TSH512

HiFi stereo/mono infrared transmitter Stereo sub-carrier generator

- Supply voltage: **2.3V to 5.5V**
- Carriers frequency range: **0.4 to 11 MHz**
- High versatility: I/O pins for each section
- Two FM transmitters for stereo
- Sinusoidal carriers for high spectral purity
- Micro or line level preamplifiers with ALC
- VOX function to save on battery power
- Transmitter 2 Standby for mono operation

DESCRIPTION

The TSH512 is a 0.4 to 11 MHz dual FM transmitter. Access pins to each section give a high versatility and allow several applications: stereo headphone, multimedia headset, audio sub-carrier generator.

The TSH512 integrates in one chip:

Low-noise audio preamplifiers with ALC (Automatic Level Control), frequency modulated oscillators, and linear output buffers to drive external transistors. The sinusoidal carriers facilitates the filtering and allows high performance audio transmission.

The VOX (Voice Operated Transmit) circuitry disables the output buffer when there is no audio to save battery power.

For MONO applications, the STAND-BY pin enables one transmitter only, reducing the supply current.

The TSH512 forms a chipset with the dual receiver TSH511.

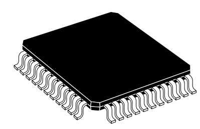
APPLICATIONS

- Infrared HiFi stereo transmitter
- Infrared Headsets
- Stereo sub-carrier for video transmitters
- Voice operated wireless webcams
- FM IF transmit systems

ORDER CODE

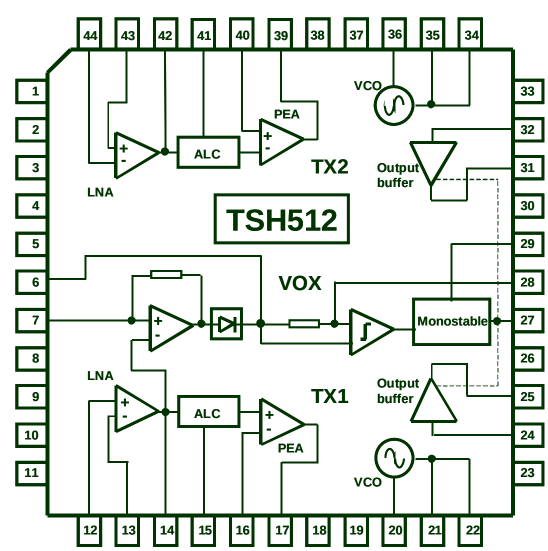
Part Number	Temperature Range	Package	Conditionning	Marking
TSH512CF	-40°C to +85°C	TQFP44	Tray	TSH512C
TSH512CFT	-40°C to +85°C	TQFP44	Tape & reel	TSH512C

PACKAGE



F
TQFP44
10 x 10 mm

PIN CONNECTION (top view)



ABSOLUTE MAXIMUM RATINGS

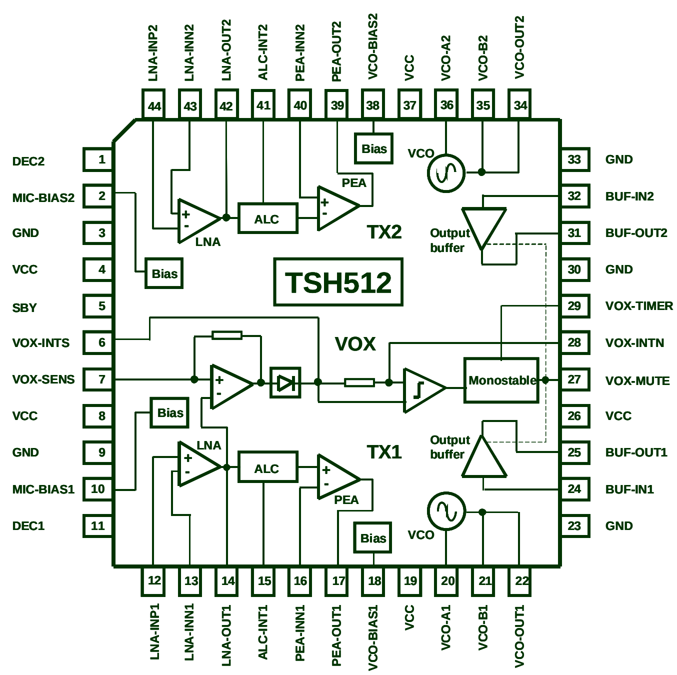
Symbol	Parameter	Value	Unit
Vcc	Supply voltage[1)]	7	V
Toper	Operating free air temperature range	-40 to +85	°C
Tstg	Storage temperature	-65 to +150	°C
Tj	Maximum junction temperature	150	°C
Rthjc	Thermal resistance junction to case	14	°C/W
Latch-up	Class[2)]	A	
ESD sensitive device: handling precautions required			
ESD **except pin 20 & 36**	HBM: Human Body Model[3)]	2	kV
	CDM: Charged Device Model[4)]	1	
	MM: Machine Model[5)]	0.2	

1. All voltages values, except differential voltage, are with respect to network ground terminal
2. Corporate ST Microelectronics procedure number 0018695
3. ElectroStatic Discharge pulse (ESD pulse) simulating a human body discharge of 100 pF through 1.5kΩ
4. Discharge to Ground of a device that has been previously charged.
5. ElectroStatic Discharge pulse (ESD pulse) approximating a pulse of a machine or mechanical equipment.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
Vcc	Supply voltage	2.3 to 5.5	V
f_{audio}	Audio frequency range	20 to 20,000	Hz
$f_{carrier}$	Carrier frequency range	0.4 to 11	MHz

BLOC DIAGRAM



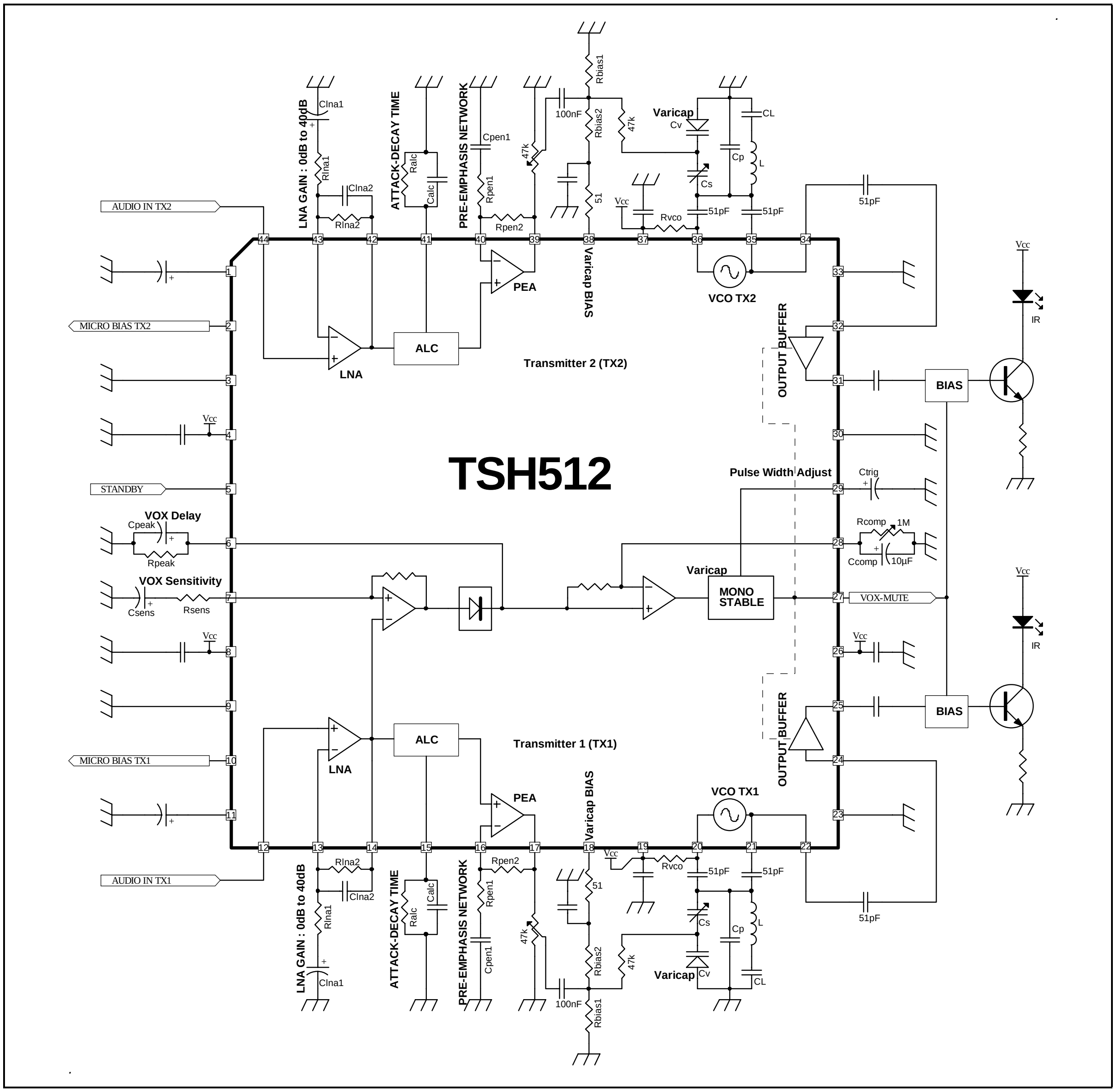
PIN DESCRIPTION

Pin	Pin name	related to	direction[1)]	Pin description
1	DEC2	TX2	-	Decoupling capacitor for internal voltage reference
2	MIC-BIAS2	TX2	O	Microphone bias
3	GND	-	-	GROUND
4	VCC	-	-	SUPPLY VOLTAGE
5	SBY	TX1 & TX2	I	Standby Control (INPUT pin)
6	VOX-INTS	TX1 & TX2	-	Time constant terminal for Audio Signal integrator in VOX
7	VOX-SENS	TX1 & TX2	-	Gain adjustment for VOX input sensitivity
8	VCC	-	-	SUPPLY VOLTAGE
9	GND	-	-	GROUND
10	MIC-BIAS1	TX1	O	Microphone bias
11	DEC1	TX1	-	Decoupling capacitor for internal voltage reference
12	LNA-INP1	TX1	I	LNA positive input
13	LNA-INN1	TX1	I	LNA negative input
14	LNA-OUT1	TX1	O	LNA output
15	ALC-INT1	TX1	-	Time constant terminal for integrator in ALC
16	PEA-INN1	TX1	I	Pre-Emphasis Amplifier negative input
17	PEA-OUT1	TX1	O	Pre-Emphasis Amplifier output
18	VCO-BIAS1	TX1	O	Bias for external VCO components
19	VCC	-	-	Supply Voltage
20	VCO-A1	TX1	-	Oscillator component connection
21	VCO-B1	TX1	-	Oscillator component connection
22	VCO-OUT1	TX1	O	VCO output
23	GND	-	-	Ground
24	BUF-IN1	TX1	I	Input to the output buffer
25	BUF-OUT1	TX1	O	Output of the output buffer
26	VCC	-	-	Supply Voltage
27	VOX-MUTE	TX1 & TX2	O	Mute control (Output pin) in VOX
28	VOX-INTN	TX1 & TX2	-	Time constant terminal for Noise integrator in VOX
29	VOX-TIMER	TX1 & TX2	-	Rise time for timer in VOX
30	GND	-	-	Ground
31	BUF-OUT2	TX2	O	Output of the output buffer
32	BUF-IN2	TX2	I	Input to the output buffer
33	GND	-	-	Ground
34	VCO-OUT2	TX2	O	VCO output
35	VCO-B2	TX2	-	Oscillator component connection
36	VCO-A2	TX2	-	Oscillator component connection
37	VCC	-	-	Supply Voltage
38	VCO-BIAS2	TX2	O	Bias for external VCO components
39	PEA-OUT2	TX2	O	Pre-Emphasis Amplifier output
40	PEA-INN2	TX2	I	Pre-Emphasis Amplifier negative input
41	ALC-INT2	TX2	-	Time constant terminal for internal peak detector in ALC
42	LNA-OUT2	TX2	O	LNA output
43	LNA-INN2	TX2	I	LNA negative input
44	LNA-INP2	TX2	I	LNA positive input

1. pin direction: I = input pin, O = output pin, - = pin to connect to supply or decoupling capacitors or external components

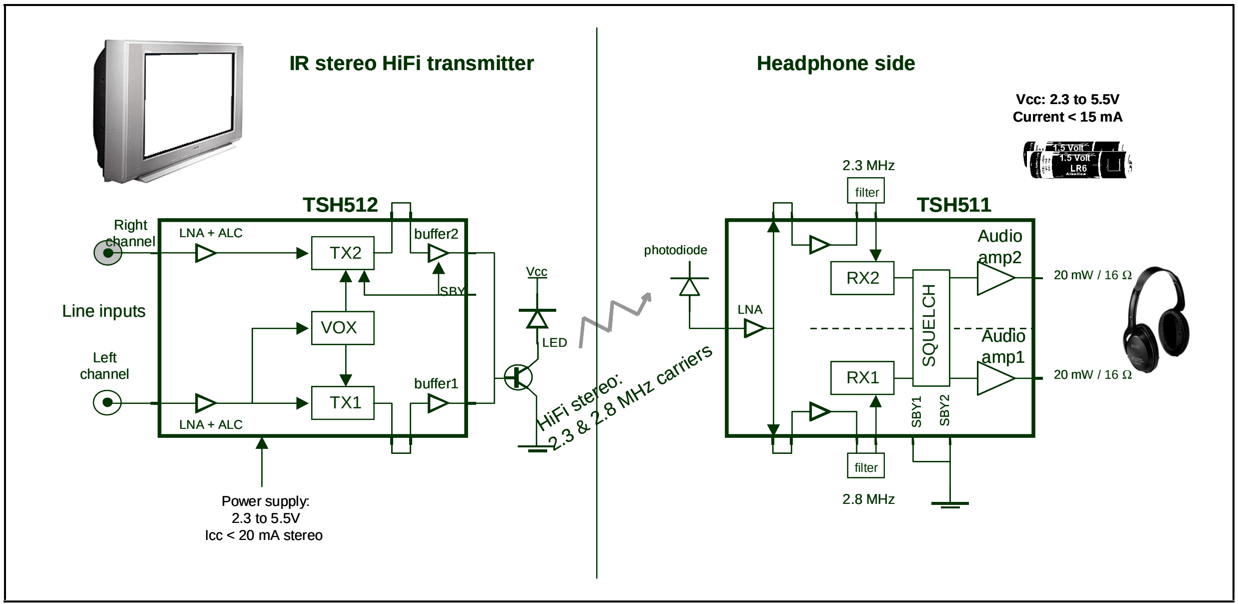
TYPICAL SCHEMATIC

Stereo infrared transmitter



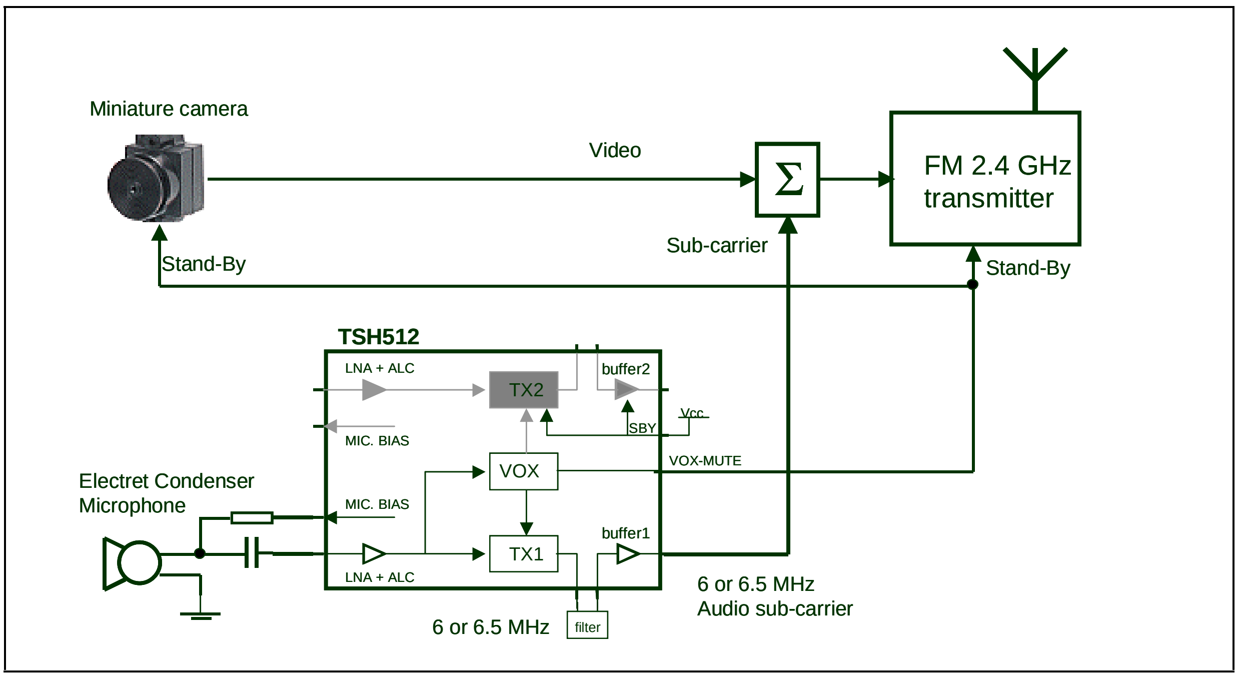
INFRARED STEREO TRANSMITTER APPLICATION (ie: stereo headphone)

The HiFi stereo audio is amplified and level regulated by ALC. The carrier of each transmitter TX1 or TX2 of the TSH512 is modulated in FM and bufferized to attack the LED final stage.



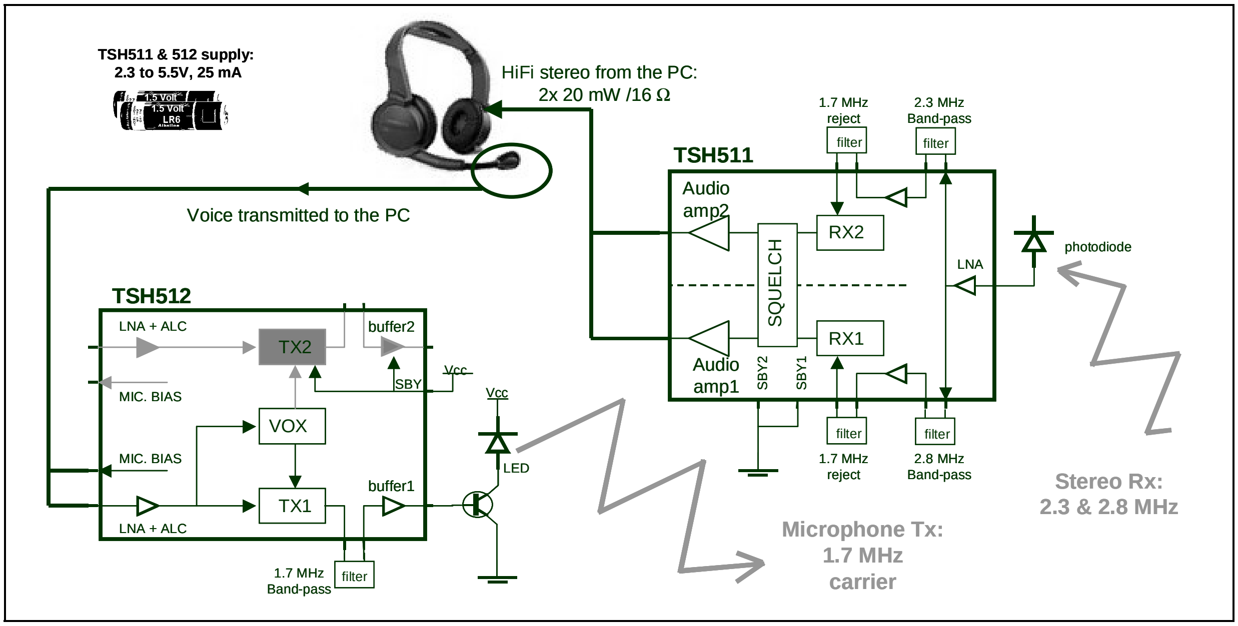
SUB-CARRIER GENERATOR APPLICATION: voice operated wireless camera

Thanks to the operating frequency the TSH512 offers the possibility to generate usual audio sub-carriers for video applications. The camera can be voice activated using the VOX-MUTE output of the TSH512. The TSH512 also provides bias, amplification, ALC for the electret microphone.



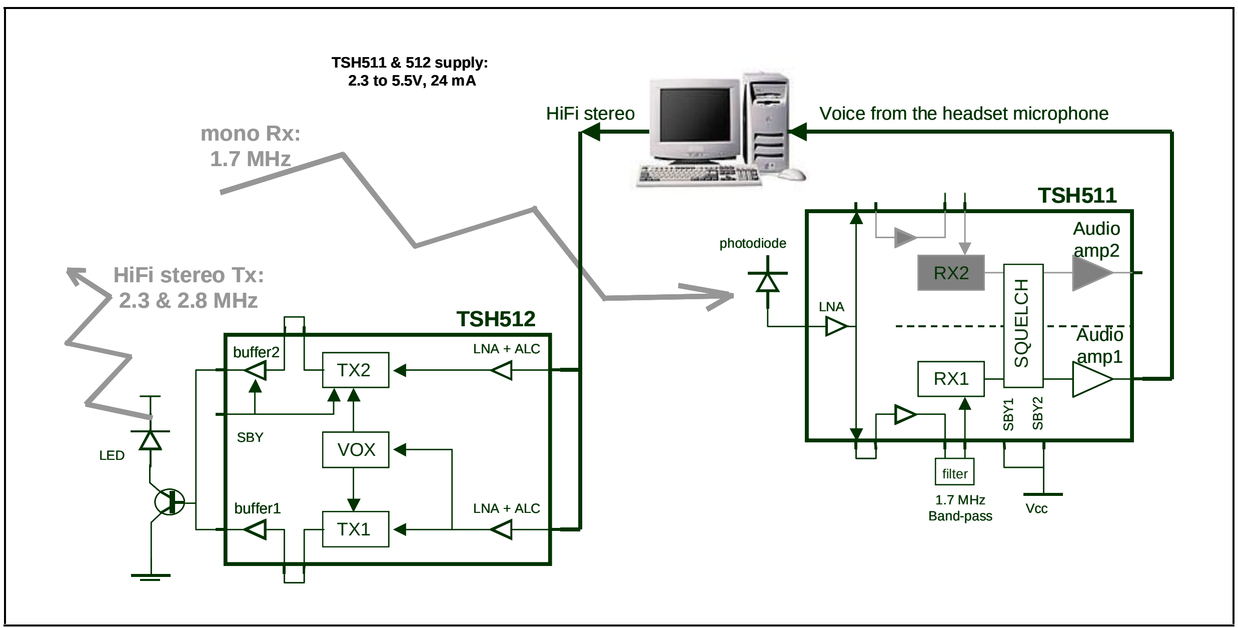
MULTIMEDIA APPLICATION: HEADSET SIDE

The TSH512 is used in mono to transmit the signal of the Electret Condenser Microphone of the headset. The circuit is supplied by batteries and the VOX function switches off the output stages to spare energy. The usual working frequency is 1.7 MHz for infrared mono operation.



MULTIMEDIA APPLICATION: COMPUTER SIDE

In multimedia application, the TSH512 transmits the HiFi stereo from the PC to the headset.



ELECTRICAL CHARACTERISTICS

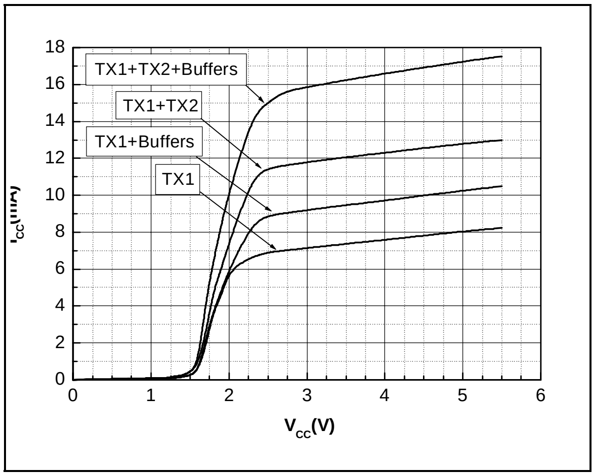
Vcc = 2.7V, Tamb = 25°C, f_{audio} = 1 kHz, $f_{carrier}$ = 2.8 MHz (unless otherwise specified)

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
Overall Circuit						
I_{CC_TOT}	Current consumption, TX1 and TX2 are on.	TX1 on, TX2 on, MIC-BIAS1 and MIC-BIAS2 not used:				
		VOX-MUTE=1, output buffers on		16	18.6	mA
		VOX-MUTE=0, output buffers off		11	12.8	mA
I_{CC_SBY}	Current consumption with TX2 in stand-by: SBY (pin5) active	TX1 on, TX2 off, MIC-BIAS1 and MIC-BIAS2 not used:				
		VOX-MUTE=1, output buffers on		10	11.5	mA
		VOX-MUTE=0, output buffers off		7	8	mA
LNA Sections (for TX1 and TX2)						
GBP_{LNA}	Gain Band Product	No external load		7		MHz
Rin_{LNA}	Input Resistance on positive input: (LNA-INP1 pin 12 or LNA-INP2 pin 44)			30		kΩ
THD_{LNA}	Total Harmonic Distortion	G_{LNA}=0dB $Vout_{LNA}$ =700mV_{PP}		0.01	0.05	%
En	Equivalent Input Noise Voltage	G_{LNA}=40dB, at f=1kHz Rs=390Ω, Rfeedback= 39kΩ		6		nV/√Hz
Automatic Level Control (ALC) Section						
G_{ALC}	Voltage Gain			20		dB
V_{ALC_OUT}	Regulated Output Level (At positive input of the PEA amplifier)		600	710	800	mVpp
Pre-Emphasis Amplifier (PEA) Section						
GBP_{PEA}	Gain Band Product (PEA-OUT1 pin17 or PEA-OUT2 pin39)	No Load		9		MHz
$V_{Opp\text{-}PEA}$	Output voltage	RL = 22kΩ		550		mVpp
Audio LNA+ALC+PEA sections						
THD_{ALC}	Total Harmonic Distorsion in linear region on PEA-OUT1 pin17 or PEA-OUT2 pin 39	G_{LNA} = 0 dB, f =1kHz Vin_{ALC} < 25mV_{rms} (-30dBu) RL = 22 kΩ tied to GND		0.05	0.15	%
THD_{AGC}	Total Harmonic Distorsion in compression region	$(Vin)_{ALC}$ = 36mV_{rms} (-27dBu)		1.3	1.7	%
		$(Vin)_{ALC}$= 100mV_{rms} (-18dBu)		3	4	%
		RL = 22 kΩ tied to GND				
ΦM_{PEA}	Phase Margin at PEA-OUT1 pin 17 or PEA-OUT2 pin 39	RL = 22 kΩ LNA and PEA at unity gain Vin = 40mV		70		°

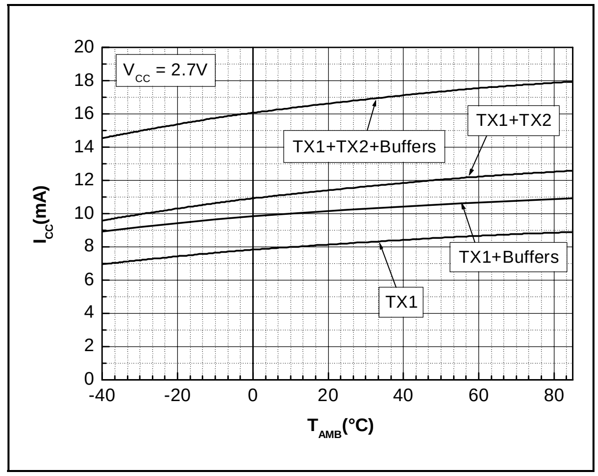
Symbol	Parameter	Test condition	Min	Typ	Max	Unit
Microphone Biasing Section						
$V_{MIC-BIAS}$	Microphone Biasing Voltage (see page 15)	$I_{MIC-BIAS}$ = 2.5 mA	2.15	2.25	2.35	V
$\Delta V_{MIC-BIAS}$	$V_{MIC-BIAS}$ temperature coefficient	Over temperature range [0, 70°C] [-40, 85°C] $I_{MIC-BIAS}$ = 2.5 mA		260 460		ppm/°C
$I_{MIC-BIAS}$	MIC-BIAS current capability	over V_{CC} range [2.3V-5.5V]	2.5			mA
PSRR-MIC-BIAS	Power Supply Rejection Ratio of MIC-BIAS	@ 1kHz and V ripple = $25mV_{RMS}$		50		dB
$en_{MIC-BIAS}$	Equivalent input noise of MIC-BIAS	V_{CC}=2.7V V_{CC}=5.0V		22 42		nV/√Hz
Vox Operated Switch (VOX) Section						
$I_{VOX-TIMER}$	Monostable Current Source (VOX-TIMER pin 29)	Vcc = 2.7V		5		µA
VTH-VOX-TIMER	Threshold voltage of the Monostable (Time Constant)			1.4		V
V_{MUTE_L}	Low Level Output Voltage (VOX-MUTE Pin27)	RL = 2 kΩ			0.2	V
V_{MUTE_H}	High Level Output Voltage (VOX-MUTE Pin27)	RL = 2 kΩ	Vcc-0.3			V
Standby						
V_{SBY_IL} max	Max. Low Level Input Voltage of Standby input (SBY Pin5)			0.1xVcc		V
V_{SBY_IH} min	Min. High Level Input Voltage of Standby input (SBY Pin5)			0.9xVcc		V
VCO Section						
$V_{VCO-BIAS}$	VCO-BIAS output voltage (VCO-BIAS1 pin18 or VCO-BIAS2 pin 38)	With No Load	1.43	1.47	1.51	V_{DC}
$I_{VCO-BIAS}$	VCO-BIAS output current capability	$V_{VCO-BIAS}$ > 1.38V		40		µA
$\delta V_{VCO-BIAS}$	VCO-BIAS voltage drift	2.3V < Vcc < 5.5V [0, 70°C] Vcc=2.7V [0, 70°C] Vcc=5.0V [-40, 85°C] Vcc=2.7V [-40, 85°C] Vcc=5.0V		8 +265 +356 +265 +356		mV/V ppm/°C ppm/°C ppm/°C ppm/°C
PN_{LO}	Phase Noise	@ 1kHz, L = 120µH (Q=30) and R_{VCO} no connected		-80		dBc
$SVR_{VCO-BIAS}$	Supply Voltage Rejection Ratio of VCO-BIAS	With No Load		43		dB
$Z_{VCO-OUT}$	VCO Output Impedance (VCO-OUT1 pin22 or VCO-OUT2 pin34)			400		Ω

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
$ZL_{VCO\text{-}OUT}$ min	Minimum Load Impedance			1		kΩ
$V_{VCO\text{-}OUT}$	VCO Output Level	L= 120µH (Q=30), VCO ouput connected to Output Buffer input, R_{VCO} = 100K	0.58	0.62	0.66	Vpp
Output Buffer						
$Z_{BUF\text{-}IN}$	Input Impedance (BUF-IN1 pin24 or BUF-IN2 pin32)			400		kΩ
G_{OB}	Linear Voltage Gain			10		dB
$V_{BUF\text{-}OUT}$ AC	Output AC voltage at 1dB compression point	Z_L=2kΩ		1.3		Vpp
	Output AC voltage (BUF-OUT1 pin 25 or BUF-OUT2 pin 31)	Z_L=2kΩ $V_{BUF\text{-}IN}$ = 0.60Vpp	1.35	1.5	1.7	
$V_{BUF\text{-}OUT}$ DC	Output DC voltage	DC Output current= 0.4 mA		1.25		V_{DC}
$H2_{BUF\text{-}OUT}$	2nd Harmonic Level	$V_{BUF\text{-}OUT}$ =1.2Vpp and Z_L=2kΩ		-40		dBc
$H3_{BUF\text{-}OUT}$	3rd Harmonic Level	$V_{BUF\text{-}OUT}$ =1.2Vpp and Z_L=2kΩ		-30		dBc

Supply current vs. Supply voltage

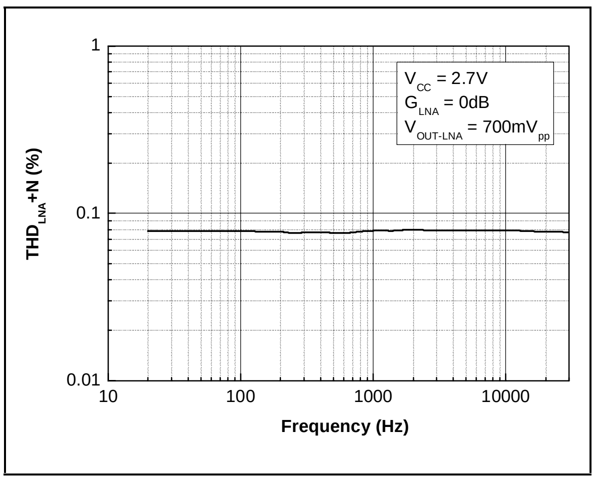


Supply current vs. Temperature

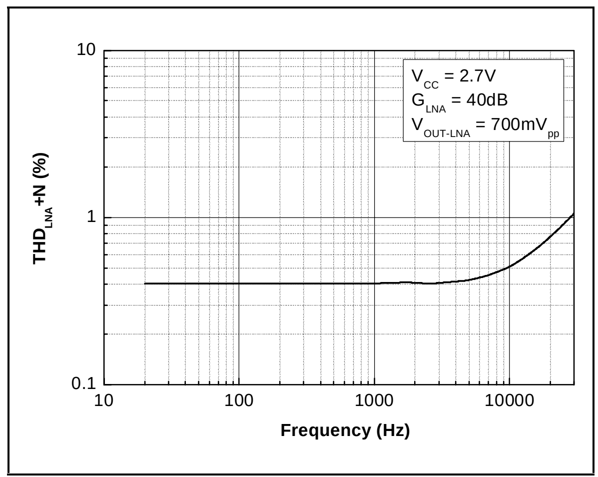


AUDIO SECTION

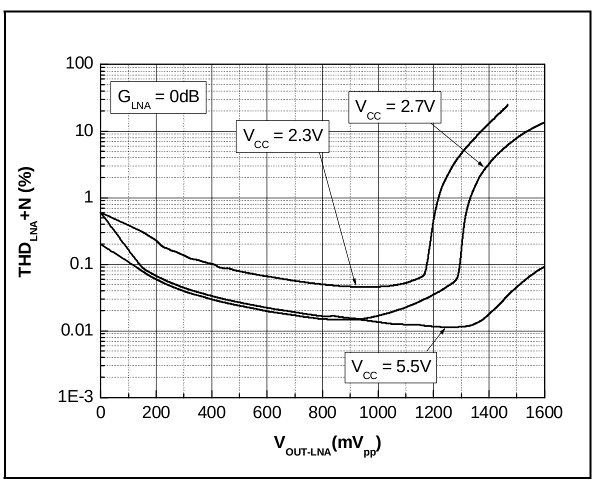
LNA Distorsion vs. Frequency



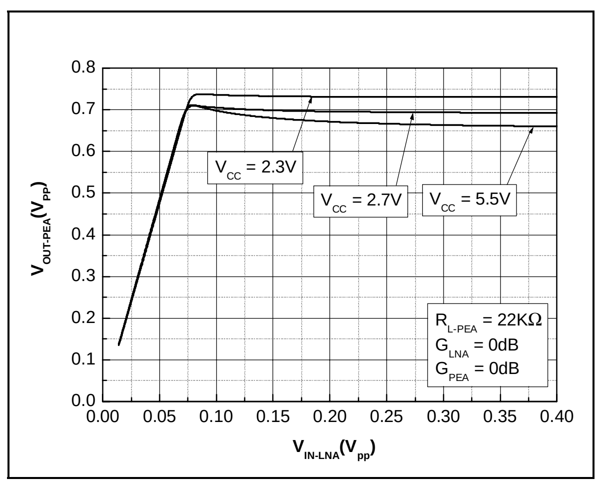
LNA Distorsion vs. Frequency



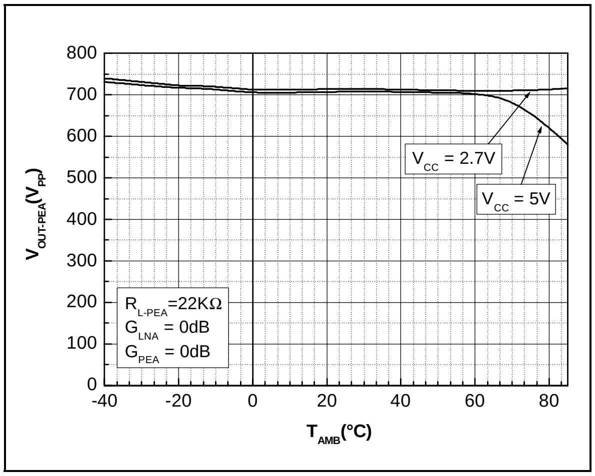
LNA Distorsion vs. LNA Output Voltage



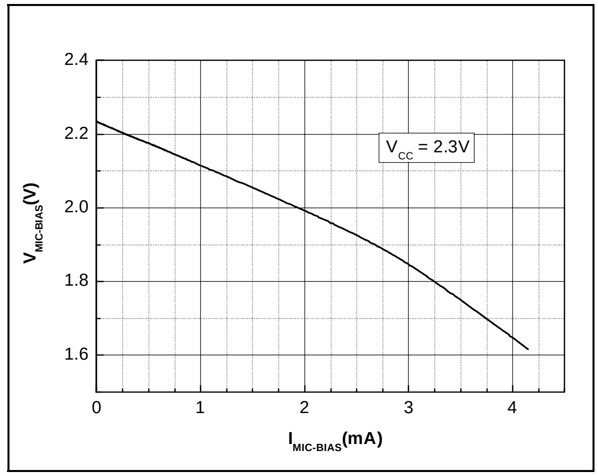
PEA Output Voltage vs. LNA Input Voltage



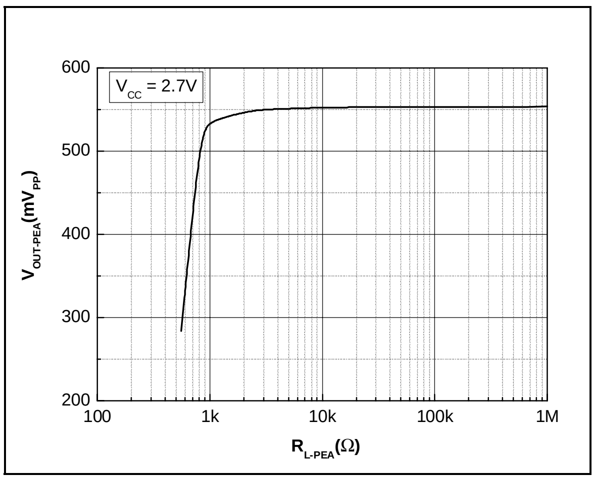
PEA Output Voltage vs. Temperature



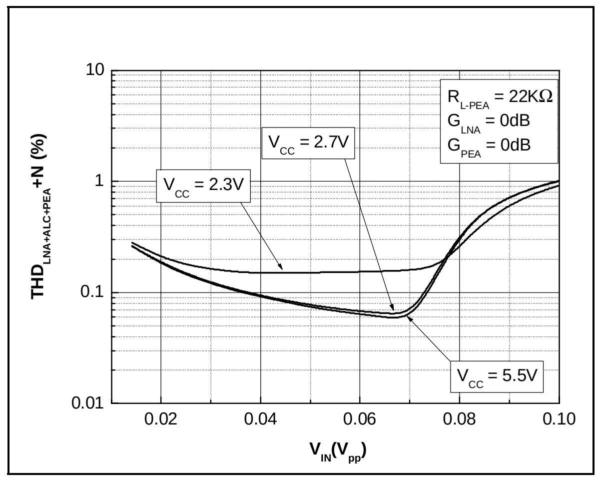
MIC-BIAS Voltage vs. MIC-BIAS Current



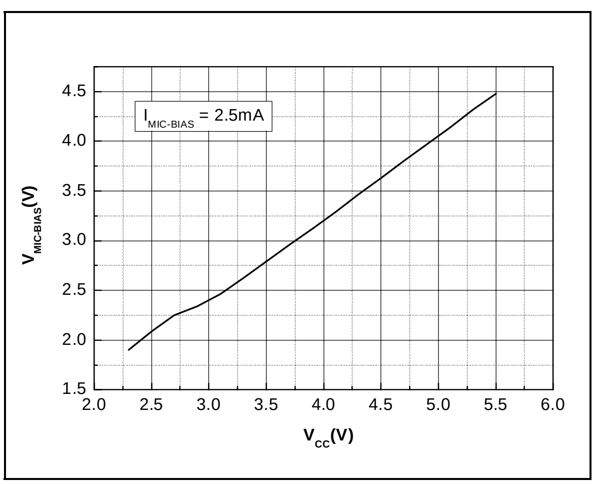
PEA Output Voltage vs. Resistor Load



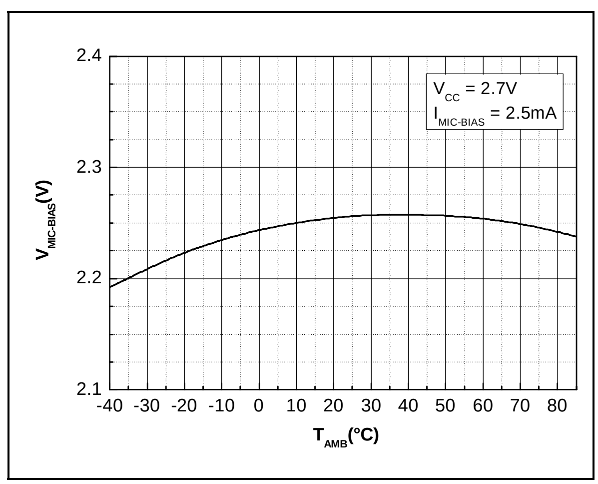
LNA+ALC+PEA Distorsion vs. Input Voltage



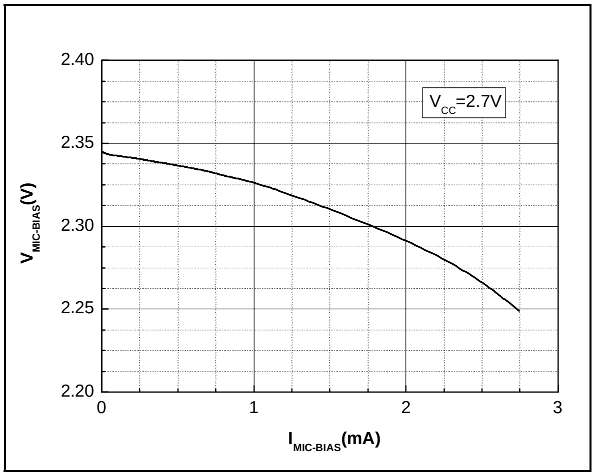
MIC-BIAS Output Voltage vs. Supply Voltage



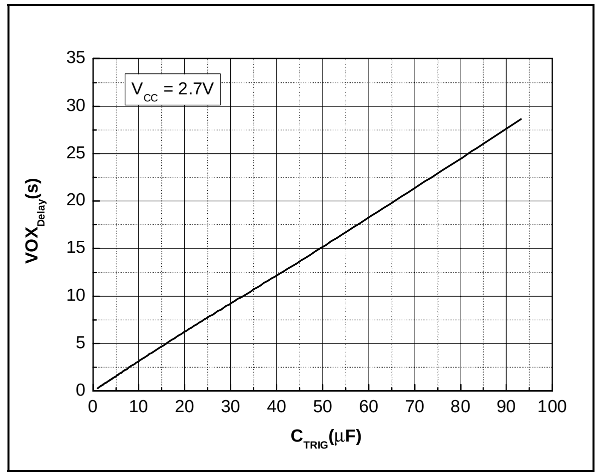
MIC-BIAS Output Voltage vs. Temperature



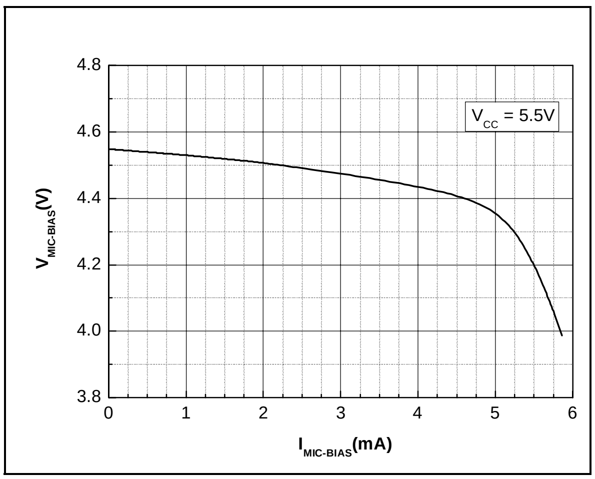
MIC-BIAS Voltage vs. MIC-BIAS Current



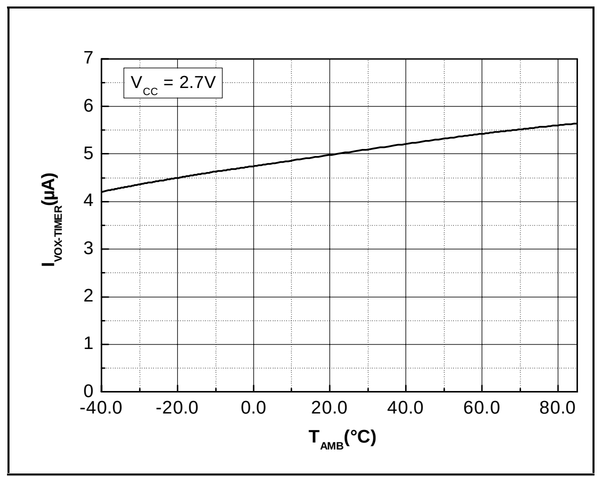
VOX Delay vs. C_{TRIG} Capacitor



MIC-BIAS Voltage vs. MIC-BIAS Current

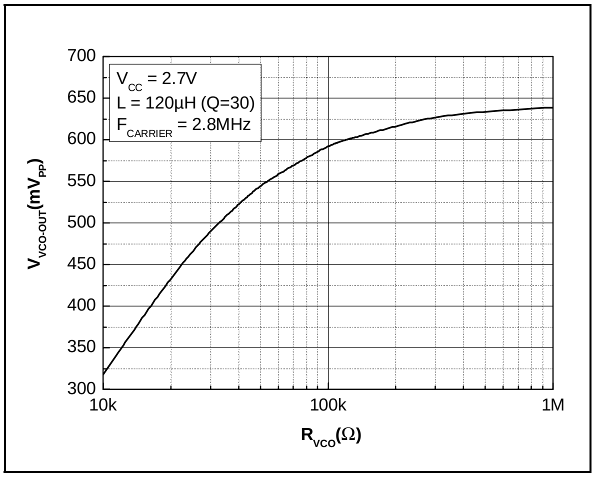


Monostable Current Source vs. Temperature

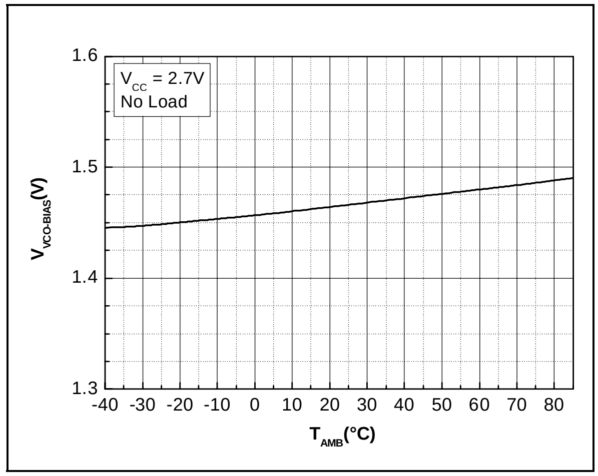


RF SECTION

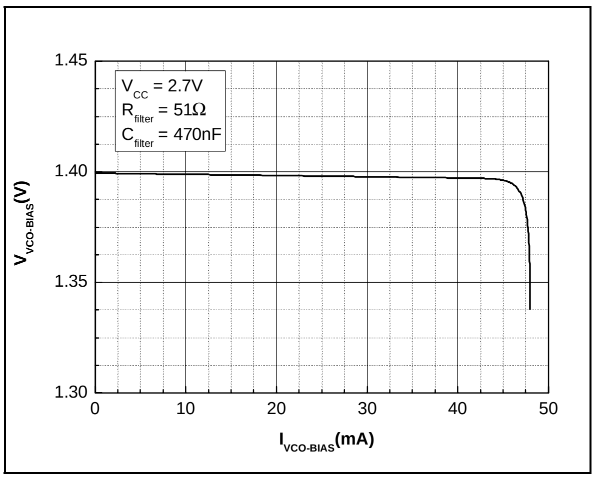
VCO Output Voltage vs. R_{VCO}



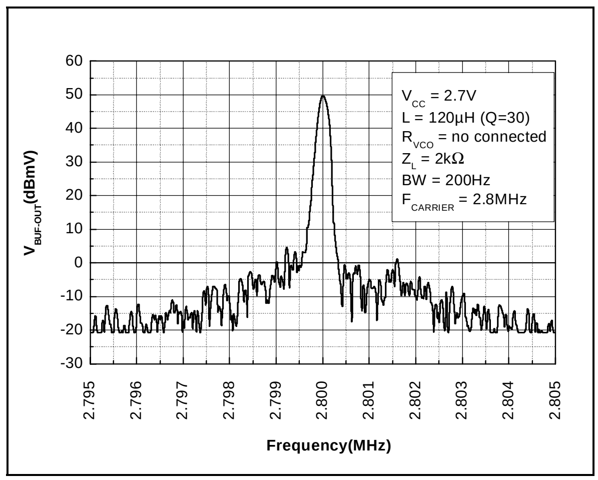
VCO-BIAS Voltage vs. Temperature



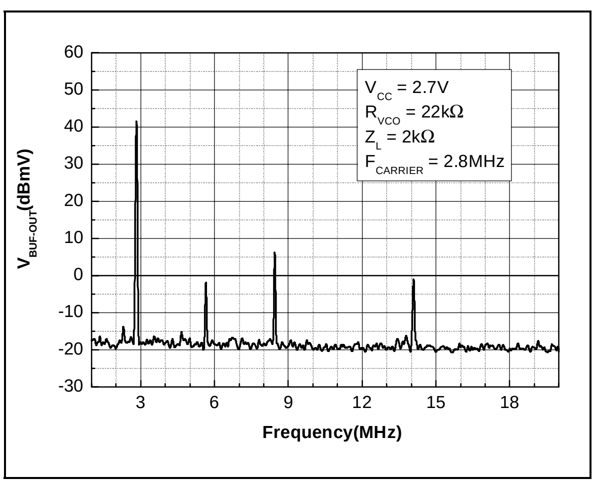
VCO-BIAS Voltage vs. VCO-BIAS Current



VCO & Output Buffer Spectrum



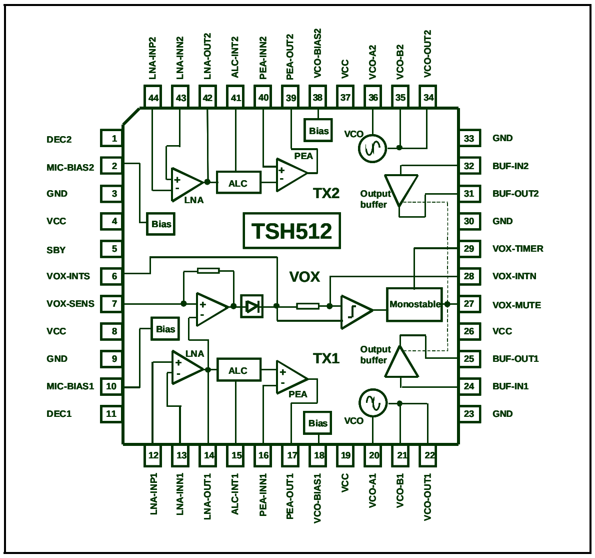
VCO & Output Buffer Spectrum



GENERAL DESCRIPTION

The TSH512 is a 0.4 to 11 MHz dual FM analog transmitter. This circuit offers the functions needed for an advanced infrared STEREO transmitter. The access pins for each section allow a high versatility and therefore a lot of applications: mono infrared transmitter, stereo transmitter, mono/stereo sub-carrier generator for video transmissions (ie: popular 2.4GHz video links).

Figure 1 : TSH512 bloc diagram



Each audio input is amplified with a Low Noise Amplifier (LNA section) allowing connection to line level sources or directly to a microphone. Built-in voltage references 'MIC BIAS' provide bias for Electret Condenser Microphones (ECM) with a high power supply rejection ratio.

Each audio path includes also an Automatic Level Control (ALC) to limit the overmodulation and the distorsion on very high signal amplitudes. The following operationnal amplifier (PEA) allows a preamphasis transfer function before modulating the varicap diode.

Built-in voltage references (VCO-BIAS) offers a regulated voltage to bias the varicap diodes. The Voltage Controlled Oscillator (VCO) is an integrated oscillator giving typically 600 mV peak to peak at 2.8 MHz.

The Output Buffer section amplifies linearly the FM carrier to provide a sinusoidal output. This sinusoidal signals reduce the intermodulation products beetween the carriers, specially in two-way or in multicarrier systems (see the chapter ' Applications').

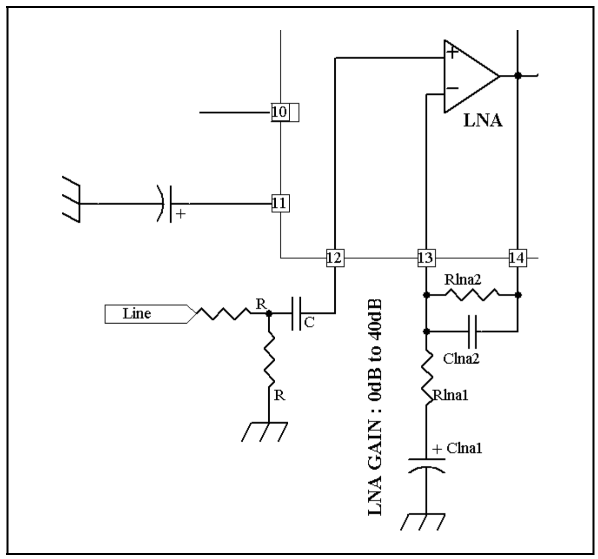
The Voice Operated Transmit (VOX) function automatically detects when an audio signal appear over the background noise.

The stand-by of the second transmitter reduces consumption in mono operation.

LNA section: Low Noise Amplifier

For each transmitter, the audio source is connected to the LNA. The LNA stage is a low noise operationnal amplifier typically usable with a gain from 0dB to 40dB.

Figure 2 : LNA schematic



The LNA gain is given by:

G_{LNA} (dB) = $20.\mathrm{Log}(1+R_{LNA2}/R_{LNA1})$

The High-pass cut-off frequency is:

$f_{HPF} = 1/(2.\pi R_{LNA1}.C_{LNA1})$

The Lowpass filter cut-off frequency is:

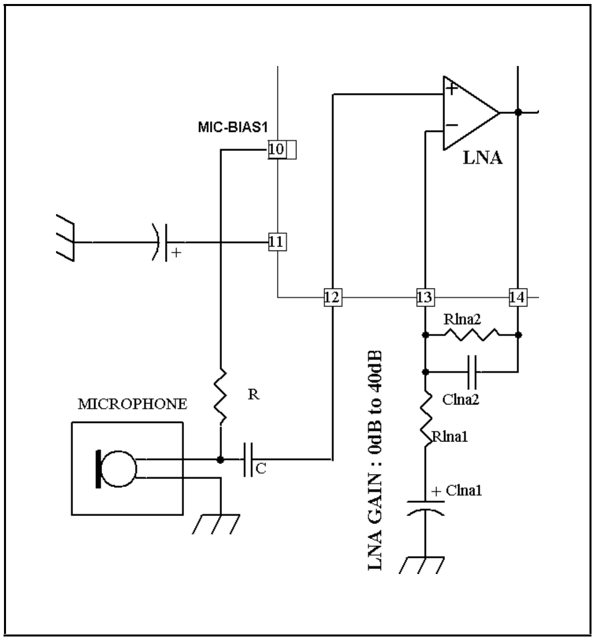
$f_{LPF} = 1/(2.\pi R_{LNA2}.C_{LNA2})$

If you connect an external circuit to the LNA output, the impedance of this external circuit should be higher than 10 MΩ and the capacitance lower than 50 pF in order to keep a good stability.

Electret Condenser Microphone source

When a Electret Condenser Microphone (ECM) is used, a high gain LNA is recommanded, but low frequencies have to be attenuated. The ECM has to be biased with a stable and clean reference voltage.The TSH512 offers you the LNA and the MIC-BIAS sections to perform this functions. (see MIC-BIAS chapter).

Figure 3 : Electret Condenser Microphone source



The capacitor C in serie with the microphone stops the DC coming from MIC-BIAS.
The resistor R provides the DC from MIC-BIAS to supply the ECM.
Thanks to the ALC (Automatic Level control), the great variations of amplitude will not overmodulate the transmitter (refer to the chapter on ALC).
The self-adaptative VOX (Voice Operated Transmit) offers an automatic transmitting with a good discrimination of the background noise (see the chapter on VOX).

MIC-BIAS section: microphone bias voltage

The MIC-BIAS bias voltages are dedicated to the bias of Electret Condenser Microphones. These bias voltages on pin 10 for TX1 and pin 2 for TX2, exhibit a low voltage noise density of 22nV/SQR(Hz). This allows more than 55 dB S/N considering a bandwith of 7 kHz. (see the figure in the 'Electret Condenser Microphone source' chapter).
The MIC-BIAS voltage is related with VCC as follow (with $I_{MIC\text{-}BIAS}$= 2.5 mA):

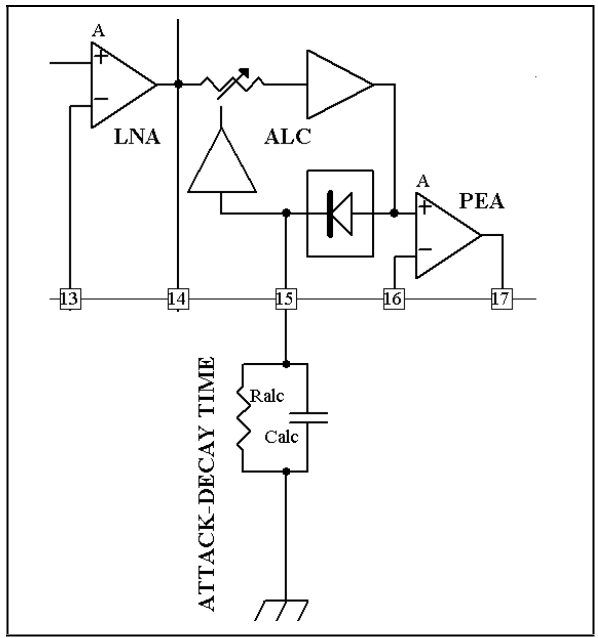
$$V_{MIC\text{-}BIAS} = 0.844.VCC-0.140 \text{ (Volts)}$$

Moreover, the supply rejection ratio is guaranteed better than 50 dB without any decoupling capacitor. To address biasing of most of the microphones, the current drive capability is 2.5 mA. The MIC-BIAS voltage depend linearly on the supply voltage Vcc (refer to the curve 'MIC-BIAS vs. VCC').

ALC section: Automatic Level Control

Both transmitters of the TSH512 are including Automatic Level Control (ALC). When the level of the audio signal is too high, the ALC compress the signal in order to avoid overmodulation of the FM VCO. Therefore, the ALC reduces the distorsion and keep a reduced transmit spectrum with very high amplitude signals.

Figure 4 : Automatic Level Control Schematic



The ALC features a 20dB gain and an output signal regulated to 700 mVpp in compression.

The attack time is the response time of the ALC to go from the linear amplification to the compression region. The attack time mainly depends on C_{ALC} capacitor value. A typical value of C_{ALC} is 1µF with music as audio signal (refer to the 'application schematic').

The decay time is the response time of the ALC to recover a full gain amplifying mode from a compression mode. The decay time depends mainly on the R_{ALC} resistor value. A typical value of R_{ALC} is 470k with music as audio signal (refer to the 'application schematic').

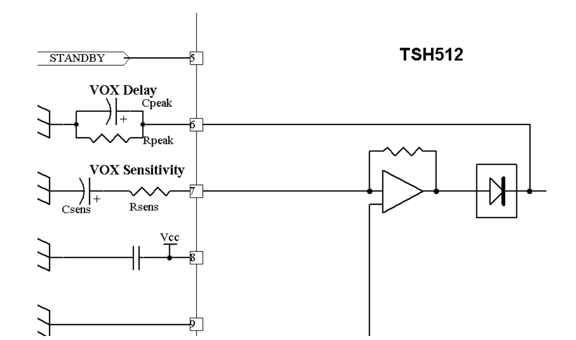
VOX description: Voice Operated Transmit

The Voice Operated Transmit section (VOX) reduces consumption when there is no audio signal to transmit. When the VOX detects that no audio signal is present, it mutes the Output Buffers of TX1 and TX2 and provides the logic signal VOX-MUTE to switch-off external LED drivers if needed.

The audio signal of TX1 is amplified with a gain depending on Rsens and Csens. Rsens and Csens are connected to pin 7. The high-pass filtering has the following cut-off frequency:

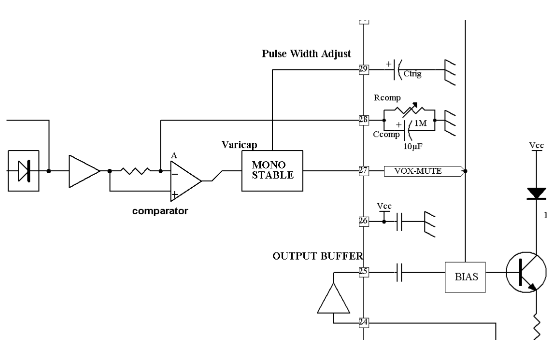
$f_{HPF} = 1/(2.\pi R_{sens}.C_{sens})$

Figure 5 : Vox delay and sensitivity schematic



On pin 6, Rpeak and Cpeak integrate the rectified audio signal with a short time constant. This filtered signal follows the audio amplitude.

Figure 6 : Vox integrator and monostable schematic



The self-adaptative VOX threshold consist in the constatation that the ambient background noise variation is slow compared to the voice or the music. On the pin 28, R_{COMP} and C_{COMP} integrates the amplitude to follow the background amplitude. Therefore, the comparator switches when an audio signal appears over the background noise. Refering to the 'application schematic', C_{COMP} will be typically a 100nF capacitor and R_{COMP} will be determined depending on the audio signal.

As soon as an audio is detected, the output of the monostable switches to 'high' state and enables both output buffers. The output of the monostable is the pin 27 and is called 'VOX-MUTE'.

The monostable holds the TSH512 in transmit mode during a delay fixed by the value of C_{TRIG} connected to pin 29

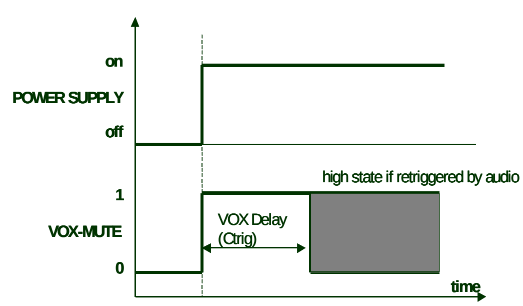
$$VOX_{DELAY} = \left(\frac{1.4V}{5\mu A}\right)\cdot Ctrig$$

Please note that the VOX function is activated with the audio coming into the first transmitter TX1.

When the application needs a permanent transmission, it is possible to inhibit the VOX function. Just remove CTRIG capacitor and connect pin 29 to ground.

As soon as the TSH512 is powered-on, the internal reset circuitry sets the VOX-MUTE to high state to enable transmission. The transmission remains during the monostable timing and continue if an audio signal triggs the monostable

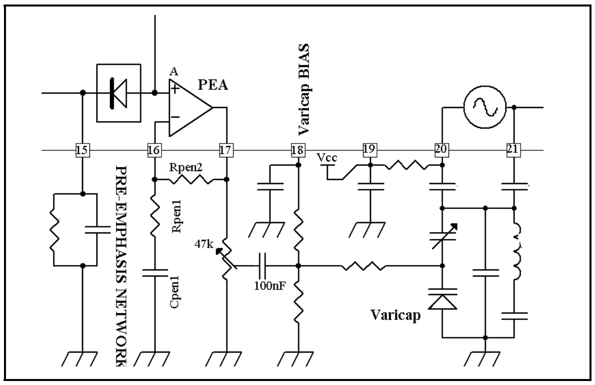
Figure 7 : VOX state at power-on



PEA section: Pre-Emphasis

The amplitude regulated audio coming from the ALC feeds the postive input of the Operational Amplifier called PEA (Pre-Emphasis). The pre-emphasis consist in a high-pass filter in order to compensate the behavior of the FM transmission.

Figure 8 : Pre-Emphasis schematic



R_{PEA1} and C_{PEA1} set the time constant of the pre-emphasis as:

$\tau = R_{PEA1} \cdot C_{PEA1}$

50 µs or 75µs time constant are generally used.

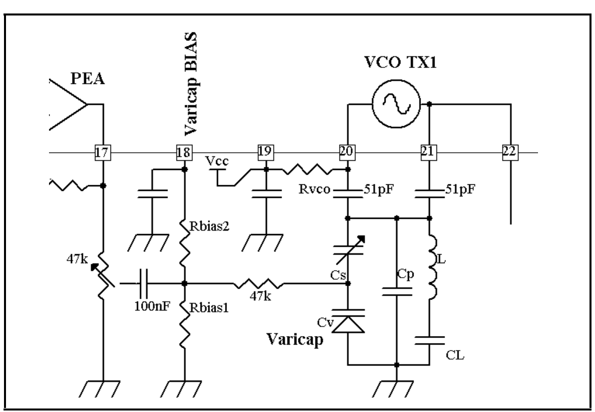
Choosing the gain of the PEA stage allows also to set the right modulation level to the varicap diode. The gain in the pass-band is:

$GPEA = 1 + (R_{PEA2}/R_{PEA1})$

VCO section: Voltage Controlled Oscillator

Each TSH512's transmitter has his own oscillator to generate the carrier. The audio signal is applied on the varicap diode to perform the Frequency Modulation. Thanks to the VCO-BIAS voltage reference, the DC bias of the varicap is stabilized. The high PSRR (Power Supply Rejection ratio) of the VCO-BIAS insure good immunity with the noise of the power supply.

Figure 9 : VCO schematic



The generated frequency can be set from 400 kHz to 11 MHz by external components. Refer to the table 1 for the usual frequencies in Infrared audio.

The working frequency is:

$$fVCO = \frac{1}{2 \cdot \pi \cdot \sqrt{(L \cdot Ct)}}$$

C_t is the total capacity of C_L, C_p, C_s and C_v.

$C_t = 1/(1/C_c+1/C_L)$ with $C_c = C_p+1/(1/C_v+1/C_s)$

It's possible to use varicap diodes SMV1212 (Alpha Ind.) or ZC833 (Zetex).

Usual Infrared frequencies

IR frequency	applications
1.6 MHz	AM mono
1.7 MHz	FM mono
2.3 MHz	FM right channel
2.8 MHz	FM left channel or mono

The output level of the VCO can be reduced by adding the resistor RVCO beetween pin 19 and pin 20 or beetween pin 36 and pin 37 for TX1 and TX2 respectively.

Output Buffer section

The output buffers are able to deliver a sinusoidal signal with 1.5Vpp amplitude in a 1KΩ load. This impedance is compatible with popular biasing circuitry of external transistor drivers of IR LEDs.

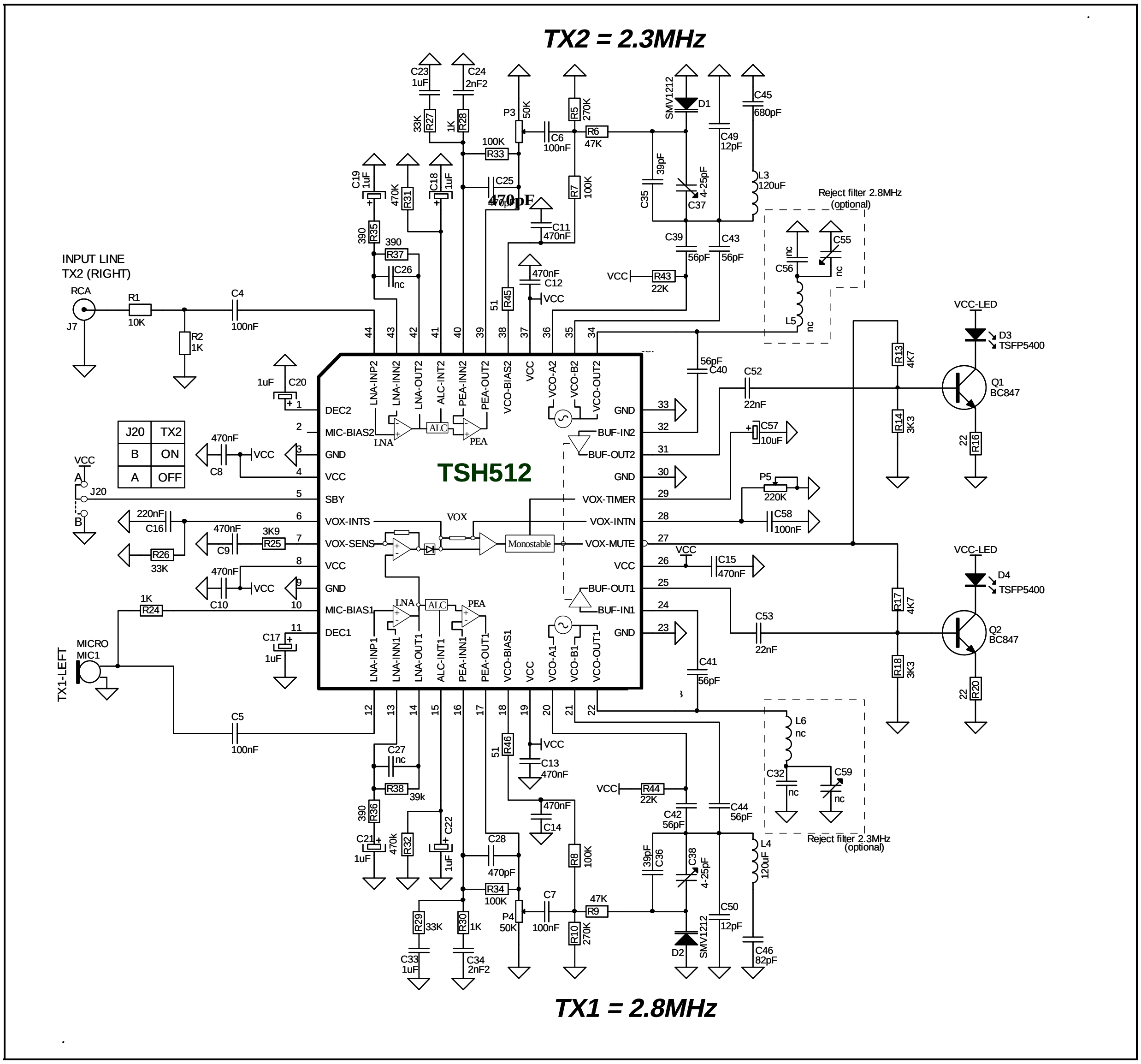
The VOX-MUTE logic signal can be used to control the external LED drivers. When the audio is not present on the TX1 input, VOX-MUTE is at 'Low' state, the TSH512's internal buffers are muted, and external drivers can be switched off by controlling their bias.

SBY pin: Standby for mono operation

A high state on the Standby pin (SBY) sets the second transmitter TX2 in power-down. The SBY pin is typically used when the TSH512 is used as a mono transmitter (ie: infrared microphone transmitter).

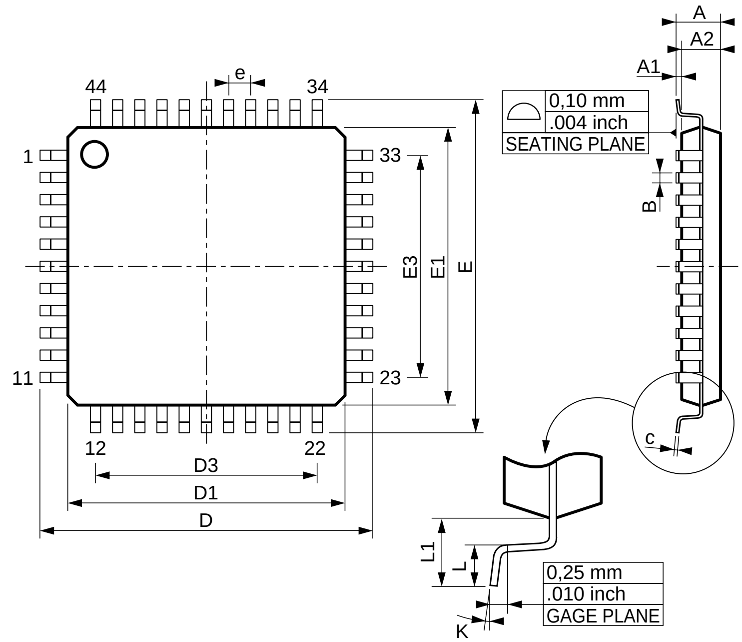
APPLICATION SCHEMATIC

The Electret Condenser Microphone is biased with MIC-BIAS1 voltage. The audio signal is transmitted on the left channel using a 2.8 MHz carrier. The VOX activates the transmitter TX1 when the audio signal is present. The audio signal at line level is attenuated and is transmitted by the second transmitter TX2 at 2.3 MHz.



PACKAGE MECHANICAL DATA

44 PINS - PLASTIC PACKAGE



Dimensions	Millimeters			Inches		
	Min.	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**
A			1.60			0.063
A1	0.05		0.15	0.002		0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
B	0.30	0.37	0.40	0.012	0.015	0.016
C	0.09		0.20	0.004		0.008
D		12.00			0.472	
D1		10.00			0.394	
D3		8.00			0.315	
e		0.80			0.031	
E		12.00			0.472	
E1		10.00			0.394	
E3		8.00			0.315	
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1.00			0.039	
K	0° (min.), 7° (max.)					