# APPLICATION MANUAL

## Dual OPAMP with Full-swing Output
## TK17020M

**CONTENTS**



MEETING YOUR NEEDS
TOKO, INC.

# Dual OPAMP with Full-swing Output
# TK17020M

## 1. DESCRIPTION

The TK17020M 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 battery-operated portable equipment.

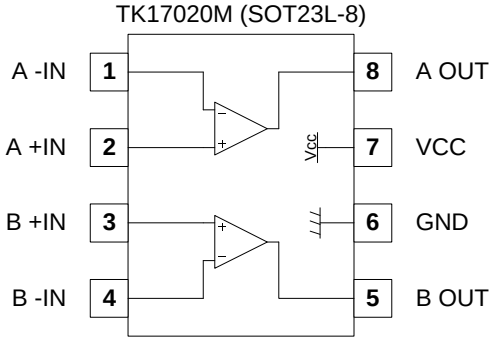
## 2. FEATURES

| | |
|---|---|
| ■ Low Voltage Operation | $V_{OP}$=1.8V to 10V |
| ■ Low Saturation Output Voltage | $V_{OM}$=Vcc-0.14V |
| ■ Slew Rate | SR=0.5V/μsec |
| ■ Unity Gain Bandwidth | GB=0.7MHz |
| ■ Small Package | SOT23L-8 |

## 3. APPLICATIONS

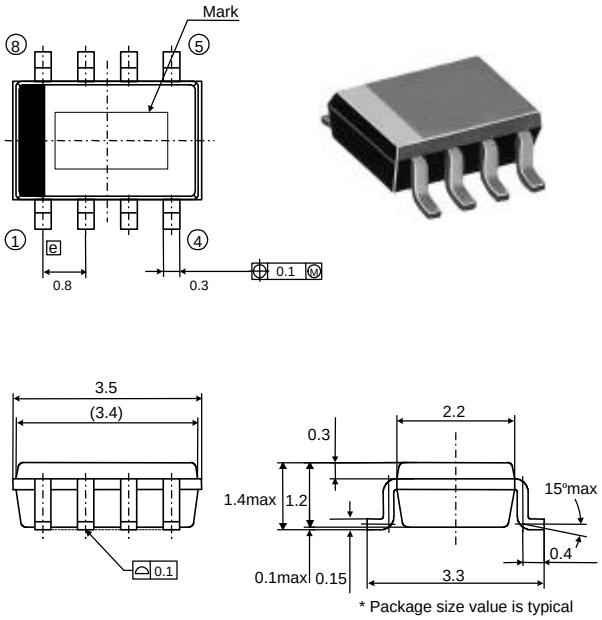
- ■ General Purpose
- ■ Portable Equipment
- ■ Low Operating Voltage Equipment

## 4. PIN CONFIGURATION




## 5. PACKAGE OUTLINE

■ SOT23L-8




## 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 | $V_{OP}$ | 1.8 ~ 10 | V | |

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

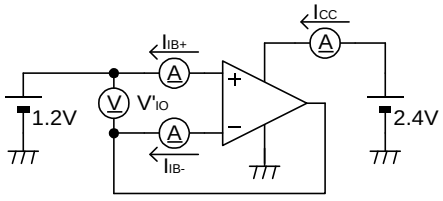
## 7. ELECTRICAL CHARACTERISTICS

$V_{CC}$=2.4V, $T_a$=25°C

| Parameter | Symbol | Value | | | Units | Conditions |
|---|---|---|---|---|---|---|
| | | MIN | TYP | MAX | | |
| Supply Current | $I_{CC}$ | - | 1.8 | 3.0 | mA | $R_L$=∞, Vin=$V_{CC}$/2 |
| Input Offset Voltage | $V_{IO}$ | - | 2 | 20 | mV | |
| Input Offset Current | $I_{IO}$ | - | 5 | 200 | nA | |
| Input Bias Current | $I_{IB}$ | - | 120 | 800 | nA | |
| Common-Mode Input Voltage Range | $V_{ICMR}$ | 0.5 | - | $V_{CC}$-1.2 | V | |
| Maximum Output Voltage | $V_{OM}$ | Vcc-0.25 | Vcc-0.1 | - | V | $R_L$ =1kΩ, $V_{OH}$ |
| | | - | 0.04 | 0.25 | V | $R_L$ =1kΩ, $V_{OL}$ |
| Source Current | $I_{SO}$ | 8 | 20 | - | mA | $A_V$=1, $V_{IN}$=1V, $V_O$=0.8V |
| Sink Current | $I_{SI}$ | 18 | 30 | - | mA | $A_V$=1, $V_{IN}$=1V, $V_O$=1.2V |
| Common-Mode Rejection Ratio | CMRR | - | 90 | - | dB | |
| Supply Voltage Rejection Ratio | SVRR | - | 70 | - | dB | |
| Open Circuit Voltage Gain | $G_{VO}$ | - | 100 | - | dB | |
| Slew Rate | SR | - | 0.5 | - | V/μs | $A_V$=1, $R_L$ =1kΩ |
| Gain-Bandwidth Product | GB | - | 0.7 | - | MHz | |
| Cross Talk | CT | - | 85 | - | dB | f=1kHz, $A_V$=1 |

## 8. TEST CIRCUIT

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

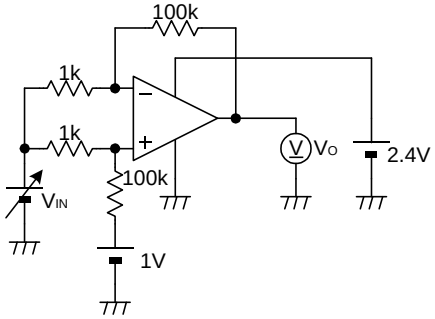



$$V_{IO} = \left|V'_{IO}\right|$$

$$I_{IO} = \left|I_{IB+} - I_{IB-}\right|$$

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

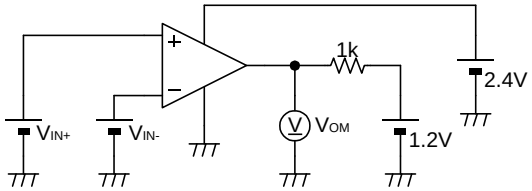
- Common-Mode Rejection Ratio, Common-Mode Input Voltage Range




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

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

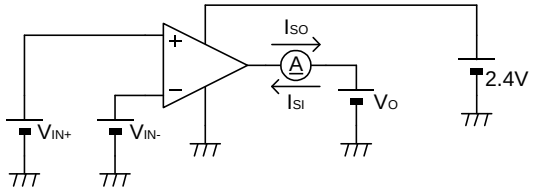
- Maximum Output Voltage




$$V_{OM+} : V_{IN+} = 1.2V, V_{IN-} = 0.8V$$

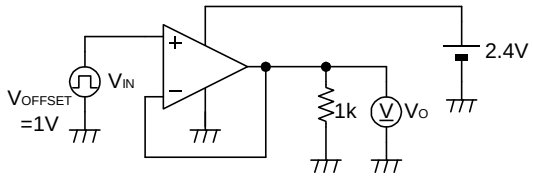
$$V_{OM-} : V_{IN+} = 0.8V, V_{IN-} = 1.2V$$

- Source Current, Sink Current



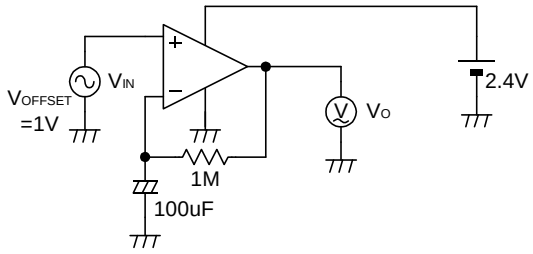

$$I_{SO} : V_{IN+} = 1.2V, V_{IN-} = 0.8V, V_O = 0.8V$$
$$I_{SI} : V_{IN+} = 0.8V, V_{IN-} = 1.2V, V_O = 1.2V$$

- Slew Rate



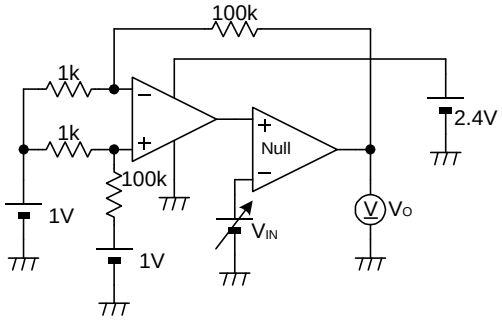

$$SR = \frac{\Delta V_O}{\Delta T_{RISE}}$$

- Gain-Bandwidth Product



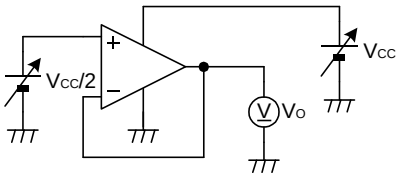

$$GB = \frac{V_O(f_T)}{V_{IN}(f_T)} \times f_T$$

- Open Circuit Voltage Gain



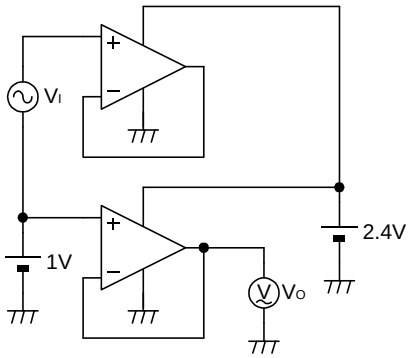

$$G_{VO} = 20\log\left(101 \times \frac{-\Delta V_{IN}}{\Delta V_O}\right)$$

- Supply Voltage Rejection Ratio




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

- Cross Talk

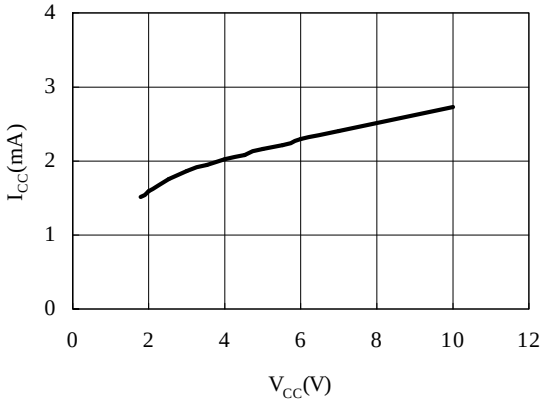



$$CT = 20\log\frac{\Delta V_I}{\Delta V_O}$$

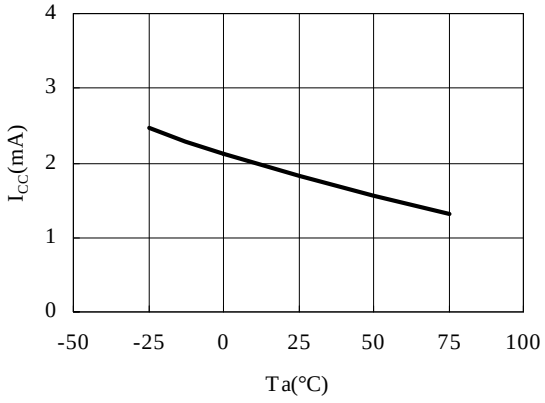
## 9. TYPICAL CHARACTERISTICS

(Ta=25°C,Vcc=2.4V)

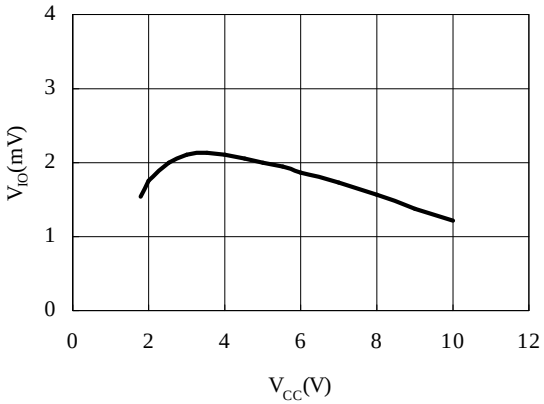
- Supply Current vs. Supply Voltage



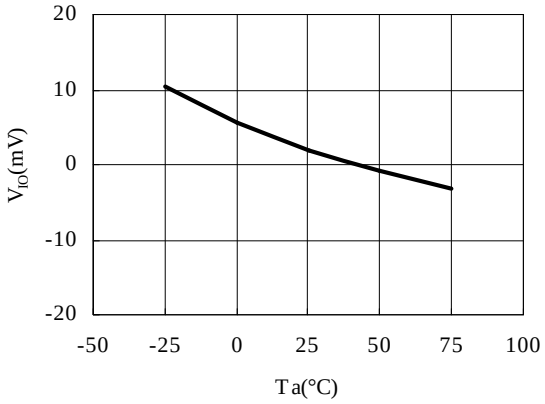

- Supply Current vs. Temperature



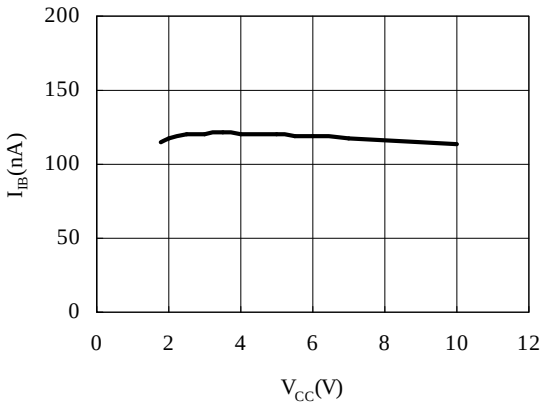

- Input Offset Voltage vs. Supply Voltage



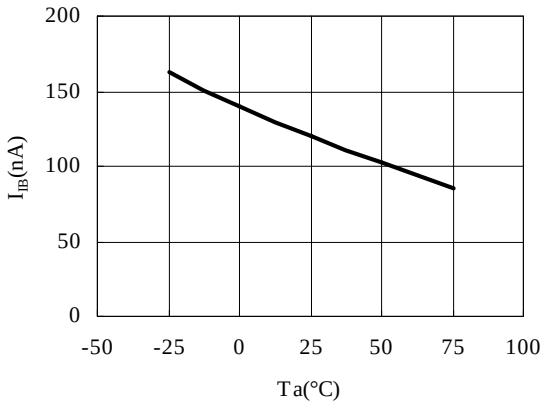

- Input Offset Voltage vs. Temperature



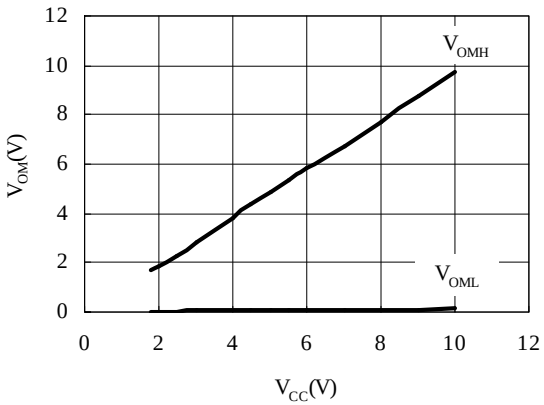

- Input Bias Current vs. Supply Voltage



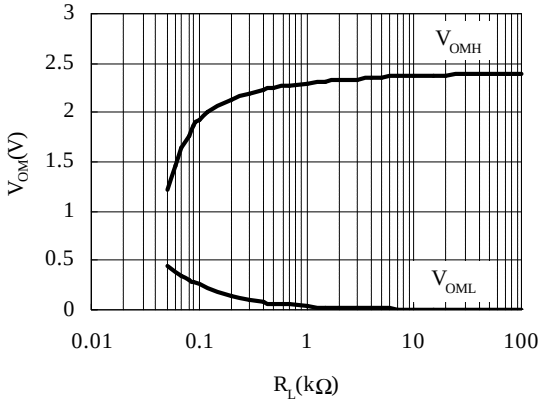

- Input Bias Current vs. Temperature



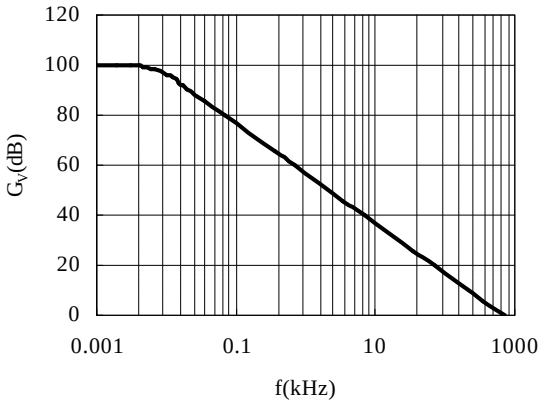
- Maximum Output Voltage vs. Supply Voltage ($R_L$=1kΩ)



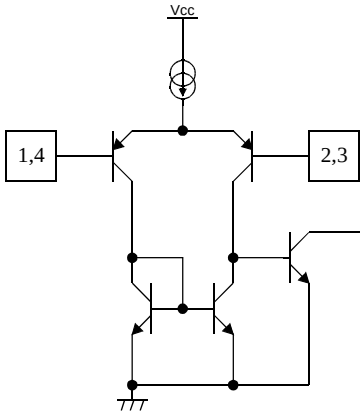
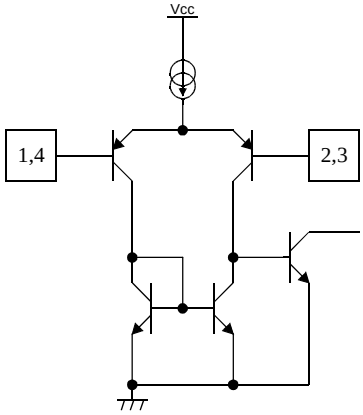
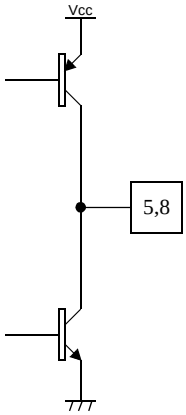

- Maximum Output Voltage vs. Load Resistance ($V_{CC}$=2.4V)




- Open Circuit Voltage Gain vs. frequency



## 10. PIN DESCRIPTION

| Pin No. | Pin Description | Internal Equivalent Circuit | Description |
|---|---|---|---|
| 1<br>4 | A-IN<br>B-IN |  | Inverting Input Terminal. |
| 2<br>3 | A+IN<br>B+IN |  | Non-Inverting Input Terminal. |
| 5<br>8 | BOUT<br>AOUT |  | Output terminal.<br>Please connect a 0.022µF capacitor to this terminal to prevent oscillation. |
| 6 | GND | | Ground Terminal |
| 7 | $V_{CC}$ | | Supply Voltage Terminal |

## 11. NOTES

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- 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.
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■ None of ozone depleting substances (ODS) under the Montreal Protocol is used in manufacturing process of us.

## 12. OFFICES

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