

Single Channel, High Speed 1MBit/s Transistor Optocoupler

**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°C
- RoHS compliant

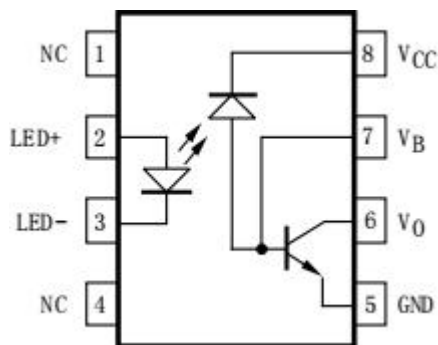
**Applications**

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

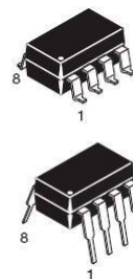
**Truth Table** (Positive Logic)

Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H
H	NC	L
L	NC	H

**Schematics**



**Package Outlines**



**Single Channel, High Speed 1MBit/s Transistor Optocoupler**
**Absolute Maximum Ratings (T<sub>A</sub> = 25°C unless otherwise specified)**

Parameter	Symbol	Value	Units
Storage temperature	T <sub>STG</sub>	-55 to +125	°C
Operating temperature	T <sub>OPR</sub>	-55 to +100	°C
Lead solder temperature	T <sub>SOL</sub>	260 for 10 sec	°C
<b>Emitter</b>			
DC/Average forward input current (Note 1)	I <sub>F (avg)</sub>	25	mA
Peak forward input current (50% duty cycle, 1 ms p.w.) (Note 2)	I <sub>F (pk)</sub>	50	mA
Peak transient input current (≤1 μs p.w., 300 pps)	I <sub>F (trans)</sub>	1	A
Reverse input voltage	V <sub>R</sub>	5	V
Input power dissipation (Note 3)	P <sub>D (i)</sub>	100	mW
<b>Detector</b>			
Average output current	I <sub>O (avg)</sub>	8	mA
Peak output current	I <sub>O (pk)</sub>	16	mA
Emitter-base reverse voltage	V <sub>EBR</sub>	5	V
Supply voltage	V <sub>CC</sub>	-0.5 to 30	V
Output voltage	V <sub>O</sub>	-0.5 to 20	V
Base current	I <sub>B</sub>	5	mA
Output power dissipation (Note 4)	P <sub>D (o)</sub>	100	mW

**Notes**

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

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>Emitter</b>						
Input forward voltage	(I <sub>F</sub> =16mA, T <sub>A</sub> =25°C)	V <sub>F</sub>		1.45	1.7	V
	(I <sub>F</sub> =16mA)				1.8	
Input reverse breakdown voltage	(I <sub>R</sub> =10μA)	BV <sub>R</sub>	5			V
Temperature coefficient of forward voltage	(I <sub>F</sub> =16mA)	(ΔV <sub>F</sub> /ΔT <sub>A</sub> )		-1.6		mV/°C
<b>Detector</b>						
Logic high output current	(I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =5.5V) (T <sub>A</sub> =25°C)	IOH		0.001	0.5	μA
	(I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V) (T <sub>A</sub> =25°C)			0.005	1	
	(I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V)				50	

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Logic low supply current		( $I_F=16\text{mA}$ , $V_O=\text{Open}$ ) ( $V_{CC}=15\text{V}$ )	ICCL		120	200	$\mu\text{A}$
Logic high supply current		( $I_F=0\text{mA}$ , $V_O=\text{Open}$ , $V_{CC}=15\text{V}$ ) ( $T_A=25^\circ\text{C}$ )	ICCH			1	$\mu\text{A}$
		( $I_F=0\text{mA}$ , $V_O=\text{Open}$ ) ( $V_{CC}=15\text{V}$ )				2	
<b>Coupled</b>							
Current transfer ratio (Note 1)	WXW6N135	( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $V_O=0.4\text{V}$ ), ( $T_A=25^\circ\text{C}$ )	CTR	7	18	50	%
		( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $V_O=0.5\text{V}$ )		5	19		
	WXW6N136	( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $V_O=0.4\text{V}$ ), ( $T_A=25^\circ\text{C}$ )		19	24	50	
		( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $V_O=0.5\text{V}$ )		15	25		
Logic low output voltage output voltage	WXW6N135	( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $I_O=1.1\text{mA}$ , $T_A=25^\circ\text{C}$ )	VOL		0.18	0.4	V
		( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $I_O=0.8\text{mA}$ )				0.5	
	WXW6N136	( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $I_O=3.0\text{mA}$ , $T_A=25^\circ\text{C}$ )			0.1	0.4	
		( $I_F=16\text{mA}$ , $V_{CC}=4.5\text{V}$ ) ( $I_O=2.4\text{mA}$ )			0.1	0.5	
<b>Switching (<math>V_{CC} = 5\text{V}</math>)</b>							
Propagation delay time to logic low	WXW6N135	$T_A=25^\circ\text{C}$ , ( $R_L=4.1\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 2)	TPHL		0.45	1.5	$\mu\text{s}$
		( $R_L=4.1\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 3)				2	
	WXW6N136	$T_A=25^\circ\text{C}$ , ( $R_L=1.9\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 2)			0.2	0.8	
		( $R_L=1.9\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 3)				1	
Propagation delay time to logic high	WXW6N135	$T_A=25^\circ\text{C}$ , ( $R_L=4.1\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 2)	TPLH		0.5	1.5	$\mu\text{s}$
		( $R_L=4.1\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 3)				2	
	WXW6N136	$T_A=25^\circ\text{C}$ , ( $R_L=4.1\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 2)			0.6	0.8	
		( $R_L=4.1\text{k}\Omega$ , $I_F=16\text{mA}$ ) (Note 3)				1	
Common mode transient immunity at logic high	WXW6N135	( $I_F=0\text{mA}$ , $V_{CM}=10\text{V}_{P-P}$ , $R_L=4.1\text{k}\Omega$ ) (Note 4) $T_A=25^\circ\text{C}$	CMH		10,000		V/ $\mu\text{s}$
	WXW6N136	( $I_F=0\text{mA}$ , $V_{CM}=10\text{V}_{P-P}$ , $R_L=1.9\text{k}\Omega$ ) (Note 4) $T_A=25^\circ\text{C}$			10,000		
Common mode transient immunity at logic low	WXW6N135	( $I_F=16\text{mA}$ , $V_{CM}=10\text{V}_{P-P}$ , $R_L=4.1\text{k}\Omega$ ) (Note 4) $T_A=25^\circ\text{C}$	CML		10,000		V/ $\mu\text{s}$
	WXW6N136	( $I_F=0\text{mA}$ , $V_{CM}=10\text{V}_{P-P}$ , $R_L=1.9\text{k}\Omega$ ) (Note 4) $T_A=25^\circ\text{C}$			10,000		
<b>Isolation</b>							
Input-output insulation leakage current		(Relative humidity=45%) ( $T_A=25^\circ\text{C}$ , $t=5\text{s}$ ) ( $V_{I-O}$ $=3000\text{VDC}$ ) (Note 5)	II-O			1	$\mu\text{A}$
Withstand insulation test voltage		( $RH\leq 50\%$ , $T_A=25^\circ\text{C}$ ) (Note5) ( $t=1\text{min.}$ )	VISO	5000			VRMS
Resistance (input to output)		(Note 5) ( $V_{I-O}=500\text{VDC}$ )	RI-O		1012		W

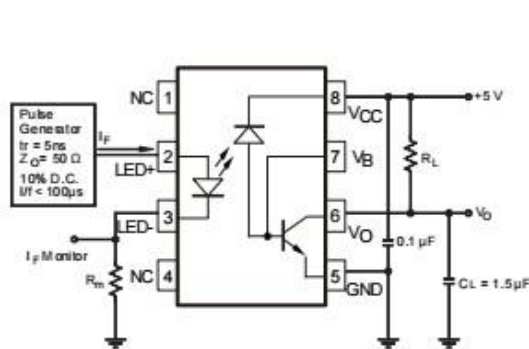
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Capacitance (input to output)	(Note 5) (f=1MHz)	CI-O	0.6		pF
DC Current gain	(I <sub>O</sub> =3mA, V <sub>O</sub> =5V)	HFE	150		

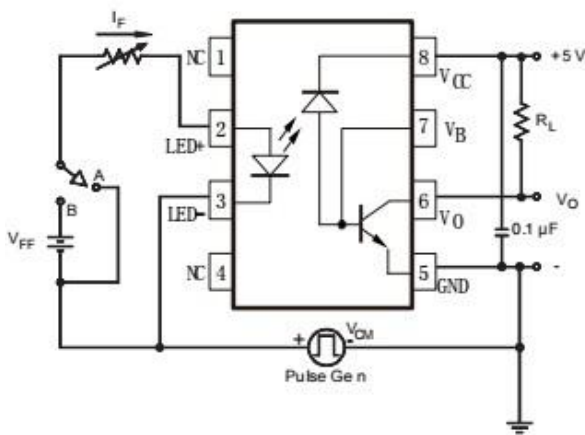
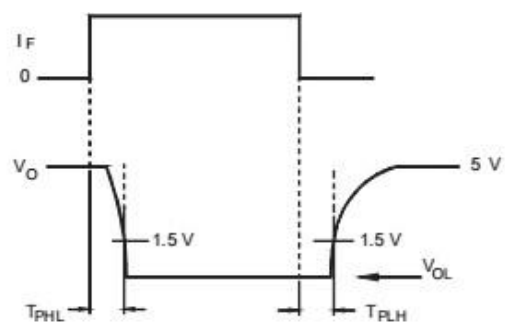
Notes

1. Current Transfer Ratio is defined as a ratio of output collector current, I<sub>O</sub>, to the forward LED input current, I<sub>F</sub>, times 100%.
2. The 4.1 kΩ load represents 1 LSTTL unit load of 0.36 mA and 6.1kΩ pull-up resistor.
3. The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and 5.6 kΩ pull-up resistor.
4. Common mode transient immunity in logic high level is the maximum tolerable (positive) dV<sub>cm</sub>/dt on the leading edge of the common mode pulse signal V<sub>CM</sub>, to assure that the output will remain in a logic high state (i.e., V<sub>O</sub>>2.0 V). Common mode transient immunity in logic low level is the maximum tolerable (negative) dV<sub>cm</sub>/dt on the trailing edge of the common mode pulse signal, V<sub>CM</sub>, to assure that the output will remain in a logic low state (i.e., V<sub>O</sub><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 are shorted together.

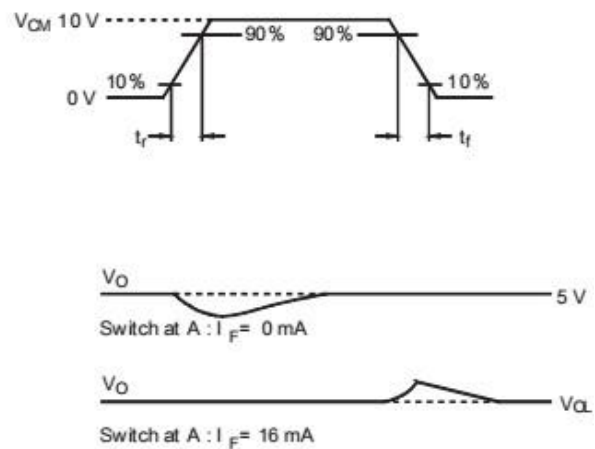
Test Circuits



Switching Time Test Circuit



Common Mode Immunity Test Circuit



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Typical Performance Curves

Fig. 1 Normalized CTR vs. Forward Current

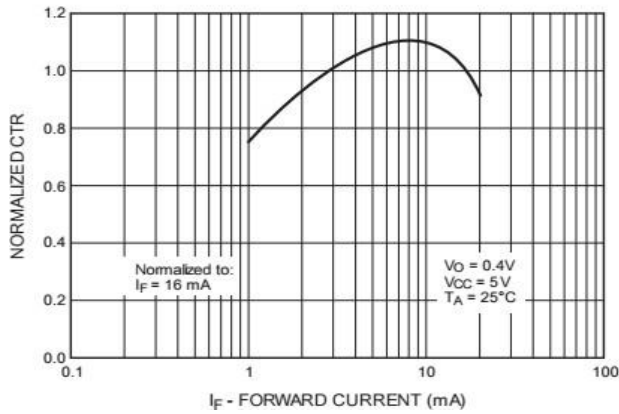


Fig. 2 Normalized CTR vs. Temperature

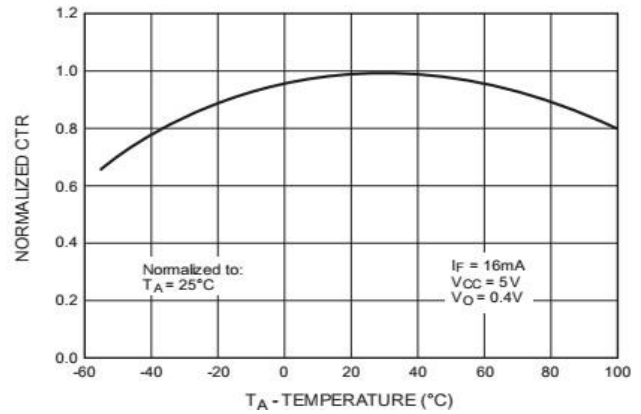


Fig. 3 Output Current vs. Output Voltage

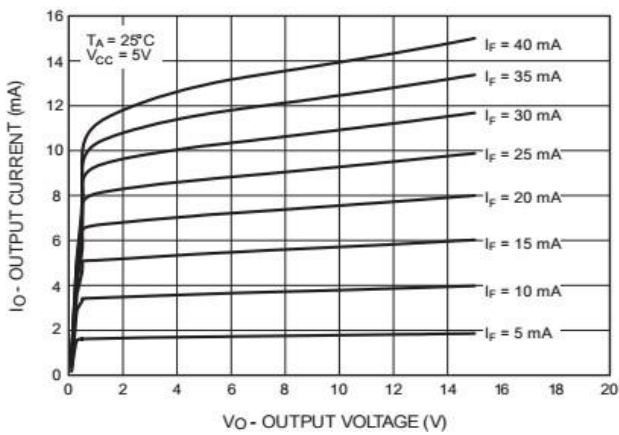


Fig. 4 Logic High Output Current vs. Temperature

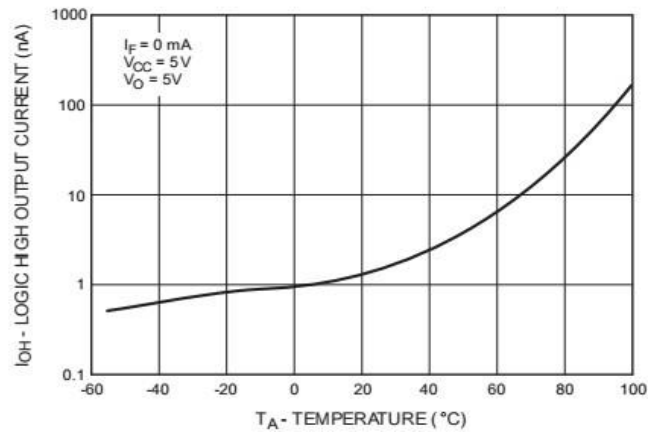


Fig. 5 Propagation Delay vs. Temperature

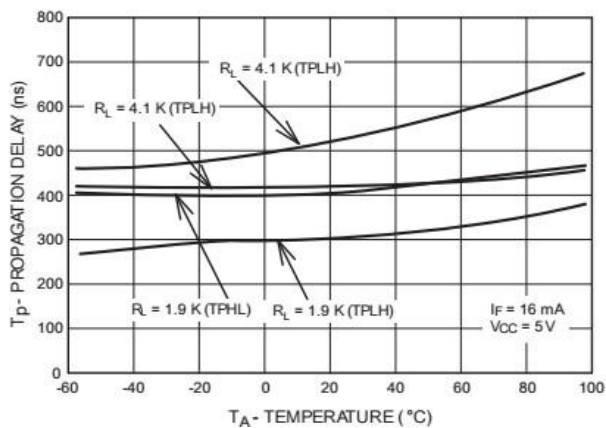
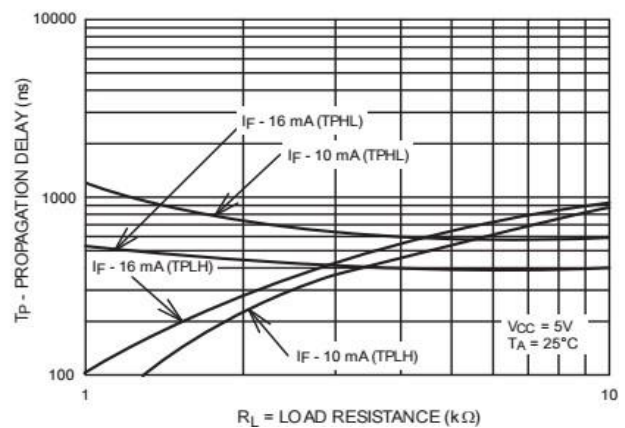


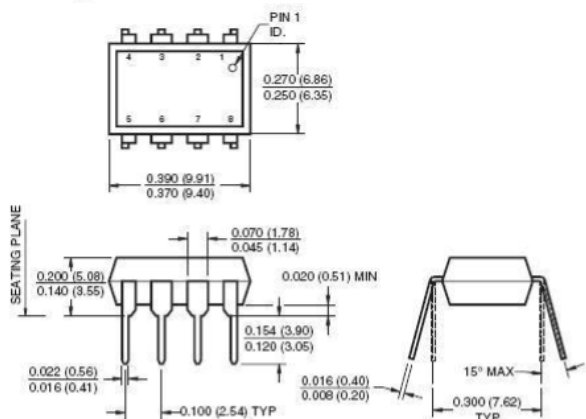
Fig. 6 Propagation Delay vs. Load Resistance



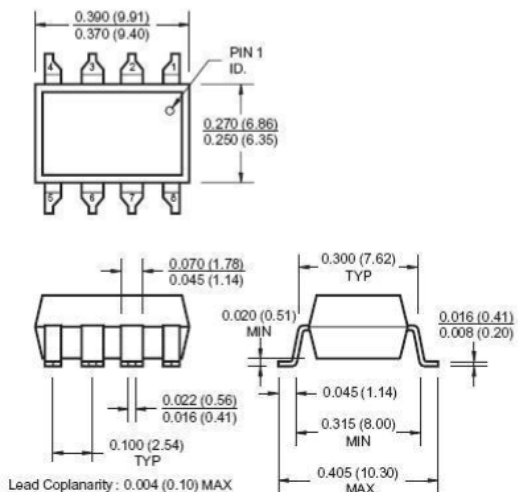
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Package Dimensions

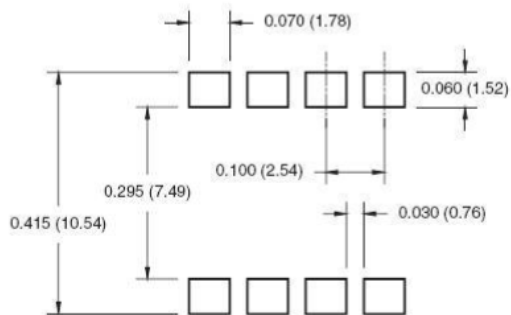
Through Hole



Surface Mount



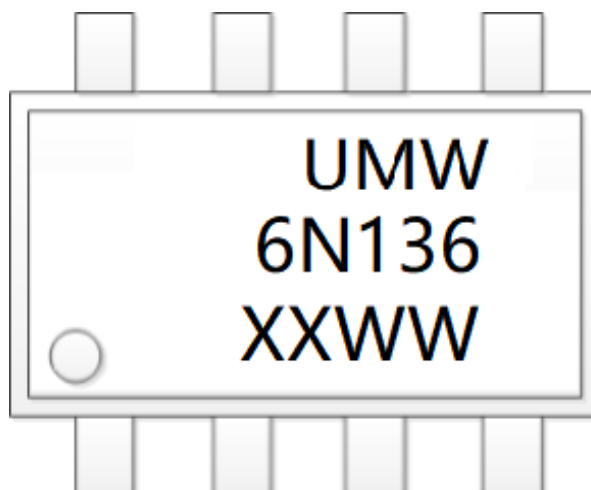
8-Pin DIP – Land Pattern



Note: All dimensions are in inches (millimeters)

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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