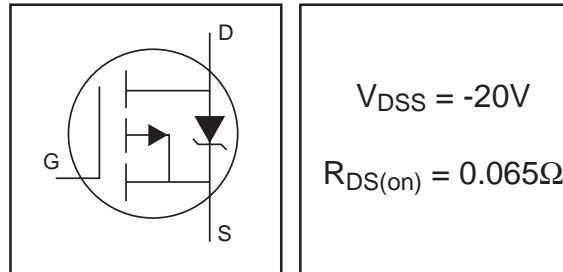


# IRLML6402

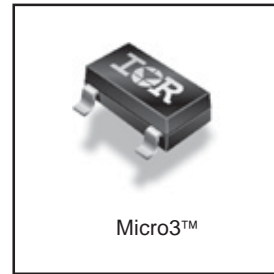
HEXFET® Power MOSFET

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



These P-Channel MOSFETs 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 battery and load management.

A thermally enhanced large pad 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. The thermal resistance and power dissipation are the best available.



	Parameter	Max.	Units
V <sub>DS</sub>	Drain- Source Voltage	-20	V
I <sub>D</sub> @ T <sub>A</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ -4.5V	-3.7	A
I <sub>D</sub> @ T <sub>A</sub> = 70°C	Continuous Drain Current, V <sub>GS</sub> @ -4.5V	-2.2	
I <sub>DM</sub>	Pulsed Drain Current ①	-22	
P <sub>D</sub> @ T <sub>A</sub> = 25°C	Power Dissipation	1.3	W
P <sub>D</sub> @ T <sub>A</sub> = 70°C	Power Dissipation	0.8	
	Linear Derating Factor	0.01	W/°C
E <sub>AS</sub>	Single Pulse Avalanche Energy④	11	mJ
V <sub>GS</sub>	Gate-to-Source Voltage	± 12	V
T <sub>J</sub> , T <sub>STG</sub>	Junction and Storage Temperature Range	-55 to + 150	°C

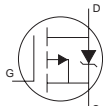
## Thermal Resistance

	Parameter	Typ.	Max.	Units
R <sub>θJA</sub>	Maximum Junction-to-Ambient③	75	100	°C/W

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

	Parameter	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
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	-0.009	—	V/°C	Reference to 25°C, I <sub>D</sub> = -1mA ②
R <sub>DSON</sub>	Static Drain-to-Source On-Resistance	—	0.050	0.065	Ω	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.7A ②
		—	0.080	0.135		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -3.1A ②
V <sub>GS(th)</sub>	Gate Threshold Voltage	-0.40	-0.55	-1.2	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
g <sub>fs</sub>	Forward Transconductance	6.0	—	—	S	V <sub>DS</sub> = -10V, I <sub>D</sub> = -3.7A ②
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	-1.0	μA	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V
		—	—	-25		V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 70°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	-100	nA	V <sub>GS</sub> = -12V
	Gate-to-Source Reverse Leakage	—	—	100		V <sub>GS</sub> = 12V
Q <sub>g</sub>	Total Gate Charge	—	8.0	12	nC	I <sub>D</sub> = -3.7A
Q <sub>gs</sub>	Gate-to-Source Charge	—	1.2	1.8		V <sub>DS</sub> = -10V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	2.8	4.2		V <sub>GS</sub> = -5.0V ②
t <sub>d(on)</sub>	Turn-On Delay Time	—	350	—	ns	V <sub>DD</sub> = -10V
t <sub>r</sub>	Rise Time	—	48	—		I <sub>D</sub> = -3.7A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	588	—		R <sub>G</sub> = 89Ω
t <sub>f</sub>	Fall Time	—	381	—		R <sub>D</sub> = 2.7Ω
C <sub>iss</sub>	Input Capacitance	—	633	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	145	—		V <sub>DS</sub> = -10V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	110	—		f = 1.0MHz

## Source-Drain Ratings and Characteristics

	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	—	—	-22		
V <sub>SD</sub>	Diode Forward Voltage	—	—	-1.2	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = -1.0A, V <sub>GS</sub> = 0V ②
t <sub>rr</sub>	Reverse Recovery Time	—	29	43	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = -1.0A
Q <sub>rr</sub>	Reverse Recovery Charge	—	11	17	nC	di/dt = -100A/μs ②

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ③ Surface mounted on 1" square single layer 1oz. copper FR4 board, steady state.
- ④ Starting T<sub>J</sub> = 25°C, L = 1.65mH  
R<sub>G</sub> = 25Ω, I<sub>AS</sub> = -3.7A.

\*\* For recommended footprint and soldering techniques refer to application note #AN-994.

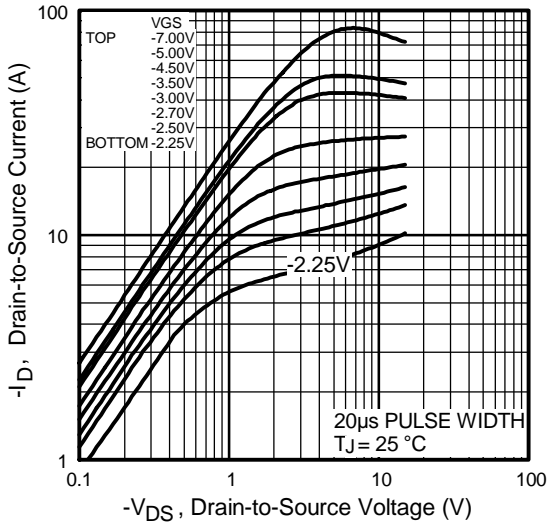


Fig 1. Typical Output Characteristics

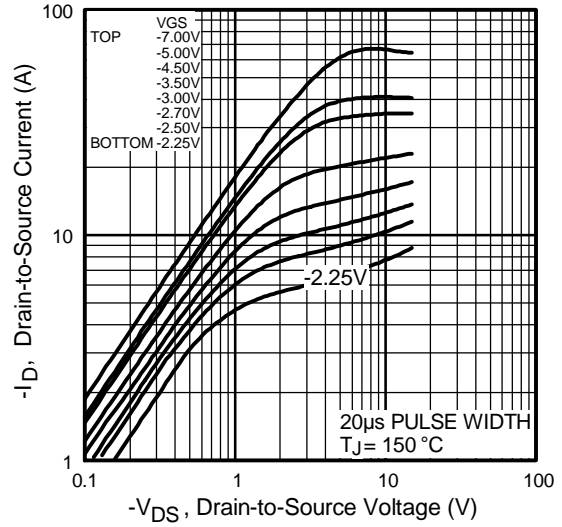


Fig 2. Typical Output Characteristics

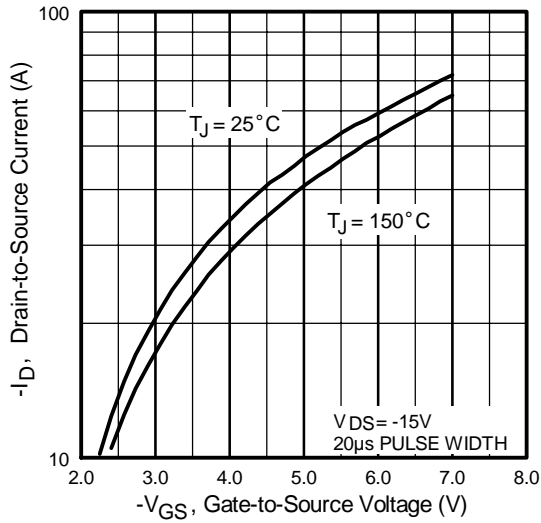


Fig 3. Typical Transfer Characteristics

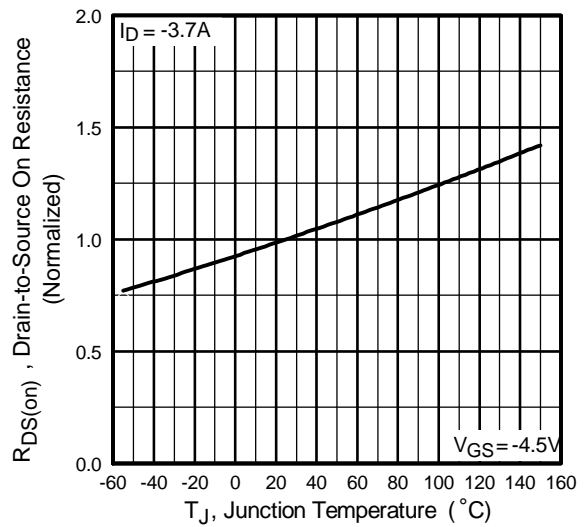
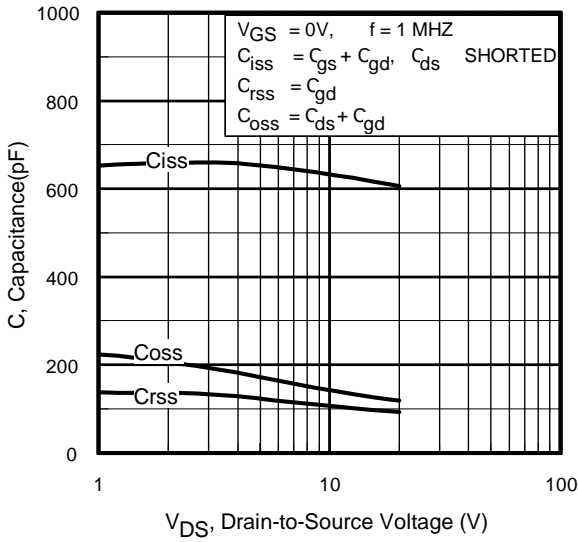
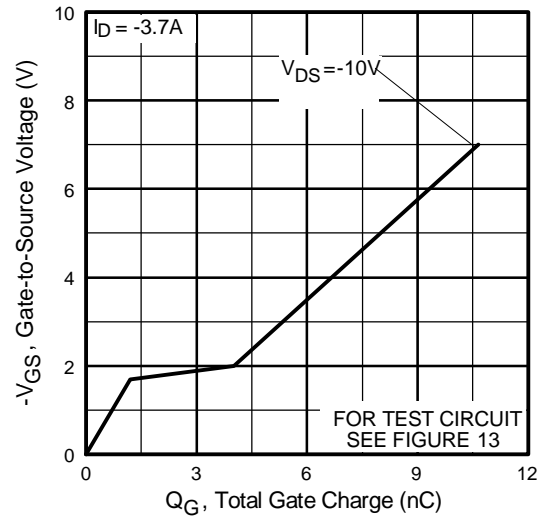


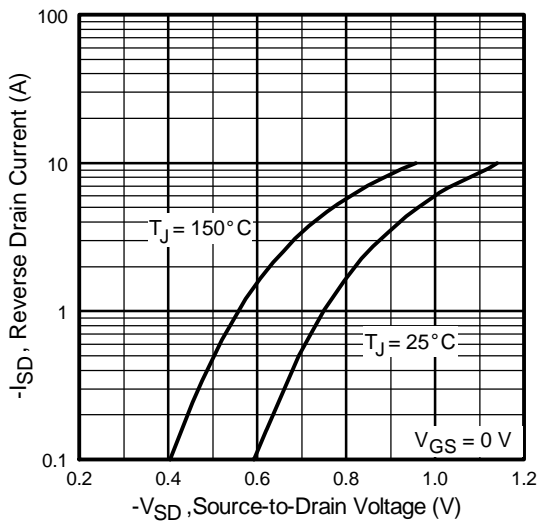
Fig 4. Normalized On-Resistance Vs. Temperature



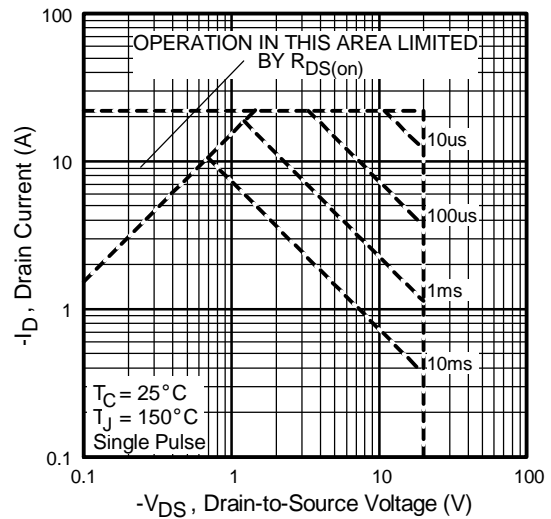
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



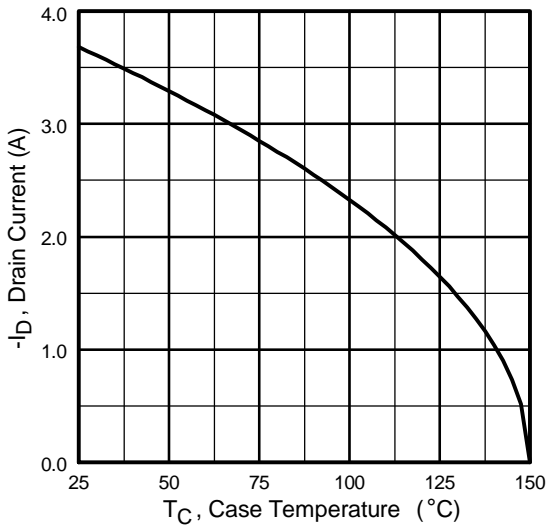
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



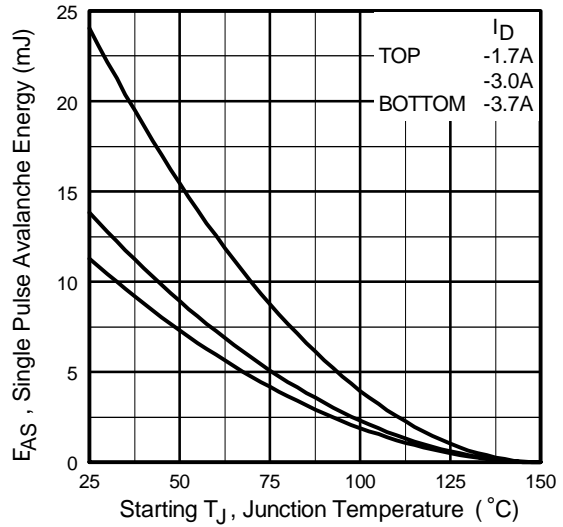
**Fig 7.** Typical Source-Drain Diode Forward Voltage



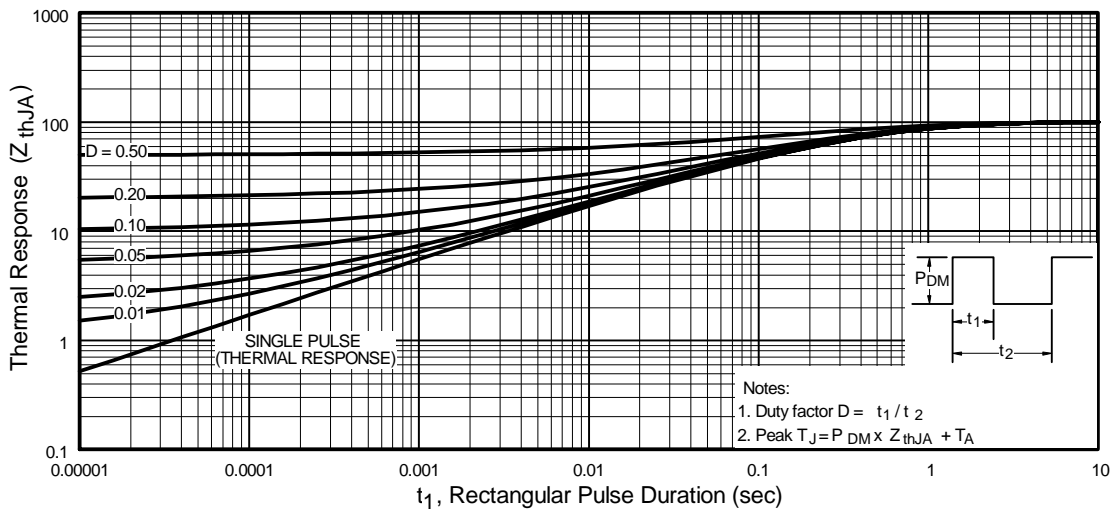
**Fig 8.** Maximum Safe Operating Area



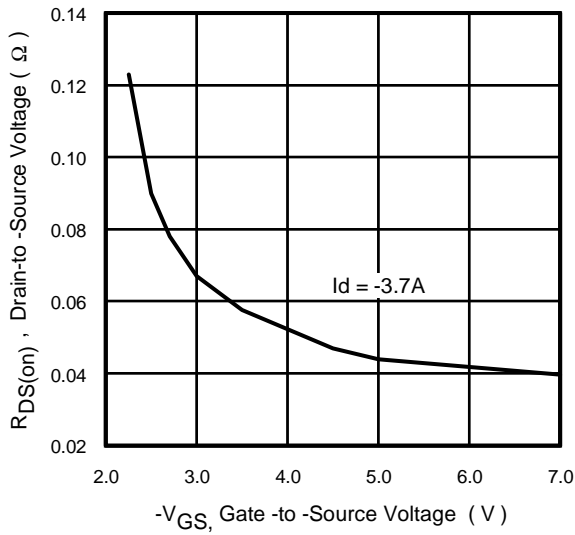
**Fig 9.** Maximum Drain Current Vs. Case Temperature



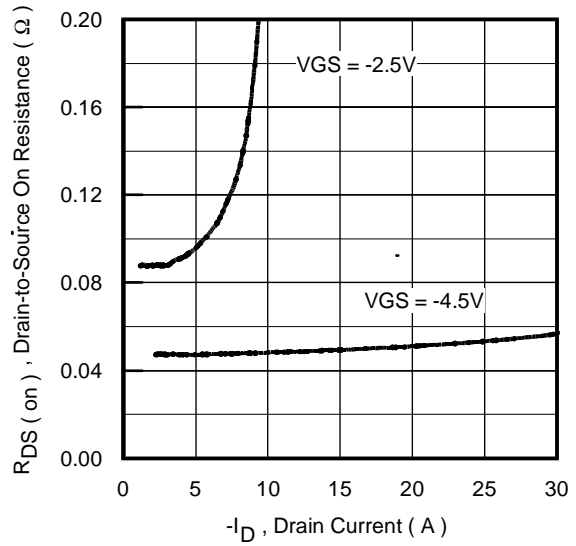
**Fig 10.** Maximum Avalanche Energy Vs. Drain Current



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



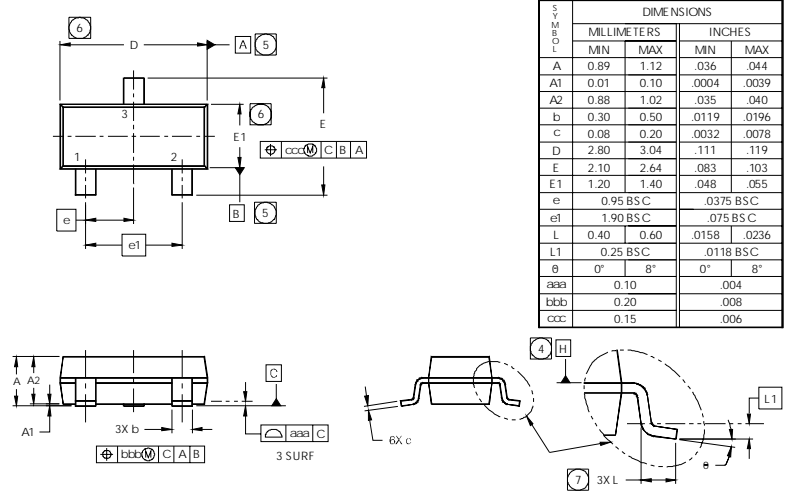
**Fig 12.** Typical On-Resistance Vs. Gate Voltage



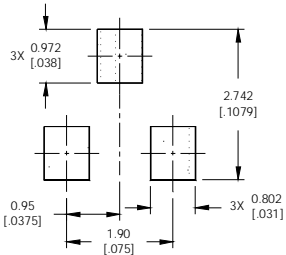
**Fig 13.** Typical On-Resistance Vs. Drain Current

## Micro3 (SOT-23/TO-263AB) Package Outline

Dimensions are shown in millimeters (inches)

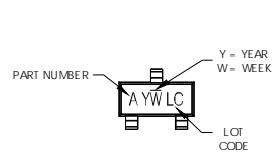


### RECOMMENDED FOOTPRINT



- NOTES
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
  2. DIMENSIONS ARE SHOWN IN MILLIMETERS AND 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.
  7. DIMENSION L IS THE LEAD LENGTH FOR SOLDERING TO A SUBSTRATE.
  8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-236AB.

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



- PART NUMBER CODE REFERENCE:
- A = IRLML2402
  - B = IRLML2803
  - C = IRLML6302
  - 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
1994	4	04	D
1995	5		
1996	6		
1997	7		
1998	8		
1999	9		
2000	0	24	X
		25	Y
		26	Z

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

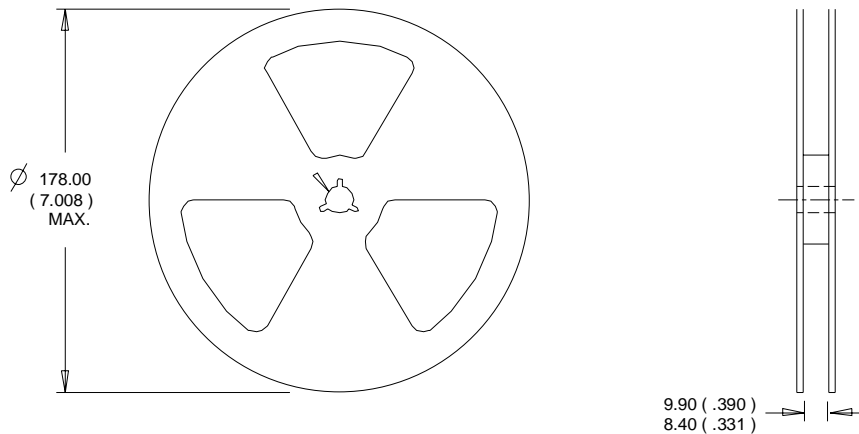
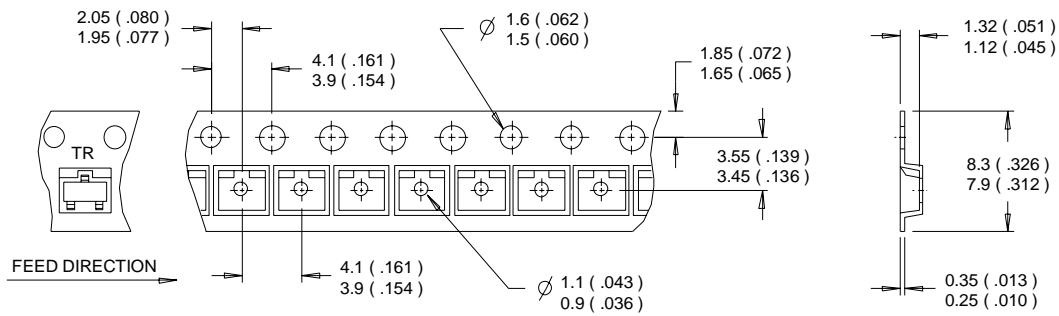
YEAR	Y	WORK WEEK	W
2001	A	27	A
2002	B	28	B
2003	C	29	C
1994	D	30	D
1995	E		
1996	F		
1997	G		
1998	H		
1999	J		
2000	K	50	X
		51	Y
		52	Z

# IRLML6402

International  
**IR** Rectifier

## Micro3™(SOT-23/TO-263AB) Tape & Reel Information

Dimensions are shown in millimeters (inches)



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

Data and specifications subject to change without notice.

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
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