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FAQ MLX90215

Terminology:

Calibration*:* The proccess of adjusting the MLX90215 for a specific output voltage span.

Gain: Also called sensitivity. The slope of the sensors output in mV/mT or mV/G.

Load: The process of sending the serial 37 bit word into RAM or temporary memory.

Programming word: The 37 bit digital waveform used for programming the MLX90215.

Offset: The output of the sensor at zero field. Quiescent operating voltage point, Voq.

RAM: Random Access Memory. Temporary (volatile) 37 bit memory.

ROM: Short for OTPROM (One Time Programmable Read Only Memory). Permanent (nonvolatile) 33 bit memory.

TC: Temperature Compensation. A function that changes the sensitivity of the sensor relative to changes in operating temperature.

Tuning: A process for adjusting the settings of the 90215 (gain or offset) for a specific application.

Zap: Refers to programming a bit in ROM. Derived from the process of fusing zener zap diodes that make up the MLX90215's ROM.

Zener Zap Cell: Basic circuit block for a single bit in ROM.

Programming:

Q. How does the MLX90215 work?

A. The MLX90215 is a programmable linear Hall IC. When immersed in a magnetic field the sensor will have an analog output voltage proportional to the field. All settings of the sensor, such as gain and offset, are programmable. This allows for improved accuracy in sensor applications. For more detailed information refer to the MLX90215 datasheet.

Q. How is the MLX90215 programmed?

A. The MLX90215 is programmed using a PTC, programming through the connector, protocol. The part is placed into programming mode by raising the supply voltage. When in programming mode, a serial bit pattern is loaded into the sensor through the output pin. When the supply voltage is returned to normal operating voltage, 5Vdc, the sensor returns to its normal operating state. Please refer to the MLX90215 datasheet and design notes for specific details.

Q. Can the MLX90215 be used unprogrammed?

A. No. The sensor must be programmed in either RAM or ROM for practical use. When unprogrammed the sensor's output will be approximately 99% of Vdd (4.95Vdc) with an unknown gain of less than 5mV/mT.

Q. Can the MLX90215 be programmed more than once?

A. The MLX90215 can function in two modes. One, is test mode, referred to as RAM. The other is operating mode, referred to as ROM.

In RAM, test mode, the sensor can be programmed an unlimited amount of times and the programmed bits will be reset to zero when the supply voltage is removed from the chip. This mode of operation is for calibration and testing, and is not intended for regular operation.

In ROM mode the programmed bits are permanently set by fusing zener zap diodes inside the chip. Once a bit is programmed in ROM it cannot be reset. Note, in ROM a logic zero is considered to be an unprogrammed bit.

Features:

Q. What is the TC and how should it be used?

A. Temperature Compensation, abbreviated TC, is a feature that adjusts the gain or sensitivity of the sensor over temperature.

The TC feature is used to compensate for magnetic temperature losses. TC values vary for different magnetic materials. It is recommend that these values be determined experimentally or from the material manufactures' datasheet. Contact Melexis application engineers for assistance.

Q. What is memlock and when should it be used?

A. Memlock is a feature which locks out access to RAM. It is used only in normal operating mode, ROM, to prevent accidental programming of the sensor. The memlock bit is set (or programmed) after all other settings have been programmed into ROM. Once the memlock bit is set the sensors RAM cannot be accessed. Connecting pin 2 to vdd will override the memlock. Note, the readback feature will not work with memlock set.

Q. What is Readback and how does it work?

A. Readback is a feature that returns the state of the selected bit (programmed or unprogrammed) in ROM. This function makes it possible to read the 33 bit word programmed in ROM.

Readback is a special test mode loaded in RAM along with the bit of interest. If the bit of interest has been zapped the Idd will rise above 25mA. If the bit is not zapped the Idd will remain at its normal operating value (5mA). Note, readback will return all zeros if the memlock bit is set.

Electrical:

Q. What are the ESD parameters for the MLX90215?

A. The MLX90215 is tested using the human body model (HBM) EIA test method A114-A. ESD testing is done during product qualification. Refer to the MLX90215 datasheet for specification limits.

Q. What is Pin 2 for?

A. Pin 2 is a test pin used by Melexis. To obtain best resistance to EMI pin2 should be tied to ground. Pin 2 can be shorted to Vdd to override the memlock bit. This allows for readback with the memlock bit set. If pin 2 is left floating it will remain in a high impedance state.

Application Specific Attributes:

Q. Can the MLX90215 be programmed for 0Vdc offset.

A. No. The temperature stability and linearity is degraded as the MLX90215 operates close to its “rails.” It is recommended that the offset not be set lower 0.5Vdc. Refer to the datasheet for more information.

Q. What is the response time of the MLX90215?

A. The response time is dependant upon the sensors sampling rate. The minimum response time is approximately 1/(3*sampling rate). The sensors sampling rate is dependant upon the gain setting. As the rough gain is increased the sampling rate decreases. Refer to the datasheet, rough gain vs. sampling rate, for more information.

Q. What is the peak to peak Noise of the MLX90215?

A. The peak to peak Noise is mainly a function of the gain adjustment. As the gain is increased the peak to peak noise is increased. The fine gain adjust will have a greater effect on the noise performance. Refer to the datasheet, peak to peak noise vs. sensitivity, for more information.

Applications

Q. Can the MLX90215 be tuned in the assembly or should it be preprogrammed?

A. The programmable features makes it possible to tune the sensor in its final assembly stage. This is very useful for position or current sensor applications.

The sensor can also be preprogrammed with tight tolerances to improve accuracy. The programming process is similar to trimming techniques used in some sensor applications.

The programmable features of the MLX90215 simplifies a design, however a basic understanding of the sensor and the magnetic circuit is necessary for a successful design.

Q. What TC code should be used for my application?

A. For optimum performance the sensor should be programmed to match the magnet's Reversible Coefficient B_r. This is best achieved using temperature measurements to program the sensor for a target specification in ppm/^{o}C. The TC code table in the MLX90215 datasheet will give a good estimate for the desired value. Please consult Melexis application engineers for assistance.

Q. What are the guide lines for over molding the MLX90215?

A. The MLX90215 is designed with advanced circuitry to compensate for offsets due to temperature and stress. These circuits have limitations and their effective range can be exceeded by extreme mechanical stress. Therefore it is recommended to use a material with a low coefficient of thermal expansion. Also observe the maximum temperature ratings of the sensor.

Caution should be used when fixing the leads of the device to a PC board then potting the device above the board. Drastic mismatches in thermoexpansion between the PCB and the potting material could pull or stress the leads. This may cause broken wire bonds and intermittent failures.

Note: It is common to have confusion with the term “molding”. The electronic industry sometimes refers to “potting” (using thermoset epoxy or silicon) as molding. Classic molding refers to the methods of thermoplastic injection molding. Classic molding will subject the device to much higher temperatures and pressure with likely adverse effects.

Q. What precautions are necessary for handling the MLX90215?

A. The MLX90215 is an ESD sensitive device. Proper ESD precautions are required for handling the sensor.

Q. Can the MLX90215’s leads be cut, bent, or formed?

A. Yes it is possible to cut or form the sensors leads. However, special caution is required for this operation. There should be no cutting or bending within 1mm below the package. It is very important that the leads be clamped before cutting or bending. Tension or torque on the leads may result in broken wire bonds and cause intermittent failures.

Trouble Shooting

The following are some simple quick troubleshooting techniques.

Q. The MLX90215 is programmed but the readback returns all zeros.

A. Check to see if the memlock bit set. Jumper pin 2 to Vdd and read back the ROM register. Check to see if the device responds to input (magnetic) and the offset voltage is correct.

Q. The MLX90215 is programmed and the readback returns all ones .

A. Check pin connections to the programmer and short circuit on Pin 1.

Q. The part is tuned in RAM but when zapped the output changes.

A. This failure is usually caused by TC programming. The TC code used in final zap must be used during the tuning process in RAM.

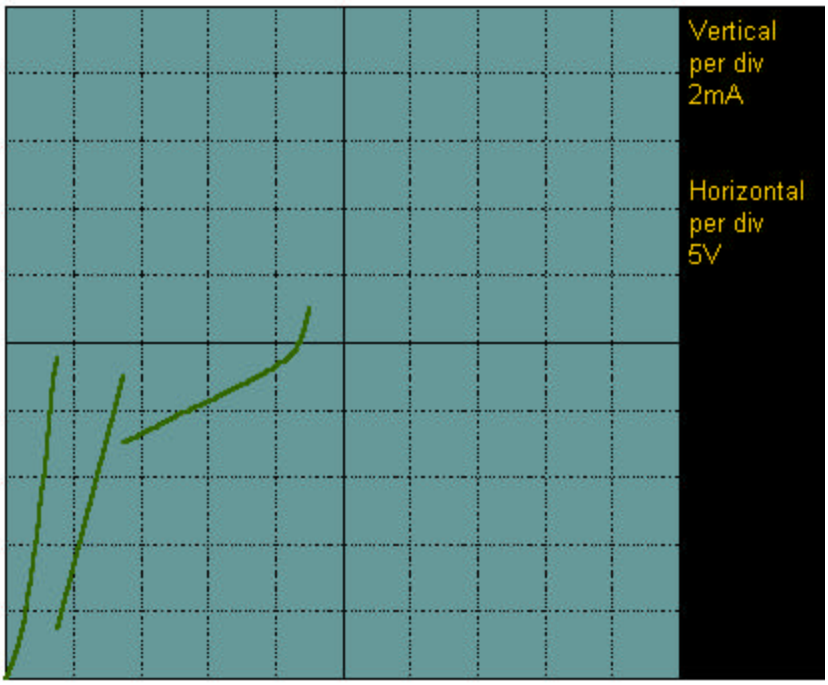
Q The output voltage is zero volts and it will not program.

A. Check the part for open or short circuit on pin1 and pin 4.

Q The output voltage is nearly equal to Vdd and the unit will not program.

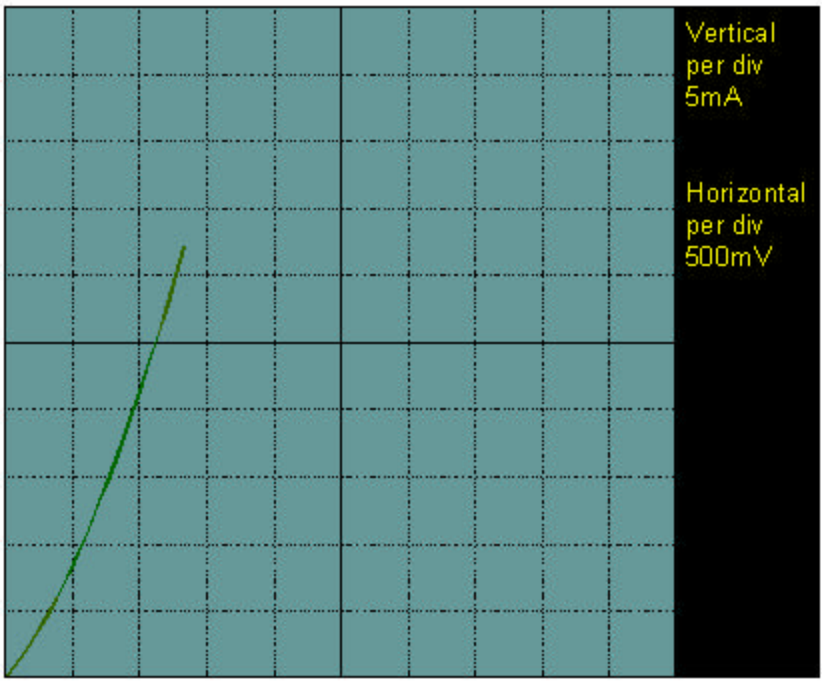
A. Check the part for an open circuit on pin3 and pin 4. Check connections and look for any voltage drops between the unit and the programmer.

MLX90215



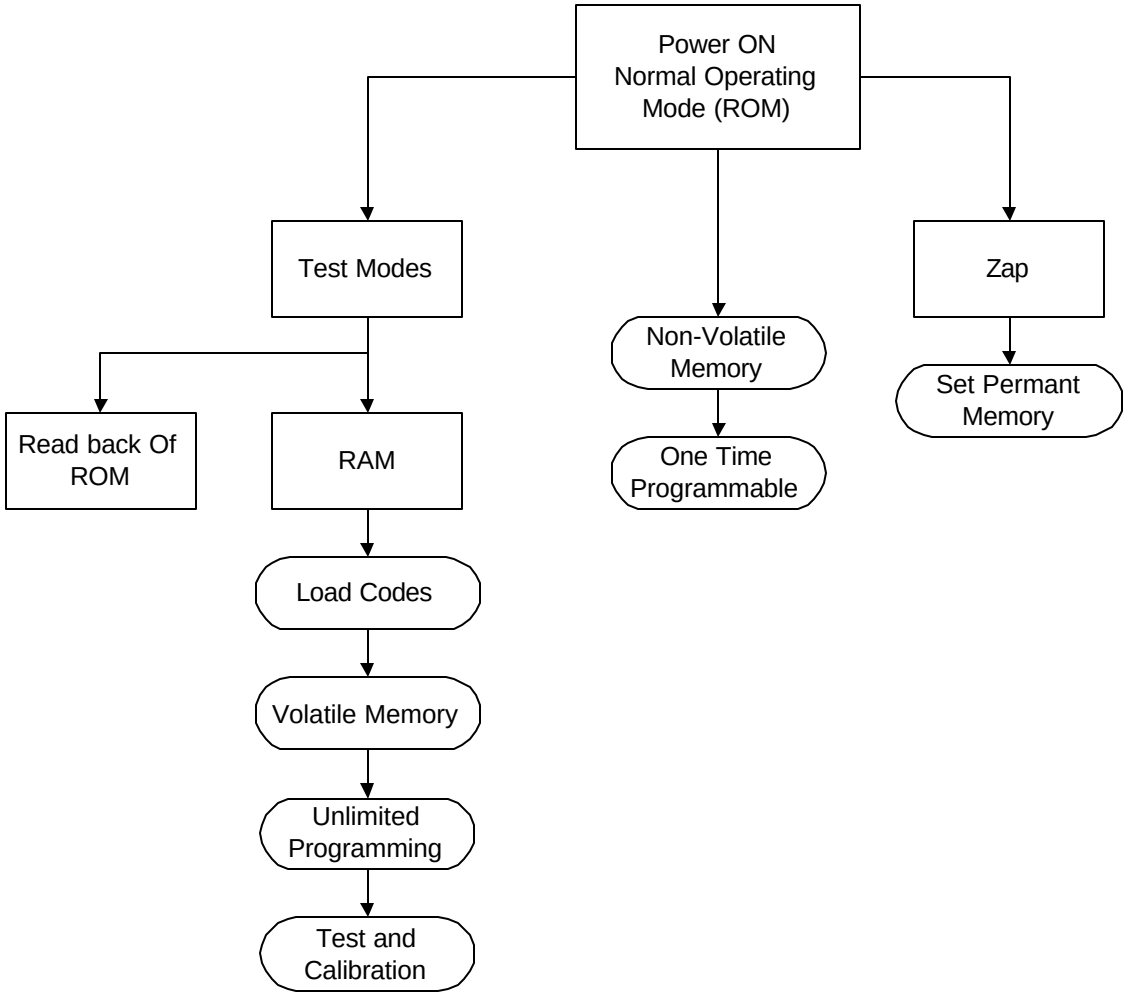
Collector to Vdd
Emitter to Ground

MLX90215

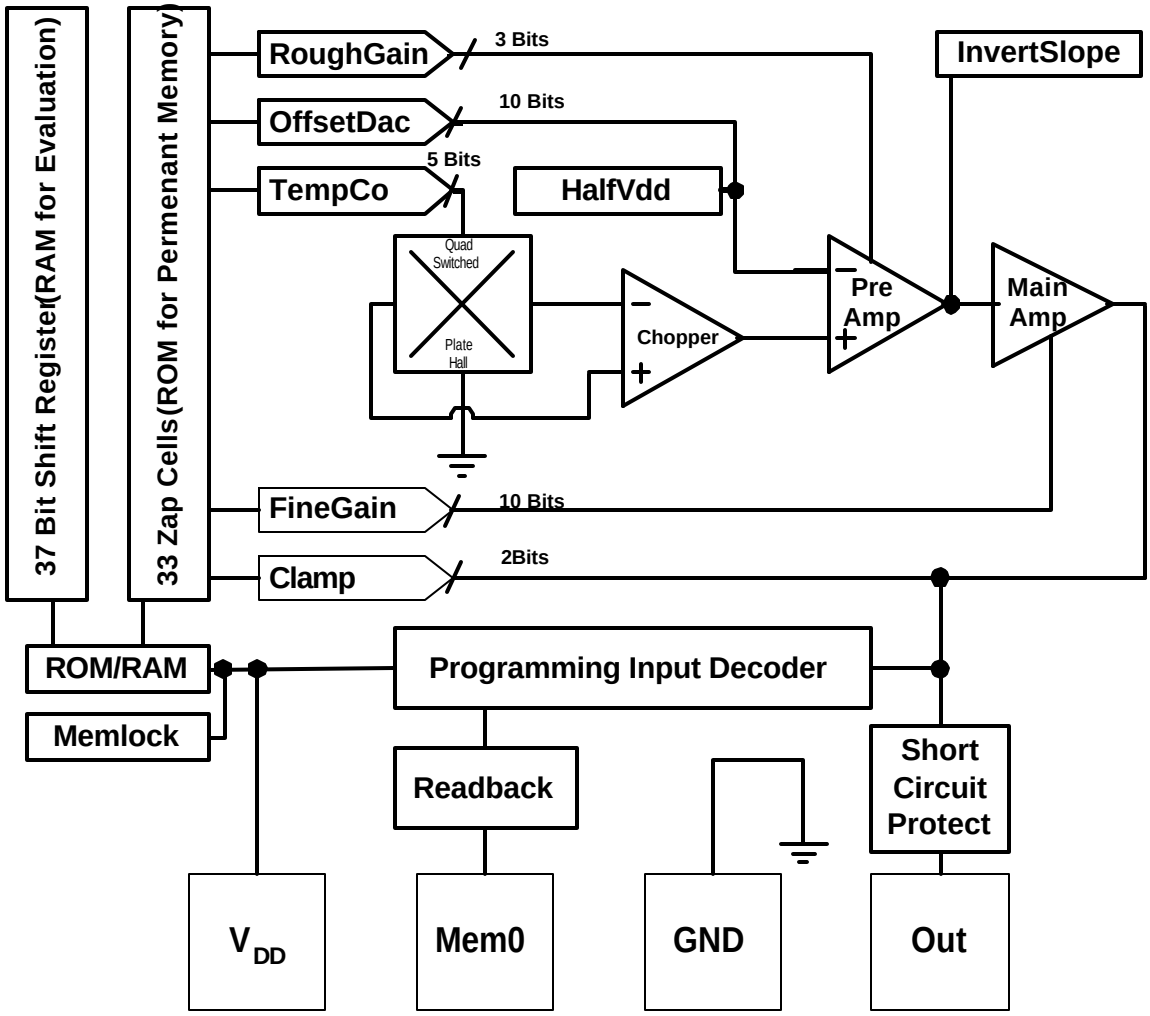


Collector to Vout
Emitter to Ground

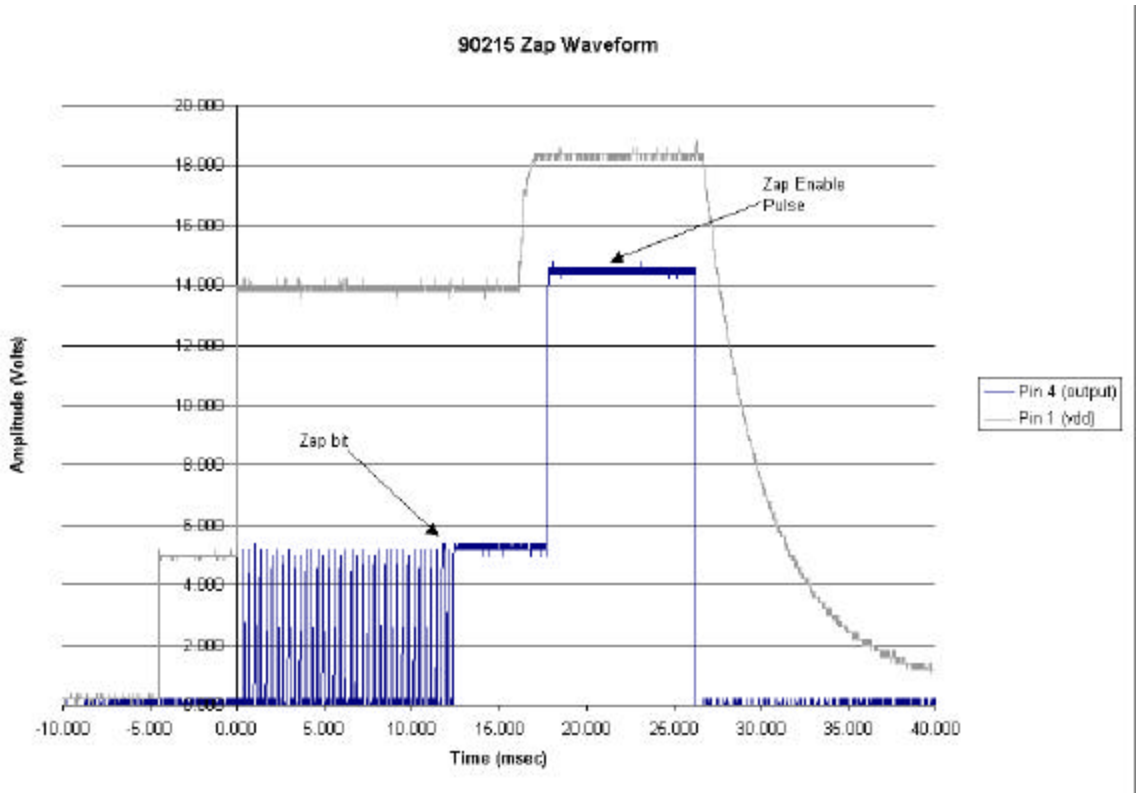
MLX90215 Operating Modes

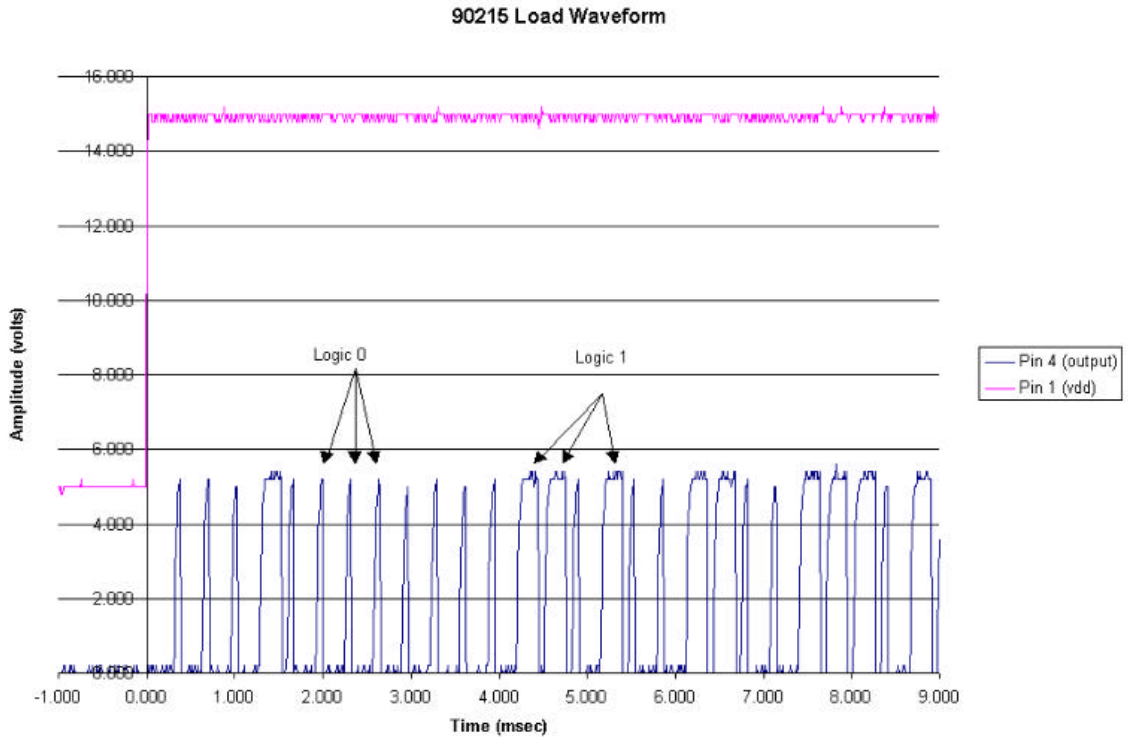


MLX90215 Block Diagram



MLX90215 Programming Waveforms




90215 Load Waveform
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
Amplitude (volts)
Logic 0
Logic 1
Pin 4 (output)
Pin 1 (vdd)
-1.000
0.000
1.000
2.000
3.000
4.000
5.000
6.000
7.000
8.000
9.000
Time (msec)