FM/AM RADIO CIRCUIT CXA1691M

DESCRIPTION

The CXA1691M is a one-chip FM/AM radio IC designed for radio-cassette tape recorders and headphone tape recorders.

FEATURE

- Small number of peripheral components
- Low current consumption (Vcc=3V)
  FM: I_D=5.3mA (Typ.)
  AM: I_D=3.4mA(Typ.)
- Built-in FM/AM select switch
- Large output of AF amplifier

FUNCTIONS

FM section

- RF amplifier; Mixer and OSC

(in corporating AFC variable capacitor);

- IF amplifier,
- Quadrature detection;
- Tuning LED driver.

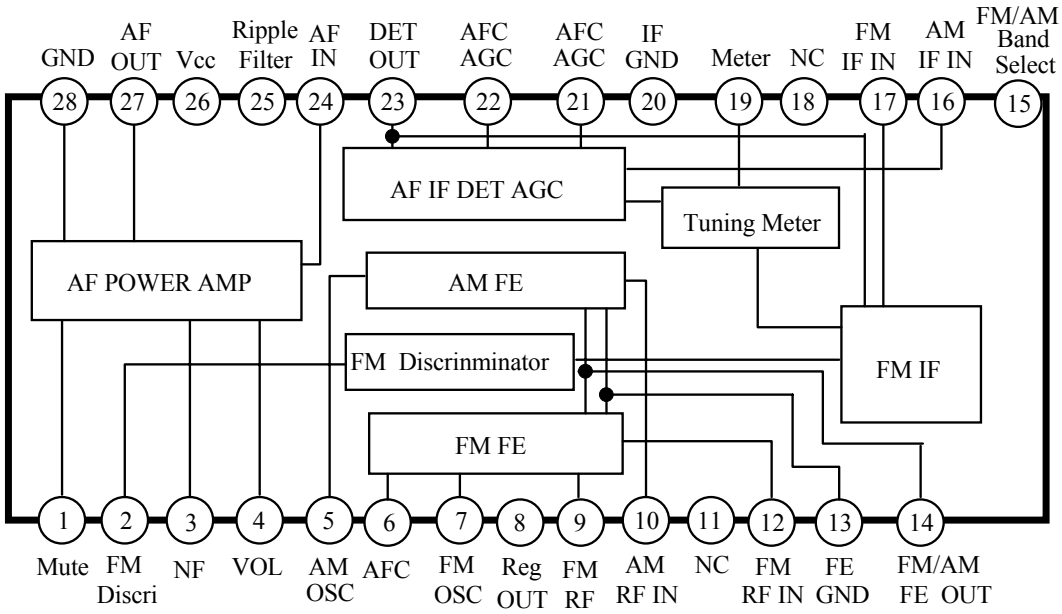
AM section

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

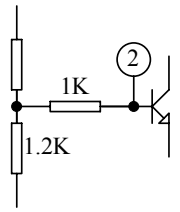
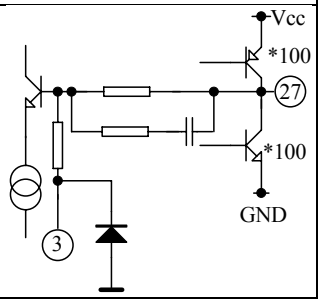
AF section

- Electronic volume control
- FM muting

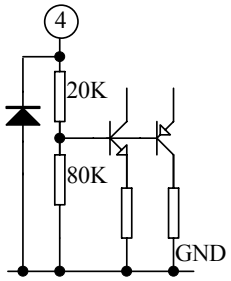
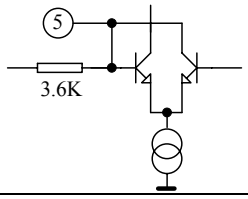
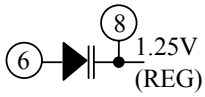
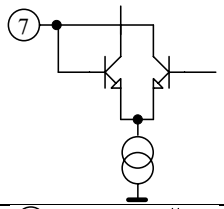
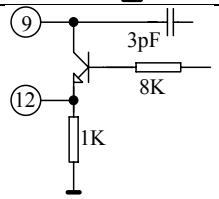
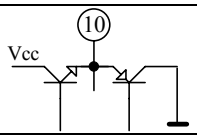
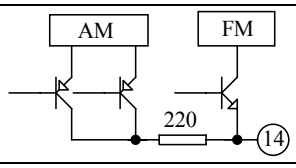
BLOCK DIAGRAM



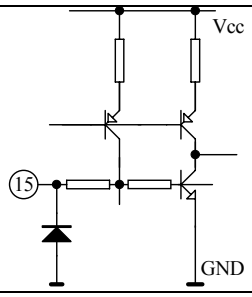
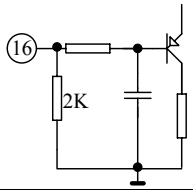
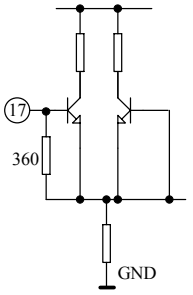
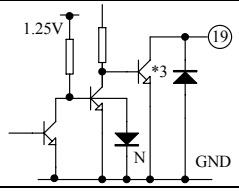
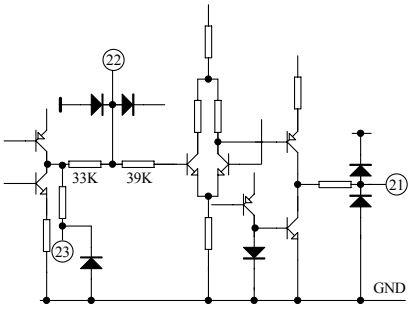
PIN CONFIGURATIONS

Pin	Symbol	Description	Voltage (V)				Equivalent circuit
			Vcc=3V		Vcc=6V		
			FM	AM	FM	AM	
1	MUTE		0	0	0	0	
2	FM DISCRI	Phase-Shift circuit, Connect ceramic discriminator	2.18	2.70	4.88	5.43	
3	NF	Negative feedback pin	1.5	1.5	3.0	3.0	
27	AF OUT	Power amplifier output pin	1.5	1.5	3.0	3.0	

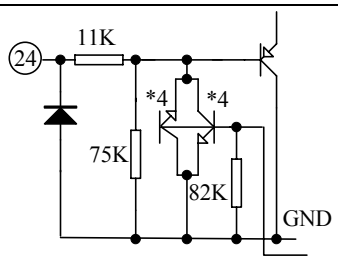
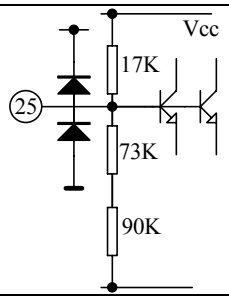
PIN CONFIGURATIONS

Pin	Symbol	Description	Voltage (V)				Equivalent circuit
			Vcc=3V		Vcc=6V		
			FM	AM	FM	AM	
4	VOL CONT	Connect variable resistor for electronic volume control	1.25	1.25	1.25	1.25	
5	AM OSC	AM local oscillation circuit	1.25	1.25	1.25	1.25	
6	AFC	AFC variable capacitor pin	1.25	*	1.25	*	
8	REG OUT	Regulator pin 1.25V(Typ.)	1.25	1.25	1.25	1.25	
7	FM OSC	FM local oscillation circuit	1.25	1.25	1.25	1.25	
9	FM RF	Connect FM RF tuning coil	1.25	1.25	1.25	1.25	
12	FM RF IN	FM RF input pin	0.3	0	0.3	0	
10	AM RF IN	AM RF input	1.25	1.25	1.25	1.25	
11	NC		0	0	0	0	
13	GND(FE GND)		0	0	0	0	
14	FM/AM FE OUT	IF output pin of FM and AM, Connect IF filter	0.36	0.2	0.36	0.2	

PIN CONFIGURATIONS

Pin	Symbol	Description	Voltage (V)				Equivalent circuit
			Vcc=3V		Vcc=6V		
			FM	AM	FM	AM	
15	BAND SELECT	FM and AM bands selection switch pin. During GND it becomes AM and during open it becomes FM	0.84	0	0.88	0	
16	AM IF IN	Input pin of AM IF	0	0	0	0	
17	FM IF IN	Input pin of FM IF	1.3	0	1.3	0	
18	NC		0	0	0	0	
19	METER	Meter drive circuit (For tuning indicator)	1.6	1.6	4.5	4.5	
20	GND		0	0	0	0	
21	AFC/AGC	AFC pin of W band. During AM, it determines time constant of AGC	1.25	1.49	1.25	1.49	
22	AFC/AGC	AFC pin of J band. During AM, it determines time constant of AGC	1.25	1.25	1.25	1.25	
23	DET OUT	Detection output pin	1.25	1.0	1.25	1.0	

PIN CONFIGURATIONS

Pin	Symbol	Description	Voltage (V)				Equivalent circuit
			Vcc=3V		Vcc=6V		
			FM	AM	FM	AM	
24	AF IN	Power amplifier input pin	0	0	0	0	
25	RIPPLE FILTER	Ripple filter	2.71	2.71	5.4	5.4	
26	Vcc	Power supply pin	3.0	3.0	6.0	6.0	
28	GND	Power GND	0	0	0	0	

* Note: The pin voltage of pin 6 during AM, it is the same pin voltage of pin22 during J BAND and is the same pin voltage of pin21 during W BAND.

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	Vcc	14	V
Allowable power dissipation	P_D	700	mW
Operating temperature	Topr	-10~60	°C
Storage Temperature	Tstg	-50~125	°C

RECOMMENDED OPERATING CONDITIONS

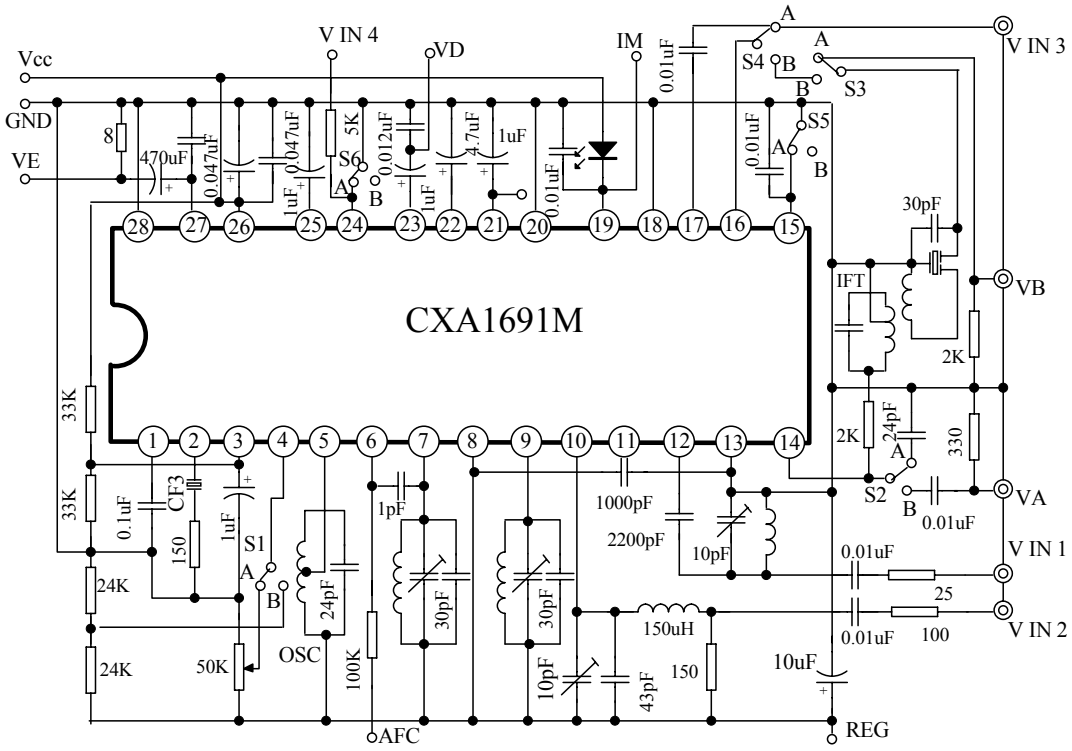
Parameter	Symbol	Value	Unit
Supply voltage	Vcc	2~7.5	V

ELECTRICAL CHARACTERISTICS

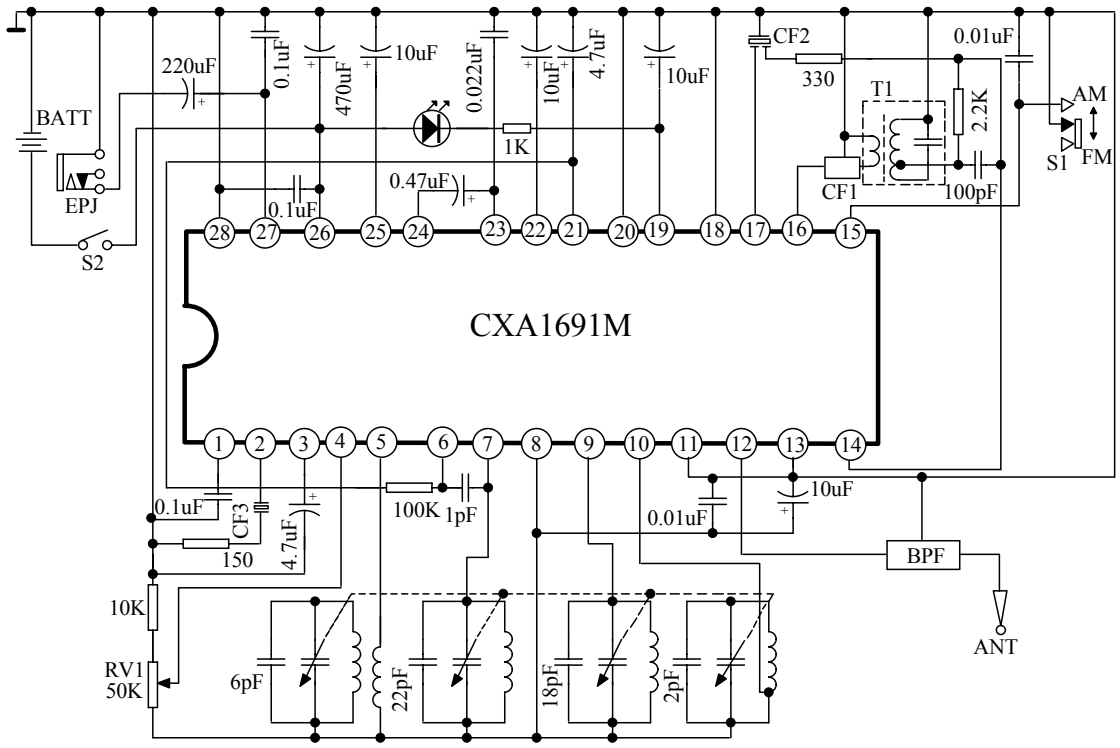
(Unless otherwise specified: Ta=25°C, Vcc=6V)

Characteristics	Test conditions	Symbol	Min	Typ	Max	Unit
AM circuit current	No signal, AM	I_{Q1}		3.5	10	mA
FM circuit current	No signal, FM	I_{Q2}		7.0	14	mA
FM front end voltage gain	Vin1=40dBμV, 100MHz	G_{V1}	32	39	46	dB
FM detection output level	Vin3=90dBμV, 10.7MHz (1kHz，22.5kHz,DEV)	V_{D1}	39	77.5	155	mVrms
FM-IF knee level	Vin3=90dBμV 10.7MHz (-3dBpoint) (1kHz，22.5kHz,DEV)	V_{D2}		24	32	dBμV
FM detection output distortion factor	Vin3=90dBμV, 10.7MHz (1kHz，75kHz,DEV)	THD_1		0.3	2.0	%
FM meter current	Vin3=60dBμV, 10.7MHz	I_{B1}	1.8	3.5	7.0	mA
AM front end voltage gain	Vin2=60dBμV, 1660kHz	G_{V2}	15	22	29	dB
AM detection output level	Vin3=85 dBμV，455kHz (1kHz，MOD=30%)	V_{D3}	39	77.5	155	mVrms
AM-IF voltage gain	Vin3 when 455kHz (1kHz，MOD=30%) Output is -34dBm	G_{V3}	14	20	27	dBμV
AM detection output distortion factor	Vin2=95dBμV,1660kHz Vcc=7.8V (1kHz，MOD=30%)	THD_2		0.6	2.0	%
AM meter current	Vin3=85dBμV，455kHz (1kHz，MOD=30%)	I_{B2}	1.3	3.0	7.0	mA
Audio voltage gain	Vin=60dBμV, 10.7MHz Vin4=-30dBm，1kHz	G_{V4}	27	31.5	36	dB
Audio distortion factor	Vin4=-20dBm,1kHz 10.7MHz， Po=50mW,Vin3=60dBμV	THD		0.3	2.5	%
Audio output power	Vcc=6V, THD=10%, R_L=8Ω	Po	400	500		mW
Muting level	Po=50mW，Vin3=OFF，Vin4=-20dBm，1kHz	V_{D4}	8	15	22	dB

TEST CIRCUIT

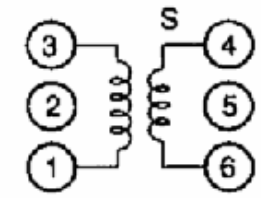


APPLICATION CIRCUIT



Coil Data

AM OSC

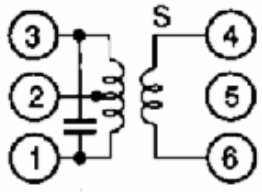


Core diameter ϕ0.06mm 2UEW

f (kHz)	L(μH) 1 to 3	Qo 1 to 3	Number of widings(t)	
			1 to 3	4 to 6
796	270	125	107	796

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

AM IFT

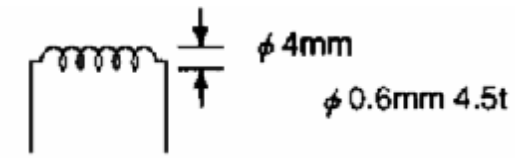


Core diameter ϕ0.07mm UEW

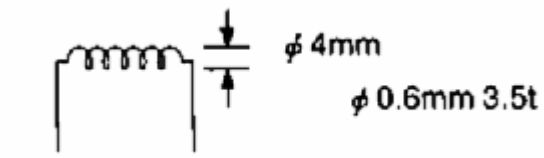
Co(pF) 1 to 3	Qo 1 to 3	Number of widings (t)		
		1 to2	2 to 3	4 to 6
180	90	111	35	7

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

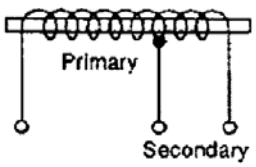
FM RF



FM OSC



AM bar antenna

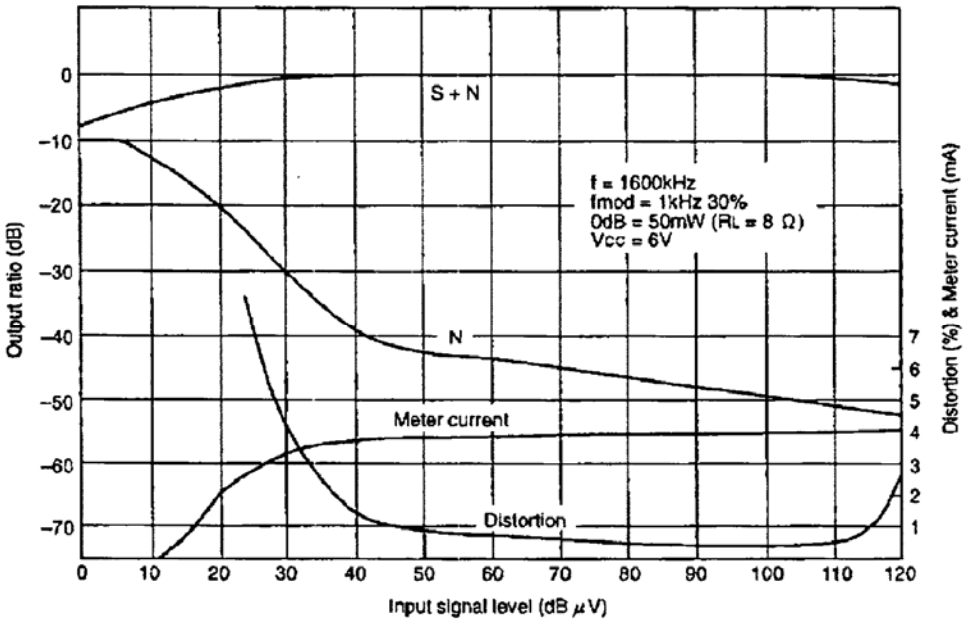


f (kHz)	L(μH)	Primary	Secondary
796	650	91t	20t

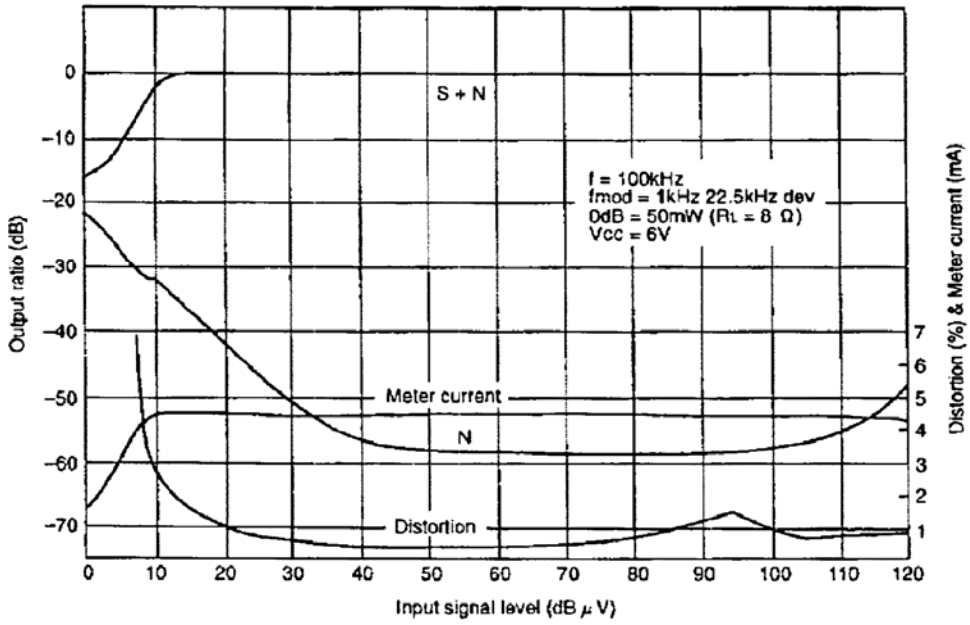
BPF	PFWE8 (88 to 108MHz)	Soshin Electric Co., Ltd.
CF1	SFU-455B	Murata Mfg. Co., Ltd. Or BFCFL-455 TOKO Co., Ltd.
CF2	SFE10.7MA5	Murata Mfg. Co., Ltd.
CF3	CDA10.7MC1	Murata Mfg. Co., Ltd.

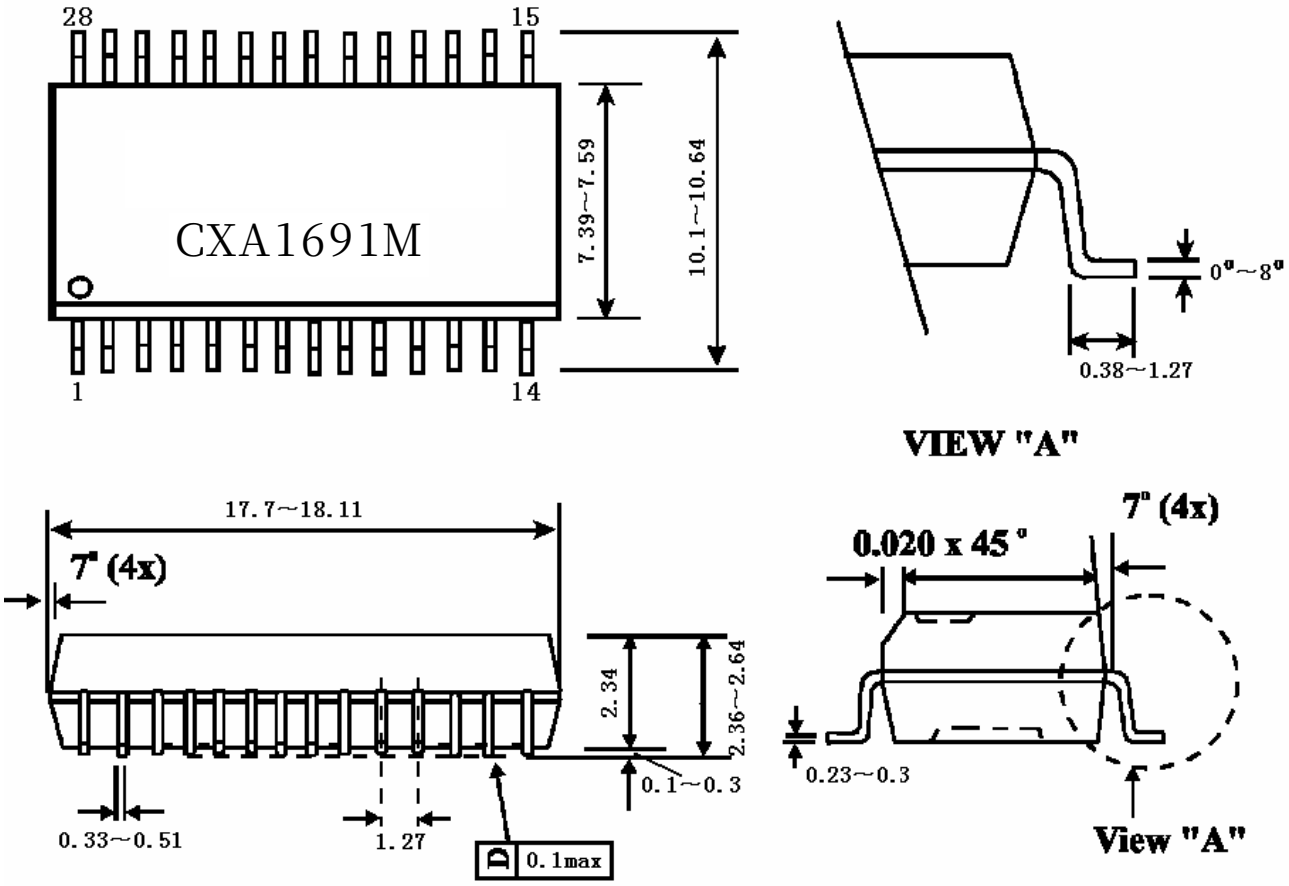
CHARACTERISTICS CURVES

AM FE+IF+AF Input-output characteristics



FM FE+IF+AF Input-output characteristics



OUTLINE DRAWING

SOP28: