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## PMW3610DM-SUDU

### Low Power Laser Mouse Sensor

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#### Data Sheet



Lead (Pb) Free  
RoHS 6 fully  
compliant



#### Description

The PMW3610DM-SUDU integrated molded lead-frame DIP laser sensor comprises of sensor and VCSEL in a single package. PMW3610DM-SUDU provides enhanced features such as programmable resolution, configurable sleep and wake up time to suit various wireless optical navigation applications.

The advanced class of VCSEL was engineered by PixArt to provide a laser diode with a single longitudinal and a single transverse mode.

The laser sensor is packaged into a 16-pin integrated molded lead-frame (DIP) package. It is designed to be used with LM18-LSI lens to achieve the optimum performance. Together these parts provide a complete and compact navigation system without moving parts. Laser calibration process is NOT required; it is pre-calibrated at sensor level which helps to facilitate high volume assembly.

#### Theory of Operation

The sensor is based on PixArt Laser Technology, which measures changes in position by optically acquiring sequential surface images (frames) and mathematically determines the direction and magnitude of movement. It contains an Image Acquisition System (IAS), a Digital Signal Processor (DSP), and a three 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  $\Delta x$  and  $\Delta y$  relative displacement values. An external microcontroller reads the  $\Delta x$  and  $\Delta y$  information from the sensor serial port. The microcontroller then translates the data into USB or RF signals before sending them to the host PC or game console.

#### Features

- Small form factor molded lead frame 16-pin DIP package
- Single low operating voltage: 1.7 – 2.1V
- 12-bits motion data registers
- High speed motion detection up to 30ips and acceleration up to 10g
- Advanced technology 832-865nm wavelength VCSEL (single mode)
- Pre-calibrated laser power
- Compliance to IEC/EN 60825-1 Eye Safety
  - Class 1 laser power output level
  - On-chip laser fault detection circuitry
- Motion detect pin output
- Internal oscillator – no clock input needed
- Built-in laser control MOSFET
- 3-wire SPI communication with NRESET
- Improved dust robustness
- Enhanced Programmability
  - Resolution up to 3200 cpi with 200 cpi step
  - Downshift and wake up time
  - Sensor orientation

#### Applications

- Laser mice
- Optical trackballs
- Motion input devices

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Pin out of PMW3610DM-SUDU Optical Mouse Sensor

Pin	Name	IN/OUT /PWR	Description
1	+VCSEL	IN	Positive terminal of VCSEL
2	SDIO	IN/OUT	Serial data input/output
3	SCLK	IN	Serial clock input
4	NC	-	-
5	NCS	IN	Chip select
6	VDDIO	IN	IO voltage input
7	NRESET	IN	Reset (Active low)
8	MOTION	OUT	Motion detect (Active low)
9	VCP	PWR	Internal PMOSFET source
10	PASS_T	PWR	Internal PMOSFET drain (to connect to +ve VCSEL)
11	GND	IN	Ground
12	CP	PWR	Charge pump capacitor +ve terminal
13	CN	PWR	Charge pump capacitor -ve terminal
14	VDD	IN	1.8V supply input
15	XYLASER	IN	XYLASER (Connect to -ve VCSEL)
16	-VCSEL	IN	Negative terminal of VCSEL

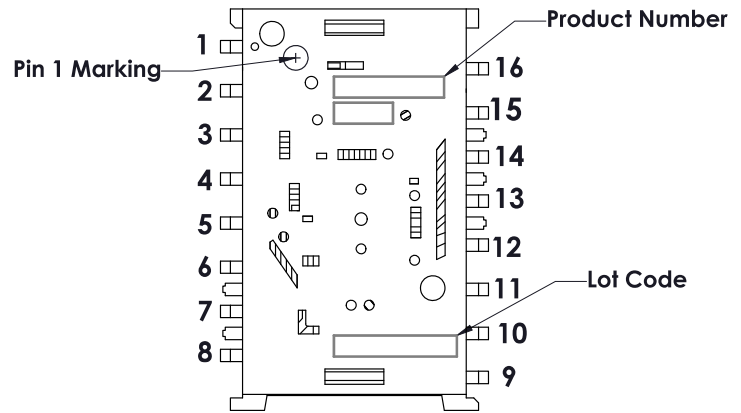


Figure 1. Package Pin out

Item	Marking	Remark
Part Number	PMW3610DM- SUDU	
Lot Code	AYWWXXXXX	A – Assy house Y – Year WW – Week XXXXX – PixArt reference

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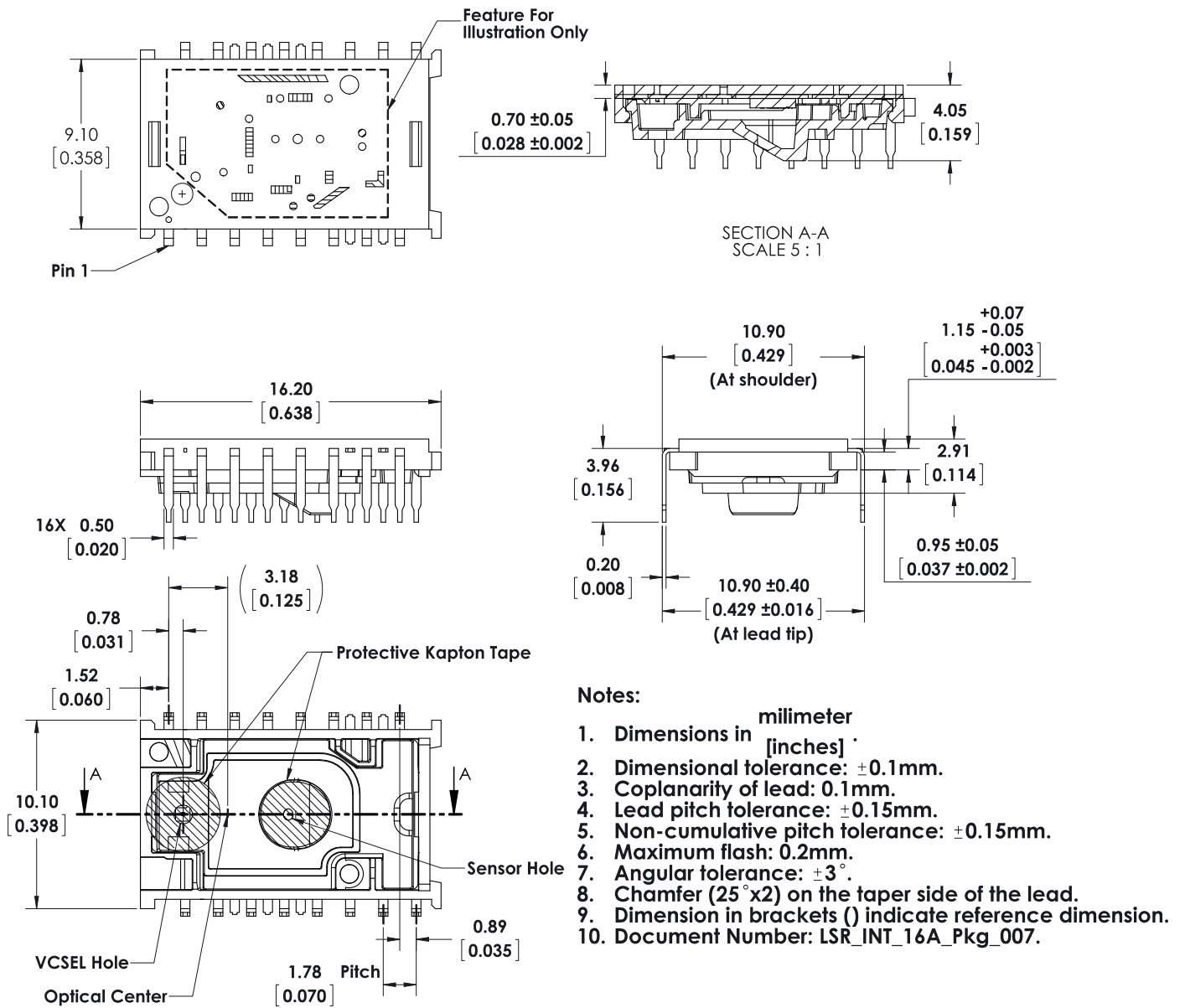


Figure 2 . Package outline drawing

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

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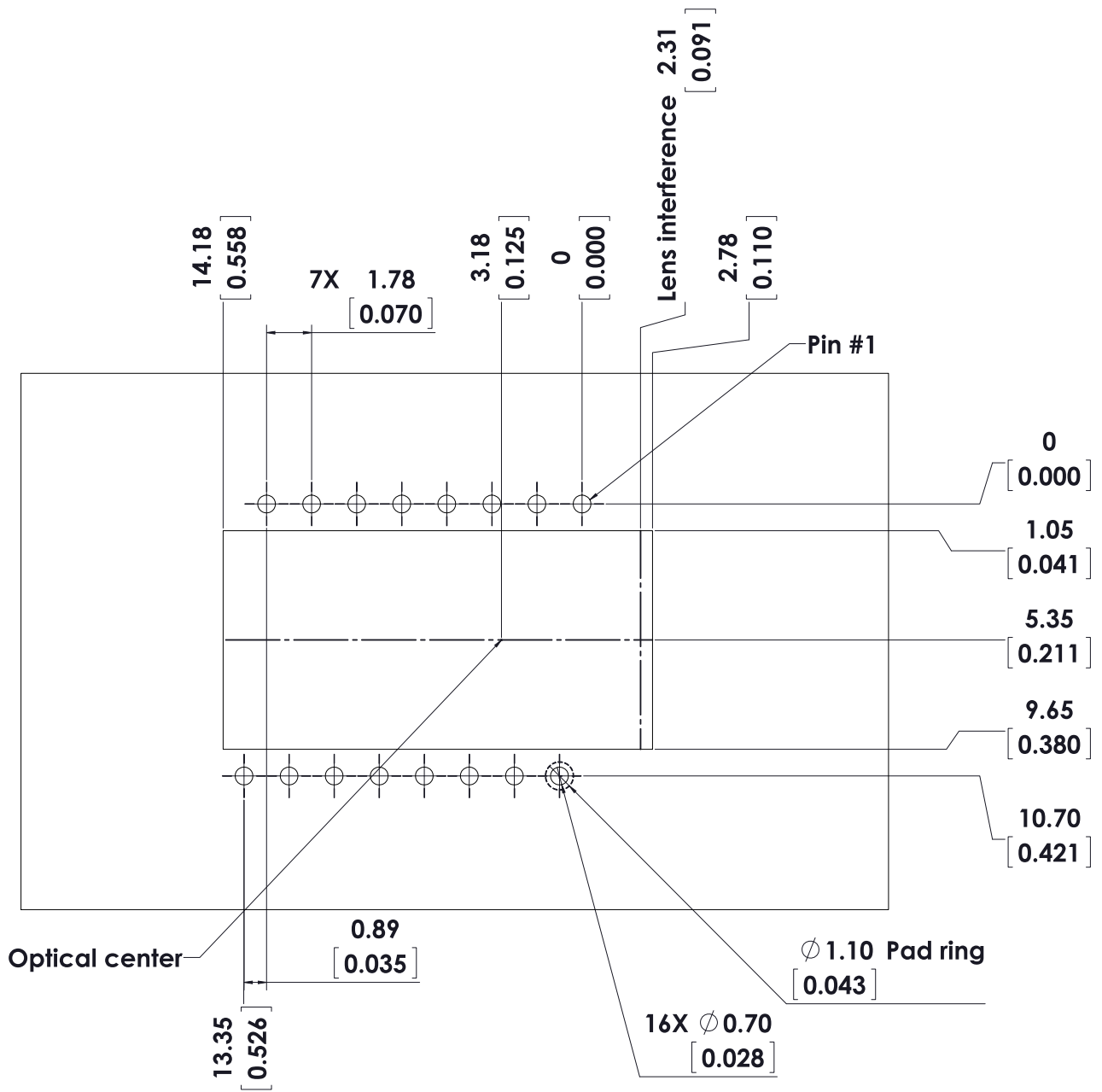


Figure 5. Recommended PCB mechanical cutouts and spacing

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## Application circuits

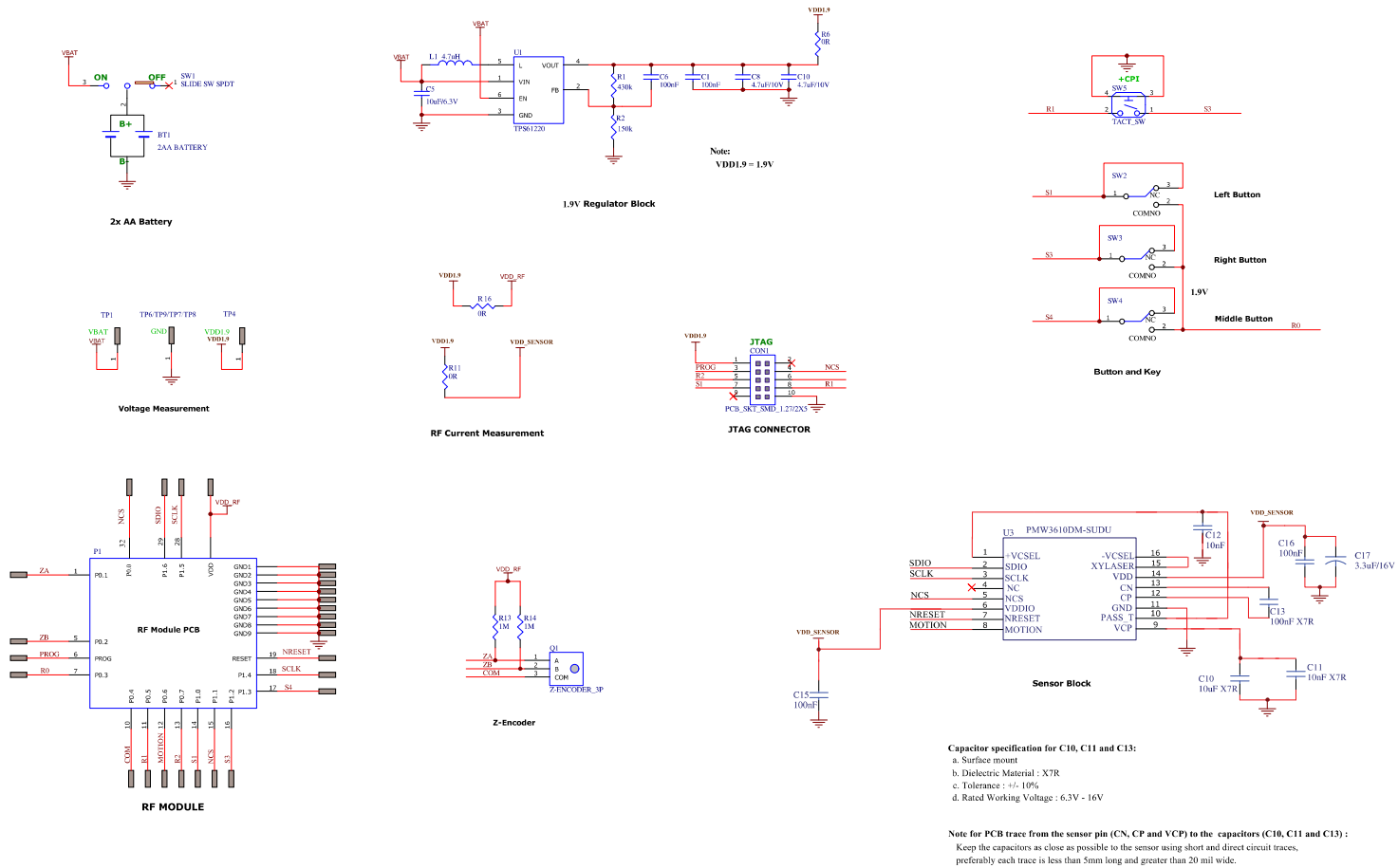


Figure 6. Schematic Diagram

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**Low Power Laser Mouse Sensor**


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**Table 1. Absolute Maximum Ratings**

Parameter	Symbol	Min.	Max.	Units	Notes
Storage Temperature	$T_S$	-40	85	C	
Lead-Free Solder Temperature			260	C	For 7 seconds, 1.8mm below seating plane. Refer to wave soldering profile in PCB Assembly & Soldering Considerations Application Note AN-5023.
Power Supply Voltage	$V_{DD}$	-0.5	2.2	Volts	
	$V_{DDIO}$	-0.5	3.4	Volts	
ESD (Human Body Model)	ESD		2	kV	All Pins
Input Voltage	$V_{IN}$	-0.5	$V_{DDIO} + 0.5$	Volts	All I/O Pins
Laser Output Power	$LOP_{MAX}$		716	$\mu W$	Class 1 Eye Safety AEL limit
VCSEL forward current	$I_f$		3.3	mA	

**Notes:**

1. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are the stress ratings only and functional operation of the device at these or any other condition beyond those indicated for extended period of time may affect device reliability.
2. The maximum ratings do not reflect eye-safe operation.
3. The inherent design of this component causes it to be sensitive to electrostatic discharge. The ESD threshold is listed above. To prevent ESD induced damage, take adequate ESD precautions when handling this product

**Table 2. Recommended Operating Conditions**

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Operating Temperature	$T_A$	0		40	$^{\circ}C$	
Power supply voltage	$V_{DD}$	1.7	1.8	2.1	Volts	Including $V_{NA}$ of 100mV <sub>pp</sub>
	$V_{DDIO}$	1.7	1.8	3.3		Including $V_{NA}$ of 100mV <sub>pp</sub>
Power supply rise time	$t_{RT}$	1			ms	0 to VDD
Supply noise (Sinusoidal)	$V_{NA}$			150	mV <sub>p-p</sub>	10kHz-50MHz
Serial Port Clock Frequency	$f_{SCLK}$			2	MHz	Active drive, 50% duty cycle
Distance from lens reference plane to surface	Z	2.2	2.4	2.6	mm	Results in +/- 0.2 mm minimum DOF.
Speed	S		24	30	in/sec	30 ips with certain surface
Acceleration	A		10		g	
Load Capacitance	$C_{out}$			100	pF	SDIO and MOTION
Peak Wavelength	$\lambda$	832		865	nm	

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**DC Electrical Specifications****Table 4. Electrical Characteristics over recommended operating conditions. Typical values at 25 °C, VDD= 1.8V.**

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
DC supply Current in various modes	I <sub>DD_RUN</sub>		0.60		mA	
	I <sub>DD_Rest1</sub>		36		uA	Average current, including LASER current. No load on SDIO
	I <sub>DD_Rest2</sub>		16		uA	
	I <sub>DD_Rest3</sub>		7		uA	
Shutdown Supply Current		3		uA		
Input Low Voltage	V <sub>IL</sub>			0.2*VDDIO	V	SCLK, SDIO
Input High Voltage	V <sub>IH</sub>	0.8*VDDIO			V	SCLK, SDIO
Input Hysteresis	V <sub>I,HYS</sub>		100		mV	SCLK, SDIO
Input Leakage Current	I <sub>leak</sub>		±1	±10	uA	Vin = 0.7*VDDIO, SCLK, SDIO
Laser Current (fault mode)	I <sub>LAS_FAULT</sub>			300	uA	XY_LASER R <sub>leakage</sub> < 75kOhms to Gnd
Output Low Voltage, SDIO, MOTION	V <sub>OL</sub>			0.2*VDDIO	V	I <sub>out</sub> = 1mA(typical test condition), SDIO, MOTION
Output High Voltage, SDIO, MOTION	V <sub>OH</sub>	0.8*VDDIO			V	I <sub>out</sub> = -1mA(typical test condition), SDIO, MOTION
Input Capacitance	C <sub>in</sub>			10	pF	SCLK, SDIO

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**Registers**

The PMW3610DM-SUDU registers are accessible via the serial port. The registers are used to read motion data and status as well as to set the device configuration.

Address	Register	Read/Write	Default Value
0x00	PROD_ID	R	0x3e
0x01	REV_ID	R	0x01
0x02	MOTION	R/W	0x09
0x03	DELTA_X_L	R	0x00
0x04	DELTA_Y_L	R	0x00
0x05	DELTA_XY_H	R	0x00
0x06	SQUAL	R	0x00
0x07	SHUTTER_HIGHER	R/W	0x00
0x08	SHUTTER_LOWER	R/W	0x22
0x09	PIX_MAX	R	0x60
0x0a	PIX_AVG	R	0x4f
0x0b	PIX_MIN	R	0x7f
0x0c	CRC0	R	0x00
0x0d	CRC1	R	0x00
0x0e	CRC2	R	0x00
0x0f	CRC3	R	0x00
0x10	SELF_TEST	W	0x00
0x11	PERFORMANCE	R/W	0x01
0x12	BURST_READ	R/W	0x0b
0x13 - 0x1a	RESERVED		
0x1b	RUN_DOWNSHIFT	R/W	0x02
0x1c	REST1_RATE	R/W	0x04
0x1d	REST1_DOWNSHIFT	R/W	0x1f
0x1e	REST2_RATE	R/W	0x0a
0x1f	REST2_DOWNSHIFT	R/W	0x2f
0x20	REST3_RATE	R/W	0x32
0x21 - 0x2c	RESERVED		
0x2d	OBSERVATION1	R/W	0x00
0x2e - 0x31	RESERVED		
0x32	DTEST2_PAD	R/W	0x00
0x33 - 0x34	RESERVED		
0x35	PIXEL_GRAB	R/W	0x00
0x36	FRAME_GRAB	R/W	0x00
0x37 - 0x39	RESERVED		
0x3a	POWER_UP_RESET	W	NA
0x3b	SHUTDOWN	W	NA
0x3c - 0x3d	RESERVED		
0x3e	NOT_REV_ID	R	0xfe
0x3f	NOT_PROD_ID	R	0xc1
0x40	RESERVED		
0x41	SPI_CLK_ON_REQ	W	NA
0x42 - 0x46	RESERVED		
0x47	PRBS_TEST_CTL	RW	0x00
0x48 - 0x7e	RESERVED		
0x7f	SPI_PAGE0	RW	0x00
0x80-0x84	RESERVED		
0x85	RES_STEP	RW	0x86
0x86 - 0x9d	RESERVED		
0x9e	VCSEL_CTL	R/W	0x00
0x9f	LSR_CONTROL	R/W	0x00
0xa0 - 0xfe	RESERVED		
0xff	SPI_PAGE1	RW	0x00

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