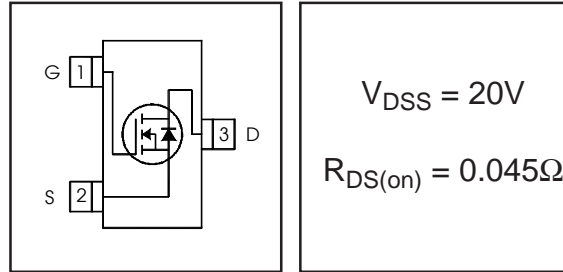


# IRLML2502

HEXFET<sup>®</sup> Power MOSFET

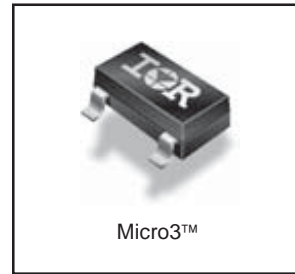
- Ultra Low On-Resistance
- N-Channel MOSFET
- SOT-23 Footprint
- Low Profile (<1.1mm)
- Available in Tape and Reel
- Fast Switching



## Description

These N-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<sup>®</sup> 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<sup>™</sup>, 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     |
| $I_D @ T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 4.5V$ | 4.2          | A     |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ 4.5V$ | 3.4          |       |
| $I_{DM}$                 | Pulsed Drain Current <sup>Ⓢ</sup>         | 33           |       |
| $P_D @ T_A = 25^\circ C$ | Power Dissipation                         | 1.25         | W     |
| $P_D @ T_A = 70^\circ C$ | Power Dissipation                         | 0.8          |       |
|                          | Linear Derating Factor                    | 0.01         | W/°C  |
| $V_{GS}$                 | Gate-to-Source Voltage                    | $\pm 12$     | V     |
| $T_J, T_{STG}$           | Junction and Storage Temperature Range    | -55 to + 150 | °C    |

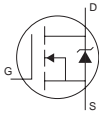
## Thermal Resistance

|                 | Parameter                                | Typ. | Max. | Units |
|-----------------|------------------------------------------|------|------|-------|
| $R_{\theta JA}$ | Maximum Junction-to-Ambient <sup>Ⓢ</sup> | 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/ΔT<sub>J</sub></sub> | Breakdown Voltage Temp. Coefficient  | —    | 0.01  | —     | V/°C  | Reference to 25°C, I <sub>D</sub> = 1mA                            |
| R <sub>DS(on)</sub>                  | Static Drain-to-Source On-Resistance | —    | 0.035 | 0.045 | Ω     | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4.2A ②                    |
|                                      |                                      | —    | 0.050 | 0.080 |       | V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 3.6A ②                    |
| V <sub>GS(th)</sub>                  | Gate Threshold Voltage               | 0.60 | —     | 1.2   | V     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA         |
| g <sub>fs</sub>                      | Forward Transconductance             | 5.8  | —     | —     | S     | V <sub>DS</sub> = 10V, I <sub>D</sub> = 4.0A                       |
| I <sub>DSS</sub>                     | Drain-to-Source Leakage Current      | —    | —     | 1.0   | μA    | V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V                        |
|                                      |                                      | —    | —     | 25    |       | V <sub>DS</sub> = 16V, 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> = 4.0A                                              |
| Q <sub>gs</sub>                      | Gate-to-Source Charge                | —    | 1.8   | 2.7   |       | V <sub>DS</sub> = 10V                                              |
| Q <sub>gd</sub>                      | Gate-to-Drain ("Miller") Charge      | —    | 1.7   | 2.6   |       | V <sub>GS</sub> = 5.0V ②                                           |
| t <sub>d(on)</sub>                   | Turn-On Delay Time                   | —    | 7.5   | —     | ns    | V <sub>DD</sub> = 10V                                              |
| t <sub>r</sub>                       | Rise Time                            | —    | 10    | —     |       | I <sub>D</sub> = 1.0A                                              |
| t <sub>d(off)</sub>                  | Turn-Off Delay Time                  | —    | 54    | —     |       | R <sub>G</sub> = 6Ω                                                |
| t <sub>f</sub>                       | Fall Time                            | —    | 26    | —     |       | R <sub>D</sub> = 10Ω ②                                             |
| C <sub>iss</sub>                     | Input Capacitance                    | —    | 740   | —     | pF    | V <sub>GS</sub> = 0V                                               |
| C <sub>oss</sub>                     | Output Capacitance                   | —    | 90    | —     |       | V <sub>DS</sub> = 15V                                              |
| C <sub>rss</sub>                     | Reverse Transfer Capacitance         | —    | 66    | —     |       | f = 1.0MHz                                                         |

## Source-Drain Ratings and Characteristics

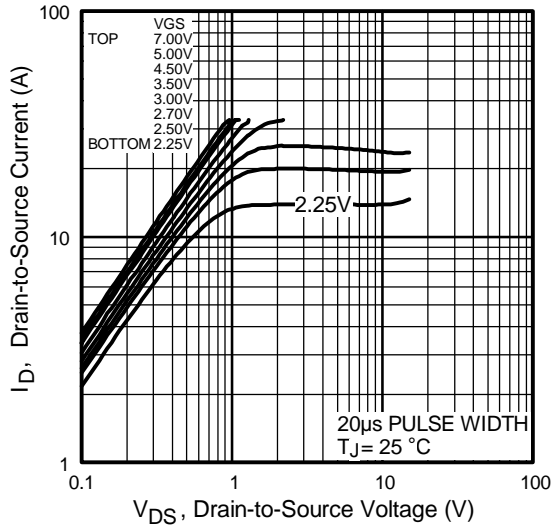
|                 | Parameter                              | Min. | Typ. | Max. | Units | Conditions                                                                                                                                           |
|-----------------|----------------------------------------|------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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   | —    | —    | 33   |       |                                                                                                                                                      |
| 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                  | —    | 16   | 24   | ns    | T <sub>J</sub> = 25°C, I <sub>F</sub> = 1.3A                                                                                                         |
| Q <sub>rr</sub> | Reverse Recovery Charge                | —    | 8.6  | 13   | nC    | di/dt = 100A/μs ②                                                                                                                                    |

### Notes:

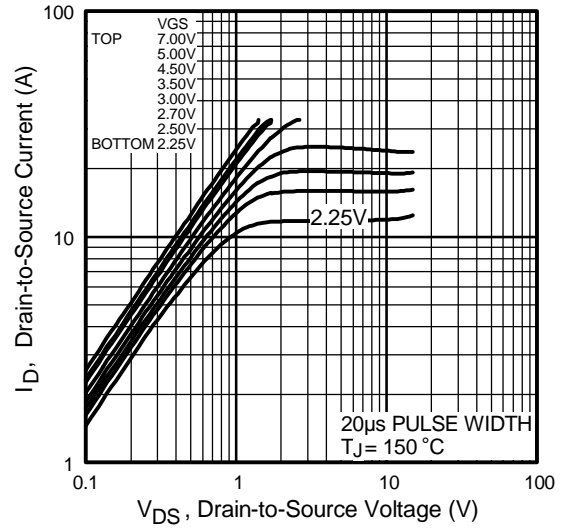
① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )

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

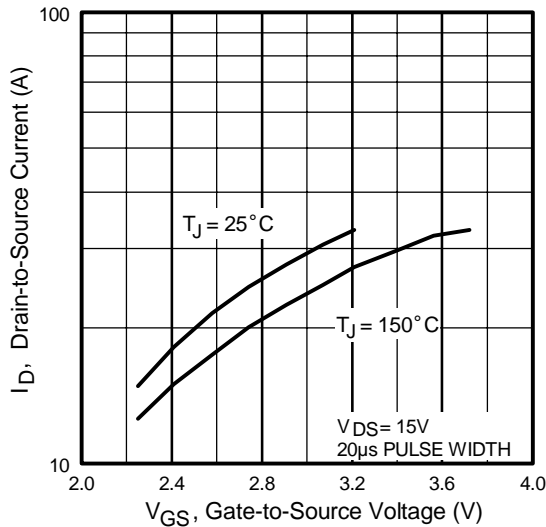
③ Surface mounted on FR-4 board, t ≤ 5sec.



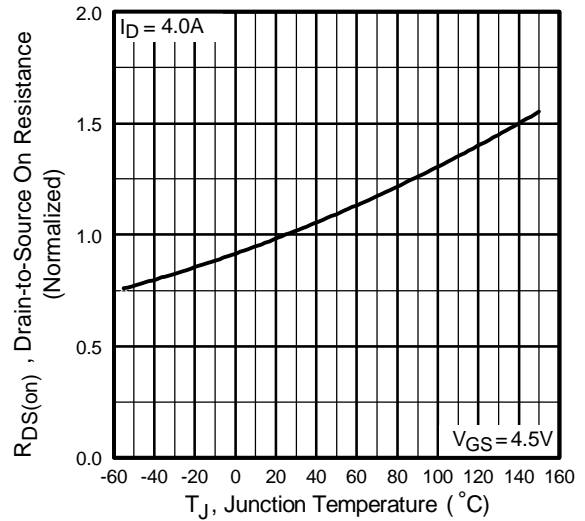
**Fig 1.** Typical Output Characteristics



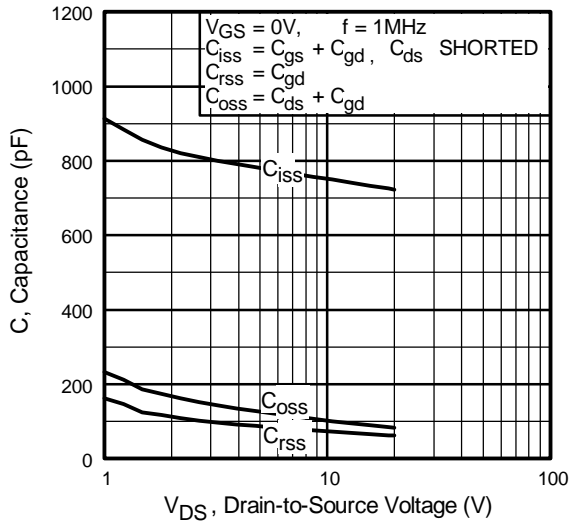
**Fig 2.** Typical Output Characteristics



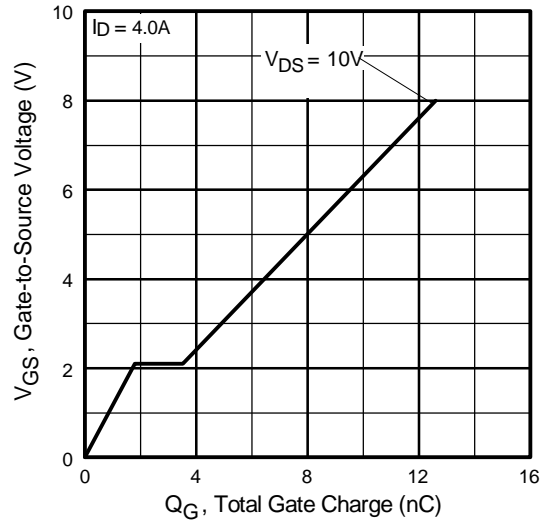
**Fig 3.** Typical Transfer Characteristics



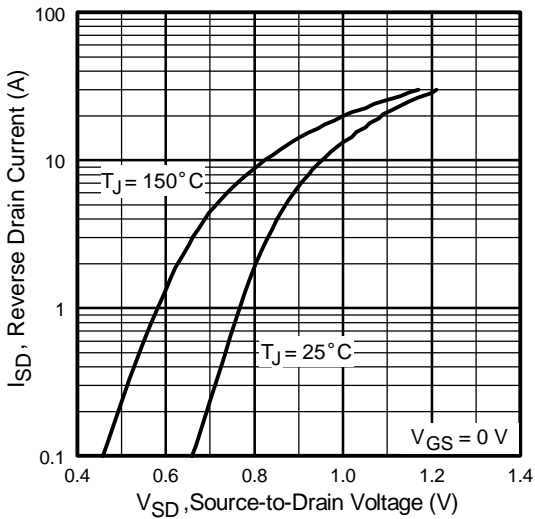
**Fig 4.** Normalized On-Resistance Vs. Temperature



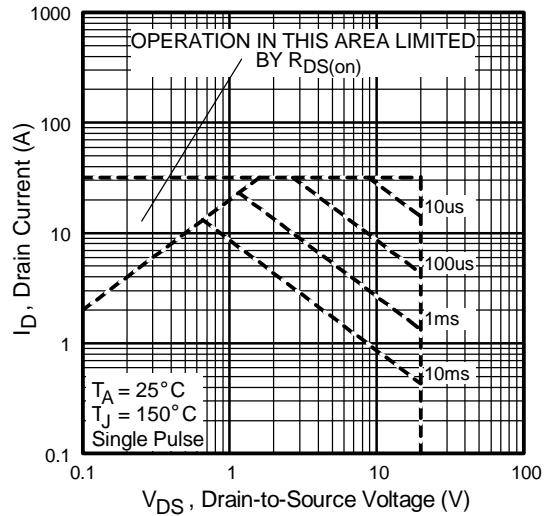
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



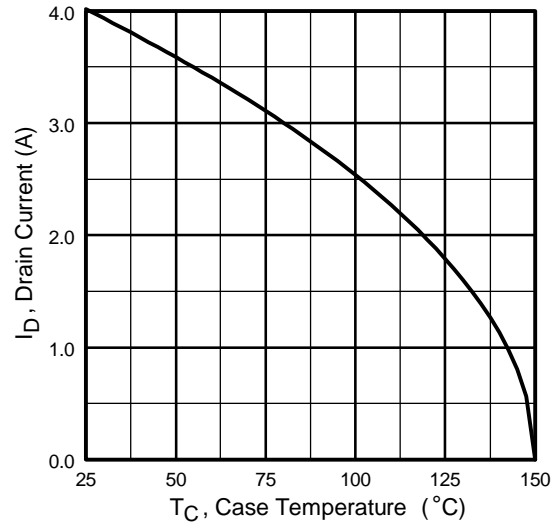
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



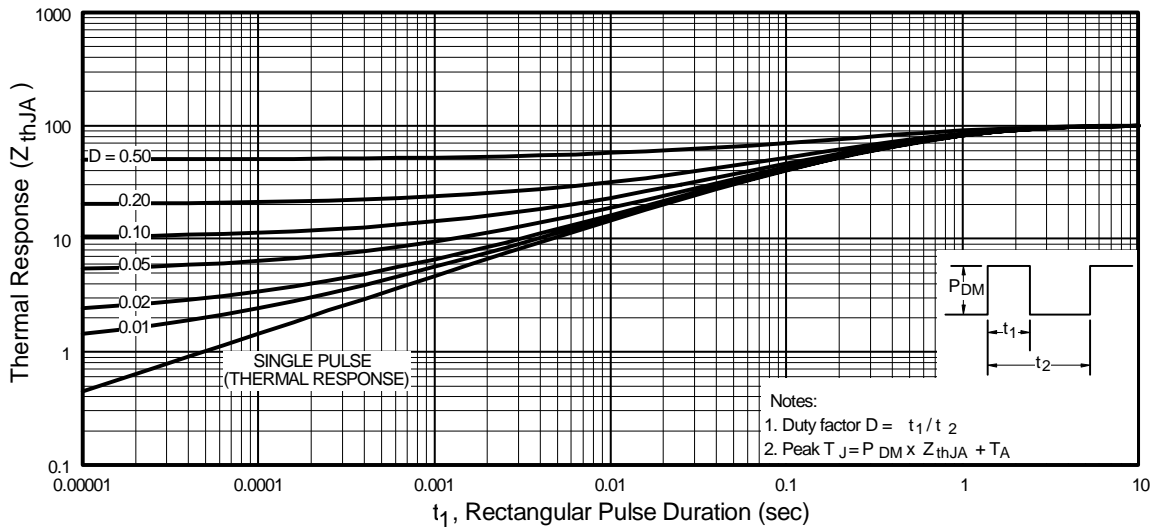
**Fig 7.** Typical Source-Drain Diode Forward Voltage



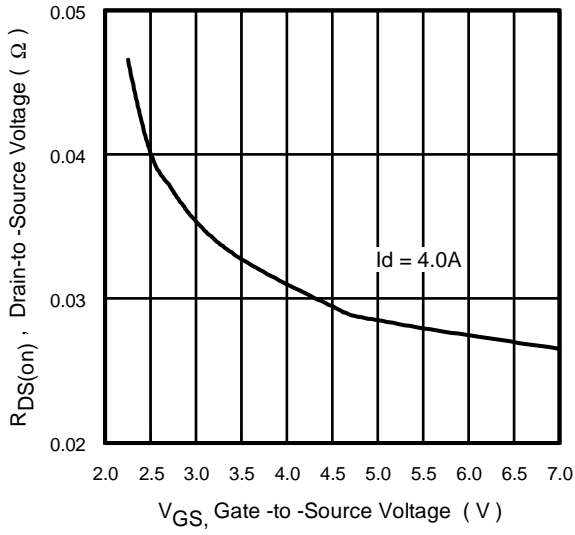
**Fig 8.** Maximum Safe Operating Area



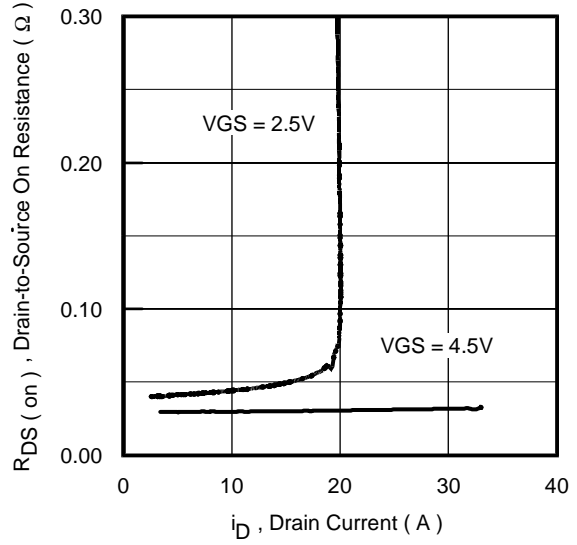
**Fig 9.** Maximum Drain Current Vs. Case Temperature



**Fig 10.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



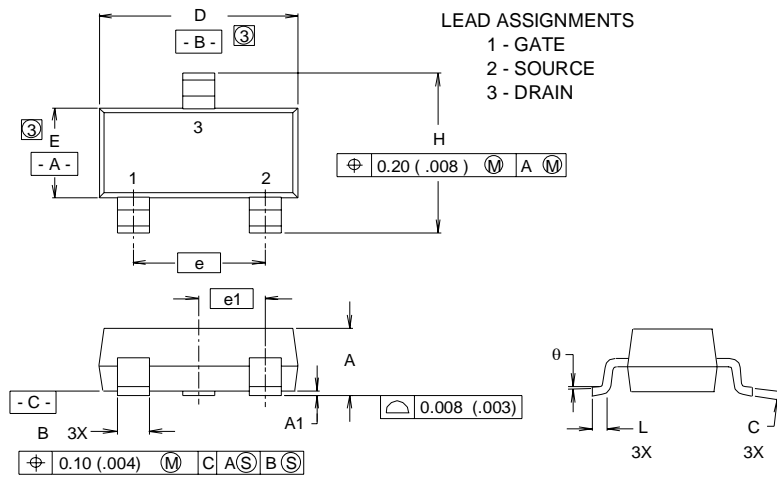
**Fig 11.** On-Resistance Vs. Gate Voltage



**Fig 12.** On-Resistance Vs. Drain Current

## Micro3™ Package Outline

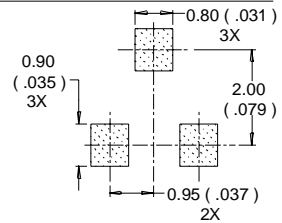
Dimensions are shown in millimeters (inches)



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

| 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 |
| $\theta$ | 0°          | 8°   | 0°          | 8°   |

### MINIMUM RECOMMENDED FOOTPRINT



# IRLML2502

## Part Marking Information

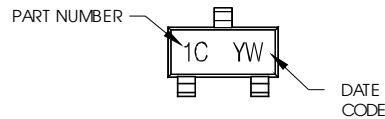
Micro3™

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

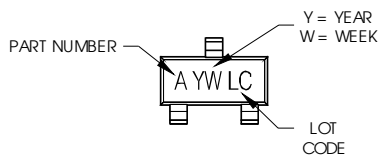
| YEAR | Y | WORK WEEK | W |
|------|---|-----------|---|
| 2001 | 1 | 01        | A |
| 2002 | 2 | 02        | B |
| 2003 | 3 | 03        | C |
| 1994 | 4 | 04        | D |
| 1995 | 5 |           |   |
| 1996 | 6 |           |   |
| 1997 | 7 |           |   |
| 1998 | 8 |           |   |
| 1999 | 9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

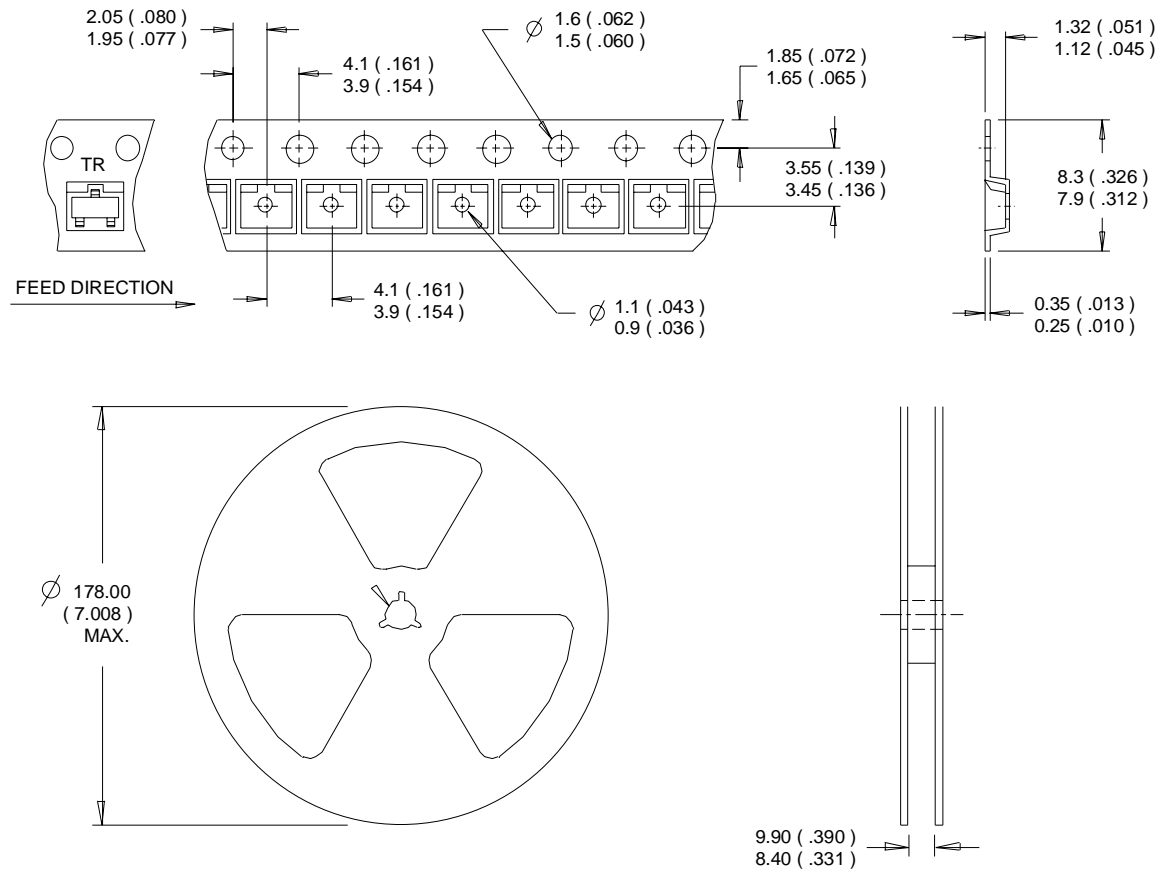
W = (27-52) IF PRECEDED BY A LETTER

| 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 |



## Micro3™ 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.