

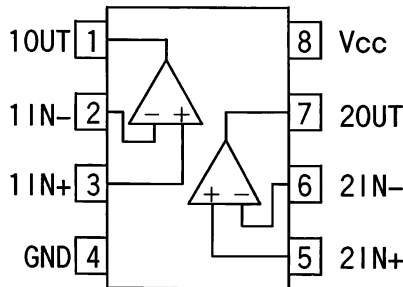
STRUCTURE SILICON MONOLITHIC INTEGRATED CIRCUIT
 FUNCTION TROPHY SERIES GROUND SENSE DUAL COMPARATORS

PRODUCT SERIES **LM2903DR LM2903PWR**
LM2903VQDR LM2903VQPWR LM2903DGKR

- FEATURES
- Operating temperature range $-40[^\circ\text{C}]$ to $+125[^\circ\text{C}]$ (Extended industrial grade)
 - Open collector output stage
 - Single supply or dual supply
 - Wide range of supply voltage
 Single supply $+2.0[\text{V}]$ to $+36[\text{V}]$
 Dual supply $\pm 1.0[\text{V}]$ to $\pm 18[\text{V}]$
 - Low supply current $0.4[\text{mA}]$ Typ
 - Low input bias current $25[\text{nA}]$ Typ
 - Low input offset current $5[\text{nA}]$ Typ
 - Common-mode voltage range includes ground
 - Differential input voltage range to maximum rated supply voltage
 - Low output voltage (saturation voltage)
 - Output compatible with TTL, MOS, CMOS



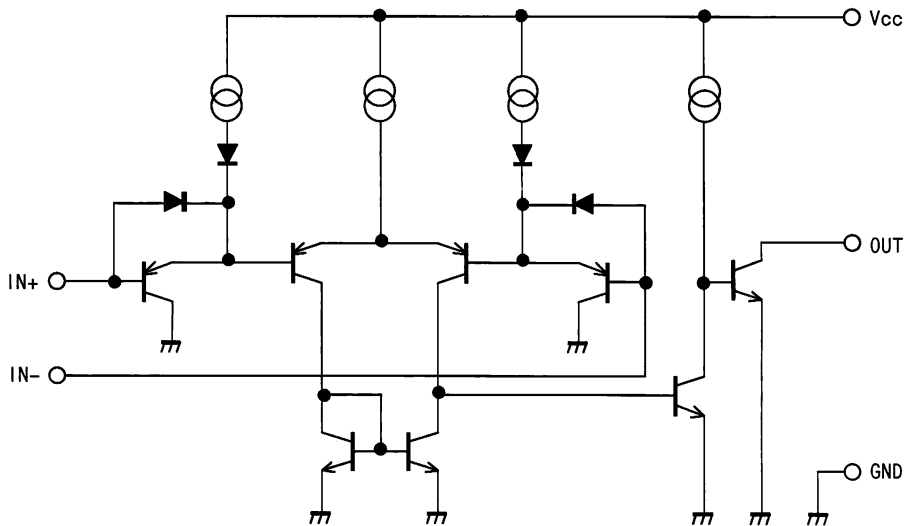
○BLOCK DIAGRAM



○PIN No. PIN NAME

PIN No.	PIN NAME
1	1OUT
2	1IN-
3	1IN+
4	GND
5	2IN+
6	2IN-
7	2OUT
8	Vcc

○SCHEMATIC DIAGRAM(Each Comparator)



○MAXIMUM RATINGS(Ta=25[°C])

Parameter	Symbol	Rating	Unit	
Supply voltage	Vcc – GND	+36	V	
Package dissipation	Pd	LM2903DR LM2903VQDR	450(*1)(*4)	mW
		LM2903PWR LM2903VQPWR	500(*2)(*4)	mW
		LM2903DGKR	470(*3)(*4)	mW
Differential voltage (*5)	Vid	±36	V	
Common mode input voltage	Vicm	Vee to Vcc – 1.5	V	
Operating temperature range	Topr	–40 to +125	°C	
Storage temperature range	Tstg	–65 to +150	°C	
Maximum junction Temperature	Tjmax	+150	°C	

(*1) To use at temperature above Ta=25[°C] reduce 3.60[mW]/[°C].

(*2) To use at temperature above Ta=25[°C] reduce 4.00[mW]/[°C].

(*3) To use at temperature above Ta=25[°C] reduce 3.76[mW]/[°C].

(*4) Mounted on a glass epoxy PCB(70[mm]×70[mm]×1.6[mm]).

(*5) The voltage difference between inverting input and non-inverting input is the differential input voltage. Then input terminal voltage is set to more than GND terminal.

○OPERATING CONDITION (Ta=–40[°C] to +125[°C])

Parameter	Symbol	Rating	Unit	
Supply Voltage	Vcc	LM2903DR LM2903PWR LM2903DGKR	+2.0 to +36.0 (Single Supply) (*6)	V
			±1.0 to ±18.0 (Dual Supply)	
		LM2903VQDR LM2903VQPWR	+2.0 to +36.0 (Single Supply) (*7)	
			±1.0 to ±18.0 (Dual Supply)	

(*6) Tested to 30[V]

(*7) Tested to 32[V]

○ELECTRIC CHARACTERISTICS (Unless otherwise specified Vcc=+5[V])

Parameter	Symbol	Temperature Range	Guaranteed limit			Unit	Condition
			Min.	Typ.	Max.		
Input Offset Voltage (*8)	VIO	25°C	-	2	7	mV	Vcc=5 to MAX(*9), VO=1.4[V] VIC=VIC(min)
		Full range	-	-	15		
Input Offset Current (*8)	IIO	25°C	-	5	50	nA	VO=1.4[V]
		Full range	-	-	200		
Input Bias Current (*8)	IIB	25°C	-	25	250	nA	VO=1.4[V]
		Full range	-	-	500		
Common-mode Input Voltage Range	VICR	25°C	-	-	Vcc-1.5	V	-
		Full range	-	-	Vcc-2.0		
Large-Signal Differential Voltage Amplification	AVD	25°C	25	100	-	V/mV	Vcc=15[V], VO=1.4 to 11.4[V] RL ≥ 15[kΩ], VRL=15[V]
High Level Output Current	IOH	25°C	-	0.1	-	nA	VID=1[V], VOH=5[V]
		Full range	-	-	1	μA	VID=1[V], VOH=MAX(*7)
Low Level Output Voltage	VOL	25°C	-	150	400	mV	VID=-1[V], IOL=4[mA]
		Full range	-	-	700		
Low Level Output Current	IOL	25°C	6	-	-	mA	VID=-1[V], VOL=1.5[V]
Supply Current	ICC	25°C	-	0.8	1	mA	RL=∞, Vcc=5V
		Full range	-	-	2.5		RL=∞, Vcc=MAX(*7)
Response Time	Tre	25°C	-	1.3	-	μs	RL=5.1[kΩ], VRL=5[V], CL=15pF VIN=100[mVp-p], overdrive=5[mV]
			-	0.3	-		RL=5.1[kΩ], VRL=5[V], CL=15pF VIN=TTL-Level input step Vref=1.4[V]

(*8) Absolute value

(*9) Maximum Supply Voltage is 30[V] for LM2903DR, LM2903PWR, LM2903DGKR0, 32[V] for LM2903VQDR, LM2903VQPWR

○APPLICATION EXAMPLE

(1) Absolute maximum ratings

Absolute maximum ratings are the values, which indicate the limits, within which the given voltage range can be safely charged to the terminal. However, it does not guarantee the circuit operation.

(2) The example of disabled circuit application

When there is a circuit not in use, it is recommended to make the non-inverting input terminal be the potential in the common-mode input voltage range like in Fig.1.

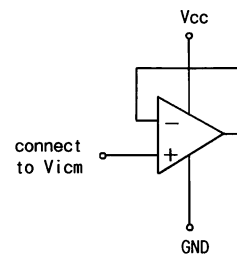


Fig.1 The example of disable circuit

(3) Applied voltage to the input terminal

Regardless of power supply voltage, GND + 36 [V] can be applied to input terminals without deterioration or destruction of its characteristics. However, this does not guarantee a circuit operation. Note that circuits do not operate normally with input voltage not within input common mode voltage in terms of the electrical characteristics.

(4) Operating power supply (single power supply/dual power supply)

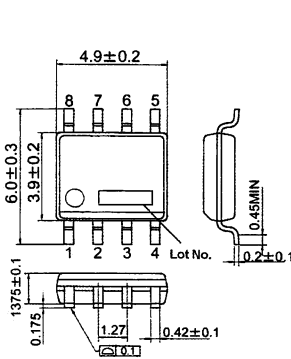
The Comparator operates if a given level of voltage is applied between Vcc and GND. Therefore, the Comparator can be operated under dual power supply or single power supply.

(5) Power dissipation (Pd)

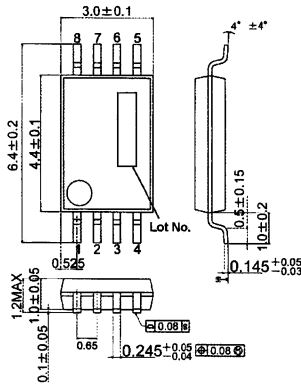
If the IC is used under excessive power dissipation. An increase in the chip temperature will cause deterioration of the radical characteristics of IC. For example, reduction of current capability. Take consideration of the effective power dissipation and thermal design with a sufficient margin. Pd is reference to the provided power dissipation curve.

- (6) Short circuits between pins and incorrect mounting
 Short circuits between pins and incorrect mounting when mounting the IC on a printed circuits board, take notice of the direction and positioning of the IC.
 If IC is mounted erroneously, It may be damaged. Also, when a foreign object is inserted between output, between output and Vcc terminal or GND terminal which causes short circuit, the IC may be damaged.
- (7) Output short circuit
 If short circuit occurs between the output terminal and GND terminal, excessive in output current may flow and generate heat, causing destruction of the IC. Take due care.
- (8) Using under strong electromagnetic field
 Be careful when using the IC under strong electromagnetic field because it may malfunction.
- (9) Usage of IC
 When stress is applied to the IC through warp of the printed circuit board, The characteristics may fluctuate due to the piezo effect.
 Be careful of the warp of the printed circuit board.
- (10) Testing IC on the set board
 When testing IC on the set board, in cases where the capacitor is connected to the low impedance, make sure to discharge per fabrication because there is a possibility that IC may be damaged by stress. When removing IC from the set board, it is essential to cut supply voltage.
 As a countermeasure against the static electricity, observe proper grounding during fabrication process and take due care when carrying and storage it.
- (11) Output terminal capacitor
 Transistor in circuits may be damaged when Vcc terminal and GND terminal is shorted with the charged output terminal capacitor.
 When IC is used as a comparator or as an application circuit, where oscillation is not activated by an output capacitor, the output capacitor must be kept below 10[μF] in order to prevent the damage mentioned above.

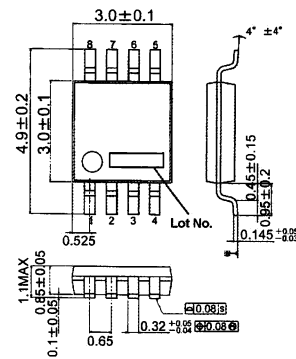
○PHYSICAL DIMENSIONS



LM2903DR/VQDR (SOIC8) (Unit:[mm])



LM2903PWR/VQPWR (TSSOP8) (Unit:[mm])



LM2903DGKR (MSOP8/VSSOP8) (Unit:[mm])

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