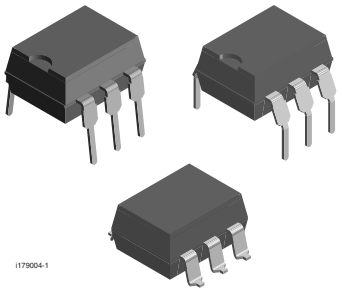
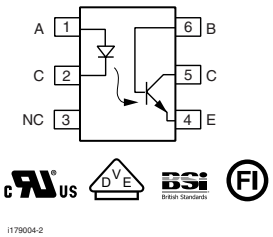
Optocoupler, Phototransistor Output, with Base Connection





FEATURES

- Isolation test voltage 5300 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

Pb-free

e3

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

AGENCY APPROVALS

- Underwriters laboratory file no. E52744
- DIN EN 60747-5-5 (VDE 0884) available with option 1

DESCRIPTION

This data sheet presents five families of Vishay industry standard single channel phototransistor couplers. These families include the 4N35, 4N36, 4N37, 4N38 couplers.
Each optocoupler consists of gallium arsenide infrared LED and a silicon NPN phototransistor.
These couplers are Underwriters Laboratories (UL) listed to comply with a 5300 V_{RMS} isolation test voltage.
This isolation performance is accomplished through Vishay double molding isolation manufacturing process. Comliance to DIN EN 60747-5-5 partial discharge isolation specification is available for these families by ordering option 1.
These isolation processes and the Vishay ISO9001 quality program results in the highest isolation performance available for a commecial plastic phototransistor optocoupler.
The devices are available in lead formed configuration suitable for surface mounting and are available either on tape and reel, or in standard tube shipping containers.
Note:
For additional design information see application note 45 normalized curves

ORDER INFORMATION	
PART	**REMARKS**
4N35-X000	CTR > 100 %, DIP-6
4N36-X000	CTR > 100 %, DIP-6
4N37-X000	CTR > 100 %, DIP-6
4N38	CTR > 20 %, DIP-6
4N35-X006	CTR > 100 %, DIP-6 400 mil (option 6)
4N35-X007	CTR > 100 %, SMD-6 (option 7)
4N35-X009	CTR > 100 %, SMD-6 (option 9)
4N36-X007	CTR > 100 %, SMD-6 (option 7)
4N36-X009	CTR > 100 %, SMD-6 (option 9)
4N37-X006	CTR > 100 %, DIP-6 400 mil (option 6)
4N38-X009	CTR > 100 %, SMD-6 (option 9)

Note
For additional information on the available options refer to option information.

ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
Forward current		I_F	60	mA
Surge current	t ≤ 10 µs	I_{FSM}	2.5	A
Power dissipation		P_{diss}	100	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}	150	mW
COUPLER				
Isolation test voltage		V_{ISO}	5300	V_{RMS}
Creepage			≥ 7	mm
Clearance			≥ 7	mm
Isolation thickness between emitter and detector			≥ 0.4	mm
Comparative tracking index	DIN IEC 112/VDE 0303, part 1		175	
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}	10^{12}	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	10^{11}	Ω
Storage temperature		T_{stg}	- 55 to + 150	°C
Operating temperature		T_{amb}	- 55 to + 100	°C
Junction temperature		T_j	100	°C
Soldering temperature (2)	max.10 s dip soldering: distance to seating plane ≥ 1.5 mm	T_{sld}	260	°C

Notes

(1) 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.

(2) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering condditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS (1)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Junction capacitance	V_R = 0 V, f = 1 MHz		C_j		50		pF
Forward voltage (2)	I_F = 10 mA		V_F		1.3	1.5	V
	I_F = 10 mA, T_{amb} = - 55 °C		V_F	0.9	1.3	1.7	V
Reverse current (2)	V_R = 6 V		I_R		0.1	10	µA
Capacitance	V_R = 0 V, f = 1 MHz		C_O		25		pF
OUTPUT							
Collector emitter breakdown voltage (2)	I_C = 1 mA	4N35	BV_{CEO}	30			V
		4N36	BV_{CEO}	30			V
		4N37	BV_{CEO}	30			V
		4N38	BV_{CEO}	80			V
Emitter collector breakdown voltage (2)	I_E = 100 µA		BV_{ECO}	7			V

ELECTRICAL CHARACTERISTICS (1)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
OUTPUT							
Collector base breakdown voltage (2)	I_C = 100 µA, I_B = 1 µA	4N35	BV_{CBO}	70			V
		4N36	BV_{CBO}	70			V
		4N37	BV_{CBO}	70			V
		4N38	BV_{CBO}	80			V
Collector emitter leakage current (2)	V_{CE} = 10 V, I_F = 0	4N35	I_{CEO}		5	50	nA
		4N36	I_{CEO}		5	50	nA
	V_{CE} = 10 V, I_F = 0	4N37	I_{CEO}		5	50	nA
	V_{CE} = 60 V, I_F = 0	4N38	I_{CEO}			50	nA
	V_{CE} = 30 V, I_F = 0, T_{amb} = 100 °C	4N35	I_{CEO}			500	µA
		4N36	I_{CEO}			500	µA
		4N37	I_{CEO}			500	µA
	V_{CE} = 60 V, I_F = 0, T_{amb} = 100 °C	4N38	I_{CEO}		6		µA
Collector emitter capacitance	V_{CE} = 0		C_{CE}		6		pF
COUPLER							
Resistance, input output (2)	V_{IO} = 500 V		R_{IO}	10^{11}			Ω
Capacitance, input output	f = 1 MHz		C_{IO}		0.5		pF

Notes

(1) T_{amb} = 25 °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 V, I_F = 10 mA	4N35	CTR_{DC}	100			%
		4N36	CTR_{DC}	100			%
		4N37	CTR_{DC}	100			%
	V_{CE} = 10 V, I_F = 20 mA	4N38	CTR_{DC}	20			%
	V_{CE} = 10 V, I_F = 10 mA, T_A = - 55 °C to + 100 °C	4N35	CTR_{DC}	40	50		%
		4N36	CTR_{DC}	40	50		%
		4N37	CTR_{DC}	40	50		%
		4N38	CTR_{DC}		30		%

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 Ω	t_{on}, t_{off}		10		µs

Note

(1) Indicates JEDEC registered values.

TYPICAL CHARACTERISTICS

T_{amb} = 25 °C, unless otherwise specied

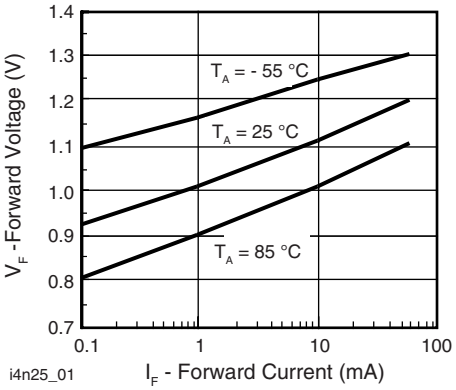


Fig. 1 - Forward Voltage vs. Forward Current

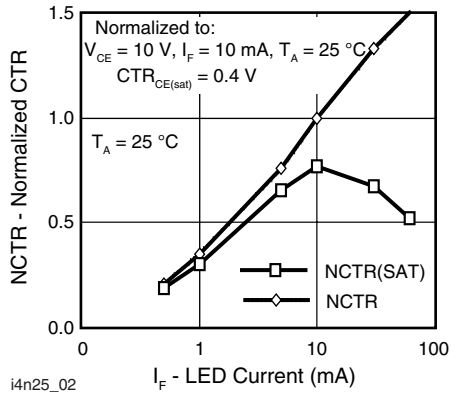


Fig. 2 - Normalized Non-Saturated and Saturated CTR vs. LED Current

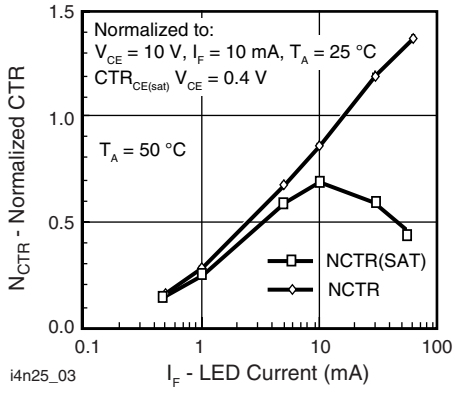


Fig. 3 - Normalized Non-Saturated and Saturated CTR vs. LED Current

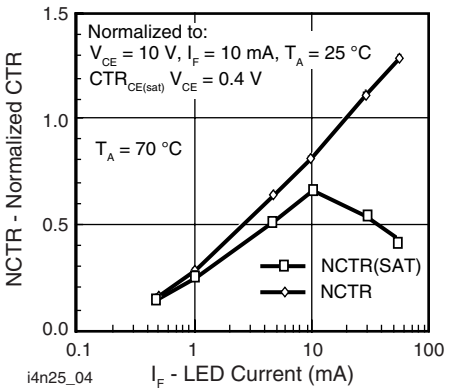


Fig. 4 - Normalized Non-Saturated and Saturated CTR vs. LED Current

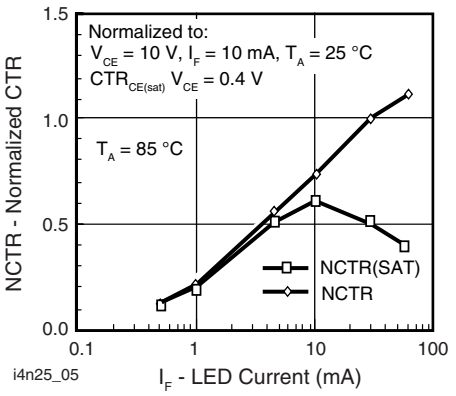


Fig. 5 - Normalized Non-Saturated and Saturated CTR vs. LED Current

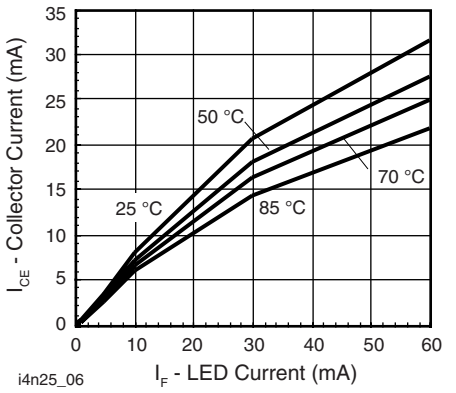


Fig. 6 - Collector Emitter Current vs. Temperature and LED Current

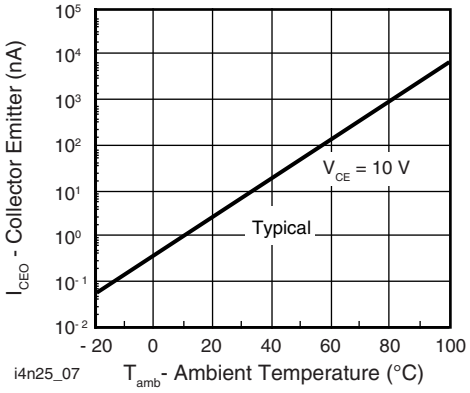


Fig. 7 - Collector Emitter Leakage Current vs. Temperature

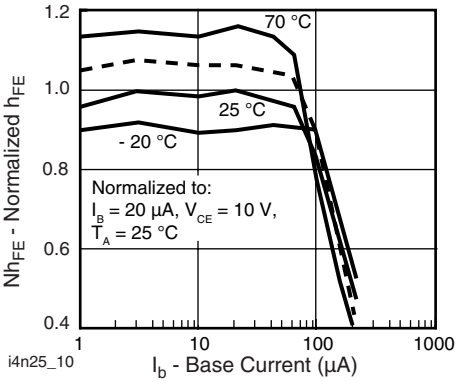


Fig. 10 - Normalized Non-Saturated h_{FE} vs. Base Current and Temperature

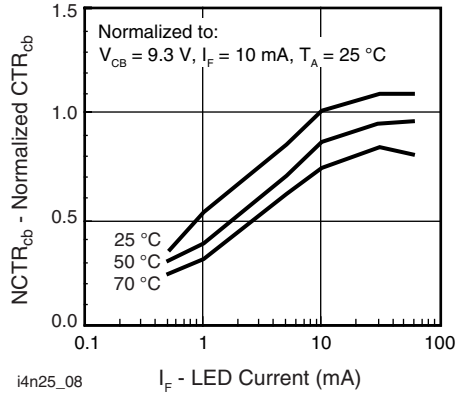


Fig. 8 - Normalized CTR_{cb} vs. LED Current and Temperature

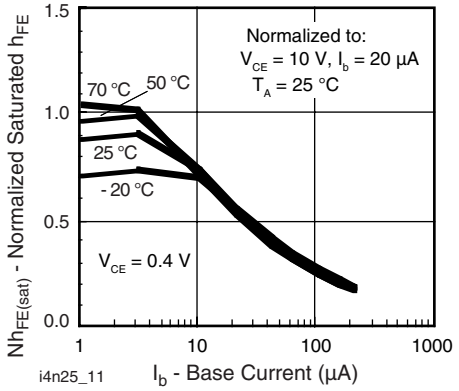


Fig. 11 - Normalized h_{FE} vs. Base Current and Temperature

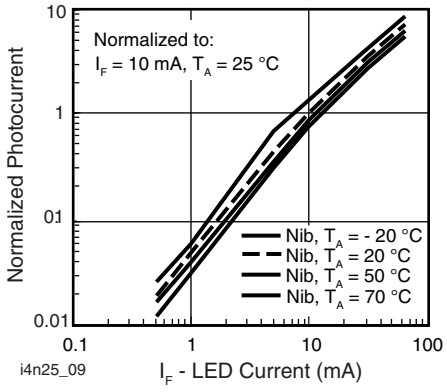


Fig. 9 - Normalized Photocurrent vs. I_F and Temperature

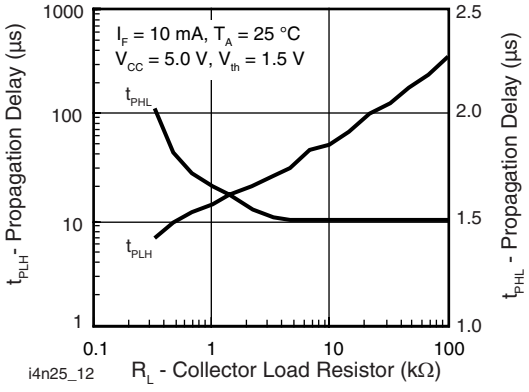


Fig. 12 - Propagation Delay vs. Collector Load Resistor

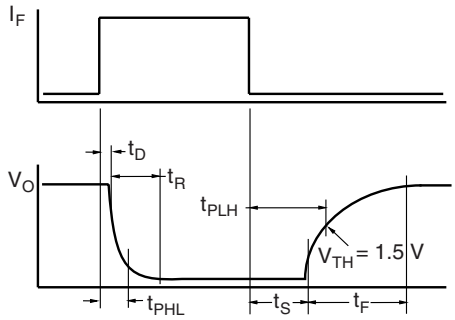


Fig. 13 - Switching Timing

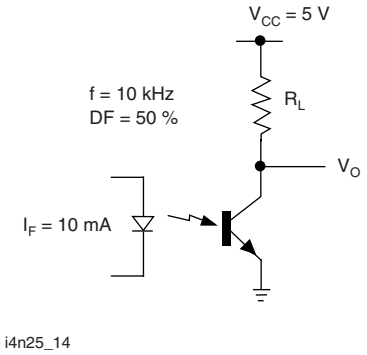
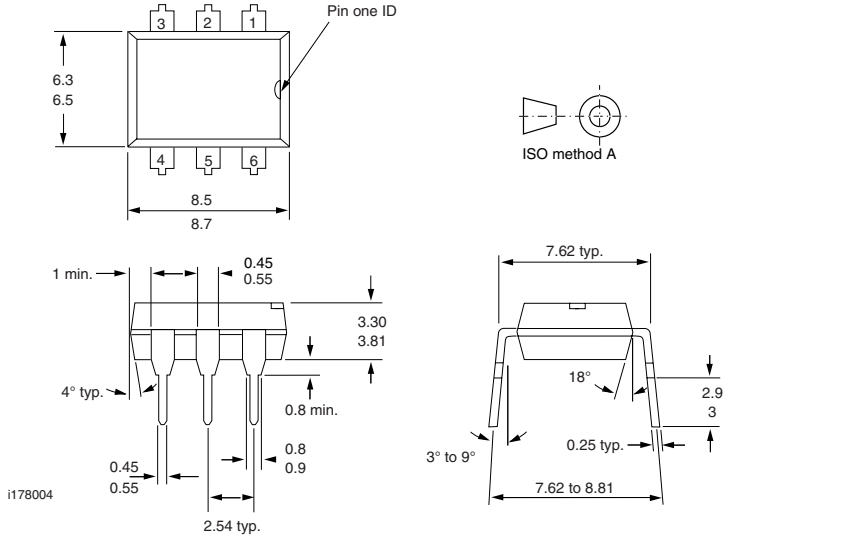
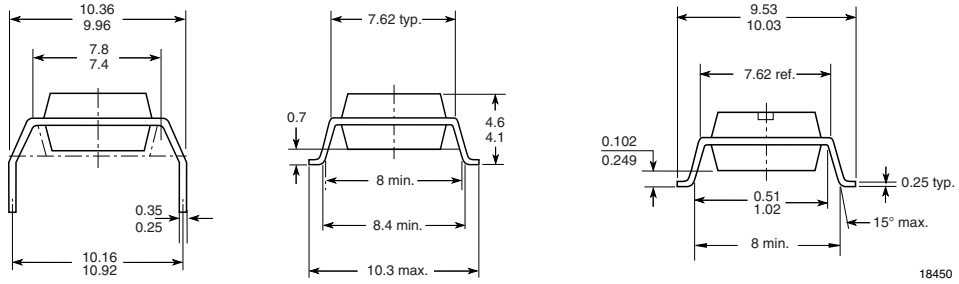


Fig. 14 - Switching Schematic

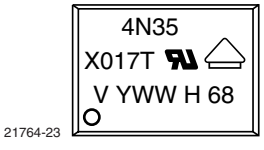
PACKAGE DIMENSIONS in millimeters



Option 6 **Option 7** **Option 9**



PACKAGE MARKING



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