

# APPLICATION MANUAL



## OPAMP with Full-swing Output TK17016/18S

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# OPAMP with Full-swing Output TK17016/18S

## 1. DESCRIPTION

The TK17016/18S is an 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.

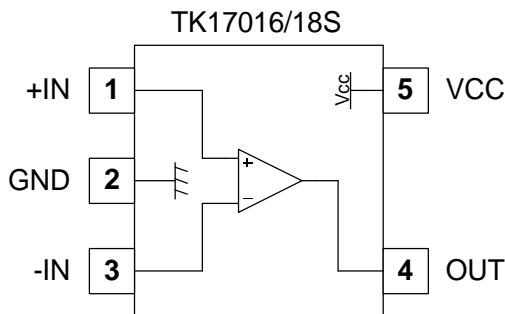
## 2. FEATURES

- 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 SOT23-5

## 3. APPLICATIONS

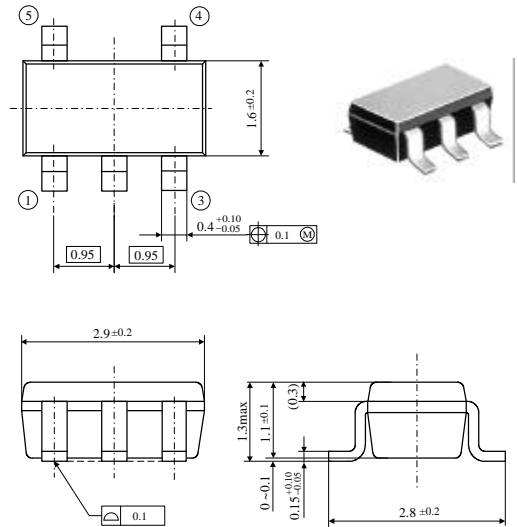
- General Purpose
- Portable Equipment
- Low Operating Voltage Equipment

## 4. PIN CONFIGURATION



## 5. PACKAGE OUTLINE

■ SOT23-5



Unit : mm

## 6. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Units	Conditions
Supply Voltage	$V_{CC}$	12	V	
Power Dissipation	$P_D$	200	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  $1.6\text{mW}/^\circ\text{C}$  for operation above  $25^\circ\text{C}$ .

**7. ELECTRICAL CHARACTERISTICS**

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

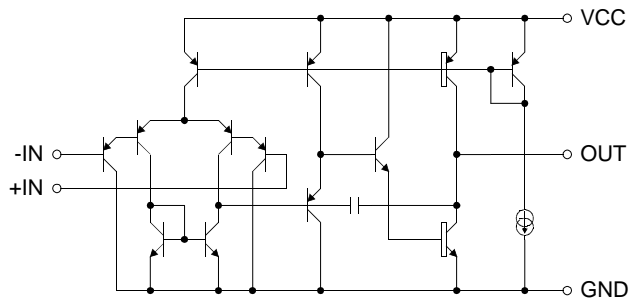
Parameter	Symbol	Value			Units	Conditions
		MIN	TYP	MAX		
Supply Current	$I_{CC}$	-	2	3	mA	$R_L=\infty, V_{in}=V_{CC}/2$
Input Offset Voltage	$V_{IO}$	-	0.5	6	mV	
Input Offset Current	$I_{IO}$	-	1	50	nA	
Input Bias Current	$I_{IB}$	-	100	300	nA	
Common-Mode Input Voltage Range (TK17016S)	$V_{ICMR}$	0~ $V_{CC}-1.5$	-	-	V	
Common-Mode Input Voltage Range (TK17018S)	$V_{ICMR}$	0.5~ $V_{CC}-1$	-	-	V	
Maximum Output Voltage	$V_{OM}$	$V_{CC}-0.3$	$V_{CC}-0.1$	-	V	$R_L \geq 5k\Omega, V_{IN+}=3V, V_{IN-}=2V$
		-	0.1	0.3	V	$R_L \geq 5k\Omega, V_{IN+}=2V, V_{IN-}=3V$
Source Current	$I_{SO}$	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	$R_L \geq 10k\Omega$
Slew Rate	SR	-	4	-	V/ $\mu$ s	$A_V=1, V_{IN}=1V_{P-P}$
Gain-Bandwidth Product	GB	-	12	-	MHz	$f=10kHz$

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

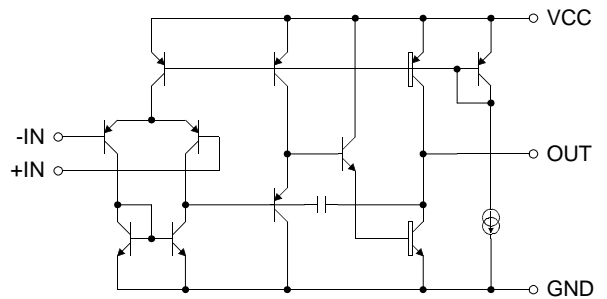
\* A practical gain range for this amplifier is from 3dB to 30dB.

**8. SIMPLIFIED SCHEMATIC**

• TK17016S

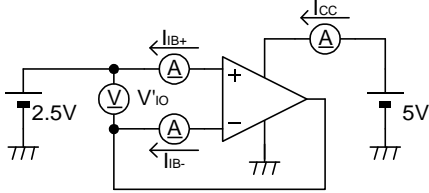


• TK17018S



**9. TEST CIRCUIT**

- Supply Current, Input Offset Voltage, Input Offset Current, Input Bias Current

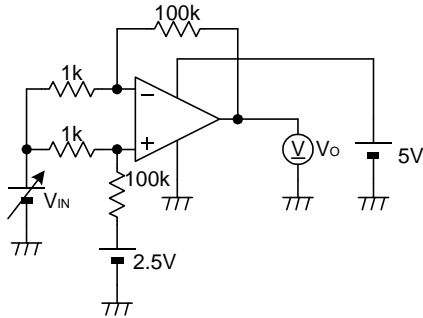


$$V_{IO} = |V'_{IO}|$$

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

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

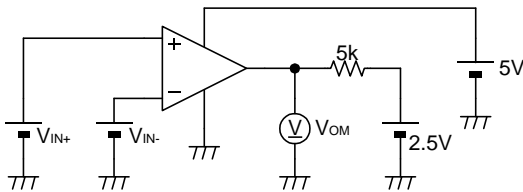
- Common-Mode Rejection Ratio, Common-Mode Input Voltage Range



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

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

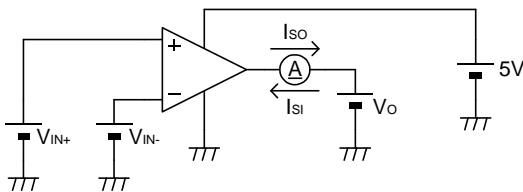
- Maximum Output Voltage



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

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

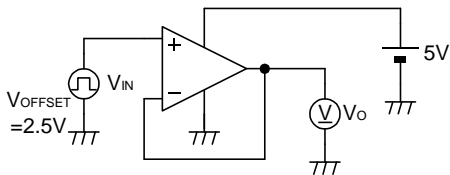
- Source Current, Sink Current



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

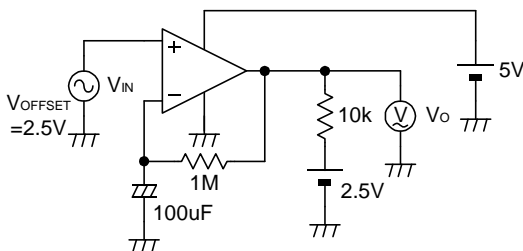
$$I_{SI} : V_{IN+} = 2V, V_{IN-} = 3V, V_O = 0.5V$$

- Slew Rate



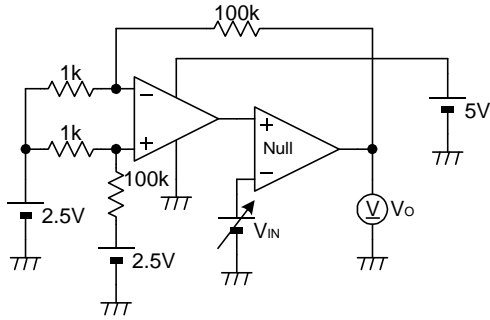
$$SR = \frac{\Delta V_O}{\Delta T_{RISE}}$$

- Gain-Bandwidth Product



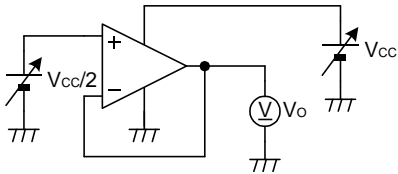
$$GB = \frac{V_O(f_T)}{V_{IN}(f_T)} \times f_T$$

• Open Circuit Voltage Gain



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

• Supply Voltage Rejection Ratio

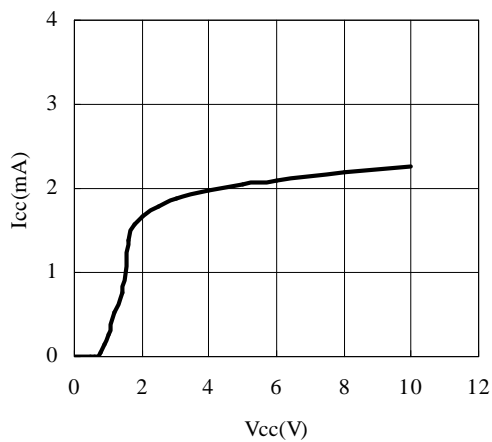


$$SVRR = 20 \log \frac{\Delta V_{CC}}{\Delta V_O}$$

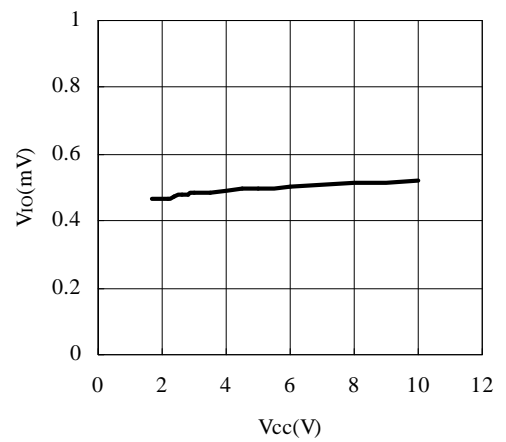
**10. TYPICAL CHARACTERISTICS**

(Ta=25°C, Vcc=5V)

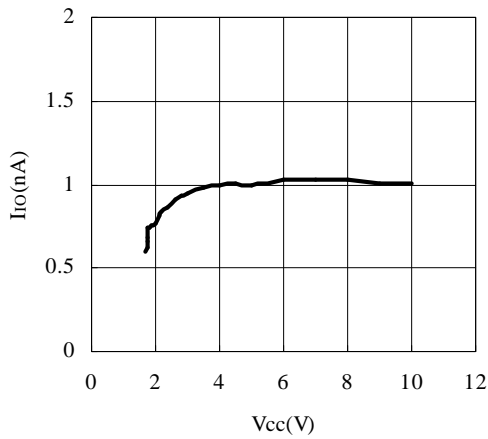
• Supply Current vs. Supply Voltage



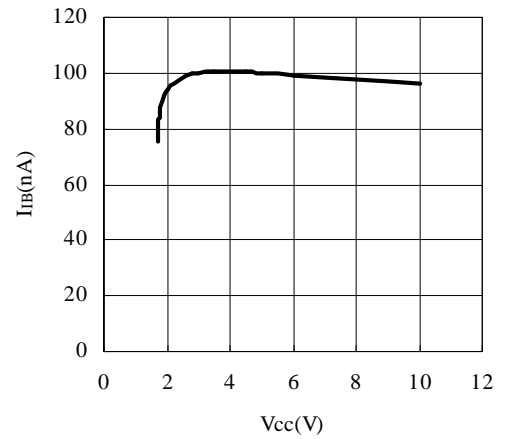
• Input Offset Voltage vs. Supply Voltage



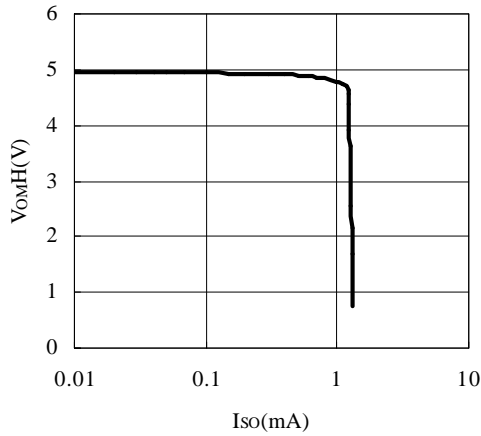
• Input Offset Current vs. Supply Voltage



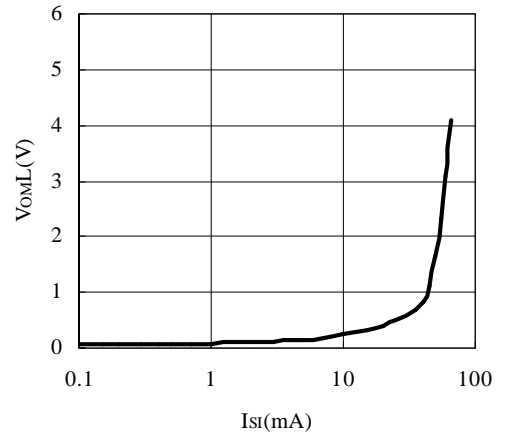
• Input Bias Current vs. Supply Voltage



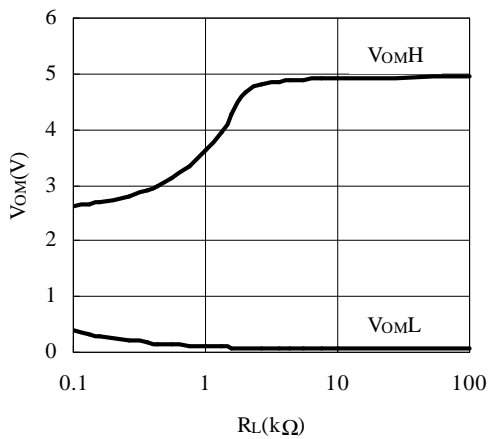
• Maximum High Output Voltage vs. Source Current  
( $V_{IN+}=3V, V_{IN-}=2V$ )



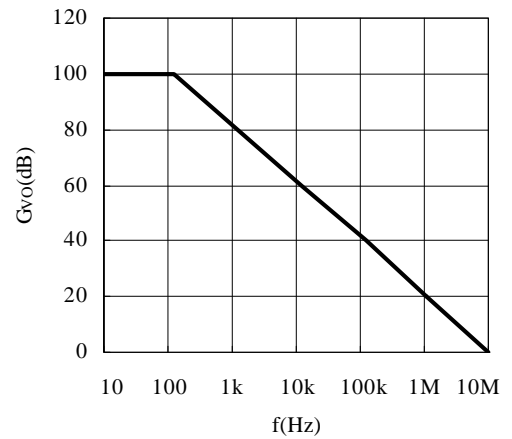
• Maximum Low Output Voltage vs. Sink Current  
( $V_{IN+}=2V, V_{IN-}=3V$ )



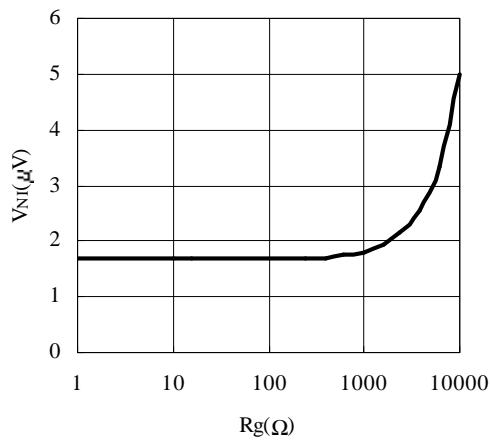
• Maximum Output Voltage vs. Load Resistance



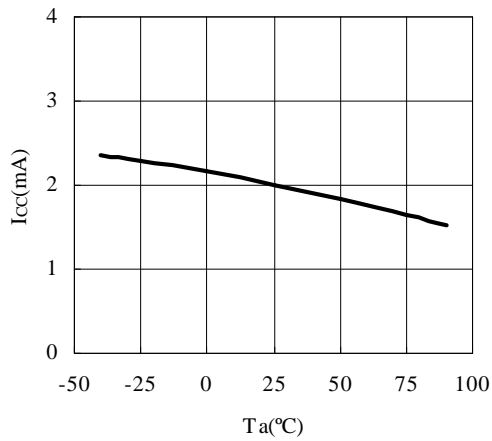
• Open Circuit Voltage Gain vs. Frequency



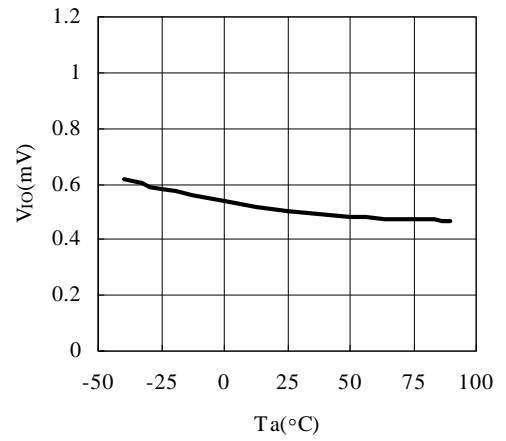
• Equivalent Input Noise Voltage vs. Source Resistance  
(Gain=60dB)



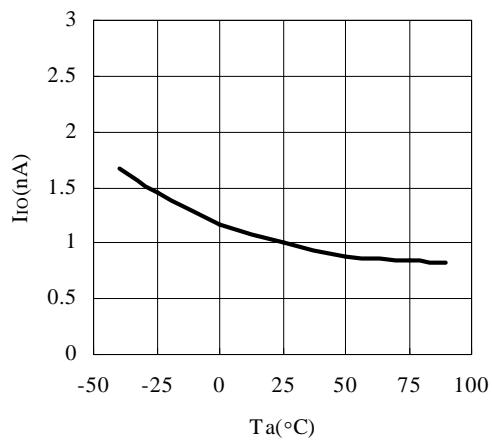
• Supply Current vs. Temperature



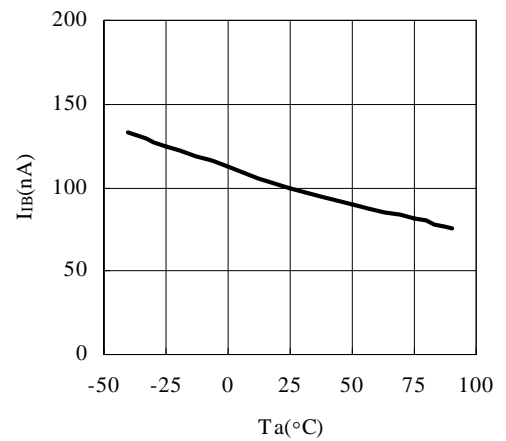
• Input Offset Voltage vs. Temperature



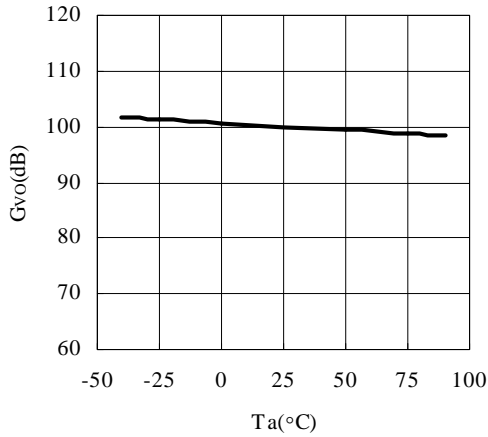
• Input Offset Current vs. Temperature



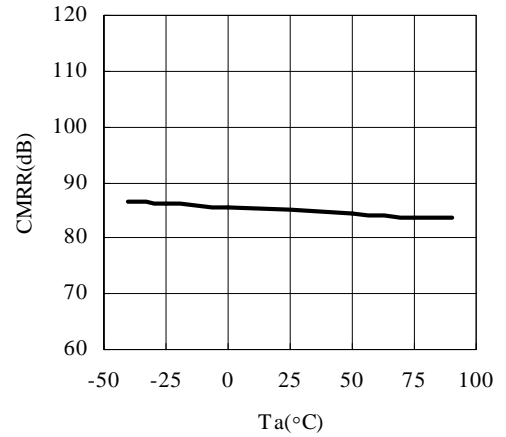
• Input Bias Current vs. Temperature



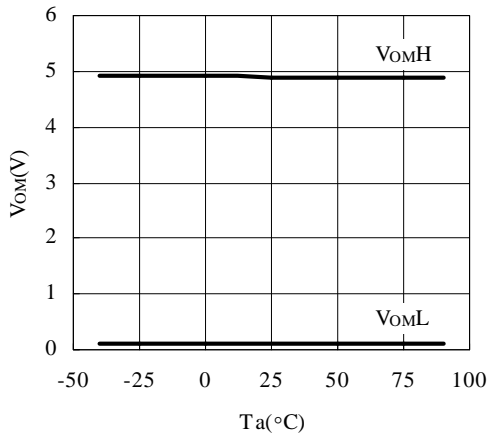
• Open Circuit Voltage Gain vs. Temperature



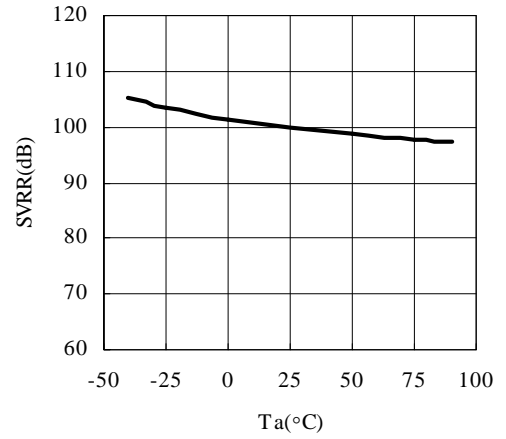
• Common-Mode Rejection Ratio vs. Temperature



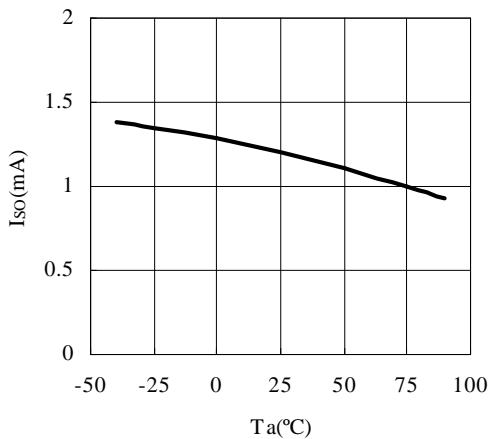
• Maximum Output Voltage vs. Temperature (R<sub>L</sub>=5kΩ)



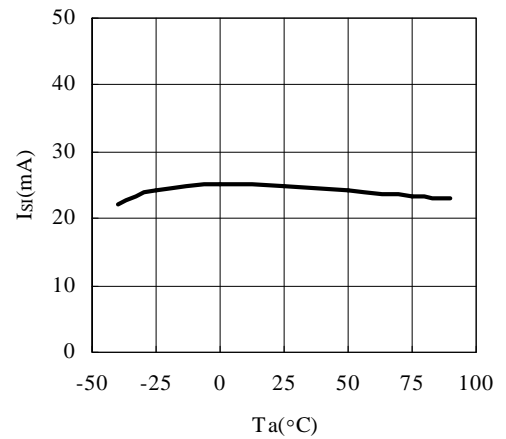
• Supply Voltage Rejection Ratio vs. Temperature



• Source Current vs. Temperature  
(V<sub>IN+</sub>=3V, V<sub>IN-</sub>=2V, V<sub>O</sub>=4.5V)



• Sink Current vs. Temperature  
(V<sub>IN+</sub>=3V, V<sub>IN-</sub>=2V, V<sub>O</sub>=0.5V)





**11. NOTES**

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- 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.

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

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1-17, Higashi-yukigaya 2-chome, Ohta-ku, Tokyo,  
145-8585, Japan  
TEL: +81.3.3727.1161  
FAX: +81.3.3727.1176 or +81.3.3727.1169  
Web site: <http://www.toko.co.jp/>

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