

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/ μ s
- CTR guaranteed: 0-70°C
- RoHS compliant

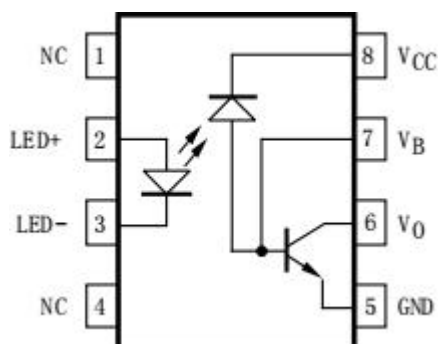
Applications

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

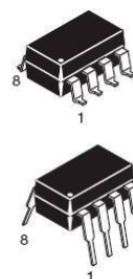
Truth Table (Positive Logic)

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

Schematics



Package Outlines



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Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Units
Storage temperature	T_{STG}	-55 to +125	$^\circ\text{C}$
Operating temperature	T_{OPR}	-55 to +100	$^\circ\text{C}$
Lead solder temperature	T_{SOL}	260 for 10 sec	$^\circ\text{C}$
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 ($\leq 1\mu\text{s}$ 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°C free -air temperature at a rate of $0.8\text{ mA}/^\circ\text{C}$.
2. Derate linearly above 70°C free -air temperature at a rate of $1.6\text{ mA}/^\circ\text{C}$.
3. Derate linearly above 70°C free -air temperature at a rate of $0.9\text{ mW}/^\circ\text{C}$.
4. Derate linearly above 70°C free -air temperature at a rate of $2.0\text{ mW}/^\circ\text{C}$.

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

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

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Logic low supply current		(I _F =16mA, V _O =Open) (V _{CC} =15V)	ICCL		120	200	μA
Logic high supply current		(I _F =0mA, V _O =Open, V _{CC} =15V) (T _A =25°C)	ICCH			1	μA
		(I _F =0mA, V _O =Open) (V _{CC} =15V)				2	
Coupled							
Current transfer ratio (Note 1)	WXW6N135	(I _F =16mA, V _{CC} =4.5V) (V _O =0.4V), (T _A =25°C)	CTR	7	18	50	%
		(I _F =16mA, V _{CC} =4.5V) (V _O =0.5V)		5	19		
	WXW6N136	(I _F =16mA, V _{CC} =4.5V) (V _O =0.4V), (T _A =25°C)		19	24	50	
		(I _F =16mA, V _{CC} =4.5V) (V _O =0.5V)		15	25		
Logic low output voltage output voltage	WXW6N135	(I _F =16mA, V _{CC} =4.5V) (I _O =1.1mA, T _A =25°C)	VOL		0.18	0.4	V
		(I _F =16mA, V _{CC} =4.5V) (I _O =0.8mA)				0.5	
	WXW6N136	(I _F =16mA, V _{CC} =4.5V) (I _O =3.0mA, T _A =25°C)			0.1	0.4	
		(I _F =16mA, V _{CC} =4.5V) (I _O =2.4mA)			0.1	0.5	
Switching (V _{CC} = 5 V)							
Propagation delay time to logic low	WXW6N135	T _A =25°C, (R _L =4.1kΩ, I _F =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, I _F =16mA) (Note 2)			0.2	0.8	
		(R _L =1.9kΩ, I _F =16mA) (Note 3)				1	
Propagation delay time to logic high	WXW6N135	T _A =25°C, (R _L =4.1kΩ, I _F =16mA) (Note 2)	TPLH		0.5	1.5	μs
		(R _L =4.1kΩ, I _F =16mA) (Note 3)				2	
	WXW6N136	T _A =25°C, (R _L =4.1kΩ, I _F =16mA) (Note 2)			0.6	0.8	
		(R _L =4.1kΩ, I _F =16mA) (Note 3)				1	
Common mode transient immunity at logic high	WXW6N135	(I _F =0mA, V _{CM} =10V _{P-P} , R _L =4.1kΩ) (Note 4)T _A =25°C	CMH		10,000		V/μs
	WXW6N136	(I _F =0mA, V _{CM} =10V _{P-P} , R _L =1.9kΩ) (Note 4)T _A =25°C			10,000		
Common mode transient immunity at logic low	WXW6N135	(I _F =16mA, V _{CM} =10V _{P-P} , R _L =4.1kΩ) (Note 4) T _A =25°C	CML		10,000		V/μs
	WXW6N136	(I _F =0mA, V _{CM} =10V _{P-P} , R _L =1.9kΩ) (Note 4)T _A =25°C			10,000		
Isolation							
Input-output insulation leakage current		(Relative humidity=45%) (T _A =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

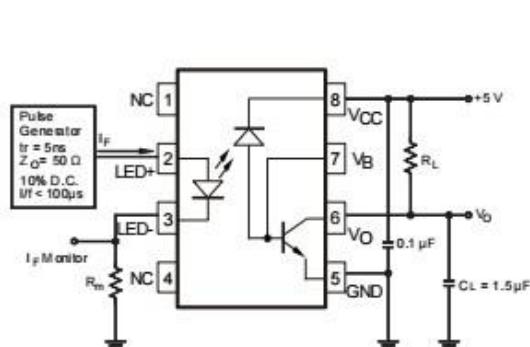
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Capacitance (input to output)	(Note 5) ($f=1\text{MHz}$)	CI-O		0.6		pF
DC Current gain	($I_O=3\text{mA}$, $V_O=5\text{V}$)	HFE		150		

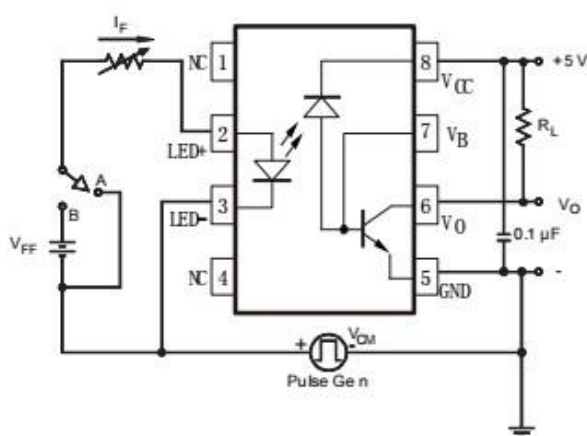
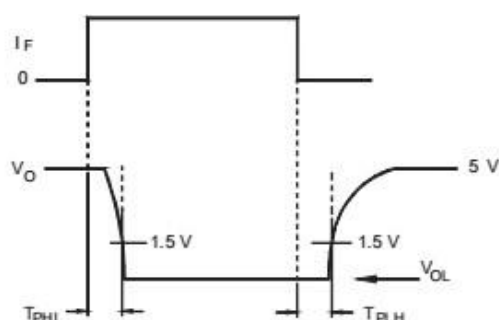
Notes

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 k Ω load represents 1 LSTTL unit load of 0.36 mA and 6.1k Ω pull-up resistor.
3. The 1.9 k Ω load represents 1 TTL unit load of 1.6 mA and 5.6 k Ω pull-up resistor.
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., $V_O > 2.0\text{V}$). 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., $V_O < 0.8\text{V}$).
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.

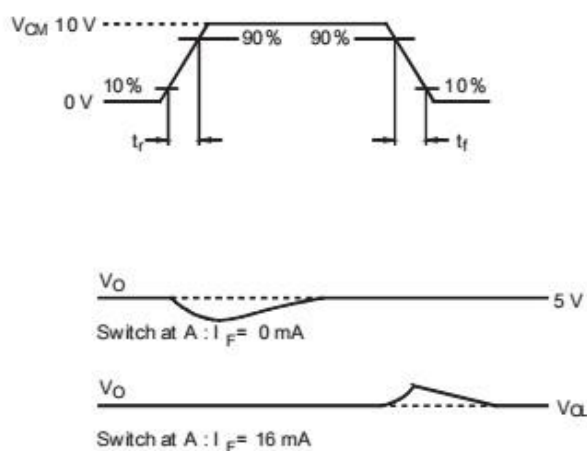
Test Circuits



Switching Time Test Circuit



Common Mode Immunity Test Circuit



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Typical Performance Curves

Fig. 1 Normalized CTR vs. Forward Current

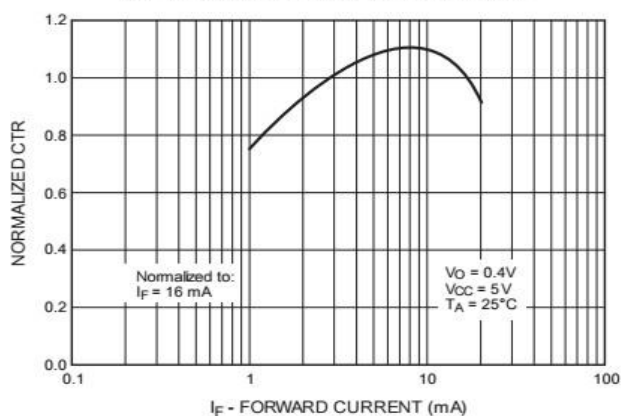


Fig. 2 Normalized CTR vs. Temperature

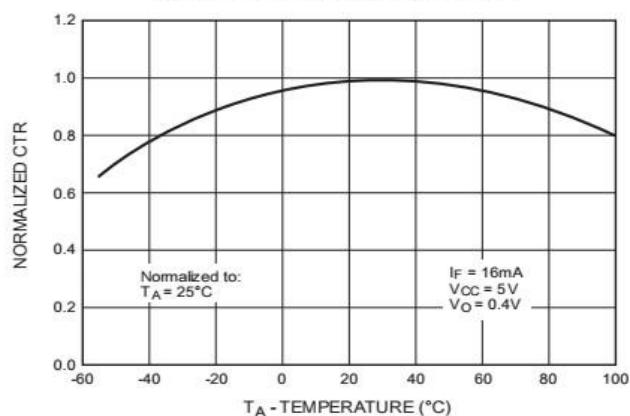


Fig. 3 Output Current vs. Output Voltage

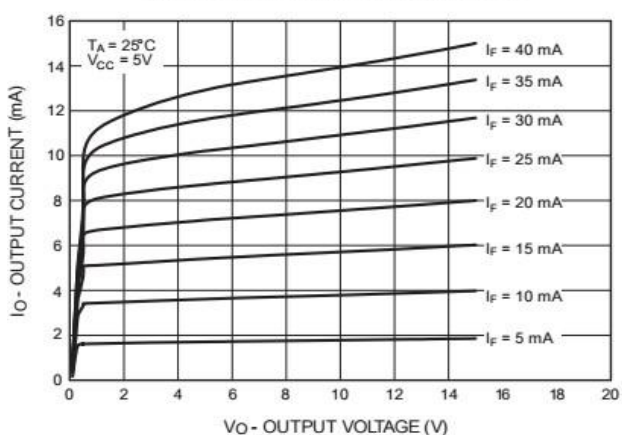


Fig. 4 Logic High Output Current vs. Temperature

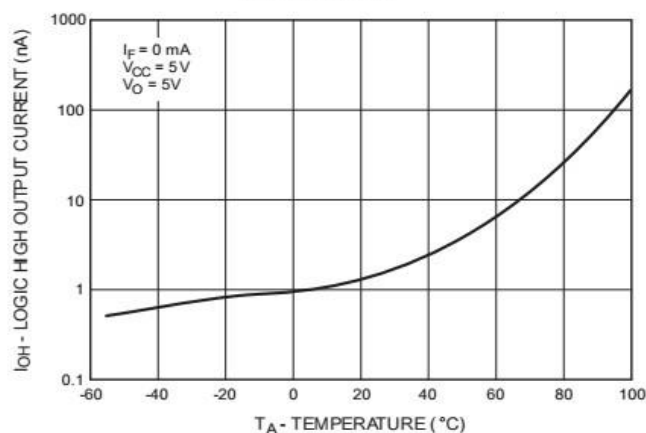


Fig. 5 Propagation Delay vs. Temperature

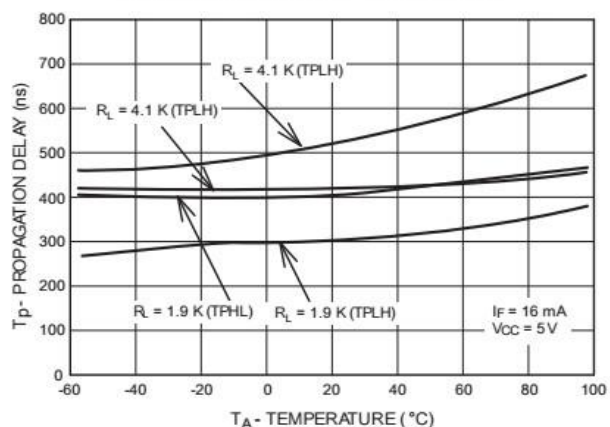
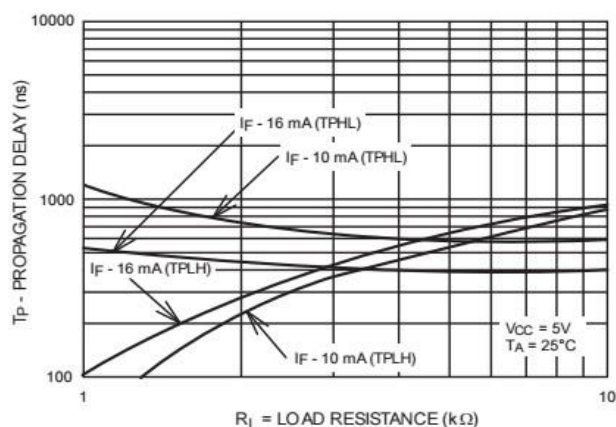


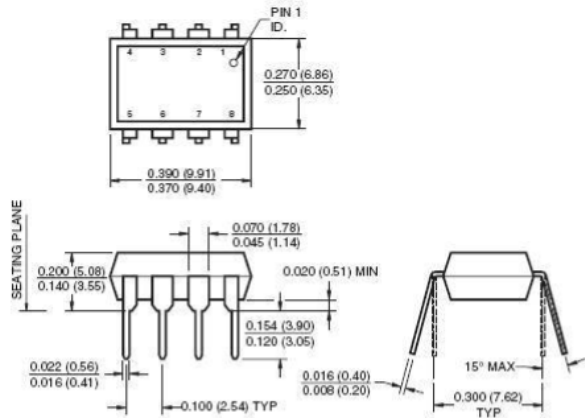
Fig. 6 Propagation Delay vs. Load Resistance



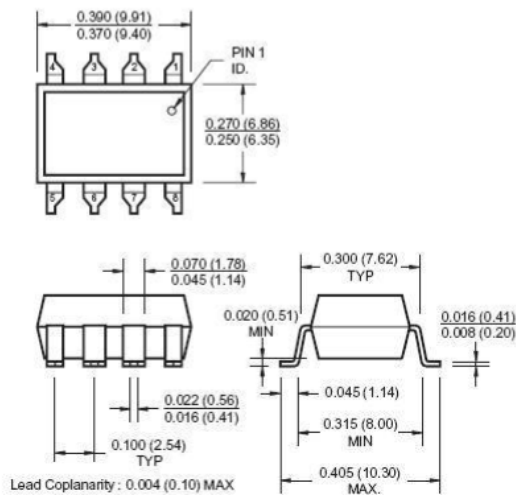
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Package Dimensions

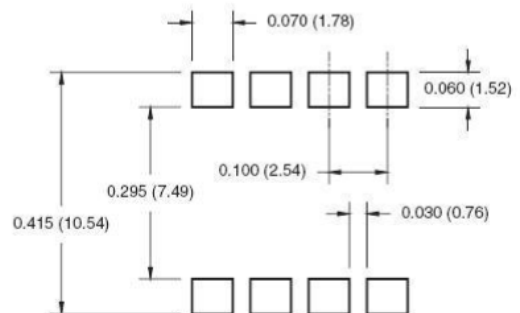
Through Hole



Surface Mount



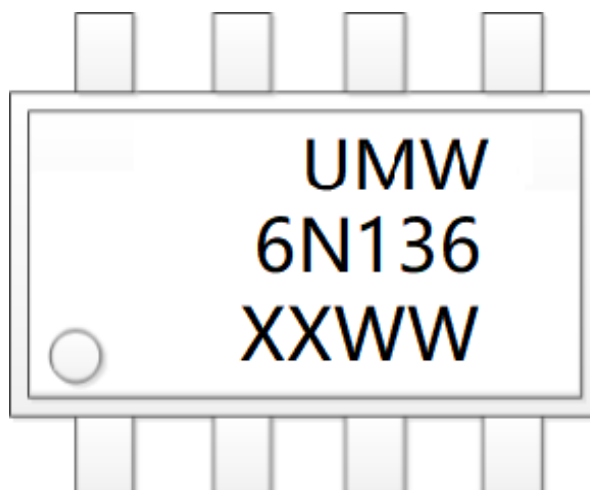
8-Pin DIP – Land Pattern



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