

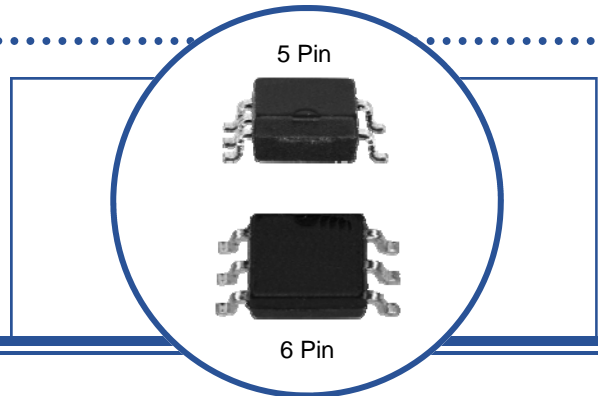
Optocoupler—SMD Package

OPIA500, OPIA600 through OPIA605



Features:

- 2,500 to 5,000 Vrms electrical isolation
- Choice of a Single and Dual LED
- Phototransistor or Photodarlington Sensor
- Low-cost plastic Dual-In-Line (DIP) package



Description:

The OPIA series optocouplers are designed for applications that use an analog output (Phototransistor or Photodarlington) in a dual-in-line package. A wide selection of configurations are available. With typical isolation voltage of 2,500 or 5,000 Volts RMS, these product meet typical power system isolation requirements.

Theory of operation: The LED transmitter is used to illuminate the Photosensor providing electrical isolation between two power systems while maintaining the ability to transmit information from one power system to the other. In many applications, analog signal levels may be required to be transmitted between two power systems while maintaining isolation between the power systems up to 5,000 volts RMS. A variety of LED and photosensor configurations are available depending on the system requirements.

The ratio Current Transfer Ratio (CTR) is identified between the output current and input current for analog photosensors. CTR ratios can range from as low as 5 to over 9,000 depending on the device.

$$CTR = \frac{\text{Photosenso } r - \text{Current}}{\text{LED} - \text{Current}} = \frac{20 \text{ mA}}{10 \text{ mA}} * 100 = 200$$

All DIP product is shipped in a shipping tube with “TU” identified on the end of the part number.
Example: OPI600DTU is a 4 Pin DIP shipped in a tube (TU).

Applications:

- High voltage isolation
- PCBoard power system isolation
- Industrial equipment power isolation
- Medical equipment power isolation
- Office equipment

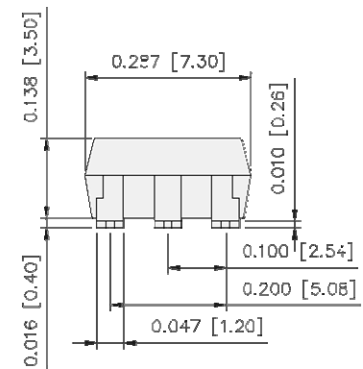
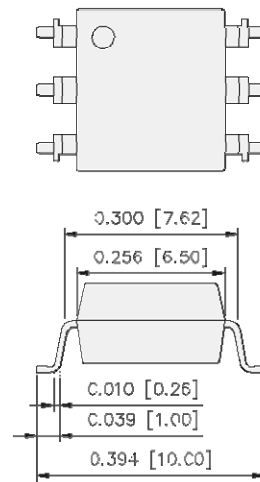
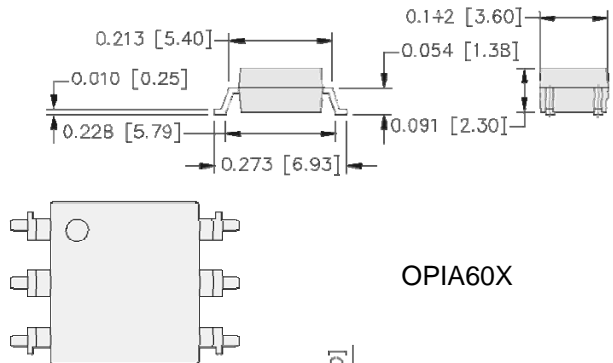
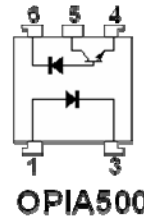
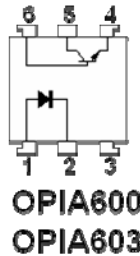
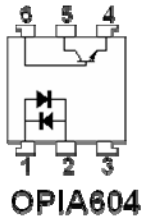
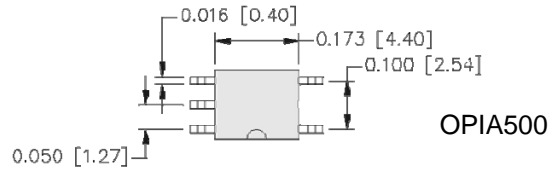
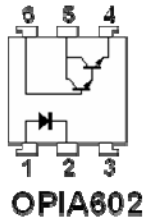
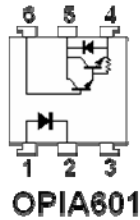
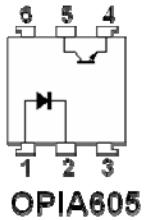


RoHS

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OPIA500, OPIA600 through OPIA605



Part Number	Pin #					
	1	2	3	4	5	6
OPIA500	A	K	E	C	K	
OPIA600	A	K		E	C	B
OPIA601	A	K		E	C	B
OPIA602	A	K		E	C	B
OPIA603	A	K		E	C	B
OPIA604	A-K	K-A		E	C	B
OPIA605	A	K		E	C	

Symbol	Definition	Symbol	Definition	Symbol	Definition	Symbol	Definition	Symbol	Definition
A	Anode	B	Base	C	Collector	E	Emitter	K	Cathode

Analog Output Devices Ordering Information

Part Number	Isolation Voltage Max. (Vrms)	CTR Min/Typ/Max	Typ. Tr / Tf (µs) R _L = 100 ohms	Package	Configuration
OPIA500B	3,750	19 / - / 50	LH-HL 0.8 / 0.8 (1.9K)	5 Pin DIP	AK-KCE
OPIA600A	5,000	60 / - / 600	5 / 4	6 Pin DIP	A K—B C E
OPIA601A	5,000	600 / - / 9,000	60 / 50	6 Pin DIP	A K—B C E (Dar)
OPIA602A	5,000	500 / 4,000 / -	5 / 60	6 Pin DIP	A K—B C E (Dar)
OPIA603A	5,000	50 / - / 600	2 / 3	6 Pin DIP	A K—B C E
OPIA604A	5,000	50 / - / 600	2 / 3	6 Pin DIP	A K, K A—B C E
OPIA605A	5,000	40 / - / 400	4 / 3	8 Pin DIP	A K—C E

Configuration: Definition of Terms
LED Identification—Sensor Identification

LED	A = Anode	K = Cathode		
Sensor	B = Base	C = Collector	E = Emitter	(Dar) = Photodarlington

Packaging	Part Number Suffix: TU = Ship in Tubes TR = Tape and Reel	Example: OPIA600DTR
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OPIA500, OPIA600 through OPIA605



Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Storage Temperature	-55° C to +125° C
Operating Temperature OPIA600, OPIA601, OPIA602 OPIA500 OPIA603, OPIA604, OPIA605	-30° C to +100° C -55° C to +85° C -55° C to +125° C
Isolation voltage (1 minute) OPIA6 __ Series OPIA500	5,000 Vrms 3,750 Vrms
Total Package Power Dissipation OPIA6 __ Series OPIA500	200 mW 100 mW
Lead Soldering Temperature (1/16" (1.6 mm) from case for 5 seconds with soldering iron)	260° C

Input Diode

Continuous Forward Current OPIA6 __ Series OPIA500	50 mA 25 mA
Peak Forward current (1 μs pulse width, 300 pps) OPIA6 __ Series OPIA500	1 A 200 mA
Reverse Voltage OPIA6 __ Series OPIA500	6 V 5 V
Power Dissipation OPIA6 __ Series OPIA500	70 mW 45 mW

Output Phototransistor

Collector-Emitter Voltage OPIA600, OPIA604, OPIA605 OPIA603 OPIA601 OPIA602	60 V 350 V 300 V 30 V
Emitter-Collector Voltage OPIA600, OPIA605 OPIA603, OPIA604 OPIA601, OPIA602	6 V 7 V -
Collector Current OPIA600, OPIA603, OPIA604, OPIA605 OPIA601, OPIA602	50 mA 150 mA
Power Dissipation OPIA500 OPIA600, OPIA605 OPIA601, OPIA602, OPIA603, OPIA604	100 mW 150 mW 200 mW

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Electrical Characteristics: (OPIA500D)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	V_F	$I_F=16\text{mA}$	• •	1.7	1.95	V
	Reverse current	I_R	$V_R=5\text{V}$	• •	• •	10	μA
	Terminal capacitance	C_t	$V=0, f=1\text{MHz}$	• •	60	250	pF
Output	High level output current (1)	$I_{OH(1)}$	$I_F=0, V_{CC}=5.5\text{V}, V_O=5.5\text{V}$	-	3	500	nA
	High level output current (2)	$I_{OH(2)}$	$I_F=0, V_{CC}=15\text{V}, V_O=15\text{V}$	-	-	1.0	μA
	High level output current (3) (*6)	$I_{OH(3)}$		-	-	50	μA
	High level supply current (1)	$I_{CCH(1)}$	$I_F=0, V_{CC}=15\text{V}, V_O=\text{Open}$	-	0.02	1.0	μA
	High level supply current (2) (*6)	$I_{CCH(2)}$		-	-	2.0	μA
	Low level supply current	I_{CCL}	$I_F=16\text{mA}, V_{CC}=15\text{V}, V_O=\text{Open}$	-	120	-	μA
	Low level supply voltage	V_L	$I_F=16\text{mA}, V_{CC}=4.5\text{V}, I_O=2.4\text{mA}$	• •	-	0.4	V
Transfer characteristics	Current transfer ratio (1)	CTR(1)	$I_F=16\text{mA}, V_{CC}=4.5\text{V}, V_O=0.4\text{V},$ $R_L=1.9\text{K ohm}$	19	• •	50	%
	Current transfer ratio (2) (*6)	CTR(2)	$R_L=1.9\text{K ohm}$	15	• •	-	%
	Isolation resistance	R_{ISO}	$\text{DC}=500\text{V}, 40 \text{ to } 60\%RH$	5×10^{10}	1×10^{11}	-	ohm
	Floating capacitance	C_f	$V=0, f=1\text{MHz}$	• •	0.6	1.0	pF
	"High-->Low" propagation delay time	t_{PHL}	$I_F=16\text{mA}, V_{CC}=5\text{V},$ $R_L=1.9\text{K ohm}$	• •	0.2	0.8	μs
	"High-->Low" propagation delay time	t_{PLH}		-	0.4	0.8	μs
	Instantaneous common mode rejection voltage (High level output)	CMH	$I_F=0, V_{CC}=5\text{V},$ $V_{CM}=1.0\text{KV(p-p)},$ $R_L=1.9\text{K ohm}$	15	30	-	KV/ μs
	Instantaneous common mode rejection voltage (High level output)	CML	$I_F=16\text{mA}, V_{CC}=5\text{V},$ $V_{CM}=1.0\text{KV(p-p)},$ $R_L=1.9\text{K ohm}$	-15	-30	-	KV/ μs

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Optocoupler—SMD Package

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Electrical Characteristics (OPIA600 Series)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
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Input Diode

V_F	Forward Voltage OPIA600, OPIA601, OPIA602, OPIA604, OPIA605 OPIA603	- 1.0	1.2 1.2	1.4 1.3	V	$I_F = 20 \text{ mA}$ $I_F = 10 \text{ mA}$
V_{FM}	Peek Forward Voltage OPIA600, OPIA601, OPIA602, OPIA604 OPIA603, OPIA605	- -	- -	3.5 3.0	V	$I_{FM} = 500 \text{ mA}$
I_R	Reverse Current OPIA600, OPIA601, OPIA602, OPIA604, OPIA605 OPIA603	- -	- -	10 10	μA	$V_R = 4 \text{ V}$ $V_R = 5 \text{ V}$
C_t	Terminal Capacitance OPIA600, OPIA601, OPIA602, OPIA604, OPIA605 OPIA603	- -	30 30	- -	pf	$V = 0.0 \text{ V}, f = 1 \text{ K Hz}$ $V = 0.0 \text{ V}, f = 1 \text{ M Hz}$

Output Phototransistor—OPIA600D, OPIA603D, OPIA604D, OPIA605D

I_{CEO}	Collector dark Current OPIA600, OPIA604, OPIA605 OPIA603	- -	- 10	100 200	nA	$I_F = 0 \text{ mA}, V_{CE} = 20 \text{ V}$ $I_F = 0 \text{ mA}, V_{CE} = 300 \text{ V}$
V_{CEO}	Collector-emitter Saturation Voltage OPIA600, OPIA604, OPIA605 OPIA603	- -	0.1 -	0.3 0.4	V	$I_F = 20 \text{ mA}, I_C = 1 \text{ mA}$ $I_F = 8 \text{ mA}, I_C = 2.4 \text{ mA}$
f_c	Cutt-Off frequency	-	80	-	K Hz	$V_{CC} = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$
t_R	Rise Time OPIA600, OPIA604 OPIA603 OPIA605	- - -	5 2 4	20 - 20	μs	$V_{CC} = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$ $V_{CC} = 10 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$ $V_{CC} = 2 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$
t_F	Fall Time OPIA600, OPIA604 OPIA603 OPIA605	- - -	4 3 3	20 - 20	μs	$V_{CC} = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$ $V_{CC} = 10 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$ $V_{CC} = 2 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$

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Optocoupler—SMD Package

OPIA500, OPIA600 through OPIA605



Electrical Characteristics (OPIA600 Series) - Continued from Previous Page

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
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Output PhotoDarlington—OPIA601D, OPIA6022D

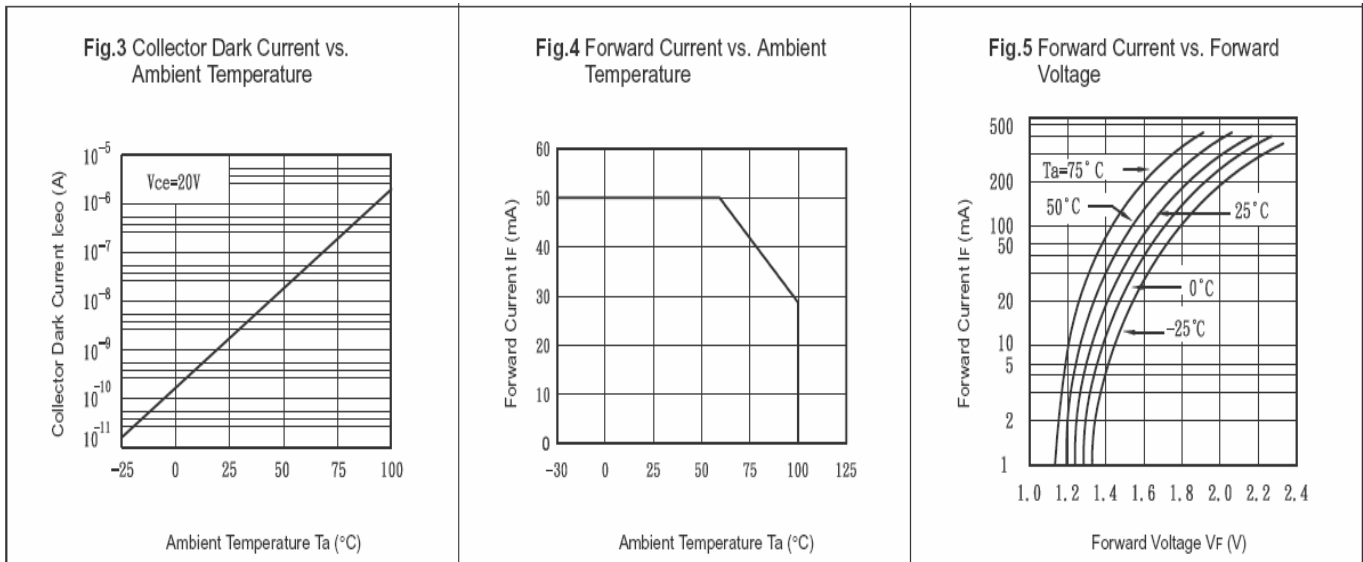
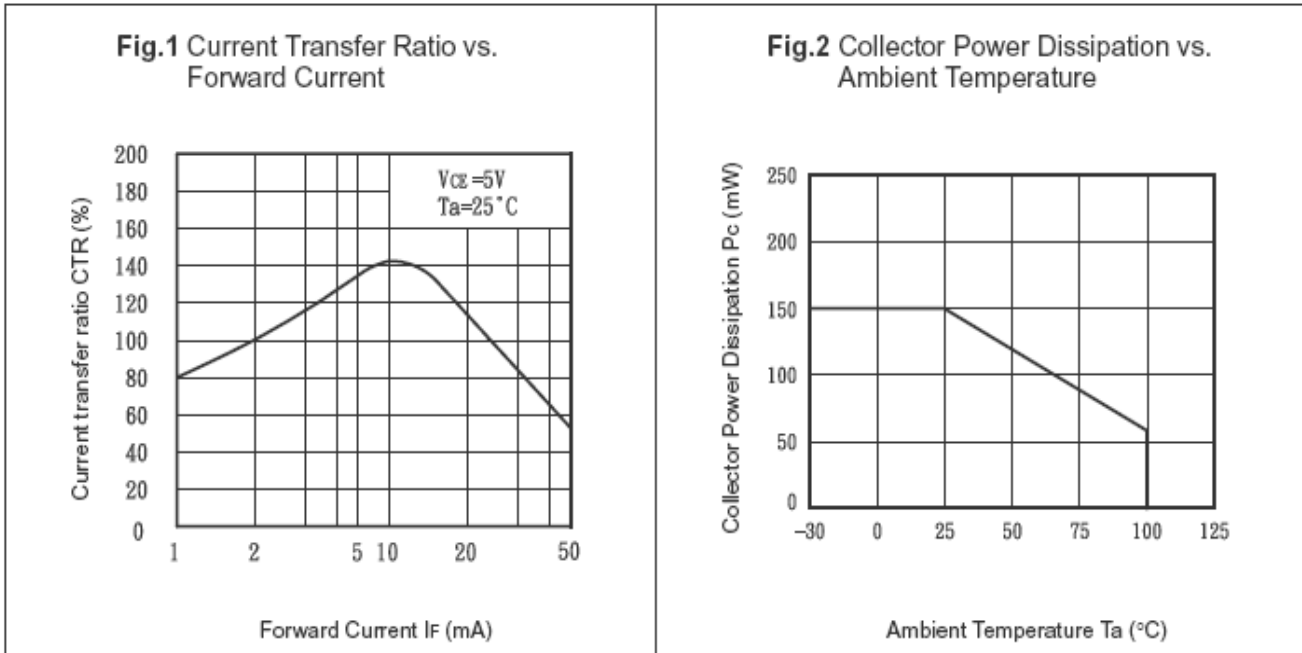
I_{CEO}	Collector dark Current OPIA601 OPIA602	- -	- -	1.0 0.1	μA	$I_F = 0 \text{ mA}, V_{CE} = 200 \text{ V}$ $I_F = 0 \text{ mA}, V_{CE} = 10 \text{ V}$
V_{CEO}	Collector-emitter Saturation Voltage OPIA601 OPIA602	- -	- -	1.5 1.0	V	$I_F = 20 \text{ mA}, I_C = 5 \text{ mA}$ $I_F = 8 \text{ mA}, I_C = 2 \text{ mA}$
f_c	Cutt-Off frequency OPIA601, OPIA602	-	7.0	-	K Hz	$V_{CC} = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$
t_r	Rise Time OPIA601 OPIA602	- -	60 5	300 40	μs	$V_{CC} = 2 \text{ V}, I_C = 20 \text{ mA}, R_L = 100 \Omega$ $V_{CC} = 10 \text{ V}, I_C = 50 \text{ mA}, R_L = 100 \Omega$
t_f	Fall Time OPIA601 OPIA602	- -	50 60	250 100	μs	$V_{CC} = 2 \text{ V}, I_C = 20 \text{ mA}, R_L = 100 \Omega$ $V_{CC} = 10 \text{ V}, I_C = 50 \text{ mA}, R_L = 100 \Omega$

Coupled Characteristics Phototransistor/Photodarlington

CTR	Current Transfer Ratio OPIA600 OPIA601 OPIA602 OPIA603 OPIA604 OPIA605	60 600 500 50 60 40	- - 4,000 - - -	600 9,000 - 600 600 400	%	$I_F = 2 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_F = 2 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_F = 10 \text{ mA}, V_{CE} = 10.0 \text{ V}$ $I_F = 5 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_F = 1 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_F = 10 \text{ mA}, V_{CE} = 5.0 \text{ V}$
C_f	Floating Capacitance	-	0.6	1.0	pF	$V = 0.0 \text{ V}, f = 1 \text{ M Hz}$
R_{ISO}	Isolation resistance	5×10^{10}	10^{11}	-	ohm	DC500V

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OPIA600



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OPIA600

Fig.6 Collector Current vs. Collector-emitter Voltage

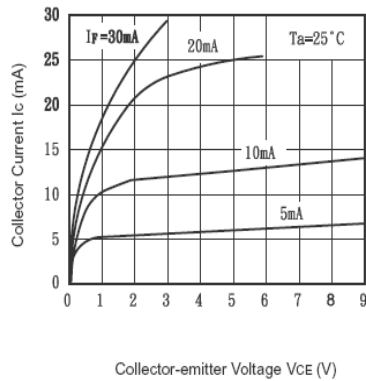


Fig.7 Relative Current Transfer Ratio vs. Ambient Temperature

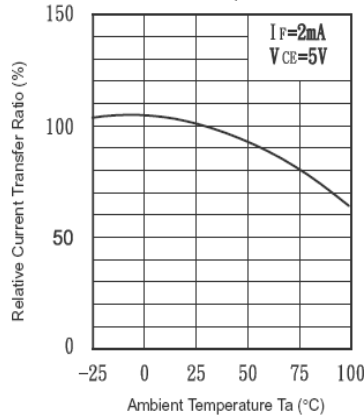


Fig.8 Collector-emitter Saturation Voltage vs. Ambient Temperature

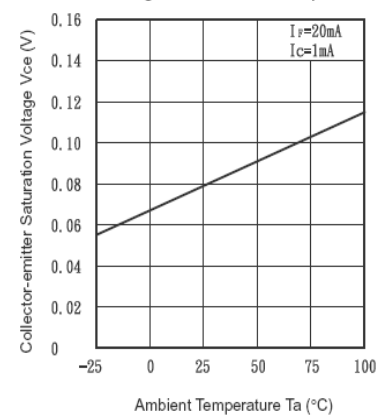


Fig.9 Collector-emitter Saturation Voltage vs. Forward Current

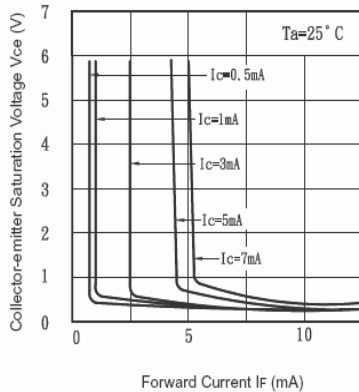


Fig.10 Response Time vs. Load Resistance

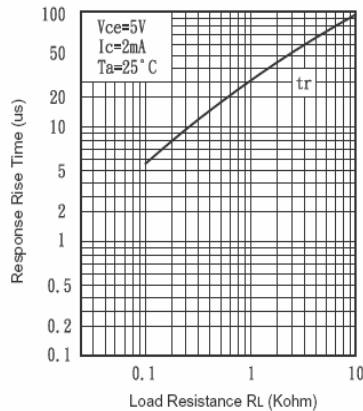
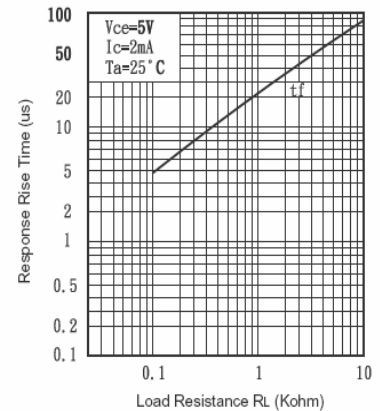


Fig.11 Response Time vs. Load Resistance



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OPIA601

Fig. 4 Forward Current vs. Ambient Temperature

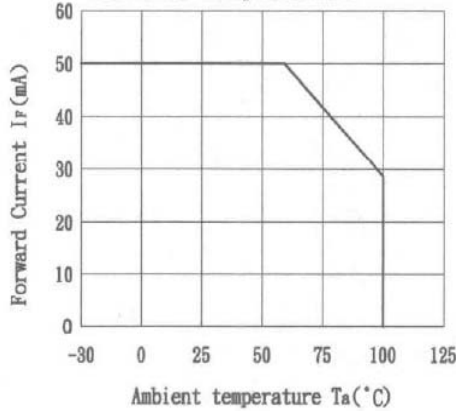


Fig. 5 Forward Current vs. Forward Voltage

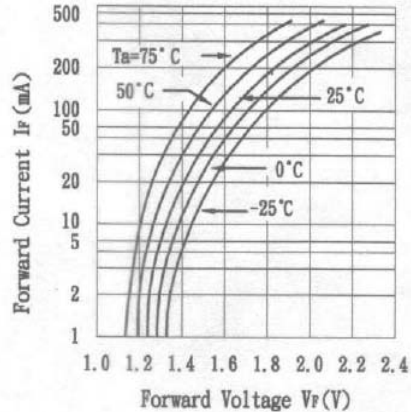


Fig. 2 Collector Power Dissipation vs. Ambient Temperature

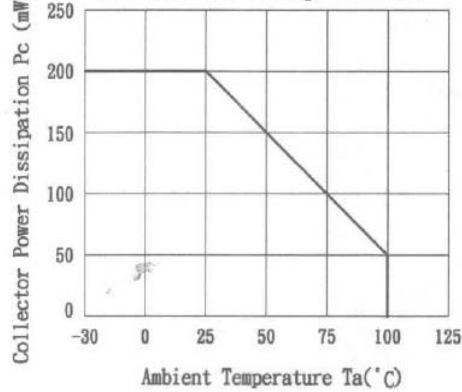


Fig. 3 Collector Dark Current vs. Ambient Temperature

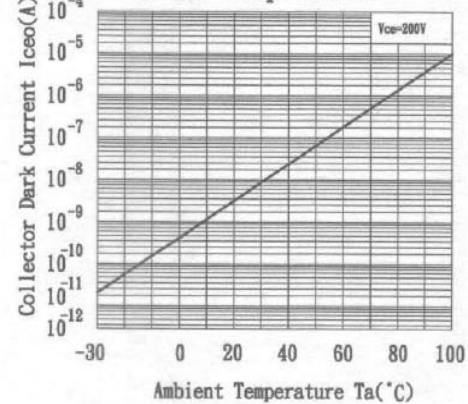


Fig. 6 Collector Current vs. Collector-emitter Voltage

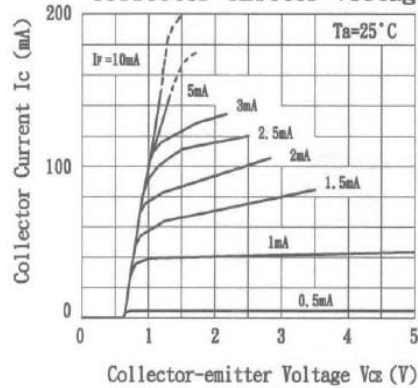
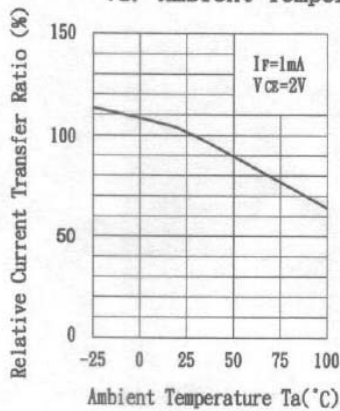


Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature



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OPIA601

Fig. 1 Current Transfer Ratio vs. Forward Current

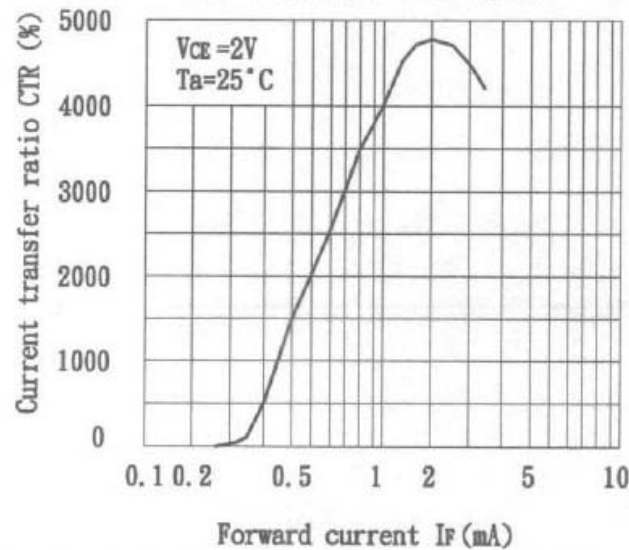


Fig. 8 Collector-emitter Saturation Voltage vs. Forward Current

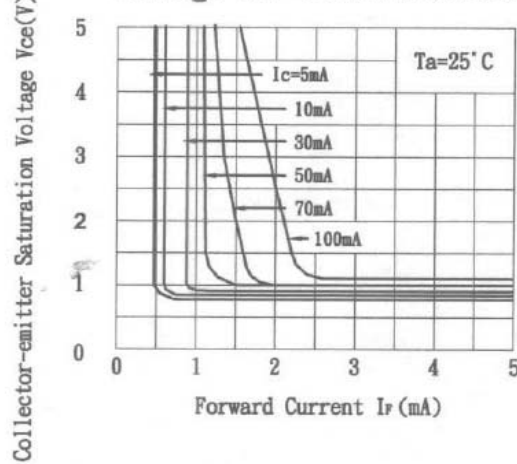
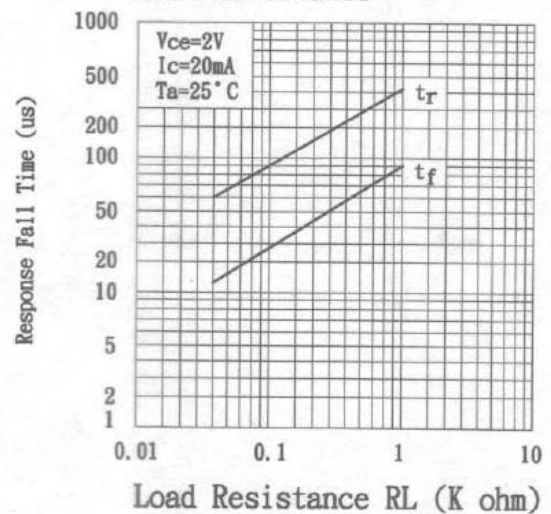


Fig. 9 Response Time vs. Load Resistance



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OPIA602

Fig. 1 Forward Current vs. Ambient Temperature

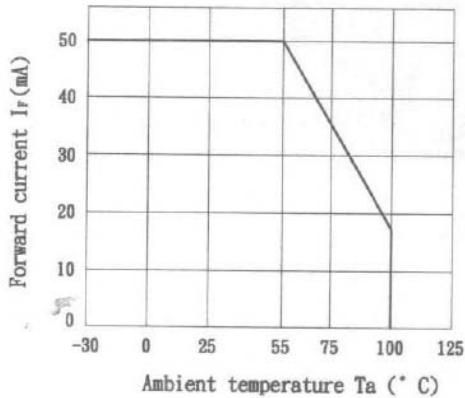


Fig. 2 Collector Power Dissipation vs. Ambient Temperature

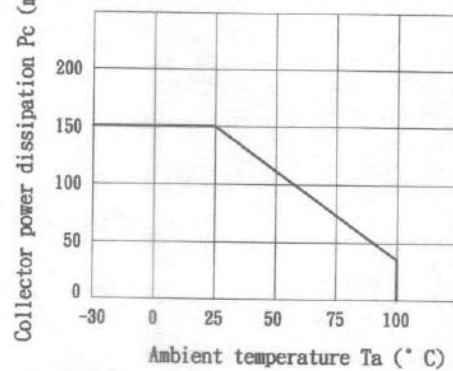


Fig. 3 Peak Forward Current vs. Duty Ratio

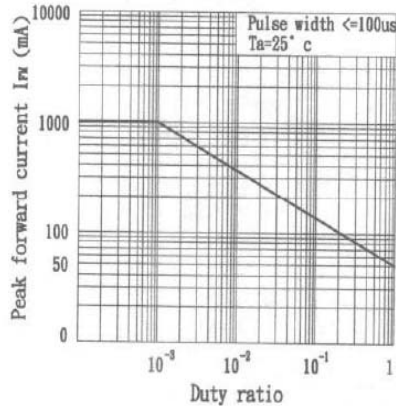


Fig. 4 Forward Current vs. Forward Voltage

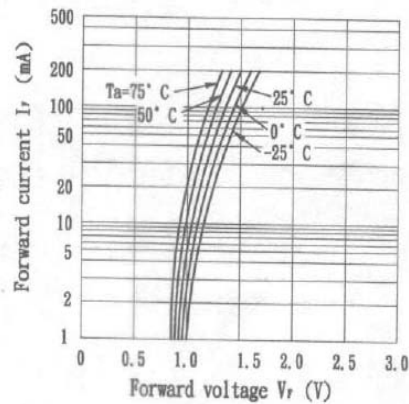


Fig. 5 Current Transfer Ratio vs. Forward Current

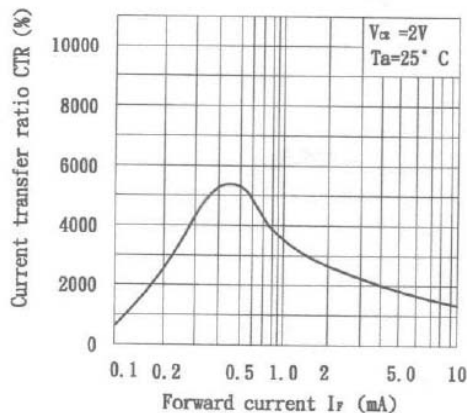
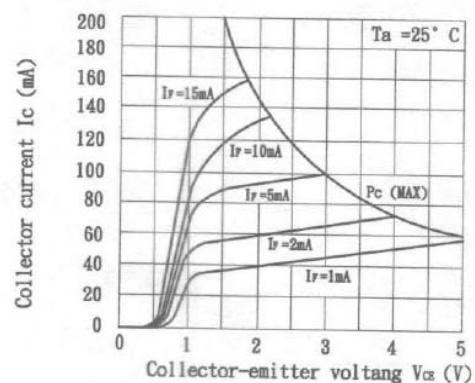


Fig. 6 Collector Current vs. Collector-emitter Voltage



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OPIA602

Fig. 11 Collector-emitter Saturation Voltage vs. Forward current

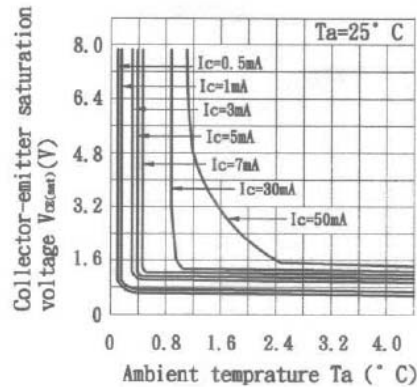


Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature

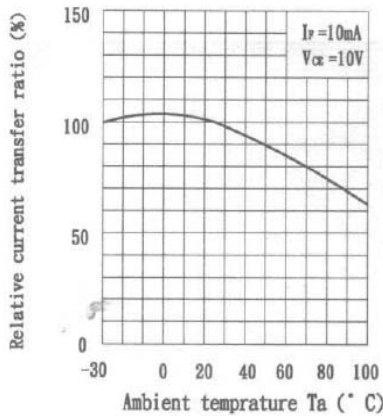


Fig. 8 Collector-emitter Saturation Voltage vs. Ambient Temperature

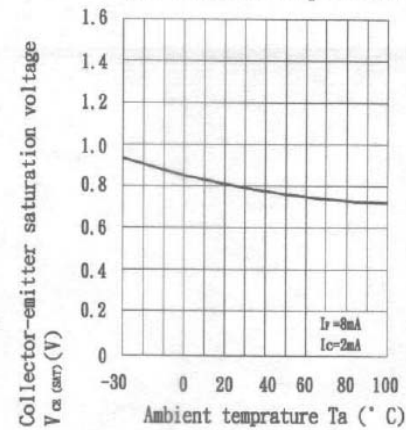


Fig. 9 Collector Dark Current vs. Ambient Temperature

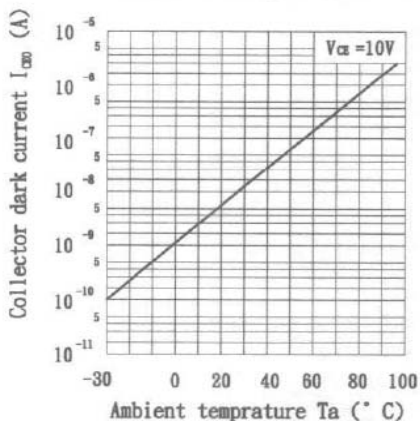
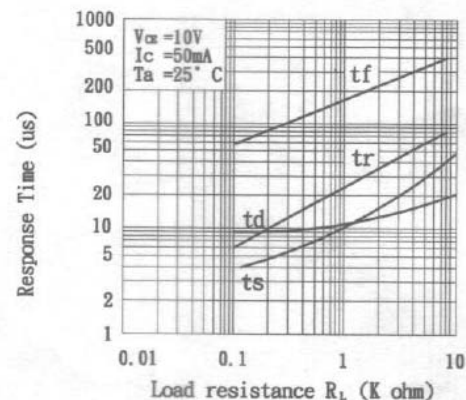


Fig. 10 Response Time vs. Load Resistance



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OPIA603

Fig. 1 Current Transfer Ratio Vs. Forward Current

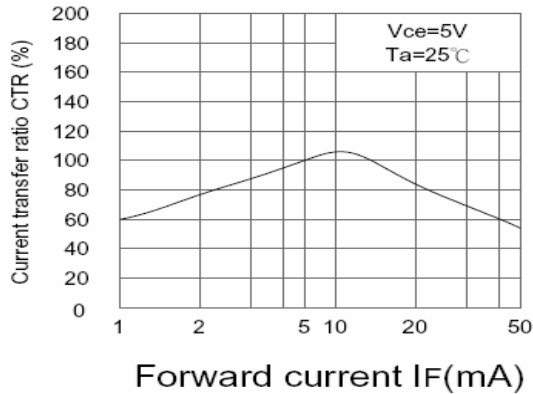


Fig.2 Collector Power Dissipation vs. Ambient Temperature

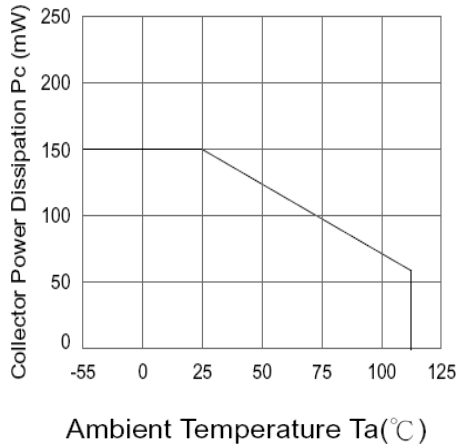


Fig.3 Collector Dark Current vs. Ambient Temperature

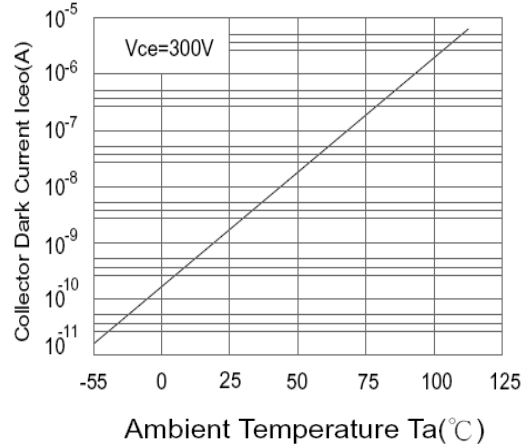


Fig.4 Forward Current vs. Ambient Temperature

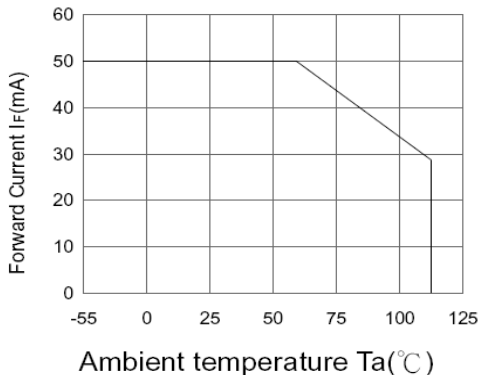
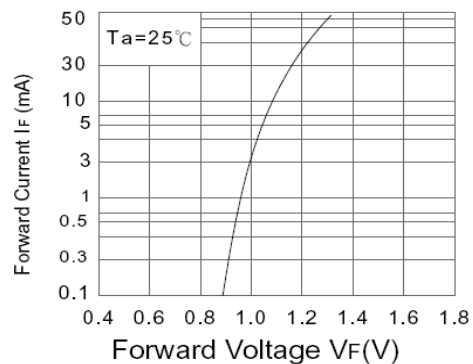


Fig.5 Forward Current vs. Forward Voltage



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OPIA603

Fig.6 Collector Current vs. Collector-emitter Voltage

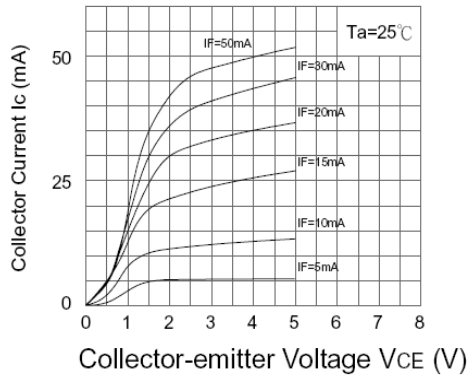


Fig.7 Relative Current Transfer Ratio vs. Ambient Temperature

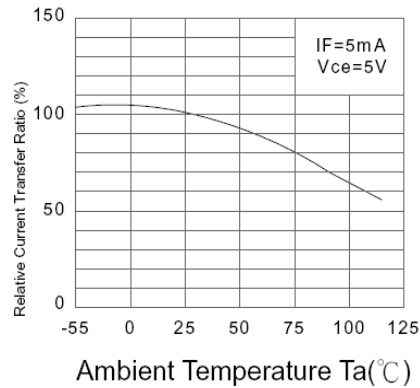


Fig.8 Collector-emitter Saturation Voltage vs. Ambient Temperature

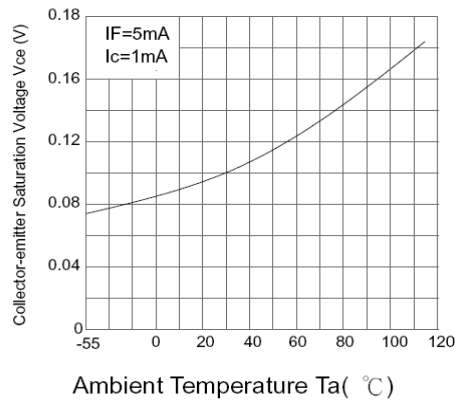


Fig.9 Collector-emitter Saturation Voltage vs. Forward Current

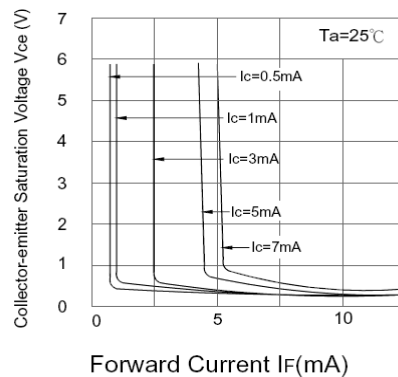


Fig.10 Response Time vs. Load Resistance

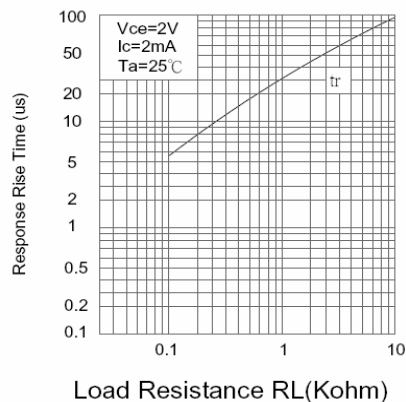
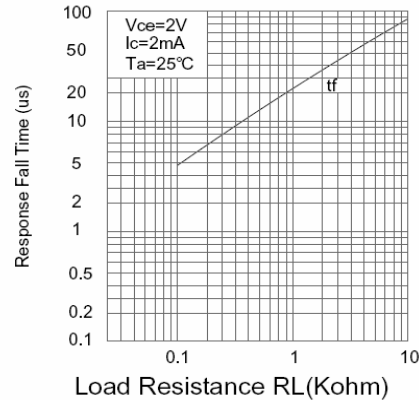
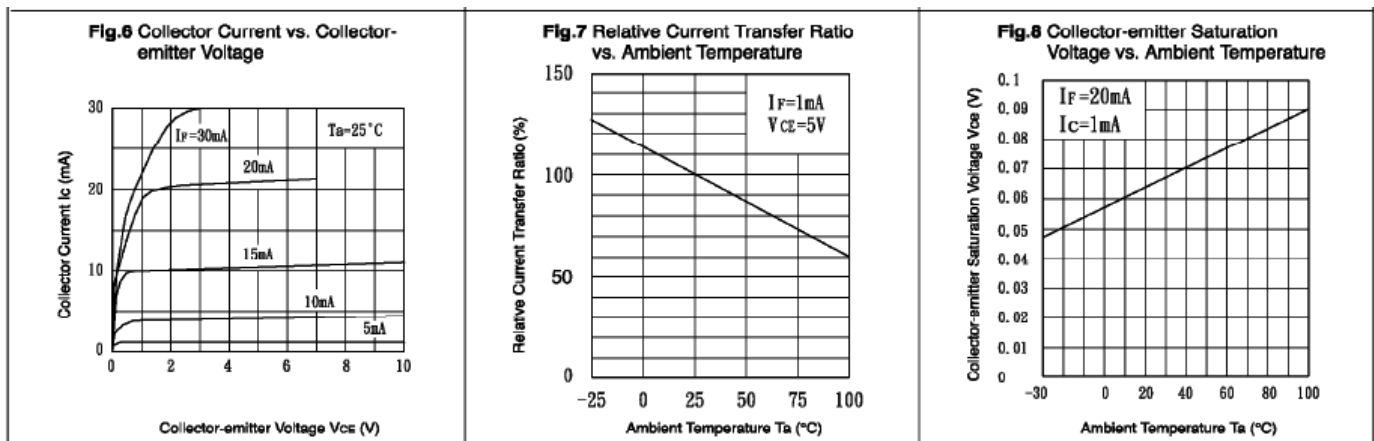
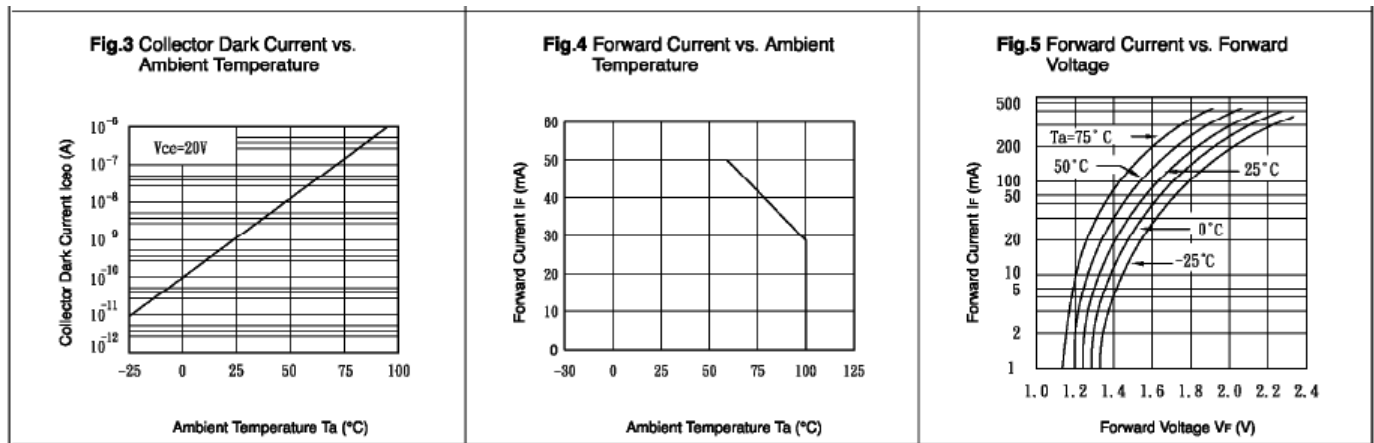
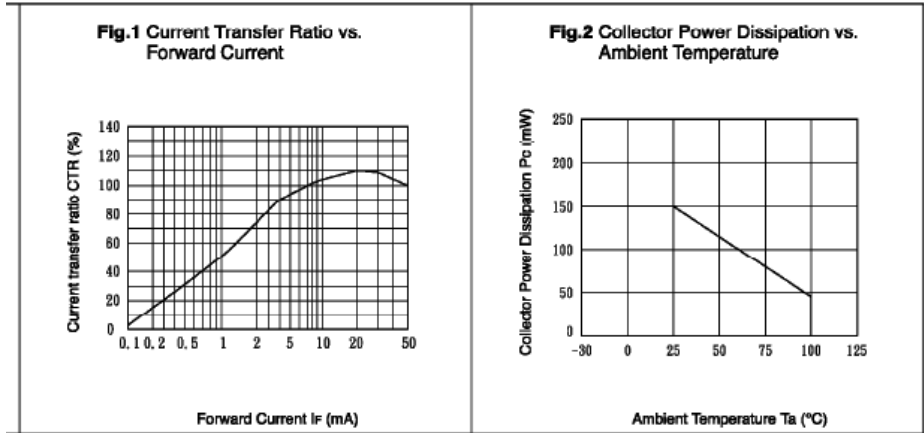


Fig.11 Response Time vs. Load Resistance



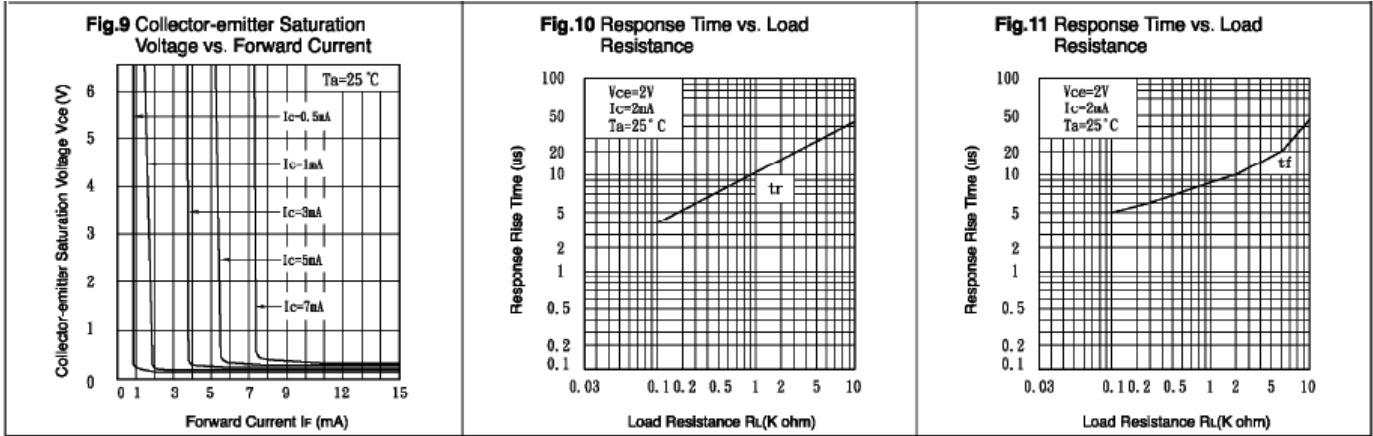
OPTEK reserves the right to make changes at any time in order to improve design and to supply the best product possible.

OPIA604



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OPIA604



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OPIA605

Fig.1 Current Transfer Ratio vs. Forward Current

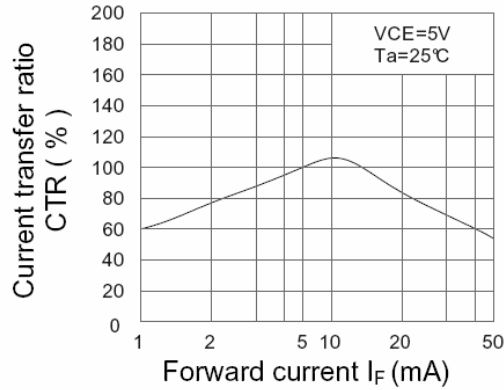


Fig.2 Collector Power Dissipation vs. Ambient Temperature

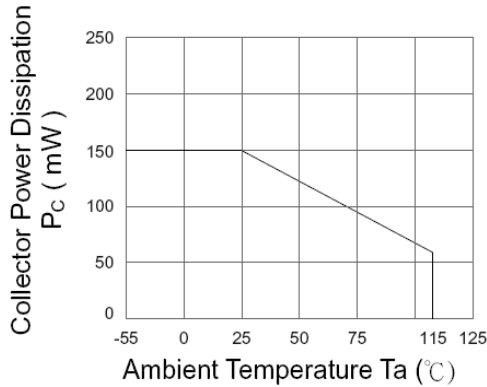


Fig.3 Collector Dark Current vs. Ambient Temperature

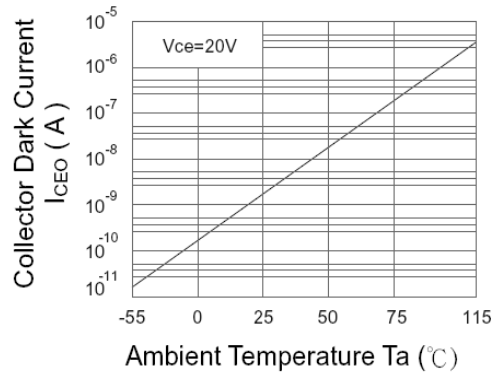


Fig.4 Forward Current vs. Ambient Temperature

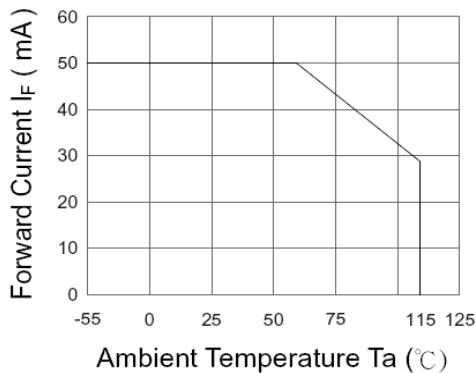
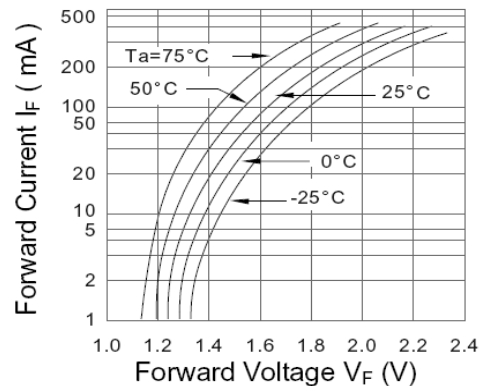


Fig.5 Forward Current vs. Forward Voltage



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OPIA605

Fig.6 Collector Current vs. Collector-Emitter Voltage

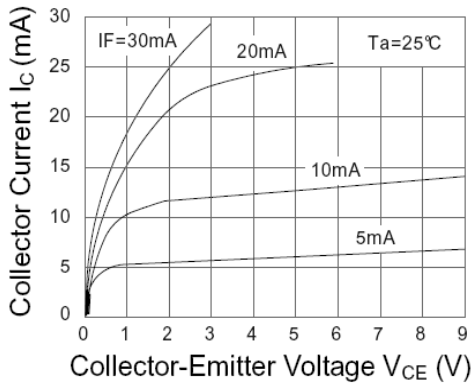


Fig.7 Relative Current Transfer Ratio vs. Ambient Temperature

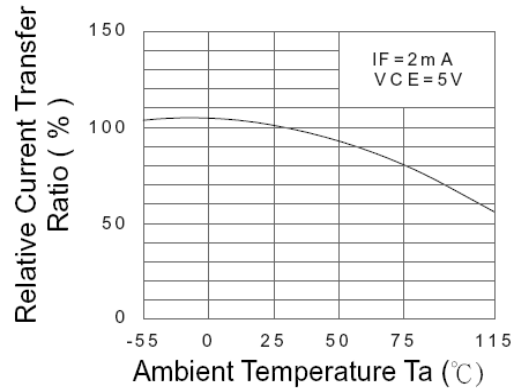


Fig.8 Collector-Emitter Saturation Voltage vs. Ambient Temperature

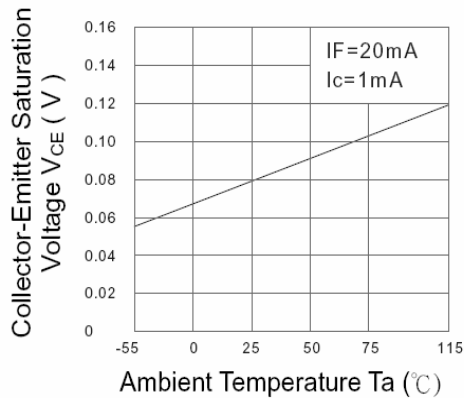


Fig.9 Collector-Emitter Saturation Voltage vs. Forward Current

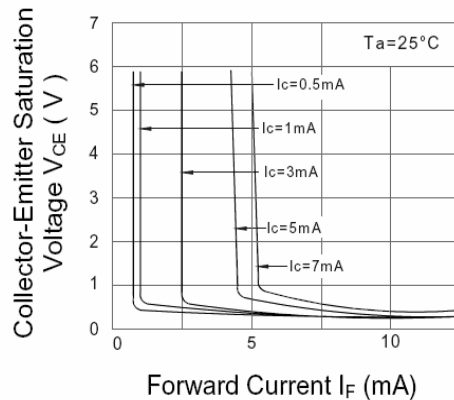


Fig.10 Response Time vs. Load Resistance

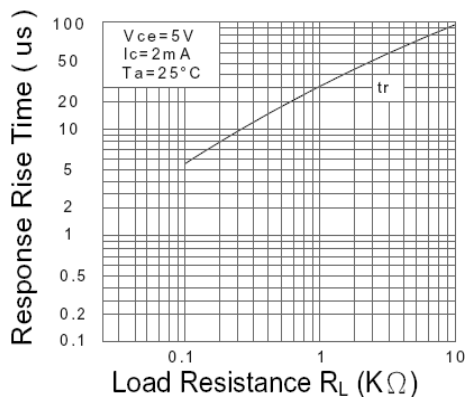
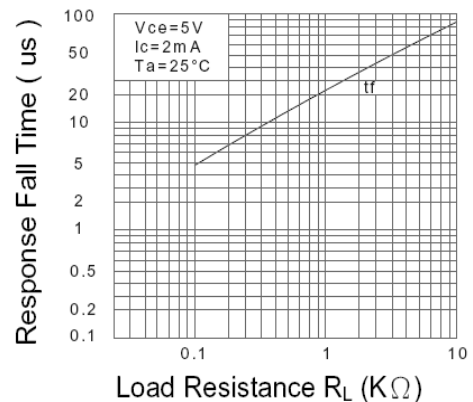


Fig.11 Response Time vs. Load Resistance



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Optocoupler—SMD Package

OPIA500, OPIA600 through OPIA605



Quality / Reliability Requirements

Parameter	Failure Criteria	Conditions
HTRB D I _{C(OFF)}	± 10%	11 samples after 500Hrs
	0 Fail	@ VCE = 5.0VDC, Ta = 70°C
HTFB D I _{C(ON)}	± 10%	50 samples after 96Hrs
	0 Fail	@ Max P _D , Ta = 25°C
MTTF @ 90% confidence	150,000 Min.	@ 25°C, 25mADC
Moisture Sensitivity Level	MSL2 or >	per JDEC std J-STD-020B
Lead Solderability	0 Fail	per Method 208 of MIL-STD-202.
Glass Transition of body	125°C Min.	DSC test method
Temperature Humidity-Bias	± 20%	85°C, 85%RH, 500Hrs, 80% min I _{ceo}
Temperature Cycle	± 20%	per Method 1010.7 of MIL-STD-883E
High Temperature Storage	± 20%	85°C, 500Hrs
Autoclave	0 Fail	T _A = 121°C, Pressure = 15psi, Humidity = 100%, Time = 96Hrs

Note: This is to be performed when a change occurs to form, fit or function.

Government and Industry Standard Compliance Requirements

European Union's Reduction of Hazardous Substances (RoHS) Directive 2002/95/EC





Label Identification

DESCRIPTION:

Size: 3" (7.5 cm) X 2.2" (5.5 cm)
 Lettering shall be black on white background.
 Format shall be as:

Notes:

- The DATE CODE is a 4-digit code for date of manufacture where YY is the last two digits of the year, and WW is week number of manufacture.
- The LOT I.D. is the manufacturing location lot identification where Y is the year of manufacture, NNNN is a sequential lot identifier, and DDD is the day of the year of manufacture. – or use equivalent label format.

OPTEK TECHNOLOGY, INC. Carrollton, TX, USA MADE IN TAIWAN
OPTEK P/N <u> OPIA410D/A </u>

QTY. <u> </u> N/A <u> </u>

DATE CODE <u> </u> (YYWW) <u> </u>

LOT I.D. <u> </u> (Y-NNNNDDD) <u> </u>


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Optocoupler—SMD Package

OPIA500, OPIA600 through OPIA605

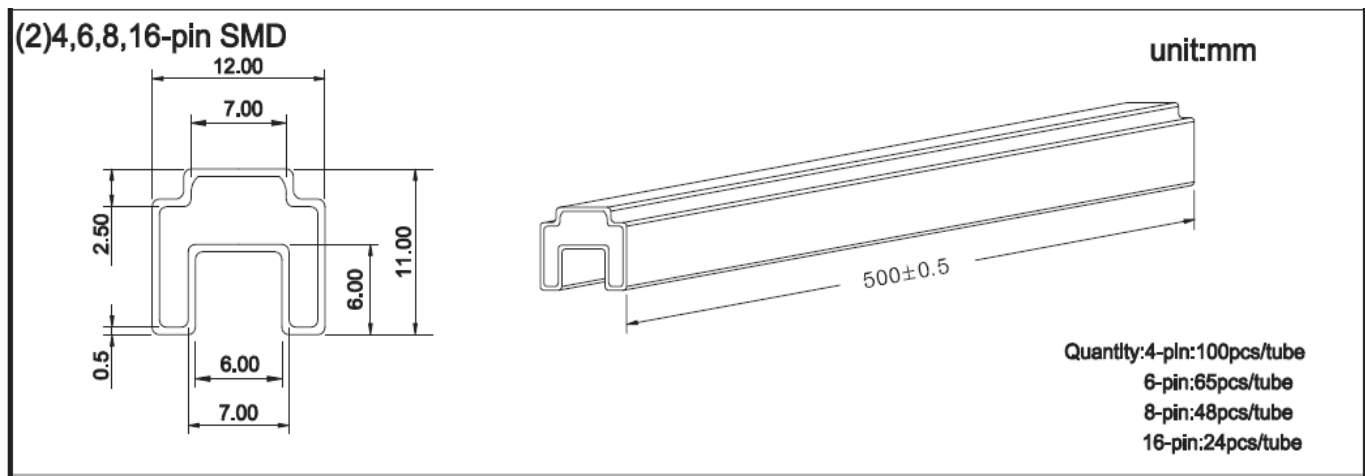


Packaging Information:

Optek's Optocoupler Part Numbers		Tube		Inner		Small Carton			Medium Carton			Large Carton		
				52 x 7 x 7.5 cm		53.5 x 16 x 17.5 cm			53.5 x 30.7 x 17.5 cm			53.5 x 30.7 x 25 cm		
		Qty	Weight	Qty	Weight	Qty	Weight	Gross Weight	Qty	Weight	Gross Weight	Qty	Weight	Gross Weight
PIH and SMD	4-PIN OPIA400D/A, OPIA410D/A - OPIA413D/A	100	44	3,000	1.40	12,000	6.0	6.5	24,000	12.0	12.5	36,000	18.0	18.5
	6-PIN OPIA600D/A Series	65	44	1,950	1.50	7,800	6.5	7.0	15,600	12.0	12.5	23,400	18.5	19.0
	8-PIN OPIA800D Series and OPID804D	48	44	1,440	1.44	5,760	6.0	6.5	11,520	12.0	12.5	17,280	18.0	18.5
MF	OPIA500B, OPIA401B - OPIA404B, OPIA414B	100	24	6,000	1.60	24,000	6.5	7.0	48,000	13.0	13.5	72,000	19.5	20.0
SSOP	OPIA405C - OPIA409C	170	--	10,200	--									

PIH = Pin-Hole Packages (Referred as D = Dual-In-Line Package)
 SMD = Standard Surface Mount Packages (Referred as A = 6.5mil SMD)
 MF or SOP = Mini-Flat Packages or Small Outside Packages (Referred as B=4.40mil SMD w/ 2.54 Lead-Spacing)
 SSOP = Slim SOP Packages (Referred as C = 4.40mil SMD with 1.27 Lead-Spacing)

Tube Packaging Specifications (TU):



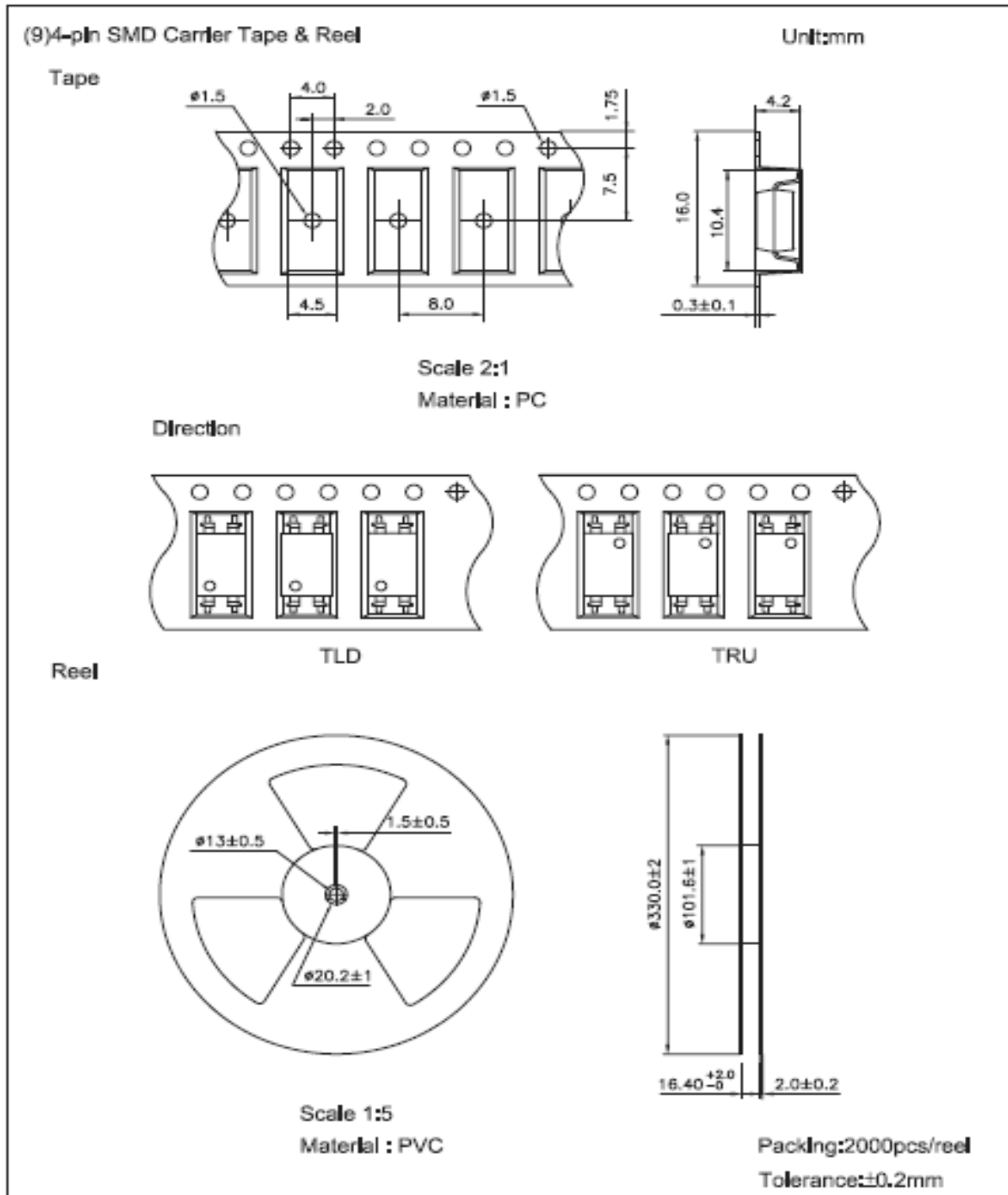
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Optocoupler—SMD Package

OPIA500, OPIA600 through OPIA605



Tape and Reel Packaging Specifications (TR):



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