



## DESCRIPTION

The AA51880 is a BJT integrated circuit using in servo motor control applications. The built-in voltage regulator provides the AA51880 with extremely stable output voltage. It also incorporates a linear one-shot and pulse-width demodulator for improved positional accuracy.

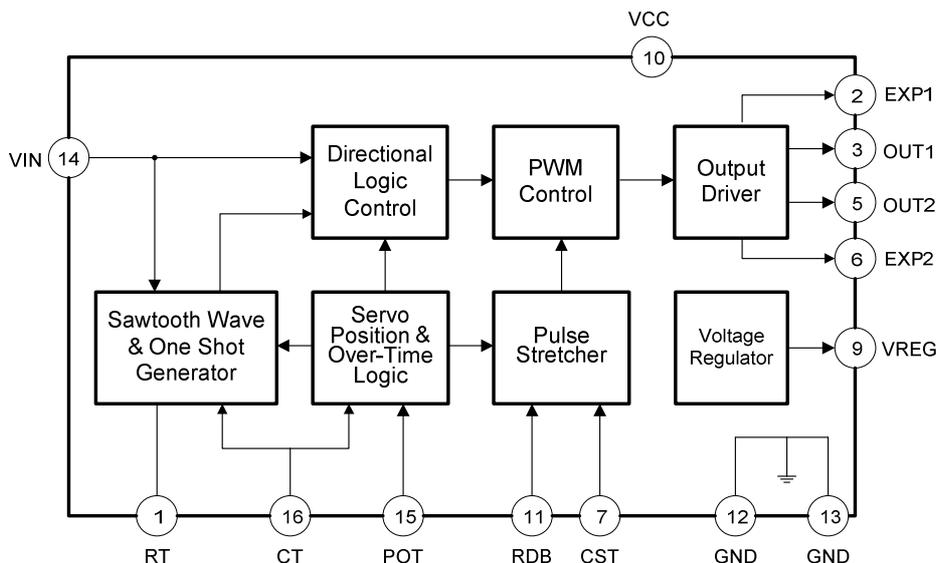
## FEATURES

- Built-in voltage regulator.
- Larger driving capability.
- Internal output NPN power transistor.
- Adjustable dead band range control.
- Incorporates a protection circuit for "H-Bridge" driving configuration.
- Small outline package.

## APPLICATIONS

- Servo motor control.
- Radio controlled car, boat, and airplane.
- IA products (such as air-condition).
- Remote positioning.

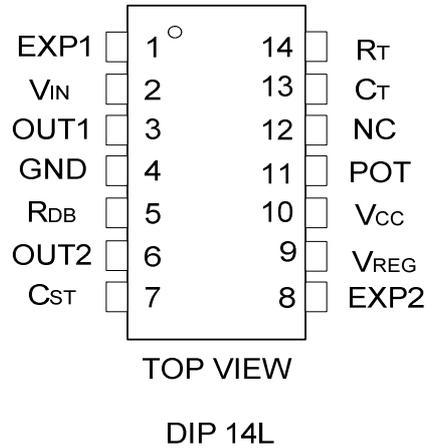
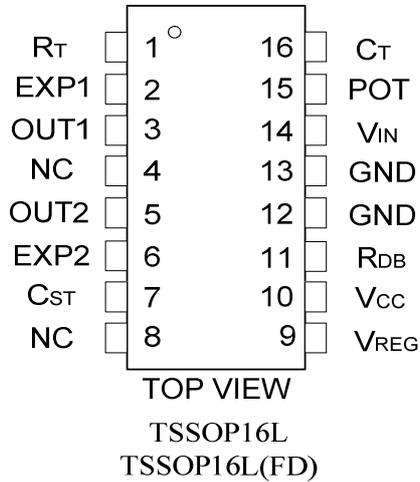
## BLOCK DIAGRAM



Note: Pin no. is for AA51880A/E; please refer to "PIN DESCRIPTION" for other package type.



## PIN DESCRIPTION



PIN NO.		PIN NAME	FUNCTION
TSSOP16	DIP14		
1	14	RT	Timing Resistor
2	1	EXP1	External PNP Transistor 1 output
3	3	OUT1	Output Driver 1
5	6	OUT2	Output Driver 2
6	8	EXP2	External PNP Transistor 2 output
7	7	CST	Stretcher capacitor
4,8	12	NC	No Connection
9	9	VREG	Regulated Voltage output
10	10	VCC	Power supply pin
11	5	RDB	Error pulse output
12,13	4	GND	Ground pin
14	2	VIN	Input signal
15	11	POT	Servo position voltage
16	13	CT	Timing Capacitor



■ **ABSOLUTE MAXIMUM RATINGS**

Ta=25°C

SYMBOL	PARAMETER	RATINGS	UNIT
V <sub>CC</sub>	Supply voltage	4.8~7	V
P <sub>d</sub>	Power dissipation	300	mW
T <sub>stg</sub>	Storage temperature range	-25~+125	°C

■ **ELECTRICAL CHARACTERISTICS**

Ta=25°C, V<sub>CC</sub>=4.8V

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
I <sub>CC</sub>	Operating current	When output is OFF	-	5	8	mA
		When output is ON	-	25	28	mA
V <sub>OL</sub>	Output voltage "L"	Load resistor 20Ω	-	0.1	0.2	V
V <sub>OH</sub>	Output voltage "H"	Load resistor 240Ω	3.5	-	-	V
I <sub>PNP</sub>	External PNP transistor drive current	Load resistor 240Ω	30	-	-	mA
V <sub>REG</sub>	Regulator output voltage	Load capacitor 0.1uF	2.3	2.45	2.6	V
I <sub>REG</sub>	Regulator output current	Load resistor 500Ω	4	-	-	mA

■ **FUNCTIONAL DESCRIPTION**

**(1) Voltage Regulator**

This circuit is composed of a band gap circuit, and outputs a 2.45-volt temperature compensated reference voltage. This reference voltage is stabilized when the supply voltage is variable.

**(2) Saw tooth wave & One-Shot Generator**

Connect a capacitor to CT pin will generate a triangular wave by constant current charging. A typical value is 0.1uF. The constant current is determined by a resistor connected to RT pin. A typical capacitor of approximately 0.1uF should be connected in parallel with the resistor to increase stability.



### **(3) Servo Position & Over-Time logic**

This circuitry consists of a pulse width comparator, which compares the servo position detection signal (POT pin) from the one-shot timer (CT pin) whose period depends on the resistance of a potentiometer connected to the servo's drive shaft. This feedback is what provides the stability for the control circuitry.

### **(4) Pulse Stretcher**

The difference between the servo control signal and the feedback signal is the error signal. This error signal is used to toggle the direction the current flows through the servo. The function of this pulse stretcher is to “stretch” the small error signal long enough and increases the duty cycle to the motor for it can maintain sufficient holding force. The circuit also implements a “dead band” function that prevents servo jitter and hunting. This is a range over which differences between the input and reference signals will not cause servo operation. When the signal differences exceed this “dead band” range, drive to the motor occurs. servo's drive shaft. The dead band will change according to the value of resistor connected to the RDB pin.

### **(5) Directional Logic Control**

The comparator circuit compares pulses from the servo control input (VIN pin) and the voltage controlled pulse generator and provides either a positive or a negative output depending on whether the signal pulse width is larger or smaller than the position generator's output pulse (POT pin). Application of this error voltage to the motor driver circuit causes the motor to turn in a direction that will minimize the error until both pulse widths are the same.

### **(6) PWM Control**

This signal generated by directional logic control block is used to control a flip-flop that toggles the direction the current flows through the motor. The outputs of the flip-flop drive an H-Bridge output driver block that handles the high current going through the motor. This blocks output will be turned on or off with each input pulse based on the status of the directional logic. The PWM drive techniques provide the benefits of reduced power dissipation, improved servo motor performance and positively affect system efficiency.

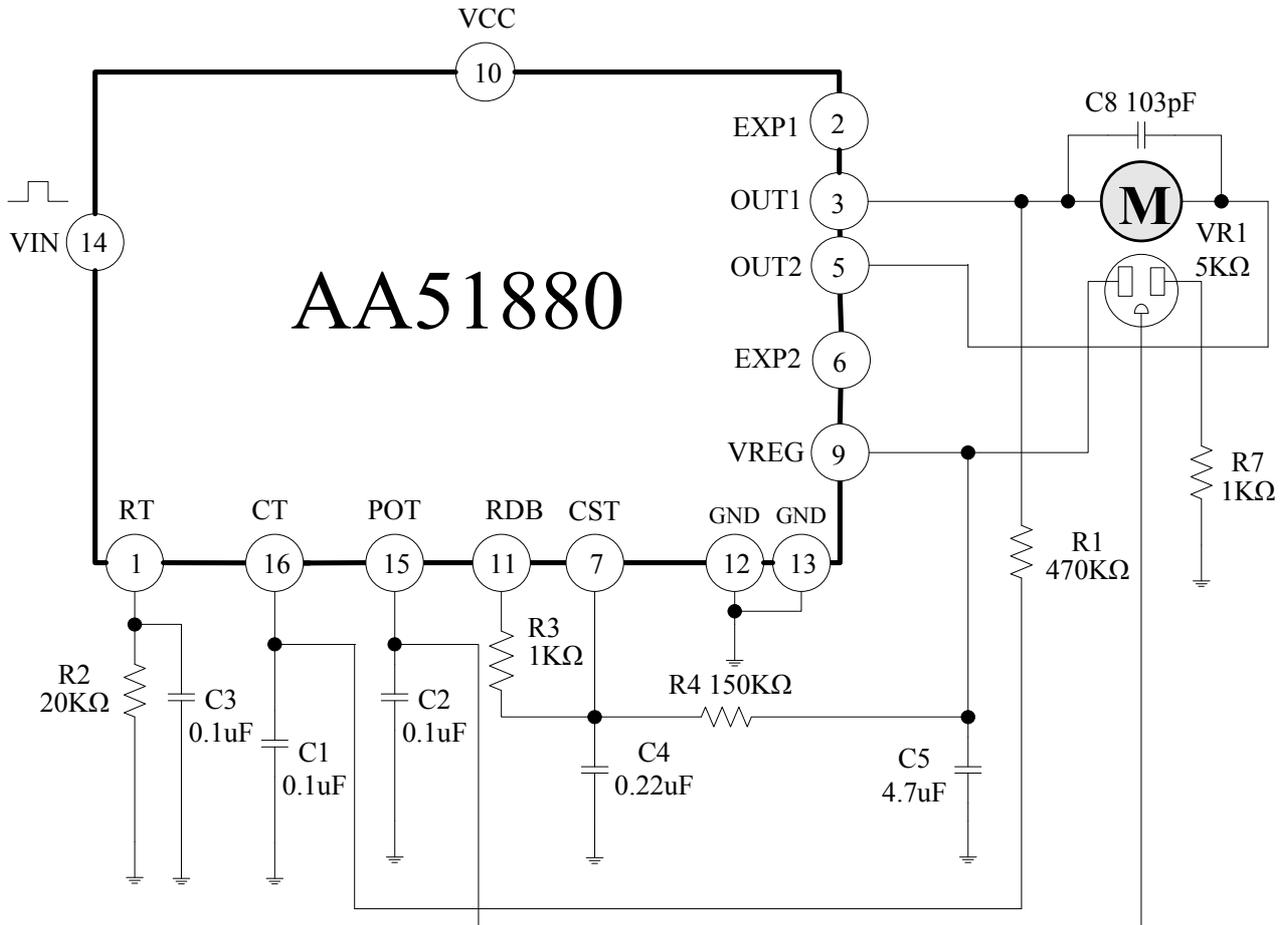
### **(7) Output driver**

The output driver controls the servo current direction. For light load application, the servo can be connected with OUT1 and OUT2 pin only. For heavy load application, the EXP1 and EXP2 pin will be connected to the base of the external PNP transistor. It drives in an H-bridge configuration (The sink NPN drivers are built inside the chip).



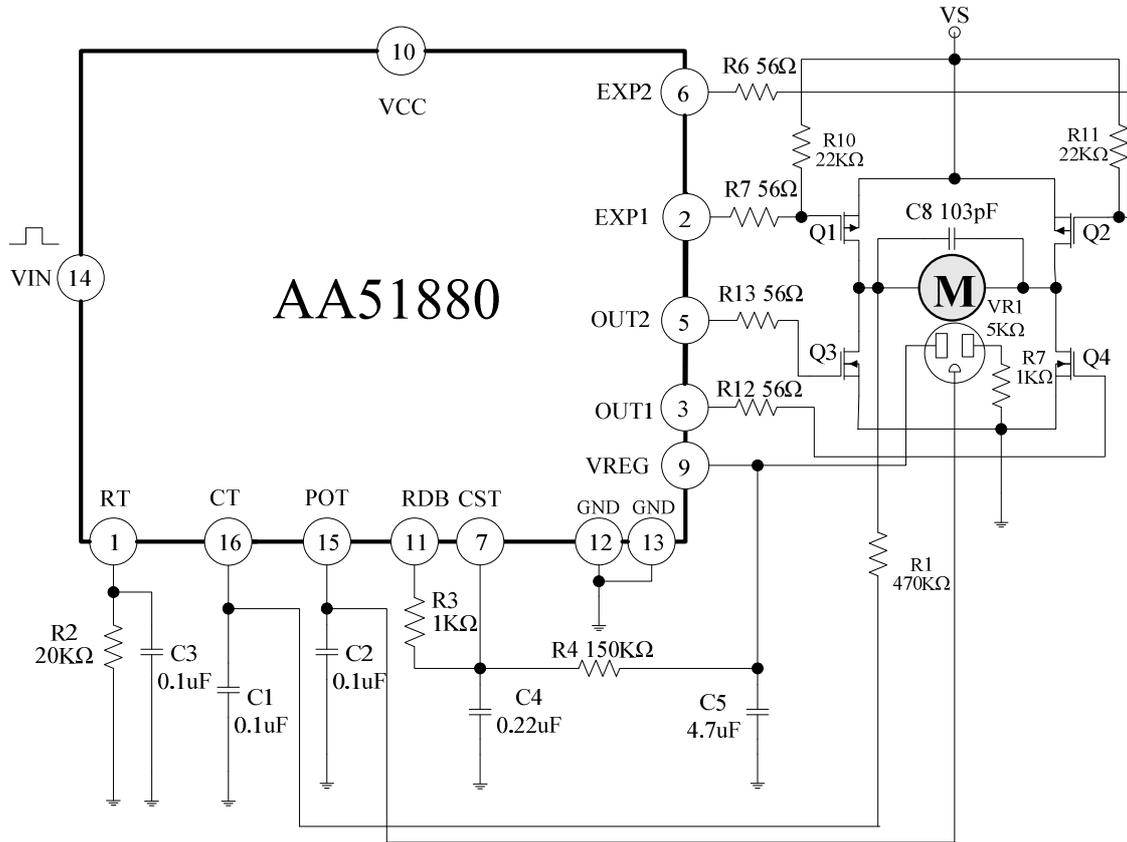
## TYPICAL APPLICATION EXAMPLE

### A. Mini-Servo Application (No external drivers needed)





D. Full H-Bridge application using two PMOSs and two NMOSs



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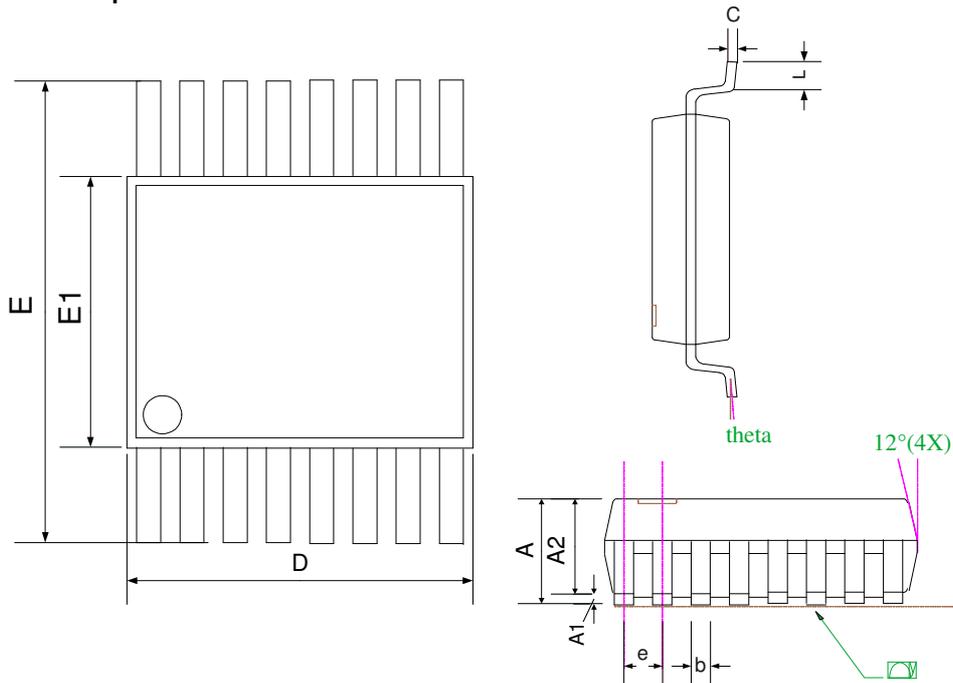


■ ORDERING INFORMATION

ORDER NO.	PACKAGE	PACKING	Q'TY	MARK CHART
AA51880A	TSSOP 16L	TAPE & REEL	2,500ea	
AA51880E	TSSOP 16L(FD)	TAPE & REEL	2,500ea	
AA51880P	DIP 14L	TUBE	25ea	

## ■ PACKAGE DIMENSIONS

### 16-pin Plastic TSSOP

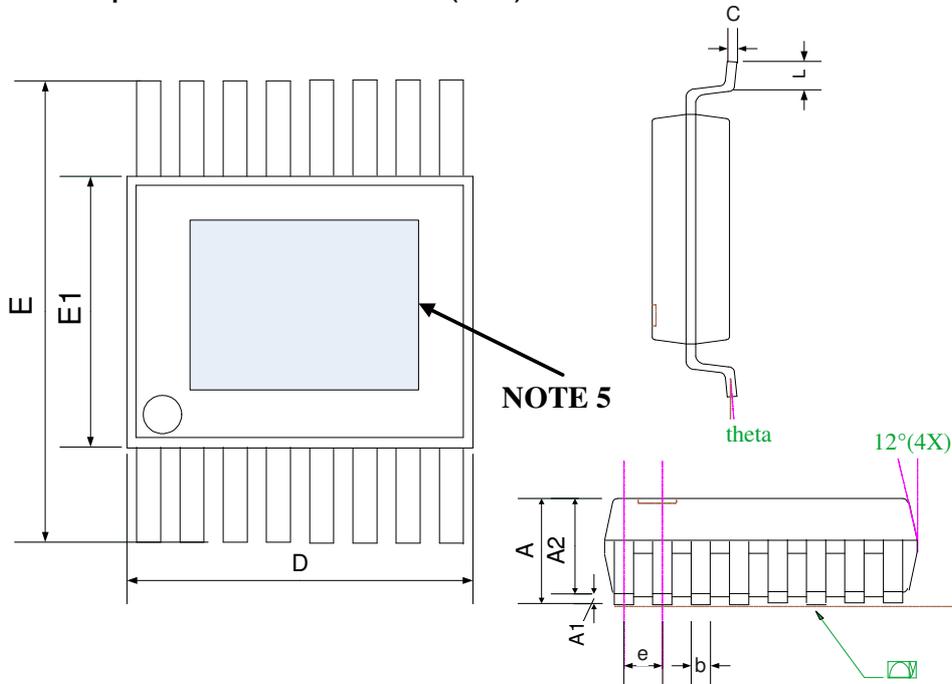


SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.20	---	---	0.048
A1	0.05	---	0.15	0.002	---	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	---	0.30	0.007	---	0.012
C	0.09	---	0.20	0.004	---	0.008
D	4.90	5.00	5.10	0.193	0.197	0.201
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.169	0.173	0.177
e	---	0.65	---	---	0.026	---
L	0.45	0.60	0.75	0.018	0.024	0.030
y	---	---	0.10	---	---	0.004
theta	0°	---	8°	0°	---	8°

**NOTE**

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS
2. TOLERANCE +/- 0.1 mm UNLESS OTHERWISE SPECIFIED
3. COPLANARITY : 0.1 mm
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. FOLLOWED FROM JEDEC MO-153

## 16-pin Plastic TSSOP(FD)

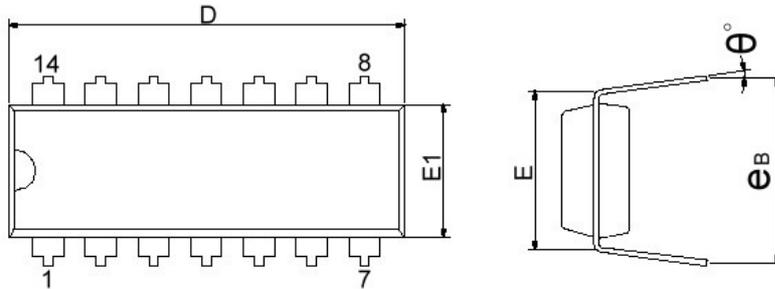


SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.15	---	---	0.045
A1	0.05	---	0.15	0.002	---	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	---	0.30	0.007	---	0.012
C	0.09	---	0.20	0.004	---	0.008
D	4.90	5.00	5.10	0.193	0.197	0.201
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.169	0.173	0.177
e	---	0.65	---	---	0.026	---
L	0.45	0.60	0.75	0.018	0.024	0.030
y	---	---	0.10	---	---	0.004
theta	0°	---	8°	0°	---	8°

**NOTE**

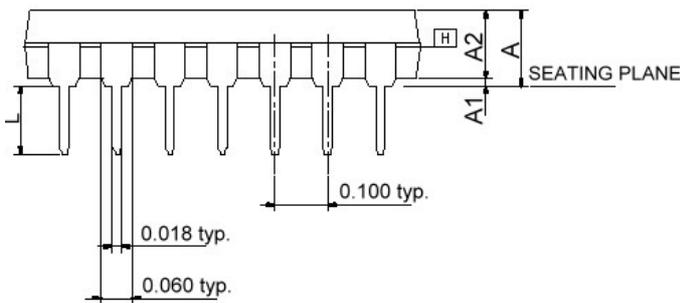
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS
2. TOLERANCE +/- 0.1 mm UNLESS OTHERWISE SPECIFIED
3. COPLANARITY : 0.1 mm
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. DIE PAD EXPOSURE SIZE IS ACCORDING TO LEAD FRAME DESIGN.
6. FOLLOWED FROM JEDEC MO-153

## 14-pin DIP



SYMBOLS	MIN.	NOR.	MAX.
A	---	---	0.210
A1	0.015	---	---
A2	0.125	0.130	0.135
D	0.735	0.750	0.775
E	0.300 BSC.		
E1	0.245	0.250	0.255
L	0.115	0.130	0.150
e <sub>B</sub>	0.335	0.355	0.375
θ °	0	7	15

UNIT : INCH



**NOTES:**

1. JEDEC OUTLINE : MS-001 AA
2. "D", "E1" DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH.
3. e<sub>B</sub> IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
4. POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION.
5. DISTANCE BETWEEN LEADS INCLUDING DAM BAR PROTRUSIONS TO BE 0.005 INCH MINIMUM. DATUM PLANE "H" COINCIDENT WITH THE BOTTOM OF LEAD WHERE LEAD EXITS BODY.

### ■ NOTES ON USE

- The application circuit examples explain typical applications of the products, and do not guarantee the success of any specific mass-production design.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Take account of common AA impedance when designing the earth line on a printed wiring board.