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Data Sheet

MTCSiCS

Integral True Color Sensor – LCC8

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1. FUNCTION

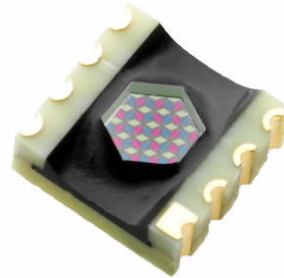
The True Color Sensors are made of 19 x 3 photo diodes (special PIN silicon technology with extended sensibility) integrated on chip. The diodes are carried out as segments of a multiple-element hexagonal matrix structure with the diameter of 2,0 mm.

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 Filter¹) 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-conform²



¹ 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.

² 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. MAXIMUM RATINGS / CHARACTERISTICS

($T_A = 25^\circ\text{C}$; 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 ²
Typical photo sensitivity of color ranges	S_{\max}	$\lambda_z = 445 \text{ nm}$ $\lambda_y = 555 \text{ nm}$ $\lambda_{xk} = 445 \text{ nm}$ $\lambda_{xl} = 600 \text{ nm}$	0,21 0,30 0,11 0,31	0,23 0,33 0,12 0,35	0,25 0,36 0,13 0,38	A/W
Spectral tolerance of filter curve	$\Delta\lambda(\lambda)$				$<1\%*\lambda$	nm
Reverse voltage	V_R		0	2,5	5	V
Dark current	I_R	$V_R = 2,5\text{V}$		10		pA
Terminal capacitance	C	$V_R = 2\text{V}$			70	pF
Rise and fall time of photo-current	t_r, t_f				2	μs
Noise equivalent power	NEP	$f_R = 100 \text{ Hz}$			$<10^{-13}$	W/ $\sqrt{\text{Hz}}$
Cross-talk					<1	%
Angle of incidence (see also chapter 11.3)	φ	$\Delta\lambda_{(\text{Filter})} < 1\%*\lambda$			10	$^\circ$
Standard Operating temperatures ³	T_{op}		-20		+100	$^\circ\text{C}$
Storage temperature range	T_{st}	RH < 70%	-40		+100	$^\circ\text{C}$
Moisture sensitivity Level	MSL	J-STD-020D.1		3		
Soldering peak temperature (see chapter 8 soldering profile)	T_p				260	$^\circ\text{C}$
Time above $T_p -20^\circ\text{C}$	sec			20	30	

³ special on request

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5. SPECTRAL CHARACTERISTIC

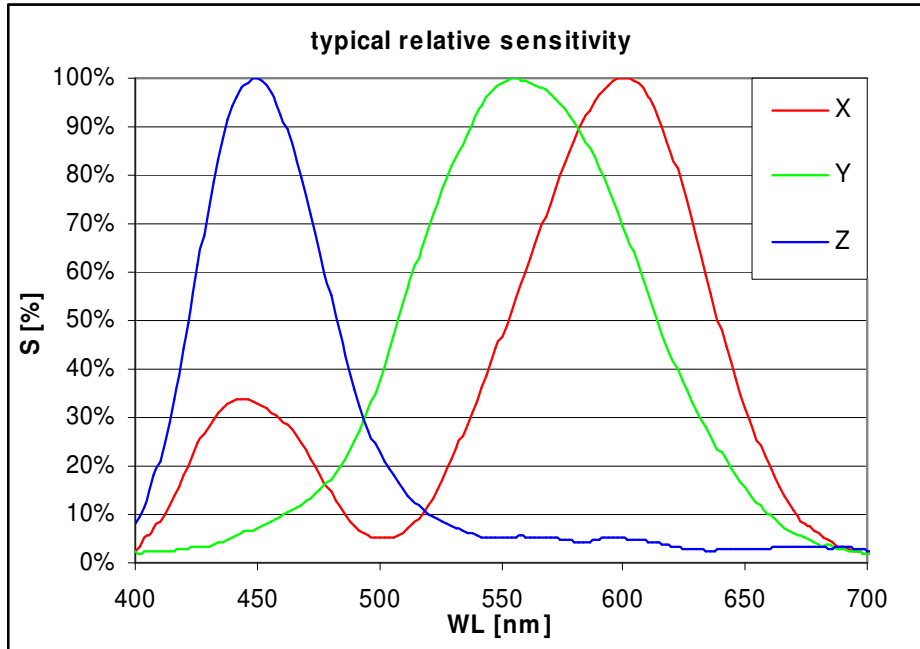


Figure: Typical (relative) sensitivity (XYZ) of the color sensor (MTCSiCS) scanned by width broadband light and limited angle of incidence ($<10^\circ$)^{4 5 6}

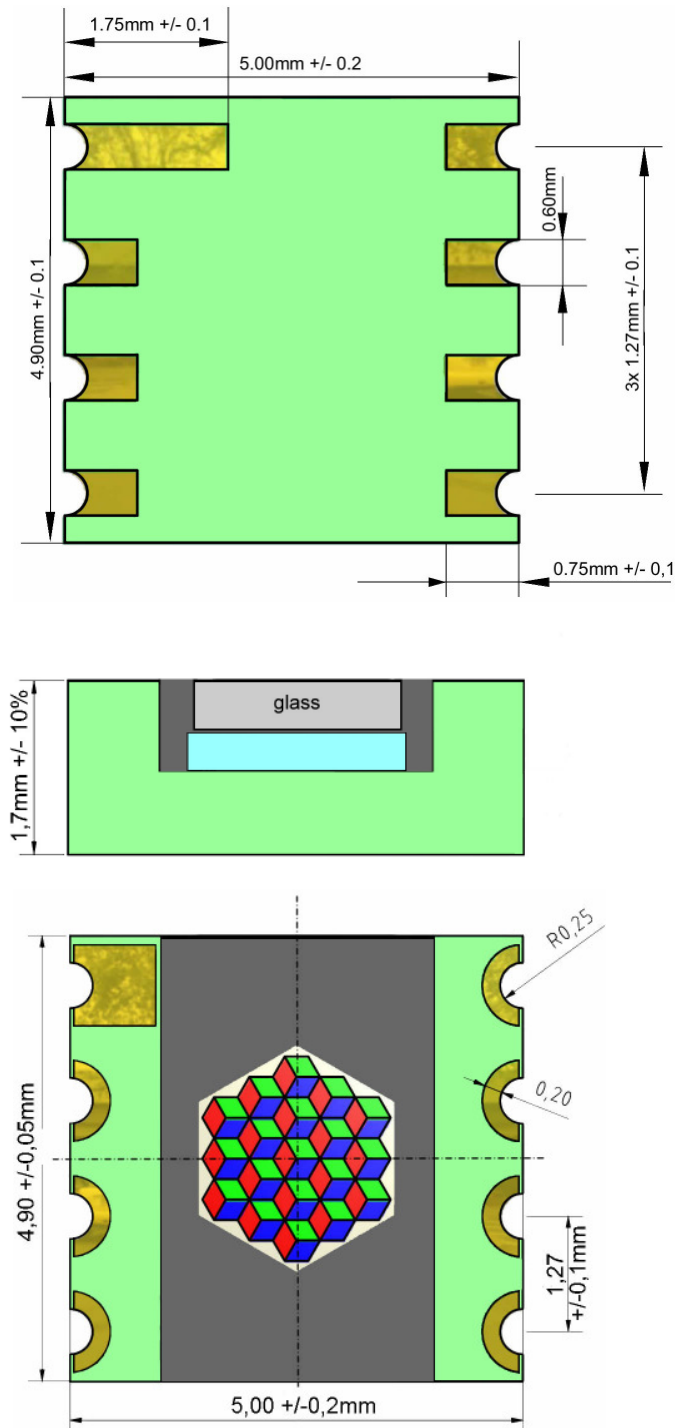
⁴ Typical characteristic sensitivity; scanned by monochromatic light with FWHM 27nm, see also chapter 11.2

⁵ Please note, there are some technical differences between the national or international standards for color measurement based on the tri-stimulus observer function and our realized sensor function. Furthermore each sensor has small production based tolerances of nearly 1% variation referred to the wavelengths. So we recommend calibrating the sensor to achieve best results with a small error in 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's possible to achieve always better results than human eyes. Please ask our technical staff for support if you want to calibrate your sensor system.

⁶ See chapter "Application notes – angle of incidence".

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6. PACKAGE OVERVIEW⁷

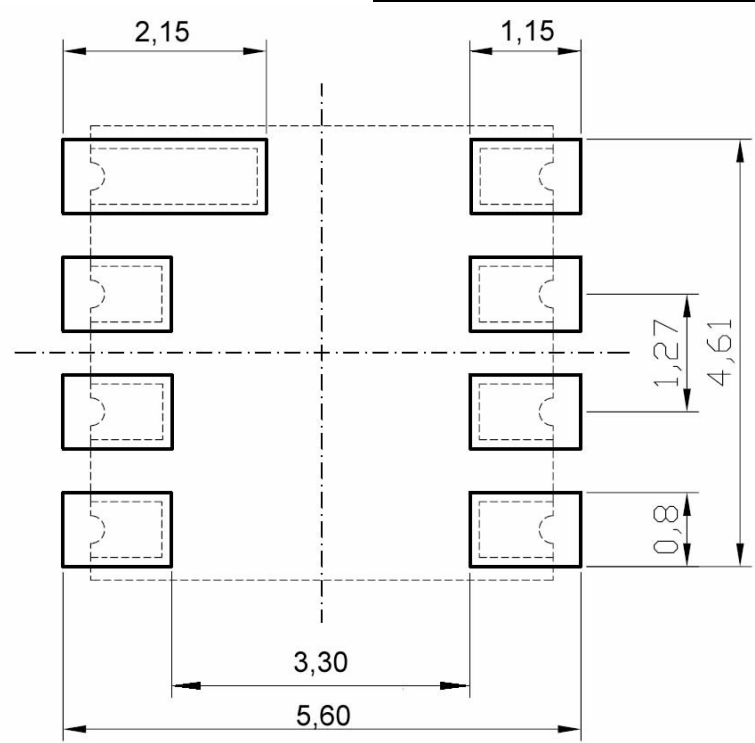


MTCSiCS in 8 Pin LCC package (bottom-, side- and top view)

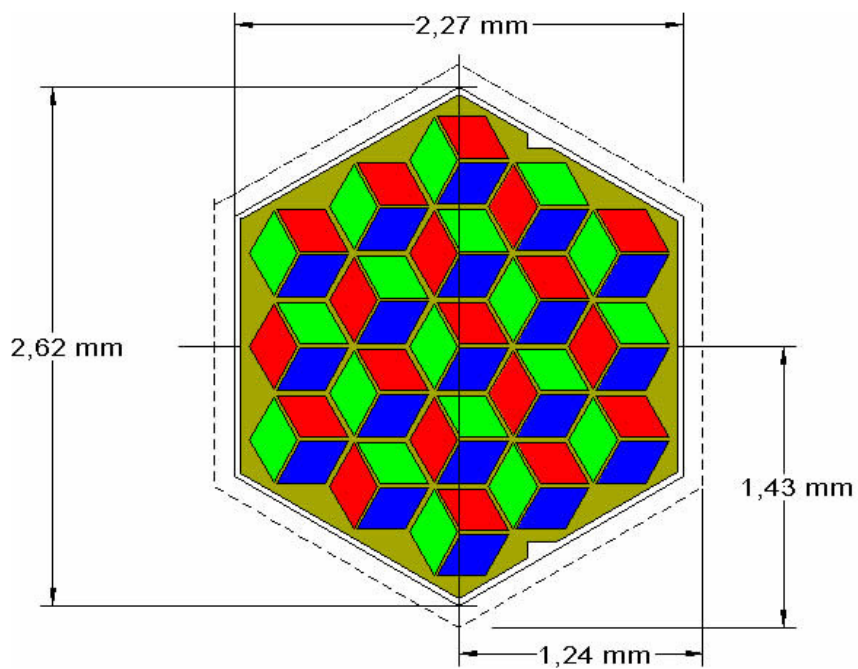
⁷ Please, protect the sensible surface (glass) of the sensor against scratch and similar mechanical injuries. It will have negative effects for the perfect function of the sensor.

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Proposal of solder pads for MTCSiCS LCC8 package



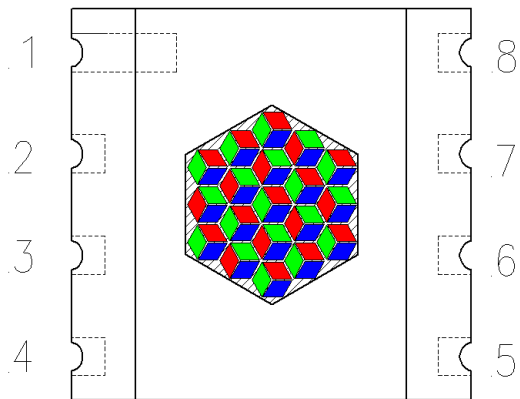
Filter dimensions of MTCSiCS

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7. PIN-CONFIGURATION

(Top view)

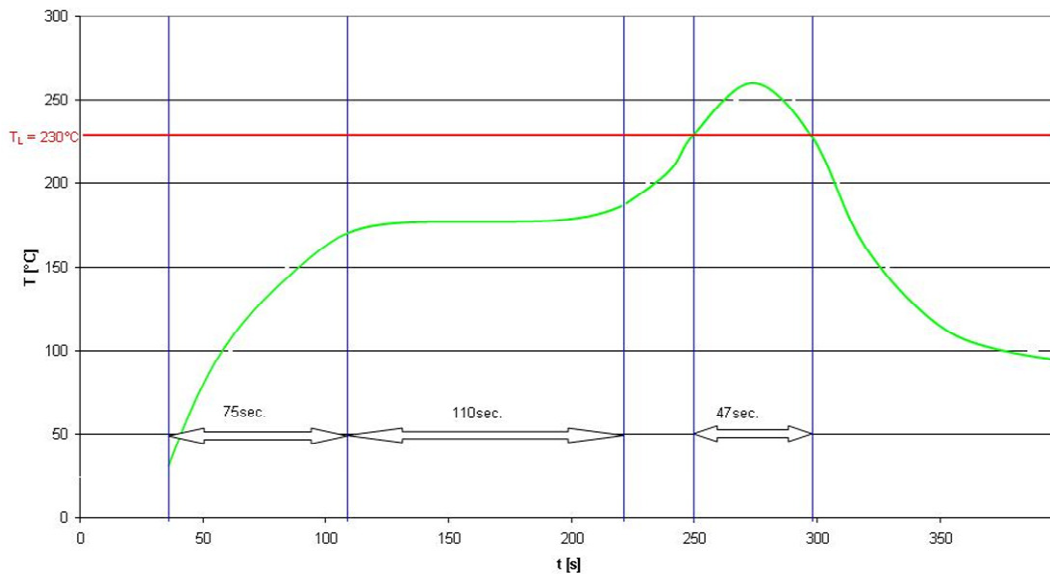
PIN	description
1	Y (green)
2	nc
3	nc
4	Z (blue)
5	X (red)
6	nc
7	TrD ⁸
8	K common cathode



LCC 8 package

8. SOLDERING PROFILE

Reflow profile for Pb-Free Assembly



Recommended reflow SOLDERING PROFILE

⁸ TrD is a 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 MAZeT's MTI04C-amplifier with the 4th channel of it).

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9. HANDLING AND STORAGE

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.

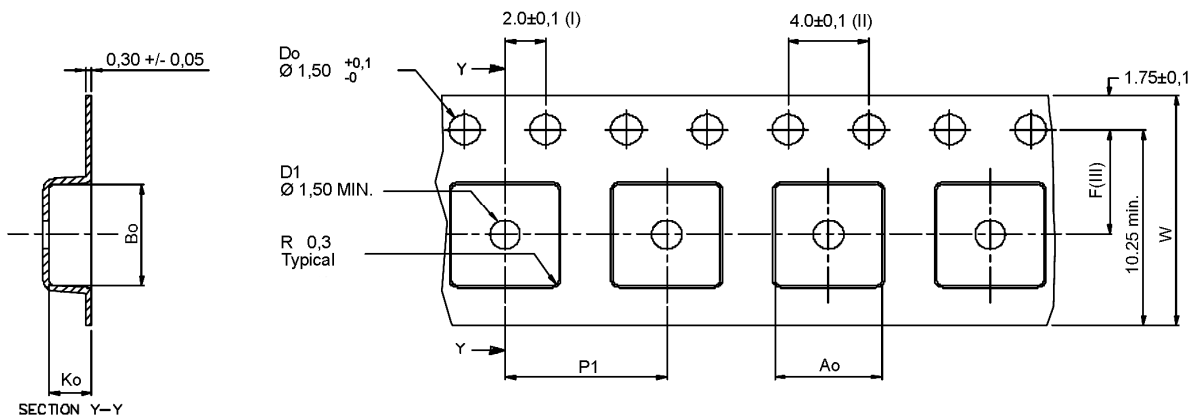
It is important to use normal ESD handling and precautions for ESD sensitive devices.

The package corresponds to a moisture level of MSL3. Each device is baked prior packing for shipment to guarantee this level. Devices are packed in a sealed aluminized envelope with humidity indicator card and desiccant. Keep the opening and handling time of moisture bag as short as possible (max. is 168 hours at $\leq 30^{\circ}\text{C}/60\% \text{ RH}$) to avoid re-baking. If necessary the recommended baking conditions are 24hours at 125°C . For baking at 125°C we further recommend to send the components to a Reel Service, they are the experts for de-reeling / baking / re-reeling.

10. PACKING INFORMATION

Standard packing is tape & reel. Otherwise has to be cleared with sales, see chapter 12.

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



Dimension

Ao	5.30 +/- 0.1
Bo	5.30 +/- 0.1
Ko	2.10 +/- 0.1
F	5.50 +/- 0.05
P1	8.00 +/- 0.1
W	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

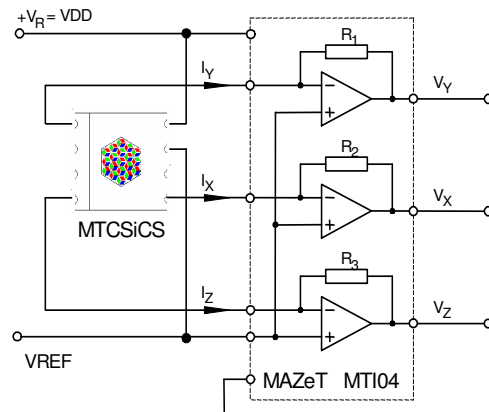
All dimension in millimeters unless otherwise stated.

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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 MT104 in the dashed box). If using the MTCSiCS as a standalone device without the amplifier MT104, please ignore the dashed box.



11.2 LIMITATIONS

The spectral filters of our color sensors are specialized for applications with broadband source of lighting >10nm. 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

True Color sensor with LCC8-package

MTCSiCS

For further information please contact:

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