

TOSHIBA Photocoupler GaAs Ired & Photo-Transistor

## TLP331, TLP332

Office Machine  
Household Use Equipment  
Programmable Controllers  
AC / DC-Input Module  
Telecommunication

The TOSHIBA TLP331 and TLP332 consist of a gallium arsenide infrared emitting diode optically coupled to a photo-transistor in a six lead plastic DIP package.

This photocoupler provides the unique feature of high current transfer ratio at both low output voltage and low input current. This makes it ideal for use in low power logic circuits, telecommunications equipment and portable electronics isolation applications.

TLP332 has no-base internal connection for high-EMI environments.

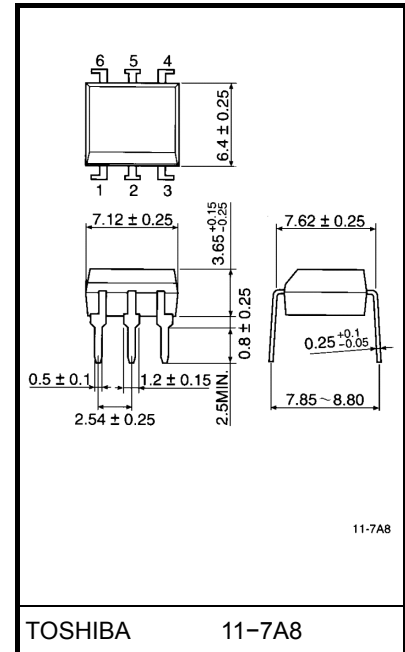
- Collector-emitter voltage: 55V (min)
- Isolation voltage: 5000Vrms (min)
- UL recognized: UL1577, file no. E67349
- Current transfer ratio

Classification (*)	Current Transfer Ratio (min)			Marking of Classification
	Ta = 25°C		Ta = -25~75°C	
	If = 1mA VCE = 0.5V	If = 0.5mA VCE = 1.5V	If = 1mA VCE = 0.5V	
Rank BV	200%	100%	100%	BV
Standard	100%	50%	50%	BV, blank

(\*) ex. Standard: TLP331  
Rank BV: TLP331(BV)

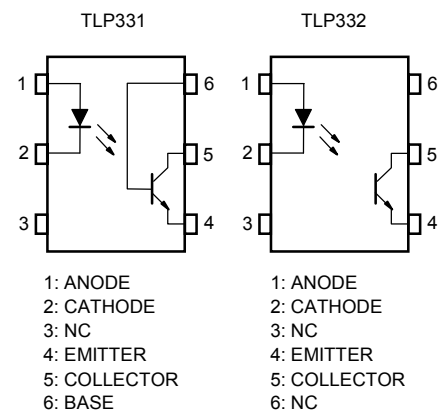
(Note) Application type name for certification test,  
please use standard product type name, i.e.  
TLP331(BV): TLP331

Unit: mm



Weight: 0.4 g

### Pin Configurations (top view)



Start of commercial production  
1986/03

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

Characteristic		Symbol	Rating	Unit
LED	Forward current	I <sub>F</sub>	50	mA
	Forward current derating (Ta ≥ 39°C)	ΔI <sub>F</sub> / °C	−0.7	mA / °C
	Peak forward current (100μs pulse, 100pps)	I <sub>FP</sub>	1	A
	Reverse Voltage	V <sub>R</sub>	5	V
	Junction temperature	T <sub>j</sub>	125	°C
Detector	Collector–emitter voltage	V <sub>CEO</sub>	55	V
	Collector–base voltage (TLP331)	V <sub>CBO</sub>	80	V
	Emitter–collector voltage	V <sub>ECO</sub>	7	V
	Emitter–base voltage (TLP331)	V <sub>EBO</sub>	7	V
	Collector current	I <sub>C</sub>	50	mA
	Power dissipation	P <sub>C</sub>	150	mW
	Power dissipation derating (Ta ≥ 25°C)	ΔP <sub>C</sub> / °C	−1.5	mW / °C
	Junction temperature	T <sub>j</sub>	125	°C
Storage temperature range		T <sub>stg</sub>	−55 to 125	°C
Operating temperature range		T <sub>opr</sub>	−55 to 100	°C
Lead soldering temperature (10s)		T <sub>sol</sub>	260	°C
Total package power dissipation		P <sub>T</sub>	250	mW
Total package power dissipation derating (Ta ≥ 25°C)		P <sub>T</sub> /°C	−2.5	mW / °C
Isolation voltage (AC, 1 minute, RH ≤ 60%) (Note 1)		BV <sub>S</sub>	5000	V <sub>rms</sub>

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 <sub>CC</sub>	—	5	25	V
Forward current	I <sub>F</sub>	—	1.6	25	mA
Collector current	I <sub>C</sub>	—	1	10	mA
Operating temperature	T <sub>opr</sub>	−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.

**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	$V_{(BR)CEO}$	$I_C = 0.5\text{mA}$	55	—	—	V
	Emitter–collector breakdown voltage	$V_{(BR)ECO}$	$I_E = 0.1\text{mA}$	7	—	—	V
	Collector–base breakdown voltage (TLP331)	$V_{(BR)CBO}$	$I_C = 0.1\text{mA}$	80	—	—	V
	Emitter–base breakdown voltage (TLP331)	$V_{(BR)EBO}$	$I_E = 0.1\text{mA}$	7	—	—	V
	Collector dark current	$I_{CEO}$	$V_{CE} = 24\text{V}$	—	10	100	nA
			$V_{CE} = 24\text{V}, T_a = 85^\circ\text{C}$	—	2	50	$\mu\text{A}$
	Collector dark current (TLP331)	$I_{CER}$	$V_{CE} = 24\text{V}, T_a = 85^\circ\text{C}$ $R_{BE} = 1\text{M}\Omega$	—	0.5	10	$\mu\text{A}$
	Collector dark current (TLP331)	$I_{CBO}$	$V_{CB} = 10\text{V}$	—	0.1	—	nA
	DC forward current gain (TLP331)	$h_{FE}$	$V_{CE} = 5\text{V}, I_C = 0.5\text{mA}$	—	1000	—	—
	Capacitance (collector to emitter)	$C_{CE}$	$V = 0, f = 1\text{MHz}$	—	12	—	pF

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

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	$I_C / I_F$	$I_F = 1\text{mA}, V_{CE} = 0.5\text{V}$ Rank BV	100	—	1200	%
			200	—	1200	
Low input CTR	$I_C / I_{F(\text{low})}$	$I_F = 0.5\text{mA}, V_{CE} = 1.5\text{V}$ Rank BV	50	—	—	%
			100	—	—	
Base photo-current (TLP331)	$I_{PB}$	$I_F = 1\text{mA}, V_{CB} = 5\text{V}$	—	10	—	$\mu\text{A}$
Collector–emitter saturation voltage	$V_{CE(\text{sat})}$	$I_C = 0.5\text{mA}, I_F = 1\text{mA}$	—	—	0.4	V
		$I_C = 1\text{mA}, I_F = 1\text{mA}$	—	0.2	—	
		Rank BV	—	—	0.4	

**Coupled Electrical Characteristics (Ta = 25~75°C)**

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

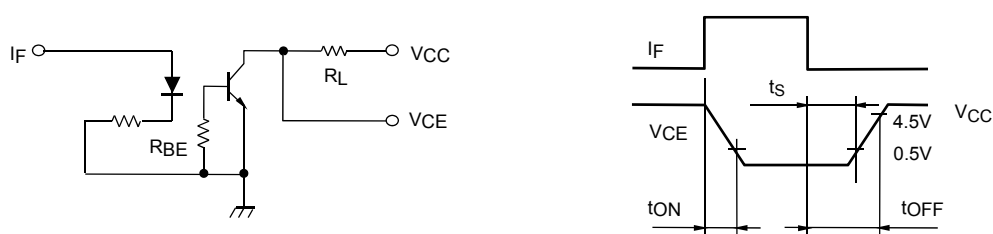
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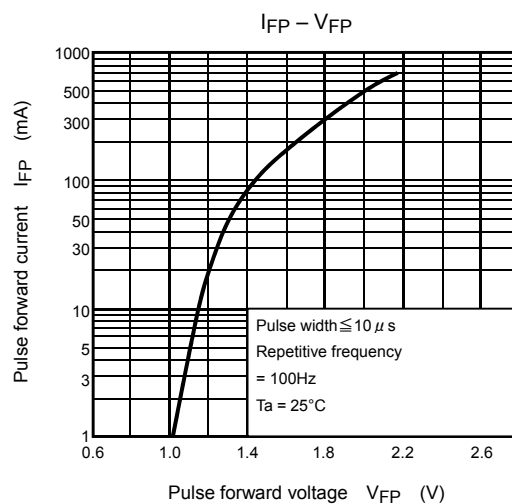
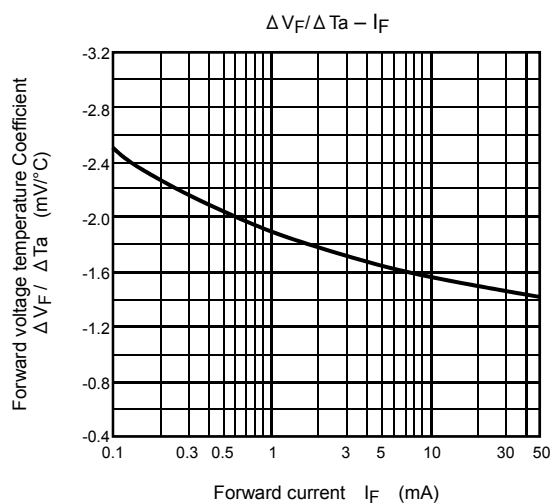
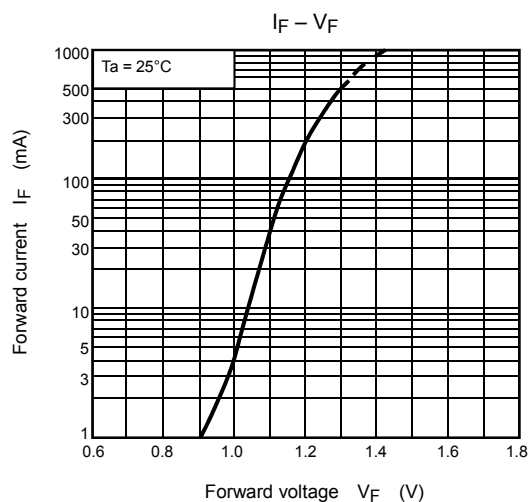
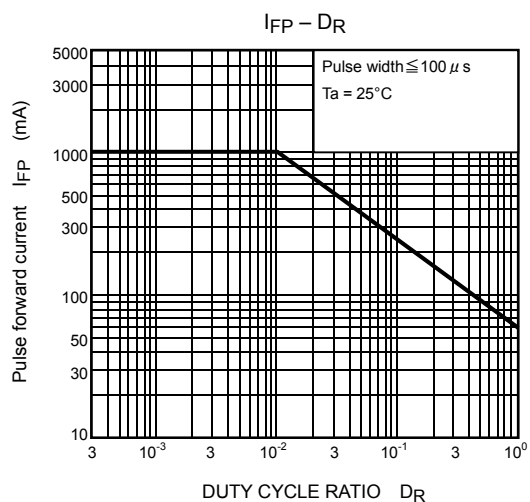
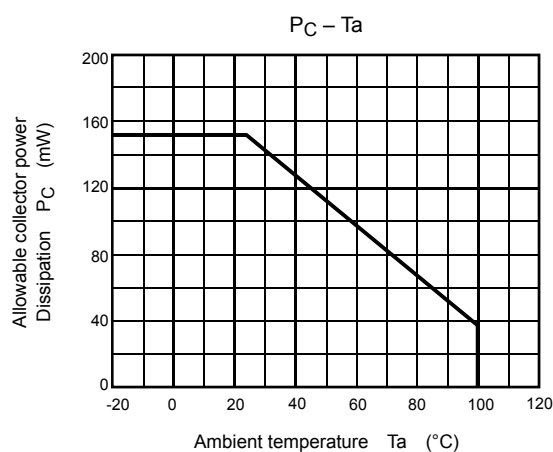
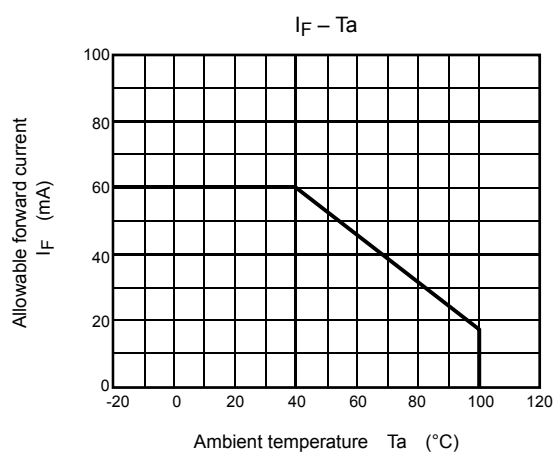
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance (input to output)	C <sub>S</sub>	V <sub>S</sub> = 0, f = 1MHz	—	0.8	—	pF
Isolation resistance	R <sub>S</sub>	V = 500V	5×10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BV <sub>S</sub>	AC, 1 minute	5000	—	—	V <sub>rms</sub>
		AC,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

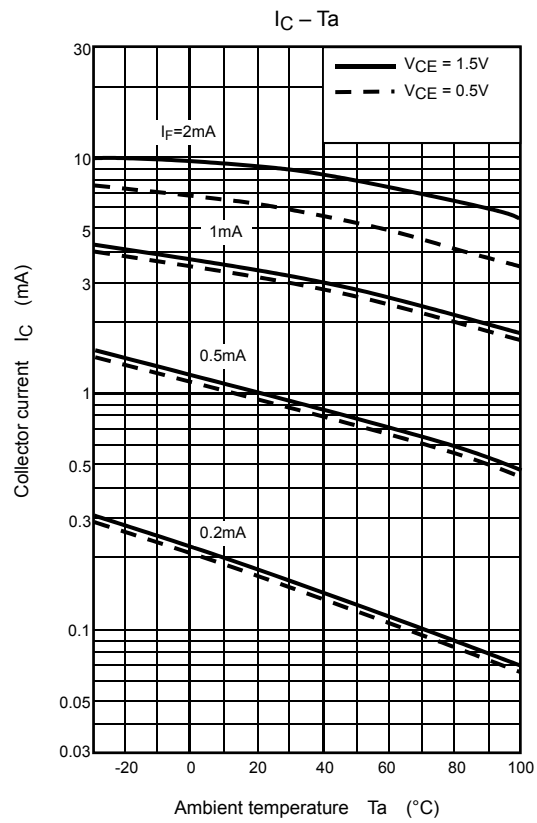
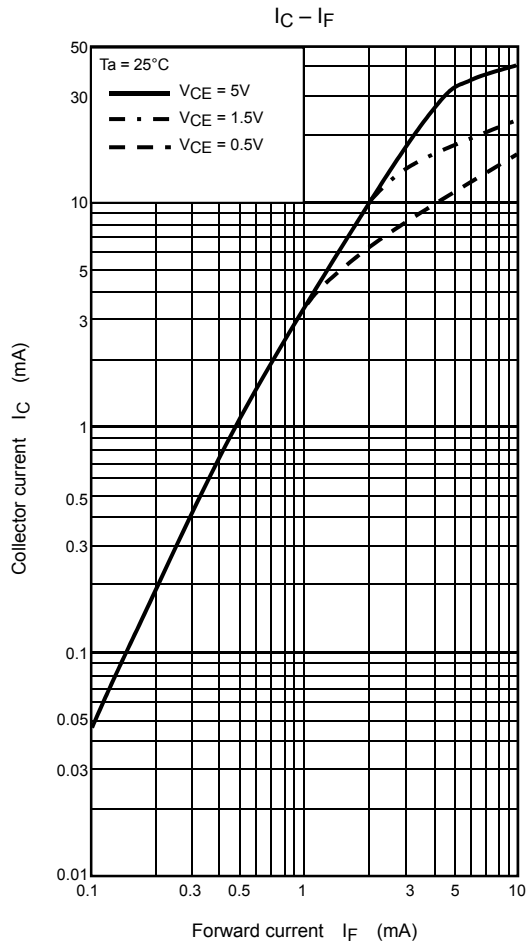
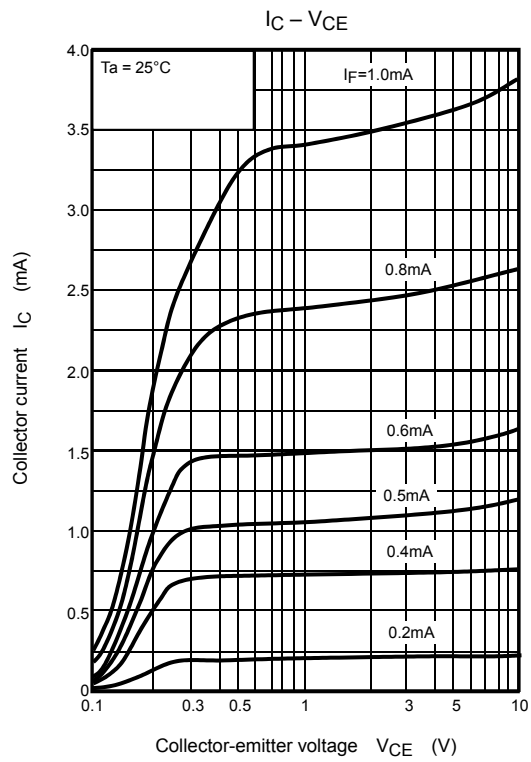
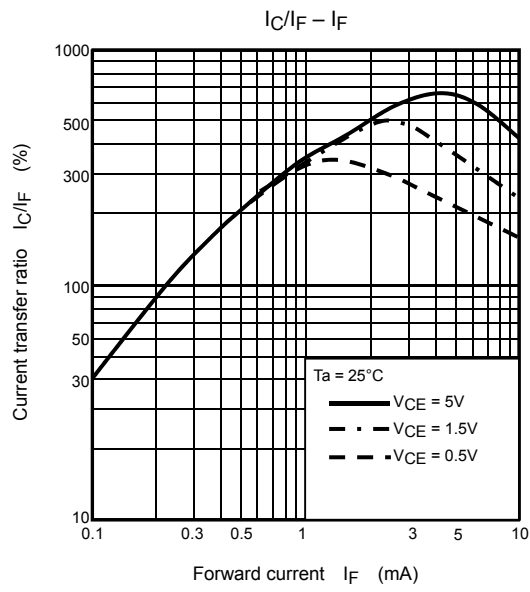
## Switching Characteristics (Ta = 25°C)

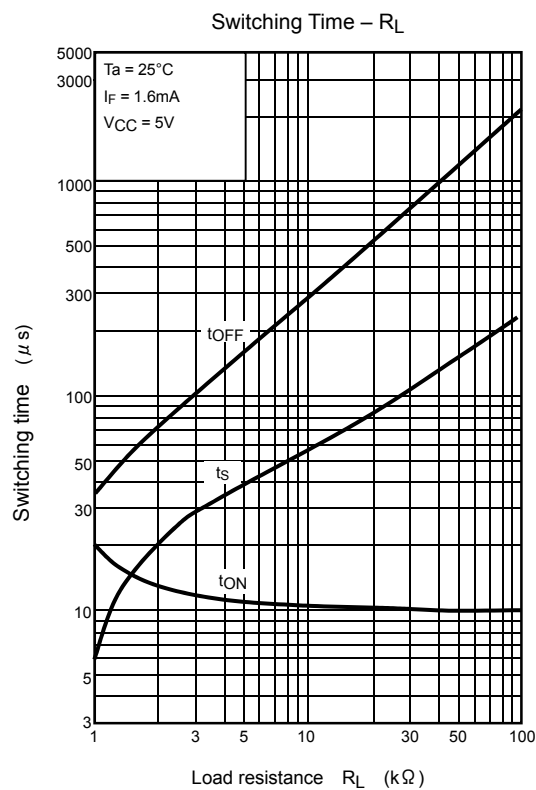
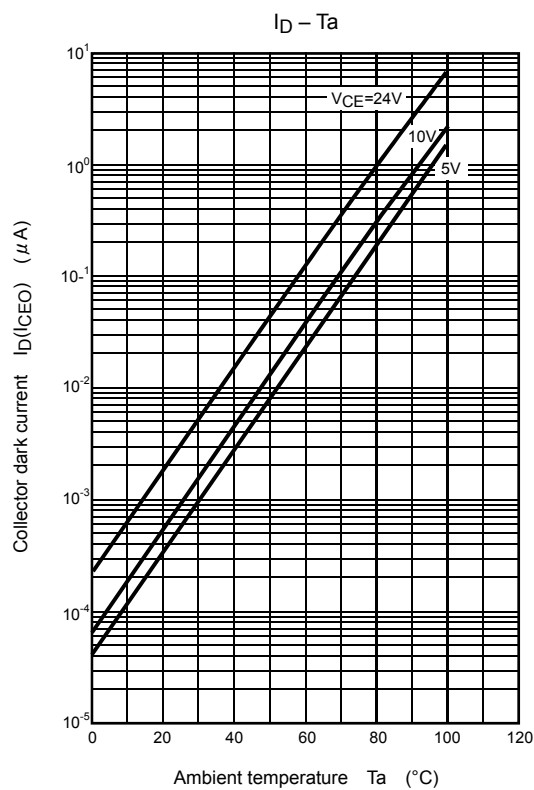
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	t <sub>r</sub>	V <sub>CC</sub> = 10V I <sub>C</sub> = 2mA R <sub>L</sub> = 100Ω	—	8	—	μs
Fall time	t <sub>f</sub>		—	8	—	
Turn-on time	t <sub>on</sub>		—	10	—	
Turn-off time	t <sub>off</sub>		—	8	—	
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 4.7kΩ (Fig.1) R <sub>BE</sub> = OPEN V <sub>CC</sub> = 5V, I <sub>F</sub> = 1.6mA	—	10	—	μs
Storage time	t <sub>S</sub>		—	50	—	
Turn-off time	t <sub>OFF</sub>		—	300	—	
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 4.7kΩ (Fig.1) R <sub>BE</sub> = 470kΩ (TLP331) V <sub>CC</sub> = 5V, I <sub>F</sub> = 1.6mA	—	12	—	μs
Storage time	t <sub>S</sub>		—	30	—	
Turn-off time	t <sub>OFF</sub>		—	100	—	

Fig. 1 Switching time test circuit









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