

TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TD62386AP,TD62386AF,TD62387AP TD62387AF,TD62388AP,TD62388AF

8 CH LOW INPUT ACTIVE DARLINGTON SINK DRIVER

The TD62386AP, TD62386AF, TD62387AP, TD62387AF and TD62388AP, TD62388AF are non-inverting transistor arrays, which are comprised of eight NPN darlington output stages and PNP input stages.

All units feature integral clamp diodes for switching inductive loads.

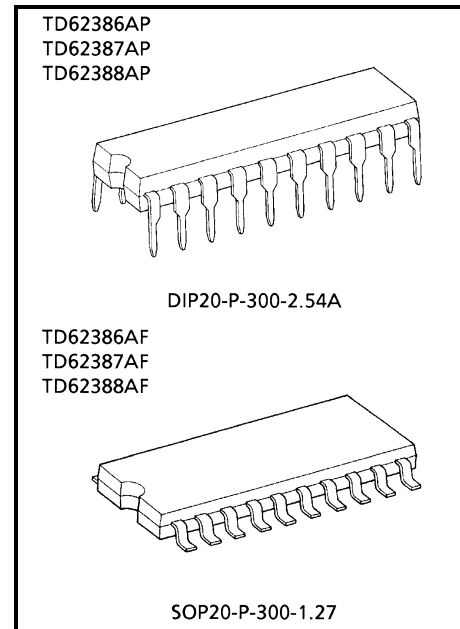
These devices are Low Level input active drivers and are suitable for operations with TTL, 5 V CMOS and 5 V Microprocessor which have sink current output drivers.

Applications include relay, hammer, lamp and LED driver.

FEATURES

- Output current (single output) 500 mA (max)
- High sustaining voltage 50 V (min)
- Output clamp diodes
- Low level active input
- Standard supply voltage
- Inputs compatible with TTL and 5 V CMOS
- Package type-AP: DIP-20 pin
- Package type-AF: SOP-20 pin

TYPE	$V_{IN} (ON)$
TD62386AP, TD62386AF	$-20 V \sim V_{CC} - 2.8 V$
TD62387AP, TD62387AF	$0 V \sim V_{CC} - 3.7 V$
TD62388AP, TD62388AF	

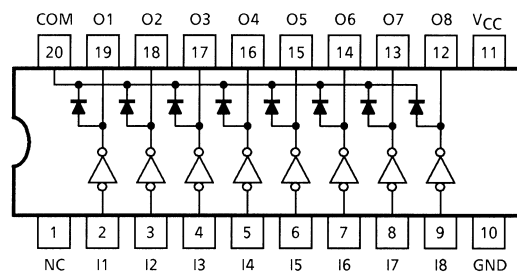


Weight

DIP20-P-300-2.54A: 2.25 g (typ.)

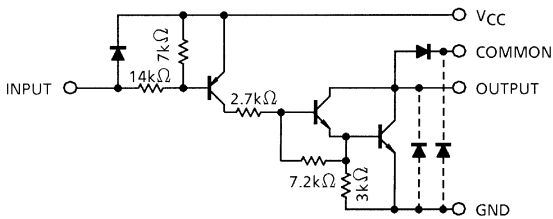
SOP20-P-300-1.27: 0.25 g (typ.)

PIN CONNECTION (TOP VIEW)

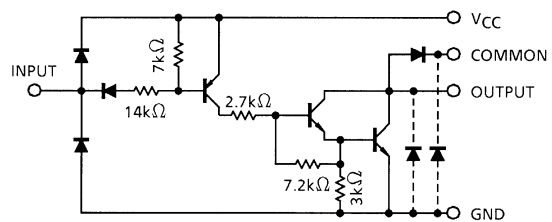


SCHEMATICS (EACH DRIVER)

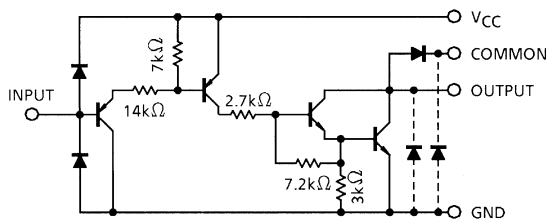
TD62386AP,TD62386AF



TD62387AP, TD62387AF



TD62388AP,TD62388AF



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

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	-0.5~7.0	V
Output Sustaining Voltage	AP	$V_{CE(SUS)}$	-0.5~50	V
	AF		-0.5~35	
Output Current		I_{OUT}	500	mA / ch
Input Voltage		V_{IN} (Note 1)	-22~ $V_{CC} + 0.5$	V
		V_{IN} (Note 2)	-0.5~7	
Input Current		I_{IN}	-10	mA
Clamp Diode Reverse Voltage		V_R	50	V
Clamp Diode Forward Current		I_F	500	mA
Power Dissipation	AP	P_D (Note 3)	1.38	W
	AF		1.0 (Note 4)	
Operating Temperature		T_{opr}	-40~85	°C
Storage Temperature		T_{stg}	-55~150	°C

Note 1: TD62386AP, TD62386AF only

Note 2: TD62387AP, TD62387AF, TD62388AP, TD62388AF only

Note 3: Delated above 25°C in the proportion of 11.7 mW / °C (AP-Type), 7.7 mW / °C (F, AF-Type).

Note 4: On PCB (50 × 50 × 1.6 mm Cu 40% Glass Epoxy)

RECOMMENDED OPERATING CONDITIONS (Ta = -40~85°C)

CHARACTERISTIC		SYMBOL	CONDITION	MIN	TYP.	MAX	UNIT
Supply Voltage		V _{CC}	—	4.5	5.0	5.5	V
Output Sustaining Voltage		V _{CE (SUS)}	—	0	—	50	V
Output Current		I _{OUT}	Tpw = 25 ms, Duty = 10% 8 Circuits	0	—	270	mA / ch
Input Voltage	TD62386AP TD62386AF	V _{IN}	—	-20	—	V _{CC}	V
	TD62387AP TD62387AF TD62388AP TD62388AF		—	0	—	5.5	
Clamp Diode Reverse Voltage		V _R	—	—	—	50	V
Clamp Diode Forward Current		I _F	—	—	—	400	mA
Power Dissipation	AP	P _D	—	—	—	0.52	W
	AF		(Note 1)	—	—	0.4	

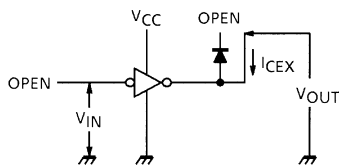
Note 1: On Glass Epoxy PCB (50 × 50 × 1.6 mm Cu 40%)

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

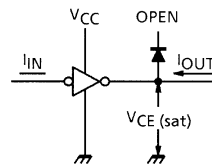
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Output Leakage Current		I _{CEX}	1	V _{CC} = 5.5 V, I _{IN} = 0 V _{OUT} = 50 V, Ta = 85°C	—	—	100	μA
Output Saturation Voltage		V _{CE (sat)}	2	V _{CC} = 4.5 V, V _{IN} = V _{IN (ON)} MAX. I _{OUT} = 350 mA	—	1.4	2.0	V
Input Current	Output On	I _{IN (ON)}	3	V _{CC} = 5.5 V, V _{IN} = 0.4 V	—	-0.32	-0.45	mA
	Output Off	I _{IN (OFF)}	4	V _{CC} = 5.5 V, V _{IN} = -20 V	—	—	-2.6	
Input Voltage (Output on)	TD62386AP TD62386AF	V _{IN (ON)}	5	—	—	—	V _{CC} - 2.8	V
	TD62387AP TD62387AF TD62388AP TD62388AF			—	—	—	V _{CC} - 3.7	
Clamp Diode Reverse Current		I _R	6	V _R = 50 V, Ta = 25°C	—	—	50	μA
				V _R = 50 V, Ta = 85°C	—	—	100	
Clamp Diode Forward Voltage		V _F	7	I _F = 350 mA	—	—	2.0	V
				I _F = 280 mA	—	—	1.8	
Supply Current		I _{CC (ON)}	8	V _{CC} = 5.5 V, V _{IN} = 0	—	17	22	mA
		I _{CC (OFF)}		V _{CC} = 5.5 V, V _{IN} = V _{CC}	—	—	100	μA
Turn-On Delay		t _{ON}	9	V _{CC} = 5 V, V _{OUT} = 50 V R _L = 125Ω, C _L = 15 pF	—	0.1	—	μs
Turn-Off Delay		t _{OFF}			—	3	—	

TEST CIRCUIT

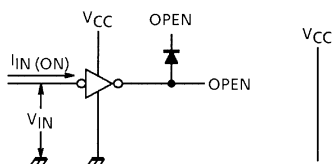
1. I_{CEX}



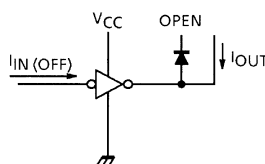
2. $V_{CE(sat)}$



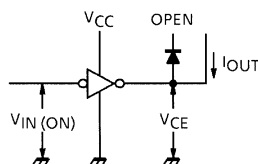
3. $I_{IN(ON)}$



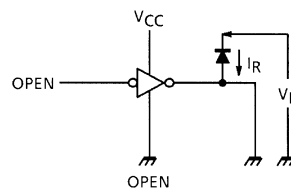
4. $I_{IN(OFF)}$



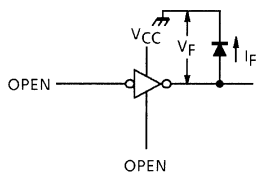
5. $V_{IN(ON)}$



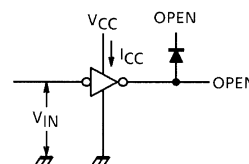
6. I_R



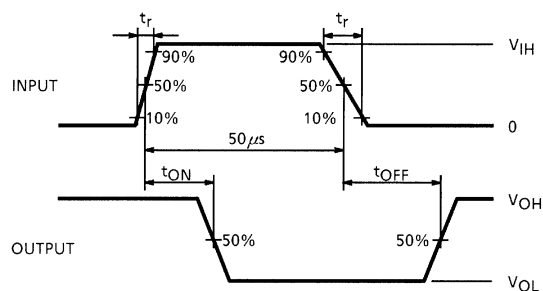
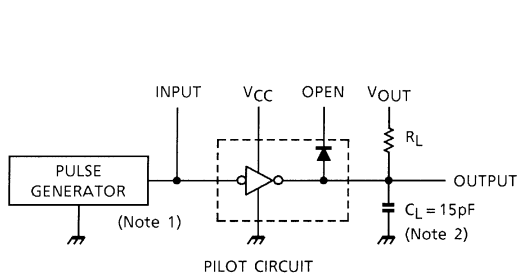
7. V_F



8. I_{CC}



9. t_{ON}, t_{OFF}

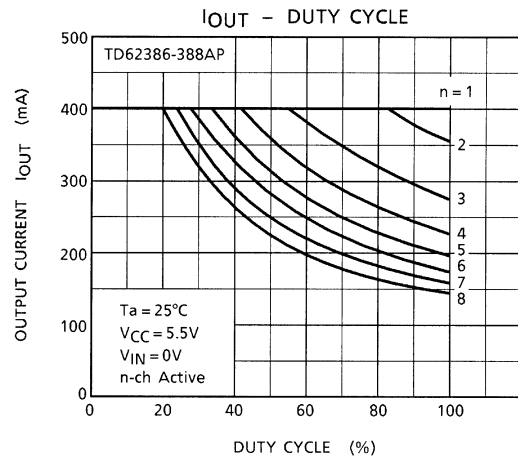
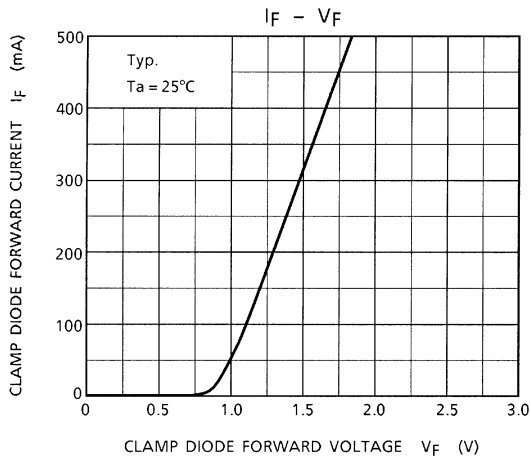
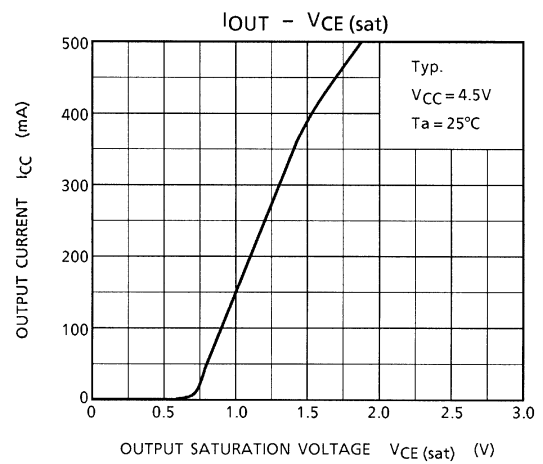
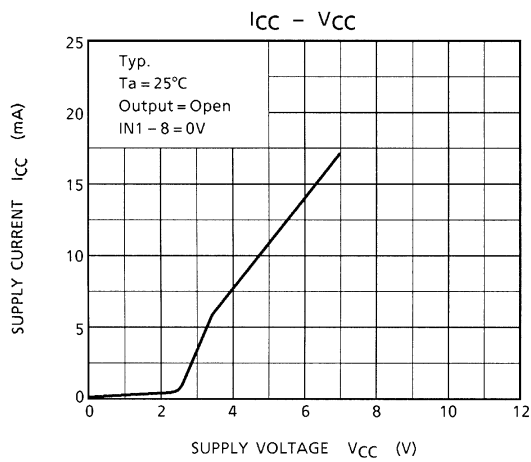
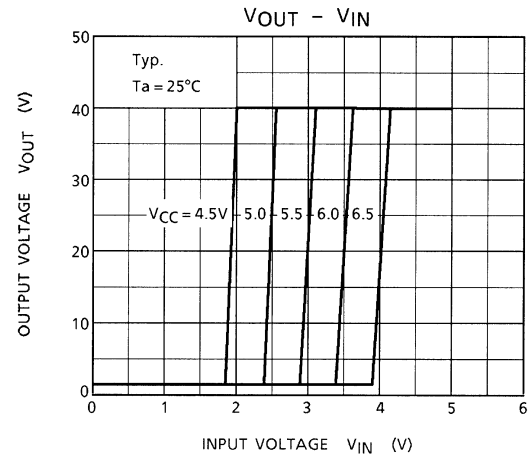
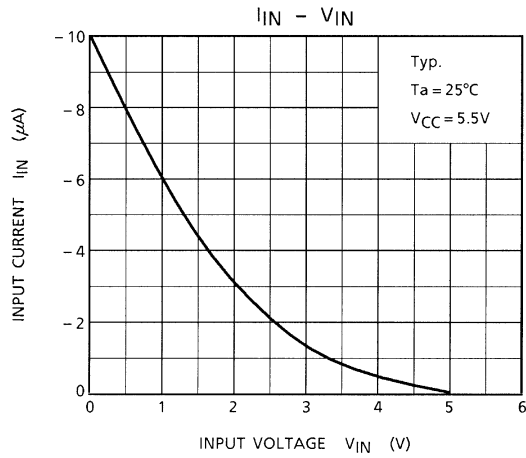


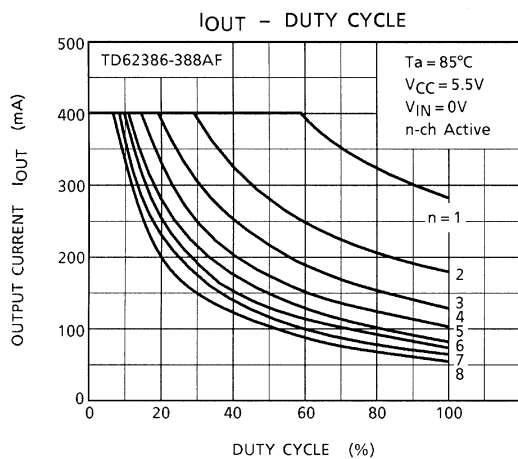
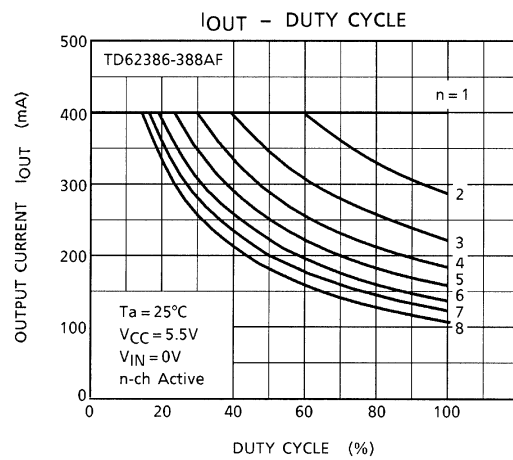
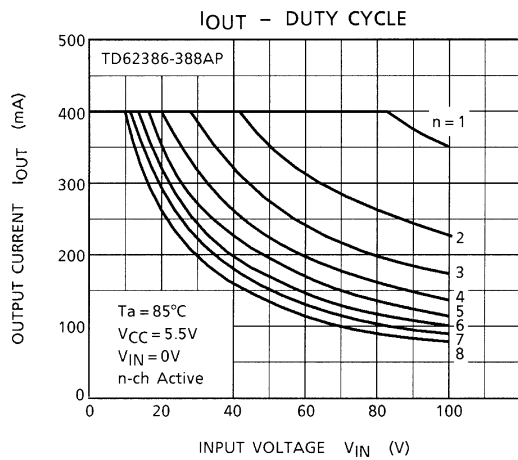
Note 1: Pulse Width 50 μ s, Duty Cycle 10%
Output Impedance 50 Ω , $t_r \leq 5$ ns, $t_f \leq 10$ ns

Note 2: C_L includes probe and jig capacitance.

PRECAUTIONS for USING

This IC does not integrate protection circuits such as overcurrent and overvoltage protectors. Thus, if excess current or voltage is applied to the IC, the IC may be damaged. Please design the IC so that excess current or voltage will not be applied to the IC. Utmost care is necessary in the design of the output line, VCC, COMMON and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

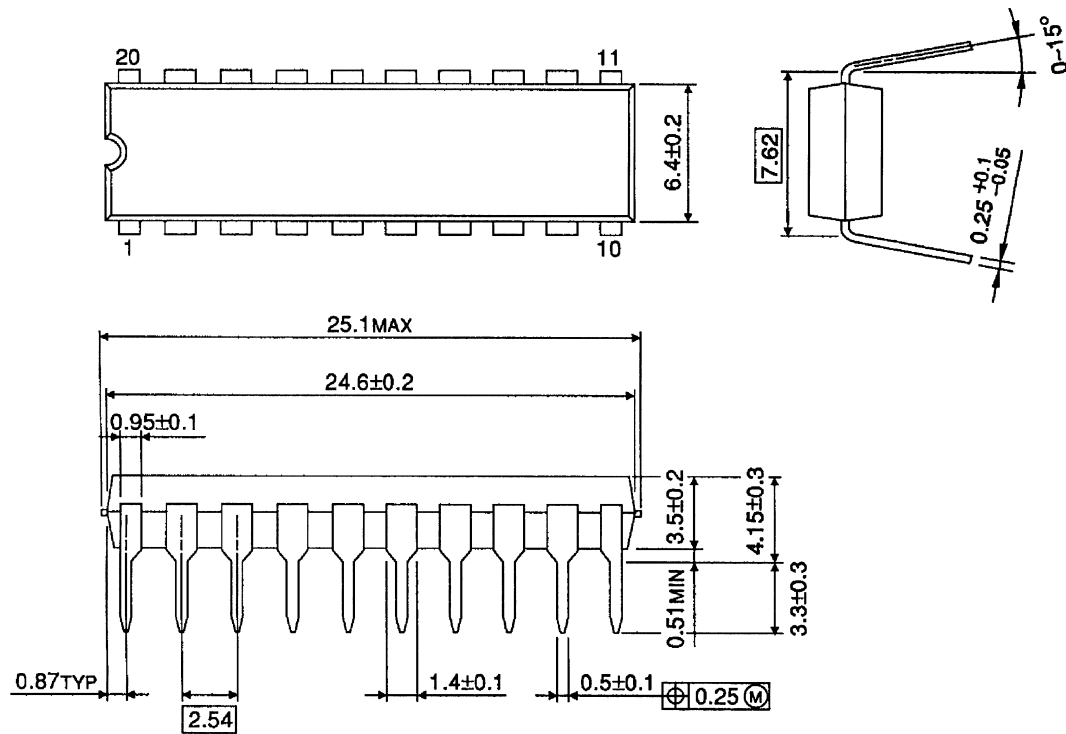




PACKAGE DIMENSIONS

DIP20-P-300-2.54A

Unit: mm

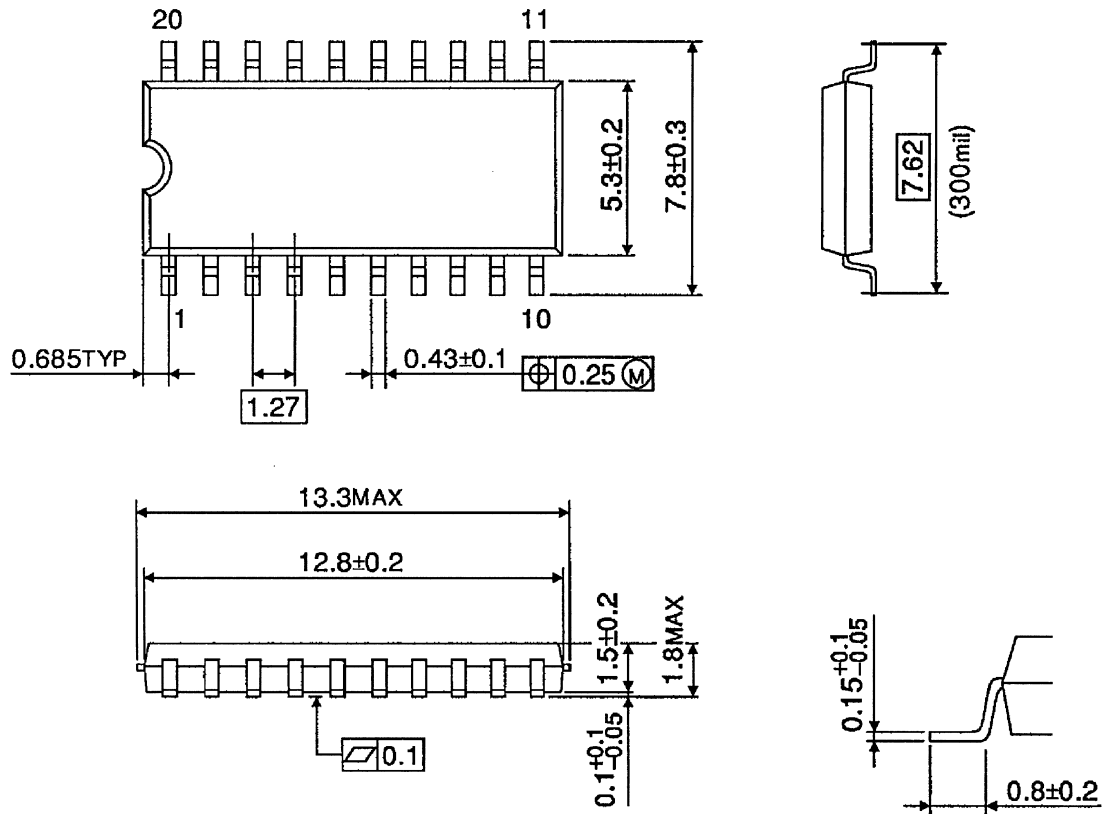


Weight: 2.25 g (typ.)

PACKAGE DIMENSIONS

SOP20-P-300-1.27

Unit: mm



Weight: 0.25 g (typ.)

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 the device breakdown, damage or deterioration, and may result 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 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.
- (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 the device breakdown, damage or deterioration, and may result injury by explosion or combustion.
In addition, do not use any device that is applied the current with inserting in the wrong orientation or incorrectly even just one time.
- (5) 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.

Points to Remember on Handling of ICs**(1) Heat Radiation Design**

In 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 (T_j) 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 with peripheral components.

(2) Back-EMF

When a motor rotates in the reverse direction, stops or slows down abruptly, a 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 maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

RESTRICTIONS ON PRODUCT USE

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