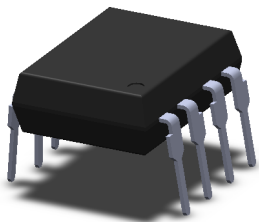


### 8 PIN DIP WIDE BODY HIGH SPEED 1Mbit/s TRANSISTOR PHOTOCOUPLER ELW135 ELW136 ELW4503



#### Features

- High speed 1Mbit/s
- High isolation voltage between input and output (Viso=5000 Vrms )
- Guaranteed performance from 0°C to 70 °C
- Wide operating temperature range of -55°C to 100 °C
- Pb free and RoHS compliant
- UL approved (No. 214129)
- VDE approved (No. 40028391)
- SEMKO approved
- NEMKO approved
- DEMKO approved
- FIMKO approved

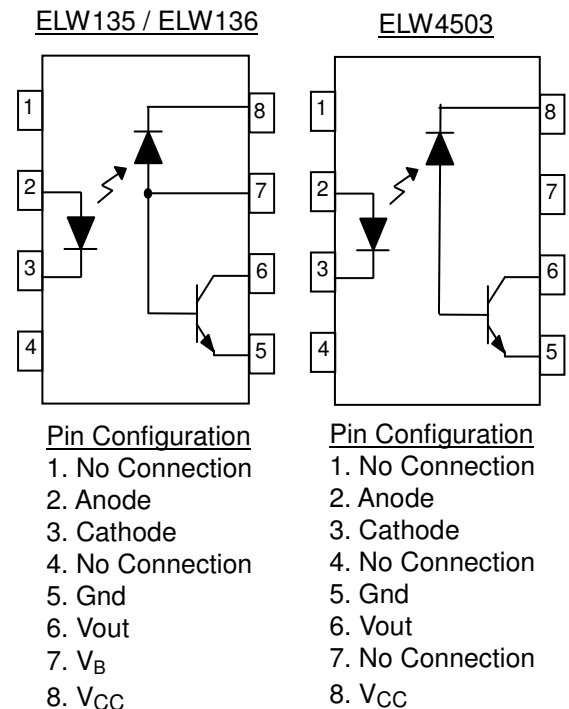
#### Description

The ELW135, ELW136 and ELW4503 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 devices are packaged in an 8-pin DIP wide body package and available in wide-lead spacing and SMD option.

#### Applications

- Line receivers
- Telecommunication equipments
- Power transistor isolation in motor drives
- Replacement for low speed phototransistor photo couplers
- Feedback loop in switch-mode power supplies
- Home appliances
- High speed logic ground isolation

#### Schematic



**Absolute Maximum Ratings (Ta=25°C)**

| Parameter                           |  | Symbol                        | Rating     | Unit  |
|-------------------------------------|--|-------------------------------|------------|-------|
| Input                               | Forward current  | $I_F$                         | 25         | mA    |
|                                     | Peak forward current<br>(50% duty, 1ms P.W)            | $I_{FP}$                      | 50         | mA    |
|                                     | Peak transient current<br>( $\leq 1\mu s$ P.W, 300pps) | $I_{Ftrans}$                  | 1          | A     |
|                                     | Reverse voltage  | $V_R$                         | 5          | V     |
|                                     | Power dissipation                                      | $P_{IN}$                      | 45         | mW    |
| Power dissipation                   |  | $P_O$                         | 100        | mW    |
| Output                              | Emitter-Base reverse<br>voltage                        | ELW135<br>ELW136<br>$V_{EBR}$ | 5          | V     |
|                                     | Base current   | ELW135<br>ELW136<br>$I_B$     | 5          | mA    |
|                                     | Average Output current                                 | $I_{O(AVG)}$                  | 8          | mA    |
|                                     | Peak Output current                                    | $I_{O(PK)}$                   | 16         | mA    |
|                                     | Output voltage   | $V_O$                         | -0.5 to 20 | V     |
|                                     | Supply voltage   | $V_{CC}$                      | -0.5 to 30 | V     |
| Isolation voltage <sup>*1</sup>     |  | $V_{ISO}$                     | 5000       | V rms |
| Operating temperature               |  | $T_{OPR}$                     | -55 ~ +100 | °C    |
| Storage temperature                 |  | $T_{STG}$                     | -55 ~ +125 | °C    |
| Soldering temperature <sup>*2</sup> |  | $T_{SOL}$                     | 260        | °C    |

Notes:

\*1 AC for 1 minute, R.H.= 40 ~ 60% R.H. In this test, pins 1, 2, 3, 4 are shorted together, and pins 5, 6, 7, 8 are shorted together.

\*2 For 10 seconds

**Electrical Characteristics (T<sub>A</sub>=0 to 70 °C unless specified otherwise)**

**Input**

| Parameter                                  | Symbol                           | Min. | Typ. | Max. | Unit  | Condition             |
|--|----------------------------------|------|------|------|-------|-----------------------|
| Forward voltage                            | V <sub>F</sub>                   | -    | 1.45 | 1.8  | V     | I <sub>F</sub> = 16mA |
| Reverse Voltage                            | V <sub>R</sub>                   | 5.0  | -    | -    | V     | I <sub>R</sub> = 10μA |
| Temperature coefficient of forward voltage | ΔV <sub>F</sub> /ΔT <sub>A</sub> | -    | -1.9 | -    | mV/°C | I <sub>F</sub> = 16mA |

**Output**

| Parameter                 | Symbol           | Min | Typ.  | Max. | Unit | Condition   |
|---------------------------|------------------|-----|-------|------|------|---|
| Logic High Output Current | I <sub>OH</sub>  | -   | 0.001 | 0.5  | μA   | I <sub>F</sub> =0mA,<br>V <sub>O</sub> =V <sub>CC</sub> =5.5V,<br>T <sub>A</sub> =25 °C   |
|                           |                  | -   | 0.01  | 1    |      | I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V,<br>T <sub>A</sub> =25 °C       |
|                           |                  | -   | -     | 50   |      | I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V                                 |
| Logic Low Supply Current  | I <sub>CCL</sub> | -   | 110   | 200  | μA   | I <sub>F</sub> =16mA, V <sub>O</sub> =Open,<br>V <sub>CC</sub> =15V                       |
| Logic High Supply Current | I <sub>CCH</sub> | -   | 0.01  | 1    | μA   | I <sub>F</sub> =0mA, V <sub>O</sub> =Open,<br>V <sub>CC</sub> =15V, T <sub>A</sub> =25 °C |
|                           |                  | -   | -     | 2    |      | I <sub>F</sub> =0mA, V <sub>O</sub> =Open,<br>V <sub>CC</sub> =15V                        |

\* Typical values at T<sub>A</sub> = 25 °C

**Transfer Characteristics ( $T_A=0$  to  $70^\circ\text{C}$  unless specified otherwise)**

| Parameter                | Symbol                        | Min | Typ. | Max. | Unit | Condition   |   |
|--------------------------|-------------------------------|-----|------|------|------|---|---|
| Current Transfer Ratio   | ELW135                        | 7   | -    | 50   | %    | $I_F = 16\text{mA}, V_O = 0.4\text{V}, V_{CC}=4.5\text{V}, T_A=25^\circ\text{C}$  |   |
|                          | ELW 136                       | 19  | -    | 50   |      |   |   |
|                          | ELW4502                       |     |      |      |      |   |   |
|                          | ELW4503                       |     |      |      |      |   |   |
|                          | ELW135                        | 5   | -    | -    |      |   | $I_F = 16\text{mA}, V_O = 0.5\text{V}, V_{CC}=4.5\text{V}$  |
|                          | ELW 136                       | 15  | -    | -    |      |   |   |
| ELW4502<br>ELW4503       |                               |     |      |      |      |   |   |
| Logic Low Output Voltage | ELW135                        | -   | 0.18 | 0.4  | V    | $I_F = 16\text{mA}, I_O = 1.1\text{mA}, V_{CC}=4.5\text{V}, T_A=25^\circ\text{C}$ |   |
|                          | ELW 136                       | -   | 0.25 | 0.4  |      |   |   |
|                          | ELW4502<br>ELW4503            |     |      |      |      |   |   |
|                          | ELW135                        | -   | -    | 0.5  |      |   | $I_F = 16\text{mA}, I_O = 0.8\text{mA}, V_{CC}=4.5\text{V}$ |
|                          | ELW 136<br>ELW4502<br>ELW4503 | -   | -    | 0.5  |      |   |   |

**Switching Characteristics ( $T_A=0$  to  $70^\circ\text{C}$  unless specified otherwise,  $I_F=16\text{mA}$ ,  $V_{CC}=5\text{V}$ )**

| Parameter  | Symbol            | Min    | Typ.   | Max. | Unit             | Condition   |
|--|-------------------|--------|--------|------|------------------|---|
| Propagation Delay Time to Logic Low (Fig.8)                        | ELW135            | -      | 0.36   | 1.5  | $\mu\text{s}$    | $R_L=4.1\text{K}\Omega$ , $T_A=25^\circ\text{C}$  |
|  |                   | -      | -      | 2.0  |                  | $R_L=4.1\text{K}\Omega$   |
|  | ELW136<br>ELW4503 | -      | 0.32   | 0.8  |                  | $R_L=1.9\text{K}\Omega$ , $T_A=25^\circ\text{C}$  |
|  |                   | -      | -      | 1.0  |                  | $R_L=1.9\text{K}\Omega$   |
| Propagation Delay Time to Logic High (Fig.8)                       | ELW135            | -      | 0.45   | 1.5  | $\mu\text{s}$    | $R_L=4.1\text{K}\Omega$ , $T_A=25^\circ\text{C}$  |
|  |                   | -      | -      | 2.0  |                  | $R_L=4.1\text{K}\Omega$   |
|  | ELW136<br>ELW4503 | -      | 0.25   | 0.8  |                  | $R_L=1.9\text{K}\Omega$ , $T_A=25^\circ\text{C}$  |
|  |                   | -      | -      | 1.0  |                  | $R_L=1.9\text{K}\Omega$   |
| Common Mode Transient Immunity at Logic High (Fig.9) <sup>*3</sup> | ELW135            | 1,000  | -      | -    | V/ $\mu\text{s}$ | $I_F = 0\text{mA}$ ,<br>$V_{CM}=10\text{Vp-p}$ ,<br>$R_L=4.1\text{K}\Omega$ , $T_A =25^\circ\text{C}$   |
|  | ELW136            | 1,000  | -      | -    |                  | $I_F = 0\text{mA}$ ,<br>$V_{CM}=10\text{Vp-p}$ ,<br>$R_L=1.9\text{K}\Omega$ , $T_A =25^\circ\text{C}$   |
|  | ELW4503           | 15,000 | 20,000 |      |                  | $I_F = 0\text{mA}$ ,<br>$V_{CM}=1500\text{Vp-p}$ ,<br>$R_L=1.9\text{K}\Omega$ , $T_A =25^\circ\text{C}$ |
| Common Mode Transient Immunity at Logic Low (Fig.9) <sup>*3</sup>  | ELW135            | 1,000  | -      | -    | V/ $\mu\text{s}$ | $I_F = 0\text{mA}$ ,<br>$V_{CM}=10\text{Vp-p}$ ,<br>$R_L=4.1\text{K}\Omega$ , $T_A =25^\circ\text{C}$   |
|  | ELW136            | 1,000  | -      | -    |                  | $I_F = 0\text{mA}$ ,<br>$V_{CM}=10\text{Vp-p}$ ,<br>$R_L=1.9\text{K}\Omega$ , $T_A =25^\circ\text{C}$   |
|  | ELW4503           | 15,000 | 20,000 |      |                  | $I_F = 0\text{mA}$ ,<br>$V_{CM}=1500\text{Vp-p}$ ,<br>$R_L=1.9\text{K}\Omega$ , $T_A =25^\circ\text{C}$ |

\* Typical values at  $T_a = 25^\circ\text{C}$

Typical Electro-Optical Characteristics Curves

Figure 1. Forward Current vs Forward Voltage

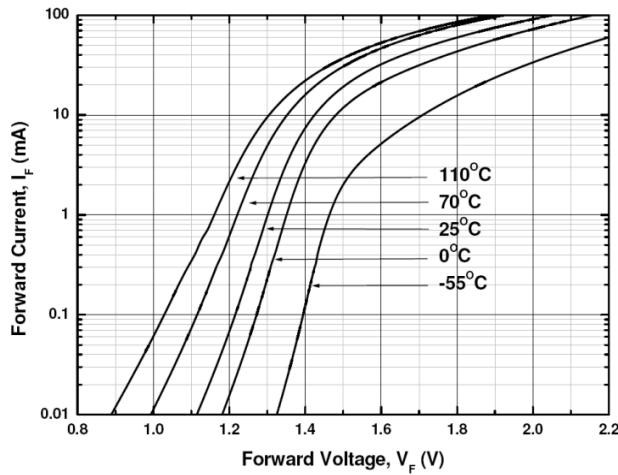


Figure 2. Current Transfer Ratio vs Forward Current

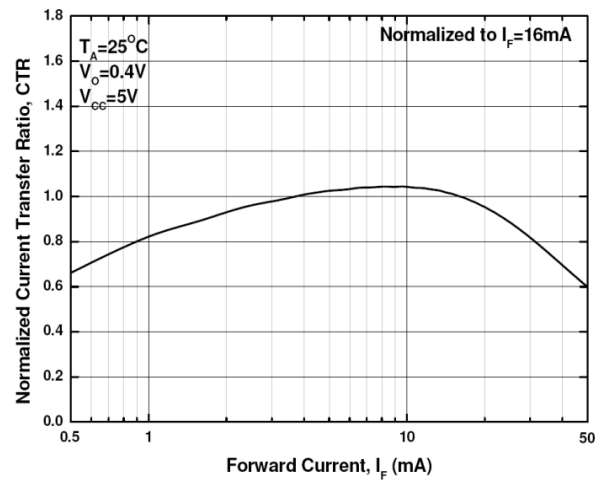


Figure 3. Current Transfer Ratio vs Ambient Temperature

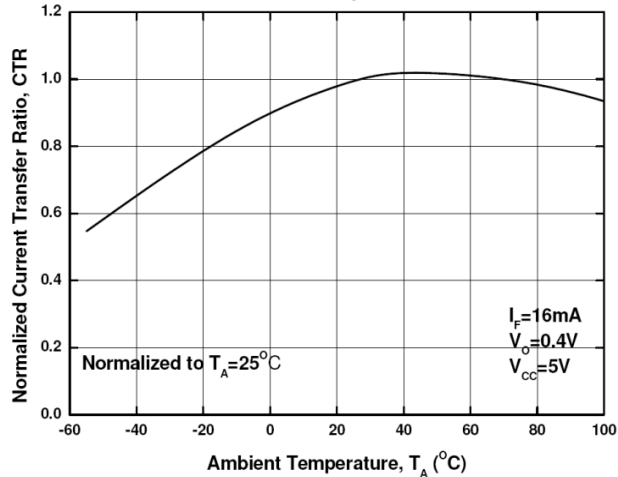


Figure 4. Output Current vs Output Voltage

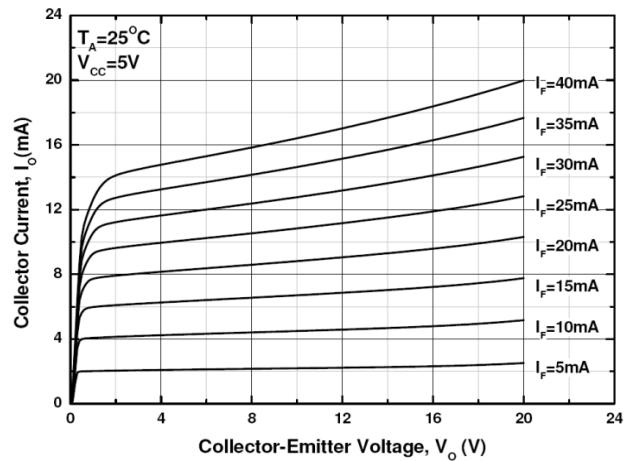


Figure 5. Logic High Output Current vs Ambient Temperature

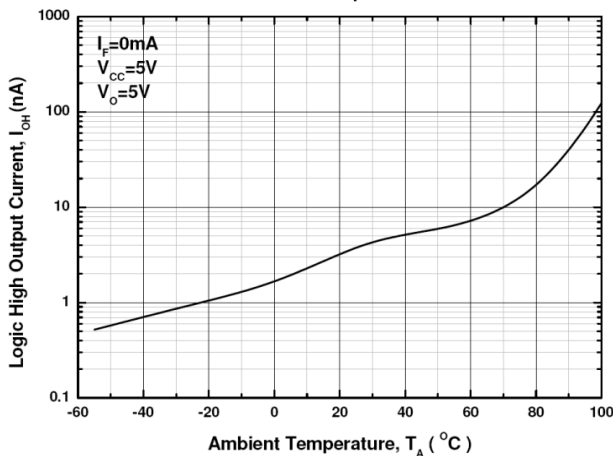


Figure 6. Propagation Delay vs. Load Resistance

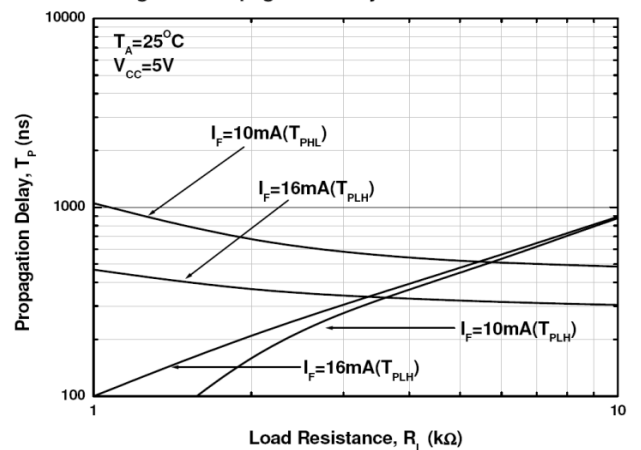


Figure 7. Propagation Delay vs. Temperature

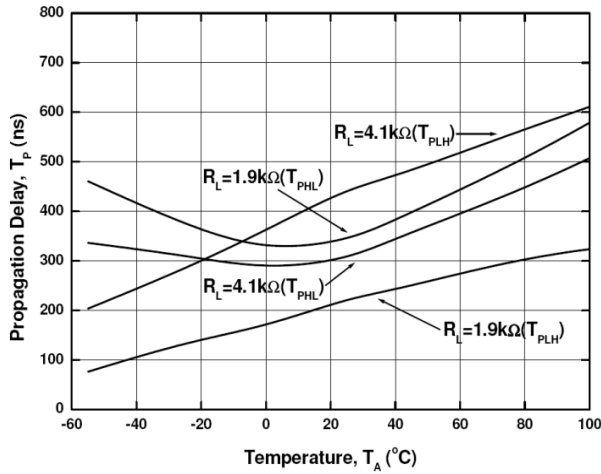


Figure 8 Switching Time Test Circuit & Waveform

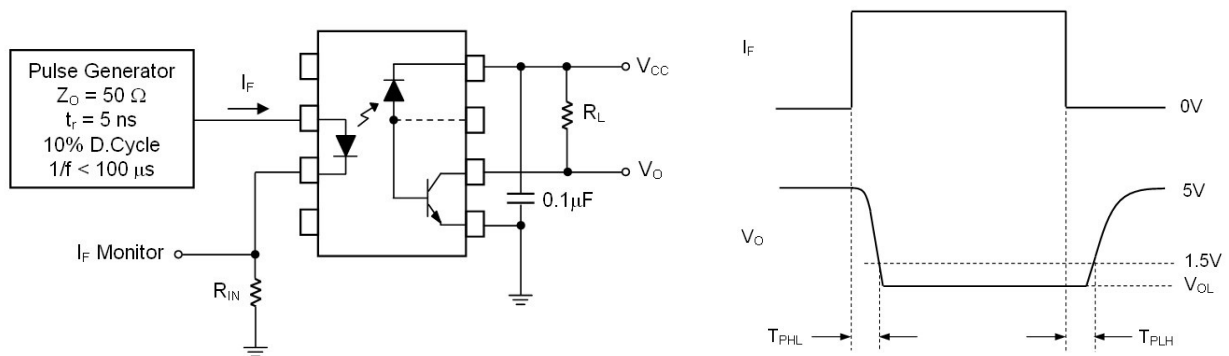
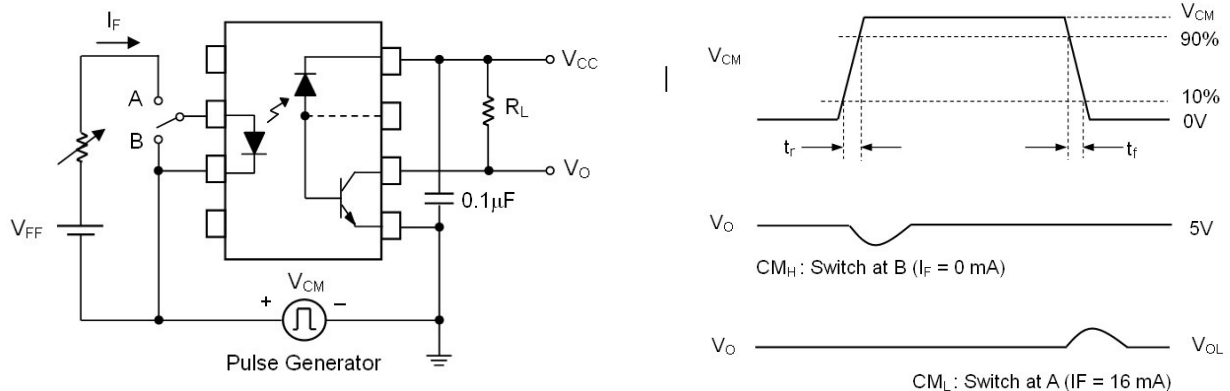


Figure 9 Transient Immunity Test Circuit & Waveform



**Note:**

\*3 Common mode transient immunity in logic high level is the maximum tolerable (positive)  $dV_{cm}/dt$  on the leading edge of the common mode pulse signal  $V_{CM}$ , to assure that the output will remain in a logic high state (i.e.,  $V_O > 2.0V$ ).

Common mode transient immunity in logic low level is the maximum tolerable (negative)  $dV_{cm}/dt$  on the trailing edge of the common mode pulse signal,  $V_{CM}$ , to assure that the output will remain in a logic low state (i.e.,  $V_O < 0.8V$ ).

## Order Information

### Part Number

**ELW13XY(Z)-V**

or

**ELW4503Y(Z)-V**

### Note

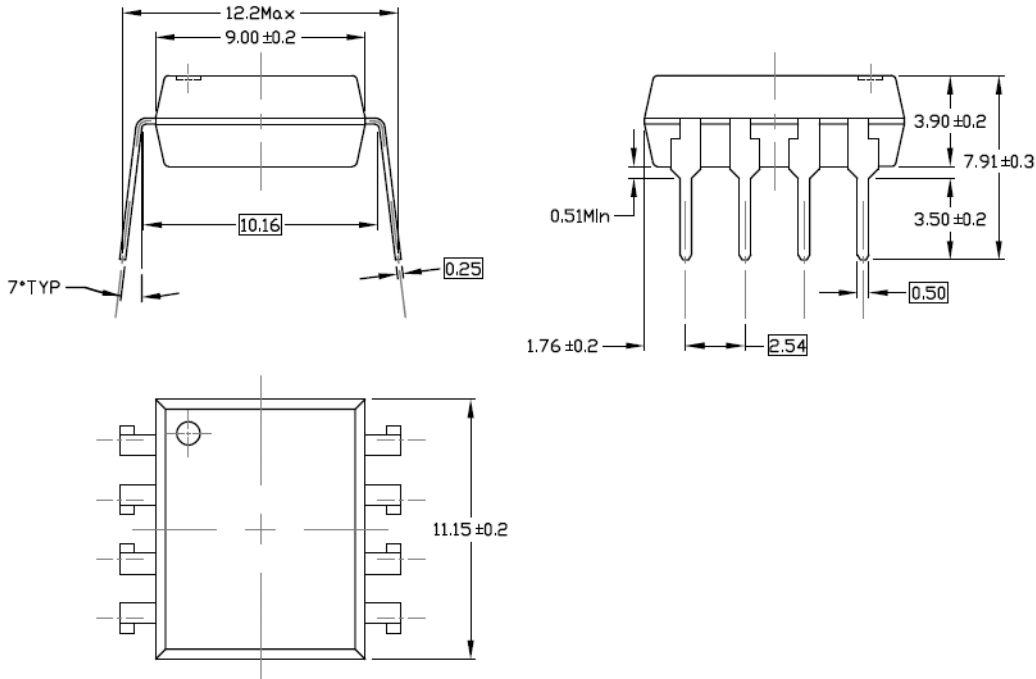
- X = Part No. (X = 5 or 6)
- Y = Lead form option (S or none)
- Z = Tape and reel option (TA, TB or none)
- V = VDE (optional)

| Option | Description                                     | Packing quantity    |
|--------|---|---------------------|
| None   | Standard DIP-8                                  | 45 units per tube   |
| S (TA) | Surface mount lead form + TA tape & reel option | 1000 units per reel |
| S (TB) | Surface mount lead form + TB tape & reel option | 1000 units per reel |

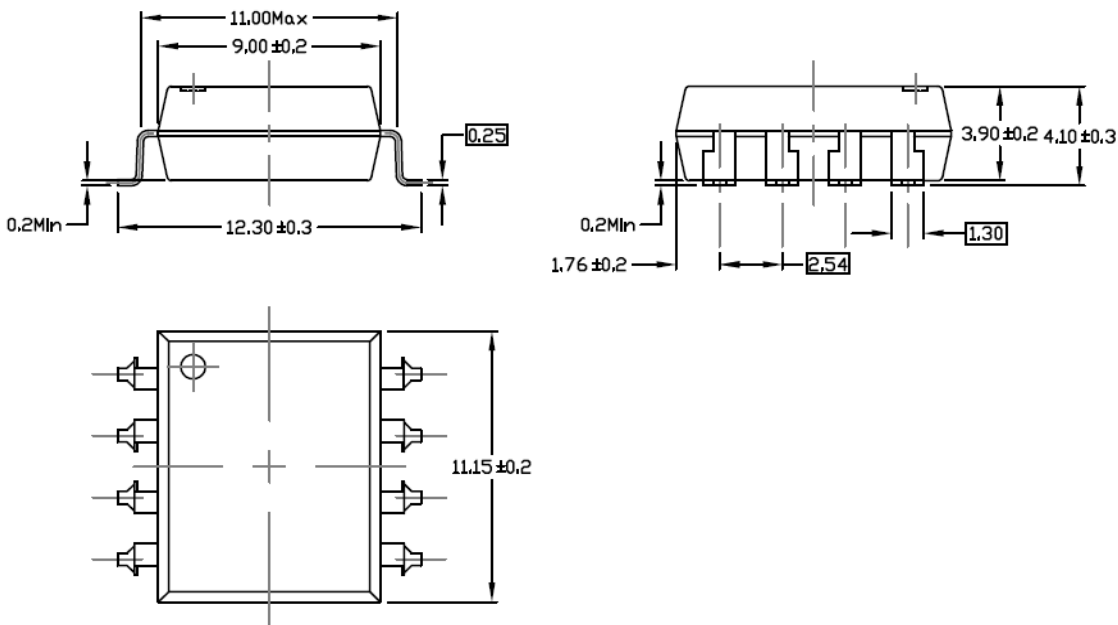


**Package Dimension**  
(Dimensions in mm)

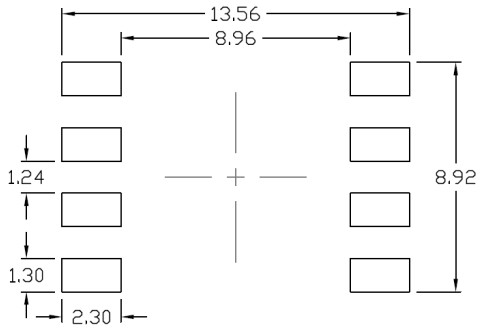
**Standard DIP Type**



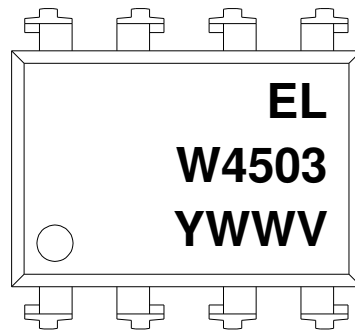
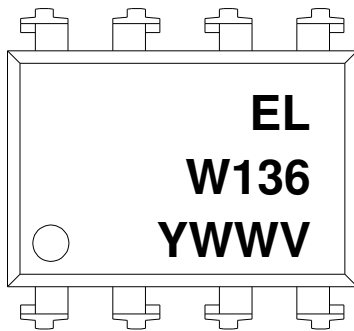
**Option S Type**



### Recommended pad layout for surface mount leadform



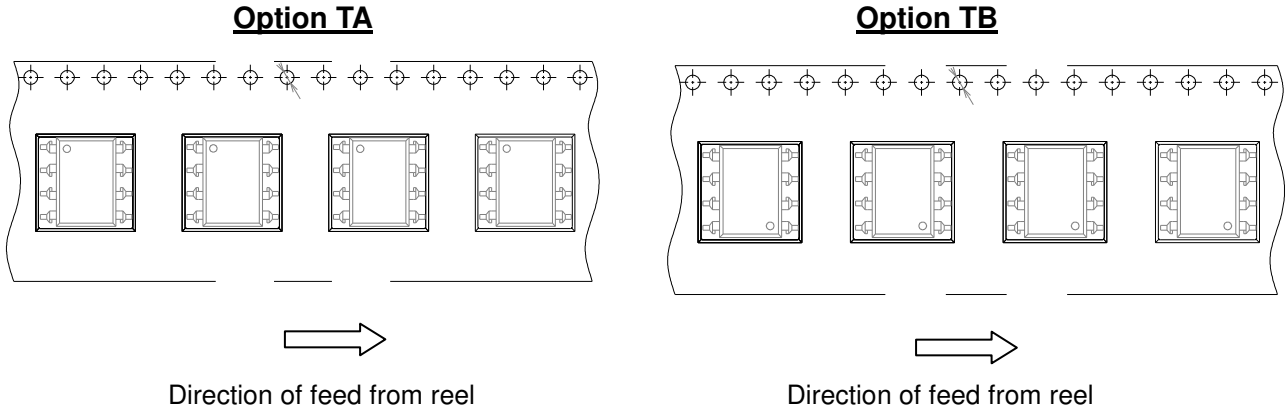
### Device Marking



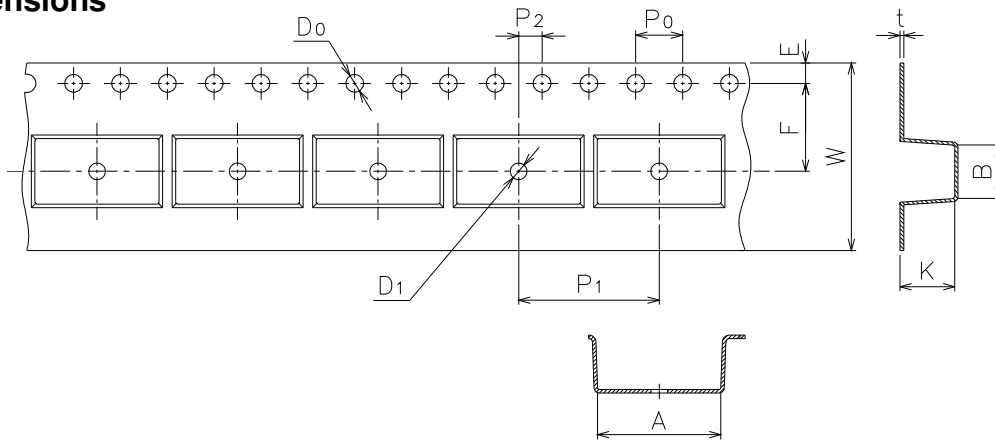
### Notes

- EL denotes EVERLIGHT
- W4503 denotes Device Number
- W136 denotes Device Number
- Y denotes 1 digit Year code
- WW denotes 2 digit Week code
- V denotes VDE (optional)

**Tape & Reel Packing Specifications**



**Tape dimensions**

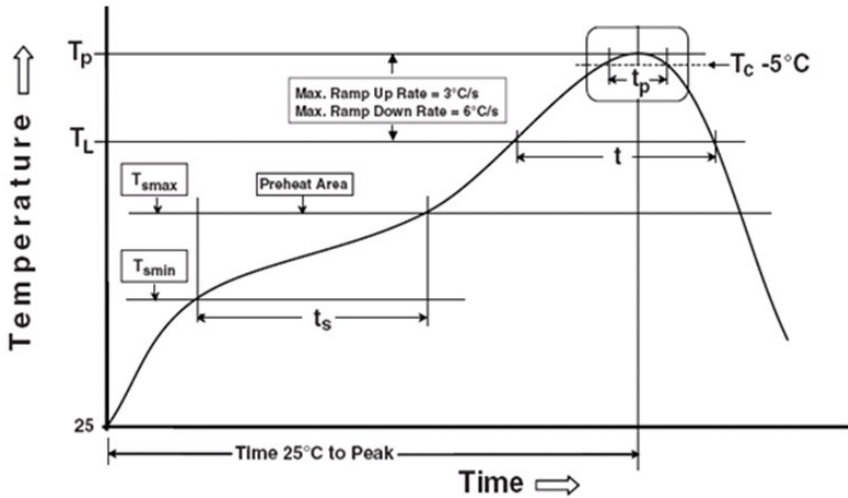


|               |           |           |           |           |           |          |
|---------------|-----------|-----------|-----------|-----------|-----------|----------|
| Dimension No. | <b>A</b>  | <b>B</b>  | <b>Do</b> | <b>D1</b> | <b>E</b>  | <b>F</b> |
| Dimension(mm) | 12.7±0.1  | 11.45±0.1 | 1.5±0.1   | 1.5±0.1   | 1.75±0.1  | 11.5±0.1 |
| Dimension No. | <b>Po</b> | <b>P1</b> | <b>P2</b> | <b>t</b>  | <b>W</b>  | <b>K</b> |
| Dimension(mm) | 4.0±0.1   | 16.0±0.1  | 2.0±0.1   | 0.4±0.05  | 24.00±0.3 | 4.6±0.1  |

## Precautions for Use

### 1. Soldering Condition

#### 1.1 (A) Maximum Body Case Temperature Profile for evaluation of Reflow Profile



Note:

Reference: IPC/JEDEC J-STD-020D

#### Preheat

|  |                 |
|--|-----------------|
| Temperature min ( $T_{smin}$ )               | 150 °C          |
| Temperature max ( $T_{smax}$ )               | 200 °C          |
| Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )  | 60-120 seconds  |
| Average ramp-up rate ( $T_{smax}$ to $T_p$ ) | 3 °C/second max |

#### Other

|  |                   |
|--|-------------------|
| Liquidus Temperature ( $T_L$ )                                       | 217 °C            |
| Time above Liquidus Temperature ( $t_L$ )                            | 60-100 sec        |
| Peak Temperature ( $T_p$ )   | 260 °C            |
| Time within 5 °C of Actual Peak Temperature: $T_p - 5^\circ\text{C}$ | 30 s              |
| Ramp- Down Rate from Peak Temperature                                | 6 °C /second max. |
| Time 25 °C to peak temperature                                       | 8 minutes max.    |
| Reflow times   | 3 times           |

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