T-79-06-10

VA701

LOW-NOISE PRECISION OPERATIONAL AMPLIFIER

PRELIMINARY INFORMATION

FEATURES

- Low Noise: 3.0 nV/√Hz at 1KHz
- High Speed: 10V/µs Slew Rate
  30MHz Gain Bandwidth
- Fast Settling: 10µs to 0.01%
- Low Offset Voltage: 10µV
- Large Output Current: ±50mA
- High Gain: 5 million
- Large Output Swing: ±4V
- Large Input Common Mode Range: ±3.5V

DESCRIPTION

The VA701 is a precision operational amplifier with performance parameters similar to that of the industry-standard OP-27 but with design architecture optimized for performance with ±5V supplies. For example, the output voltage swing is typically ±4V while input common mode range is ±3.5V.

The low offset voltage of 25µV and offset current of 50nA maximum makes the amplifier ideal for precision instrumentation applications. In addition, the low noise of 3nV/√Hz insures that amplification accuracy is maintained with low level input signals. The device is available in 8-pin DIP, SOIC, metal can (TO-99), and die package configuration with the industry-standard operational amplifier pinout (except SOIC).

ABSOLUTE MAXIMUM RATINGS

Supply Voltages ..... ±6.5V
Common Mode Input Voltage ..... ±Vs
Differential Input Voltage ..... ±0.7V
Power Dissipation (Note 1, 2) 450mW
Operating Temperature Range:
  Commercial ..... 0° to 70°C
  Military ..... -55° to +125°C
Storage Temperature Range ..... -65° to +150°C
Lead Temperature (Soldering to 60 Sec) ..... 300°C

Note 1: Power derating above T_A = 70°C to be based on a maximum junction temperature of 150°C and the following thermal resistance factors:

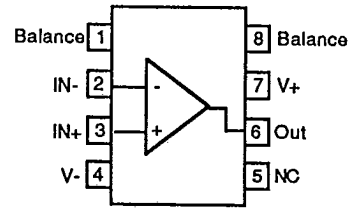
PACKAGE	θ_{JC} (°C/W)	θ_{JA} (°C/W)
DIP	75	180
SOIC	115	180
TO-99	115	250

Note 2: Continuous short circuit protection is allowed to the following case and ambient temperatures:

PACKAGE	T_C (°C)	T_A (°C)
DIP	110	70
SOIC	95	70
TO-99	95	30

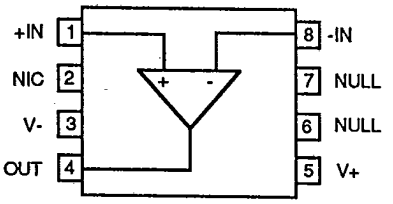
CONNECTION DIAGRAMS

Dual-In-Line



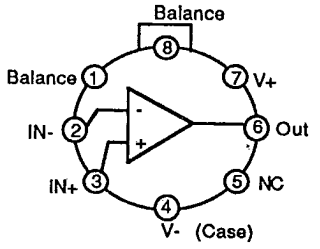
Top View

SOIC Package



Top View

Metal Can Package



Top View

PACKAGE TYPES AVAILABLE

- 8-Pin Plastic DIP
- 8-Pin CERDIP
- 8-Pin SOIC
- 8-Pin Metal Can, TO-99

ELECTRICAL CHARACTERISTICS (V_S = ±5V, T_A = 25°C unless otherwise stated)

PARAMETER	SYMBOL	CONDITIONS	VA701J			VA701K			VA701L			VA701S			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V_{OS}			100	400		50	100		10	25		10	25	µV
		0°≤T_A≤70°C		200	600		65	140		15	40				
		-55°≤T_A ≤ +125°C			4								25	50	
Input Offset Voltage Drift		0°≤T_A≤70°C		2	4		1	2			0.6				µV/°C
		-55°≤T_A ≤ +125°C												0.6	
Long Term V_{os} Stability	V_{OS}/Time	(Notes 1, 2)			3			3			1			1	µV/Mo
Input Offset Current	I_{OS}				150			100			50			50	nA
		0°≤T_A≤70°C			200			150			100				
		-55°≤T_A ≤ +125°C												100	
Input Offset Current Drift		0°≤T_A≤70°C		150			100			100					pA/°C
		-55°≤T_A ≤ +125°C											300		
Input Bias Current	I_B			50	200		25	100		10	40		10	40	nA
		0°≤T_A≤70°C			300			150			60				
		-55°≤T_A ≤ +125°C												75	
Input Differential Resistance (Note 3)	R_{IN}				0.8			0.8			1.5			1.5	MΩ
Input Common Mode Resistance	R_{INCM}			2			2			3			3		GΩ
Large Signal Voltage Gain (Note 3)	A_V	R_L> 2KΩ V_{OUT} = ±3.5V	700	6,000		700	6,000		1,000	6,000		1,000	6,000		V/mV
Input Common Mode Range	V_{CM}		±3.5			±3.5			±3.5			±3.5			V
Output Voltage Swing	V_{OUT}	R_L = 2KΩ	±3.5	±4.0		±3.5	±4.0		±3.5	±4.0		±3.5	±4.0		V
		R_L = 51Ω	±2.5			±2.5			±2.5			±2.5			
Power Supply Current	I_S			8	12		8	12		8	12		8	12	mA
Positive Current Limit	$+I_{SC}$		60		180	60		180	60		180	60		180	mA
Negative Current Limit	$-I_{SC}$		60		180	60		180	60		180	60		180	mA
Common-Mode Rejection Ratio	CMRR	V_{CM} = ±3.5	100			100			114			114			dB
Power-Supply Rejection Ratio	PSRR	ΔV_{ps} = ±1.0V	94			94			100			100			dB

Notes: *1. Long term input offset voltage stability refers to the average trend line of V_{OS} vs Time over extend periods after the first 30 days of operation. Excluding the initial hour of operation, changes in V_{OS} during the first 30 days are typically 2.5µV.*

2. Sample tested only.

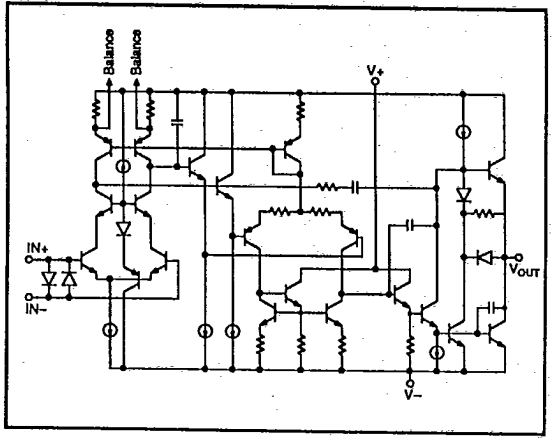
3. Not tested, guaranteed by design.

AC and NOISE CHARACTERISTCS (V_S = ±5V, T_A = 25°C unless otherwise stated)

PARAMETER	SYMBOL	CONDITIONS	VA701J			VA701K			VA701L			VA701S			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Input Noise Voltage	enp-p	f = 10Hz (Note 1)		0.25	0.75		0.18	0.36		0.18	0.36		0.18	0.36	µVp-p
Input Noise Voltage Density	e_n	f = 1KHz (Note 1)		3.8	4.5		3.0	3.8		3.0	3.8		3.0	3.8	nV/√Hz
Input Noise Current Density	i_n	f = 1KHz		1.0			1.0			1.0			1.0		pA/√Hz
Slew Rate	SR		6.0	10		6.0	10		6.0	10		6.0	10		V/µs
Gain Bandwidth Product	GBW	f = 100KHz		30			30			30			30		MHz
		f = 16MHz		16			16			16			16		
Settling Time	t_s	±3.5V Step		10			10			10			10		µs

Note 1: Sample tested only.

SIMPLIFIED SCHEMATIC



LSP FAMILY DATA SHEETS

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WAFER ELECTRICAL CHARACTERISTICS (V_S = ±5V, T_A = 25°C unless otherwise stated)

PARAMETER	SYMBOL	CONDITIONS	VA701X MIN	VA701X TYP	VA701X MAX	UNITS
Input Offset Voltage	V_{os}				25	µV
Input Offset Current	I_{os}				50	nA
Input Bias Current	I_B				40	nA
Input Common Mode Range	V_{CM}		±3.5			V
Common Mode Rejection Ratio	CMRR	V_{CM} = ±3.5V	114			dB
Power Supply Rejection Ratio	PSRR	ΔV_{ps} = ±1.0V	100			dB
Large-Signal Voltage Gain	A_V	$R_L \geq 2K\Omega$, V_{OUT} = ±3.5V	1000	6,000		V/mV
Output Voltage Swing	V_{OUT}	R_L = 2KΩ	±3.5			V
		R_L = 51Ω	±2.5			V
Power Supply Current	I_s				12	mA
Gain Bandwidth	GBW			30		MHz
Slew Rate	SR	$R_L \geq$ 2KΩ		10		V/µs
Settling Time	t_s	± 3.5V step		10		µs
Input Noise Voltage Density	e_N	f = 1KHz		3.0		nV/√Hz
Input Noise Current Density	I_N	f = 1KHz		1.0		pA/√Hz

LSP FAMILY DATA SHEETS

DICE POLICY

Electrical Characteristics

Each die is electrically tested to the commercial or military grade DC parameters to guard band limits at 25°C to guarantee operation over the full temperature range.

Quality Assurance

All dice are 100% visually inspected to the requirement of MIL-STD-883C, Method 2010.2, Condition 3.

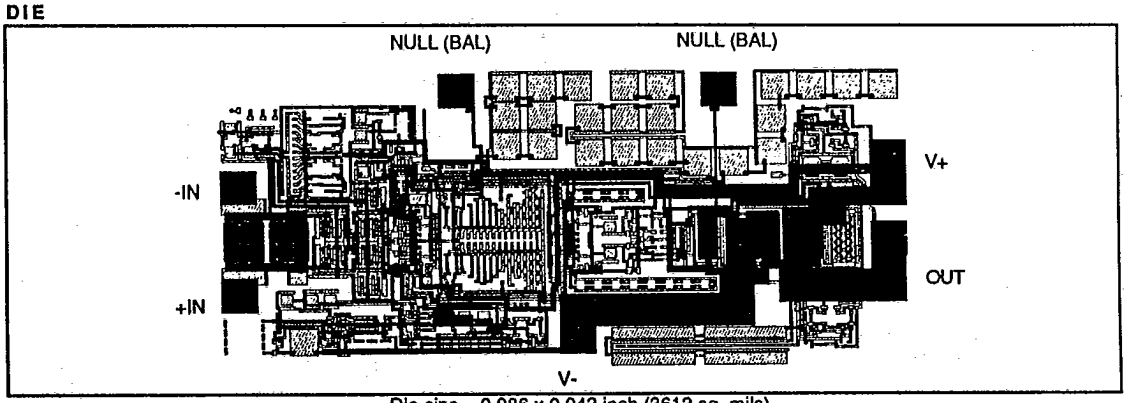
All dice are glass passivated with only the bonding pads exposed to provide scratch protection.

All dice are provided with gold backing.

Shipping Packages/Order Information

All dice are packaged in die crates with individual compartments which prevent damage to the die during shipping. Minimum order for dice is 100, supplied only in multiples of 100.

DIE



Die size = 0.086 x 0.042 inch (3612 sq. mils)
= 2.18 x 1.07 mm (2.33 sq. mm)