

APR9301 RE-RECORDING VOICE IC **Single-Chip Voice Recording & Playback Device** **for Single 20 to 30 Second Message**

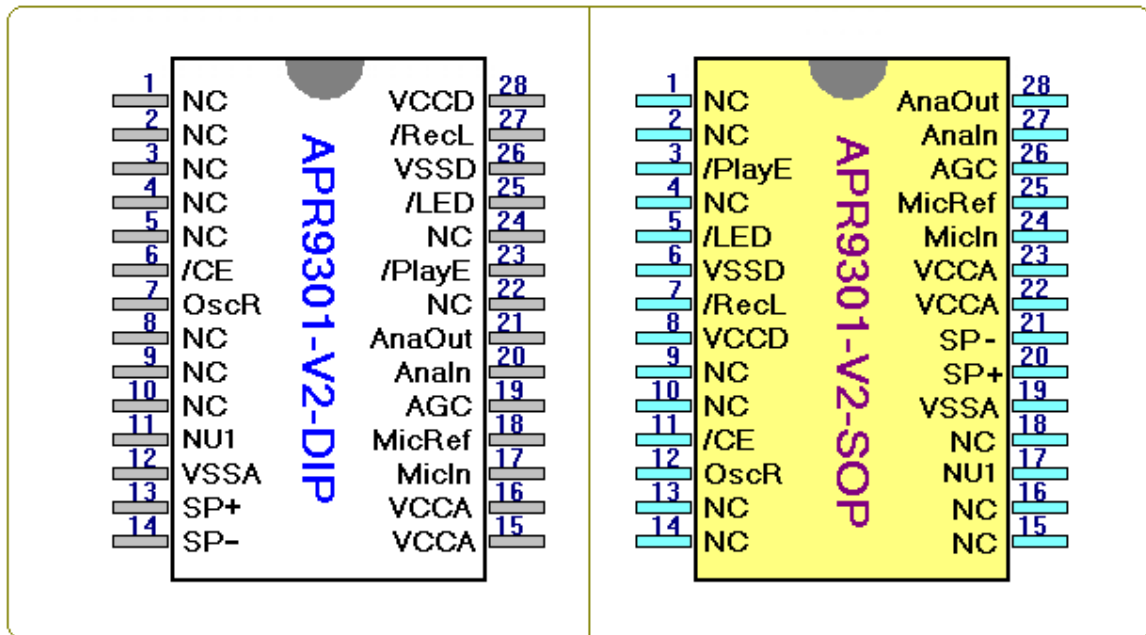
■ **Features :**

- Single-chip, high quality voice recording & Playback solution
 - No external ICs required
 - Minimum external components
- Non-volatile Flash memory technology
 - No battery backup required
 - 100K record cycles (typical)
 - 100-year message retention (typical)
- Single message of 20 to 30 seconds, with external resistor selection
- Chip enable pin for simple message expansion
- User-friendly, easy-to-use operation
 - Programming & development systems not required
 - Level-activated recording & edge-activated playback switches
- Low power consumption
 - Operating current: 25mA (typical, no load)
 - Standby current: 1uA (typical, no load)
- Automatic power-down feature for longer battery life
- Single 5V power supply

General Description :

The APR9301 device offers true single-chip solid-state storage capability and requires no software or microcontroller support. It provides high-quality recording and playback with a single 20- to 30-second message. It is ideal for portable voice recorders, toys, and many other consumer and industrial applications.

APLUS's proprietary analog/multi-level storage technology is implemented in advanced Flash non-volatile memory cells, each of which can typically store more than 256 voltage levels. The APR9301 device stores and reproduces voice signals in their natural forms, eliminating distortion that is often introduced by encoding and compression. The device combines a small size with low power consumption, non-volatility, and ease-of-use for a cost effective solution to voice recording and playback

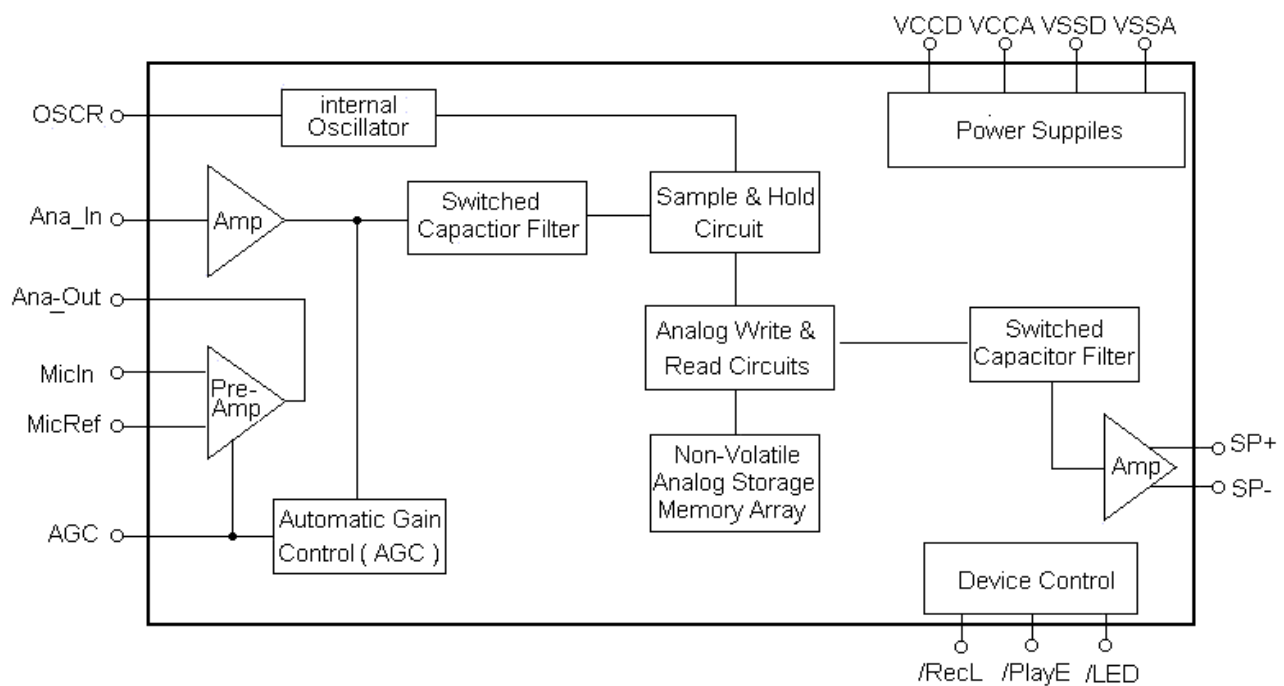


PS : The APR9301 DIP & SOP is not [PIN to PIN]

■ **Functional Block Diagram :**

Figure 2 shows the functional block diagram for the APR9301 device.

Figure 2 APR9301 Functional Block Diagram



Sample Application

Figure 3 shows the diagram for a single, 20-second message recording and playback application using the APR9301 device. When pins are connected as shown in this example, the operating modes are as follows:

Record Mode (Level-Activated)

A single voice message of up to 20 seconds can be recorded. The /LED pin will go low during the actual recording process to provide a visual indication if an LED light is connected to this pin. The chip is in record mode as long as the /RecL pin stays low level-activated). If the message lasts longer than 20 seconds, recording will terminate automatically after the last available memory cell is written. If the message is shorter than 20 seconds, the recording operation will stop when the /RecL pin goes high. The speaker driver is automatically tristated during the recording operation. Messages of up to 30 seconds can be recorded by using different OscR resistor values (see Table 1).

Playback Mode (Edge-Activated)

Playback always starts from the beginning of the message. The chip is in playback mode after the /PlayE pin pulses low (edge-activated). Playback will stop immediately when the /PlayE pin pulses low a second time.

If the newly recorded message is shorter than the previously recorded message, the remaining portion of the previous message will not be played after the new message is played back.

The input preamplifier, AGC, and main amplifier circuits are disabled during playback.

Standby Mode (/CE = "0)

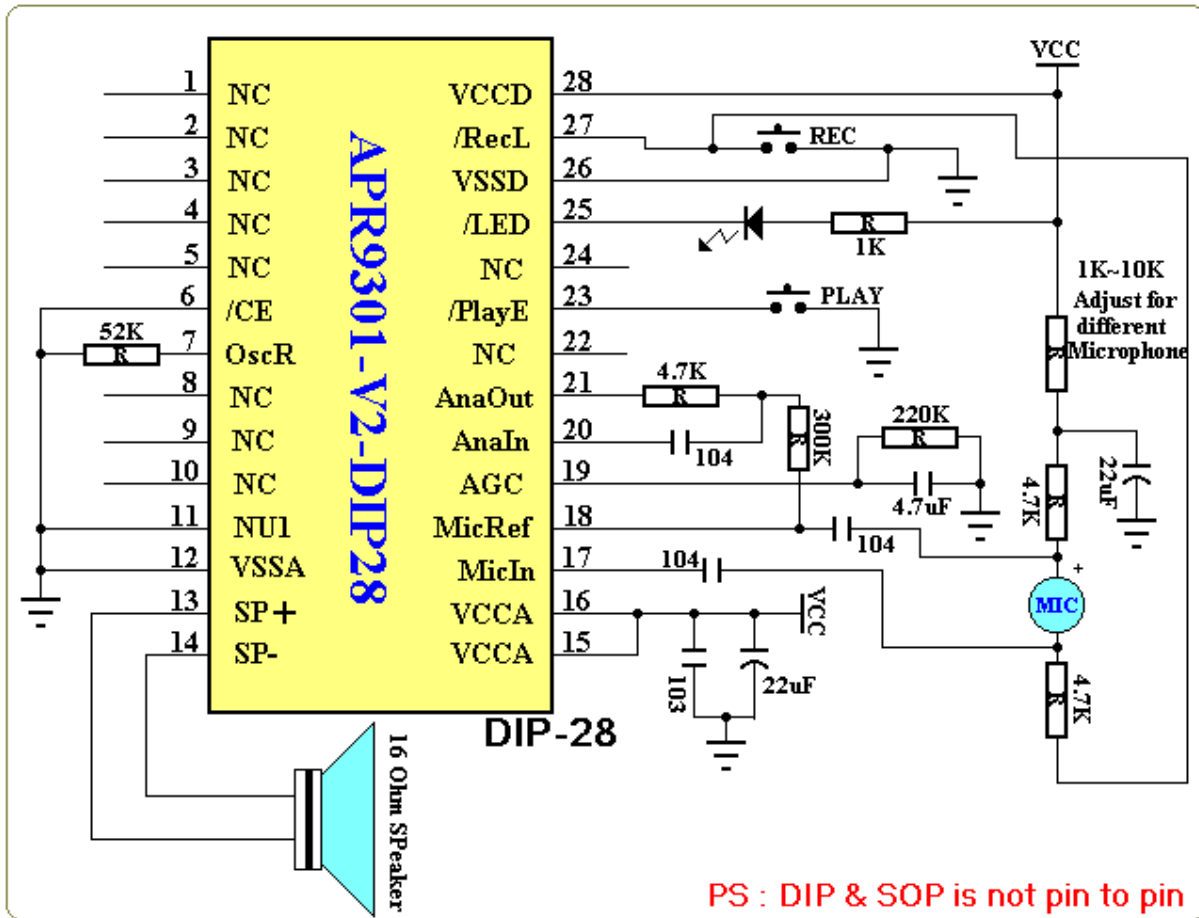
The chip will automatically return to the standby state after recording or playback operation is completed.

Power Down Mode (/CE = "1 `)

The chip is always in standby state.

No recording or playback is allowed. Current consumption is typically less than 1uA.

Figure 3 Sample Application for the APR9301 :



NC=No Connect (must be floating)
 Pins 23 and 27 have internal pull-up resistors.
 The typical sampling frequency is 6.4kHz with OscR=52K ω

Table 1 Typical Dependence of Sampling Frequency and Total Voice Duration on OscR Resistor Value

(VccA = VccD = 5V; VssA = Vssd = 0V; TA = 25°C)

| OscR value | Sampling Frequency Typical | Cutoff Frequency (3dB Point) | Total Voice Duration Typical | Working Voltage |
|--------------|----------------------------|------------------------------|------------------------------|-----------------|
| 38k Ω | 8kHz | 3.4kHz | 16 SECONDS | 4.5V ~ 6.5V |
| 52k Ω | 6.4kHz | 2.7kHz | 20 SECONDS | 4.5V ~ 6.5V |
| 67k Ω | 5.3kHz | 2.3kHz | 24 SECONDS | 4.8V ~ 6.5V |
| 75k Ω | 4.5kHz | 2kHz | 30 SECONDS | 5.2V ~ 6.5V |

Absolute Maximum Ratings

Stresses greater than those listed in Table 2 may cause permanent damage to the device. These specifications represent a stress rating only. Operation of the device at these or any other conditions above those specified in the recommended DC Characteristics or recommended Analog Characteristics of this specification is not implied. Operation of the device at maximum conditions for extended periods may affect reliability.

Table 2 Absolute Maximum Ratings.

| Item | Symbol | Condition | Min | Max | Unit |
|------------------------|------------------|---------------------------|------|-----------------------|------|
| Power Supply Voltage | V _{cc} | TA = 25°C | 4.5 | 6.5 | V |
| Input Voltage | V _{IN1} | TA = 25°C | -0.3 | V _{cc} + 0.3 | V |
| Input Voltage | V _{IN2} | I _{IN} < 20 mA | -1.0 | V _{cc} + 1.0 | V |
| Storage Temperature | T _{STG} | -- | -65 | 150 | °C |
| Temperature Under Bias | T _{BS} | -- | -65 | 125 | °C |
| Lead Temperature | T _{LD} | < 10s | -- | 300 | °C |

Table 3 DC Characteristics (Note 1)

| Item | Symbol | Condition | Mm | Typ | Max | Unit |
|---------------------------------|------------------|---|-----------------------|-----|------|------|
| Input High Voltage | V _{IH} | -- | 0.8 x V _{cc} | -- | -- | V |
| Input Low Voltage | V _{IL} | -- | -- | -- | 0.8 | V |
| Output High Voltage | V _{OH} | I _{OL} = -1.6mA | 2.4 | -- | -- | V |
| Output Low Voltage | V _{OL} | I _{OL} = 4.0mA | -- | -- | 0.45 | V |
| Input Leakage Current | I _{IH} | V _{IH} = V _{cc} | -- | -- | 1.0 | uA |
| Input Leakage Current | I _{IL} | V _{IL} = V _{ss} (Note 2) | -1.0 | -- | -- | uA |
| Output Tristate Leakage Current | I _{oz} | V _{OUT} = V _{CC} or V _{OUT} =V _{SS} | -1.0 | -- | 1.0 | uA |
| Operating Current Consumption | I _{cc} | Internal Clock, No Load | -- | 25 | -- | mA |
| Standby Current Consumption | I _{ccs} | No Load | -- | 1.0 | -- | uA |

Table 4 Analog Characteristics (Note 1)

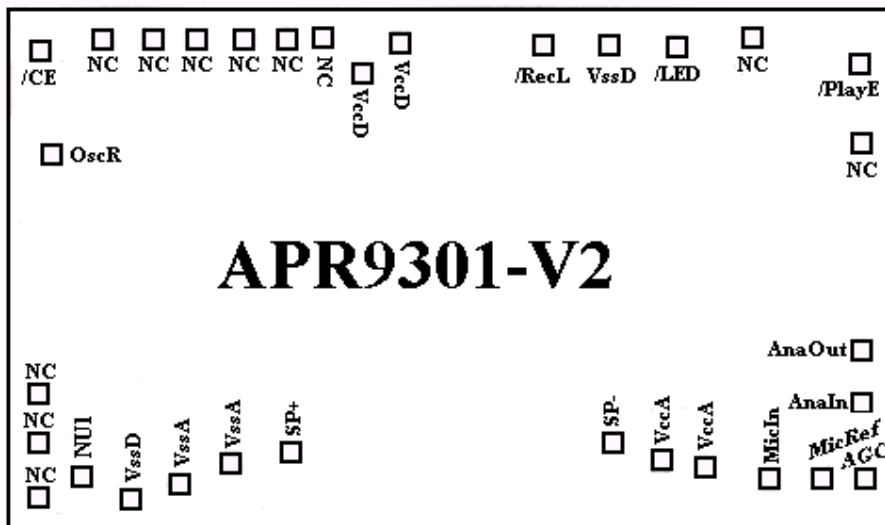
| Item | Symbol | Condition | Mim | Typ | Max | Unit |
|--------------------------------|--------|------------------------|-----|------|-----|-------|
| MicIn Input Voltage | VMI | -- | -- | -- | 20 | mVp-p |
| MicIn Input Resistance | RMI | -- | -- | 10 | -- | kΩ |
| MicIn Amp Gain (1) | GMI1 | AGC ≤ 2.2V | -- | 24 | -- | dB |
| MicIn Amp Gain (2) | GMI2 | AGC ≥ 3.0V | -- | -45 | -15 | dB |
| AnaIn Input Voltage | VANI | -- | -- | -- | 50 | mVp-p |
| AnaIn Input Resistance | RANI | -- | -- | 10 | -- | kΩ |
| AnaIn Amp Gain | GANI | AnaIn to SP+/- | -- | 22 | -- | dB |
| AGC Output Resistance | RAGC | -- | -- | 1 | -- | kΩ |
| SP+/- Output Power | Psp | Rsp+/- = 16Ω | -- | 12.2 | -- | mW |
| Voltage Amplitude Across SP+/- | Vsp | Rsp+/- ≥ 16Ω | -- | 1.25 | -- | Vp-p |
| Total Harmonic Distortion | THD | @ 1kHz & 20mVp-p input | | 1 | | % |

Note 1: Typical Values: VCCD = VCCA = 5V; VSSD = VSSA = 0V; TA = 25°C

Note 2: Except pins 23 and 27 which have internal pull-up resistors.

Bonding Pad Diagram & Description of Bonding Pad Coordinates :

Figure 5 APR9301 Die Bonding Pad Diagram



Notes:
Die diagram is with respect to die center(um)

Die Dimensions:
X=214± 1 mils(5500um)
Y=144± 1 mils(3750um)

Die Thickness:
13.8± 1.0 mils
(350± 25um)

Pad Opening:
4.3mils
110um

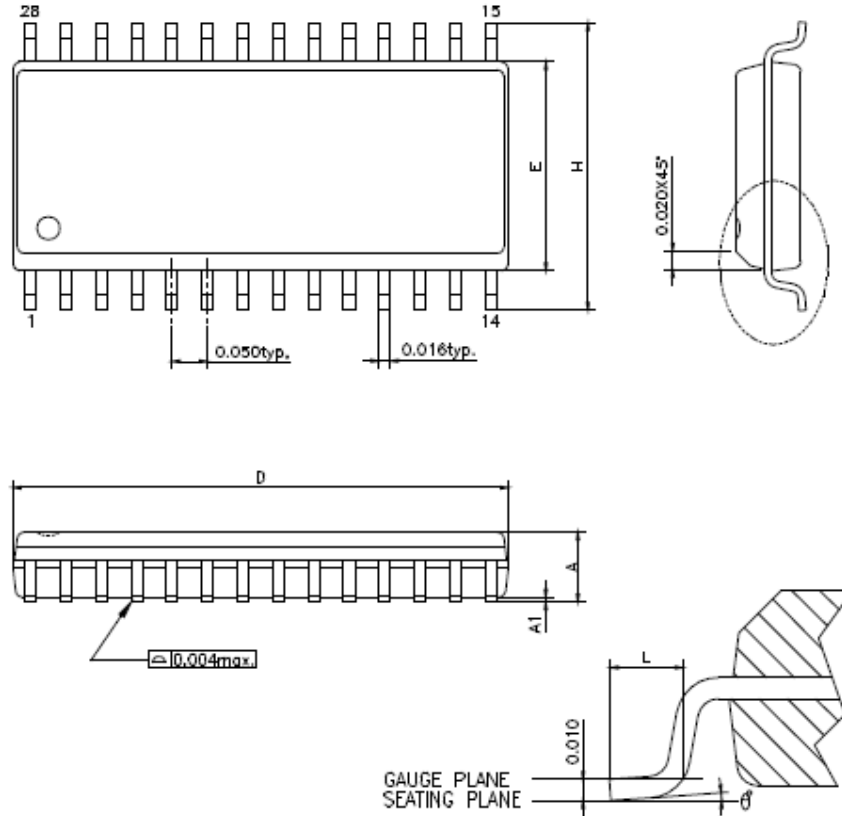
*** Connect substrate to Ground.**

Table 5 APR9301 Bonding Pad Coordinates :

| Pin | Pin Name | X - Axis (Note) | Y - Axis (Note) |
|--------|---------------------------------------|-----------------|-----------------|
| /CE | Chip Enable | -2496.2 | 1565.8 |
| OscR | Oscillator Frequency-Setting Resistor | -2459.55 | 729.8 |
| NU1 | Connect to Ground | -1808.45 | -1496.1 |
| VSSD | Digital Ground Supply | -1564.05 | -1572 |
| VSSA | Analog Ground Supply | -1384.05 | -1548.7 |
| VSSA | Analog Ground Supply | -1204.35 | -1477.1 |
| SP+ | Non-Inverting Speaker Output | -707.15 | -1390 |
| SP- | Inverting Speaker Output | 479.15 | -1389.9 |
| VCCA | Analog Power Supply | 976.45 | -1492 |
| VCCA | Analog Power Supply | 1190.4 | -1523.7 |
| MinIn | Microphone Input | 1619.45 | -1551.4 |
| MicRef | Microphone Reference Input | 2035.45 | -1551.4 |
| AGC | Automatic Gain Control | 2487.45 | -1551.4 |
| AnaIn | Analog Signal Input | 2487.45 | -1049.9 |
| AnaOut | Analog Signal Output | 2487.45 | -648.9 |
| /PlayE | Edge-Activated Playback | 2493.65 | 1371.1 |
| /LED | LED Output | 1430.7 | 1565.8 |
| VSSD | Connect to Ground | 865.75 | 1565.8 |
| /RecL | Level-Activated Record | 258.15 | 1565.8 |
| VCCD | Digital Power Supply | -229.4 | 1579.05 |
| VCCD | Digital Power Supply | -510.8 | 1541.6 |

Note: With respect to die center(um)


■ PACKAGE OUTLINE : SOP - 28 (300 MIL)



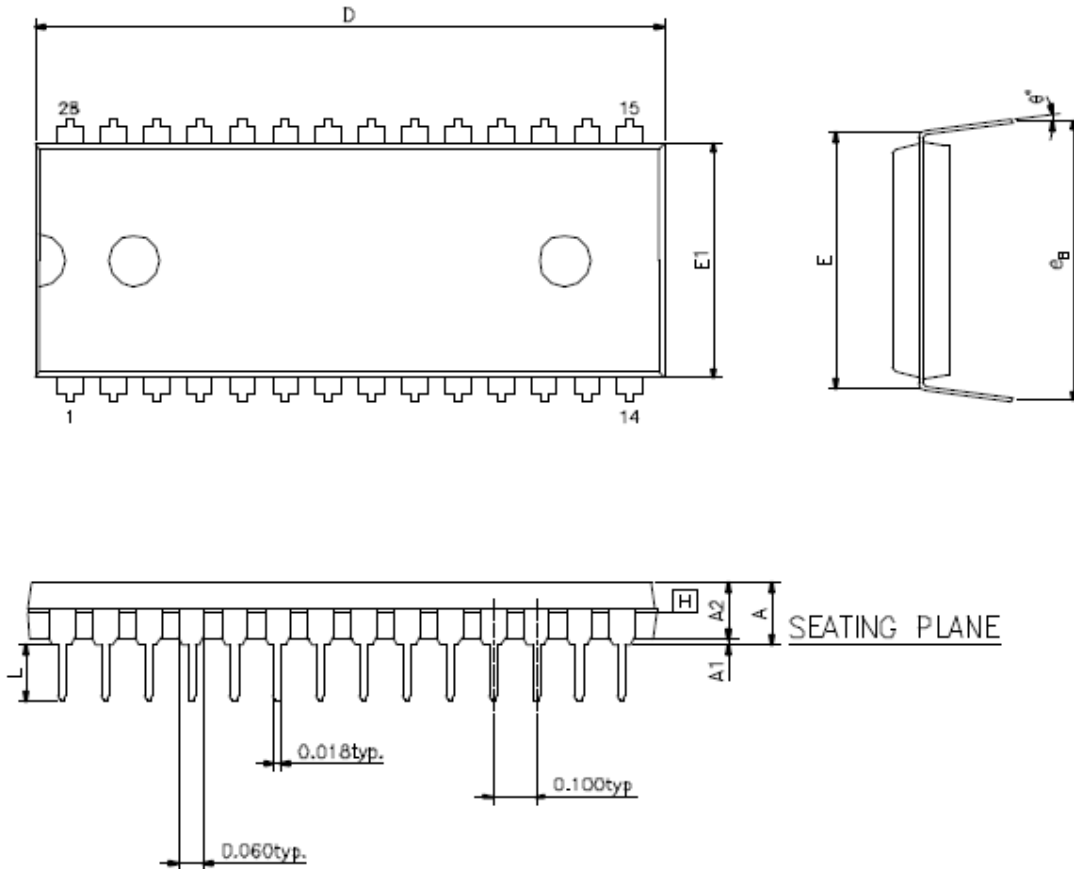
| | SYMBOLS | MIN. | NOM | MAX. |
|---|----------------|-------|-------|-------|
| ⚠ | A | — | — | 0.104 |
| ⚠ | A1 | 0.004 | — | — |
| ⚠ | D | 0.697 | 0.718 | 0.724 |
| | E | 0.291 | 0.295 | 0.299 |
| | H | 0.394 | 0.406 | 0.419 |
| | L | 0.016 | 0.035 | 0.050 |
| ⚠ | θ° | 0 | 4 | 8 |

UNIT : INCH

NOTES:

1. JEDEC OUTLINE : MO-119 AB 
- ⚠ 2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .25mm (.010in) PER SIDE.
3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.010in) PER SIDE.

■ PACKAGE OUTLINE : DIP - 28 (600 MIL)



| SYMBOLS | MIN. | NOR. | MAX. |
|----------------|-----------|-------|-------|
| A | - | - | 0.220 |
| A1 | 0.015 | - | - |
| A2 | 0.150 | 0.155 | 0.160 |
| D | 1.455 | 1.460 | 1.470 |
| E | 0.600 BSC | | |
| E1 | 0.540 | 0.545 | 0.550 |
| L | 0.115 | 0.158 | 0.200 |
| e _B | 0.630 | 0.650 | 0.670 |
| θ | 0 | 7 | 15 |

UNIT : INCH

NOTE:

1. JEDEC OUTLINE : MS-011 AB
2. E1 DOES NOT INCLUDE MOLD FLASH.