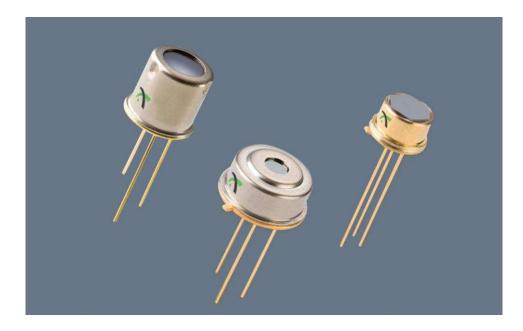


## DigiPile<sup>™</sup> Family

# **Digital Thermopiles**



The DigiPile<sup>™</sup> is a Thermopile Detector with digital output. It combines a time-proven MEMS-based sensing element with a fully integrated low noise amplifier, A/D converter and integrated ambient temperature sensor. An internal clock and control unit enable the DigiPile to open a dialogue with any outside microprocessor without the need for costly additional components.

Along with the DigiPile's more reliable digital design functionality, the move from analog to digital provides OEM designers with a number of distinct advantages including reduced PCB space requirements, improved EMI resistance, and need for fewer additional components like low offset/low noise amplifier and associated filters.

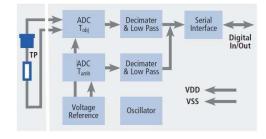
The DigiPile is specifically designed for a range of OEM applications including thermometry, pyrometry, and non-contact temperature sensing. The DigiPile will be offered in a range of housings and sensing areas with the first models from Excelitas covering the popular TO-46 and TO-5 metal housings. We are also offering a DigiPile model with a built-in lens, ideally suited to applications like forehead thermometry where a focusing system is desirable.

### **Key Features**

- More reliable digital design functionality than with analog – all "Digi" models include Thermopile infrared Detector and proprietary digitizing circuit (ADC)
- Reduced PCB space requirements
   by up to 20%
- Integrated design no need for costly additional components like low noise amplifier and associated filters
- High signal to noise ratio based on our new thermopile chip with increased signal strength
- Improved EMI resistance
- Low operating voltage, down to 2.4V
- Low current consumption
- Range of housings and sensing areas to be offered
- Option of model with integrated lens, where a focusing system is particularly useful
- RoHS-compliant

### **Applications**

- Thermometry
- Pyrometry
- Non-contact, high-precision temperature sensing





# $\mathbf{DigiPile}^{\mathsf{TM}}\ \mathbf{Family}$

# **Digital Thermopiles**

### DigiPile Models

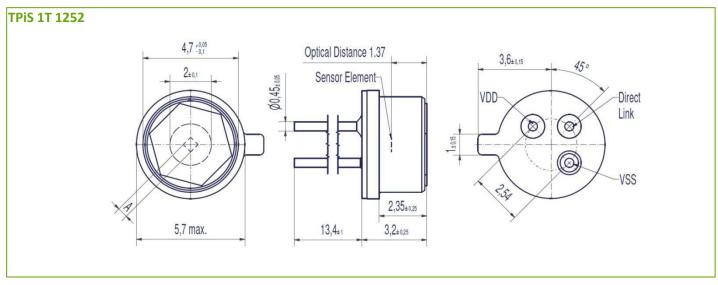
Operating Conditions         VDD         2.43.6         2.43.6         2.43.6         V           Supply Current         Iso         1115         1115         1115         μΑ         V <sub>CO</sub> = 3.3 V           Operating Temperature         To         -2070         -2070         -2070         °C         ¹           Storage Temperature         To         -40100         -40100         °C         ***           Thermopile Characteristics           Sensitivity         Supply Current         A         0.51 x 0.51         0.51 x 0.51         mm²           Sensitivity         Supply Current         A         0.51 x 0.51         0.51 x 0.51         mm²           Sensitivity         Supply Current         A         0.51 x 0.51         0.51 x 0.51         mm²           Sensitivity         Supply Current         A         0.51 x 0.51         0.51 x 0.51         mm²           Sensitivity         Supply Current         A         0.51 x 0.51         0.51 x 0.51         mm²           Sensitivity of Tube         8         8         8         counts/K         counts/K         counts/K         counts/K         counts/K         counts/K         counts/K         counts/K         coun	Parameter	Symbol	TPiS 1T 1252	TPS 1T 1254	TPS 1T 1256 L5.5	Unit	Remarks / Conditions	
Supply Current         I <sub>00</sub> 1115         1115         1115         μA         V <sub>00</sub> = 3.3 V           Operating Temperature         T <sub>o</sub> -2070         -2070         "C         ¹           Storage Temperature         T <sub>s</sub> -40100         -40100         "C           Thermopile Characteristics           Sensitive Area         A         0.51 x 0.51         0.51 x 0.51         mm²           Sensitivity         S <sub>40</sub> 290 °         150 °         67 °         counts/K         T <sub>tobs</sub> = 313K = 40°C, T <sub>sens</sub> = 298K = 25°C           Sensitivity         S <sub>200</sub> 400 °         200 °         85 °         T <sub>tobs</sub> = 313K = 40°C, T <sub>sens</sub> = 298K = 25°C           Noise         8         8         8         counts/K         T <sub>tobs</sub> = 313K (=40°C), T <sub>sens</sub> = 298K (=25°C)           Time Constant         τ         45         45         ms           Ambient Temperature sensor Characteristics           Sensitivity of T <sub>sens</sub> 90         90         counts/K         Linear for T <sub>sens</sub> from 0°C to 90°C           Count @ T <sub>sens</sub> = 25°C         7800         7800         7800         counts/K         Linear for T <sub>sens</sub> from 0°C to 90°C <td colspan<="" td=""><td colspan="7">Operating Conditions</td></td>	<td colspan="7">Operating Conditions</td>	Operating Conditions						
Operating Temperature         To         -2070         -2070         -2070         'C         1           Storage Temperature         Ts         -40100         -40100         "C         **           Thermopile Characteristics           Sensitive Area         A         0.51 x 0.51         0.51 x 0.51         0.51 x 0.51         mm²           Sensitivity         S <sub>40</sub> 290 °         150 °         67 °         counts/K         T <sub>x00</sub> = 313K = 40°C, T <sub>xm0</sub> = 298K = 25°C           Sensitivity         S <sub>100</sub> 400°         200°         85 °         T <sub>x00</sub> = 373K = 100°C, T <sub>xm0</sub> = 298K = 25°C           Noise         8         8         8         counts/K         T <sub>x00</sub> = 373K = 100°C, T <sub>xm0</sub> = 298K = 25°C           Noise         8         8         8         counts         T <sub>x00</sub> = 373K = 100°C, T <sub>xm0</sub> = 298K = 25°C           Noise         8         8         8         counts         T <sub>x00</sub> = 373K = 100°C, T <sub>xm0</sub> = 298K = 25°C           Noise         8         8         8         counts/K         Inear 100°C, T <sub>xm0</sub> = 298K = 25°C           Noise         8         8         8         counts/K         Linear 100°C, T <sub>xm0</sub> = 298K = 25°C           Noise         8         8         8	Operating Voltage	VDD	2.43.6	2.43.6	2.43.6	V		
Storage Temperature   T <sub>S</sub>   -4010   -4010   -40100   °C	Supply Current	I <sub>DD</sub>	1115	1115	1115	μΑ	V <sub>DD</sub> = 3.3 V	
Thermopile Characteristics	Operating Temperature	To	-2070	-2070	-2070	°C	1	
Sensitive Area   A   0.51 x 0.51   0.51 x 0.51   mm²	Storage Temperature	Ts	-40100	-40100	-40100	°C		
Sensitivity	Thermopile Characteristics							
Sensitivity         S <sub>100</sub> 400²         200²         85³         T <sub>obj</sub> = 373K = 100°C, T <sub>amb</sub> = 298K = 25°C           Noise         8         8         8         counts         T <sub>obj</sub> = 313K (=40°C), T <sub>amb</sub> = 298K (=25°C)           Time Constant         τ         45         45         ms           Ambient Temperature sensor Characteristics           Sensitivity of T <sub>amb</sub> 90         90         90         counts/K         Linear for T <sub>amb</sub> from 0°C to 90°C           Count @ T <sub>amb</sub> = 25°C         7800         7800         7800         counts           Optical Characteristics           Field of View         84         56         5         Degree         At 50% intensity points           Optical Axis         0 +/- 10         0 +/- 10         0 +/- 2         Degree           Average Filter           Transmittance         T <sub>A</sub> >75         >75         50         % Wavelength Range from 7.5 μm to 13.5 μm           Cut on Wavelength         λ (5 %)         5.5         5.5         -         μm         At 25°C           Electrical Characteristics           ADC Resolution T <sub>obj</sub> 17         Bits         Max Count	Sensitive Area	А	0.51 x 0.51	0.51 x 0.51	0.51 x 0.51	mm <sup>2</sup>		
Noise	Sensitivity	S <sub>40</sub>	290 <sup>2</sup>	150 <sup>2</sup>	67 <sup>3</sup>	counts/K	T <sub>obj</sub> = 313K = 40°C, T <sub>amb</sub> = 298K = 25°C	
Time Constant τ 45 45 45 ms  Ambient Temperature sensor Characteristics  Sensitivity of T <sub>amb</sub> 90 90 90 counts/K Linear for T <sub>amb</sub> from 0°C to 90°C  Count @ T <sub>amb</sub> = 25°C 7800 7800 7800 counts  Optical Characteristics  Field of View 84 56 5 Degree At 50% intensity points  Optical Axis 0+/-10 0+/-10 0+/-2 Degree  Average Filter Transmittance T A >75 >75 50 % Wavelength Range from 7.5 μm to 13.5 μm  Cut on Wavelength λ (5%) 5.5 5.5 - μm At 25°C  Electrical Characteristics  ADC Resolution T <sub>obj</sub> 17 Bits Max Count = 2 <sup>17</sup> ADC Resolution T <sub>amb</sub> 14 Bits Max Count = 2 <sup>14</sup> ADC Sensitivity of T <sub>obj</sub> 0.70.9 0.70.9 μ/count  ADC Offset T <sub>obj</sub> 64500 64500 64500 counts  Input Low Voltage V <sub>II</sub> 0.2 V <sub>DD</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> V	Sensitivity	S <sub>100</sub>	400 <sup>2</sup>	200 <sup>2</sup>	85 <sup>3</sup>		T <sub>obj</sub> = 373K = 100°C, T <sub>amb</sub> = 298K = 25°C	
Ambient Temperature sensor Characteristics         90         90         90         counts/K         Linear for T <sub>amb</sub> from 0°C to 90°C           Count @ T <sub>amb</sub> = 25°C         7800         7800         7800         counts           Optical Characteristics           Field of View         84         56         5         Degree         At 50% intensity points           Optical Axis         0 +/- 10         0 +/- 10         0 +/- 2         Degree           Average Filter Transmittance         T <sub>A</sub> >75         >75         50         % Wavelength Range from 7.5 μm to 13.5 μm           Cut on Wavelength         λ (5 %)         5.5         5.5         -         μm         At 25°C           Electrical Characteristics           ADC Resolution T <sub>obj</sub> 17         Bits         Max Count = 2 <sup>17</sup> ADC Resolution T <sub>obj</sub> 0.70.9         0.70.9         0.70.9         μV/count           ADC Sensitivity of T <sub>obj</sub> 0.70.9         0.70.9         0.70.9         μV/count           ADC Offset T <sub>obj</sub> 64500         64500         64500         counts           Input Low Voltage         V <sub>IL</sub> 0.2 V <sub>ob</sub> 0.2 V <sub>ob</sub> 0.8 V <sub>ob</sub> 0.8 V <sub>ob</sub> 0.8 V <sub>ob</sub> </td <td>Noise</td> <td></td> <td>8</td> <td>8</td> <td>8</td> <td>counts</td> <td>T<sub>obj</sub> = 313K (=40°C), T<sub>amb</sub> = 298K (=25°C)</td>	Noise		8	8	8	counts	T <sub>obj</sub> = 313K (=40°C), T <sub>amb</sub> = 298K (=25°C)	
Sensitivity of T <sub>amb</sub> 90         90         90         counts/K         Linear for T <sub>amb</sub> from 0°C to 90°C           Count @ T <sub>amb</sub> = 25°C         7800         7800         7800         counts           Optical Characteristics           Field of View         84         56         5         Degree         At 50% intensity points           Optical Axis         0 +/- 10         0 +/- 10         0 +/- 2         Degree           Average Filter Transmittance         T <sub>A</sub> >75         >75         50         % Wavelength Range from 7.5 μm to 13.5 μm           Cut on Wavelength         λ (5 %)         5.5         5.5         -         μm         At 25°C           Electrical Characteristics           ADC Resolution T <sub>obj</sub> 17         Bits         Max Count = 2 <sup>17</sup> ADC Resolution T <sub>amb</sub> 14         Bits         Max Count = 2 <sup>14</sup> ADC Sensitivity of T <sub>obj</sub> 0.70.9         0.70.9         0.70.9         μV/count           ADC Offset T <sub>obj</sub> 64500         64500         64500         counts           Input Low Voltage         V <sub>IH</sub> 0.8 V <sub>oD</sub> 0.8 V <sub>oD</sub> 0.8 V <sub>oD</sub> V	Time Constant	τ	45	45	45	ms		
Count @ T <sub>amb</sub> = 25°C         7800         7800         7800         counts           Optical Characteristics           Field of View         84         56         5         Degree         At 50% intensity points           Optical Axis         0 +/- 10         0 +/- 10         0 +/- 2         Degree           Average Filter Transmittance         T <sub>A</sub> >75         >75         50         %         Wavelength Range from 7.5 μm to 13.5 μm           Cut on Wavelength         λ (5 %)         5.5         5.5         -         μm         At 25°C           Electrical Characteristics           ADC Resolution T <sub>obj</sub> 17         Bits         Max Count = 2 <sup>17</sup> ADC Resolution T <sub>amb</sub> 14         Bits         Max Count = 2 <sup>14</sup> ADC Sensitivity of T <sub>obj</sub> 0.70.9         0.70.9         μV/count           ADC Offset T <sub>obj</sub> 64500         64500         64500         counts           Input Low Voltage         V <sub>IL</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> V           Input High Voltage         V <sub>IH</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> V	Ambient Temperature sensor Characteristics							
Optical Characteristics           Field of View         84         56         5         Degree         At 50% intensity points           Optical Axis         0 +/- 10         0 +/- 10         0 +/- 2         Degree           Average Filter Transmittance         TA         >75         >75         50         %         Wavelength Range from 7.5 μm to 13.5 μm           Cut on Wavelength         λ (5 %)         5.5         5.5         -         μm         At 25°C           Electrical Characteristics           ADC Resolution Tobj         17         Bits         Max Count = 2 <sup>17</sup> ADC Resolution Tamb         14         Bits         Max Count = 2 <sup>14</sup> ADC Sensitivity of Tobj         0.70.9         0.70.9         μV/count           ADC Offset Tobj         64500         64500         64500         counts           Input Low Voltage         ViL         0.2 VpD         0.2 VpD         0.2 VpD         V           Input High Voltage         ViH         0.8 VpD         0.8 VpD         0.8 VpD         V	Sensitivity of T <sub>amb</sub>		90	90	90	counts/K	Linear for T <sub>amb</sub> from 0°C to 90°C	
Field of View         84         56         5         Degree         At 50% intensity points           Optical Axis         0 +/- 10         0 +/- 10         0 +/- 2         Degree           Average Filter Transmittance $T_A$ >75         >75         50         %         Wavelength Range from 7.5 μm to 13.5 μm           Cut on Wavelength         λ (5 %)         5.5         5.5         -         μm         At 25°C           Electrical Characteristics           ADC Resolution $T_{abb}$ 17         Bits         Max Count = 2 <sup>17</sup> ADC Resolution $T_{amb}$ 14         Bits         Max Count = 2 <sup>14</sup> ADC Sensitivity of $T_{obj}$ 0.70.9         0.70.9         0.70.9         μV/count           ADC Offset $T_{obj}$ 64500         64500         counts           Input Low Voltage $V_{IL}$ 0.2 $V_{DD}$ 0.2 $V_{DD}$ 0.2 $V_{DD}$ V           Input High Voltage $V_{IL}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ V	Count @ T <sub>amb</sub> = 25°C		7800	7800	7800	counts		
Optical Axis         0 +/- 10         0 +/- 10         0 +/- 2         Degree           Average Filter Transmittance $T_A$ >75         >75         50         %         Wavelength Range from 7.5 μm to 13.5 μm           Cut on Wavelength         λ (5 %)         5.5         5.5         -         μm         At 25°C           Electrical Characteristics           ADC Resolution $T_{obj}$ 17         Bits         Max Count = 2 <sup>17</sup> ADC Resolution $T_{amb}$ 14         Bits         Max Count = 2 <sup>14</sup> ADC Sensitivity of $T_{obj}$ 0.70.9         0.70.9         μV/count           ADC Offset $T_{obj}$ 64500         64500         counts           Input Low Voltage $V_{IL}$ 0.2 $V_{DD}$ 0.2 $V_{DD}$ V           Input High Voltage $V_{IH}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ V	Optical Characteristics							
Average Filter Transmittance $T_A$ >75 >75 50 % Wavelength Range from 7.5 μm to 13.5 μm Cut on Wavelength $λ$ (5 %) 5.5 5.5 - μm At 25°C    Electrical Characteristics    ADC Resolution $T_{obj}$ 17 Bits Max Count = $2^{17}$ ADC Resolution $T_{amb}$ 14 Bits Max Count = $2^{14}$ ADC Sensitivity of $T_{obj}$ 0.70.9 0.70.9 μν/count ADC Offset $T_{obj}$ 64500 64500 64500 counts Input Low Voltage $V_{IL}$ 0.2 $V_{DD}$ 0.2 $V_{DD}$ 0.2 $V_{DD}$ 0.8 $V_{DD}$ 0.9 $V_{DD$	Field of View		84	56	5	Degree	At 50% intensity points	
Transmittance $I_A$ >/5 >/5 50 % Wavelength Range from 7.5 μm to 13.5 μm Cut on Wavelength $\lambda$ (5 %) 5.5 5.5 - μm At 25°C  Electrical Characteristics  ADC Resolution $T_{obj}$ 17 Bits Max Count = $2^{17}$ ADC Resolution $T_{amb}$ 14 Bits Max Count = $2^{14}$ ADC Sensitivity of $T_{obj}$ 0.70.9 0.70.9 μV/count  ADC Offset $T_{obj}$ 64500 64500 counts  Input Low Voltage $V_{IL}$ 0.2 $V_{DD}$ 0.2 $V_{DD}$ 0.2 $V_{DD}$ V  Input High Voltage $V_{IH}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ 0.8 $V_{DD}$ V	Optical Axis		0 +/- 10	0 +/- 10	0 +/- 2	Degree		
Electrical Characteristics  ADC Resolution $T_{obj}$ ADC Resolution $T_{amb}$ ADC Resolution $T_{amb}$ 14  Bits Max Count = $2^{17}$ ADC Sensitivity of $T_{obj}$ 0.70.9  0.70.9  0.70.9  0.70.9  0.70.9  0.70.9  Vult  Input Low Voltage  V <sub>IL</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> 0.8 V <sub>DD</sub> V  Input High Voltage  V <sub>IH</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> V	-	T <sub>A</sub>	>75	>75	50	%	Wavelength Range from 7.5 μm to 13.5 μm	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Cut on Wavelength	λ (5 %)	5.5	5.5	-	μm	At 25°C	
ADC Resolution $T_{amb}$	Electrical Characteristics							
ADC Sensitivity of T <sub>obj</sub> 0.70.9 0.70.9 μV/count  ADC Offset T <sub>obj</sub> 64500 64500 counts  Input Low Voltage V <sub>IL</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> V  Input High Voltage V <sub>IH</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> V	ADC Resolution T <sub>obj</sub>			17		Bits	Max Count = 2 <sup>17</sup>	
ADC Offset T <sub>obj</sub> 64500 64500 counts  Input Low Voltage V <sub>IL</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> V  Input High Voltage V <sub>IH</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> V	ADC Resolution T <sub>amb</sub>			14		Bits	Max Count = 2 <sup>14</sup>	
Input Low Voltage V <sub>IL</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> 0.2 V <sub>DD</sub> V Input High Voltage V <sub>IH</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> V	ADC Sensitivity of T <sub>obj</sub>		0.70.9	0.70.9	0.70.9	μV/count		
Input High Voltage V <sub>IH</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> 0.8 V <sub>DD</sub> V	ADC Offset T <sub>obj</sub>		64500	64500	64500	counts		
	Input Low Voltage	V <sub>IL</sub>	0.2 V <sub>DD</sub>	0.2 V <sub>DD</sub>	0.2 V <sub>DD</sub>	V		
	Input High Voltage	V <sub>IH</sub>	0.8 V <sub>DD</sub>	0.8 V <sub>DD</sub>	0.8 V <sub>DD</sub>	V		
Pull Down Current 200 200 $\mu$ A Direct link pin to $V_{DD}$	Pull Down Current		200	200	200	μА	Direct link pin to V <sub>DD</sub>	
Pull Up Current 130 130 130 $\mu A$ Direct link pin to $V_{SS}$	Pull Up Current		130	130	130	μА	Direct link pin to V <sub>SS</sub>	
LPF Cut-Off Frequency 8 8 8 Hz	LPF Cut-Off Frequency		8	8	8	Hz		

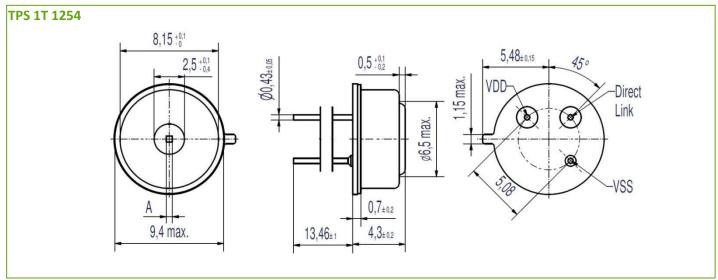
<sup>&</sup>lt;sup>1</sup>The electrical parameters may vary from specified values accordance with their temperature dependence.

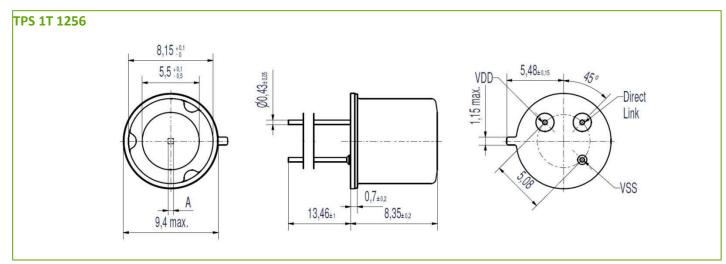
 $<sup>^2</sup>$  With standard filter (LWP, cut-on 5.5  $\mu$ m)

<sup>&</sup>lt;sup>3</sup> Uncoated lens

### **Physical Configuration**



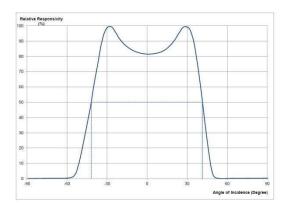




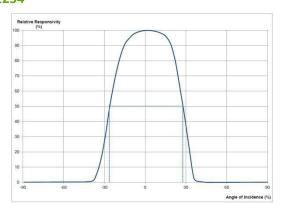
## DigiPile<sup>™</sup> Family

## **Digital Thermopiles**

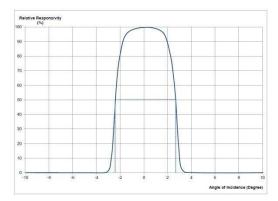
#### **TPIS 1T 1252**



### **TPS 1T 1254**



### **TPS 1T 1256**



Excelitas Technologies 22001 Dumberry Road Vaudreuil-Dorion, Quebec Canada J7V 8P7 Telephone: (+1) 450.424.3300 Toll-free: (+1) 800.775.6786 Fax: (+1) 450.424.3345 detection@excelitas.com European Headquarters Excelitas Technologies GmbH & Co. KG Wenzel-Jaksch-Str. 31 D-65199 Wiesbaden Germany

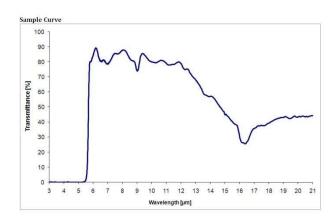
Telephone: (+49) 611 492 430 Fax: (+49) 611 492 165 Asia Headquarters Excelitas Technologies Bldg.4, Lane 67, Li Bing Rd

Bldg. 4, Lane 67, Li Bing Rd Zhangjiang Hi-Tech Park, Shanghai 201203, PRC Telephone: +86 (21) 38769510

Fax: +86 (21) 50791316

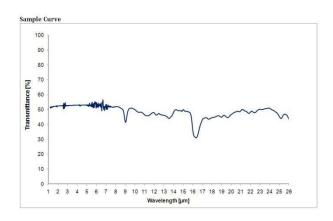
Filter Identifier

Cut-on wavelength (CWL)	5.5 μm
Cut-on tolerance range	± 0.3 μm
Average Transmittance from 7.5μm to 13.5μm	> 70 %
Average Transmittance from visual to 5μm	< 0.5 %
Substrate material	Silicon



Filter Identifier G12
-----------------------

Substrate material	Silicon, uncoated





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