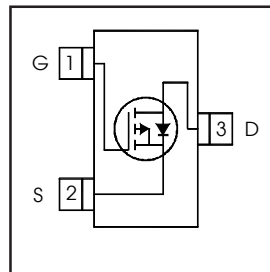


- Ultra Low On-Resistance
- P-Channel MOSFET
- SOT-23 Footprint
- Low Profile (<1.1mm)
- Available in Tape and Reel
- Fast Switching
- Lead-Free
- RoHS Compliant, Halogen-Free

HEXFET® Power MOSFET

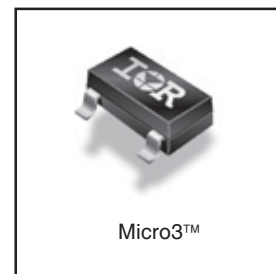


| |
|----------------------------|
| $V_{DS} = -20V$ |
| $R_{DS(on)} = 0.065\Omega$ |

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.



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

Absolute Maximum Ratings

| | Parameter | Max. | Units |
|--------------------------|--------------------------------------------|--------------|-------|
| V_{DS} | Drain- Source Voltage | -20 | V |
| $I_D @ T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V$ | -3.7 | A |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V$ | -2.2 | |
| I_{DM} | Pulsed Drain Current ① | -22 | |
| $P_D @ T_A = 25^\circ C$ | 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 Energy④ | 11 | mJ |
| V_{GS} | Gate-to-Source Voltage | ± 12 | V |
| T_J, T_{STG} | Junction and Storage Temperature Range | -55 to + 150 | °C |

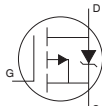
Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|------------------------------|------|------|-------|
| $R_{\theta JA}$ | 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 _{DS(on)} | 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 | -1.2 | 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 |

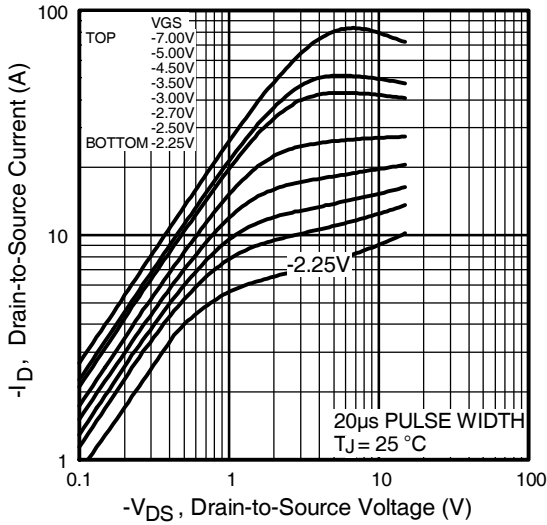
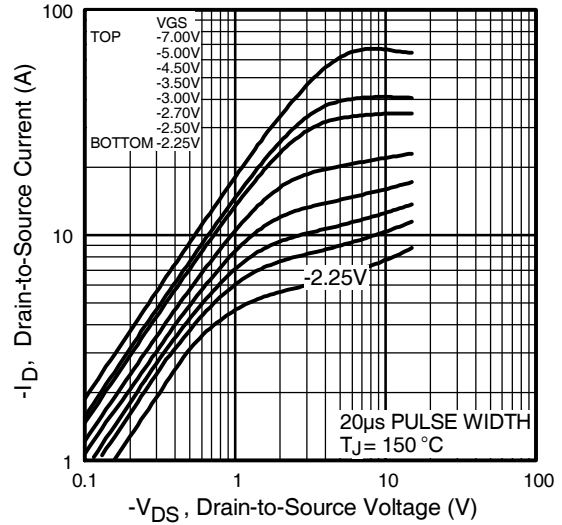
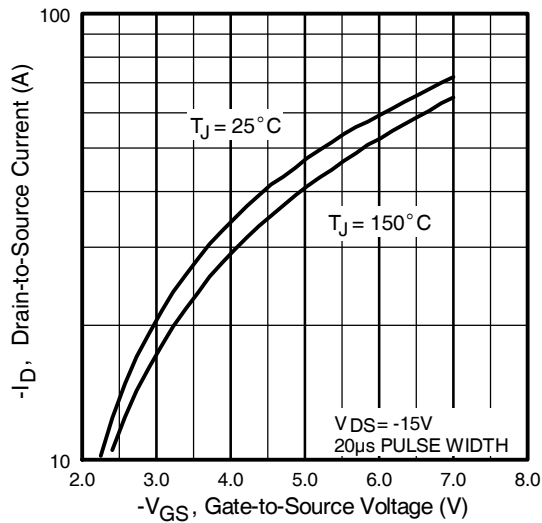
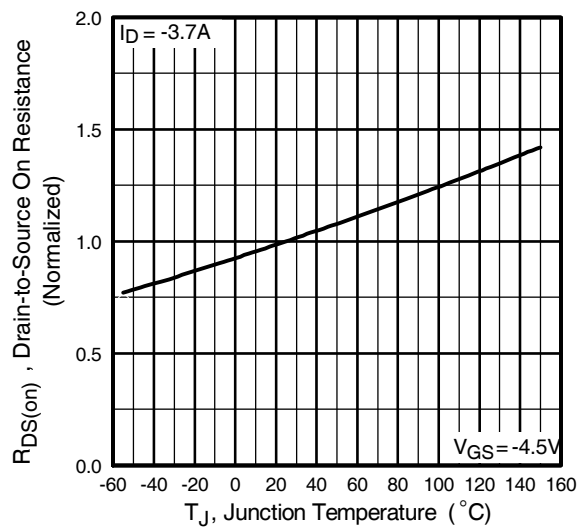
Source-Drain Ratings and Characteristics

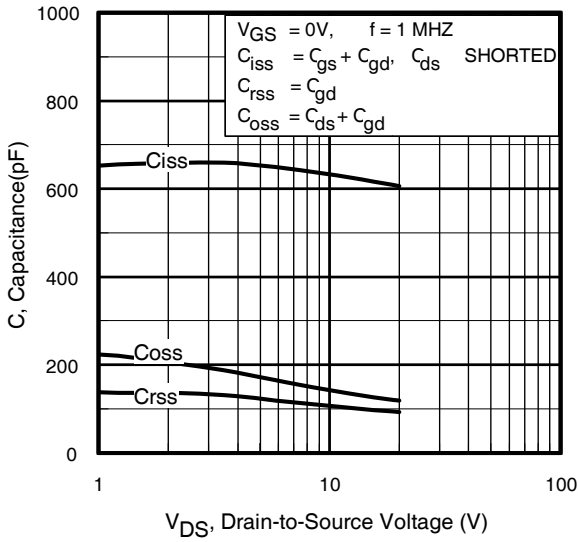
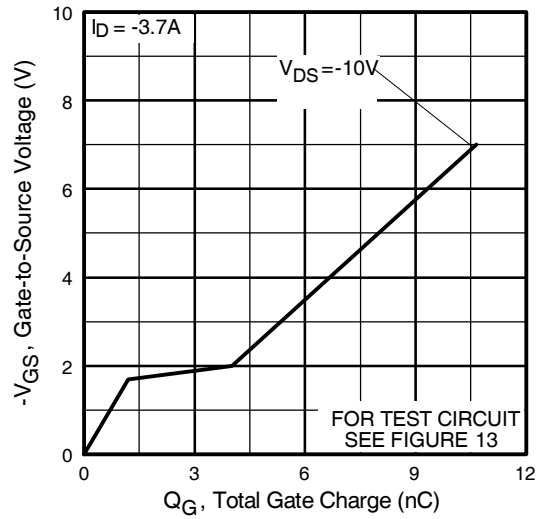
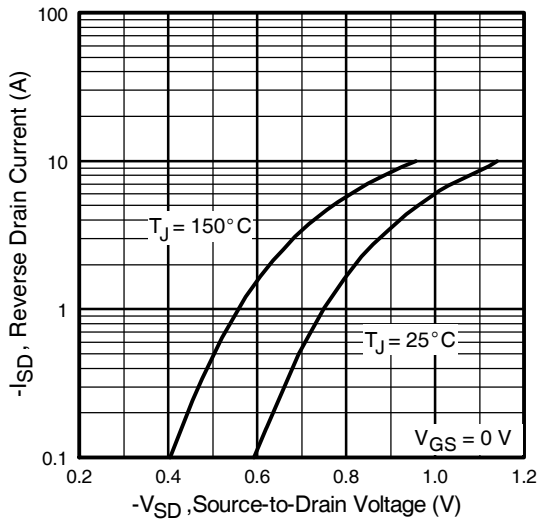
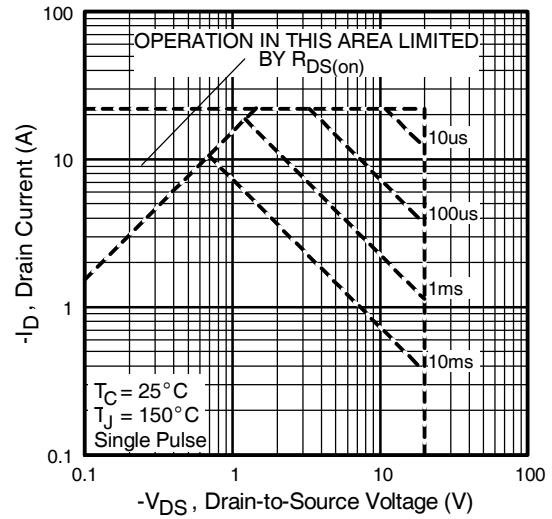
| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|----------------------------------------|------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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

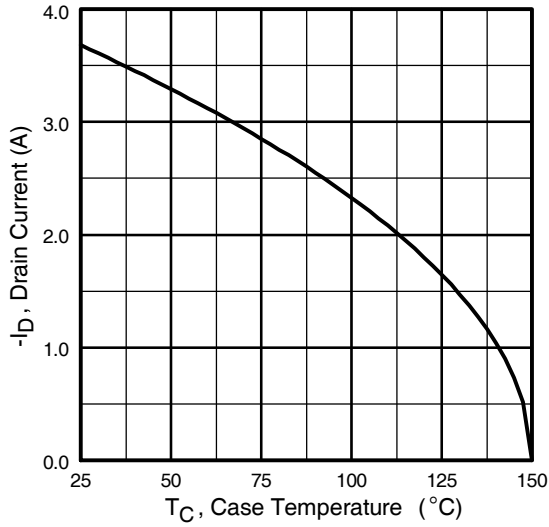


Fig 9. Maximum Drain Current Vs. Case Temperature

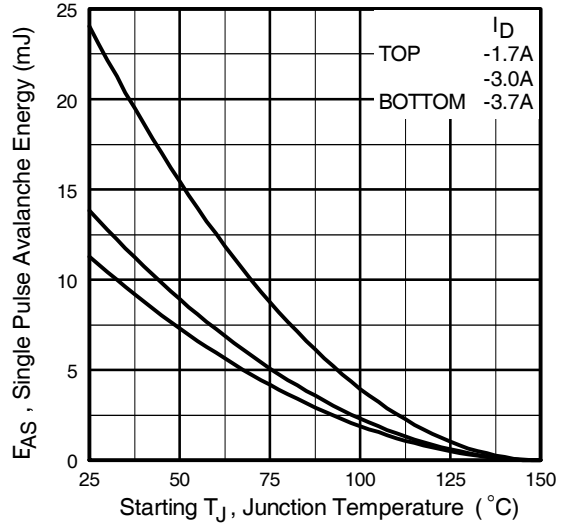


Fig 10. Maximum Avalanche Energy Vs. Drain Current

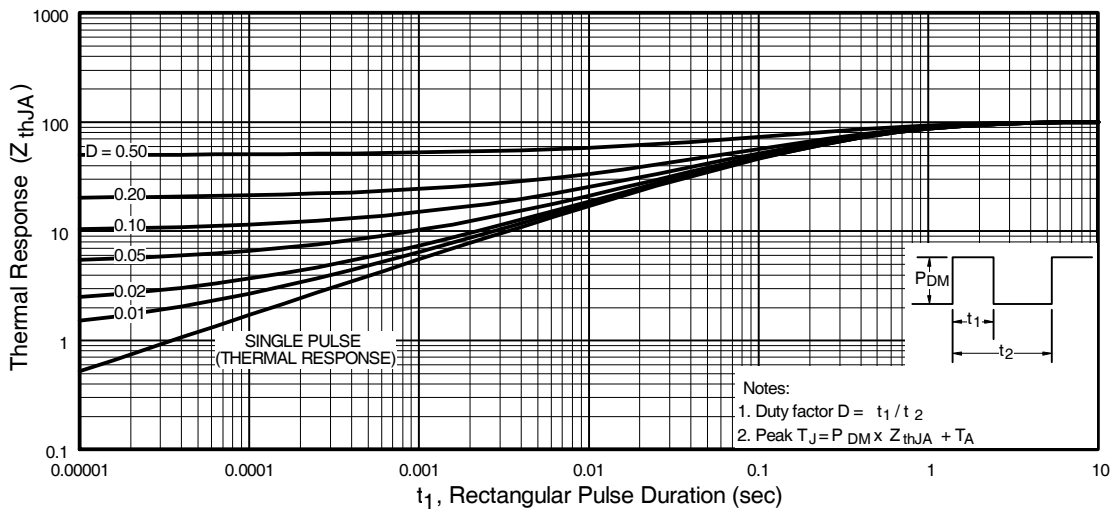


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

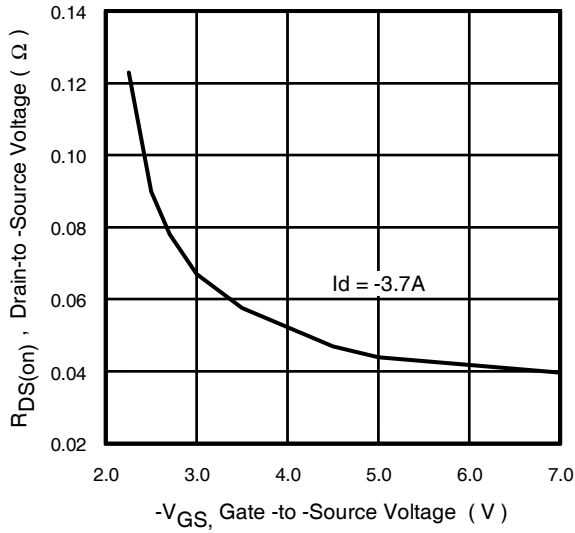


Fig 12. Typical On-Resistance Vs. Gate Voltage

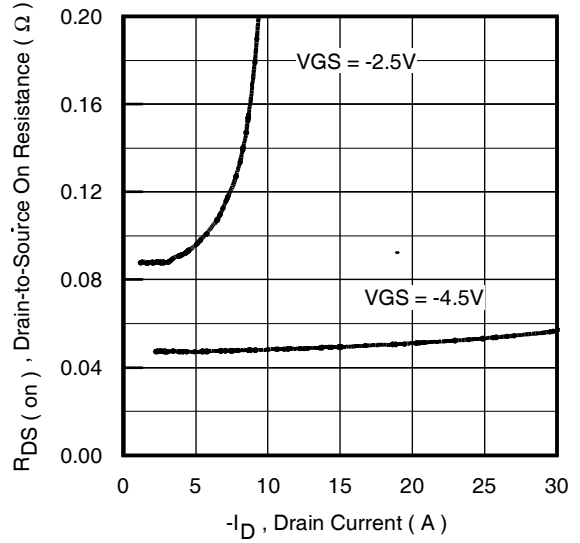
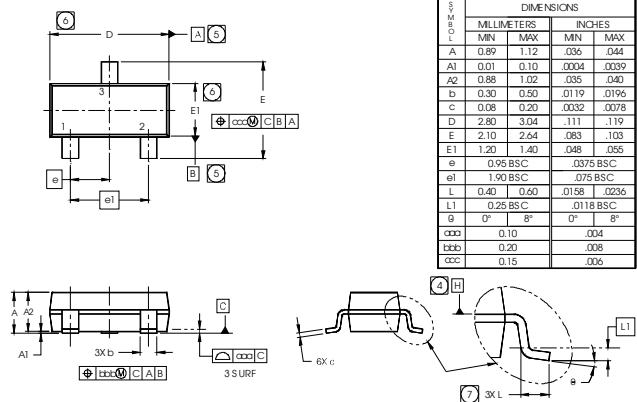


Fig 13. Typical On-Resistance Vs. Drain Current



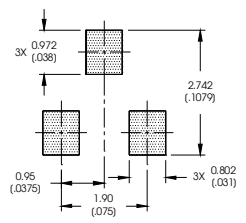
Micro3 (SOT-23) (Lead-Free) Package Outline

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 | 2.54 | .083 | .103 |
| E1 | 1.20 | 1.40 | .048 | .056 |
| 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 | |
| Ø | Ø | Ø | Ø | Ø |
| ØØ | 0.10 | | .004 | |
| ØØØ | 0.20 | | .008 | |
| ØØØØ | 0.15 | | .006 | |

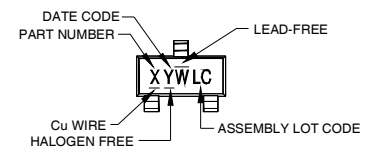
RECOMMENDED FOOTPRINT



- 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 after 02/26/2001



- 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

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

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 |

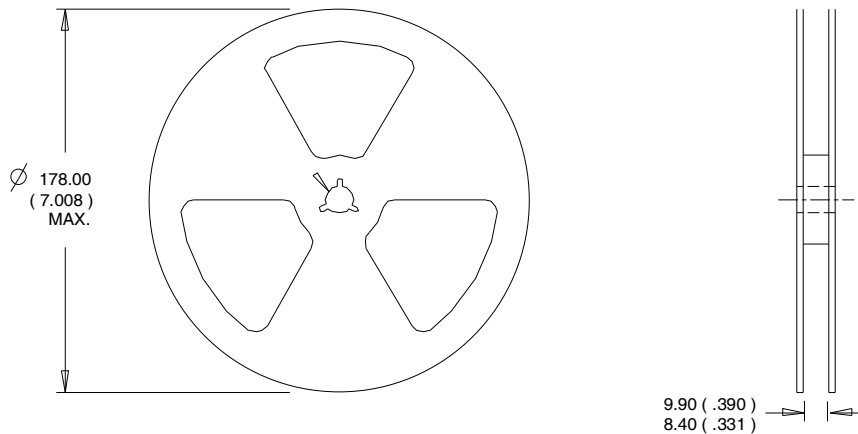
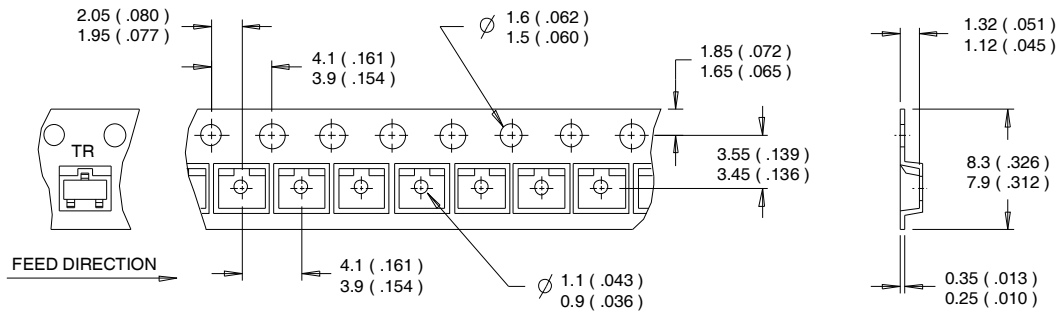
W = (27-52) IF PRECEDED BY A LETTER

| 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 |

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

Micro3™(SOT-23/TO-263AB) 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 |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4/28/2014 | <ul style="list-style-type: none"> • 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. |

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