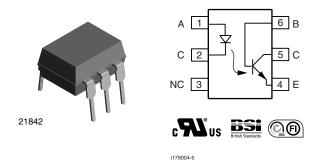


Vishay Semiconductors

### Optocoupler, Phototransistor Output, with Base Connection



#### **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<sub>RMS</sub>
- 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 <sub>F</sub>	50	mA				
Surge current	t ≤ 10 µs	I <sub>FSM</sub>	1	Α				
Power dissipation		P <sub>diss</sub>	70	mW				
OUTPUT								
Collector emitter breakdown voltage		V <sub>CEO</sub>	70	V				
Emitter base breakdown voltage		V <sub>EBO</sub>	7	V				
Collector current		I <sub>C</sub>	50	mA				
Collector current	$t \leq 1 \ ms$	Ic	100	mA				
Power dissipation		P <sub>diss</sub>	70	mW				
COUPLER								
Isolation test voltage		V <sub>ISO</sub>	5000	$V_{RMS}$				
Creepage			≥ 7	mm				
Clearance			≥ 7	mm				
Isolation thickness between emitter and detector			≥ 0.4	mm				

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

#### **Notes**

<sup>(2)</sup> Refer to wave profile for soldering condditions for through hole devices (DIP).

ELECTRICAL CHARACTER	RISTICS (1)						
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT							
Junction capacitance	V <sub>R</sub> = 0 V, f = 1 MHz		Cj		50		pF
Forward voltage (2)	I <sub>F</sub> = 10 mA		$V_{F}$		1.3	1.5	V
Forward voltage (=)	$I_F = 10 \text{ mA}, T_{amb} = -55 ^{\circ}\text{C}$		V <sub>F</sub>	0.9	1.3	1.7	V
Reverse current (2)	V <sub>R</sub> = 6 V		I <sub>R</sub>		0.1	10	μΑ
Capacitance	V <sub>R</sub> = 0 V, f = 1 MHz		Co		25		pF
OUTPUT							
		4N35	BV <sub>CEO</sub>	30			V
Collector emitter breakdown voltage <sup>(2)</sup>	$I_C = 1 \text{ mA}$	4N36	BV <sub>CEO</sub>	30			V
vollage		4N37	BV <sub>CEO</sub>	30			V
Emitter collector breakdown voltage <sup>(2)</sup>	I <sub>E</sub> = 100 μA		BV <sub>ECO</sub>	7			V
OUTPUT					•	•	
	I <sub>C</sub> = 100 μA, I <sub>B</sub> = 1 μA	4N35	BV <sub>CBO</sub>	70			V
Collector base breakdown voltage (2)		4N36	BV <sub>CBO</sub>	70			V
Voltage		4N37	BV <sub>CBO</sub>	70			V
	V <sub>CE</sub> = 10 V, I <sub>F</sub> = 0	4N35	I <sub>CEO</sub>		5	50	nA
		4N36	I <sub>CEO</sub>		5	50	nA
	$V_{CE} = 10 \text{ V}, I_F = 0$	4N37	I <sub>CEO</sub>		5	50	nA
Collector emitter leakage current (2)	V <sub>CE</sub> = 30 V, I <sub>F</sub> = 0, T <sub>amb</sub> = 100 °C	4N35	I <sub>CEO</sub>			500	μΑ
		4N36	I <sub>CEO</sub>			500	μΑ
		4N37	I <sub>CEO</sub>		_	500	μΑ
Collector emitter capacitance	V <sub>CE</sub> = 0		C <sub>CE</sub>		6		pF
COUPLER							
Resistance, input output (2)	V <sub>IO</sub> = 500 V		R <sub>IO</sub>	10 <sup>11</sup>			Ω
Capacitance, input output	f = 1 MHz	•	C <sub>IO</sub>		0.6		pF

#### Notes

 $<sup>^{(1)}</sup>$   $T_{amb} = 25$  °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.

 $T_{amb} = 25 \, ^{\circ}C$ , 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.

<sup>(2)</sup> Indicates JEDEC registered value.



## Optocoupler, Phototransistor Output, Vishay Semiconductors with Base Connection

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN	TYP.	MAX	UNIT
DC current transfer ratio (1)	V <sub>CE</sub> = 10 V, I <sub>F</sub> = 10 mA	4N35	CTR <sub>DC</sub>	100			%
		4N36	CTR <sub>DC</sub>	100			%
		4N37	CTR <sub>DC</sub>	100			%
	V <sub>CE</sub> = 10 V, I <sub>F</sub> = 10 mA, T <sub>A</sub> = -55 °C to + 100 °C	4N35	CTR <sub>DC</sub>	40	50		%
		4N36	CTR <sub>DC</sub>	40	50		%
		4N37	CTR <sub>DC</sub>	40	50		%

#### Note

(1) Indicates JEDEC registered values.

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

#### Note

(1) Indicates JEDEC registered values.

#### **TYPICAL CHARACTERISTICS**

T<sub>amb</sub> = 25 °C, unless otherwise specied

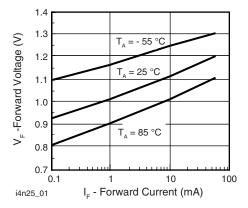


Fig. 1 - Forward Voltage vs. Forward Current

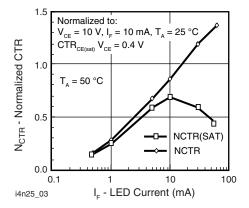


Fig. 3 - Normalized Non-Saturated and Saturated CTR vs. LED Current

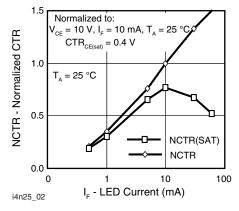


Fig. 2 - Normalized Non-Saturated and Saturated CTR vs. LED Current

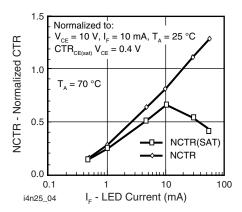


Fig. 4 - Normalized Non-Saturated and Saturated CTR vs. LED Current

### Vishay Semiconductors Optocoupler, Phototransistor Output, with Base Connection



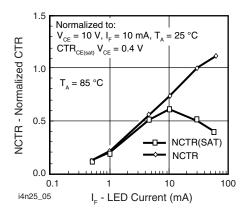


Fig. 5 - Normalized Non-Saturated and Saturated CTR vs. LED Current

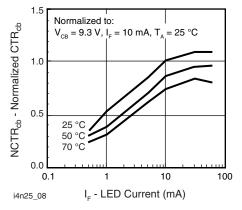


Fig. 8 - Normalized CTR<sub>cb</sub> vs. LED Current and Temperature

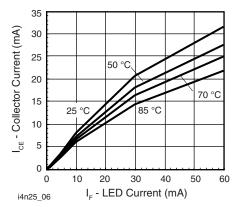


Fig. 6 - Collector Emitter Current vs. Temperature and LED Current

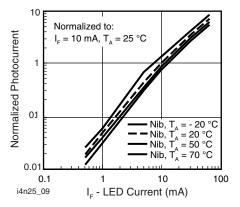


Fig. 9 - Normalized Photocurrent vs. I<sub>F</sub> and Temperature

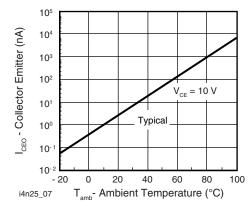


Fig. 7 - Collector Emitter Leakage Current vs. Temperature

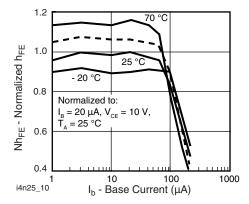


Fig. 10 - Normalized Non-Saturated  $h_{\text{FE}}$  vs. Base Current and Temperature



## Optocoupler, Phototransistor Output, Vishay Semiconductors with Base Connection

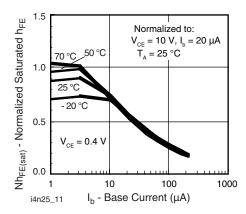


Fig. 11 - Normalized h<sub>FE</sub> vs. Base Current and Temperature

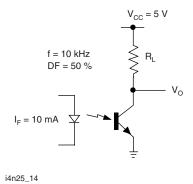


Fig. 14 - Switching Schematic

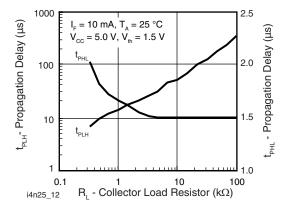


Fig. 12 - Propagation Delay vs. Collector Load Resistor

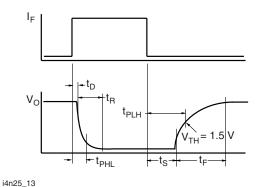
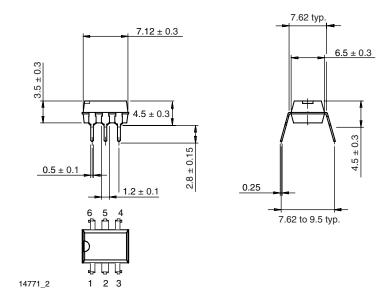


Fig. 13 - Switching Timing

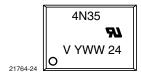
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#### **PACKAGE DIMENSIONS** in millimeters



#### **PACKAGE MARKING**





### **Legal Disclaimer Notice**

Vishay

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