



# CTW135, CTW136, CTW4502, CTW4503

## 9mm, 1Mbit/s High Speed Phototransistor Optocoupler

### Features

- High speed 1MBit/s
- High isolation voltage between input and output (Viso=5000 Vrms )
- Guaranteed CTR performance from 0°C to 70°C
- Operating temperature range -55°C to 100°C
- MSL class 1
- Regulatory Approvals
  - ✓ UL - UL1577 (E364000)
  - ✓ VDE - EN60747-5-5(VDE0884-5)
  - ✓ CQC – GB4943.1, GB8898(19001231774)
  - ✓ IEC62368 (FI/41119)

### Description

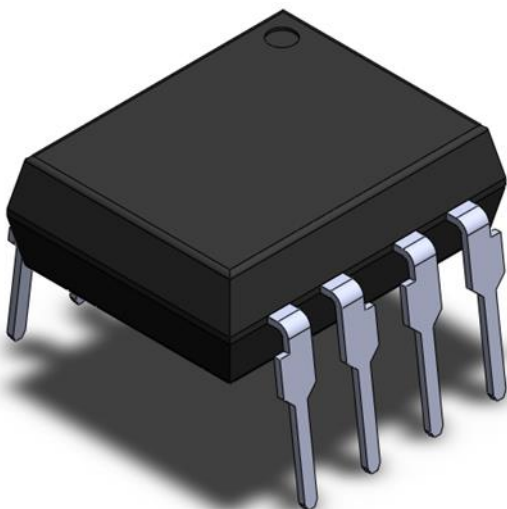
The CTW135, CTW136, CTW4502, and CTW4503 devices each consist of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor.

The device is packaged in an 8-pin wide body DIP and also available in surface mount option.

### Applications

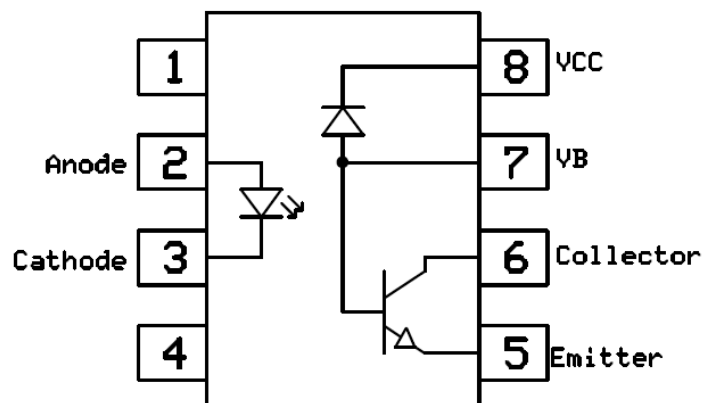
- Line receivers
- Telecommunication equipment
- High speed logic ground isolation
- Feedback loop in switch-mode power supplies
- Home appliances

### Package Outline



Note: Different bending options available. See package dimension.

### Schematic



### CTW135 / CTW136

Pin 7 not connected for CTW4502/CTW4503



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### Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ , 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. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameters	Ratings	Units	Notes
V <sub>ISO</sub>	Isolation voltage (AC, 1 minute, 40 ~ 60% R.H.)	5000	V <sub>RMS</sub>	
T <sub>OPR</sub>	Operating temperature	-55 ~ +100	°C	
T <sub>STG</sub>	Storage temperature	-55 ~ +125	°C	
T <sub>SOL</sub>	Soldering temperature (For 10 seconds)	260	°C	
<b>Emitter</b>				
I <sub>F</sub>	Forward current	25	mA	
I <sub>FP</sub>	Peak forward current (50% duty, 1ms P.W)	50	mA	
I <sub>F(TRANS)</sub>	Peak transient current (≤1μs P.W,300pps)	1	A	
V <sub>R</sub>	Reverse voltage	5	V	
P <sub>D</sub>	Power dissipation	40	mW	
<b>Detector</b>				
P <sub>D</sub>	Power dissipation	100	mW	
V <sub>EBR</sub>	Emitter-Base reverse voltage	5	V	
I <sub>B</sub>	Base current	5	mA	
I <sub>O(AVG)</sub>	Average Output current	8	mA	
I <sub>O (Peak)</sub>	Peak Output current	16	mA	
V <sub>O</sub>	Output voltage	-0.5 to 20	V	
V <sub>CC</sub>	Supply voltage	-0.5 to 30	V	



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### Electrical Characteristics $T_A = 0 - 70^\circ\text{C}$ (unless otherwise specified). Typical values are measured at $T_A = 25^\circ\text{C}$ and $V_{CC}=5\text{V}$

#### Emitter Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
$V_F$	Forward voltage	$I_F = 16\text{mA}$	-	1.45	1.6	V	
$V_R$	Reverse Voltage	$I_R = 10\mu\text{A}$	5.0	-	-	V	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	$I_F = 16\text{mA}$	-	-1.8	-	mV/°C	

#### Detector Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
$I_{OH}$	Logic High Output Current	$I_F=0\text{mA}$ , $V_O=V_{CC}=5.5\text{V}$ , $T_A=25^\circ\text{C}$	-	0.001	0.5	$\mu\text{A}$	
		$I_F=0\text{mA}$ , $V_O=V_{CC}=15\text{V}$ , $T_A=25^\circ\text{C}$	-	0.01	1		
		$I_F=0\text{mA}$ , $V_O=V_{CC}=15\text{V}$	-	-	50		
$I_{CCL}$	Logic Low Supply Current	$I_F=16\text{mA}$ , $V_O=\text{Open}$ , $V_{CC}=15\text{V}$	-	140	200	$\mu\text{A}$	
$I_{CCH}$	Logic High Supply Current	$I_F=0\text{mA}$ , $V_O=\text{Open}$ , $V_{CC}=15\text{V}$ , $T_A=25^\circ\text{C}$	-	0.01	1	$\mu\text{A}$	
		$I_F=0\text{mA}$ , $V_O=\text{Open}$ , $V_{CC}=15\text{V}$	-	-	2		



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### Electrical Characteristics $T_A = 0 - 70^\circ\text{C}$ (unless otherwise specified). Typical values are measured at $T_A = 25^\circ\text{C}$ and $V_{CC}=5\text{V}$

#### Transfer Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes					
CTR	Current Transfer Ratio	CTW135 CTW4502	$I_F=16\text{mA}, V_O=0.4\text{V}, V_{CC}=4.5\text{V},$ $T_A=25^\circ\text{C}$	7	-	50	%					
		CTW136 CTW4503		19	-	50						
		CTW135 CTW4502	$I_F=16\text{mA}, V_O=0.5\text{V}, V_{CC}=4.5\text{V}$	5	-	-						
		CTW136 CTW4503		15	-	-						
		V <sub>OL</sub>	Logic Low Output Voltage	CTW135 CTW4502	$I_F=16\text{mA}, I_O=1.1\text{mA}, V_{CC}=4.5\text{V},$ $T_A=25^\circ\text{C}$	-			0.18	0.4	V	
				CTW136 CTW4503		-			0.18	0.4		
CTW135 CTW4502	$I_F=16\text{mA}, I_O=0.8\text{mA},$ $V_{CC}=4.5\text{V}$			-	-	0.5						
CTW136 CTW4503				-	-	0.5						



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### Electrical Characteristics $T_A = 0 - 70^\circ\text{C}$ (unless otherwise specified). Typical values are measured at $T_A = 25^\circ\text{C}$ and $V_{CC} = 5\text{V}$

#### Switching Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes	
$T_{PHL}$	Propagation Delay Time Logic High to Logic Low	CTW135	$R_L = 4.1\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	-	0.35	1.5	$\mu\text{s}$	
		CTW4502	$R_L = 4.1\text{K}\Omega$	-	-	2.0		
	CTW136	$R_L = 1.9\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	-	0.35	0.8			
	CTW4503	$R_L = 1.9\text{K}\Omega$	-	-	1.0			
$T_{PLH}$	Propagation Delay Time Logic Low to Logic High	CTW135	$R_L = 4.1\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	-	0.5	1.5	$\mu\text{s}$	
		CTW4502	$R_L = 4.1\text{K}\Omega$	-	-	2.0		
	CTW136	$R_L = 1.9\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	-	0.3	0.8			
	CTW4503	$R_L = 1.9\text{K}\Omega$	-	-	1.0			
$CM_H$	Common Mode Transient Immunity at Logic High	CTW135	$I_F = 0\text{mA}$ , $V_{CM} = 10\text{Vp-p}$ , $R_L = 4.1\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	1,000	-	-	$\text{V}/\mu\text{s}$	
		CTW136	$I_F = 0\text{mA}$ , $V_{CM} = 10\text{Vp-p}$ , $R_L = 1.9\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	1,000	-	-		
		CTW4502 CTW4503	$I_F = 0\text{mA}$ , $V_{CM} = 1500\text{Vp-p}$ , $R_L = 1.9\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	15,000	20,000			
$CM_L$	Common Mode Transient Immunity at Logic Low	CTW135	$I_F = 16\text{mA}$ , $V_{CM} = 10\text{Vp-p}$ , $R_L = 4.1\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	1,000	-	-	$\text{V}/\mu\text{s}$	
		CTW136	$I_F = 16\text{mA}$ , $V_{CM} = 1500\text{Vp-p}$ , $R_L = 1.9\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	1,000	-	-		
		CTW4502 CTW4503	$I_F = 16\text{mA}$ , $V_{CM} = 1500\text{Vp-p}$ , $R_L = 1.9\text{K}\Omega$ , $T_A = 25^\circ\text{C}$	15,000	20,000			



### Typical Characteristic Curves $T_A = 25^\circ\text{C}$ , unless otherwise specified

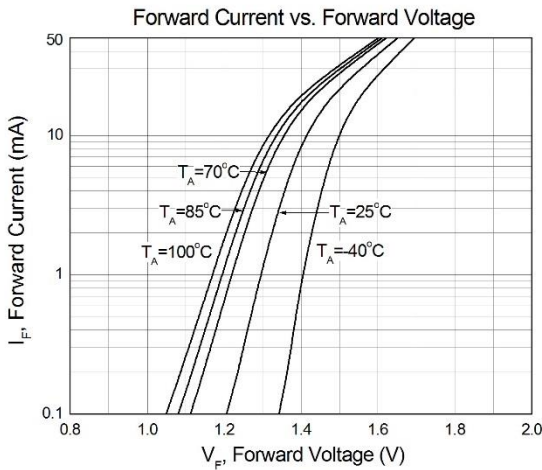


Figure 1

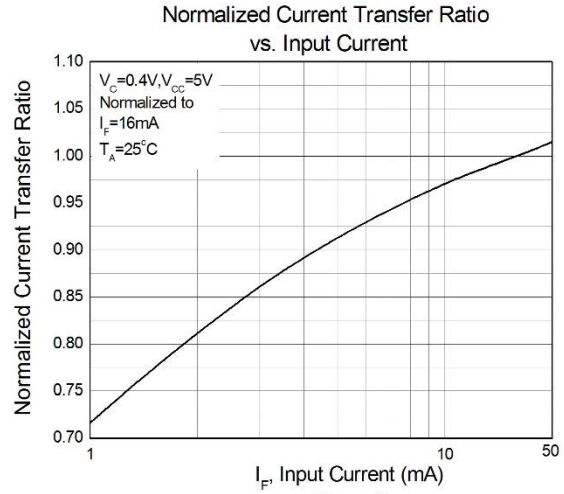


Figure 2

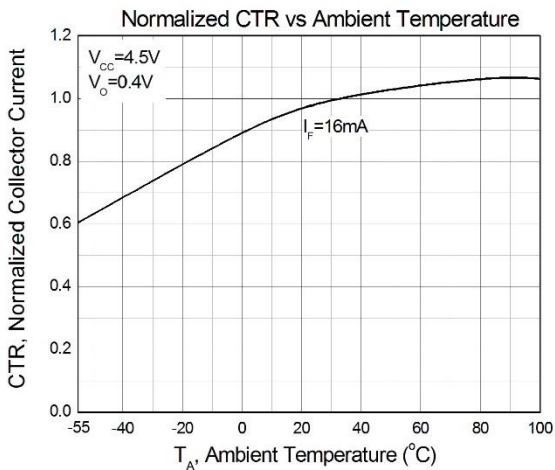


Figure 3

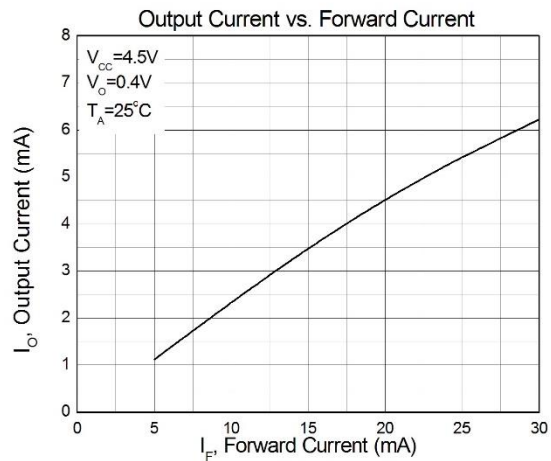


Figure 4

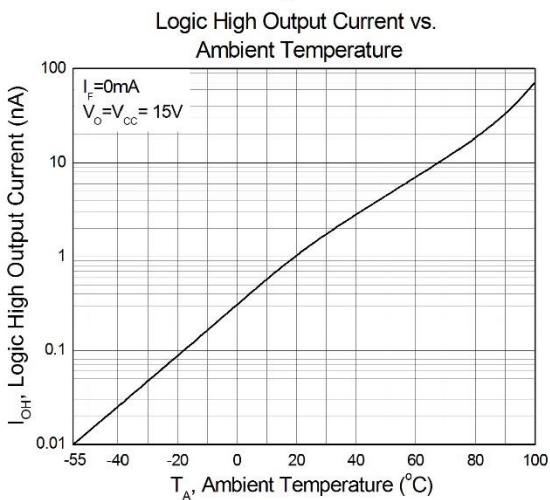


Figure 5

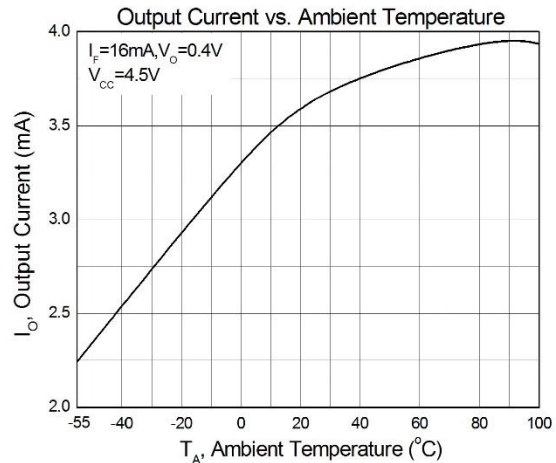


Figure 6



### Typical Characteristic Curves $T_A = 25^\circ\text{C}$ , unless otherwise specified

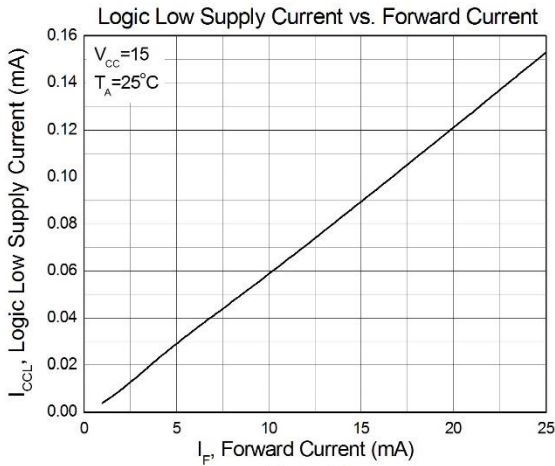


Figure 7

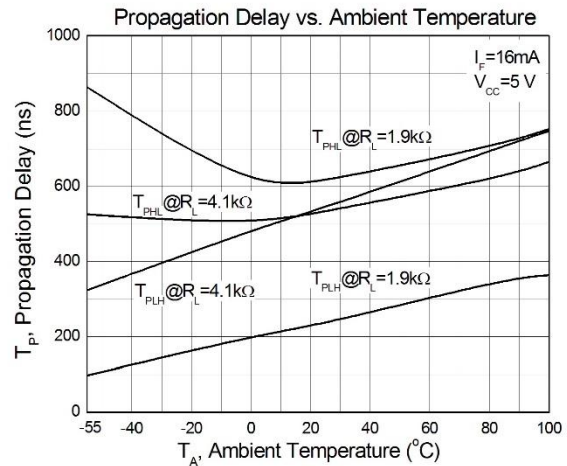


Figure 8

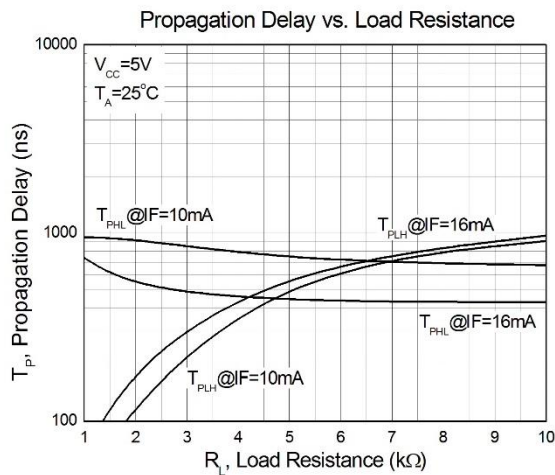


Figure 9



# CTW135, CTW136, CTW4502, CTW4503

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### Test Circuits

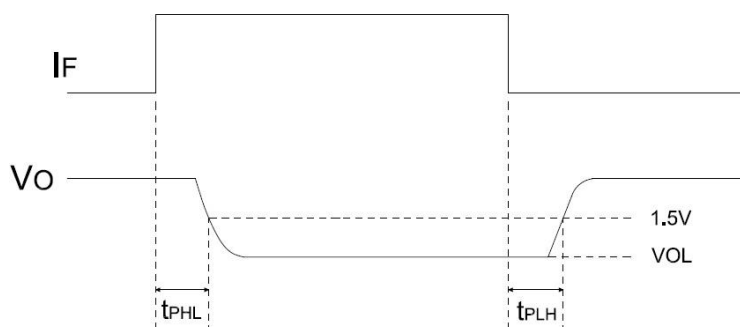
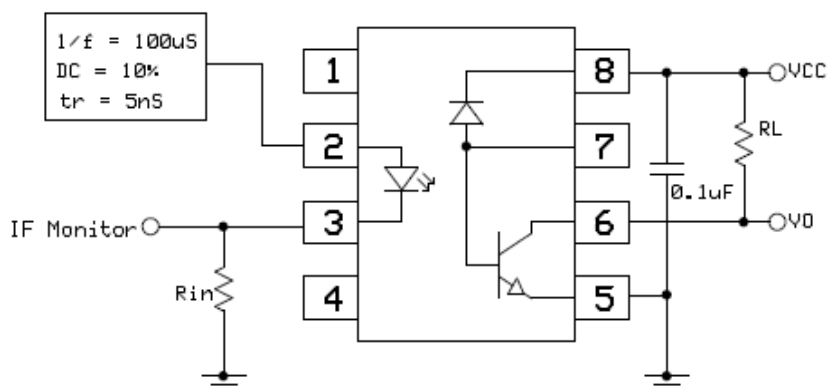


Figure 10: Switching Time Test Circuits





### Test Circuits

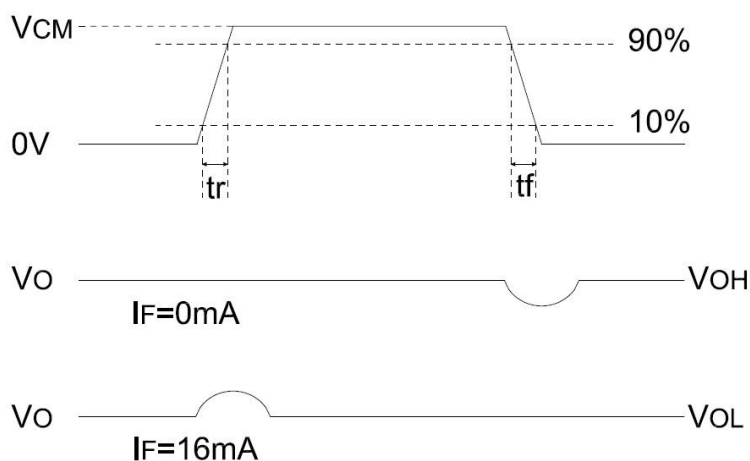
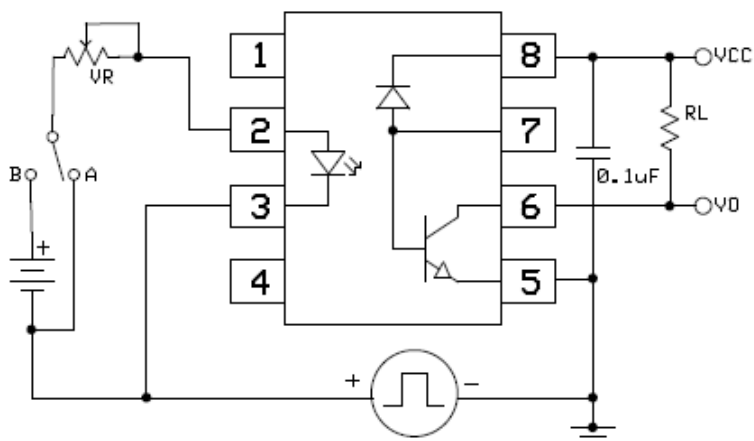


Figure 11: CMR Test Circuit

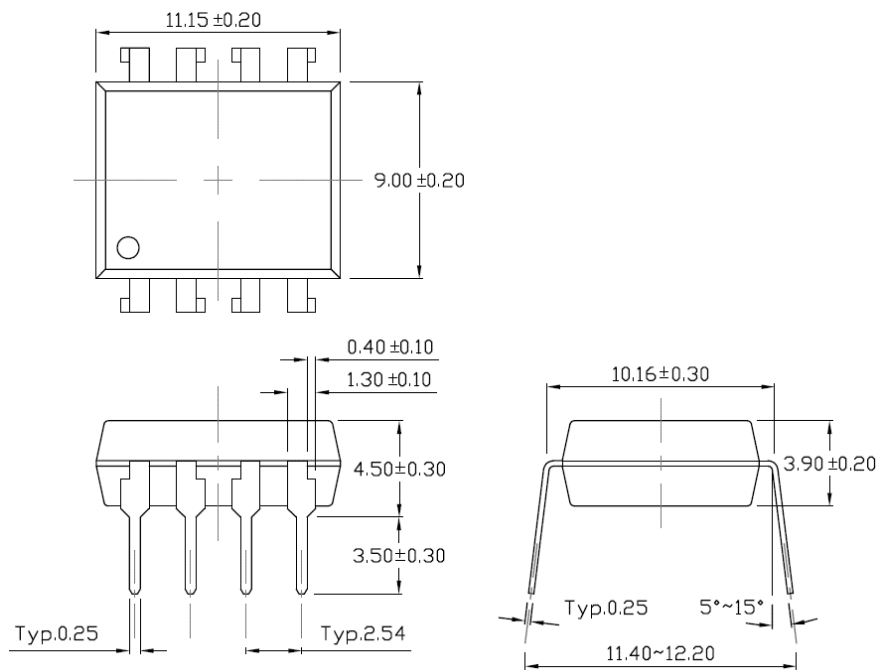


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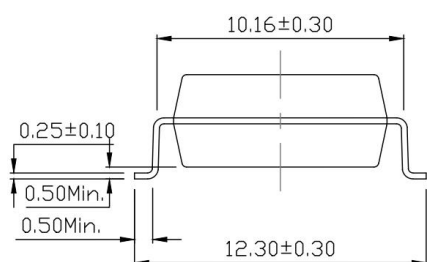
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### Package Dimension *Dimensions in mm unless otherwise stated*

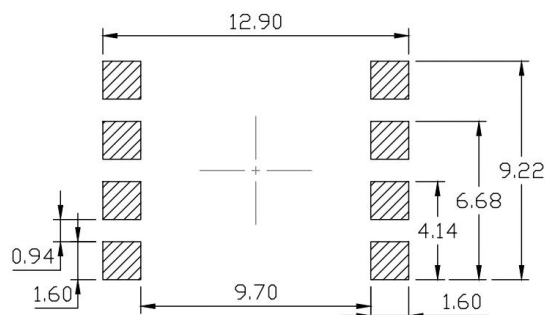
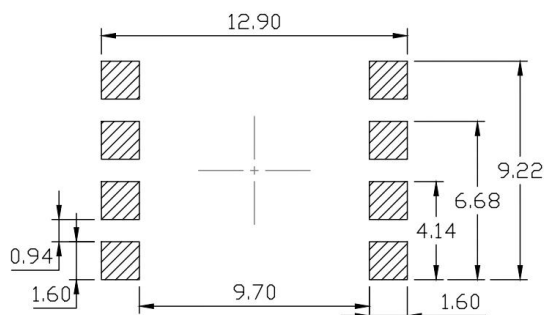
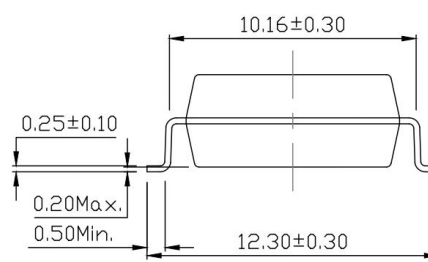


### Package Dimension *Dimensions in mm unless otherwise stated*

#### S Type



#### SL Type

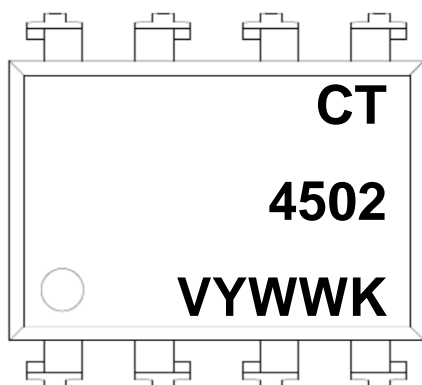




# CTW135, CTW136, CTW4502, CTW4503

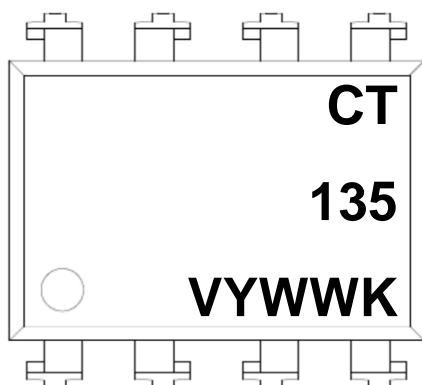
## 9mm, 1Mbit/s High Speed Phototransistor Optocoupler

### Marking Information



**Note:**

- CT : Denotes “CT Micro”
- 4502 : Part Number
- V : VDE Safety Mark Option (Blank or V)
- Y : One Digit Year Code
- WW : Two Digit Work Week
- K : Manufacturing Code



**Note:**

- CT : Denotes “CT Micro”
- 6N135 : Part Number
- V : VDE Safety Mark Option (Blank or V)
- Y : One Digit Year Code
- WW : Two Digit Work Week
- K : Manufacturing Code



# CTW135, CTW136, CTW4502, CTW4503

## 9mm, 1Mbit/s High Speed Phototransistor Optocoupler

### Ordering Information

#### CTW13X(V)(Y)(Z)

- X = Part Number (5,6 for CTW13X series)
- V = VDE Safety Mark Option (Blank or V)
- Y = Lead Form Option (SL or none)
- Z = Tape and Reel Option (Blank, T1 or T2)

#### CT450X(V)(Y)(Z)

- X = Part Number (2,3 for CTW450X series)
- V = VDE Safety Mark Option (Blank or V)
- Y = Lead Form Option (SL or none)
- Z = Tape and Reel Option (Blank, T1 or T2)

<b>Option</b>	<b>Description</b>	<b>Quantity</b>
None	Standard 8 Pin Dip	40 Units/Tube
S(T1)	Surface Mount (Low Profile) Lead Forming– With Option 1 Taping	750 Units/Reel
S(T2)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	750 Units/Reel
SL(T1)	Surface Mount (Low Profile) Lead Forming– With Option 1 Taping	750 Units/Reel
SL(T2)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	750 Units/Reel



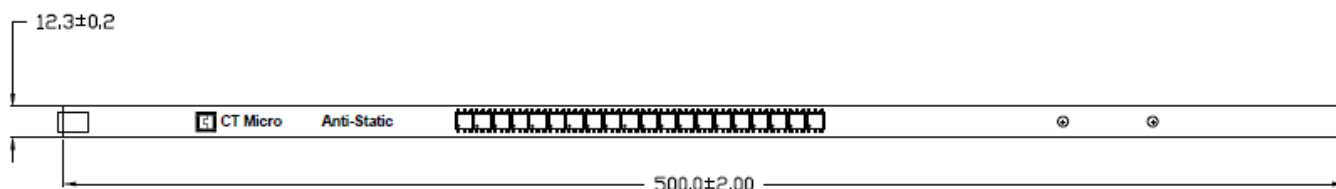
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# CTW135, CTW136, CTW4502, CTW4503

## 9mm, 1Mbit/s High Speed Phototransistor Optocoupler

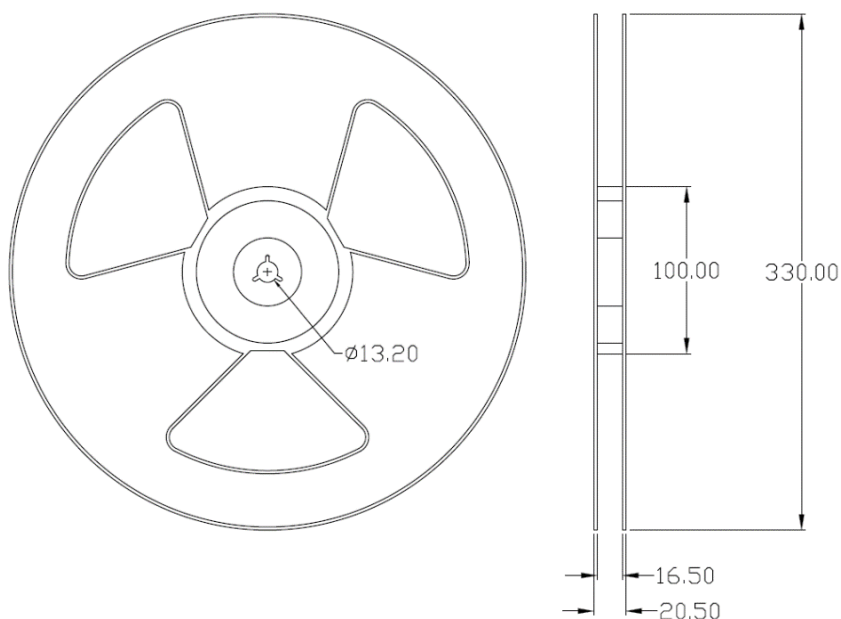
### Carrier Specifications *Dimensions in mm unless otherwise stated*

#### Tube Option Standard DIP



### Reel Dimension *All dimensions are in mm, unless otherwise stated*

#### Option S(T1/T2)

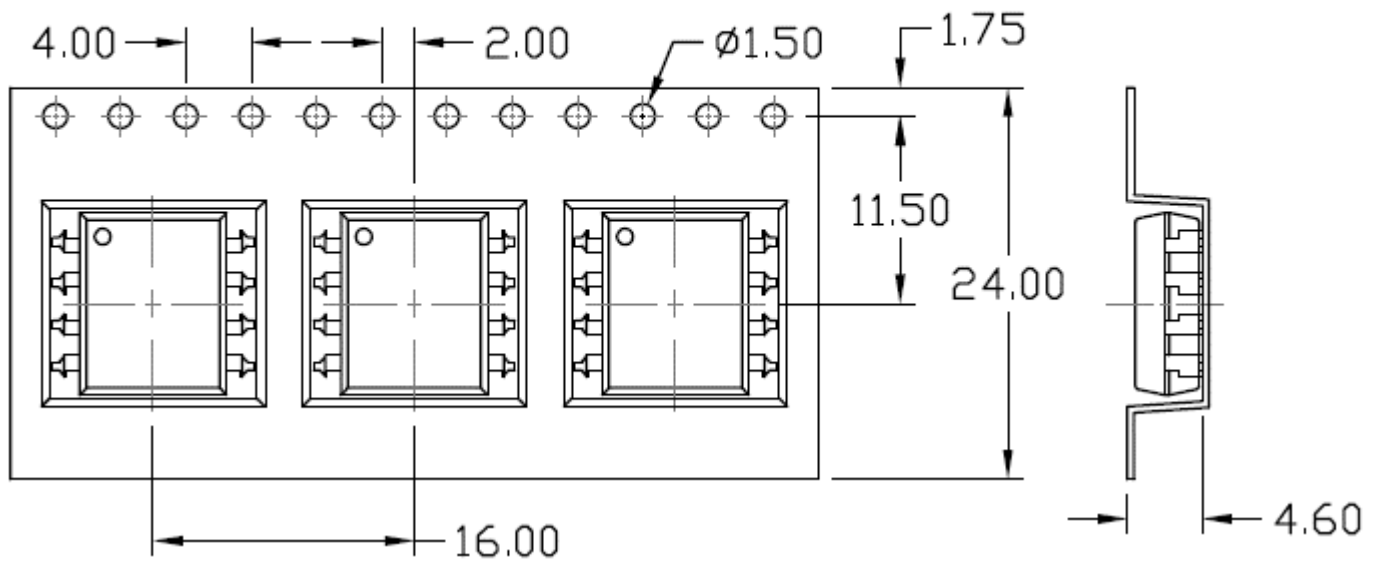




**Carrier Tape Specifications** *Dimensions in mm unless otherwise stated*

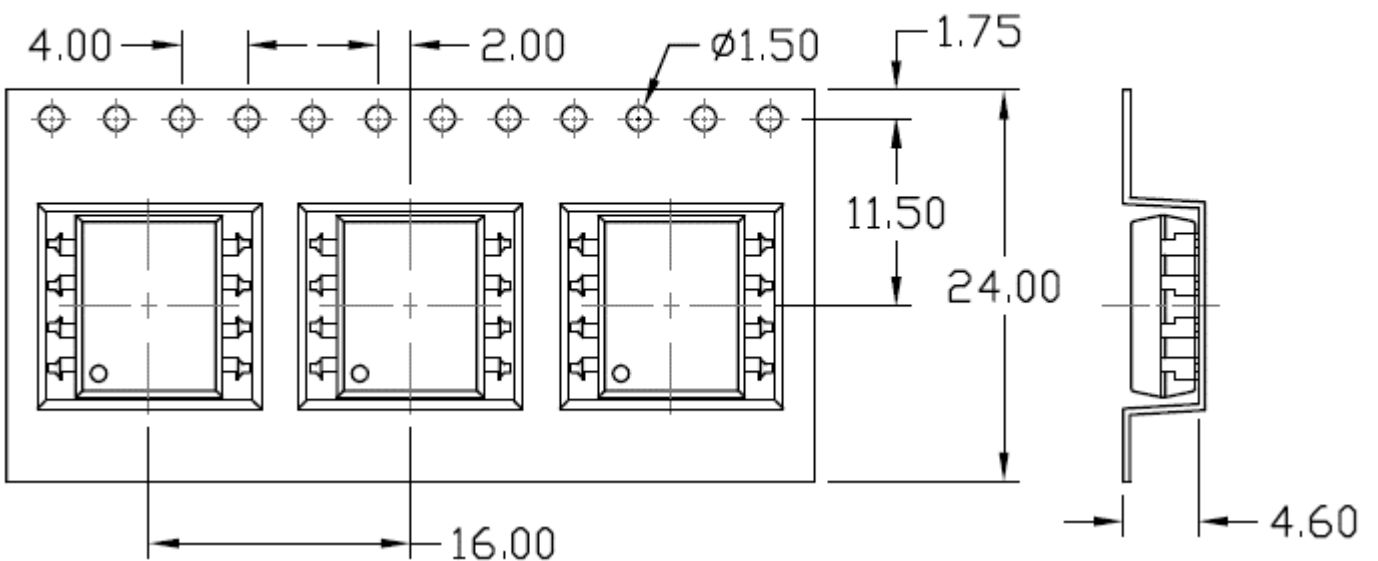
**Option SL(T1)**

Input Direction



**Option SL(T2)**

Input Direction





### Solderability spec (Follow the JEDEC standard JESD22-B102)

Reflow Soldering: Immersed surface, other than the end of pin as cut-surface, must be covered by solder.

Solder-Bath: More than 95% of the electrode must be covered with solder.

### Wave soldering (Follow the JEDEC standard JESD22-A111)

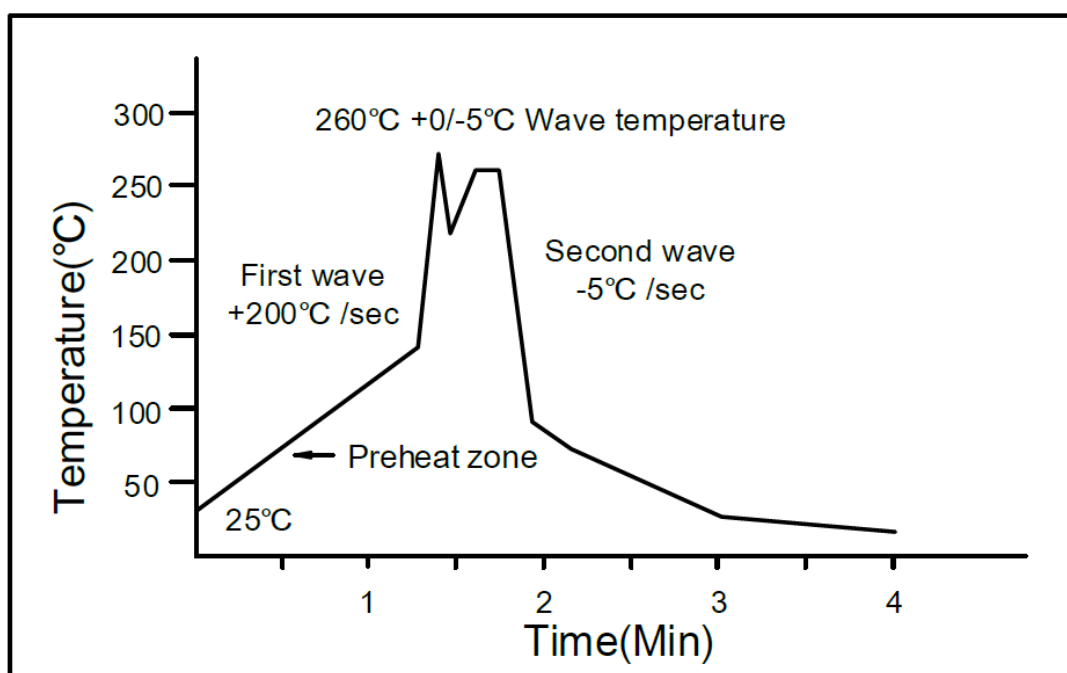
One time soldering is recommended within the condition of temperature.

Temperature:  $260 \pm 0/-5^\circ\text{C}$ .

Time: 10 sec.

Preheat temperature: 25 to  $140^\circ\text{C}$ .

Preheat time: 30 to 80 sec.



### Iron soldering (Follow the standard MIL-STD 202G, Method 210F)

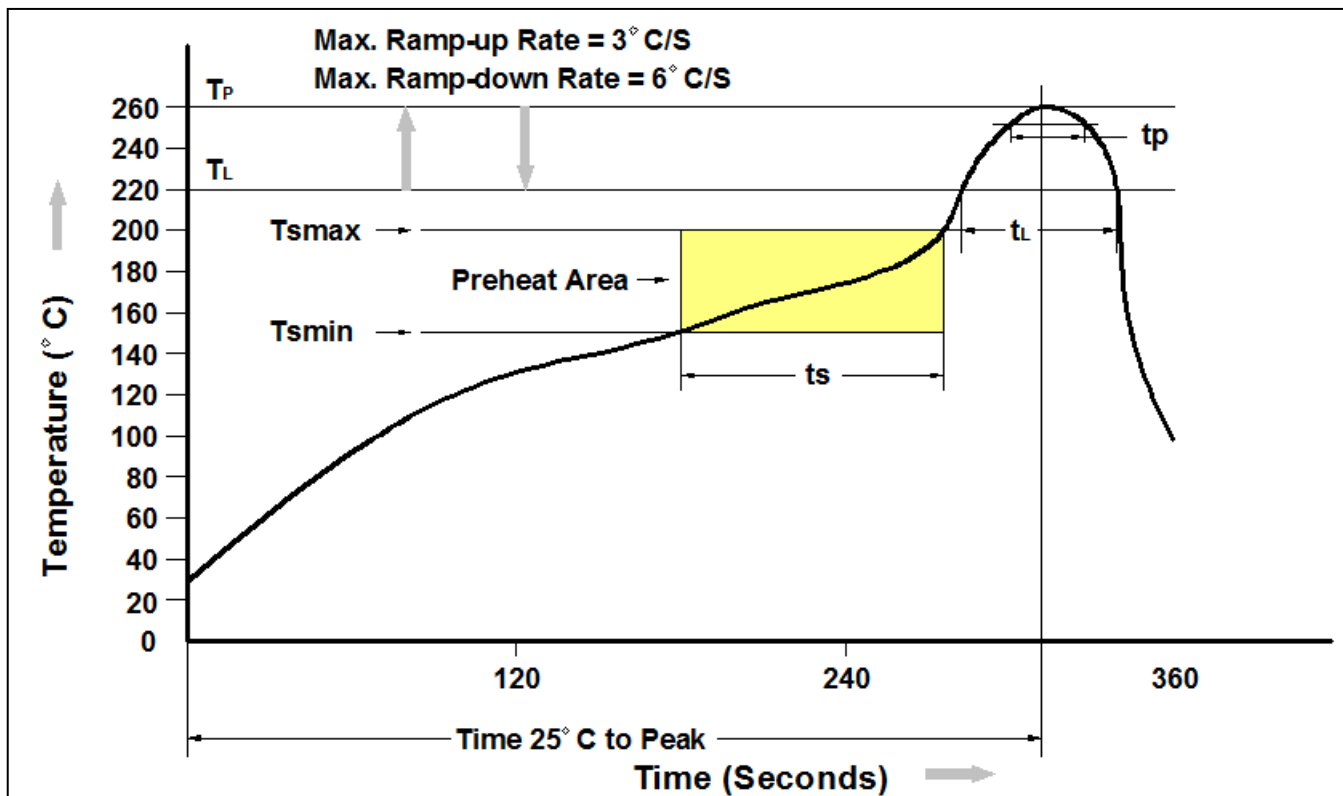
Allow single lead soldering in every single process.

One time soldering is recommended. Temperature:  $350 \pm 10^\circ\text{C}$

Time: 5 sec max.



**Reflow Profile (Follow the JEDEC standard J-STD-020)**



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T Amin)	150°C
Temperature Max. (Tsmax)	200°C
Time (ts) from (T Amin to Tsmax)	60-120 seconds
Ramp-up Rate (tL to tp)	3°C/second max.
Liquidous Temperature (TL)	217°C
Time (tL) Maintained Above (TL)	60 – 150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time (tp) within 5°C of 260°C	30 seconds
Ramp-down Rate (TP to TL)	6°C/second max
Time 25°C to Peak Temperature	8 minutes max.





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- 2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.*