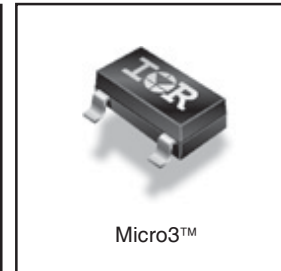
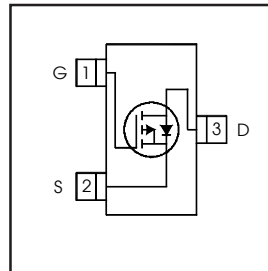


HEXFET® Power MOSFET

$V_{DS}$	<b>-12</b>	<b>V</b>
$R_{DS(on) max}$ (@ $V_{GS} = -4.5V$ )	<b>0.05</b>	<b><math>\Omega</math></b>
$Q_g$ (typical)	<b>10</b>	<b>nC</b>
$I_D$ (@ $T_A = 25^\circ C$ )	<b>-4.3</b>	<b>A</b>



**Features**

Industry-standard pinout SOT-23 Package
Compatible with Existing Surface Mount Techniques
RoHS Compliant, Halogen-Free
MSL1, Industrial qualification

⇒

**Benefits**

Multi-Vendor Compatibility
Easier Manufacturing
Environmentally Friendlier
Increased Reliability

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRLML6401TRPbF-1	Micro3™ (SOT-23)	Tape and Reel	3000	IRLML6402TRPbF-1

**Absolute Maximum Ratings**

	Parameter	Max.	Units
$V_{DS}$	Drain- Source Voltage	-12	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V$	-4.3	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V$	-3.4	
$I_{DM}$	Pulsed Drain Current ①	-34	
$P_D @ T_A = 25^\circ C$	Power Dissipation	1.3	W
$P_D @ T_A = 70^\circ C$	Power Dissipation	0.8	
	Linear Derating Factor	0.01	W/°C
$E_{AS}$	Single Pulse Avalanche Energy②	33	mJ
$V_{GS}$	Gate-to-Source Voltage	± 8.0	V
$T_J, T_{STG}$	Junction and Storage Temperature Range	-55 to + 150	°C

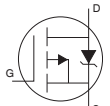
**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient③	75	100	°C/W

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

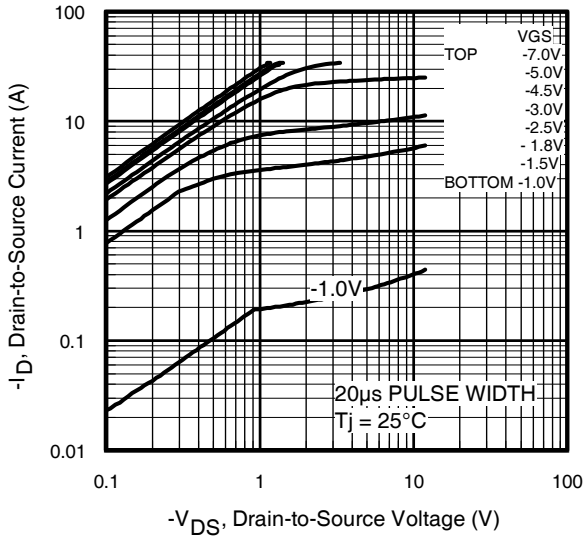
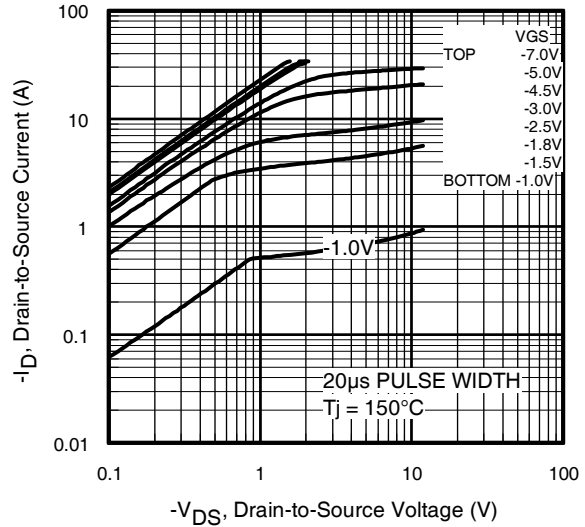
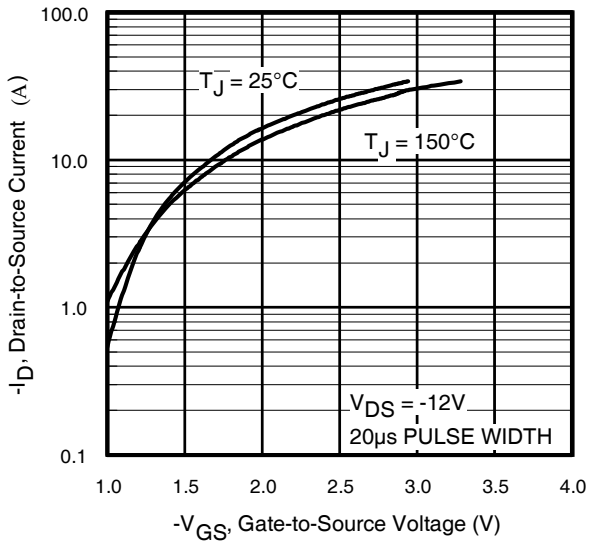
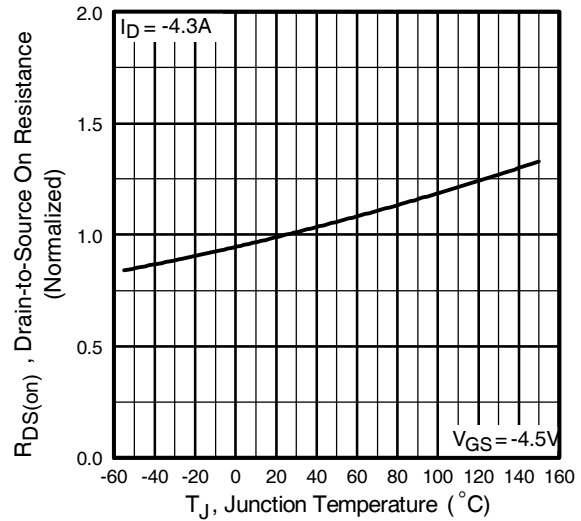
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	-12	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	-0.007	—	V/°C	Reference to 25°C, I <sub>D</sub> = -1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	—	0.050	Ω	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -4.3A ②
		—	—	0.085		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2.5A ②
		—	—	0.125		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -2.0A ②
V <sub>GS(th)</sub>	Gate Threshold Voltage	-0.40	-0.55	-0.95	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
g <sub>fs</sub>	Forward Transconductance	8.6	—	—	S	V <sub>DS</sub> = -10V, I <sub>D</sub> = -4.3A
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	-1.0	μA	V <sub>DS</sub> = -12V, V <sub>GS</sub> = 0V
		—	—	-25		V <sub>DS</sub> = -9.6V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 55°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	-100	nA	V <sub>GS</sub> = -8.0V
	Gate-to-Source Reverse Leakage	—	—	100		V <sub>GS</sub> = 8.0V
Q <sub>g</sub>	Total Gate Charge	—	10	15	nC	I <sub>D</sub> = -4.3A
Q <sub>gs</sub>	Gate-to-Source Charge	—	1.4	2.1		V <sub>DS</sub> = -10V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	2.6	3.9		V <sub>GS</sub> = -5.0V ②
t <sub>d(on)</sub>	Turn-On Delay Time	—	11	—	ns	V <sub>DD</sub> = -6.0V
t <sub>r</sub>	Rise Time	—	32	—		I <sub>D</sub> = -1.0A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	250	—		R <sub>D</sub> = 6.0Ω
t <sub>f</sub>	Fall Time	—	210	—		R <sub>G</sub> = 89Ω ②
C <sub>iss</sub>	Input Capacitance	—	830	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	180	—		V <sub>DS</sub> = -10V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	125	—		f = 1.0MHz

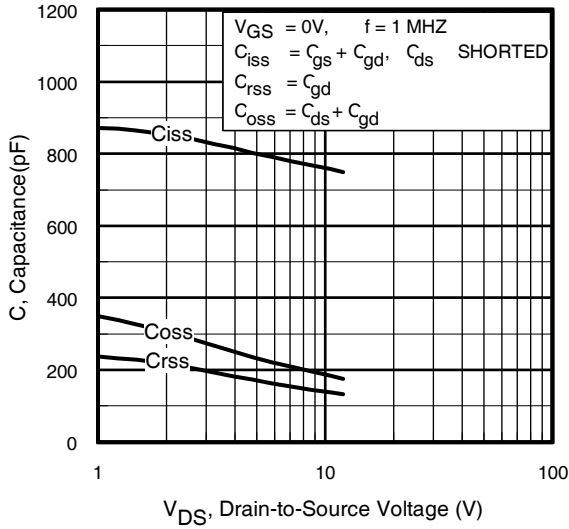
**Source-Drain Ratings and Characteristics**

	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	—	—	-34		
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	—	22	33	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = -1.3A
Q <sub>rr</sub>	Reverse Recovery Charge	—	8.0	12	nC	di/dt = -100A/μs ②

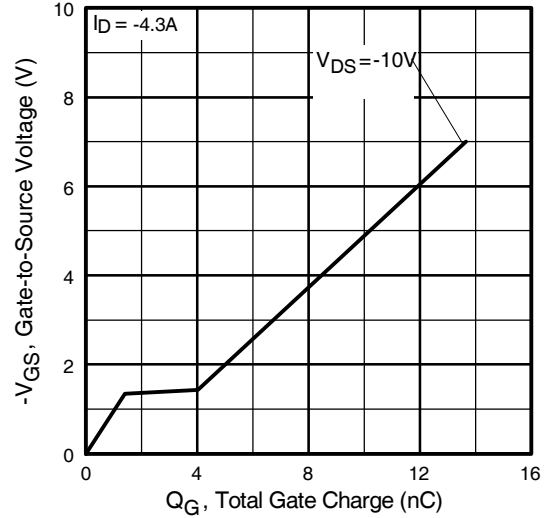
**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Pulse width ≤ 300μs; 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 = 3.5mH  
R<sub>G</sub> = 25Ω, I<sub>AS</sub> = -4.3A.

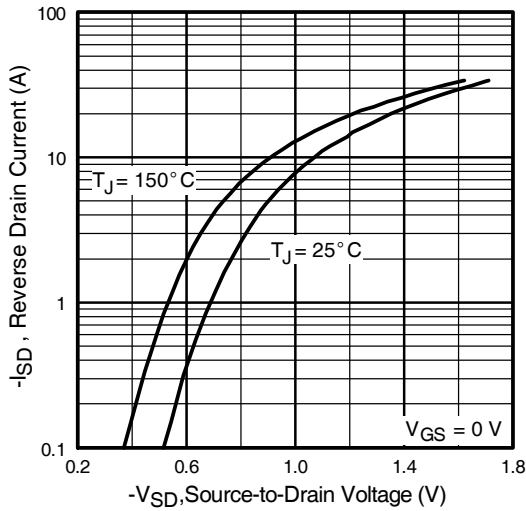

**Fig 1. Typical Output Characteristics**

**Fig 2. Typical Output Characteristics**

**Fig 3. Typical Transfer Characteristics**

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



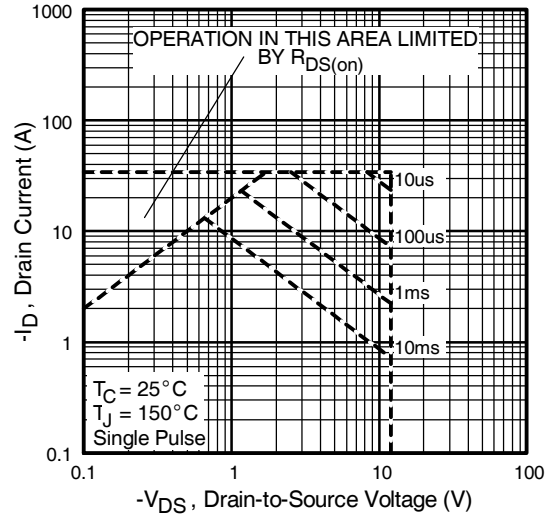
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



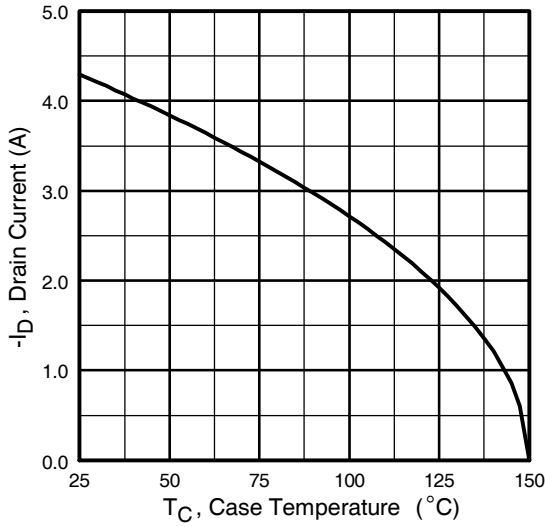
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



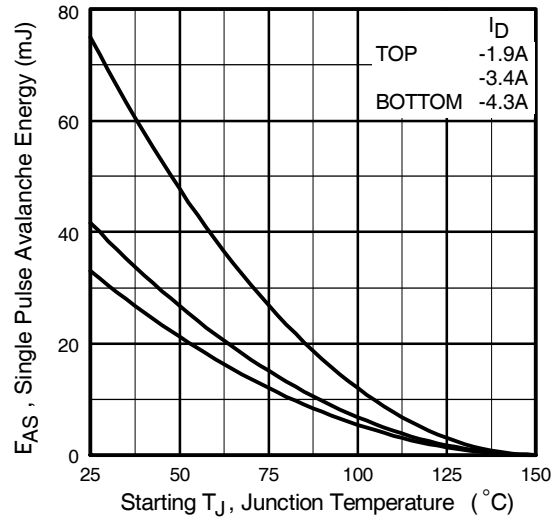
**Fig 7.** Typical Source-Drain Diode Forward Voltage



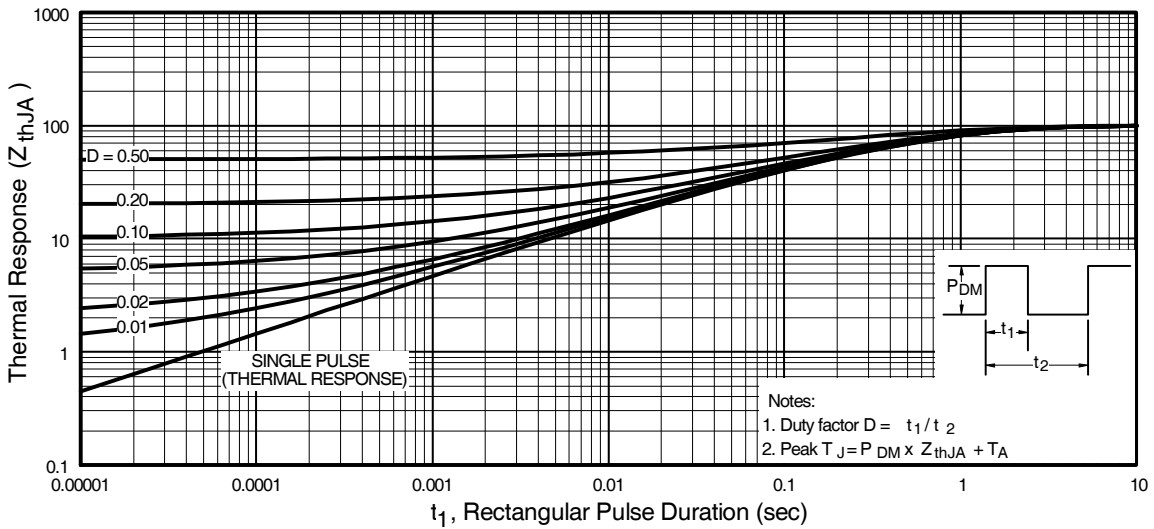
**Fig 8.** Maximum Safe Operating Area



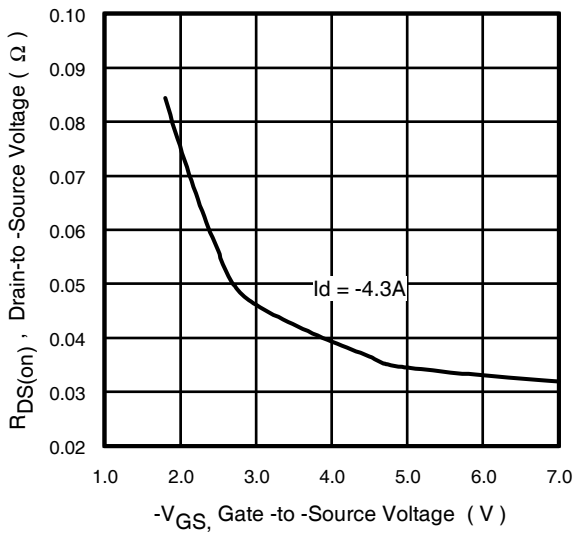
**Fig 9.** Maximum Drain Current Vs. Case Temperature



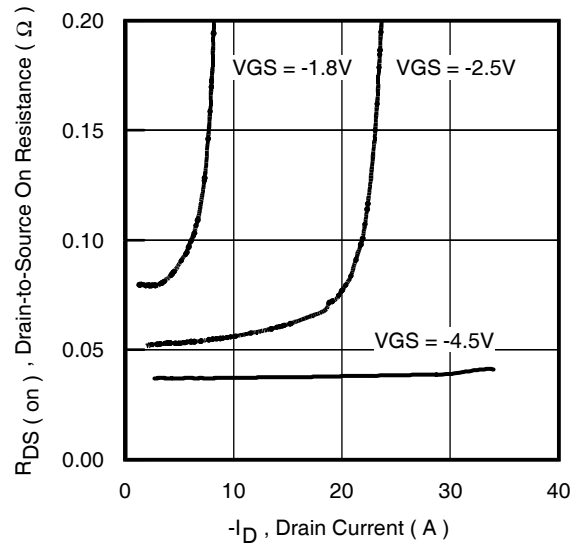
**Fig 10.** Maximum Avalanche Energy Vs. Drain Current



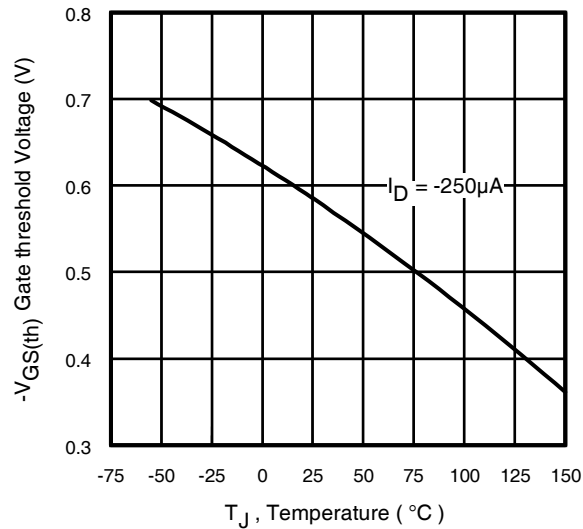
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



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



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



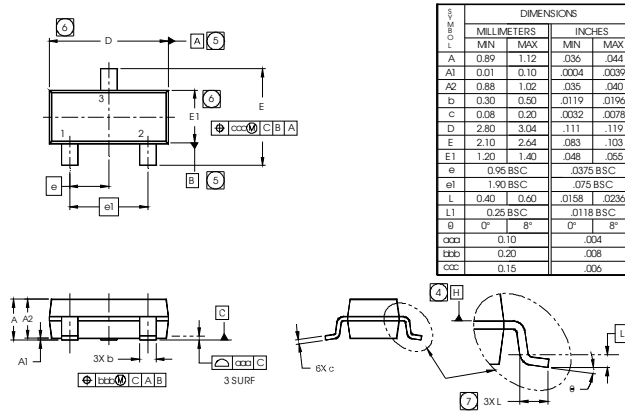
**Fig 14.** Typical Threshold Voltage Vs. Junction Temperature



# IRLML6401PbF-1

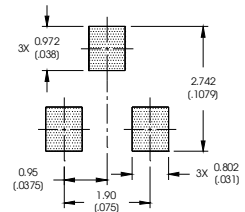
## Micro3 (SOT-23) (Lead-Free) Package Outline

Dimensions are shown in millimeters (inches)



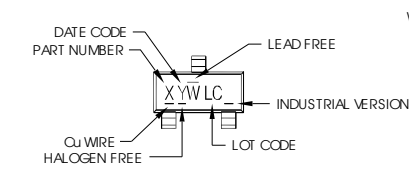
DIMENSIONS	DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.89	1.12	.036	.044
A1	0.01	0.10	.0004	.0039
A2	0.88	1.02	.035	.040
b	0.30	0.53	.0119	.0196
c	0.08	0.20	.0032	.0078
D	2.80	3.04	.111	.119
E	2.10	2.64	.083	.103
E1	1.20	1.40	.048	.055
e	0.95 BSC		.0375 BSC	
et	1.90 BSC		.075 BSC	
L	0.40	0.60	.0158	.0236
L1	0.25 BSC		.0118 BSC	
B	0°	8°	0°	8°
C1	0.10		.004	
C2	0.20		.008	
C3	0.15		.006	

### 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



- X = PART NUMBER CODE REFERENCE:
- |               |               |
|---------------|---------------|
| A = IRLML2402 | S = IRLML6244 |
| B = IRLML2803 | T = IRLML6246 |
| C = IRLML6302 | U = IRLML6344 |
| D = IRLML5103 | V = IRLML6346 |
| E = IRLML6402 | W = IRFML8244 |
| F = IRLML6401 | X = IRLML2244 |
| G = IRLML2502 | Y = IRLML2246 |
| H = IRLML5203 | Z = IRFML9244 |
| I = IRLML0030 |               |
| J = IRLML2030 |               |
| K = IRLML0100 |               |
| L = IRLML0060 |               |
| M = IRLML0040 |               |
| N = IRLML2060 |               |
| P = IRLML9301 |               |
| R = IRLML9303 |               |

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
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	24 25 26	X Y Z

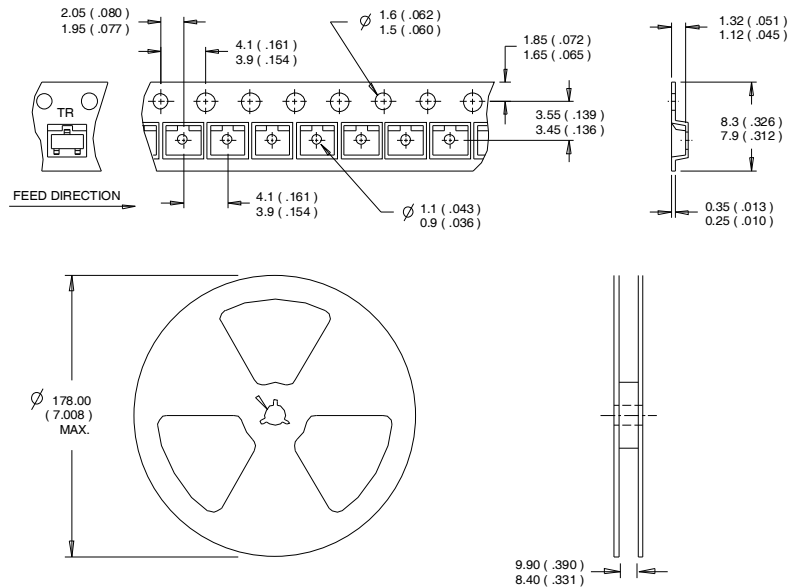
W = (27-52) IF PRECEDED BY A LETTER

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 51 52	X Y Z

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

## Micro3™ 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/>

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

Qualification level	Industrial (per JEDEC JESD47F <sup>††</sup> guidelines)	
Moisture Sensitivity Level	Micro3™ (SOT-23)	M6L1 (per JEDEC J-STD-020D <sup>††</sup> )
RoHS compliant	Yes	

<sup>†</sup> Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/product-info/reliability>

<sup>††</sup> Applicable version of JEDEC standard at the time of product release

### Revision History

Date	Comment
10/28/2014	• Updated partmarking to reflect Industrial partmarking on page 7.

International  
 Rectifier

IR WORLD HEADQUARTERS: 101 N. Sepulveda Blvd., El Segundo, California 90245, USA

To contact International Rectifier, please visit <http://www.irf.com/whoto-call/>