ELM822xA 1.5μA CMOS operational amplifier

■General description

ELM822xA is low power CMOS OP-AMP with low current consumption-Typ.1.5μA provided with input common mode voltage range and push-pull output stage. ELM822xA makes it easy to design power circuits and is able to operate from single +1.2V power supply. ELM822xA is suitable for application such as portable devices which require low power and single source.

■Features

- Operation from a single power source
- Low voltage operation : 1.2V≤Vdd≤6.0V
- Low current consumption : Typ.1.5μA
- Common-mode input voltage range
  : Vss to Vdd-0.3V(Vdd=1.5V)
  : Vss to Vdd-0.1V(Vdd=3.0V)
- Output stage : Push-pull
- Unity gain bandwidth : Typ.15kHz
- Package : SOT-25, SC-70-5(SOT-353)

■Application

- Battery-operated portable devices
- Micropower signal process
- Low voltage analog circuit

■Maximum absolute ratings

Parameter	Symbol	Limit	Unit
Power supply voltage	Vdd	7.0	V
Input voltage	Vin	Vss-0.3 to Vdd+0.3	V
Output voltage	Vout	Vss-0.3 to Vdd+0.3	V
Output circuit		Continuous	Sec.
Power dissipation	Pd	300 (SOT-25)	mW
		150 ((SC-70-5)(SOT-353))	
Operating temperature	Top	-40 to +85	°C
Storage temperature	Tstg	-55 to +125	°C

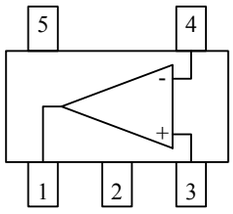
■Selection guide

ELM822xA-x

Symbol		
a	Package	B: SOT-25 C: SC-70-5(SOT-353)
b	Product version	A
c	Taping direction	S, N: Refer to PKG file

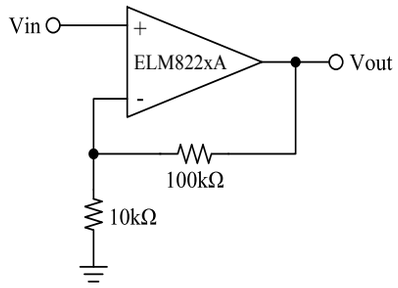
ELM822 x A - x
↑ ↑ ↑
a b c

■Pin configuration



Pin No.	Pin name
1	OUT
2	VDD
3	IN+
4	IN-
5	VSS

■Standard circuit



■Electrical characteristics

Vss=0V, Top=-40~+85°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating voltage	Vdd		1.2		6.0	V

Vdd=1.5V Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input offset voltage	Vio	Vcm=Vdd/2, Unity gain follower			±6	mV
Input bias current	Iib				1.0	nA
Common-mode input voltage range	Vcmr	For CMRR≥45dB	0.00		1.20	V
Maximum output voltage swing	Voutsh	Vid=100mV, RL=10kΩ to Vss	1.40			V
Minimum output voltage swing	Voutsl	Vid=100mV, RL=10kΩ to Vdd			0.10	V
Source current	Isource	Vout=1.2V, Vid=100mV	0.4	1.0		mA
Sink current	Isink	Vout=0.3V, Vid=100mV	1.0	2.5		mA
Large-signal voltage gain	Avd	RL=100kΩ to Vss, Vcm=0.75V		95		dB
Common-mode rejection ratio	CMRR	RL=100kΩ to Vss, Vcm=0.75V		85		dB
Supply voltage rejection ratio	PSRR	RL=100kΩ to Vss, Vcm=0.75V		95		dB
Current consumption	Iss	Vcm=Vdd/2, Unity gain follower		1.5	3.8	μA
Short current	Ishortp	Vout to Vss shrot, Vid=100mV		1.4		mA
	Ishortn	Vout to Vdd shrot, Vid=100mV		4.0		mA
Unity gain bandwidth	GBW			15		kHz
Slew rate	SR	RL=100kΩ, CL=20pF	7.0	14.0		mV/μs

Vdd=3.0V Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input offset voltage	Vio	Vcm=Vdd/2, Unity gain follower			±6	mV
Input bias current	Iib				1.0	nA
Common-mode input voltage range	Vcmr	For CMRR≥45dB	0.00		2.90	V
Maximum output voltage swing	Voutsh	Vid=100mV, RL=10kΩ to Vss	2.90			V
Minimum output voltage swing	Voutsl	Vid=100mV, RL=10kΩ to Vdd			0.10	V
Source current	Isource	Vout=2.7V, Vid=100mV	1.5	4.0		mA
Sink current	Isink	Vout=0.3V, Vid=100mV	3.0	7.5		mA
Large-signal voltage gain	Avd	RL=100kΩ to Vss, Vcm=1.5V		100		dB
Common-mode rejection ratio	CMRR	RL=100kΩ to Vss, Vcm=1.5V		90		dB
Supply voltage rejection ratio	PSRR	RL=100kΩ to Vss, Vcm=1.5V		100		dB
Current consumption	Iss	Vcm=Vdd/2, Unity gain follower		1.5	3.8	μA
Short current	Ishortp	Vout to Vss shrot, Vid=100mV		14		mA
	Ishortn	Vout to Vdd shrot, Vid=100mV		25		mA
Unity gain bandwidth	GBW			15		kHz
Slew rate	SR	RL=100kΩ, CL=20pF	7.5	14.5		mV/μs

■Note

1) Common mode input voltage range

ELM822xA common mode input voltage range is fixed under the condition of CMRR≥45dB; ELM822xA is able to accept the input above its specification if the degradation of CMRR is not considered. Even if the input voltage exceeds either positive or negative power voltage, troubles such as reverse of output will not occur.

As maximum absolute rating, the input voltage is possible within (Vss-0.3)V to (Vdd+0.3)V.

2) Operation from single power source

ELM822xA is designed to be most suitable for single power source; therefore, ELM822xA is able to share power supply with logic circuit one. Meanwhile, ELM822xA can also operate from double power sources. To protect power supplies of ELM822xA and logic circuit from noise, please separate wire from power supply and use decoupling (bypass) capacitor. Using the capacitor can improve PSRR characteristics, especially on 10kHz to 100kHz or more.

3) Feedback

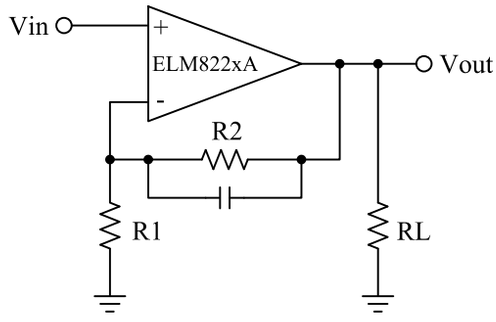
When OP-AMP circuit is used with feedback resistor, oscillation may happen in the circuit with loop-gain like unity gain follower.

a) When large feedback resistance is used, the phase margin is decreased by its combination with the parasitic capacitance of the input part of OP-AMP. In this situation, please connect small capacitor in parallel with feedback resistor as shown in fig-1.

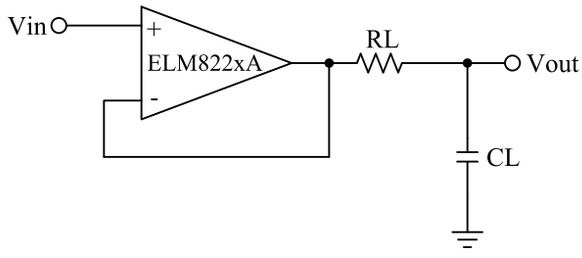
b) For capacitive load, external resistor in series connection will be effective as shown in fig-2. (RL=300 to 500Ω)

c) Being used as an unity gain follow, ELM822xA is able to drive capacitive load of 100pF directly without oscillation.

a) fig-1

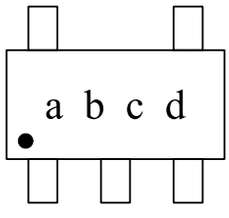


b) fig-2

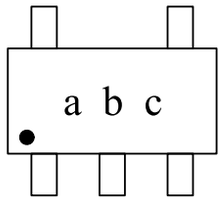


■Marking

SOT-25

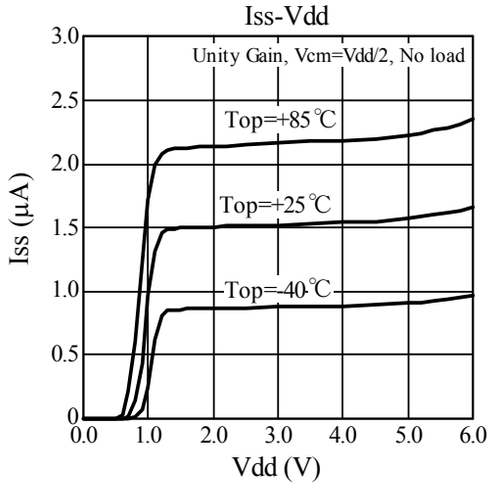


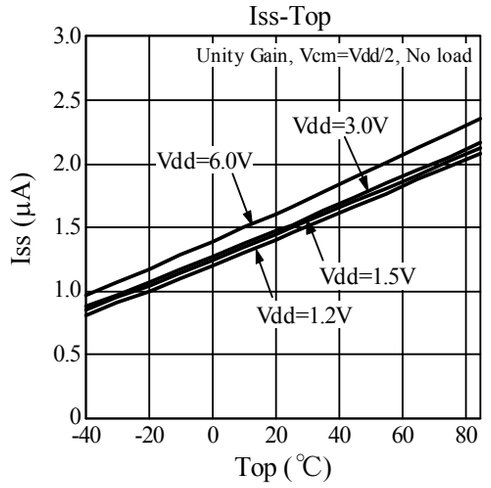
SC-70-5

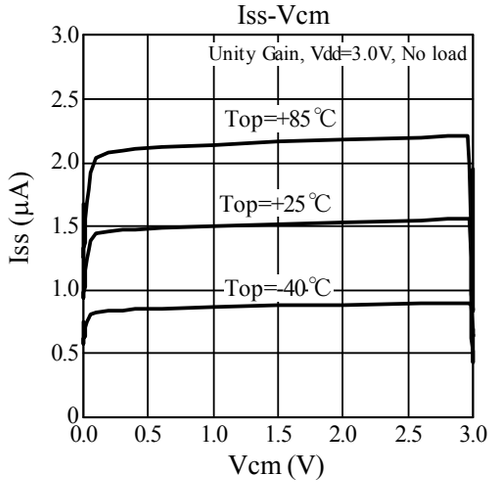


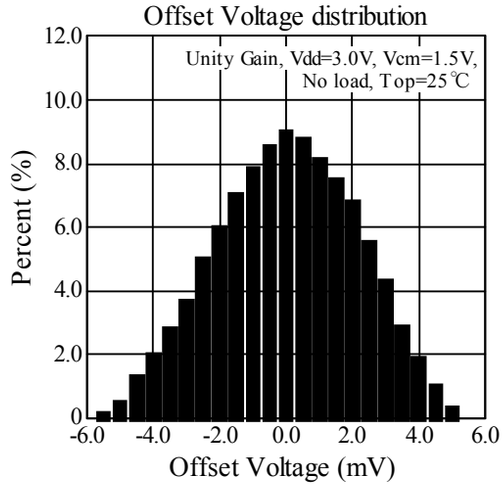
Symbol	Mark	Content
a, b	5 A	ELM822BA (SOT-25)
	> 0	ELM822CA (SC-70-5)
c	0 to 9 and A to Z (I, O, X excepted.)	Lot No.
d	0 to 9 and A to Z (I, O, X excepted.)	Lot No.

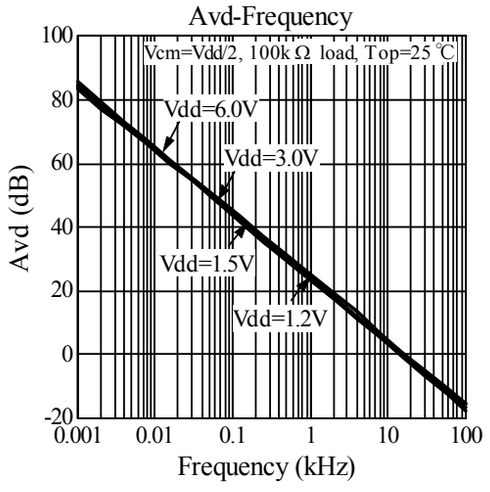
■Typical characteristics

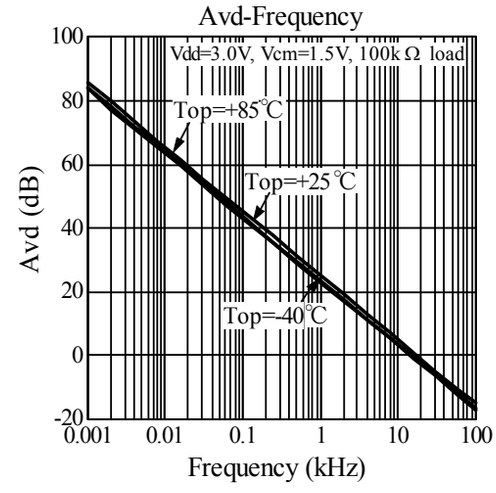


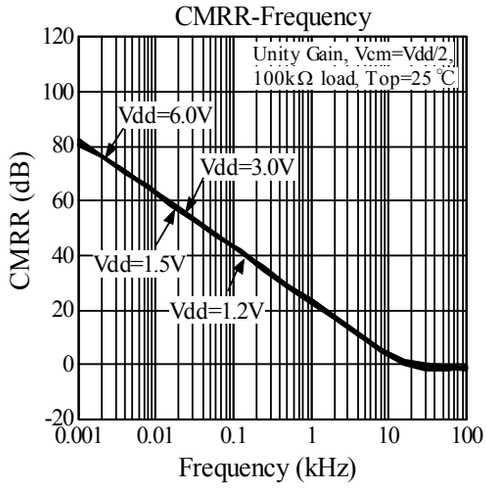


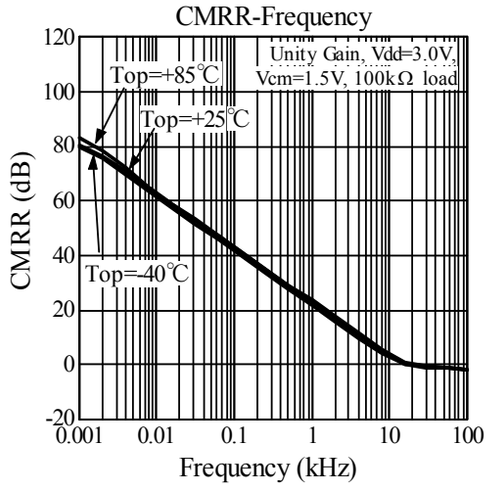


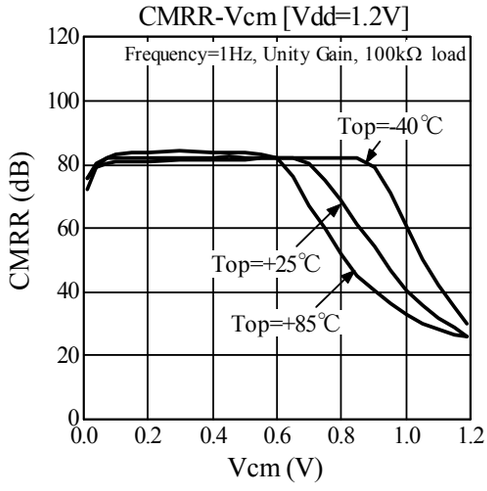


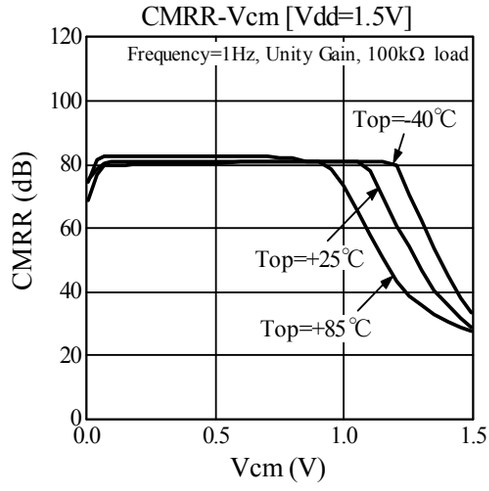


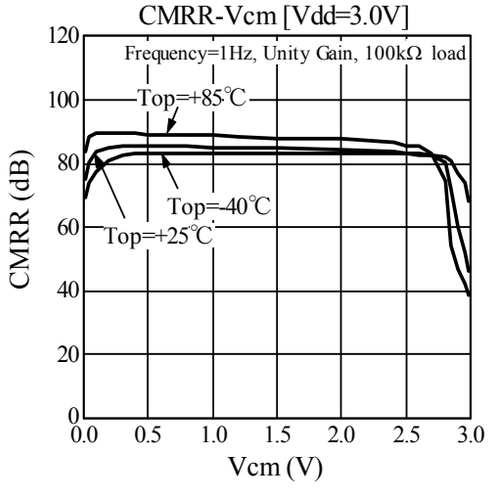


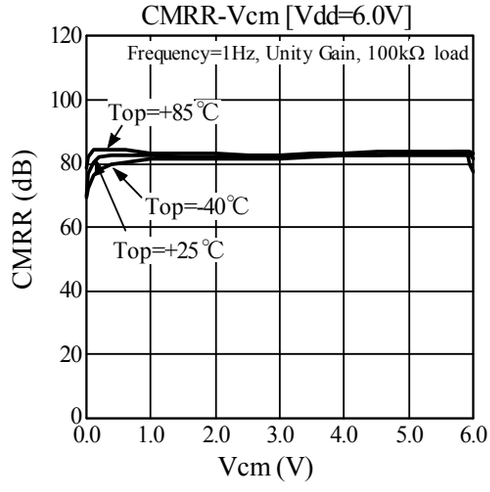

CMRR-Frequency
Unity Gain, Vcm=Vdd/2,
100kΩ load, Top=25℃
Vdd=6.0V
Vdd=3.0V
Vdd=1.5V
Vdd=1.2V
CMRR (dB)
Frequency (kHz)


CMRR-Frequency
Unity Gain, Vdd=3.0V,
Vcm=1.5V, 100kΩ load
Top=+85℃
Top=+25℃
Top=-40℃
CMRR (dB)
Frequency (kHz)

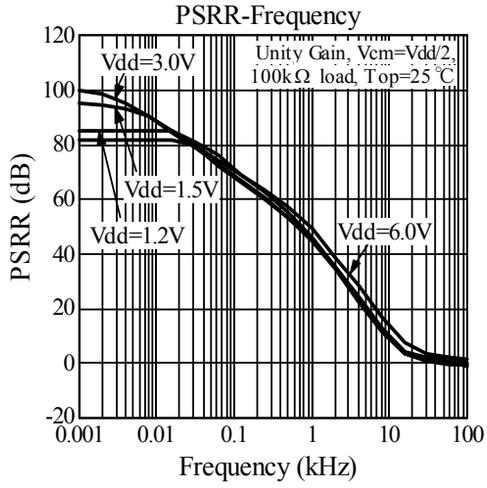

CMRR-Vcm [Vdd=1.2V]
Frequency=1Hz, Unity Gain, 100kΩ load
Top=-40℃
Top=+25℃
Top=+85℃
CMRR (dB)
Vcm (V)


CMRR-Vcm [Vdd=1.5V]
Frequency=1Hz, Unity Gain, 100kΩ load
Top=-40℃
Top=+25℃
Top=+85℃
CMRR (dB)
Vcm (V)

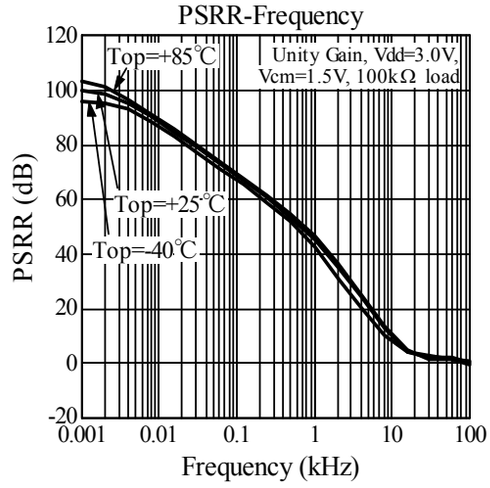

CMRR-Vcm [Vdd=3.0V]
Frequency=1Hz, Unity Gain, 100kΩ load
Top=+85℃
Top=-40℃
Top=+25℃
CMRR (dB)
Vcm (V)


CMRR-Vcm [Vdd=6.0V]
Frequency=1Hz, Unity Gain, 100kΩ load
Top=+85℃
Top=-40℃
Top=+25℃
CMRR (dB)
Vcm (V)

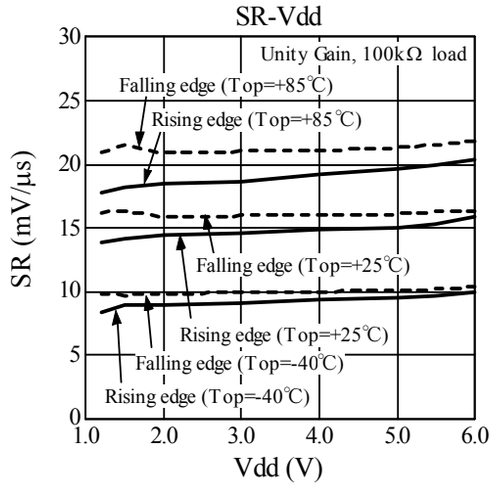
PSRR-Frequency



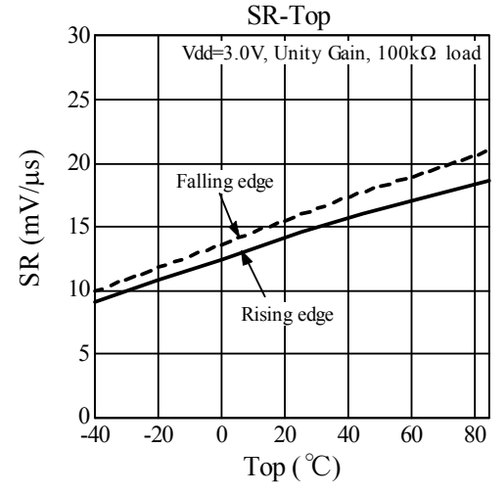
PSRR-Frequency



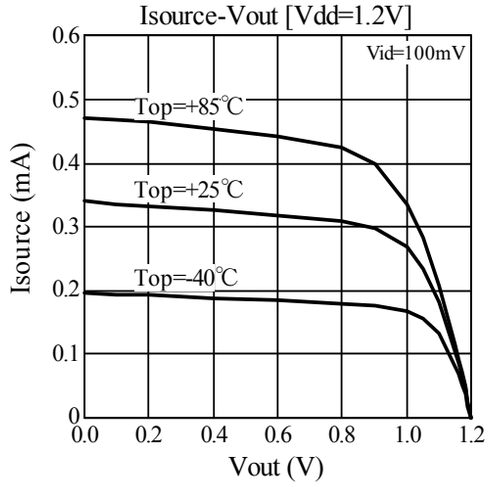
SR-Vdd



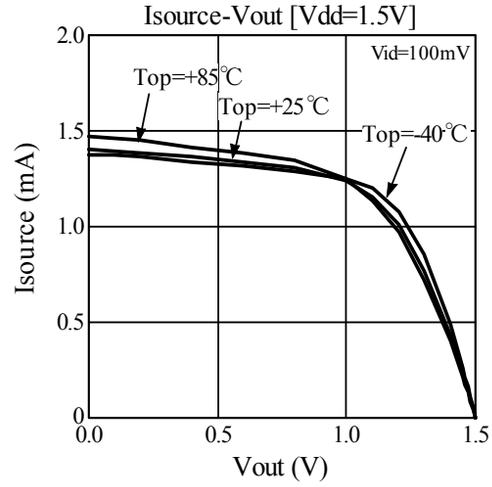
SR-Top

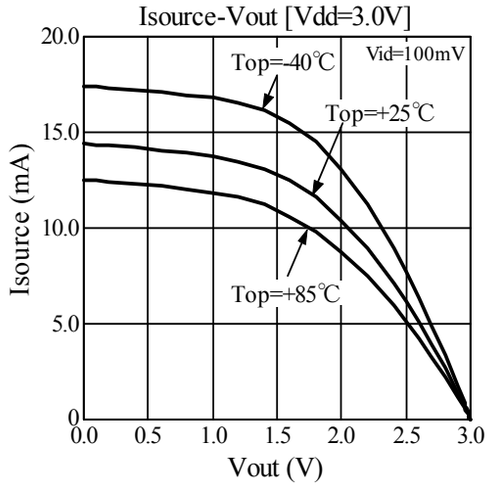


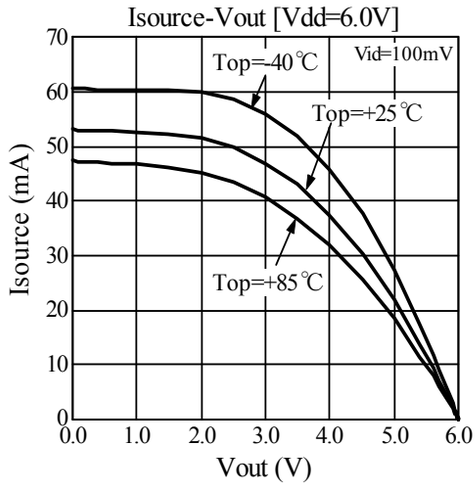
Isource-Vout [Vdd=1.2V]

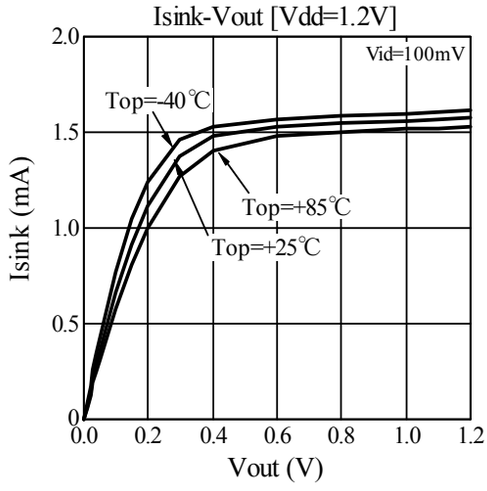


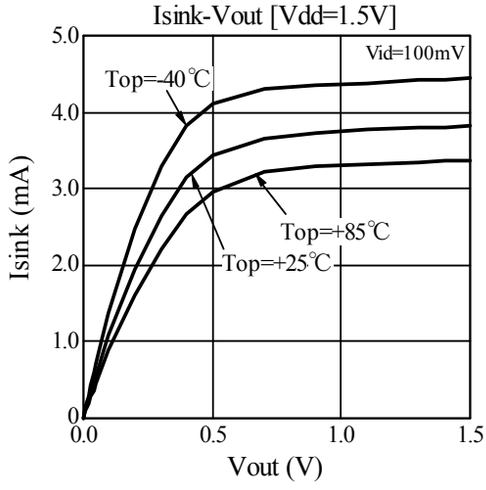
Isource-Vout [Vdd=1.5V]

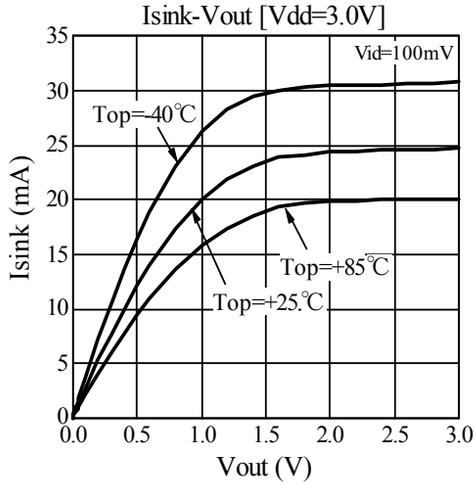


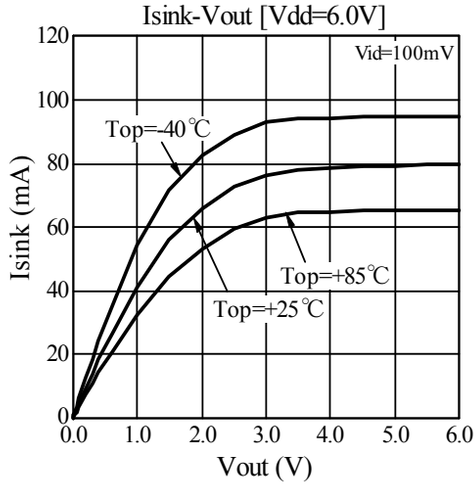

Isource-Vout [Vdd=3.0V]
Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Isource (mA)
Vout (V)
20.0
15.0
10.0
5.0
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0

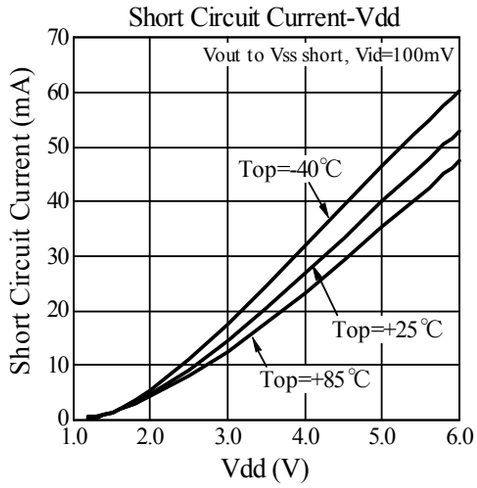

Isource-Vout [Vdd=6.0V]
Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Isource (mA)
Vout (V)
70
60
50
40
30
20
10
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0

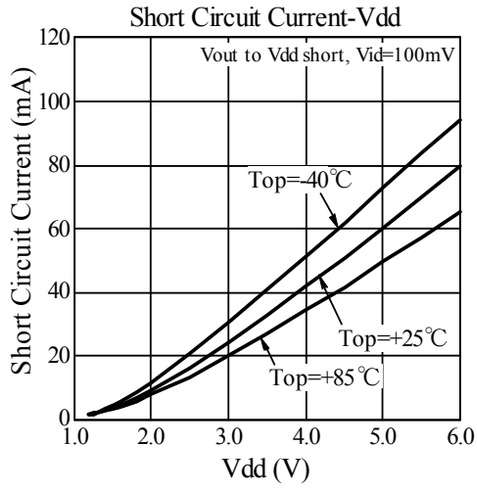

Isink-Vout [Vdd=1.2V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
2.0
1.5
1.0
0.5
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2

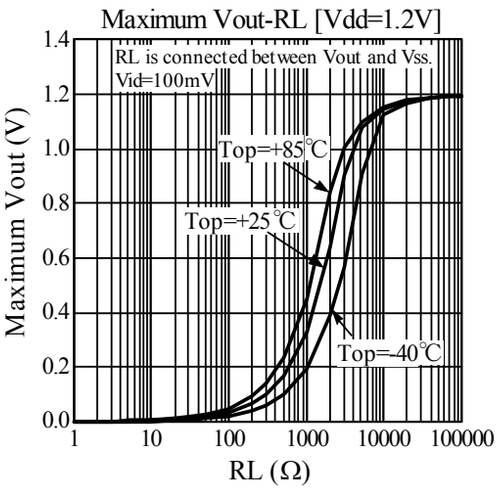

Isink-Vout [Vdd=1.5V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
5.0
4.0
3.0
2.0
1.0
0
0.0
0.5
1.0
1.5

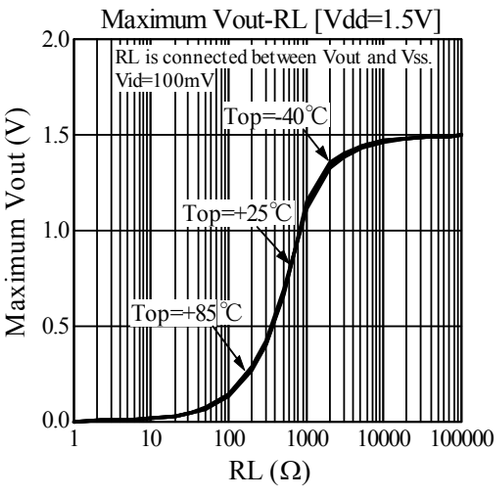

Isink-Vout [Vdd=3.0V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
35
30
25
20
15
10
5
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0

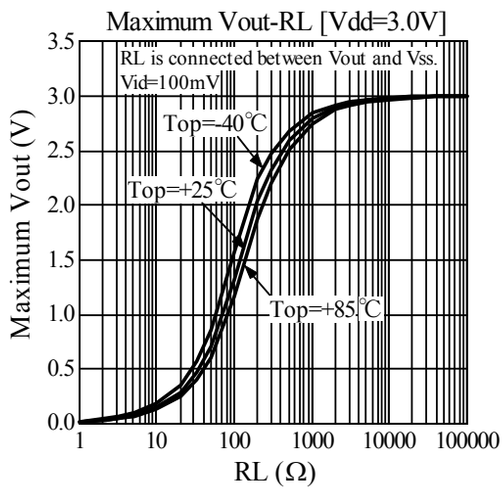

Isink-Vout [Vdd=6.0V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0

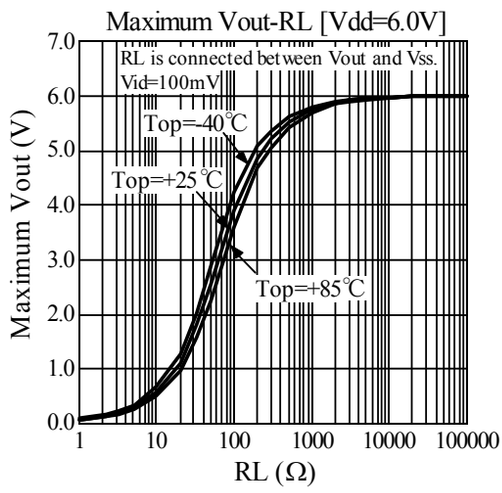

Short Circuit Current-Vdd
Vout to Vss short, Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Short Circuit Current (mA)
Vdd (V)

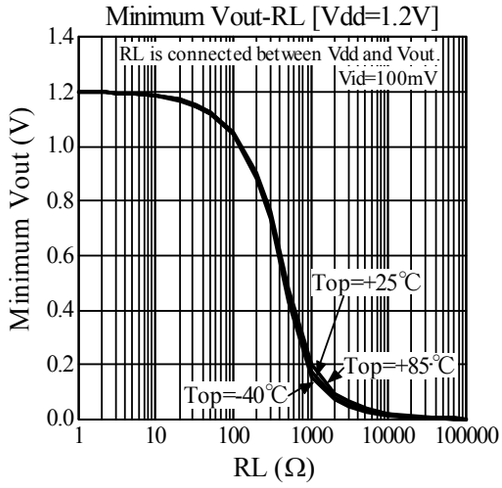

Short Circuit Current-Vdd
Vout to Vdd short, Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Short Circuit Current (mA)
Vdd (V)

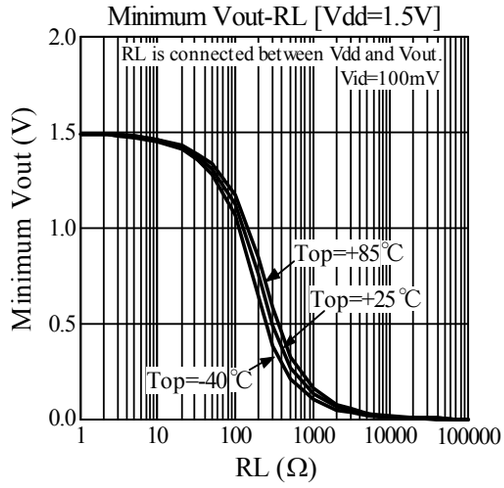

Maximum Vout-RL [Vdd=1.2V]
RL is connected between Vout and Vss.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Maximum Vout (V)
RL (Ω)

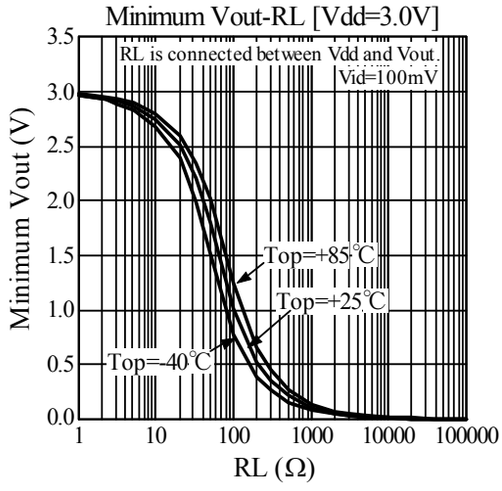

Maximum Vout-RL [Vdd=1.5V]
RL is connected between Vout and Vss.
Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Maximum Vout (V)
RL (Ω)

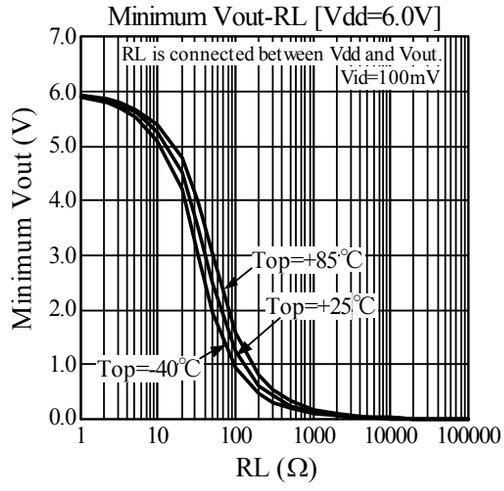

Maximum Vout-RL [Vdd=3.0V]
RL is connected between Vout and Vss.
Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Maximum Vout (V)
RL (Ω)

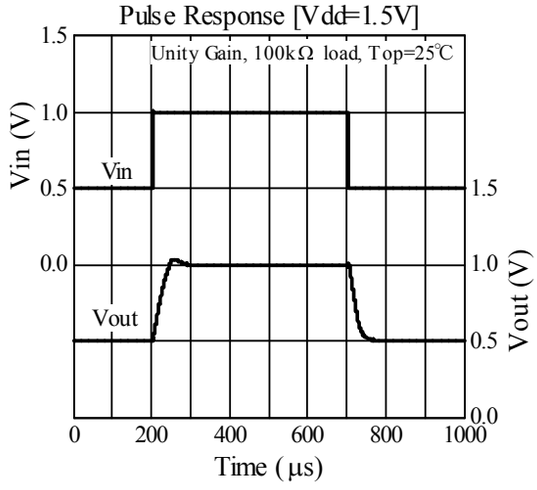

Maximum Vout-RL [Vdd=6.0V]
RL is connected between Vout and Vss.
Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Maximum Vout (V)
RL (Ω)

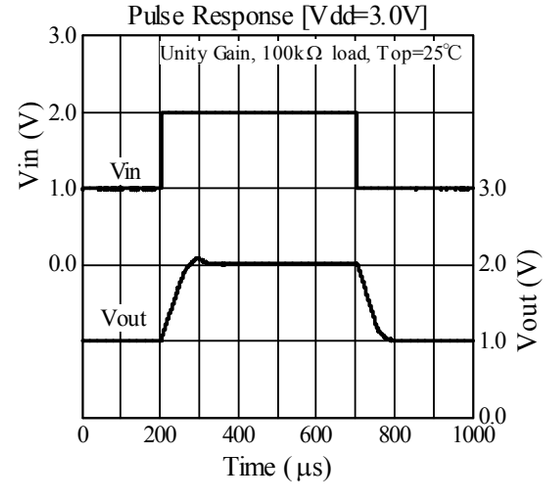

Minimum Vout-RL [Vdd=1.2V]
RL is connected between Vdd and Vout.
Vid=100mV
Top=+25℃
Top=+85℃
Top=-40℃
Minimum Vout (V)
RL (Ω)


Minimum Vout-RL [Vdd=1.5V]
RL is connected between Vdd and Vout.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Minimum Vout (V)
RL (Ω)


Minimum Vout-RL [Vdd=3.0V]
RL is connected between Vdd and Vout.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Minimum Vout (V)
RL (Ω)


Minimum Vout-RL [Vdd=6.0V]
RL is connected between Vdd and Vout.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Minimum Vout (V)
RL (Ω)


Pulse Response [Vdd=1.5V]
Unity Gain, 100kΩ load, Top=25℃
Vin
Vout
Vin (V)
Vout (V)
Time (μs)


Pulse Response [Vdd=3.0V]
Unity Gain, 100kΩ load, Top=25℃
Vin
Vout
Vin (V)
Vout (V)
Time (μs)