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# 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 $\mu A$  Typical
- Compatible with all Forms of Logic
- Low Input Bias Current: 25nA Typical
- Low Input Offset Current:  $\pm 5nA$  Typical
- Low Offset Voltage:  $\pm 1mV$  Typical

## Description

The KA393 / KA393A / KA2903 series consists of two independent voltage comparators designed to operate from a single power supply over a wide voltage range.



Figure 1. DIP Package



Figure 2. SOIC Package

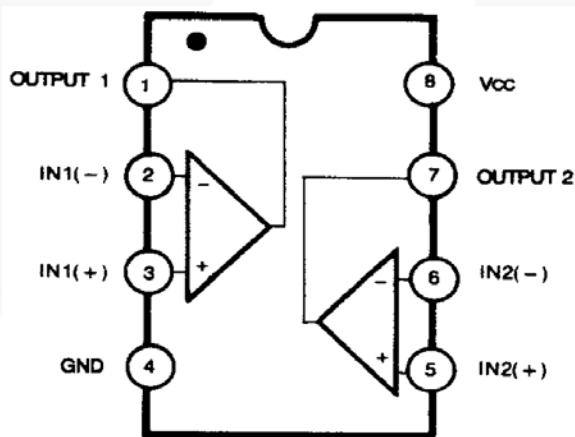


Figure 3. Block Diagram

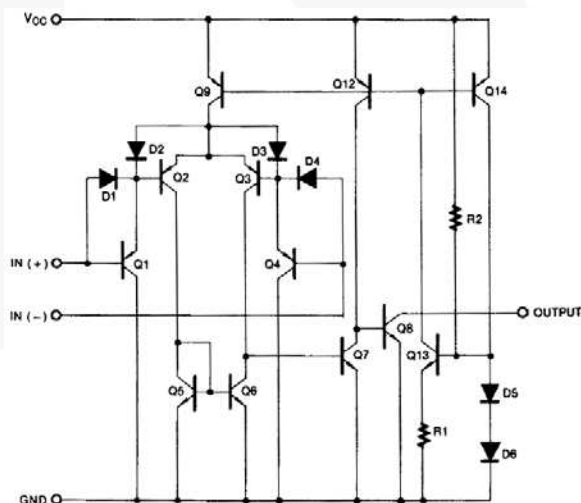


Figure 4. Schematic

## Ordering Information

Part Number	Operating Temperature Range	Package	Packing Method
KA393	0 to 70°C	8-Lead DIP	Tube
KA393A	0 to 70°C		Tube
KA393DTF	0 to 70°C	8-Lead SOIC	Tape and Reel
KA393ADTF	0 to 70°C		Tape and Reel
KA2903DTF	-40 to 85°C		Tape and Reel

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
$V_{CC}$	Power Supply Voltage		$\pm 18$	36	V
$V_{I(DIFF)}$	Differential Input Voltage			36	V
$V_I$	Input Voltage		-0.3	+36.0	V
	Output Short Circuit to GND		Continuous		
$P_D$	Power Dissipation, $T_A = 25^\circ\text{C}$	8-DIP		1040	mW
		8-SOIC		480	
$T_{OPR}$	Operating Temperature	KA393 / KA393A	0	+70	$^\circ\text{C}$
		KA2903	-40	+85	
$T_{STG}$	Storage Temperature		-65	+150	$^\circ\text{C}$
$R\theta_{JA}$	Thermal Resistance, Junction-to-Ambient	8-DIP		120	$^\circ\text{C}/\text{W}$
		8-SOIC		260	
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114		1000	V
		Charged Device Model, JESD22-C101		2000	

## Electrical Characteristics

$V_{CC} = 5V$  and  $T_A = 25^\circ C$ , Unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
$V_{IO}$	Input Offset Voltage	KA393	$V_{O(P)} = 1.4V, R_S = 0\Omega$		$\pm 1$	$\pm 5$	mV
			$V_{CM} = 0$ to $1.5V, T_A = 0$ to $+70^\circ C$			$\pm 9$	
		KA393A	$V_{O(P)} = 1.4V, R_S = 0\Omega$		$\pm 1$	$\pm 2$	
			$V_{CM} = 0$ to $1.5V, T_A = 0$ to $+70^\circ C$			$\pm 4$	
$I_{IO}$	Input Offset Current	$T_A = 25^\circ C$		$\pm 5$	$\pm 50$	nA	
		$T_A = 0$ to $+70^\circ C$			$\pm 150$		
$I_{BIAS}$	Input Bias Current	$T_A = 25^\circ C$		65	250	nA	
		$T_A = 0$ to $+70^\circ C$			400		
$V_{I(R)}$	Input Common-Mode Voltage Range	$T_A = 25^\circ C$	0		$V_{CC} - 1.5$	V	
		$T_A = 0$ to $+70^\circ C$	0		$V_{CC} - 2.0$		
$I_{CC}$	Supply Current	$R_L = \infty, V_{CC} = 5V$		0.6	1.0	mA	
		$R_L = \infty, V_{CC} = 30V$		0.8	2.5		
$V_G$	Voltage Gain	$V_{CC} = 15V, R_L \geq 15K\Omega$ , (for Large $V_{O(P-P)}$ Swing)	50	200		V/mV	
$t_{LRES}$	Large Signal Response Time	$V_I = \text{TTL Logic Swing } V_{REF} = 1.4V$ , $V_{RL} = 5V, R_L = 5.1K\Omega$		350		ns	
$t_{RES}$	Response Time	$V_{RL} = 5V, R_L = 5.1K\Omega$		1.4		$\mu s$	
$I_{SINK}$	Output Sink Current	$V_{I(-)} \geq 1V, V_{I(+)} = 0V, V_{O(P)} \leq 1.5V$	6	18		mA	
$V_{SAT}$	Output Saturation Voltage	$V_{I(-)} \geq 1V, V_{I(+)} = 0V$		160	400	mV	
		$I_{SINK} = 4mA, T_A = 0$ to $+70^\circ C$			700		
$I_{O(LKG)}$	Output Leakage Current	$V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 5V$		0.1		nA	
		$V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 30V$			1.0	$\mu A$	

### KA2903

$V_{IO}$	Input Offset Voltage	$V_{O(P)} = 1.4V, R_S = 0\Omega$		$\pm 1$	$\pm 7$	mV
		$V_{CM} = 0$ to $1.5V, T_A = -40$ to $+85^\circ C$		$\pm 9$	$\pm 15$	
$I_{IO}$	Input Offset Current	$T_A = 25^\circ C$		$\pm 5$	$\pm 50$	nA
		$T_A = -40$ to $+85^\circ C$		$\pm 50$	$\pm 200$	
$I_{BIAS}$	Input Bias Current	$T_A = 25^\circ C$		65	250	nA
		$T_A = -40$ to $+85^\circ C$			500	
$V_{I(R)}$	Input Common-Mode Voltage Range	$T_A = 25^\circ C$	0		$V_{CC} - 1.5$	V
		$T_A = -40$ to $+85^\circ C$	0		$V_{CC} - 2.0$	
$I_{CC}$	Supply Current	$R_L = \infty, V_{CC} = 5V$		0.6	1.0	mA
		$R_L = \infty, V_{CC} = 30V$		1.0	2.5	
$V_G$	Voltage Gain	$V_{CC} = 15V, R_L \geq 15K\Omega$ , (for Large $V_{O(P-P)}$ Swing)	25	100		V/mV
$t_{LRES}$	Large Signal Response Time	$V_I = \text{TTL Logic Swing } V_{REF} = 1.4V$ , $V_{RL} = 5V, R_L = 5.1K\Omega$		350		ns
$t_{RES}$	Response Time	$V_{RL} = 5V, R_L = 5.1K\Omega$		1.5		$\mu s$
$I_{SINK}$	Output Sink Current	$V_{I(-)} \geq 1V, V_{I(+)} = 0V, V_{O(P)} \leq 1.5V$	6	16		mA
$V_{SAT}$	Output Saturation Voltage	$V_{I(-)} \geq 1V, V_{I(+)} = 0V$		160	400	mV
		$I_{SINK} = 4mA, T_A = -40$ to $+85^\circ C$			700	
$I_{O(LKG)}$	Output Leakage Current	$V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 5V$		0.1		nA
		$V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 30V$			1.0	$\mu A$

Typical Performance Characteristics

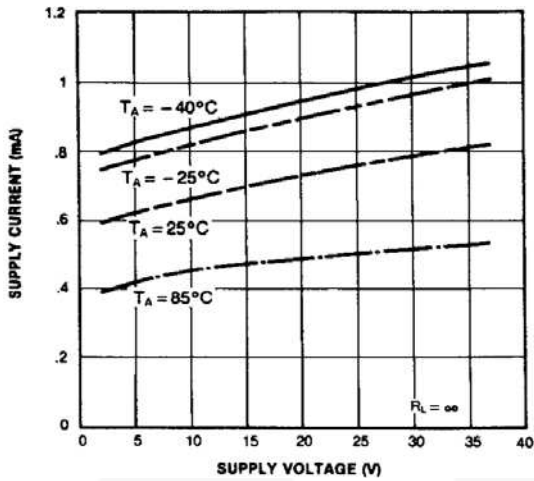


Figure 5. Supply Current vs. Supply Voltage

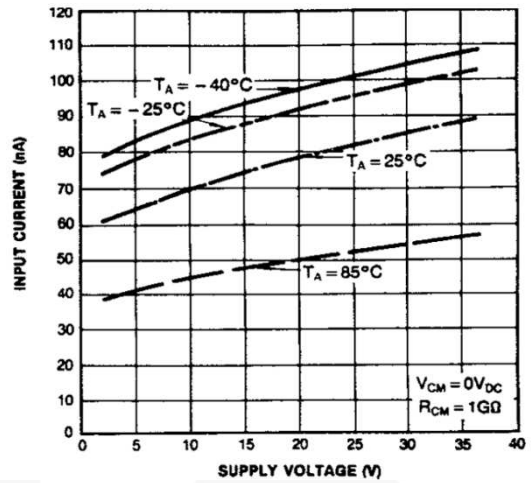


Figure 6. Input Current vs. Supply Voltage

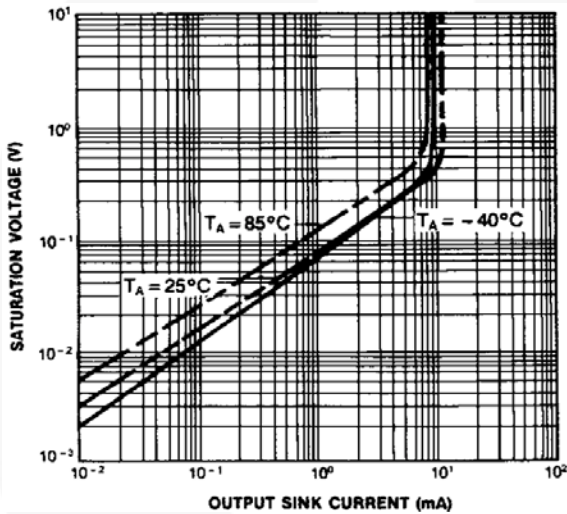


Figure 7. Output Saturation Voltage vs. Sink Current

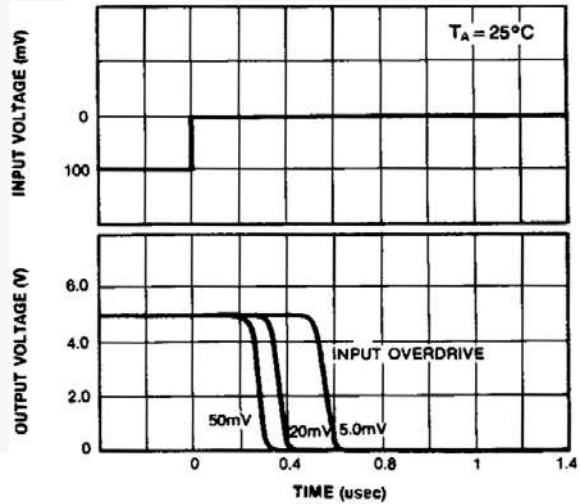


Figure 8. Response Time for Various Input Overdrive-Negative Transitions

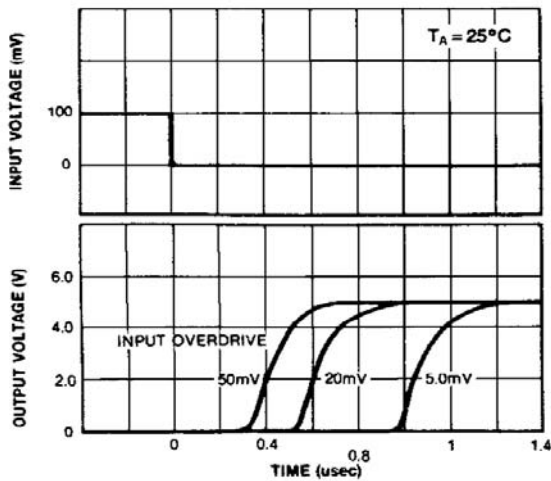


Figure 9. Response Time for Various Input Overdrive-Positive Transitions

Physical Dimensions

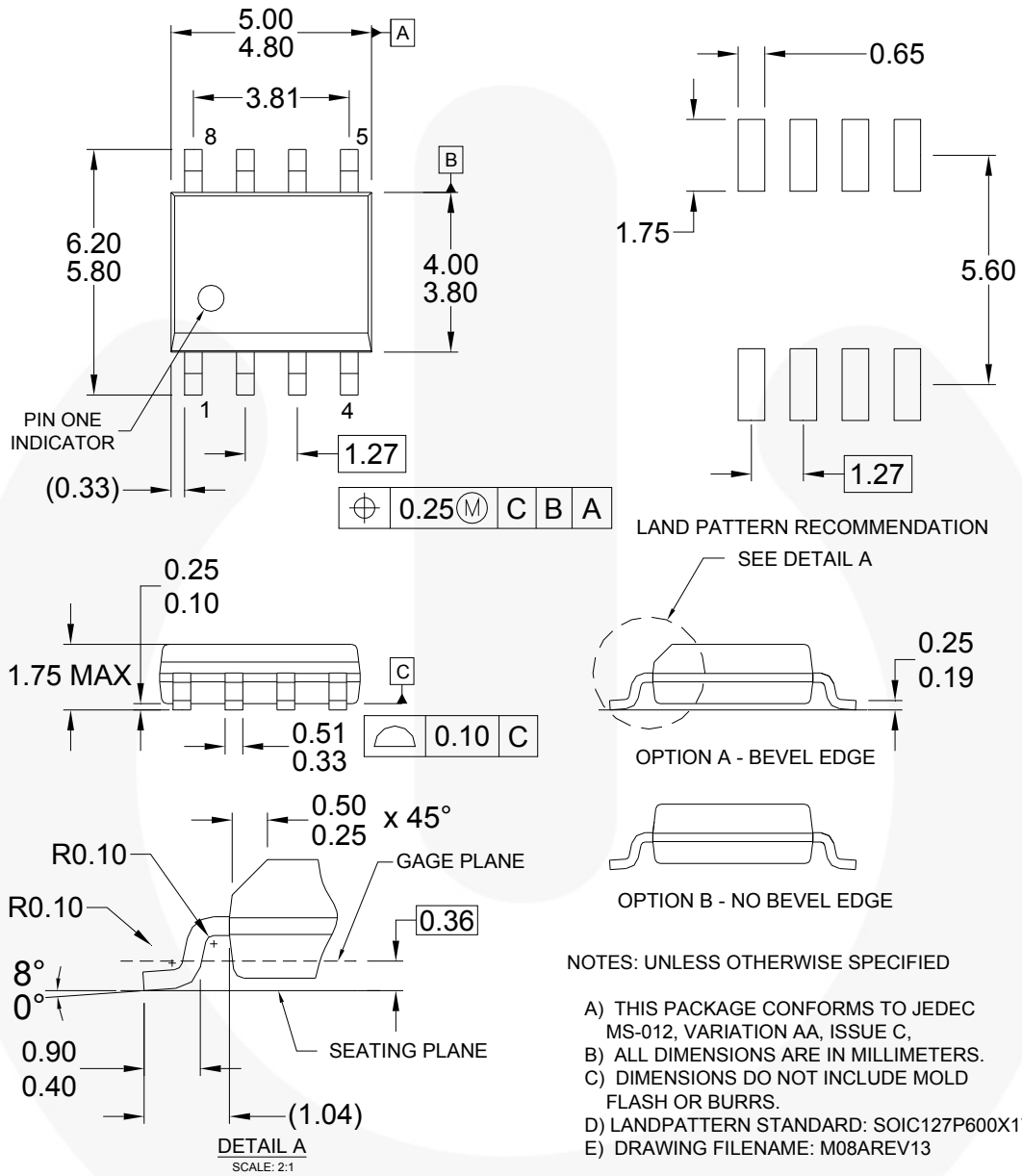
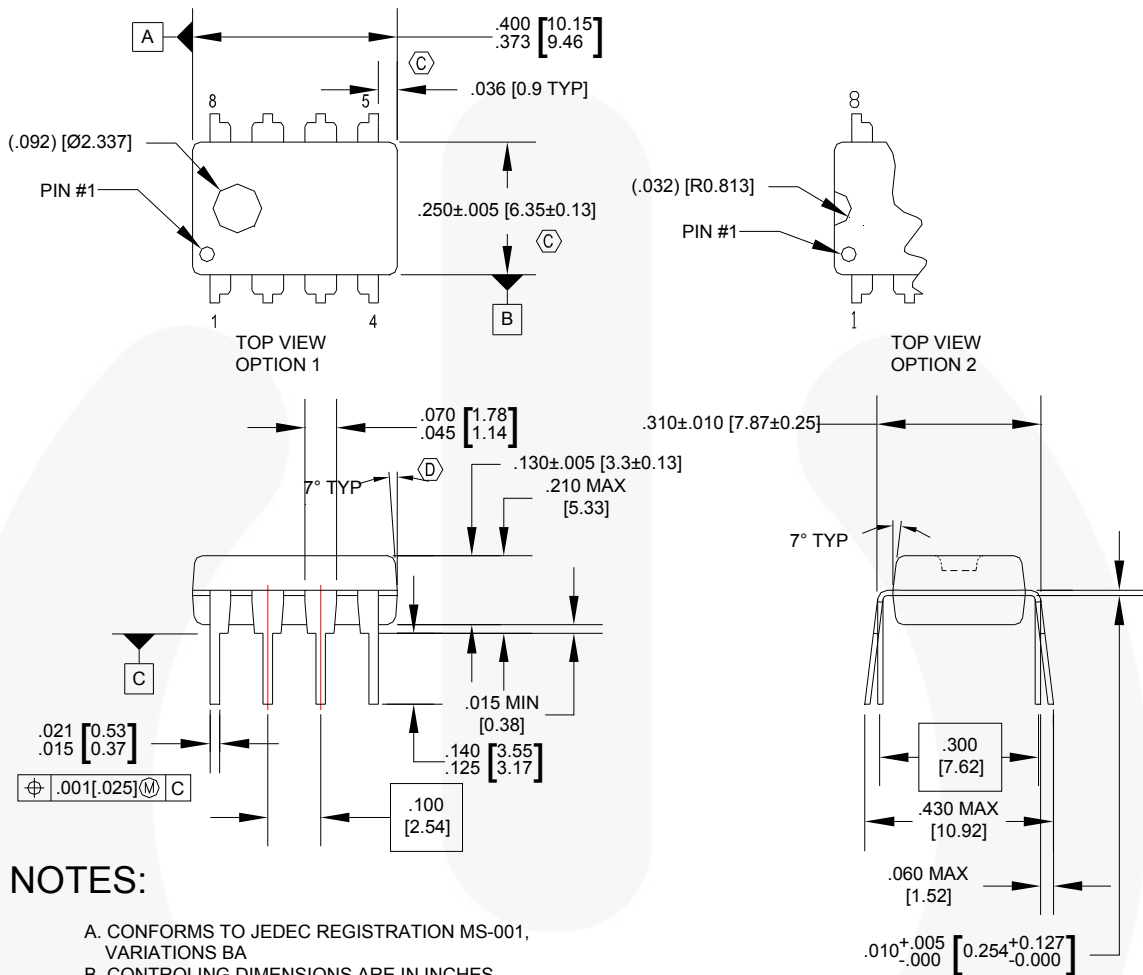


Figure 10.8-Lead, Small-Outline Integrated Circuit (SOIC), JEDEC MS-012, .150" Narrow Body

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Physical Dimensions



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MS-001, VARIATIONS BA
- B. CONTROLLING DIMENSIONS ARE IN INCHES  
REFERENCE DIMENSIONS ARE IN MILLIMETERS
- C. DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCHES OR 0.25MM.
- D. DOES NOT INCLUDE DAMBAR PROTRUSIONS.  
DAMBAR PROTRUSIONS SHALL NOT EXCEED .010 INCHES OR 0.25MM.
- E. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

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Figure 1. 8-Lead, DIP, JEDEC MS-001, .300" Wide

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