TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA2111N, TA2111F, TA2111FN

3 V AM/FM 1 Chip Tuner IC

TA2111N/F/FN are AM/FM 1 chip tuner ICs, which are designed for portable radios and 3 V Head phone radios. FM local oscillation voltage is set up low relativity, for NEW FCC.

Features

- For NEW FCC.
- AM Detector coil, FM IFT, IF coupling condenser are not needed.
- For adopting ceramic discriminator, it is not necessary to adjust the FM quad detector circuit.
- Built-in FM MPX VCO circuit.
- Built-in varactor diode for AFC.
- Built-in AM low cut circuit.
- Low supply current. (V_{CC} = 3 V, Ta = 25°C) I_{CCq} (FM) = 9.0 mA (typ.) I_{CCq} (AM) = 5.0 mA (typ.)
- Operating supply voltage range: VCC = $1.8 \sim 7 \text{ V}$ (Ta = 25° C)



Weight SDIP24-P-300-1.78: 1.2 g (typ.) SSOP24-P-300-1.00: 0.31 g (typ.) SSOP24-P-300-0.65A: 0.14 g (typ.)

Note 1: Handle with care to prevent devices from deteriorations by static electricity.

Block Diagram



Explanation of Terminals (Terminal voltage at no signal with test circuit, V_{CC} = 3 V, Ta = 25°C)

Pin	Characteristics	Internal Circuit	Terminal Voltage (Typ.) (V)			
No.	Characteriettee		AM	FM		
1	FM-RF IN	RF GND 2	0	0.8		
2	RF GND (GND for FM RF, FM OSC stage)	_	0	0		
3	AM LOW CUT	AM DET 10kΩ GND 9 FM DET 100kΩ T 100kΩ T 2 RF GND	1.0	0.8		
4	MIX OUT	VCC 6 FM MIX AM AM MIX RF GND 2 GND	3.0	2.9		
5	AGC (AM AGC)		0	0		
6	V _{CC} (V _{CC} for AM, FM IF, FM MPX stage)	_	3.0	3.0		
7	AM IF IN		2.3	2.6		

TA2111N/F/FN

Pin	Characteristics	Internal Circuit	Terminal Voltage (Typ.) (V)			
No.	Characteristics	AM	FM			
8	FM IF IN	V _{CC} 6	3.0	3.0		
9	GND (GND for AM, FM IF, FM MPX stage)		0	0		
10	TUN LED (Tuning LED)		_	_		
11	ST LED (Stereo LED)	19kHz (1) GND (9)	_	_		
12	QUAD (FM QUAD. Detector)	V _{CC} (6)	2.5	2.2		
13 14	R-OUT (R-ch Output) L-OUT (L-ch Output)	V _{CC} (6) (13/14) GND (3)	1.2	1.2		

TA2111N/F/FN

Pin	Characteristics	Terminal Voltage (Typ.) (V)		
No.	Characteristics		AM	FM
15	LPF1 • LPF terminal for synchronous Detector • VCO stop terminal V15 = V _{CC} → VCO STOP		2.3	2.3
16	LPF2 • LPF terminal for phase Detector • Bias terminal for AM/FM SW circuit V16 = V _{CC} → AM V16 = OPEN → FM	(I) (I) (I) (I) (I) (I) (I) (I)	3	2.2
17	MPX IN	17-w- GND (9	0.7	0.7
18	DET OUT	V _{CC} (6) AM AM FM FM FM FM FM FM FM FM FM F	1.0	0.9

TA2111N/F/FN

Pin	Characteristics	Internal Circuit	Terminal Voltage (Typ.) (V)			
No.	Characteristics		AM	FM		
19	AFC	cf. pin 3				
20	AM OSC	V _{CC} (6) (1) (3) (3) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4	3.0	3.0		
21	FM OSC	RF V _{CC} 2 GND 9	3.0	3.0		
22	RF V _{CC} (V _{CC} for FM OSC stage)	_	3.0	3.0		
23	FM RF OUT	cf. pin 1	3.0	3.0		
24	AM RF IN		3.0	3.0		

Application Note

1. AM low-cut circuit

- The AM Low-Cut action is carried out by the bypass of the high frequency component of the positive-feedback signal at the AF AMP stage. The external capacitor: C₃ by-passes this component.
- The cut-off frequency f_L is determined by the internal resistance 10 k Ω (typ.) and the external capacitor C₃ as following ;

$$f_{L} = \frac{1}{2 \times \pi \times 10 \times 10^{3} \times C_{3}} (Hz)$$

- In the case of the AM Low-Cut function is not needed, set up the value of C₃ over 1 μ F. In the condition of C₃ \geq 1 μ F, the frequency characteristic has flat response at the low frequency.
- In FM mode, C3 is a capacitor for AFC Low-Pass filter circuit.

2. FM detection circuit

For the FM detection circuit, detection coil is able to use instead of ceramic discriminator. Recommended circuit and recommended coil are as follows. In this case, please take care that V_{in} (lim.) falls a little.



Toot Fraguanay	Co	0	Turns Wire		Turns				Poforonco
restriequency	(pF)	Q ₀	1-2	2-3	1-3	4-6	(mmφ)	Reference	
10.7 MHz	51	45	_	_	30	_	0.08 UEW	TOKO Co., Ltd. 600BEAS-10018Z	

Maximum Ratings (Ta = 25°C)

Characteristic	cs	Symbol	Rating	Unit	
Supply voltage		V _{CC}	8	V	
LED current		ILED	10	mA	
LED voltage		VLED	8	V	
	TA2111N		1200	mW	
Power dissipation	TA2111F	P _D (Note 2)	400		
	TA2111FN		500		
Operating temperature		T _{opr}	-25~75	°C	
Storage temperature		T _{stg}	-55~150	°C	

Note 2: Derated above Ta = 25°C in the proportion of 9.6 mW/°C for TA2111N, of 3.2 mW/°C for TA2111F and of 4 mW/°C for TA2111FN.



<u>TOSHIBA</u>

Electrical Characteristics

unless otherwise specified, Ta = 25°C, V_{CC} = 3 V,

F/E : f = 98 MHz, f_m = 1 kHz FM IF : f = 10.7 MHz, Δf = ±22.5 kHz, f_m = 1 kHz AM : f = 1 MHz, MOD = 30%, f_m = 1 kHz MPX : f_m = 1 kHz

Characteristics			Symbol	Test Circuit	Test Cond	lition	Min	Тур.	Max	Unit	
Supply	Supply current			1	Vin = 0, FM mode		_	9	12.5	m۸	
			I _{CC (AM)}	1	Vin = 0, AM mode		_	5	7.5	IIIA	
F/E	Input limiting voltage		Vin (lim)	1	-3dB limiting	-3dB limiting		7	_	dBµV EMF	
	Local OSC voltage	1	V _{OSC}	2	f _{OSC} = 108.7 MHz		_	105	_	mVrms	
	Input limiting voltag	je	Vin (lim) IF	1	-3dB limiting		35	40	45	dBµV EMF	
	Recovered output	voltage	V _{OD}	1	Vin = 80dBµV EMF	-	60	75	90	mVrms	
	Signal to noise ration	0	S/N	1	Vin = 80dBµV EMF		—	65	—	dB	
FM IF	Total harmonic dist	tortion	THD	1	Vin = 80dBµV EMF	-	_	0.2	_	%	
	AM rejection ration		AMR	1	Vin = 80dBµV EMF	-	_	45	_	dB	
	LED on sensitivity		VL	1	I _L = 1 mA		40	45	50	dBµV EMF	
	Soft mute attenuati	on	MUTE	1	Vin = 0		_	20	_	dB	
	Gain		GV	1	Vin = 25dBµV EMF		18	35	70	mVrms	
	Recovered output	voltage	V _{OD}	1	Vin = 60dBµV EMF		50	70	90	mVrms	
АМ	Signal to noise ratio		S/N	1	Vin = 60dBµV EMF		_	41	—	dB	
	Total harmonic distortion		THD	1	Vin = 60dBµV EMF		_	0.7	—	%	
	LED on sensitivity		VL	1	I _L = 1 mA	23	28	33	dBµV EMF		
D: 10			_	_	FM mode		_	0.75	_	kΩ	
Pin 18	Pin 18 output resistance		R ₁₈		AM mode		_	15.5	_		
	Input resistance		R _{IN}	_	_		_	55	_	kΩ	
	Output resistance		R _{OUT}		_			5	_	kΩ	
	Max composite sig voltage	nal input	Vin MAX (STEREO)	1	L + R = 90%, P = 10%, f _m = 1 kHz, THD = 3%		_	700	_	mVrms	
					l + R =	f _m = 100 Hz	—	45	—		
	Separation		Sep	1	180 mVrms,	f _m = 1 kHz		45	—	dB	
					P = 20 moments	f _m = 10 kHz	—	45	_		
	Total harmonic	Monaural	THD (MONAURAL)	1	Vin = 200 mVrms		_	0.3	_	%	
MPX	distortion	Stereo	THD (STEREO)	1	L + R = 180 mVrms P = 20 mVrms	S,	_	0.3	_	/0	
	Voltage gain		GV	1	Vin = 200 mVrms	Vin = 200 mVrms		-1	0.5	dB	
	Channel balance		C.B.	1	Vin = 200 mVrms		-1.5	0	1.5	dB	
	Stereo LED	ON	V _{L (ON)}	1	Pilot input		—	8	12	m) /	
	sensitivity	OFF	V _{L (OFF)}	1	i not input		3	6	_	mvnns	
	Stereo LED hystere	esis	V _H	1	To LED turn off fro on	m LED turn	_	2	_	mVrms	
	Capture range		C.R.	1	P = 20 mVrms		_	±8	_	%	
	Signal to noise ratio		S/N	1	_	_	80	—	dB		

Test Circuit 1



<u>TOSHIBA</u>

Test Circuit 2



Coil Data

Coil No	Toot From	L	Co	0	Turns					Wire	Reference
COILINO.	Test Fleq.	(µH)	(pF)	Qo	1-2	2-3	1-3	1-4	4-6	(mmφ)	Relefence
L ₁ FM RF	100 MHz			79	l	l	_	$2\frac{1}{2}$	_	0.16UEW	TOKO Co., Ltd. 666SNF-305NK
L ₂ FM OSC	100 MHz	_	_	76			_	2	_	0.16UEW	TOKO Co., Ltd. 666SNF-306NK
T ₁ AM OSC	796 kHz	268	_	65	19	95	_		_	0.05UEW	TOKO Co., Ltd. 5PNR-5146Y
T ₂ AM IFT	455 kHz	_	470	60	_		109	_	7	0.05UEW	TOKO Co., Ltd. 5PLG-5147X

L₁ : FM RF

L₂ : FM OSC









TA2111N/F/FN



FM (IF)





FM (IF)



AM





AM VOD - Ta 40 (dB) RECOVERED OUTPUT VOLTAGE VOD 20 V_{OD} (0dB = 70mV_{rms}) 0 $V_{CC} = 3V$ - 20 $V_{in} = 60 dB \mu V EMF$ f_{in} = 1MHz f_m = 1kHz - 40 MOD = 30% 80 - 40 - 20 0 20 40 60 AMBIENT TEMPERATURE Ta (°C)

MPX



TOTAL HARMONIC DISTORTION THD (%)

MPX



MPX

(%)

TOTAL HARMONIC DISTORTION THD









Package Dimensions

SDIP24-P-300-1.78

Unit : mm



Weight: 1.2 g (typ.)

Unit : mm

Package Dimensions

SSOP24-P-300-1.00









Weight: 0.31 g (typ.)

Package Dimensions



Weight: 0.14 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
 In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.