



## Description

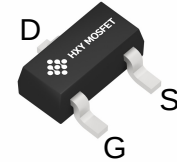
The IRLML0040TRPBF uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

## General Features

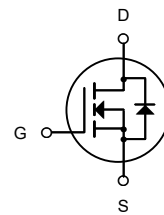
$V_{DS} = 40V$   $I_D = 5A$   
 $R_{DS(ON)} < 38m\Omega$  @  $V_{GS} = 10V$   
 $R_{DS(ON)} < 52m\Omega$  @  $V_{GS} = 4.5V$

## Application

Battery protection  
Load switch  
Uninterruptible power supply



SOT-23



N-Channel MOSFET

## Ordering Information

| Product ID     | Pack   | Marking | Qty(PCS) |
|----------------|--------|---------|----------|
| IRLML0040TRPBF | SOT-23 | 2318    | 3000     |

## Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Symbol          | Parameter                                         | Rating     | Units        |
|-----------------|---------------------------------------------------|------------|--------------|
| $V_{DS}$        | Drain-Source Voltage                              | 40         | V            |
| $V_{GS}$        | Gate-Source Voltage                               | $\pm 20$   | V            |
| $I_D$           | Drain Current – Continuous ( $T_C = 25^\circ C$ ) | 5          | A            |
|                 | Drain Current – Continuous ( $T_C = 70^\circ C$ ) | 4.2        | A            |
| $P_D$           | Power Dissipation ( $T_C = 25^\circ C$ )          | 1.56       | W            |
| $T_{STG}$       | Storage Temperature Range                         | -55 to 150 | $^\circ C$   |
| $T_J$           | Operating Junction Temperature Range              | -55 to 150 | $^\circ C$   |
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient            | 80         | $^\circ C/W$ |



| Symbol                                                                              | Parameter                                             | Condition                                                                                      | Min | Typ  | Max  | Unit |
|-------------------------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------|-----|------|------|------|
| Static Electrical Characteristics @ T <sub>J</sub> = 25℃ (unless otherwise stated)  |                                                       |                                                                                                |     |      |      |      |
| V <sub>(BR)DSS</sub>                                                                | Drain-Source Breakdown Voltage                        | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                      | 40  | --   | --   | V    |
| I <sub>DSS</sub>                                                                    | Zero Gate Voltage Drain Current(T <sub>A</sub> =25℃)  | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V                                                      | --  | --   | 1    | μA   |
|                                                                                     | Zero Gate Voltage Drain Current(T <sub>A</sub> =125℃) | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V                                                      | --  | --   | 100  | uA   |
| I <sub>GSS</sub>                                                                    | Gate-Body Leakage Current                             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                     | --  | --   | ±100 | nA   |
| V <sub>GS(TH)</sub>                                                                 | Gate Threshold Voltage                                | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                       | 0.7 | 1.9  | 2.5  | V    |
| R <sub>DS(ON)</sub>                                                                 | Drain-Source On-State Resistance②                     | V <sub>GS</sub> =10V, I <sub>D</sub> =5A                                                       | --  | 30   | 38   | mΩ   |
| R <sub>DS(ON)</sub>                                                                 | Drain-Source On-State Resistance②                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =4A                                                      | --  | 36   | 52   | mΩ   |
| Dynamic Electrical Characteristics @ T <sub>J</sub> = 25℃ (unless otherwise stated) |                                                       |                                                                                                |     |      |      |      |
| C <sub>iss</sub>                                                                    | Input Capacitance                                     | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V,<br>f=1MHz                                           | --  | 340  | --   | pF   |
| C <sub>oss</sub>                                                                    | Output Capacitance                                    |                                                                                                | --  | 60   | --   | pF   |
| C <sub>rss</sub>                                                                    | Reverse Transfer Capacitance                          |                                                                                                | --  | 30   | --   | pF   |
| R <sub>g</sub>                                                                      | Gate Resistance                                       | f=1MHz                                                                                         |     | 7.8  |      | Ω    |
| Q <sub>g</sub>                                                                      | Total Gate Charge                                     | V <sub>DS</sub> =20V<br>I <sub>D</sub> =5A,<br>V <sub>GS</sub> =10V                            | --  | 5.8  | --   | nC   |
| Q <sub>gs</sub>                                                                     | Gate Source Charge                                    |                                                                                                | --  | 0.4  | --   | nC   |
| Q <sub>gd</sub>                                                                     | Gate Drain Charge                                     |                                                                                                | --  | 2    | --   | nC   |
| Switching Characteristics @ T <sub>J</sub> = 25℃ (unless otherwise stated)          |                                                       |                                                                                                |     |      |      |      |
| t <sub>d(on)</sub>                                                                  | Turn on Delay Time                                    | V <sub>DD</sub> =20V,<br>I <sub>D</sub> =3.5A,<br>R <sub>G</sub> =1Ω,<br>V <sub>GS</sub> =4.5V | --  | 4.1  | --   | ns   |
| t <sub>r</sub>                                                                      | Turn on Rise Time                                     |                                                                                                | --  | 11.6 | --   | ns   |
| t <sub>d(off)</sub>                                                                 | Turn Off Delay Time                                   |                                                                                                | -   | 24   | --   | ns   |
| t <sub>f</sub>                                                                      | Turn Off Fall Time                                    |                                                                                                | --  | 7.6  | --   | ns   |
| Source Drain Diode Characteristics @ T <sub>J</sub> = 25℃ (unless otherwise stated) |                                                       |                                                                                                |     |      |      |      |
| I <sub>SD</sub>                                                                     | Source drain current(Body Diode)                      | T <sub>A</sub> =25℃                                                                            | --  | --   | 1.75 | A    |
| V <sub>SD</sub>                                                                     | Forward on voltage②                                   | T <sub>J</sub> =25℃, I <sub>SD</sub> =3.5A,<br>V <sub>GS</sub> =0V                             | --  | 0.79 | 1.2  | V    |

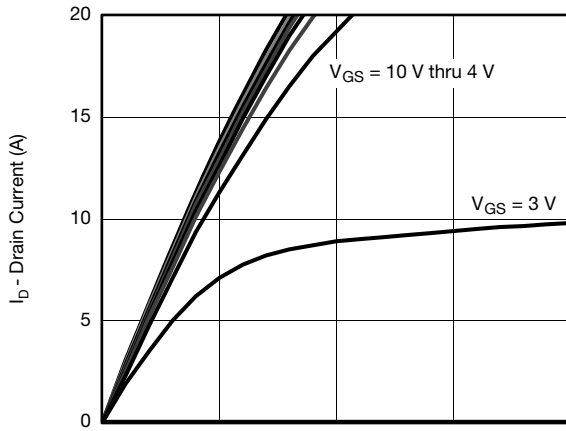
Notes:

① Pulse width limited by maximum allowable junction temperature

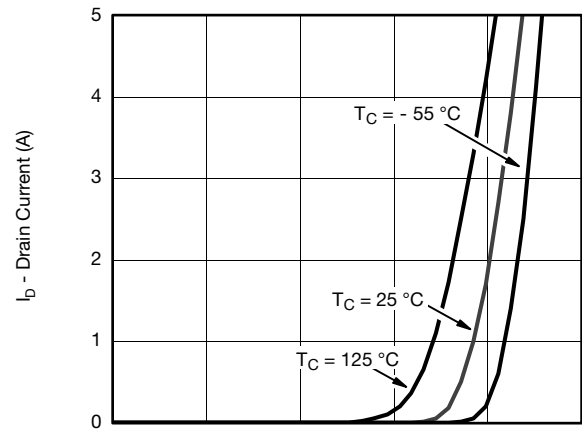
②Pulse test ; Pulse width≤300μs, duty cycle≤2%.



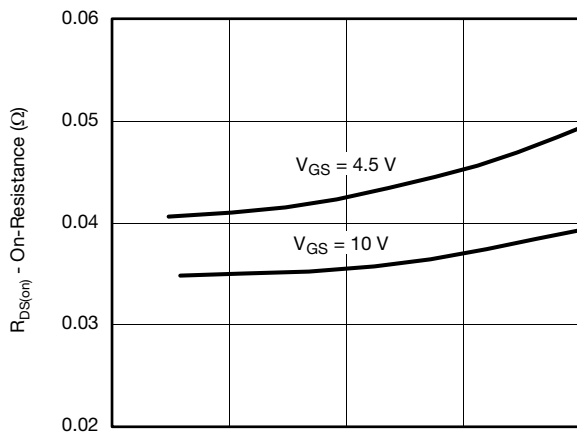
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



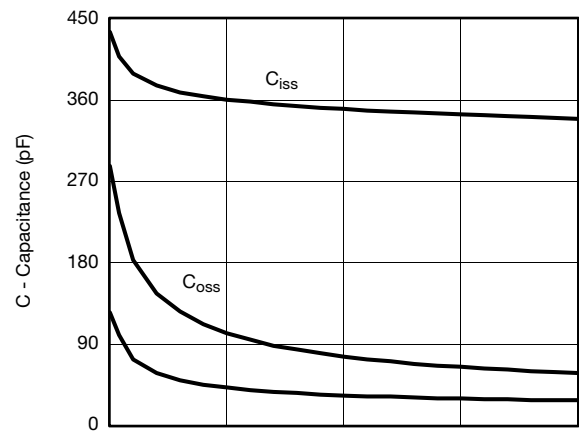
$V_{DS}$  - Drain-to-Source Voltage (V)  
**Output Characteristics**



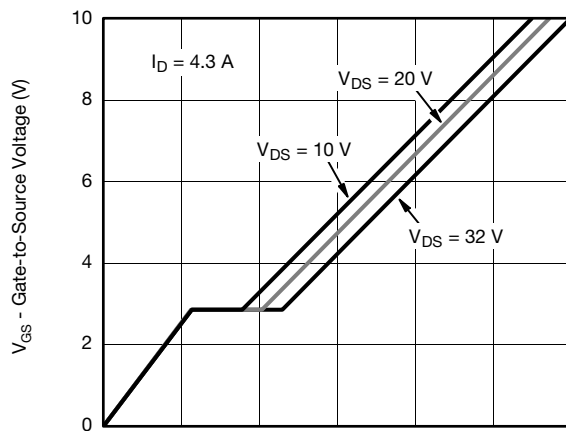
$V_{GS}$  - Gate-to-Source Voltage (V)  
**Transfer Characteristics**



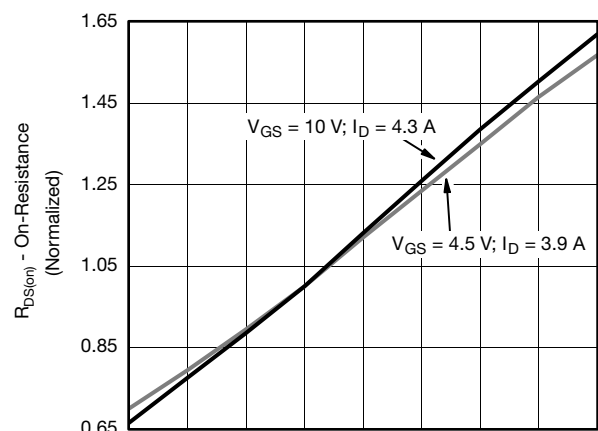
$I_D$  - Drain Current (A)  
**On-Resistance vs. Drain Current and Gate Voltage**



$V_{DS}$  - Drain-to-Source Voltage (V)  
**Capacitance**



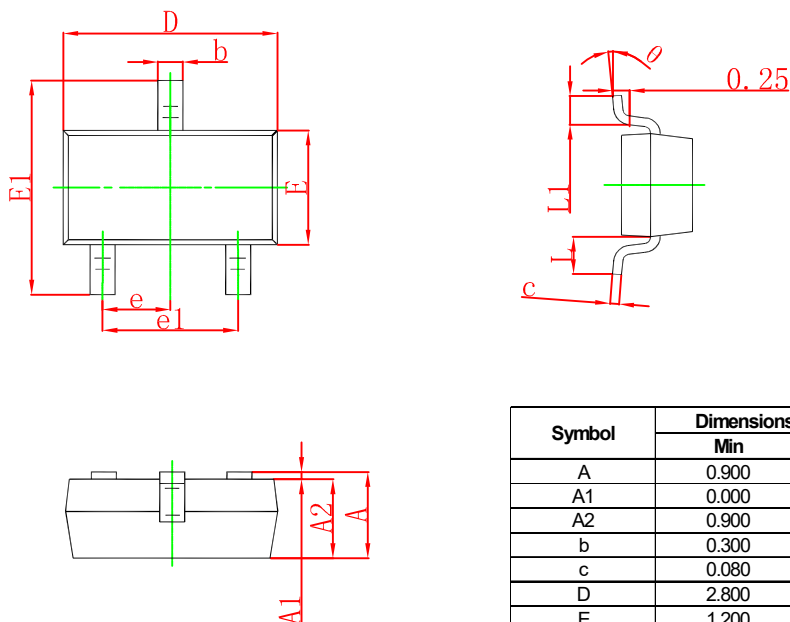
$Q_g$  - Total Gate Charge (nC)  
**Gate Charge**



$T_J$  - Junction Temperature ( $^{\circ}\text{C}$ )  
**On-Resistance vs. Junction Temperature**

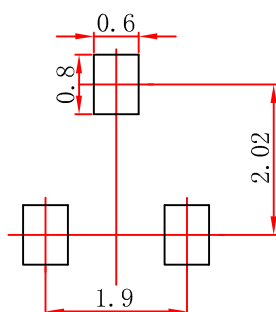


## SOT-23 Package Outline Dimensions



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.900                     | 1.150 | 0.035                | 0.045 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.050 | 0.035                | 0.041 |
| b      | 0.300                     | 0.500 | 0.012                | 0.020 |
| c      | 0.080                     | 0.150 | 0.003                | 0.006 |
| D      | 2.800                     | 3.000 | 0.110                | 0.118 |
| E      | 1.200                     | 1.400 | 0.047                | 0.055 |
| E1     | 2.250                     | 2.550 | 0.089                | 0.100 |
| e      | 0.950 TYP                 |       | 0.037 TYP            |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.550 REF                 |       | 0.022 REF            |       |
| L1     | 0.300                     | 0.500 | 0.012                | 0.020 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

## SOT-23 Suggested Pad Layout



Note:  
1. Controlling dimension: in millimeters.  
2. General tolerance:  $\pm 0.05\text{mm}$ .  
3. The pad layout is for reference purposes only.



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