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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

www.fairchildsemi.com

LM2903,LM393/LM393A,LM293A

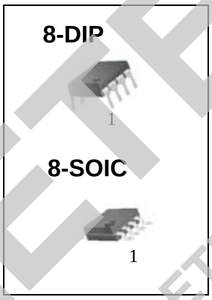
Dual Differential Comparator

Features

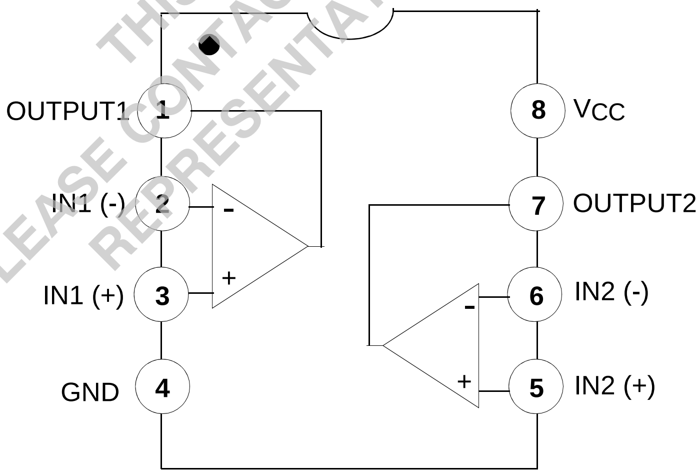
- Single Supply Operation: 2V to 36V
- Dual Supply Operation: ±1V to ±18V
- Allow Comparison of Voltages Near Ground Potential
- Low Current Drain 800μA Typ.
- Compatible with all Forms of Logic
- Low Input Bias Current 25nA Typ.
- Low Input Offset Current ±5nA Typ.
- Low Offset Voltage ±1mV Typ.

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.

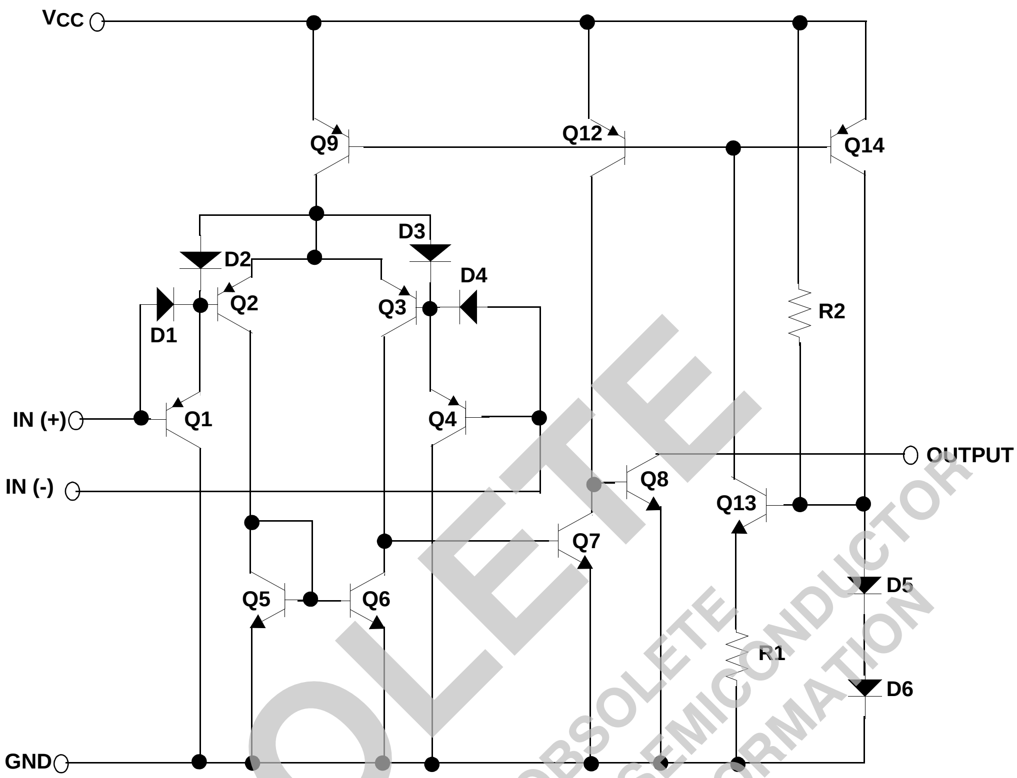


Internal Block Diagram



Rev. 2.0.2

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-SOIC	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-SOIC	$R_{\theta ja}$	 120 260	°C/W

Electrical Characteristics

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

Parameter	Symbol	Conditions		LM293A/LM393A Min.	LM293A/LM393A Typ.	LM293A/LM393A Max.	LM393 Min.	LM393 Typ.	LM393 Max.	Unit
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, $V_{I(+)}$ = 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 Min.	LM2903 Typ.	LM2903 Max.	Unit
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

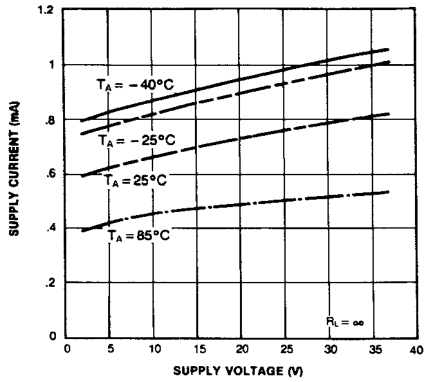


Figure 1. Supply Current vs Supply Voltage

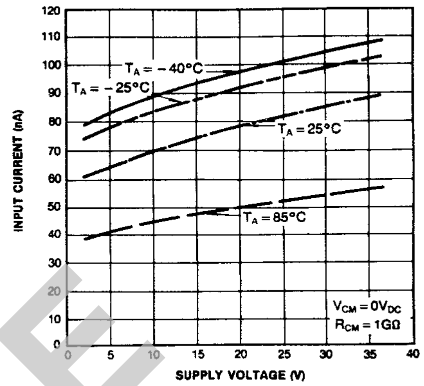


Figure 2. Input Current vs Supply Voltage

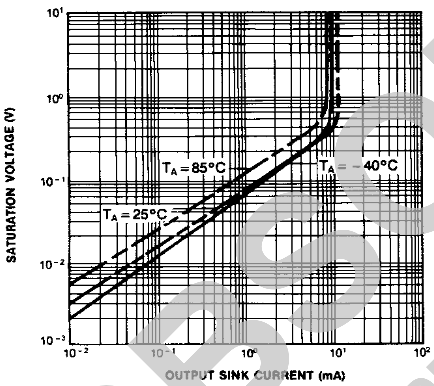


Figure 3. Output Saturation Voltage vs Sink Current

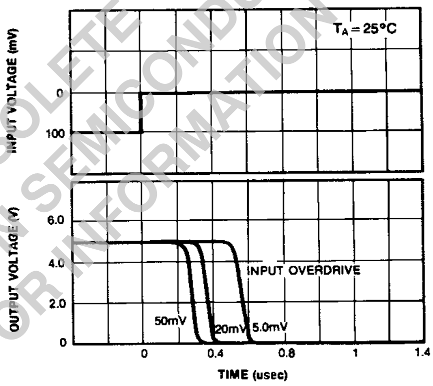


Figure 4. Response Time for Various Input Overdrive-Negative Transition

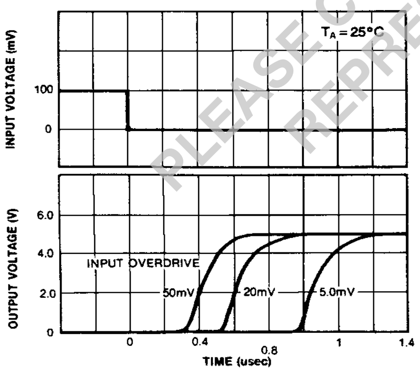


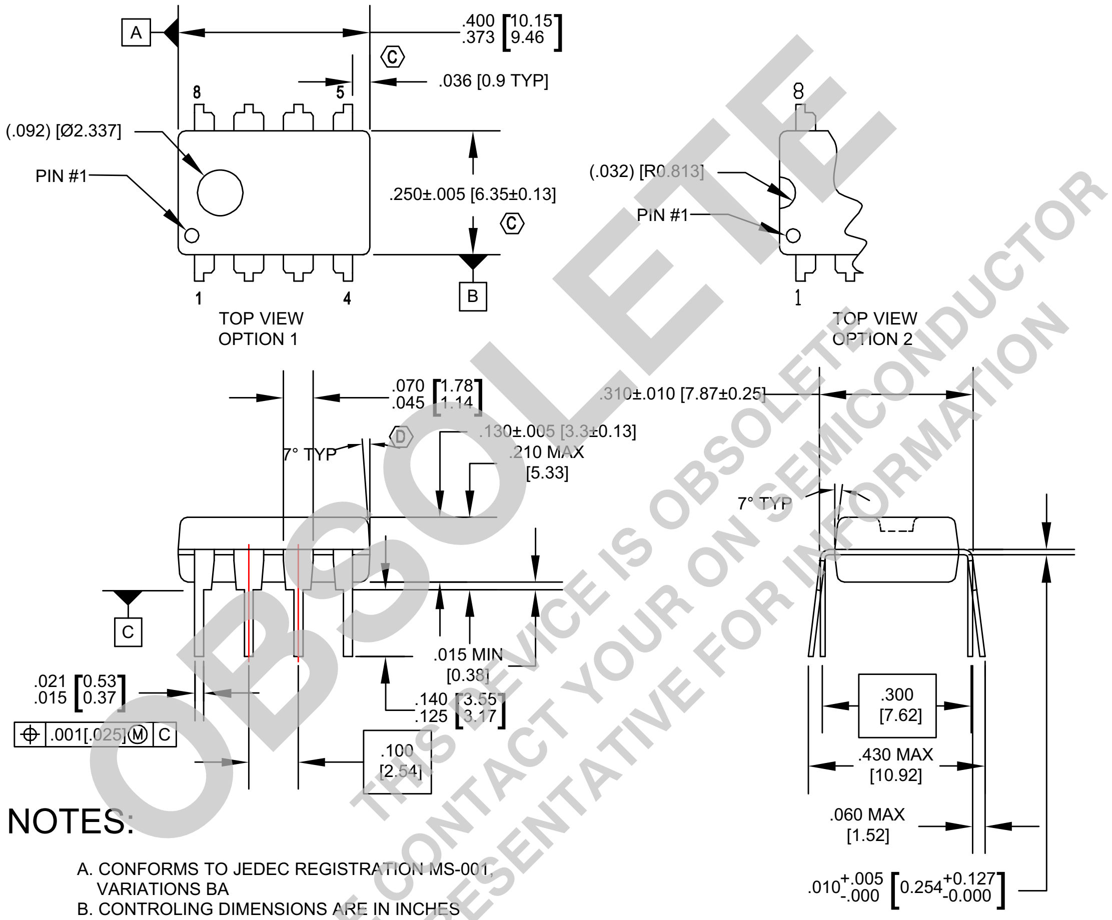
Figure 5. Response Time for Various Input Overdrive-Positive Transition

Mechanical Dimensions

Package

Dimensions in millimeters

8-DIP



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MS-001, VARIATIONS BA

B. CONTROLING 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.

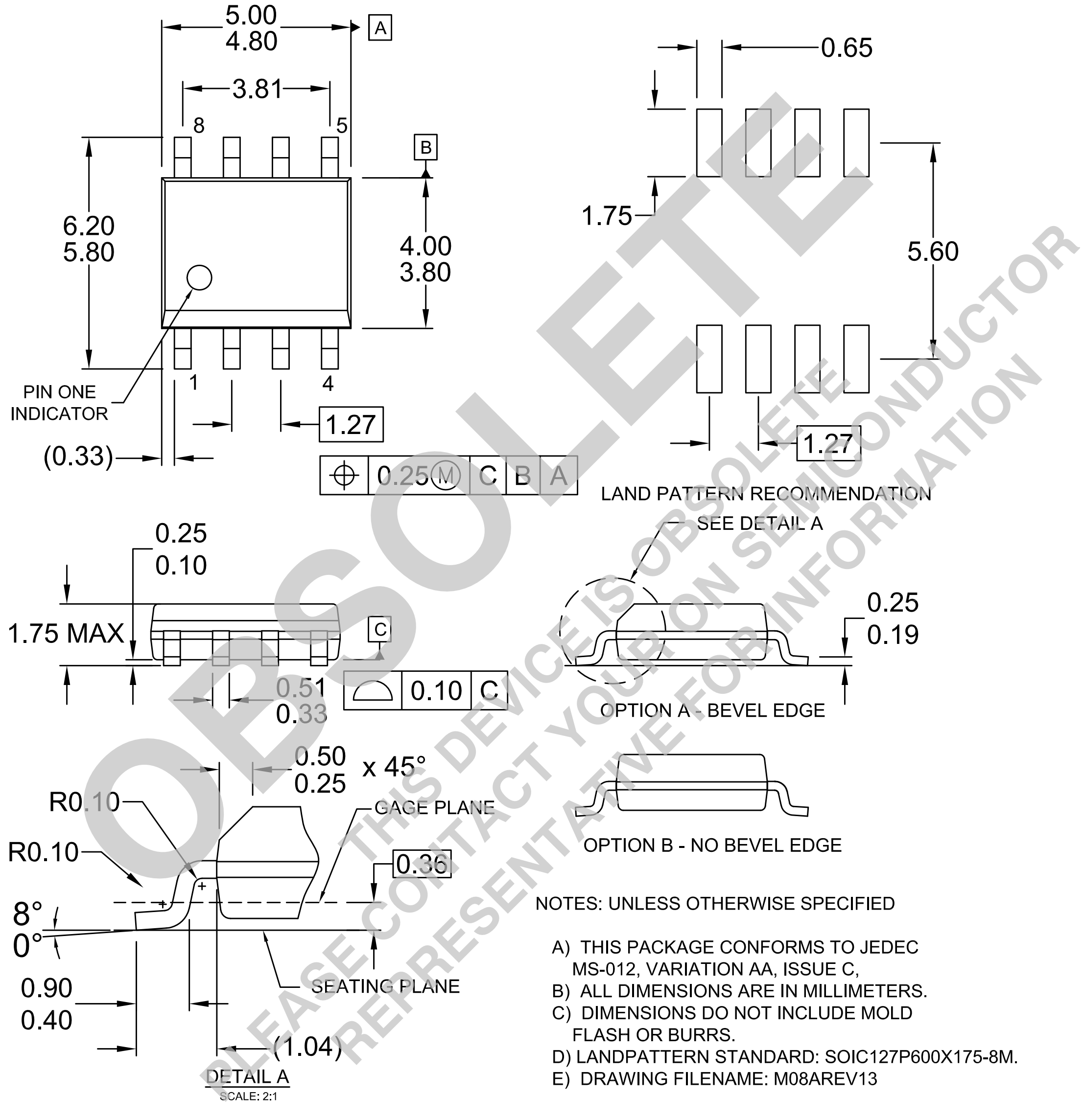
N08EREVG

Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

8-SOIC



NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA, ISSUE C,
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
D) LANDPATTERN STANDARD: SOIC127P600X175-8M.
E) DRAWING FILENAME: M08AREV13

Ordering Information

Product Number	Operating Temperature	Package	Packing Method
LM393N	0 ~ +70°C	8-DIP	Rail
LM393AN			Rail
LM393M		8-SOIC	Rail
LM393MX			Tape & Reel
LM393AM			Rail
LM393AMX			Tape & Reel
LM2903N	-40 ~ +105°C	8-DIP	Rail
LM2903M		8-SOIC	Rail
LM2903MX			Tape & Reel
LM293AN	-25 ~ +85°C	8-DIP	Rail

7/24/12 0.0m 001
Stock#DS400295

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