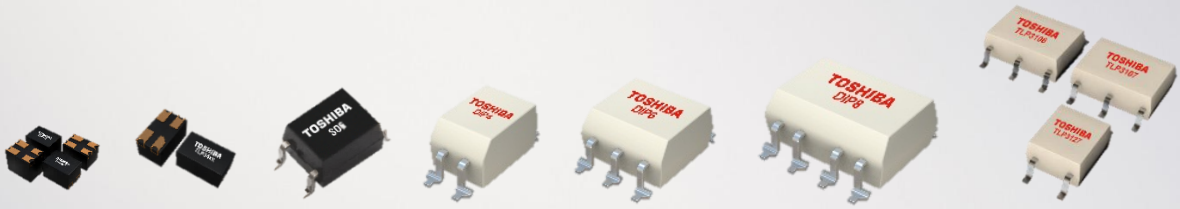
Photorelays



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°C
- Optical isolation with guaranteed internal galvanic isolation

Advantages

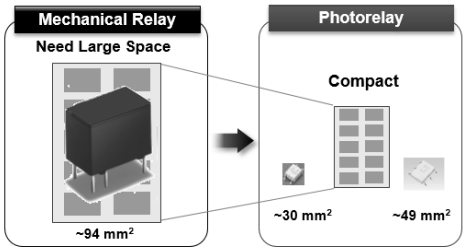
- No wear and tear induced degradation
- Clear output signal
- Devices offer highest currents and fastest switching
- Improved system efficiency, lowest power consumption
- Suitable photorelay for each application and available space
- Products are flexible applicable in harsh industrial environments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

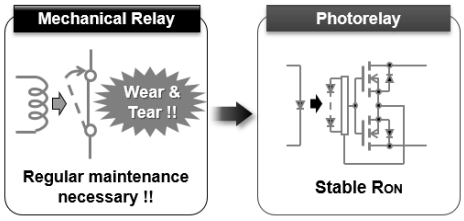
Comparison between photorelays and mechanical relays

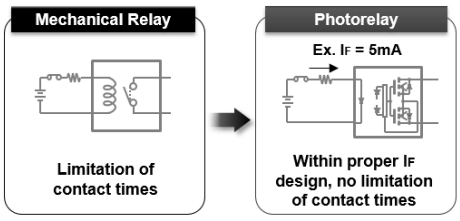
Mechanical relays need greater space on the PCBs and create noise. Photorelays are very compact and the necessary space on the PCB is only 1/2 to 1/3 compared with the space requirement of mechanical relays. Photorelays do not create any noise, which makes them ideal in applications, where silent operation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



Technical advantages of photorelays over mechanical relays

The excellent combination of Toshiba's high performance, long life LEDs and MOSFETs guarantee stable contact resistance R_{ON} and unlimited cycles of operation, this means they are maintenance free. Photorelays guarantee 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 guarantees a wide operation temperature range of -40°C to + 110°C and is higher compared with conventional photorelays. Additionally the SO6 package features a higher isolation voltage BV_s with min. $3750V_{rms}$.

The 4pin SO6 package is a widely used package in Toshiba and has therefore an excellent cost performance.

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

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 lineup 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°C to + 85°C, it's max. case temperature Tc (max.) is 105°C.

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

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

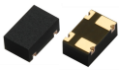
VSON4 / S-VSON4 / S-VSON4T / VSONR4 / P-SON4 packages are the smallest packages of Toshibas Photorelays. These packages offer excellent performance based on a chip-on-chip construction. Its operation temperature range is specified from – 40°C to +110°C, so that these small packages are ideal candidates for industrial applications.

Main applications are related to automated test equipment, but even in factory automation applications and PLCs, these very small photorelays are more and more used.

Latest 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.

P-SON4 is coming soon and will be 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.	Input Voltage V_{ON} max.	BVs min.	Package – dimension (L) x (W) x (H) in mm				
							VSON4 2.54 x 1.45 x 1.4	S-VSON4 2.0 x 1.45 x 1.65	S-VSON4T 2.0 x 1.45 x 1.3	VSONR4 2.8 x 1.5 x 1.3	P-SON4 3.75 x 2.1 x 1.3
											
20 V	1.0 A	0.22 Ω	40 pF	7.2	-	500 V	TLP3403				
20 V	1.0 A	0.22 Ω	40 pF	7.2	3.0 V	500 V				TLP3403R	
20 V	450 mA	1.2 Ω	5 pF	4	-	500 V	TLP3431				
20 V	200 mA	5 Ω	0.8 pF	2.4	-	500 V	TLP3450				
30 V	4.5 A	0.05 Ω	450 pF	11.3	-	500 V					TLP3480**
30 V	1.5 A	0.2 Ω	120 pF	12	3.0 V	500 V			TLP3406SRH		
30 V	1.5 A	0.2 Ω	120 pF	12	1.6 V	500 V			TLP3406SRL		
30 V	1.5 A	0.2 Ω	120 pF	12	-	500 V		TLP3406S			
40 V	250 mA	3 Ω	5 pF	10	-	500 V	TLP3414				
40 V	140 mA	10 Ω	0.7 pF	3.5	-	500 V	TLP3441				
40 V	120 mA	14 Ω	0.45 pF	5.4	-	500 V			TLP3440S		
40 V	120 mA	14 Ω	0.45 pF	5.4	-	500 V	TLP3440				
40 V	100 mA	20 Ω	0.3 pF	4.5	-	500 V	TLP3442				
50 V	300 mA	1.5 Ω	12 pF	12	-	500 V	TLP3475				
50 V	300 mA	1.5 Ω	12 pF	12	3.0 V	500 V				TLP3475R	
60 V	3.0 A	0.1 Ω	300 pF	11.3	-	500 V					TLP3481**
60 V	1.0 A	0.3 Ω	80 pF	16	3.0 V	500 V			TLP3407SRH		
60 V	1.0 A	0.3 Ω	80 pF	16	1.6 V	500 V			TLP3407SRL		
60 V	1.0 A	0.3 Ω	80 pF	16	3.0 V	500 V			TLP3407SR		
60 V	1.0 A	0.3 Ω	80 pF	16	-	500 V		TLP3407S			
60 V	400 mA	1.5 Ω	20 pF	20	3.0 V	500 V				TLP3412R	
60 V	400 mA	1.5 Ω	20 pF	20	3.0 V	500 V			TLP3412SRH		
60 V	400 mA	1.5 Ω	20 pF	20	-	500 V	TLP3412				
60 V	400 mA	1.5 Ω	12 pF	12	-	500 V		TLP3475S			
60 V	120 mA	15 Ω	0.7 pF	7	-	500 V	TLP3451				
80 V	200 mA	8 Ω	6.5 pF	39	-	500 V	TLP3419				
80 V	120 mA	12 Ω	5 pF	35	-	500 V	TLP3417				
100 V	2.0 A	0.2 Ω	170 pF	22.1	-	500 V					TLP3482**
100 V	650 mA	0.6 Ω	50 pF	20	-	500 V		TLP3409S			
100 V	100 mA	14 Ω	6 pF	48	-	500 V	TLP3420				
200 V	200 mA	8 Ω	75 pF	338	-	500 V					TLP3483**
400 V	120 mA	35 Ω	60 pF	1080	-	500 V					TLP3484**

**under development

High current photorelay lineup

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

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

* new product

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