

**DUAL DIFFERENTIAL COMPARATOR**

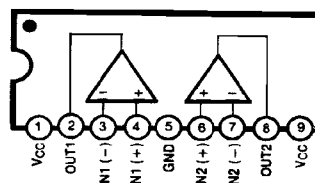
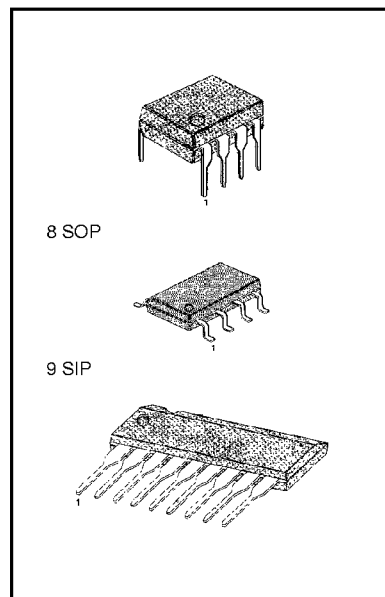
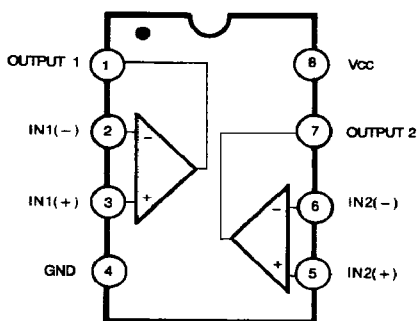
8 DIP

The LM293 series consists of two independent voltage comparators designed to operate from a single power supply over a wide voltage range.

**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  $\pm 5nA$  WP
- Low Offset Voltage  $\pm 1mV$  Typ

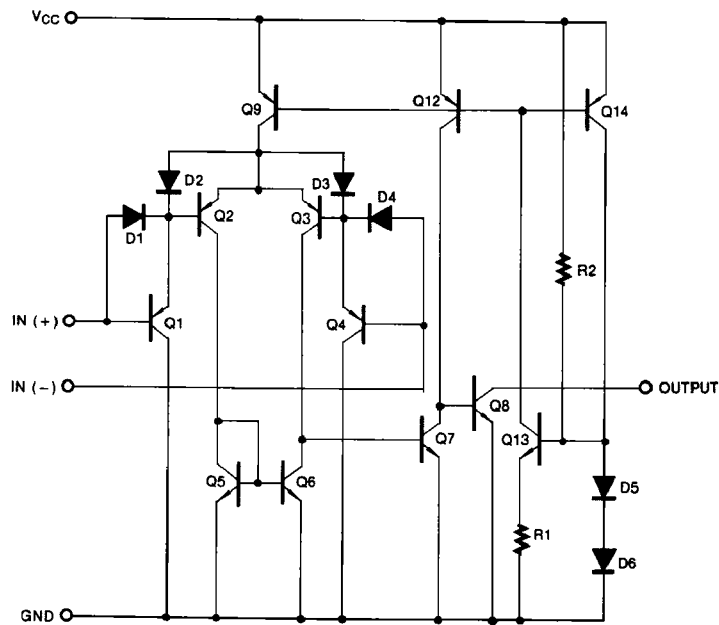
**BLOCK DIAGRAM**



**ORDERING INFORMATION**

Device	Package	Operating Temperature
LM393N LM393AN	8 DIP	0 ~ + 75°C
LM393S LM393AS	9 SIP	
LM393M LM393AM	8 SOP	
LM293N LM293AN	8 DIP	
LM293S LM293AS	9 DIP	
LM293M LM293AM	8 SOP	
LM2903N LM2903M	8 DIP 8 SOP	-40 ~ + 85°C
LM2903S	9 SIP	

**SCHEMATIC DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

Characteristic	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}$	$\pm 18$ 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	$P_D$	570	mW
Operating Temperature	$T_{OPR}$	0 ~ + 70	°C
LM393/LM393A		- 25 ~ + 85	
LM293/LM293A		- 40 ~ + 85	
Storage Temperature	$T_{STG}$	- 65 ~ + 150	°C

**ELECTRICAL CHARACTERISTICS** ( $V_{CC}=5V$ ,  $T_A=25^\circ C$ , unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM293A/LM393A			LM293/LM393			Unit
			Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$V_{IO}$	$V_{CM}=0V$ to $V_{CC}=1.5V$ $V_{O(P)}=1.4V$ , $R_S=0\Omega$ NOTE 1		$\pm 1$	$\pm 2$		$\pm 1$	$\pm 5$	mV
Input Offset Current	$I_{IO}$	NOTE 1		$\pm 5$	$\pm 50$		$\pm 5$	$\pm 50$	nA
Input Bias Current	$I_{BIAS}$	NOTE 1		65	250		65	250	nA
Input Common Mode Voltage Range	$V_{I(R)}$	NOTE 1	0		$V_{CC}-1.5$	0		$V_{CC}-1.5$	V
Supply Current	$I_{CC}$	$R_L = \infty$ $R_L = \infty$ , $V_{CC} = 30V$		0.6	1		0.6	1	mA
Voltage Gain	$G_V$	$V_{CC}=15V$ , $R_L \geq 15K\Omega$ (for large $V_{O(P)}$ -Pulse Swing)	50	200		50	200		V/mV
Large Signal Response Time	$t_{RES}$	$V_I = \text{TTL Logic Swing}$ $V_{REF}=1.4V$ , $V_{RL}=5V$ , $R_L=5.1K\Omega$		350			350		ns
Response Time	$t_{RES}$	$V_{RL}=5V$ , $R_L=5.1K\Omega$		1.4			1.4		$\mu s$
Output Sink Current	$I_{SINK}$	$V_{I(-)} \geq 1V$ , $V_{I(+)} = 0V$ , $V_{O(P)} \leq 1.5V$	6	18		6	18		mA
Output Saturation Voltage	$V_{SAT}$	$V_{I(-)} \geq 1V$ , $V_{I(+)} = 0V$ $I_{SINK} = 4mA$ NOTE 1		160	400		160	400	mV
Output Leakage Current	$I_{O(LKG)}$	$V_{I(-)} = 0V$ , $V_{I(+)} = 1V$ NOTE 1		0.1			0.1		nA
		$V_{O(P)} = 30V$			1.0			1.0	$\mu A$

## NOTE 1

LM393/A:  $0 \leq T_A \leq +70^\circ C$ LM293/A:  $-25 \leq T_A \leq +85^\circ C$ LM2903:  $-40 \leq T_A \leq +85^\circ C$

**ELECTRICAL CHARACTERISTICS** ( $V_{CC}=5V$ ,  $T_A=25^\circ C$ , unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM2903			Unit
			Min	Typ	Max	
Input Offset Voltage	$V_{IO}$	$V_{CM}=0V$ to $V_{CC}=1.5V$		$\pm 1$	$\pm 7$	mV
		$V_{O(P)}=1.4V$ , $R_S=0\Omega$ NOTE 1		$\pm 9$	$\pm 15$	
Input Offset Current	$I_{IO}$			$\pm 5$	$\pm 50$	nA
		NOTE 1		$\pm 50$	$\pm 200$	
Input Bias Current	$I_{BIAS}$			65	250	nA
		NOTE 1			500	
Input Common Mode Voltage Range	$V_{I(R)}$		0		$V_{CC}-1.5$	V
		NOTE 1	0		$V_{CC}-2$	
Supply Current	$I_{CC}$	$R_L = \infty$		0.6	1	mA
		$R_L = \infty$ , $V_{CC} = 30V$		1	2.5	
Voltage Gain	$G_V$	$V_{CC}=15V$ , $R_L \geq 15K\Omega$ (for large $V_{O(P-P)swing}$ )	25	100		V/mV
Large Signal Response Time	$t_{RES}$	$V_I = TTL$ Logic Swing $V_{REF}=1.4V$ , $V_{RL}=5V$ , $R_L=5.1K\Omega$		350		ns
Response Time	$t_{RES}$	$V_{RL}=5V$ , $R_L=5.1K\Omega$		1.5		$\mu s$
Output Sink Current	$I_{SINK}$	$V_{I(-)} \geq 1V$ , $V_{I(+)} = 0V$ , $V_{O(P)} \leq 1.5V$	6	16		mA
Output Saturation Voltage	$V_{SAT}$	$V_{I(-)} \geq 1V$ , $V_{I(+)} = 0V$		160	400	mV
		$I_{SINK} = 4mA$ NOTE 1			700	
Output Leakage Current	$I_{O(LKG)}$	$V_{I(-)} = 0V$ , $V_{I(+)} = 1V$		0.1		nA
		$V_{O(P)} = 5V$ $V_{O(P)} = 30V$			1.0	$\mu A$

NOTE 1

LM393/A:  $0 \leq T_A \leq +70^\circ C$ LM293/A:  $-25 \leq T_A \leq +85^\circ C$ LM2903:  $-40 \leq T_A \leq +85^\circ C$

TYPICAL PERFORMANCE CHARACTERISTICS

Fig. 1 SUPPLY CURRENT

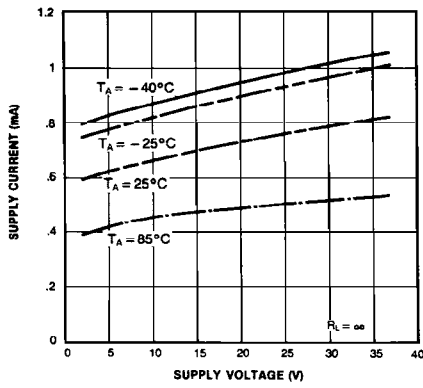


Fig. 2 INPUT CURRENT

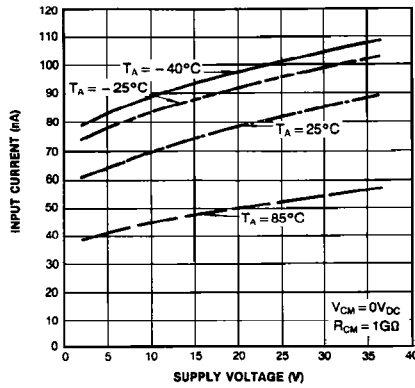


Fig. 3 OUTPUT SATURATION VOLTAGE

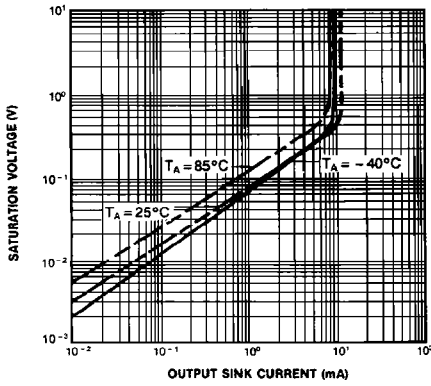


Fig. 4 RESPONSE TIME FOR VARIOUS INPUT OVERDRIVE-NEGATIVE TRANSITION

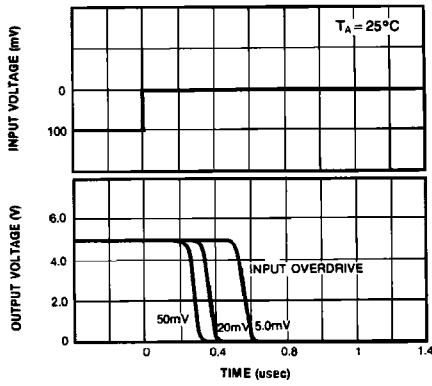
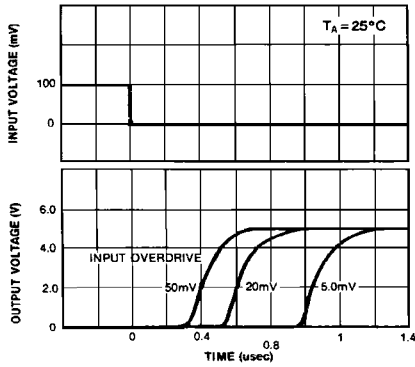


Fig. 5 RESPONSE TIME FOR VARIOUS INPUT OVERDRIVE-POSITIVE TRANSITION



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