OKI

OKI Semiconductor

ML6190A

Preliminary

Longwave Time Code RF Receiver LSI

GENERAL DESCRIPTION

The ML6190A receives standard low-frequency radio waves, and detects and outputs time codes superimposed on those radio waves.

Features

- High sensitivity (0.7 µVrms typ.)
- Low supply current (17 µA typ.)
- Low standby current (0.1 µA max.)
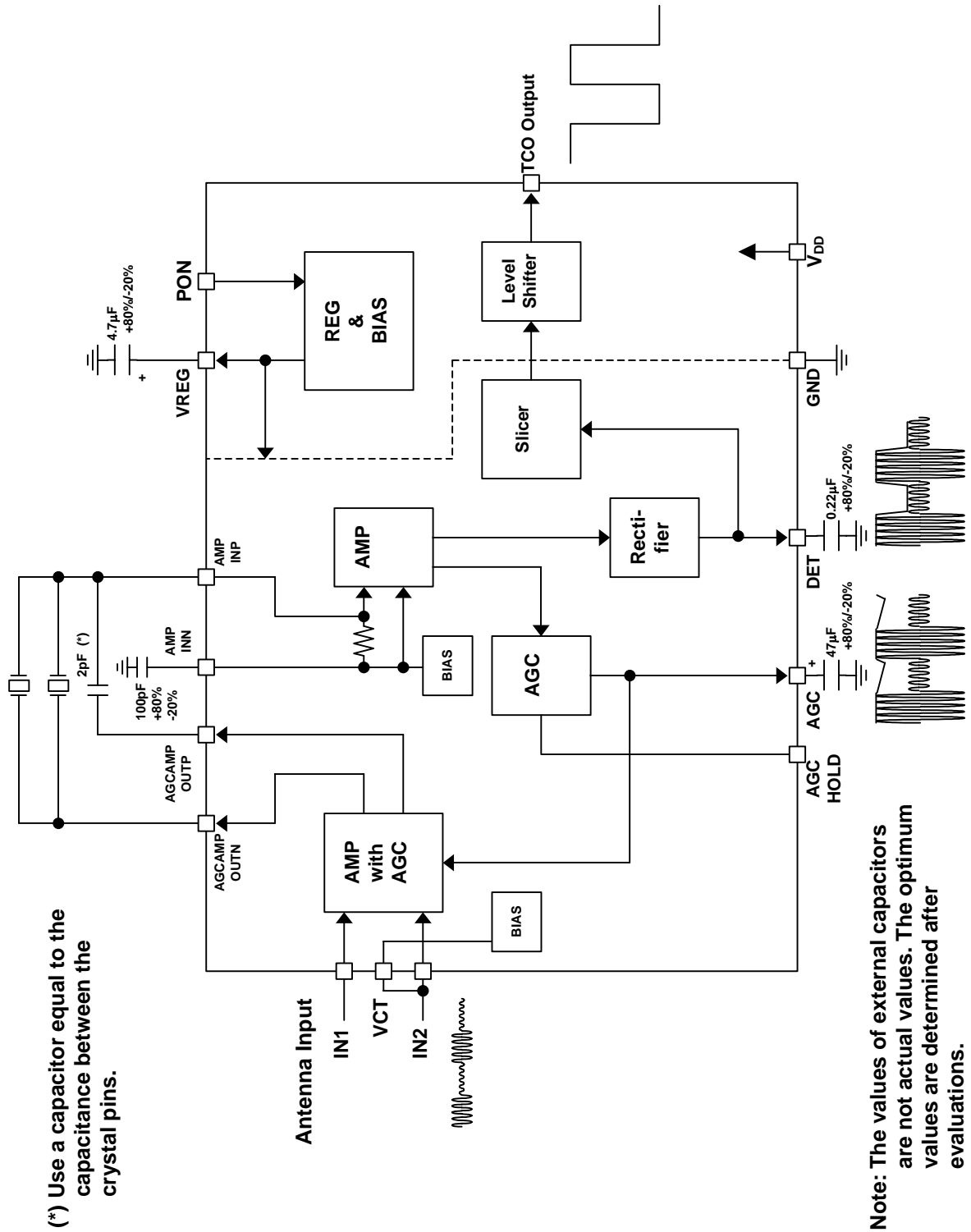- Low voltage drive (V_{DD} = 1.1 V to 3.6 V)

Functions
- RF amplifier
- AGC circuit
- Rectifier
- Slicer
- Time code output

Package
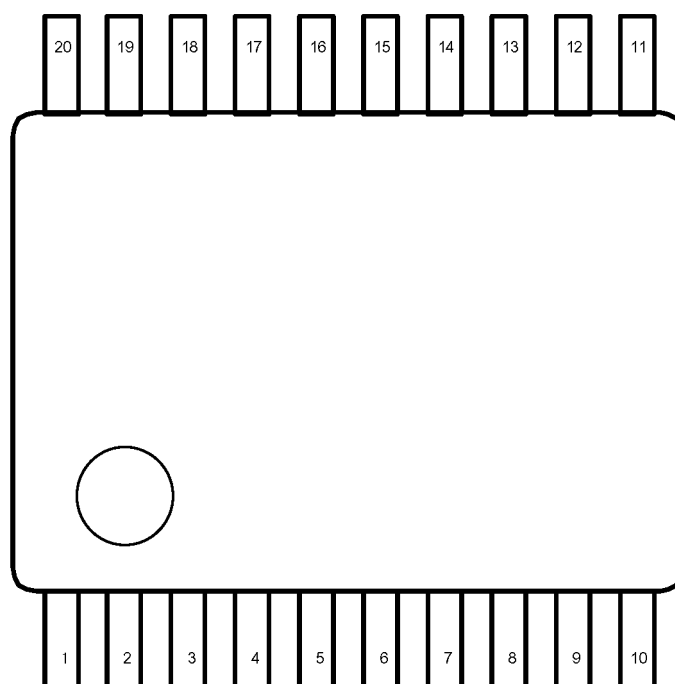20-pin SSOP (SSOP20-P-44-0.65-K) (ML6190AMB)

BLOCK DIAGRAM

(*) Use a capacitor equal to the capacitance between the crystal pins.

Note: The values of external capacitors are not actual values. The optimum values are determined after evaluations.

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PIN SPECIFICATIONS

• Package

  20-pin SSOP (0.65 mm pitch)

• Pin configuration

Pin	Symbol	Function	Pin	Symbol	Function
1	VREG	Regulator output pin	11	AMPINP	AMP input pin
2	V_{DD}	External power supply pin	12	AMPINN	AMP input pin
3	GND	GND pin	13	AGCAMPOUTN	AGCAMP output pin
4	PON	Power-on input pin	14	AGCAMPOUTP	AGCAMP output pin
5	TCO	Time code output pin	15	GND	GND pin
6	AGC_HOLD	AGC hold input pin	16	NC	—
7	AGC	AGC pin for external capacitor	17	NC	—
8	DET	DET pin for external capacitor	18	VCT	Center tap pin
9	TEST	TEST pin	19	IN2	Antenna input pin
10	GND	GND pin	20	IN1	Antenna input pin

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• Pin descriptions

Pin	Symbol	I/O	Description
1	VREG	—	Regulator output pin Connect a 4.7 μF capacitor between this pin and the GND pin.
2	V_{DD}	—	External power supply pin
3	GND	—	Ground pin
4	PON	I	Power-on input pin "H": Normal operation "L": Standby operation
5	TCO	O	Time code output pin The "H" output for the large amplitude signal, the "L" output for the small amplitude signal, and "H" output in the standby state.
6	AGC_HOLD	I	AGC hold input pin "H": AGC operation "L": AGC hold operation
7	AGC	—	AGC pin for an external capacitor Connect a 47 μF capacitor between this pin and the GND pin.
8	DET	—	DET pin for an external capacitor Connect a 0.22μF capacitor between this pin and the GND pin.
9	TEST	—	TEST pin Leave this pin open.
10	GND	—	Ground pin
11	AMPINP	I	AMP input pin
12	AMPINN	I	AMP input pin Connect a 100 pF capacitor between this pin and the GND pin.
13	AGCAMPOUTN	O	Output pin for AMP with AGC
14	AGCAMPOUTP	O	Output pin for AMP with AGC
15	GND	—	Ground pin
18	VCT	—	Antenna center tap pin Connect this pin to the IN2 pin
19	IN2	I	Antenna input pin
20	IN1	I	Antenna input pin

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RADIO WAVE RECEIVING IC SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Maximum supply voltage	V_{DD}	Ta = 25°C	−0.3 to +3.8	V
Input voltage	V_{IN}		−0.3 to V_{DD}+0.3	V
Storage temperature	T_{STG}	—	−55 to +125	°C

Recommended Operating Conditions

Parameter	Symbol	Condition	Rating	Unit
Operating voltage	V_{DD}	—	1.1 to 3.6	V
Operating temperature	T_{OP}	—	−40 to +85	°C

Electrical Characteristics

VDD = 1.5 V, GND = 0 V, Ta = 25 °C, and f_{IN} = 40 kHz unless otherwise specified.

• DC characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply current	I_{DD}	—	—	17	38	μA
Standby current	I_{STB}	—	—	—	0.1	μA
Voltage sensitivity	V_{INmin}	—	—	0.7	—	μVrms
Maximum signal input	V_{INmax}	—	100	—	—	mVrms
Input resistance	R_{in}	Between IN1 and IN2 pins	2	—	—	MΩ
		Between AMPINP and AMPINN pins		500		kΩ
Input capacitance	C_{in}	—		a few pF		pF
Receiving frequency	f_{IN}	—	40	—	100	kHz

• TCO output characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output voltage (high)	V_{OH}	—	V_{DD}−0.1	—	—	V
Output voltage (low)	V_{OL}	—	—	—	0.1	V
Output current (high)	I_{OH}	VO = V_{DD} − 0.1 V	—	−35	—	μA
Output current (low)	I_{OL}	VO = 0.1 V	—	35	—	μA
Output pulse width (500 ms input)	T_{500}	—	480	500	650	ms
Output pulse width (800 ms input)	T_{800}	—	750	800	970	ms
Output pulse width (200 ms input)	T_{200}	—	180	200	400	ms

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• AGC hold characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
AGC_HOLD "H" input voltage	V_{IHAH}	During normal operation	$0.8{*}V_{DD}$	—	—	V
AGC_HOLD "L" input voltage	V_{ILAH}	During AGC hold	—	—	$0.2{*}V_{DD}$	V
AGC_HOLD "H" input current	$|I_{IHAH}|$	$VI = V_{DD}$	—	0.01	—	μA
AGC_HOLD "L" input current	$|I_{ILAH}|$	$VI = 0.0V$	—	0.01	—	μA

• PON characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
PON "H" input voltage	V_{IHPON}	During normal operation	$0.8{*}V_{DD}$	—	—	V
PON "L" input voltage	V_{ILPON}	During standby mode	—	—	$0.2{*}V_{DD}$	V
PON "H" input current	$|I_{IHPON}|$	$VI = V_{DD}$	—	0.01	—	μA
PON "L" input current	$|I_{ILPON}|$	$VI = 0.0V$	—	0.01	—	μA

• AC characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
AGC recovery time	T_{AGC}	At a change of 40 dB in electric field	—	TBD	—	sec
Response delay	T_{TCO}	Phase delay relative to input signal	—	100	—	ms

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## DESCRIPTION OF EACH BLOCK

(1) AMP Block

Radio waves received by the antenna will be amplified by AMP with AGC. Signals output from AMP with AGC will go through an external quartz resonator, which serves as a band-pass filter, and will be amplified again at AMP.


Crystal
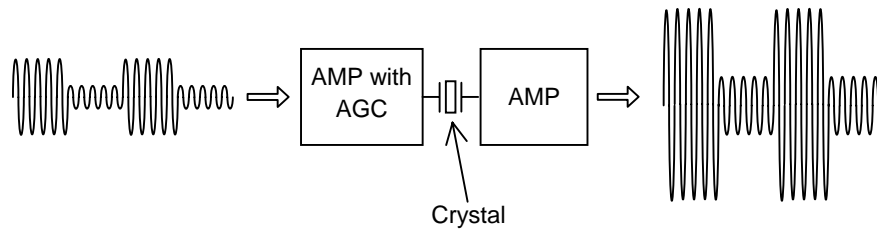
(2) AGC Block

Output signals from AMP will be input to the AGC block and the rectifier block. After signals are input to the AGC block, their high side peak amplitudes are detected. As AGC signals, they will be fed back to AMP with AGC.

The AGC block has the AGC hold function. When the AGC hold signal is "H," the block performs the regular AGC operation. The AGC block performs the AGC hold operation when the AGC hold signal is "L."

AGC signal
(To AMP with AGC)
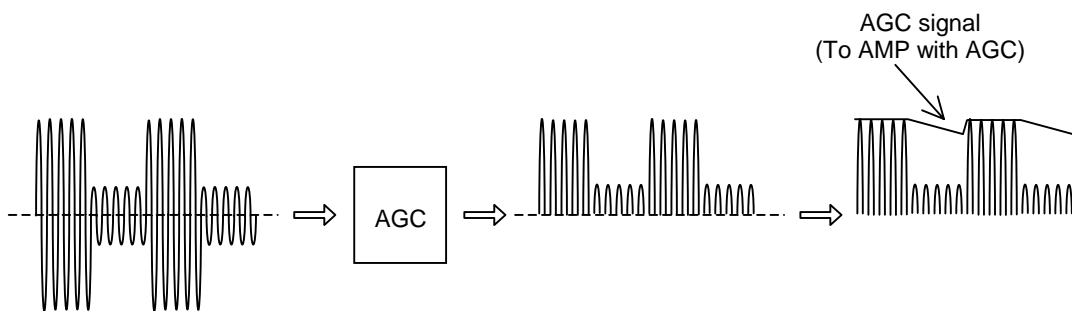
(3) Rectifier Block

After signals are input to the rectifier block, their high side peak amplitudes are detected. As DET signals, they will be transferred to the slicer block.


DET signal
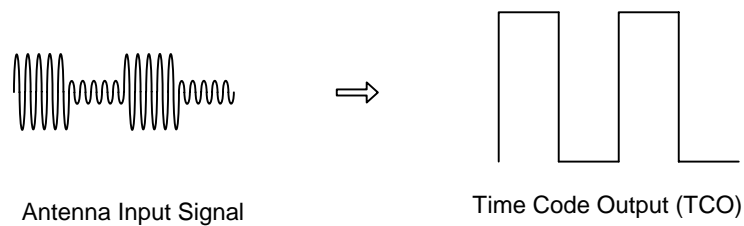(to slicer block)
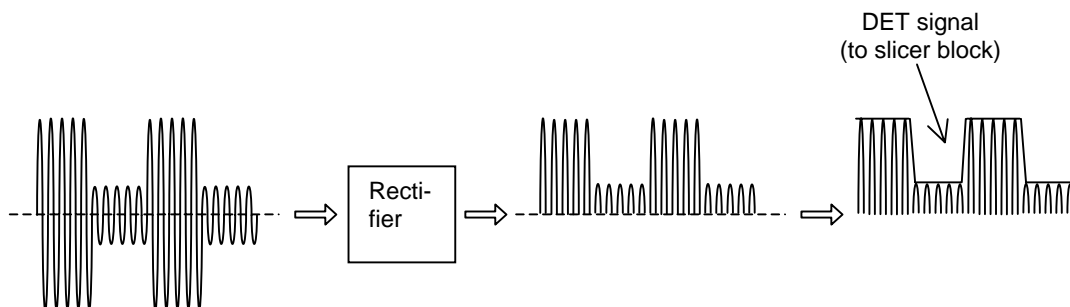
(4) Slicer Block

Signals output from the rectifier block are input to the slicer block and will be shaped to V_{DD} as "1" and GND as "0". Then, these outputs will be output as time codes (TCO).

This LSI has the standby function. When the PON signal is "H," the LSI will perform the regular operation. When the PON signal is "L," the LSI will be in standby state.

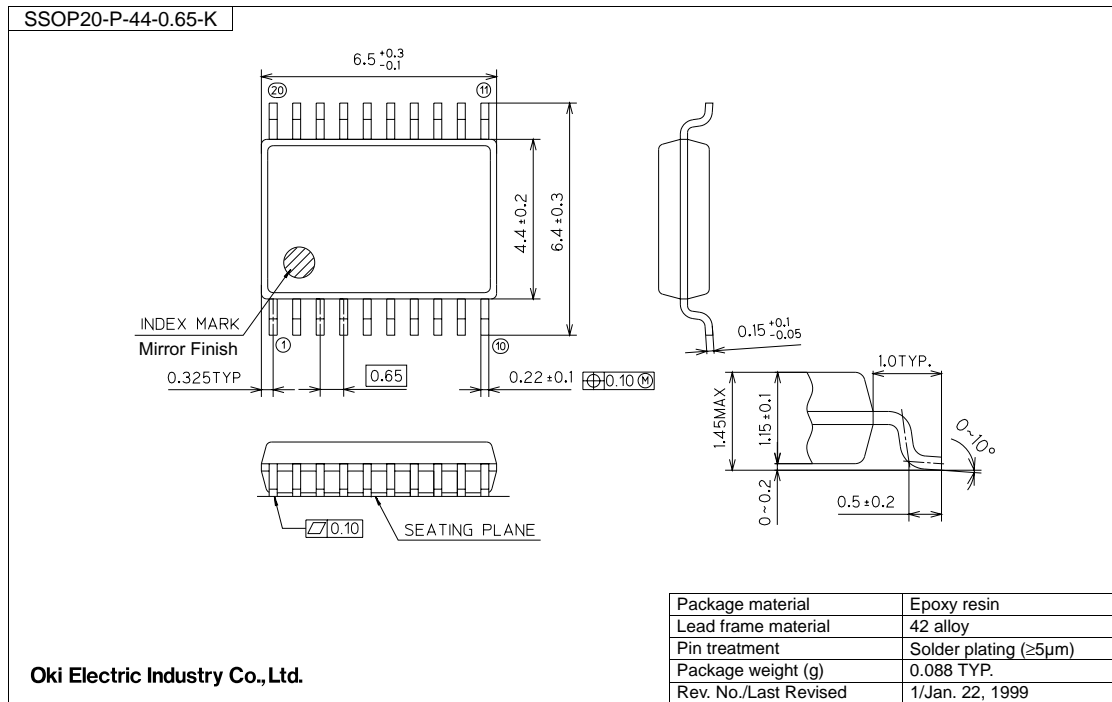The TCO during the standby state is "H."
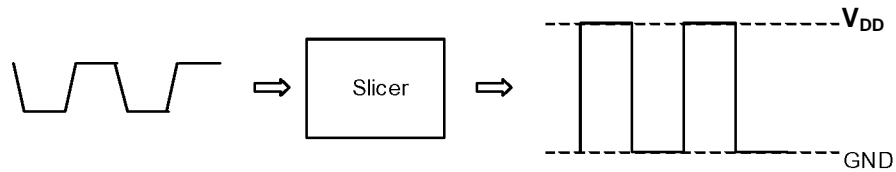
(5) Time Code Output

The time code output (TCO) of the ML6190A is in phase with actual time codes input from the antenna. A "H" level is output for the large amplitude signal and a "L" level is output for the small amplitude signal.

Antenna Input Signal   Time Code Output (TCO)

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PACKAGE DIMENSIONS

(Unit: mm)

SSOP20-P-44-0.65-K

Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5μm)
Package weight (g)	0.088 TYP.
Rev. No./Last Revised	1/Jan. 22, 1999

Oki Electric Industry Co., Ltd.

Notes for Mounting the Surface Mount Type Package

The surface mount type packages are very susceptible to heat in reflow mounting and humidity absorbed in storage. Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

REVISION HISTORY

Document No.	Date	Page Previous Edition	Page Current Edition	Description
PEDL6190A-01	Mar. 31, 2003	–	–	Preliminary edition 1
PEDL6190A-02	June.9, 2003	–	–	Preliminary edition 2
		1	1	Changed the product name from ML6190AMB to ML6190A in the content of the "GENERAL DESCRIPTION" Section.
		1	1	Changed the low supply current from 30 μF to 38 μF in the "Feature" Section.
		2	2	Partially changed the block diagram.
		3	3	Partially changed the contents of the "Pin configuration" table.
		–	4	Added the "Pin descriptions" Section.
		4	5	Partially changed the contents of the "Absolute Maxim Ratings" Section.
		4	5	Partially changed the contents of the "DC characteristics" and "TCO output characteristics" Sections.
		4	5	Changed V_{CC} to V_{DD} in the "AGC hold characteristics" table.
		5	6	Changed V_{CC} to V_{DD} in the "PON characteristics" table.
		6	7	Partially changed the contents of the "AMP Block" and "AGC Block" Sections.
		7	8	Changed VCC to VDD in the content of the "Slicer Block" Section.
		7	8	Partially added the content of the "Time Code Output" Section.
		–	9	Added package dimension drawing.
PEDL6190A-03	Oct.23, 2003	–	–	Preliminary edition 3
		1	1	Partially changed the contents of the "Features" Section.
		2	2	Partially changed the block diagram.
		3	3	Changed Pin 9 from NC to TEST in the "Pin configuration" table.
		4	4	Added the TEST pin in the content of the "Pin descriptions".
		5	5	Partially changed the contents of the "Recommended Operating Conditions" Section.
		5	5	Partially changed the contents of the "DC characteristics" Section.

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<u>NOTICE</u>

1. The information contained herein can change without notice owing to product and/or technical improvements. Before using the product, please make sure that the information being referred to is up-to-date.

2. The outline of action and examples for application circuits described herein have been chosen as an explanation for the standard action and performance of the product. When planning to use the product, please ensure that the external conditions are reflected in the actual circuit, assembly, and program designs.

3. When designing your product, please use our product below the specified maximum ratings and within the specified operating ranges including, but not limited to, operating voltage, power dissipation, and operating temperature.

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