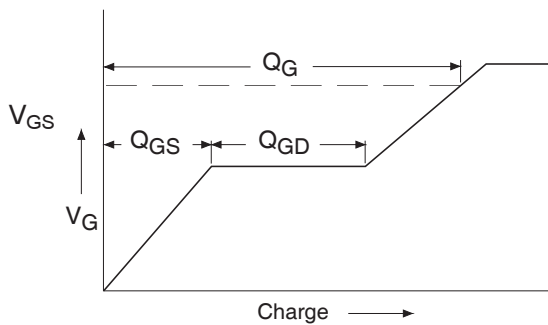
International  
**IR** Rectifier



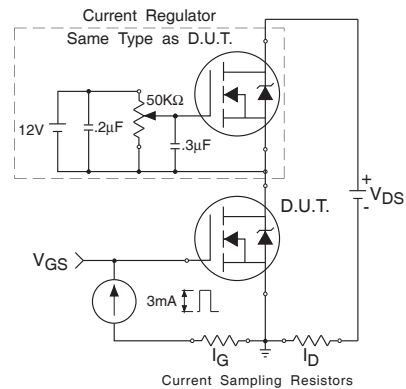
**Fig 12.** Typical On-Resistance Vs. Gate Voltage



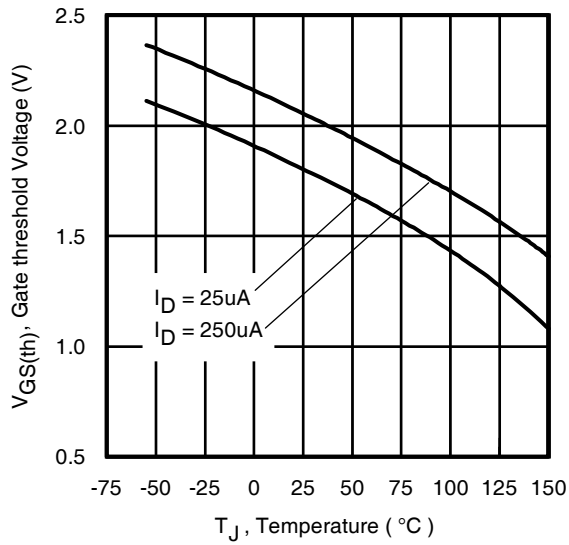
**Fig 13.** Typical On-Resistance Vs. Drain Current



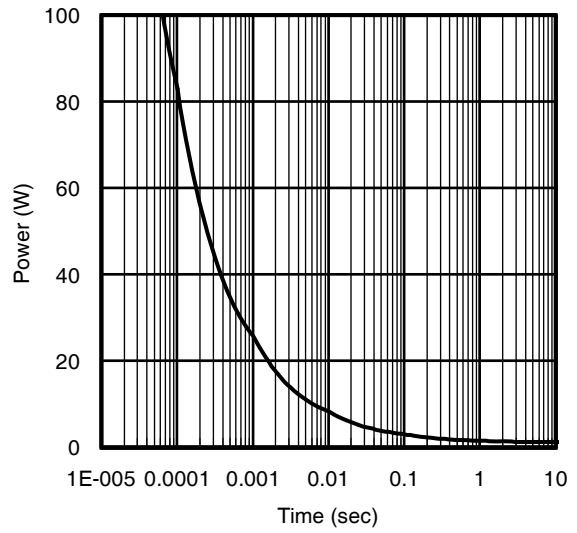
**Fig 14a.** Basic Gate Charge Waveform



**Fig 14b.** Gate Charge Test Circuit



**Fig 15.** Typical Threshold Voltage Vs. Junction Temperature



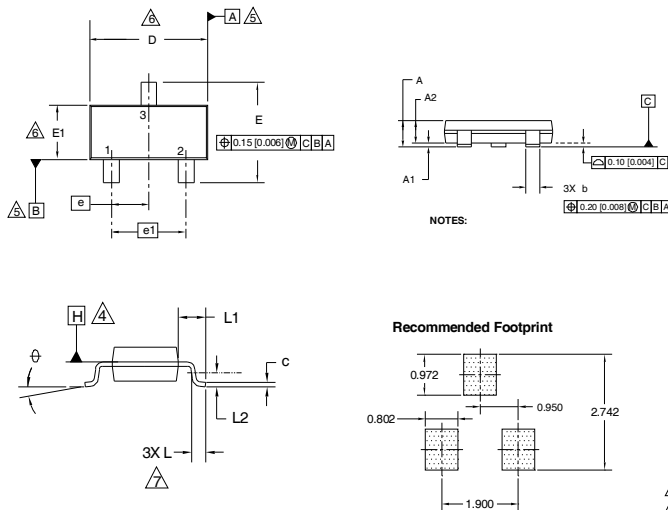
**Fig 16.** Typical Power Vs. Time

# IRLML0040TRPbF

International  
**IR** Rectifier

## Micro3 (SOT-23) Package Outline

Dimensions are shown in millimeters (inches)

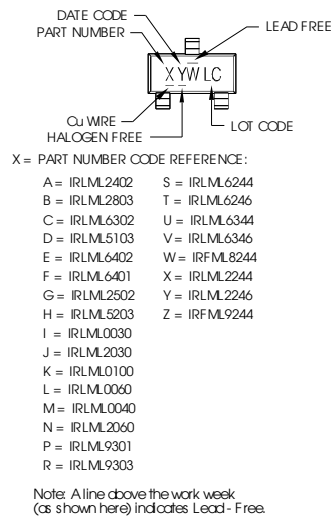


SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.89	1.12	0.035	0.044
A1	0.01	0.10	0.0004	0.004
A2	0.88	1.02	0.035	0.040
b	0.30	0.50	0.012	0.020
c	0.08	0.20	0.003	0.008
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E1	1.20	1.40	0.047	0.055
e	0.95	BSC	0.037	BSC
e1	1.90	BSC	0.075	BSC
L	0.40	0.60	0.016	0.024
L1	0.54	REF	0.021	REF
L2	0.25	BSC	0.010	BSC
⌀	0	8	0	8

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES)
3. CONTROLLING DIMENSION: MILLIMETER
4. DATUM PLANE H IS LOCATED AT THE MOLD PARTING LINE
5. DATUM A AND B TO BE DETERMINED AT DATUM PLANE H
6. DIMENSIONS D AND E1 ARE MEASURED AT DATUM PLANE H. DIMENSIONS DOES NOT INCLUDE MOLD PROTRUSIONS OR INTERLEAD FLASH. MOLD PROTRUSIONS OR INTERLEAD FLASH SHALL NOT EXCEED 0.25 MM [0.010 INCH] PER SIDE
7. DIMENSION L IS THE LEAD LENGTH FOR SOLDERING TO A SUBSTRATE
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-236 AB.

## Micro3 (SOT-23/TO-236AB) Part Marking Information

Notes: This part marking information applies to devices produced after 02/26/2001



### DATE CODE MARKING INSTRUCTIONS

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

YEAR	Y	WORK WEEK	W
2011	2001	1 01	A
2012	2002	2 02	B
2013	2003	3 03	C
2014	2004	4 04	D
2015	2005	5	
2016	2006	6	
2017	2007	7	
2018	2008	8	
2019	2009	9	
2020	2010	0 24	X
		25	Y
		26	Z

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

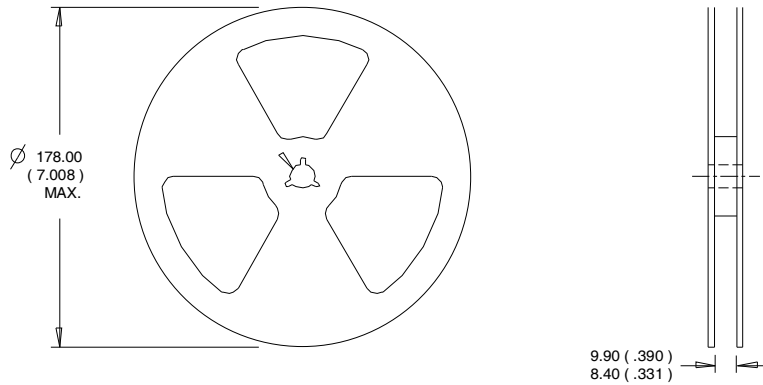
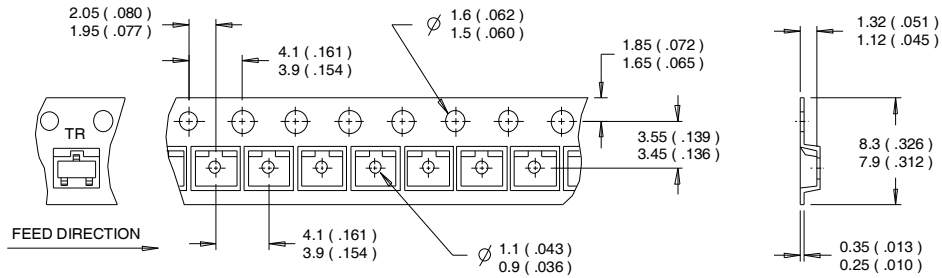
YEAR	Y	WORK WEEK	W
2011	2001	A 27	A
2012	2002	B 28	B
2013	2003	C 29	C
2014	2004	D 30	D
2015	2005	E	
2016	2006	F	
2017	2007	G	
2018	2008	H	
2019	2009	J	
2020	2010	K 50	X
		51	Y
		52	Z

Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>



## Micro3™ (SOT-23) Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES:
1. CONTROLLING DIMENSION : MILLIMETER.
  2. OUTLINE CONFORMS TO EIA-481 & EIA-541.

Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>  
[www.irf.com](http://www.irf.com)

# IRLML0040TRPbF

International  
**IR** Rectifier

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRLML0040TRPbF	Micro3 (SOT-23)	Tape and Reel	3000	

## Qualification information<sup>†</sup>

Qualification level	Consumer <sup>††</sup> (per JEDEC JES D47F <sup>†††</sup> guidelines)		
Moisture Sensitivity Level	Micro3 (SOT-23)	MSL1 (per IPC/JEDEC J-STD-020D <sup>†††</sup> )	
RoHS compliant	Yes		

- † Qualification standards can be found at International Rectifier's web site  
<http://www.irf.com/product-info/reliability>
- †† Higher qualification ratings may be available should the user have such requirements.  
Please contact your International Rectifier sales representative for further information:  
<http://www.irf.com/whoto-call/salesrep/>
- ††† Applicable version of JEDEC standard at the time of product release.

## Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Pulse width ≤ 400µs; duty cycle ≤ 2%.
- ③ Surface mounted on 1 in square Cu board
- ④ Refer to [application note #AN-994](#).

Data and specifications subject to change without notice.

International  
**IR** Rectifier

IR WORLD HEADQUARTERS: 101N.Sepulveda blvd, El Segundo, California 90245, USA Tel: (310) 252-7105  
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