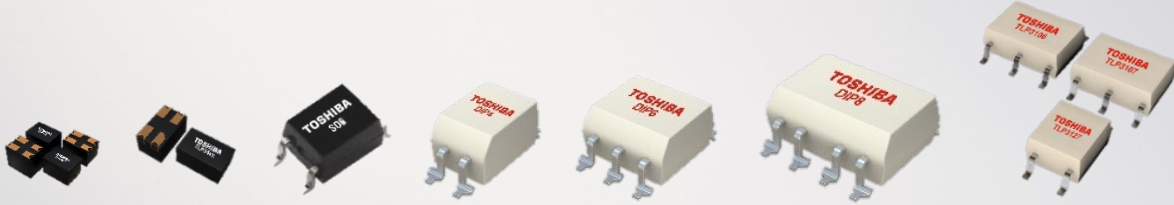


Photorelays



Ideal for Industrial Applications

Photorelays are a type of photocoupler consisting of an LED optically coupled with a MOSFET. They offer many advantages over mechanical relays such as long operational life, low-current drive and fast response. Widely used for contact switching in various industrial applications, Toshiba photorelays provide low R_{ON} , low C_{OFF} devices in various packages featuring high current and high off-state voltage.

Applications

- Factory automation
- Programmable Logic Controllers
- Security systems
- Measurement equipment
- Heating ventilation and air conditioning
- Battery management systems
- Automatic test equipment
- Smart meters

Features

- No mechanical contacts, no wear and tear
- No contact bounce
- Leading edge technology for best technical performance
- Drive directly from MCU
- Large package variety including smallest S-VSON package
- Wide range of photorelays with extended temperature range from -40°C up to $+110^{\circ}\text{C}$
- Optical isolation with guaranteed internal galvanic isolation

Advantages

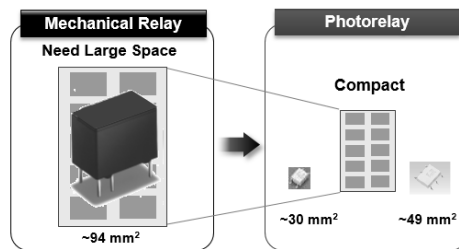
- No wear and tear induced degradation
- Clear output signal
- Devices offer highest currents and fastest switching
- Improved system efficiency, lowest power consumption
- Suitable photorelay for each application and available space
- Products are flexible applicable in harsh industrial environments
- Provides best in class Isolation

Benefits

- Maintenance free
- Fewer field failures due to higher product reliability and lifetime
- Less EMI considerations
- No filtering effort
- Smaller footprint compared with mechanical relays
- High speed switching
- No operational noise
- Less power consumption
- Simple design for best performance

Comparison between photorelays and mechanical relays

Mechanical relays need greater space on the PCBs and create noise. Photorelays are very compact and the necessary space on the PCB is only 1/2 to 1/3 compared with the space requirement of mechanical relays. Photorelays do not create any noise, which makes them ideal in applications, where silent operation is necessary.



Technical advantages of photorelays over mechanical relays

The excellent combination of Toshiba's high-performance, long-life LEDs and MOSFETs ensures stable contact resistance R_{ON} and unlimited cycles of operation, this means they are maintenance free. Photorelays ensure low power consumption, they can be directly driven from a MCU as they operate with low input current. Additionally, photorelays have excellent high speed and low noise switching characteristics.



High operation temperature photorelays in 4pin SO6 package

Toshiba has introduced several halogen free photorelays in advanced 4 pin SO6 package, which ensure a wide operation temperature range of $-40^{\circ}C$ to $+110^{\circ}C$. This range is higher compared with conventional photorelays. The SO6 package also features a higher isolation voltage BV_s with min. $3750V_{rms}$.

Photorelays in 4pin SO6 package can be found in the table on page 4 in column 4pin SO6.

The 2 latest versions TLP170AM and TLP170GM are featuring low trigger current.

UL 508 recognized photorelays

UL 508 is a safety standard for industrial control equipment such as Programmable Logic Controllers (PLC), power units and Uninterruptable Power Supplies (UPS).

Devices used in such equipment are also defined by UL 508.

Specifically, switching devices including mechanical relays and solid state relays are requested to comply with the UL 508 standard. Photorelays belong to the solid state relay product group and are within the scope of UL 508.

Toshiba has a wide line-up of UL 508 recognized photorelays related to UL product category NRNT – industrial control switch and solid state control device for non-motor rated loads.

Its operation temperature ranges from $-40^{\circ}C$ to $+85^{\circ}C$, it's max. case temperature T_c (max.) is $105^{\circ}C$.

UL 508 recognized photorelays can be found in the table on page 4, marked with "UL".

TLP4590A – new high current photorelay in 1-Form-B configuration

Supplied in a compact DIP6 package, the TLP4590A offers engineers a more convenient and reliable alternative to conventional mechanical relays. This 1-Form-B (normally closed) photorelay has an on-state current rating of 1.2A and a 60V off-state output terminal voltage rating. Its sensitivity is enhanced thanks to the low trigger LED current of 2mA (maximum) exhibited.

Small packages – VSON4 / S-VSON4 / S-VSON4T / VSONR4 / P-SON4 / S-VSON16T

VSON4 / S-VSON4 / S-VSON4T / VSONR4 / P-SON4 / S-VSON16T packages are the smallest packages of Toshiba's Photorelays. These packages offer excellent performance based on a chip-on-chip construction. Their operation temperature range is specified from – 40°C to +110°C, so that these small packages are ideal candidates for automated test equipment, but even in factory automation applications and PLCs, these very small photorelays are more and more used.

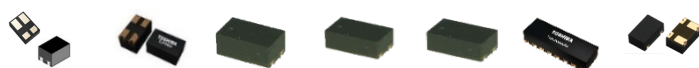
Many products have built-in resistor on input side, these Photorelays can be directly driven by low voltages, and external resistor is no longer needed to drive the LED.

Latest devices are 4-channel devices in space optimized S-VSON16T package.

P-SON4 package is able to support high current switching up to 4.5A.

Photorelays in smallest packages

Off-State Voltage V_{OFF}	On-State Current I_{ON}	On-state Resistance R_{ON} max.	Terminal Capacitance C_{OFF} typ.	C(pF) x R(Ω) typ.	Trigger LED Current I_{FT} or Input Voltage V_{ON} max.	BVs min.	Package – dimension (L) x (W) x (H) in mm						
							WSON4 2.0x1.45x0.8	VSON4 2.54x1.45x1.4	S-VSON4 2.0x1.45x1.65	S-VSON4T 2.0x1.45x1.3	VSONR4 2.8x1.5x1.3	S-VSON16T 6.25x2.0x1.3	P-SON4 3.75x2.1x1.3



20 V	1.5 A	0.2 Ω	120 pF	12	3.0 V	500 V							TLP3403SRHA ^H		
20 V	1.0 A	0.22 Ω	40 pF	7.2	3 mA / 3.0 V	500 V		TLP3403					TLP3403R		
20 V	450 mA	1.2 Ω	5 pF	4	3 mA	500 V		TLP3431							
20 V	200 mA	5 Ω	0.8 pF	2.4	3 mA	500 V		TLP3450							
30 V	4.5 A	0.05 Ω	450 pF	11.3	3 mA	500 V									TLP3480
30 V	1.5 A	0.2 Ω	120 pF	12	3 mA / 3.0 V	500 V				TLP3406S	TLP3406SRH				
30 V	900 mA	0.2 Ω	120 pF	12	3.0 V	300 V								TLP3406SRHA4* ^H	
40 V	250 mA	3 Ω	5 pF	10	3 mA	500 V		TLP3414							
40 V	140 mA	10 Ω	0.7 pF	3.5	3 mA	500 V		TLP3441							
40 V	120 mA	14 Ω	0.45 pF	5.4	3 mA	500 V		TLP3440			TLP3440S				
40 V	100 mA	20 Ω	0.3 pF	4.5	3 mA	500 V		TLP3442							
50 V	300 mA	1.5 Ω	12 pF	12	3 mA / 3.0 V	500 V		TLP3475					TLP3475R		
60 V	3.0 A	0.1 Ω	250 pF	11.3	3 mA	500 V									TLP3481
60 V	1.0 A	0.3 Ω	80 pF	16	3 mA / 3.0 V	500 V				TLP3407S	TLP3407SRH TLP3407SRA*				
60 V	1.0 A	0.3 Ω	80 pF	16	1.6 V	500 V					TLP3407SRL				
60 V	600 mA	0.3 Ω	80 pF	24	3.0 V	300 V								TLP3407SRA4* ^H	
60 V	400 mA	1.5 Ω	20 pF	20	3 mA / 3.0 V	500 V		TLP3412					TLP3412R		
60 V	400 mA	1.5 Ω	20 pF	20	3.0 V	500 V						TLP3412SRLA ^H			
60 V	400 mA	1.5 Ω	20 pF	20	3.0 V	500 V						TLP3412SRH ^H TLP3412SRA TLP3412SRHA*			
60 V	250 mA	1.5 Ω	20 pF	20	3.0 V	300 V								TLP3412SRHA4* ^H	
60 V	400 mA	1.5 Ω	12 pF	12	3 mA / 3.0 V	500 V				TLP3475S	TLP3475SRHA* ^H				
60 V	400 mA	1.5 Ω	12 pF	13.2	3 mA	300 V	TLP3475W								
60 V	250 mA	1.5 Ω	12 pF	12	3.0 V	300 V								TLP3475SRHA4* ^H	
60 V	120 mA	15 Ω	0.7 pF	7	3 mA	500 V		TLP3451							
80 V	200 mA	8 Ω	6.5 pF	39	3 mA	500 V		TLP3419							
80 V	120 mA	12 Ω	5 pF	35	3 mA	500 V		TLP3417							
100 V	2.0 A	0.2 Ω	170 pF	22.1	3 mA	500 V									TLP3482
100 V	650 mA	0.6 Ω	50 pF	20	3 mA	500 V				TLP3409S					
100 V	100 mA	14 Ω	6 pF	48	3 mA	500 V		TLP3420							
200 V	350 mA	8 Ω	75 pF	338	3 mA	500 V									TLP3483*
400 V	180 mA	35 Ω	60 pF	1080	3 mA	500 V									TLP3484*

^H Photocouplers with a maximum operating temperature of 125°C
Partnumbers with "R" voltage controlled

*new products

High current photorelay line-up

Off-State Voltage V _{OFF}	On-State Current I _{ON}	On-state Resistance R _{ON} max.	Terminal Capacitance C _{OFF} typ.	Trigger Current I _{FT} max.	BV _s min.	Package							
						SO4	4 pin SO6	2.54SOP4	2.54SOP6	DIP4	DIP6	DIP8	
600 V	0.6 A	2 Ω	4300 pF	5 mA	2500 V								TLP3549 UL
600 V	0.09 A	60 Ω	75 pF	3 mA	5000 V					TLP240J UL			
600 V	0.09 A	60 Ω	75 pF	2 mA	5000 V					TLP223J* H			
400 V	0.4 A	5 Ω	410 pF	1 mA	2500 V								TLP3548 UL
400 V	0.12 A	35 Ω	80 pF	3 mA	5000 V					TLP240GA UL			
400 V	0.12 A	35 Ω	80 pF	2 mA	5000 V					TLP223GA* H			
400 V	0.11 A	65 Ω	30 pF	3 mA	3750 V		TLP172GAM H						
350 V	0.11 A	50 Ω	30 pF	3 mA	3750 V		TLP172GM H UL						
350 V	0.11 A	35 Ω	30 pF	1 mA	3750 V		TLP170GM*						
350 V	0.10 A	50 Ω	30 pF	3 mA	5000 V					TLP240G UL			
200 V	1.5 A	0.5 Ω	400 pF	5 mA	2500 V								TLP3825 H
200 V	0.7 A	0.2 Ω	110 pF	3 mA	2500 V					TLP3558A H UL			
200 V	0.4 A	2 Ω	100 pF	3 mA	1500 V			TLP3145 H					
200 V	0.25 A	8 Ω	90 pF	3 mA	5000 V					TLP240D UL			
100 V	3.5 A	0.08 Ω	450 pF	3 mA	2500 V								TLP3546A H UL
100 V	3.0 A	0.15 Ω	720 pF	5 mA	2500 V								TLP3823 H
100 V	3.0 A	0.065 Ω	460 pF	3 mA	1500 V				TLP3109A H				
100 V	2.0 A	0.2 Ω	110 pF	3 mA	2500 V					TLP3556A H UL			
100 V	2.0 A	0.07 Ω	500 pF	3 mA	1500 V				TLP3109				
100 V	2.0 A	0.2 Ω	300 pF	3 mA	5000 V					TLP241B H			
100 V	1.5 A	0.2 Ω	160 pF	3 mA	1500 V			TLP3149 H					
80 V	1.4A	0.28Ω	130pF	3 mA	5000V					TLP241BP* H			
60 V	5.0 A	0.05 Ω	850 pF	5 mA	2500 V								TLP3547 UL
60 V	4.0 A	0.04 Ω	750 pF	3 mA	1500 V				TLP3107A H				
60 V	4.0 A	0.06 Ω	640 pF	3 mA	2500 V								TLP3545A H UL
60 V	3.3 A	0.06 Ω	700 pF	3 mA	1500 V				TLP3107				
60 V	3.0 A	0.1 Ω	250 pF	3 mA	2500 V					TLP3555A H UL			
60 V	2.5 A	0.1 Ω	400 pF	3 mA	2500 V								TLP3542
60 V	2.5 A	0.1 Ω	240 pF	3 mA	1500 V			TLP3147 H					
60 V	2.3 A	0.07 Ω	1000 pF	3 mA	1500 V				TLP3103				
60 V	1.4 A	0.25 Ω	100 pF	3 mA	3750 V		TLP3122A H UL						
60 V	1.0 A	0.3 Ω	95 pF	3mA	3750 V	TLP3640A* H							
60 V	0.7 A	2 Ω	100 pF	3 mA	3750 V		TLP176AM H UL						
60 V	0.7 A	0.3 Ω	100 pF	1 mA	3750 V		TLP170AM*						
60 V	0.5 A	2 Ω	130 pF	3 mA	5000 V					TLP240A UL			
40 V	3.5 A	0.06 Ω	1000 pF	3 mA	2500 V								TLP3544
40 V	2.5 A	0.06 Ω	1000 pF	3 mA	1500 V				TLP3102				
40 V	2.5 A	0.15 Ω	300 pF	3 mA	2500 V					TLP3554			
40 V	2.0 A	0.15 Ω	300 pF	3 mA	5000 V					TLP241A UL			
30 V	5.0 A	0.04 Ω	1100 pF	3 mA	2500 V								TLP3543A H UL
30 V	4.5 A	0.03 Ω	1200 pF	3 mA	1500 V				TLP3106A H				
30 V	4.0 A	0.05 Ω	450 pF	3 mA	2500 V					TLP3553A H			
30 V	4.0 A	0.04 Ω	1100 pF	3 mA	1500 V				TLP3106				
30 V	3.3 A	0.05 Ω	450 pF	3 mA	1500 V			TLP3146 H					
20 V	4.0 A	0.05 Ω	1000 pF	3 mA	2500 V								TLP3543
20 V	2.5 A	0.05 Ω	1000 pF	3 mA	1500 V				TLP3100				

[H](#) Photocouplers with a maximum operating temperature of 110°C [H](#) [UL](#) Ta max = 110°C, for UL 508 application, Ta max = 85°C
[UL](#) UL 508 recognized

* new products