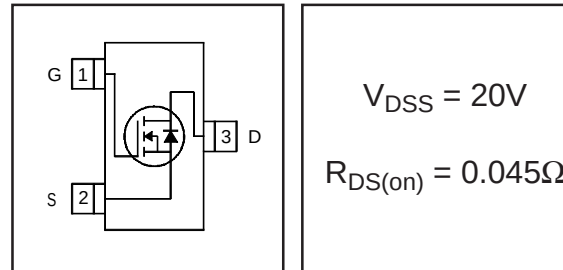


# IRLML2502

HEXFET® Power MOSFET

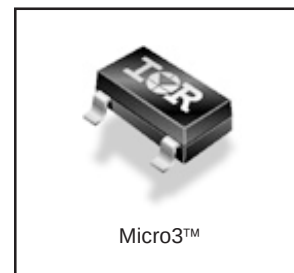
- Ultra Low On-Resistance
- N-Channel MOSFET
- SOT-23 Footprint
- Low Profile (<1.1mm)
- Available in Tape and Reel
- Fast Switching



## 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® 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     |
| $I_D @ T_A = 25^\circ C$ | 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 ①                    | 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    |

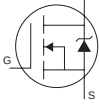
## Thermal Resistance

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

## Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|                                 | Parameter                            | Min. | Typ.  | Max.  | Units               | Conditions                                          |
|---------------------------------|--------------------------------------|------|-------|-------|---------------------|-----------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 20   | —     | —     | V                   | $V_{GS} = 0V, I_D = 250\mu A$                       |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.01  | —     | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1mA$          |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 0.035 | 0.045 | $\Omega$            | $V_{GS} = 4.5V, I_D = 4.2A$ ②                       |
|                                 |                                      | —    | 0.050 | 0.080 |                     | $V_{GS} = 2.5V, I_D = 3.6A$ ②                       |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 0.60 | —     | 1.2   | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                   |
| $g_{fs}$                        | Forward Transconductance             | 5.8  | —     | —     | S                   | $V_{DS} = 10V, I_D = 4.0A$                          |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 1.0   | $\mu A$             | $V_{DS} = 16V, V_{GS} = 0V$                         |
|                                 |                                      | —    | —     | 25    |                     | $V_{DS} = 16V, V_{GS} = 0V, T_J = 70^\circ\text{C}$ |
| $I_{GSS}$                       | 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                  | $I_D = 4.0A$                                        |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | 1.8   | 2.7   |                     | $V_{DS} = 10V$                                      |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | 1.7   | 2.6   |                     | $V_{GS} = 5.0V$ ②                                   |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 7.5   | —     | ns                  | $V_{DD} = 10V$                                      |
| $t_r$                           | Rise Time                            | —    | 10    | —     |                     | $I_D = 1.0A$                                        |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 54    | —     |                     | $R_G = 6\Omega$                                     |
| $t_f$                           | Fall Time                            | —    | 26    | —     |                     | $R_D = 10\Omega$ ②                                  |
| $C_{iss}$                       | Input Capacitance                    | —    | 740   | —     | pF                  | $V_{GS} = 0V$                                       |
| $C_{oss}$                       | Output Capacitance                   | —    | 90    | —     |                     | $V_{DS} = 15V$                                      |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 66    | —     |                     | $f = 1.0MHz$                                        |

## Source-Drain Ratings and Characteristics

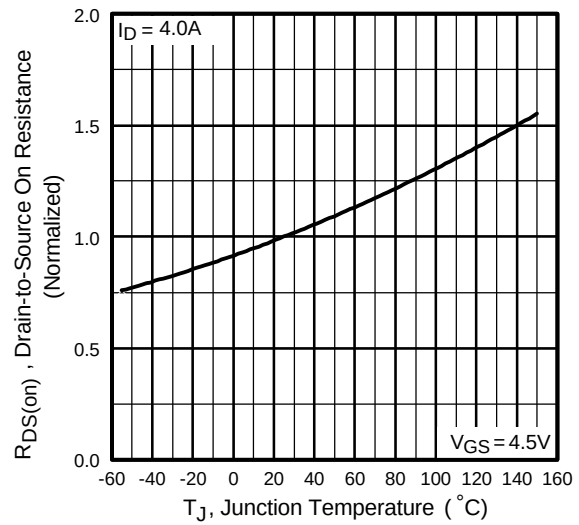
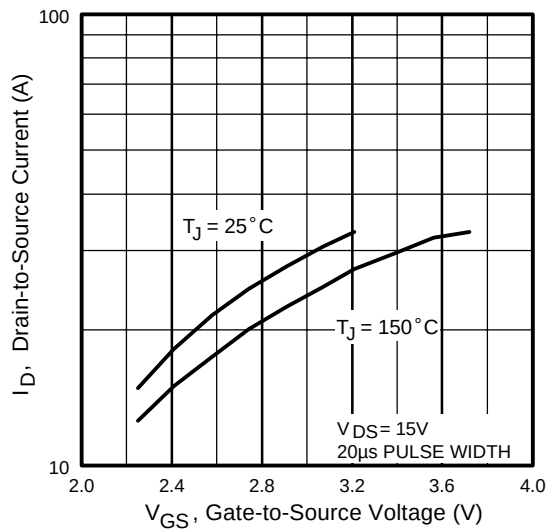
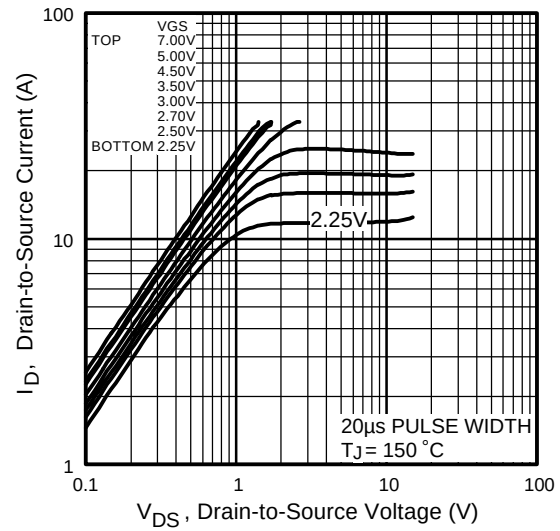
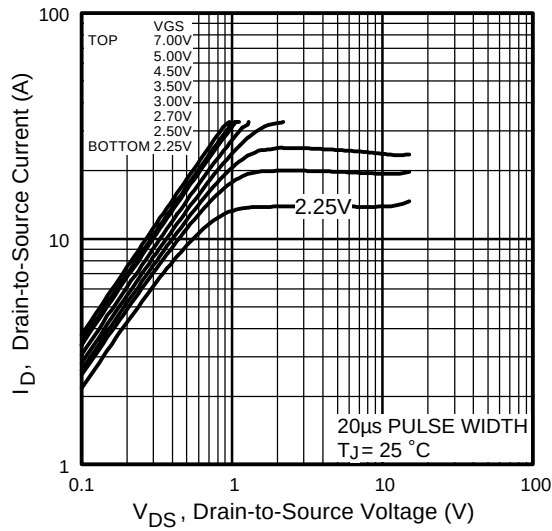
|          | Parameter                              | Min. | Typ. | Max. | Units | Conditions                                                                                                                                           |
|----------|----------------------------------------|------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | 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   | —    | —    | 33   |       |                                                                                                                                                      |
| $V_{SD}$ | Diode Forward Voltage                  | —    | —    | 1.2  | V     | $T_J = 25^\circ\text{C}, I_S = 1.3A, V_{GS} = 0V$ ②                                                                                                  |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 16   | 24   | ns    | $T_J = 25^\circ\text{C}, I_F = 1.3A$                                                                                                                 |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 8.6  | 13   | nC    | $di/dt = 100A/\mu s$ ②                                                                                                                               |

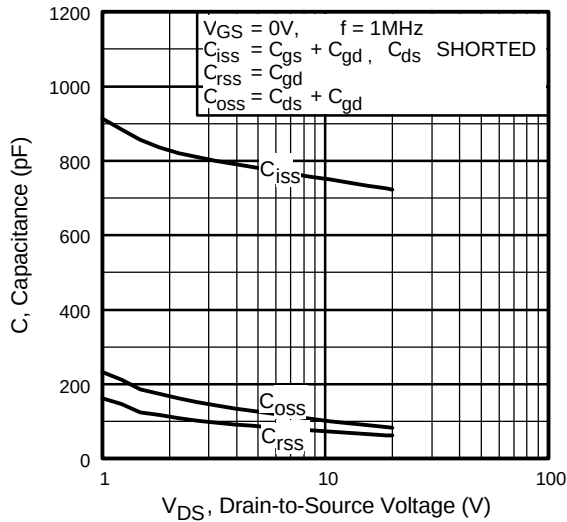
### Notes:

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

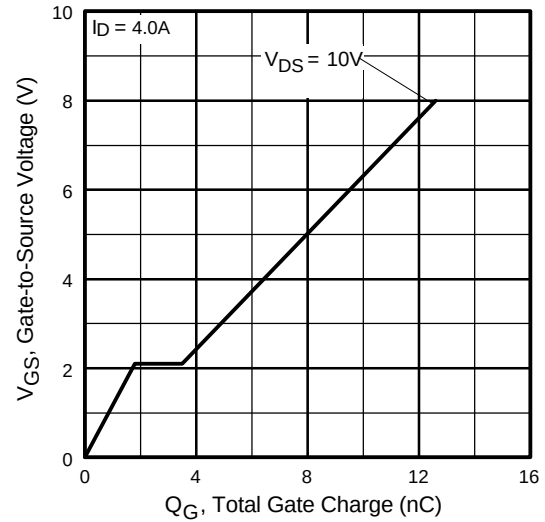
② Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .

③ Surface mounted on FR-4 board,  $t \leq 5sec$ .

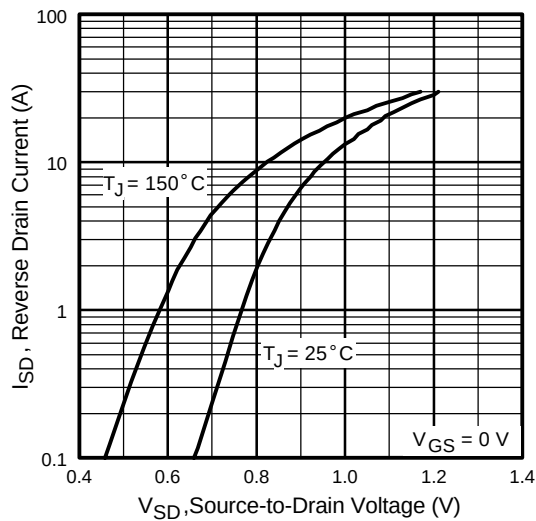




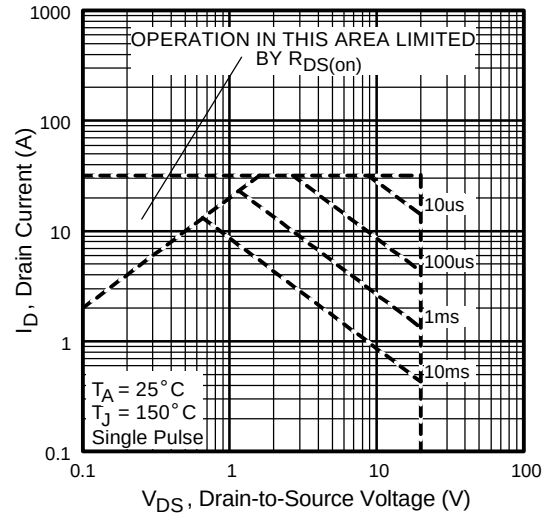
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



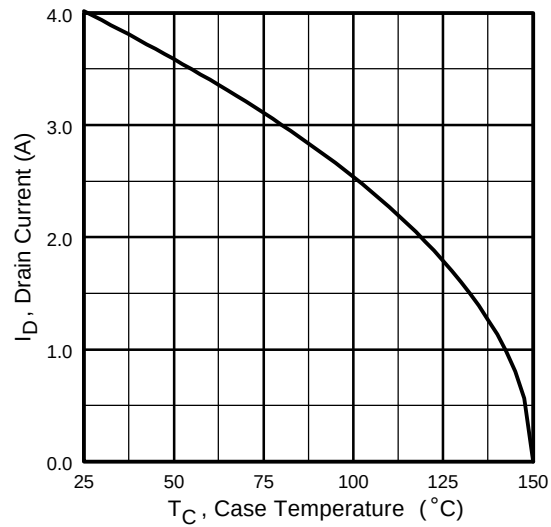
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



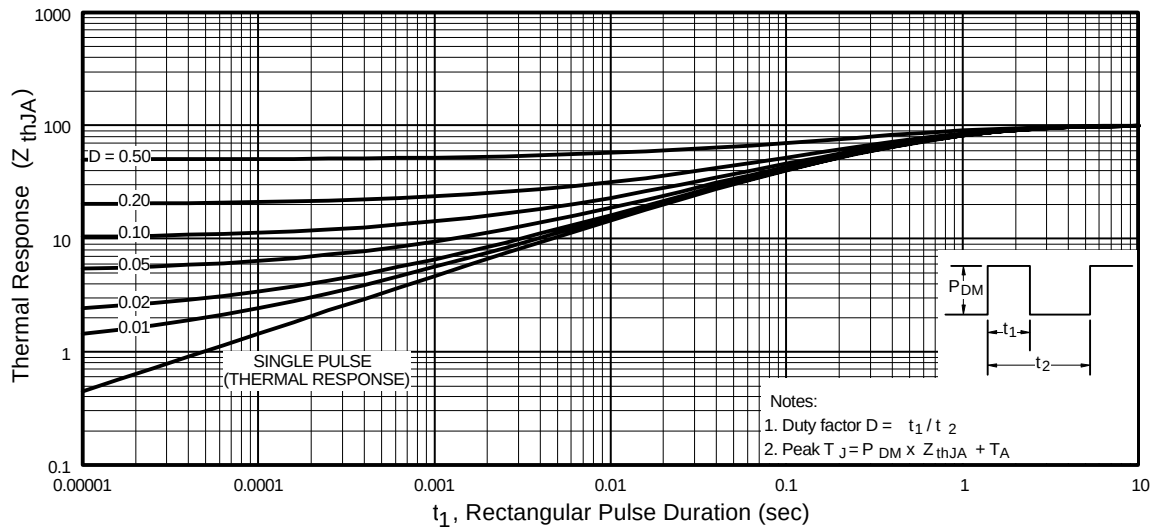
**Fig 7.** Typical Source-Drain Diode Forward Voltage



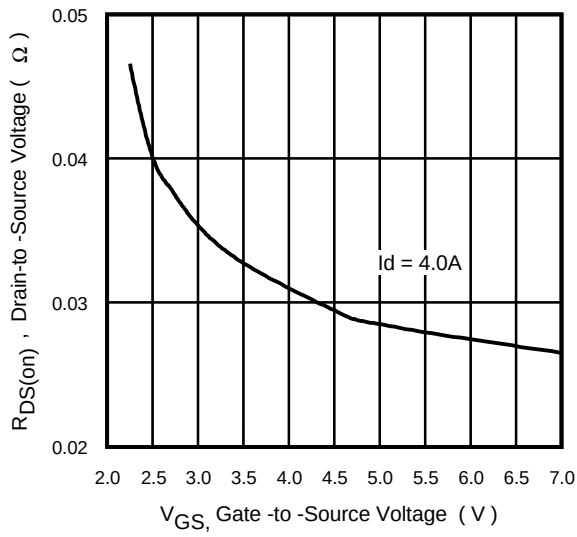
**Fig 8.** Maximum Safe Operating Area



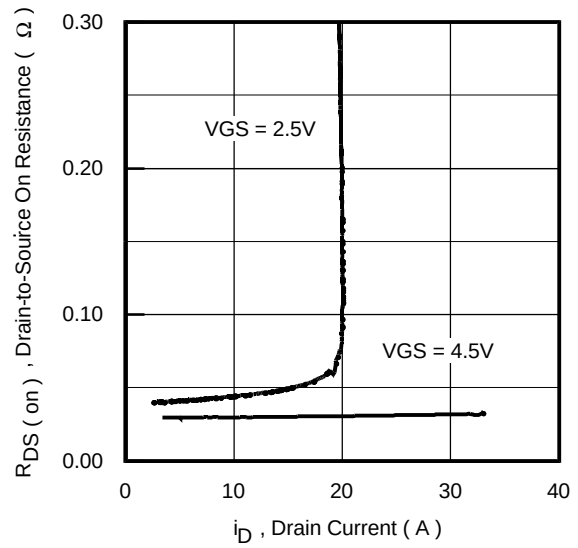
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



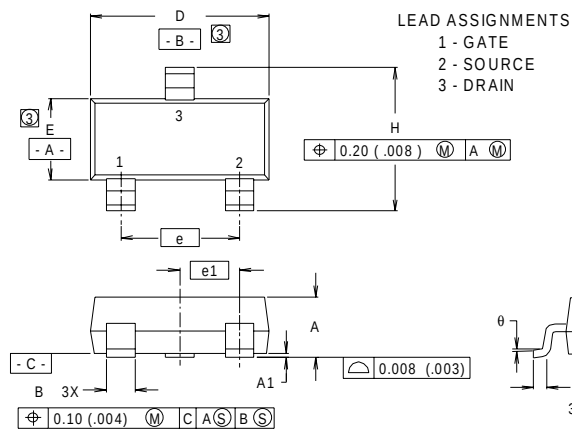
**Fig 11.** On-Resistance Vs. Gate Voltage



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

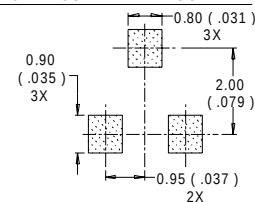
## Micro3™ Package Outline

Dimensions are shown in millimeters (inches)



| 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

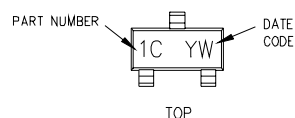


- NOTES:
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
  2. CONTROLLING DIMENSION : INCH.
  3. DIMENSIONS DO NOT INCLUDE MOLD FLASH.

## Micro3™ Part Marking Information

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

### 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

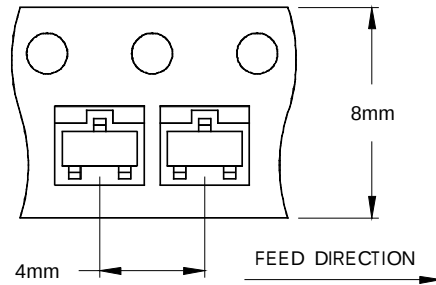
| YEAR | Y | WORK WEEK | W |
|------|---|-----------|---|
| 2001 | A | 27        | A |
| 2002 | B | 28        | B |
| 2003 | C | 29        | C |
| 1994 | D | 30        | D |
| 1995 | E |           |   |
| 1996 | F |           |   |
| 1997 | G |           |   |
| 1998 | H |           |   |
| 1999 | J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

# IRLML2502

International  
**IR** Rectifier

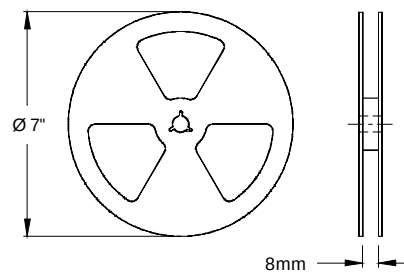
## Micro3™ Tape & Reel Information

Dimensions are shown in millimeters (inches)



### NOTES:

1. OUTLINE CONFORMS TO EIA-481 & EIA-541.



### NOTES:

1. OUTLINE CONFORMS TO EIA-481 & EIA-541.

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
**IR EUROPEAN REGIONAL CENTRE:** 439/445 Godstone Rd, Whyteleafe, Surrey CR3 0BL, UK Tel: ++ 44 (0)20 8645 8000  
**IR CANADA:** 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200  
**IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590  
**IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111  
**IR JAPAN:** K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086  
**IR SOUTHEAST ASIA:** 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630  
**IR TAIWAN:** 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936

*Data and specifications subject to change without notice. 5/00*