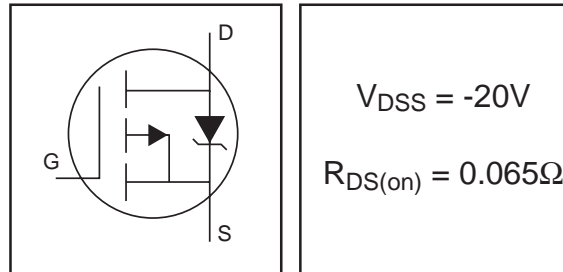


IRLML6402

HEXFET® Power MOSFET

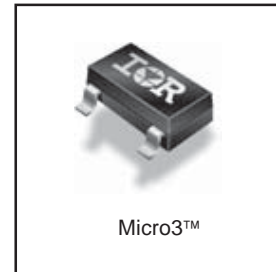
- Ultra Low On-Resistance
- P-Channel MOSFET
- SOT-23 Footprint
- Low Profile (<1.1mm)
- Available in Tape and Reel
- Fast Switching



Description

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.



Absolute Maximum Ratings

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

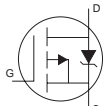
Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|------------------|------------------------------|------|------|-------|
| R _{θJA} | Maximum Junction-to-Ambient③ | 75 | 100 | °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 |
| ΔV _{(BR)DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | — | -0.009 | — | V/°C | Reference to 25°C, I _D = -1mA ② |
| R _{DSON} | Static Drain-to-Source On-Resistance | — | 0.050 | 0.065 | Ω | V _{GS} = -4.5V, I _D = -3.7A ② |
| | | — | 0.080 | 0.135 | | V _{GS} = -2.5V, I _D = -3.1A ② |
| V _{GS(th)} | Gate Threshold Voltage | -0.40 | -0.55 | -0.95 | V | V _{DS} = V _{GS} , I _D = -250μA |
| g _{fs} | Forward Transconductance | 6.0 | — | — | S | V _{DS} = -10V, I _D = -3.7A ② |
| I _{DSS} | Drain-to-Source Leakage Current | — | — | -1.0 | μA | V _{DS} = -20V, V _{GS} = 0V |
| | | — | — | -25 | | V _{DS} = -20V, V _{GS} = 0V, T _J = 70°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 | — | 8.0 | 12 | nC | I _D = -3.7A |
| Q _{gs} | Gate-to-Source Charge | — | 1.2 | 1.8 | | V _{DS} = -10V |
| Q _{gd} | Gate-to-Drain ("Miller") Charge | — | 2.8 | 4.2 | | V _{GS} = -5.0V ② |
| t _{d(on)} | Turn-On Delay Time | — | 350 | — | ns | V _{DD} = -10V |
| t _r | Rise Time | — | 48 | — | | I _D = -3.7A |
| t _{d(off)} | Turn-Off Delay Time | — | 588 | — | | R _G = 89Ω |
| t _f | Fall Time | — | 381 | — | | R _D = 2.7Ω |
| C _{iss} | Input Capacitance | — | 633 | — | pF | V _{GS} = 0V |
| C _{oss} | Output Capacitance | — | 145 | — | | V _{DS} = -10V |
| C _{rss} | Reverse Transfer Capacitance | — | 110 | — | | f = 1.0MHz |

Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|--|------|------|------|-------|--|
| I _S | Continuous Source Current (Body Diode) | — | — | -1.3 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | -22 | | |
| V _{SD} | Diode Forward Voltage | — | — | -1.2 | V | T _J = 25°C, I _S = -1.0A, V _{GS} = 0V ② |
| t _{rr} | Reverse Recovery Time | — | 29 | 43 | ns | T _J = 25°C, I _F = -1.0A |
| Q _{rr} | 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_J = 25°C, L = 1.65mH
R_G = 25Ω, I_{AS} = -3.7A.

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

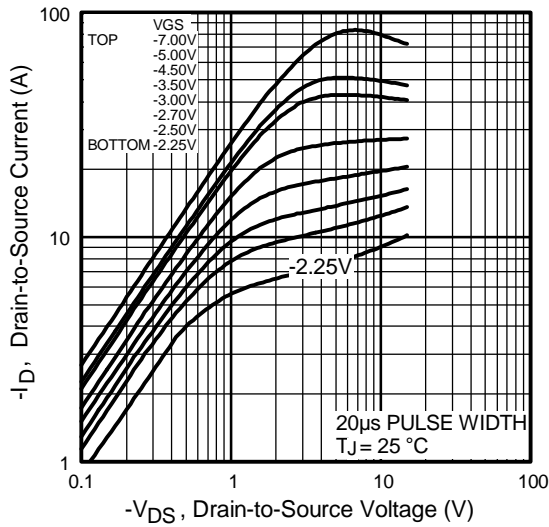


Fig 1. Typical Output Characteristics

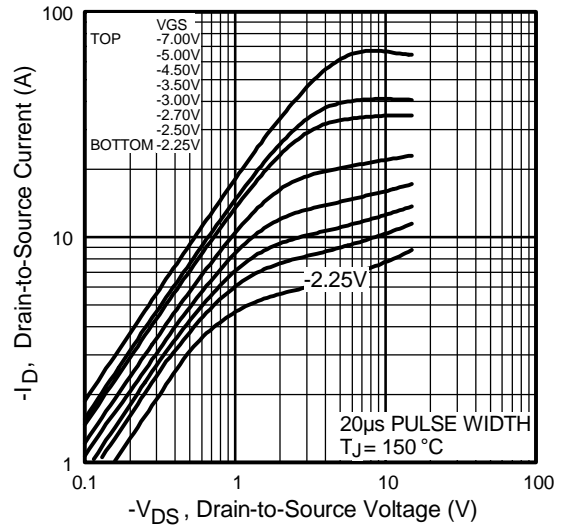


Fig 2. Typical Output Characteristics

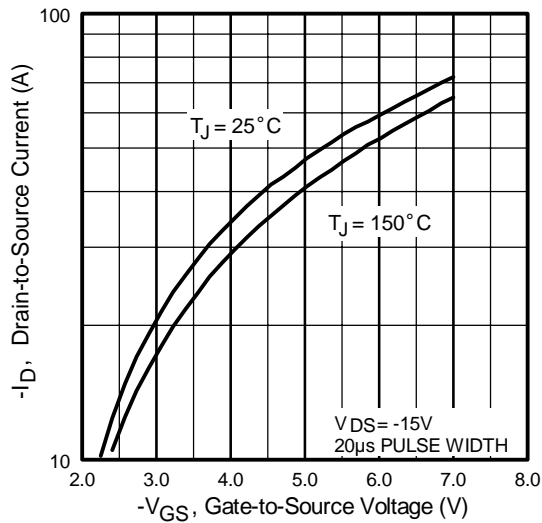


Fig 3. Typical Transfer Characteristics

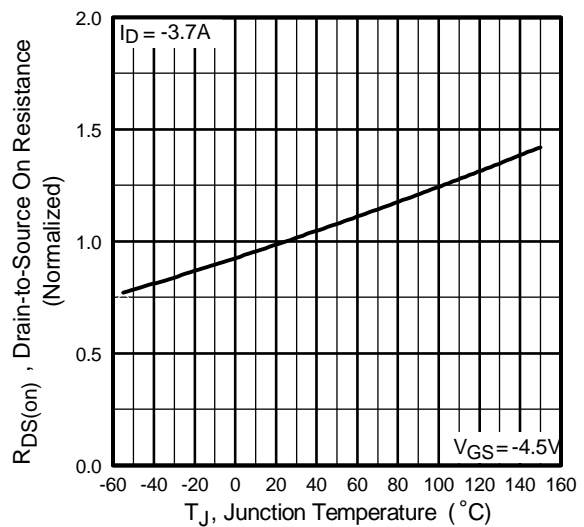


Fig 4. Normalized On-Resistance Vs. Temperature

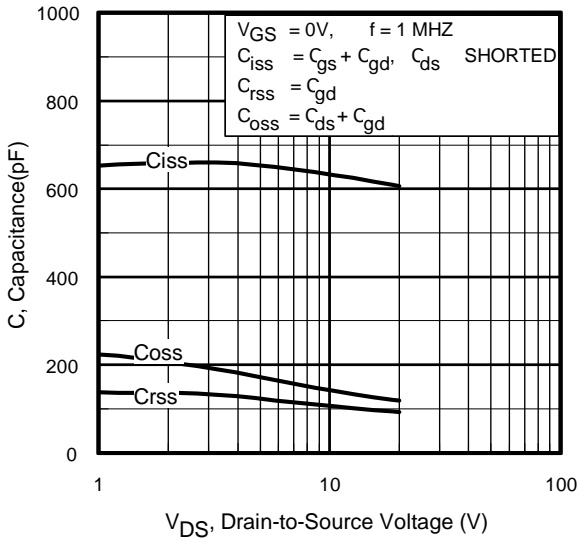


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

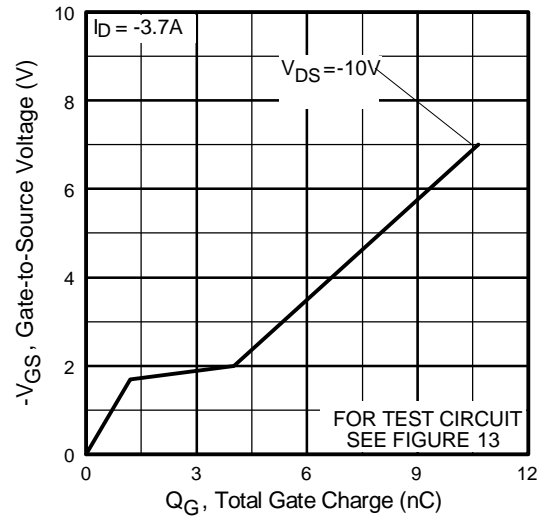


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

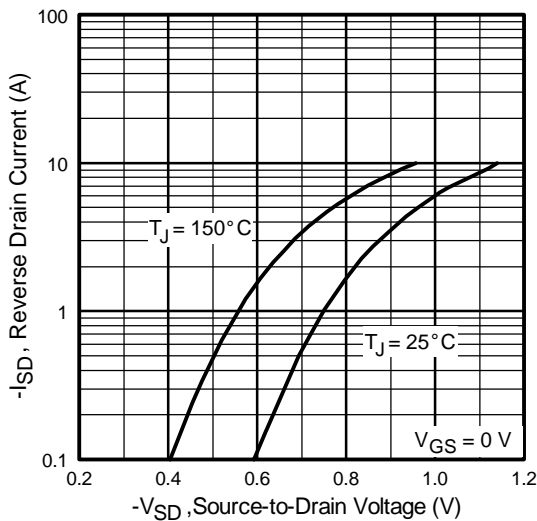


Fig 7. Typical Source-Drain Diode Forward Voltage

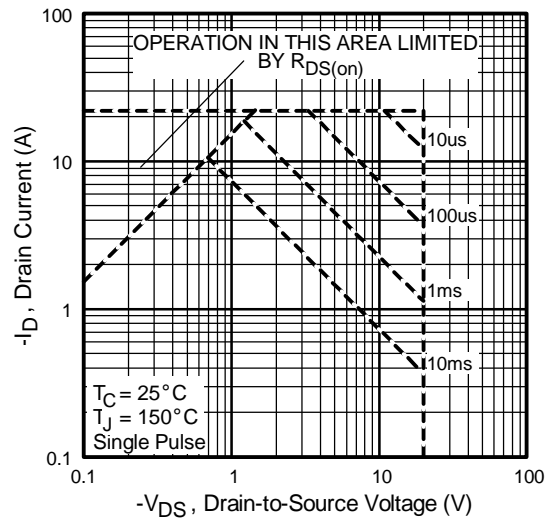


Fig 8. Maximum Safe Operating Area

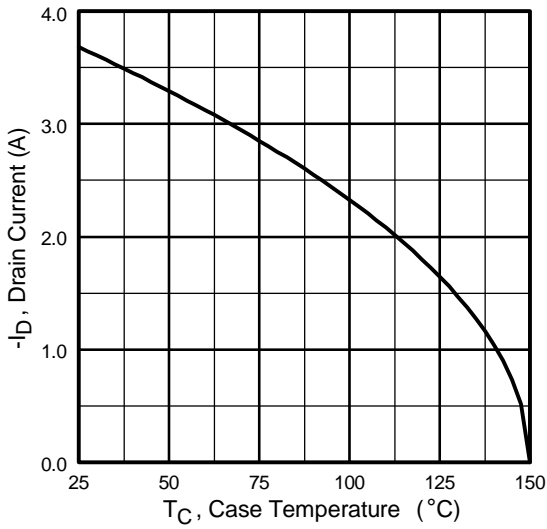


Fig 9. Maximum Drain Current Vs. Case Temperature

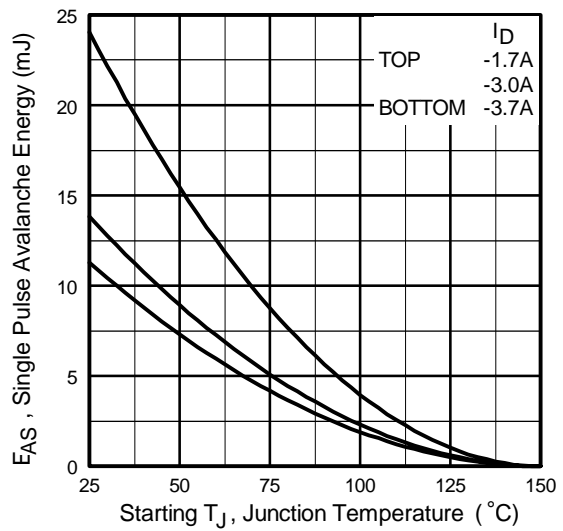


Fig 10. Maximum Avalanche Energy Vs. Drain Current

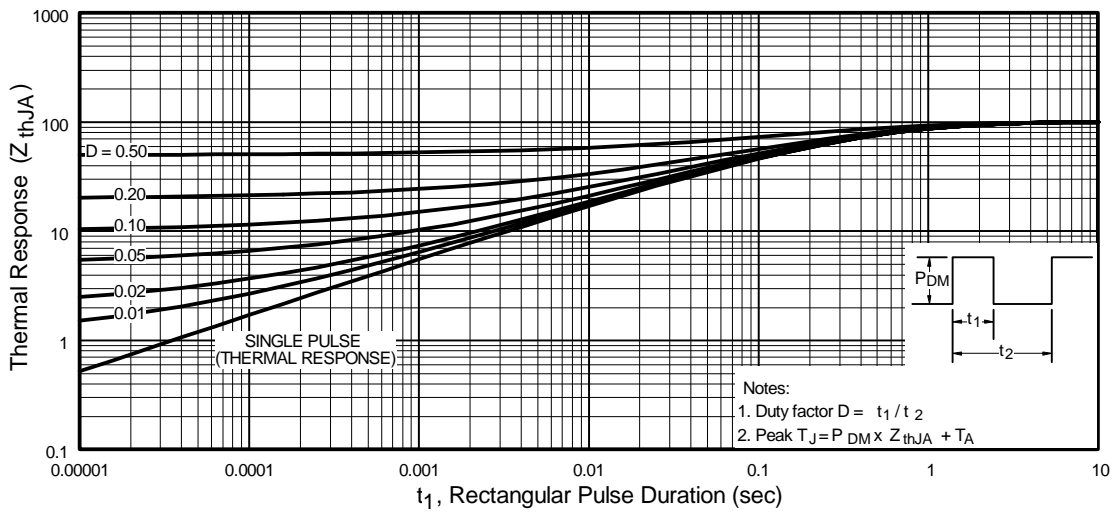


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

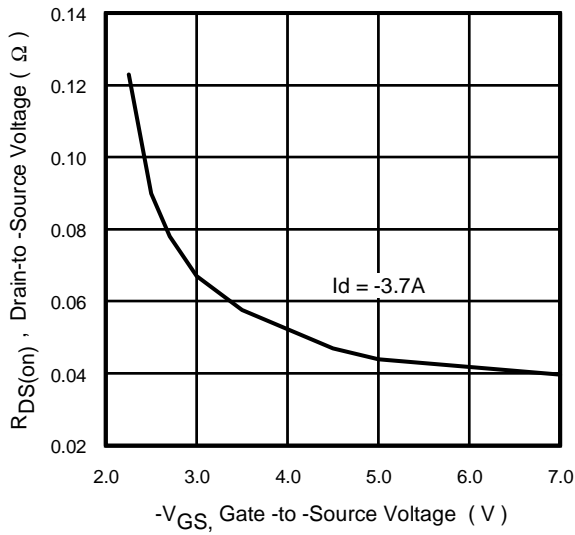


Fig 12. Typical On-Resistance Vs. Gate Voltage

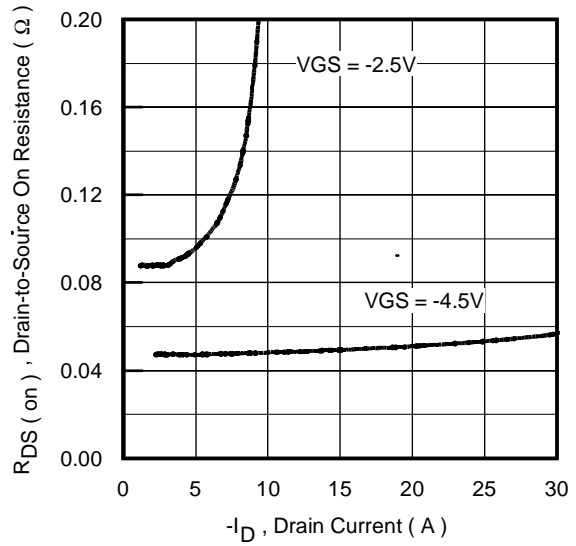
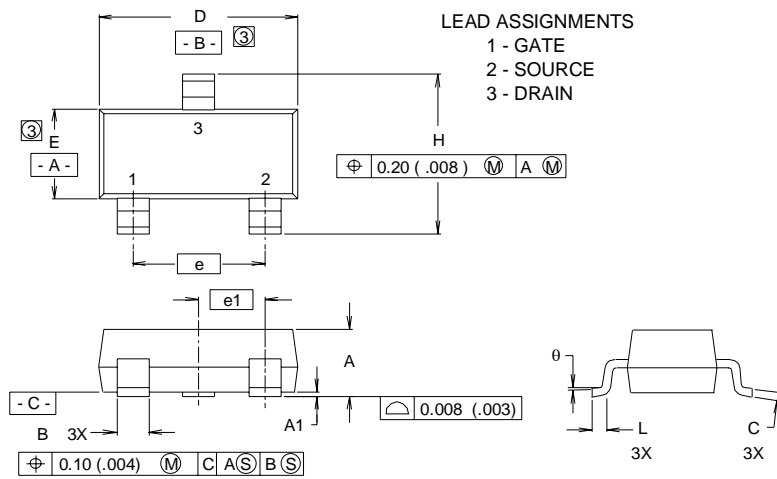


Fig 13. Typical On-Resistance Vs. Drain Current

Package Outline

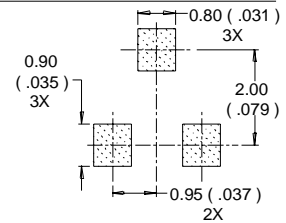
Micro3™

Dimensions are shown in millimeters (inches)



| DIM | INCHES | | MILLIMETERS | |
|----------|-------------|------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | .032 | .044 | 0.82 | 1.11 |
| A1 | .001 | .004 | 0.02 | 0.10 |
| B | .015 | .021 | 0.38 | 0.54 |
| C | .004 | .006 | 0.10 | 0.15 |
| D | .105 | .120 | 2.67 | 3.05 |
| e | .0750 BASIC | | 1.90 BASIC | |
| e1 | .0375 BASIC | | 0.95 BASIC | |
| E | .047 | .055 | 1.20 | 1.40 |
| H | .083 | .098 | 2.10 | 2.50 |
| L | .005 | .010 | 0.13 | 0.25 |
| θ | 0° | 8° | 0° | 8° |

MINIMUM RECOMMENDED FOOTPRINT



- NOTES:
 1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
 2. CONTROLLING DIMENSION : INCH.
 3. DIMENSIONS DO NOT INCLUDE MOLD FLASH.

IRLML6402

Part Marking Information

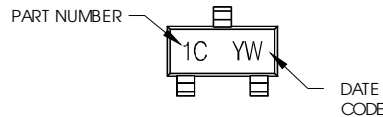
Micro3™

International
IRF Rectifier

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

EXAMPLE: THIS IS AN IRLML6302

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



PART NUMBER CODE REFERENCE:

- 1A = IRLML2402
- 1B = IRLML2803
- 1C = IRLML6302
- 1D = IRLML5103
- 1E = IRLML6402
- 1F = IRLML6401
- 1G = IRLML2502
- 1H = IRLML5203

DATE CODE EXAMPLES:

- YWW = 9503 = 5C
- YWW = 9532 = EF

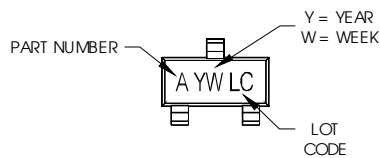
| YEAR | Y | WORK WEEK | W |
|------|---|-----------|---|
| 2001 | 1 | 01 | A |
| 2002 | 2 | 02 | B |
| 2003 | 3 | 03 | C |
| 1994 | 4 | 04 | D |
| 1995 | 5 | | |
| 1996 | 6 | | |
| 1997 | 7 | | |
| 1998 | 8 | | |
| 1999 | 9 | | |
| 2000 | 0 | 24 | X |
| | | 25 | Y |
| | | 26 | Z |

WW = (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 |

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

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



PART NUMBER CODE REFERENCE:

- A = IRLML2402
- B = IRLML2803
- C = IRLML6302
- D = IRLML5103
- E = IRLML6402
- F = IRLML6401
- G = IRLML2502
- H = IRLML5203

| 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 |

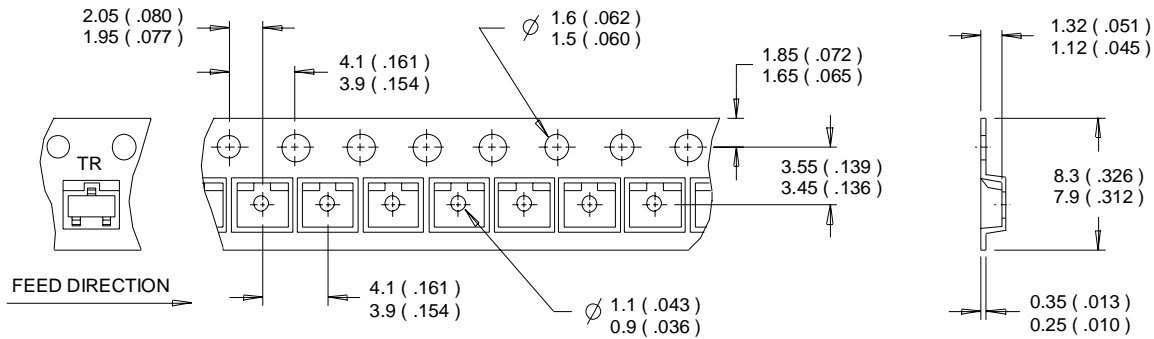
W = (27-52) IF PRECEDED BY A LETTER

| 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 |

Tape & Reel Information

Micro3™

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
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
 TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information. 04/03