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# 4N35-X, 4N36-X, 4N37-X, 4N38

Vishay Semiconductors

ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	6	V
Forward current		I <sub>F</sub>	60	mA
Surge current	t ≤ 10 μs	I <sub>FSM</sub>	2.5	A
Power dissipation		P <sub>diss</sub>	70	mW
<b>OUTPUT</b>				
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 peak current	t <sub>p</sub> /T = 0.5, t <sub>p</sub> ≤ 10 ms	I <sub>CM</sub>	100	mA
Output power dissipation		P <sub>diss</sub>	150	mW
<b>COUPLER</b>				
Isolation test voltage	t = 1 s	V <sub>ISO</sub>	5000	V <sub>RMS</sub>
Creepage distance			≥ 7	mm
Clearance distance			≥ 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 <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °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
Soldering temperature <sup>(1)</sup>	2 mm from case, ≤ 10 s	T <sub>sld</sub>	260	°C

**Notes**

- 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.
- <sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage <sup>(1)</sup>	I <sub>F</sub> = 10 mA		V <sub>F</sub>		1.2	1.5	V
	I <sub>F</sub> = 10 mA, T <sub>amb</sub> = - 55 °C		V <sub>F</sub>	0.9	1.3	1.7	V
Reverse current <sup>(1)</sup>	V <sub>R</sub> = 6 V		I <sub>R</sub>		0.1	10	μA
Capacitance	V <sub>R</sub> = 0 V, f = 1 MHz		C <sub>O</sub>		25		pF
<b>OUTPUT</b>							
Collector emitter breakdown voltage <sup>(1)</sup>	I <sub>C</sub> = 1 mA	4N35	BV <sub>CEO</sub>	30			V
		4N36	BV <sub>CEO</sub>	30			V
		4N37	BV <sub>CEO</sub>	30			V
		4N38	BV <sub>CEO</sub>	80			V
Emitter collector breakdown voltage <sup>(1)</sup>	I <sub>E</sub> = 100 μA		BV <sub>ECO</sub>	7			V
Collector base breakdown voltage <sup>(1)</sup>	I <sub>C</sub> = 100 μA, I <sub>B</sub> = 1 μA	4N35	BV <sub>CBO</sub>	70			V
		4N36	BV <sub>CBO</sub>	70			V
		4N37	BV <sub>CBO</sub>	70			V
		4N38	BV <sub>CBO</sub>	80			V

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)								
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT	
<b>OUTPUT</b>								
Collector emitter leakage current <sup>(1)</sup>	$V_{CE} = 10\text{ V}, I_F = 0$	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	
	$V_{CE} = 60\text{ V}, I_F = 0$	4N38	$I_{CEO}$			50	nA	
	$V_{CE} = 30\text{ V}, I_F = 0,$ $T_{amb} = 100\text{ }^{\circ}\text{C}$		4N35	$I_{CEO}$			500	$\mu\text{A}$
			4N36	$I_{CEO}$			500	$\mu\text{A}$
		4N37	$I_{CEO}$			500	$\mu\text{A}$	
	$V_{CE} = 60\text{ V}, I_F = 0,$ $T_{amb} = 100\text{ }^{\circ}\text{C}$	4N38	$I_{CEO}$		6		$\mu\text{A}$	
Collector emitter capacitance	$V_{CE} = 0$		$C_{CE}$		6		pF	
<b>coupler</b>								
Resistance, input output <sup>(1)</sup>	$V_{IO} = 500\text{ V}$		$R_{IO}$	$10^{11}$			$\Omega$	
Capacitance, input output	$f = 1\text{ MHz}$		$C_{IO}$		0.5		pF	

**Notes**

- 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.
- (1) Indicates JEDEC registered value.

<b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$ <sup>(1)</sup>	$V_{CE} = 10\text{ V}, I_F = 10\text{ mA}$	4N35	$CTR_{DC}$	100			%
		4N36	$CTR_{DC}$	100			%
		4N37	$CTR_{DC}$	100			%
	$V_{CE} = 10\text{ V}, I_F = 20\text{ mA}$	4N38	$CTR_{DC}$	20			%
	$V_{CE} = 10\text{ V}, I_F = 10\text{ mA},$ $T_A = -55\text{ }^{\circ}\text{C to } +100\text{ }^{\circ}\text{C}$	4N35	$CTR_{DC}$	40	50		%
		4N36	$CTR_{DC}$	40	50		%
		4N37	$CTR_{DC}$	40	50		%
4N38		$CTR_{DC}$		30		%	

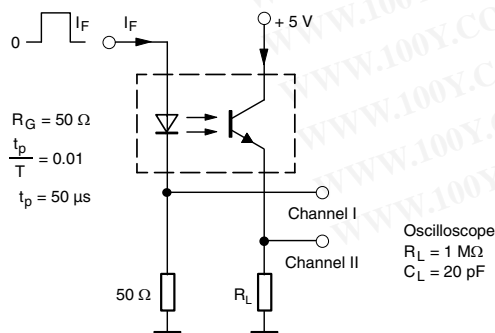
**Note**

- (1) Indicates JEDEC registered values.

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Turn-on time <sup>(1)</sup>	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$	$t_{on}$		10		$\mu\text{s}$	
Turn-off time <sup>(1)</sup>	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$	$t_{off}$		10		$\mu\text{s}$	

**Note**

- (1) Indicates JEDEC registered values.



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Fig. 1 - Test Circuit, Non-Saturated Operation

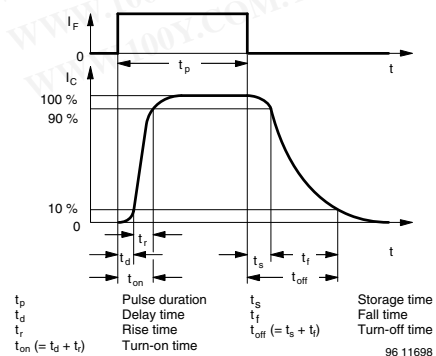


Fig. 2 - Switching Times



TYPICAL CHARACTERISTICS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

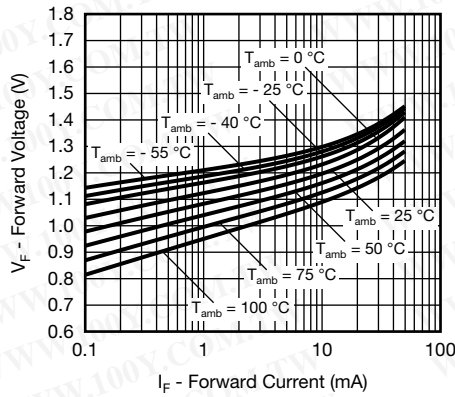


Fig. 3 - Forward Voltage vs. Forward Current

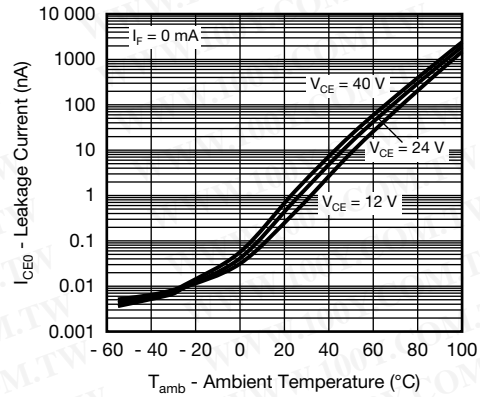


Fig. 6 - Leakage Current vs. Ambient Temperature

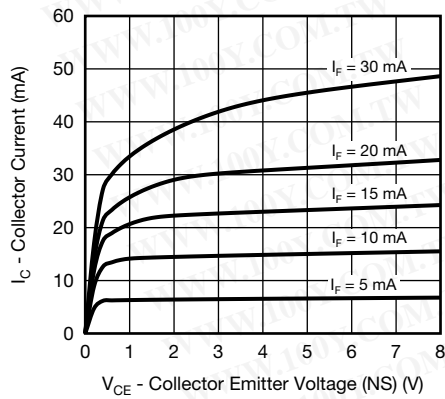


Fig. 4 - Collector Current vs. Collector Emitter Voltage (NS)

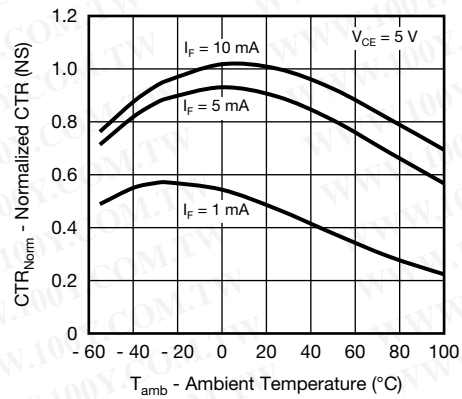


Fig. 7 - Normalized CTR (NS) vs. Ambient Temperature

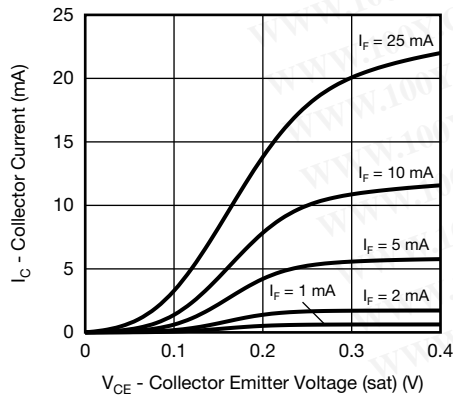


Fig. 5 - Collector Current vs. Collector Emitter Voltage (sat)

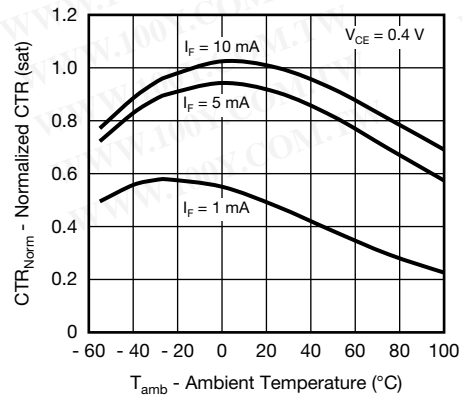


Fig. 8 - Normalized CTR (sat) vs. Ambient Temperature

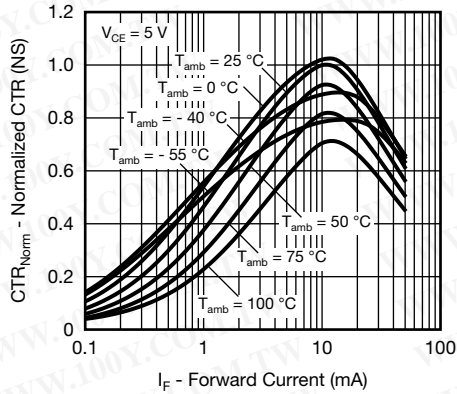


Fig. 9 - Normalized CTR (NS) vs. Forward Current

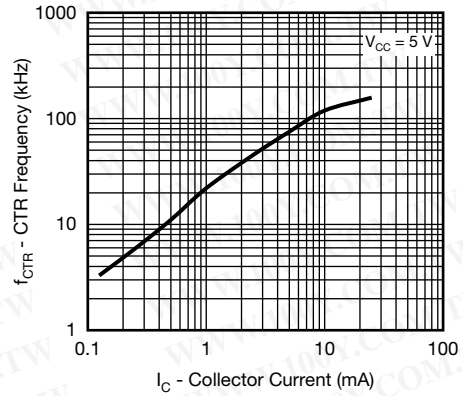


Fig. 12 - CTR Frequency vs. Collector Current

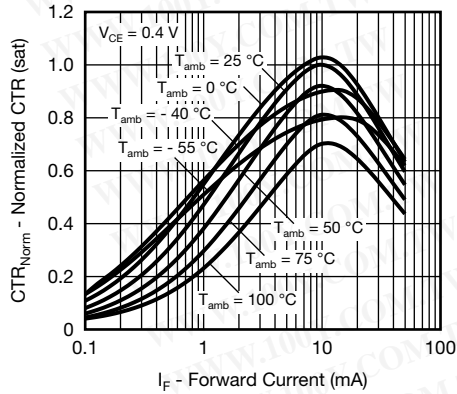


Fig. 10 - Normalized CTR (sat) vs. Forward Current

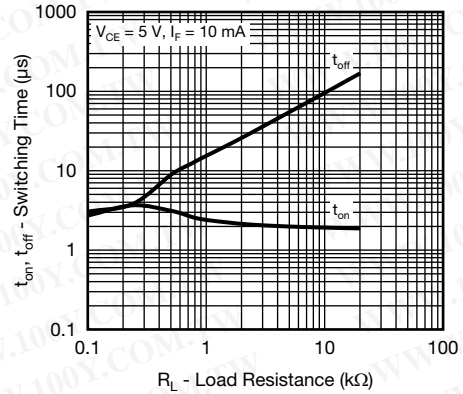


Fig. 13 - Switching Time vs. Load Resistance

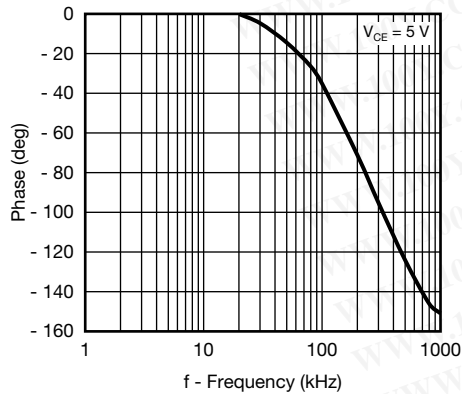
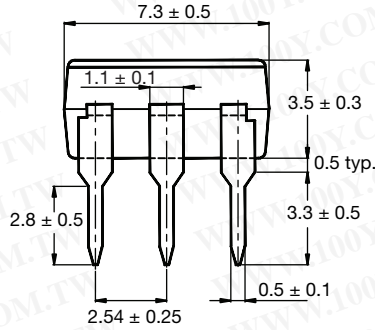
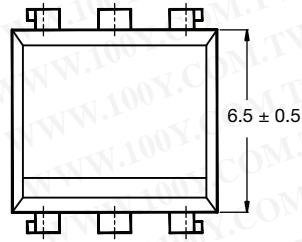


Fig. 11 - CTR Frequency vs. Phase Angle

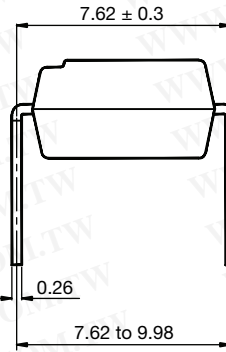


## PACKAGE DIMENSIONS in millimeters



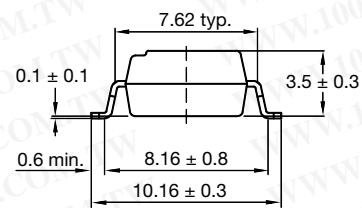
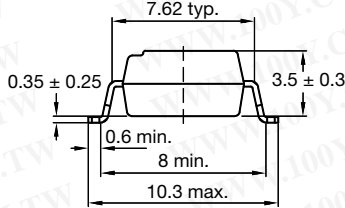
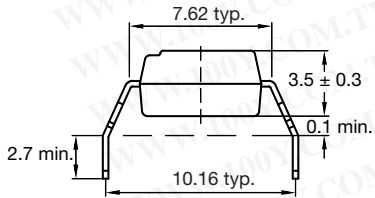
22530

Option 6

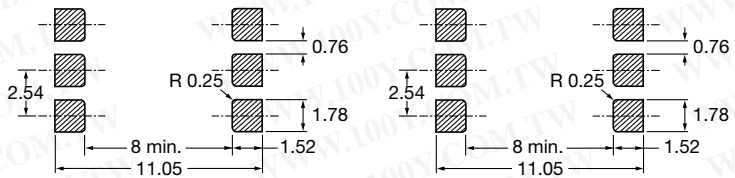


Option 7

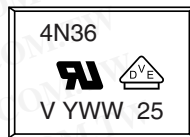
Option 9



20802-34



## PACKAGE MARKING



### Notes

- VDE logo is only marked on option 1 parts. Option information is not marked on the part.
- Tape and reel suffix (T) is not part of the package marking.



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