1. Features and Benefits

- Wide operating voltage range: from 2.7V to 24V
- Integrated self-diagnostic functions activating dedicated Safe Mode
- Reverse supply voltage protection
- Under-Voltage Lockout protection
- Integrated capacitor for PCB less designs
- HW component Qualified according to ISO26262-8:13 for use in safety critical systems.

2. Application Examples

- Automotive, Consumer and Industrial
- Brake light switch
- Window lifter
- Door lock
- Seatbelt buckle
- Seat positioning
- Transmission applications
- Electrical power steering

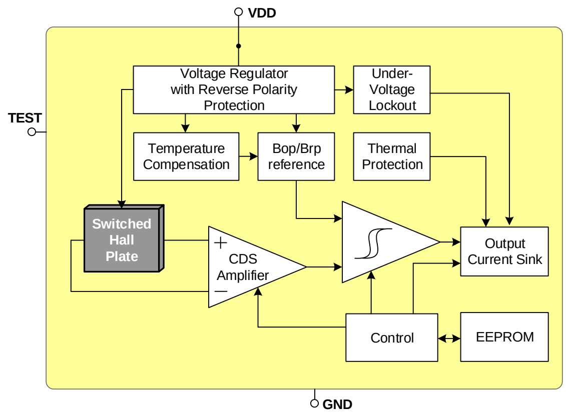
3. Ordering Information

Product Code	Temperature Code	Package Code	Option Code	Packing Form Code
MLX92241	L	UA	BAA-0xx	BU
MLX92241	L	SE	BAA-0xx	RE
MLX92241	L	UA	BAA-1xx	BU
MLX92241	L	SE	BAA-2xx	RE
MLX92241	L	UA	BAA-3xx	BU

Legend:

Temperature Code:	L(-40°C to 150°C)
Package Code:	UA = TO92-3L | SE = TSOT-3L
Option Code:	0xx => Perpendicular sensitive
	1xx => Integrated capacitor (UA package only)
	2xx => IMC (SE package only)
	3xx => Integrated capacitor and IMC (UA package only)
Packing Form:	BU = Bulk | RE = Reel | CA=Papertape in Ammopack | CR=Papertape on Reel
Ordering example:	MLX92241LUA-BAA-1xx-BU

4. Functional Diagram



5. General Description

The Melexis MLX92241 is based on the Melexis Hall-effect latest platform, designed in mixed signal submicron CMOS technology.

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

Based on the proven in use platform, the magnetic core is using an improved offset cancellation system allowing faster and more accurate processing while being temperature insensitive and stress independent. In addition a pre-programmable temperature coefficient is implemented to compensate the natural behavior of certain types of magnets becoming weaker with rise in temperature.

The included voltage regulator operates from 2.7 to 24V, hence covering a wide range of applications. With the built-in reverse voltage protection, a serial resistor or diode on the supply line is not required so that even remote sensors can be specified for low voltage operation down to 2.7V while being reverse voltage tolerant.

In an event of a drop below the minimum supply voltage during operation, the under-voltage lock-out protection will automatically freeze the device, preventing the electrical perturbation to affect the magnetic measurement circuitry. The output current state is therefore only updated based on a proper and accurate magnetic measurement result.

The two-wire interface not only saves one wire, but also allows implementation of diagnostic functions as reverse polarity connection and malfunction detection.

The on-chip thermal protection also switches off the output if the junction temperature increases above an abnormally high threshold. It will automatically recover once the temperature decreases below a safe value.

The MLX92241 is delivered in a Green and RoHS compliant Plastic Single-in-Line (TO-92) for through-hole mount, or PCB-less design with integrated capacitor or in 3-pin Thin Small Outline Transistor (TSOT) for surface mount process.

Contents

6. Glossary of Terms

Tesla	Units for the magnetic flux density, 1 mT = 10 Gauss
TC	Temperature Coefficient in ppm/°C
NC	Not Connected
POR	Power on Reset
IMC	integrated magnetic concentrator (lateral sensing)

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	Value	Units
Supply Voltage [1, 2]	V_{DD}	+28	V
Supply Voltage (Load Dump) [1, 4]	V_{DD}	+32	V
Supply Current [1, 2, 3]	I_{DD}	+20	mA
Supply Current [1, 3, 4]	I_{DD}	+50	mA
Reverse Supply Voltage [1, 2]	V_{DDREV}	-24	V
Reverse Supply Voltage [1, 4]	V_{DDREV}	-30	V
Reverse Supply Current [1, 2, 5]	I_{DDREV}	-20	mA
Reverse Supply Current [1, 4, 5]	I_{DDREV}	-50	mA
Maximum Junction Temperature [6]	T_J	+165	°C
ESD Sensitivity – HBM [7]	-	8	kV
ESD Sensitivity – System level [8]	-	15	kV
ESD Sensitivity – CDM [9]	-	1000	V
Magnetic Flux Density	B	Unlimited	mT

[1] The maximum junction temperature should not be exceeded
[2] For maximum 1 hour
[3] Including current through protection device
[4] For maximum 500ms
[5] Through protection device
[6] For 1000 hours.
[7] Human Model according AEC-Q100-002 standard
[8] Indirect discharge according VW TL82466 standard, typical value, only for option MLX92241LUA-BAA-1xx
[9] Charged Device Model according AEC-Q100-011 standard

8. General Electrical Specifications

DC Operating Parameters V_{DD} = 2.7V to 24V, T_J = -40°C to 165°C (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ[1]	Max	Units
OFF Supply Current (selectable by a dedicated bit)	I_{OFF}	V_{DD} = 3.5 to 24V	2	-	5	mA
			5	-	6.9	
ON Supply Current	I_{ON}	V_{DD} = 3.5 to 24V	12	-	17	mA
Reverse Supply current	I_{DDREV}	V_{DD} = -16V	-1	-	-	mA
Safe Mode Supply Current	I_{SAFE}		-	-	1	mA
Supply Current Rise/Fall Time[2]	t_R/t_F	V_{DD} = 12V, C_{LOAD}=50pF to GND	0.1	0.3	1	µs
Power-On Time[3, 4]	t_{ON}	V_{DD} = 5V, dV_{DD}/dt > 2V/us, activated output with >1mT overdrive	-	40	70	µs
Chopping Frequency	f_{CHOP}		-	350	-	kHz
Delay Time[2, 5]	t_D	Average over 1000 successive switching events @10kHz, Latch, B_{OP} set to 5mT, triangle wave magnetic field with B>±20mT	-	7.5	-	µs
Output Jitter (p-p)[2, 6]	t_{JITTER}	Over 1000 successive switching events @10kHz, Latch, B_{OP} set to 5mT, triangle wave magnetic field with B>±20mT	-	±3.5	-	µs
Maximum Switching Frequency [2, 7]	f_{SW}	Latch, B_{OP} set to 5mT, triangle wave magnetic field with B>±20mT	-	50	-	kHz
Under-voltage Lockout Threshold	V_{UVL}		-	-	2.7	V
Under-voltage Lockout Reaction time [2]	t_{UVL}		-	1	-	µs
Integrated bypass capacitor	C_{BP}	Only for option MLX92241LUA-BAA-1xx	-	68	-	nF
Thermal Protection Activation	T_{PROT}	Junction Temperature	-	190[8]	-	°C
Thermal Protection Release	T_{REL}	Junction Temperature	-	180[8]	-	°C
UA Package Thermal Resistance	R_{THJA}	Single layer PCB, JEDEC standard test boards	-	200	-	°C/W
SE Package Thermal Resistance	R_{THJA}	Single layer PCB, JEDEC standard test boards	-	300	-	°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}=2.7V to the first refresh of the supply current state
4 Power-On Slew Rate is not critical for the proper device start-up
5 The Delay Time is the time from magnetic threshold reached to the start of the output switching
6 Output jitter is the unpredictable deviation of the Delay time.
7 Maximum switching frequency corresponds to the maximum frequency of the applied magnetic field which is detected without loss of pulses
8 T_{PROT} and T_{REL} are the corresponding junction temperature values

9. Magnetic Specifications

9.1. MLX92241LSE-BAA-007

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	13.4	16.0	19.0	12.4	15.0	18.1	-1100(2)	3.3	Z-axis sensitive South pole Direct Switch	SE (TSOT-3L)
T_J = 25°C	13.2	15.0	16.8	12.2	14.0	15.8				
T_J = 150°C	10.1	13.0	16.1	9.0	12.0	15.1				

9.2. MLX92241LSE-BAA-019

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	6.0	9.2	12.0	5.0	7.2	10.5	0(2)	3.3	Z-axis sensitive South pole Inverted Switch	SE (TSOT-3L)
T_J = 25°C	6.0	9.2	12.0	5.0	7.2	10.5				
T_J = 150°C	5.7	9.2	12.5	4.6	7.2	11.0				

9.3. MLX92241LSE-BAA-021

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	6.0	9.2	12.0	5.0	7.2	10.5	0(2)	6	Z-axis sensitive South pole Inverted Switch	SE (TSOT-3L)
T_J = 25°C	6.0	9.2	12.0	5.0	7.2	10.5				
T_J = 150°C	5.7	9.2	12.5	4.6	7.2	11.0				

9.4. MLX92241LSE-BAA-023

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ (1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	-10.9	-8.5	-5.9	-7.9	-5.5	-3.5	-1100(2)	6	Z-axis sensitive North pole Direct Switch	SE (TSOT-3L)
T_J = 25°C	-9.5	-7.9	-6.1	-7.0	-5.3	-3.9				
T_J = 150°C	-9.6	-6.8	-3.8	-8.2	-5.0	-2.7				

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

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

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^oC; T_1 = 25^oC; T_2 = 150^oC$$

[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.5. MLX92241LSE-BAA-024

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	6.8	8.7	10.7	5.3	7.3	9.4	0[2]	6	Z-axis sensitive South pole Inverted Switch	SE (TSOT-3L)
T_J = 25°C	7.2	8.7	10.3	5.7	7.3	9.0				
TJ = 150°C	6.8	8.7	10.7	5.3	7.3	9.4				

9.6. MLX92241LSE-BAA-025

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	-9.0	-6.4	-4.0	-6.5	-4.3	-2.0	-1100[2]	6	Z-axis sensitive North pole Direct Switch	SE (TSOT-3L)
T_J = 25°C	-8.0	-6.0	-4.0	-6.0	-4.0	-2.0				
T_J = 150°C	-7.5	-5.2	-3.0	-5.6	-3.5	-1.5				

9.7. MLX92241LSE-BAA-027

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	9.0	11.5	14.5	2.8	4.6	6.4	-2000[2]	3.3	Z-axis sensitive South pole Direct Switch	SE (TSOT-3L)
T_J = 25°C	8.0	10.0	12.3	2.5	4.0	5.6				
T_J = 150°C	5.5	7.5	9.7	1.4	3.0	4.6				

9.8. MLX92241LSE-BAA-029

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	7.9	10.1	12.4	5.8	8.1	10.5	-1100[2]	6	Z-axis sensitive South pole Direct Switch	SE (TSOT-3L)
T_J = 25°C	7.5	9.2	11.0	5.4	7.2	9.1				
T_J = 150°C	6.0	7.9	10.0	3.9	5.9	8.1				

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

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

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^oC; T_1 = 25^oC; T_2 = 150^oC$$

[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.9. MLX92241LSE-BAA-032

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	3.6	6.0	8.4	1.5	3.6	6.1	-1100[2]	3.3	Z-axis sensitive South pole Direct Switch	SE (TSOT-3L)
T_J = 25°C	3.9	5.6	7.1	2.0	3.6	5.3				
T_J = 150°C	2.0	4.8	7.1	1.3	3.5	6.7				

9.10. MLX92241LUA-BAA-033

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	17.5	21.4	25.9	15.4	19.4	24.0	-1100[2]	6	Z-axis sensitive South pole Direct Switch	UA (T092-3L)
T_J = 25°C	17.1	20.0	23.1	15.0	18.0	21.2				
T_J = 150°C	13.8	17.3	21.1	11.7	15.3	19.2				

9.11. MLX92241LSE-BAA-034

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	3.6	6.0	8.4	1.5	3.9	6.1	-1100[2]	6	Z-axis sensitive South pole Inverted Switch	SE (TSOT-3L)
T_J = 25°C	3.9	5.5	7.1	2.0	3.5	5.3				
T_J = 150°C	2.0	4.8	7.1	1.3	3.0	6.7				

9.12. MLX92241LSE-BAA-035

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	22.2	26.8	31.7	21.0	25.8	30.9	-1100[2]	6	Z-axis sensitive South pole Direct switch	SE (TSOT-3L)
T_J = 25°C	21.8	25.0	28.5	20.6	24.0	27.7				
T_J = 150°C	17.7	21.6	25.9	16.5	20.6	25.1				

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

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

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^oC; T_1 = 25^oC; T_2 = 150^oC$$

[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.13. MLX92241LSE-BAA-036

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	6.8	8.7	10.7	5.3	7.3	9.4	0[2]	6	Z-axis sensitive South pole Direct switch	SE (TSOT-3L)
T_J = 25°C	7.2	8.7	10.3	5.7	7.3	9.0				
T_J = 150°C	6.8	8.7	10.7	5.3	7.3	9.4				

9.14. MLX92241LSE-BAA-038

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	6.8	8.7	10.7	5.3	7.3	9.4	0[2]	3.3	Z-axis sensitive South pole Inverted switch	SE (TSOT-3L)
T_J = 25°C	7.2	8.7	10.3	5.7	7.3	9.0				
T_J = 150°C	6.8	8.7	10.7	5.3	7.3	9.4				

9.15. MLX92241LUA-BAA-101

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	12.0	17.0	22.8	11.4	15.4	21.4	0[2]	6	Z-axis sensitive South pole Inverted Switch	UA (T092-3L)
T_J = 25°C	14.5	17.0	19.5	13.0	15.4	17.8				
T_J = 150°C	12.0	17.0	22.8	11.4	15.4	21.4				

9.16. MLX92241LUA-BAA-103

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	4.4	6.4	8.7	2.2	4.3	6.3	-1100[2]	3.3	Z-axis sensitive South pole Inverted Switch	UA (T092-3L)
T_J = 25°C	4.4	6.0	7.6	2.3	4.0	5.5				
T_J = 150°C	3.1	5.2	7.5	1.6	3.5	5.6				

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

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

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^oC; T_1 = 25^oC; T_2 = 150^oC$$

[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.17. MLX92241LUA-BAA-104

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	6.7	8.5	10.5	5.6	7.5	9.6	-700(2)	6	Z-axis sensitive South pole Inverted Switch	UA (T092-3L)
T_J = 25°C	6.6	8.0	9.5	5.5	7.0	8.6				
T_J = 150°C	5.6	7.3	9.1	4.5	6.3	8.2				

9.18. MLX92241LUA-BAA-106

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	2.0	4.0	6.0	1.0	2.7	5.5	0(2)	6	Z-axis sensitive South pole Direct Switch	UA (T092-3L)
T_J = 25°C	2.0	4.0	6.0	1.0	2.7	5.5				
T_J = 150°C	2.0	4.0	6.0	1.0	2.7	5.5				

9.19. MLX92241LUA-BAA-107

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	2.7	4.3	5.9	1.7	3.3	5.0	-1100(2)	6	Z-axis sensitive South pole Inverted Switch	UA (T092-3L)
T_J = 25°C	2.8	4.0	5.2	1.8	3.0	4.2				
T_J = 150°C	1.9	3.5	5.3	0.8	2.5	4.3				

9.20. MLX92241LUA-BAA-108

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	5.8	8.5	10.9	3.5	5.6	8.0	-1100(2)	3.3	Z-axis sensitive South pole Direct Switch	UA (T092-3L)
T_J = 25°C	5.8	7.9	9.5	3.6	5.2	7.0				
T_J = 150°C	3.6	6.6	9.6	2.1	4.4	8.2				

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

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

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^oC; T_1 = 25^oC; T_2 = 150^oC$$

3 *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.21. MLX92241LUA-BAA-110

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (1)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	5.9	8.5	10.9	3.5	5.5	7.9				
T_J = 25°C	6.1	7.9	9.5	3.9	5.3	7.0	-1100(2)	6	Z-axis sensitive South pole Direct Switch	UA (T092-3L)
T_J = 150°C	3.8	6.8	9.6	2.7	5.0	8.2				

9.22. MLX92241LUA-BAA-111

DC Operating Parameters V_{DD} = 6V to 10V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	2.4	3.9	5.5	1.4	2.7	4.1				
T_J = 25°C	2.5	3.8	5.1	1.5	2.6	3.7	0(2)	6	Z-axis sensitive South pole Direct Switch	UA (T092-3L)
T_J = 150°C	2.0	3.8	5.7	1.0	2.6	4.3				

9.23. MLX92241LUA-BAA-112

DC Operating Parameters V_{DD} = 6V to 10V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(1)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	-5.5	-3.9	-2.4	-4.1	-2.7	-1.4				
T_J = 25°C	-5.1	-3.8	-2.5	-3.7	-2.6	-1.5	0(2)	6	Z-axis sensitive North pole Inverted Switch	UA (T092-3L)
T_J = 150°C	-5.7	-3.8	-2.0	-4.3	-2.6	-1.0				

9.24. MLX92241LUA-BAA-113

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) (3)			Release Point B_{RP} (mT) (3)			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ(2)	Max	Min	Typ(1)	Max	Typ(1)			
T_J = -40°C	5.9	8.5	10.9	3.5	5.5	7.9				
T_J = 25°C	6.1	7.9	9.5	3.9	5.3	7.0	-1100(3)	3.3	Z-axis sensitive South pole Inverted Switch	UA (T092-3L)
T_J = 150°C	3.8	6.8	9.6	2.7	5.0	8.2				

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

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

$$\frac{B_{OPT2}-B_{OPT1}}{B_{OP25^oC}\times\left(T_2-T_1\right)}*10^6, ppm/^oC; T_1=25^oC; T_2=150^oC$$

[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.25. MLX92241LUA-BAA-114

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [1]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	5.9	8.5	10.9	3.5	5.5	7.9	-1100[2]	6	Z-axis sensitive South pole Inverted Switch	UA (T092-3L)
T_J = 25°C	6.1	7.9	9.5	3.9	5.3	7.0				
T_J = 150°C	3.8	6.8	9.6	2.7	5.0	8.2				

9.26. MLX92241LUA-BAA-117

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[2]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	22.2	26.8	31.7	21.0	25.8	30.9	-1100[3]	6	Z-axis sensitive South pole Direct switch	UA (T092-3L)
T_J = 25°C	21.8	25.0	28.5	20.6	24.0	27.7				
T_J = 150°C	17.7	21.6	25.9	16.5	20.6	25.1				

9.27. MLX92241LUA-BAA-118

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [4]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	15.8	19.2	22.6	13.7	17.2	20.7	-1100[2]	3.3	Z-axis sensitive South pole Inverted switch	UA (T092-3L)
T_J = 25°C	15.1	17.5	20.0	13.0	15.5	18.1				
T_J = 150°C	12.2	15.1	18.3	10.1	13.1	16.4				

9.28. MLX92241LUA-BAA-119

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	14.5	17.4	20.8	12.4	15.4	18.9	-1100[2]	6	Z-axis sensitive South pole Inverted switch	UA (T092-3L)
T_J = 25°C	13.8	16.0	18.3	11.7	14.0	16.4				
T_J = 150°C	11.2	13.8	16.7	9.1	11.8	14.8				

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

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

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^oC; T_1 = 25^oC; T_2 = 150^oC$$

[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.29. MLX92241LUA-BAA-120

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	17.4	20.8	24.5	15.3	18.8	22.6	-1100[2]	3.3	Z-axis sensitive South pole Inverted switch	UA (T092-3L)
T_J = 25°C	16.7	19.0	21.5	14.6	17.0	19.6				
T_J = 150°C	13.6	16.4	19.6	11.5	14.4	17.7				

9.30. MLX92241LUA-BAA-121

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	14.5	17.4	20.8	12.4	15.4	18.9	-1100[2]	3.3	Z-axis sensitive South pole Inverted switch	UA (T092-3L)
T_J = 25°C	13.8	16.0	18.3	11.7	14.0	16.4				
T_J = 150°C	11.2	13.8	16.7	9.1	11.8	14.8				

9.31. MLX92241LUA-BAA-122

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	35.3	41.5	48.5	34.1	40.5	47.7	-1100[2]	6	Z-axis sensitive South pole Direct switch	UA (T092-3L)
T_J = 25°C	33.9	38.0	42.4	32.7	37	41.6				
T_J = 150°C	27.7	32.8	38.6	26.5	31.8	37.8				

9.32. MLX92241LUA-BAA-123

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	6.7	8.6	10.6	5.6	7.6	9.7	0[2]	6	Z-axis sensitive South pole Inverted switch	UA (T092-3L)
T_J = 25°C	7.1	8.6	10.1	6.0	7.6	9.2				
T_J = 150°C	6.7	8.6	10.6	5.6	7.6	9.7				

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

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

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^oC; T_1 = 25^oC; T_2 = 150^oC$$

[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*

9.33. MLX92241LUA-BAA-125

DC Operating Parameters V_{DD} = 3.5V to 24V, T_J = -40°C to 165°C

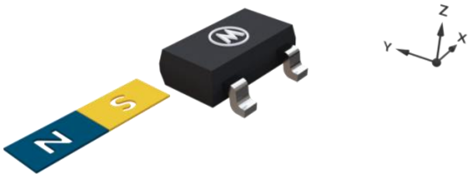
Test Condition	Operating Point B_{OP} (mT) [3]			Release Point B_{RP} (mT) [3]			TC (ppm/°C)	Ioff (mA)	Output Behavior Active Pole	Package Information
	Min	Typ[1]	Max	Min	Typ[1]	Max	Typ[1]			
T_J = -40°C	9.9	12.2	14.7	8.5	10.9	13.5	0[2]	6	Z-axis sensitive South pole Inverted switch	UA (T092-3L)
T_J = 25°C	10.4	12.2	14.0	9.0	10.9	12.8				
T_J = 150°C	9.9	12.2	14.7	8.5	10.9	13.5				

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

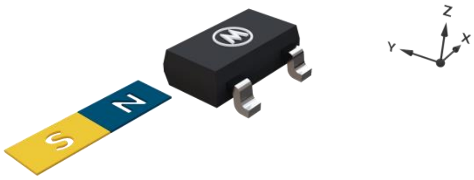
[2] *Temperature coefficient is calculated using the following formula:*

$$\frac{B_{OPT2} - B_{OPT1}}{B_{OP25^oC} \times (T_2 - T_1)} * 10^6, ppm/^o C; T_1 = 25^o C; T_2 = 150^o C$$

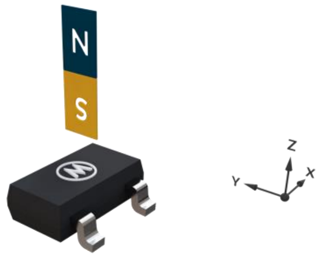
[3] *Final magnetic parameters will be covered in the PPAP documentation set, the table below is based on theoretical calculations*



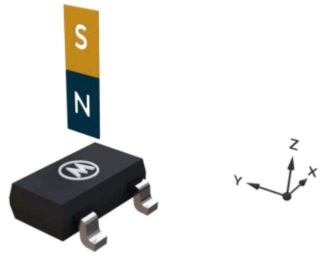
South active pole (IMC version)



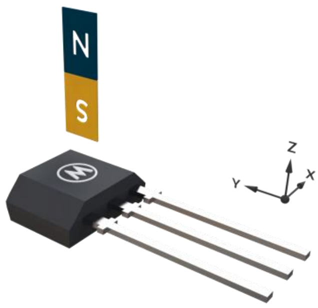
North active pole (IMC version)



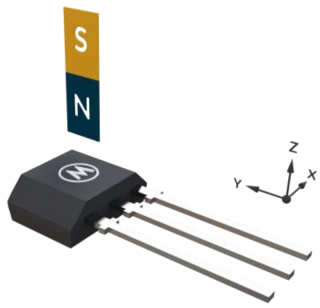
South active pole



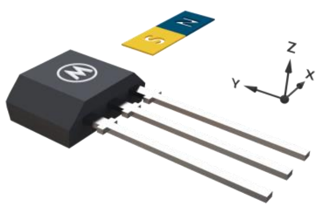
North active pole



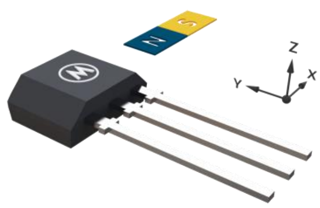
South active pole



North active pole

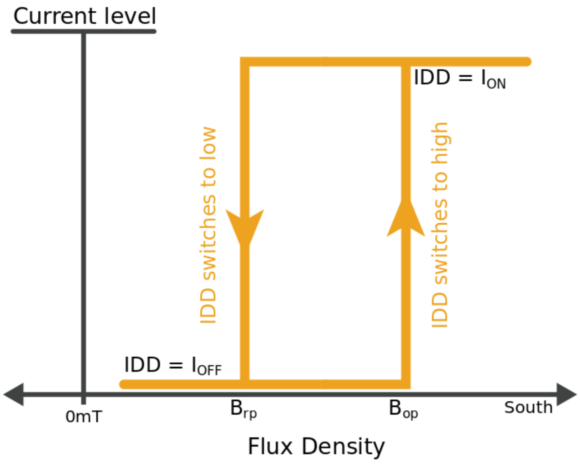


South active pole (IMC version)

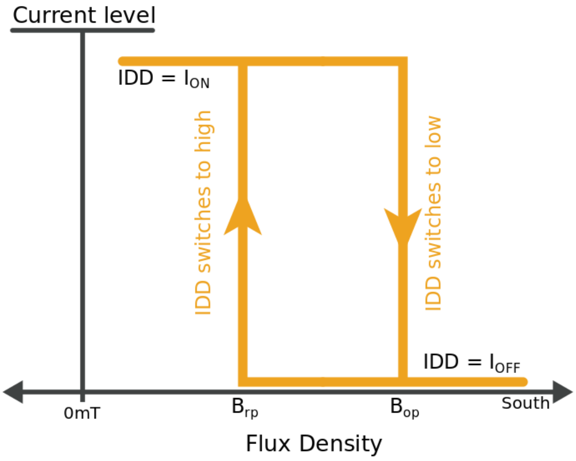


North active pole (IMC version)

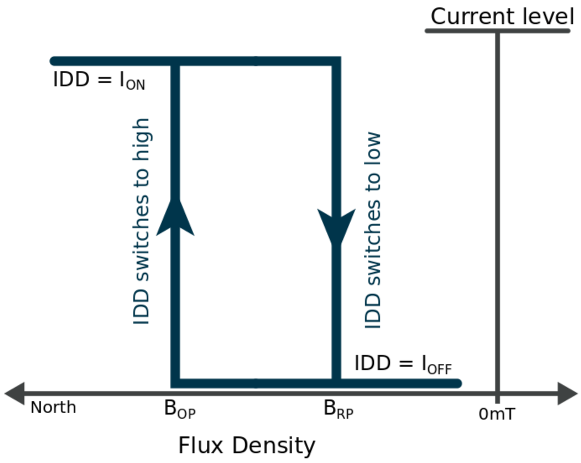
10. Magnetic Behavior



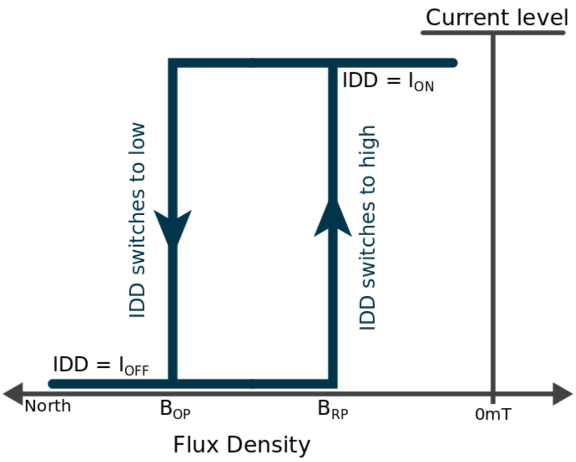
Direct South Active Pole



Inverted South Active Pole



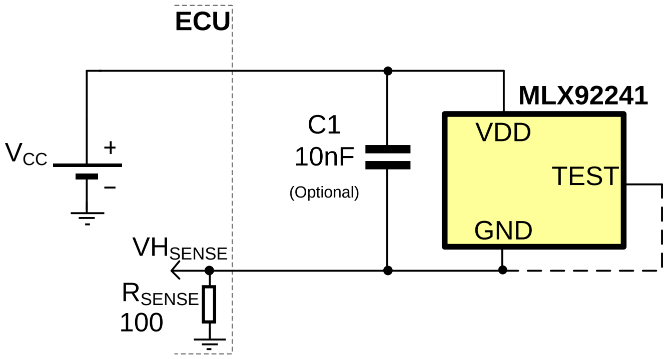
Direct North Active Pole



Inverted North Active Pole

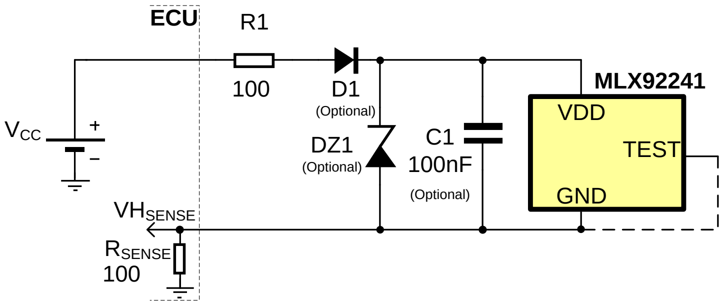
11. Application Information

11.1. Typical Automotive Application Circuit



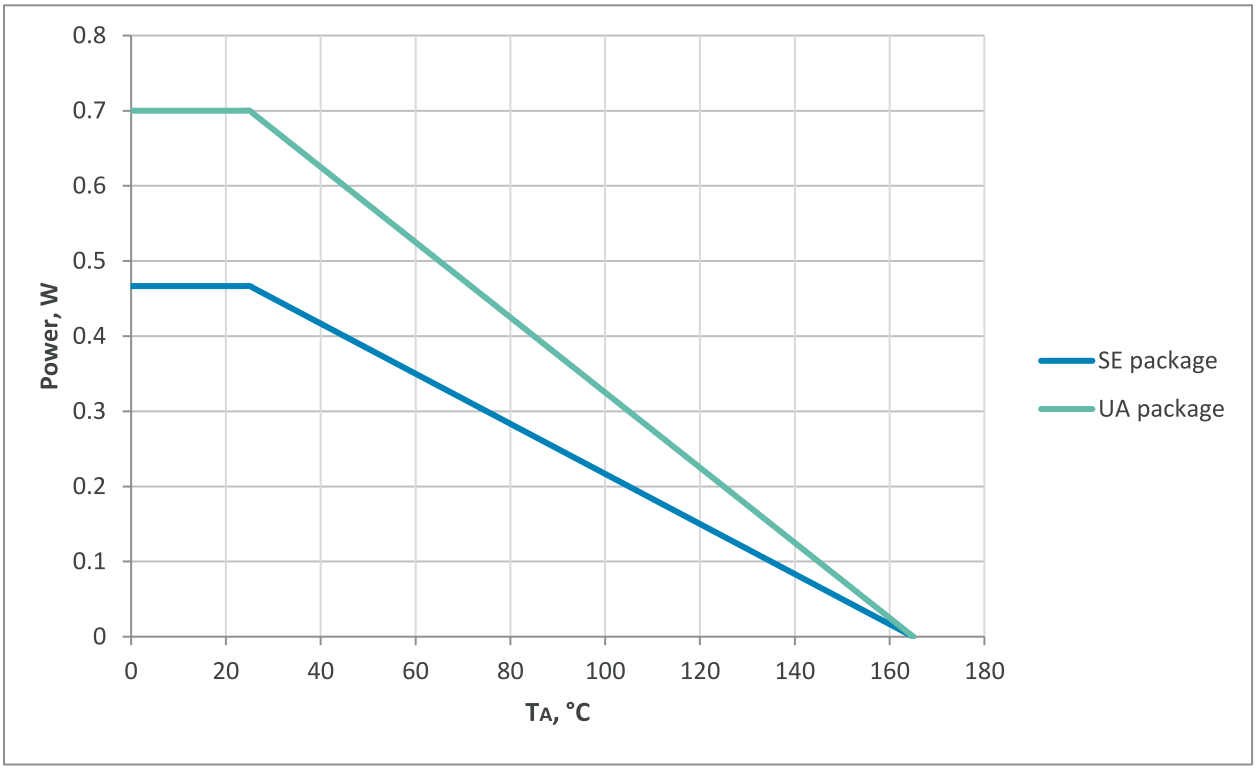
Notes:
1. For proper operation, a 10 to 100nF bypass capacitor should be placed as close as possible to the V_{DD} and ground (GND) pin.
For MLX92241LUA-BAA-1xx C1 is not required.
2. The TEST pin is to be connected to GND or left open.

11.2. Automotive and Harsh, Noisy Environments Application Circuit

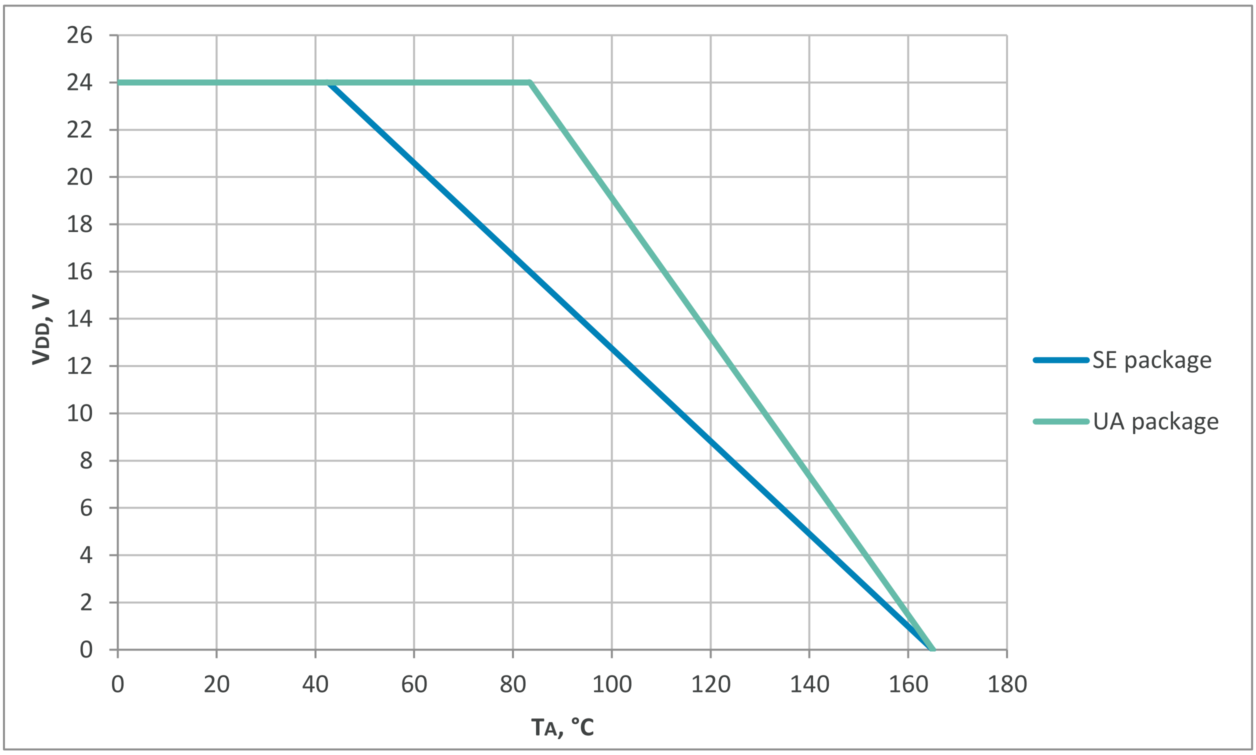


Notes:
1. For proper operation, a 10 to 100nF bypass capacitor should be placed as close as possible to the V_{DD} and ground (GND) pin.
For MLX92241LUA-BAA-1xx C1 is not required.
2. The device can tolerate positive voltages up to +28 (+32)V and negative voltages down to -24 (-30)V.
If bigger transients over the supply line are expected the usage of D1 and DZ1 (24...27V) is recommended.
The series resistor R1 is used to limit the current through DZ1 and to improve the EMC performance.

11.3. Power Derating Curve



11.4. Voltage Derating Curve



12. Standard information regarding manufacturability of Melexis products

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 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

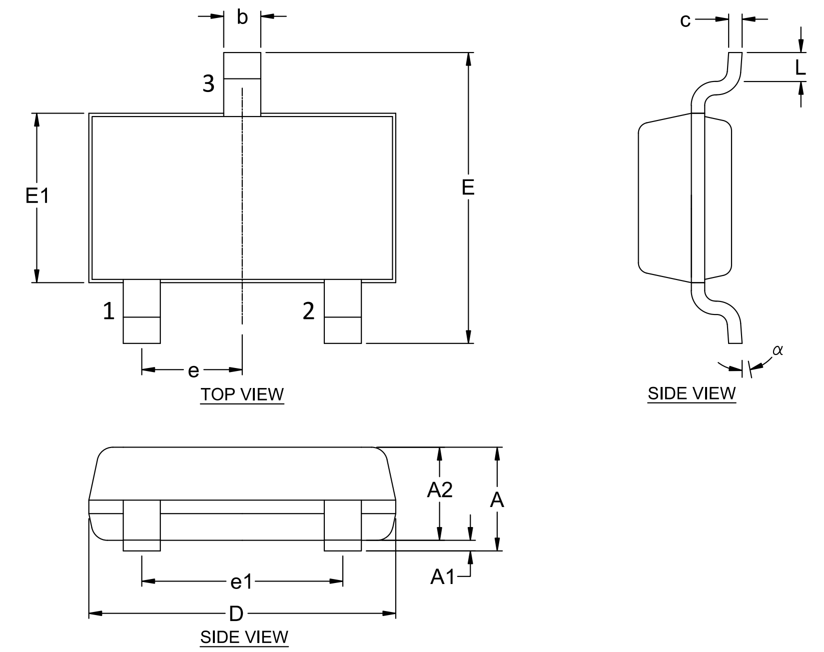
13. ESD Precautions

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. TSOT-3L (SE Package)

14.1.1. TSOT-3L – Package dimensions

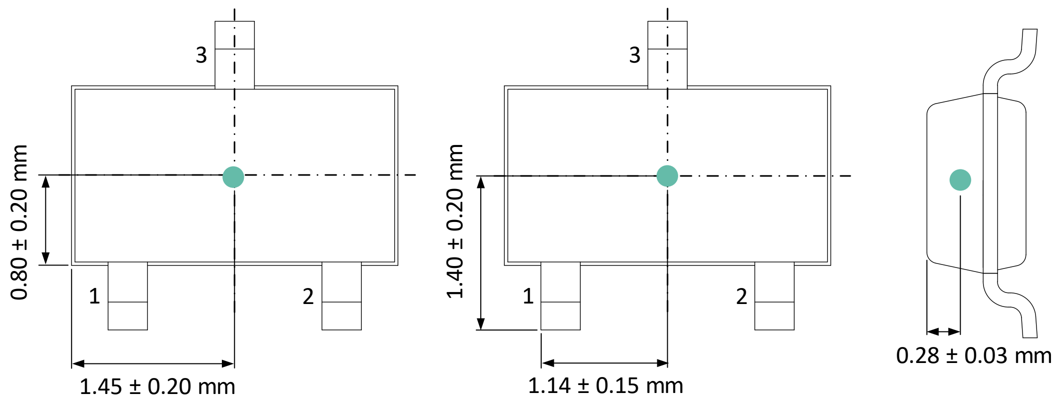


SYMBOL	MINIMUM	MAXIMUM
A	---	1.00
A1	0.025	0.10
A2	0.85	0.90
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
L	0.30	0.50
b	0.30	0.45
c	0.10	0.20
e	0.95 BSC	
e1	1.90 BSC	
α	0°	8°

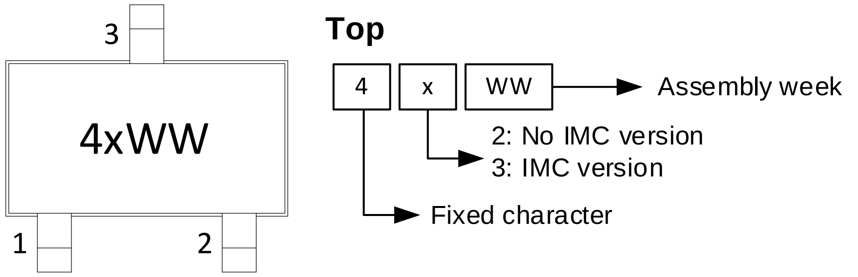
NOTE :

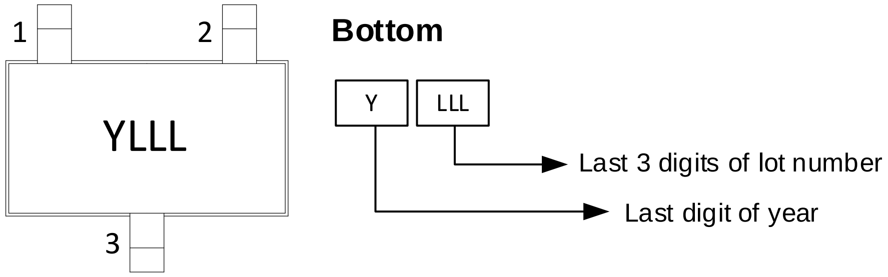
1. ALL DIMENSIONS IN MILLIMETERS (mm) UNLESS OTHERWISE STATED.
2. DIMENSION D DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS OF MAX 0.15 mm PER SIDE.
3. DIMENSION E DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS OF MAX 0.25 mm PER SIDE.
4. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION OF MAX 0.07 mm.
5. DIMENSION L IS THE LENGTH OF THE TERMINAL FOR SOLDERING TO A SUBTRATE.
6. FORMED LEAD SHALL BE PLANAR WITH RESPECT TO ONE ANOTHER WITH 0.076 mm SEATING PLANE.

14.1.2. TSOT-3L – Sensitive spot



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

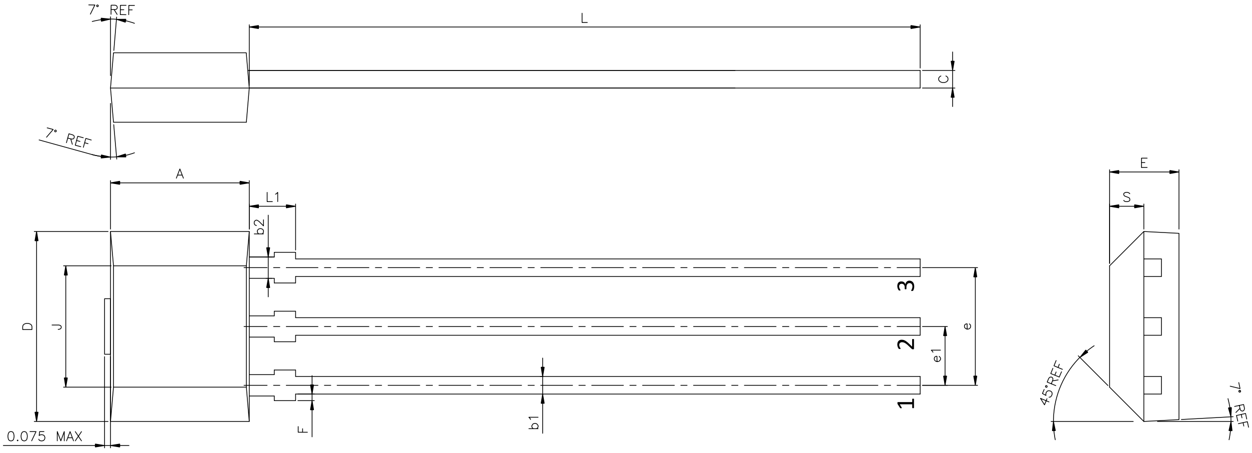




Pin #	Name	Type	Function
1	VDD	Supply	Supply Voltage pin
2	TEST	I/O	For Melexis use only
3	GND	Ground	Ground pin

14.2. TO92-3L (UA Package)

14.2.1. TO92-3L – Package dimensions



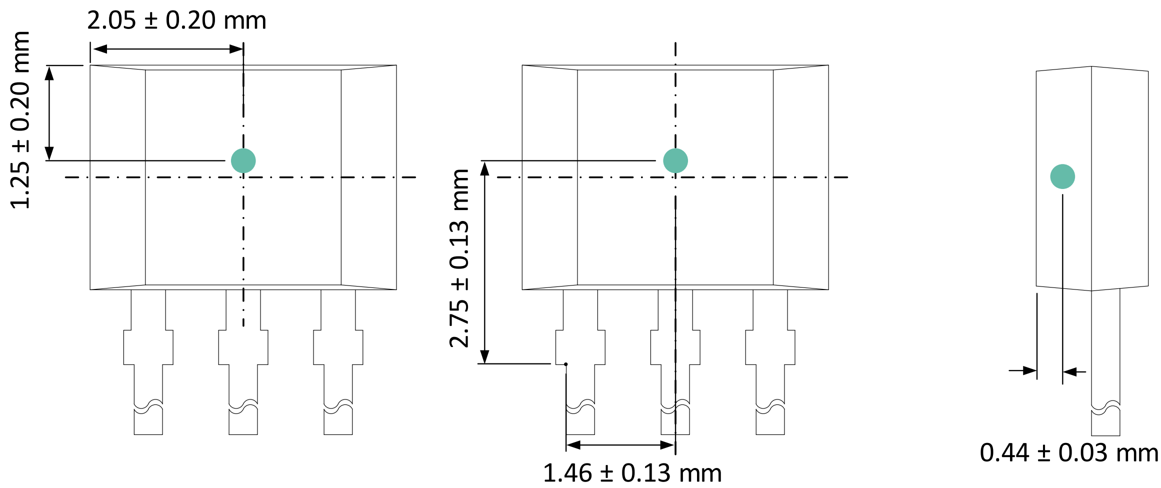
SYMBOL	MINIMUM	MAXIMUM
A	2.90	3.10
D	4.00	4.20
E	1.40	1.60
F	0.00	0.15
J	2.51	2.72
L	14.00	15.00
L1	0.90	1.10
S	0.63	0.84
b1	0.35	0.44
b2	0.43	0.52
c	0.35	0.44
e	2.51	2.57
e1	1.24	1.30

NOTES :

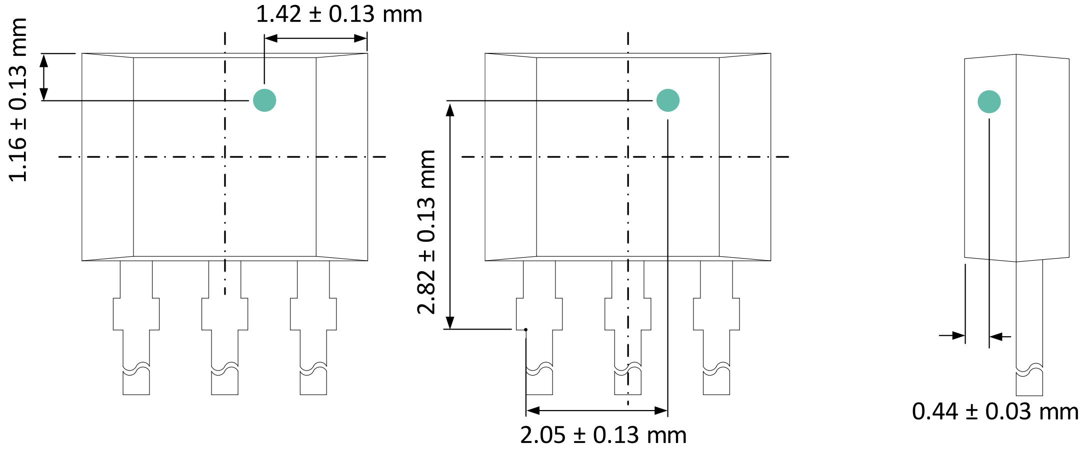
1. DIMENSIONS IN MILLIMETERS (mm) UNLESS NOTED OTHERWISE.
2. PACKAGE DIMENSIONS DO NOT INCLUDE MOLD FLASHES AND PROTRUSIONS.
3. DIMENSION A AND D DO NOT INCLUDE MOLD GATE AND SIDE FLASH (PROTRUSION) of MAXIMUM 0.127 mm PER SIDE.
4. THE LEADS MAY BE SLIGHTLY DEFORMED DURING TRANSPORTATION IF PACKED IN 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.

14.2.2. TO92-3L – Sensitive spot

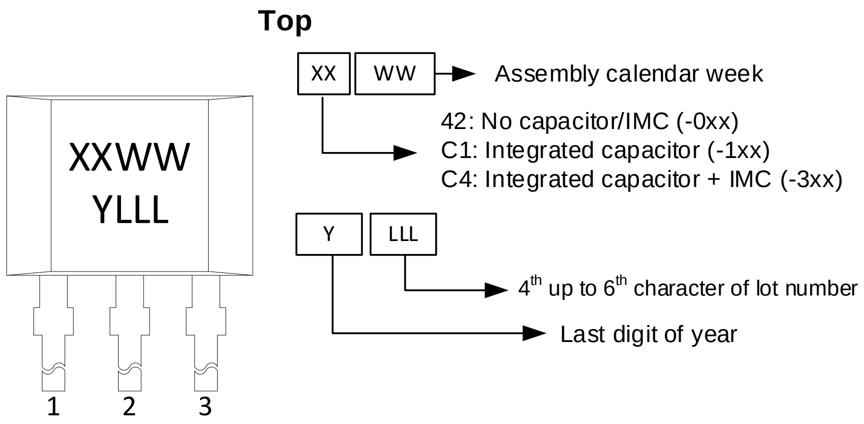
Without integrated capacitor (-0xx)



With integrated capacitor (-1xx, -3xx)



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



Without integrated capacitor (-0xx)

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

With integrated capacitor (-1xx, -3xx)

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

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