

# EVVOSEMI<sup>®</sup>

THINK CHANGE DO



ESD



TVS



MOS



LDO



Diode



Sensor



DC-DC

## Product Specification

|              |             |                 |
|--------------|-------------|-----------------|
| ▶ Domestic   | Part Number | EIRLML6402-S1   |
| ▶ Overseas   | Part Number | EV-IRLML6402-S1 |
| ▶ Equivalent | Part Number | IRLML6402       |

"S1" means SOT-23

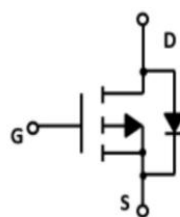
EV is the abbreviation of name EVVO

**-20V P-Channel Enhancement Mode MOSFET****Description**

The IRLML6402 uses advanced trench It utilizes the latest processing techniques to achieve the high cell density and reduces the on-resistance with high repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in power switching application and a wide variety of other applications

**Application**

Advanced MOSFET process technology  
Special designed for PWM, load switching and general purpose applications  
Ultra low on-resistance with low gate charge  
Fast switching and reverse body recovery  
150°C operating temperature

**General Features**
 $V_{DS} = -20V, I_D = -4.2A$ 
 $R_{DS(ON)} = 33m\Omega @ V_{GS}=4.5V$ 
 $R_{DS(ON)} = 45m\Omega @ V_{GS}=2.5V$ 
**SOT-23 Pin Configuration****Absolute max Rating: @T<sub>A</sub>=25°C unless otherwise specified**

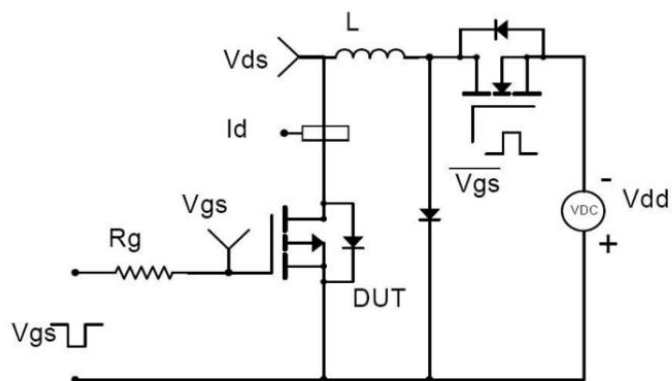
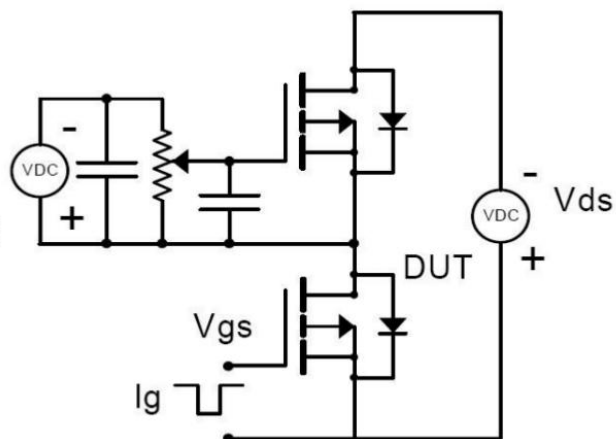
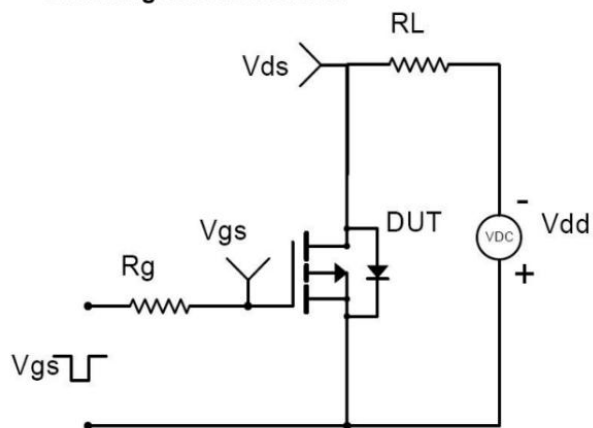
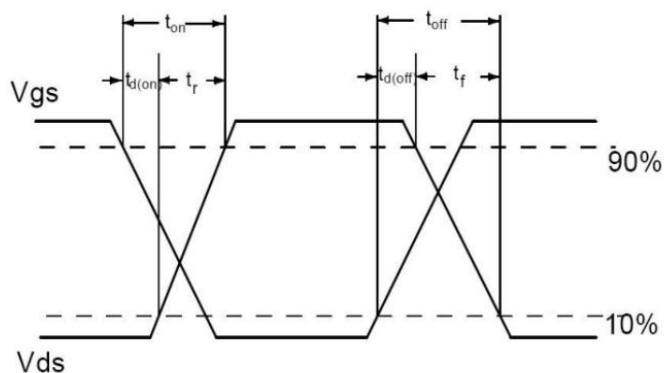
| Symbol                  | Parameter                                        | Max.        | Units |
|-------------------------|--------------------------------------------------|-------------|-------|
| $I_D @ TC = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$         | -4.2①       | A     |
| $I_D @ TC = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$         | -2.4 ①      |       |
| $I_{DM}$                | Pulsed Drain Current ②                           | -30         |       |
| $P_D @ TC = 25^\circ C$ | Power Dissipation ③                              | 1.4         | W     |
| $V_{DS}$                | Drain-Source Voltage                             | -20         | V     |
| $V_{GS}$                | Gate-to-Source Voltage                           | $\pm 8$     | V     |
| $T_J \quad T_{STG}$     | Operating Junction and Storage Temperature Range | -55 to +150 | °C    |
| $R_{\theta JA}$         | Junction-to-ambient ( $t \leq 10s$ ) ④           | 90          | °C /W |

**-20V P-Channel Enhancement Mode MOSFET**
**Electrical Characterizes @ $T_A=25^{\circ}\text{C}$  unless otherwise specified**

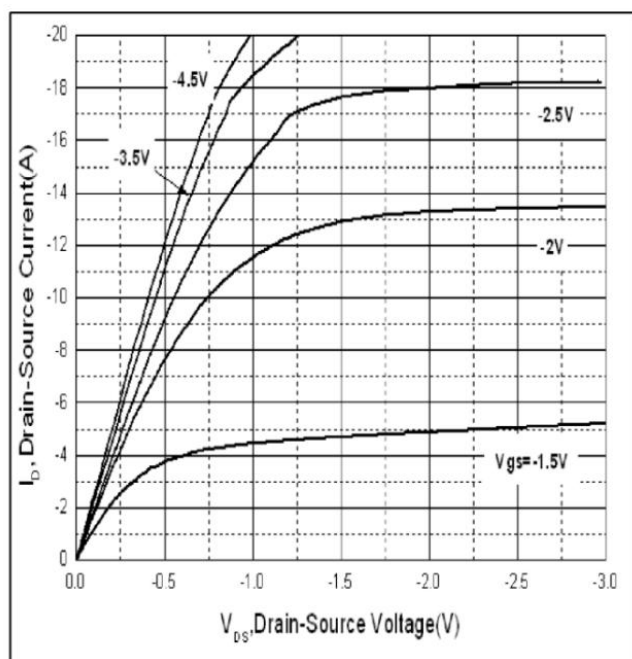
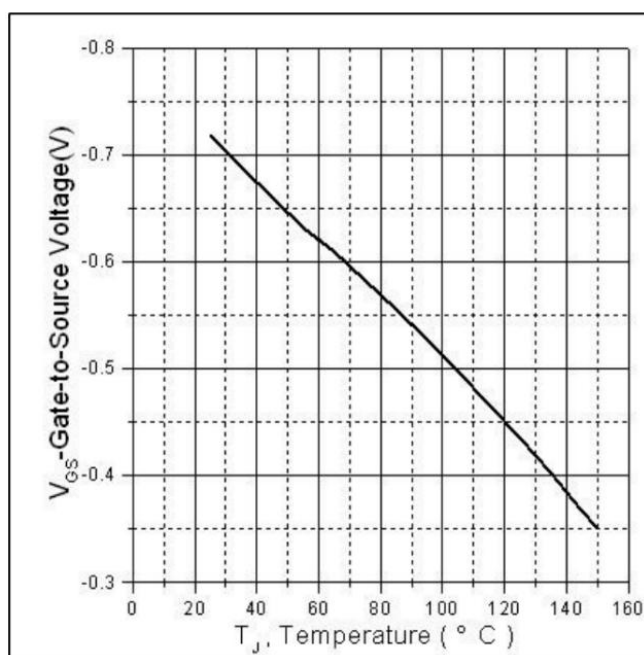
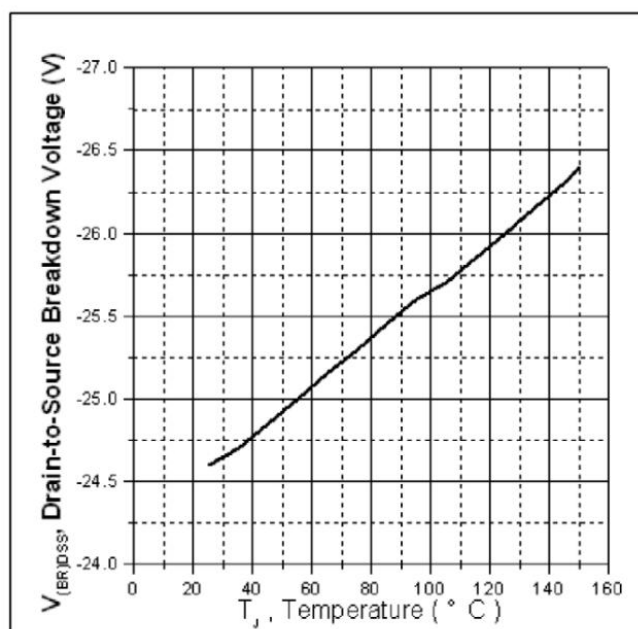
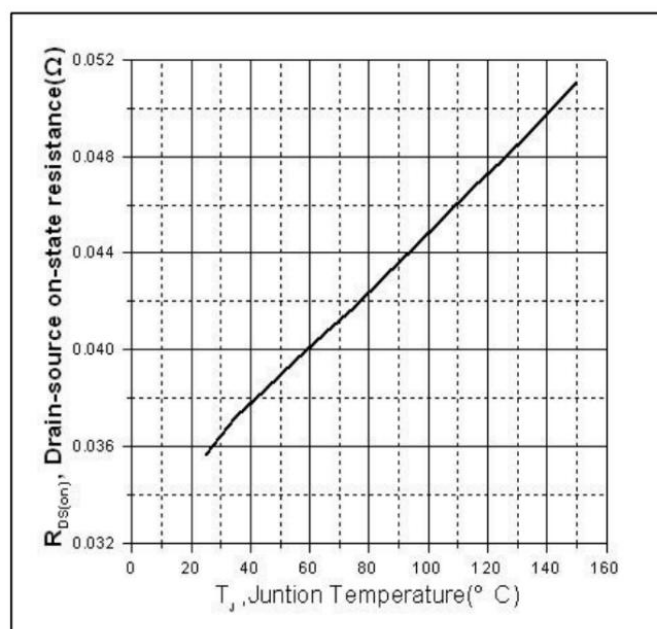
| Symbol              | Parameter                            | Conditions                                         | Min. | Typ.  | Max. | Units |
|---------------------|--------------------------------------|----------------------------------------------------|------|-------|------|-------|
| V(BR)DSS            | Drain-to-Source breakdown voltage    | $V_{GS} = 0V, I_D = -250\mu A$                     | -20  | —     | —    | V     |
| R <sub>DS(on)</sub> | Static Drain-to-Source on-resistance | $V_{GS}=-4.5V, I_D = -4A$                          | —    | 33    | 35   | mΩ    |
|                     |                                      | $V_{GS}=-2.5V, I_D = -4A$                          | —    | 45    | 54   |       |
|                     |                                      | $V_{GS}=-1.8V, I_D = -2A$                          | —    | 60    | 70   |       |
| V <sub>GS(th)</sub> | Gate threshold voltage               | $V_{DS} = V_{GS}, I_D = -250\mu A$                 | -0.3 | —     | -1.0 | V     |
|                     |                                      | $T_J = 125^{\circ}\text{C}$                        | —    | -0.44 | —    |       |
| IDSS                | Drain-to-Source leakage current      | $V_{DS} = -16V, V_{GS} = 0V$                       | —    | —     | -1   | μA    |
|                     |                                      | $T_J = 125^{\circ}\text{C}$                        | —    | —     | -50  |       |
| IGSS                | Gate-to-Source forward leakage       | $V_{GS} = 8V$                                      | —    | —     | 10   | μA    |
|                     |                                      | $V_{GS} = -8V$                                     | —    | —     | -10  |       |
| Q <sub>g</sub>      | Total gate charge                    | $I_D = -4A,$<br>$V_{DS}=-10V,$<br>$V_{GS} = -4.5V$ | —    | 10    | —    | nC    |
| Q <sub>gs</sub>     | Gate-to-Source charge                |                                                    | —    | 0.77  | —    |       |
| Q <sub>gd</sub>     | Gate-to-Drain("Miller") charge       |                                                    | —    | 3.5   | —    |       |
| t <sub>d(on)</sub>  | Turn-on delay time                   | $V_{GS}=-4.5V, V_{DS}=-10V,$<br>$R_{GEN}=3\Omega,$ | —    | 10    | —    | ns    |
| t <sub>r</sub>      | Rise time                            |                                                    | —    | 8.6   | —    |       |
| t <sub>d(off)</sub> | Turn-Off delay time                  |                                                    | —    | 29    | —    |       |
| t <sub>f</sub>      | Fall time                            |                                                    | —    | 13    | —    |       |
| C <sub>iss</sub>    | Input capacitance                    | $V_{GS} = 0V, V_{DS}=-10V, f = 1\text{MHz}$        | —    | 886.6 | —    | pF    |
| C <sub>oss</sub>    | Output capacitance                   |                                                    | —    | 140.6 | —    |       |
| C <sub>rss</sub>    | Reverse transfer capacitance         |                                                    | —    | 129.2 | —    |       |

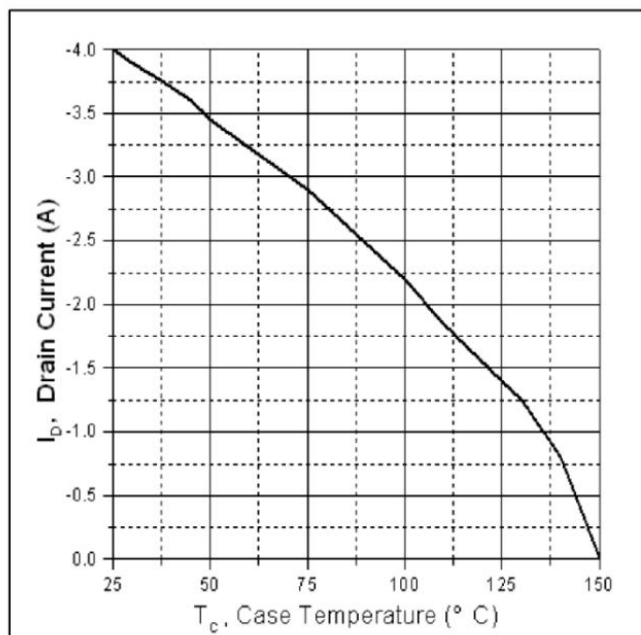
**Notes:**

- ① Calculated continuous current based on maximum allowable junction temperature.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ The power dissipation PD is based on max. junction temperature, using junction-to-case thermal resistance.
- ④ The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in 2 FR 4 board with 2oz. Copper, in a still air environment with  $T_A = 25^{\circ}\text{C}$

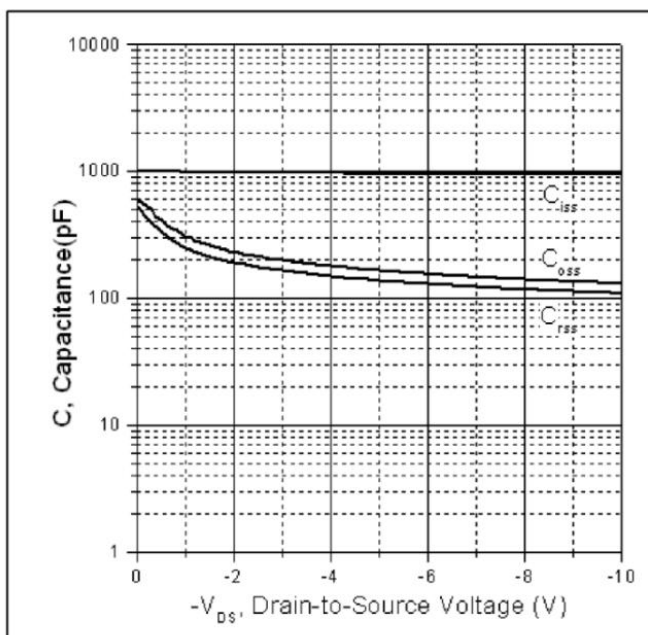
**-20V P-Channel Enhancement Mode MOSFET****Test circuits and Waveforms****EAS test circuit:****Gate charge test circuit:****Switching time test circuit:****Switch Waveforms:**



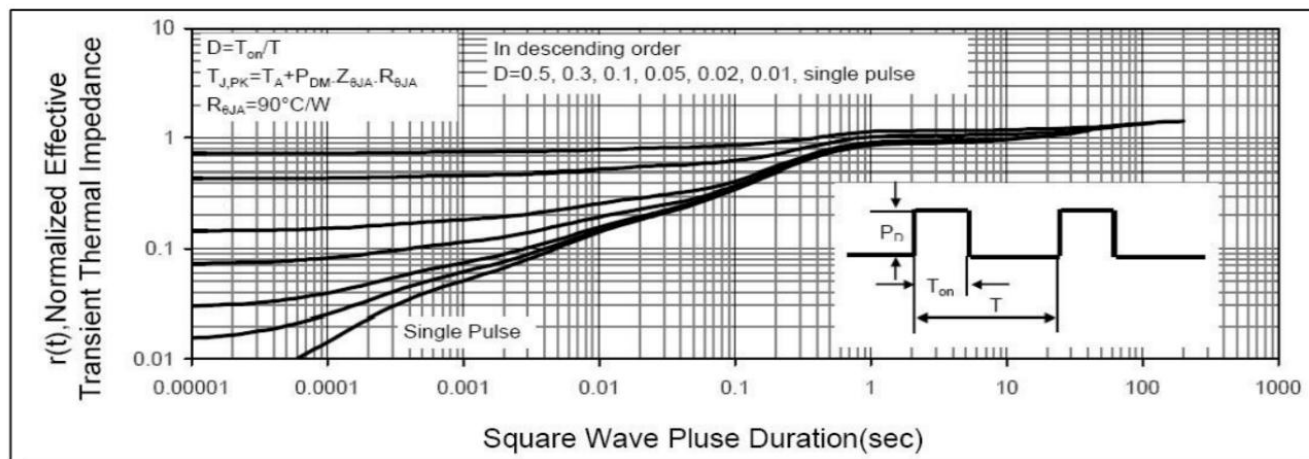
**-20V P-Channel Enhancement Mode MOSFET**
**Typical electrical and thermal characteristics**

**Figure 1: Typical Output Characteristics**

**Figure 2: Gate to source cut-off voltage**

**Figure 3: Drain-to-Source Breakdown Voltage Vs.**
**Case Temperature**

**Figure 4: Normalized On-Resistance Vs. Case**
**Temperature**

**-20V P-Channel Enhancement Mode MOSFET**
**Typical electrical and thermal characteristics**


**Figure 5. Maximum Drain Current Vs. Case Temperature**



**Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage**

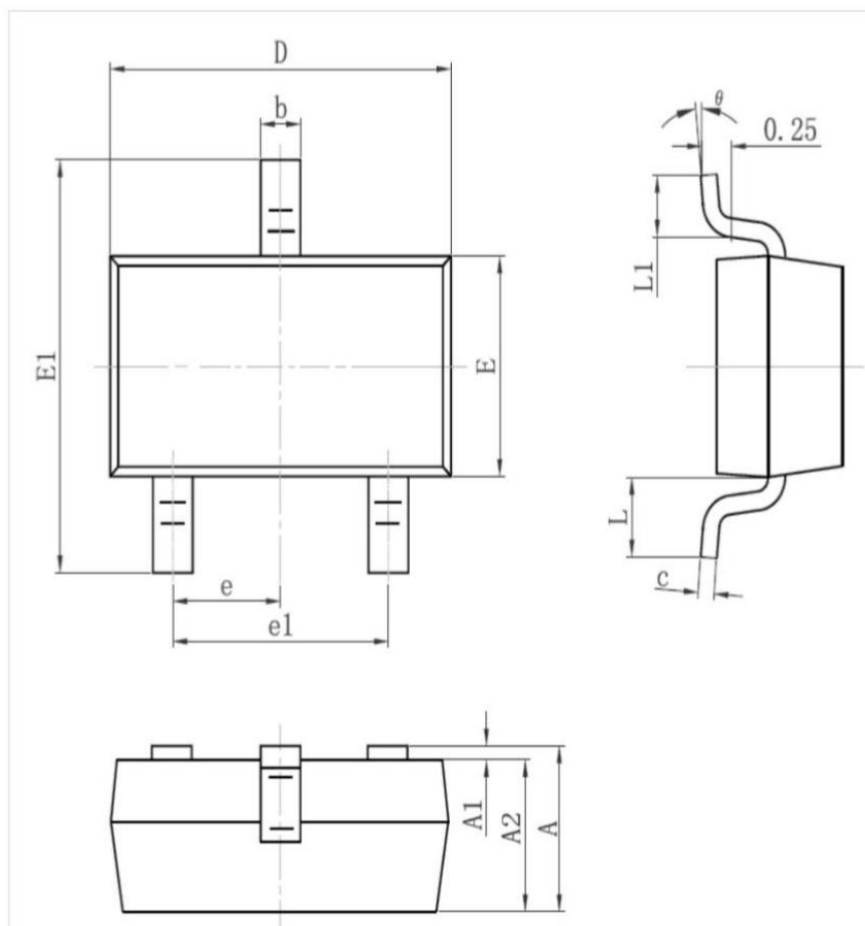


**Figure7. Maximum Effective Transient Thermal Impedance Junction-to-Case**

## -20V P-Channel Enhancement Mode MOSFET

**Mechanical Data**

SOT-23 PACKAGE OUTLINE DIMENSION



| Symbol | Dimension In Millimeters |       | Dimension 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      | 0.95TYP                  |       | 0.037TYP            |       |
| e1     | 1.800                    | 2.000 | 0.071               | 0.079 |
| L      | 0.55REF                  |       | 0.022REF            |       |
| L1     | 0.300                    | 0.500 | 0.012               | 0.020 |
| θ      | 0°                       | 8°    | 0°                  | 8°    |



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