

# HA1631D01/02/03/04 Series

## Dual CMOS Comparator (Push Pull/Open Drain Output)

REJ03D0804-0200

Rev.2.00

Nov 20, 2006

### Description

The HA1631D01/02/03/04 are low power dual CMOS Comparator featuring low voltage operation with typical current supply of 10  $\mu$ A/100  $\mu$ A. They are designed to operate from a single power supply and have push-pull full swing outputs that allow direct connections to logic devices. The Open Drain version HA1631D03/04 enable Output Level shifting through external pull up resistors. Available in MMPAK-8 and TSSOP-8 package.

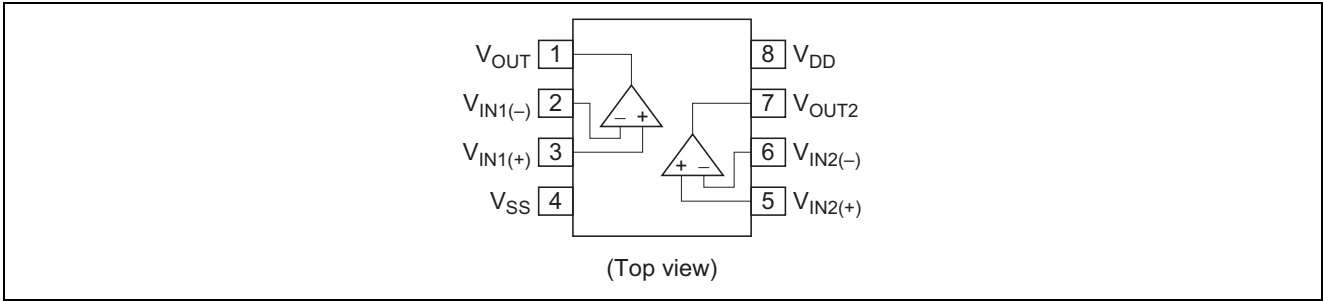
### Features

- Low supply current  
 HA1631D01/03 :  $I_{DDtyp} = 5 \mu A$  (per comparators)  
 HA1631D02/04 :  $I_{DDtyp} = 50 \mu A$  (per comparators)
- Low voltage operation :  $V_{DD} = 1.8$  to  $5.5$  V
- Low input offset voltage :  $V_{IOmax} = 5$  mV
- Low input bias current :  $I_{IBtyp} = 1$  pA
- Maximum output voltage :  $V_{OHmin} = 2.9$  V (at  $V_{DD} = 3.0$  V)
- Input common voltage range includes ground
- On-chip ESD protection
- Available in MMPAK-8, TSSOP-8 package using Pb free lead frame

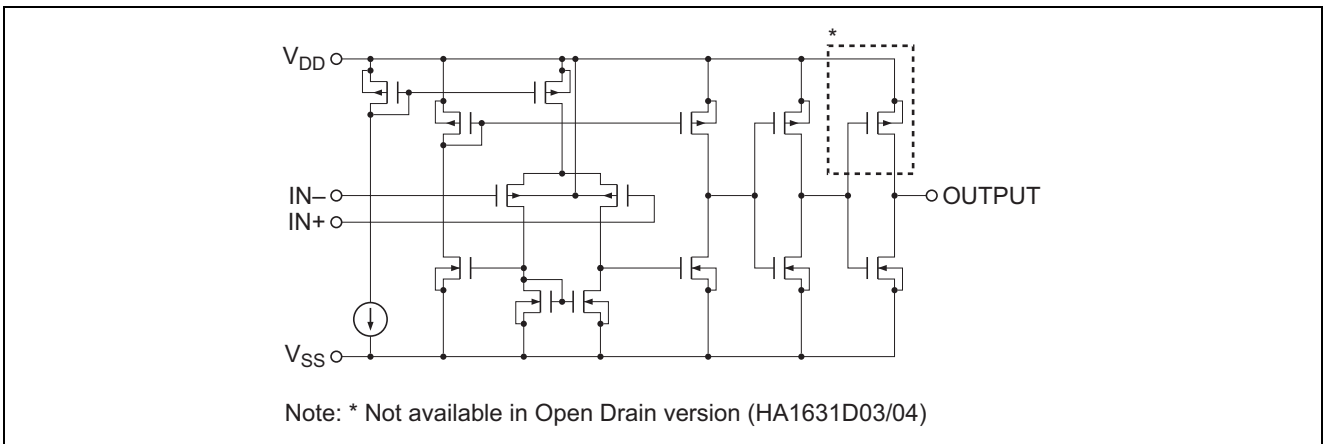
### Ordering Information

| Type No.    | Package Name | Package Code |
|-------------|--------------|--------------|
| HA1631D01T  | TTP-8DAV     | PTSP0008JC-B |
| HA1631D02T  |              |              |
| HA1631D03T  |              |              |
| HA1631D04T  |              |              |
| HA1631D01MM | MMPAK-8      | PLSP0008JC-A |
| HA1631D02MM |              |              |
| HA1631D03MM |              |              |
| HA1631D04MM |              |              |

## Pin Arrangement



## Equivalent Circuit (1/2)



## Absolute Maximum Ratings

(Ta = 25°C)

| Item                       | Symbol                | Ratings                              | Unit | Remarks |
|----------------------------|-----------------------|--------------------------------------|------|---------|
| Supply voltage             | V <sub>DD</sub>       | 7.0                                  | V    |         |
| Differential input voltage | V <sub>IN(diff)</sub> | -V <sub>DD</sub> to +V <sub>DD</sub> | V    | Note 1  |
| Input voltage              | V <sub>IN</sub>       | -0.1 to +V <sub>DD</sub>             | V    |         |
| Output current             | I <sub>OUT</sub>      | 28                                   | mA   | Note 2  |
| Power dissipation          | P <sub>T</sub>        | 192                                  | mW   | TSSOP-8 |
| Operating temperature      | T <sub>opr</sub>      | -40 to +85                           | °C   |         |
| Storage temperature        | T <sub>stg</sub>      | -55 to +125                          | °C   |         |

- Notes: 1. Do not apply input voltage exceeding V<sub>DD</sub> or 7 V.  
2. The maximum output current is the maximum allowable value for continuous operation.

## Electrical Characteristics

(Ta = 25°C, V<sub>DD</sub> = 3.0 V, V<sub>SS</sub> = 0 V)

| Item  | Symbol               | Min                  | Typ | Max    | Unit | Test Conditions   |  |
|---|----------------------|----------------------|-----|--------|------|---|--|
| Input offset voltage                              | V <sub>IO</sub>      | —                    | —   | 5      | mV   | V <sub>IN</sub> = V <sub>DD</sub> /2, R <sub>L</sub> = 1 MΩ             |  |
| Input bias current                                | I <sub>IB</sub>      | —                    | (1) | —      | pA   | V <sub>IN</sub> = V <sub>DD</sub> /2                                    |  |
| Input offset current                              | I <sub>IO</sub>      | —                    | (1) | —      | pA   | V <sub>IN</sub> = V <sub>DD</sub> /2                                    |  |
| Common mode input voltage range                   | V <sub>CM</sub>      | -0.1                 | —   | 2.1    | V    |   |  |
| Supply current                                    | HA1631D01/03         | I <sub>DD</sub>      | —   | 10     | 20   | μA  | V <sub>DD</sub> = 3 V, V <sub>IN+</sub> = 1 V,<br>V <sub>IN-</sub> = 0 V |
|   | HA1631D02/04         |                      | —   | 100    | 200  | μA  |  |
| Response time                                     | HA1631D01            | TP <sub>LH</sub>     | —   | (1.20) | —    | μs  | 1 V DC bias,<br>100 mV overdrive,<br>C <sub>L</sub> = 15 pF              |
|   | HA1631D01/03         | TP <sub>HL</sub>     | —   | (0.55) | —    | μs  |  |
|   | HA1631D01            | t <sub>r</sub>       | —   | (24)   | —    | ns  |  |
|   | HA1631D01/03         | t <sub>f</sub>       | —   | (7)    | —    | ns  |  |
|   | HA1631D02            | TP <sub>LH</sub>     | —   | (0.33) | —    | μs  |  |
|   | HA1631D02/04         | TP <sub>HL</sub>     | —   | (0.17) | —    | μs  |  |
|   | HA1631D02            | t <sub>r</sub>       | —   | (12)   | —    | ns  |  |
| Output source current<br>(Only for HA1631D01/02)  | I <sub>OSOURCE</sub> | 6                    | 13  | —      | mA   | V <sub>out</sub> = 2.5 V  |  |
|   |                      | 7                    | 14  | —      | mA   | V <sub>out</sub> = 0.5 V  |  |
| Common mode<br>rejection ratio                    | HA1631D01/03         | CMRR                 | 60  | 80     | —    | dB  | V <sub>IN1</sub> = 0 V, V <sub>IN2</sub> = 2 V                           |
|   | HA1631D02/04         |                      | 50  | 70     | —    | dB  |  |
| Power supply rejection ratio                      | PSRR                 | 60                   | 80  | —      | dB   | V <sub>DD1</sub> = 1.8 V, V <sub>DD2</sub> = 5 V                        |  |
| Output voltage high<br>(Only for HA1631D01/02)    | V <sub>OH</sub>      | V <sub>DD</sub> -0.1 | —   | —      | V    | R <sub>L</sub> = 10 kΩ to V <sub>SS</sub>                               |  |
| Output voltage low                                | V <sub>OL</sub>      | —                    | —   | 0.1    | V    | R <sub>L</sub> = 10 kΩ to V <sub>DD</sub>                               |  |
| Output leakage current<br>(Only for HA1631D03/04) | I <sub>LO</sub>      | —                    | —   | 0.1    | μA   | V <sub>IN+</sub> = 1 V, V <sub>IN-</sub> = 0 V,<br>V <sub>O</sub> = 3 V |  |
| Operating voltage range                           | V <sub>opr</sub>     | 1.8                  | —   | 5.5    | V    |   |  |

Note: ( ): Design specification

## Table of Graphs

| Electrical Characteristics      |                |  | HA1631D01<br>Figure | HA1631D02<br>Figure | HA1631D03<br>Figure | HA1631D04<br>Figure | Test<br>Circuit No. |
|---------------------------------|----------------|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Supply current                  | $I_{DD}$       | vs. Supply voltage(Out H)                  | 1-1                 | 2-1                 | 3-1                 | 4-1                 | 1                   |
|                                 |                | vs. Supply voltage(Out L)                  | 1-2                 | 2-2                 | 3-2                 | 4-2                 | 2                   |
|                                 |                | vs. Temperature(Out H)                     | 1-3                 | 2-3                 | 3-3                 | 4-3                 | 1                   |
|                                 |                | vs. Frequency(Out H)                       | 1-26                | 2-26                | 3-20                | 4-20                | 15                  |
| Output high voltage             | $V_{OH}$       | vs. Rload                                  | 1-19                | 2-19                | —                   | —                   | 4                   |
| Output source current           | $I_{SOURCE}$   | vs. Output high voltage                    | 1-4                 | 2-4                 | —                   | —                   | 3                   |
| Output low voltage              | $V_{OL}$       | vs. Rload                                  | 1-18                | 2-18                | 3-15                | 4-15                | 6                   |
| Output sink current             | $I_{SINK}$     | vs. Output low voltage                     | 1-5                 | 2-5                 | 3-4                 | 4-4                 | 5                   |
| Input offset voltage            | $V_{IO}$       | vs. Supply voltage                         | 1-6                 | 2-6                 | 3-5                 | 4-5                 | 8                   |
|                                 |                | vs. Temperature                            | 1-7                 | 2-7                 | 3-6                 | 4-6                 | 7                   |
| Common mode input voltage range | $V_{CM}$       | vs. Temperature                            | 1-8                 | 2-8                 | 3-7                 | 4-7                 | 9                   |
| Power supply rejection ratio    | PSRR           | vs. Supply voltage                         | 1-9                 | 2-9                 | 3-8                 | 4-8                 | 11                  |
| Common mode rejection ratio     | CMRR           | vs. Input voltage                          | 1-10                | 2-10                | 3-9                 | 4-9                 | 12                  |
| Input bias current              | $I_{IB}$       | vs. Temperature                            | 1-11                | 2-11                | 3-10                | 4-10                | 10                  |
|                                 |                | vs. Input voltage( $V_{DD} = 3\text{ V}$ ) | 1-12                | 2-12                | 3-11                | 4-11                | 10                  |
|                                 |                | vs. Input voltage( $V_{DD} = 7\text{ V}$ ) | 1-13                | 2-13                | 3-12                | 4-12                | 10                  |
| Falling time                    | $t_f$          | vs. Temperature                            | 1-14                | 2-14                | 3-13                | 4-13                | 13                  |
|                                 |                | vs. Cload                                  | 1-16                | 2-16                | 3-14                | 4-14                | 13                  |
|                                 |                | Time waveform                              | 1-21                | 2-21                | 3-16                | 4-16                | 13                  |
| Rising time                     | $t_r$          | vs. Temperature                            | 1-15                | 2-15                | —                   | —                   | 13                  |
|                                 |                | vs. Cload                                  | 1-17                | 2-17                | —                   | —                   | 13                  |
|                                 |                | Time waveform                              | 1-20                | 2-20                | —                   | —                   | 13                  |
| Propagation delay time          | $TP_{LH}$      | Time waveform                              | 1-22                | 2-22                | —                   | —                   | 13                  |
|                                 | $TP_{HL}$      | Time waveform                              | 1-23                | 2-23                | 3-17                | 4-17                | 13                  |
| Cross talk                      | $V_{OUT}(CH1)$ | vs. Input voltage                          | 1-24                | 2-24                | 3-18                | 4-18                | 14                  |
|                                 | $V_{OUT}(CH2)$ | vs. Input voltage                          | 1-25                | 2-25                | 3-19                | 4-19                | 14                  |

Main Characteristics

(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

Figure 1-1 HA1631D01  
Supply Current vs. Supply Voltage  
(Output High)

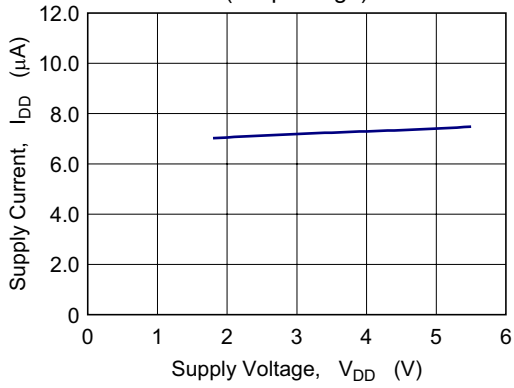


Figure 1-2 HA1631D01  
Supply Current vs. Supply Voltage  
(Output Low)

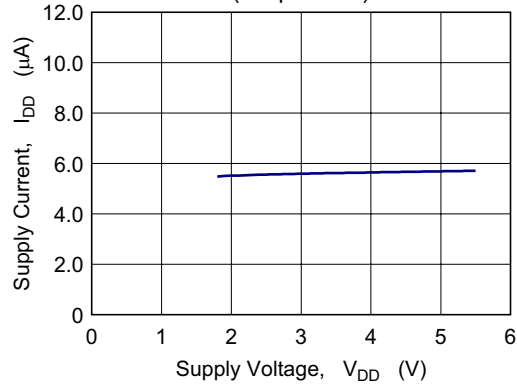


Figure 1-3 HA1631D01  
Supply Current vs. Ambient Temperature

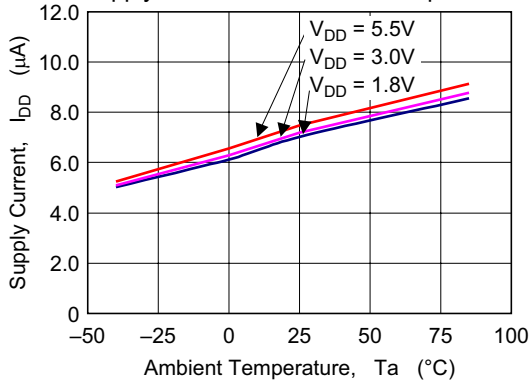


Figure 1-4 HA1631D01  
Output High Voltage vs. Output Source Current

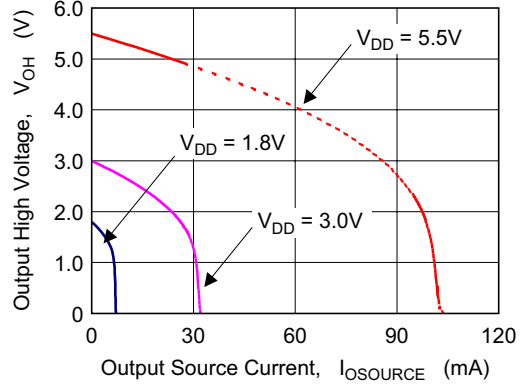


Figure 1-5 HA1631D01  
Output Low Voltage vs. Output Sink Current

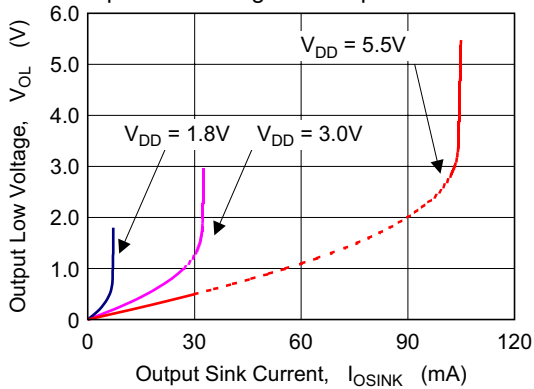
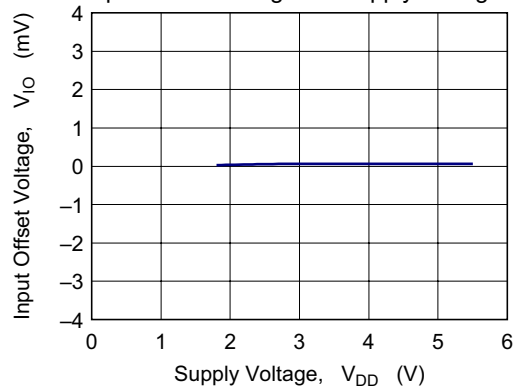
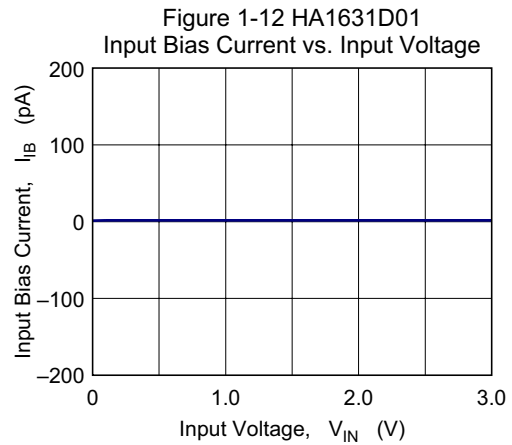
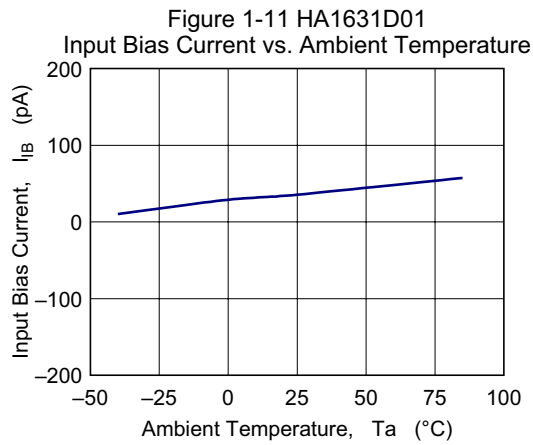
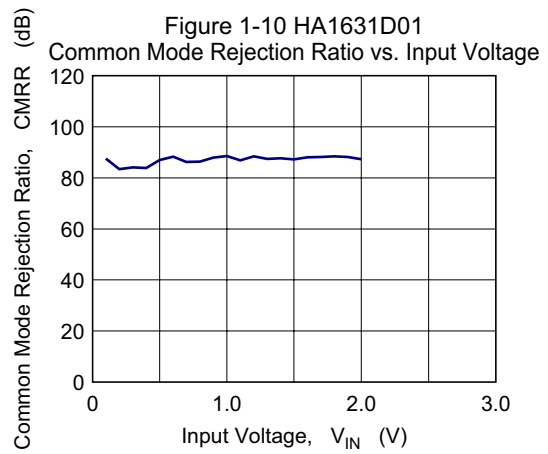
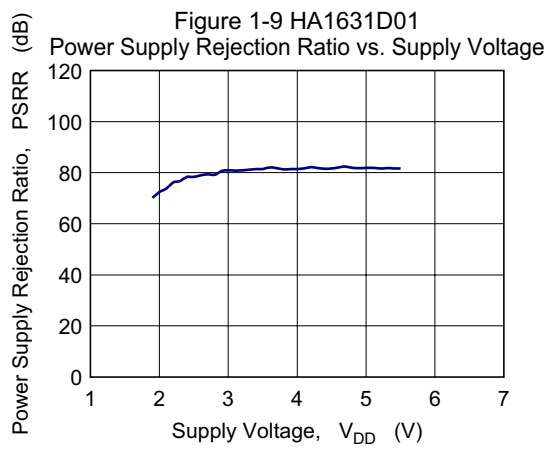
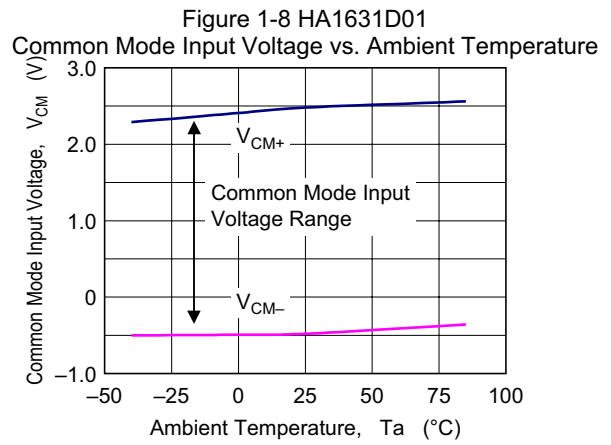
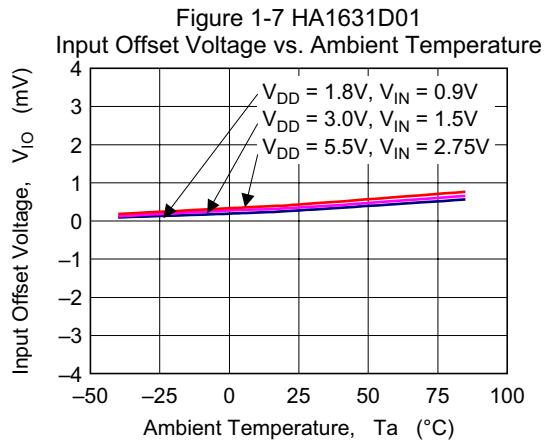


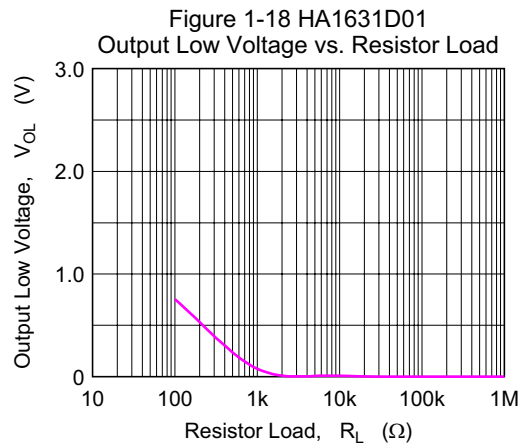
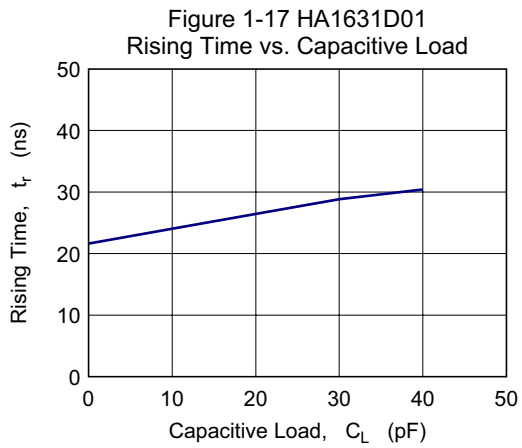
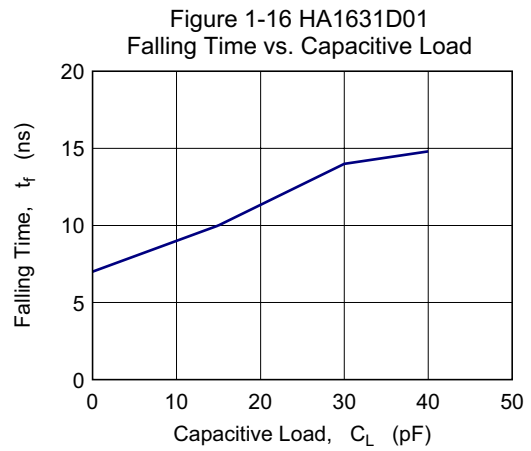
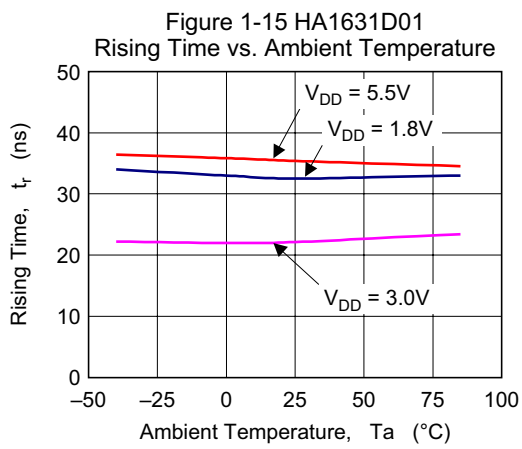
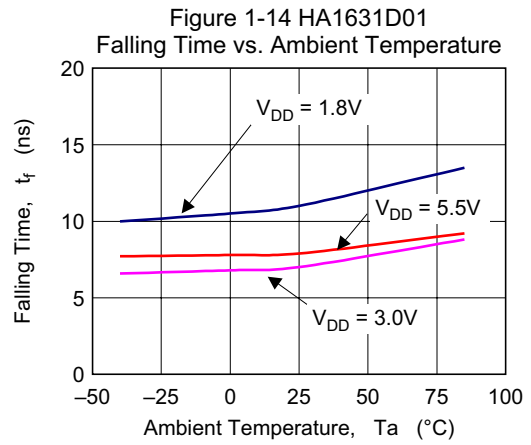
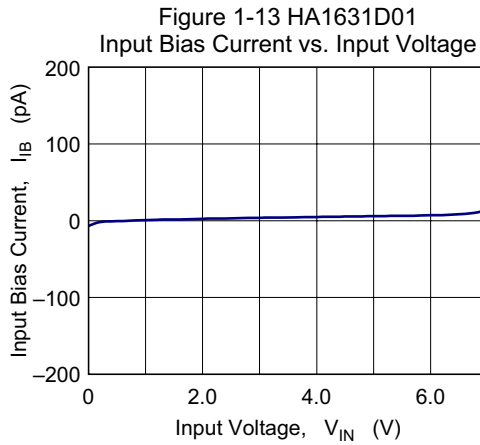
Figure 1-6 HA1631D01  
Input Offset Voltage vs. Supply Voltage



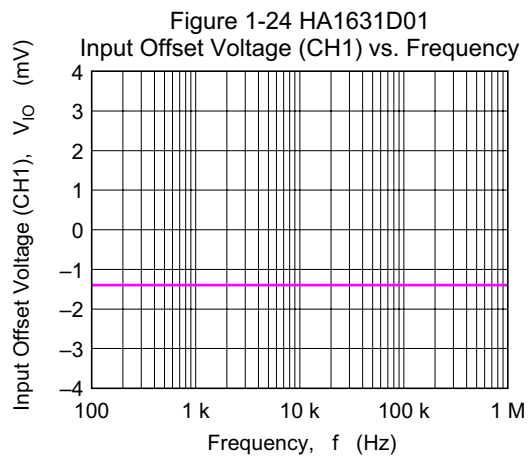
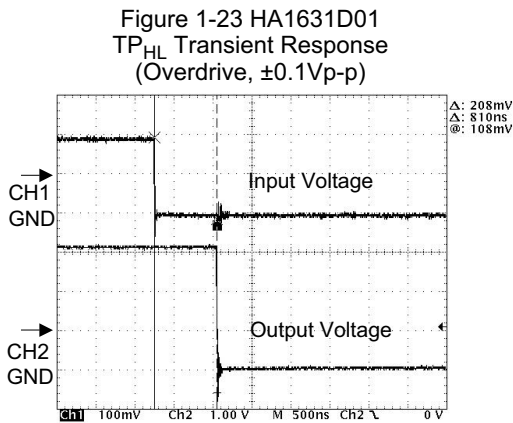
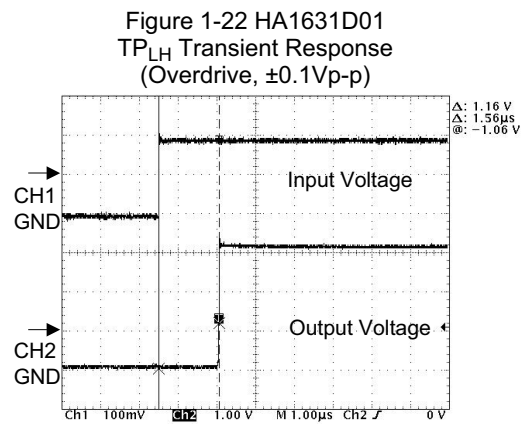
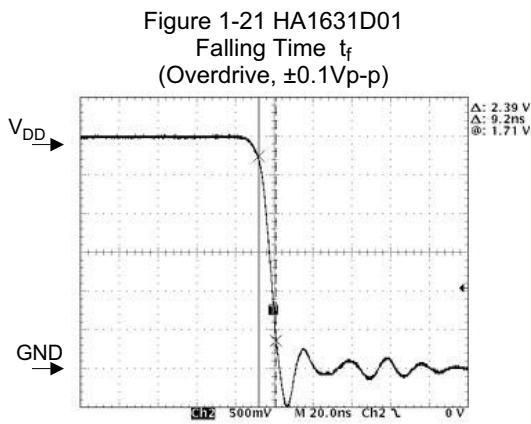
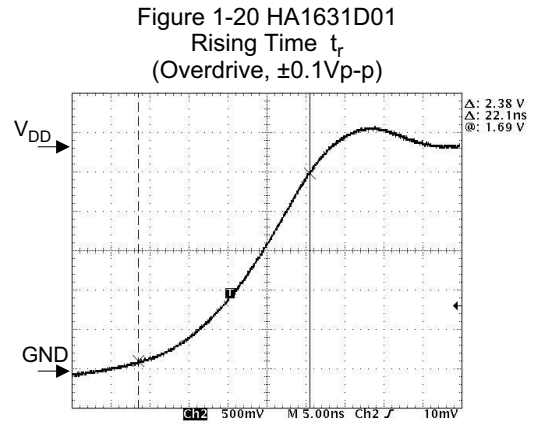
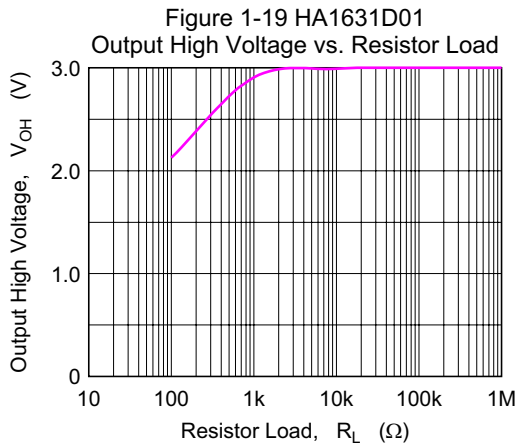
(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

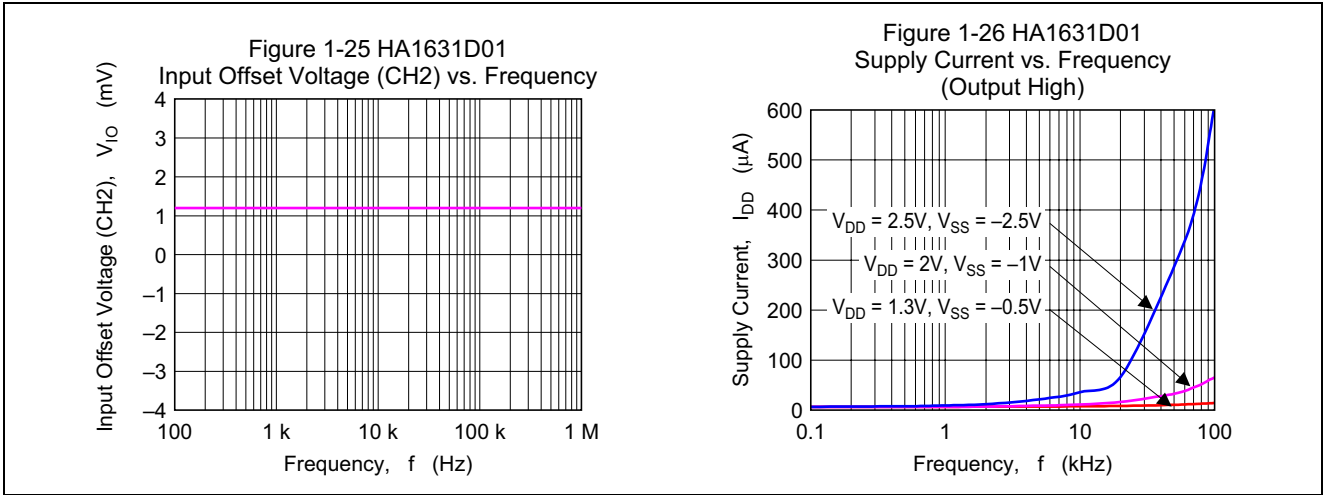


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Figure 2-1 HA1631D02  
Supply Current vs. Supply Voltage  
(Output High)

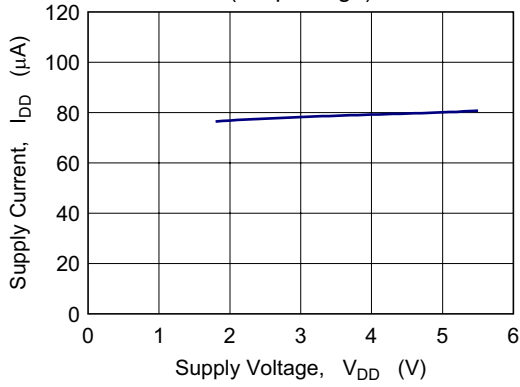


Figure 2-2 HA1631D02  
Supply Current vs. Supply Voltage  
(Output Low)

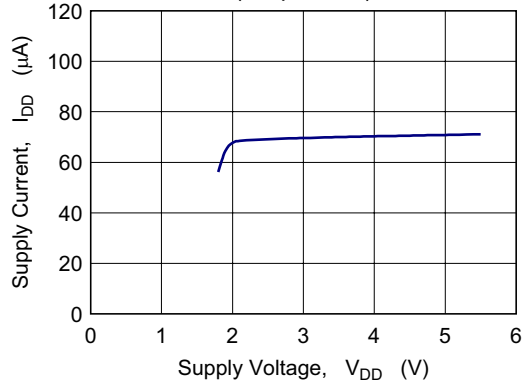


Figure 2-3 HA1631D02  
Supply Current vs. Ambient Temperature

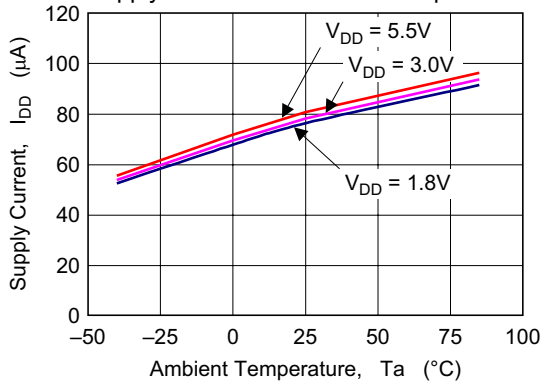


Figure 2-4 HA1631D02  
Output High Voltage vs. Output Source Current

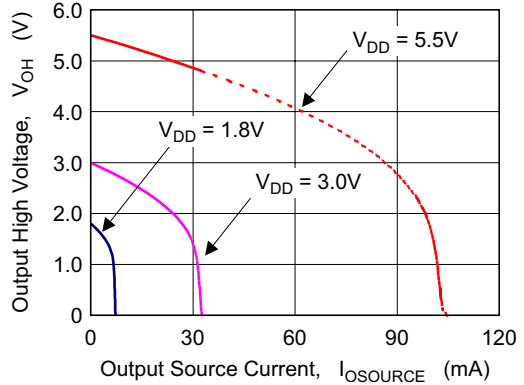


Figure 2-5 HA1631D02  
Output Low Voltage vs. Output Sink Current

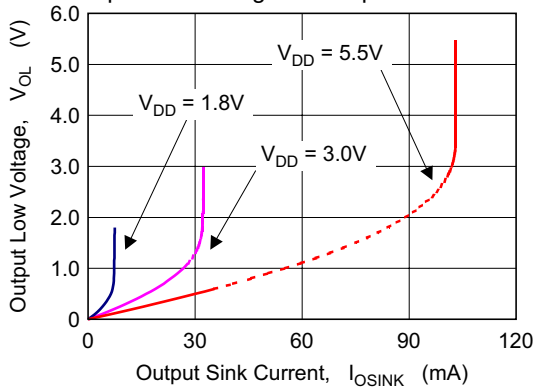
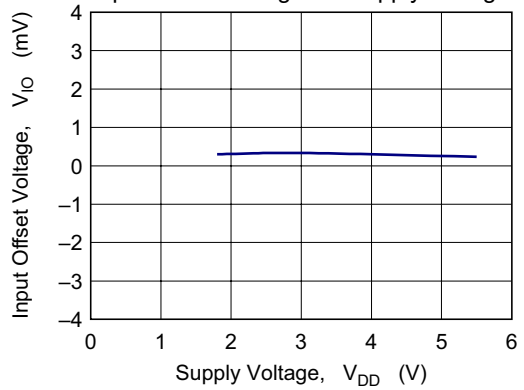
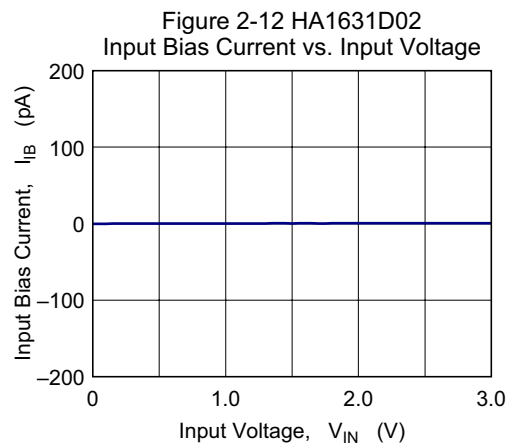
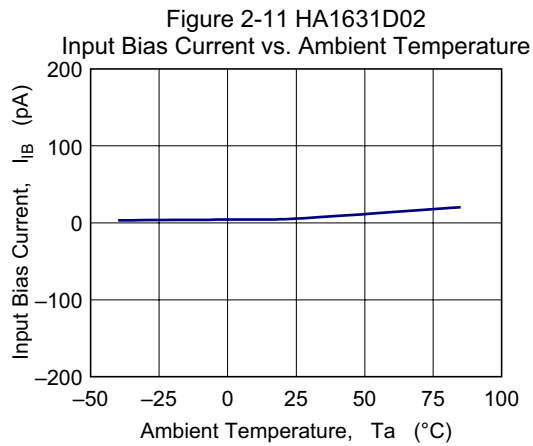
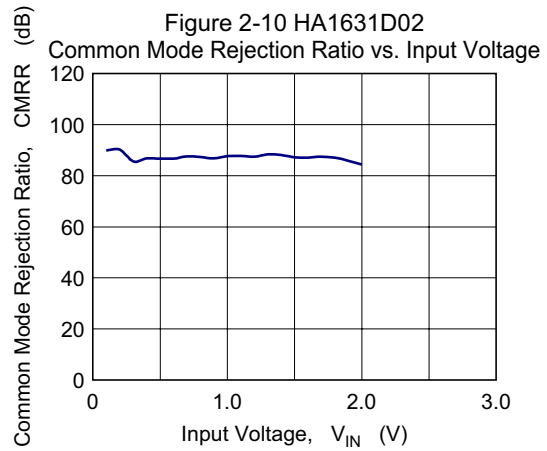
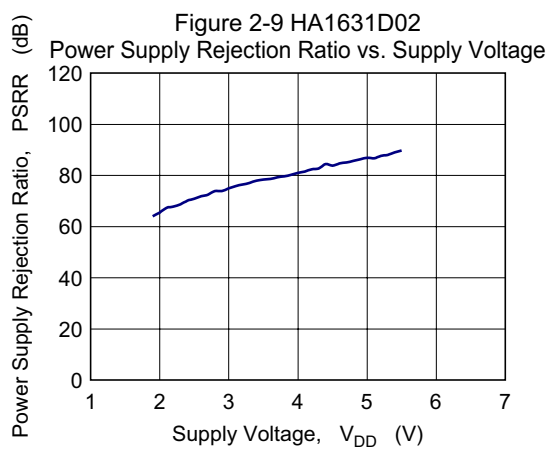
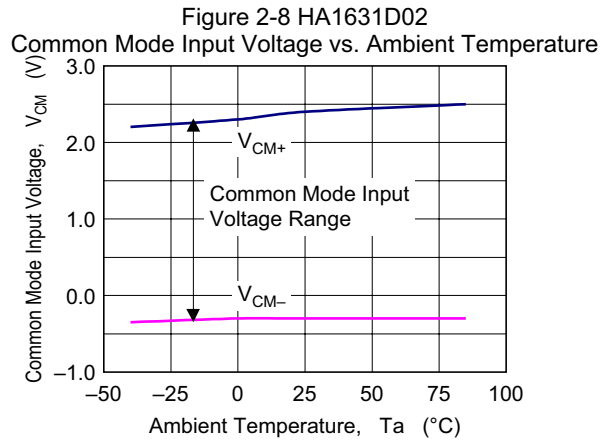
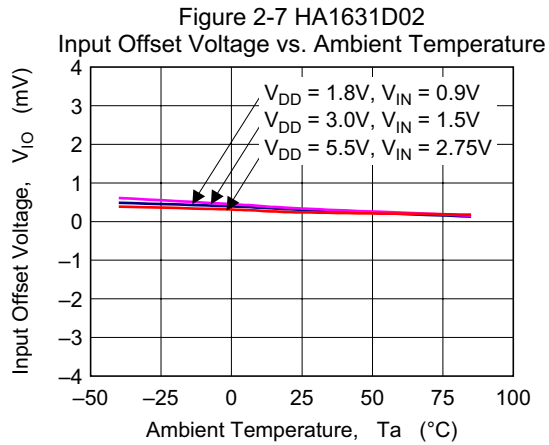


Figure 2-6 HA1631D02  
Input Offset Voltage vs. Supply Voltage



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

Figure 2-13 HA1631D02  
Input Bias Current vs. Input Voltage

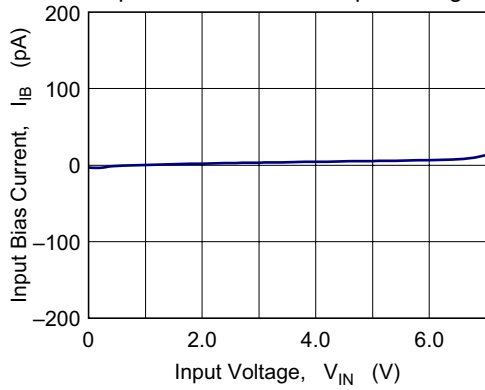


Figure 2-14 HA1631D02  
Falling Time vs. Ambient Temperature

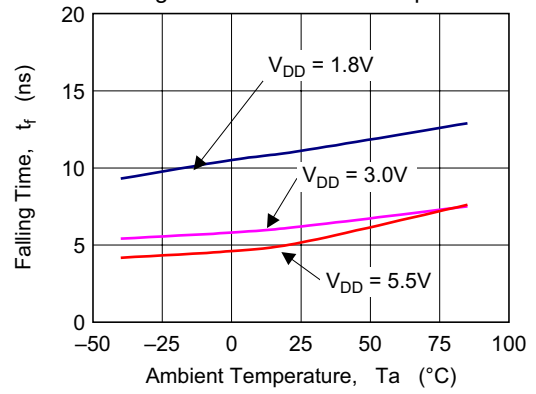


Figure 2-15 HA1631D02  
Rising Time vs. Ambient Temperature

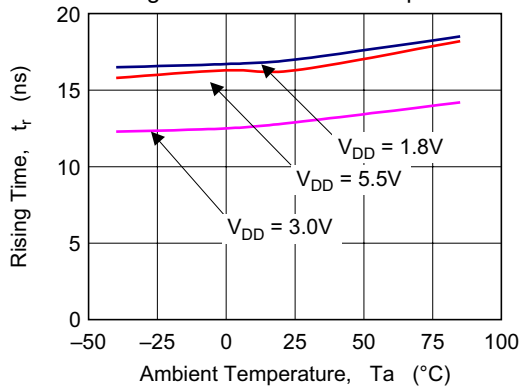


Figure 2-16 HA1631D02  
Falling Time vs. Capacitive Load

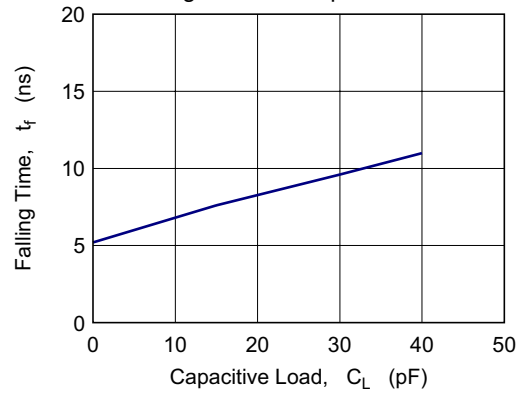


Figure 2-17 HA1631D02  
Rising Time vs. Capacitive Load

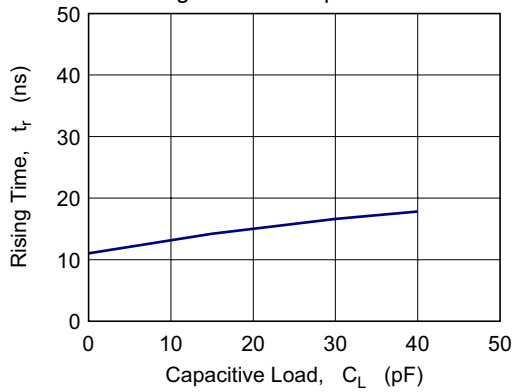
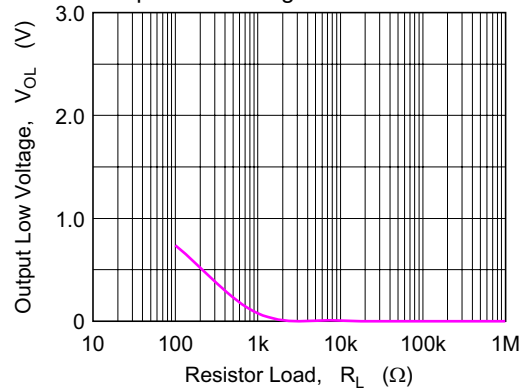
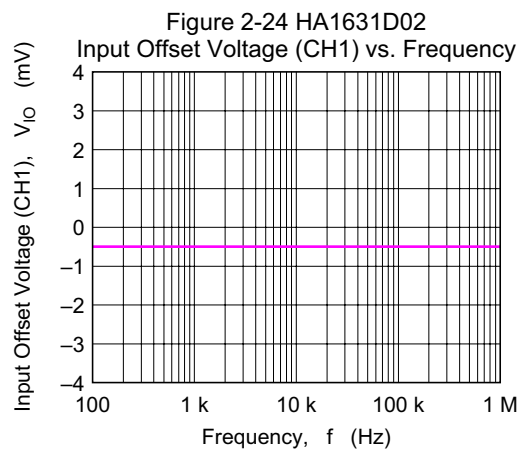
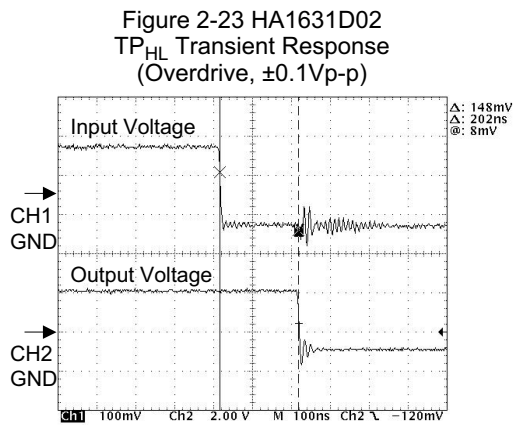
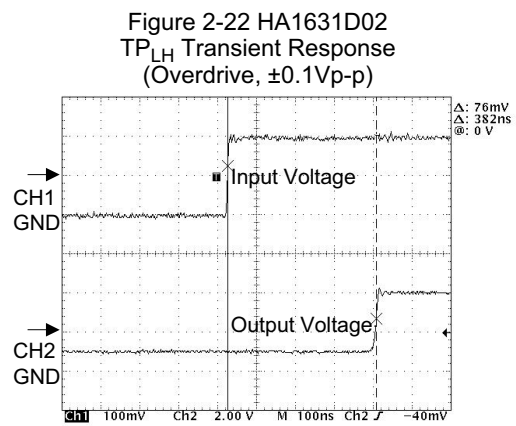
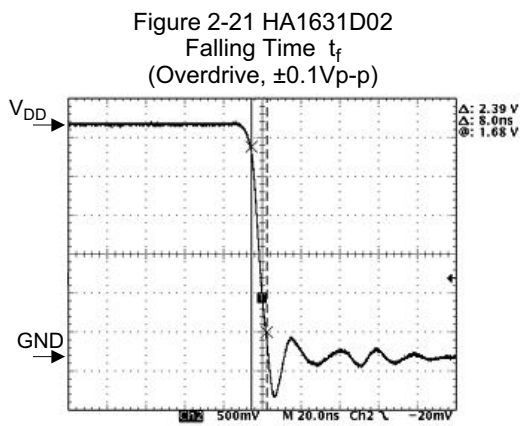
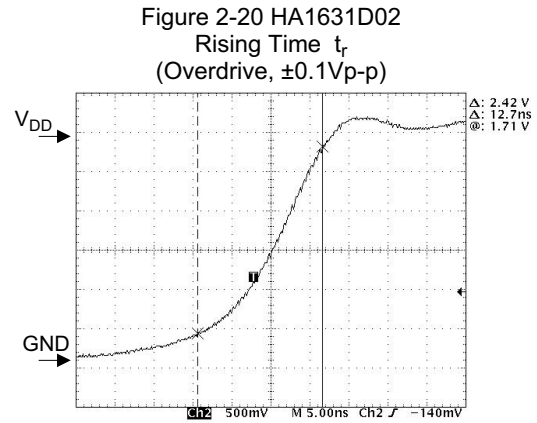
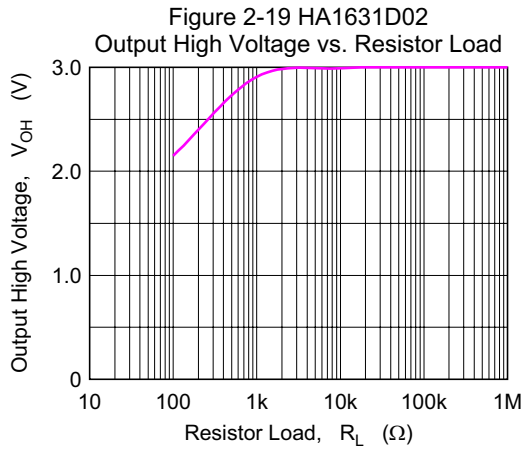


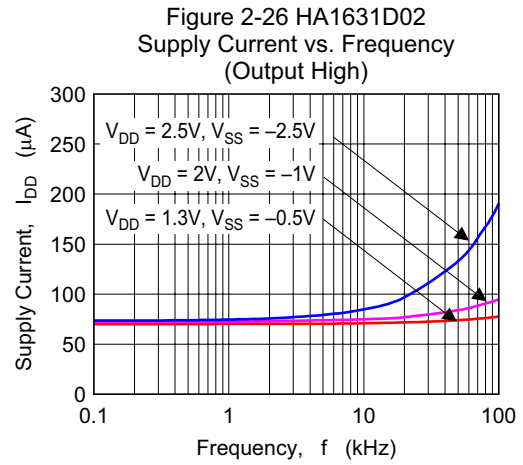
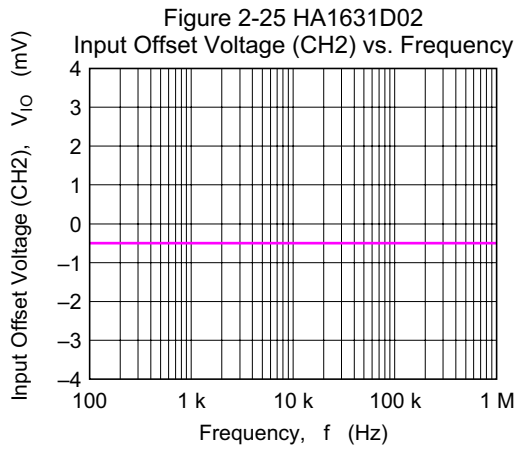
Figure 2-18 HA1631D02  
Output Low Voltage vs. Resistor Load



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

Figure 3-1 HA1631D03  
Supply Current vs. Supply Voltage  
(Output High)

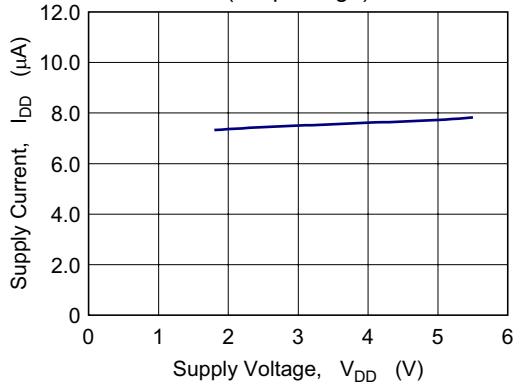


Figure 3-2 HA1631D03  
Supply Current vs. Supply Voltage  
(Output Low)

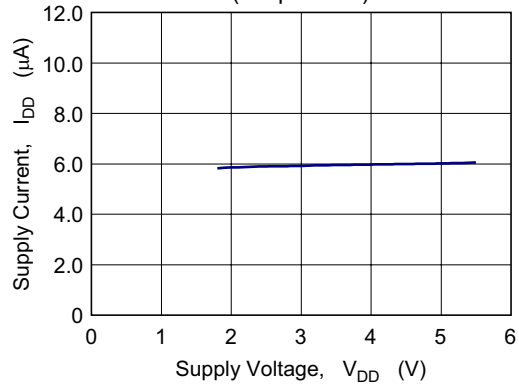


Figure 3-3 HA1631D03  
Supply Current vs. Ambient Temperature

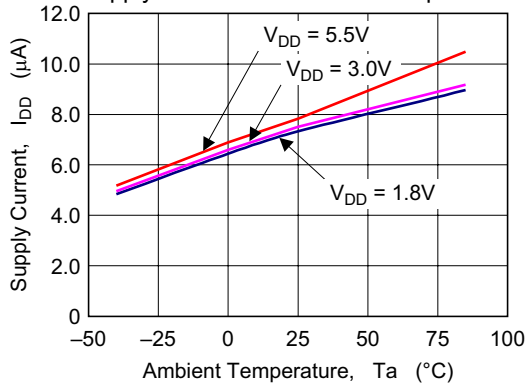


Figure 3-4 HA1631D03  
Output Low Voltage vs. Output Sink Current

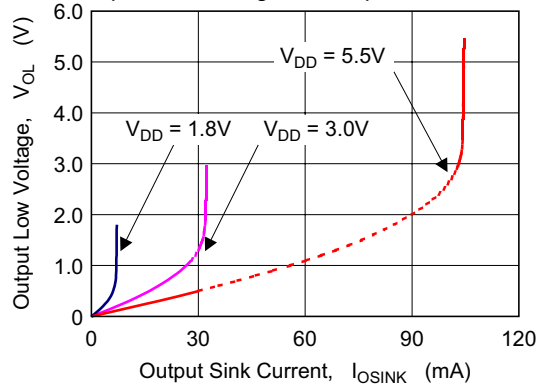


Figure 3-5 HA1631D03  
Input Offset Voltage vs. Supply Voltage

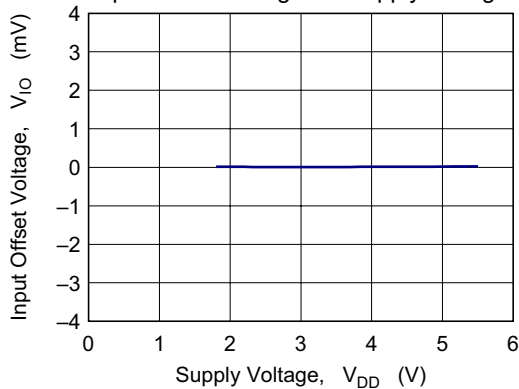
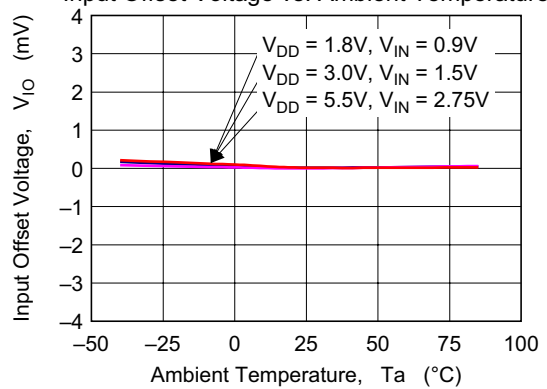


Figure 3-6 HA1631D03  
Input Offset Voltage vs. Ambient Temperature



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

Figure 3-7 HA1631D03  
Common Mode Input Voltage vs. Ambient Temperature

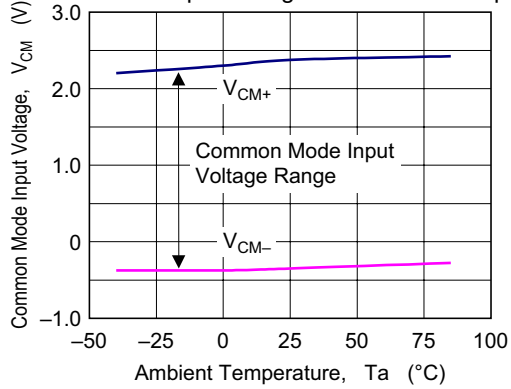


Figure 3-8 HA1631D03  
Power Supply Rejection Ratio vs. Supply Voltage

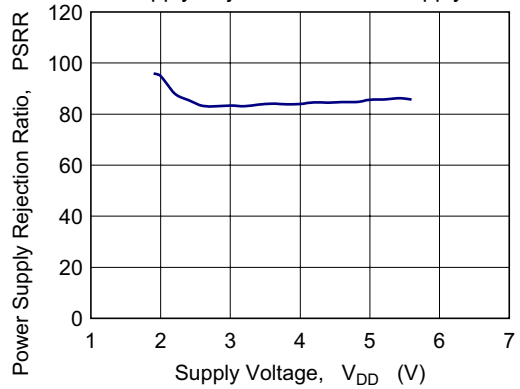


Figure 3-9 HA1631D03  
Common Mode Rejection Ratio vs. Input Voltage

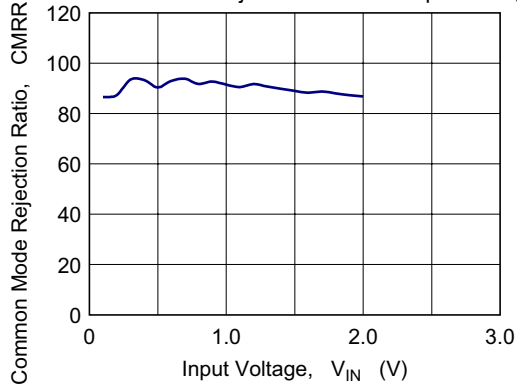


Figure 3-10 HA1631D03  
Input Bias Current vs. Ambient Temperature

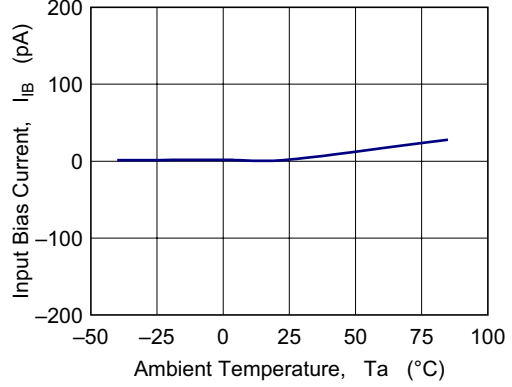


Figure 3-11 HA1631D03  
Input Bias Current vs. Input Voltage

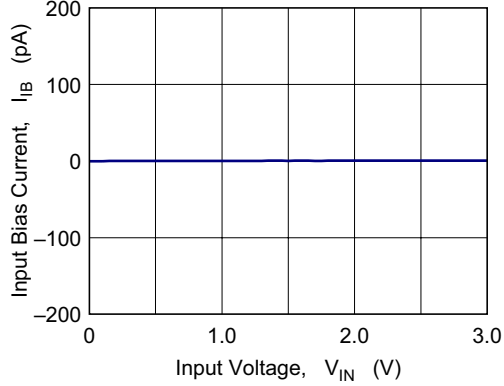
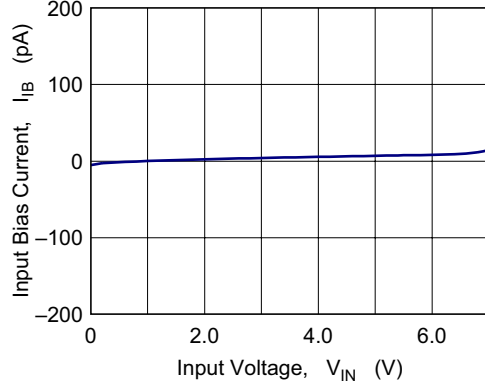
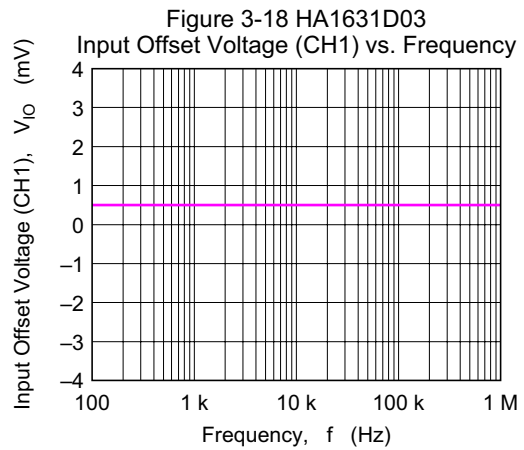
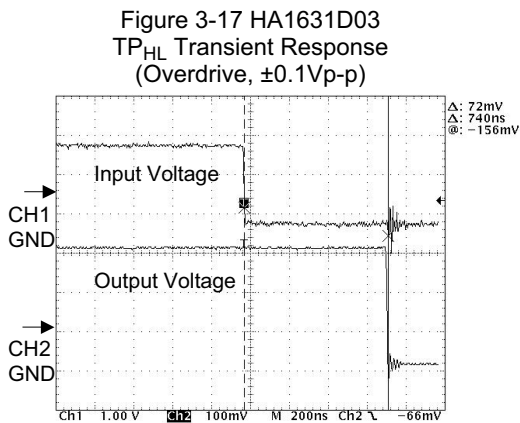
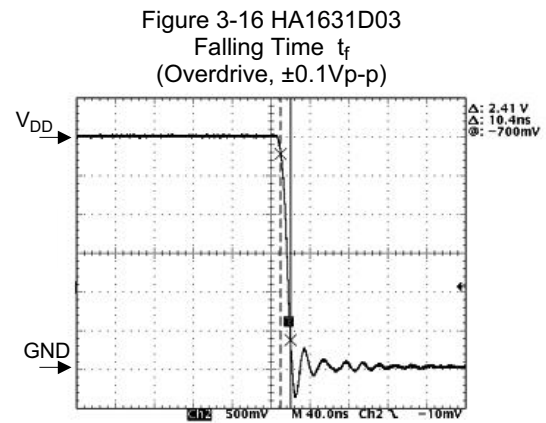
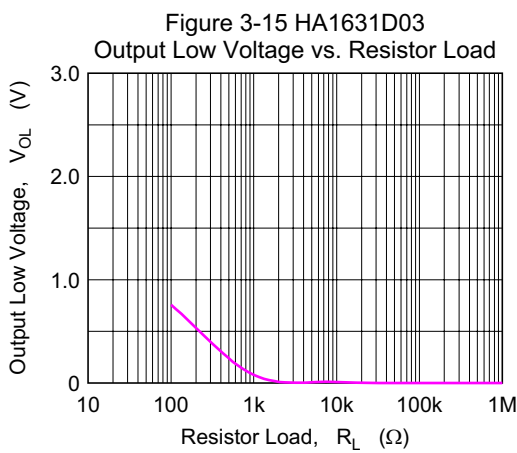
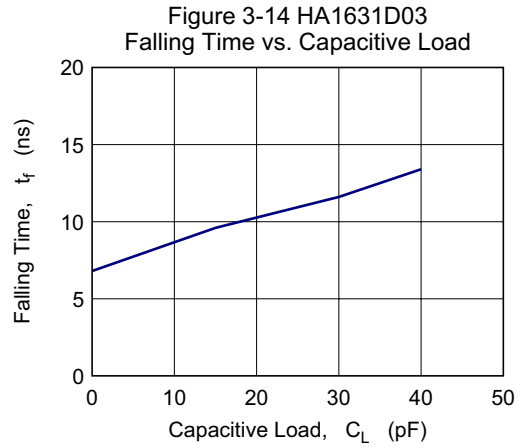
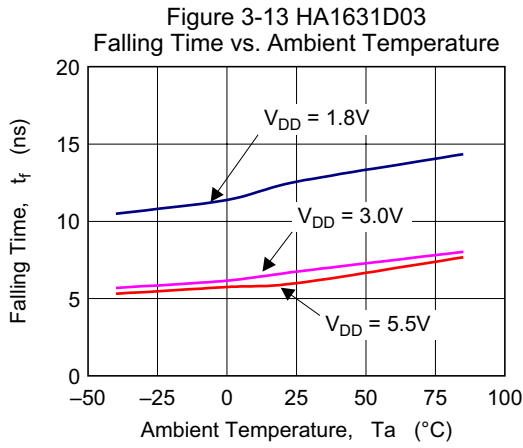


Figure 3-12 HA1631D03  
Input Bias Current vs. Input Voltage

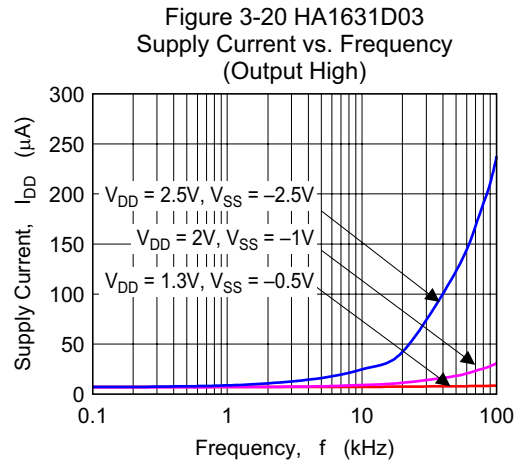
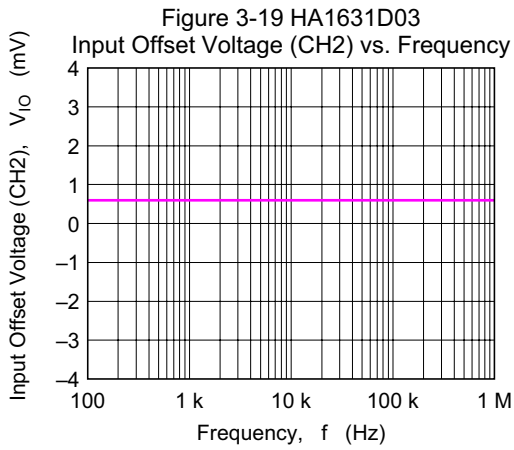




(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

Figure 4-1 HA1631D04  
Supply Current vs. Supply Voltage  
(Output High)

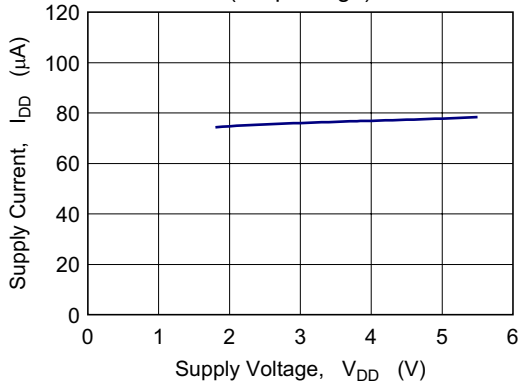


Figure 4-2 HA1631D04  
Supply Current vs. Supply Voltage  
(Output Low)

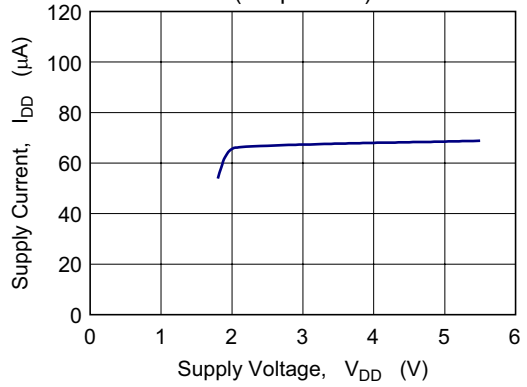


Figure 4-3 HA1631D04  
Supply Current vs. Ambient Temperature

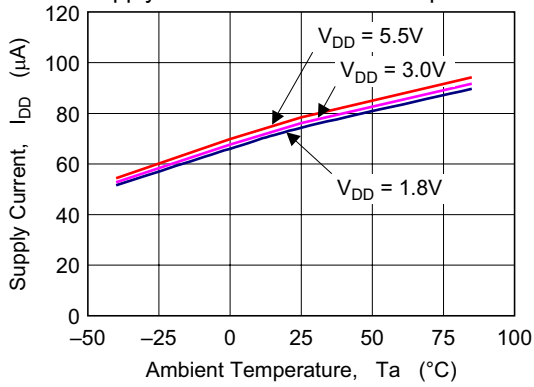


Figure 4-4 HA1631D04  
Output Low Voltage vs. Output Sink Current

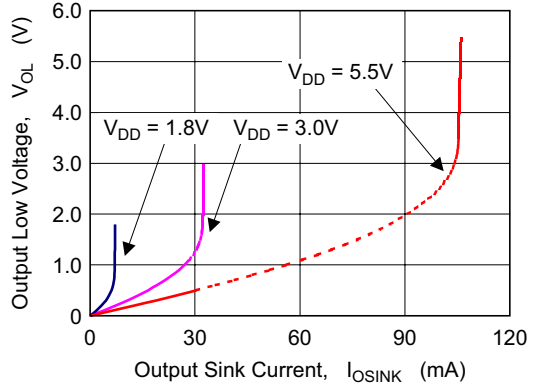


Figure 4-5 HA1631D04  
Input Offset Voltage vs. Supply Voltage

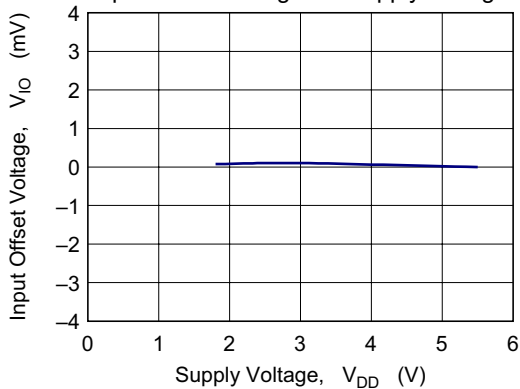
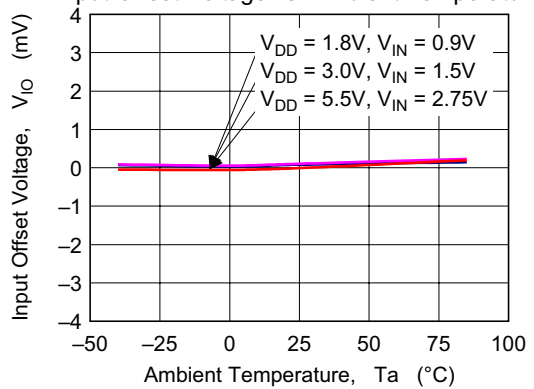
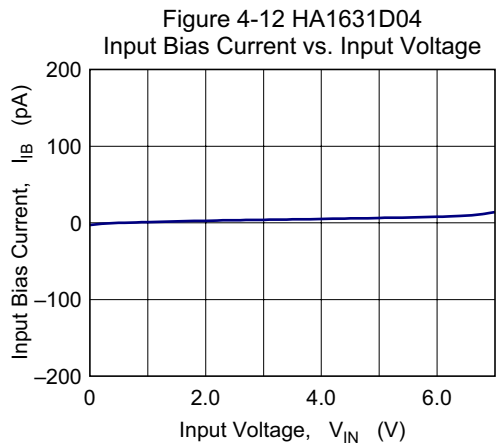
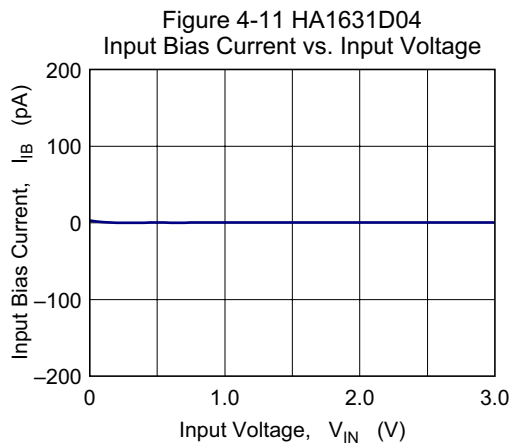
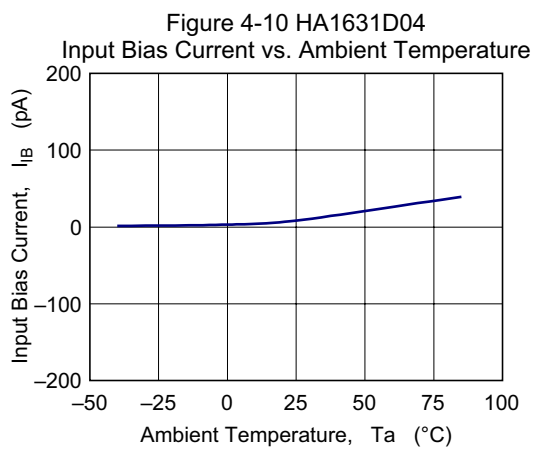
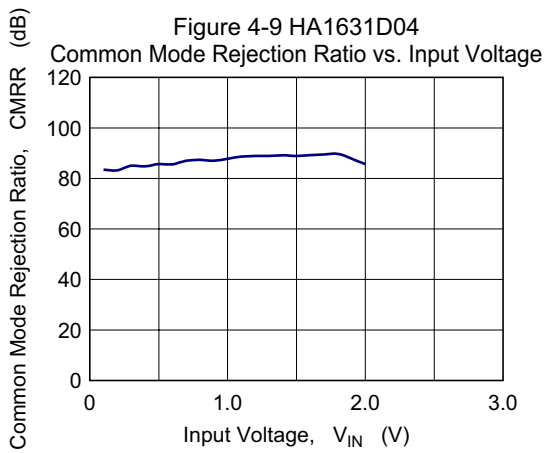
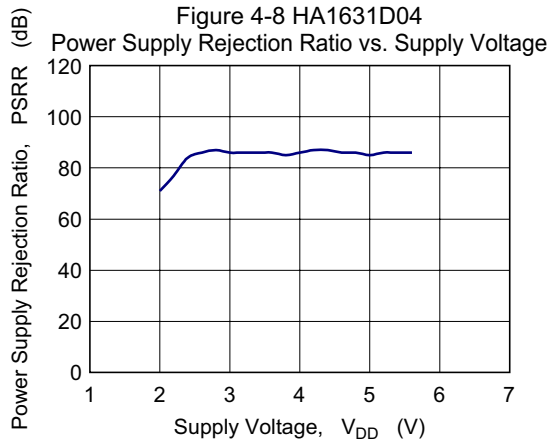
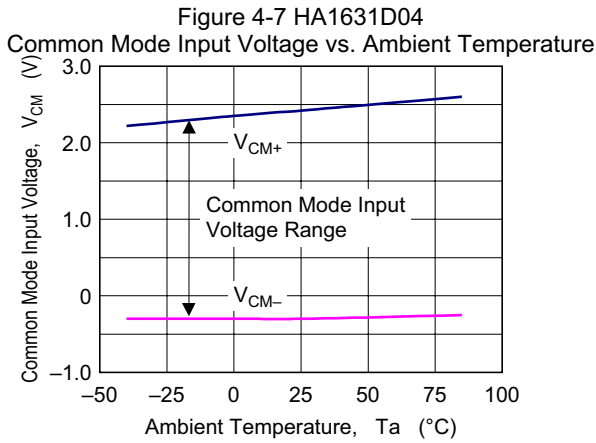


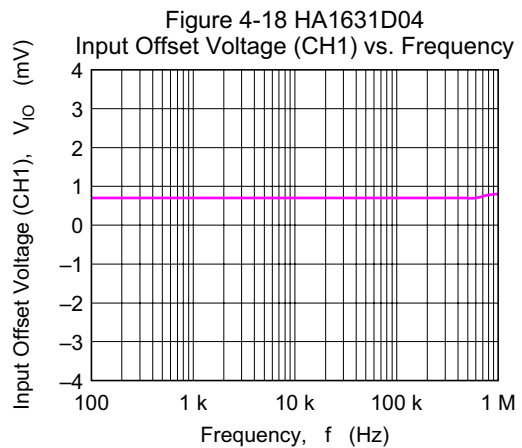
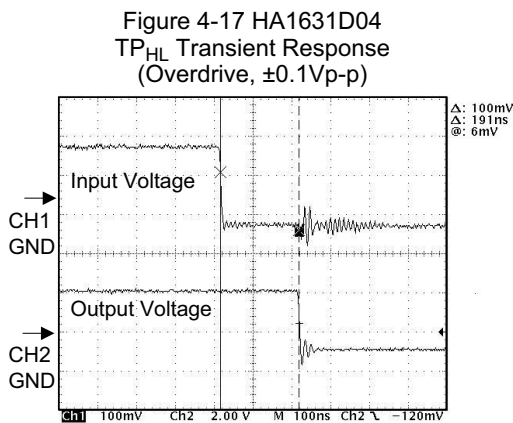
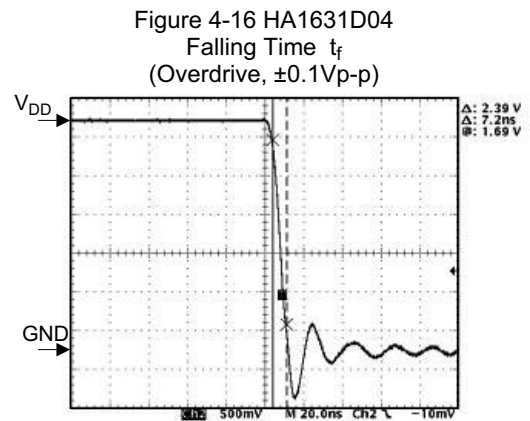
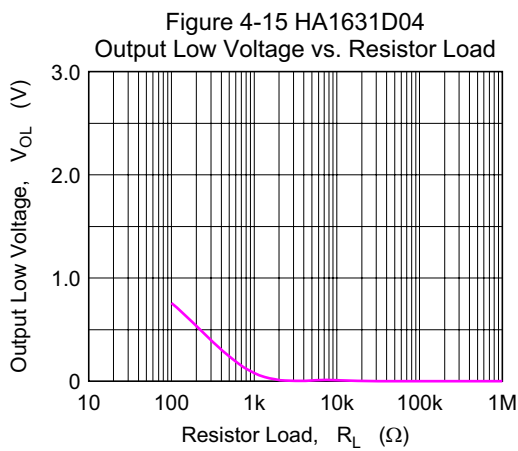
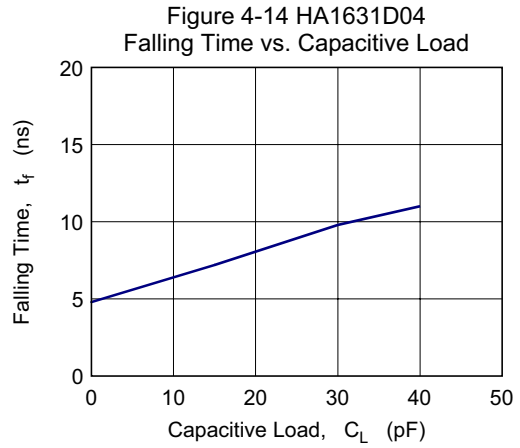
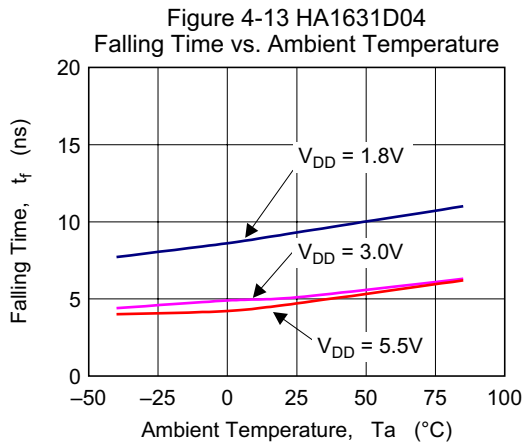
Figure 4-6 HA1631D04  
Input Offset Voltage vs. Ambient Temperature



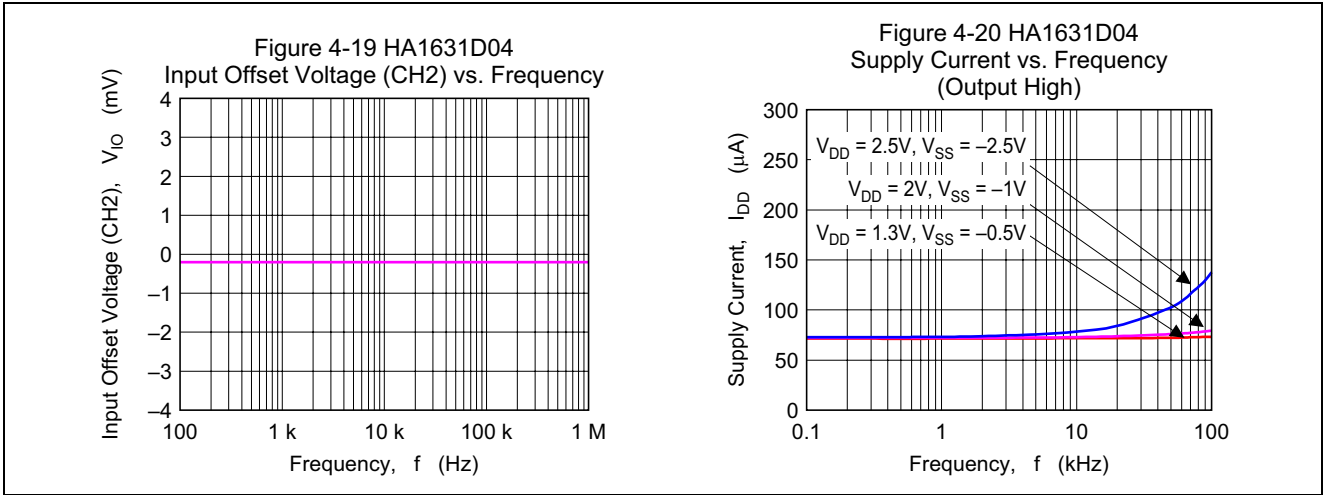
(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



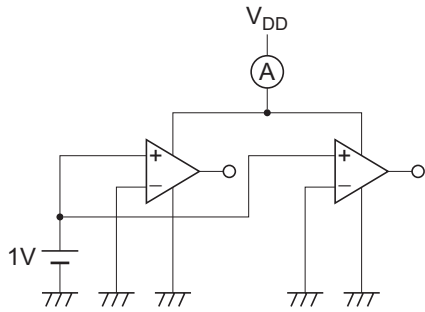
(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )



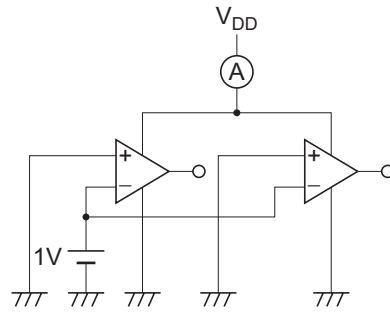
Test Circuits

(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

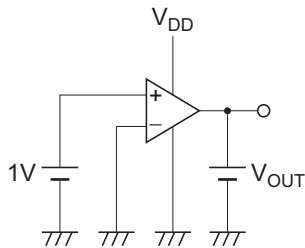
1. Supply Current,  $I_{DD}$  (Output High)



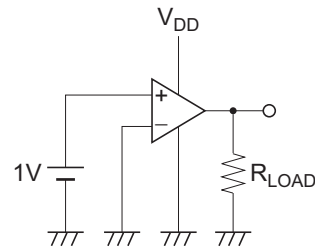
2. Supply Current,  $I_{DD}$  (Output Low)



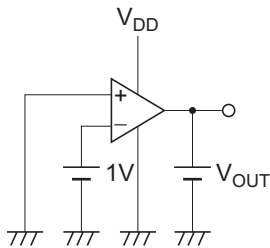
3. Output Source Current,  $I_{OSOURCE}$



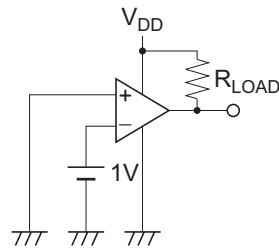
4. Output Voltage High,  $V_{OH}$



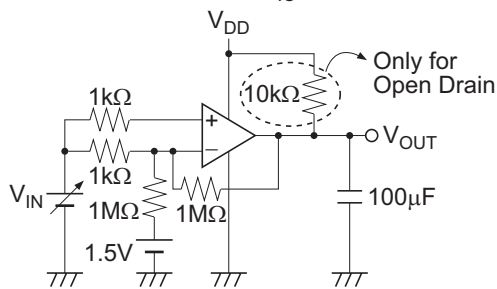
5. Output Sink Current,  $I_{OSINK}$



6. Output Voltage Low,  $V_{OL}$

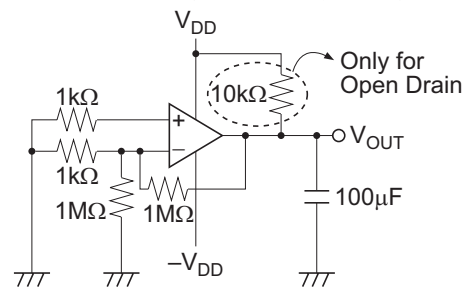


7. Input Offset Voltage,  $V_{IO}$



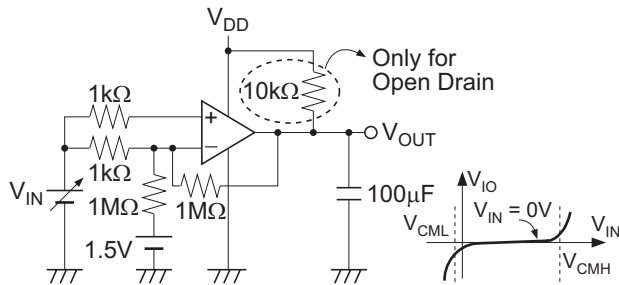
Note:  $V_{IO} = V_{OUT} - 1.5\text{ V}$

8. Input Offset Voltage vs. Supply Voltage



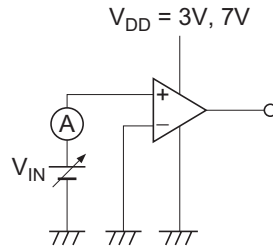
(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

9. Common Mode Input Voltage,  $V_{CM}$

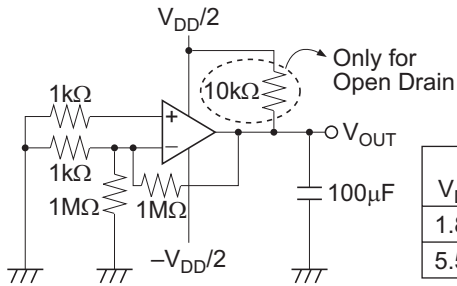


Note:  $V_{CML}$  and  $V_{CMH}$  are values of  $V_{IN}$  when  $V_{IO}$  changes more than 50dB taking  $V_{IN} = 0\text{ V}$  as reference.

10. Input Bias Current,  $I_{IB}$

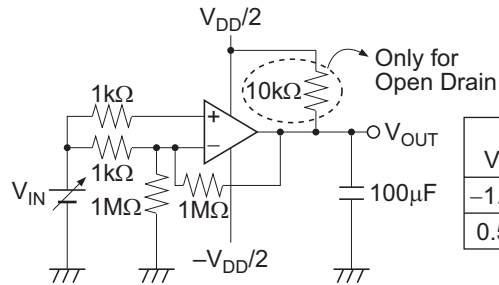


11. Power Supply Rejection Ratio, PSRR



| $V_{DD}$ | Measure Point | Calculate $V_{IO}$        | PSRR Calculation   |
|----------|---------------|---------------------------|--|
| 1.8V     | $V_{OUT1}$    | $V_{IO1} = V_{OUT1}/1000$ | $PSRR = \left  20\log \frac{ (V_{IO2} - V_{IO1}) }{5.5V - 1.8V} \right $ |
| 5.5V     | $V_{OUT2}$    | $V_{IO2} = V_{OUT2}/1000$ |  |

12. Common Mode Rejection Ratio, CMRR

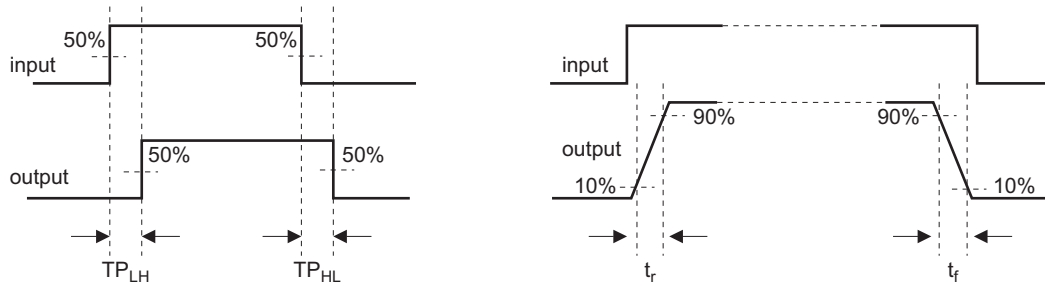
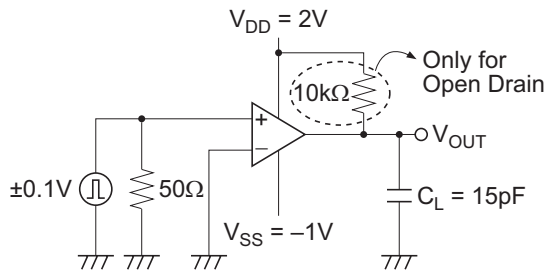


| $V_{IN}$ | Measure Point | Calculate $V_{IO}$        | CMRR Calculation  |
|----------|---------------|---------------------------|---|
| -1.5V    | $V_{OUT1}$    | $V_{IO1} = V_{OUT1}/1000$ | $CMRR = \left  20\log \frac{ (V_{IO2} - V_{IO1}) }{0.5V - (-1.5V)} \right $ |
| 0.5V     | $V_{OUT2}$    | $V_{IO2} = V_{OUT2}/1000$ |   |

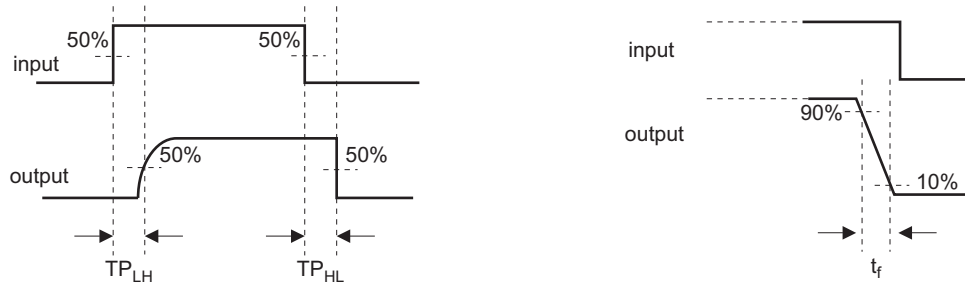


(unless otherwise noted,  $V_{DD} = 3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

13. Response Time  $t_r$ ,  $t_f$  and Delay Time  $TP_{HL}$ ,  $TP_{LH}$

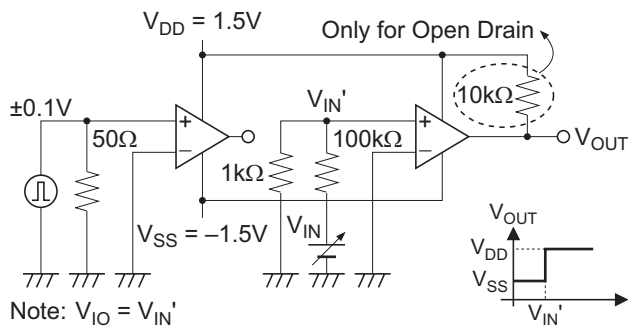


Only for Push Pull HA1631D01/02

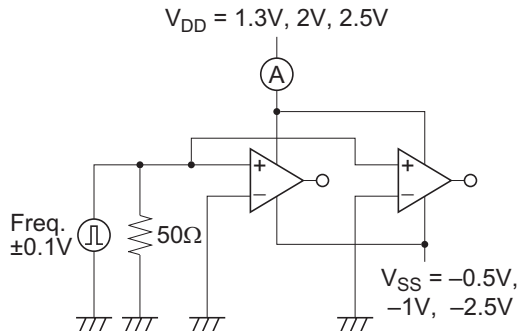


Only for Open Drain HA1631D03/04

14. Cross Talk

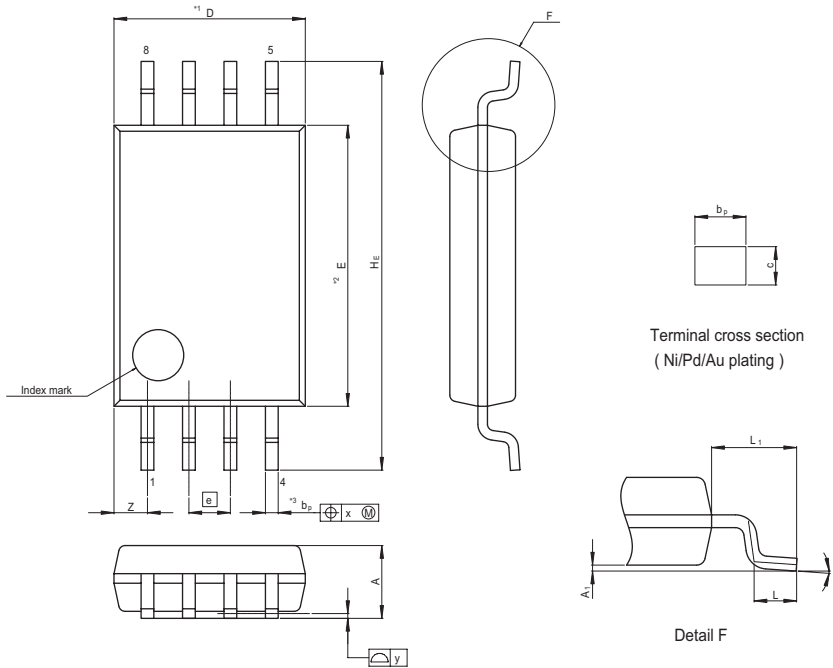


15. Supply Current,  $I_{DD}$  (Output High) vs. Frequency



Package Dimensions

|                     |              |               |            |
|---------------------|--------------|---------------|------------|
| JEITA Package Code  | RENESAS Code | Previous Code | MASS[Typ.] |
| P-TSSOP8-4.4x3-0.65 | PTSP0008JC-B | TTP-8DAV      | 0.034g     |

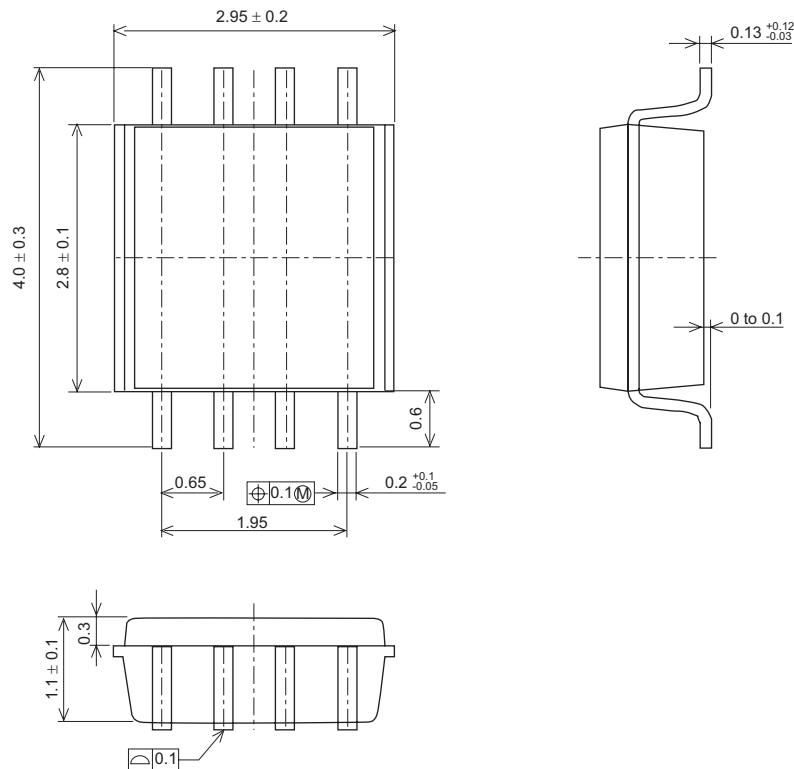


NOTE)  
 1. DIMENSIONS\*\*1 (Nom)\*AND\*\*2  
 DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION\*\*3\*DOES NOT  
 INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters |      |       |
|------------------|--------------------------|------|-------|
|                  | Min                      | Nom  | Max   |
| D                | —                        | 3.00 | 3.30  |
| E                | —                        | 4.40 | —     |
| A <sub>2</sub>   | —                        | —    | —     |
| A <sub>1</sub>   | 0.03                     | 0.07 | 0.10  |
| A                | —                        | —    | 1.10  |
| b <sub>p</sub>   | 0.15                     | 0.20 | 0.25  |
| b <sub>1</sub>   | —                        | —    | —     |
| c                | 0.10                     | 0.15 | 0.20  |
| c <sub>1</sub>   | —                        | —    | —     |
| θ                | 0°                       | —    | 8°    |
| H <sub>E</sub>   | 6.20                     | 6.40 | 6.60  |
| Ⓜ                | —                        | 0.65 | —     |
| x                | —                        | —    | 0.13  |
| y                | —                        | —    | 0.10  |
| Z                | —                        | —    | 0.805 |
| L                | 0.40                     | 0.50 | 0.60  |
| L <sub>1</sub>   | —                        | 1.00 | —     |

|              |                           |              |               |            |
|--------------|---------------------------|--------------|---------------|------------|
| Package Name | JEITA Package Code        | RENESAS Code | Previous Code | MASS[Typ.] |
| MMPAK-8      | P-LSOP8-2.8 x 2.95 - 0.65 | PLSP0008JC-A | —             | 0.02 g     |

Unit: mm



Notes:

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