DISCRETE PYROS

KEY FEATURES

1. **BROAD SPECTRAL RESPONSE**
   From 0.1 to 1000 µm

2. **EASY TO INTEGRATE FORMAT**
   TO5 and TO8 packages make the QS detectors small and easy to integrate in an existing system

3. **LARGE AREA SENSORS**
   5 mm Ø and 9 mm Ø diameter pyroelectric sensors make optical alignment easier

4. **SEVERAL IR WINDOWS IN OPTION**
   - Quartz: 0.2 – 3.0 µm
   - Barium Fluoride: 0.2 – 17.5 µm
   - Sapphire: 0.1 – 7.0 µm
   - Silicon: 1.1 – 9.0 µm and 50 – 1000 µm
   - AR Germanium: 8 – 14 µm

AVAILABLE MODELS

4 families of products to choose from:

- QS-L Discrete Pyro Detectors, Low Noise Level
- QS-H Discrete Pyro Detectors, High Average Power
- QS-IF Hybrid Pyro Detectors, Current Mode, Fast Response
- QS-IL Hybrid Pyro Detectors, Current Mode, Low Noise Level

ACCESSORIES

QS-I-TEST
Evaluation Test Box (current)

Permanent IR Windows
(Various types available)

Pelican Carrying Case

SEE ALSO

QS-L & QS-H

Approved or in the process of being approved*

Discrete Pyro Detectors, Low Noise Level

SPECIFICATIONS

	QS2-L	QS3-L	QS5-L	QS9-L
CURRENT RESPONSIVITY	0.5 µA/W	0.5 µA/W	0.25 µA/W	0.25 µA/W
EFFECTIVE APERTURE	2 mm Ø	3 mm Ø	5 mm Ø	9 mm Ø
PACKAGE	TO5	TO5	TO5	TO8
MEASUREMENT CAPABILITY				
Spectral Range	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm
Max Average Power	50 mW	50 mW	50 mW	50 mW
Capacitance (at 1000 Hz)	22 pF	60 pF	90 pF	250 pF
Current Responsivity (at 630 nm)	0.5 µA/W	0.5 µA/W	0.25 µA/W	0.25 µA/W
Thermal Frequency (3 dB)	1.6 Hz	0.8 Hz	0.5 Hz	0.25 Hz
Temperature Coefficient	0.2%/°C	0.2%/°C	0.2%/°C	0.2%/°C
ORDERING INFORMATION				
Product Name	QS2-L	QS3-L	QS5-L	QS9-L
Product Number	201659	201662	201664	201666

	QS2-H	QS3-H	QS5-H	QS9-H
CURRENT RESPONSIVITY	500 mW	500 mW	500 mW	500 mW
EFFECTIVE APERTURE	2 mm Ø	3 mm Ø	5 mm Ø	9 mm Ø
PACKAGE	TO5	TO5	TO5	TO8
MEASUREMENT CAPABILITY				
Spectral Range	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm
Max Average Power	500 mW	500 mW	500 mW	500 mW
Capacitance (at 1000 Hz)	12 pF	30 pF	90 pF	250 pF
Current Responsivity (at 630 nm)	0.25 µA/W	0.25 µA/W	0.25 µA/W	0.25 µA/W
Thermal Frequency (3 dB)	5 Hz	5 Hz	5 Hz	5 Hz
Temperature Coefficient	0.2%/°C	0.2%/°C	0.2%/°C	0.2%/°C
ORDERING INFORMATION				
Product Name	QS2-L	QS3-L	QS5-L	QS9-L
Product Number	201661	201663	201665	201667
PHYSICAL CHARACTERISTICS				
Effective Aperture	2 mm Ø	3 mm Ø	5 mm Ø	9 mm Ø
Package	TO5	TO5	TO5	TO8
Sensor	Pyroelectric	Pyroelectric	Pyroelectric	Pyroelectric
Absorber	MT	MT	MT	MT
Dimensions (Excluding pins)	9.1Ø x 6.4D mm	9.1Ø x 6.4D mm	9.1Ø x 6.4D mm	15.2Ø x 6.4D mm
Weight	1.0 g	1.0 g	1.0 g	1.5 g

Specifications are subject to change without notice

QS-IF

Approved or in the process of being approved*

Hybrid Pyro Detectors, Current Mode, Fast Response

SPECIFICATIONS

	QS2-IF	QS3-IF	QS5-IF	QS9-IF
VOLTAGE RESPONSIVITY	50 V/W	50 V/W	25 V/W	25 V/W
CURRENT RESPONSIVITY	0.5 µA/W	0.5 µA/W	0.25 µA/W	0.25 µA/W
EFFECTIVE APERTURE	2 mm Ø	3 mm Ø	5 mm Ø	9 mm Ø
PACKAGE	TO5	TO5	TO5	TO8
MEASUREMENT CAPABILITY				
Spectral Range	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm
Max Average Power	50 mW	50 mW	50 mW	50 mW
Noise Equivalent Power [a]	$8x10^{-8}$ W/(Hz)^{½}	$8x10^{-8}$ W/(Hz)^{½}	$1.6x10^{-7}$ W/(Hz)^{½}	$1.6x10^{-7}$ W/(Hz)^{½}
Detectivity [a]	$2.2x10^{6}$ cm(Hz)^{½} /W	$3.3x10^{6}$ cm(Hz)^{½} /W	$2.8x10^{6}$ cm(Hz)^{½} /W	$5.0x10^{6}$ cm(Hz)^{½} /W
Capacitance (at 1000 Hz)	22 pF	60 pF	90 pF	250 pF
Current Responsivity (at 630 nm)	0.5 µA/W	0.5 µA/W	0.25 µA/W	0.25 µA/W
Voltage Responsivity [b]	50 V/W	50 V/W	25 V/W	25 V/W
Thermal Frequency (3 dB)	1.6 Hz	0.8 Hz	0.5 Hz	0.25 Hz
Feedback Resistor	100 MΩ	100 MΩ	100 MΩ	100 MΩ
Supply Voltage	± 12 V	± 12 V	± 12 V	± 12 V
PHYSICAL CHARACTERISTICS				
Effective Aperture	2 mm Ø	3 mm Ø	5 mm Ø	9 mm Ø
Package	TO5	TO5	TO5	TO8
Sensor	Pyroelectric	Pyroelectric	Pyroelectric	Pyroelectric
Absorber	MT	MT	MT	MT
Dimensions	9.1Ø x 6.4D mm	9.1Ø x 6.4D mm	9.1Ø x 6.4D mm	15.2Ø x 6.4D mm
Weight	1.0 g	1.0 g	1.0 g	1.5 g
ORDERING INFORMATION				
Product Name	QS2-IF	QS3-IF	QS5-IF	QS9-IF
Product Number	201680	201681	201682	201683

Specifications are subject to change without notice

a. 630 nm, 15 Hz, largeur de bande de 1 Hz
b. 630 nm, 15 Hz

QS-I-TEST EVALUATION TEST BOX

	QS-I-TEST
Batteries	+9V/-9V
R_f Resistors	10^{5} - 10^{10} Ω
C_f Compensating	Yes
Package	101.6H x 127L x 58.4P
Optical Mount	¼-20 Threaded
Front Bezel	SM1 (1.035-40)
Product Number	201693

** For details, contact your Gentec-EO representative*

QS-IL

Approved or in the process of being approved*

Hybrid Pyro Detectors, Current Mode, Low Noise Level

SPECIFICATIONS

	QS2-IL	QS3-IL	QS5-IL	QS9-IL
VOLTAGE RESPONSIVITY	25 kV/W	25 kV/W	13 kV/W	13 kV/W
CURRENT RESPONSIVITY	0.5 µA/W	0.5 µA/W	0.25 µA/W	0.25 µA/W
EFFECTIVE APERTURE	2 mm Ø	3 mm Ø	5 mm Ø	9 mm Ø
PACKAGE	TO5	TO5	TO5	TO8
MEASUREMENT CAPABILITY				
Spectral Range	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm	0.1 - 1000 µm
Max Average Power	50 mW	50 mW	50 mW	50 mW
Noise Equivalent Power [a]	$2x10^{-9}$ W/(Hz)^{½}	$2x10^{-9}$ W/(Hz)^{½}	$6x10^{-9}$ W/(Hz)^{½}	$6x10^{-9}$ W/(Hz)^{½}
Detectivity [a]	$9.0x10^{7}$ cm(Hz)^{½} /W	$1.3x10^{8}$ cm(Hz)^{½} /W	$7.0x10^{7}$ cm(Hz)^{½} /W	$1.3x10^{8}$ cm(Hz)^{½} /W
Capacitance (at 1000 Hz)	22 pF	60 pF	90 pF	250 pF
Current Responsivity (at 630 nm)	0.5 µA/W	0.5 µA/W	0.25 µA/W	0.25 µA/W
Voltage Responsivity [b]	25 kV/W	25 kV/W	13 kV/W	13 kV/W
Thermal Frequency (3 dB)	1.6 Hz	0.8 Hz	0.5 Hz	0.25 Hz
Feedback Resistor	100 GΩ	100 GΩ	100 GΩ	100 GΩ
Supply Voltage	± 5 to ± 12 V	± 5 to ± 12 V	± 5 to ± 12 V	± 5 to ± 12 V
PHYSICAL CHARACTERISTICS				
Effective Aperture	2 mm Ø	3 mm Ø	5 mm Ø	9 mm Ø
Package	TO5	TO5	TO5	TO8
Sensor	Pyroelectric	Pyroelectric	Pyroelectric	Pyroelectric
Absorber	MT	MT	MT	MT
Dimensions	9.1Ø x 6.4D mm	9.1Ø x 6.4D mm	9.1Ø x 6.4D mm	15.2Ø x 6.4D mm
Weight	1.0 g	1.0 g	1.0 g	1.5 g
ORDERING INFORMATION				
Product Name	QS2-IL	QS3-IL	QS5-IL	QS9-IL
Product Number	201685	201686	201687	201688

Specifications are subject to change without notice

a. 630 nm, 5 Hz, 1 Hz Bandwidth
b. 630 nm, 15 Hz

QS-I-TEST EVALUATION TEST BOX

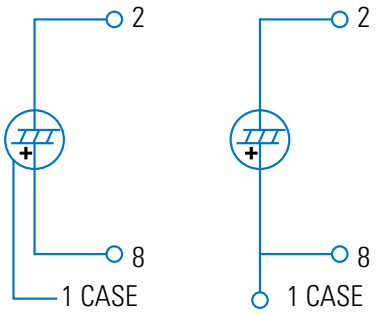
	QS-I-TEST
Batteries	+9V/-9V
R_f Resistors	10^{5} - 10^{10} Ω
C_f Compensating	Yes
Package	101.6H x 127L x 58.4P
Optical Mount	¼-20 Threaded
Front Bezel	SM1 (1.035-40)
Product Number	201693

** For details, contact your Gentec-EO representative*

DISCRETE PYROS

PYROELECTRIC THERMAL DETECTORS

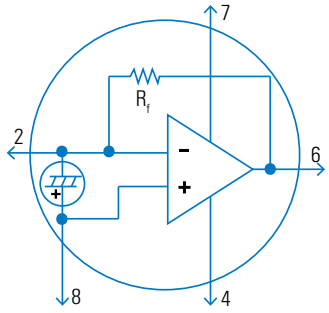
Our pyroelectric detectors are a class of room temperature thermal detectors that produce a current output that is directly proportional to the rate of change of temperature when exposed to a source of radiation. They are best described by an AC current source, capacitor and resistor. Their current output is governed by the equation ***I = p(T)·A·dT/dt***, where ***I*** is current, ***p(T)*** is the Pyro Coefficient, ***A*** is the area as defined by the front electrode, and ***dT/dt*** is the rate of temperature change of the pyro crystal. The advantages of a pyroelectric detector over other IR detectors are: room temperature operation, broad spectral response, high sensitivity (D*) and fast response (sub-nsec into 50 Ω).



QS-L (left) and QS-H (right) Pin-Outs

QS-L AND QS-H DISCRETE PYROS

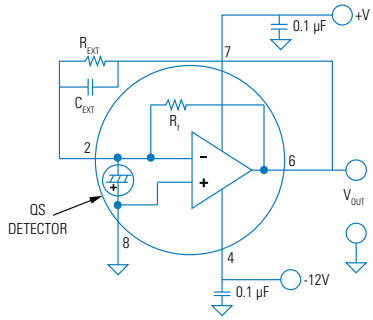
Our passive Discrete Pyroelectric Detectors range from 1 to 9 mm in diameter and are provided in two configurations: high sensitivity or high average power. They present a pyroelectric detector element covered with our metallic coating (MT) and are packaged in a miniature TO-5 or TO-8 can. The diagram shown left identifies the Pin-out for both types of detectors. Our organic black coating (BL), increases the optical absorption and helps flatten the spectral response. We also offer a number of permanent IR Windows that can be added to the TO can. These discrete pyro detectors are ideal for pulsed laser applications.



QS-IF and QS-IL Pin-Out

QS-IF AND QS-IL CURRENT MODE HYBRID PYROS

These detectors offer high gain (>10^5 V/W) and/or high bandwidth (>10 MHz). In this configuration, the pyroelectric detector element is combined to a low noise operational amplifier. The QS-IL models are designed for high performance at low to medium frequencies, while the QS-IF models offer good performance at medium to high frequencies. These detectors are very easy to use. Simply supply the +/- 10 to 15 V to power the operational amplifier and add an external resistor, if required, to adjust the bandwidth and you are ready to measure pulsed, modulated or chopped sources, from nJ to mJ and nW to W. These detectors also make great candidates for any variety of broadband analytical instruments or laser measurement products.

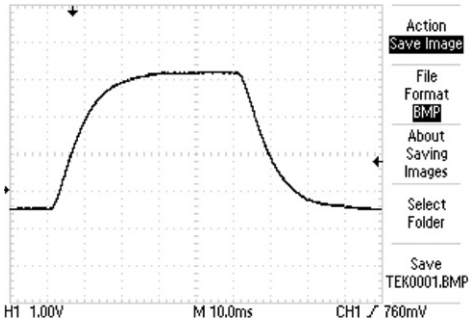


QS-VL and QS-IL Circuitry

VOLTAGE OUTPUT VS. FREQUENCY

Our QS-VL and QS-IL Hybrid Detectors are designed to maximize voltage output at low frequencies and therefore include load and feedback resistors in the 100 GΩ to 300 GΩ range. They are also designed into 8-pin TO packages that allow the addition of an “external resistor” to lower the output and increase the bandwidth. The circuit diagram at the left shows a typical hook up for our QS5-IL detector (with our MT coating), using external resistors and capacitors. Our QS-IF series, on the other hand, are designed for high bandwidth applications and therefore include a smaller feedback resistor of 100 MΩ. For expert help on designing a detector circuit please contact us info@gentec-eo.com.

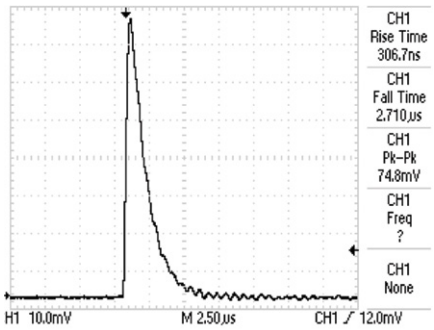
DISCRETE PYROS



Typical QS-IL Voltage Output in Power Measurement Mode

OPERATION IN POWER MEASUREMENT MODE

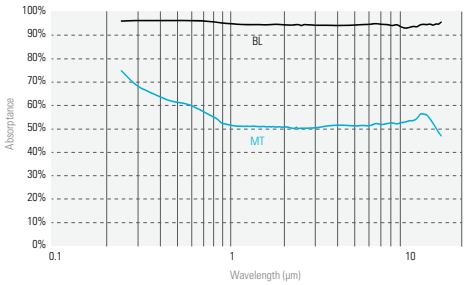
When using our QS-IL Hybrid Detector to measure the Power (in Watts) of your CW or High Rep Rate source (Quasi-CW), you will need to employ an optical chopper. The diagram at the left shows the typical voltage output of a QS5-IL when used with our QS-I-TEST evaluation test box. Note that the voltage output is an approximate "square wave" whose rise and fall times are governed by the RC time constant of the circuit. The optical power is directly proportional to the peak voltage minus the baseline voltage. We calibrate these devices when operating in this mode.



Typical QS-IL Voltage Output in Energy Measurement Mode

OPERATION IN ENERGY MEASUREMENT MODE

Our Pyroelectric Detectors are an ideal choice when measuring the performance of your pulsed laser in the range of nJ to mJ, across the full spectrum! The scope trace at the left represents the typical output from a QS9-IL, when used with our QS-I-TEST set up as an integrating Joulemeter. Note the fast rise to a peak and then slower decay governed by the RC time constant selected for the integrating circuit. In this configuration you can measure absolute pulse energy, rep rate, and pulse-to-pulse stability. The maximum pulse width of your source is determined by the RC time constant you select and there is no limit as to how short the pulse can be!



Absorption Curves of QS Pyroelectric Detectors

BROAD SPECTRAL RESPONSE

Unlike photoconductive and photovoltaic detectors, our Pyroelectric Thermal Detectors are not limited to a small part of the electromagnetic spectrum. They are truly broad spectrum detectors, sensitive from 0.1 µm to 3000 µm (EUV, FAR IR, and THz). Any and all radiation absorbed by our coatings or pyro crystal will result in a measurable signal. The two plots at the left show the relative spectral response of detectors with MT and BL coatings. Note that the well documented, NIST traceable calibrated portion of these curves runs from 0.25 µm to 15 µm. There are currently no traceable optical standards for measurements > 15 µm.