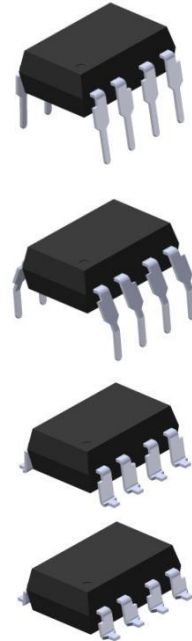


Features

- High speed 1Mbit/s
- High isolation voltage between input and output ($V_{iso}=5000 V_{rms}$)
- 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. 132249)
- SEMKO approved
- NEMKO approved
- DEMKO approved
- FIMKO approved
- CSA approved (No. 2037145)



Description

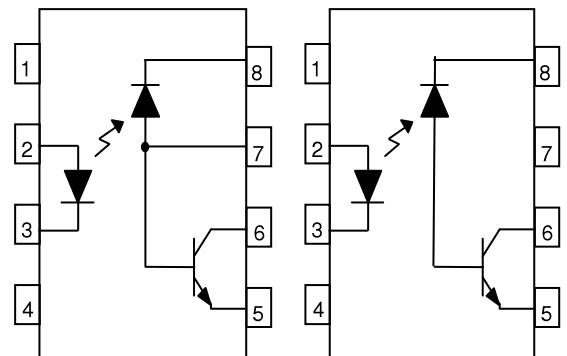
The 6N135, 6N136, EL4502 and EL4503 devices each consist of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor.

The devices are packaged in an 8-pin DIP 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



6N135 / 6N136

EL4502 / EL4503

Pin Configuration

1. No Connection
2. Anode
3. Cathode
4. No Connection
5. Gnd
6. Vout
7. V_B
8. V_{CC}

Pin Configuration

1. No Connection
2. Anode
3. Cathode
4. No Connection
5. Gnd
6. Vout
7. No Connection
8. V_{CC}

Absolute Maximum Ratings ($T_a=25^\circ\text{C}$)

| Parameter | | Symbol | Rating | Unit |
|-------------------------------------|--|-----------------------------|------------|------------------|
| Input | Forward current | I_F | 25 | mA |
| | Peak forward current (50% duty, 1ms P.W) | I_{FP} | 50 | mA |
| | Peak transient current ($\leq 1\mu\text{s}$ P.W, 300pps) | I_{Ftrans} | 1 | A |
| | Reverse voltage | V_R | 5 | V |
| | Power dissipation | P_{IN} | 45 | mW |
| Output | Power dissipation | P_O | 100 | mW |
| | Emitter-Base reverse voltage | 6N135 6N136 V_{EBR} | 5 | V |
| | Base current | 6N135 6N136 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 ^{*1} | | V_{ISO} | 5000 | V rms |
| Operating temperature | | T_{OPR} | -55 ~ +100 | $^\circ\text{C}$ |
| Storage temperature | | T_{STG} | -55 ~ +125 | $^\circ\text{C}$ |
| Soldering temperature ^{*2} | | T_{SOL} | 260 | $^\circ\text{C}$ |

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 ($T_A=0$ to 70°C unless specified otherwise)

Input

| Parameter | Symbol | Min. | Typ.* | Max. | Unit | Conditions |
|--|-------------------------|------|-------|------|----------------------|-----------------------|
| Forward voltage | V_F | - | 1.45 | 1.8 | V | $I_F = 16\text{mA}$ |
| Reverse Voltage | V_R | 5.0 | - | - | V | $I_R = 10\mu\text{A}$ |
| Temperature coefficient of forward voltage | $\Delta V_F/\Delta T_A$ | - | -1.9 | - | mV/ $^\circ\text{C}$ | $I_F = 16\text{mA}$ |

Output

| Parameter | Symbol | Min. | Typ.* | Max. | Unit | Conditions |
|---------------------------|-----------|------|-------|------|---------------|--|
| Logic High Output Current | I_{OH} | - | 0.001 | 0.5 | μA | $I_F=0\text{mA}, V_O=V_{CC}=5.5\text{V}, T_A=25^\circ\text{C}$ |
| | | - | 0.01 | 1 | | $I_F=0\text{mA}, V_O=V_{CC}=15\text{V}, T_A=25^\circ\text{C}$ |
| | | - | - | 50 | | $I_F=0\text{mA}, V_O=V_{CC}=15\text{V}$ |
| Logic Low Supply Current | I_{CCL} | - | 140 | 200 | μA | $I_F=16\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}$ |
| Logic High Supply Current | I_{CCH} | - | 0.01 | 1 | μA | $I_F=0\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}, T_A=25^\circ\text{C}$ |
| | | - | - | 2 | | $I_F=0\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}$ |

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

Transfer Characteristics ($T_A=0$ to 70°C unless specified otherwise)

| Parameter | | Symbol | Min. | Typ.* | Max. | Unit | Conditions |
|--------------------------|---------------------------|----------|------|-------|------|------|---|
| Current Transfer Ratio | 6N135 | CTR | 7 | - | 50 | % | $I_F = 16\text{mA}$, $V_O = 0.4\text{V}$, $V_{CC}=4.5\text{V}$, $T_A=25^\circ\text{C}$ |
| | 6N136 EL4502 EL4503 | | 19 | - | 50 | | |
| | 6N135 | | 5 | - | - | | $I_F = 16\text{mA}$, $V_O = 0.4\text{V}$, $V_{CC}=4.5\text{V}$ |
| | 6N136 EL4502 EL4503 | | 15 | - | - | | |
| Logic Low Output Voltage | 6N135 | V_{OL} | - | 0.18 | 0.4 | V | $I_F = 16\text{mA}$, $I_O = 1.1\text{mA}$, $V_{CC}=4.5\text{V}$, $T_A=25^\circ\text{C}$ |
| | 6N136 EL4502 EL4503 | | - | 0.25 | 0.4 | | $I_F = 16\text{mA}$, $I_O = 3\text{mA}$, $V_{CC}=4.5\text{V}$, $T_A=25^\circ\text{C}$ |
| | 6N135 | | - | - | 0.5 | | $I_F = 16\text{mA}$, $I_O = 0.8\text{mA}$, $V_{CC}=4.5\text{V}$ |
| | 6N136 EL4502 EL4503 | | - | - | 0.5 | | $I_F=16\text{mA}$, $I_O=2.4\text{mA}$, $V_{CC}=4.5\text{V}$ |

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

| Parameter | | Symbol | Min. | Typ.* | Max. | Unit | Conditions |
|--|---------------------------|---------------|-------|-------|------|------------------------|---|
| Propagation Delay Time to Logic Low (Fig.8) | 6N135 | TPHL | - | 0.35 | 1.5 | μs | $R_L=4.1\text{K}\Omega$, $T_A=25^\circ\text{C}$ |
| | | | - | - | 2.0 | | $R_L=4.1\text{K}\Omega$ |
| | 6N136 EL4502 EL4503 | | - | 0.35 | 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) | 6N135 | TPLH | - | 0.5 | 1.5 | μs | $R_L=4.1\text{K}\Omega$, $T_A=25^\circ\text{C}$ |
| | | | - | - | 2.0 | | $R_L=4.1\text{K}\Omega$ |
| | 6N136 EL4502 EL4503 | | - | 0.3 | 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) ^{*3} | 6N135 | CM_H | 1,000 | - | - | $\text{V}/\mu\text{s}$ | $I_F = 0\text{mA}$, $V_{CM}=10\text{Vp-p}$, $R_L=4.1\text{K}\Omega$, $T_A = 25^\circ\text{C}$ |
| | 6N136 EL4502 | | 1,000 | - | - | | $I_F = 0\text{mA}$, $V_{CM}=10\text{Vp-p}$, $R_L=1.9\text{K}\Omega$, $T_A = 25^\circ\text{C}$ |
| | EL4503 | | 15000 | 20000 | - | | $I_F = 0\text{mA}$, $V_{CM}=1500\text{Vp-p}$, $R_L=1.9\text{K}\Omega$, $T_A = 25^\circ\text{C}$ |
| Common Mode Transient Immunity at Logic Low (Fig.9) ^{*3} | 6N135 | CM_L | 1,000 | - | - | $\text{V}/\mu\text{s}$ | $I_F = 16\text{mA}$, $V_{CM}=10\text{Vp-p}$, $R_L=4.1\text{K}\Omega$, $T_A = 25^\circ\text{C}$ |
| | 6N136 EL4502 | | 1,000 | - | - | | $I_F = 16\text{mA}$, $V_{CM}=10\text{Vp-p}$, $R_L=1.9\text{K}\Omega$, $T_A=25^\circ\text{C}$ |
| | EL4503 | | 15000 | 20000 | - | | $I_F = 0\text{mA}$, $V_{CM}=1500\text{Vp-p}$, $R_L=1.9\text{K}\Omega$, $T_A = 25^\circ\text{C}$ |

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

Typical Performance Curves

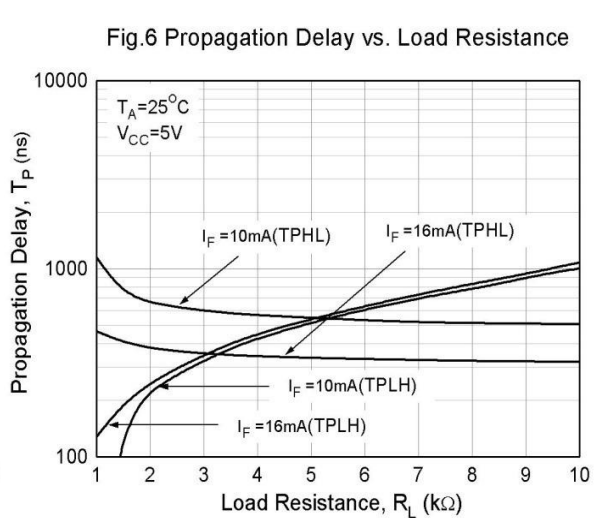
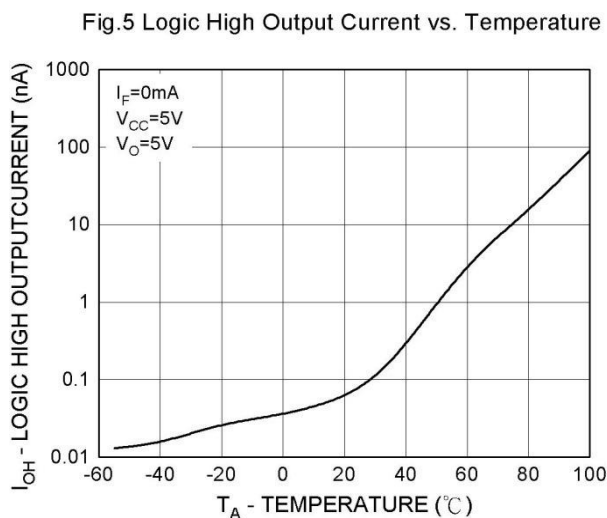
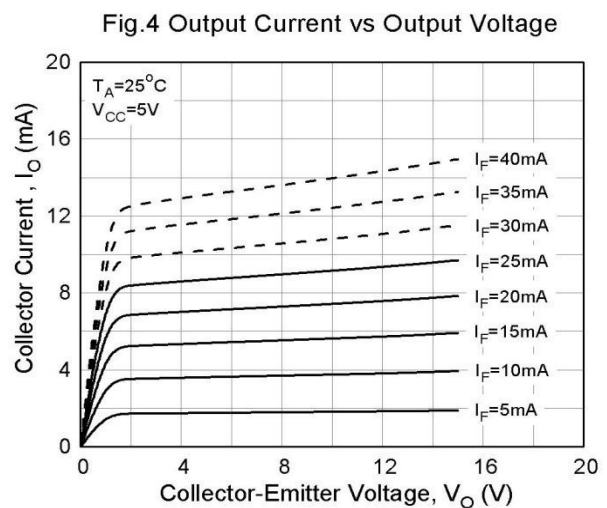
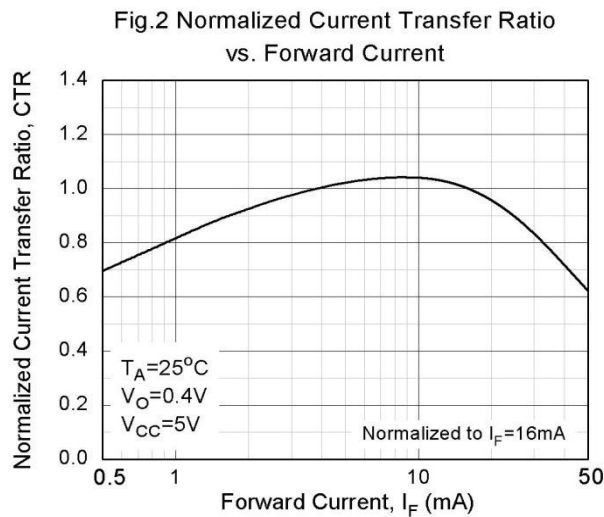
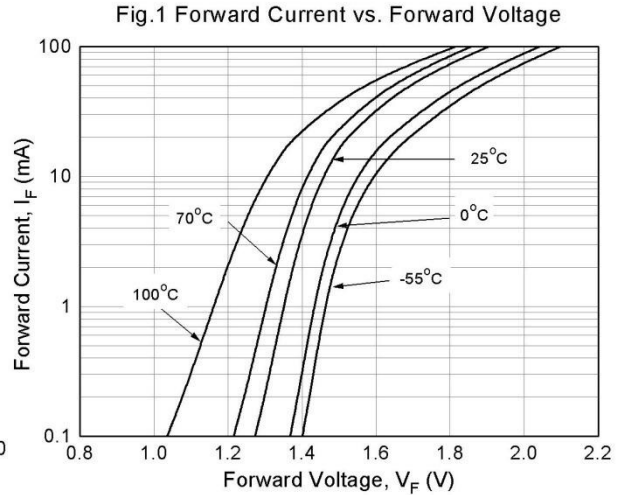
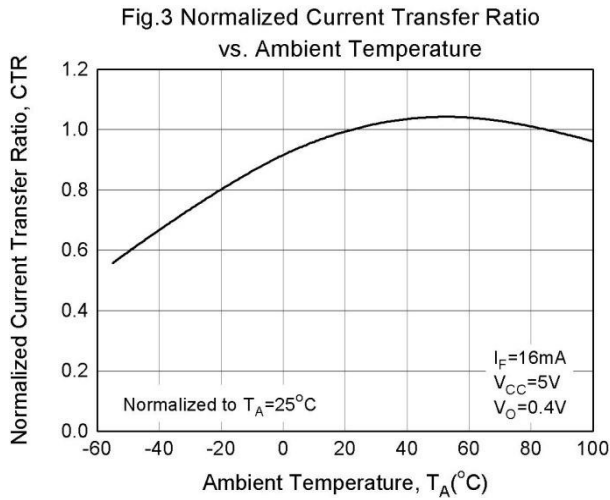


Fig.7 Propagation Delay vs. Temperature

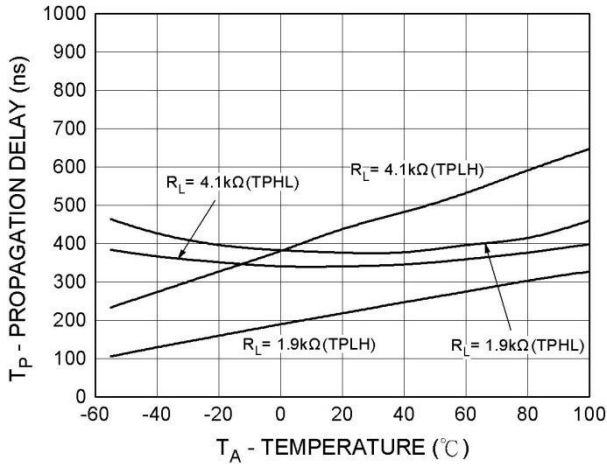


Figure 8 Switching Time Test Circuit & Waveform

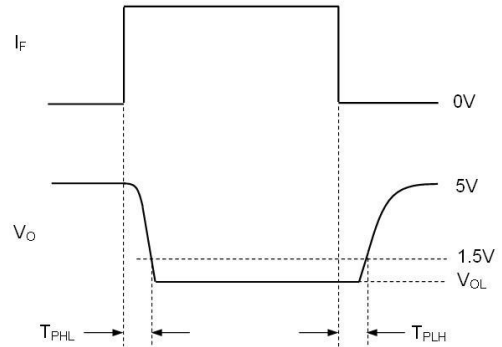
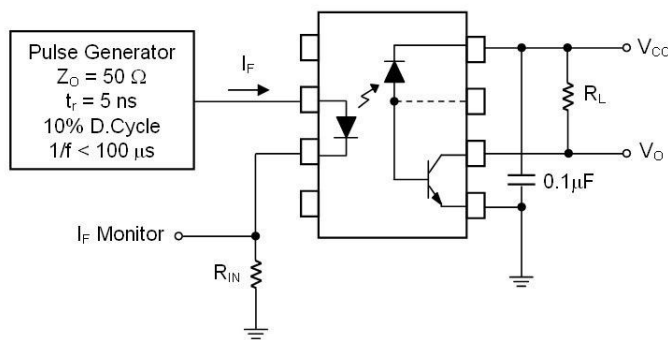
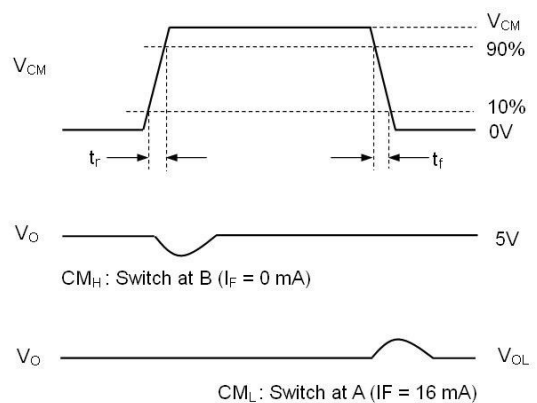
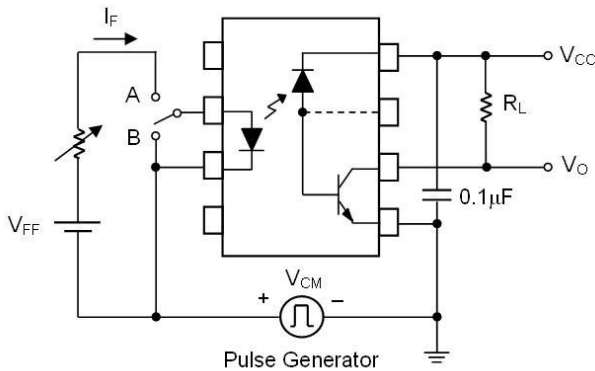


Figure 9 Transient Immunity Test Circuit &



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

6N13XY(Z)-V

or

EL450XY(Z)-V

Note

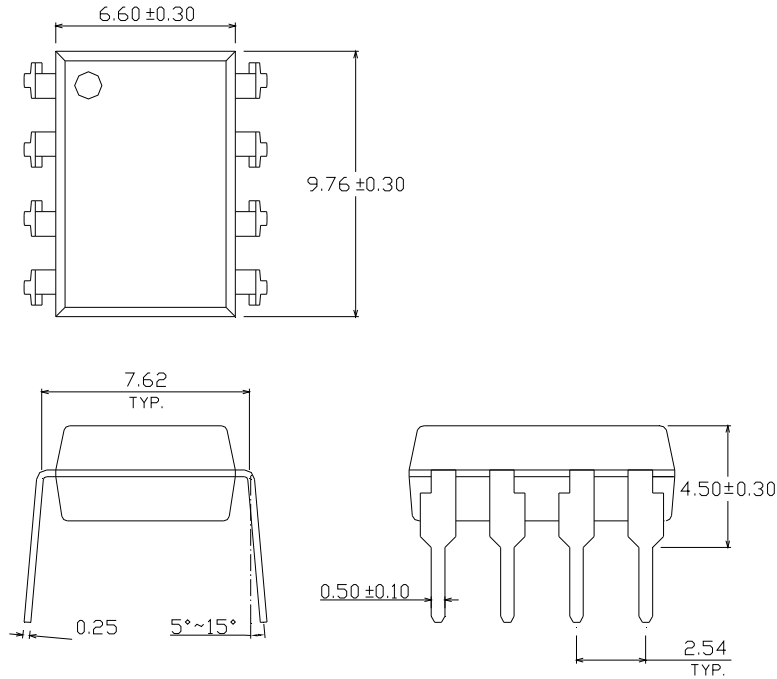
- X = Part No. (X = 5 or 6) for 6N series; (X=2 or 3) for EL45 series
- Y = Lead form option (S, S1, M or none)
- Z = Tape and reel option (TA, TB or none)
- V = VDE (optional)

| Option | Description | Packing quantity |
|---------|---|---------------------|
| None | Standard DIP-8 | 45 units per tube |
| M | Wide lead bend (0.4 inch spacing) | 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 |
| S1 (TA) | Surface mount lead form (low profile) + TA tape & reel option | 1000 units per reel |
| S1 (TB) | Surface mount lead form (low profile) + TB tape & reel option | 1000 units per reel |

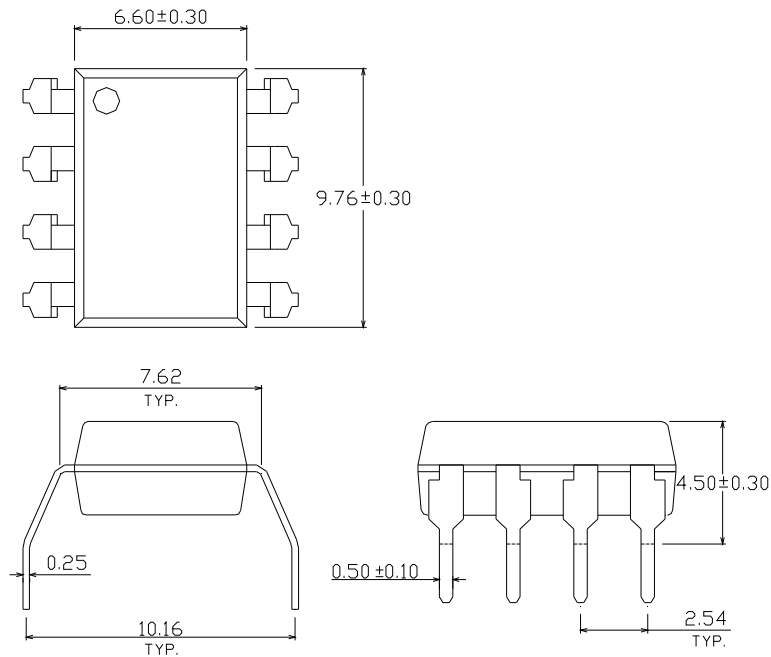
Package Drawing

(Dimensions in mm)

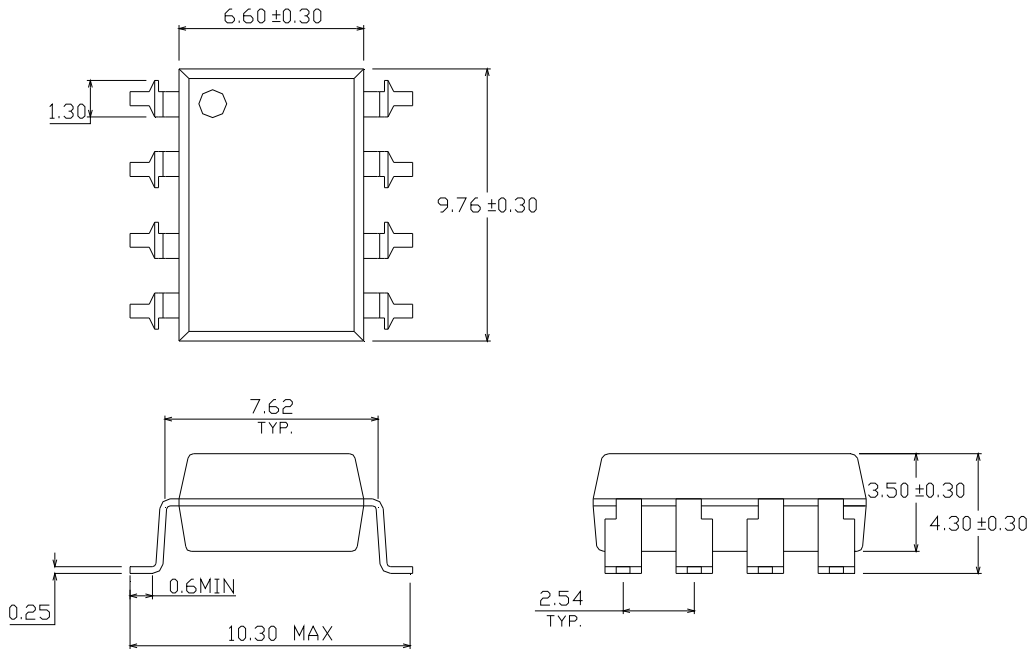
Standard DIP Type



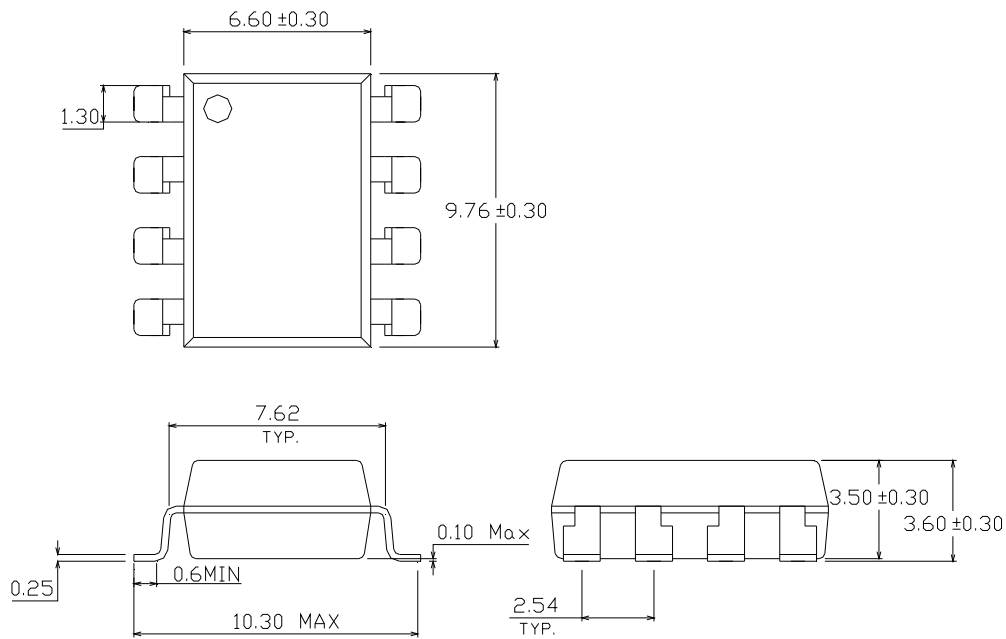
Option M Type



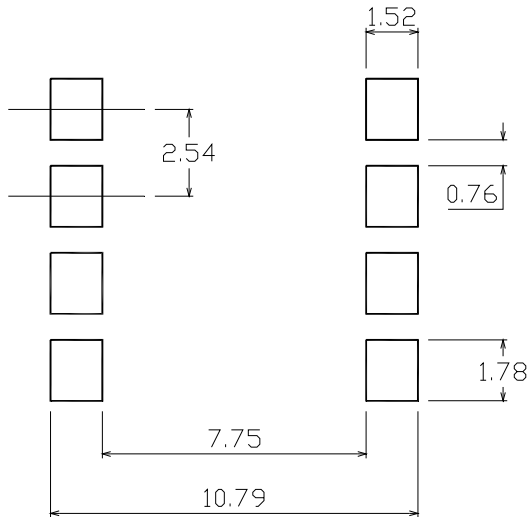
Option S Type



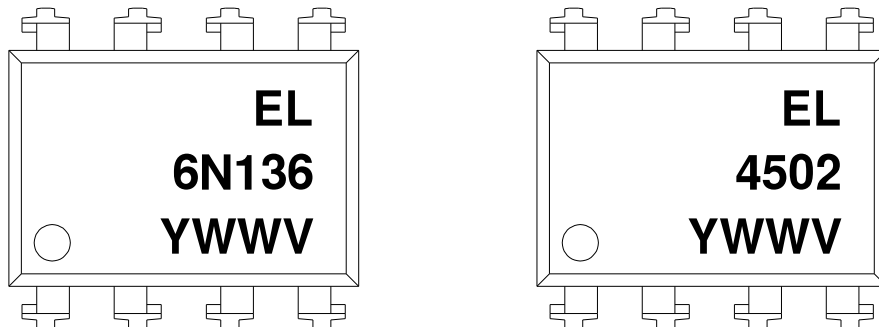
Option S1 Type



Recommended pad layout for surface mount leadform



Device Marking



Notes

4502

6N136 denotes Device Number

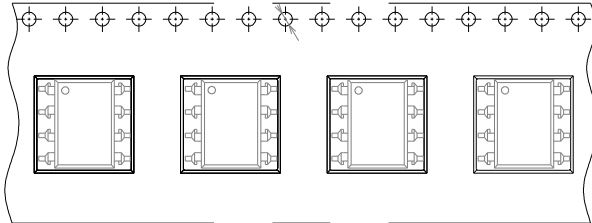
Y denotes 1 digit Year code

WW denotes 2 digit Week code

V denotes VDE (optional)

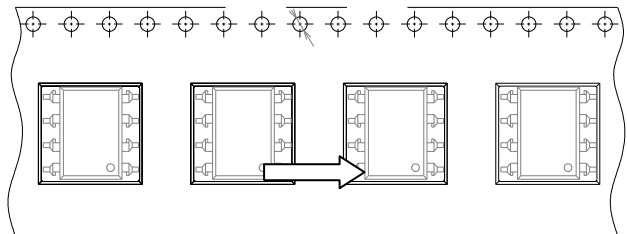
Tape & Reel Packing Specifications

Option TA



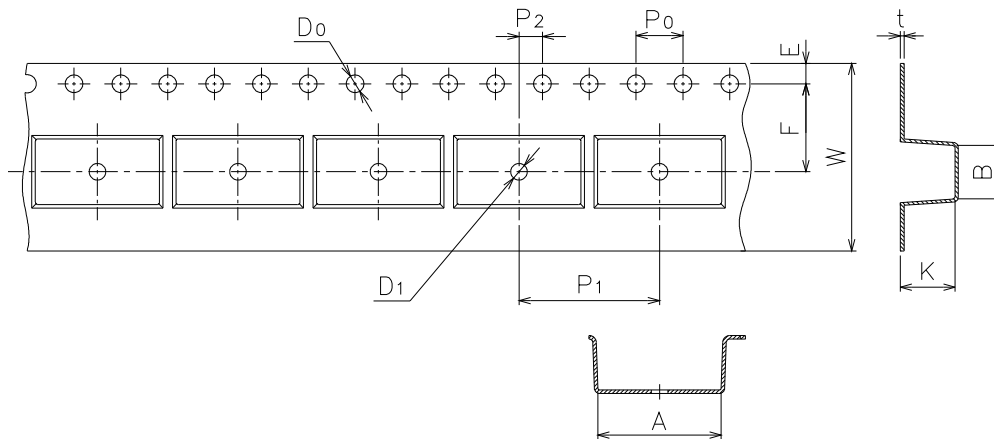
Direction of feed from reel

Option TB



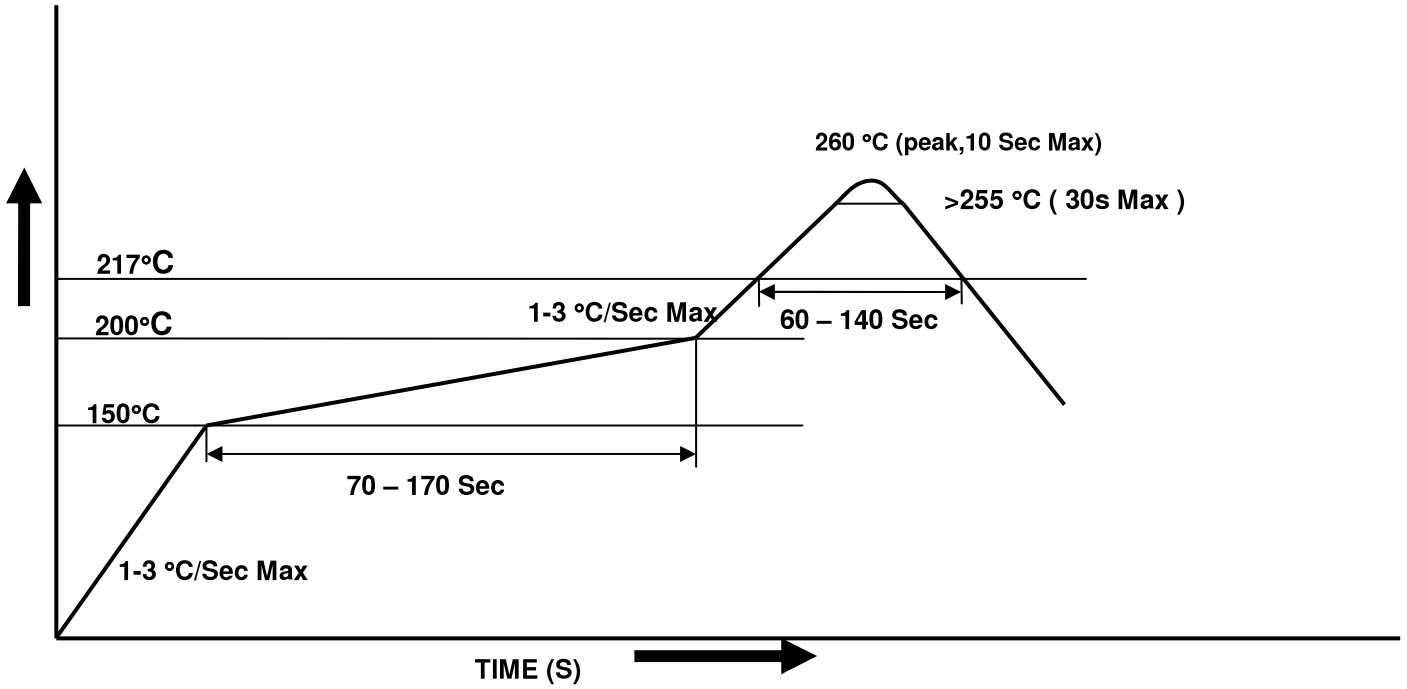
Direction of feed from reel

Tape dimensions



| | | | | | | |
|---------------|-----------|-----------|-----------|-----------|-------------------|----------|
| Dimension No. | A | B | Do | D1 | E | F |
| Dimension(mm) | 10.4±0.1 | 10.0±0.1 | 1.5±0.1 | 1.5±0.1 | 1.75±0.1 | 7.5±0.1 |
| Dimension No. | Po | P1 | P2 | t | W | K |
| Dimension(mm) | 4.0±0.1 | 12.0±0.1 | 2.0±0.1 | 0.4±0.1 | 16.0+0.3/ -0.1 | 4.5±0.1 |

Solder Reflow Temperature Profile



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