

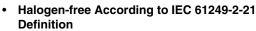
# LML2402-VB Datasheet

# N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY						
V <sub>DS</sub> (V)	$R_{DS(on)}\left(\Omega\right)$	$R_{DS(on)}(\Omega)$ $I_{D}(A)^{e}$				
	0.028 at V <sub>GS</sub> = 4.5 V	6 <sup>a</sup>				
20	0.042 at V <sub>GS</sub> = 2.5 V	6 <sup>a</sup>	8.8 nC			
	0.050 at V <sub>GS</sub> = 1.8 V	5.6				

# DefinitiTrenchf100 % FComplia

**FEATURES** 





- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC



#### **APPLICATIONS**

- DC/DC Converters
- Load Switch for Portable Applications

	SOT-23		
G 1 S 2		3	D
	Top View		

<b>ABSOLUTE MAXIMUM RATIN</b>	IGS T <sub>A</sub> = 25 °C,	unless othe	rwise noted		
Parameter	Symbol	Limit	Unit		
Drain-Source Voltage		$V_{DS}$	20	V	
Gate-Source Voltage		$V_{GS}$	± 12		
	T <sub>C</sub> = 25 °C		6 <sup>a</sup>		
Continuous Proin Current (T = 150 °C)	T <sub>C</sub> = 70 °C	] [	5.1		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>A</sub> = 25 °C	- I <sub>D</sub>	5 <sup>b, c</sup>		
	T <sub>A</sub> = 70 °C		4 <sup>b, c</sup>	A	
Pulsed Drain Current		I <sub>DM</sub>	20		
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	1	1.75		
Continuous Source-Diam Diode Current	T <sub>A</sub> = 25 °C	l <sub>S</sub>	1.04 <sup>b, c</sup>		
	T <sub>C</sub> = 25 °C		2.1		
Maximum Power Dissipation	T <sub>C</sub> = 70 °C	1 5	1.3	w	
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	P <sub>D</sub>	1.25 <sup>b, c</sup>	VV	
	T <sub>A</sub> = 70 °C	] [	0.8 <sup>b, c</sup>		
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C	
Soldering Recommendations (Peak Tempera	,	260			

THERMAL RESISTANCE RATINGS							
Parameter		Symbol	Typical	Maximum	Unit		
Maximum Junction-to-Ambient <sup>b, d</sup> $t \le 5 s$		R <sub>thJA</sub>	80	100	°C/W		
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	40	60	- C/VV		

#### Notes:

- a. Package limited
- b. Surface Mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 125  $^{\circ}\text{C/W}.$
- e. Based on  $T_C$  = 25 °C.

服务热线:400-655-8788

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Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit	
Static			l				
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	20			V	
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	I <sub>D</sub> = 250 μA		25		mV/°C	
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = 250 μA		- 2.6			
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}$ , $I_{D} = 250 \mu A$	0.45		1.0	V	
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 8 \text{ V}$			± 100	nA	
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V			1	_	
Zero Gate Voltage Drain Current	IDSS	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 70 °C			10	μΑ	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \le 5 \text{ V}, V_{GS} = 4.5 \text{ V}$	20			Α	
	, ,	$V_{GS} = 4.5 \text{ V}, I_D = 5.0 \text{ A}$		0.028			
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	$V_{GS} = 2.5 \text{ V}, I_D = 4.7 \text{ A}$		0.042		Ω	
	\ \ \ \ \	$V_{GS} = 1.8 \text{ V}, I_D = 4.3 \text{ A}$		0.050		_	
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 5.0 A		24		S	
Dynamic <sup>b</sup>	1			L		<u>,L</u>	
Input Capacitance	C <sub>iss</sub>			865			
Output Capacitance	C <sub>oss</sub>	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		105		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	De la de		55			
· ·		V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 5.0 A		12	18	+	
Total Gate Charge	Qg	103 10 1, 103 0 1, 1 <sub>0</sub> 010 11		8.8	14	nC	
Gate-Source Charge	Q <sub>gs</sub>	$V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 5.0 \text{ A}$		1.1			
Gate-Drain Charge	Q <sub>gd</sub>	23 - 7 d3 - 7 D - 1		0.7			
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.5	2.4	4.8	Ω	
Turn-On Delay Time	t <sub>d(on)</sub>			8	16		
Rise Time	t <sub>r</sub>	$V_{DD}$ = 10 V, $R_L$ = 2.2 $\Omega$		17	26	1	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D\cong$ 4 A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 $\Omega$		31	47	-	
Fall Time	t <sub>f</sub>			8	16	-	
Turn-On Delay Time	t <sub>d(on)</sub>			5	10	ns	
Rise Time	t <sub>r</sub>	$V_{DD}$ = 10 V, $R_L$ = 2.2 $\Omega$		13	20	1	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D\cong 4$ A, $V_{GEN}=5$ V, $R_g=1$ $\Omega$		21	32	-	
Fall Time	t <sub>f</sub>			6	12	-	
Drain-Source Body Diode Characteristic	<u> </u>		<u> </u>	<u> </u>			
Continuous Source-Drain Diode Current	Is	T <sub>C</sub> = 25 °C			1.75		
Pulse Diode Forward Current	I <sub>SM</sub>	-			20	- A	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 4 A, V <sub>GS</sub> = 0 V		0.75	1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>	2 00		12	20	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			5	10	nC	
Reverse Recovery Fall Time	t <sub>a</sub>	$I_F = 4$ A, $dI/dt = 100$ A/ $\mu$ s, $T_J = 25$ °C		7		<u> </u>	
Reverse Recovery Rise Time	t <sub>b</sub>	<del> </del>		5		ns	

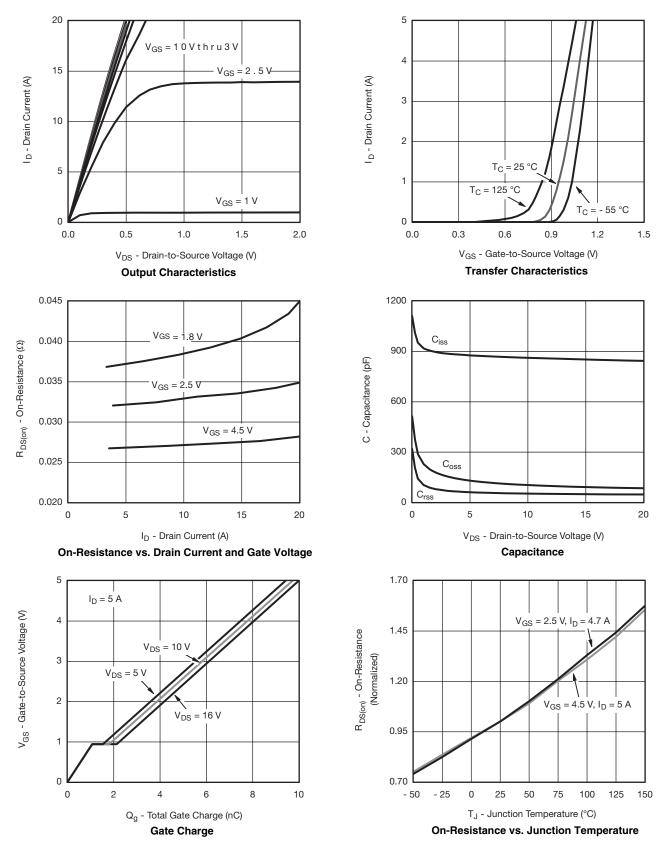
### Notes:

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

a. Pulse test; pulse width  $\leq$  300  $\mu s,$  duty cycle  $\leq$  2 % b. Guaranteed by design, not subject to production testing.



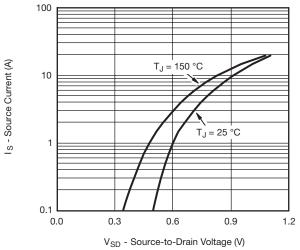
# TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



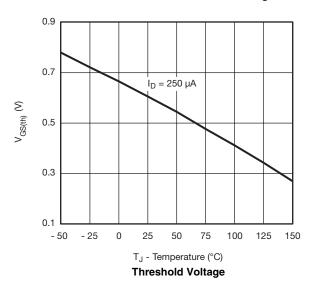
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# TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



#### Source-Drain Diode Forward Voltage



0.06  $I_D = 5 \text{ A}$ 0.05

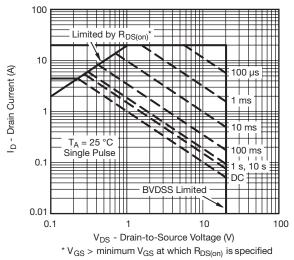
0.04  $T_J = 125 \text{ °C}$ 0.02

0 2 4 6 8  $V_{GS}$  - Gate-to-Source Voltage (V)

On-Resistance vs. Gate-to-Source Voltage



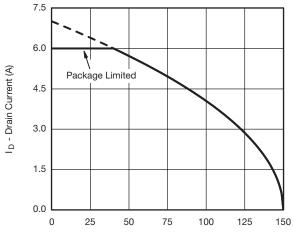
Single Pulse Power (Junction-to-Ambient)



Safe Operating Area, Junction-to-Ambient

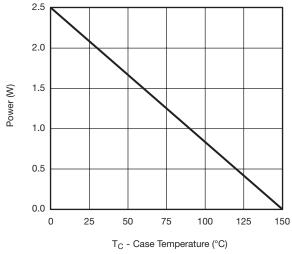


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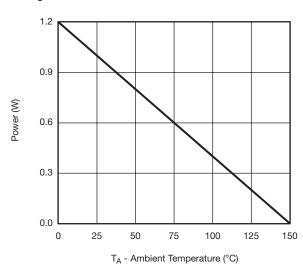


T<sub>C</sub> - Case Temperature (°C)

#### **Current Derating\***







Power Derating, Junction-to-Ambient

<sup>\*</sup> The power dissipation  $P_D$  is based on  $T_{J(max.)}$  = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

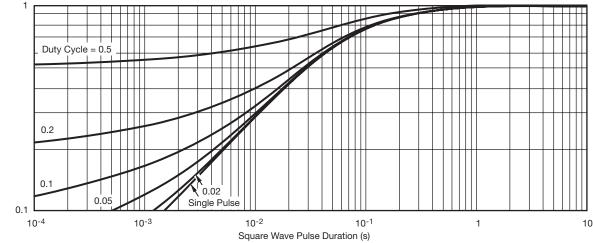
Normalized Effective Transient Thermal Impedance



# TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



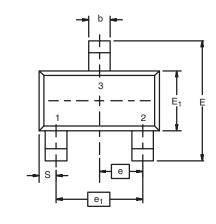
Normalized Thermal Transient Impedance, Junction-to-Ambient

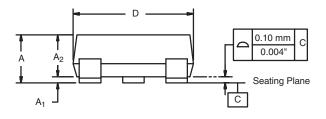


Normalized Thermal Transient Impedance, Junction-to-Foot



# SOT-23 (TO-236): 3-LEAD







Dim	MILLIN	IETERS	INCHES		
	Min	Max	Min	Max	
Α	0.89	1.12	0.035	0.044	
A <sub>1</sub>	0.01	0.10	0.0004	0.004	
A <sub>2</sub>	0.88	1.02	0.0346	0.040	
b	0.35	0.50	0.014	0.020	
С	0.085	0.18	0.003	0.007	
D	2.80	3.04	0.110	0.120	
E	2.10	2.64	0.083	0.104	
E <sub>1</sub>	1.20	1.40	0.047	0.055	
е	0.95	0.95 BSC 0.0374 Ref		4 Ref	
e <sub>1</sub>	1.90 BSC		0.0748 Ref		
L	0.40	0.60	0.016	0.024	
L <sub>1</sub>	0.64 Ref		0.025 Ref		
S	0.50 Ref		0.020 Ref		
q	3°	8°	3°	8°	
ECN: S-03946-Rev. K. 09-	Jul-01				

DWG: 5479



# **RECOMMENDED MINIMUM PADS FOR SOT-23**



Recommended Minimum Pads Dimensions in Inches/(mm)



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