

# BA3902 BA3904A BA3906

## Power supply, standard voltage

The BA3902, BA3904A, and BA3906 are power supplies used in car audio systems.

### Features

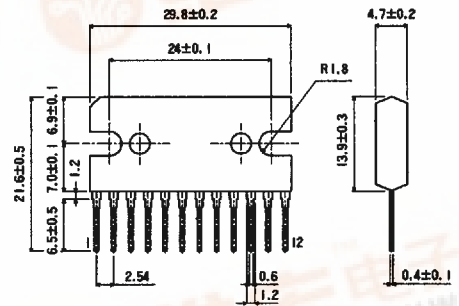
- available in an SIP-M12 package
- four power sources available from each IC
  - BA3902: 5.0 V, 8.5 V (×2), 9.0 V
  - BA3904A: 5.6 V, 8.55 V (×2), 9.0 V
  - BA3906: 5.6 V, 8.3 V (×3)
- incorporates a chip enable output and a mute output for the reference voltage output and accessory voltage detection
- all output circuits use a PNP transistor with a low saturation voltage
- AM and FM band selection switch included with a standby switch, which shuts down the IC when OFF
- internal output overload protection circuit prevents damage to the IC in the event the load is short circuited
- overvoltage protection circuit
- internal thermal overload also protects the IC

### Applications

- car radio

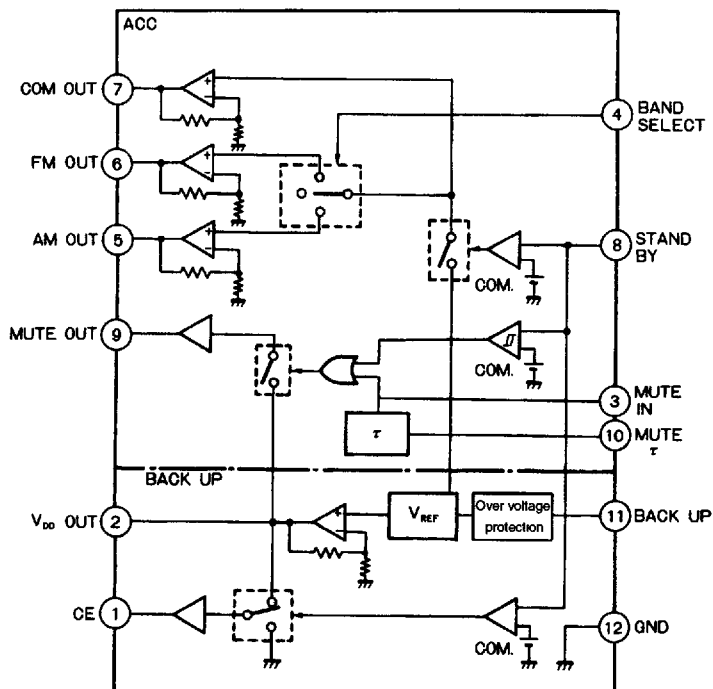
### Dimensions (Units : mm)

BA2902, BA3904A, and BA3906 (SIP-M12)



13902, BA3904A, BA3906 System power supply, BA3900 & BA3910 series

Block diagram



absolute maximum ratings ( $T_a = 25^\circ\text{C}$ )

Parameter	Symbol	Limits	Unit	Conditions
Supply voltage	BACK UP	24	V	
Power dissipation	$P_d$	3000	mW	
Operating temperature	$T_{opr}$	$-30 \sim +85$	$^\circ\text{C}$	
Storage temperature	$T_{stg}$	$-55 \sim +150$	$^\circ\text{C}$	
Maximum supply voltage	BACK UP peak	50	V	$t_r \geq 1 \text{ ms}$ , maximum supply time is $< 200 \text{ ms}$

Recommended operating conditions ( $T_a = 25^\circ\text{C}$ )

Parameter	Symbol	Min	Typical	Max	Unit	
Recommended operating supply	BA3902 BA4904A	BACK UP	10	13.2	16	V
	BA3906	BACK UP	9.2	13.2	16	V
Operating voltage range	BA3904A BA3906	BACK UP	9.0	13.2	24	V

**Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ , BACK UP = 13.2 V)**  
 (Sheet 1 of 3)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions	
Standby current	$I_{st}$		0.7	1.0	mA	Stand by = 0 V	
<b>Output voltage 1 (<math>V_{DD}</math>)</b>							
Output voltage 1	BA3902	$V_{O1}$	4.7	5.0	5.3	V	$I_{O1} = 40 \text{ mA}$
	BA3904A		5.3	5.6	5.9		
	BA3906		5.3	5.6	5.9		
Line regulation	$\Delta V_{O11}$		20	100	mV	Back up = 10 ~ 16 V, $I_{O1} = 40 \text{ mA}$	
Load regulation	$\Delta V_{O12}$		20	100	mV	$I_{O1} = 10 \sim 50 \text{ mA}$	
Dropout voltage	$\Delta V_{O13}$		0.45	1.0	V	$I_{O1} = 40 \text{ mA}$	
Output current	BA3902	$I_{11}$	0		60	mA	$V_{O1} \geq 4.7 \text{ V}$
	BA3904A		0		60		$V_{O1} \geq 5.3 \text{ V}$
	BA3906		0		60		$V_{O1} \geq 5.3 \text{ V}$
<b>Output voltage 2 (COM)</b>							
Output voltage 2	BA3902	$V_{O2}$	8.6	9.0	9.4	V	$I_{O2} = 80 \text{ mA}$
	BA3904A		8.6	9.0	9.4		
	BA3906		7.95	8.3	8.65		
Line regulation	$\Delta V_{O21}$		10	200	mV	Back up = 10 ~ 16 V, $I_{O2} = 80 \text{ mA}$	
Load regulation	$\Delta V_{O22}$		20	200	mV	$I_{O2} = 10 \sim 100 \text{ mA}$	
Dropout voltage	BA3902	$\Delta V_{O23}$		0.3	0.6	V	$I_{O2} = 80 \text{ mA}$
	BA3904A			0.3	0.6		
	BA3906			0.3	0.55		
Output current	BA3902	$I_{21}$	0		130	mA	$V_{O2} \geq 8.6 \text{ V}$
	BA3904A		0		130		$V_{O2} \geq 8.6 \text{ V}$
	BA3906		0		125		$V_{O2} \geq 7.85 \text{ V}$
<b>Output voltage 3 (FM)</b>							
Output voltage 3	BA3902	$V_{O3}$	8.1	8.5	8.9	V	$I_{O3} = 150 \text{ mA}$
	BA3904A		8.2	8.55	8.9		
	BA3906		7.95	8.3	8.65		
Line regulation	$\Delta V_{O31}$		10	200	mV	Back up = 10 ~ 16 V, $I_{O3} = 150 \text{ mA}$	
Load regulation	$\Delta V_{O32}$		20	200	mV	$I_{O3} = 10 \sim 200 \text{ mA}$	

**BA3902, BA3904A, BA3906** System power supply, BA3900 & BA3910 series

**Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ , BACK UP = 13.2 V)**  
**(Sheet 2 of 3)**

Parameter		Symbol	Min	Typical	Max	Unit	Conditions
Dropout voltage	BA3902	$\Delta V_{O33}$		0.4	0.6	V	$I_{O3} = 150 \text{ mA}$
	BA3904A			0.4	0.55		
	BA3906			0.4	0.55		
Output current	BA3902	$I_{31}$	0		200	mA	$V_{O3} \geq 8.1 \text{ V}$
	BA3904A		0		250		$V_{O3} \geq 8.1 \text{ V}$
	BA3906		0		250		$V_{O3} \geq 7.85 \text{ V}$
<b>Output voltage 4 (AM)</b>							
Output voltage 4	BA3902	$V_{O4}$	8.1	8.5	8.9	V	$I_{O4} = 80 \text{ mA}$
	BA3904A		8.2	8.55	8.9		
	BA3906		7.95	8.3	8.65		
Line regulation		$\Delta V_{O41}$		10	200	mV	Back up = 10 ~ 16 V, $I_{O4} = 80 \text{ mA}$
Load regulation		$\Delta V_{O42}$		20	200	mV	$I_{O4} = 10 \sim 100 \text{ mA}$
Dropout voltage	BA3902	$\Delta V_{O43}$		0.3	0.6	V	$I_{O4} = 80 \text{ mA}$
	BA3904A			0.3	0.55		
	BA3906			0.3	0.55		
Output current	BA3902	$I_{41}$	0		130	mA	$V_{O4} \geq 8.1 \text{ V}$
	BA3904A		0		145		$V_{O4} \geq 8.1 \text{ V}$
	BA3906		0		145		$V_{O4} \geq 7.85 \text{ V}$
<b>Input 1 (STAND BY)</b>							
Input change level		$V_{IH1}$	5.5	6.0	6.5	V	COM = ON
Input current, high		$V_{H1}$	100	180	260	$\mu\text{A}$	Stand by = 8 V
CE up threshold voltage		$V_{TH11}$	6.0	6.3	6.6	V	Stand by > $V_{TH11}$ , CE = HIGH
CE down threshold voltage		$V_{TH12}$	5.2	5.5	5.8	V	Stand by < $V_{TH12}$ , CE = LOW
MUTE down threshold voltage	BA3902	$V_{TH21}$	6.7	7.1	7.5	V	Stand by < $V_{TH21}$ , MUTE OUT = LOW
	BA3904A		6.85	7.25	7.65		
	BA3906		6.85	7.25	7.65		
MUTE up threshold voltage		$V_{TH22}$	7.6	8.0	8.4	V	Stand by > $V_{TH22}$ , MUTE OUT = HIGH
<b>Input 2 (BAND SELECT)</b>							
FM out change level		$V_{IH2}$	1.0	1.4	1.8	V	
AM out change level		$V_{IM2}$	3.0	3.4	3.8	V	
Input current, high		$I_{H2}$		10	60	$\mu\text{A}$	Band select = 5 V

**Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ , BACK UP = 13.2 V)**  
**(Sheet 3 of 3)**

Parameter	Symbol	Min	Typical	Max	Unit	Conditions	
<b>Input 3 (MUTE IN)</b>							
MUTE OUT change level	$V_{TH3}$	1.4	2.3	3.3	V	Mute out HI	
Input current, high	$I_{H3}$		100	170	$\mu\text{A}$	Mute in = 5 V	
MUTE OUT output current	$I_{O5}$	12	19		mA	Mute out > 4.2 V	
CE output voltage	BA3902 BA3904A BA3906	$V_{O61}$	$0.82 \times V_{DD}$		$V_{DD}$	V	CE = HIGH, $I_{O6} = 1 \text{ mA}$
			$0.82 \times 5$				
			$0.82 \times 5$				
CE output voltage	$V_{O62}$		0	0.3	V	CE = LOW	
Ripple rejection ratio	RR		60		dB	$f = 100 \text{ Hz}$	

**Figure 1 Test circuit**

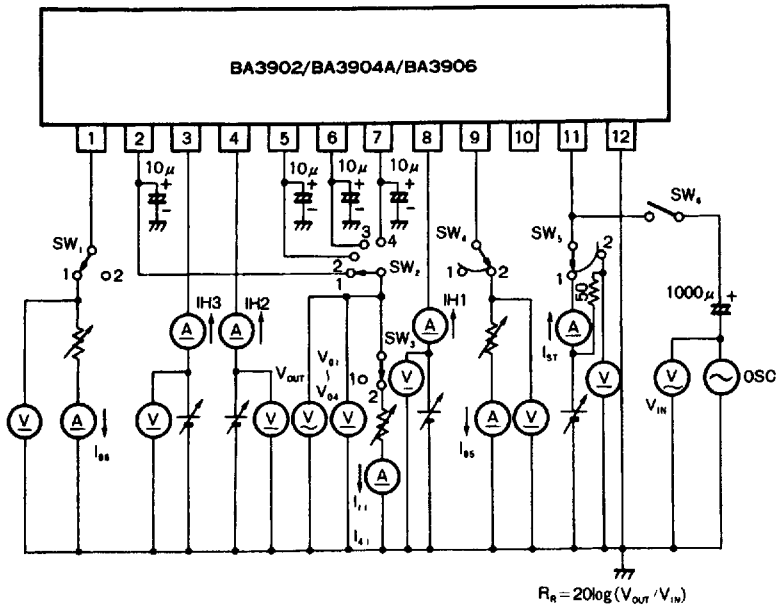


Figure 2 Application example—BA3902

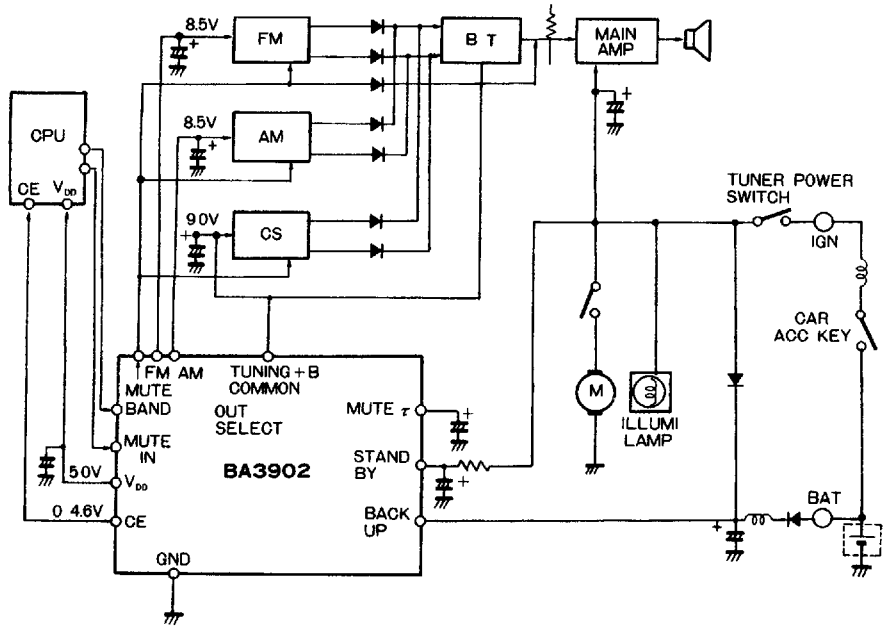
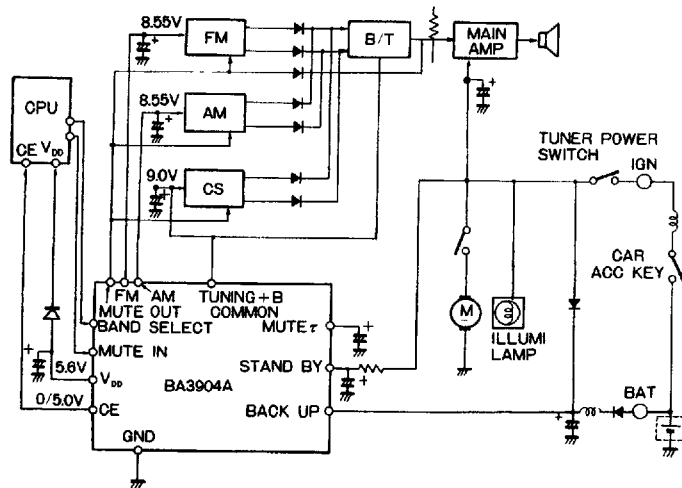
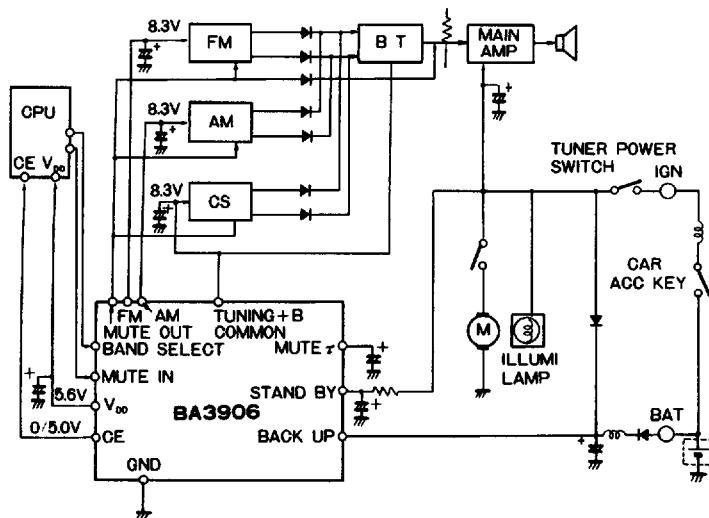


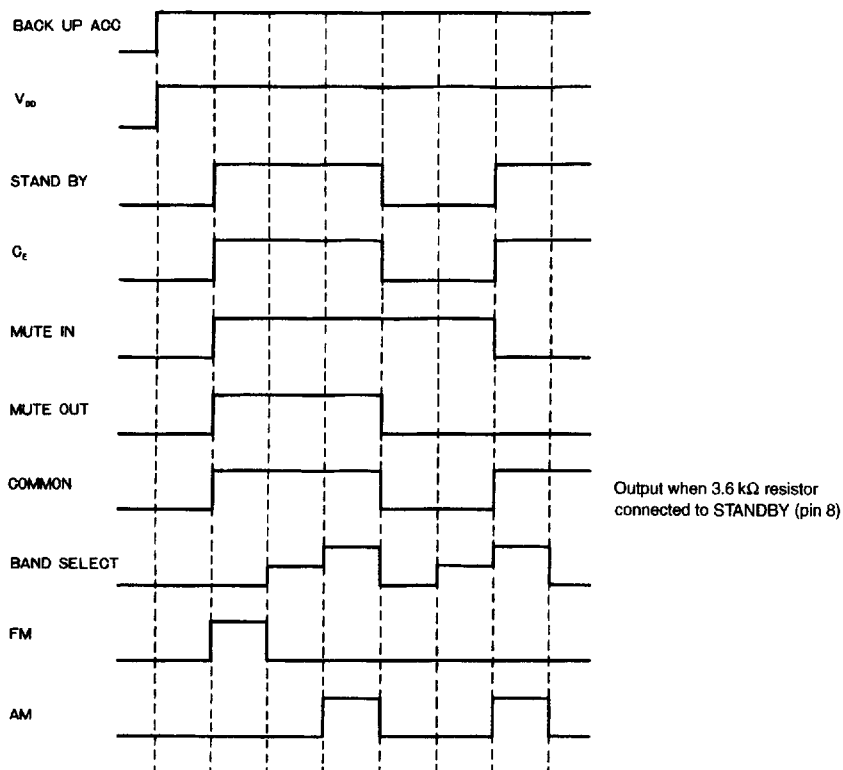
Figure 3 Application example—BA3904A



**Figure 4 Application example—BA3906**



**Figure 5 Input and output timing chart**



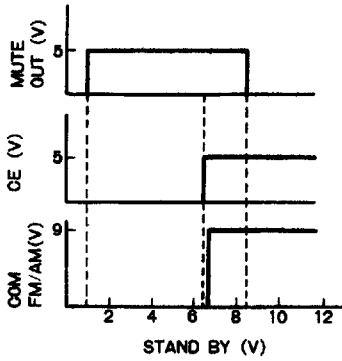


Figure 6 Standby (pin 8) 3.6 kΩ

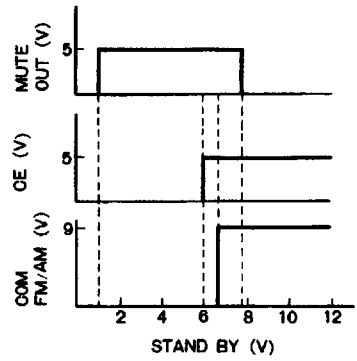


Figure 7

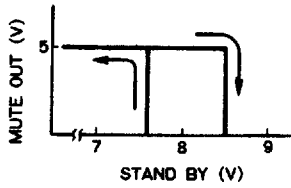


Figure 8 MUTEOUT (pin 9) output pin

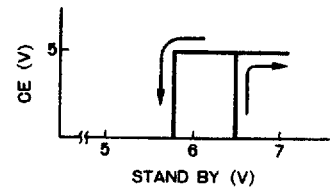
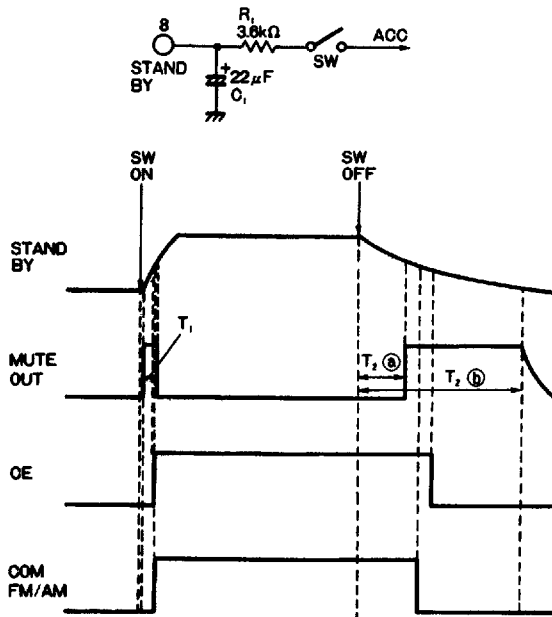


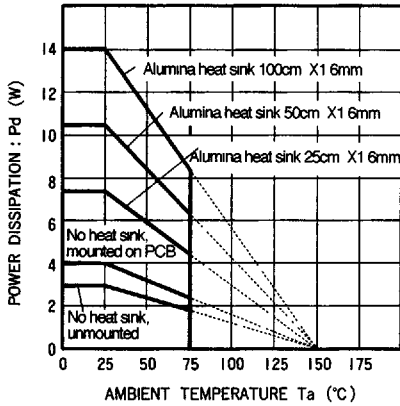
Figure 9 CE (pin 1) output pin

Figure 10





**Electrical characteristic curves**

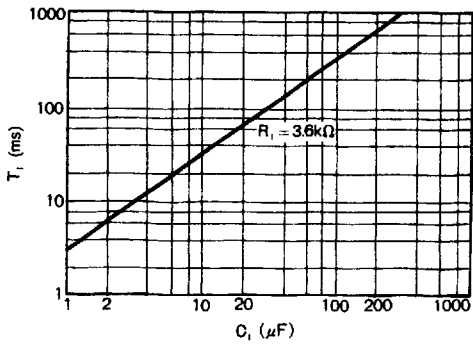


**Figure 11**

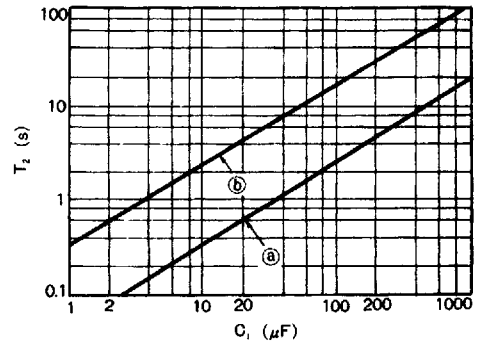
**STAND BY (pin 8)**

**BACK UP = 13.2 v**

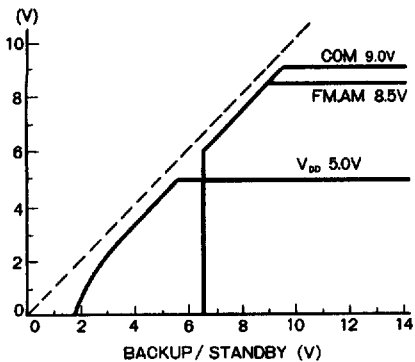
**STAND BY: SW ON = 13.2 V: SW OFF = OPEN**



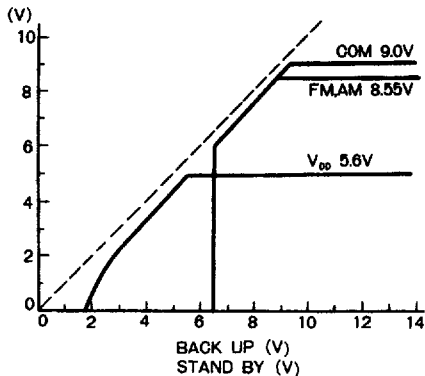
**Figure 12**



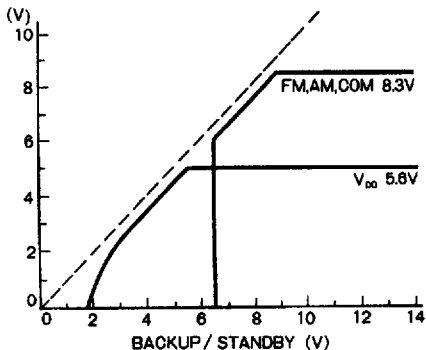
**Figure 13**



**Figure 14 (BA3902)**



**Figure 15 (BA3904A)**



**Figure 16 BA3906**