

Introduction to Thermopile Detectors

Thermopile Detector Overview

Dexter Research Center is a leader in the manufacture of stable, high quality, high output radiation sensing thermopile detectors with a linear dynamic range from the UV to long wave IR. Thermopile detectors are passive radiation sensing voltage-generating devices, that require no bias or cooling and do not emit any radiation. Our detector's spectral absorption is flat from the ultraviolet to the far infrared. Spectral sensitivity is defined by the selection of optical band-pass filters. Thermopile output is generally in the micro-Volt to milli-Volt range depending on target size, temperature and radiance.

What are Thermopile Detectors?

Thermopile detectors can be thought of as a series array of miniature thermocouple junctions connected in series as differential pairs. These differential pairs make up the cold junctions and the hot junctions (see figure 1). In fact, the hot and cold junctions are connected by alternating n-type and p-type materials, called "Arms", creating a Seebeck effect between the junctions. A voltage is

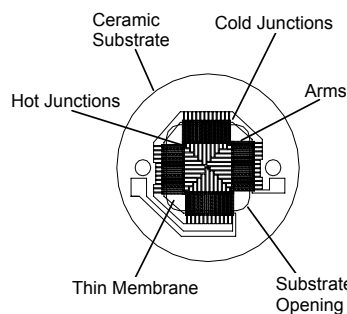


Figure 1:
Key features of the Model 2M
Thin Film thermopile detector

produced, proportional to the temperature gradient between the hot and cold junctions. For Thin Film based thermopiles, the arm materials are antimony (Sb) and bismuth (Bi). For Silicon thermopiles, the arm materials can be alternating n-type and p-type Poly-Silicon or n-type with gold (Au) or aluminum (Al). The cold junctions are typically thermally connected to the detector package and are located around the perimeter of the substrate opening. The hot junctions are located in the center of the detector pattern and are coated with an energy absorber. The hot junctions define the active area of the detector and are suspended on a thin membrane, thermally isolating them from the rest of the package.

Our detectors are designed in small TO-18, TO-5, or TO-8 transistor type packages. Before the detector package is hermetically sealed (encapsulated), the package is evacuated of ambient air and back-filled with one of four gases. The backfill gas provides one of the key thermal paths for dissipation of energy from the active area. Please reference Application Brief #7: "Effects of Encapsulation Gas on Thermopile Detectors" for a discussion of these effects on detector performance.

The unique energy absorbing materials used by Dexter Research Center enable our thermopile detectors to have a spectral response that is essentially flat from the ultraviolet to the far infrared. Depending on the detector application, spectral sensitivity is limited by the choice of optical band-pass filters. We have a wide range of optical filters and window materials in stock and available for customization of your detector for your application. Dexter Research also offers optional internal apertures, internal heatsinks, and several choices of package aperture sizes to meet your design requirements.

Thermopile detectors are very low noise detectors and have the same amount of noise as a resistor of equal resistance. Unlike Pyroelectric detectors, thermopile detectors generate no $1/f$ or microphonic noise, but only the Johnson noise of their resistance. Thermopile detectors provide a stable output for DC radiation up to a frequency limited by the time constant. Unlike Pyroelectric detectors, no chopper is required.

8585 Rev B

Update: 5/17/06

Information subject to change without notice

Types of Thermopile Detectors

Dexter Research Center offers two distinct types of thermopile detectors, the Bismuth-Antimony Thin Film based and the Silicon based. There are several performance differences between the two types of detectors as follows. Thin Film based thermopiles have lower resistance and lower noise voltage than a Silicon based thermopile, therefore Thin Film detectors provide a higher Signal-to-Noise ratio. A Thin Film thermopile with equal output to that of a Silicon based thermopile will have a slower time constant. In general, Thin Film thermopiles are available with larger active areas. Please see the table below for a comparison of these two types of thermopiles.

Several Thin Film thermopile models are designed with an internal compensating element. The compensating element is blinded and is typically connected in opposition to the active element, thus minimizing the effect of a sudden change in ambient package temperature. This temperature compensation is effective for no more than 5 seconds. Dexter Research Center has also created compensated Silicon thermopiles (the models starting with "ST"). Please ask our sales representative for more information.

Examples of Thermopile Detector Applications

- Hand-Held Non-Contact Temperature Measurements
- Non-Contact Temperature Measurements in industrial applications and process control
- Infrared Radiometry
- Tympanic Thermometers
- Automotive Exhaust Gas Analysis and Emissions Control
- Refrigerant Leak Detection
- Medical Gas Analysis including Anesthetic monitoring, incubator CO and CO₂, Blood Alcohol Breathalyzers
- Horizon sensors for Aircraft, Satellites, and hobbyist applications
- Thermal Imaging
- Thermal Positioning and Targeting
- Automotive Climate Control
- Automotive Occupancy Sensing
- Household Appliance Temperature Measurement
- Aircraft Flame and Fire Detection
- Hazard Control including Flame and explosion Detection
- Fire Detection in transportation tunnels
- Black ice detection and warning
- Blood Glucose monitoring
- Security Human Presence and Detection
- Humidity measurement

Thin Film based vs. Silicon based thermopiles

Parameter	Thin Film	Silicon
Output Voltage	Higher	Lower
Signal-to-Noise Ratio	Higher	Lower
Temperature Coefficient of R	-0.36%/°C	-0.01%/°C
Noise Voltage	Lower	Higher
Time Constant	Slower	Faster
Cost	Higher	Lower
Operating Temperature	100°C	125°C

Single-Channel Thin-Film by Specification	M5	M14	1M	1SC Comp	M34	DR34 Comp	DR46 Comp	2M	3M	6M
Active Area Size (mm)	0.5 Dia	.92 x .4	1.0 Dia	1.0 x 1.0	3.16 x.4	3.16 x.4	4 x .6	2 x 2	3 x 3	6.0 Dia
Element Area (mm ²)	0.196	0.368	0.785	1.0	1.264	1.264	2.4	4.0	9.0	28.3
Number of Junctions	10	12	15	18	40	40	50	48	72	59
Number of Channels	1	1	1	1 Comp	1	1 Comp	1 Comp	1	1	1
Output Voltage (μV)	35	20	60	48	115	115	210	250	440	370
Signal-to-Noise Ratio	5,000	2,857	8,571	3,582	10,088	7,099	11,602	19,531	25,581	18,317
Responsivity \mathcal{R} (V/W)	54.1	16.5	23.5	14.5	27.6	27.6	26.5	18.9	14.8	4.0
Resistance (kΩ)	3	3	3	11	8	16	20	10	18	25
Temp. Coefficient of \mathcal{R} (%/°C)	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
Temp. Coefficient of Resistance (%/°C)	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20
Noise Voltage (nV/√Hz)	7.0	7.0	7.0	13.4	11.4	16.2	18.1	12.8	17.2	20.2
Noise Equivalent Power (nW/√Hz)	0.13	0.43	0.30	0.92	0.42	0.59	0.68	0.68	1.16	5.10
Detectivity (10 ⁸ √Hz/W)	3.4	1.4	2.9	1.1	2.7	1.9	2.3	3.0	2.6	1.0
Time Constant (ms)	28	14	32	48	38	38	40	85	100	221
Field of View (Degrees)	64°/78°	53°/105°	56°/85°	20°/84°	NA	NA	NA	38°/95°	63°/120°	75°/137°
Package Type	TO-5	TO-18	TO-5	TO-5	TO-5	TO-5	TO-8	TO-5	TO-5	TO-8
Operating Temperature (°C)	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100
Element Matching (%)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Element Separation (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Single-Channel Silicon by Specification	S25 TO-18	S25 TO-5	S60M TO-18	S60M TO-5	ST60 Micro	ST60 TO-18	ST60 TO-5	ST60 LCC	ST120 TO-5	ST150
Active Area Size (mm)	.25 x .25	.25 x .25	.6 x .6	.6 x .6	.61 x .61	.61 x .61	.61 x .61	.61 x .61	1.2 x 1.2	1.5 x 1.5
Element Area (mm ²)	0.0625	0.0625	.036	.036	.037	.037	.037	.037	1.44	2.25
Number of Junctions	20	20	72	72	80	80	80	80	80	120
Number of Channels	1	1	1	1	1	1	1	1	1	1
Output Voltage (μV)	23	40	89	120	54	60	62	62	180	230
Signal-to-Noise Ratio	1,186	2,062	2,320	3,125	1,724	1,916	1,981	1,981	4,660	6,571
Responsivity \mathcal{R} (V/W)	111.5	193.9	74.9	101.0	44.0	48.9	50.5	50.5	37.9	31.0
Resistance (kΩ)	23	23	90	90	60	60	60	60	90	75
Temp. Coefficient of \mathcal{R} (%/°C)	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
Temp. Coefficient of Resistance (%/°C)	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.02	0.11
Noise Voltage (nV/√Hz)	19.4	19.4	38.4	38.4	31.3	31.3	31.3	31.3	38.4	35.0
Noise Equivalent Power (nW/√Hz)	0.17	0.10	0.51	0.38	0.71	0.64	0.62	0.62	1.02	1.13
Detectivity (10 ⁸ √Hz/W)	1.44	2.5	1.17	1.6	0.86	.95	1.0	1.0	1.18	1.3
Time Constant (ms)	16	12	12	12	18	15	18	18	25	38
Field of View (Degrees)	88°/103°	69°/76°	76°/111°	64°/81°	36°/77°	40°/69°	64°/81°	45°/81°	52°/86°	88°/103°
Package Type	TO-18	TO-5	TO-18	TO-5	Micro-TO	TO-18	TO-5	LCC	TO-5	TO-5
Operating Temperature (°C)	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 100	-50 to 125	-50 to 100
Element Matching (%)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Element Separation (mm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

1M

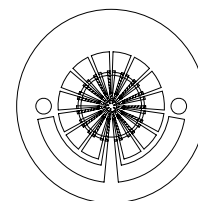
Thin Film Based Thermopile Detector

Features: A thin film-based thermopile with a 1.0mm diameter active area with good signal-to-noise ratio in a TO-5 package and a moderate time constant of 32ms with Argon encapsulation gas.

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) Internal aperture precisely defines active area for applications with FOV and/or spot size requirements. See [Aperture Options](#) for available sizes. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature measurement.

Benefit: Small active area with good signal-to-noise ratio.



Detector circuit overlay



1M

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	Ø1mm Dia.			AA	mm	Hot junction size, per element.
Element Area	.785			A	mm ²	
Number of Junctions	15					Per element.
Number of Channels	1					Per detector package.
Output Voltage	50	60	80	V _s	µV	DC, H=330µW/cm ² (3)
Signal-to-Noise Ratio	6,173	8,571	14,035	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	19.3	23.2	30.9	R	V/W	DC, R=V _s /H A (2)
Resistance	2.0	3.0	4.0	R	kΩ	Detector element
Temperature Coefficient of R		-.36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-.2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	5.7	7.0	8.1	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.19	.30	.42	NEP	nW/√Hz	DC, NEP= V _n H A/V _s (2)
Detectivity	2.1	2.9	4.8	D*	10 ⁸ cm ² √Hz/W	DC, D*=V _s / V _n H A (2)
Time Constant		32		T	ms	Chopped, -3dB point (1)
Field of View	56°/85°			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-5					Standard package hole size: Ø.150"
Operating Temperature	-50		100	T _a	°C	

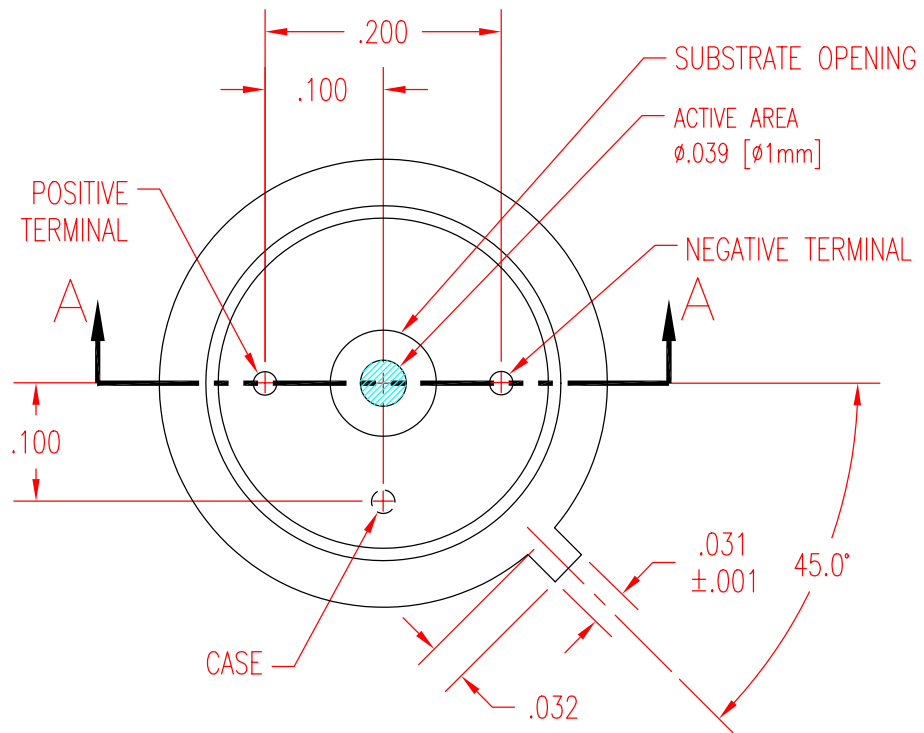
General Specifications: Flat spectral response from 100nm to > 100µm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

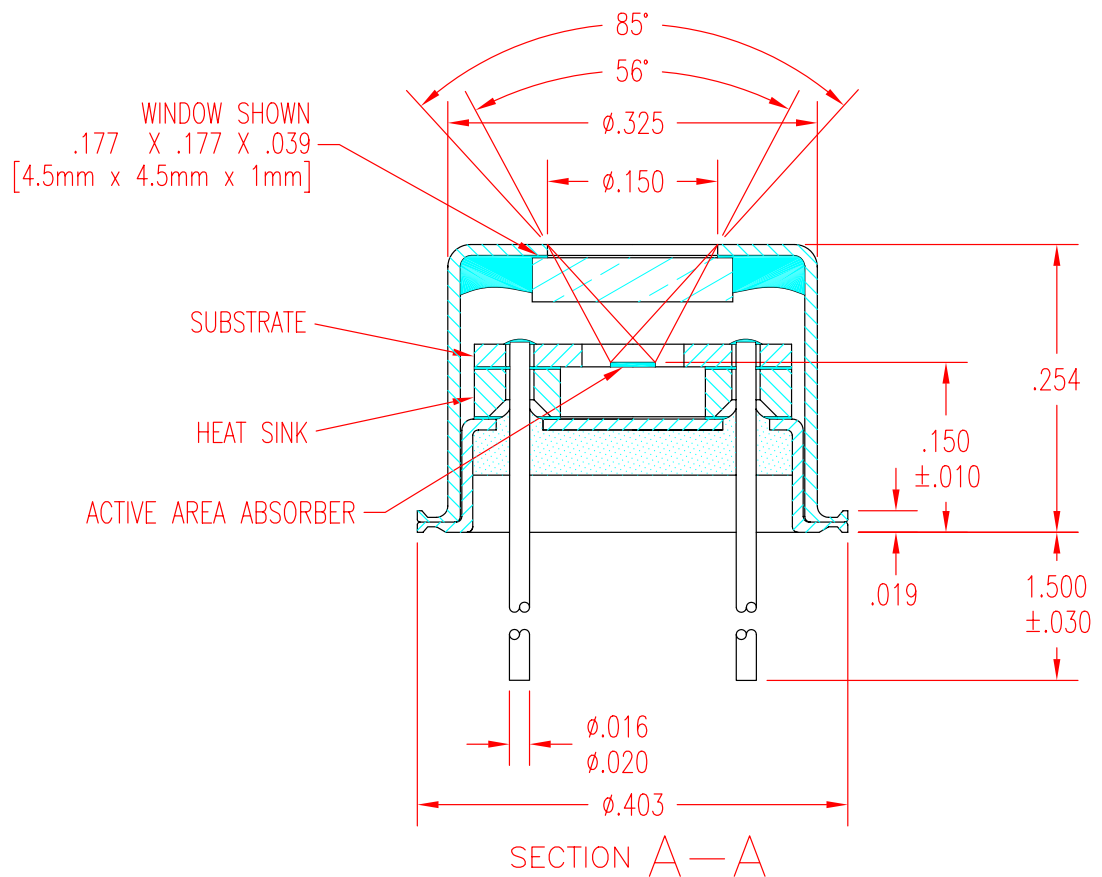
8502 Rev F

Update: 6/16/05

Information subject to change without notice



TOP VIEW
WITHOUT COVER



2M

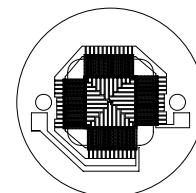
Thin Film Based Thermopile Detector

Features: A thin film-based single element thermopile detector that offers the world's highest sensitivity in a TO-5 package. Dare to compare. Low noise voltage of 12.8nV/ $\sqrt{\text{Hz}}$.

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) Order this unit encapsulated with Xenon and this becomes a super-high output detector with very low noise. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for gas analysis, fire detection and non-contact temperature measurement.

Benefit: Extremely high output with best signal-to-noise performance with a time constant of 85ms when encapsulated with Argon gas.



Detector circuit overlay



2M

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	2 x 2			AA	mm	Hot junction size, per element.
Element Area	4			A	mm ²	
Number of Junctions	48					Per element.
Number of Channels	1					Per detector package.
Output Voltage	200	250	300	V _s	μV	DC, H=330 $\mu\text{W}/\text{cm}^2$ (3)
Signal-to-Noise Ratio	12,739	19,531	30,303	SNR	$\sqrt{\text{Hz}}$	DC, SNR=V _s /V _n
Responsivity	15.2	18.9	22.7	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	5	10	15	R	k Ω	Detector element
Temperature Coefficient of \mathcal{R}		-.36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-.2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	9.9	12.8	15.7	V _n	nV/ $\sqrt{\text{Hz}}$	V _n \approx 4kTR
Noise Equivalent Power	.44	.68	1.0	NEP	nW/ $\sqrt{\text{Hz}}$	DC, NEP= V _n HA/V _s (2)
Detectivity	1.9	3.0	4.6	D*	10 ⁸ cm $\sqrt{\text{Hz}}/\text{W}$	DC, D*=V _s /V _n H \sqrt{A} (2)
Time Constant		85		τ	ms	Chopped, -3dB point (1)
Field of View	38°/95°			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-5					Standard package hole size: \varnothing .150"
Operating Temperature	-50		100	T _a	°C	

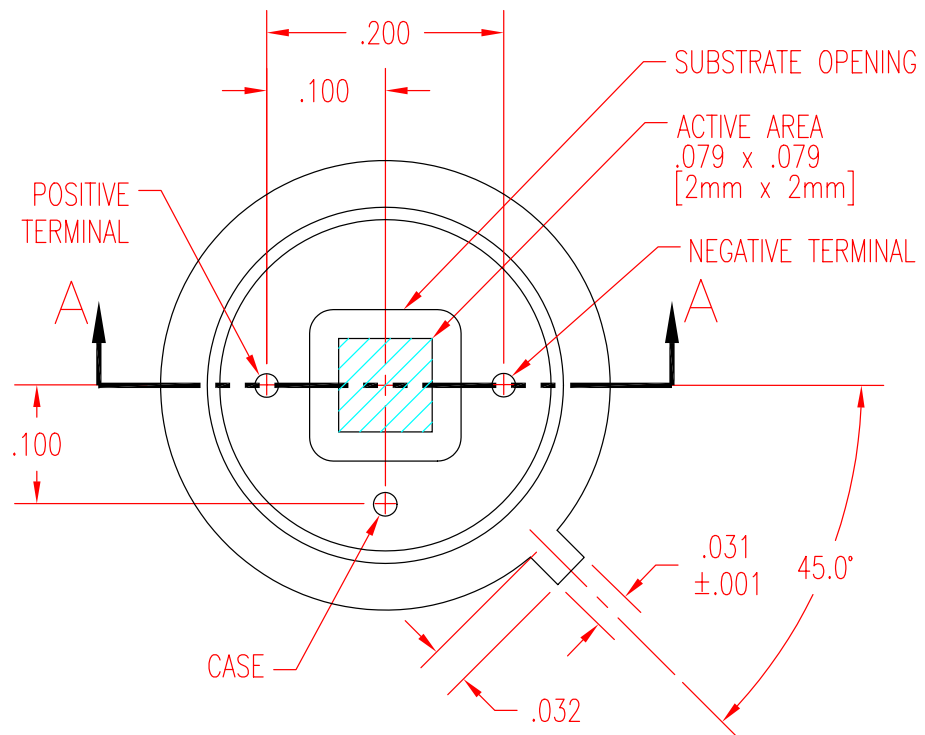
General Specifications: Flat spectral response from 100nm to > 100 μm . Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold \geq .5W/cm²

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

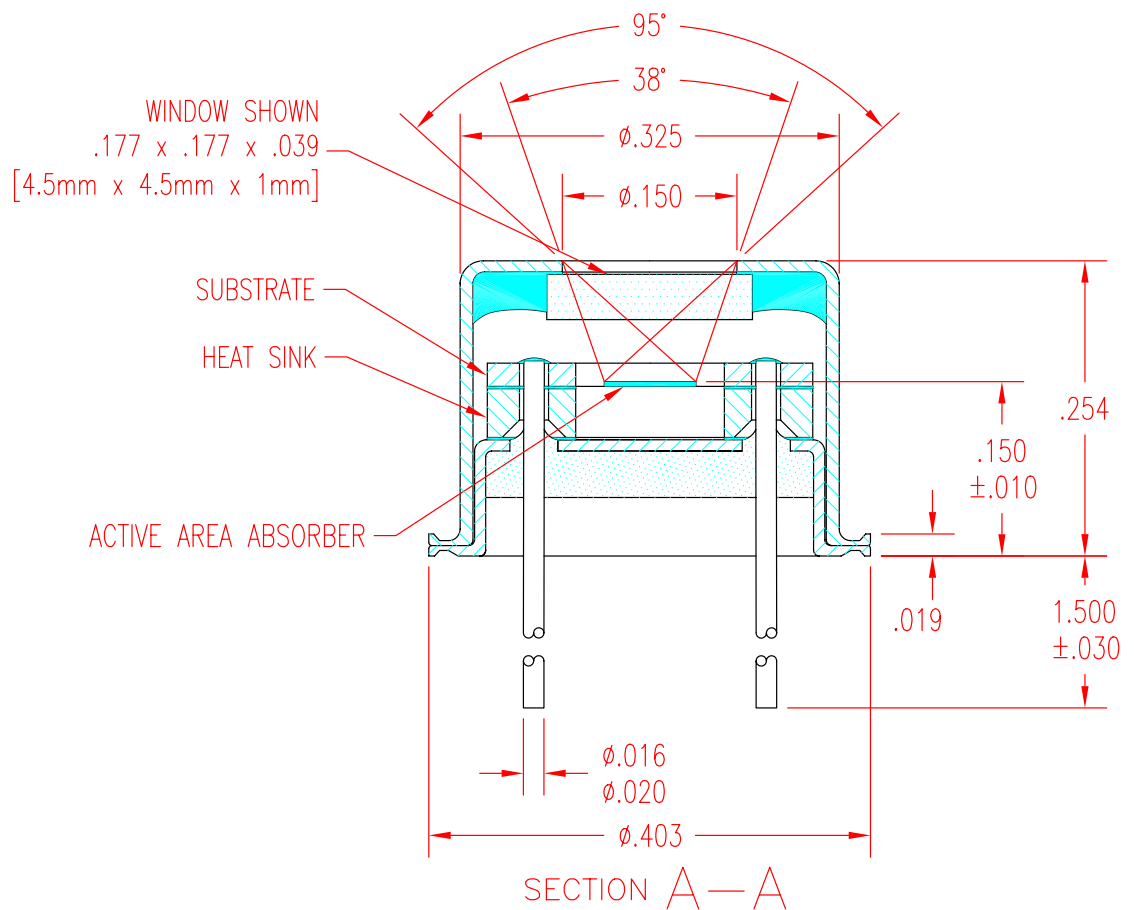
8503 Rev H

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Information subject to change without notice



TOP VIEW
WITHOUT COVER



3M

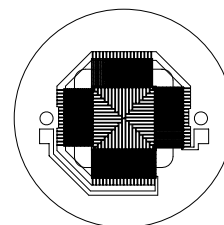
Thin Film Based Thermopile Detector

Features: A thin film-based single element thermopile. The highest output detector in our line-up.

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for laser power measurement and can be used for gas analysis.

Benefit: Highest signal-to-noise ratio with larger TO-8 package and higher cost.



Detector circuit overlay



3M

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	3 x 3			AA	mm	Hot junction size, per element.
Element Area	9			A	mm ²	
Number of Junctions	72					Per element.
Number of Channels	1					Per detector package.
Output Voltage	400	440	500	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	25,478	25,581	22,624	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	13.5	14.8	16.8	R	V/W	DC, R=V _s /HA (2)
Resistance	15	18	30	R	kΩ	Detector element
Temperature Coefficient of R		-.36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-.2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	15.7	17.2	22.1	V _n	nV/√Hz	V _n =4kTR
Noise Equivalent Power	.93	1.16	1.64	NEP	nW/√Hz	DC, NEP= V _n HA/V _s (2)
Detectivity	1.8	2.6	3.2	D*	10 ⁸ cm ² √Hz/W	DC, D*=V _s /V _n H√A (2)
Time Constant		100		τ	ms	Chopped, -3dB point (1)
Field of View	63°/120°			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-8					Standard package hole size: Ø.250"
Operating Temperature	-50		100	T _a	°C	

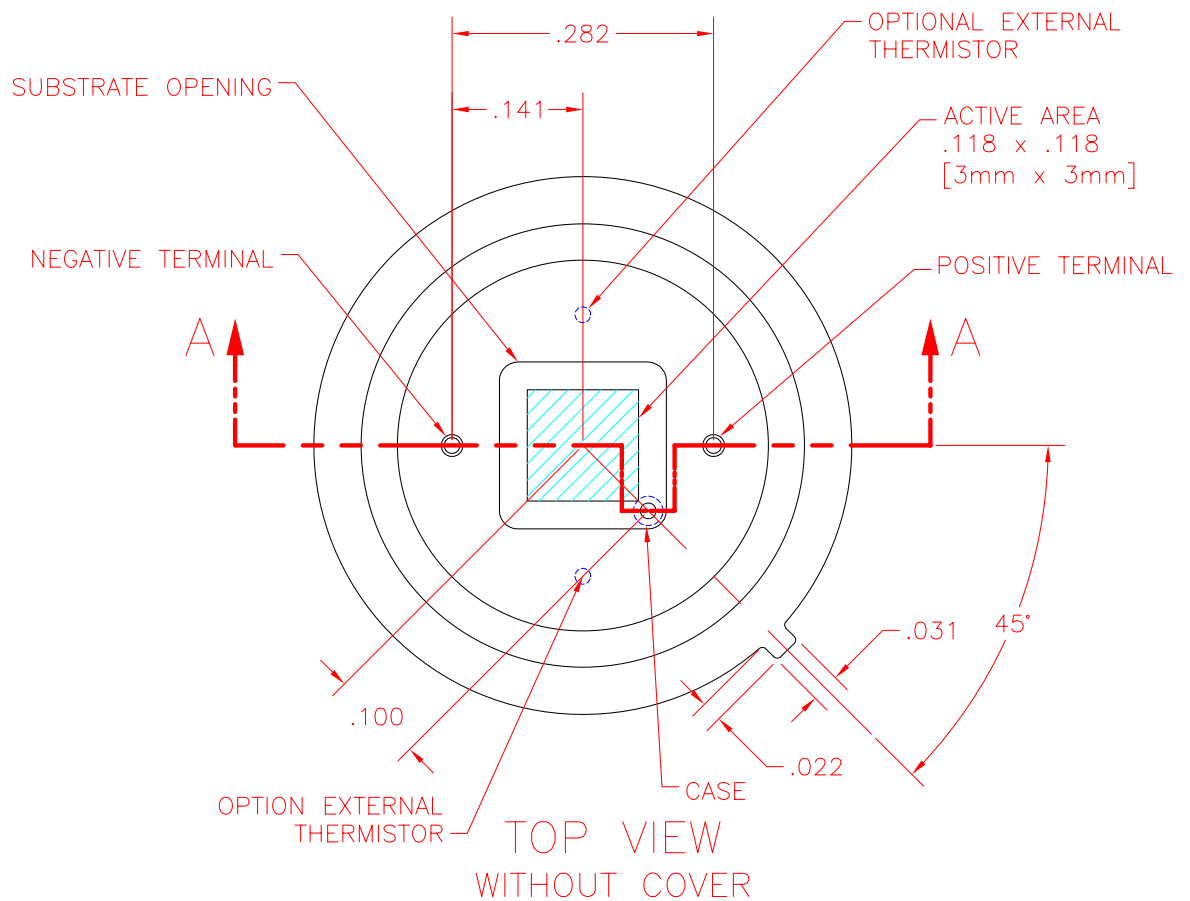
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

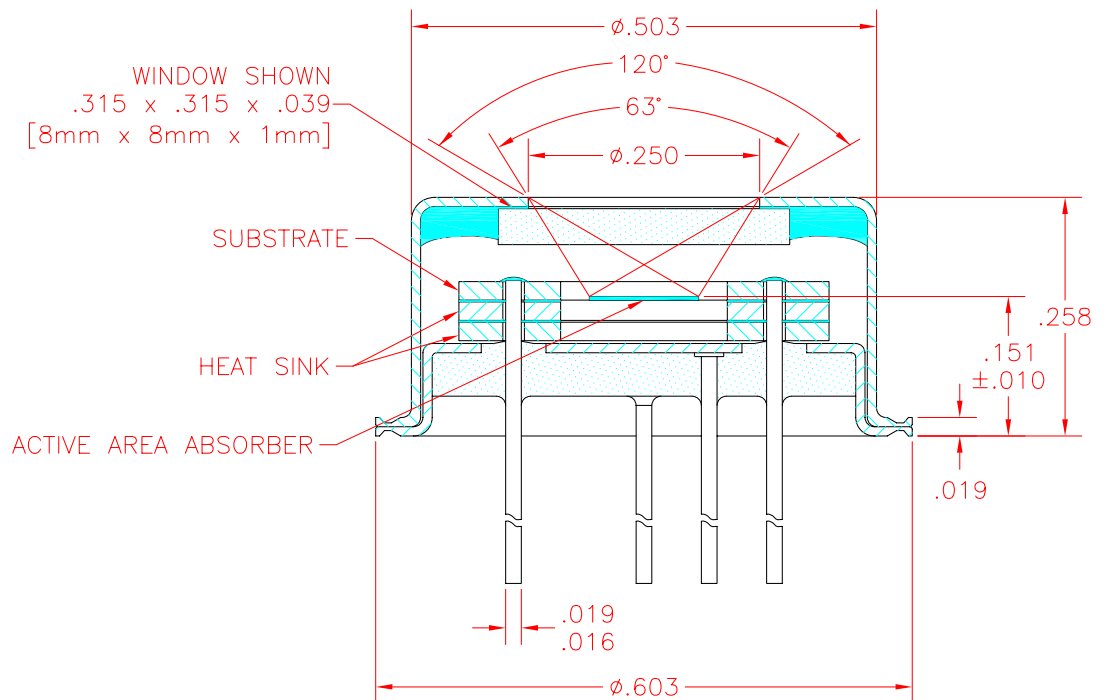
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8506 Rev H

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Information subject to change without notice





SECTION A—A

NOTE: SOME FEATURES REMOVED FOR CLARITY

6M

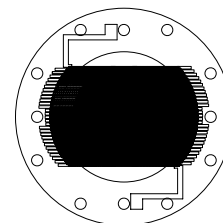
Thin Film Based Thermopile Detector

Features: A thin film-based single element thermopile with the largest active area in our line up at 6.0mm diameter in a TO-8 package

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) Internal 30k Ω 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. See [Thermopile Configuration Table](#) for options.

Applications: Very large active area and high output makes it an excellent choice for laser power measurements.

Benefit: Large active area and high output that is higher in cost and in a large package size.



Detector circuit overlay



6M

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	\varnothing 6mm Dia			AA	mm	Hot junction size, per element.
Element Area	28.3			A	mm ²	
Number of Junctions	59					Per element.
Number of Channels	1					Per detector package.
Output Voltage	300	370	450	V_s	μ V	DC, $H=330\mu$ W/cm ² (3)
Signal-to-Noise Ratio	12,552	18,317	28,662	SNR	\sqrt Hz	DC, $SNR=V_s/V_n$
Responsivity	3.2	4.0	4.8	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	15	25	35	R	k Ω	Detector element
Temperature Coefficient of \mathcal{R}		-36			%/ $^{\circ}$ C	Best linear fit, 0 $^{\circ}$ to 85 $^{\circ}$ C (1)
Temperature Coefficient of R		-2			%/ $^{\circ}$ C	Best fit, 0 $^{\circ}$ to 85 $^{\circ}$ C (1)
Noise Voltage	15.7	20.2	23.9	V_n	nV/ \sqrt Hz	$V_n^2=4kTR$
Noise Equivalent Power	3.25	5.10	7.45	NEP	nW/ \sqrt Hz	DC, $NEP=V_n/HA/V_s$ (2)
Detectivity	.7	1.0	1.6	D^*	10 ⁸ cm \sqrt Hz/W	DC, $D^*=V_s/V_n H/VA$ (2)
Time Constant		221		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View	75 $^{\circ}$ /137 $^{\circ}$			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-8					Standard package hole size: \varnothing .437"
Operating Temperature	-50		100	T_a	$^{\circ}$ C	

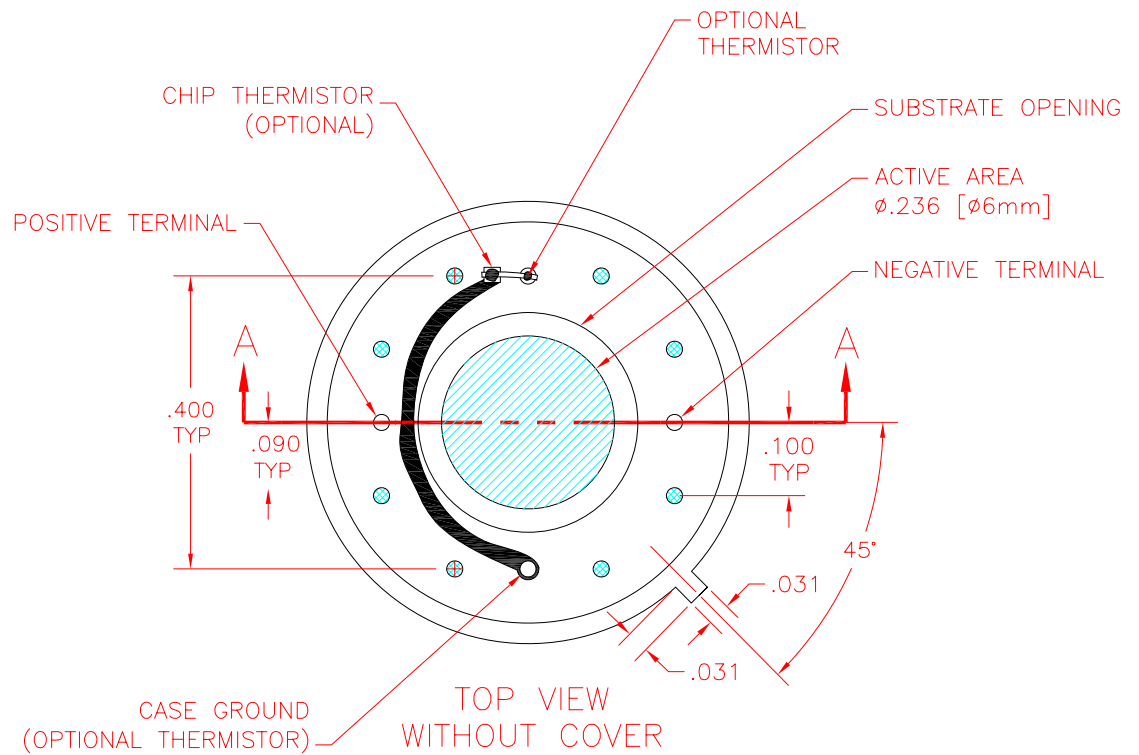
General Specifications: Flat spectral response from 100nm to > 100 μ m. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold \geq .5W/cm²

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

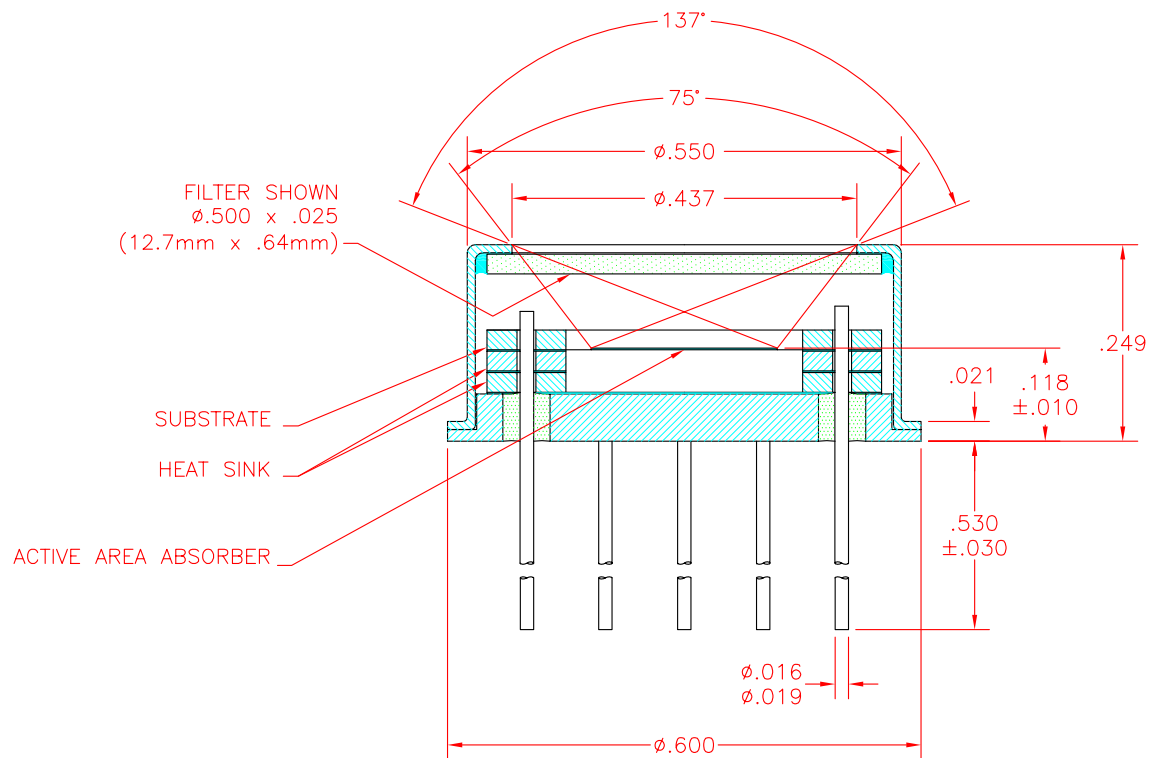
8507 Rev J

Update: 10/10/06

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ALL SHADED PINS – NO CONNECTION



M5

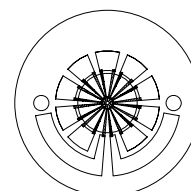
Thin Film Based Thermopile Detector

Features: A thin film-based thermopile offering very low noise and a small 0.5mm diameter active area in a TO-5 package. This is one of the lowest noise thermopiles you can buy and provides a time constant 28ms time constant with Argon encapsulation gas.

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) Internal aperture precisely defines active area for applications with FOV and/or spot size requirements. See [Aperture Options](#) for available sizes. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature measurement.

Benefit: Small active area with medium signal-to-noise ratio.



Detector circuit overlay



M5

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	Ø.5mm Dia.			AA	mm	Hot junction size, per element.
Element Area	.196			A	mm ²	
Number of Junctions	10					Per element.
Number of Channels	1					Per detector package.
Output Voltage	22	35	45	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	2,716	5,000	7,895	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	34.0	54.1	69.6	R	V/W	DC, R=V _s /H (2)
Resistance	2.0	3.0	4.0	R	kΩ	Detector element
Temperature Coefficient of R		-.36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-.2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	5.7	7.0	8.1	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.08	.13	.24	NEP	nW/√Hz	DC, NEP= V _n H/ΔV _s (2)
Detectivity	1.9	3.4	5.4	D*	10 ⁶ cm ² √Hz/W	DC, D*=V _s /V _n H/ΔV _s (2)
Time Constant		28		T	ms	Chopped, -3dB point (1)
Field of View	64°/78°			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-5					Standard package hole size: Ø.150"
Operating Temperature	-50		100	T _a	°C	

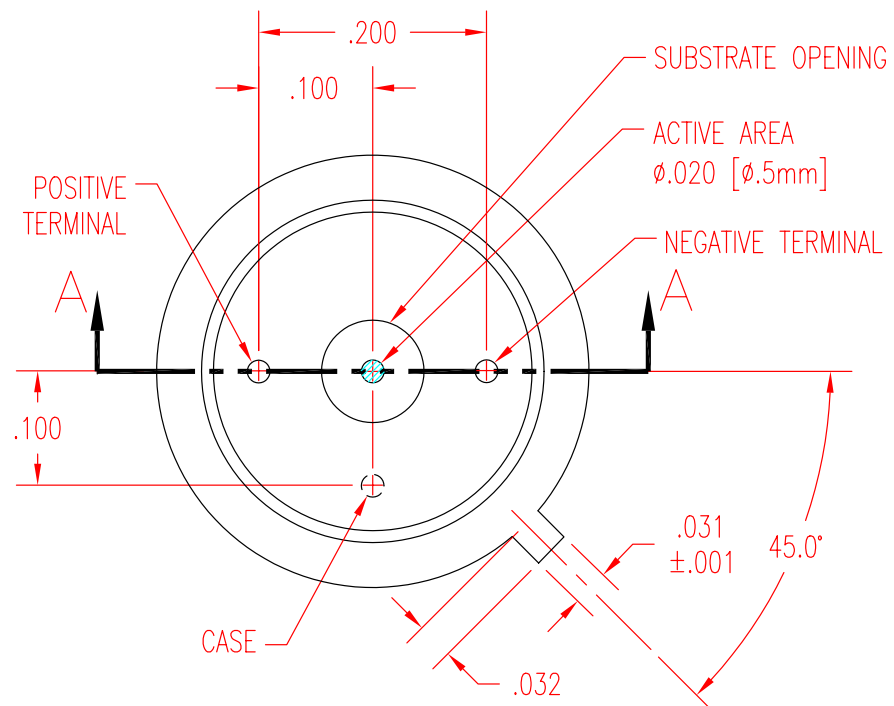
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

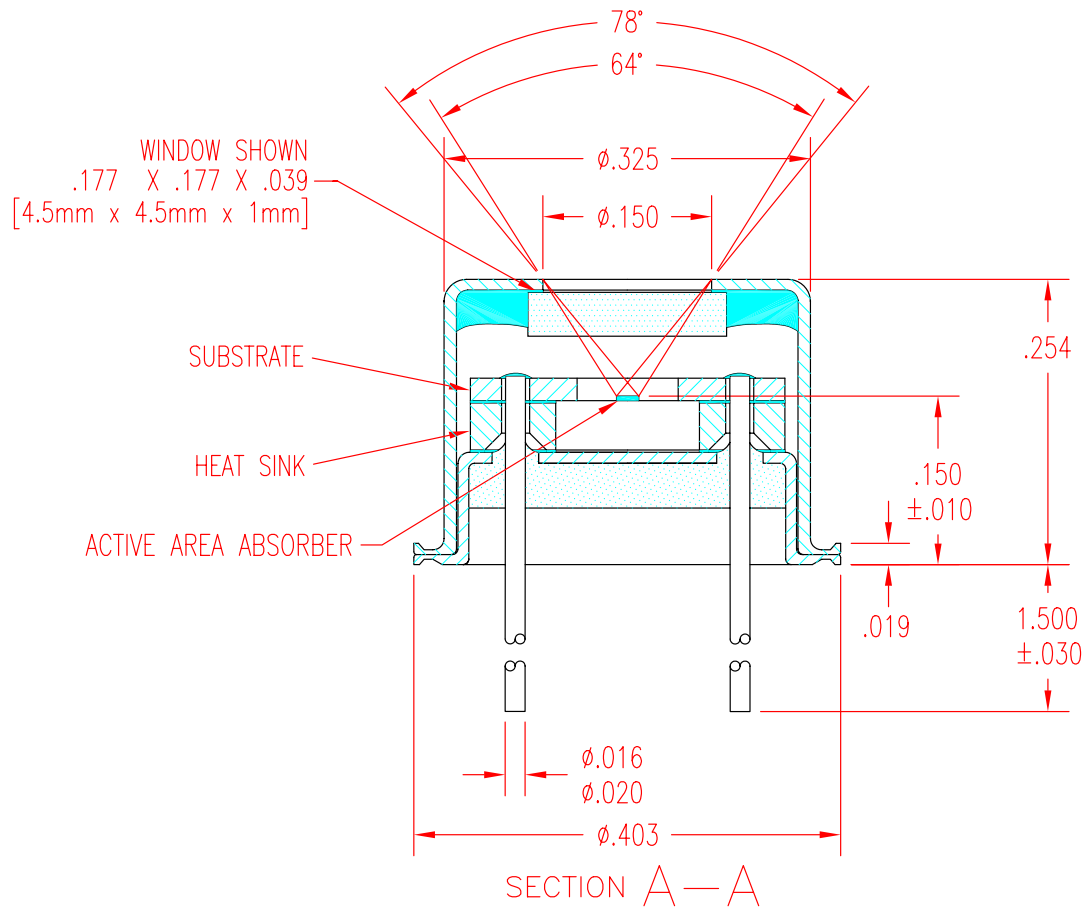
8501 Rev G

Update: 6/16/05

Information subject to change without notice



TOP VIEW
WITHOUT COVER



M14

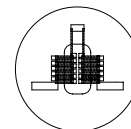
Thin Film Based Thermopile Detector

Features: A single-channel thin film-based thermopile offering very low noise in a compact TO-18 package with a small active area of 0.92mm x 0.4mm. This is one of the lowest noise thermopiles you can buy and provides a fast 14ms time constant with Argon encapsulation gas.

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for ear thermometers and handheld non-contact temperature measurement.

Benefit: Small package size and very low noise with lower signal-to-noise ratio.



Detector circuit overlay



M14

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.92 x .4		AA	mm	Hot junction size, per element.
Element Area		.368		A	mm ²	
Number of Junctions		12				Per element.
Number of Channels		1				Per detector package.
Output Voltage	15	20	25	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	1,852	2,857	5,000	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	12.4	16.5	20.6	ℳ	V/W	DC, ℳ=V _s /H A (2)
Resistance	1.5	3.0	4.0	R	kΩ	Detector element
Temperature Coefficient of ℳ		-.36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-.2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	5.0	7.0	8.1	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.24	.43	.66	NEP	nW/√Hz	DC, NEP= V _n H A/V _s (2)
Detectivity	.93	1.4	2.5	D*	10 ⁶ cm ² √Hz/W	DC, D*=V _s / V _n H A (2)
Time Constant		14		T	ms	Chopped, -3dB point (1)
Field of View		53°/105°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-18				Standard package hole size:∅.080
Operating Temperature	-50		100	T _a	°C	

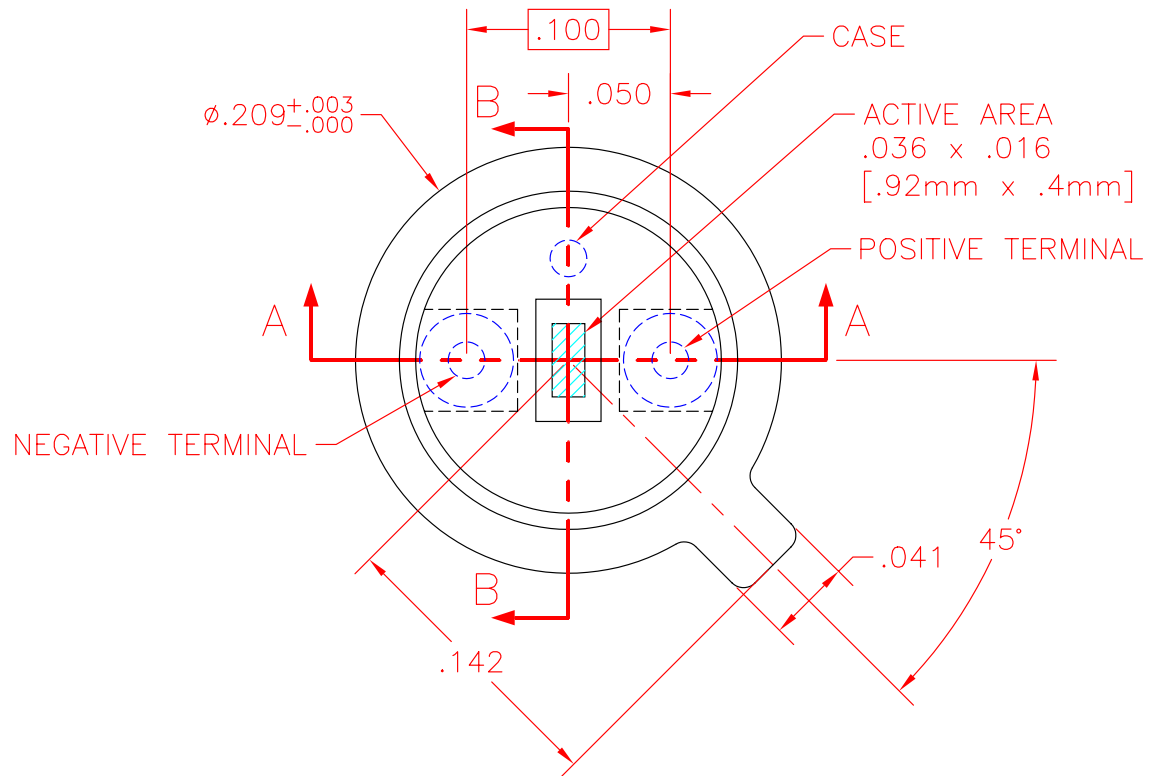
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8500 Rev G

Update: 6/16/05

Information subject to change without notice



TOP VIEW
W/O COVER



M34

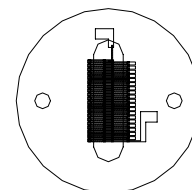
Thin Film Based Thermopile Detector

Features: A thin-film thermopile in a TO-5 package with an active area of 3.16mm x 0.4mm that offers low noise output.

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Non-contact temperature measurement for industrial and medical, including infant incubators.

Benefit: Centered rectangular active area and low noise with moderate output.



Detector circuit overlay

Technical Specifications

M34

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	3.16 x .4			AA	mm	Hot junction size, per element.
Element Area	1.264			A	mm ²	
Number of Junctions	40					Per element.
Number of Channels	1					Per detector package.
Output Voltage	90	115	130	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	6,429	10,088	16,049	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	21.6	27.6	31.2	ℳ	V/W	DC, ℳ=V _s /HA (2)
Resistance	4.0	8.0	12.0	R	kΩ	Detector element
Temperature Coefficient of ℳ		-36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	8.1	11.4	14.0	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.26	.42	.65	NEP	nW/√Hz	DC, NEP= V _n HA/V _s (2)
Detectivity	1.7	2.7	4.3	D*	10 ⁶ cm√Hz/W	DC, D*=V _s / V _n H√A (2)
Time Constant		38		τ	ms	Chopped, -3dB point (1)
Field of View	NA			FOV	Degrees	Not Applicable
Package Type	TO-5 with 3 Pins					Standard package hole size: Ø.150"
Operating Temperature	-50		100	T _a	°C	

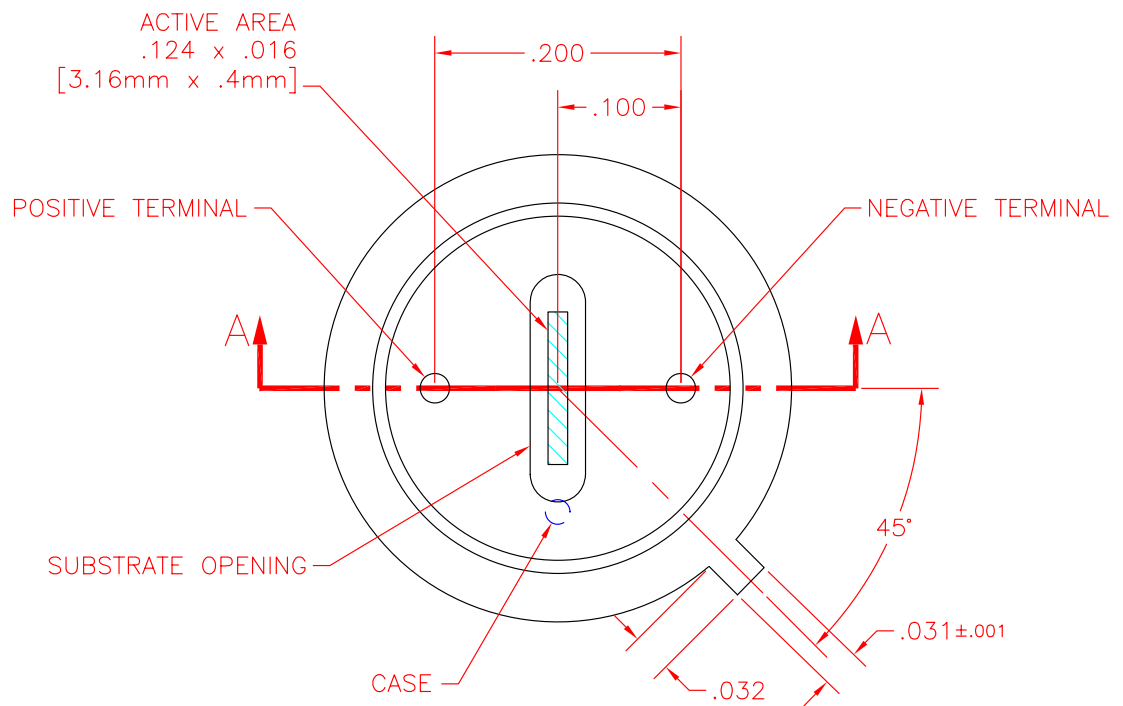
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

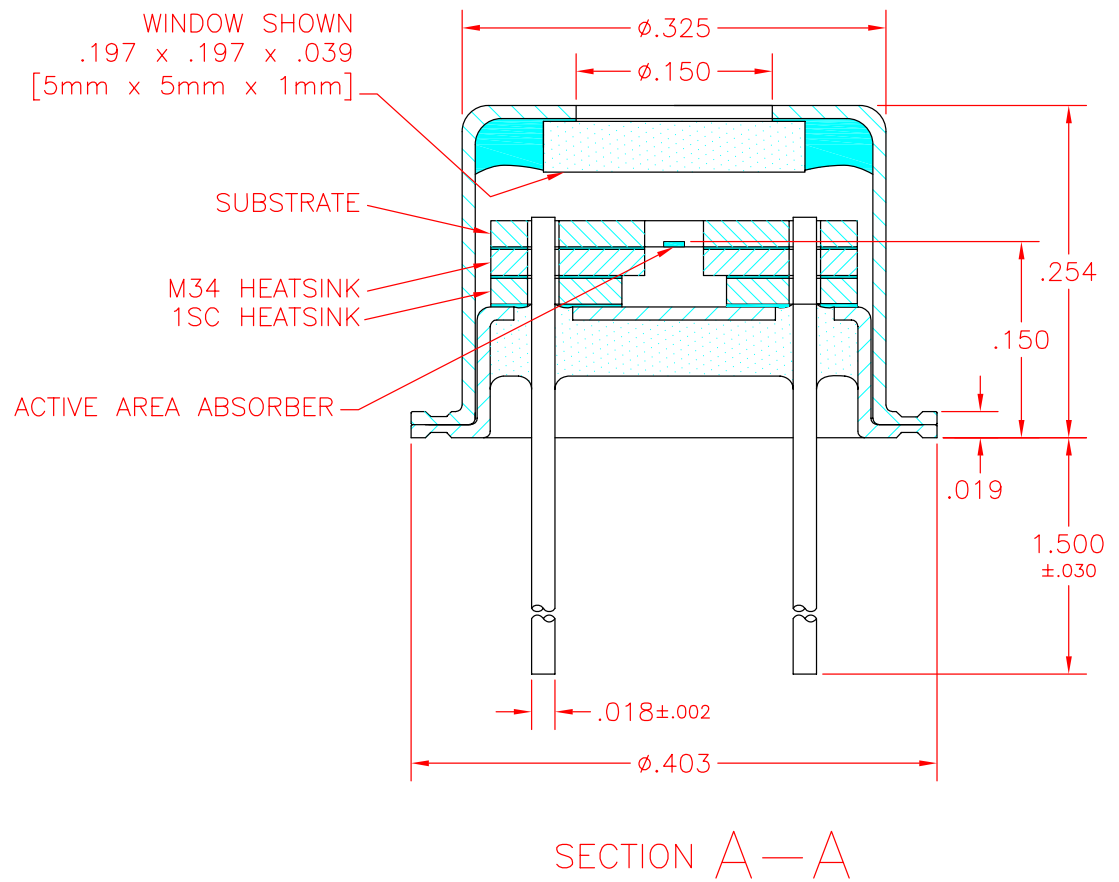
8637 Rev A

Update: 6/22/05

Information subject to change without notice



TOP VIEW
WITHOUT COVER



1SC

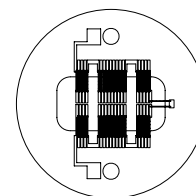
Thin Film Based Thermopile Detector

Features: A thin film-based single channel thermopile detector that offers thermal compensation to minimize effects of sudden ambient temperature change during the initial five seconds of change. The 1SC Compensated comes in a TO-5 package with a medium sized 1.0 x 1.0mm active area. Compensation is achieved through the integration of two additional half-sized thermopile elements. Internal aperture is standard and precisely defines active area for applications with FOV and/or spot size requirements.

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature measurement.

Benefit: Thermal compensation with increase in noise and a time constant of 48ms in Argon encapsulation gas.



Detector circuit overlay



1SC

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	1 x 1			AA	mm	Hot junction size, per element.
Element Area	1			A	mm ²	
Number of Junctions	18					Per element.
Number of Channels	1 Compensated					Per detector package.
Output Voltage	40	48	55	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	2,649	3,582	4,545	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	12.1	14.5	16.7	ℳ	V/W	DC, ℳ=V _s /H A (2)
Resistance	7.0	11.0	14.0	R	kΩ	Detector element
Temperature Coefficient of ℳ		-36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	12.1	13.4	15.1	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.73	.92	1.30	NEP	nW/√Hz	DC, NEP= V _n HA/V _s (2)
Detectivity	.8	1.1	1.4	D*	10 ⁸ cm√Hz/W	DC, D*=V _s / V _n H√A (2)
Time Constant		48		τ	ms	Chopped, -3dB point (1)
Field of View	20°/89°			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-5					Standard package hole size: Ø.150"
Operating Temperature	-50		100	T _a	°C	

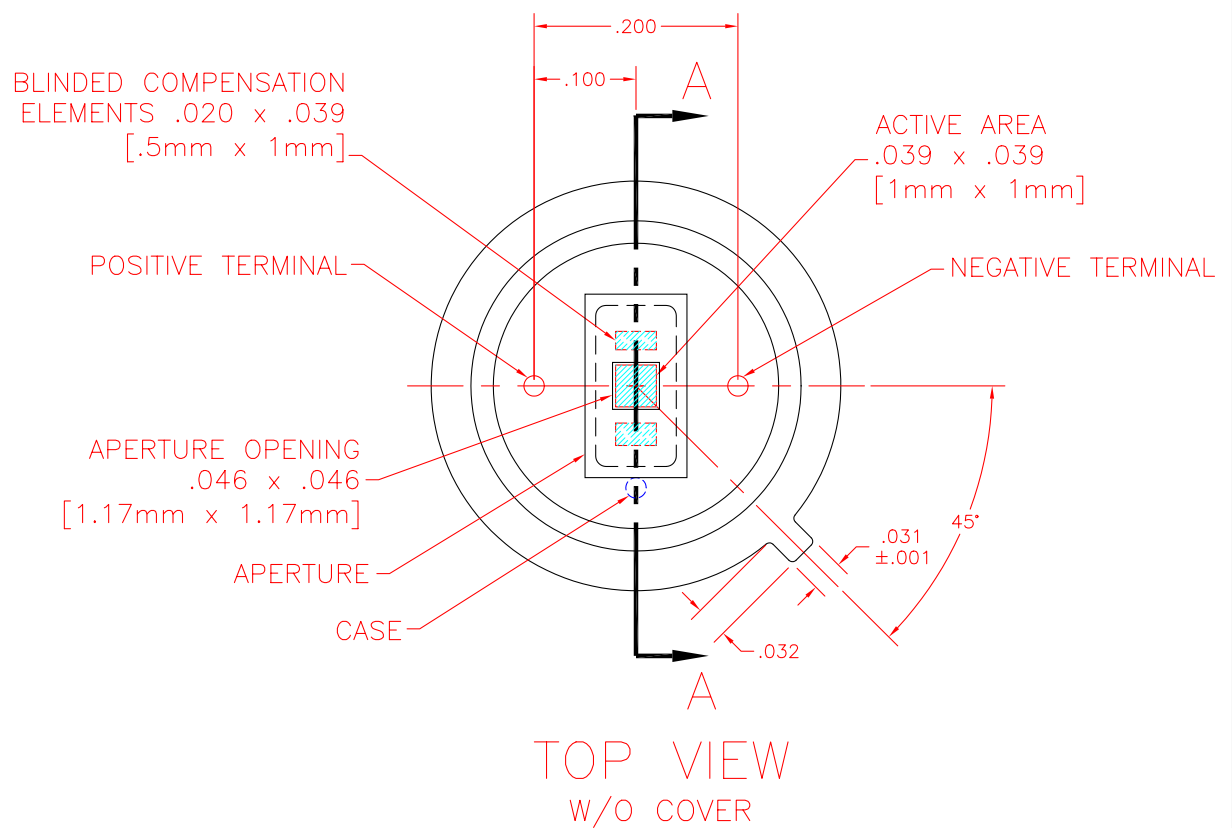
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

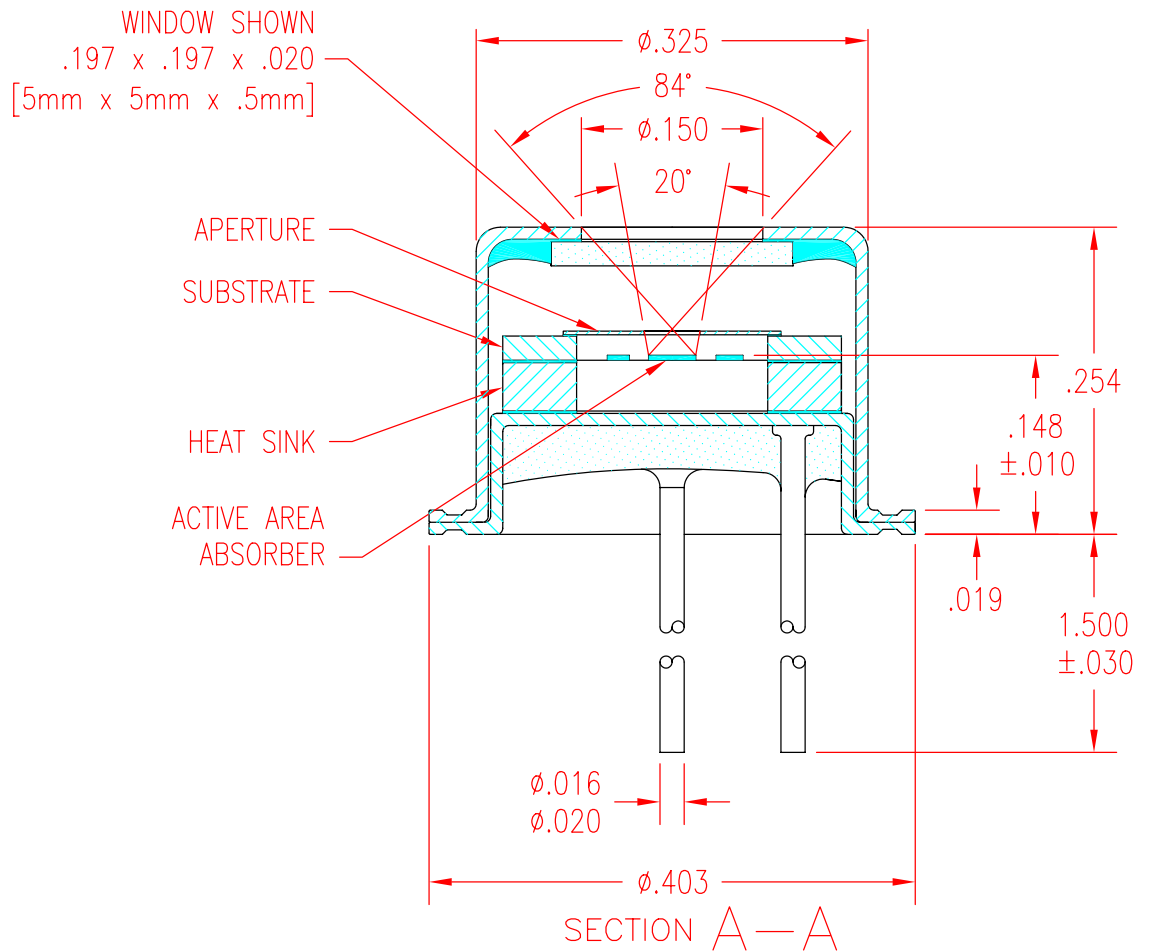
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8508 Rev H

Update: 6/22/05

Information subject to change without notice





NOTE: SOME FEATURES REMOVED FOR CLARITY

DR34 Compensated

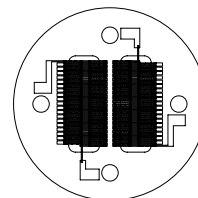
Thin Film Based Thermopile Detector

Features: A one-channel compensated thin-film thermopile in a TO-5 package. The active area and compensating element area are 3.16mm x 0.4mm each. Internal aperture minimizes channel-to-channel crosstalk and thus increasing sensitivity.

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Industrial and medical monitoring including infant incubators.

Benefit: Compensated rectangular shaped active area in a TO-5 package with moderate output.



Detector circuit overlay



DR34 Compensated

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	3.16 x .4			AA	mm	Hot junction size, per element.
Element Area	1.264			A	mm ²	
Number of Junctions	40					Per element.
Number of Channels	1 Compensated					Per detector package.
Output Voltage	90	115	130	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	4,545	7,099	11,404	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	21.6	27.6	31.2	R	V/W	DC, R=V _s /H A (2)
Resistance	8	16	24	R	kΩ	Detector element
Temperature Coefficient of R		-.36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-.2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	11.4	16.2	19.8	V _n	nV/√Hz	V _n ≈4kTR
Noise Equivalent Power	.37	.59	.92	NEP	nW/√Hz	DC, NEP= V _n H A/V _s (2)
Detectivity	1.2	1.9	3.1	D*	10 ⁸ cm√Hz/W	DC, D*=V _s /V _n H√A (2)
Time Constant		38		T	ms	Chopped, -3dB point (1)
Field of View	NA			FOV	Degrees	Not Applicable
Package Type	TO-5 with 3 Pins					Standard package hole size: Ø.180"
Operating Temperature	-50		100	T _a	°C	

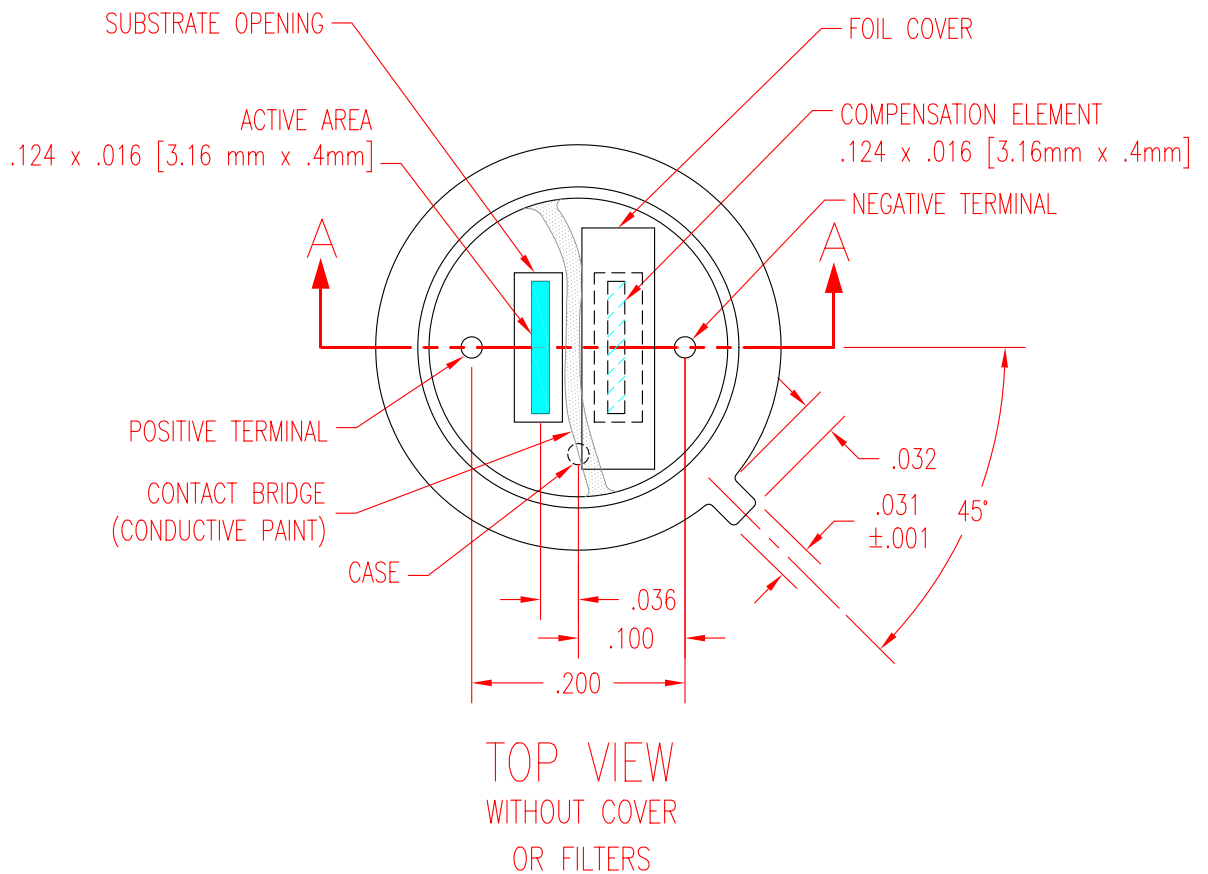
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

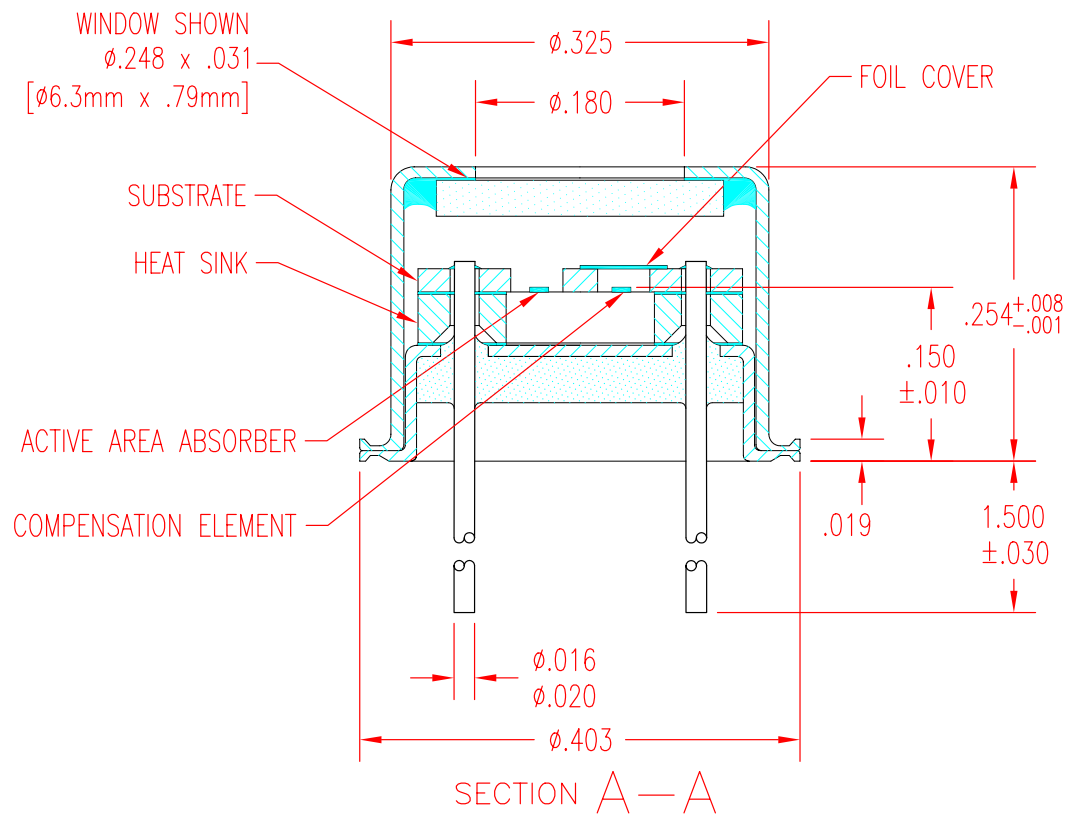
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8635 Rev A

Update: 6/22/05

Information subject to change without notice





DR46 Compensated

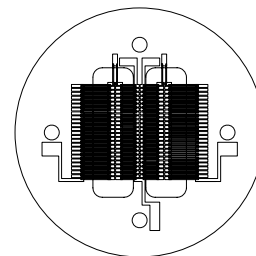
Thin Film Based Thermopile Detector

Features: A one-channel compensated thin-film thermopile in a TO-8 package. The active area and compensating element area are 4mm x 0.6mm each. Offers high output with very good signal-to-noise ratio. Internal aperture minimizes channel-to-channel crosstalk increasing sensitivity.

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Non-contact temperature measurement, fire detection / suppression.

Benefit: High output, low noise compensated rectangular shaped active area in a TO-8 package.



Detector circuit overlay



DR46 Compensated

Technical Specifications

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	4 x .6			AA	mm	Hot junction size, per element.
Element Area	2.4			A	mm ²	
Number of Junctions	50					Per element.
Number of Channels	1 Compensated					Per detector package.
Output Voltage	170	210	250	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	7,692	11,602	16,556	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	21.5	26.5	31.6	R	V/W	DC, R=V _s /H A (2)
Resistance	14	20	30	R	kΩ	Detector element
Temperature Coefficient of R		-.36			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		-.2			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	15.1	18.1	22.1	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.48	.68	1.03	NEP	nW/√Hz	DC, NEP= V _n H A V _s (2)
Detectivity	1.5	2.3	3.2	D*	10 ⁹ cm ² √Hz/W	DC, D*=V _s / V _n H √A (2)
Time Constant		40		T	ms	Chopped, -3dB point (1)
Field of View	NA			FOV	Degrees	Not Applicable
Package Type	TO-8 with 3 Pins					Standard package hole size: Ø.437"
Operating Temperature	-50		100	T _a	°C	

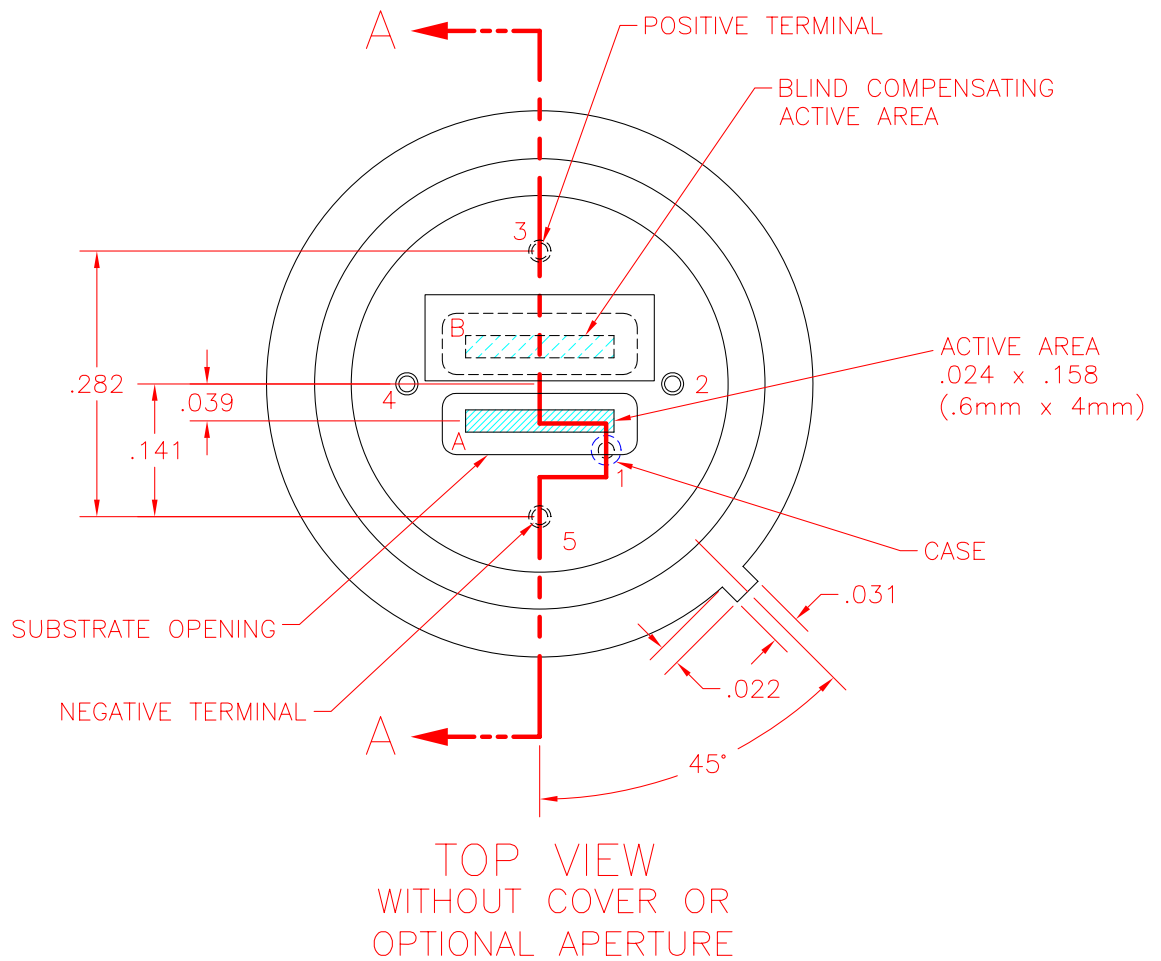
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

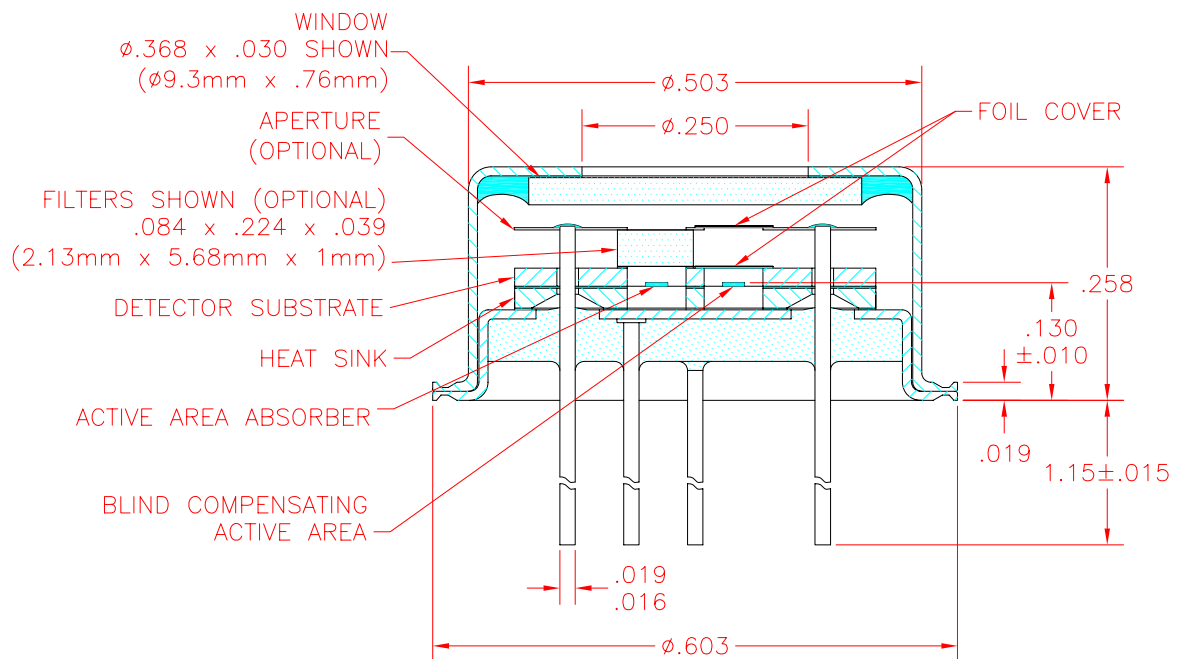
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8636 Rev A

Update: 6/22/05

Information subject to change without notice





SECTION A-A

S25* TO-5

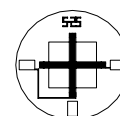
Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile that offers the smallest single element active area size at 0.25mm x 0.25mm in a TO-5 package. Delivers a very fast 12ms time constant in Argon encapsulation gas and even faster with Neon gas at 9ms. Delivers a very low Temperature Coefficient of Responsivity of -0.04%/°C.

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) Internal aperture precisely defines active area for applications with FOV and/or spot size requirements. See [Aperture Options](#) for available sizes. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature measurement when extremely small spot size is a design requirement.

Benefit: Small active area, fast time constant with lower output that has a higher cost.



Detector circuit overlay



Technical Specifications

S25 TO-5

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	.25 x .25			AA	mm	Hot junction size, per element.
Element Area	.0625			A	mm ²	
Number of Junctions	20					Per element.
Number of Channels	1					Per detector package.
Output Voltage	35	40	45	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	1,636	2,062	2,616	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	169.7	193.9	218.2	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	18	23	28	R	kΩ	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	17.2	19.4	21.4	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.08	.10	.13	NEP	nW/√Hz	DC, NEP= V _n HA/V _s (2)
Detectivity	2.0	2.5	3.2	D*	10 ⁸ cm√Hz/W	DC, D*=V _s /V _n H√A (2)
Time Constant		18		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View	69°/76°			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-5					Standard package hole size: ∅.150"
Operating Temperature	-50		100	T _a	°C	

General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

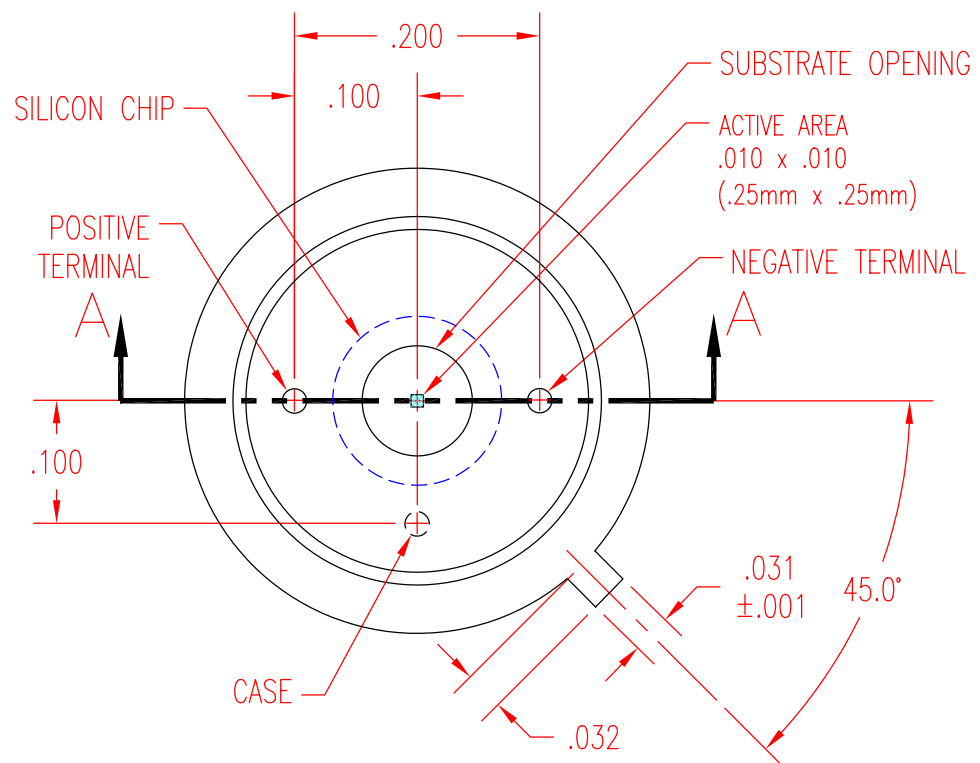
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

*Protected by U.S. Patent No. 5,059,543 and U.S. Patent No. 5,100,479

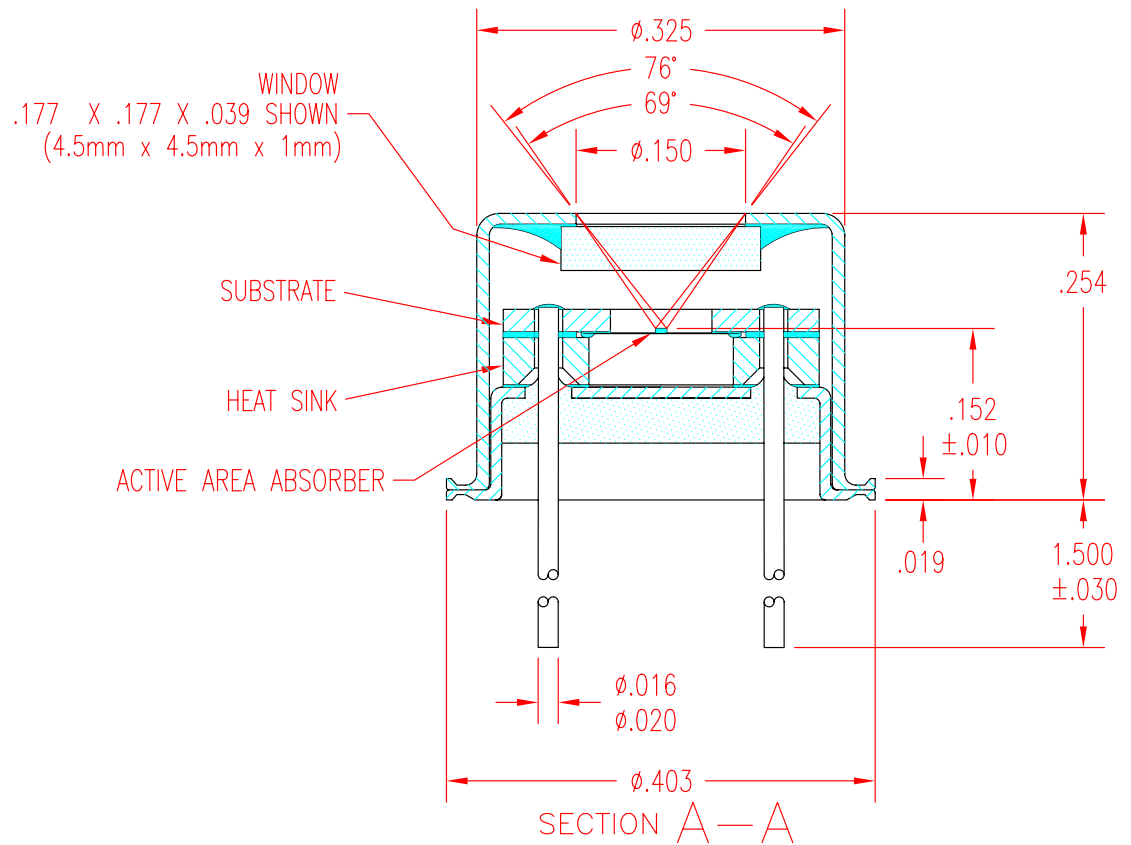
8515 Rev k

Update: 6/8/06

Information subject to change without notice



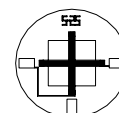
TOP VIEW
WITHOUT COVER



S25* TO-18

Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile that offers the smallest single element active area size at 0.25mm x 0.25mm in a small TO-18 package. Delivers a very fast 12ms time constant in Argon encapsulation gas and even faster with Neon gas at 9ms. Delivers a very low Temperature Coefficient of Responsivity of -0.04%/°C.



Detector circuit overlay

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature measurement when extremely small spot size is a design requirement.

Benefit: Small active area, fast time constant in a small package with lower output that has a higher cost

Technical Specifications

S25 TO-18

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.25 x .25		AA	mm	Hot junction size, per element.
Element Area		.0625		A	mm ²	
Number of Junctions		20				Per element.
Number of Channels		1				Per detector package.
Output Voltage		23		V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio		1,186		SNR	√Hz	DC, SNR=V _s /V _n
Responsivity		111.5		\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	18	23	28	R	kΩ	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	17.2	19.4	21.4	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power		.17		NEP	nW/√Hz	DC, NEP= V _n HA/V _s (2)
Detectivity		1.44		D*	10 ⁸ cm√Hz/W	DC, D*=V _s / V _n H√A (2)
Time Constant		16		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		88°/103°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-18				Standard package hole size: Ø.080"
Operating Temperature	-50		100	T _a	°C	

General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

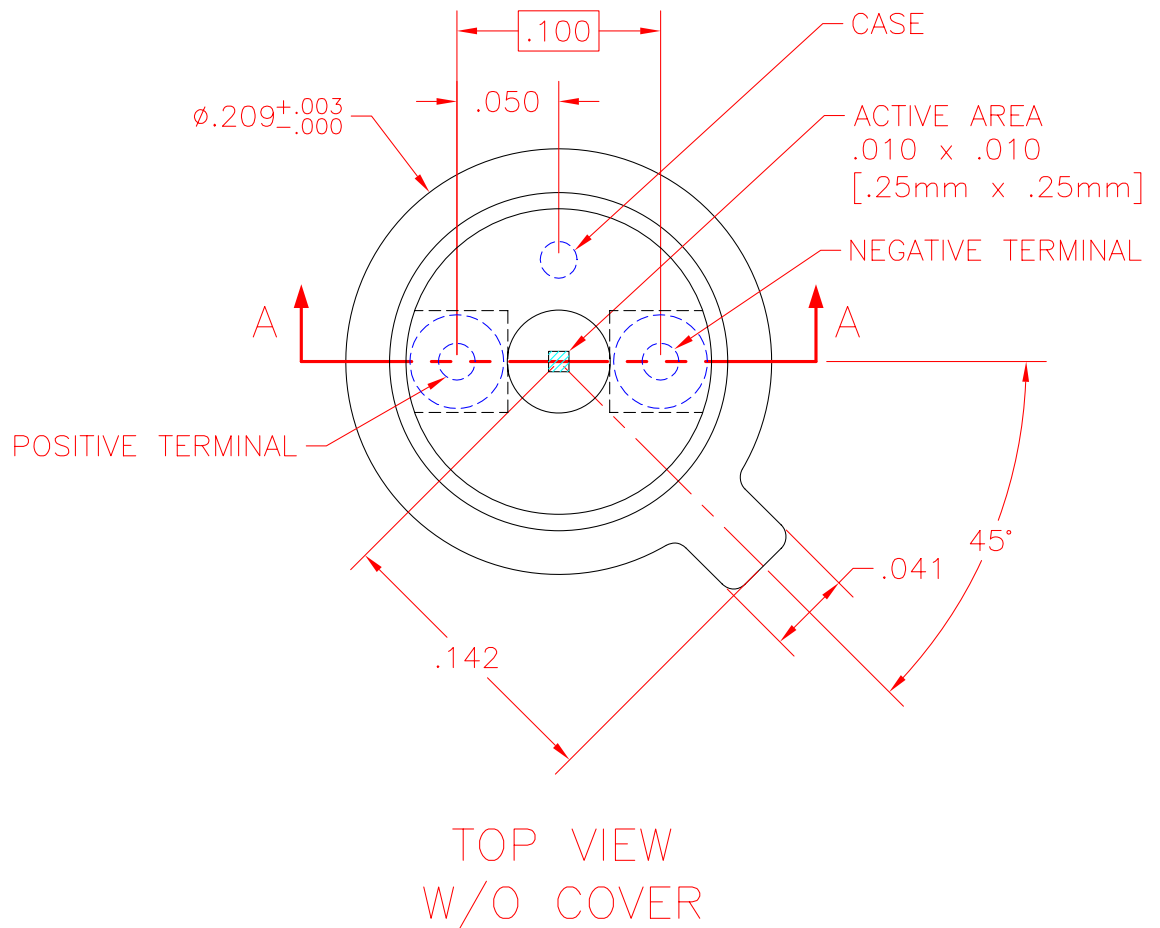
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

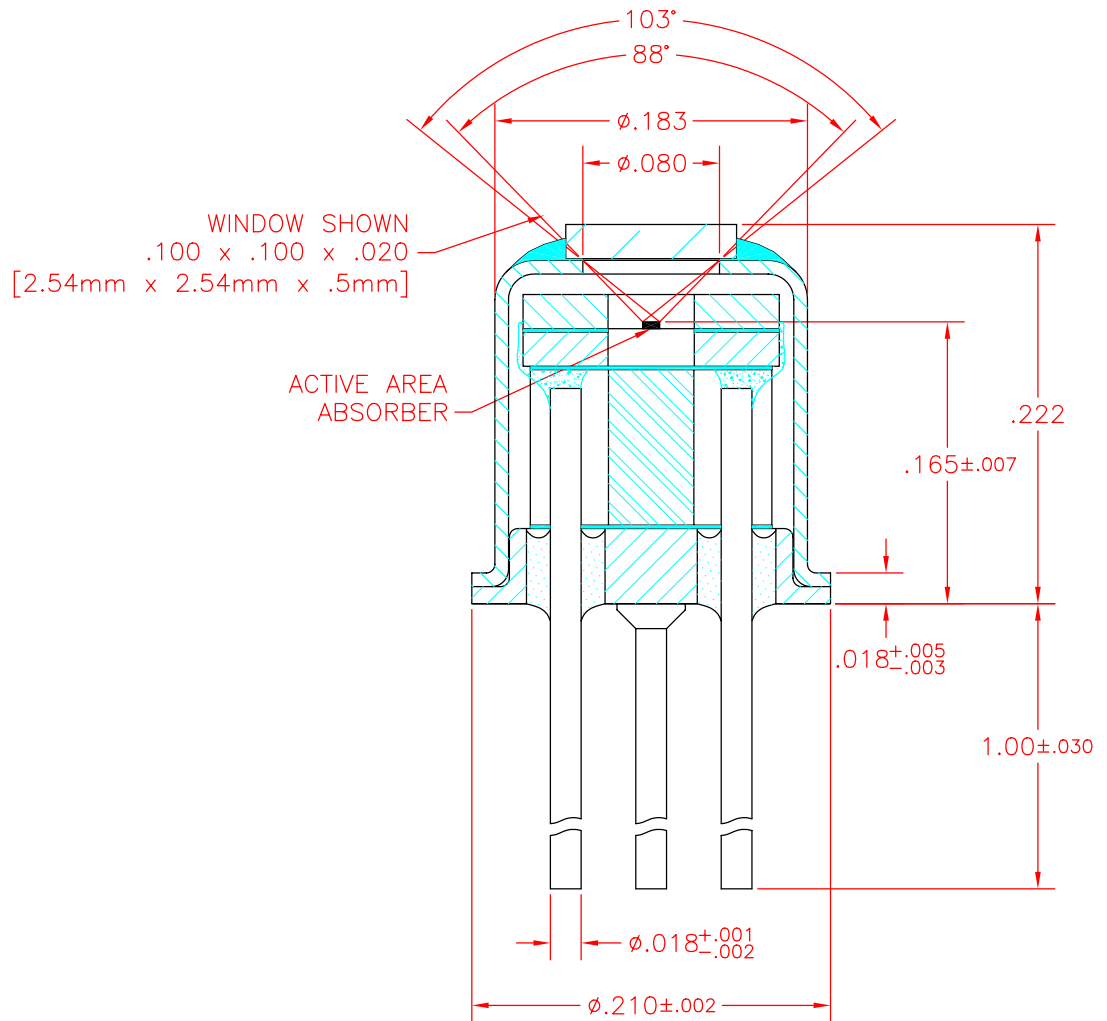
*Protected by U.S. Patent No. 5,059,543 and U.S. Patent No. 5,100,479

8631 Rev C

Update: 7/20/06

Information subject to change without notice





SECTION A—A

S60M* TO-5

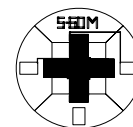
Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile with very high output for its small 0.6mm x 0.6mm active area in a TO-5 package. Delivers a very fast 12ms time constant in Argon encapsulation gas and even faster with Neon gas at 9ms. Delivers a very low Temperature Coefficient of Responsivity of $-0.04\%/^{\circ}\text{C}$.

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) Internal aperture precisely defines active area for applications with FOV and/or spot size requirements. See [Aperture Options](#) for available sizes. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature and gas analysis.

Benefit: High output, small active area, fast time constant that has a higher cost.



Detector circuit overlay



Technical Specifications

S60M TO-5

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.6 x .6		AA	mm	Hot junction size, per element.
Element Area		.36		A	mm ²	
Number of Junctions		72				Per element.
Number of Channels		1				Per detector package.
Output Voltage	90	120	140	V _s	μV	DC, H=330 μW/cm ² (3)
Signal-to-Noise Ratio	2,123	3,125	4,294	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	75.8	101.0	117.8	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/H_A$ (2)
Resistance	65	90	110	R	kΩ	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	32.6	38.4	42.4	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.28	.38	.56	NEP	nW/√Hz	DC, NEP= V _n H A/V _s (2)
Detectivity	1.1	1.6	2.2	D*	10 ⁶ cm√Hz/W	DC, D*=V _s /V _n H√A (2)
Time Constant		12		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		64°/81°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-5				Standard package hole size: Ø.150"
Operating Temperature	-50		100	T _a	°C	

General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

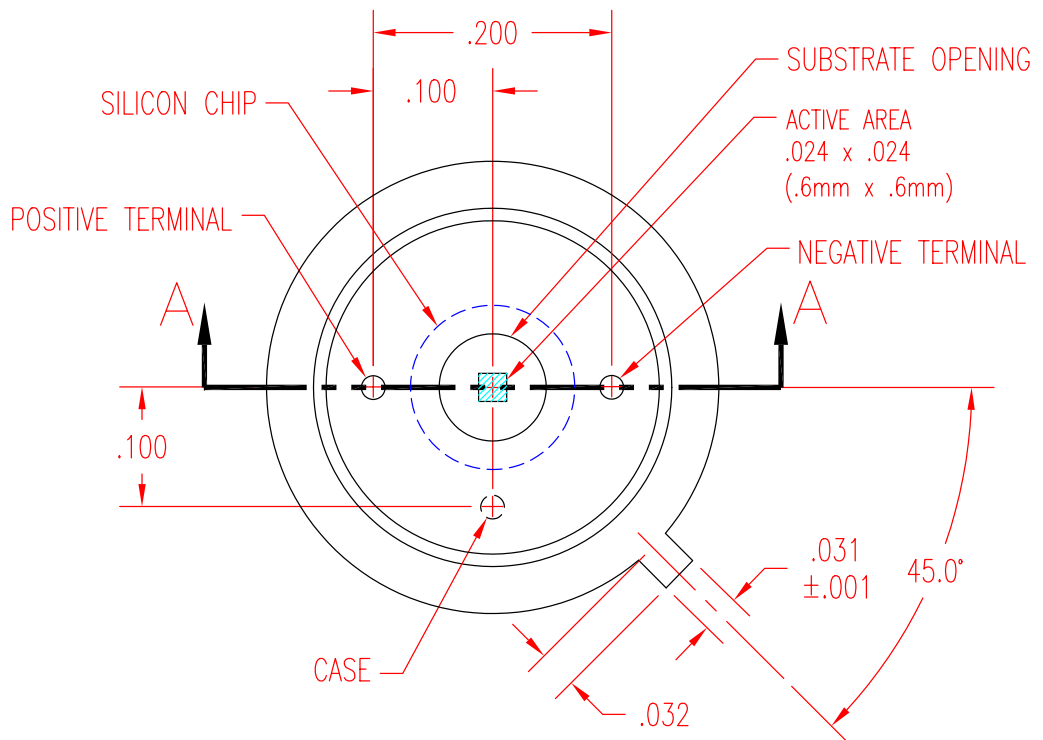
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

*Protected by U.S. Patent No. 5,059,543 and U.S. Patent No. 5,100,479

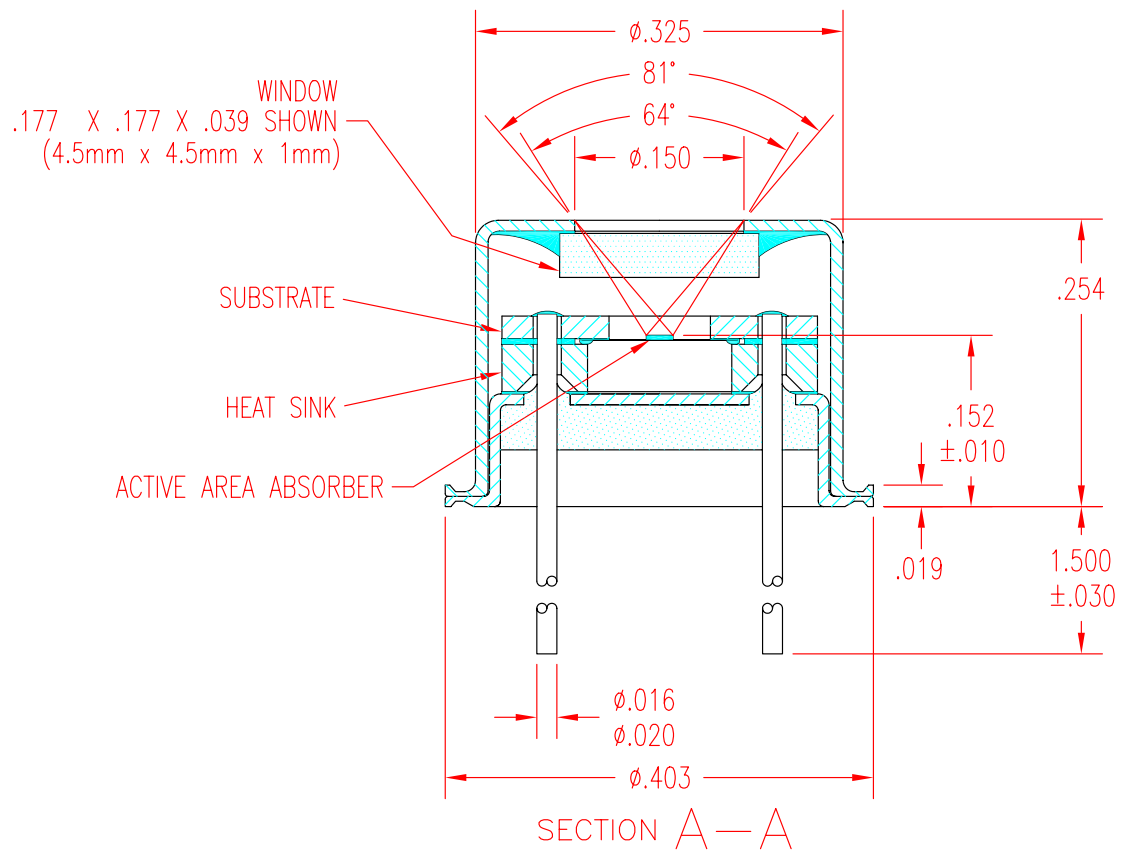
8516 Rev k

Update: 6/8/06

Information subject to change without notice



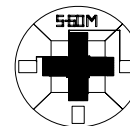
TOP VIEW
WITHOUT COVER
OR APERTURE



S60M* TO-18

Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile with very high output for its small 0.6mm x 0.6mm active area in a small TO-18 package. Delivers a very fast 12ms time constant in Argon encapsulation gas and even faster with Neon gas at 9ms. Delivers a very low Temperature Coefficient of Responsivity of $-0.04\%/^{\circ}\text{C}$.



Detector circuit overlay

Options: See [Standard Windows and Filters](#) for list of optical filter options. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature and gas analysis.

Benefit: High output, small active area, fast time constant in a small package that has a higher cost

Technical Specifications

S60M TO-18

Specifications apply at 23°C with KBr Window and Argon encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.6 x .6		AA	mm	Hot junction size, per element.
Element Area		.36		A	mm ²	
Number of Junctions		72				Per element.
Number of Channels		1				Per detector package.
Output Voltage		89		V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio		2,320		SNR	√Hz	DC, SNR=V _s /V _n
Responsivity		74.9		\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	65	90	110	R	kΩ	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	32.6	38.4	42.4	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power		.51		NEP	nW/√Hz	DC, NEP= V _n HA/V _s (2)
Detectivity		1.17		D*	10 ⁸ cm ² √Hz/W	DC, D*=V _s /V _n H/A (2)
Time Constant		12		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		76°/111°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-18				Standard package hole size: ∅.080"
Operating Temperature	-50		100	T _a	°C	

General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

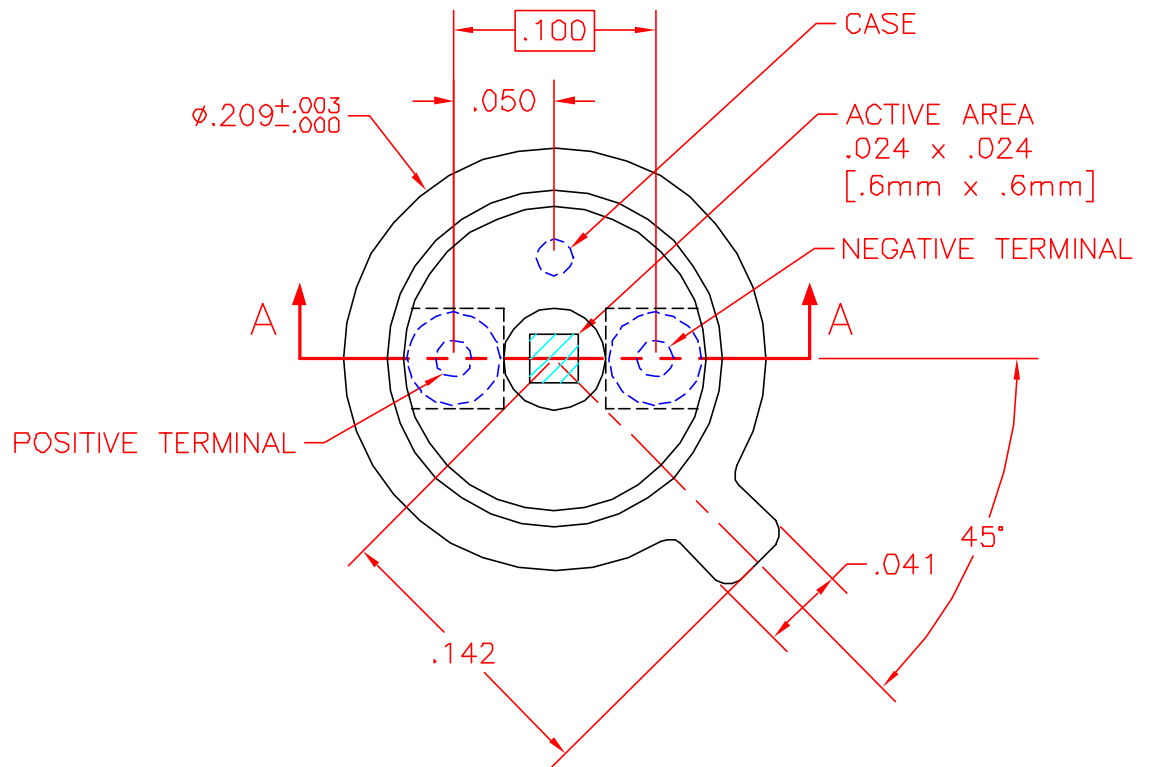
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

*Protected by U.S. Patent No. 5,059,543 and U.S. Patent No. 5,100,479

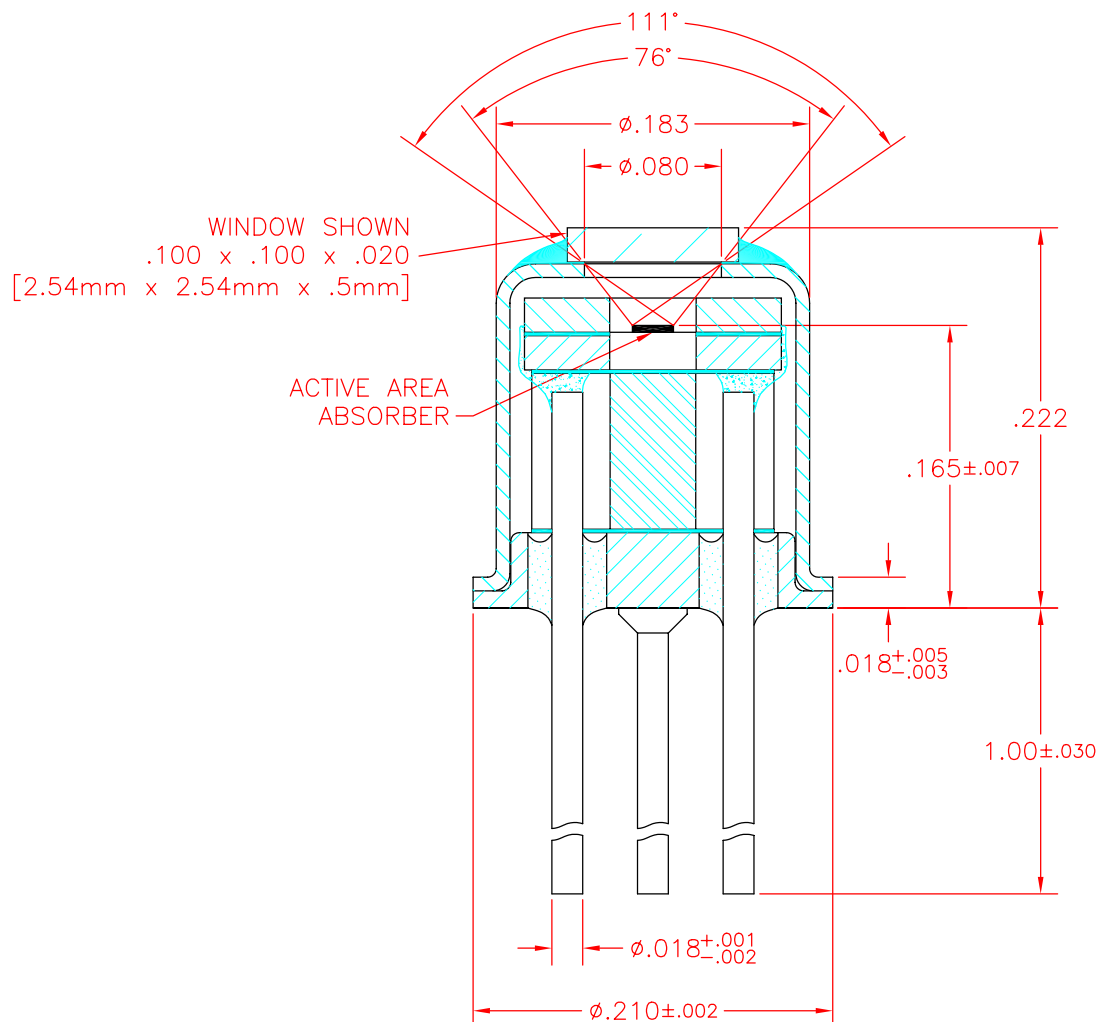
8632 Rev D

Update: 7/20/06

Information subject to change without notice



TOP VIEW
W/O COVER



SECTION A—A

ST60 Micro-TO & ST60R Micro-TO

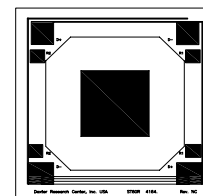
Silicon Based Thermopile Detector

Features: The world's smallest detector at 0.161" diameter x 0.128" tall. Dare to compare. Time constant of 18ms with Nitrogen encapsulation gas. Delivers a very low Temperature Coefficient of Responsivity of -0.04%/°C. ST60R Micro version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor.

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) **ST60R Micro** version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor. 3) Internal 30k Ω 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature, horizon sensor, tympanic ear thermometer, infant thermometer applications.

Benefit: Smallest size at affordable price with medium output.



Detector circuit overlay



Technical Specifications

Specifications apply at 23°C with KBr Window and Nitrogen encapsulating gas

ST60 Micro TO

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.61 x .61		AA	mm	Hot junction size, per element.
Element Area		.37		A	mm ²	
Number of Junctions		80				Per element.
Number of Channels		1				Per detector package.
Output Voltage		54		V _s	μ V	DC, H=330 μ W/cm ² (3)
Signal-to-Noise Ratio		1,724		SNR	$\sqrt{\text{Hz}}$	DC, SNR=V _s /V _n
Responsivity		44.0		\mathcal{R}	V/W	DC, \mathcal{R} =V _s /H A (2)
Resistance	40	60	80	R	k Ω	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	25.6	31.3	36.2	V _n	nV/ $\sqrt{\text{Hz}}$	V _n ² =4kTR
Noise Equivalent Power		.71		NEP	nW/ $\sqrt{\text{Hz}}$	DC, NEP= V _n H A/V _s (2)
Detectivity		.86		D*	10 ⁸ cm $\sqrt{\text{Hz}}$ /W	DC, D*=V _s / V _n H $\sqrt{\text{A}}$ (2)
Time Constant		18		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		36°/77°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		Micro-TO				Standard package hole size: \varnothing .058"
Operating Temperature	-50		100	T _a	°C	
ST60R Thermistor Option	~24	30	~36	R _T	k Ω	PTC Poly-Silicon resistor on detector die.
ST60R Thermistor Temperature Coefficient of R	.107	.11	.113		%/°C	$\Delta R/(R\Delta T)$, Best fit, 0° to 85°C (1)

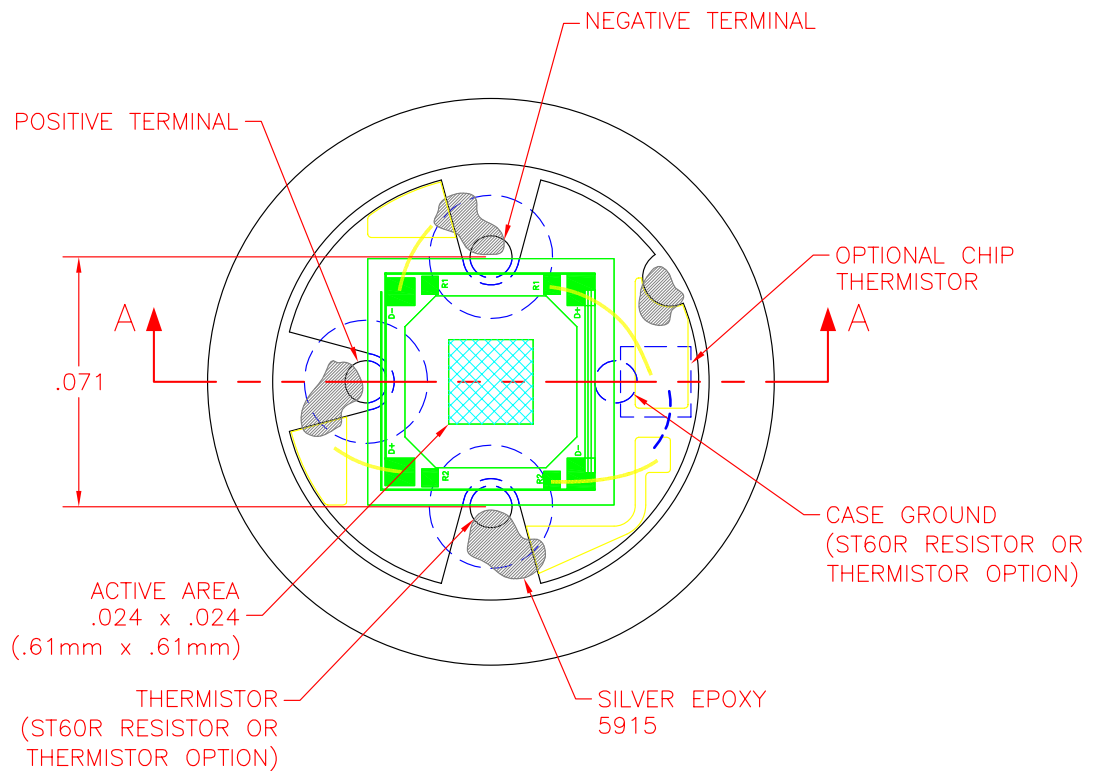
General Specifications: Flat spectral response from 100nm to > 100 μ m. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold \geq .5W/cm²

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

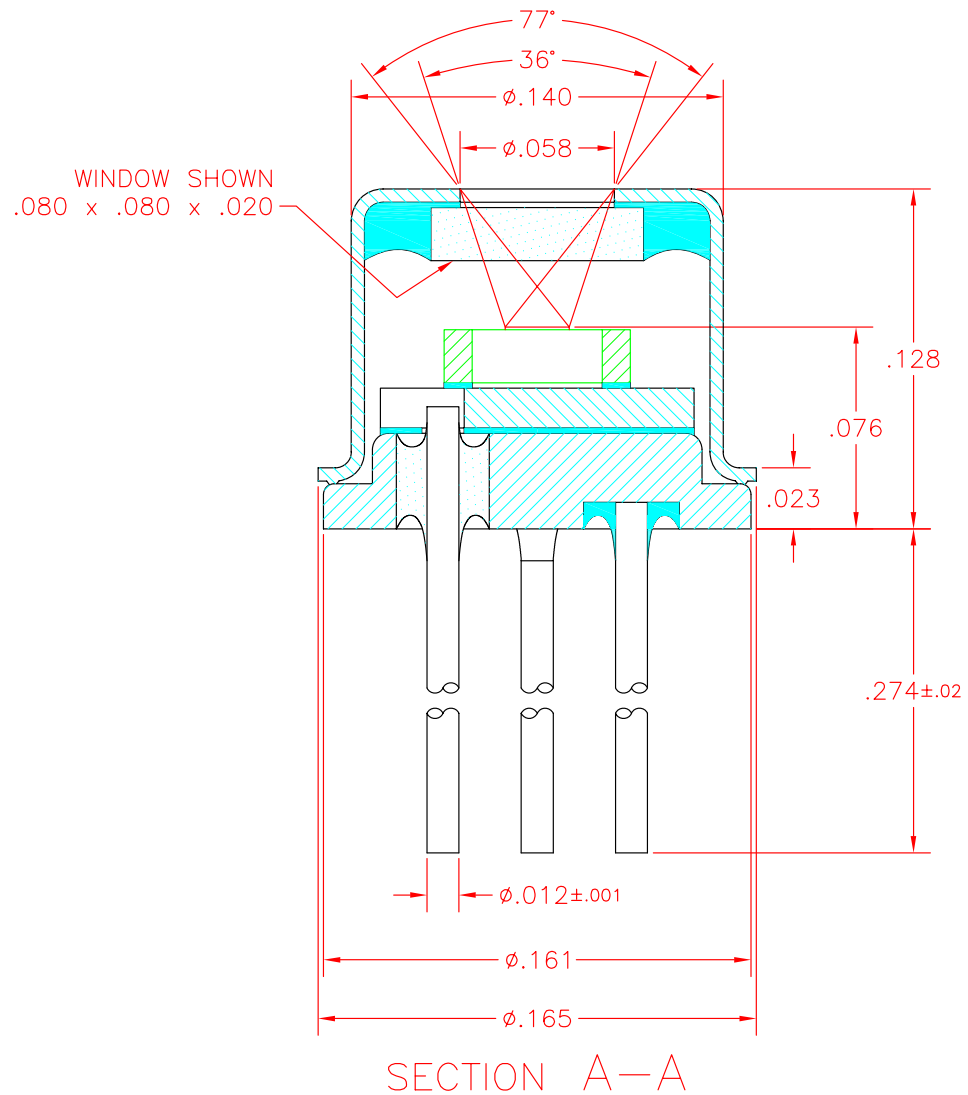
8634 Rev C

Update: 12/11/06

Information subject to change without notice



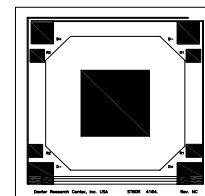
TOP VIEW
WITHOUT COVER



ST60 TO-5 & ST60R TO-5

Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile provides lowest cost solutions in a small active area of 0.61mm x 0.61mm in a TO-5 package. Time constant of 18ms with Nitrogen encapsulation gas. Delivers a very low Temperature Coefficient of Responsivity of -0.04%/°C. This detector has a very short thermal shock response to ambient temperature change.



Detector circuit overlay

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) **ST60R TO-5** version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor. 3) Internal 30kΩ 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. 4) Internal aperture precisely defines active area for applications with FOV and/or spot size requirements. See [Aperture Options](#) for available sizes. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature, fire suppression, horizon sensor, and gas analysis.

Benefit: Low cost and small active area size with medium output.



ST60 TO-5

Technical Specifications

Specifications apply at 23°C with KBr Window and Nitrogen encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.61 x .61		AA	mm	Hot junction size, per element.
Element Area		.37		A	mm ²	
Number of Junctions		80				Per element.
Number of Channels		1				Per detector package.
Output Voltage	50	62	74	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	1,381	1,981	2,891	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	40.7	50.5	60.3	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/H_A$ (2)
Resistance	40	60	80	R	kΩ	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	25.6	31.3	36.2	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.42	.62	.89	NEP	nW/√Hz	DC, NEP= V _n H A/V _s (2)
Detectivity	.69	.98	1.44	D*	10 ⁹ cm ² √Hz/W	DC, D*=V _s / V _n H √A (2)
Time Constant		18		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		64°/81°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-5				Standard package hole size: Ø.150"
Operating Temperature	-50		100	T _a	°C	
ST60R Thermistor Option	~24	30	~36	R _T	kΩ	PTC Poly-Silicon resistor on detector die.
ST60R Thermistor Temperature Coefficient of R	.107	.11	.113		%/°C	ΔR/(RΔT), Best fit, 0° to 85°C (1)

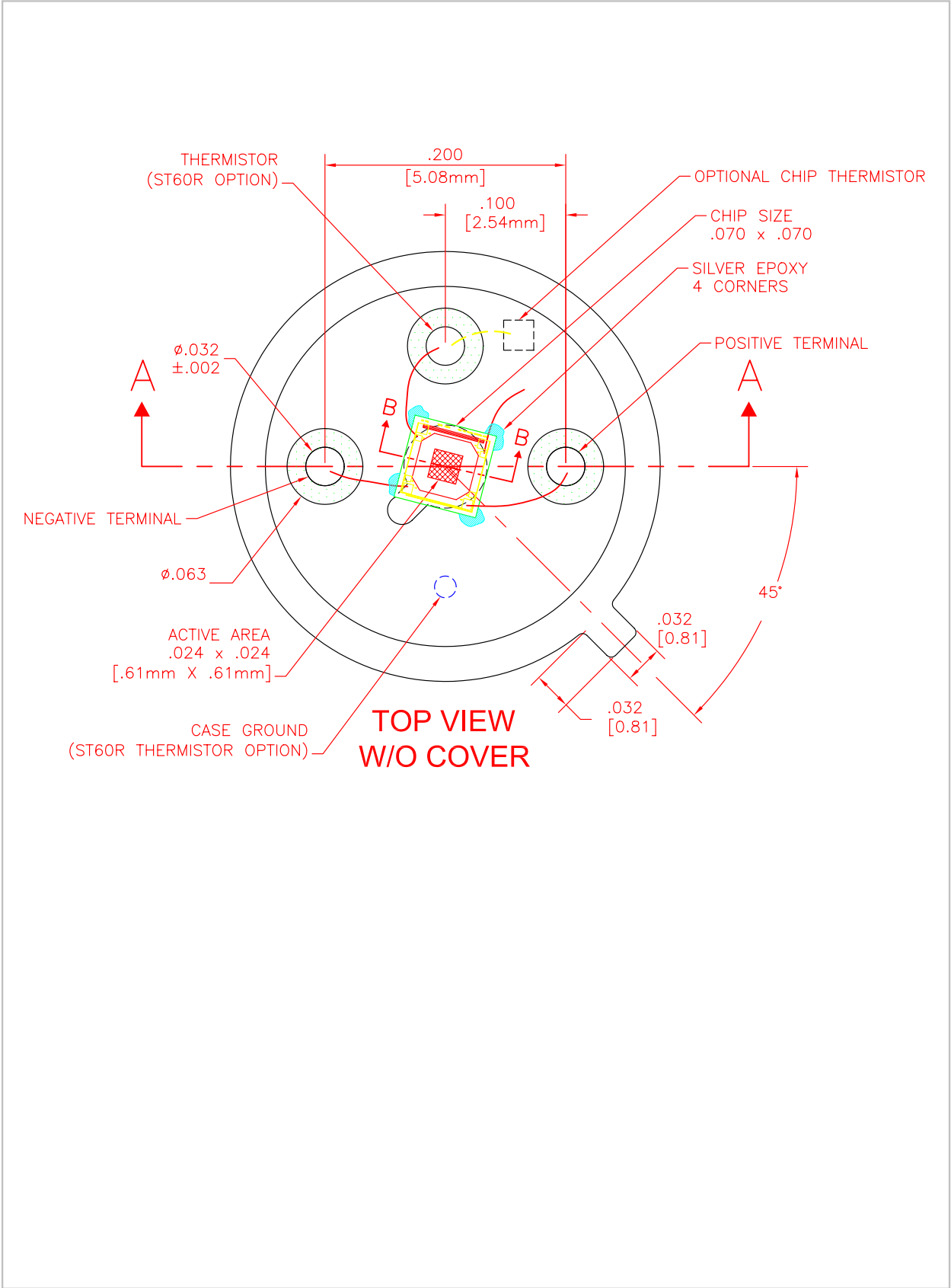
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²

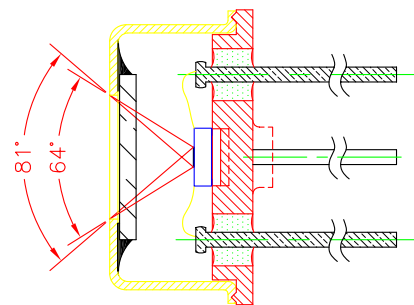
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8518 rev V

Update: 6/8/06

Information subject to change without notice





ST60 TO-5 & ST60R TO-5 With Diffractive Lens

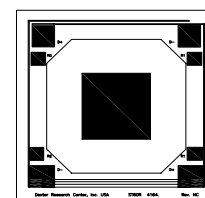
Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile with integrated diffractive lens and internal baffle that provides lowest cost solutions in a small active area of 0.61mm x 0.61mm in a TO-5 package. Time constant of 18ms with Nitrogen encapsulation gas and 9° FOV. Delivers a very low Temperature Coefficient of Responsivity of -0.04%/°C. This detector has a very short thermal shock response to ambient temperature change.

Options: 1) **ST60R TO-5** version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor. 2) Internal 30kΩ 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for 9° FOV non-contact temperature measurement

Benefit: Low cost, narrow FOV, and small active area size with medium output.



Detector circuit overlay



ST60 TO-5

Technical Specifications

Specifications apply at 23°C with AR coated Diffractive Lens (P/N: DC-6132) and Nitrogen encapsulating gas

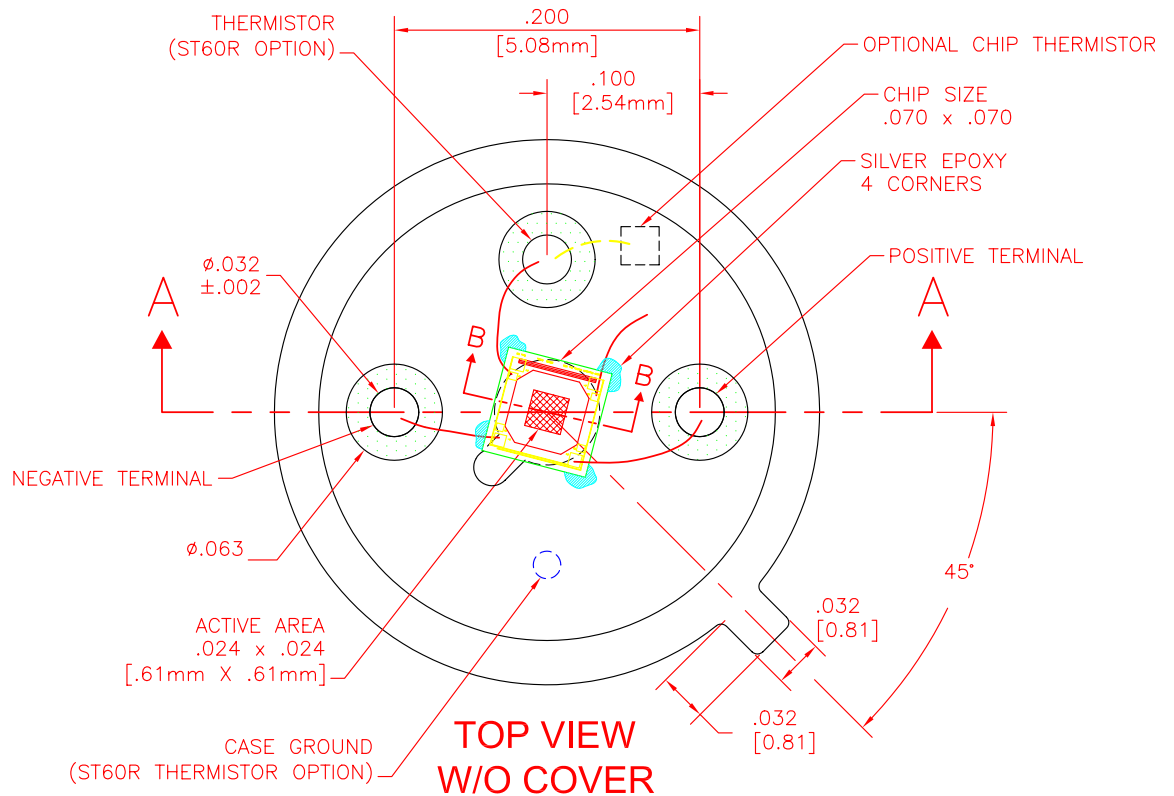
Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.61 x .61		AA	mm	Hot junction size, per element.
Element Area		.37		A	mm ²	
Number of Junctions		80				Per element.
Number of Channels		1				Per detector package.
Output Voltage	240	295	350	V _s	μV	DC, H=330μW/cm ² (3)
Signal-to-Noise Ratio	6,630	9,425	13,672	SNR	√Hz	DC, SNR=V _s /V _n
Responsivity	195.5	240.2	285.0	\mathcal{R}	V/W	DC, \mathcal{R} =V _s /H A (2)
Resistance	40	60	80	R	kΩ	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/°C	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/°C	Best fit, 0° to 85°C (1)
Noise Voltage	25.6	31.3	36.2	V _n	nV/√Hz	V _n ² =4kTR
Noise Equivalent Power	.09	.13	.19	NEP	nW/√Hz	DC, NEP= V _n HA/V _s (2)
Detectivity	3.30	4.68	6.80	D*	10 ³ cm ² √Hz/W	DC, D*=V _s /V _n H√A (2)
Time Constant		18		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		9°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-5 with Lens				Standard package hole size: Ø.150"
Operating Temperature	-50		100	T _a	°C	
ST60R Thermistor Option	~24	30	~36	R _T	kΩ	PTC Poly-Silicon resistor on detector die.
ST60R Thermistor Temperature Coefficient of R	.107	.11	.113		%/°C	ΔR/(RΔT), Best fit, 0° to 85°C (1)

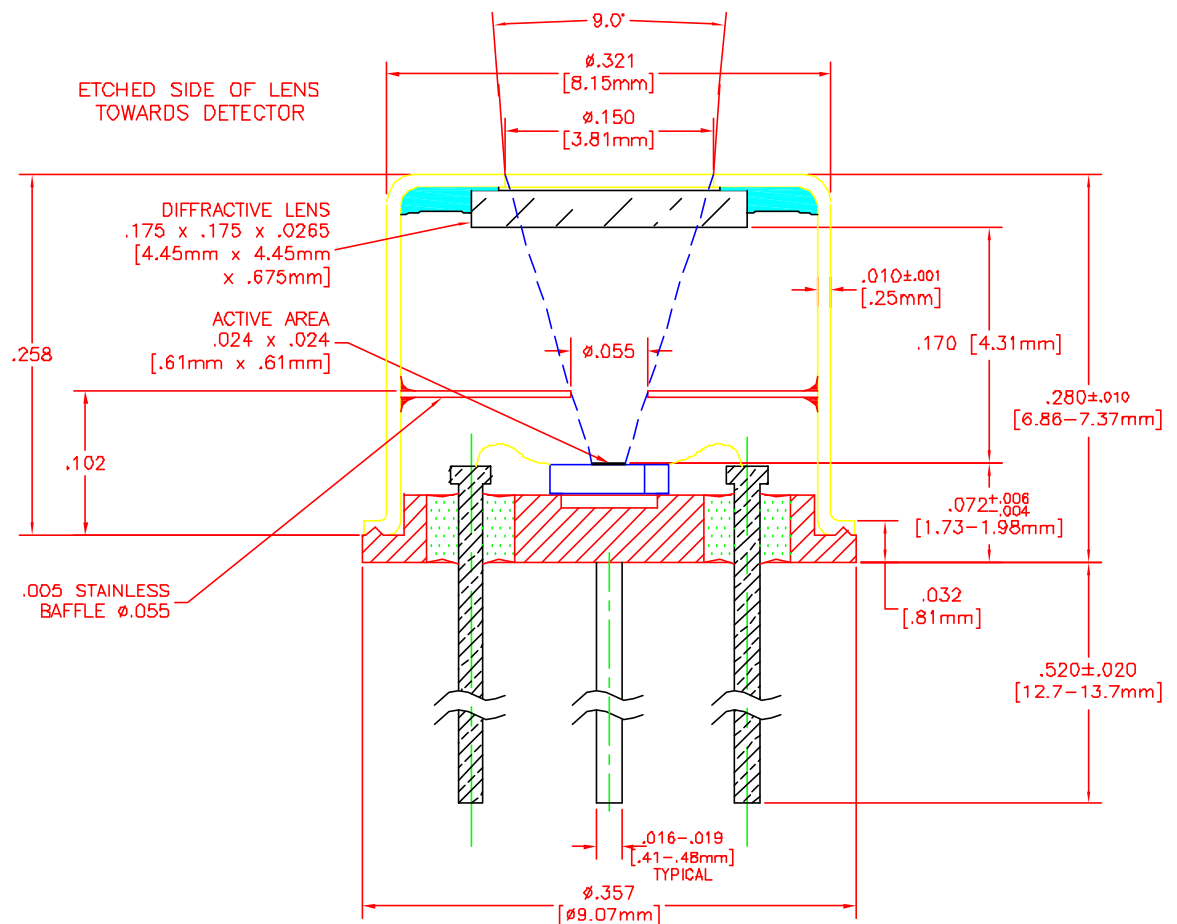
General Specifications: Flat spectral response from 100nm to > 100μm. Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold ≥ .5W/cm²
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8650 rev A

Update: 6/8/06

Information subject to change without notice

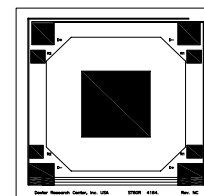




ST60 TO-18 & ST60R TO-18

Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile provides lowest cost solutions in a small active area of 0.61mm x 0.61mm in a small TO-18 package. Time constant of 18ms with Nitrogen encapsulation gas. Delivers a very low Temperature Coefficient of Responsivity of $-0.04\%/^{\circ}\text{C}$. This detector has a very short thermal shock response to ambient temperature change.



Detector circuit overlay

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) **ST60R TO-18** version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor. 3) Internal 30k Ω 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature, horizon sensor, tympanic ear thermometer, infant thermometer applications.

Benefit: High output, small active area, fast time constant in a small package.



ST60 TO-18

Technical Specifications

Specifications apply at 23°C with KBr Window and Nitrogen encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.61 x .61		AA	mm	Hot junction size, per element.
Element Area		.37		A	mm ²	
Number of Junctions		80				Per element.
Number of Channels		1				Per detector package.
Output Voltage		60		V _s	μV	DC, H=330 $\mu\text{W}/\text{cm}^2$ (3)
Signal-to-Noise Ratio		1,916		SNR	$\sqrt{\text{Hz}}$	DC, SNR=V _s /V _n
Responsivity		48.9		\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	40	60	80	R	k Ω	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/ $^{\circ}\text{C}$	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/ $^{\circ}\text{C}$	Best fit, 0° to 85°C (1)
Noise Voltage	25.6	31.3	36.2	V _n	nV/ $\sqrt{\text{Hz}}$	V _n ² =4kTR
Noise Equivalent Power		.64		NEP	nW/ $\sqrt{\text{Hz}}$	DC, NEP= V _n HA/V _s (2)
Detectivity		.95		D*	10 ⁸ cm $\sqrt{\text{Hz}}/\text{W}$	DC, D*=V _s /V _n HVA (2)
Time Constant		15		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		40°/69°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-18				Standard package hole size: $\varnothing.080"$
Operating Temperature	-50		100	T _a	$^{\circ}\text{C}$	
ST60R Thermistor Option	~24	30	~36	R _T	k Ω	PTC Poly-Silicon resistor on detector die.
ST60R Thermistor Temperature Coefficient of R	.107	.11	.113		%/ $^{\circ}\text{C}$	$\Delta R/(\Delta T)$, Best fit, 0° to 85°C (1)

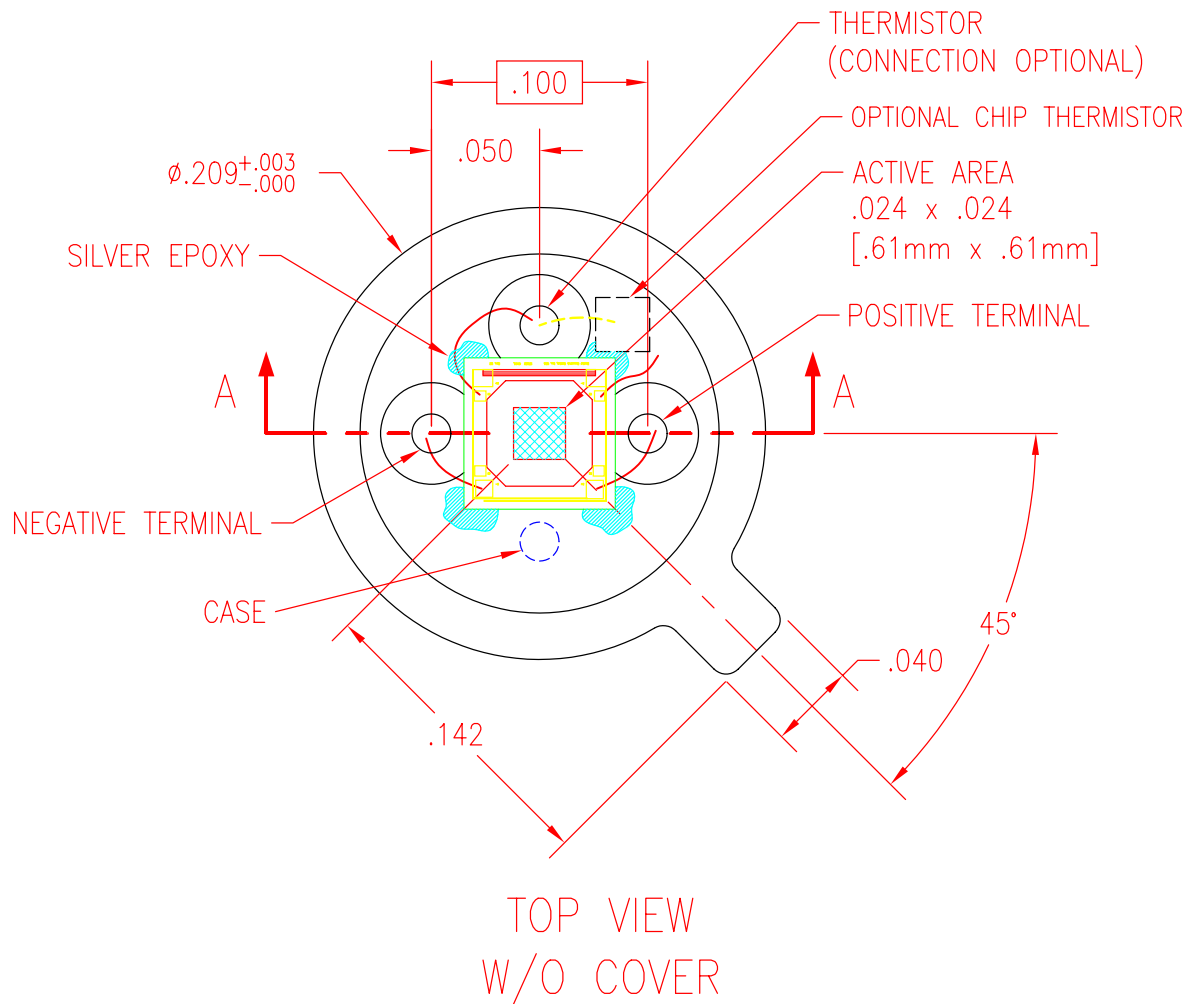
General Specifications: Flat spectral response from 100nm to > 100 μm . Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold $\geq .5\text{W}/\text{cm}^2$

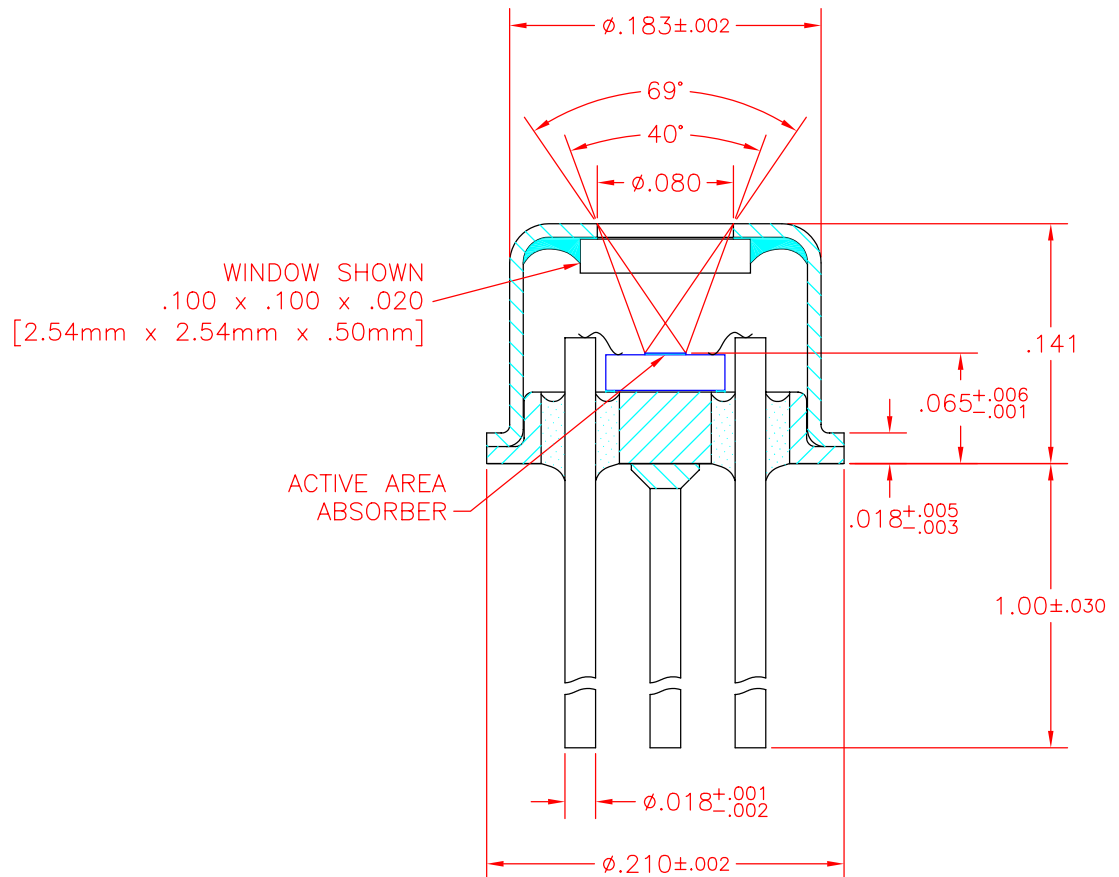
Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8633 Rev C

Update: 12/11/06

Information subject to change without notice



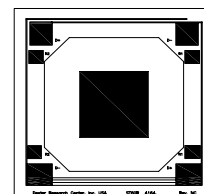


NOTE: SEE DWG 1041.1 FOR TOP VIEW

PRELIMINARY**ST60 LCC & ST60R LCC**

Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile in a LCC package for surface mount assembly in a small active area of 0.61mm x 0.61mm. Time constant of 18ms with Nitrogen encapsulation gas. Delivers a very low Temperature Coefficient of Responsivity of $-0.04\%/^{\circ}\text{C}$. This detector has a very short thermal shock response to ambient temperature change.

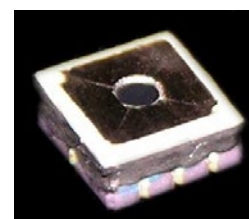


Detector circuit overlay

Options: 1) See [Standard Windows and Filters](#) for list of optical filter options. 2) **ST60R LCC** version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor. 3) Internal 30k Ω 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005 See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for non-contact temperature, and horizon sensor.

Benefit: Low cost surface mount assembly and small active area size with medium output.



ST60 LCC Package

Technical Specifications

Specifications apply at 23°C with KBr Window and Nitrogen encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		.61 x .61		AA	mm	Hot junction size, per element.
Element Area		.37		A	mm ²	
Number of Junctions		80				Per element.
Number of Channels		1				Per detector package.
Output Voltage	50	62	74	V _s	μV	DC, H=330 $\mu\text{W}/\text{cm}^2$ (3)
Signal-to-Noise Ratio	1,381	1,981	2,891	SNR	$\sqrt{\text{Hz}}$	DC, SNR=V _s /V _n
Responsivity	40.7	50.5	60.3	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	40	60	80	R	k Ω	Detector element
Temperature Coefficient of \mathcal{R}		-.04			%/ $^{\circ}\text{C}$	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			%/ $^{\circ}\text{C}$	Best fit, 0° to 85°C (1)
Noise Voltage	25.6	31.3	36.2	V _n	nV/ $\sqrt{\text{Hz}}$	V _n ² =4kTR
Noise Equivalent Power	.42	.62	.89	NEP	nW/ $\sqrt{\text{Hz}}$	DC, NEP= V _n HA/V _s (2)
Detectivity	.69	.98	1.44	D*	10 ⁸ cm $\sqrt{\text{Hz}}/\text{W}$	DC, D*=V _s /V _n HVA (2)
Time Constant		18		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		45°/81°		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		LCC				Standard package hole size: $\varnothing.069"$
Operating Temperature	-50		100	T _a	$^{\circ}\text{C}$	
ST60R Thermistor Option	~24	30	~36	R _T	k Ω	PTC Poly-Silicon resistor on detector die.
ST60R Thermistor Temperature Coefficient of R	.107	.11	.113		%/ $^{\circ}\text{C}$	$\Delta R/(\Delta T)$, Best fit, 0° to 85°C (1)

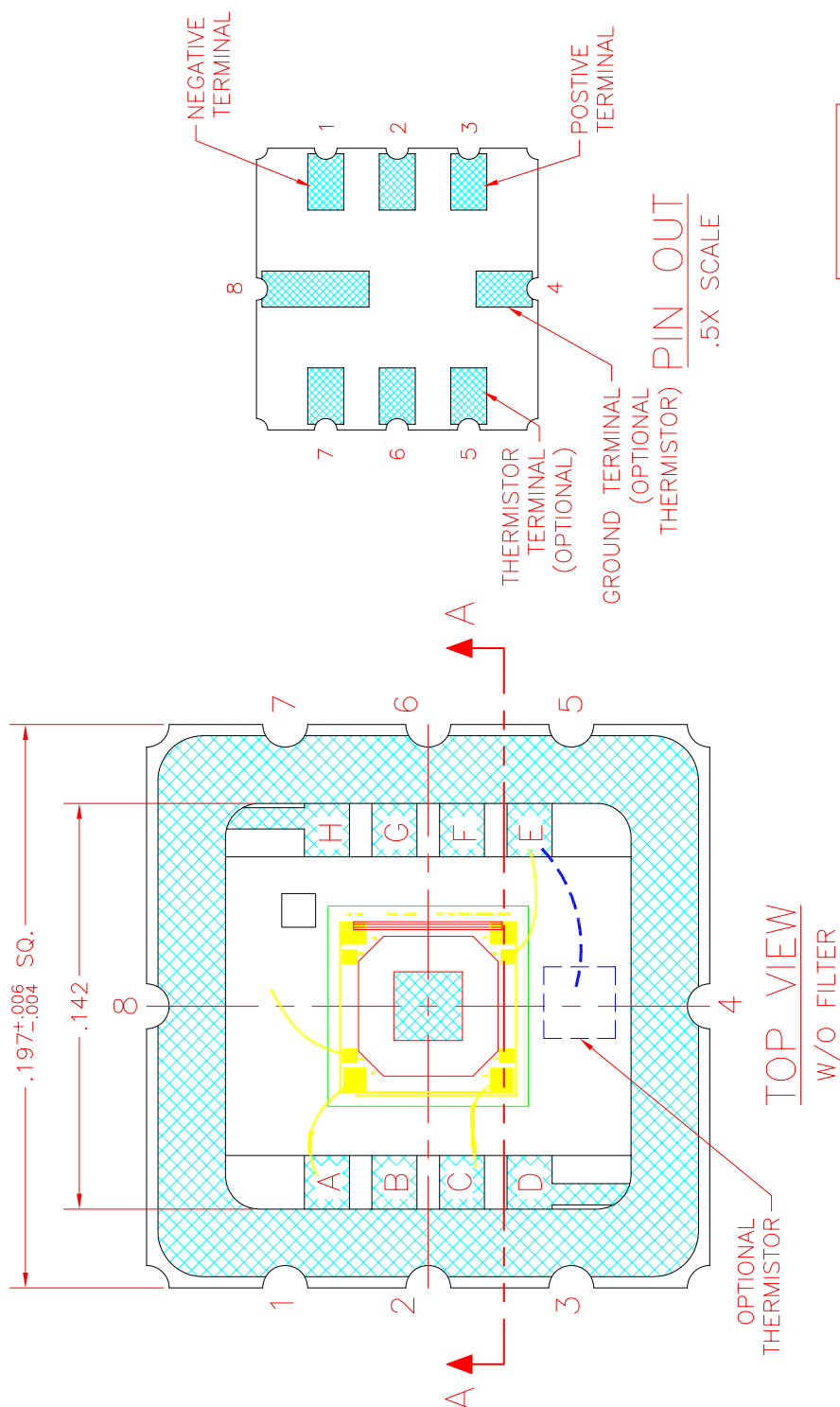
General Specifications: Flat spectral response from 100nm to > 100 μm . Linear signal output from 10⁻⁶ to 0.1W/cm². Maximum incident radiance 0.1W/cm², damage threshold $\geq .5\text{W}/\text{cm}^2$

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm². (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

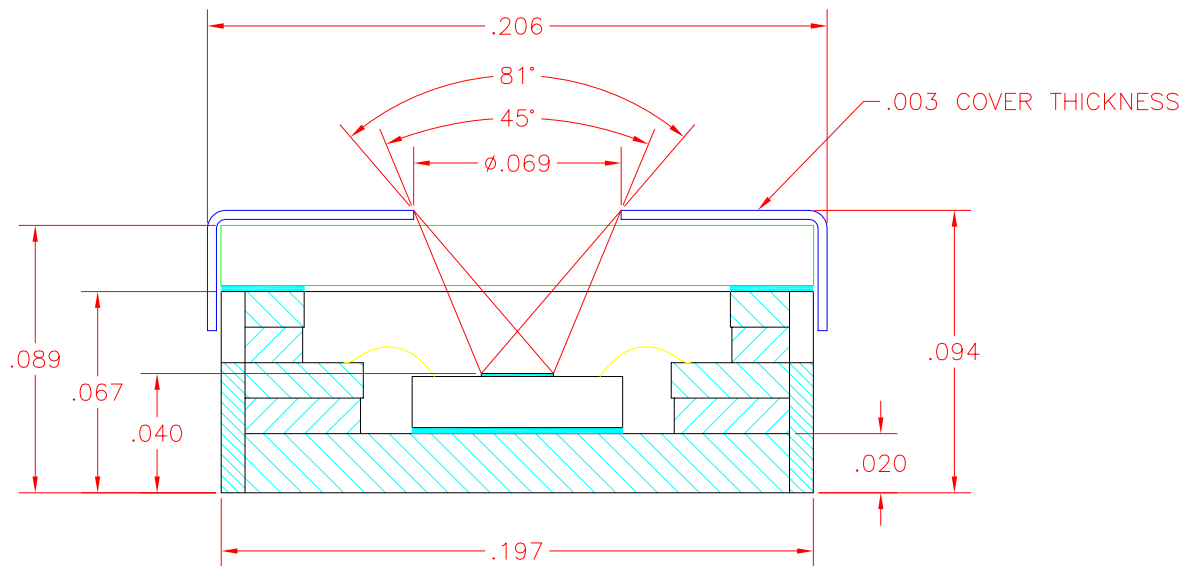
8660 rev A

Update: 6/27/06

Information subject to change without notice



PIN OUT	
1	D-
2	NO CONNECTION
3	D+
4	CASE GROUND / OPTIONAL THERMISTOR
5	OPTIONAL THERMISTOR
6	NO CONNECTION
7	NO CONNECTION
8	NO CONNECTION



SECTION A—A

PRELIMINARY

ST120 TO-5

Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile provides lowest cost solutions in a small active area of 1.2mm x 1.2mm in a TO-5 package. Time constant of 25ms with Nitrogen encapsulation gas. Delivers a very low Temperature Coefficient of Responsivity of $-0.04\%/^{\circ}\text{C}$. This detector has a very short thermal shock response to ambient temperature change.

Options: **1)** See [Standard Windows and Filters](#) for list of optical filter options. **2)** Internal $30\text{k}\Omega$ 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. **3)** Internal aperture precisely defines active area for applications with FOV and/or spot size requirements. See [Aperture Options](#) for available sizes. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for gas analysis, fire suppression, non-contact temperature, and horizon sensor.

Benefit: Low cost with high output.

Technical Specifications

Specifications apply at 23°C with KBr Window and Nitrogen encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		1.2 x 1.2		AA	mm	Hot junction size, per element.
Element Area		1.44		A	mm^2	
Number of Junctions		80				Per element.
Number of Channels		1				Per detector package.
Output Voltage		180		V_s	μV	DC, $H=330\mu\text{W}/\text{cm}^2$ (3)
Signal-to-Noise Ratio		4,692		SNR	$\sqrt{\text{Hz}}$	DC, $\text{SNR}=V_s/V_n$
Responsivity		37.9		\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance		90		R	$\text{k}\Omega$	Detector element
Temperature Coefficient of \mathcal{R}		-.04			$\%/^{\circ}\text{C}$	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.02			$\%/^{\circ}\text{C}$	Best fit, 0° to 85°C (1)
Noise Voltage		38.4		V_n	$\text{nV}/\sqrt{\text{Hz}}$	$V_n^2=4\text{kTR}$
Noise Equivalent Power		1.01		NEP	$\text{nW}/\sqrt{\text{Hz}}$	DC, $\text{NEP}=V_n H A/V_s$ (2)
Detectivity		1.18		D^*	$10^{\circ}\text{cm}\sqrt{\text{Hz}}/\text{W}$	DC, $D^*=V_s/V_n H A$ (2)
Time Constant		25		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		$52^{\circ}/86^{\circ}$		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-5				Standard package hole size: $\varnothing.150"$
Operating Temperature	-50		125	T_a	$^{\circ}\text{C}$	

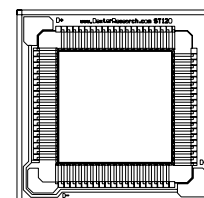
General Specifications: Flat spectral response from 100nm to $>100\mu\text{m}$. Linear signal output from 10^{-6} to $0.1\text{W}/\text{cm}^2$. Maximum incident radiance $0.1\text{W}/\text{cm}^2$, damage threshold $\geq .5\text{W}/\text{cm}^2$

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm^2 . (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8662 Rev D

Update: 7/20/06

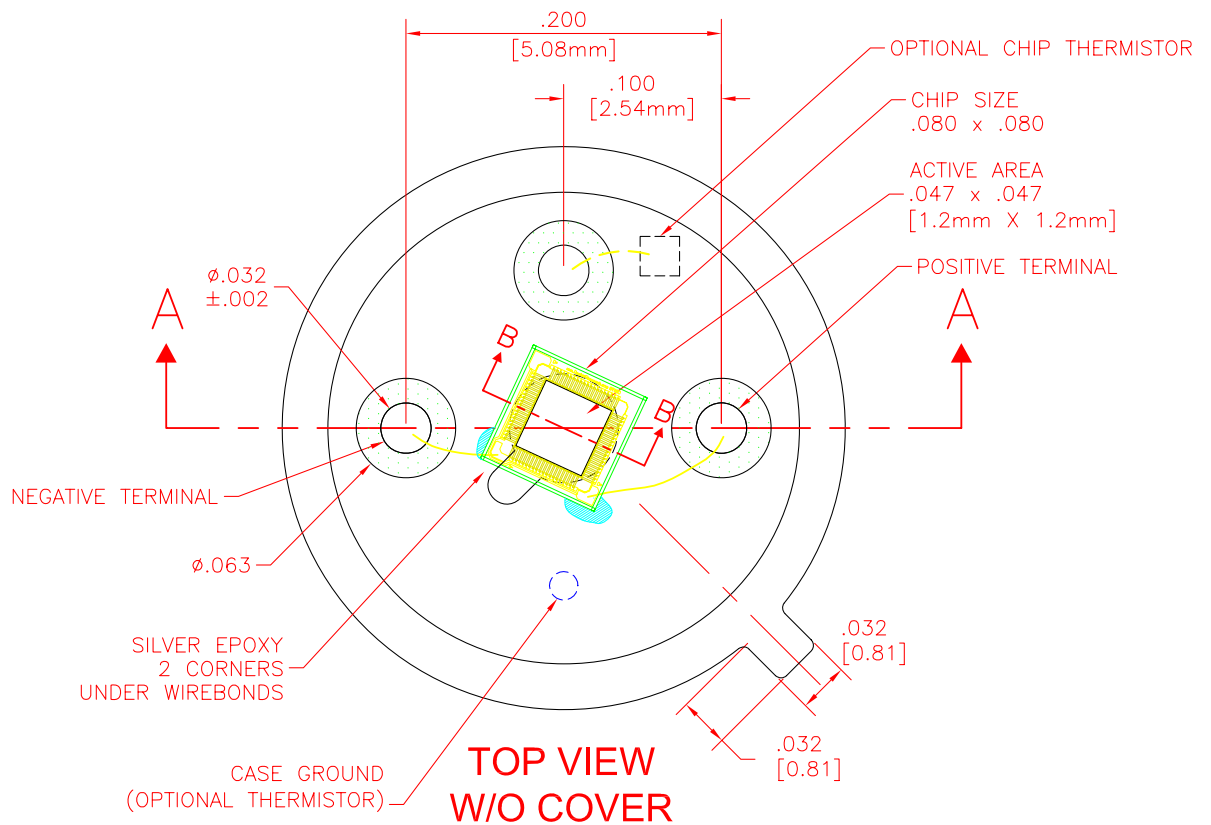
Information subject to change without notice

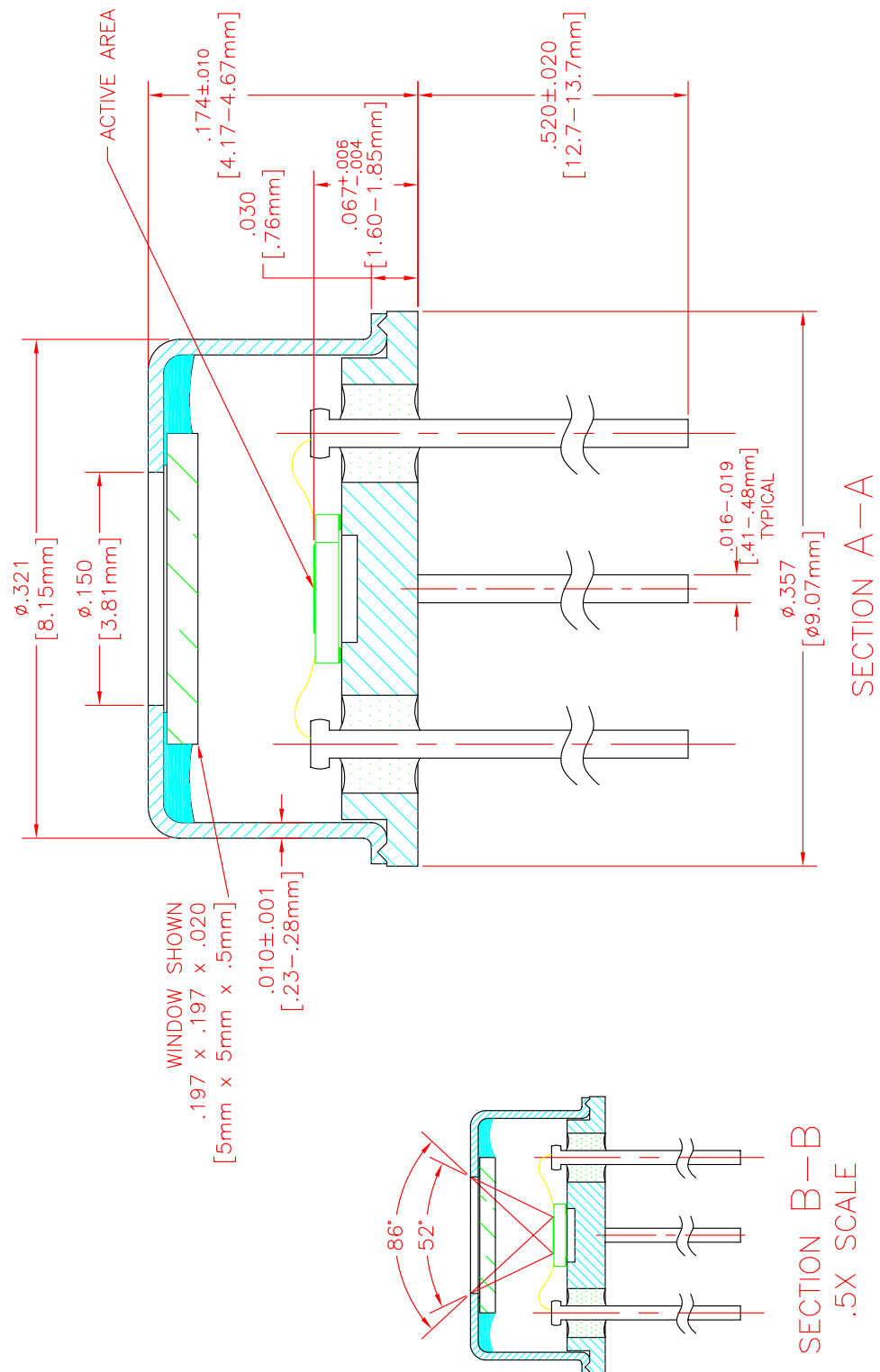


Detector circuit overlay



ST120 TO-5





ST150 & ST150R

Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile that delivers a very low Temperature Coefficient of Responsivity of $-0.04\%/^{\circ}\text{C}$ with a high output voltage and a quick time constant of 38ms. This Low-cost detector comes in a TO-5 package. This detector has a very short thermal shock response to ambient temperature change.

Options: **1)** See [Standard Windows and Filters](#) for list of optical filter options. **2)** **ST150R** version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor. **3)** Internal $30\text{k}\Omega$ 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. **4)** Internal aperture precisely defines active area for applications with FOV and/or spot size requirements. See [Aperture Options](#) for available sizes. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for gas analysis, fire detection, and non-contact temperature measurement.

Benefit: High output and low cost with larger $1.5\text{mm} \times 1.5\text{mm}$ active area.

Technical Specifications

Specifications apply at 23°C with KBr Window and Nitrogen encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size		1.5 x 1.5		AA	mm	Hot junction size, per element.
Element Area		2.25		A	mm^2	
Number of Junctions		120				Per element.
Number of Channels		1				Per detector package.
Output Voltage	180	230	280	V_s	μV	DC, $H=330\mu\text{W}/\text{cm}^2$ (3)
Signal-to-Noise Ratio	4,688	6,571	8,946	SNR	$\sqrt{\text{Hz}}$	DC, $\text{SNR}=V_s/V_n$
Responsivity	24.2	31.0	37.7	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	60	90	120	R	$\text{k}\Omega$	Detector element
Temperature Coefficient of \mathcal{R}		-.04			$\%/^{\circ}\text{C}$	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			$\%/^{\circ}\text{C}$	Best fit, 0° to 85°C (1)
Noise Voltage	31.3	35.0	38.4	V_n	$\text{nV}/\sqrt{\text{Hz}}$	$V_n^2=4\text{kTR}$
Noise Equivalent Power	.83	1.13	1.58	NEP	$\text{nW}/\sqrt{\text{Hz}}$	DC, $\text{NEP}=V_n/HA/V_s$ (2)
Detectivity	.95	1.3	1.8	D^*	$10^8\text{cm}^2/\sqrt{\text{Hz}}/\text{W}$	DC, $D^*=V_s/V_n \cdot HA/V_s$ (2)
Time Constant		38		\mathcal{T}	ms	Chopped, -3dB point (1)
Field of View		$42^{\circ}/92^{\circ}$		FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type		TO-5,				Standard package hole size: $\varnothing.150''$
Operating Temperature	-50		100	T_a	$^{\circ}\text{C}$	Short durations to 125°C possible
ST150R Thermistor Option	55	75	95	R_T	$\text{k}\Omega$	PTC Poly-Silicon resistor on detector die.
ST150R Thermistor Temperature Coefficient of R	.107	.11	.113		$\%/^{\circ}\text{C}$	$\Delta R/(R\Delta T)$, Best fit, 0° to 85°C (1)

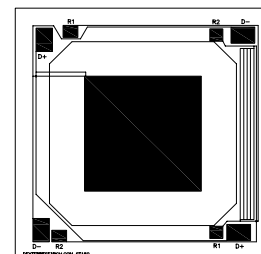
General Specifications: Flat spectral response from 100nm to $>100\mu\text{m}$. Linear signal output from 10^{-6} to $0.1\text{W}/\text{cm}^2$. Maximum incident radiance $0.1\text{W}/\text{cm}^2$, damage threshold $\geq .5\text{W}/\text{cm}^2$

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm^2 . (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8519 rev R

Update: 6/8/06

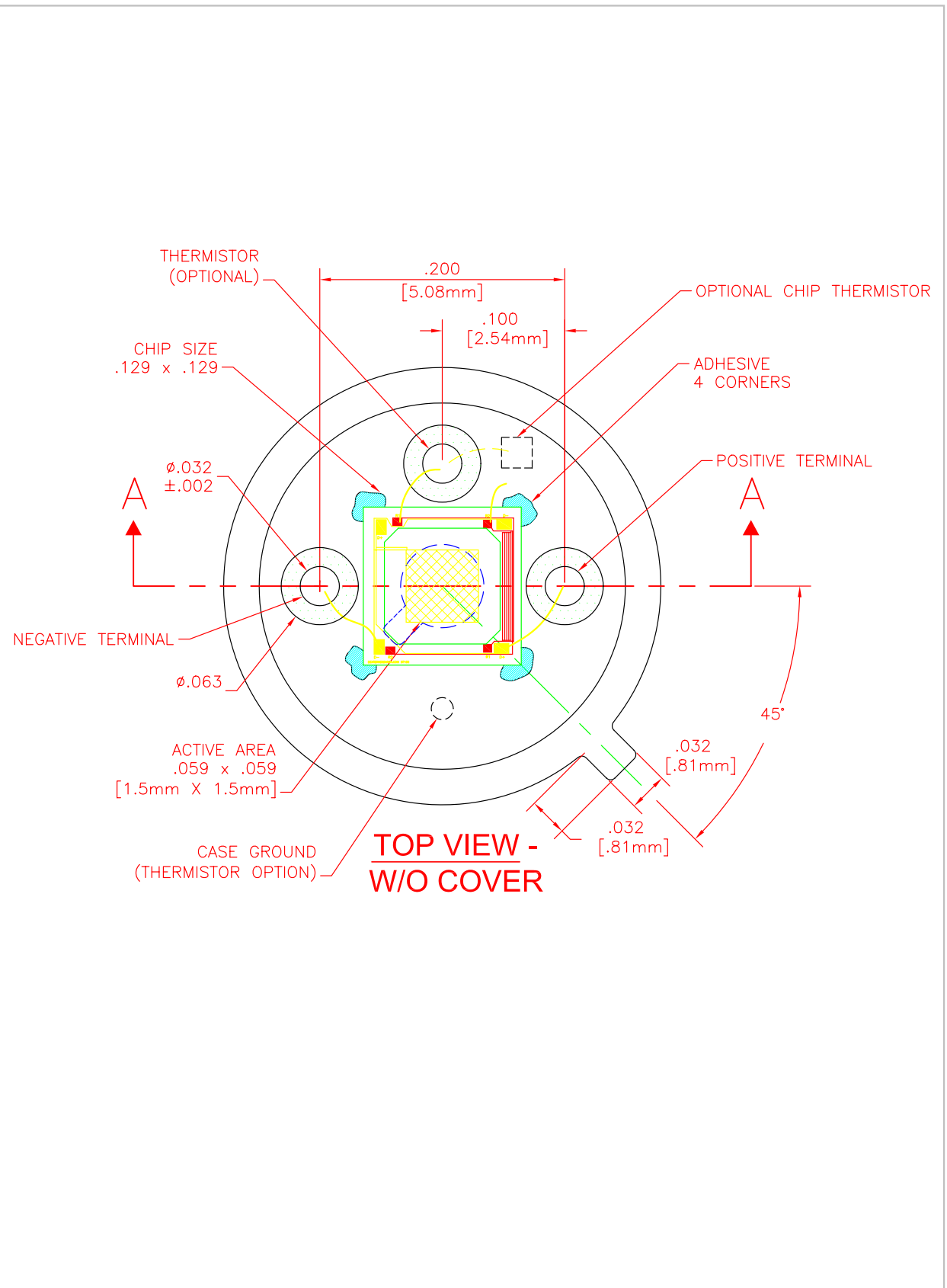
Information subject to change without notice

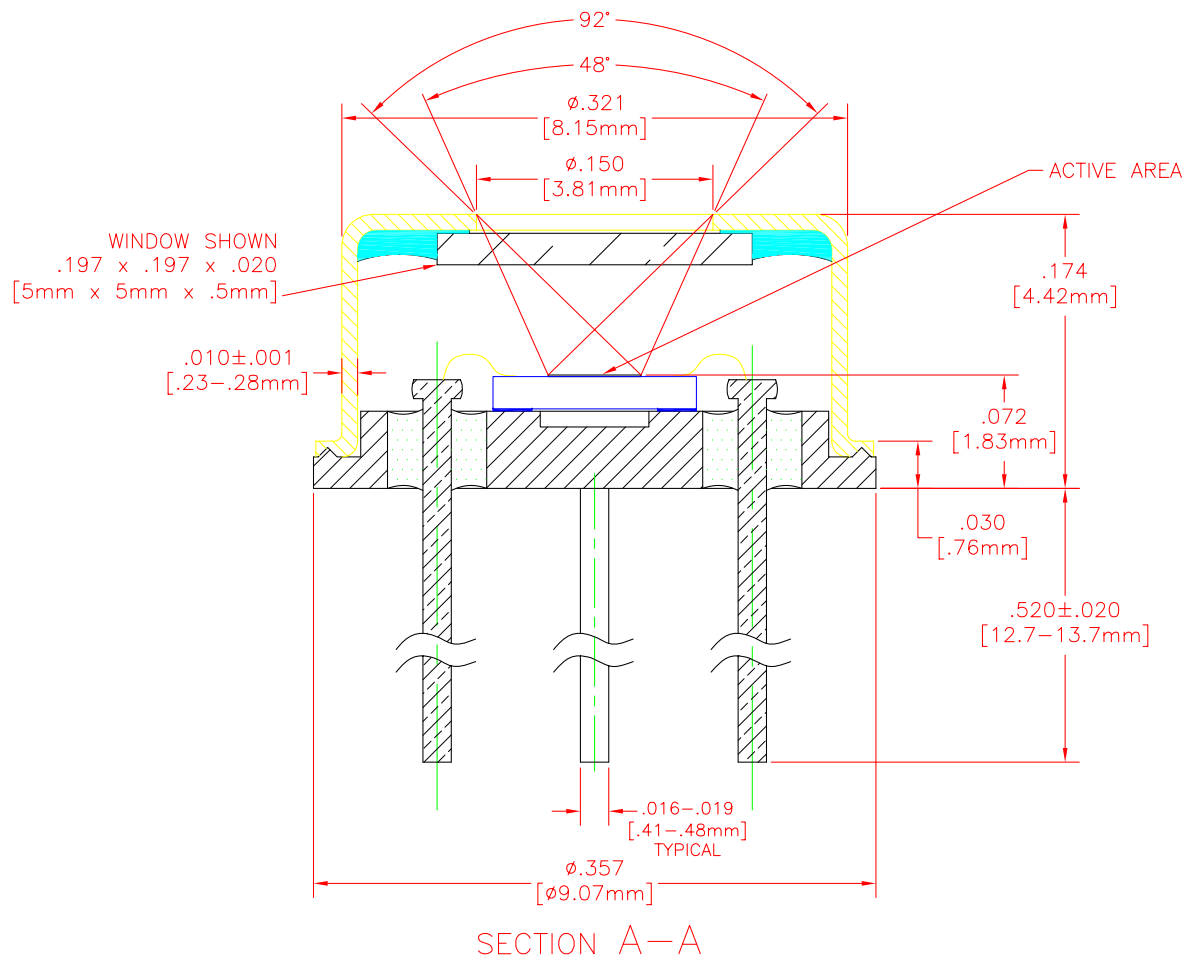


Detector circuit overlay



ST150





ST150 & ST150R With Diffractive Lens

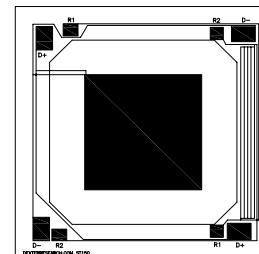
Silicon Based Thermopile Detector

Features: A single-channel silicon-based thermopile with integrated diffractive lens and internal baffle that delivers a very low Temperature Coefficient of Responsivity of $-0.04\%/^{\circ}\text{C}$ with a high output voltage, 19.5° FOV and a quick time constant of 38ms. This Low-cost detector comes in a TO-5 package and has a very short thermal shock response to ambient temperature change.

Options: **1) ST150R** version offers a low-cost (20% tolerance) poly-silicon resistor to be used as a PTC thermistor. **2)** Internal $30\text{k}\Omega$ 5% NTC chip thermistor provides ambient package temperature measurement. See [Thermistor Options](#) p/n: DC-4005. See [Thermopile Configuration Table](#) for more options.

Applications: Excellent for 19.5° FOV non-contact temperature measurement.

Benefit: High output, narrow FOV, and low cost with larger $1.5\text{mm} \times 1.5\text{mm}$ active area.



Detector circuit overlay



ST150

Technical Specifications

Specifications apply at 23°C with AR coated Diffractive Lens (P/N: DC-6132) and Nitrogen encapsulating gas

Parameter	Min	Typical	Max	Symbol	Units	Comments
Active Area size	1.5 x 1.5			AA	mm	Hot junction size, per element.
Element Area	2.25			A	mm^2	
Number of Junctions	120					Per element.
Number of Channels	1					Per detector package.
Output Voltage	240	325	400	V_s	μV	DC, $H=330\mu\text{W}/\text{cm}^2$ (3)
Signal-to-Noise Ratio	6,250	9,286	12,780	SNR	$\sqrt{\text{Hz}}$	DC, $\text{SNR}=V_s/V_n$
Responsivity	32.3	43.8	53.9	\mathcal{R}	V/W	DC, $\mathcal{R}=V_s/HA$ (2)
Resistance	60	90	120	R	$\text{k}\Omega$	Detector element
Temperature Coefficient of \mathcal{R}		-.04			$\%/^{\circ}\text{C}$	Best linear fit, 0° to 85°C (1)
Temperature Coefficient of R		.11			$\%/^{\circ}\text{C}$	Best fit, 0° to 85°C (1)
Noise Voltage	31.3	35.0	38.4	V_n	$\text{nV}/\sqrt{\text{Hz}}$	$V_n^2=4\text{kTR}$
Noise Equivalent Power	.58	.80	1.19	NEP	$\text{nW}/\sqrt{\text{Hz}}$	DC, $\text{NEP}=V_n HA/V_s$ (2)
Detectivity	1.26	1.87	2.58	D^*	$10^8\text{cm}^2\sqrt{\text{Hz}}/\text{W}$	DC, $D^*=V_s/V_n H\sqrt{A}$ (2)
Time Constant		38		τ	ms	Chopped, -3dB point (1)
Field of View	19.5°			FOV	Degrees	See Assembly Drawings for FOV Description.
Package Type	TO-5 with Lens					Package hole size: $\varnothing.150"$
Operating Temperature	-50		100	T_a	$^{\circ}\text{C}$	Short durations to 125°C possible
ST150R Thermistor Option	55	75	95	R_T	$\text{k}\Omega$	PTC Poly-Silicon resistor on detector die.
ST150R Thermistor Temperature Coefficient of R	.107	.11	.113		$\%/^{\circ}\text{C}$	$\Delta R/(R\Delta T)$, Best fit, 0° to 85°C (1)

General Specifications: Flat spectral response from 100nm to $> 100\mu\text{m}$. Linear signal output from 10^{-6} to $0.1\text{W}/\text{cm}^2$. Maximum incident radiance $0.1\text{W}/\text{cm}^2$, damage threshold $\geq .5\text{W}/\text{cm}^2$

Notes: (1) Parameter is not 100% tested. 90% of all units meet these specifications. (2) A is detector area in cm^2 . (3) Test Conditions: 500K Blackbody source; Detector active surface 10cm from 0.6513cm Diameter Blackbody Aperture.

8651 rev A

Update: 6/8/06

Information subject to change without notice

