# *Stereo Headphone Driver, 6dB Gain Low Voltage, Internal Mute Function No Popping Noise When Power On / Off*

## FEATURES

- Large output voltage swing
- Low supply voltage 2.7 to 6.5V
- Internal mute function
- No popping noise
- High SNR , Slew rate
- Low distortion
- Excellent power supply ripple rejection
- Low power consumption

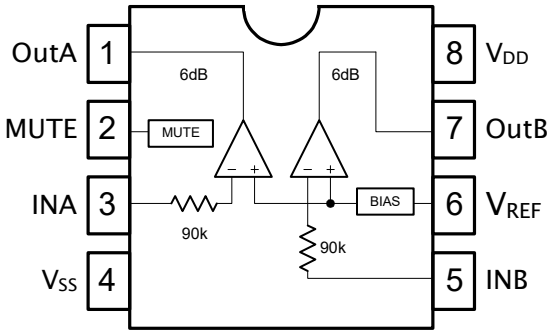
## APPLICATIONS

- MP3, PDA
- Portable Digital Audio.
- CD-ROM, DVD-ROM, CD-RW, DVD-RW
- Cross-reference : BH3544F
- Space saving package SOP8, MSOP8.

## DESCRIPTION

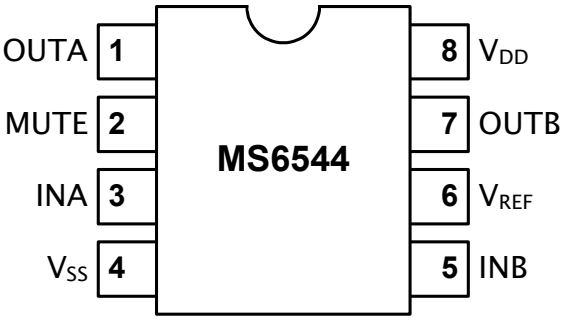
The MS6544 is an integrated class AB stereo headphone driver contained in SO8 and MSOP8 packages. The mute function to prevent popping sounds when the power is turned on and off. It has good performance at low voltage operation, the MS6544 ideally suited for use in portable digital audio equipment.

## BLOCK DIAGRAM




## PIN CONFIGURATION

| Symbol | Pin | Description |
|---|---|---|
| OutA | 1 | Output A |
| Mute | 2 | Mute control<br>(Low: mute on, High: mute off) |
| INA | 3 | Input A |
| $V_{SS}$ | 4 | Negative supply |
| INB | 5 | Input B |
| $V_{REF}$ | 6 | Reference volatge |
| OutB | 7 | Output B |
| $V_{DD}$ | 8 | Positive supply |




SOP8，MSOP8

## ORDERING INFORMATION

| Package | Part number | Packaging Marking | Transport Media |
|---|---|---|---|
| 8-Pin SOP | MS6544GTR | MS6544G | 2.5k Units Tape and Reel |
| 8-Pin SOP | MS6544GU | MS6544G | 100 Units Tube |
| 8-Pin MSOP | MS6544MGTR | MS6544G | 3.5k Units Tape and Reel |
| 8-Pin MSOP | MS6544MU | MS6544G | 80 Units Tube |

Lead free, RoHS Compliance

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| $V_{DD}$ | Supply Voltage | 6.5 | V |
| $V_{ESD}$ | Electrostatic Handling | -4500 to 4500 | V |
| $T_{STG}$ | Storage Temperature Range | -65 to 150 | ℃ |
| $T_A$ | Operating Ambient Temperature Range | -40 to 85 | ℃ |
| $T_J$ | Maximum Junction Temperature | 150 | ℃ |
| $T_S$ | Soldering Temperature, 10 seconds | 260 | ℃ |
| $R_{THJA}$ | Thermal Resistance from Junction to Ambient in Free Air<br>SOP8<br>MSOP8 | <br>175<br>235 | ℃/W |

## OPERATING RATINGS

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage | 2.7 | - | 6.5 | V |

## 5V ELECTRICAL CHARACTERISTICS

(Ta=25℃, $V_{DD}$=5V, $V_{SS}$=0V, Vo=2Vpp, f=1kHz, $A_V$=1, $R_L$=32Ω; unless otherwise specified)

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **DC Characteristics** | | | | | | | |
| $I_Q$ | Quiescent current | Vo=0Vpp 2 channels | Mute On | - | 1.5 | 1.6 | mA |
| | | | Mute Off | 3.7 | 3.9 | 4.1 | mA |
| $V_{TM}$ | Mute control voltage | Mute on | | 0 | - | 1 | V |
| | | Mute off | | 3.3 | - | $V_{DD}$ | V |
| $G_{VC}$ | Voltage Gain | 6dB | | 5 | 6 | 7 | dB |
| PSRR | Power supply rejection ratio | Vripple = -20dBV, 100Hz | | 57 | 60 | - | dB |
| CS | Channel separation | Vo=0dBV | | 100 | 117 | - | dB |
| ATT | Mute attenuation | Vo=0dBV | | 100 | 115 | - | dB |
| **AC Characteristics** | | | | | | | |
| S/N | Signal-to-noise | Vo=4Vpp | | 95 | 99 | - | dB |
| THD+N | Total harmonic distortion plus noise | Vo=2Vpp | | - | -64 | -62 | dB |
| SR | Slew rate | Unity gain inverting | | - | 5 | - | V/μs |
| Po | Maximum output power | (THD+N)/S<0.1%, 2 ch | | 130 | 140 | - | mW |
| $V_O$ | Maximum output voltage swing | (THD+N)/S<0.1% | | 4.1 | 4.2 | - | Vpp |

## 3.3V ELECTRICAL CHARACTERISTICS

(Ta=25℃, $V_{DD}$=3.3V, $V_{SS}$=0V, Vo=2Vpp, f=1kHz, $A_V$=1, $R_L$=32Ω; unless otherwise specified)

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **DC Characteristics** | | | | | | | |
| $I_Q$ | Quiescent current | Vo=0Vpp 2 channels | Mute On | - | 1.3 | 1.4 | mA |
| | | | Mute Off | - | 3.3 | 3.5 | mA |
| $V_{TM}$ | Mute control voltage | Mute on | | 0 | - | 1 | V |
| | | Mute off | | 2.7 | - | $V_{DD}$ | V |
| PSRR | Power supply rejection ratio | Vripple = -20dBV, 100Hz | | 57 | 60 | - | dB |
| CS | Channel separation | Vo=0dBV | | 100 | 115 | - | dB |
| ATT | Mute attenuation | Vo=0dBV | | 100 | 115 | - | dB |
| **AC Characteristics** | | | | | | | |
| S/N | Signal-to-noise | Vo=2.6Vpp | | 93 | 97 | - | dB |
| THD+N | Total harmonic distortion plus noise | Vo=2Vpp | | - | -64 | -62 | dB |
| Po | Maximum output power | (THD+N/S)<0.1%, 2 ch | | 49 | 52 | - | mW |
| $V_O$ | Maximum output voltage swing | (THD+N)/S<0.1% | | 2.5 | 2.6 | - | Vpp |

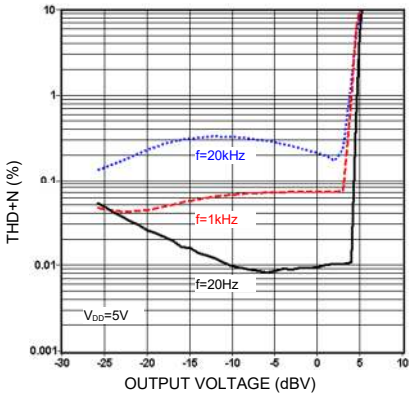
## 2.7V ELECTRICAL CHARACTERISTICS

(Ta=25℃, $V_{DD}$=2.7V, $V_{SS}$=0V, Vo=2Vpp, f=1kHz, $A_V$=1, $R_L$=32Ω; unless otherwise specified)

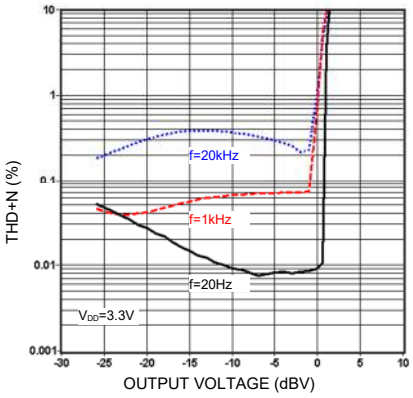
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **DC Characteristics** | | | | | | | |
| $I_Q$ | Quiescent current | Vo=0Vpp 2 channels | Mute On | - | 1.2 | 1.3 | mA |
| | | | Mute Off | - | 3.0 | 3.2 | mA |
| $V_{TM}$ | Mute control voltage | Mute on | | 0 | - | 1 | V |
| | | Mute off | | 2.5 | - | $V_{DD}$ | V |
| PSRR | Power supply rejection ratio | Vripple = -20dBV, 100Hz | | 57 | 60 | - | dB |
| CS | Channel separation | Vo=-3dBV | | 100 | 112 | - | dB |
| ATT | Mute attenuation | Vo=-3dBV | | 100 | 115 | - | dB |
| **AC Characteristics** | | | | | | | |
| S/N | Signal-to-noise | Vo=2Vpp | | 92 | 96 | - | dB |
| THD+N | Total harmonic distortion plus noise | Vo=2Vpp | | - | -64 | -62 | dB |
| Po | Maximum output power | (THD+N/S)<0.1%, 2 ch | | 28 | 31 | - | mW |
| $V_O$ | Maximum output voltage swing | (THD+N)/S<0.1% | | 1.9 | 2 | - | Vpp |

## TYPICAL PERFORMANCE CHARACTERISTICS

(Ta=25℃, $R_L$=32Ω; unless otherwise specified)




**THD+N vs. output voltage**

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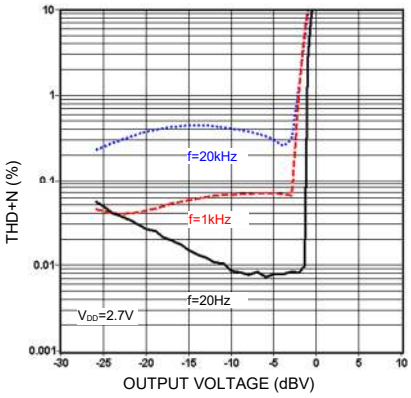
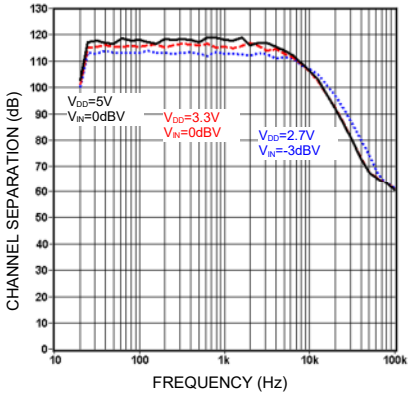
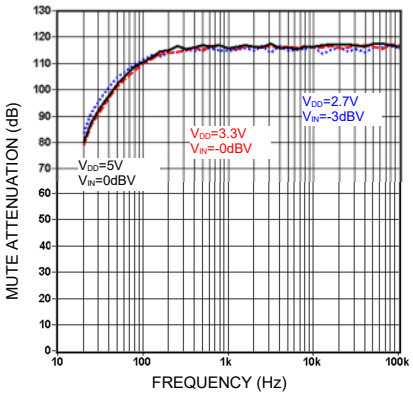


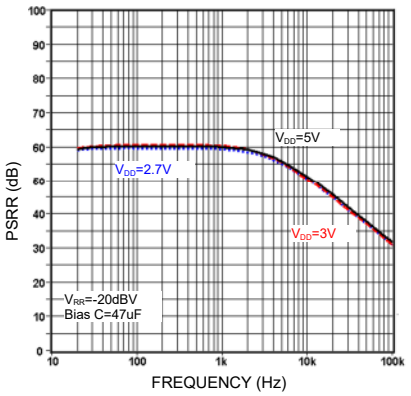

**THD+N vs. output voltage**



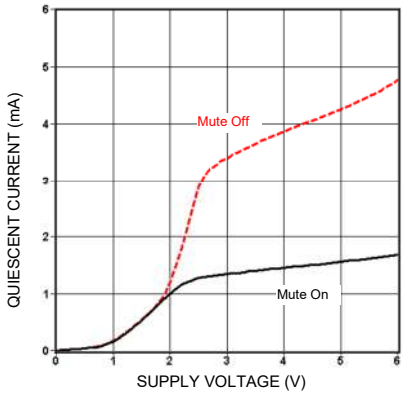

**Channel separation vs. frequency**




**Mute Attenuation vs. frequency**



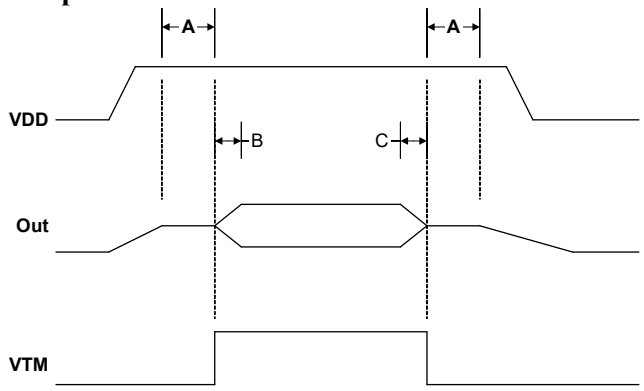

**PSRR vs. frequency**




**Quiescent current vs. supply voltage**

## MUTE FUNCTION

### Mute operation

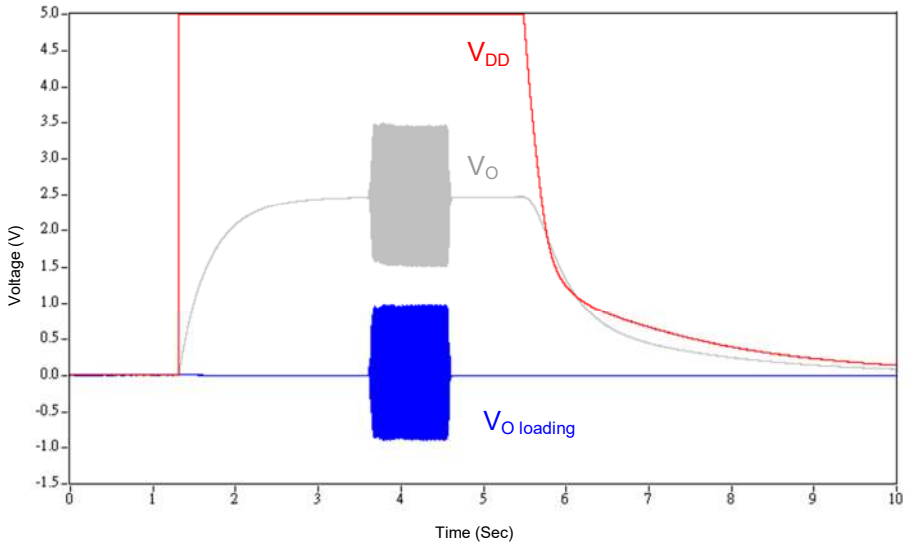



A: Mute period
Set Mute = Low to prevent the popping noise when power is turned on and off.

B: Mute release time
The time constant is decided by R and C of pin 2.

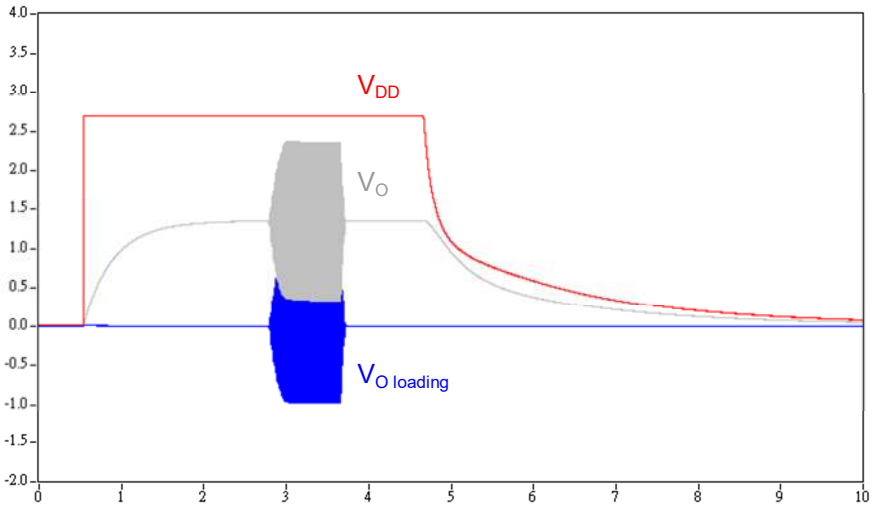
C: Mute start time
The time constant like Mute release time.

### Mute function to prevent the popping noise




Conditions :
VDD = 5V, Vo =2Vpp

Process :
Mute On, VDD On, Mute Off
Mute On, VDD Off

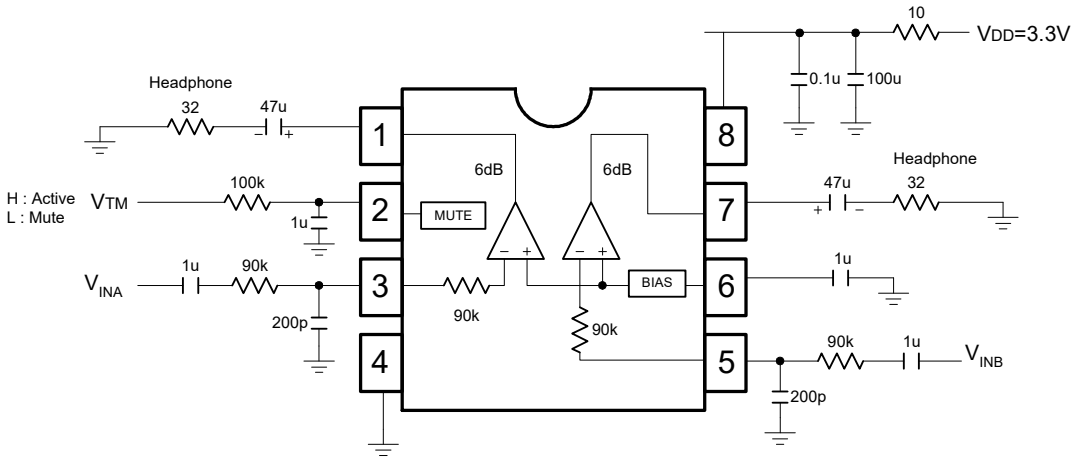



Conditions :
VDD = 2.7V, Vo =2Vpp

Process :
Mute On, VDD On, Mute Off
Mute On, VDD Off

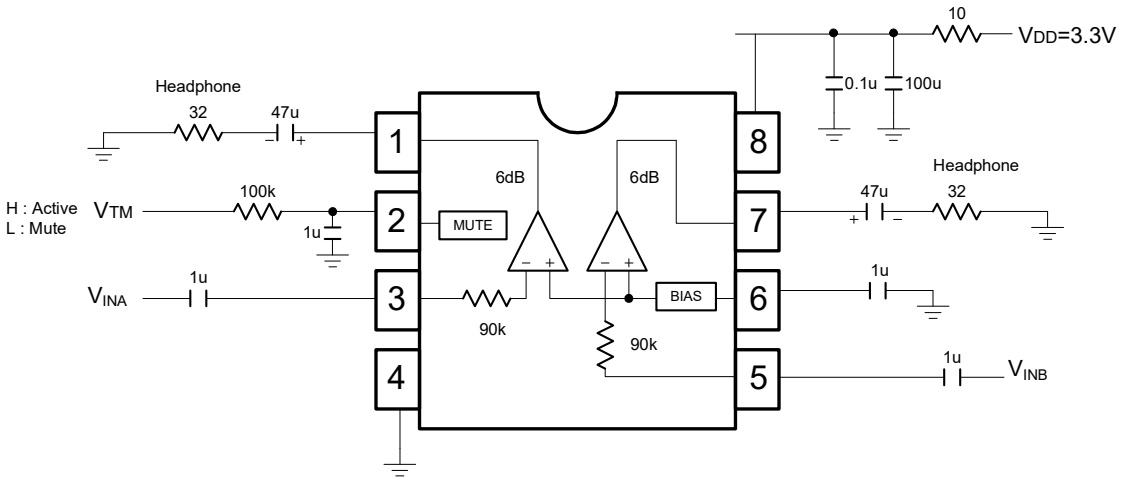
## APPLICATION INFORMATION

### Low voltage application




$f_{-3dB}$ = 17.6kHz
$DC_{gain}$ = 1

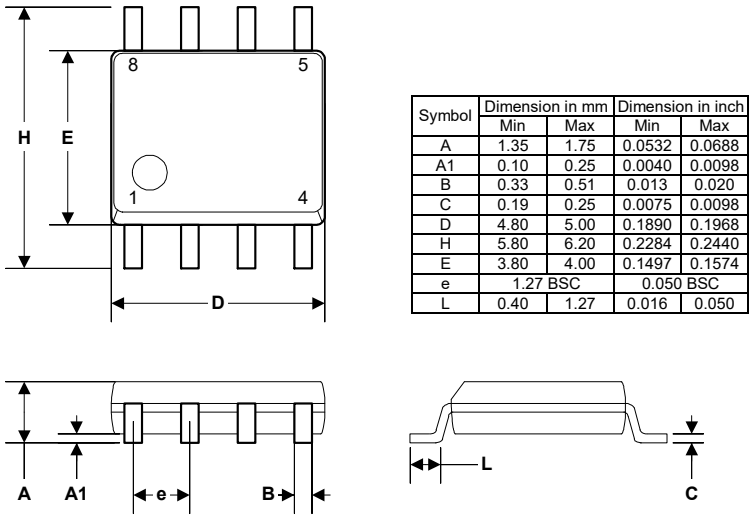
**Fig.1 The 1st order low pass filter for MP3 solution with MS6544.**




$DC_{gain}$ = 2 for MS6544

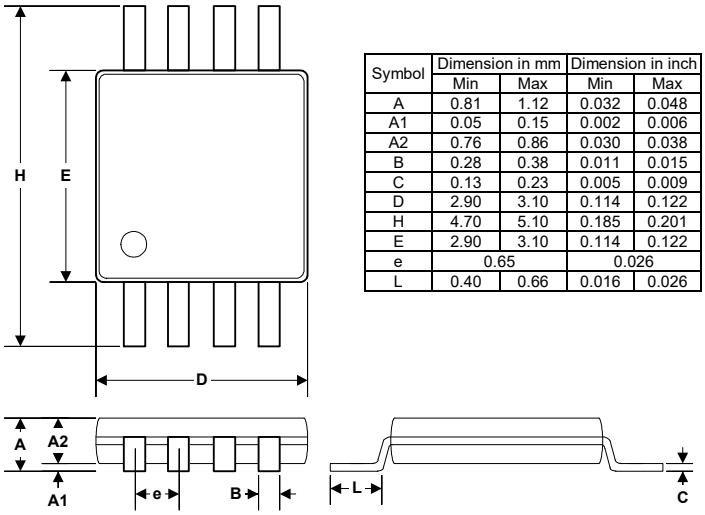
**Fig.2 The basic application.**

## EXTERNAL DIMENSIONS




| Symbol | Dimension in mm | | Dimension in inch | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.35 | 1.75 | 0.0532 | 0.0688 |
| A1 | 0.10 | 0.25 | 0.0040 | 0.0098 |
| B | 0.33 | 0.51 | 0.013 | 0.020 |
| C | 0.19 | 0.25 | 0.0075 | 0.0098 |
| D | 4.80 | 5.00 | 0.1890 | 0.1968 |
| H | 5.80 | 6.20 | 0.2284 | 0.2440 |
| E | 3.80 | 4.00 | 0.1497 | 0.1574 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 0.40 | 1.27 | 0.016 | 0.050 |

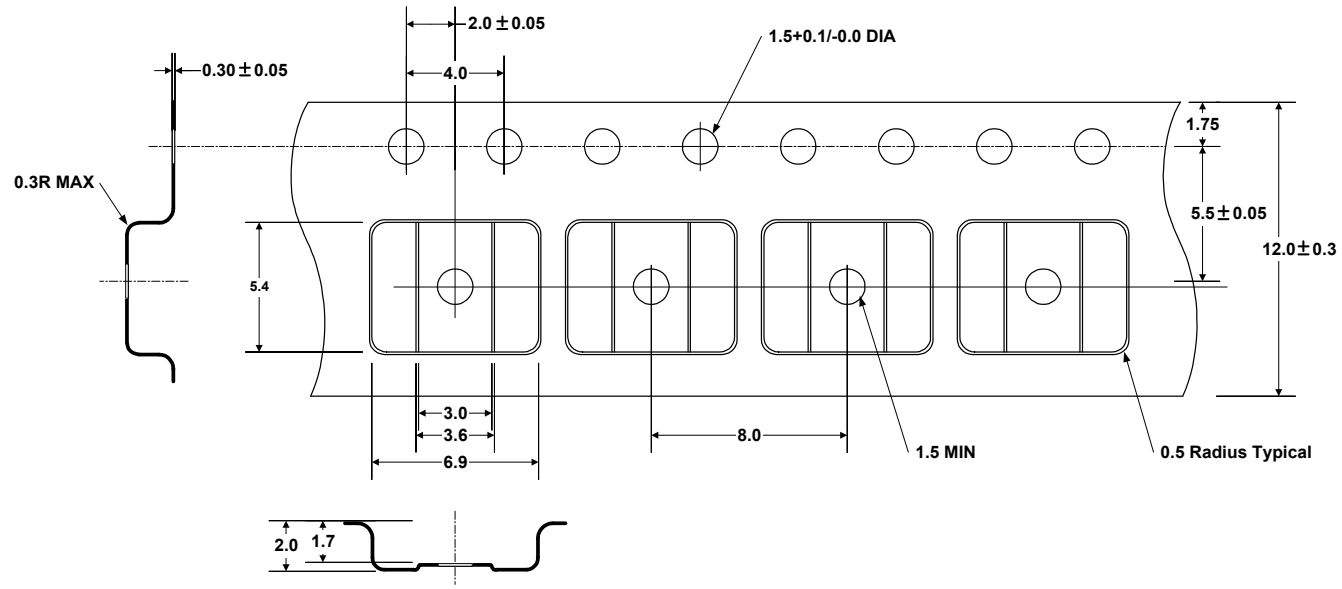
**SOP8**



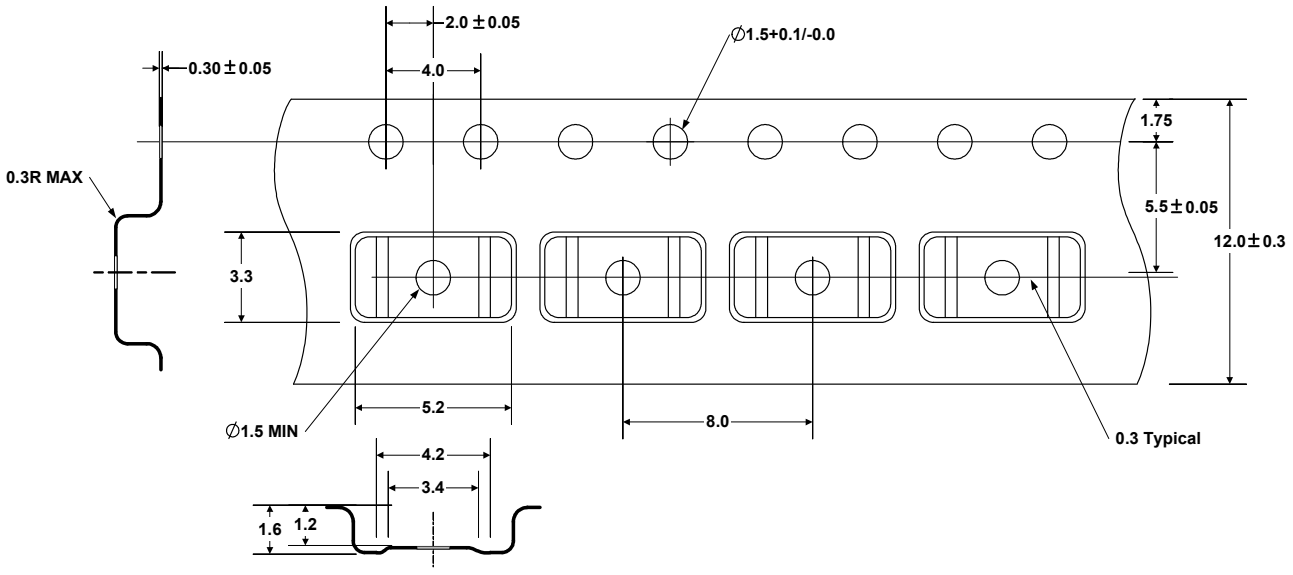

| Symbol | Dimension in mm | | Dimension in inch | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.81 | 1.12 | 0.032 | 0.048 |
| A1 | 0.05 | 0.15 | 0.002 | 0.006 |
| A2 | 0.76 | 0.86 | 0.030 | 0.038 |
| B | 0.28 | 0.38 | 0.011 | 0.015 |
| C | 0.13 | 0.23 | 0.005 | 0.009 |
| D | 2.90 | 3.10 | 0.114 | 0.122 |
| H | 4.70 | 5.10 | 0.185 | 0.201 |
| E | 2.90 | 3.10 | 0.114 | 0.122 |
| e | 0.65 | | 0.026 | |
| L | 0.40 | 0.66 | 0.016 | 0.026 |

**MSOP8**

## TAPE AND REEL (Unit : mm)




**SOP8**




**MSOP8**