LM2903,LM393/LM393A,LM293A

Dual Differential Comparator

Features

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

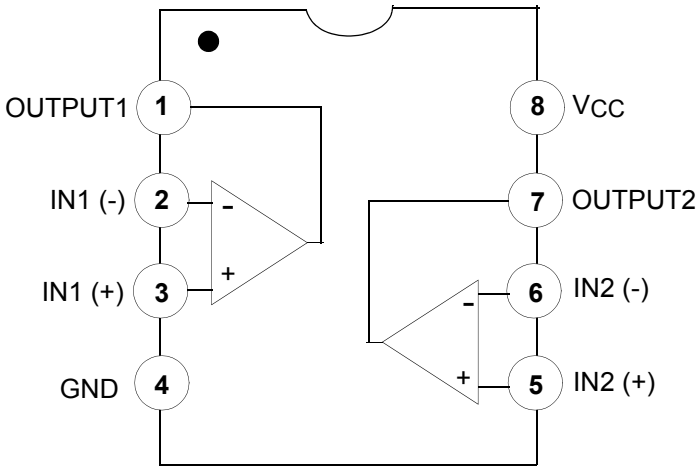
Description

The LM2903, LM393/LM393A, LM293A consist of two independent voltage comparators designed to operate from a single power supply over a wide voltage range.

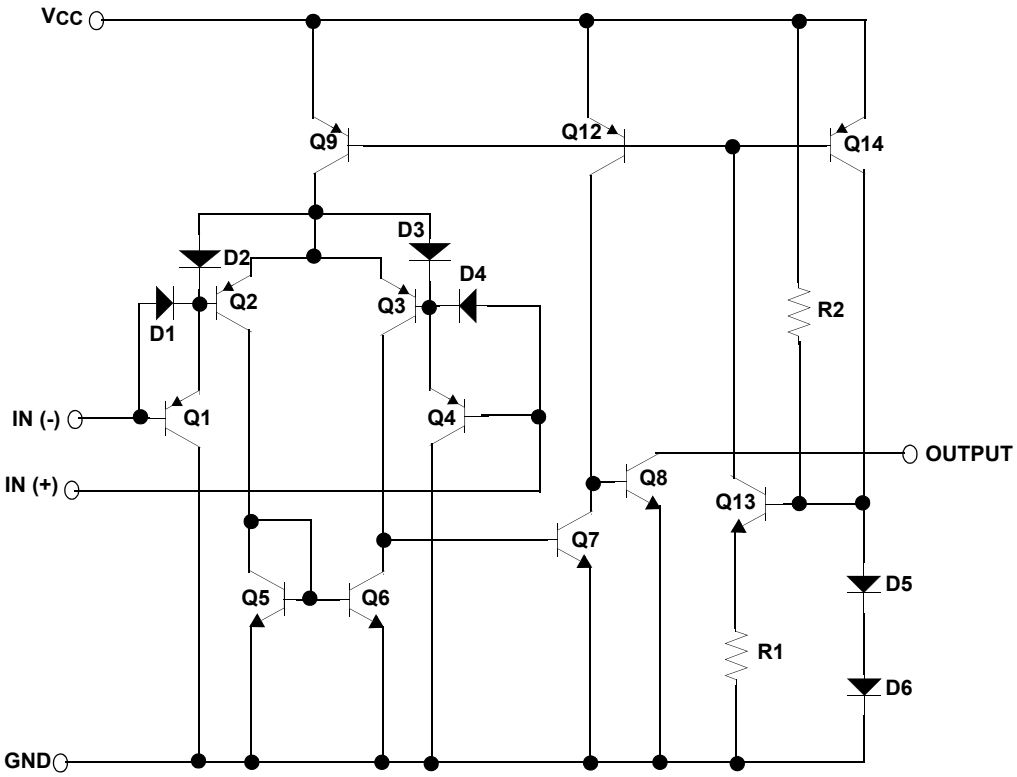
8-DIP

8-SOP

Internal Block Diagram



Schematic Diagram



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	±18 or 36	V
Differential Input Voltage	$V_{I(DIFF)}$	36	V
Input Voltage	V_I	-0.3 to +36	V
Output Short Circuit to GND	-	Continuous	-
Power Dissipation, T_a = 25°C 8-DIP 8-SOP	P_D	 1040 480	mW
Operating Temperature LM393/LM393A LM2903 LM293A	T_{OPR}	 0 ~ +70 -40 ~ +105 -25 ~ +85	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-Ambient Max. 8-DIP 8-SOP	$R_{\theta ja}$	 120 260	°C/W

Electrical Characteristics

(V_{CC} = 5V, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Conditions		LM293A/LM393A			LM393			Unit
				Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	V_{IO}	$V_{O(P)}$ =1.4V, R_S = 0Ω		-	±1	±2	-	±1	±5	mV
		V_{CM}= 0 to 1.5V	Note1	-	-	±4.0	-	-	±9.0	
Input Offset Current	I_{IO}			-	±5	±50	-	±5	±50	nA
			Note1	-	-	±150	-	-	±150	
Input Bias Current	I_{BIAS}			-	65	250	-	65	250	nA
			Note1	-	-	400	-	-	400	
Input Common Mode Voltage Range	$V_{I(R)}$			0	-	V_{CC} -1.5	0	-	V_{CC} -1.5	V
			Note1	0	-	V_{CC}-2	0	-	V_{CC}-2	
Supply Current	I_{CC}	R_L = ∞ , V_{CC} = 5V		-	0.6	1	-	0.6	1	mA
		R_L = ∞, V_{CC} = 30V		-	0.8	2.5	-	0.8	2.5	
Voltage Gain	G_V	V_{CC} =15V, R_L ≥ 15kΩ (for large $V_{O(P-P)swing}$)		50	200	-	50	200	-	V/mV
Large Signal Response Time	T_{LRES}	V_I =TTL Logic Swing V_{REF} =1.4V, V_{RL} = 5V, R_L = 5.1kΩ		-	350	-	-	350	-	nS
Response Time	T_{RES}	V_{RL} =5V, R_L =5.1kΩ		-	1.4	-	-	1.4	-	μS
Output Sink Current	I_{SINK}	$V_{I(-)}$ ≥ 1V, $V_{I(+)}$ =0V, $V_{O(P)}$ ≤1.5V		6	18	-	6	18	-	mA
Output Saturation Voltage	V_{SAT}	$V_{I(-)}$ ≥ 1V, VI(+) = 0V		-	160	400	-	160	400	mV
		I_{SINK} = 4mA	Note1	-	-	700	-	-	700	
Output Leakage Current	$I_{O(LKG)}$	$V_{I(-)}$ = 0V, $V_{I(+)}$ = 1V	$V_{O(P)}$ = 5V	-	0.1	-	-	0.1	-	nA
			$V_{O(P)}$ = 30V	-	-	1.0	-	-	1.0	μA

Note1
LM393/LM393A: 0 ≤ T_A ≤ +70°C
LM2903: -40 ≤ T_A ≤ +105°C
LM293A : -25 ≤ T_A ≤ +85°C

Electrical Characteristics (Continued)

(V_{CC} = 5V, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Conditions		LM2903			Unit
				Min.	Typ.	Max.	
Input Offset Voltage	V_{IO}	$V_{O(P)}$ =1.4V, R_S = 0Ω		-	±1	±7	mV
		V_{CM}= 0 to 1.5V	Note1	-	±9	±15	
Input Offset Current	I_{IO}			-	±5	±50	nA
			Note1	-	±50	±200	
Input Bias Current	I_{BIAS}			-	65	250	nA
			Note1	-	-	500	
Input Common Mode Voltage Range	$V_{I(R)}$			0	-	V_{CC} -1.5	V
			Note1	0	-	V_{CC}-2	
Supply Current	I_{CC}	R_L = ∞, V_{CC} = 5V		-	0.6	1	mA
		R_L = ∞, V_{CC} = 30V		-	1	2.5	
Voltage Gain	G_V	V_{CC} =15V, R_L≥15kΩ (for large $V_{O(P-P)swing}$)		25	100	-	V/mV
Large Signal Response Time	T_{LRES}	V_I =TTL Logic Swing V_{REF} =1.4V, V_{RL} = 5V, R_L = 5.1kΩ		-	350	-	nS
Response Time	T_{RES}	V_{RL} = 5V, R_L = 5.1kΩ		-	1.5	-	μS
Output Sink Current	I_{SINK}	$V_{I(-)}$ ≥ 1V, $V_{I(+)}$ = 0V, $V_{O(P)}$ ≤ 1.5V		6	16	-	mA
Output Saturation Voltage	V_{SAT}	$V_{I(-)}$ ≥ 1V, VI(+) = 0V		-	160	400	mV
		I_{SINK} = 4mA	Note1	-	-	700	
Output Leakage Current	$I_{O(LKG)}$	$V_{I(-)}$ = 0V,	$V_{O(P)}$ = 5V	-	0.1	-	nA
		$V_{I(+)}$ = 1V	$V_{O(P)}$ = 30V	-	-	1.0	μA

Note1
LM393/LM393A: 0 ≤ T_A ≤ +70°C
LM2903: -40 ≤ T_A ≤ +105°C
LM293A : -25 ≤ T_A ≤ +85°C

Typical Performance Characteristics

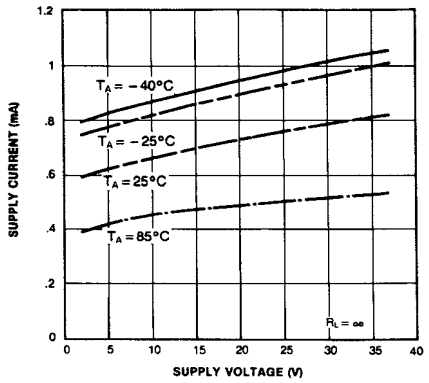


Figure 1. Supply Current vs Supply Voltage

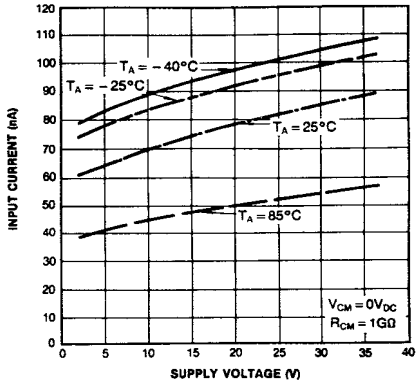


Figure 2. Input Current vs Supply Voltage

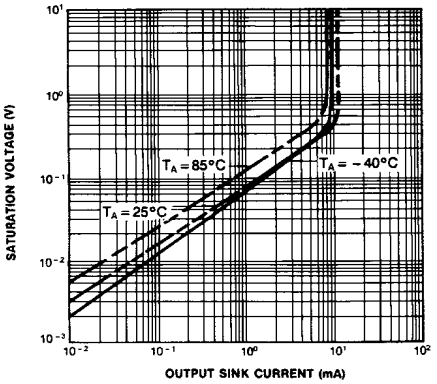


Figure 3. Output Saturation Voltage vs Sink Current

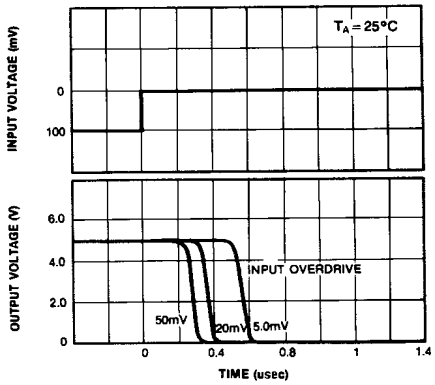


Figure 4. Response Time for Various Input Overdrive-Negative Transition

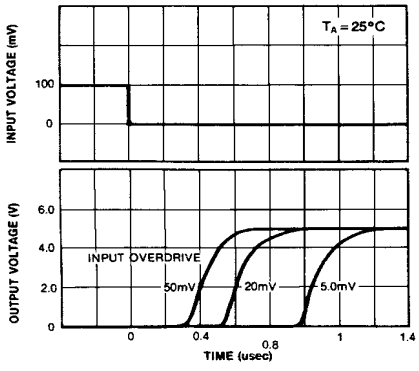


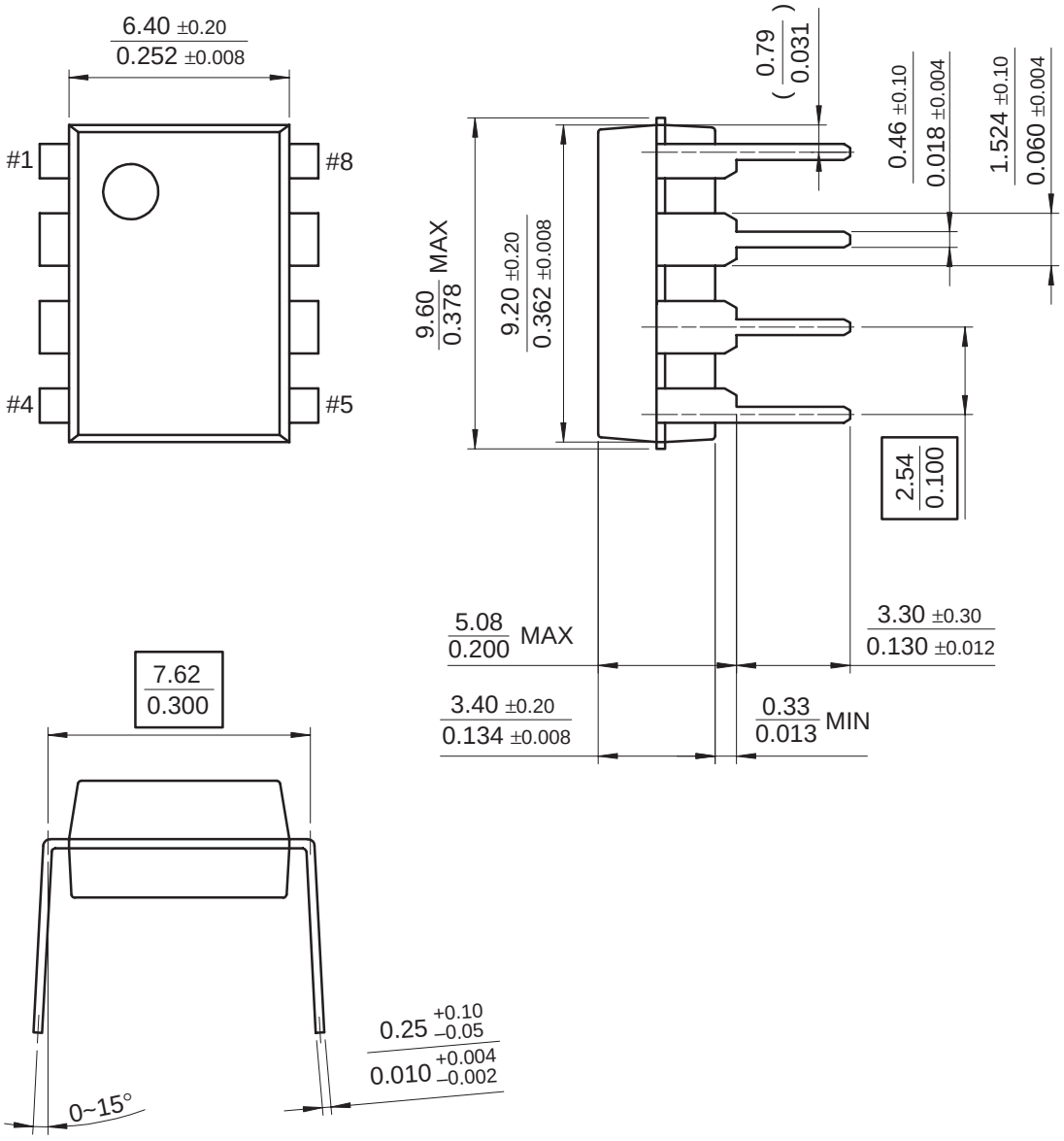
Figure 5. Response Time for Various Input Overdrive-Positive Transition

Mechanical Dimensions

Package

Dimensions in millimeters

8-DIP

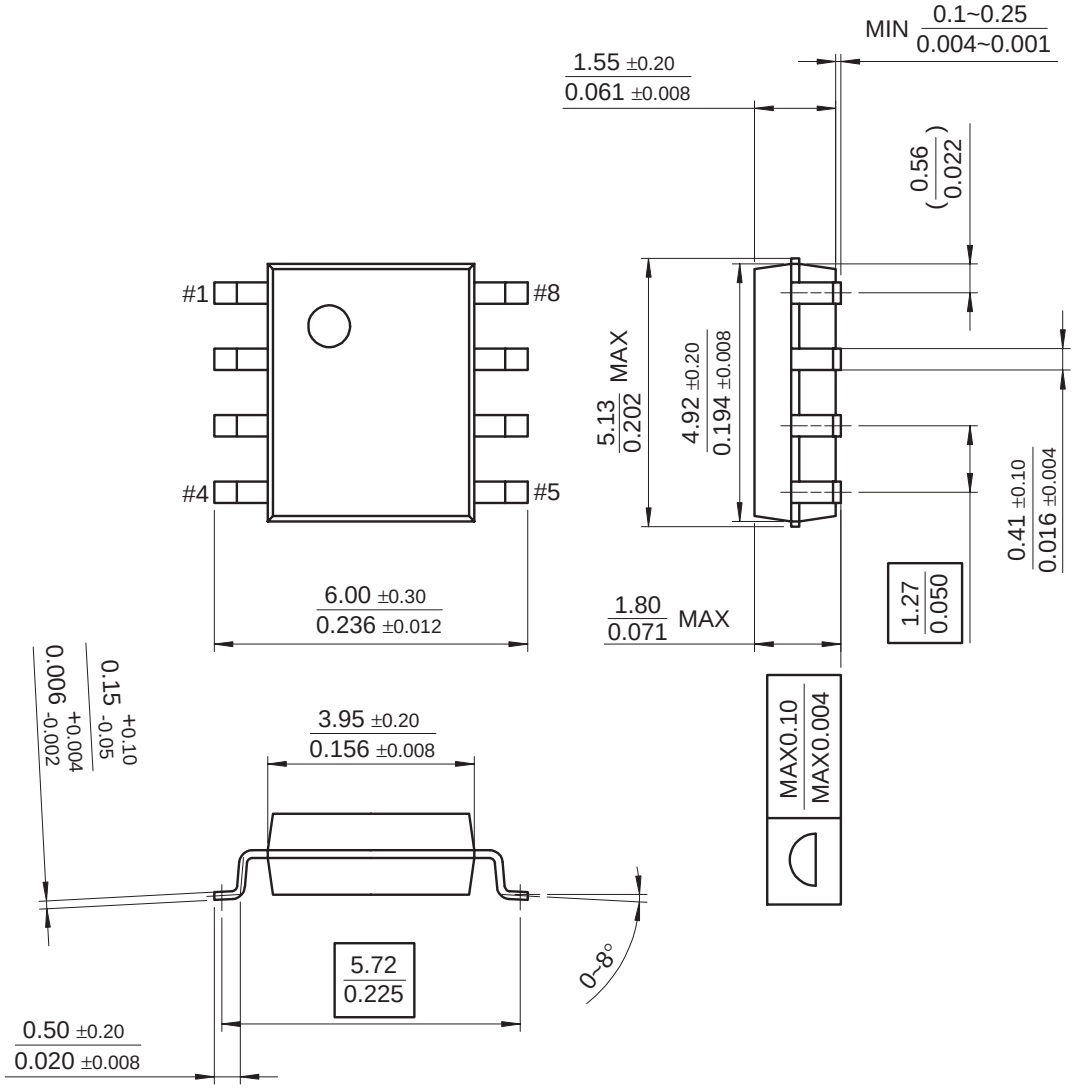


Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

8-SOP



Ordering Information

Product Number	Package	Operating Temperature
LM393N	8-DIP	0 ~ +70°C
LM393AN		
LM393M	8-SOP	
LM393AM		
LM2903N	8-DIP	-40 ~ +105°C
LM2903M	8-SOP	
LM293AN	8-DIP	-25 ~ +85°C
LM293AM	8-SOP	