

TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

# TLP180

Telephone Use Equipment  
 Programmable Controllers  
 AC/DC-Input Module  
 Telecommunication

The TOSHIBA mini flat coupler TLP180 is a small outline coupler, suitable for surface mount assembly.  
 TLP180 consist of a photo transistor, optically coupled to a gallium arsenide infrared emitting diode connected inverse parallel, and can operate directly by AC input current.

- Collector-emitter voltage: 80 V (min)
- Current transfer ratio: 50% (min)  
 Rank GB: 100% (min)
- Isolation voltage: 3750 Vrms (min)
- UL recognized: UL1577, file No. E67349
- c-UL approved :CSA Component Acceptance Service  
 No. 5A, File No.E67349

- Option (V4) type  
 VDE approved : EN60747-5-5  
 Maximum Operating Insulation Voltage: 565 Vpk  
 Highest Permissible Overvoltage: 6000 Vpk

**Note: When a EN60747-5-5 approved type is needed,  
 Please designate "Option(V4)"**

## Current Transfer Ratio

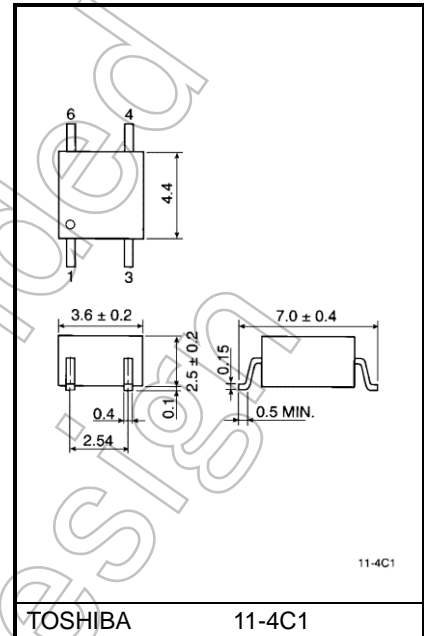
Classi- fication (Note 1)	Current Transfer Ratio (%) (Ic/If) If = 5 mA, VCE = 5 V, Ta = 25°C		Marking Of Classification
	Min	Max	
Standard	50	600	Blank, YE, GR, BL , GB
Rank Y	50	150	YE
Rank GR	100	300	GR
Rank BL	200	600	BL
Rank GB	100	600	GB , GR , BL

Note: The product with the Rank Y and BL are limited in production.  
 For details, please contact your nearest Toshiba sales representative.

Note 1: Ex. rank GB: TLP180 (GB)

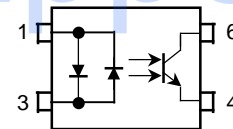
Note: Application type name for certification test,  
 please use standard product type name, i.e.  
 TLP180(GB): TLP180

Unit: mm



Weight: 0.09 g (typ.)

## Pin Configuration (top view)



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

Start of commercial production  
 1995-12

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

Characteristic		Symbol	Rating	Unit
LED	Forward current	$I_{F(RMS)}$	±50	mA
	Forward current derating (Ta ≥ 53°C)	$\Delta I_F/^\circ C$	-0.7	mA/°C
	Pulse forward current (Note 1)	$I_{FP}$	±1	A
	Diode power dissipation	$P_D$	100	mW
	Diode power dissipation derating (Ta ≥ 53°C)	$\Delta P_D/^\circ C$	-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
	Power dissipation	$P_C$	150	mW
	Power dissipation derating (Ta ≥ 25°C)	$\Delta P_C/^\circ C$	-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)		$\Delta P_T/^\circ C$	-2.0	mW/°C
Isolation voltage (AC, 60 s, R.H. ≤ 60%) (Note 2)		$BV_S$	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: Pulse width ≤ 100 μs, f = 100 Hz

Note 2: Device considered a two terminal device: Pins 1 and 3 shorted together and 4 and 6 shorted together.

## Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Supply voltage	$V_{CC}$	—	5	48	V
Forward current	$I_{F(RMS)}$	—	16	20	mA
Collector current	$I_C$	—	1	10	mA
Operating temperature	$T_{opr}$	-25	—	85	°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)

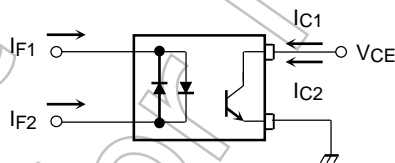
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V <sub>F</sub>	I <sub>F</sub> = ±10 mA	1.0	1.15	1.3	V
	Capacitance	C <sub>T</sub>	V = 0 V, f = 1 MHz	—	60	—	pF
Detector	Collector-emitter breakdown voltage	V <sub>(BR)CEO</sub>	I <sub>C</sub> = 0.5 mA	80	—	—	V
	Emitter-collector breakdown voltage	V <sub>(BR)ECO</sub>	I <sub>E</sub> = 0.1 mA	7	—	—	V
	Collector dark current	I <sub>CEO</sub>	V <sub>CE</sub> = 48 V (ambient light below 1000 lx) (Note 1)	—	0.01 (2)	0.1 (10)	μA
			V <sub>CE</sub> = 48 V, Ta = 85°C (ambient light below 1000 lx) (Note 1)	—	2 (4)	50 (50)	μA
Capacitance (collector to emitter)		C <sub>CE</sub>	V = 0 V, f = 1 MHz	—	10	—	pF

Note 1: Please use standard electric lamp to light up the device's marking surface.

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

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	I <sub>C</sub> /I <sub>F</sub>	I <sub>F</sub> = ±5 mA, V <sub>CE</sub> = 5 V Rank GB	50	—	600	%
			100	—	600	
Saturated CTR	I <sub>C</sub> /I <sub>F(sat)</sub>	I <sub>F</sub> = ±1 mA, V <sub>CE</sub> = 0.4 V Rank GB	—	60	—	%
			30	—	—	
Collector-emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 2.4 mA, I <sub>F</sub> = ±8 mA Rank GB	—	—	0.4	V
			I <sub>C</sub> = 0.2 mA, I <sub>F</sub> = ±1 mA	—	0.2	
		—	—	0.4	—	
Off-state collector current	I <sub>C(off)</sub>	V <sub>F</sub> = ±0.7 V, V <sub>CE</sub> = 48 V	—	1	10	μA
CTR symmetry	I <sub>C(ratio)</sub>	I <sub>C</sub> (I <sub>F</sub> = -5 mA) / I <sub>C</sub> (I <sub>F</sub> = 5 mA) (Note 1)	0.33	1	3	—

$$\text{Note 1: } I_{C(\text{ratio})} = \frac{I_{C2}(I_F = I_{F2}, V_{CE} = 5V)}{I_{C1}(I_F = I_{F1}, V_{CE} = 5V)}$$



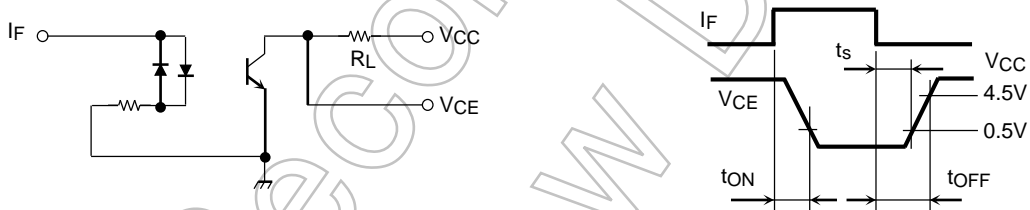
**Isolation Characteristics (Ta = 25°C)**

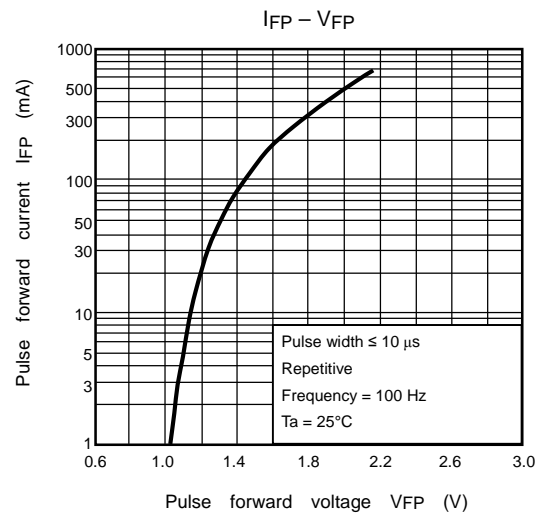
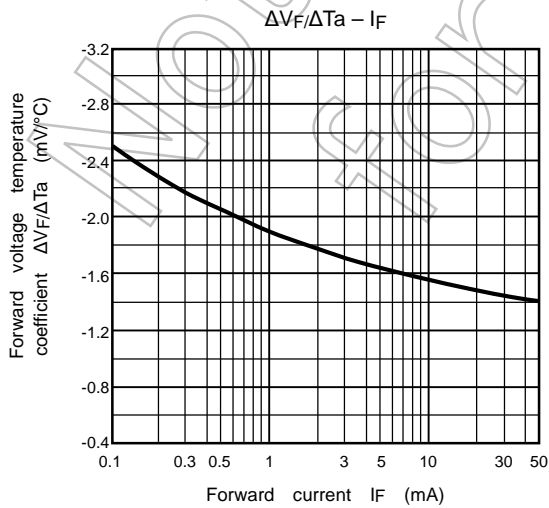
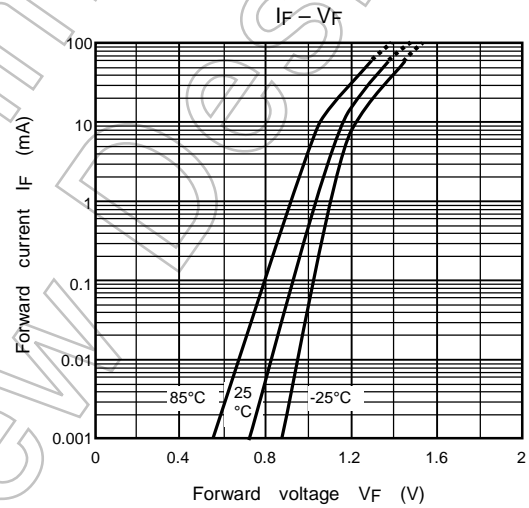
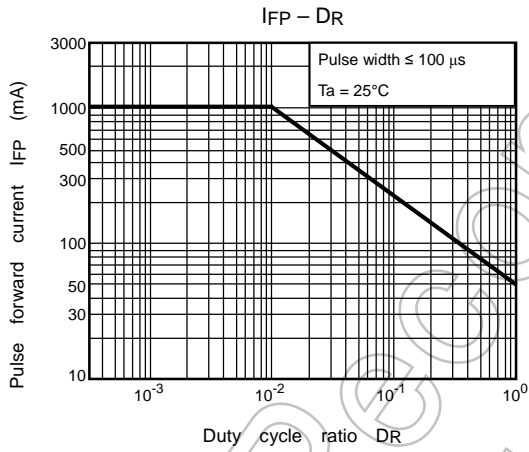
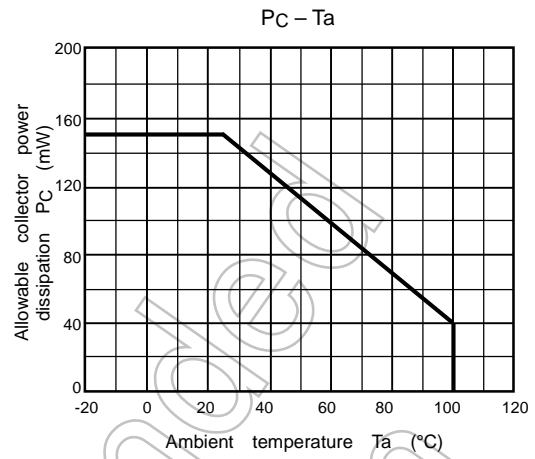
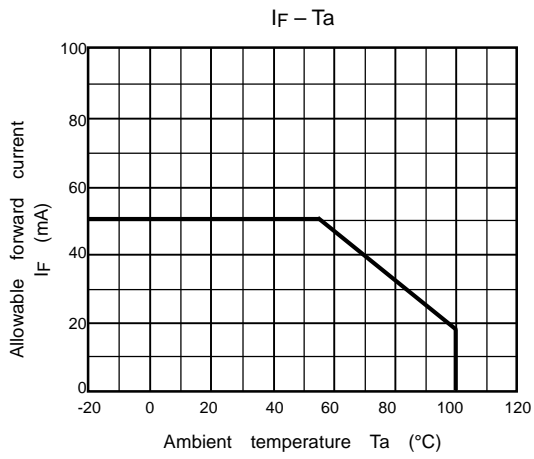
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance input to output	Cs	Vs = 0 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	Rs	Vs = 500 V, R.H. ≤ 60%	5×10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BVs	AC, 60 s	3750	—	—	Vrms
		AC, 1 s, in oil	—	10000	—	
		DC, 60 s, in oil	—	10000	—	Vdc

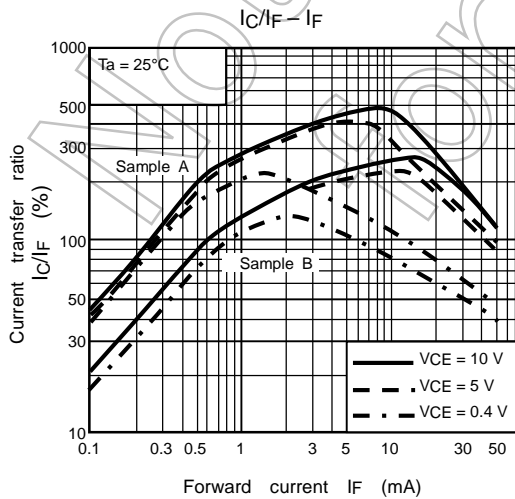
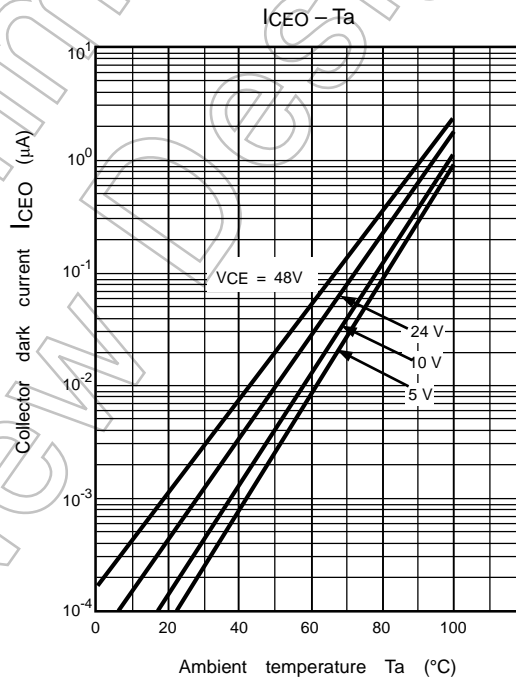
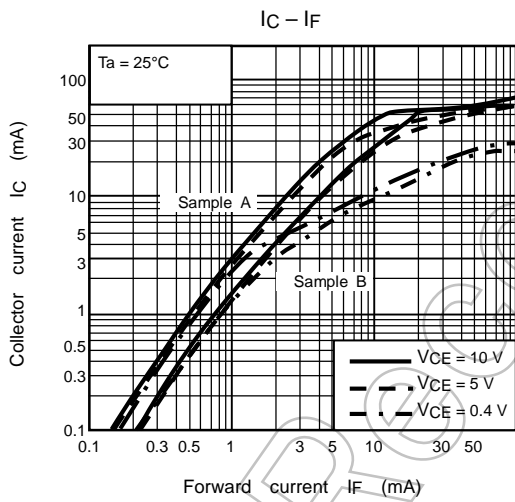
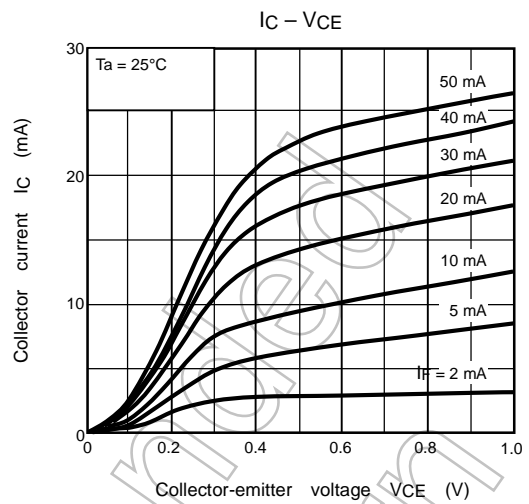
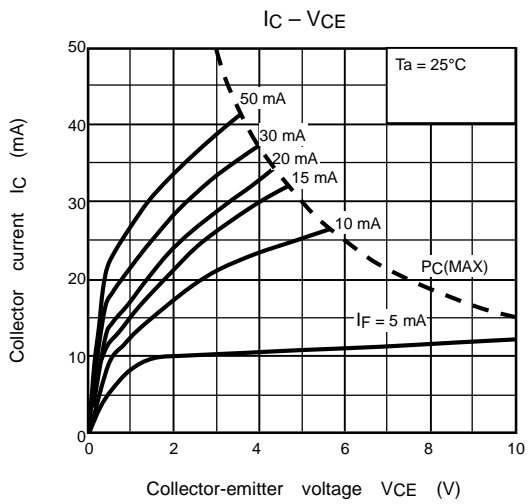
**Switching Characteristics (Ta = 25°C)**

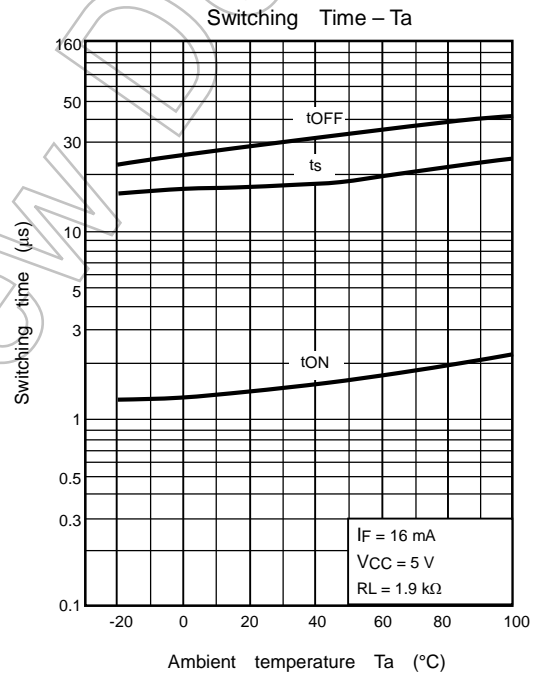
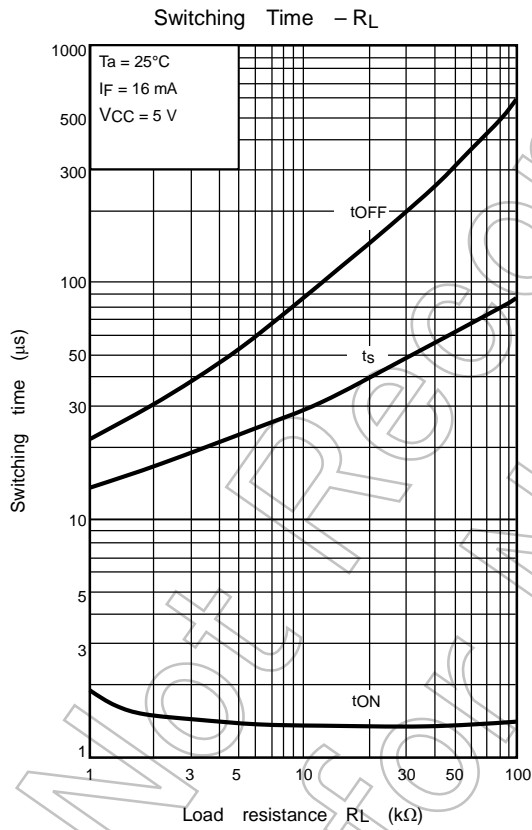
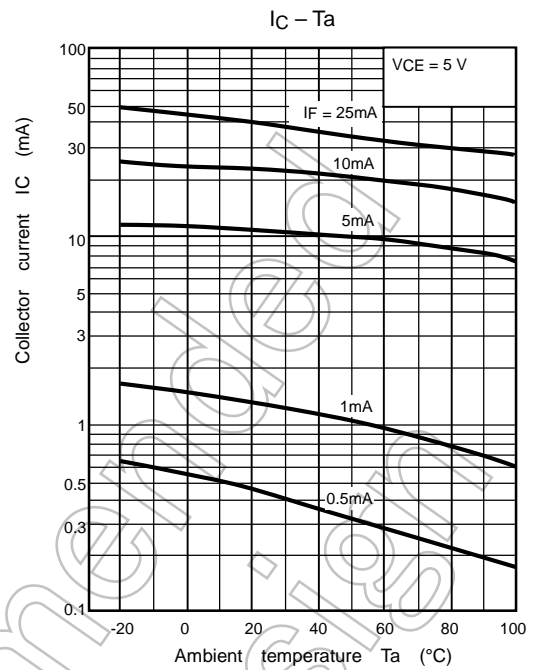
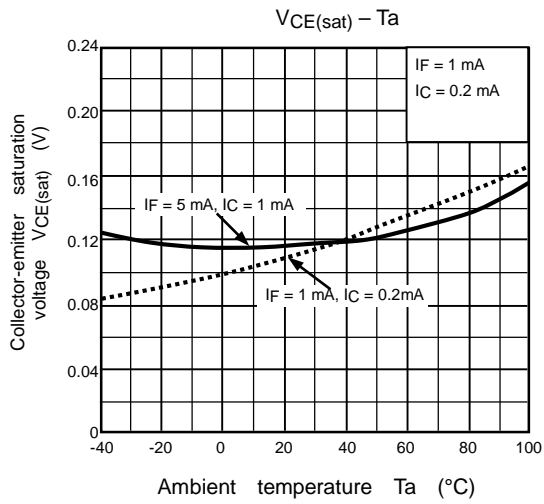
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	tr	VCC = 10 V, IC = 2 mA RL = 100 Ω	—	2	—	μs
Fall time	tf		—	3	—	
Turn-on time	tON		—	3	—	
Turn-off time	tOFF		—	3	—	
Turn-on time	tON	RL = 1.9 kΩ VCC = 5 V, IF = ±16 mA (Fig.1)	—	2	—	μs
Storage time	ts		—	25	—	
Turn-off time	tOFF		—	40	—	

Fig. 1: Switching time test circuit









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