APPLICATION MANUAL

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

CONTENTS

MEETING YOUR NEEDS
TOKO, INC.

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

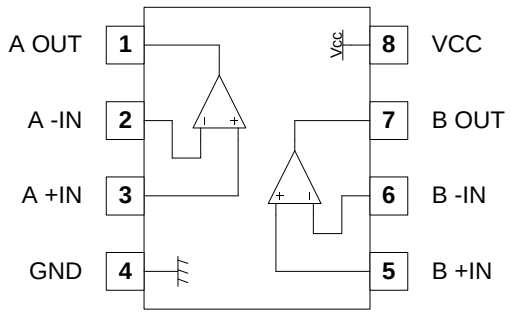
■ Low Voltage Operation	V_{OP}=2V to 10V
■ Low Saturation Output Voltage	V_{OM}=Vcc-0.2V
■ Slew Rate	SR=4V/µsec
■ Unity Gain Bandwidth	GB=12MHz
■ Small Package	SOP-8,SOT23L-8

3. APPLICATIONS

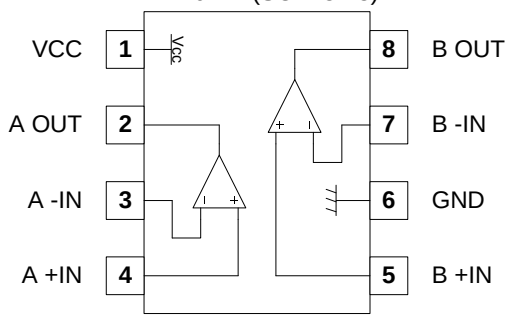
■ General Purpose
■ Portable Equipment
■ Low Operating Voltage Equipment

4. PIN CONFIGURATION

TK1702xM (SOP-8)

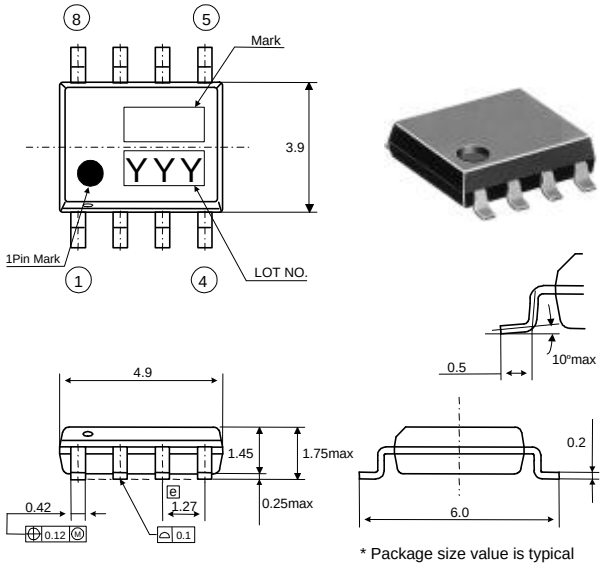


TK1702xL (SOP23L-8)



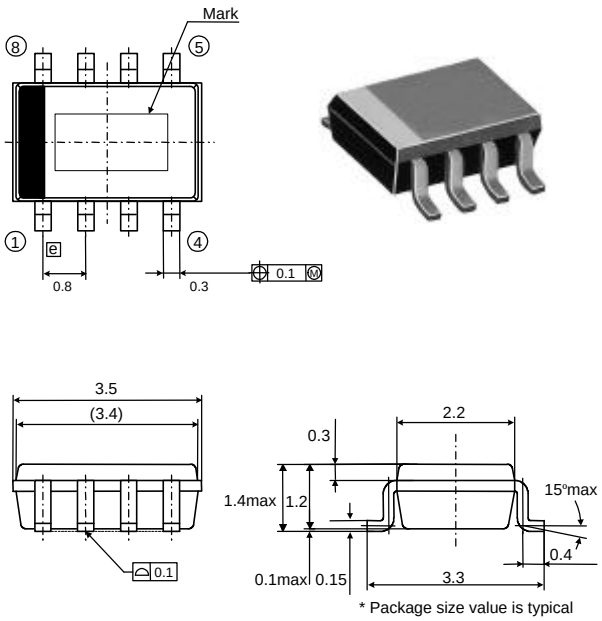
5. PACKAGE OUTLINE

■ SOP-8



* Package size value is typical

■ SOT23L-8



* Package size value is typical

6. ABSOLUTE MAXIMUM RATINGS

T_a=25°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	°C	
Operating Temperature Range	T_{OP}	-40 ~ +85	°C	
Operating Voltage Range	V_{OP}	2 ~ 10	V	

* P_D must be decreased at the rate of 3.2mW/°C for operation above 25°C.

7. ELECTRICAL CHARACTERISTICS

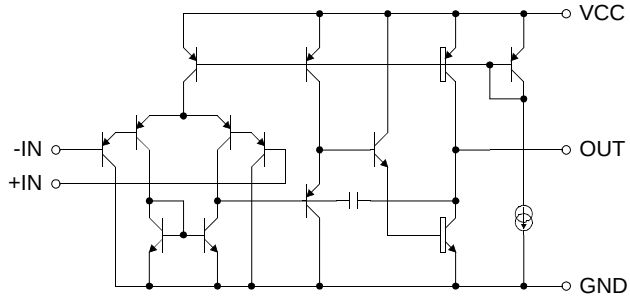
V_{CC}=5V, T_a=25°C

Parameter	Symbol	Value			Units	Conditions
		MIN	TYP	MAX		
Supply Current (TK17021,23M/L)	I_{CC}	-	10	15	mA	R_L=∞, Vin=V_{CC}/2
Supply Current (TK17022,24M/L)	I_{CC}	-	4	6	mA	R_L=∞, Vin=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~ Vcc-1.5	-	-	V	
Common-Mode Input Voltage Range (TK17023,24M/L)	V_{ICMR}	0.5~ Vcc-1	-	-	V	
Maximum Output Voltage	V_{OM}	Vcc-0.3	Vcc-0.1	-	V	R_L ≥5kΩ, V_{IN}+=3V, V_{IN}-=2V
		-	0.1	0.3	V	R_L ≥5kΩ, V_{IN}+=2V, V_{IN}-=3V
Source Current (TK17021,23M/L)	I_{SO}	2	3.6	-	mA	V_{IN}+=3V, V_{IN}-=2V
Source Current (TK17022,24M/L)	I_{SO}	0.7	1.2	-	mA	V_{IN}+=3V, V_{IN}-=2V
Sink Current	I_{SI}	8	25	-	mA	V_{IN}+=2V, V_{IN}-=3V
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 ≥10kΩ
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

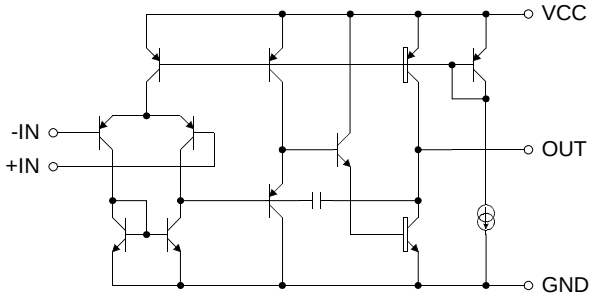
* Note: This amplifier may oscillate when used as a buffer with a capacitive load.
* A practical gain range for this amplifier is from 3dB to 30dB.

8. SIMPLIFIED SCHEMATIC

- TK17021,22M/L



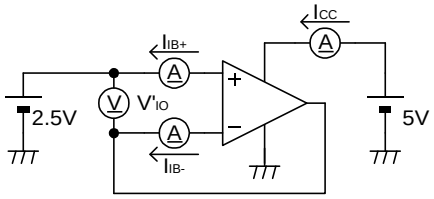
- TK17023,24M/L



* 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

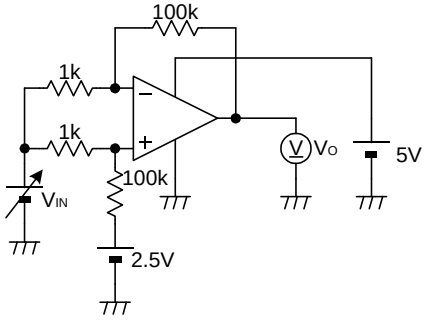


$$V_{IO} = |V'_{IO}|$$

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

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

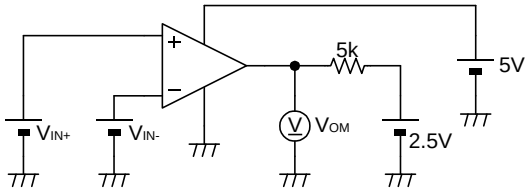
- Common-Mode Rejection Ratio, Common-Mode Input Voltage Range



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

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

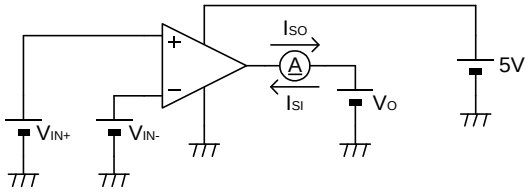
- Maximum Output Voltage



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

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

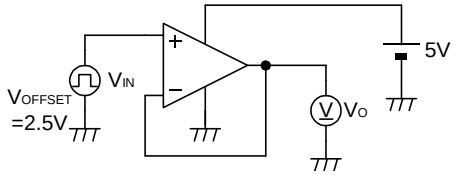
- Source Current, Sink Current



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

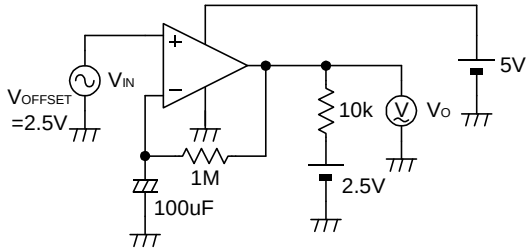
$$I_{SI} : V_{IN+} = 2V, V_{IN-} = 3V, V_O = 0.5V$$

- Slew Rate



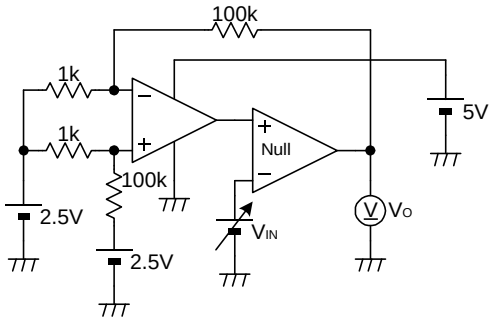
$$SR = \frac{\Delta V_O}{\Delta T_{RISE}}$$

- Gain-Bandwidth Product



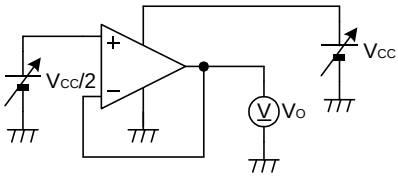
$$GB = \frac{V_O(f_T)}{V_{IN}(f_T)} \times f_T$$

- Open Circuit Voltage Gain



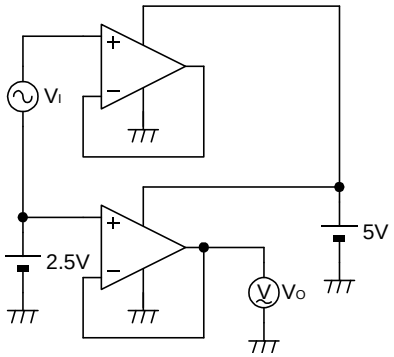
$$G_{VO} = 20\log\left(101 \times \frac{-\Delta V_{IN}}{\Delta V_O}\right)$$

- Supply Voltage Rejection Ratio



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

- Cross Talk

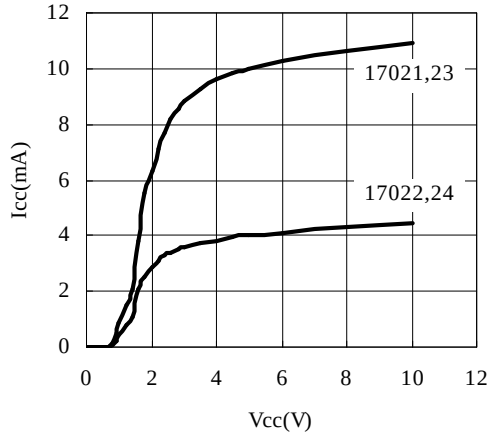


$$CT = 20\log\frac{\Delta V_I}{\Delta V_O}$$

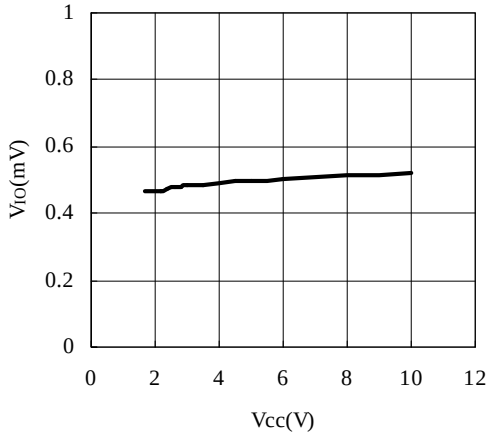
10. TYPICAL CHARACTERISTICS

(Ta=25°C,Vcc=5V)

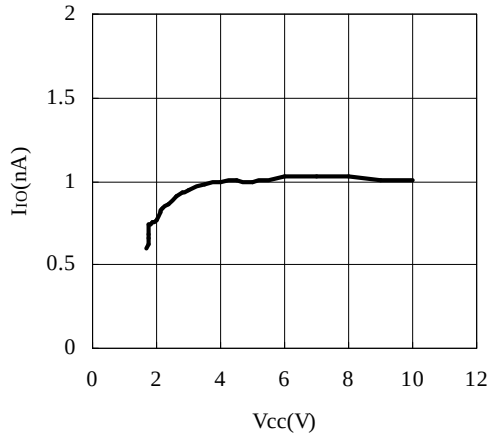
- Supply Current vs. Supply Voltage



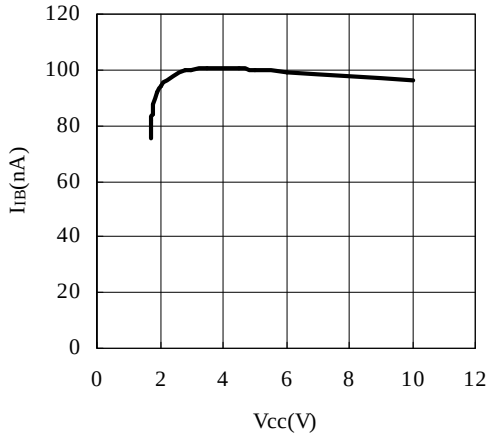
- Input Offset Voltage vs. Supply Voltage



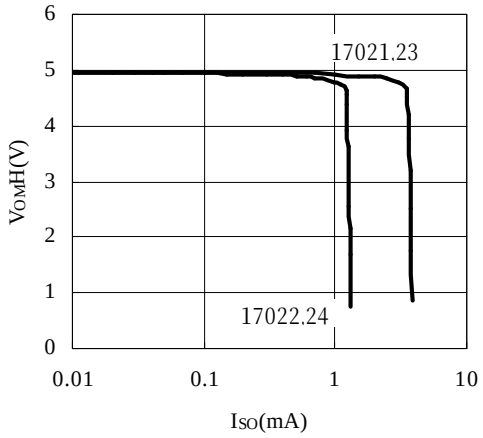
- Input Offset Current vs. Supply Voltage



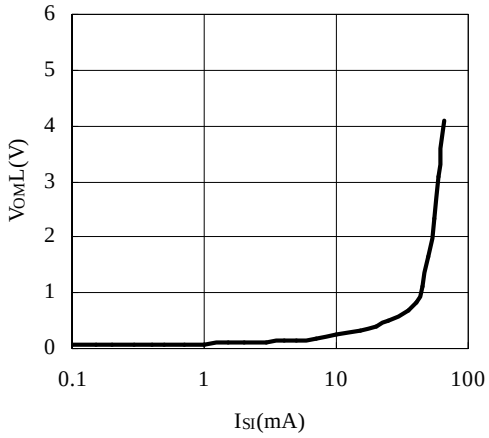
- Input Bias Current vs. Supply Voltage



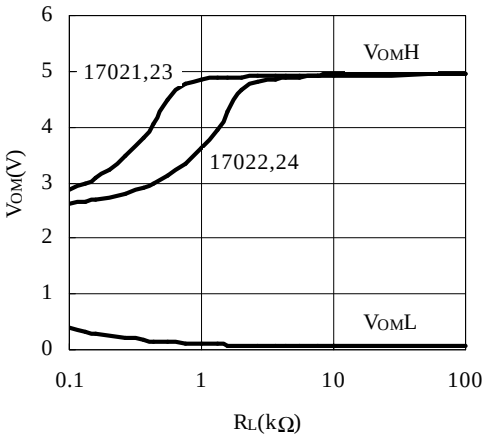
- Maximum High Output Voltage vs. Source Current (V_{IN+}=3V,V_{IN-}=2V)



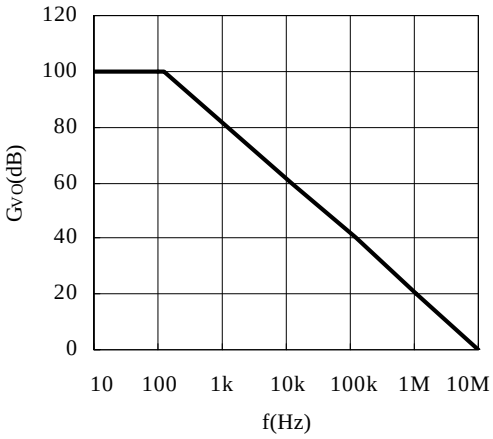
- Maximum Low Output Voltage vs. Sink Current (V_{IN+}=2V,V_{IN-}=3V)



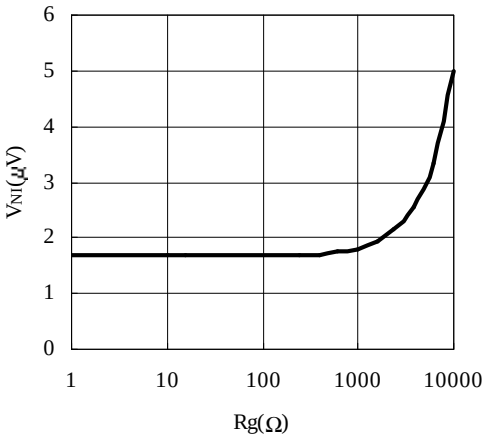
- Maximum Output Voltage vs. Load Resistance



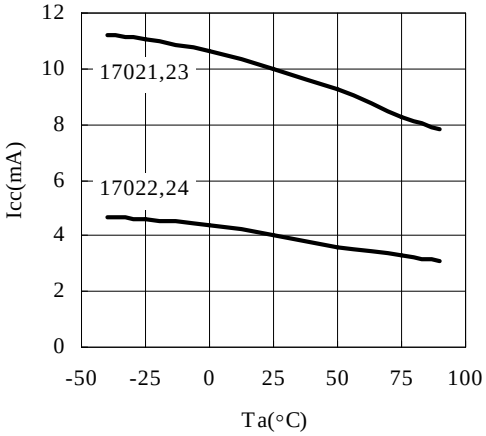
- Open Circuit Voltage Gain vs. Frequency



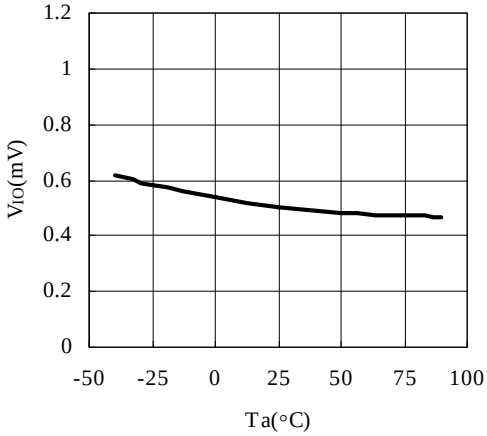
- Equivalent Input Noise Voltage vs. Source Resistance (Gain=60dB)



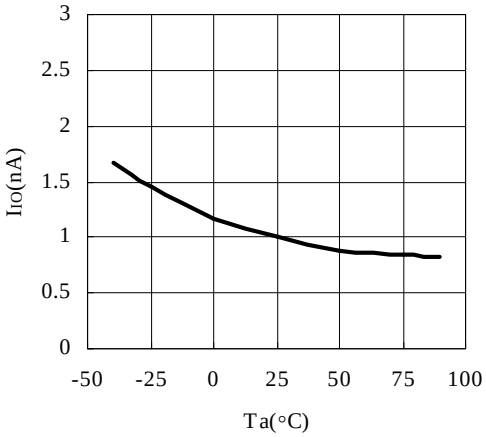
- Supply Current vs. Temperature



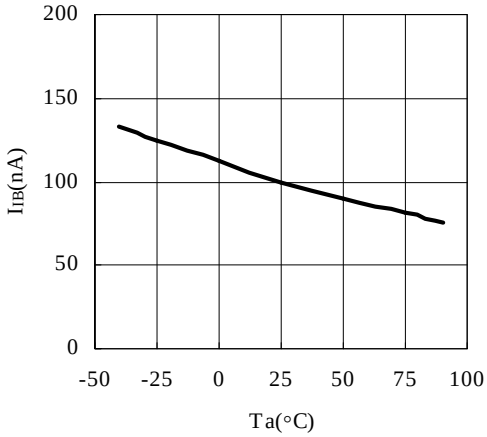
- Input Offset Voltage vs. Temperature



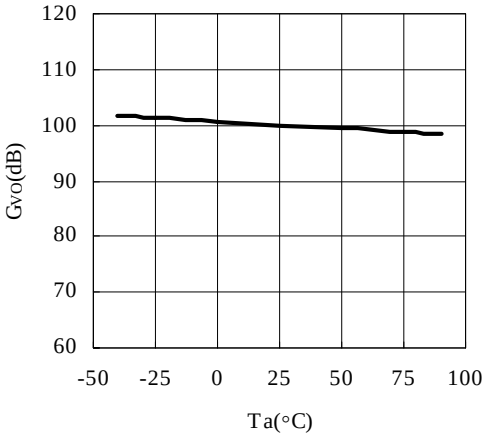
- Input Offset Current vs. Temperature



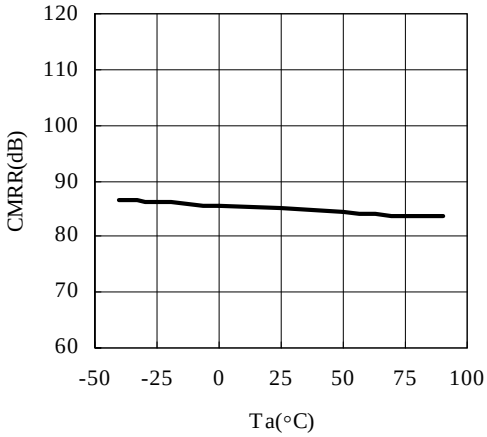
- Input Bias Current vs. Temperature



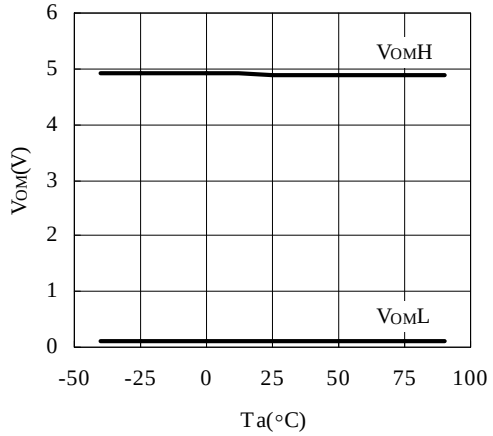
- Open Circuit Voltage Gain vs. Temperature



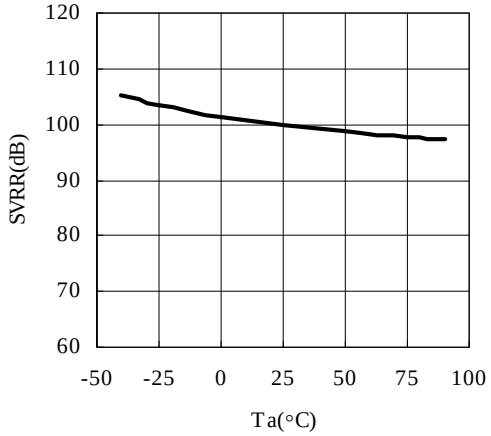
- Common-Mode Rejection Ratio vs. Temperature



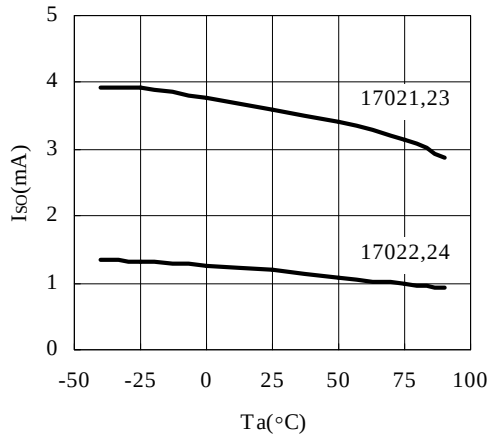
- Maximum Output Voltage vs. Temperature (R_L=5kΩ)



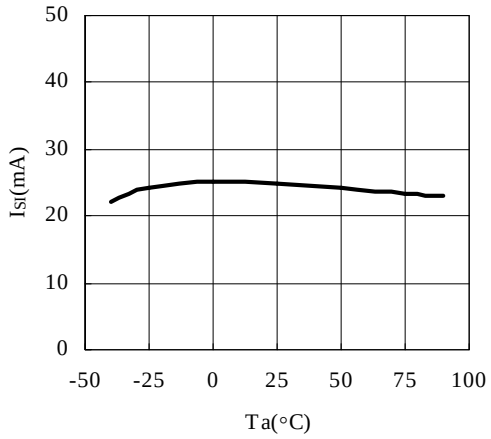
- Supply Voltage Rejection Ratio vs. Temperature



- 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

■ Please be sure that you carefully discuss your planned purchase with our office if you intend to use the products in this application manual under conditions where particularly extreme standards of reliability are required, or if you intend to use products for applications other than those listed in this application manual.

- Power drive products for automobile, ship or aircraft transport systems; steering and navigation systems, emergency signal communications systems, and any system other than those mentioned above which include electronic sensors, measuring, or display devices, and which could cause major damage to life, limb or property if misused or failure to function.
- Medical devices for measuring blood pressure, pulse, etc., treatment units such as coronary pacemakers and heat treatment units, and devices such as artificial organs and artificial limb systems which augment physiological functions.
- Electrical instruments, equipment or systems used in disaster or crime prevention.

■ Semiconductors, by nature, may fail or malfunction in spite of our devotion to improve product quality and reliability. We urge you to take every possible precaution against physical injuries, fire or other damages which may cause failure of our semiconductor products by taking appropriate measures, including a reasonable safety margin, malfunction preventive practices and fire-proofing when designing your products.

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■ TOKO is not responsible for any problems nor for any infringement of third party patents or any other intellectual property rights that may arise from the use or method of use of the products listed in this application manual. Moreover, this application manual does not signify that TOKO agrees implicitly or explicitly to license any patent rights or other intellectual property rights which it holds.

■ None of the ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

12. OFFICES

If you need more information on this product and other TOKO products, please contact us.

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