

## LOW VOLTAGE AUDIO POWER AMPLIFIER

### ■ GENERAL DESCRIPTION

The NJM2135 is a Low voltage audio power amplifier for speaker drivers. No external coupling capacitors are required because of the differential output. The closed loop gain is adjusted by two external resistors. The low supply current in power down mode contributes to the reduction of power consumption of portable battery powered equipment, cellular phones, for example.

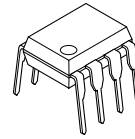
### ■ FEATURES

- Operating Voltage ( +2V ~ +16V )
- Low Operating Current in Power Down Mode ( 0.1 $\mu$ A typ. )
- Low Operating Current in Normal Operation Mode ( 2.7mA typ. )
- Output Power Exceeds 250mW (  $V^+=6V, R_L=32\Omega$  )
- Gain Range ( GVD=0~43dB, Voice Band )
- Load Impedance ( 8~200 $\Omega$  )
- Bipolar Technology
- Package Outline

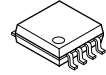
DIP8, DMP8, SIP8, SSOP8  
MSOP8 (VSP8)\*

\*MEET JEDEC MO-187-DA

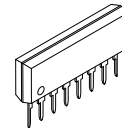
### ■ PACKAGE OUTLINE



**NJM2135D**  
( DIP8 )



**NJM2135M**  
( DMP8 )



**NJM2135L**  
( SIP8 )

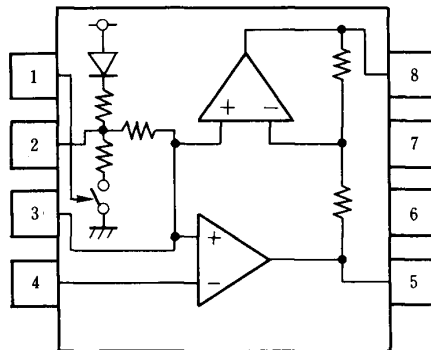


**NJM2135V**  
( SSOP8 )



**NJM2135R**  
( MSOP8 (VSP8) )

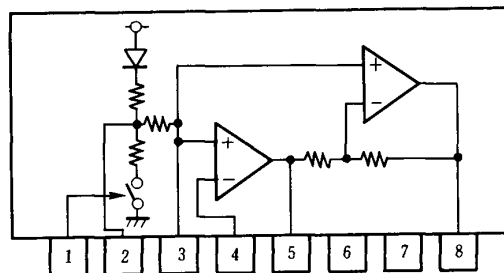
### ■ PIN CONFIGURATION



**NJM2135D**  
**NJM2135M**  
**NJM2135V**  
**NJM2135R**

#### PIN FUNCTION

1. CD
2.  $V_{REF1}$
3.  $V_{REF2}$
4.  $-V_{IN}$
5.  $V_{OUT1}$
6.  $V^+$
7. GND
8.  $V_{OUT2}$



**NJM2135L**

# NJM2135

## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25°C )

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	+18	V
Output Peak Current	I <sub>OP</sub>	± 250	mA
Maximum Input Voltage	V <sub>IN</sub> ( 1-4pin )	-0.3, V <sup>+</sup> +0.3	V
	V <sub>IN</sub> ( 5-8pin )	-0.3, V <sup>+</sup> +0.3 ( In power down )	V
Power Dissipation	P <sub>D</sub>	( DIP8 ) 500	mW
		( SIP8 ) 800	
		( DMP8 ) 500 ( note1 )	
		( SSOP8 ) 360 ( note1 )	
		MSOP8(VSP8) 320	
Operating Temperature Range	T <sub>opr</sub>	-20~+75	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

( note1 ) Mounted on PC Board

## ■ ELECTRICAL CHARACTERISTICS

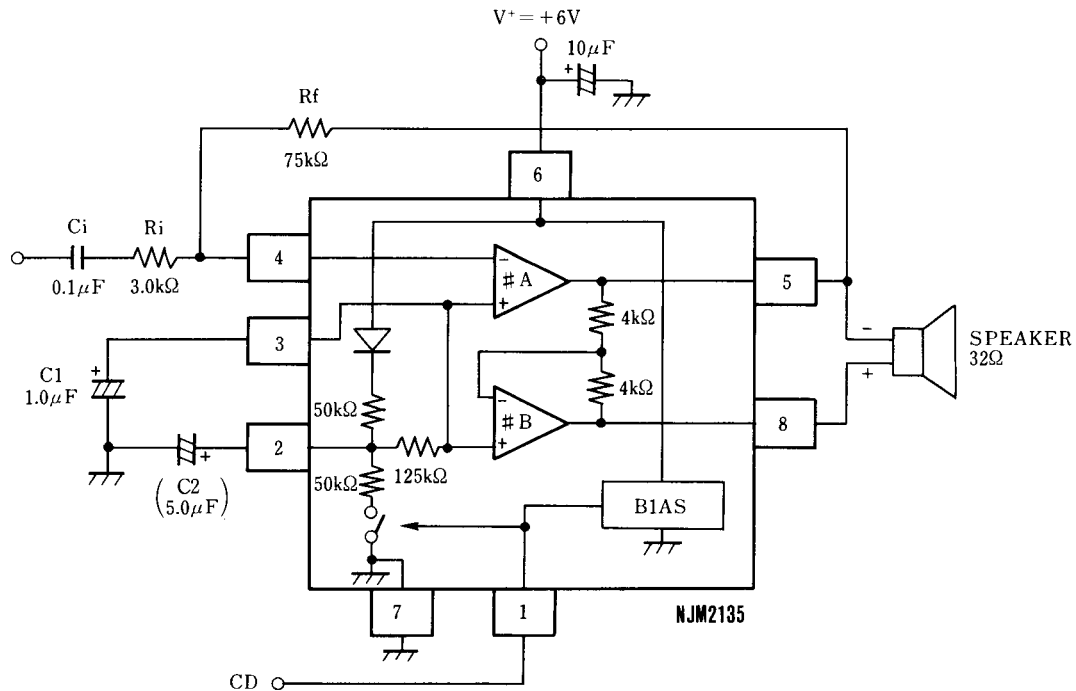
( V<sup>+</sup>=6.0V, Ta=25°C unless otherwise specified )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Current ( NO SIGNAL ) ( At Power Down Mode )	I <sub>CC1</sub>	V <sup>+</sup> =3.0V, R <sub>L</sub> =∞, 1pin=2.0V	-	2.7	4.0	mA
	I <sub>CC2</sub>	V <sup>+</sup> =16.0V, R <sub>L</sub> =∞, 1pin=2.0V	-	3.4	5.0	mA
	I <sub>CCD</sub>	V <sup>+</sup> =3.0V, R <sub>L</sub> =∞, 1pin=0.8V	-	0.1	1.0	μA
Open Loop Gain	A <sub>v1</sub>	AMP#A, f<100Hz	77	83	-	dB
Closed Loop Gain	A <sub>v2</sub>	AMP#B, f=1kHz, R <sub>L</sub> =32Ω	-0.35	-	+0.35	dB
Output Power ( note2 )	P <sub>O1</sub>	V <sup>+</sup> =3.0V, R <sub>L</sub> =16Ω, THD≤10%	55	-	-	mW
	P <sub>O2</sub>	V <sup>+</sup> =6.0V, R <sub>L</sub> =32Ω, THD≤10%	250	-	-	mW
	P <sub>O3</sub>	V <sup>+</sup> =12.0V, R <sub>L</sub> =100Ω, THD≤10% ( note3 )	400	-	-	mW
Total Harmonic Distortion ( f=1kHz )	THD1	V <sup>+</sup> =6V, R <sub>L</sub> =32Ω, P <sub>O</sub> =125mW, G <sub>VD</sub> =34dB	-	0.5	1.0	%
	THD2	V <sup>+</sup> ≥3V, R <sub>L</sub> =8Ω, P <sub>O</sub> =20mW, G <sub>VD</sub> =12dB	-	0.5	-	%
	THD3	V <sup>+</sup> ≥12V, R <sub>L</sub> =32Ω, P <sub>O</sub> =200mW, G <sub>VD</sub> =34dB	-	0.6	-	%
Power Supply Rejection Ratio ( V <sup>+</sup> =6.0V, ΔV <sup>+</sup> =3.0V )	PSRR1	C1=∞, C2=0.01μF, DC	50	-	-	dB
	PSRR2	C1=0.1μF, C2=0, f=1kHz	-	12	-	dB
	PSRR3	C1=1.0μF, C2=5.0μF, f=1kHz	-	52	-	dB
Mute Attenuation	MAT	f=1kHz~20kHz, 1pin=2.0V	-	70	-	dB
Output Voltage ( R <sub>F</sub> =75kΩ, DC )	V <sub>O1</sub>	V <sup>+</sup> =3.0V, R <sub>L</sub> =16Ω	1.00	1.15	1.25	V
	V <sub>O2</sub>	V <sup>+</sup> =6.0V	-	2.55	-	V
	V <sub>O3</sub>	V <sup>+</sup> =12.0V	-	5.45	-	V
Output High Level	V <sub>OH</sub>	I <sub>OUT</sub> =-75mA, V <sup>+</sup> =2.0~16.0V	-	V <sup>+</sup> -1.1	-	V
Output Low Level	V <sub>OL</sub>	I <sub>OUT</sub> =75mA, V <sup>+</sup> =2.0~16.0V	-	0.21	-	V
Output DC Offset	ΔV <sub>O</sub>	R <sub>F</sub> =75kΩ, R <sub>L</sub> =32Ω, 5pin~8pin	-30	0	+30	mV
Input Bias Current	I <sub>B</sub>	4pin	-	-30	-200	nA
Equivalent Resistance	R <sub>+IN</sub>	3pin	100	150	220	kΩ
	R <sub>REF</sub>	2pin	18	25	40	kΩ
CD Input Voltage H	V <sub>CDH</sub>	1pin	2.0	-	V <sup>+</sup>	V
CD Input Voltage L	V <sub>CDL</sub>	1pin	0.0	-	0.8	V
CD Input Resistance	R <sub>CD</sub>	V <sup>+</sup> =V <sub>CD</sub> =16.0V, 1pin	50	90	175	kΩ

( note2 ) NJM2135M, NJM2135V, NJM2135R : Mounted on PC Board

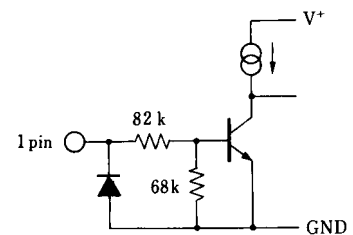
( note3 ) NJM2135V, NJM2135R is excluded

## APPLICATION CIRCUIT



( note )

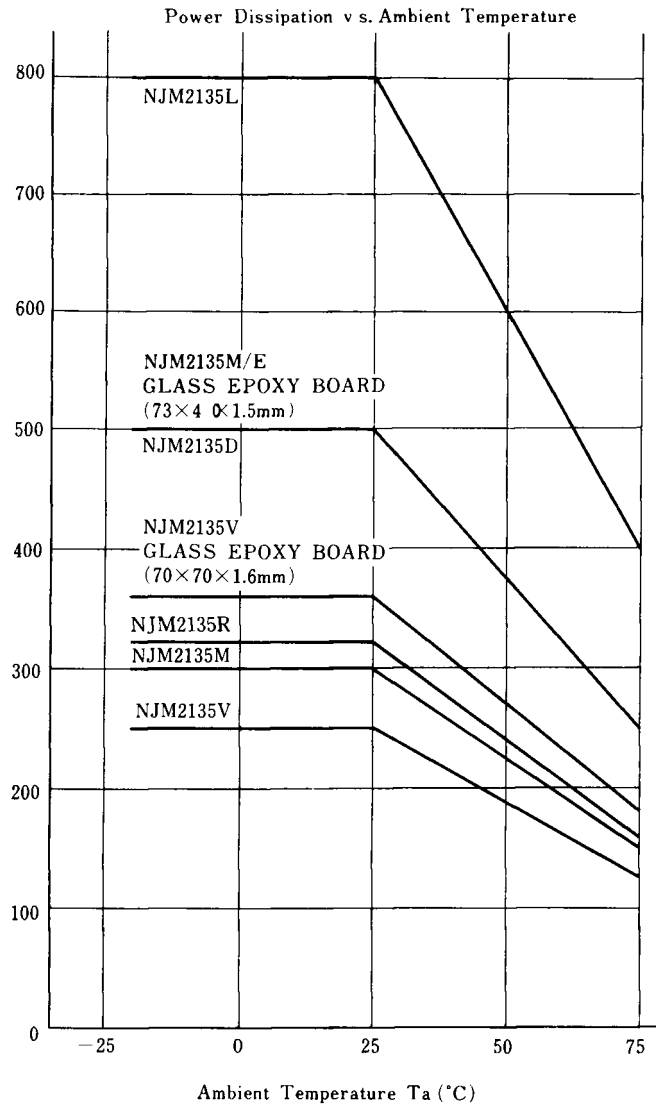
1. The NJM2135 is active mode during the CD terminal is High level ( >2.0V ) and it is stand-by mode during the CD terminal is Low level ( <0.8V ).
2. C1 and C2 improve power supply rejection ratio.  
In case of C1 is enough large, C2 is unnecessary.
3. Please note that the C1 and C2 make slow power rise up to the NJM2135 regardless the external power supply condition.
4. Input current flow on the internal resistor shown in the equivalent circuit of CD terminal.
5. No snubber resistor and capacitor are required normally. But the snubber resistor and capacitor are required if the NJM2135 oscillates by condition of PCB layout, stray capacitor and speaker wire length.
6. When the NJM2135 change the mode to active or stand-by the CD terminal ON/OFF, the actual operation takes some delay by the charge and discharge of C1, C2.
7. When the power turns on in stand-by mode, the NJM2135 operates during charging time of C1 and C2.
8. If the supply voltage fluctuate large during the stand-by mode, the mode of active and stand-by of NJM2135 becomes unstable.



# NJM2135

## ■ POWER DISSIPATION

The allowable power is restricted by the ambient temperature. Characteristics of the allowable power ( PD : Power Dissipation ) against ambient temperature is indicated below.



**[CAUTION]**

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