TOSHIBA SYSTEM CATALOG

FOR PERSONAL AUDIO USE

PERSONAL AUDIO SYSTEM BLOCK

The following provides an introduction to the new lineup of personal audio semiconductor devices offered by Toshiba. All of these devices have been manufactured and designed for high levels of audio performance to satisfy the diverse range of customer needs.

Personal audio equipment provides various new ways to enjoy music in any form desired. Toshiba's semiconductor devices consist of an appealing lineup that provides effective support for personal audio equipment.

Digital Tuning System

Single-chip digital tuning system TC9318FB-001

This single-chip digital tuning system IC is perfect for headphone stereos and other portable equipment.
As a result of being equipped with five bands consisting of FM, MW, LW, TV and SW bands, this IC is able to accommodate applications in regions throughout the world.

DSPs for Personal Audio Use

Single-chip DSP for Karaoke: TC9409BF and TC9465F

These DSPs for Karaoke realize functions such as microphone echo, key control and vocal cancel with a single chip.
(The TC9465F is not equipped with a key control function.)

FM Character Multiplex System

TC9408F/FB, TA2091F

FM character multiplex broadcasting involves multiplexing a digital signal with an ordinary FM stereo broadcast to provide services offering news, program information, traffic information and other types of character information. Toshiba has developed its TA2091F (bandpass filter) and TC9408F/FB which can be combined with a conventional tuner for simple system configuration.

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Radio-frequency Signal Processing System

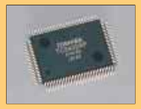
Single-chip tuner compatible with new FCC standards: TA2111N/F/FN

These single-chip ICs for radio-cassette players and 3 V headphone stereos are compatible with new U.S. FCC standards (to go into effect in June 1999). These ICs feature a built-in resonator circuit for MPX VCO and built-in AFC diode enabling reduced overall costs.

CD Player Units

Digital Servo System: TC9432AF

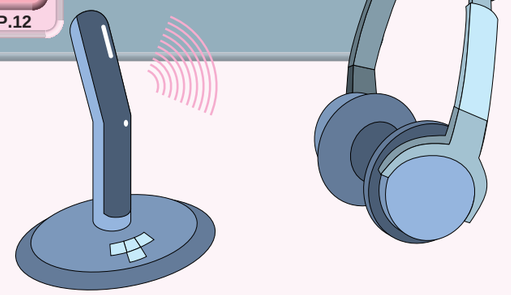
This digital servo system IC was developed for the purpose of achieving a completely adjustment-free system as well as a significant reduction in the number of externally connected components. Combining with the TA2109F or TA2096FN makes it possible to configure an extremely simple CD player system.



Infrared Wireless Headphone System

TA2061AF and TA2056FN

A wireless headphone system using infrared rays can be easily configured by using the TA2061AF for the transmitter and the TA2056FN for the receiver.



DSPs for Personal Audio Use

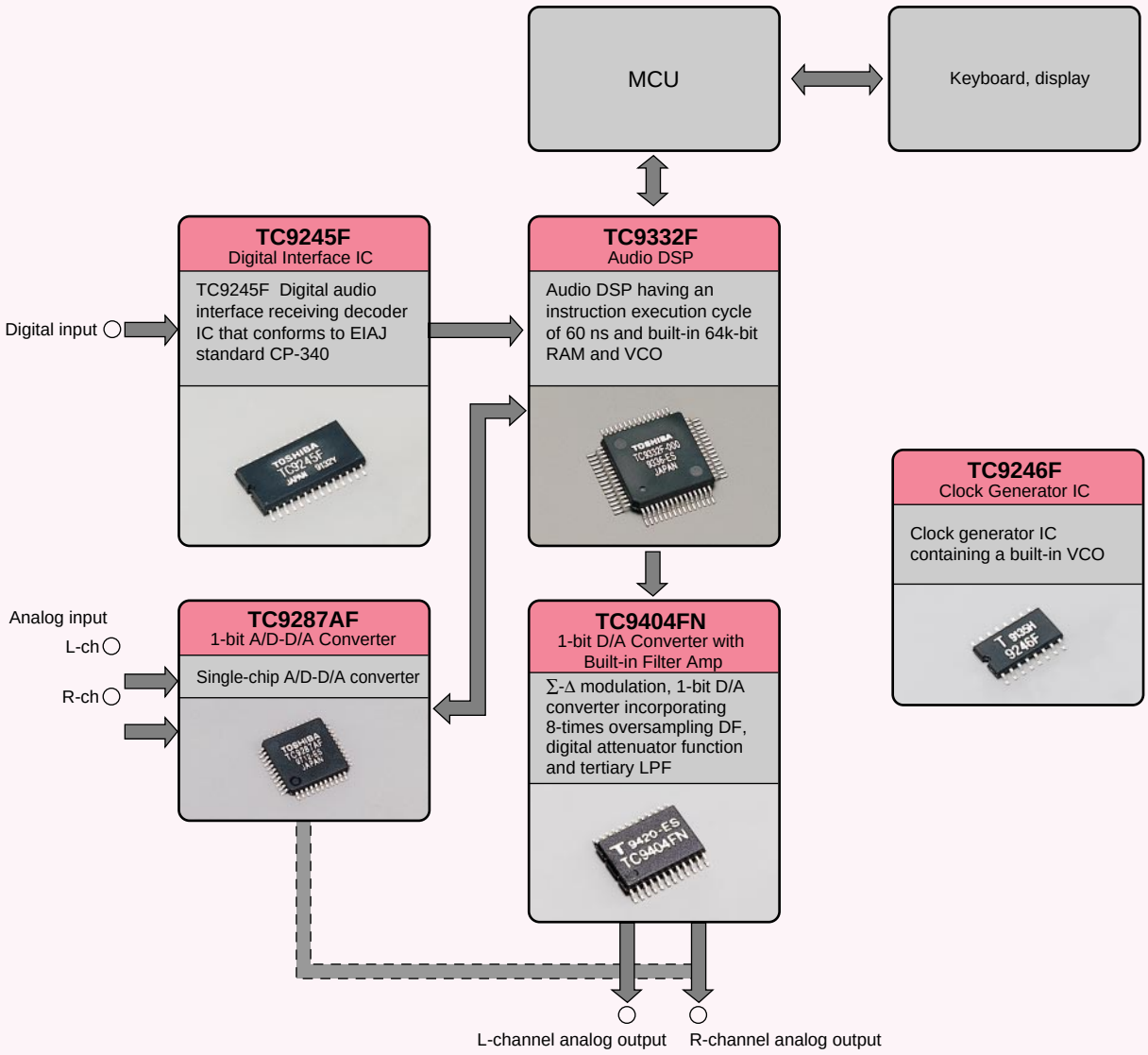
Toshiba offers a wide lineup of DSPs for personal audio use featuring compact packages and low power consumption for greater ease of use. You can select the particular device that matches the purpose of use, including 4-channel or 2-channel surround system DSPs.

TC9332F

These high-speed, high-precision audio DSPs are able to easily perform digital signal processing including equalizing, dynamic range control, sound field control and other functions on a real-time basis in personal audio equipment.

- Serial data interface
  Data input ports: 2
  Data output ports: 3
  Data word length: 24 bits/16 bits
  Data format: 2's complement
- Built-in RAM for data delay
  Delay RAM: 64k bits (4096 words x 16 bits)
- Built-in VCO oscillation circuit
- Programs, coefficient data and offset data can be set and changed through a microcontroller interface.
- 60-pin QFP package
- Instruction execution cycle: 60 ns
- Main bus width: 24 bits
- Calculator (multiplier/adder): 24 bits x 16 bits + 43 bits
- Program ROM: 1024 words x 32 bits
- Data RAM: 128 words x 24 bits
- Coefficient RAM: 320 words x 16 bits
- Coefficient ROM: 256 words x 16 bits
- Offset address RAM: 64 words x 16 bits

TC9332F Audio DSP System



TC9409BF/TC9465F

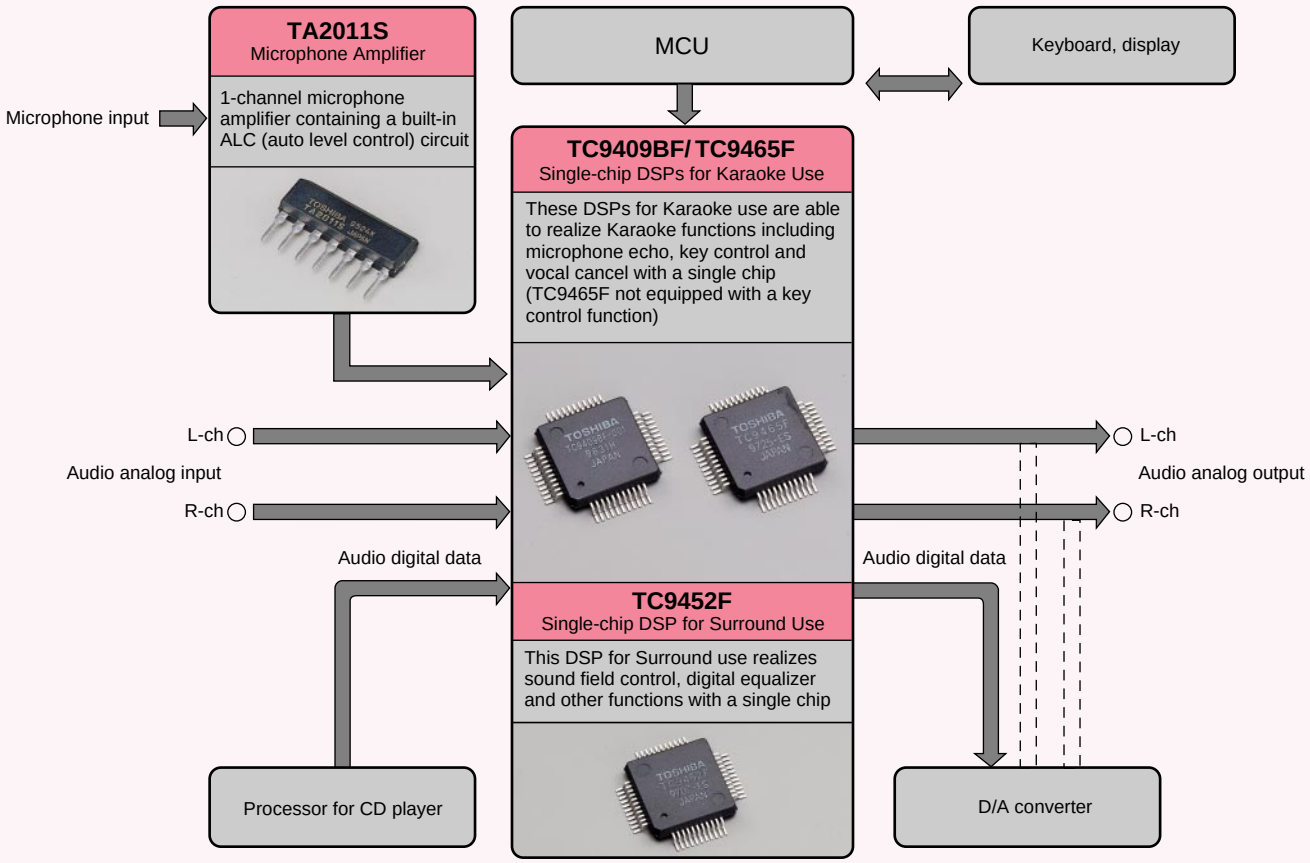
The TC9409BF is a DSP for Karaoke use containing a built-in A/D-D/A converter that is able to realize Karaoke functions including microphone echo, key control and vocal cancel as well as DSP functions such as sound field control, bass and treble control with a single chip. The TC9465F is also a DSP for Karaoke use without the key control function of the TC9409BF.

- The A/D converter contains 3 channels and has a built-in prefilter operational amplifier for each input. THD + N: −65 dB, S/N ratio: 78 dB (typ.)
- The D/A converter contains 2 channels and has a built-in tertiary analog postfilter for each output. THD + N: −85 dB, S/N ratio: 93 dB (typ.)
- Serial data interface
  Data input port: 1
  Input data format: Compatible with 16, 18 and 20-bit MSB first rear-packing data
  Data output port: 1
  Output data format: Compatible with 16 and 20-bit MSB first rear-packing data
- Built-in RAM for data delay
  Delay RAM: 64k bits (4096 words x 16 bits)
- 44-pin QFP package

Karaoke Functions

- Microphone echo or sound field control (SFC): Delay time can be changed.
- Vocal cancel: Only the vocal portion is attenuated from an ordinary stereo source.
- Vocal change: The vocal portion of a stereo source or multiplexed source can be made to fade in or out according to the presence or absence of a microphone input.
- Multiplexed source compatibility: The addition ratio of the left and right channels can be varied to allow mixing of the digital and analog inputs.
- Key control: 14 steps (max. ±1 octave)
- Bass and treble functions: Frequency characteristics can be set for bass and treble.
- Coefficient data and offset data can be set and changed through a microcontroller interface.
- The TC9465F is not equipped with the key control function of the TC9409BF. Other Karaoke functions are the same as those of the TC9409BF.
- The TC9465F is microcontroller software-compatible and pin-compatible with the TC9409BF.

TC9409BF Karaoke/Surround DSP System



DSPs for Personal Audio Use

TC9452F

The TC9452F is a DSP for Surround use containing a built-in A/D-D/A converter that is able to realize DSP functions including sound field control (SFC) and digital equalizing as well as Karaoke functions such as microphone echo and vocal cancel with a single chip.

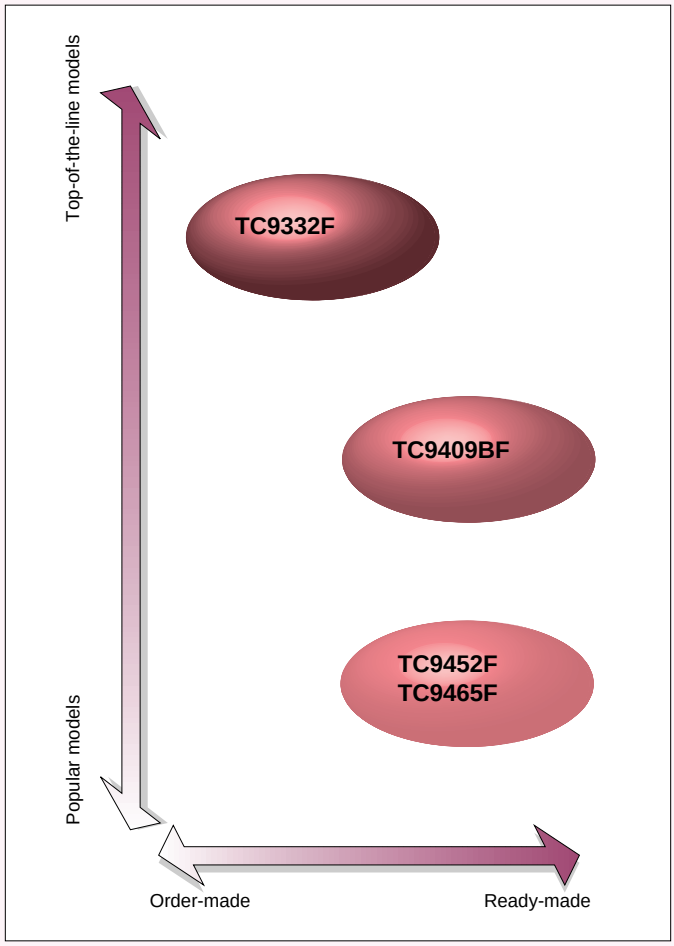
- The A/D converter contains 3 channels and has a built-in prefilter operational amplifier for each input.
  THD + N: −65 dB, S/N ratio: 78 dB (typ.)
- The D/A converter contains 2 channels and has a built-in tertiary analog postfilter for each output.
  THD + N: −85 dB, S/N ratio: 93 dB (typ.)
- Serial data interface
  Data input port: 1
  Input data format: Compatible with 16, 18 and 20-bit MSB first rear-packing data
  Data output port: 1
  Output data format: Compatible with 16 and 20-bit MSB first rear-packing data
- Built-in RAM for data delay
  Delay RAM: 64k bits (4096 words x 16 bits)
- 44-pin QFP package
  Pin-compatible with the TC9409BF and TC9465F.

DSP Functions

- Sound field control (SFC) and microphone echo: Delay time can be changed. Allows sound field control of reflection and reverb type.
- Compressor or bass boost: Allows dynamic operation corresponding to the input.
- 2-band parametric equalizer: Frequency characteristics can be set by an 18-bit coefficient.
- Artificial stereo: This creates the expanding effect of stereo sound from a monaural source.
- Vocal cancel: Only the vocal portion is attenuated from an ordinary stereo source.
- Coefficient data and offset data can be set and changed through a microcontroller interface.

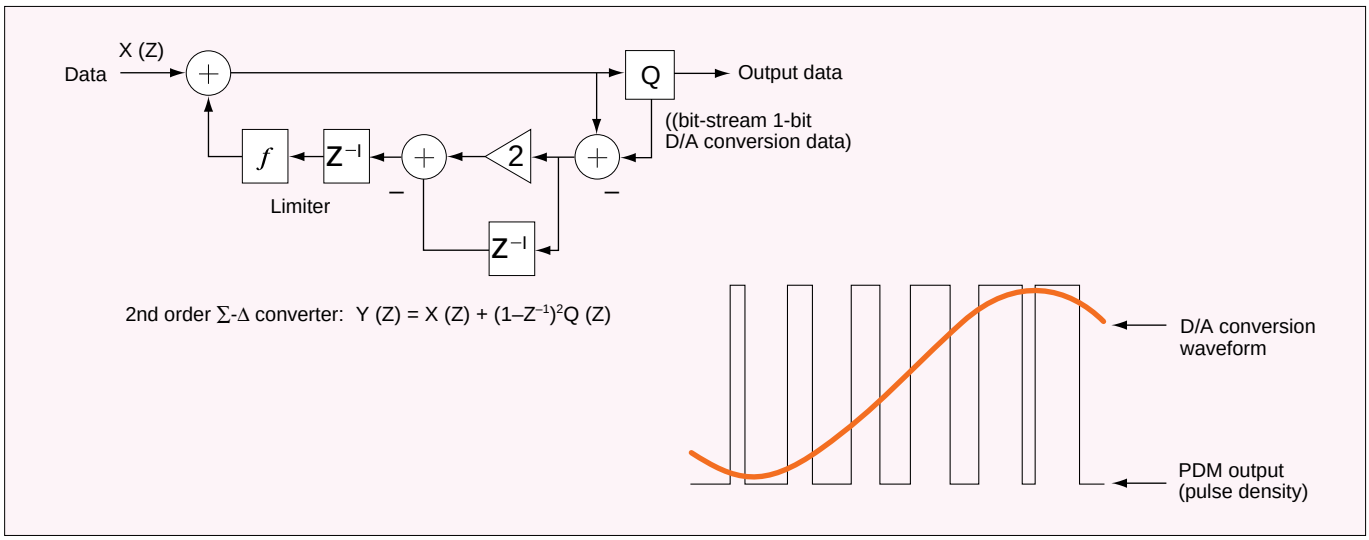
Audio DSP System

The proliferation of audio signal digital processing technology and the surround and sound field control (SFC) functions provided in audio equipment are proceeding in integrated fashion.
DSP ICs for audio use, which integrate various functions, including equalizing, sound field simulation and dynamic range control, dramatically expand the possibilities of sound expression in comparison with conventional analog processing ICs.
As a result, these ICs are currently the object of the highest expectations in terms of future evolution and development.
Toshiba offers a wide lineup of audio DSPs that provide ample support for the future proliferation of these devices, including the TC9332F, for use in top-of-the-line equipment and featuring mask-ROM compatibility, built-in data delay RAM and a high degree of expandability, the TC9409BF for use in Karaoke systems featuring a built-in A/D-D/A converter and delay RAM, and the TC9452F/TC9465F which have been streamlined exclusively for use in popular models.



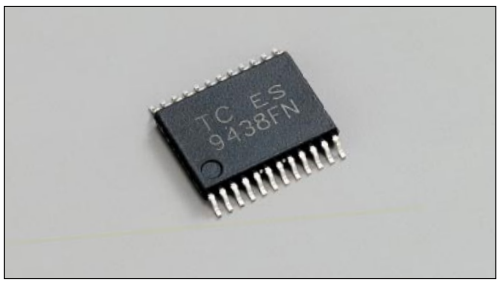
D/A Converters

Since D/A converters are considered to have an effect on the quality of digital sound, Toshiba has available a lineup of 1-bit D/A converters that are theoretically free of sound distortion. These D/A converters are able to faithfully reproduce microsignals, making it possible to obtain analog signals offering a high level of sound quality.



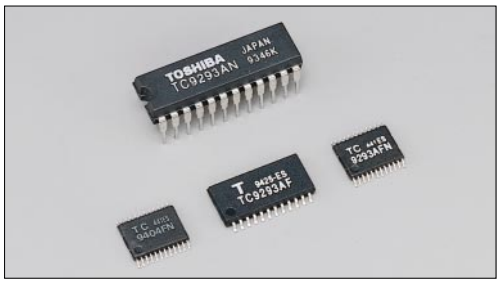
Popular Types

TC9438FN



This 1-bit D/A converter features a built-in tertiary low-pass filter and a built-in 8-times oversampling digital filter. The DAC oversampling ratio is 128 fs/192 fs, causing noise in the audible range to be shifted to a higher range.
The TC9438FN is able to operate at a low voltage (2.4 V) and contains a built-in dynamic digital bass boost function as well as 0-data-detection output function for both L and R channels.
AC characteristics (at power supply voltage of 5 V and oversampling ratio of 192 fs)
S/N ratio: 94 dB (typ.), THD + N: −87 dB (typ.)
Available in 24-pin packages (pitch: 0.65 mm)

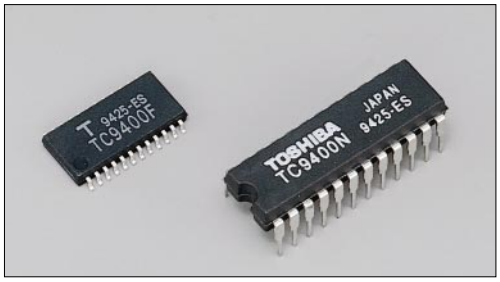
TC9404FN, TC9293AF/AFN/AN



These 1-bit D/A converters feature a built-in tertiary low-pass filter and a built-in 8-times oversampling digital filter. The DAC oversampling ratio is 192 fs, causing noise in the audible range to be shifted to a higher range. These D/A converters incorporate a digital attenuator that is able to vary output over 128 steps.
They also contain two types of digital bass boost functions and a built-in zero-data-detection output function for both the L and R channels.
AC characteristics
S/N ratio: 96 dB (typ.), THD + N: −85 dB (typ.)
Available in 24-pin packages (pitch: 0.65 mm)

Intermediate Types

TC9400F/N



These 1-bit D/A converters are equipped with a built-in FIR-type, 8-times oversampling digital filter. They also contain a built-in digital attenuator able to vary output over 128 steps. The DAC oversampling ratio is 192 fs.
AC characteristics
S/N ratio: 100 dB (typ.), THD + N: −90 dB (typ.)
The TC9400F is available in a 24-pin package (pitch: 1.0 mm), while the TC9400N is available in a 24-pin shrink DIP package.

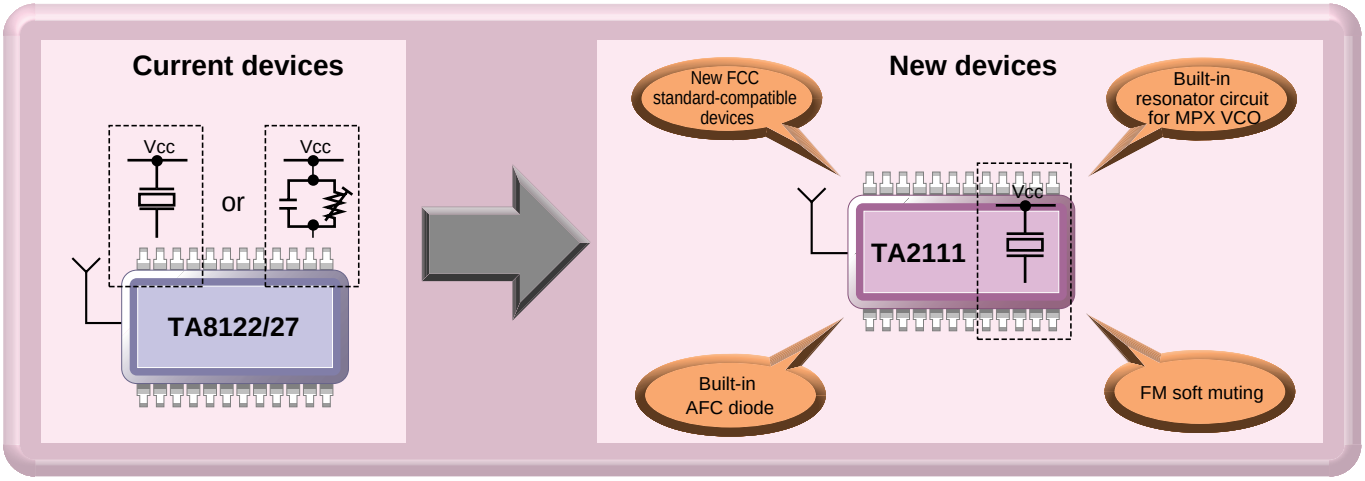
Radio-frequency Signal Processing System

Toshiba is proceeding with the development of a new family of tuner ICs to satisfy the new FCC standards to be deployed in the U.S. (starting in June 1999).

3 V Single-chip Tuners TA211N/F/FN

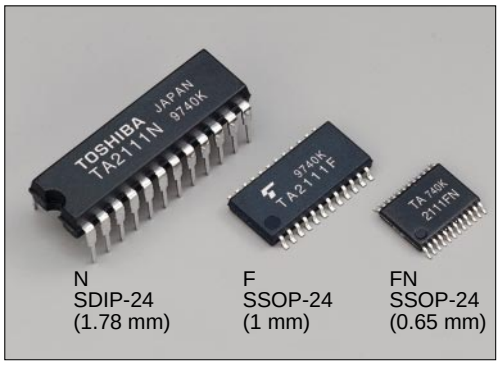
For Radio/Cassette Players and 3 V Headphone Stereos

The TA2111N/F/FN lower the oscillation level of FM local oscillation circuits to satisfy the new FCC standards.



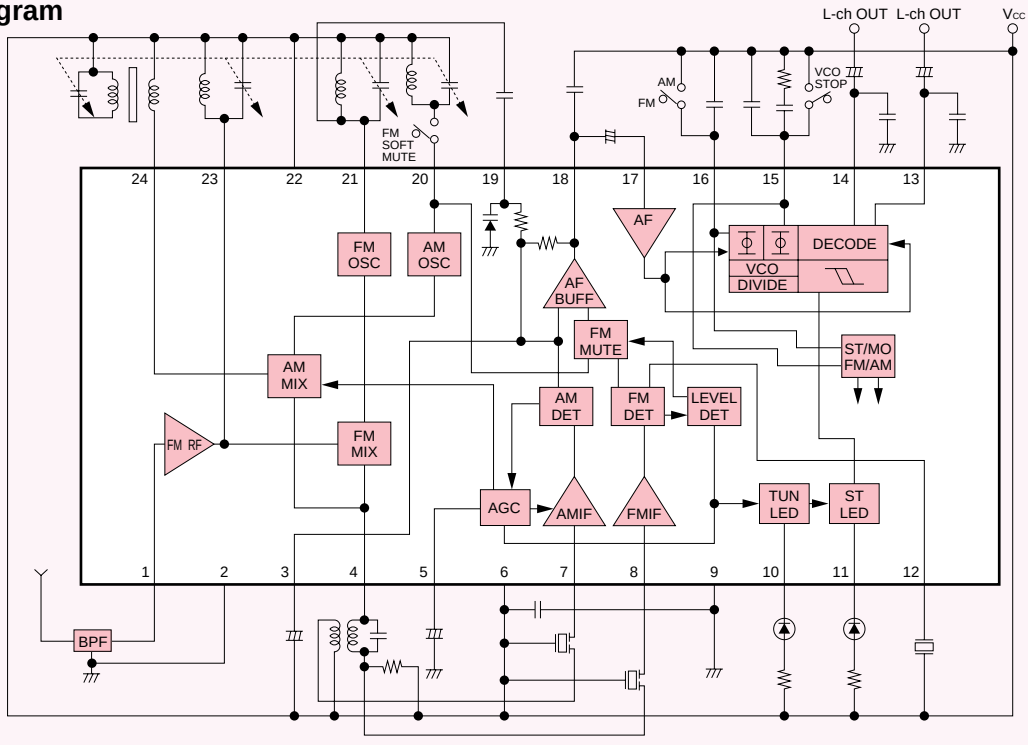
Features

- Single-chip tuner: FM front-end + AM/FM IF + FM stereo decoder
- Compatible with new FCC standards (Low spurious radiation FM tuner)
- Adjustment-free FM detector circuit
- Built-in resonator circuit for FM stereo decoder VCO
- Built-in varactor diode for FM AFC
- Built-in FM soft muting circuit
- Built-in AM low-cut circuit
- Operating power supply voltage range: Vcc(opr) = 1.8 to 7 V (Ta = 25°C)



3 V Single-chip Tuner TA2111N/ F/FN

Block Diagram



ICs for Radio-frequency Systems

Device	Package	Application		Function				Remarks
		Radio-cassette	Headphone stereo	FM			Other	
				F/E	IF	MPX		
TA7358P/AP	SIP9	○	3 V	○				RF amp, mixer, local oscillator
TA8158F	SSOP10							
TA7371AF	SOP8		1.5 V	○				AFC diode
TA8168SN	SSIP12	○		TV				AFC diode, IF amp
TA8176SN	SSIP12	○		TV				Local oscillation buffer, IF amp, double RF tuning compatibility, AGC
TA8176F	SSOP16							
TA8182FN	SSOP16		1.5 V	TV				Built-in 2-system front end (TV/FM), IC amp, band switch, power switch
TA7343AP	SIP9	○				○		PLL type, f_{MONI} = 38 kHz
TA8126S	SIP9	○	3 V				D/D converter for electronic tuning (sine wave oscillation)	Vo = 30 V/15 V (selectable)
TA8126F	SSOP10							
TA8198F	SSOP10		3 V					Vo = 15 V, power switch, built-in constant current source for DTS
TA2018FN	SSOP10		1.5 V					Vo = 30 V, power switch, built-in constant current source for DTS
TA2030FN	SSOP16		1.5 V	TV				Built-in 2-system front end (TV/FM), IF amp, band switch, power switch

Devices shown with ▭ are produced by Toshiba Electronics Malaysia Sdn. Bhd.

Mixed ICs for Radio-frequency Systems

Device	Package	Application			Function					Remarks
		Radio-cas-sette	Headphone stereo	Other	FM			AM	PW	
					F/E	IF	MPX			
TA7792P	DIP16		1.5 V 3 V		○	○		○		AM detector coil and FM IF coil not required
TA7792F	SSOP16									
TA8164P	DIP16		3 V	Portable radio	○	○		○		AM detector coil not required
TA2003P	DIP16		3 V	Portable radio	○	○	○	○		AM/FM IF coil not required, adjustment-free FM detector circuit
TA2003F	SSOP16									
TA8122AN	SDIP24	○	3 V		○	○	○	○		AM detector coil and FM IF coil not required, adjustment-free FM detector circuit and VCO circuit, normal S curve: TA8123AN/AF
TA8122AF	SSOP24									
TA8127N	SDIP24	○	3 V		○	○	○	○		AM detector coil not required, reverse S curve, adjustment-free FM detector circuit and VCO circuit
TA8127F	SSOP24									
TA8167N	SDIP24	○	3 V		○	○	○	○		Lower FM local oscillation voltage than TA8127N
TA2008AN	SDIP24	○			○	○	○	○		IF count method for DTS, adjustment-free FM detector circuit and VCO circuit
▼TA2111N	SDIP24	○			○	○	○	○		1-chip tuner compatible with new FCC standards, FM soft muting, AFC diode, external connection of VCO circuit not required
▼TA2111F	SSOP24		3 V							
▼TA2111FN	SSOP4									
TA8153FN	SSOP24		1.5 V			○	○	○		FM band signal detection, AM IF output, AM low-cut function, power switch
TA8132AN	SDIP24	○	3 V			○	○	○		IF count method for DTS, adjustment-free FM detector circuit and VCO circuit, AM low-cut function, AM local oscillation buffer
TA8132AF	SSOP24									
TA8186P	DIP16	○				○	○	○		AM IFT used for MPX VCO resonator circuit, FM soft muting
TA2022AFN	SSOP24		1.5 V			○	○	○		IF count method for DTS, adjustment-free FM detector circuit, AM detector coil not required, auto-stop sensitivity adjustment, AM stereo compatibility
TA2057N	SDIP24	○				○	○	○		IF count method for DTS, adjustment-free FM detector circuit and VCO circuit, AM local oscillation buffer, auto-stop sensitivity adjustment, AM stereo compatibility
☆TA2099N	SDIP24	○				○	○	○		IF count method for DTS, external connection of VCO circuit not required, FM auto-stop sensitivity and LED sensitivity adjustment, blender control
TA2029FN	SSOP30			Portable radio	○	○		○	○	IF count method for DTS, electronic volume, adjustment-free FM detector circuit, Po = 100 mW (3 V/8 Ω)

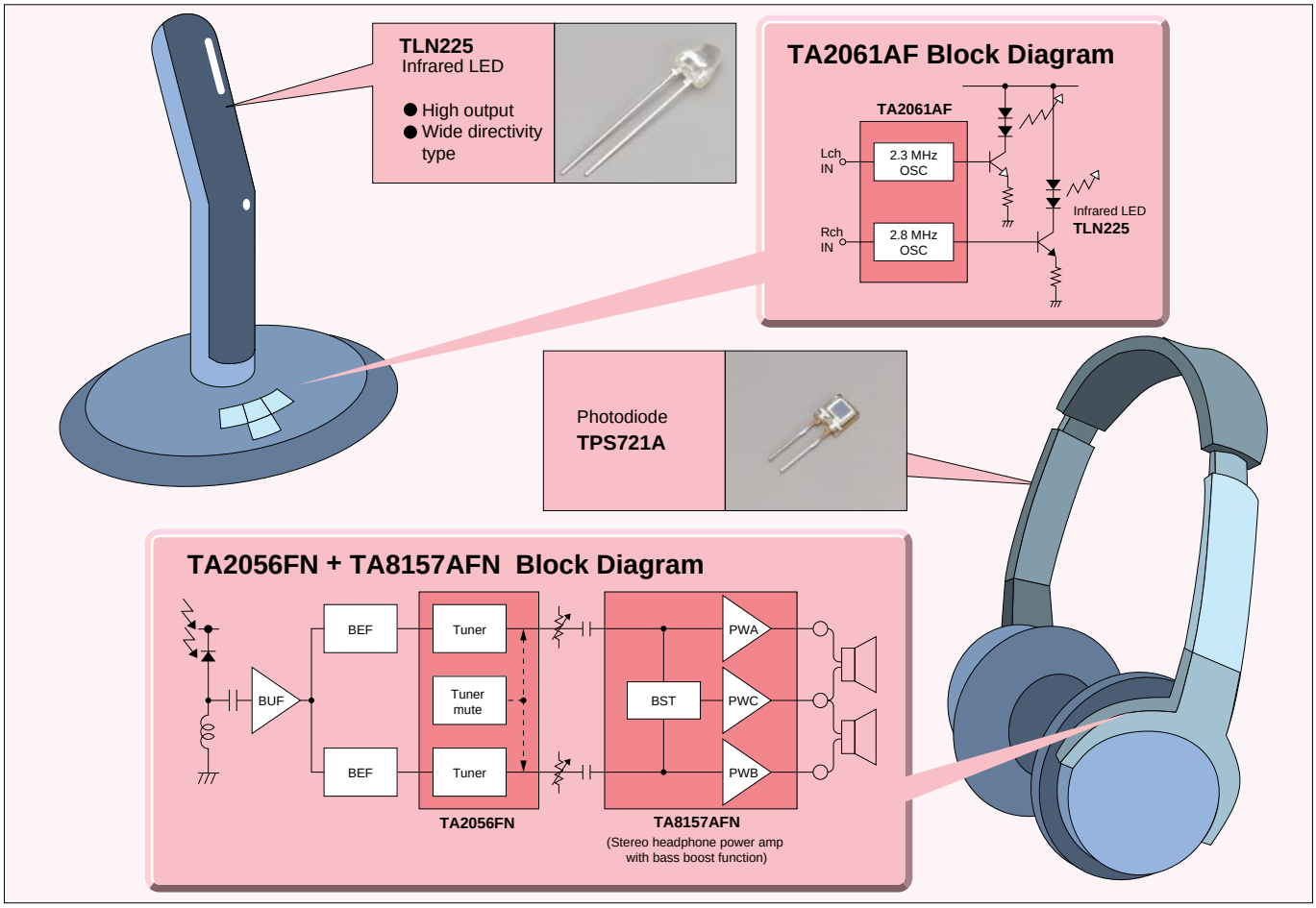
☆ : Under development ▼ : New product

Devices shown with ▭ are produced by Toshiba Electronics Malaysia Sdn. Bhd.

Infrared Wireless Headphone System

Communication and transfer devices utilizing infrared rays are currently attracting considerable attention. Although their use in the telecommunications field has already been established, awareness of infrared technology is growing gradually, thanks to its use in the field of audio equipment and other consumer products, where wireless headphones and wireless speakers have been released onto the market. In the future, the market is likely to witness the practical application of infrared rays to simultaneously handle audio and visual data in the form of a union with multimedia applications.

Toshiba has developed its TA2061AF transmitter and TA2056FN receiver for stereo wireless transmission systems using linear audio signals. Although conventional systems were composed by combining discrete components and FM radio ICs in the absence of dedicated ICs, this infrared transmitter and receiver were developed to serve as dedicated ICs, thereby enabling wireless systems to be composed quite easily. In particular, the receiver IC is able to operate at 1.5 V, making it optimal for wireless headphone systems.



TA2061AF

Transmitter

- Built-in 2.3 MHz/2.8 MHz VCO
- Built-in pre-emphasis
- Audio AGC
- Few external components
- Operating power supply voltage range: Vcc(opr) = 4 to 16 V
- 16-pin flat package (pitch: 1 mm)

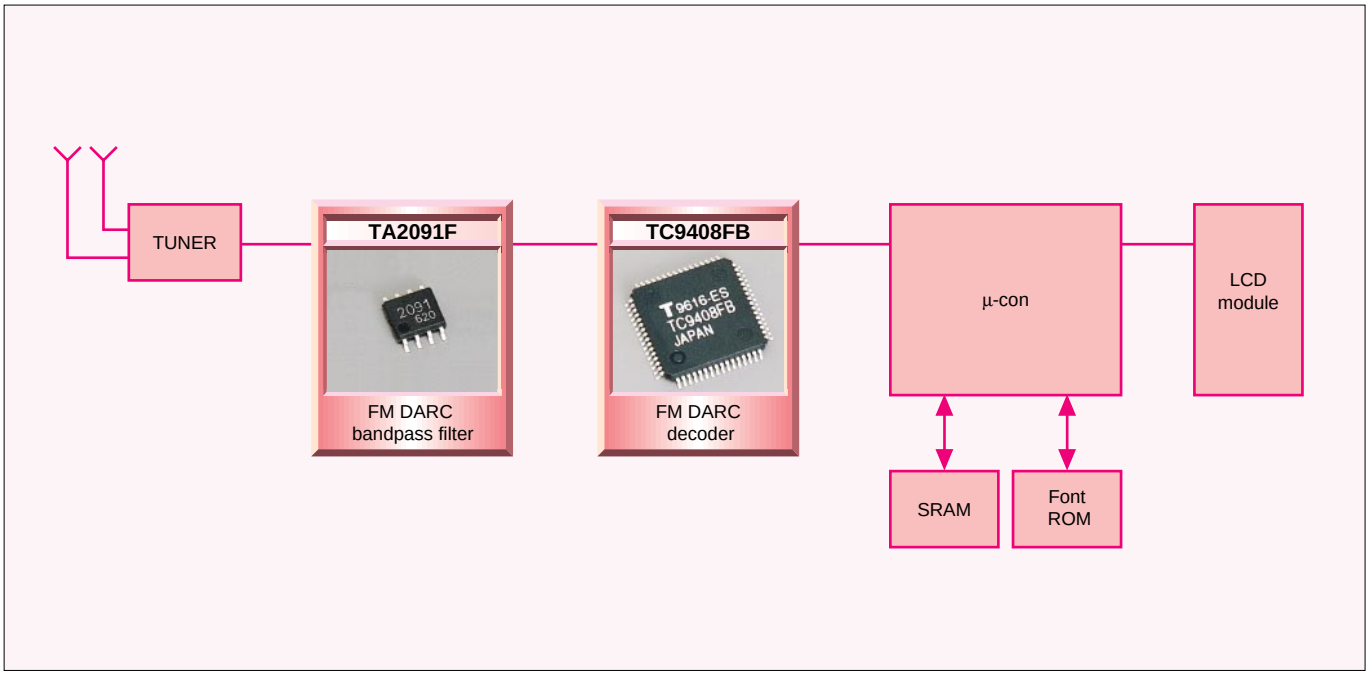
TA2056FN

Tuner for 1.5 V Wireless Headphones

- Built-in 2-system tuner (for f = 2.3/2.8 MHz)
- Countermeasures for spurious radiation not required due to the use of a direct detection type
- Built-in mute function: ATT = 65 dB (typ.)
- Low current consumption: Icc = 4 mA (typ.)
- Operating power supply voltage range: Vcc(opr) = 0.95 to 2.2 V
- 24-pin flat package (pitch: 0.65 mm)

FM Character Multiplex System

FM character multiplex broadcasts refer to the DARC (DAta Radio Channel) system developed by the NHK Broadcasting Technology Laboratory in Japan. This system is used to provide service in the form of characters, graphics, traffic information or data by multiplexing a digital signal on current FM stereo broadcasts.
Combining a decoder IC, microcontroller and LCD module in a conventional tuner enables program information or weather information and so forth to be displayed on, for example, a liquid crystal panel.
Toshiba has developed its TA2091F and TC9408F/FB decoder ICs for FM character multiplex broadcasts to continue to fortify its lead in the current age of multimedia.



Schematic Diagram of Receiver

The DARC (DAta Radio Channel) FM multiplex broadcasting technology was developed by NHK (Nippon Hoso Kyokai). DARC is the registered trademark of NHK Engineering Service, Ltd. (NHK-ES). A separate agreement must be concluded with NHK-ES in the case of producing and selling electronic devices using DARC technology. Electronic devices using DARC technology are entitled to display the official logo mark shown below.

DARC
DATA RADIO CHANNEL

Digital Tuning System

Amidst the current trend towards multiple stations, the demands being placed on digital tuning systems, including tuning functions and memory functions, are growing not only with respect to radio-cassettes but also for headphone stereos. Toshiba offers a wide assortment of ICs for digital tuning systems to meet these demands of multi-functional audio equipment.

The TC9318FB-001 is a single-chip digital tuning system optimal for headphone stereos and other portable audio equipment. It is equipped with 5 bands consisting of FM, MW, LW, TV and SW, enabling it to accommodate applications throughout the world.

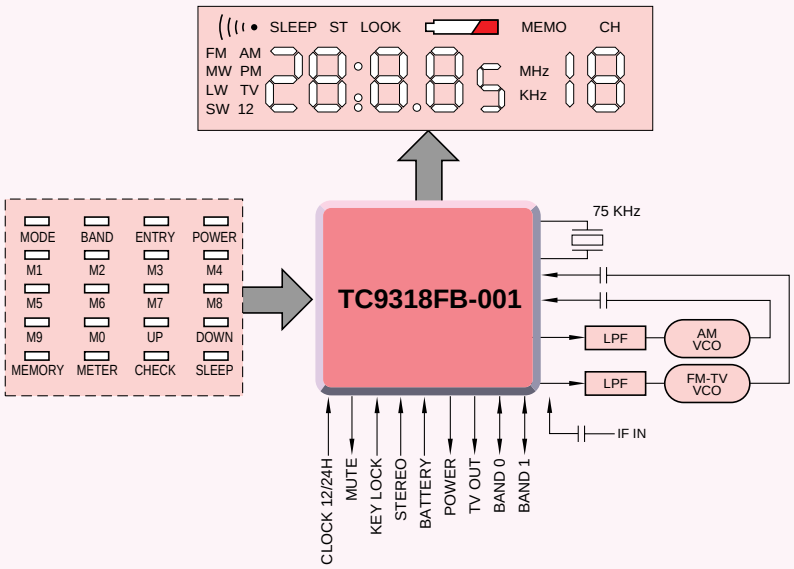
Features

■ Tuning Functions
- ● Manual tuning (up/down)
  Dial tuning (rotary switch type)
- ● Direct tuning (when DIRECT jumper = 1)
- ● Seek tuning

■ Memory Functions
- ● When DIRECT jumper = 0
  Fixed memory: 10 stations each for the FM, MW, LW, TV and SW bands
  Last memory: Available for each band
- ● When DIRECT jumper = 1
  Random memory: 18 stations
  Last memory: None

■ Clock Functions
- ● Dual/single clock selection function
- ● 12/24-hour clock selection function
- ● Sleep timer function
- ● Alarm timer function

■ Other Functions
- ● Auto-off function
- ● Battery check function



PLL (Microcomputer Compatible)

Device	Operating power supply (V)	Functions/Features	No. of ports	Package
TC9216P	4.4 to 5.5 V	● High-speed PLL with built-in 2-modulus prescaler ● Built-in 16-bit programmable counter ● Built-in 16-bit IF counter ● Operating frequency: 0.5 to 140 MHz	Output ports: Max. 4 I/O ports: Max. 2	DIP16
TC9217P/F			Output ports: Max. 4 I/O ports: Max. 5	DIP20/SOP20
TC9256P/F	4.5 to 5.5 V	● High-speed PLL with built-in 2-modulus prescaler ● Built-in 16-bit programmable counter ● Built-in 20-bit IF counter ● Operating frequency: 0.5 to 150 MHz	N channel: Open Drain outputs: 3 I/O ports: Max. 2	DIP16/SOP16
TC9257P/F			N channel: Open Drain outputs: 4 I/O ports: Max. 5	DIP20/SOP20
TC9418FN	1.8 to 3.6 V	● High-speed PLL with built-in 2-modulus prescaler ● Built-in 17-bit programmable counter ● Built-in 20-bit IF counter ● Operating frequency: 0.5 to 230 MHz	N channel: Open Drain outputs: 4 I/O ports: 4	SSOP24-P-300A
TB2110FN	1.0 to 2.5 V	● High-speed PLL with built-in 2-modulus prescaler ● Built-in 16-bit programmable counter ● Built-in 20-bit IF counter ● Operating frequency: 0.5 to 250 MHz ● Built-in DC/DC converter	Output ports: 4 Input port: 1	SSOP24-P-300A

Prescalers

Device	Max. operating frequency	Functions	Operating power supply (V)	Package
TD6134AF	250 MHz	2-modulus, N = 60/64,120/128	1.8 to 5.5 V	SOP8
TD7101F	150 MHz	2-modulus, N = 15/16, 60/64	1.8 to 5.5 V	SOP8
TD7103F	250 MHz	2-modulus, N = 60/64, 120/128	1.0 to 3.0 V	SSOP10
TD7104F	1.0 GHz	N = 1, 2, 4, 8	3.0 to 6.0 V	SOP8

Digital Tuning System

	Series Name	DTS-10	DTS-11		DTS-12	DTS-21			DTS-22
Controller	Device	**TC9309AF**	**TC9308AF**	**TC9316F/FA/FB**	**TC9307AF**	**TC9317F**	**TC9318FA/FB**	**▼TC9327F**	**TC9314F**
	Package	QFP80 • 0.8 mm pitch	QFP60 • 0.8 mm pitch	QFP60 • 0.8 mm pitch QFP64 • 0.5 mm pitch • 0.65 mm pitch	QFP44 • 0.8 mm pitch	QFP80 • 0.5 mm pitch	QFP64 • 0.5 mm pitch • 0.65 mm pitch	QFP80 • 0.5 mm pitch	QFP80 • 0.8 mm pitch
	Operating power supply (V)	4.5 to 5.5 V	1.8 to 3.6 V		4.5 to 5.5 V	1.8 to 3.6 V			2.7 to 5.5 V
	CPU	Equivalent to 4-bit MCU, built-in PLL							
	For OTP	**TC93P09F**	—			**☆TC93P18FA/FB**		**☆TC93P27F**	**☆TC93P14F**
	ROM	16 x 3968 steps	16 x 2048 steps			16 x 4096 steps		16 x 7168 steps	16 x 6144 steps
	RAM	4 x 256 words	4 x 128 words			4 x 256 words			384 words
	Instructions	61 (11.1 µs)	65 (80 µs)		65 (40/80 µs)	62 (40 µs)	60 (40 µs)	62 (40 µs)	54 (40 µs)
	Subroutines	2	1			2			4
	Key input ports	4							
	I/O ports Input ports Output ports	15 3 12	4 4 8	8 Max. 1 Max. 8	7/5/3 0/1 7	Max. 56 Max. 3 Max. 2	10 Max. 2 Max. 8	Max. 36 Max. 3 Max. 2	Max. 28 Max. 5 Max. 11
	Display	5 V LCD	3 V LCD						
	(Duty)	1/2		1/3	1/4	1/3		1/4	1/3
	(Bias)	1/2			1/3	1/2			
	Segments	64	40	60	36/44/52	Max. 90	69	Max. 100	Max. 90
	A/D converter	2 (6 bits)	—			2 (6 bits)		3 (6 bits)	2 (6 bits)
	D/A converter	1 (6 bits)	—			1 (12-bit PWM method)	—	1 (12-bit PWM method)	1 (6 bits)
	X'tal	7.2 MHz	75 KHz		150/75 KHz	75 KHz			
	PLL reference frequency (KHz)	1, 3.125, 5, 6.25, 9, 10, 12.5 25, 50, 100	1, 3, 3.125, 5, 6.25, 12.5, 25		1, 3, 3.125, 5, 6.25, (10), 12.5, 25	1, 3, 3.125, 5, 6.25, 12.5, 25			
	IF counter	20 MHz, 16-bit universal counter	2 MHz, 16-bit universal counter	12MHz, 16-bit universal counter		12MHz, 20-bit universal counter			
	Prescaler	Built-in 185 MHz prescaler	**TD6134AF** (3 V, VHF/FM) **TD7101F** (3 V, FM/SW) **TD7103F** (1.5 V, VHF/FM)		Built-in 130 MHz prescaler	**TD6134AF** **TD7101F** **TD7103F**	Built-in 230 MHz prescaler		Built-in 130 MHz prescaler

☆: Under development ▼: New product

Audio-frequency Signal Processing System/Output System

Toshiba offers a lineup of products that place the emphasis on sound quality in order to faithfully reproduce audio signals input from various types of media that are pure and true to the sound source. Moreover, a wide range of power packages as well as ultra-compact packages are available to accommodate various power supply voltages and best suit each specific application.

Analog Signal/Sound Field Processing

TA2068N (System Preamplifier for Single-Cassette Use)

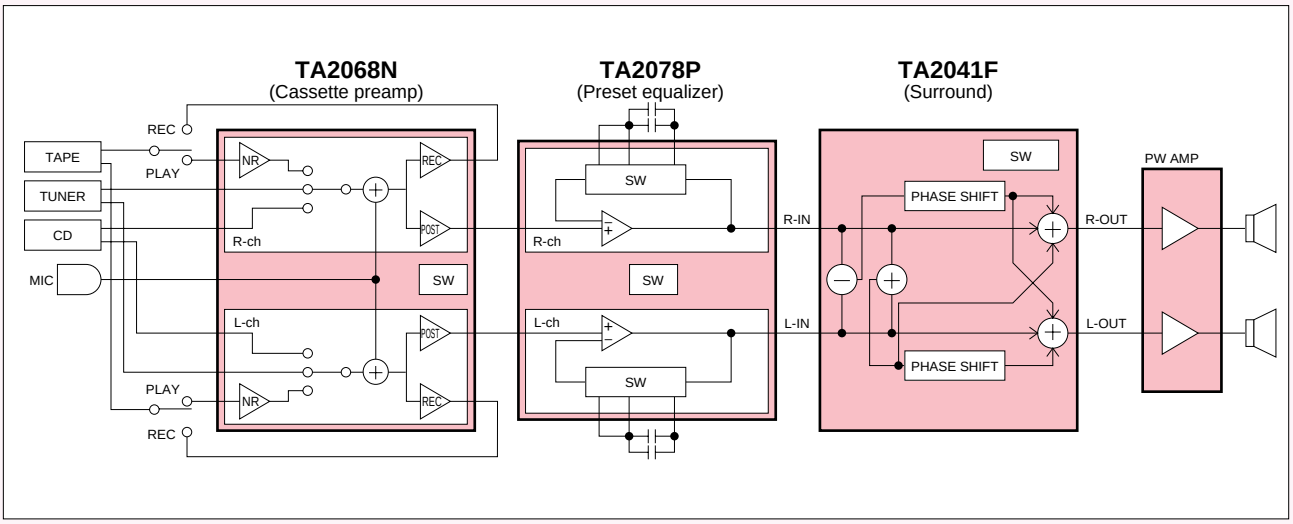
- 2 channels
- TAPE/RADIO/CD (LINE IN) selector switch
- Built-in ALC circuit (playback amplifier)
- MIC mixing

TA2078P (3-mode Preset Equalizer)

- 2 channels
- Built-in 3-mode equalizer

TA2041F

- 2 channels
- 3-mode artificial surround
- 2 types of packages



Preamplifiers

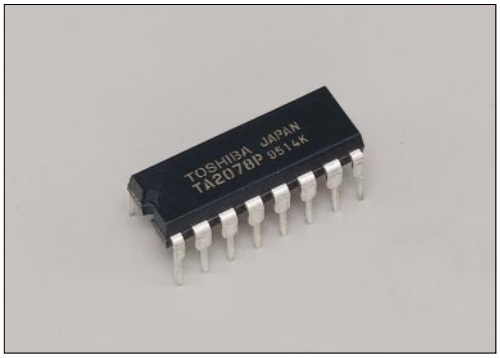
Device	Package	Application		Function			Features	Operating voltage
		Radio-cas-sette	Headphone stereo	Preamp: Play-back	Preamp: Record-ing	Other		
TA7668BP	DIP16	○		○	○		2 channels, recording/playback amplifier, built-in ALC circuit	6 to 15 V
TA7784P	DIP16	○		○			2 channels, for auto-reverse, equalizer selector switch	3.5 to 15 V
TA8125S	SIP9	○		○			2 channels, high open-loop gain	6 to 14 V
TA8135P	DIP16	○			○		2 channels, high-performance ALC, recording mute, for NR system	6 to 14 V
TA8142AP	DIP16	○		○	○		2 channels, double-cassette-compatible preamp, built-in ALC circuit	4 to 13.5 V
TA8189N	SDIP24	○		○	○		2 channels, double-cassette-compatible preamp, equalizer selector switch, mixer output, built-in ALC circuit, headphone selector switch	4 to 13.5 V
TA8173AP	DIP16	○				Surround	4-stage phase-delay filter, built-in normal/delay switching circuit	4 to 12 V
TA8193S	SIP9	○				Line amp	2 channels, line amp, GV = 20 dB fixed, low noise	5 to 16 V
TA2011S	SIP7	○				Microphone amp	Built-in ALC circuit, built-in feedback resistor, GV = 20 dB fixed	4 to 14 V
TA2068N	SDIP24	○		○	○		2 channels, system preamp, recording/playback amp, monitor amp, microphone amp (mixing compatibility)	4 to 9 V
TA2041F	SSOP24	○				Surround	2 channels, built-in 3-mode surround/normal switching circuit	4 to 12 V
TA2078P	DIP16	○				Preset equalizer	2 channels, high-low booster (2 modes), high-low cut-off (1 mode), built-in flat 4-mode equalizer	7.5 to 14 V
TA7330P/F	SIP7/SSOP16		3.0 V	○	○		For compact tape recorders, built-in ALC circuit	2 to 5 V
TA7709P/F	DIP16/SSOP16	○	3.0 V	○			2 channels, playback preamp, input coupling condenser not required	1.6 to 5 V
TA7795FN	SSOP16		1.5 V	○			2 channels, for auto-reverse, equalizer selector switch	0.9 to 4.5 V
TA8155F/FN	SSOP24		1.5 V	○	○		2 channels, playback amp, recording amp, power switch, microphone amp with ALC, buffer amp, selector switch	0.9 to 4 V

Devices shown with ▭ are produced by Toshiba Electronics Malaysia Sdn. Bhd.

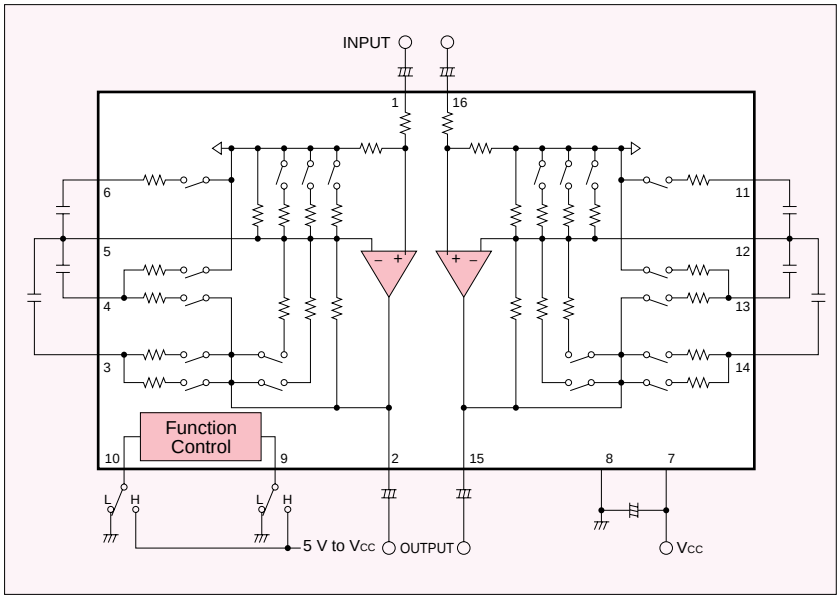
TA2078P

(3-mode Preset Equalizer)

- 2 channels
- Mode selector switch
  (rock, classic, pops and normal)
- Operating power supply voltage range:
  Vcc(opr) = 7.5 to 14 V



Block Diagram



Power Amplifiers

Device	Package	Application		Function				Features				Operating voltage
		Radio-cassette	Headphone stereo	Preamp	Power amp			Thermal shutdown protection circuit	Power switch	Muting	Other	
					Power supply (V)	Output voltage						
						R_L = 4Ω	R_L = 8Ω					
TA7331P	SIP9	○	○		3 V	0.2 W	0.12 W				Low voltage, low power consumption	2 to 5 V
TA7331F	SSOP16		○									2 to 4 V
TA7368P	SIP9	○	○		6 V	0.72 W	0.45 W				Low voltage, low power consumption	2 to 10 V
TA7368F	SSOP10		○		3 V	0.12 W	—					
TA7376P	SIP9	○	○		6 V	—	0.4 W x 2				Low voltage, low power consumption	1.8 to 6 V
TA7628HP	DIP16	○		○	6 V	—	0.96 W	Recording/playback preamp, buffer amp, ALC, power amp				3.5 to 9 V
TA7769P	DIP16	○			6 V	1 W x 2	—	○				4.5 to 9 V
TA8216H	HZIP12	○			24 V	13 W x 2	—	○		○		10 to 24 V
					28 V	—	13 W x 2					10 to 37 V
TA8217P	HDIP12	○			9 V	2.5 W x 2	—	○			Double ripple filter	4.5 to 12 V
TA8223K	MSIP15	○			12 V	4.5 W x 2	—	○	○			6 to 18 V
					15 V	7 W x 2 (R_L = 3Ω)						
TA8227P	HDIP12	○			9 V	2.5 W x 2	—	○	○			5 to 12 V
TA8229K	MSIP15	○			9 V	2.5 W x 2	—	○	○			6 to 15 V
					12 V	4.6 W x 2						

Power Amplifiers for Headphone Stereos

Device	Package	Application	Function				Features	Operating voltage
		Headphone stereo	Preamp		Power amp			
			Play-back	Record-ing	Output power			
					R_L = 16Ω	R_L = 32Ω		
TA7688F	SSOP16	3.0 V			38 mW x 2	27 mW x 2	Ripple filter, power switch	1.8 to 5 V
TA8145FN	SSOP16	1.5 V			8 mW x 2	—	OCL, ripple filter, GV = 22 dB, power switch, mute switch	0.9 to 2.2 V
TA8157AFN	SSOP24	1.5 V			9 mW x 2	—	OCL, built-in amplifier for bass boosting, GV = 24 dB, ripple filter, power switch, mute switch	0.9 to 2.2 V
TA8159FN	SSOP30	1.5 V	○		6 mW x 2	—	OCL, ripple filter, GV = 28 dB, power switch, mute switch	0.9 to 2.2 V
TA2002F/FN	SSOP24	○	○		50 mW x 2	33 mW x 2	OCL power amp (GV = 27 dB), power mute switch, auto-reverse, ripple filter, power switch, premute switch	1.8 to 4.5 V

Devices shown with ▭ are produced by Toshiba Electronics Malaysia Sdn. Bhd.

CD Player Units

<Digital Servo System>

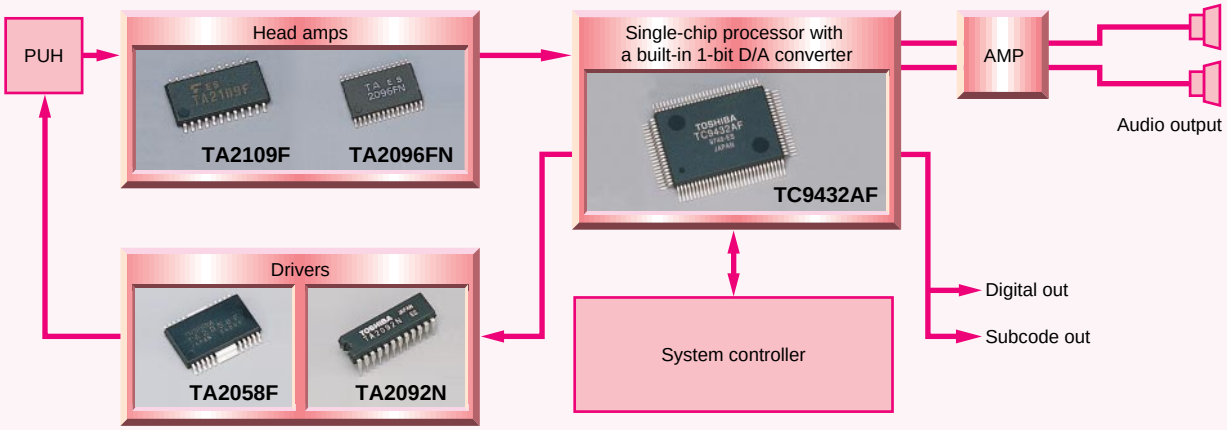
The TC9432AF was developed for the purpose of creating a completely adjustment-free system and achieving a significant reduction in the number of externally connected components. The TC9432AF contains a built-in 1-bit D/A converter and digital equalizer for the servo. Combining with the TA2109F or TA2096FN makes it possible to configure an extremely simple CD player system.

<Analog Servo System>

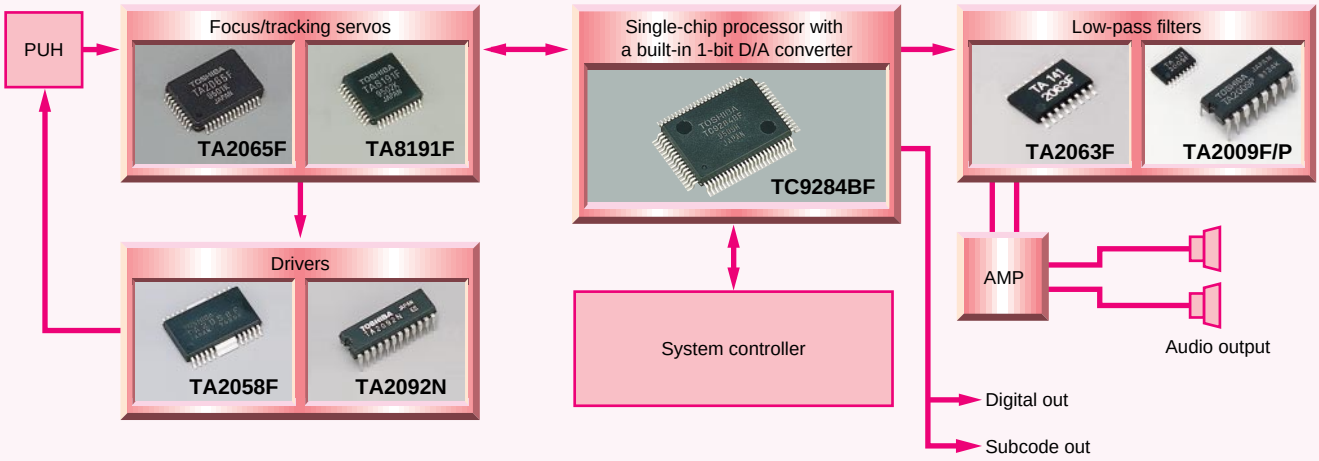
The TC9284BF and TA2065F were developed for the purpose of simplifying system configuration (by reducing the number of peripheral circuit components). Since the TC9284BF in particular contains a built-in 1-bit D/A converter, the area occupied by the LSI on the board can be reduced by roughly 20% in comparison with connecting a D/A converter externally. In addition, the TA2065F incorporates roughly 20 more externally connected components (resistors and condensers) than previous products (TA8191F). Consequently, combining the TC9284BF and TA2065F allow configuration of an extremely simple CD player system.

Recommended System Block Diagrams

<Digital Servo System>



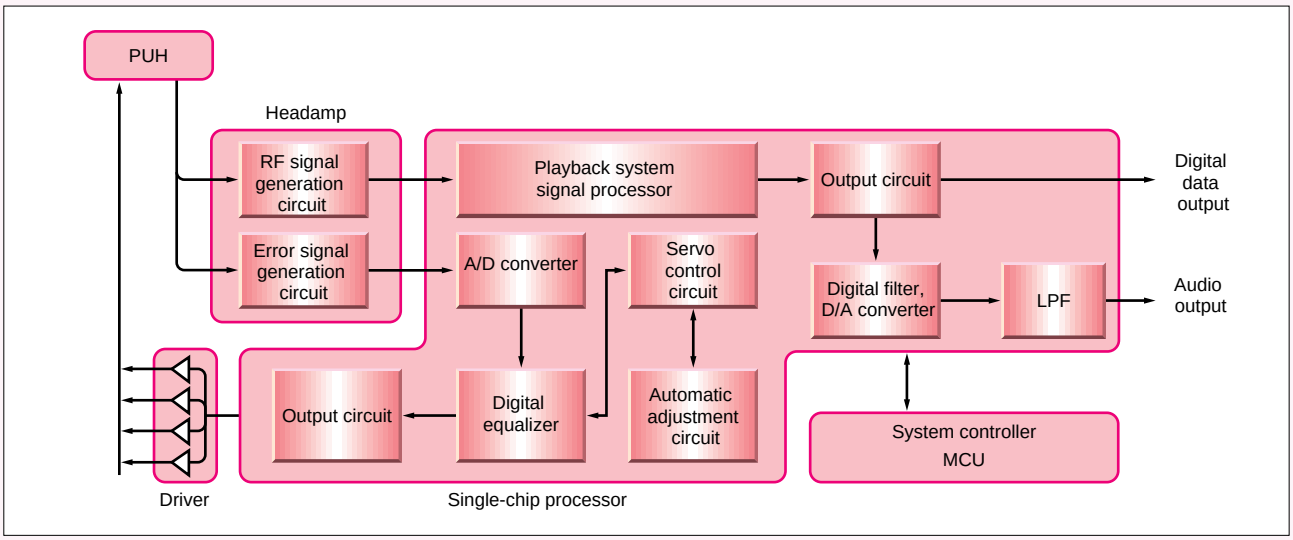
<Analog Servo System>



Completely Adjustment-free, Reduced-component Digital Servo System

Features

(1) Completely adjustment-free
(2) Built-in digital equalizer
(3) High correction capability
(4) Built-in 1-bit D/A converter and analog filter



The advantages of digital servo systems include a completely adjustment-free system (realization of volume zero and stable servo), significant reduction in the number of components (30-40 components equal to less than 1/2 the number of previous products) and accommodation of high-speed search.
Toshiba offers its TC9432AF single-chip processor, featuring a built-in 1-bit D/A converter and servo digital equalizer, high correction capability (C1/C2 = double/quadruple) and accommodation of 4-times playback, along with its TA2109F head amp, offering built-in RF, focus/tracking error generation circuit and ALPC circuit, as members of its lineup of digital servo systems.

IC/LSI Family

Device		Name	Functions	Process	Package
TC9296AF	Digital servo system	Single-chip processor with built-in 1-bit D/A converter	Synchronization isolation, EFM demodulation, error detection, correction and compensated output, microcontroller interface, PLL, data slicing, CLV servos, focus/tracking servo control, search control, peak search, variable pitch (TC9296AF only), 8-times oversampling digital filter, 1-bit D/A converter, analog filter (TC9432AF only)	CMOS	QFP100
TC9432AF					
TA2066F/FN		Head amp	RF amp, focus error amp, tracking amp, ALPC		MFP24 VSOP24
TA2096FN				Bipolar	VSOP30
TA2109F					MFP24
TC9284BF	Analog servo system	Single-chip processor with built-in 1-bit D/A converter	Synchronization isolation, EFM demodulation, error detection, correction and compensated output, microcontroller interface, PLL, data slicing, CLV servos, focus/tracking servo control, search control, 8-times oversampling digital filter, 1-bit D/A converter	CMOS	QFP80
TA2065F		Focus/tracking servo LSI	Focus/tracking error amp, RF amp, focus/tracking servo amp, ALPC	Bipolar	QFP48
TA8191F					QFP44
TA2058F		4-ch BTL driver	BTL driver	Bipolar	HSOP20
TA2092N					SDIP24
TA8192F		2-ch BTL driver	BTL driver	Bipolar	HSOP20
TA2009F/P		Filter amp	LPF amp	Bipolar	SOP16 DIP16
TA2063F		Filter amp	LPF amp	Bipolar	SOP16

* See page 9 for further information on D/A converters.

CD Application Device Software (Microcontrollers)

CDS-500/700/800 Series

Summary

Members of the CDS-500/700/800 series are CD player system application software that provide optimum control of our TC9284BF, TC9296AF and TC9432AF LSIs for CD players using our 4-bit and 8-bit microcontrollers (TLCS-47 and 870 series). In addition, since functional upgrades are based on these software products, the use of this application software results in improved development efficiency along with shorter development times.

Features

- LCD display (28 segments, 3 common)
- Music calendar display function (display of up to 20 selections)
- Up/down direct selection function
- Direct selection function by keyboard entry
- Fast-forward and reverse functions
- Residual disc space display function
- Program memory registration function
- Repeat function (1 selection, all selections or repeating between A and B)
- Random selection function
- Introduction scan function
- Auto-space function (inserts a blank space of 4 seconds duration between selections)
- Auto-pause function

System Configuration

Series Name	CDS-541	CDS-581	CDS-760	CDS-7C0	CDS-840	☆CDS-8H0
MCU	TMP47C421ADF-VA37	TMP47C820DF-NA21	TMP47P820VDF	TMP87PH20F	TMP47P422VF	TMP87PH20F
Single-chip processor for CD use	TC9284BF	TC9284BF	TC9296AF	TC9296AF	TC9432AF	TC9432AF
Applicable systems	Portable CD players, CD-radio-cassettes	Cabinet-type CD-radio-cassettes	Portable CD players, CD-radio-cassettes	Cabinet-type CD-radio-cassettes	Portable CD players, CD-radio-cassettes	Cabinet-type CD-radio-cassettes
Front-loading function		●				
Selection search function	●	●	●	●	●	●
Fast-forward/reverse	●	●	●	●	●	●
Random selection function		●		●		●
Repeat function	1 selection, all selections	1 selection, all selections	1 selection, all selections	1 selection, all selections, A-B	1 selection, all selections	1 selection, all selections
Memory function (max. no. of selections)	20	20	20	30		30
Residual disc space display		●		●		●
Introduction scan		●		●		●
Music calendar		●		●		●
Auto-space function		●		●		●
Auto-pause function		●		●		●
Remote control function		●		●		

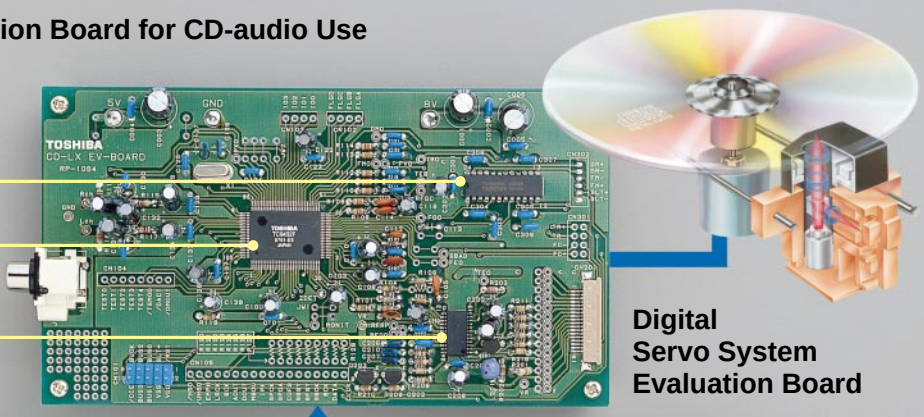
☆ : Under development

Example of Application Software Development Environment

Microcontroller board for digital servo system evaluation

LSI Evaluation Boards for CD Players

Digital Servo System Evaluation Board for CD-audio Use

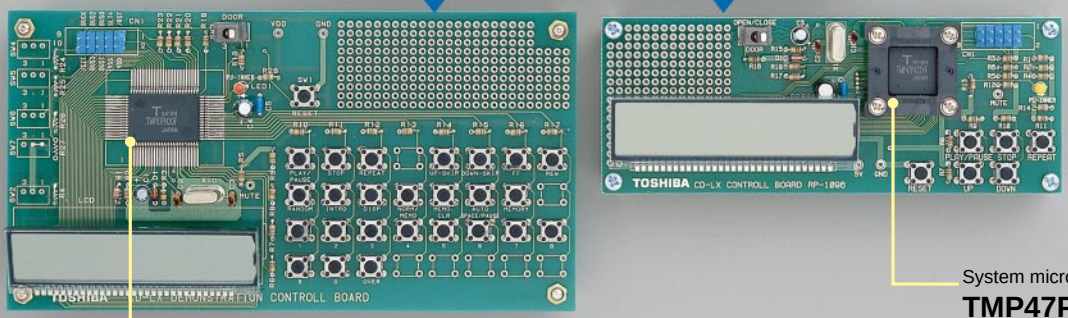


4-channel driver
TA2092N

Single-chip processor with built-in 1-bit D/A converter
TC9432AF

Head amp
TA2109F

Digital Servo System Evaluation Board

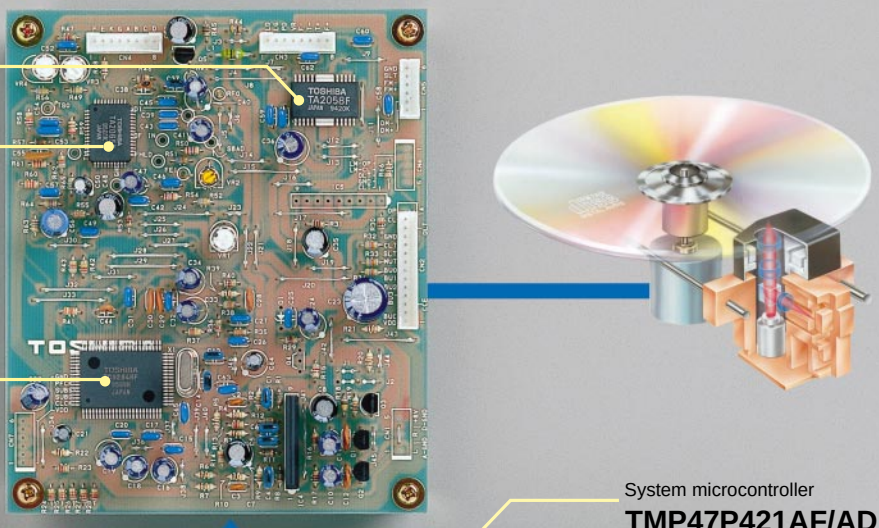


System microcontroller
TMP47P422VF

System microcontroller
TMP87PH20F

Microcontroller Board for Digital Servo System Evaluation

Analog Servo System Evaluation Board for CD-audio Use



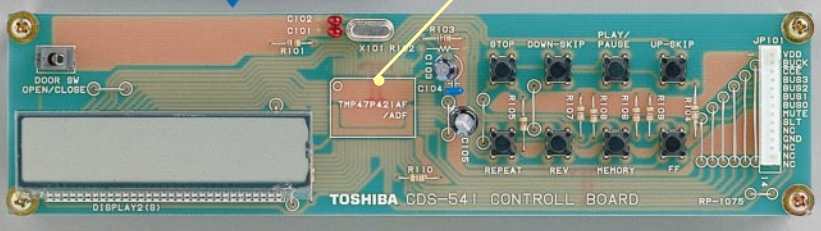
4-channel driver
TA2058F

Head amp
TA2065F

Single-chip processor with built-in 1-bit D/A converter
TC9284BF

Analog Servo System Evaluation Board

System microcontroller
TMP47P421AF/ADF

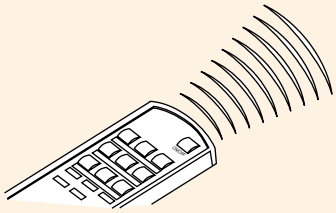


Micro-controller Board for Analog Servo System Evaluation

Remote Control System

As the types of audio equipment become increasingly diverse, remote controllers have essentially become an integral component of audio systems, and the diversity of the functions they provide has become correspondingly greater. Toshiba is responding to these diverse needs by providing a wide range of ICs for use in remote control systems.

Infrared Remote Controllers (for Transmission)

Device	TC9243P/F	TC9028P/F	TC9290P/F
Package	DIP20/SOP20	DIP20/SOP20	DIP20/SOP20
Operating power supply (V)	2.0 to 4.0 V	2.0 to 4.0 V	3.0 to 5.5 V
Oscillation frequency	400 to 800 kHz	400 to 800 kHz (455 kHz typ.)	400 to 800 kHz
Subcarrier frequency	fosc/12	fosc/12,fosc/8 (optional: fosc/24, fosc/16)	None
Transmission format	Fixed	Programmable	Fixed
Function keys	32 keys	Standard 32 keys	32 keys
Key input ports	8	4	8
Key output ports	4	—	4
I/O ports	—	8	—
Double-function keys	4 priorities x 28 combinations	—	4 priorities x 28 combinations
Internal system codes	16	—	16
ROM size		768 x 8 bits	For wired remote controller and DTS/microcontrollers, optimal for key input extension
RAM size		16 x 4 bits	
Instruction execution time		11µs (fosc = 455 kHz)	
No. of basic instructions		44 types	
Subroutines		1 level	
Timer frequency divider		1-bit reading time: 8 steps selectable from 10 to 14 steps 4-bit reading time: 12 to 15 steps	
Receiving decoder	**TC9244P** (9 functions)	General-purpose microcontroller	**TC9244P** (9 functions)
	TC9285P (11 functions)		**TC9285P** (11 functions)
	TC9259N (11 functions)		**TC9259N** (17 functions)

Electronic Volume ICs

Classification	Device	Functions	Package
Volume	**TC9235P/F**	Up/down-type electronic volume	DIP16-P-300-2.54A
	TC9260P/F	Serial data control-type electronic volume	SOP16-P-300-1.27
Tone control	**TC9184AP**	Serial data control-type electronic tone control	DIP16-P-300-2.54A
High dielectric strength volume	**TC9210P**	High dielectric strength, serial data control-type electronic volume	DIP16-P-300-2.54A
	TC9211P	High dielectric strength, serial data control-type electronic volume + loudness	DIP20-P-300-2.54A
	TC9299P	High dielectric strength, serial data control-type electronic volume	DIP16-P-300-2.54A
	▼ **TC9412AP**	High dielectric strength, serial data control-type electronic volume + loudness	DIP20-P-300-2.54A
	▼ **TC9412AF**		SOP24-P-450-1.27A
	▼ **TC9413AP**	High dielectric strength, serial data control-type electronic volume	DIP16-P-300-2.54A
	☆ **TC9459N**	High dielectric strength, serial data control-type electronic volume + loudness	SDIP28-P-400-1.78
	☆ **TC9459F**		SOP24-P-450-1.27A
	☆ **TC9463N**	6-ch, high dielectric strength, serial data control-type electronic volume	SDIP28-P-400-1.78
	☆ **TC9463F**		SOP28-P-450-1.27
Single-chip volume	▼ **TC9421F**	Volume, 2-band tone control, 4-input selector, fader	QFP44-P-1414-0.80D
	☆ **TC9422N**	Volume, 2-band tone control, 4-input selector	SDIP28-P-400-1.78
	☆ **TC9422F**		SOP28-P-450-1.27
	☆ **TC9448F**	7-band graphic equalizer, 0 to ±14 dB, 2 dB steps	QFP60-P-1414-0.80D

▼: New product ☆: Under development

Analog Switches

With electronic control of audio equipment having currently become the norm, analog switches play a more important role than ever. Toshiba offers a complete lineup of analog switch arrays and other ICs able to accommodate a wide range of specifications.

Analog Switch Arrays (TC9273N/F, TC9274N/F)

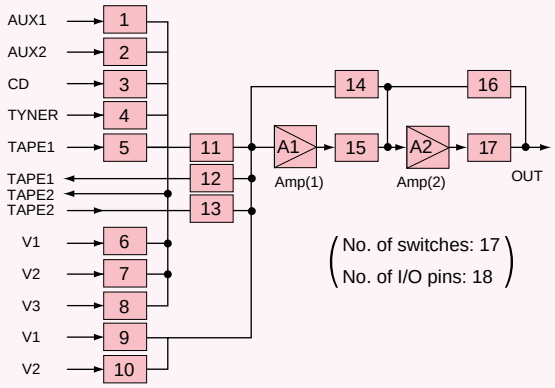
The TC9273N/F and TC9274N/F are analog switch array ICs developed exclusively for use in home stereo systems and other audio equipment. External wiring can be performed logically and efficiently, as these ICs allow switch connections to be laid out as desired to match the specifications of the particular set being used.

Features

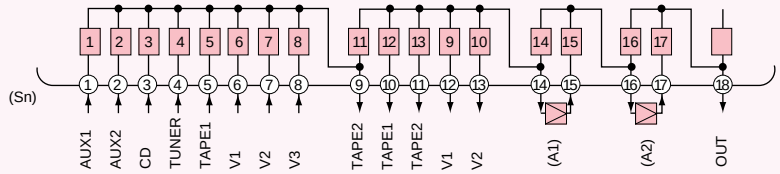
- Operating power supply voltage
  Dual power supplies: ±8 to ±17 V
  Single power supply: 8 to 18 V
- Switches
  TC9273N/F: 10 switches x 2 channels
  TC9274N/F: 18 switches x 2 channels
- Switch connections can be set with an aluminum mask process
- Built-in interface for 5 V system microcontrollers

Application Circuit Example

1) Switch connection example of applicable set (N :Switch number)



2) Example of the above circuit realized with a switch array



Classification	Device	Functions	Package
Analog switch	**TC9162AN/AF**	High dielectric strength, analog function switch array	SDIP28-P-400-1.78 SOP28-P-450-1.27
	TC9163AN/AF		
	TC9164AN/AF		
	TC9208N	6-circuit stereo, high dielectric strength analog switch	SDIP28-P-400-1.78
	TC9209N	4-circuit tape monitor stereo, high dielectric strength analog switch	
	TC9214AP/AF	High dielectric strength, low distortion rate analog switch 1-contact, analog switch x 3.2-contact analog switch x 1	DIP16-P-300-2.54A SOP16-P-300-1.27
	TC9215AP/AF	High dielectric strength, low distortion rate analog switch 2-circuit, 1-contact analog switch x 1,2-circuit analog switch x 1	DIP16-P-300-2.54A SOP16-P-300-1.27
	TC9273N/F	High dielectric strength, analog switch array Semi-custom compatibility	SDIP28-P-400-1.78 SOP28-P-450-1.27
	TC9274N/F		SDIP42-P-600-1.78 QFP44-P-1414-0.80D

Microcontrollers

When selecting a microcontroller for control of the increasingly diverse and multi-functional personal audio systems of today, we strongly recommend our complete lineup of high-performance microcontrollers. In addition, together with offering OTP (one-time PROM) for functional evaluation of application systems that can be used in the initial production stage, Toshiba also has available a complete assortment of support tools (RTE) that provide powerful support in developing application software.

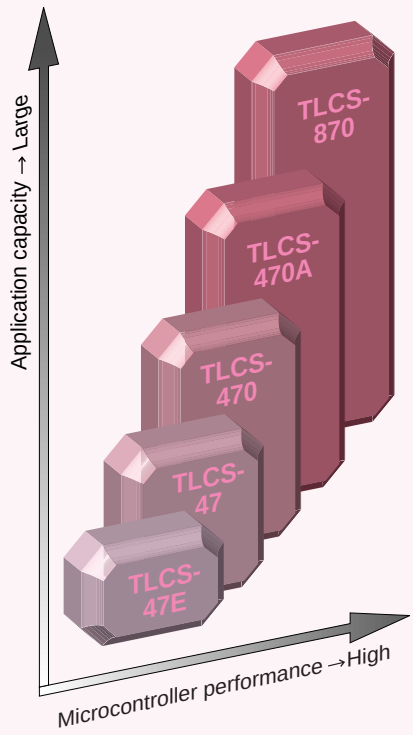
Microcontroller Lineup

	TLCS-47E	TLCS-47	TLCS-470	TLCS-470A	TLCS-870
ROM	4KB max		8KB max	16KB max	64KB max
RAM	256 W max		512 W max	768 W max	
Min. instruction execution time	1.9 µs @4.2 MHz		1.3 µs @6 MHz 244 µs @32.8 kHz		0.5 µs @8 MHz 122 µs @32.8 kHz
No. of instructions	90 types		92 types	105 types	129 types
Interrupts	6 sources max.				15 sources max.
Basic internal functions (※ see next page)	Interval timer				Time-based timer
	※		Watchdog timer		
	12-bit timer/counter x 2 channels				※
	4-bit serial interface		8-bit serial interface		

Wide Variety of Support Tools for Development of Application Software

Toshiba offers various types of highly functional support tools for development of application software.

Please refer to the "Toshiba Microcomputer Products Guide" for further details regarding support tool products.



Toshiba accepts orders for original software development.

Toshiba offers a special service for the development of microcontroller software for original applications. Please inquire at your nearest dealer for details.

4-bit Microcontrollers TLCS-47/470/470A Series

Device	OTP	Display driver	Additional functions		ROM (bytes)	RAM (nibbles)	I/O ports	Package
TMP47C222N/F	**TMP47P422VN/VF**	LCD	8-bit A/D converter x 4 channels, zero-cross detection circuit, pulsed output circuit		2K	192	20/22	SDIP42/ QFP44
TMP47C422N/F					4K	256		
TMP47C620DF	**TMP47P820VDF**		8-bit, high-speed timer/counter x 2 channels, watchdog timer		6K	384	36	QFP80
TMP47C820DF					8K	512		
TMP47C446ADF	**TMP47P446VDF**		8-bit A/D converter x 4 channels, watchdog timer		4K	256	24	QFP64
TMP47C670N	**TMP47P870N**	VFT	4-bit A/D conversion input x 4 channels, 14-bit PWM output, remote control judg-ment circuit	Watch-dog timer	6K	384	53	SDIP64
TMP47C870N					8K	512		
TMP47C1270AN	**TMP47P1670VN**				12K	768		
TMP47C1670AN					16K			
TMP47C662AN	**TMP47P862VN**		8-bit A/D converter x 8 channels, 12-bit PPG output x 2 channels		6K	384	55	
TMP47C862AN					8K	512		
TMP47C660AN/AF	**TMP47P860VN/VF**	LED	8-bit A/D converter x 8 channels, remote control judgment circuit		6K	384	56	SDIP64 QFP64
TMP47C860AN/AF					8K	512		
TMP47C1260N/F	**TMP47P1660VN/VF**				12K	768		
TMP47C1660N/F					16K			

Package Types N/E: SDIP, F/G: QFP

8-bit Microcontrollers TLCS-870 Series

Device	OTP	Display driver	Additional functions	ROM (bytes)	RAM (bytes)	I/O ports	Package
TMP87C800N/F	**TMP87PH00N/F**	LED	Timer/counter x 4 channels, serial interface x 2 channels	8K	256	58	SDIP64 QFP64
TMP87CH00N/F				16K			
TMP87CC20F	**TMP87PH20F**	LCD	8-bit PWM output, timer/counter x 5 channels, serial interface x 1 channel	12K	512	45	QFP80
TMP87CH20F				16K			
TMP87CK20AF	**TMP87PM20F**			24K	1K		
TMP87CM20AF				32K			
TMP87CH21F/DF	**TMP87PP21F/DF**		8-bit PWM output, timer/counter x 4 channels, serial interface x 2 channels, 8-bit A/D converter x 8 channels	16K	1K	52	QFP80
TMP87CM21F/DF				32K			
TMP87CM23F	**TMP87PP23F**		8-bit PWM output, timer/counter x 5 channels, serial interface x 2 channels, 8-bit A/D converter x 8 channels	32K	1K	70	QFP100
TMP87CP23F				48K	2K		
TMP87CH29U	**TMP87PM29U**		8-bit PWM output, timer/counter x 4 channels, UART x 1 channel, 8-bit A/D converter x 5 channels	16K	1K	43	SVFP64
TMP87CK29U				24K			
TMP87CM29U				32K			
TMP87C874F	**TMP87PM74F**	VFT	I^2C bus x 1 channel, timer/counter x 4 channels, serial interface x 1 channel, 8-bit A/D converter x 12 channels	8K	512	71	QFP80
TMP87CH74F				16K			
TMP87CH75F	**TMP87PM75F**		I^2C bus x 1 channel, timer/counter x 4 channels, serial interface x 1 channel, 8-bit A/D converter x 12 channels	16K	512	89	QFP100
TMP87CM75F				32K	1K		
TMP87C840N/F	**TMP87PH40N/F**	LED	Timer/counter x 4 channels, serial interface x 2 channels, 8-bit A/D converter x 8 channels	8K	256	56	SDIP64 QFP64
TMP87CC40N/F				12K	512		
TMP87CH40N/F				16K			
TMP87CK40N/F	**TMP87PM40N/F**			24K	1K		
TMP87CM40AN/F				32K			
TMP87C446N	**TMP87PH46N**		Timer/counter x 4 channels, serial interface x 1 channel, serial output x 1 channel, 8-bit A/D converter x 8 channels	4K	512	35	SDIP42
TMP87C846N				8K			
TMP87CH46N				16K			
TMP87C447U	**TMP87PH47U**			4K		37	QFP44
TMP87C847U				8K			
TMP87CH47U				16K			
TMP87CM64F	**TMP87PS64F**		Timer/counter x 5 channels, serial interface x 3 channels, 8-bit A/D converter x 16 channels	32K	1K	90	QFP100
TMP87CP64F				48K	2K		
TMP87CS64F				60K			

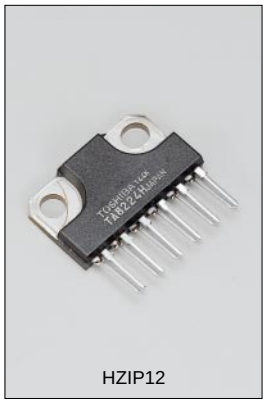
Package Type P:DIP,N/E:SDIP,F/G:QFP

Semiconductor Devices for Power Supply Circuits

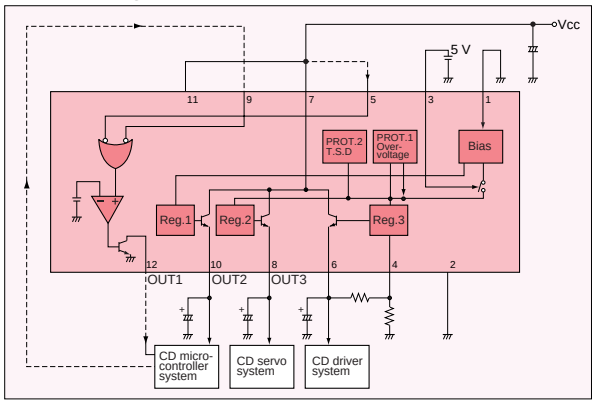
TA8224H

Multiregulator IC for CD Drivers

- Three constant-voltage power supply outputs
  OUT1: 5 V (typ.)/100 mA (max)
  OUT2: 5 V (typ.)/300 mA (max)
  OUT3: 8 V (typ., variable voltage)/1.2 A (max)
- Built-in reset circuit: 2 inputs, 1 output
- Built-in standby circuit and various protection circuits
- Operating input voltage range
  V_{IN}(opr) = 6 to 20 V (when outputs 1 to 3 are active)
  V_{IN}(opr) = 6 to 24 V (when only output 1 is active)


HZIP12

Block Diagram



±5 V Regulator IC with Reset Function

Device	Output voltage/current	Remarks	Package
TA2019AP	±5 V / ±100 mA	Reset, thermal shutdown protection circuit, output on/off terminal	DIP16

3-terminal Regulators

Device	Polarity	Output current	Output voltage lineup (V)														Remarks	Package
			5	5.7	6	7	7.5	8	9	10	12	13.2	15	18	20	24		
TA78xxS	Positive	1 A	○	○	○	○		○	○	○	○		○	○	○	○		TO-220NIS
TA78MxxS	Positive	500 mA	○		○			○	○	○	○		○	○	○	○		
TA79xxxS	Negative	1 A	○		○	○		○	○	○	○		○	○	○	○		
TA78DMxxS	Positive	500 mA	○					○	○		○						Dropout 0.75 V(max)	
TA78DLxxS	Positive	250 mA	○		○			○	○	○	○		○				Dropout 0.6 V(max)	
TA78LxxxAP	Positive	150 mA	○		○	○	○	○	○	○	○	○	○	○	○	○		TO-92MOD
TA78DSxxBP	Positive	30 mA	○		○			○	○	○	○		○				Dropout 0.3 V(max)	
TA76431S	Positive	150 mA	Variable (2.5–36 V)														Shunt regulator	
TA79LxxxP	Negative	150 mA	○		○			○	○	○	○		○	○	○	○		
TA78LxxS	Positive	100 mA	○			○		○	○	○	○		○					TO-92
TA78LxxF	Positive	150 mA	○		○	○		○	○	○	○		○	○	○	○		SOT-89 (PW-MINI)
TA78DSxxF	Positive	30 mA	○		○			○	○	○	○		○				Dropput 0.3 V(max)	
TA79LxxF	Negative	150 mA	○		○			○	○	○	○		○	○	○	○		
TA76431F	Positive	150 mA	Variable (2.5–36 V)														Shunt regulator	
TA78xxF	Positive	1 A	○	○	○	○	○	○	○	○	○		○	○	○	○		PW-MOLD
TA78MxxF	Positive	500 mA	○		○		○	○	○	○	○		○	○	○	○		
TA78xxSB	Positive	1 A	○	○	○	○	○	○	○	○	○		○	○	○	○		TPL
TA78MxxSB	Positive	0.5 A	○		○		○	○	○	○	○		○	○	○	○		
TA79xxxSB	Negative	1 A	○		○	○	○	○	○	○	○		○	○	○	○		

General-purpose Rectifiers

$I_{F(AV)}$(A) \ V_{RAM}(V)	100	400	600	1000	Package
1	**U1BC44**	**U1GC44**	**U1JC44**		I-FLAT(SMD)
1	**S5688B**	**S5688G**	**S5688J**	**S5688N**	DO-41SS
1	**1S1885**	**1S1887**	**1S1888**	**1S1830**	DO-15
1.2	**1S1885A**	**1S1887A**	**1S1888A**		DO-15
1.5	**1R5BZ41**	**1R5GZ41**	**1R5JZ41**	**1R5NZ41**	DO-15L
2	**U2BC44**	**U2GC44**	**U2JC44**		I-FLAT2(SMD)
3	**3BZ41**	**3GZ41**	**3JZ41**	**3NZ41**	DO-201AD

Bridge Rectifiers

I_O(A) \ V_{RRM}(V)	400	600	Package
0.5	**0R5G4B42**		DIP
1	**1G4B42**	**1J4B42**	DIP
1	**U1G4B42**	**U1J4B42**	H-FLAT-L(SMD)

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