

Optocoupler, Phototransistor Output, with Base Connection



21842



I179004-5

DESCRIPTION

Each optocoupler consists of gallium arsenide infrared LED and a silicon NPN phototransistor.

AGENCY APPROVALS

- Underwriters laboratory file no. E52744
- BSI: EN 60065:2002, EN 60950:2000
- FIMKO; EN 60065, EN 60335, EN 60950 certificate no. 25156

FEATURES

- Isolation test voltage 5000 V_{RMS}
- Interfaces with common logic families
- Input-output coupling capacitance < 0.5 pF
- Industry standard dual-in-line 6 pin package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC


RoHS
COMPLIANT

APPLICATIONS

- AC mains detection
- Reed relay driving
- Switch mode power supply feedback
- Telephone ring detection
- Logic ground isolation
- Logic coupling with high frequency noise rejection

ORDER INFORMATION

PART	REMARKS
4N35	CTR > 100 %, DIP-6
4N36	CTR > 100 %, DIP-6
4N37	CTR > 100 %, DIP-6

ABSOLUTE MAXIMUM RATINGS (1)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V _R	6	V
Forward current		I _F	50	mA
Surge current	t ≤ 10 μs	I _{FSM}	1	A
Power dissipation		P _{diss}	70	mW
OUTPUT				
Collector emitter breakdown voltage		V _{CEO}	70	V
Emitter base breakdown voltage		V _{EBO}	7	V
Collector current		I _C	50	mA
	t ≤ 1 ms	I _C	100	mA
Power dissipation		P _{diss}	70	mW
COUPLER				
Isolation test voltage		V _{ISO}	5000	V _{RMS}
Creepage			≥ 7	mm
Clearance			≥ 7	mm
Isolation thickness between emitter and detector			≥ 0.4	mm

ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
COUPLER				
Comparative tracking index	DIN IEC 112/VDE 0303, part 1		175	
Isolation resistance	$V_{IO} = 500 \text{ V}$, $T_{amb} = 25 \text{ }^\circ\text{C}$	R_{IO}	10^{12}	Ω
	$V_{IO} = 500 \text{ V}$, $T_{amb} = 100 \text{ }^\circ\text{C}$	R_{IO}	10^{11}	Ω
Storage temperature		T_{stg}	- 55 to + 150	$^\circ\text{C}$
Operating temperature		T_{amb}	- 55 to + 100	$^\circ\text{C}$
Junction temperature		T_j	100	$^\circ\text{C}$
Soldering temperature (2)	max. 10 s dip soldering: distance to seating plane $\geq 1.5 \text{ mm}$	T_{sld}	260	$^\circ\text{C}$

Notes

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

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(2) Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS (1)								
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT	
INPUT								
Junction capacitance	$V_R = 0 \text{ V}$, $f = 1 \text{ MHz}$		C_j		50		pF	
Forward voltage (2)	$I_F = 10 \text{ mA}$		V_F		1.3	1.5	V	
	$I_F = 10 \text{ mA}$, $T_{amb} = - 55 \text{ }^\circ\text{C}$		V_F	0.9	1.3	1.7	V	
Reverse current (2)	$V_R = 6 \text{ V}$		I_R		0.1	10	μA	
Capacitance	$V_R = 0 \text{ V}$, $f = 1 \text{ MHz}$		C_O		25		pF	
OUTPUT								
Collector emitter breakdown voltage(2)	$I_C = 1 \text{ mA}$	4N35	BV_{CEO}	30			V	
		4N36	BV_{CEO}	30			V	
		4N37	BV_{CEO}	30			V	
Emitter collector breakdown voltage(2)	$I_E = 100 \text{ } \mu\text{A}$		BV_{ECO}	7			V	
OUTPUT								
Collector base breakdown voltage (2)	$I_C = 100 \text{ } \mu\text{A}$, $I_B = 1 \text{ } \mu\text{A}$	4N35	BV_{CBO}	70			V	
		4N36	BV_{CBO}	70			V	
		4N37	BV_{CBO}	70			V	
Collector emitter leakage current (2)	$V_{CE} = 10 \text{ V}$, $I_F = 0$	4N35	I_{CEO}		5	50	nA	
		4N36	I_{CEO}		5	50	nA	
	$V_{CE} = 10 \text{ V}$, $I_F = 0$	4N37	I_{CEO}		5	50	nA	
		$V_{CE} = 30 \text{ V}$, $I_F = 0$, $T_{amb} = 100 \text{ }^\circ\text{C}$	4N35	I_{CEO}			500	μA
			4N36	I_{CEO}			500	μA
			4N37	I_{CEO}			500	μA
Collector emitter capacitance	$V_{CE} = 0$		C_{CE}		6		pF	
COUPLER								
Resistance, input output (2)	$V_{IO} = 500 \text{ V}$		R_{IO}	10^{11}			Ω	
Capacitance, input output	$f = 1 \text{ MHz}$		C_{IO}		0.6		pF	

Notes

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

Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

(2) Indicates JEDEC registered value.

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN	TYP.	MAX	UNIT
DC current transfer ratio ⁽¹⁾	$V_{CE} = 10\text{ V}, I_F = 10\text{ mA}$	4N35	CTR_{DC}	100			%
		4N36	CTR_{DC}	100			%
		4N37	CTR_{DC}	100			%
	$V_{CE} = 10\text{ V}, I_F = 10\text{ mA}, T_A = -55\text{ }^\circ\text{C to } +100\text{ }^\circ\text{C}$	4N35	CTR_{DC}	40	50		%
		4N36	CTR_{DC}	40	50		%
		4N37	CTR_{DC}	40	50		%

Note
⁽¹⁾ Indicates JEDEC registered values.

SWITCHING CHARACTERISTICS							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Switching time ⁽¹⁾	$V_{CC} = 10\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	t_{on}, t_{off}		10		μs	

Note
⁽¹⁾ Indicates JEDEC registered values.

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


Fig. 1 - Forward Voltage vs. Forward Current

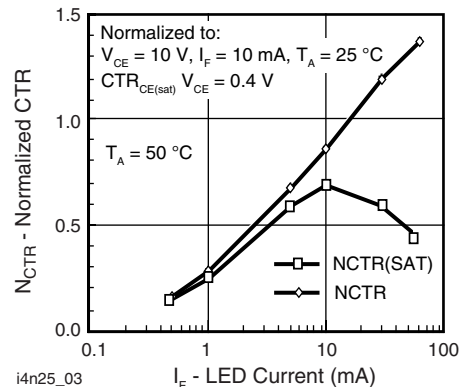


Fig. 3 - Normalized Non-Saturated and Saturated CTR vs. LED Current



Fig. 2 - Normalized Non-Saturated and Saturated CTR vs. LED Current

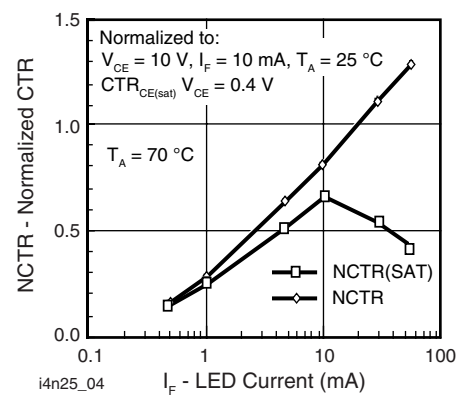


Fig. 4 - Normalized Non-Saturated and Saturated CTR vs. LED Current

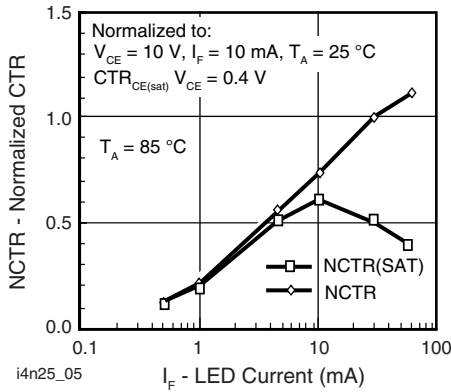


Fig. 5 - Normalized Non-Saturated and Saturated CTR vs. LED Current

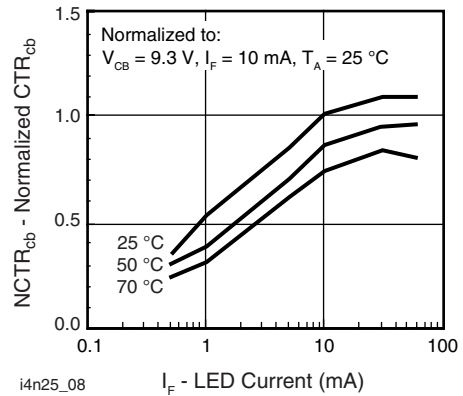


Fig. 8 - Normalized CTR_{cb} vs. LED Current and Temperature

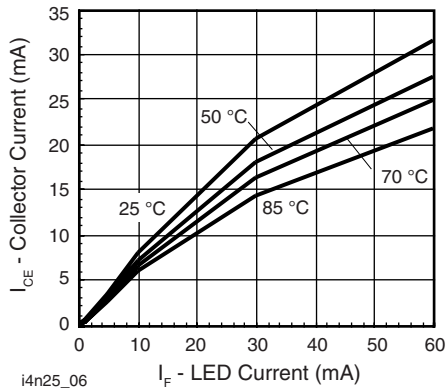


Fig. 6 - Collector Emitter Current vs. Temperature and LED Current

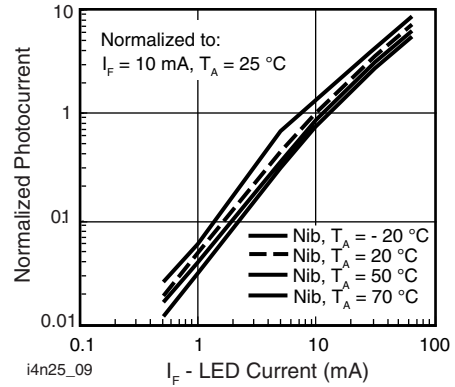


Fig. 9 - Normalized Photocurrent vs. I_F and Temperature

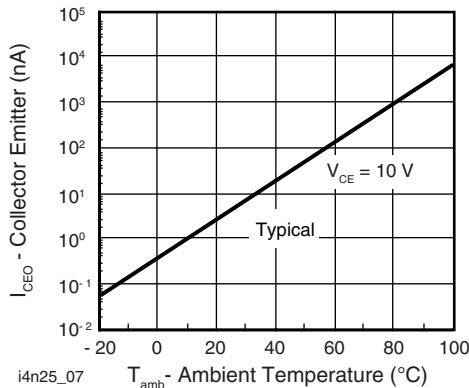


Fig. 7 - Collector Emitter Leakage Current vs. Temperature

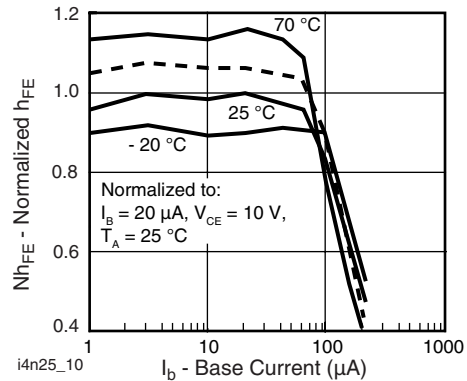


Fig. 10 - Normalized Non-Saturated h_{FE} vs. Base Current and Temperature



Fig. 11 - Normalized h_{FE} vs. Base Current and Temperature



i4n25_14

Fig. 14 - Switching Schematic



i4n25_12

Fig. 12 - Propagation Delay vs. Collector Load Resistor



i4n25_13

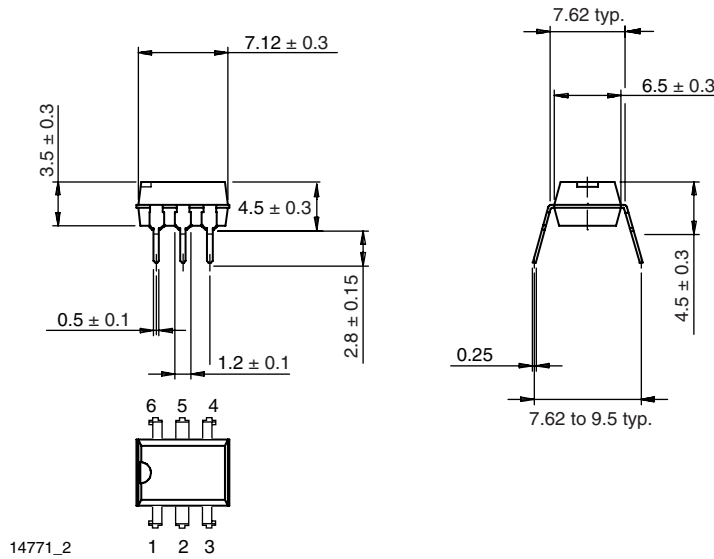
Fig. 13 - Switching Timing

4N35, 4N36, 4N37



Vishay Semiconductors Optocoupler, Phototransistor Output,
with Base Connection

PACKAGE DIMENSIONS in millimeters



PACKAGE MARKING





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