

FM/AM RADIO CIRCUIT

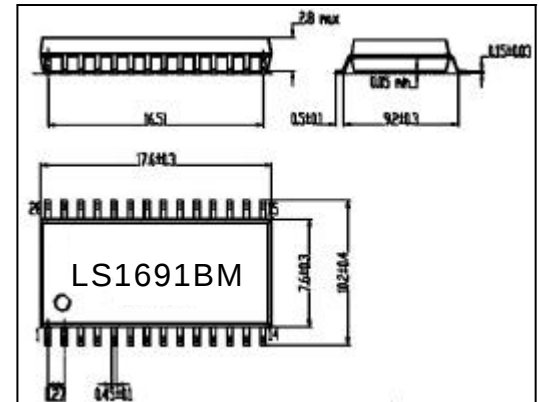
DESCRIPTION

The LS1691BM 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 ($V_{CC}=3V$)
FM: $I_D=5.3mA$ (Typ.)
AM: $I_D=3.4mA$ (Typ.)
- Built-in FM/AM select switch
- Large output of AF amplifier

Outline Drawing



FUNCTIONS

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

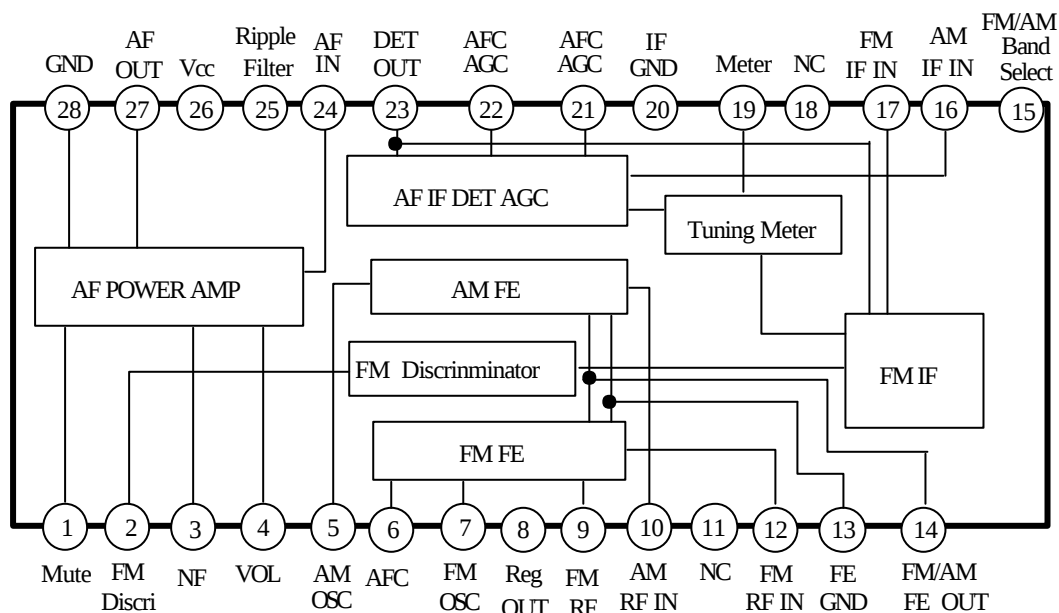
- Electronic volume control
- FM muting

LIGHTNING

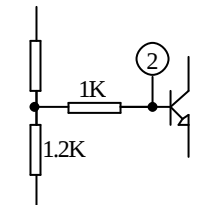
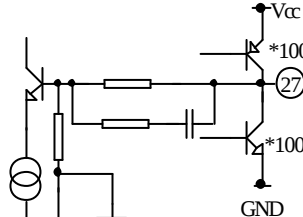
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Devices

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BLOCK DIAGRAM



PIN CONFIGURATIONS

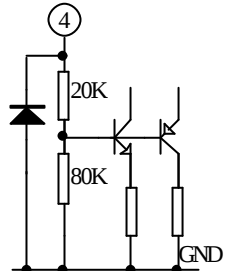
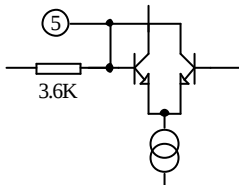
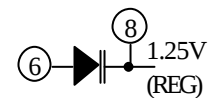
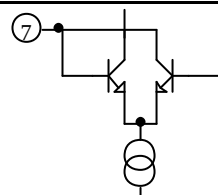
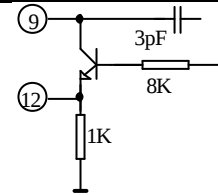
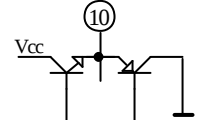
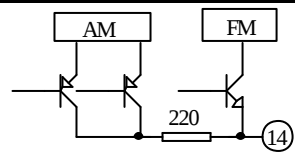
Pin	Symbol	Description	Voltage (V)				Equivalent circuit
			Vcc=3V		Vcc=6V		
			FM	AM	FM	AM	
1	MUTE		0	0	0	0	
2	FM DISCRI	Phase-Shift circuit, Connect ceramic discriminator	2.18	2.70	4.88	5.43	
3	NF	Negative feedback pin	1.5	1.5	3.0	3.0	
27	AF OUT	Power amplifier output pin	1.5	1.5	3.0	3.0	

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PIN CONFIGURATIONS

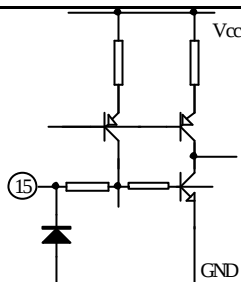
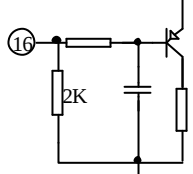
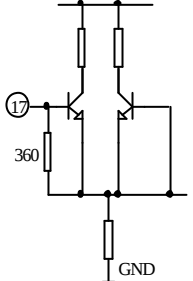
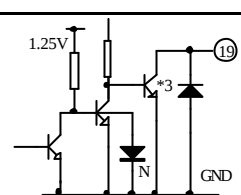
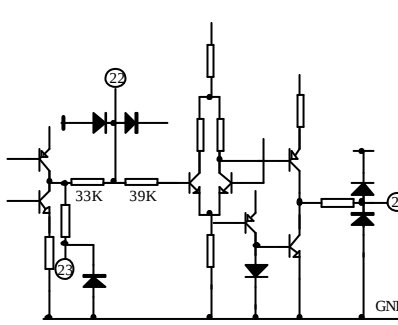
Pin	Symbol	Description	Voltage (V)				Equivalent circuit
			Vcc=3V		Vcc=6V		
			FM	AM	FM	AM	
4	VOL CONT	Connect variable resistor for electronic volume control	1.25	1.25	1.25	1.25	
5	AM OSC	AM local oscillation circuit	1.25	1.25	1.25	1.25	
6	AFC	AFC variable capacitor pin	1.25	*	1.25	*	
8	REG OUT	Regulator 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	

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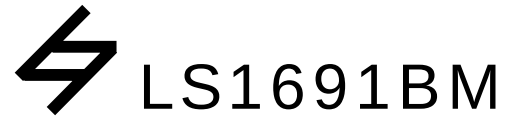
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PIN CONFIGURATIONS

Pin	Symbol	Description	Voltage (V)				Equivalent circuit
			V _{cc} =3V		V _{cc} =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	

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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)

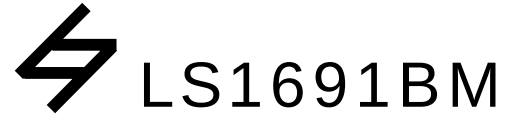
Characteristic	Symbol	Value	Unit
Supply Voltage	Vcc	14	V
Allowable power dissipation	P _D	700	mW
Operating temperature	T _{opr}	-10~60	°C
Storage Temperature	T _{stg}	-50~125	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Supply voltage	Vcc	2~7.5	V

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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	%
Muting level	Po=50mW, Vin3=OFF, Vin4=-20dBm, 1kHz	V _{D4}	8	15	22	dB

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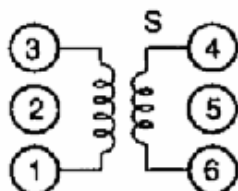
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Coil Data

AM OSC

Core diameter $\phi 0.06\text{mm}$ 2UEW

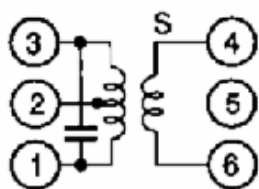


f (kHz)	L(μH)	Qo	Number of windings(t)	
			1 to 3	4 to 6
796	270	125	107	796

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

AM IFT

Core diameter $\phi 0.07\text{mm}$ UEW

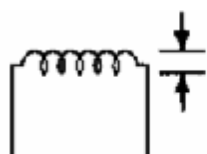


Co(pF)	Qo	Number of windings (t)		
		1 to 2	2 to 3	4 to 6
180	90	111	35	7

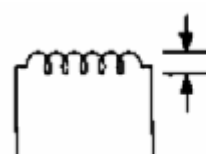
Equivalent to 21K7-H5 R12-8558A. Mitsumi Electric Co.,Ltd. or 7MC-7789N TOKO Co., Ltd.

FM RF

FM OSC

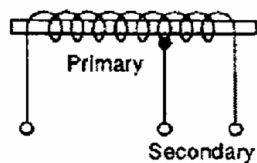


$\phi 4\text{mm}$
 $\phi 0.6\text{mm}$ 4.5t



$\phi 4\text{mm}$
 $\phi 0.6\text{mm}$ 3.5t

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.

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CHARACTERISTICS CURVES

