MLX90125

Antenna coil for MLX90109

Features and Benefits

- Matches standard capacitance values for realizing resonance
- Tight tolerances: inductance value down to +/-3%
- Optimized for Read and/or Write performance with the MLX90109
- Optimized for minimum area coverage on PCB
- Long leads for flexible mounting in modules
- Lightweight
- Cost optimized

Applications

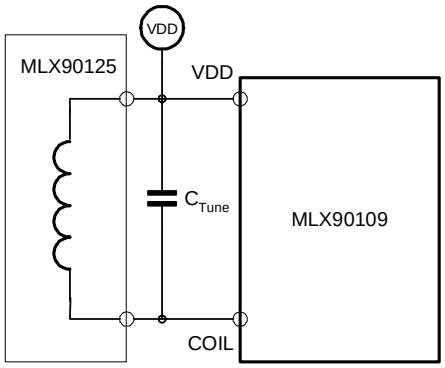
- Lightweight Portable readers, readers with multiple antenna's …

Ordering Information

Part No.	Temperature Suffix	Package Code	Options(Internal diameter, Inductance)
MLX90125	C (0°C to 70°C)	ZA	A (17mm ID, 74uH) B (28mm ID, 74uH) (*) C (39mm ID, 74uH) (*)

(*) under qualification.

1. Functional Diagram



2. Description

The MLX90125 encompasses a set of standard available coils that with a tune capacitor forms the parallel reader antenna for the MLX90109 reader IC. On top of the high level of integration of the MLX90109, it further minimizes the development effort for novice and experienced users to realize a reader basestation.

The coil is targeted towards lightweight and compact systems; like portable appliances, tools, or even access control systems. Therefore the physical dimensions are optimized in weight and size. The coil can be mounted on a PCB around other mounted components. Or it can be positioned in any orientation as required by the application.

The inductance values have been chosen such that with a single standard capacitor value the resonance frequency can be realized. Since the parallel antenna resonance determines the readers' carrier frequency, special care is taken to minimize the tolerance on the inductance value.

CONTENTS

3. Absolute Maximum Ratings

Supply Voltage, V_{DD} (overvoltage)	V
Supply Voltage, V_{DD} (operating)	V
Supply Current, I_{DD}	mA
Output Current, I_{OUT}	mA
Operating Temperature Range, T_A	-50°C
Operating Temperature Range, T_S	100°C

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
MLX90125 is qualified for application with MLX90109. Please refer to MLX90109 datasheet for applicable absolute maximum ratings.

4. MLX90125-CZA-A Electrical Specifications

Operating Parameters at 125kHz, 1Vac, T = 25°C (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Coil inductance	Lant		71.5	73.7	75.9	uH
Coil Quality factor	Qant		22.5	25	27.5	
Antenna impedance	Zant	Calculated = Wres*Lant*Qant	1.26		1.64	kOhm
Self resonance Frequency	SRFcoil		3000			kHz

5. MLX90125-CZA-A Physical Specifications (see fig 1.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Coil height	H				3	mm
Outside Diameter	OD				18.9	mm
Inside diameter	ID		16.9	17	17.5	mm
Lead length	LL			20		mm
Tin plated Lead end	LE			5		mm
Number of Turns	Nr			52		

6. MLX90125-CZA-B Electrical Specifications

Operating Parameters at 125kHz, 1Vac, T = 25°C (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Coil inductance	Lant		71.5	73.7	75.9	uH
Coil Quality factor	Qant			(22)		
Antenna impedance	Zant	Calculated = Wres*Lant*Qant	(1.1)			kOhm
Self resonance Frequency	SRFcoil		3000			kHz

7. MLX90125-CZA-B Physical Specifications (see fig 1.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Coil height	H			(3)		mm
Outside Diameter	OD			(29)		mm
Inside diameter	ID			(28)		mm
Lead length	LL			(35)		mm
Tin plated Lead end	LE			(5)		mm
Number of Turns	Nr			(36)		

8. MLX90125-CZA-C Electrical Specifications

Operating Parameters at 125kHz, 1Vac, T = 25ºC (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Coil inductance	Lant		71.5	73.7	75.9	uH
Coil Quality factor	Qant			(22)		
Antenna impedance	Zant	Calculated = Wres*Lant*Qant	(1.1)			kOhm
Self resonance Frequency	SRFcoil		3000			kHz

9. MLX90125-CZA-C Physical Specifications (see fig 1.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Coil height	H			(3)		mm
Outside Diameter	OD			(40)		mm
Inside diameter	ID			(39)		mm
Lead length	LL			(35)		mm
Tin plated Lead end	LE			(5)		mm
Number of Turns	Nr			(36)		

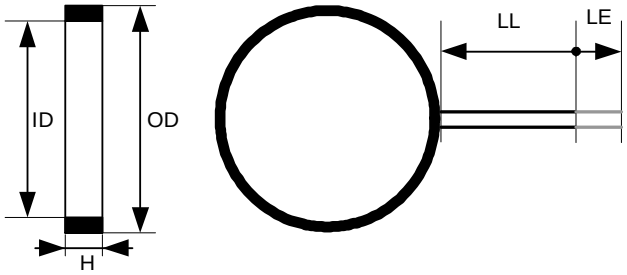


Fig. 1

10. Applications Information

Antenna Resonance Frequency:

The MLX90125 can be applied with a single Tune capacitor in parallel to realize the target resonance frequency as can be found from :

Fres = 1/sqrt(Lant*Ctune)

For 125kHz we find

C [nF]	12	18	22	27	30	33
L [uH]	135.1	90.1	73.7	60.0	54.0	49.1

When applied with a high Q transponder, the spread on the reader resonance frequency should be minimal, and a 2% capacitor is then recommended. Together with the +/-3% of the coil this yields a 2.5% spread on the resonance frequency. For application with low Q transponders like the MLX90127, a 5% capacitor giving an overall 3.5% spread on the resonance frequency is acceptable.

For instance 125kHz +/-3.5% implies a resonance frequency range of [120.6, 129.4]kHz

Temperature drift of the inductance value from -40 to +85C is characterized to be less than 1%.

Antenna Impedance.

The antenna impedance is an important system design parameter for the MLX90109 (see MLX90109 datasheet). For normal read and write operation Zant = Vant/IDD is minimum 500Ohms, and minimum 1kOhm for auto start up. The Antenna impedance can be approximated as

Zant = Qant.Wres.Lant with Wres = 2π*Fres

We can calculate the minimum Qant to guarantee good operation of the reader. In the table an overview of the minimum Q is mentioned for realizing a 1.1kOhm at 125kHz. This guarantees auto start up with some process tolerance.

L [uH]	135.1	108.1	90.1	73.7	54.0
Qant (1.1kOhm)	10.4	13.0	15.6	19.0	25.9

Mind …

- That higher Qant reduces the total reader current consumption, but it has no influence on the antenna current. The latter is directly related with inductance value and the antenna voltage amplitude.
- That in reality the coupling with the tag may drastically reduce the antenna impedance. For instance when the MLX90127 is held against (0mm distance) the 18mm reader coil (MLX90125-CZA-A) VMODU has to be increased to 2V to guaranteed correct read out by the MLX90109 using the 18mm. (see EVB90109)

Temperature drift of the quality factor compared to the reference value at 25C is typically:
-40°C: --
+85°C: --
(Data to be completed in next revision)

Antenna current.

The reading distance is linked with the ampere turns generated by the reader coil.

Iant = Qant*IDDant = Vant/(Wres*Lant)

Reducing the inductance value increases the antenna current, but it reduces the number of turns proportional to its square root, so the overall gain is limited.

See following table for antenna currents [mA] for VMODU=0.8V, 2.2V and 4V.

L [uH]	Iant(0.8)	Iant(2.2)	Iant(4.0)
135	41.5	28.3	10.4
108	51.9	35.4	13.0
90	62.2	42.4	15.6
74	75.7	51.6	18.9
54	103.7	70.7	25.9

See datasheets of MLX90109 (Reader IC) and EVB90109 (evaluation board + case study of the chipset 90109+90125 with 90127 transponder) for more application information.

11. Application Comments

How to apply the coil on a PCB?
=> Apply 2 dots of glue on the coil after soldering the leads to the PCB to fix the coil.

12. FAQ

Question1 : What is the maximum voltage over the capacitor?

Answer: The absolute maximum voltage across the tune capacitor Ctune is limited to the antenna voltage amplitude. For parallel resonant antenna's the amplitude is limited to the applied supply voltage. This is contrary to the situation with serial antenna's where the voltage resonance pushes the antenna voltage up.

Question2 : What about customized coils?

Answer: The set of coils will grow gradually based on volume requests. Next to wire bonded coils, also SMD mountable coil cores can be offered, baring in mind a cost increase, and a significant loss of PCB area.
Coil diameters can range from 5mm to 150mm, bearing in mind that the reading distance is closely related to the diameter. When applying the MLX90127 transponder it is of little use to increase the reader coil size above 40mm. With smart card size transponders, up to 150mm reader coils have been demonstrated a reading range of up to 200mm

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