

**HIGH FREQUENCY NPN TRANSISTOR ARRAY**

**FEATURES**

- **FIVE MONOLITHIC 9 GHz fr TRANSISTORS:**  
Two of these use a common emitter pin and can be used as differential amplifiers
- **OUTSTANDING h<sub>FE</sub> LINEARITY**
- **TWO PACKAGE OPTIONS:**  
  - μPA103B: Superior thermal dissipation due to studded ceramic package
  - μPA103G: Reduced circuit size due to 14-pin plastic SOP package for surface mounting

**DESCRIPTION AND APPLICATIONS**

The μPA103 is a user configurable Silicon bipolar transistor array consisting of a common emitter pair and three individual bipolar transistors. It is available in a surface mount 14-pin plastic SOP package and a 14-pin ceramic package. Typical applications include: differential amplifiers and oscillators, high speed comparators, advanced cellular phone systems, electro-optic and other signal processing up to 1.5 gigabits/second.

**ORDERING INFORMATION**

PART NUMBER	PACKAGE
μPA103B-E1	14-pin ceramic package
μPA103G-E1	14-pin plastic SOP (225 mil)

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25 °C)**

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CB0</sub> *	Collector to Base Voltage	V	15
V <sub>CE0</sub> *	Collector to Emitter Voltage	V	6
V <sub>EBO</sub> *	Emitter to Base Voltage	V	2.5
I <sub>c</sub> *	Collector Current	mA	40
P <sub>T</sub>	Power Dissipation	μPA103B	mW 650
		μPA103G	mW 350
T <sub>J</sub>	Junction Temperature	μPA103B	°C 200
		μPA103G	°C 125
T <sub>STG</sub>	Storage Temperature	μPA103B	°C -55 to +200
		μPA103G	°C -55 to +125

\* Absolute maximum ratings for each transistor.

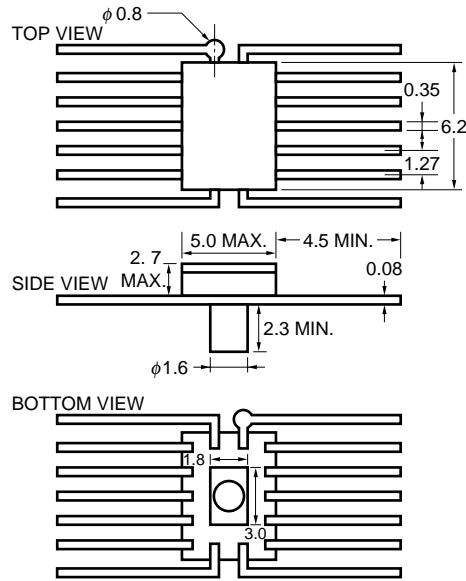
**Caution electro-static sensitive devices**

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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

PACKAGE DIMENSIONS (UNIT: mm)

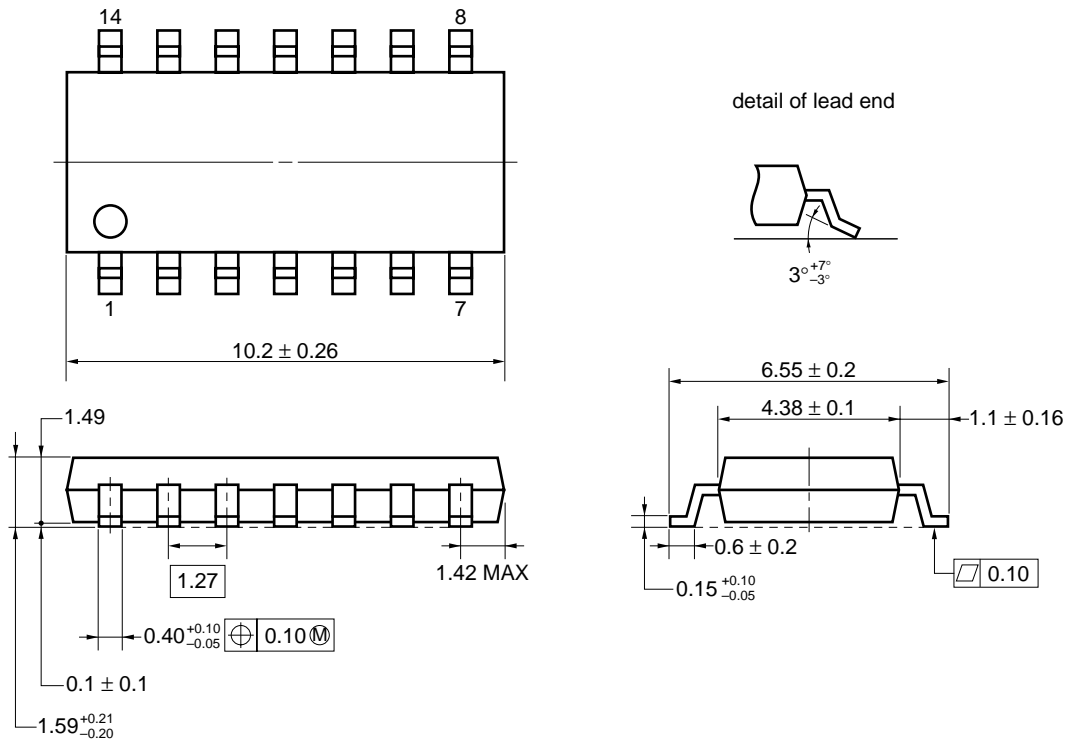
μPA103B

14 PIN CERAMIC PACKAGE



μPA103G

★ 14 PIN PLASTIC SOP (225 mil)



**NOTE** Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.

See connection diagram for description of leads.

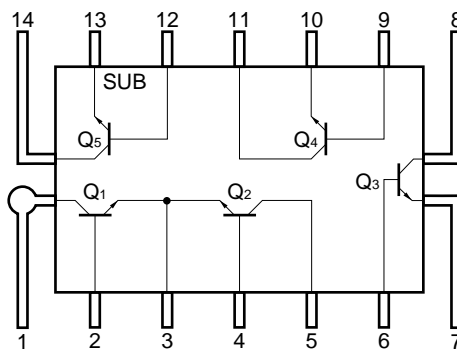
**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified  $T_A = +25\text{ }^\circ\text{C}$  μPA103B, μPA103G common)

SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN.	TYP.	MAX.
$I_{CBO}$	Collector Cutoff Current at $V_{CB} = 5\text{ V}$ , $I_E = 0$ (Q1 to Q5)	$\mu\text{A}$			1.0
$I_{EBO}$	Emitter Cutoff Current at $V_{EB} = 1\text{ V}$ , $I_C = 0$ (Q1 to Q5)	$\mu\text{A}$			1.0
$h_{FE}$	Direct Current Amplification at $V_{CE} = 3\text{ V}$ , $I_C = 5\text{ mA}$ (Q1 to Q5)		40	100	250
$h_{FE1}/h_{FE2}$	Direct Current Amplification Ratio at $V_{CE} = 3\text{ V}$ , $I_C = 5\text{ mA}$ , (Q1, Q2)		0.9	1.0	1.1
$V_{BE}$	Emitter to Base Voltage at $V_{CE} = 3\text{ V}$ , $I_C = 5\text{ mA}$ (Q1, Q2)	V		0.8	1.0
$\Delta V_{BE}$	Emitter to Base Voltage Difference, $V_{CE} = 3\text{ V}$ , $I_C = 5\text{ mA}$ [Q1 - Q2]	mV		8.0	20
$C_{CB}$	Collector to Base Capacitance at $V_{CB} = 3\text{ V}$ , $f = 1\text{ MHz}$ (Q1 to Q5)	pF		0.9	1.8
$C_{EB}$	Emitter to Base Capacitance at $V_{EB} = 0$ , $f = 1\text{ MHz}$ (Q1 to Q4)	pF		1.4	2.8
$C_{CS}$	Collector/Substrate Capacitance at $V_{CS} = 3\text{ V}$ , $f = 1\text{ MHz}$ (Q1 to Q4)	pF		1.4	2.8
$f_T$	Gain Bandwidth Product* at $V_{CE} = 3\text{ V}$ , $I_C = 10\text{ mA}$	GHz		9.0	

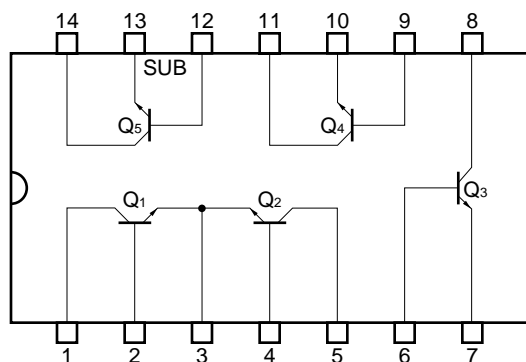
\* Measured by installing a single transistor in a Micro-X package: the value shown is a reference value.

**CONNECTION DIAGRAM** (Top View)

μPA103B

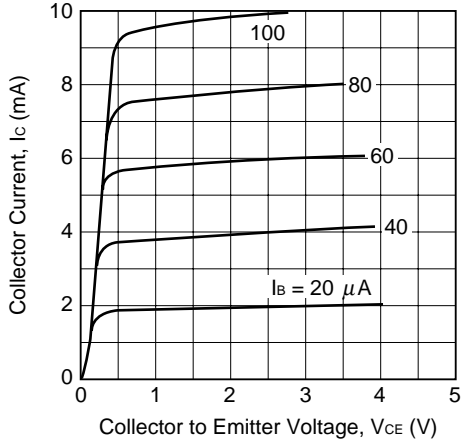


μPA103G

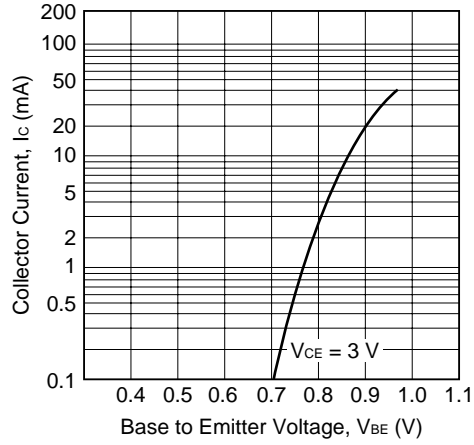


TYPICAL PERFORMANCE CHARACTERISTICS ( $T_A = +25\text{ }^\circ\text{C}$ )

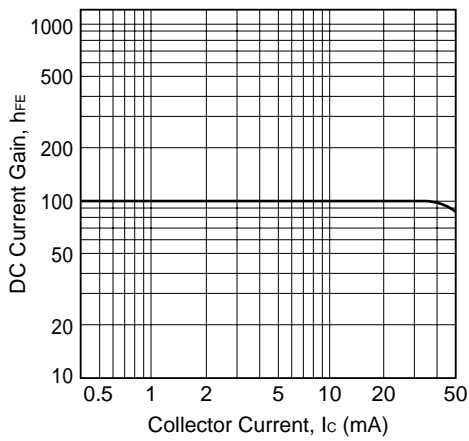
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



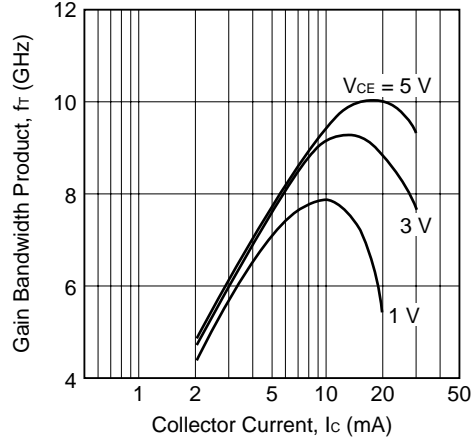
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



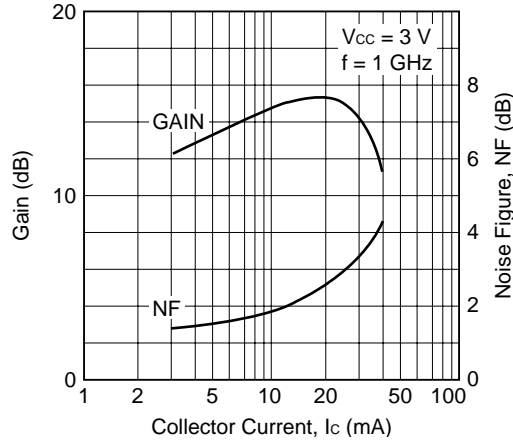
DC CURRENT GAIN vs. COLLECTOR CURRENT



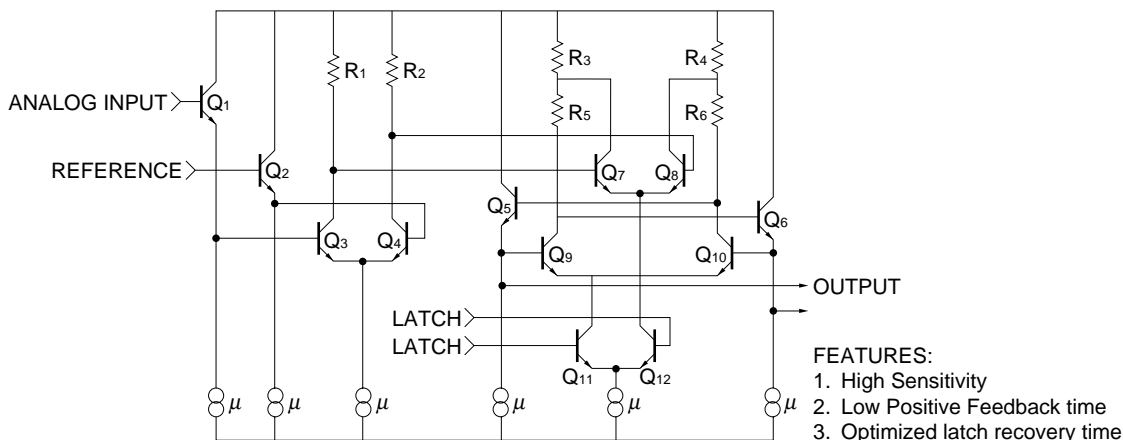
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



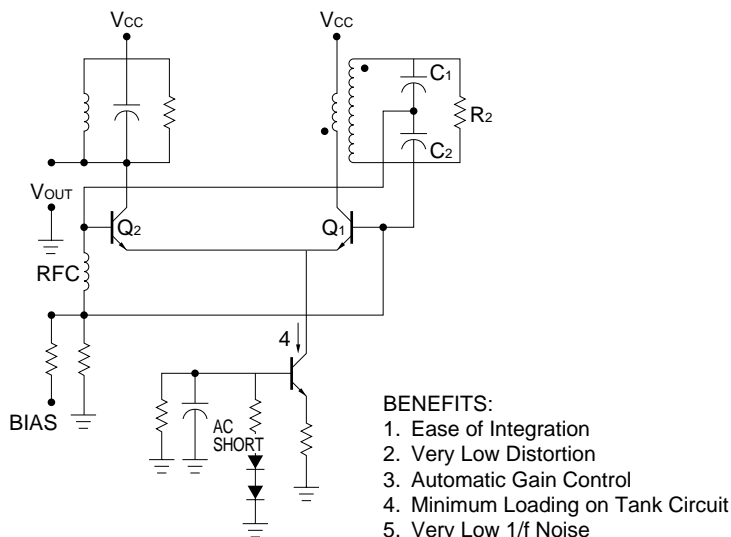
GAIN AND NOISE FIGURE OF INDIVIDUAL TRANSISTOR



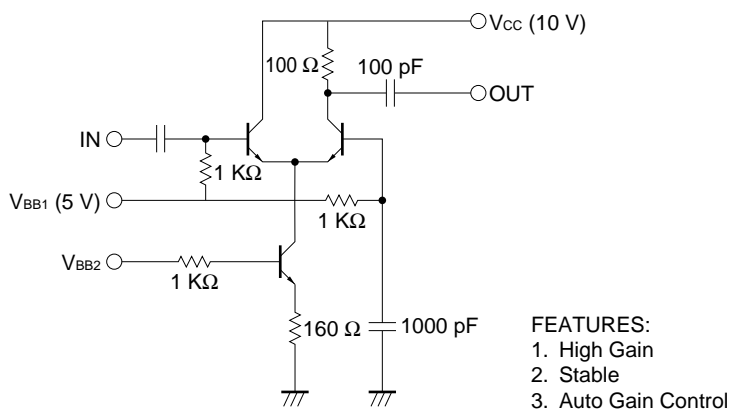
**TYPICAL HIGH SPEED COMPARATOR**



**TYPICAL DIFFERENTIAL OSCILLATOR**



**TYPICAL COMMON MODE DIFFERENTIAL AMP**



The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

**NOTES ON CORRECT USE**

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as wide as possible to minimize ground impedance (to prevent undesired operation).
- (3) Design circuits connected Sub pin to the lowest voltage to prevent latch-up.
- (4) Design circuits as each pin voltage difference within 15 V maximum.

**RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered in the following recommended conditions. Other soldering methods and conditions than the recommended conditions are to be consulted with our sales representatives.

**μPA103G**

Soldering process	Soldering conditions	Recommended condition symbol
Infrared ray reflow	Package peak temperature: 235 °C, Hour: within 30 s. (more than 210 °C), Time: 2 times, Limited days: no. <sup>Note</sup>	IR35-00-2
VPS	Package peak temperature: 215 °C, Hour: within 40 s. (more than 200 °C), Time: 2 times, Limited days: no. <sup>Note</sup>	VP15-00-2
Wave soldering	Soldering tub temperature: less than 260 °C, Hour: within 10 s. Time: 1 time, Limited days: no. <sup>Note</sup>	WS60-00-1
Pin part heating	Pin area temperature: less than 300 °C, Hour: within 3 s./pin Limited days: no. <sup>Note</sup>	

**μPA103B**

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 230 °C or below, Reflow time: 10 seconds or below (210 °C or higher), Number of reflow process: 1, Exposure limit*: None	
Partial heating method	Terminal temperature: 260 °C or below, Flow time: 10 seconds or below, Exposure limit*: None	

**Note** It is the storage days after opening a dry pack, the storage conditions are 25 °C, less than 65 % RH.

**Caution** The combined use of soldering method is to be avoided (However, except the pin area heating method).

For details of recommended soldering conditions for surface mounting, refer to information document SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).

[MEMO]

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