To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

HA1630D01/02/03 Series

Ultra-Small Low Voltage Operation CMOS Dual Operational Amplifier

REJ03D0800-0200
Rev.2.00
Feb 07, 2007

Description

The HA1630D01/02/03 are dual CMOS Operational Amplifiers realizing low voltage operation, low input offset voltage and low supply current. In addition to a low operating voltage from 1.8V, these device output can achieve full swing output voltage capability extending to either supply. Available in an ultra-small TSSOP-8 and MMPAK-8 package that occupy more small area against the SOP-8.

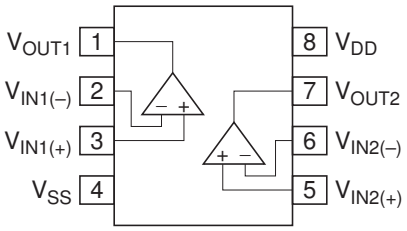
Features

- Low power and single supply operation — V_{DD} = 1.8 to 5.5 V
- Low input offset voltage — V_{IO} = 4.0 mV Max
- Low supply current (per channel) — I_{DD} = 15 µA Typ (HA1630D01)
  I_{DD} = 50 µA Typ (HA1630D02)
  I_{DD} = 100 µ/A Typ (HA1630D03)
- Maximum output voltage — V_{OH} = 2.9 V Min (at V_{DD} = 3.0 V)
- Low input bias current — I_{IB} = 1 pA Typ

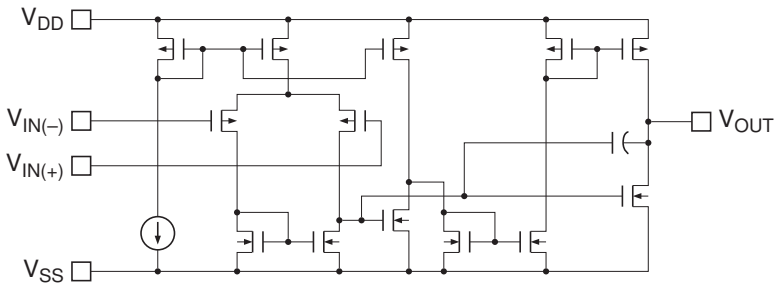
Ordering Information

Type No.	Package Name	Package Code
HA1630D01T	TTP-8DA	PTSP0008JC-B
HA1630D02T		
HA1630D03T		
HA1630D01MM	MMPAK-8	PLSP0008JC-A
HA1630D02MM		
HA1630D03MM		

Pin Arrangement



Equivalent Circuit (per one channel)



Absolute Maximum Ratings

(Ta = 25°C)

Items	Symbol	Ratings	Unit	Note
Supply voltage	V_{DD}	7	V	
Differential input voltage	$V_{IN(diff)}$	$-V_{DD}$ to $+V_{DD}$	V	
Input voltage	V_{IN}	-0.3 to $+V_{DD}$	V	*1
Power dissipation	P_T	240/145	mW	TTP-8DA/MMPAK-8 *2
Operating temp. Range	Topr	–40 to +85	℃	
Storage temp. Range	Tstg	–55 to +125	℃	

Notes: 1. Do not apply Input Voltage exceeding V_{DD} or 7 V.
2. The value of PTSP0008JC-B (TTP-8DAV) / PLSP0008JC-A (MMPAK-8). It computes from heat resistance θja = 520℃/W, and 690℃/W each other.

Electrical Characteristics

(V_{DD} = 3.0 V, Ta = 25°C)

Items	Symbol	Min	Typ	Max	Unit	Test Condition
Input offset voltage	V_{IO}	—	—	4.0	mV	Vin = 1.5 V
Input offset current	I_{IO}	—	(1.0)	—	pA	Vin = 1.5 V
Input bias current	I_{IB}	—	(1.0)	—	pA	Vin = 1.5 V
Output high voltage	V_{OH}	2.9	—	—	V	R_L = 1 MΩ
Output source current	$I_{O\ SOURCE}$	6	12	—	µA	V_{OH} = 2.5 V (HA1630D01)
		25	50	—		V_{OH} = 2.5 V (HA1630D02)
		50	100	—		V_{OH} = 2.5 V (HA1630D03)
Output low voltage	V_{OL}	—	—	0.1	V	R_L = 1 MΩ
Output sink current	$I_{O\ SINK}$	—	(0.8)	—	mA	V_{OL} = 0.5 V (HA1630D01)
		—	(1.0)	—		V_{OL} = 0.5 V (HA1630D02)
		—	(1.2)	—		V_{OL} = 0.5 V (HA1630D03)
Common mode input voltage range	V_{CM}	–0.1 to 2.1	—	—	V	
Slew rate	SR	—	(0.125)	—	V/µs	C_L = 20 pF (HA1630D01)
		—	(0.50)	—		C_L = 20 pF (HA1630D02)
		—	(1.00)	—		C_L = 20 pF (HA1630D03)
Voltage gain	A_V	60	80	—	dB	
Gain bandwidth product	BW	—	(200)	—	kHz	C_L = 20 pF (HA1630D01)
		—	(680)	—		C_L = 20 pF (HA1630D02)
		—	(1200)	—		C_L = 20 pF (HA1630D03)
Power supply rejection ratio	PSRR	60	80	—	dB	
Common mode rejection ratio	CMRR	60	80	—	dB	
Supply current	I_{DD}	—	30	60	µA	R_L = ∞ (HA1630D01)
		—	100	200		R_L = ∞ (HA1630D02)
		—	200	400		R_L = ∞ (HA1630D03)

Note: 1. ( ) : Design specification

Table of Graphs

Electrical Characteristics			HA1630D01 Figure	HA1630D02 Figure	HA1630D03 Figure	Test Circuit
Supply current	I_{DD}	vs Supply voltage	1-1	2-1	3-1	2
		vs Ambient temperature	1-2	2-2	3-2	
Output high voltage	V_{OH}	vs Output source current	1-3	2-3	3-3	4
		vs Supply voltage	1-4	2-4	3-4	
Output source current	$I_{O\ SOURCE}$	vs Ambient temperature	1-5	2-5	3-5	6
Output low voltage	V_{OL}	vs Output sink current	1-6	2-6	3-6	5
Output sink current	$I_{O\ SINK}$	vs Ambient temperature	1-7	2-7	3-7	6
Input offset voltage	V_{IO}	Distribution	1-8	2-8	3-8	1
		vs Supply voltage	1-9	2-9	3-9	
		vs Ambient temperature	1-10	2-10	3-10	
Common mode input voltage range	V_{CM}	vs Ambient temperature	1-11	2-11	3-11	7
Power supply rejection ratio	PSRR	vs Frequency	1-12	2-12	3-12	1
Common mode rejection ratio	CMRR	vs Frequency	1-13	2-13	3-13	7
Voltage gain & phase angle	A_V	vs Frequency	1-14	2-14	3-14	10
Input bias current	I_{IB}	vs Ambient temperature	1-15	2-15	3-15	3
		vs Input voltage	1-16	2-16	3-16	
Slew Rate (rising)	SRr	vs Ambient temperature	1-17	2-17	3-17	9
Slew Rate (falling)	SRf	vs Ambient temperature	1-18	2-18	3-18	
Slew rate		Large signal transient response	1-19	2-19	3-19	
		Small signal transient response	1-20	2-20	3-20	
Total harmonic distortion + noise	(0 dB)	vs. Output voltage p-p	—	2-21	3-21	8
	(40 dB)	vs. Output voltage p-p	—	2-22	3-22	
Maximum p-p output voltage		vs Frequency	1-21	2-23	3-23	
Voltage noise density		vs Frequency	1-22	2-24	3-24	
Channel separation		vs Frequency	1-23	2-25	3-25	

Main Characteristics (HA1630D01)

Figure 1-1. HA1630D01
Supply Current vs. Supply Voltage

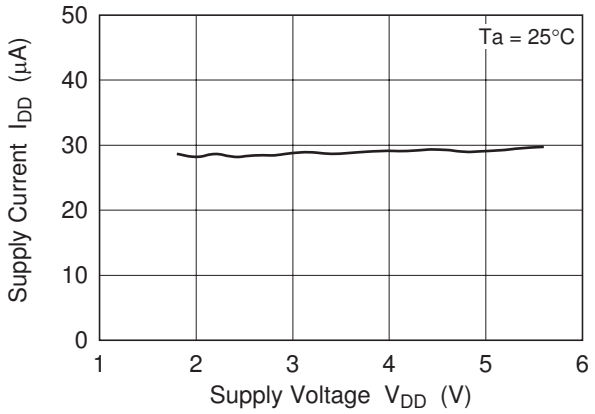


Figure 1-2. HA1630D01
Supply Current vs. Ambient Temperature

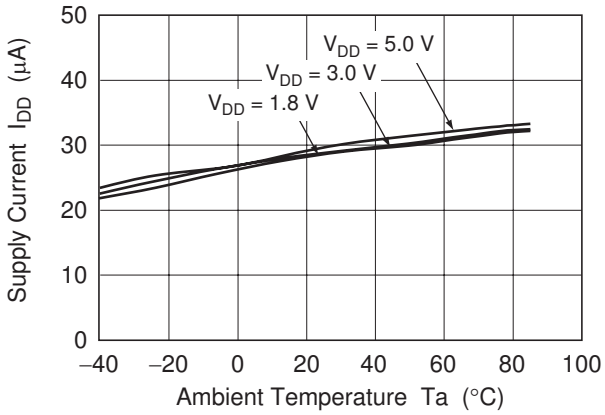


Figure 1-3. HA1630D01
Output High Voltage vs. Output Source Current

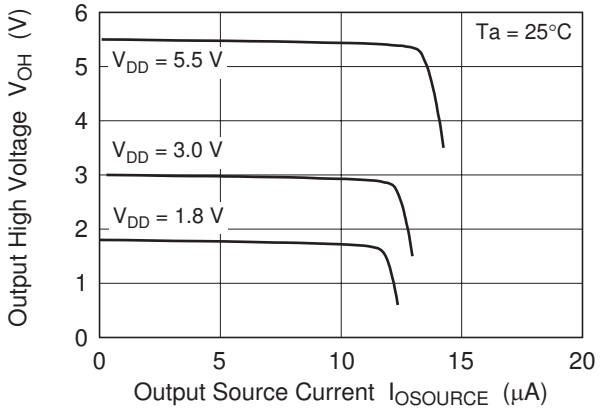


Figure 1-4. HA1630D01
Output High Voltage vs. Supply Voltage

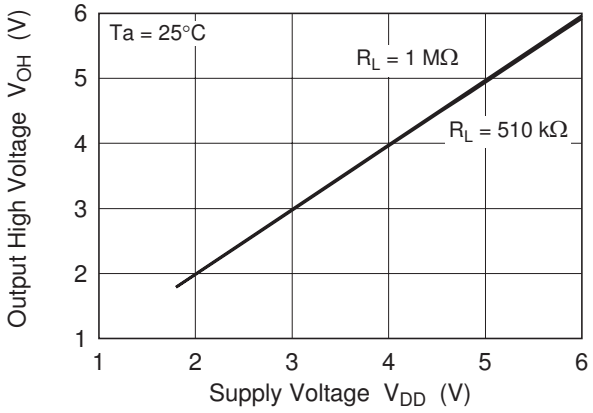


Figure 1-5. HA1630D01
Output Source Current vs. Ambient Temperature

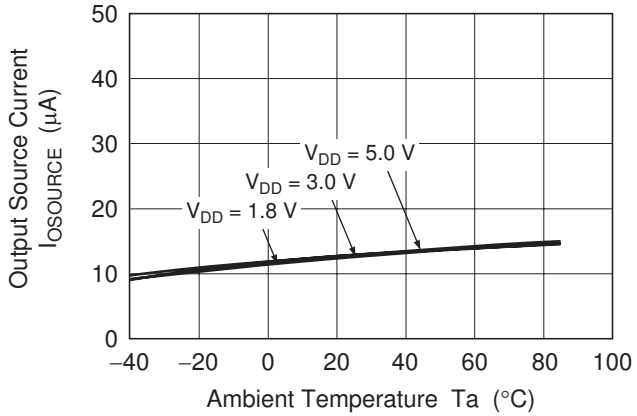


Figure 1-6. HA1630D01
Output Low Voltage vs. Output Sink Current

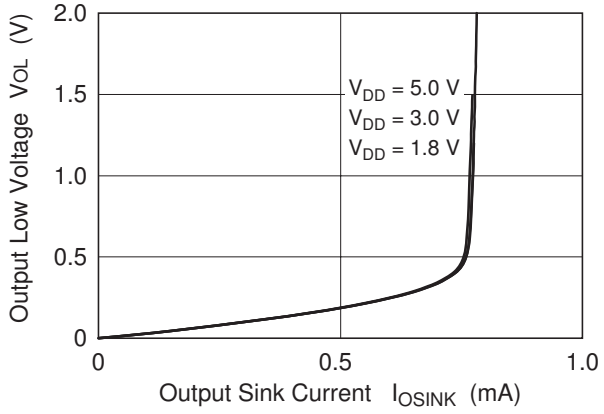


Figure 1-7. HA1630D01
Output Sink Current vs. Ambient Temperature

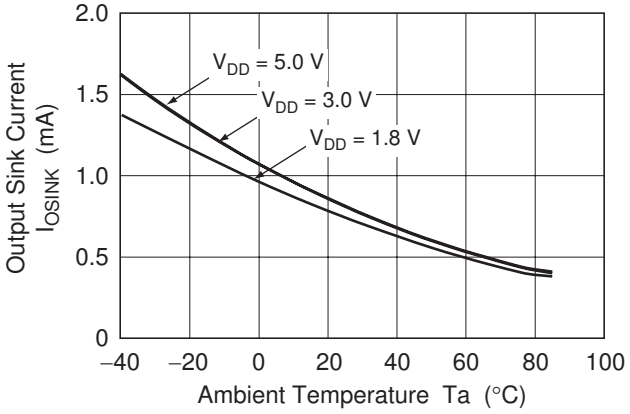


Figure 1-8. HA1630D01
Input Offset Voltage Distribution

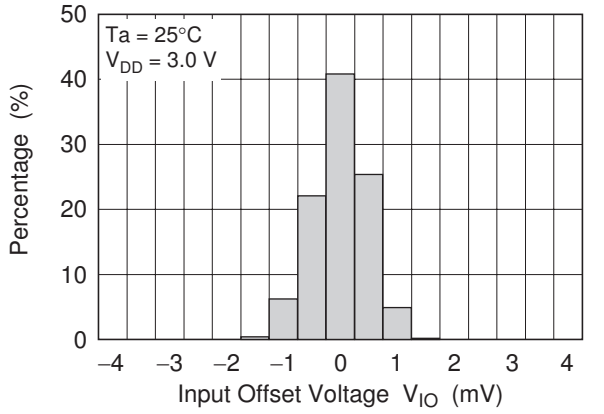


Figure 1-9. HA1630D01
Input Offset Voltage vs. Supply Voltage

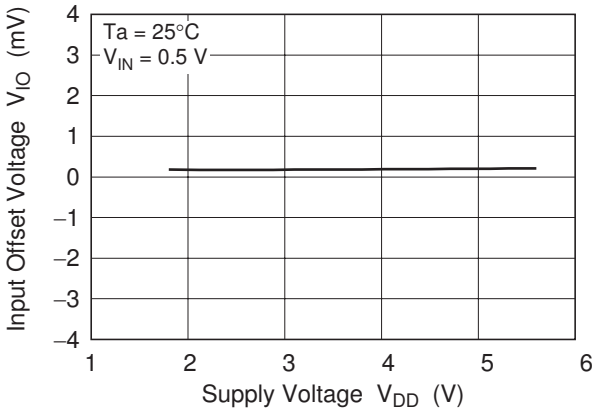


Figure 1-10. HA1630D01
Input Offset Voltage vs. Ambient Temperature

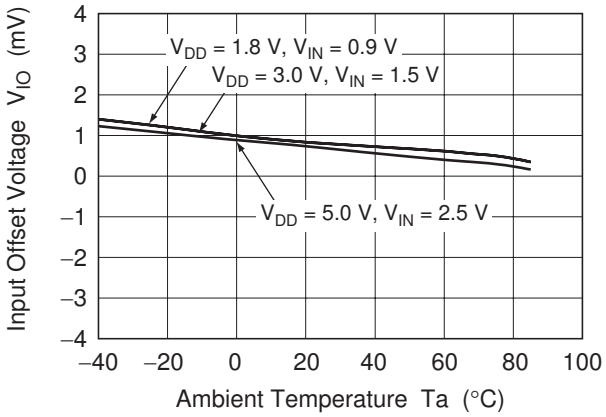


Figure 1-11. HA1630D01
Common Mode Input Voltage vs.
Ambient Temperature

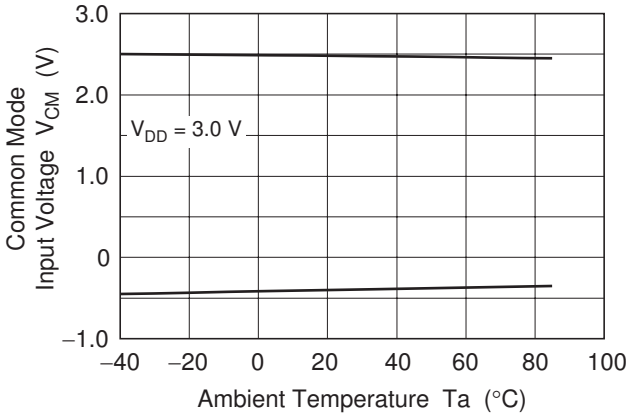


Figure 1-12. HA1630D01
Power Supply Rejection Ratio vs. Frequency

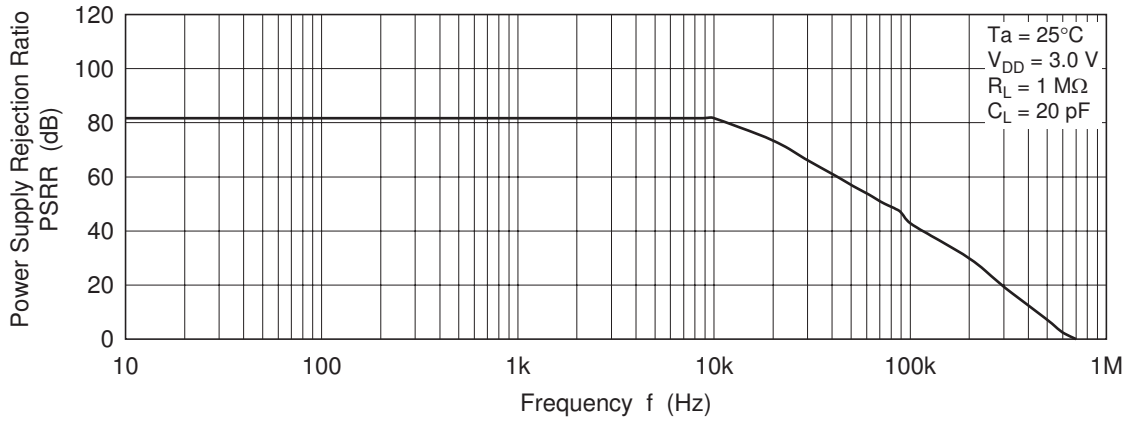


Figure 1-13. HA1630D01
Common Mode Rejection Ratio vs. Frequency

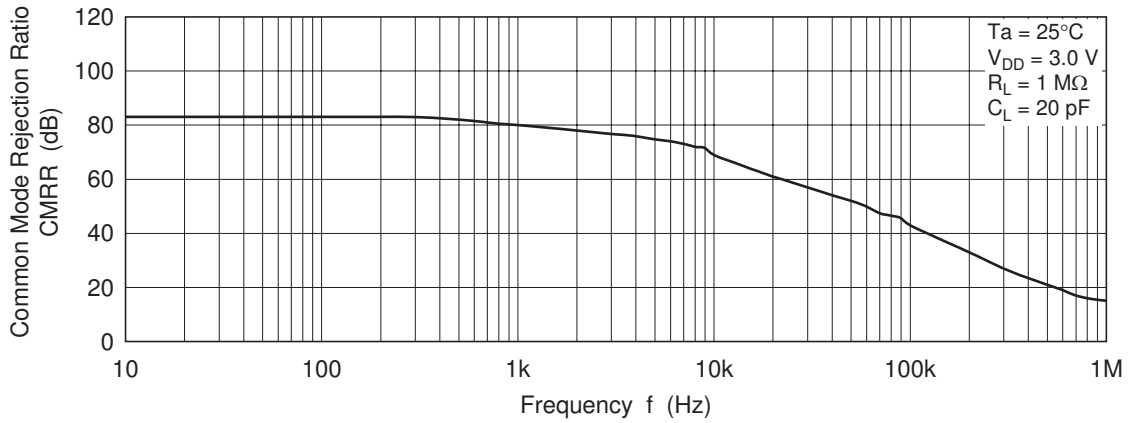


Figure 1-14. HA1630D01
Open Loop Voltage Gain and Phase Angle vs. Frequency

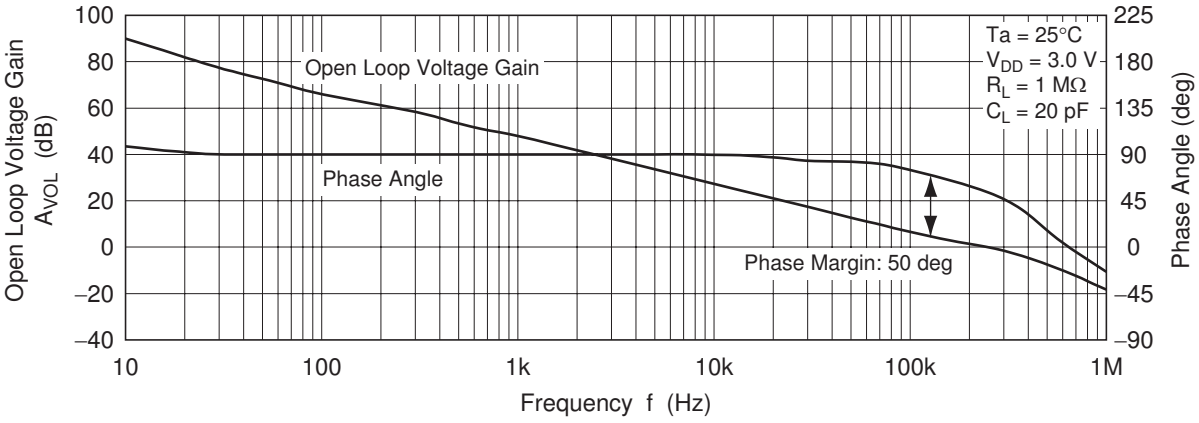


Figure 1-15. HA1630D01
Input Bias Current vs. Ambient Temperature

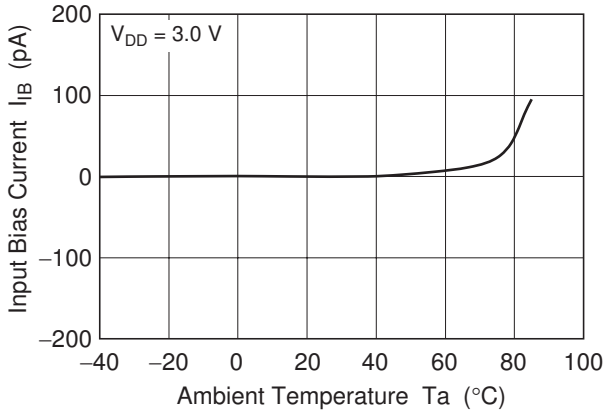


Figure 1-16. HA1630D01
Input Bias Current vs. Input Voltage

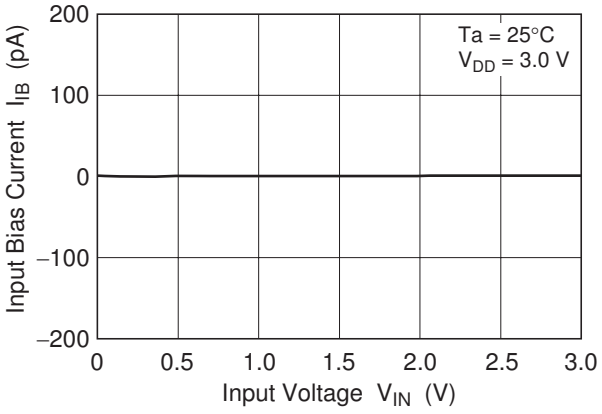


Figure 1-17. HA1630D01
Slew Rate (rising) vs. Ambient Temperature

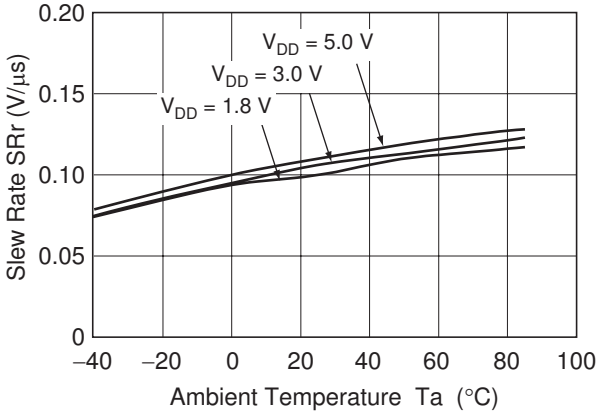


Figure 1-18. HA1630D01
Slew Rate (falling) vs. Ambient Temperature

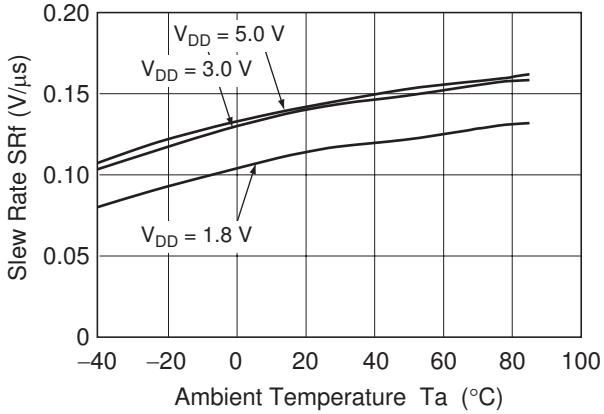


Figure 1-19. HA1630D01
Large Signal Transient Response

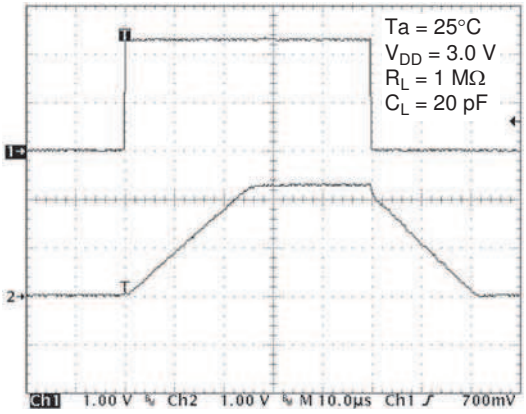


Figure 1-20. HA1630D01
Small Signal Transient Response

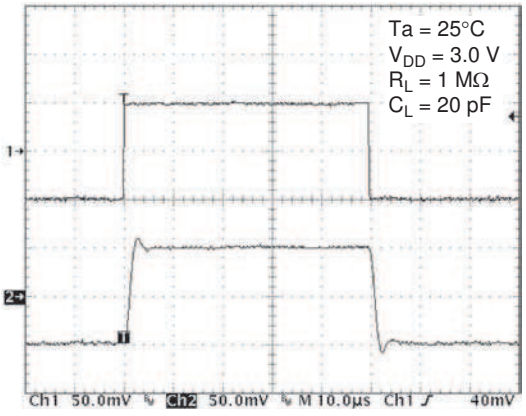


Figure 1-21. HA1630D01
Voltage Output p-p vs. Frequency

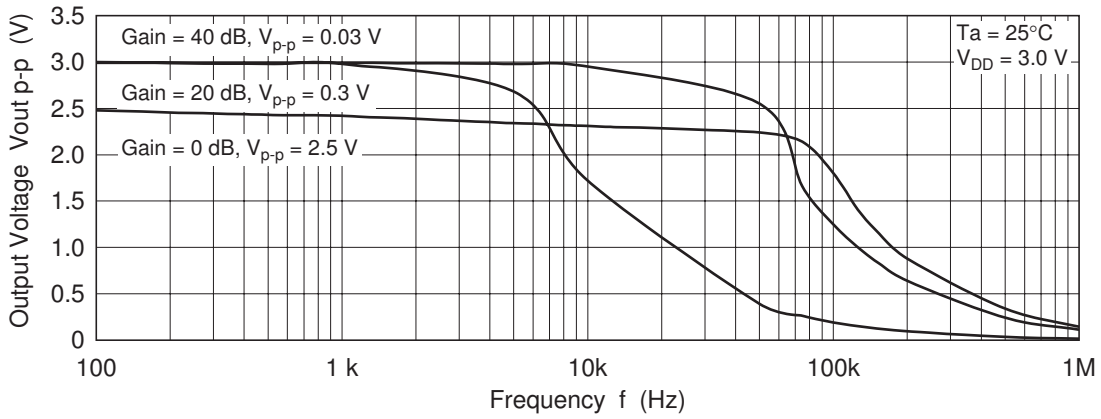


Figure 1-22. HA1630D01
Voltage Noise Density vs. Frequency

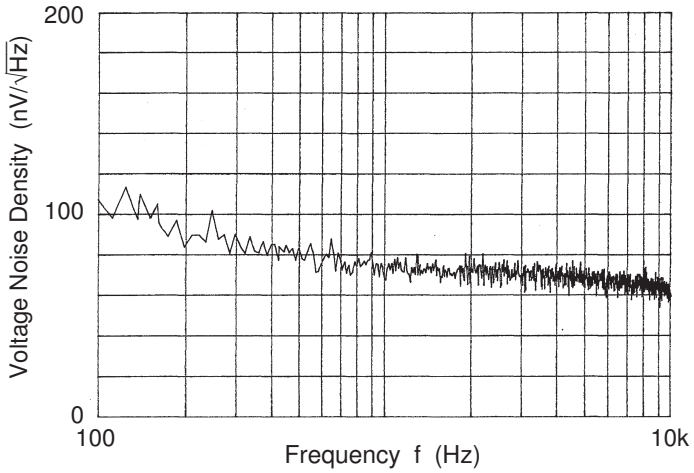
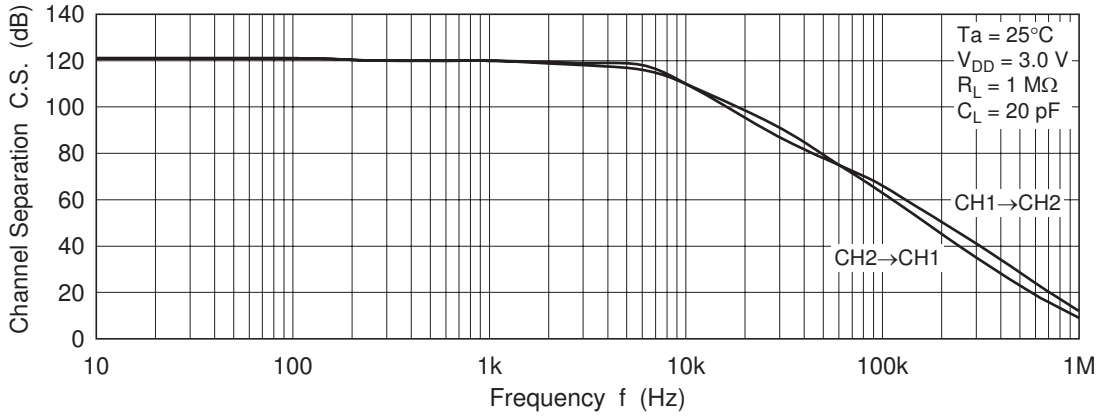


Figure 1-23. HA1630D01
Channel Separation vs. Frequency



Main Characteristics (HA1630D02)

Figure 2-1. HA1630D02
Supply Current vs. Supply Voltage

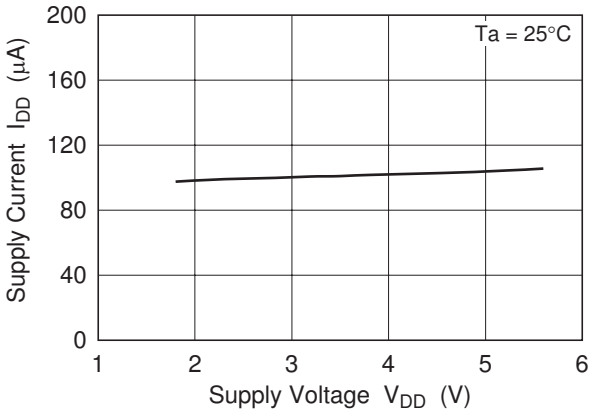


Figure 2-2. HA1630D02
Supply Current vs. Ambient Temperature

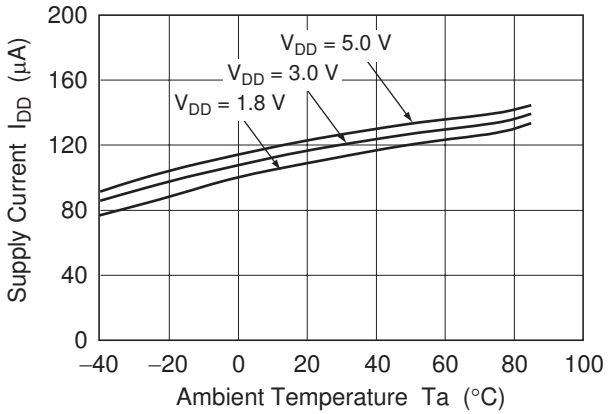


Figure 2-3. HA1630D02
Output High Voltage vs. Output Source Current

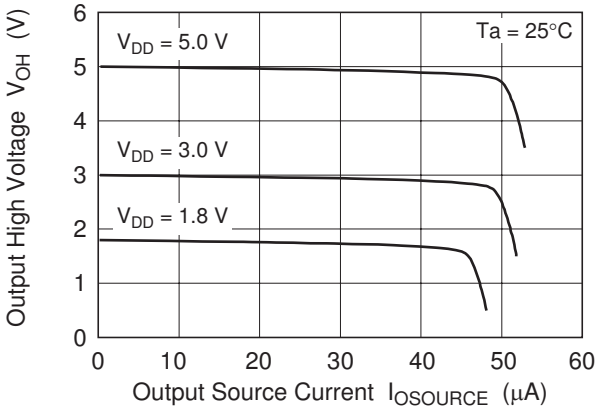


Figure 2-4. HA1630D02
Output High Voltage vs. Supply Voltage

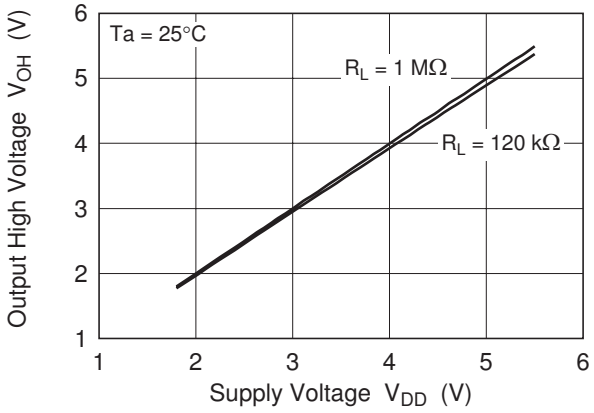


Figure 2-5. HA1630D02
Output Source Current vs. Ambient Temperature

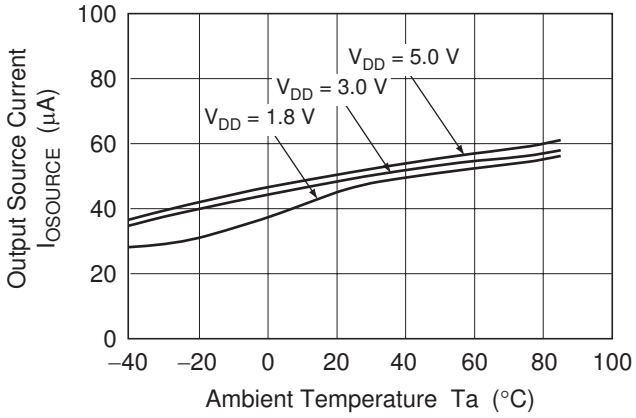


Figure 2-6. HA1630D02
Output Low Voltage vs. Output Sink Current

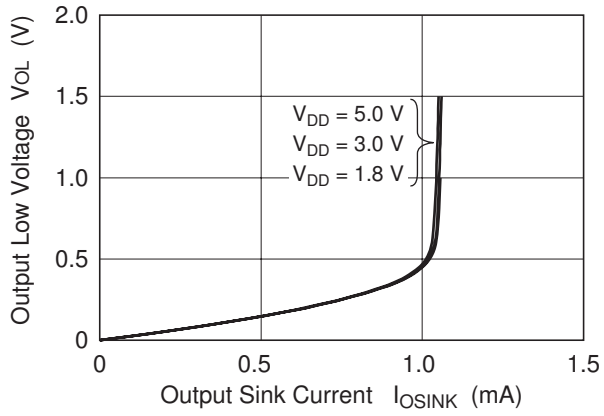


Figure 2-7. HA1630D02
Output Sink Current vs. Ambient Temperature

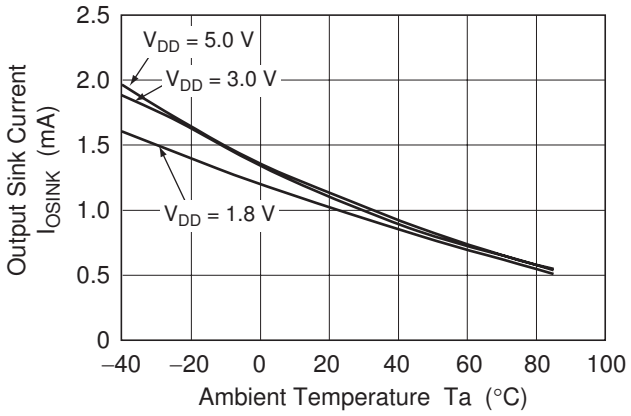


Figure 2-8. HA1630D02
Input Offset Voltage Distribution

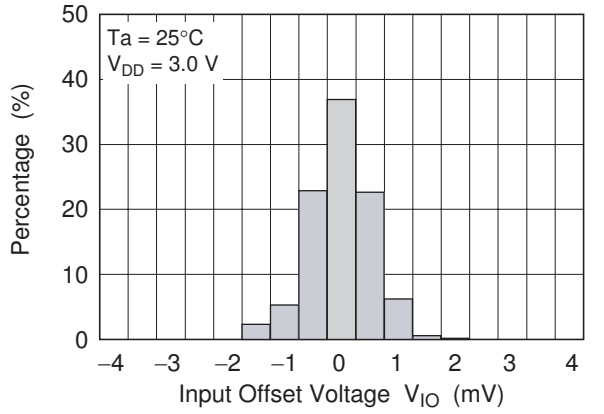


Figure 2-9. HA1630D02
Input Offset Voltage vs. Supply Voltage

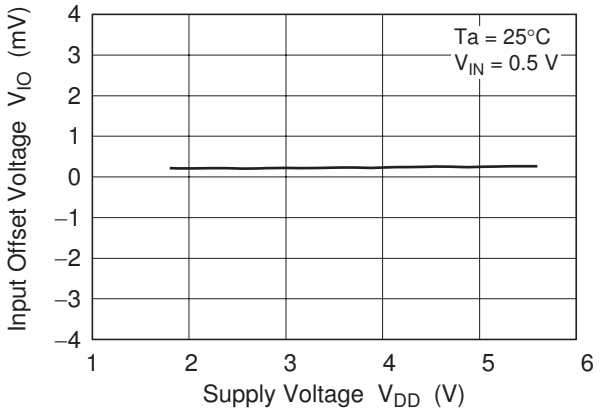


Figure 2-10. HA1630D02
Input Offset Voltage vs. Ambient Temperature

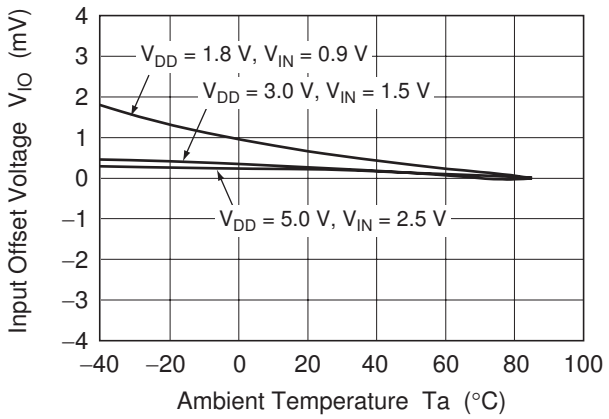


Figure 2-11. HA1630D02
Common Mode Input Voltage vs.
Ambient Temperature

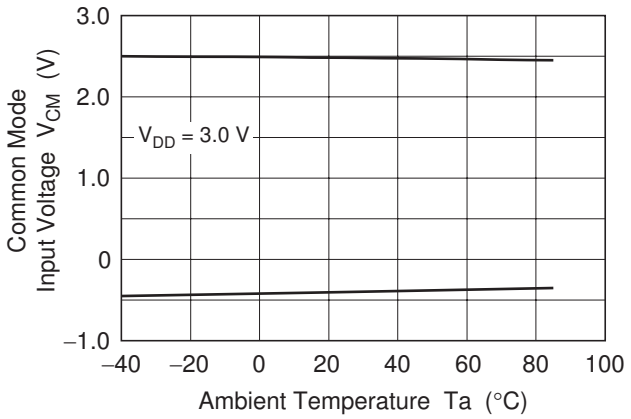


Figure 2-12. HA1630D02
Power Supply Rejection Ratio vs. Frequency

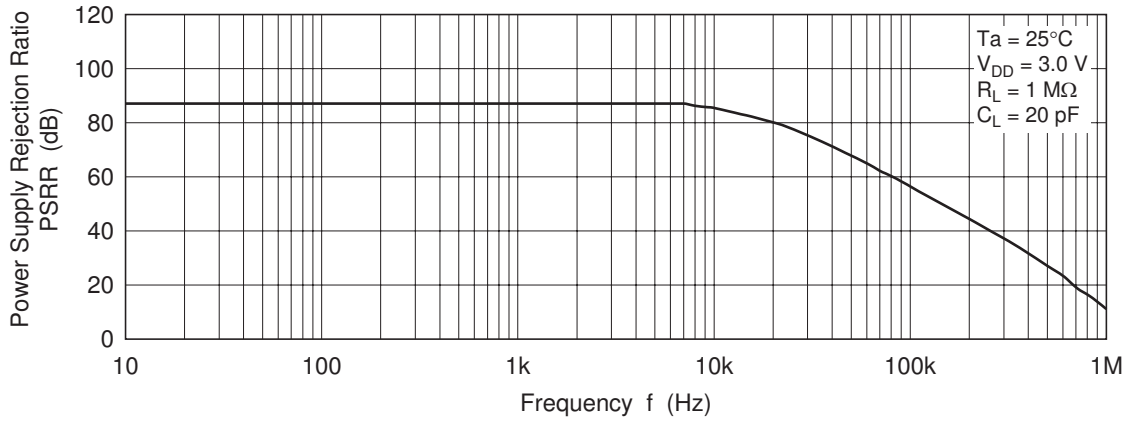


Figure 2-13. HA1630D02
Common Mode Rejection Ratio vs. Frequency

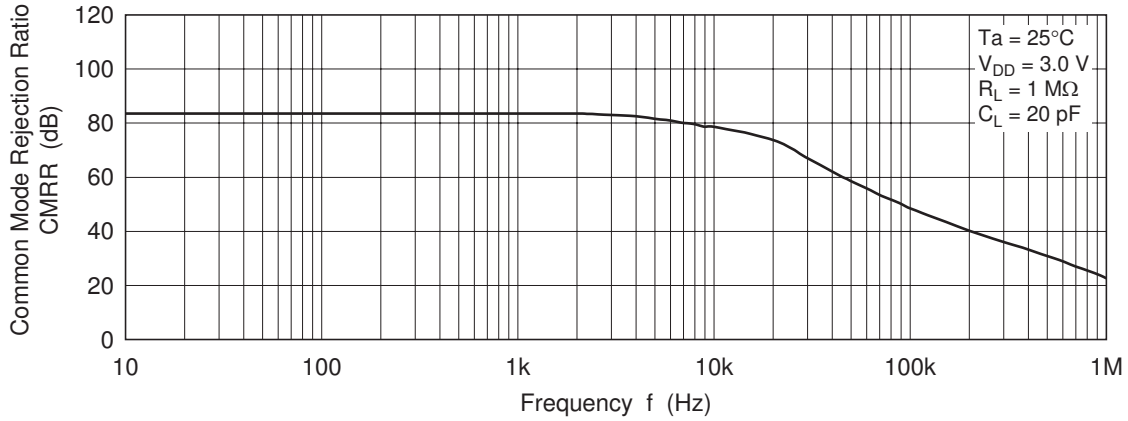


Figure 2-14. HA1630D02
Open Loop Voltage Gain and Phase Angle vs. Frequency

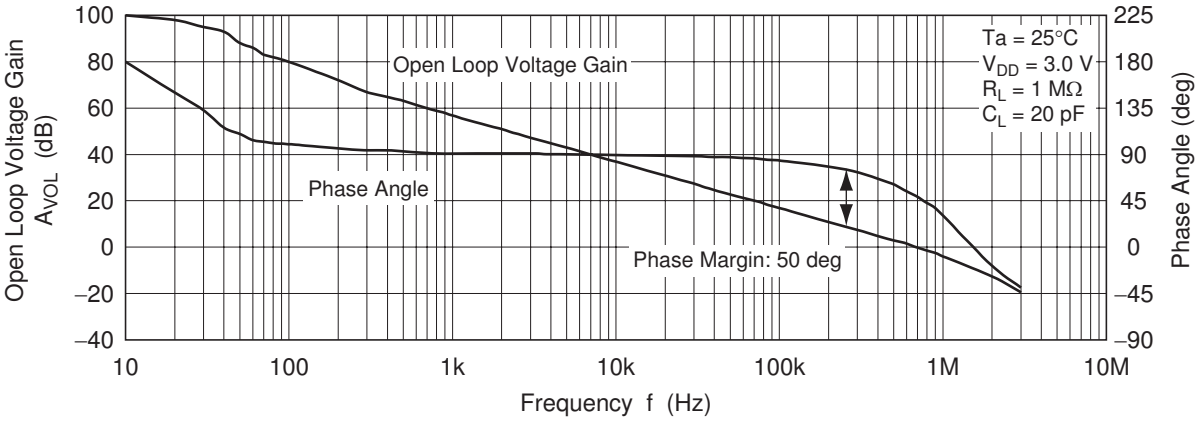


Figure 2-15. HA1630D02
Input Bias Current vs. Ambient Temperature

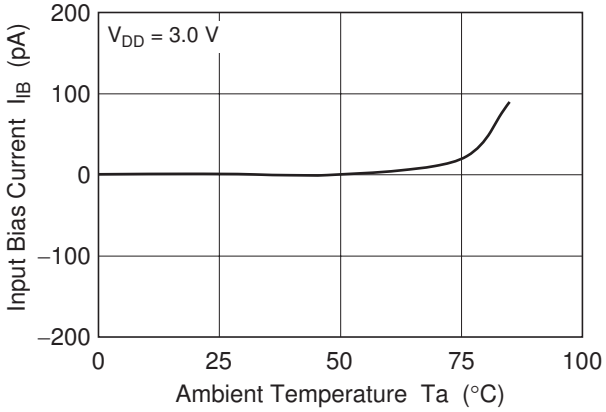


Figure 2-16. HA1630D02
Input Bias Current vs. Input Voltage

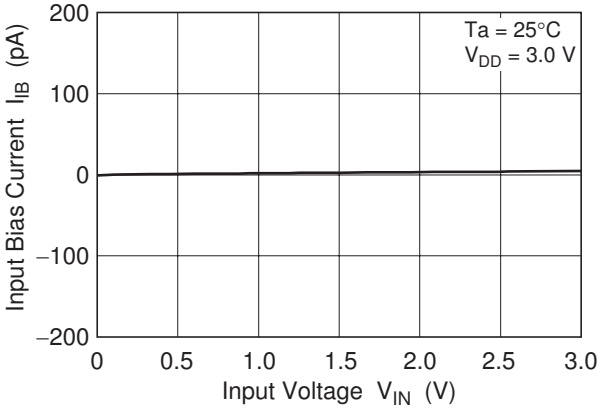


Figure 2-17. HA1630D02
Slew Rate (rising) vs. Ambient Temperature

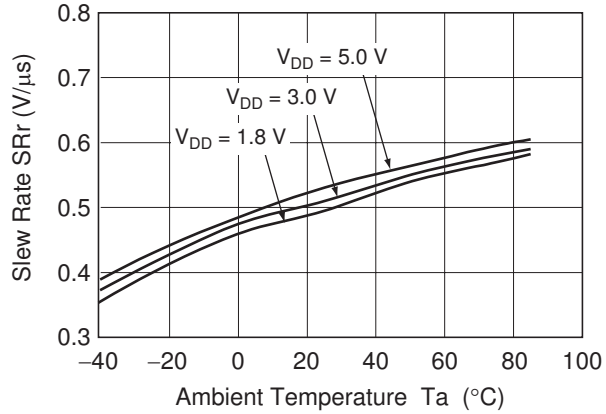


Figure 2-18. HA1630D02
Slew Rate (falling) vs. Ambient Temperature

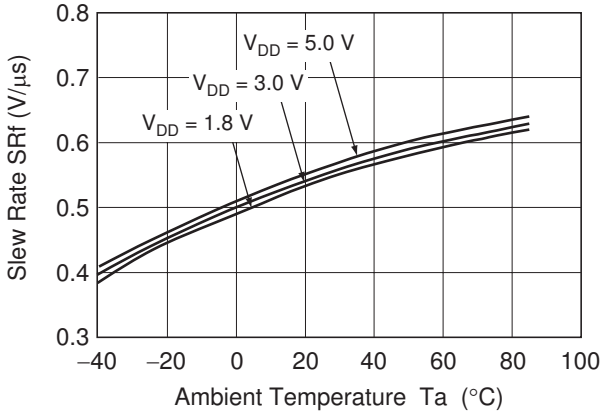


Figure 2-19. HA1630D02
Large Signal Transient Response

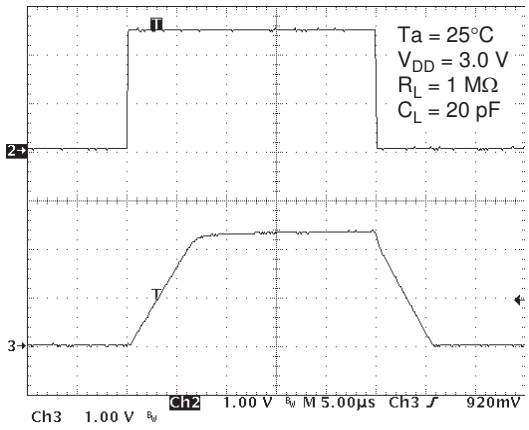


Figure 2-20. HA1630D02
Small Signal Transient Response

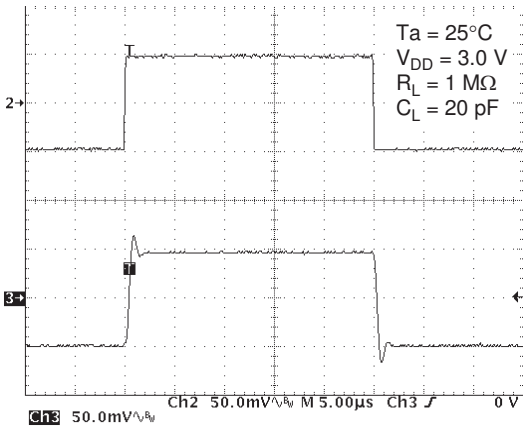


Figure 2-21. HA1630D02
Total Harmonic Distortion + Noise vs.
Output Voltage p-p

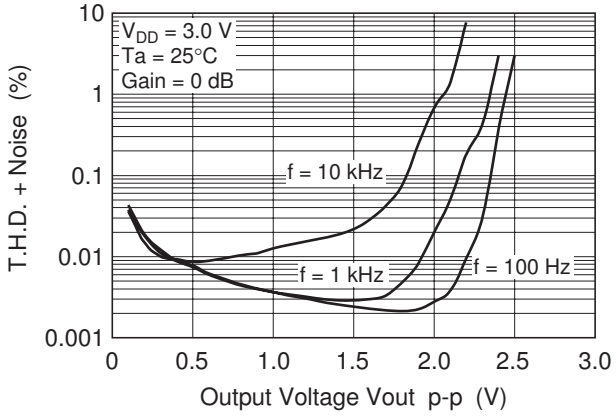


Figure 2-22. HA1630D02
Total Harmonic Distortion + Noise vs.
Output Voltage p-p

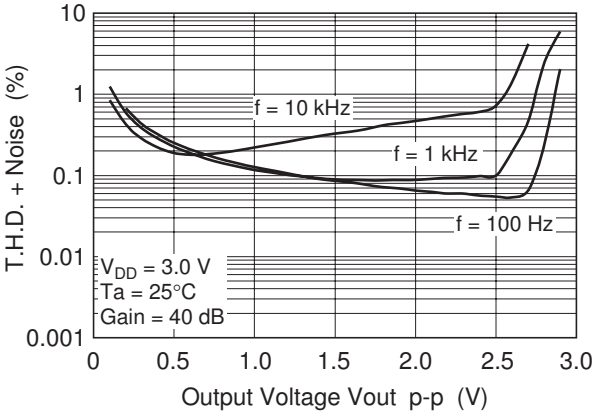


Figure 2-23. HA1630D02
Voltage Output p-p vs. Frequency

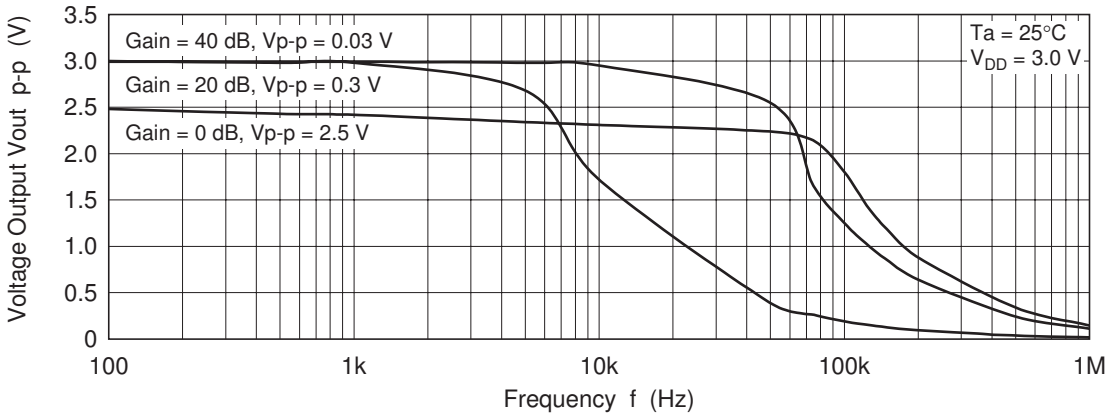


Figure 2-24. HA1630D02
Voltage Noise Density vs. Frequency

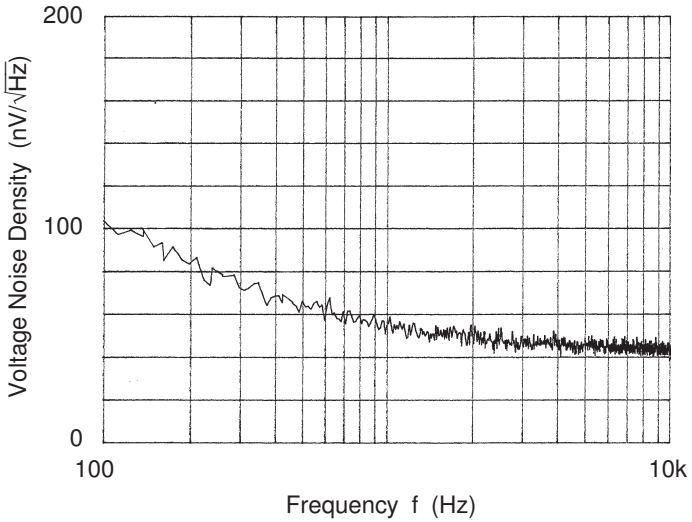
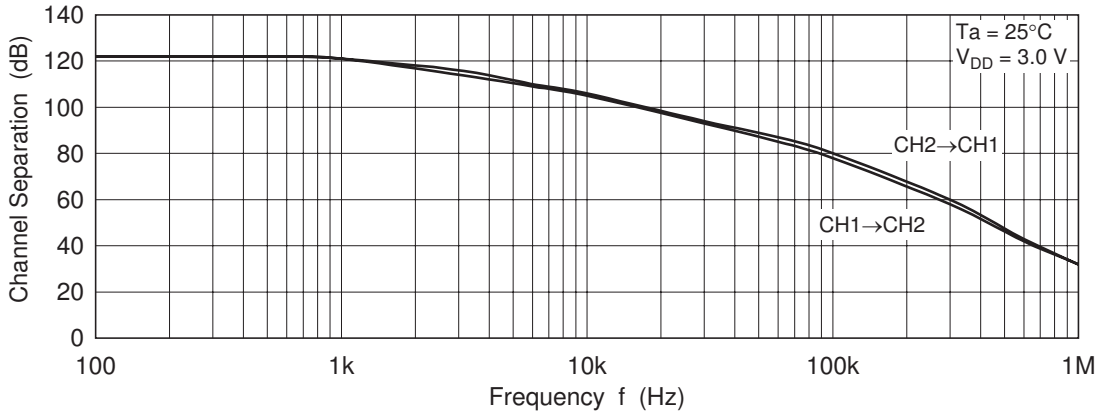


Figure 2-25. HA1630D02
Channel Separation vs. Frequency



Main Characteristics (HA1630D03)

Figure 3-1. HA1630D03
Supply Current vs. Supply Voltage

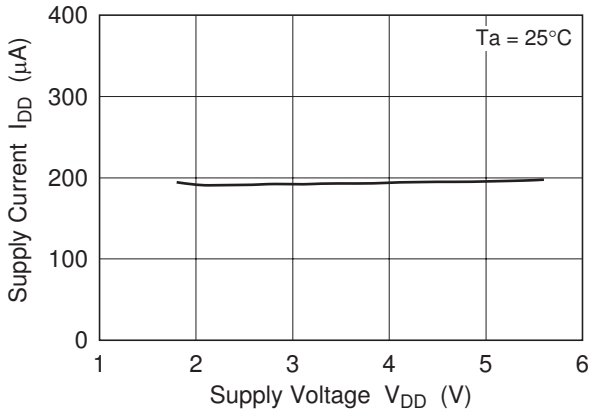


Figure 3-2. HA1630D03
Supply Current vs. Ambient Temperature

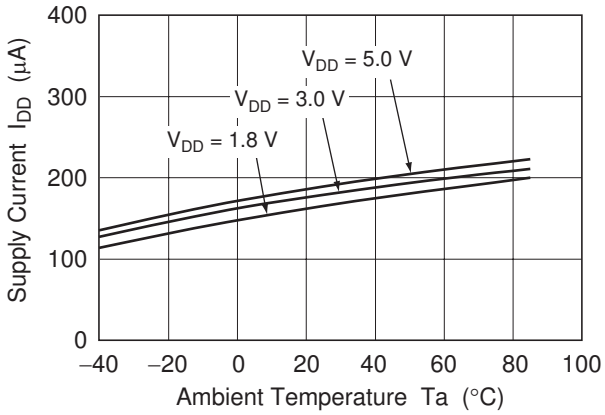


Figure 3-3. HA1630D03
Output High Voltage vs. Output Source Current

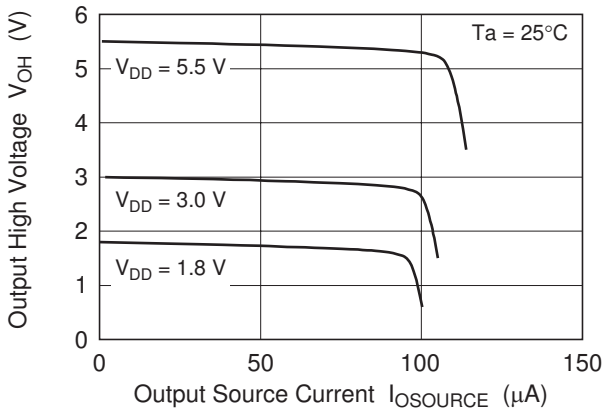


Figure 3-4. HA1630D03
Output High Voltage vs. Supply Voltage

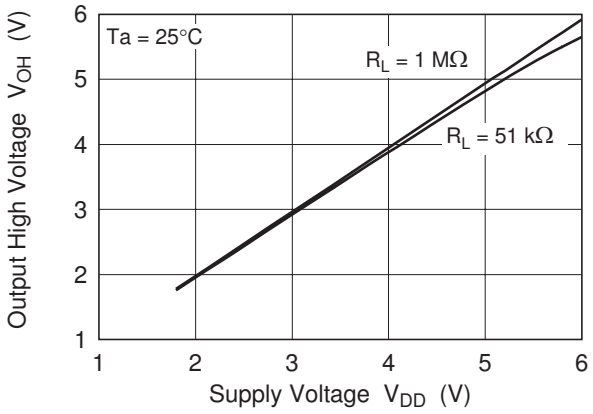


Figure 3-5. HA1630D03
Output Source Current vs. Ambient Temperature

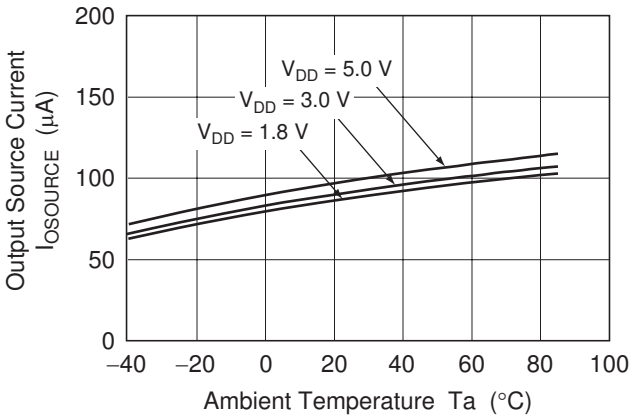


Figure 3-6. HA1630D03
Output Low Voltage vs. Output Sink Current

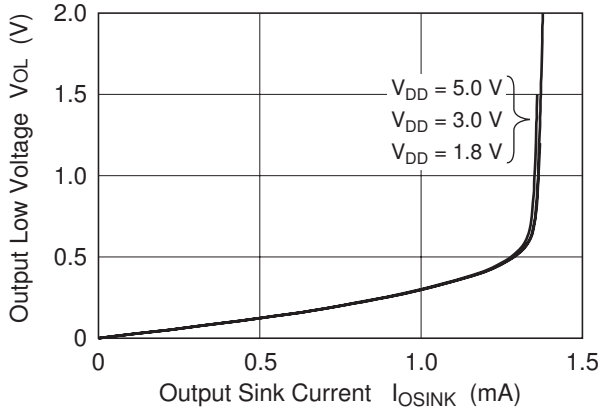


Figure 3-7. HA1630D03
Output Sink Current vs. Ambient Temperature

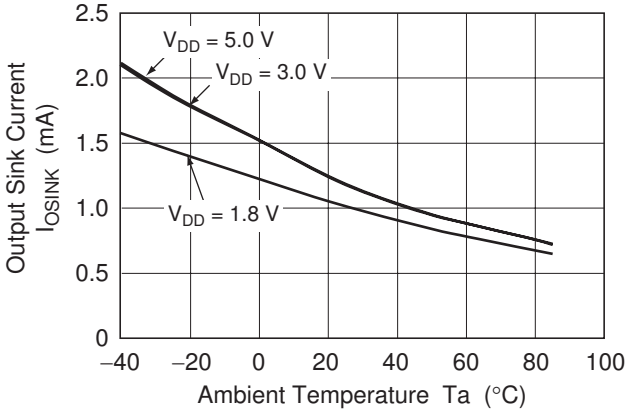


Figure 3-8. HA1630D03
Input Offset Voltage Distribution

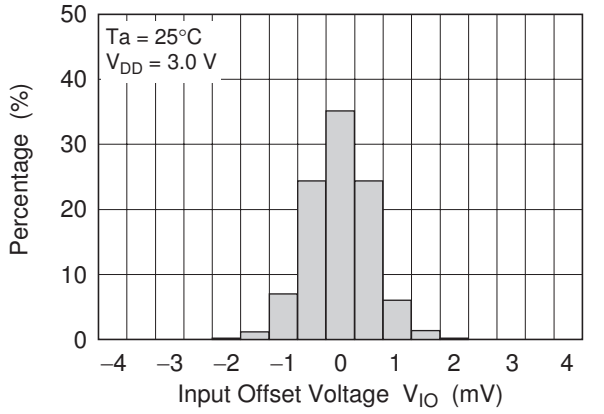


Figure 3-9. HA1630D03
Input Offset Voltage vs. Supply Voltage

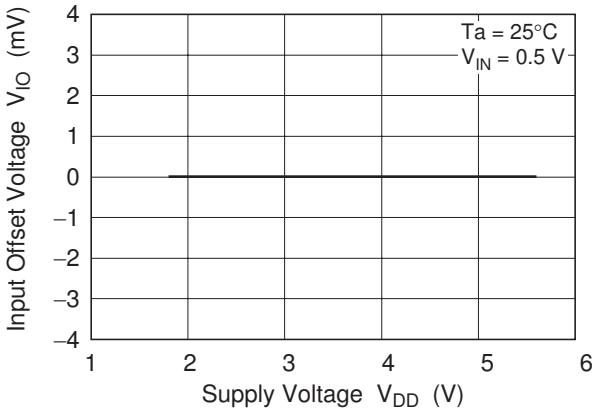


Figure 3-10. HA1630D03
Input Offset Voltage vs. Ambient Temperature

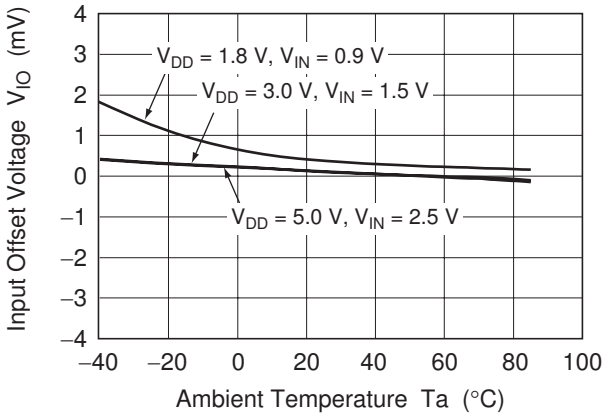


Figure 3-11. HA1630D03
Common Mode Input Voltage vs.
Ambient Temperature

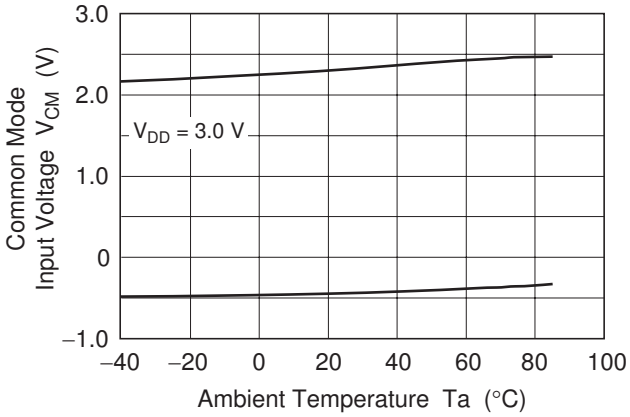


Figure 3-12. HA1630D03
Power Supply Rejection Ratio vs. Frequency

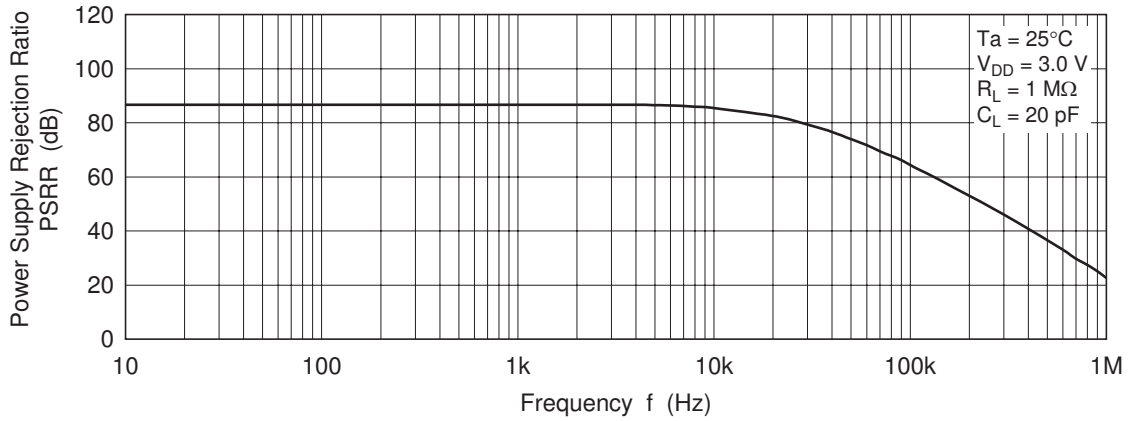


Figure 3-13. HA1630D03
Common Mode Rejection Ratio vs. Frequency

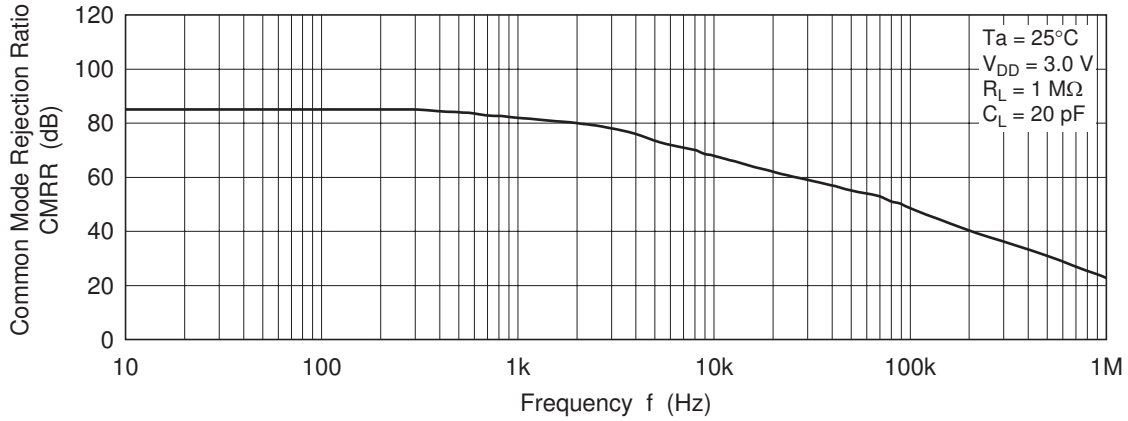


Figure 3-14. HA1630D03
Open Loop Voltage Gain and Phase Angle vs. Frequency

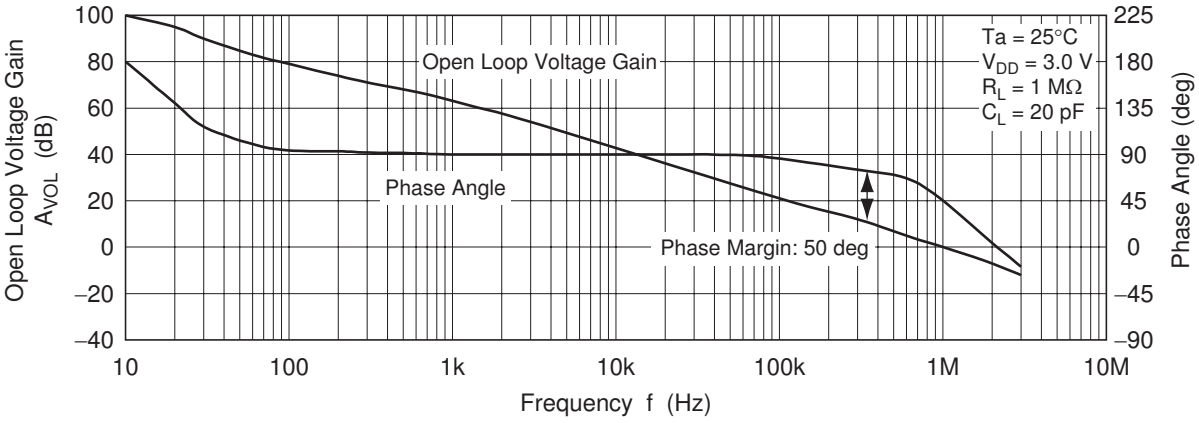


Figure 3-15. HA1630D03
Input Bias Current vs. Ambient Temperature

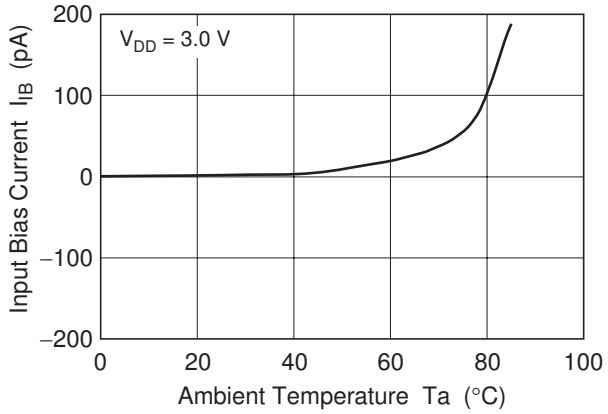


Figure 3-16. HA1630D03
Input Bias Current vs. Input Voltage

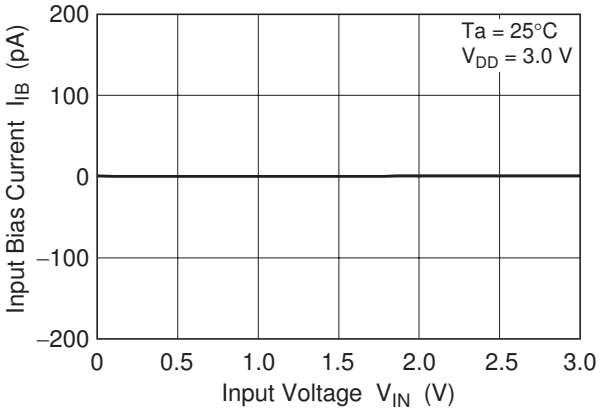


Figure 3-17. HA1630D03
Slew Rate (rising) vs. Ambient Temperature

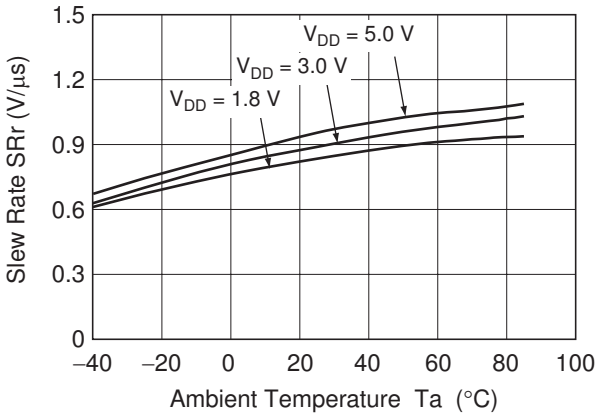


Figure 3-18. HA1630D03
Slew Rate (falling) vs. Ambient Temperature

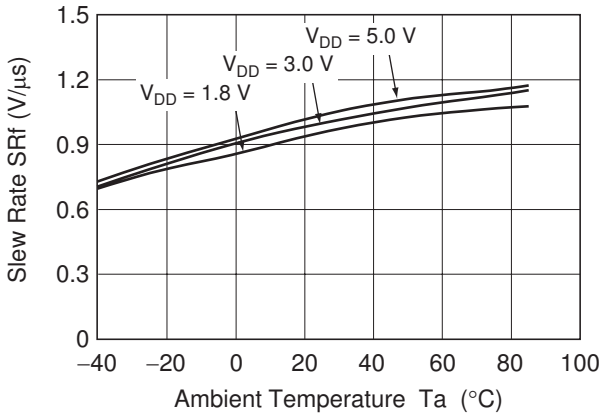


Figure 3-19. HA1630D03
Large Signal Transient Response

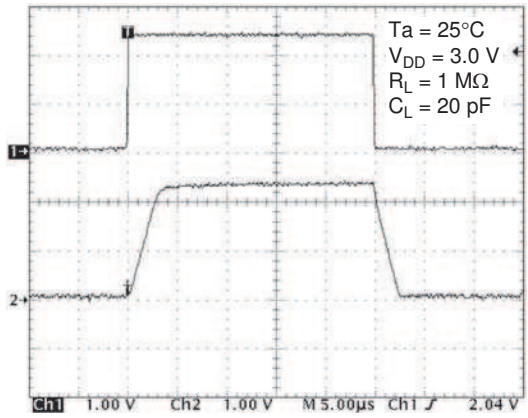


Figure 3-20. HA1630D03
Small Signal Transient Response

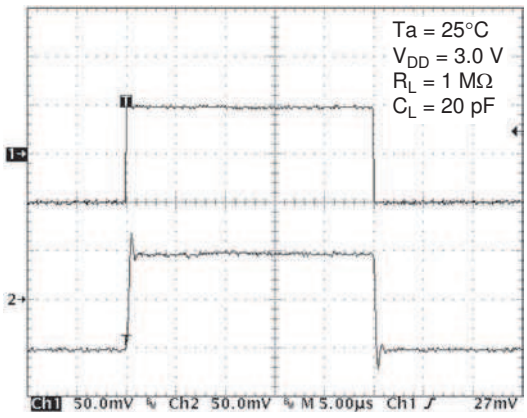


Figure 3-21. HA1630D03
Total Harmonic Distortion + Noise vs.
Output Voltage p-p

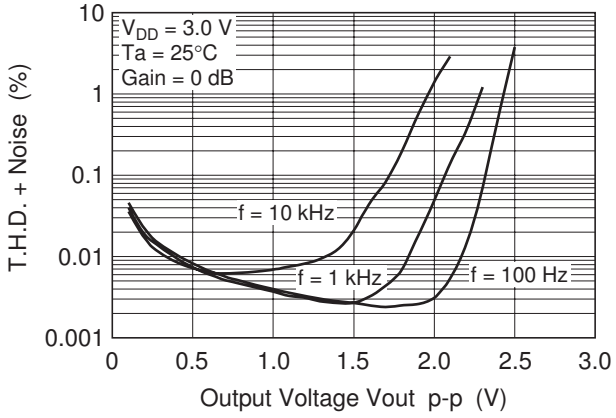


Figure 3-22. HA1630D03
Total Harmonic Distortion + Noise vs.
Output Voltage p-p

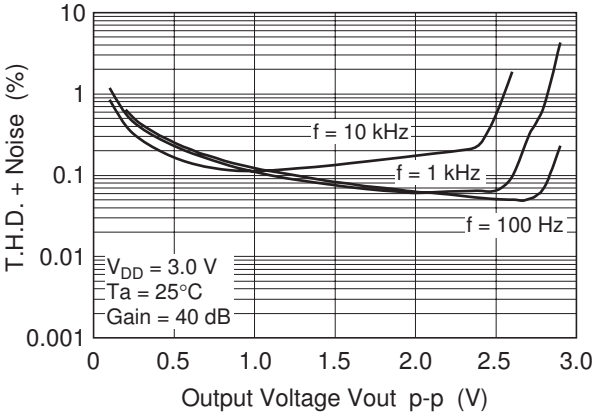


Figure 3-23. HA1630D03
Voltage Output p-p vs. Frequency

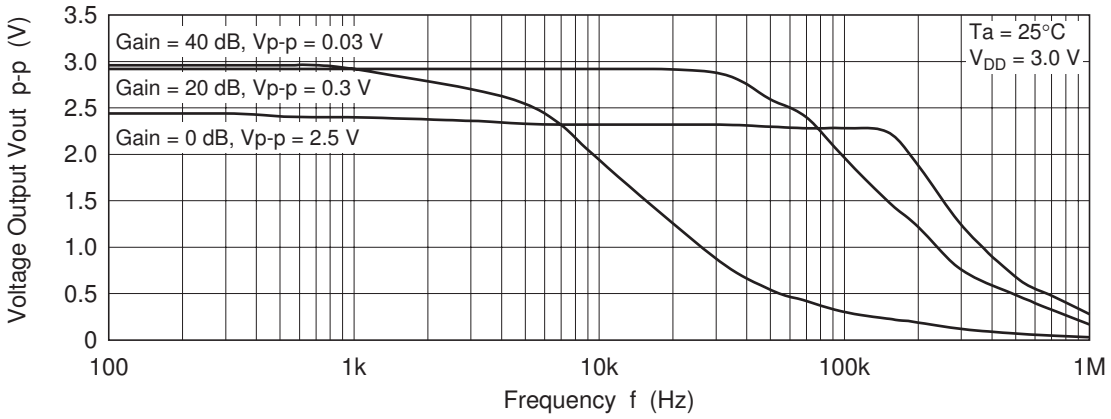


Figure 3-24. HA1630D03
Voltage Noise Density vs. Frequency

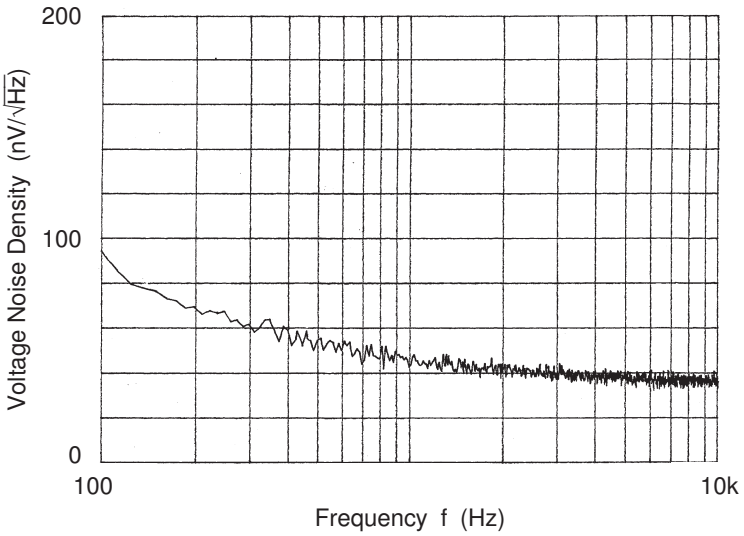
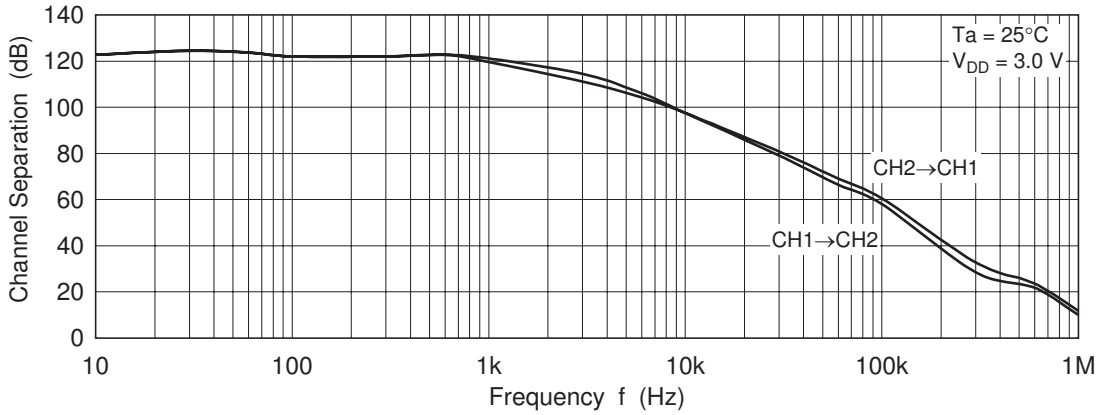
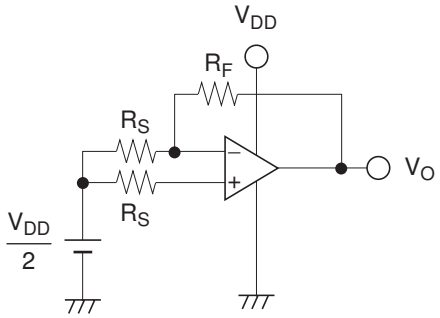


Figure 3-25. HA1630D03
Channel Separation vs. Frequency



Test Circuits

1. Power Supply Rejection Ratio, PSRP & Voltage Offset, V_{IO}



V_{IO}

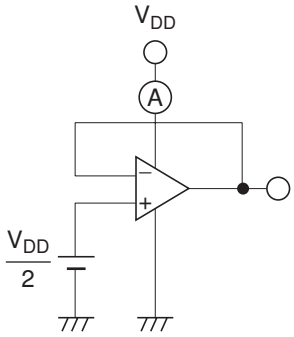
$$V_{IO} = \left(V_O - \frac{V_{DD}}{2}\right) \times \frac{R_S}{R_S + R_F}$$

PSRR

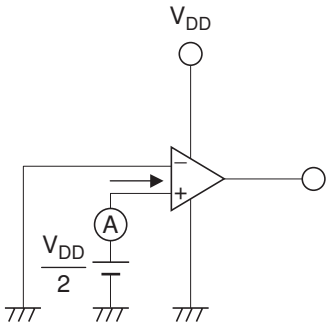
$$PSRR = -20\log\left(\left|\frac{V_{O1} - V_{O2}}{V_{DD1} - V_{DD2}}\right| \times \frac{R_S}{R_S + R_F}\right)$$

Measure V_O corresponding to V_{DD1} = 1.8 V and V_{DD2} = 5.5 V

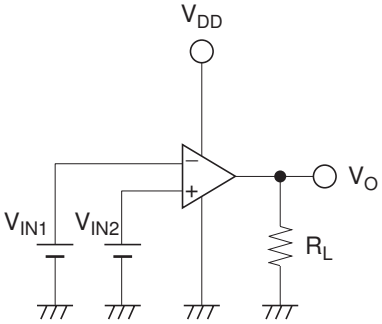
2. Supply Current, I_{DD}



3. Input Bias Current, I_{IB}



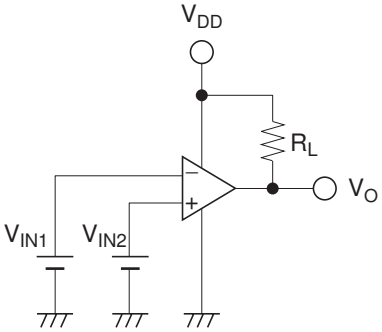
4. Output High Voltage, V_{OH}



V_{OH}

R_L = 1 MΩ
$V_{IN1} = V_{DD} / 2 - 0.05$ V
$V_{IN2} = V_{DD} / 2 + 0.05$ V

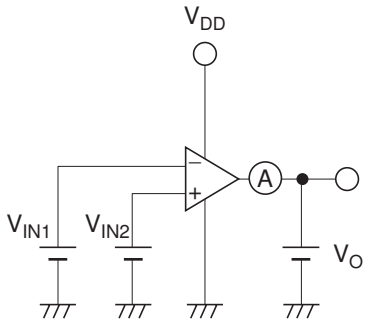
5. Output Low Voltage, V_{OL}



V_{OL}

R_L = 1 MΩ
$V_{IN1} = V_{DD} / 2 + 0.05$ V
$V_{IN2} = V_{DD} / 2 - 0.05$ V

6. Output Source Current, $I_{OSOURCE}$ & Output Sink Current, I_{OSINK}



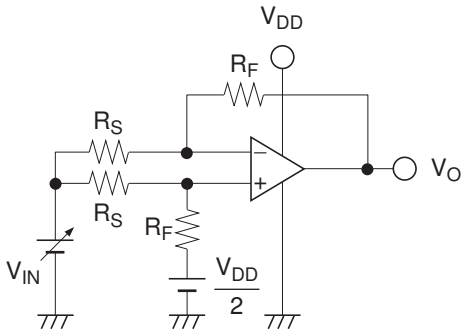
$I_{OSOURCE}$

$V_O = V_{DD} - 0.5$ V
$V_{IN1} = V_{DD} / 2 - 0.05$ V
$V_{IN2} = V_{DD} / 2 + 0.05$ V

I_{OSINK}

$V_O = + 0.5$ V
$V_{IN1} = V_{DD} / 2 + 0.05$ V
$V_{IN2} = V_{DD} / 2 - 0.05$ V

7. Common Mode Input Voltage, V_{CM} & Common Mode Rejection Ratio, CMRR

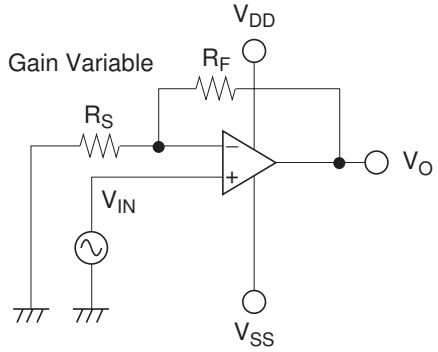


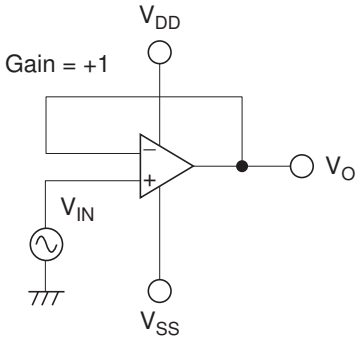
CMRR

$$CMRR = -20\log\left(\left|\frac{V_{O1} - V_{O2}}{V_{IN1} - V_{IN2}}\right| \times \frac{R_S}{R_S + R_F}\right)$$

Measure V_O corresponding to $V_{IN1} = 0$ V and $V_{IN2} = 2.1$ V

8. Total Harmonic Distortion, THD

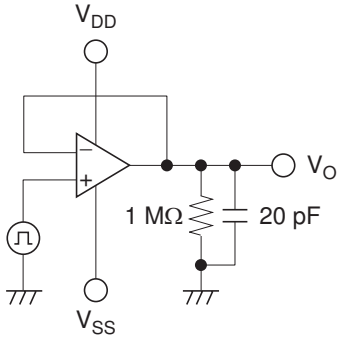




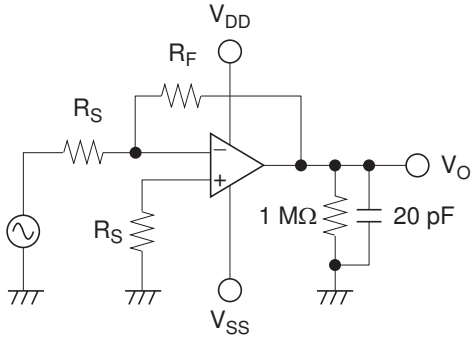
THD

Gain Variable
$1 + R_F / R_S = 100$
freq = 100 Hz, 1 kHz, 10 kHz

9. Slew Rate, SR

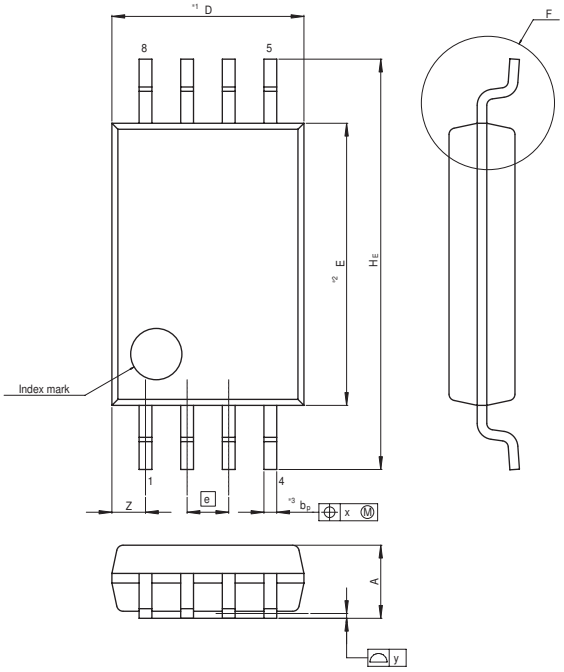


10. Gain, A_V & Phase, GBW

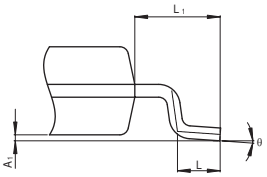


Package Dimensions

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



Terminal cross section
(Ni/Pd/Au plating)



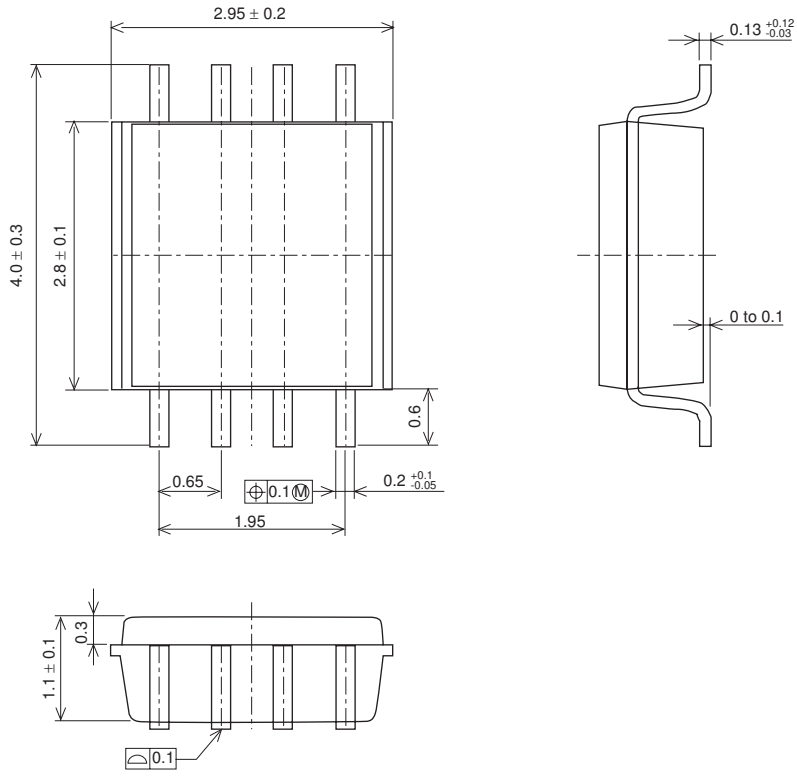
Detail F

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_2	—	—	—
A_1	0.03	0.07	0.10
A	—	—	1.10
b_p	0.15	0.20	0.25
b_1	—	—	—
c	0.10	0.15	0.20
c_1	—	—	—
θ	0°	—	8°
H_E	6.20	6.40	6.60
e	—	0.65	—
x	—	—	0.13
y	—	—	0.10
Z	—	—	0.805
L	0.40	0.50	0.60
L_1	—	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

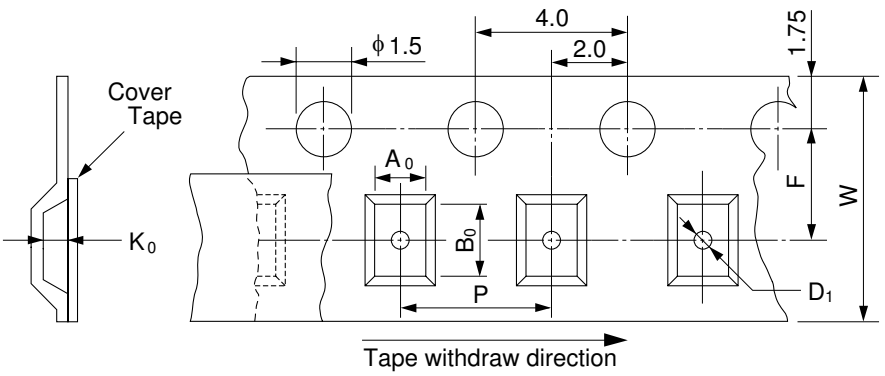


Taping & Reel Specification

[Taping]

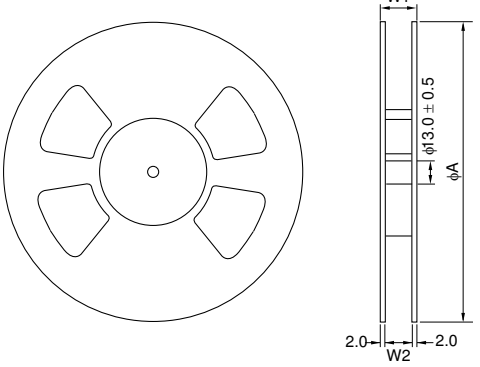
Package Code	W	P	Ao	Bo	Ko	E	F	D1	Maximum Storage No.
TSSOP-8	12	8	6.9	3.6	1.7	1.75	5.5	1.5	3,000 pcs/reel
MMPAK-8	12	4.0	3.15	4.35	—	—	5.5	1.05	3,000 pcs/reel

Unit: mm



[Reel]

Package	Tape width	W1	W2	A
TSSOP-8	12	17.4	13.4	330
MMPAK-8	12	17.0	13.0	178

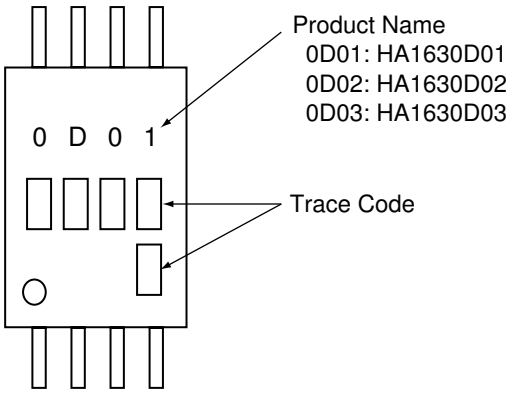


[Ordering Information]

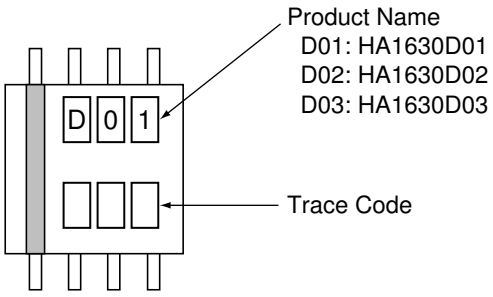
Ordering Unit
3,000 pcs

Mark Indication

TSSOP-8



MMPAK-8



Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

RENESAS SALES OFFICES

http://www.renesas.com

Refer to "**http://www.renesas.com/en/network**" for the latest and detailed information.

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510

Colophon .7.0