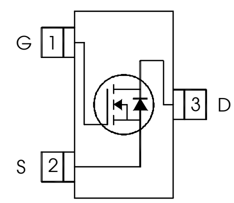
International
IOR Rectifier

IRLML2402PbF

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

HEXFET® Power MOSFET



V_{DSS} = 20V

$R_{DS(on)}$ = 0.25Ω

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.

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRLML2402TRPbF	Micro3™ (SOT-23)	Tape and Reel	3000	IRLML2402TRPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 4.5V	1.2	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 4.5V	0.95	
I_{DM}	Pulsed Drain Current ①	7.4	
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

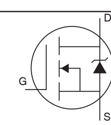
Thermal Resistance

	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	–––	0.024	–––	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	–––	0.25	Ω	V_{GS} = 4.5V, I_D = 0.93A ③
		–––	–––	0.35		V_{GS} = 2.7V, I_D = 0.47A ③
$V_{GS(th)}$	Gate Threshold Voltage	0.70	–––	–––	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	1.3	–––	–––	S	V_{DS} = 10V, I_D = 0.47A
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	–––	2.6	3.9	nC	I_D = 0.93A
Q_{gs}	Gate-to-Source Charge	–––	0.41	0.62		V_{DS} = 16V
Q_{gd}	Gate-to-Drain ("Miller") Charge	–––	1.1	1.7		V_{GS} = 4.5V, See Fig. 6 and 9 ③
$t_{d(on)}$	Turn-On Delay Time	–––	2.5	–––	ns	V_{DD} = 10V
t_r	Rise Time	–––	9.5	–––		I_D = 0.93A
$t_{d(off)}$	Turn-Off Delay Time	–––	9.7	–––		R_G = 6.2Ω
t_f	Fall Time	–––	4.8	–––		R_D = 11Ω, See Fig. 10 ③
C_{iss}	Input Capacitance	–––	110	–––	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	–––	51	–––		V_{DS} = 15V
C_{rss}	Reverse Transfer Capacitance	–––	25	–––		*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	–––	–––	7.4		
V_{SD}	Diode Forward Voltage	–––	–––	1.2	V	T_J = 25°C, I_S = 0.93A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	–––	25	38	ns	T_J = 25°C, I_F = 0.93A
Q_{rr}	Reverse RecoveryCharge	–––	16	24	nC	di/dt = 100A/µs ③

Notes:

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

② $I_{SD} \leq$ 0.93A, di/dt $\leq$ 90A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 150°C

③ Pulse width $\leq$ 300µs; duty cycle $\leq$ 2%.

④ Surface mounted on FR-4 board, t $\leq$ 5sec.

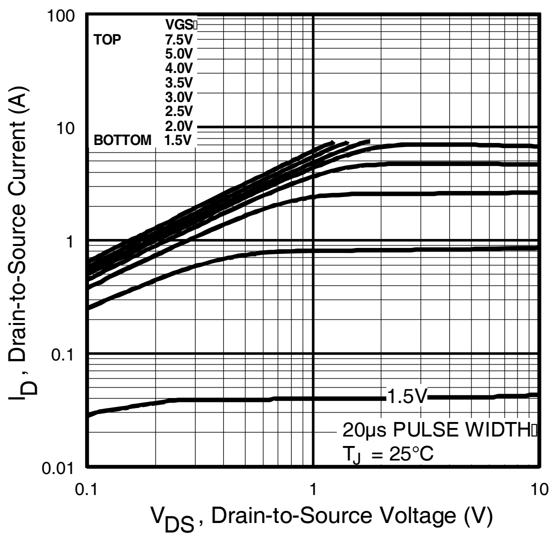


Fig 1. Typical Output Characteristics

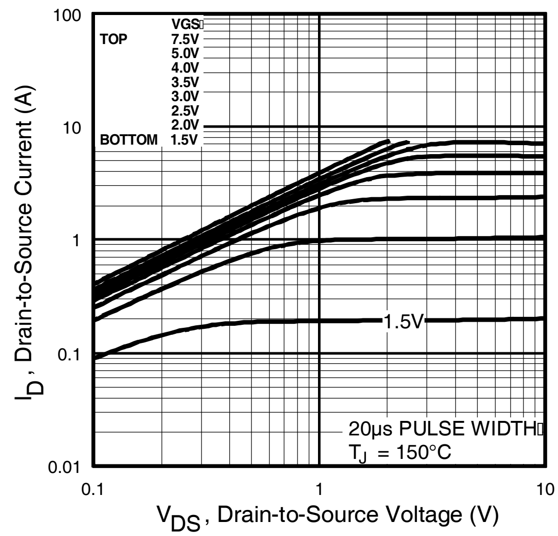


Fig 2. Typical Output Characteristics

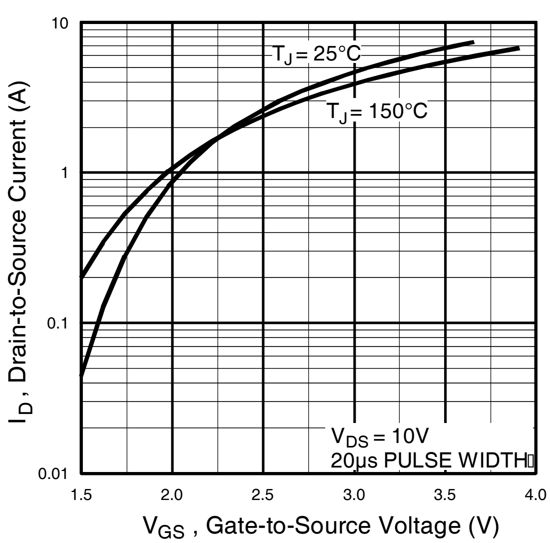


Fig 3. Typical Transfer Characteristics

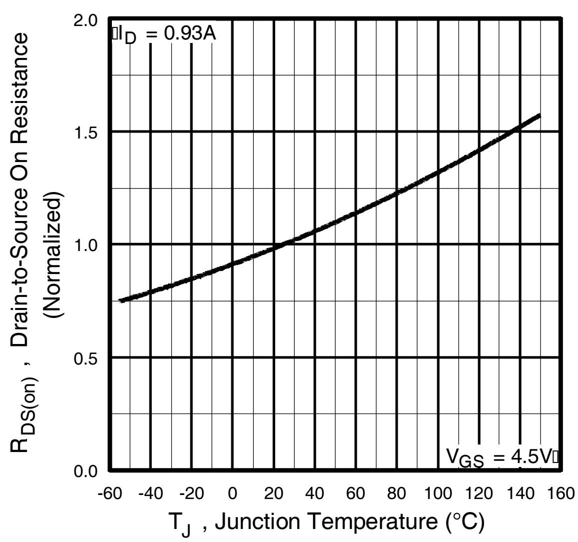


Fig 4. Normalized On-Resistance Vs. Temperature

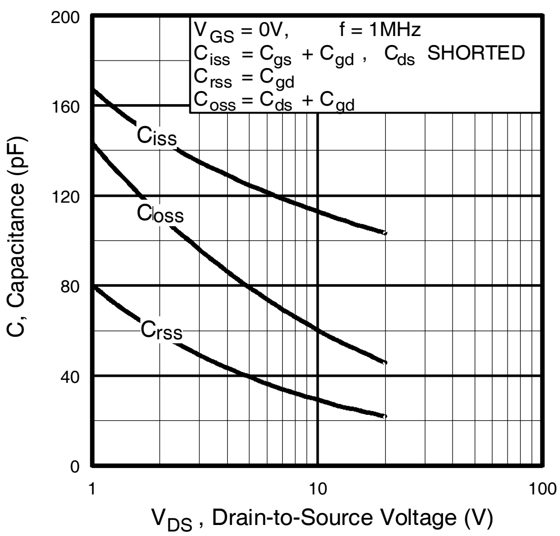


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

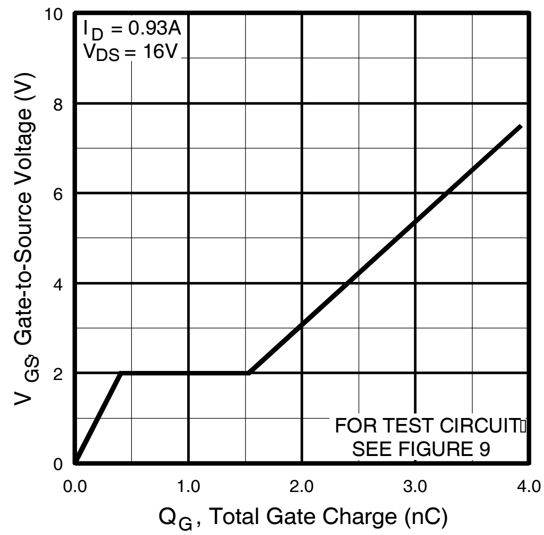


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

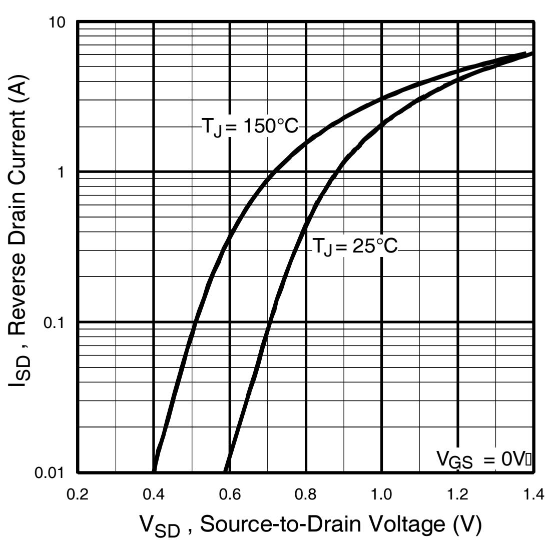


Fig 7. Typical Source-Drain Diode Forward Voltage

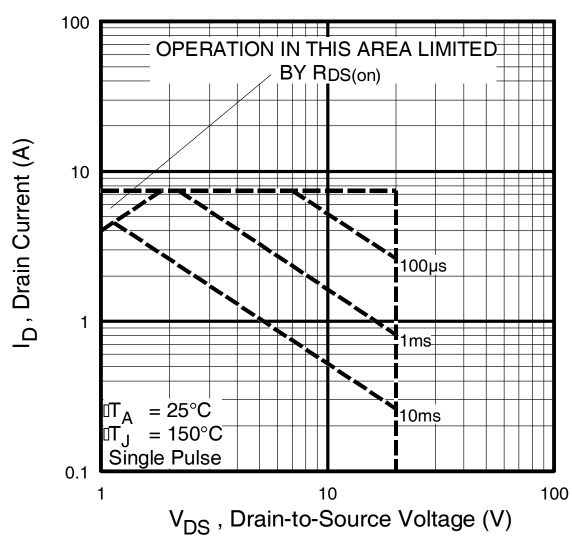


Fig 8. Maximum Safe Operating Area

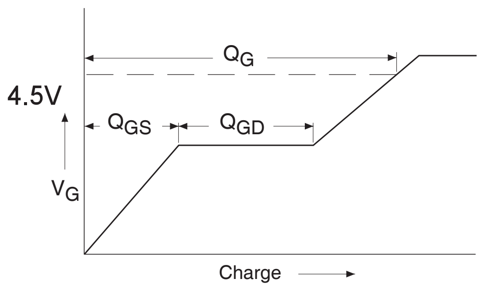


Fig 9a. Basic Gate Charge Waveform

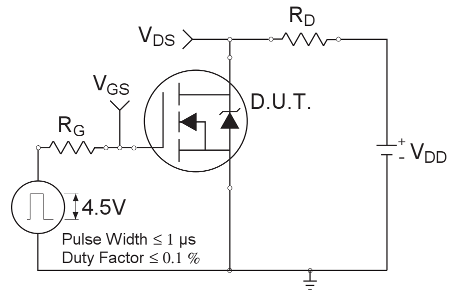


Fig 10a. Switching Time Test Circuit

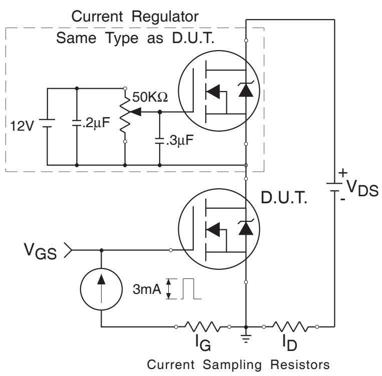


Fig 9b. Gate Charge Test Circuit

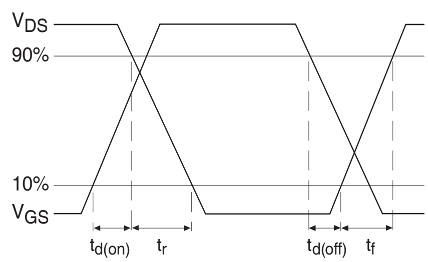


Fig 10b. Switching Time Waveforms

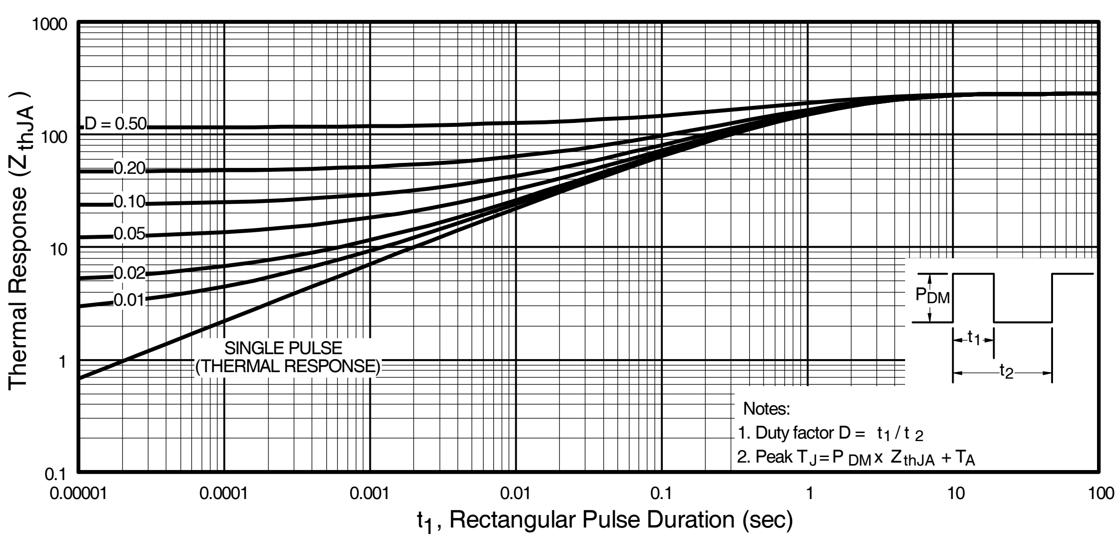
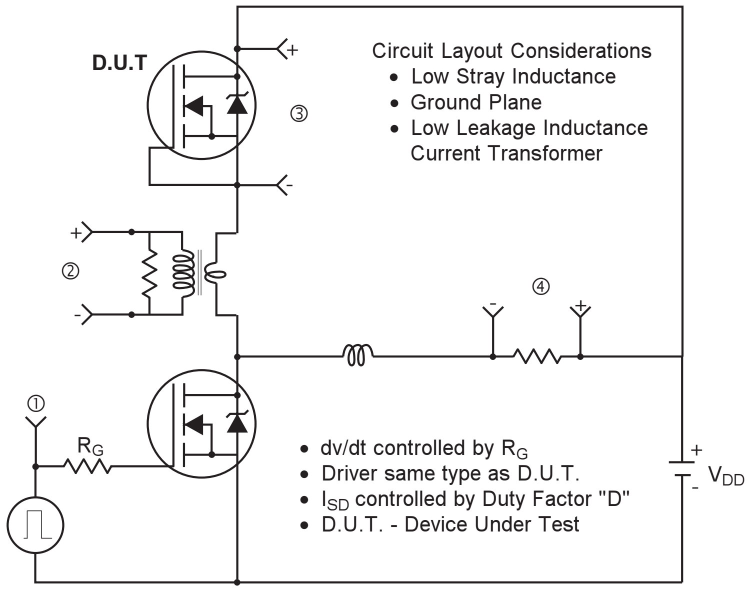
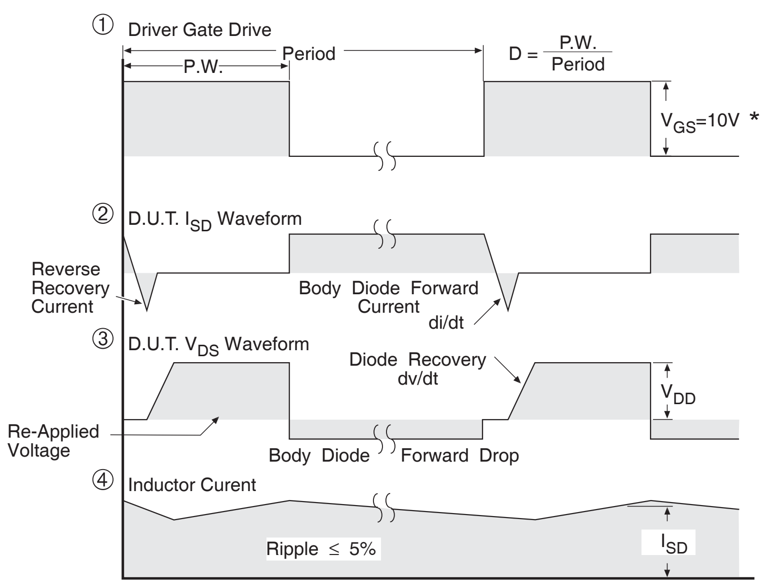


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

Peak Diode Recovery dv/dt Test Circuit



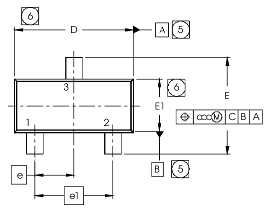


* V_{GS} = 5V for Logic Level Devices

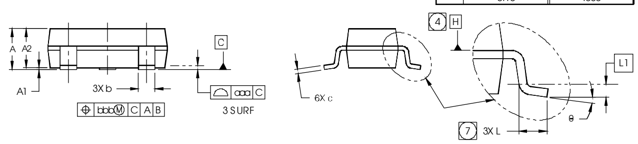
Fig 12. For N-Channel HEXFETS

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

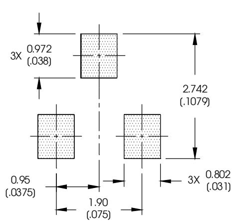
Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.89	1.12	.036	.044
A1	0.01	0.10	.0004	.0039
A2	0.88	1.02	.035	.040
b	0.30	0.50	.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	
e1	1.90 BSC		.075 BSC	
L	0.40	0.60	.0158	.0236
L1	0.25 BSC		.0118 BSC	
θ	0°	8°	0°	8°
aaa	0.10		.004	
bbb	0.20		.008	
ccc	0.15		.006	



RECOMMENDED FOOTPRINT

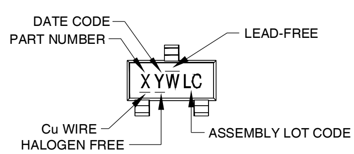


NOTES

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

Notes: This part marking information applies to devices produced after02/26/2001



X = PART NUMBER CODE REFERENCE:

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

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	0	24	X
			25	Y
			26	Z

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

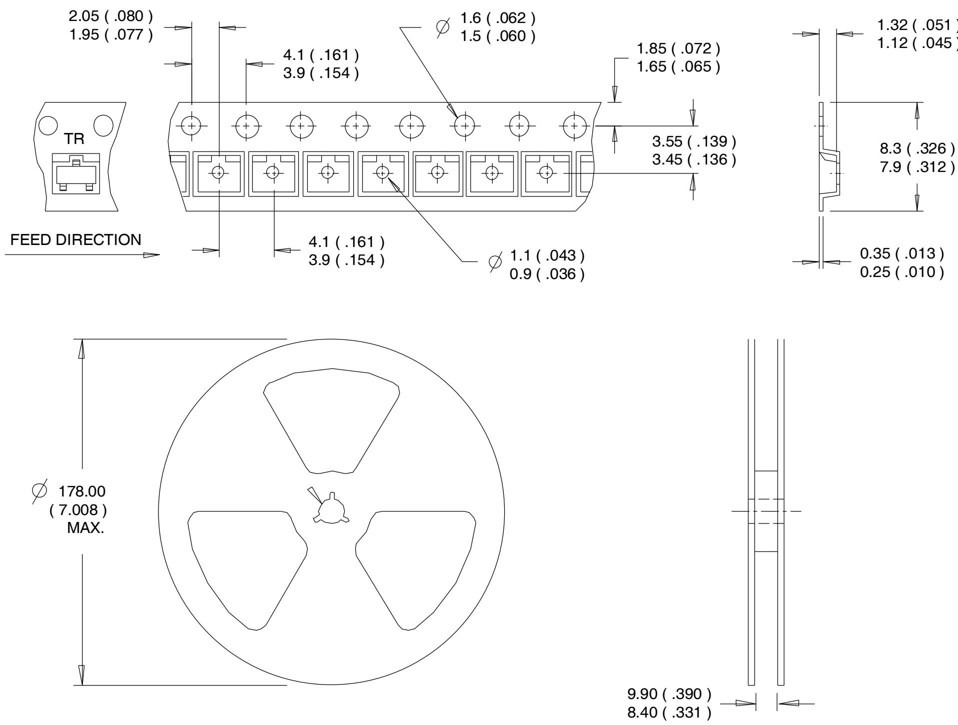
YEAR		Y	WORK WEEK	W
2011	2001	A	27	A
2012	2002	B	28	B
2013	2003	C	29	C
2014	2004	D	30	D
2015	2005	E		
2016	2006	F		
2017	2007	G		
2018	2008	H		
2019	2009	J		
2020	2010	K	50	X
			51	Y
			52	Z

DATE CODE EXAMPLE:
YWW = 432 = DF
YWW = 503 = 5C

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†

Qualification level	Consumer (per JEDEC JESD47F†† guidelines)	
Moisture Sensitivity Level	Micro3™ (SOT-23)	MSL1 (per JEDEC J-STD-020D††)
RoHS compliant	Yes	

† Qualification standards can be found at International Rectifier's web site: http://www.irf.com/product-info/reliability
†† Applicable version of JEDEC standard at the time of product release

Revision History

Date	Comment
4/24/2014	• Updated data sheet with new IR corporate template. • Updated package outline & part marking on page 7. • Added Qualification table -Qual level "Consumer" on page 9. • Added bullet point in the Benefits "RoHS Compliant, Halogen -Free" on page 1.

International
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IMPORTANT NOTICE

WARNINGS