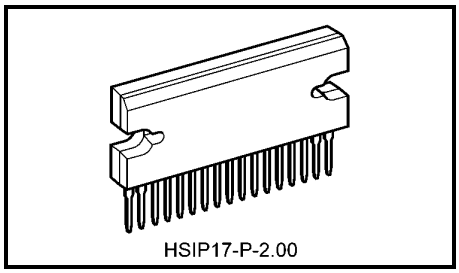
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8231LQ

42W BTL × 2CH Audio Power IC

The TA8231LQ is BTL audio power amplifier for consumer application. It is designed for high power,low distortion and low noise.
It contains various kind of protectors and the function of stand−by.

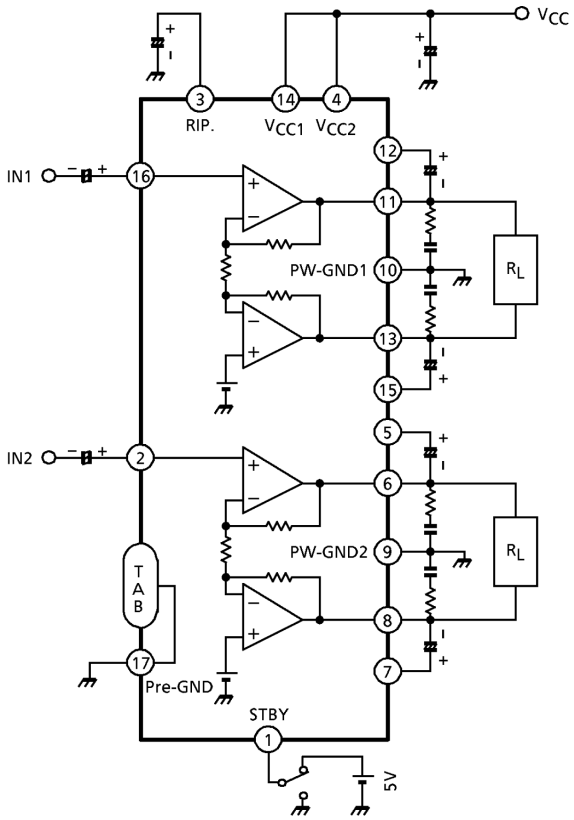


Weight: 9.8g (typ.)

Feature

- High power
  : $P_{OUT\ (1)}$ = 42W (typ.)
  (V_{CC} = 14.4V, f = 1kHz, THD = 10%, R_L = 2Ω)
  : $P_{OUT\ (2)}$ = 37W (typ.)
  (V_{CC} = 13.2V, f = 1kHz, THD = 10%, R_L = 2Ω)
  : $P_{OUT\ (3)}$ = 22W (typ.)
  (V_{CC} = 13.2V, f = 1kHz, THD = 10%, R_L = 4Ω)
- Excellent output power bandwidth
  : $P_{OUT\ (4)}$ = 17W (typ.)
  (V_{CC} = 13.2V, f = 20Hz~20kHz, THD = 1%, R_L = 4Ω)
- Fixed voltage gain
  : G_V = 32dB (typ.)
  V_{CC} = 13.2V, V_{out} = 0.775V_{rms} (0dBm)
- Low thermal resistance
  : θ_{j-c} = 1.5°C / W (typ.)
- Low distortion
  : THD = 0.02% (typ.)
  (V_{CC} = 13.2V, f = 1kHz, P_{out} = 4W, R_L = 4Ω)
- Built−in stand−by switch function
  : I_{STBY} = 100μA (typ.)
  (With pin(1) set at high, power is turned on)
- Built−in various protection circuit
  : Thermal shut down,Over voltage,Out to GND,Out to V_{CC},Out to Out short
- Operating supply voltage
  : $V_{CC\ (opr)}$ = 9~18V

Block Diagram
(G_V = 32dB)

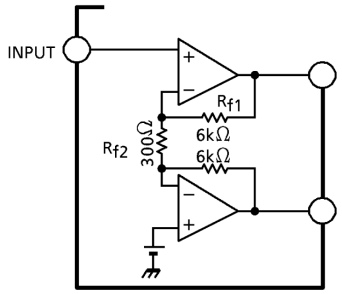


Caution And Application Method

(Description is made only on the single channel.)

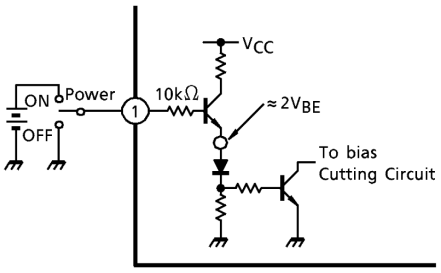
1. Voltage gain adjustment
   This IC has no NF (negative feedback) terminals. Therefore, the voltage gain can't adjusted, but it makes the device a space and total costs saver.
   The voltage gain is decided only internal by expression below.

$$G_V = 20\log\frac{R_{f1}}{R_{f2}} + 6\,(dB) = 32\,(dB)$$



2. Stand–by SW function

By means of controlling pin(1) (stand–by terminal) to high and low,the power supply can be set to on and off.
The threshold voltage of pin(1) is set at about 3V (typ.), and the power supply current is about 100μA (typ.) at the stand–by state.



(Fig. 2) With pin① set to High, Power is turned ON.

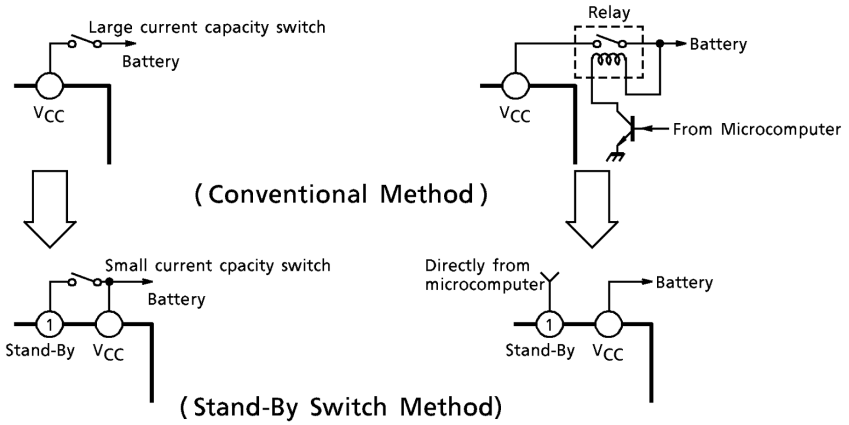
Pin (1) control voltage: $V_{(SB)}$

Stand–by	Power	$V_{(SB)}$ (V)
On	Off	0~2
Off	On	3~V_{CC}

~Advantage of stand–by SW~

(1) Since V_{CC} can directly be controlled to on / off by the microcomputer, the switching relay can be omitted.

(2) Since the control current is microscopic, the switching relay of small current capacity is satisfactory for switching.



3. Preventive measure against oscillation

For preventing the oscillation, it is advisable to use C4, the condenser of polyester film having small characteristic fluctuation of the temperature and the frequency.
The resistance R to be series applied to C4 is effective for phase correction of high frequency, and improves the oscillation allowance.
Since the oscillation allowance is varied according to the causes described below, perform the temperature test to check the oscillation allowance.

(1) Capacity value of condenser
(2) Kind of condenser
(3) Layout of printed board

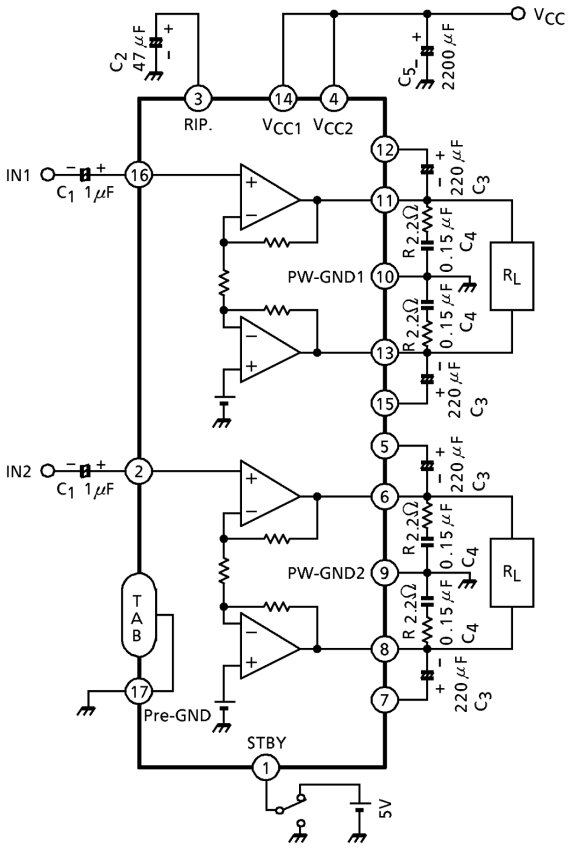
Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Peak supply voltage (0.2s)	$V_{CC\ (surge)}$	50	V
DC supply voltage	$V_{CC\ (DC)}$	25	V
Operating supply voltage	$V_{CC\ (opr)}$	18	V
Output current (peak)	$I_{O\ (peak)}$	9	A
Power dissipation	P_D	50	W
Operating temperature	T_{opr}	−30~85	°C
Storage temperature	T_{stg}	−55~150	°C

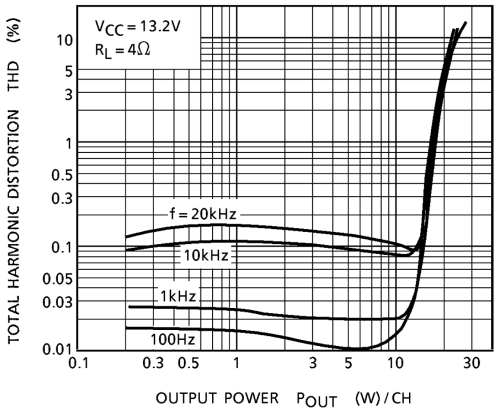
Electrical Characteristics
(unless otherwise specified V_{CC} = 13.2V, f = 1kHz, R_g = 600Ω, Ta = 25°C)

Characteristic	Symbol	Test Cir−cuit	Condition	Min	Typ.	Max	Unit
Quiescent current	I_{ccq}	—	V_{in} = 0	—	150	250	mA
Output power	$P_{out\ (1)}$	—	V_{CC} = 14.4V, THD = 10%, R_L = 2Ω	—	42	—	W
	$P_{out\ (2)}$	—	THD = 10%, R_L = 2Ω	28	37	—	W
	$P_{out\ (3)}$	—	THD = 10%, R_L = 4Ω	19	22	—	W
	$P_{out\ (4)}$	—	THD = 1%, f = 20Hz~20kHz, R_L = 4Ω	—	17	—	W
Total harmonic distortion	THD	—	P_{out} = 4W	—	0.02	0.2	%
Voltage gain	G_V	—	V_{out} = 0.775V_{rms} (0dBm)	30.5	32	33.5	dB
Voltage gain ratio	ΔG_V	—	V_{out} = 0.775V_{rms} (0dBm)	−1	0	1	dB
Output noise voltage	$V_{NO\ (1)}$	—	R_g = 0Ω, DIN45405 Noise Filter	—	0.07	—	mV_{rms}
	$V_{NO\ (2)}$	—	R_g = 0Ω, BW = 20Hz~20kHz	—	0.06	0.1	mV_{rms}
Ripple rejection ratio	R.R.	—	f_{ripple} = 100Hz, V_{out} = 0.775V_{rms} (0dBm), R_g = 600Ω	40	60	—	dB
Cross talk	C.T.	—	R_g = 600Ω, V_{out} = 0.775V_{rms} (0dBm)	—	60	—	dB
Input resistance	R_{IN}	—	—	—	30	—	kΩ
Output offset voltage	V_{offset}	—	V_{in} = 0	−200	0	200	mV
Stand−by current	I_{STBY}	—	Pin(1): GND	—	100	150	μA

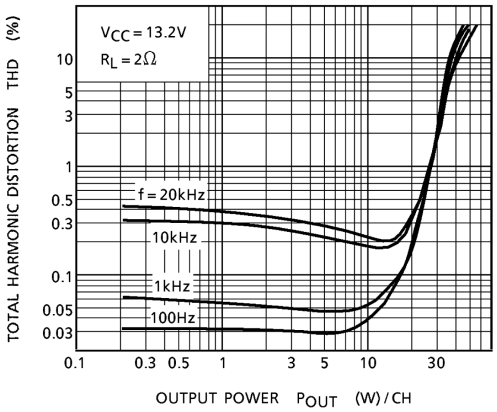
Test Circuit
(G_V = 32dB)



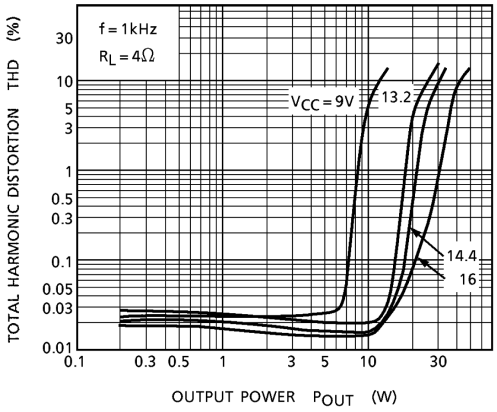
THD – P_{OUT}



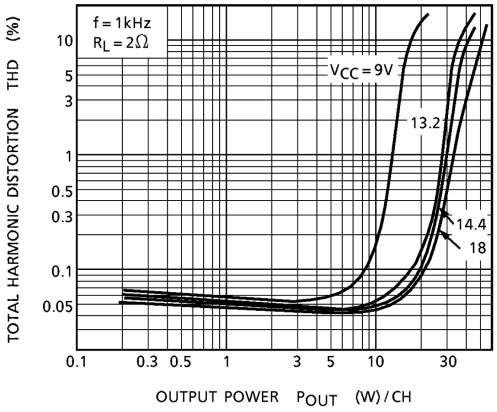
THD – P_{OUT}



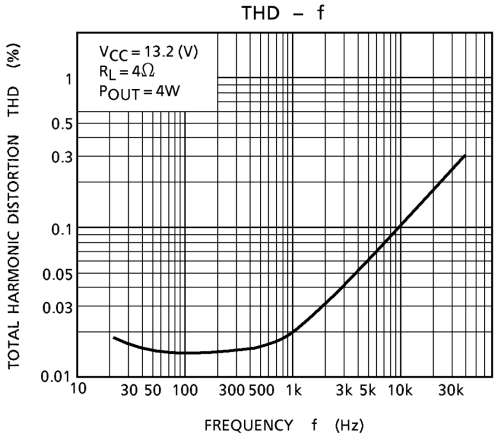
THD – P_{OUT}



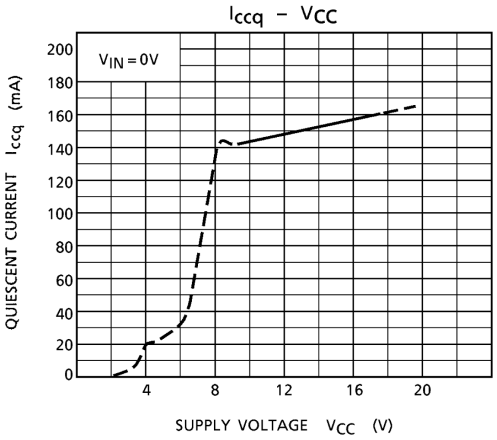
THD – P_{OUT}



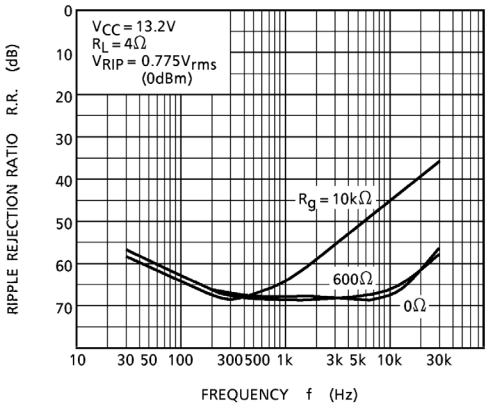
THD – f



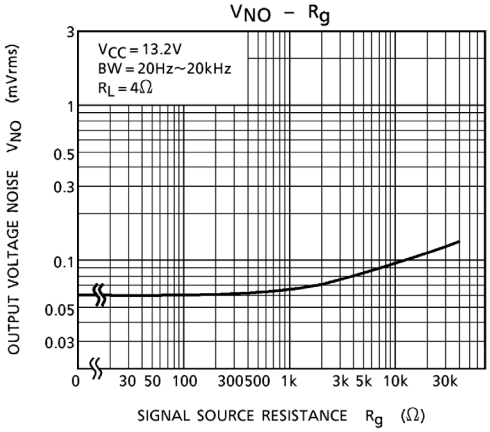
I_{ccq} – V_{CC}



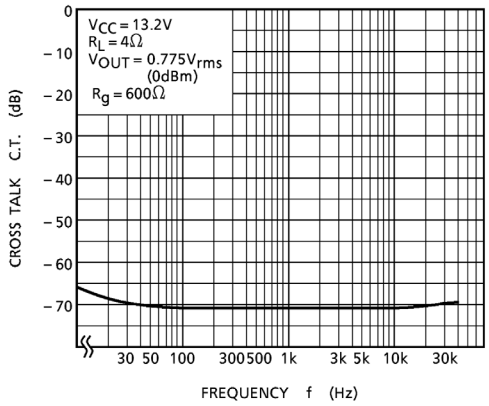
R.R. – f



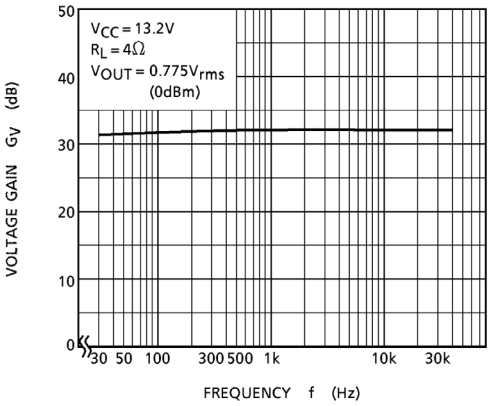
V_{NO} – R_g



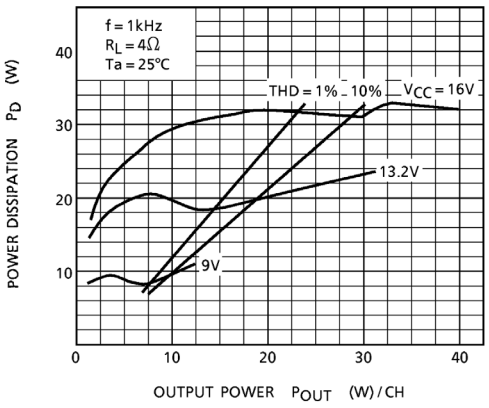
C.T. – f



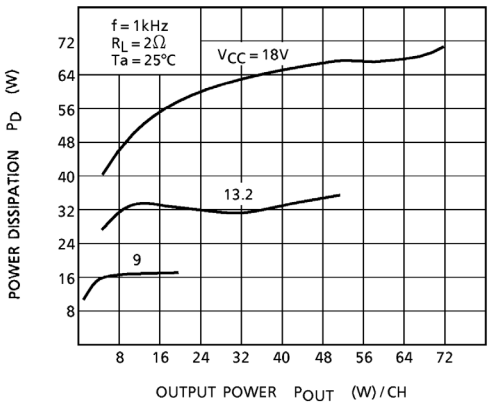
G_V – f

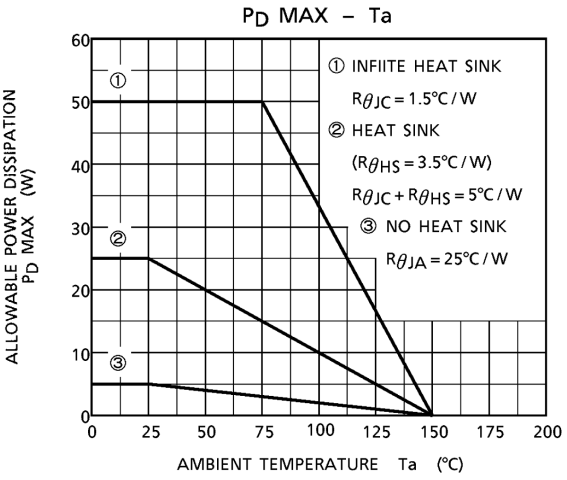


P_D – P_{out}



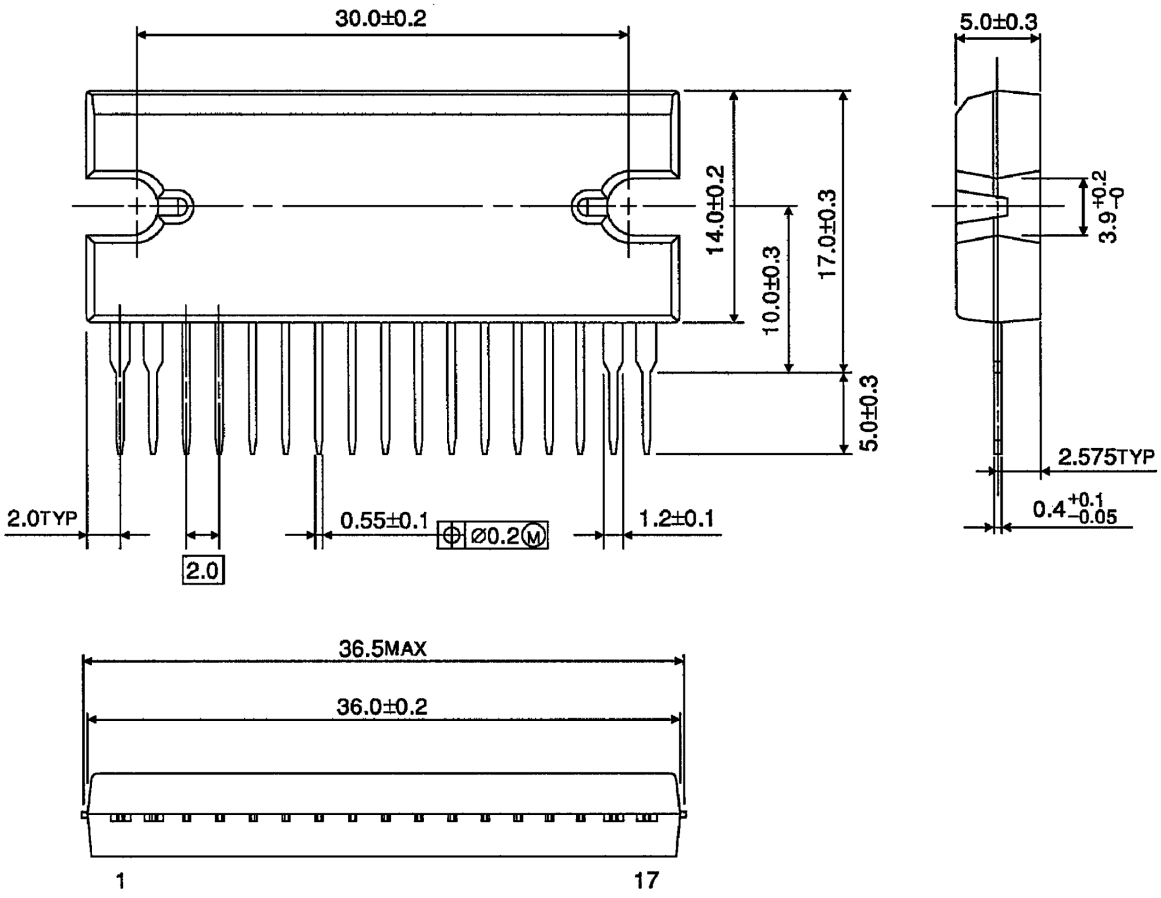
P_D – P_{OUT}




P_D MAX – Ta
ALLOWABLE POWER DISSIPATION P_D MAX (W)
60
50
40
30
20
10
0
0
25
50
75
100
125
150
175
200
AMBIENT TEMPERATURE Ta (°C)
① INFIITE HEAT SINK
$R_{\theta JC}$ = 1.5°C / W
② HEAT SINK
($R_{\theta HS}$ = 3.5°C / W)
$R_{\theta JC} + R_{\theta HS}$ = 5°C / W
③ NO HEAT SINK
$R_{\theta JA}$ = 25°C / W

Package Dimensions

HSIP17-P-2.00 Unit : mm



Weight: 9.8g (typ.)

- Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.

- If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF. For details on how to connect a protection circuit such as a current limiting resistor or back electromotive force adsorption diode, refer to individual IC datasheets or the IC databook. IC breakdown may cause injury, smoke or ignition.

- Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition.

- Carefully select external components (such as inputs and negative feedback capacitors) and load components (such as speakers), for example, power amp and regulator. If there is a large amount of leakage current such as input or negative feedback condenser, the IC output DC voltage will increase. If this output voltage is connected to a speaker with low input withstand voltage, overcurrent or IC failure can cause smoke or ignition. (The over current can cause smoke or ignition from the IC itself.) In particular, please pay attention when using a Bridge Tied Load (BTL) connection type IC that inputs output DC voltage to a speaker directly.

- Over current Protection Circuit
  Over current protection circuits (referred to as current limiter circuits) do not necessarily protect ICs under all circumstances. If the Over current protection circuits operate against the over current, clear the over current status immediately. Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the over current protection circuit to not operate properly or IC breakdown before operation. In addition, depending on the method of use and usage conditions, if over current continues to flow for a long time after operation, the IC may generate heat resulting in breakdown.

- Thermal Shutdown Circuit
  Thermal shutdown circuits do not necessarily protect ICs under all circumstances. If the Thermal shutdown circuits operate against the over temperature, clear the heat generation status immediately. Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the thermal shutdown circuit to not operate properly or IC breakdown before operation.

- Heat Radiation Design
  When using an IC with large current flow such as power amp, regulator or driver, please design the device so that heat is appropriately radiated, not to exceed the specified junction temperature (Tj) at any time and condition. These ICs generate heat even during normal use. An inadequate IC heat radiation design can lead to decrease in IC life, deterioration of IC characteristics or IC breakdown. In addition, please design the device taking into considerate the effect of IC heat radiation with peripheral components.

- Installation to Heat Sink
  Please install the power IC to the heat sink not to apply excessive mechanical stress to the IC. Excessive mechanical stress can lead to package cracks, resulting in a reduction in reliability or breakdown of internal IC chip. In addition, depending on the IC, the use of silicon rubber may be prohibited. Check whether the use of silicon rubber is prohibited for the IC you intend to use, or not. For details of power IC heat radiation design and heat sink installation, refer to individual technical datasheets or IC databooks.

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- This product generates heat during normal operation. However, substandard performance or malfunction may cause the product and its peripherals to reach abnormally high temperatures.
  The product is often the final stage (the external output stage) of a circuit. Substandard performance or malfunction of the destination device to which the circuit supplies output may cause damage to the circuit or to the product. 030619_R

About solderability, following conditions were confirmed

- Solderability

  (1) Use of Sn-37Pb solder Bath
  - solder bath temperature = 230°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

  (2) Use of Sn-3.0Ag-0.5Cu solder Bath
  - solder bath temperature = 245°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux