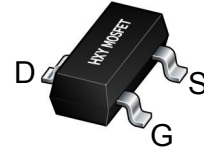




### Description

The IRLML6401 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other Switching application.



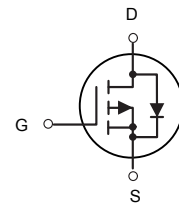
**SOT-23**

### General Features

$V_{DS} = -20V, I_D = -5A$   
 $R_{DS(ON)} < 45m\Omega @ V_{GS}=4.5V$

### Application

- High power and current handing capability
- Lead free product is acquired
- Surface mount package
- PWM applications
- Load switch
- Power management



P-Channel MOSFET

### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
IRLML6401	SOT-23	A5SHB	3000PCS

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

Symbol	Parameter	Limit	Unit
$V_{DS}$	Drain-Source Voltage	-20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Drain Current-Continuous	-5	A
$I_{DM}$	Drain Current-Pulsed (Note 1)	-14	A
$P_D$	Maximum Power Dissipation	1.31	W
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 2)	120	$^\circ C/W$



**Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-20	---	---	V
ΔBV <sub>DSS</sub> /ΔT	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	---	-0.014	---	V/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4.9A	---	35	45	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-3.4A	---	45	60	
		V <sub>GS</sub> =-1.8V, I <sub>D</sub> =-2A	---	65	85	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-0.4	---	-1.0	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	3.95	---	mV/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-16V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	-1	uA
		V <sub>DS</sub> =-16V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	---	---	-5	
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V	---	---	±100	nA
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-3A	---	12.8	---	S
Q <sub>g</sub>	Total Gate Charge (-4.5V)	V <sub>DS</sub> =-15V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A	---	10.2	14.3	nC
Q <sub>gs</sub>	Gate-Source Charge		---	1.89	2.6	
Q <sub>gd</sub>	Gate-Drain Charge		---	3.1	4.3	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =-10V, V <sub>GS</sub> =-4.5V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =-3A	---	5.6	11.2	ns
T <sub>r</sub>	Rise Time		---	40.8	73	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	33.6	67	
T <sub>f</sub>	Fall Time		---	18	36	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz	---	857	1200	pF
C <sub>oss</sub>	Output Capacitance		---	114	160	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	108	151	

**Diode Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current <sup>1,4</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-4.9	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,4</sup>		---	---	-14	A
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =-3A, di/dt=100A/μs, T <sub>J</sub> =25°C	---	21.8	---	nS
Q <sub>rr</sub>	Reverse Recovery Charge		---	6.9	---	nC

Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2.The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
- 3.The power dissipation is limited by 150°C junction temperature
- 4.The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.



### Typical Characteristics

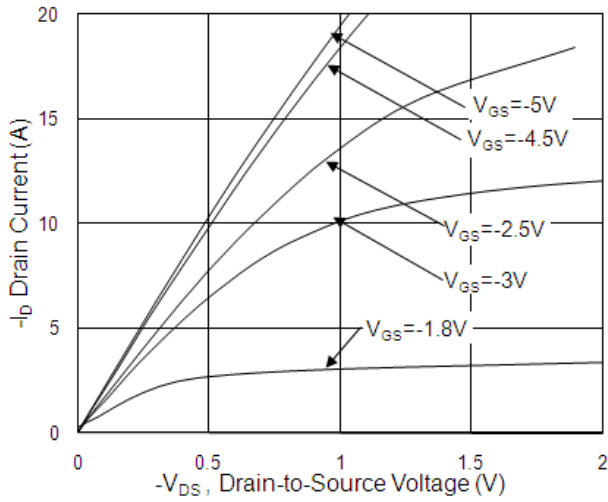


Fig.1 Typical Output Characteristics

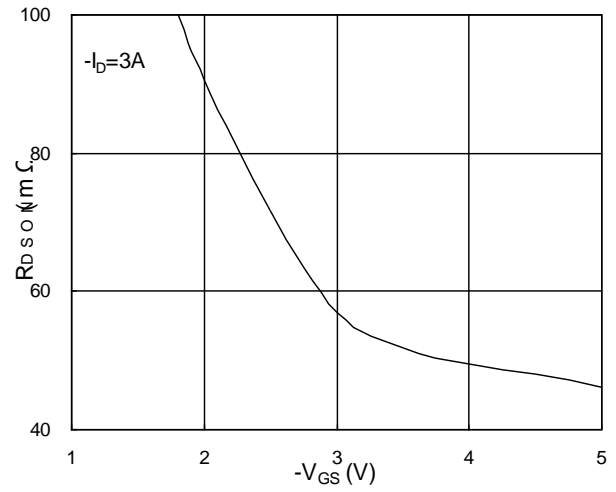


Fig.2 On-Resistance vs. G-S Voltage

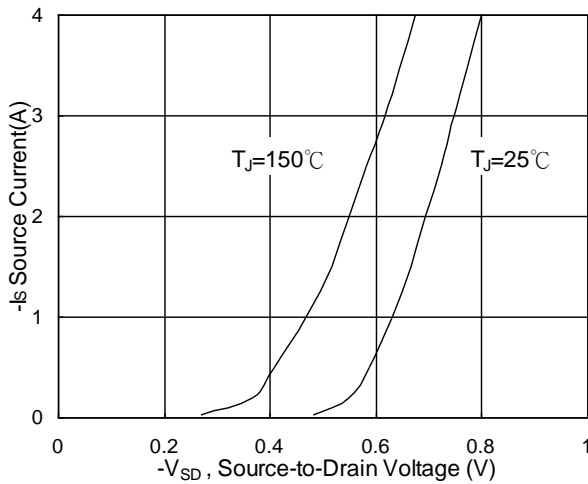


Fig.3 Forward Characteristics of Reverse

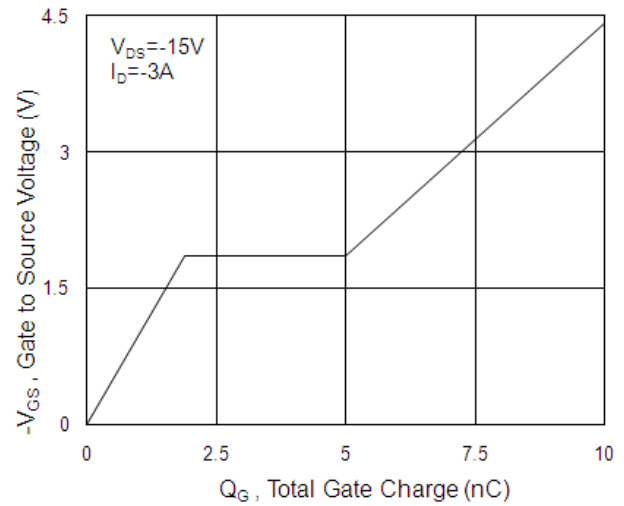


Fig.4 Gate-charge Characteristics

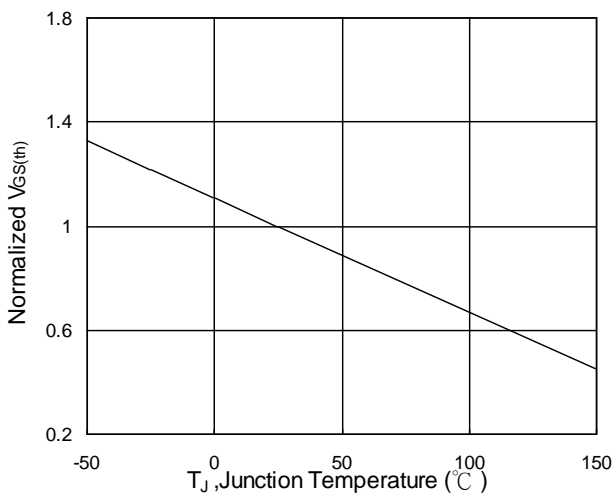


Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$

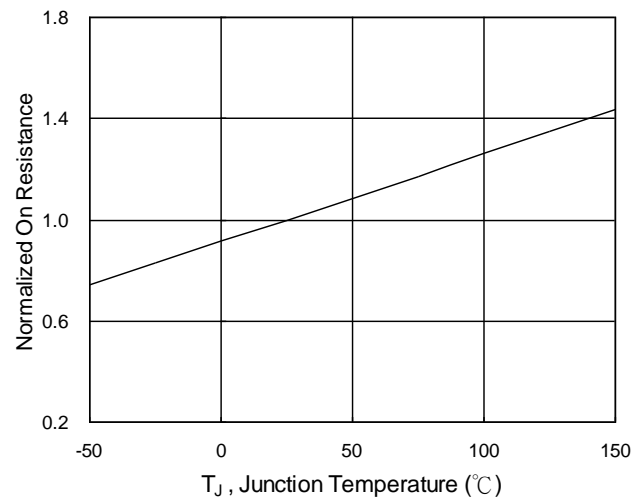


Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$

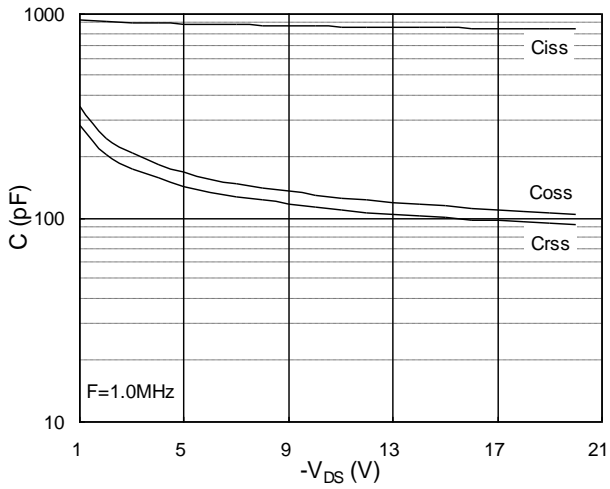


Fig.7 Capacitance

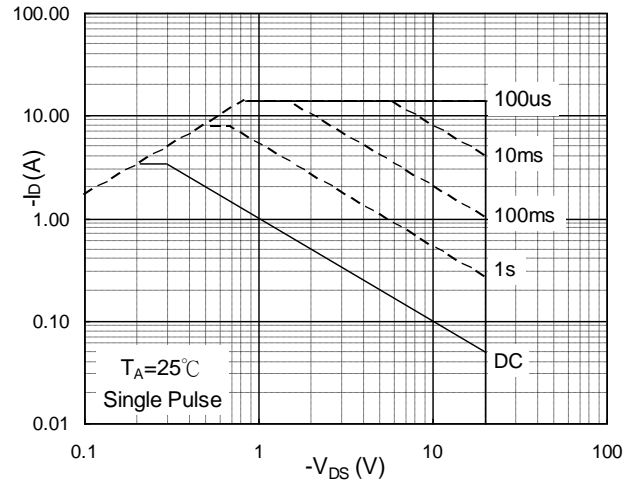


Fig.8 Safe Operating Area

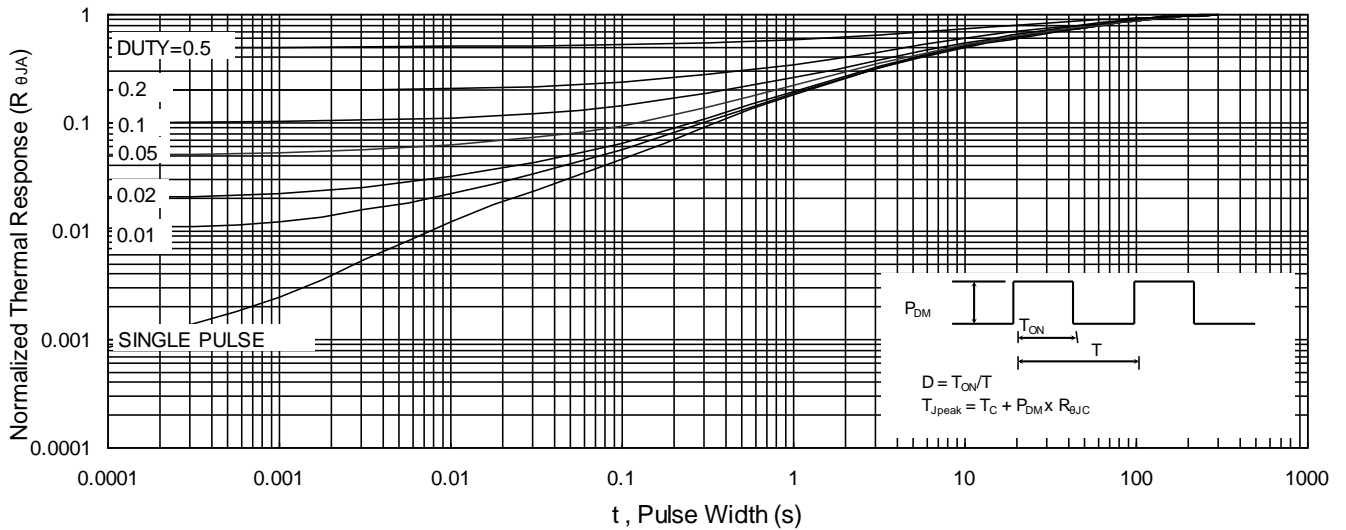


Fig.9 Normalized Maximum Transient Thermal Impedance

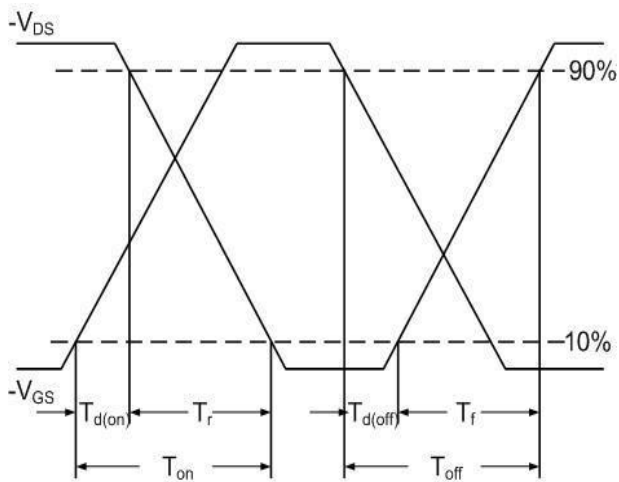


Fig.10 Switching Time Waveform

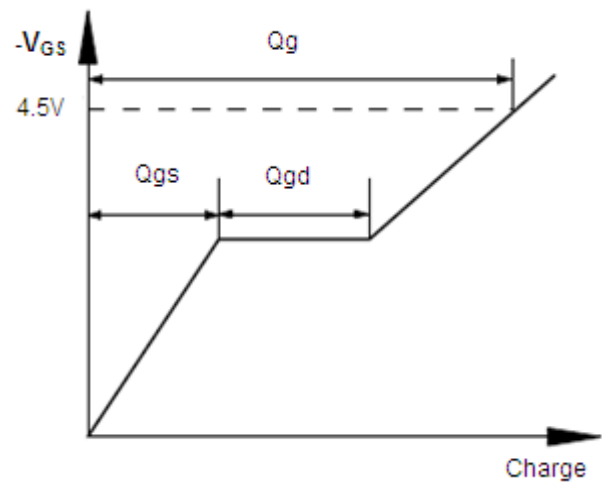
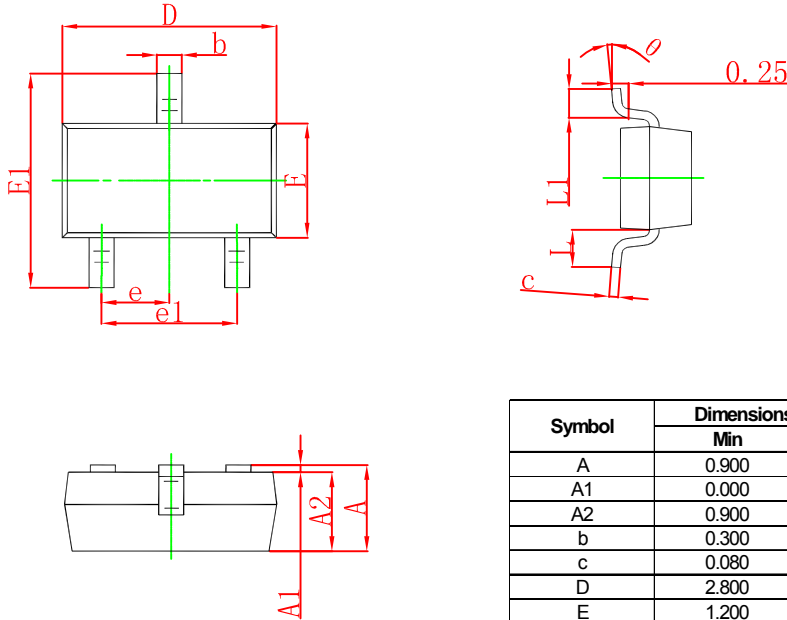


Fig.11 Gate Charge Waveform

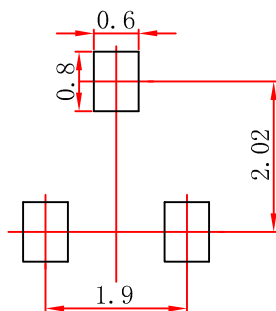


### SOT-23 Package Outline Dimensions



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:  $\pm 0.05$ mm.
  3. The pad layout is for reference purposes only.



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