1. General Descriptions

TRA1309AP is a speaker amplifier that can accept PWM signal and doesn't need any external device for these input signals. PWM input supports mainly for TRITAN's PWM output. The TRA1309AP contains advanced de-pop circuitry which eliminates pops during chip enable and disable. The gain can be adjusted by connecting a resistor between RGAIN and SPKN to determine gain. Internal sound processing is added for better sound quality.

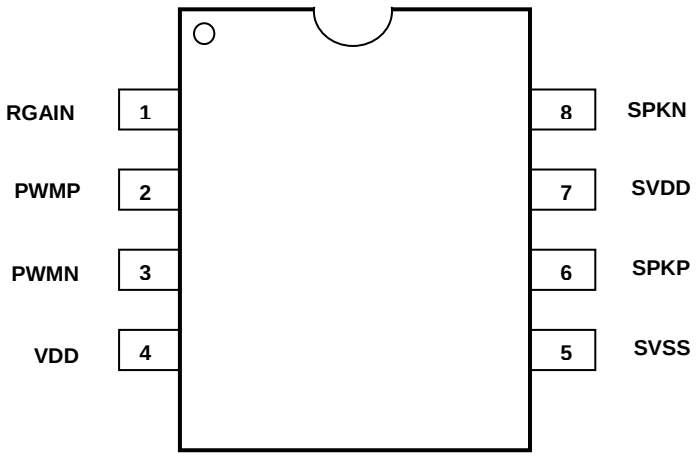
2. Features

- Accept PWM and doesn't need any external devices for these input signals.
- Mute function
- Wide operation voltage : 2.4V~5.5V
- sound processing for better sound quality
- Auto power ON/OFF
- Low standby current : 2u A, typical.
- High output power Pout = 0.8W (VDD=5.5V, THD=1%)

3. Ordering Information

Part Number	Package Type	Description
TRA1309AP-P	DIP 8	Plastic dual in-line package; 8 leads (300mil); PWM mode
TRA1309AP-S	SO 8	Plastic small outline package; 8 leads; body with 3.9 mm; PWM mode

4.1 Pin Configuration



- This chip only applicable for Tritan's SPEECH series PWM and TRD16P101/102/201 PWM

4.2 Packaging and Pads Information

Signal Name	Pin Type	Signal Description
SVDD	I	Speaker driver power input
SVSS	I	Speaker driver ground input
VDD	I	Internal circuit power input
PWMP	I	PWMP signal input
PWMN	I	PWMN signal input
RGAIN	I	Gain adjust pad
SPKP	O	Positive speaker output
SPKN	O	Negative speaker output

5. ELECTRICAL CHARACTERISTICS

5.1 Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
DC Supply Voltage	VDD	-0.5 to 5.5	V
Input Voltage	Vi	-0.5 to Vdd+0.5	V
Operating Temperature Range	Ta	-20 to 75	℃
Storage Temperature Range	Tstg	-40 to 150	℃

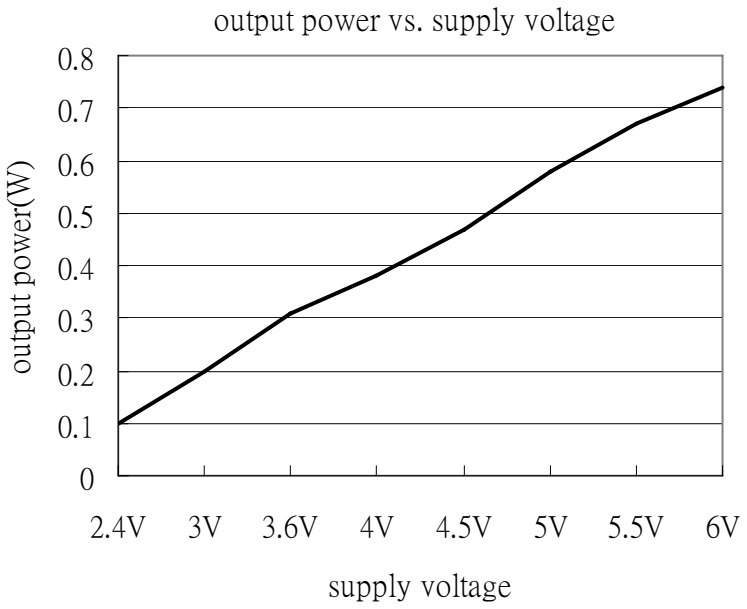
5.2 DC/AC Characteristics

Ta=25℃ unless otherwise noted

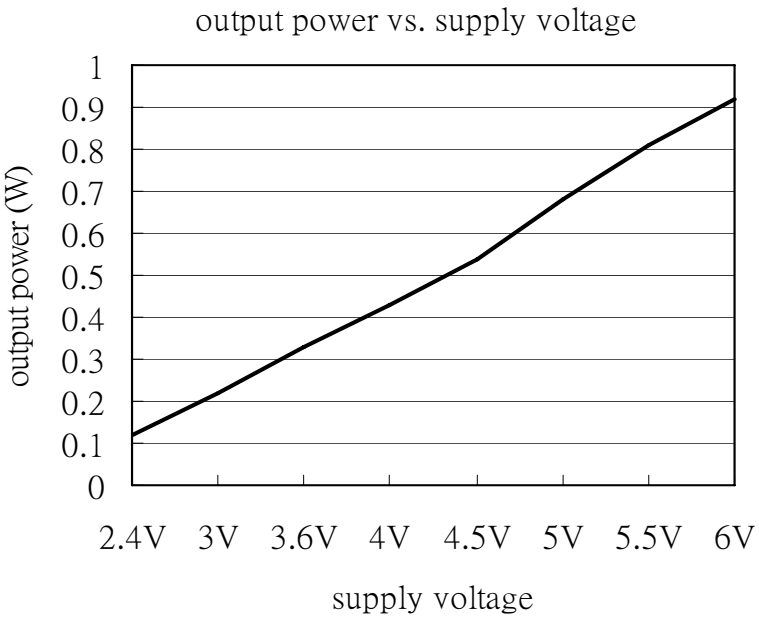
Parameters		Symbol	Minimum	Typical	Maximum	
Power supply range		VDD	2.4 V	-	5.5 V	
Operating current		Iop		6mA		VDD=5.5V
Standby current		Imute		2uA		PWMP=floating PWMN=floating
Input high voltage		Vih	1V			VDD=2.4V~5.5V
Input low voltage		Vil			0.5V	VDD=2.4V~5.5V
Input current		Ic			5 uA	When PWMP or PWMN connect to VSS will sink this current
Pull up resistor		Rpull-h		2Meg ohm		VDD=3.3V PWMP & PWMN
Output power	SOP	Pout		0.6W		VDD=5.5V,THD=1%, R_L=8Ω
	DIP			0.8W		
Mute time		Mt		30mS 200mS		T_{ON} T_{OFF}
THD+Noise		THD+N		1%		VDD=5V,Pout=0.6W,R_L=8Ω,Gain=2

5.3 Output power perfomance

1. Output power vs. supply voltage (Fin = 1Khz, R_L = 8Ω, THD=1%, normal mode)



2. Output power vs. supply voltage (Fin = 1Khz, R_L = 8Ω, THD=1%, PB mode)



6. FUNCTIONAL DESCRIPTION

6.1 PWM signal transfer to Analog signal

The PWMP direct connect to TRA1309A's PWMP and the PWMN direct connect to TRA1309A's PWMN (Fig 7-1). No external output components are needed.

Gain can be adjusted using R1(or VR). Since PWM signal is harder to be simply defined. Power gain description is as followed :

Suppose using Tritan's 3AB/5AB, PWM is connected to 8 ohm speaker, the output power is P1.
P2 is the speaker power output using above circuit, condition is same as P1.
P2 = 1.1 x P1

This gain setting will almost assure output signal in "non-distortion" area in any VDD/SVDD.
But if 3AB/5AB chip uses lower VDD and 1309AP uses higher VDD(and SVDD), then the output power gain(P2/P1) will be higher. Output power gain will increase propotionally to the ratio of these two VDDs.

Note : Load capacitance on SPKP/SPKN must be take care of as followed :

Reisitor load between SPKP and SPKN	Maximum load capacitance
Open	100pF
8ohm	300pF

In case stability problem is found, connect a 22pF ~ 100pF capacitor between RGAIN and SPKN.

6.2 Mute function(AutoPowerOn/Off)

When PWM input is disabled (floating), TRA1309AP will enter standby mode automatically with mute-off sequence. SPKP/N will be floated after ~200mS. When PWM is enabled, TRA1309AP will be turned on automatically and mute-on sequence is executed (Fig 6-2). SPKP/N will work after ~30mS.

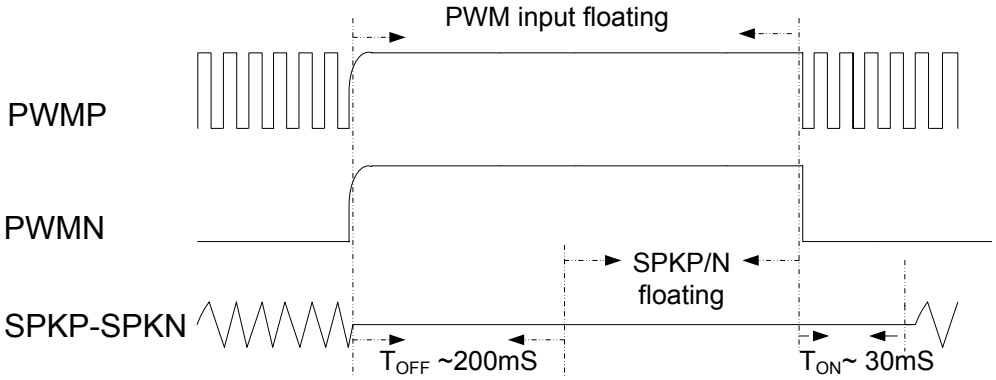


Fig 6-2 Mute sequence in TRA1309AP

***1 : PWM Input floating (Mute) must consider as below**

Parasitic capacitor (Maximum)	Rise time after PWM floating (Maximum)
50pF	100uS

7. Application circuit

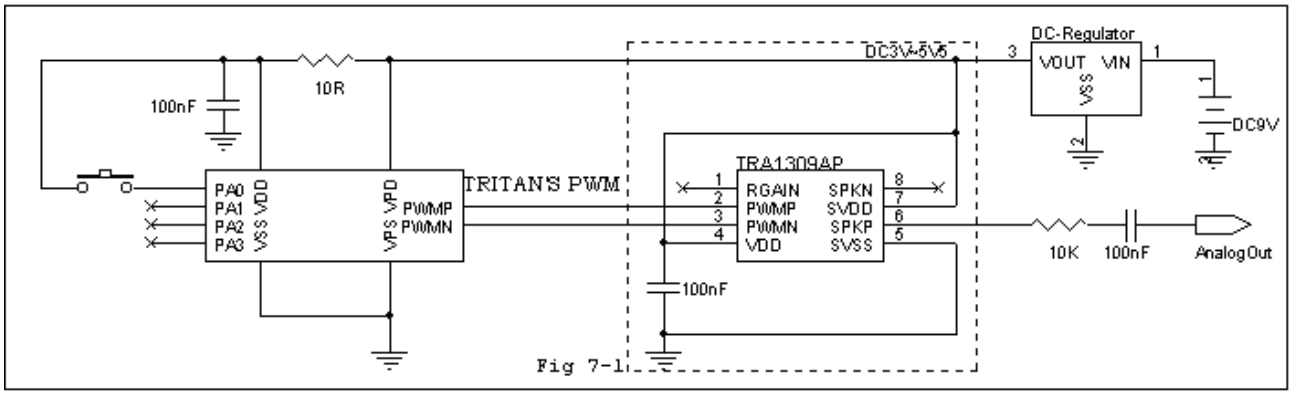


Fig 7-1

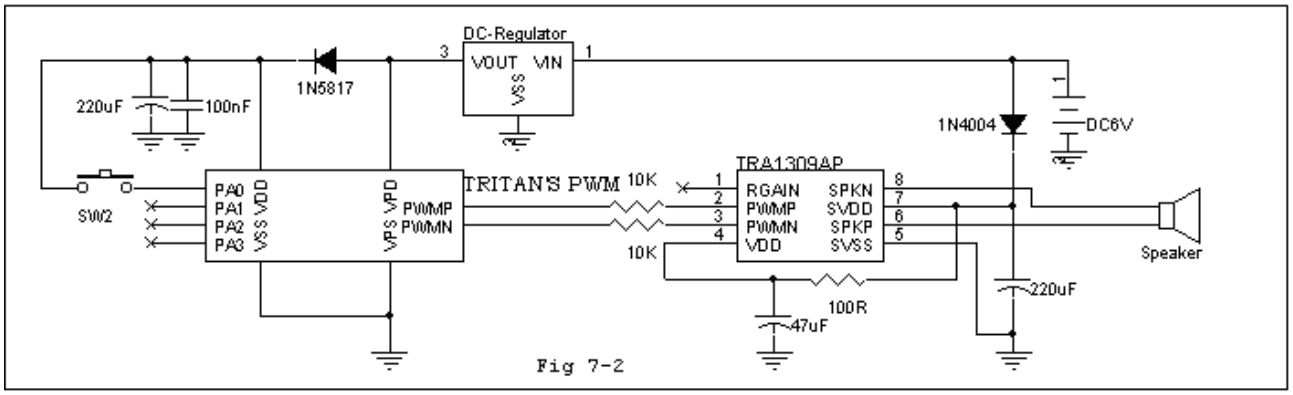


Fig 7-2

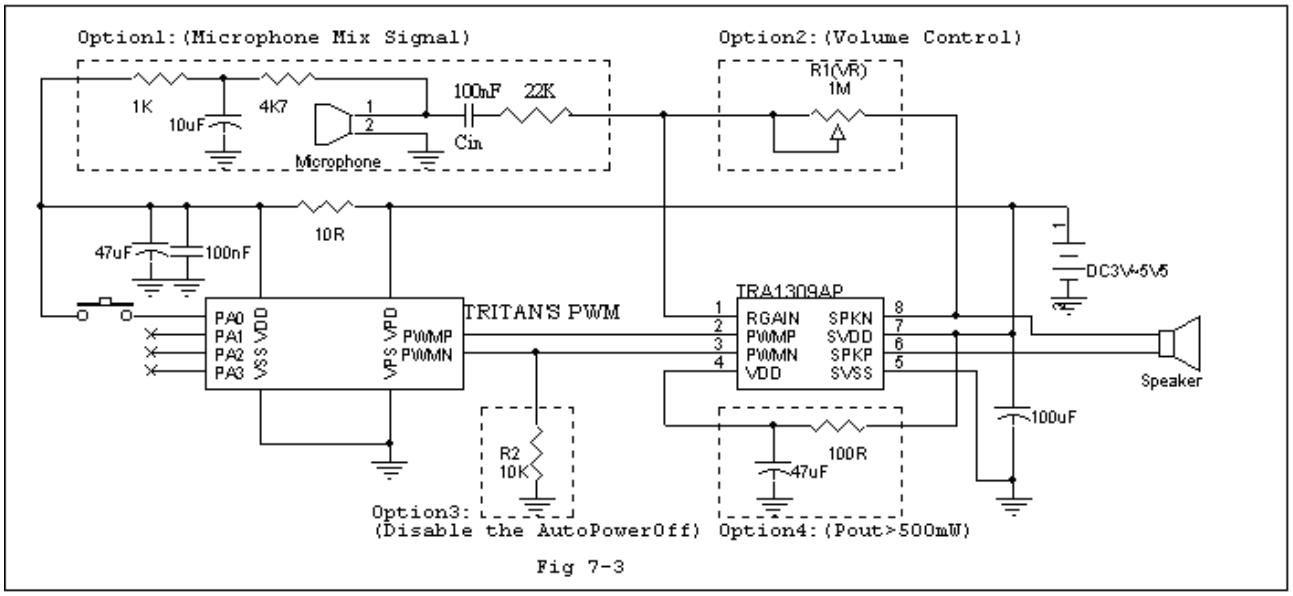
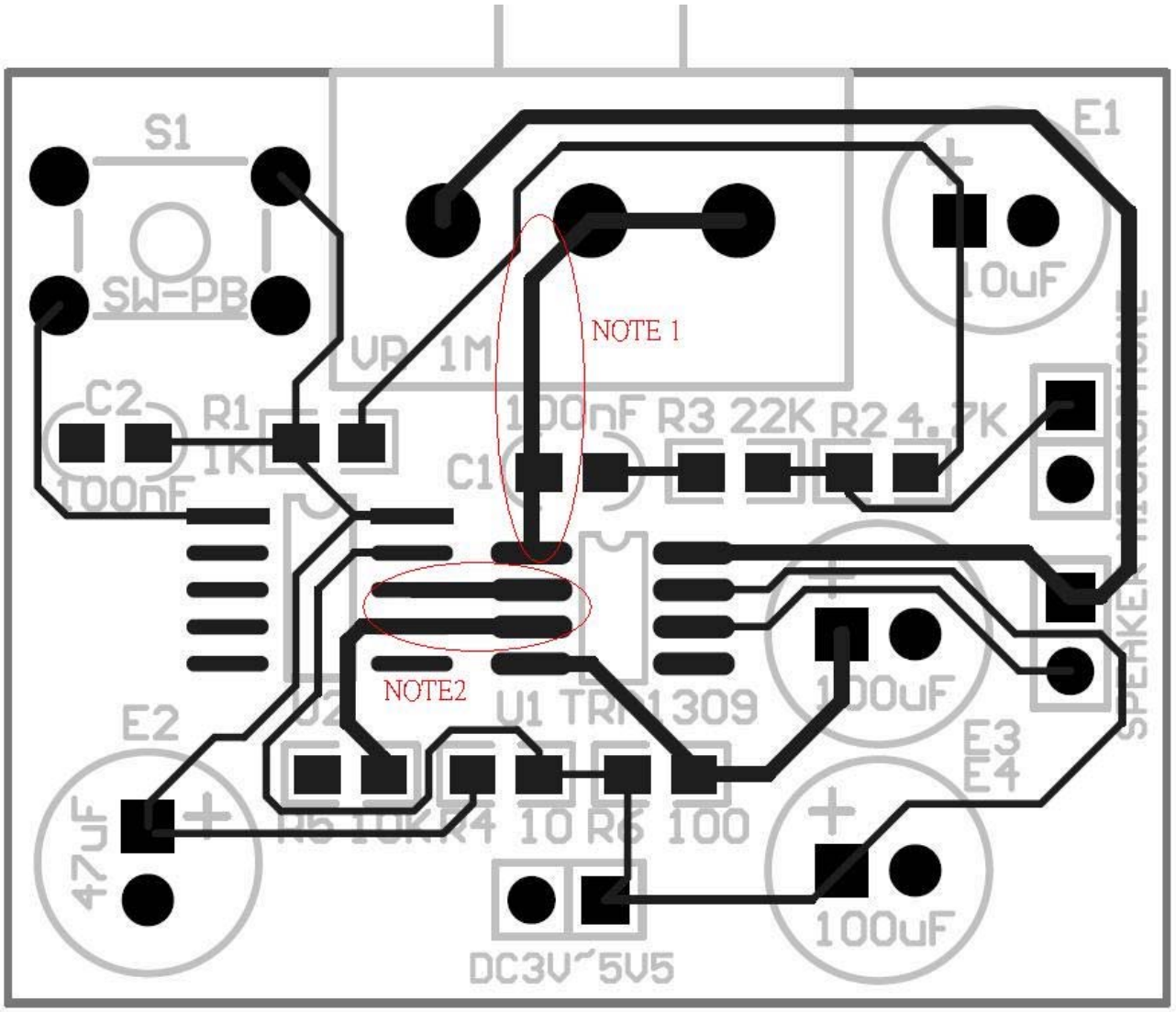


Fig 7-3

- If VR is used(Option2), 1MΩ is suggested, wire of RGAIN must be kept as short as possible
- An analog mix signal input may be used or not. (Option 1) It's gain = (VR // 250K)/Rin1 .
- If output power is small. (Output power < 0.5W) SVDD can be shorted to VDD. When high output power is needed (Output power > 0.5W). Option 4 must be used.
- R2=10Kohm(Option3) can be disable the Auto Power Off function.

The PCB layout example of Fig 7-3

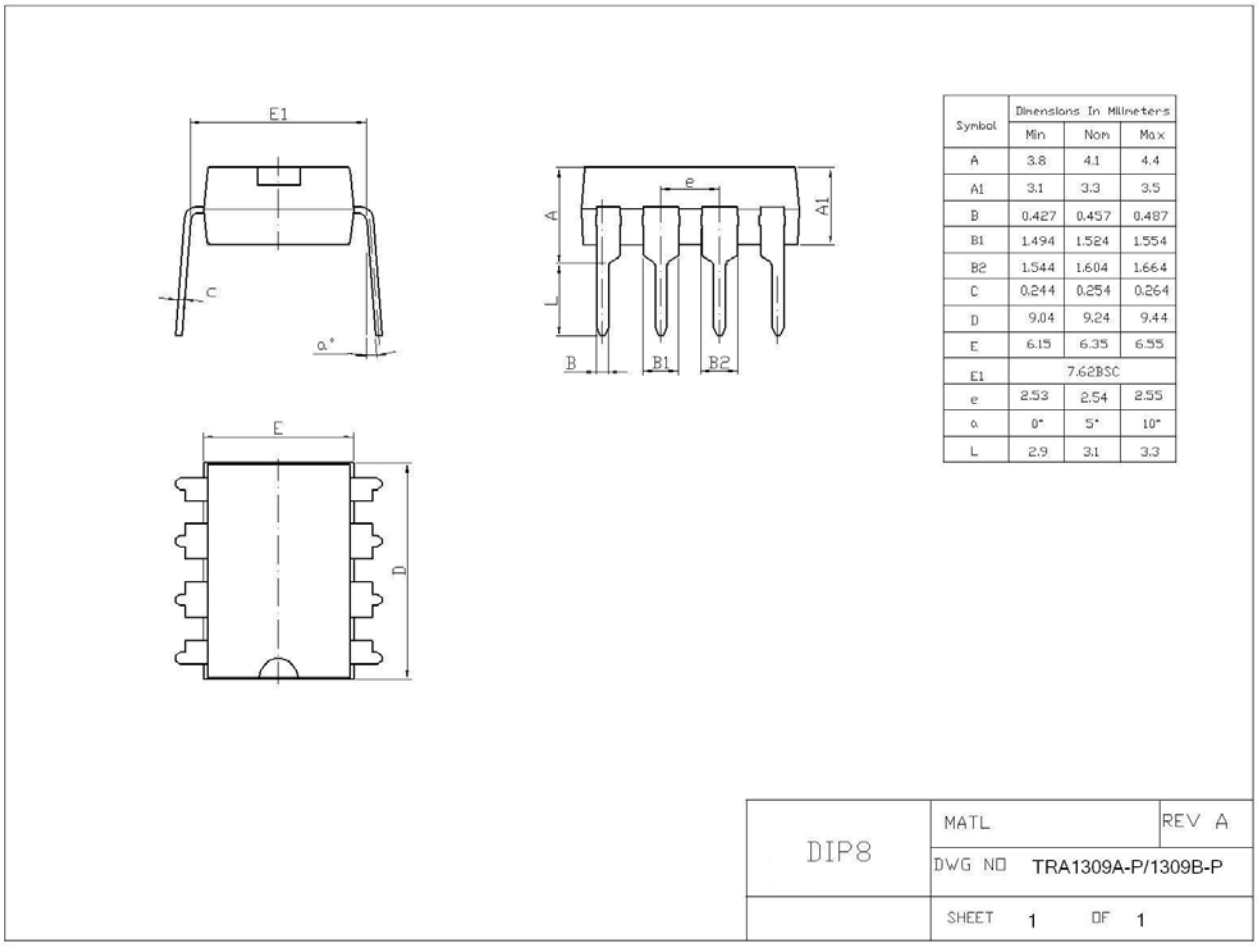


Note 1 : TRA1309AP RGAIN wire to VR and MIC input as short as possible (<2cm is needed)

Note 2: Tritan's PWM wire to TRA1309AP input as short as possible (<2cm is needed)

8.PACKAGE OUTLINES

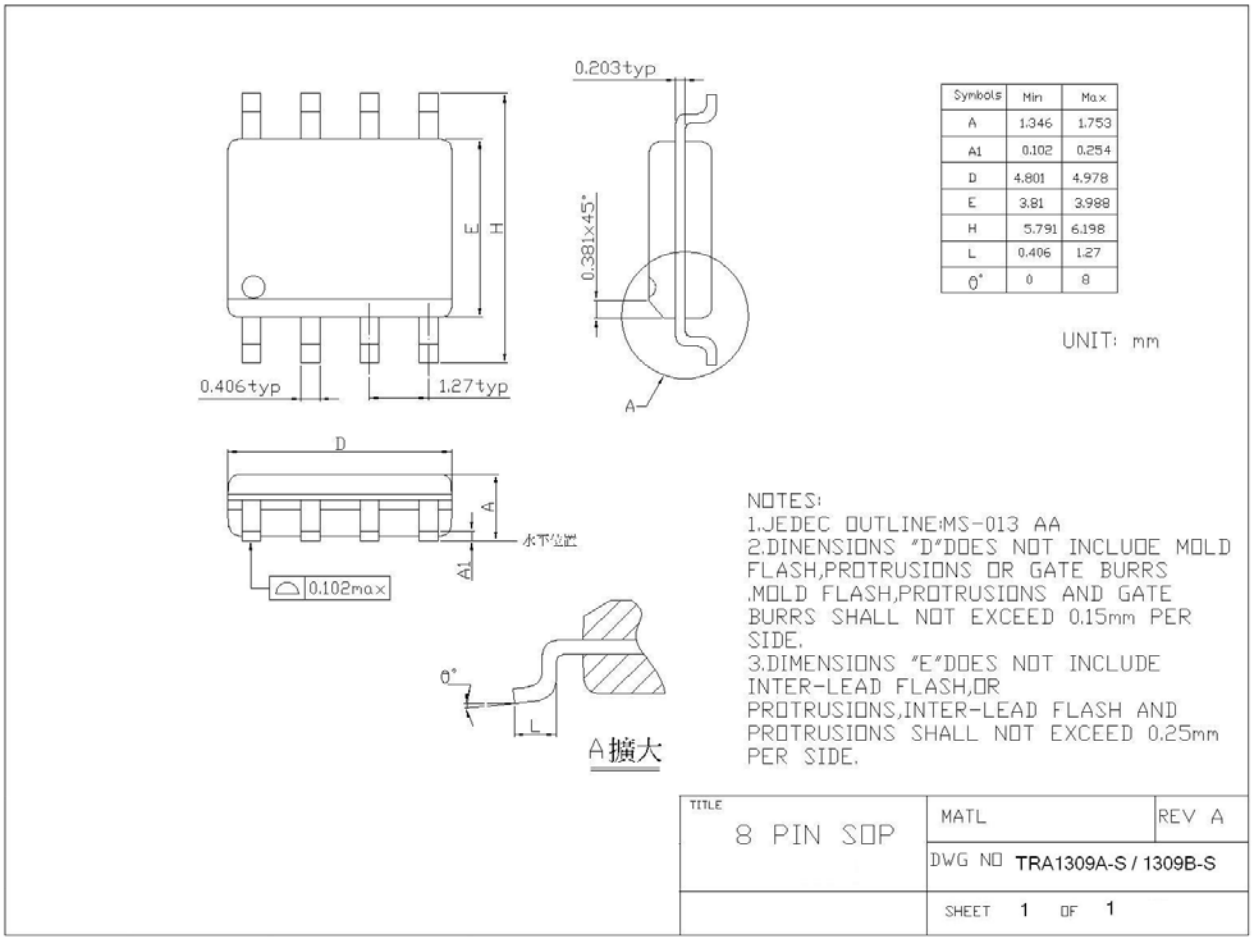
8.1 DIP8: plastic dual in-line package; 8 leads (300mil)



Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A	3.8	4.1	4.4
A1	3.1	3.3	3.5
B	0.427	0.457	0.487
B1	1.494	1.524	1.554
B2	1.544	1.604	1.664
C	0.244	0.254	0.264
D	9.04	9.24	9.44
E	6.15	6.35	6.55
E1	7.62BSC		
e	2.53	2.54	2.55
α	0°	5°	10°
L	2.9	3.1	3.3

DIP8	MATL	REV A
	DWG NO TRA1309A-P/1309B-P	
	SHEET 1 OF 1	

8.2 SOP8: plastic small outline package; 8 leads; body width 3.9mm



Symbols	Min	Max
A	1.346	1.753
A1	0.102	0.254
D	4.801	4.978
E	3.81	3.988
H	5.791	6.198
L	0.406	1.27
θ°	0	8

REVISION HISTORY

REVISION	DESCRIPTION	PAGE	DATE
V1.0	New created, PWM mode with package, extracted/modified from TRA1309A_V1.5		2009.05.07
V1.2	Gain calculated. gain = (VR // 250K)/Rin1	5	2010/06/11
V1.3	The note of the applicable IC	1	2011/12/19
V1.4	Mute consideration and PCB layout example	4,6	2012/03/15