6N135S and 6N136S
ZERO-CROSS TRIAC DRIVER PHOTOCOUPLER

General Description

The 6N135S, 6N136S, 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



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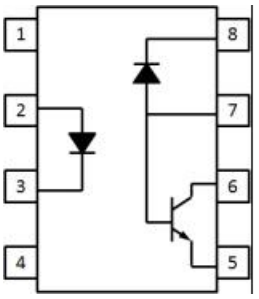
Features

- High speed 1Mbit/s
- High isolation voltage between input and output (Viso=5000 Vrms)
- Guaranteed performance from 0°C to 70°C
- Wide operating temperature range of -55°C to 100°C
- Pb free and RoHS compliant

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



Pin Configuration

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

Absolute Maximum Ratings (Ta=25℃)

	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 (≤1μs P.W,300pps)	I_{Ftrans}	1	A
	Reverse voltage	V_R	5	V
	Power dissipation	P_{IN}	45	mW

Absolute Maximum Ratings (Ta=25℃)

Output	Power dissipation		P_O	100	mW
	Emitter-Base reverse voltage	6N135S 6N136S	V_{EBR}	5	V
	Base current	6N135S 6N136S	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
Total Power Dissipation			P_{TOT}	200	mW
Isolation Voltage*1			V_{ISO}	5000	Vrms
Operating Temperature			T_{OPR}	-55 to 100	℃
Storage Temperature			T_{STG}	-55 to 125	℃
Soldering Temperature*2			T_{SOL}	260	℃

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

Switching Characteristics

(T_A=0 to 70°C unless specified otherwise, I_F=16mA, Vcc=5V)

Parameter		Symbol	Min	Typ.	Max.	Unit	Condition
Propagation Delay Time to Logic Low (Fig.8)	6N135S	TPHL	-	0.35	1.5	μs	R_L =4.1KΩ, TA=25°C
			-	-	2.0		R_L=4.1KΩ
	6N136S		-	0.35	0.8		R_L=1.9KΩ, T_A=25°C
			-	-	1.0		R_L =1.9KΩ
Propagation Delay Time to Logic High (Fig.8)	6N135S	TPLH	-	0.5	1.5	μs	R_L =4.1KΩ, TA=25°C
			-	-	2.0		R_L =4.1KΩ
	6N136S		-	0.3	0.8		R_L =1.9KΩ, TA=25°C
			-	-	1.0		R_L =1.9KΩ
Common Mode Transient Immunity at Logic High (Fig.9)*3	6N135S	CM_H	1,000	-	-	V/μs	I_F = 0mA , V_{CM}=10Vp-p, R_L=4.1KΩ, T_A =25°C
	6N136S		1,000	-	-		I_F = 0mA , V_{CM}=10Vp-p, R_L=1.9KΩ, T_A =25°C
Common Mode Transient Immunity at Logic Low (Fig.9)*3	6N135S	CM_L	1,000	-	-	V/μs	I_F = 16mA , V_{CM}=10Vp-p, R_L=4.1KΩ, T_A =25°C
	6N136S		1,000	-	-		I_F = 16mA , V_{CM}=10Vp-p, R_L=1.9KΩ, T_A=25°C

* Typical values at T_a = 25°C

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

Input

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward Voltage	V_F	-	1.45	1.8	V	I_F =16mA
Reverse Voltage	V_R	5.0	-	-	V	I_R = 10μA
Temperature coefficient of forward voltage	$\Delta V_F/\Delta T_A$	-	-1.9	-	mV/°C	I_F =16mA

Output

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

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

Parameter		Symbol	Min	Typ.	Max.	Unit	Condition
Current Transfer Ratio	6N135	CTR	7	-	50	%	I_F = 16mA ,V_O = 0.4V, V_{CC}=4.5V, T_A=25°C
	6N136 EF4502 EF4503		19	-	50		
	6N135		5	-	-		I_F = 16mA ,V_O = 0.5V, V_{CC}=4.5V
	6N136 EF4502 EF4503		15	-	-		
Logic Low Output Voltage	6N135	V_{OL}	-	0.18	0.4	V	I_F = 16mA ,I_O = 1.1mA, V_{CC}=4.5V, T_A=25°C
	6N136 EF4502 EF4503		-	0.25	0.4		I_F = 16mA ,I_O = 3mA, V_{CC}=4.5V, T_A=25°C
	6N135		-	-	0.5		I_F = 16mA ,I_O =0.8mA, V_{CC}=4.5V
	6N136 EF4502 EF4503		-	-	0.5		I_F= 16mA ,I_O=2.4mA, V_{CC}=4.5V

RATING AND CHARACTERISTIC CURVES

Fig.1 Forward Current vs. Forward Voltage

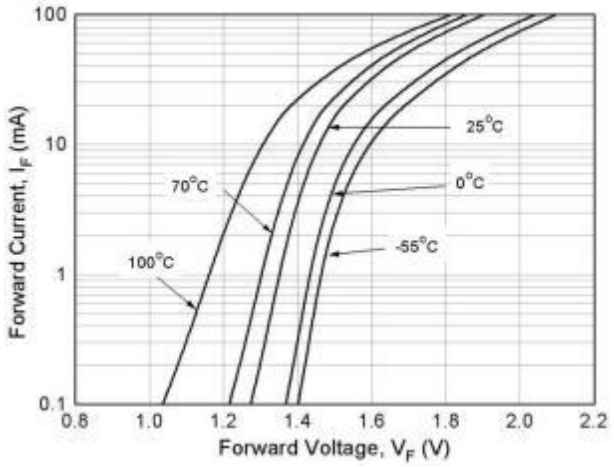


Fig.2 Normalized Current Transfer Ratio vs. Forward Current

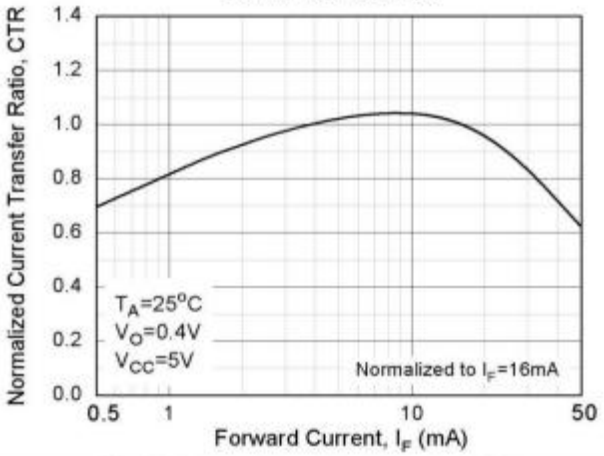


Fig.3 Normalized Current Transfer Ratio vs. Ambient Temperature

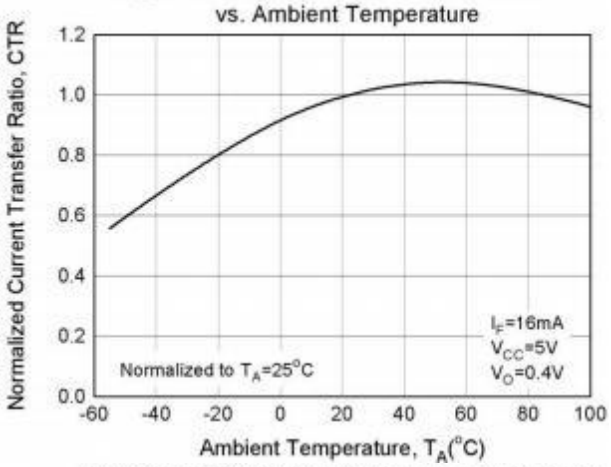


Fig.4 Output Current vs Output Voltage

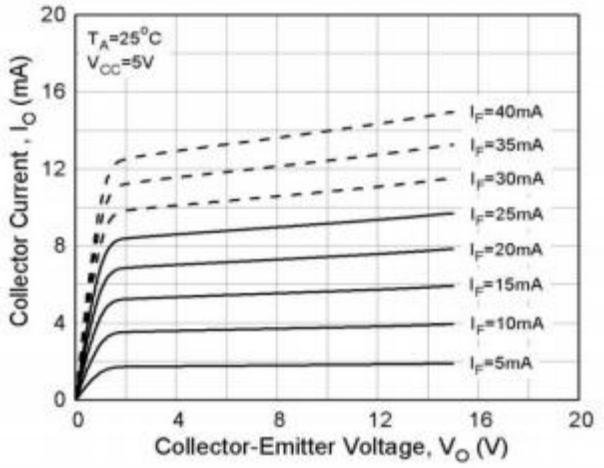


Fig.5 Logic High Output Current vs. Temperature

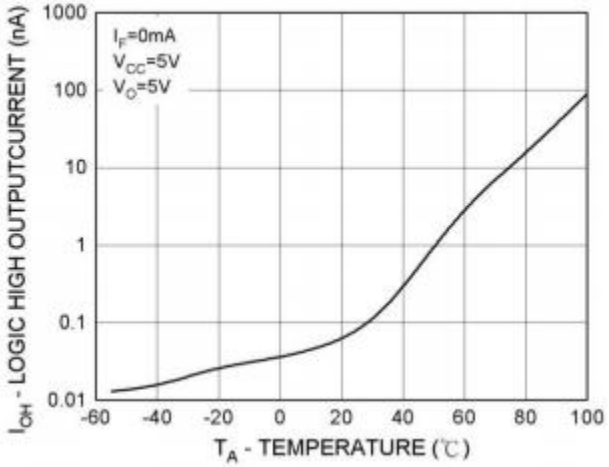
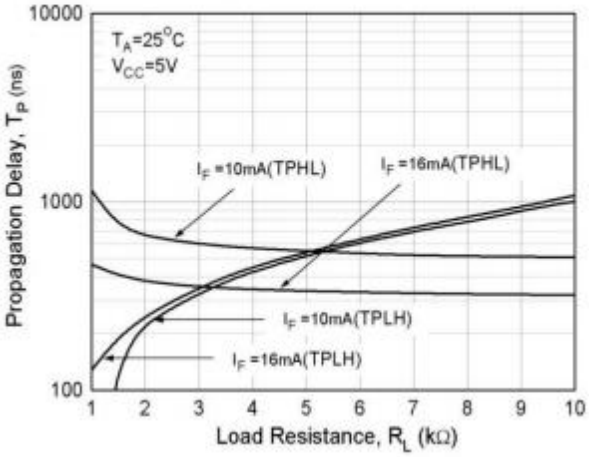


Fig.6 Propagation Delay vs. Load Resistance



RATING AND CHARACTERISTIC CURVES

Fig.7 Propagation Delay vs. Temperature

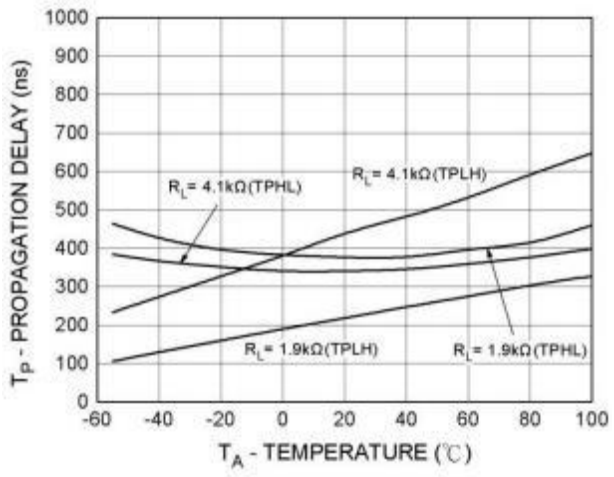


Figure 8 Switching Time Test Circuit & Waveform

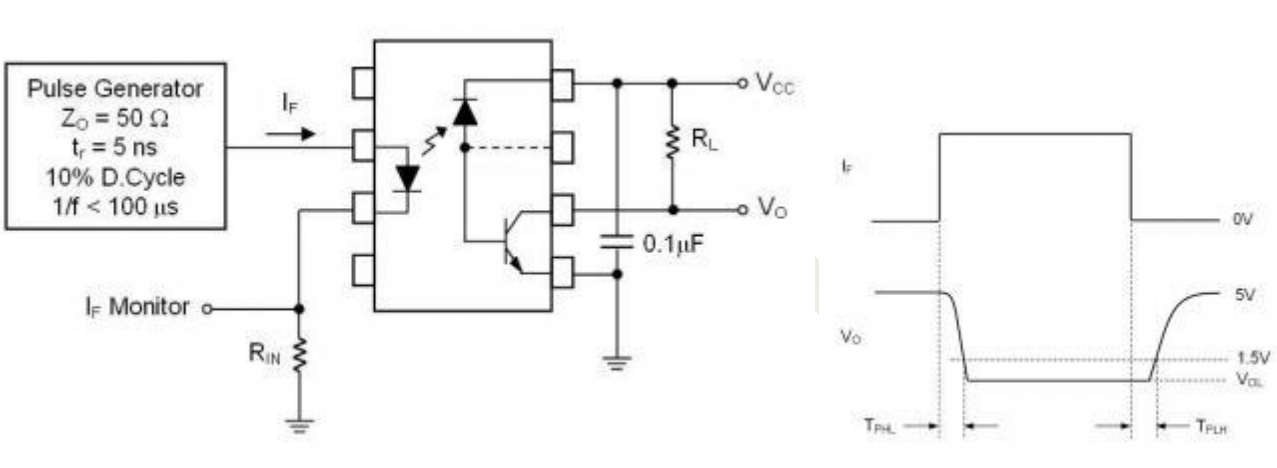
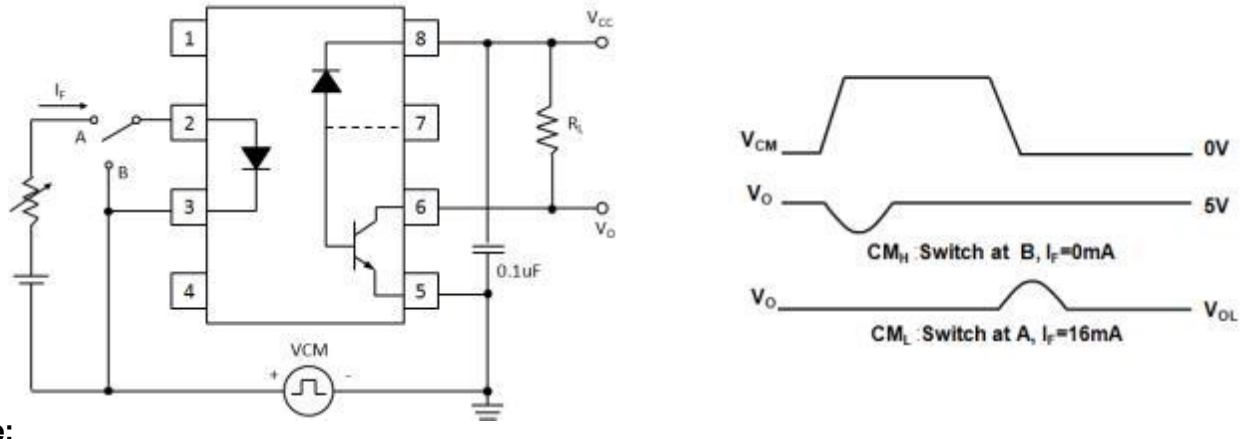


Figure 9 Transient Immunity Test Circuit & Waveform



Note:

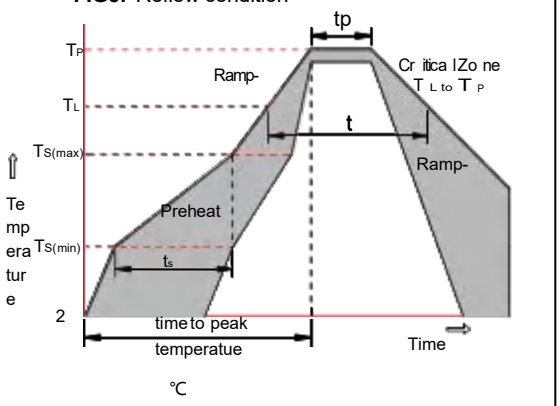
*3 Common mode transient immunity in logic high level is the maximum tolerable (positive) dVcm/dt on the leading edge of the common mode pulse signal VCM, to assure that the output will remain in a logic high state (i.e., VO > 2.0V).

Common mode transient immunity in logic low level is the maximum tolerable (negative) dVcm/dt on the trailing edge of the common mode pulse signal, VCM, to assure that the output will remain in a logic low state (i.e., VO < 0.8V).

Soldering parameters

Reflow Condition		Pb-Free assembly (see as bellow)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150℃
	-Temperature Max($T_{s(max)}$)	+200℃
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3℃/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3℃/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217℃
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_p)		+260(+0/-5)℃
Time within 5℃ of actual Peak Temp (t_p)		30 secs. Max
Ramp-down Rate		6℃/sec. Max
Time 25℃ to Peak Temp (T_P)		8 min. Max
Do not exceed		+260℃

FIG5: Reflow condition



Package Dimensions & Suggested Pad Layout

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