

Precision, Low Noise, Rail-to-Rail Output, Single CMOS Operational Amplifier

■ GENERAL DESCRIPTION

The NJU7076B is a high precision Rail-to-Rail output Single CMOS operational amplifier featuring a low noise of $10\text{nV}/\sqrt{\text{Hz}}$ (typ.), low input offset voltage of $300\mu\text{V}$ (max.), low temperature drift of $0.5\mu\text{V}/^\circ\text{C}$ (typ.) and low bias current of 1pA (typ.).

The output swing can reach 20mV from the rails, while driving a $10\text{k}\Omega$ load (at 5V operation). The NJU7076B also has a high RF immunity which can reduce malfunctions caused by RF noises from mobile phones and others. The combination of these specifications makes the NJU7076B well-suited for sensor applications such as a temperature sensor, weight sensor and others, high precision current sensing amplifiers and current voltage converters.

■ PACKAGE OUTLINE



**NJU7076BF3
(SC-88A)**

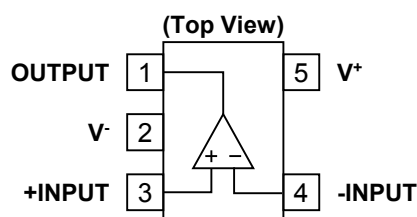
■ FEATURES

- High Precision
 - Low Offset Voltage $300\mu\text{V}$ max.
 - Low Offset Voltage Drift $0.5\mu\text{V}/^\circ\text{C}$ typ.
- Low Noise $10\text{nV}/\sqrt{\text{Hz}}$ typ.
- Low Input Bias Current 1pA typ.
- Rail-to-Rail Output
 - $R_L=10\text{k}\Omega$ 20mV from Rail typ.
 - $R_L=600\Omega$ 80mV from Rail typ.
- Ground sense
- RF Immunity
- Operating Voltage 2.2V to 5.5V
- Unity-Gain Stable
- Package SC-88A

■ APPLICATIONS

- Thermocouple / Thermopile Amplifiers
- Strain Gauge / Pressure sensor Amplifiers
- Load Cell and Bridge Transducer Amplifiers
- High Resolution Data Acquisition
- Precision Current Sensing
- Battery monitoring
- Photo-Diode pre amplifier

■ PIN CONFIGURATION



■ ABSOLUTE MAXIMUM RATINGS(Ta=25°C, unless otherwise noted.)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V^+ - V^-$	7 ⁽¹⁾	V
Differential Input Voltage ⁽²⁾	V_{ID}	± 7 ⁽³⁾	V
Input Voltage	V_{IN}	$V^- - 0.3$ to $V^+ + 0.3$	V
Power Dissipation ⁽⁴⁾	P_D	(2-layer / 4-layer)	mW
SC-88A		360 / 490	mW
Operating Temperature Range	T_{opr}	-40 to +125	°C
Storage Temperature Range	T_{stg}	-55 to +150	°C

(1) Supply Voltage is the voltage difference between V^+ and V^- .

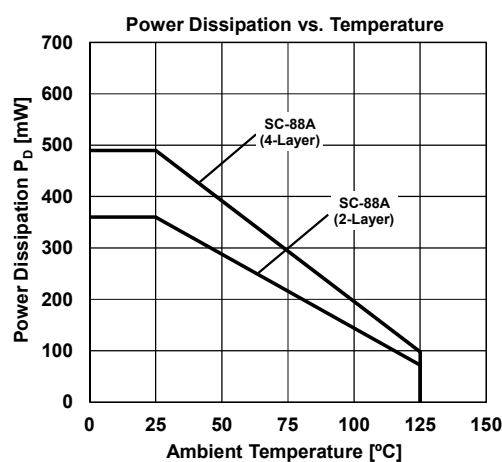
(1) Differential voltage is the voltage difference between +INPUT and -INPUT.

(3) For supply voltage less than 7V, the absolute maximum rating is equal to the supply voltage.

(4) Power dissipation is the power that can be consumed by the IC at Ta=25°C, and is the typical measured value based on JEDEC condition. When using the IC over Ta=25°C subtract the value $[mW/°C]=PD/(T_{stg}(MAX)-25)$ per temperature.

2-layer: EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layers, FR-4) mounting

4-layer: EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 4layers, FR-4) mounting


■ RECOMMENDED OPERATING CONDITIONS(Ta=25°C)

PARAMETER	Value	UNIT
Supply Voltage	+2.2 to +5.5 (± 1.1 to ± 2.75)	V

■ ELECTRICAL CHARACTERISTICS($V^+=5V$, $V^-=0V$, $V_{COM}=V^+/2$, $T_a=25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DC CHARACTERISTICS						
Supply Current	I _{SUPPLY}	No Signal, R _L =OPEN	-	0.6	0.9	mA
		No Signal, R _L =OPEN, Ta = -40°C to 125°C	-	-	0.9	mA
Input Offset Voltage	V _{IO}	Ta=-40°C to 125°C	-	20	300	μV
			-	-	400	μV
Input Offset Voltage Drift	ΔV _{IO} /ΔT	Ta=-40°C to 125°C ⁽⁵⁾	-	0.5	5	μV/°C
Input Bias Current	I _B		-	1	-	pA
Input Offset Current	I _{IO}		-	1	-	pA
Open-Loop Voltage Gain	A _V	Vo=0.5V to 4.5V, R _L =10kΩ to 2.5V	100	130	-	dB
		Vo=0.5V to 4.5V, R _L =10kΩ to 2.5V, Ta= -40°C to 125°C	100	-	-	dB
Common-Mode Rejection Ratio	CMR	V _{ICM} =0V to 4V	70	90	-	dB
		V _{ICM} =0V to 4V, Ta= -40°C to 125°C	70	-	-	dB
Supply Voltage Rejection Ratio	SVR	V ⁺ =2.2V to 5.5V	70	90	-	dB
		V ⁺ =2.2V to 5.5V, Ta= -40°C to 125°C	70	-	-	dB
High-level Output Voltage	V _{OH}	R _L =10kΩ to 2.5V	4.95	4.98	-	V
		R _L =10kΩ to 2.5V, Ta= -40°C to 125°C	4.95	-	-	V
		R _L =600Ω to 2.5V	4.85	4.92	-	V
		R _L =600Ω to 2.5V, Ta= -40°C to 125°C	4.85	-	-	V
		I _{SOURCE} =2mA	4.9	4.96	-	V
		I _{SOURCE} =2mA, Ta= -40°C to 125°C	4.85	-	-	V
Low-level Output Voltage	V _{OL}	R _L =10kΩ to 2.5V	-	0.02	0.05	V
		R _L =10kΩ to 2.5V, Ta= -40°C to 125°C	-	-	0.05	V
		R _L =600Ω to 2.5V	-	0.08	0.15	V
		R _L =600Ω to 2.5V, Ta= -40°C to 125°C	-	-	0.2	V
		I _{SINK} =2mA	-	0.04	0.1	V
		I _{SINK} =2mA, Ta= -40°C to 125°C	-	-	0.15	V
Common-Mode Input Voltage Range	V _{ICM}	CMR≥70dB	0	-	4	V
		CMR≥70dB, Ta= -40°C to 125°C	0	-	4	V
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	G _V =40dB, R _F =100kΩ, R _L =10kΩ to 2.5V, C _L =20pF, f=100kHz	-	1.3	-	MHz
Phase Margin	Φ _m	G _V =40dB, R _F =100kΩ, R _L =10kΩ to 2.5V, C _L =20pF	-	60	-	deg
Gain Margin	G _m	G _V =40dB, R _F =100kΩ, R _L =10kΩ to 2.5V, C _L =20pF	-	12	-	dB
Equivalent Input Noise Voltage	e _n	f=1kHz	-	10	-	nV/√Hz
Slew Rate	SR	G _V =0dB, R _L =10kΩ to 2.5V, C _L =20pF, V _{IN} =3V _{PP}	-	0.5	-	V/μs
Total Harmonic Distortion	THD	G _V =20dB, R _L =10kΩ to 2.5V, f=1kHz, V _O =3V _{PP}	-	0.01	-	%

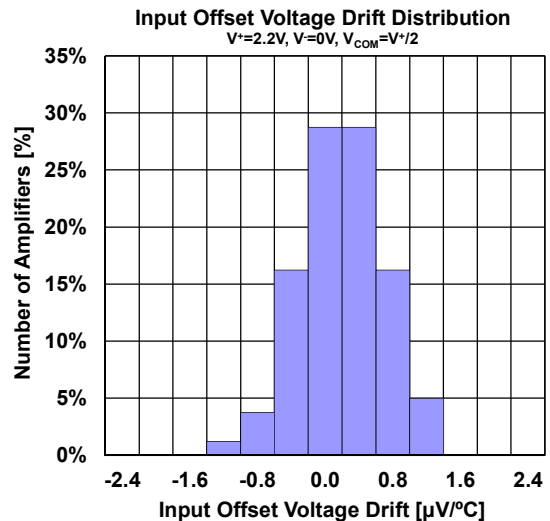
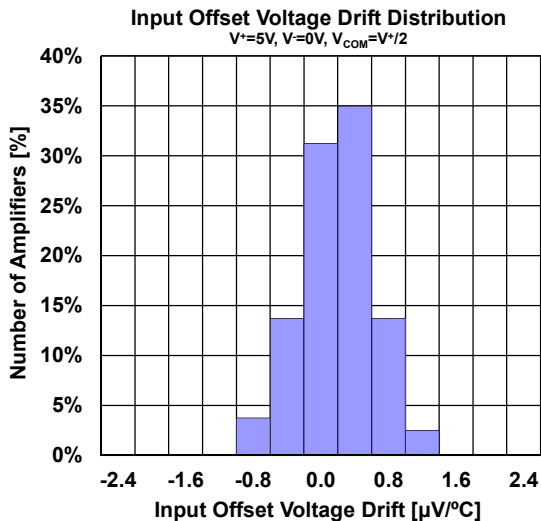
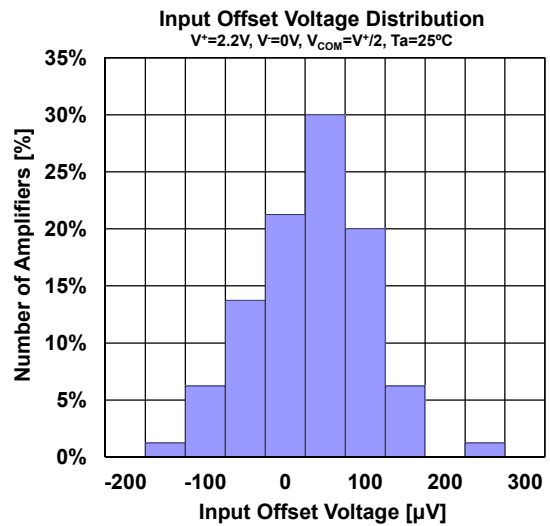
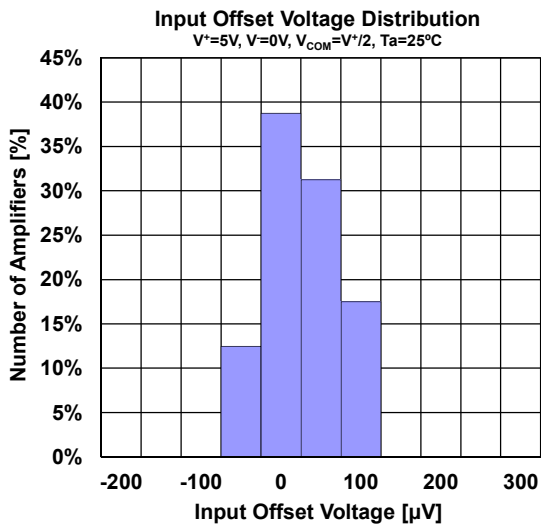
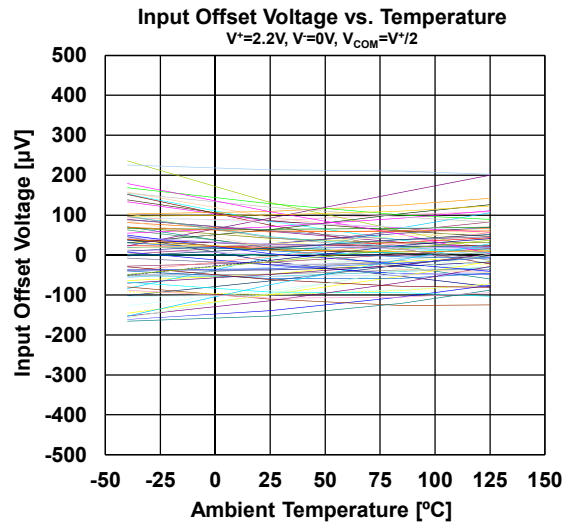
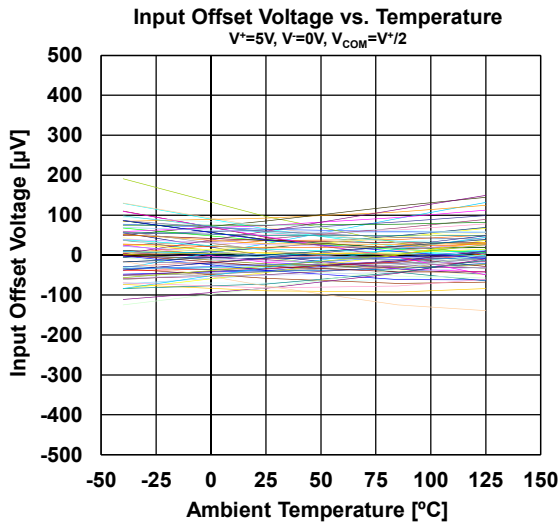
(5) Guaranteed by two points of Temperature $-40^\circ C$ and $+125^\circ C$

■ ELECTRICAL CHARACTERISTICS($V^+=2.2\text{V}$, $V^-=0\text{V}$, $V_{\text{COM}}=V^+/2$, $T_a=25^\circ\text{C}$, unless otherwise noted.)

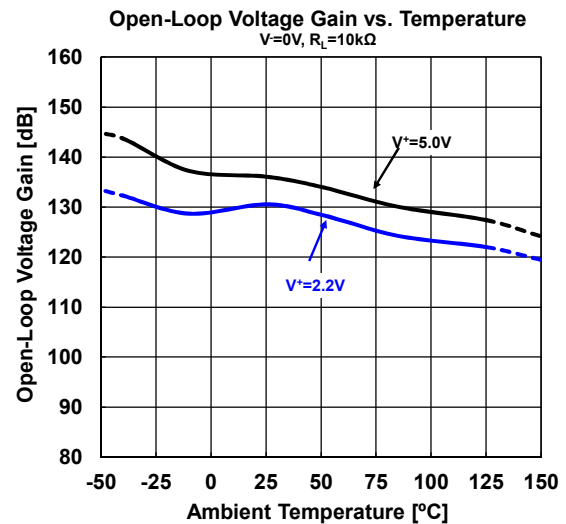
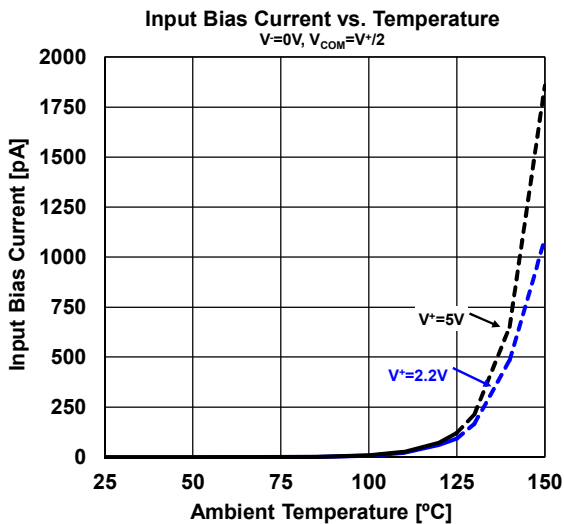
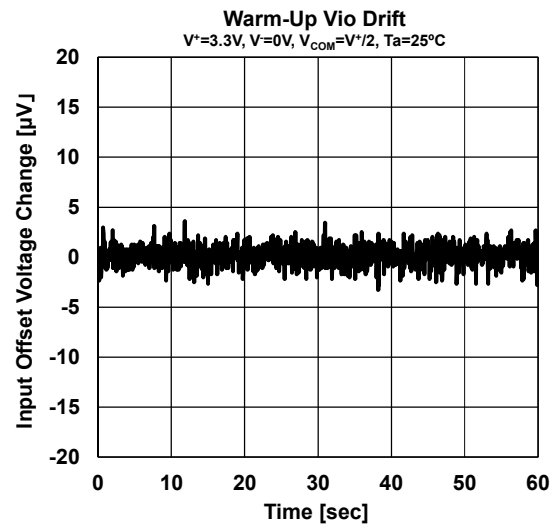
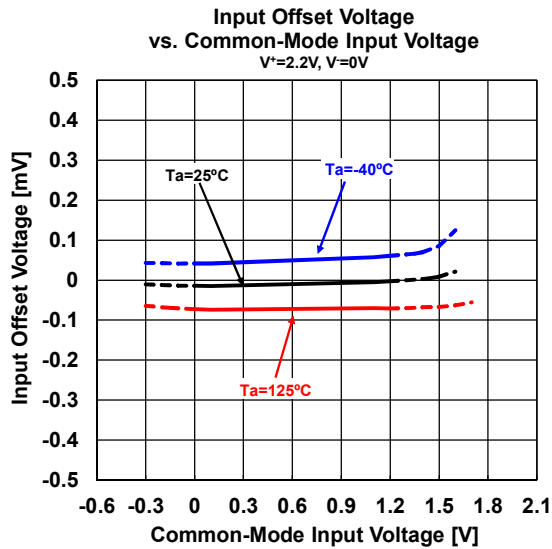
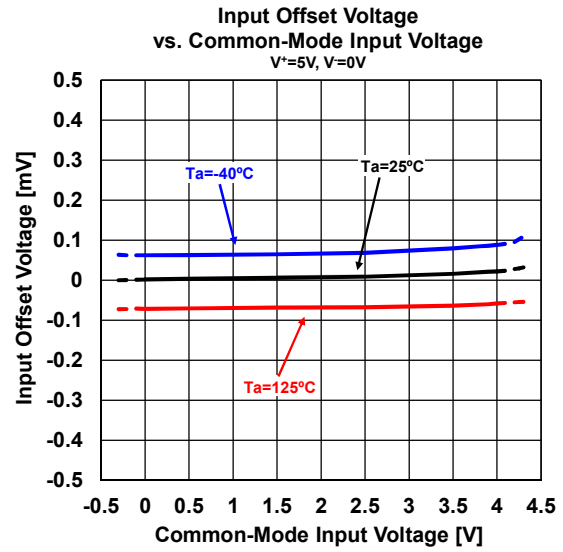
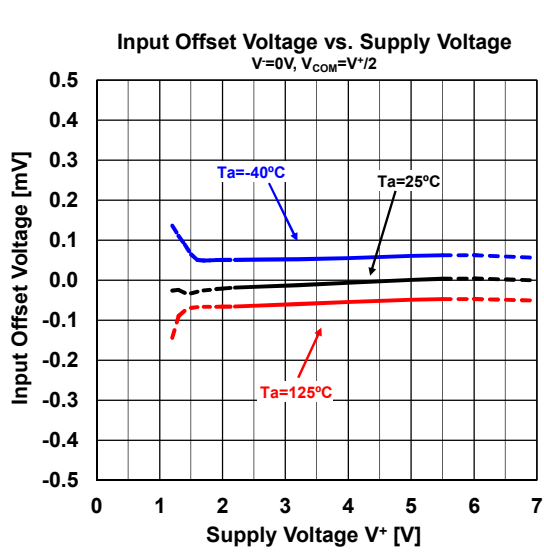
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DC CHARACTERISTICS						
Supply Current	I _{SUPPLY}	No Signal, R _L =OPEN	-	0.55	0.82	mA
		No Signal, R _L =OPEN, Ta = -40°C to 125°C	-	-	0.82	mA
Input Offset Voltage	V _{IO}		-	60	300	μV
		Ta= -40°C to 125°C	-	-	400	μV
Input Offset Voltage Drift	ΔV _{IO} /ΔT	Ta= -40°C to 125°C ⁽⁵⁾	-	0.6	5	μV/°C
Input Bias Current	I _B		-	1	-	pA
Input Offset Current	I _{IO}		-	1	-	pA
Open-Loop Voltage Gain	A _V	Vo=0.6V to 1.6V, R _L =10kΩ to 1.1V	100	130	-	dB
		Vo=0.6V to 1.6V, R _L =10kΩ to 1.1V, Ta= -40°C to 125°C	100	-	-	dB
Common-Mode Rejection Ratio	CMR	V _{ICM} =0V to 1.2V	70	90	-	dB
		V _{ICM} =0V to 1.2V, Ta= -40°C to 125°C	70	-	-	dB
High-level Output Voltage	V _{OH}	R _L =10kΩ to 1.1V	2.15	2.18	-	V
		R _L =10kΩ to 1.1V, Ta= -40°C to 125°C	2.15	-	-	V
		R _L =600Ω to 1.1V	2.1	2.14	-	V
		R _L =600Ω to 1.1V, Ta= -40°C to 125°C	2.05	-	-	V
		I _{SOURCE} =2mA	2.05	2.13	-	V
		I _{SOURCE} =2mA, Ta= -40°C to 125°C	2	-	-	V
Low-level Output Voltage	V _{OL}	R _L =10kΩ to 1.1V	-	0.02	0.05	V
		R _L =10kΩ to 1.1V, Ta= -40°C to 125°C	-	-	0.05	V
		R _L =600Ω to 1.1V	-	0.06	0.1	V
		R _L =600Ω to 1.1V, Ta= -40°C to 125°C	-	-	0.15	V
		I _{SINK} =2mA	-	0.07	0.15	V
		I _{SINK} =2mA, Ta= -40°C to 125°C	-	-	0.2	V
Common-Mode Input Voltage Range	V _{ICM}	CMR≥70dB	0	-	1.2	V
		CMR≥70dB, Ta= -40°C to 125°C	0	-	1.2	V
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	G _V =40dB, R _F =100kΩ, R _L =10kΩ to 1.1V, C _L =20pF, f=100kHz	-	1.2	-	MHz
Phase Margin	Φ _m	G _V =40dB, R _F =100kΩ, R _L =10kΩ to 1.1V, C _L =20pF	-	60	-	deg
Gain Margin	G _m	G _V =40dB, R _F =100kΩ, R _L =10kΩ to 1.1V, C _L =20pF	-	12	-	dB
Equivalent Input Noise Voltage	e _n	f=1kHz	-	10	-	nV/√Hz
Slew Rate	SR	G _V =0dB, R _L =10kΩ, C _L =20pF, V _{IN} =1V _{PP}	-	0.5	-	V/μs
Total Harmonic Distortion	THD	G _V =20dB, R _L =10kΩ, f=1kHz, V _O =1V _{PP}	-	0.01	-	%

(5) Guaranteed by two points of Temperature -40°C and $+125^\circ\text{C}$

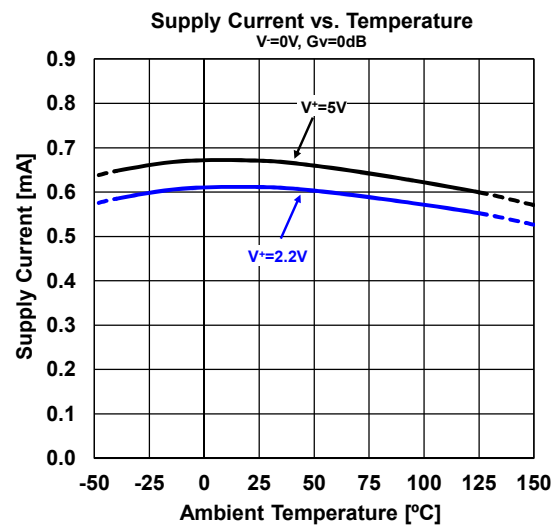
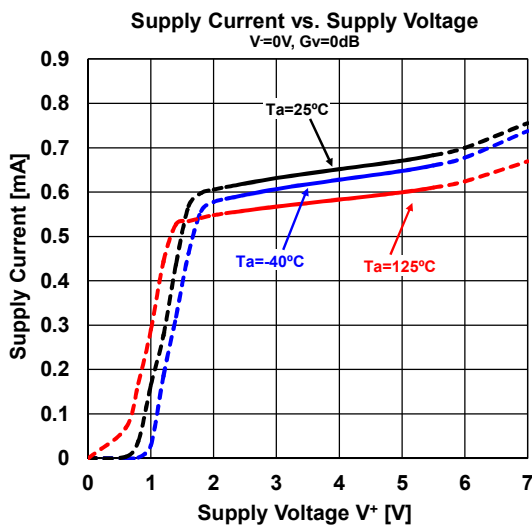
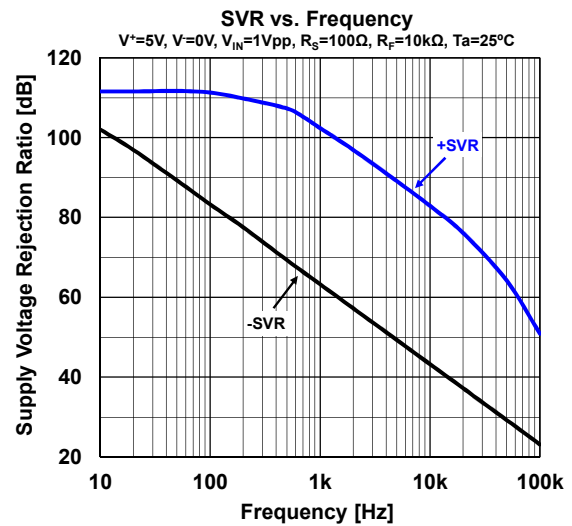
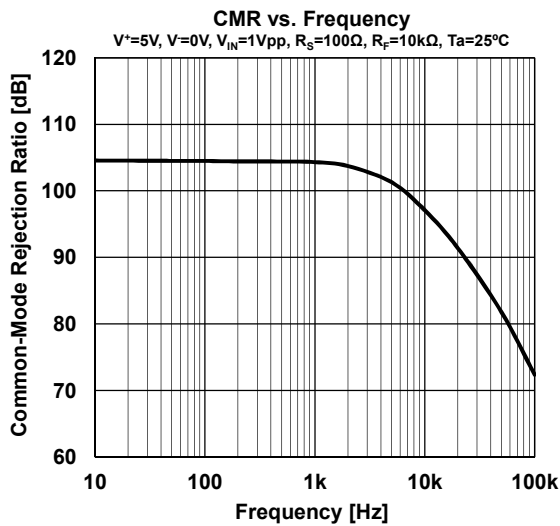
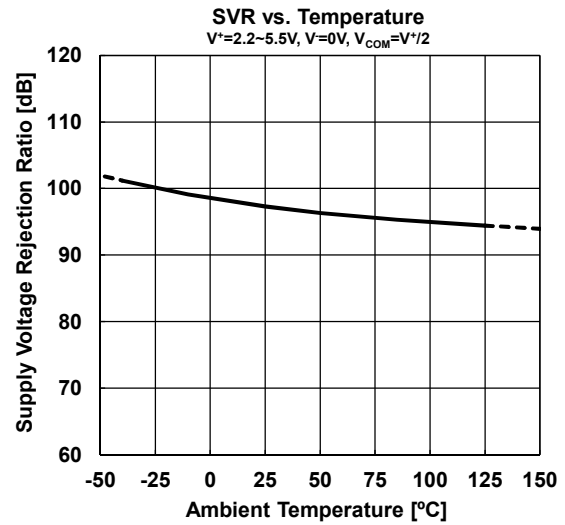
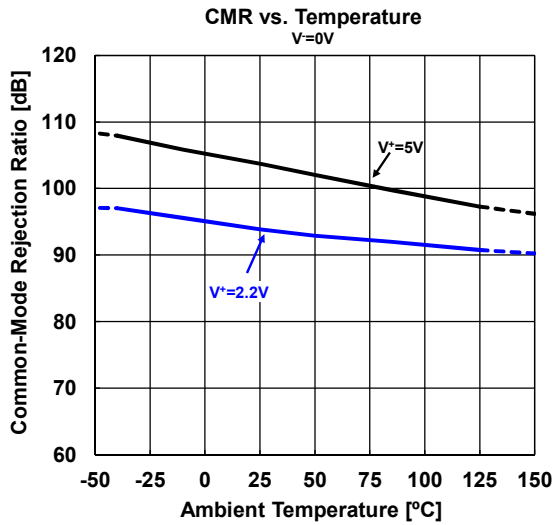
■ TYPICAL CHARACTERISTICS



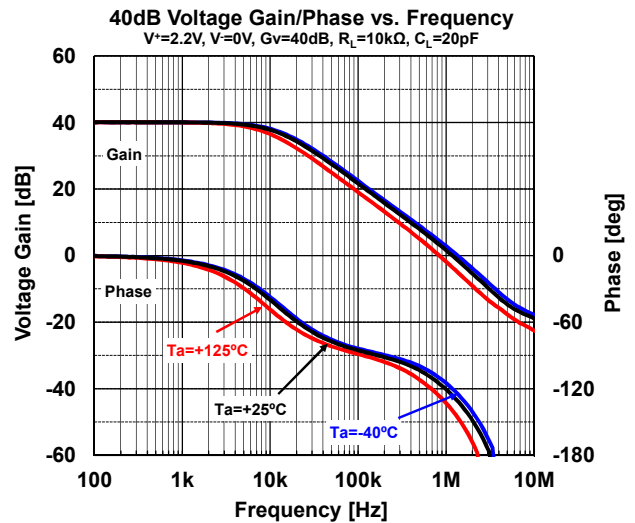
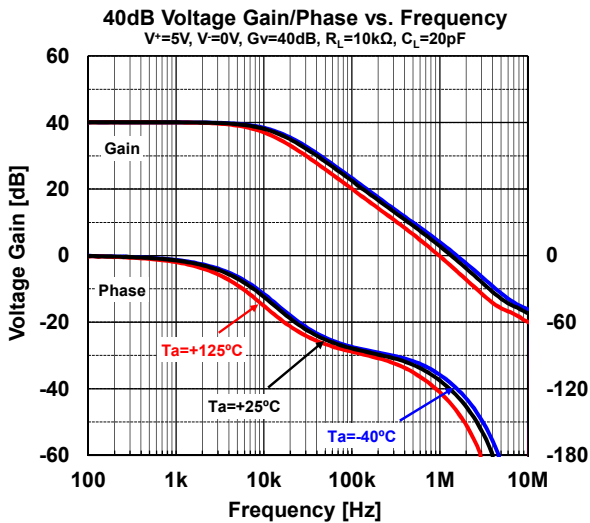
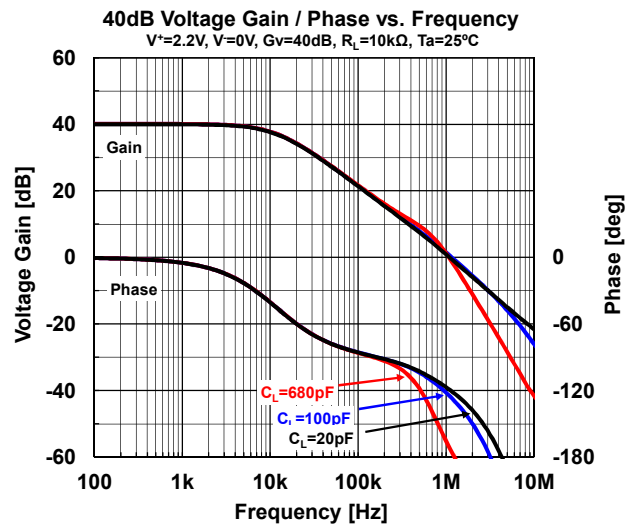
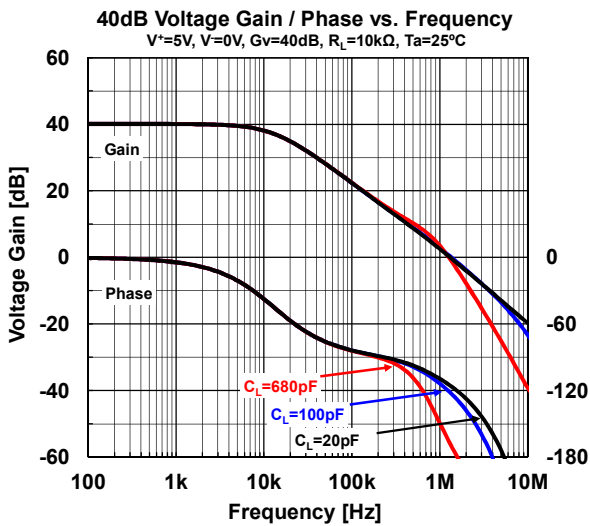
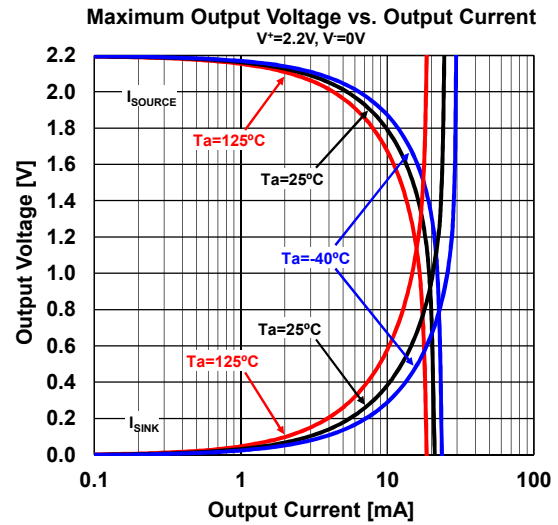
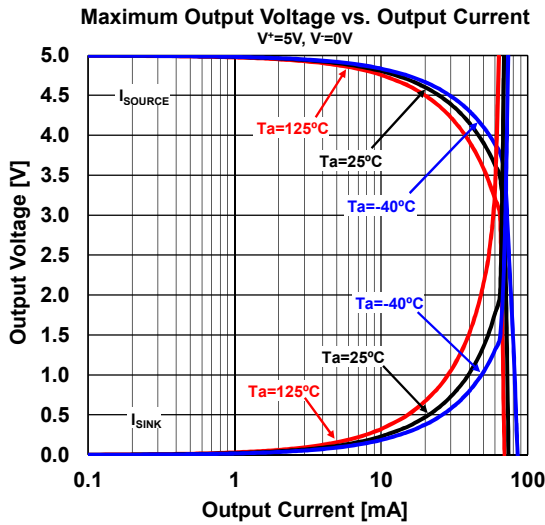
TYPICAL CHARACTERISTICS



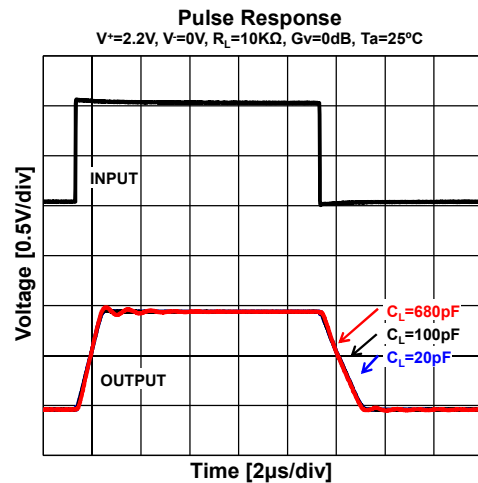
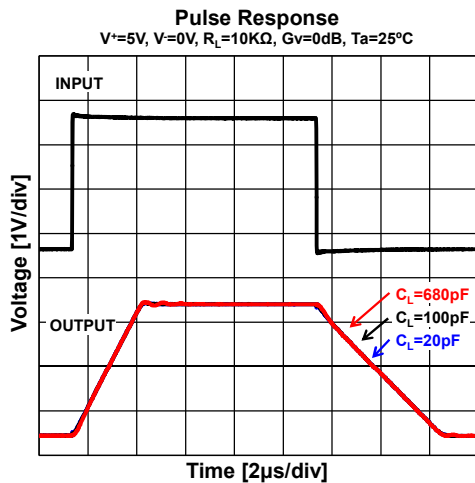
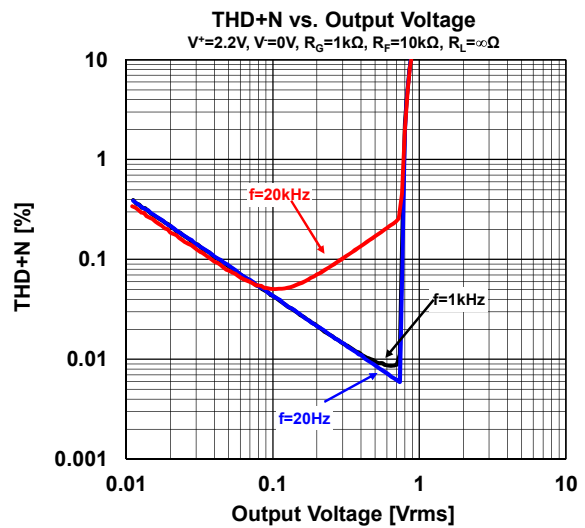
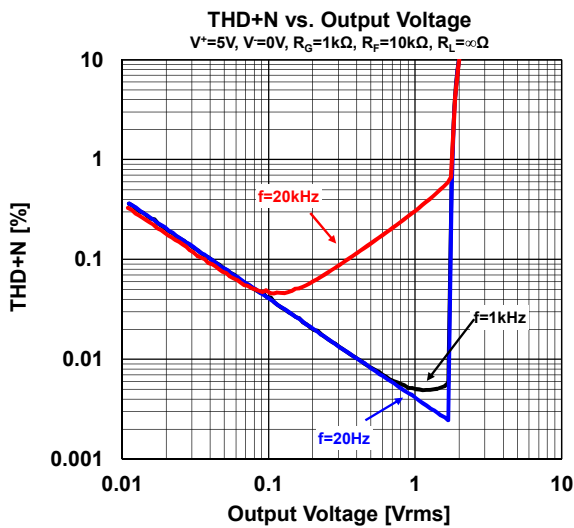
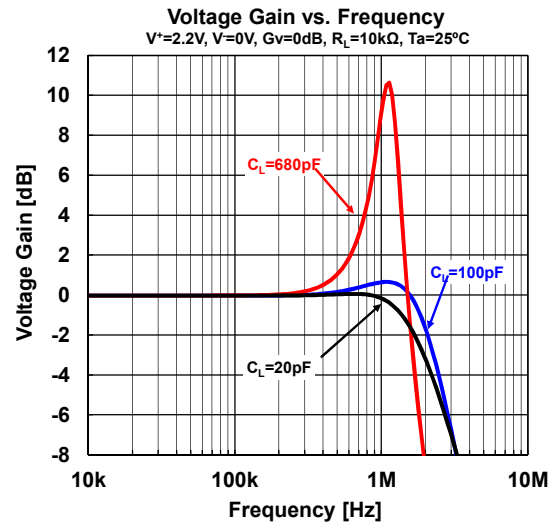
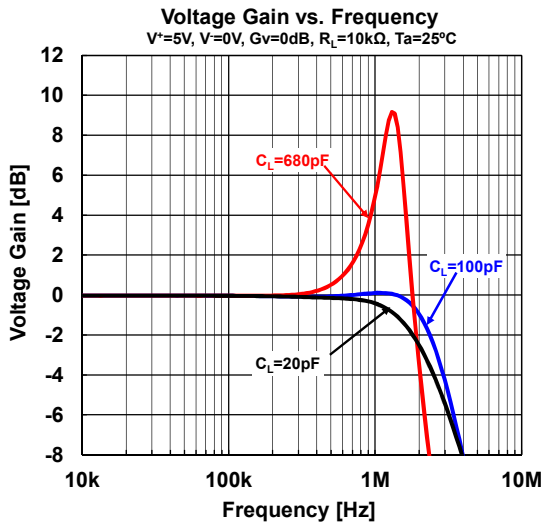
■ TYPICAL CHARACTERISTICS



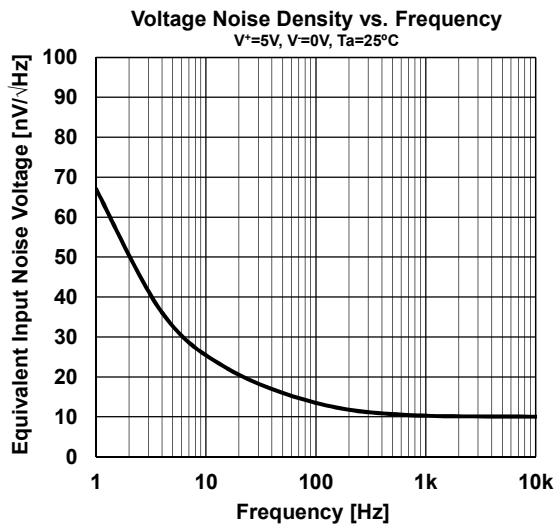
■ TYPICAL CHARACTERISTICS



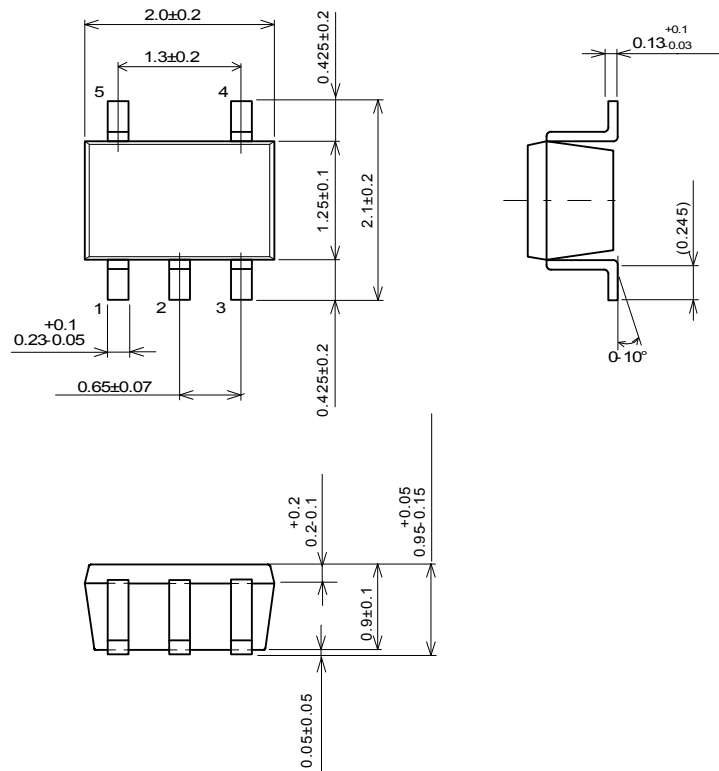
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



■ PACKAGE DIMENSIONS



Unit: mm

SC-88A Package

[CAUTION]
 The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.