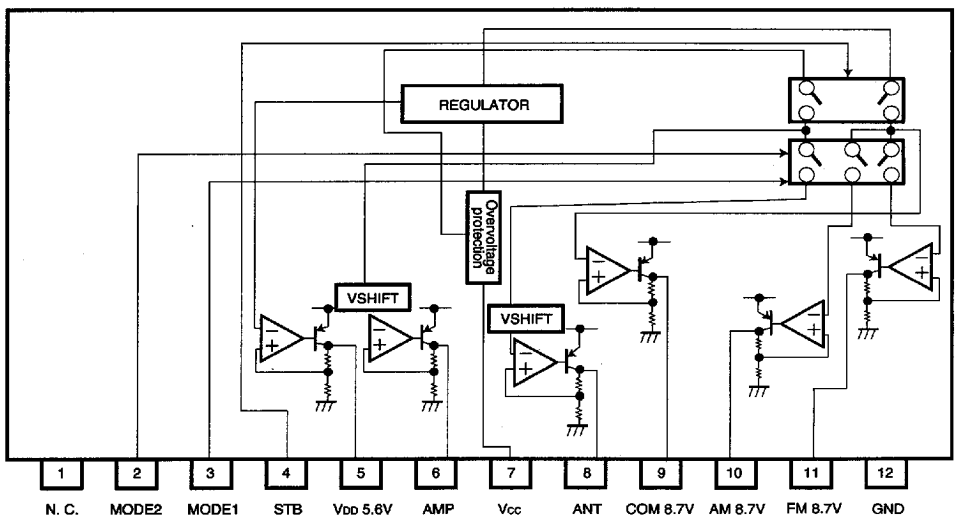
Reference voltage power supply
BA3911

The BA3911 is a single-chip power supply IC for use in car audio systems. One 5.6V output for microcontrollers, three 8.7V outputs, and two outputs interlocked with BACKUP and ACC systems are built in.

●Applications
Car audio systems

●Features
1) A power supply IC for car audio systems ; one 5.6V output for microcontrollers, three 8.7V outputs, and two outputs interlocked with BACKUP and ACC systems are built in.
2) All output circuits use a PNP transistor with a low saturation voltage.
3) Output current limit circuit prevents damage to the IC in the event output is short-circuited.
4) Overvoltage protection circuit provides protection against surges from the ACC or BACKUP inputs.
5) Compact 12-pin POWER package allows a large power dissipation.
6) Thermal protection circuit prevents heat damage to the IC.

●Block diagram



●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	Unit
Applied voltage	V_{CC}	24	V
Power dissipation	Pd	3000	mW
Operating temperature	Topr	−30～85	℃
Storage temperature	Tstg	−55～150	℃
Peak applied voltage	$V_{CC\ PEAK}$	50*1	V

*1 tr≧1msec
Applied time less than 200 msec.

●Recommended operating conditions (Ta=25℃)

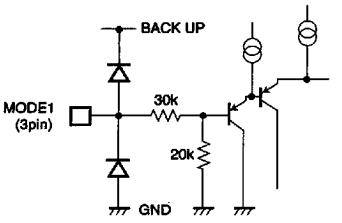
Parameter	Symbol	Min.	Typ.	Max.	Unit
Recommended power supply voltage	V_{CC}	10	13.2	16	V
Operable power supply voltage*	V_{CC}	6.3	13.2	24	V

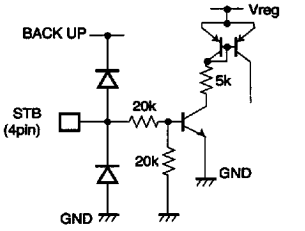
* Values of electrical characteristics are not guaranteed (in particular, during a voltage drop).

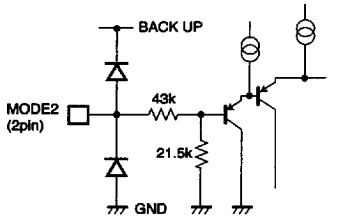
●Pin description

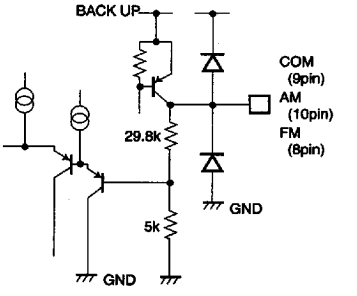
Pin No.	Pin name	Function
1	N.C.	Not used
2	MODE2 SW	AM and ANT outputs are turned ON when this pin is 5 V
3	MODE1 SW	AM and FM outputs are switched when this pin is 5 V
4	STAND BY	Only V_{DD} is output during the 0V standby state; COM and AM outputs are turned ON when this pin is 5 V
5	V_{DD} output	5.6 V power supply with a maximum output current of 100 mA for microcontrollers;output is always available if BACKUP power supply is connected
6	AMP output	Power supply to activate a remote amplifier; a voltage of about 0.5 V (typical) lower than the V_{CC} pin voltage is provided with a maximum output current of 500 mA
7	V_{CC}	Connected to BACKUP and ACC power supplies of a car
8	ANT output	Power supply to drive an antenna; a voltage of about 0.5 V (typical) lower than the V_{CC} pin voltage is provided with a maximum output current of 500 mA
9	COM output	8.7 V power supply with a maximum output current of 150 mA; this can be used as system common power supply (such as tone,volume, and balance control) as well as power supplies for cassette player equalizers and electronic tuning variable capacitors
10	AM output	8.7 V power supply with a maximum output current of 150 mA for AM receivers
11	FM output	8.7 V power supply with a maximum output current of 250 mA for FM receivers
12	GND	Connected to the IC's substrate.

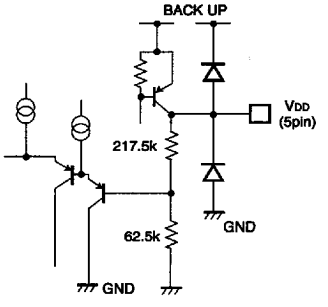
●Input/output circuits

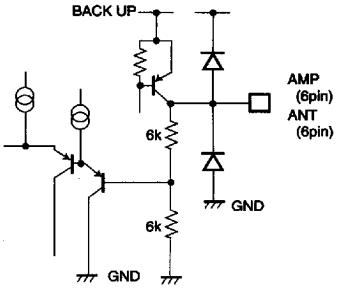












●Electrical characteristics (unless otherwise noted, Ta=25℃ and V_{CC}=13.2V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Standby circuit current	I_{ST}	—	0.55	0.80	mA	STAND BY pin = 0 V
Output voltage (V_{DD}) 1	V_{O1}	5.30	5.60	5.90	V	I_{O1}=80mA
Voltage variation	ΔV_{O11}	—	100	200	mV	V_{CC}=10~16V I_{O1}=80mA
Load variation	ΔV_{O12}	—	30	150	mV	I_{O1}=0~80mA
Minimum I/O voltage differential	ΔV_{O13}	—	0.3	0.7	V	I_{O1}=80mA
Output current capacity	I_{O1}	100	150	—	mA	V_{O1}≧5.3V
Ripple rejection ratio	R.R1	43	47	—	dB	f=100Hz V_{RR}=−10dBV
Output voltage (COM) 2	V_{O2}	8.25	8.70	9.15	V	I_{O2}=120mA
Voltage variation	ΔV_{O21}	—	100	200	mV	V_{CC}=10~16V I_{O2}=120mA
Load variation	ΔV_{O22}	—	50	180	mV	I_{O2}=0~120mA
Minimum I/O voltage differential	ΔV_{O23}	—	0.4	0.7	V	I_{O2}=120mA
Output current capacity	I_{O2}	150	200	—	mA	V_{O2}≧8.25V
Ripple rejection ratio	R.R2	40	45	—	dB	f=100Hz V_{RR}=−10dBV
I/O voltage differential (AMP) 3	ΔV_{O31}	—	0.5	0.9	V	I_{O3}=400mA
Load variation	ΔV_{O32}	—	300	600	mV	I_{O3}=0~400mA
Output current capacity	I_{O3}	500	650	—	mA	V_{O3}≧12.3V
I/O voltage differential (ANT) 4	ΔV_{O41}	—	0.5	0.9	V	I_{O4}=400mA
Load variation	ΔV_{O42}	—	300	600	mV	I_{O4}=0~400mA
Output current capacity	I_{O4}	500	650	—	mA	V_{O4}≧12.3V
Output voltage (AM) 5	V_{O5}	8.25	8.70	9.15	V	I_{O5}=120mA
Voltage variation	ΔV_{O51}	—	100	200	mV	V_{CC}=10~16V I_{O5}=120mA
Load variation	ΔV_{O52}	—	50	180	mV	I_{O5}=0~120mA
Minimum I/O voltage differential	ΔV_{O53}	—	0.4	0.7	V	I_{O5}=120mA
Output current capacity	I_{O5}	150	200	—	mA	V_{O5}≧8.25V
Ripple rejection ratio	R.R5	40	45	—	dB	f=100Hz V_{RR}=−10dBV
Output voltage (FM) 6	V_{O6}	8.25	8.70	9.15	V	I_{O6}=200mA
Voltage variation	ΔV_{O61}	—	100	200	mV	V_{CC}=10~16V I_{O6}=200mA
Load variation	ΔV_{O62}	—	50	180	mV	I_{O6}=0~200mA
Minimum I/O voltage differential	ΔV_{O63}	—	0.4	0.7	V	I_{O6}=200mA
Output current capacity	I_{O6}	250	350	—	mA	V_{O6}≧8.25V
Ripple rejection ratio	R.R5	40	45	—	dB	f=100Hz V_{RR}=−10dBV

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input (STAND BY)						
Standby level voltage	V_{th1-1}	—	—	1.1	V	
Active level voltage	V_{th1-2}	1.7	—	—	V	
Input current when HIGH	I_{in1}	100	175	250	μA	V_{th1}=5V
Input (MODE 2 SW)						
Standby level voltage	V_{th2-1}	—	—	1.6	V	
Active level voltage	V_{th2-2}	2.4	—	—	V	
Input current when HIGH	I_{in2}	40	90	140	μA	V_{th2}=5V
Input (MODE 1 SW)						
Voltage when AM ON	V_{th3-1}	—	—	1.1	V	
Voltage when FM ON	V_{th3-2}	2.7	—	—	V	
Input current when HIGH	I_{in3}	50	100	150	μA	V_{th3}=5V

◎Not designed for radiation resistance.

* Set output current to less than the minimum value of output current capacity

●Estimate of allowable power dissipation

Except under transitional conditions, the power dissipation of this IC is 3W per unit at 25℃.
The heat reduction characteristics, including some cases where heat sinks are used, are listed on a separate page for your referral.

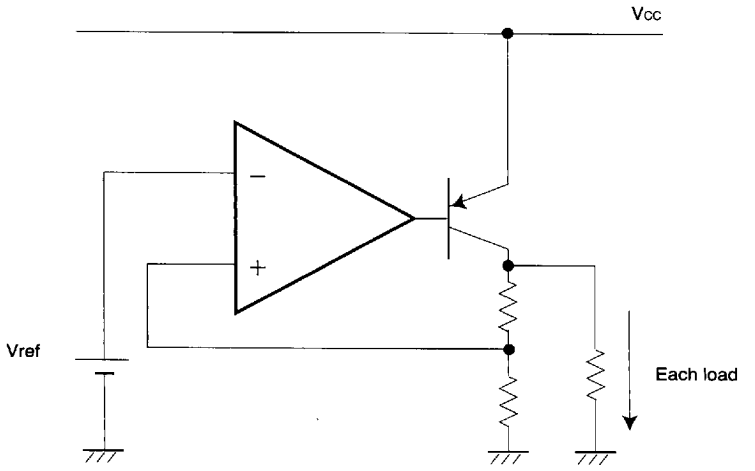


Fig.1

A = maximum voltage for V_{CC}

I_1 = maximum output current for V_{DD}
I_2 = maximum output current for COM
I_3 = maximum output current for AMP
I_4 = maximum output current for ANT
I_5 = maximum output current for AM
I_6 = maximum output current for FM

• Power consumed by V_{DD} 5.6V	$P_1 = (A - 5.6V) \times I_1 + (I_1/20 + I_1/10) \times A$
• Power consumed by COM 8.7V	$P_2 = (A - 8.7V) \times I_2 + (I_2/30 + I_2/10) \times A$
• Power consumed by AMP	$P_3 = 0.5V \times I_3 + (I_3/100 + I_3/10) \times A$
• Power consumed by ANT	$P_4 = 0.5V \times I_4 + (I_4/100 + I_4/10) \times A$
• Power consumed by AM 8.7V	$P_5 = (A - 8.7V) \times I_5 + (I_5/30 + I_5/10) \times A$
• Power consumed by FM 8.7V	$P_6 = (A - 8.7V) \times I_6 + (I_6/50 + I_6/10) \times A$
• Power consumed internally by each circuit	$P_7 = V_{CC} \times$ circuit current (about 5mA)

$P_{MAX.} = P_1 + P_2 + P_3 + P_4 + (P_5 \text{ or } P_6, \text{ whichever is larger}) + P_7$

●Input/output timing chart

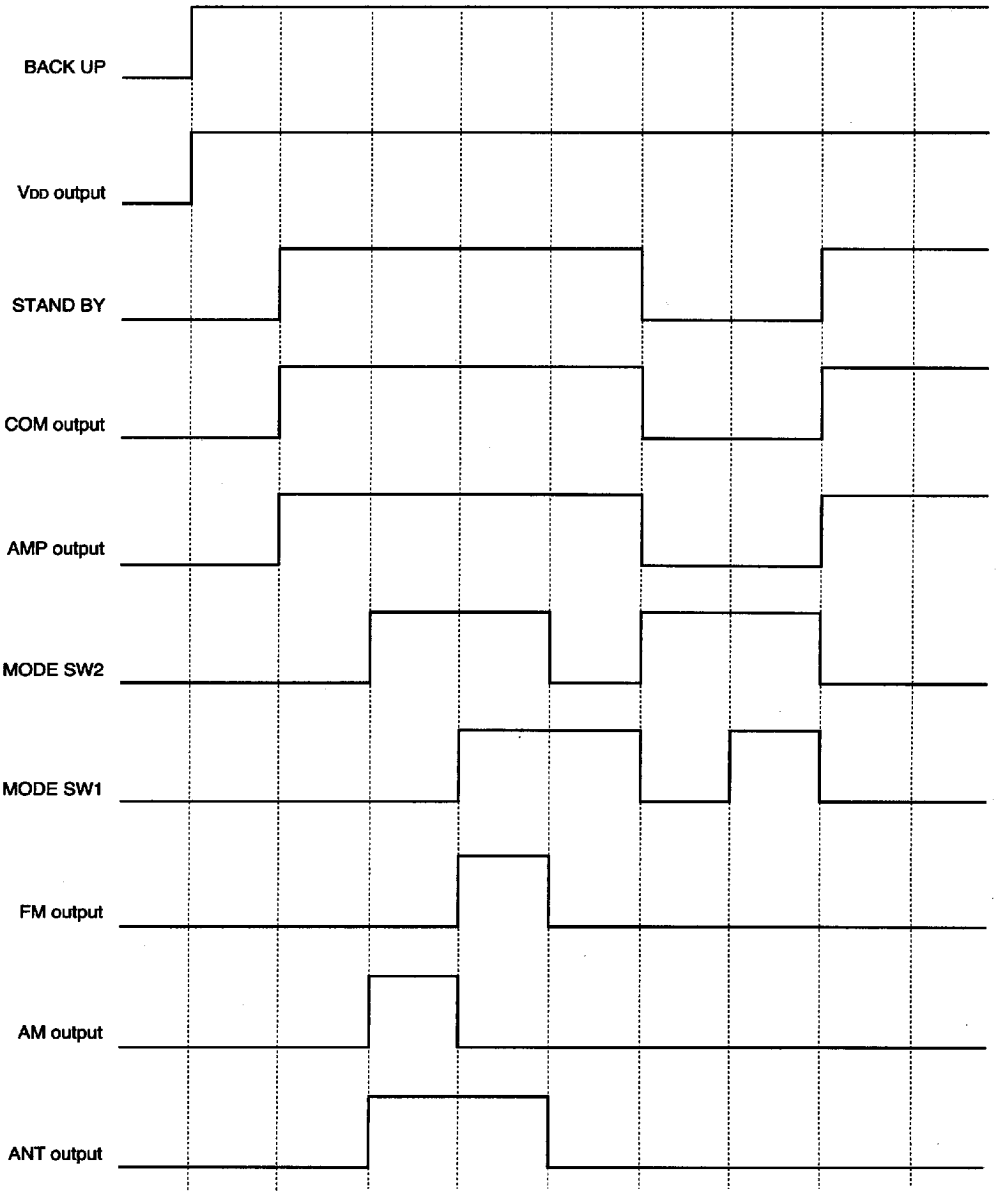


Fig.2

●Application example

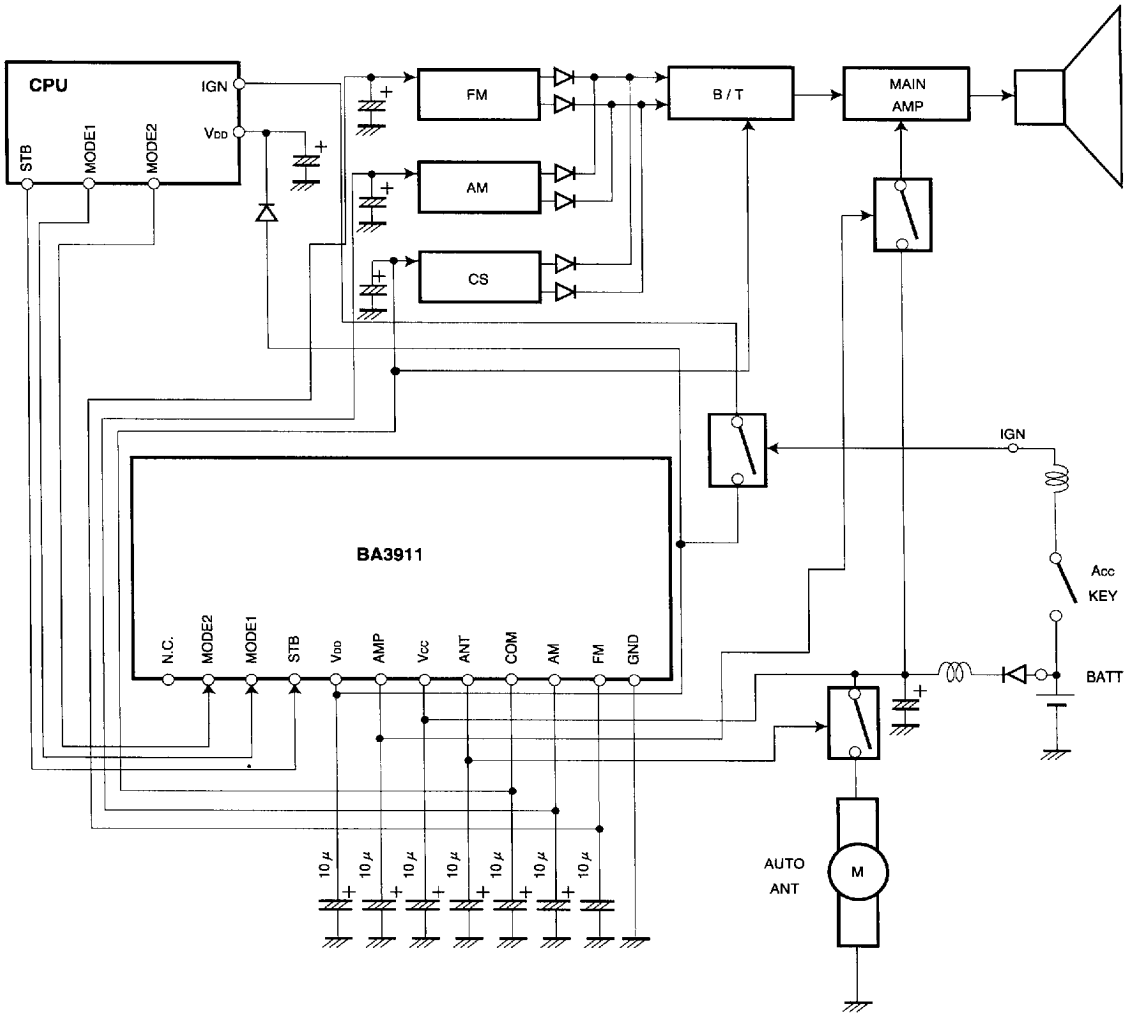


Fig.3

●Operation notes

1. Example of application

The application circuit of Fig. 3 is recommended for use. Make sure to confirm the adequacy of parts characteristics. When using the circuit with changes to external circuit constants, make sure to leave sufficient margins in consideration of fluctuations in the IC and external components including static and transitional characteristics. Note that ROHM has not carried out extensive survey regarding the patent right.

2. Operating power supply

When operating within proper ranges of power supply voltage and ambient temperature, most circuit functions are guaranteed. Although the rated values of electrical characteristics cannot be absolutely guaranteed, characteristic values do not change drastically within the proper ranges.

3. Power dissipation (Pd)

Refer to the heat reduction characteristics (Fig. 4) and the rough estimation of IC power dissipation given on a separate page. Make sure your design allows a maximum power within the operating temperature range.

4. Overvoltage protection circuit

The overvoltage protection circuit turns OFF each output when the potential difference between V_{CC} (pin 7) and GND (pin 12) is more than about 26V at normal temperature. Make sure to use the IC within this voltage limit.

5. Preventing oscillation at each output

To stop oscillation of output, make sure to connect a capacitor having a capacitance of 10 μF or greater between GND and each of the V_{DD} (pin 5), AMP (pin 6), ANT (pin 8), COM (pin 9), AM (pin 10), and FM (pin 11) output pins. We recommend using a tantalum electrolytic capacitor whose capacitance is unsusceptible to temperature.

6. Overcurrent protection circuit

An overcurrent protection circuit is installed on each of the V_{DD} (pin 5), AMP (pin 6), ANT (pin 8), COM (pin 9), AM (pin 10), and FM (pin 11) outputs, based on the respective output current. This prevents IC destruction by overcurrent, by limiting the current with a curve shape of "7" in the voltage-current graph. The IC is designed with margins so that current flow will be restricted and latching will be prevented even if a large current suddenly flows through a large capacitor. The circuit should be carefully set because output current is further restricted when output voltage is less than $1V_F$ (considered as short mode).

7. Thermal protection circuit

A built-in thermal protection circuit prevents thermal damage to the IC. All outputs except V_{DD} are switched OFF when the circuit operates, and revert to the original state when temperature drops to a certain level.

8. Grounding

Each ground line in the application circuit of Fig. 3 must be adequately short regarding the GND pin (pin 12). Make sure to arrange the ground lines in a pattern that prevents mutual interference.

9. Although the quality of this IC is rigorously controlled, the IC may be destroyed when applied voltage or operating temperature exceeds their absolute maximum ratings. Because short mode or open mode cannot be specified when the IC is destroyed, be sure to take physical safety measures such as fusing if special mode is expected.

10. We recommend installing a bypass line in particular applications if there is a mode where potential difference between each output and input (V_{CC}) or GND is reversed from the normal state.

●Thermal derating characteristics

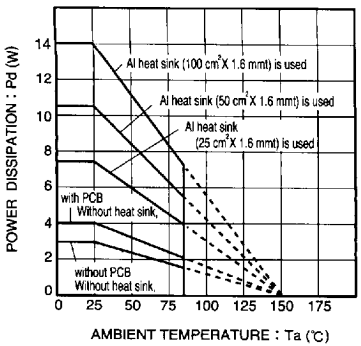


Fig.4 Thermal derating curves

●Electrical characteristic curves

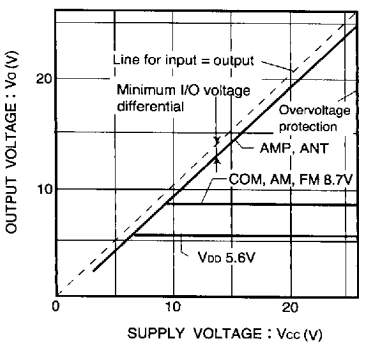


Fig.5 Output voltage vs. supply voltage

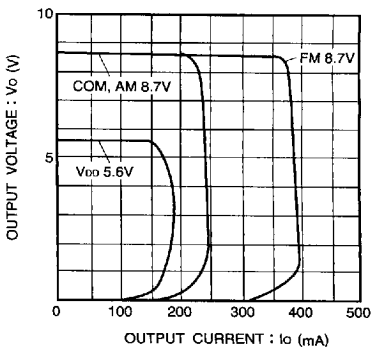


Fig.6 Output voltage vs. output current

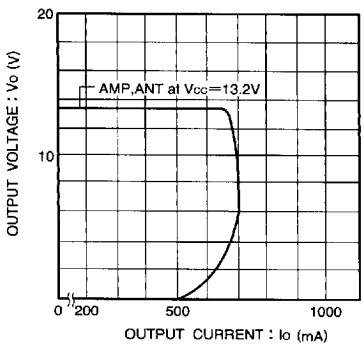


Fig.7 Output voltage vs. output current

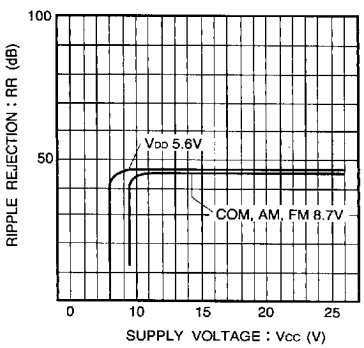


Fig.8 Ripple rejection vs. supply voltage

●External dimensions (Units: mm)