CORNING

Varioptic® Lenses

Marketing Datasheet

Corning® Varioptic® A-PE-25H Series Variable Focus Lens

Overview

A-PE-25H Series is based on Corning® Varioptic® A-25H liquid lens providing a fast and robust variable focus, it is designed to compensate for temperature related variation using V-temp® feature and relieve customer from calibration work. In addition, it embeds V-speed® response time optimization algorithm further accelerating the liquid lens change from one optical power to another. Pre-implemented V-sweep® algorithm allows customer to make linear change of the optical power of the variable focus lens with time. For opto-electrical information on this lens, please refer to the A-25H Series Marketing Data Sheet (MADS).

Ordering Information

- **Corning® Varioptic® A-PE-25HX-33 variable focus lens:** Packaged A-25HX (X=0,1,9) with electronic board and 6-pin, 0.5 mm pitch straight flex cable with on-flex thermistor

Performance Summary

- 18 diopters dynamic range
- Low wave front error, 30 nm typical
- Embeds liquid lens driver, temperature sensor and microcontroller
- Integrate individual lens thermal calibration parameters
- Embeds response time optimization algorithm
- I²C / RS 232 interface

Applications

Corning Varioptic A-PE-25H liquid lenses have been used in:

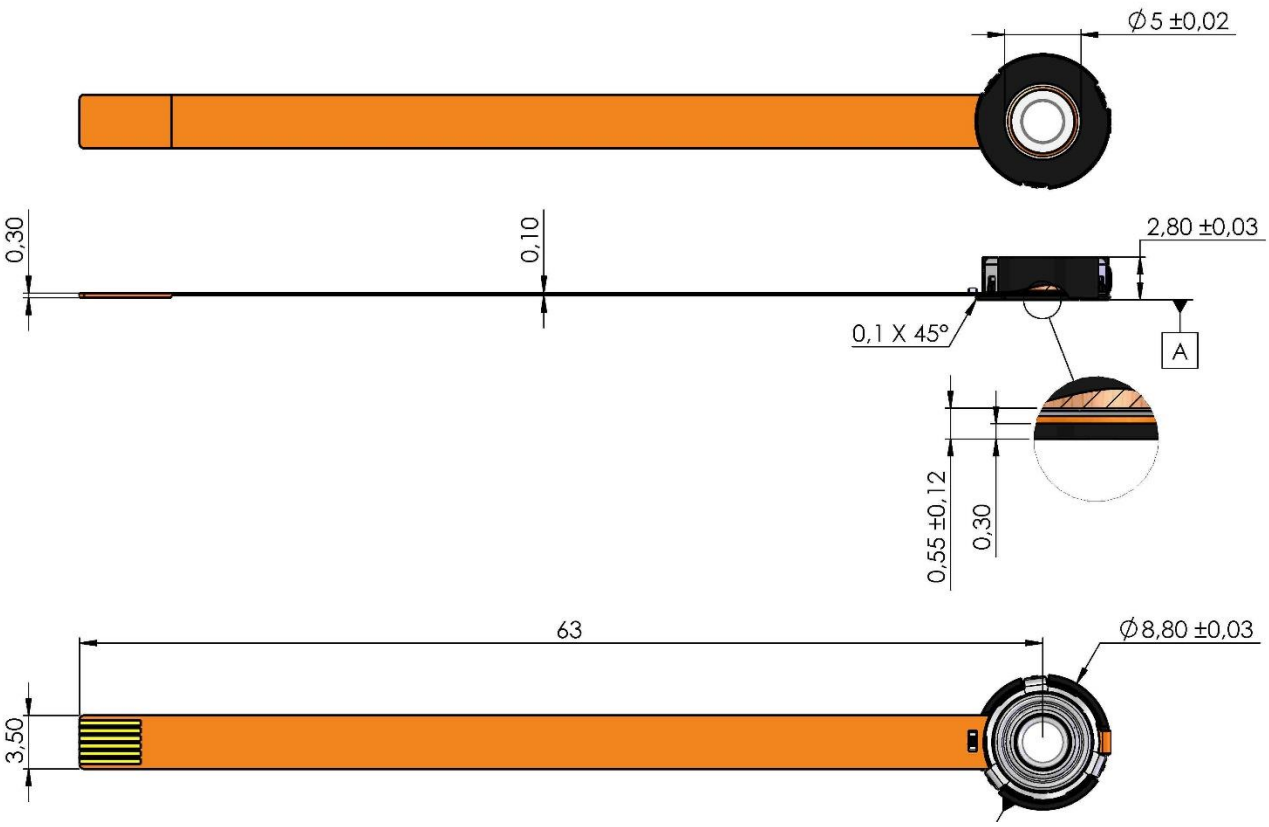
- Barcode readers, machine vision
- Biometrics
- Lasers
- …

Contents

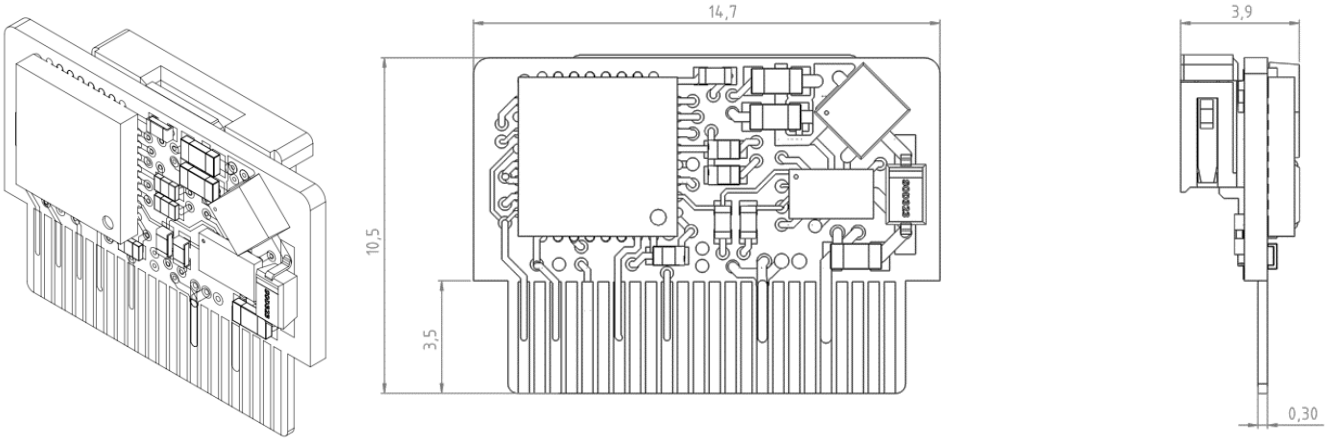
ESD

Mechanical Dimensions

Packaged Lens



Electronic board

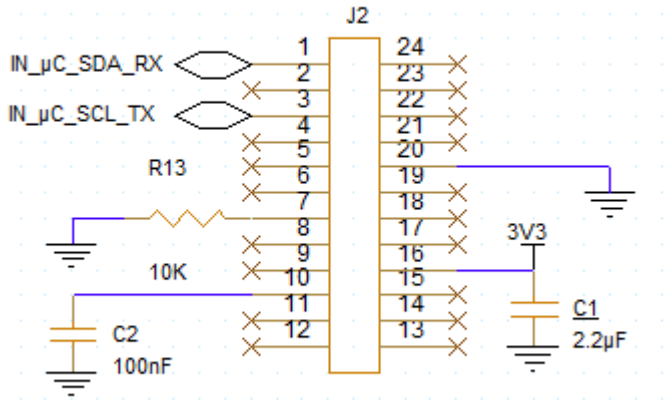


General Description Of The Board

The APE-25HX-YY electronic embeds a 32 bits microcontroller. The chip contains V-Temp temperature compensation algorithm, V-Speed response time optimization algorithm and individual lens thermal calibration parameters.

Connector Pinout

Pin Number	PCB I/O name
1	OUT_I2C_RS232_SDA_RX
2	NC
3	OUT_I2C_RS232_SCL_TX
4	NC
5	SWDIO
6	NC
7	BOOT0
8	NC
9	NC
10	NRST
11	NC
12	NC
13	NC
14	NC
15	NC
16	3,3V
17	NC
18	NC
19	NC
20	GND
21	NC
22	NC
23	NC
24	NC



Notes:

(1) The many unused pin on J2 connector are designed for improving PCB mechanical retention into the customer SMT connector.
(2) Recommended connector for A-PE Series board is 24 pins ZIF connector 24FLT-SM2-TB(LF)(SN) from JST
(3) IN_µC_SDA_RX/IN_µC_SCL_TX: Those pins can be used either in I2C or RS232, for I2C pull-ups are already present on the board.
(4) R13 pull down resistor on pin 7(BOOT0) and C2 decoupling capacitor on pin 10 (Reset) can be optional depending of EMC conditions.

Absolute Maximum Ratings

Parameter	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Notes*
Operating Temperature	T	-30	..	60	°C	
Storage Temperature	T_{stg}	-40	..	85	°C	
Input Voltage	Vin	2.8	3.3	3.6	V	

Important note:

Corning Varioptic Lenses and electronic boards are sensitive to electrostatic discharge (ESD). Use caution when handling.

Embedded Features

- **V-Speed**: Up to x5 faster compared to standard response time
- **V-Temp**: Up to x5 improvement on thermal stability
- **V-Sweep**: Driving profile of the liquid lens with linear change of the optical power of the lens with time, allowing the user to take pictures while the lens is still moving with virtually no settling time. For more information on this feature, please refer to the A-PE-25H Technical Data Sheet (TEDS).

Register Definition

Field name	Bit	Description
Focus		*address: 0x0000*
Foc [15:0]	[15:0]	The focus value is a 16 bit integer corresponding to the following V_{rms} value : Code 0x0000 = 24Vrms … Code 0xB3B0 = 70Vrms V_{rms} = N x 0.001 + 24 (in Volts) where N = code from 0x 0000 to 0x B3B0 Please note that the voltage will be adjusted to the closest voltage step allowed by Maxim MAX14574 IC (44mV resolution step). Maxim MAX14574 has a 10-bit resolution
SW Version		*address: 0x0004*
VER	[7..0]	Software version: this register indicates the version of the module firmware.
V-temp		*address: 0x0028*
V-temp_ON/OFF	B0	This bit, if set, indicates V-temp feature is running
V-speed		*address: 0x0080*
V-speed_ON/OFF	B0	This bit, if set, indicates V-temp feature is running

UART Protocol (RS232)

Hardware settings

Baud rate	57 600 Bds
Parity	No parity
Data length	32 bits
Number of stop bits	1 bit

Writing frame

STX	0x37	Add_LSB	Add_MSB	Nb_data	Data_1_1	Data_1_2	…	Data_2_1	…	Data_n	CRC

STX = 0x02

0x37 = Write command

Add_LSB

& Add_MSB = Address from first register to be written (if there are several data to write, the address will be automatically incremented).

Nb_data = Number of 32-bits words to be written

Data_1 to n = Registers value

CRC = 1 control byte calculated as follow:

Sum of all bytes (STX, CDE, ADD, NB_DATA, DATA)

Ex :

0x02	0x37	0x03	0x00	0x01	0x12	0x34	0x56	0x78	0xCA

Response of the board if transmission is successful:

STX	0x37	ACK	CRC

With ACK = 0x06

Response of the board if transmission is not successful:

STX	0x37	NACK	CRC

With NACK = 0x15

In this case the application should send again the same frame.

Reading frame

STX	0x38	Add_LSB	Add_MSB	Nb_data	CRC

STX = 0x02

0x38 = Read command

Add_MSB

& Add_LSB = Address of the first register to be read (if more than one register, the address will be automatically incremented).

Nb_data = Number of 32-bits word to be read

CRC = 1 control byte calculated as follow:

Sum of all bytes (STX, CDE, ADD, NB_DATA, DATA)

Ex:

0x02	0x38	0x03	0x00	0x01	0xB5

Response if transmission is successful:

STX	0x38	Data_1	Data_2	Data_3	Data_4	CRC

Response if transmission is not successful:

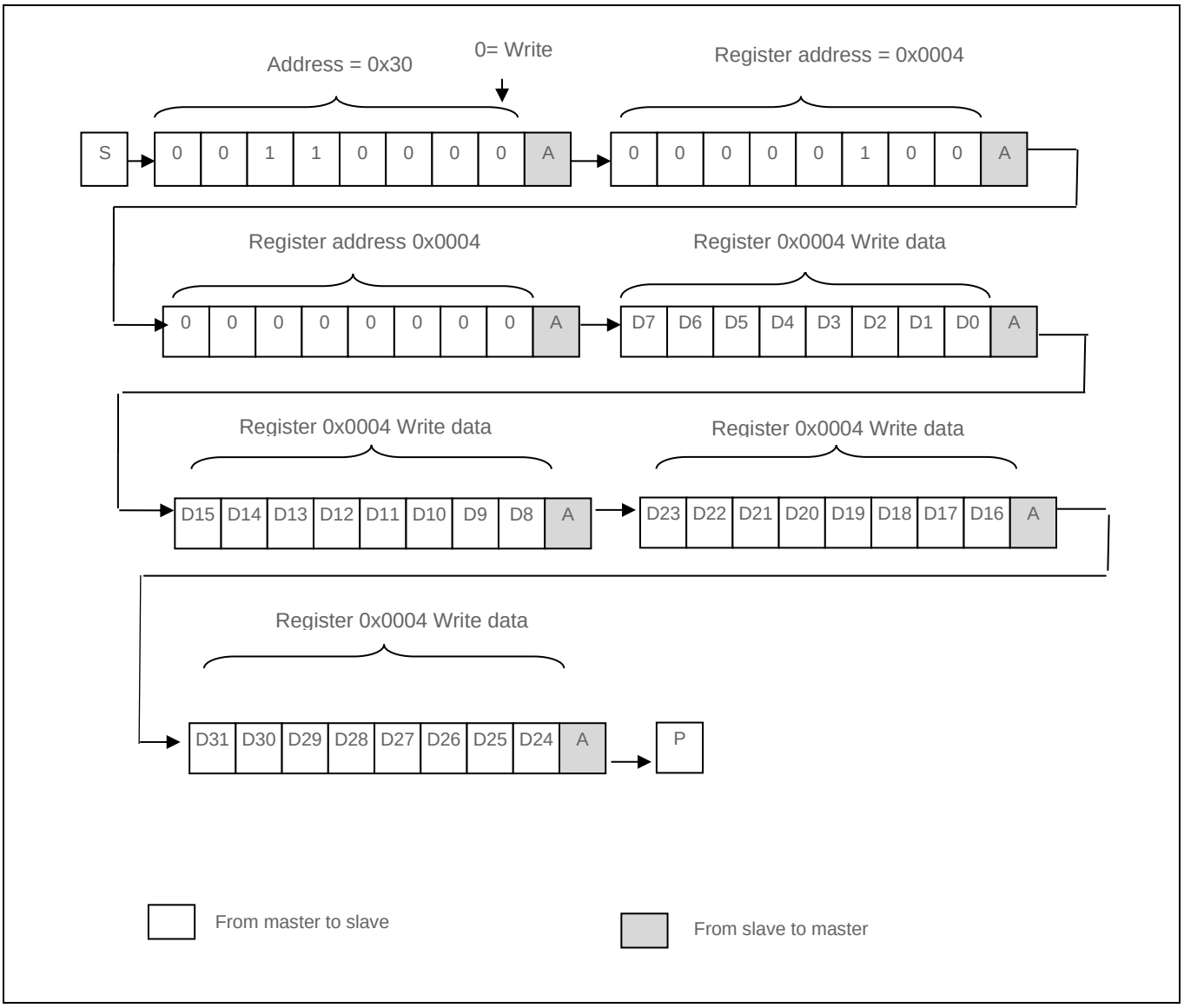
STX	0x38	NACK	0x15

I2C Protocol

Maximum frequency of SCL is 400 KHz.
The lens is a slave device, its address is 0x30 for writing and 0x31 for reading.

Writing frame

To write to the device, the master generates a START condition and then transmits the slave address with the R/W bit set to zero, followed by at least one data byte. The 2-first data byte is the register address, which determines which register is to be written. The device asserts an ACK on SDA if a valid register address is detected. 32 bits data received after the register address goes into the selected register. For each additional 32 bits word received from the master, the device auto-increments the register address. After all bytes are written, the master generates a STOP condition. The following examples shows a single-register I2C write.



Reading frame

To read from the device, the master generates a START condition and then transmits the slave address with the R/W bit set to zero. The master then sends the registers address to be read. After the device asserts an ACK on SDA, the master sends a repeated START condition followed by the slave address with the R/W bit set to one. The device then sends an ACK followed by the bytes contained in the register. The device auto increments the register address, and, if the master asserts an ACK, the device sends the next bytes. To end the read transaction, the master must generate a NACK followed by a STOP condition.