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DATA SHEET

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# BIPOLAR ANALOG INTEGRATED CIRCUITS

## $\mu$ PC2800A

### PREAMPLIFIER FOR INFRARED REMOTE CONTROL

#### DESCRIPTION

The  $\mu$ PC2800A is a receiver preamplifier for infrared remote control systems. It can be directly connected to a PIN photodiode and integrates a high-gain first-stage amplifier, limiter, bandpass filter, detection circuit, and waveform shaping circuit to provide a receiver preamplifier on a single chip.

#### FEATURES

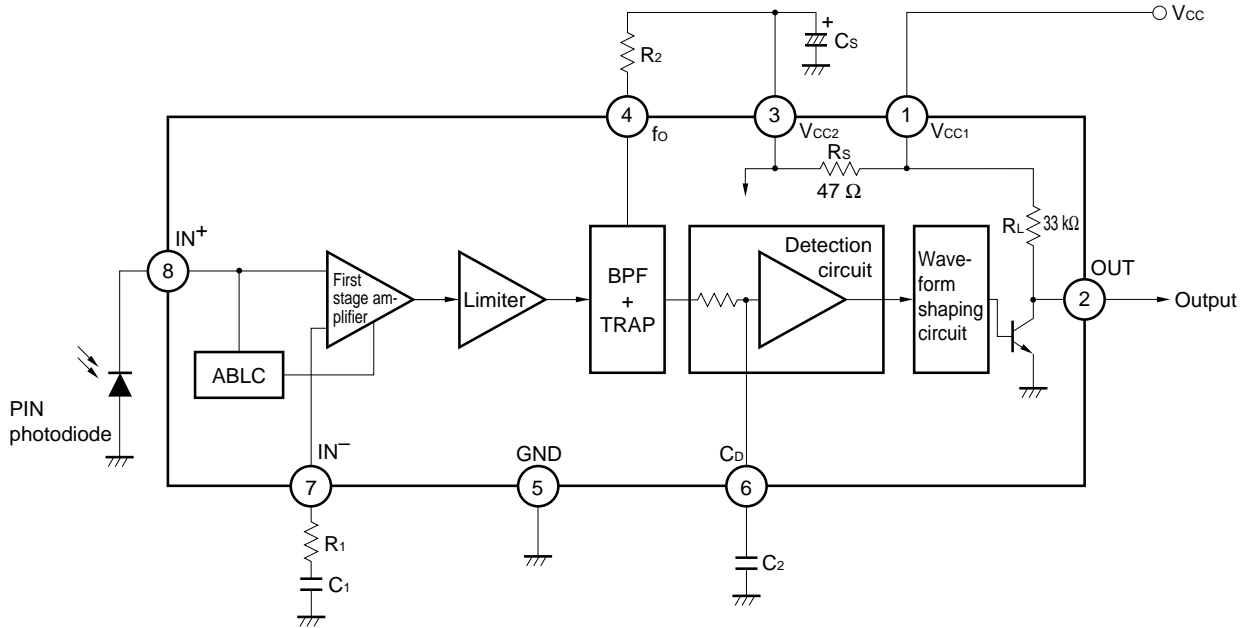
- High reliability due to high-frequency lighting fluorescent lamp  
Internal trap circuit
- Internal bandpass filter  
Central frequency variable by external resistor:  $f_0 = 30$  to  $80$  kHz  
Few variation of central frequency thanks to  $f_0$  trimming
- Low external components  
Internal output pull-up resistor and power supply filter resistor  
Only low external capacitance required
- ABLC (Automatic Bias Level Control) circuit  
Controls fluctuation of bias level cause by disturbance from external light
- Open-collector output  
Open-collector output (active low) with pull-up resistor ( $33$  k $\Omega$  TYP.)

#### ★ ORDERING INFORMATION

Part Number	Package
$\mu$ PC2800AGR	8-pin plastic SOP (225 mil)



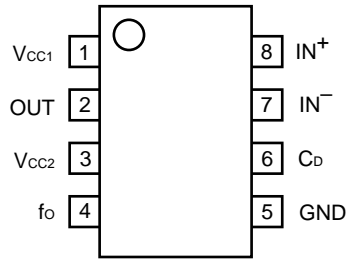
**BLOCK DIAGRAM**



**PIN CONFIGURATION (Top View)**

8-pin plastic SOP (225 mil)

- $\mu$ PC2800AGR



Pin No.	Symbol	Pin Name
1	V <sub>CC1</sub>	Power input pin
2	OUT	Output pin
3	V <sub>CC2</sub>	Power output pin
4	f <sub>o</sub>	BPF frequency setting pin
5	GND	Ground pin
6	C <sub>D</sub>	Detection capacitor connection pin
7	IN <sup>-</sup>	First-stage amplifier gain setting pin
8	IN <sup>+</sup>	Signal input pin

1. PIN FUNCTION

Pin No.	Symbol	Pin Name	Internal Equivalent Circuit	Function
1	V <sub>CC1</sub>	Power input pin		Supply a voltage of 5 V $\pm$ 10% to this pin. If the IC malfunctions due to power noise, connect a bypass capacitor.
2	OUT	Output pin		An open-collector output pin (active low) with a pull-up resistor (33 k $\Omega$ TYP.) Connect an external pull-up resistor of 2.2 k $\Omega$ or more, if any, to this pin.
3	V <sub>CC2</sub>	Power output pin		Connect a capacitor of 47 $\mu$ F or so to this pin to stabilize the supply voltage to the internal circuit.
4	f <sub>o</sub>	BPF frequency setting pin		Sets the central frequency of the internal bandpass filter by an external resistance (refer to f <sub>o</sub> vs. R <sub>2</sub> Characteristics in CHARACTERISTIC CURVE). Use a resistor with excellent accuracy and temperature characteristics.
5	GND	Ground pin		GND pin
6	C <sub>D</sub>	Detection capacitor connection pin		Connect a smoothing capacitor to this pin to obtain a DC voltage corresponding to the output signal level of the internal bandpass filter. The 0.01 $\mu$ F is the most suitable value for the external capacitor between pin 6 and GND. In case of reducing this capacitor, confirm that the output pulses from pin 2 have enough width even if the longest burst signal is inputted.

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Pin No.	Symbol	Pin Name	Internal Equivalent Circuit	Function
7	IN <sup>-</sup>	First-stage gain setting pin		<p>Reverse input pin of the first-stage amplifier.</p> <p>Connect a capacitor (0.01 <math>\mu</math>F) to prevent direct current so that the first-stage amplifier operates as an AC amplifier. The gain of the amplifier can be adjusted by an external resistor (0 to 1 k<math>\Omega</math>) (refer to <b>A<sub>v</sub> vs. R<sub>1</sub> Characteristics</b> in <b>CHARACTERISTIC CURVE</b>).</p>
8	IN <sup>+</sup>	Signal input pin		<p>This pin has an internal impedance of 90 k<math>\Omega</math> (TYP.) and can be directly connected to a PIN photodiode.</p> <p>Because this is the input pin of a high-sensitivity amplifier, exercise care that noise is not superimposed on this pin. Keep the wiring length of the cathode of the PIN photodiode as short as possible.</p>

## 2. EXAMPLE OF MEASURES TO PREVENT MALFUNCTIONING DUE TO NOISE

### 2.1 Radiation noise

- Keep the wiring length between the PIN photodiode and pin 8 as short as possible.
- Keep the signal lines of pins 2 and 6 as far away as possible from those of pins 7 and 8.
- Commonly ground the anode of the PIN photodiode and the external capacitor connected to pin 7. Separate the GND and power GND of pin 6 from these.
- Cover the entire circuit in a shield case.

### 2.2 Power noise

- Monitor the noise superimposed on pin 3 with an oscilloscope. If high-frequency noise is superimposed, connect a ceramic capacitor of 0.1  $\mu$ F or so between pin 3 and GND. If low-frequency noise is superimposed, increase the capacitance of the capacitor between pin 3 and GND. If necessary, connect a capacitor between pin 1 and GND.

### 2.3 External light disturbance noise

- Use a PIN photodiode with an excellent spectral sensitivity.
- Use a PIN photodiode with a lens and with a narrow directional angle.

### 2.4 Noise

- Insert an external resistor ( $R_1$ : 1 k $\Omega$  or less) in series to  $C_1$  between pin 7 and GND to decrease the voltage gain. In this case, however, the distance is shortened and care must be exercised not to decrease the voltage gain too much.

## ★ 3. NOTICE FOR USE

The  $\mu$ PC2800A is designed for the infrared remote control receivers of audio-visual equipment, air conditioner and so on. Therefore the  $\mu$ PC2800A may not be suitable for some applications that require accurate pulse widths such as data communications. In case of using the  $\mu$ PC2800A under the accurate pulse width condition, confirm that the output pulses from pin 2 have enough accuracy in actual environmental changing (refer to the following examples).

Example of environmental changing:

Operating ambient temperature, supply voltage, external disturbing light, external noise, input burst length, input carrier frequency, strength of input light, direction of input light, distance from transmitter, characteristics of parts (including the  $\mu$ PC2800A) and so on.

4. ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings (T<sub>A</sub> = 25 °C)

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	6.0	V
Output current	I <sub>OUT</sub>	2.5	mA
Input voltage	V <sub>IN</sub>	0 to V <sub>CC</sub>	V
Permissible package loss	P <sub>D</sub>	270	mW
Operating temperature	T <sub>A</sub>	-20 to +75	°C
Storage temperature	T <sub>stg</sub>	-40 to +125	°C

**Caution** If any of the parameters exceeds the absolute maximum ratings, even momentarily, the quality of the product may be impaired. The absolute maximum ratings are values that may physically damage the product(s). Be sure to use the product(s) within the ratings.

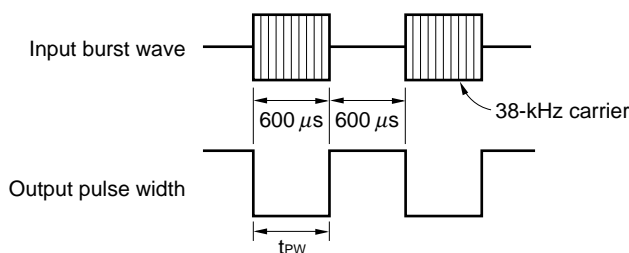
Recommended Operating Range

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage	V <sub>CC</sub>	4.5	5.0	5.5	V
Input frequency	f <sub>IN</sub>	30	38	80	kHz

Electrical Characteristics (T<sub>A</sub> = 25 °C, V<sub>CC</sub> = 5.0 V)

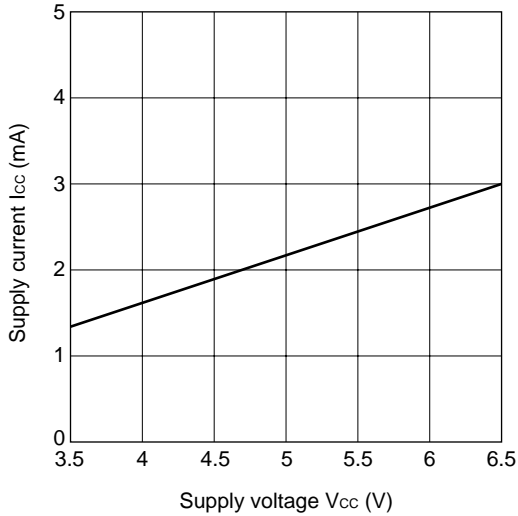
Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Supply current	I <sub>CC</sub>			2.1	2.8	mA
Input pin voltage	V <sub>IN1</sub>	I <sub>IN</sub> = 0	2.0	2.5	3.1	V
Input pin voltage	V <sub>IN2</sub>	I <sub>IN</sub> = -300 μA	0.6	0.8	1.7	V
Voltage gain	A <sub>V</sub>	f <sub>IN</sub> = 38 kHz CW, V <sub>IN</sub> = 30 μV <sub>p-p</sub>	74	78	82	dB
BPF bandwidth	f <sub>BW</sub>	-3 dB bandwidth, V <sub>IN</sub> = 30 μV <sub>p-p</sub> , R <sub>2</sub> = 130 kΩ	2.0	2.5	3.0	kHz
Internal input resistance	r <sub>IN</sub>	f <sub>IN</sub> = 38 kHz CW, V <sub>IN</sub> = 0.2 V <sub>p-p</sub>	60	90	140	kΩ
Output pulse width 1	t <sub>PW1</sub>	f <sub>IN</sub> = 38 kHz burst wave, V <sub>IN</sub> = 500 μV <sub>p-p</sub> <sup>Note</sup>	440		770	μs
Output pulse width 2	t <sub>PW2</sub>	f <sub>IN</sub> = 38 kHz burst wave, V <sub>IN</sub> = 50 mV <sub>p-p</sub> <sup>Note</sup>	440		770	μs
Low-level output voltage	V <sub>OL</sub>			0.2	0.4	V
High-level output voltage	V <sub>OH</sub>		4.8	5.0		V

Note

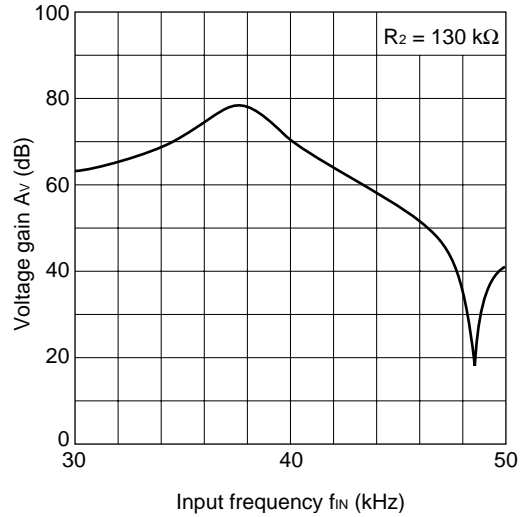


CHARACTERISTIC CURVE ( $T_A = 25\text{ }^\circ\text{C}$ )

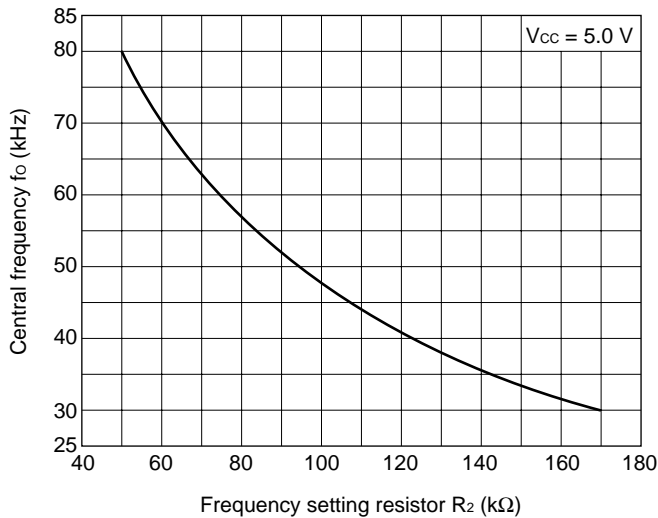
$I_{CC}$  vs.  $V_{CC}$  Characteristics



$A_v$  vs.  $f_{IN}$  Characteristics



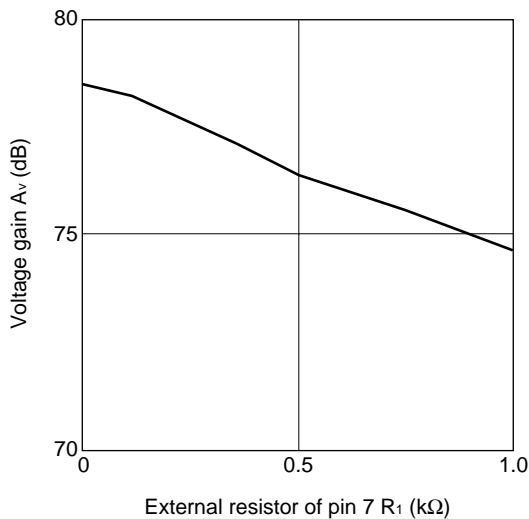
$f_o$  vs.  $R_2$  Characteristics<sup>Note 1</sup>



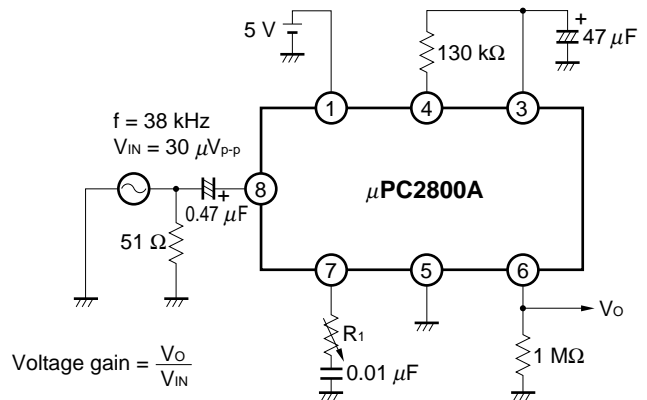
**Note 1.** The relation between  $f_o$  and  $R_2$  (recommended value) is as follows:

$f_o$ (kHz)	$R_2$ (recommended value) (k $\Omega$ )
32.7	155
36.0	139
36.7	136
38.0	130
40.0	123
56.7	80
70.0	60

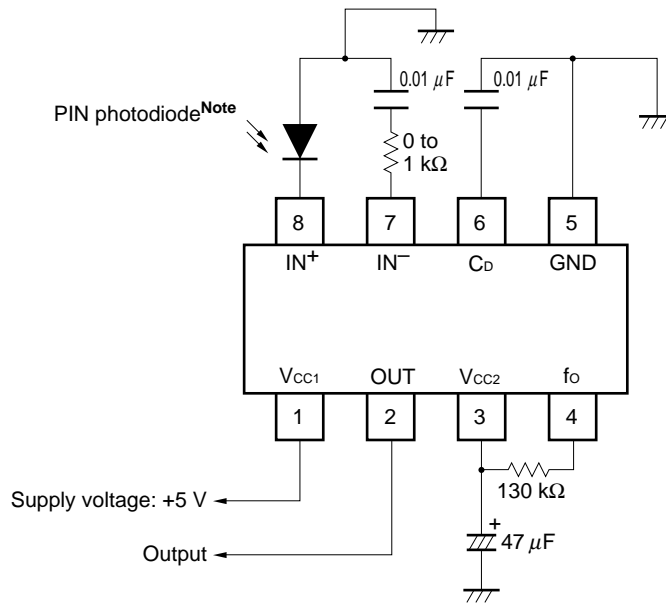
$A_v$  vs.  $R_1$  Characteristics<sup>Note 2</sup>



**Note 2.** This is the value of a resistor that is externally connected as follows:



5. APPLICATION CIRCUIT EXAMPLE ( $f_o = 38 \text{ kHz}$ )

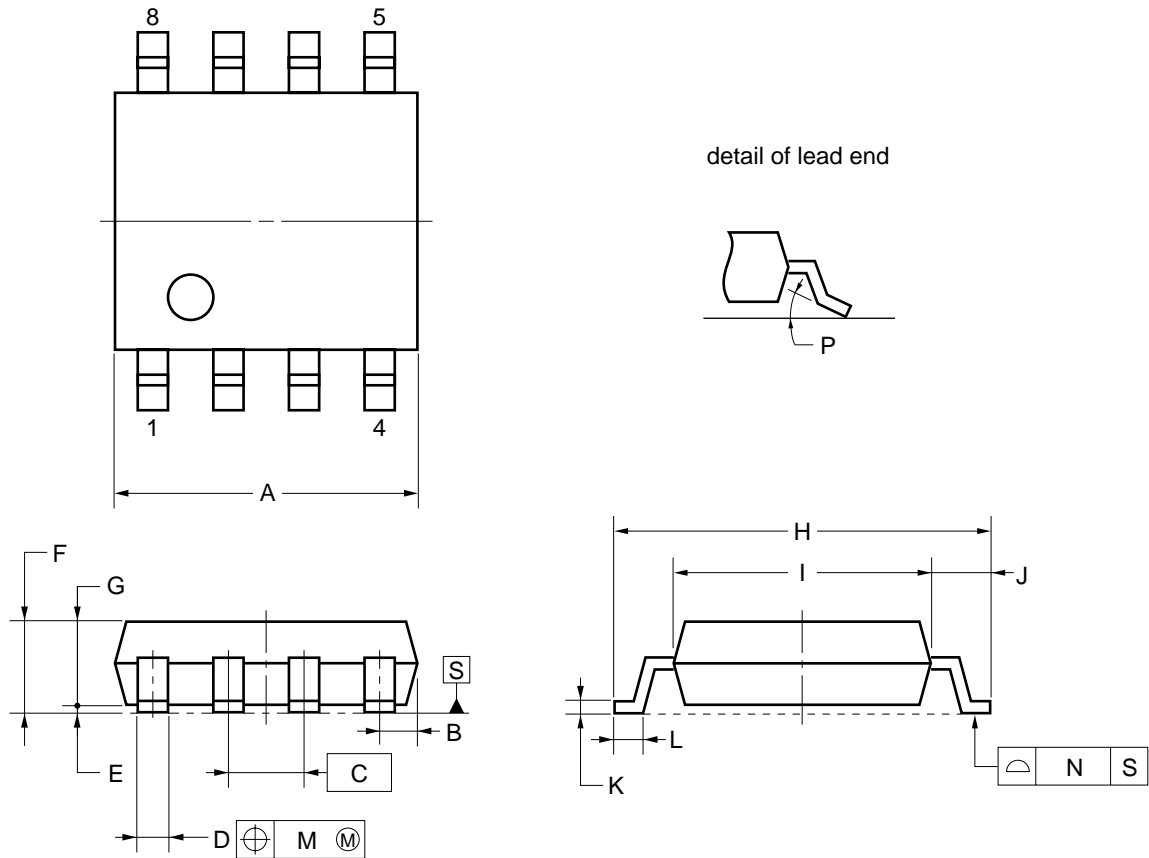


**Note** PH302, 302C, 310, 320, etc.



6. PACKAGE DRAWINGS

8 PIN PLASTIC SOP (225 mil)



**NOTE**  
 Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	5.2 <sup>+0.17</sup> <sub>-0.20</sub>
B	0.78 MAX.
C	1.27 (T.P.)
D	0.42 <sup>+0.08</sup> <sub>-0.07</sub>
E	0.1±0.1
F	1.59±0.21
G	1.49
H	6.5±0.3
I	4.4±0.15
J	1.1±0.2
K	0.17 <sup>+0.08</sup> <sub>-0.07</sub>
L	0.6±0.2
M	0.12
N	0.10
P	3° <sup>+7°</sup> <sub>-3°</sub>

## 7. RECOMMENDED SOLDERING CONDITIONS

Solder this product under the following recommended conditions.

For details of the recommended soldering conditions, refer to information document **Semiconductor Device Mounting Technology Manual (C10535E)**.

For soldering methods and conditions other than those recommended, consult NEC.

### Surface Mount Type

#### $\mu$ PC2800AGR: 8-pin plastic SOP (225 mil)

Process	Conditions	Symbol
Infrared ray reflow	Peak temperature: 230 °C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210 °C or higher), Maximum number of reflow processes: 1 time.	IR30-00-1
VPS	Peak temperature: 215 °C or below (Package surface temperature), Reflow time: 40 seconds or less (at 200 °C or higher), Maximum number of reflow processes: 1 time.	VP15-00-1
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or less, Maximum number of flow processes: 1 time, Pre-heating temperature: 120 °C or below (Package surface temperature).	WS60-00-1
Partial heating method	Pin temperature: 300 °C or below, Heat time: 3 seconds or less (Per each side of the device).	—

**Caution** Apply only one kind of soldering condition to a device, except for “partial heating method”, or the device will be damaged by heat stress.

[MEMO]

## [MEMO]

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

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Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.