

LC7520

3012A

CMOS LSI

Electronic Volume Control for Graphic Equalizer

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The 3-chip configuration consisting of the LC7520, a controller (LC7060 or general-purpose microcomputer LC6502, etc.), and a display LSI (LC7560 → LCD, LC7565 → FLT, LED) provides an electronic graphic equalizer system having the following features.

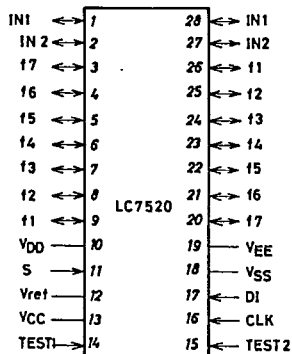
Functions

- On-chip electronic volume control for graphic equalizer with 7 bands each of right/left.
- 2dB/step variable in each band.
- Maximum boost of +10dB, maximum cut of -10dB, and 11 positions in each band.
- Setting can be made separately for right/left band.
- Band setting is made by serial data input. There are 2 control lines.
- Wide dynamic range.
- CMOS LSI of 40V breakdown voltage.

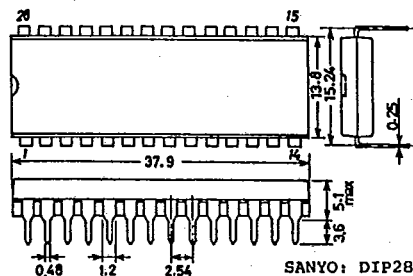
Features

- The gain in each band can be increased/decreased with one touch.
- Since the preset memory contents can be called with one touch, your desired frequency characteristic to the music can be selected.
(Example) User option 2 modes + Maker option 3 modes + Last channel memory
- '0dB in each band (flat function)', 'The frequency characteristic in each band is reversed with respect to 0dB (reverse function).' - These functions can be software-controlled with one touch.
- Spectrum analyzing display facilitates recording equalization.
- Since 2 control lines can be also used for a display LSI, wiring between microcomputer and LSI is facilitated.

Pin Assignment



Case Outline 3012A-D28IC
(unit:mm)



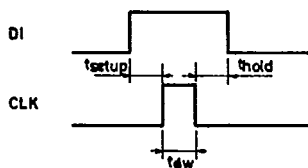
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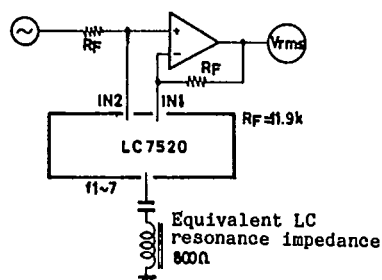
Absolute Maximum Ratings at $T_a=25^{\circ}\text{C}, V_{SS}=0\text{V}$					unit
Maximum Supply Voltage	$V_{DD\max}$	V_{DD}	$V_{EE}\leq V_{SS}$	$V_{DD}-V_{EE}\leq 40$	V
	$V_{EE\max}$	V_{EE}			
	V_{ref}	V_{ref}	$V_{SS}\leq V_{ref}$	$V_{DD}-V_{ref}\leq 11$	V
	$V_{CC\max}$	V_{CC}		V_{SS} to $V_{SS}+7$	V
Maximum Input Voltage	$V_{I1\max}$	CLK, DI		$V_{SS}-0.3$ to $V_{CC}+0.3$	V
	$V_{I2\max}$	f1 to f7, IN1, 2		$V_{EE}-0.3$ to $V_{DD}+0.3$	V
	$V_{I3\max}$	S, TEST1, 2		$V_{ref}-0.3$ to $V_{DD}+0.3$	V
Allowable Power Dissipation	$P_{d\max}$	$T_a\leq 75^{\circ}\text{C}$		150	mW
Operating Temperature	T_{opg}			-30 to +75	$^{\circ}\text{C}$
Storage Temperature	T_{stg}			-40 to +125	$^{\circ}\text{C}$

Allowable Operating Conditions at $T_a=25^{\circ}\text{C}, V_{SS}=0\text{V}$					unit
Supply Voltage	V_{DD}	V_{DD}	$V_{EE}\leq V_{SS}$	$8\leq V_{DD}-V_{EE}\leq 37$	V
	V_{EE}	V_{EE}	$V_{CC}\leq V_{DD}$		
	V_{ref}	V_{ref}	$V_{DD}-V_{ref}\leq 10$	0 to $V_{DD}-4.5$	V
	V_{CC}	V_{CC}		4.5 to (5.0typ) to 5.5	V
Input "H"-Level Voltage	V_{IH1}	CLK, DI		$0.8V_{CC}$ to V_{CC}	V
	V_{IH2}	S	$V_{ref}+0.9(V_{DD}-V_{ref})$	to V_{DD}	V
Input "L"-Level Voltage	V_{IL1}	CLK, DI		V_{SS} to $0.2V_{CC}$	V
	V_{IL2}	S	V_{ref} to $V_{ref}+0.1(V_{DD}-V_{ref})$		V
Input Pulse Width	t_{pw}	CLK		1 min.	us
Setup Time	t_{setup}	DI		1 min.	us
Hold Time	t_{hold}	DI		1 min.	us

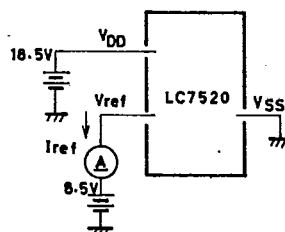
Electrical Characteristics at $T_a=25^{\circ}\text{C}, V_{SS}=0\text{V}$					min	typ	max	unit
Total Harmonic Distortion THD1 IN1, 2: All bands flat, $f=20\text{kHz}$, output 1V							0.005	%
THD2 IN1, 2: Boost, $f=20\text{kHz}$, output 1V							0.05	%
Crosstalk	CT	$f=1\text{kHz}$				60		dB
Setting Error	ΔB	[Other band flat] Test Circuit 1 (No reversion occurs.)	$\pm 10\text{dB}$	± 9	± 10	± 11.5		dB
			$\pm 8\text{dB}$	± 6.6	± 7.6	± 9.0		dB
			$\pm 6\text{dB}$	± 4.9	± 5.9	± 7.2		dB
			$\pm 4\text{dB}$	± 3.0	± 3.8	± 4.9		dB
			$\pm 2\text{dB}$	± 1.0	± 1.9	± 3.0		dB
Analog SW OFF Leak Current	I_{off}	IN1, IN2, f1 to f7					10	uA
Pull-down Resistance	R_{PD}	S : $V_{DD}=13\text{V}, S$				100		kohm
Current Dissipation	I_{DD}						1	mA
	I_{CC}						0.5	mA
Current Dissipation	I_{ref}	$V_{DD}-V_{ref}: V_{DD}-V_{ref}=10\text{V}$ Test Circuit 2			-1			mA



Test Circuit 1



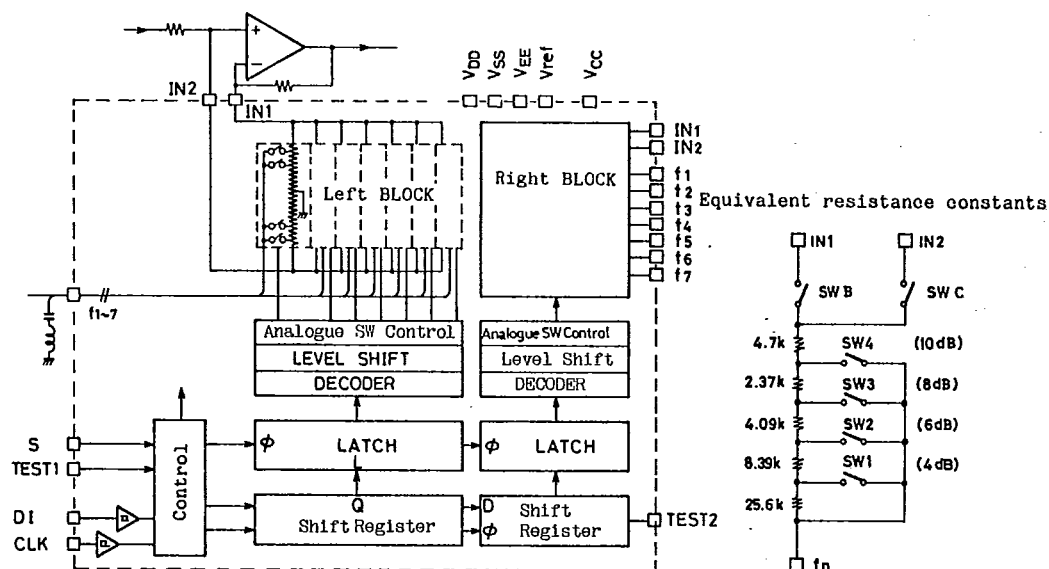
Test Circuit 2



LC7520

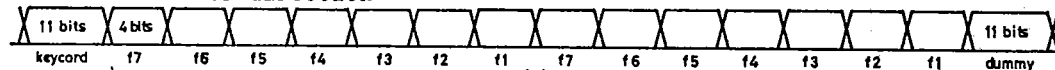
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Equivalent Circuit Block Diagram



Data Code 78 bits in all

→ Data transfer direction



LC7520 Pin S='0'

1 1 1 1 1 0 0 0 0 1 0

Pin S='1'

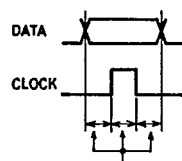
1 1 1 1 1 0 0 0 0 1 1

Transfer
→ direction

10 dB	0 1 0 1
8	0 1 0 0
6	0 0 1 1
4	0 0 1 0
2	0 0 0 1
0	0 1 1 0
-2	1 0 0 1
-4	1 0 1 0
-6	1 0 1 1
-8	1 1 0 0
-10	1 1 0 1

0 0 0 0 0 0 0 0 0 0 0

last bit



1us or greater

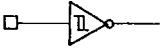
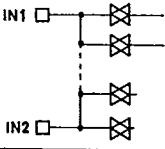
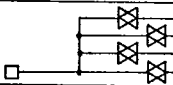
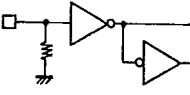
Note 1. When power is applied, data "0" must be first transferred for 67 clocks (initial clock) or more. If data transfer is stopped halfway, the transfer of the remaining data must be completed or data transfer must be started after the initial clocks have been transferred.

Note 2. When the DI, CLK pins are shared with the LC7560, etc., the maximum initial clocks for such device must be transferred.

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Pin Description

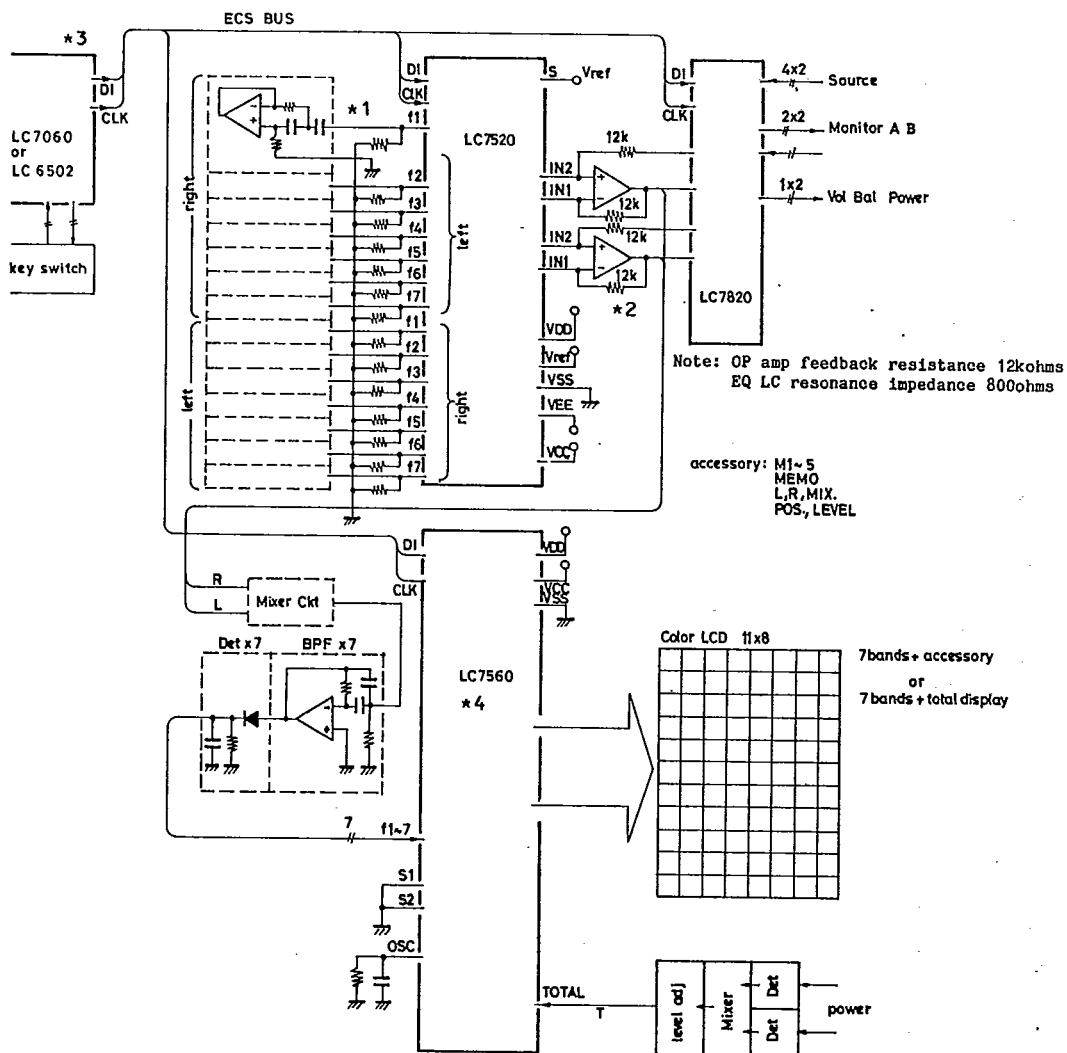
Pin Name	Pin No.	Pin Configuration	Description
V _{DD}	10		Power supply pin, +18V(typ)., power supply for audio signal.
V _{ref}	12		Power supply pin, V _{DD} -5V(typ)., power supply for logic drive.
V _{SS}	18		Power supply pin 0V.
V _{EE}	19		Power supply pin, -18V(typ)., power supply for audio signal.
V _{CC}	13		Power supply pin, +5V.
D _I	17		- Used to input data from CPU. - Schmitt inverter type.
CLK	16		- Used to input CLK from CPU. - Schmitt inverter type.
IN1 IN2	1,28 2,27		- Audio signal input pin. - Normally, IN1 is connected to inverting input of OP amp. - Normally, IN2 is connected to noninverting input of OP amp. - Provided in Lch/Rch.
f1tof7	3to9 20to26		- Bandpass filter connecting pin. - f1 to f7 x 2 (right/left) = 14 pins in all.
S	11		- Select pin at 2-chip used mode. - With pull-down resistor. - To accept data under key code 7C3, S must be set to '1'.—→Connected to V_{DD}. - To accept data under key code 7C2, S must be set to '0'.—→Connected to V_{ref}.
TEST1	14		- IC test pin. - Open during operation.
TEST2	15		

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Sample Application Circuit

(1) 7-Band LCD MIX Display (LC7520 x 1, LC7560 x 1)

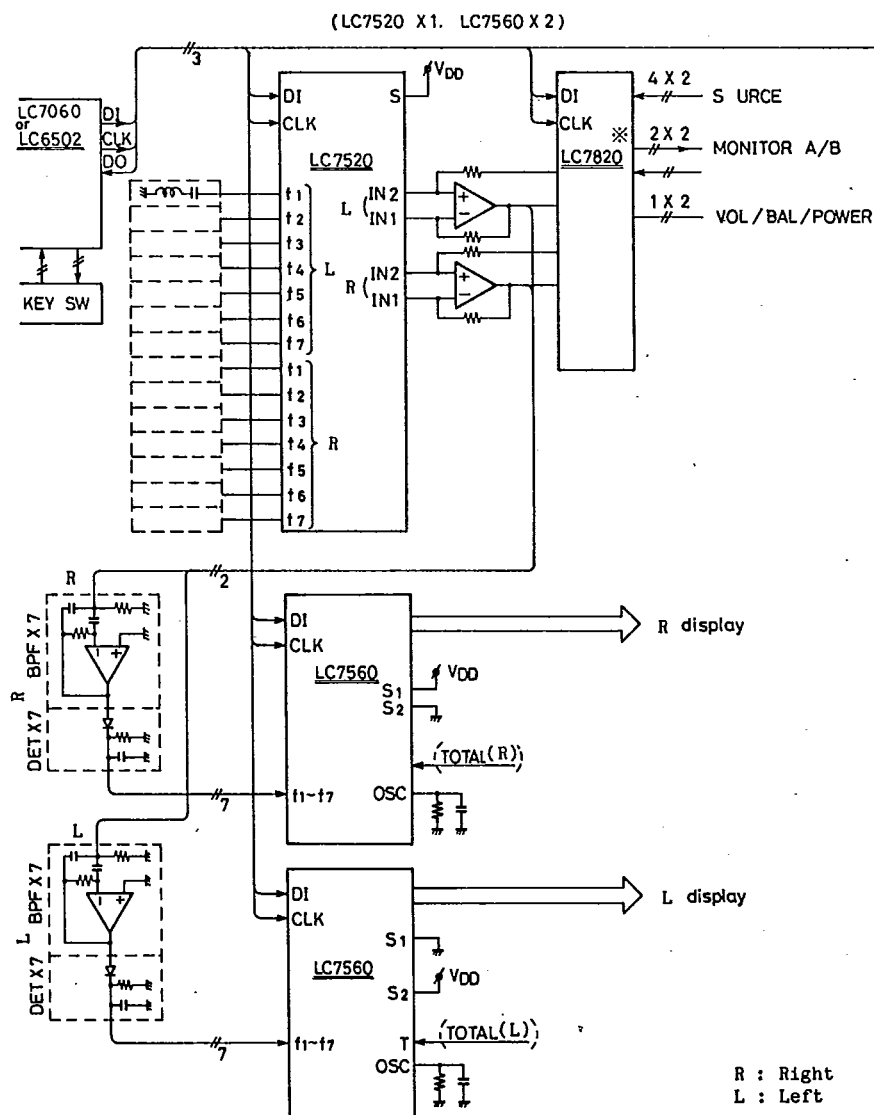


- *1 It is recommended that pins f1 to f7 are connected to the signal Gnd through resistors of 1Mohm so that noise is minimized at the select mode.
- *2 The optimum conditions for 2dB/step are as follows:
OP amp feedback resistance: 12kohms
Equivalent LC resonance impedance: 800ohms
- *3 The LC7060 is available as a standard controller.
- *4 The LC7560 (LCD driver), LC7565 (FLT, LED driver) are available as spectrum analyzing display drivers for graphic equalizer output signal.

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(2) 7-Band R/L Separate Display (LC7520 x 1, LC7560 x 2)

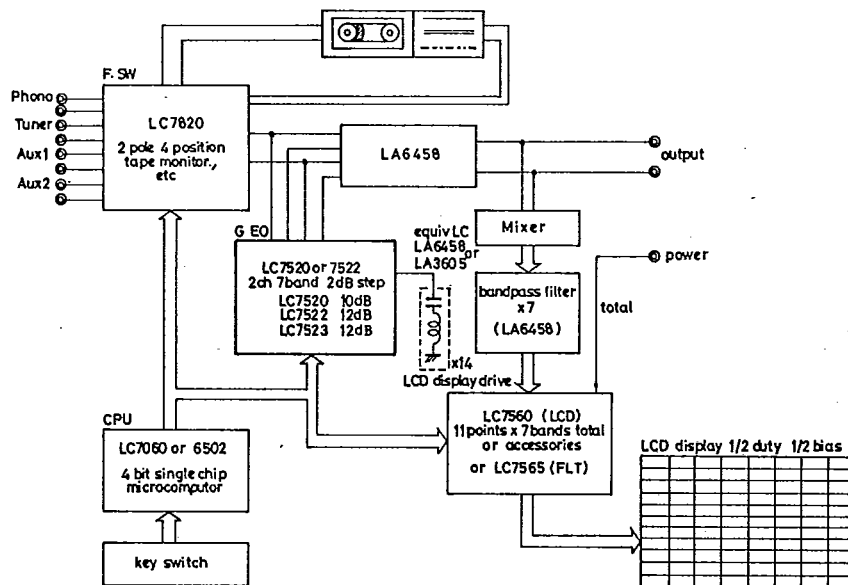


(3) 14-Band R/L Separate Display (LC7520 x 2, LC7560 x 4)

The diagram illustrates the system architecture for the LC7560-based video system. It shows the following components and their interconnections:

- LC7060 or LC6502:** Provides DI, CLK, and DO signals. It is connected to a KEY SW and two X14 crystals.
- LC7520 #1 and #2:** These chips receive DI, CLK, and S signals. They are connected to VDD and Vref. Their IN1 and IN2 inputs are connected to the outputs of the LC7060/LC6502 and the LC7820. The outputs of LC7520 #1 and #2 are connected to the inputs of the LC7820.
- LC7820:** Receives DI, CLK, and S signals. It is connected to a 4x2 SOURCE, a 2x2 MONITOR A/B, and a 2x2 VOL/BAL/POWER. Its outputs are connected to the inputs of the LC7560 chips.
- LC7560 #1 and #2:** These chips receive DI, CLK, and S signals. They are connected to VDD and Vref. Their IN1 and IN2 inputs are connected to the outputs of the LC7820. The outputs of LC7560 #1 and #2 are connected to the inputs of the LC7560 chips.
- LC7560 #3 and #4:** These chips receive DI, CLK, and S signals. They are connected to VDD and Vref. Their IN1 and IN2 inputs are connected to the outputs of the LC7820. The outputs of LC7560 #3 and #4 are connected to the inputs of the LC7560 chips.
- Left display (11x16) and Right display (11x16):** The outputs of the LC7560 chips are connected to the displays.
- Other components:** The diagram includes a KEY SW, two X14 crystals, and two BPF/DET filters (X14).

[Reference 1] ECS System/Graphic Equalizer Application Circuit Block Diagram



[Reference 2] Main Specifications for LC7060 (Graphic Equalizer Controller)

Use

Controller LSI for graphic equalizer electronic volume control LSI: LC7520, 7522, 7523; LCD driver: LC7560; FLT driver: LC7565

Functions

- 7 bands, 2dB/step, $\pm 10\text{dB}(\pm 12\text{dB})$ variable, (): LC7522/7565/7565-combined use.
- Max. 8 memories (user option 5 modes, maker option 3 modes) + last channel memory.
- Possible to control function switch (5 positions) and electronic volume control.
- 2 control lines for graphic equalizer electronic volume control and display IC.
- Buzzer sound is generated when a key is operated.
- On-chip remote control reception program.

Features

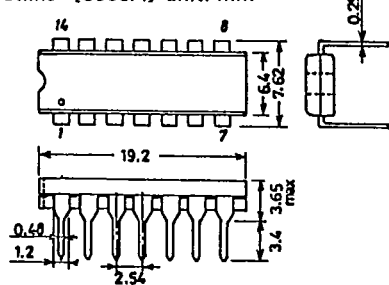
- Any combination of graphic equalizer electronic volume control LSI LC7520, 7522, 7523 and display driver LSI LC7560, 7565 may be used. (Port-selectable)
- FLAT function to permit the FLAT mode to be entered with one touch.
- REVERSE function to permit the frequency characteristic to be reversed with respect to 0dB with one touch.
- Tuner band select and SCAN output.
- MUTE and MUTE output.
- Backup operation available.

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AUDIO-USE MOS IC CASE OUTLINES

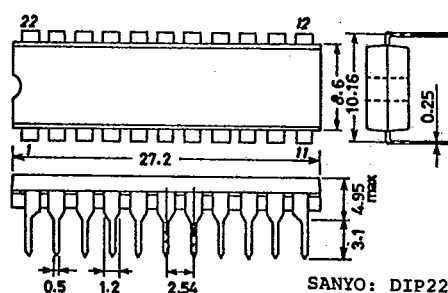
- All of Sanyo audio-use MOS IC case outlines are illustrated below.
- All dimensions are in mm, and dimensions which are not followed by min. or max. are represented by typical values.
- No marking is indicated.

Case Outline—[3003A] unit: mm



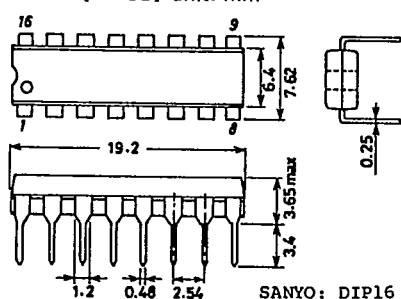
SANYO: DIP14

Case Outline—[3010A] unit: mm



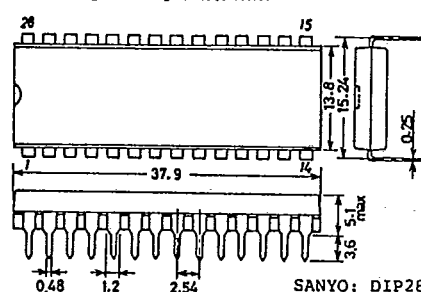
SANYO: DIP22

Case Outline—[3006B] unit: mm



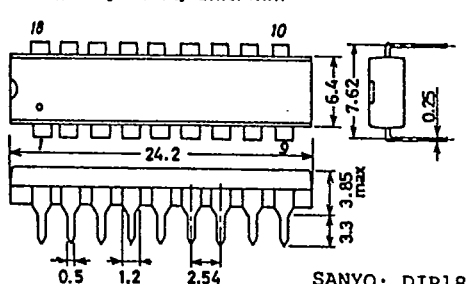
SANYO: DIP16

Case Outline—[3012A] unit: mm



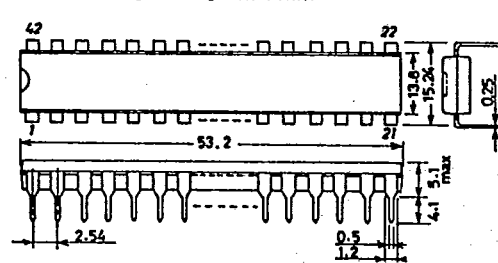
SANYO: DIP28

Case Outline—[3007A] unit: mm



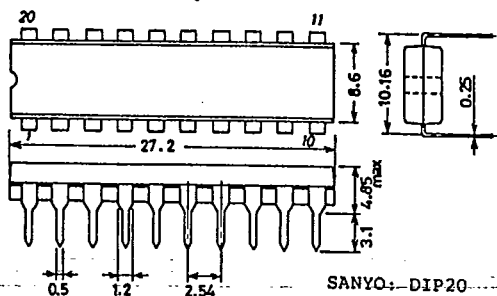
SANYO: DIP18

Case Outline—[3014A] unit: mm



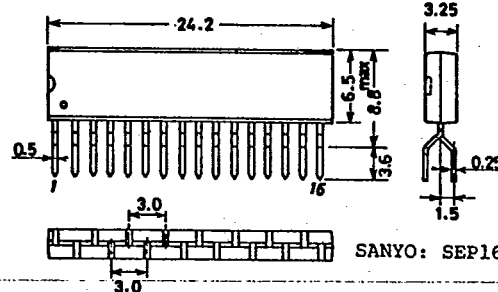
SANYO: DIP42

Case Outline—[3008A] unit: mm



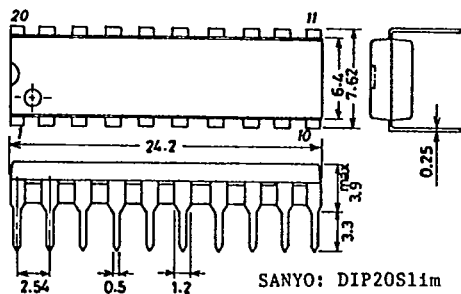
SANYO: DIP20

Case Outline—[3020A] unit: mm

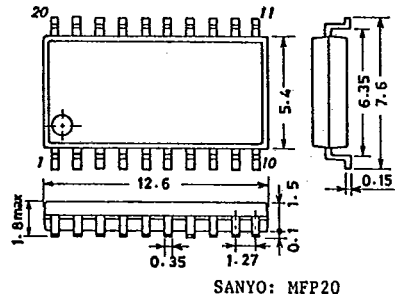


SANYO: SEP16

Case Outline—[3021B] unit: mm

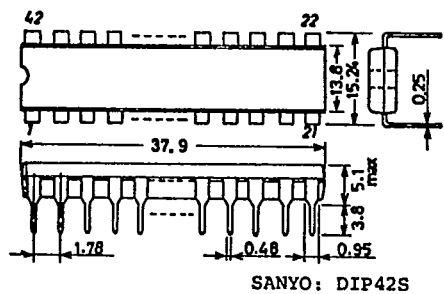


Case Outline—[3036B] unit: mm

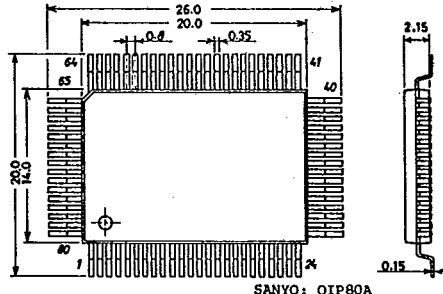


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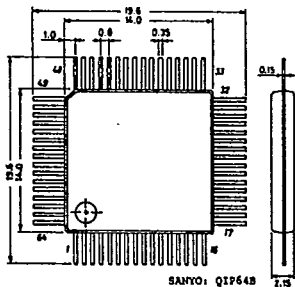
Case Outline—[3025B] unit: mm



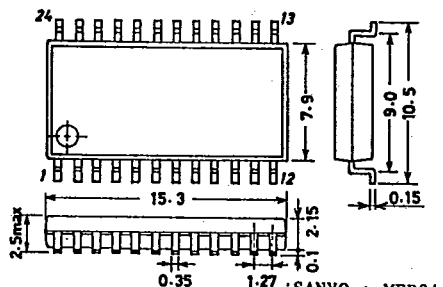
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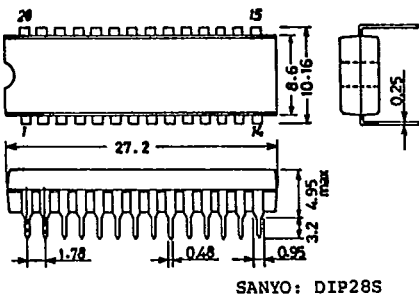
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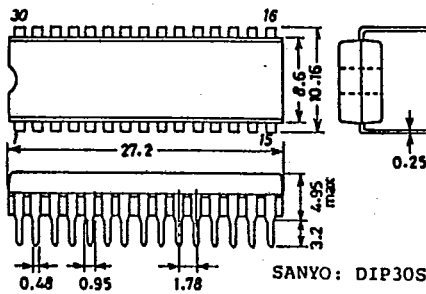
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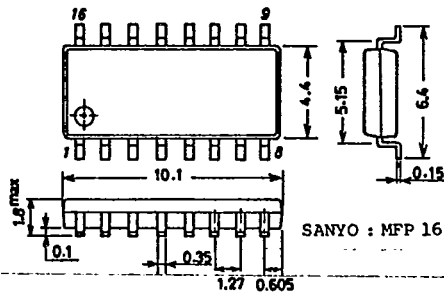
Case Outline—[3029A] unit: mm



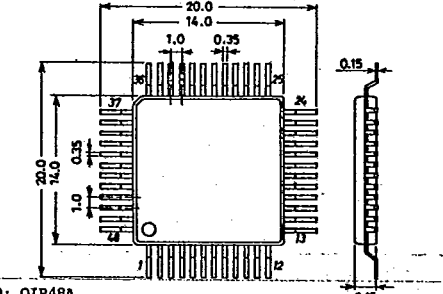
Case Outline—[3047A] unit: mm



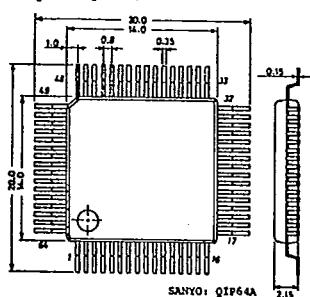
Case Outline—[3035A] unit: mm



Case Outline—[3052A] unit: mm



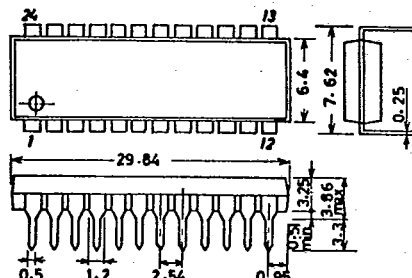
Case Outline—[3057] unit: mm



SANYO: OIP64A

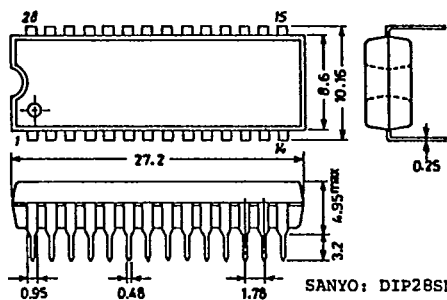
Case Outline—[3084] unit: mm

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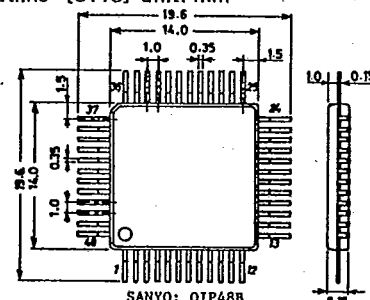
SANYO: DIP-24S11m

Case Outline—[3063] unit: mm



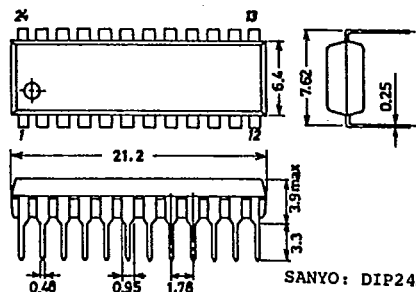
SANYO: DIP28SN

Case Outline-- [3118] unit: mm



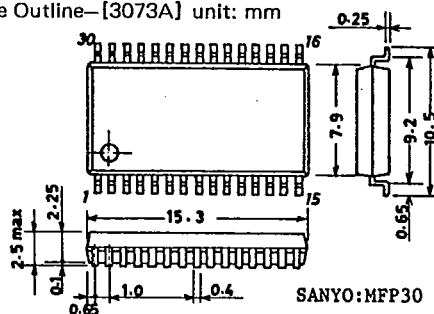
SANYO: QIP48B

Case Outline—[3067] unit: mm



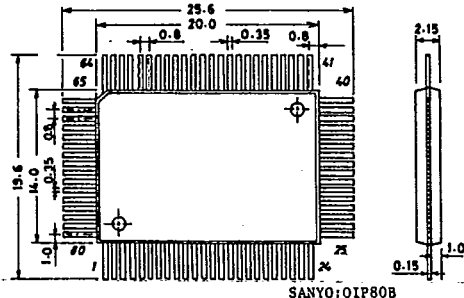
SANYO: DIP24S

Case Outline—[3073A] unit: mm



SANYO:MFP30

Case Outline—[3074] unit: mm



SANYO:QIP80B