MLX92223LUA-AAA

2-Wire Hall Effect Latch with Resistive Output Characteristic

1. Features and Benefits

- Emulates 392Ω resistor
- Wide operating voltage range: from 3.8V to 16V
- Reverse supply voltage protection
- Advanced thermal management with current limit and thermal protection
- Integrated decoupling capacitor for PCB less designs.

2. Application Examples

- Automotive, Consumer and Industrial
- Seat positioning
- Seat Motor

3. Ordering Information

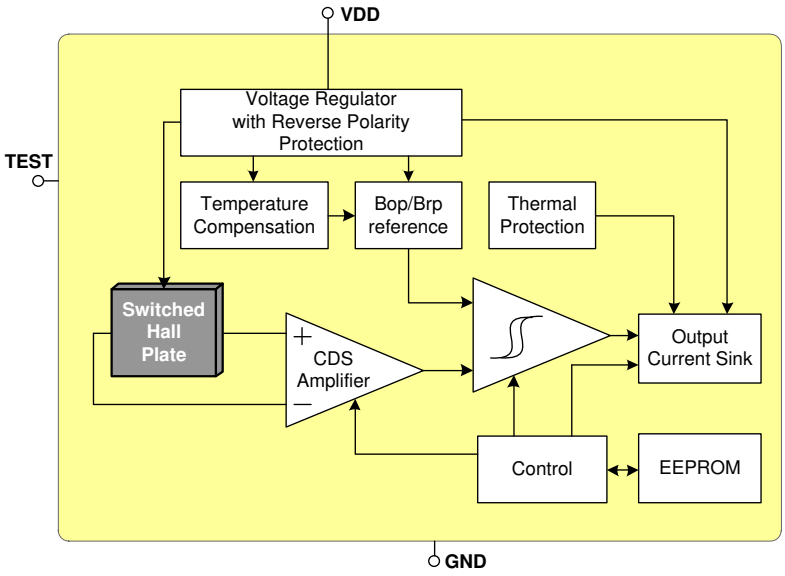
Product Code	Temperature Code	Package Code	Option Code	Packing Form Code
MLX92223	L	UA	AAA-1xx	BU
MLX92223	L	UA	AAA-1xx	RE

Legend:

Temperature Code: L (-40°C to 150°C)
Package Code: UA = TO92-3L
Option Code: AAA-1xx = 2 wire hall effect Latch with integrated capacitor

Packing Form: BU = Bulk | RE = Reel | CA = Ammopack delivery
Ordering example: MLX92223LUA-AAA-1xx-BU

4. Functional Diagram



5. General Description

The Melexis MLX92223 is based on the Melexis Hall-effect switch latest platform, designed in mixed signal submicron CMOS technology.

The device integrates a voltage regulator, Hall sensor, current sink-configured output driver and integrated capacitor all in a single package.

The MLX92223 magnetic core is using an advanced offset cancellation system. In addition, a pre-programmable temperature coefficient is implemented to compensate the natural behavior of certain types of magnets becoming weaker at high temperature.

The included voltage regulator operates from 3.8 to 16V, hence covering a wide range of applications. With the built-in reverse voltage protection, a series diode on the supply line is not required so that even remote sensors can be specified for low voltage operation down to 3.8V while being reverse voltage tolerant.

Advanced thermal management with current limit above V_{DD} = 16.8V is implemented. The on-chip thermal protection switches the supply current below I_{PROT} if the junction temperature increases above the protection threshold T_{PROT}. It will automatically recover once the temperature decreases below T_{REL}.

The MLX92223 is delivered in a Green and RoHS compliant Plastic Single-in-Line (TO-92 flat) for through-hole mount and with integrated capacitor for PCB-less design.

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6. Glossary of Terms

Tesla	Units for the magnetic flux density, 1 mT = 10 Gauss
TC	Temperature Coefficient , ppm/°C
NC	Not Connected
POR	Power on Reset

7. Absolute Maximum Ratings

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

Parameter	Symbol	Conditions	Value	Units
Supply Voltage (1, 2)	V_{DD}		+28	V
Battery Voltage (1, 6)	V_B	1 min, R_S=182Ω±1%, T_A=85°C, B<B_{OP}	+24	V
Battery Voltage (1, 6)	V_B	1 min jump-start, R_S=182Ω±1%, T_A=25°C, B<B_{OP}	+26	V
Battery Voltage (1, 6)	V_B	0.5s load dump, R_S=182Ω±1%, T_A=25°C, B<B_{OP}	+35	V
Reverse Supply Voltage (1, 2)	V_{DDREV}		-24	V
Reverse Supply Voltage (1)	V_{DDREV}	For 500ms	-30	V
Maximum Junction Temperature (3)	T_J		+165	°C
ESD Sensitivity – HBM (4)	-		8	kV
ESD Sensitivity – CDM (5)	-		1000	V
ESD Sensitivity – System ESD (7)			8	kV
Magnetic Flux Density	B		Unlimited	mT

[1] The maximum junction temperature should not be exceeded
[2] For maximum 1 hour
[3] For 1000 hours.
[4] Human Model according AEC-Q100-002 standard
[5] Charged Device Model according AEC-Q100-011 standard
[6] Refer to section "Typical Automotive Application Circuit"
[7] System level ESD, contact discharge VDD-GND (330Ohm, 150pF)

8. General Electrical Specifications

Electrical Operating Parameters, V_{DD} = 3.8V to 16V, T_J = -40°C to 165°C (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ [1]	Max	Units
OFF Supply Current	I_{OFF}		4.5	6	7.5	mA
ON Supply Current	I_{ON}		-	$I_{OFF}+I_R$	-	mA
Proportional Supply Current Part	I_R	V_{DD} = 3.8V to 16V	-10%	$V_{DD}/392\Omega$	+10%	mA
		V_{DD} > 16.8V	36	43		mA
Protection Supply Current	I_{PROT}		-	-	1	mA
Reverse Supply Current	I_{DDREV}	V_{DD} = -16V	-1	-	-	mA
Supply Current Rise Time [2]	$t_{R\ IDD}$	V_B = 12V, $R_S \leq 1\Omega$	0.7	1.7	4	µs
Supply Current Fall Time [2]	$t_{F\ IDD}$	V_B = 12V, $R_S \leq 1\Omega$	0.4	1	2.5	µs
Supply Voltage Rise Time [2]	$t_{R\ VDD}$	V_B = 12V, R_S = 182Ω, C_{bypass} = 68nF	-	27	-	µs
Supply Voltage Fall Time [2]	$t_{F\ VDD}$	V_B = 12V, R_S = 182Ω, C_{bypass} = 68nF	-	19	-	µs
Power-On Time [3, 4]	t_{ON}	V_{DD} = 5V, dV_{DD}/dt > 2V/us, B < B_{OP} - 1mT	-	40	70	µs
Chopping Frequency	f_{CHOP}		-	350	-	kHz
Maximum Switching Frequency [2]	f_{SW}	Triangular magnetic field with $B_{pk-pk} \geq 10x\ B_{OP}$ $B_{OP} = -B_{RP}$ = 1mT	-	50	-	kHz
Integrated bypass capacitor	C_{BP}		-	68	-	nF
Thermal Protection Activation	T_{PROT}		-	190[5]	-	°C
Thermal Protection Release	T_{REL}		-	180[5]	-	°C
UA Package Thermal Resistance	R_{THJA}		-	165	-	°C/W

1 Typical values are defined at T_A = +25°C and V_{DD} = 12V.

2 Guaranteed by design and verified by characterization, not production tested.

3 The Power-On Time represents the time from reaching V_{DD} = 3.8V to the first refresh of the supply current state.

4 Power-On Slew Rate is not critical for the proper device start-up.

5 T_{PROT} and T_{REL} are the corresponding junction temperature values.

9. Magnetic Specifications

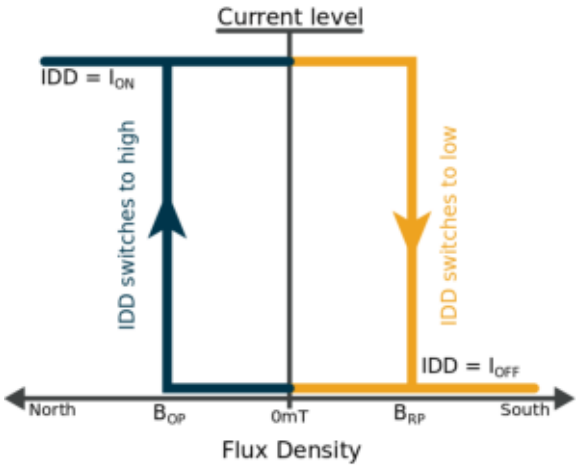
9.1. MLX92223LUA-AAA-100

Magnetic Parameters, V_{DD} = 3.8V to 16V, T_J = -40°C to 165°C (unless otherwise specified)

Test Condition	Operating Point B_{OP} (mT)			Release Point B_{RP} (mT)			TC (ppm/°C)	Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]		
T_J = -40°C	-16	-10	-6	6	10	16	0[2]	Z-axis sensitive North pole	UA (TO92-3)
T_J = 25°C	-14	-10	-7	7	10	14			
T_J = 150°C	-16	-10	-6	6	10	16			

10. Magnetic Behavior

10.1. Latch Sensor



North Active Pole



North active pole

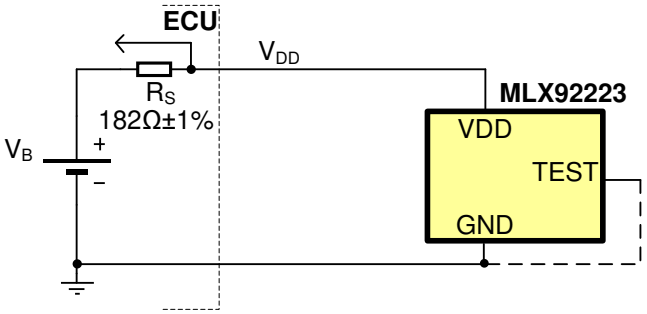
[1] *Typical values are defined at T_A = +25°C and V_{DD} = 12V*

[2] *Temperature coefficient is calculated using the following formula:*

$$TC = \frac{(B_{OPT2} - B_{RPT2}) - (B_{OPT1} - B_{RPT1})}{(B_{OPT1} - B_{RPT1}) \times (T_2 - T_1)} * 10^6, ppm/°C\ ;\ T_1 = 25°C; T_2 = 150°C$$

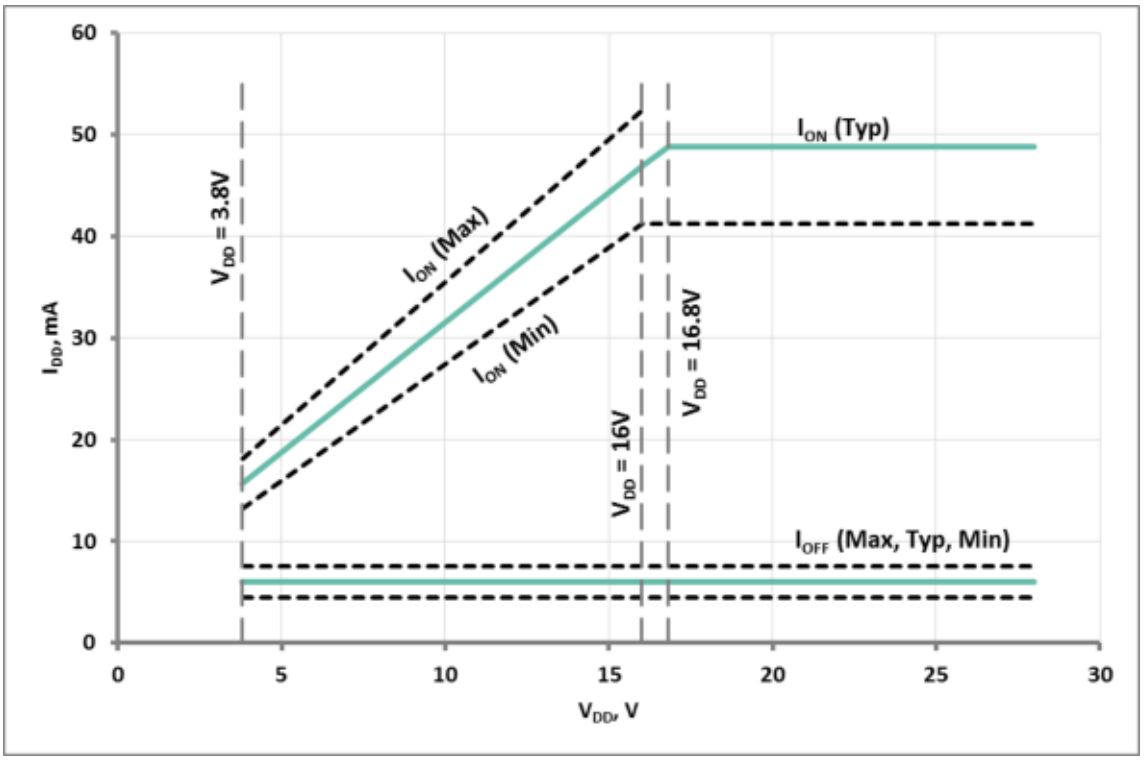
11. Application Information

11.1. Typical Automotive Application Circuit

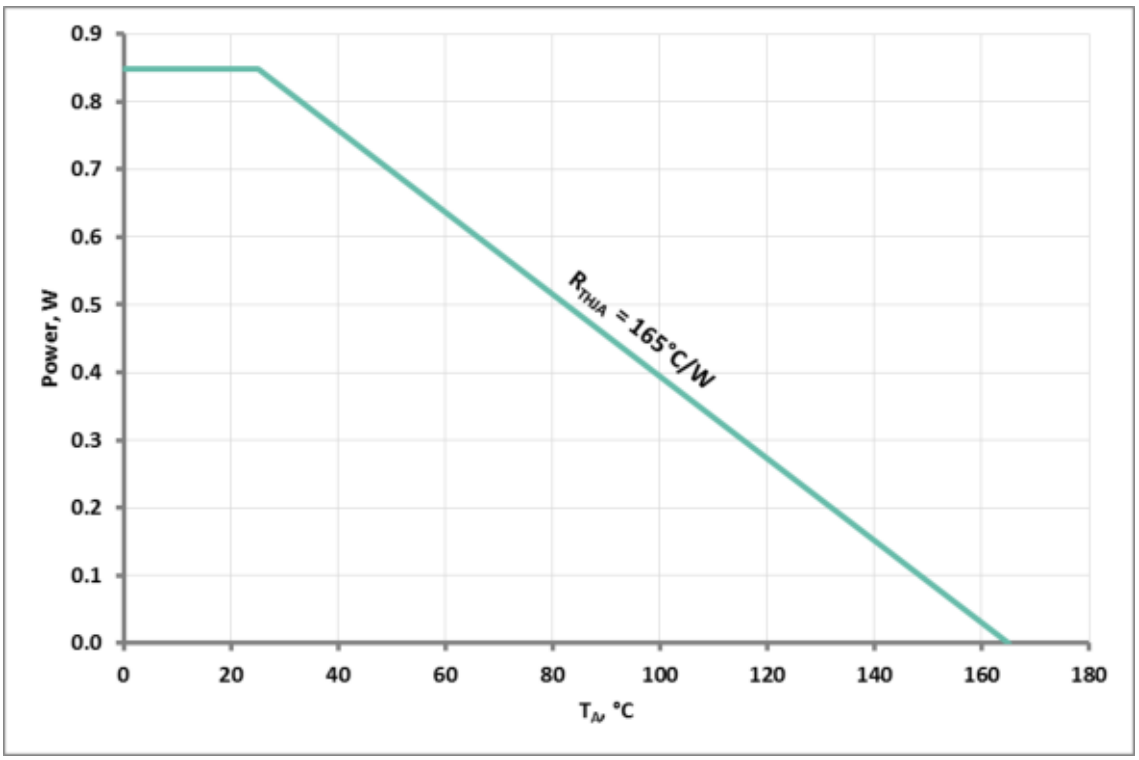


Notes:
1. For proper operation R_S should be equal or higher than 50Ω.
2 The TEST pin is to be connected to GND or left open.

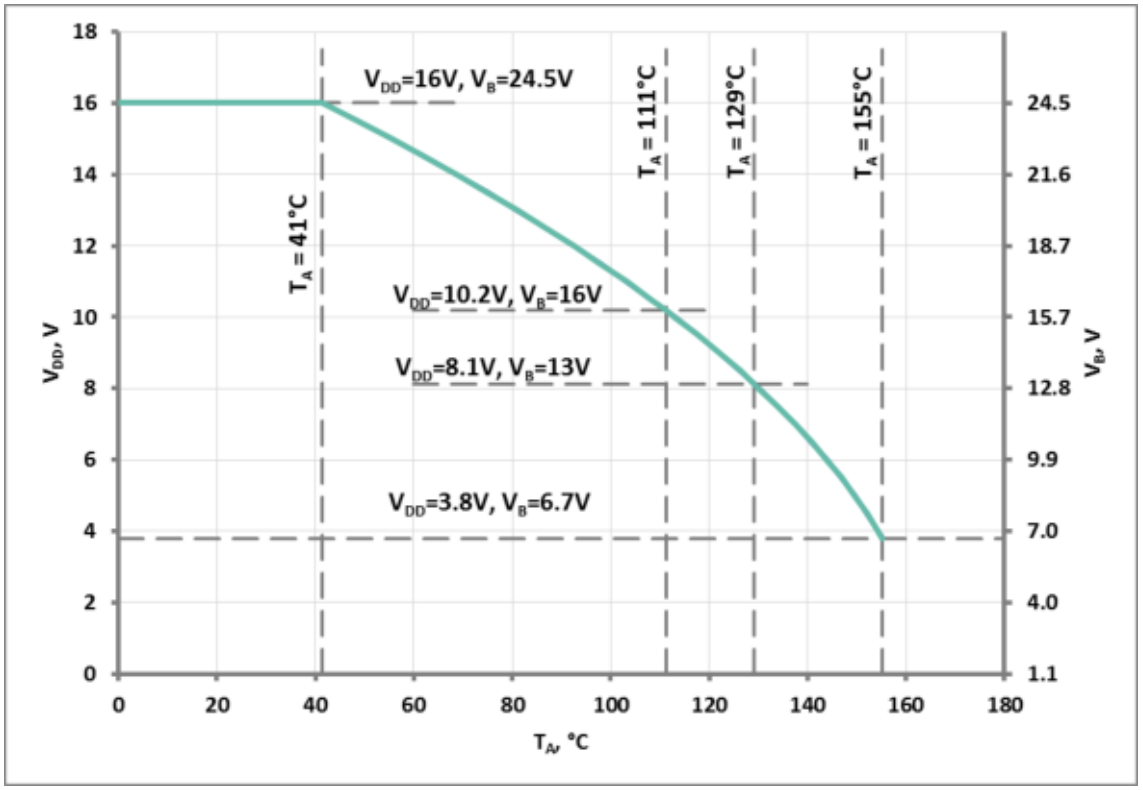
11.2. Supply Current Diagram



11.3. Power Dissipation Derating Curve



11.4. Voltage Derating Curve (valid for R_S=182Ω)



12. Standard information regarding manufacturability of Melexis products with different soldering processes

Our products are classified and qualified regarding soldering technology, solderability and moisture sensitivity level according to following test methods:

Reflow Soldering SMD's (Surface Mount Devices)

- IPC/JEDEC J-STD-020
  Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices (classification reflow profiles according to table 5-2)
- EIA/JEDEC JESD22-A113
  Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing (reflow profiles according to table 2)

Wave Soldering SMD's (Surface Mount Devices) and THD's (Through Hole Devices)

- EN60749-20
  Resistance of plastic- encapsulated SMD's to combined effect of moisture and soldering heat
- EIA/JEDEC JESD22-B106 and EN60749-15
  Resistance to soldering temperature for through-hole mounted devices

Iron Soldering THD's (Through Hole Devices)

- EN60749-15
  Resistance to soldering temperature for through-hole mounted devices

Solderability SMD's (Surface Mount Devices) and THD's (Through Hole Devices)

- EIA/JEDEC JESD22-B102 and EN60749-21
  Solderability

For all soldering technologies deviating from above mentioned standard conditions (regarding peak temperature, temperature gradient, temperature profile etc) additional classification and qualification tests have to be agreed upon with Melexis.

The application of Wave Soldering for SMD's is allowed only after consulting Melexis regarding assurance of adhesive strength between device and board.

Melexis recommends reviewing on our web site the General Guidelines soldering recommendation (http://www.melexis.com/Quality_soldering.aspx) as well as trim&form recommendations (http://www.melexis.com/Assets/Trim-and-form-recommendations-5565.aspx).

Melexis is contributing to global environmental conservation by promoting **lead free** solutions. For more information on qualifications of **RoHS** compliant products (RoHS = European directive on the Restriction Of the use of certain Hazardous Substances) please visit the quality page on our website: http://www.melexis.com/quality.aspx

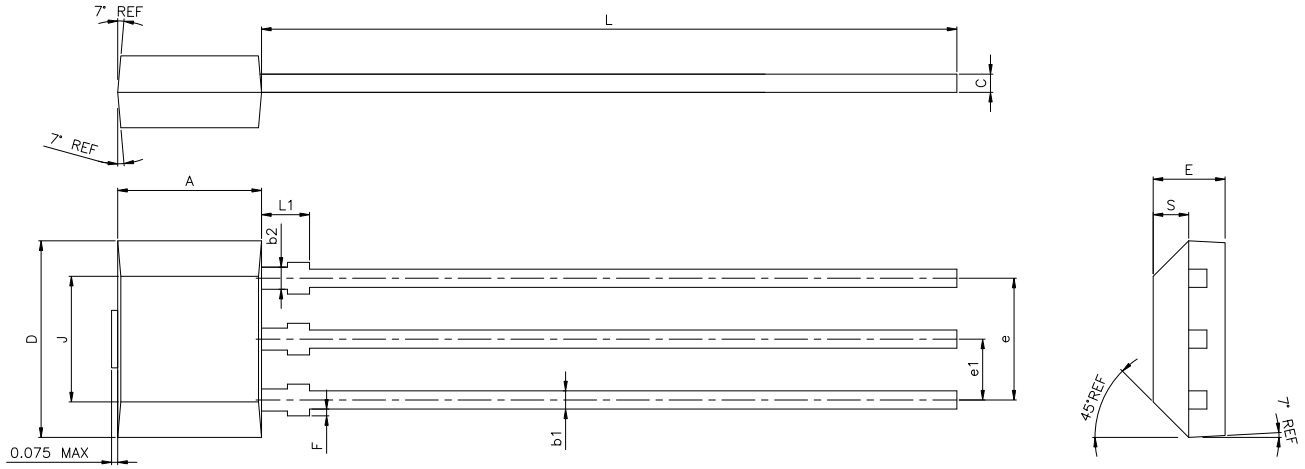
13. ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

14. Package Information

14.1. TO92 - 3L (UA Package) with integrated capacitor

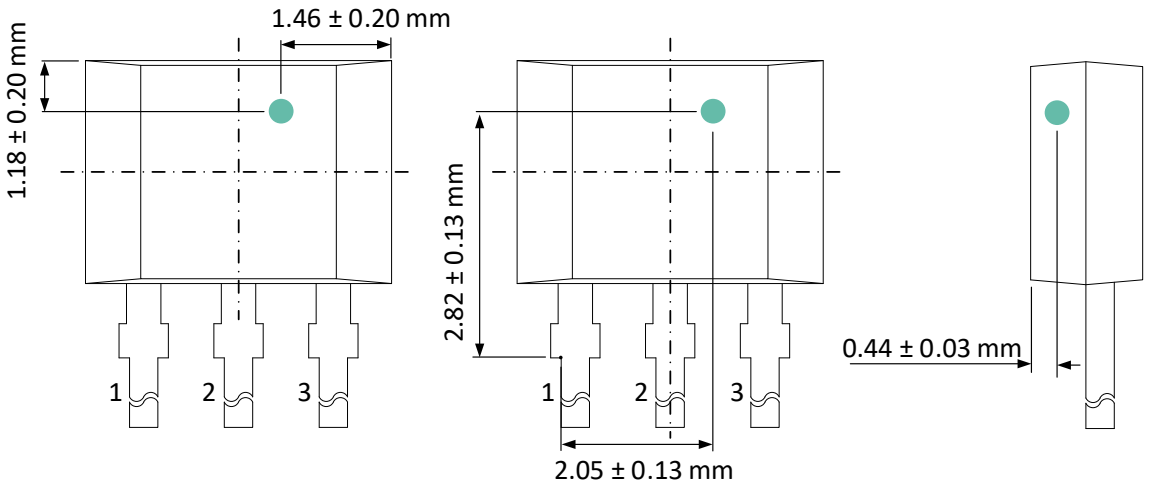
14.1.1. TO92-3L – Package dimensions



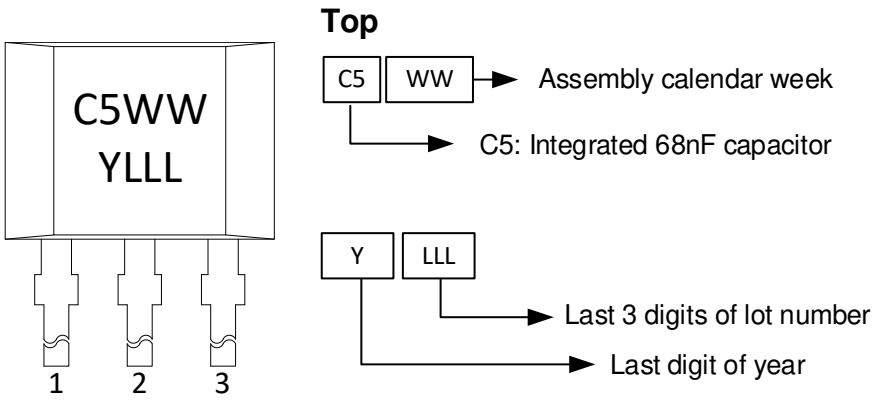
SYMBOL	MINIMUM	MAXIMUM
A	2.90	3.10
D	4.00	4.20
E	1.40	1.60
F	0.00	0.15
J	2.51	2.72
L	14.00	15.00
L1	0.90	1.10
S	0.63	0.84
b1	0.35	0.44
b2	0.43	0.52
c	0.35	0.44
e	2.51	2.57
e1	1.24	1.30

NOTES :
1. DIMENSIONS IN MILLIMETERS (mm) UNLESS NOTED OTHERWISE.
2. PACKAGE DIMENSIONS DO NOT INCLUDE MOLD FLASHES AND PROTRUSIONS.
3. DIMENSION A AND D DO NOT INCLUDE MOLD GATE AND SIDE FLASH (PROTRUSION) of MAXIMUM 0.127 mm PER SIDE.
4. THE LEADS MAY BE SLIGHTLY DEFORMED DURING TRANSPORTATION IF PACKED IN BULK (BAG), AFFECTING e1 DIMENSION. IT IS RECOMMENDED TO ORDER RADIAL TAPE (REEL OR AMMOPACK) IF SUCH DEFORMATION IS CRITICAL FOR THE LEAD FORMING PROCESS, EVEN IF MANUAL LOADING INTO THE TOOL IS FORESEEN.

14.1.2. TO92-3L – Sensitive spot



14.1.3. TO92-3L – Package marking / Pin definition



Pin #	Name	Type	Function
1	VDD	Supply	Supply Voltage pin
2	TEST	I/O	For Melexis use only
3	GND	Ground	Ground pin

15. Contact

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For additional information, please contact our Direct Sales team and get help for your specific needs:

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