DATASHEET

MTCSiCF

Integral True Color Sensor
QFN16
Order No.: 090400-402-26AEZ00
Status: certified

INTRODUCTION

The MTCSiCF is a True Color Sensor IC with a filter function based on the color standard CIE 1931/DIN 5033 (human eye perception) in a compact QFN16 package. The MTCSiCF is long-term stable over the entire product lifetime and resistant to external influences such as temperature or aging drifts, due to the special JENCOLOR® interference filter technology.

The JENCOLOR® sensors are made of 19x3 photodiodes integrated on-chip (special pin silicon technology with advanced sensitivity). The diodes are aligned as segments of a multiple-element hexagonal matrix structure with the diameter of 2 mm.

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

Based on the QFN package and the special JENCOLOR® interference filter technology, the MTCSiCF is long-term stable over the entire product lifetime and resistant to external influences such as temperature drifts. The MTCSiCF operates within temperature ranges of -20°C to 100°C.

APPLICATIONS

▪ General Color measurement and control
▪ Portable color measurement devices for consumer and industrial applications
▪ Highly color sensitive sensor for human eye perception “True Color” reproduction and system calibration
▪ Detector for various light sources, mood lighting, regulated color temperature, CCT and many more
▪ Active closed-loop systems for LED lighting – regulation of temperature shifts and aging

FEATURES

▪ JENCOLOR® interference filter technology
▪ Filter curves based on CIE 1931/DIN 5033
▪ Human eye perception
▪ High transmission and blocking
▪ No aging of the filter
▪ High temperature stability up to 100°C
▪ High signal frequency
▪ Minimal cross talk
▪ Compact size (diameter of the optical sensitive surface approx. 2 mm)
▪ Easily compatible with analog and digital signal converters from MAZeT

1 Sensors utilizing the JENCOLOR® interference filter technology implement the standard observer functions as defined under DIN 5033 Part 2 – Color Measurement; CIE 1931 (Commission Internationale de l’Eclairage or International Commission on Illumination) Standard Colorimetric Systems. (see relative sensitivity) This implementation method allows colors to be determined according to the three-range procedure that is defined in part 5 of DIN 5033.

2 LED lighting control management for solid-state lighting (SSL), LED spotlights, cabin lighting, day-light management / Human and Color Centric Lighting (HCL and CCL), Color Light Output (CLO), ambient light color detection / correction, (O)LED display control, and dynamic display color balancing, portable light color measurement, and digital light projection (DLP).

Production data information is current as of publication date. Products conform to specifications per the terms of MAZeT GmbH. The information in this document is subject to change without notice, please confirm that this is the latest version. Please check with a MAZeT sales representative for availability and further information. Full legal notices can be found on the final page.
INTRODUCTION .................................................................................................................. 1
APPLICATIONS .................................................................................................................. 1
FEATURES .......................................................................................................................... 1
1 SPECTRAL CHARACTERISTIC ......................................................................................... 3
2 MAXIMUM RATINGS / CHARACTERISTICS ................................................................. 3
3 PACKAGE OVERVIEW .................................................................................................. 4
4 PIN CONFIGURATION .................................................................................................. 5
5 HANDLING .................................................................................................................... 6
6 PACKAGING INFORMATION .......................................................................................... 6
7 SOLDERING INFORMATION ........................................................................................... 7
8 APPLICATION NOTES .................................................................................................... 8
  8.1 Narrowband Luminous Sources ................................................................................ 8
  8.2 Angle of Incidence ................................................................................................... 8
  8.3 Effects of Temperature .............................................................................................. 9
  8.4 Schematic of Reference Design ............................................................................... 9
  8.5 Notes for PCB Layout ............................................................................................. 10
  8.6 Notes for Manufacturing ......................................................................................... 11
  8.7 Sensor Calibration .................................................................................................. 11
ORDERING INFORMATION ............................................................................................... 13
LEGAL NOTES AND WARNINGS ..................................................................................... 14
1 SPECTRAL CHARACTERISTIC

The filter response curves are based on the CIE 1931 standard. For more information regarding the color matching function - please read for example: http://en.wikipedia.org/wiki/CIE_1931_color_space.

Figure 1: Typical sensitivity of the XYZ color sensor (MTCSiCF) evaluated via broadband light and limited angle of incidence (<10°)

2 MAXIMUM RATINGS / CHARACTERISTICS

Table 1: Maximum Ratings/Characteristics (Ta = 25°C; per single diode)

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>SYMBOL</th>
<th>CONDITION</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of light sensitivity area</td>
<td>D</td>
<td></td>
<td>2.0</td>
<td></td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>Light sensitivity area per single color array</td>
<td>A</td>
<td></td>
<td>0.54</td>
<td></td>
<td></td>
<td>mm²</td>
</tr>
<tr>
<td>Typical photo sensitivity of color ranges</td>
<td>Smax</td>
<td>λZ = 445 nm</td>
<td>0.25</td>
<td></td>
<td>0.28</td>
<td>A/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>λY = 555 nm</td>
<td>0.30</td>
<td></td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>λK = 445 nm</td>
<td>0.10</td>
<td></td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>λK = 600 nm</td>
<td>0.30</td>
<td></td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>λL = 600 nm</td>
<td>0.31</td>
<td></td>
<td>0.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>λL = 600 nm</td>
<td>0.15</td>
<td></td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient of photo sensitivity</td>
<td>TK</td>
<td>λ = 445 nm</td>
<td>0</td>
<td>250</td>
<td>500</td>
<td>ppm/K</td>
</tr>
<tr>
<td></td>
<td></td>
<td>λ = 550 nm</td>
<td></td>
<td>500</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>λ = 600 nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>λ = 670 nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spectral tolerance of filter curve</td>
<td>Δλ(λ)</td>
<td></td>
<td>&lt; ±1%*λ</td>
<td></td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td>VR</td>
<td></td>
<td>0</td>
<td>2.5</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Dark current</td>
<td>IR</td>
<td>VR = 2.5 V</td>
<td>20</td>
<td></td>
<td></td>
<td>pA</td>
</tr>
<tr>
<td>Terminal capacitance</td>
<td>C</td>
<td>VR = 2.5 V</td>
<td>70</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
</tbody>
</table>

3 Typical characteristic sensitivity; monitored via monochromatic light at FWHM 27 nm
4 See chapter 8.2 Angle of Incidence
3 PACKAGE OVERVIEW

Figure 2: MTCSiCF in QFN16-package - top- and side view

The color sensor is center positioned with deviation of ±0.075mm.

---

5 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.
Figure 3: MTCSI in QFN16 package - dimensions bottom side and PCB lands

Recommended PCB finishing is gold plated.

4 PIN CONFIGURATION

Table 2: Pin configuration

<table>
<thead>
<tr>
<th>PIN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>nc</td>
</tr>
<tr>
<td>5</td>
<td>Z - function</td>
</tr>
<tr>
<td>6</td>
<td>nc</td>
</tr>
<tr>
<td>7</td>
<td>nc</td>
</tr>
<tr>
<td>8</td>
<td>X - function</td>
</tr>
<tr>
<td>9 - 12</td>
<td>nc</td>
</tr>
<tr>
<td>13</td>
<td>TrD</td>
</tr>
<tr>
<td>14 - 15</td>
<td>nc</td>
</tr>
<tr>
<td>16</td>
<td>Y - function</td>
</tr>
<tr>
<td>17</td>
<td>K - common cathode contact backside</td>
</tr>
</tbody>
</table>

Note: The X Y Z pins are the True Color Sensor signals, cathode is the common connector and TrD is an added isolation-diode to split up the potential of the 3 functional pin diodes XYZ.

TrD is important to shield the single pin diodes for the XYZ detection and minimize crosstalk among the 3 filtered areas/diodes. Chapter 8.4 illustrates how the signal ASICs of MAZeT need to be connected to the sensors. (e.g. MCDC04/ MDDC04) Otherwise ask our sales team for support.

The term "nc" means the contact is not connected internally, it is not required for any electrical function but is important for IC soldering and mechanical functions. In PCB contact all “nc" to common cathode to avoid potential differences between the pin diodes and neighbored wires.
5 HANDLING

Take care that the sensor surface is clean at all time. Dust, scratches will adversely affect the sensor parameters. Sensors should be handled with care as any other optical device. It is important to use regular ESD handling and precautions for ESD sensitive devices.

6 PACKAGING INFORMATION

Standard packing is tape and reel. Usually in a moisture barrier bag (MBB sealed aluminized envelope) with desiccant (e.g. silica gel) and humidity indicator card to protect them from ambient moisture during shipping, handling, and storage before use. This package has been assigned a moisture sensitivity level of MSL 3 and the devices should be stored under the following conditions:

- Temperature range 5°C to 50°C
- Relative humidity 60% maximum
- Total time 6 months from the date code on the aluminized envelope — if unopened
- Opening time 168 hours or less

Re-baking is required if the devices have been stored unopened for more than 6 months or if the aluminized envelope has been open for more than 168 hours. If a re-baking process is required, it should be performed at 90°C for 4 hours.

Figure 5: MTCSiCF package in Tape and reel - sizes of reel

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Index Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ao 5.30 +/- 0.1</td>
<td></td>
</tr>
<tr>
<td>Bo 5.30 +/- 0.1d</td>
<td></td>
</tr>
<tr>
<td>Ko 2.10 +/- 0.1</td>
<td></td>
</tr>
<tr>
<td>F 5.50 +/- 0.05</td>
<td></td>
</tr>
<tr>
<td>P1 8.00 +/- 0.1</td>
<td></td>
</tr>
<tr>
<td>W 12.00 +0.3/- 0.1</td>
<td></td>
</tr>
</tbody>
</table>

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

All dimension in millimeters unless otherwise stated.
7 SOLDERING INFORMATION

According to the JEDEC standard the QFN package has been tested and has demonstrated the ability to be reflow-soldered to a PCB substrate. The solder reflow profile describes the expected maximum heat exposure of components during the solder reflow process of product on a PCB. Temperature is measured on top of component. The component should be limited to a maximum of three passes through this solder reflow profile.

Table 3: Profile features according JEDEC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>IPC/JEDEC J-STD-020D.1 (Pb-Free)</th>
<th>RECOMMENDED DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time [s] from 150°C to 200°C (preheat)</td>
<td>60 – 120</td>
<td>100</td>
</tr>
<tr>
<td>Average ramp-up rate [°C/s] (200°C to peak temperature)</td>
<td>max. 3.0</td>
<td>0.5 – 1.0</td>
</tr>
<tr>
<td>Liquidus temperature [°C]</td>
<td>217</td>
<td>217</td>
</tr>
<tr>
<td>Time [s] above liquidus (217°C)</td>
<td>60 – 150</td>
<td>110</td>
</tr>
<tr>
<td>Peak package body temperature [°C]</td>
<td>min. 260</td>
<td>&lt;= 260</td>
</tr>
<tr>
<td>Time [s] within 5°C of the classification temperature</td>
<td>min. 30</td>
<td>35 – 45</td>
</tr>
<tr>
<td>Average ramp-down rate [°C/s] (Peak temperature to 200°C)</td>
<td>max. 6.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Time [s] from 25°C to peak temperature</td>
<td>max. 480</td>
<td>350</td>
</tr>
</tbody>
</table>

Do not exceed the recommended values shown in the table or following figure. For further information see the JEDEC standard J-STD-020D.1.
Reflow profile for Pb-Free assembly:

Figure 6: Recommended reflow soldering profile

Do not to exceed the recommended values. For further information see JEDEC J-STD-020D.1.

8 APPLICATION NOTES

8.1 Narrowband Luminous Sources

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

8.2 Angle of Incidence

The packaging of the sensor IC has an aperture angle (beam width) of nearly 90°. Traditional interference filter work depending on angle of incidence. Using a <10° angle of incidence will allow the best results with no filter shifts. This can be ensured by using lenses or optical holes that limit the angle of incidence to the sensor device <10°. An angle of incidence of more than 10° will result in a filter shift. The filter response and accuracy will be distorted the greater the angle deviation is. Please note a filter deviation resulting from this fact can differ from standard observer function and/or from the filter functions specified in this document. Please ask our sales team for support.

---

6 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.
8.3 Effects of Temperature

The specified operation temperature range and documented parameters regarding temperature influence are described in chapter 2. The functionality of the filters do not depend on any temperature changes. The temperature coefficient of the photo sensitivity and the dark current of the photodiodes need to be considered, since these have an influence on the sensor response in case of changing temperature. Common signal converters do not implement temperature compensation. MAZeT offers various signal ASICs including temperature compensation. Please ask our sales team about the application-specific solution to prevent negative influence caused by temperature shifts.

8.4 Schematic of Reference Design

Figure 7 shows a typical connection of the MTCSiCF to MAZeTs A/D converter MCDC047. Please note the connections for the anodes XYZ / TRD and for the common cathode.

If digital and analog grounds are routed separately onto the printed circuit board, they should be connected together near the device.

Figure 7: Typical connection MTCSiCF with MCDC04EQ

Figure 8 shows typical connections of the MTCSiCF to MAZeTs MDDC048. Please note the connections for the anodes XYZ / TRD and for the common cathode. If digital and analog grounds are routed separately onto the printed circuit board, they should be connected together near the device.

---

7 The converter MCDC04 is a low noise sensor interface application specific standard product (ASSP) with I²C interface. It is suitable for coupling of multi-channel optical sensors or sensors using current output. It converts input currents to a digital output (16 bit) and realizes a continuous or triggered measurement via current integration with a high bandwidth (1 : 1,000,000) – for more details see MAZeTs data sheet MCDC04EQ.

8 The converter MDDC04 is an integrated circuit with a 4 channel transimpedance amplifier, one analog-to-digital converter (12 bit ADC). The transimpedance or gain of each channel is individually programmable.
Please make sure that all specified components within the application circuit work according to their operating range and to the parameters in the data sheet. For example, color sensor (input current) and voltage regulators (workspace load current, separated analog and digital or decoupled power supplies based on a common regulator) need special treatment to avoid noise or deviations during operation.

For more schematic details compare our reference designs provided in our data sheets for the signal ASICS MCDC04EQ, MDDC04AQ or alternatives. These provide special notes for PCB layout of the sensor in combination with the special signal ASIC.

8.5 Notes for PCB Layout

The connections between sensor outputs and converter inputs have to be protected against any kind of electromagnetic coupling and have to be guarded with the potential of reference voltage\(^9\) to avoid leakage currents. Confusing leakage currents with equivalent values like the sensor currents can occur, without guarding layers at the inputs of the PCB isolation resistance! Digital signals and circuit lines with high current loads should not be used directly beneath or next to the color sensor as well as the converter.

Often the converter operates internally with minimal currents (pAmps). Therefore, protection measures need to be performed to shield the converter and sensor against EMC stress or external interferences.

When measuring very small photocurrents a separate shielding (metal cover) of the sensor and of the wires between sensor and converter is recommended. This shield is connected to Vref or VSS. If the sensor is exposed to strong alternating magnetic fields, then a magnetic absorber prevents the induction of additional currents into the wires from the sensor to the converter.

The connections between the color sensor (anode and cathode) and the converter should be as short as possible (<10 mm) and without interlayer connections. The signal for cathode(s) or anode(s) should have the same cross-section on the PCB.

---

\(^9\) VRT/VPD – see data sheets of MCDC04EQ and MDDC04EQ
Color Sensor, converter and its external components for references and/or power supply (e.g. $R_{\text{ext}}$ in case of MCDC04EQ) should be placed on the same PCB side.

Around the sensor signal lines a conductor connected with the potential of reference voltage should be created. One level below the signals a reference voltage potential area should be used that extends only to the analog inputs and the signal lines.

8.6 Notes for Manufacturing

JENCOLOR® sensors are optoelectronic components operating at high precision, resolution and smallest currents of nA in operation and pA in standby. This must be considered in the development and manufacturing. So mechanical stress, EMC, dirt and moisture must be avoided.

For manufacturing purposes we recommend completely removing the moisture on the boards with JENCOLOR® sensors. This refers to residual moisture on / below the sensor and converter. In sensor operations residual moisture can lead to leakage currents and result in increased offset values. Offset means a lower resolution, lower accuracy and measuring inaccuracies in sensor mode. These have particular impact on small measurement signals from the sensor. If cleaning of a PCB with water is necessary then make sure to fully dry the board later on with suitable processes and technologies (e.g. baking). This avoids residual moisture as reason for leakage currents and noise.

8.7 Sensor Calibration

Since the main variables of color change upon the arrangement of the observer, the object and light - it is essential to optimize and calibrate color measurement tasks to the specific application, especially for absolute color measurements according to the CIE 1931/DIN 5033.The calibration has three functions. It converts the measured values from the amplifier and/or analog-to-digital converter into the color space XYZ/xyY/Luv/Lab or others. Secondly, it compensates production-related tolerances of the individual sensors (see chapter 2 for tolerances). Thirdly, the accuracy of the XYZ sensor is extremely sensitive to the opto-mechanical design and variations of the system in which it resides. These influences need to be corrected as other (e.g. external) effects like temperatures or others can influence other components in the sensor system and therefore the overall sensor response.

Depending on the application and system accuracy a sensor calibration will be possible by an individual, system or by an in-series calibration. In the process of calibration there are conditions which are required to receive reliable results in the CIE 1931 color space. Using a standardized illumination source such as A, F2 and D65 as reference, the angle of incidence as well as the arrangement of sensor and illumination are important input variables of the calibration and determine the quality of the XYZ transformation. MAZeT offers special white papers and application notes to find an optimized application-specific solution (time, costs and quality) for calibration. Please ask our sales team.

For calibration the (color) target, measured by a spectrometer ($n \times XYZ$ as absolute color values and reference) and the color sensor ($n \times ADC$ measured), must be known. By a simple coefficient matrix method the relationship between the measured sensors values and absolute color coordinates in CIE 1931 color space can be made: $T$ (1) is the matrix of the reference measurement ($XYZ$ values of spectrometer), $S$ (EQ1) is the sensor signal matrix ($ADC$ values of Sensor) and $K$ is the transformation matrix (EQ2). After the transposition of $S$, a transformation matrix $K$ (linear regression) will be calculated (EQ2). The result (EQ3) is the correction matrix $K$ which will be used to transform measured sensor values ($ADC$ result of a color target) into the color space XYZ based in CIE 1931 (EQ4).
(Notice: matrixes are not set up as a square matrix and depend on the number of targets n.)

\[
T = \begin{pmatrix}
X_1 & X_n \\
Y_1 & Y_n \\
Z_1 & Z_n
\end{pmatrix}; \quad S = \begin{pmatrix}
x_{adc} 1 & x_{adc} n \\
y_{adc} 1 & y_{adc} n \\
z_{adc} 1 & z_{adc} n
\end{pmatrix}
\]  \quad (EQ1)

\[
K = (T * S^T) * (S * S^T)^{-1}
\]  \quad (EQ2)

\[
K = \begin{pmatrix}
x_{k1} & x_{k2} & x_{kn} \\
y_{k1} & y_{k2} & y_{ky} \\
z_{k1} & z_{k2} & z_{kn}
\end{pmatrix}
\]  \quad (EQ3)

\[
\begin{pmatrix}
X_{Sensor} \\
Y_{Sensor} \\
Z_{Sensor}
\end{pmatrix} = K \begin{pmatrix}
x_{adc} \\
y_{adc} \\
z_{adc}
\end{pmatrix}
\]  \quad (EQ4)

X Sensor, Y Sensor, and Z Sensor are in the CIE system which specifies the color and brightness of particular homogenous visual stimulus. X adc, y adc, z adc are measured values of the sensor. Xn, Yn, Zn are by a spectrometer measured color coordinates of the target for the calibration. Xk..., yk..., zk... are coefficients of the correction matrix. X1, Y1, Z1 ...and will be changed based on the system setup.
## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>NAME</th>
<th>STATUS</th>
<th>PACKAGE</th>
<th>ARTICLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTCSI CFO</td>
<td>Series</td>
<td>QFN16</td>
<td>090400-402-26AEZ00</td>
</tr>
</tbody>
</table>

For more information please contact:

**MAZeT GmbH Sales:**
Göschwitzer Straße 32
07745 JENA | GERMANY
Phone: +49 3641 2809-0
Fax: +49 3641 2809-12
sales@mazet.de
www.mazet.de
LEGAL NOTES AND WARNINGS

Failure to comply with these instructions could result in death or serious injury.

Misuse of documentation – The information contained in this document is the property of MAZeT. Photocopying or otherwise reproducing any part of the catalog, whether electronically or mechanically is prohibited, except where the express permission of MAZeT GmbH has been obtained. In general, all company and brand names, as well as the names of individual products, are protected by brand, patent or product law.

State of document - The information provided in this document is for reference only. Do not use this document as product installation guide since products can be under development to improve performance or any other purpose. Before you start any development or place an order please contact your supplier or MAZeT for the latest version of this document. MAZeT explicitly reserves the right to make technical changes to information described in the document.

Information and Disclaimer – The information provided in this document is based on the knowledge of the MAZeT GmbH as of the date of publication. The MAZeT GmbH cannot give warranty regarding the accuracy of information provided by third parties. MAZeT GmbH may not have conducted testing or chemical analysis on all incoming material or chemicals. MAZeT GmbH performs and continues to perform reasonable measures to provide the most accurate data at the given time. Additional efforts to integrate information provided by third parties are performed and continue to be performed. Certain supplier information may be proprietary or limited and not available at release.

Personal Injury: All products are conform to the specifications in accordance with the terms and conditions of MAZeTs standard warranty. Production processing does not necessarily include testing of all parameters.

RoHS Directive 2011/65/EU /REACH INFORMATION - RoHS compliance and PB free: The products of MAZeT fully comply with the current RoHS-directives. Our semiconductor products do not contain any of the six substance chemical categories, for example including the restriction on lead usage (lead weight may not exceed 0.1% in homogeneous materials). RoHS compliant products are suitable for the usage in lead-free specified processes, when designed to be soldered at high temperatures.

REACH information: MAZeT products do not contain any of the latest REACH Substances of Very High Concern (SVHC) regarding the Europe Union (EU) Regulation 1907/2006. The latest 155 substances restricted per the REACH Regulation were last updated on June 16, 2014. Please refer to the following for the most current candidate list of substances: http://echa.europa.eu/candidate-list-table.

MAZeT solutions are not designed or intended for use in critical applications, in which the failures or malfunctions of the product may result in personal injury or death. Use of MAZeT products in life support systems is expressly unauthorized and any use by customer is completely at their own risk. In the case of a restricted use of the product described here, an application of the product outside of this limitation is at your own risk.
Warranty disclaimer – The warranty expressed herein shall be in lieu of any other warranties, expressed or implied, including, without limitation, any implied warranties or conditions of merchantability and fitness for a particular purpose., which are expressly disclaimed, and is in lieu of any and all other obligations or liability on supplier’s part- For the avoidance of doubt, supplier shall not be liable for any special, incidental, indirect or consequential loss or damage, including loss of revenue or profit, of any kind of nature, arising at any time, from any cause whatsoever resulting from the use or operation of the products or any breach of this limited warranty.

Legal liability - MAZeT assumes no responsibility for the use of any foreign products or circuits described in this document or customer product design, conveys no license, either expressed or implied, under any patent or other right, and makes no representation that the foreign circuits are free of patent infringement. MAZeT further makes no claim as to the suitability of its products for any particular purpose, nor does MAZeT assume any liability arising out of the use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages.

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

**WEEE Disposal:** - The product should be disposed in to according the Directive 2002/96 / EC of the European Council on Waste Electrical and Electronic Equipment [WEEE] and the German electoral law [ElektroG] of 16 March 2005. Please contact our technical support if you need more details.