



## UM604A

## LINEAR INTEGRATED CIRCUIT

### QUAD OPERATIONAL AMPLIFIER AND PROGRAMMABLE VOLTAGE REFERENCE

#### DESCRIPTION

The UTC **UM604A** is a monolithic IC that includes four op-amps and an adjustable shunt voltage reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.

#### FEATURES

##### OPERATIONAL AMPLIFIER

- \* Low supply current : 375 $\mu$ A/op. (@  $V_{CC} = 5V$ )
- \* Low input bias current : 20nA
- \* Medium speed : 0.9MHz
- \* Low input offset voltage : 0.5mV typ for UM604
- \* Wide power supply range:  $\pm 1.5 \sim \pm 15V$

##### VOLTAGE REFERENCE

- \* Adjustable output voltage :  $V_{REF}$  to 36V
- \* Reference voltage tolerance
  - UM604A-1:  $\pm 0.4\%$
  - UM604A-2:  $\pm 1\%$
- \* Sink current capability : 1 ~ 100mA
- \* Typical output impedance : 0.2 $\Omega$

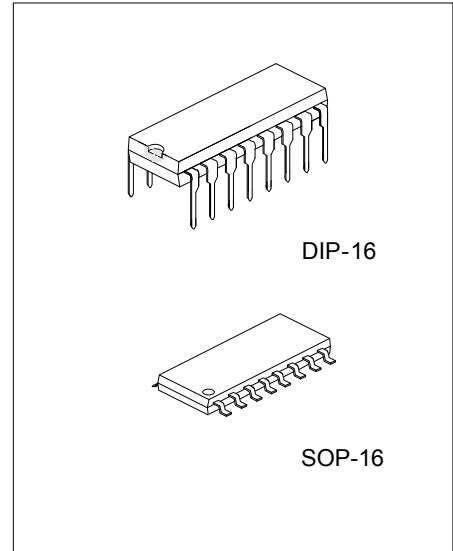
#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
UM604AL-D16-T	UM604AG-D16-T	DIP-16	Tube
UM604AL-S16-R	UM604AG-S16-R	SOP-16	Tape Reel

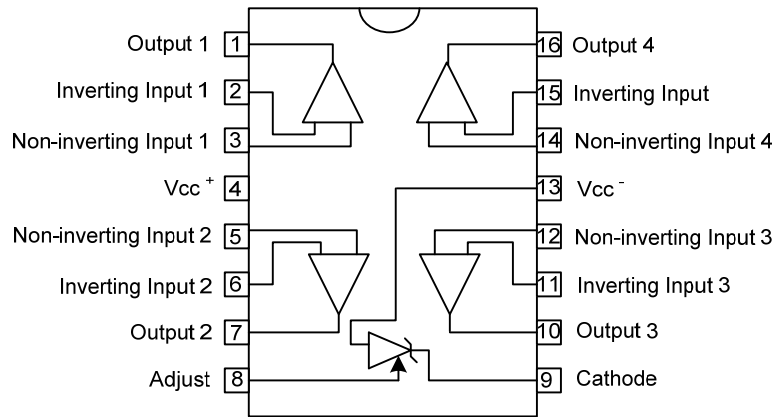
<p>UM604AL-D16-T</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) T: Tube, R: Tape Reel</li> <li>(2) D16: DIP-16, S16: SOP-16</li> <li>(3) G: Halogen Free and Lead Free, L: Lead Free</li> </ul>
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#### MARKING

DIP-16	SOP-16



## ■ PIN CONFIGURATION



### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{CC}$	36	V
Differential Input Voltage	$V_{DIFF}$	36	V
Input Voltage	$V_{IN}$	-0.3 ~ +36	V
Output Short-Circuit Duration	$I_D$	Infinite	
Junction Temperature	$T_J$	+150	°C
Operating Temperature	$T_{OPR}$	-55 ~ +125	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ ELECTRICAL CHARACTERISTICS

( $V_{CC}^+ = 5V$ ,  $V_{CC}^- = 0V$ ,  $T_A = 25^\circ C$  unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Total Supply Current, Excluding Current In The Voltage Reference	$I_{CC}$	$V_{CC}^+ = 5V$ , no load, $T_{MIN} < T_A < T_{MAX}$	1.4		2.4	mA
		$V_{CC}^+ = 30V$ , no load, $T_{MIN} < T_A < T_{MAX}$			4	mA

### ■ ELECTRICAL CHARACTERISTICS

( $V_{CC}^+ = 5V$ ,  $V_{CC}^- = \text{Ground}$ ,  $V_{OUT} = 1.4V$ ,  $T_A = 25^\circ C$  unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$V_{I(OFF)}$	$T_A = 25^\circ C$		0.5	3	mV
		$T_{MIN} \leq T_A \leq T_{MAX}$			4	mV
		$T_A = 25^\circ C$		1	5	mV
		$T_{MIN} \leq T_A \leq T_{MAX}$			6	mV
Input Offset Voltage Drift	$\Delta V_{I(OFF)}$			7		$\mu V/^\circ C$
Input Offset Current.	$I_{I(OFF)}$	$T_A = 25^\circ C$		2	30	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			50	nA
Input Bias Current	$I_{I(BIAS)}$	$T_A = 25^\circ C$		20	150	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			200	nA
Large Signal Voltage Gain	$G_V$	$V_{CC} = 15V$ , $R_L = 2k$ , $V_{OUT} = 1.4V \sim 11.4V$	50	100		V/mV
		$T_{MIN} \leq T_A \leq T_{MAX}$	25			V/mV
Supply Voltage Rejection Ratio	SVR	$V_{CC} = 5V \sim 30V$	65	100		dB
Input Common Mode Voltage Range	$V_{I(CM)}$	$V_{CC} = +30V$ (see Note 1)	0		$(V_{CC}^+) - 1.5$	V
		$T_{MIN} \leq T_A \leq T_{MAX}$	0		$(V_{CC}^+) - 2$	V
Common Mode Rejection Ratio	CMRR	$T_A = 25^\circ C$	70	85		dB
		$T_{MIN} \leq T_A \leq T_{MAX}$	60			dB
Output Current Source	$I_{O(SOUR)}$	$V_{OUT} = 2V$ , $V_{CC} = +15V$ , $V_{ID} = +1V$	20	40		mA
Output Short Circuit to Ground	$I_{O(SC)}$	$V_{CC} = +15V$		40	60	mA
Output Current Sink	$I_{O(SINK)}$	$V_{ID} = -1V$ , $V_{CC} = +15V$ , $V_{OUT} = +2V$	10	20		mA
High Level Output Voltage	$V_{OH}$	$R_L = 10k$ , $V_{CC}^+ = 30V$		27	28	V
		$T_{MIN} \leq T_A \leq T_{MAX}$		27		V
Low Level Output Voltage	$V_{OL}$	$R_L = 10k$		5	20	mV
		$T_{MIN} \leq T_A \leq T_{MAX}$			20	mV
Slew Rate at Unity Gain	SR	$V_{IN} = 0.5 \sim 3V$ , $V_{CC} = 15V$ $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain	0.1	0.3		V/ $\mu s$
Gain Bandwidth Product	GBP	$V_{CC} = 30V$ , $R_L = 2k$ , $C_L = 100pF$ $f = 100kHz$ , $V_{IN} = 10mV$	0.5	0.9		MHz
Total Harmonic Distortion	THD	$f = 1kHz$ $G_V = 20dB$ , $R_L = 2$ , $V_{CC} = 30V$ $C_L = 100pF$ , $V_O = 2V_{pp}$		0.02		%

### ■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Equivalent Input Noise Voltage	eN	F=1kHz, V <sub>CC</sub> =30V, R <sub>S</sub> =100Ω		50		$\frac{nV}{\sqrt{Hz}}$
Channel Separation	CS	1kHz<f<20kHz		120		dB

Note 1: The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V, the upper end of the common-mode voltage range is V<sub>CC</sub><sup>+</sup>-1.5V. But either of both inputs can go to +36V without damage.

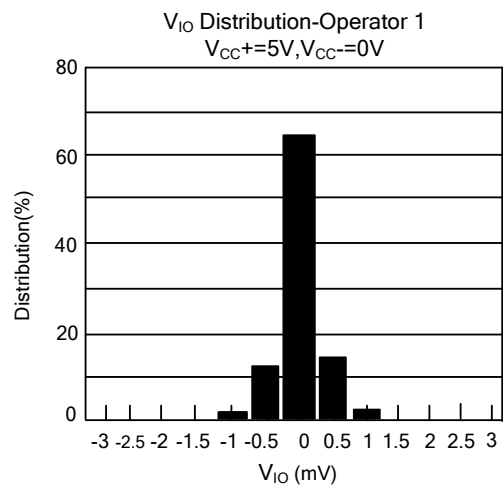
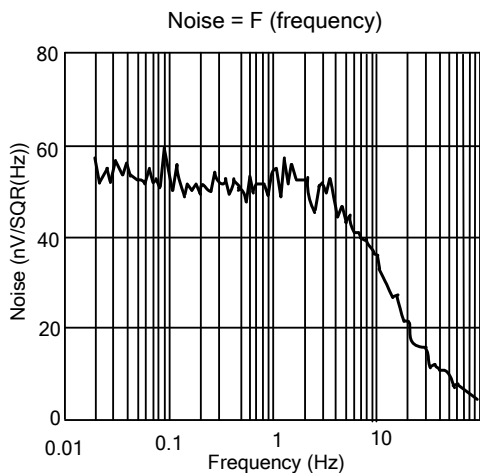
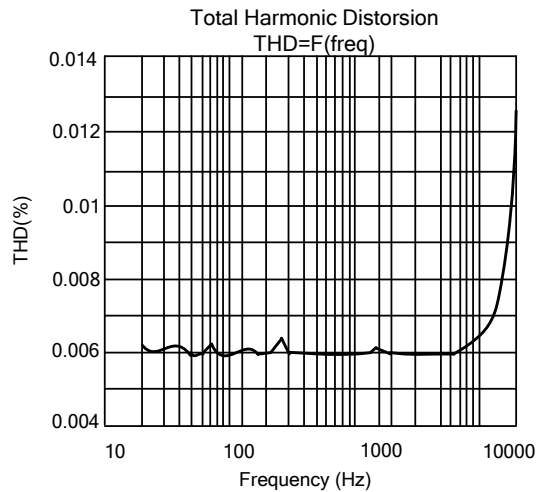
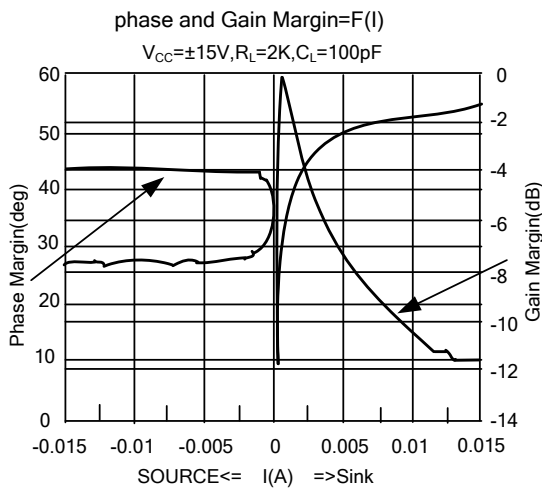
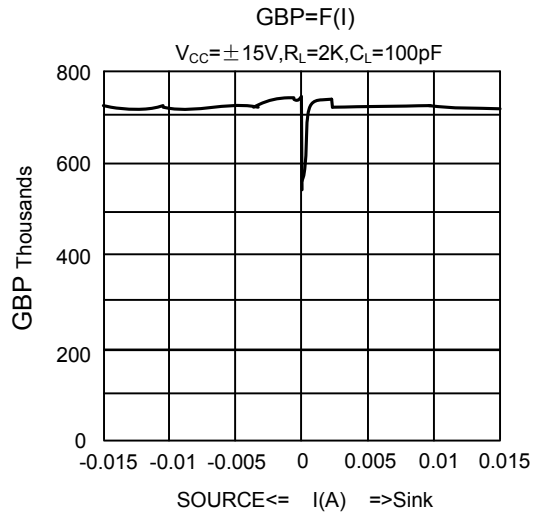
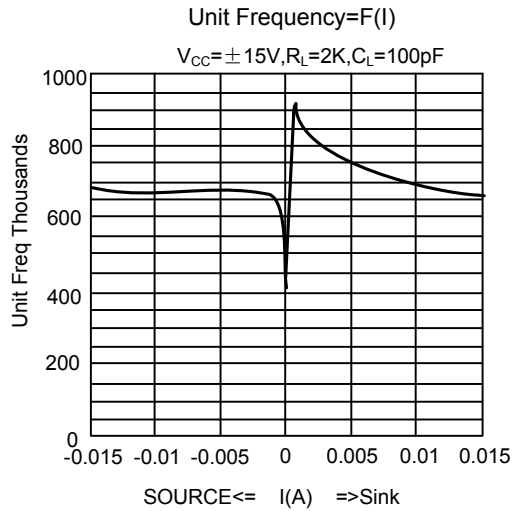
### ■ VOLTAGE REFERENCE

PARAMETER	SYMBOL	RATING	UNIT
Cathode Current	I <sub>K</sub>	1 ~ 100	mA

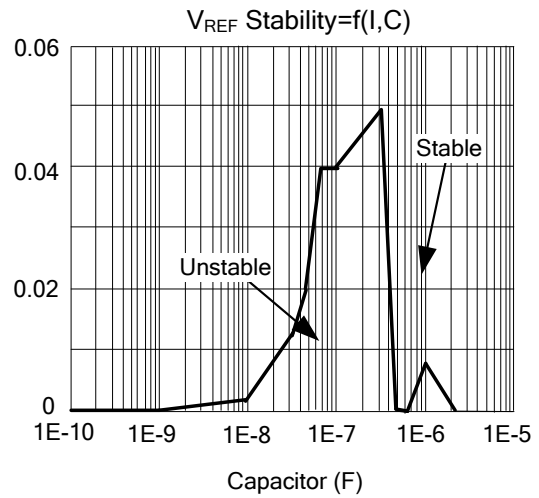
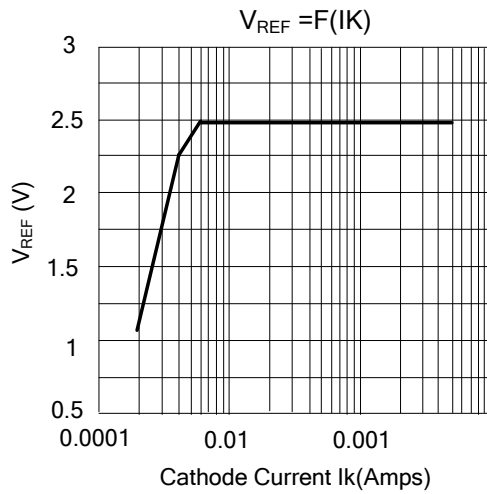
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Input Voltage	V <sub>REF</sub>	±0.4%, T <sub>A</sub> =25°C	2.49	2.5	2.51	V
		T <sub>MIN</sub> ≤T <sub>A</sub> ≤T <sub>MAX</sub>	2.48		2.52	V
		±1%, T <sub>A</sub> =25°C	2.475	2.5	2.525	V
		T <sub>MIN</sub> ≤T <sub>A</sub> ≤T <sub>MAX</sub>	2.45		2.55	V
Reference Input Voltage Deviation Over Temperature Range	ΔV <sub>REF</sub>	V <sub>KA</sub> =V <sub>REF</sub> ; I <sub>K</sub> =10mA, T <sub>MIN</sub> ≤T <sub>A</sub> ≤T <sub>MAX</sub>		7	30	mV
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I <sub>K</sub> =10mA, ΔV <sub>KA</sub> =36V ~ 3V	-2	-1.1		MV/V
Reference Input Current	I <sub>REF</sub>	I <sub>K</sub> =10mA		1.5	2.5	μA
		T <sub>MIN</sub> ≤T <sub>A</sub> ≤T <sub>MAX</sub>			3	μA
Reference Input Current Deviation over T°Range				0.8	1.2	μA
Minimum Cathode Current for Regulation	I <sub>MIN</sub>	V <sub>KA</sub> =V <sub>REF</sub>		0.5	1	mA
Off-State Cathode current	I <sub>OFF</sub>			180	500	nA
Dynamic Impedance-note <sup>1)</sup>	[Z <sub>KA</sub> ]	V <sub>KA</sub> =V <sub>REF</sub> , ΔI <sub>K</sub> =1 ~ 100mA, f<1kHz		0.2	0.5	Ω

Note: The dynamic impedance is defined as  $[Z_{KA}] = \frac{\Delta V_{KA}}{\Delta I_K}$ .

### OPERATIONAL AMPLIFIERS



## ■ OPERATIONAL AMPLIFIERS(Cont.)



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