

UNITYOPTO

MCS-12086

Data Sheet

Description

The MCS-12086 is a mainstream, small form factor optical mouse sensor. It is used to implement a non mechanical tracking engine for computer mice.

It is based on optical navigation technology, which measures changes in position by optically acquiring sequential surface images (frames) and mathematically determining the direction and magnitude of movement.

The sensor is housed in an 8-pin staggered dual inline package (DIP). There are no moving parts, so precision optical alignment is not required, thereby facilitating high volume assembly.

The output format is a two wire serial port. The current X and Y information are available in registers accessed via the serial port.

The MCS-12086 is capable of high-speed motion detection – up to 30ips and 8g. In addition, it has an on-chip oscillator and built-in LED driver to minimize external components. Frame rate is also adjusted internally.

Theory of Operation

The MCS-12086 is based on Optical Navigation Technology, which measures changes in position by optically acquiring sequential surface images (frames) and mathematically determining the direction and magnitude of movement.

The MCS-12086 contains an Image Acquisition System (IAS), a Digital Signal Processor (DSP), and a two wire serial port.

The IAS acquires microscopic surface images via the lens and illumination system. These images are processed by the DSP to determine the direction and distance of motion. The DSP calculates the Δx and Δy relative displacement values.

An external microcontroller reads the Δx and Δy information from the sensor serial port. The microcontroller then translates the data into PS2 or USB signals before sending them to the host PC.

Features

- Small form factor, pin-to-pin compatible with MCS-12085
- Register-to-register compatible with MCS-12085
- Built-in LED driver for simpler circuitry
- High speed motion detection up to 30 ips and 8g
- Self-adjusting frame rate for optimum performance
- Internal oscillator – no clock input needed
- Default 1050 cpi resolution, adjustable from 150 to 1350 cpi via 150 cpi step
- Operating voltage: 5V nominal
- Two-wire serial interface
- 3 capacitors, 3 resistors and 1 transistor required for Schematic A
- Only 3 capacitors are required for Schematic B



Applications

- Optical Mice
- Optical trackballs
- Integrated input devices

Pinout of MCS-12086 Optical Mouse Sensor

Pinout	Name	Description	I/O type
1	NCS	No Connect	
2	NC	No Connect	
3	SDIO	Serial Port Data	I/O
4	SCLK	Serial Port Clock	I
5	XY_LED	Digital Shutter Signal Out	O
6	GND	System Ground	Ground
7	VDD5	5V DC Input	Power
8	REGO	Regulator Output	O

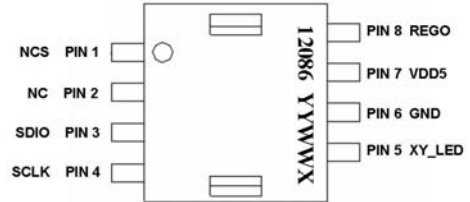


Fig 1. Package outline drawing (top view)

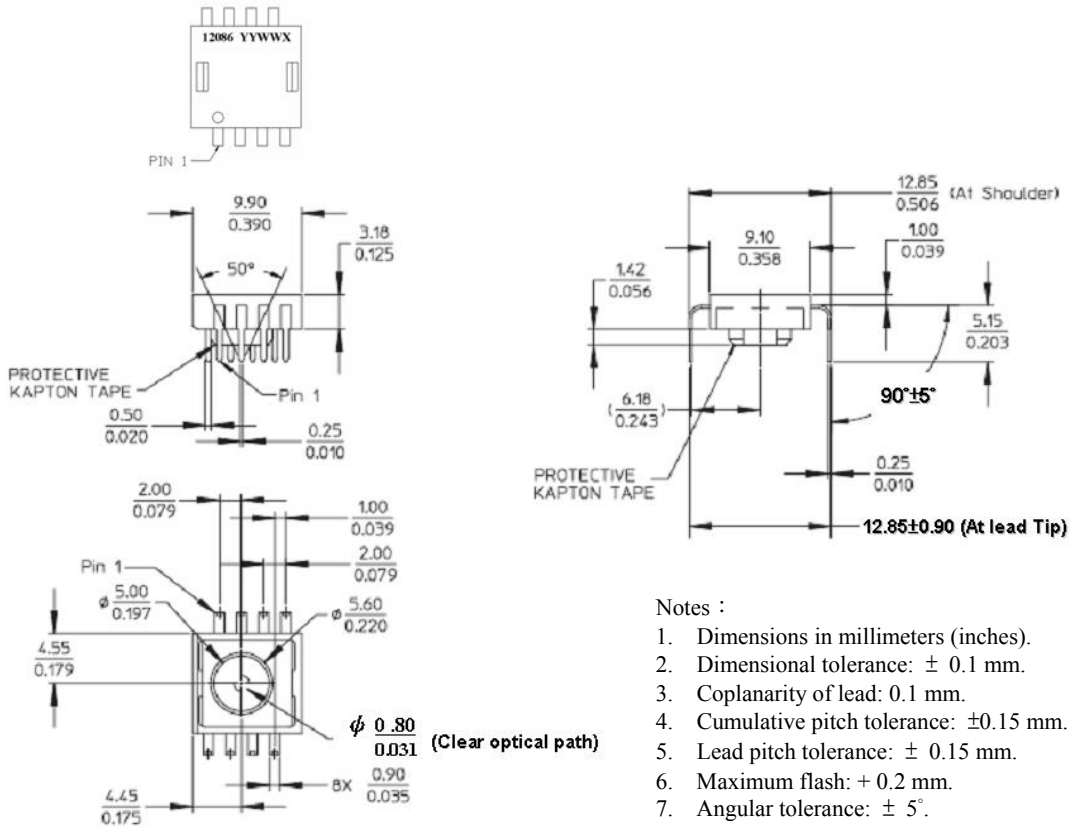


Fig 2. Package outline drawing

CAUTION:

It is advised that normal static precautions should be taken in the handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.

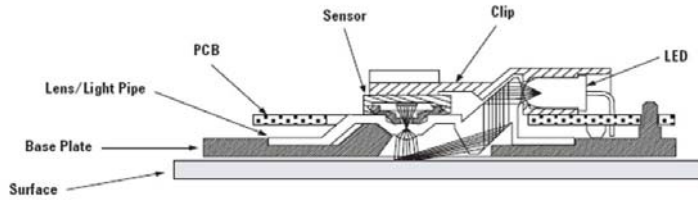


Fig 3. Sectional view of PCB assembly highlighting optical mouse components (optical mouse sensor, clip, lens, LED, PCB and base plate).

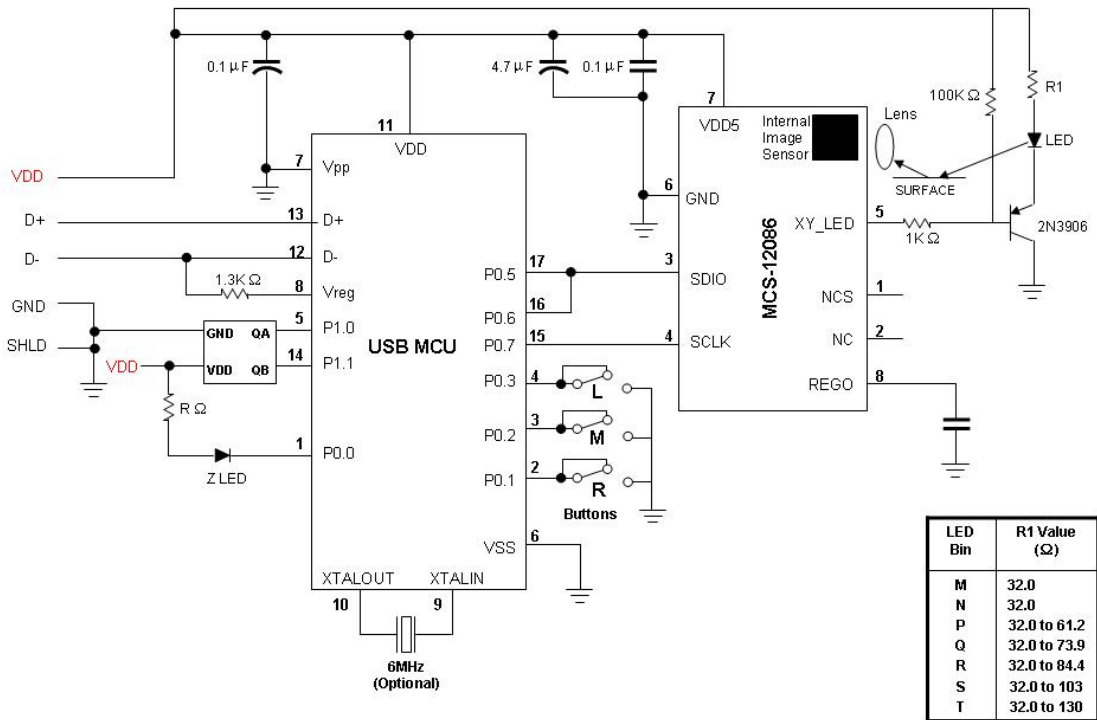


Fig 4a. Schematic Diagram for Interface between MCS-12086 and Microcontroller.(compatible with MCS-12085)

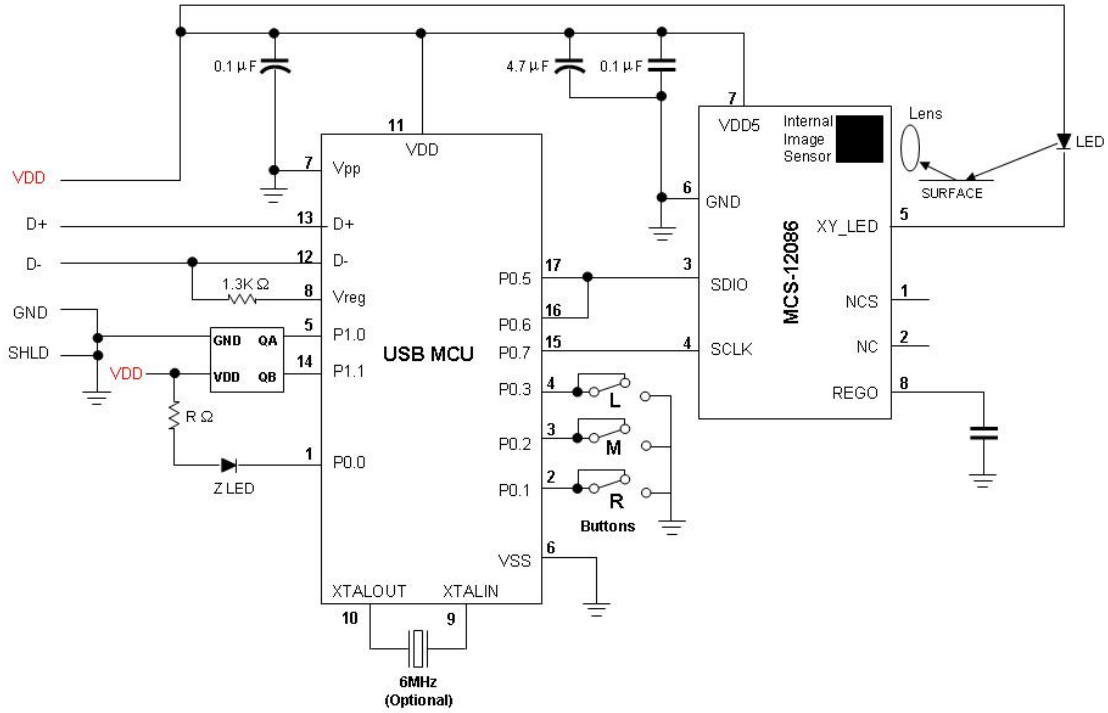


Fig 4b. Schematic Diagram for Interface between MCS-12086 and Microcontroller.(Simplified version)

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units	Notes
Storage Temperature	T_S	-40	85	C	
Operating Temperature	T_A	-15	55	C	
Lead Solder Temp			260	C	For 10 seconds, 1.6 mm below seating plane.
Supply Voltage	V_{DD}	-0.5	5.5	V	
ESD			2	kV	All pins, human body model MIL 883 Method 3015
Input Voltage	V_{IN}	-0.5	$V_{DD}+0.5$	V	SDIO, CLK, LED_CNTL
Input Voltage	V_{IN}	-0.5	3.6	V	REGO

Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Operating Temperature	T_A	0		40	C	
Power Supply Voltage	V_{DD}	4.1	5.0	5.5	V	Register values related for voltage transients below 4.10V but greater than 3.9V
Power Supply Rise Time	V_{RT}			100	ms	
Supply Noise	V_N			100	mV	Peak to peak within 0-100 MHz bandwidth
Serial Port Clock Frequency	SCLK			2	MHz	
Resonator Impedance	X_{RES}			55	Ω	
Distance from Lens Reference plane to Surface	Z	2.3	2.4	2.5	mm	Results in ± 0.2 mm DOF
Speed	S			30	ips	
Acceleration	A			8	g	
Light Level onto IC	IRR_{INC}	80		25,000 30,000	mW/m^2	$\lambda = 639$ nm $\lambda = 875$ nm
SDIO Read Hold Time	t_{HOLD}	100			us	Hold time for valid data
SDIO Serial Write-write Time	t_{SWW}	100			us	Time between two write commands
SDIO Serial Write-read Time	t_{SWR}	100			us	Time between write and read operation
SDIO Serial Read-write Time	t_{SRW}	250			ns	Time between read and write operation
SDIO Serial Read-read Time	t_{SRR}	250			ns	Time between two read commands
Data Delay after PD deactivated	$t_{COMPUTE}$	3.1			ms	After $t_{COMPUTE}$, all registers contain data from first image after wakeup from Power-Down mode. Note that an additional 75 frames for AGC stabilization may be required if mouse movement occurred while power down.
SDIO Write Setup Time	t_{SETUP}	60			ns	Data valid time before the rising of SCLK.

AC Electrical Specifications

Electrical Characteristics over recommended operating conditions. Typical values at 25°C, V_{DD} = 5 V

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Power Down (PD)	t _{PD}	1.33			μs	32 clock cycle minimum after setting bit 6 in the Configuration register
Power Up after PD mode deactivated	t _{PUPD}			50	ms	From PD mode deactivation to accurate reports 610 μs + 75 frames
Power Up from VDD	t _{PU}			40	ms	From V _{DD} to valid accurate reports 610 μs + 50 frames
Rise and Fall Times SDIO	t _r		30		ns	C _L = 30 pF (the rise time is between 10% to 90%)
	t _f		16		ns	C _L = 30 pF (the fall time is between 10% to 90%)
Serial Port Transaction Timer	t _{SPTT}		90		ms	Serial port will reset if current transaction is not complete within t _{SPTT}
Transient Supply Current	I _{DDT}		TBD	TBD	mA	Max supply current during a V _{DD} ramp from 0 to 5.0V with > 500 μs rise time. Does not include charging current for bypass capacitors.

Preliminary