

30068

T-74-05-01

CMOS LSI

Electronic Volume Controller

©568C

Applications

- An electronic volume control system is composed by using the LC7500 in conjunction with the electronic volume attenuator IC LA2600.

General Description

- The LC7500 contains a 5-bit binary up/down counter, an oscillation circuit, a clock signal generator, and a control circuit, etc. and provides up/down control of volume electronically.

Functions

- A 5-bit binary up/down counter is built in.
- Any value can be preset in the high-order 4 bits of the 5-bit binary up/down counter. In this case, the LSB is preset at "L" level.
- By connecting a ladder-type resistance network to the 5-bit output, the D-A conversion output is supplied to the LA2600.
- The following methods are used to cause the step to go up/down.

a) Manual up/down

- Each time the UP switch (or DOWN switch) is pushed, the contents of the 5-bit binary up/down counter will increase (or decrease) at a 1 step/push rate.

b) Auto up/down

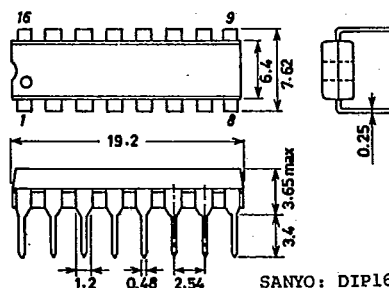
- If the UP switch (or DOWN switch) is held pushed for more than approximately 0.6 second, the contents of the 5-bit binary up/down counter will increase (or decrease) at an approximately 5Hz rate.
- If both of the UP and DOWN switches are pushed, the contents of the 5-bit binary up/down counter will remain unaffected.
- When the contents of the 5-bit binary up/down counter become "31" (or "0"), the contents of the counter will not change any more even if the UP switch (or DOWN switch) is pushed further.

Last stop memory

- Even if the UP switch (or DOWN switch) is pushed at the time of backup, the contents of the 5-bit binary up/down counter will remain unaffected.

- The clock signal generator generates the clock signal only when the UP switch (or DOWN switch) is pushed.

Case Outline 3006B-D16IC
(unit : mm)



Note : The LC7500M is available as a miniflat package version.

LC7500

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Pin Name

Pin No.	Name	Description	Pin No.	Name	Description
1	V _{DD}	Supply voltage (+)	9	A OUT	Count output
2	UP	UP input	10	B OUT	Count output
3	DOWN	DOWN input	11	C OUT	Count output
4	E IN	Preset jam data input	12	D OUT	Count output
5	D IN	Preset jam data input	13	E OUT	Count output
6	C IN	Preset jam data input	14	V _{ref}	Reference voltage input
7	B IN	Preset jam data input	15	PRESET	Initialize input
8	V _{SS}	Supply voltage (-)	16	OSC	Oscillator input

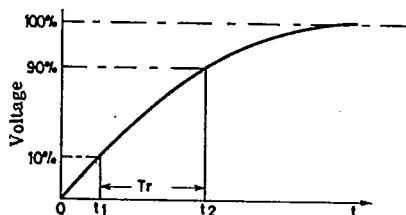
Note) Output pins must not be shorted to each other.

Absolute Maximum Ratings at Ta = 25°C, V_{SS} = 0V

Maximum Supply Voltage				V _{DD} max	Total applied time: within 30min.	-0.3 to +11	V
Reference Voltage	V _{ref}	V _{ref} ≤ V _{DD}		-0.3 to +14	V		
		V _{ref} ≤ V _{DD} , total applied time: within 30min.		-0.3 to +11	V		
				-0.3 to +14	V		
Note 1) Tr ≥ 10μs. $\overline{\text{UP}}, \overline{\text{DOWN}} + V_{DD}$ or Open							
Input Voltage	V _{IN}			-0.3 to V _{DD} + 0.3	V		
Allowable Power Dissipation	P _d max	T _a = -30°C to +75°C		100	mW		
Operating Temperature	T _{opg}			-30 to +75	°C		
Storage Temperature	T _{stg}			-40 to +125	°C		

Allowable Operating Conditions at Ta = 25°C, V_{SS} = 0V

		min	typ	max	unit
Supply Voltage	V _{DD} (1) Note 2)	8.0	9.3	10.3	V
	V _{DD} (2) Backup	4.5		10.3	V
Reference Voltage	V _{ref} V _{ref} ≤ V _{DD}	8.0	9.3	10.3	V
Input 'H'-Level Voltage	V _{IH} (1) UP, DOWN, V _{ref}	0.75V _{DD}		V _{DD}	V
	V _{IH} (2) PRESET	3.3		V _{DD}	V
	V _{IH} (3) B IN, C IN, D IN, E IN	0.85V _{DD}		V _{DD}	V
Input 'L'-Level Voltage	V _{IL} (1) UP, DOWN, V _{ref}	V _{SS}		0.25V _{DD}	V
	V _{IL} (2) PRESET	V _{SS}		0.5	V
	V _{IL} (3) B IN, C IN, D IN, E IN	V _{SS}		0.15V _{DD}	V
Pin PRESET External	t _p	PRESET, V _{DD} rise time:	30		msec
Time Constant		within 10msec.			
Oscillation Guaranteed	R _X	OSC, carbon film resistor,	150 - 5%	150	150 + 5% kΩ
External Resistance		f _{OSC} = 640Hz			
Oscillation Guaranteed	C _X	OSC, polystyrene film capacitor,	0.015 - 5%	0.015	0.015 + 5% μF
External Capacitance		f _{OSC} = 640Hz			
Operating Frequency	f _{opr}	OSC		5	kHz

Note1) Power supply rise time Tr (rise time) = t₂ - t₁Note 2) V_{DD} (1) : Normal operation guaranteed voltage, V_{DD} (2) : Backup guaranteed supply voltage

LC7500

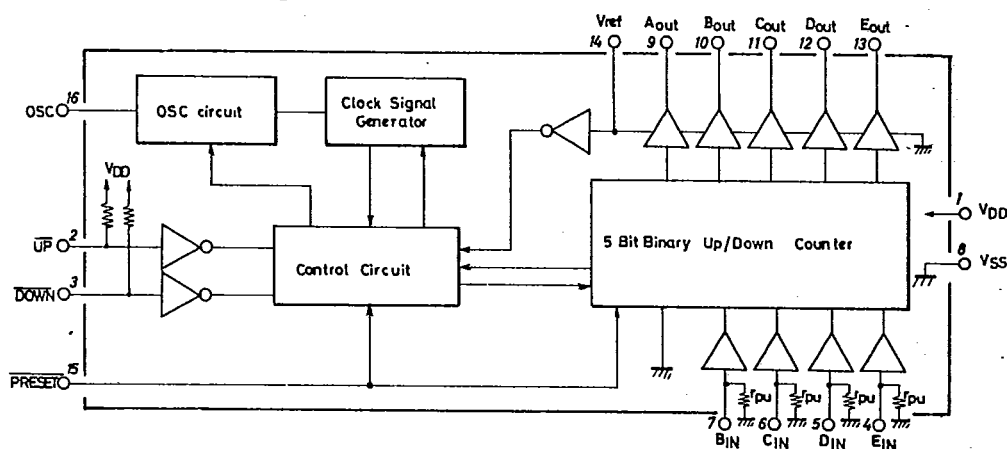
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Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{SS} = 0\text{V}$, $V_{DD} = 8.0$ to 10.3V , $V_{ref} = +8.0$ to $+10.3\text{V}$, at $V_{ref} \leq V_{DD}$

			min	typ	max	unit
Input Floating Voltage	$V_{IF}(1)$	UP, DOWN, input pin open	$V_{DD} - 0.5$			V
	$V_{IF}(2)$	B IN, C IN, D IN, E IN, after applying $V_{IN} = V_{SS}$			0.5	V
Input 'L'-Level Current	$I_{IL}(1)$	UP, DOWN, $V_{IN} = V_{SS}$	-170		-24	μA
	$I_{IL}(2)$	PRESET, $V_{ref}, V_{IN} = V_{SS}$	-3			μA
	$I_{IL}(3)$	B IN, C IN, D IN, E IN, $V_{IN} = 0.1V_{DD}$	-80		-3	μA
Input 'H'-Level Current	$I_{IH}(1)$	B IN, C IN, D IN, E IN, $V_{IN} = V_{DD}$			3	μA
	$I_{IH}(2)$	PRESET, $V_{IN} = V_{DD}$			3	μA
Output 'L'-Level Voltage	$V_{OL}(1)$	A OUT, $I_{OL} = 1\text{mA}$ Note)			0.8	V
	$V_{OL}(2)$	B OUT, $I_{OL} = 1\text{mA}$			0.4	V
	$V_{OL}(3)$	C OUT, $I_{OL} = 1\text{mA}$			0.2	V
	$V_{OL}(4)$	D OUT, $I_{OL} = 1\text{mA}$			0.1	V
	$V_{OL}(5)$	E OUT, $I_{OL} = 1\text{mA}$			0.05	V
Output 'H'-Level Voltage	$V_{OH}(1)$	A OUT, $I_{OH} = -1\text{mA}$	$V_{ref} - 0.8$			V
	$V_{OH}(2)$	B OUT, $I_{OH} = -1\text{mA}$	$V_{ref} - 0.4$			V
	$V_{OH}(3)$	C OUT, $I_{OH} = -1\text{mA}$	$V_{ref} - 0.2$			V
	$V_{OH}(4)$	D OUT, $I_{OH} = -1\text{mA}$	$V_{ref} - 0.1$			V
	$V_{OH}(5)$	E OUT, $I_{OH} = -1\text{mA}$	$V_{ref} - 0.05$			V
Oscillation Frequency	f_{OSC}	OSC, $R_X = 150\text{k}\Omega$, $C_X = 0.015\mu\text{F}$	510	640	770	Hz
Current Dissipation	$I_{DD}(1)$	V_{DD} : UP, DOWN = V_{SS} , $V_{DD} = 10.3\text{V}$, $V_{ref} = 8.0\text{V}$ B IN to E IN, PRESET = V_{DD}			2.0	mA
	$I_{DD}(2)$	V_{DD} : $V_{DD} = 5.5\text{V}$, backup B IN to E IN, PRESET, $V_{ref} = V_{DD}$, B IN to E IN, PRESET, $V_{ref} = V_{SS}$			0.2	mA
	I_{ref}	V_{ref} : no load			3	μA

Note) Current direction Plus (no sign) : Flowing into device, Minus : Flowing out of device

Equivalent Circuit Block Diagram

Note) r_{pu} is a special resistor which has a standard resistance value at "L" level and a high resistance value at "H" level. V_{ref} provides the following two functions.1) Supplying a reference voltage for the output buffer ($V_{ref} = 8.0$ to 10.3V)2) Inhibit function ($V_{ref} \leq 0.25V_{DD}$)

UP, DOWN function inhibit and output buffer cutoff

Pin Description**UP**

- Each time the "L" level voltage is applied, the volume will increase by 1 step. However, when the maximum level (31st step) is reached, no further increase will occur.
- If the "L" level voltage is held applied for more than approximately 0.6 second, the volume will automatically increase by 1 step for every approximately 0.2 second. When the maximum level of volume is reached, the volume will automatically stop increasing.

DOWN

- Each time the "L" level voltage is applied, the volume will decrease by 1 step. However, when the minimum level (0 step) is reached, no further decrease will occur.
- If the "L" level voltage is held applied for more than approximately 0.6 second, the volume will automatically decrease by 1 step for every approximately 0.2 second. When the minimum level of volume is reached, the volume will automatically stop decreasing.
- If the "L" level voltage is applied to pins **UP** and **DOWN** simultaneously, the count operation will stop.

PRESET

- If the "L" level voltage is applied, the LSI system will be initialized. The internal counter is initialized to be the value designated by jam data inputs B_{IN} to E_{IN} . The LSB is initialized to be "L" level.
- With a capacitor and a resistor attached to pin **PRESET** externally, preset function works only when the power supply is turned ON.

OSC

- With a capacitor and a resistor attached to pin **OSC** externally, oscillation of the reference frequency is provided. Oscillation is provided only when the "L" level voltage is applied to pin **UP** or **DOWN**. When V_{ref} becomes "L" level, oscillation will stop.

 B_{IN} , C_{IN} , D_{IN} , E_{IN} : Jam Data Inputs

- By attaching a capacitor and a resistor to pin **PRESET** as specified, the high-order 4 bits (B_{OUT} to E_{OUT}) of the counter are initialized as designated by B_{IN} to E_{IN} when the power supply is turned ON.
- At the "H" ("L") level input, the corresponding bits are initialized to be "H" ("L") level. A_{OUT} (LSB) is initialized to be "L" level.

 A_{OUT} , B_{OUT} , C_{OUT} , D_{OUT} , E_{OUT} : Count Outputs of Counter (A_{OUT} : LSC, B_{OUT} : MSB)

- The count contents of the internal 5-bit binary up/down counter are output. When V_{ref} is 0V (at the time of backup), the outputs will be "L" level.

 V_{ref} : Input Pin of Reference Voltage

- This is used as the power supply for the output buffers of the count outputs (A_{OUT} to E_{OUT}). Oscillation of the oscillator is stopped by detecting that V_{ref} has become 0V at the time of backup, and even if the UP or DOWN switch is pushed during backup, the holding step will not change.

Input Signal

- Switch signal Logic "L" ----- V_{SS}
 Logic "H" ----- V_{DD}
- PRESET** C, R are attached externally.
- OSC** C, R are attached externally.

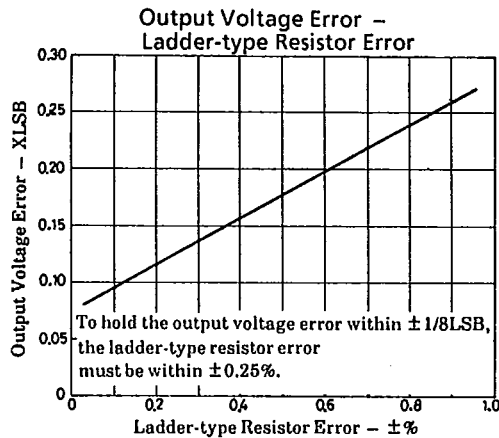
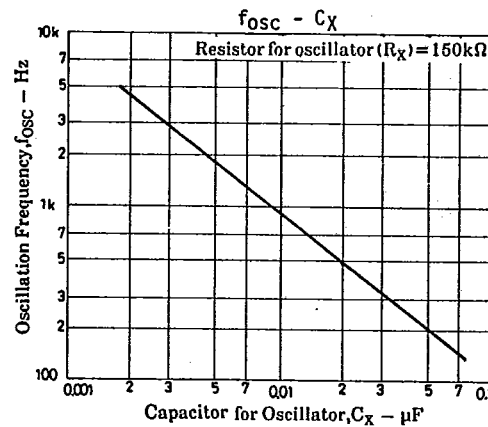
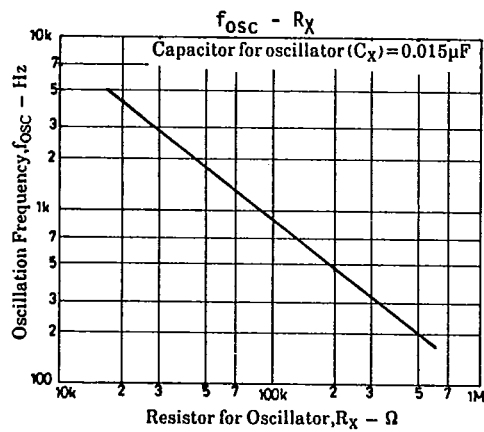
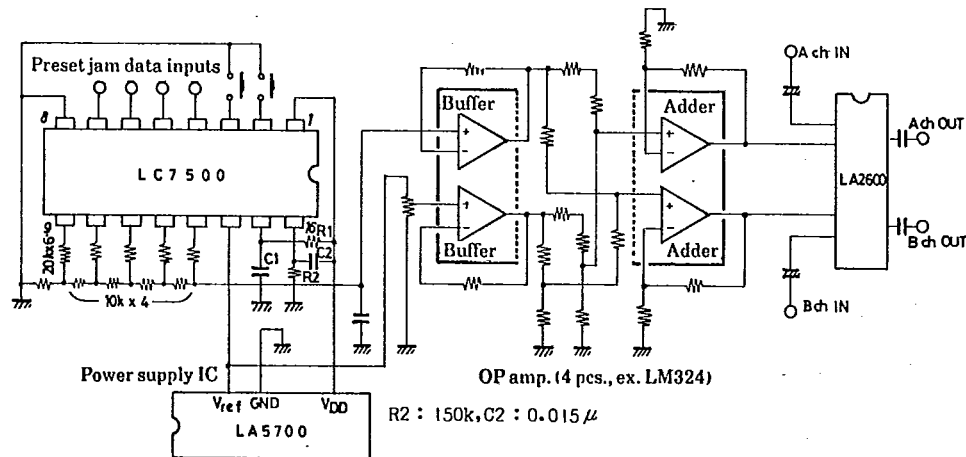
Output Configuration 5 bits (32 steps)

- Complementary output Logic "L" ----- V_{SS}
 Logic "H" ----- V_{ref}
- Ladder-type resistors externally attached 10k Ω , 20k Ω

LC7500

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Sample Application Circuit

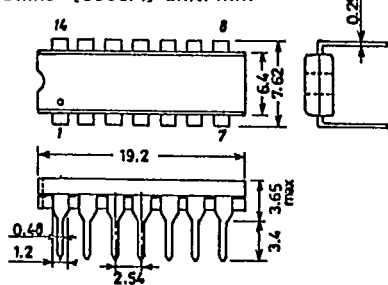


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AUDIO-USE MOS IC CASE OUTLINES

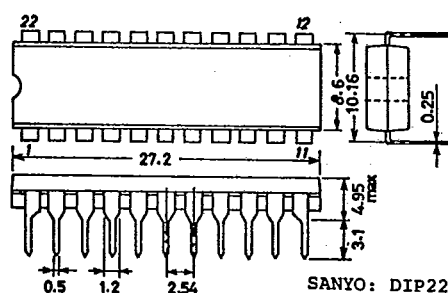
- All of Sanyo audio-use MOS IC case outlines are illustrated below.
- All dimensions are in mm, and dimensions which are not followed by min. or max. are represented by typical values.
- No marking is indicated.

Case Outline—[3003A] unit: mm



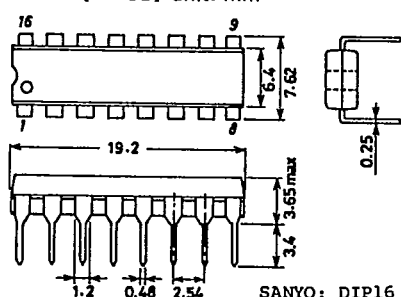
SANYO: DIP14

Case Outline—[3010A] unit: mm



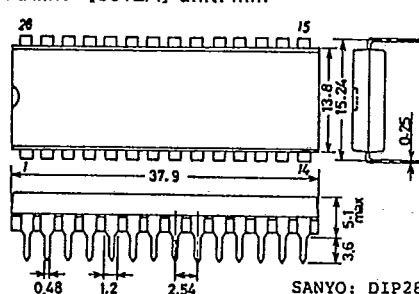
SANYO: DIP22

Case Outline—[3006B] unit: mm



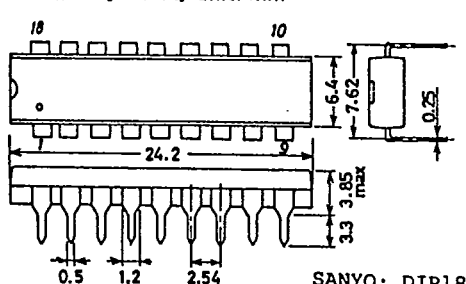
SANYO: DIP16

Case Outline—[3012A] unit: mm



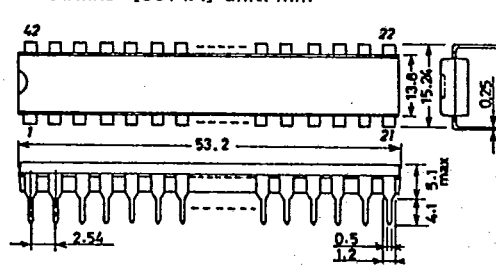
SANYO: DIP28

Case Outline—[3007A] unit: mm



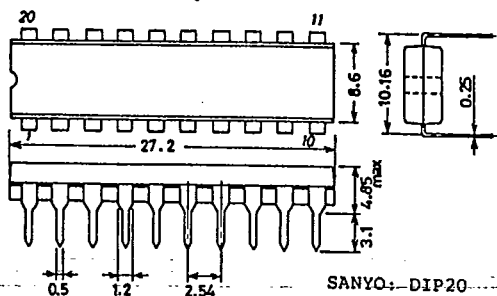
SANYO: DIP18

Case Outline—[3014A] unit: mm



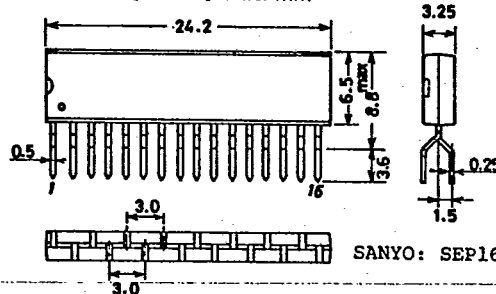
SANYO: DIP42

Case Outline—[3008A] unit: mm



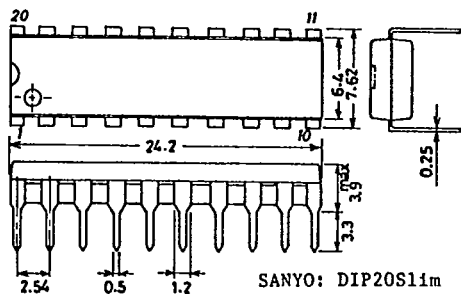
SANYO: DIP20

Case Outline—[3020A] unit: mm

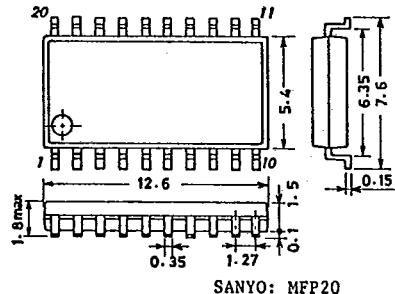


SANYO: SEP16

Case Outline—[3021B] unit: mm

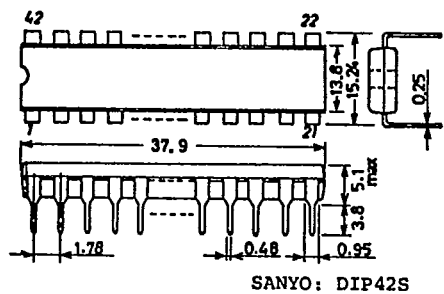


Case Outline—[3036B] unit: mm

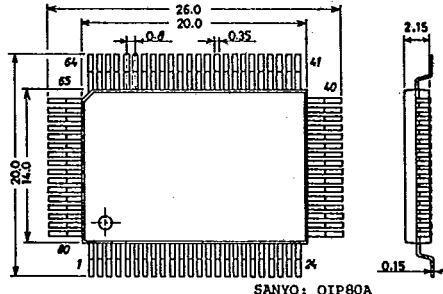


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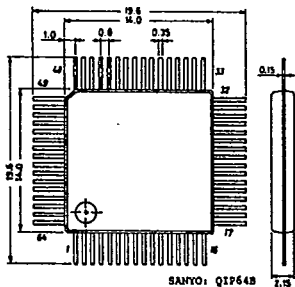
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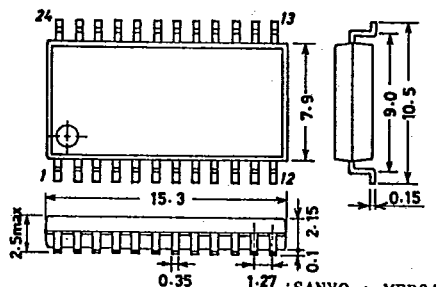
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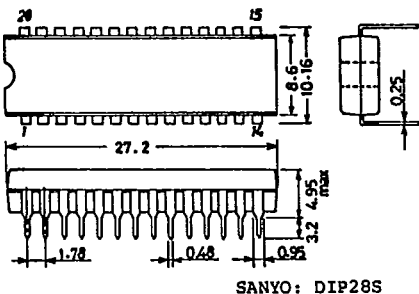
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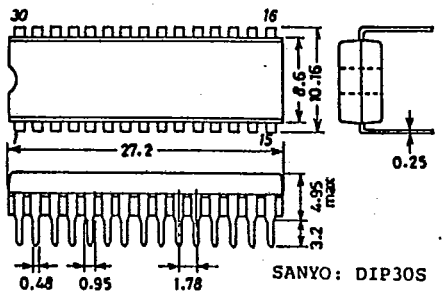
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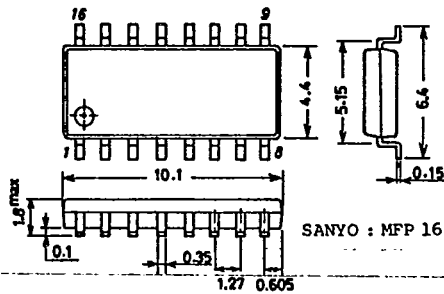
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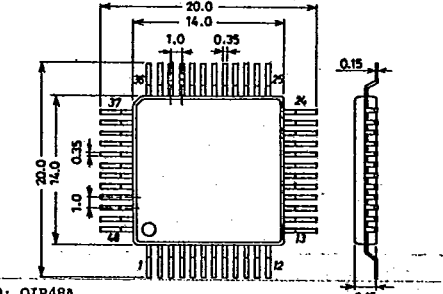
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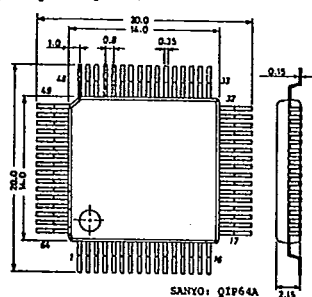
Case Outline—[3035A] unit: mm



Case Outline—[3052A] unit: mm



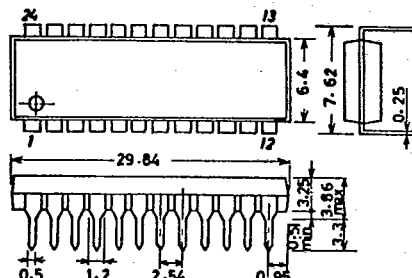
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SANYO: OIP64A

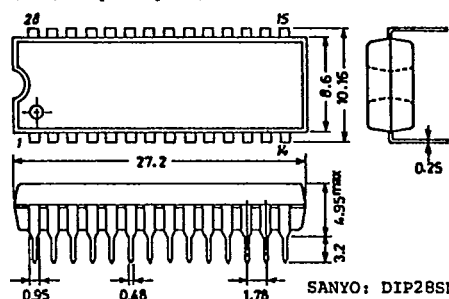
Case Outline—[3084] unit: mm

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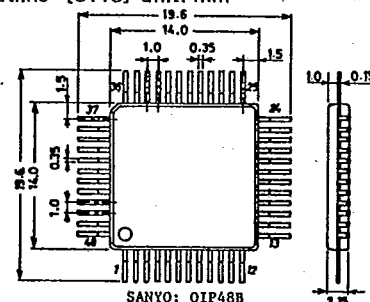
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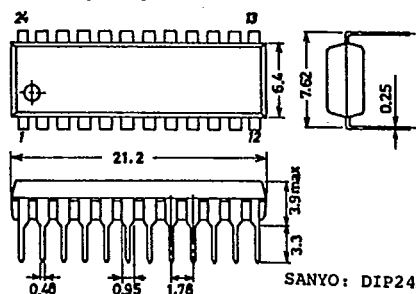
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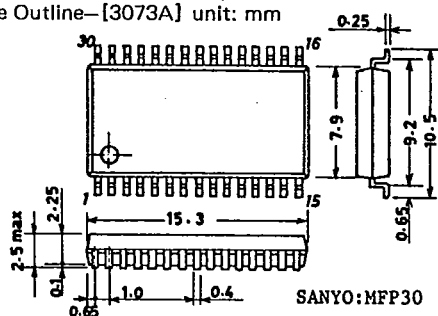
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Case Outline—[3067] unit: mm



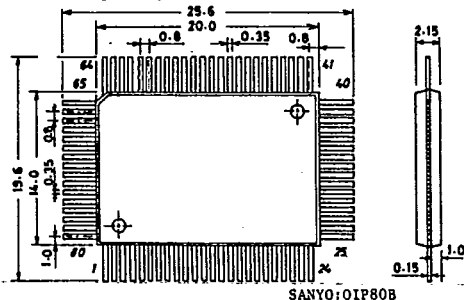
SANYO: DIP24S

Case Outline—[3073A] unit: mm



SANYO:MFP30

Case Outline—[3074] unit: mm



SANYO:OIP80B