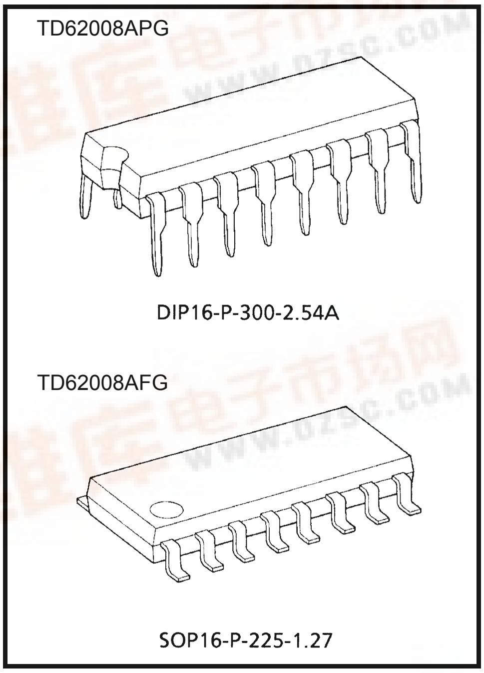
TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TD62008APG,TD62008AFG

7CH DARLINGTON SINK DRIVER

The TD62008APG and TD62008AFG are high−voltage, high−current darlington drivers comprised of seven NPN darlington pairs.
All units feature integral clamp diodes for switching inductive loads and protective diodes against a negative input voltage.
The TD62008APG and TD62008AFG are suitable for interfaces from plus and minus dual supply voltage systems to plus single supply voltage systems.
Applications include relay, hammer, lamp and display (LED) drivers.
Please observe the thermal conditions for use.
The suffix (G) appended to the part number represents a RoHS product.

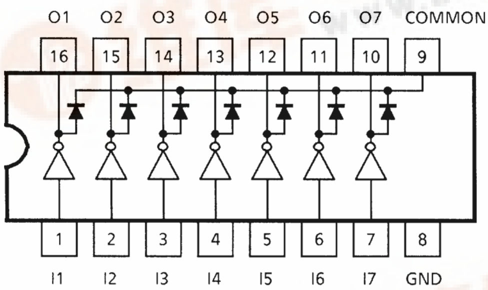


Weight
DIP16−P−300−2.54A : 1.11 g (typ.)
SOP16−P−225−1.27 : 0.16 g (typ.)

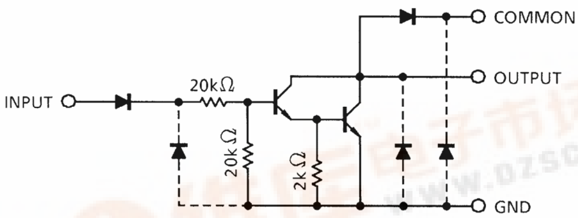
Features

- Output current (single output) 400 mA (Max)
- High sustaining voltage output 50 V (Min)
- Output clamp diodes
- Protective diodes against a negative input voltage
- Inputs base resistor R_{IN} = 20 kΩ
- Inputs compatible with 9~15 V PMOS, CMOS.
- Package type−APG : DIP−16 pin
- Package type−AFG : SOP−16 pin

Pin Connection (top view)



Schematics (each driver)



Note: The input and output parasitic diodes cannot be used as clamp diodes.

Absolute Maximum Ratings (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Output Sustaining Voltage		$V_{CE (SUS)}$	−0.5 ~ 50	V
Output Current		I_{OUT}	400	mA / ch
Input Voltage		V_{IN}	−40 ~ 40	V
Clamp Diode Reverse Voltage		V_R	50	V
Clamp Diode Forward Current		I_F	400	mA
Power Dissipation	APG	P_D	1.47	W
	AFG		0.625 (Note)	
Operating Temperature		T_{opr}	−40 ~ 85	°C
Storage Temperature		T_{stg}	−55 ~ 150	°C

Note: On Glass Epoxy PCB (30 × 30 × 1.6 mm Cu 50%)

Operating Conditions (Ta = −40 ~ 85°C)

CHARACTERISTIC		SYMBOL	CONDITION	MIN	TYP.	MAX	UNIT
Output Sustaining Voltage		$V_{CE (SUS)}$		0	—	50	V
Output Current		I_{OUT}	DC 1 Circuit, T_{pw} = 25%, Duty = 40%	0	—	400	mA
			T_{pw} = 25 ms, Duty = 10%, 7 Circuits	0	—	200	
Input Voltage		V_{IN}		−35	—	35	V
Clamp Diode Reverse Voltage		V_R		—	—	50	V
Clamp Diode Forward Current		I_F		—	—	400	mA
Power Dissipation	APG	P_D		—	—	0.52	W
	AFG		Ta = 85°C (Note)	—	—	0.325	

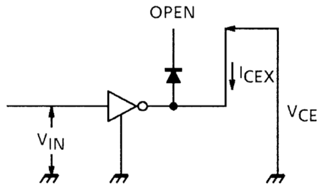
Note: On Glass Epoxy PCB (30 × 30 × 1.6 mm Cu 50%)

Electrical Characteristics (Ta = 25°C)

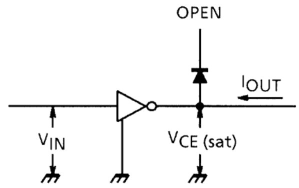
CHARACTERISTIC		SYMBOL	TEST CIR−CUIT	TEST CONDITION		MIN	TYP.	MAX	UNIT
Output Leakage Current		I_{CEX}	1	V_{OUT} = 50 V		—	—	100	μA
Collector−Emitter Saturation Voltage		$V_{CE\ (sat)}$	2	I_{OUT} = 400 mA		—	1.3	2.4	V
				I_{OUT} = 200 mA		—	1.0	1.6	
Input Current	"H" Level	$I_{IN\ (ON)}$	4	V_{IN} = 18 V		—	0.85	1.8	mA
				V_{IN} = 35 V		—	—	3.8	
	"L" Level	$I_{IN\ (OFF)}$	4	V_{IN} = −35 V		—	—	−20	μA
DC Current Transfer Ratio		h_{FE}	3	V_{CE} = 4 V, I_{OUT} = 350 mA		1000	3000	—	
Clamp Diode Reverse Current		I_R	5	V_R = 50 V, V_R = 35 V (Type−F)		—	—	100	μA
Clamp Diode Forward Voltage		V_F	6	I_F = 400 mA		—	1.5	2.4	V
Turn−On Delay		t_{ON}	7	C_L = 15 pF	V_{OUT} = 50 V, R_L = 156 Ω	—	0.1	—	μs
Turn−Off Delay		t_{OFF}			V_{OUT} = 50 V, R_L = 156 Ω	—	0.2	—	μs

Test Circuit

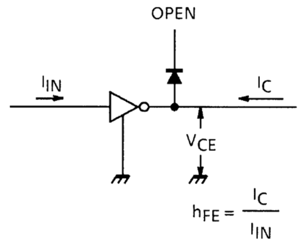
1. I_{CEX}



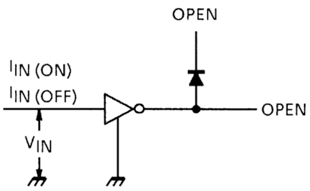
2. $V_{CE\ (sat)}$



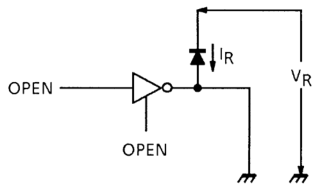
3. h_{FE}



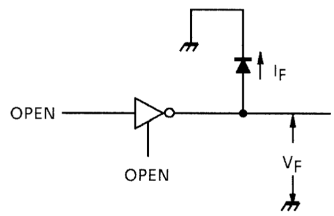
4. $I_{IN\ (ON)}$, $I_{IN\ (OFF)}$



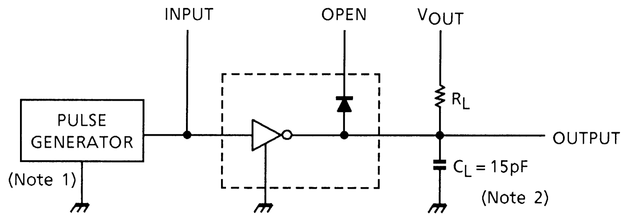
5. I_R

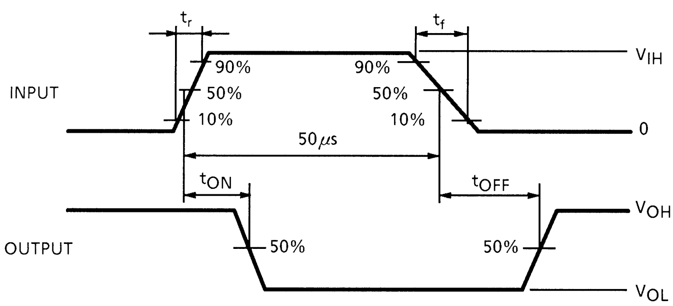


6. V_F



7. t_{ON}, t_{OFF}



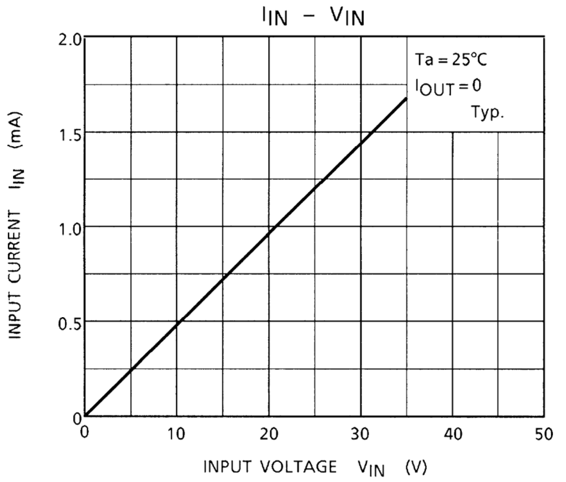


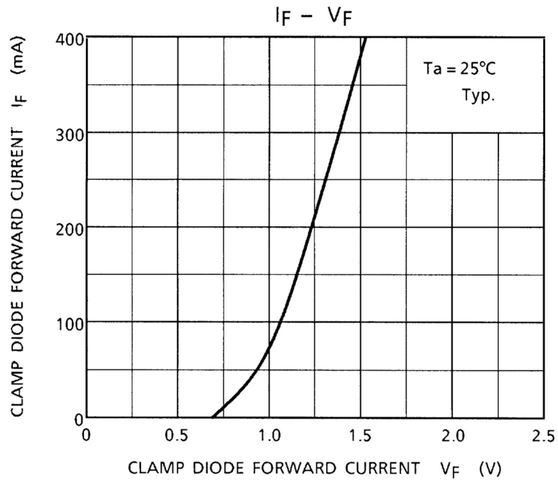
Note 1: Pulse Width 50 μs
Duty Cycle 10%
Output Impedance 50 Ω
tr ≤ 5 ns, tf ≤ 10 ns

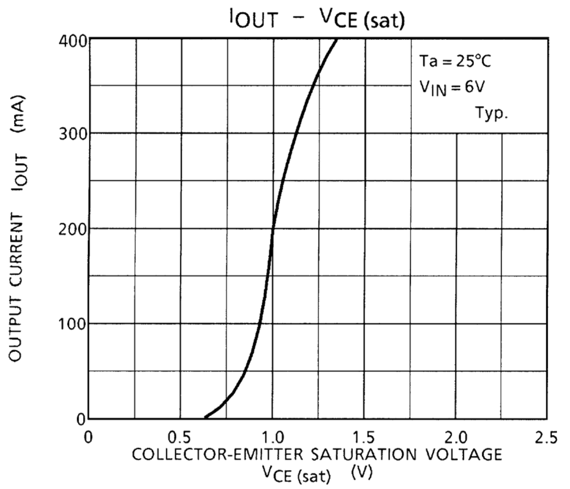
Note 2: CL includes probe and jig capacitance

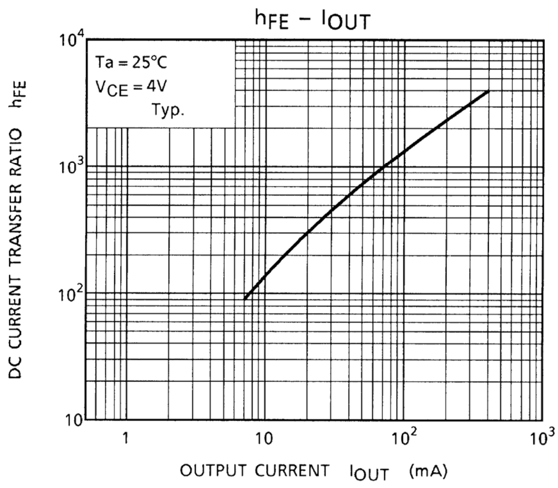
Precautions for Use

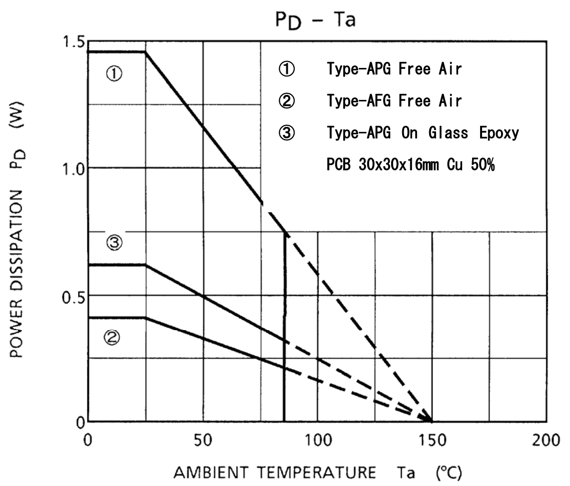
This IC does not include built-in protection circuits for excess current or overvoltage.
If this IC is subjected to excess current or overvoltage, it may be destroyed.
Hence, the utmost care must be taken when systems which incorporate this IC are designed.
Utmost care is necessary in the design of the output line, COMMON and GND line since the IC may be destroyed due to short−circuit between outputs, air contamination fault, or fault by improper grounding.

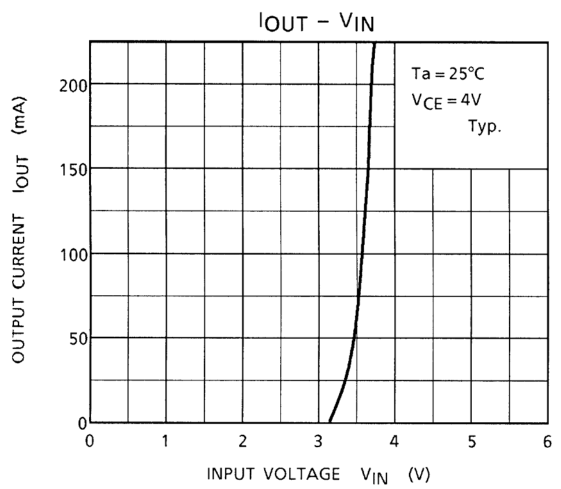

IIN – VIN
Ta = 25°C
IOUT = 0
Typ.
INPUT CURRENT IIN (mA)
INPUT VOLTAGE VIN (V)


IF – VF
Ta = 25°C
Typ.
CLAMP DIODE FORWARD CURRENT IF (mA)
CLAMP DIODE FORWARD CURRENT VF (V)


IOUT – VCE (sat)
Ta = 25°C
VIN = 6V
Typ.
OUTPUT CURRENT IOUT (mA)
COLLECTOR-EMITTER SATURATION VOLTAGE
VCE (sat) (V)

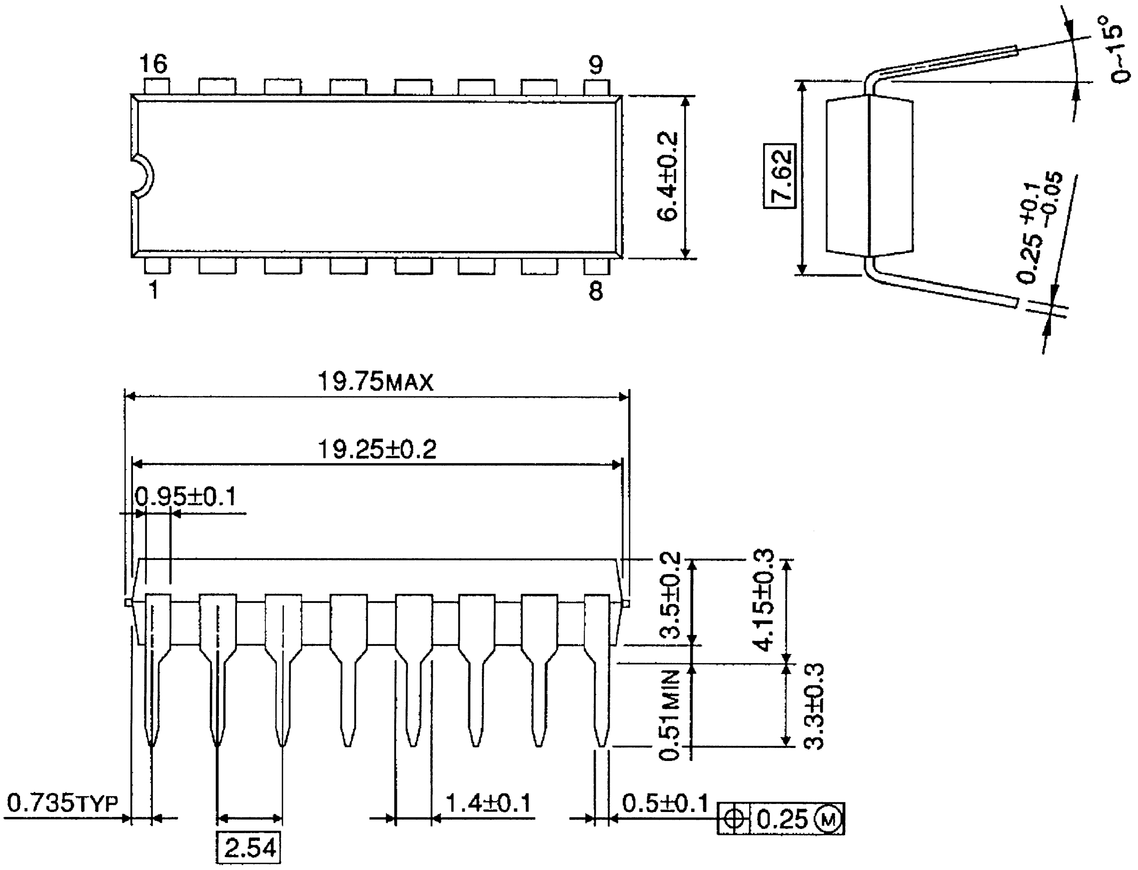

hFE – IOUT
Ta = 25°C
VCE = 4V
Typ.
DC CURRENT TRANSFER RATIO hFE
OUTPUT CURRENT IOUT (mA)


PD – Ta
① Type-APG Free Air
② Type-AFG Free Air
③ Type-APG On Glass Epoxy
PCB 30x30x16mm Cu 50%
POWER DISSIPATION PD (W)
AMBIENT TEMPERATURE Ta (°C)


IOUT – VIN
Ta = 25°C
VCE = 4V
Typ.
OUTPUT CURRENT IOUT (mA)
INPUT VOLTAGE VIN (V)

Package Dimensions

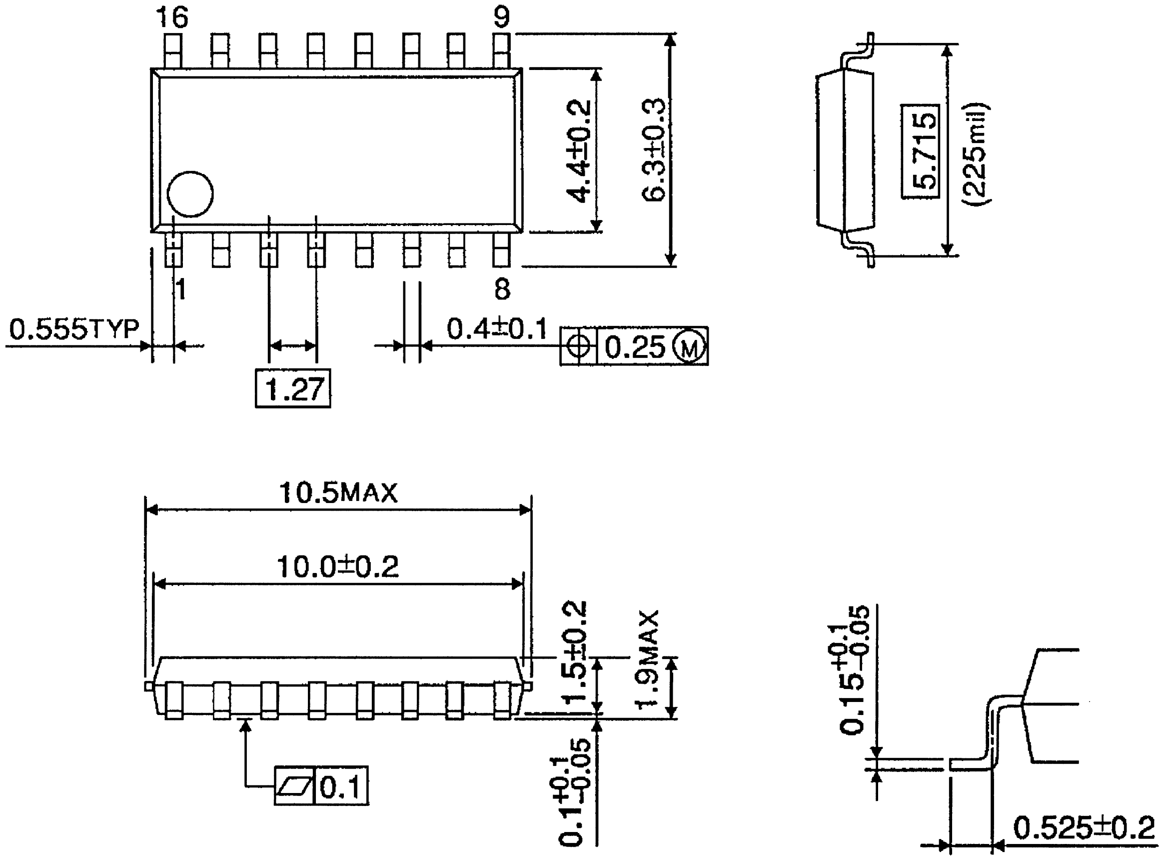
DIP16−P−300−2.54A Unit : mm



Weight: 1.11 g (Typ.)

Package Dimensions

SOP16−P−225−1.27 Unit : mm



Weight: 0.16 gTyp.)

Notes on Contents

1. Equivalent Circuits

The equivalent circuit diagrams may be simplified or some parts of them may be omitted for explanatory purposes.

2. Test Circuits

Components in the test circuits are used only to obtain and confirm the device characteristics. These components and circuits are not guaranteed to prevent malfunction or failure from occurring in the application equipment.

IC Usage Considerations

Notes on Handling of ICs

(1) The absolute maximum ratings of a semiconductor device are a set of ratings that must not be exceeded, even for a moment. Do not exceed any of these ratings.
Exceeding the rating(s) may cause breakdown, damage or deterioration of the device, and may result in injury by explosion or combustion.

(2) Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of overcurrent 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. A breakdown could cause a large current to continuously flow and lead to smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings are required, such as fuse capacity, fusing time and insertion circuit location.

(3) 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. 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.

(4) Do not insert devices in the wrong orientation or incorrectly.
Make sure that the positive and negative terminals of power supplies are connected properly.
Otherwise, the current or power consumption may exceed the absolute maximum rating, and exceeding the rating(s) may cause breakdown, damage or deterioration of the device, and may result injury by explosion or combustion.
In addition, do not use any device that has had current applied even once while inserted in the wrong orientation or incorrectly .

(5) Carefully select external components such as power amps and regulators (including input and negative feedback capacitors), and load components such as speakers.
If there is a large amount of leakage current, such as from input or negative feedback condensers, the IC output DC voltage will increase. If this output voltage is connected to a speaker with a low input voltage threshold, overcurrent or IC failure could cause smoke or ignition. (The overcurrent 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 directly to a speaker.

Points to Remember on Handling of ICs

(1) Heat Radiation Design
When using an IC with a large current flow, such as in a power amp, regulator or driver, please design the device so that heat is appropriately radiated, so as 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 consideration the effect of IC heat radiation on peripheral components.

(2) Back-EMF
When a motor rotates in the reverse direction, stops or slows down abruptly, current flows back to the motor's power supply due to the effect of back-EMF. If the current sink capability of the power supply is small, the device's motor power supply and output pins might be exposed to conditions beyond absolute maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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