# Single Channel，High Speed 1MBit/s Transistor Optocouple

## Description

The UMW6N135/6N136 optocoupler consists of an 850nm AlGaAs LED optically coupled to a high speed photodetector transistor. A separate connection for the bias of the photodiode improves the speed by several orders of magnitude over conventional phototransistor optocouplers 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 (M-type) and SMD option.

## Features

- Open-Collector Output
- TTL Compatible
- High bit rate: 1 MBit/s
- Superior CMR-10 kV/μs
- CTR guaranteed: 0-70℃
- RoHS compliant

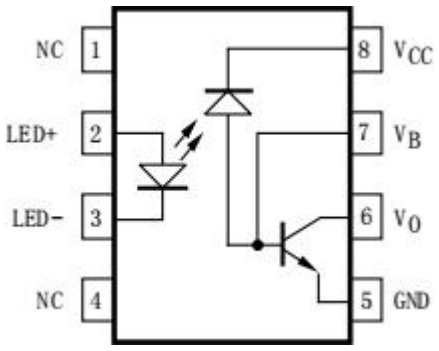
**Truth Table** (Positive Logic)

| Input | Enable | Output |
|---|---|---|
| H | H | L |
| L | H | H |
| H | L | H |
| L | L | H |
| H | NC | L |
| L | NC | H |

## Applications

- Output interface to CMOS-LSTTL-TTL
- Telecommunication equipment
- Power transistor isolation in motor drives
- Replacement for low speed phototransistor photo couplers
- Home applianWXW

## Schematics



## Absolute Maximum Ratings ($T_A$ = 25℃ unless otherwise specified)

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Storage temperature | $T_{STG}$ | -55 to +125 | °C |
| Operating temperature | $T_{OPR}$ | -55 to +100 | °C |
| Lead solder temperature | $T_{SOL}$ | 260 for 10 sec | °C |
| **Emitter** | | | |
| DC/Average forward input current (Note 1) | $I_{F\ (avg)}$ | 25 | mA |
| Peak forward input current (50% duty cycle, 1 ms p.w.) (Note 2) | $I_{F\ (pk)}$ | 50 | mA |
| Peak transient input current (≤1μs p.w., 300 pps) | $I_{F\ (trans)}$ | 1 | A |
| Reverse input voltage | $V_R$ | 5 | V |
| Input power dissipation (Note 3) | $P_{D\ (i)}$ | 100 | mW |
| **Detector** | | | |
| Average output current | $I_{O\ (avg)}$ | 8 | mA |
| Peak output current | $I_{O\ (pk)}$ | 16 | mA |
| Emitter-base reverse voltage | $V_{EBR}$ | 5 | V |
| Supply voltage | $V_{CC}$ | -0.5 to 30 | V |
| Output voltage | $V_O$ | -0.5 to 20 | V |
| Base current | $I_B$ | 5 | mA |
| Output power dissipation (Note 4) | $P_{D\ (o)}$ | 100 | mW |

Notes
1. Derate linearly above 70℃ free -air temperature at a rate of 0.8 mA/℃.
2. Derate linearly above 70℃ free -air temperature at a rate of 1.6 mA/℃.
3. Derate linearly above 70℃ free -air temperature at a rate of 0.9 mW/℃.
4. Derate linearly above 70℃ free -air temperature at a rate of 2.0 mW/℃.

## Electro-optical Characteristics ($T_A$= 0 to 70°C unless otherwise specified)

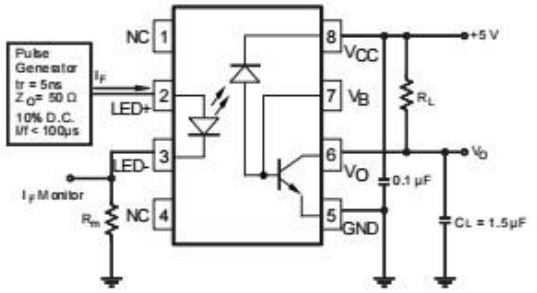
| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Emitter** | | | | | | |
| Input forward voltage | ($I_F$=16mA, $T_A$=25°C) | VF | | 1.45 | 1.7 | V |
| | (IF=16mA) | | | | 1.8 | |
| Input reverse breakdown voltage | ($I_R$=10μA) | $BV_R$ | 5 | | | V |
| Temperature coefficient of forward voltage | ($I_F$=16mA) | ($\Delta V_F/\Delta T_A$) | | -1.6 | | mV/°C |
| **Detector** | | | | | | |
| Logic high output current | ($I_F$=0mA, $V_O$=$V_{CC}$=5.5V) (TA=25°C) | IOH | | 0.001 | 0.5 | μA |
| | ($I_F$=0mA, $V_O$=$V_{CC}$=15V) (TA=25°C) | | | 0.005 | 1 | |
| | ($I_F$=0mA, $V_O$=$V_{CC}$=15V) | | | | 50 | |

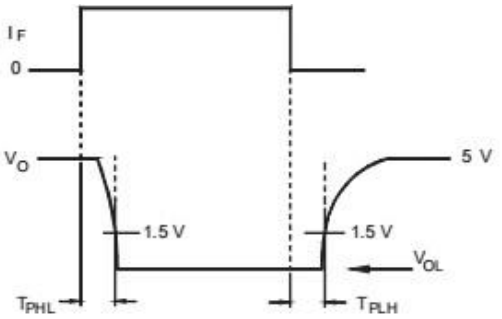
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Logic low supply current | | ($I_F$=16mA, $V_O$=Open) (VCC=15V) | ICCL | | 120 | 200 | μA |
| Logic high supply current | | ($I_F$=0mA, $V_O$=Open, VCC=15V) (TA=25°C) | ICCH | | | 1 | μA |
| | | ($I_F$=0mA, $V_O$=Open) (VCC=15V) | | | | 2 | |
| **Coupled** | | | | | | | |
| Current transfer ratio (Note 1) | WXW6N135 | ($I_F$=16mA, $V_{CC}$=4.5V) (VO=0.4V), (TA=25°C) | CTR | 7 | 18 | 50 | % |
| | | (IF=16mA, VCC=4.5V) (VO=0.5V) | | 5 | 19 | | |
| | WXW6N136 | ($I_F$=16mA, $V_{CC}$=4.5V) (VO=0.4V), (TA=25°C) | | 19 | 24 | 50 | |
| | | ($I_F$=16mA, $V_{CC}$=4.5V) (VO=0.5V) | | 15 | 25 | | |
| Logic low output voltage output voltage | WXW6N135 | ($I_F$=16mA, $V_{CC}$=4.5V) (IO=1.1mA, TA=25°C) | VOL | | 0.18 | 0.4 | V |
| | | ($I_F$=16mA, $V_{CC}$=4.5V) (IO=0.8mA) | | | | 0.5 | |
| | WXW6N136 | ($I_F$=16mA, $V_{CC}$=4.5V) (IO=3.0mA, TA=25°C) | | | 0.1 | 0.4 | |
| | | ($I_F$=16mA, $V_{CC}$=4.5V) (IO=2.4mA) | | | 0.1 | 0.5 | |
| **Switching (VCC = 5 V)** | | | | | | | |
| Propagation delay time to logic low | WXW6N135 | $T_A$=25°C, ($R_L$=4.1kΩ, IF=16mA) (Note 2) | TPHL | | 0.45 | 1.5 | μs |
| | | ($R_L$=4.1kΩ, $I_F$=16mA) (Note 3) | | | | 2 | |
| | WXW6N136 | $T_A$=25°C, ($R_L$=1.9kΩ, IF=16mA) (Note 2) | | | 0.2 | 0.8 | |
| | | ($R_L$=1.9kΩ, $I_F$=16mA) (Note 3) | | | | 1 | |
| Propagation delay time to logic high | WXW6N135 | TA=25°C, (RL=4.1kΩ, IF=16mA) (Note 2) | TPLH | | 0.5 | 1.5 | μs |
| | | (RL=4.1kΩ, IF=16mA) (Note 3) | | | | 2 | |
| | WXW6N136 | TA=25°C, (RL=4.1kΩ, IF=16mA) (Note 2) | | | 0.6 | 0.8 | |
| | | (RL=4.1kΩ, IF=16mA) (Note 3) | | | | 1 | |
| Common mode transient immunity at logic high | WXW6N135 | ($I_F$=0mA, $V_{CM}$=10$V_{P-P}$, RL=4.1kΩ) (Note 4)TA=25°C | \|CMH\| | | 10,000 | | V/μs |
| | WXW6N136 | (IF=0mA, VCM=10VP-P, RL=1.9kΩ) (Note 4)TA=25°C | | | 10,000 | | |
| Common mode transient immunity at logic low | WXW6N135 | ($I_F$=16mA, $V_{CM}$=10$V_{P-P}$, RL=4.1kΩ) (Note 4) TA=25°C | \|CML\| | | 10,000 | | V/μs |
| | WXW6N136 | (IF=0mA, VCM=10VP-P, RL=1.9kΩ) (Note 4)TA=25°C | | | 10,000 | | |
| **Isolation** | | | | | | | |
| Input-output insulation leakage current | | (Relative humidity=45%) (TA=25°C, t=5s) ($V_{I-O}$ =3000VDC) (Note 5) | $I_{I-O}$ | | | 1 | μA |
| Withstand insulation test voltage | | (RH≤50%, $T_A$=25°C) (Note5) (t=1min.) | VISO | 5000 | | | VRMS |
| Resistance (input to output) | | (Note 5) ($V_{I-O}$=500VDC) | RI-O | | 1012 | | W |

| | | | | | | |
|---|---|---|---|---|---|---|
| Capacitance (input to output) | (Note 5) (f=1MHz) | CI-O | | 0.6 | | pF |
| DC Current gain | ($I_O$=3mA, $V_O$=5V) | HFE | | 150 | | |

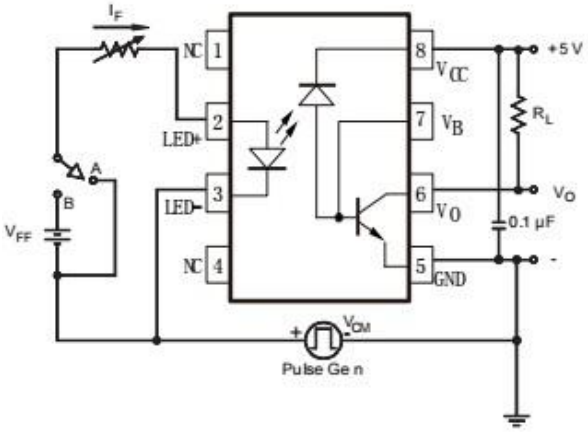
Notes
1. Current Transfer Ratio is defined as a ratio of output collector current, $I_O$, to the forward LED input current, $I_F$, times 100%.
2. The 4.1 kΩ load represents 1 LSTTL unit load of 0.36 mA and 6.1kΩ pull-upresistor.
3. The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and 5.6 kΩ pull-upresistor.
4. 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., $V_O$>2.0 V). 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., $V_O$<0.8 V).
5. Device is considered a two terminal device: Pins 1, 2, 3 and 4 are shorted together and Pins 5, 6, 7 and 8 areshorted together.

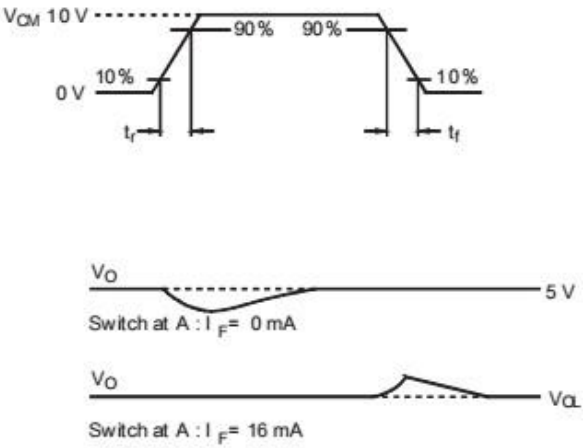
## Test Circuits




Switching Time Test Circuit




Common Mode Immunity Test Circuit

## Typical Performance Curves

Fig. 1 Normalized CTR vs.Forward Current

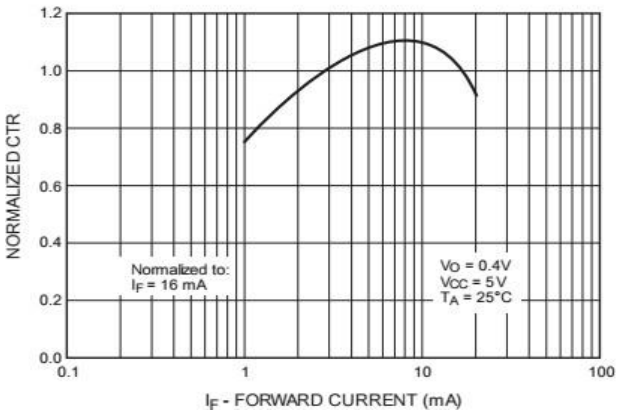



Fig. 2 Normalized CTR vs.Temperature

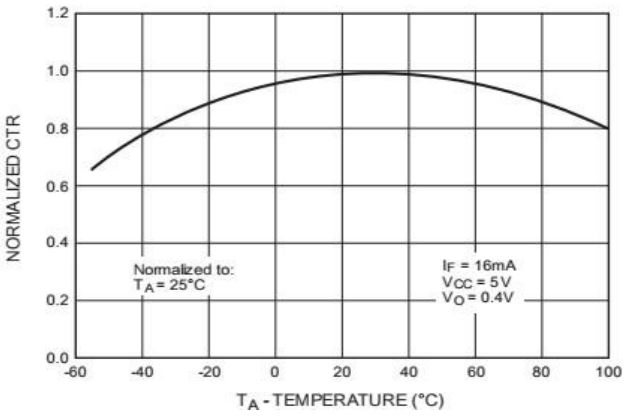



Fig. 3 Output Current vs.Output Voltage

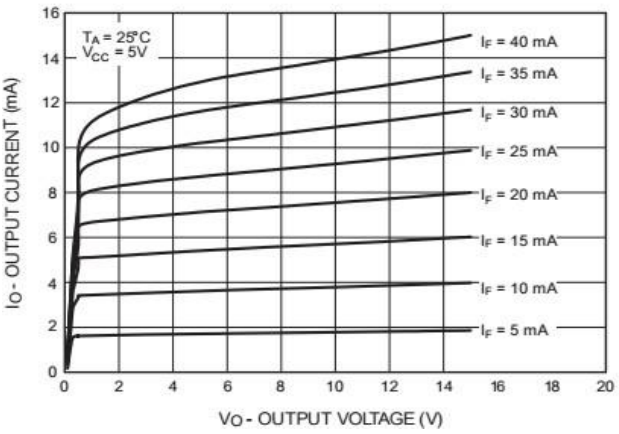



Fig. 4 Logic High Output Current vs.Temperature

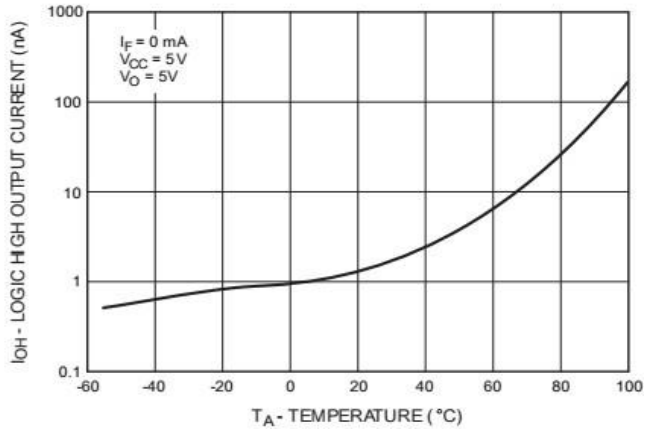



Fig. 5 Propagation Delay vs.Temperature

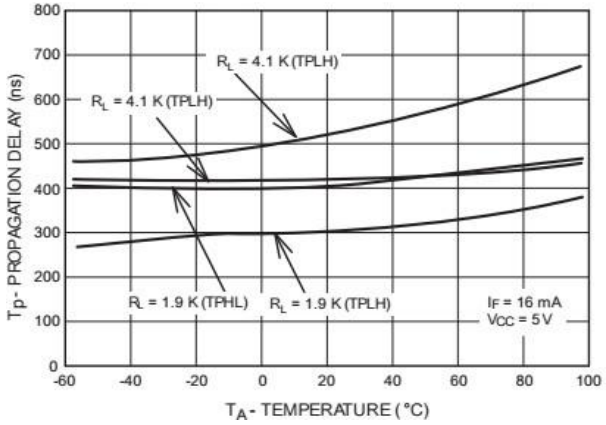
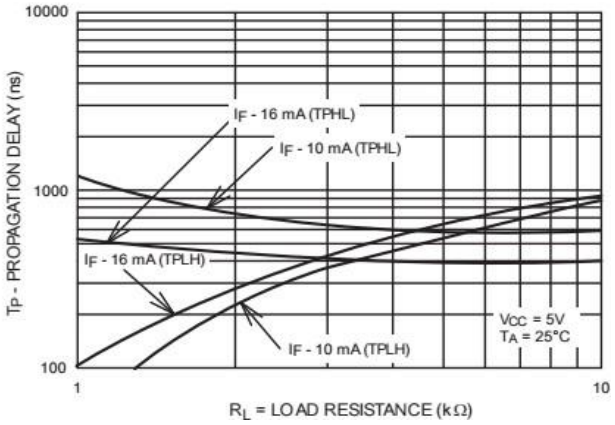
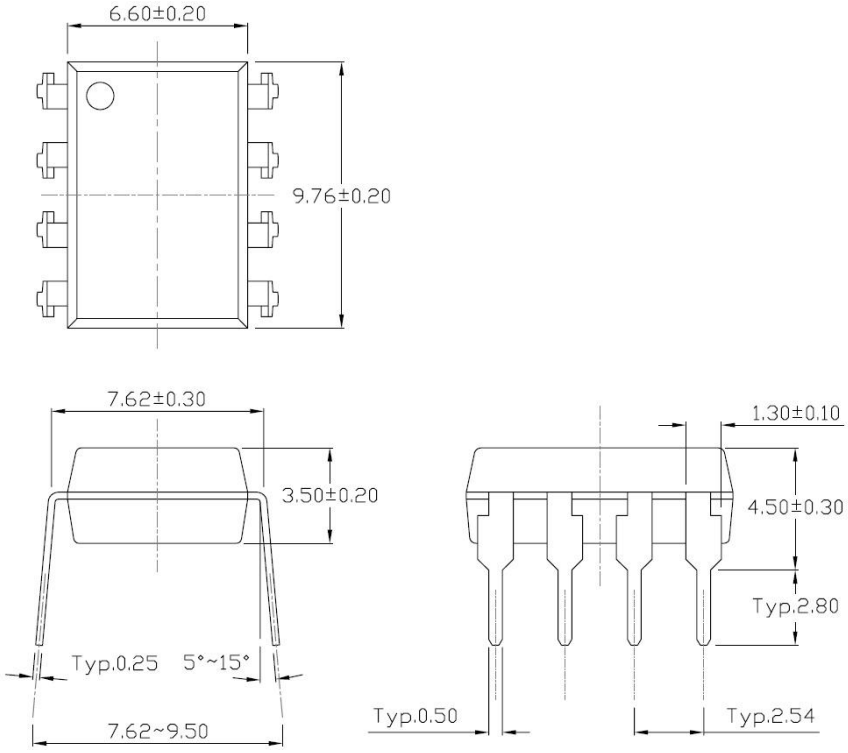



Fig. 6 Propagation Delay vs. Load Resistance

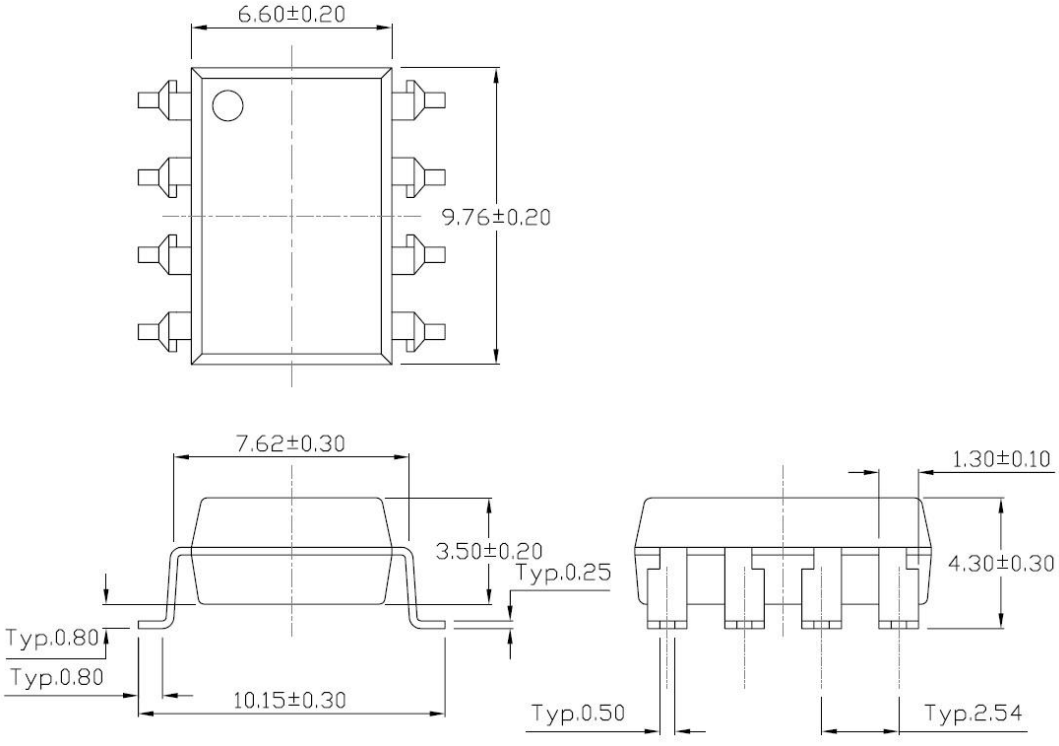


## Package Dimensions *Dimensions in mm unless otherwise stated*

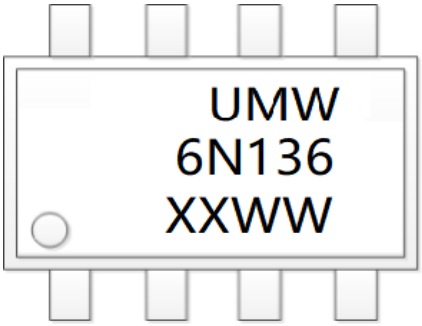
### Through Hole (DIP Type)




### Surface Mount Lead Forming (S Type)



**Marking**




- “XX” denotes YEAR;
- “WW” denotes WEEK

## ORDERING INFORMATION

| Order Code | Description | Base qty |
|---|---|---|
| UMW 6N135M | Iron frame, DIP-8, Halogen/lead -free | 1280/BOX |
| UMW 6N135S | Copper frame,SOP-8,Halogen-free | 1000/REEL |
| UMW 6N136M | Iron frame, DIP-8, Halogen/lead -free | 1280/BOX |
| UMW 6N136S | Copper frame,SOP-8,Halogen-free | 1000/REEL |