

# KA293/KA293A, KA393/KA393A, KA2903

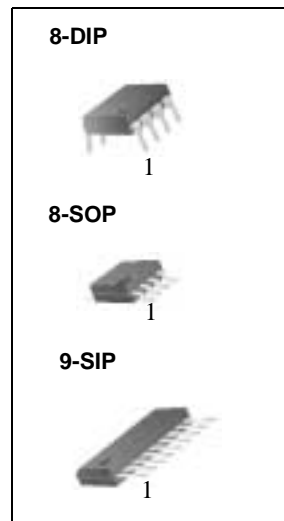
## Dual Differential Comparator

### Features

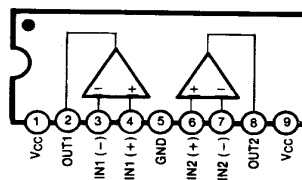
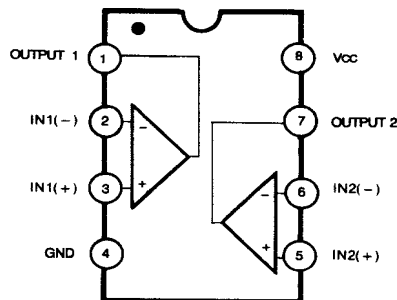
- Single Supply Operation: 2V to 36V
- Dual Supply Operation:  $\pm 1V$  to  $\pm 18V$
- Allow Comparison of Voltages Near Ground Potential
- Low Current Drain 800 $\mu A$  Typ.
- Compatible with all Forms of Logic
- Low Input Bias Current 25nA Typ.
- Low Input Offset Current  $\pm 5nA$  Typ.
- Low Offset Voltage  $\pm 1mV$  Typ.

### Description

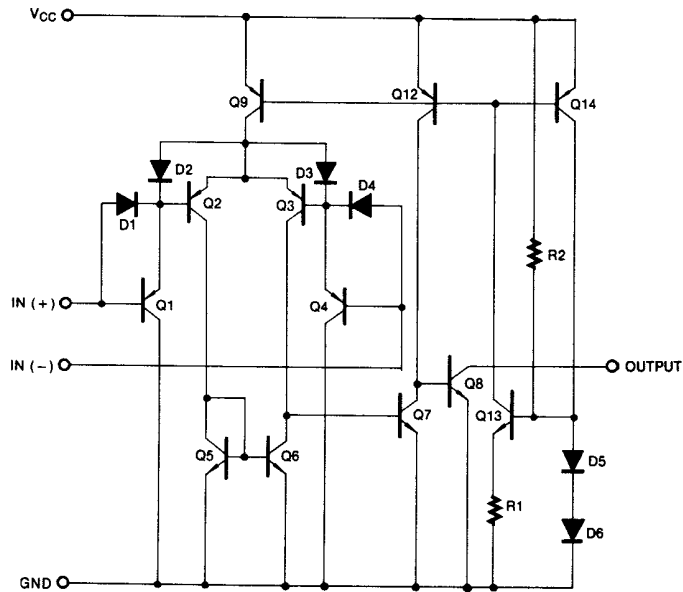
The KA293 series consists of two independent voltage comparators designed to operate from a single power supply over a wide voltage range.



### Internal Block Diagram



## Schematic Diagram



## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Power Supply Voltage	VCC	±18 or 36	V
Differential Input Voltage	VI(DIFF)	36	V
Input Voltage	VI	- 0.3 to +36	V
Output Short Circuit to GND	-	Continuous	-
Power Dissipation, Ta = 25°C 8-DIP 8-SOP	PD	1040 480	mW
Operating Temperature KA393/KA393A KA293/KA293A KA2903	TOPR	0 ~ + 70 - 25 ~ + 85 - 40 ~ + 85	°C
Storage Temperature	TSTG	- 65 ~ + 150	°C

## Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-Ambient Max. 8-DIP 8-SOP	Rθja	120 260	°C/W

## Electrical Characteristics

(VCC = 5V, TA = 25°C, unless otherwise specified)

Parameter	Symbol	Conditions	KA293A/KA393A			KA293/KA393			Unit	
			Min.	Typ.	Max.	Min.	Typ.	Max.		
Input Offset Voltage	V <sub>IO</sub>	V <sub>O(P)</sub> = 1.4V, R <sub>S</sub> = 0Ω	-	±1	±2	-	±1	±5	mV	
		V <sub>CM</sub> = 0 to 1.5V   Note 1	-	-	±4.0	-	-	±9.0		
Input Offset Current	I <sub>IO</sub>		-	±5	±50	-	±5	±50	nA	
		Note 1	-	-	±150	-	-	±150		
Input Bias Current	I <sub>BIAS</sub>		-	65	250	-	65	250	nA	
		Note 1	-	-	400	-	-	400		
Input Common Mode Voltage Range	V <sub>I(R)</sub>		0	-	V <sub>CC</sub> - 1.5	0	-	V <sub>CC</sub> - 1.5	V	
		Note 1	0	-	V <sub>CC</sub> - 2	0	-	V <sub>CC</sub> - 2		
Supply Current	I <sub>CC</sub>	R <sub>L</sub> = ∞, V <sub>CC</sub> = 5V	-	0.6	1	-	0.6	1	mA	
		R <sub>L</sub> = ∞, V <sub>CC</sub> = 30V	-	0.8	2.5	-	0.8	2.5		
Voltage Gain	G <sub>V</sub>	V <sub>CC</sub> = 15V, R <sub>L</sub> ≥ 15KΩ (for large V <sub>O(P-P)</sub> swing)	50	200	-	50	200	-	V/mV	
Large Signal Response Time	T <sub>LRES</sub>	V <sub>I</sub> = TTL Logic Swing V <sub>REF</sub> = 1.4V, V <sub>R</sub> = 5V, R <sub>L</sub> = 5.1KΩ	-	350	-	-	350	-	nS	
Response Time	T <sub>RES</sub>	V <sub>R</sub> = 5V, R <sub>L</sub> = 5.1KΩ	-	1.4	-	-	1.4	-	μS	
Output Sink Current	I <sub>SINK</sub>	V <sub>I(-)</sub> ≥ 1V, V <sub>I(+)</sub> = 0V, V <sub>O(P)</sub> ≤ 1.5V	6	18	-	6	18	-	mA	
Output Saturation Voltage	V <sub>SAT</sub>	V <sub>I(-)</sub> ≥ 1V, V <sub>I(+)</sub> = 0V	-	160	400	-	160	400	mV	
		I <sub>SINK</sub> = 4mA   Note 1	-	-	700	-	-	700		
Output Leakage Current	I <sub>O(LKG)</sub>	V <sub>I(-)</sub> = 0V, V <sub>I(+)</sub> = 1V	V <sub>O(P)</sub> = 5V	-	0.1	-	-	0.1	-	nA
			V <sub>O(P)</sub> = 30V	-	-	1.0	-	-	1.0	μA

### NOTE 1

KA393 / KA393A : 0 ≤ T<sub>A</sub> ≤ +70°C

KA293 / KA293A : -25 ≤ T<sub>A</sub> ≤ +85°C

KA2903 : -40 ≤ T<sub>A</sub> ≤ +85°C

**Electrical Characteristics** (Continued)

(VCC =5V, TA=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	KA2903			Unit
			Min.	Typ.	Max.	
Input Offset Voltage	V <sub>IO</sub>	V <sub>O(P)</sub> =1.4V, R <sub>S</sub> =0Ω	-	±1	±7	mV
		V <sub>CM</sub> = 0 to 1.5V   Note 1	-	±9	±15	
Input Offset Current	I <sub>IO</sub>		-	±5	±50	nA
		Note 1	-	±50	±200	
Input Bias Current	I <sub>BIAS</sub>		-	65	250	nA
		Note 1	-	-	500	
Input Common Mode Voltage Range	V <sub>I(R)</sub>		0	-	V <sub>CC</sub> -1.5	V
		Note 1	0	-	V <sub>CC</sub> -2	
Supply Current	I <sub>CC</sub>	R <sub>L</sub> = ∞, V <sub>CC</sub> = 5V	-	0.6	1	mA
		R <sub>L</sub> = ∞, V <sub>CC</sub> = 30V	-	1	2.5	
Voltage Gain	G <sub>V</sub>	V <sub>CC</sub> =15V, R <sub>L</sub> ≥15KΩ (for large V <sub>O(P-P)</sub> swing)	25	100	-	V/mV
Large Signal Response Time	T <sub>LR</sub>	V <sub>I</sub> =TTL Logic Swing V <sub>REF</sub> =1.4V, V <sub>R</sub> =5V, R <sub>L</sub> =5.1KΩ	-	350	-	nS
Response Time	T <sub>R</sub>	V <sub>R</sub> =5V, R <sub>L</sub> =5.1KΩ	-	1.5	-	μS
Output Sink Current	I <sub>SINK</sub>	V <sub>I(-)</sub> ≥1V, V <sub>I(+)</sub> =0V, V <sub>O(P)</sub> ≤1.5V	6	16	-	mA
Output Saturation Voltage	V <sub>SAT</sub>	V <sub>I(-)</sub> ≥1V, V <sub>I(+)</sub> =0V	-	160	400	mV
		I <sub>SINK</sub> = 4mA   NOTE 1	-	-	700	
Output Leakage Current	I <sub>O(LKG)</sub>	V <sub>I(-)</sub> = 0V, V <sub>O(P)</sub> = 5V	-	0.1	-	nA
		V <sub>I(+)</sub> = 1V, V <sub>O(P)</sub> = 30V	-	-	1.0	μA

**NOTE 1**KA393 / KA393A : 0 ≤ T<sub>A</sub> ≤ +70°CKA293 / KA293A : -25 ≤ T<sub>A</sub> ≤ +85°CKA2903 : -40 ≤ T<sub>A</sub> ≤ +85°C

## Typical Performance Characteristics

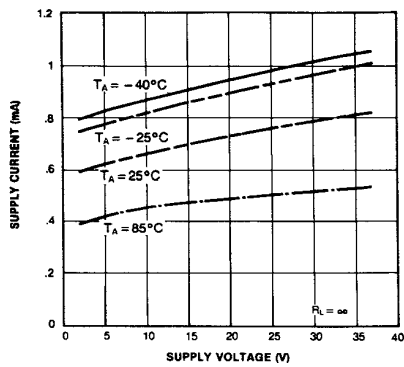


Figure 1. Supply Current vs Supply Voltage

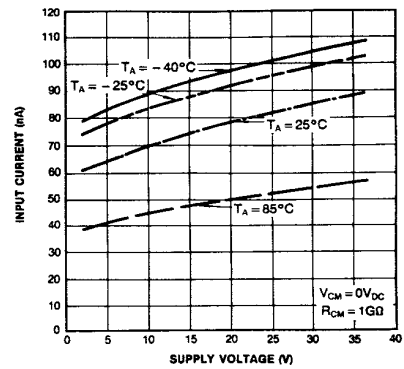


Figure 2. Input Current vs Supply Voltage

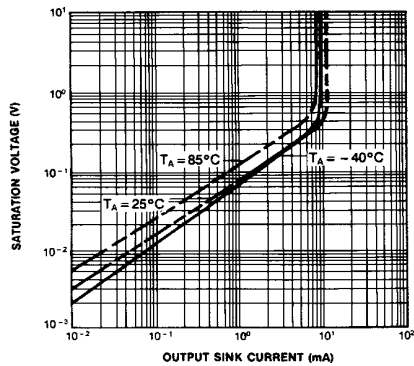


Figure 3. Output Saturation Voltage vs Sink Current

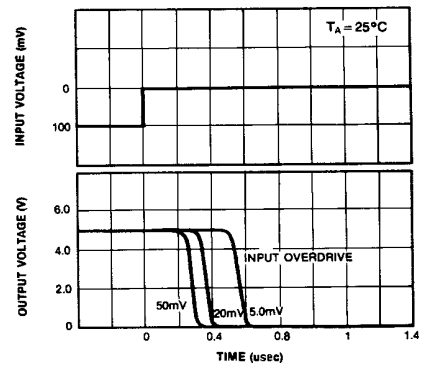


Figure 4. Response Time for Various Input Overdrive-Negative Transition

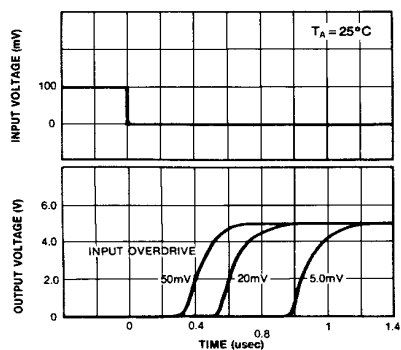


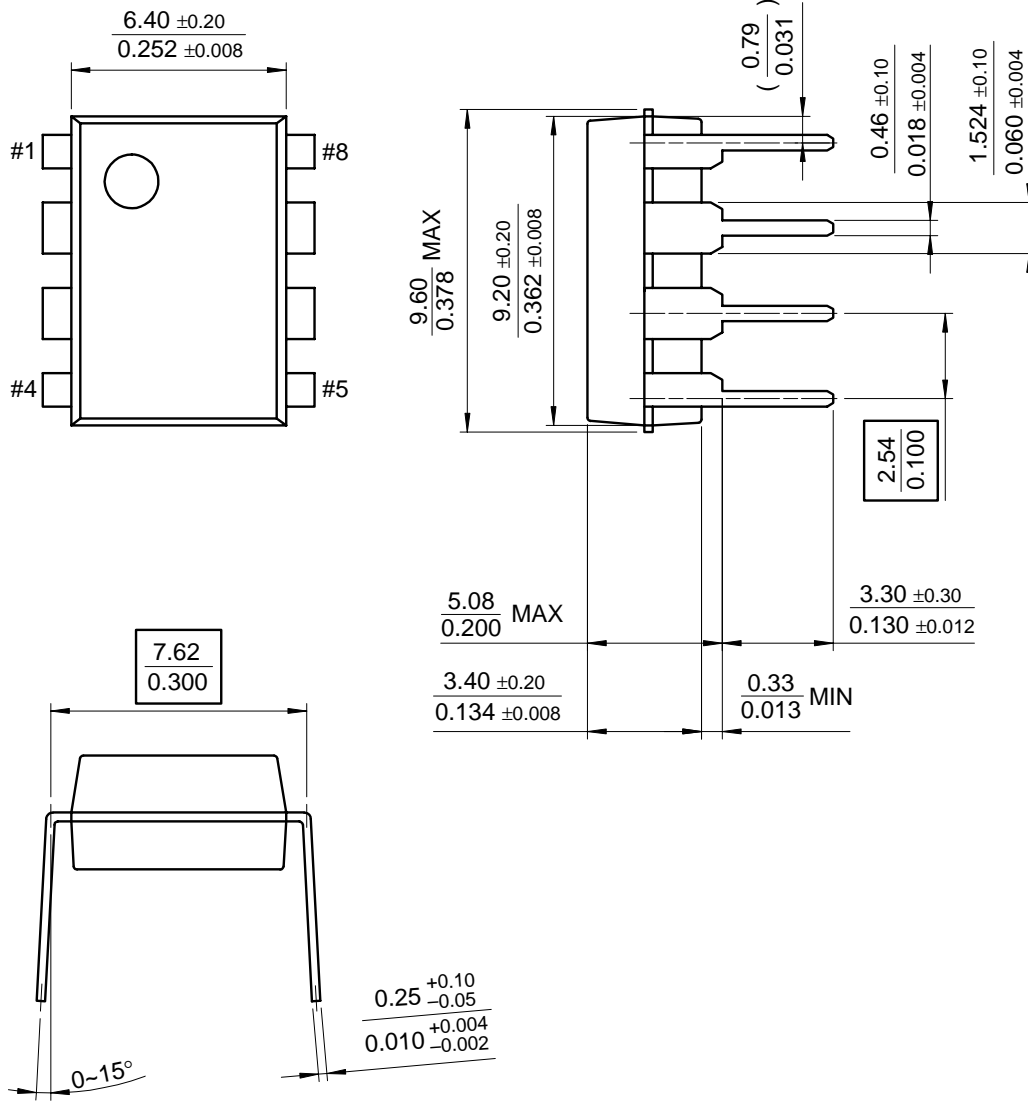
Figure 5. Response Time for Various Input Overdrive-Positive Transition

# Mechanical Dimensions

## Package

Dimensions in millimeters

### 8-DIP

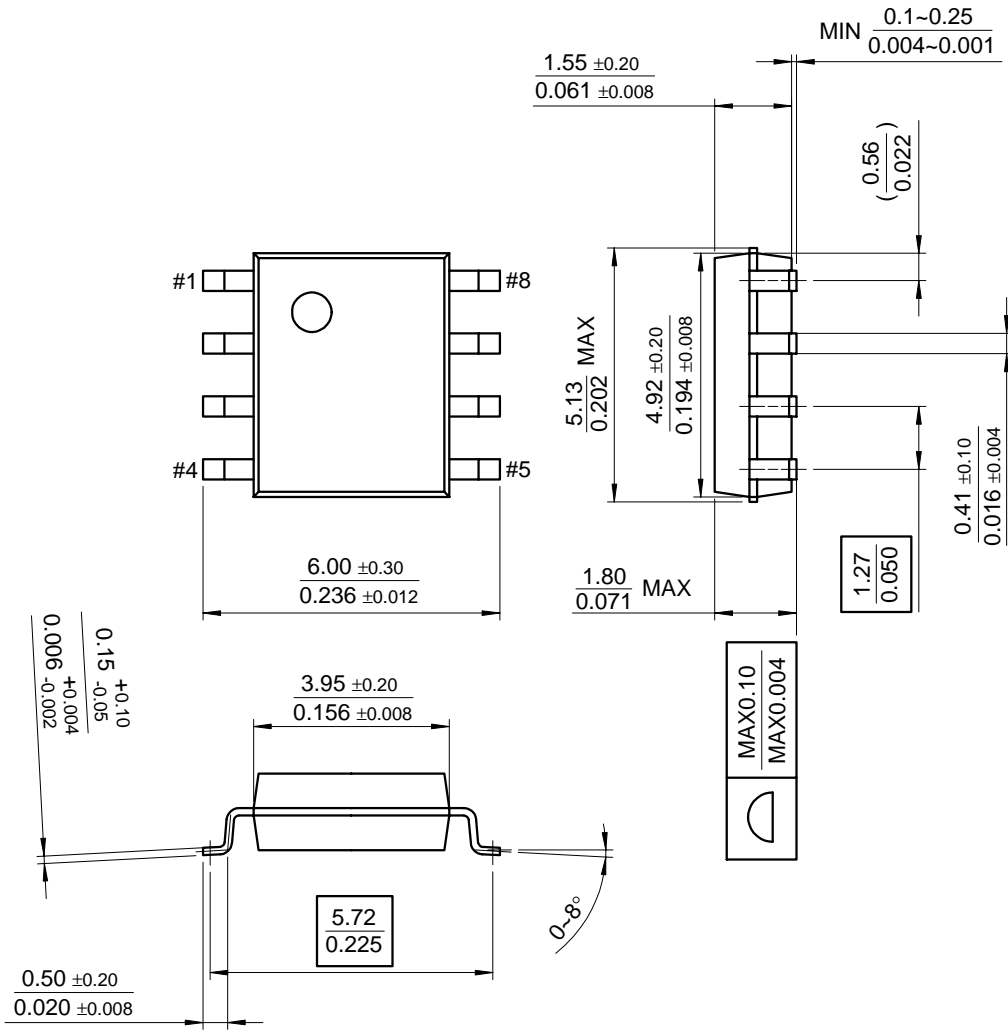


**Mechanical Dimensions** (Continued)

Package

Dimensions in millimeters

**8-SOP**

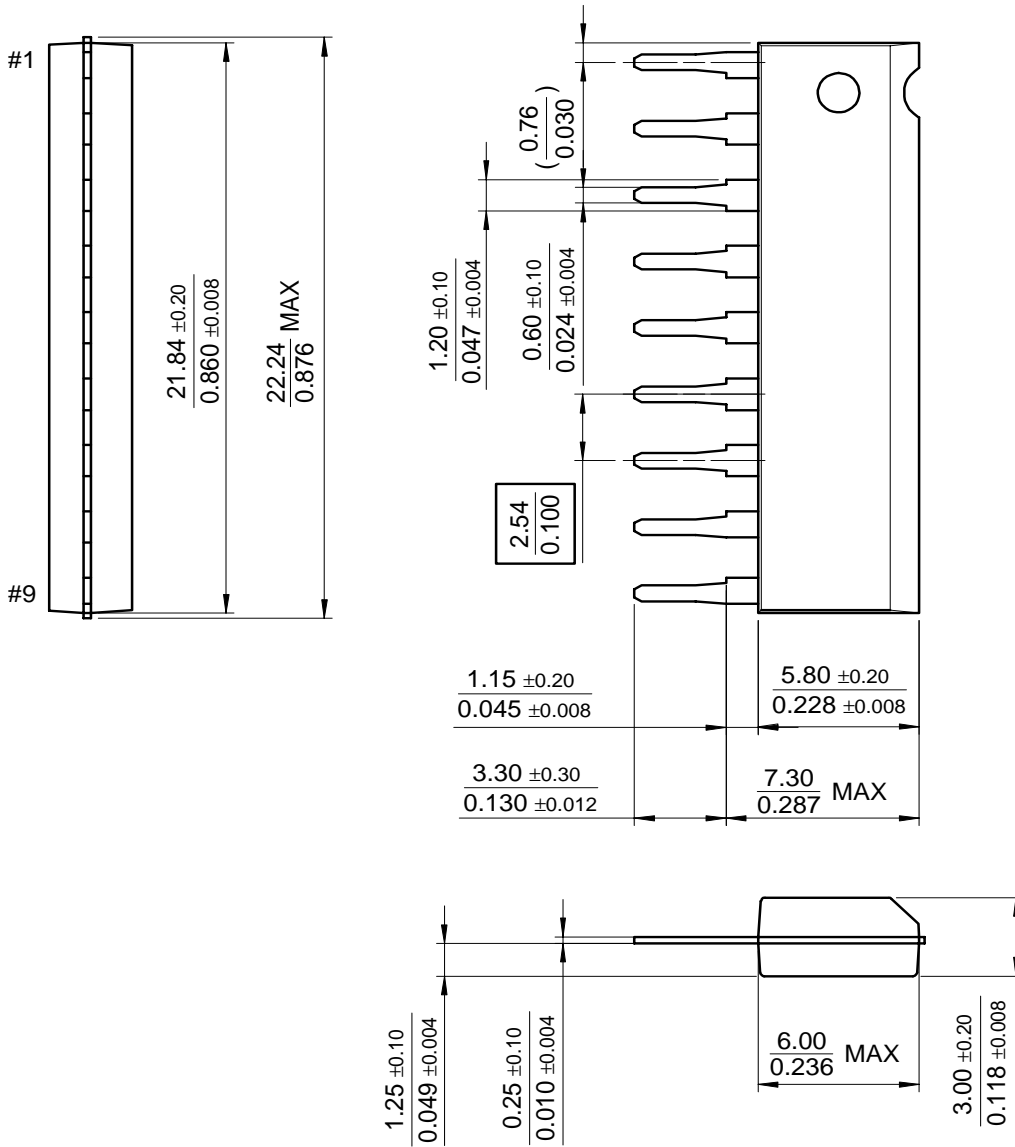


# Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

## 9-SIP





## Ordering Information

Product Number	Package	Operating Temperature
KA393	8-DIP	0 ~ + 70°C
KA393A		
KA393D	8-SOP	
KA393AD		
KA393S	9-SIP	
KA293	8-DIP	-25 ~ + 85°C
KA293A		
KA293D	8-SOP	
KA293AD		
KA2903	8-DIP	-40 ~ + 85°C
KA2903D	8-SOP	

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