Würth Elektronik reveals the questions about optocoupler phototransistor types

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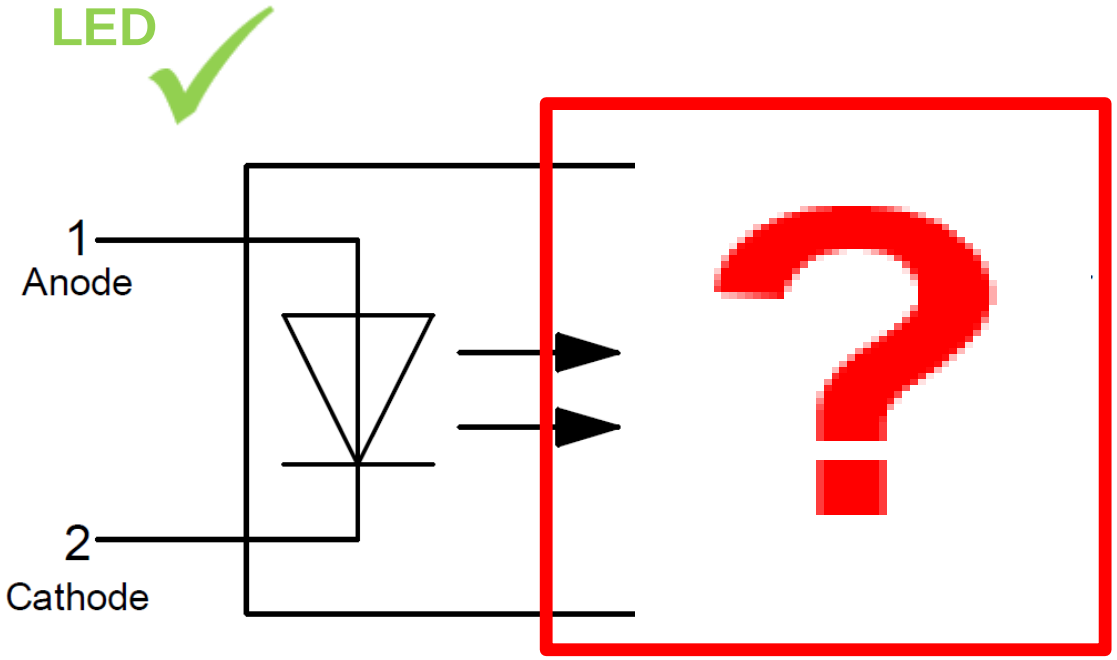
Agenda

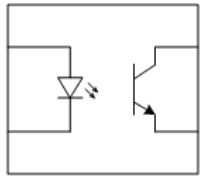
- **Introduction Optocoupler**
  - Optocoupler types
  - Design and function of an Optocoupler
- **Application Area**
- **WE Optocoupler Parameters**
  - Technical Parameters
  - Lifetime – The suitable Application Note
- **Product Portfolio**
- **Why WE Optocoupler?**

Optocoupler Types

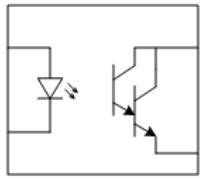
LED



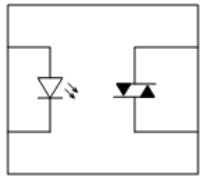
- **Phototransistor**



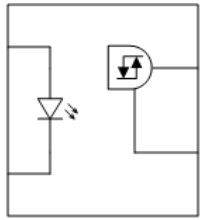
- **Darlington**



- **Triac**

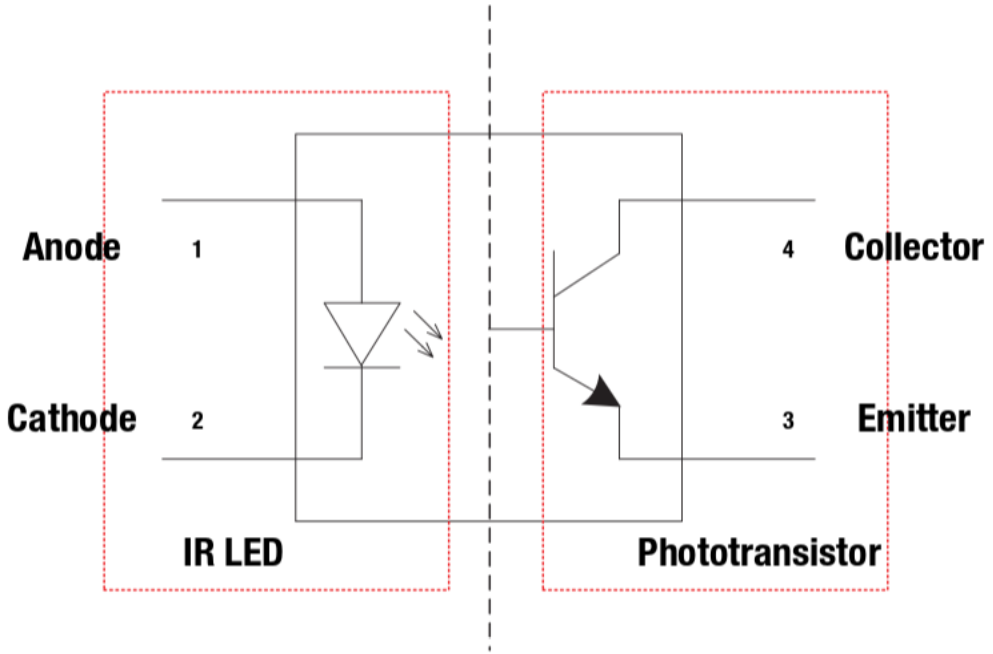


- **High Speed**



Structure & Function

Two isolated circuits
Galvanic isolation



Structure

- Housing with infrared LED & detector
- Optical transmission by infrared light beam
- Components with lightproof housing

Function

- Insulation and surge protection of electrical systems
- Safe isolation of persons from dangerous electrical installations
- Separation of two control circuits/ power circuits

Application areas

Where do we need two galvanic isolated circuits

Power supply

- Separation between the high potential input and the low potential output
- Optocoupler as potential separator

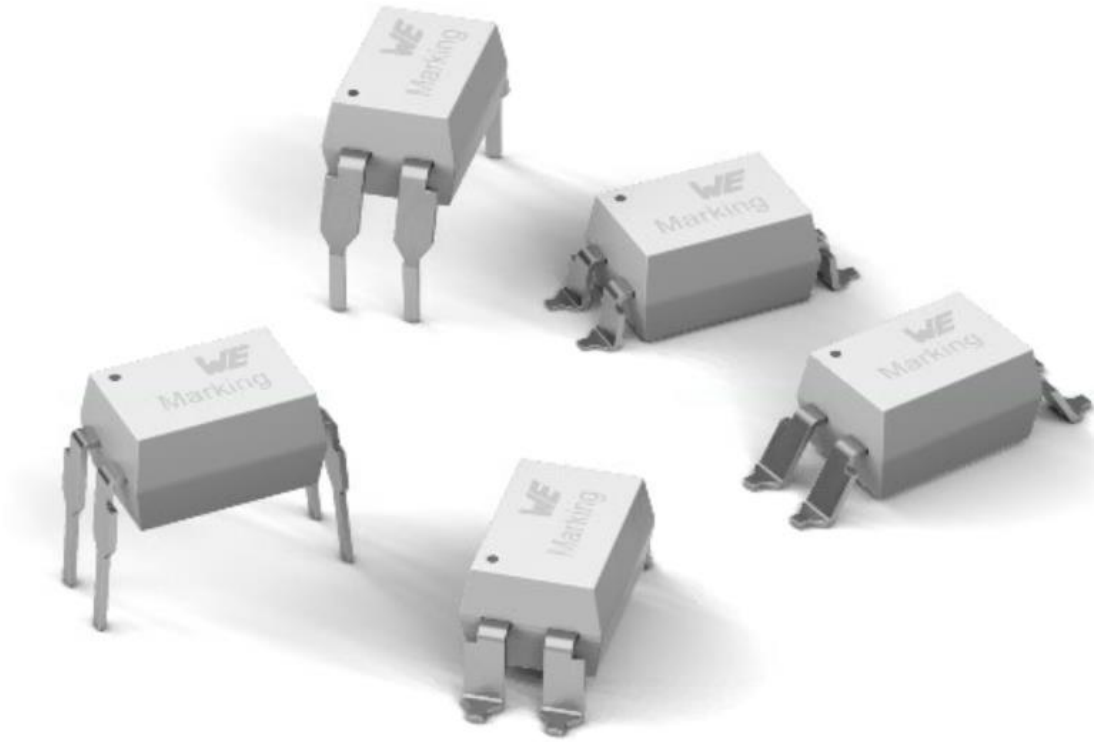
- **Digital Signaltransfer**
- **Interface cards in Computers**
  - Different devices have different potentials
- **Overvoltage protection from Programmable Logic Controller systems**
- **Regulation and control circuits**
- **Charging devices**

Requirements

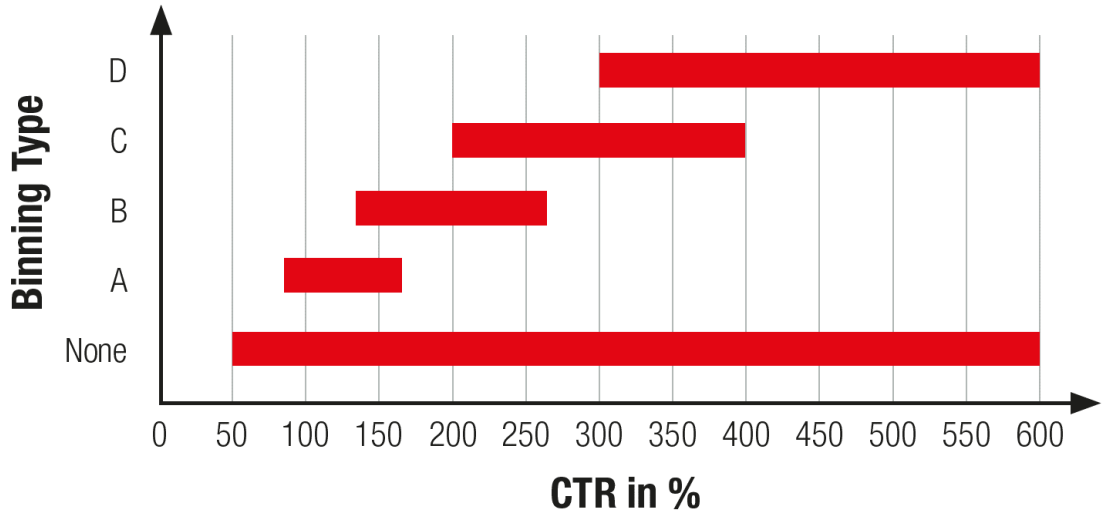
- **... the component must be stable**
- **... the insulation must be guaranteed**
- **...the current transfer ratio (CTR) should be high**
- **...the component should not age**

Series 816 / 817 / 814
DIP4

5 different package types

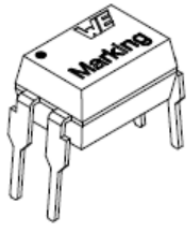


CTR binning for each type

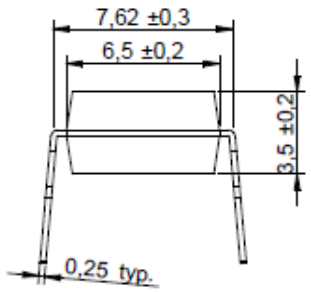


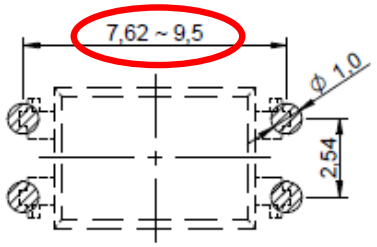
Mounting and Soldering Pads

Standard

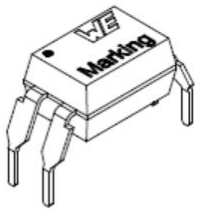


THT





M- Type



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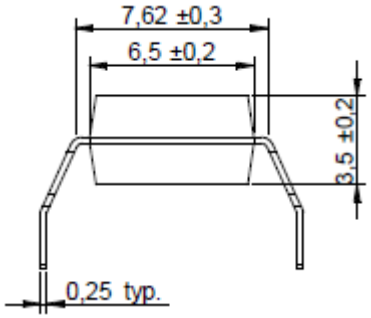
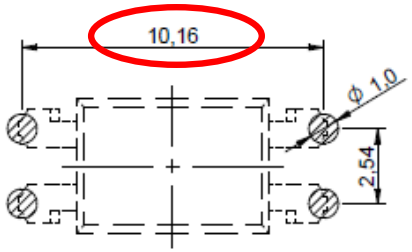
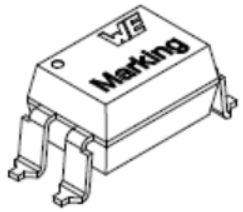
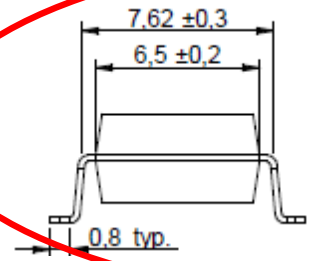


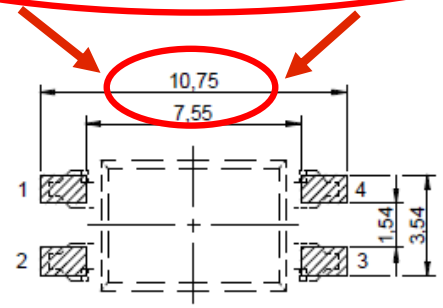


S - Type



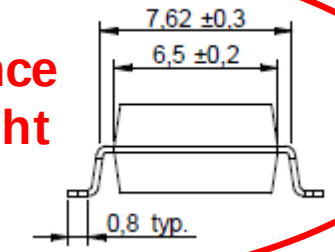
SMT





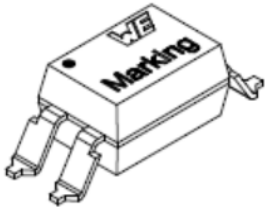
SL – Type

SMT

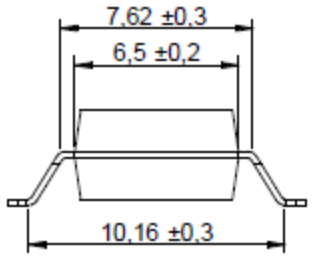


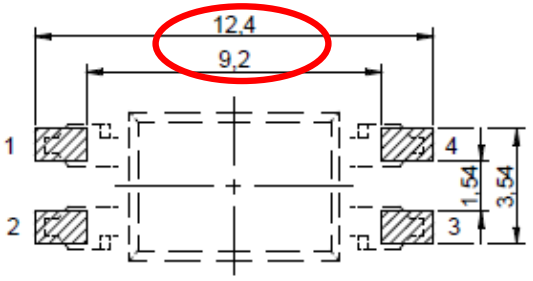
Difference in Height

SLM – Type



SMT





Optocoupler Datasheet
General Properties

General Properties:

Type	Optocoupler Phototransistor
Input	DC
Package	DIP 4, Standard
Plastic Housing Color	White

Certification:

RoHS Approval	Compliant [2011/65/EU&2015/863]
REACh Approval	Conform or declared [(EC)1907/2006]
Halogen Free	Conform [IEC 61249-2-21]
Halogen Free	Conform [JEDEC JS709B]
VDE Approval	40051484 [DIN EN 60747-5-5 (VDE0884-5); EN 60747-5-5:2011; A1:2015]
UL Approval	E513104 [UL 1577]
CQC Approval	CQC20001244742 [GB4943.1-2001; GB8898-2011]

General Information:

Operating Temperature	-55 up to +110 °C
Storage Conditions (for single parts)	-55 up to +125 °C
Storage Conditions (in original packaging)	< 40 °C ; < 75 % RH
Moisture Sensitivity Level (MSL)	1

Certificates

Electrical Properties

Absolute Maximum Ratings Input Properties (Ambient Temperature 25 °C unless otherwise specified):

Properties		Test conditions	Value	Unit
Forward Current	I_F		60	mA
Peak Forward Current	$I_{F\ Peak}$	duty/ 100 @ 100 Hz	1	A
Reverse Voltage	V_{REV}		6	V
Input Power Dissipation	P_I		100	mW

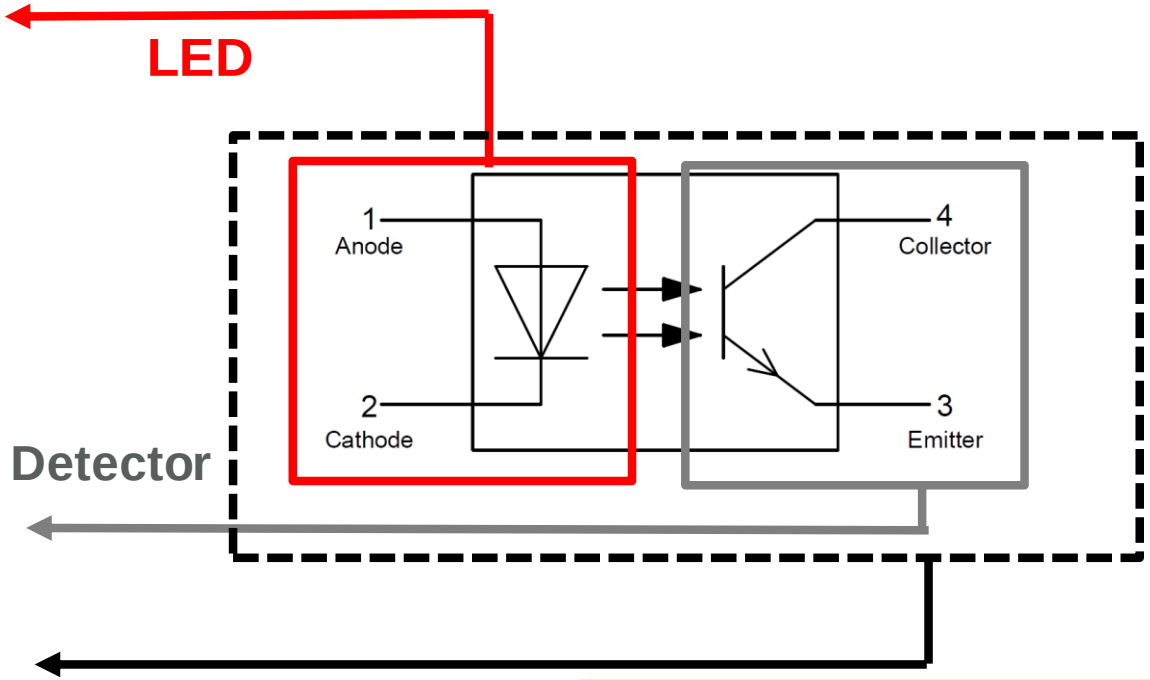
Absolute Maximum Ratings Output Properties:

Properties		Value	Unit
Collector Emitter Voltage	V_{CE}	80	V
Emitter Collector Voltage	V_{EC}	7	V
Collector Current	$I_{CE.P}$	50	mA
Output Power Dissipation	P_O	150	mW

Absolute Maximum Ratings Common Properties:

Properties		Test conditions	Value	Unit
Power Dissipation [1]	P_{Diss}		200	mW
Isolation Voltage	V_{ISO}	AC for 1 Minute, RH 40~60 %	5000	V (RMS)

[1] Total power dissipation of the whole component



Component information

Isolation Voltage is the maximum voltage that can be applied between input and output without getting a breakthrough.

Electrical Properties

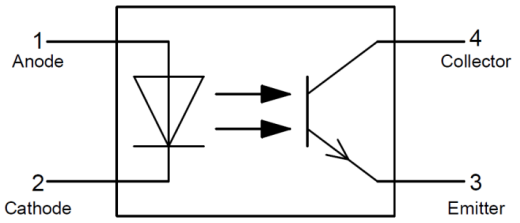
Electrical & Optical Transfer Properties:

Properties		Test conditions	Value			Unit
			min.	typ.	max.	
Current Transfer Ratio	CTR	I_F = 5 mA V_{CE} = 5 V	80		160	%
Collector-Emitter Saturation Voltage	V_{CEsat}	I_F = 20 mA I_C = 1 mA		0.06	0.2	V
Rise Time	t_r	V_{CE} = 2 V I_C = 2 mA R_L = 100 Ω		3	18	µs
Fall Time	t_f	V_{CE} = 2 V I_C = 2 mA R_L = 100 Ω		4	18	µs
Cut-Off Frequency	f_c	V_{CE} = 2 V I_C = 2 mA R_L = 100 Ω -3 dB		80		kHz
Floating Capacitance	C_{IO}	V = 0 V f = 1 MHz		0.4		pF
Isolation Resistance	R_{ISO}	DC = 500 V 40~60 % R.H.	1	100		TΩ

Binning Options

CTR Binning- Series 816			
	Min.	Max	Unit
None	50	600	%
A	80	160	%
B	130	260	%
C	200	400	%
D	300	600	%

$$CTR = 100 \times I_C / I_F [\%]$$

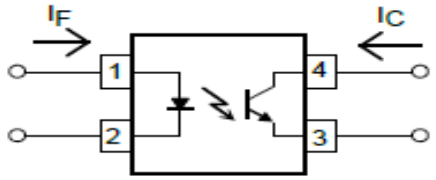


Optocoupler CTR

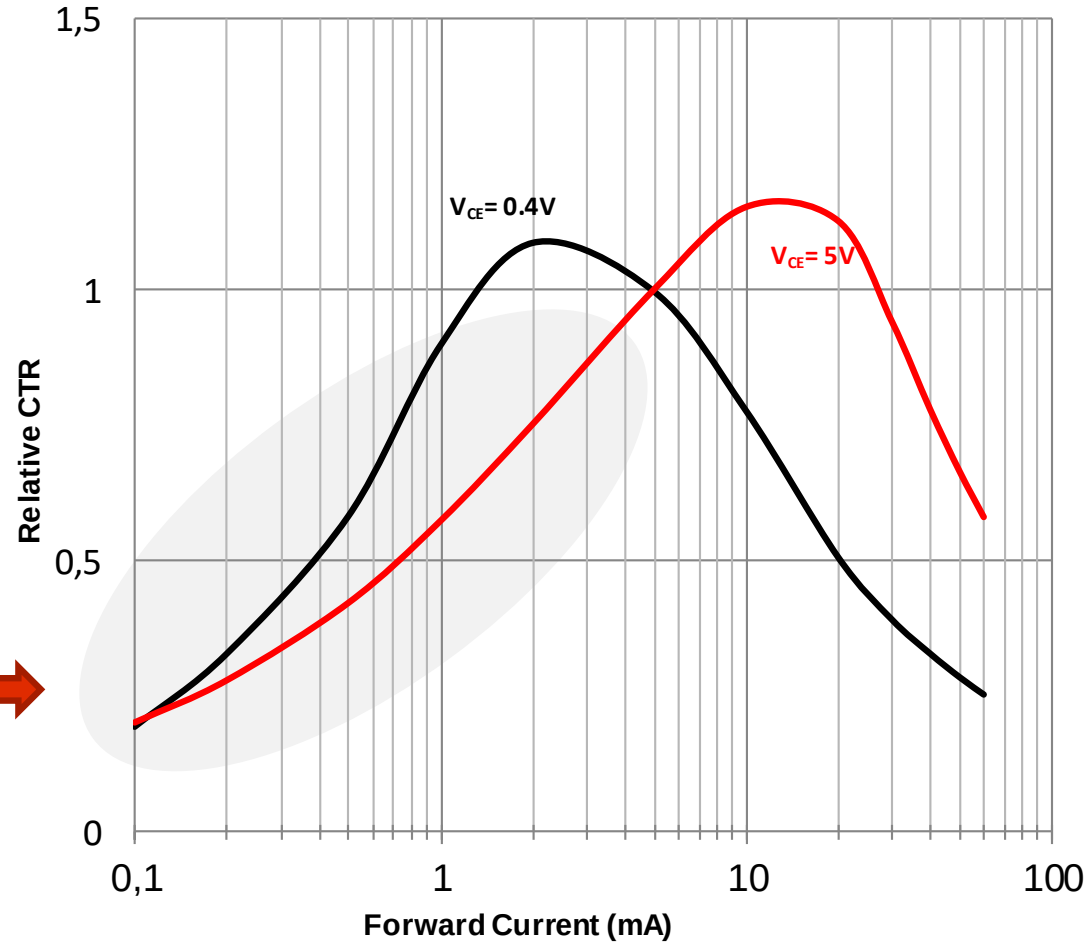
Attention in circuit design

CTR depends on

- **Light Intensity LED**
  - Light emission decreases over time
- **CTR – Forward Current dependency IF**
  - Lower Input current = CTR Decrease
- **WE keep higher CTR value in low current operation**

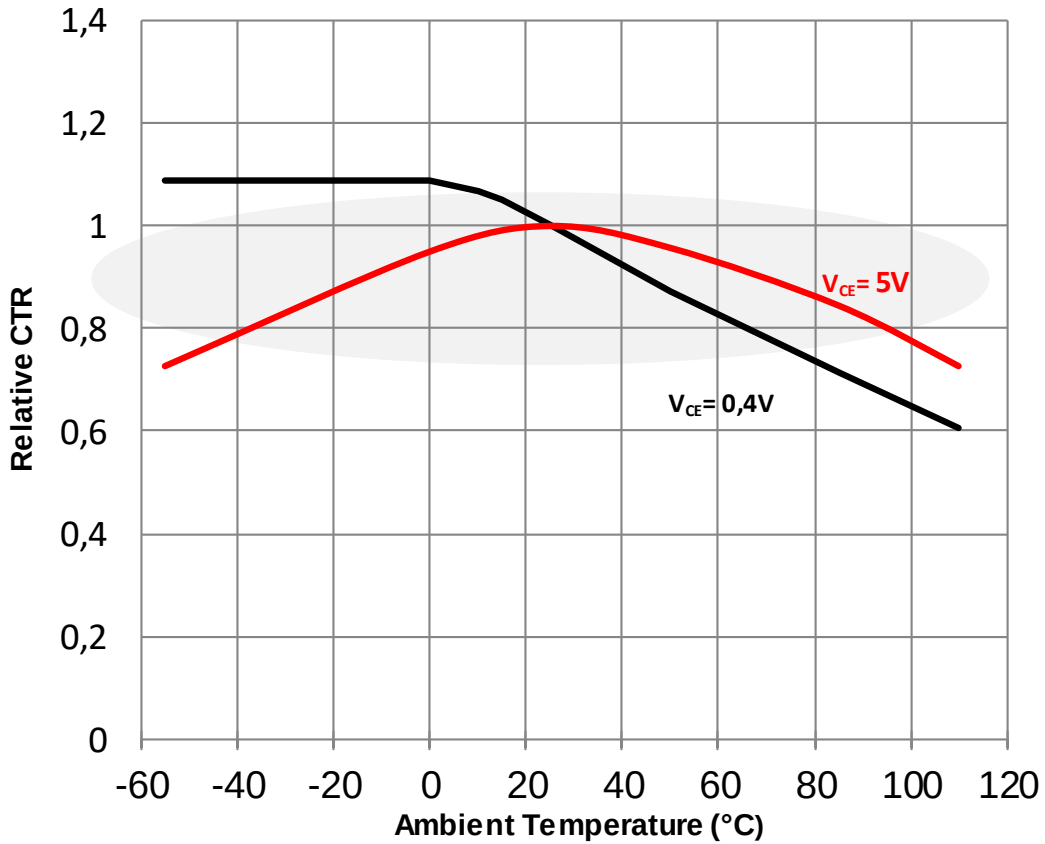


$CTR = 100 \times I_C / I_F [\%]$



Optocoupler-CTR

- **CTR – temperature dependency**
  - High temperature – decrease of light intensity
  - Increase of gain factor
- **Good stability over complete temperature range**



App Note- Lifetime Estimation

You want to estimate the lifetime of your optocoupler?

- *Background of Lifetime Estimation*
- *Definition and Calculation of Lifetime parameter*
- *Degradation Parameters*
- *Design improvements for increase of lifetime*
- *Long lifetime of ~ 25 years for WE Optocoupler*

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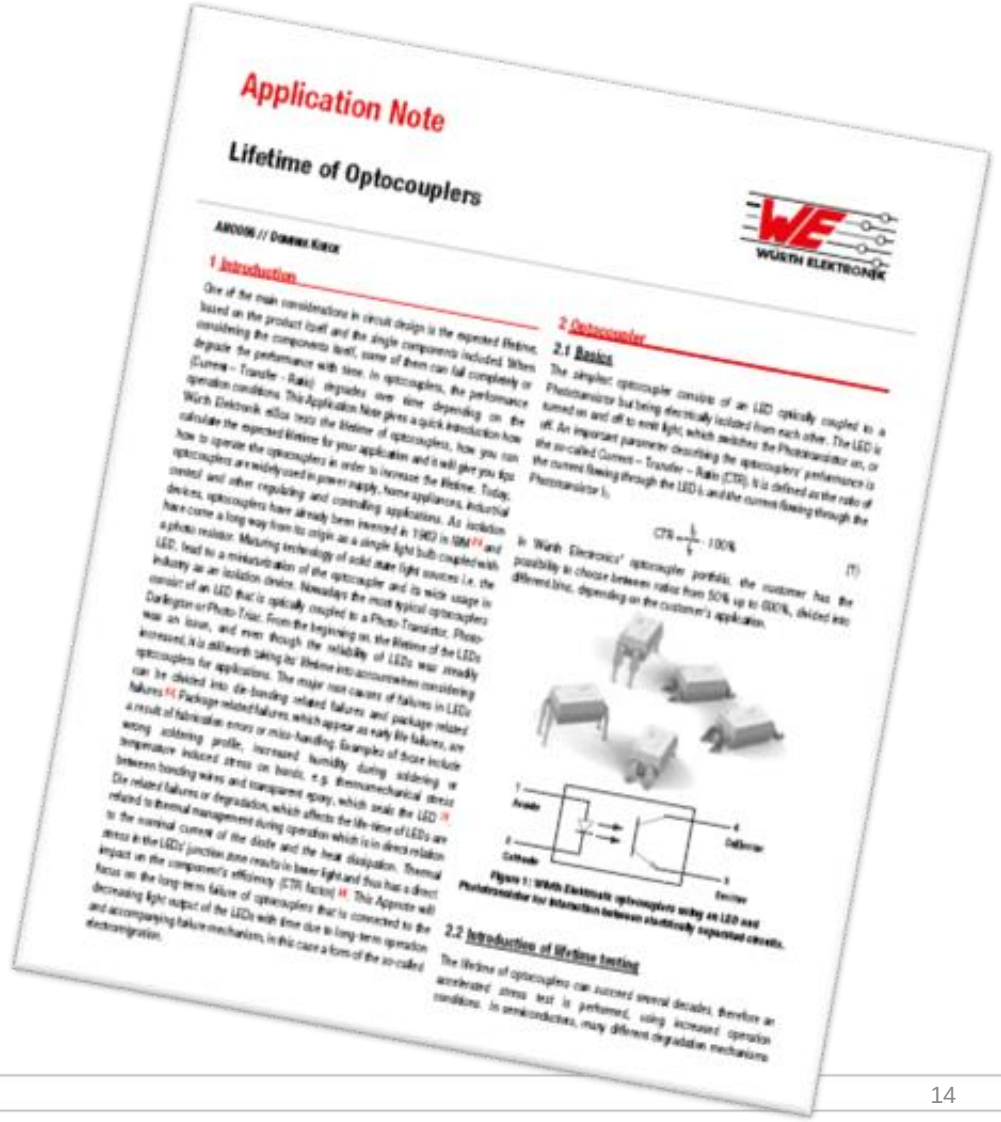

Application Note

Lifetime of Optocouplers

WÜRTH ELEKTRONIK

1 Introduction

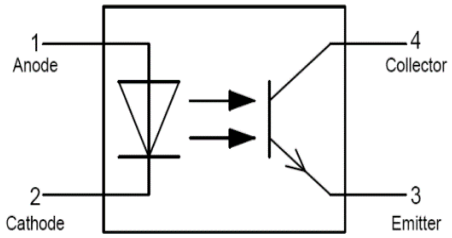
2 Optocoupler

2.1 Basics

2.2 Introduction of lifetime testing

Overview of packages

DC Type



DIP 4
10,16 x 4,58 x 3,9 mm

Series 816,817

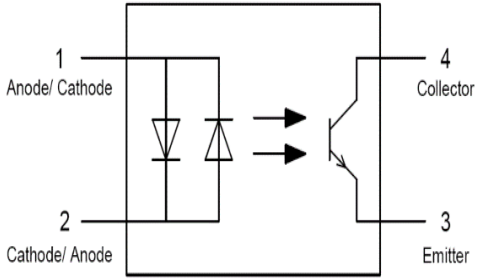
SOP 4
7,0 x 3,6 x 2,0 mm

Series 356,357

LSOP 4
10,20 x 3,6 x 2,0 mm

Series 10x

AC Type



DIP 4
10,16 x 4,58 x 3,9 mm

Series 814

SOP 4
7,0 x 3,6 x 2,0 mm

Series 354

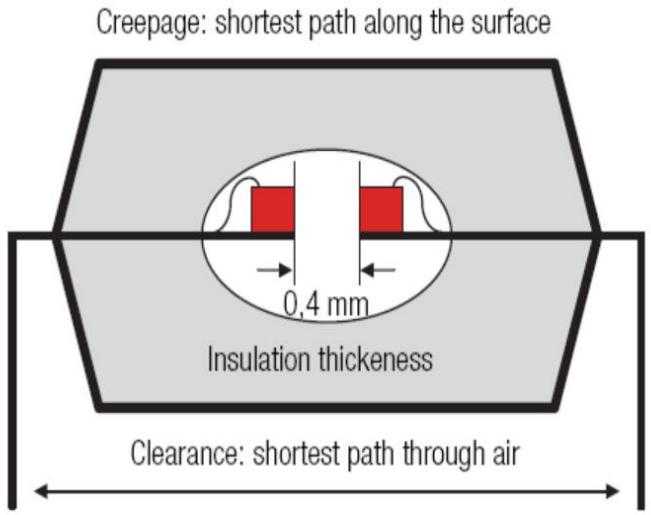
Leadframe options - Standard, M, S, SL, SLM

Phototransistor Products

Part Number:	14081614xx	14081714xx	14081424xx	14035614xx	14035714xx	14035424xx	14010xx
Series:	816 (DC)	817 (DC)	814(AC)	356 (DC)	357(DC)	354(AC)	101x (DC)
V_{CEmax}:	80 V	35 V	80 V	80 V	35 V	80 V	80 V
Package:	DIP 4 Dual in Line Package			SOP 4 Small Outline Package			LSOP 4 Long Small Outline Package
Vlso	5kV			3,75 kV			5 kV

Available Products:

- **Different CTR** binnings available – for all size and form
- Isolation Voltage depends on Clearance and Creepage
- Different Isolation voltage – depending on package size
- Range of max Collector-Emitter Voltage



Why WE Optocoupler

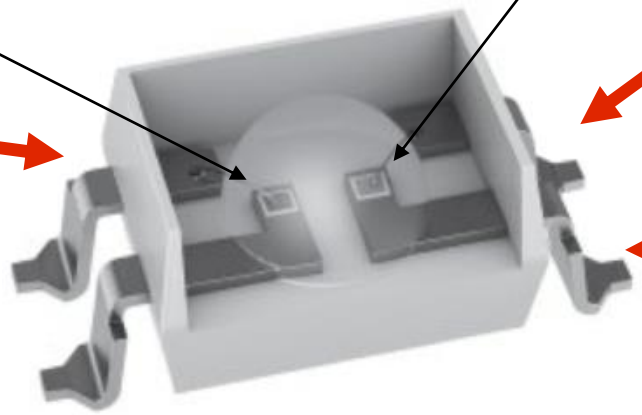
Coplanar Structure

- Fixed Isolation Gap
- High Stability of CTR

Keeping stable CTR in high operating temperature

Detector

Emitter



Keeping high CTR value in low current operation

Copper Leadframe

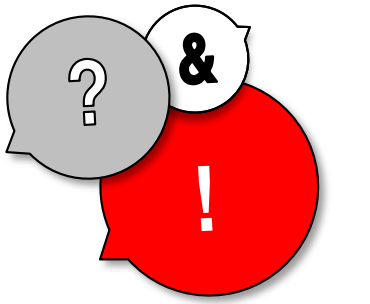
- For high reliability and solderability

All Package Types available with every binning

All products ex stock

Thank you for your attention!

Questions



& Answers

We are here for you now! .