

Features

- Very small chip size
- Optimized for Low cost
- Integrated tuning and buffer capacitance
- Low power consumption, for maximum operating distance
- Deep modulation for maximum reading distance
- Operating frequency [100; 150kHz]
- Mask programmable modulation schemes and data rates.

Applications

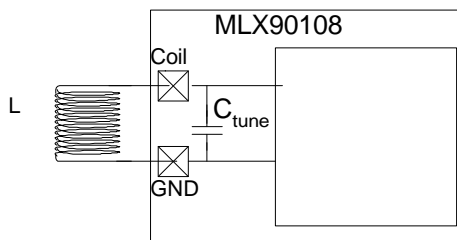
- Automotive Key, Access control, ID cards, Laundry ticketing, Consumer goods, Industrial Applications

Ordering Information

Part No.	Temperature Range	Package
MLX90108	25 °C Consumer -40 to 85 °C Automotive	Sawed wafer on frame, with/without Gold bumps Bare die in blistertape with/without Gold bumps SOIC-8 150mils

Production parts available Q2 2000

Functional Diagram



Description

The MLX90108 is a dedicated 64 bit Read Only (RO) Transponder (TAG). Clock and power supply are taken from the electromagnetic field. By switching a resistor in parallel to the resonant circuit formed by the integrated tuning capacitor and the external coil, the transponder amplitude modulates the electromagnetic field. Encoding of the data and data rate depend on the version.

It is a low cost solution for high volume applications. The tuning and buffer capacitors are integrated on chip. Operating frequency (SRF) range is [100; 150]kHz.

The unique identification code (ID) is EEPROM programmed in test mode during probing. Data coding and data rate are mask programmed. An optimized layout for gold bumps and a standard version are available for all options. This allows the device to be integrated into any assembly form.

MLX90108 Electrical Specifications

All specifications are valid for Manchester, Biphase and PSK encoding, and for 2kbaud and 4kbaud and 8kbaud data rate options, $T_{oper} = -40^{\circ}\text{C}$ to 85°C , Operating frequency = 120kHz (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Regulated supply voltage	VDD	(2)	1.2		4.0	V
Sensitivity level Manch/Biph	Vac	(3)	200	150		mV
Sensitivity level PSK	Vac	(3)	600	400		mV
EEPROM data retention	Tret	Critical reading ID	10	1000		year
Modulation Depth ASK		Weak power: Vac = 200mVpp	0.2		4	V(4)
		Medium power: Vac = 5Vpp	2.8		7.5	V(4)
		High power: Vac = 20Vpp	5		10	V(4)
Coil-GND tune capacitor		$T_{oper}=25^{\circ}\text{C}$	77.2	80	82.8	pF(5)
DC input current clamping	IclampLow	VdutDC = +/- 2V		40	1000	nA
	IclampHigh	VdutDC = +/- 10V	1	3.5	10	mA

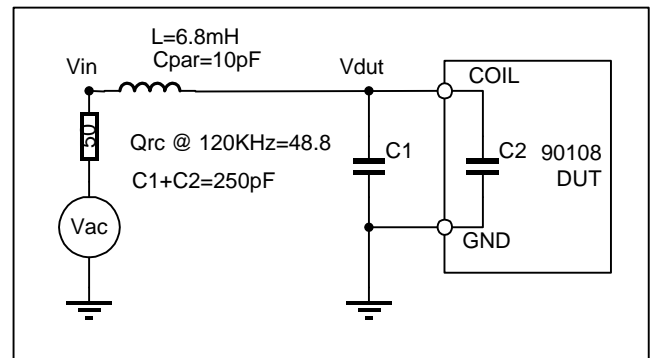
Notes:

Note (1): All specification values are tested 100%, or guaranteed by characterization.

Note (2): Maximum supply voltage is generated by forcing 10mA between coil and ground pin.

Note (3): Continuous (without POR restart) normal reading of the 64bit ID on test set up as depicted besides.

Note (4): Min = Vbottom (modulation on),
Max = Vtop (modulation off).



Note (5): Statistical spread on wafer basis within one lot is 3.5%. Temperature shift is typically -0.5% on -40°C , and +1% at 85°C . On the MLX90108D a maximum Lot to lot spread of 20% is possible: average of a lot can vary between 64 and 96pF.

General Description

The MLX90108 is a 64 bit Read Only (RO) transponder. The integrated tune capacitance and the external coil form a resonant LC antenna that absorbs part of the electromagnetic energy radiated by the transceiver LC antenna. Physically, a magnetic coupling occurs between the transceiver, also referred to as "reader", and transponder antennas

To amplitude modulate (AM) the RF carrier, the transponder damps the electromagnetic field by switching a resistor in parallel with its coil. This way the transponder repetitively transmits its 64 bit-identification code (ID) to the reader base station.

Frequency tuning

Tuning and buffer capacitors are integrated to optimize total system cost.

The 80pF integrated tuning capacitor is +/-20% accurate from batch to batch. A spread of max +/-2.5% is guaranteed across a full batch, which is typically 200k dice.

Clock Extractor:

Master clock is taken from the carrier frequency which is picked up on the coil. Depending on the options, the carrier frequency is divided by 16(8kBaud: PSK only), 32(4kbaud) or 64(2kbaud)to generate the bit rate.

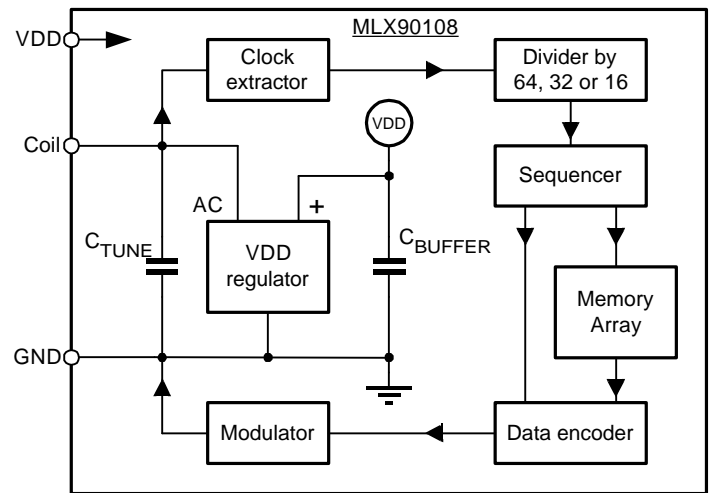
VDD regulator:

Supply voltage is taken from the AC voltage induced in the coil. Overvoltage protection is done by current clamping.

POR level

When the transponder is placed in an external radio frequency (RF) field of appropriate frequency and amplitude, the internal power supply (VDD) can build up as charge on the integrated buffer capacitance. The modulation resistor is switched on and off as soon as VDD has reached the Power On Reset (POR) level. When the modulation resistor is switched on, the LC circuit is no longer tuned, therefore no energy is taken from the field, and VDD drops due to internal consumption. Hence, by switching the modulation resistor on and off, it is possible to oscillate around the POR level. This phenomenon is referred to as hiccuping. The modulation resistor is switched off when the transponder drops below the POR level.

Block diagram



Sensitivity level

The minimum electromagnetic force (e.m.f.) needed to avoid hiccuping is defined by Vacsens. At this level the power supply will not drop below the POR level while the modulation resistance is switched on during modulation.

Modulator

The modulator consists of a modulation resistor that is switched in parallel with the resonant LC circuit (antenna). The MLX90108 offers different encoding schemes and AM modulation techniques, which are discussed below, each optimized for maximum operating and reading distance under different field conditions.

EEPROM

The Identification code is written in EEPROM during wafer test. After POR the device will read out the data periodically. Data retention is guaranteed as specified (Tret, Ncyc).

Coding schemes

Biphase/Manchester AM

Biphase and Manchester are Amplitude Modulation encoding schemes, which rely on the build up of the voltage on the transponder resonant circuit during a certain period, defined by the baudrate.

In weak RF fields the quality factor of the transponder antenna is significant, therefore the rising edge is much slower than the falling edge of the envelope. Consequently a symmetrically driven modulator gives an asymmetrical envelope on the reader antenna. This is anticipated by delaying each falling edge by a fixed number of RF clock pulses. The modulator is hence driven asymmetrical. Each ON state is reduced by 8 (4) clocks in 2 (4) kBaud mode, and each OFF state is prolonged by the same amount. This guarantees good reading in strong and weak fields, at large distance and in proximity of the reader antenna.

Manchester:

For a "1" bit, there is a transition from 0 to 1 in the middle of the bit period. Reciprocal, for a "0" logic bit there is a transition from 1 to 0 in the middle of the bit period.

Biphase:

At the beginning of each bit, a transition will occur. A logic bit "1" will keep its state for the whole bit duration and a logic bit "0" will show a transition in the middle of the bit duration.

Phase Shift keying (PSK) AM

PSK is an Amplitude Modulation encoding scheme that relies on the change of phase of the modulation. Every other period, i.e. at half the carrier frequency, the field is modulated. Therefore the voltage can not build up on the transponder resonant circuit, and hence the sensitivity level is much higher than for the other coding schemes.

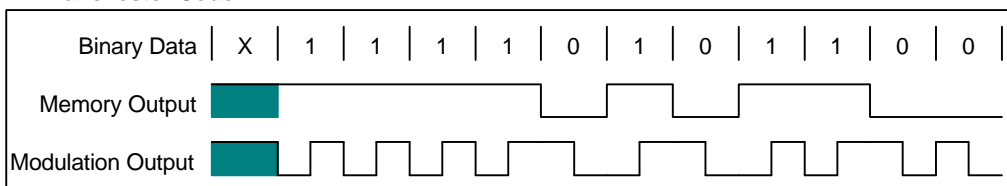
Each data bit lasts for 16 carrier periods. A 180° phase shift occurs at the beginning of a data bit when a logic "0" is read from the memory. There is no phase shift when a logic "1" is read from the memory.

PSK readers operate in the frequency domain. Therefore the demodulation is insensitive to skew in the time domain.

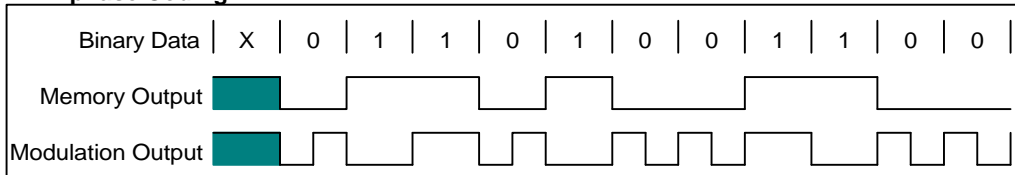
The modulation depth is still optimized for different field strengths, and reading distances.

Speed	Clocks per Bit	Clocks 'ON' state	Clocks 'OFF' state
2kbaud (MAN/BI)	64	Long ON = 64 - 8 Short ON = 32 - 8	Long ON = 64 + 8 Short ON = 32 + 8
4kbaud (MAN/BI)	32	Long ON = 32 - 4 Short ON = 16 - 4	Long ON = 32 + 4 Short ON = 16 + 4
8kBaud (PSK)	16	No asymmetrical behavior	

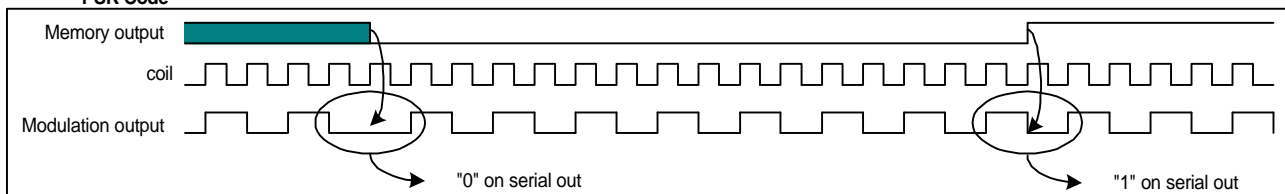
Manchester Code



Biphase Coding



PSK Code



Unique Features

- Flexible configuration.
- Small chip size
- Large reading distance
- Ready for direct bonding

Cross Reference

This product is compatible with EM Marin EM4002 family, or any other RO transponder in the 120kHz range.

Absolute Maximum Ratings

Maximum Power Supply (VDDmax)	-0.7 to 7V
Maximum current forced between coil and ground pin (Icoilmax)	+ / - 30mA
Operating Frequency (Freq)	60 to 150kHz
Normal Operating Temperature (Toper)	-40 to 85°C
Maximum Storage Temperature in SO8 (Tstore)	-55 to 125°C
Electrostatic discharge (HBM) on coil pin (Vesdcoil)	500V
Electrostatic discharge (HBM) on other pins (Vesd)	1500V

ESD Precautions

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

Disclaimer

Melexis reserves the right to periodically make modifications to product specifications. The information included herein is believed to be accurate and reliable. However, Melexis assumes no responsibility for its use, nor for any infringements of patents or other rights of third parties which may result from its use.

Ordering Information

Part No. Basic option

- MLX90108D*: with gold bumps
- MLX90108E*: without gold bumps

Part No. Coding and Data rate

- MLX90108*A: Manchester @4kBaud
- MLX90108*B: Manchester @2kBaud
- MLX90108*C: Biphase @4kBaud
- MLX90108*D: Biphase @2kBaud
- MLX90108*G: PSK @8kBaud

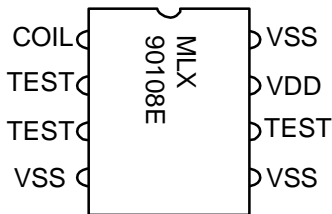
Delivery form and testing level

- Sawn on Blue foil: 25 °C
- Sawn in Blister tape: 25 °C
- SO8 Automotive: -40 °C to 85 °C
- SO8 Consumer: 25 °C

The MLX90108 is qualified according to automotive standards.

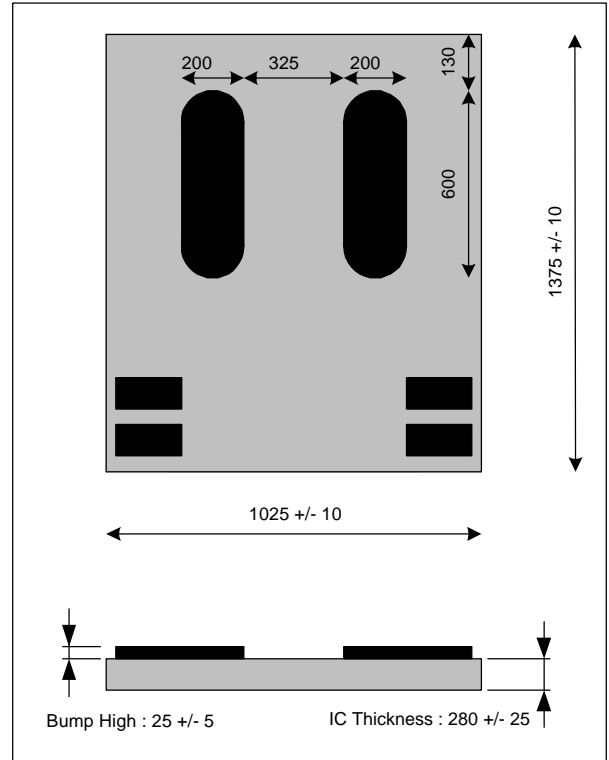
90108E-SO8 Pinout

Pin	Name	Function
1	COIL	Coil connection 1
2	TEST	Pin to set chip in test mode
3	TEST	Pin to set chip in test mode Keeping at Vdd/2 will reset the chip
4	VSS	Coil connection 2 / ground connection
5	VSS	Coil connection 2 / ground connection
6	TEST	Pin to set chip in test mode
7	VDD	External chip supply for testmode
8	VSS	Coil connection 2 / ground connection



90108D Chip dimensions

All dimensions in microns



90108E Chip dimensions

All dimensions in microns

