# International IƏR Rectifier

# IRLML6302GPbF

HEXFET® Power MOSFET

- Generation V Technology
- Ultra Low On-Resistance
- P-Channel MOSFET
- SOT-23 Footprint
- Low Profile (<1.1mm)
- Available in Tape and Reel
- Fast Switching
- Lead-Free
- Halogen-Free

V_{DSS} = -20V

$R_{DS(on)}$ = 0.60Ω

Micro3™
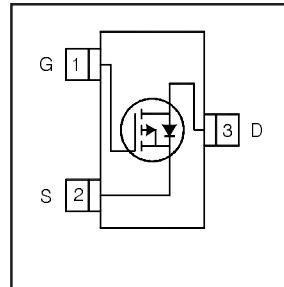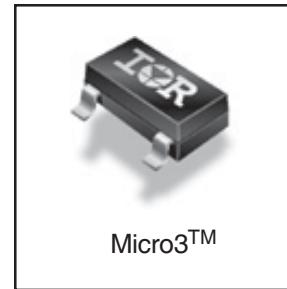
Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon 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 and reliable device for use in a wide variety of applications.

A customized leadframe has been incorporated into the standard SOT-23 package to produce a HEXFET Power MOSFET with the industry's smallest footprint. This package, dubbed the Micro3, is ideal for applications where printed circuit board space is at a premium. The low profile (<1.1mm) of the Micro3 allows it to fit easily into extremely thin application environments such as portable electronics and PCMCIA cards.

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ -4.5V	-0.78	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ -4.5V	-0.62	
I_{DM}	Pulsed Drain Current ①	-4.9	
P_D @ T_A = 25°C	Power Dissipation	540	mW
	Linear Derating Factor	4.3	mW/°C
V_{GS}	Gate-to-Source Voltage	± 12	V
dv/dt	Peak Diode Recovery dv/dt ②	-5.0	V/ns
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 ④	—	230	°C/W

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-20	——	——	V	V_{GS} = 0V, I_D = -250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	-4.9	——	mV/°C	Reference to 25°C, I_D = -1mA
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	——	——	0.60	Ω	V_{GS} = -4.5V, I_D = -0.61A ③
		——	——	0.90		V_{GS} = -2.7V, I_D = -0.31A ③
$V_{GS(th)}$	Gate Threshold Voltage	-0.70	——	-1.5	V	V_{DS} = V_{GS}, I_D = -250µA
g_{fs}	Forward Transconductance	0.56	——	——	S	V_{DS} = -10V, I_D = -0.31A
I_{DSS}	Drain-to-Source Leakage Current	——	——	-1.0	µA	V_{DS} = -16V, V_{GS} = 0V
		——	——	-25		V_{DS} = -16V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	-100	nA	V_{GS} = -12V
	Gate-to-Source Reverse Leakage	——	——	100		V_{GS} = 12V
Q_g	Total Gate Charge	——	2.4	3.6		I_D = -0.61A
Q_{gs}	Gate-to-Source Charge	——	0.56	0.84	nC	V_{DS} = -16V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	1.0	1.5		V_{GS} = -4.5V, See Fig. 6 and 9 ③
$t_{d(on)}$	Turn-On Delay Time	——	13	——		V_{DD} = -10V
t_r	Rise Time	——	18	——	ns	I_D = -0.61A
$t_{d(off)}$	Turn-Off Delay Time	——	22	——		R_G = 6.2Ω
t_f	Fall Time	——	22	——		R_D = 16Ω, See Fig. 10 ③
C_{iss}	Input Capacitance	——	97	——		V_{GS} = 0V
C_{oss}	Output Capacitance	——	53	——	pF	V_{DS} = -15V
C_{rss}	Reverse Transfer Capacitance	——	28	——		ƒ = 1.0MHz, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	-0.54	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	-4.9		
V_{SD}	Diode Forward Voltage	——	——	-1.2	V	T_J = 25°C, I_S = -0.61A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	——	35	53	ns	T_J = 25°C, I_F = -0.61A
Q_{rr}	Reverse Recovery Charge	——	26	39	nC	di/dt = -100A/µs ④
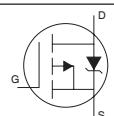
Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② I_{SD} ≤ -0.61A, di/dt ≤ 76A/µs, V_{DD}≤$V_{(BR)DSS}$, T_J≤ 150°C

③ Pulse width ≤ 300µs; duty cycle ≤ 2%.

④ Surface mounted on FR-4 board, t ≤ 5sec.
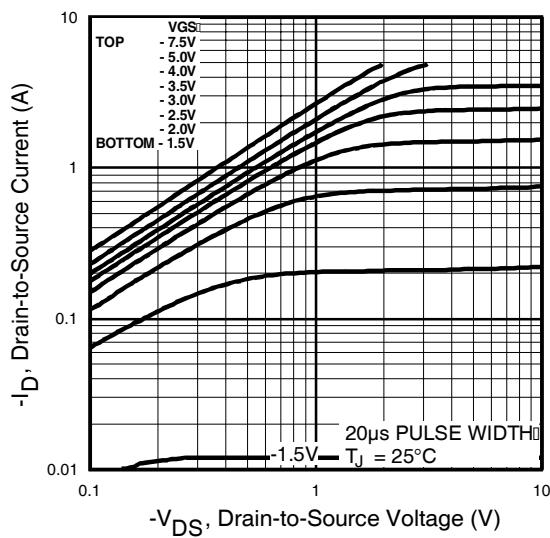
IRLML6302GPbF


Fig 1. Typical Output Characteristics
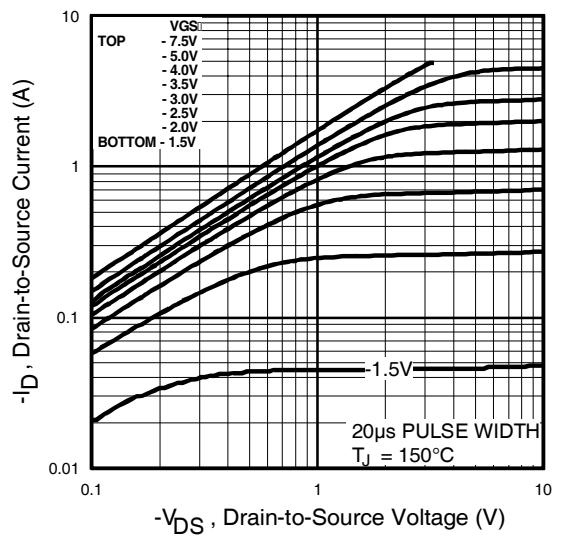
**Fig 2.** Typical Output Characteristics
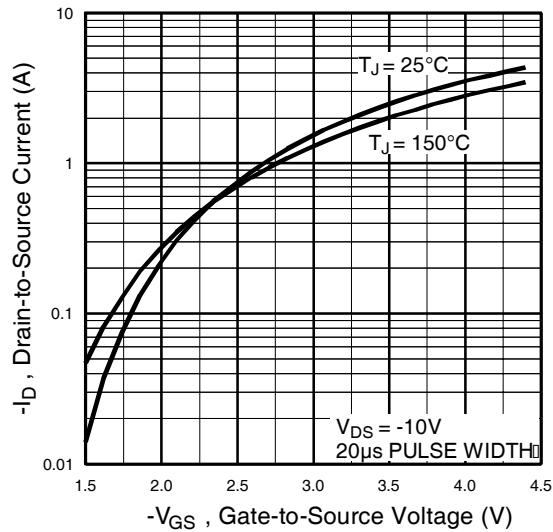

Fig 3. Typical Transfer Characteristics
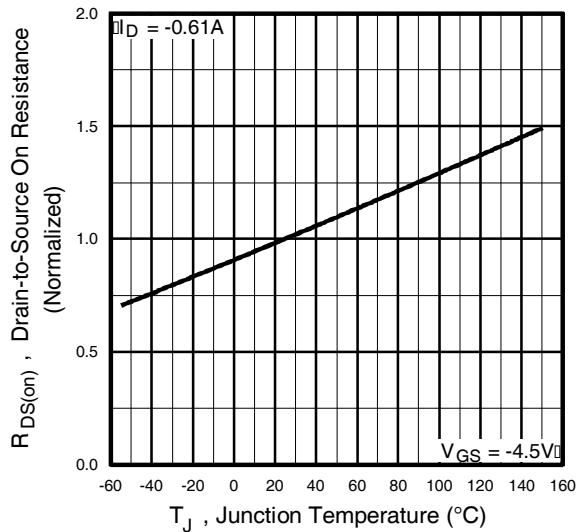
Fig 4. Normalized On-Resistance Vs. Temperature

IRLML6302GPbF

International
I&R Rectifier
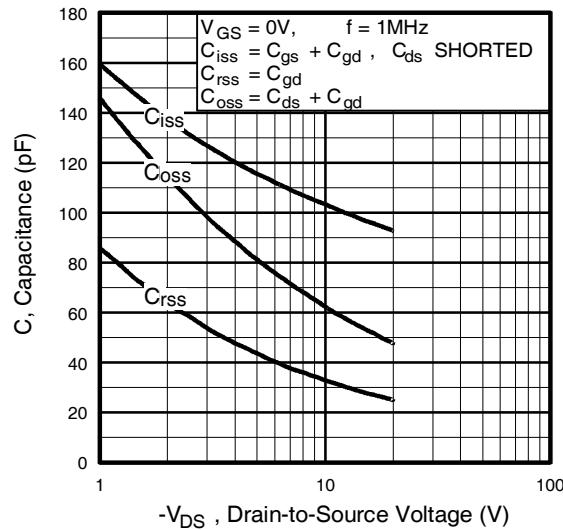

Fig 5. Typical Capacitance Vs.
Drain-to-Source Voltage
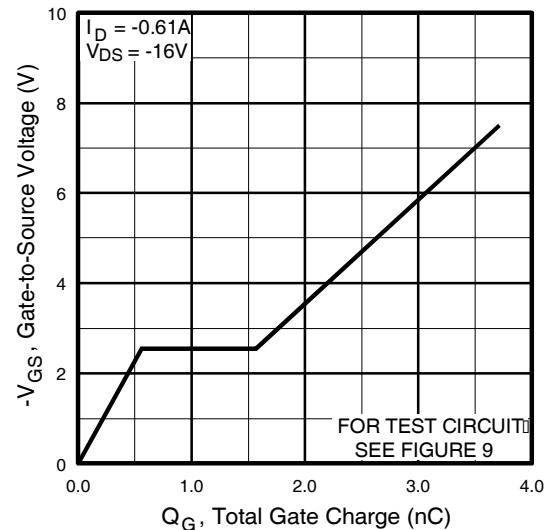

Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage
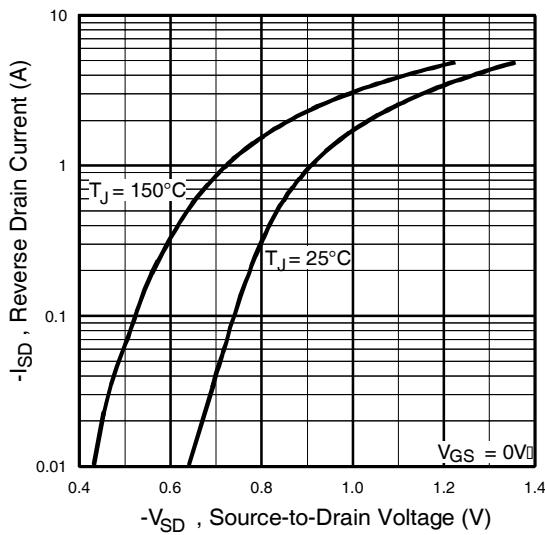
Fig 7. Typical Source-Drain Diode
Forward Voltage
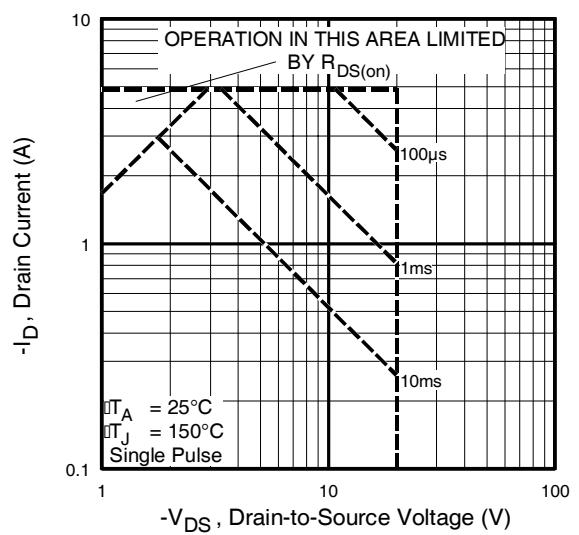
Fig 8. Maximum Safe Operating Area

www.irf.com
4
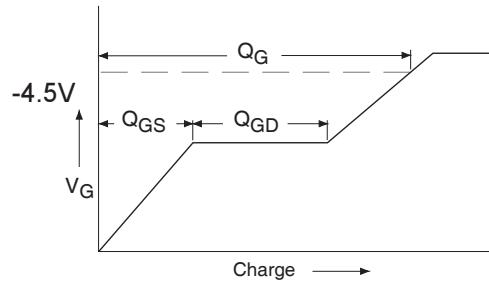
Fig 9a. Basic Gate Charge Waveform

Fig 10a. Switching Time Test Circuit


Fig 9b. Gate Charge Test Circuit
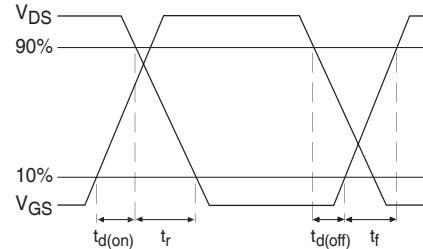
Fig 10b. Switching Time Waveforms

Notes:
1. Duty factor D = t_1 / t_2
2. Peak $T_J = P_{DM}$ x Z_{thJA} + T_A
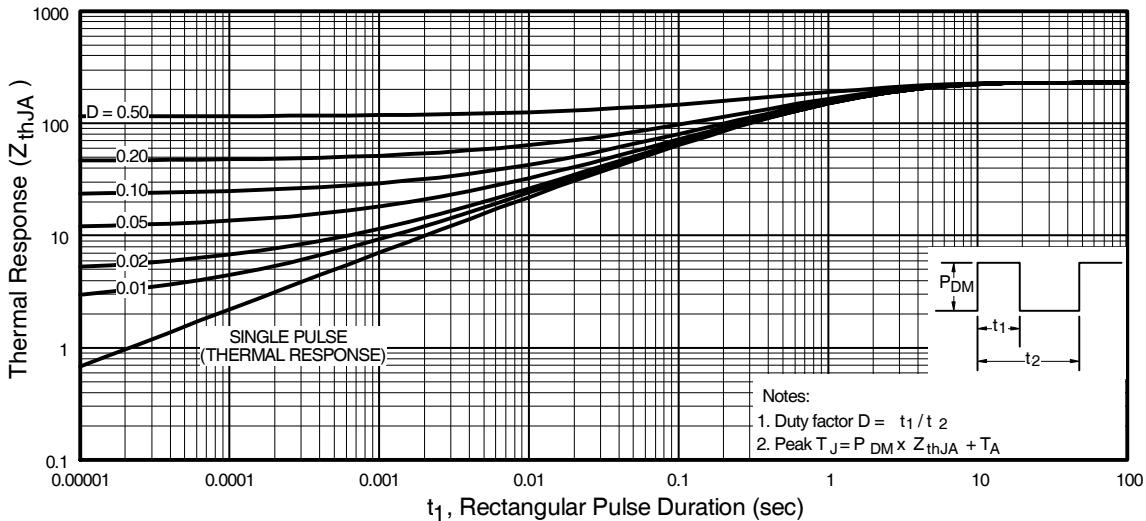
Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

Peak Diode Recovery dv/dt Test Circuit

D.U.T

③

Circuit Layout Considerations
- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance Current Transformer

②

④

①

R_G

$V_{GS}*$

- dv/dt controlled by R_G
- I_{SD} controlled by Duty Factor "D"
- D.U.T. - Device Under Test

**

V_{DD} *
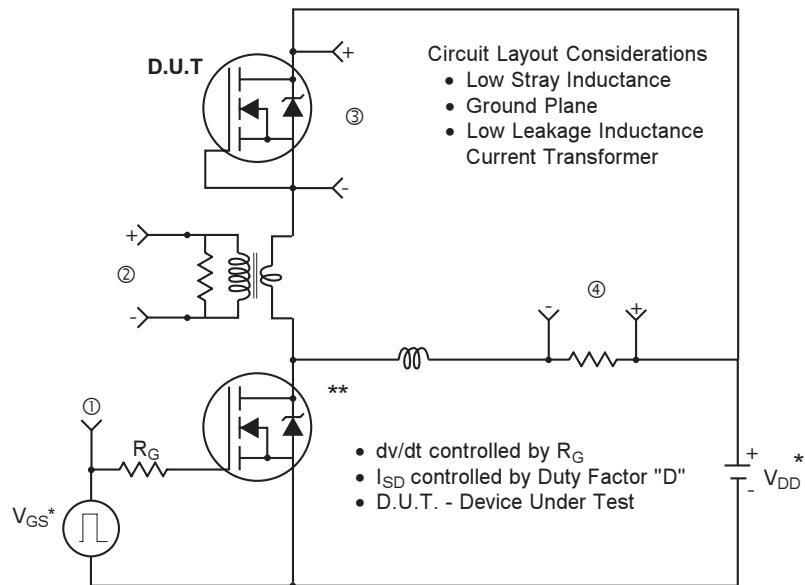
* Reverse Polarity for P-Channel
** Use P-Channel Driver for P-Channel Measurements

① Driver Gate Drive

$D = \dfrac{P.W.}{Period}$

P.W.

Period

P.W.

$[V_{GS}=10V]$ ***

② D.U.T. I_{SD} Waveform

Reverse Recovery Current

Body Diode Forward Current

di/dt

③ D.U.T. V_{DS} Waveform

Diode Recovery dv/dt

$[V_{DD}]$

Re-Applied Voltage

Body Diode Forward Drop

④ Inductor Curent

Ripple ≤ 5%

$[I_{SD}]$

*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices
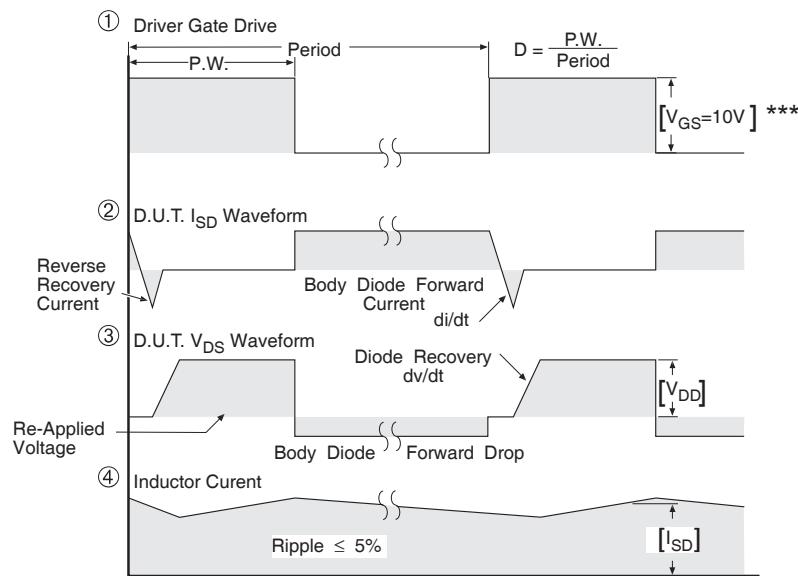
Fig 13. For P-Channel HEXFETS

International IOR Rectifier

Micro3 (SOT-23) (Lead-Free) Package Outline
Dimensions are shown in millimeters (inches)
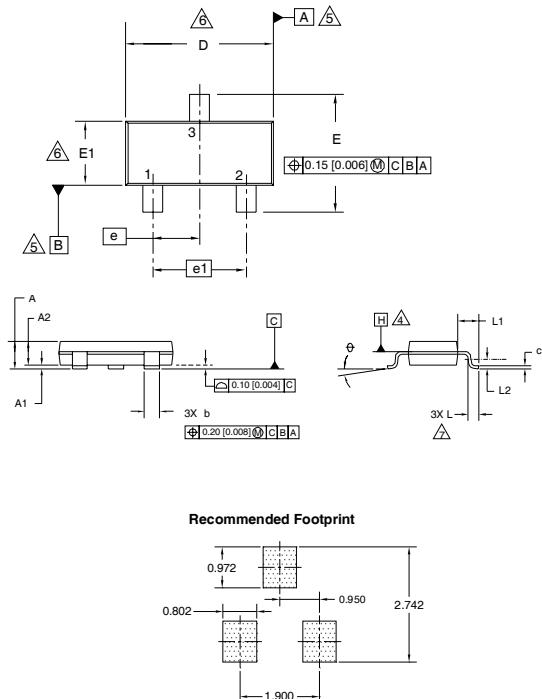
| SYMBOL	DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.89	1.12	0.035	0.044
A1	0.01	0.10	0.0004	0.004
A2	0.88	1.02	0.035	0.040
b	0.30	0.50	0.012	0.020
c	0.08	0.20	0.003	0.008
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E1	1.20	1.40	0.047	0.055
e	0.95	BSC	0.037	BSC
e1	1.90	BSC	0.075	BSC
L	0.40	0.60	0.016	0.024
L1	0.54	REF	0.021	REF
L2	0.25	BSC	0.010	BSC
θ	0	8	0	8

Recommended Footprint

NOTES:

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

Micro3 / SOT-23 Package Marking

PART NUMBER CODE REFERENCE:

A = IRLML2402
B = IRLML2803
C = IRLML2402
D = IRLML5103
E = IRLML6402
F = IRLML6401
G = IRLML2502
H = IRLML5203

Note: A line above the work week
(as shown here) indicates Lead-free
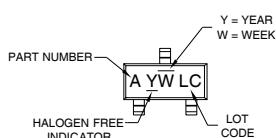
W = (1-26) IF PRECEDED BY LAST DIGIT OF CALENDAR YEAR

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

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

IRLML6302GPbF

Micro3™ Tape & Reel Information
Dimensions are shown in millimeters (inches)

2.05 (.080)
1.95 (.077)

4.1 (.161)
3.9 (.154)

Ø 1.6 (.062)
1.5 (.060)

1.85 (.072)
1.65 (.065)

1.32 (.051)
1.12 (.045)

TR

3.55 (.139)
3.45 (.136)

8.3 (.326)
7.9 (.312)

FEED DIRECTION

4.1 (.161)
3.9 (.154)

Ø 1.1 (.043)
0.9 (.036)

0.35 (.013)
0.25 (.010)

Ø 178.00
(7.008)
MAX.

9.90 (.390)
8.40 (.331)
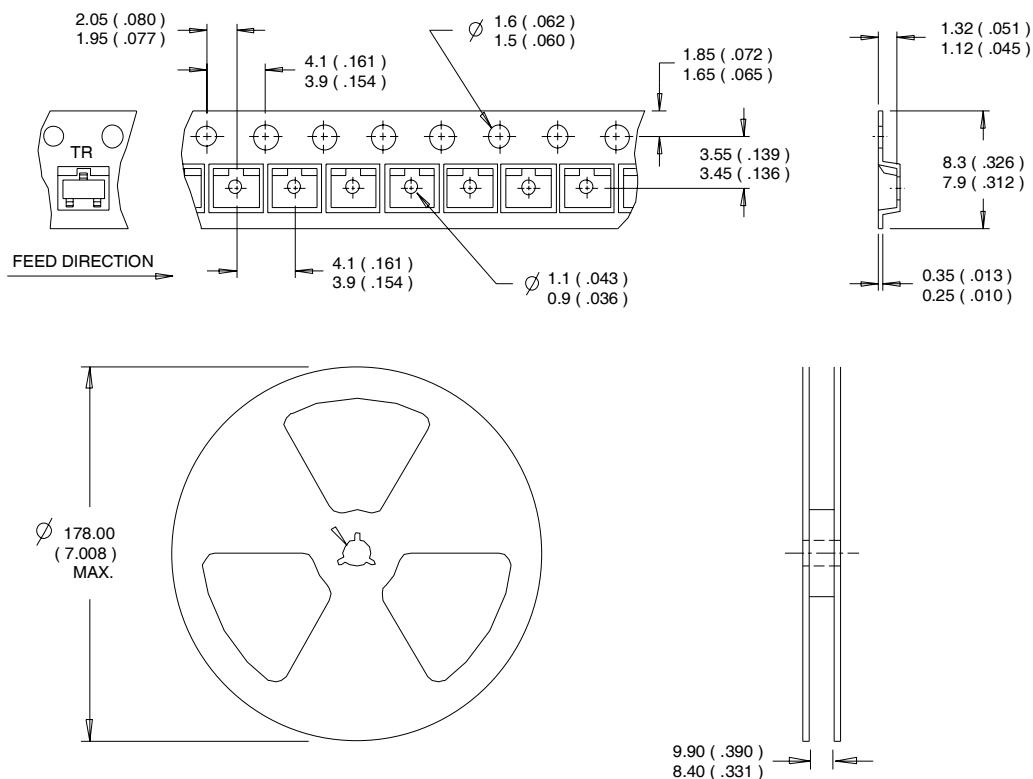
NOTES:
1. CONTROLLING DIMENSION : MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.

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

Data and specifications subject to change without notice.