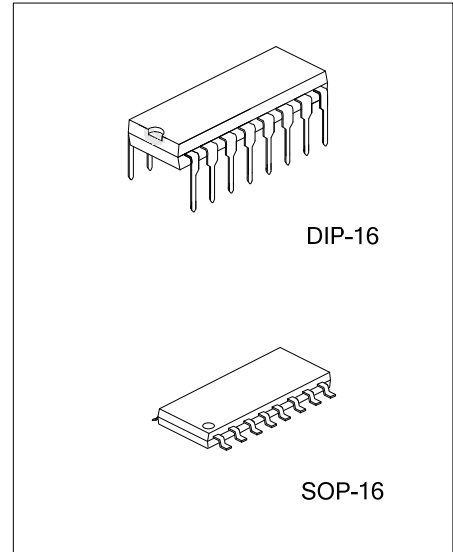




## UM602A

## LINEAR INTEGRATED CIRCUIT

DUAL OPERATIONAL  
AMPLIFIER-DUAL  
COMPARATOR AND  
ADJUSTABLE VOLTAGE  
REFERENCE



### DESCRIPTION

The UTC **UM602A** is a monolithic IC that includes two op-amps, two comparators and a precision voltage reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.

### FEATURES

#### OPERATIONAL AMPLIFIERS

- \*Low supply current: 200 $\mu$ A/amp.
- \*Medium speed: 2.1MHz
- \*Low level output voltage close to  $V_{CC}$ : 0.1V typ.
- \*Input common mode voltage range includes ground

#### COMPARATORS

- \*Low supply current: 200 $\mu$ A/amp. ( $V_{CC}=5V$ )
- \*Input common mode voltage range includes ground
- \*Low output saturation voltage: 250mV( $I_O=4mA$ )

#### REFERENCE

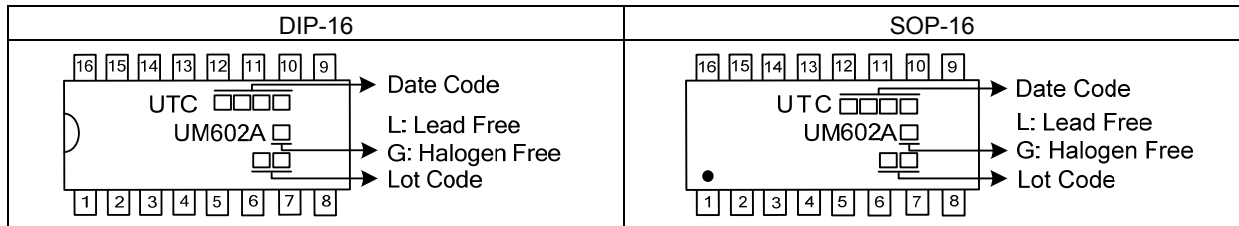
- \* Adjustable output voltage:  $V_{REF}$  to 32V
- \* Reference voltage tolerance
  - UM602A-1:  $\pm 0.4\%$
  - UM602A-2:  $\pm 1\%$
- \* Sink current capability: 1~100mA

### ORDERING INFORMATION

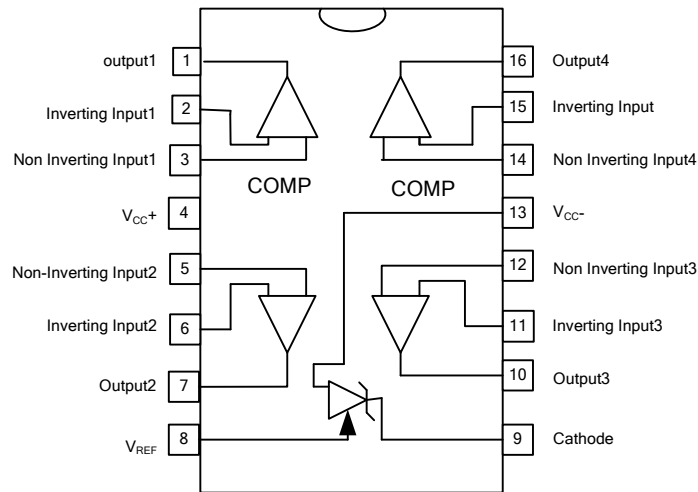
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UM602AL-D16-T	UM602AG-D16-T	DIP-16	Tube
UM602AL-S16-R	UM602AG-S16-R	SOP-16	Tape Reel

<p>UM602AG-D16-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) D16: DIP-16, S16: SOP-16 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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### MARKING



### PIN CONFIGURATION



### PIN DESCRIPTION

PIN	NAME	TYPE	FUNCTION
1.	$V_{REF}$	OUTPUT	Voltage Reference Output 1.24V, 10mA max. Do not short circuit
2.	$C_{SEN}$	INPUT	Current source enable input. This current source can be used to offset the voltage measurement on the sense resistor and therefore to modify the charge current. The current source is enabled when the input voltage on pin 2 is lower than 0.8V
3.	$C_{RREF}$	INPUT	Current Limitation Reference Input
4.	GND	INPUT	Ground
5.	$C_{RIN}$	INPUT	Current Limitation Loop Input, connected to the sense resistor
6.	OUTPUT	OUTPUT	Output pin common to the voltage regulation and current limitation loops. This output can drive the primary side (LED) of an optocoupler
7.	$V_{RIN}$	INPUT	Voltage Regulation Loop Input
8.	$V_{CC}$	INPUT	Power Supply Input (4.5 ~ 32VDC)

■ ABSOLUTE MAXIMUM RATING ( $T_A=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
DC Supply Voltage	$V_{CC}$	36	V
Differential Input Voltage	$V_{ID}$	36	V
Input Voltage	$V_{IN}$	-0.3 ~ +36	V
Power Dissipation	$P_D$	200	mW
Junction Temperature	$T_J$	150	$^\circ\text{C}$
Operating Temperature Range	$T_{OPR}$	-40 ~ +125	$^\circ\text{C}$

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Total Supply Current	$I_{CC}$			0.8	1.5	mA
		$T_{MIN} < T_A < T_{MAX}$			2	mA

■ OPERATIONAL AMPLIFIERS (Independent op-amp)

( $V_{CC}^+=5\text{V}$ ,  $V_{CC}^-=0\text{V}$ ,  $R_1$  Connected to  $V_{CC}/2$ ,  $T_A=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$V_{IO}$	$T_A=25^\circ\text{C}$		1	4.5	mV
		$T_{MIN} \leq T_A \leq T_{MAX}$			6.5	mV
Input Offset Voltage Drift	$DV_{IO}$			10		$\mu\text{V}/^\circ\text{C}$
Input Bias Current	$I_{IB}$	$T_A=25^\circ\text{C}$		20	100	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			200	nA
Input Offset Current	$I_{IO}$	$T_A=25^\circ\text{C}$		5	20	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			40	nA
Large Signal Voltage Gain	$A_{VD}$	$R_1=10\text{k}\Omega$ , $V_{CC}^+=30\text{V}$ , $V_O=5\text{V}\sim 25\text{V}$	50	100		V/mV
		$T_{MIN} \leq T_A \leq T_{MAX}$	25			V/mV
Supply Voltage Rejection Ratio	SVR	$V_O=5\text{V}\sim 30\text{V}$	80	100		dB
Input Common Mode Voltage Range	$V_{ICM}$	$T_A=25^\circ\text{C}$	$V_{CC}^-$		$V_{CC}^+$ -1.8	V
		$T_{MIN} \leq T_A \leq T_{MAX}$	$V_{CC}^-$		$V_{CC}^+$ -2.2	V
Common Mode Rejection Ratio	CMR	$V_{CC}^+=30\text{V}$ , $V_{ICM}=0\text{V}\sim(V_{CC}^+)-1.8\text{V}$	70	90		dB
Output Short Circuit Current	$I_{SC}$	$V_{ID}=\pm 1\text{V}$ , $V_O=2.5\text{V}$	Source	3	6	mA
			Sink	3	6	mA
High Level Output Voltage	$V_{OH}$	$V_{CC}^+=30\text{V}$	$R_L=10\text{k}\Omega$	27	28	V
			$T_{MIN} \leq T_A \leq T_{MAX}$	26		V
Low Level Output Voltage	$V_{OL}$	$R_L=10\text{k}\Omega$		100	150	mV
			$T_{MIN} \leq T_A \leq T_{MAX}$			210
Slew Rate	SR	$V_{CC}=\pm 15\text{V}$ , $V_I=\pm 10\text{V}$ , $R_L=10\text{k}\Omega$ , $C_L=100\text{pF}$	1.6	2		V/ $\mu\text{s}$
Gain Bandwidth Product	GBP	$R_L=10\text{k}\Omega$ , $C_L=100\text{pF}$ , $f=100\text{kHz}$	1.4	2.1		MHz
Phase Margin	$\Phi_m$	$R_L=10\text{k}\Omega$ , $C_L=100\text{pF}$		45		Degrees
Total Harmonic Distortion	THD			0.05		%
Equivalent Input Noise Voltage	$e_n$	$f=1\text{kHz}$		29		$\frac{\text{nV}}{\sqrt{\text{Hz}}}$
Channel Separation	CS			120		dB

### ■ COMPARATORS

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$V_{IO}$	$T_A = 25^\circ\text{C}$			5	MV
		$T_{MIN} \leq T_A \leq T_{MAX}$			9	MV
Input Offset Current	$I_{IO}$	$T_A = 25^\circ\text{C}$			50	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			150	nA
Input Bias Current	$I_{IB}$	$T_A = 25^\circ\text{C}$			250	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$				nA
High Level Output Voltage	$I_{OH}$	$V_{ID} = 1V$ , $V_{CC} = V_O + 30V$		0.1		nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			1	$\mu\text{A}$
Low Level Output Voltage	$V_{OL}$	$V_{ID} = -1V$ , $I_{sink} = 4\text{mA}$		250	400	mV
		$T_{MIN} \leq T_A \leq T_{MAX}$			700	
Large Signal Voltage Gain	$A_{VD}$	$R_1 = 15K$ , $V_{CC} = 15V$ , $V_O = 1 \sim 11V$		200		V/mV
Output Sink Current	$I_{SINK}$	$V_{ID} = -1V$ , $V_O = 1.5V$	6	16		mA
Input Common Mode Voltage Range	$V_{ICM}$	$T_A = 25^\circ\text{C}$	0		$V_{CC}^+$ -1.5	V
		$T_{MIN} \leq T_A \leq T_{MAX}$	0		$V_{CC}^+$ -2	V
Differential Input Voltage	$V_{ID}$				$V_{CC}^+$	V
Response Time (Note1)	$t_{RE}$	$R_1 = 5.1k \sim V_{CC}^+$ , $V_{REF} = 1.4V$		1.3		$\mu\text{s}$
Large Signal Response Time	$t_{REL}$	$V_{REF} = 1.4V$ , $V_I = \text{TTL}$ , $R_1 = 5.1k \sim V_{CC}^+$		300		ns

Notes: 1. The response time specified is for 100mV input step with 5mV overdrive.

2. For larger overdrive signals, 300ns can be obtained.

### ■ VOLTAGE REFERENCE

PARAMETER	SYMBOL	VALUE	UNIT
Cathode to Anode Voltage	$V_{KA}$	$V_{REF} \sim 36$	V
Cathode Current	$I_K$	1 to 100	mA

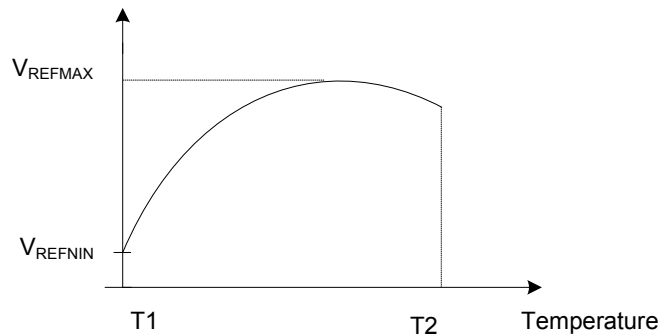
### ■ VOLTAGE REFERENCE (Cont.)

(T<sub>A</sub>=25°C, unless otherwise specified)

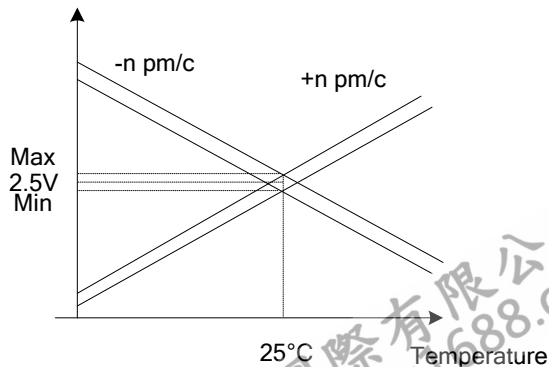
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	
Reference Input Voltage (T <sub>A</sub> =25°C) (Figure 1)	V <sub>REF</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>K</sub> =10mA	UM602A-1	2.490	2.500	2.510	V
			UM602A-2	2.475	2.500	2.525	V
Reference Input Voltage Deviation Over Temperature Range (Figure 1, Note 1)	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	
Temperature Coefficient of Reference Input Voltage (Note 2)	$\frac{\Delta V_{REF}}{\Delta T}$	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>		±22	±100	ppm/°C	
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage (Figure2)	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I <sub>K</sub> =10mA, ΔV <sub>KA</sub> =36~3V		-1.1	-2	mV/V	
Reference Input Current (Figure2)	I <sub>REF</sub>	I <sub>K</sub> =10mA, R <sub>1</sub> =10kΩ, R <sub>2</sub> =∞	T <sub>A</sub> =25°C		1.5	2.5	μA
			T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub>			3	μA
Reference Input Current Deviation Over Temperature Range (Figure 2)	ΔI <sub>REF</sub>	I <sub>K</sub> =10mA, R <sub>1</sub> =10kΩ, R <sub>2</sub> =∞, T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub>		0.5	1	μA	
Minimum Cathode Current for Regulation-(figure1)	I <sub>MIN</sub>	V <sub>KA</sub> =V <sub>REF</sub>		0.5	1	mA	
Off-State Cathode Current (Figure 3)	I <sub>OFF</sub>			180	500	nA	

Notes: 1. ΔV<sub>REF</sub> is defined as the difference between the maximum and minimum values obtained over the full temperature range.

$$V_{REF} = V_{REFMAX} - V_{REFMIN}$$



2. The temperature coefficient is defined as the slopes (positive and negative) of the voltage vs temperature limits within which the reference voltage is guaranteed.



3. The dynamic Impedance is defined as:  $|Z_{KA}| = \frac{V_{KA}}{I_K}$

■ VOLTAGE REFERENCE (Cont.)

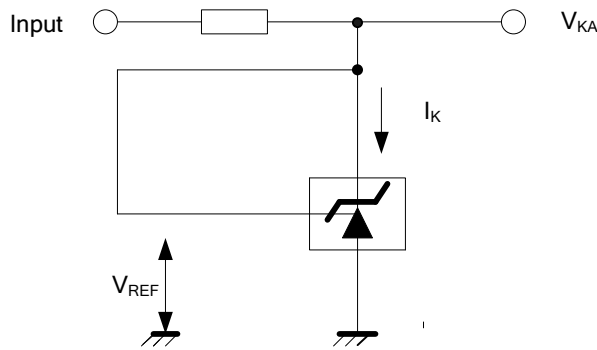


Figure 1: Test Circuit for  $V_{KA} = V_{REF}$

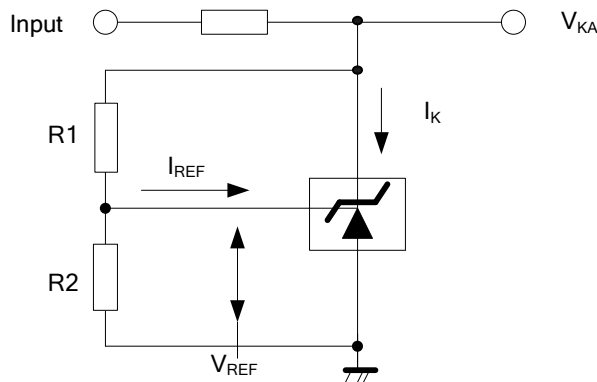


Figure 2: Test Circuit for  $V_{KA} > V_{REF}$

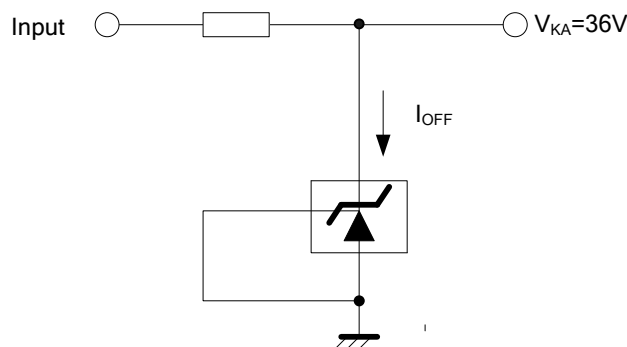


Figure 3: Test Circuit for  $I_{off}$

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