



# Car Audio, Automotive LAN Data Communication Equipment

'05-8



# SANYO Car Audio and Automotive LAN Devices

**Automotive electronics is a field where advances are occurring on a daily basis, notably with regard to the sound and information space realized through refined proprietary technologies.**

Automotive network technology controls many different types of information such as automotive AV.

SANYO's LSIs powerfully support activities such as listening, watching, searching, and relaxing in this ubiquitous age, and support diverse needs with a diversified product lineup and a broad array of technologies.

The proprietary technologies of SANYO, a world leader in this field, are defining the present and near future of automotive devices.

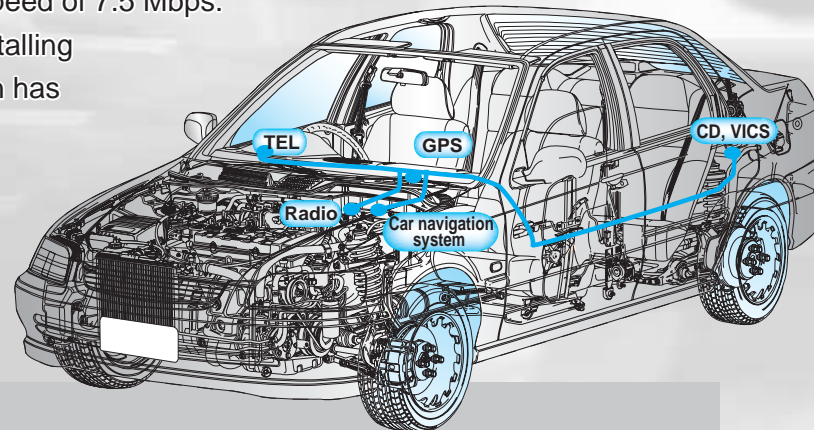
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CARNET is a LAN that uses the ARCNET token passing bus method.

It can achieve a high transmission speed of 7.5 Mbps.

Since noise can be minimized by installing this LAN in vehicles, such installation has very little impact on other devices.



## Features

- Hub function supporting connection of up to 8 nodes
- Construction of LAN with high transmission speed of 7.5 Mbps yet ultra low noise possible
- Twisted pair cables can be used
- Easy to use due to compact size

## LA2330W

CARNET/transceiver **Under development**

A 7.5 Mbps automotive LAN can be configured by combining the LA2330W with a protocol IC for CARNET (ARCNET controller TMC20040C Series).

- On-chip driver/receiver for The audio equipment control bus
- On-chip driver/receiver for CAN
- Includes 8 non-inverted type open-collector output comparator circuits

### Features

- The audio equipment control bus block, CAN block bus output withstand voltage of 18 V
- Vehicle signal detection block input withstand voltage of 18 V
- Each block is independent (incl. power supply and GND line), and each is provided with a standby function.

### Functions

- Transceiver block for CARNET
  - (1) Transmitter (D/A converter (3-bit), LPF (for EMI prevention), output driver)
  - (2) Receiver (attenuator, receiving amplifier, noise elimination LPF (for reception signal), comparator (for waveform shaping))
- Driver/receiver block for The audio equipment control bus
  - (1) Transmitter (output driver)
  - (2) Receiver (receiving amplifier, hysteresis comparator (for waveform shaping))
- Driver/receiver block for CAN
  - (1) Transmitter (LPF (for EMI prevention), output driver)
  - (2) Receiver (attenuator, comparator)
- Non-inverted type open-collector output comparator

## LA2333T

The audio equipment control bus transceiver + comparator

**Under development**

1-chip IC incorporating an The audio equipment control bus transceiver and comparator

### Features

- The audio equipment control bus output withstand voltage of 18 V
- Vehicle signal detection block input withstand voltage of 18V

### Functions

- Driver/receiver block for The audio equipment control bus
  - (1) Transmitter (output driver)
  - (2) Receiver (receiving amplifier, hysteresis comparator (for waveform shaping))
- Non-inverted type open collector output comparator

## LA2351M

Transceiver for CARNET

The LA2351M is a low-noise transceiver IC for automotive LANs.

### Features

- Support of either 3-bit digital or staircase signals as input signal  
If a 3-bit digital signal cannot be routed as an EMI countermeasure, place an R-2R ladder in the vicinity of the protocol chip and route the signal following D/A conversion, connecting it to the LPF input.
- A 5-Mbps or 7.5 Mbps automotive LAN can be constructed by combining the LA2351M with a protocol IC for automotive LAN (ARCNET controller TMC20040C Series).
- On-chip adjustment LPF
- Low-noise data communication is possible.

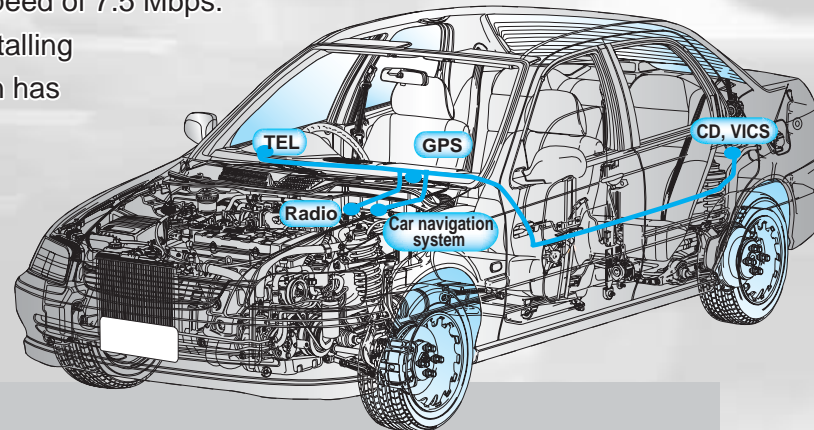
### Functions

- Transmitter (transmit) block
  - 1) D/A converter (3-bit)
  - 2) LPF (for EMI prevention)
  - 3) Output driver
- Receiver (receive) block
  - 1) Receiving amplifier
  - 2) Noise elimination LPF (for reception signal)
  - 3) Comparator (for waveform shaping)

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  - (2) Receiver (attenuator, receiving amplifier, noise elimination LPF (for reception signal), comparator (for waveform shaping))
- Driver/receiver block for The audio equipment control bus
  - (1) Transmitter (output driver)
  - (2) Receiver (receiving amplifier, hysteresis comparator (for waveform shaping))
- Driver/receiver block for CAN
  - (1) Transmitter (LPF (for EMI prevention), output driver)
  - (2) Receiver (attenuator, comparator)
- Non-inverted type open-collector output comparator

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### Features

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- Vehicle signal detection block input withstand voltage of 18V

### Functions

- Driver/receiver block for The audio equipment control bus
  - (1) Transmitter (output driver)
  - (2) Receiver (receiving amplifier, hysteresis comparator (for waveform shaping))
- Non-inverted type open collector output comparator

## LA2351M

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### Features

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- On-chip adjustment LPF
- Low-noise data communication is possible.

### Functions

- Transmitter (transmit) block
  - 1) D/A converter (3-bit)
  - 2) LPF (for EMI prevention)
  - 3) Output driver
- Receiver (receive) block
  - 1) Receiving amplifier
  - 2) Noise elimination LPF (for reception signal)
  - 3) Comparator (for waveform shaping)

# CAN

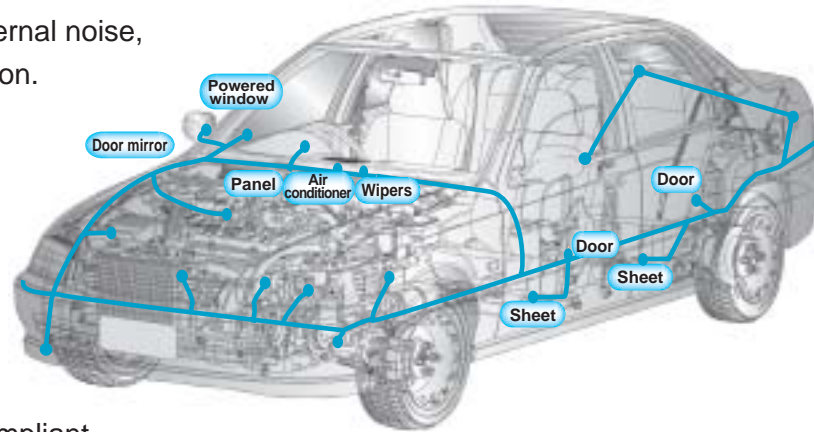
# MOST

CAN is a high-reliability LAN for controlling body transmission devices. CAN can achieve a high transmission rate of 1 Mbps and is strong against external noise, thus allowing stable communication.

MOST is an automotive LAN that uses POF (plastic optical fiber). It allows the construction of a low-noise high-speed (50 Mbps) LAN. POF multimedia (TV, DVD, car navigation, etc.) can be controlled in one go by using this high-speed LAN. The MOST standard is licensed by OASIS.

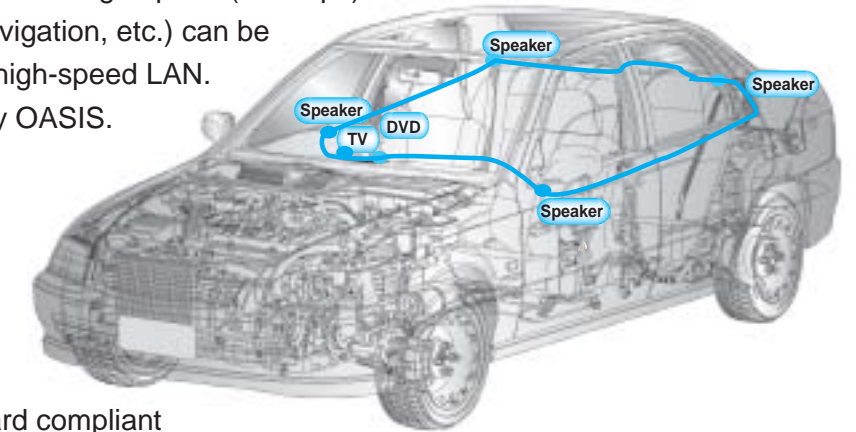
## Features

- ISO11898 compliant
- Low power consumption
- Transmission speed of up to 1 Mbps
- On-chip lamp signal control



## Features

- MOST standard compliant
- Low power consumption (low current during standby)
- Transmission speed of up to 50 Mbps
- Few external parts (unit downsizing possible)
- High throughput makes stable communication possible



## LA2360M

Transceiver for CAN **Under development**

The LA2360M is a transceiver IC for CAN.

### Features

- ISO11898 compliant
- Transmission speed of 1 Mbps

### Functions

- Transmitter (transmit) block
  - Output driver
- Receiver (receive) block
  - Attenuator
  - Comparator

## LA2361JM/LA2361AM

Transceiver for CAN **Under development**

### Features

- ISO11898 compliant
- Low power consumption
- Transmission speed of 1 Mbps
- Low output noise

### Functions

- Transmitter (transmit) block
  - Output driver
- Receiver (receive) block
  - Attenuator
  - Comparator

## LA2340M/LV2341M

MOST transceiver **Under development**

The LA2340M is an I/V converter that can be used to configure an optical electric converter (OEC) when combined with a photo diode (PD).

The LV2341M is a LED driver that can be used to configure an electric optical converter (EOC) when combined with a LED.

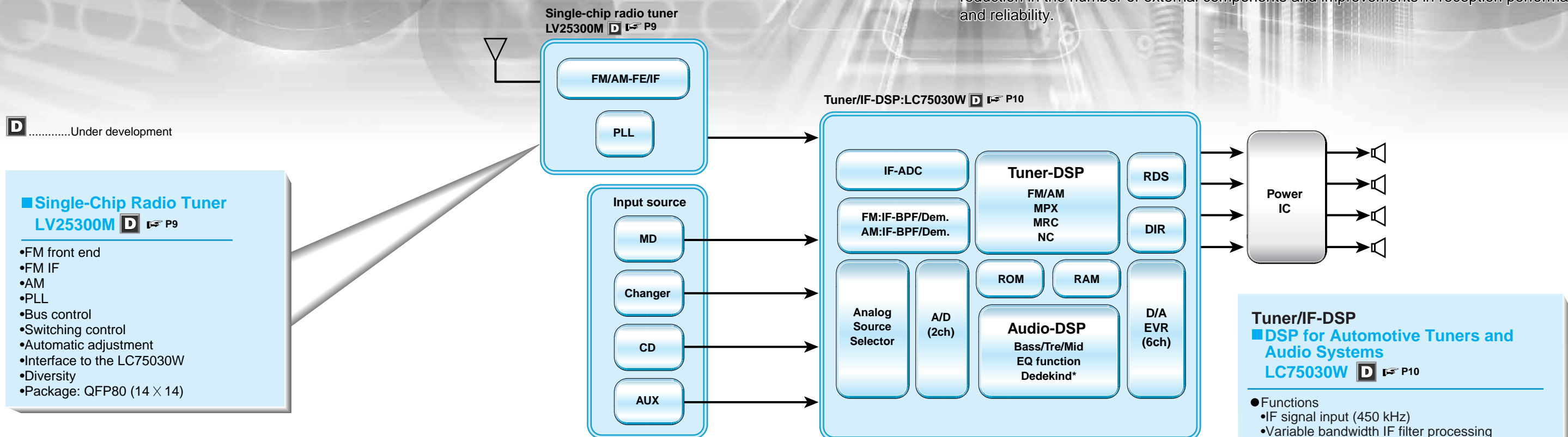
### Features

- 50-Mbps automotive LAN can be constructed with POF
- Standby function
- Transmission speed of up to 50 Mbps
- POF cable
- Power supply voltage: +5 V

# Digital Radio System Chipsets

For Automotive AV Equipment

SANYO's digital radio system is a chipset consisting of the LC75030W car audio tuner/IF-DSP system IC and the LV25300M tuner system IC. By converting the analog waveform to digital with the DSP, this chipset achieves a significant reduction in the number of external components and improvements in reception performance and reliability.



**D** .....Under development

**Single-Chip Radio Tuner LV25300M** **D** P9

- FM front end
- FM IF
- AM
- PLL
- Bus control
- Switching control
- Automatic adjustment
- Interface to the LC75030W
- Diversity
- Package: QFP80 (14 × 14)

**Tuner/IF-DSP DSP for Automotive Tuners and Audio Systems LC75030W** **D** P10

- Functions
  - IF signal input (450 kHz)
  - Variable bandwidth IF filter processing
  - FM/AM detection processing and noise cancellation processing
  - FM stereo demodulation
  - RDS data demodulation circuit
  - Analog source selector and A/D converter
  - Electronic volume control
  - 6-channel D/A converter
  - Interrupt audio mixing
- Featuring
  - High-precision adjacent channel detection algorithm and variable bandwidth IF filter
  - Two noise detection circuit systems and software waveform interpolation
  - DSP software provides optimal tuner settings, standardization, and adjustment-free manufacturing
  - Provides a 6-channel D/A converter and dedicated analog output pins for independent rear seat outputs.
  - Low power achieved by optimized design of the tuner circuit and DSP software.
- Package: SQFP144 (20 × 20)

**For Microcontrollers Control**

**Microcontroller with On-Chip LCD Drivers LC877 Series** P25 to 26

- ROM: 24 K to 128 KB
- RAM 1536 to 4096 × 9bits
- VDD: 5 V (300 ns), 2.5 V (750 ns)
- DC control software packages are available, and custom development can be easily supported.
- Package: Refer to the package lineup. P26

**Flash memory version** P25 to 26

**Wide Range of RAM and ROM Options**

**Signal Control Microcontrollers LC875 Series** P23 to 24

- This series is optimal since the abundant internal RAM can be used for smooth data management.
- ROM: 8 KB to 256 KB
- RAM: 1024 to 8192 × 9 bits

**Flash memory version** P23 to 24

**MPU** P23 to 26

- LC877 Series
- LC87F7XXX
- LC875 Series
- LC87F5XXX

All products described in this catalog contain developed products or products that are diverted from general types. In accordance with standard of quality management system ISO/TS16949 for automotive industry, there is a case where all demanded articles couldn't be supported, so please confirm to the salesman of our company at every order.

CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.



Dedekind function(Dedekind\*) is Dedekind R&D's trade name.

Flash products are licensed from Silicon Storage Technology, Inc.,(USA), and manufactured and sold by SANYO Electric Co., Ltd.

## Extensive lineup provides full support for a wide range of systems

- AM/FM Tuner Block**
- Varactor diodes for AM tuning
    - SVC354 (3 diodes), SVC364 (4 diodes), SVC371 (6 diodes)
  - Varactor diodes for FM tuning
    - SVC230 (CR (C2.0V/C8.0V) ≥1.65, Q ≥100)
    - SVC243 (CR (C1.0V/C6.5V) ≥7.0, Q ≥40)
    - SVC272 (CR (C2.0V/C8.0V) ≥2.3, Q ≥150)

- SVC273 (CR (C2.0V/C8.0V) ≥3.1, Q ≥100)
  - \*: SV272, SV273: MCPH3 miniature package (2.1 × 2.0 mm)
- Dual gate MOSFETs for amplifiers
  - 3SK263 (V<sub>DS</sub> = 15 Vmin, I<sub>DSX</sub> = 2.4 to 24 mA, |y<sub>fs</sub>| = typ 14 ms), 3SK264 (V<sub>DS</sub> = 15 V, I<sub>DSX</sub> = 5.0 to 24 mA, |y<sub>fs</sub>| = typ 17 ms)
- JFET and transistors for AMP amplifiers
  - CPH5901 (high gain, typ 50 ms), CPH5905 (High ESD resistance type)

- Transistors for buffers
  - 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz), 2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- PIN diodes for AGC and switching
  - Series with r<sub>s</sub> = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H
- Other transistors (power supply, interface, and switch drive)
  - Bipolar transistors: 50C02CH (V<sub>CEO</sub> = 15 V, I<sub>C</sub> = 1 A, V<sub>CE</sub> (sat) = max 280 V) 2SC5706 (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 5 A, V<sub>CES</sub> (sat) = typ 90 mV) 2SD1913 (V<sub>CEO</sub> = 60 V, I<sub>C</sub> = 3A, PC = 20 W, h<sub>FE</sub> 70 to 280)

- PicoMOS™
  - 5LN 01M (Nch) Package: MCP (2.1 × 2.0 mm) V<sub>DSS</sub> = 50 V, I<sub>D</sub> = 100 mA, R<sub>DS</sub> (on) <V<sub>GS</sub> = 2.5V> = max 9.9 Ω
- Low on resistance power MOSFET
  - CPH6424 (Nch) Package: CPH6 (2.8 × 2.9 mm) V<sub>DSS</sub> = 60 V, I<sub>D</sub> = 3 A, R<sub>DS</sub> (on) <V<sub>GS</sub> = 4 V> = 150 mΩ

# 1-chip Tuner

# LV25300M

Under development



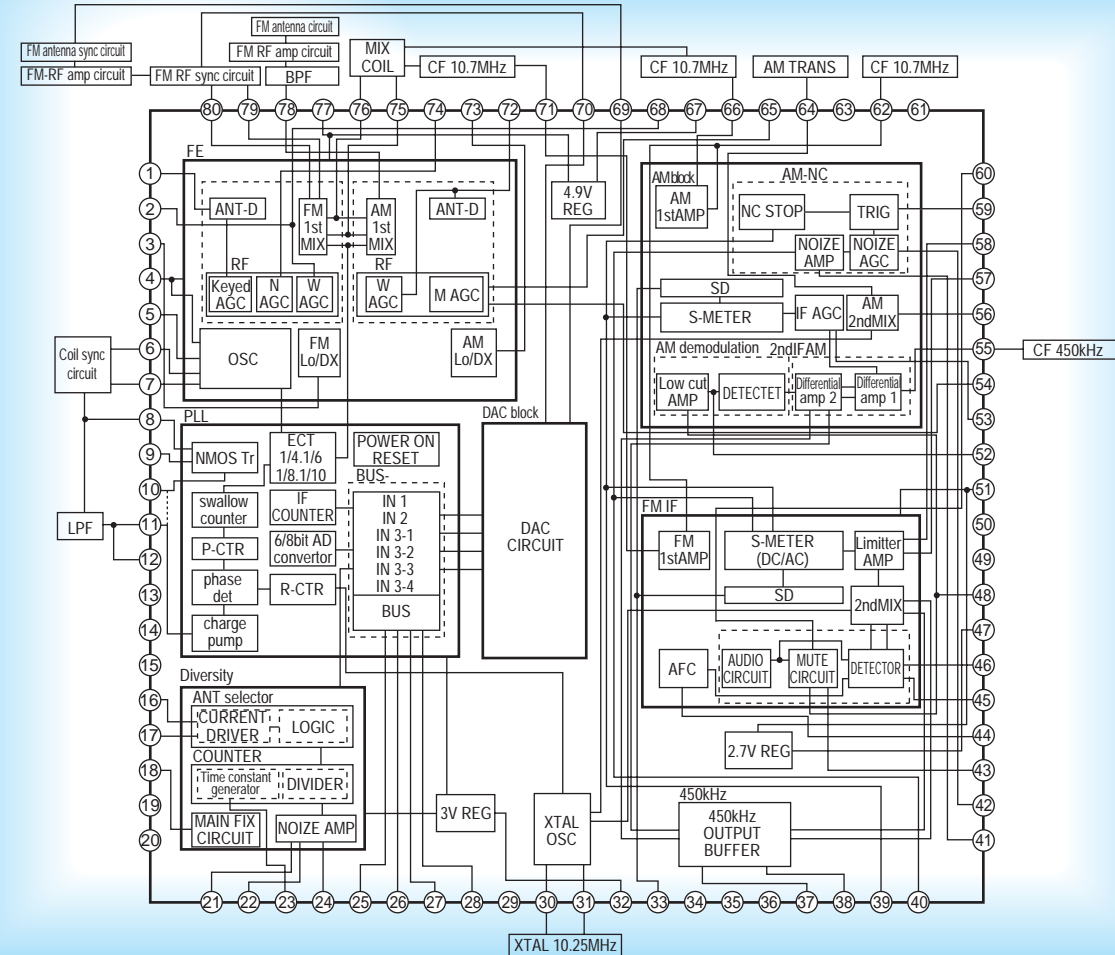
## Functions

The LV25300M is a tuning system that supports the LC75030W (SANYO audio DSP) that allows the creation of standard tuner modules. Various setting changes can be performed with the software of the control microcontroller according to the intended application, making the LV25300M ideal for combined use with the LC75030W. Small tuner modules can be developed with a smaller number of parts compared to conventional tuners and at a lower total cost. Since the LV25300M has a serial bus (CCB SANYO bus), the number of communication lines with the microcontroller is reduced by 4 and line routing problems during set production can be avoided, making a smaller board size possible. AM/FM wave demodulation is done through digital processing by outputting the IF signal (450 kHz) of the LV25300M to the LC75030W. Since the LC75030W has a function to change the IF selectivity according to the level of adjacent interference, just two 10.7 MHz ceramic filters suffice to achieve both high sound quality and adjacent interference, which used to be difficult until now because these are somewhat mutually exclusive characteristics. Moreover, the LV25300M comes with an antenna switching diversity function that switches two antennas in response to various electric field changes during operation, a malfunction prevention circuit that operates through antenna switching frequency detection, and a weak electric field detection and antenna fixing circuit that uses S meter voltage, making stable reception possible. Optimum tuner reception is possible by outputting the voltages of the LV25300M's S meter output and the AM/FM IF outputs to a DSP and judging the radio wave status in real time, and performance combinations and specification differentiation can be performed by software.

## Features

- FM F.E
- FM IF
- AM
- PLL
- Bass control
- Switching control
- Automatic adjustment
- Connection to LC75030W (Interface)
- Diversity function
- Package: QFP80 (14 × 14)

### Block Diagram



CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.



# Tuner/IF-DSP

# LC75030W

Under development

## Functions

The LC75030W is a DSP for car tuner/audio.

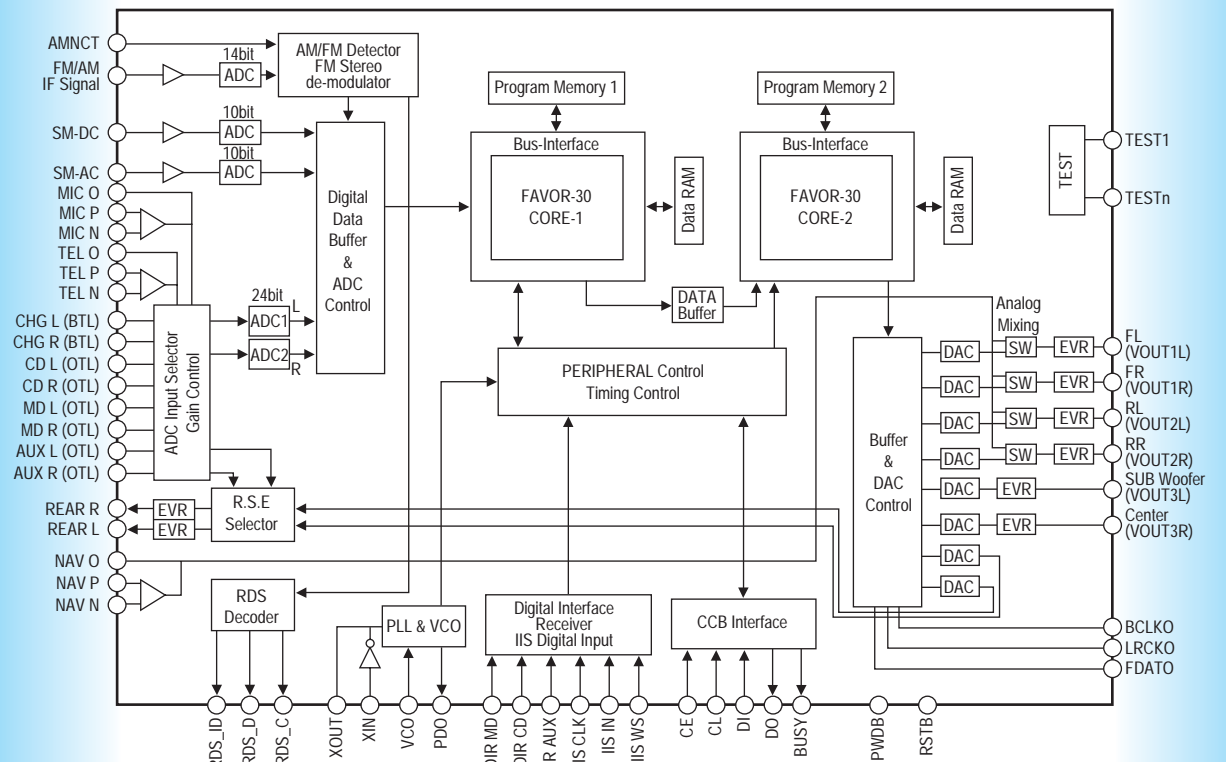
## Features

- IF signal input (450 kHz)
- Processing for variable IF filter bandwidth
- FM/AM demodulation processing, noise cancellation processing
- FM stereo demodulation
- RDS data demodulation circuit
- Analog source selector and ADC
- Electronic volume
- DAC: 6 channels
- Interrupt voice mixing

## Features

- High-accuracy adjacent station detection algorithm and variable IF bandwidth filter
- Waveform interpolation processing using two noise detection circuit and software systems
- DSP software for optimum tuning, standardization, and adjustment-free operation
- Analog output pin for dedicated rear sheet output that is independent of 6-channel DAC
- Realization of low power consumption through optimized design of tuner circuit and DSP software
- Package: SQFP144 (20 × 20)

### Block Diagram



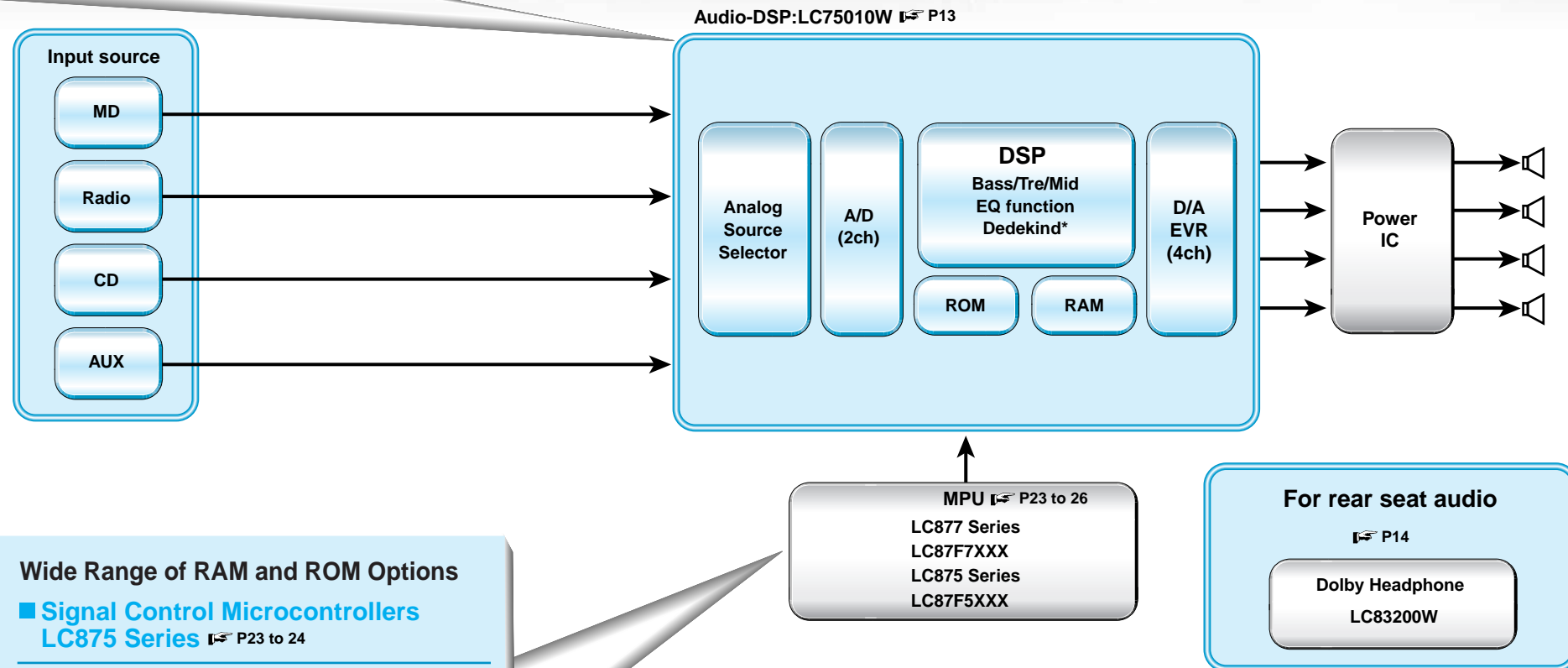
# Car Audio DSP System Chipsets

For Automotive AV Equipment

The LC75010W is a system-on-chip audio DSP that integrates A/D and D/A converters, a DSP core and all other required functions on the same chip, making it optimal for use in car audio systems. It is provided as a custom IC that includes DSP software that conforms to user specifications.

## Car Audio DSP LC75010W P13

- Hardware configuration
  - Analog source selector (Single-sided inputs: 3 channels, differential inputs: 1 channel)
  - A/D converter (stereo, one system)
  - DSP core
  - Program ROM and data RAM
  - D/A converter (4 channels)
  - Electronic volume control (4 channels)
  - Microcontroller interface (CCB: A SANYO-designed bus format)
- Software functions (example)
  - Equalizer function
  - Bass, middle, and treble control functions
  - Balance and fader functions
  - Volume control
  - Dedekind functions
  - User-specified DSP software functions
- Package: SQFP100 (14 × 14)



### For Microcontrollers Control

#### Microcontroller with On-Chip LCD Drivers LC877 Series P25 to 26

- ROM: 24 K to 128 KB
- RAM 1536 to 4096 × 9bits
- VDD: 5 V (300 ns), 2.5 V (750 ns)
- DC control software packages are available, and custom development can be easily supported.
- Package: Refer to the package lineup. P26

#### Flash memory version P25 to 26

### Wide Range of RAM and ROM Options

#### Signal Control Microcontrollers LC875 Series P23 to 24

- This series is optimal since the abundant internal RAM can be used for smooth data management.
- ROM: 8 KB to 256 KB
- RAM: 1024 to 8192 × 9 bits

#### Flash memory version P23 to 24

Dedekind function(Dedekind\*) is Dedekind R&D's trade name.

Flash products are licensed from Silicon Storage Technology, Inc.,(USA), and manufactured and sold by SANYO Electric Co., Ltd.

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CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.



## Extensive lineup provides full support for a wide range of systems

### AM/FM Tuner Block

- Varactor diodes for AM tuning
  - SVC354 (3 diodes), SVC364 (4 diodes), SVC371 (6 diodes)
- Varactor diodes for FM tuning
  - SVC230 (CR (C2.0V/C8.0V) ≥1.65, Q≥100)
  - SVC243 (CR (C1.0V/C6.5V) ≥7.0, Q ≥40)
  - SVC272 (CR (C2.0V/C8.0V) ≥2.3, Q ≥150)

- SVC273 (CR (C2.0V/C8.0V) ≥3.1, Q ≥100)  
\*: SV272, SV273: MCPH3 miniature package (2.1 × 2.0 mm)
- JFET and transistors for AMP amplifiers  
CPH5901 (high gain, typ 50 ms), CPH5905 (High ESD resistance type)
- Dual gate MOSFETs for FM amplifiers
  - 3SK263 (V<sub>DS</sub> = 15 V<sub>min</sub>, I<sub>DSX</sub> = 2.4 to 24 mA, |y<sub>fs</sub>| = typ 14 ms),
  - 3SK264 (V<sub>DS</sub> = 15 V, I<sub>DSX</sub> = 5.0 to 24 mA, |y<sub>fs</sub>| = typ 17 ms)

### Transistors for AM and FM buffers

- 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz),  
2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- PIN diodes for AM AGC and switching
  - Series with r<sub>s</sub> = typ 5 Ω: ISV247, ISV233, ISV246, ISV234, CPH5512
- PIN diodes for FM AGC and switching
  - Series with r<sub>s</sub> = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H

### Other transistors (power supply, interface, and switch drive)

- Bipolar transistors: 50C02CH (V<sub>CEO</sub> = 15 V, I<sub>C</sub> = 1 A, V<sub>CE</sub> (sat) = max 280 mV) (NPN)  
2SC5706 (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 5 A, V<sub>CE</sub> (sat) = typ 90 mV)  
2SD1913 (V<sub>CEO</sub> = 60 V, I<sub>C</sub> = 3 A, P<sub>C</sub> = 20 W, h<sub>FE</sub> 70 to 280)
- MOSFET: 5LN 01M (V<sub>DSS</sub> = 50 V, I<sub>D</sub> = 100 mA R<sub>DS</sub> (on) (Nch) <V<sub>GS</sub> = 2.5 V> = 9.9 Ω)  
CPH6424 (V<sub>DSS</sub> = 60 V, I<sub>D</sub> = 3 A R<sub>DS</sub> (on) <V<sub>GS</sub> = 4 V> typ 150 mΩ)



# LC75010W

## Overview

The LC75010W is a 1-chip DSP that is ideal for car stereos as it incorporates major required functions such as A/D, D/A, and a DSP core. This is a custom IC that incorporates DSP software based on the user specifications.

## Features

- Analog source selector
  - ◆ Single input: 3 systems, differential input: 1 system
- A/D
  - ◆ Stereo: 1 system
- DSP core
  - ◆ 24-bit fixed decimal point DSP
- D/A
  - ◆ 4 systems
- Analog volume
  - ◆ 4 systems
- Microcontroller interface
  - ◆ 1 system (SANYO Electric original format)  
(CCB: Computer Control Bus)

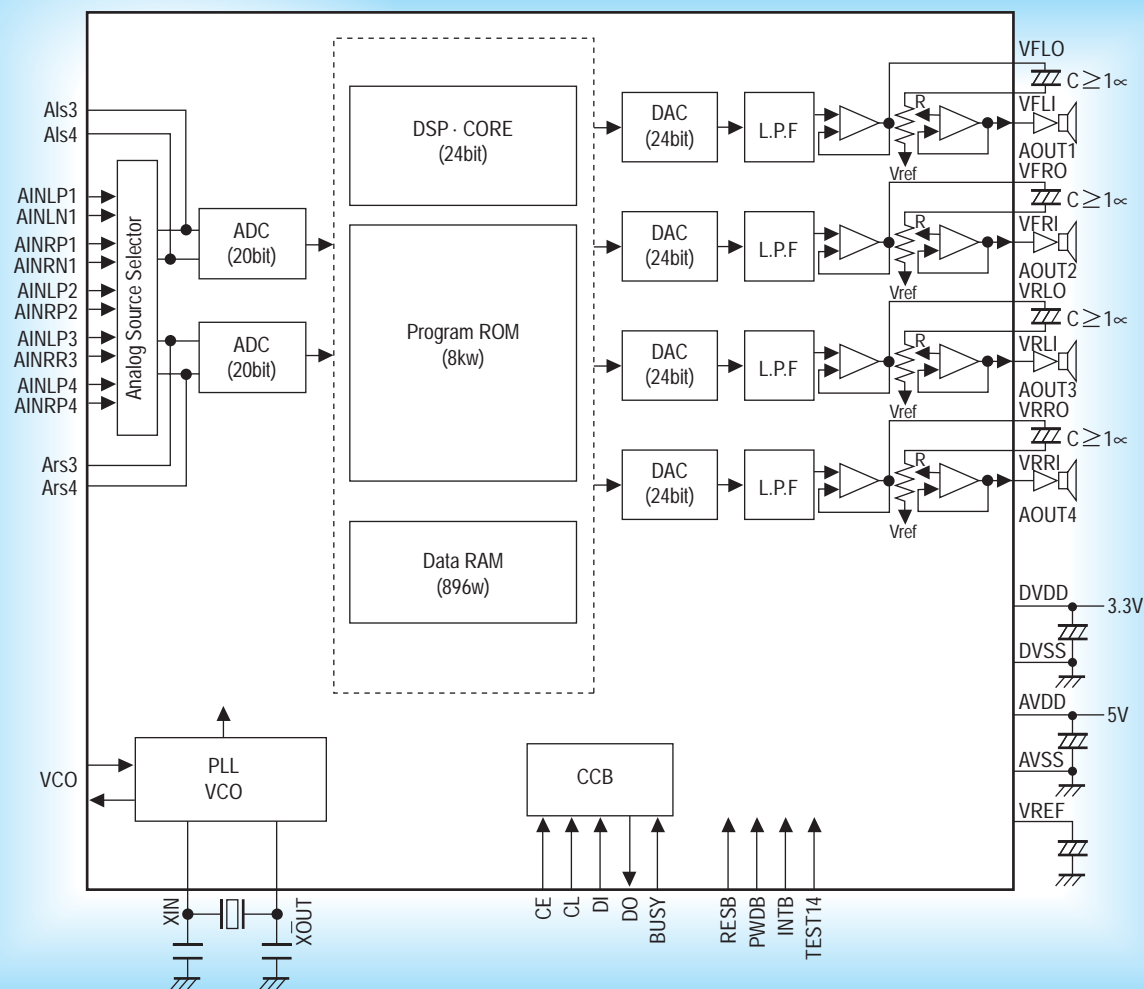
- Analog characteristic (S/N)
  - ◆ Typ. 90 dB (Note)
- Analog characteristic (dynamic range)
  - ◆ Typ. 90 dB (Note)
- Analog characteristic (THD + N)
  - ◆ Typ. -85 dB (Note)
- Power supply voltage (5 V)
  - ◆ 4.75 V to 5.25 V
- Power supply voltage (3.3 V)
  - ◆ 3.0 V to 3.6 V
- Operating ambient temperature
  - ◆ -40°C to 85°C
- Package: SQFP100 (14 × 14)

Note: Analog characteristics are according to SANYO Electric measurement conditions.

CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.



Block Diagram



# LC83200W

## Overview

The LC83200W is an IC that integrates the functions required for Dolby Headphone on one chip. It generates a Dolby Headphone audio output signal from either a 5.1-channel or 2-channel audio input. The LC83200W provides DH1, DH2, DH3, and Stereo Mixdown as room modes and can be used in all products that have a headphone pin.

## Features

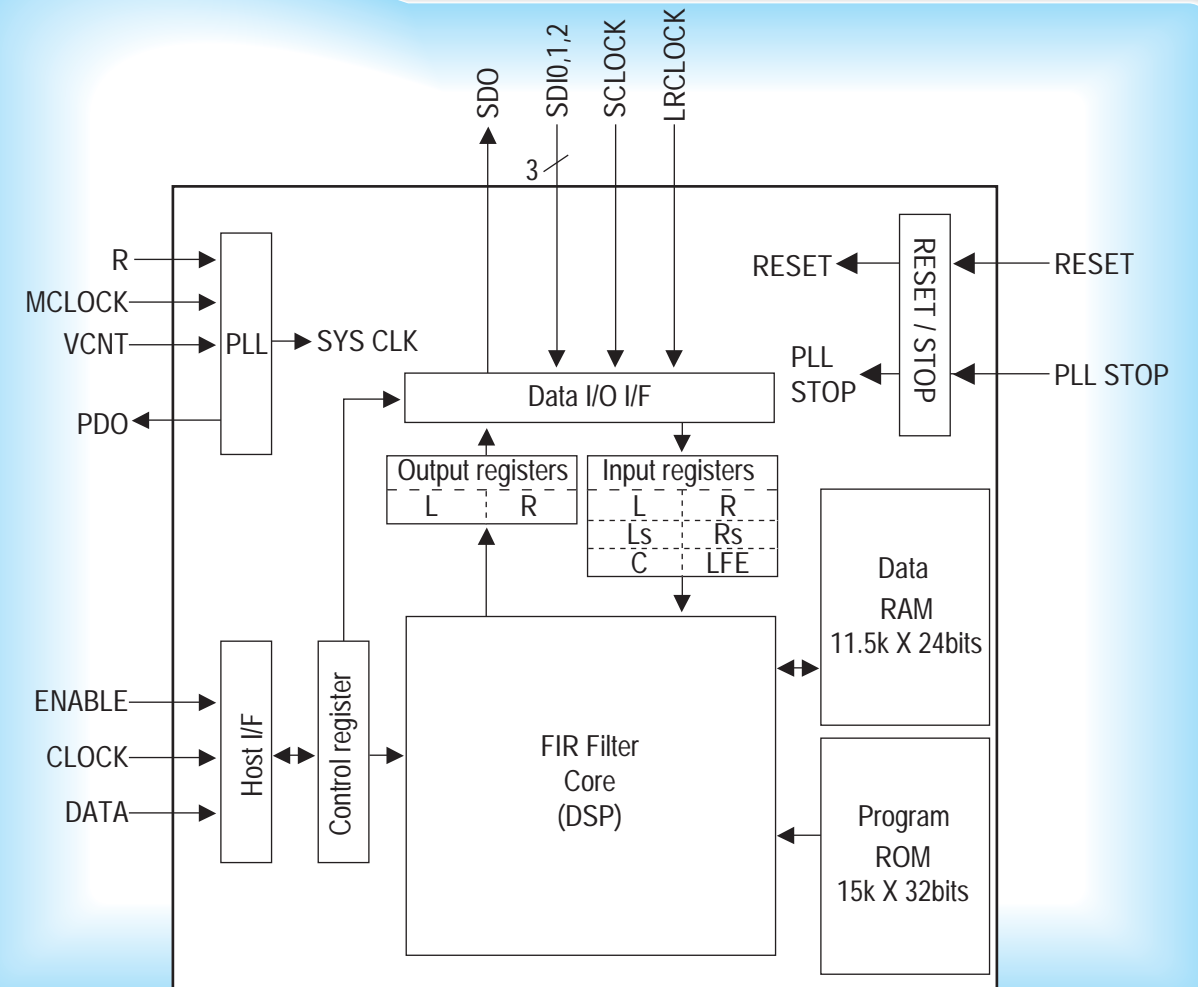
- Supports Dolby Headphone room modes DH1, DH2, DH3, and Stereo Mixdown.
- Sampling rate of 44.1/48 kHz
- Audio serial input: 2 channels (L, R) or 5.1 channels (L, C, R, Ls, Rs, LFE)
- Audio serial output: 2 channels (L, R)
- External memory not required
- 50 MHz internal operation frequency (External clock: 27 MHz/13.5 MHz or 512/256 fs clock)
- 2 power supplies (Logic block: 2.5 V; I/O block: 3.3 V)
- PLL stop (PLL STOP pin)
- Registers can be controlled through serial setting via microcontroller I/F or parallel setting via pins.
- Package: SQFP48 (7 × 7)

Manufactured under license from Dolby Laboratories.

"Dolby" and the double-D symbol are trademarks of Dolby Laboratories. Confidential unpublished works. Copyright 1998-1999 Dolby Laboratories. All rights reserved.



Block Diagram



# Car Audio CD/MP3/WMA System Chipsets

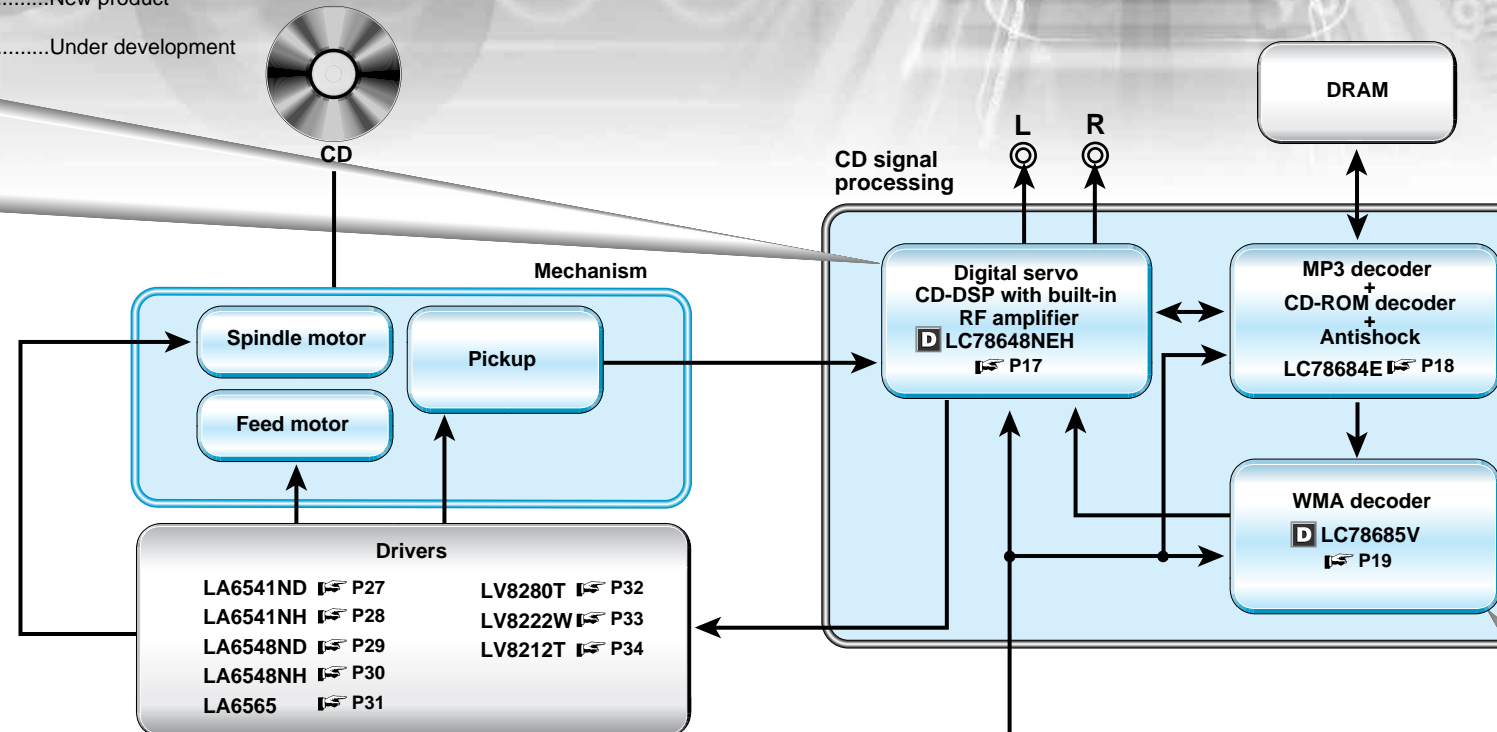
For Automotive AV Equipment

Supports system simplification by providing both single-chip CD signal processing with built-in analog signal processing and an MP3 decoder with built-in CD-ROM decoder.

**N** .....New product  
**D** .....Under development

## Digital Servo Integrated RF Amplifier System-on-Chip IC LC78648NEH\* **D** P17

- Servo error amplifier
- Automatic adjustment
- Defect and jitter detection
- Digital servo signal processing
- Audio CD playback
- Jitter-free playback (VCEC)
- Simplified CLV playback
- 2X-speed playback
- Supports AGC and CD-R/RW playback
- Mechanical shock detection, interruption detection
- Error detection and correction (dual errors in both C1 and C2)
- 8X oversampling digital filters
- Package : QFP80 (14 × 14)



## MP3 Decoder + CD-ROM Decoder LC78684E\* P18

- Low power: Operates on 1.8 V internally and 3.3 V externally
- Hardwired structure adopted for all decoding functions
- Antishock control (CD-DA playback mode: up to 180 s)
- Supports memory card playback at external MPEG data input
- CD-ROM (MP3) playback function
- Digital audio output from LRCK, BCK, and DATA signals (serial data)
- Digital bass boost function (4 modes) and attenuator function
- Serial microcontroller interface
- Package: QFP80 (14 × 14)

## WMA\* Decoder LC78685V **N** P19

- WMA decoder
- Supports WMA version 8
- Bit rates: 192 bps to 32 kbps
- Sampling frequency: 22.05 kHz to 48 kHz
- Digital attenuator
- Package: SSOP24 (275mil)

## For Microcontrollers Control

### Microcontroller with On-Chip LCD Drivers LC877 Series P25 to 26

- ROM: 24 K to 128 KB
- RAM 1536 to 4096 × 9bits
- VDD: 5 V (300 ns), 2.5 V (750 ns)
- DC control software packages are available, and custom development can be easily supported.
- Package: Refer to the package lineup. P26

### Flash memory version P25 to 26

## Wide Range of RAM and ROM Options

### Signal Control Microcontrollers LC875 Series P23 to 24

- This series is optimal since the abundant internal RAM can be used for smooth data management.
- ROM: 8 KB to 256 KB
- RAM: 1024 to 8192 × 9 bits

### Flash memory version P23 to 24

Flash products are licensed from Silicon Storage Technology, Inc.,(USA), and manufactured and sold by SANYO Electric Co., Ltd.

## Extensive lineup provides full support for a wide range of systems

### AM/FM Tuner Block

- Varactor diodes for AM tuning
- SVC354 (3 diodes), SVC364 (4 diodes), SVC371 (6 diodes)
- Varactor diodes for FM tuning
- SVC230 (CR (C2.0V/C8.0V) ≥ 1.65, Q ≥ 100)
- SVC243 (CR (C1.0V/C6.5V) ≥ 7.0, Q ≥ 40)
- SVC272 (CR (C2.0V/C8.0V) ≥ 2.3, Q ≥ 150)

- SVC273 (CR (C2.0V/C8.0V) ≥ 3.1, Q ≥ 100)
- \*: SV272, SV273: MCPH3 miniature package (2.1 × 2.0 mm)
- JFET and transistors for AMP amplifiers
- CPH5901 (high gain, typ 50 ms), CPH5905 (High ESD resistance type)
- Dual gate MOSFETs for FM amplifiers
- 3SK263 (V<sub>DS</sub> = 15 Vmin, I<sub>DSX</sub> = 2.4 to 24 mA, |y<sub>fs</sub>| = typ 14 ms),
- 3SK264 (V<sub>DS</sub> = 15 V, I<sub>DSX</sub> = 5.0 to 24 mA, |y<sub>fs</sub>| = typ 17 ms)

### Transistors for AM and FM buffers

- 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz),
- 2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- PIN diodes for AM AGC and switching
- Series with rs = typ 5 Ω: ISV247, ISV233, ISV246, ISV234, CPH5512
- PIN diodes for FM AGC and switching
- Series with rs = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H

### Other transistors (power supply, interface, and switch drive)

- Bipolar transistors: 50C02CH (V<sub>CEO</sub> = 15 V, I<sub>C</sub> = 1 A, V<sub>CE</sub> (sat) = max 280 mV) (NPN)
- 2SC5706 (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 5 A, V<sub>CEO</sub> (sat) = typ 90 mV)
- 2SD1913 (V<sub>CEO</sub> = 60 V, I<sub>C</sub> = 3 A, PC = 20 W, h<sub>FE</sub> 70 to 280)
- MOSFET: 5LN 01M (V<sub>DSS</sub> = 50 V, I<sub>D</sub> = 100 mA R<sub>DS</sub> (on) (Nch)
- <V<sub>GS</sub> = 2.5 V> = max 9.9 Ω)
- CPH6424 (V<sub>DSS</sub> = 60 V, I<sub>D</sub> = 3 A R<sub>DS</sub> (on)
- <V<sub>GS</sub> = 4 V> typ 150 mΩ)

\*WMA (Windows Media Audio)  
Windows Media™ is a trademark or registered trademark of Microsoft Corporation in the US and other countries.  
\* Requires a priori consultation with your SANYO sales representative or SANYO business office before their use.

■ All products described in this catalog contain developed products or products that are diverted from general types. In accordance with standard of quality management system ISO/TS16949 for automotive industry, there is a case where all demanded articles couldn't be supported, so please confirm to the salesman of our company at every order.

# Super System-on-Chip Digital Servo IC with On-Chip RF System

## LC78648NEH

Conditional Product  
Under development

\*: Use of conditional products requires consultation with a SANYO representative prior to the use of the device.

### Overview

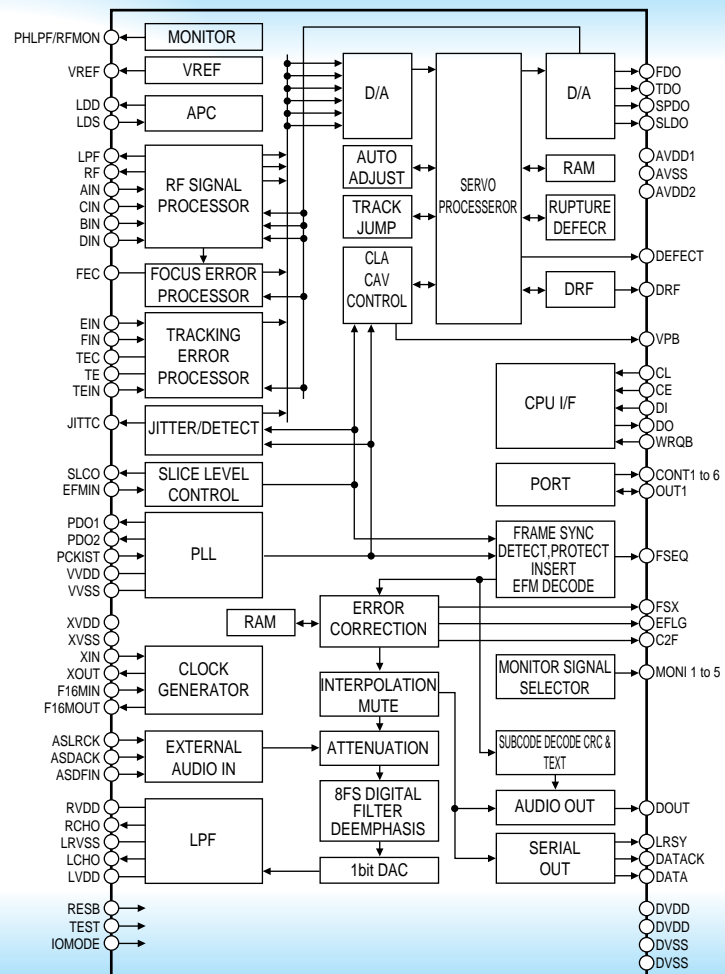
The LC78648NEH integrates, on a single chip, the RF signal processing, servo control, EFM signal processing, and audio signal processing required for audio CD playback. This single IC can perform all the CD data signal processing required to convert the signal read from the disc to an analog audio signal. A basic CD player system can be implemented with just three ICs (this IC, a microcontroller, and a driver IC) and a minimal number of external components.

### Features

- Playback functions
  - ◆ Playback speeds: 1X, 2X - CD-R/W: 1X, 2X
  - ◆ Jitter-free playback (VCEC)
- RF processing block
  - ◆ RF system: AGC, CD-R and R/W playback, peak hold, bottom hold
  - ◆ Error system: Variable balance TE signal playback, FE signal playback
  - ◆ Detection: Track count signal, jitter, defect (black and mirror)
  - ◆ Laser power control
  - ◆ DC offset voltage cancellation
- Servo control block
  - ◆ Implements all servo functions (tracking, focus, sled, and spindle) in digital
  - ◆ Automatic control function: Focus gain, focus bias, focus offset, tracking gain, tracking offset, tracking balance
  - ◆ Mechanical shock detection
  - ◆ Interruption detection
- EFM processing block
  - ◆ Error detection and correction (C1: double, C2: double)
  - ◆ Jitter margin:  $\pm 4$  frames
  - ◆ DOUT output
  - ◆ Built-in text decoder
  - ◆ EFM signal sync detection, protection, and interpolation
- Audio processing block
  - ◆ Interpolation (4 sample interpolation)
  - ◆ Digital attenuator
  - ◆ Deemphasis filter
  - ◆ 1-bit D/A converter (third-order  $\Delta\Sigma$  noise shaper converter)
  - ◆ 8x oversampling digital filters
  - ◆ Fadeout function
  - ◆ Bilingual function
  - ◆ Built-in second-order audio output low-pass filter
  - ◆ Supports external supply of the digital filter and D/A converter clock
- Supply voltage: 3.3 V
- Package: QFP80 (14 x 14)

\*: This product is subject to change without notice for improvement. When considering the use of this product, first refer to the latest SANYO "Semiconductor News" publication related to this device and finally refer to the latest specifications for the device.

### Block Diagram



# Compact Disc Player MP3 Decoder

## LC78684E

Conditional Product

\*: Use of conditional products requires consultation with a SANYO representative prior to the use of the device.

### Overview

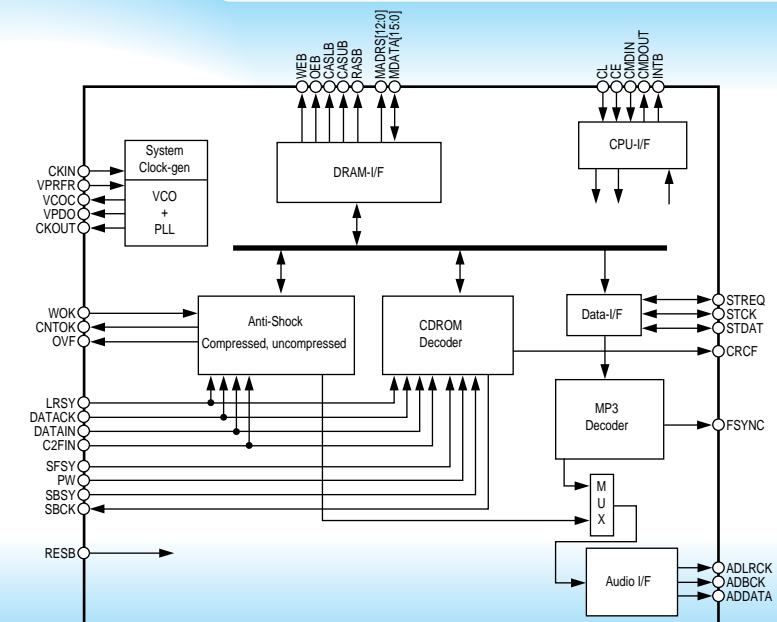
The LC78684E integrates, on a single chip, CD-ROM signal-processing functions, MP3 signal-processing functions, and CD-DA anti-skip signal-processing functions. These signal-processing functions are implemented as hard-wired circuits for reduced power consumption. The LC78684E, in combination with a CD DSP, DRAM, an audio D/A converter, and other devices can implement CD players that provide playback of MPEG layer 3 (MP3) audio recorded on CD media as well as anti-skip CD-DA playback.

### Features

- MP3 (MPEG audio standard ISO/IEC 11172-3 layer 3) decoder functions
  - ◆ Decoding and output as a digital audio signal of MP3 data decoded by the CD-ROM decoder
  - ◆ Supports all bit rates including variable bit rate decoding
  - ◆ Supports the following sampling frequencies
    - ◆ MPEG1 (Fs = 32, 44.1, and 48 kHz)
    - ◆ MPEG2 (Fs = 16, 22.05, and 24 kHz)
    - ◆ MPEG2.5 (Fs = 8, 11.025, and 12 kHz)
  - ◆ Supports readout of the MPEG header information and ancillary information
  - ◆ Provides automatic muting on CRC errors using an MP3 CRC check function
  - ◆ MPEG data external serial input function supports memory card playback
- CD-ROM decoder functions
  - ◆ Support for CD-ROM mode 1 and mode 2 (form 1 and form 2)
  - ◆ CD-ROM error correction function for faithful decoding of data written to CD-ROM discs
  - ◆ Header and sector management
  - ◆ Supports up to 4x speed playback
  - ◆ In addition to data buffering also supports C2 error flag buffering
  - ◆ Can provide external serial output of the decoded CD-ROM data
- CD-DA playback functions (anti-skip support)
  - ◆ Up to 180 seconds of skip-proof operation when 64M of DRAM is used
  - ◆ Provides compressed/uncompressed selection as well as a data through output function
  - ◆ VCEC (variable speed) function supports up to 4x speed playback
- Audio signal processing
  - ◆ Serial audio signal output using the LRCK, BCK, and DATA signals (Output supports the I<sup>2</sup>S format, 16- or 20-bit PCM output precision, 16-, 24-, and 32-bit output modes selectable for data-slot output)
  - ◆ Digital bass boost function (4 modes), attenuator function, and muting ( $-\infty$ , -12 dB) function
  - ◆ Base clock (384 Fs) output pin for external digital filters and D/A converter
- DRAM interface
  - ◆ Supports use of 1 to 64M bits of external memory (EDO, 2 CAS, 16-bit data bus memory)
  - ◆ A user area can be allocated in DRAM during CD-ROM (MP3) playback
- Supply voltages
  - ◆ Internal: 1.8 V
  - ◆ I/O: 3.3 V
  - ◆ Analog system: 3.3 V
- Package: QFP80 (14 x 14)

\*: This product is subject to change without notice for improvement. When considering the use of this product, first refer to the latest SANYO "Semiconductor News" publication related to this device and finally refer to the latest specifications for the device.

### Block Diagram



# WMA Decoder

## LC78685V



\*: Use of conditional products requires consultation with a SANYO representative prior to the use of the device.

### Overview

The LC78685V is a WMA\* decoder IC. This IC is implemented using a dedicated hard wired circuit structure to achieve low power consumption. Various format (CD-DA, MP3, and WMA) audio data recorded on CDs can be played back by adding this IC to a system structure consisting of a CD player signal-processing IC and a CD-MP3 IC (such as the LC78684).

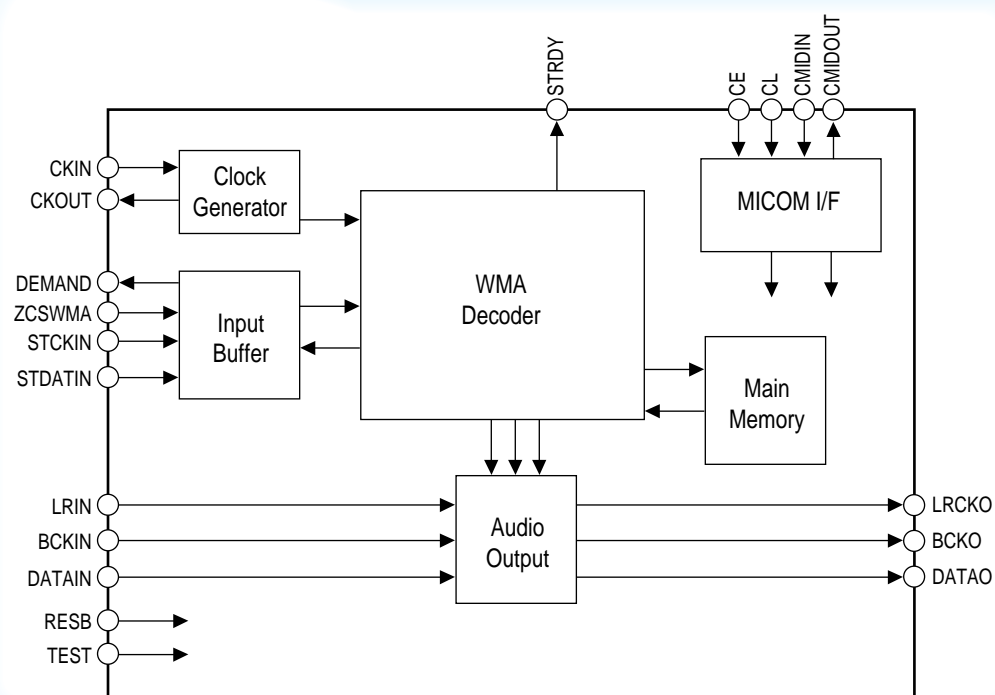
The LC78685V makes it easy to implement CD players that provide multiformat decoding functions.

### Features

- WMA (Windows Media Audio) decoding functions
  - ◆ Supports version 8
  - ◆ Bit rates: 32 to 192 kbps
  - ◆ Sampling frequencies: 22.05 kHz to 48 kHz
  - ◆ Header information readout function
  - ◆ Automatic framing error recovery function
- Audio data functions
  - ◆ WMA playback mode
    - : Serial audio signal output using the LRCK, BCK, and DATA signals (Output supports the I<sup>2</sup>S format, 16- or 20-bit PCM output precision, 16-, 24-, and 32-bit output modes selectable for data-slot output)
    - : Attenuator and muting (∞, -12 dB) functions
    - : Base clock (384 Fs) output for external digital filters and D/A converter
- Audio data other than WMA
  - ◆ The system clock and audio data input to the CKIN, LRCKIN, BCKIN, and DATAIN pins is output directly without change from the CKOUT, LRCKO, BCKO, and DATA pins. That is, CD-DA and MP3 playback data from the LC78684 is directly output to the D/A converter.
- Supply voltages
  - ◆ Internal: 1.8 V
  - ◆ I/O: 3.3 V
- Package: SSOP24 (275 mil)

\*: WMA: Windows Media Audio  
Windows Media is a registered trademark of Microsoft Corporation in the US and other countries.

### Block Diagram



# 7.5 Mbps Automotive LAN Transceiver

## LA2351M

### Overview

The LA2351M is a low-noise transceiver IC for automotive LANs.

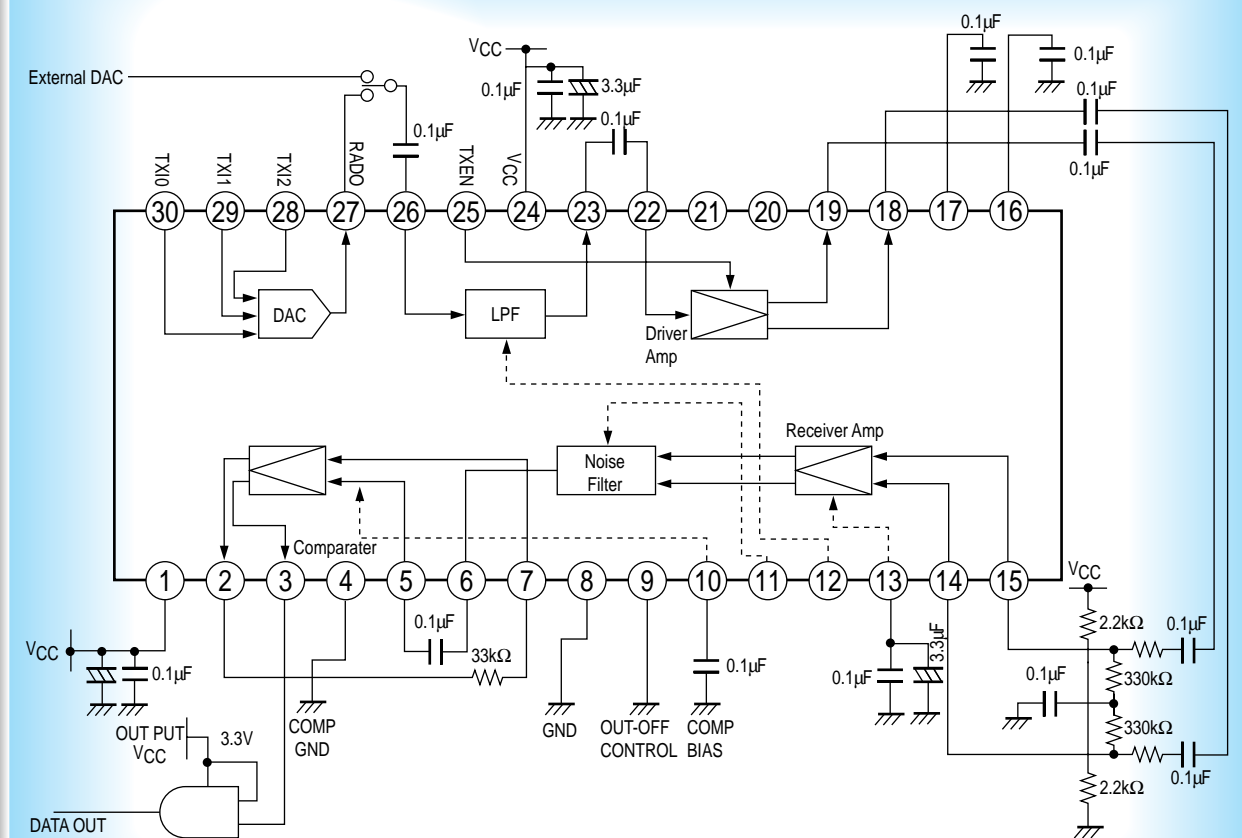
### Functions

- Transmitter block
  - ◆ A/D converter (3 bits)
  - ◆ Low-pass filter (for EMI prevention)
  - ◆ Output driver
- Receiver block
  - ◆ Reception amplifier
  - ◆ Noise rejection low-pass filter (for the received signal)
  - ◆ Comparator (for waveshaping)

### Features

- Accepts either 3-bit digital or stepped waveform signals as the input signal. If a 3-bit digital signal cannot be used due to EMI and wiring issues, provide an R-2R ladder near the protocol chip and connect the D/A converted signal to the low-pass filter input.
- A 5 Mbps or 7.5 Mbps automotive LAN can be implemented by combining the LA2351M with an automotive LAN protocol IC (ARCNET controller TMC20040C series device).
- The low-pass filter required for adjustment is built in
- Supports low-noise data communication
- Package: MFP30SD (375 mil)

### Block Diagram



# POF 50 Mbps Automotive LAN

## LA2340M/LV2341M Under development

### Overview

The LA2340M is an I/V converter that can form an OEC (optical-electrical converter) when combined with a photodiode.  
The LV2341M is an LED driver that can form an EOC (electrical-optical converter) when combined with an LED.

### Features

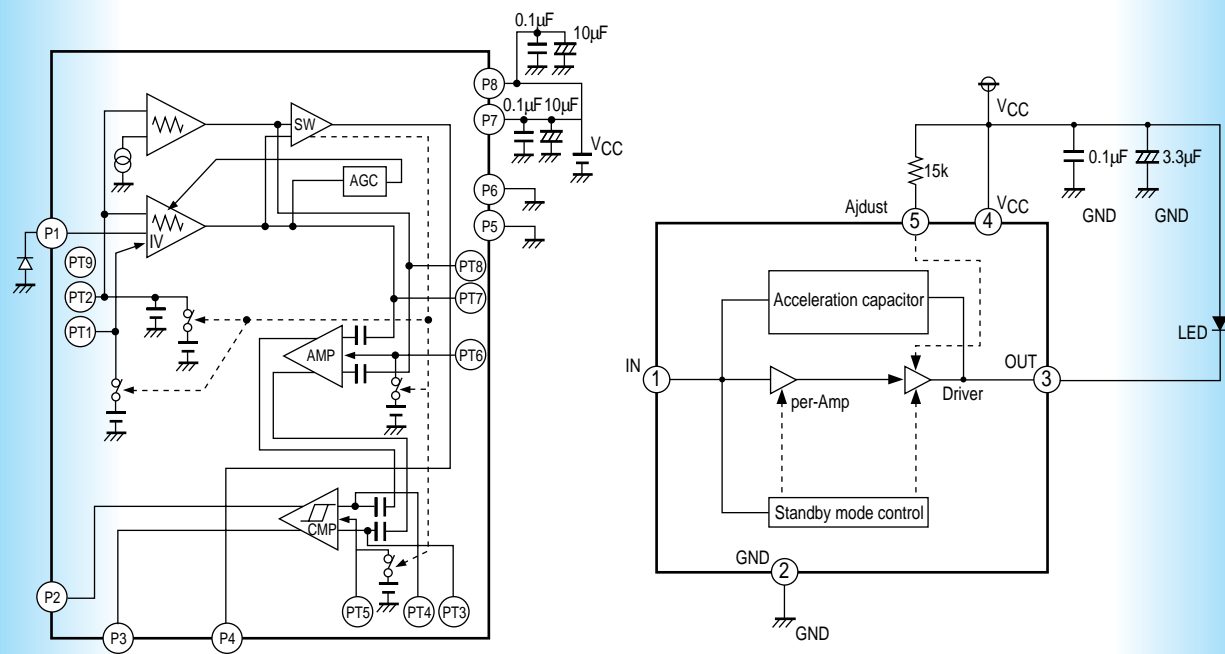
- These ICs can form a POF-based 50 Mbps automotive LAN
- Standby function

\*:This product is subject to change without notice for improvement. When considering the use of this product, first refer to the latest SANYO "Semiconductor News" publication related to this device and finally refer to the latest specifications for the device.

### Block Diagram

LA2340M

LV2341M



# CAN Transceiver

## LA2360M Under development

### Overview

The LA2360M is a CAN transceiver.

### Functions

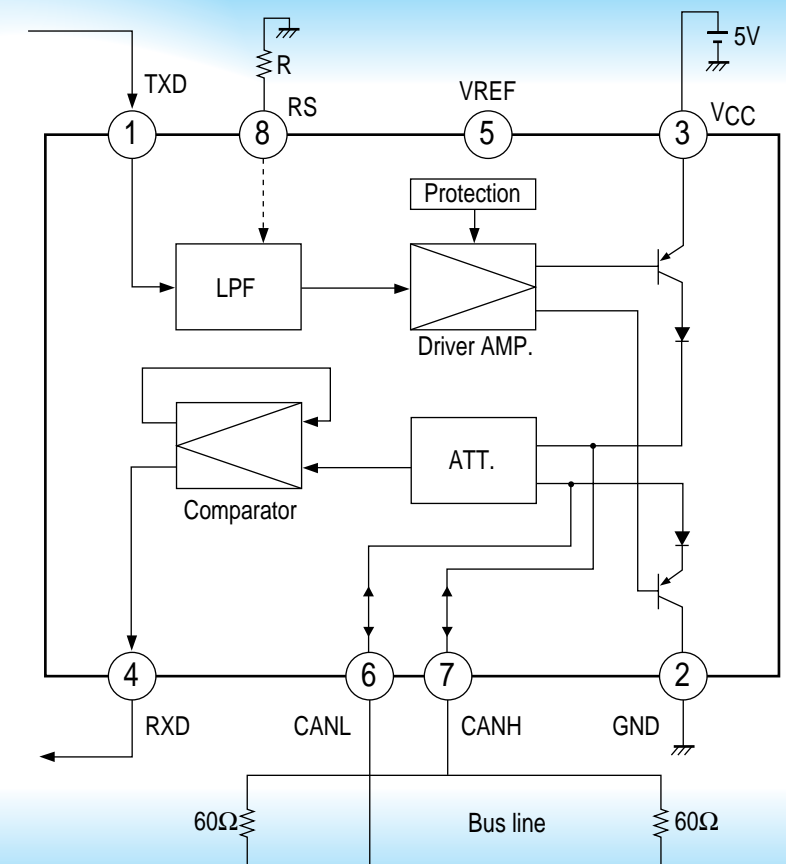
- Transmitter block
  - ◆ Low-pass filter (for EMI prevention)
  - ◆ Output driver
- Receiver block
  - ◆ Attenuator
  - ◆ Comparator

### Features

- Conforms to the ISO 11898 standard
- Transmission speed: 1 Mbps
- Up to 100 nodes can be connected
- Package: MFP8 (225 mil)

\*:This product is subject to change without notice for improvement. When considering the use of this product, first refer to the latest SANYO "Semiconductor News" publication related to this device and finally refer to the latest specifications for the device.

### Block Diagram



# LC875 Series

## Flash ROM Versions

**LC87F5BP6A, LC87F5CC8A, LC87F5DC8A,  
LC87F5864B, LC87F5G32A, LC87F5JC8A**

### Overview

The LC875 Series are 8-bit microcontrollers based on a CPU core that operates with a minimum instruction cycle time of 100 ns and feature a rich set of peripheral functions. These peripheral functions include two multifunction 16-bit timer/counter circuits that can be split into 8-bit timers, four 8-bit timers with built-in prescaler, a clock time base timer, two synchronous SIO circuits with an automatic transfer function, a synchronous/asynchronous SIO circuit, two 12-bit PWM circuits, a 12-input 8-bit A/D converter, a high-speed 8-bit parallel interface, a high-speed clock counter, a system clock divider function, and a powerful interrupt system.

### Features

- **Timers**
  - One 16-bit timer/counter with capture register (can be divided and used as two 8-bit timers)
  - One 16-bit timer/counter with PWM/toggle output function (can be divided and used as two 8-bit timers)
  - Four 8-bit timers with 6-bit prescaler function
  - Clock time base timer
- **High-speed clock counter**
  - This circuit can count up to 20 MHz clock signals when a 10 MHz main clock frequency is used.
- **SIO**
  - Two 8-bit SIO circuits with automatic transfer function
  - Two 8-bit baud rate generator circuits included
  - Maximum clock frequency: 4/3 tCYC
  - One 8-bit synchronous/asynchronous SIO circuit
  - Asynchronous operation: 8 to 2048 tCYC, synchronous operation: 2 to 512 tCYC
- **AD converter:** 8-bit converter with 12 input channels
- **PWM:** Two 12-bit variable period PWM generator circuits
- **Parallel interface**
  - Provides a polarity reversing function. Readout and write operations can be performed in 1 tCYC cycle.
- **Remote controller receiver**
  - (shared function of the P73/INT3/TOIN pin)
- **Watchdog timer**
  - (using external resistor and capacitor components)
- **Interrupts** (Multiple interrupt control with three levels : low level (L), high level (H), and highest level (X))
  - 26 sources/10 vectors (LC875B series)
  - 21 sources/10 vectors (LC8752/54/5A series)
  - 20 sources/10 vectors (LC8757/55 series)
- **High-speed multiply and divide instructions**
  - 16 bits × 8 bits (execution time: 5 tCYC)
  - 24 bits × 16 bits (execution time: 12 tCYC)
  - 16 bits ÷ 8 bits (execution time: 8 tCYC)
  - 24 bits ÷ 16 bits (execution time: 12 tCYC)
- **System clock divider function**
  - Standby functions
  - Halt mode: instruction execution is stopped, peripheral circuit operation continues
  - Hold mode: instruction execution is stopped, peripheral circuit operation is stopped
  - Crystal hold mode: instruction execution is stopped, peripheral circuit operation other than the clock time base timer is stopped.

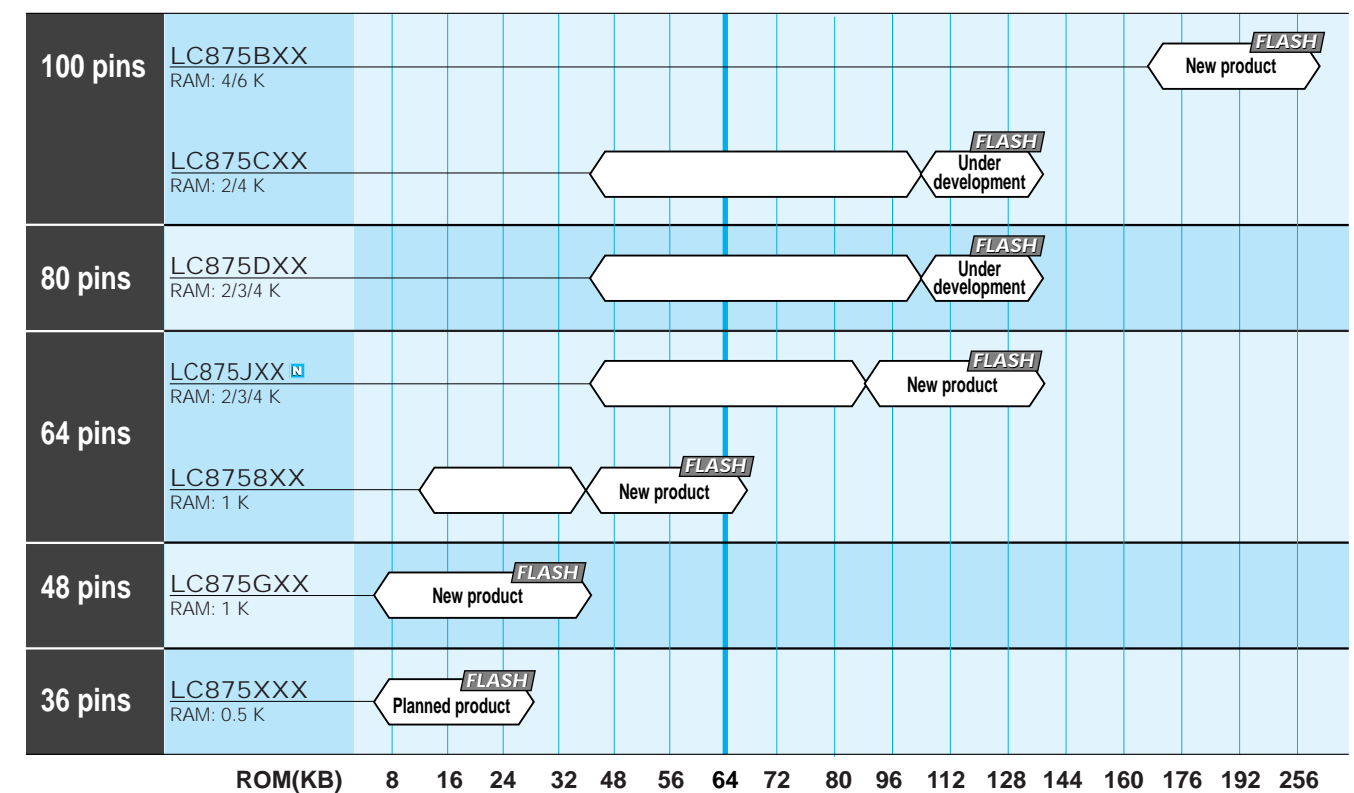
### Lineup

- **LC875B Series (100 pins)**
  - ROM: 176 to 256 KB
  - RAM: 4096 to 6144 × 9 bits
- **LC875C Series (100 pins)**
  - ROM: 48 to 128 KB
  - RAM: 2048 to 4096 × 9 bits
- **LC875D Series (80 pins)**
  - ROM: 48 to 96 KB
  - RAM: 2048 to 4096 × 9 bits
- **LC875J Series (64 pins)**
  - ROM: 48 to 128 KB
  - RAM: 2048 to 4096 × 9 bits
- **LC8758 Series (64 pins)**
  - ROM: 16 to 32 KB
  - RAM: 1024 × 9 bits
- **LC875G Series (48 pins)**
  - ROM: 8 to 32 KB
  - RAM: 1024 × 9 bits

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Flash products are licensed from Silicon Storage Technology, Inc.,(USA), and manufactured and sold by SANYO Electric Co., Ltd.

## LC875 Series Product System



## Package Lineup

| 100 pins                         | 80 pins   | 64 pins  | 48 pins       | 36 pins                            |
|----------------------------------|---|--|---------------|------------------------------------|
| QIP100E(14×20)<br>TQFP100(14×14) | QIP80E(14×20)<br>TQFP80J(12×12)<br>QFP80(14×14) | QIP64E(14×14)<br>DIP64S(600mil)<br>SQFP64(10×10)<br>TQFP64J(7×7) | QIP48E(14×14) | MFP36SDJ(375mil)<br>DIP36S(400mil) |

\* : The packages listed above are representative types. The content of this catalog is current as of June 2004 but is subject to change without notice for improvements to the products. Accordingly, when considering using these products, always contact your SANYO representative for the latest delivery specifications for these products.

# LC877 Series

## Flash ROM Versions LC87F7CC8A, LC87F7BC8A

### Overview

The LC877 Series are 8-bit microcontrollers based on a CPU core that operates with a minimum instruction cycle time of 100 ns and feature a rich set of peripheral functions. These peripheral functions include 24 to 128 KB of ROM, 2048, or 4096 bytes of RAM, an LCD display controller/driver, a multifunction 16-bit timer /counter circuit that can be split into 8-bit timers, a 16-bit timer/PWM generator that can be split into 8-bit timers, four 8-bit timers with built-in prescaler, a clock time base timer, a high-speed clock counter, a system clock divider function, a synchronous SIO circuit with an automatic transfer function, a synchronous /asynchronous SIO circuit, an 8-bit A/D converter, a small-signal detection circuit, and a powerful interrupt system.

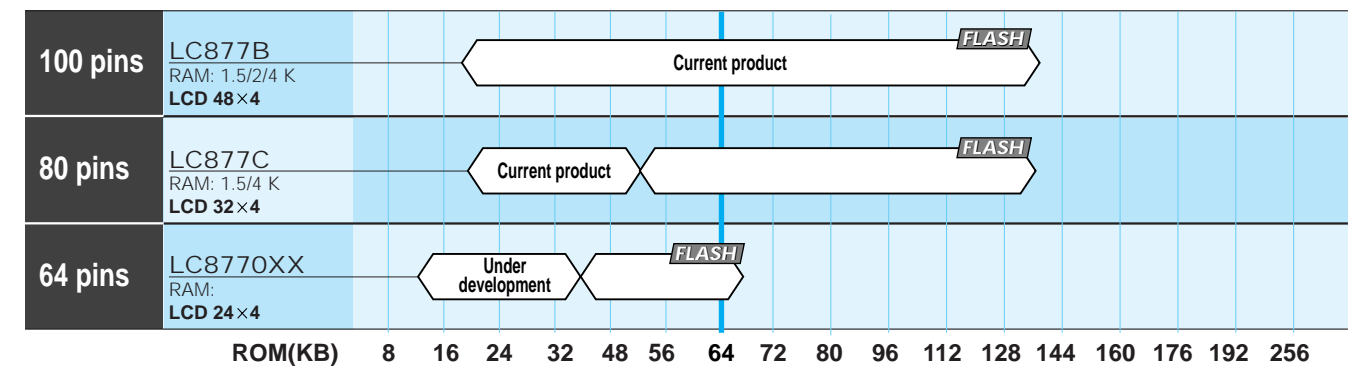
### Features

- **LCD display controller/driver**  
(48 segments × 4 common signals)
- **Small-signal detection circuit**  
(for microphone and similar signals)
- **Timers**
  - One 16-bit timer/counter with capture register (can be divided and used as two 8-bit timers)
  - One 16-bit timer/counter with PWM/toggle output function (can be divided and used as two 8-bit timers)
  - Four 8-bit timers with 6-bit prescaler function (LC877B series)
  - Clock time base timer
- **High-speed clock counter**  
This circuit can count up to 20 MHz clock signals when a 10 MHz main clock frequency is used.
- **Serial interface circuits**
  - 8-bit synchronous serial interface
  - 8-bit synchronous/asynchronous serial interface
- **AD converter**  
15-input 8-bit A/D converter (LC877B series)
- **Remote controller receiver**  
(shared function of the P73/INT3/TOIN pin)
- **Watchdog timer**  
(using external resistor and capacitor components)
- **Interrupts**  
20 sources/10 vectors (LC877B series)  
(Multiple interrupt control with three levels: low level (L), high level (H), and highest level (X))
- **High-speed multiply and divide instructions**
  - 16 bits × 8 bits (execution time: 5 tCYC)
  - 24 bits × 16 bits (execution time: 12 tCYC)
  - 16 bits ÷ 8 bits (execution time: 8 tCYC)
  - 24 bits ÷ 16 bits (execution time: 12 tCYC)
- **System clock divider function**
- **Standby functions**
  - Halt mode: instruction execution is stopped, peripheral circuit operation continues
  - Hold mode: instruction execution is stopped, peripheral circuit operation is stopped
  - Crystal hold mode: instruction execution is stopped, peripheral circuit operation other than the clock time base timer is stopped

### Lineup

- **LC877C series**
  - ROM: 24 to 48 KB
  - RAM 2048 × 9 bits and 4096 × 9 bits
- **LC877B series**
  - ROM: 24 or 128 KB
  - RAM 2048 × 9 bits to 4096 × 9 bits

### LC877 (LCD) Series Product System



### Package Lineup

| 100 pins         | 80 pins          | 64 pins         |
|------------------|------------------|-----------------|
| QIP100E(14 × 20) | QFP80(14 × 14)   | TQFP64J(7 × 7)  |
| SQFP100(14 × 14) | TQFP80J(12 × 12) | QIP64E(14 × 14) |
| TQFP100(14 × 14) |                  |                 |

■ All products described in this catalog contain developed products or products that are diverted from general types. In accordance with standard of quality management system ISO/TS16949 for automotive industry, there is a case where all demanded articles couldn't be supported, so please confirm to the salesman of our company at every order.

\*: The packages listed above are representative types.  
The content of this catalog is current as of June 2004 but is subject to change without notice for improvements to the products.  
Accordingly, when considering using these products, always contact your SANYO representative for the latest delivery specifications for these products.

# Four-Channel Driver IC for CD Players/Decks

## LA6541ND

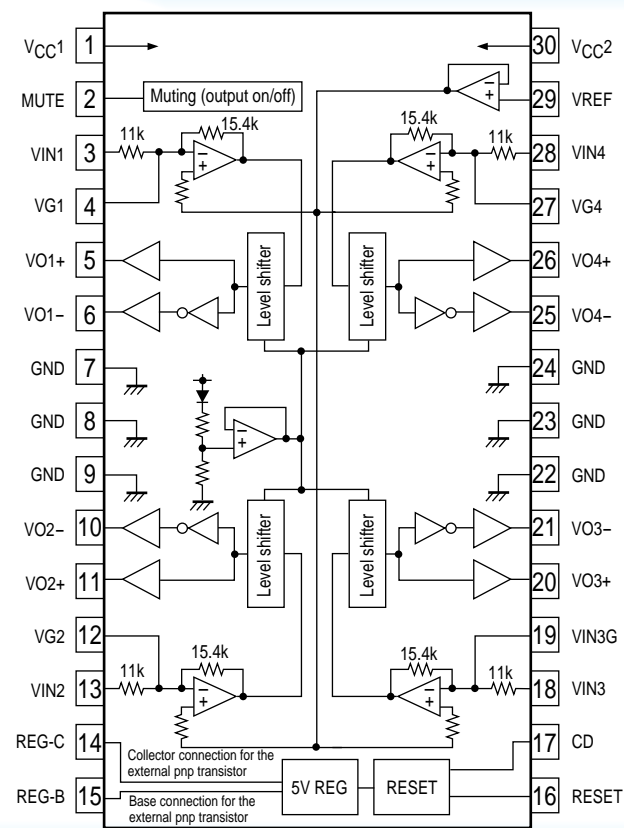
### Overview

The LA6541ND is a 4-channel driver for CD players/decks that features BTL amplifier circuits in all four channels.

### Functions and Features

- Four power amplifier (BTL connection) circuits
- I<sub>omax</sub>: 0.7 A
- Built-in level shifter circuits
- Built-in muting circuit mutes all outputs (This circuit operates for the BTL amplifier channels but does not affect the regulator circuit.)
- Built-in regulator (5 V output, requires an external pnp transistor)
- Thermal shutdown circuit
- Package: DIP30SDLF (400 mil)

### Block Diagram



# Four-Channel Driver IC for CD Players/Decks

## LA6541NH

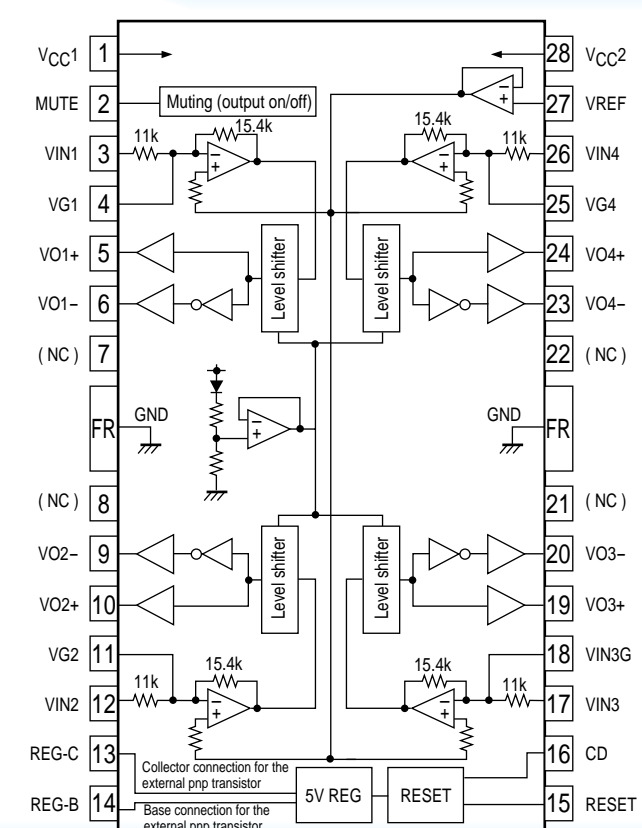
### Overview

The LA6541NH is a 4-channel driver for CD players/decks that features BTL amplifier circuits in all four channels.

### Functions and Features

- Four power amplifier (BTL connection) circuits
- I<sub>omax</sub>: 0.7 A
- Built-in level shifter circuits
- Built-in muting circuit mutes all outputs (This circuit operates for the BTL amplifier channels but does not affect the regulator circuit.)
- Built-in regulator (5 V output, requires an external pnp transistor)
- Thermal shutdown circuit
- Package: HSOP28H (375 mil)

### Block Diagram





# LA6548ND

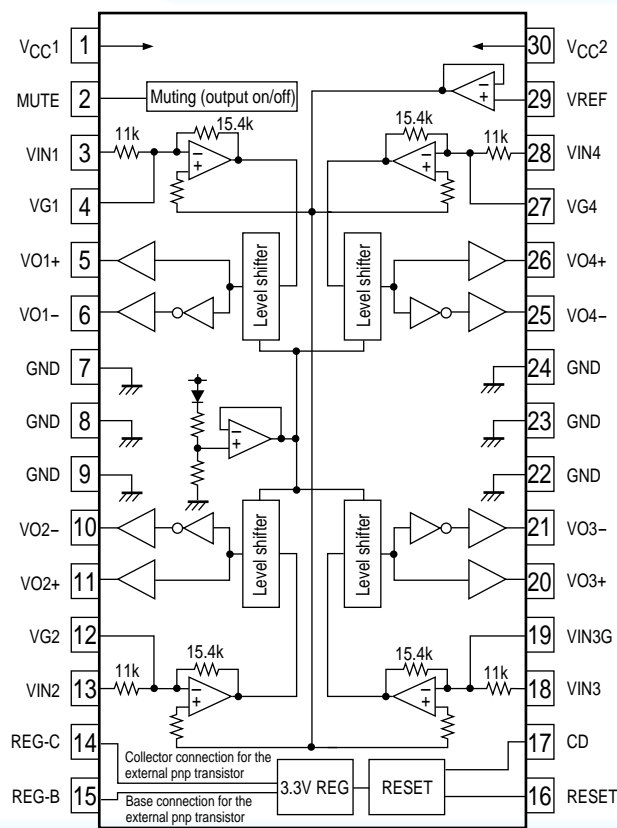
## Overview

The LA6548ND is a 4-channel driver for CD players/decks that features BTL amplifier circuits in all four channels.

## Functions and Features

- Four power amplifier (BTL connection) circuits
- I<sub>omax</sub>: 0.7 A
- Built-in level shifter circuits
- Built-in muting circuit mutes all outputs (This circuit operates for the BTL amplifier channels but does not affect the regulator circuit.)
- Built-in regulator (3.3 V output, requires an external pnp transistor)
- Thermal shutdown circuit
- Package: DIP30SDLF (400 mil)

Block Diagram



# LA6548NH

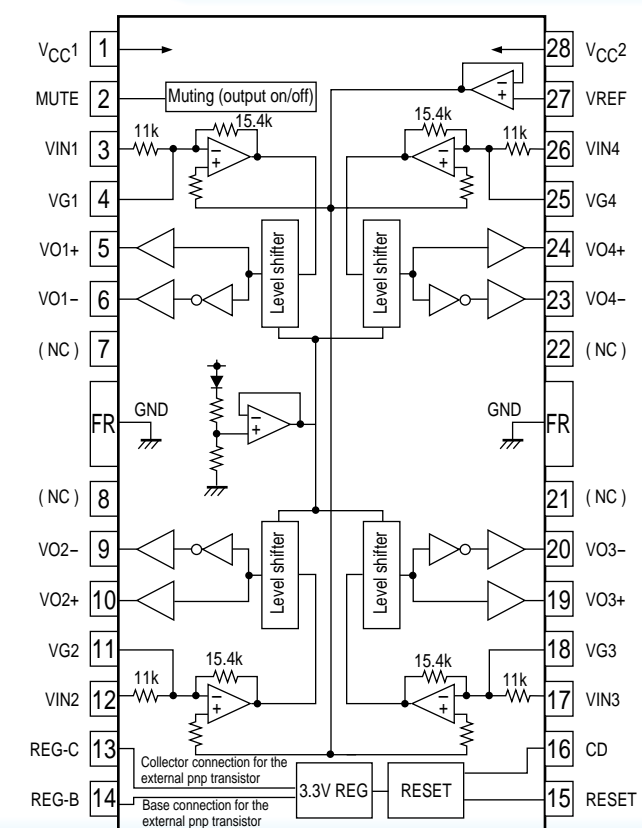
## Overview

The LA6548NH is a 4-channel driver for CD players/decks that features BTL amplifier circuits in all four channels.

## Functions and Features

- Four power amplifier (BTL connection) circuits
- I<sub>omax</sub>: 0.7 A
- Built-in level shifter circuits
- Built-in muting circuit mutes all outputs (This circuit operates for the BTL amplifier channels but does not affect the regulator circuit.)
- Built-in regulator (3.3 V output, requires an external pnp transistor)
- Thermal shutdown circuit
- Package: HSOP28H (375 mil)

Block Diagram



# Five-Channel Driver IC for CD Players/Decks

## LA6565

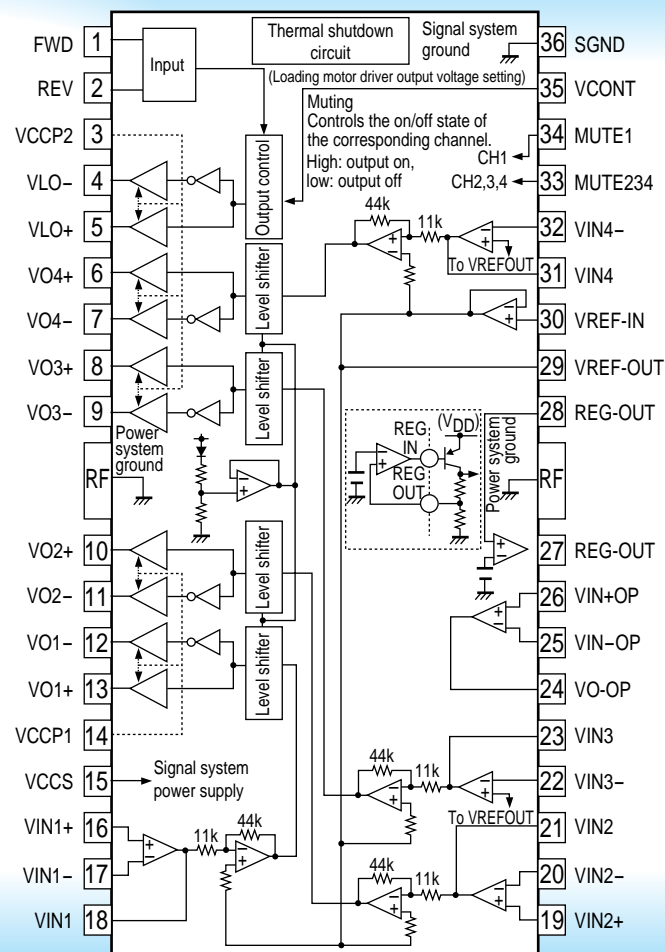
### Overview

The LA6565 is a 5-channel driver for CD players/decks that features BTL amplifier circuits in four channels plus a single H-bridge driver circuit.

### Functions and Features

- Five power amplifier circuits (bridge connection (BTL connection): 4 channels, H bridge: 1 channel)
- I<sub>omax</sub>: 1 A
- Built-in level shifter circuits (except for the H-bridge channel)
- Built-in muting circuits (two systems) mute all outputs (This circuit operates for the BTL amplifier channels but does not affect H-bridge and the regulator circuit.)
- Built-in regulator (requires an external pnp transistor and is set with an external resistor)
- Output voltage setting function (for the loading motor channel)
- Thermal shutdown circuit
- Package: HSOP36R (375 mil)

Block Diagram



# DVD-ROM Spindle Motor Driver IC

## LV8280T

### Overview

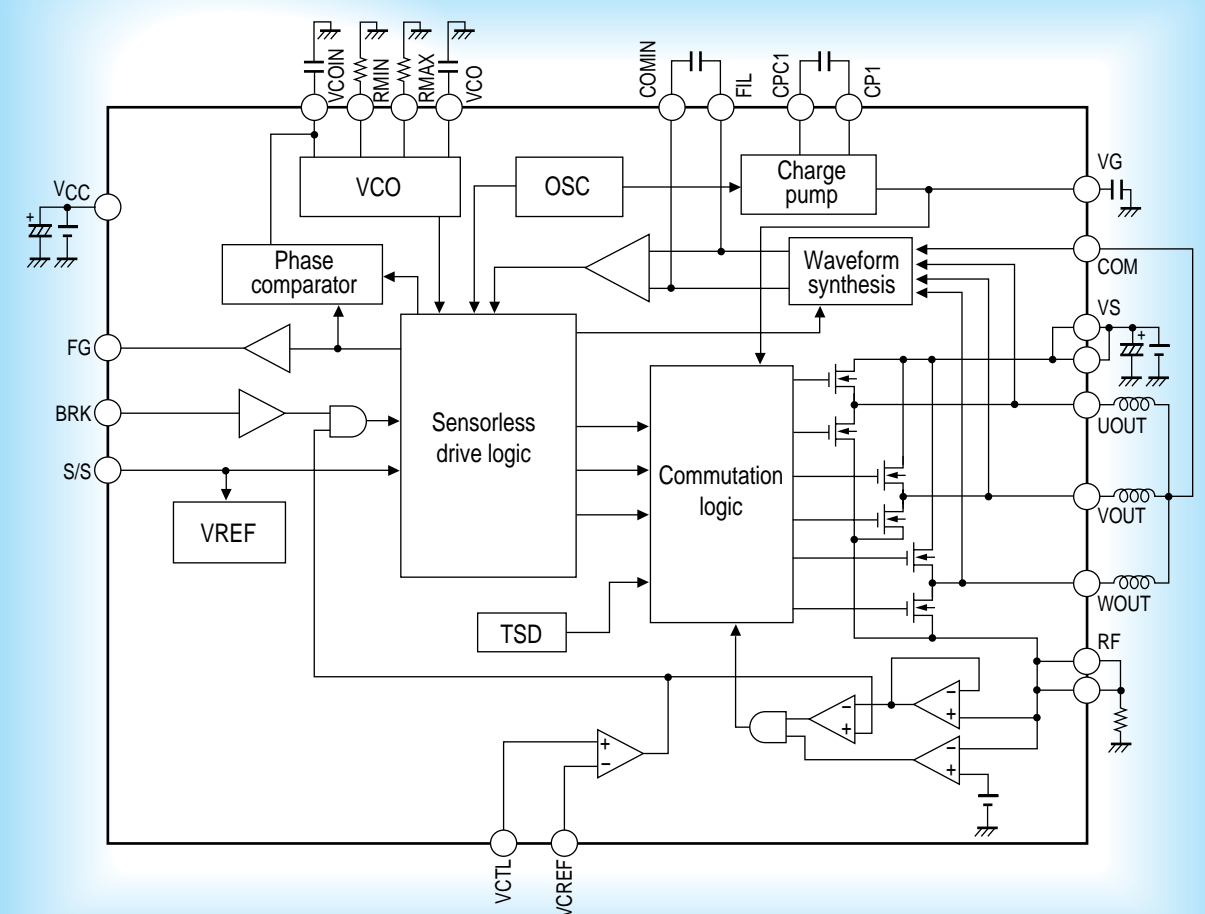
The LV8280T is a sensorless motor driver IC that provides a reverse torque braking function and is appropriate as the spindle motor driver in CD-ROM/DVD players. This IC adopts a direct PWM drive technique and uses a MOSFET as the output transistor for high-efficiency motor drive.

Since this IC can implement motor drive without the use of a Hall effect device, it can be effective in supporting motor system miniaturization, thinner form factors, and reduced power consumption.

### Functions and Features

- Three-phase full-wave sensorless motor driver
- Direct PWM drive (low side control)
- MOSFET output
- Synchronous commutation
- Supports switching between reverse torque braking and short-circuit braking
- Voltage controlled amplifier
- Analog input, PWM output
- FG output (Two outputs: single Hall device equivalent FG and three Hall device equivalent FG outputs)
- Current limiter circuit
- Thermal protection circuit
- Standby mode power saving circuit
- Package: TSSOP30 (275 mil)

Block Diagram



# System Motor Driver IC for CD and MD Players

## LV8222W

### Overview

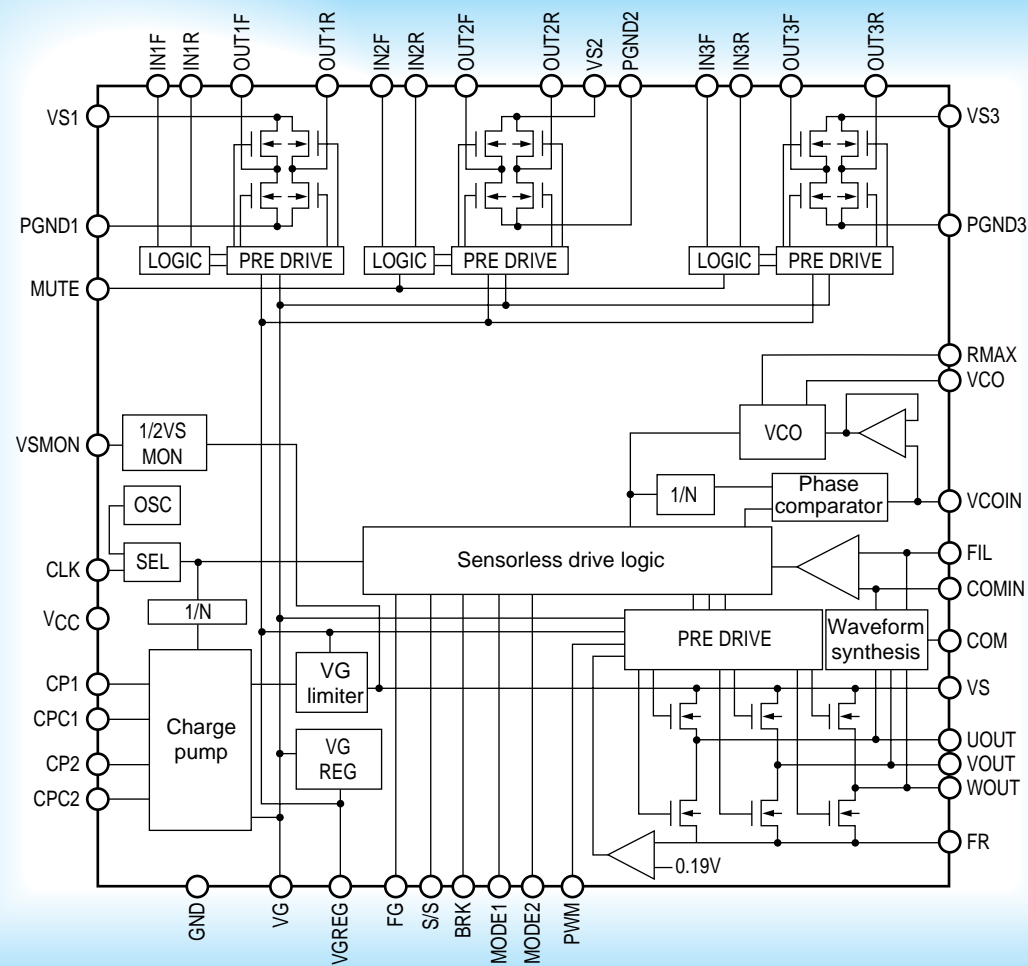
The LV8222W is a system motor driver IC that integrates, on a single chip, all the motor driver circuits required by CD and MD players. Since this IC provide both a 3-phase PWM spindle motor driver and sled, focus, and tracking drivers (3 PWM H-bridge driver channels), it can contribute to end product motor system miniaturization, thinner form factors, and reduced power consumption.

Since the spindle motor driver adopts a direct PWM sensorless drive technique, it provides high-efficiency motor drive with a minimal number of external components.

### Functions and Features

- Direct PWM drive
- Three-phase full-wave sensorless motor driver (spindle block)
- Reverse torque braking (spindle block)
- MOS output transistors
- Standby mode power saving function
- Digital inputs, PWM outputs (spindle, sled, focus, and tracking)
- FG output
- VS voltage detection function
- Current limiter circuit
- Thermal protection circuit
- Package: SQFP48 (7 × 7 mm)

Block Diagram



# System Motor Driver IC for CD and DVD Players

## LV8212T

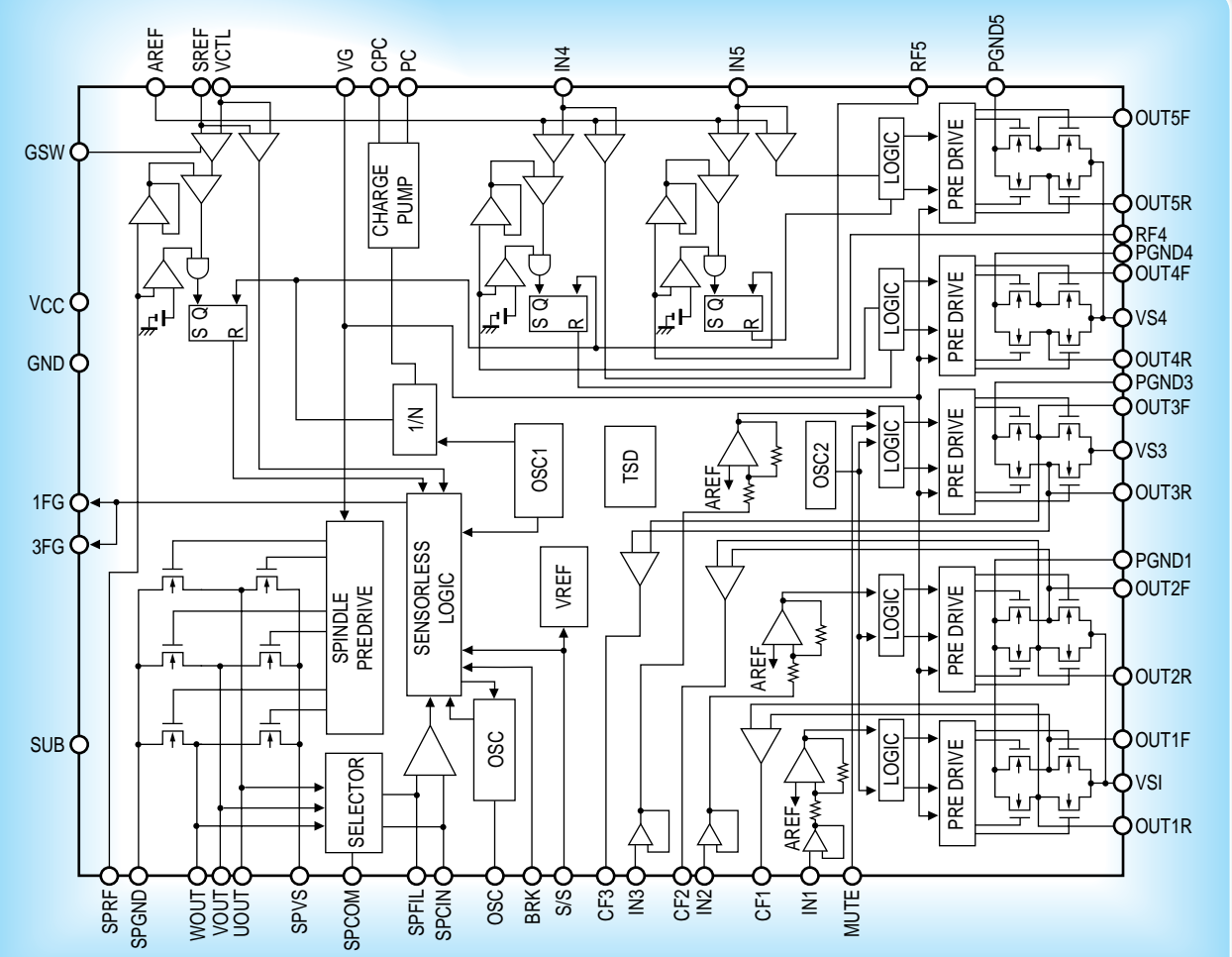
### Overview

The LV8212T is a system motor driver IC that integrates, on a single chip, all the motor driver circuits required by CD and DVD players. Since this IC provide not only a spindle motor driver, but also sled, focus, and tracking motor drivers (H-bridge drivers) for a total of 5 driver channels, it can contribute to end product motor system miniaturization and thinner form factors. Since the spindle motor driver adopts a direct PWM sensorless drive technique, it provides high-efficiency motor drive with a minimal number of external components.

### Functions and Features

- Direct PWM drive (low side control)
- Three-phase full-wave sensorless motor driver (spindle block)
- Soft switching drive (spindle block)
- Synchronous commutation drive circuit
- Supports switching between reverse torque braking and short-circuit braking (spindle block)
- Analog input, PWM output (focus, tracking, sled, and spindle)
- Current control adopted in the sled block (channels 4 and 5)
- MOS output transistors
- Standby mode power saving function
- FG output (Two outputs: single Hall device equivalent FG (1FG) and three Hall device equivalent FG (3FG) outputs)
- Current limiter circuit
- Thermal protection circuit
- Package: TQFP64J (7 × 7 mm)

Block Diagram



# Car Audio Built-in PLL Tuner System Chipsets (1)

For Automotive AV Equipment

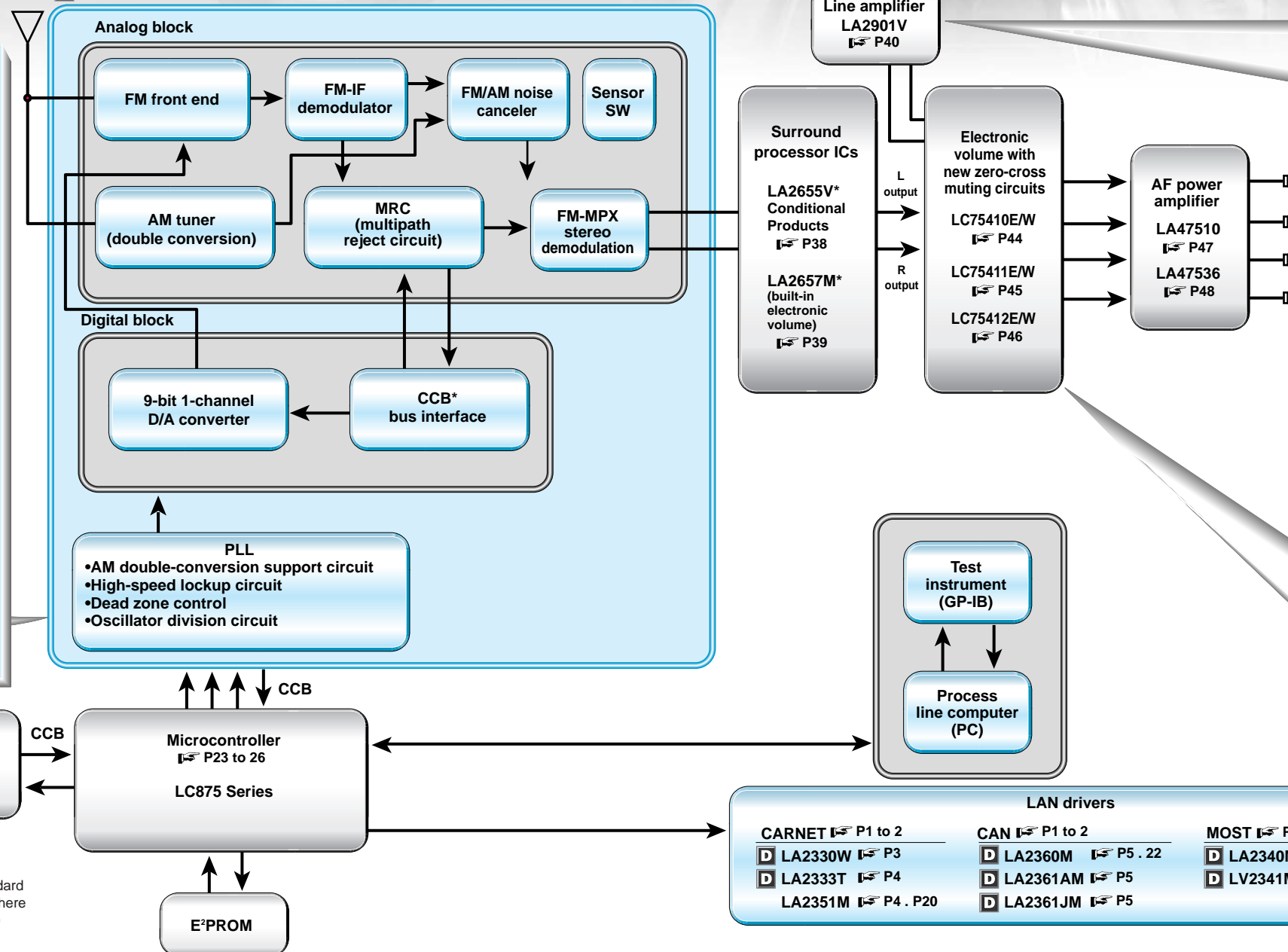
SANYO has now added a PLL circuit to their original-design single-chip tuner IC. Microcontroller control provides increased performance and reliability and fewer adjustments in tuner systems.

**D** ..... Under development

## Microcontroller Tuner IC Microcontroller Single-Chip Car Tuner with On-Chip PLL Circuit LV25200M **D** P37

- No external FM RF amplifier required
- Adjacent channel noise reduction variable band filter
- AM noise canceller
- Tuner supports all broadcast band standards used worldwide
- Meets the new FCC regulations
- Tuner specifications can be modified by changing the microprocessor software
- Auto-adjustment system  
Automatic adjustment achieved by connecting the line computer and the E<sup>2</sup>PROM through the microprocessor
- Best receiving system  
Optimizes the tuner functions in real time according to the reception conditions
- Improved performance and reliability, circuit simplification, and design standardization achieved by the adoption of a microprocessor controlled tuner
- On-chip PLL circuit
- Package: QFP80 (14 × 14)

Microcontroller single-chip car tuner with on-chip PLL circuit  
**D** LV25200M P37



## Line Amplifier Four-Channel High Output Preamplifier IC LA2901V P40

- Provides a high output voltage of 5.3 V rms (with a THD of 0.1%) for improved signal-to-noise ratio when driving an external power amplifier
- Low output noise voltage: 12 μV
- Low total harmonic distortion: 0.005%
- Superb audio fidelity
- Package: SSOP24 (275mil)

## Electronic Volume Control Single-Chip Electronic Volume Control with New Zero-Cross Muting Circuit LC75410E/W, LC75411E/W, LC75412E/W P44 to 46

- Built-in differential input amplifiers (LC75410E/W, LC75412E/W)
- Zero-cross muting
- Input gain control
- Loudness control
- Package: (LC75410E) QIP64E (14 × 14)  
(LC75410W) SQFP64 (10 × 10)  
(LC75411E) QIP44M (10 × 10)  
(LC75411W) SQFP48 (7 × 7)  
(LC75412E) QIP64E (14 × 14)  
(LC75412W) SQFP64 (10 × 10)

CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.



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## Extensive lineup provides full support for a wide range of systems

### AM/FM Tuner Block

- Varactor diodes for AM tuning
  - SVC354 (3 diodes), SVC364 (4 diodes), SVC371 (6 diodes)
- Varactor diodes for FM tuning
  - SVC230 (CR (C2.0V/C8.0V) ≥ 1.65, Q ≥ 100)
  - SVC243 (CR (C1.0V/C6.5V) ≥ 7.0, Q ≥ 40)
  - SVC272 (CR (C2.0V/C8.0V) ≥ 2.3, Q ≥ 150)

- SVC273 (CR (C2.0V/C8.0V) ≥ 3.1, Q ≥ 100)  
\*: SV272, SV273: MCPH3 miniature package (2.1 × 2.0 mm)
- JFET and transistors for AMP amplifiers
  - CPH5901 (high gain, typ 50 ms), CPH5905 (High ESD resistance type)
- Dual gate MOSFETs for FM amplifiers
  - 3SK263 (V<sub>DS</sub> = 15 V<sub>min</sub>, I<sub>DSX</sub> = 2.4 to 24 mA, |y<sub>fs</sub>| = typ 14 ms), 3SK264 (V<sub>DS</sub> = 15 V, I<sub>DSX</sub> = 5.0 to 24 mA, |y<sub>fs</sub>| = typ 17 ms)

### Transistors for AM and FM buffers

- 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz), 2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- PIN diodes for AM AGC and switching
  - Series with r<sub>s</sub> = typ 5 Ω: ISV247, ISV233, ISV246, ISV234, CPH5512
  - PIN diodes for FM AGC and switching
    - Series with r<sub>s</sub> = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H

### Other transistors (power supply, interface, and switch drive)

- Bipolar transistors: 50C02CH (V<sub>CEO</sub> = 15 V, I<sub>C</sub> = 1 A, V<sub>CE</sub> (sat) = max 280 mV) (NPN)  
2SC5706 (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 5 A, V<sub>CE</sub> (sat) = typ 90 mV)  
2SD1913 (V<sub>CEO</sub> = 60 V, I<sub>C</sub> = 3 A, PC = 20 W, h<sub>FE</sub> 70 to 280)
- MOSFET: 5LN 01M (V<sub>DSS</sub> = 50 V, I<sub>D</sub> = 100 mA R<sub>DS</sub> (on) <V<sub>GS</sub> = 2.5 V> = 9.9 Ω)  
CPH6424 (V<sub>DSS</sub> = 60 V, I<sub>D</sub> = 3 A R<sub>DS</sub> (on) <V<sub>GS</sub> = 4 V> typ 150 mΩ)

# Bus Control Tuner IC

## LV25200M

Under development



### Overview

The LV25200M integrates an optimal reception system for varying reception conditions plus AM NC functions that support reception worldwide. It also reduces the number of external components required.

### Functions

- FM front end
- Multiplex
- PLL
- FM IF
- AM upconversion
- Autoalignment
- Noise canceller
- FM/AM switch
- MRC

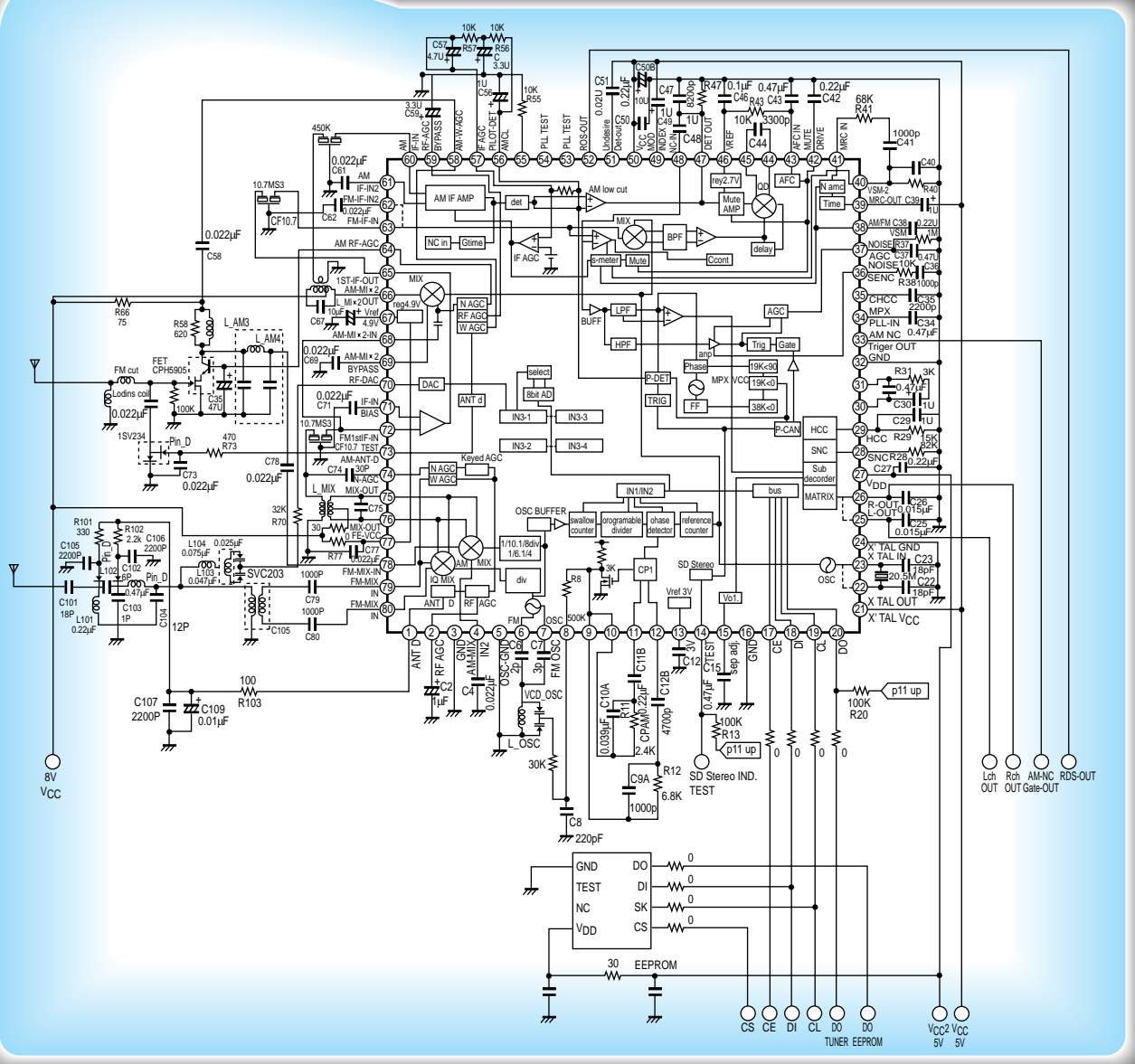
### Features

- FM
- Image rejection mixer adopted
- Built-in IF band filter
- Supports reception in all areas worldwide
- Crystal oscillator: 20.5 MHz
- PLL
- Supports high-speed locking
- Serial bus control circuit (SANYO CCB bus)
- AM
- Increased mixer dynamic range, improved noise filter
- Increased IF amplifier dynamic range, improved noise filter
- Built-in noise canceller
- MC, MPX, and MRC
- Built-in MPX VCO (Obviates the need for a ceramic oscillator)
- Package: QFP80 (14 × 14 mm)



\*: CCB is SANYO's original bus format.  
All bus addresses are managed by SANYO for this format.

### Block Diagram



# Clear Surround Control IC Includes Plus Sound Algorithm

## LA2655V

Conditional Product

\*: Use of conditional products requires consultation with a SANYO representative prior to the use of the device.

### Overview

The LA2655V is a sound field recreation IC that is optimal for audio equipment and that includes the Plus Sound algorithm.

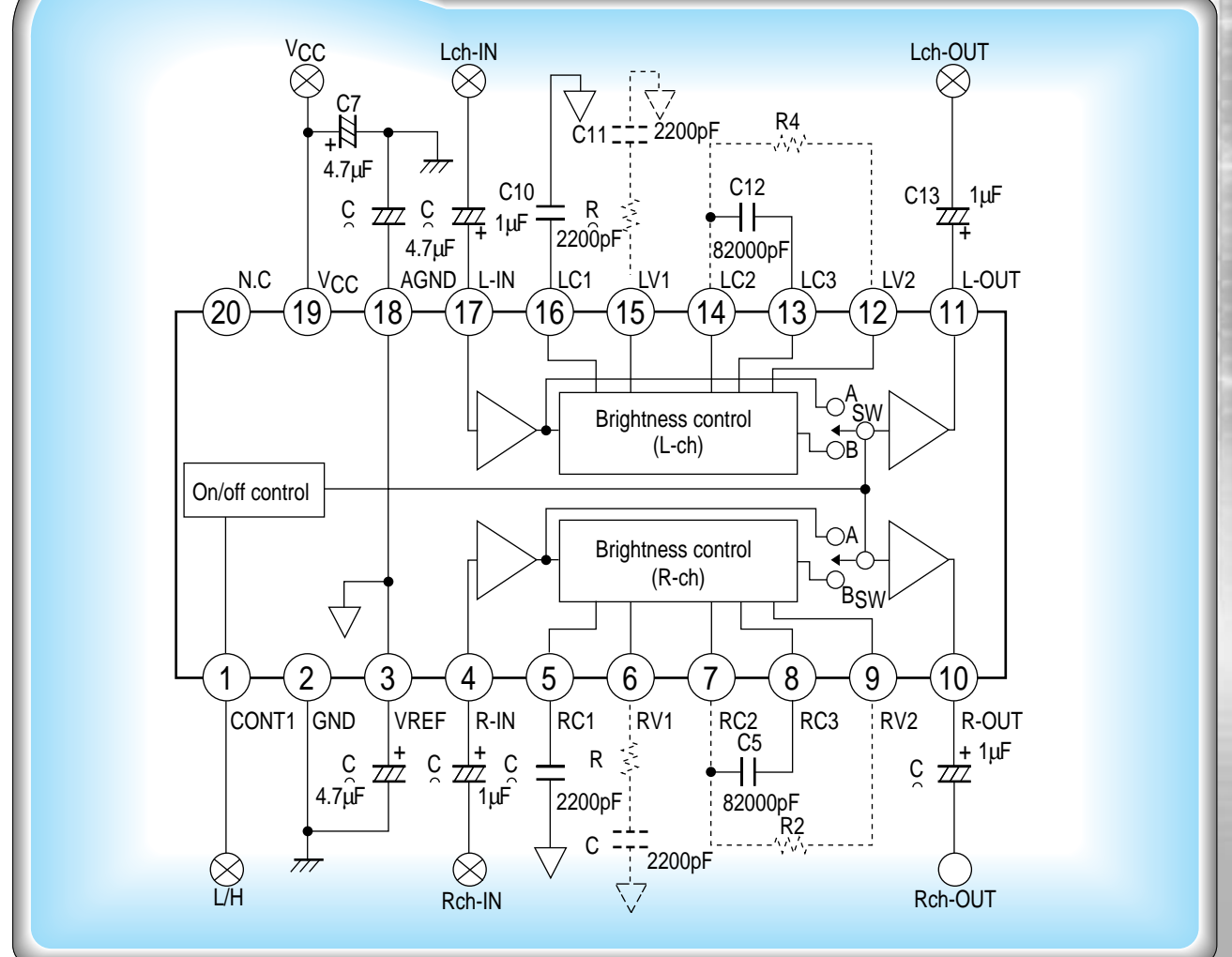
The LA2655V is optimal for use in radio/cassette players, personal computers, TV sets, and other consumer audio products including mini-compo systems.

The Plus Sound algorithm corrects for both delays and attenuations of the high and low frequency signals due to the characteristics of the speakers and creates audio with extreme clarity.

### Functions

- Plus Sound algorithm
- Clear Surround signal processing
- Variable clear level effect (using external components)
- Package: SSOP20 (225 mil)

### Block Diagram



\*: This product is subject to change without notice for improvement. When considering the use of this product, first refer to the latest SANYO "Semiconductor News" publication related to this device and finally refer to the latest specifications for the device.

# Car Audio Electronic Volume Control IC with BBE Surround Processor

## LA2657M

Conditional Product

\* : Use of conditional products requires consultation with a SANYO representative prior to the use of the device.

### Overview

The LA2657M is an audio signal processor for car audio that integrates the functions of the LC75421 IC and a BBE surround processing on a single chip. The LA2657M's main functions include input functions, input gain adjustment, tone controls, super bass function, balance control, volume fader control, and the BBE surround processor.

**BBE**

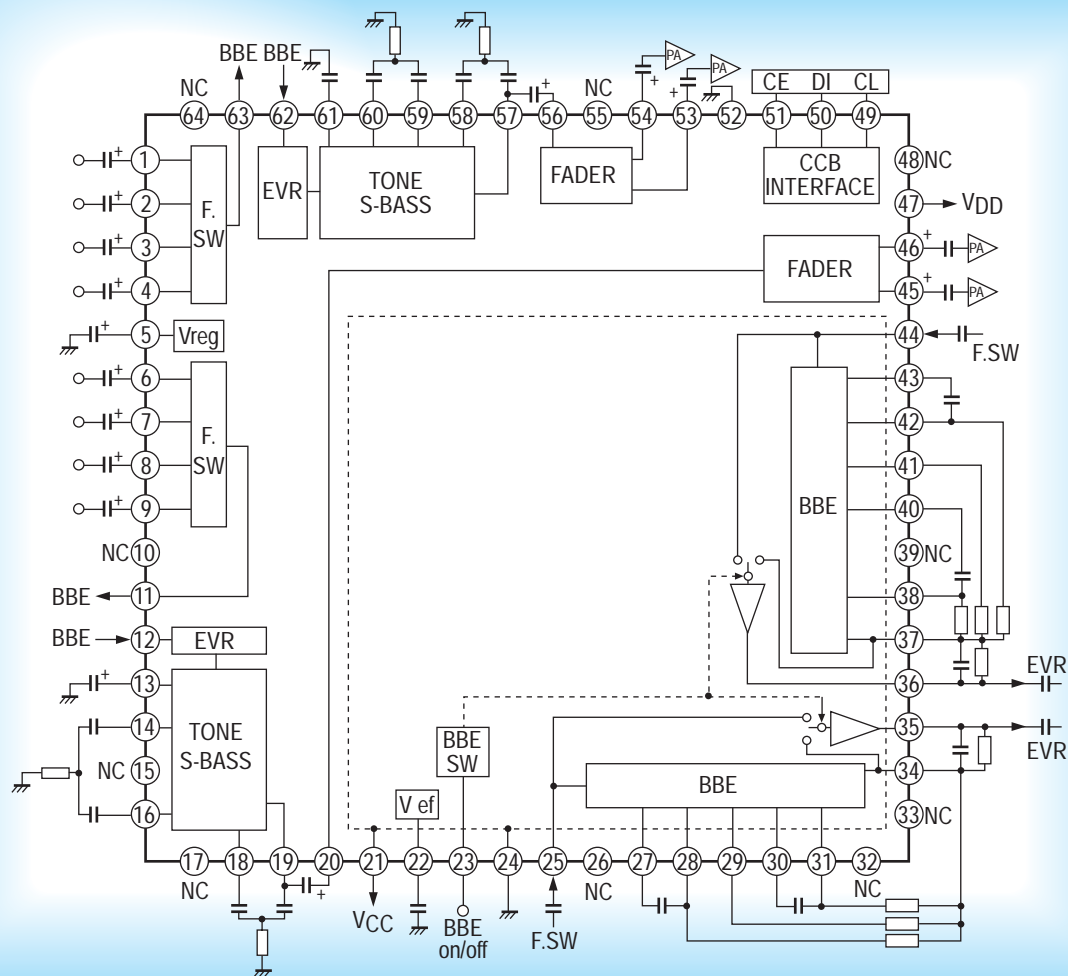
BBE and BBE symbol are registered trademarks of BBE Sound, Inc.

### Functions

- Input functions: Four input systems (L+R) (The LC75421 provides five input systems.)
- Input gain control (0 to 18.75 dB in 1.25 dB steps)
- BBE processor
- Tone controls (Bass:  $\pm 11.9$  dB, treble:  $\pm 11.9$  dB. Both in 1.7 dB steps)
- Super bass (0 to 20 dB in 2 dB steps)
- Master volume control (0 dB to -79 dB in 1 dB steps,  $-\infty$ )
- Bus control
- Fader (0 to -20 dB in 2 dB steps, -20 to -25 dB in 5 dB steps, -25 to -45 dB in 10 dB steps, -60 dB,  $-\infty$ )
- CCB bus (On/off control of the BEE function is not provided over the CCB bus.)
- Package: QIP64E (14 × 14 mm)

\* This product is subject to change without notice for improvement. When considering the use of this product, first refer to the latest SANYO "Semiconductor News" publication related to this device and finally refer to the latest specifications for the device.

### Block Diagram



# Four Channel High-Output Line Amplifier for Car Audio

## LA2901V

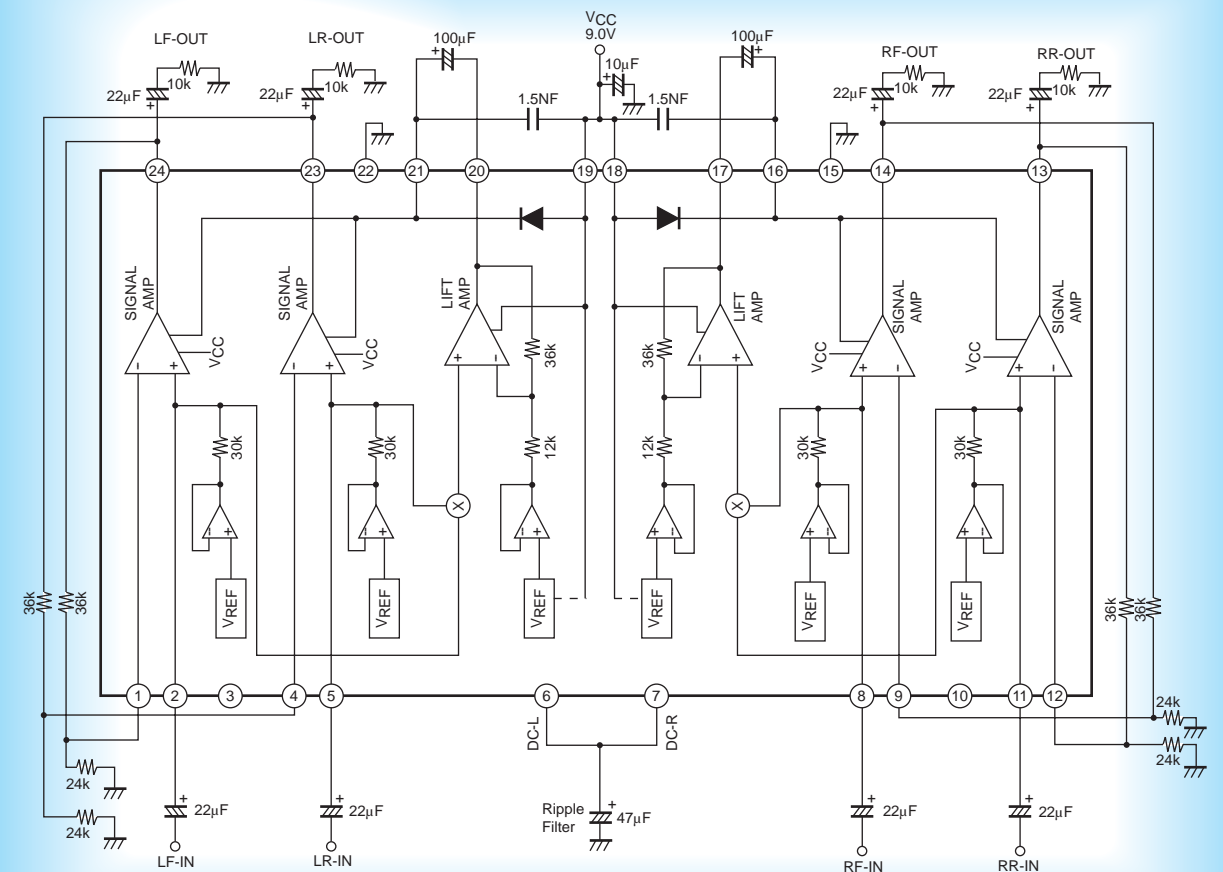
### Overview

The LA2901V is a 4-channel high-output line amplifier designed for car audio applications. Since the output voltage is increased significantly over conventional line amplifiers, the LA2901V achieves a high signal-to-noise ratio and high audio quality in the connection from the main unit to the external amplifier and can improve power amplifier performance. The LA2901V also provides significant space savings over earlier solution but reducing by one half the number of capacitors previously required to boost the signal system supply voltage and by adopting the SSOP miniature package.

### Functions and Features

- High output level (5.3 V rms)
- Low output noise voltage (12  $\mu$ V)
- Low total harmonic distortion (0.004 %)
- High ripple rejection ratio (70 dB)
- Minimal number of external components required
- Superb audio quality
- Package: SSOP24 (275 mil)

### Block Diagram



We recommend the use of 1% tolerance or better resistors for the 24 k $\Omega$  and 36 k $\Omega$  feedback resistors.

# Car Audio Built-in PLL Tuner System Chipsets (2)

For Automotive AV Equipment

SANYO has now added a PLL circuit to their original-design single-chip tuner IC. The optimum chip segmentation realized high-performance, unadjusted, and high-reliability of car tuner systems at low costs.

**D** .....Under development

## Car Audio Single-Chip Tuner Complete Car Tuner with Built-in PLL Circuit LA17000M **I** P43

- Built-in PLL circuit
- A/D converter (6 bits, 1 channel)
- Includes an IF counter and I/O ports for simplified interfacing
- Adopts an AM double conversion reception technique
- Further improved to noise reduction
- Superlative three-signal characteristics
- Improved medium and weak field NC characteristics
- Improved separation characteristics
- Built-in anti-birdie filter
- Multipath sensor outputs (analog and digital outputs)
- Support for lower total system costs
- AM double-conversion (up-conversion system)
- Improved FM IF circuit (automatic wide/narrow CF switching with software in the presence of adjacent channel interference)
- Reduction in sample-to-sample IF gain variations by 1/3 simplifies adjustments during manufacturing
- Supports end-product miniaturization
- High-frequency signal lines can be handled inside the tuner pack
- Easily meets the new FCC regulations
- Package: QFP80 (14 × 14)

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**CCB** CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.

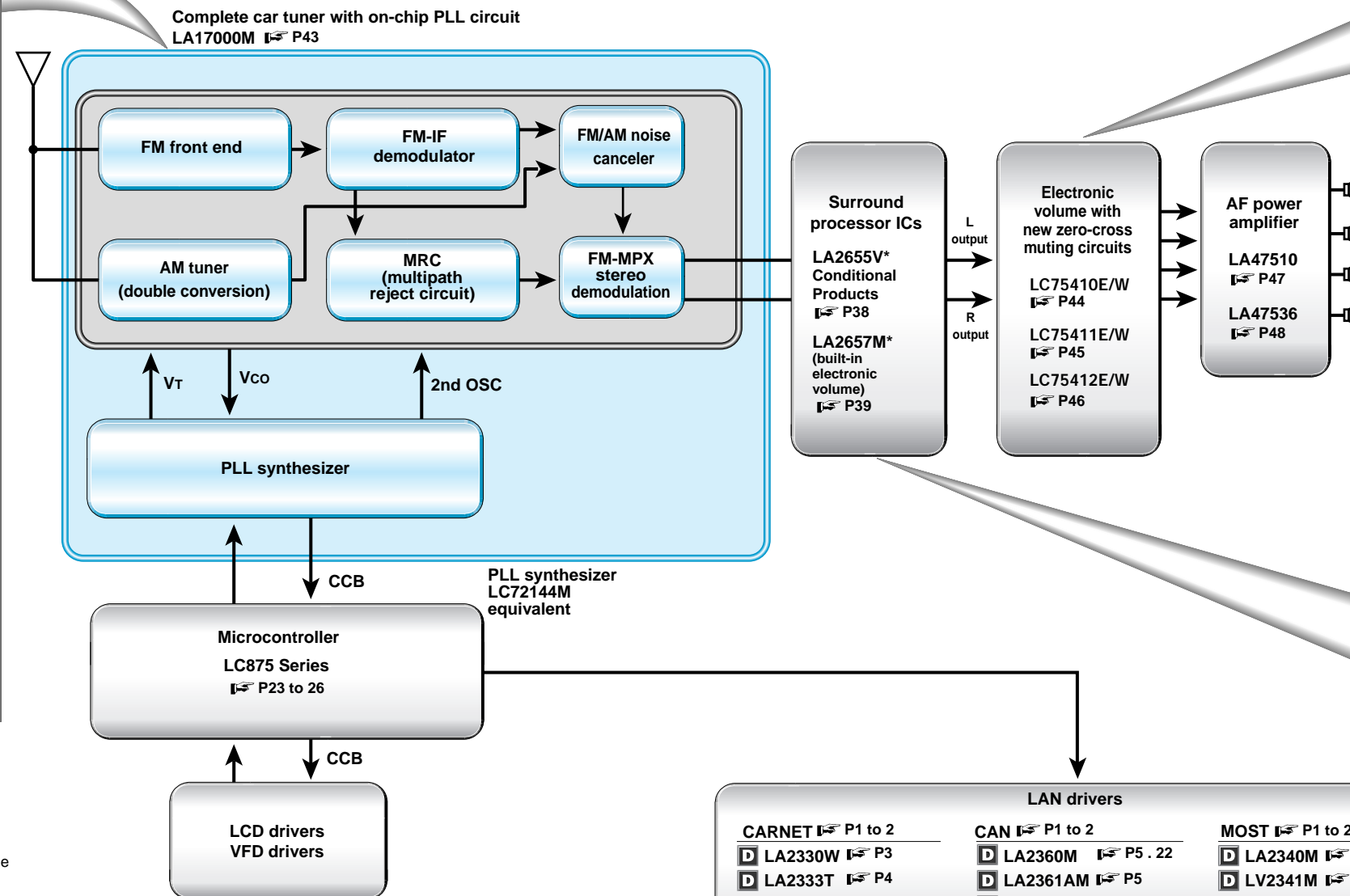
### AM/FM Tuner Block

- **Varactor diodes for AM tuning**
- SVC354 (3 diodes), SVC364 (4 diodes), SVC371 (6 diodes)
- **Varactor diodes for FM tuning**
- SVC230 (CR (C2.0V/C8.0V) ≥ 1.65, Q ≥ 100)
- SVC243 (CR (C1.0V/C6.5V) ≥ 7.0, Q ≥ 40)
- SVC272 (CR (C2.0V/C8.0V) ≥ 2.3, Q ≥ 150)

- SVC273 (CR (C2.0V/C8.0V) ≥ 3.1, Q ≥ 100)  
\*: SV272, SV273: MCPH3 miniature package (2.1 × 2.0 mm)
- **JFET and transistors for AMP amplifiers**
- CPH5901 (high gain, typ 50 ms), CPH5905 (High ESD resistance type)
- **Dual gate MOSFETs for FM amplifiers**
- 3SK263 (V<sub>DS</sub> = 15 Vmin, I<sub>DSX</sub> = 2.4 to 24 mA, |y<sub>fs</sub>| = typ 14 ms), 3SK264 (V<sub>DS</sub> = 15 V, I<sub>DSX</sub> = 5.0 to 24 mA, |y<sub>fs</sub>| = typ 17 ms)

- **Transistors for AM and FM buffers**
- 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz), 2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- **PIN diodes for AM AGC and switching**
- Series with r<sub>s</sub> = typ 5 Ω: ISV247, ISV233, ISV234, CPH5512
- **PIN diodes for FM AGC and switching**
- Series with r<sub>s</sub> = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H

- **Other transistors (power supply, interface, and switch drive)**
- Bipolar transistors: 50C02CH (V<sub>CEO</sub> = 15 V, I<sub>C</sub> = 1 A, V<sub>CE</sub> (sat) = max 280 mV) (NPN), 2SC5706 (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 5 A, V<sub>CE</sub> (sat) = typ 90 mV), 2SD1913 (V<sub>CEO</sub> = 60 V, I<sub>C</sub> = 3 A, P<sub>C</sub> = 20 W, h<sub>FE</sub> 70 to 280)
- MOSFET: 5LN 01M (V<sub>DSS</sub> = 50 V, I<sub>D</sub> = 100 mA R<sub>DS</sub> (on) <V<sub>GS</sub> = 2.5 V> = 9.9 Ω) (Nch), CPH6424 (V<sub>DSS</sub> = 60 V, I<sub>D</sub> = 3 A R<sub>DS</sub> (on) <V<sub>GS</sub> = 4 V> typ 150 mΩ)



## Electronic Volume Control Single-Chip Electronic Volume Control with New Zero-cross Muting Circuit LC75410E/W, LC75411E/W, LC75412E/W **I** P44, P45, P46

- Built-in differential input amplifiers (LC75410E/W, LC75412E/W)
- Zero-cross muting
- Input gain control
- Loudness control
- Package: (LC75410E) QIP64E (14 × 14), (LC75410W) SQFP64 (10 × 10), (LC75411E) QIP44M (10 × 10), (LC75411W) SQFP48 (7 × 7), (LC75412E) QIP64E (14 × 14), (LC75412W) SQFP64 (10 × 10)

## BBE Sound Processor IC LA2657M\* **I** P39

- Input function
- Input gain control
- BBE
- Tone and balance controls
- Super bass
- Master volume control
- Fader
- CCB support
- Package: QFP64E (14 × 14)

| LAN drivers                    |                                   |                                   |
|--------------------------------|-----------------------------------|-----------------------------------|
| <b>CARNET</b> <b>I</b> P1 to 2 | <b>CAN</b> <b>I</b> P1 to 2       | <b>MOST</b> <b>I</b> P1 to 2      |
| <b>D</b> LA2330W <b>I</b> P3   | <b>D</b> LA2360M <b>I</b> P5 . 22 | <b>D</b> LA2340M <b>I</b> P6 . 21 |
| <b>D</b> LA2333T <b>I</b> P4   | <b>D</b> LA2361AM <b>I</b> P5     | <b>D</b> LV2341M <b>I</b> P6 . 21 |
| LA2351M <b>I</b> P4 . P20      | <b>D</b> LA2361JM <b>I</b> P5     |                                   |

**BBE**  
BBE and BBE symbol are registered trademarks of BBE Sound, Inc.  
\* Requires a priori consultation with your SANYO sales representative or SANYO business office before their use.

Extensive lineup provides full support for a wide range of systems

# Car Audio Tuner IC with Built-in PLL Circuit

## LA17000M

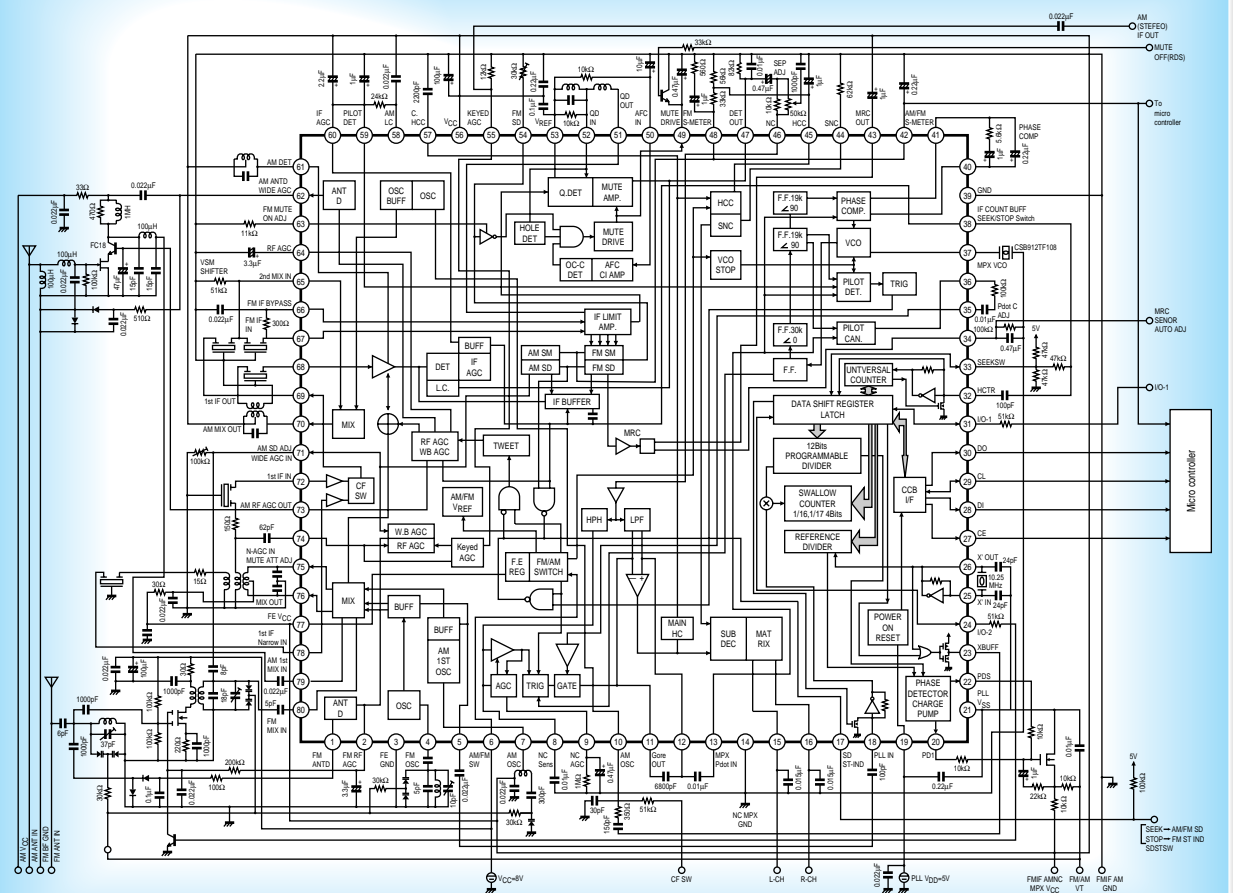
### Overview

The LA17000M is a car audio system tuner IC that integrates both a PLL frequency synthesizer and all AM/FM functions on a single chip. The LA17000M combines the functions of two ICs, a PLL IC (such as the LC72144) and an FM tuner IC (such as the LA1781M) on a single chip that provides PLL, AM (upconversion), FM FE, FM IF, NC, MCP, and MRC functions. The LA17000M achieves increased performance, adjustment-free manufacturing, and high reliability at low cost in car tuner systems by providing an optimal functional allocation in the IC.

### Functions

- Built-in PLL
  - ◆ A/D converter (6 bits, 1 channel)
  - ◆ IF counter and I/O ports for simplified interface design
  - ◆ Supports AM double conversion reception
- Strengthened noise reduction
  - ◆ Superlative three-signal characteristics
  - ◆ Improved weak and medium-field NC characteristics
  - ◆ Improved separation characteristics
  - ◆ Built-in anti-birdie filter (analog and digital outputs)
  - ◆ Anti-multipath sensor outputs (analog and digital outputs)
- Support for lower costs
  - ◆ AM double conversion (upconversion)
  - ◆ Improved FM IF circuit (automatic wide/narrow ceramic filter switching under adjacent channel interference conditions)
  - ◆ IF gain sample-to-sample variations reduced to 1/3 that in previous devices. This simplifies end product adjustment during manufacture. Furthermore, a shifter pin is provided for VSM adjustment.
- Supports end product miniaturization
  - ◆ High-frequency signal lines can be handled within the tuner pack.
  - ◆ Easily meets FCC requirements
- Package: QFP80 (14 × 14 mm)

Block Diagram



# Electronic Volume and Tone Control IC for Car Audio Systems

## LC75410E/W



### Overview

The LC75410E/W is an electronic volume and tone control IC that implements a rich set of audio control functions with a minimal number of external components. Functions include volume, balance, fader, bass/midrange/treble, and loudness controls, as well as input selection/switching functions and an input gain control.

### Functions

- Volume control: A total of 161 positions from 0 dB to -79.5 dB in 0.5 dB steps and -∞ dB. A balance function can be implemented by controlling the left and right channel volume controls separately.
- Fader control: The rear or front outputs can be attenuated by one of 16 levels (A total of 16 settings with attenuations of 0 to -2 dB in 1 dB steps, -2 to -20 dB in 2 dB steps, -20 to -30 dB in 10 dB steps, and -45, -60, and -∞ dB settings.)
- Bass/midrange/treble controls: Each band can be controlled in 1 dB steps from 0 dB to ±6 dB, and in 2 dB steps from ±8 dB to ±12 dB
- Input gain control: The input signal can be amplified by 0 to +18.75 dB in 1.25 dB steps
- Input switching: One of five input systems (left and right channels) can be selected (Four of the input systems are single-ended inputs, one uses differential inputs.)
- Loudness control: The -32 dB position of the 2 dB step volume control ladder resistor can be tapped and a loudness function implemented with external capacitor and resistor components

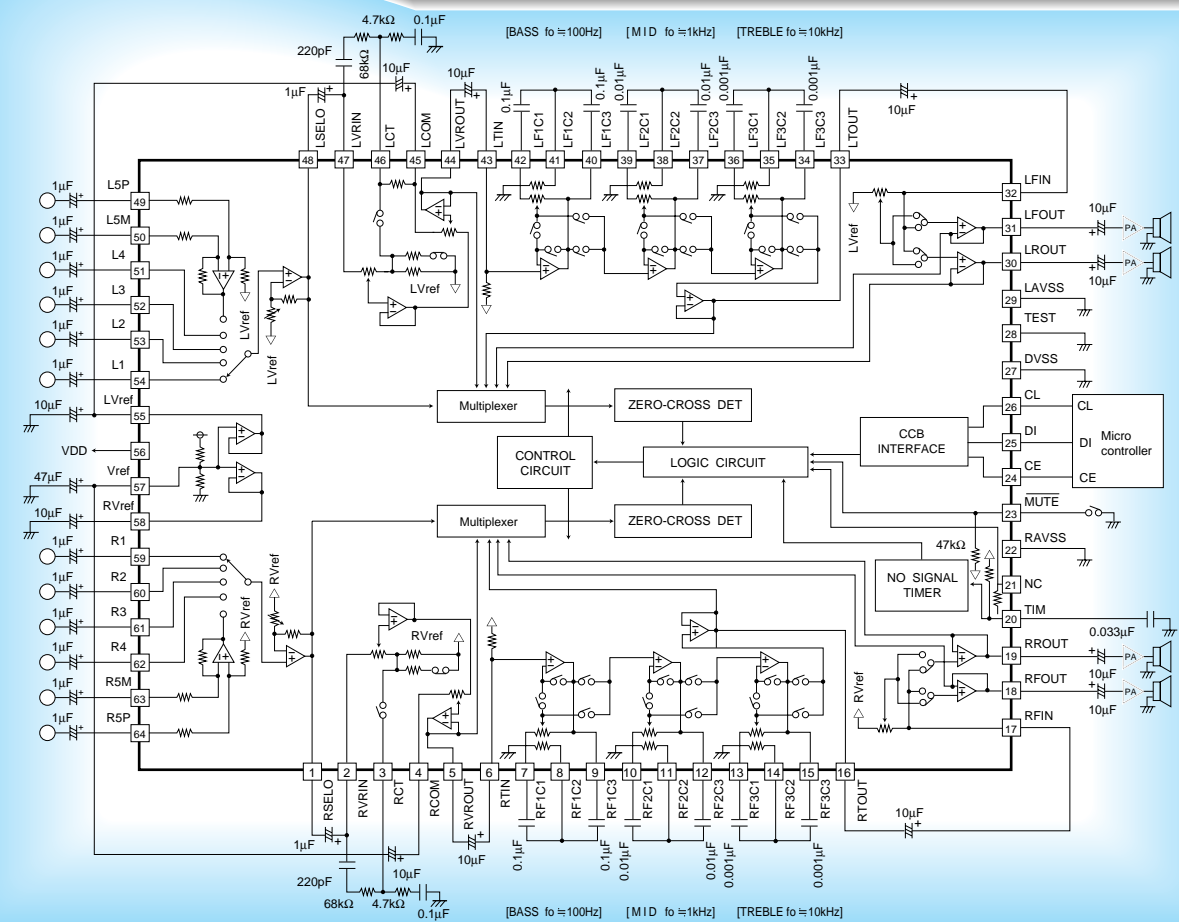
### Features

- On-chip buffer amplifiers reduce the number of external components
- Internal switches are implemented in a silicon gate CMOS process that minimizes the noise generated when switching. This results in low noise even when switching in the no-signal state.
- Zero-cross switching circuits used for low noise even when input signals are present
- Built-in VDD/2 reference voltage generation circuit
- All functions are controlled using serial data (CCB)
- Packages: LC75410E: QIP64E (14 × 14 mm)  
LC75410W: SQFP64 (10 × 10 mm)

\*: CCB is SANYO's original bus format. All bus addresses are managed by SANYO for this format.



Block Diagram





# Electronic Volume and Tone Control IC for Car Audio Systems

## LC75411E/W CCB

### Overview

The LC75411E/W is an electronic volume and tone control IC that implements a rich set of audio control functions with a minimal number of external components. Functions include volume, balance, fader, bass/treble, and loudness controls, as well as input selection/switching functions and an input gain control.

### Functions

- Volume control: A total of 161 positions from 0 dB to -79.5 dB in 0.5 dB steps and  $-\infty$  dB. A balance function can be implemented by controlling the left and right channel volume controls separately.
- Fader control: The rear or front outputs can be attenuated by one of 16 levels (A total of 16 settings with attenuations of 0 to -2 dB in 1 dB steps, -2 to -20 dB in 2 dB steps, -20 to -30 dB in 10 dB steps, and -45, -60, and  $-\infty$  dB settings.)
- Bass/treble controls: Each band can be controlled in 1 dB steps from 0 dB to  $\pm 6$  dB, and in 2 dB steps from  $\pm 8$  dB to  $\pm 12$  dB
- Input gain control: The input signal can be amplified by 0 to +18.75 dB in 1.25 dB steps
- Input switching: One of 4 input systems (left and right channels) can be selected
- Loudness control: The -32 dB position of the 2 dB step volume control ladder resistor can be tapped and a loudness function implemented with external capacitor and resistor components

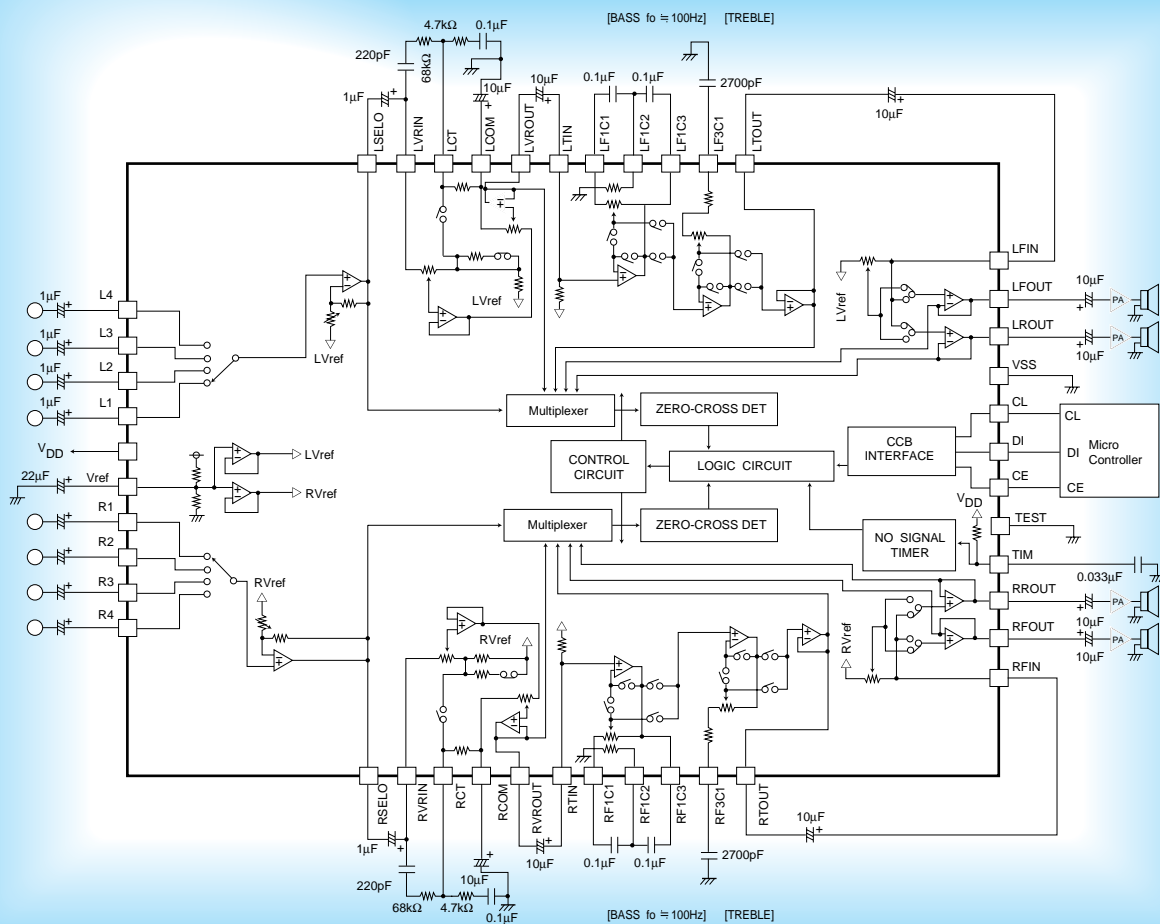
### Features

- On-chip buffer amplifiers reduce the number of external components
- Internal switches are implemented in a silicon gate CMOS process that minimizes the noise generated when switching. This results in low noise even when switching in the no-signal state
- Zero-cross switching circuits used for low noise even when input signals are present
- Built-in VDD/2 reference voltage generation circuit
- All functions are controlled using serial data (CCB)
- Packages: LC75411E: QIP44M (10 × 10 mm)  
LC75411W: SQFP48 (7 × 7 mm)

\*:CCB is SANYO's original bus format.  
All bus addresses are managed by SANYO for this format.



Block Diagram



# Electronic Volume and Tone Control IC for Car Audio Systems

## LC75412E/W CCB

### Overview

The LC75412E/W is an electronic volume and tone control IC that implements a rich set of audio control functions with a minimal number of external components. Functions include volume, balance, fader, bass/treble, and loudness controls, as well as input selection/switching functions and an input gain control.

### Functions

- Volume control: A total of 81 positions from 0 dB to -79 dB in 1 dB steps and  $-\infty$  dB. A balance function can be implemented by controlling the left and right channel volume controls separately.
- Fader control: The rear or front outputs can be attenuated by one of 16 levels (A total of 16 settings with attenuations of 0 to -2 dB in 1 dB steps, -2 to -20 dB in 2 dB steps, -20 to -30 dB in 10 dB steps, and -45, -60, and  $-\infty$  dB settings.)
- Bass/treble controls: Each band can be controlled in 2 dB steps from 0 dB to  $\pm 18$  dB
- Input gain control: The input signal can be amplified by 0 to +18.75 dB in 1.25 dB steps
- Input switching: One of six input systems (left and right channels) can be selected (Five of the input systems are single-ended inputs, one uses differential inputs.)
- Loudness control: Taps are output starting at the -32 dB position of the ladder resistor and a loudness function implemented with external capacitor and resistor components

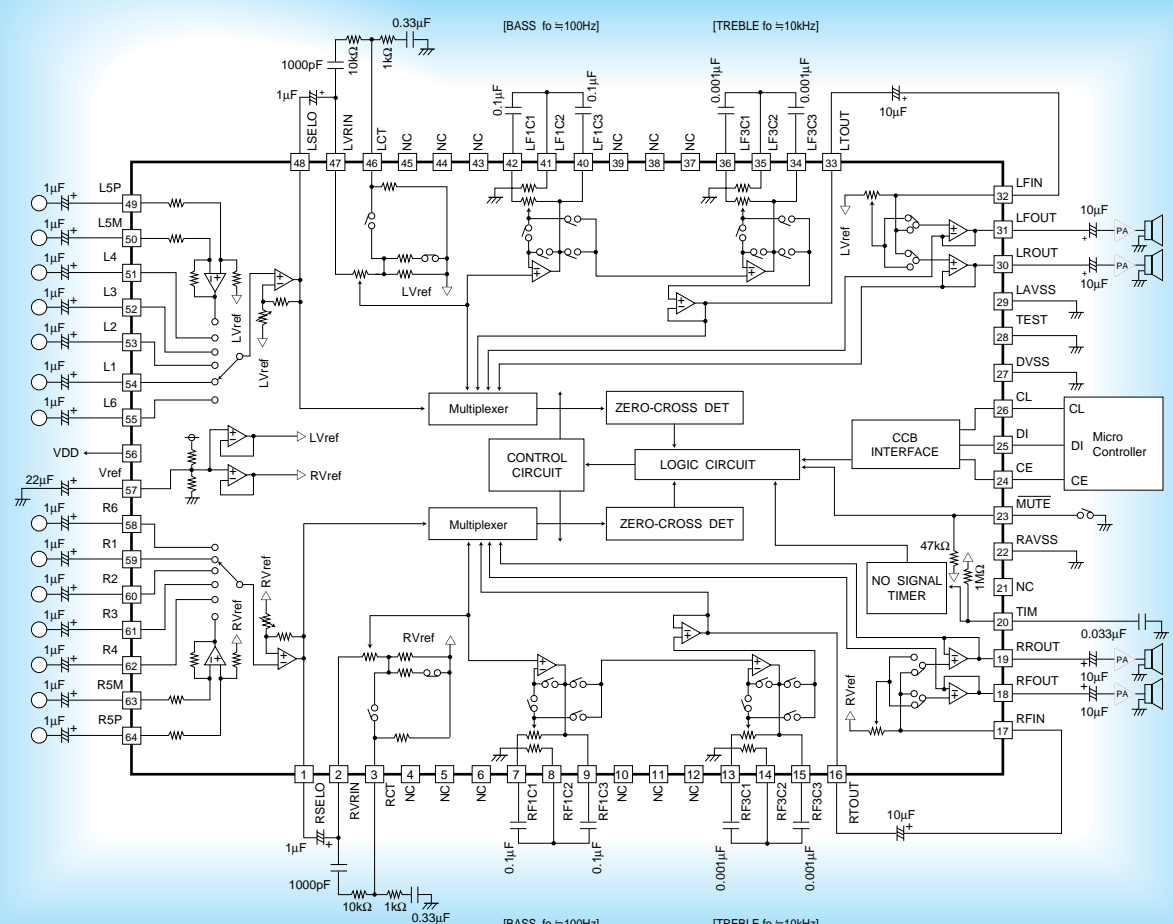
### Features

- On-chip buffer amplifiers reduce the number of external components
- Internal switches are implemented in a silicon gate CMOS process that minimizes the noise generated when switching. This results in low noise even when switching in the no-signal state
- Zero-cross switching circuits used for low noise even when input signals are present
- Built-in VDD/2 reference voltage generation circuit
- All functions are controlled using serial data (CCB)
- Packages: LC75412E: QIP64E (14 × 14 mm)  
LC75412W: SQFP64 (10 × 10 mm)

\*:CCB is SANYO's original bus format.  
All bus addresses are managed by SANYO for this format.



Block Diagram



# Power Amplifier

## LA47510

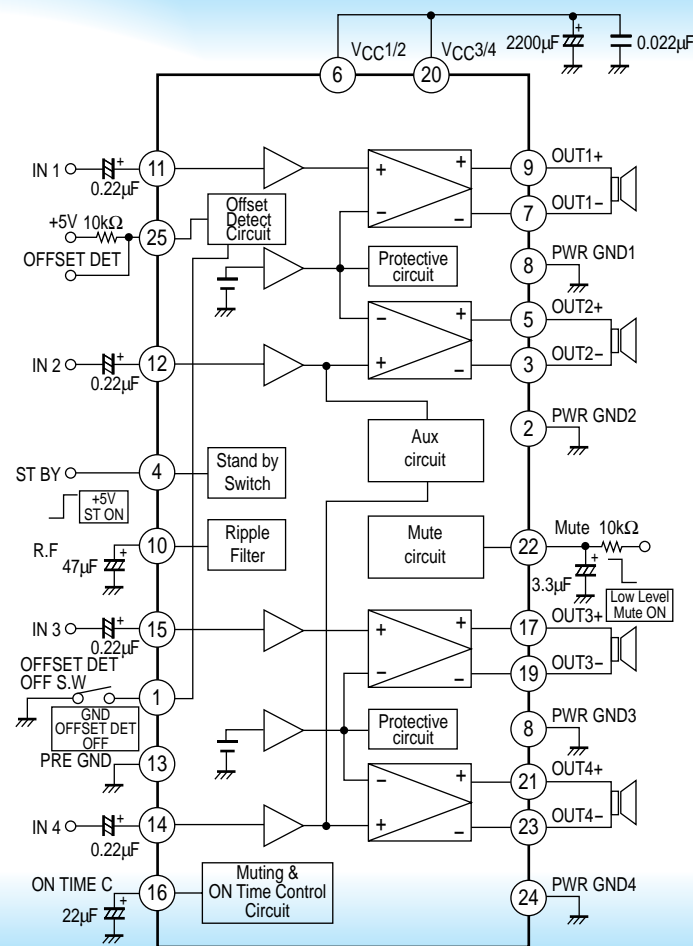
### Overview

The LA47510 is a four-channel BTL power amplifier IC designed for use in car stereo systems.

### Functions

- Maximum output: 50 W × 4 (VCC = 14.4 V, RL = 4 Ω)
- Offset detection function
- Offset detection function off switch
- Muting function
- Standby switch
- Built-in each protection circuit
  - ◆ Output pin-to-Vcc short
  - ◆ Output pin-to-GND short
  - ◆ Load short
  - ◆ Overvoltage
  - ◆ Thermal shutdown
- Package: HZIP25

Block Diagram



# Power Amplifier

## LA47536

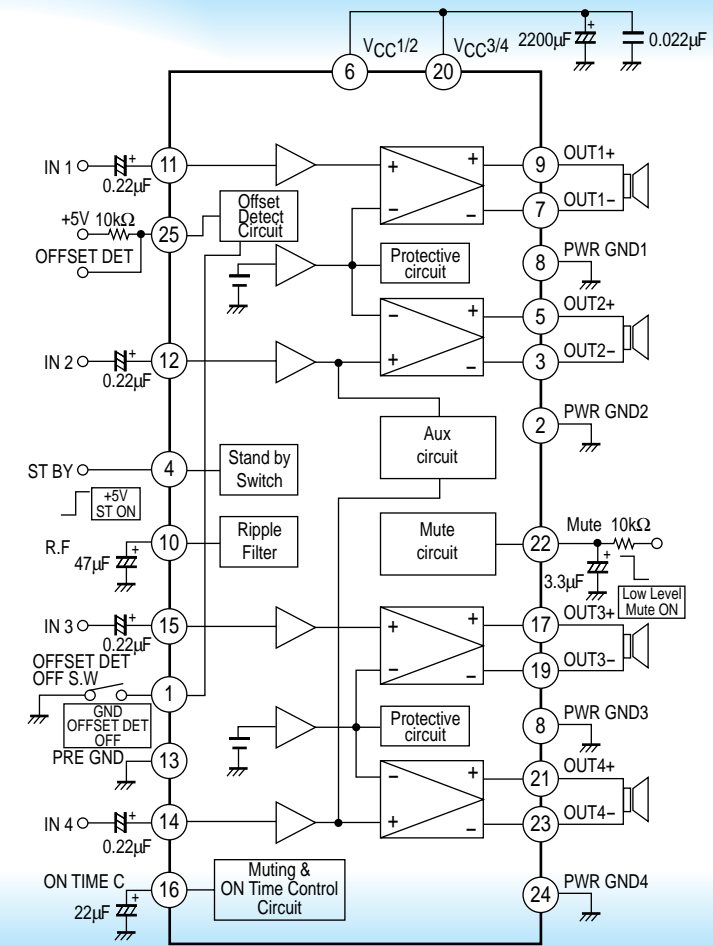
### Overview

The LA47536 is a four-channel BTL power amplifier IC designed for use in car stereo systems.

### Functions

- Maximum output: 45 W × 4 (VCC = 14.4 V, RL = 4 Ω)
- Offset detection function
- Offset detection function off switch
- Muting function
- Standby switch
- Built-in each protection circuit
  - ◆ Output pin-to-Vcc short
  - ◆ Output pin-to-GND short
  - ◆ Load short
  - ◆ Overvoltage
  - ◆ Thermal shutdown
- Package: HZIP25

Block Diagram



# Car Audio Standard Tuner System Chipsets

For Automotive AV Equipment

Bus interface incorporated in SANYO's original single-chip tuner IC. With the SANYO ETR controller IC, computer control of the tuner is possible.

## Car Audio Single-Chip Tuner Single-Chip Tuner ICs for Car Audio LA1776M N P51

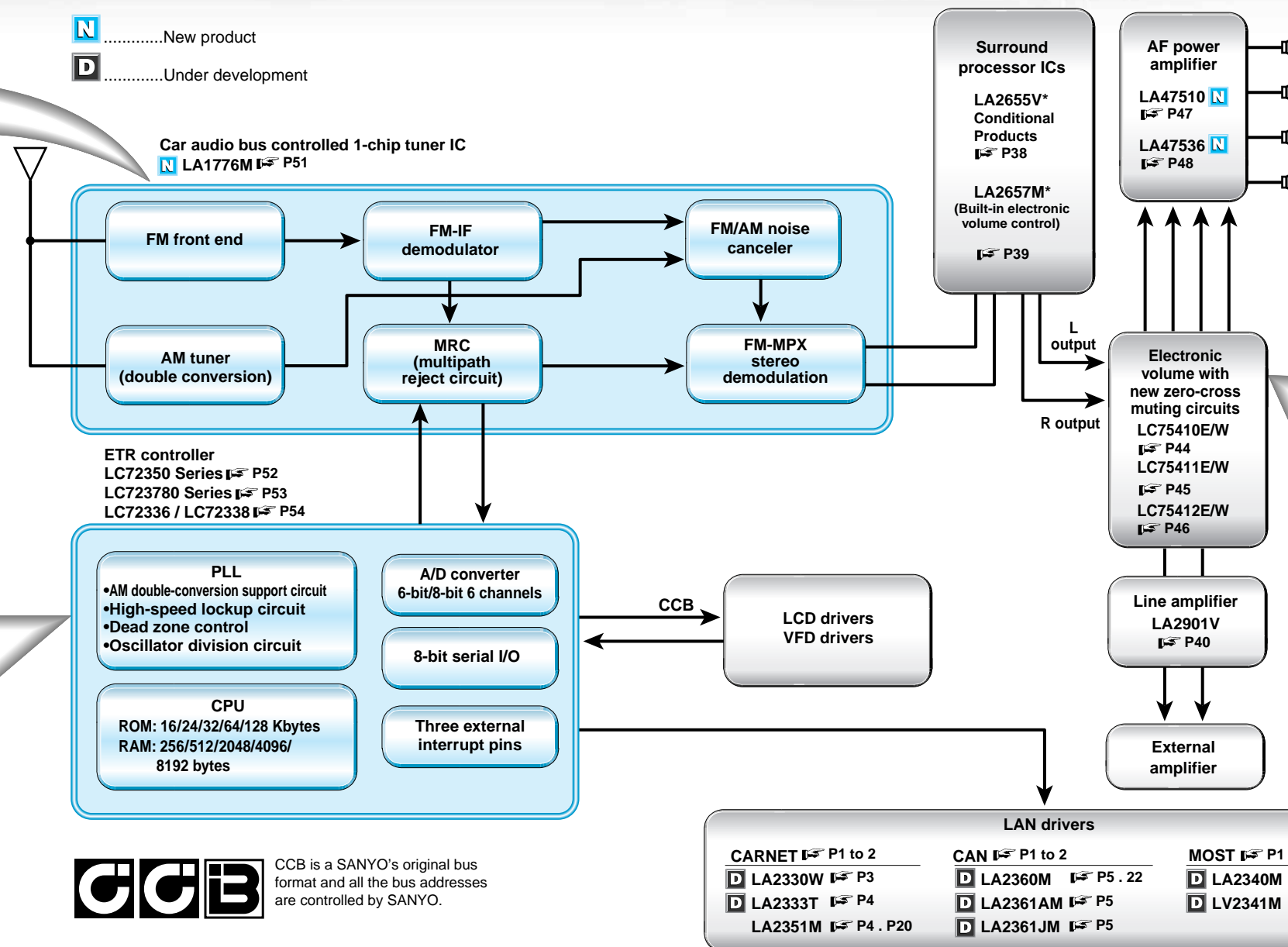
- Further improved noise reduction
- Superlative three-signal characteristics
- Improved medium and weak field NC characteristics
- Improved separation characteristics
- Built-in anti-birdie filter
- Support for lower total system costs
- AM double conversion (up-conversion system)
- Sample-to-sample IF gain variations reduced by 1/3 from earlier Sanyo products, making adjustments during final product assembly significantly easier.
- Package: QIP64E (14 × 4)

## ETR Controller Electronic Tuning Radio Controller LC72350 Series P52 LC723780 Series P53

- Large-capacity ROM: up to 128 Kbytes
- High-speed operation:  
One machine cycle takes 1.33 μs
- High-performance built-in PLL
- Direct PLL
- High-speed lockup circuit
- Package: (LC72350) QIP80E (14 × 20)  
(LC723780) QIP100E (14 × 20)

■ All products described in this catalog contain developed products or products that are diverted from general types. In accordance with standard of quality management system ISO/TS16949 for automotive industry, there is a case where all demanded articles couldn't be supported, so please confirm to the salesman of our company at every order.

N .....New product  
D .....Under development



## Electronic Volume Control Single-chip Electronic Volume Control with New Zero-cross Muting Circuit LC75410E/W, LC75411E/W, LC75412E/W P44 to 46

- Built-in differential input amplifiers (LC75410E/W, LC75412E/W)
- Zero-cross muting
- Input gain control
- Loudness control
- Package: (LC75410E) QIP64E (14 × 14)  
(LC75410W) SQFP64 (10 × 10)  
(LC75411E) QIP44M (10 × 10)  
(LC75411W) SQFP48 (7 × 7)  
(LC75412E) QIP64E (14 × 14)  
(LC75412W) SQFP64 (10 × 10)

\*Requires a priori consultation with your SANYO sales representative or SANYO business office before their use.

## Extensive lineup provides full support for a wide range of systems

### AM/FM Tuner Block

- Varactor diodes for AM tuning
- SVC354 (3 diodes), SVC364 (4 diodes), SVC371 (6 diodes)
- Varactor diodes for FM tuning
- SVC230 (CR (C2.0V/C8.0V) ≥ 1.65, Q ≥ 100)
- SVC243 (CR (C1.0V/C6.5V) ≥ 7.0, Q ≥ 240)
- SVC272 (CR (C2.0V/C8.0V) ≥ 2.3, Q ≥ 150)

- SVC273 (CR (C2.0V/C8.0V) ≥ 3.1, Q ≥ 100)  
\*: SV272, SV273: MCPH3 miniature package (2.1 × 2.0 mm)
- JFET and transistors for AMP amplifiers
- CPH5901 (high gain, typ 50 ms), CPH5905 (High ESD resistance type)
- Dual gate MOSFETs for FM amplifiers
- 3SK263 (V<sub>DS</sub> = 15 Vmin, I<sub>DSX</sub> = 2.4 to 24 mA, |y<sub>fs</sub>| = typ 14 ms), 3SK264 (V<sub>DS</sub> = 15 V, I<sub>DSX</sub> = 5.0 to 24 mA, |y<sub>fs</sub>| = typ 17 ms)

- Transistors for AM and FM buffers
- 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz), 2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- PIN diodes for AM AGC and switching
- Series with r<sub>s</sub> = typ 5 Ω: ISV247, ISV233, ISV246, ISV234, CPH5512
- PIN diodes for FM AGC and switching
- Series with r<sub>s</sub> = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H

- Other transistors (power supply, interface, and switch drive)
- Bipolar transistors: 50C02CH (V<sub>CEO</sub> = 15 V, I<sub>C</sub> = 1 A, V<sub>CE</sub> (sat) = max 280 mV) (NPN)  
2SC5706 (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 5 A, V<sub>CE</sub> (sat) = typ 90 mV)  
2SD1913 (V<sub>CEO</sub> = 60 V, I<sub>C</sub> = 3 A, P<sub>C</sub> = 20 W, h<sub>FE</sub> 70 to 280)
- MOSFET: 5LN 01M (V<sub>DSS</sub> = 50 V, I<sub>D</sub> = 100 mA R<sub>DS</sub> (on) <V<sub>GS</sub> = 2.5 V> = 9.9 Ω)  
CPH6424 (V<sub>DSS</sub> = 60 V, I<sub>D</sub> = 3 A R<sub>DS</sub> (on) <V<sub>GS</sub> = 4 V> typ 150 mΩ)

# System-on-Chip Tuner IC for Car Stereo Systems

## LA1776M New product

### Overview

The LA1776M is a car radio AM/FM tuner IC that is based on the current LA1787M but features improved AM upconversion (for improved reception characteristics) and improvements in most other characteristics as well. The LA1776M pin arrangement is only slightly changed from the LA1787M for easy printed circuit board pattern design.

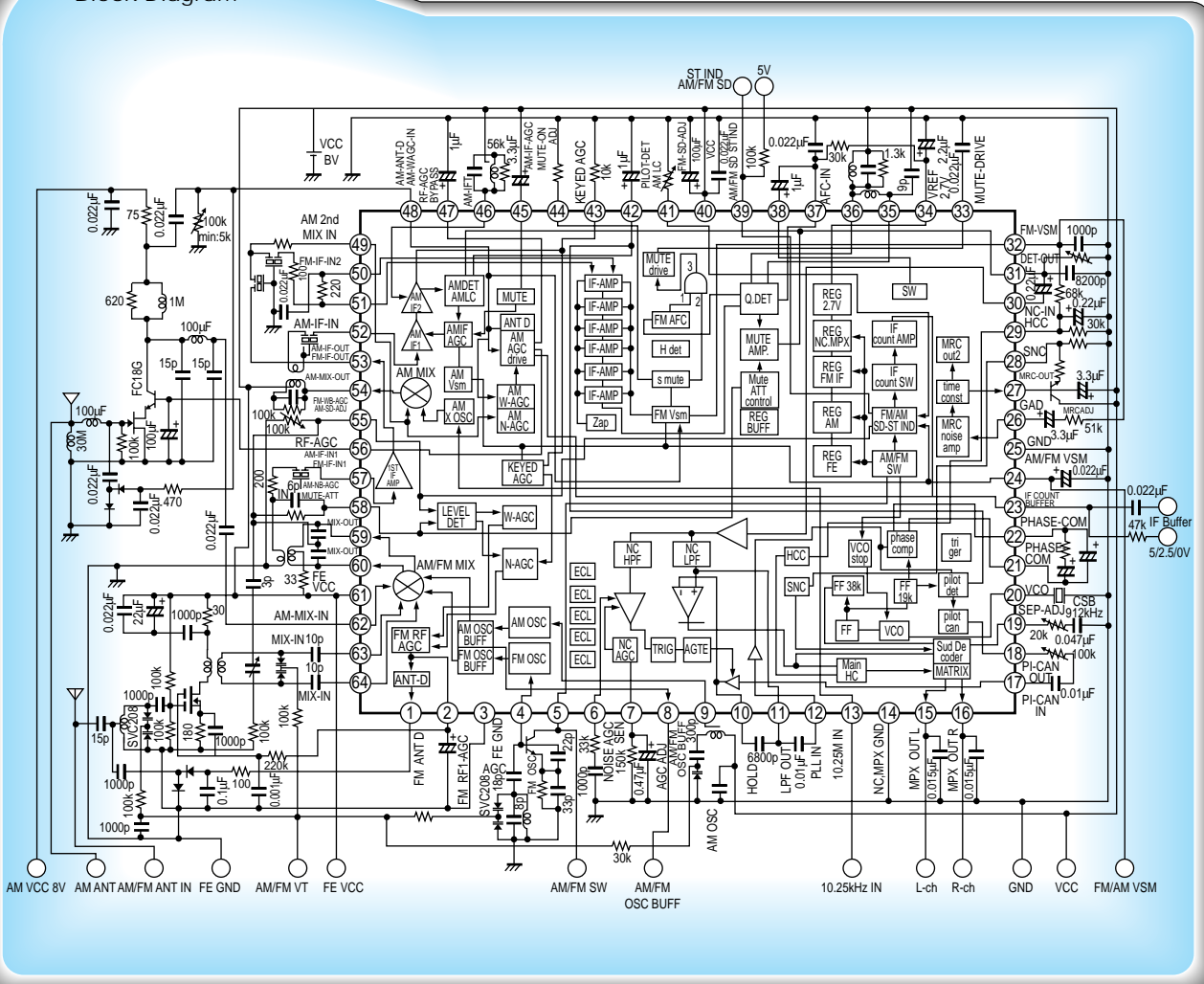
### Functions

- FM front end
- FM IF
- Noise canceller
- MRC
- Multiplex
- AM upconversion
- FM/AM switch

### Features

- Characteristics improved by new noise prevention measures in the mixer and amplifier blocks
- Three-signal characteristics improved due to increased dynamic range in the FM front end mixer
- Improved AM practical sensitivity and saturation signal-to-noise ratio
- FM S-meter shifter function can adjust for sample-to-sample variations in the S-meter (Fixed resistors are used for SD, KEYEDAGC, MUTE ON ADJ, MUTE ATT, SNC, and HCC.)
- High-speed search is possible using the FM band muting time constant switching function
- The low power consumption of the earlier device has been reduced even further
- Increased flexibility in the MRC setting
- Package: QIP64E (14 × 14 mm)

Block Diagram



# Electronic Tuning ETR Controllers

## LC72350 Series

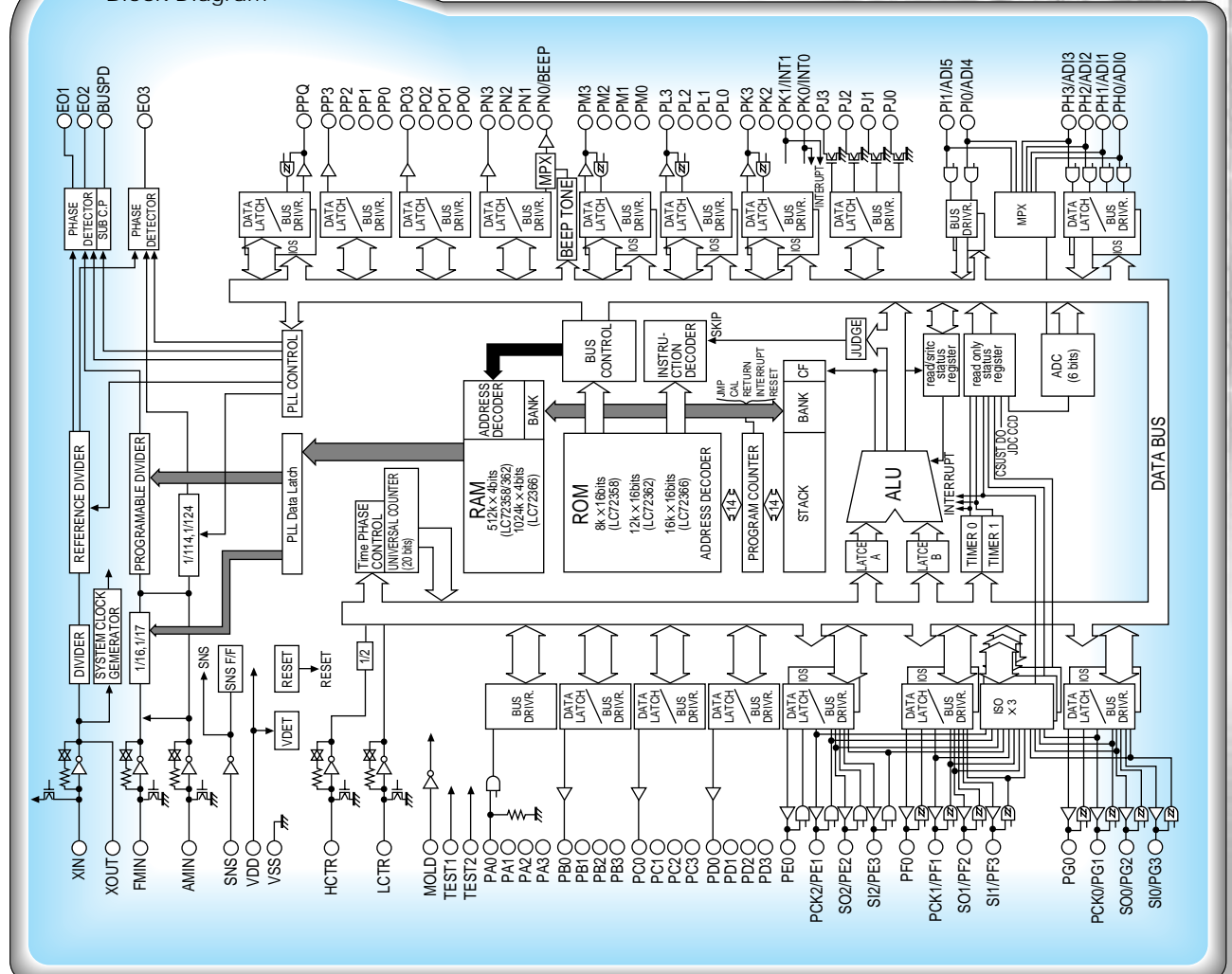
### Overview

The LC72350 Series (LC72358N, LC72362N, and LC72366) are system-on-chip electronic tuning microcontrollers with a 1.33 μs instruction execution time. These devices include both a high-speed locking circuit and a high-performance direct PLL circuit that can control the local oscillator C/N characteristics.

### Functions

- ROM: 16 KB (LC72358N)  
24 KB (LC72362N)  
32 KB (LC72366)
- RAM: 512 nibbles (LC72358N and LC72362N)  
1024 nibbles (LC72366)
- A/D converter: 6-bit successive approximation A/D converter with 6 input channels
- PLL: Built-in sub-charge pump for high-speed locking, built-in dead zone control
- Serial I/O: Three channels (8-bit 3-wire serial I/O)
- Multiple interrupt support: 4 levels
- Cycle time: 1.33 μs (4.5 MHz)
- QTP version: LC72P366
- Package: QIP80E (14 × 20 mm)

Block Diagram



## LC723780 Series

### Overview

The LC723780 series are large-memory ETR controllers that provide up to 128 KB of ROM and up to 8 KB of RAM.

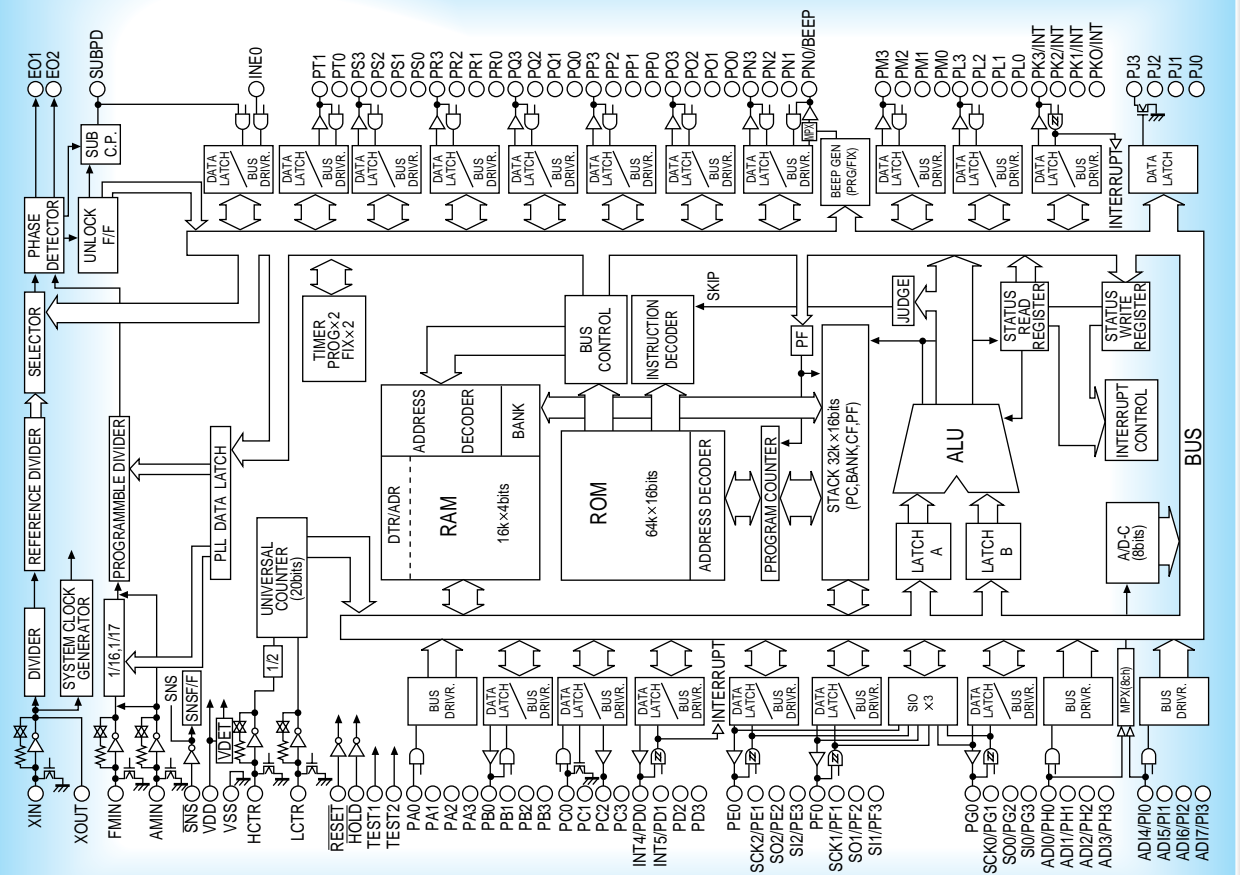
In addition to a rich set of table reference instructions to take advantage of the large ROM capacity, these devices also feature an improved interrupt system for direct control of the CD mechanism and the CD DSP, support for RDS products, and powerful communications for use within the end product and with external systems as well.

In car audio applications in particular, these communication functions allow a reduction in the number connecting wires between the front panel circuit board and the main system circuit board.

### Functions

- ROM/RAM: 40 KB/2 KB (LC723781)  
48 KB/2 KB (LC723782)  
64 KB/4 KB (LC723783)  
96 KB/6 KB (LC723784)  
128 KB/8 KB (LC723785)
- Cycle time: 1.33 μs/833 ns (all instructions are one word) at 4.5 MHz/7.2 MHz
- Serial I/O: Three channels (supports 8-bit, 2- or 3-wire systems) MSB/LSB first switching
- Multiple interrupts: 16 levels
- A/D converter: 8-bit successive approximation A/D converter with 8 input channels
- PLL block: Dead zone control, unlocked state detection circuit
- QTP version: LC72F3781
- Package: QIP100E (14 × 20 mm)

Block Diagram



## LC72336/LC72338

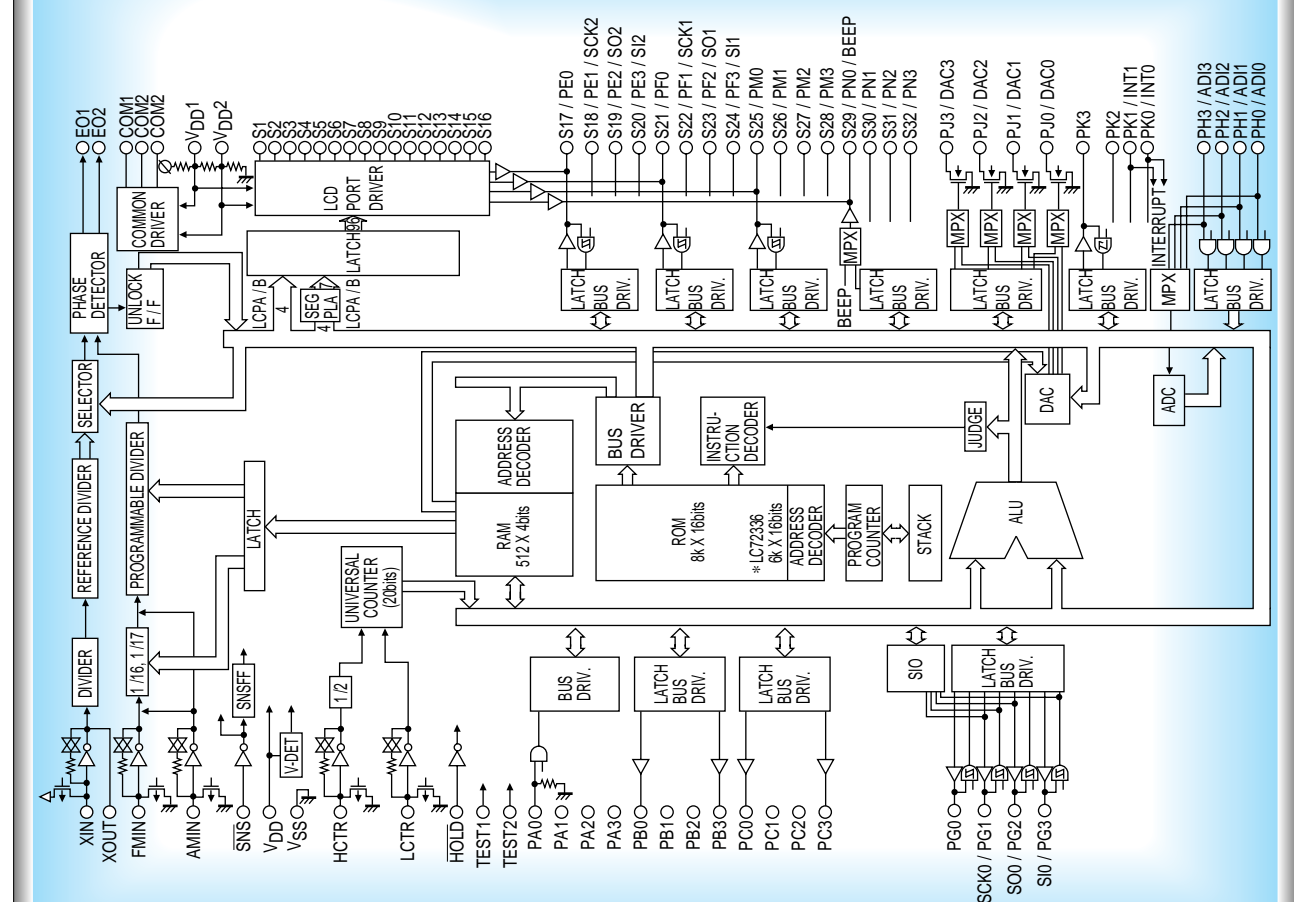
### Overview

The LC72336 and LC72338 are system-on-chip electronic tuning microcontrollers that integrate both a PLL circuit that can operate at up to 150 MHz and a 1/3 duty LCD driver. They also feature a highly efficient instruction set and powerful hardware

### Functions

- High-speed programmable divider
- Program memory (ROM): LC72336 - 6143 words × 16 bits (12 KB)  
LC72338 - 8191 words × 16 bits (16 KB)
- Data memory (RAM): 512 × 4 bits
- All instructions are one word
- Cycle time: 1.33 μs
- Stack: 8 levels
- LCD driver: Up to 96 segments (1/3 duty, 1/3 bias)
- Serial I/O: Up to 3 channels (8-bit 3-wire type)
- External interrupt: Two channels (INT0 and INT1)  
Supports both rising edge and falling edge detection
- Package: LC72336 - QIP80E (14 × 20 mm)  
LC72338 - QIP80E (14 × 20 mm)

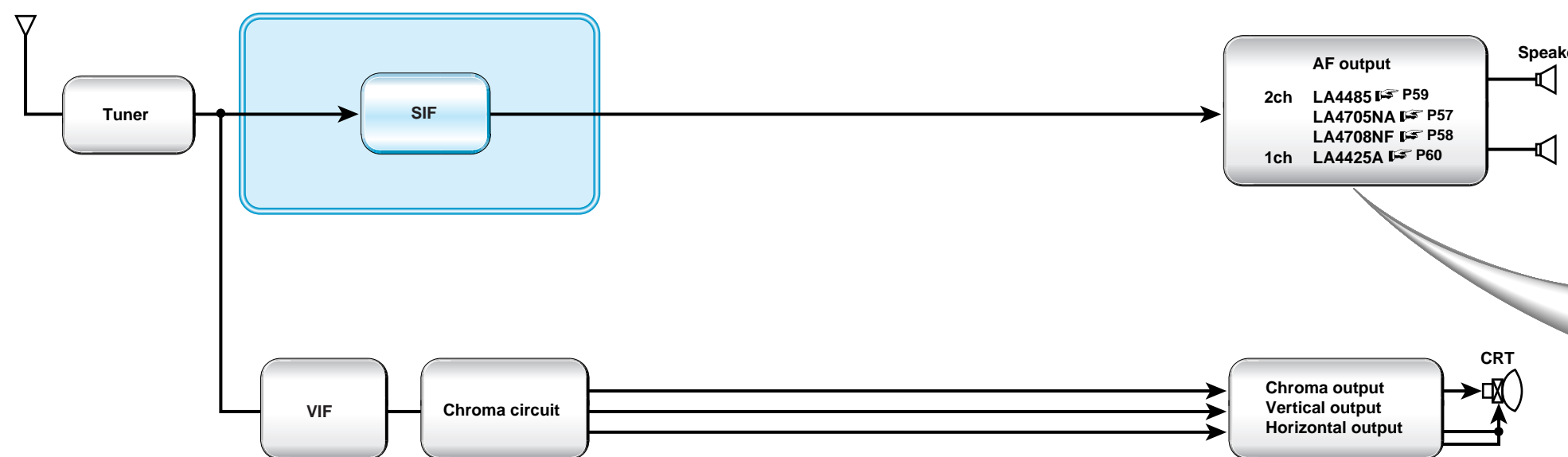
Block Diagram



# Multiplexed Stereo Decoder System Chipsets

For Automotive AV Equipment

Automotive AV Equipment Related Products  
SANYO provides high-quality TV audio based on unique audio processing technologies.



- Car stereo two-channel BTL audio frequency power amplifier  
15 W (Total output: 25 W + 25 W)  
LA4705NA P57  
20 W (Total output: 30 W + 30 W)  
LA4708NF P58

- Extremely low levels of impulse noise
- Supports loads as low as  $RL = 2 \Omega$
- Superb sound quality design ( $f_L < 10 \text{ Hz}$ ,  $f_H = 130 \text{ kHz}$ )
- Noise filter circuit does not required capacitors
- The turn-on time can be set arbitrarily with an external capacitor
- Built-in standby mode switching circuit (microcontroller support)
- Full complement of protection circuits (Protection against shorting to power, shorting to ground, and load shorting as well as overvoltage and thermal protection circuits)

- Car Stereo 5 W AF Power Amplifiers that Require Minimal External Components  
Two channels: LA4485 P59  
One channel: LA4425A P60

- Extremely few external components required  
LA4485: Dual mode: 4 or 5 components  
BTL mode: 3 or 4 components  
LA4425A: 2 components
- Wide operating supply voltage range
- Impulse noise reduction circuit
- Standby mode switching function (LA4485)
- Audio muting function (LA4485)
- Full complement of protection circuits (Protection against overvoltage, excessive temperatures, and output DC shorting)

Monolithic Linear IC  
Car Stereo 17 W Two-Channel BTL AF Amplifier

# LA4705NA

## Overview

The LA4705NA is a two-channel BTL power amplifier IC designed for car stereo systems. It was designed with particular emphasis placed on achieving superb audio quality.

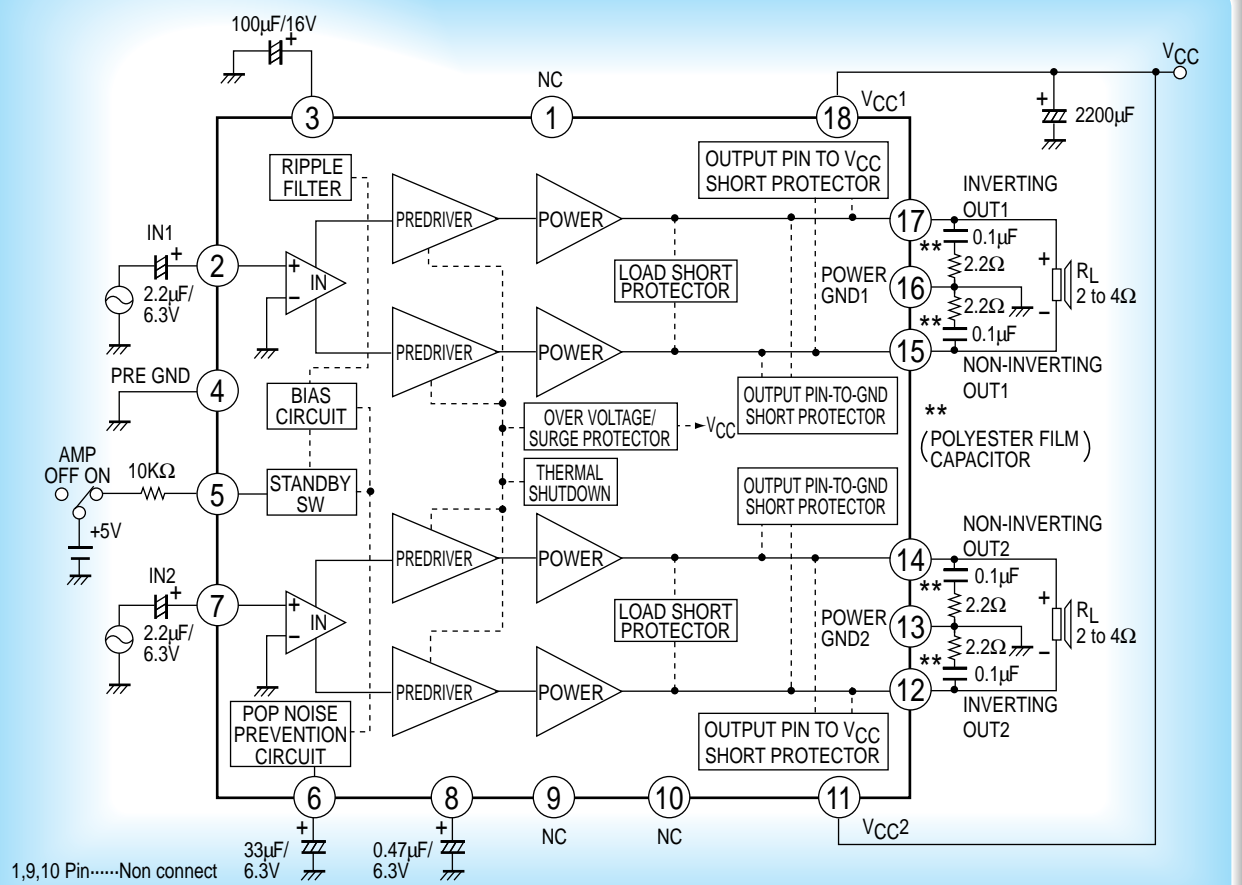
The low band frequency characteristics were extended with a new capacitor-free noise filter circuit, and improvements in both circuit and pattern designs allow crosstalk, a source of audio quality problems, to be reduced, resulting in audio with powerful bass and clear treble.

The LA4705NA also features a full complement of protection circuits and a standby mode switch.

## Functions

- Total output: 25 W + 25 W ( $V_{CC} = 14.4\text{ V}$ , THD = 30%,  $R_L = 4\ \Omega$ )
- Supports loads as low as  $R_L = 2\ \Omega$
- Superb sound quality design ( $f_L < 10\text{ Hz}$ ,  $f_H = 130\text{ kHz}$ )
- Noise filter circuit does not require capacitors
- The turn-on time can be set arbitrarily with an external capacitor
- Extremely low levels of impulse noise
- Built-in standby mode switching circuit (microcontroller support)
- Built-in each protection circuit
  - ◆ Output pin-to-Vcc short
  - ◆ Output pin-to-GND short
  - ◆ Load short
  - ◆ Overvoltage
  - ◆ Thermal shutdown
- Package: SIP18H

Block Diagram



Monolithic Linear IC  
Car Stereo 20 W Two-Channel BTL AF Amplifier

# LA4708NF

## Overview

The LA4708NF is two-channel BTL power amplifier IC designed for car stereo systems. It was designed with particular emphasis placed on achieving superb audio quality.

The low band frequency characteristics were extended with a new capacitor-free noise filter circuit, and improvements in both circuit and pattern designs allow crosstalk, a source of audio quality problems, to be reduced, resulting in audio with powerful bass and clear treble.

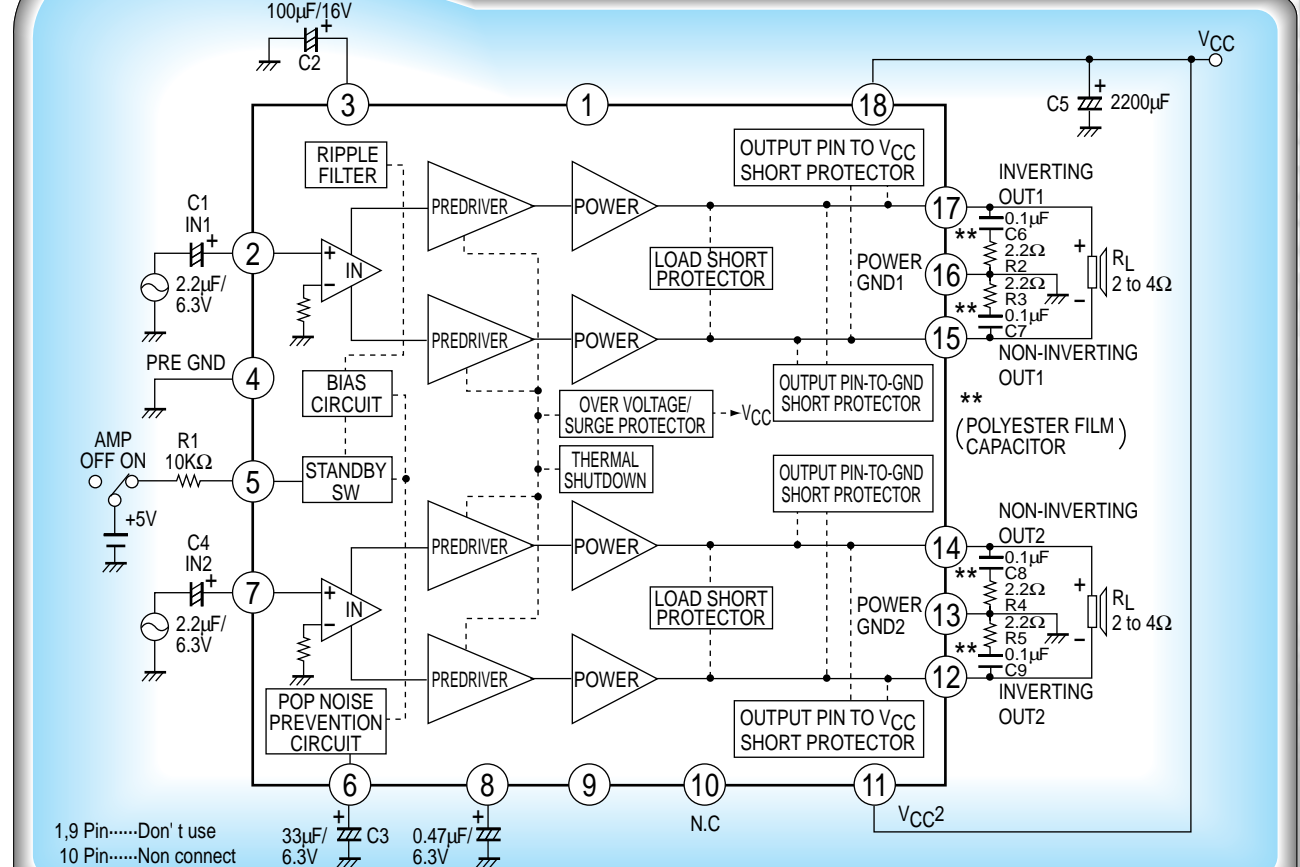
The LA4708NF also features a full complement of protection circuits and a standby mode switch.

Note that the LA4708NF is pin compatible with the LA4705NA (car stereo 17 W two-channel power amplifier IC), and allows end product power to be increased simply by switching ICs. (Pins 1 and 9 must be left open to allow the same circuit board to be used.)

## Functions

- High power with a total output of 30 W + 30 W ( $V_{CC} = 13.2\text{ V}$ , THD = 30%,  $R_L = 4\ \Omega$ )
- Supports loads as low as  $R_L = 2\ \Omega$  ( $V_{CC} = 13.2\text{ V}$ , THD = 30%,  $P_O = 30\text{ W}$ )
- Superb sound quality design ( $f_L < 10\text{ Hz}$ ,  $f_H = 130\text{ kHz}$ )
- Noise filter circuit does not require capacitors
- The turn-on time can be set arbitrarily with an external capacitor
- Extremely low levels of impulse noise
- Built-in standby mode switching circuit (microcontroller support)
- Built-in each protection circuit
  - ◆ Output pin-to-Vcc short
  - ◆ Output pin-to-GND short
  - ◆ Load short
  - ◆ Overvoltage
  - ◆ Thermal shutdown
- Package: SIP18H

Block Diagram



Monolithic Linear IC  
Car Radio/Car Stereo 5 W Two-Channel Power Amplifier  
that Requires Minimal External Components

# LA4485

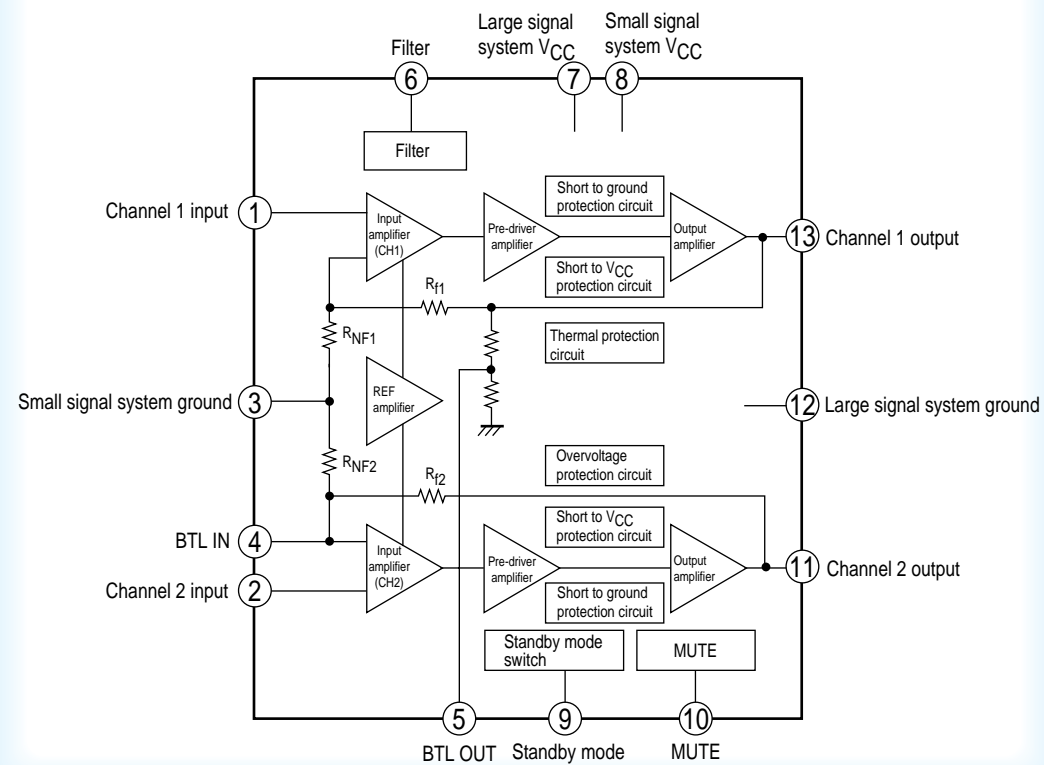
## Overview

The LA4485 obviates the need for the BS capacitor, noise filter capacitor, and oscillation prevention RC components previously required by power amplifier ICs by integrating them on the IC itself. The LA4485 requires only the barest minimum of external components and both dual and BTL type operation are supported in the power series ("stylish power").

## Functions

- Dual: 5 W × 2, BTL: 15 W
- Extremely few external components required: 4 or 5 in dual mode, 3 or 4 in BTL mode
- Built-in Each protection circuits
  - ◆ Overvoltage protection circuit
  - ◆ Thermal protection circuit
  - ◆ Output DC short protection circuit (with respect to both  $V_{CC}$  and ground)
- Circuit to handle application of  $+V_{CC}$  to the outputs
- Built-in impulse protection circuit
- Standby mode switching function
- Audio muting function
- Package: SIP13H

Block Diagram



Monolithic Linear IC  
Car Radio/Car Stereo 5 W Power Amplifier that Requires  
Minimal External Components

# LA4425A

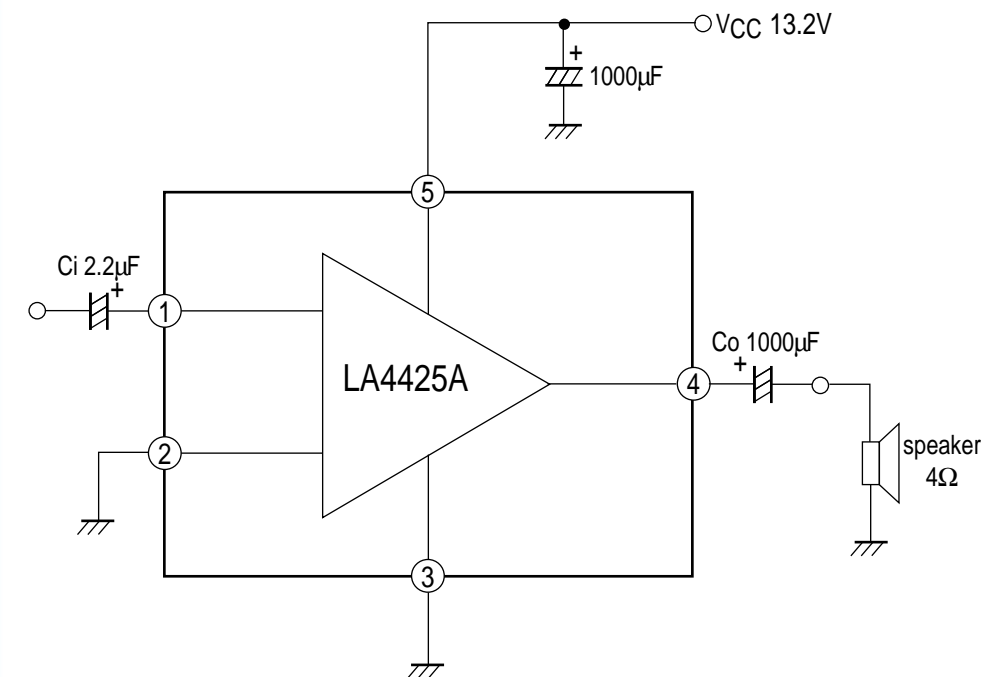
## Overview

The LA4425A is a 5 W power amplifier IC for car radio and car stereo systems that requires an extremely small number of external components.

## Functions

- The industry's first power amplifier that requires so few external components
  - ◆ Provided in the industry's smallest package: SIP-5H (a TP126 type package)
  - ◆ Only required 2 external components: input and output coupling capacitors only
- As a power IC, evaluation, adjustment, and investigation are essentially unnecessary  
This leads to simplified management
- Wide operating supply voltage range: 5 to 16 V
- Built-in Each protection circuits
  - ◆ Overvoltage protection circuit
  - ◆ Thermal protection circuit
  - ◆ Output DC short protection circuit
- Built-in impulse protection circuit
- Package: SIP5H

Block Diagram





# FM Multiplex Broadcasting System Chipsets

For Automotive AV Equipment

FM multiplex broadcasting is a new data transmission system that allows reception by mobile receivers and features a large transmission capacity and a wide service area. SANYO has proposed ICs that exactly match the requirements of each functional block and is now aiming at further product line expansion in this area.

\*The DARC system is an FM multiplex broadcasting system proposed by NHK (Japan Broadcasting Corporation). It is appropriate for reception from mobile receivers.  
\*A contract with VICS Center is required to acquire VICS decoder ICs.

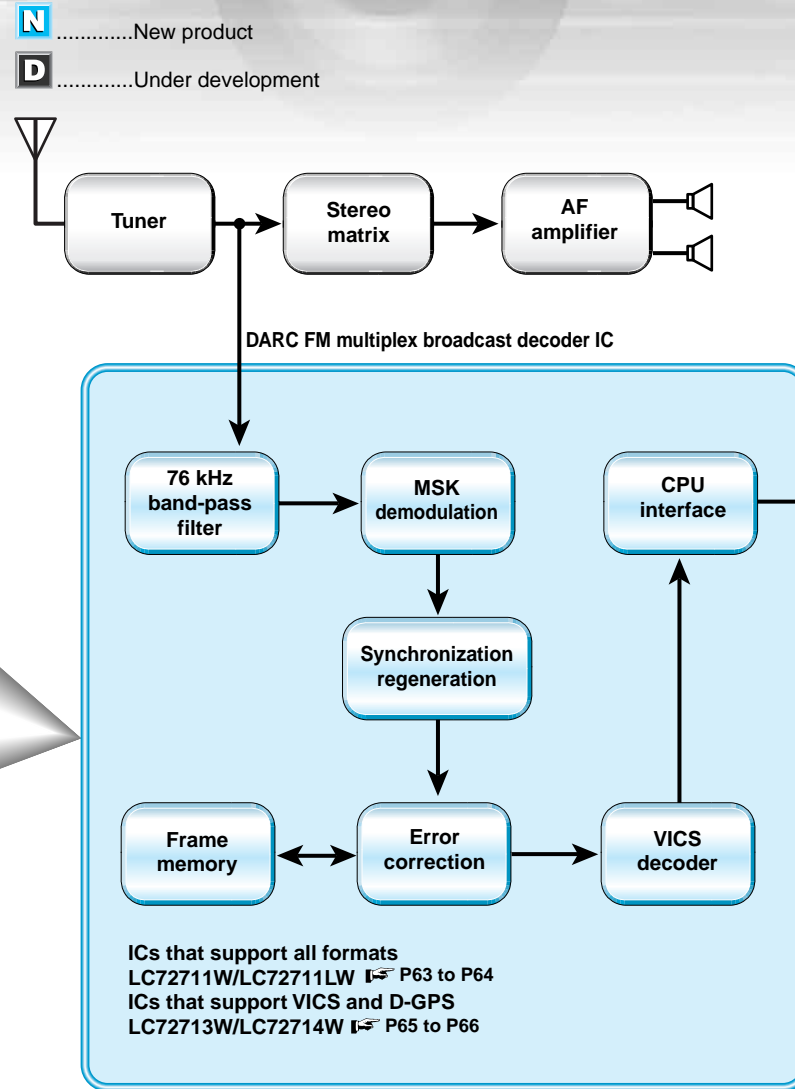
## DARC System FM Multiplex Data Decoder

■ **VICS-IC**  
**LC72713W** I<sup>2</sup>S P65  
**LC72714W** I<sup>2</sup>S P66

- Built-in dedicated VICS decoder circuit
- VICS data and D-GPS data can be acquired at the same time with a single tuner.
- On-chip 76-kHz bandpass filter based on SC technology
- Adopts a delay detection technique that is particularly effective in mobile reception
- Clock recovery using a digital PLL circuit
- Block and frame synchronization detection circuits
- Error correction circuit using (272, 190) codes
- On-chip frame memory for product code
- Layer 4 CRC code check circuit
- Selectable CCB serial and parallel interfaces
- Operating temperature: -40 to +85°C
- Supply voltage: 4.5 to 5.5 V (LC72713W)  
2.7 to 3.6 V (LC72714W)
- Package: SQFP64 (10 × 10)

■ **Support for All Broadcast Systems**  
**LC72711W** I<sup>2</sup>S P63  
**LC72711LW** I<sup>2</sup>S P64

- Supports FM multiplex all frame methods (methods A through C)
- For reception of FM multiplex services other than VICS
- Operating temperature: -40 to +85°C
- Supply voltage: 4.5 to 5.5 V (LC72711W)  
2.7 to 3.6 V (LC72711LW)
- Package: SQFP64 (10 × 10)



| LAN drivers                            |                                     |                                      |
|--|-------------------------------------|--------------------------------------|
| <b>CARNET</b> I <sup>2</sup> S P1 to 2 | <b>CAN</b> I <sup>2</sup> S P1 to 2 | <b>MOST</b> I <sup>2</sup> S P1 to 2 |
| D LA2330W I <sup>2</sup> S P3          | D LA2360M I <sup>2</sup> S P5 . 22  | D LA2340M I <sup>2</sup> S P6 . 21   |
| D LA2333T I <sup>2</sup> S P4          | D LA2361AM I <sup>2</sup> S P5      | D LV2341M I <sup>2</sup> S P6 . 21   |
| LA2351M I <sup>2</sup> S P4 . P20      | D LA2361JM I <sup>2</sup> S P5      |                                      |

## Wide Range of RAM and ROM Options

■ **Signal Control Microcontrollers**  
**LC875B Series** I<sup>2</sup>S P23 to 24

- Manages the broadcast (received) data and controls the LCD driver as an FM multiplex broadcasting signal controller
- This series is optimal since the abundant internal RAM can be used for smooth data management  
 ROM: 176 Kbytes to 256 Kbytes  
 RAM: 4 to 6 Kbytes

■ **LC87F5BP6A (Flash Version)** I<sup>2</sup>S P23 to 24

- Provides a dedicated 8-bit bus for optimal data management and LCD display
- Includes 256 KB of flash memory as on-board reprogrammable ROM
- Includes 6 KB of RAM

■ All products described in this catalog contain developed products or products that are diverted from general types. In accordance with standard of quality management system ISO/TS16949 for automotive industry, there is a case where all demanded articles couldn't be supported, so please confirm to the salesman of our company at every order.

Flash products are licensed from Silicon Storage Technology, Inc.,(USA), and manufactured and sold by SANYO Electric Co., Ltd.



CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.

The DARC (Data Radio Channel) FM multiplex broadcasting technology was developed by NHK (Japan Broadcasting Corporation).  
 DARC is a registered trademark of NHK Engineering Service (NHK-ES).  
 A separate contract with NHK-ES is required for the production and sale of electronic equipment using DARC technology.  
 The logo shown here can be displayed on electronic equipment using DARC technology.



## Extensive lineup provides full support for a wide range of systems

### Tuner Block

- **Varactor diodes for tuning**
- SVC230 (CR (C2.0V/C8.0V) ≥1.65, Q ≥100)
- SVC243 (CR (C1.0V/C6.5V) ≥7.0, Q ≥40)
- SVC272 (CR (C2.0V/C8.0V) ≥2.3, Q ≥150)
- SVC273 (CR (C2.0V/C8.0V) ≥3.1, Q ≥100)
- \*: SV272, SV273: MCPH3 miniature package (2.1 × 2.0 mm)

- **Dual gate MOSFETs for amplifiers**
- 3SK263 (V<sub>DS</sub> = 15 Vmin, I<sub>DSX</sub> = 2.4 to 24 mA, |y<sub>fs</sub>| = typ 14 ms), 3SK264 (V<sub>DS</sub> = 15 V, I<sub>DSX</sub> = 5.0 to 24 mA, |y<sub>fs</sub>| = typ 17 ms)
- **Transistors for buffers**
- 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz), 2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- **PIN diodes for AGC and switching**
- Series with rs = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H

- **Transistors for AM and FM buffers**
- 2SC2812N (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 150 mA, f<sub>T</sub> = typ 100 MHz), 2SC2814 (V<sub>CEO</sub> = 20 V, I<sub>C</sub> = 30 mA, f<sub>T</sub> = typ 320 MHz)
- **PIN diodes for AM AGC and switching**
- Series with rs = typ 5 Ω: ISV247, ISV233, ISV246, ISV234, CPH5512
- **PIN diodes for FM AGC and switching**
- Series with rs = typ 6 Ω: ISV294, ISV315, ISV316, ISV298H

- **Other transistors (power supply, interface, and switch drive)**
- Bipolar transistors: 50C02CH (V<sub>CEO</sub> = 15 V, I<sub>C</sub> = 1 A, V<sub>CE</sub> (sat) = max 280 mV (NPN)), 2SC5706 (V<sub>CEO</sub> = 50 V, I<sub>C</sub> = 5 A, V<sub>CE</sub> (sat) = typ 90 mV), 2SD1913 (V<sub>CEO</sub> = 60 V, I<sub>C</sub> = 3 A, PC = 20 W, h<sub>FE</sub> 70 to 280)
- MOSFET: 5LN 01M (V<sub>DSS</sub> = 50 V, I<sub>D</sub> = 100 mA R<sub>DS</sub> (on) (Nch) <V<sub>GS</sub> = 2.5 V> = 9.9 Ω), CPH6424 (V<sub>DSS</sub> = 60 V, I<sub>D</sub> = 3 A R<sub>DS</sub> (on) <V<sub>GS</sub> = 4 V> typ 150 mΩ)

# Mobile FM Multiplex Broadcast (DARC System) Receiver IC

## LC72711W

### Overview

The LC72711W is a data demodulation IC for the reception of mobile FM multiplex broadcasts in the DARC system.

The LC72711W includes a bandpass filter for the extraction of the DARC signal from the FM baseband.

This IC is optimal for worldwide FM multiplex products since it supports all of the FM multiplex frame structures (methods A, A', B, and C) in the ITU-R recommendations.

The LC72711W and LC72711LW support both parallel connection and CCB serial interface in place of the CPU interface provided by the LC72709E.

### Functions

- Adjustment-free SCF based 76 kHz bandpass filter
- Supports all FM multiplex frame structures (methods A, A', B, and C) under CPU control
- MSK delay detection circuit using a 1T delay
- Error correction function using a 2T delay (in the MSK detection stage)
- Digital PLL based clock regeneration circuit
- Shift register type 1T and 2T delay circuits
- Block and frame synchronization detection circuits
- Function for setting the allowable BIC error count and synchronization protection count
- Error correction using (272,190) codes
- Layer 4 CRC code checking circuit
- Includes the frame memory and memory control circuit required for vertical correction
- 7.2 MHz crystal oscillator circuit
- Two power saving modes (standby and EC stop modes)
- Either a CPU parallel interface (DMA) or a CCB serial interface can be used
- Supply voltage: 4.5 to 5.5 V
- Package: SQFP64 (10 × 10 mm)

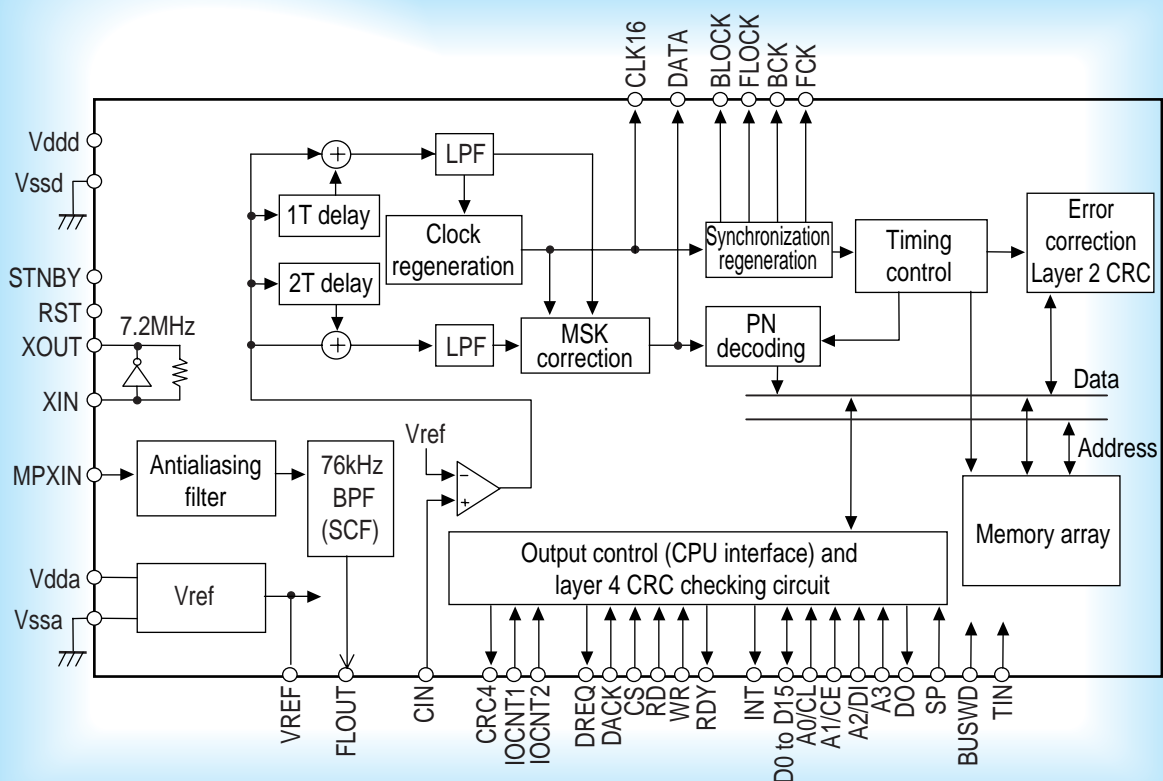
\* CCB is SANYO's original bus format.  
All bus addresses are managed by SANYO for this format.



The DARC (Data Radio Channel) FM multiplex broadcast technology was developed by NHK (Japan Broadcasting Corporation).  
DARC is a registered trademark of NHK Engineering Services, Inc. (NHK-ES).  
A separate contract with NHK-ES is required for the manufacturer or sale of electronic equipment that uses DARC technology.  
The logo shown here may be used with electronic equipment that uses DARC technology.



Block Diagram



# Mobile FM Multiplex Broadcast (DARC System) Receiver IC

## LC72711LW

### Overview

The LC72711LW is a data demodulation IC for the reception of mobile FM multiplex broadcasts in the DARC system.

The LC72711LW includes a bandpass filter for the extraction of the DARC signal from the FM baseband.

This IC is optimal for worldwide FM multiplex products since it supports all of the FM multiplex frame structures (methods A, A', B, and C) in the ITU-R recommendations.

The LC72711W and LC72711LW support both parallel connection and CCB serial interface in place of the CPU interface provided by the LC72709E.

### Functions

- Adjustment-free SCF based 76 kHz bandpass filter
- Supports all FM multiplex frame structures (methods A, A', B, and C) under CPU control
- MSK delay detection circuit using a 1T delay
- Error correction function using a 2T delay (in the MSK detection stage)
- Digital PLL based clock regeneration circuit
- Shift register type 1T and 2T delay circuits
- Block and frame synchronization detection circuits
- Function for setting the allowable BIC error count and synchronization protection count
- Error correction using (272,190) codes
- Layer 4 CRC code checking circuit
- Includes the frame memory and memory control circuit required for vertical correction
- 7.2 MHz crystal oscillator circuit
- Two power saving modes (standby and EC stop modes)
- Either a CPU parallel interface (DMA) or a CCB serial interface can be used
- Supply voltage: 2.7 to 3.6 V
- Package: SQFP64 (10 × 10 mm)

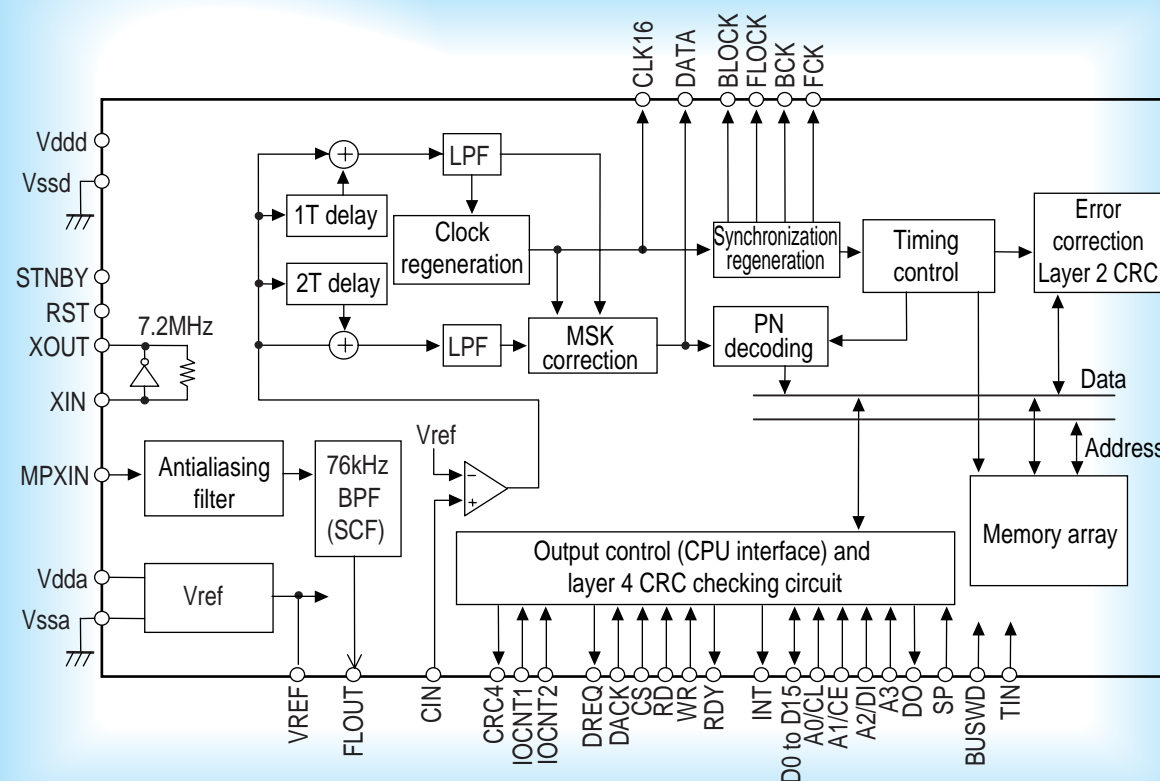
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Block Diagram



# Mobile FM Multiplex Broadcast Receiver IC with Built-in VICS Decoder

## LC72713W

### Overview

The LC72713W is a data demodulation IC for the reception of mobile FM multiplex broadcasts in the DARC system.

The LC72713W includes a bandpass filter for the extraction of the DARC signal from the FM baseband. This IC also includes a data circuit for processing VICS data and can implement a compact and highly functional VICS reception system. The LC72713W features improvements over the circuits included in the LC72710W for receiving VICS data and dGPS data in a single tuner.

Note that a separate contract with Vehicle Information and Communication Center is required for sample evaluation of this IC and to manufacture VICS products.

### Functions

- Adjustment-free SCF based 76 kHz bandpass filter
- VICS decoder circuit
- MSK delay detection circuit using a 1T delay
- Error correction function using a 2T delay (in the MSK detection stage)
- Digital PLL based clock regeneration circuit
- Shift register type 1T and 2T delay circuits
- Block and frame synchronization detection circuits
- Function for setting the allowable BIC error count and synchronization protection count
- Error correction using (272,190) codes
- Layer 4 CRC code checking circuit
- Includes the frame memory and memory control circuit required for vertical correction
- 7.2 MHz crystal oscillator circuit
- Two power saving modes (standby and EC stop modes)
- Dedicated frame synchronization circuit optimal for simultaneous reception of dGPS and VICS data
- Either a CPU parallel interface (DMA) or a CCB serial interface can be used
- Supply voltage: 4.5 to 5.5 V
- Package: SQFP64 (10 × 10 mm)

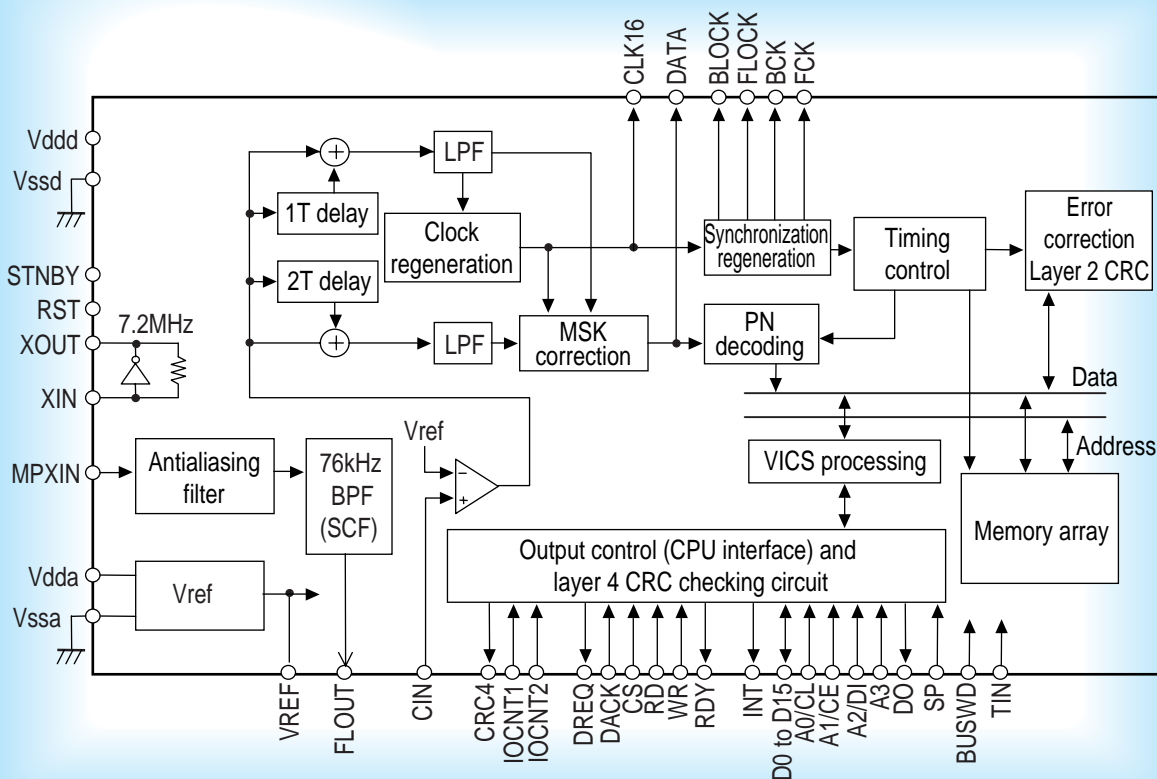
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The logo shown here may be used with electronic equipment that uses DARC technology.



Block Diagram



# Mobile FM Multiplex Broadcast Receiver IC with Built-in VICS Decoder

## LC72714W

### Overview

The LC72714W is a data demodulation IC for the reception of mobile FM multiplex broadcasts in the DARC system.

The LC72714W includes a bandpass filter for the extraction of the DARC signal from the FM baseband. This IC also includes a data circuit for processing VICS data and can implement a compact and highly functional VICS reception system. The LC72714W features improvements over the circuits included in the LC72710W for receiving VICS data and dGPS data in a single tuner.

Note that a separate contract with Vehicle Information and Communication Center is required for sample evaluation of this IC and to manufacture VICS products.

### Functions

- Adjustment-free SCF based 76 kHz bandpass filter
- VICS decoder circuit
- MSK delay detection circuit using a 1T delay
- Error correction function using a 2T delay (in the MSK detection stage)
- Digital PLL based clock regeneration circuit
- Shift register type 1T and 2T delay circuits
- Block and frame synchronization detection circuits
- Function for setting the allowable BIC error count and synchronization protection count
- Error correction using (272,190) codes
- Layer 4 CRC code checking circuit
- Includes the frame memory and memory control circuit required for vertical correction
- 7.2 MHz crystal oscillator circuit
- Two power saving modes (standby and EC stop modes)
- Dedicated frame synchronization circuit optimal for simultaneous reception of dGPS and VICS data
- Either a CPU parallel interface (DMA) or a CCB serial interface can be used
- Supply voltage: 2.7 to 3.6 V
- Package: SQFP64 (10 × 10 mm)

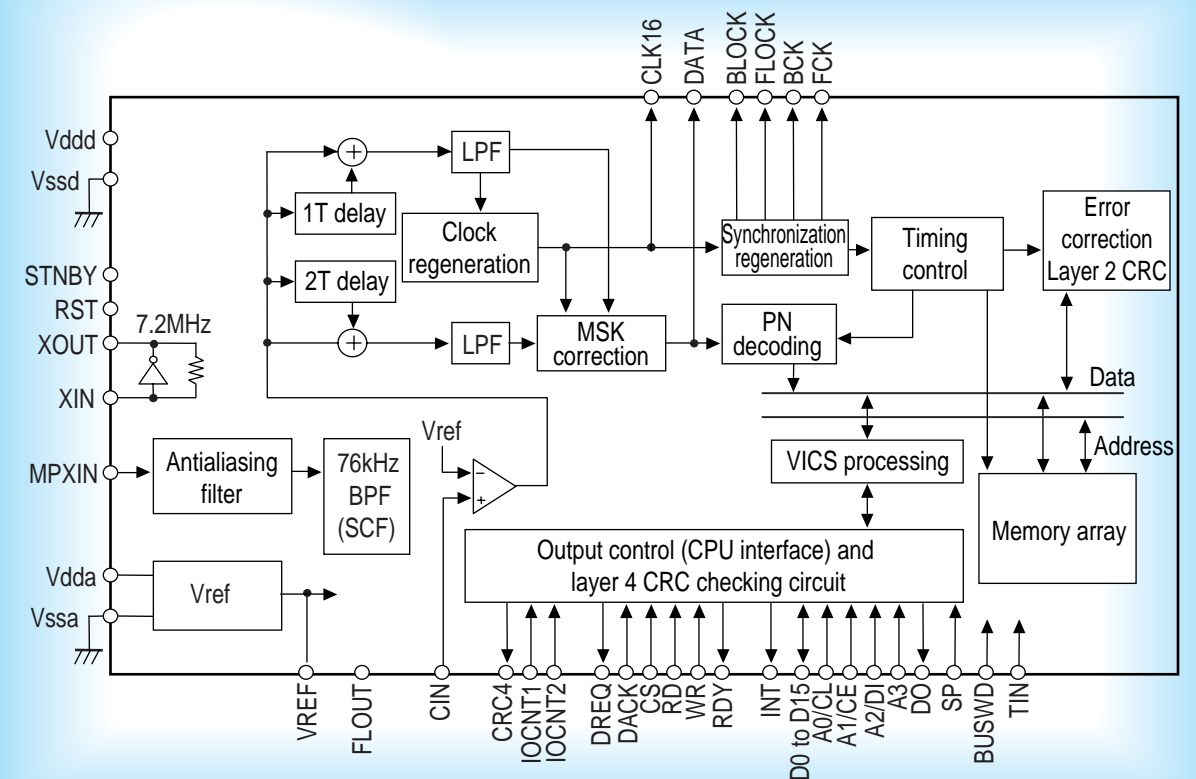
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Block Diagram



# RDS System Chipsets

For Automotive AV Equipment

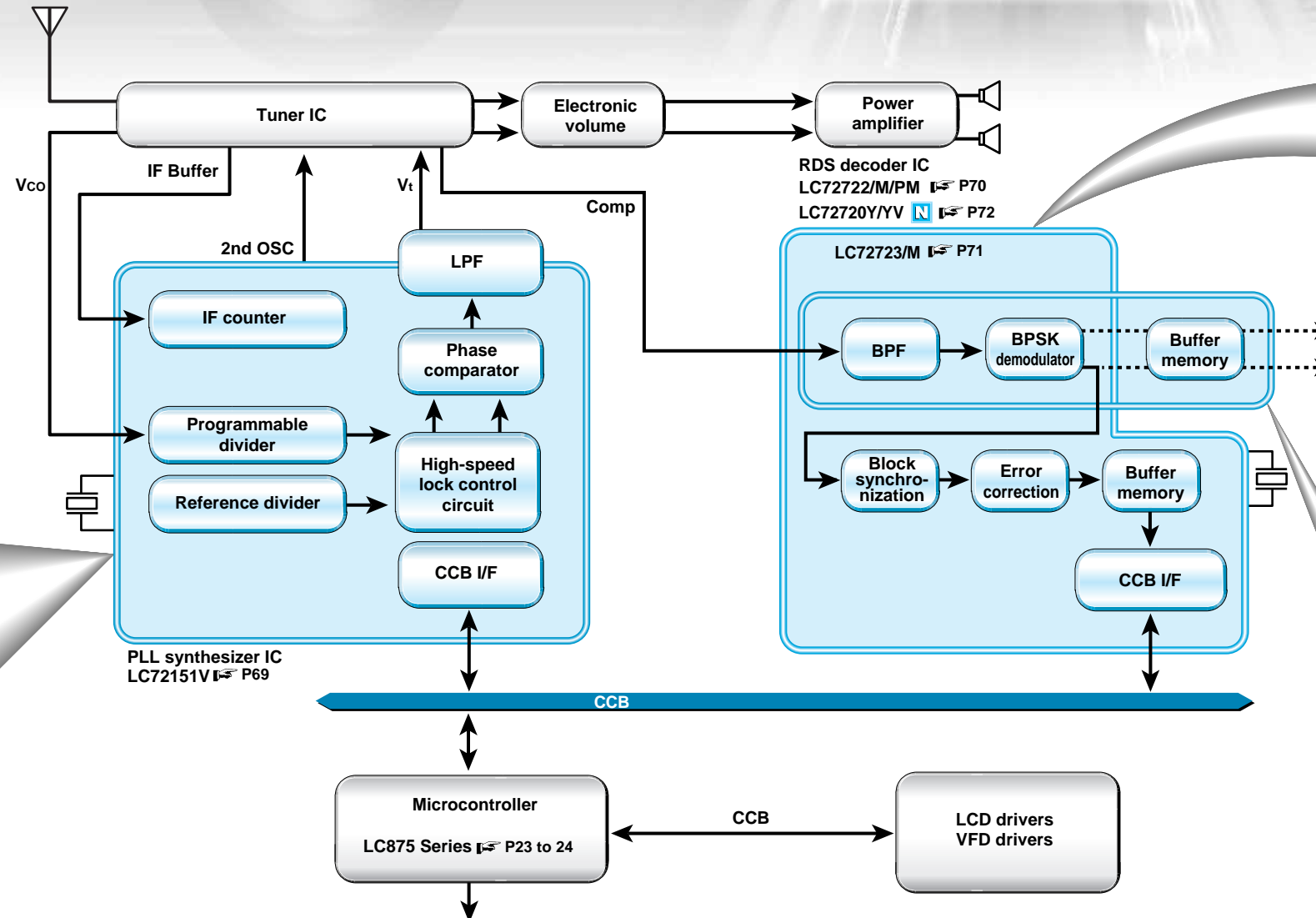
Supports both the European Broadcasting Union's RDS (Radio Data System) and the US NRSC (National Radio System Committee) RBDS (Radio Broadcast Data System) standards. Performs efficient error correction using a soft decision technique. This product also supports master operation in which data is read out in synchronization with the RDS clock output.

**N** .....New product  
**D** .....Under development

## PLL Synthesizer

### High-Speed Locking PLL Frequency Synthesizer IC LC72151V **N** P69

- Includes an extremely fast FM frequency lock up circuit
  - The PLL circuit can lock in 500  $\mu$ s due to optimal low-pass filter constants
- Programmable divider
  - FMIN: 10 to 160 MHz
  - AMIN: 0.5 to 40 MHz
- IF counter
  - HCTR: 0.4 to 25 MHz
  - LCTR: 10 to 500 kHz
- Reference frequency
  - Provides 11 different reference frequencies (using a 10.25 or 10.35 MHz crystal)
  - Crystal oscillator circuit supports AM upconversion
- Phase comparator
  - Dead band width control
  - Unlocked state detection circuit
  - Deadlock clear circuit
- Active low-pass filter amplifier
  - Built-in operational amplifier for high-speed FM frequency locking
  - MOS transistor for AM reception
- Serial data input and output
  - CCB format
- Package: SSOP30 (275mil)



## RDS Decoder

### Single-Chip RDS Decoder LC72722/M/PM **N** P70

- Bandpass filter
  - 57 kHz switched capacitor filter
- RDS demodulator
  - Reproduction of both clock and data signals
- Block synchronization
  - Supports both forward and backward protection
- Error correction
  - Soft/hard decision
- Buffer memory
  - Holds 24 blocks of data temporarily
- Serial data input and output
  - CCB format
- Package: (LC72722) DIP24S (300mil)  
 (LC72722M) MIP24S (300mil)  
 (LC72722PM) MFP24 (375mil)

### Single-Chip RDS Signal-Processing System IC LC72720Y/YV **N** P72

- Supply voltage: 3.0 to 3.6 V
- Packages: (LC72720Y) DIP24S (300mil)  
 (LC72720YV) SSOP30 (275mil)

### RDS Data Demodulator LC72723/M **N** P71

- Bandpass filter
  - 57 kHz switched capacitor filter
- RDS demodulator
  - Reproduction of both clock and data signals
- Buffer memory
  - Holds 128 bits of data temporarily
- Data output
  - Master/slave mode switchable readout
- Package: (LC72723) DIP16 (300mil)  
 (LC72723M) MFP16 (225mil)

| LAN drivers                  |                                   |                                   |
|------------------------------|-----------------------------------|-----------------------------------|
| CARNET <b>N</b> P1 to 2      | CAN <b>N</b> P1 to 2              | MOST <b>N</b> P1 to 2             |
| <b>D</b> LA2330W <b>N</b> P3 | <b>D</b> LA2360M <b>N</b> P5 . 22 | <b>D</b> LA2340M <b>N</b> P6 . 21 |
| <b>D</b> LA2333T <b>N</b> P4 | <b>D</b> LA2361AM <b>N</b> P5     | <b>D</b> LV2341M <b>N</b> P6 . 21 |
| LA2351M <b>N</b> P4 . P20    | <b>D</b> LA2361JM <b>N</b> P5     |                                   |

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CCB is a SANYO's original bus format and all the bus addresses are controlled by SANYO.

## Extensive lineup provides full support for a wide range of systems

### Tuner Block

- Varactor diodes for tuning
  - SVC230 (CR (C2.0V/C8.0V)  $\geq 1.65$ , Q  $\geq 100$ )
  - SVC243 (CR (C1.0V/C6.5V)  $\geq 7.0$ , Q  $\geq 40$ )
  - SVC272 (CR (C2.0V/C8.0V)  $\geq 2.3$ , Q  $\geq 150$ )
  - SVC273 (CR (C2.0V/C8.0V)  $\geq 3.1$ , Q  $\geq 100$ )
- \*: SV272, SV273: MCPH3 miniature package (2.1 x 2.0 mm)

- Dual gate MOSFETs for amplifiers
  - 3SK263 ( $V_{DS} = 15$  Vmin,  $I_{DSX} = 2.4$  to 24 mA,  $|y_{fs}| = \text{typ } 14$  ms),  
 3SK264 ( $V_{DS} = 15$  V,  $I_{DSX} = 5.0$  to 24 mA,  $|y_{fs}| = \text{typ } 17$  ms)
- Transistors for buffers
  - 2SC2812N ( $V_{CEO} = 50$  V,  $I_C = 150$  mA,  $f_T = \text{typ } 100$  MHz),  
 2SC2814 ( $V_{CEO} = 20$  V,  $I_C = 30$  mA,  $f_T = \text{typ } 320$  MHz)
- PIN diodes for AGC and switching
  - Series with  $r_s = \text{typ } 6 \Omega$ : ISV294, ISV315, ISV316, ISV298H

- Transistors for AM and FM buffers
  - 2SC2812N ( $V_{CEO} = 50$  V,  $I_C = 150$  mA,  $f_T = \text{typ } 100$  MHz),  
 2SC2814 ( $V_{CEO} = 20$  V,  $I_C = 30$  mA,  $f_T = \text{typ } 320$  MHz)
- PIN diodes for AM AGC and switching
  - Series with  $r_s = \text{typ } 5 \Omega$ : ISV247, ISV233, ISV246, ISV234, CPH5512
- PIN diodes for FM AGC and switching
  - Series with  $r_s = \text{typ } 6 \Omega$ : ISV294, ISV315, ISV316, ISV298H

- Other transistors (power supply, interface, and switch drive)
  - Bipolar transistors: 50C02CH ( $V_{CEO} = 15$  V,  $I_C = 1$  A,  $V_{CE}(\text{sat}) = \text{max } 280$  mV) (NPN)  
 2SC5706 ( $V_{CEO} = 50$  V,  $I_C = 5$  A,  $V_{CES}(\text{sat}) = \text{typ } 90$  mV)  
 2SD1913 ( $V_{CEO} = 60$  V,  $I_C = 3$  A, PC = 20 W,  $h_{FE} 70$  to 280)
  - MOSFET: 5LN 01M ( $V_{DSS} = 50$  V,  $I_D = 100$  mA  $R_{DS}(\text{on})$  (Nch)  $<V_{GS} = 2.5$  V  $> = 9.9 \Omega$ )  
 CPH6424 ( $V_{DSS} = 60$  V,  $I_D = 3$  A  $R_{DS}(\text{on})$   $<V_{GS} = 4$  V  $> \text{typ } 150$  m $\Omega$ )

# Car Audio Electronic Tuning PLL Frequency Synthesizer

## LC72151V

### Overview

The LC72151V is a PLL frequency synthesizer IC that includes a high-speed locking circuit for FM reception. This device makes it easy to implement high-performance RDS AM/FM tuners.

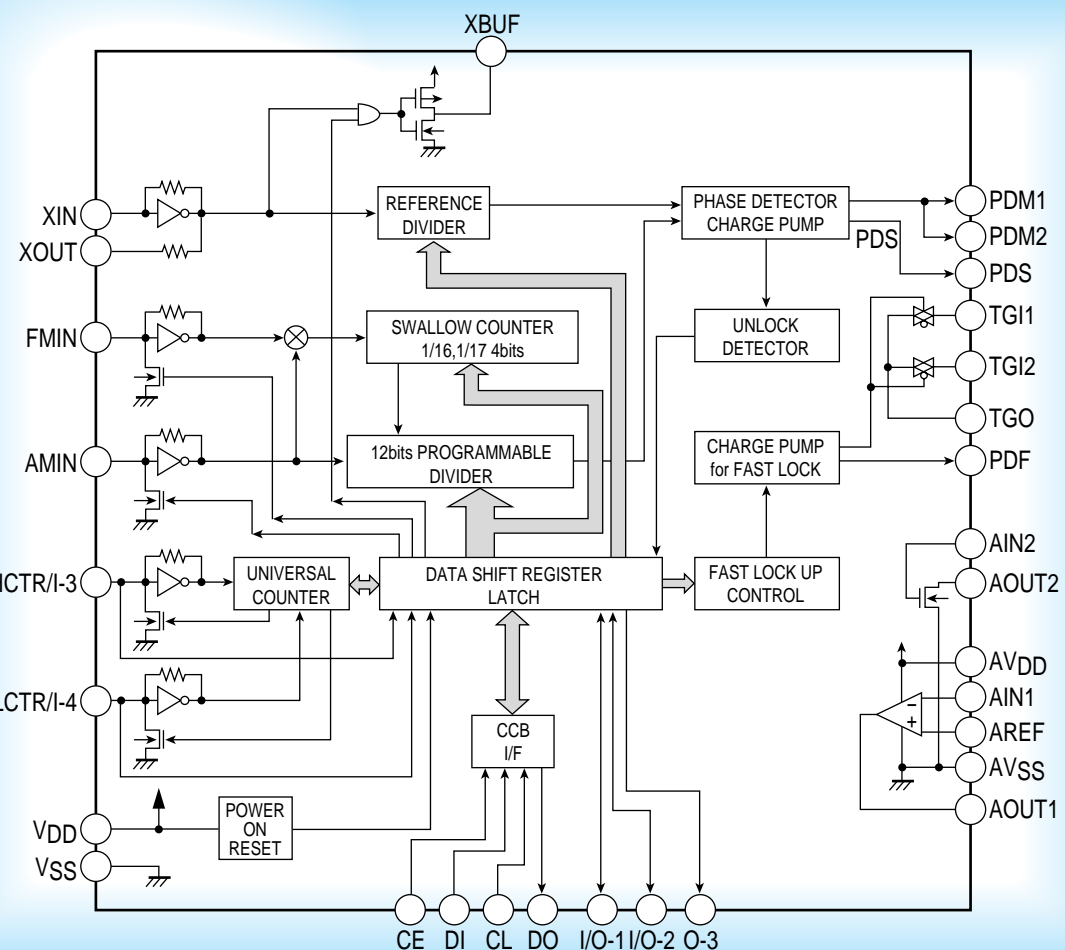
### Functions

- High-speed programmable dividers
  - ◆ FMIN: 10 to 160 MHz pulse swallower
  - ◆ AMIN: 2 to 40 MHz pulse swallower
  - ◆ 0.5 to 10 MHz direct divider
- IF counters
  - ◆ HCTR: 0.4 to 25 MHz for FM IF counting
  - ◆ LCTR: 10 to 500 kHz for AM IF counting
  - ◆ 1.0 to  $20 \times 10^3$  Hz for frequency measurement
- Reference frequency
  - ◆ One of 11 frequencies can be selected (crystal element: 10.25 or 10.35 MHz)
  - ◆ 1.3\*, 3.125, 5, 6.25, 9\*, 10, 12.5, 25, 30\*, and 50 kHz
  - \*: These frequencies cannot be used when a 10.25 crystal element is used.
- Phase comparator
  - ◆ Supports dead zone control
  - ◆ Unlocked state detection circuit
  - ◆ Deadlock clear circuit
- Active low-pass filter amplifier
  - ◆ Built-in operational amplifier for FM high-speed locking circuit
  - ◆ Built-in MOS transistor for AM
- Crystal oscillator output buffer
- I/O ports: general-purpose I/O: 2 pins
  - ◆ Input: 4 pins (maximum)
  - ◆ Output: 3 pins (maximum)
- Serial data I/O
  - ◆ Control and communication using the CCB format
- Operating ranges
  - ◆ Supply voltage: 4.5 to 5.5 V (VDD)
  - ◆ 7.5 to 9.5 V (AVDD)
  - ◆ Operating temperature: -40 to +85°C
- Package: SSOP30 (275 mil)

\*:CCB is SANYO's original bus format.  
All bus addresses are managed by SANYO for this format.



Block Diagram



# RDS Signal-Processing System-on-Chip IC

## LC72722/M/PM

### Overview

The LC72722, LC72722M, and LC72722PM are system-on-chip signal demodulation and processing ICs for the European Broadcasting Union (EBU) Radio Data System (RDS) and the US National Radio System Committee (NRSC) Radio Broadcast Data System (RBDS).

These ICs integrate, on the same chip, bandpass filter, demodulation, synchronization, and error correction circuits as well as buffer RAM, and provide effective error correction using soft decision error correction.

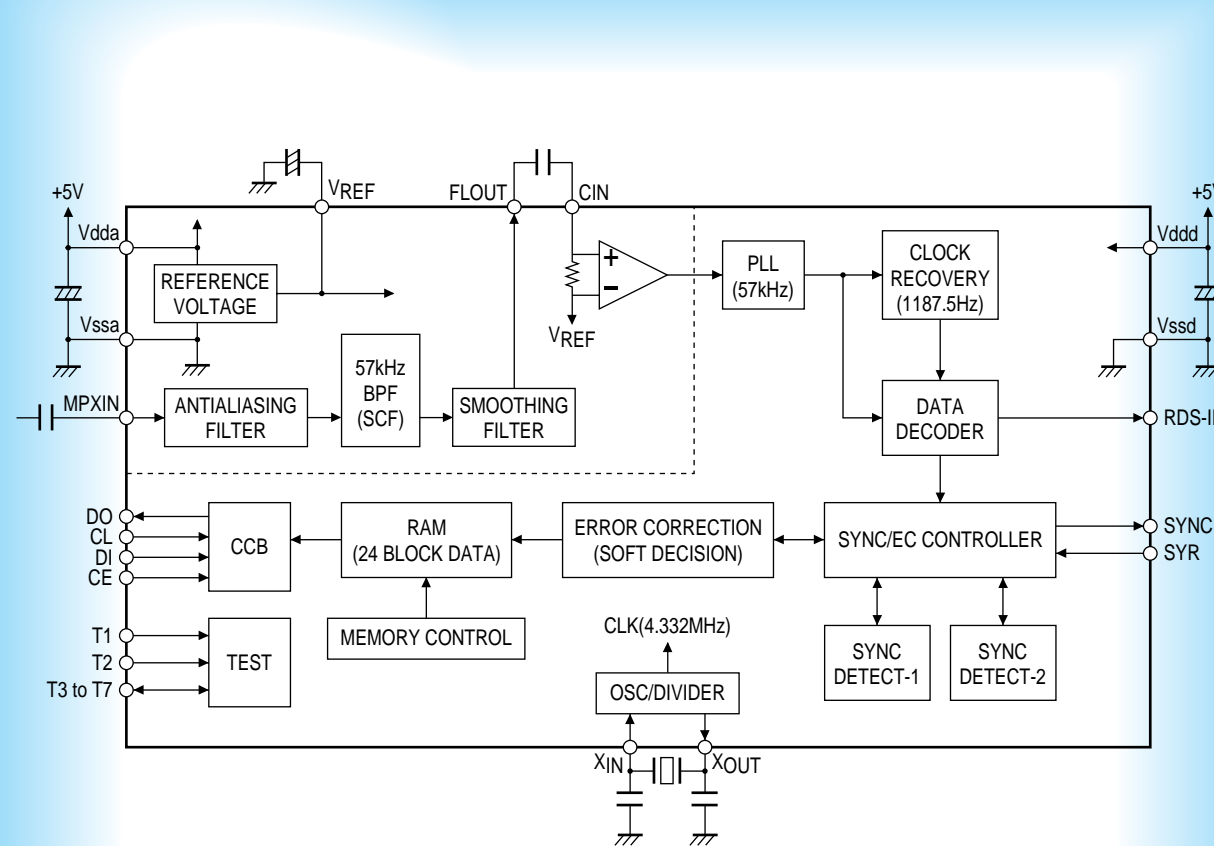
### Functions

- Bandpass filter: switched capacitor filter (SCF)
- Demodulation: RDS data clock regeneration and demodulated data reliability information
- Synchronization: Block synchronization detection with variable forward and backward protection conditions
- Error correction: soft decision and hard decision error correction
- Buffer RAM: 24 blocks (about 500 ms) of data and flag memory
- Data I/O: CCB interface (power on reset)
- Packages: (LC72722):DIP24S(300mil)
- (LC72722M):MFP24S(300mil)
- (LC72722PM):MFP24(375mil)

\*:CCB is SANYO's original bus format.  
All bus addresses are managed by SANYO for this format.



Block Diagram



## LC72723/M

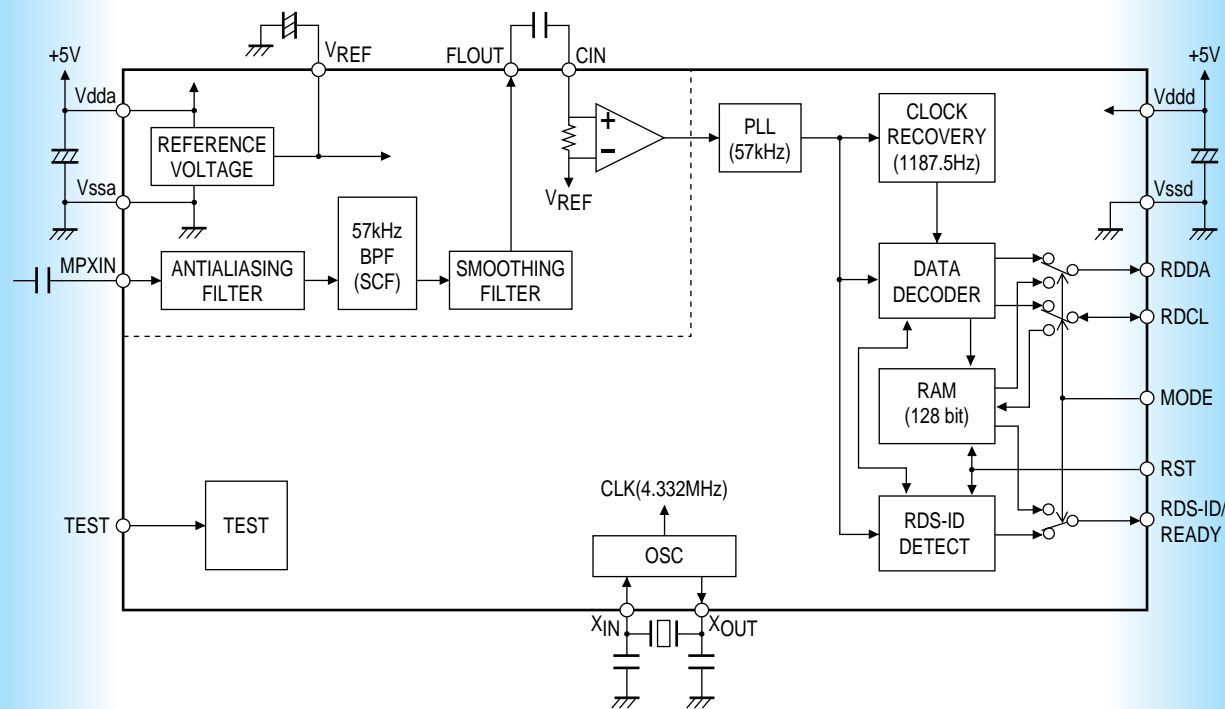
### Overview

The LC72723 and LC72723M are Radio Data System (RDS) demodulation and signal-processing ICs. These ICs integrate a bandpass filter, the demodulation circuit, and data buffer RAM on the same chip and allow the RDS data to be read out in slave mode operation with an externally provided clock input signal. (Master mode operation, in which the data is output in synchronization with the internal RDS clock output, is also supported.)

### Functions

- Bandpass filter: switched capacitor filter (SCF)
- RDS demodulation: 57 kHz carrier regeneration, clock regeneration, biphase and differential decoding
- Buffer RAM: 128 bits (about 100 ms)
- Data I/O: Data readout in either master or slave mode
- RDS ID detection: Supports ID reset
- Standby mode: The crystal oscillator is stopped
- Fully adjustment free
- Packages: (LC72723) : DIP16(300mil)  
(LC72723M) : MFP16(225mil)

Block Diagram



## LC72720Y/YV CCB

### Overview

The LC72720Y and LC72720YV are single-chip system ICs that implement the signal processing required by the European Broadcasting Union RDS (Radio Data System) standard and by the US NRSC (National Radio System Committee) RDBS (Radio Broadcast Data System) standard. These ICs include band-pass filter, demodulator, synchronization, and error correction circuits as well as data buffer RAM on chip and perform effective error correction using a soft-decision error correction technique.

### Functions

- Band-pass filter: Switched capacitor filter (SCF)
- Demodulator: RDS data clock regeneration and demodulated data reliability information
- Synchronization: Block synchronization detection (with variable backward and forward protection conditions)
- Error correction: Soft-decision/hard-decision error correction
- Buffer RAM: Adequate for 24 blocks of data (about 500 ms) and flag memory
- Data I/O: CCB interface (power on reset)

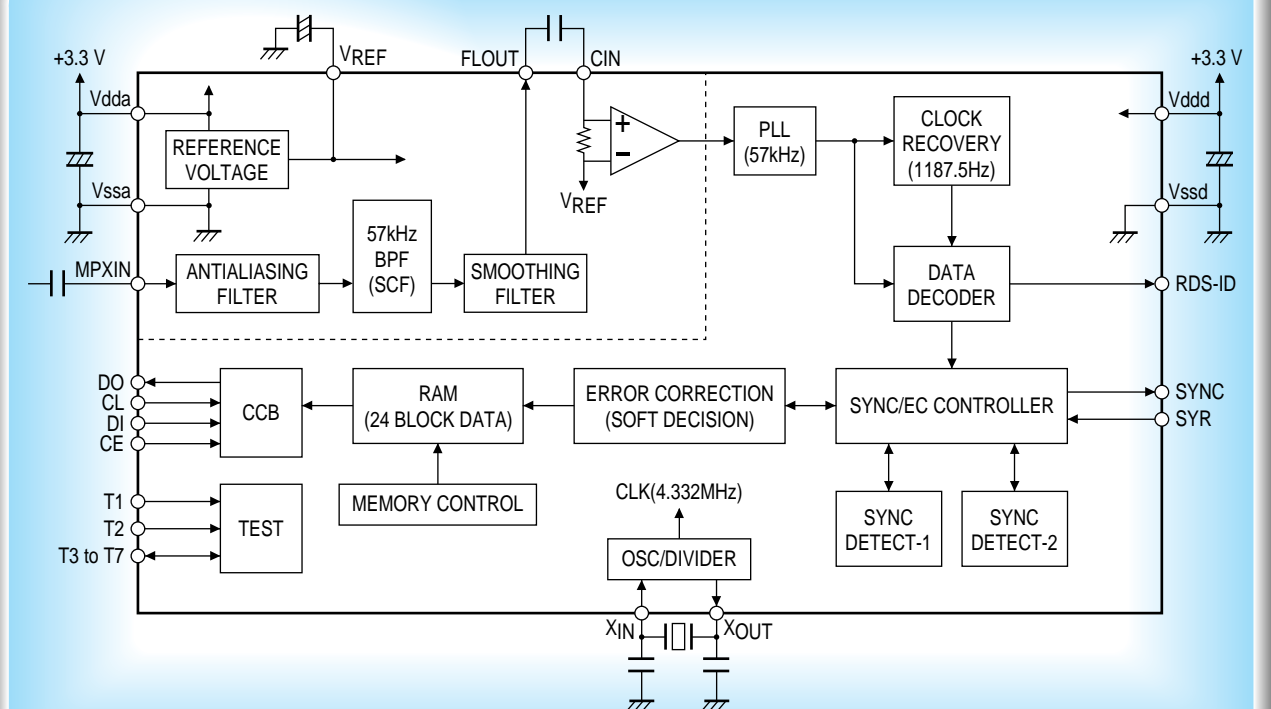
### Features

- Error correction capability improved by soft-decision error correction
- The load on the control microprocessor can be reduced by storing decoded data in the on-chip data buffer RAM
- Two synchronization detection circuits provide continuous and stable detection of the synchronization timing
- Data can be read out starting with the backward-protection block data after a synchronization reset
- Fully adjustment free
- Low voltage (supply voltage: 3.0 V min) type
- Operating power-supply voltage: 3.0 to 3.6 V
- Operating temperature: -40 to +85°C
- Packages: (LC72720Y) : DIP24S(300mil)  
(LC72720YV) : SSOP30(275mil)

\*:CCB is SANYO's original bus format.  
All bus addresses are managed by SANYO for this format.

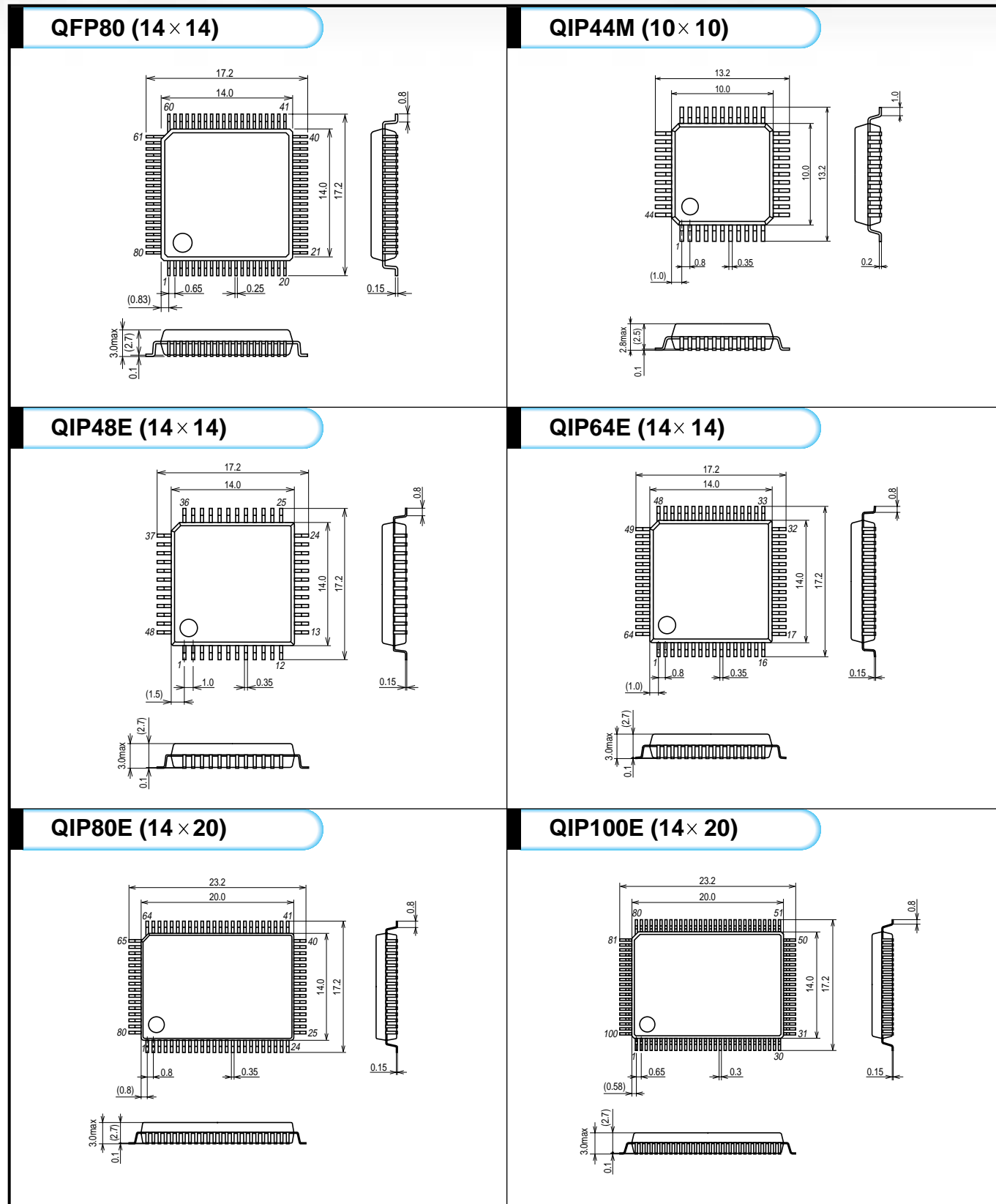


Block Diagram

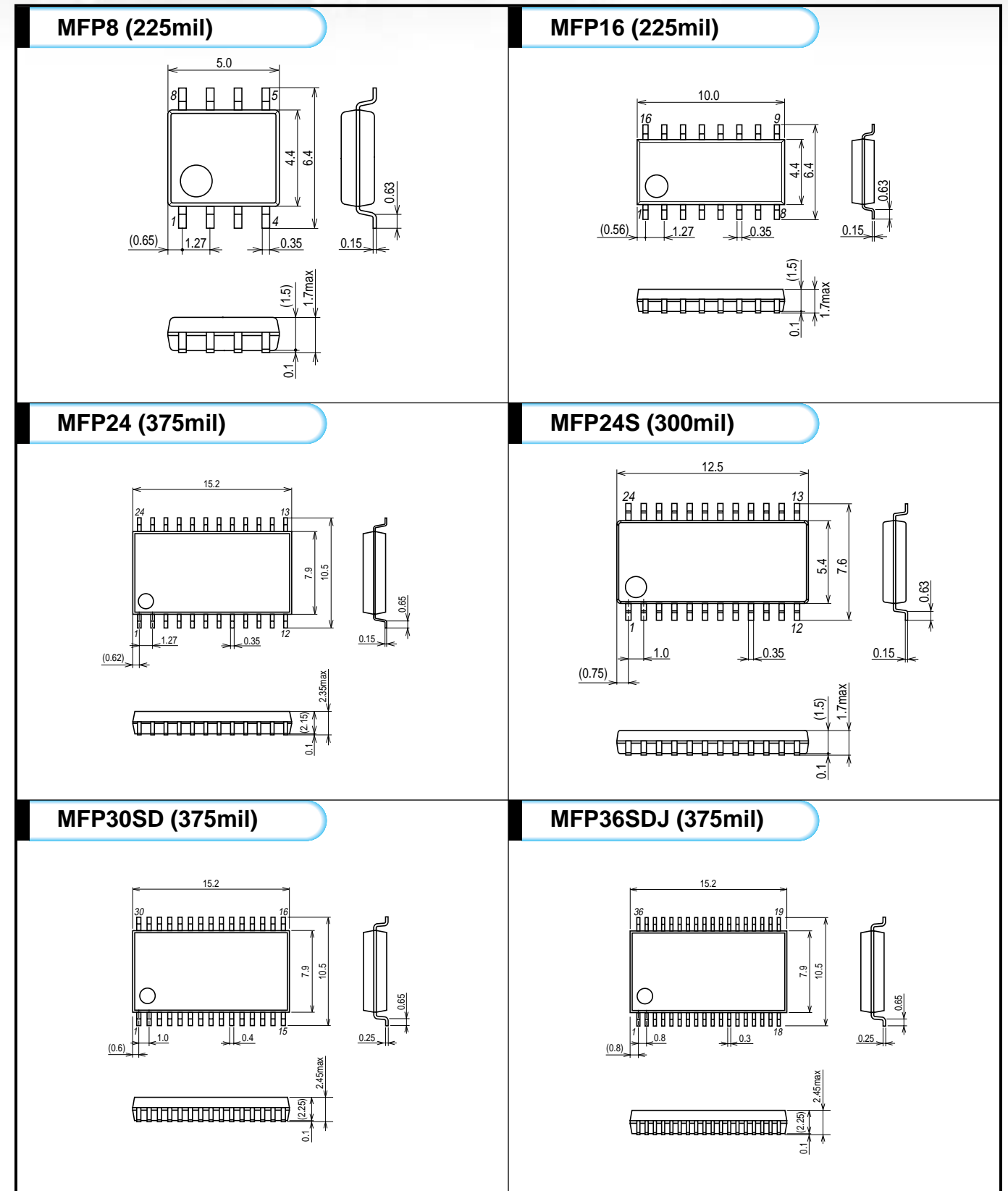


# Package Dimensions

QFP(QIP) (Reference Drawing) (unit:mm)



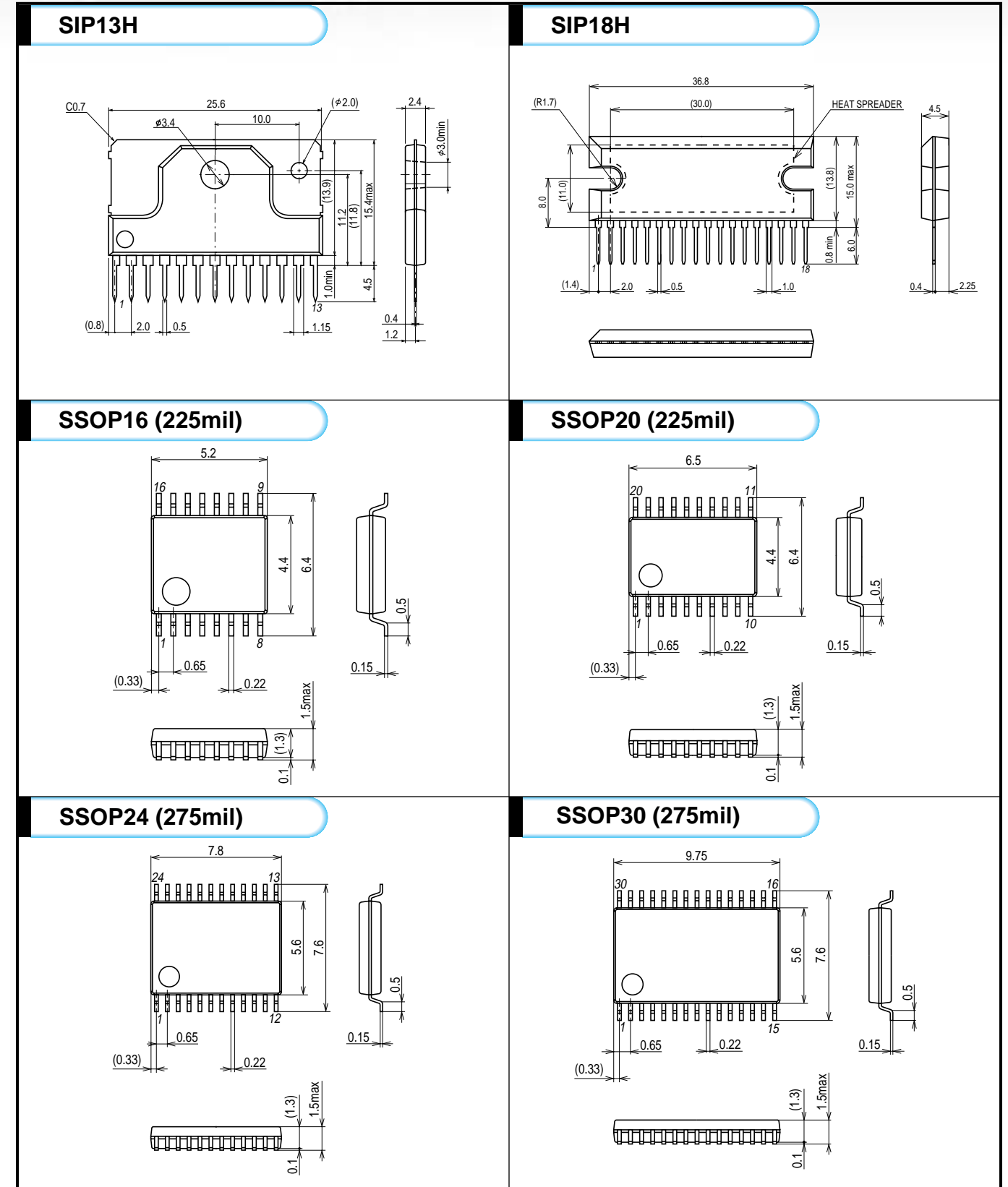
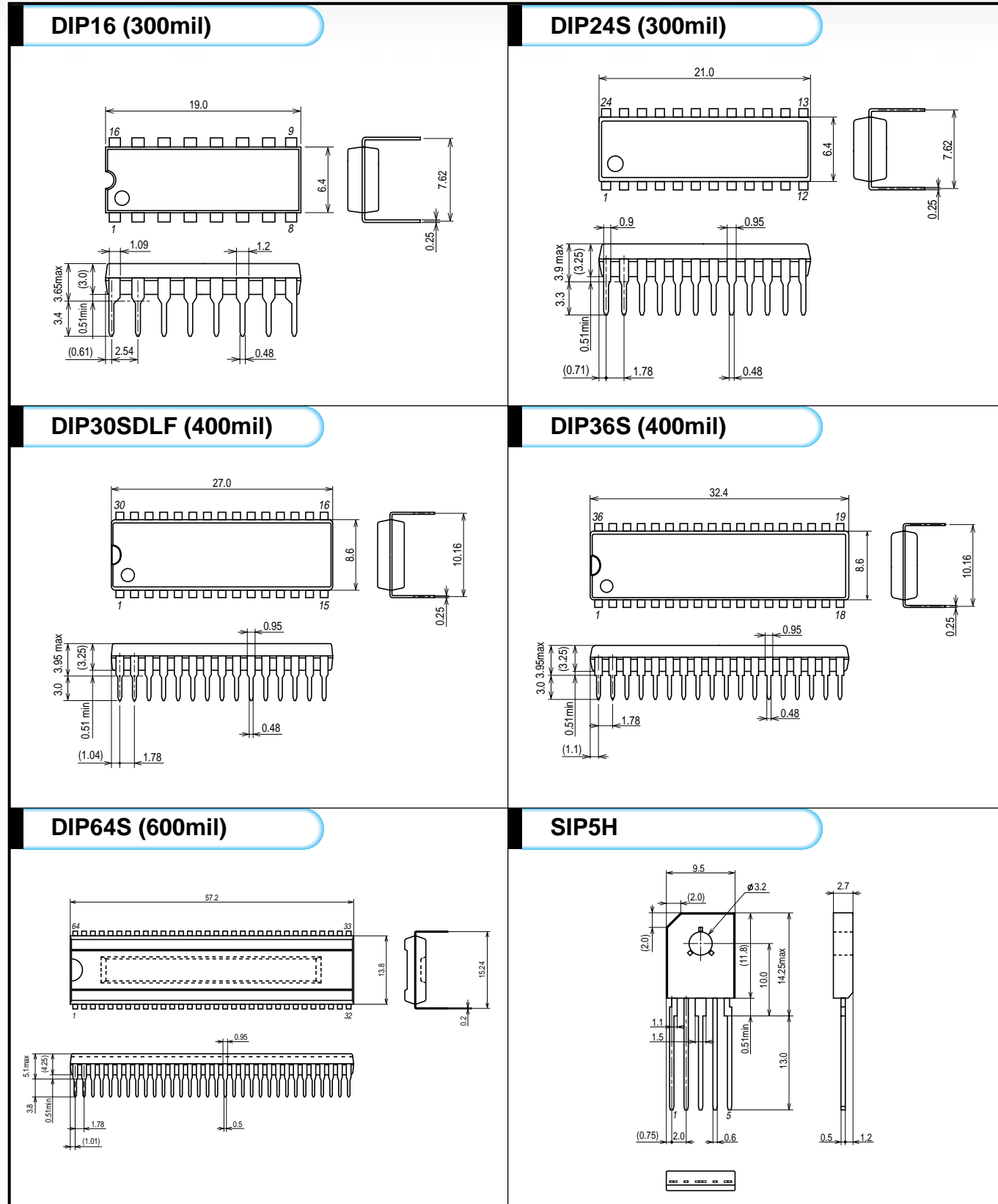
MFP(SOP) (Reference Drawing) (unit:mm)



# Package Dimensions

(Reference Drawing) (unit:mm)

(Reference Drawing) (unit:mm)

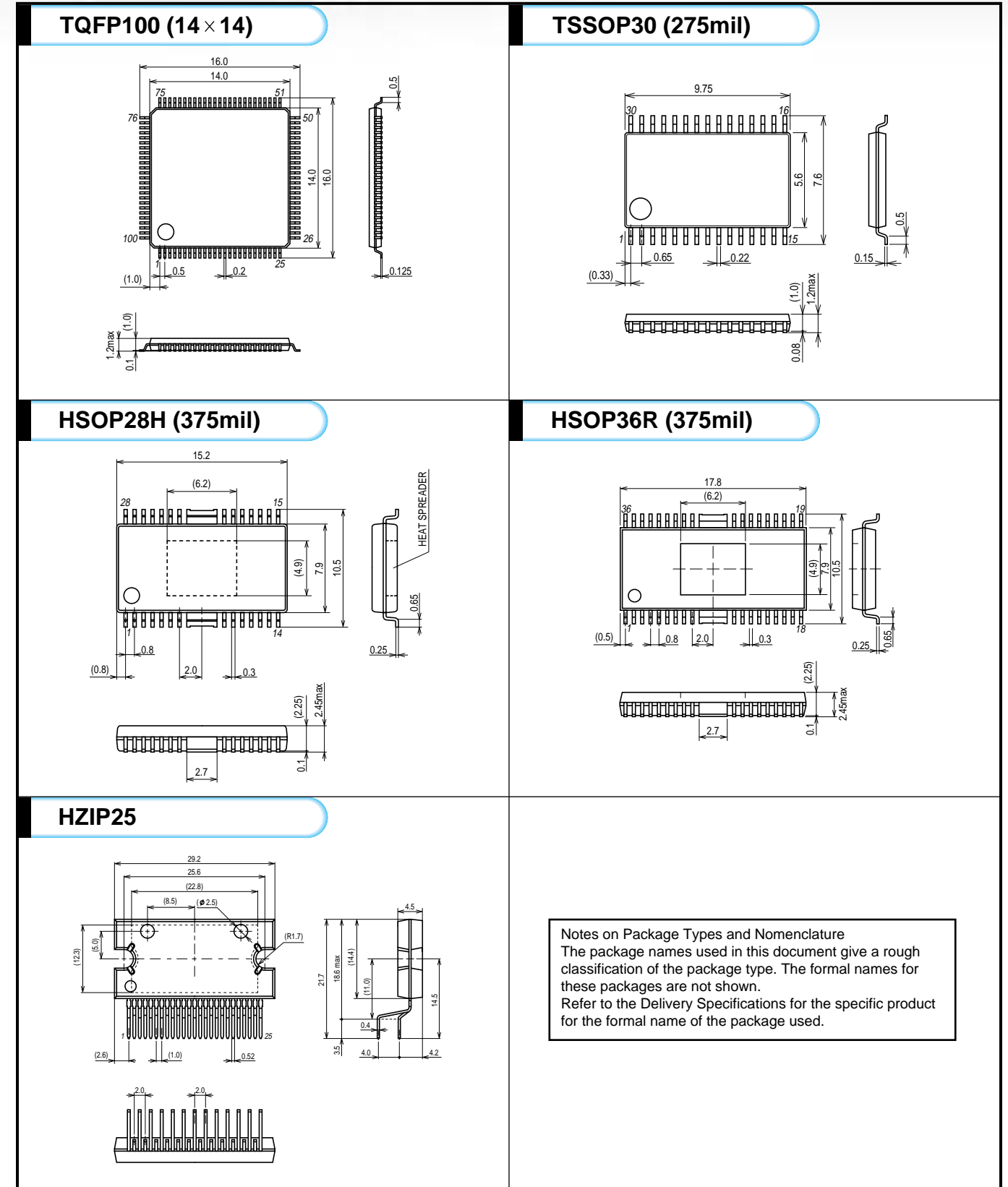
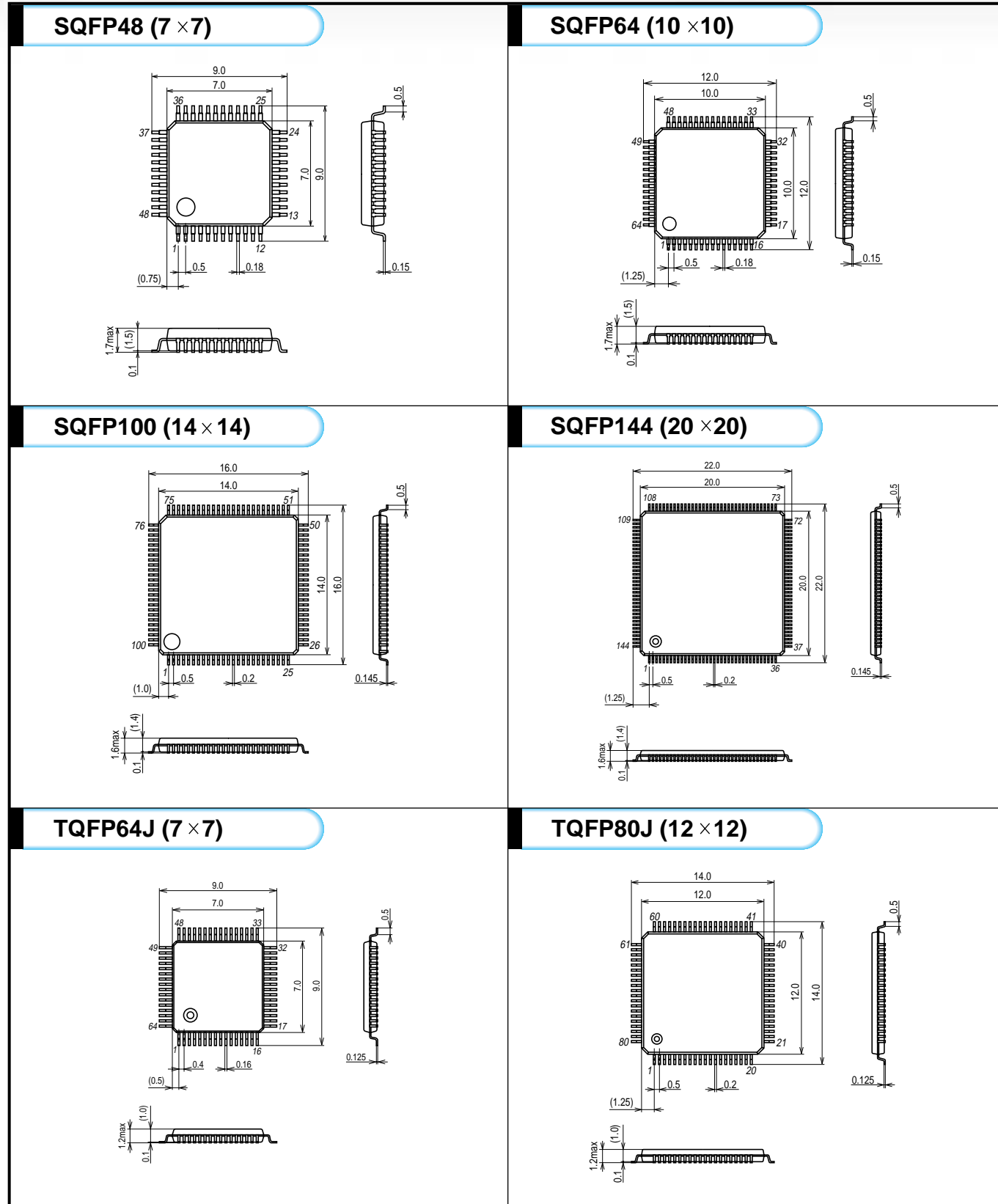




# Package Dimensions

(Reference Drawing) (unit:mm)

(Reference Drawing) (unit:mm)



**Notes on Package Types and Nomenclature**  
 The package names used in this document give a rough classification of the package type. The formal names for these packages are not shown. Refer to the Delivery Specifications for the specific product for the formal name of the package used.

# MEMO

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