
HA12187FP

Bus Interface Driver/Receiver IC

HITACHI

ADE-207-174A (Z)

2nd Edition
Jun. 1999

Description

The HA12187FP was developed to be used as a bus interface driver/receiver IC in automotive audio equipment controllers. It implements a two-wire serial bus.

Functions

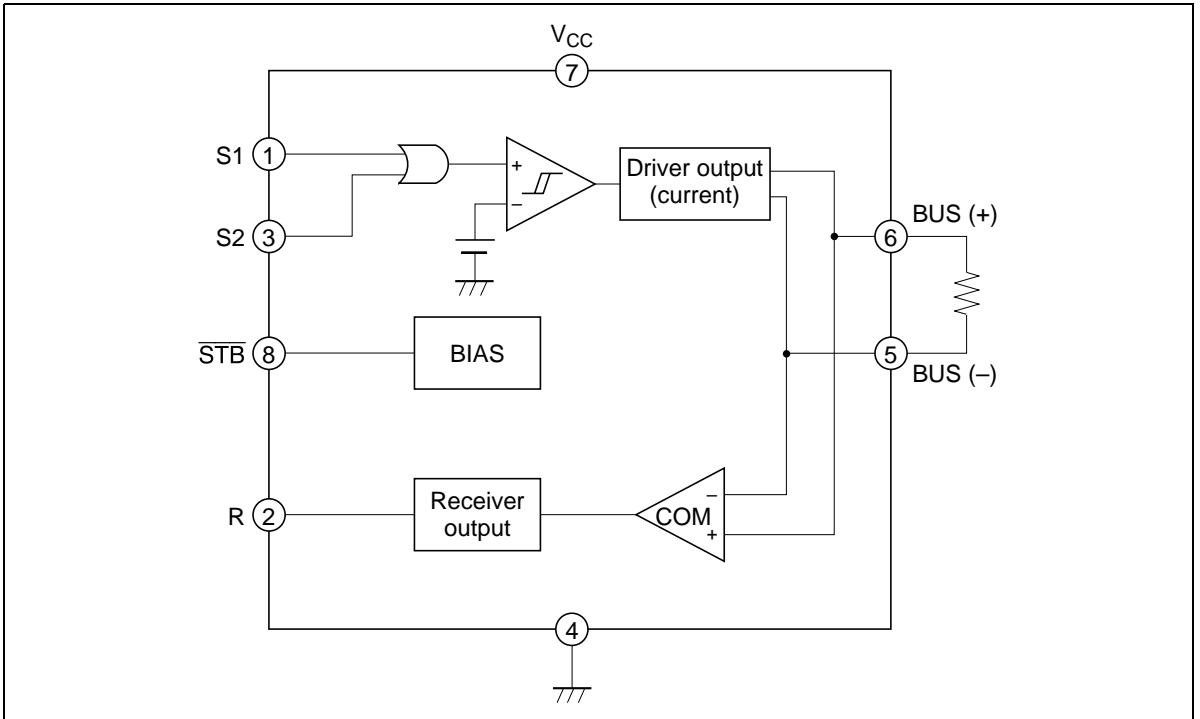
- Two-input OR circuit
- Input comparator circuit
- Current output driver circuit
- Receiver input comparator circuit
- Receiver output circuit
- Standby circuit

Features

- Supports two data inputs (Pins 1 and 3 are the input pins)
- Comparators with hysteresis characteristics were adopted for the inputs
- Current drive output drivers adopted (Output current: 3.8 mA typical)
- Comparators with hysteresis characteristics were adopted for the receivers
- Wide receiver common-mode input operating range (Common-mode input operating range: 0 to 5 V typical)
- The driver output and the receiver input can withstand high voltages (Maximum rating: 18 V)
- Standby function (The IC enters standby mode when pin 8 goes low)
- Operating power-supply voltage range: 5 V \pm 0.5 V

HA12187FP

Block Diagram



Pin Functions

Pin No.	Symbol	Function	Equivalent Circuit
1	S1	Data input	
2	R out	Receiver output	
3	S2	Data input	
4	GND	GND	
5	BUS (-)	Bus output (-) Receiver input (-)	
6	BUS (+)	Bus output (+) Receiver input (+)	
7	V _{CC}	Power supply	
8	STB	Standby control input	

HA12187FP

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit	Notes
Power-supply voltage	V _{cc}	7	V	
Allowable power dissipation	Pd	400	mW	Ta ≤ 85°C
Operating temperature	Topr	-40 to 85	°C	
Storage temperature	Tstg	-55 to 125	°C	
Input voltage	Vin	-1.0 to 6.7	V	
Bus input voltage	Bus	18	V	

Note: Recommended operating power supply voltage range: 5 V ±0.5 V

Electrical Characteristics ($V_{CC} = 5.0\text{ V}$, $T_a = 25^\circ\text{C}$)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	Test Pin	Test Circuit	
S1	High-level input voltage	V_{IHS1}	3.5	—	—	V	$V1 = 0\text{ V} \rightarrow 5\text{ V}$, $V3 = 0\text{ V}$ With the potential difference between pin 5 and pin 6 120 mV or more	1	Figure 1
	Low-level input voltage	V_{ILS1}	—	—	1.5	V	$V1 = 5\text{ V} \rightarrow 0\text{ V}$, $V3 = 0\text{ V}$ With the potential difference between pin5 and pin 6 20 mV or less	1	
	High-level input current	I_{IHS1}	—	—	1	μA	$V1 = 5\text{ V}$, $V3 = 0\text{ V}$	1	
	Low-level input current	I_{ILS1}	—	—	1	μA	$V1 = 0\text{ V}$, $V3 = 0\text{ V}$	1	
S2	High-level input voltage	V_{IHS2}	3.5	—	—	V	$V3 = 0\text{ V} \rightarrow 5\text{ V}$, $V1 = 0\text{ V}$ With the potential difference between pin 5 and pin 6 120 mV or more	3	Figure 1
	Low-level input voltage	V_{ILS2}	—	—	1.5	V	$V3 = 5\text{ V} \rightarrow 0\text{ V}$, $V1 = 0\text{ V}$ With the potential difference between 5 and pin 6 20 mV or less	3	
	High-level input current	I_{IHS2}	—	—	1	μA	$V1 = 0\text{ V}$, $V3 = 5\text{ V}$	3	
	Low-level input current	I_{ILS2}	—	—	1	μA	$V1 = 0\text{ V}$, $V3 = 0\text{ V}$	3	
Driver	High-level output current	I_{OH}	3.0	3.8	4.8	mA	$I_{OH} = V_{OHD+} - V_{OHD-} / 62\ \Omega$	5, 6	Figure 1
	Low-level output leakage current	I_{OL}	—	—	1	μA	Pin 5 voltage = V_{OP-} $I_{OL} = V_{OP+} - V_{OP-} / R_I$	5, 6	
	Reference operating voltage (+)	V_{OP+}	2.3	2.5	2.7	V	$V1 = 0\text{ V}$, $V3 = 0\text{ V}$	6	
	Reference operating voltage (-)	V_{OP-}	2.3	2.5	2.7	V	$V1 = 0\text{ V}$, $V3 = 0\text{ V}$	5	
Current drain 1	I_{CCH}	5.5	7.3	9.5	mA	$V1 = 5\text{ V}$, $V3 = 0\text{ V}$	7	Figure 1	
Current drain 2	I_{CCL}	1.7	2.2	2.7	mA	$V1 = 0\text{ V}$, $V3 = 0\text{ V}$	7	Figure 1	

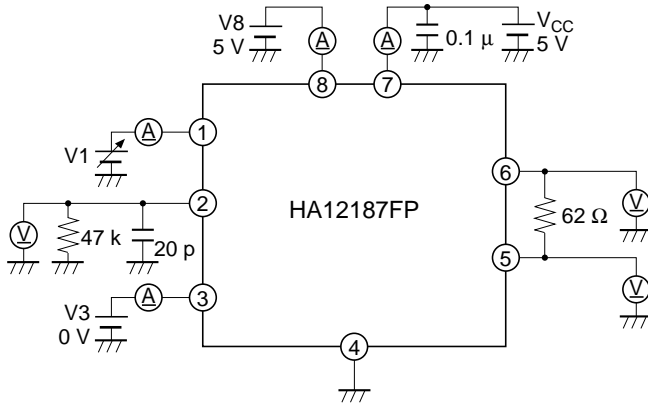
HA12187FP

Electrical Characteristics ($V_{CC} = 5.0 \text{ V}$, $T_a = 25^\circ\text{C}$) (cont)

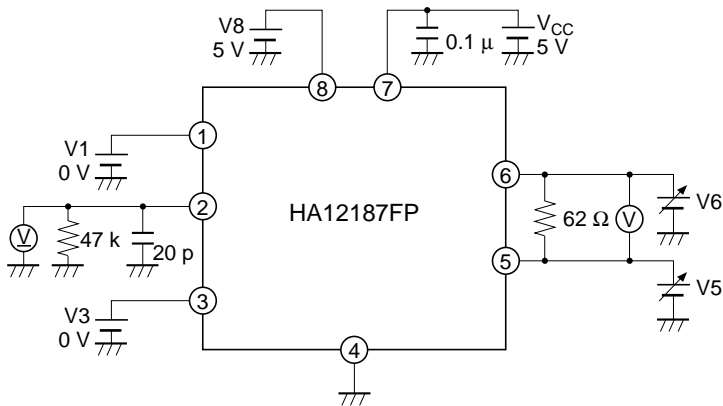
Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Pin	Test Circuit
Receiver High-level input voltage (1)	V_{IH1}	—	80	120	mV	$V_6 = 0 \rightarrow 5 \text{ V}$, pin 2 = 4 V or more, $V_1 = 0 \text{ V}$, $V_3 = 0 \text{ V}$, $V_5 = V_{OP-}$, $V_{IH1} = V_6 - V_5$	2	Figure 2
Low-level input voltage (1)	V_{IL1}	20	45	—	mV	$V_6 = 5 \rightarrow 0 \text{ V}$, pin 2 = 1 V or less, $V_1 = 0 \text{ V}$, $V_3 = 0 \text{ V}$, $V_5 = V_{OP-}$, $V_{IL1} = V_6 - V_5$	2	Figure 2
Input hysteresis voltage (1)	V_{IHYS1}	10	35	60	mV	$V_{IHYS1} = V_{IH1} - V_{IL1}$		
High-level common-mode input voltage	V_{IHCOM}	4.5	—	—	V	$V_5 = 0 \rightarrow 5 \text{ V}$, pin 2 = 4 V or more, $V_1 = 0 \text{ V}$, $V_3 = 0 \text{ V}$, $V_6 - V_5 = 120 \text{ mV}$	5	Figure 2
Low-level common-mode input voltage	V_{ILCOM}	5	—	—	V	$V_5 = 0 \rightarrow 5 \text{ V}$, pin 2 = 1 V or less, $V_1 = 0 \text{ V}$, $V_3 = 0 \text{ V}$, $V_6 - V_5 = 20 \text{ mV}$	5	Figure 2
Receiver input resistance*1	RI	25	35	45	k Ω	$V_1 = 0 \text{ V}$, $RI = \frac{0.6 \text{ V}}{I_1 - I_2}$	5, 6	Figure 3
High-level output voltage	V_{OH}	4.5	—	—	V	$V_1 = 5 \text{ V}$, $V_3 = 0 \text{ V}$	2	Figure 1
Low-level output voltage	V_{OL}	—	—	1.0	V	$V_1 = 0 \text{ V}$, $V_3 = 0 \text{ V}$	2	Figure 1
Power supply off output leakage current	I_{OLEAK}	—	—	1	μA	V_{CC} off, $V_8 = 0 \text{ V}$, $V_6 = 5 \text{ V}$, $V_1 = 0 \text{ V}$, $V_3 = 0 \text{ V}$, SW1 on	5, 6	Figure 4
STB on voltage	VSTBon	—	—	1.5	V	$V_8 = 5 \rightarrow 0 \text{ V}$, $V_1 = 5 \text{ V}$, V_8 when $I_{CC} \leq 20 \mu\text{A}$	7	Figure 4
STB off voltage	VSTBoff	3.5	—	—	V	$V_8 = 0 \rightarrow 5 \text{ V}$, $V_1 = 5 \text{ V}$, V_8 when $I_{CC} \geq 4.5 \text{ mA}$	7	Figure 4
Standby mode current drain	I_{CCstb}	—	10	20	μA	$V_1 = 5 \text{ V}$, $V_3 = 0 \text{ V}$, $V_8 = 0 \text{ V}$	7	Figure 4
Standby mode leakage current	Istb-Leak	—	—	1	μA	$V_1 = 5 \text{ V}$, $V_3 = 0 \text{ V}$, $V_8 = 0 \text{ V}$, $V_6 = 5 \text{ V}$, SW1 on	5, 6	Figure 4
Delay time (L \rightarrow H)	DLY1	—	600	800	nS	See the operating waveform figure	2	Figure 5
Delay time (H \rightarrow L)	DLY2	—	450	800	nS	See the operating waveform figure	2	Figure 5

Note: 1. I_1 is the measured current when $V_6 = (V_{OP+}) + 0.3 \text{ V}$, and I_2 is the measured current when $V_6 = (V_{OP+}) - 0.3 \text{ V}$.

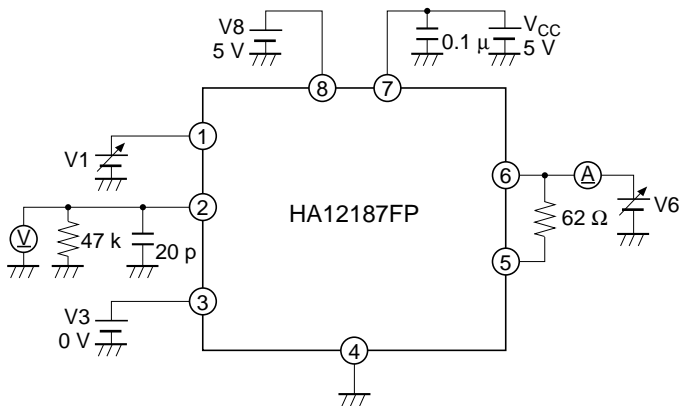
Test Circuits



Test Circuit 1

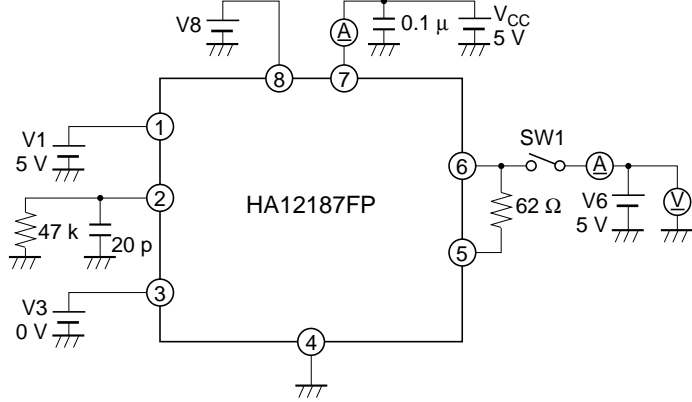


Test Circuit 2

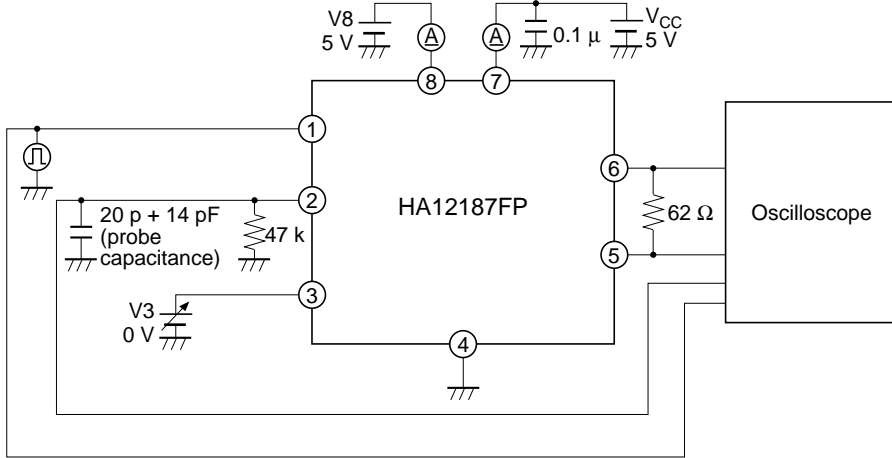


Test Circuit 3

HA12187FP

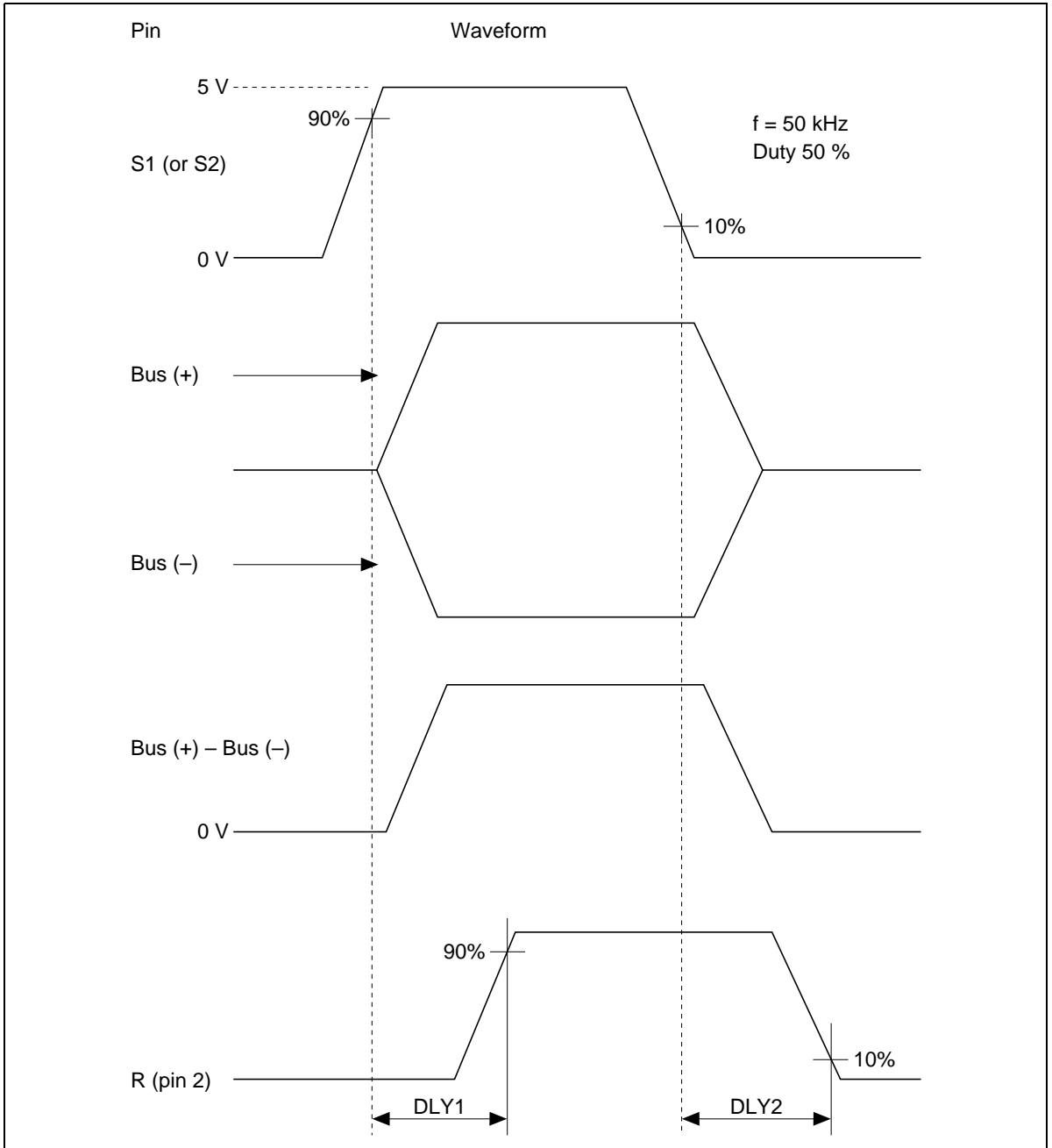


Test Circuit 4

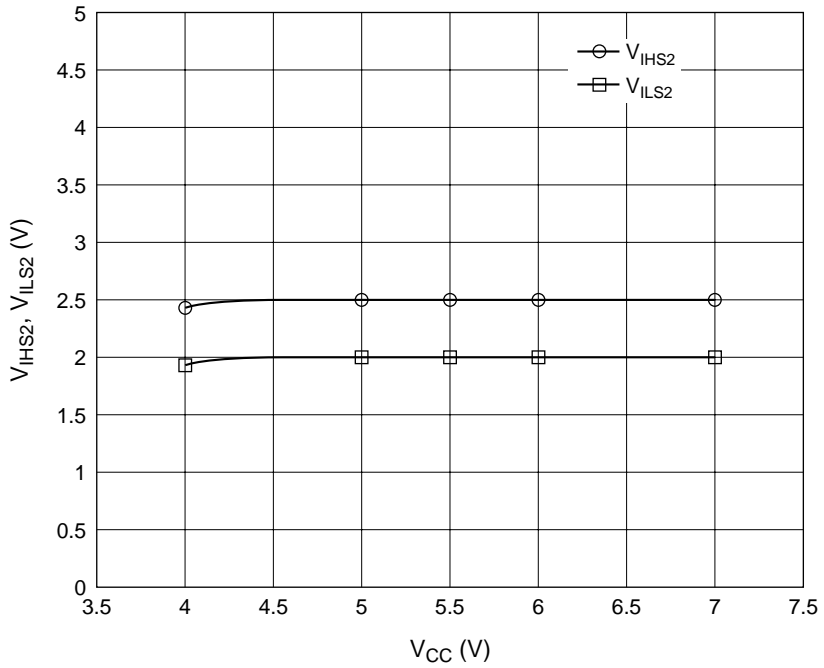
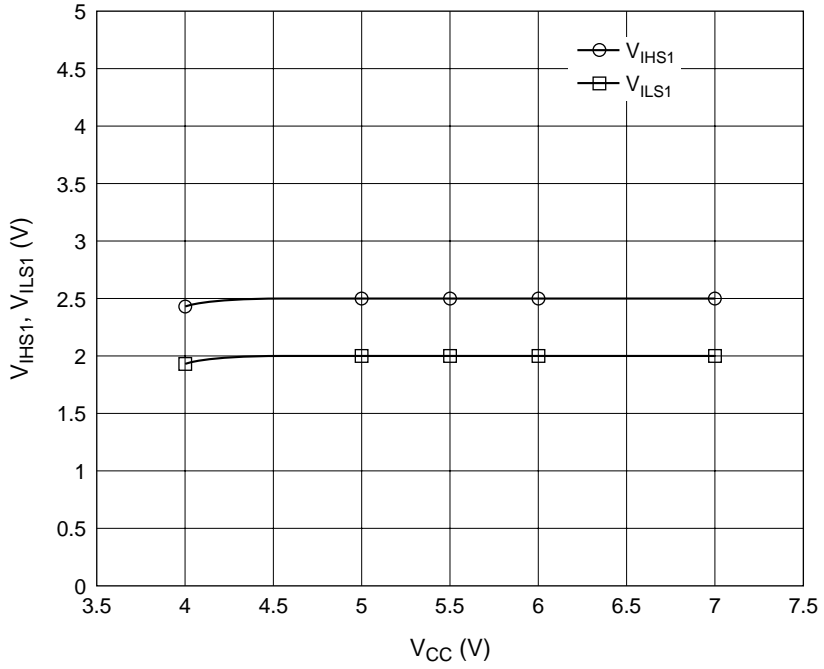


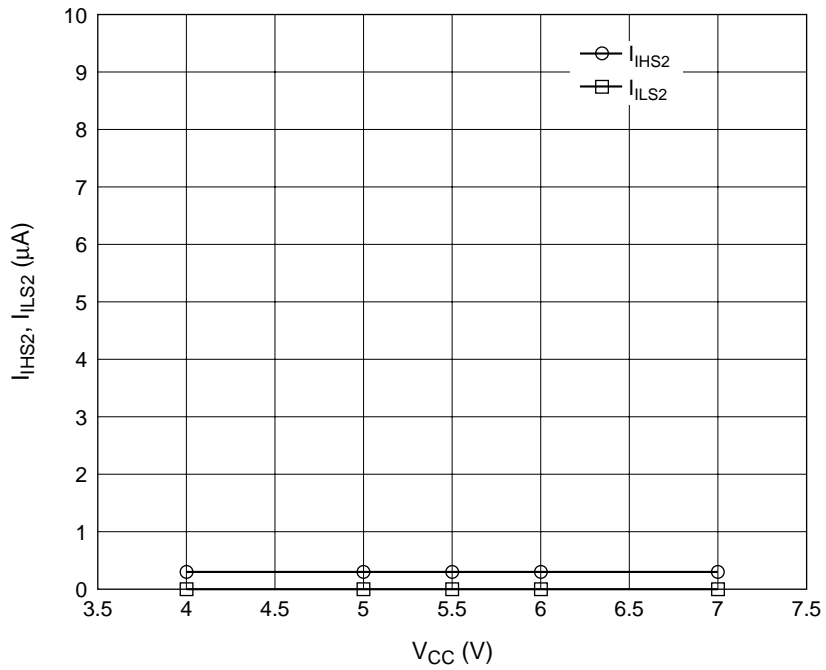
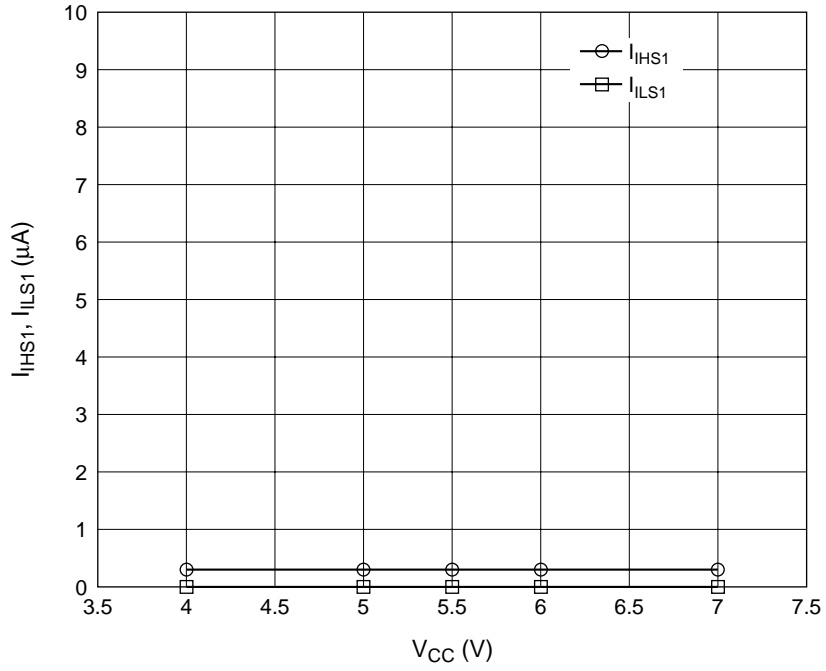
Test Circuit 5

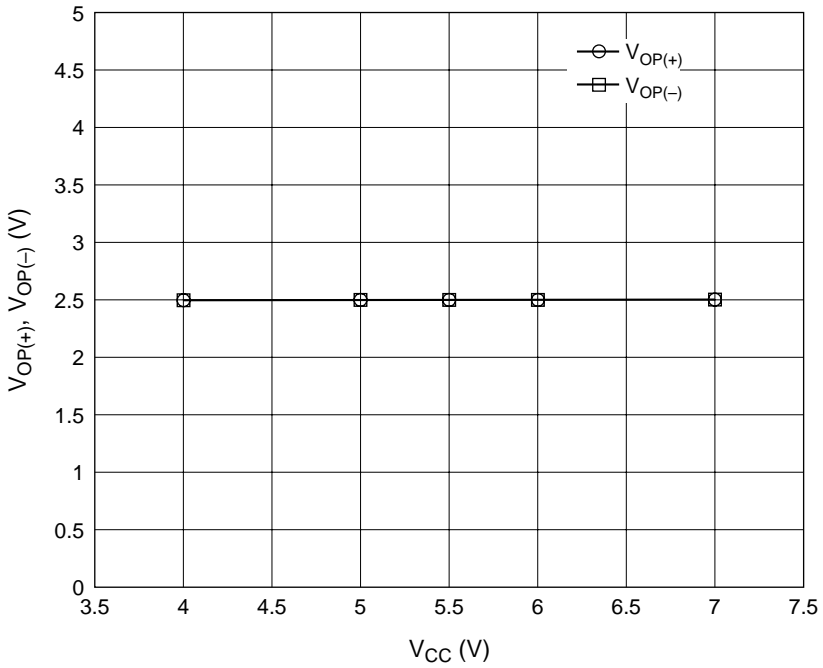
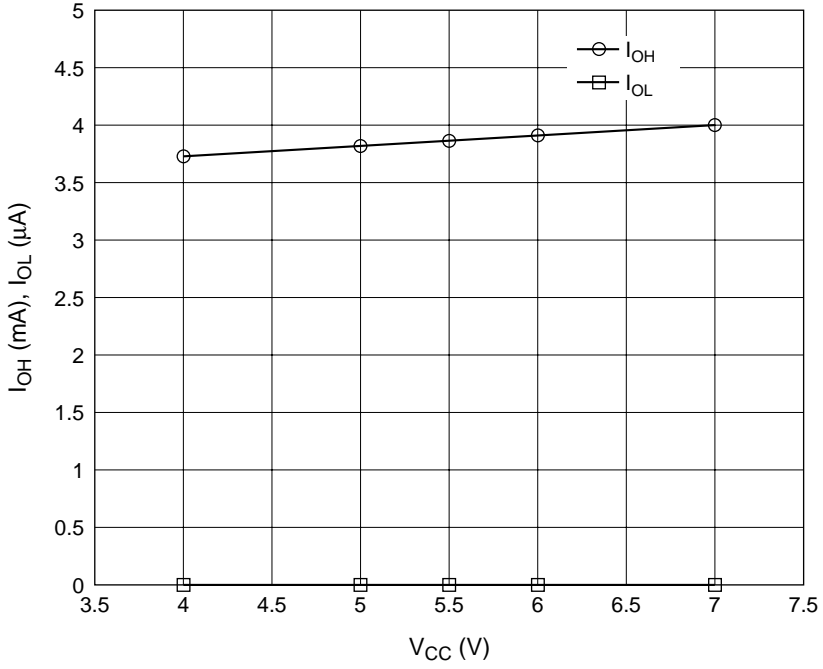
Operating Waveforms

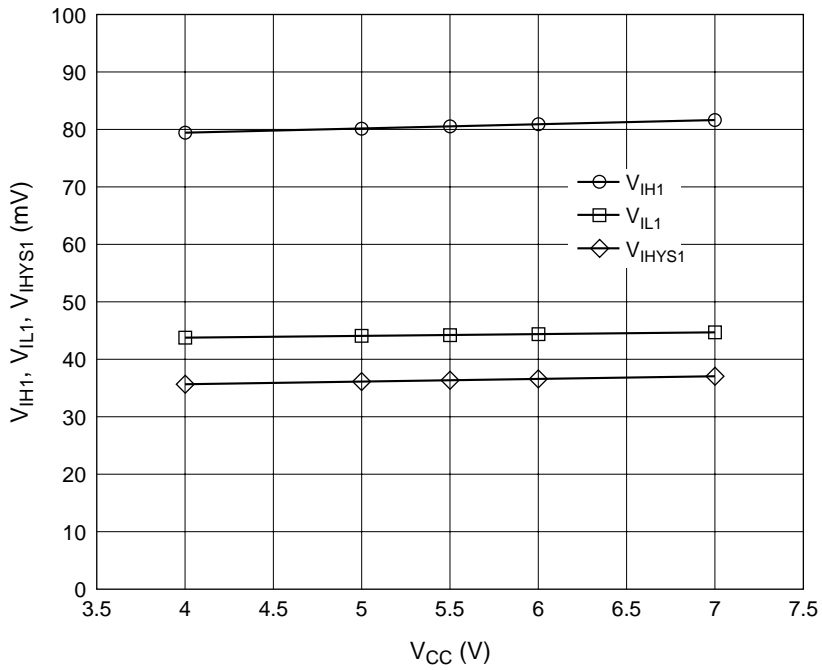
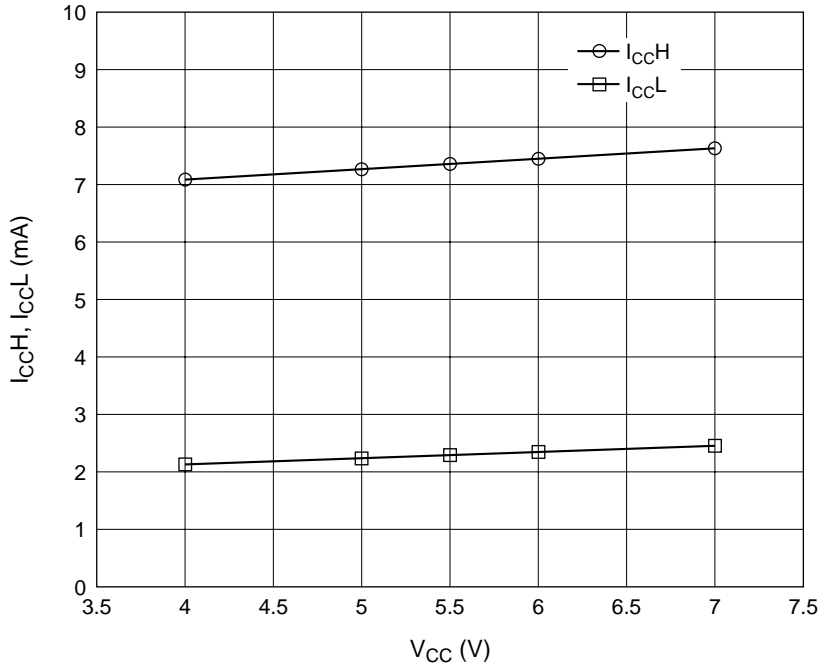


Main Characteristics

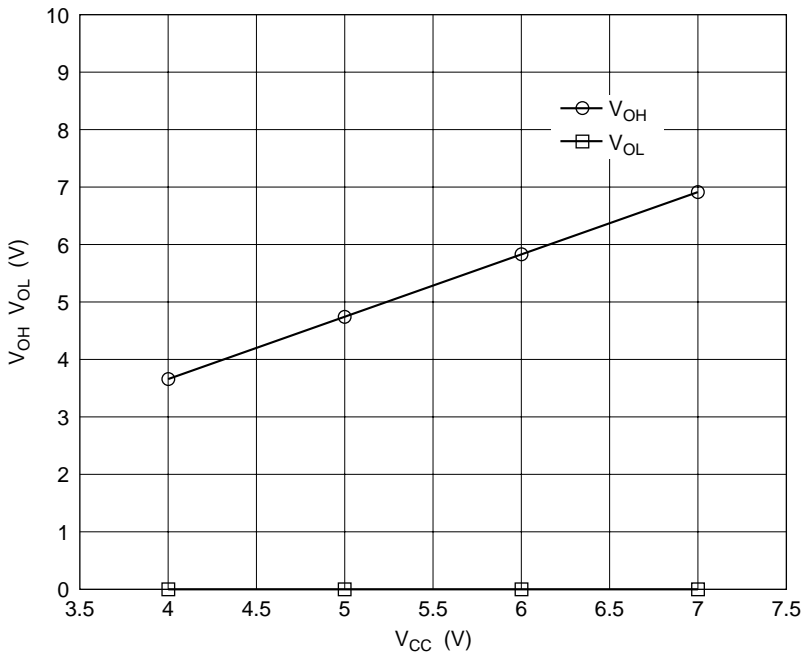
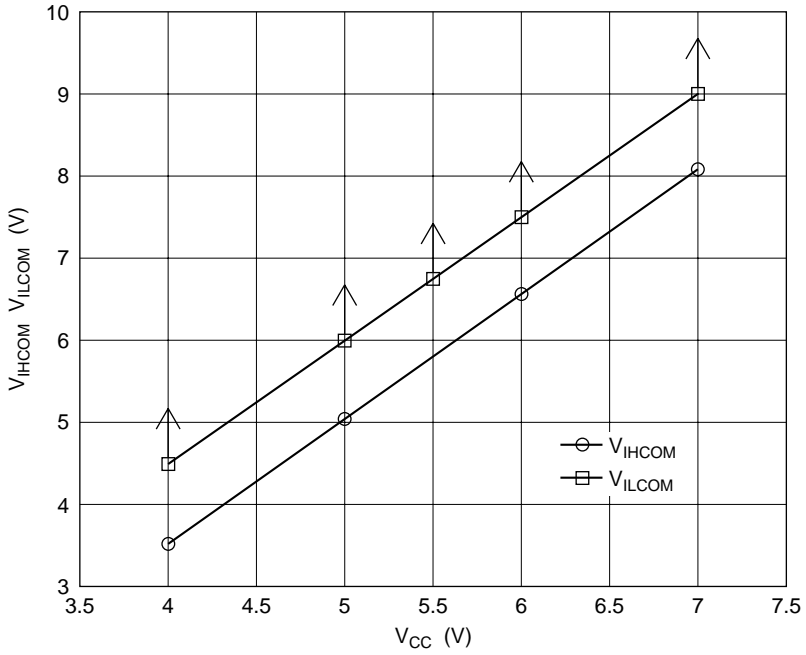


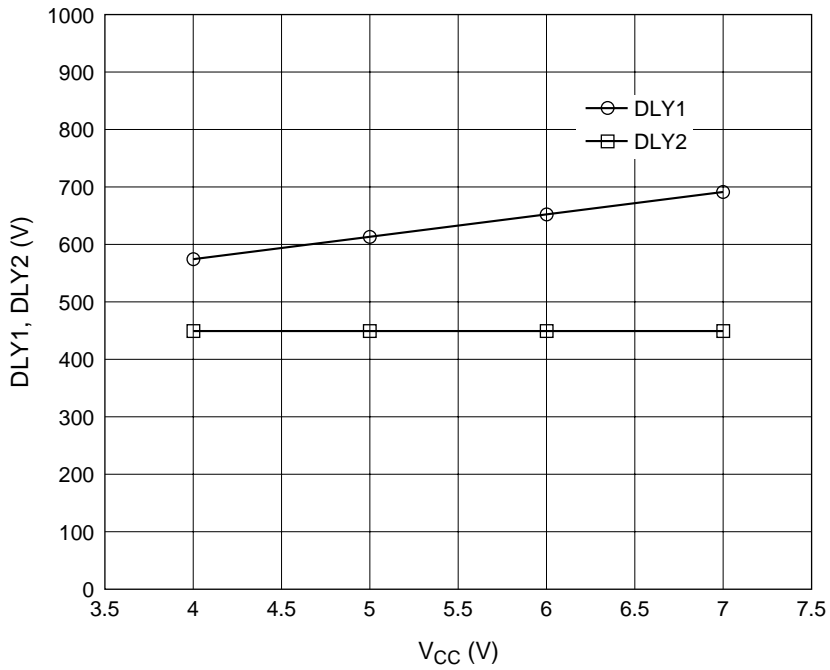
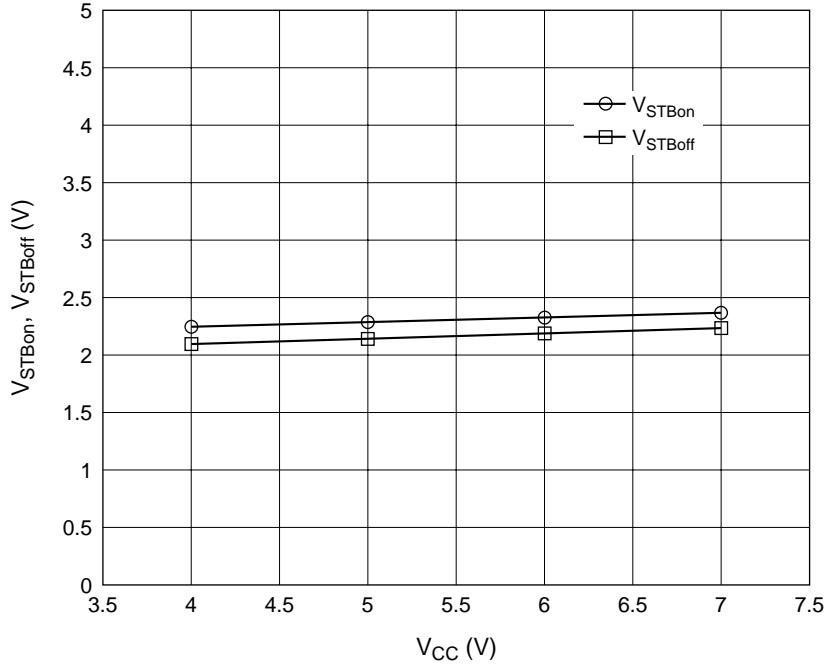


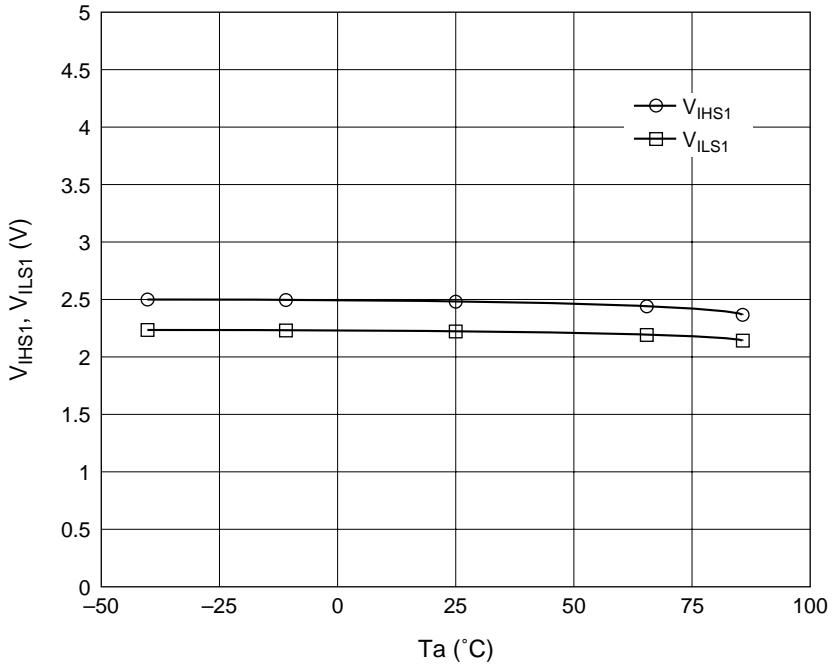
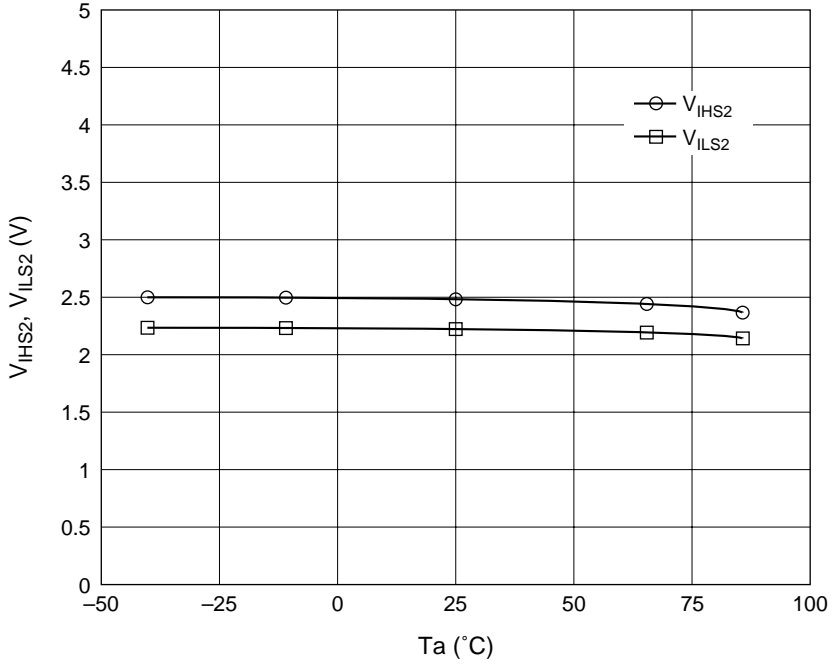


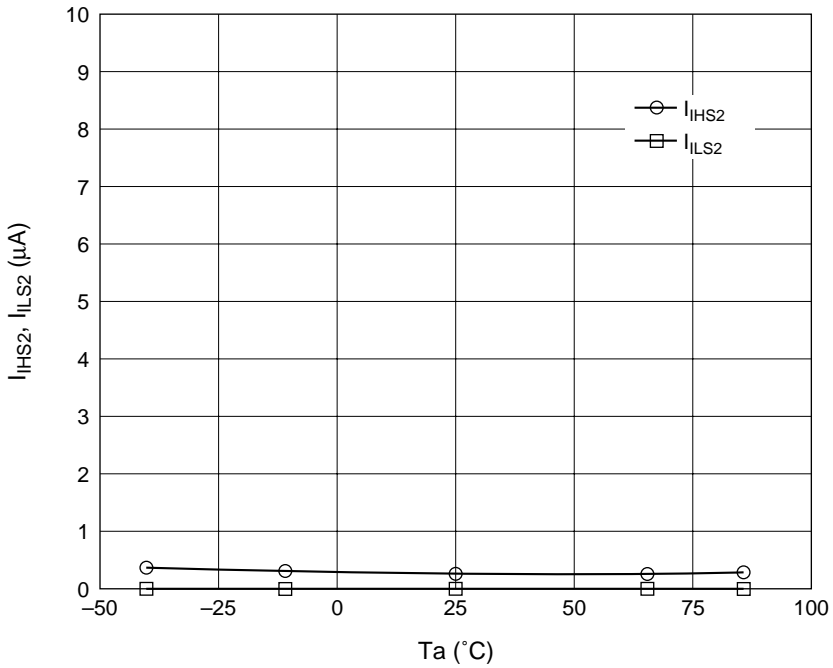
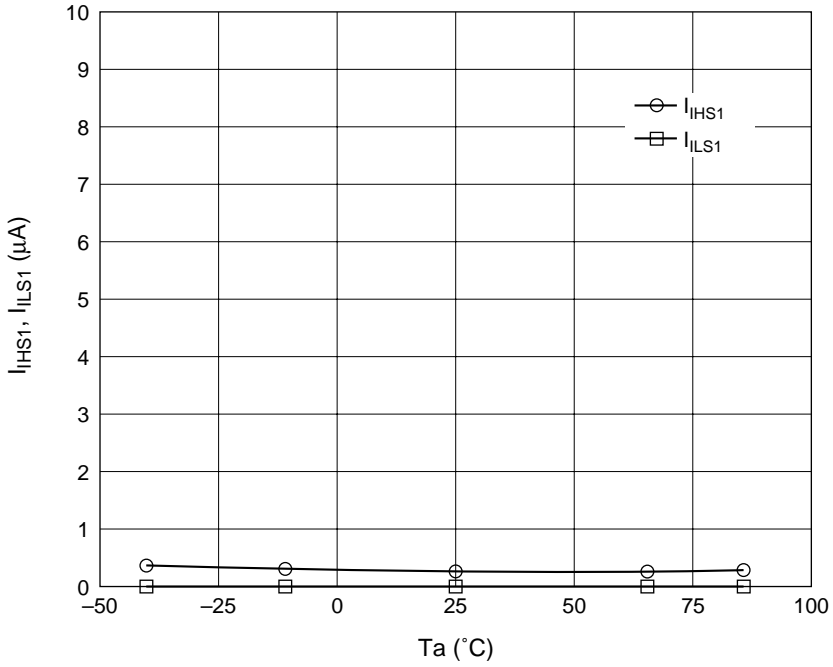


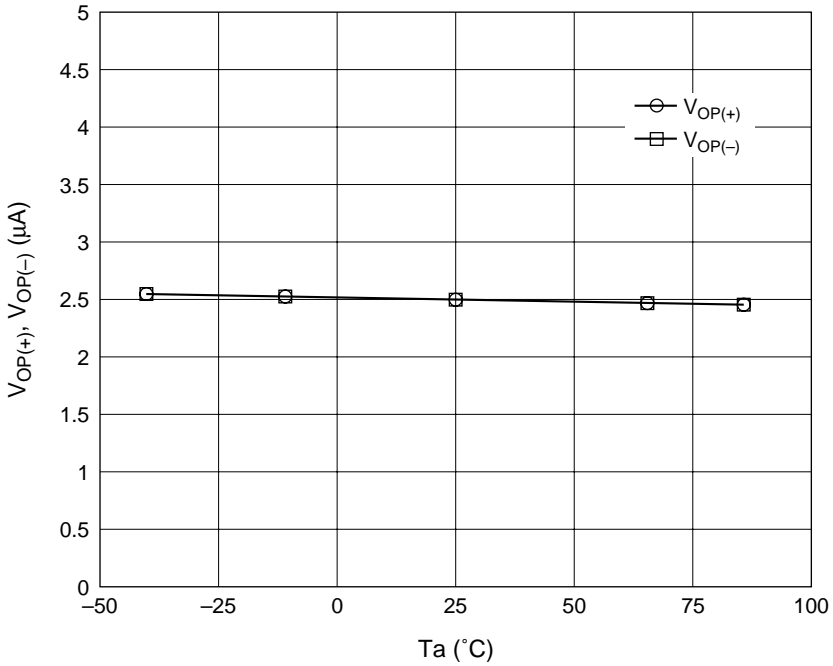
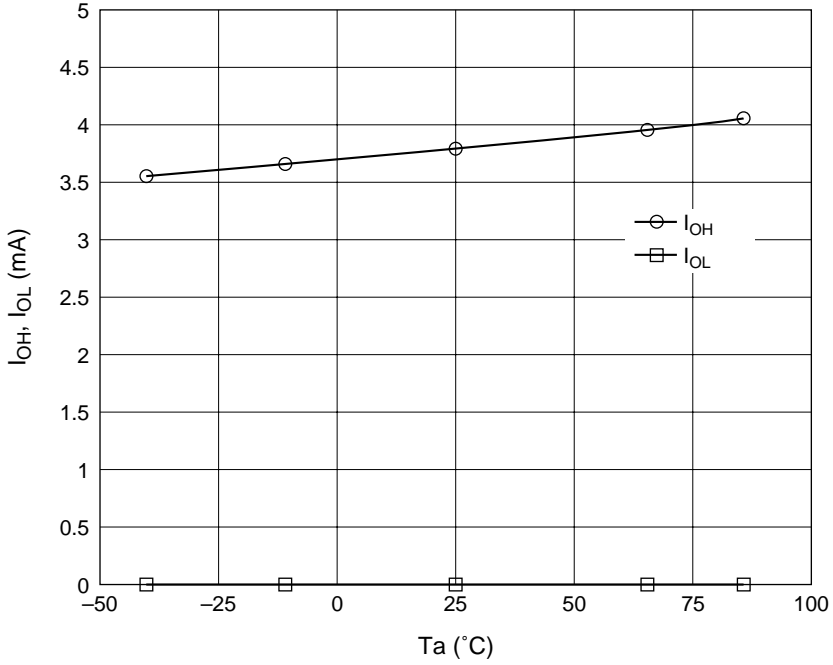
HA12187FP

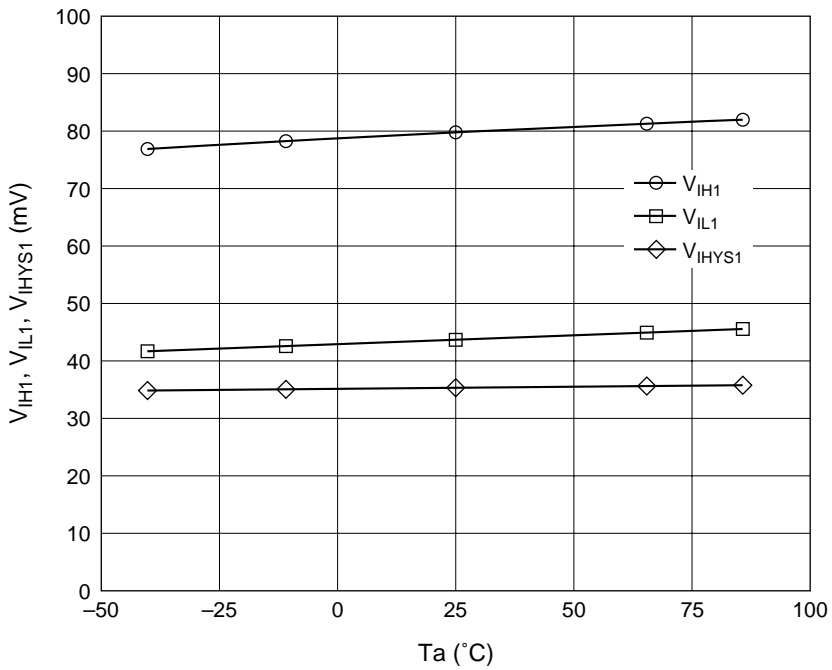
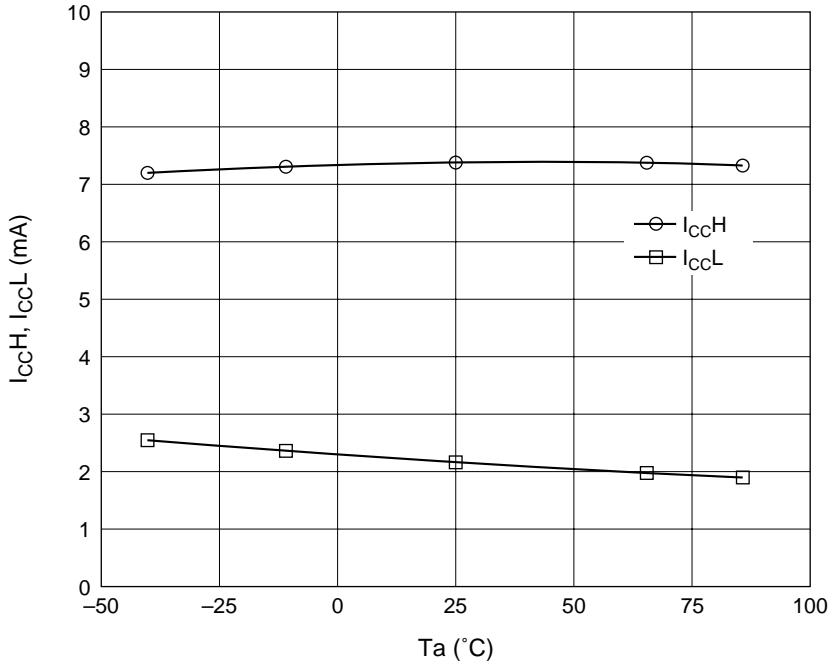


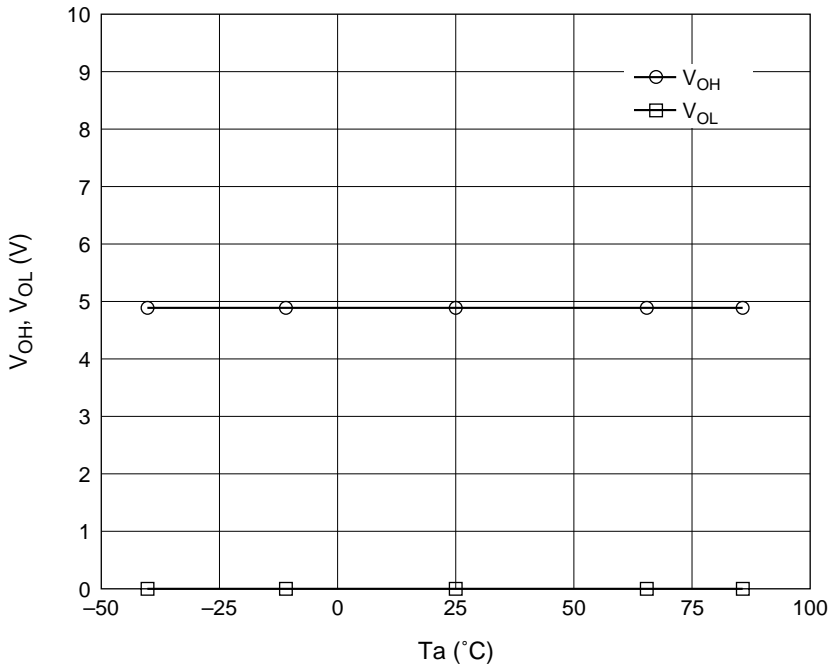
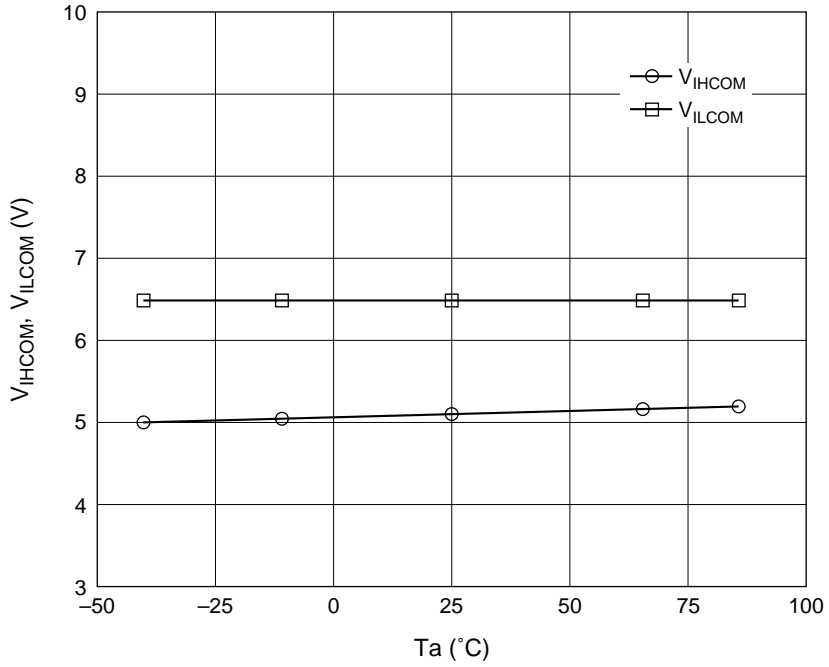


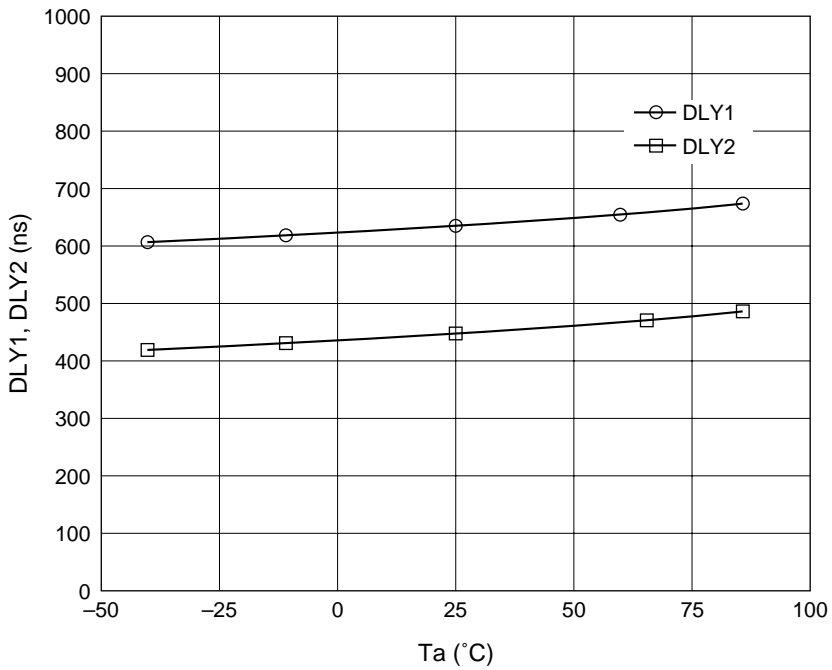
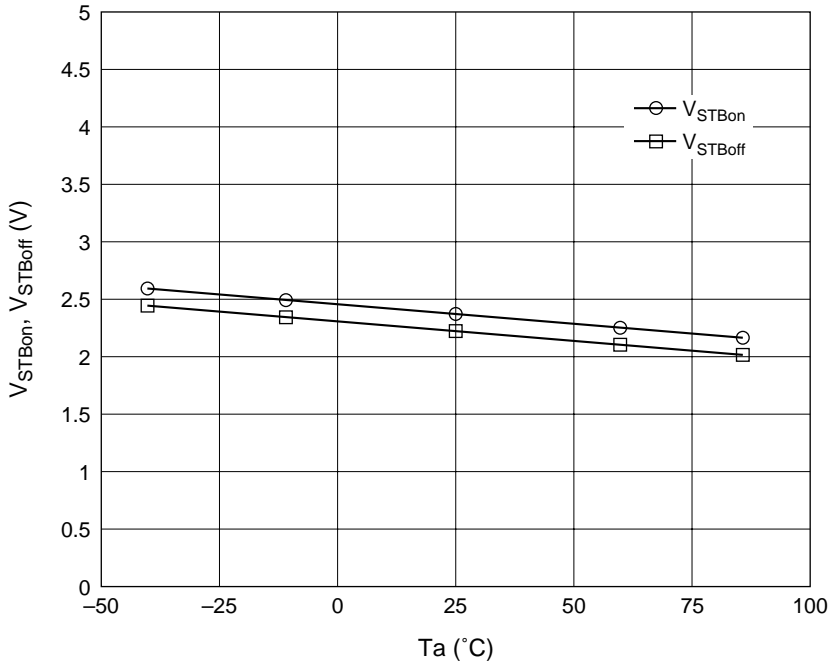








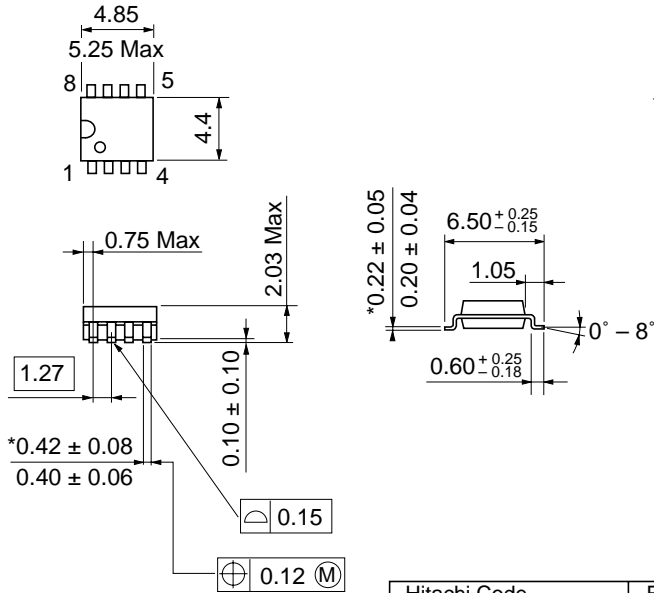




HA12187FP

Package Dimensions

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-8D
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.10 g

Disclaimer

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

Sales Offices

HITACHI

Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL NorthAmerica : <http://semiconductor.hitachi.com/>
 Europe : <http://www.hitachi-eu.com/hel/ecg>
 Asia : <http://sicapac.hitachi-asia.com>
 Japan : <http://www.hitachi.co.jp/Sicd/indx.htm>

For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose, CA 95134
Tel: <1>(408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic Components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585160

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00,
Singapore 049318
Tel : <65>-538-6533/538-8577
Fax : <65>-538-6933/538-3877
URL : <http://www.hitachi.com.sg>

Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road,
Hung-Kuo Building,
Taipei (105), Taiwan
Tel : <886>-(2)-2718-3666
Fax : <886>-(2)-2718-8180
Telex : 23222 HAS-TP
URL : <http://www.hitachi.com.tw>

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower,
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon,
Hong Kong
Tel : <852>-(2)-735-9218
Fax : <852>-(2)-730-0281
URL : <http://www.hitachi.com.hk>

Copyright © Hitachi, Ltd., 2000. All rights reserved. Printed in Japan.
Colophon 2.0