

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

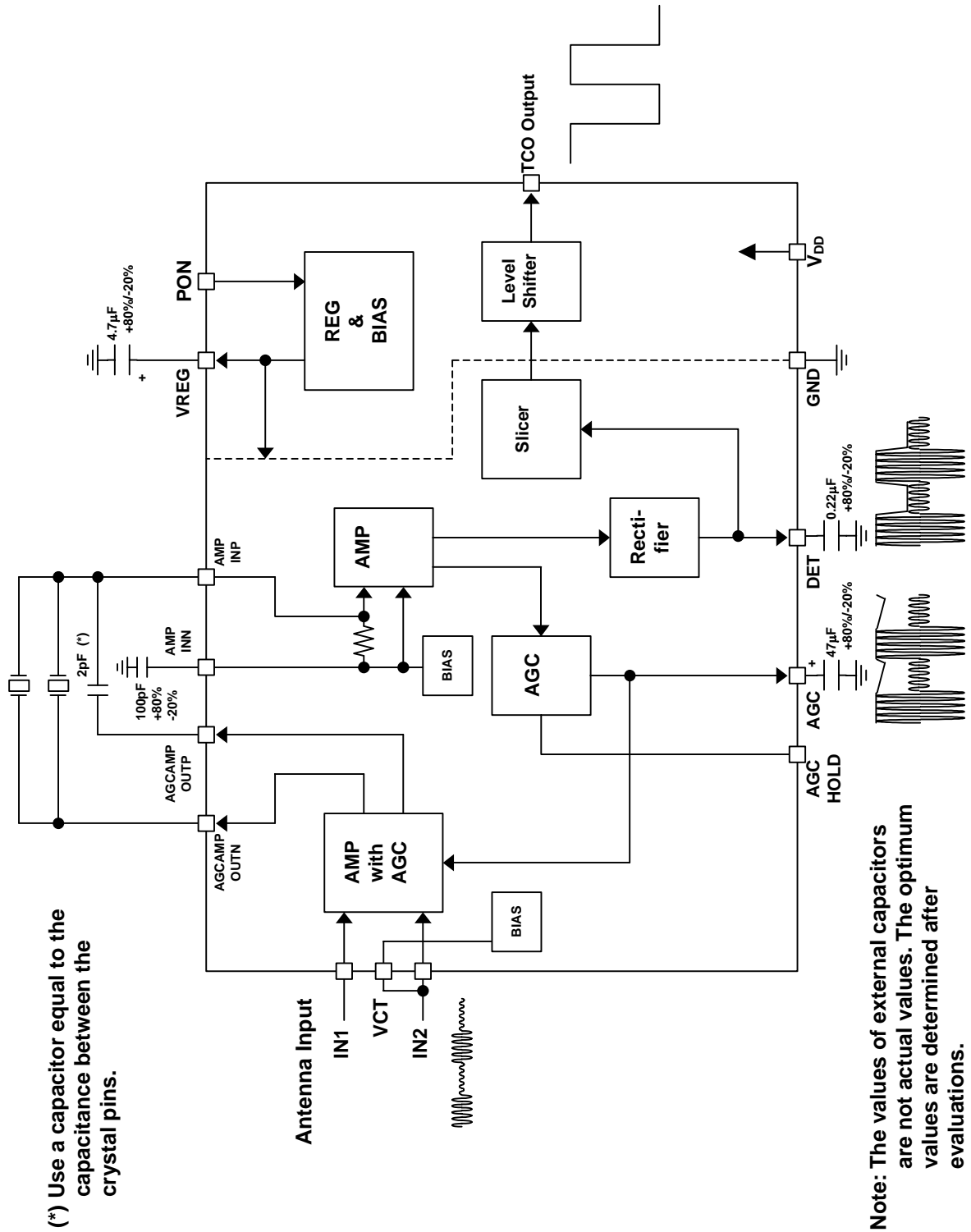
**Functions**

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

**Package**

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

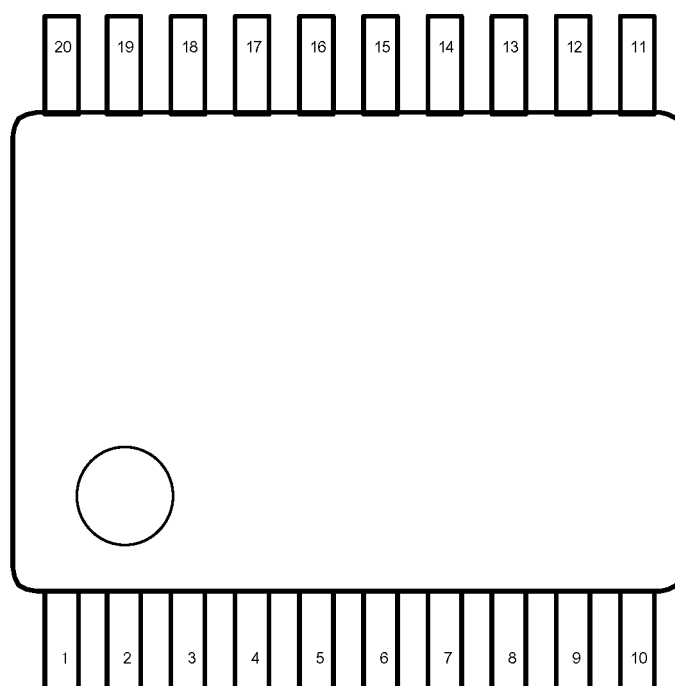
**BLOCK DIAGRAM**



**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<br>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<br>“H”: Normal operation<br>“L”: Standby operation  |
| 5   | TCO             | O   | Time code output pin<br>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<br>“H”: AGC operation<br>“L”: AGC hold operation  |
| 7   | AGC             | —   | AGC pin for an external capacitor<br>Connect a 47 $\mu$ F capacitor between this pin and the GND pin.  |
| 8   | DET             | —   | DET pin for an external capacitor<br>Connect a 0.22 $\mu$ F capacitor between this pin and the GND pin.  |
| 9   | TEST            | —   | TEST pin<br>Leave this pin open.   |
| 10  | GND             | —   | Ground pin   |
| 11  | AMPINP          | I   | AMP input pin  |
| 12  | AMPINN          | I   | AMP input pin<br>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<br>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 | $V_{DD}$  | $T_a = 25^\circ\text{C}$ | -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          | $^\circ\text{C}$ |

### 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 | $^\circ\text{C}$ |

### Electrical Characteristics

$V_{DD} = 1.5\text{ V}$ ,  $GND = 0\text{ V}$ ,  $T_a = 25\text{ }^\circ\text{C}$ , and  $f_{IN} = 40\text{ kHz}$  unless otherwise specified.

#### • DC characteristics

| Parameter            | Symbol      | Condition                      | Min      | Typ | Max | Unit             |
|----------------------|-------------|--------------------------------|----------|-----|-----|------------------|
| Supply current       | $I_{DD}$    | —                              | —        | 17  | 38  | $\mu\text{A}$    |
| Standby current      | $I_{STB}$   | —                              | —        | —   | 0.1 | $\mu\text{A}$    |
| Voltage sensitivity  | $V_{INmin}$ | —                              | —        | 0.7 | —   | $\mu\text{Vrms}$ |
| Maximum signal input | $V_{INmax}$ | —                              | 100      | —   | —   | $\text{mVrms}$   |
| Input resistance     | $R_{in}$    | Between IN1 and IN2 pins       | 2        | —   | —   | $\text{M}\Omega$ |
|                      |             | Between AMPINP and AMPINN pins | —        | 500 | —   | $\text{k}\Omega$ |
| 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)             | $I_{OH}$  | $V_O = V_{DD} - 0.1\text{ V}$ | —            | -35 | —   | $\mu\text{A}$ |
| Output current (low)              | $I_{OL}$  | $V_O = 0.1\text{ V}$          | —            | 35  | —   | $\mu\text{A}$ |
| 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<br>"H" input voltage | $V_{IH\text{AH}}$   | During normal operation | $0.8 \cdot V_{DD}$ | —    | —                  | V             |
| AGC_HOLD<br>"L" input voltage | $V_{IL\text{AH}}$   | During AGC hold         | —                  | —    | $0.2 \cdot V_{DD}$ | V             |
| AGC_HOLD<br>"H" input current | $ I_{IH\text{AH}} $ | $V_I = V_{DD}$          | —                  | 0.01 | —                  | $\mu\text{A}$ |
| AGC_HOLD<br>"L" input current | $ I_{IL\text{AH}} $ | $V_I = 0.0\text{V}$     | —                  | 0.01 | —                  | $\mu\text{A}$ |

- PON characteristics

| Parameter             | Symbol               | Condition               | Min                | Typ  | Max                | Unit          |
|-----------------------|----------------------|-------------------------|--------------------|------|--------------------|---------------|
| PON "H" input voltage | $V_{IH\text{PON}}$   | During normal operation | $0.8 \cdot V_{DD}$ | —    | —                  | V             |
| PON "L" input voltage | $V_{IL\text{PON}}$   | During standby mode     | —                  | —    | $0.2 \cdot V_{DD}$ | V             |
| PON "H" input current | $ I_{IH\text{PON}} $ | $V_I = V_{DD}$          | —                  | 0.01 | —                  | $\mu\text{A}$ |
| PON "L" input current | $ I_{IL\text{PON}} $ | $V_I = 0.0\text{V}$     | —                  | 0.01 | —                  | $\mu\text{A}$ |

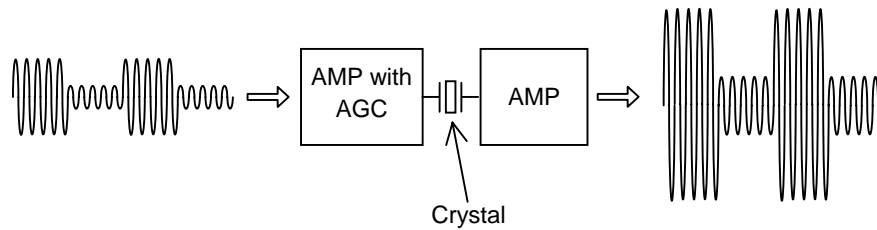
- AC characteristics

| 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**

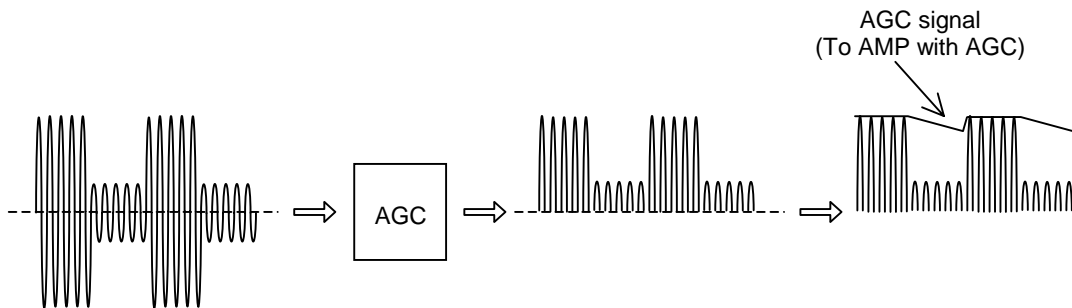
Radio waves received by the antenna will be amplified by AMP with AGC. Signals output from AMP with AGC will go through an external quartz resonator, which serves as a band-pass filter, and will be amplified again at AMP.



**(2) AGC Block**

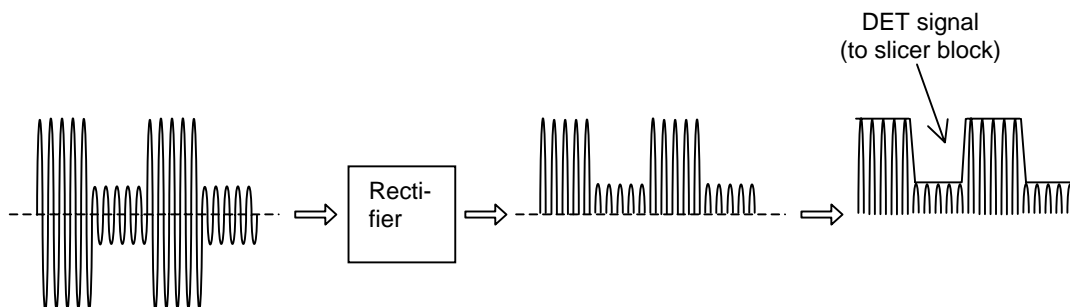
Output signals from AMP will be input to the AGC block and the rectifier block. After signals are input to the AGC block, their high side peak amplitudes are detected. As AGC signals, they will be fed back to AMP with AGC.

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.

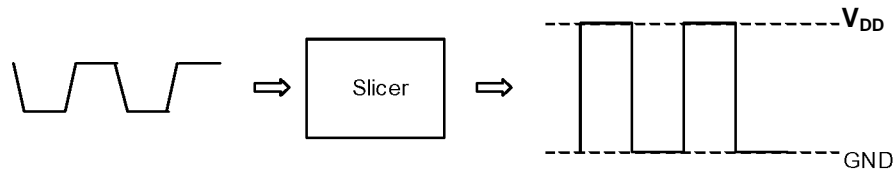


**(4) Slicer Block**

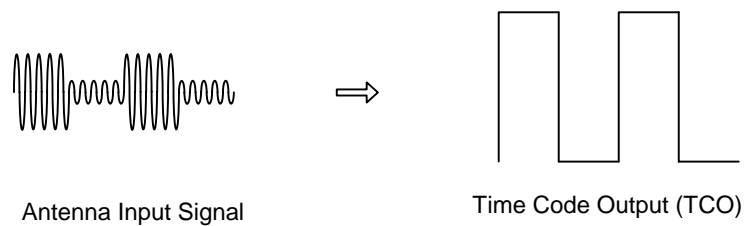
Signals output from the rectifier block are input to the slicer block and will be shaped to  $V_{DD}$  as "1" and GND as "0". Then, these outputs will be output as time codes (TCO).

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**

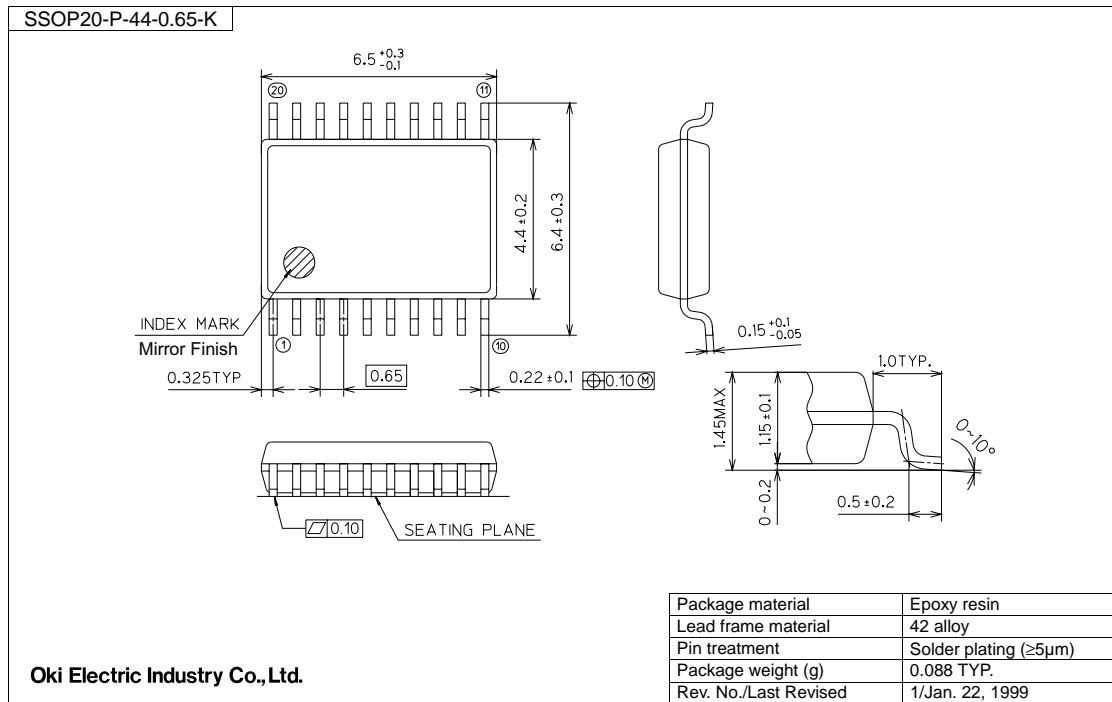
The time code output (TCO) of the ML6190A is in phase with actual time codes input from the antenna. A "H" level is output for the large amplitude signal and a "L" level is output for the small amplitude signal.





**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 $V_{CC}$ 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 $V_{CC}$ to $V_{DD}$ 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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