



# UM603/A

## LINEAR INTEGRATED CIRCUIT

### DUAL OPERATIONAL AMPLIFIER AND CURRENT CONTROLLER

#### DESCRIPTION

The UTC **UM603/A** is a monolithic IC that includes one independent op-amp and another op-amp for which the non inverting input is wired to a 2.5V fixed voltage reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems

#### FEATURES

##### OPERATIONAL AMPLIFIER

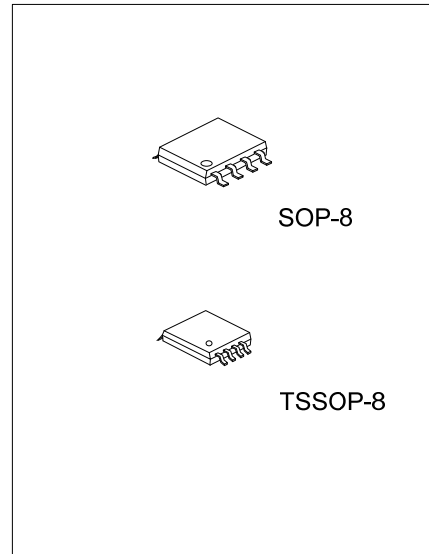
- \*Low input offset voltage: 0.5mV typ. for UTC **UM603A**
- \*Low supply current: 350uA/op.(@ V<sub>CC</sub>= 5 V)
- \*Medium bandwidth(unity gain): 0.9MHz
- \*Large output voltage swing: 0 V ~ (V<sub>CC</sub>-1.5 V)
- \*Input common mode voltage range includes ground
- \*Wide power supply range: 3V ~ 32V ±1.5 ~ ±16V

##### VOLTAGE REFERENCE

- \*Fixed output voltage reference 2.5V
- \*±0.4% and ±1% voltage precision
- \*Sink current capability : 1 ~ 100mA
- \*Typical output impedance : 0.2Ω

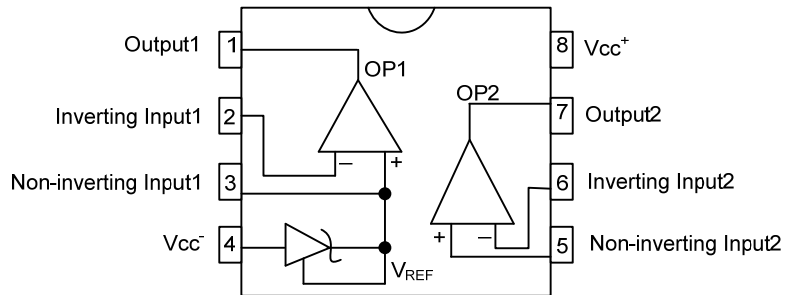
#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
UM603L-P08-R	UM603G-P08-R	TSSOP-8	Tape Reel
UM603L-P08-T	UM603G-P08-T	TSSOP-8	Tube
UM603L-S08-R	UM603G-S08-R	SOP-8	Tape Reel
UM603L-S08-T	UM603G-S08-T	SOP-8	Tube
UM603AL-P08-R	UM603AG-P08-R	TSSOP-8	Tape Reel
UM603AL-P08-T	UM603AG-P08-T	TSSOP-8	Tube
UM603AL-S08-R	UM603AG-S08-R	SOP-8	Tape Reel
UM603AL-S08-T	UM603AG-S08-T	SOP-8	Tube



<p>UM603L-P08-R</p> <ul style="list-style-type: none"> <li>(1)Packing Type</li> <li>(2)Package Type</li> <li>(3)Lead Free</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel, T: Tube</li> <li>(2) P08: TSSOP-8, S08: SOP-8</li> <li>(3) G: Halogen Free, L: Lead Free</li> </ul>
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## ■ PIN CONFIGURATION



## ■ PIN DESCRIPTION

PIN NO	PIN NAME	I/O	PIN DESCRIPTION
1	Output 1	O	OP1 output
2	Inverting Input1	I	OP1 inverting input
3	Non-Inverting Input1	O	A 2.5V fixed voltage reference output, wired to OP1 non-inverting input
4	V <sub>CC-</sub>		
5	Non-Inverting Input2	I	OP2 non-inverting input
6	Inverting Input2	I	OP2 inverting input
7	Output 2	O	OP2 output
8	V <sub>CC+</sub>		

### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	36	V
Differential Input Voltage	$V_{I(DIFF)}$	36	V
Input Voltage	$V_{IN}$	-0.3 ~ +36	V
Junction Temperature	$T_J$	+125	°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.

### ■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	SOP-8	175	°C/W
	TSSOP-8	120	

### ■ ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Total Supply Current, excluding Current in the Voltage Reference	$I_{CC}$	$V_{CC}^+=5V$ , no load, $T_{MIN} \leq T_A \leq T_{MAX}$	0.7		1.2	mA
		$V_{CC}^+=30V$ , no load, $T_{MIN} \leq T_A \leq T_{MAX}$			2	

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>OPERATOR1</b> (op-amp with non-inverting input connected to the internal $V_{REF}$ )							
Input Offset Voltage	UM603A	$V_{I(OFF)}$	$V_{I(CM)}=0V$	$T_A=25^\circ\text{C}$	0.5	2	mV
				$T_{MIN} \leq T_A \leq T_{MAX}$		3	
Input Offset Voltage	UM603	$V_{I(OFF)}$	$V_{I(CM)}=0V$	$T_A=25^\circ\text{C}$	1	4	mV
				$T_{MIN} \leq T_A \leq T_{MAX}$		5	
Input Offset Voltage Drift	$DV_{I(OFF)}$			7		$\mu\text{V}/^\circ\text{C}$	
Input Bias Current	$I_{I(BIAS)}$	negative input		20		nA	
Large Signal Voltage Gain	$A_{VD}$	$V_{I(CM)}=0V$ , $V_{CC}=15V$ , $R_L=2k$		100		V/mV	
Supply Voltage Rejection Ratio	SVR	$V_{I(CM)}=0V$ , $V_{CC}=5V \sim 30V$	65	100		dB	
Output Current Source	$I_{SOURCE}$	$V_{OUT}=2V$ , $V_{CC}=+15V$ , $V_{ID}=+1V$	20	40		mA	
Short Circuit to Ground	$I_{SC}$	$V_{CC}=+15V$		40	60	mA	
Output Current Sink	$I_{SINK}$	$V_{ID}=-1V$ , $V_{CC}=+15V$ , $V_{OUT}=2V$	10	20		mA	
High Level Output Voltage	$V_{OH}$	$V_{CC}^+=30V$	$T_A=25^\circ\text{C}$ , $R_L=10k$	27		V	
			$T_{MIN} \leq T_A \leq T_{MAX}$	27	28		
Low Level Output Voltage	$V_{OL}$	$R_L=10k$		5	20	mV	
		$T_{MIN} \leq T_A \leq T_{MAX}$		5	20		
Slew Rate at Unity Gain	SR	$V_{IN}=0.5 \sim 3V$ , $V_{CC}=15V$ $R_L=2k$ , $C_L=100\text{pF}$ , unity gain	0.2	0.4		V/ $\mu\text{s}$	
Gain Bandwidth Product	$G_{BP}$	$V_{CC}=30V$ , $R_L=2K$ , $C_L=100\text{pF}$ $f=100\text{kHz}$ , $V_{IN}=10\text{mV}$	0.5	0.9		MHz	
Total Harmonic Distortion	THD	$f=1\text{kHz}$ , $C_L=100\text{pF}$ , $V_{OUT}=2V_{PP}$ $A_v=20\text{dB}$ , $R_L=2k$ , $V_{CC}=30V$		0.02		%	

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OPERATOR2</b> (independent op-amp)(Note 1)						
Input Offset Voltage	UM603A	$V_{I(OFF)}$	$T_A = 25^\circ C$	0.5	2	mV
			$T_{MIN} \leq T_A \leq T_{MAX}$		3	
Input Offset Voltage	UM603	$V_{I(OFF)}$	$T_A = 25^\circ C$	1	4	mV
			$T_{MIN} \leq T_A \leq T_{MAX}$		5	
Input Offset Voltage Drift	$DV_{I(OFF)}$			7		$\mu V/^\circ C$
Input Offset Current	$I_{I(OFF)}$			2	30	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			50	
Input Bias Current	$I_{I(BIAS)}$			20	150	nA
		$T_{MIN} \leq T_A \leq T_{MAX}$			200	
Large Signal Voltage Gain	$A_{VD}$	$V_{CC} = 15V$ , $R_L = 2k$ , $V_{OUT} = 1.4V \sim 11.4V$	50	100		V/mV
		$T_{MIN} \leq T_A \leq T_{MAX}$	25			
Supply Voltage Rejection Ratio	SVRR	$V_{CC} = 5V \sim 30V$	65	100		dB
Input Common Mode Voltage Range	$V_{I(CM)}$	$V_{CC} = +30V$ (Note 1)	0		$(V_{CC}^+) - 1.5$	V
		$T_{MIN} \leq T_A \leq T_{MAX}$	0		$(V_{CC}^+) - 2$	
Common Mode Rejection Ratio	CMRR		70	85		dB
		$T_{MIN} \leq T_A \leq T_{MAX}$	60			
Output Current Source	$I_{O(SOURCE)}$	$V_{CC} = +15V$ , $V_{OUT} = 2V$ , $V_{JD} = +1V$	20	40		mA
Short Circuit to Ground	$I_{SC}$	$V_{CC} = +15V$		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	$V_{OH}$	$V_{CC}^+ = 30V$	$T_A = 25^\circ C$ , $R_L = 10k$	27	28	V
			$T_{MIN} \leq T_A \leq T_{MAX}$	27		
Low Level Output Voltage	$V_{OL}$	$R_L = 10k$		5	20	mV
		$T_{MIN} \leq T_A \leq T_{MAX}$		5	20	
Slew Rate at Unity Gain	SR	$V_{IN} = 0.5 \sim 3V$ , $V_{CC} = 15V$ $R_L = 2k$ , $C_L = 100pF$ , unity gain	0.2	0.4		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	$f = 1kHz$ , $C_L = 100pF$ , $V_{OUT} = 2V_{PP}$ $A_v = 20dB$ , $R_L = 2k$ , $V_{CC} = 30V$ ,		0.02		%

## ■ VOLTAGE REFERENCE

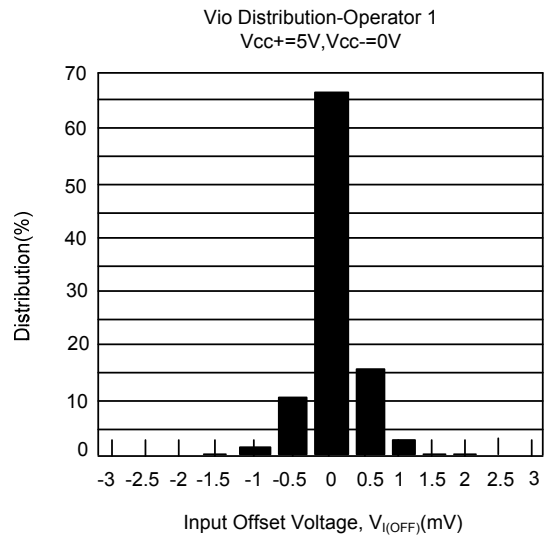
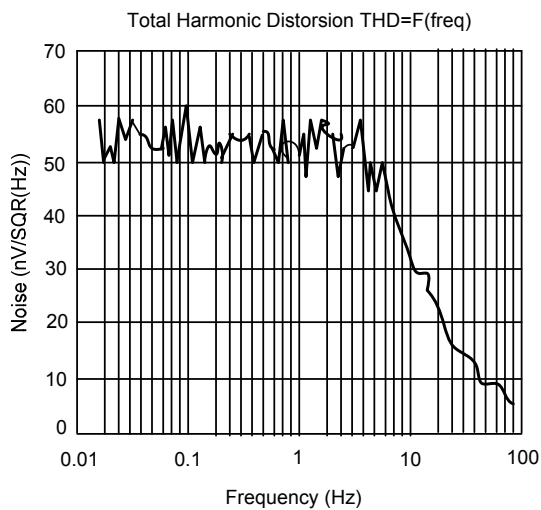
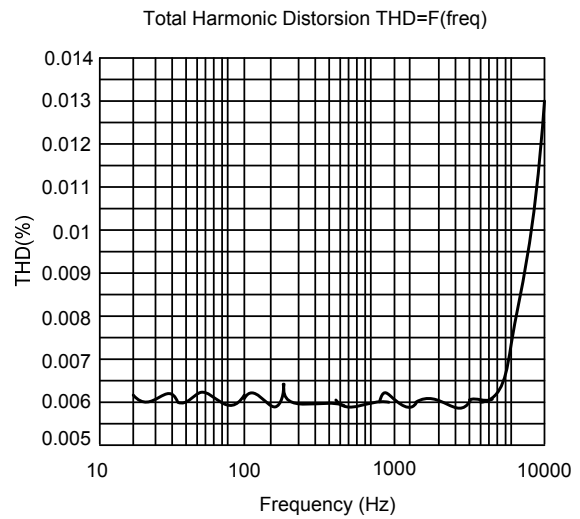
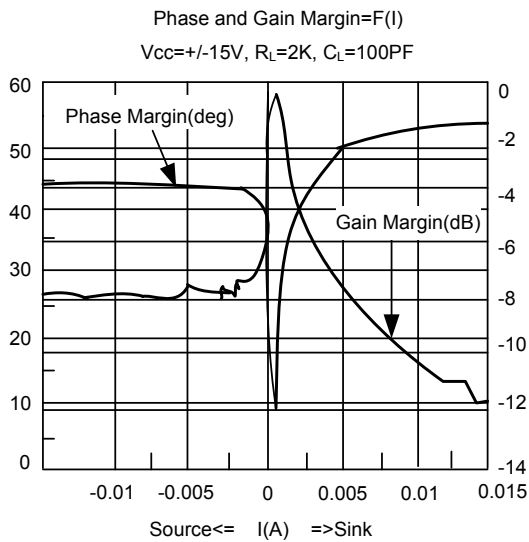
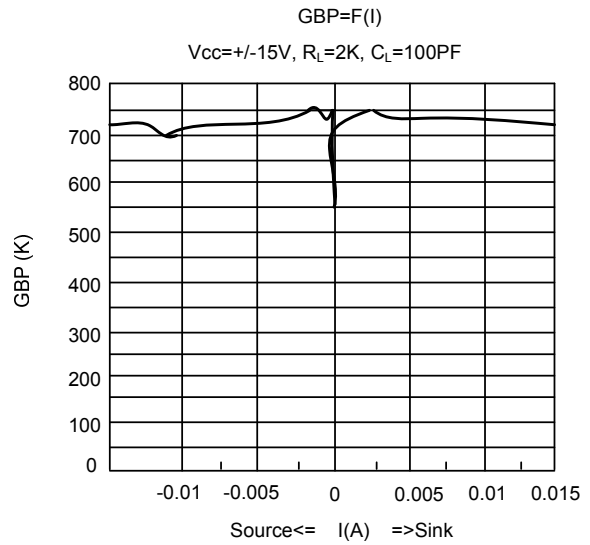
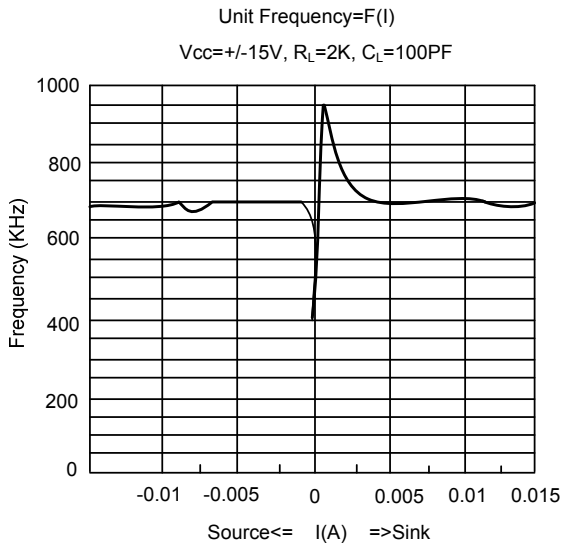
PARAMETER	SYMBOL	Value	UNIT
Cathode Current	$I_K$	1 ~ 100	mA

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Reference Input Voltage	UM603A	$V_{REF}$	$\pm 0.4\%$ , $T_A = 25^\circ C$	2.49	2.5	2.51	V
			$T_{MIN} \leq T_A \leq T_{MAX}$ , $V_{KA} = V_{REF}$ , $I_{KA} = 10mA$	2.48		2.52	
	UM603	$V_{REF}$	$\pm 1\%$ , $T_A = 25^\circ C$	2.475	2.5	2.525	
			$T_{MIN} \leq T_A \leq T_{MAX}$ , $V_{KA} = V_{REF}$ , $I_{KA} = 10mA$	2.45		2.55	
Reference Input Voltage Deviation Over Temperature Range	$\Delta V_{REF}$	$V_{KA} = V_{REF}$ , $I_K = 10mA$ , $T_{MIN} \leq T_A \leq T_{MAX}$		7	30	mV	
Minimum Cathode Current for Regulation	$I_{MIN}$	$V_{KA} = V_{REF}$		0.5	1	mA	
Dynamic Impedance(Note 2)	$Z_{KA}$	$V_{KA} = V_{REF}$ , $\Delta I_K = 1 \sim 100mA$ , $f < 1kHz$		0.2	0.5	$\Omega$	

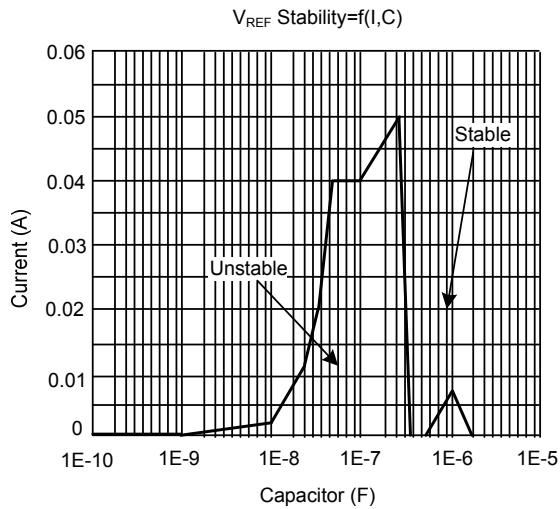
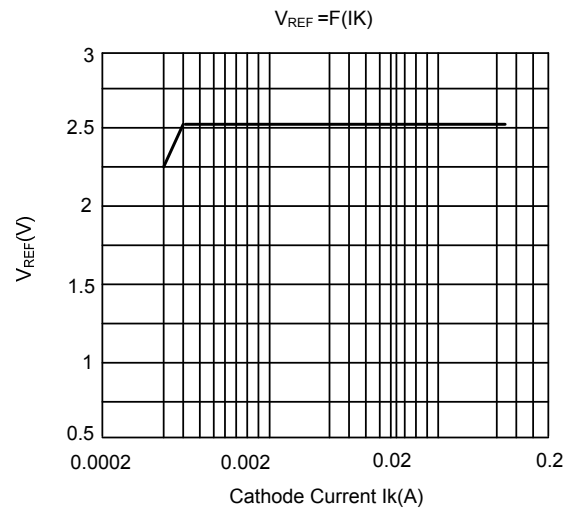
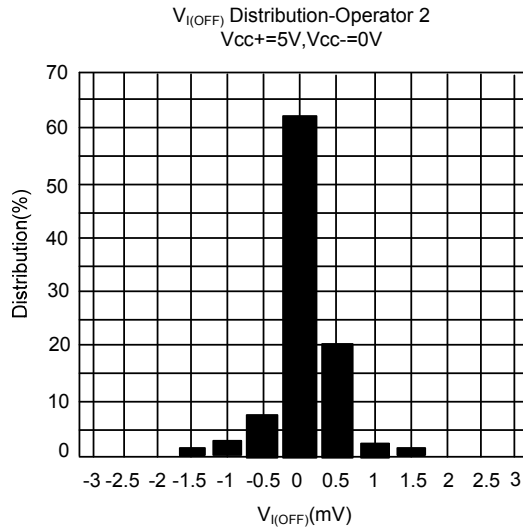
Note: 1. The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is  $V_{CC}^+ - 1.5V$ . But either of both inputs can go to +36V without damage.

2. The dynamic impedance is defined as  $[Z_{KA}] = \Delta kA / \Delta I_K$

## TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS(Cont.)



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