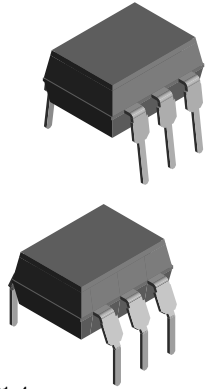
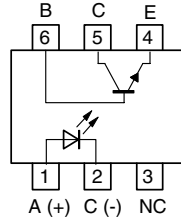


## Optocoupler, Phototransistor Output



17201\_4



18537\_4

### DESCRIPTION

The 4N25V, 4N25GV, 4N35V, 4N35GV series consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 6-lead plastic dual inline package.

### VDE STANDARDS

These couplers perform safety functions according to the following equipment standards:

#### DIN EN 60747-5-5 (VDE 0884)

Optocoupler for electrical safety requirements

#### IEC 60950

Office machines (applied for reinforced isolation for mains voltage  $\leq 400 V_{RMS}$ )

#### VDE 0804

Telecommunication apparatus and data processing

#### IEC 60065

Safety for mains-operated electronic and related household apparatus

### FEATURES

- Special construction: therefore, extra low coupling capacity of typical 0.2 pF, high common mode rejection
- Low temperature coefficient of CTR
- Rated isolation voltage (RMS includes DC)  $V_{IOWM} = 600 V_{RMS}$  (848 V peak)
- Rated recurring peak voltage (repetitive)  $V_{IORM} = 600 V_{RMS}$
- Thickness through insulation  $\geq 0.4$  mm
- Creepage current resistance according to VDE 0303/IEC 60112 comparative tracking index: **CTI**  $\geq 275$
- Rated impulse voltage (transient overvoltage)  $V_{IOTM} = 6$  kV peak
- Isolation test voltage (partial discharge test voltage)  $V_{pd} = 1.6$  kV
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT

### APPLICATIONS

- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):
  - for appl. class I - IV at mains voltage  $\leq 300$  V
  - for appl. class I - III at mains voltage  $\leq 600$  V according to DIN EN 60747-5-5

### AGENCY APPROVALS

- UL1577, file no. E52744, double protection
- BSI: BS EN 41003, BS EN 60065 (BS 415), pending
- DIN EN 60747-5-5 (VDE 0884)
- FIMKO (SETI): EN 60950, certificate no. FI25155

ORDER INFORMATION <sup>(1)</sup>	
PART	REMARKS
4N25GV	CTR > 20 % wide lead spacing, DIP-6
4N35GV	CTR > 100 % wide lead spacing, DIP-6
4N25V	CTR > 20 %, DIP-6
4N35V	CTR > 100 %, DIP-6

#### Note

<sup>(1)</sup> G = leadform 10.16 mm; G is not marked on the body.

ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	5	V
Forward current		$I_F$	60	mA
Forward surge current	$t_p \leq 10 \mu\text{s}$	$I_{FSM}$	3	A
Power dissipation		$P_{diss}$	70	mW
Junction temperature		$T_j$	125	°C
<b>OUTPUT</b>				
Collector emitter voltage		$V_{CEO}$	32	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	50	mA
Collector peak current	$t_p/T = 0.5, t_p \leq 10 \text{ ms}$	$I_{CM}$	100	mA
Power dissipation		$P_{diss}$	70	mW
Junction temperature		$T_j$	125	°C
<b>COUPLER</b>				
Isolation test voltage (RMS)		$V_{ISO}$	5000	$V_{RMS}$
Total power dissipation		$P_{tot}$	200	mW
Ambient temperature range		$T_{amb}$	- 55 to + 100	°C
Storage temperature range		$T_{stg}$	- 55 to + 125	°C
Soldering temperature (2)	2 mm from case, $t \leq 10 \text{ s}$	$T_{sld}$	260	°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.

ELECTRICAL CHARACTERISTICS (1)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	$I_F = 50 \text{ mA}$	$V_F$		1.2	1.4	V
Junction capacitance	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$	$C_j$		50		pF
<b>OUTPUT</b>						
Collector emitter voltage	$I_C = 1 \text{ mA}$	$V_{CEO}$	32			V
Emitter collector voltage	$I_E = 100 \mu\text{A}$	$V_{ECO}$	7			V
Collector emitter leakage current	$V_{CE} = 10 \text{ V}, I_F = 0, T_{amb} = 100 \text{ }^\circ\text{C}$	$I_{CEO}$			50	nA
	$V_{CE} = 30 \text{ V}, I_F = 0, T_{amb} = 100 \text{ }^\circ\text{C}$	$I_{CEO}$			500	nA
<b>COUPLER</b>						
Collector emitter saturation voltage	$I_F = 50 \text{ mA}, I_C = 2 \text{ mA}$	$V_{CEsat}$			0.3	V
Cut-off frequency	$V_{CE} = 5 \text{ V}, I_F = 10 \text{ mA}, R_L = 100 \Omega$	$f_c$		110		kHz
Coupling capacitance	$f = 1 \text{ MHz}$	$C_k$		1		pF

### Note

(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.

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$V_{CE} = 10\text{ V}, I_F = 10\text{ mA}$	4N25V	CTR	20	100		%
		4N25GV	CTR				
		4N35V	CTR	100	150		%
		4N35GV	CTR				
	$V_{CE} = 10\text{ V}, I_F = 10\text{ mA}, T_{amb} = 100\text{ }^\circ\text{C}$	4N35V	CTR	40			%
		4N35GV	CTR				

MAXIMUM SAFETY RATINGS (1)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward current		$I_F$			130	mA
<b>OUTPUT</b>						
Power dissipation		$P_{diss}$			265	mW
<b>COUPLER</b>						
Rated impulse voltage		$V_{IOTM}$			6	kV
Safety temperature		$T_{si}$			150	$^\circ\text{C}$

**Note**

(1) According to DIN EN 60747-5-5 (see figure 2). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

INSULATION RATED PARAMETERS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Partial discharge test voltage - routine test	100 %, $t_{test} = 1\text{ s}$	$V_{pd}$	1600			V
Partial discharge test voltage - lot test (sample test)	$t_{Tr} = 60\text{ s}, t_{test} = 10\text{ s},$ (see figure 2)	$V_{IOTM}$	6000			V
		$V_{pd}$	1400			V
Insulation resistance	$V_{IO} = 500\text{ V}$	$R_{IO}$	$10^{12}$			$\Omega$
	$V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^\circ\text{C}$	$R_{IO}$	$10^{11}$			$\Omega$
	$V_{IO} = 500\text{ V}, T_{amb} = 150\text{ }^\circ\text{C}$ (construction test only)	$R_{IO}$	$10^9$			$\Omega$

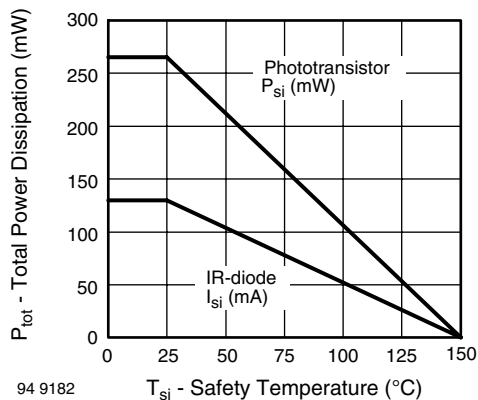


Fig. 1 - Derating Diagram

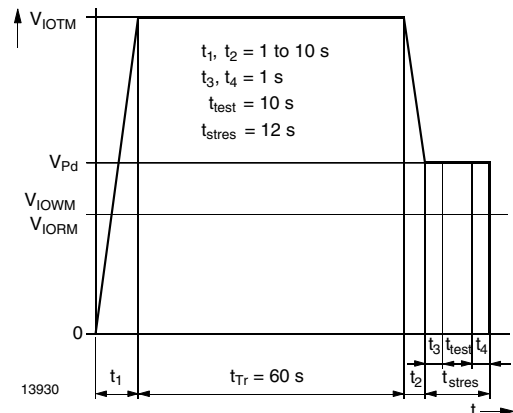
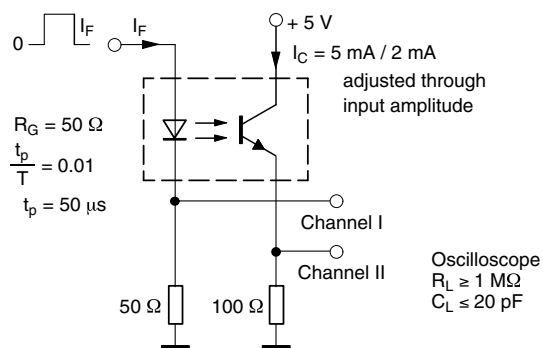


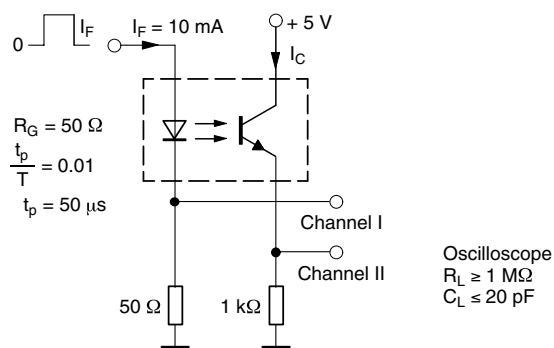
Fig. 2 - Test Pulse Diagram for Sample Test according to DIN EN 60747-; IEC 60747

SWITCHING CHARACTERISTICS							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Delay time (see figure 3)	$V_S = 5\text{ V}, I_C = 5\text{ mA}, R_L = 100\ \Omega$	4N25V 4N25GV	$t_d$		4		$\mu\text{s}$
	$V_S = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	4N35V 4N35GV	$t_d$		2.5		$\mu\text{s}$
Rise time (see figure 3)	$V_S = 5\text{ V}, I_C = 5\text{ mA}, R_L = 100\ \Omega$	4N25V 4N25GV	$t_r$		7		$\mu\text{s}$
	$V_S = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	4N35V 4N35GV	$t_r$		3		$\mu\text{s}$
Fall time (see figure 3)	$V_S = 5\text{ V}, I_C = 5\text{ mA}, R_L = 100\ \Omega$	4N25V 4N25GV	$t_f$		6.7		$\mu\text{s}$
	$V_S = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	4N35V 4N35GV	$t_f$		4.2		$\mu\text{s}$
Storage time (see figure 3)	$V_S = 5\text{ V}, I_C = 5\text{ mA}, R_L = 100\ \Omega$	4N25V 4N25GV	$t_s$		0.3		$\mu\text{s}$
	$V_S = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	4N35V 4N35GV	$t_s$		0.3		$\mu\text{s}$
Turn-on time (see figure 3)	$V_S = 5\text{ V}, I_C = 5\text{ mA}, R_L = 100\ \Omega$	4N25V 4N25GV	$t_{on}$		11		$\mu\text{s}$
	$V_S = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	4N35V 4N35GV	$t_{on}$			10	$\mu\text{s}$
Turn-off time (see figure 3)	$V_S = 5\text{ V}, I_C = 5\text{ mA}, R_L = 100\ \Omega$	4N25V 4N25GV	$t_{off}$		7		$\mu\text{s}$
	$V_S = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	4N35V 4N35GV	$t_{off}$			10	$\mu\text{s}$
Turn-on time (see figure 4)	$V_S = 5\text{ V}, I_F = 10\text{ mA}, R_L = 1\text{ k}\Omega$	4N25V 4N25GV	$t_{on}$		25		$\mu\text{s}$
		4N35V 4N35GV	$t_{on}$		9		$\mu\text{s}$
Turn-off time (see figure 4)	$V_S = 5\text{ V}, I_F = 10\text{ mA}, R_L = 1\text{ k}\Omega$	4N25V 4N25GV	$t_{off}$		42.5		$\mu\text{s}$
		4N35V 4N35GV	$t_{off}$		25		$\mu\text{s}$



14950

Fig. 3 - Test circuit, Non-Saturated Operation



95 10844

Fig. 4 - Test Circuit, Saturated Operation

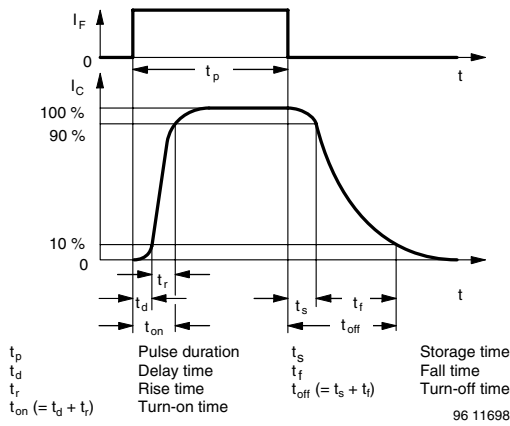


Fig. 5 - Switching Times

### TYPICAL CHARACTERISTICS

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

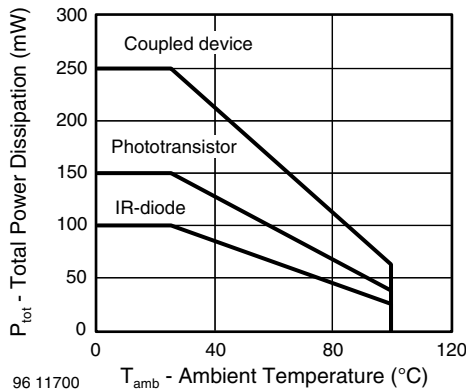


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

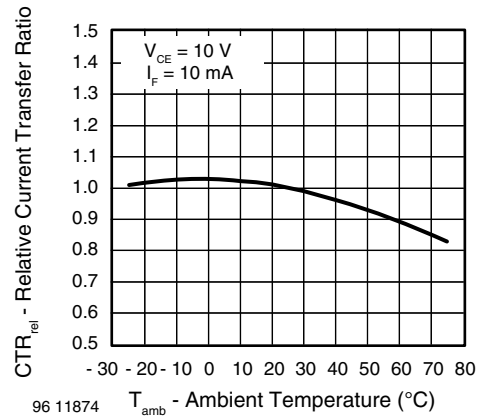


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

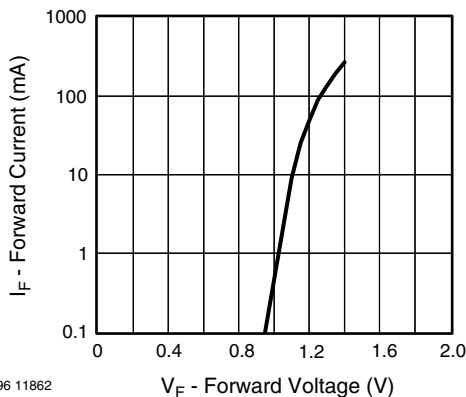


Fig. 7 - Forward Current vs. Forward Voltage

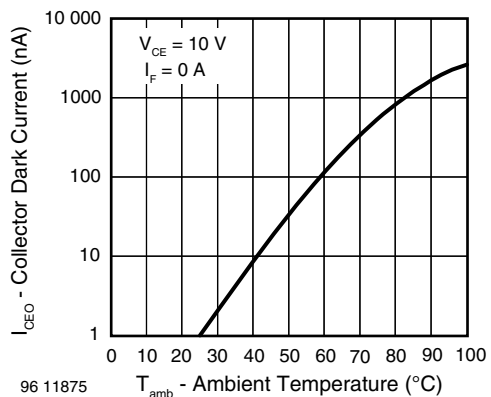


Fig. 9 - Collector Dark Current vs. Ambient Temperature

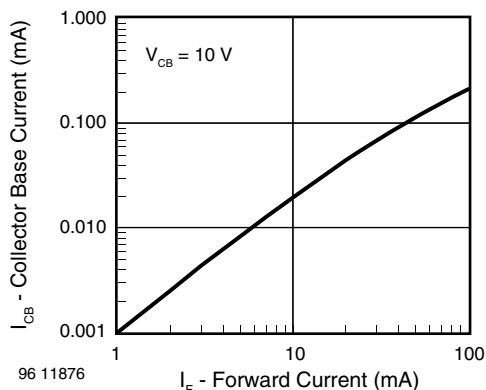


Fig. 10 - Collector Base Current vs. Forward Current

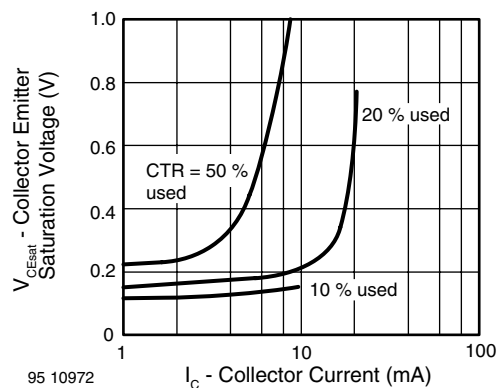


Fig. 13 - Collector Emitter Saturation Voltage vs. Collector Current

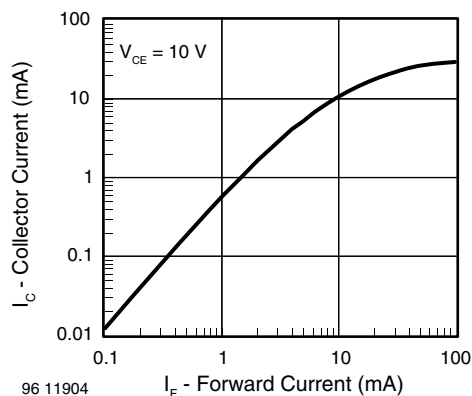


Fig. 11 - Collector Current vs. Forward Current

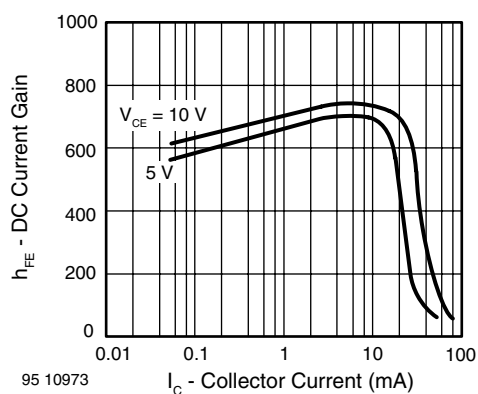


Fig. 14 - DC Current Gain vs. Collector Current

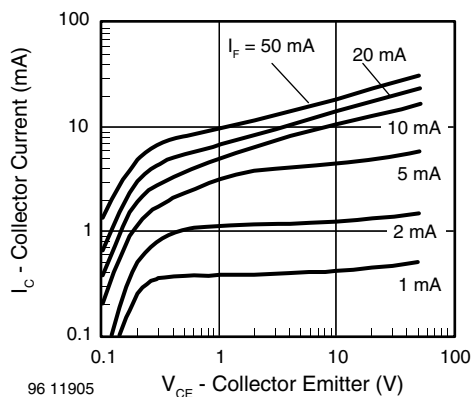


Fig. 12 - Collector Current vs. Collector Emitter Voltage

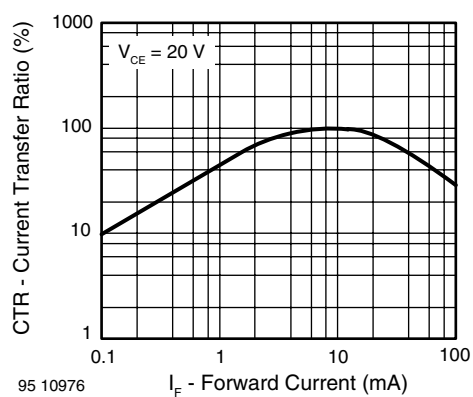


Fig. 15 - Current Transfer Ratio vs. Forward Current

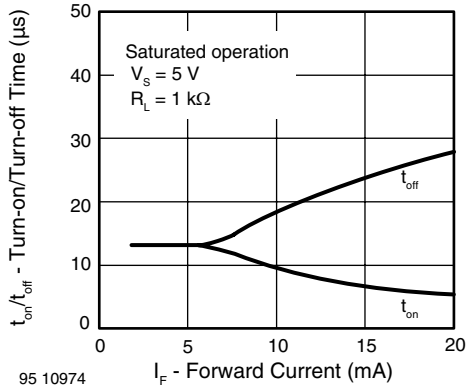


Fig. 16 - Turn-on/off Time vs. Forward Current

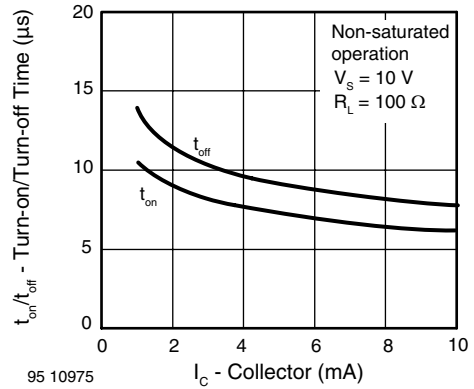
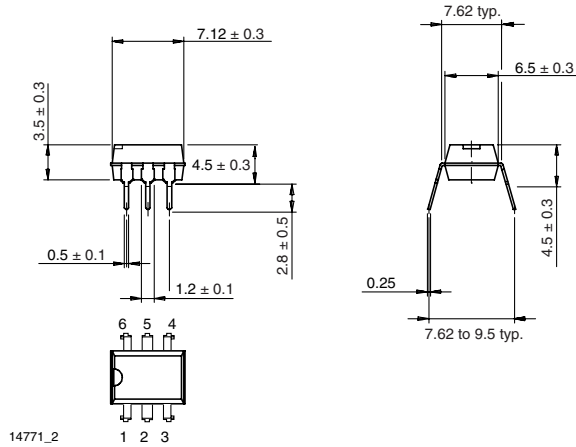


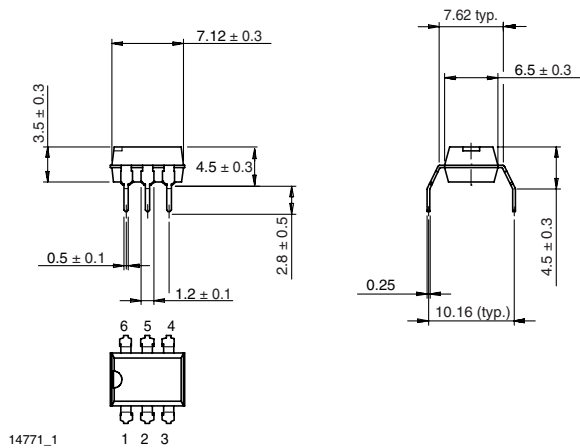
Fig. 17 - Turn-on/off Time vs. Collector Current

### PACKAGE DIMENSIONS in millimeters

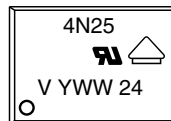
#### DIP-6



#### DIP-6, 400 mil



### PACKAGE MARKING



21764-32



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