

phototransistors



Features

- Low-cost visible and near-IR photodetection
- Available with gains from 100 to over 1500
- Moderately fast response times
- Available in a wide range of packages including epoxy-coated, transfer-molded, cast, hermetic packages, chip form and surface mounting technology
- Usable with almost any visible or near-infrared light source such as IREDs, neon, fluorescent, incandescent bulbs, lasers, flame sources, sunlight, etc.
- Same general electrical characteristics as familiar signal transistors



Typical Applications

- Computer/business equipment
 - Write-protect control
 - Margin controls—printers
- Industrial
 - LED light source—light pens
 - Security systems
 - Safety shields
- Consumer
 - Coin counters
 - Lottery card readers
 - Position sensors—joysticks
 - Remote controllers—toys, appliances, audio/visual equipment
 - Games—laser tag
 - Camera shutter control



Principle of Operation

Phototransistors are solid-state light detectors that possess internal gain. They can be used to provide either an analog or digital output signal.

Datasheets available upon request.

Description

Phototransistors are photodiode-amplifier combinations integrated within a single silicon chip. These are combined to overcome the major fault of photodiodes: unity gain. Many applications demand a greater output signal from the photodetector than can be generated by a photodiode alone. While the signal from a photodiode can always be amplified through use of an external op-amp or other circuitry, this approach is often not as practical or as cost-effective as the use of phototransistors. The phototransistor can be viewed as a photodiode whose output photocurrent is fed into the base of a conventional small-signal transistor. While not required for operation of the device as a photodetector, a base connection is often provided, allowing the designer the option of using base current to bias the transistor. The typical gain of a phototransistor can range from 100 to over 1500.

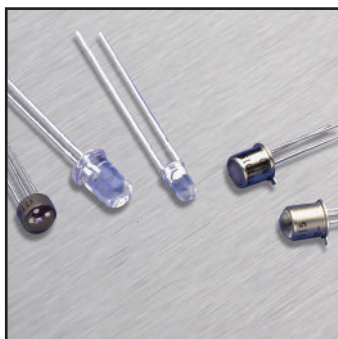
Phototransistors can be used as ambient-light detectors. When used with a controllable light source, typically an IRED, they are often employed as the detector element for optoisolators and transmissive or reflective optical switches.

All phototransistors are RoHS compliant.

Absolute Maximum Ratings

Maximum Temperatures	-25°C to 80°C (CR10TE, CR50TE)
Storage and Operating:	-40°C to 100°C
	-40°C to 110°C (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117)
	-40°C to 85°C (VTT7222, VTT7223, VTT7225, VTT7122, VTT7123, and VTT7125)
	-40°C to 70°C (VTT9002, VTT9003, VTT9102, and VTT9103)
Continuous Power Dissipation:	50 mW
	100 mW (VTT9002, VTT9003, VTT9102, and VTT9103)
	200 mW (CR10TE, CR50TE)
	250 mW (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117)
Derate above 30°C:	0.71 mW/°C
	2.5 mW/°C (VTT9002, VTT9003, VTT9102, and VTT9103)
	3.12 mW/°C (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117)
	0.91 mW/°C (VTT7122, VTT7123, VTT7125)
Maximum Current:	25 mA
	200 mA (VTT1015, VTT1016, VTT1017, VTT1115, VTT1116, and VTT1117)
Lead-Soldering Temperature:	260°C (1.6 mm from case, 5 sec. max.)

phototransistors



NPN Phototransistors

0.25", small area, high speed

0.04", medium area, high sensitivity

0.05", large area, high sensitivity

Table Key

I_C	Light Current
I_{CEO}	Dark Current $H=0$
$V_{BR(CEO)}$	Collector Breakdown $I_C=100 \mu A, H=0$
$V_{BR(ECO)}$	Emitter Breakdown $I_E=100 \mu A, H=0$
$V_{CE(SAT)}$	Saturation Voltage $I_C=1 \text{ mA}, H=400 \text{ fc}$
t_R/t_F	Rise/Fall Time $I_C=1 \text{ mA}, R_L=100 \Omega$

.025" x .025" NPN Phototransistors

Technical Specification

Part Number	Light Current mA min.	$H \text{ fc (mW/cm}^2\text{)}$ $V_{CE}=5 \text{ V}$	Dark Current nA max.	V_{CE} Volts	$V_{BR(CEO)}$ Volts min.	$V_{BR(ECO)}$ Volts min.	$V_{CE(SAT)}$ Volts max.	t_R/t_F $\mu\text{sec, typ.}$	Angular Response $\theta_{1/2}$
VTT1222WH	1.9	100 (5)	10	20	50	6	0.25	2	$\pm 40^\circ$
VTT1223WH	1.5	100 (5)	10	20	40	6	0.25	3	$\pm 40^\circ$
VTT1225H	4	100 (5)	100	10	30	5	0.25	1.5	$\pm 5^\circ$
VTT1226H	7.5	100 (5)	100	10	30	5	0.25	3	$\pm 5^\circ$
VTT1227H	12	100 (5)	100	10	30	5	0.25	4	$\pm 5^\circ$
VTT1322WH	0.8	100 (5)	10	20	50	6	0.25	2	$\pm 40^\circ$
VTT1323WH	1	100 (5)	10	20	40	6	0.25	3	$\pm 40^\circ$
VTT3122EH	1.2	100 (5)	100	20	40	6	0.25	2.5	$\pm 8^\circ$
VTT3123EH	4	100 (5)	100	10	30	4	0.25	4	$\pm 8^\circ$
VTT3323LAH	2	20 (1)	100	10	30	5	0.25	3	$\pm 10^\circ$
VTT3324LAH	4	20 (1)	100	10	30	5	0.25	4	$\pm 10^\circ$
VTT3325LAH	6	20 (1)	100	10	30	5	0.25	5	$\pm 10^\circ$
VTT3423LAH	1	20 (1)	100	10	30	5	0.25	3	$\pm 10^\circ$
VTT3424LAH	2	20 (1)	100	10	30	5	0.25	4	$\pm 10^\circ$
VTT3425LAH	3	20 (1)	100	10	30	5	0.25	5	$\pm 10^\circ$
VTT7122H	1	100 (5)	100	10	30	5	0.25	2	$\pm 36^\circ$
VTT7123H	2	100 (5)	100	10	30	5	0.25	2	$\pm 36^\circ$
VTT7125H	4.5	100 (5)	100	10	30	5	0.25	2	$\pm 36^\circ$
VTT7222H	0.9	100 (5)	100	10	30	5	0.25	2	$\pm 36^\circ$
VTT7223H	1.8	100 (5)	100	10	30	5	0.25	2	$\pm 36^\circ$
VTT7225H	4	100 (5)	100	10	30	5	0.25	4	$\pm 36^\circ$

Electro-Optical Characteristics @ 25°C

Clear T-1 3/4 (5 mm) Plastic Package

VTT1212 VTT1223W VTT1227

VTT1214 VTT1225

VTT1222W VTT1226

IRT T-1 3/4 (5mm) Plastic Package

VTT1322W VTT1312

VTT1323W VTT1314

Coax Hermetic (with case lead)

VTT3122E VTT3123E

Clear Long T-1 (3 mm) Plastic Package

VTT3323LA VTT3324LA VTT3325LA

IRT Long T-1 (3 mm) Plastic Package

VTT3423LA VTT3424LA VTT3425LA

Molded, Lensed Lateral Package

VTT7122 VTT7123 VTT7125

IRT Molded, Lensed Lateral Package

VTT7222 VTT7223 VTT7225

Clear Epoxy TO-106 Ceramic Package

VTT9002 VTT9003

Epoxy Lensed TO-106 Ceramic Package

VTT9102 VTT9103

.04" x .04" NPN Phototransistors

Technical Specification

Part Number	Light Current mA min.	$H \text{ fc (mW/cm}^2\text{)}$ $V_{CE}=5 \text{ V}$	Dark Current nA max.	V_{CE} Volts	$V_{BR(CEO)}$ Volts min.	$V_{BR(ECO)}$ Volts min.	$V_{CE(SAT)}$ Volts max.	t_R/t_F $\mu\text{sec, typ.}$	Angular Response $\theta_{1/2}$
VTT1212H	2	20 (1)	100	10	30	5	0.25	4	$\pm 10^\circ$
VTT1214H	4	20 (1)	100	10	30	5	0.25	6	$\pm 10^\circ$
VTT1312H	1	20 (1)	100	10	30	5	0.25	4	$\pm 10^\circ$
VTT1314H	2.4	20 (1)	100	10	30	5	0.25	6	$\pm 10^\circ$
VTT9002H	2	100 (5)	100	10	30	6	0.55	4	$\pm 50^\circ$
VTT9003H	5	100 (5)	100	10	30	6	0.55	6	$\pm 50^\circ$
VTT9102H	6	100 (5)	100	5	30	4	0.55	6	$\pm 42^\circ$
VTT9103H	13	100 (5)	100	5	30	4	0.55	10	$\pm 42^\circ$

Electro-Optical Characteristics @ 25°C

TO-46 Flat Window Package

VTT1015 VTT1016 VTT1017

TO-46 Lensed Package

VTT1115 VTT1116 VTT1117

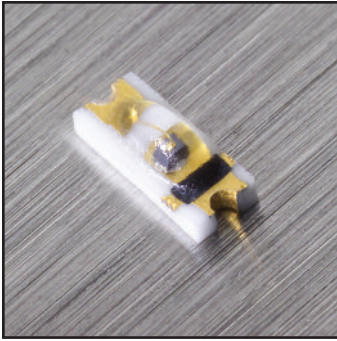
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t_R/t_F	Rise/Fall Time $I_C=1 \text{ mA}, R_L=100 \Omega$

.05" x .05" NPN Phototransistors**Technical Specification**

Part Number	Light Current mA min.	$H \text{ fc (mW/cm}^2\text{)}$ $V_{CE}=5 \text{ V}$	Dark Current nA max.	V_{CE} Volts	$V_{BR(CEO)}$ Volts min.	$V_{BR(ECO)}$ Volts min.	$V_{CE(SAT)}$ Volts max.	t_R/t_F $\mu\text{sec, typ.}$	Angular Response $\theta_{1/2}$
VTT1015H	0.4	100 (5)	25	20	40	6	0.4	5	$\pm 35^\circ$
VTT1016H	1	100 (5)	25	20	30	6	0.4	5	$\pm 35^\circ$
VTT1017H	2.5	100 (5)	25	10	20	4	0.4	8	$\pm 35^\circ$
VTT1115H	1	20 (1)	100	10	30	6	0.4	5	$\pm 15^\circ$
VTT1116H	2	20 (1)	100	10	30	4	0.4	8	$\pm 15^\circ$
VTT1117H	4	20 (1)	100	10	30	4	0.4	8	$\pm 15^\circ$

Electro-Optical Characteristics @ 25°C

**CR10TE**

- Surface mounting device
- Solid state ceramic chip
- High thermal conductivity
- Special type (CR10TE-DLF) with daylight filter on request

Technical Specification

Part Number	Package*	Spectral Range	Peak Sensitivity Wavelength (nm)	Vce (V)	P-Current	Dark Current (nA)	Active Area (mm ²)	Rise/Fall Time	Orientation
CR10TE	Ceramic SMD (A1)	400–1070	850	40	3	400	0.19	10/10	High Vce
CR50TE	Ceramic SMD (A2)	400–1070	850	40	3	400	0.19	10/10	High Vce

* All packages are listed on our website.