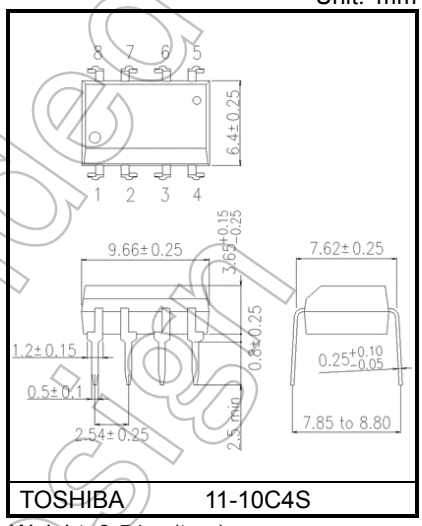
TOSHIBA Photocoupler IRED & Photo-IC

TLP557

Industrial Inverter
Inverter for Air Conditioner
Power Transistor Base Drive

Unit: mm



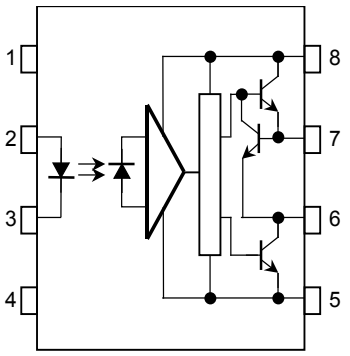
TOSHIBA 11-10C4S

Weight: 0.54 g (typ.)

The TOSHIBA TLP557 consists of an infrared emitting diode and an integrated photodetector.
This unit is 8-lead DIP package.
TLP557 is suitable for base driving circuit of power transistor module up to 20A.
External resistor needs to connect between pin 6 and pin 7.
This is for constant current driving.

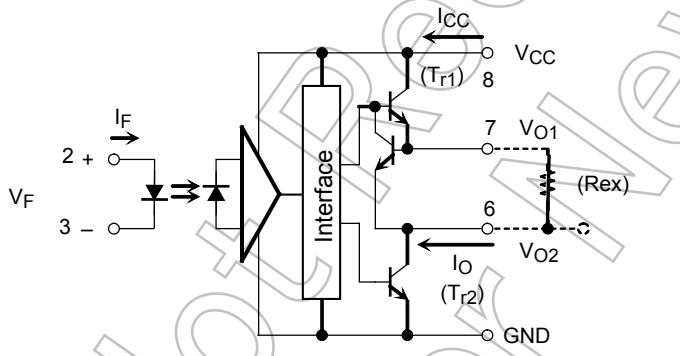
- Input threshold current: I_F = 5 mA (max)
- Guaranteed performance temperature range: -30 to 70°C
- Supply voltage: 16 V (max)
- Output current: ±0.3 A (max)
- Switching time (t_{pLH}/t_{pHL}): 5 μs (max)
- Isolation voltage: 2500 Vrms (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349

Pin Configuration (top view)



1 : N.C.
2 : Anode
3 : Cathode
4 : N.C.
5 : GND
6 : V_{O2}(Output)
7 : V_{O1}(Rex Terminal)
8 : V_{CC}

Schematic



Truth Table

		Tr1	Tr2
Input LED	ON	ON	OFF
	OFF	OFF	ON

Start of commercial production
1987-06

Absolute Maximum Ratings

Characteristic		Symbol	Rating	Unit
LED	Forward current	I_F	25	mA
	Peak transient forward current (Pw ≤ 1 μs, 300 pps)	I_{FPT}	1	A
	Reverse voltage	V_R	5	V
	Diode power dissipation	P_D	45	mW
	Junction temperature	T_j	125	°C
Detector	Output current (f ≤ 5kHz, Duty ≤ 50%)	I_O	+0.32/-0.32	A
	Peak output current (P_W ≤ 10μs, f ≤ 5kHz)	I_{OP}	+2/-0.5	A
	Output voltage	V_O	16	V
	Supply voltage	V_{CC}	16	V
	O_1 terminal to O_2 terminal (pin 7-pin 6) voltage	V_{1-2}	1.5	V
	O_2 terminal to O_1 terminal (pin 6-pin 7) voltage	V_{2-1}	5	V
	Power dissipation	P_O	0.5	W
	Power dissipation derating (Ta > 50 °C)	$\Delta P_O/\Delta Ta$	-6.7	mW/°C
	Junction temperature	T_j	125	°C
Total package power dissipation		P_{OT}	0.55	W
Total package power dissipation derating (Ta > 50 °C)		ΔPOT/ΔTa	-7.4	mW/°C
Operating temperature range		T_{opr}	-30 to 70	°C
Storage temperature range		T_{stg}	-55 to 125	°C
Lead solder temperature (10 s)		T_{sol}	260	°C
Isolation voltage (AC, 60 s, R.H.≤ 60 %, Ta=25°C) (Note 1)		BV_S	2500	Vrms

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).

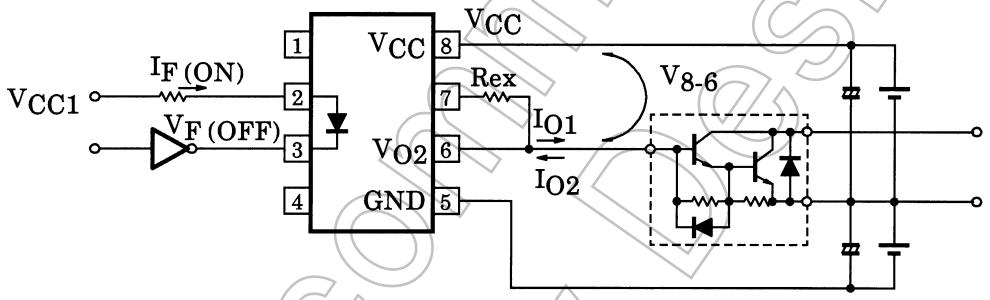
Note 1: Device considered a two terminal device: Pins 1, 2, 3 and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current on	I_F(ON)	7	8	20	mA
Input voltage off	V_F(OFF)	0	—	0.8	V
Supply voltage	V_{CC}	5	6	13	V
I_{B1} Drive current	I_{O1}	—	0.15	0.25	A
I_{B2} Drive current	I_{O2}	—	—	0.5	A
External resistance	Rex	2.7	4.3	—	Ω
V_{CC}-V_{O2} (pin 8-pin 6) ON voltage (Note 1)	V_{8-6}	2.3	3 (I_{O1} = 0.15A)	2.5 (I_{O1} = 0.25A)	V
Operating temperature	Topr	-30	25	70	°C

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

Note 1:



Electrical Characteristics (Ta = -30 to 70°C, unless otherwise specified)

Characteristic	Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Input forward voltage	V_F	—	I_F = 5 mA , Ta = 25 °C		—	1.55	1.7	V
Temperature coefficient of forward voltage	$\Delta V_F/\Delta Ta$	—	I_F = 5 mA		—	-2.0	—	mV/°C
Input reverse current	I_R	—	V_R = 5 V, Ta = 25 °C		—	—	10	μA
Input capacitance	C_T	—	V = 0 V, f = 1 MHz , Ta = 25 °C		—	—	250	pF
O_1 Output leakage current	I_{O1L}	1	V_{CC} = 16 V, V_{O1} = 0 V, V_F = 0.8 V		—	0.01	200	μA
O_2 Output leakage current	I_{O2L}	2	V_{CC} = 16 V, V_{O2} = 16 V, I_F = 5 mA		—	0.2	200	μA
O_1 Output current	I_O	3	$V_{8\text{-}6}$ = 2.3 V Rex = 2.7 Ω I_F = 5 mA, Ta = 25 °C	V_{CC} = 6 V	0.22	0.27	0.32	A
				V_{CC} = 16 V	0.22	0.27	0.32	
O_2 High level output voltage	V_{OH}	4	V_{CC} = 6 V, Rex = 2.7 Ω I_F = 5 mA		3.5	5.5	—	V
O_2 Low level output voltage	V_{OL}	5	V_F = 0.8 V, Rex = 2.7 Ω I_O = 0.25 A, Ta = 25 °C	V_{CC} = 6 V	—	0.2	0.4	V
				V_{CC} = 16 V	—	0.2	0.4	
			V_F = 0.8 V, Rex = 2.7 Ω I_O = 0.5 A (Note 1) Ta = 25 °C	V_{CC} = 6 V	—	0.4	—	V
				V_{CC} = 16 V	—	0.4	—	
High level supply current	I_{CCH}	—	V_{CC} = 6 V, I_F = 5 mA Rex = 2.7 Ω, Ta = 25 °C		—	3.8	10	mA
			V_{CC} = 6 V, I_F = 5 mA, Rex = 2.7 Ω		—	—	13	
			V_{CC} = 16 V, I_F = 5 mA, Rex = 2.7 Ω		—	5.2	17	
Low level supply current	I_{CCL}	—	V_{CC} = 6 V, I_F = 0 mA Rex = 2.7 Ω, Ta = 25 °C		—	11	17	mA
			V_{CC} = 6 V, I_F = 0 mA, Rex = 2.7 Ω		—	—	22	
			V_{CC} = 16 V, I_F = 0 mA, Rex = 2.7 Ω		—	13	25	
"Output L→H" threshold input current	I_{FLH}	—	Rex = 2.7 Ω I_O = 0.25 A V_{O2} > 3 V	V_{CC} = 6 V	—	2.5	5	mA
				V_{CC} = 16 V	—	—	5	
"Output H→L" threshold input current	V_{FHL}	—	Rex = 2.7Ω I_O = 0.25A V_{O2} < 0.4V	V_{CC} = 6 V	0.8	—	—	V
				V_{CC} = 16 V	0.8	—	—	
Input current hysteresis	I_{HYS}	—	V_{CC} = 6 V, Rex = 2.7 Ω, Ta = 25 °C		—	0.05	—	mA
Supply voltage	V_{CC}	—	—		5	—	16	V
Capacitance (input-output)	C_S	—	V_S = 0 V, f = 1 MHz, Ta = 25 °C		—	1.0	2.0	pF
Resistance (input-output)	R_S	—	V_S = 500 V , Ta = 25 °C, R.H.≤ 60 %		5×10^{10}	10^{12}	—	Ω

Note: All typical values are at Ta = 25 °C

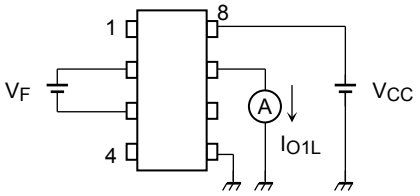
Note 1: Duration of I_O time ≤ 100 μs

Switching Characteristics (Ta = -30 to 70°C unless otherwise specified)

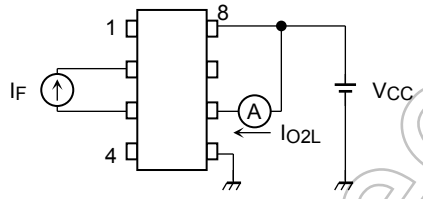
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time, L→H	t_{pLH}	6	V_{CC} = 6 V, I_F = 8 mA Rex = 2.7 Ω f = 5 kHz, Duty = 10 %	—	1	5	μs
Propagation delay time, H→L	t_{pHL}			—	1	5	μs
Output rise time	t_r			—	0.05	—	μs
Output fall time	t_f			—	0.05	—	μs
Common mode transient immunity at high level output	CM_H	7	V_{CM} = 600 V, I_F = 8 mA V_{CC} = 6 V, Rex = 270 Ω R = 1 kΩ, Ta = 25 °C	-2000	—	—	V/μs
Common mode transient immunity at low level output	CM_L	7	V_{CM} = 600 V, I_F = 0 mA V_{CC} = 6 V, Rex = 270 Ω R = 1 kΩ, Ta = 25 °C	2000	—	—	V/μs

Note: All typical values are at Ta = 25 °C.

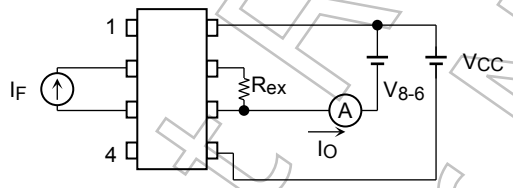
Test Circuit 1: I_{O1L}



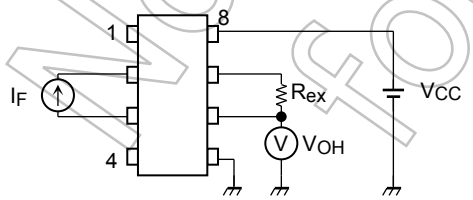
Test Circuit 2: I_{O2L}



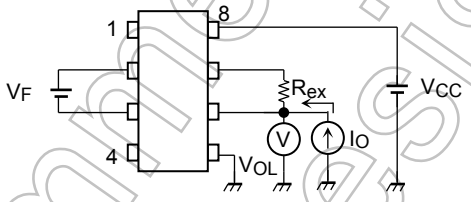
Test Circuit 3: I_O



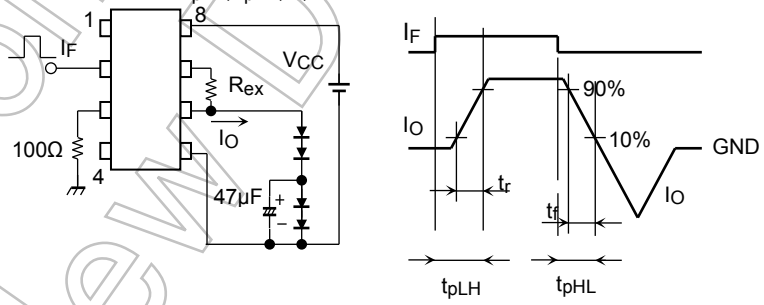
Test Circuit 4: V_{OH}



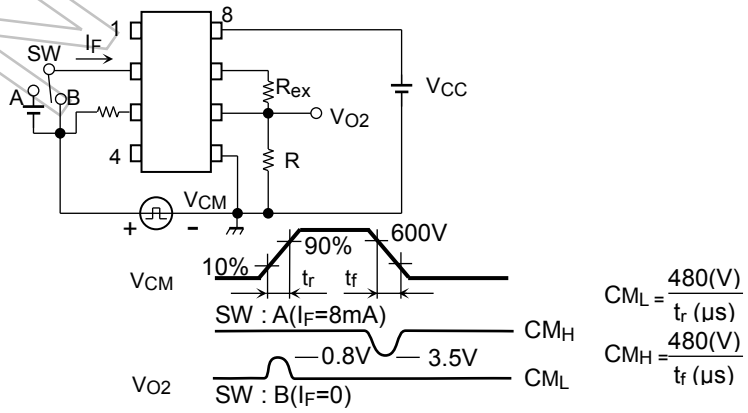
Test Circuit 5: V_{OL}



Test Circuit 6: t_{pLH}, t_{pHL}, t_r, t_f

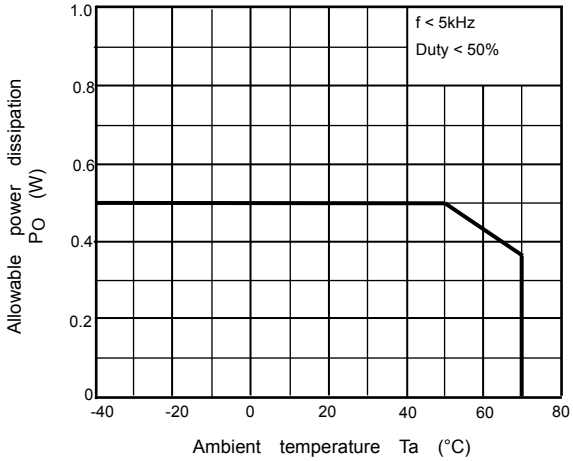


Test Circuit 7: CM_H, CM_L

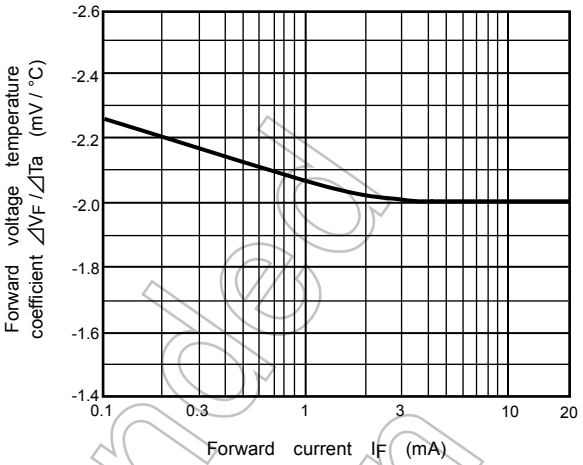


Note: CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

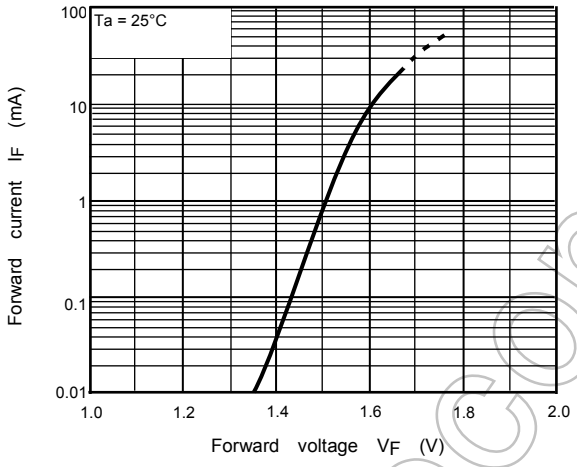
P_O – Ta



$\Delta V_F / \Delta Ta$ – I_F



I_F – V_F



NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

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, lifesaving and/or life supporting 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, and devices related to power plant. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative or contact us via our website.
- 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.**