Low Power Loss Zero-Crossing Detector

Features

- Input Voltage Range: 3-5.5V
- Integrate Rectifier Diode
- Require Less Peripheral Devices
- Environment Temperature: -40℃~85℃
- Low Quiescent Current<10uA
- Effectively Prevent Power Line Noise
- Integrate Zener Diode
- SOT-23-3 package

Applications

- PLC
- Power Equipment Access
- Domestic Appliance
- RGB Lighting Synchronous Control

General Description

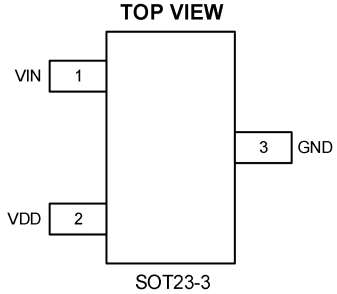
GZ1001 is a special chip for zero-crossing detection circuit by detecting input voltage. When input line voltage is less than threshold, GZ1001 drives the optical coupling chip, providing zero-crossing detection signal to application control system, while the input voltage is greater than the threshold, the output presents high resistance.

GZ1001 has extremely low power consumption, a quiescent current of less than 10 μA, so that most of the electrical energy is used to drive the optocoupler to obtain a wide zero-crossing detection pulse to make it easier to be detected by the system. A schmitt flip-flop is used in VIN pin, the high level is 2.5V, the low level is 0.6V, Internal hysteresis also makes GZ1001 easier to filter the glitch on the power line and effectively prevent error zero-crossing detection caused by noise on power line signal. A rectifier diode is integrated inside GZ1001, rectifying the input voltage to provide power supply for IC and optocoupler with only a capacitor, a zener diode is also integrated at input terminal to limit the maximum voltage, overall solution requires only a few peripheral devices.

GZ1001 is available in SOT23-3.

Pin Description

Pin Configuration



Top Marking: M5YLL (device code: M5, Y=year code, LL= lot number code)

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Pin Description

Pin	Name	Function
1	VIN	Input voltage detection pin.
2	VDD	Power supply, connect to the negative of LED.
3	GND	Ground pin.

Order Information (1)

Marking	Part No.	Model	Description	Package	T/R Qty
M5YLL	TBD	GZ1001S01	GZ1001S01 Zero-Crossing Detector, VIN 3-5.5V, SOT23-3	SOT23-3	3000PCS

Note (1): All GQ parts are Pb-Free and adhere to the RoHS directive.

Specifications

bsolute Maximum Ratings (1) (2)

Item	Min	Max	Unit
V_{IN} voltage	0	7	V
Current on V_{DD} (I_{DD})	0	10	mA
V_{DD} voltage	-0.5	7	V
Current on GND (I_{GND})		10	mA
Power dissipation (3)	Internally Limited		
Operating temperature	-40	85	°C
Storage temperature, T_{stg}	–55	150	°C
Lead Temperature (Soldering, 10sec.)		260	°C

Note (1): Exceeding these ratings may damage the device.

Note (2): The device is not guaranteed to function outside of its operating conditions.

Note (3): The maximum allowable power dissipation is a function of the maximum junction

temperature, $T_{J(MAX)}$, the junction-to-ambient thermal resistance, $R_{\theta JA}$, and the ambient temperature, T_A. The maximum allowable power dissipation at any ambient temperature is calculated using: $P_{D(MAX)} = (T_{J(MAX)} - T_A)/R_{\theta JA}$. Exceeding the maximum allowable power dissipation causes excessive die temperature, and the regulator goes into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage. Thermal shutdown engages at T_J=160°C (typical) and disengages at T_J= 130°C (typical).

ESD Ratings

Item	Description	Value	Unit
$V_{(ESD-HBM)}$	Human Body Model (HBM) ANSI/ESDA/JEDEC JS-001-2014 Classification, Class: 2	±2000	V
$V_{(ESD-CDM)}$	Charged Device Mode (CDM) ANSI/ESDA/JEDEC JS-002-2014 Classification, Class: C0b	±200	V
$I_{LATCH-UP}$	JEDEC STANDARD NO.78E APRIL 2016 Temperature Classification, Class: I	±150	mA

Recommended Operating Conditions

Item	Min	Max	Unit
Operating junction temperature (1)	-40	125	°C
Operating temperature range	-40	85	°C
Input voltage V_{IN}	3	5.5	V

Note (1): All limits specified at room temperature (TA = 25°C) unless otherwise specified. All room temperature limits are 100% production tested. All limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).

Thermal Information

Item	Description	Value	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance (1)(2)	208	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	112	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	56	°C/W
ψ_{JT}	Junction-to-top characterization parameter	9.2	°C/W
ψ_{JB}	Junction-to-board characterization parameter	52	°C/W

Note (1): The package thermal impedance is calculated in accordance to JESD 51-7.

Note (2): Thermal Resistances were simulated on a 4-layer, JEDEC board

Electrical Characteristics

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V_{IN} =V_{OUT}+1V, T_A=25℃, unless otherwise noted.

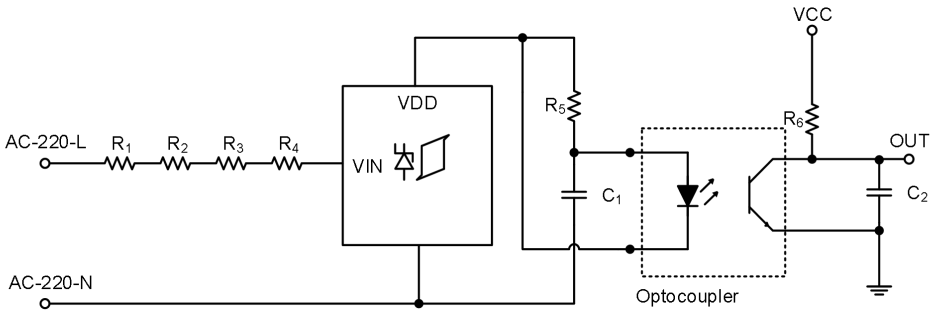
Parameter	Test Conditions	Min	Typ.	Max	Units
Input Voltage		3	5	5.5	V
Input Voltage Hysteresis			1.2		V
Supply Current (Quiescent), I_{DD1}	V_{IN}=5V			10	μA
Supply Current (Quiescent), I_{DD2}	V_{DD}=5V, V_{IN}=GND	20	25	30	mA
V_{IN} Detect Threshold			167		mV
Output Voltage Delay Time			200		ns

Typical Application Circuit

GZ1001 can realize zero-crossing detection of power line by circuit shown as the following figures. C_1 is used to storage energy for electrical energy for chips and optocoupler.

Note: C_1, a typical 56nF, recommendation of no more than 100nF. R_1, R_2, R_3, R_4 can use as typical 750KΩ. R_5 use 4.7KΩ. R_6 use 10KΩ. C_2 use 1nF.

While V_{IN}>V_{th}, C_1 is charged by V_{IN} through integrated rectifier diode, While V_{IN}<V_{th}, The AC input is near zero-crossing point, VDD discharge path is opened. The energy stored on the C_1 is released through the optocoupler light emitting diode, producing zero crossing pulse at output pin.



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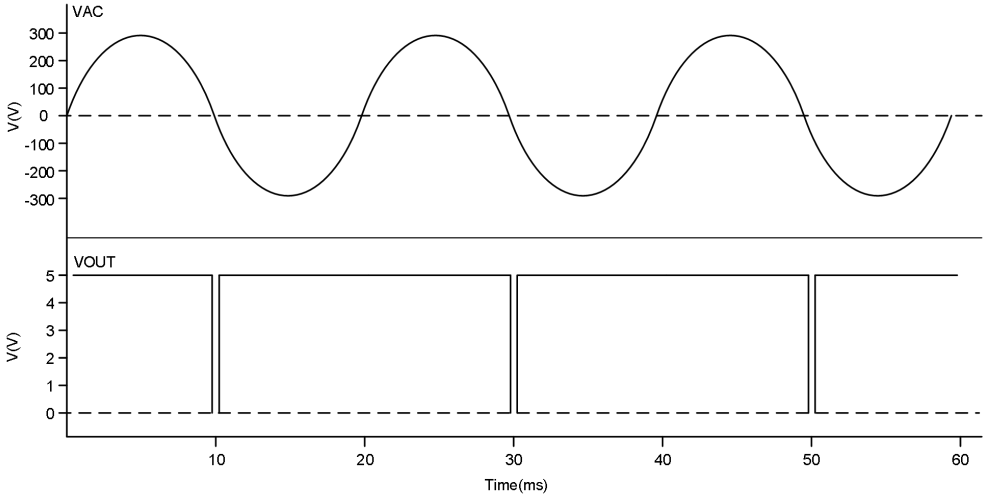
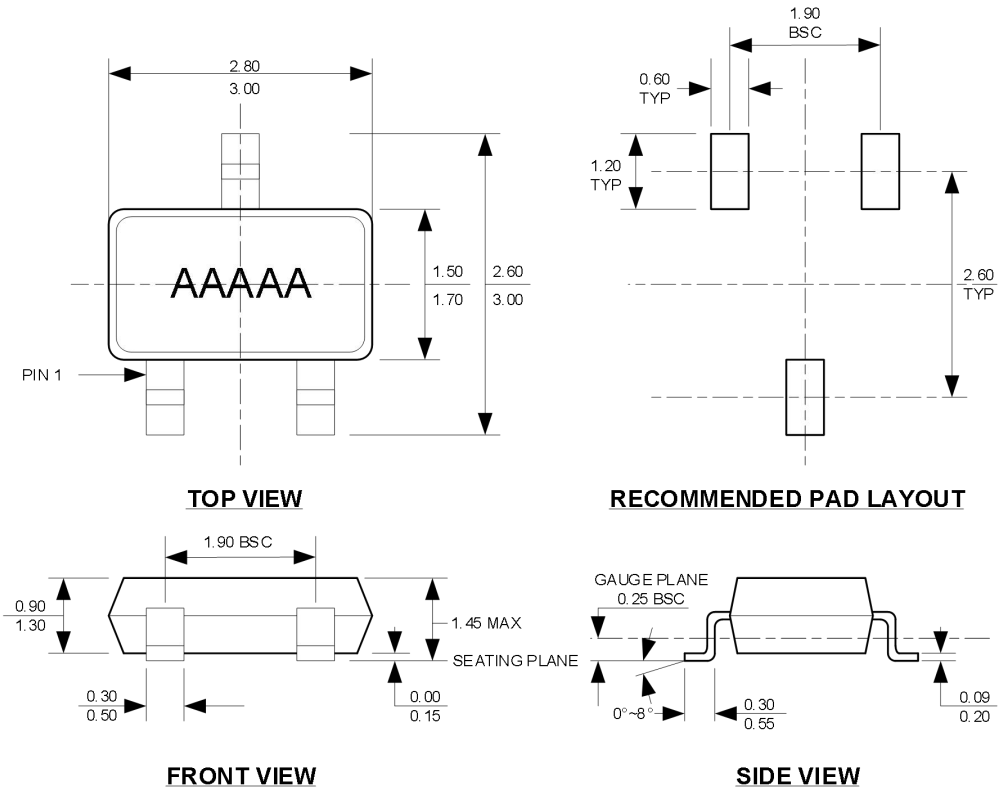


Package Description

SOT23-3



TOP VIEW **RECOMMENDED PAD LAYOUT**

FRONT VIEW **SIDE VIEW**

NOTE:
1. CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
2. PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
3. PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
4. LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
5. DRAWING CONFORMS TO JEDEC MS-012, VARIATION BA.
6. DRAWING IS NOT TO SCALE.