<u>ENGINEERING SAMPLES</u>

<u>PYRO-ELECTRIC IR-DETECTOR</u>

Customer :

Type : PYD 1798

Part no. : 3615

No. of samples:

Dual element detector, serial opposed format, two elements based on pyroceramic. The signal is converted to a digital value using Sigma-Delta and DSP techniques.

This specification is provided by

Excelitas Technologies GmbH & Co. KG, Wiesbaden.

It covers the complete technical data of a pyro-electric IR detector. All detectors have met the requirements of Excelitas test-specifications and passed outgoing inspection.

We kindly ask for approval with the return of a signed copy.

Checked: Date: 17.06.11

Customer approval: Date:

Electrical Configuration:

The pyro-electric sensing elements are connected to a built-in IC, whose detailed description follows:

The ADC contains an on-chip low-power oscillator, an analogue-to-digital converter which generates a digital signal from the voltage level of the sensing elements, a digitalised temperature dependent voltage and a serial interface, which outputs the digital signal as a bitstream to DIRECT LINK. The ADC block diagram and the data transmission are shown below.

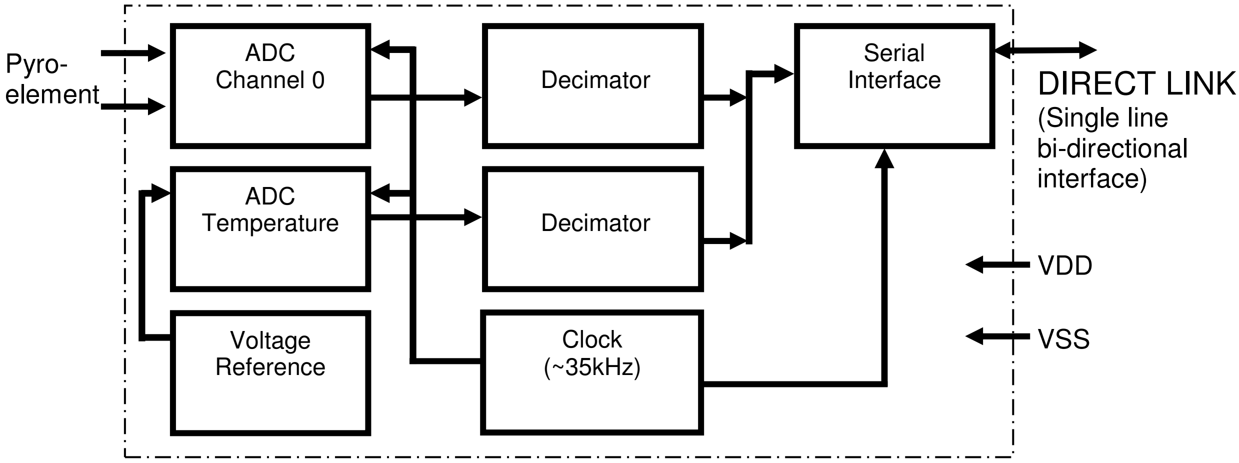


Diagram 1: Block Diagram

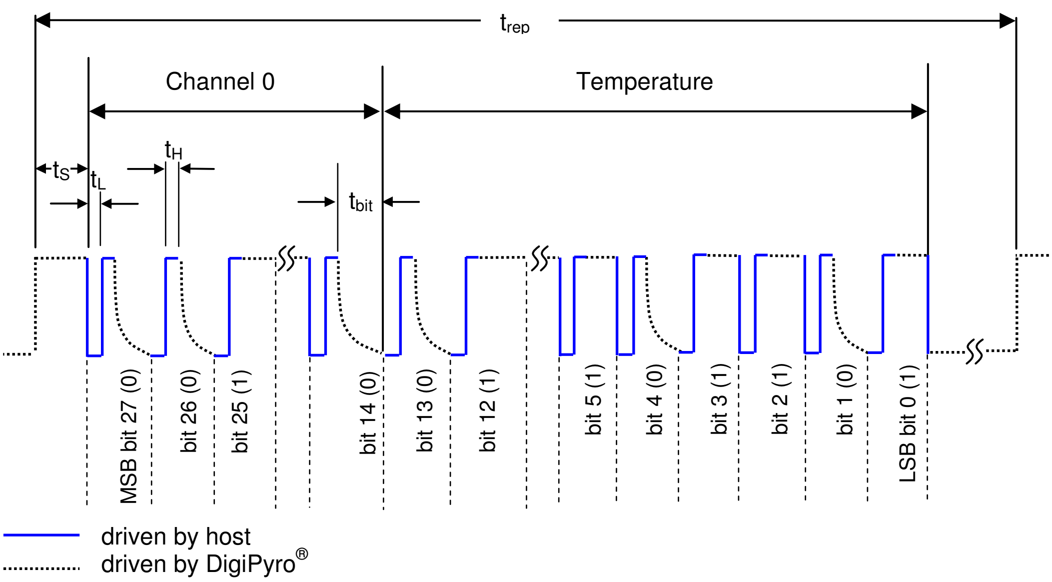


Fig. 1: Data Transmission Diagram

The serial interface has a 2 x 14 bit binary output format (Channel 0, Temperature) which allows a physical data value range from 0 … 16383 for each channel. The DIRECT LINK pin is bi-directional data output and clock input.

A data transmission cycle (t_{REP}) will start when the ADC has converted a new data value and passed it through the serial interface. Start of transmission is indicated from the DigiPyro® by pulling DIRECT LINK pin to HIGH. The data transmission should be interrupt driven to minimize noise.

After setup time (t_s) has passed the DigiPyro® expects a LOW to HIGH transition (t_L,t_H) on the DIRECT LINK pin and will subsequently output the data bit state. After Data bit settling time (t_{bit}) the DigiPyro® waits for the next LOW to HIGH transition and the sequence will be repeated until all 28 bits are shifted out. After output of the last bit (bit 0) and corresponding data bit settling time (t_{bit}), the host controller must force DIRECT LINK pin to LOW and subsequently release DIRECT LINK. The DigiPyro® remains with DIRECT LINK pin at LOW level until the next signal sample is available at the serial interface and a new transmission cycle starts.

The data bit settling time t_{bit} specified under electrical data is a minimum time. For the LOW level it can vary depending on the capacitive load of the DIRECT LINK pin. It is recommended to start host interface implementation with a longer data bit settling time t_{bit} to ensure proper LOW level settling and then reduce t_{bit} empirically to optimize for reliable data transmission at maximum transmission speed.

If data transmission is interrupted during Data Clock Low time (t_L), the serial interface will be updated with a new value if t_L lasts longer than the serial interface update time (t_{REP}), which can cause false reading if data transmission will be continued. Therefore data transmission should preferable be interrupted during Data Clock High time (t_H). If interruption lasts longer than the serial interface update time (t_{REP}) the serial interface will not be updated with new values as long as the DIRECT LINK pin is kept HIGH.

If a host reads the serial interface output faster than the update rate of the serial interface (t_{REP}) the data bits are all read as “0”.

To avoid saturation of the detector the DigiPyro® contains an out of range detection logic. The input of the ADC is shorted for a duration of 512 system clocks when the digital values are above 15872 counts or below 511 counts.

Electrical Data:

Tab.1: Electrical data for ADC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Operating Voltage	V_{DD}	2.7	3.3	3.6	V	
Supply Current	I_{DD}			15	µA	V_{DD} = 3.3V
Input Low Voltage	V_{IL}			$0.2V_{DD}$	V	
Input High Voltage	V_{IH}	$0.8V_{DD}$			V	
Pull up Current			130		µA	Input to V_{SS}
Pull down Current			200		µA	Input to V_{DD}
Data Setup Time	t_s	25			µs	
Data Clock Low Time	t_L	200			ns	
Data Clock High Time	t_H	200			ns	
Data Bit Settling Time	t_{bit}	1			µs	C_{LOAD} = 10pF
Serial Interface Update Time	t_{REP}	12.4	14.6	16.8	ms	@ 25 °C
Mode Selection Time	t_M	3			1/ f_{CLK}	Speed Mode
ADC Counts of Bits			28		Bits	
ADC Resolution			14		Bits	Max Count = 2^{14} -1
ADC Sensitivity		6.0	6.5	7.1	µV/Count	
ADC Temperature Coefficient		-300		300	ppm/K	
ADC Output Offset		7000	8192	9200	Counts	
Gain Temperature		72	80	88	Counts/K	-20°C to + 90°C
Linearity of Temperature		-5		5	%	-20°C to + 90°C
Counts at Ambient Temperature		5700	6700	7700	Counts	@ 25 °C
Internal Clock Frequency	f_{CLK}	30.2	35.0	39.8	kHz	- 20 °C to + 80 °C
Temperature Coefficient	T_C (f_{CLK})	-1000		+1000	ppm/K	- 20 °C to + 80 °C

Responsivity: **min.: 3.3 kV/W** typ.: 4.0 kV/W

Responsivity is measured within spectral range 7 - 14 µm as per fig. 3 at 1Hz.

Match: **max.: 10 %**

Electrical balance (match) is measured with same test set up as responsivity, both elements exposed to radiation. A percent value is calculated as

$$\frac{100 \times s_m}{s}$$

s_m : signal (match)

s : signal of left or right element.

Noise: **max.: 78 µV$_{pp}$** typ.: 20 µV$_{pp}$

After a 10 minute settling time, noise is monitored for the duration of 1500 sec. at a temperature of 25℃, shut from infrared energy, digital filter between 0.4 to 10Hz.

Typical Responsivity vs. Frequency

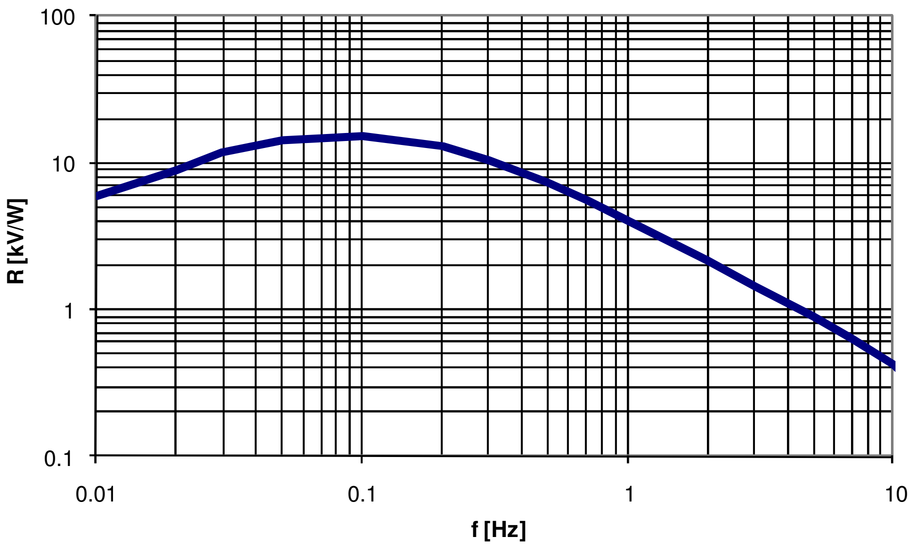


Fig.2: Frequency response

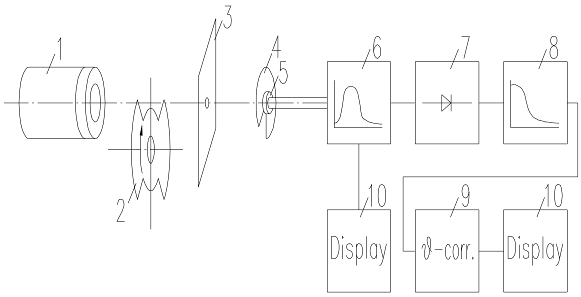
Sample data

The samples attached to this specification have been randomly selected. Test equipment as per fig. 3 and fig.4.

Tab.2: Sample data

Sample no.	R_A [kV/W]	R_B [kV/W]	Match [kV/W]
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Test Set up



1: Black Body Radiator 373K = 100℃
2: 1 Hz Chopper
3: Aperture
4: Cover plate
5: Detector
6: Bandpass filter 1 Hz
7: Rectifier
8: Lowpass filter
9: Temperature compensation
10: Display

Fig.3: Test Set – up

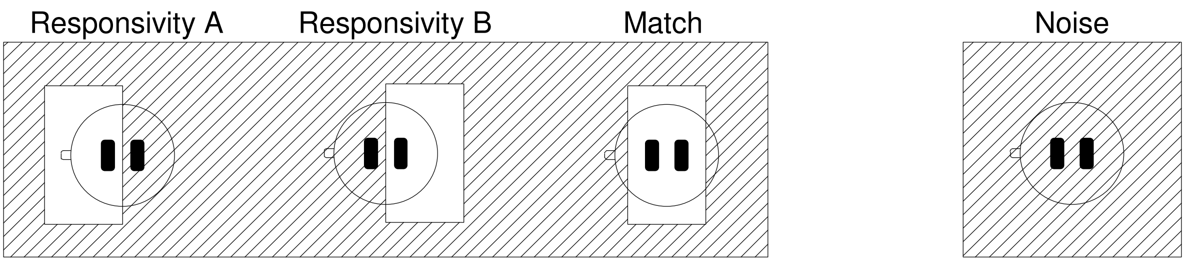


Fig.4.: Responsivity measurement

Spectral range:

The spectral range of the detector is determined by the built-in filter (window).

Substrate: Silicon, multilayer coated

Cut – on: 5.5 ± 0.3 µm

Transmission: T > 77% average between 7 µm and 14 µm

Blocking: T < 0.1% for λ < 5 µm

Physical Configuration:

Housing: TO- 5 metal housing with infrared transparent window

Element size: 2 x 1, see also drawing: 2/71865

Connections: Refer to drawing: 2/71865

Field of View

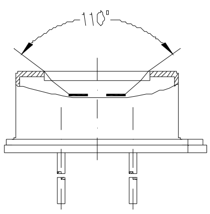


Fig.5: Field of View

Operating temperature: -40°C to +85°C

The electrical parameters may vary from specified values accordance with their temperature dependence.

Storage temperature: -40°C to +85°C

Avoid storage under high humid environment.

Microphonic noise: max: 30 μV_{rms} /g

Excelitas IR-detectors covered herein have passed qualification test for microphonic noise in x-y-z axis, exciting frequencies from 5Hz to 2kHz.

Humidity:

The IR-detector shall not increase noise or decrease responsivity when exposed to 95% R.H. at 30°C. Operation below dew point might affect performance.

Hermetic seal:

This IR-detector is sealed to pass a He-leakage test with maximum leak rate of 10^{-8} mbar·l·s^{-1}.

Quality:

Excelitas Technologies is a **QS 9000** certified manufacturer with established SPC and TQM. Detector out-going inspections include the parameters Responsivity, Match, Offset, Noise, Gross leak (Mil Std 883 method 1014C1). Individual data are not stored, statistical details can be disclosed on request.

Handling:

Handle the detectors as ESD sensitive devices and protect them from electrostatic discharges. Working areas should be conductive and grounded. When handling detectors, operators shall be grounded. Avoid mechanical stress on the housing and especially on the leads. Be careful when cutting or bending leads to avoid damage. Do not bend leads less then 5 mm from their base. Do not drop detectors on the floor.

Avoid touching the detector window. To clean windows, only use ethyl alcohol with a cotton swab when necessary. Do not expose detector to aggressive detergents such as Freon, trichloroethylene, etc.

Soldering conditions:

For the soldering of the detectors within PCBs, the typically applied and recommended process is wave soldering. The soldering temperature should not exceed 285° C with a maximum exposure time of 5 seconds. During the automatic wave solder process we strongly advise to restrict preheating when the detector is directly exposed to the radiation of such heaters. In this case, the detector should be protected from the heat.
Manual soldering is also possible when maintaining similar temperature profiles. Reflow soldering is not possible due to the high temperature profiles of the process.

Product Safety & RoHS:

Modern high-tech materials are applied in the production of our pyro-electric detectors. Some of these materials are sensitive to high temperature exposure or to specific forms of stress. Our parts are compliant with environmental regulations as can be reviewed on the Excelitas website. We recommend to always check your local regulations. Disposal shall only be carried out in accordance with the latest legislation and directives. In Europe, WEEE directives must be followed.

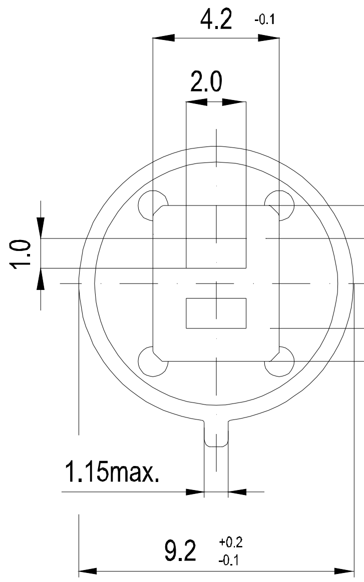
The leads of these detectors have been pre-tinned with lead free tin process and may be applied through lead-free solder processes. As such the detectors will enable the design of RoHS compliant products.

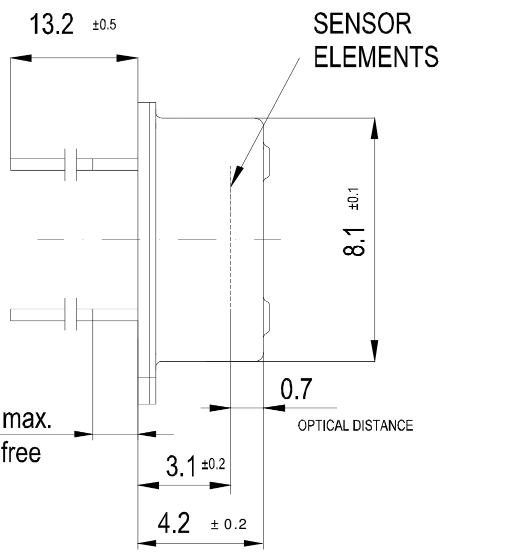
Marking:

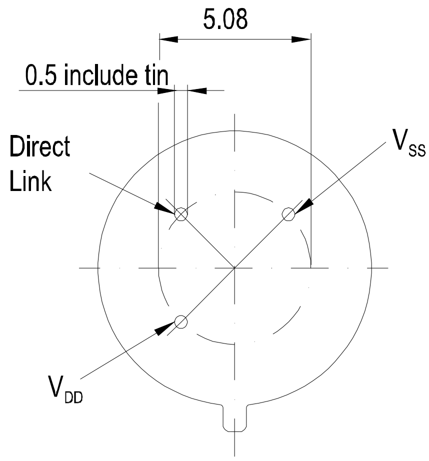
The marking of the detector includes the principal type plus a 4 digit number that represents the Excelitas storage and specification number (3XXX) and a date code, consisting of years and week detail. The marking is on the top or side of the detector.

Performance Advice

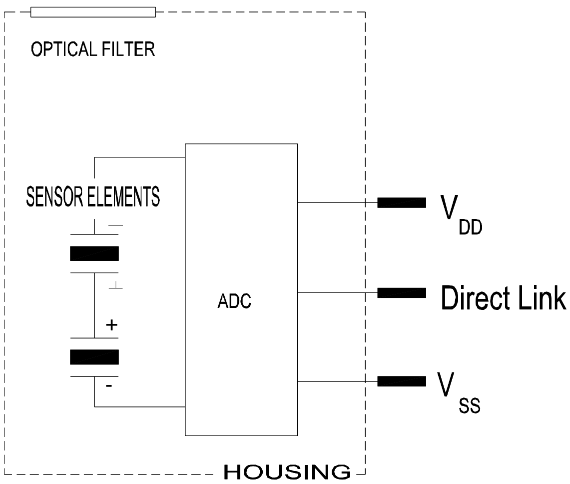
Before taking a reading, during testing, and / or operation the unit has to become thermally stable due to its nature as a thermal detector and the high sensitivity of the device.
All data are specified at room temperature. When operating at other temperatures within the specified operating range, parameters may vary. The detectors might operate outside the quoted range but may have degraded performance.







BOTTOM VIEW



Index NO.	Änderung REVISION	Datum DATE	Name NAME
2	2/4065	28.01.2011	Tkocz
1	2/4041	27.09.2010	Tkocz
0	2/4004	10.09.2009	Tkocz

Allgemeintoleranzen GENERAL TOLERANCES	Werkstückkanten/EDGES OF WORKING-PARTS ACC. DIN 6784	Form-u.Lagetoleranzen GEOMETRICAL TOLERANCES
	Datum DATE	Name NAME
Gez. DRAWN BY	10.09.2009	Tkocz
Gepr. CHECKED BY	23.01.2011	
Werkstoff MATERIAL		
Maßstab SCALE	5 : 1	
Benennung/TITLE	ELEMENTORIENTATION AND CONNECTIONS PYD 1798	
Zeichnung Nr./DRAWING NO.	2/ 71865	
Ersatz für/REPLACEMENT FOR		
Ersetzt durch/REPLACED BY		

EXCELITAS TECHNOLOGIES

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