

Digital Power Amplifier R2S15102NP

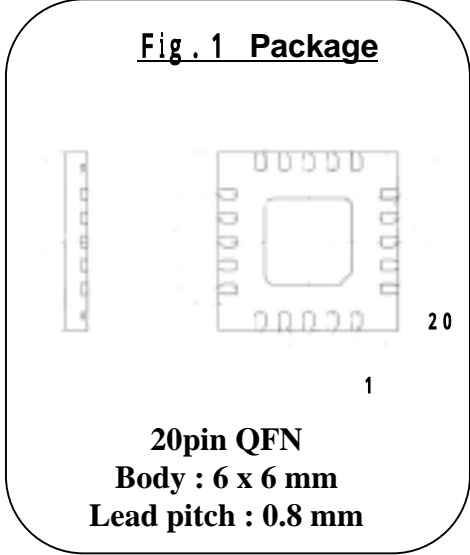
10Wx2ch(SE)/20Wx1ch(BTL) Digital Audio Power Amplifier

1. Outline

R2S15102NP is a Digital Power Amplifier IC developed for TV.
 R2S15102NP can realize maximum Power 10W × 2ch
 (VD = 24V, THD = 10%, SE) at 8 Ω load.
 It is possible to replace from the conventional analog amplifier
 system to the digital amplifier system easily.

2. Feature

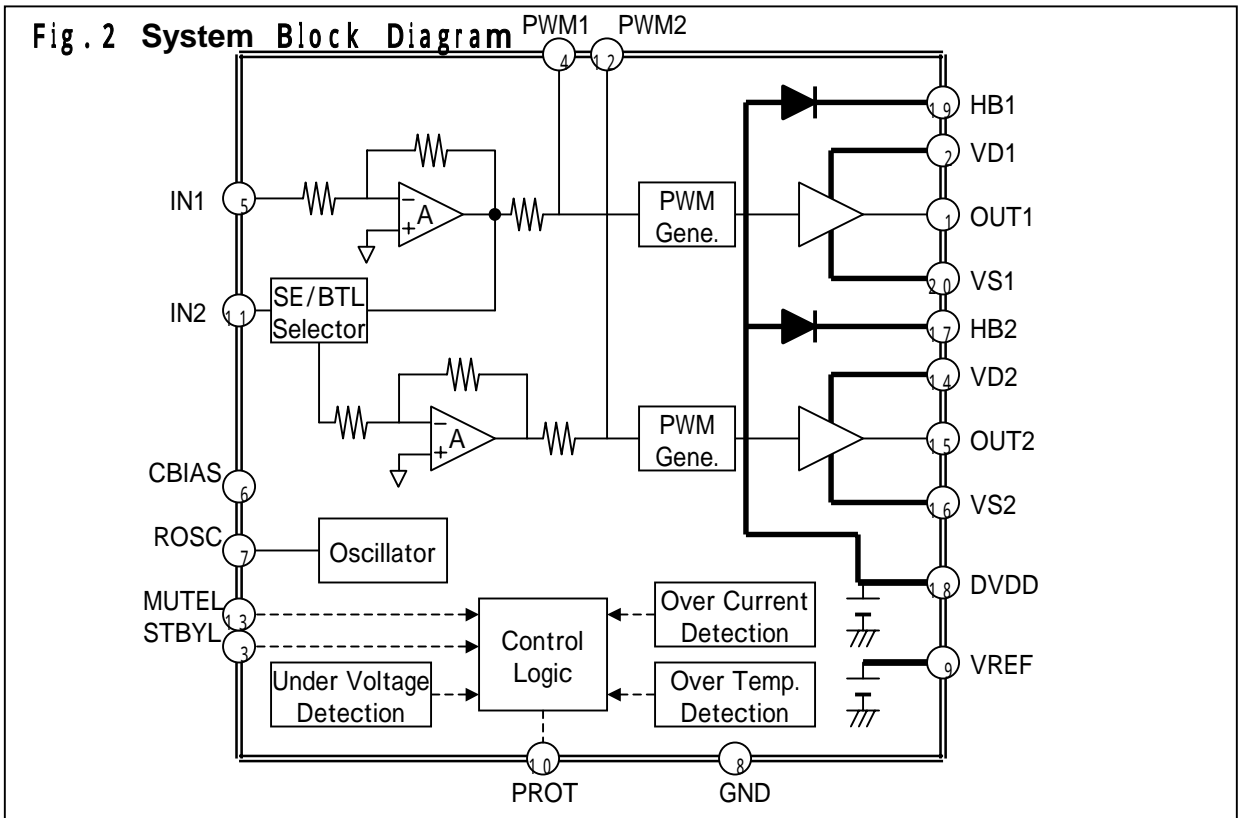
- High Output Power(THD=10%)without external Heat Sink
 (note) the thermal pad is soldered the thermal pad with
 the printed-circuit board directly.
- Recommended Power Condition
 - SE operation mode :10Wx2ch(VD=24V) at 8 Ω
 - BTL operation mode: 20Wx1ch(VD=18V) at 8 Ω
- The RENESAS original circuits realize high power efficiency,
 low noise and low distortion characteristics.
- Pop sound Less
- Built-in protection function
 (Over Current, Over Temperature and Under Voltage)
- Built-in Mute and Stand-by function



3. Operating Condition

- Recommended Power supply voltage : from 11V to 25V
- Recommended Speaker Impedance : from 4 to 8Ω

4. Block Diagram



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5 . Pin Configuration(Table.1)

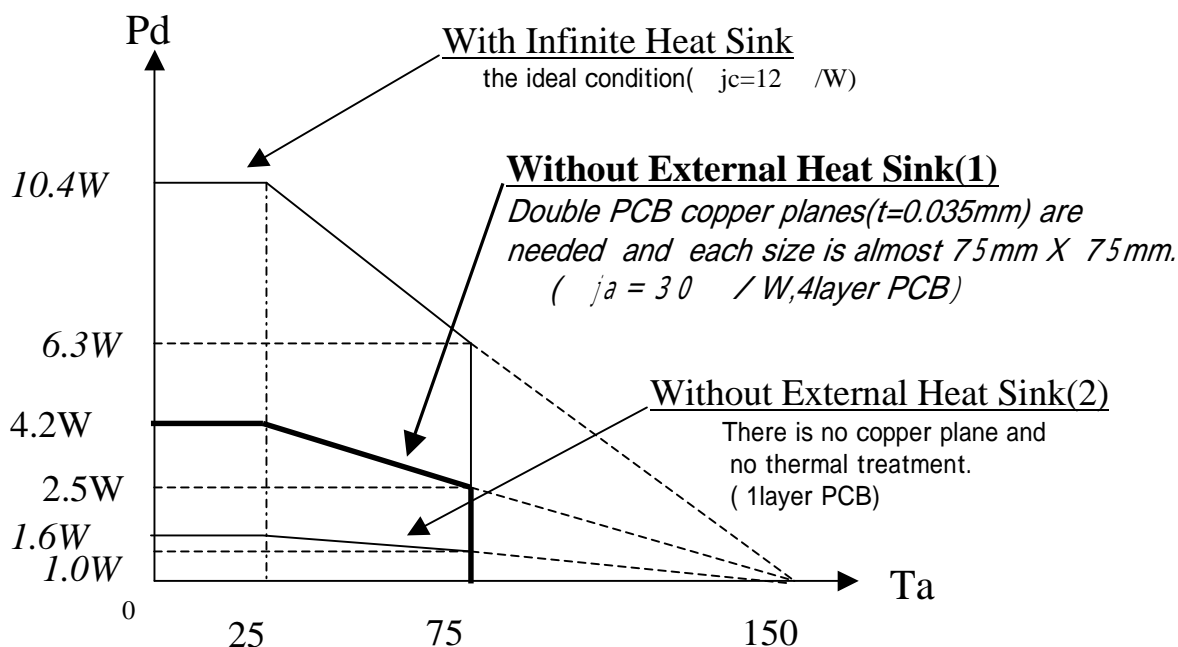
No.	NAME	I/O	Description	
1	OUT1	O	Power Output pin #1	
2	VD1	-	Power supply pin for power output stage #2	
3	STBYL	I	Stand-by control pin. When this is “L”, circuit current is reduced. There is the pull-down resistor:50Kohm(typ.).	
4	PWM1	I	PWM input pin #1 (for phase compensation)	
5	IN1	I	Analog input #1. The gain is depended on the external resistance .	
6	CBIAS	I/O	A capacitor is connected so that it may not be influenced of power supply change(Ripple Filter).	
7	ROSC	I	Control pin for PWM carrier frequency	
8	GND	-	GND pin for analog block	
9	VREF	I/O	Capacitor connection pin for analog block reference voltage source	
10	PROT	O	Protection Timer pin. At protection mode,the output becomes “L”-level. (The timing capacitor is connected)	
11	IN2	I	SE operation	Analog input #2(as same as IN1)
		I	BTL operation	When this is connected to DVDD pin via the resister(82Kohm), Reversed signal of OUT1 is output to OUT2.
12	PWM2	I	PWM input pin#2 (for phase compensation)	
13	MUTEL	I	Mute control pin. When this is “L”, it becomes mute status.	
14	VD2	-	Power supply pin for power output stage #2	
15	OUT2	O	Power Output pin #2	
16	VS2	-	Ground pin for power output stage #2	
17	HB2	I/O	Capacitor connection pin for bootstrap	
18	DVDD	O	Built-in power supply pin for internal digital block.	
19	HB1	I/O	Capacitor connection pin for bootstrap #1	
20	VS1	-	Ground pin for power output stage #1	

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6 . Absolute Maximum Rating(Table.2)

Symbol	Parameter	Condition	Value	Unit
VD max	Maximum VD Voltage	VD1,VD2 pin voltage	27	V
HB max	Maximum HB Voltage	HB1, HB2 pin voltage	40	V
Pd	Power dispassion	Ta = 25°C :See Fig.3	4.2	W
ja	Thermal Resistance	See Fig.3	30	/W
Tj	Junction temperature	Maximum Temperature	150	
Ta	Operating ambient temperature	Temperature range	-20 ~ 75	
Tstg	Storage temperature	Temperature range	-40 ~ 150	

Fig.3 Thermal De-rating(on PCB: printed-circuit board):Size 75mm x 75mm

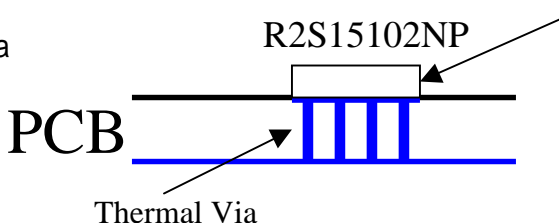


(NOTE)

PCB pattern design for high effective thermal conductivity

(1)The exposed die pad is **directly** soldered with the printed-circuit board pattern .

(2)Thermal Via



(caution)

There are side expositions of the die pad at corners of the package.

(The die pad is grounded.)

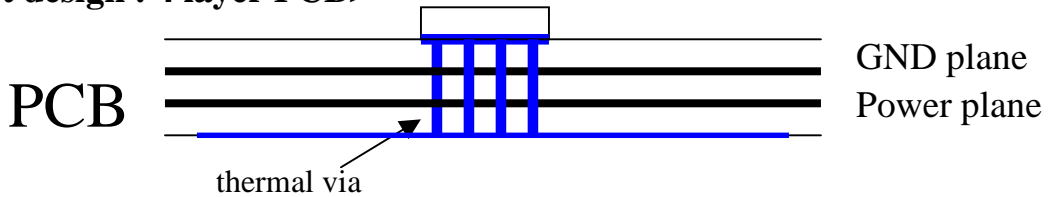
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Consideration about the PCB design

The Power dissipation at 10Wx2ch(SE) or 20Wx1ch(BTL) is estimated almost 2W. It has enough margin, designing the PCB at $ja=30$ /W.

(1)PCB basic design (copper plane)

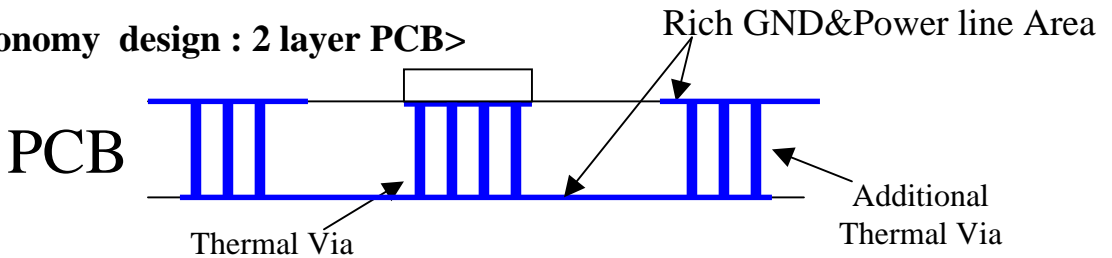
<the best design : 4 layer PCB>



<PCB size estimation >

10Wx2ch: 75mm x 75mm

<the economy design : 2 layer PCB>



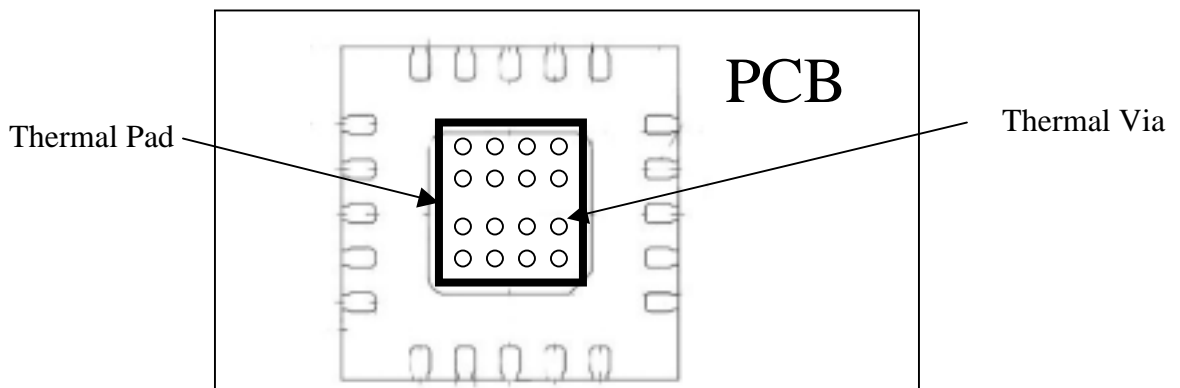
The GND&Power line total area size is also equal to the above GND&Power line total area size of the 4layer PCB.

<PCB size estimation >

10Wx2ch: (75+)mm x (75+) mm

(2)PCB Thermal Pad

The exposed die pad is **directly** soldered with the printed-circuit board pattern .



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7 . Recommended Operating condition(Table.3)

Symbol	Parameter	Condition	MIN	TYP	MAX	Unit
VD	Supply Voltage	VD1,VD2 pin voltage	11	-	25	V
VH	Control voltage of high level	STBYL, MUTEL	2	-	5	V
VL	Control voltage of low level	STBYL, MUTEL	0	-	0.8	V
fosc	Carrier Frequency	R=33k at Pin#7	300	400	600	kHz

- (note)
- STBYL: High level:normal operation Low level:Stand-by
 - MUTEL:High level:normal operation Low level:Mute
 - The carrier frequency can be changed by the resistance at Pin#.7 .

8 . Electronic Characteristics(Table.4)

(Unless otherwise noted, Ta=25°C, VD=24V, Carrier Frequency=400kHz, f=1kHz,SE operation)

Symbol	Parameter		Condition	MIN	TYP	MAX	Unit
IVD	Circuit Current		No Signal	14	22	30	mA
			MUTE	-	23	-	mA
			Stand-by	-	-	10	uA
VDPR	Detection Voltage		VD under-voltage	-	9.8	-	V
TPR	Protection Temperature		Thermal Shut-dawn	-	150	-	
TRL	Release Temperature		Thermal Shut-dawn	-	120	-	
IPR	Protection Current		Output over-current	-	6	-	A
Pomax	Maximum output power	at SE	THD=10%、VD=24V、RL=8	8	10	-	W/ch
		at BTL	THD=10%、VD=18V、RL=8	16	20	-	W
THD	Total Harmonic Distortion		Po=1W	-	0.1	1.0	%
No	Output Noise level		A-Weighted filter	-	100	300	uVrms
Eff	Power Efficiency	at SE	Po=10+10W	-	93	-	%
		at BTL	Po=20W	-	89	-	%
Mute	Mute Attenuation		Ref.Po=5W	-	95	-	dB
PSRR	Ripple Rejection Ratio		dVD=400mVrms,f=1KHz	-	55	-	dB

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9 . Application Examples

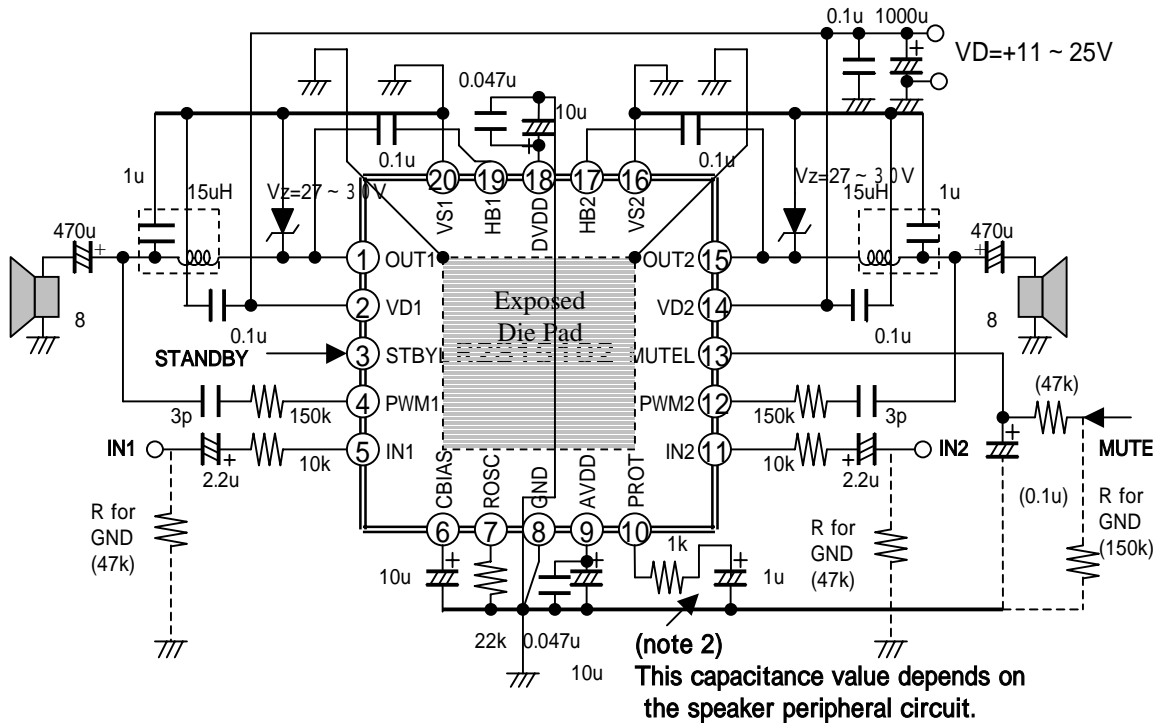
This is only an example for one situation.

Please, refer to the detailed application note for designing actual circuit about SE or BTL operation.

Fig.4 SE operation mode(10Wx2ch)

(note)

“R for GND” ‘s are for the evaluation only and not needed actually.



(note 2)
This capacitance value depends on the speaker peripheral circuit.

(Note 1) There is a “sleep mode” controlled by STBYL(Pin#3).

Don't use the STBYL(Pin#3) function at usual operation because of the POP sound.

<Please use the mute function by the MUTEL(Pin#13) at the timing of Power-ON and Power-OFF .>

(Note 2) The capacitance at Pin#10(PROT) depends on the DC cut capacitance at the speaker. Please choose the following combination ;

DC Cut Capacitance	Capacitance at Pin#10	Wait time for operation
470uF	1uF	about 1Sec.
1000uF	2.2uF	about 2.2Sec.

(There is the combination <470uF,1uF> in Fig.4)