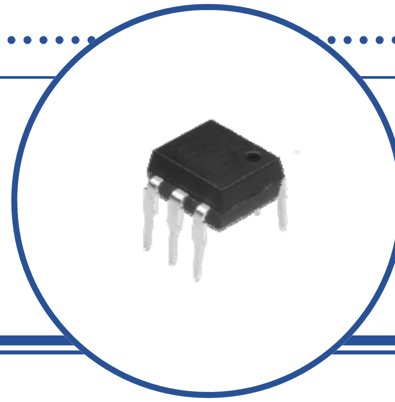
Optocoupler—DIP Package
OPIA500, OPIA600 through OPIA605

TT electronics
OPTEK Technology

Features:
- 3,750 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 3,750 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.

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

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).
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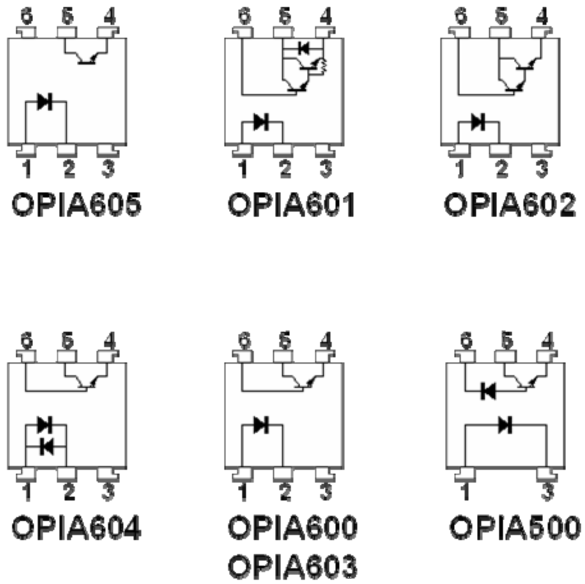
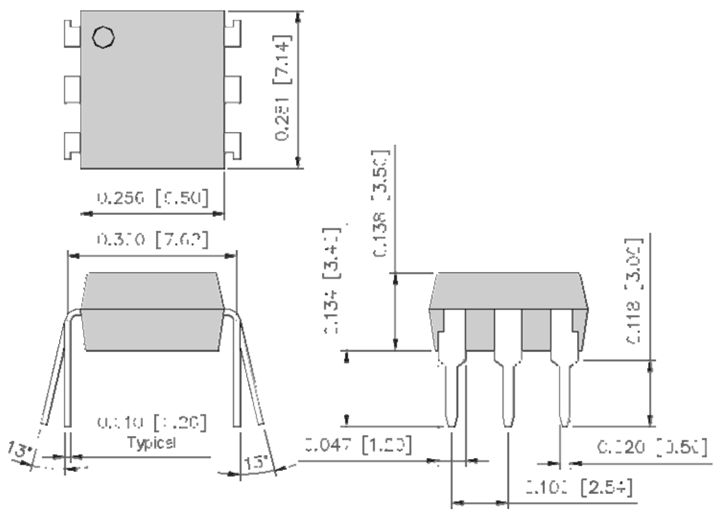
Applications:
- High voltage isolation
- PCBoard power system isolation
- Industrial equipment power isolation
- Medical equipment power isolation
- Office equipment

RoHS

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





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
A	Anode	B	Base	C	Collector	E	Emitter

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
OPIA500D	3,750	19 / - / 50	LH-HL 0.8 / 0.8 (1.9K)	5 Pin DIP	A K—K C E
OPIA600D	5,000	60 / - / 600	5 / 4	6 Pin DIP	A K—B C E
OPIA601D	5,000	600 / - / 9,000	60 / 50	6 Pin DIP	A K—B C E (Dar)
OPIA602D	5,000	500 / 4,000 / -	5 / 60	6 Pin DIP	A K—B C E (Dar)
OPIA603D	5,000	50 / - / 600	2 / 3	6 Pin DIP	A K—B C E
OPIA604D	5,000	50 / - / 600	2 / 3	6 Pin DIP	A K, K A—B C E
OPIA605D	5,000	40 / - / 400	4 / 3	8 Pin DIP	A K—C E

Configuration: Definition of Terms LED Identification—Sensor Identification					
Configuration Information	LED	A = Anode	K = Cathode		
	Sensor	10K Logic	10K Inverted Logic	NAND Gate	
Packaging	Part Number Suffix: **TU** = Ship in Tubes				Example: OPIA600DTU

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Absolute Maximum Ratings (T_A = 25° 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

Electrical Characteristics: (OPIA500D)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	V_F	I_F=16mA	• •	1.7	1.95	V
	Reverse current	I_R	VR=5V	• •	• •	10	uA
	Terminal capacitance	Ct	V=0, f=1MHz	• •	60	250	pF
Output	High level output current (1)	$I_{OH\ (1)}$	I_F=0,V_{CC}=5.5V,V_O=5.5V	-	3	500	nA
	High level output current (2)	$I_{OH\ (2)}$	I_F=0,V_{CC}=15V,V_O=15V	-	-	1.0	uA
	High level output current (3) (*6)	$I_{OH\ (3)}$		-	-	50	uA
	High level supply current (1)	$I_{CCH\ (1)}$	I_F=0,V_{CC}=15V,V_O=Open	-	0.02	1.0	uA
	High level supply current (2) (*6)	$I_{CCH\ (2)}$		-	-	2.0	uA
	Low level supply current	I_{CCL}	I_F=16mA,V_{CC}=15V,V_O=Open	-	120	-	uA
	Low level supply voltage	V_L	I_F=16mA,V_{CC}=4.5V,I_O=2.4mA	• •	-	0.4	V
Transfer charac-teristics	Current transfer ratio (1)	CTR(1)	I_F=16mA,V_{CC}=4.5V,V_O=0.4V, RL=1.9K ohm	19	• •	50	%
	Current transfer ratio (2) (*6)	CTR(2)		15	• •	-	%
	Isolation resistance	R_{ISO}	DC=500V,40 to 60%RH	$5x10^{10}$	$1x10^{11}$	-	ohm
	Floating capacitance	Cf	V=0,f=1MHZ	• •	0.6	1.0	pF
	"High-->Low" propagation delay time	t_{PHL}	I_F=16mA,V_{CC}=5V, RL=1.9K ohm	• •	0.2	0.8	us
	"High-->Low" propagation delay time	t_{PLH}		-	0.4	0.8	us
	Instantaneous common mode rejection voltage (High level output)	CM_H	I_F=0,V_{CC}=5V, V_{CM}=1.0KV(p-p), RL=1.9K ohm	15	30	-	KV/us
	Instantaneous common mode rejection voltage (High level output)	CM_L	I_F=16mA,V_{CC}=5V, V_{CM}=1.0KV(p-p), RL=1.9K ohm	-15	-30	-	KV/us

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Electrical Characteristics (OPIA600 Series)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode						
V_F	Forward Voltage OPIA600, OPIA601, OPIA602, OPI604, OPIA605 OPIA603	- 1.0	1.2 1.2	1.4 1.3	V	I_F = 20 mA I_F = 10 mA
V_{FM}	Peek Forward Voltage OPIA600, OPIA601, OPIA602, OPI604 OPIA603, OPIA605	- -	- -	3.5 3.0	V	I_{FM} = 500 mA
I_R	Reverse Current OPIA600, OPIA601, OPIA602, OPI604, OPIA605 OPIA603	- -	- -	10 10	µA	V_R = 4 V V_R = 5 V
C_t	Terminal Capacitance OPIA600, OPIA601, OPIA602, OPI604, OPIA605 OPIA603	- -	30 30	- -	pf	V = 0.0 V, f = 1K Hz V = 0.0 V, f = 1M Hz
Output Phototransistor—OPIA600D, OPIA603D, OPIA604D, OPIA605D						
I_{CEO}	Collector dark Current OPIA600, OPIA604, OPIA605 OPIA603	- -	- 10	100 200	nA	I_F = 0 mA, V_{CE} = 20 V I_F = 0 mA, V_{CE} = 300 V
V_{CEO}	Collector-emitter Saturation Voltage OPIA600, OPIA604, OPIA605 OPIA603	- -	0.1 -	0.3 0.4	V	I_F = 20 mA, I_C = 1 mA I_F = 8 mA, I_C = 2.4 mA
f_C	Cutt-Off frequency	-	80	-	K Hz	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω
t_R	Rise Time OPIA600, OPIA604 OPIA603 OPIA605	- - -	5 2 4	20 - 20	µs	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω V_{CC} = 10 V, I_C = 2 mA, R_L = 100 Ω V_{CC} = 2 V, I_C = 2 mA, R_L = 100 Ω
t_F	Fall Time OPIA600, OPIA604 OPIA603 OPIA605	- - -	4 3 3	20 - 20	µs	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω V_{CC} = 10 V, I_C = 2 mA, R_L = 100 Ω V_{CC} = 2 V, I_C = 2 mA, R_L = 100 Ω

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Electrical Characteristics (OPIA600 Series) - Continued from Previous Page

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Output PhotoDarlington—OPIA601D, OPIA6022D						
I_{CEO}	Collector dark Current OPIA601 OPIA602	- -	- -	1.0 0.1	µA	I_F = 0 mA, V_{CE} = 200 V I_F = 0 mA, V_{CE} = 10 V
V_{CEO}	Collector-emitter Saturation Voltage OPIA601 OPIA602	- -	- -	1.5 1.0	V	I_F = 20 mA, I_C = 5 mA I_F = 8 mA, I_C = 2 mA
f_C	Cutt-Off frequency OPIA601, OPIA602	-	7.0	-	K Hz	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω
t_R	Rise Time OPIA601 OPIA602	- -	60 5	300 40	µs	V_{CC} = 2 V, I_C = 20 mA, R_L = 100 Ω V_{CC} = 10 V, I_C = 50 mA, R_L = 100 Ω
t_F	Fall Time OPIA601 OPIA602	- -	50 60	250 100	µs	V_{CC} = 2 V, I_C = 20 mA, R_L = 100 Ω V_{CC} = 10 V, I_C = 50 mA, R_L = 100 Ω
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 mA, V_{CE} = 5.0 V I_F = 2 mA, V_{CE} = 5.0 V I_F = 10 mA, V_{CE} = 10.0 V I_F = 5 mA, V_{CE} = 5.0 V I_F = 1 mA, V_{CE} = 5.0 V I_F = 10 mA, V_{CE} = 5.0 V
C_f	Floating Capacitance	-	0.6	1.0	pF	V = 0.0 V, f = 1M Hz
R_{ISO}	Isolation resistance	$5X10^{10}$	10^{11}	-	ohm	DC500V

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OPIA600

Fig.1 Current Transfer Ratio vs. Forward Current

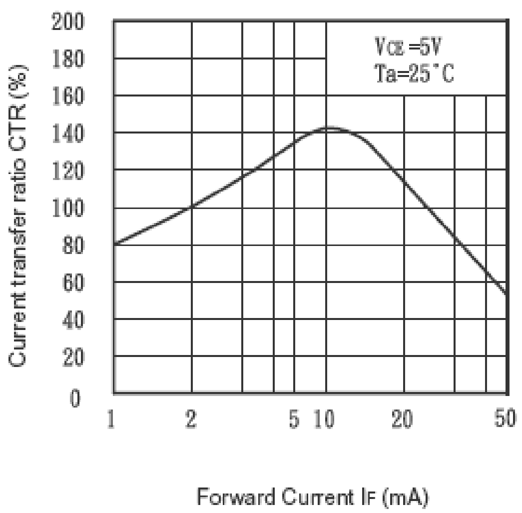


Fig.2 Collector Power Dissipation vs. Ambient Temperature

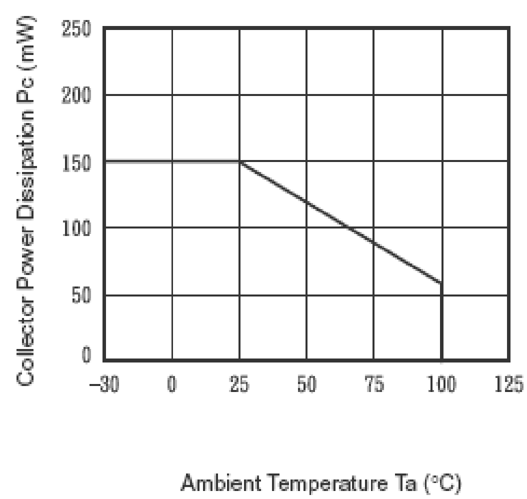


Fig.3 Collector Dark Current vs. Ambient Temperature

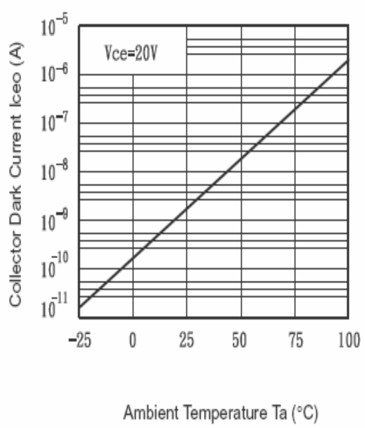


Fig.4 Forward Current vs. Ambient Temperature

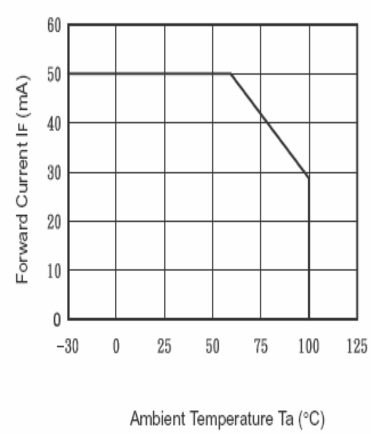
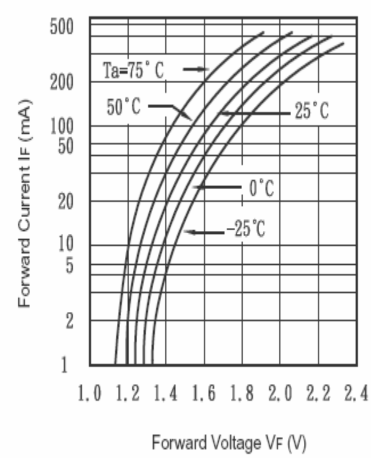


Fig.5 Forward Current vs. Forward Voltage



OPIA600

Fig.6 Collector Current vs. Collector-emitter Voltage

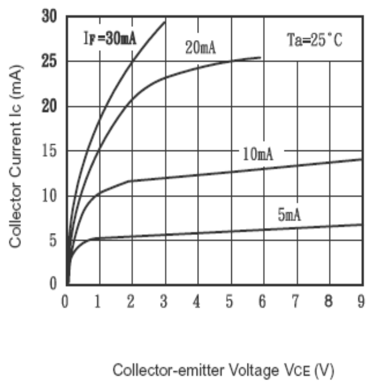


Fig.7 Relative Current Transfer Ratio vs. Ambient Temperature

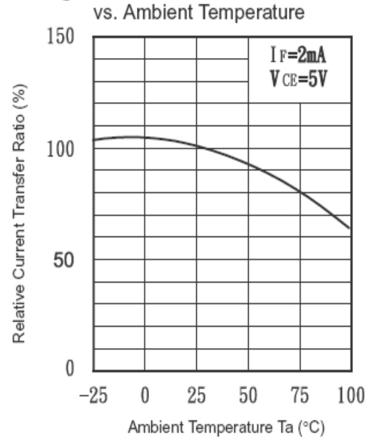


Fig.8 Collector-emitter Saturation Voltage vs. Ambient Temperature

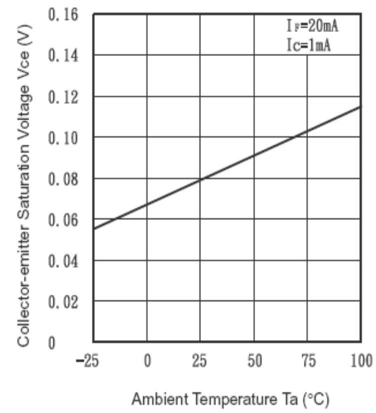


Fig.9 Collector-emitter Saturation Voltage vs. Forward Current

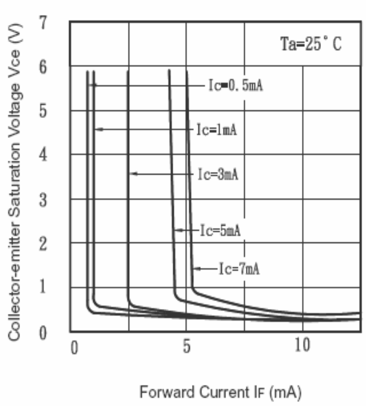


Fig.10 Response Time vs. Load Resistance

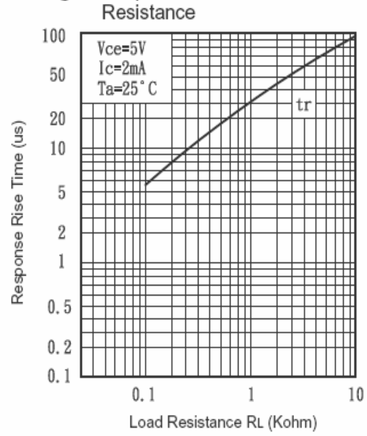
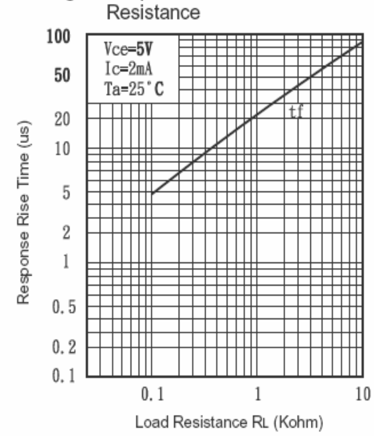


Fig.11 Response Time vs. Load Resistance



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OPIA601

Fig. 4 Forward Current vs. Ambient Temperature

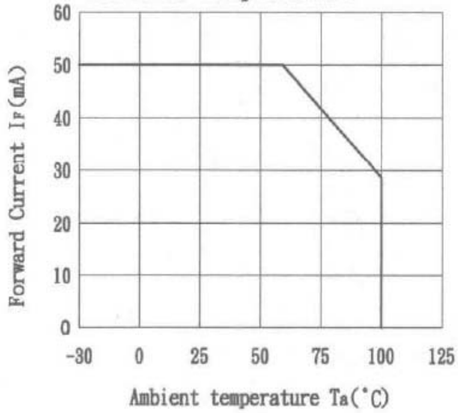


Fig. 5 Forward Current vs. Forward Voltage

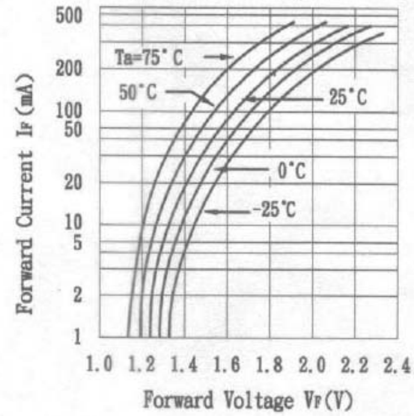


Fig. 2 Collector Power Dissipation vs. Ambient Temperature

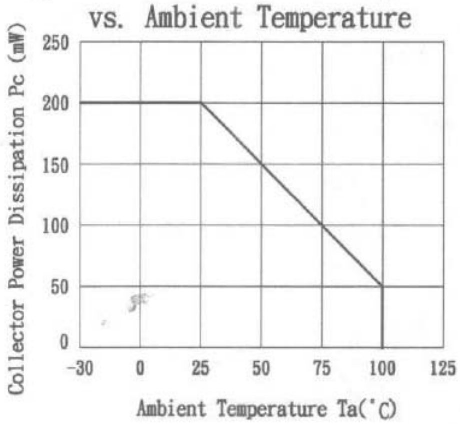


Fig. 3 Collector Dark Current vs. Ambient Temperature

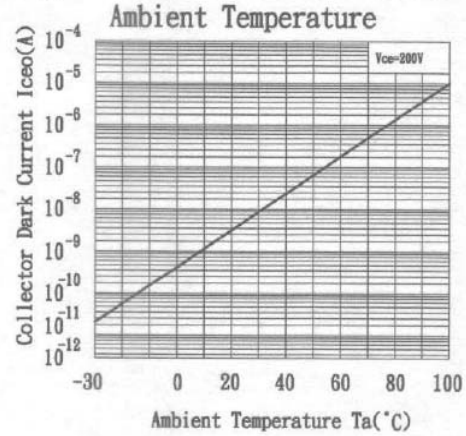


Fig. 6 Collector Current vs. Collector-emitter Voltage

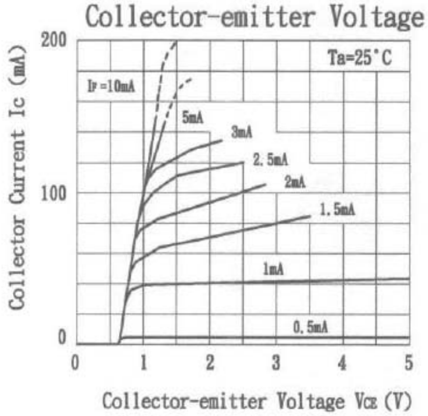
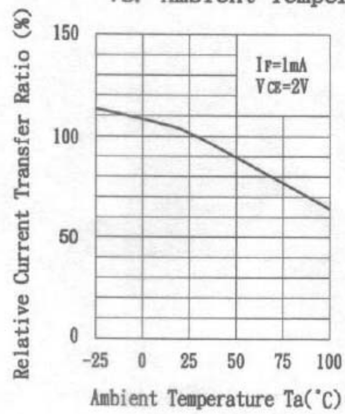


Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature



OPIA601

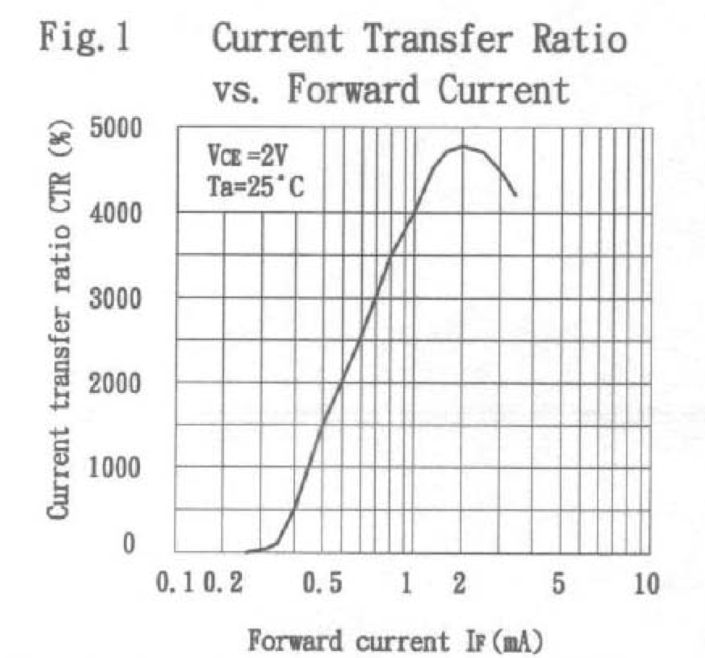


Fig. 1
Current Transfer Ratio vs. Forward Current
VCE =2V
Ta=25°C
Current transfer ratio CTR (%)
5000
4000
3000
2000
1000
0
0.1 0.2
0.5
1
2
5
10
Forward current IF (mA)

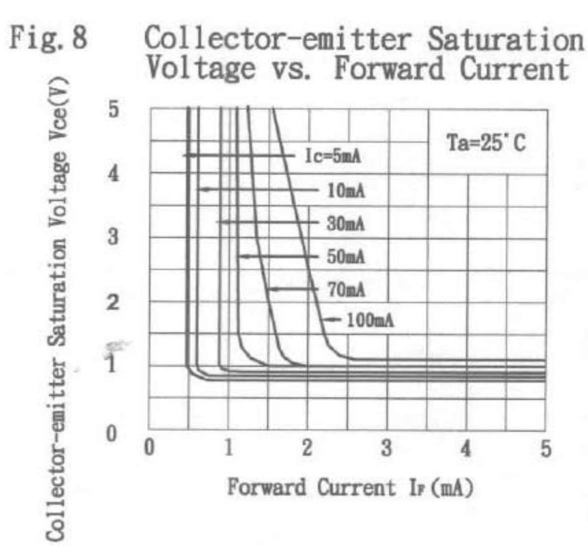


Fig. 8
Collector-emitter Saturation Voltage vs. Forward Current
Ta=25°C
Ic=5mA
10mA
30mA
50mA
70mA
100mA
Collector-emitter Saturation Voltage Vce(V)
5
4
3
2
1
0
0
1
2
3
4
5
Forward Current IF (mA)

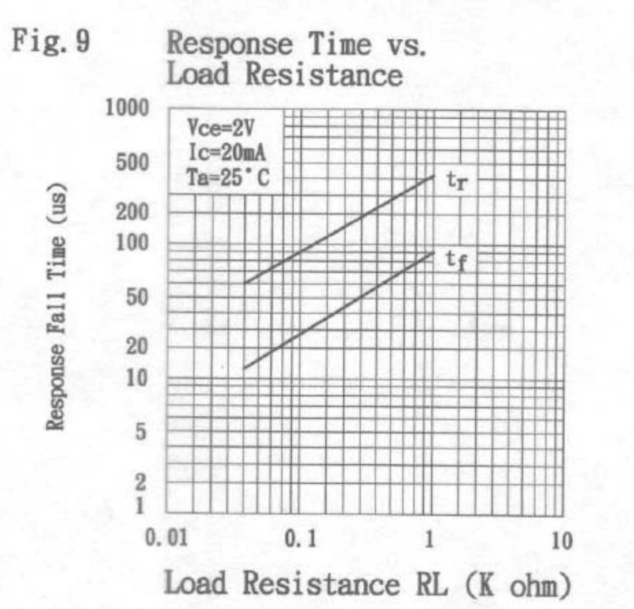


Fig. 9
Response Time vs. Load Resistance
Vce=2V
Ic=20mA
Ta=25°C
tr
tf
Response Fall Time (us)
1000
500
200
100
50
20
10
5
2
1
0.01
0.1
1
10
Load Resistance RL (K ohm)

OPIA602

Fig. 1 Forward Current vs. Ambient Temperature

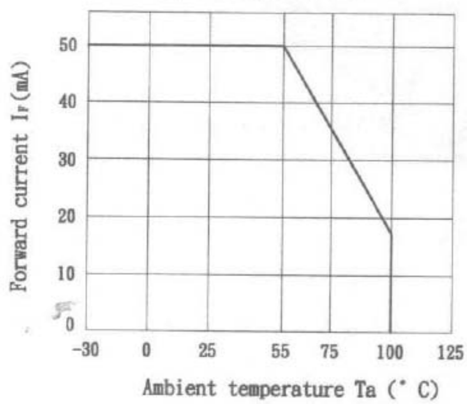


Fig. 2 Collector Power Dissipation vs. Ambient Temperature

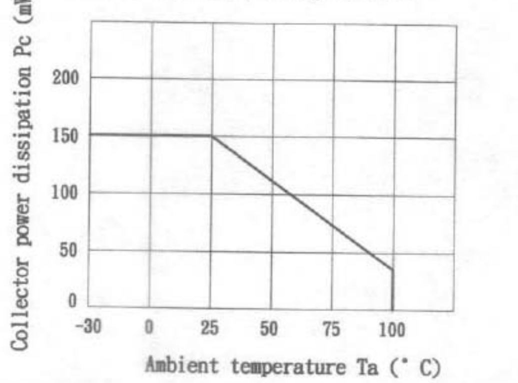


Fig. 3 Peak Forward Current vs. Duty Ratio

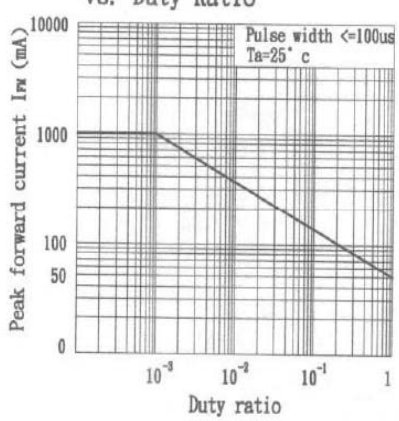


Fig. 4 Forward Current vs. Forward Voltage

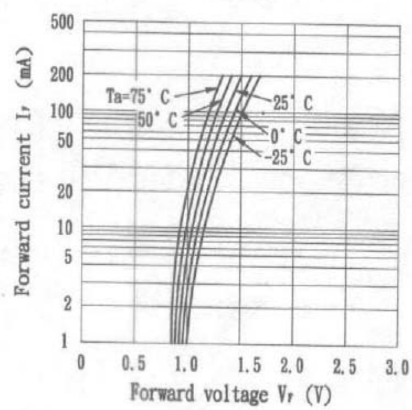


Fig. 5 Current Transfer Ratio vs. Forward Current

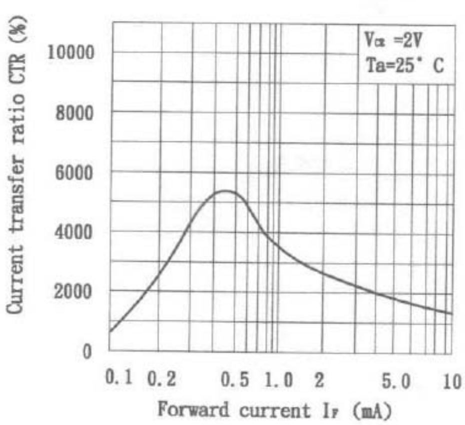
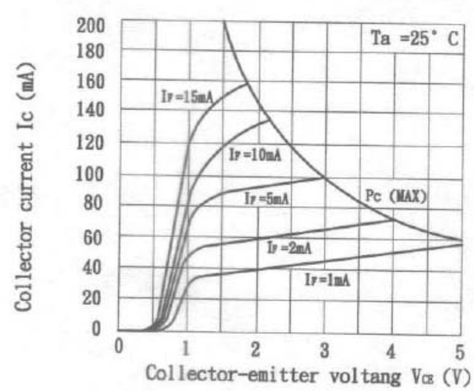


Fig. 6 Collector Current vs. Collector-emitter Voltage



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OPIA602

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

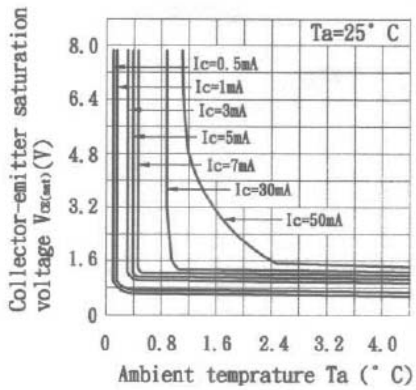


Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature

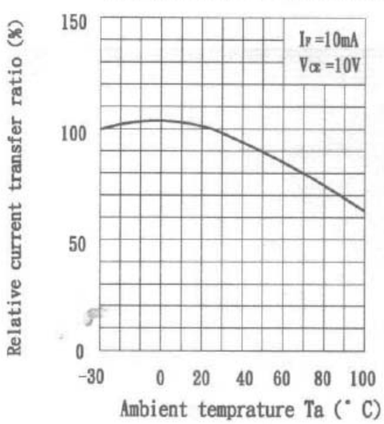


Fig. 8 Collector-emitter Saturation Voltage vs. Ambient Temperature

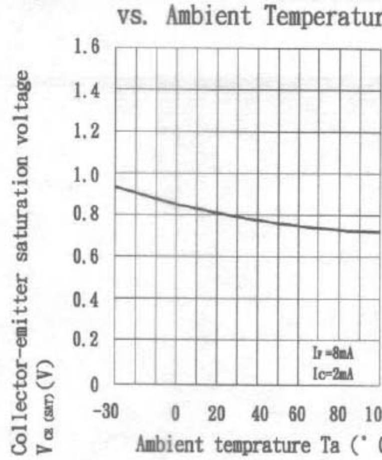


Fig. 9 Collector Dark Current vs. Ambient Temperature

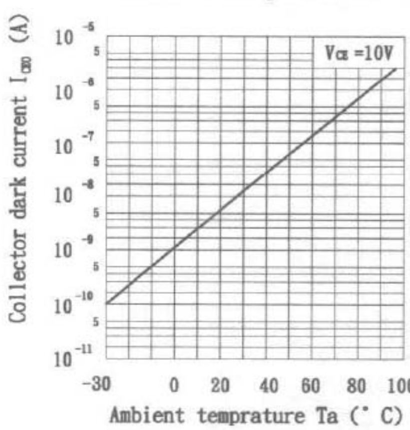
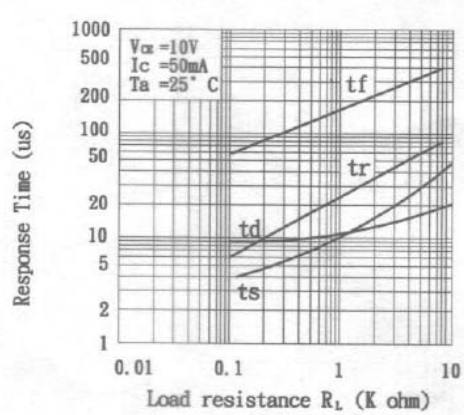


Fig. 10 Response Time vs. Load Resistance



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OPIA603

Fig. 1 Current Transfer Ratio Vs. Forward Current

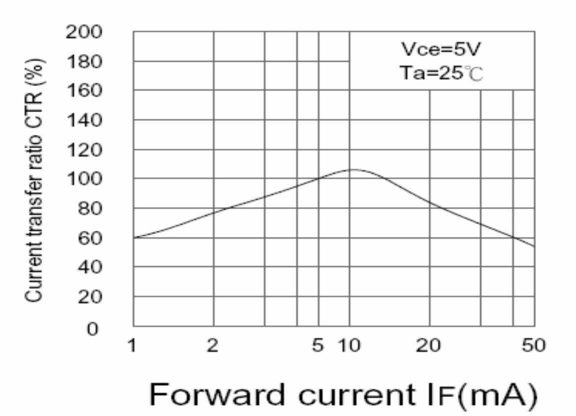


Fig.2 Collector Power Dissipation vs. Ambient Temperature

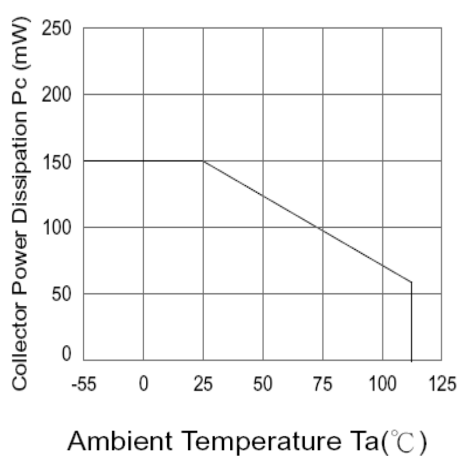


Fig.3 Collector Dark Current vs. Ambient Temperature

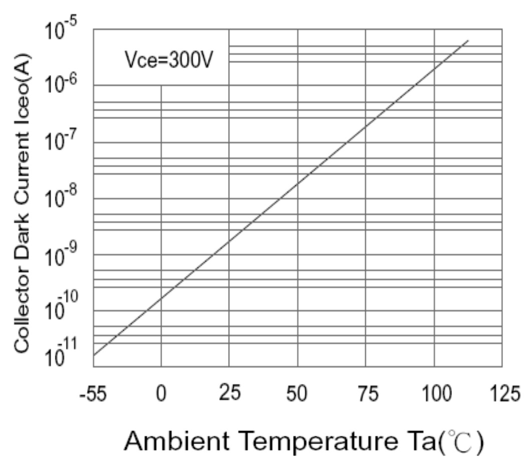


Fig.4 Forward Current vs. Ambient Temperature

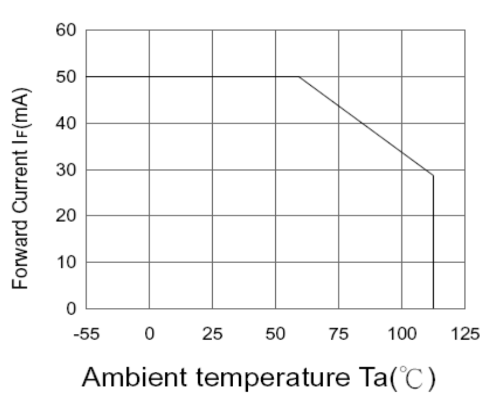
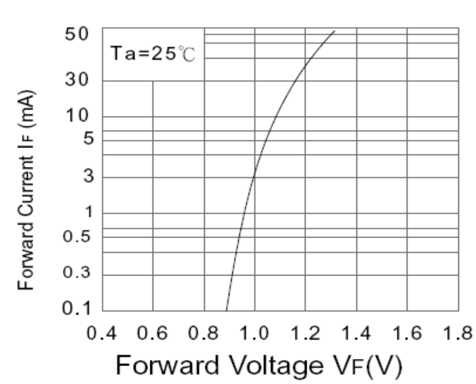


Fig.5 Forward Current vs. Forward Voltage



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OPIA603

Fig.6 Collector Current vs. Collector-emitter Voltage

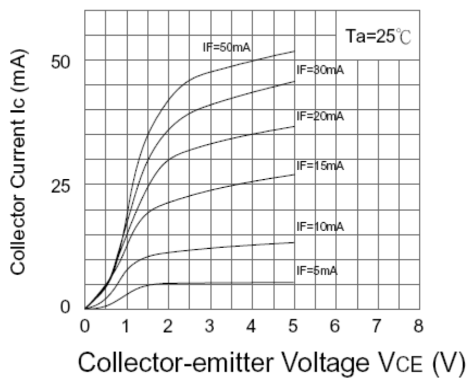


Fig.7 Relative Current Transfer Ratio vs. Ambient Temperature

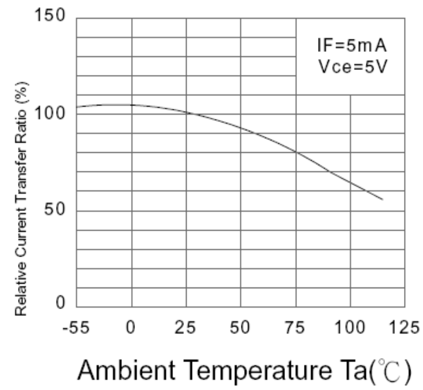


Fig.8 Collector-emitter Saturation Voltage vs. Ambient Temperature

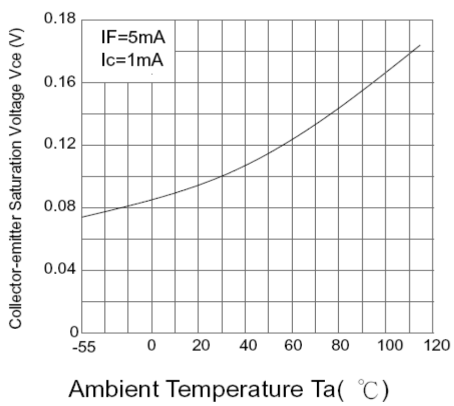


Fig.9 Collector-emitter Saturation Voltage vs. Forward Current

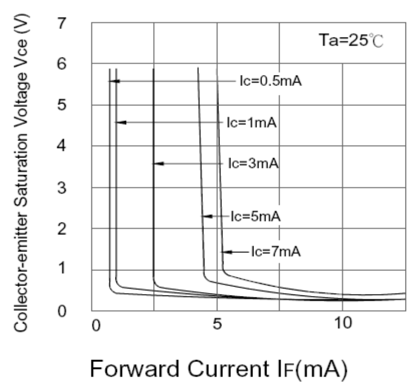


Fig.10 Response Time vs. Load Resistance

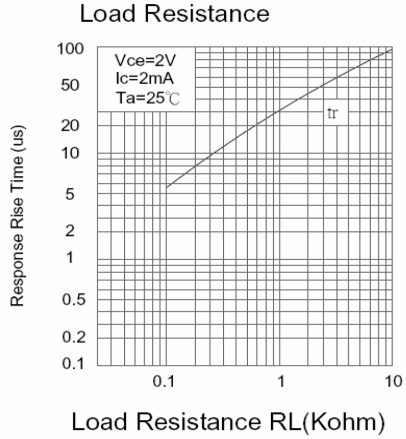
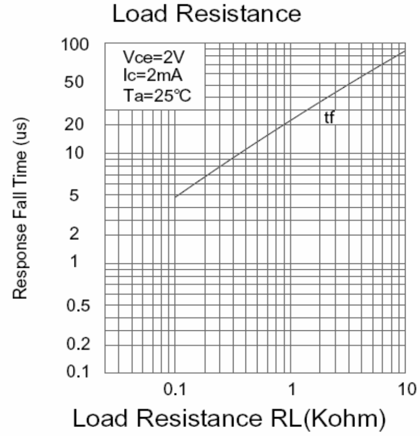


Fig.11 Response Time vs. Load Resistance



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OPIA604

Fig.1 Current Transfer Ratio vs. Forward Current

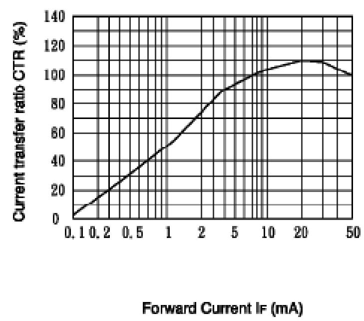


Fig.2 Collector Power Dissipation vs. Ambient Temperature

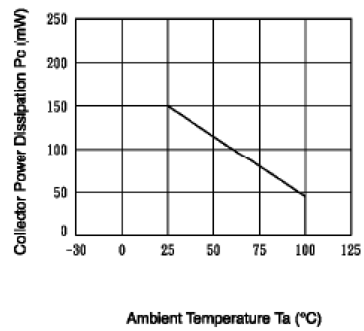


Fig.3 Collector Dark Current vs. Ambient Temperature

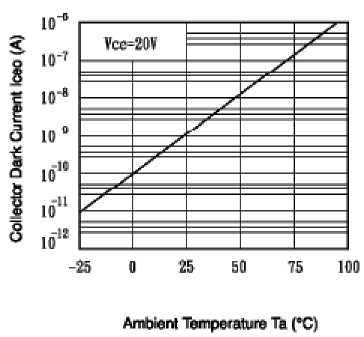


Fig.4 Forward Current vs. Ambient Temperature

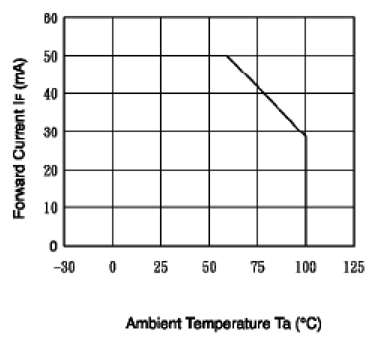


Fig.5 Forward Current vs. Forward Voltage

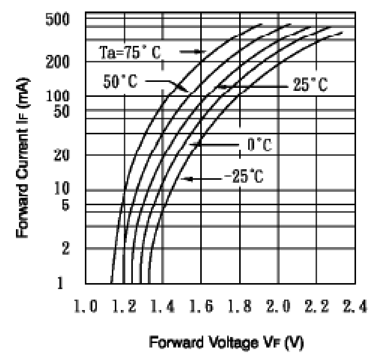


Fig.6 Collector Current vs. Collector-emitter Voltage

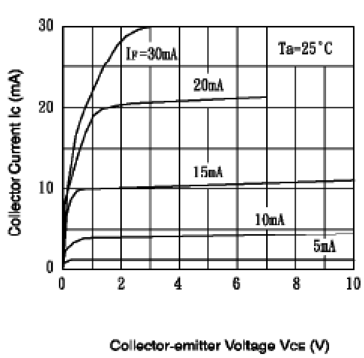


Fig.7 Relative Current Transfer Ratio vs. Ambient Temperature

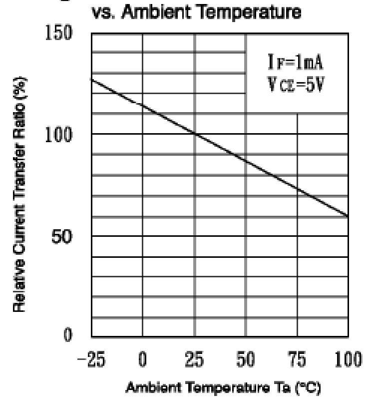
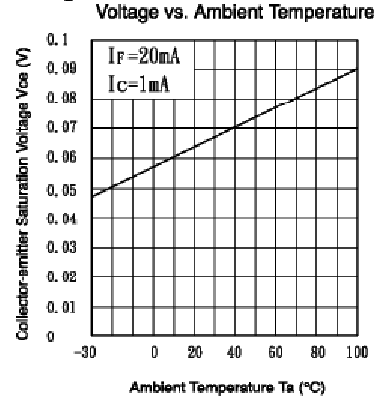


Fig.8 Collector-emitter Saturation Voltage vs. Ambient Temperature



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OPIA604

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

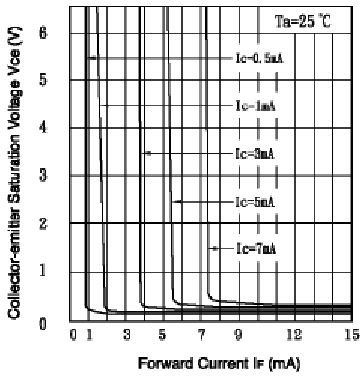


Fig.10 Response Time vs. Load Resistance

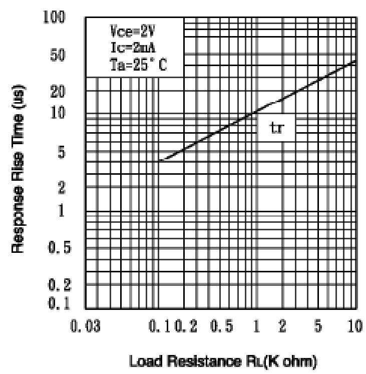
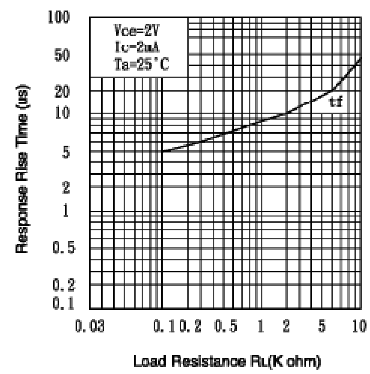


Fig.11 Response Time vs. Load Resistance



OPIA605

Fig.1 **Current Transfer Ratio vs. Forward Current**

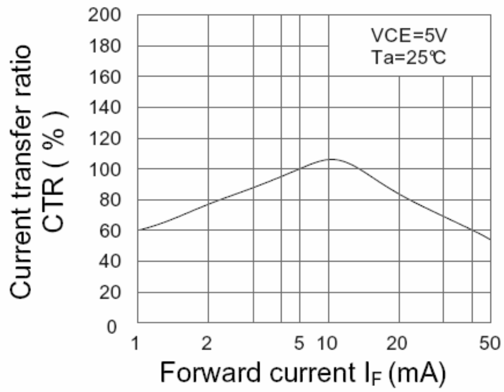


Fig.2 **Collector Power Dissipation vs. Ambient Temperature**

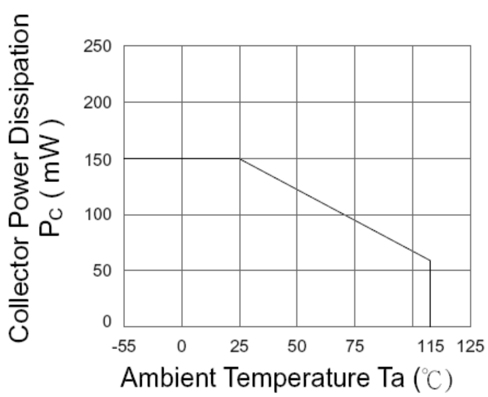


Fig.3 **Collector Dark Current vs. Ambient Temperature**

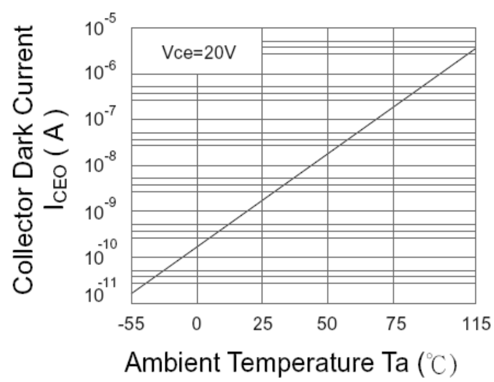


Fig.4 **Forward Current vs. Ambient Temperature**

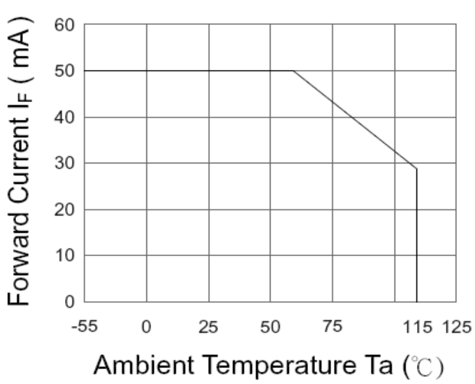


Fig.5 **Forward Current vs. Forward Voltage**

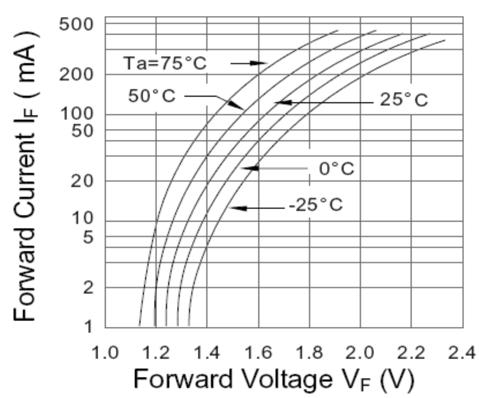


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Fig.6 **Collector Current vs. Collector-Emitter Voltage**

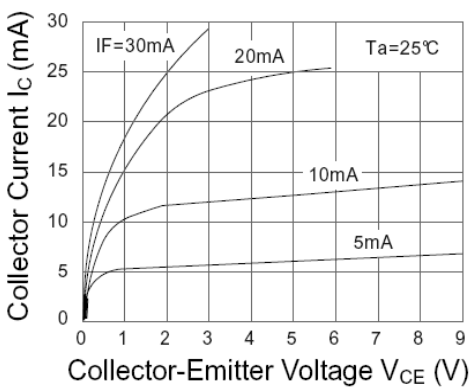


Fig.7 **Relative Current Transfer Ratio vs. Ambient Temperature**

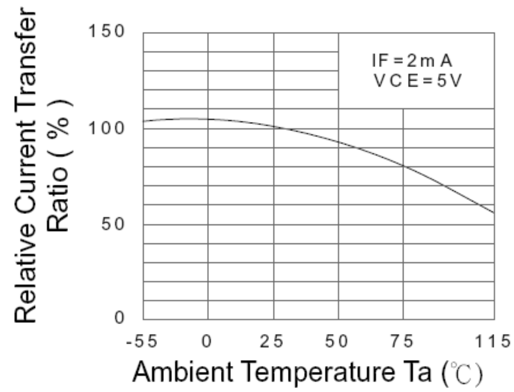


Fig.8 **Collector-Emitter Saturation Voltage vs. Ambient Temperature**

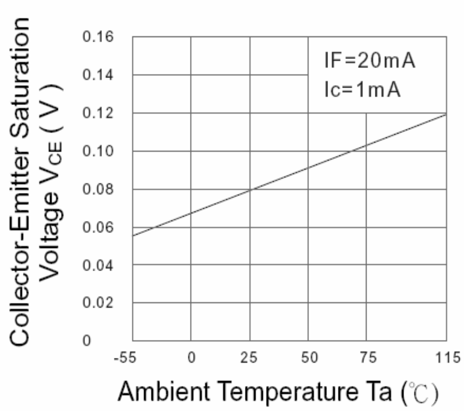


Fig.9 **Collector-Emitter Saturation Voltage vs. Forward Current**

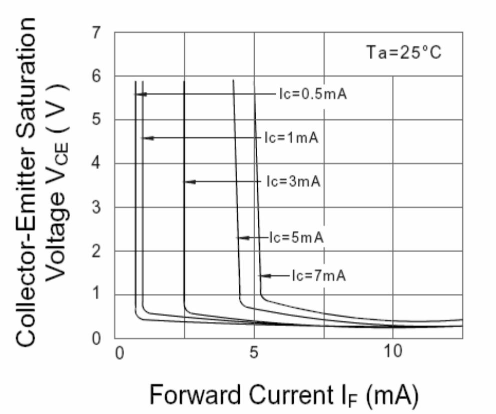


Fig.10 **Response Time vs. Load Resistance**

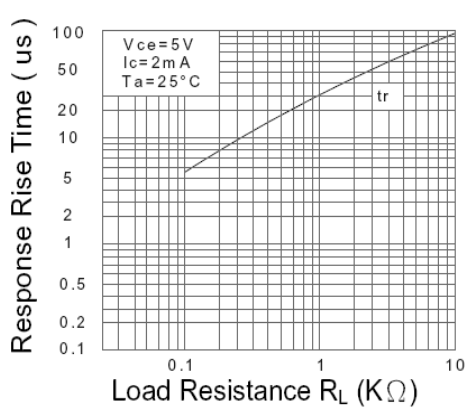
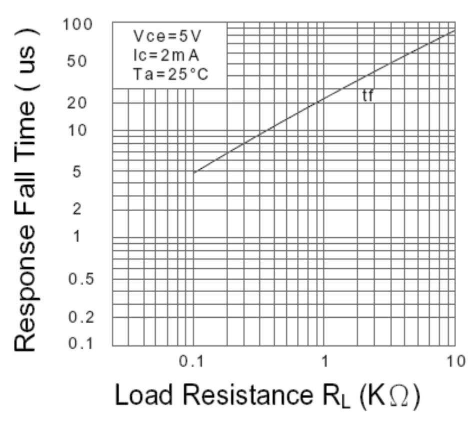


Fig.11 **Response Time vs. Load Resistance**



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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 stnd 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 Iceo
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:
1. 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.
2. 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 OPIA410D/A
QTY. N/A
DATE CODE (YYWW)
LOT I.D. (Y-NNNNDDD)

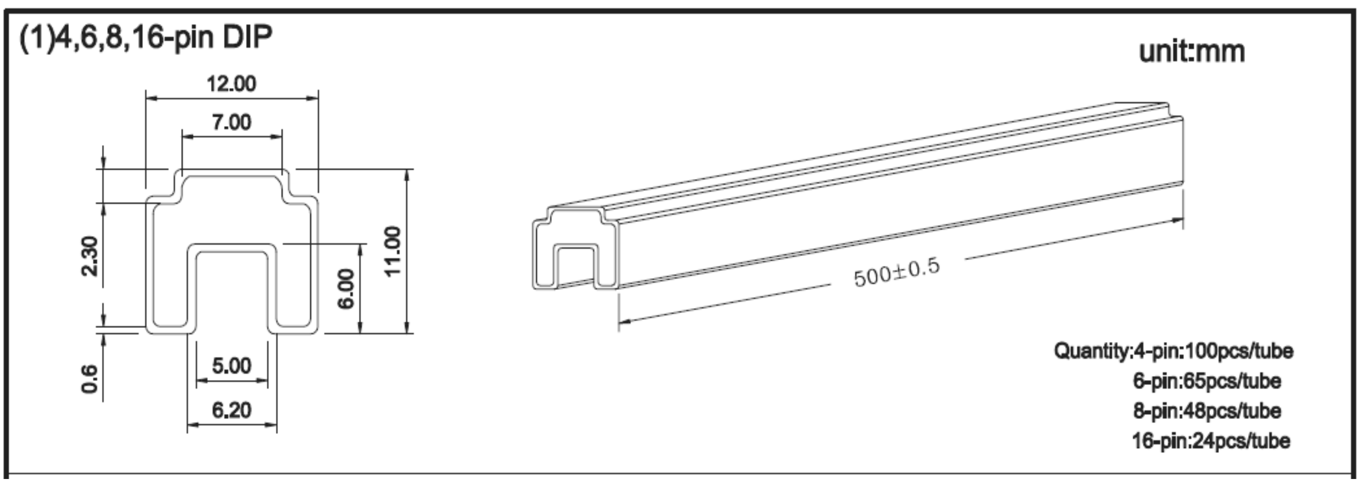
TT electronics
OPTEK Technology

Packaging Information:

Optek's Optocoupler Part Numbers	Packaging Quantities	Tube		Inner 52 x 7 x 7.5 cm		Small Carton 53.5 x 16 x 17.5 cm			Medium Carton 53.5 x 30.7 x 17.5 cm			Large Carton 53.5 x 30.7 x 25 cm		
		Qty	Weight	Qty	Weight	Qty	Weight	Gross Weight	Qty	Weight	Gross Weight	Qty	Weight	Gross Weight
P/H 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
P/H and SMD	6-PIN OPIA6XXD/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
P/H and SMD	8-PIN OPIA8XXD 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
M/F	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	--									

P/H = Pin-Hole Packages (Referred as D = Dual-In-Line Package)
SMD = Standard Surface Mount Packages (Referred as A = 6.5mil SMD)
M/F 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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