

APPLICATION MANUAL



Single Supply OP Amp
TK17013S

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Single Supply OP Amp TK17013S

1. DESCRIPTION

The TK17013S is a general purpose single operational amplifier featuring low voltage operation and a small package. It is suitable for use with portable equipment.

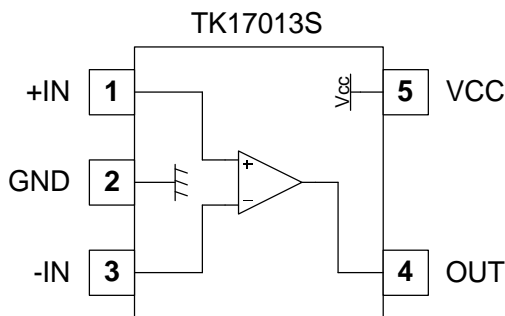
2. FEATURES

- Low Voltage Operation $V_{OP}=2V$ to $10V$
- Slew Rate $SR=0.75V/\mu sec$
- Unity Gain Bandwidth $GB=2MHz$
- Small Package $SOT23-5$

3. APPLICATIONS

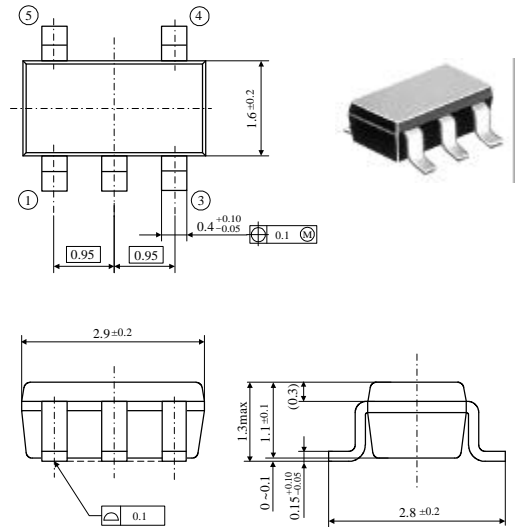
- General Purpose
- Portable Equipment
- Low Operating Voltage Equipment

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 $1.6mW/°C$ for operation above $25°C$.

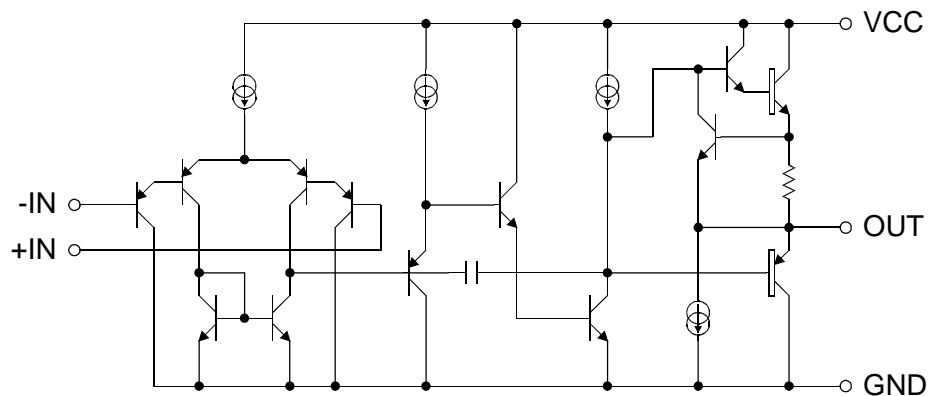
7. ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Value			Units	Conditions
		MIN	TYP	MAX		
Supply Current	I_{CC}	-	0.5	0.9	mA	$R_L=\infty, V_{in}=GND$
Input Offset Voltage	V_{IO}	-	1	5	mV	
Input Offset Current	I_{IO}	-	5	50	nA	
Input Bias Current	I_{IB}	-	25	250	nA	
Common-Mode Input Voltage Range	V_{ICMR}	0~ $V_{CC}-1.5$	-	-	V	
Maximum Output Voltage	V_{OM}	3.5	-	-	V	$R_L=2k\Omega$
Source Current	I_{SO}	20	40	-	mA	$V_O=2V, V_{IN+}=1V, V_{IN-}=0V$
Sink Current	I_{SI}	8	20	-	mA	$V_O=2V, V_{IN+}=0V, V_{IN-}=1V$
		30	60	-	μA	$V_O=0.2V, V_{IN+}=0V, V_{IN-}=1V$
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	$R_L \geq 2k\Omega$
Slew Rate	SR	-	0.75	-	V/ μs	$A_V=1, R_L=\infty, V_{IN}=1V_{P-P}$
Gain-Bandwidth Product	GB	-	2	-	MHz	$f=10kHz$

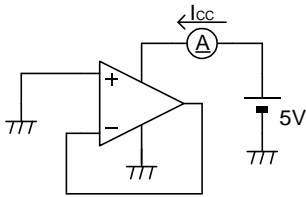
8. SIMPLIFIED SCHEMATIC

- TK17013S

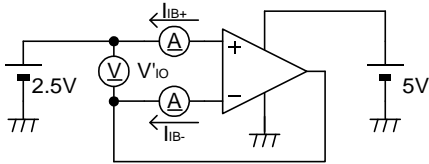


9. TEST CIRCUIT

- Supply Current



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

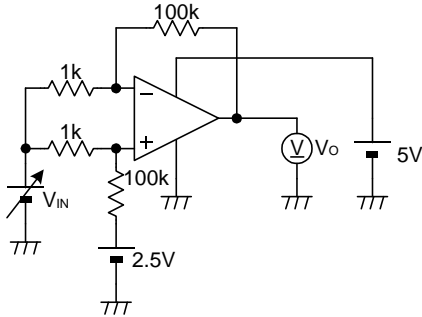


$$V_{IO} = |V'_{IO}|$$

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

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

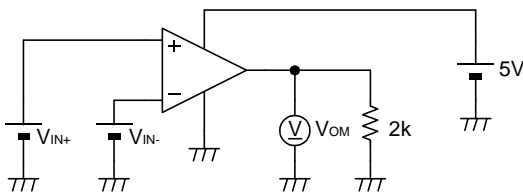
- Common-Mode Rejection Ratio, Common-Mode Input Voltage Range



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

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

- Maximum Output Voltage

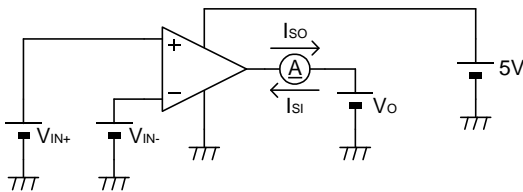


$$V_{OM+} : V_{IN+} = 1V, V_{IN-} = 0V$$

$$V_{OM-} : V_{IN+} = 0V, V_{IN-} = 1V$$

$$V_{OM} = V_{OM+} - V_{OM-}$$

- Source Current, Sink Current

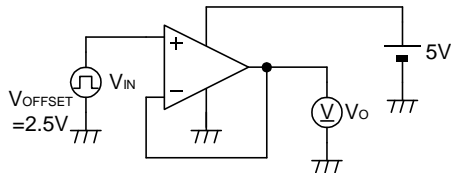


$$I_{SO} : V_{IN+} = 1V, V_{IN-} = 0V, V_O = 2V$$

$$I_{SI1} : V_{IN+} = 0V, V_{IN-} = 1V, V_O = 2V$$

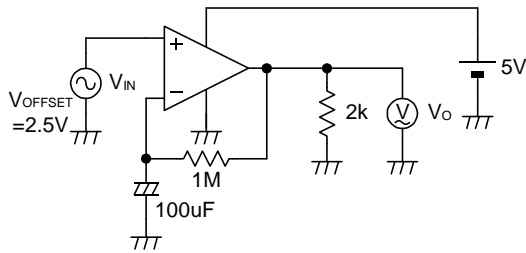
$$I_{SI2} : V_{IN+} = 0V, V_{IN-} = 1V, V_O = 0.2V$$

• Slew Rate



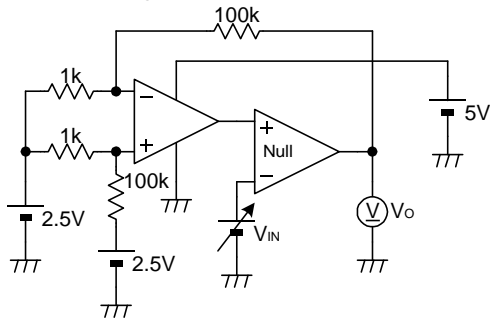
$$SR = \frac{\Delta V_O}{\Delta T_{RISE}}$$

• Gain-Bandwidth Product



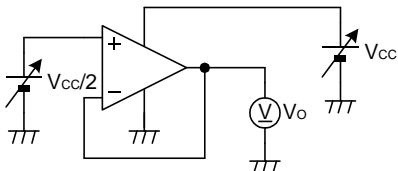
$$GB = \frac{V_O(f_T)}{V_{IN}(f_T)} \times f_T$$

• Open Circuit Voltage Gain



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

• Supply Voltage Rejection Ratio

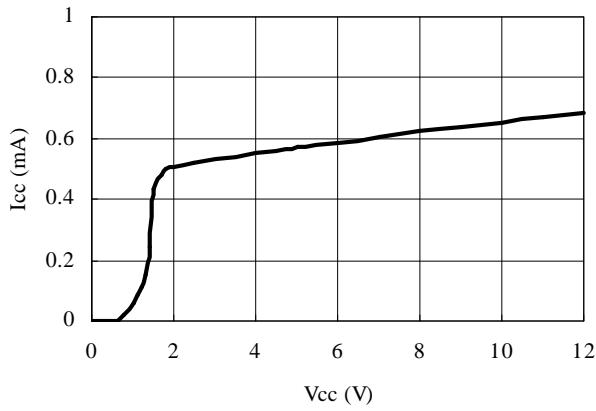


$$SVRR = 20 \log \frac{\Delta V_{CC}}{\Delta V_O}$$

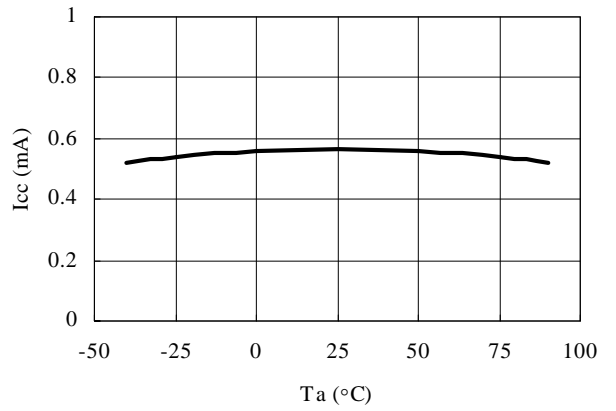
10. TYPICAL CHARACTERISTICS

($T_a=25^{\circ}\text{C}, V_{cc}=5\text{V}$)

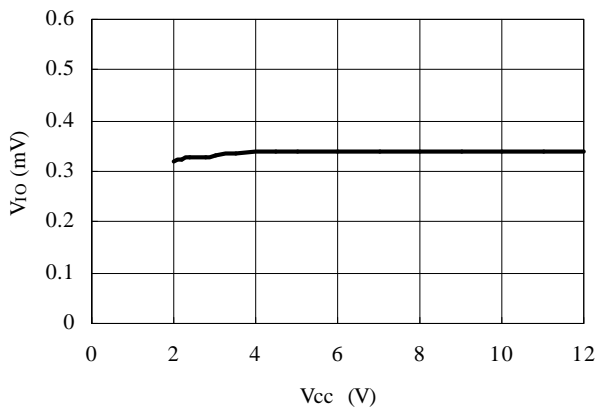
• Supply Current vs. Supply Voltage



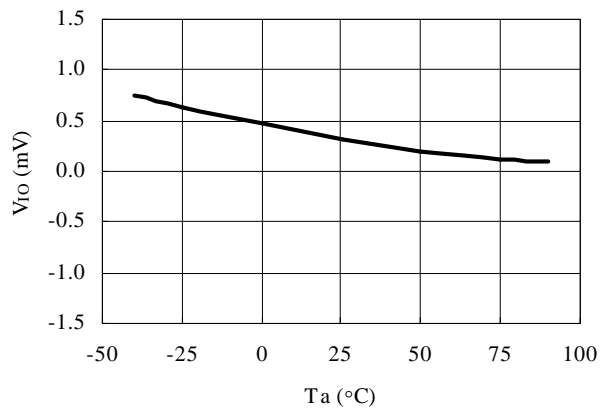
• Supply Current vs. Temperature



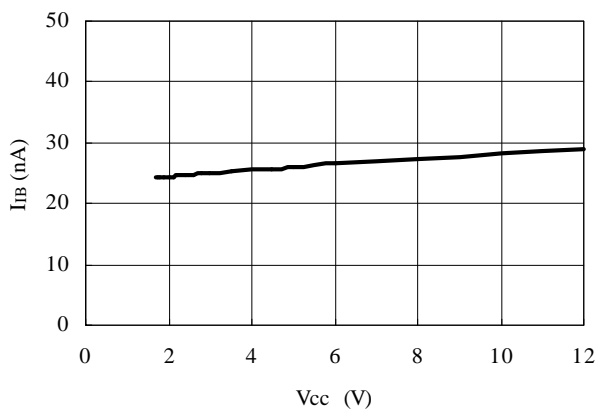
• Input Offset Voltage vs. Supply Voltage



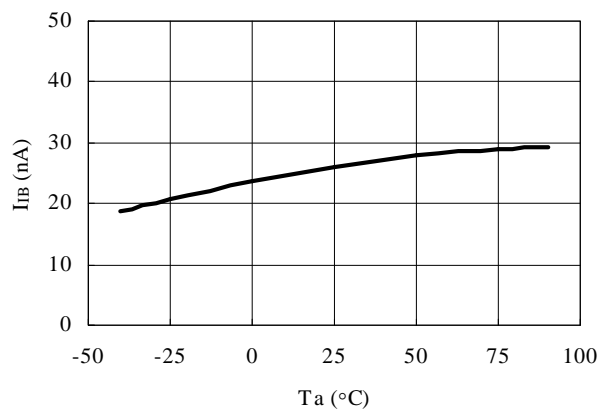
• Input Offset Voltage vs. Temperature



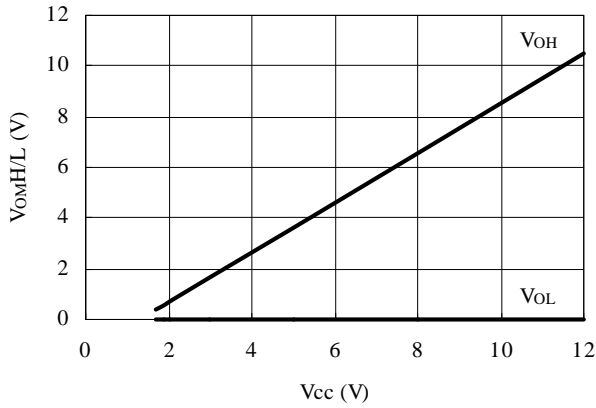
• Input Bias Current vs. Supply Voltage



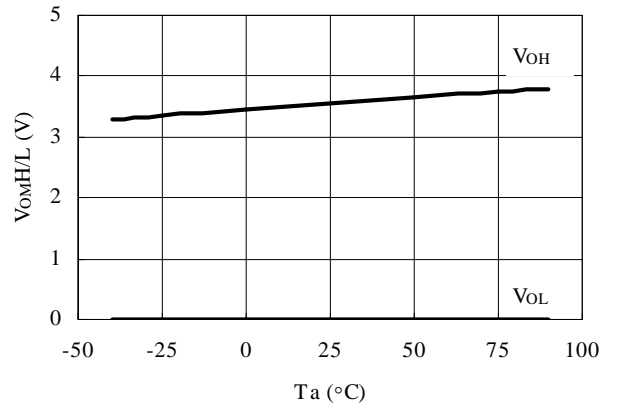
• Input Bias Current vs. Temperature



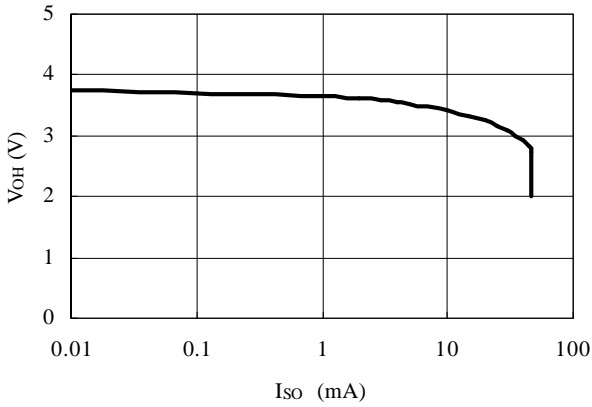
• Maximum Output Voltage vs. Supply Voltage



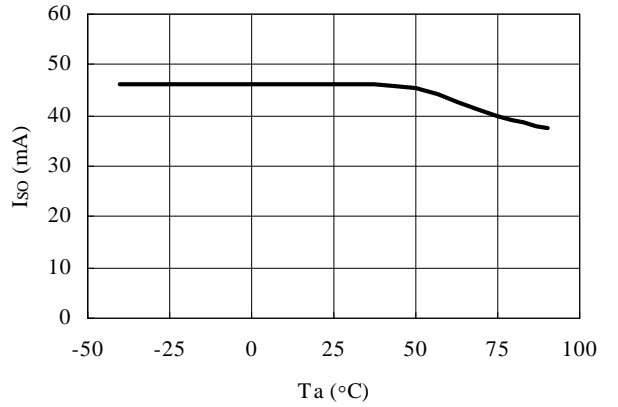
• Maximum Output Voltage vs. Temperature



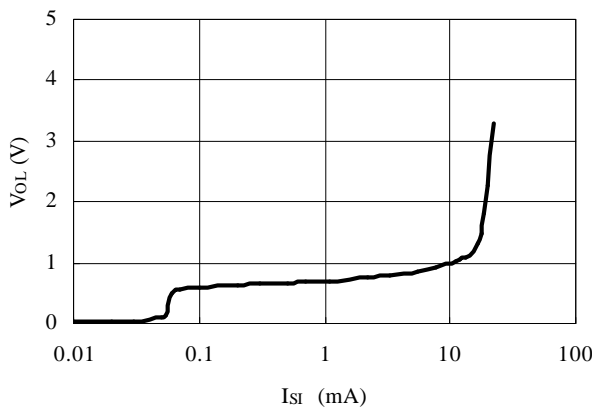
• Maximum High Output Voltage vs. Source Current
(V_{IN+}=1V, V_{IN-}=0V)



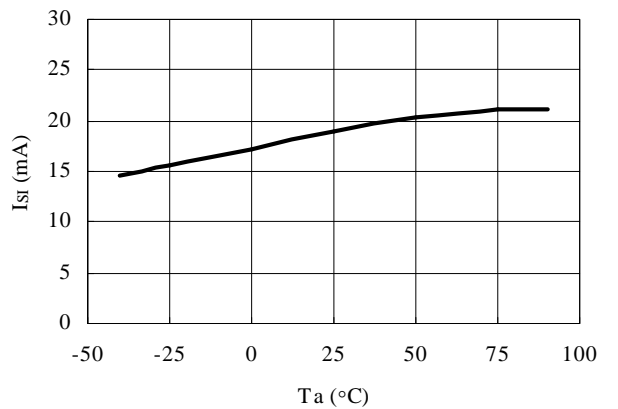
• Source Current vs. Temperature
(V_O=2V, V_{IN+}=1V, V_{IN-}=0V)



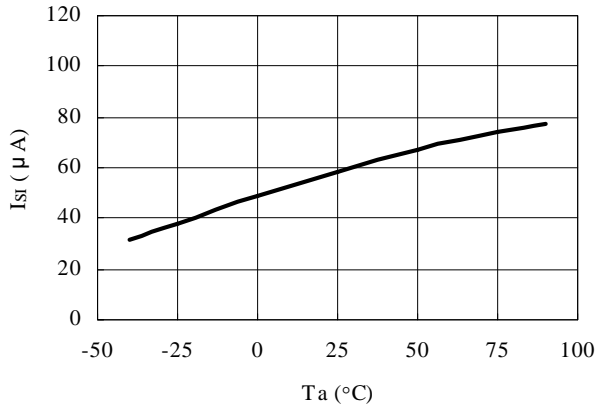
• Maximum Low Output Voltage vs. Sink Current
(V_{IN+}=0V, V_{IN-}=1V)



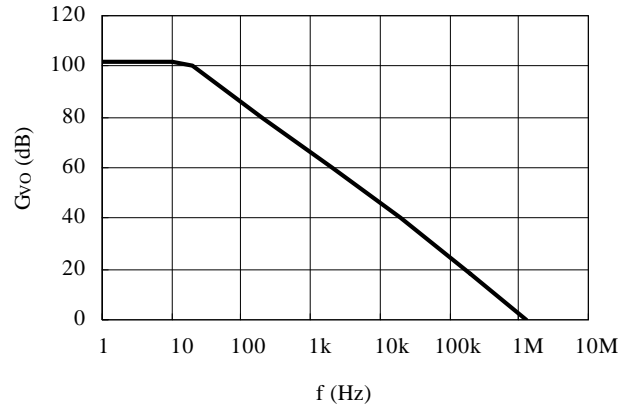
• Sink Current vs. Temperature
(V_O=2V, V_{IN+}=0V, V_{IN-}=1V)



- Sink Current vs. Temperature
($V_O=0.2V$, $V_{IN+}=0V$, $V_{IN-}=1V$)



- Open Circuit Voltage Gain vs. Frequency



11. NOTES

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