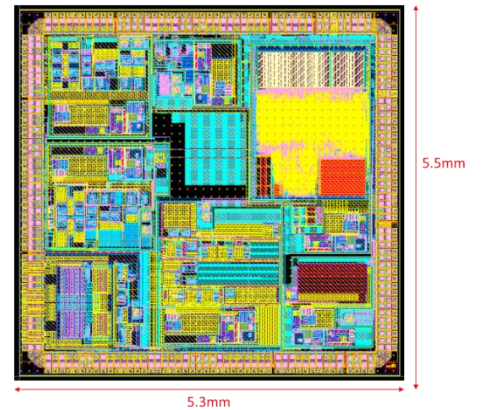




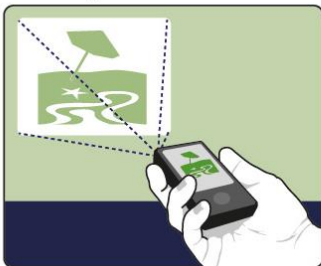
Features

- Both Electro-magnetic and Electro-static actuators drivers
- 2D (Vertical and horizontal) capacitance sensing
- Programmable Gain and BW for sensing and control circuitry
- Capacitance calibration for sensors
- Current actuation of up to 500mA with 13bit resolution
- Horizontal control based on MEMS resonance with analog PII
- Programmable phase and duty cycle for PLL
- Programmable number of scan lines 480-734
- Programmable number of retrace lines 1-128
- Field Rate: 60Hz
- Support interlace/non-interlace modes
- Option to input external control signals for Vertical and Horizontal loops
- Timing generator to control RGB module
- SPI interface with external Host
- 3.3v supply with on-chip voltage regulators for analog circuitry
- Eye Safety Alarm
- DFT
- 5.5mmx5.3mm Die size
- 35 functional pins
- 0.18 μ m HV TowerJazz CMOS



Applications

Pico Projectors



Automotive HUD



Gesture Sensing



Eyewear Displays



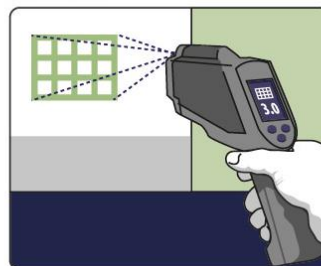
Large Displays



Medical



Industrial



More to emerge...



General Description

The MAR2100 is Driver and control IC for Maradin's MAR1100 dual-axis MEMS based scanning mirror. MAR2100 is targeted for miniature laser projectors and laser steering applications. A general block diagram of MAR2100 is depicted in the following figure.

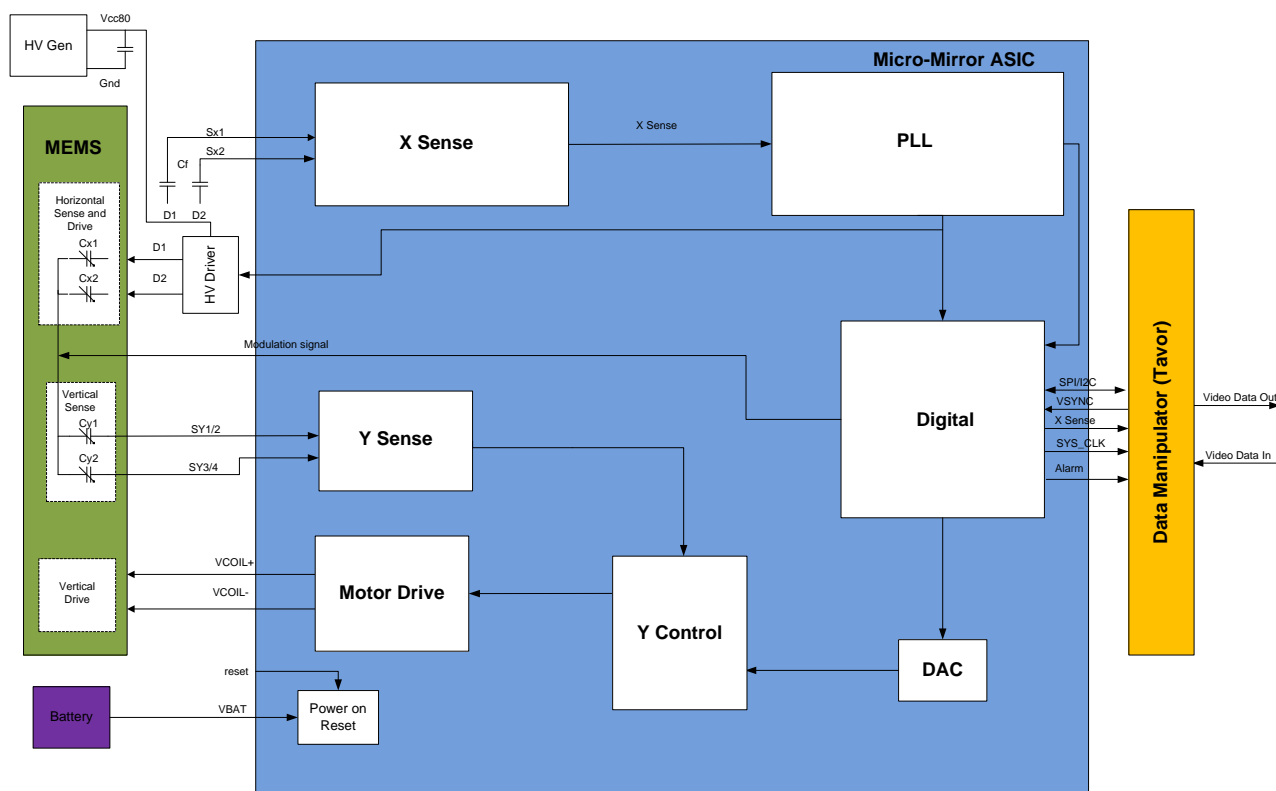


Figure 1 - ASIC Block Diagram

MAR2100 drives and controls Maradin's MAR1100 dual axis scanning mirror and generates the timing signals to synchronize the laser module through the Host, also called as Data Manipulator. As MAR1100 scanner has two uncoupled actuators – one for horizontal scan and one for vertical scan, MAR2100 controller IC supports both drivers.

The horizontal electro-static scan also provides the capacitance change when the angular position of the mirror changes around the x-axis. This capacitance value is converted to voltage by X sense that serves as the reference clock for the PLL. The PLL locks to the MEMS mirror resonance frequency and outputs a 155MHz clock signal which is used for generating timing signals providing a sub-pixel, up to 1/5-pixel resolution control. The programmability of phase allows locking to the MEMS resonance frequency. The MEMS mirror is driven by high voltage (up 120V, generated externally) to achieve large enough deflection angle, supporting HD resolutions.

The Digital block of the MAR2100 contains nonvolatile memory (NVM) that stores the position of the vertical lines, this data is converted to an analog signal using a high resolution digital-to-analog converter (DAC). The output of the DAC is used as a position reference signal in the vertical position control loop (Y control). The position control loop generates the control voltage which is used by the high current driver to actuate the micro-motor in the vertical MEMS. The angular position of the mirror is sensed by measuring the capacitance of y-axis capacitive sensor.

The ASIC communication with the Host is through a standard SPI interface.



System Block Diagram

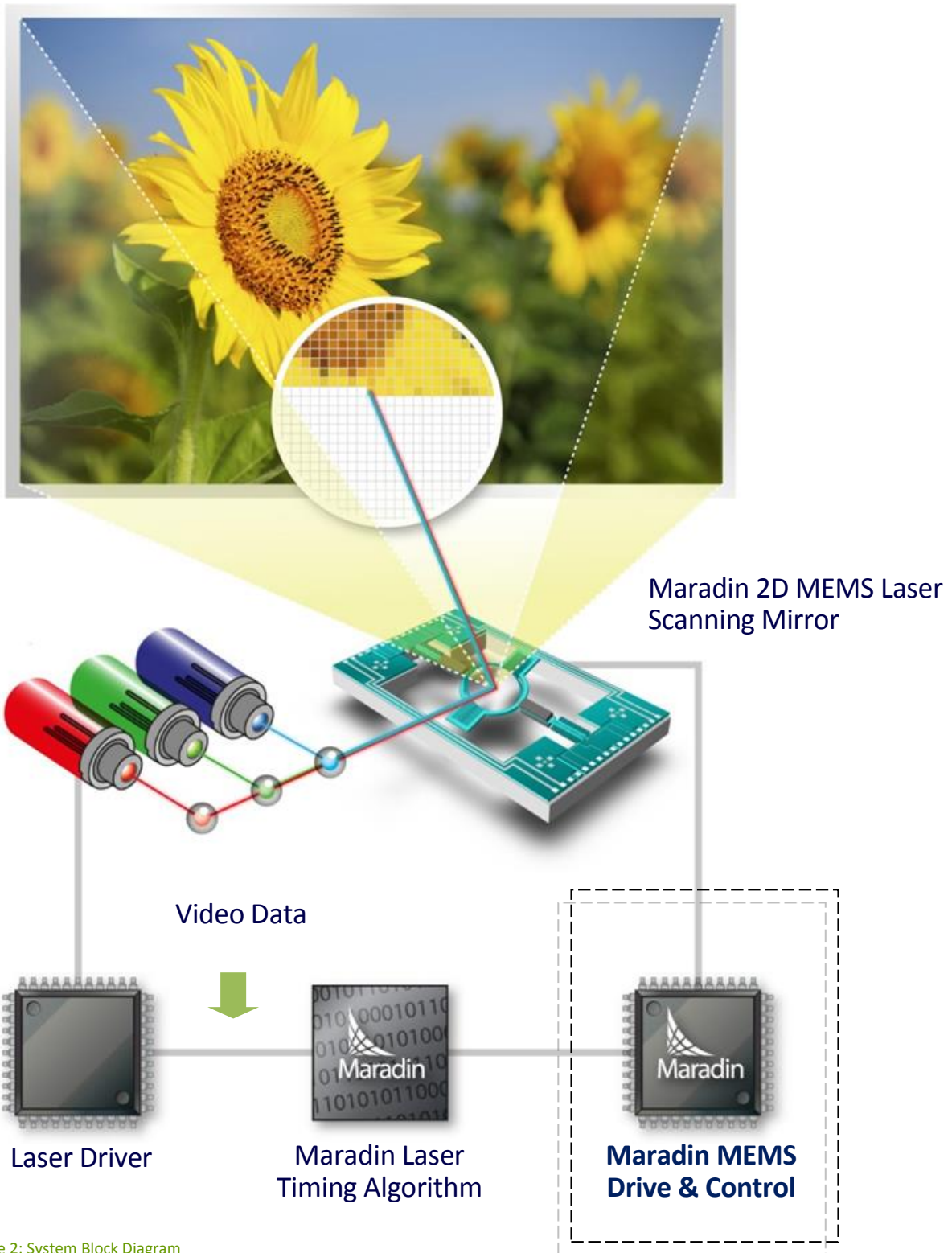


Figure 2: System Block Diagram



Electrical and Optical Characteristics

	Parameter	Min	Typical Value	Max	Unit	Remarks
General	Resolution (HxV)	1x480	854x600	1280x734	Pixel	
	Pixel position error		±1/5		Pixel	Both vertical and Horizontal
	Resonant frequency (H)	10000	10250	10500	Hz	
	Resonant frequency (V)	1600	1800	2000	Hz	
	Optical angle (H x V)		36x27	45x30	Deg.	HFOV x VHOV
	Alarm	5		15	KHz	For X movement
	Power		0.5		W	
PLL	Supply Voltage		1.8V			Regulated Supply
	Input clock Frequency	6	10.25	30	KHz	MEMS frequency
	VCO Frequency	145	155	165	MHz	
	Settling time	3	5	7	mS	
	Programmable Counter	1008	3040	5104		
	Output Duty Cycle	0.62	15%	100%		
	Output Phase Adjustment	-1080	27	360	deg	
	Jitter		2		nS	
X Sense	Supply Voltage		1.8V			Regulated Supply
	X-MEMS Capacitance					
	Actuating Voltage					
	Gain	11		500		
	BW	100	150		KHz	
	Jitter		6.5		nS	1/8 of a pixel
Y Sense	Supply Voltage		1.8V			Regulated Supply
	Y-MEMS Capacitance	0		1.2	pF	
	Gain	50		600		
	BW		400		KHz	
	Output Noise		500		uV	Integration range DC to 0.5MHz
DAC	Supply Voltage		1.8V			Regulated Supply
	Resolution		13		Bit	
	INL			1	LSB	
	DNL			1	LSB	
	Rise Time		3		uS	
Y Drive	Supply Voltage	3	3.3	3.6	V	
	Maximum Driving current	440	480	500	mA	
Power Manage	Input Supply Voltage	3	3.3	3.6	V	
	Output Supply Voltage	1.75	1.8	1.85	V	
	Line and Load Regulation			95	%	



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