

# 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  $\mu$ Vrms typ.)
- Low supply current (17  $\mu$ A typ.)
- Low standby current (0.1  $\mu$ A max.)
- Low voltage drive ( $V_{DD}$  = 1.1 V to 3.6 V)

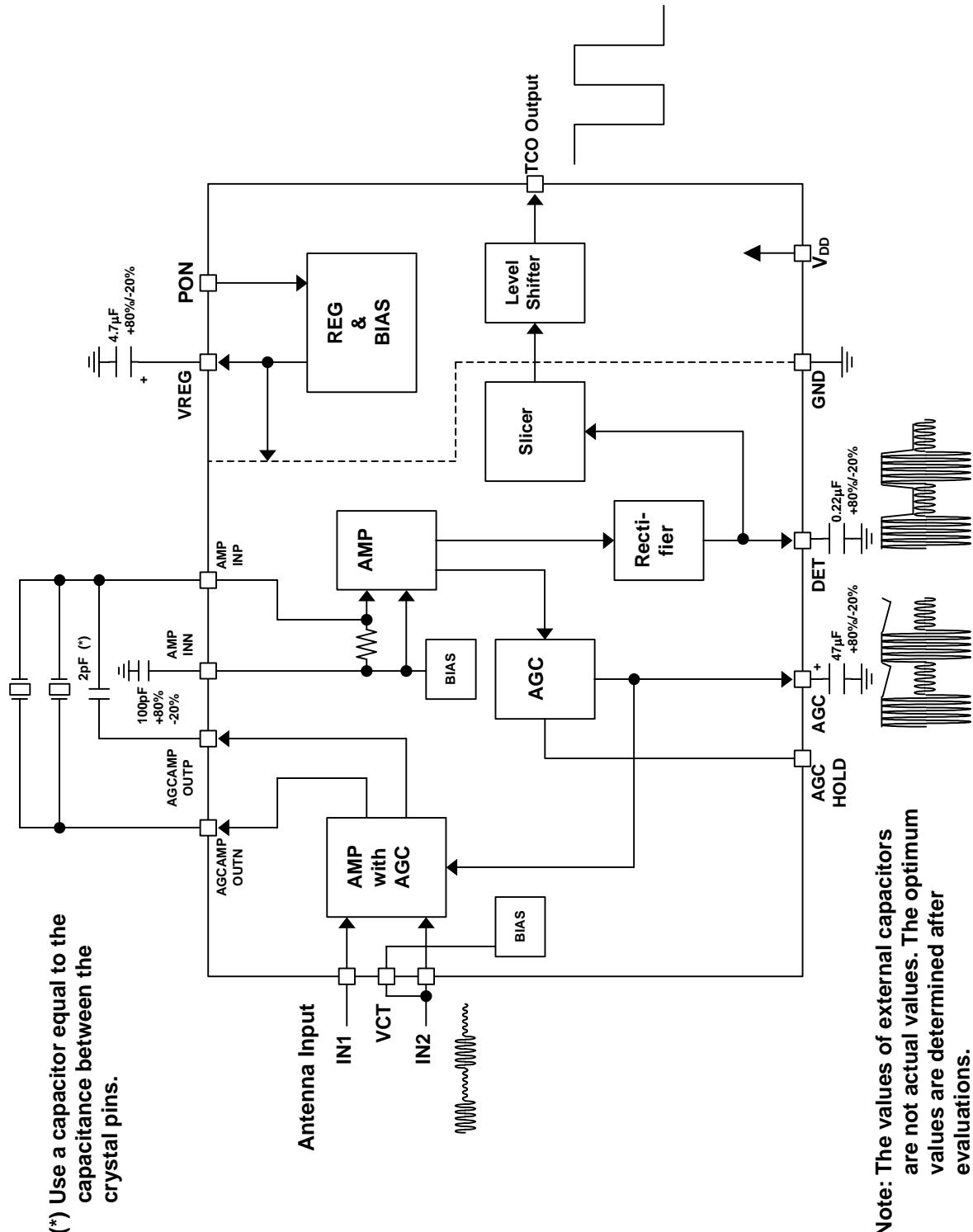
#### Functions

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

#### Package

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

## BLOCK DIAGRAM

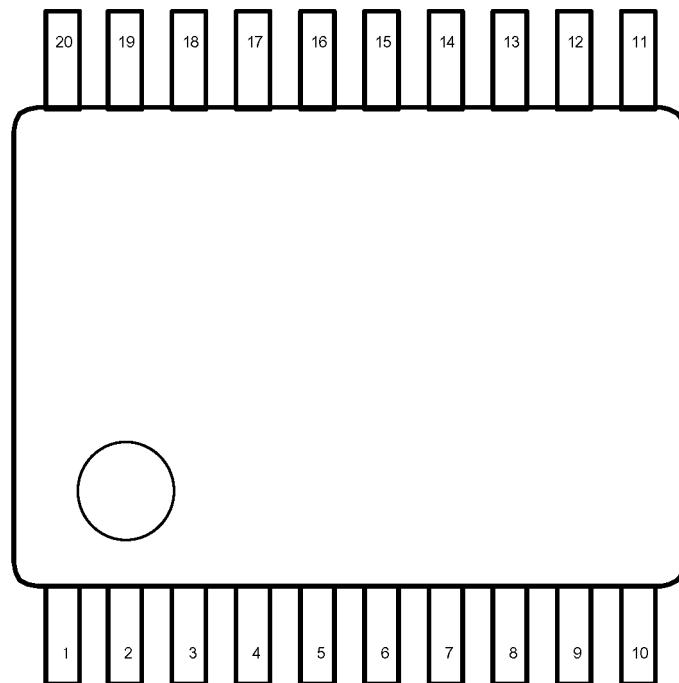


(\*) Use a capacitor equal to the capacitance between the crystal pins.

**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 <sub>DD</sub>	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

- Pin descriptions

Pin	Symbol	I/O	Description
1	VREG	—	Regulator output pin Connect a 4.7 $\mu$ F capacitor between this pin and the GND pin.
2	V <sub>DD</sub>	—	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 $\mu$ F capacitor between this pin and the GND pin.
8	DET	—	DET pin for an external capacitor Connect a 0.22 $\mu$ F 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

## RADIO WAVE RECEIVING IC SPECIFICATIONS

### Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Maximum supply voltage	$V_{DD}$	$T_a = 25^\circ C$	−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

$V_{DD} = 1.5$  V,  $GND = 0$  V,  $T_a = 25$  °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

- 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	$V_{ILA}$	During AGC hold	—	—	$0.2*V_{DD}$	V
AGC_HOLD "H" input current	$ I_{IHAH} $	$VI = V_{DD}$	—	0.01	—	$\mu A$
AGC_HOLD "L" input current	$ I_{ILA} $	$VI = 0.0V$	—	0.01	—	$\mu A$

- 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	—	$\mu A$
PON "L" input current	$ I_{ILPON} $	$VI = 0.0V$	—	0.01	—	$\mu A$

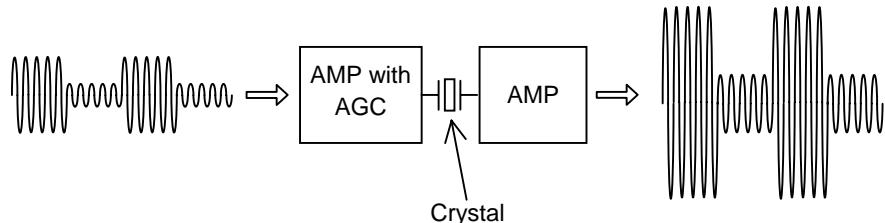
- AC characteristics

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

## DESCRIPTION OF EACH BLOCK

### (1) AMP Block

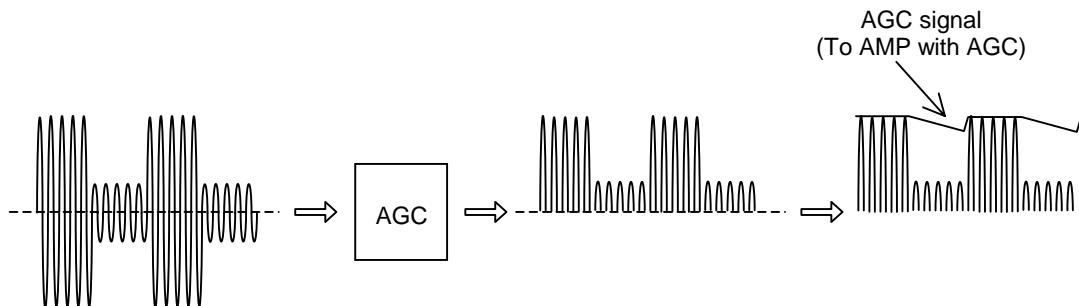
Radio waves received by the antenna will be amplified by AMP with AGC. Signals output from AMP with AGC will go through an external quartz resonator, which serves as a band-pass filter, and will be amplified again at AMP.



### (2) AGC Block

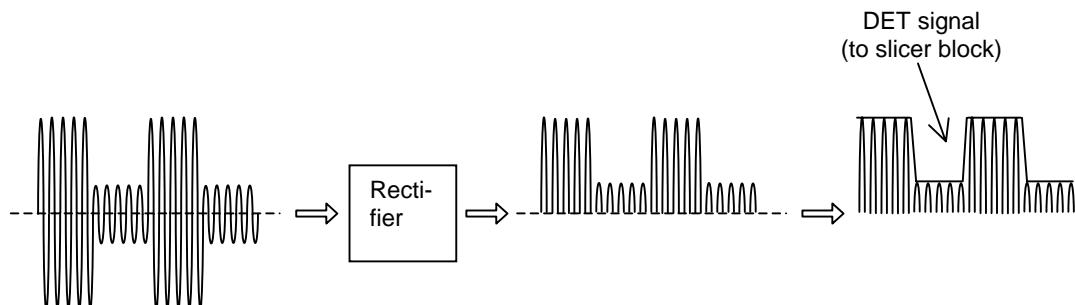
Output signals from AMP will be input to the AGC block and the rectifier block. After signals are input to the AGC block, their high side peak amplitudes are detected. As AGC signals, they will be fed back to AMP with AGC.

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."



### (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.

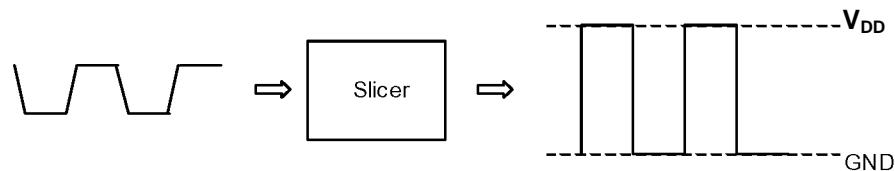


**(4) Slicer Block**

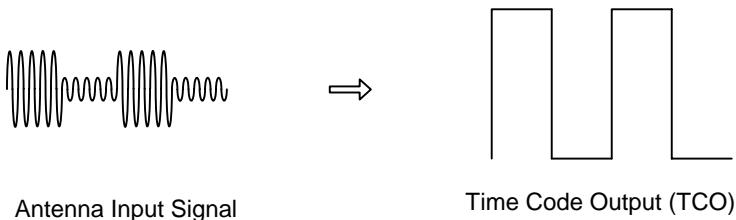
Signals output from the rectifier block are input to the slicer block and will be shaped to  $V_{DD}$  as "1" and GND as "0". Then, these outputs will be output as time codes (TCO).

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."

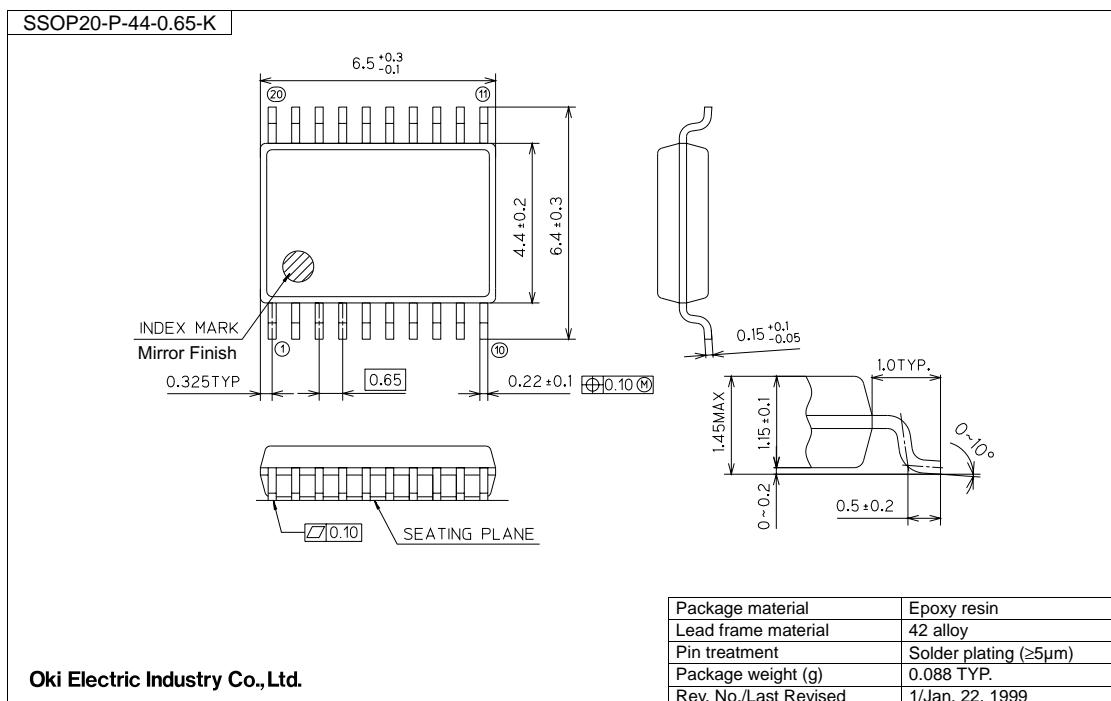
**(5) Time Code Output**

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.



## PACKAGE DIMENSIONS

(Unit: mm)



## 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		Description
		Previous Edition	Current Edition	
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 $\mu$ F to 38 $\mu$ F 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 <sub>CC</sub> to V <sub>DD</sub> in the "AGC hold characteristics" table.
		5	6	Changed V <sub>CC</sub> to V <sub>DD</sub> in the "PON characteristics" table.
		6	7	Partially changed the contents of the "AMP Block" and "AGC Block" Sections.
		7	8	Changed V <sub>CC</sub> to V <sub>DD</sub> 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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