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## Data Sheet

# MTCSiCS

## Integral True Color Sensor – LCC8

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## 1 INTRODUCTION

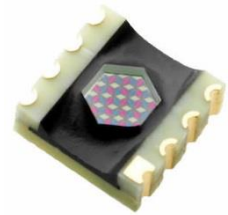
The True Color Sensors are made of 19 x 3 photo diodes (special PIN silicon technology with extended sensibility) integrated on chip. The diodes are carried out as segments of a multiple-element hexagonal matrix structure with the diameter of 2,0 mm.

The design as Si-PIN photo diodes allows signal frequencies up to MHz-range. In order to achieve a small cross talk between the photodiodes the individual sectors were separated from each other by additional structures.

Each of these photodiodes is sensitized with new dielectric spectral filter (named True Color Filter<sup>1</sup>) for its color range, preferably for the primary **color standard CIE (Commission Internationale de l'Eclairage or International Commission on Illumination) color space**.

## 2 APPLICATION

- General Color measurements, checks and regulations
- Portable color reader for consumer and industrial applications
- Closed loop for RGB lighting (SSL) – regulation of temperature shifts
- Sensor for display color adjustment and backlight/contrast control
- Color sensitive sensor for “True Color” reproduction and system calibration
- Detector for various light sources, mood lighting, regulated color temperature



## 3 FEATURES

Dielectric filters guaranties the good optical properties of the color sensors, such as:

- high transmission
- no ageing of the filter
- high temperature stability
- high signal frequency
- reduced cross talk
- small size (diameter of the optical sensitive surface ca. 2 mm)
- alike tri-stimulus interference filter for color measurement to DIN 5033 (CIE 1931)
- LCC package
- EU RoHS-conform<sup>2</sup>



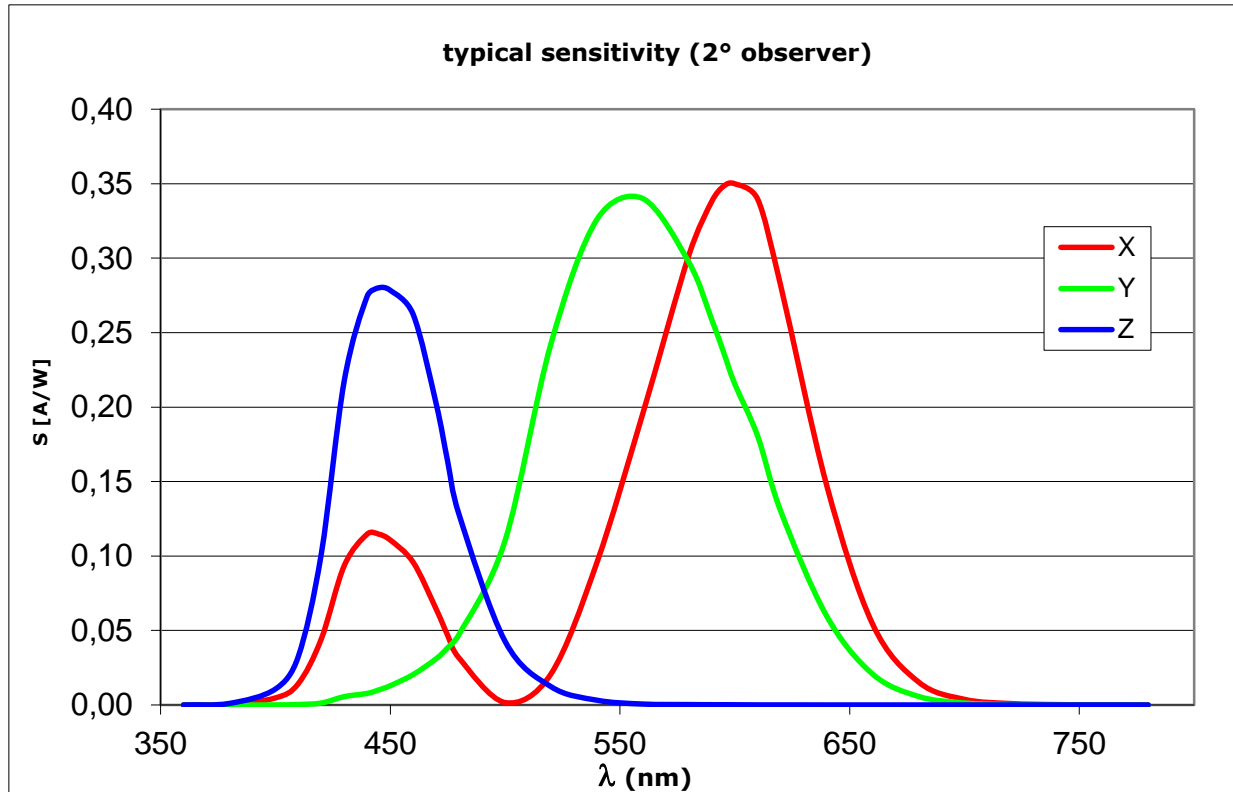
<sup>1</sup> The new generation of JENCOLOR sensors is committed to implementing (see relative sensitivity) the standard distribution functions as defined under DIN 5033 Part 2 – Color Measurement; CIE 1931 Standard Colorimetric Systems. This implementation method allows colors to be determined according to the three-range procedure that is defined in part 6 of DIN 5033.

<sup>2</sup> EU RoHS: Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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## 4 SPECTRAL CHARACTERISTICS

Figure 1: Typical (relative) sensitivity (XYZ) of the color sensor (MTCSiCS) scanned by width broadband light and limited angle of incidence ( $<10^\circ$ )<sup>3,4</sup>



The filter function corresponds to a technical implementation of the CIE's - color matching function XYZ. For more information regarding the color matching function details please read for example: [http://en.wikipedia.org/wiki/CIE\\_1931\\_color\\_space](http://en.wikipedia.org/wiki/CIE_1931_color_space).

<sup>3</sup> Please note, there are some technical differences between the national or international standards for color measurement based on the tri-stimulus function. Furthermore each sensor has small production based tolerances of nearly 1% variation referred to the wavelengths. So we recommend calibrating the sensor based on the application usage to achieve best results with the least error margin possible within the color space. The calibration depends on the sensor, light source, color target, algorithm for calibration and all interferences hit the sensor. In most of cases it is possible to achieve better results than human eye. Please ask our technical support team for assistance if you want to calibrate your sensor system.

<sup>4</sup> See chapter 11.3 „Angle of incidence“.

## 5 MAXIMUM RATINGS / CHARACTERISTICS

(T<sub>A</sub> = 25°C; per single diode)

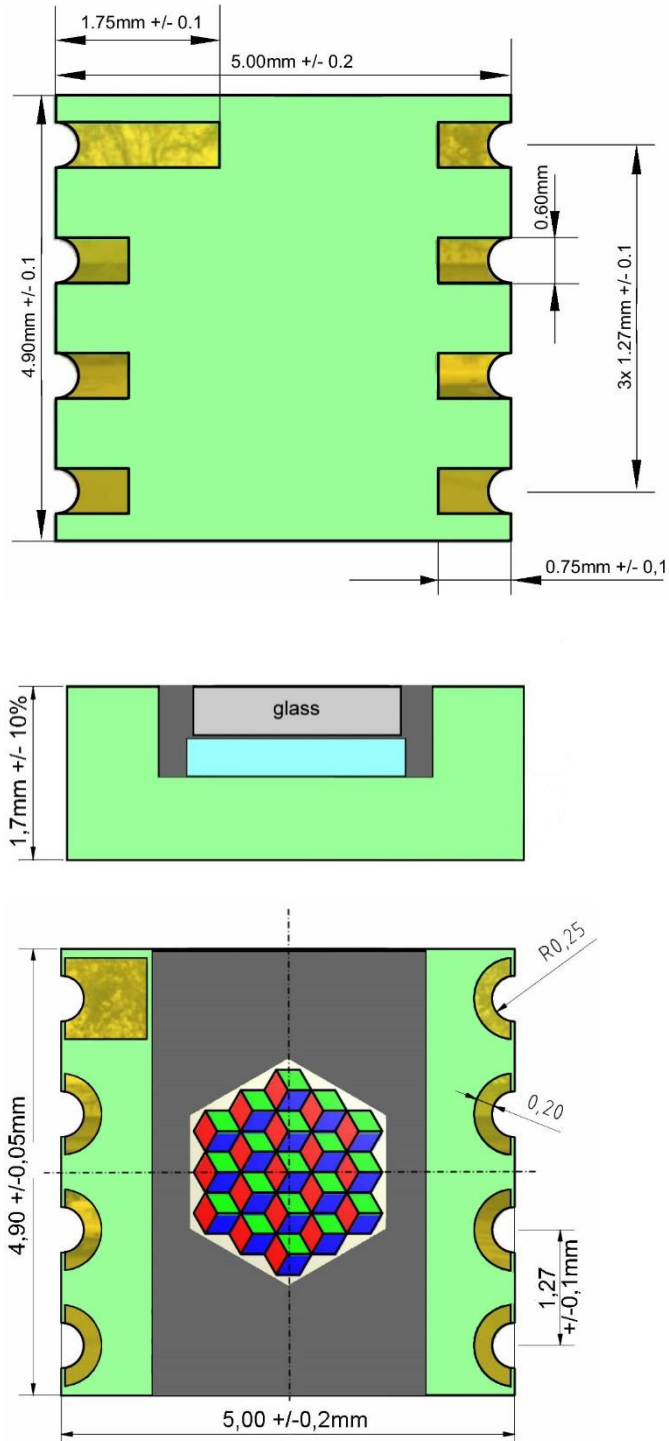
Description	Symbol	Condition	min.	typ.	max.	Unit
Diameter of light sensitivity area	D			2,0		mm
Light sensitivity area per single color array (19 diodes)	A			0,76		mm <sup>2</sup>
Typical photo sensitivity of color ranges	S <sub>max</sub>	λ <sub>Z</sub> = 445 nm λ <sub>Y</sub> = 555 nm λ <sub>Xk</sub> = 445 nm λ <sub>Xl</sub> = 600 nm	0,25 0,30 0,10 0,30	0,28 0,34 0,12 0,35	0,31 0,38 0,15 0,40	A/W
Temperature coefficient of photo sensitivity	TK	λ <sub>Z</sub> = 445 nm λ <sub>Y</sub> = 550 nm λ <sub>Xk</sub> = 600 nm λ <sub>Xl</sub> = 670 nm		0 250 500 1000		Ppm/K
Temperature coefficient of photo sensitivity	TK	λ <sub>Z</sub> = 445 nm λ <sub>Y</sub> = 550 nm λ <sub>Xk</sub> = 600 nm λ <sub>Xl</sub> = 670 nm		0 250 500 1000		ppm/K
Spectral tolerance of filter curve	Δλ(λ)				<1%*λ	nm
Reverse voltage	V <sub>R</sub>		0	2,5	5	V
Dark current	I <sub>R</sub>	V <sub>R</sub> = 2,5V		10		pA
Terminal capacitance	C	V <sub>R</sub> = 2V			70	pF
Rise and fall time of photo-current	t <sub>r</sub> , t <sub>f</sub>				2	μs
Noise equivalent power	NEP	f <sub>R</sub> = 100 Hz			<10 <sup>-13</sup>	W/√Hz
Cross-talk					<1	%
Angle of incidence (see also chapter 11.3 )	φ	Δλ <sub>(Filter)</sub> < 1%*λ			10	Grad
Standard operating temperatures <sup>5</sup>	T <sub>op</sub>		-20		+100	°C
Storage temperature range	T <sub>st</sub>	RH < 70%	-40		+100	°C
Soldering peak temperature (see chapter 8 )	T <sub>p</sub>				260	°C
Time above T <sub>p</sub> -20°C	sec			20	30	
Moisture Sensitive Level	MSL	JEDEC J-STD-020		3		

<sup>5</sup> special on request

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## 6 PACKAGE OVERVIEW<sup>6</sup>

Figure 2: MTCSiCS in 8 Pin LCC package (bottom-, side- and top view)



<sup>6</sup> Please, protect the sensible surface (glass) of the sensor against scratch and similar mechanical injuries. It will have negative effects for the perfect function of the sensor.

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Figure 3: Proposal of solder pads for MTCSiCS LCC8 package

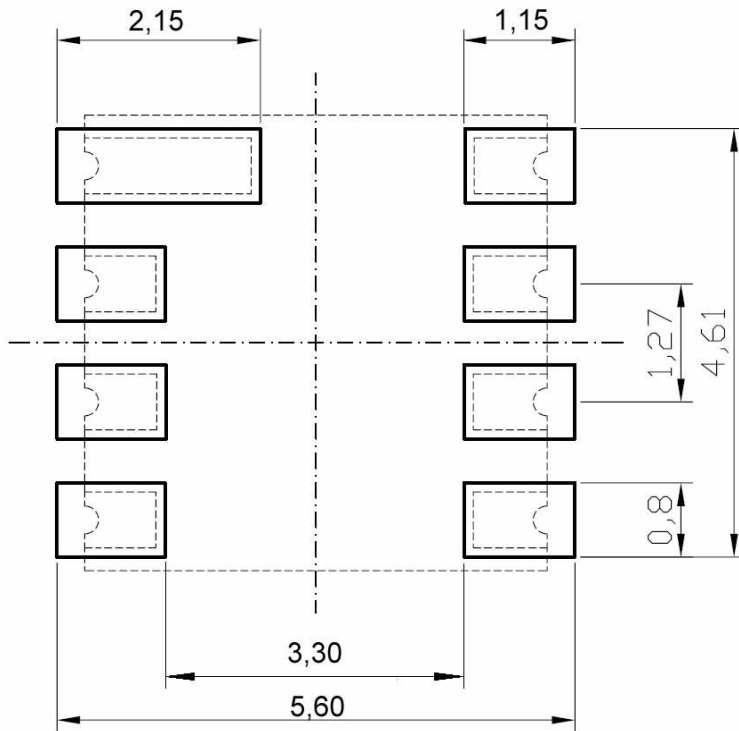
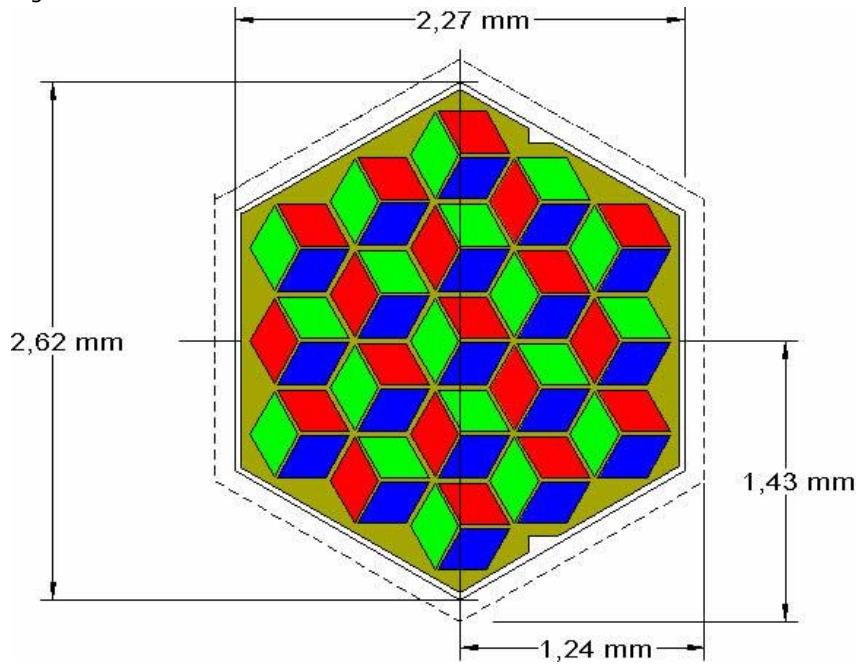


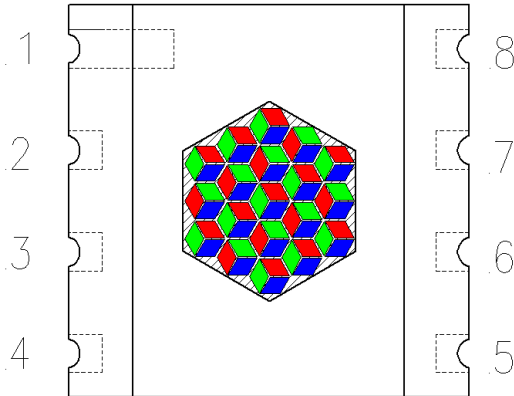
Figure 4: Filter dimensions of MTCSiCS



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## 7 PIN-CONFIGURATION

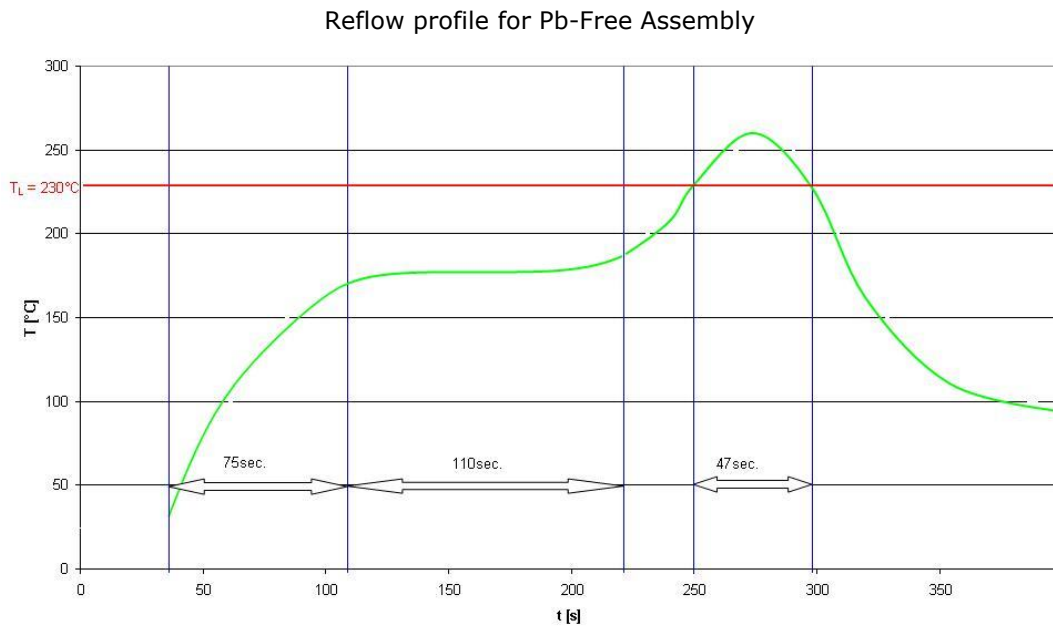
Figure 5: LCC 8 package (Top view)



PIN	description
1	Y (green)
2	nc
3	nc
4	Z (blue)
5	X (red)
6	nc
7	TrD <sup>7</sup>
8	K common cathode

## 8 SOLDERING PROFILE

Figure 6: Recommended reflow soldering profile<sup>8</sup>



<sup>7</sup> TrD is an isolation diode to split up the potential of the 3 functional PIN diodes. It's important for shielding the single color diodes to minimize cross-talk among the 3 colored areas/diodes. In general the TrD has to be connected with the Vref or in the case of MAZeTs MTI04C-amplifier with the 4th channel of it).

<sup>8</sup> Please note the sensor includes sensitive materials and components. High temperatures and time for soldering more than specified here could damage or destroy the sensor (see also chapter 9 ).

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## 9 HANDLING

Care should be taken to keep the sensor surface clean. Dust, scratches will adversely affect the sensor parameters. Sensors should be handled as optical device.

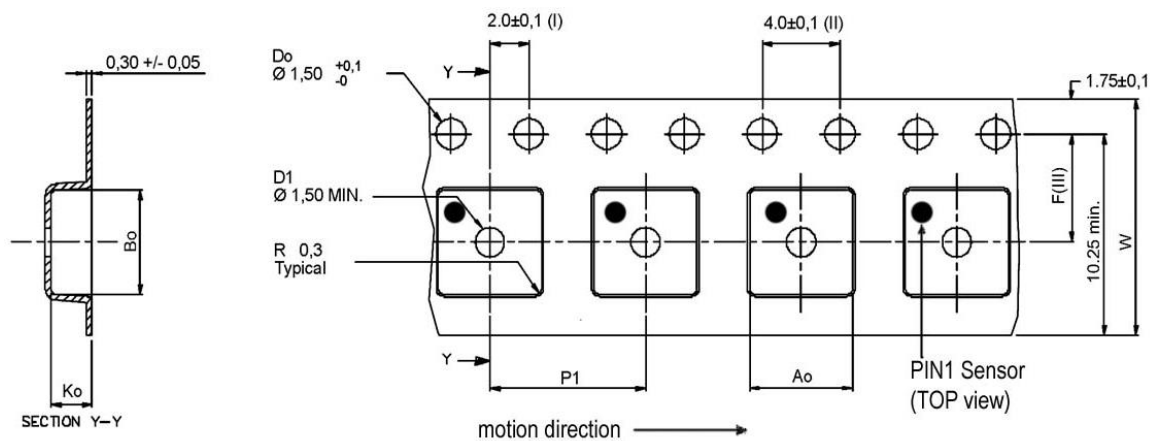
It is important to use normal ESD handling and precautions for ESD sensitive devices.

Each sensor element is baked prior packing for shipment (24 hours at 125°C). Devices are packed in a sealed aluminized envelope with humidity indicator card and desiccant. Keep the opening and handling time of bag as short as possible and note our defined MSL (see chapter 5 ).

## 10 PACKING INFORMATION

Standard packing is tape & reel or tube. Otherwise has to be cleared with our sales team (see page 10).

Tape embossed carriers are made of conductive polystyrene (IV).



### Dimension

<b>Ao</b>	5.30 +/- 0.1
<b>Bo</b>	5.30 +/- 0.1
<b>Ko</b>	2.10 +/- 0.1
<b>F</b>	5.50 +/- 0.05
<b>P1</b>	8.00 +/- 0.1
<b>W</b>	12.00 +0.3/- 0.1

### Index Information

- (I) Measured from centerline of sprocket hole to centerline of pocket
- (II) Cumulative tolerance of 10 sprocket holes is +/- 0.20
- (III) Measured from centreline of sprocket hole to centreline of pocket
- (IV) Other material available

All dimension in millimeters unless otherwise stated.

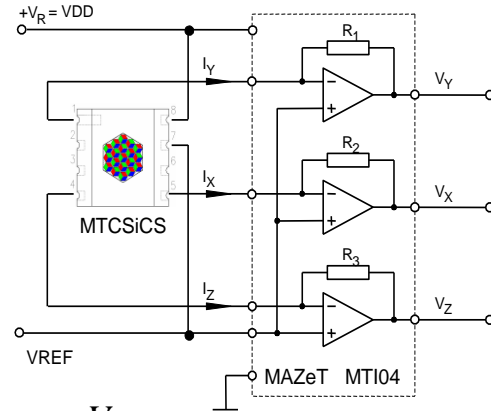


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## 11 APPLICATION NOTES

### 11.1 Circuit

Opposite figure shows a circuit for the conversion of photo current to an equivalent voltage. These voltage can be processed e.g. with an ADC. By the selection of suitable resistors the output voltage range can be adjusted to the photo current value (for example the pin-programmable transimpedance amplifier MTI04 in the dashed box). If using the MTCSiCS as a standalone device without the amplifier MTI04, please ignore the dashed box.



$$R_x \approx \frac{V_{Out}}{I_{Photo}}$$

### 11.2 Narrowband luminous sources

The spectral filters of our color sensors are specialized for applications with broadband source of lighting >10 nm. Please ask our sales team before you use our sensor in combination with narrowband luminous sources.

### 11.3 Angle of incidence

In reliance on the packaging the sensor IC has an aperture angle (beam width) of nearly 90°. Traditional an interference filter works depends on angle of incidence. So a bumped light beam with different angles to vertical until 10° will not causes any filter shifts. Make sure by using lenses or optical holes that the angle of incidence for the sensor device will be smaller than 10°.

## 12 ORDERING INFORMATION

Name	Status	Package	Article
MTCSiCS	series	LCC8	090400-193-26AEZ00

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**Misuse of Documentation** – The information presented in this data sheet is for reference only. Because these products are under development do not use this document as product installation guide. Before you start any development ask your supplier for the latest version of this sheet. **Failure to comply with these instructions could result in death or serious injury.**

**ESD Warning** – Sensor handling precautions should be observed to avoid static discharge.