ELM832xC 20μA Low power CMOS operational amplifier

■General description

ELM832xC is a low current consumption-Typ.20μA CMOS OP-AMP provided with a wide common mode input voltage range. It has a quasi rail-to-rail input stage and a push-pull rail-to-rail output stage. ELM832xC can operate down to 1.2V. ELM832xC 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.21μA(Vdd=3.0V)
- N-channel depletion differential input
  : No gm dependence on input operating points
- Common-mode input voltage range
  : Quasi rail-to-rail input
  Vss to Vdd-0.3V(Vdd=1.5V)
  Vss to Vdd-0.1V(Vdd=3.0V)
- Output stage : Push-pull rail-to-rail output
- Unity gain bandwidth : Typ.150kHz(Vdd≥1.5V)
- 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 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

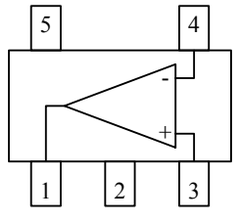
■Selection guide

ELM832xC-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

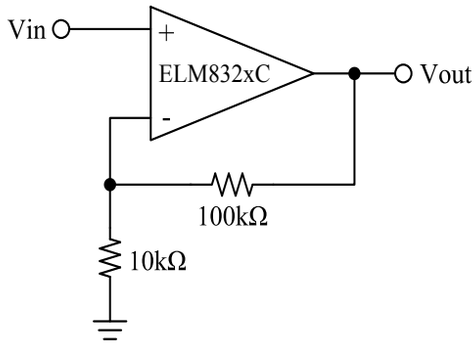
ELM832 x C - x
↑ ↑ ↑
a b c

■Pin configuration

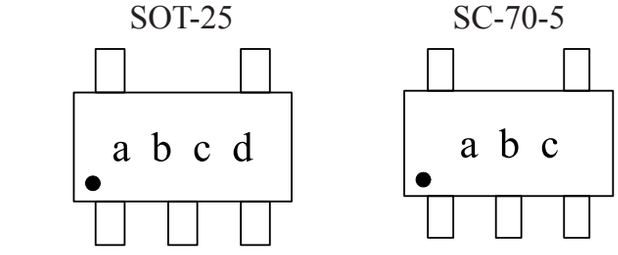


Pin No.	Pin name
1	OUT
2	VDD
3	IN+
4	IN-
5	VSS

■Standard circuit



■Marking



Symbol	Mark	Content
a, b	5 B	ELM832BC (SOT-25)
	> 1	ELM832CC (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≥50dB	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=10kΩ to Vss, Vcm=0.75V		100		dB
Common-mode rejection ratio	CMRR	RL=10kΩ to Vss, Vcm=0.75V		80		dB
Supply voltage rejection ratio	PSRR	RL=10kΩ to Vss, Vcm=0.75V		85		dB
Current consumption	Iss	Vcm=Vdd/2, Unity gain follower		20	40	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			150		kHz
Slew rate	SR	RL=100kΩ, CL=20pF	80	190		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≥50dB	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=10kΩ to Vss, Vcm=1.5V		105		dB
Common-mode rejection ratio	CMRR	RL=10kΩ to Vss, Vcm=1.5V		85		dB
Supply voltage rejection ratio	PSRR	RL=10kΩ to Vss, Vcm=1.5V		100		dB
Current consumption	Iss	Vcm=Vdd/2, Unity gain follower		21	45	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			150		kHz
Slew rate	SR	RL=100kΩ, CL=20pF	80	200		mV/μs

■Note

1) Common mode input voltage range

ELM832xC common mode input voltage range is fixed under the condition of CMRR≥50dB; ELM832xC 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

ELM832xC is designed to be most suitable for single power source, ELM832xC is able to share power supply with logic circuit one. Meanwhile, ELM832xC can also operate from double power sources.To protect power supplies of ELM832xC 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

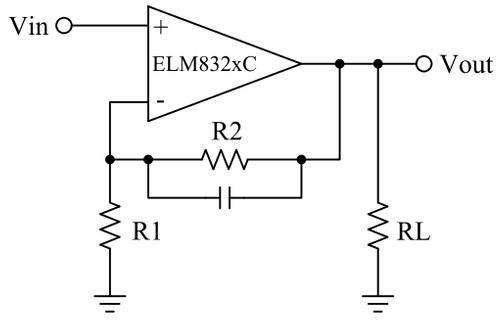
When OP-AMP circuit is used with feedback resistor, oscillation may happen in the circuit with loop-gain like unity gain follower.

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.

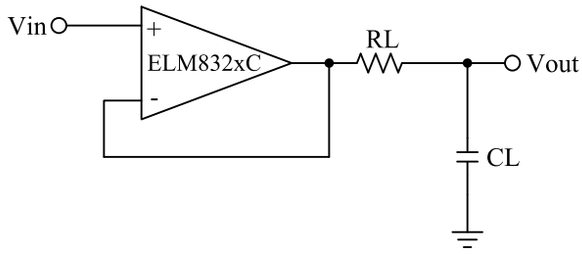
b) For capacitive load, external resistor in series connection will be effective as shown in fig-2. (RL=300 to 500Ω)

c) Being used as an unity gain follow, ELM832xC is able to drive capacitive load of 100pF directly without oscillation.

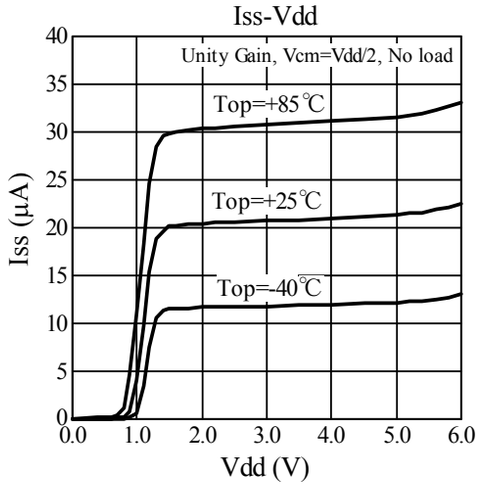
a) fig-1

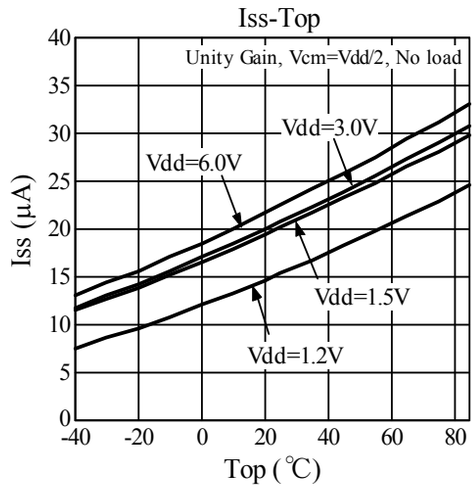


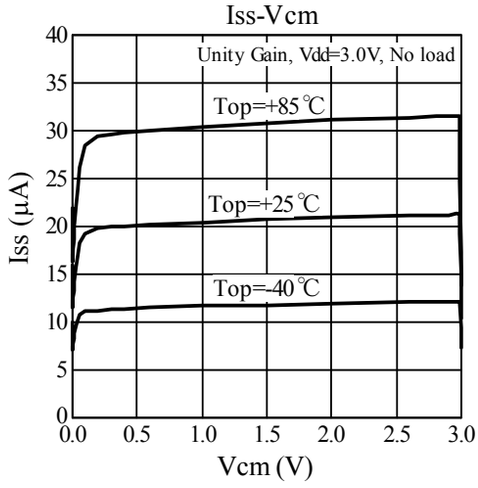
b) fig-2

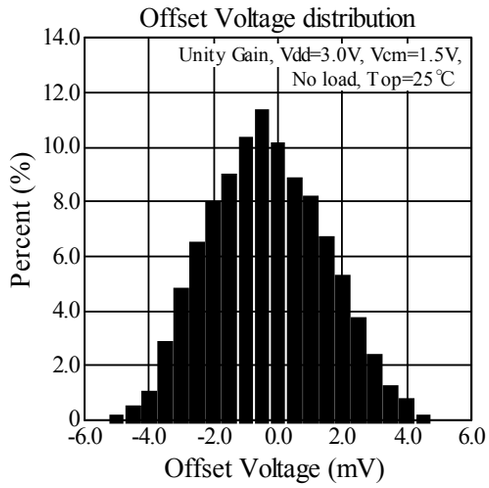


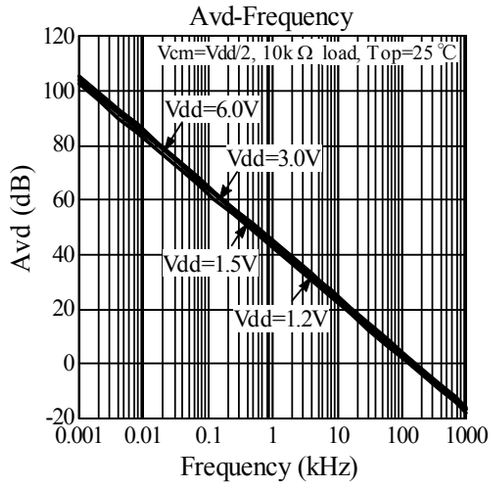
■Typical characteristics

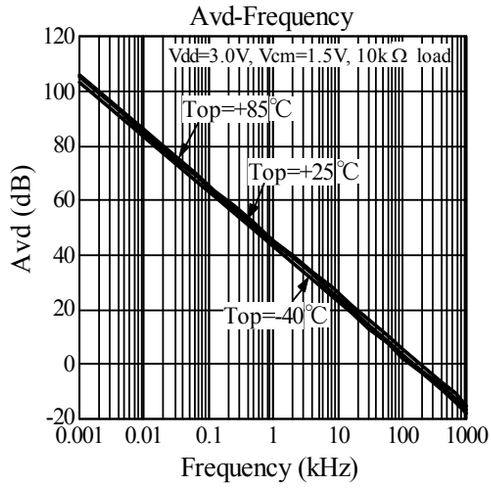


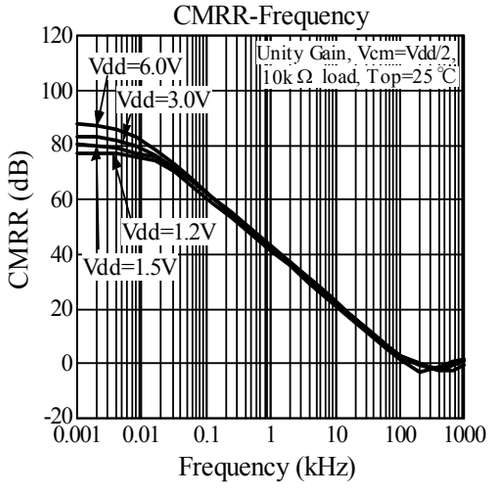


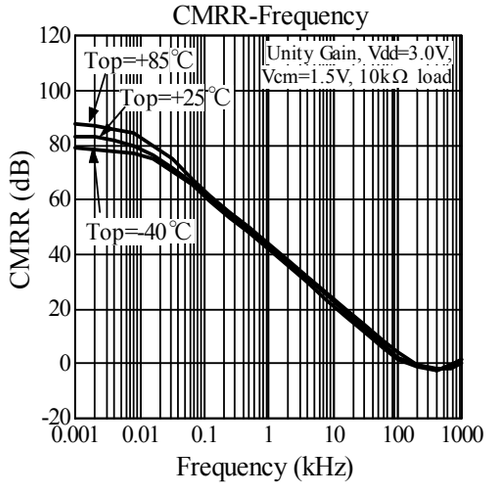


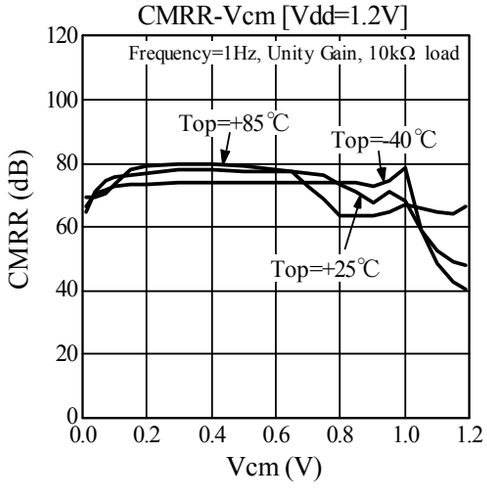


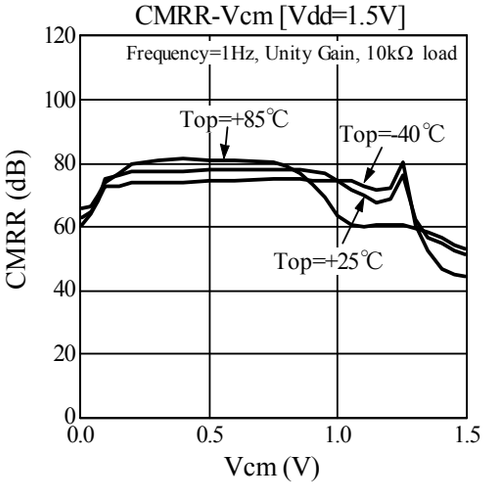


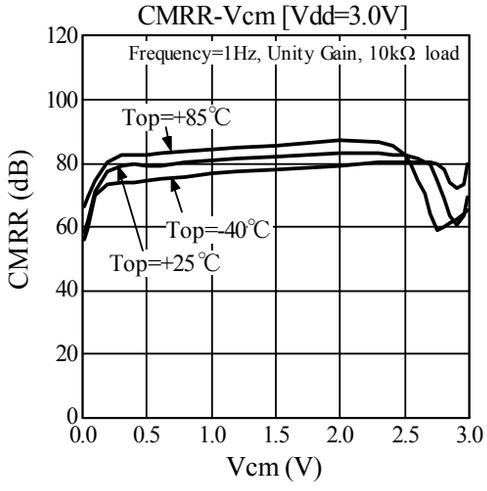


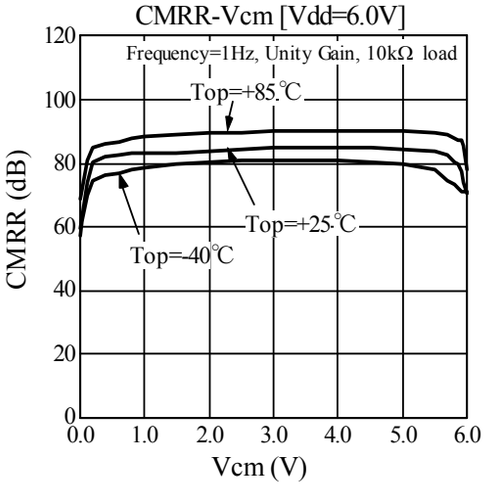

CMRR-Frequency
Unity Gain, Vcm=Vdd/2,
10kΩ load, Top=25℃
Vdd=6.0V
Vdd=3.0V
Vdd=1.2V
Vdd=1.5V
CMRR (dB)
Frequency (kHz)

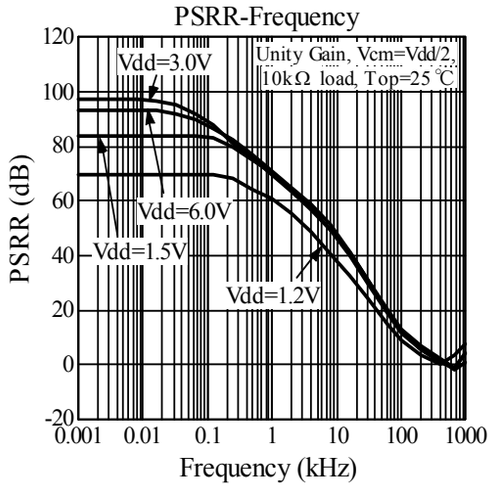

CMRR-Frequency
Unity Gain, Vdd=3.0V,
Vcm=1.5V, 10kΩ load
Top=+85℃
Top=+25℃
Top=-40℃
CMRR (dB)
Frequency (kHz)

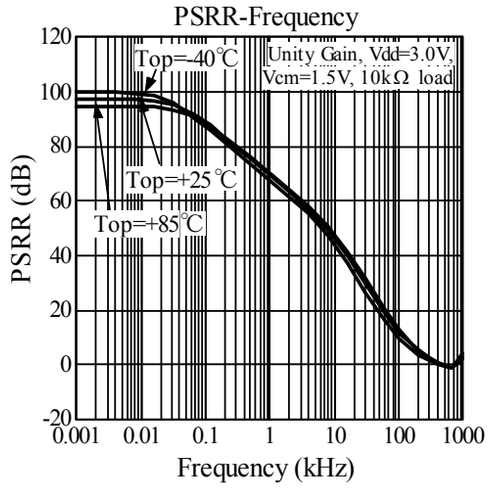

CMRR-Vcm [Vdd=1.2V]
Frequency=1Hz, Unity Gain, 10kΩ load
Top=+85℃
Top=-40℃
Top=+25℃
CMRR (dB)
Vcm (V)

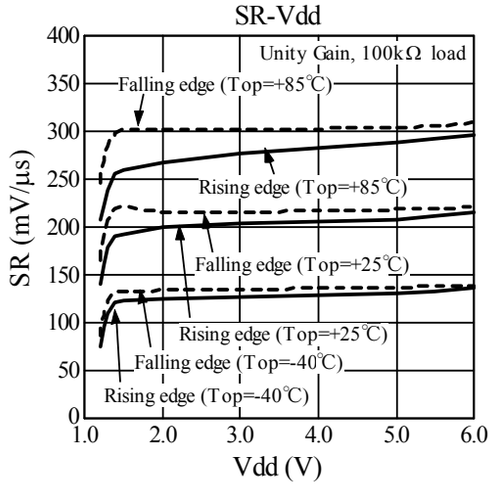

CMRR-Vcm [Vdd=1.5V]
Frequency=1Hz, Unity Gain, 10kΩ load
Top=+85℃
Top=-40℃
Top=+25℃
CMRR (dB)
Vcm (V)

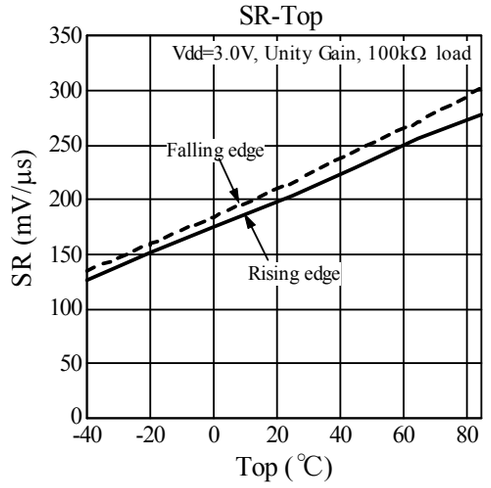

CMRR-Vcm [Vdd=3.0V]
Frequency=1Hz, Unity Gain, 10kΩ load
Top=+85℃
Top=-40℃
Top=+25℃
CMRR (dB)
Vcm (V)

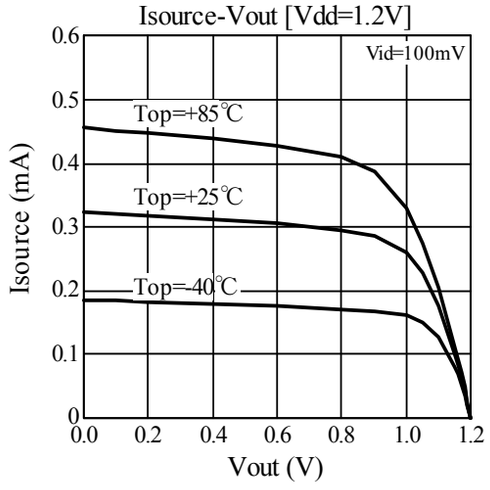

CMRR-Vcm [Vdd=6.0V]
Frequency=1Hz, Unity Gain, 10kΩ load
Top=+85℃
Top=+25℃
Top=-40℃
CMRR (dB)
Vcm (V)

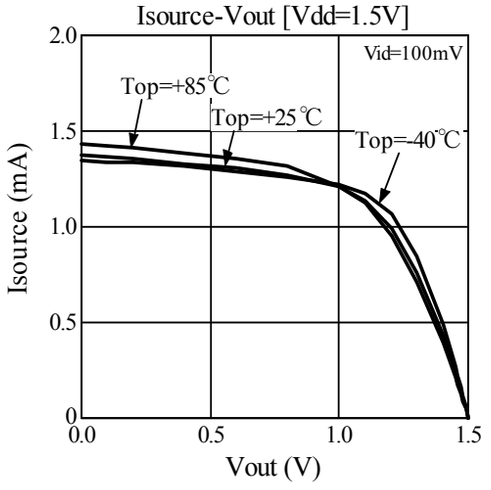

PSRR-Frequency
Unity Gain, Vcm=Vdd/2,
10kΩ load, Top=25℃
Vdd=3.0V
Vdd=6.0V
Vdd=1.5V
Vdd=1.2V
PSRR (dB)
Frequency (kHz)

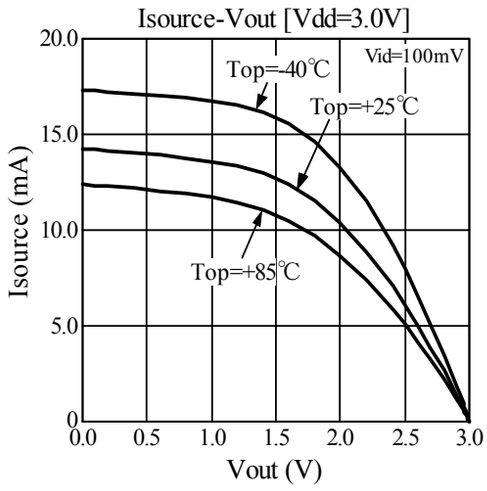

PSRR-Frequency
Unity Gain, Vdd=3.0V,
Vcm=1.5V, 10kΩ load
Top=-40℃
Top=+25℃
Top=+85℃
PSRR (dB)
Frequency (kHz)

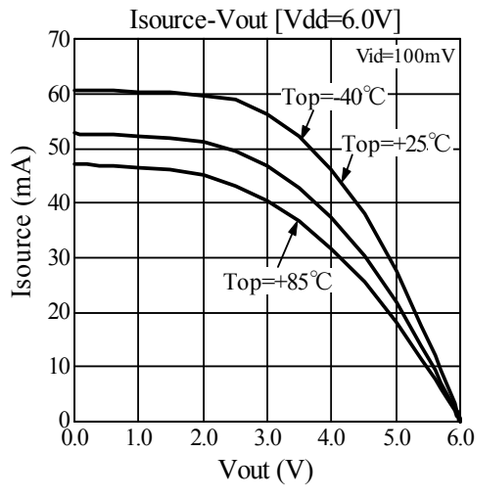

SR-Vdd
Unity Gain, 100kΩ load
Falling edge (Top=+85℃)
Rising edge (Top=+85℃)
Falling edge (Top=+25℃)
Rising edge (Top=+25℃)
Falling edge (Top=-40℃)
Rising edge (Top=-40℃)
SR (mV/μs)
Vdd (V)

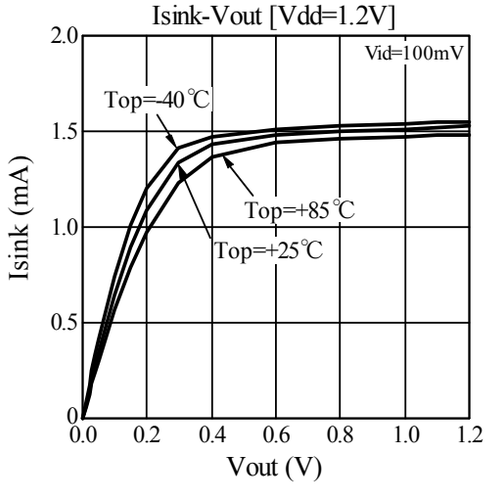

SR-Top
Vdd=3.0V, Unity Gain, 100kΩ load
Falling edge
Rising edge
SR (mV/μs)
Top (℃)

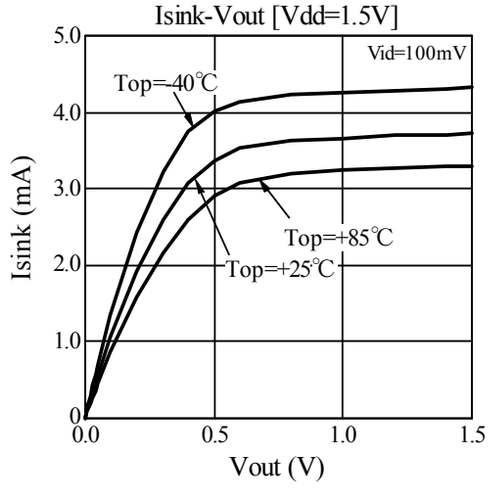

Isource-Vout [Vdd=1.2V]
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Isource (mA)
Vout (V)

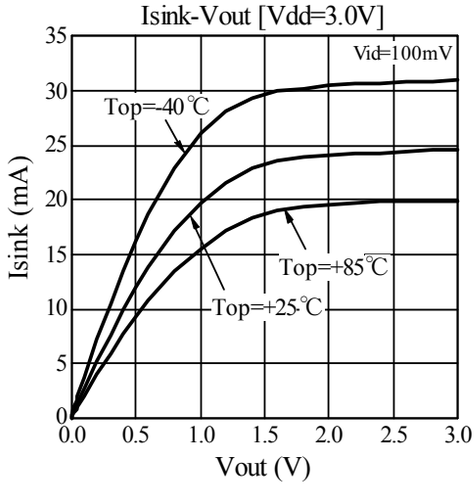

Isource-Vout [Vdd=1.5V]
Vid=100mV
Top=+85℃
Top=+25℃
Top=-40℃
Isource (mA)
Vout (V)

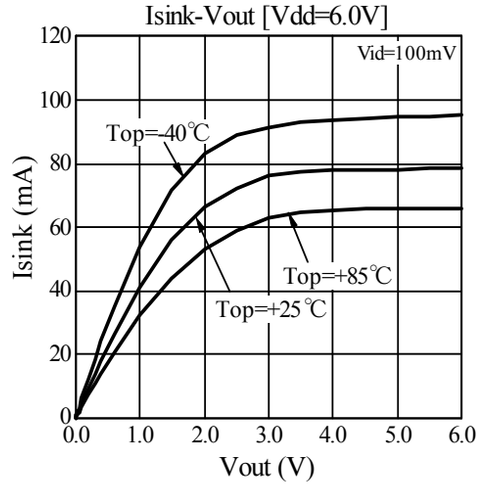

Isource-Vout [Vdd=3.0V]
Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Isource (mA)
Vout (V)

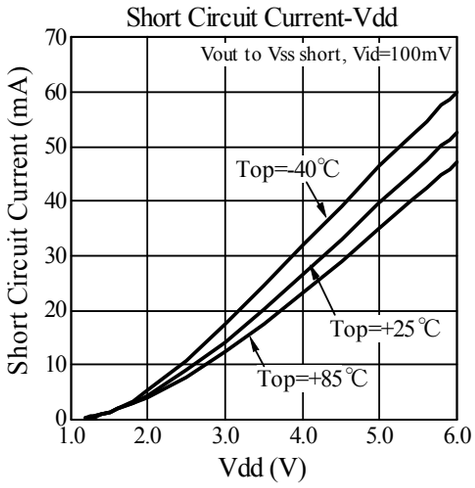

Isource-Vout [Vdd=6.0V]
Vid=100mV
Top=-40℃
Top=+25℃
Top=+85℃
Isource (mA)
Vout (V)

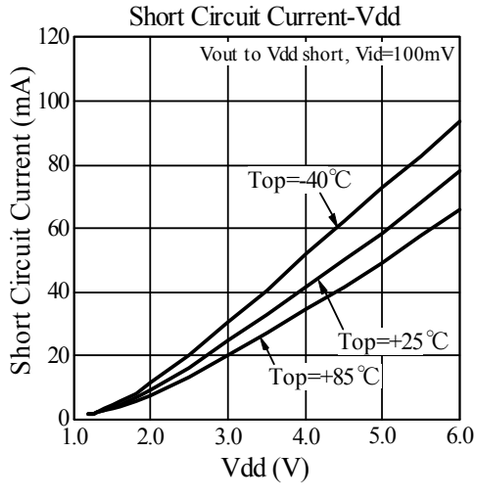

Isink-Vout [Vdd=1.2V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)

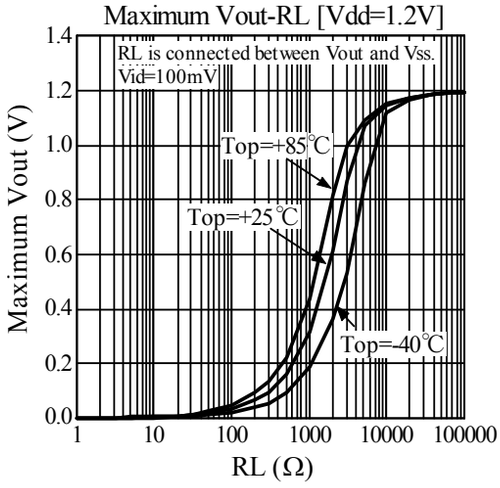

Isink-Vout [Vdd=1.5V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)

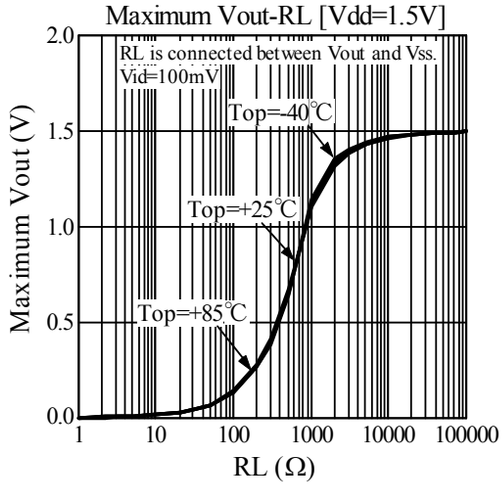

Isink-Vout [Vdd=3.0V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)

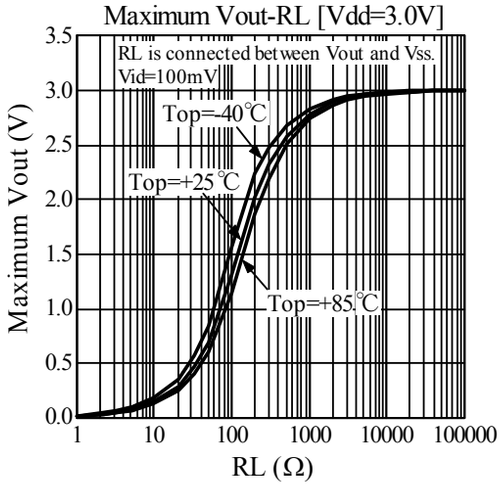

Isink-Vout [Vdd=6.0V]
Vid=100mV
Top=-40℃
Top=+85℃
Top=+25℃
Isink (mA)
Vout (V)

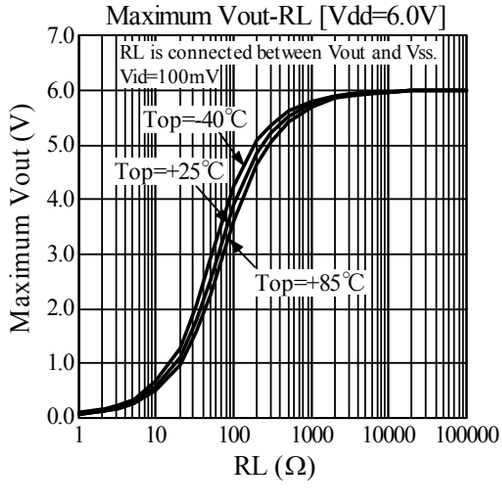

Short Circuit Current-Vdd
Vout to Vss short, Vid=100mV
Short Circuit Current (mA)
Top=-40℃
Top=+25℃
Top=+85℃
Vdd (V)

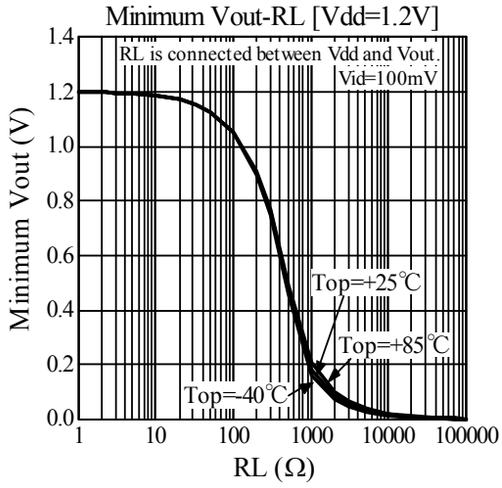

Short Circuit Current-Vdd
Vout to Vdd short, Vid=100mV
Short Circuit Current (mA)
Top=-40℃
Top=+25℃
Top=+85℃
Vdd (V)

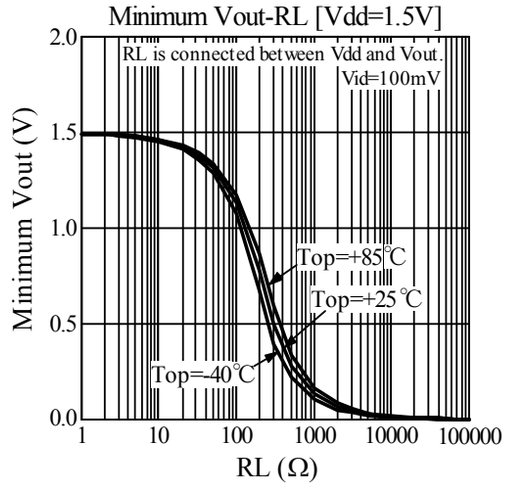

Maximum Vout-RL [Vdd=1.2V]
RL is connected between Vout and Vss.
Vid=100mV
Maximum Vout (V)
Top=+85℃
Top=+25℃
Top=-40℃
RL (Ω)

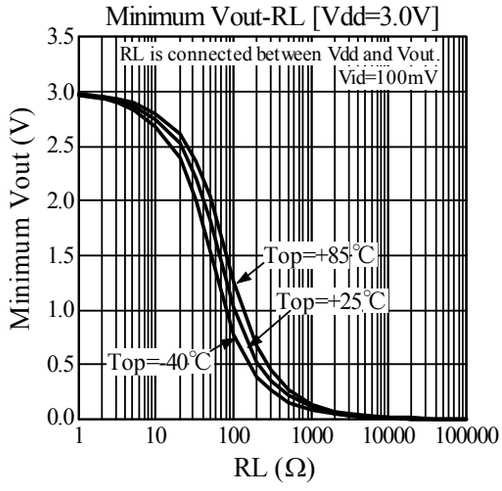

Maximum Vout-RL [Vdd=1.5V]
RL is connected between Vout and Vss.
Vid=100mV
Maximum Vout (V)
Top=-40℃
Top=+25℃
Top=+85℃
RL (Ω)

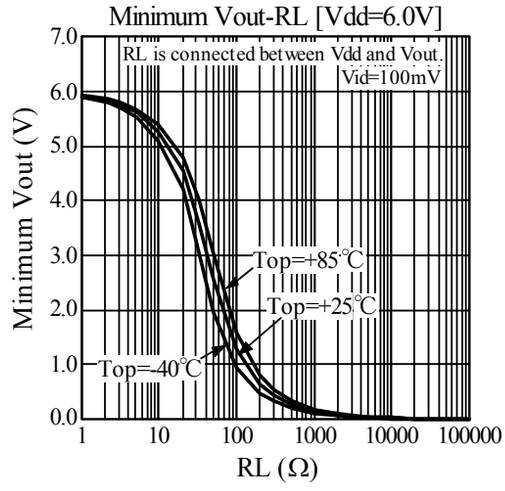

Maximum Vout-RL [Vdd=3.0V]
RL is connected between Vout and Vss.
Vid=100mV
Maximum Vout (V)
Top=-40℃
Top=+25℃
Top=+85℃
RL (Ω)

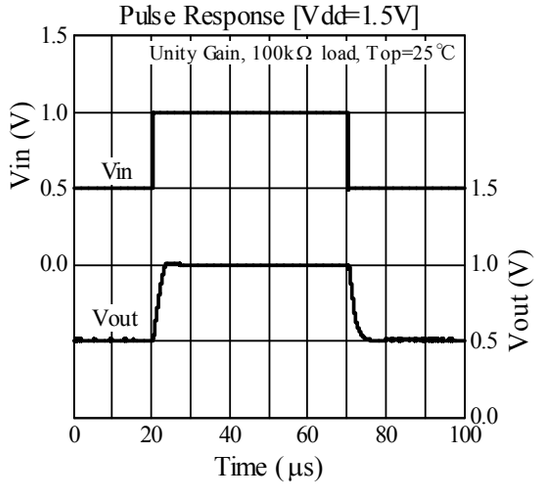

Maximum Vout-RL [Vdd=6.0V]
RL is connected between Vout and Vss.
Vid=100mV
Maximum Vout (V)
Top=-40℃
Top=+25℃
Top=+85℃
RL (Ω)

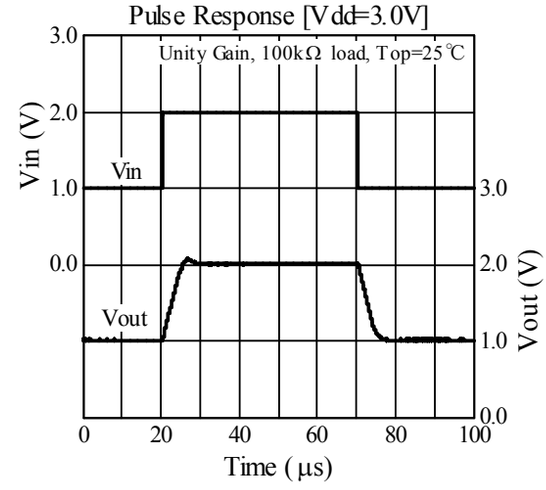

Minimum Vout-RL [Vdd=1.2V]
RL is connected between Vdd and Vout.
Vid=100mV
Top=+25℃
Top=+85℃
Top=-40℃
Minimum Vout (V)
RL (Ω)


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)