

**NEW PRODUCTS 7**

# INDUSTRY'S FIRST SINGLE-CHIP LSI WITH RF AMPLIFIER FOR CD PLAYER

## μPD63710

*Masanori Ogura*

**Introduction**

The compact-disc player market is now mature, in fact saturated, in the home audio and portable fields. However, this is not the case in the automobile field, where the market is expected to grow at a rate of about 10% annually. The most recent player systems are required to offer high cost performance as well as be space saving by reducing the number of components.

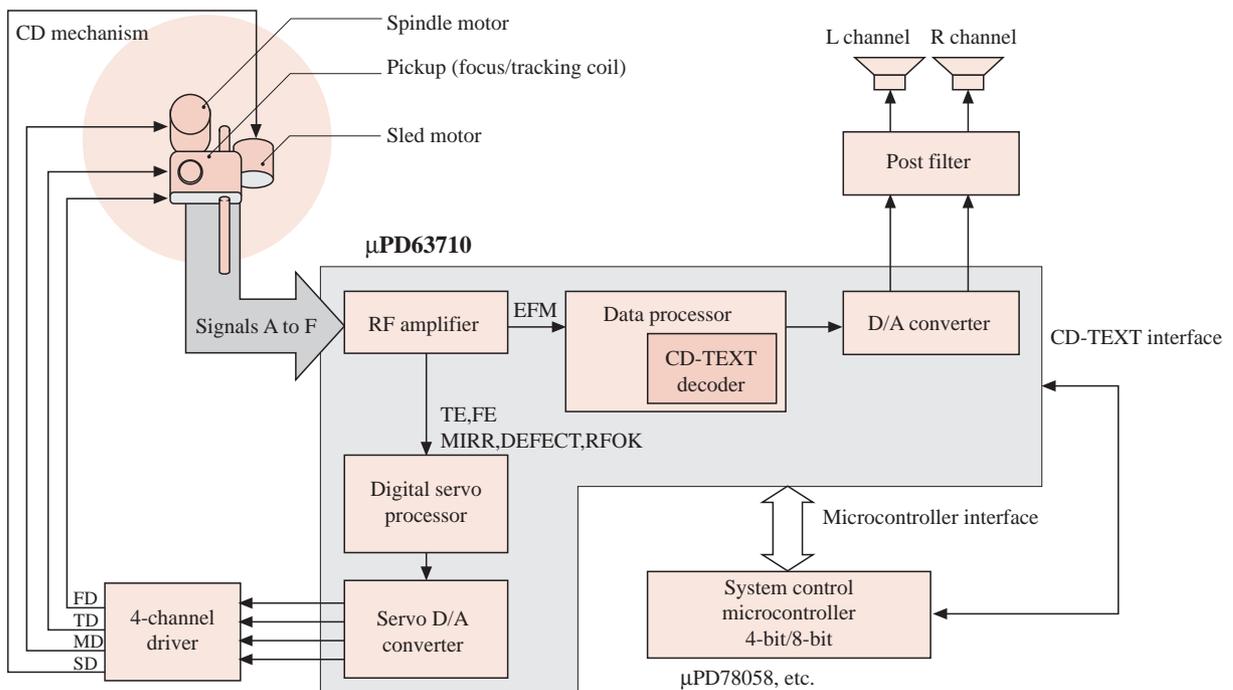
Especially in the field of automobiles, a compact disc player needs to be as small as possible because it must coexist with other equipment such as a mini-disc player and an in-dash TV in a limited space. The single-chip LSI for CD, μPD63710, to be introduced in this article has been developed to satisfy these requirements.

The μPD63710 integrates the functions necessary for a compact disc player on a

single chip, and in addition to existing-product specifications, contains an RF amplifier and its peripheral components to enhance system integration. As a result, this LSI can reduce the number of external components, helping to create a small and cost-effective system (Fig. 1).

**Product Outline**

- Industry-first integration of digital servo



**Fig. 1 System Configuration Example of CD Player Using μPD63710**

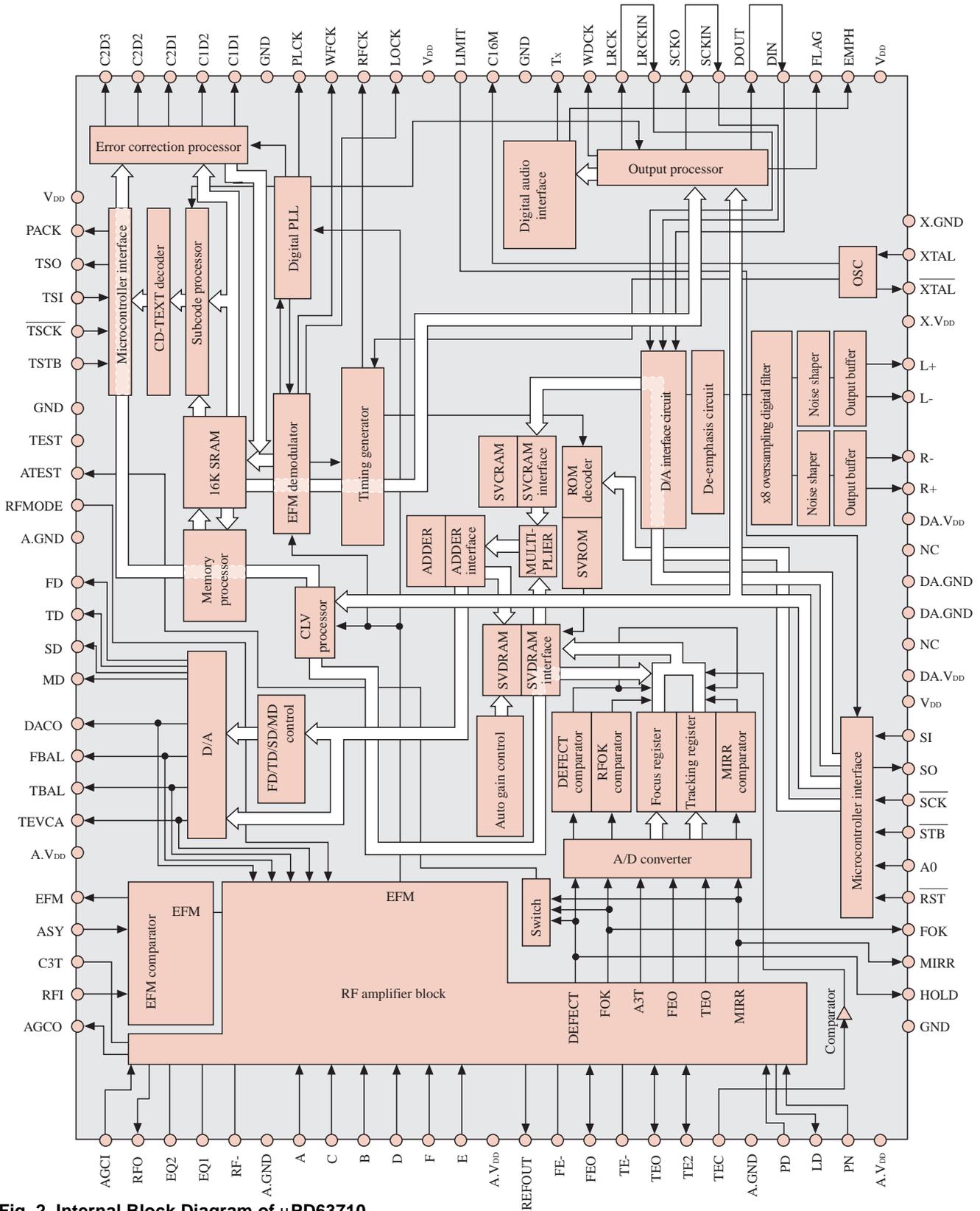


Fig. 2 Internal Block Diagram of μPD63710

for CD, signal processor for CD, audio DAC, and RF amplifier on a single chip

- Supports standard-speed/double-speed play back
- Employs a digital loop filter for 4-channel servo control. Because the filter coefficient is programmable, various filter characteristics can be realized to accord with the CD mechanism used (sampling frequency of digital filter: 176.4 kHz).
- Realizes fully automatic adjustment of servo system by microcontroller. Offset/gain/balance for both focusing and tracking can be automatically controlled by microcontroller.
- Includes a digital attenuation function that can set 256 steps independently for L/R channels as audio output processing.
- CIRC error correction function.  
C1: Duplex correction  
C2: Quadruplex correction (in CD-ROM mode)
- Includes a x8 oversampling digital filter and 4th-order  $\Delta\Sigma$  1-bit D/A converter for audio.
- Supports both current output and voltage output pickups
- Supply voltage: 5 V, single power source
- Package: 100-pin plastic LQFP (fine pitch) (14 mm x 14 mm)

Figure 2 shows the internal block diagram of the  $\mu$ PD63710.

**Features**

**1. Integration of functions necessary for compact disc player on single chip**

The biggest feature of the  $\mu$ PD63710 is the incorporation of the industry's first CMOS RF amplifier and its peripheral components. In addition, this LSI integrates the functions necessary for a compact disc player, such as digital servo, CD signal processor, and audio DAC, on a single chip, contributing to the creation of a small-size and cost-effective application set.

**2. Employment of digital PLL circuit**

Because a digital PLL is employed for bit clock playback, no external component is necessary for this block. As a result, fluctuations in characteristics due to temperature changes and aging can be suppressed.

**3. Flexible setting of filter coefficients**

The four-channel servo system employs a digital loop filter. The coefficients of each filter can be flexibly set. By this, various characteristics that match the optimum servo characteristics of the pickup to be used can be realized. In addition, offset, gain, and balance for focusing and tracking can be automatically adjusted by a microcontroller, so that the optimum servo characteristics can always be realized without being affected by variations of the pickup and disc.

**4. CD-TEXT decode function**

The  $\mu$ PD63710 has a CD-TEXT decode function (that also supports Mode2), which facilitates the creation of a small-size and high-performance system.

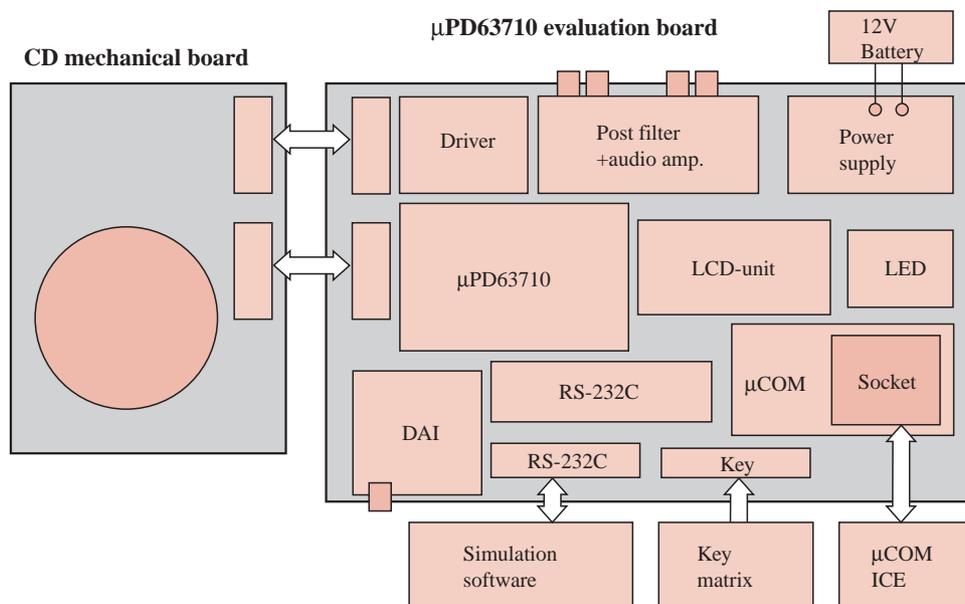
**Support Tools**

To evaluate and verify the basic functions of the  $\mu$ PD63710 and to develop the microcontroller firmware, a  $\mu$ PD63710 evaluation board is available. In addition, filter simulation software that sets the coefficient of the internal digital loop filter of the  $\mu$ PD63710 to the optimum value is also available.

**1. Outline of  $\mu$ PD63710 evaluation board**

The  $\mu$ PD63710 evaluation board has a microcontroller ( $\mu$ PD78P058) for system control and the firmware already written to the memory has the following specifications:

- Key input from a key matrix board or key input from a personal computer via RS-232C interface can be selected.
- Under the control of a personal computer, the board can be directly operated with the servo coefficients calculated with filter simulation software.
- Because each servo of focus, spindle, tracking, and sled can be individually controlled in the servo evaluation mode, evaluation and verification can be



**Fig. 3 Configuration of  $\mu$ PD63710 Evaluation Board**

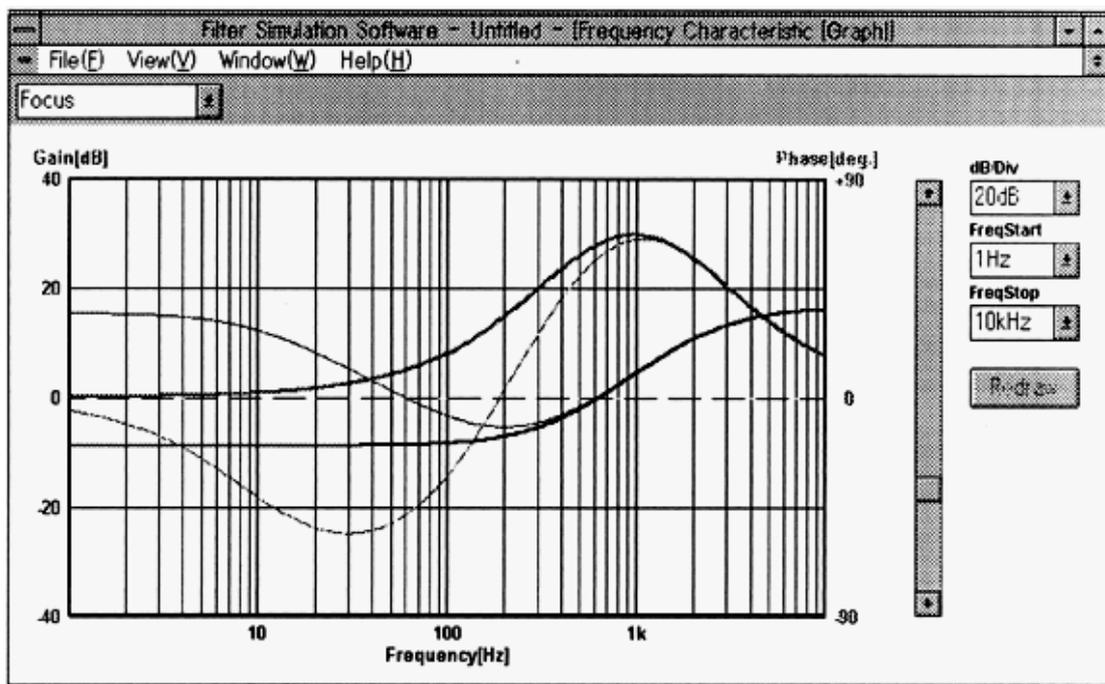


Fig. 4 Display Example for Calculating Frequency Characteristics with  $\mu$ PD63710 Filter Simulation Software

performed with an emphasis placed on the servo characteristics of the  $\mu$ PD63710.

- In the system evaluation mode, the basic operations of a CD player, such as fast-forward/rewind, random, and repeat playback, can be verified. By connecting an emulation board with an emulation probe, firmware of a microcontroller can be developed instead of using the  $\mu$ PD78P058 (Fig. 3).

**2. Outline of  $\mu$ PD63710 filter simulation software**

The  $\mu$ PD63710 filter simulation software performs the following simulation for each of the filters for focus, tracking, sled, spindle, and gain detection:

- If a specific coefficient is set, the frequency characteristics of the gain and phase under the set conditions are calculated.
- By setting a filter type and parameters related to the filter type, the characteristics that can be realized are approximated and

coefficients are calculated.

- An output wave with a sine wave input to the filter is shown above (Fig. 4). The calculated coefficients can be saved to or read from a file.

**Future Development**

NEC has successfully integrated an RF amplifier on an LSI for CD, which has been considered a difficult task. Based on this success, NEC will continue promoting the development of SOC (System-On-a-Chip).