

## Reflective Optical Sensor with Transistor Output



### FEATURES

- Package type: leaded
- Detector type: phototransistor
- Dimensions (L x W x H in mm): 10.2 x 5.8 x 7
- Peak operating distance: 2.5 mm
- Operating range within > 20 % relative collector current: 0.2 mm to 15 mm
- Typical output current under test:  $I_C = 1$  mA
- Daylight blocking filter
- Emitter wavelength: 950 nm
- Lead (Pb)-free soldering released
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT

### DESCRIPTION

The TCRT5000 and TCRT5000L are reflective sensors which include an infrared emitter and phototransistor in a leaded package which blocks visible light. The package includes two mounting clips. TCRT5000L is the long lead version.

### APPLICATIONS

- Position sensor for shaft encoder
- Detection of reflective material such as paper, IBM cards, magnetic tapes etc.
- Limit switch for mechanical motions in VCR
- General purpose - wherever the space is limited

### PRODUCT SUMMARY

PART NUMBER	DISTANCE FOR MAXIMUM CTR <sub>rel</sub> <sup>(1)</sup> (mm)	DISTANCE RANGE FOR RELATIVE $I_{out} > 20\%$ (mm)	TYPICAL OUTPUT CURRENT UNDER TEST <sup>(2)</sup> (mA)	DAYLIGHT BLOCKING FILTER INTEGRATED
TCRT5000	2.5	0.2 to 15	1	Yes
TCRT5000L	2.5	0.2 to 15	1	Yes

#### Notes

<sup>(1)</sup> CTR: current transference ratio,  $I_{out}/I_{in}$

<sup>(2)</sup> Conditions like in table basic characteristics/sensors

### ORDERING INFORMATION

ORDERING CODE	PACKAGING	VOLUME <sup>(1)</sup>	REMARKS
TCRT5000	Tube	MOQ: 4500 pcs, 50 pcs/tube	3.5 mm lead length
TCRT5000L	Tube	MOQ: 2400 pcs, 48 pcs/tube	15 mm lead length

#### Note

<sup>(1)</sup> MOQ: minimum order quantity

### ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT (EMITTER)</b>				
Reverse voltage		$V_R$	5	V
Forward current		$I_F$	60	mA
Forward surge current	$t_p \leq 10 \mu s$	$I_{FSM}$	3	A
Power dissipation	$T_{amb} \leq 25^\circ C$	$P_V$	100	mW
Junction temperature		$T_j$	100	$^\circ C$

ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>OUTPUT (DETECTOR)</b>				
Collector emitter voltage		$V_{CEO}$	70	V
Emitter collector voltage		$V_{ECO}$	5	V
Collector current		$I_C$	100	mA
Power dissipation	$T_{amb} \leq 55^\circ\text{C}$	$P_V$	100	mW
Junction temperature		$T_j$	100	$^\circ\text{C}$
<b>SENSOR</b>				
Total power dissipation	$T_{amb} \leq 25^\circ\text{C}$	$P_{tot}$	200	mW
Ambient temperature range		$T_{amb}$	- 25 to + 85	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	- 25 to + 100	$^\circ\text{C}$
Soldering temperature	2 mm from case, $t \leq 10$ s	$T_{sd}$	260	$^\circ\text{C}$

**Note**

<sup>(1)</sup>  $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified

## ABSOLUTE MAXIMUM RATINGS



Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

BASIC CHARACTERISTICS <sup>(1)</sup>						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT (EMITTER)</b>						
Forward voltage	$I_F = 60$ mA	$V_F$		1.25	1.5	V
Junction capacitance	$V_R = 0$ V, $f = 1$ MHz	$C_j$		17		pF
Radiant intensity	$I_F = 60$ mA, $t_p = 20$ ms	$I_e$			21	mW/sr
Peak wavelength	$I_F = 100$ mA	$\lambda_P$	940			nm
Virtual source diameter	Method: 63 % encircled energy	$d$		2.1		mm
<b>OUTPUT (DETECTOR)</b>						
Collector emitter voltage	$I_C = 1$ mA	$V_{CEO}$	70			V
Emitter collector voltage	$I_e = 100$ $\mu$ A	$V_{ECO}$	7			V
Collector dark current	$V_{CE} = 20$ V, $I_F = 0$ A, $E = 0$ lx	$I_{CEO}$		10	200	nA
<b>SENSOR</b>						
Collector current	$V_{CE} = 5$ V, $I_F = 10$ mA, $D = 12$ mm	$I_C$ <sup>(2) (3)</sup>	0.5	1	2.1	mA
Collector emitter saturation voltage	$I_F = 10$ mA, $I_C = 0.1$ mA, $D = 12$ mm	$V_{CEsat}$ <sup>(2) (3)</sup>			0.4	V

**Note**

<sup>(1)</sup>  $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified

<sup>(2)</sup> See figure 3

<sup>(3)</sup> Test surface: mirror (Mfr. Spindler a. Hoyer, Part No. 340005)



Fig. 2 - Test Circuit



Fig. 3 - Test Circuit

### BASIC CHARACTERISTICS

$T_{amb} = 25^\circ\text{C}$ , unless otherwise specified



Fig. 4 - Forward Current vs. Forward Voltage



Fig. 6 - Collector Current vs. Forward Current



Fig. 5 - Relative Current Transfer Ratio vs. Ambient Temperature



Fig. 7 - Collector Emitter Saturation Voltage vs. Collector Current

# TCRT5000, TCRT5000L

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Reflective Optical Sensor with  
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Fig. 8 - Current Transfer Ratio vs. Forward Current



Fig. 9 - Relative Collector Current vs. Distance

## PACKAGE DIMENSIONS in millimeters, TCRT5000

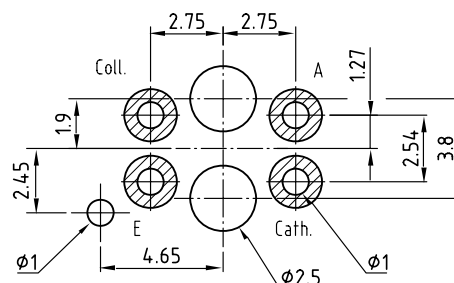


\* Tolerances related to reference plain

weight: ca. 0.23g



Footprint Top View



Drawing-No.: 6.550-5096.01-4

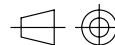
Issue: 4; 11.04.02

96 12073

**PACKAGE DIMENSIONS** in millimeters, **TCRT5000L**

\* Tolerances related to reference plain "A"

\*\* Tolerances related  
 on lead end



technical drawings  
according to DIN  
specifications



weight: ca. 0.23g

Drawing-No.: 6.550-5146.01-4

Issue: 4; 11.04.02

95 11267

Footprint Top View



# TCRT5000, TCRT5000L

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## TUBE DIMENSIONS in millimeters, TCRT5000



With rubber stopper  
Tolerance:  $\pm 0.5\text{mm}$   
Length:  $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5139.01-4  
Issue: 1; 10.05.00  
20298

## TUBE DIMENSIONS in millimeters, TCRT5000L



With stopper pins  
Tolerance:  $\pm 0.5\text{mm}$   
Length:  $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5178.01-4  
Issue: 1; 25.02.00  
20299

## Packaging and Ordering Information

PART NUMBER	MOQ <sup>(1)</sup>	PCS PER TUBE	TUBE SPEC. (FIGURE)	CONSTITUENTS (FORMS)
CNY70	4000	80	1	28
TCPT1300X01	2000	Reel	<sup>(2)</sup>	29
TCRT1000	1000	Bulk	-	26
TCRT1010	1000	Bulk	-	26
TCRT5000	4500	50	2	27
TCRT5000L	2400	48	3	27
TCST1030	5200	65	5	24
TCST1030L	2600	65	6	24
TCST1103	1020	85	4	24
TCST1202	1020	85	4	24
TCST1230	4800	60	7	24
TCST1300	1020	85	4	24
TCST2103	1020	85	4	24
TCST2202	1020	85	4	24
TCST2300	1020	85	4	24
TCST5250	4860	30	8	24
TCUT1300X01	2000	Reel	<sup>(2)</sup>	29
TCZT8020-PAER	2500	Bulk	-	22

### Notes

<sup>(1)</sup> MOQ: minimum order quantity

<sup>(2)</sup> Please refer to datasheets

### TUBE SPECIFICATION FIGURES



With rubber stopper

Tolerance:  $\pm 0.5\text{mm}$

Length:  $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5097.01-4

Issue: 1; 25.02.00

15198

Fig. 1



Drawing-No.: 9.700-5139.01-4  
Issue: 1; 10.05.00

Drawing refers to following types: TCRT 5000

15210

Fig. 2



Drawing-No.: 9.700-5178.01-4  
Issue: 1; 25.02.00

15201

Fig. 3





With rubber stopper  
Tolerance:  $\pm 0.5\text{mm}$   
Length:  $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5100.01-4  
Issue: 1; 25.02.00

15199

Fig. 4



With stopper pins  
Tolerance:  $\pm 0.5\text{mm}$   
Length:  $575 \pm 1\text{mm}$

Drawing-No.: 9.700-5140.01-4  
Issue: 1; 25.02.00

15202

Fig. 5



Drawing-No.: 9.700-5205.01-4  
Issue: 1; 25.02.00

15196

Fig. 6



Drawing-No.: 9.700-5245.01-4  
Issue: 1; 25.02.00

15195

Fig. 7



Fig. 8



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