

APPLICATION MANUAL



Dual OPAMP with Full-swing Output TK17021,22,23,24M/L

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Dual OPAMP with Full-swing Output TK17021,22,23,24M/L

1. DESCRIPTION

The TK17021,22,23,24M/L is dual operational amplifier with full-swing output.

The features are low voltage operation, low saturation output, and a small package.

It is suitable for use with portable equipment.

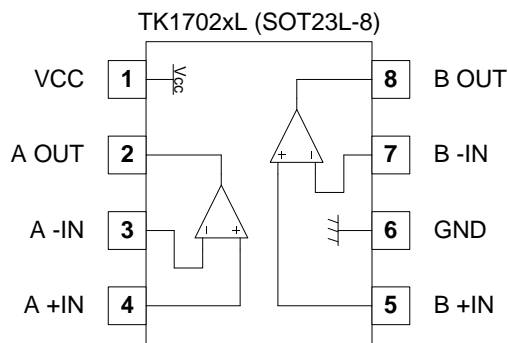
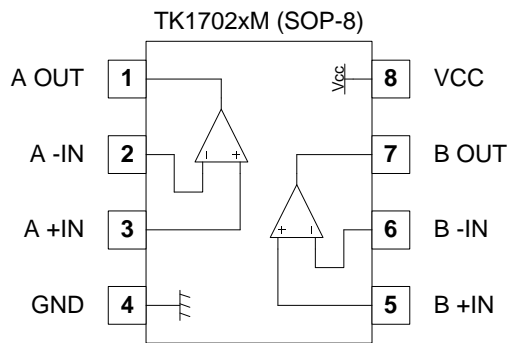
2. FEATURES

- Low Voltage Operation $V_{OP}=2V$ to $10V$
- Low Saturation Output Voltage $V_{OM}=V_{CC}-0.2V$
- Slew Rate $SR=4V/\mu\text{sec}$
- Unity Gain Bandwidth $GB=12\text{MHz}$
- Small Package SOP-8, SOT23L-8

3. APPLICATIONS

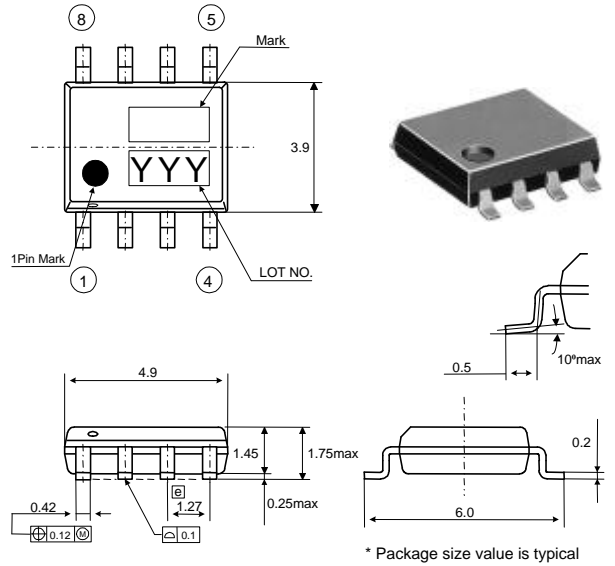
- General Purpose
- Portable Equipment
- Low Operating Voltage Equipment

4. PIN CONFIGURATION

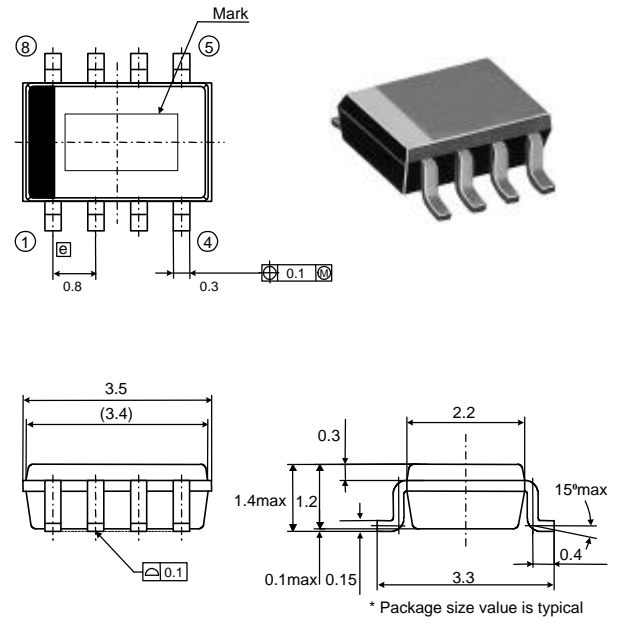


5. PACKAGE OUTLINE

■ SOP-8



■ SOT23L-8



6. ABSOLUTE MAXIMUM RATINGS

$T_a=25^{\circ}\text{C}$

Parameter	Symbol	Rating	Units	Conditions
Supply Voltage	V_{CC}	12	V	
Power Dissipation	P_D	400	mW	*
Storage Temperature Range	T_{stg}	-55 ~ +150	$^{\circ}\text{C}$	
Operating Temperature Range	T_{OP}	-40 ~ +85	$^{\circ}\text{C}$	
Operating Voltage Range	V_{OP}	2 ~ 10	V	

* P_D must be decreased at the rate of 3.2mW/ $^{\circ}\text{C}$ for operation above 25 $^{\circ}\text{C}$.

7. ELECTRICAL CHARACTERISTICS

$V_{CC}=5\text{V}, T_a=25^{\circ}\text{C}$

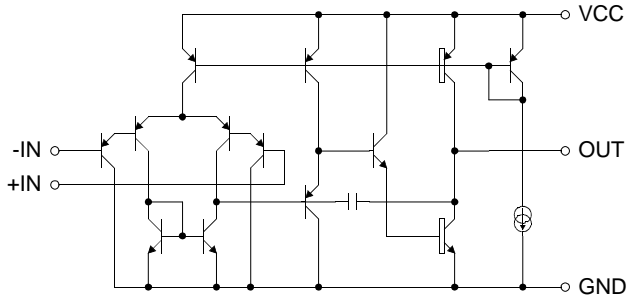
Parameter	Symbol	Value			Units	Conditions
		MIN	TYP	MAX		
Supply Current (TK17021,23M/L)	I_{CC}	-	10	15	mA	$R_L=\infty, V_{in}=V_{CC}/2$
Supply Current (TK17022,24M/L)	I_{CC}	-	4	6	mA	$R_L=\infty, V_{in}=V_{CC}/2$
Input Offset Voltage	V_{IO}	-	0.5	6	mV	
Input Offset Current	I_{IO}	-	1	50	nA	
Input Bias Current	I_{IB}	-	100	300	nA	
Common-Mode Input Voltage Range (TK17021,22M/L)	V_{ICMR}	0~ $V_{CC}-1.5$	-	-	V	
Common-Mode Input Voltage Range (TK17023,24M/L)	V_{ICMR}	0.5~ $V_{CC}-1$	-	-	V	
Maximum Output Voltage	V_{OM}	$V_{CC}-0.3$	$V_{CC}-0.1$	-	V	$R_L \geq 5\text{k}\Omega, V_{IN+}=3\text{V}, V_{IN-}=2\text{V}$
		-	0.1	0.3	V	$R_L \geq 5\text{k}\Omega, V_{IN+}=2\text{V}, V_{IN-}=3\text{V}$
Source Current (TK17021,23M/L)	I_{SO}	2	3.6	-	mA	$V_{IN+}=3\text{V}, V_{IN-}=2\text{V}$
Source Current (TK17022,24M/L)	I_{SO}	0.7	1.2	-	mA	$V_{IN+}=3\text{V}, V_{IN-}=2\text{V}$
Sink Current	I_{SI}	8	25	-	mA	$V_{IN+}=2\text{V}, V_{IN-}=3\text{V}$
Common-Mode Rejection Ratio	CMRR	60	85	-	dB	
Supply Voltage Rejection Ratio	SVRR	60	100	-	dB	
Open Circuit Voltage Gain	G_{VO}	60	100	-	dB	$R_L \geq 10\text{k}\Omega$
Slew Rate	SR	-	4	-	V/ μs	$A_V=1, V_{IN}=1V_{P-P}$
Gain-Bandwidth Product	GB	-	12	-	MHz	f=10kHz
Cross Talk	CT	-	80	-	dB	f=1kHz

* Note: This amplifier may oscillate when used as a buffer with a capacitive load.

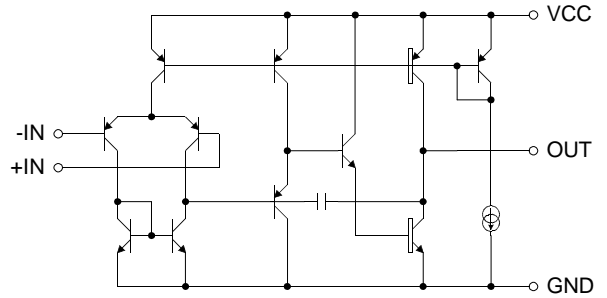
* A practical gain range for this amplifier is from 3dB to 30dB.

8. SIMPLIFIED SCHEMATIC

• TK17021,22M/L



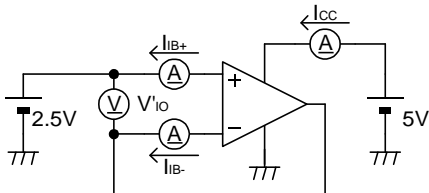
• TK17023,24M/L



* The circuit in the above figure represents one of the two devices in the package.

9. TEST CIRCUIT

• Supply Current, Input Offset Voltage, Input Offset Current, Input Bias Current

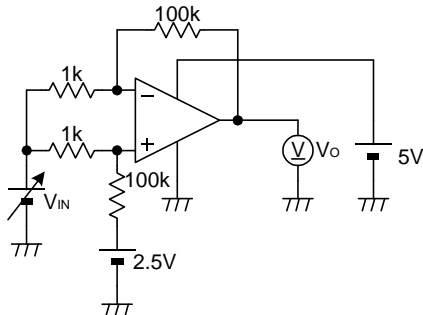


$$V_{IO} = |V'_{IO}|$$

$$I_{IO} = |I_{IB+} - I_{IB-}|$$

$$I_{IB} = \frac{I_{IB+} + I_{IB-}}{2}$$

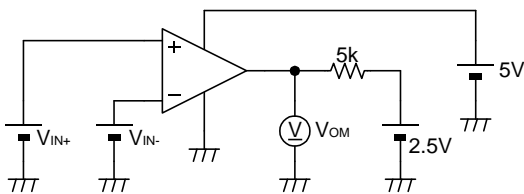
• Common-Mode Rejection Ratio, Common-Mode Input Voltage Range



$$CMRR = 20 \log \left(101 \times \left| \frac{\Delta V_{IN}}{\Delta V_O} \right| \right)$$

$$V_{ICMR} : CMRR > 60dB$$

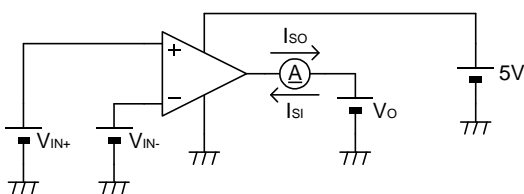
• Maximum Output Voltage



$$V_{OM+} : V_{IN+} = 3V, V_{IN-} = 2V$$

$$V_{OM-} : V_{IN+} = 2V, V_{IN-} = 3V$$

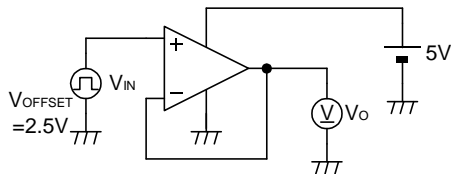
• Source Current, Sink Current



$$I_{SO} : V_{IN+} = 3V, V_{IN-} = 2V, V_O = 4.5V$$

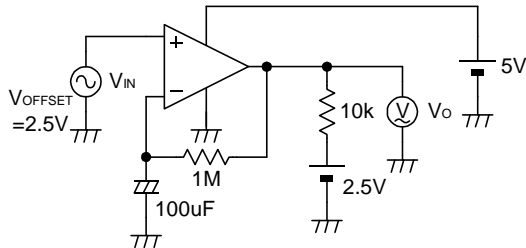
$$I_{SI} : V_{IN+} = 2V, V_{IN-} = 3V, V_O = 0.5V$$

• Slew Rate



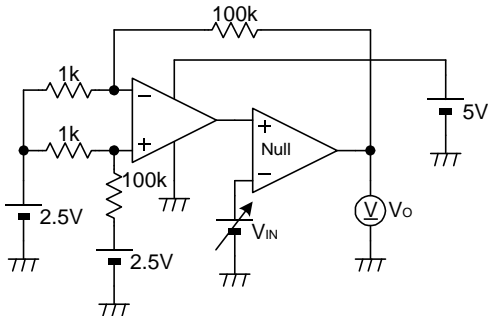
$$SR = \frac{\Delta V_O}{\Delta T_{RISE}}$$

• Gain-Bandwidth Product



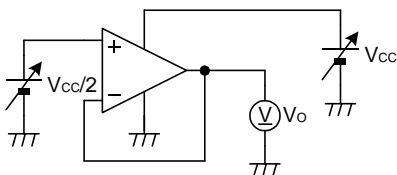
$$GB = \frac{V_O(f_T)}{V_{IN}(f_T)} \times f_T$$

• Open Circuit Voltage Gain



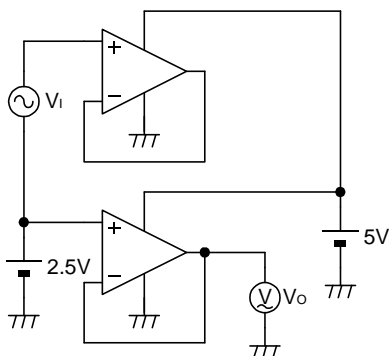
$$G_{VO} = 20 \log \left(101 \times \frac{-\Delta V_{IN}}{\Delta V_O} \right)$$

• Supply Voltage Rejection Ratio



$$SVRR = 20 \log \frac{\Delta V_{CC}}{\Delta V_O}$$

• Cross Talk

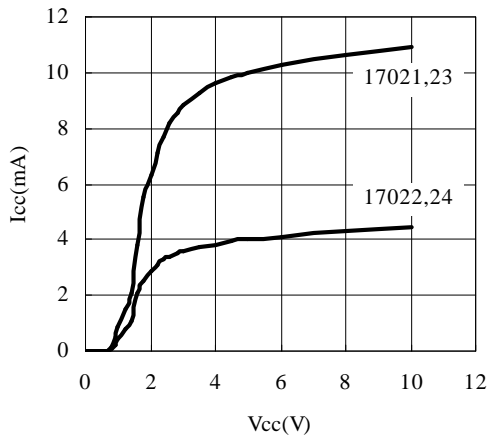


$$CT = 20 \log \frac{\Delta V_1}{\Delta V_O}$$

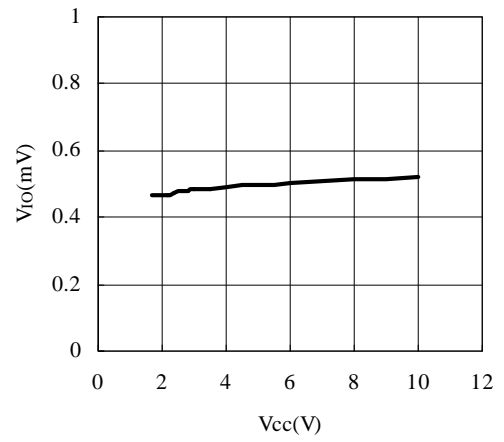
10. TYPICAL CHARACTERISTICS

(Ta=25°C, Vcc=5V)

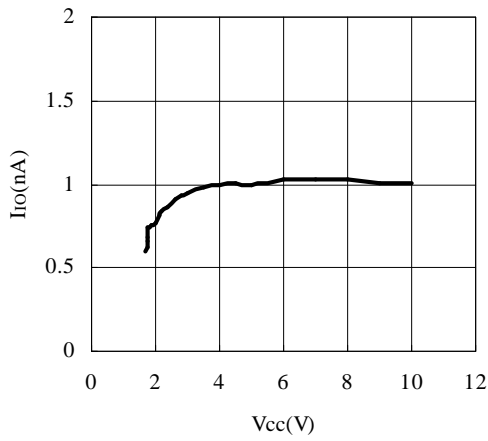
• Supply Current vs. Supply Voltage



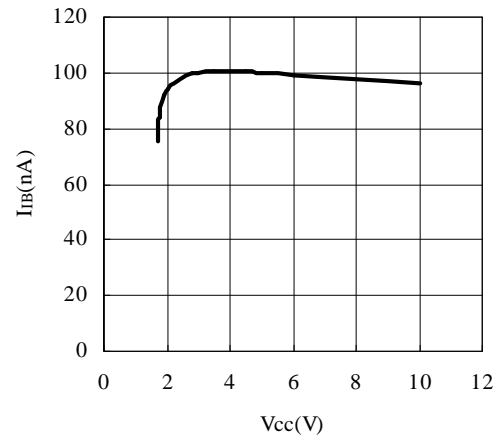
• Input Offset Voltage vs. Supply Voltage



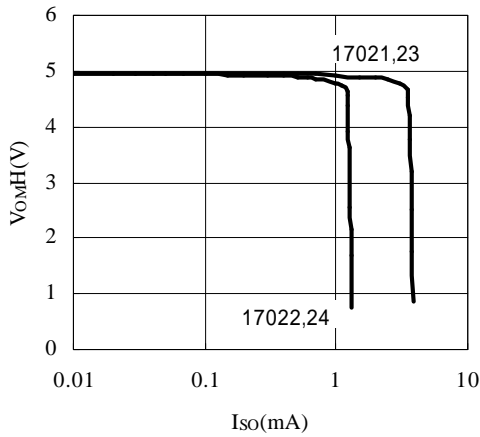
• Input Offset Current vs. Supply Voltage



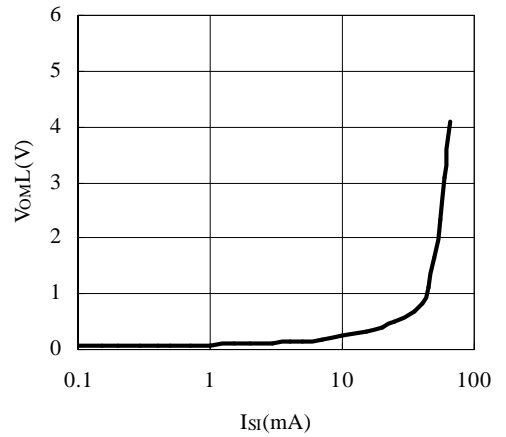
• Input Bias Current vs. Supply Voltage



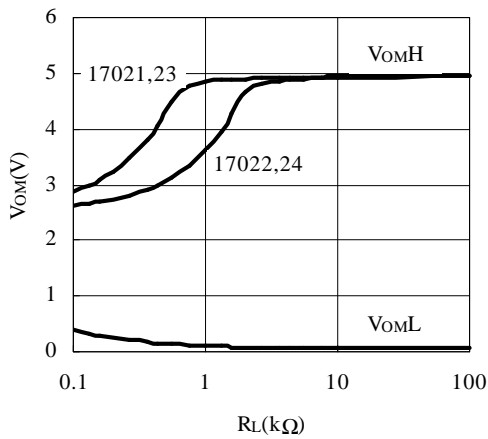
- Maximum High Output Voltage vs. Source Current
($V_{IN+}=3V, V_{IN-}=2V$)



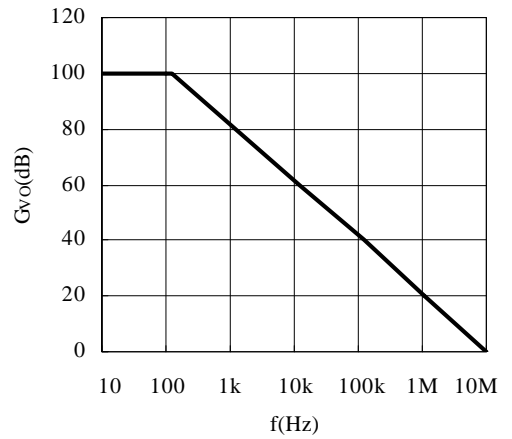
- Maximum Low Output Voltage vs. Sink Current
($V_{IN+}=2V, V_{IN-}=3V$)



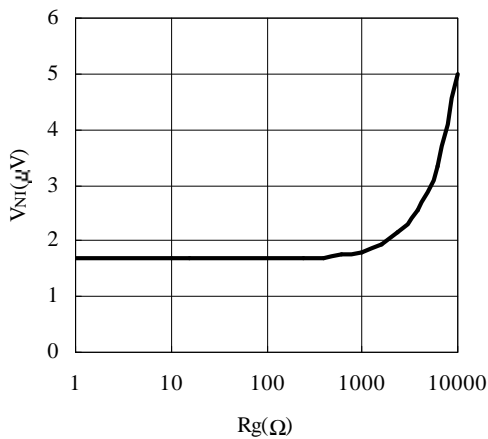
- Maximum Output Voltage vs. Load Resistance



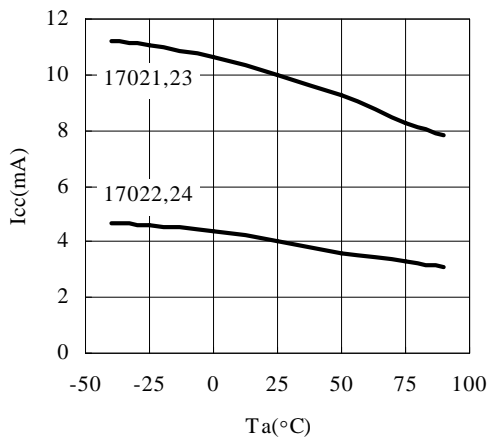
- Open Circuit Voltage Gain vs. Frequency



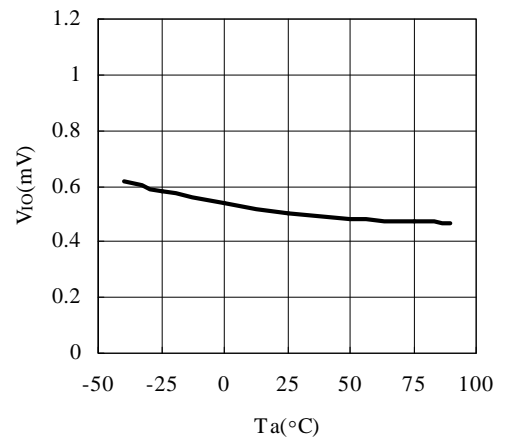
- Equivalent Input Noise Voltage vs. Source Resistance
(Gain=60dB)



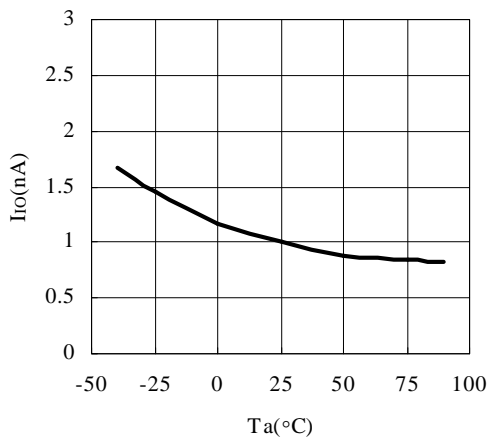
• Supply Current vs. Temperature



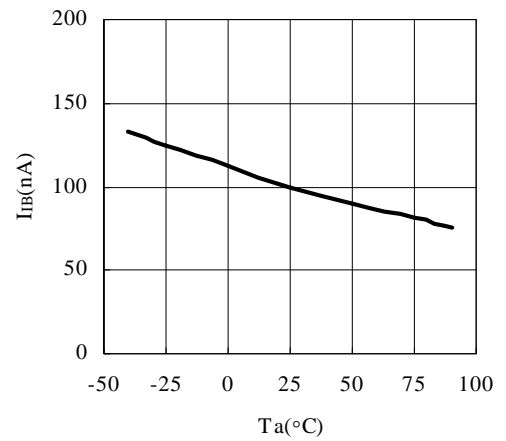
• Input Offset Voltage vs. Temperature



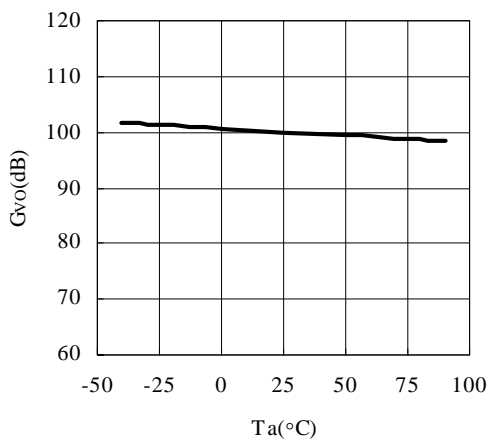
• Input Offset Current vs. Temperature



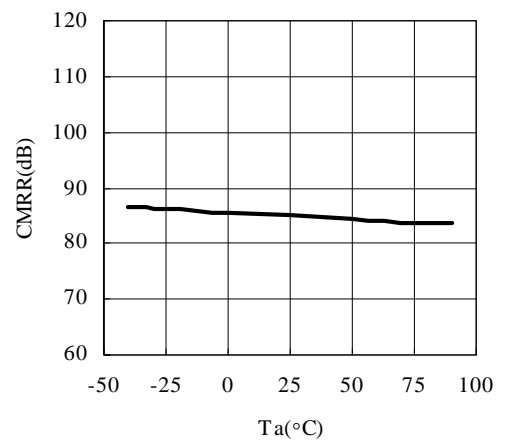
• Input Bias Current vs. Temperature



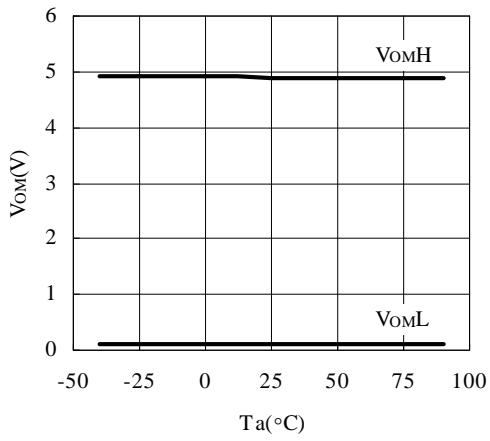
• Open Circuit Voltage Gain vs. Temperature



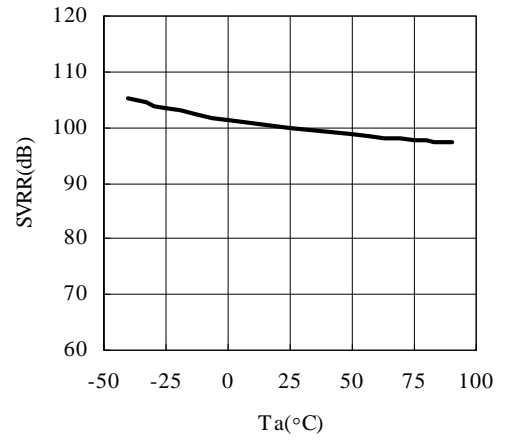
• Common-Mode Rejection Ratio vs. Temperature



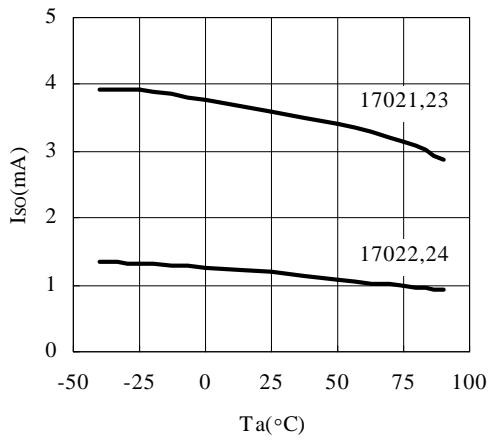
• Maximum Output Voltage vs. Temperature ($R_L=5k\Omega$)



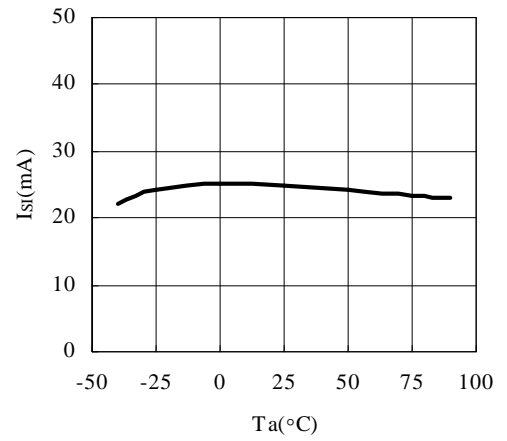
• Supply Voltage Rejection Ratio vs. Temperature



• Source Current vs. Temperature
($V_{IN+}=3V, V_{IN-}=2V, V_O=4.5V$)



• Sink Current vs. Temperature
($V_{IN+}=3V, V_{IN-}=2V, V_O=0.5V$)



11. NOTES

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