**36V General-purpose Low power Comparators**

###### General Description

The ET8903 is dual-channel comparators with open-drain output that feature 250μA quiescent current, a wide range of supply voltages from 2.0V to 36V with rail-to-rail inputs helps to implement in a wide variety of applications where require critical response time, power-sensitive, high-voltage. The output of the ET8903 could be connected to other open-collector outputs to achieve wired-AND relationship. All input and output pins can tolerate a continuous short-circuit fault condition to either rail.

The ET8903 is offered in SOP8 package, All devices are rated over -40°C to +125°C extended industrial temperature range.

###### Features

* 2.0V to 36V Single supply or ±1.0V to ±18V Dual supply
* Low quiescent current: 250μA
* Common-mode input voltage range includes Ground
* Differential input voltage range equal to power supply
* -40°C to 125°C Operation temperature
* available in packages: SOP8
* Output Compatible with TTL,MOS,CMOS logic levels

###### Applications

* Industrial Application
* Solar Inverter
* White Goods
* Battery Management System
* Medical Equipment

###### Device Information

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| **Part No.** | **Package** | **Packing Option** | **MSL** |
| ET85903M | SOP8 | Tape and Reel , 4K | 3 |

###### Pin Configuration

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| ET8903MTop View |

###### Pin Function

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| **Pin Number** | **Symbol** | **Descriptions** |
| **ET8903M** |
| 1,7 | OUT | Output |
| 4 | GND | Ground |
| 3,5 | +IN | Non-inverting input |
| 2,6 | -IN | Inverting input |
| 8 | V+ | Positive power supply |

###### Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are only stress ratings, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions are not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

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| **Symbol** | **Parameter** | **Value** | **Unit** |
| VS | Supply Voltage,V+ to GND | 36 | V |
| VID | Differential input voltage | ±36 | V |
| VIN | Input voltage range (either input) | -0.3 to 38 | V |
| IIN | Input Current | -50 | mA |
| VO | Output Voltage | 36 | V |
| IO | Output Current | 20 | mA |
| TJ(MAX) | Maximum Junction Temperature | +150 | °C |
| TSTG | Storage Temperature | -65 to +150 | °C |
| VESD  | Human body model (HBM),per ESDA/JEDECJS-001-2017**(1)** | ±1500 | V |
| Charged device model (CDM), per ESDA/JEDEC JS-002-2018**(2)**  | ±750 | V |

***Note1***: JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500V HBM is possible if necessary precautions are taken.

***Note2***: JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250V CDM is possible if necessary precautions are taken.

###### Thermal Characteristics

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| **Symbol** | **Package** | **Ratings** | **Value** | **Unit** |
| RθJA | SOP8 | Thermal Characteristics, Thermal Resistance, Junction-to-Air | 125 | °C/W |

###### Electrical Characteristics

At TA = 25°C and VS = 5V,unless otherwise noted.

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| **Symbol** | **Parameter** | **Conditions** | **Min** | **Typ** | **Max** | **Unit** |
| **OFFSET VOLTAGE** |
| VOS | Input Offset Voltage | VIC = VICR min, VO = 1.4 V,VS = 5 V to VS\_MAX,TA = 25°C |  | 1 |  | mV |
| VIC = VICR min, VO = 1.4 V,VS = 5 V to VS\_MAX,TA = -40°C to +125°C |  | 2 |  | mV |
| **INPUT BIAS CURRENT** |
| IB | Input Bias Current | IIN(+)-IIN(-), with Output in Linear range, VCM=0 V**(3)** |  | 22 |  | nA |
| IOS | Input Offset Current | IIN(+)-IIN(-),VCM=0 V |  | 1 |  | nA |
| **INPUT VOLTAGE** |
| VCM | Common-mode Voltage Range | VS = 30V**(4)** | -0.3 |  | VS - 1.4 | V |
| **OPEN-LOOP GAIN** |
| AVD | Large-signalDifferential-voltageAmplification | VS = 15V, VO = 1.4V to 11.4V, RL ≥ 15 kΩ to VS, TA = 25°C |  | 25 | 100 | V/mV |
| **OUTPUT** |
| VOL | Low Output Voltage Swing | VID = -1 V, IOL = 4 mA |  | 152 | 370 | mV |
| IOH | High-level Output Current | VID = 1 V, VOH = 5 V |  | 0.1 |  | nA |
| IOL | Low-level Output Current | VID = -1 V, VOL = 1.5 V | 6 | 16 |  | mA |
| **POWER SUPPLY**  |
| VS | Specified Voltage  |  | 2.0 |  | 36 | V |
| ICC | Supply Current(one comparator) | VO = 2.5 V, No load, VS = 5 V |  | 0.23 | 0.5 | mA |
| VO = 2.5 V, No load, VS = MAX |  | 0.28 | 0.63 | mA |
| **SWITCHING CHARACTERISTICS** |
| tPD | Propagation Delay Time | VRL= 5V, RL=5.1kΩ |  | 1.4 |  | µs |
| VIN = TTL Logic Swing, VREF=1.4 V |  | 330 |  | ns |

***Note3***: The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.

***Note4***: The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is VS −1.5 V at 25°C, but either or both inputs can go to 36 V without damage, independent of the magnitude of VS.

**Typical Characteristics**

At TA = +25°C, and VCM = VS/2,and RL = 10kΩ connected to VS/2, unless otherwise noted.

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| Figure 1.Supply Current vs Supply Voltage | Figure 2.Offset Voltage vs Supply Voltage |
| Figure 3.Offset Voltage vs Common-mode Voltage | Figure 4.Propagation Delay Falling Edge |
| Figure 5.Propagation Delay Rising Edge |  |

###### Functional Description

**Operating Voltage**

The ET8903 is 36V General-purpose low power comparators is fully specified and ensured for operation from 2.0 to 36V and offers an excellent speed-to-power combination with propagation delay of 1us and a quiescent supply current of 250μA. The open-drain output allows the user to configure the output logic low voltage (VOL) and allows the comparator to be used in AND functionality.

In addition,and many specifications apply over the industrial temperature range of -40°C to +85°C,parameters

that vary significantly with operating voltages or temperature are illustrated in the Typical Characteristics graphs.

**Maximizing performance through proper layout**

To achieve the maximum performance of the extremely high input impedance and low offset voltage of the ET8903 devices, care is needed in laying out the circuit board. The PCB surface must remain clean and free of moisture to avoid leakage currents between adjacent traces. Surface coating of the circuit board reduces surface moisture and provides a humidity barrier，reducing parasitic resistance on the board. The use of guard rings around the comparator inputs further reduces leakage currents. Figure 6 shows proper guard ring configuration and the top view of a surface-mount layout. The guard ring does not need to be a specific width, but it should form a continuous loop around both input. By setting the guard ring voltage equal to the voltage at the non-inverting input, parasitic capacitance is minimized as well. For further reduction of leakage currents, components can be mounted to the PCB using Teflon stand off insulators.

Other potential sources of offset error are thermo-electric voltages on the circuit board. This voltage, also called Seebeck voltage, occurs at the junction of two dissimilar metals and is proportional to the temperature of the junction. The most common metallic junctions on a circuit board are solder-to-board trace and solder-to component lead. If the temperature of the PCB at one end of the component is different from the temperature at the other end, the resulting Seebeck voltages are not equal, resulting in a thermal voltage error. This thermocouple error can be reduced by using dummy components to match the thermoelectric error source.

Placing the dummy component as close as possible to its partner ensures both Seebeck voltages are equal, thus canceling the thermocouple error. Maintaining a constant ambient temperature on the circuit board further reduces this error. The use of a ground plane helps distribute heat throughout the board and reduces EMI noise Pickup.

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| Figure 6.Use a guard ring around sensitive pins |

###### Package Dimension

SOP8

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| SOP8-模型 SOP8-模型SOP8-模型 SOP8-模型 **Recommended Land Pattern** Unit: mm |

###### Revision History and Checking Table

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| --- | --- | --- | --- | --- | --- |
| **Version** | **Date** | **Revision Item** | **Modifier** | **Function & Spec Checking** | **Package & Tape****Checking** |
| 1.0 | 2024-02-28 | Original Version | Huyt | Shibo | Liujy |
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