ELM842xC 140μA Low power class-A output CMOS operational amplifier

■General description

ELM842xC is a low current consumption-Typ.140μA CMOS OP-AMP provided with a wide common mode input voltage range. It has a quasi rail-to-rail input stage and a class-A rail-to-rail output stage. ELM842xC can operate down to 1.2V. ELM842xC is suitable for portable devices which require low power and a single voltage source.

■Features

- Operation from a single power source
- Low voltage operation : 1.2V≤Vdd≤6.0V
- Low current consumption : Typ.130μA(Vdd=1.5V)
- N-channel depletion differential input
  : No gm dependence on input operating points
- Common-mode input voltage range
  : Quasi rail-to-rail input
  0.08V to Vdd-0.05V(Vdd=1.5V)
  0.04V to Vdd-0.1V(Vdd=3.0V)
- Output stage : 90μA Class-A rail-to-rail output
- Unity gain bandwidth : Typ.1MHz(Vdd≥1.5V)
- Package : SOT-25, SC-70-5(SOT-353)

■Application

- Battery-operated portable devices
- Signal process in low power circuit
- 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 short 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

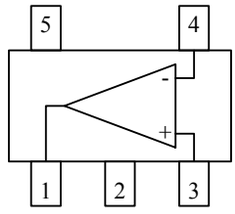
■Selection guide

ELM842xC-x

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

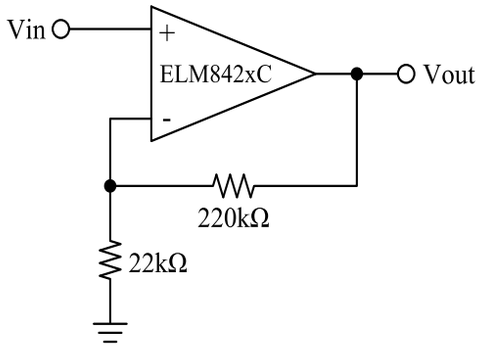
ELM842 x C - x
↑ ↑ ↑
a b c

■Pin configuration

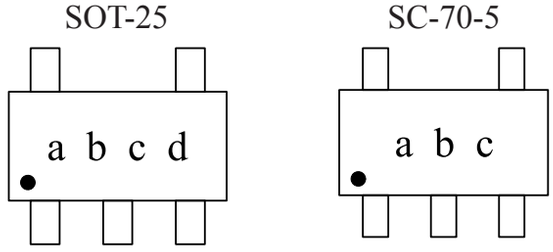


Pin No.	Pin name
1	OUT
2	VDD
3	IN+
4	IN-
5	VSS

■Standard circuit



■Marking



Symbol	Mark	Content
a, b	5 C	ELM842BC (SOT-25)
	> 2	ELM842CC (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.

■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≥40dB	0.08		1.45	V
Maximum output voltage swing	Voutsh	Vid=100mV, RL=200kΩ to Vss	1.42			V
Minimum output voltage swing	Voutsl	Vid=100mV, RL=10kΩ to Vdd			0.10	V
Source current	Isource	Vout=0.75V, Vid=100mV	40	90		μA
Sink current	Isink	Vout=0.3V, Vid=100mV	1.0	2.5		mA
Large-signal voltage gain	Avd	RL=200kΩ to Vss, Vcm=0.75V		110		dB
Common-mode rejection ratio	CMRR	RL=200kΩ to Vss, Vcm=0.75V		90		dB
Supply voltage rejection ratio	PSRR	RL=200kΩ to Vss, Vcm=0.75V		70		dB
Current consumption	Iss	Vcm=Vdd/2, Unity gain follower		130	310	μA
Short current	Ishortp	Vout to Vss shrot, Vid=100mV		100		μA
	Ishortn	Vout to Vdd shrot, Vid=100mV		4.0		mA
Unity gain bandwidth	GBW			1		MHz
Slew rate	SR	RL=200kΩ, CL=20pF	0.45	1.00		V/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≥40dB	0.04		2.90	V
Maximum output voltage swing	Voutsh	Vid=100mV, RL=200kΩ to Vss	2.80			V
Minimum output voltage swing	Voutsl	Vid=100mV, RL=10kΩ to Vdd			0.10	V
Source current	Isource	Vout=1.5V, Vid=100mV	45	100		μA
Sink current	Isink	Vout=0.3V, Vid=100mV	3.0	7.5		mA
Large-signal voltage gain	Avd	RL=200kΩ to Vss, Vcm=1.5V		110		dB
Common-mode rejection ratio	CMRR	RL=200kΩ to Vss, Vcm=1.5V		110		dB
Supply voltage rejection ratio	PSRR	RL=200kΩ to Vss, Vcm=1.5V		100		dB
Current consumption	Iss	Vcm=Vdd/2, Unity gain follower		140	360	μA
Short current	Ishortp	Vout to Vss shrot, Vid=100mV		110		μA
	Ishortn	Vout to Vdd shrot, Vid=100mV		25		mA
Unity gain bandwidth	GBW			1		MHz
Slew rate	SR	RL=200kΩ, CL=20pF	0.45	1.00		V/μs

■Note

1) Load resistance

ELM842xC is designed for low power consumption applications; hence, the output source current is only 90μA (Typ. under the conditions of at Vdd=1.5V, Vout=0.75V and Top=25°C). As a result, ELM842xC is not able to maintain output voltage swing when trying to drive small load resistance. Considering this, load and feedback resistance for ELM842xC should be selected carefully.

ELM recommends the following load/feedback resistors depending on power supply voltage range.

< Power supply voltage >		< total resistance value of load/feedback resistor >
Vdd≤5.5V	:	R≥250kΩ
Vdd≤3.6V	:	R≥200kΩ
Vdd≤1.8V	:	R≥150kΩ

2) Operation from single power source

ELM842xC is designed to be most suitable for single power source; therefore, ELM842xC is able to share power supply with logic circuit one. Meanwhile, ELM842xC can also operate from double power sources.To protect power supplies of ELM842xC 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

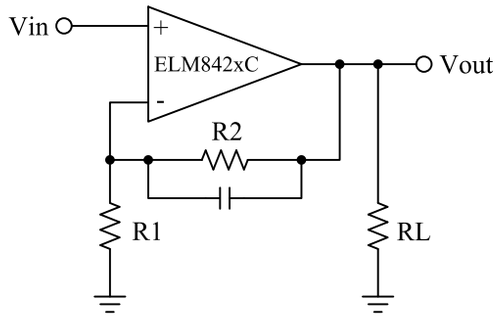
When OP-AMP circuit is used with feedback resistor, oscillation may happen in the circuit with loop-gain like unity gain follower.

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.

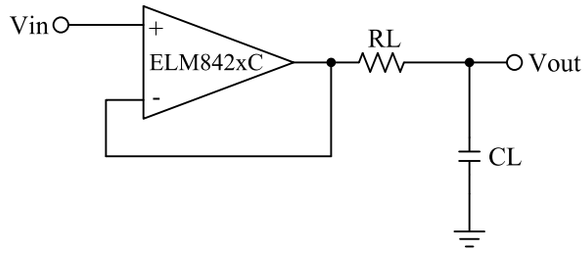
b) For capacitive load, external resistor in series connection will be effective as shown in fig-2. (RL=300 to 500Ω)

c) Being used as an unity gain follow, ELM842xC is able to drive capacitive load of 100pF directly without oscillation.

a) fig-1



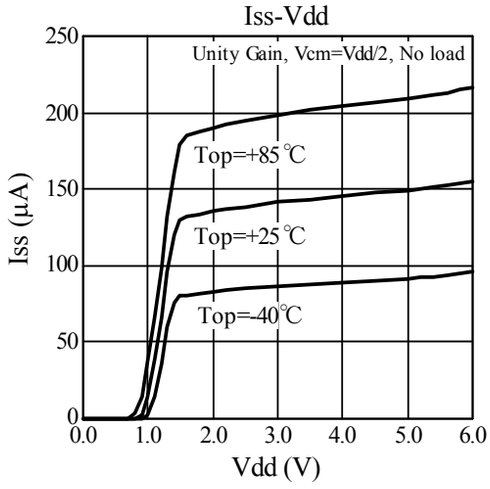
b) fig-2

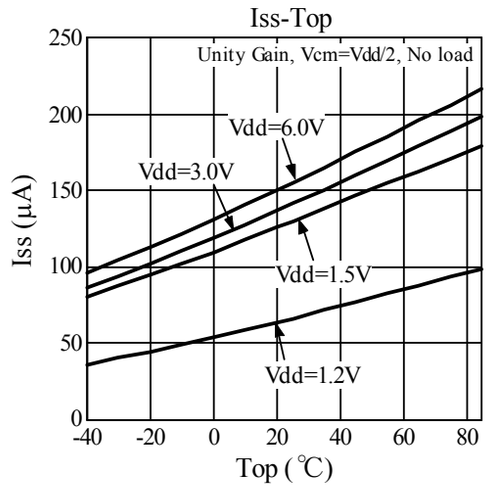


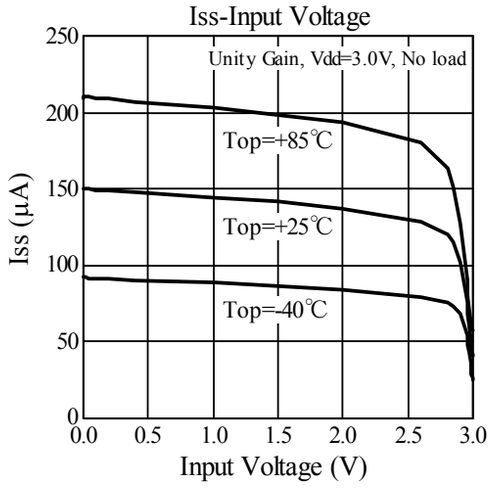
4) Operation at Vdd<1.2V

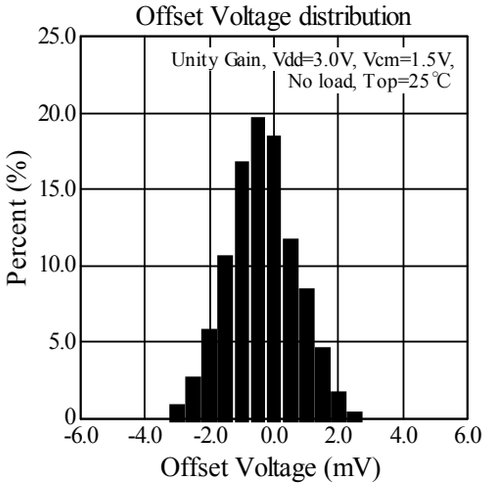
ELM842xC is able to maintain operation when supply voltage is below 1.2V (Vdd≥1.2V) since all input voltage is acceptable within the range of power supply voltage. However, AC characteristics will become weak under this situation because of the decrease of bias current in the IC. For further information, please contact ELM.

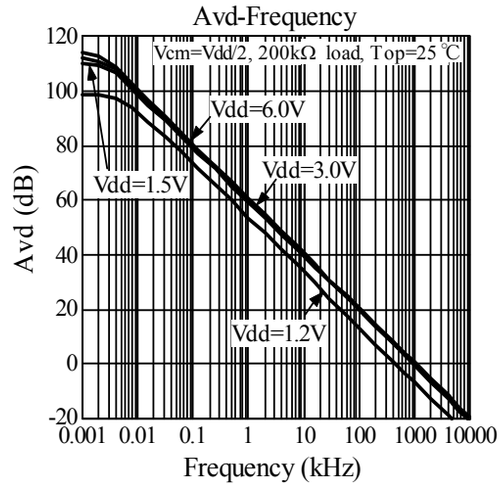
■Typical characteristics

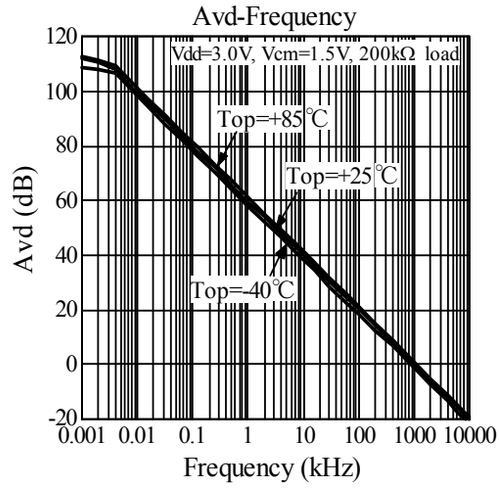


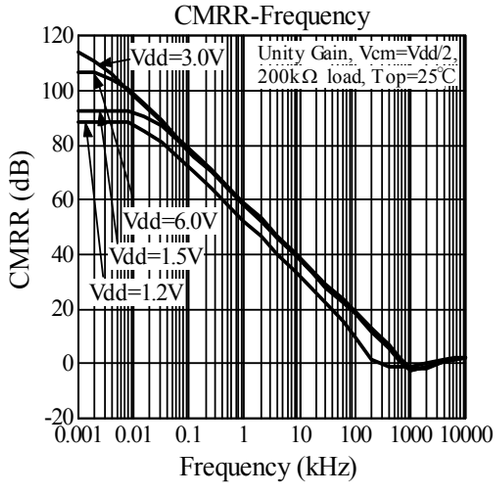


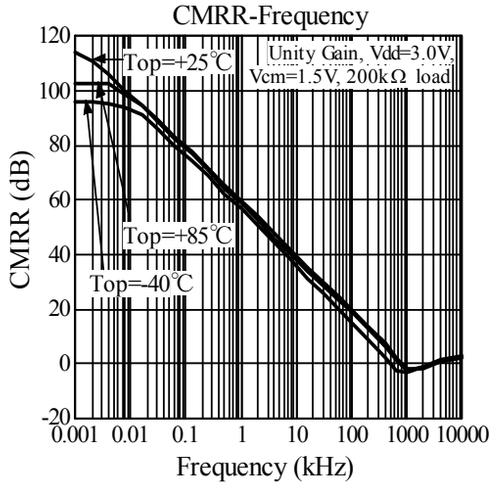


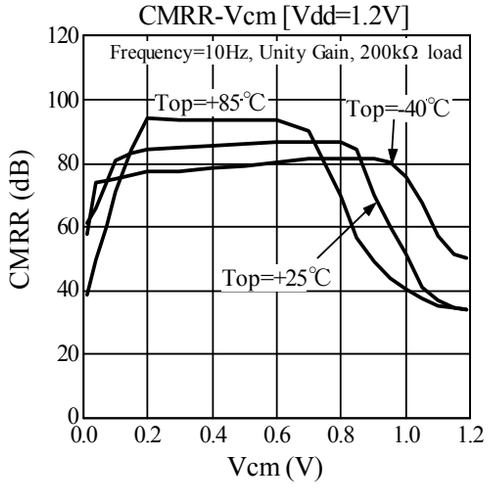


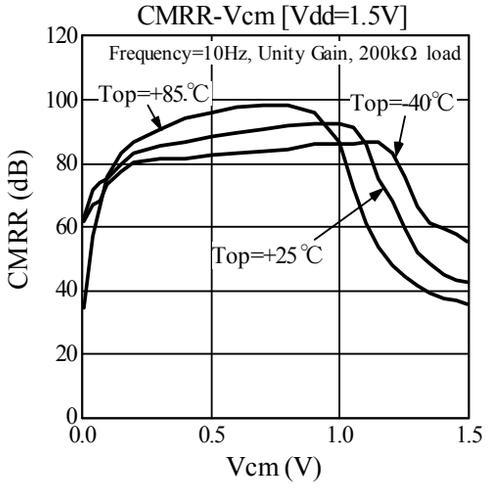


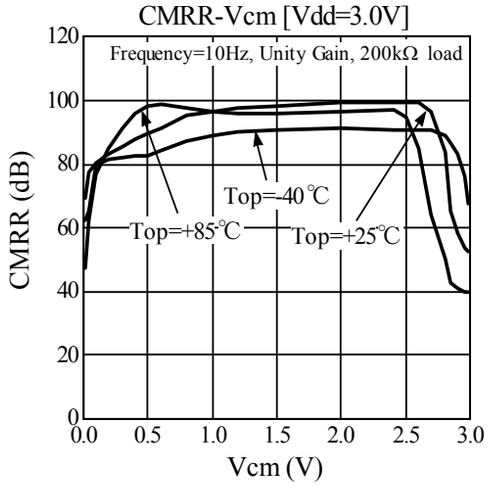


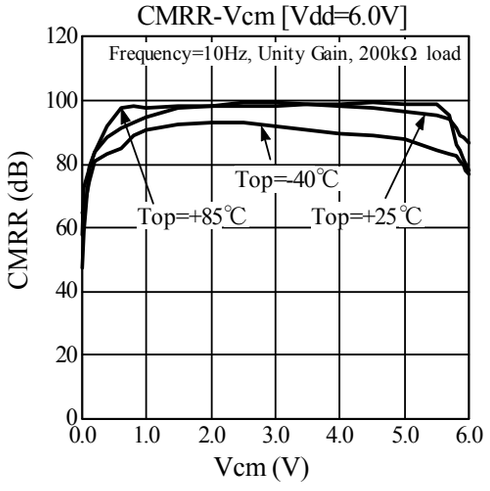

CMRR-Frequency
Vdd=3.0V
Unity Gain, Vcm=Vdd/2,
200kΩ load, Top=25℃
Vdd=6.0V
Vdd=1.5V
Vdd=1.2V
CMRR (dB)
Frequency (kHz)

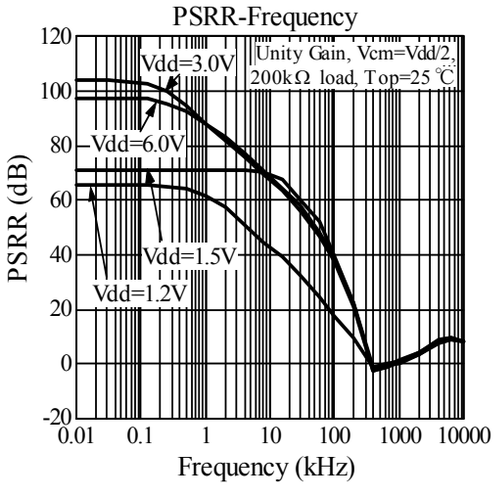

CMRR-Frequency
Top=+25℃
Unity Gain, Vdd=3.0V,
Vcm=1.5V, 200kΩ load
Top=+85℃
Top=-40℃
CMRR (dB)
Frequency (kHz)

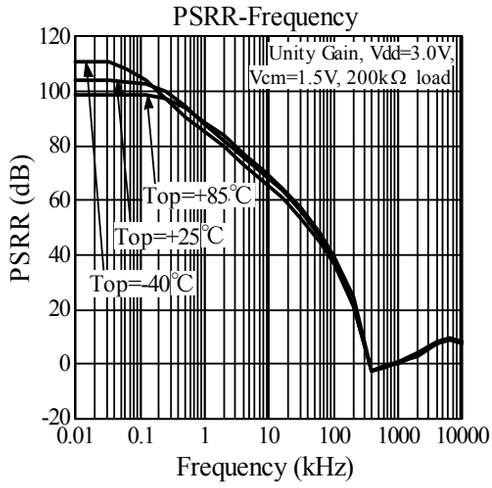

CMRR-Vcm [Vdd=1.2V]
Frequency=10Hz, Unity Gain, 200kΩ load
Top=+85℃
Top=-40℃
Top=+25℃
CMRR (dB)
Vcm (V)

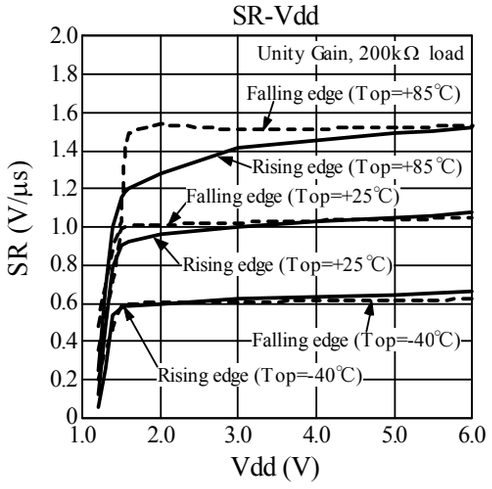

CMRR-Vcm [Vdd=1.5V]
Frequency=10Hz, Unity Gain, 200kΩ load
Top=+85℃
Top=-40℃
Top=+25℃
CMRR (dB)
Vcm (V)

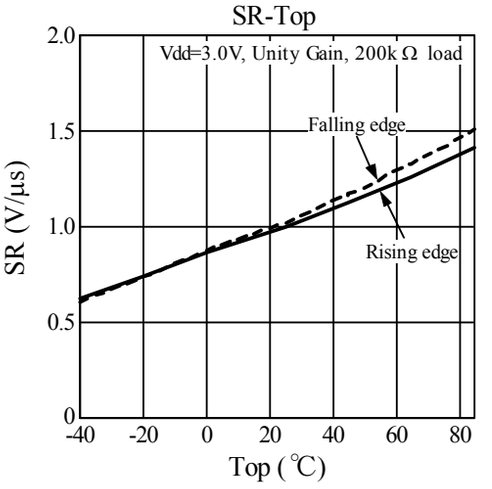

CMRR-Vcm [Vdd=3.0V]
Frequency=10Hz, Unity Gain, 200kΩ load
Top=-40℃
Top=+85℃
Top=+25℃
CMRR (dB)
Vcm (V)

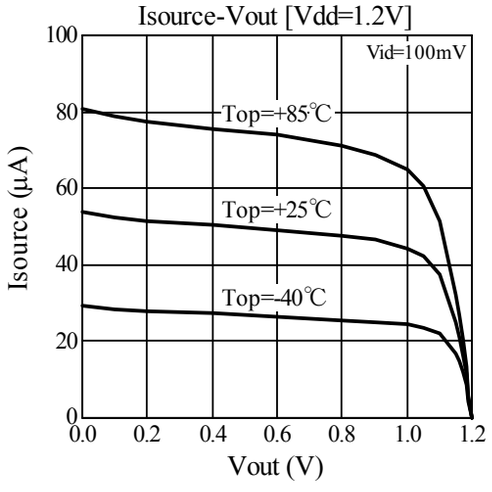

CMRR-Vcm [Vdd=6.0V]
Frequency=10Hz, Unity Gain, 200kΩ load
Top=-40℃
Top=+85℃
Top=+25℃
CMRR (dB)
Vcm (V)

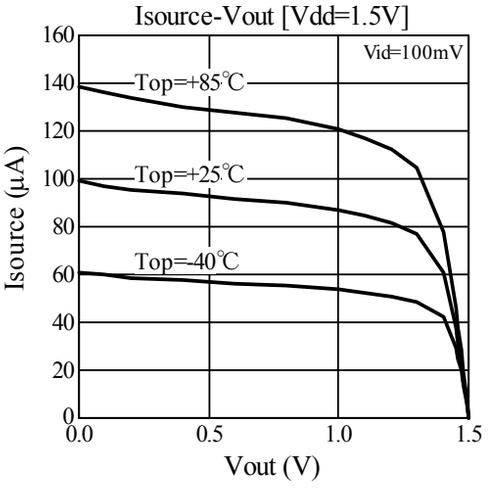

PSRR-Frequency
Unity Gain, Vcm=Vdd/2,
200kΩ load, Top=25℃
Vdd=3.0V
Vdd=6.0V
Vdd=1.5V
Vdd=1.2V
PSRR (dB)
Frequency (kHz)

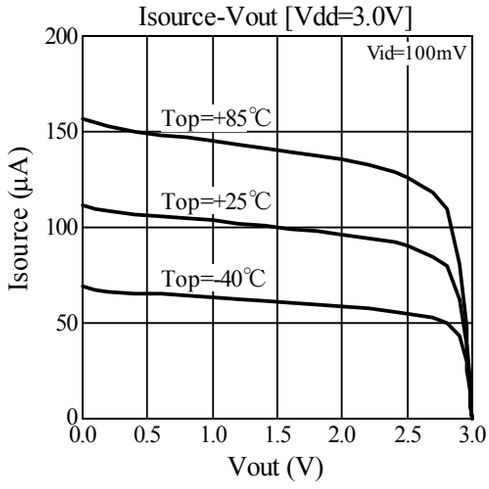

PSRR-Frequency
Unity Gain, Vdd=3.0V,
Vcm=1.5V, 200kΩ load
Top=+85℃
Top=+25℃
Top=-40℃
PSRR (dB)
Frequency (kHz)

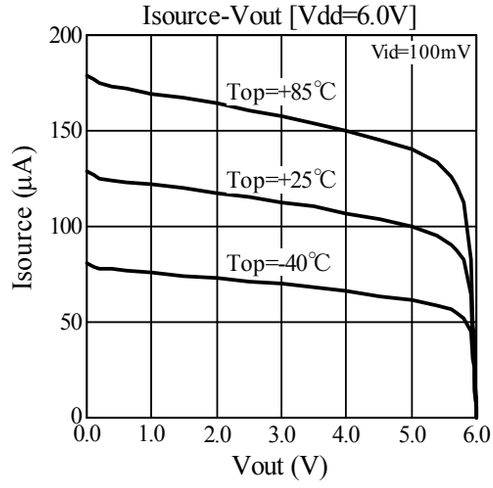

SR-Vdd
Unity Gain, 200kΩ load
Falling edge (Top=+85℃)
Rising edge (Top=+85℃)
Falling edge (Top=+25℃)
Rising edge (Top=+25℃)
Falling edge (Top=-40℃)
Rising edge (Top=-40℃)
SR (V/µs)
Vdd (V)

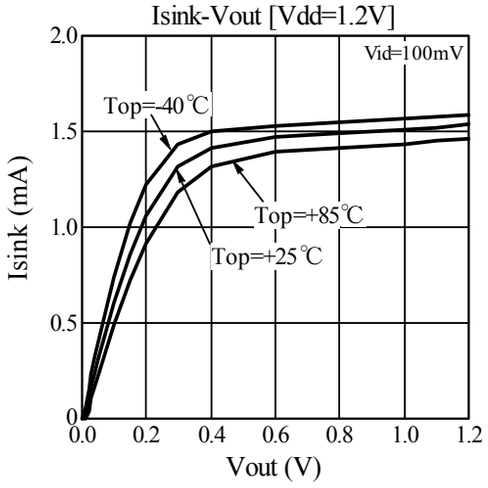

SR-Top
Vdd=3.0V, Unity Gain, 200kΩ load
Falling edge
Rising edge
SR (V/µs)
Top (℃)

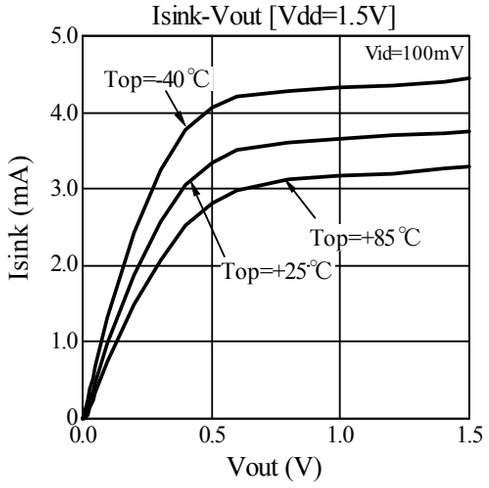

Isource-Vout [Vdd=1.2V]
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Isource (µA)
Vout (V)

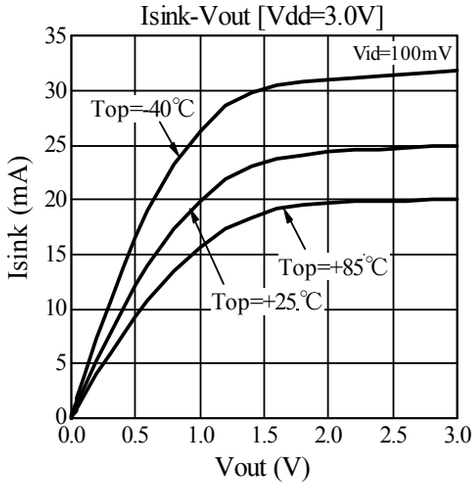

Isource-Vout [Vdd=1.5V]
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Isource (µA)
Vout (V)

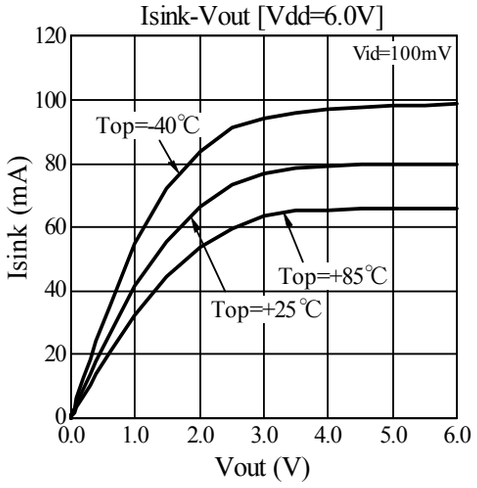

Isource-Vout [Vdd=3.0V]
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Isource (µA)
Vout (V)
0
50
100
150
200
0.0
0.5
1.0
1.5
2.0
2.5
3.0

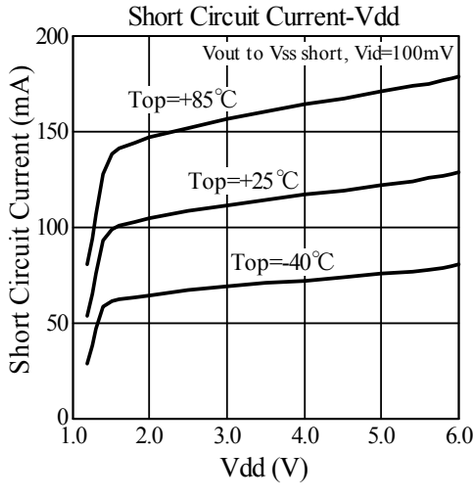

Isource-Vout [Vdd=6.0V]
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Isource (µA)
Vout (V)
0
50
100
150
200
0.0
1.0
2.0
3.0
4.0
5.0
6.0

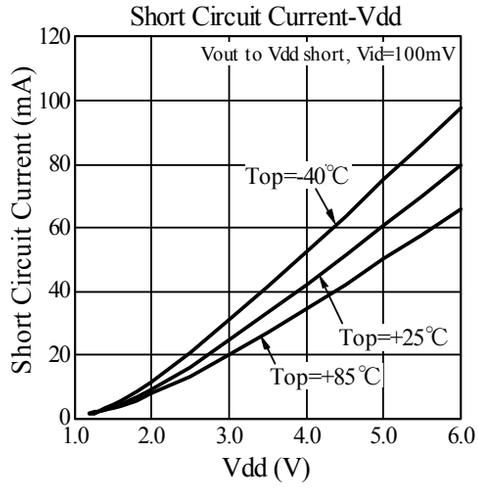

Isink-Vout [Vdd=1.2V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2

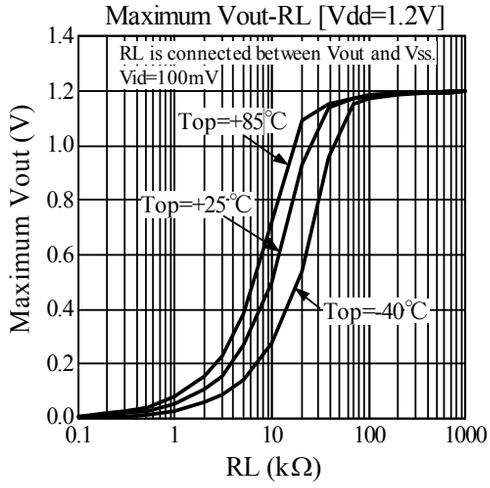

Isink-Vout [Vdd=1.5V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
0
1.0
2.0
3.0
4.0
5.0
0.0
0.5
1.0
1.5

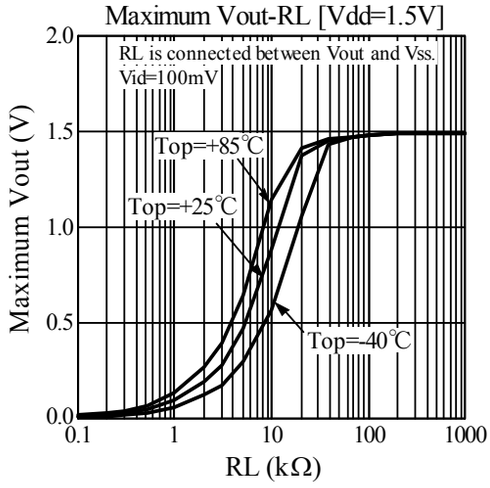

Isink-Vout [Vdd=3.0V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
0
5
10
15
20
25
30
35
0.0
0.5
1.0
1.5
2.0
2.5
3.0

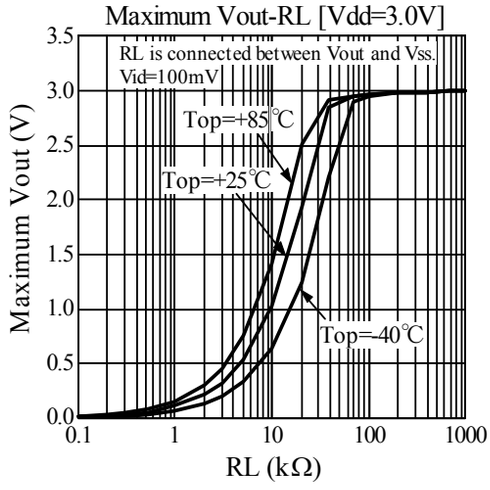

Isink-Vout [Vdd=6.0V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)
0
20
40
60
80
100
120
0.0
1.0
2.0
3.0
4.0
5.0
6.0

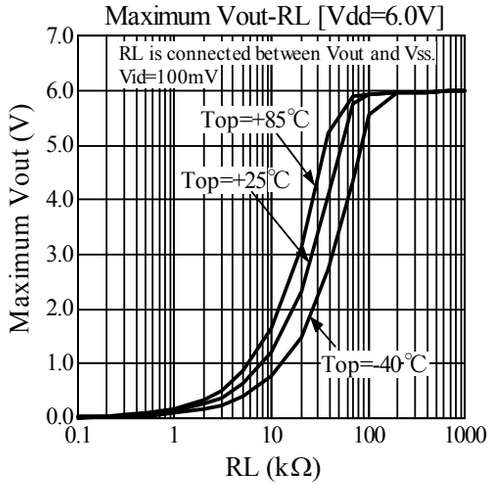

Short Circuit Current-Vdd
Vout to Vss short, Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Short Circuit Current (mA)
Vdd (V)

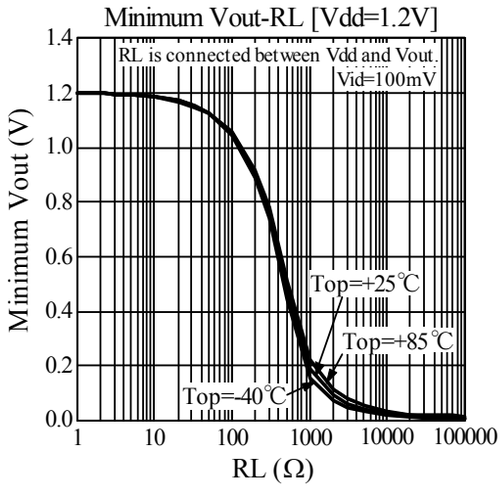

Short Circuit Current-Vdd
Vout to Vdd short, Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Short Circuit Current (mA)
Vdd (V)

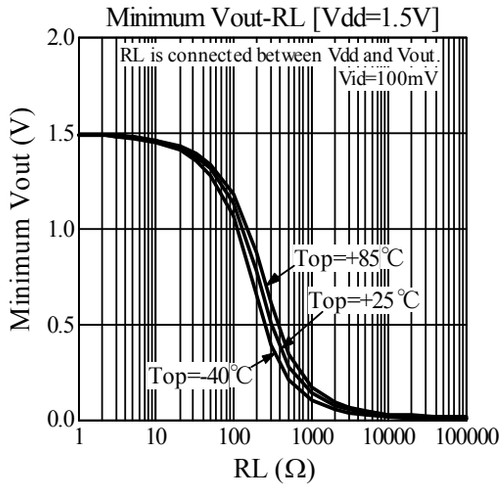

Maximum Vout-RL [Vdd=1.2V]
RL is connected between Vout and Vss.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Maximum Vout (V)
RL (kΩ)

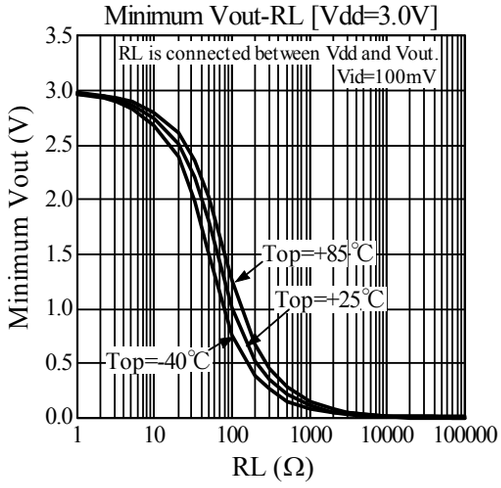

Maximum Vout-RL [Vdd=1.5V]
RL is connected between Vout and Vss.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Maximum Vout (V)
RL (kΩ)

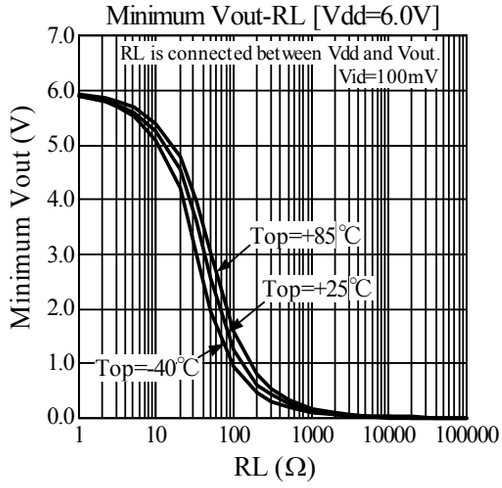

Maximum Vout-RL [Vdd=3.0V]
RL is connected between Vout and Vss.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Maximum Vout (V)
RL (kΩ)

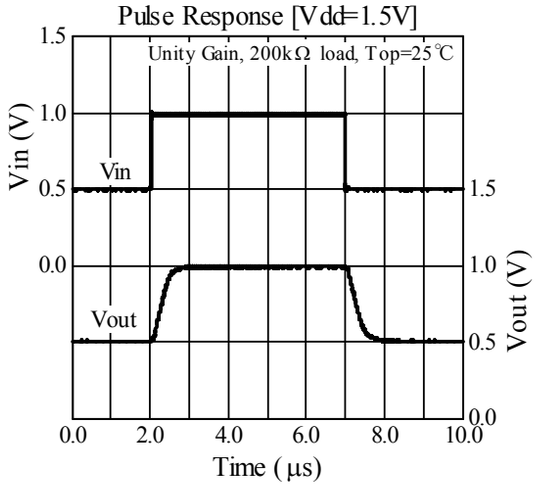

Maximum Vout-RL [Vdd=6.0V]
RL is connected between Vout and Vss.
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Maximum Vout (V)
RL (kΩ)

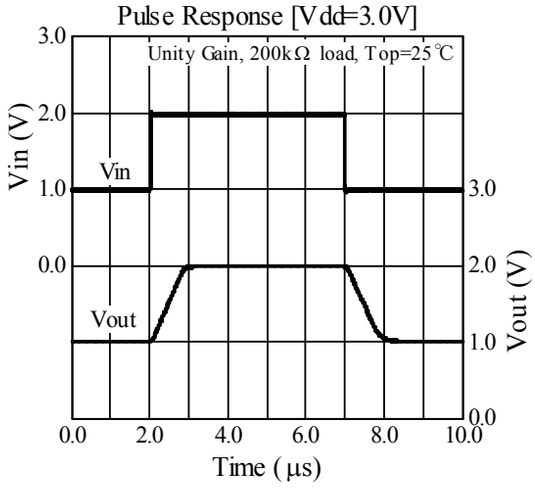

Minimum Vout-RL [Vdd=1.2V]
RL is connected between Vdd and Vout.
Vid=100mV
Minimum Vout (V)
RL (Ω)
Top=+25℃
Top=+85℃
Top=-40℃


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


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


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


Pulse Response [Vdd=1.5V]
Unity Gain, 200kΩ load, Top=25℃
Vin (V)
Vout (V)
Vin
Vout
Time (µs)


Pulse Response [Vdd=3.0V]
Unity Gain, 200kΩ load, Top=25℃
Vin (V)
Vout (V)
Vin
Vout
Time (µs)