

**OPI8012, OPI8013, OPI8014, OPI8015  
OPTOCOUPERS/OPTOISOLATORS**

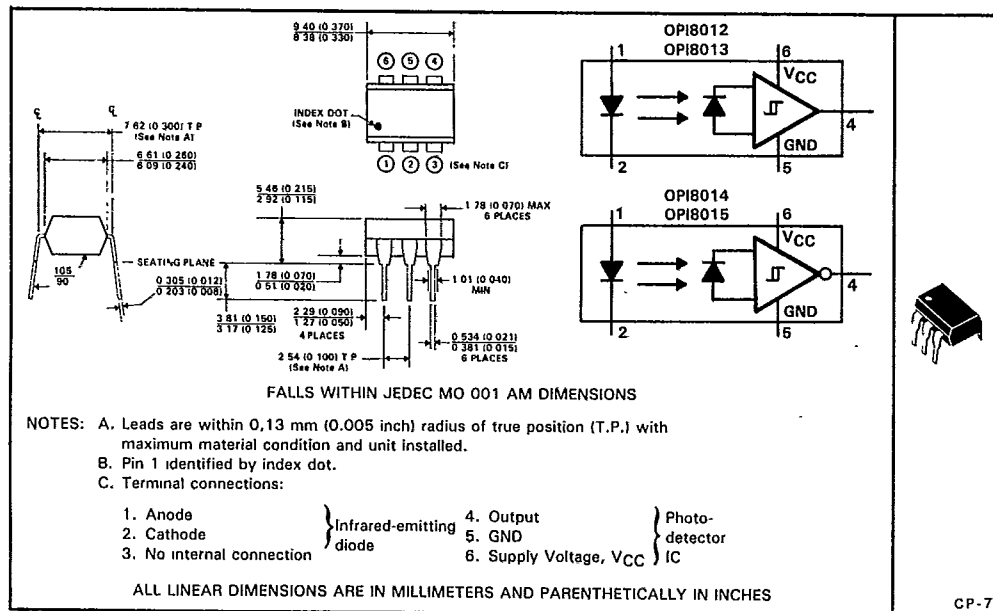
D2961, SEPTEMBER 1986

- Gallium Arsenide Emitter Optically Coupled to a Photo-Detector Integrated Circuit
- Output Compatible with TTL/LSTTL Logic Levels
- Fan-Out of 8 TTL Loads
- Four Output Versions:  
 OPI8012 Buffer Totem-Pole  
 OPI8013 Buffer Open-Collector  
 OPI8014 Inverter Totem-Pole  
 OPI8015 Inverter Open-Collector
- High-Voltage Electrical Isolation . . . 3540-V Peak Rating
- Directly Interchangeable with TRW Optron OPI8012, OPI8013, OPI8014, OPI8015 *7-41-89*
- Standard 6-Pin Dual-In-Line Package
- Schmitt Trigger Stage with Hysteresis for High Noise Immunity
- 200-kilobaud Data Rate
- 70-ns Maximum Rise Time or Fall Time
- UL Recognized — File Number E65085

**mechanical data**

Each device consists of a gallium arsenide infrared emitting diode and a silicon monolithic photo-detector integrated circuit. The device is mounted on a 6-pin lead frame encapsulated within an electrically nonconductive plastic compound. The photo-detector IC incorporates a photodiode, a linear amplifier, a Schmitt Trigger hysteresis stage, and a digital output stage.

**3**



Optocouplers (Isolators)

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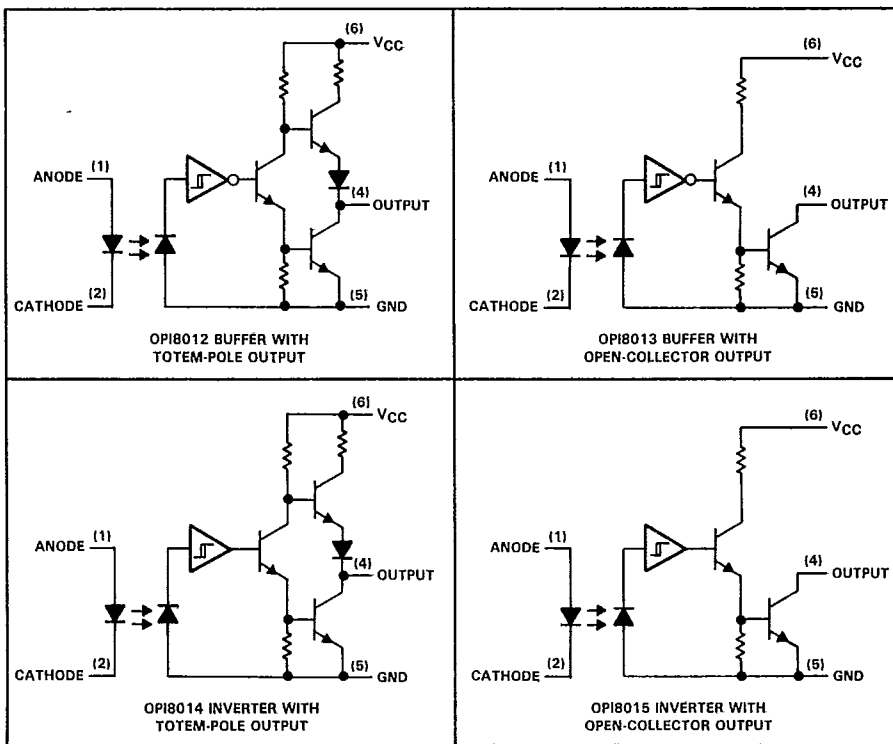
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**OPI8012, OPI8013, OPI8014, OPI8015**  
**OPTOCOUPLEDERS/OPTOISOLATORS**

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schematic diagrams



3 Optocouplers (Isolators)

absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

Supply voltage, V <sub>CC</sub> .....	10 V
Peak input-to-output isolation voltage (see Note 1) .....	3540 V
Output voltage (OPI8013, OPI8015) .....	35 V
Input diode reverse voltage .....	3 V
Input diode continuous forward current .....	25 mA
Continuous total power dissipation at (or below) 25°C free-air temperature:	
Input diode (see Note 2) .....	100 mW
Output IC (see Note 3) .....	200 mW
Total (input diode plus output IC, see Note 4) .....	250 mW
Duration of output short to V <sub>CC</sub> or GND (OPI8012, OPI8014) .....	1 s
Duration of output short to V <sub>CC</sub> (OPI8013, OPI8015) .....	1 s
Storage temperature range .....	-55°C to 150°C
Operating free-air temperature range .....	-55°C to 100°C
Lead temperature 1,6 mm (1/16 inch) from the case for 1 second .....	260°C

- NOTES: 1. This rating applies between the input leads (pins 1 and 2) shorted together and the output, V<sub>CC</sub>, and GND leads (pins 4, 5, and 6) shorted together.  
 2. Derate linearly to 100°C free-air temperature at the rate of 1.33 mW/°C  
 3. Derate linearly to 100°C free-air temperature at the rate of 2.67 mW/°C  
 4. Derate linearly to 100°C free-air temperature at the rate of 3.33 mW/°C

OPI8012, OPI8014  
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recommended operating conditions

	OPI8012 OPI8014			UNIT
	MIN	NOM	MAX	
Supply voltage, V <sub>CC</sub>	4.75	5	5.25	V
High-level output current, I <sub>OH</sub>			-800	μA
Low-level output current, I <sub>OL</sub>			12.8	mA
Operating free-air temperature, T <sub>A</sub>	-40		70	°C

electrical characteristics, T<sub>A</sub> = -40°C to 70°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS	OPI8012			OPI8014			UNIT	
		MIN	TYP†	MAX	MIN	TYP†	MAX		
V <sub>F</sub>	Input diode forward voltage I <sub>F</sub> = 10 mA, T <sub>A</sub> = 25°C		1.2	1.5		1.2	1.5	V	
I <sub>R</sub>	Input diode reverse current V <sub>R</sub> = 3 V, T <sub>A</sub> = 25°C			100			100	μA	
I <sub>FT+</sub>	Input diode positive-going threshold current V <sub>CC</sub> = 5 V		1.5	10		1.5	10	mA	
I <sub>FT+</sub> / I <sub>FT-</sub>	Hysteresis ratio V <sub>CC</sub> = 5 V		1.4			1.4			
V <sub>OH</sub>	High-level output voltage V <sub>CC</sub> = 4.75 V, I <sub>F</sub> = 0 I <sub>OH</sub> = -800 μA		2.4	3.2		2.4	3.2	V	
V <sub>OL</sub>	Low-level output voltage V <sub>CC</sub> = 4.75 V, I <sub>F</sub> = 0 I <sub>OL</sub> = 12.8 mA		0.2	0.4		0.2	0.4	V	
I <sub>OS</sub>	Short-circuit output current V <sub>CC</sub> = 5.25 V, V <sub>O</sub> = 0					-30	-50	-100	mA
I <sub>CC</sub>	Supply current V <sub>CC</sub> = 5.25 V								
		I <sub>F</sub> = 0		8	15		4	15	mA
		I <sub>F</sub> = 10 mA		10	15		9	15	mA

†Typical values are at T<sub>A</sub> = 25°C.

switching characteristics, T<sub>A</sub> = 25°C

PARAMETER	TEST CONDITIONS	OPI8012			OPI8014			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t <sub>r</sub>	Rise time		25	70		25	70	ns
t <sub>f</sub>	Fall time		9	70		9	70	ns
t <sub>PLH</sub>	Propagation delay time, low-to-high-level output		1	5		3	5	μs
t <sub>PHL</sub>	Propagation delay time, high-to-low-level output		3	5		1	5	μs

Optocouplers (Isolators)



**OPI8013, OPI8015  
OPTOCOUPLEDERS/OPTOISOLATORS**

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**recommended operating conditions**

	OPI8013 OPI8015			UNIT
	MIN	NOM	MAX	
Supply voltage, $V_{CC}$	4.75	5	5.25	V
High-level output voltage, $V_{OH}$			30	V
Low-level output current, $I_{OL}$			12.8	mA
Operating free-air temperature, $T_A$	-40		70	°C

**electrical characteristics,  $T_A = -40^\circ\text{C}$  to  $70^\circ\text{C}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	OPI8013			OPI8015			UNIT
		MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_F$ Input diode forward voltage	$I_F = 10\text{ mA}$ , $T_A = 25^\circ\text{C}$		1.2	1.5		1.2	1.5	V
$I_R$ Input diode reverse current	$V_R = 3\text{ V}$ , $T_A = 25^\circ\text{C}$			100			100	$\mu\text{A}$
$I_{FT+}$ Input diode positive-going threshold current	$V_{CC} = 5\text{ V}$		1.5	10		1.5	10	mA
$I_{FT+} + I_{FT-}$ Hysteresis ratio	$V_{CC} = 5\text{ V}$		1.4			1.4		
$I_{OH}$ High-level output current	$V_{CC} = 4.75\text{ V}$ , $V_{OH} = 30\text{ V}$ , $I_F = 0$					0.02	100	$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$V_{CC} = 4.75\text{ V}$ , $I_F = 0$		0.2	0.4				V
	$I_{OL} = 12.8\text{ mA}$ , $I_F = 10\text{ mA}$					0.2	0.4	
$I_{CC}$ Supply current	$V_{CC} = 5.25\text{ V}$ , $I_F = 0$		8	15		4	15	mA
	$I_F = 10\text{ mA}$		10	15		9	15	

†Typical values are at  $T_A = 25^\circ\text{C}$ .

**switching characteristics,  $T_A = 25^\circ\text{C}$**

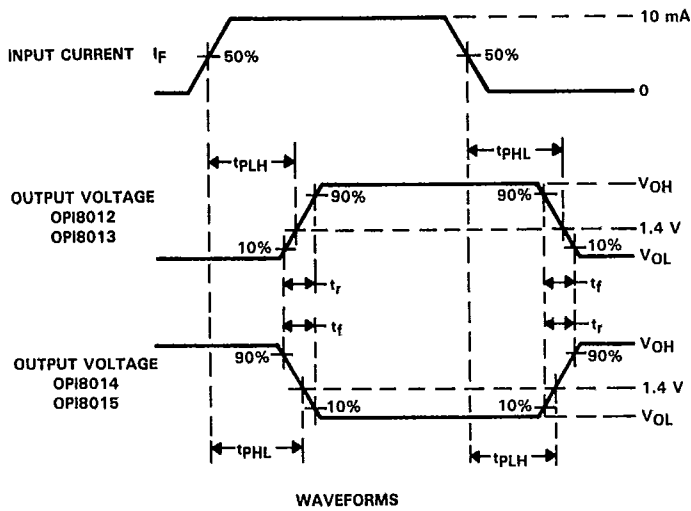
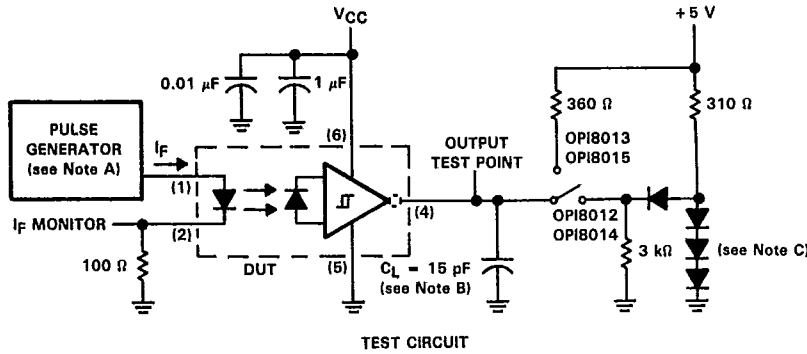
PARAMETER	TEST CONDITIONS	OPI8013			OPI8015			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX		
$t_r$ Rise time	$V_{CC} = 5\text{ V}$ , $R_L = 360\ \Omega$ , $I_F = 10\text{ mA}$ , See Figure 1		30	70		30	70	ns	
$t_f$ Fall time			9	70		9	70	ns	
$t_{PLH}$ Propagation delay time, low-to-high-level output				1	5		3	5	$\mu\text{s}$
$t_{PHL}$ Propagation delay time, high-to-low-level output				3	5		1	5	$\mu\text{s}$

3 Optocouplers (Isolators)

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PARAMETER MEASUREMENT INFORMATION



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Optocouplers (Isolators)

- NOTES: A. The input pulse is supplied by a pulse generator with the following characteristics: PRF = 10 kHz, duty cycle = 50%,  $t_r < 20$  ns,  $t_f < 20$  ns,  $Z_{out} = 50 \Omega$ .  
 B.  $C_L$  includes probe and jig capacitance.  
 C. All diodes are 1N3064 or 1N916.

FIGURE 1. SWITCHING TIMES

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3 Optocouplers (Isolators)

POSITIVE-GOING THRESHOLD CURRENT  
vs  
FREE-AIR TEMPERATURE

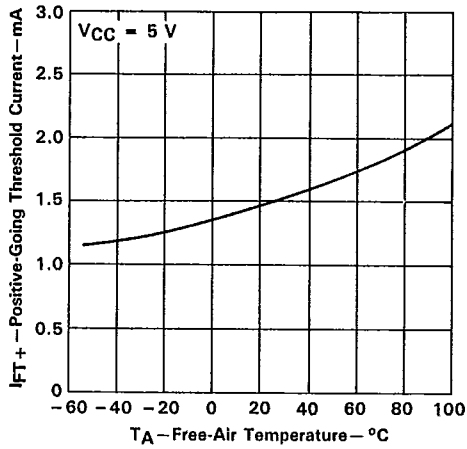


FIGURE 2

HYSTERESIS RATIO  
vs  
FREE-AIR TEMPERATURE

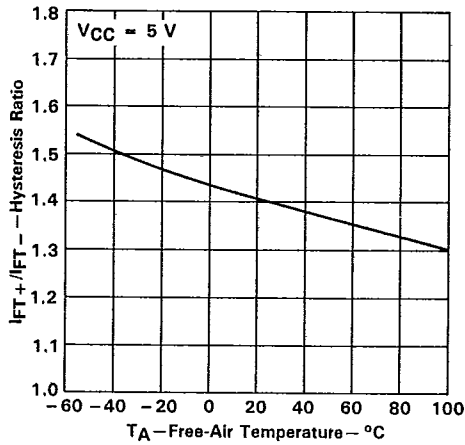


FIGURE 3

OPI8012, OPI8014  
OUTPUT VOLTAGE  
vs  
FREE-AIR TEMPERATURE

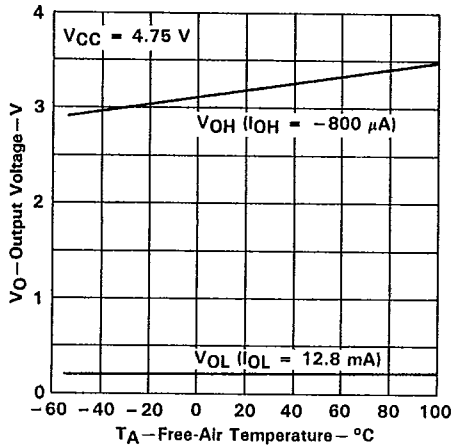


FIGURE 4

OPI8013, OPI8015  
LOW-LEVEL OUTPUT VOLTAGE  
vs  
FREE-AIR TEMPERATURE

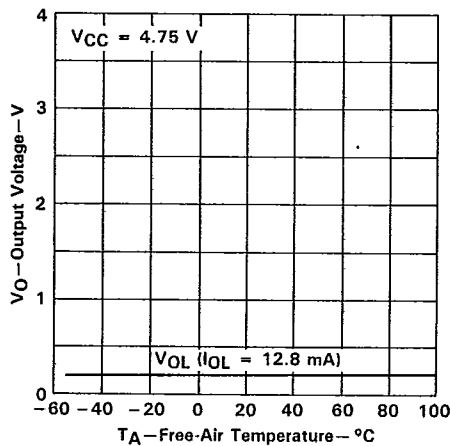


FIGURE 5

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TYPICAL CHARACTERISTICS

OPI8013, OPI8015  
HIGH-LEVEL OUTPUT CURRENT  
vs  
FREE-AIR TEMPERATURE

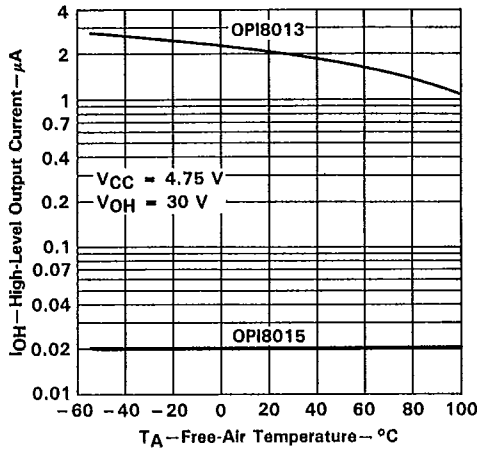


FIGURE 6

OPI8012, OPI8014  
SHORT-CIRCUIT OUTPUT CURRENT  
vs  
FREE-AIR TEMPERATURE

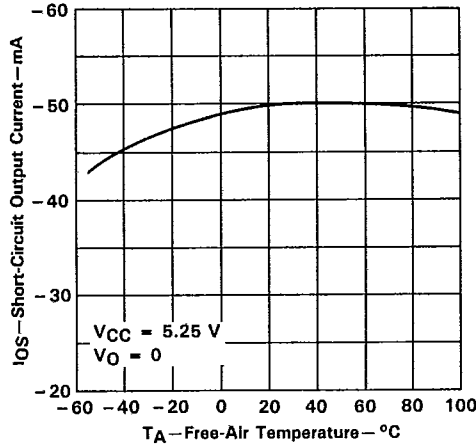


FIGURE 7

OPI8012, OPI8013  
NORMALIZED SUPPLY CURRENT  
vs  
FREE-AIR TEMPERATURE

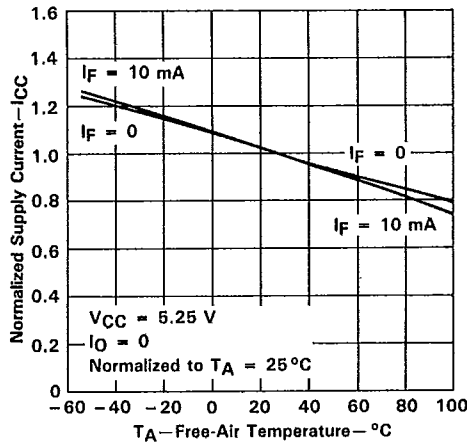


FIGURE 8

OPI8014, OPI8015  
NORMALIZED SUPPLY CURRENT  
vs  
FREE-AIR TEMPERATURE

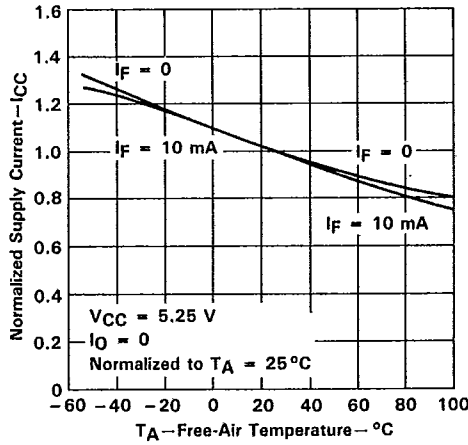


FIGURE 9

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Optocouplers (Isolators)

OPI8012, OPI8014  
RISE TIME AND FALL TIME  
vs  
FREE-AIR TEMPERATURE

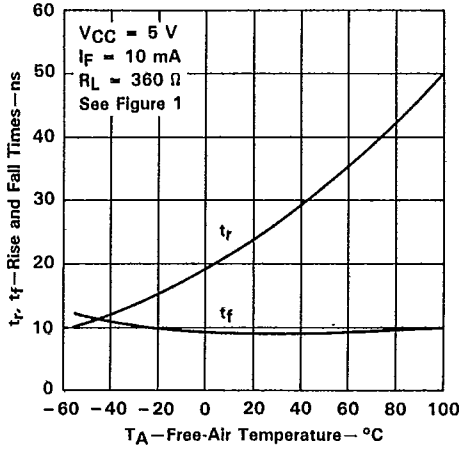


FIGURE 10

OPI8013, OPI8015  
RISE TIME AND FALL TIME  
vs  
FREE-AIR TEMPERATURE

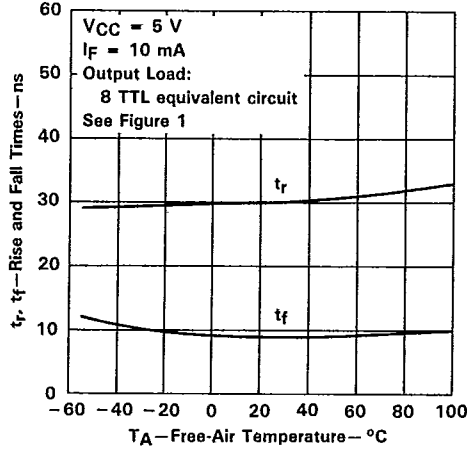


FIGURE 11

OPI8012, OPI8013  
PROPAGATION DELAY TIME  
vs  
FREE-AIR TEMPERATURE

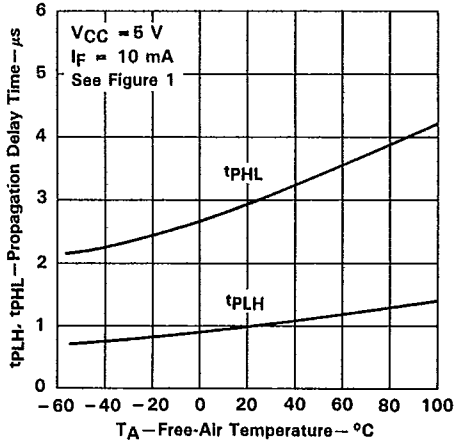


FIGURE 12

OPI8014, OPI8015  
PROPAGATION DELAY TIME  
vs  
FREE-AIR TEMPERATURE

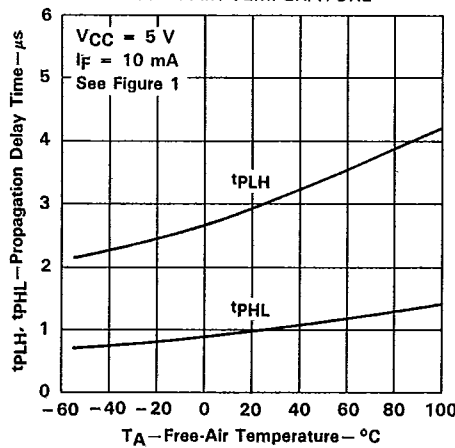


FIGURE 13