

FM/AM Radio

Description

CXA1691AM/AS is a one-chip FM/AM radio IC designed for radio-cassette tape recorders.

Features

- Small number of peripheral components.
- Low current consumption ($V_{CC}=3\text{ V}$)
 - For FM : $I_D=5.8\text{ mA}$ (Typ.)
 - For AM : $I_D=4.7\text{ mA}$ (Typ.)
- Built-in FM/AM select switch.
- Large output of AF amplifier.
 - $V_{CC}=6\text{ V}$, EIAJ output= 450 mW (Typ.) when load impedance $8\ \Omega$

Function

FM section

- RF amplifier, Mixer and OSC (incorporating AFC variable capacitor).
- IF amplifier
- Quadrature detection
- Tuning LED driver

AM section

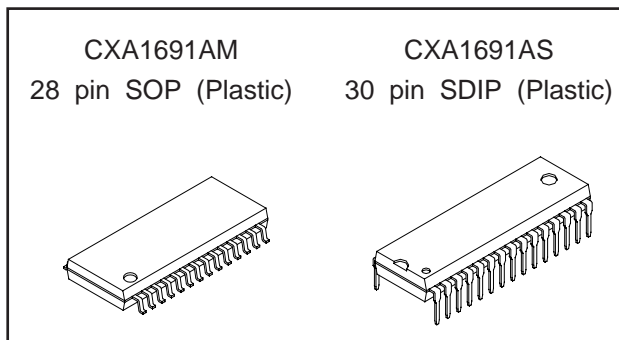
- RF amplifier, Mixer and OSC (with RF AGC)
- IF amplifier (with IF AGC)
- Detector
- Tuning LED driver

AF section

- Electronic volume control
- FM muting

Structure

Bipolar monolithic IC



Absolute Maximum Ratings ($T_a=25\text{ }^\circ\text{C}$)

| | | | |
|-------------------------------|-----------|-------------|-------------------|
| • Supply voltage | V_{CC} | 14 | V |
| • Operating temperature | T_{opr} | -10 to +60 | $^\circ\text{C}$ |
| • Storage temperature | T_{stg} | -50 to +125 | $^\circ\text{C}$ |
| • Allowable power dissipation | P_D | 700 | mW (CXA1691AM) |
| | P_D | 1000 | mW (CXA1691AS) |

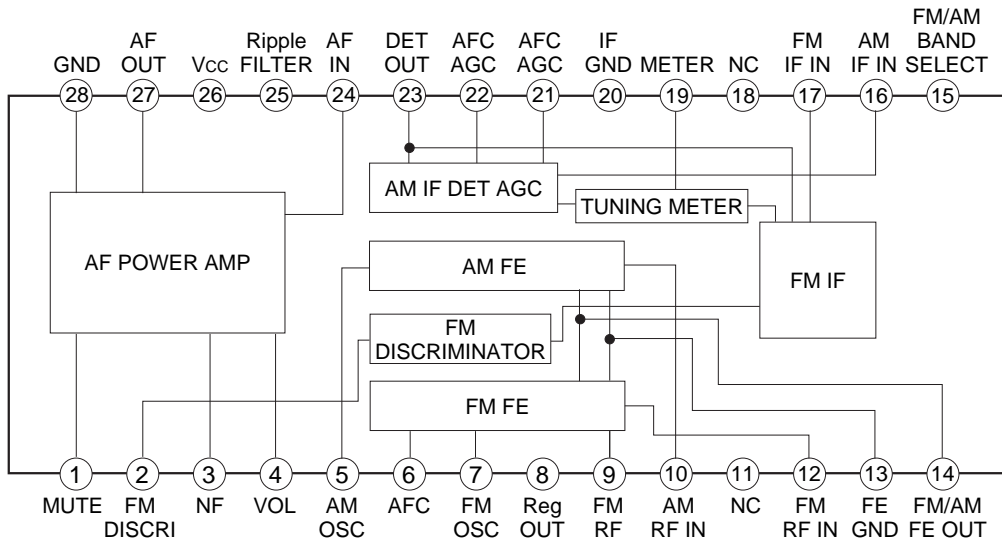
Recommended Operating Conditions

| | | | |
|----------------|----------|----------|------------------|
| Supply voltage | V_{CC} | 2 to 7.5 | V (CXA1691AM) |
| | V_{CC} | 2 to 8.5 | V (CXA1691AS) |

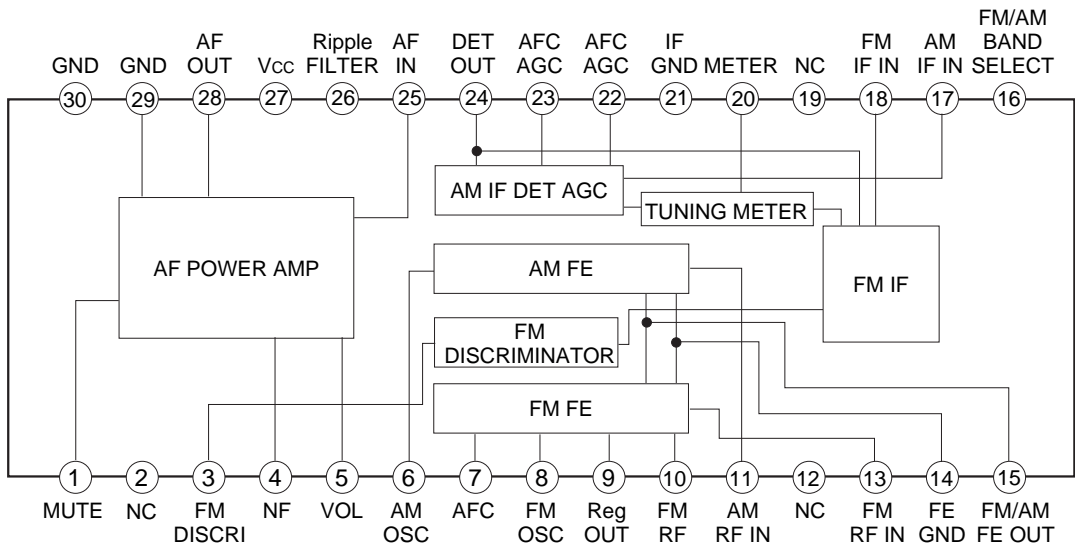
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Block Diagram

CXA1691AM

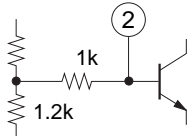
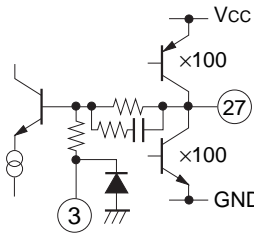
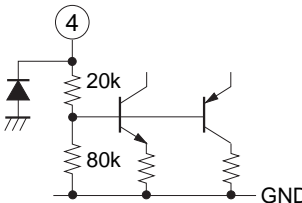
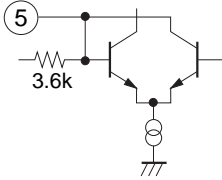
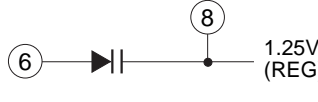
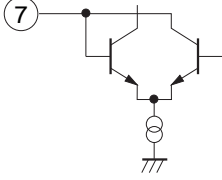


CXA1691AS



Standard Circuit Design Data

(The pin numbers in the parenthesis are for CXA1691AS.)

| No. | Symbol | Voltage (V) | | | | Equivalent circuit | Description |
|-------------|-----------|-------------|------|---------|------|--|--|
| | | Vcc=3 V | | Vcc=6 V | | | |
| | | FM | AM | FM | AM | | |
| 1 (1, 2) | MUTE | 0 | 0 | 0 | 0 | | |
| 2 (3) | FM DISCRI | 2.18 | 2.70 | 4.88 | 5.43 |  | Phase-shift circuit Connect ceramic discriminator |
| 3 (4) | NF | 1.5 | 1.5 | 3.0 | 3.0 |  | Negative feedback pin |
| 27 (28) | AF OUT | 1.5 | 1.5 | 3.0 | 3.0 | | Power amplifier output pin |
| 4 (5) | VOL CONT | 1.25 | 1.25 | 1.25 | 1.25 |  | Connect variable resistor for electronic volume control. |
| 5 (6) | AM OSC | 1.25 | 1.25 | 1.25 | 1.25 |  | AM local oscillation circuit |
| 6 (7) | AFC | 1.25 | * | 1.25 | * |  | AFC variable capacitor pin |
| 8 (9) | REG OUT | 1.25 | 1.25 | 1.25 | 1.25 | | Regulator pin 1.25 V (Typ.) |
| 7 (8) | FM OSC | 1.25 | 1.25 | 1.25 | 1.25 |  | FM local oscillation circuit |

| No. | Symbol | Voltage (V) | | | | Equivalent circuit | Description |
|---------|-----------------|-------------|------|---------|------|--------------------|--|
| | | Vcc=3 V | | Vcc=6 V | | | |
| | | FM | AM | FM | AM | | |
| 9 (10) | FM RF | 1.25 | 1.25 | 1.25 | 1.25 | | Connect FM RF tuning coil |
| 12 (13) | FM RF IN | 0.3 | 0 | 0.3 | 0 | | FM RF input pin |
| 10 (11) | AM RF IN | 1.25 | 1.25 | 1.25 | 1.25 | | AM RF input pin |
| 11 (12) | NC | 0 | 0 | 0 | 0 | | |
| 13 (14) | GND (FE GND) | 0 | 0 | 0 | 0 | | |
| 14 (15) | FM/AM FE OUT | 0.36 | 0.2 | 0.36 | 0.2 | | IF output pin of FM and AM. Connect IF filter. |
| 15 (16) | BAND SELECT | 0.84 | 0 | 0.88 | 0 | | FM and AM bands selection switch pin. During GND it becomes AM and during open it becomes FM. |
| 16 (17) | AM IF IN | 0 | 0 | 0 | 0 | | Input pin of AM IF. |
| 17 (18) | FM IF IN | 1.30 | 0 | 1.30 | 0 | | Input pin of FM IF. |
| 18 (19) | NC | 0 | 0 | 0 | 0 | | |

| No. | Symbol | Voltage (V) | | | | Equivalent circuit | Description |
|----------------|------------------|----------------------|------|----------------------|------|--------------------|---|
| | | V _{CC} =3 V | | V _{CC} =6 V | | | |
| | | FM | AM | FM | AM | | |
| 19 (20) | METER | 1.6 | 1.6 | 4.5 | 4.5 | | Meter drive circuit (For tuning indicator) |
| 20 (21) | GND | 0 | 0 | 0 | 0 | | |
| 21 (22) | AFC/AGC | 1.25 | 1.49 | 1.25 | 1.49 | | AFC pin of W band. During AM, it determines time constant of AGC |
| 22 (23) | AFC/AGC | 1.25 | 1.25 | 1.25 | 1.25 | | AFC pin of J band. During AM, it determines time constant of AGC. |
| 23 (24) | DET OUT | 1.25 | 1.0 | 1.25 | 1.0 | | Detection output pin |
| 24 (25) | AF IN | 0 | 0 | 0 | 0 | | Power amplifier input pin |
| 25 (26) | RIPPLE FILTER | 2.71 | 2.71 | 5.4 | 5.4 | | Ripple filter |
| 26 (27) | V _{CC} | 3.0 | 3.0 | 6.0 | 6.0 | | Power supply pin |
| 28 (29, 30) | GND | 0 | 0 | 0 | 0 | | Power GND |

* The pin voltage of pin 6 during AM, it is the same pin voltage of pin 22 (23) during J BAND and is the same pin voltage of pin 21 (22) during W BAND.

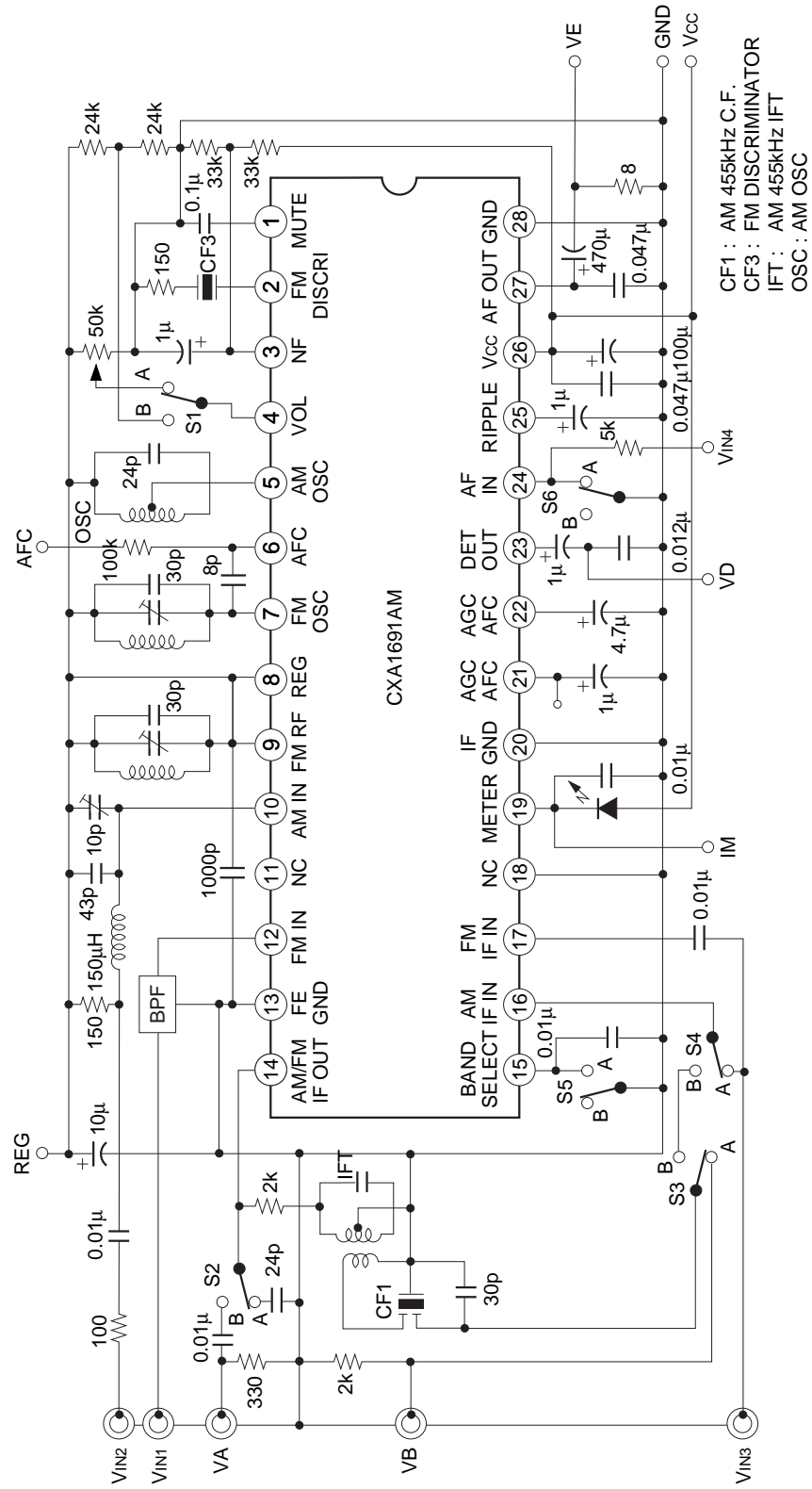
(See the Electrical Characteristics Test Circuit, Ta=25 °C, Vcc=6 V)

Electrical Characteristics

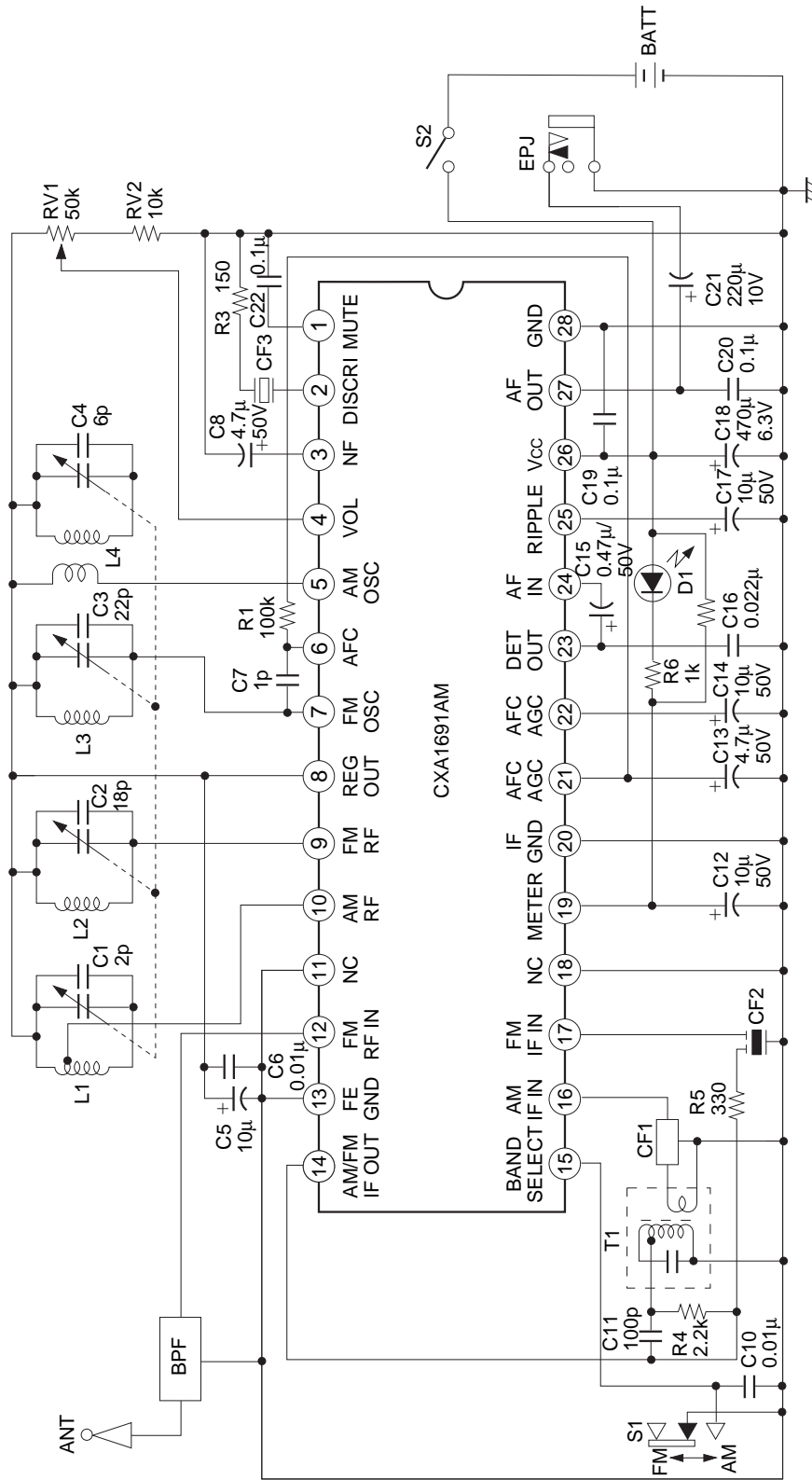
| No. | Item | Symbol | SW conditions | | | | | | Test Point | Conditions | Min. | Typ. | Max. | Unit |
|-----|---------------------------------------|--------|---------------|---|---|---|---|---|------------|--|------|------|------|-------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | |
| 1 | AM circuit current | ID1 | A | B | A | A | A | A | IA | No signal, AM | — | 4.8 | 10.0 | mA |
| 2 | FM circuit current | ID2 | A | B | A | A | B | A | IA | No signal, FM | — | 7.6 | 14.0 | mA |
| 3 | FM front end voltage gain | GV1 | A | B | A | A | B | A | VA | V _{IN1} =40 dBμV, 100 MHz | 32 | 39 | 46 | dB |
| 4 | FM detection output level | VD1 | A | — | — | A | B | A | VD | V _{IN3} =90 dBμV, 10.7 MHz (1 kHz, 22.5 kHz DEV) | 39 | 77.5 | 155 | mVrms |
| 5 | FM IF knee level | VD2 | A | — | — | A | B | A | VD | V _{IN3} =level at a point 3 dB down from V _{IN3} =90 dBμV, 10.7 MHz (1 kHz, 22.5 kHz DEV) | — | 24 | 32 | dBμV |
| 6 | FM detection output distortion factor | THD1 | A | — | — | A | B | A | VD | V _{IN3} =90 dBμV, 10.7 MHz (1 kHz, 75 kHz DEV) | — | 0.3 | 2.0 | % |
| 7 | FM meter current | IB1 | A | — | — | A | B | A | IM | V _{IN3} =60 dBμV, 10.7 MHz | 1.8 | 3.5 | 7.0 | mA |
| 8 | AM front end voltage gain | GV2 | A | A | A | A | A | A | VB | V _{IN2} =60 dBμV, 1660 kHz | 15 | 22 | 29 | dB |
| 9 | AM IF voltage gain | GV3 | A | A | — | A | A | A | VD | V _{IN3} when 455 kHz (1 kHz, 30 % MOD) output is -34 dBm | 14 | 20 | 27 | dBμV |
| 10 | AM detection output level | VD3 | A | A | — | A | A | A | VD | V _{IN3} =85 dBμV, 455 kHz (1 kHz, 30 % MOD) | 39 | 77.5 | 155 | mVrms |
| 11 | AM meter current | IB2 | A | A | — | A | A | A | IM | V _{IN3} =85 dBμV, 455 kHz (1 kHz, 30 % MOD) | 1.3 | 3.0 | 7.0 | mA |
| 12 | AM detection output distortion factor | THD2 | A | A | B | A | A | A | VD | V _{IN2} =95 dBμV, 1660 kHz (1 kHz, 30 % MOD) | — | 0.6 | 2.0 | % |
| 13 | Audio voltage gain | GV4 | A | — | — | — | — | B | VE | V _{IN3} =60 dBμV, 10.7 MHz V _{IN4} =-30 dBm, 1 kHz | 27 | 31.5 | 36 | dB |
| 14 | Audio distortion factor | THD3 | A | — | — | — | — | B | VE | Distortion factor for 50 mW output V _{IN3} =60 dBμV, 10.7 MHz V _{IN4} =-20 dBm, 1 kHz | — | 0.9 | 2.5 | % |
| 15 | Muting level | VD4 | A | — | — | — | — | B | VE | Muting level for 50 mW output V _{IN4} =-20dBm, 1 kHz Attenuation for 60 dBμV input with V _{IN3} OFF | 8 | 15 | 22 | dB |

0 dBμV=1 μV

Electrical Characteristics Test Circuit

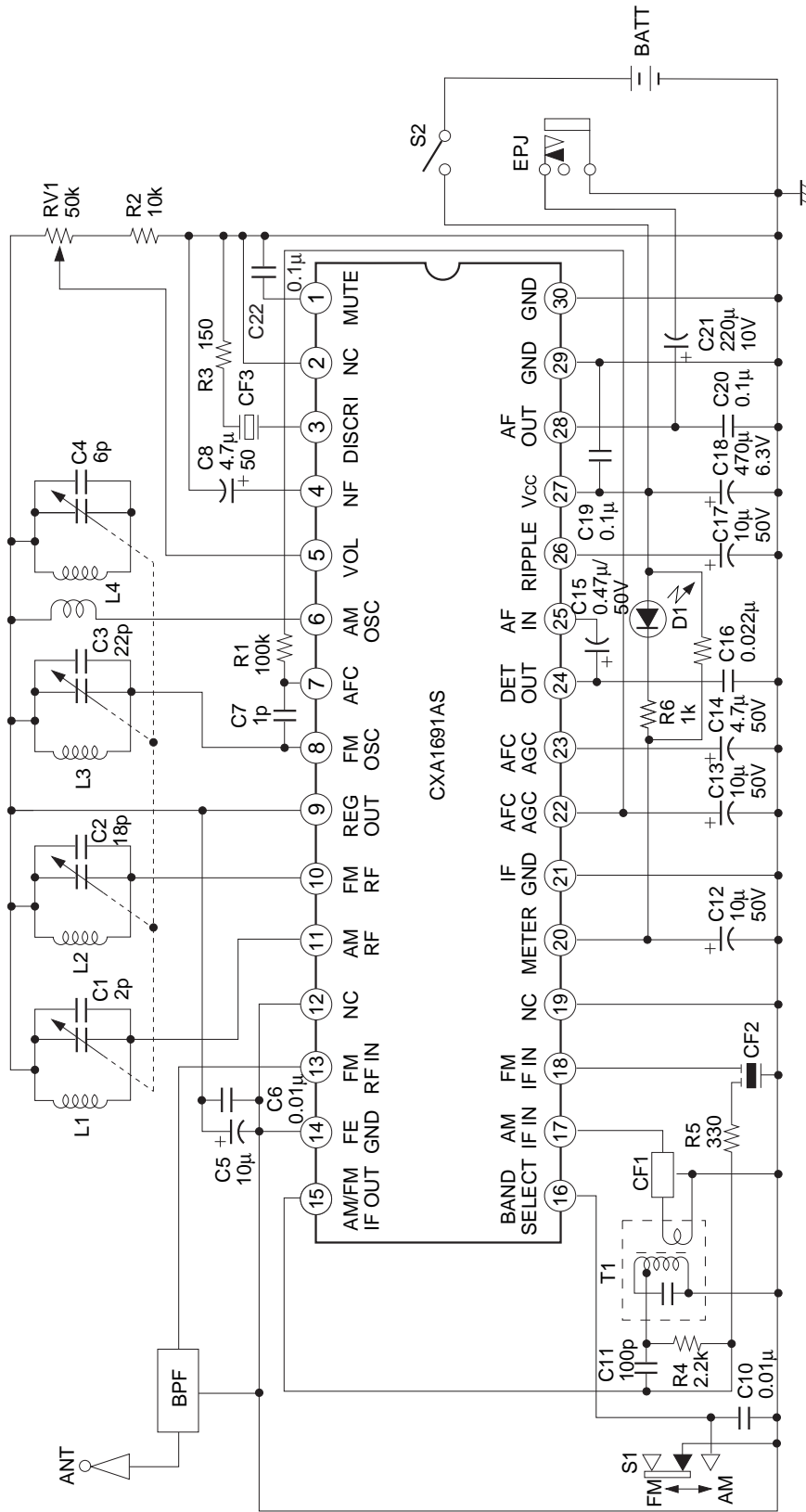


Application Circuit 1



Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

Application Circuit 2

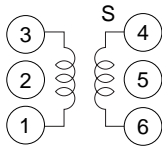


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Coil data

AM OSC

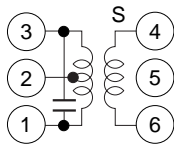


Core diameter ϕ 0.06 mm 2UEW

| f (kHz) | L (μ H) | Qo | Number of windings (t) | |
|---------|--------------|-----|------------------------|--------|
| | | | 1 to 3 | 4 to 6 |
| 796 | 270 | 125 | 107 | 29 |

Equivalent to L-5K7-H5 R12-1684X. Mitsumi Electric Co., Ltd.
or 7TRS-8441X TOKO Co., Ltd.

AM IFT

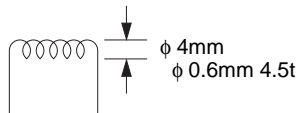


Core diameter ϕ 0.07 mm UEW

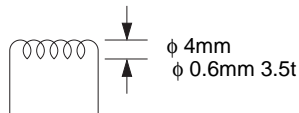
| Co (pF) | Qo | Number of windings (t) | | |
|---------|----|------------------------|--------|--------|
| | | 1 to 2 | 2 to 3 | 4 to 6 |
| 180 | 90 | 111 | 35 | 7 |

Equivalent to 21K7-H5 R12-8558A. Mitsumi Electric Co., Ltd.
or 7MC-7789N TOKO Co., Ltd.

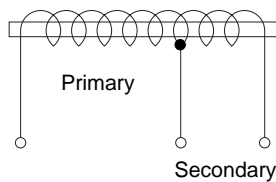
FM RF



FM OSC



AM bar antenna



| f (kHz) | L (μ H) | Primary | Secondary |
|---------|--------------|---------|-----------|
| 796 | 650 | 91 t | 20 t |

BPF PFW8
(88 to 108 MHz) Soshin Electric Co., Ltd.

CF1 SFU-455B Murata Mfg. Co., Ltd. Or BFCFL-455 TOKO Co., Ltd.

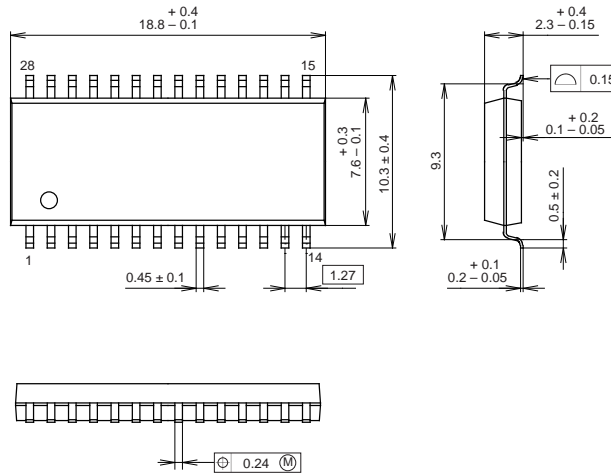
CF2 SFE10.7MA5 Murata Mfg. Co., Ltd.

CF3 CDA10.7MC1 Murata Mfg. Co., Ltd.

Package Outline Unit : mm

CXA1691AM

28PIN SOP (PLASTIC)



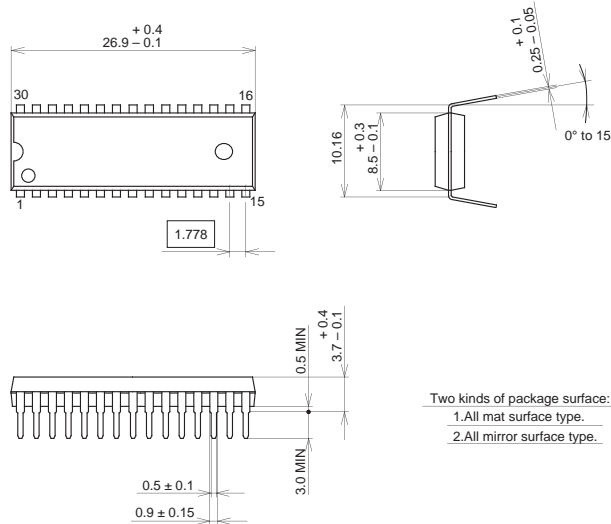
PACKAGE STRUCTURE

| | |
|------------|---------------|
| SONY CODE | SOP-28P-L04 |
| EIAJ CODE | SOP028-P-0375 |
| JEDEC CODE | — |

| | |
|------------------|-----------------|
| PACKAGE MATERIAL | EPOXY RESIN |
| LEAD TREATMENT | SOLDER PLATING |
| LEAD MATERIAL | 42/COPPER ALLOY |
| PACKAGE MASS | 0.7g |

CXA1691AS

30PIN SDIP (PLASTIC)



Two kinds of package surface:
 1.All mat surface type.
 2.All mirror surface type.

PACKAGE STRUCTURE

| | |
|------------|----------------|
| SONY CODE | SDIP-30P-01 |
| EIAJ CODE | SDIP030-P-0400 |
| JEDEC CODE | — |

| | |
|------------------|--------------------------|
| MOLDING COMPOUND | EPOXY RESIN |
| LEAD TREATMENT | SOLDER/PALLADIUM PLATING |
| LEAD MATERIAL | COPPER ALLOY |
| PACKAGE MASS | 1.8g |

NOTE : PALLADIUM PLATING
 This product uses S-PdPPF (Sony Spec.-Palladium Pre-Plated Lead Frame).