

PAJ7025R2: Multiple Objects Tracking Sensor Module

Ordering Information

Part Number	Package Type
PAJ7025R2	Module-20pins



Lead (Pb) Free
RoHS 6 fully
compliant



For any additional inquiries, please contact us at <http://www.pixart.com/contact.asp>

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1.0 General Description

1.1 Introduction

PAJ7025 is a multiple objects tracking (MOT) sensor which integrates a high quality CMOS image sensor, image processing DSP and SPI™ protocol.

As the figure below depicts, PAJ7025 captures grey image by built-in sensor and analyzes objects with PixArt image processing DSP. Object features including object area, object center coordinate, 4-way object boundary, average/maximum object brightness, object radius, object range, and aspect ratio are accessible through SPI™ interface.

In the application environment the moving object(s) could have active IR light source or passive IR reflector.

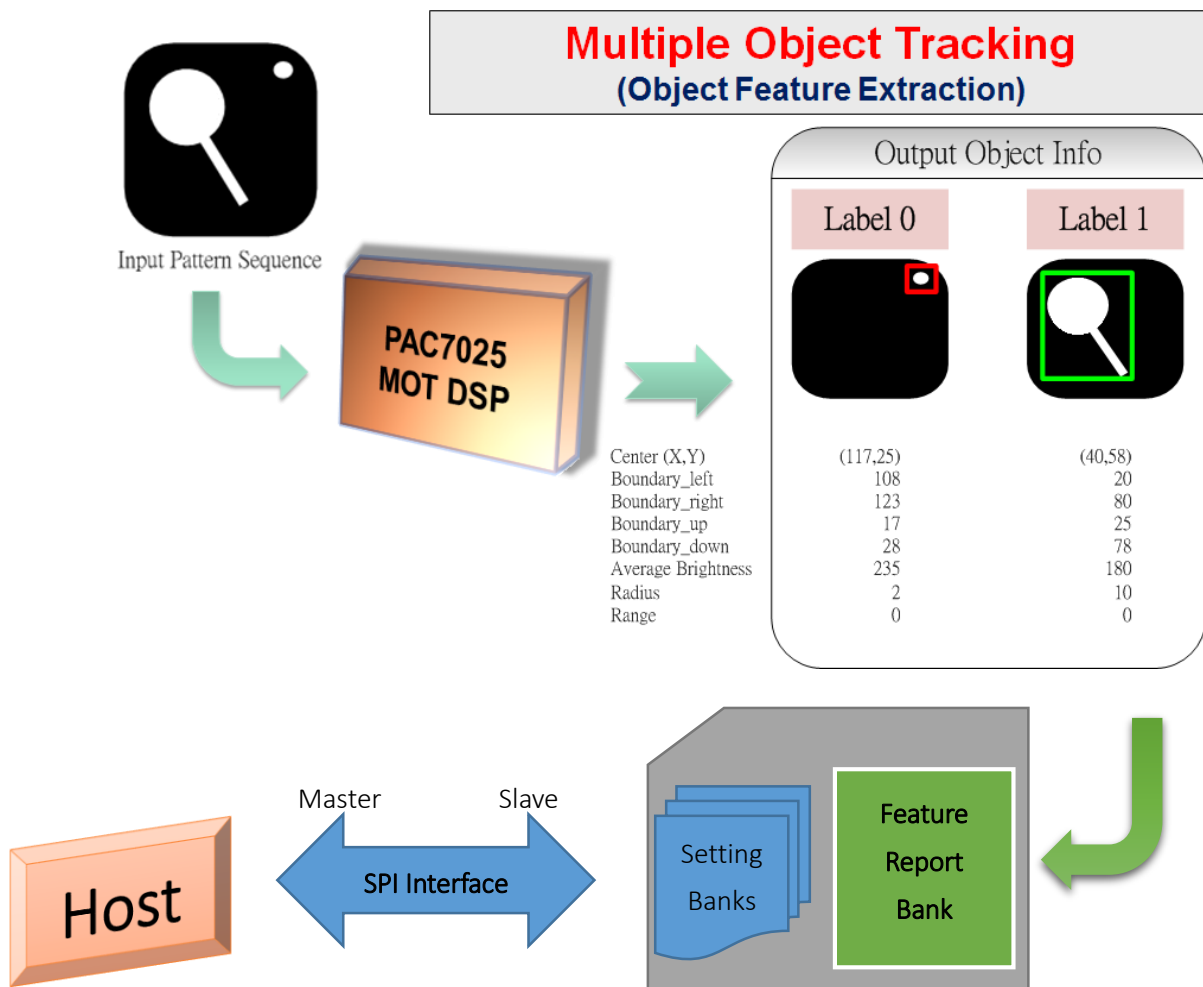


Figure 1. System Blocks

1.2 Block Diagram

PAJ7025 Block Diagram

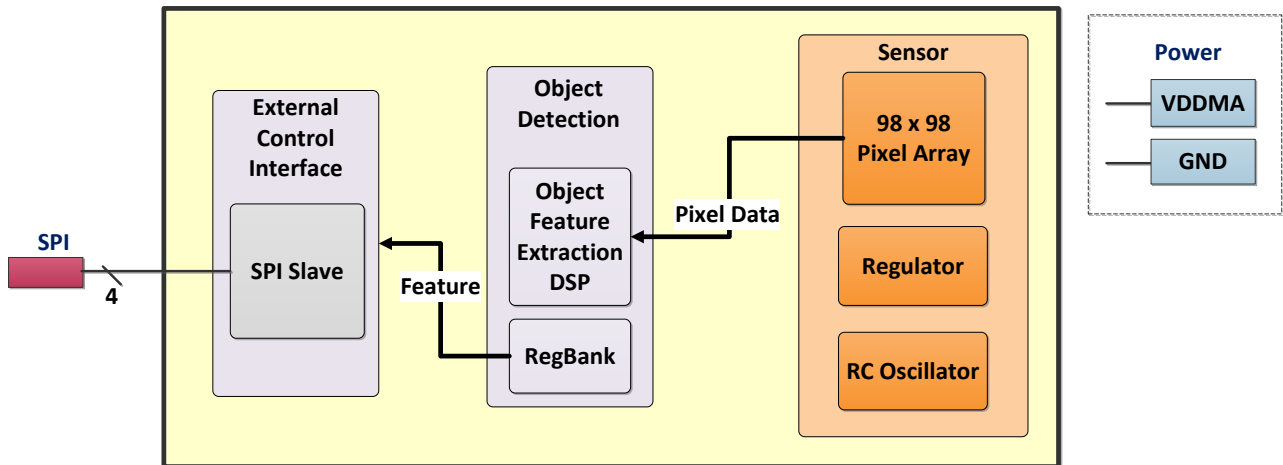


Figure 2. Sensor Architecture Blocks Diagram

1.3 Features

- Sensor color type: black and white
- Pixel size: 11um * 11um
- Number of array elements: 98 * 98
- Pixel depth: 8 bits
- Scan mode: progressive
- Shutter Type: Global Shutter
- Programmable object center coordinate resolution: up to 4095*4095
- Object number: up to 16
- System clock: 10MHz±3% @25°C (internal clock)
- Interface: SPI™ with speed: up to 14Mhz (bits/sec)
- Programmable frame rate control: 10fps~200fps.
- Programmable Gain setting: 1X~8X
- Programmable exposure time.
- Object features: Object center coordinate, object area, object boundary, object brightness etc
- Two modes for power management
- Normal mode and Power down mode.
- Main Power supply and IO voltage: VDDMA&VDDIO: 2.0~3.6V
- Package Module-20pins

1.4 Pin Description

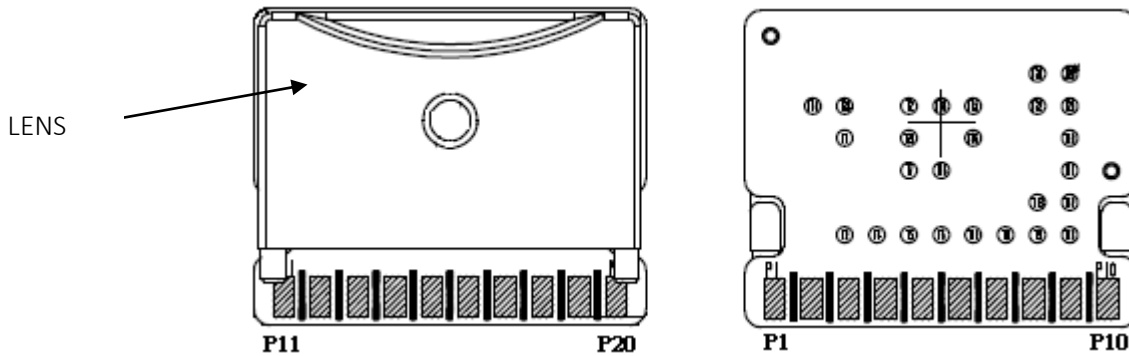


Figure 3. Module Pinout Configuration

Table 1. Pin Signal Description

Pin No.	Name	Type	Definition
1	G0	I/O	KEY scan function. Please leave it as floating.
2	G1	I/O	KEY scan function. Please leave it as floating.
3	G2	I/O	KEY scan function. Please leave it as floating.
4	G3	I/O	KEY scan function. Please leave it as floating.
5	G4	I/O	KEY scan function. Please leave it as floating.
6	G5	I/O	KEY scan function. Please leave it as floating.
7	G6	I/O	KEY scan function. Please leave it as floating.
8	G7	I/O	KEY scan function. Please leave it as floating.
9	G8	OUT	KEY scan function. Please leave it as floating.
10	G9/CSB	I/O	SPI Chip Select pin, active low.
11	G10/SCK	I/O	SCK: Serial Communications Clock for SPI.
12	G11/MISO	I/O	MISO: Serial Data Output.
13	G12/MOSI	I/O	MOSI: Serial Data Input pin.
14	VSSD	GND	This pin must be connected to ground.
15	CP_1	I/O	Reserved pin. Please leave it as floating.
16	CP_2	I	Reserved pin. Please leave it as floating.
17	VDDMA	PWR	Power supply (+2.0 Vdc~ +3.6 Vdc).
18	G14/LED_FRT	I/O	Reserved pin for IR LED Control
19	G13/LED_SIDE	I/O	Reserved pin for IR LED Control
20	VSSD_LED	GND	This pin must be connected to ground.

2.0 Mechanical Specifications

2.1 Mechanical Dimension

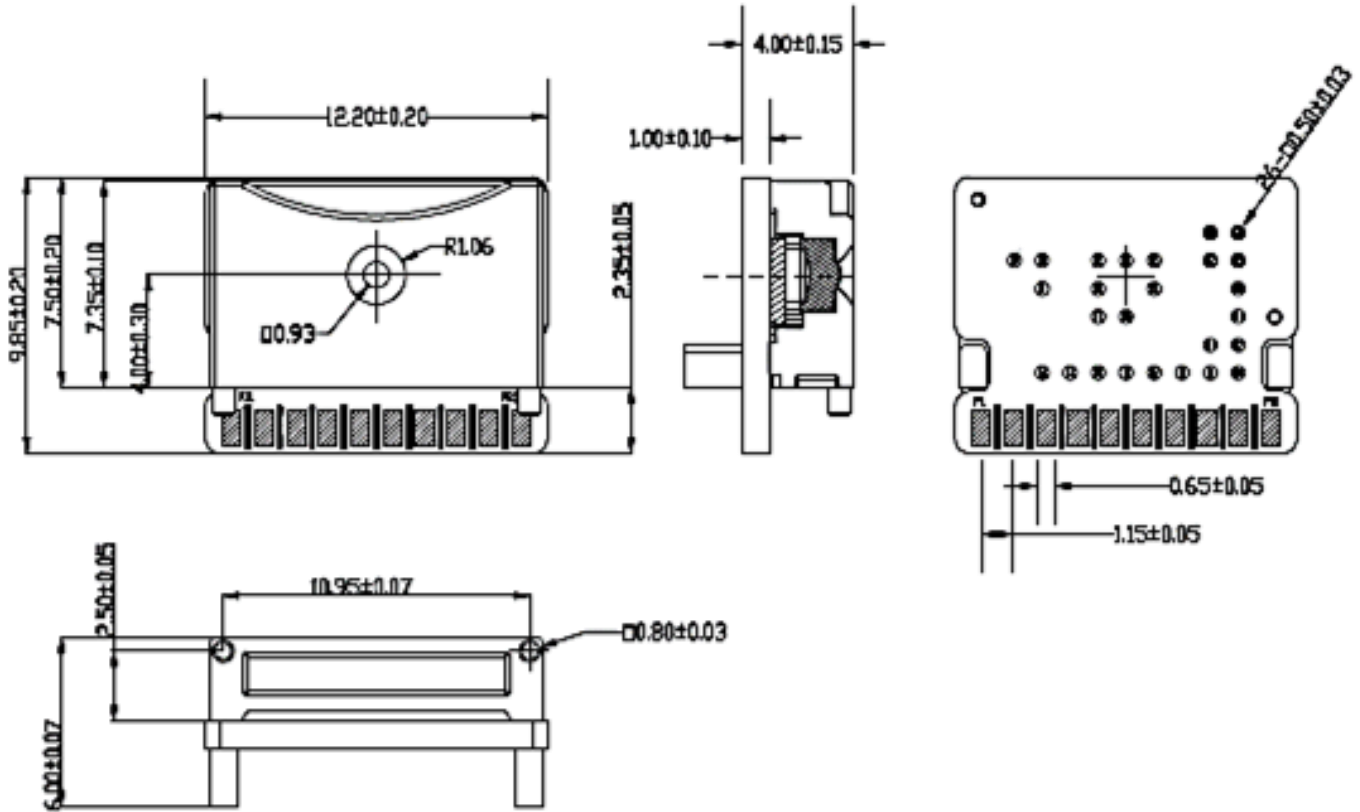


Figure 4. Module Outline Drawing

3.0 Operating Specifications

3.1 Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit	Notes
T _{STG}	Storage temperature	-25	125	°C	
T _A	Operating Temperature	0	40	°C	
T _{solder}	Lead Solder Temp	-	250	°C	Lead free
ESD	HBM (Human Body mode)	-	2000	V	
	MM (Machine mode)	-	200		
VDDMA	I/O power & Analog power DC External Power Input	-0.3	3.96	V	
V _{IN}	DC input voltage	-0.3	VDDMA+0.3	V	All I/O pin

Notes:

1. Maximum Ratings are those values beyond which damage to the device may occur.
2. Exposure to these conditions or beyond those indicated may adversely affect device reliability.
3. Functional operation under absolute maximum-rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

3.2 Recommend Operating Condition

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
T _A	Operating Temperature	0	-	40	°C	
VDDMA	I/O power & Analog power DC External Power Input	2.0	2.8	3.6	V	

3.3 Electrical Specifications

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
IDD	Supply Current	2	6	10	mA	Sensor on measurement @25°C, VDDMA=3.6V, 200 ±3% fps
	Power-down current	5	14	60	µA	@25°C, VDDMA=3.6V
VIH	Input High Voltage	0.7*VDDMA	-	-	V	
VIL	Input Low Voltage	-	-	0.3* VDDMA	V	
VOL	Output Low Voltage	-	-	0.1* VDDMA	V	Note2
VOH	Output High Voltage	0.9* VDDMA			V	Note2

Notes:

1. VDDMA= VDDI/O = 2.0~3.6V
2. All the GPIO maximum output current is 4mA, Capacitance load spec. =100pF @ maximum Frequency = 14Mhz±1.5%
3. IR-TX LED driving pin is 130~170mA.

3.4 Optical Specifications

Parameter		Specification	
Lens	Effective Focal Length	1.484307 mm	±5%
	Fno	1.838227 mm	±5%
	Image Circle	1.658 mm	
	Black Focal Length	0.975 mm	
	Distortion	<2.8%	
	Relative Illumination	>60%	
	Chief Ray Angle	15.5 °	
	Component	1P	
Sensor	Image Area	1.52 mm	
	Sensor Pixel Size	11µm*11µm	
	Sensor Pixel Resolution	90*90	
	Angle Field of View (2w)		
	Diagonal	Y = 1.52 mm or 52.2°	
	Vertical	Y = 1.07 mm or 38.3°	
	Horizontal	Y = 1.07 mm or 38.3°	
Dimension	Total Track	2.17 mm	

3.5 IR Filter on module

The module has coated an IR pass filter for IR application, the profile as below shown.

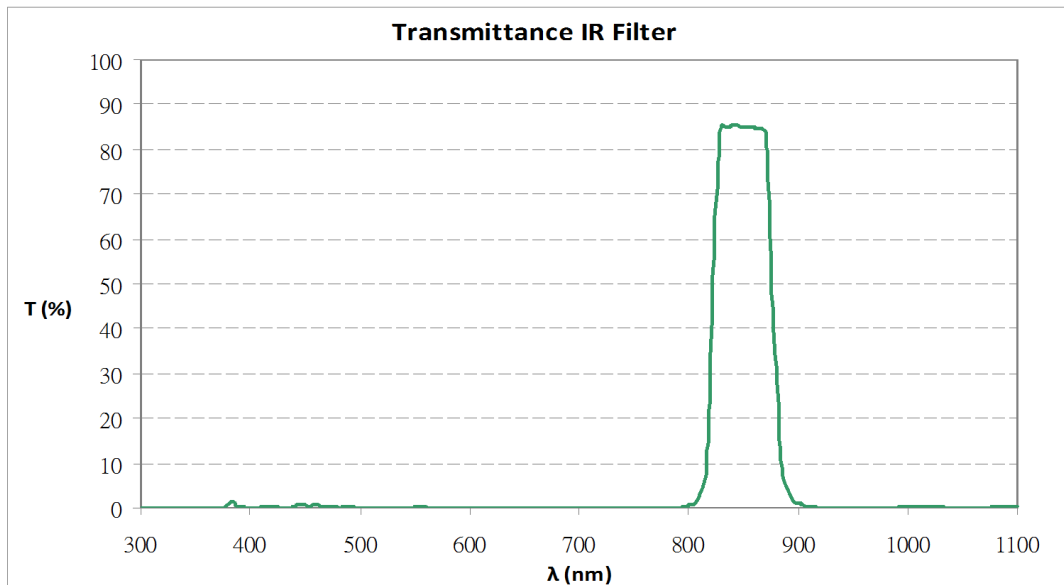
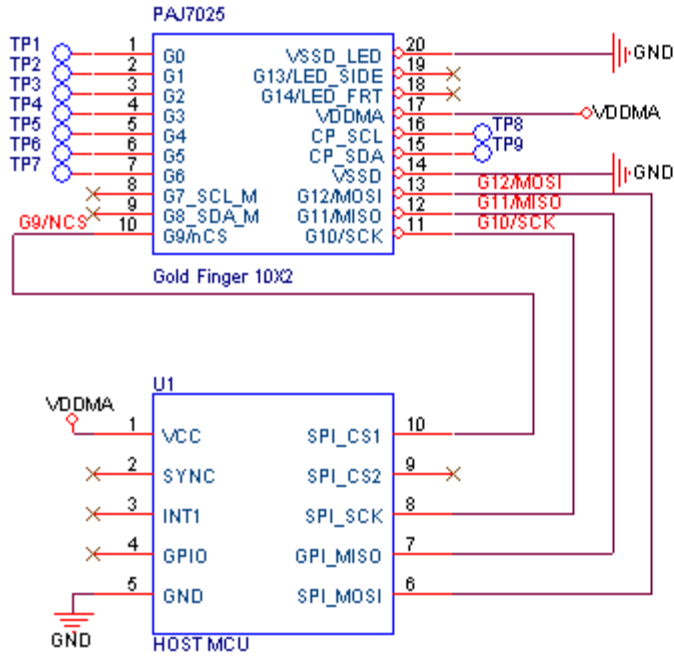
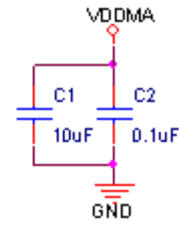


Figure 5. IR Filter Spectrum Response

4.0 Reference Schematics



VDDMA: +2.0 Vdc~+3.6 Vdc



C1,C2 Close to the PAJ7025

Figure 6. Application Circuit

5.0 Register Table

Table 2. Register Bank 0

Register Name	Address		Default Value (DEC)	Description
	HEX	DEC		
Sync_Update_Flag	0x01	001	0	Bank 0 updated flag (WRITE ONLY)
Product ID Low-Byte	0x02	002	28709	Product ID, HEX 7025 (READ ONLY)
Product ID High-Byte	0x03	003		Product ID, HEX 7025 (READ ONLY)
Cmd_oahb[7:0]	0x0B	011	9605	DSP settings; area max threshold
Cmd_oahb[13:8]	0x0C	012		DSP settings; area max threshold
Cmd_nthd[7:0]	0x0F	015	10	DSP settings; noise threshold
Cmd_orientation_ratio[7:0]	0x10	016	3	DSP settings; used for aspect ratio
Cmd_orientation_factor[3:0]	0x11	017	4	DSP settings; used for aspect ratio
Cmd_dsp_operation_mode[0]	0x12	018	0	DSP settings; 0-> object tracking off, 1-> object tracking on
Cmd_max_object_num [4:0]	0x19	025	16	DSP settings; set tracking number
Cmd_FrameSubtraction_On	0x28	040	0	1->Frame Subtraction Enable
Reserved	0x2F	047	1	
Reserved			1	
Reserved			1	
Reserved			0	
Reserved			0	
Reserved			0	
Reserved	0x30	048	0	
Cmd_Global_RESETN[0]	0x64	100	1	Software Reset; setting to 0 resets PAJ7025

Table 3. Register Bank 1

Register Name	Address		Default Value (DEC)	Description
	HEX	DEC		
Sync_Update_Flag	0x01	001	0	Bank 1 updated flag (WRITE ONLY)
B_global[4:0]	0x05	005	16	Sensor gain 1 (READ ONLY)
B_ggh[1:0]	0x06	006	0	Sensor gain 2 (READ ONLY)
B_expo[07:00]	0x0E	014	8192	Sensor Exposure Length (READ ONLY)
B_expo[15:08]	0x0F	015		
B_tg_outgen_DebugMode[7:0]	0x2B	043	0	Sensor Test Image Mode Select

Table 4. Register Bank 2

Register Name	Address		Default Value (DEC)	Description
	HEX	DEC		
Cmd_frame_period[07:00]	0x07	007	49780	frame period; unit = 100ns
Cmd_frame_period[15:08]	0x08	008		
Cmd_frame_period[19:16]	0x09	009		
B_global[4:0]	0x0B	011	16	Sensor gain 1 (Need Bank1 Sync)
B_ggh[1:0]	0x0C	012	0	Sensor gain 2 (Need Bank1 Sync)
B_expo[07:00]	0x0F	015	8192	Sensor Exposure Length (Need Bank1 Sync) unit = 200ns
B_expo[15:08]	0x10	016		
Cmd_oalb[07:00]	0x46	070	3	DSP settings; area min threshold
Cmd_thd[07:00]	0x47	071	151	DSP settings; brightness threshold
Cmd_scale_resolution_x[07:00]	0x60	096	2940	DSP settings; x-axis Interpolated Resolution
Cmd_scale_resolution_x[11:08]	0x61	097		
Cmd_scale_resolution_y[07:00]	0x62	098	2940	DSP settings; y-axis Interpolated Resolution
Cmd_scale_resolution_y[11:08]	0x63	099		

Document Revision History

Revision Number	Date	Change Description
1.0	29 Jan 2016	New creation from full DS version 1.1