

DUAL OPERATIONAL AMPLIFIER AND CURRENT CONTROLLER

DESCRIPTION

The FA103/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

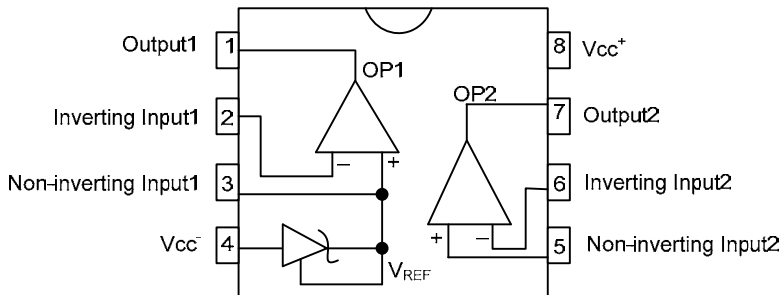
OPERATIONAL AMPLIFIER

- * Low input offset voltage: 0.5mV typ. for FA103A
- * Low supply current: 350uA/op.(@ Vcc=5V)
- * Medium bandwidth(unity gain): 0.9MHz
- * Large output voltage swing: 0 V ~ (Vcc-1.5V)
- * Input common mode voltage range includes ground
- * Wide power supply range: 3V ~ 32V , ±1.5 ~ ±16V

VOLTAGE REFERENCE

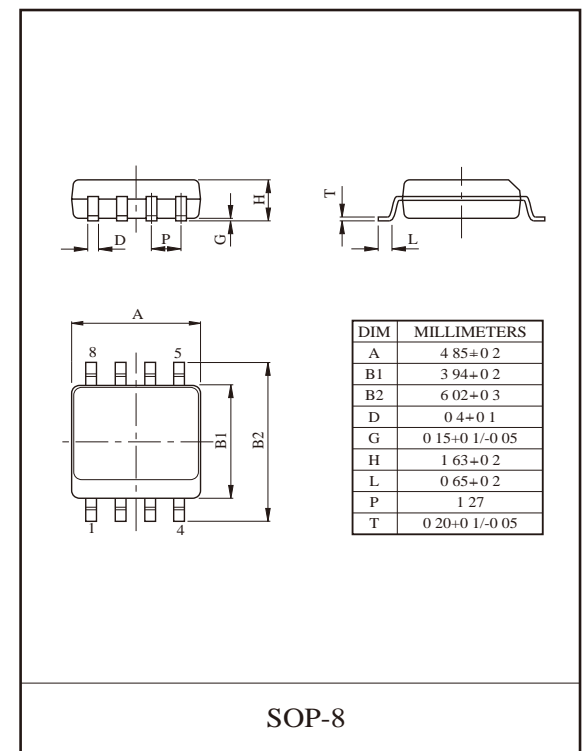
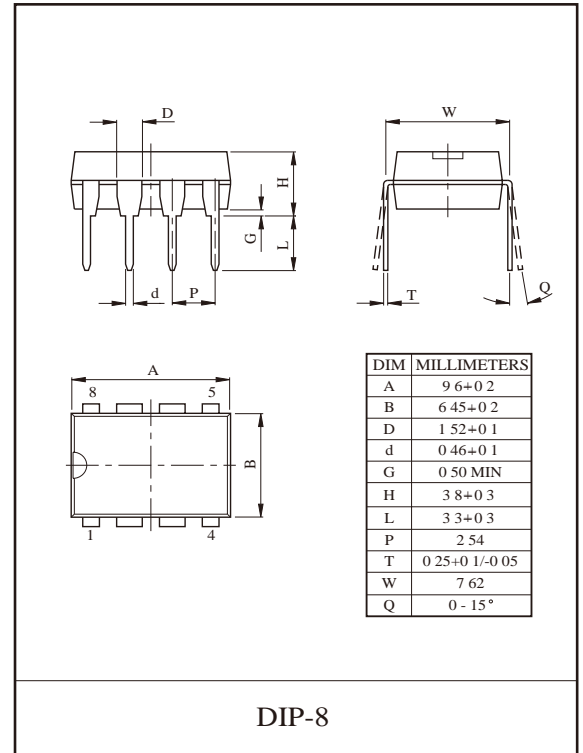
- * Fixed output voltage reference 2.5V
- * ±0.4% and ±1% voltage precision
- * Sink current capability : 1 ~ 100mA
- * Typical output impedance : 0.2Ω

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 _{CC-}		
5	Non-Inverting Input2	I	OP2 non-inverting input
6	Inverting Input2	I	OP2 inverting input
7	Output 2	O	OP2 output
8	V _{CC+}		



■ 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	+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.

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT	
Thermal Resistance Junction to Ambient	SOP-8	θ_{JA}	175	°C/W
	DIP-8			

■ 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	
OPERATOR1 (op-amp with non-inverting input connected to the internal V_{REF})							
Input Offset Voltage	FA103A	$V_{I(OFF)}$	$V_{I(CM)}=0V$ $T_a=25^\circ\text{C}$ $T_{MIN} \leq T_a \leq T_{MAX}$		0.5	2 3	mV
	FA103				1	4 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}	$V_{CC}^+=30V$ $T_a=25^\circ\text{C}$, $R_L=10k$ $T_{MIN} \leq T_a \leq T_{MAX}$	27 27	28		V	
Low Level Output Voltage	V_{OL}	$R_L=10k$ $T_{MIN} \leq T_a \leq T_{MAX}$		5	20 20	mV	
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/ μs	
Gain Bandwidth Product	G_{BP}	$V_{CC}=30V$, $R_L=2K$, $C_L=100pF$ $f=100kHz$, $V_{IN}=10mV$	0.5	0.9		MHz	
Total Harmonic Distortion	THD	$f=1kHz$ $A_v=20dB$, $R_L=2k$, $V_{CC}=30V$ $C_L=100pF$, $V_{OUT}=2V_{PP}$		0.02		%	

■ ELECTRICAL CHARACTERISTICS(Cont.)

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

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OPERATOR2 (independent op-amp)(Note 1)							
Input Offset Voltage	FA103A	$V_{I(OFF)}$	$T_a=25^\circ\text{C}$		0.5	2	mV
			$T_{MIN}\leq T_a\leq T_{MAX}$			3	
	FA103		$T_a=25^\circ\text{C}$		1	4	mV
			$T_{MIN}\leq T_a\leq T_{MAX}$			5	
Input Offset Voltage Drift		$DV_{(OFF)}$			7		$\mu\text{V}/^\circ\text{C}$
Input Offset Current		$I_{(OFF)}$	$T_{MIN}\leq T_a\leq T_{MAX}$		2	30	nA
						50	
Input Bias Current		$I_{(BIAS)}$	$T_{MIN}\leq T_a\leq T_{MAX}$		20	150	nA
						200	
Large Signal Voltage Gain		A_{vd}	$V_{CC}=15V$, $R_L=2k$, $V_{OUT}=1.4V\sim 11.4V$ $T_{MIN}\leq T_a\leq T_{MAX}$	50	100		V/mV
				25			
Supply Voltage Rejection Ratio		SVRR	$V_{CC}=5V\sim 30V$	65	100		dB
Input Common Mode Voltage Range		$V_{(CM)}$	$V_{CC}=+30V$ (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}	$V_{CC+}=30V$	27	28		V
			$T_a=25^\circ\text{C}$, $R_L=10k$ $T_{MIN}\leq T_a\leq T_{MAX}$	27			
Low Level Output Voltage		V_{OL}	$R_L=10k$ $T_{MIN}\leq T_a\leq T_{MAX}$		5	20	mV
						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/ μs
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	$f=1kHz$ $A_v=20dB$, $R_L=2k$, $V_{CC}=30V$, $C_L=100pF$, $V_{OUT}=2V_{pp}$		0.02		%

■ VOLTAGE REFERENCE

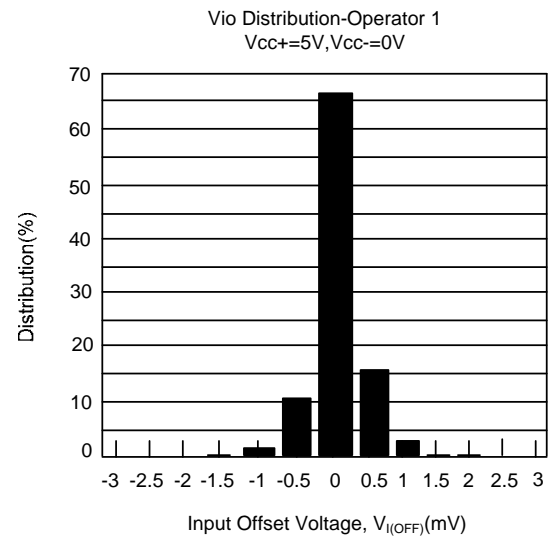
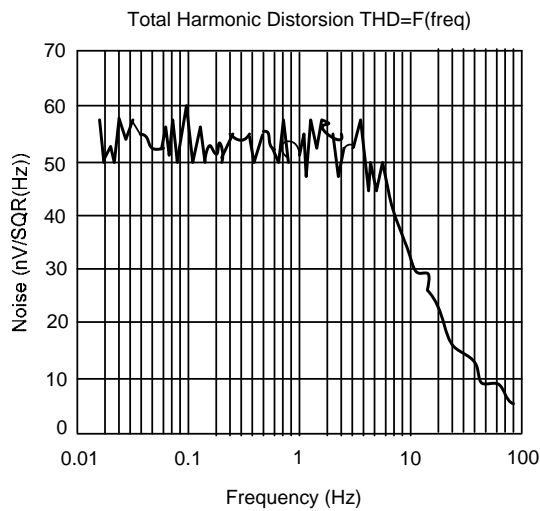
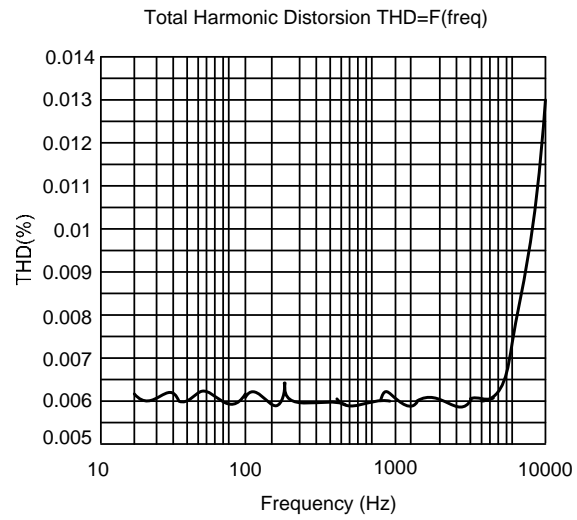
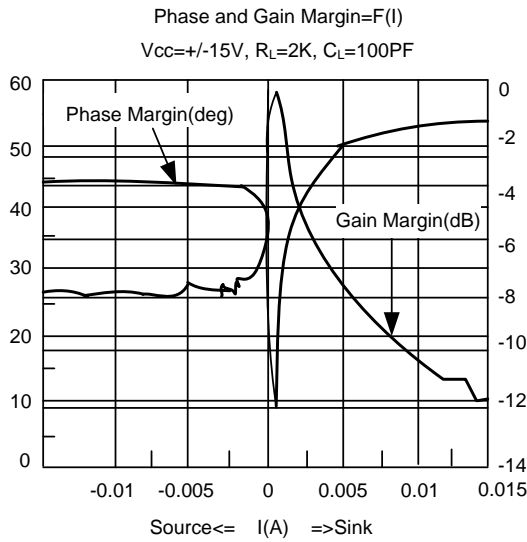
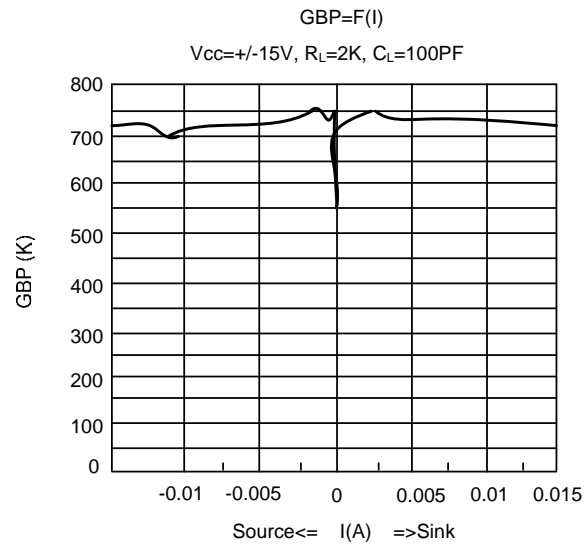
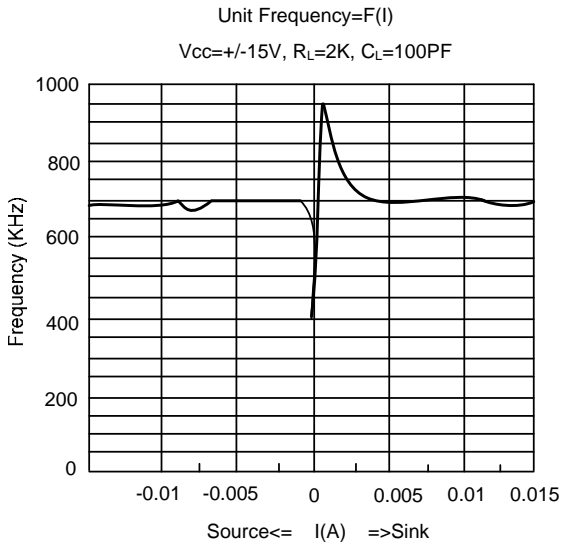
PARAMETER	SYMBOL	Value	UNIT
Cathode Current	I_k	1 ~ 100	mA

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Input Voltage	FA103A	V_{REF}	$\pm 0.4\%$, $T_a=25^\circ\text{C}$	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	
	FA103		$\pm 1\%$, $T_a=25^\circ\text{C}$	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		ΔV_{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	Ω

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.

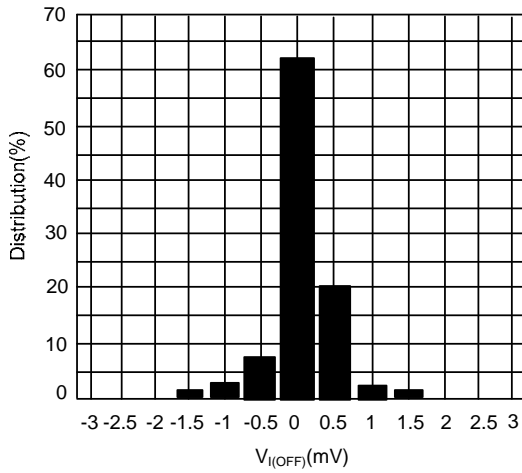
2. The dynamic impedance is defined as $[Z_{KA}] = \Delta kA / \Delta I_k$

TYPICAL CHARACTERISTICS

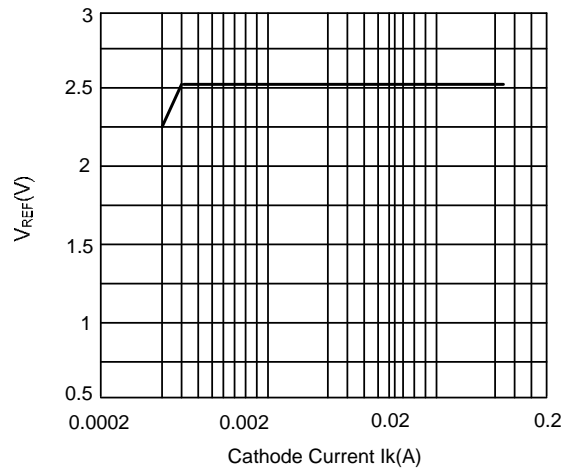


■ TYPICAL CHARACTERISTICS(Cont.)

$V_{I(OFF)}$ Distribution-Operator 2
 $V_{CC+}=5V, V_{CC-}=0V$



$V_{REF}=F(I_K)$



V_{REF} Stability=f(I,C)

