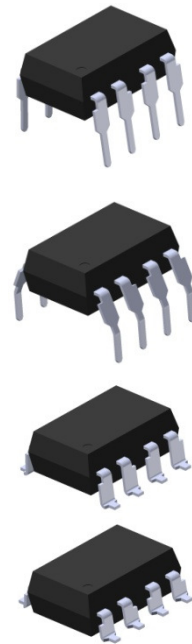


### Features

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



### Description

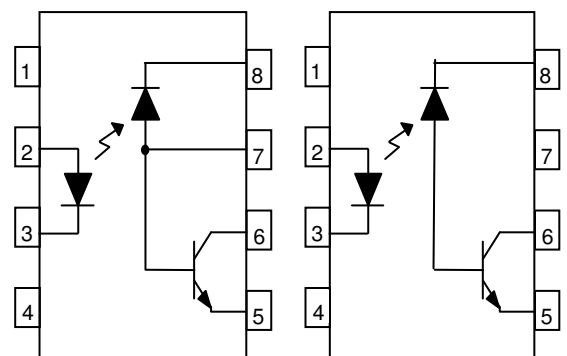
The 6N135, 6N136, EL4502 and EL4503 devices each consist of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor 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<sub>a</sub>=25°C)

Parameter		Symbol	Rating	Unit
Input	Forward current	I <sub>F</sub>	25	mA
	Peak forward current (50% duty, 1ms P.W)	I <sub>FP</sub>	50	mA
	Peak transient current (≤1μs P.W,300pps)	I <sub>Ftrans</sub>	1	A
	Reverse voltage	V <sub>R</sub>	5	V
	Power dissipation	P <sub>IN</sub>	45	mW
Output	Power dissipation	P <sub>O</sub>	100	mW
	Emitter-Base reverse voltage	6N135 6N136 V <sub>EBR</sub>	5	V
	Base current	6N135 6N136 I <sub>B</sub>	5	mA
	Average Output current	I <sub>O(AVG)</sub>	8	mA
	Peak Output current	I <sub>O(PK)</sub>	16	mA
	Output voltage	V <sub>O</sub>	-0.5 to 20	V
	Supply voltage	V <sub>CC</sub>	-0.5 to 30	V
Isolation voltage *1		V <sub>ISO</sub>	5000	V rms
Operating temperature		T <sub>OPR</sub>	-55 ~ +100	°C
Storage temperature		T <sub>STG</sub>	-55 ~ +125	°C
Soldering temperature *2		T <sub>SOL</sub>	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 ( $T_A=0$ to $70^\circ\text{C}$ 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	$\mu\text{A}$	$I_F=0\text{mA}, V_O=V_{CC}=5.5\text{V}, T_A=25^\circ\text{C}$
		-	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	$\mu\text{A}$	$I_F=16\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}$
Logic High Supply Current	$I_{CCH}$	-	0.01	1	$\mu\text{A}$	$I_F=0\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}, T_A=25^\circ\text{C}$
		-	-	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 $70^\circ\text{C}$ 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 $70^\circ\text{C}$ 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	-	0.35	1.5	$\mu\text{s}$	$R_L=4.1\text{K}\Omega$ , $T_A=25^\circ\text{C}$
		-	-	2.0		$R_L=4.1\text{K}\Omega$
	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	-	0.5	1.5	$\mu\text{s}$	$R_L=4.1\text{K}\Omega$ , $T_A=25^\circ\text{C}$
		-	-	2.0		$R_L=4.1\text{K}\Omega$
	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) <sup>*3</sup>	6N135	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) <sup>*3</sup>	6N135	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

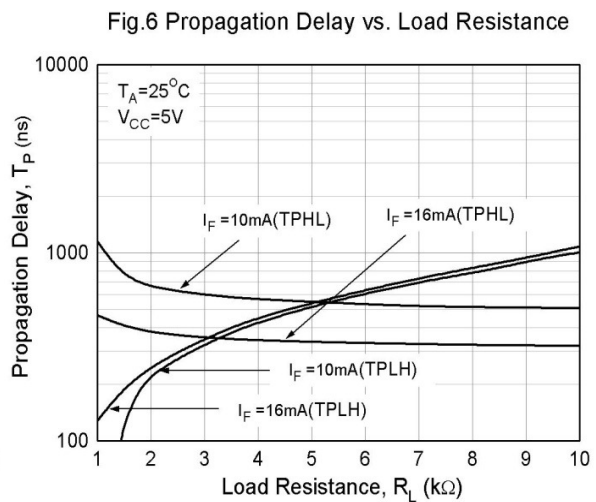
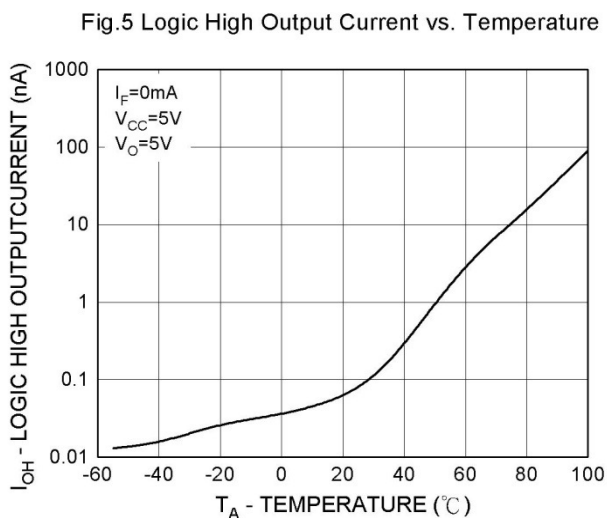
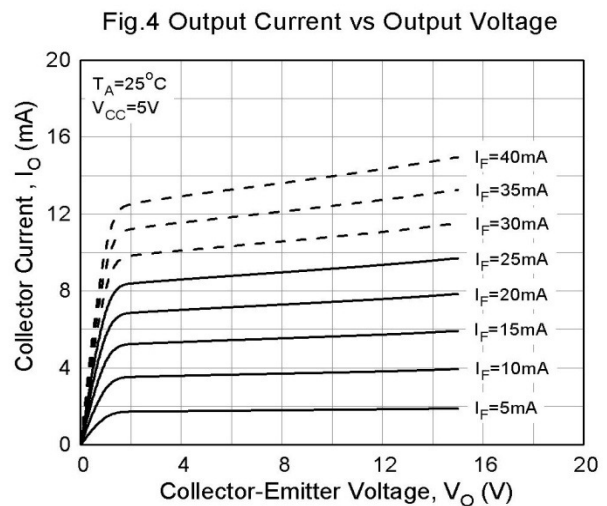
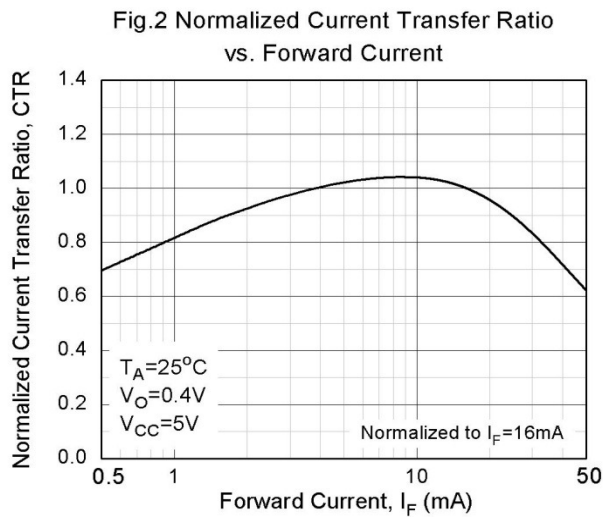
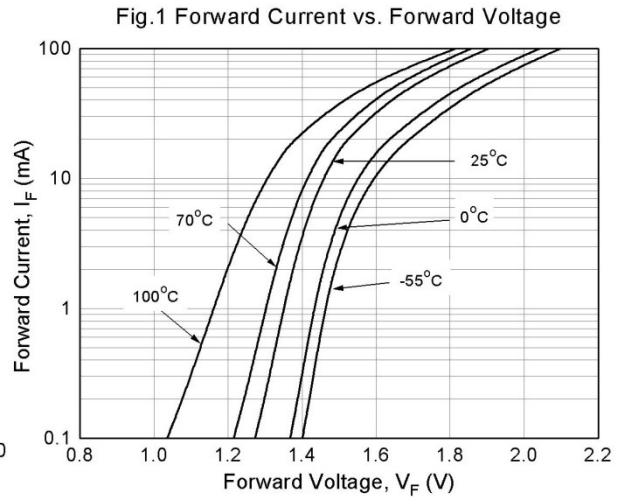
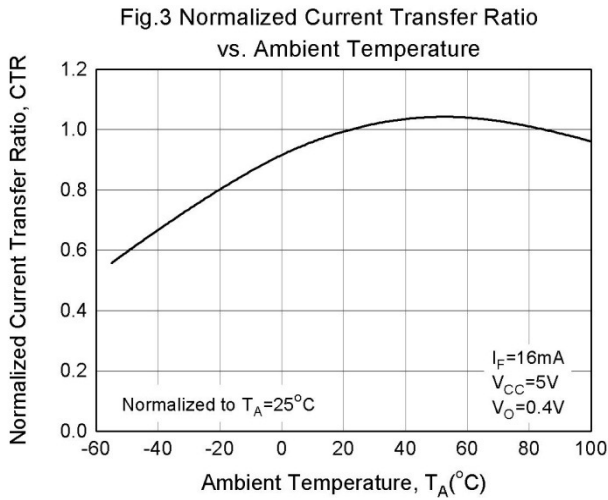


Fig.7 Propagation Delay vs. Temperature

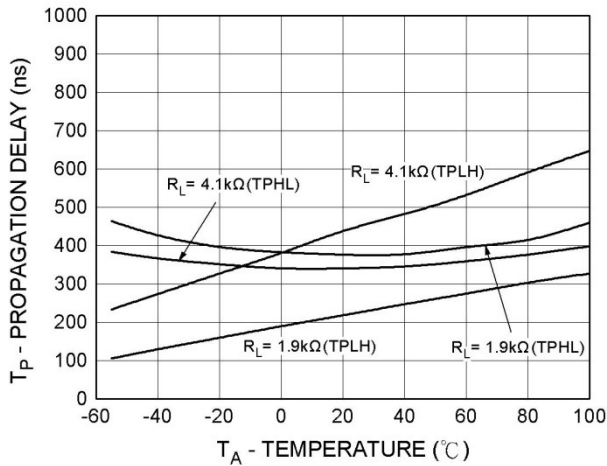


Figure 8 Switching Time Test Circuit & Waveform

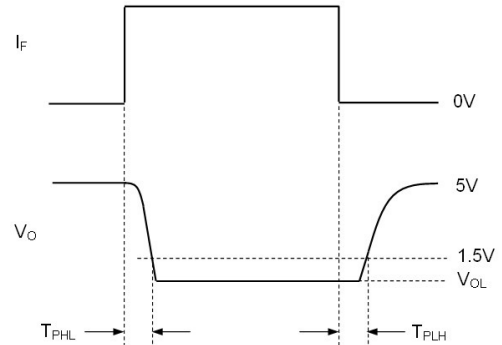
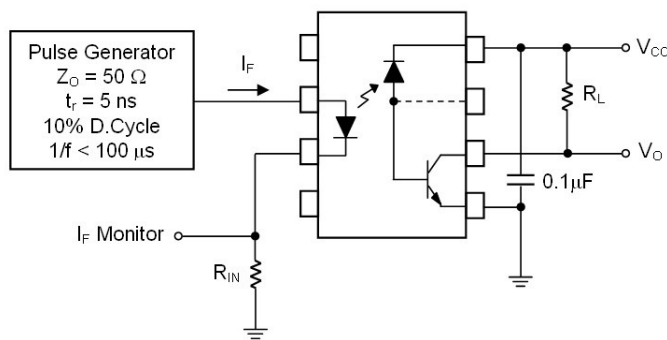
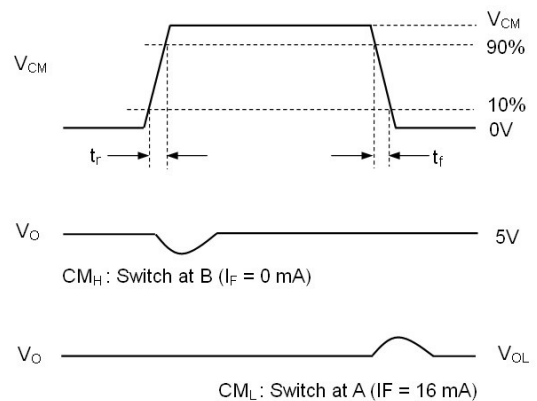
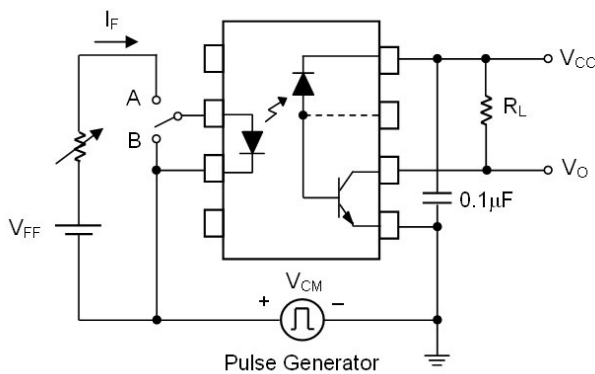


Figure 9 Transient Immunity Test Circuit &



**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)

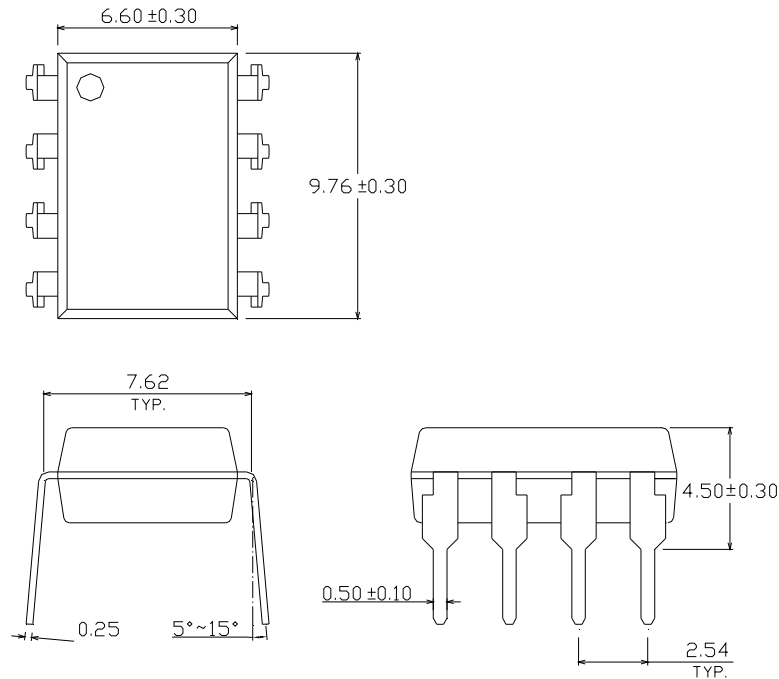
V = VDE (optional)

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

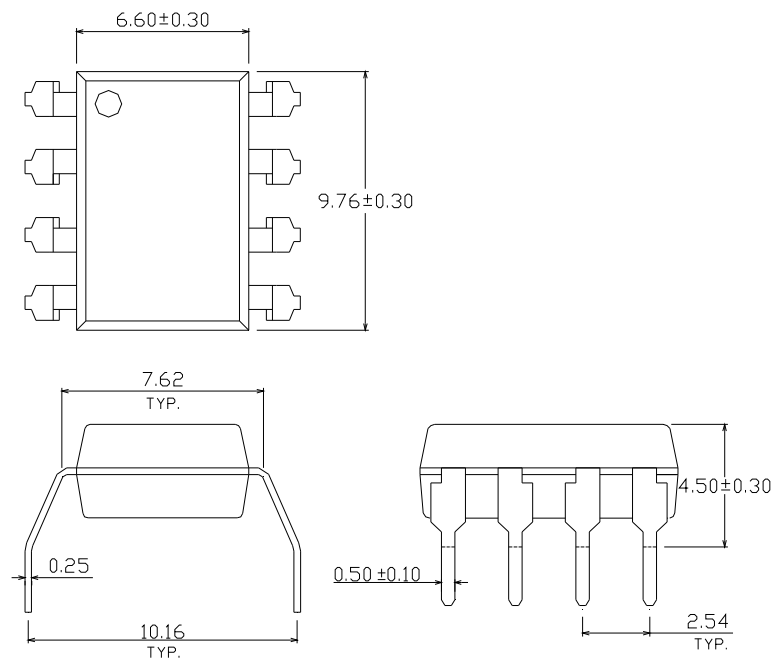


### Package Drawing (Dimensions in mm)

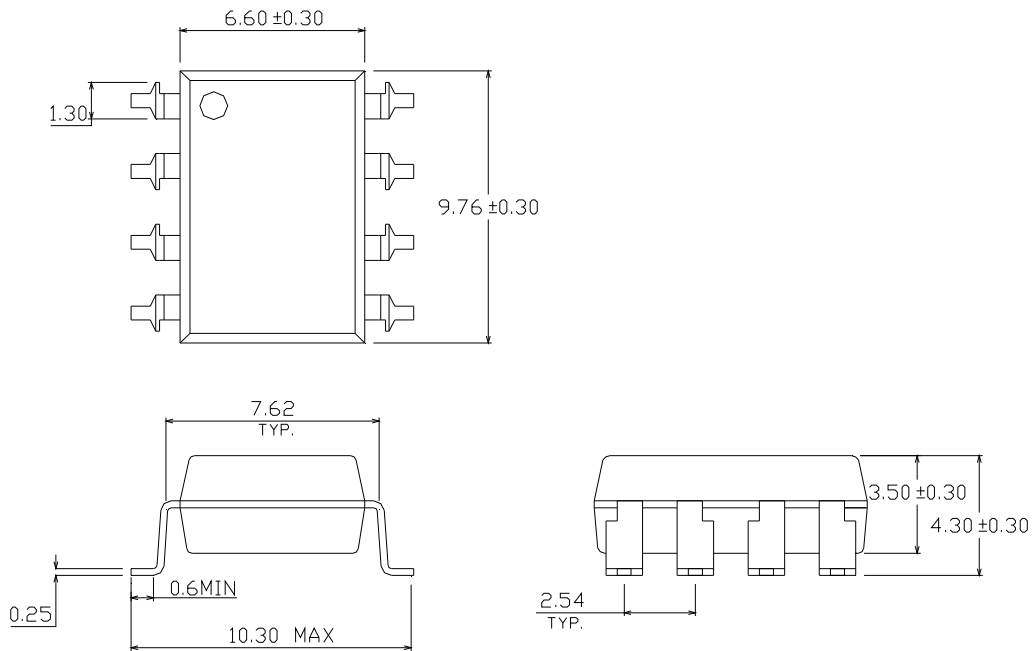
#### Standard DIP Type



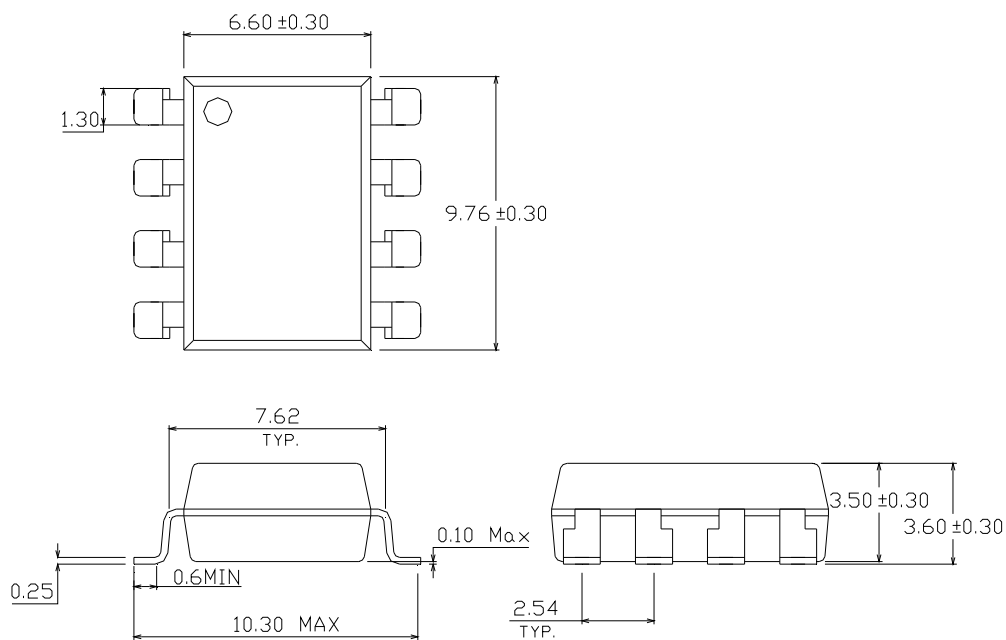
#### Option M Type



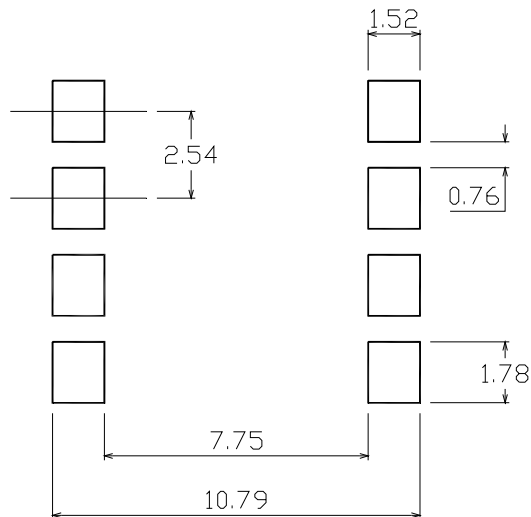
### Option S Type



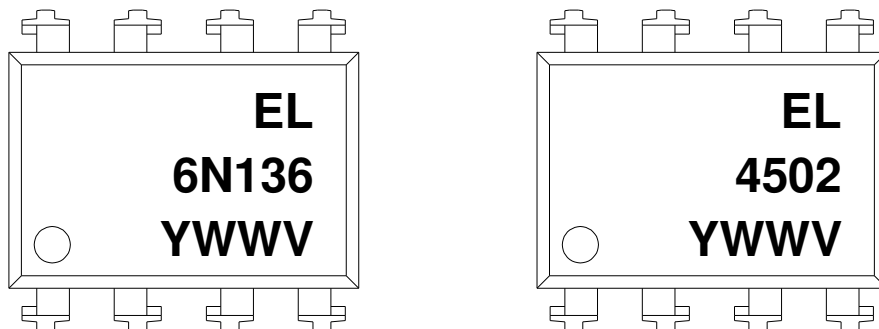
### Option S1 Type



### Recommended pad layout for surface mount leadform



### Device Marking

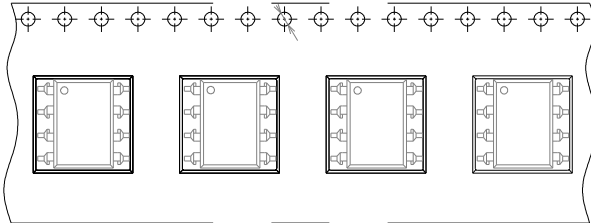


### Notes

- 4502
- 6N136 denotes Device Number
- Y denotes 1 digit Year code
- WW denotes 2 digit Week code
- V denotes VDE (optional)

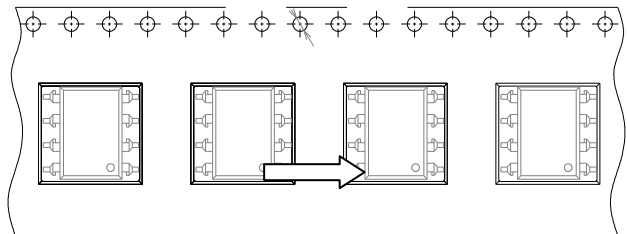
### Tape & Reel Packing Specifications

#### Option TA



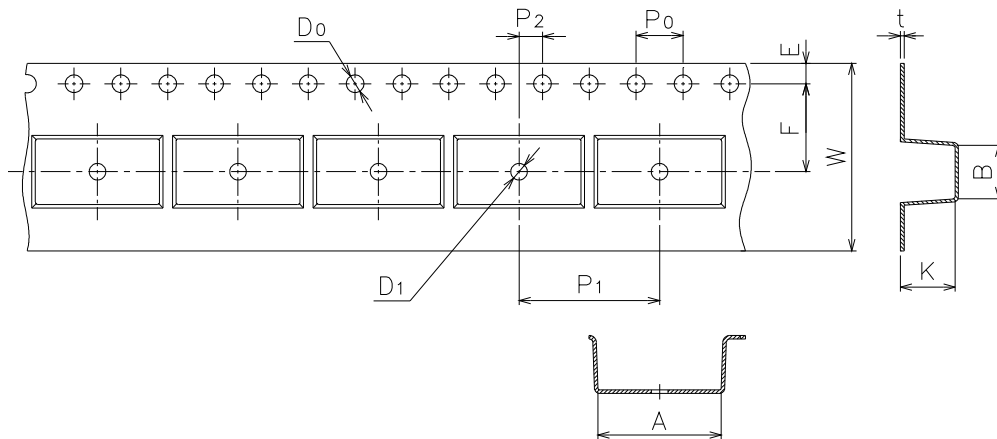
Direction of feed from reel

#### Option TB



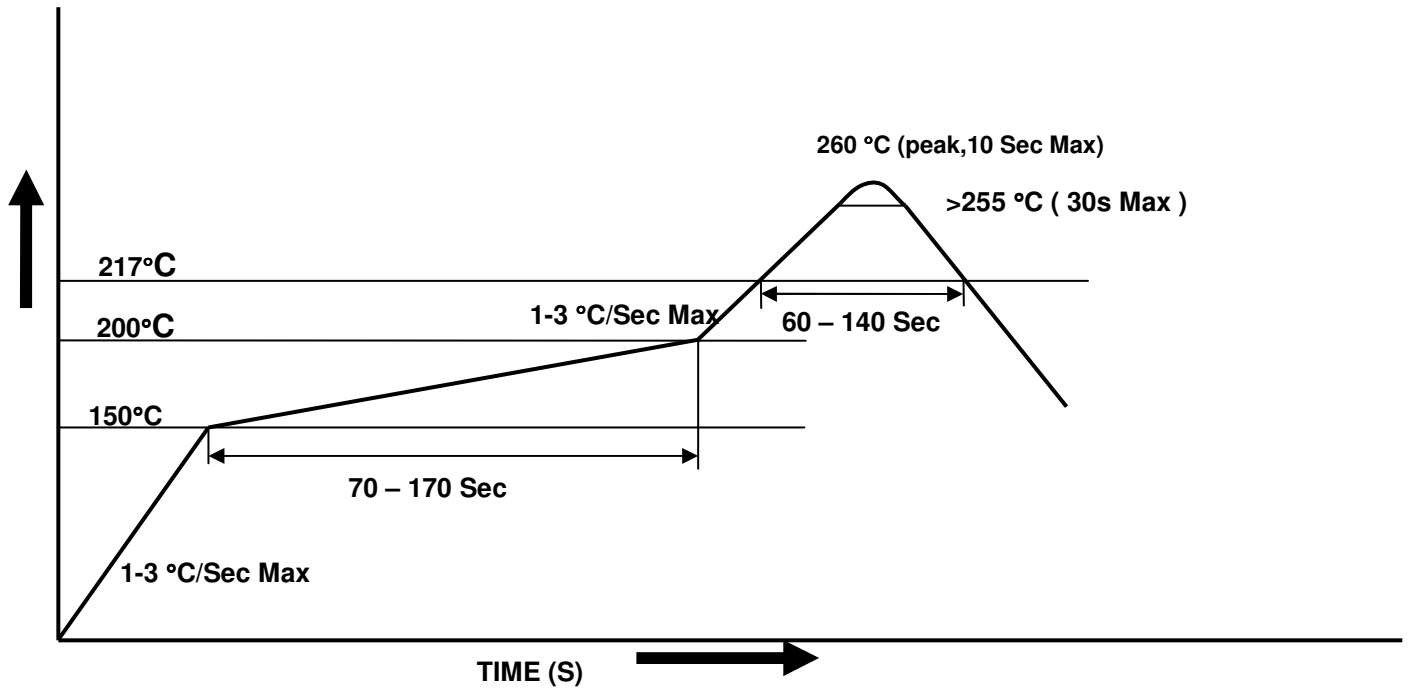
Direction of feed from reel

### Tape dimensions



Dimension No.	<b>A</b>	<b>B</b>	<b>Do</b>	<b>D1</b>	<b>E</b>	<b>F</b>
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.	<b>Po</b>	<b>P1</b>	<b>P2</b>	<b>t</b>	<b>W</b>	<b>K</b>
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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