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November 2015

# FOD852

## 4-Pin DIP Photodarlington Output Optocoupler

### Features

- High Current Transfer Ratio: 1000% Minimum
- Safety and Regulatory Approvals
  - UL1577, 5,000 VAC<sub>RMS</sub> for 1 Minute
  - DIN EN/IEC60747-5-5

### Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

### Description

The FOD852 consists of gallium arsenide infrared emitting diode driving a silicon photodarlington output (with integral base-emitter resistor) in a 4-pin dual in-line package.

### Functional Block Diagram

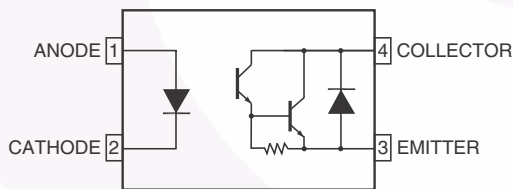


Figure 1. Schematic

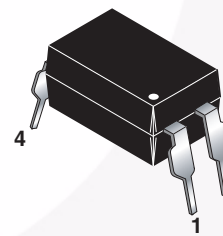


Figure 2. Package Outlines

## Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–III
Climatic Classification		30/110/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	1360	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1560	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	850	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6000	V <sub>peak</sub>
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	175	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	400	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	700	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>11</sup>	Ω

### Note:

1. Safety limit values – maximum values allowed in the event of a failure.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.  $T_A = 25^\circ\text{C}$  Unless otherwise specified.

Symbol	Parameter	Value	Units
<b>Total Device</b>			
$T_{STG}$	Storage Temperature	-55 to +125	$^\circ\text{C}$
$T_{OPR}$	Operating Temperature	-30 to +100	$^\circ\text{C}$
$T_J$	Junction Temperature	-55 to +100	$^\circ\text{C}$
$T_{SOL}$	Lead Solder Temperature	260 for 10 seconds	$^\circ\text{C}$
$P_{TOT}$	Total Device Power Dissipation	200	mW
<b>Input</b>			
$I_F$	Continuous Forward Current	50	mA
$V_R$	Reverse Voltage	6	V
$P_D$	LED Power Dissipation	70	mW
<b>Output</b>			
$V_{CEO}$	Collector-Emitter Voltage	300	V
$V_{ECO}$	Emitter-Collector Voltage	0.1	V
$I_C$	Continuous Collector Current	150	mA
$P_C$	Collector Power Dissipation	150	mW

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Input</b>						
$V_F$	Forward Voltage	$I_F = 10\text{ mA}$		1.2	1.4	V
$I_R$	Reverse Current	$V_R = 4\text{ V}$			10	$\mu\text{A}$
$C_t$	Terminal Capacitance	$V = 0, f = 1\text{ kHz}$		30	250	pF
<b>Output</b>						
$I_{CEO}$	Collector Dark Current	$V_{CE} = 200\text{ V}, I_F = 0$			200	nA
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 0.1\text{ mA}, I_F = 0$	300			V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 10\text{ }\mu\text{A}, I_F = 0$	0.1			V

### Transfer Characteristics

Symbol	DC Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$I_C$	Collector Current	$I_F = 1\text{ mA}, V_{CE} = 2\text{ V}$	10	40	150	mA
CTR	Current Transfer Ratio <sup>(2)</sup>		1,000	4,000	15,000	%
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$I_F = 20\text{ mA}, I_C = 100\text{ mA}$			1.2	V
$f_C$	Cut-Off Frequency	$V_{CE} = 2\text{ V}, I_C = 20\text{ mA}, R_L = 100\text{ }\Omega, -3\text{ dB}$	1	7		kHz
$t_R$	Response Time (Rise)	$V_{CE} = 2\text{ V}, I_C = 20\text{ mA}, R_L = 100\text{ }\Omega$		100	300	$\mu\text{s}$
$t_F$	Response Time (Fall)			20	100	$\mu\text{s}$

### Isolation Characteristics

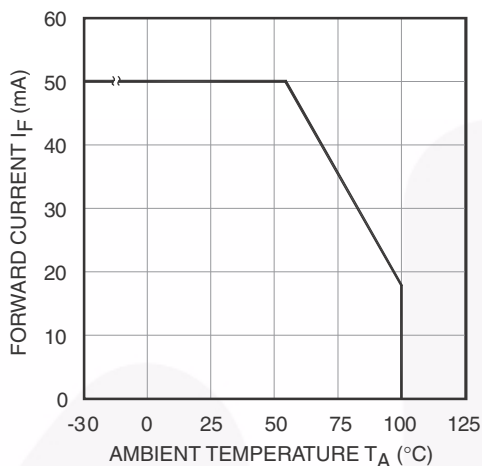
Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Units
$V_{ISO}$	Input-Output Isolation Voltage	$f = 60\text{ Hz}, t = 1\text{ minute}, I_{I-O} \leq 2\text{ }\mu\text{A}$	5000			$V_{AC_{RMS}}$
$R_{ISO}$	Isolation Resistance	$V_{I-O} = 500\text{ V}_{DC}$		$10^{12}$		$\Omega$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = 0, f = 1\text{ MHz}$		0.6	1.0	pf

**Note:**

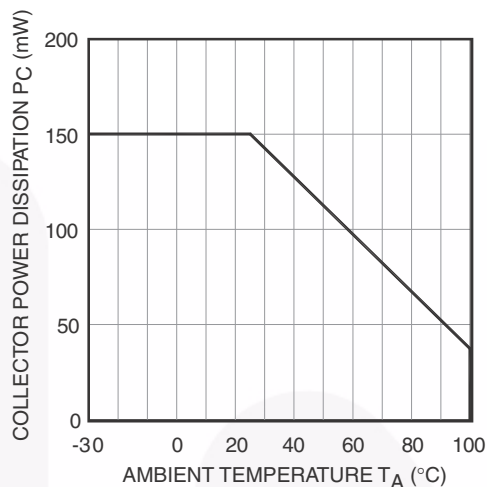
2. Current Transfer Ratio (CTR) =  $I_C / I_F \times 100\%$ .

### Typical Electrical/Optical Characteristic Curves

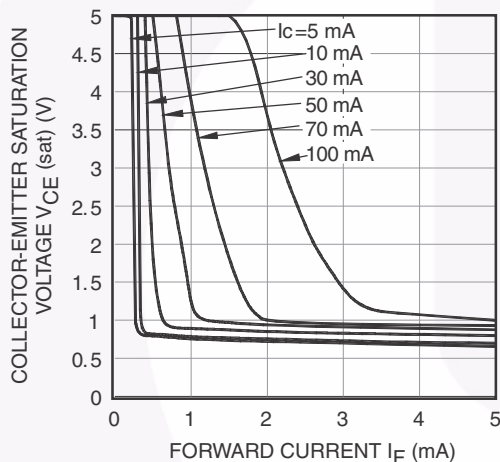
$T_A = 25^\circ\text{C}$  unless otherwise specified.



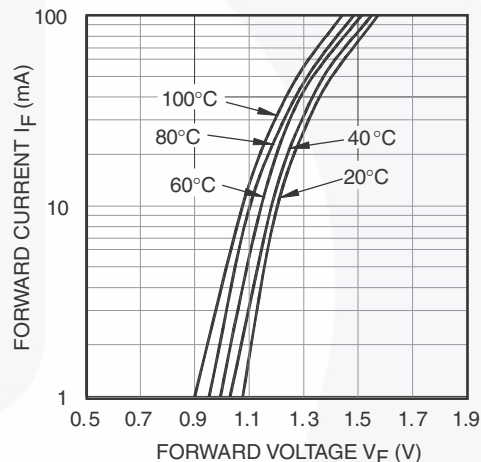
**Figure 3. Forward Current vs. Ambient Temperature**



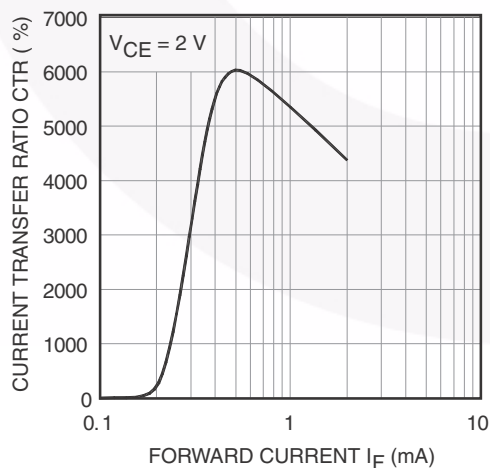
**Figure 4. Collector Power Dissipation vs. Ambient Temperature**



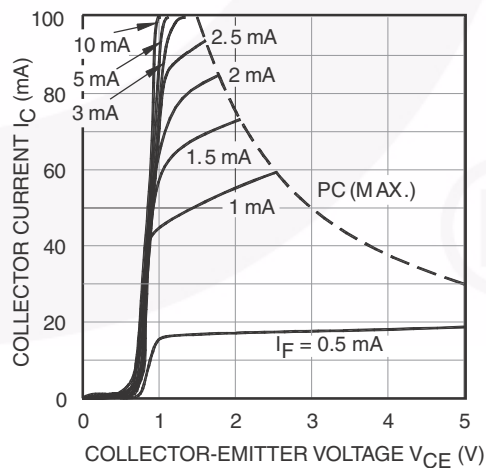
**Figure 5. Collector-Emitter Saturation Voltage vs. Forward Current**



**Figure 6. Forward Current vs. Forward Voltage**



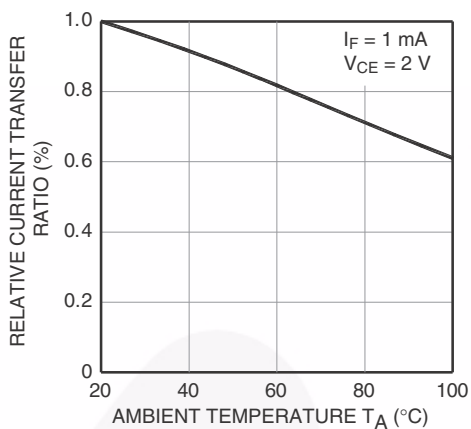
**Figure 7. Current Transfer Ratio vs. Forward Current**



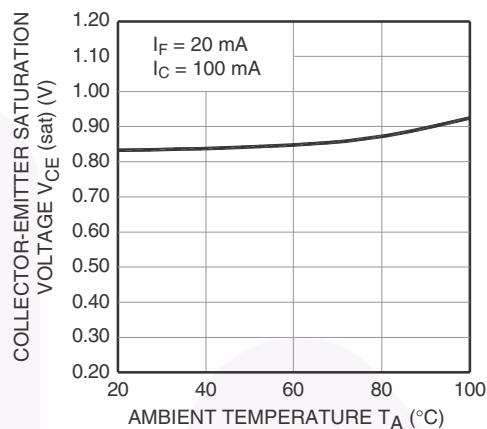
**Figure 8. Collector Current vs. Collector-Emitter Voltage**

### Typical Electrical/Optical Characteristic Curves (Continued)

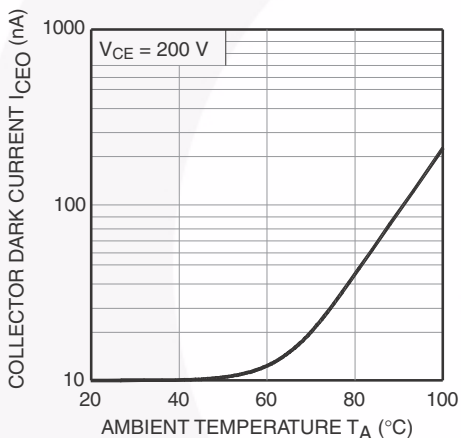
$T_A = 25^\circ\text{C}$  unless otherwise specified.



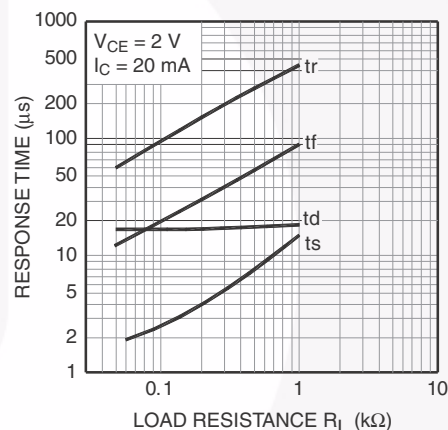
**Figure 9. Relative Current Transfer Ratio vs. Ambient Temperature**



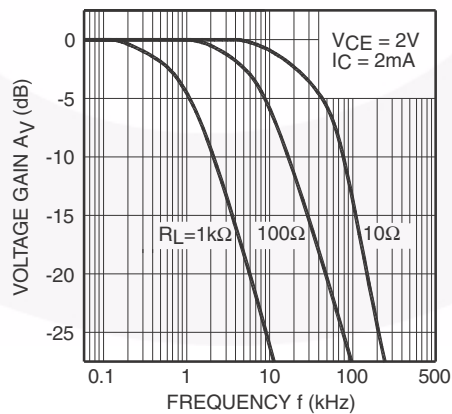
**Figure 10. Collector-Emitter Saturation Voltage vs. Ambient Temperature**



**Figure 11. Collector Dark Current vs. Ambient Temperature**



**Figure 12. Response Time vs. Load Resistance**



**Figure 13. Frequency Response**

## Test Circuits

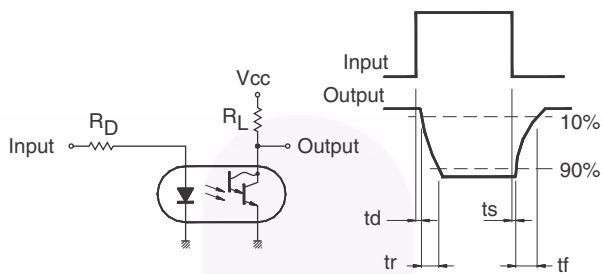


Figure 14. Test Circuit for Response Time

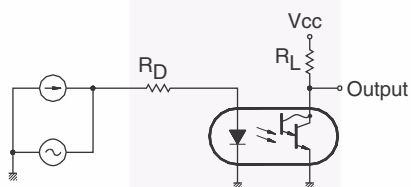
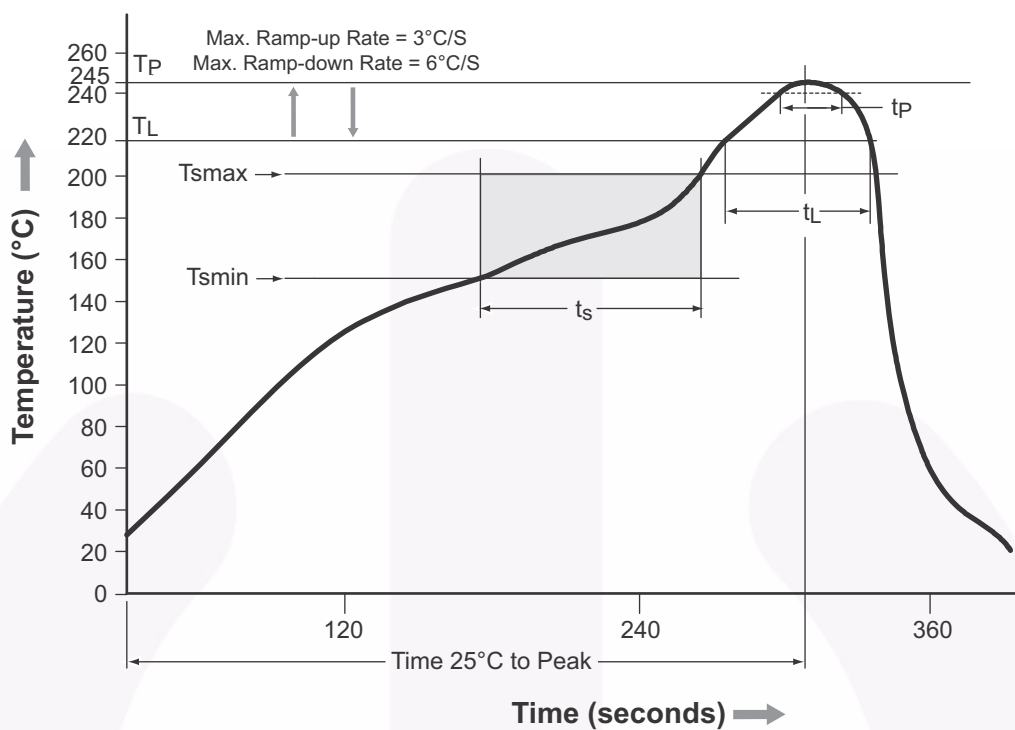


Figure 15. Test Circuit for Frequency Response



### Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60–120 seconds
Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.
Liquidous Temperature (T <sub>L</sub> )	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60–150 seconds
Peak Body Package Temperature	245°C +0°C / -5°C
Time (t <sub>P</sub> ) within 5°C of 260°C	30 seconds
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

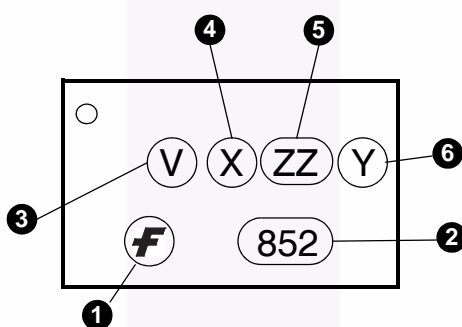
Figure 16. Reflow Profile



## Ordering Information

Part Number	Package	Packing Method
FOD852	DIP 4-Pin	Tube (100 units per tube)
FOD852S	SMT 4-Pin (Lead Bend)	Tube (100 units per tube)
FOD852SD	SMT 4-Pin (Lead Bend)	Tape and Reel (1,000 units per reel)
FOD852300	DIP 4-Pin, DIN EN/IEC60747-5-5 option	Tube (100 units per tube)
FOD8523S	SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option	Tube (100 units per tube)
FOD8523SD	SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option	Tape and Reel (1,000 units per reel)
FOD852300W	DIP 4-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 option	Tube (100 units per tube)

## Marking Information



Definitions	
1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on parts ordered with this option)
4	One-Digit Year Code, e.g., '5'
5	Two-Digit Work Week, Ranging from '01' to '53'
6	Assembly Package Code Y = Manufactured in Thailand YA = Manufactured in China

### Carrier Tape Specifications

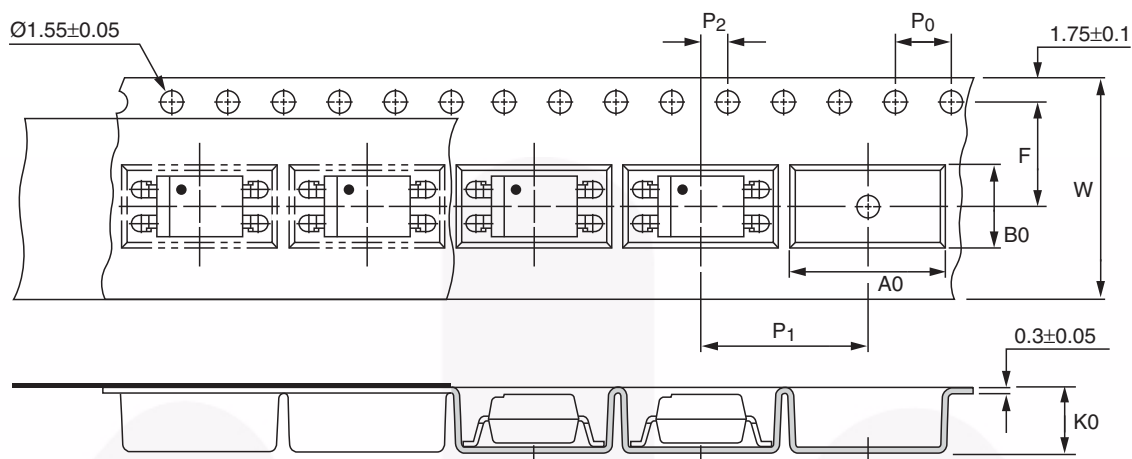


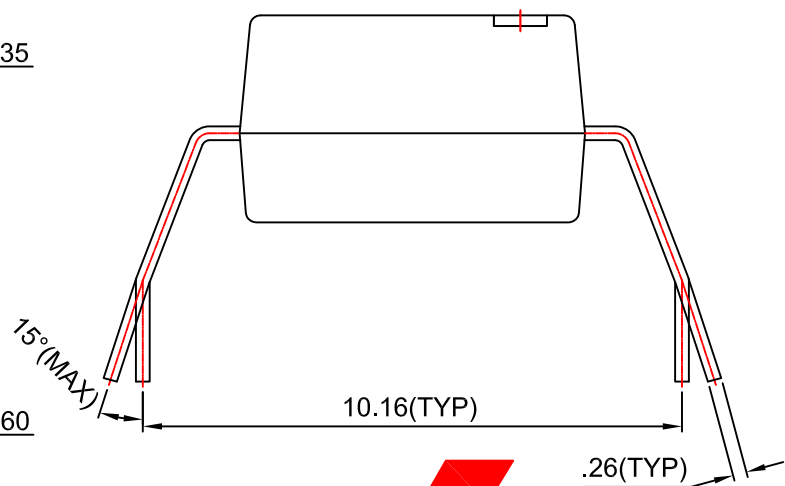
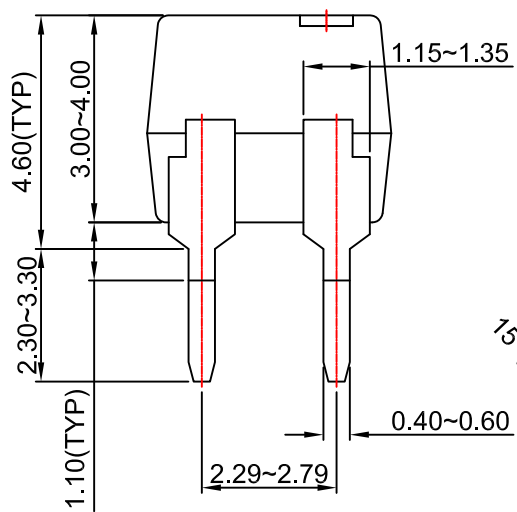
Figure 17. Carrier Tape Specification

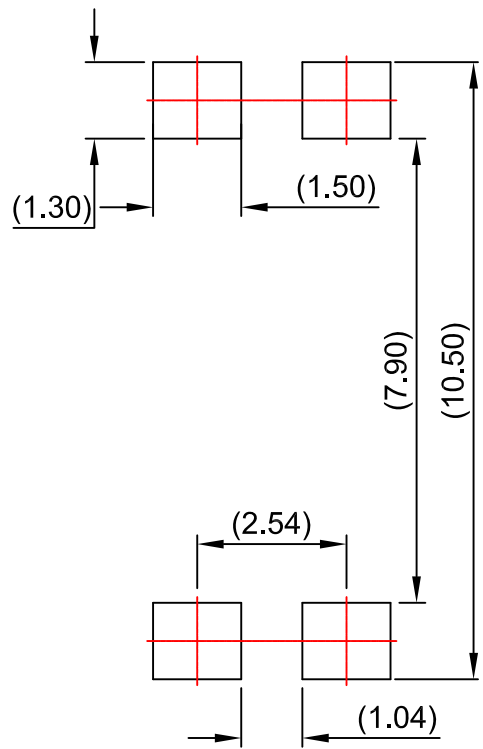
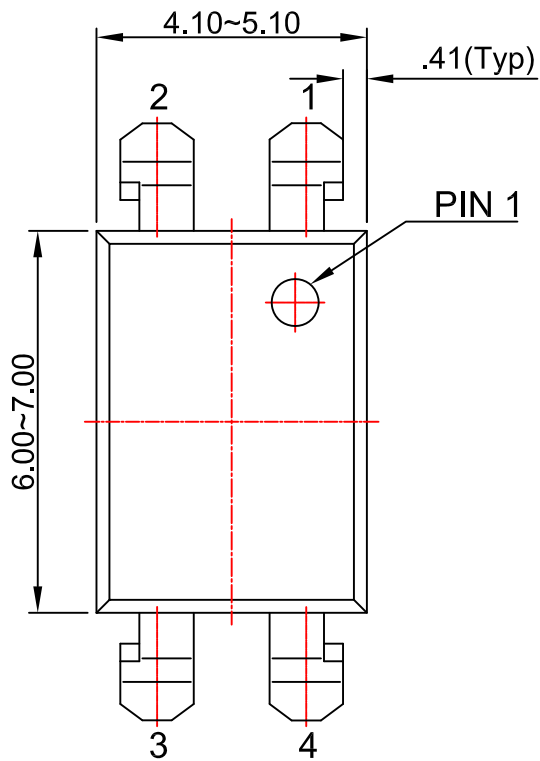
Symbol	Description	Dimensions in mm (inches)
W	Tape wide	16 ± 0.3 (0.63)
P <sub>0</sub>	Pitch of sprocket holes	4 ± 0.1 (0.15)
F	Distance of compartment	7.5 ± 0.1 (0.295)
P <sub>2</sub>		2 ± 0.1 (0.079)
P <sub>1</sub>	Distance of compartment to compartment	12 ± 0.1 (0.472)
A <sub>0</sub>	Compartment	10.45 ± 0.1 (0.411)
B <sub>0</sub>		5.30 ± 0.1 (0.209)
K <sub>0</sub>		4.25 ± 0.1 (0.167)



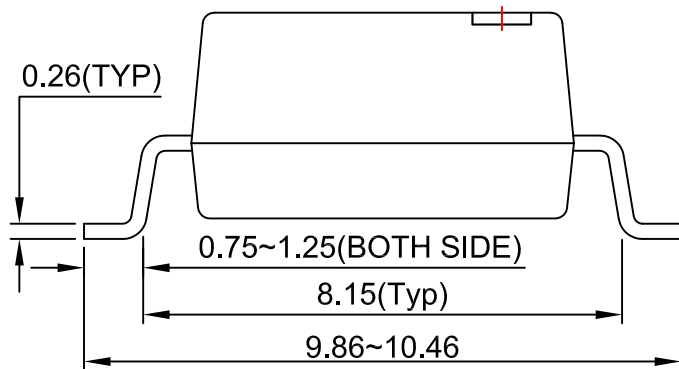
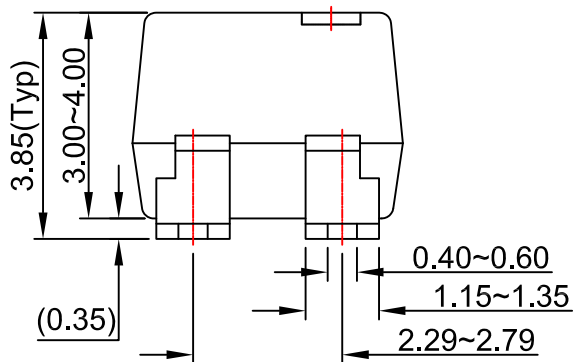
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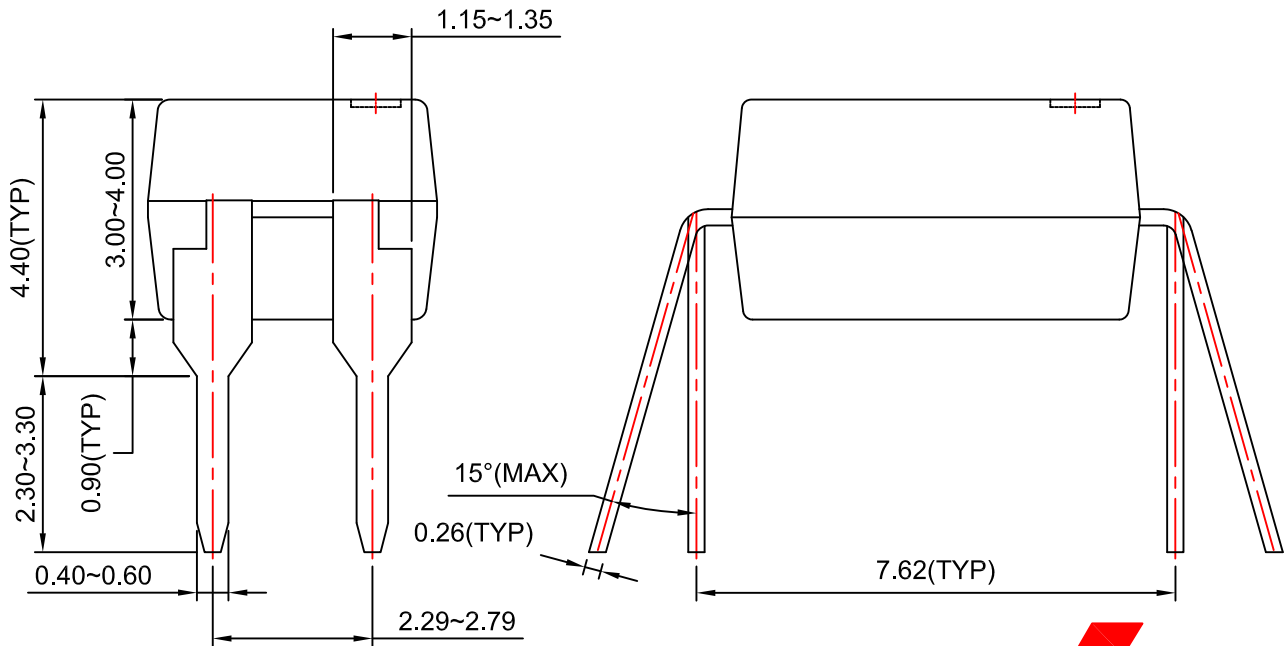
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