

KA3303/KA3403

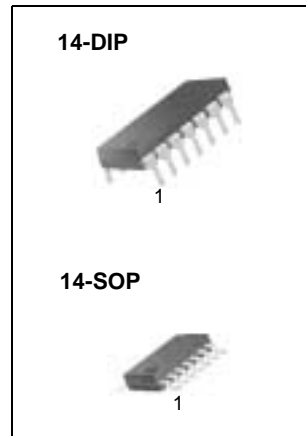
Quad Operational Amplifier

Features

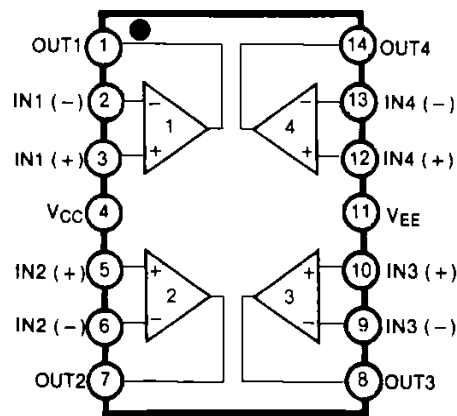
- Output voltage can swing to GND or negative supply
- Wide power supply range;
- Single supply of 3.0V to 36V
- Dual supply of $\pm 1.5V$ to $\pm 18V$
- Electrical characteristics similar to the KA741
- Class AB output stage for minimal crossover distortion
- Short circuit protected output.

Description

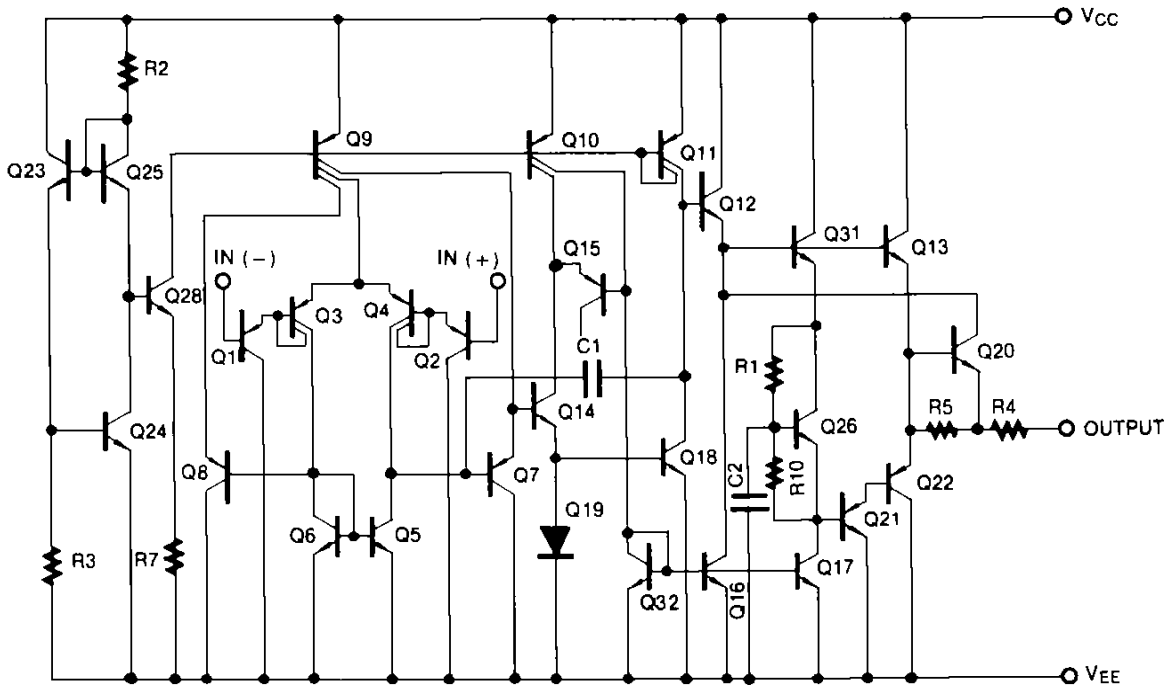
The KA3303 series is a monolithic Quad operational amplifier consisting of four independent amplifiers. The device has high gain, internally frequency compensated operational amplifiers designed to operate from a single power supply or dual power supplies over a wide range of voltages. The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications.



Internal Block Diagram



Schematic Diagram



Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|-------------------------------|----------------------|-------------|------|
| Supply Voltage | VCC | ±18 or +36 | V |
| Differential Input Voltage | V _{I(DIFF)} | 36 | V |
| Input Voltage | V _I | ±18 | V |
| Output Short Circuit Duration | - | Continuous | - |
| Power Dissipation | P _D | 670 | mW |
| Operating Temperature | | | |
| KA3303 | T _{OPR} | -40 ~ + 85 | °C |
| KA3403 | | 0 ~ + 70 | °C |
| Storage Temperature | T _{STG} | -65 ~ + 150 | °C |

Electrical Characteristics

(VCC = +15V, VEE = -15V for KA3403, VCC = +14V, VEE = GND for KA3303, TA = 25 °C, unless otherwise specified)

| Parameter | Symbol | Conditions | KA3303 | | | KA3403 | | | Unit |
|---------------------------------|---------------------|---|-------------|---------------|------|-------------|---------------|------|------|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Input Offset Voltage | V _{IO} | - | - | 1.5 | 8.0 | - | 1.5 | 10 | mV |
| | | Note1 | - | - | 10 | - | - | 12 | |
| Input Offset Current | I _{IO} | - | - | 5 | 75 | - | 5 | 50 | nA |
| | | Note1 | - | - | 150 | - | - | 100 | |
| Input Bias Current | I _{BIAS} | - | - | 30 | 200 | - | 30 | 200 | nA |
| | | Note1 | - | - | 500 | - | - | 400 | |
| Large Signal Voltage Gain | G _V | V _{O(P-P)} = ±10V | 20 | 200 | - | 20 | 200 | - | V/mV |
| | | R _L = 2KΩ | Note1 | 15 | - | - | 15 | - | |
| Input Impedance | R _I | - | 0.3 | 1.0 | - | 0.3 | 1.0 | - | MΩ |
| Output Voltage Swing | V _{O(P-P)} | R _L = 10KΩ | +12 | +12.5 | - | ±12 | ±13.5 | - | V |
| | | R _L = 2KΩ | +10 | +12 | - | ±10 | ±13 | - | |
| | | R _L = 2KΩ | Note1 | +10 | - | - | ±10 | - | |
| Input Common Mode Voltage Range | V _{I(R)} | - | 12V -VEE | 12.5V -VEE | - | 13V -VEE | 13.5V -VEE | - | V |
| Common Mode Rejection Ratio | CMRR | R _S ≥ 10KΩ | 70 | 90 | - | 70 | 90 | - | dB |
| Power Supply Current | I _{CC} | V _{O(P)} = 0, R _L = ∞ | - | 2.8 | 7.0 | - | 2.3 | 7.0 | mA |
| Output Short Circuit Current | I _{SC} | Each amplifier | ±10 | ±30 | ±45 | ±10 | ±20 | ±45 | mA |
| Positive Supply Rejection Ratio | PSRR(+) | - | - | 30 | 150 | - | 30 | 150 | μV/V |
| Negative Supply Rejection Ratio | PSRR(-) | - | - | - | - | - | 30 | 150 | μV/V |

Electrical Characteristics (Continued)

(VCC = +15V, VEE = -15V for KA3403, VCC = +14V, VEE = GND for KA3303, TA = 25 °C, unless otherwise specified)

| Parameter | Symbol | Conditions | KA3303 | | | KA3403 | | | Unit |
|---|--------------------------|---|--------|------|------|--------|------|------|------------------|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Average Temperature Coefficient of Input Offset Current (Note2) | $\Delta I_{IO}/\Delta T$ | - | - | 50 | - | - | 50 | - | pA/°C |
| Input Offset Voltage Drift (Note2) | $\Delta V_{IO}/\Delta T$ | - | - | 10 | - | - | 10 | - | $\mu V/^\circ C$ |
| Power Bandwidth (Note2) | GBW | $G_V = 1, R_L = 2K\Omega, V_{O(P-P)} = 20VP-P, THD=5\%$ | - | 9.0 | - | - | 9.0 | - | KHz |
| Small Signal Bandwidth (Note2) | BW | $G_V = 1, R_L = 10K\Omega, V_{O(P-P)} = 50mV$ | - | 1.0 | - | - | 1.0 | - | MHz |
| Slew Rate (Note2) | SR | $G_V = 1, V_I = -10V \text{ to } +10V$ | - | 0.4 | - | - | 0.4 | - | V/ μs |
| Rise Time (Note2) | T _R | $G_V = 1, R_L = 10K\Omega, V_{O(P-P)} = 50mV$ | - | 0.35 | - | - | 0.35 | - | μs |
| Fall Time (Note2) | T _F | $G_V = 1, R_L = 10K\Omega, V_{O(P-P)} = 50mV$ | - | 0.35 | - | - | 0.35 | - | μs |
| Over Shoot (Note2) | OS | $G_V = 1, R_L = 10K\Omega, V_{O(P-P)} = 50mV$ | - | 20 | - | - | 20 | - | % |
| Phase Margin (Note2) | MPH | $G_V = 1, R_L = 2K\Omega, C_L = 200pF$ | - | 60 | - | - | 60 | - | Degree |
| Crossover Distortion (Note2) | CD | $V_I = 30mVP-P, V_{O(P-P)} = 2.0VP-P, f = 10KHz$ | - | 1.0 | - | - | 1.0 | - | % |

Note:

- KA3403: $0^\circ C \leq T_A \leq +70^\circ C$, KA3303: $-40^\circ C \leq T_A \leq +85^\circ C$
- Guaranteed by design.

Electrical Characteristics

($V_{CC} = 5.0V$, $V_{EE} = GND$, $T_A = 25^\circ C$ unless otherwise specified)

| Parameter | Symbol | Conditions | KA3303 | | | KA3403 | | | Unit |
|-------------------------------------|--------------|---|----------------|----------------|------|----------------|----------------|------|-----------|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Input Offset Voltage | V_{IO} | - | - | - | 10 | - | 2.0 | 10 | mV |
| Input Offset Current | I_{IO} | - | - | - | 75 | - | 30 | 50 | nA |
| Input Bias Current | I_{BIAS} | - | - | - | 500 | - | 200 | 500 | nA |
| Large Signal Open Loop Voltage Gain | G_V | $R_L = 2.0K\Omega$ | 10 | 200 | - | 10 | 200 | - | V/mV |
| Power Supply Rejection Ratio | PSRR | - | - | - | 150 | - | - | 150 | $\mu V/V$ |
| Output Voltage Range | $V_{O(P-P)}$ | $R_L = 10K\Omega$, $V_{CC} = 5.0V$ | 3.3 | 3.5 | - | 3.3 | 3.5 | - | V |
| | | $R_L = 10K\Omega$, $5.0V \leq V_{CC} \leq 30V$ | $V_{CC} - 2.0$ | $V_{CC} - 1.7$ | - | $V_{CC} - 2.0$ | $V_{CC} - 1.7$ | - | |
| Supply Current | I_{CC} | - | - | 2.5 | 7.0 | - | 2.5 | 7.0 | mA |
| Channel Separation | CS | $f = 1KHz$ to $20KHz$ | - | 120 | - | - | 120 | - | dB |

Typical Performance Characteristics

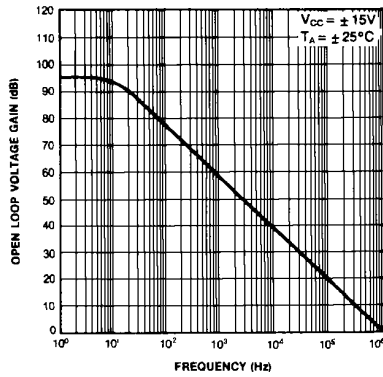


Figure 1. Open Loop Frequency Response

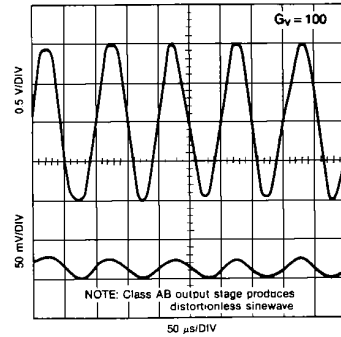


Figure 2. Wave Response

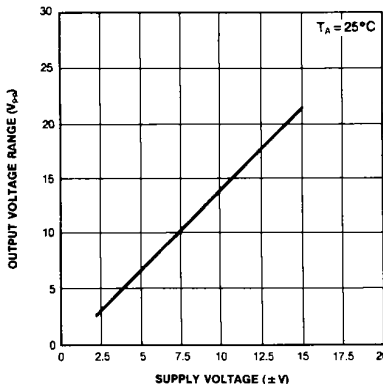


Figure 3. Output Swing

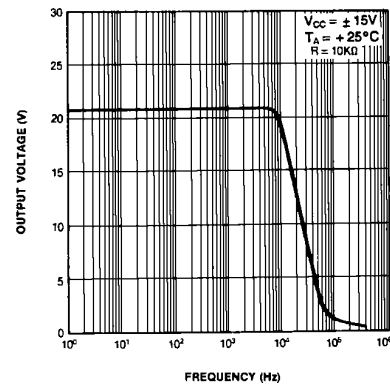


Figure 4. Output Voltage vs Frequency

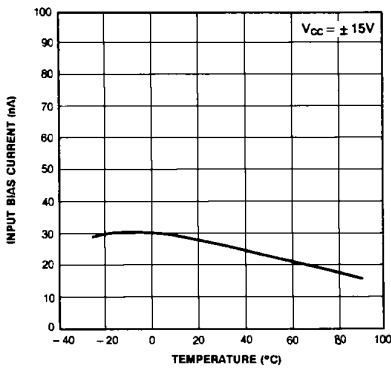


Figure 5. Input Bias Current vs Temperature

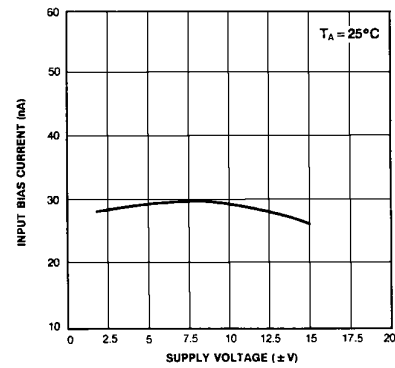


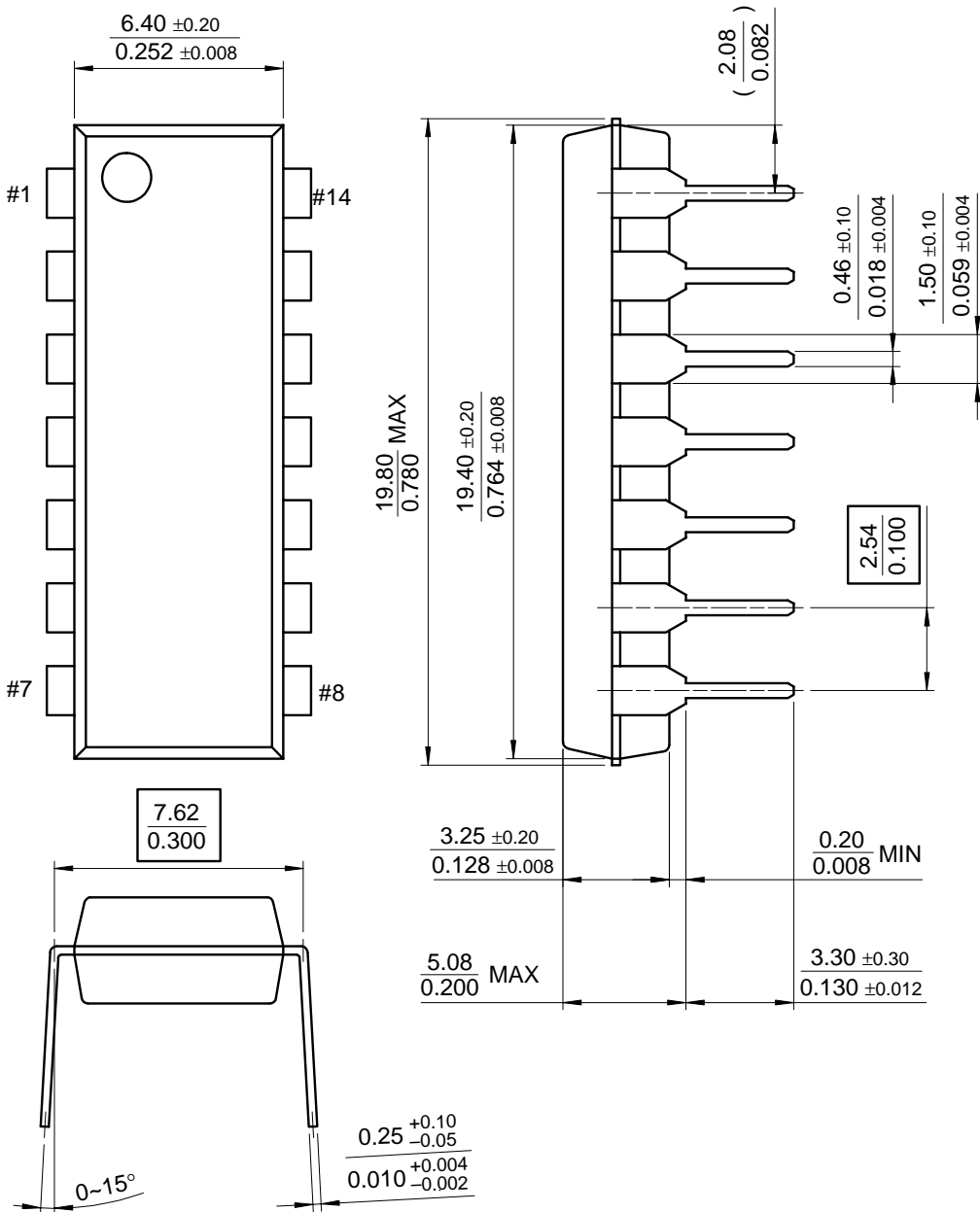
Figure 6. Input Bias Current vs Supply Voltage

Mechanical Dimensions

Package

Dimensions in millimeters

14-DIP

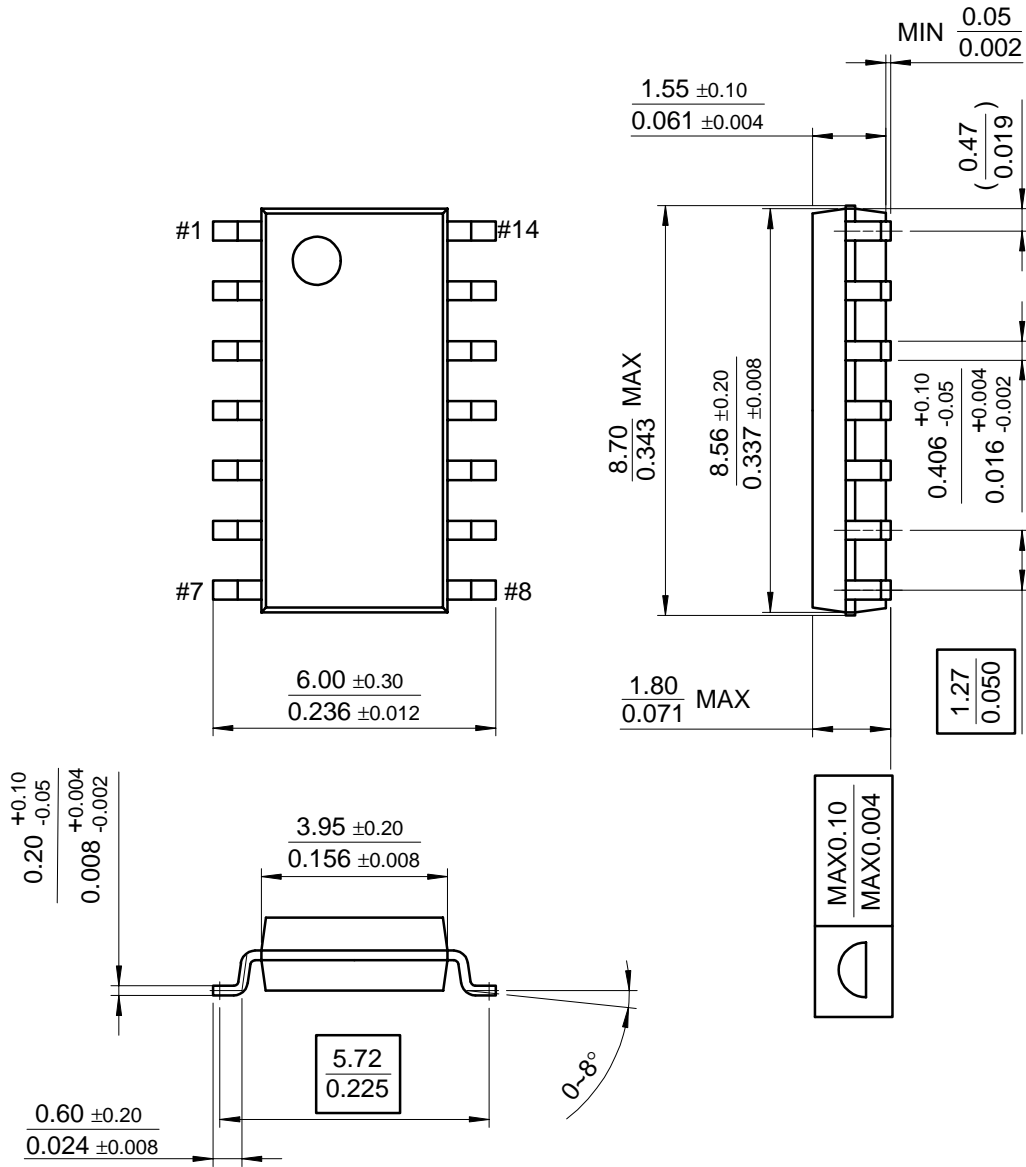


Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

14-SOP



Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| KA3403 | 14-DIP | 0 ~ + 70°C |
| KA3403D | 14-SOP | |
| KA3303 | 14-DIP | -40 ~ + 85°C |
| KA3303D | 14-SOP | |

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