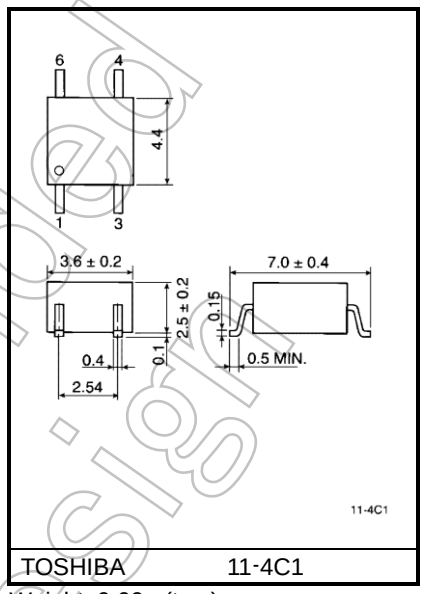
TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

# TLP124

Programmable Controllers
AC / DC-Input Module
Solid-State Relays

Unit: mm



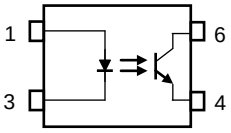

TOSHIBA 11-4C1

Weight: 0.09g (typ.)

The TOSHIBA mini flat coupler TLP124 is a small outline coupler, suitable for surface mount assembly.
TLP124 consists of a photo transistor optically coupled to a gallium arsenide infrared emitting diode.

- Collector-emitter voltage: 80 V (min)
- Current transfer ratio: 100% (min)
  Rank BV: 200% (min)
- Isolation voltage: 3750 Vrms (min)
- UL recognized: UL1577, file No. E67349
- c-UL approved :CSA Component Acceptance Service
  No. 5A, File No.E67349

**Pin Configurations**
**(top view)**




1 : Anode
3 : Cathode
4 : Emitter
6 : Collector



Start of commercial production
1988-04

## Current Transfer Ratio

| Classification (Note 1) | Current Transfer Ratio (min) | | | Marking of Classification |
|---|---|---|---|---|
| | Ta = 25°C | | Ta = -25 to 75°C | |
| | $I_F$ = 1 mA<br>$V_{CE}$ = 0.5 V | $I_F$ = 0.5 mA<br>$V_{CE}$ = 1.5 V | $I_F$ = 1 mA<br>$V_{CE}$ = 0.5 V | |
| Rank BV | 200% | 100% | 100% | BV |
| Standard | 100% | 50% | 50% | BV, Blank |

Note 1: Ex, rank BV: TLP124(BV)

Note: Application type name for certification test, please use standard product type name, i, e. TLP124(BV): TLP124

## Absolute Maximum Ratings (Ta = 25°C)

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| LED | Forward current | $I_F$ | 50 | mA |
| | Forward current derating (Ta ≥ 53°C) | $\Delta I_F$/°C | -0.7 | mA/°C |
| | Peak forward current (100 μs pulse, 100 pps) | $I_{FP}$ | 1 | A |
| | Reverse voltage | $V_R$ | 5 | V |
| | Diode power dissipation | $P_D$ | 100 | mW |
| | Diode power dissipation derating (Ta ≥ 53°C) | $\Delta P_D$/°C | -1.39 | mW/°C |
| | Junction temperature | $T_j$ | 125 | °C |
| Detector | Collector-emitter voltage | $V_{CEO}$ | 80 | V |
| | Emitter-collector voltage | $V_{ECO}$ | 7 | V |
| | Collector current | $I_C$ | 50 | mA |
| | Peak collector current (10 ms pulse, 100 pps) | $I_{CP}$ | 100 | mA |
| | Power dissipation | $P_C$ | 150 | mW |
| | Power dissipation derating (Ta ≥ 25°C) | $\Delta P_C$/°C | -1.5 | mW/°C |
| | Junction temperature | $T_j$ | 125 | °C |
| Storage temperature range | | $T_{stg}$ | -55 to 125 | °C |
| Operating temperature range | | $T_{opr}$ | -55 to 100 | °C |
| Lead soldering temperature (10 s) | | $T_{sol}$ | 260 | °C |
| Total package power dissipation | | $P_T$ | 200 | mW |
| Total package power dissipation derating (Ta ≥ 25°C) | | $\Delta P_T$/°C | -2.0 | mW/°C |
| Isolation voltage (AC, 60 s, R.H. ≤ 60%) (Note 1) | | $BV_S$ | 3750 | 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: Pins1, 3 shorted together and pins 4, 6 shorted together.

## Recommended Operating Conditions

| Characteristic | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | — | 5 | 48 | V |
| Forward current | $I_F$ | — | 1.6 | 20 | mA |
| Collector current | $I_C$ | — | 1 | 10 | mA |
| Operating temperature | $T_{opr}$ | -25 | — | 75 | °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.

## Electrical Characteristics (Ta = 25°C)

| | Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| LED | Forward voltage | $V_F$ | $I_F$ = 10 mA | 1.0 | 1.15 | 1.3 | V |
| | Reverse Current | $I_R$ | $V_R$ = 5 V | — | — | 10 | μA |
| | Capacitance | $C_T$ | V = 0 V, f = 1 MHz | — | 30 | — | pF |
| Detector | Collector-emitter breakdown voltage | $V_{(BR)CEO}$ | $I_C$ = 0.5 mA | 80 | — | — | V |
| | Emitter-collector breakdown voltage | $V_{(BR)ECO}$ | $I_E$ = 0.1 mA | 7 | — | — | V |
| | Collector dark current | $I_{CEO}$ | $V_{CE}$ = 48 V | — | 10 | 100 | nA |
| | | | $V_{CE}$ = 48 V, Ta = 85°C | — | 2 | 50 | μA |
| | Capacitance collector to emitter | $C_{CE}$ | V = 0 V, f = 1 MHz | — | 12 | — | pF |

## Coupled Electrical Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Current transfer ratio | $I_C/I_F$ | $I_F$ = 1 mA, $V_{CE}$ = 0.5 V | | 100 | — | 1200 | % |
| | | | Rank BV | 200 | — | 1200 | |
| Low input CTR | $I_C/I_{F(low)}$ | $I_F$ = 0.5 mA, $V_{CE}$ = 1.5 V | | 50 | — | — | % |
| | | | Rank BV | 100 | — | — | |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ = 0.5 mA, $I_F$ = 1 mA | | — | — | 0.4 | V |
| | | $I_C$ = 1 mA, $I_F$ = 1 mA | | — | 0.2 | — | |
| | | | Rank BV | — | — | 0.4 | |
| Off-state collector current | $I_{C(off)}$ | $V_F$ = 0.7 V, $V_{CE}$ = 48 V | | — | — | 10 | μA |

## Coupled Electrical Characteristics (Ta = -25 to 75°C)

| Characteristic | Symbol | Test Condition | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Current transfer ratio | $I_C/I_F$ | $I_F$ = 1 mA, $V_{CE}$ = 0.5 V | | 50 | — | — | % |
| | | | Rank BV | 100 | — | — | % |
| Low input CTR | $I_C/I_{F(low)}$ | $I_F$ = 0.5 mA, $V_{CE}$ = 1.5 V | | — | 50 | — | % |
| | | | Rank BV | — | 100 | — | % |

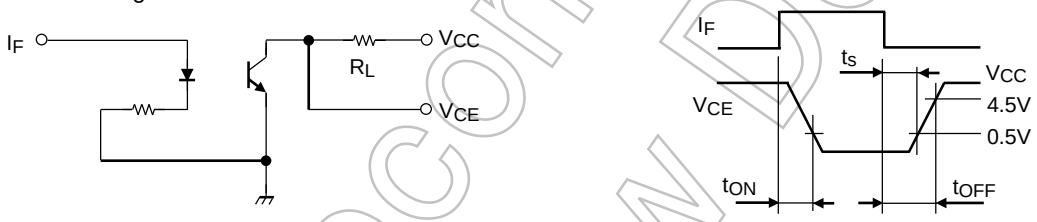
## Isolation Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Capacitance (input to output) | $C_S$ | $V_S$ = 0 V, f = 1 MHz | — | 0.8 | — | pF |
| Isolation resistance | $R_S$ | $V_S$ = 500 V, R.H. ≤ 60% | $5\times10^{10}$ | $10^{14}$ | — | Ω |
| Isolation voltage | $BV_S$ | AC, 60 s | 3750 | — | — | $V_{rms}$ |
| | | AC, 1 s, in oil | — | 10000 | — | |
| | | DC, 60 s, in oil | — | 10000 | — | $V_{dc}$ |

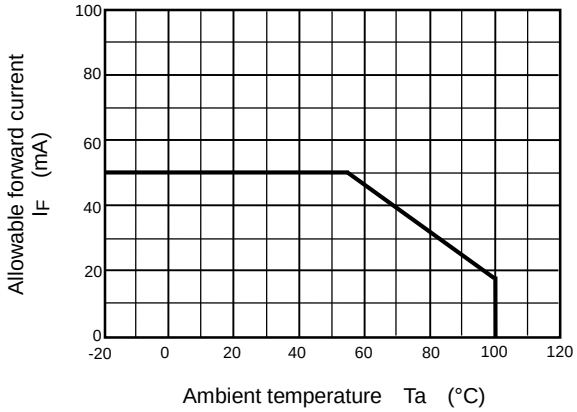
## Switching Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Rise time | $t_r$ | $V_{CC}$ = 10 V, $I_C$ = 2 mA<br>$R_L$ = 100 Ω | — | 8 | — | μs |
| Fall time | $t_f$ | | — | 8 | — | |
| Turn-on time | $t_{ON}$ | | — | 10 | — | |
| Turn-off time | $t_{OFF}$ | | — | 8 | — | |
| Turn-on time | $t_{ON}$ | $R_L$ = 4.7 kΩ (Fig.1)<br>$V_{CC}$ = 5 V, $I_F$ = 1.6 mA | — | 10 | — | μs |
| Storage time | $t_s$ | | — | 50 | — | |
| Turn-off time | $t_{OFF}$ | | — | 300 | — | |

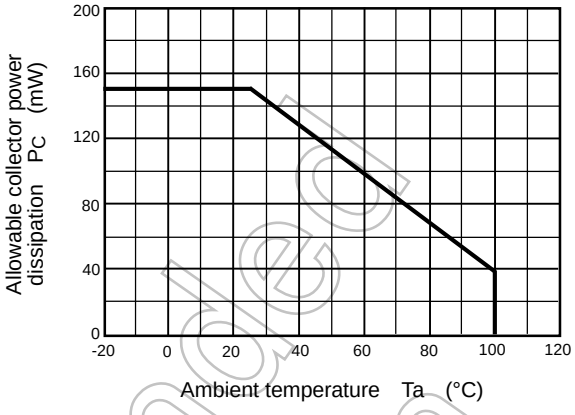
Fig. 1 Switching time test circuit



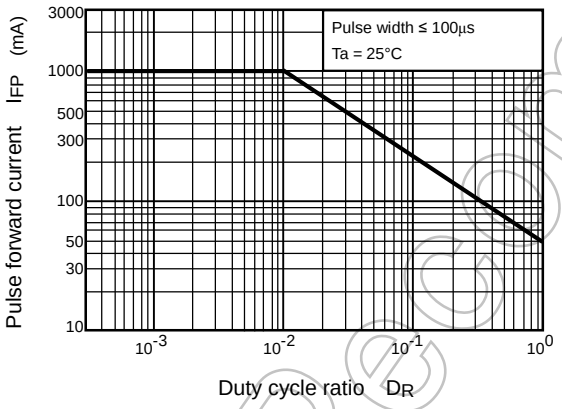
$I_F$ – Ta



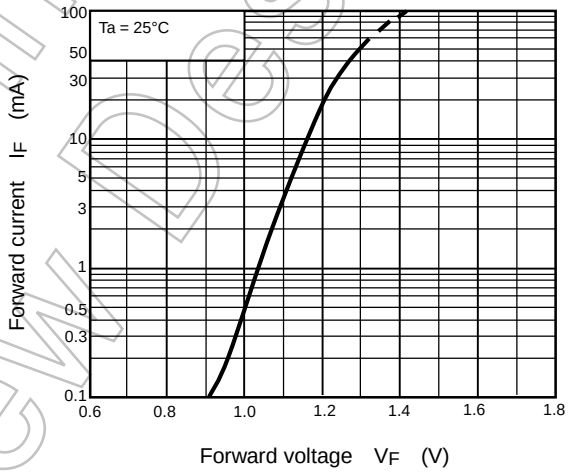

$P_C$ – Ta



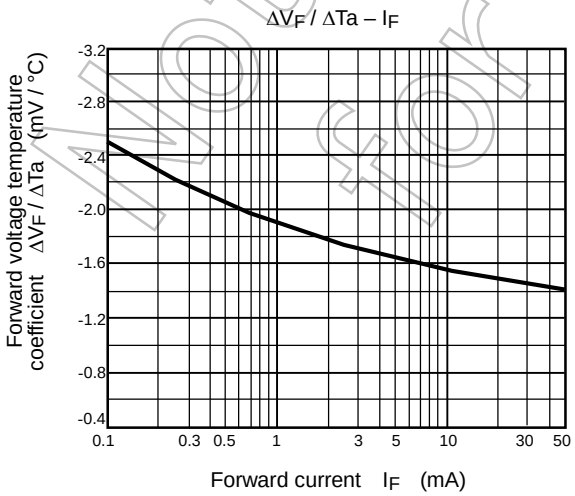

$I_{FP}$ – $D_R$



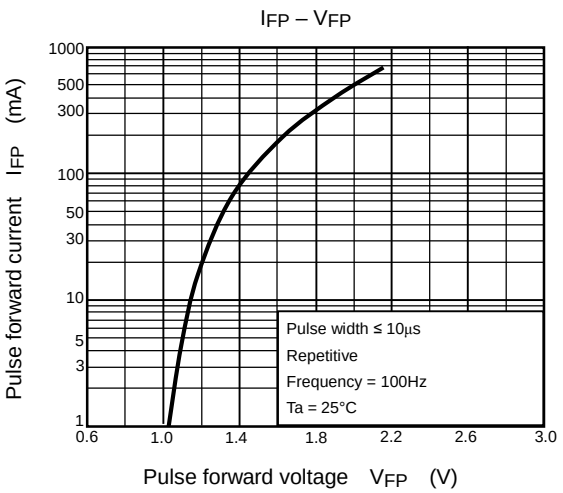

$I_F$ – $V_F$



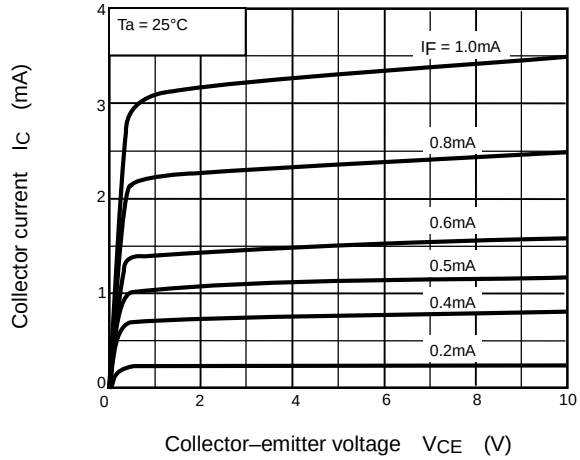

$\Delta V_F / \Delta Ta$ – $I_F$



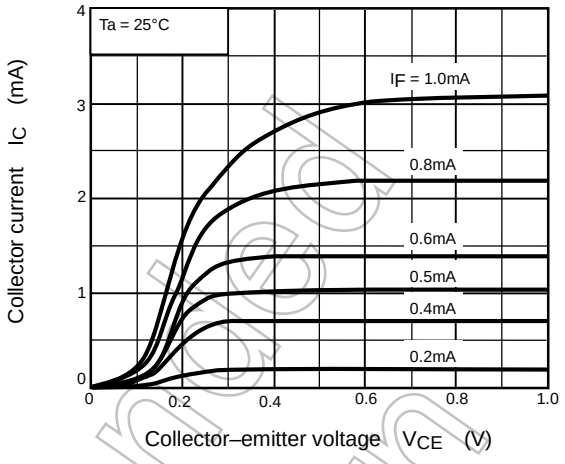

$I_{FP}$ – $V_{FP}$



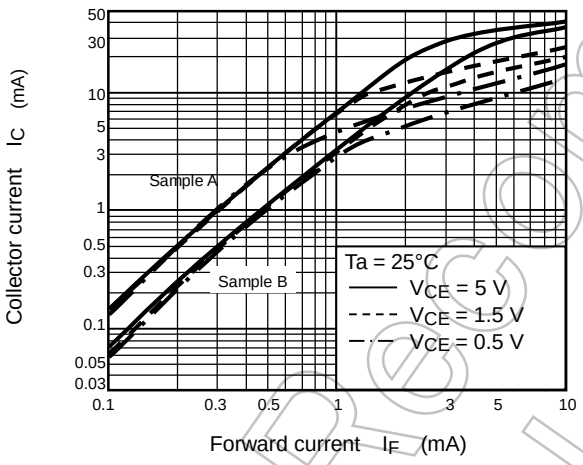
$I_C - V_{CE}$



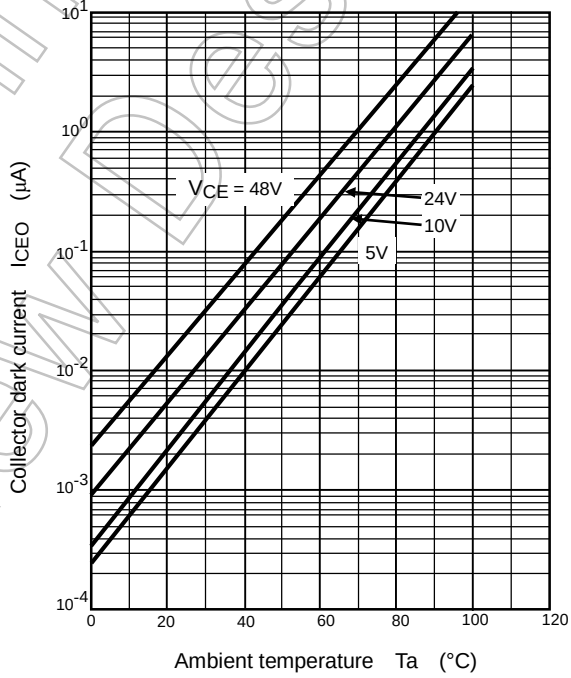

$I_C - V_{CE}$



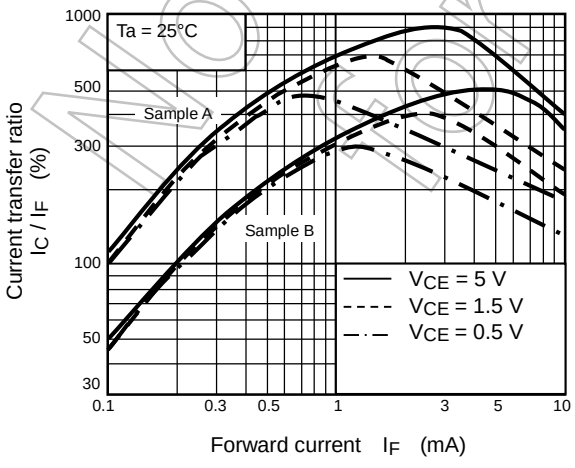

$I_C - I_F$



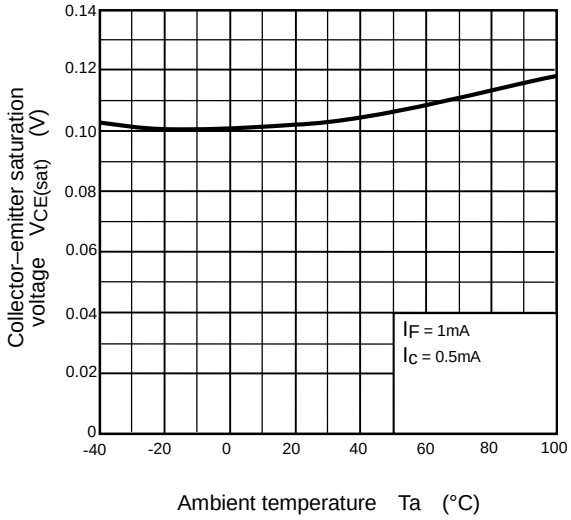

$I_{CEO} - Ta$



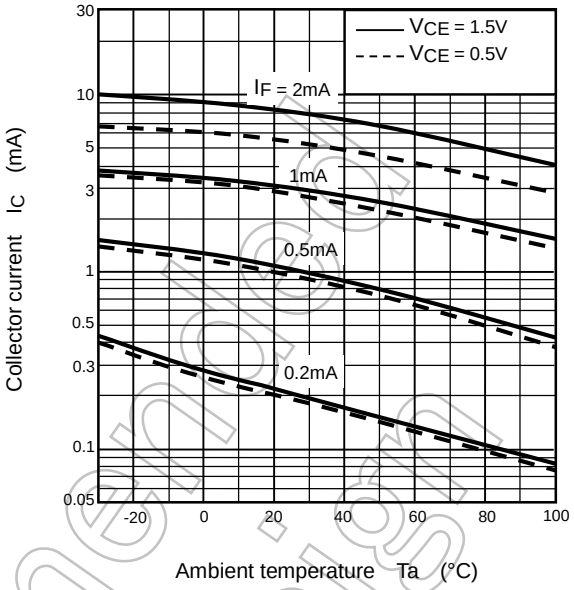

$I_C / I_F - I_F$



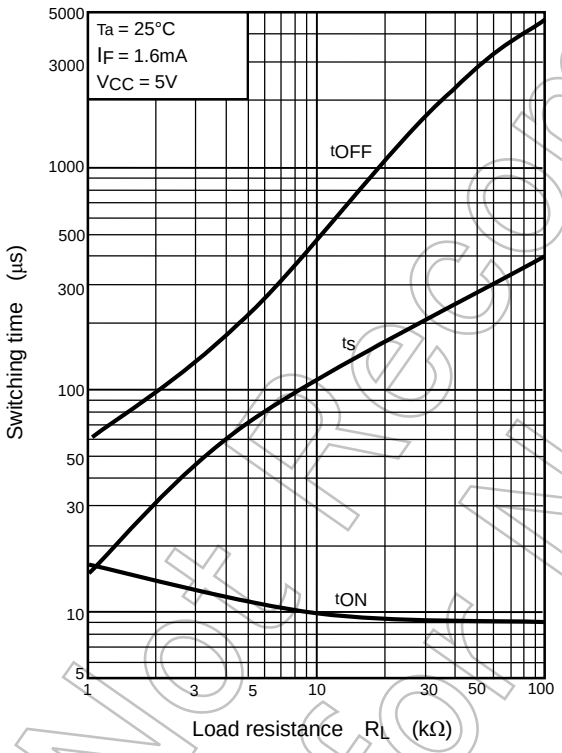
$V_{CE(sat)}$ – Ta




$I_C$ – Ta




Switching Time – $R_L$



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