

TLP2116

- Plasma Display Panels (PDP)
- High-Speed Interfaces
- Factory Automation (FA)

The TOSHIBA TLP2116 dual photocoupler consists of a pair of GaAlAs light-emitting diodes optically coupled to integrated high gain and high-speed photodetectors.

- Inverter logic (totem-pole output)
- Package: SO8
- Guaranteed performance over temperature : -40 to 100°C
- Power supply voltage: 4.5 to 5.5 V
- Input thresholds current: $I_{FHL} = 5 \text{ mA (max)}$
- Propagation delay time (t_{pHL}/t_{pLH}): 75 ns (max)
- Switching speed: 15 MBd (typ.) (NRZ)
- Common mode transient immunity: $\pm 10 \text{ kV}/\mu\text{s}$
- Isolation voltage: 2500 Vrms
- UL approved : UL1577, File No.E67349
- c-UL approved : CSA Component Acceptance Service

No. 5A, File No.E67349

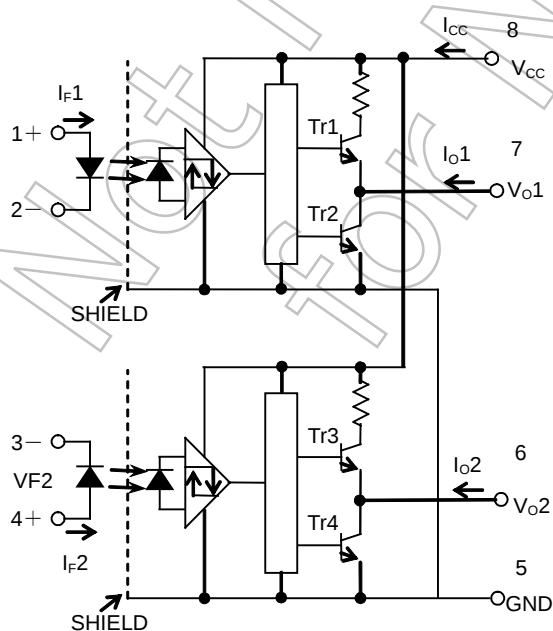
- VDE-approved: EN60747-5-5 (note 1)

(Note 1) When a EN60747-5-5 approved type is needed,
Please designate the "option(V4)"

Truth Table

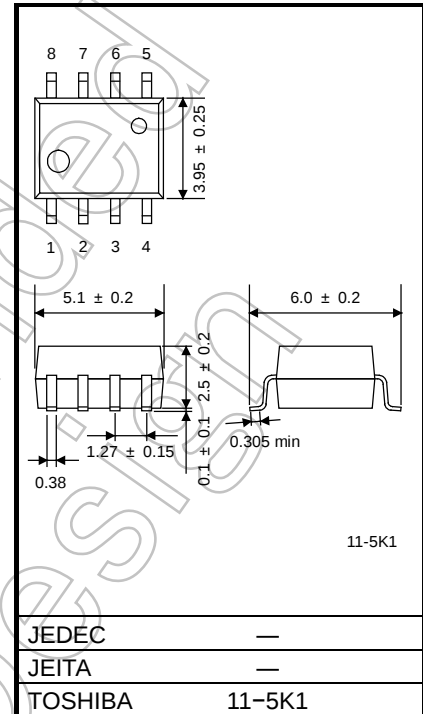
Input	LED1(2)	Tr1(3)	Tr2(4)	Output 1(2)
H	ON	OFF	ON	L
L	OFF	ON	OFF	H

Schematic



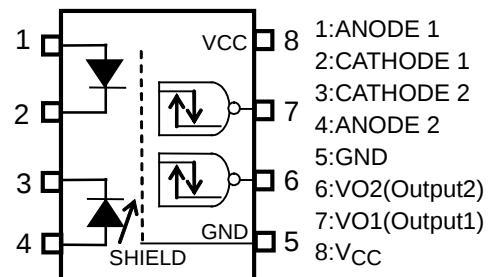
A bypass capacitor of 0.1 μF must be connected between pins 8 and 5.

Unit: mm



Weight: 0.21 g (typ.)

Pin Configuration (Top View)



Start of commercial production
2008-02

Absolute Maximum Ratings (Ta=25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current (Each Channel)	I _F	20	mA
	Forward current derating (Ta ≥ 85°C) (Each Channel)	ΔI _F /ΔTa	-0.5	mA/°C
	Peak transient forward current (Each Channel) (Note 1)	I _{FPT}	1	A
	Reverse voltage (Each Channel)	V _R	5	V
	Input Power Dissipation (Each Channel)	P _D	40	mW
	Input Power Dissipation Derating (Each Channel) (Ta ≥ 85°C)	ΔP _D /°C	-1.0	mW/°C
DETECTOR	Output current (Each Channel)	I _O	10	mA
	Output voltage (Each Channel)	V _O	6	V
	Supply voltage	V _{CC}	6	V
	Output power dissipation (Each Channel)	P _O	40	mW
	Output Power Dissipation Derating (Ta ≥ 85°C) (Each Channel)	ΔP _O /°C	-1.0	mW/°C
Operating temperature range		T _{opr}	-40 to 100	°C
Storage temperature range		T _{stg}	-55 to 125	°C
Lead solder temperature (10 s)		T _{sol}	260	°C
Isolation voltage (AC, 1 minute, R.H. ≤ 60%, Ta=25°C) (Note 2)		BV _S	2500	V _{rms}

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Pulse width PW ≤ 1 μs, 300pps.

Note 2: This device is regarded as a two terminal device: pins 1, 2, 3 and 4 are shorted together, as are pins 5, 6, 7 and 8.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current, ON (Each Channel)	I _{F(ON)}	8	—	18	mA
Input voltage, OFF (Each Channel)	V _{F(OFF)}	0	—	0.8	V
Supply voltage(*) (Note 3)	V _{CC}	4.5	5.0	5.5	V
Operating temperature	T _{opr}	-40	—	100	°C

(*) This item denotes operating ranges, not meaning of recommended operating conditions.

Note 3: The detector of this product requires power supply voltage (V_{CC}) of 4.5 V or higher for stable operation.

If the V_{CC} is lower than this value, I_{CCH} may increase, or output may be unstable.

Be sure to use the product after checking the supply current, and the operation of a power-on/-off.

Note 4: A ceramic capacitor (0.1 μF) should be connected from pin 8 (V_{CC}) to pin 5 (GND) to stabilize the operation of the high gain linear amplifier. Failure to provide the bypass may impair the switching property.

The total lead length between capacitor and coupler should not exceed 1 cm.

Electrical Characteristics

(Unless otherwise specified, Ta = -40 to 100°C, V_{CC} = 4.5 to 5.5V)

Characteristic	Symbol	Conditions	Min	Typ.	Max	Unit
Input forward voltage (Each Channel)	V _F	I _F = 10 mA, Ta = 25°C	1.3	1.65	1.75	V
Temperature coefficient of forward voltage (Each Channel)	$\Delta V_F / \Delta T_a$	I _F = 10 mA	—	-2.0	—	mV/°C
Input reverse current (Each Channel)	I _R	V _R = 5 V, Ta = 25°C	—	—	10	μA
Input capacitance (Each Channel)	C _T	V = 0 V, f = 1 MHz, Ta = 25°C	—	45	—	pF
Logic low output voltage (Each Channel)	V _{OL}	I _{OL} = 1.6 mA, I _F = 12 mA, V _{CC} = 5 V	—	—	0.4	V
Logic high output voltage (Each Channel)	V _{OH}	I _{OH} = -0.02 mA, V _F = 1.05 V, V _{CC} = 5 V	4.0	—	—	V
Logic low supply current	I _{CC} L	I _F = 12 mA	—	—	10.0	mA
Logic high supply current	I _{CC} H	V _F = 0 V (Note 3)	—	—	10.0	mA
Input current logic low output (Each Channel)	I _{FHL}	I _O = 1.6 mA, V _O < 0.4 V	—	—	5	mA
Input voltage logic high output (Each Channel)	V _{FLH}	I _O = -0.02 mA, V _O > 4.0 V	0.8	—	—	V

*All typical values are at Ta=25°C, V_{CC}=5 V unless otherwise specified

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	C _S	V _S = 0 V, f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation resistance	R _S	R.H. ≤ 60%, V _S = 500 V (Note 2)	1×10 ¹²	10 ¹⁴	—	Ω
Isolation voltage	B _V S	AC, 1 minute	2500	—	—	V _{rms}
		AC, 1 second, in oil	—	5000	—	
		DC, 1 minute, in oil	—	5000	—	V _{dc}

Switching Characteristics

(Unless otherwise specified, Ta = -40 to 100°C, Vcc = 4.5 to 5.5V)(Each Channel)

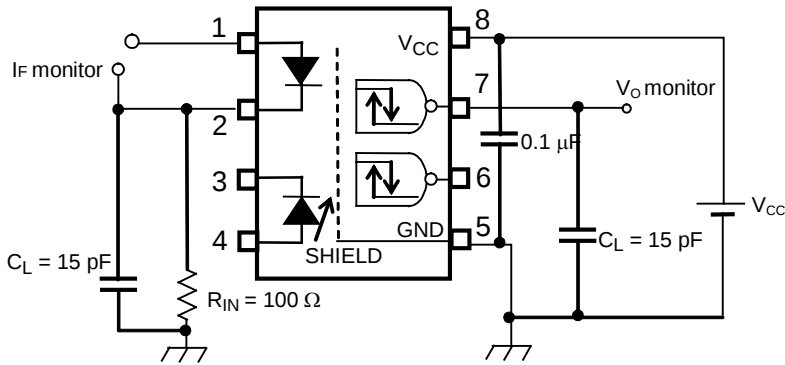
Characteristic	Symbol	Test Circuit	Conditions		Min	Typ.	Max	Unit
Propagation delay time to logic low output	t _{pHL}	1	I _F = 0→12 mA	R _{IN} = 100 Ω C _L = 15 pF (Note 5)	—	—	75	ns
Propagation delay time to logic high output	t _{pLH}		I _F = 12→0 mA		—	—	75	ns
Propagation delay time to logic low output	t _{pHL}	2	V _{IN} = 0→5 V (I _F = 0→8 mA)	R _{IN} = 430 Ω C _{IN} = 27 pF C _L = 15 pF (Note 5)	—	—	75	ns
Propagation delay time to logic high output	t _{pLH}		V _{IN} = 5→0 V (I _F = 8→0 mA)		—	—	75	ns
Switching time dispersion between ON and OFF	t _{pHL} - t _{pLH}	1	I _F = 12 mA, R _{IN} = 100 Ω, C _L = 15 pF (Note 5)		—	—	30	ns
Output fall time (90 - 10%)	t _f		I _F = 0→12 mA	R _{IN} = 100 Ω C _L = 15 pF (Note 5)	—	15	—	ns
Output rise time (10 - 90%)	t _r		I _F = 12→0 mA		—	15	—	ns
Common mode transient immunity at high level output	CM _H	3	V _{CM} = 1000 Vp-p , I _F = 0 mA, V _O (min) = 4 V , Ta = 25°C		10000	—	—	V/μs
Common mode transient immunity at low level output	CM _L		V _{CM} = 1000 Vp-p , I _F = 12 mA, V _O (max) = 0.4 V , Ta = 25°C		-10000	—	—	V/μs

*All typical values are at Ta=25°C

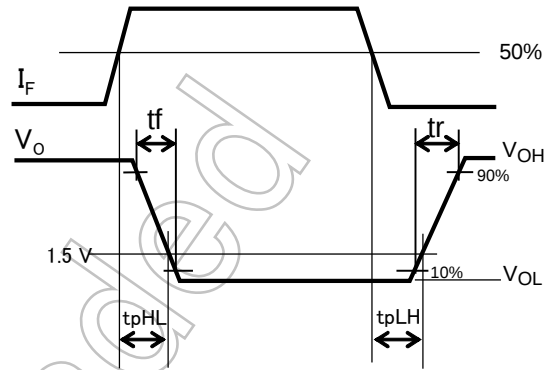
Note 5: CL is approximately 15 pF which includes probe and jig/stray wiring capacitance.

Test Circuit 1: Switching Time Test Circuit

$I_F=12\text{ mA (P.G)}$
 $(f=5\text{ MHz, duty}=50\%,$
less than $t_r = t_f = 5\text{ ns})$

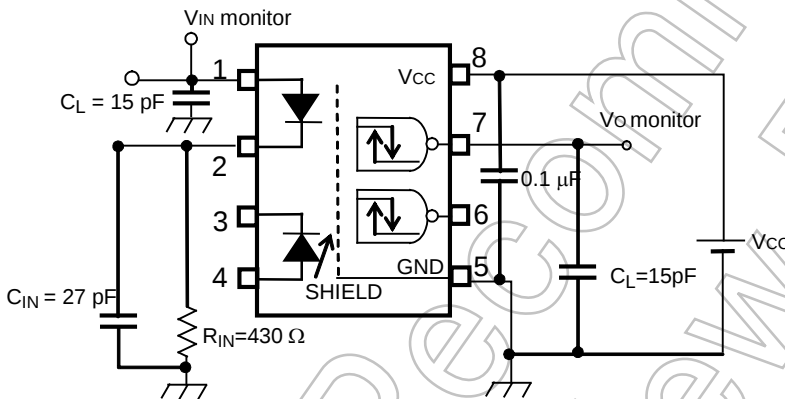


C_L is capacitance of the probe and JIG.
(P.G): Pulse Generator

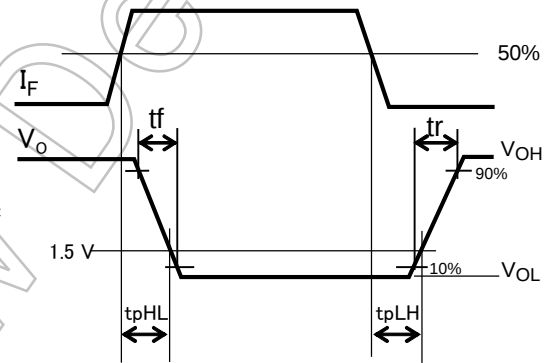


Test Circuit 2: Switching Time Test Circuit

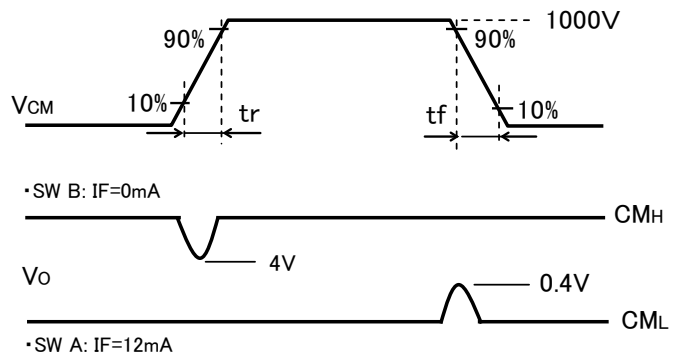
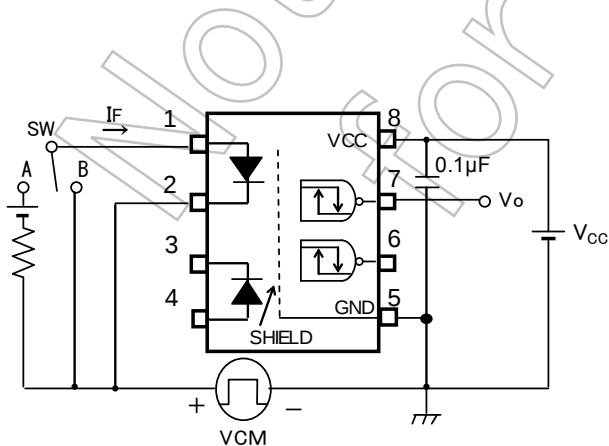
$V_{IN}=5V\text{ (P.G)}$
 $(f=5\text{ MHz, duty}=50\%,$
less than $t_r = t_f = 5\text{ ns})$



C_L is capacitance of the probe and JIG.
(P.G): Pulse Generator



Test Circuit 3: Common-Mode Transient Immunity Test Circuit



$$CM_H = \frac{800(V)}{tr(\mu s)} \quad CM_L = -\frac{800(V)}{tf(\mu s)}$$

RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA". Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- GaAs (Gallium Arsenide) is used in Product. GaAs is harmful to humans if consumed or absorbed, whether in the form of dust or vapor. Handle with care and do not break, cut, crush, grind, dissolve chemically or otherwise expose GaAs in Product.
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**