

TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

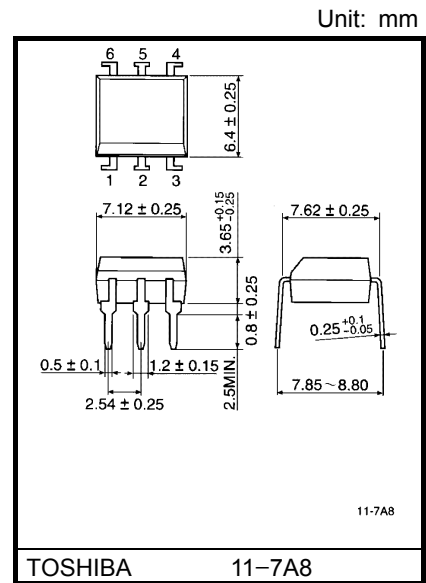
# TLP371, TLP372

Office Machine  
 Household Use Equipment  
 Telecommunication  
 Solid State Relay  
 Programmable Controllers

The TOSHIBA TLP371 and TLP372 consists of a gallium arsenide infrared emitting diode optically coupled to a Darlington connected photo-transistor which has an integrated base-emitter resistor to optimize switching speed and elevated temperature characteristics in a six lead plastic DIP package.

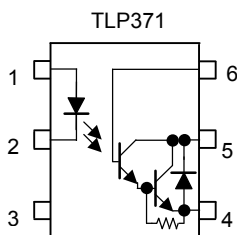
TLP372 has no-base internal connection for high-EMI environments.

- Current transfer ratio: 1000% (min) ( $I_F = 1\text{mA}$ )
- Isolation voltage: 5000 Vrms (min)
- UL recognized: UL1577, file no. E67349

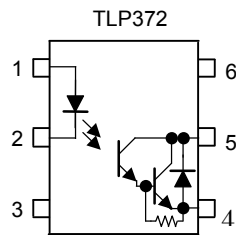


Weight: 0.4 g (typ.)

## Pin Configurations (top view)



- 1 : Anode
- 2 : Cathode
- 3 : NC
- 4 : Emitter
- 5 : Collector
- 6 : Base



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Start of commercial production  
 1986/03

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

Characteristic		Symbol	Rating	Unit
LED	Forward current	$I_F$	60	mA
	Forward current derating (Ta ≥ 39°C)	$\Delta I_F / ^\circ\text{C}$	-0.7	mA / °C
	Peak forward current (100µs pulse, 100pps)	$I_{FP}$	1	A
	Reverse voltage	$V_R$	5	V
	Junction temperature	$T_j$	125	°C
Detector	Collector-emitter voltage	$V_{CEO}$	300	V
	Collector-base voltage (TLP371)	$V_{CBO}$	300	V
	Emitter-collector voltage	$V_{ECO}$	0.3	V
	Emitter-base voltage (TLP371)	$V_{EBO}$	7	V
	Collector current	$I_C$	150	mA
	Power dissipation	$P_C$	300	mW
	Power dissipation derating (Ta ≥ 25°C)	$\Delta P_C / ^\circ\text{C}$	-3.0	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		$P_T$	350	mW
Total package power dissipation derating (Ta ≥ 25°C)		$\Delta P_T / ^\circ\text{C}$	-3.5	mW / °C
Isolation voltage (AC, 1minute, R.H. ≤ 60%) (Note 1)		$BV_S$	5000	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 and 3 shorted together and pins 4,5 and 6 shorted together.

## Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Supply voltage	$V_{CC}$	—	—	200	V
Forward current	$I_F$	—	16	25	mA
Collector current	$I_C$	—	—	120	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.

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

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	$V_F$	$I_F = 10 \text{ mA}$	1.0	1.15	1.3	V
	Reverse current	$I_R$	$V_R = 5 \text{ V}$	—	—	10	$\mu\text{A}$
	Capacitance	$C_T$	$V = 0, f = 1 \text{ MHz}$	—	30	—	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR) CEO}$	$I_C = 0.1 \text{ mA}$	300	—	—	V
	Emitter-collector breakdown voltage	$V_{(BR) ECO}$	$I_E = 0.1 \text{ mA}$	0.3	—	—	V
	Collector-base breakdown voltage (TLP371)	$V_{(BR) CBO}$	$I_C = 0.1 \text{ mA}$	300	—	—	V
	Emitter-base breakdown voltage (TLP371)	$V_{(BR) EBO}$	$I_E = 0.1 \text{ mA}$	7	—	—	V
	Collector dark current	$I_{CEO}$	$V_{CE} = 200 \text{ V}$	—	10	200	nA
			$V_{CE} = 200 \text{ V}$ $T_a = 85^\circ\text{C}$	—	—	20	$\mu\text{A}$
	Collector dark current (TLP371)	$I_{CER}$	$V_{CE} = 200 \text{ V}$ $T_a = 85^\circ\text{C}$ $R_{BE} = 10 \text{ M}\Omega$	—	0.5	10	$\mu\text{A}$
	Collector dark current (TLP371)	$I_{CBO}$	$V_{CE} = 200 \text{ V}$	—	0.1	—	nA
	DC forward current gain (TLP371)	$h_{FE}$	$V_{CE} = 5 \text{ V}$ , $I_C = 10 \text{ mA}$	—	7000	—	—
Capacitance (collector to emitter)	$C_{CE}$	$V = 0, f = 1 \text{ MHz}$	—	10	—	pF	

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

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	$I_C / I_F$	$I_F = 1 \text{ mA}, V_{CE} = 1 \text{ V}$	1000	4000	—	%
Saturated CTR	$I_C / I_F (\text{sat})$	$I_F = 10 \text{ mA}, V_{CE} = 1 \text{ V}$	500	—	—	%
Base photo-current (TLP371)	$I_{PB}$	$I_F = 1 \text{ mA}, V_{CB} = 1 \text{ V}$	—	6	—	$\mu\text{A}$
Collector-emitter saturation voltage	$V_{CE (\text{sat})}$	$I_C = 10 \text{ mA}, I_F = 1 \text{ mA}$	—	—	1.0	V
		$I_C = 100 \text{ mA}, I_F = 10 \text{ mA}$	0.3	—	1.2	

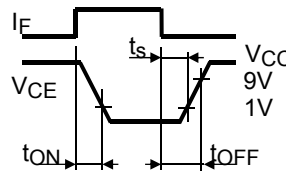
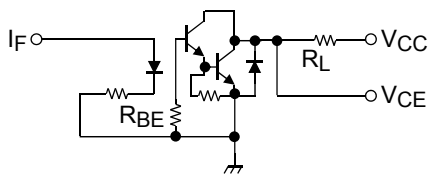
## Isolation Characteristics (Ta = 25°C)

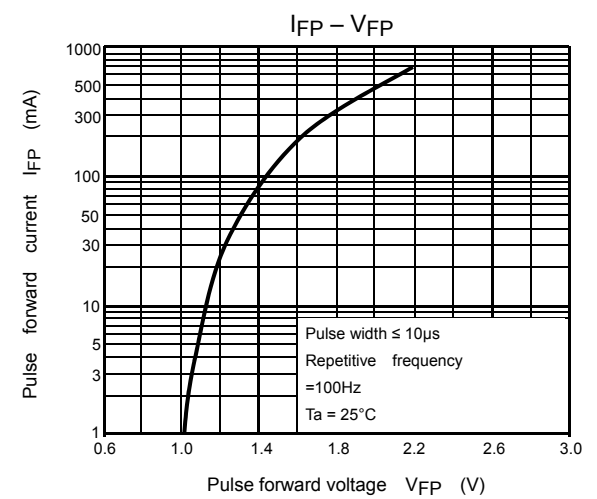
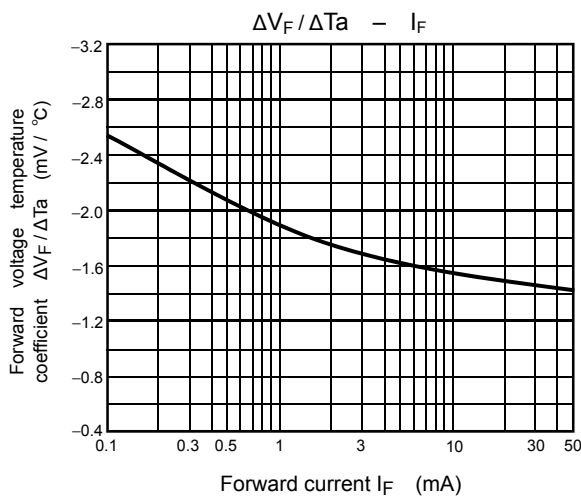
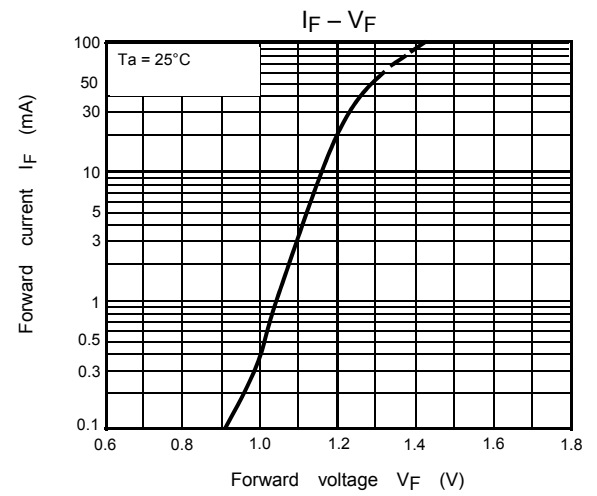
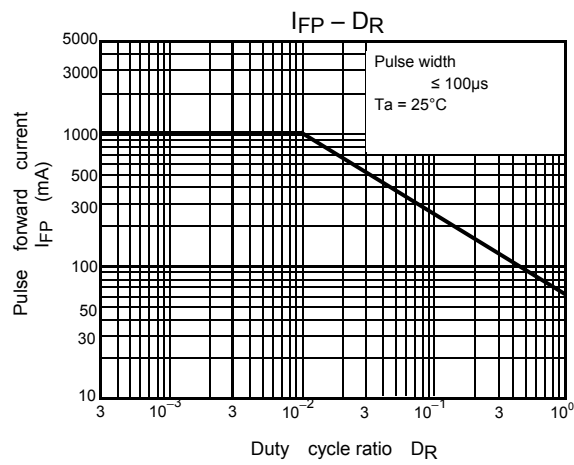
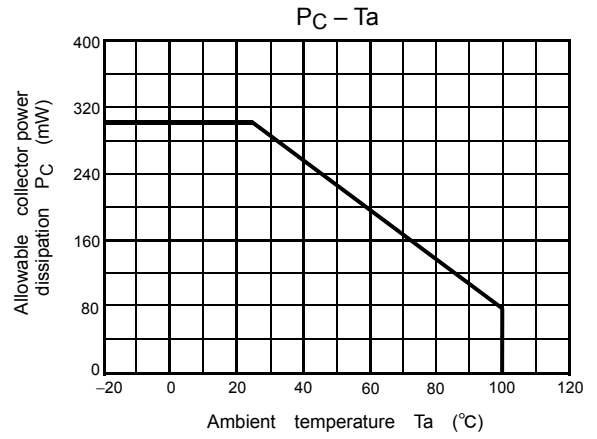
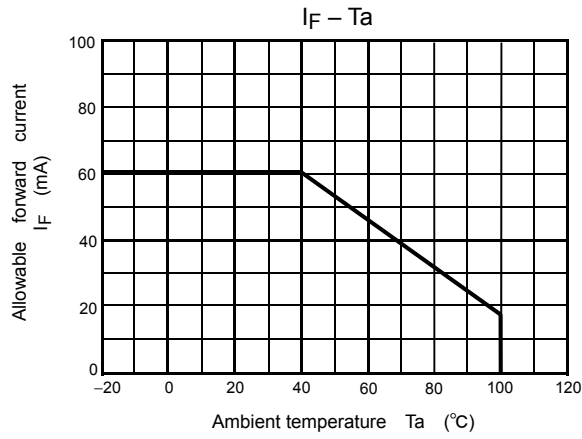
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance (input to output)	C <sub>S</sub>	V <sub>S</sub> = 0, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R <sub>S</sub>	V <sub>S</sub> = 500 V	5×10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BV <sub>S</sub>	AC, 1 minute	5000	—	—	V <sub>rms</sub>
		AC, 1 second, in oil	—	10000	—	
		DC, 1 minute, in oil	—	10000	—	V <sub>dc</sub>

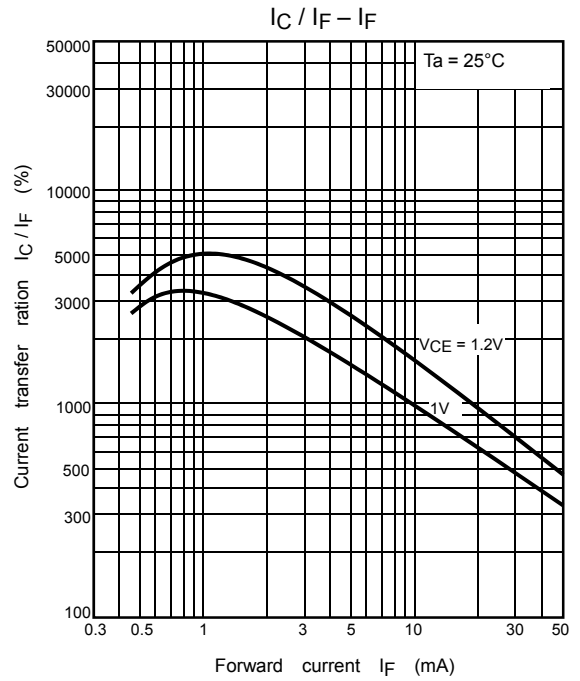
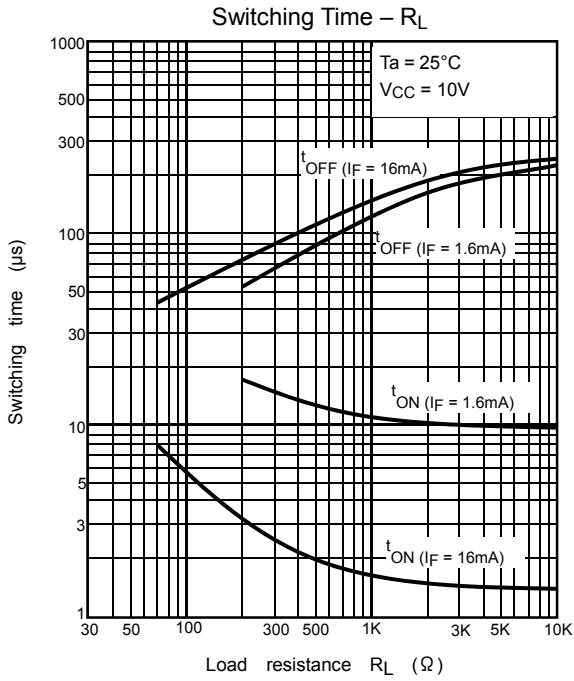
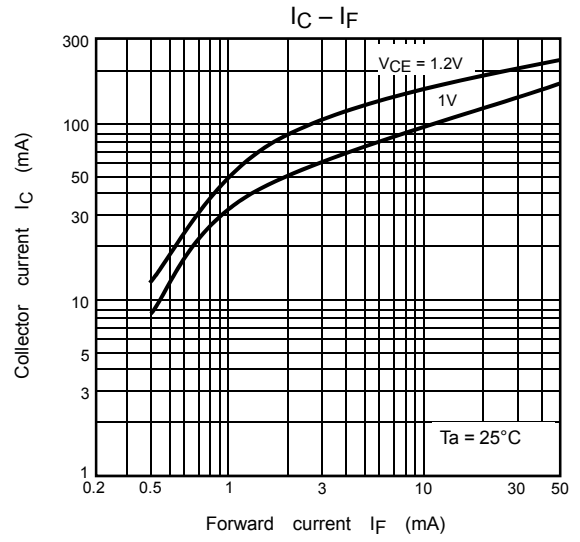
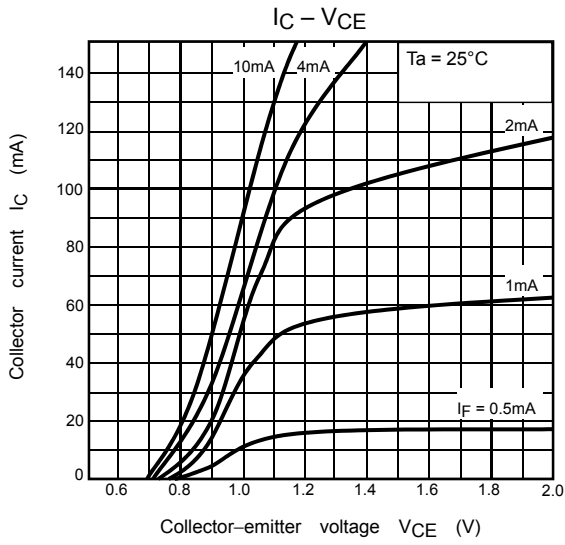
## Switching Characteristics (Ta = 25°C)

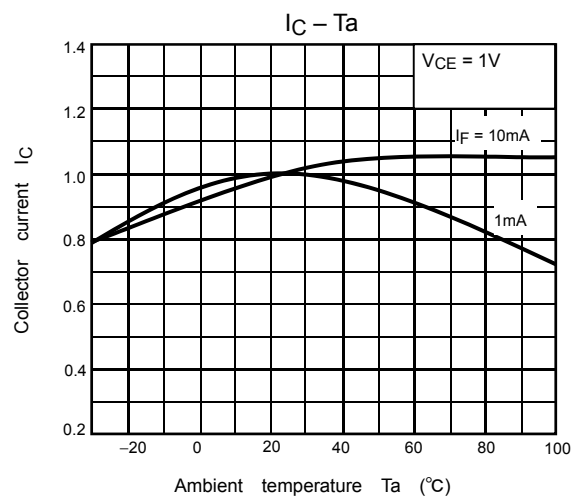
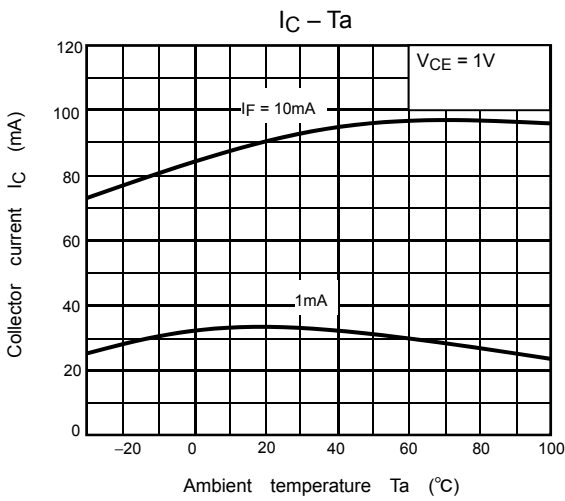
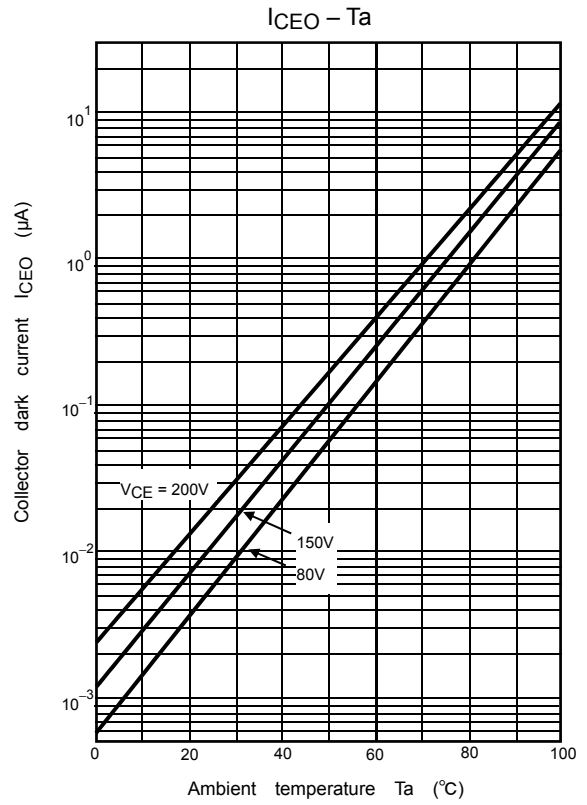
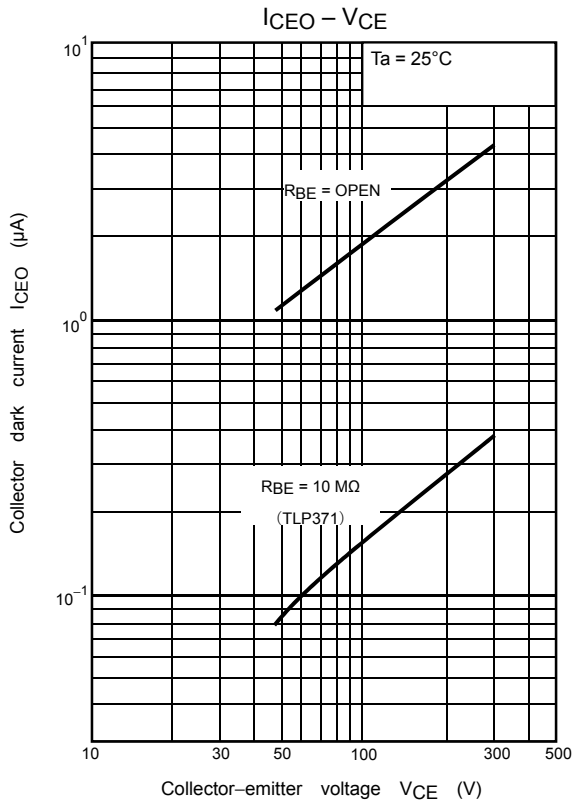
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	t <sub>r</sub>	V <sub>CC</sub> = 10 V I <sub>C</sub> = 10 mA R <sub>L</sub> = 100Ω	—	40	—	μs
Fall time	t <sub>f</sub>		—	15	—	
Turn-on time	t <sub>on</sub>		—	50	—	
Turn-off time	t <sub>off</sub>		—	15	—	
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 180Ω (Fig.1) R <sub>BE</sub> = OPEN V <sub>CC</sub> = 5 V, I <sub>F</sub> = 16 mA	—	3	—	μs
Storage time	t <sub>s</sub>		—	45	—	
Turn-off time	t <sub>OFF</sub>		—	90	—	
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 180Ω (Fig.1) R <sub>BE</sub> = 10 MΩ(TLP371) V <sub>CC</sub> = 10 V, I <sub>F</sub> = 16 mA	—	5	—	μs
Storage time	t <sub>s</sub>		—	40	—	
Turn-off time	t <sub>OFF</sub>		—	80	—	

Fig.1: Switching time test circuit









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