Technical Data

MC44BC374T/D
Rev. 3.1 07/2002

MC44BC374T
PLL Tuned PAL/NTSC UHF and VHF Audio/ Video High Integration Modulator ICs

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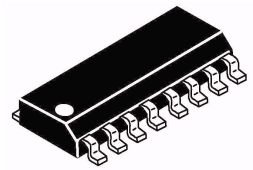
MC44BC374T



SO16NB Package

Ordering Information

Device	Temp Range	Package
MC44BC374TD, R2	-20°C to +85°C	SO16NB
NOTE: For tape and reel, add R2 suffix.		

Contents List

The modulator is intended for use in VCRs, set-top boxes, and similar devices.

Figure 1 shows the pin connections.

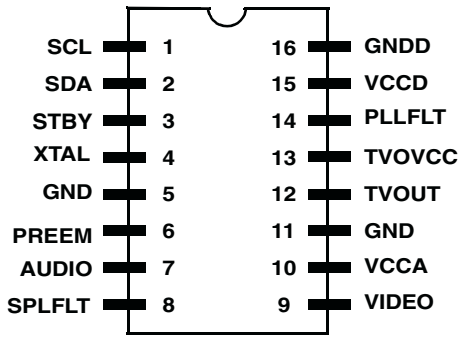


Figure 1. Pin Connections

1 Features

The channel is set by an on-chip high-speed I^2C compatible bus receiver. A Phase-Locked Loop (PLL) tunes the modulator over the full UHF range.

The modulator incorporates a sound subcarrier oscillator and uses a second PLL to derive 4.5, 5.5, 6.0, and 6.5MHz subcarrier frequencies. These frequencies are selectable using the bus. The modulation standard is set to System B/G.

The picture-to-sound ratio is adjusted using the bus. In addition, an on-chip video test pattern generator can be turned ON with a 1KHz audio test signal.

Compared with the MC44BC374C, this modulator has one IIC programming difference. A hardware standby mode in addition to the software standby mode, and no logic output port.

The MC44BC374T also has the following features:

- No external varicaps diodes/inductor or tuned components
- Channel 21-69 UHF operation
- VHF range possible by internal dividers (30MHz–450MHz)
- Integrated on-chip programmable UHF oscillator
- Extremely low external components count
- High speed I^2C-bus compatible (800kHz)
- Fixed video modulation depth (80%)
- Peak White Clip disabled via the bus
- Programmable picture/sound carrier ratio (12dB and 16dB)
- Integrated on-chip programmable sound subcarrier oscillator (4.5MHz to 6.5MHz)—No external varicaps
- On-chip video test pattern generator with sound test signal (1kHz)
- Low-power modulator standby mode programmable by I^2C bus or switchable by STBY pin voltage
- Transient output inhibit during PLL Lock-up at power-ON
- Start-up on channel ‘36’ (591.25 MHz)
- Custom masked versions with unique start-up settings possible (no I^2C bus programming required)
- Extremely robust ESD protection, minimum 4kV, typical 6kV
- Available in channel ‘71’ start up frequency (MC44BC374T1)

2 Device Overview

Figure 2 shows a simplified block diagram of the MC44BC374T device.

The MC44BC374T device has three main sections:

1. A high speed I^2C-compatible bus section
2. A PLL section to synthesize the UHF/VHF output channel frequency (from an integrated UHF oscillator, divided for VHF output)
3. A modulator section, which accepts audio and video inputs, then uses them to modulates the UHF/VHF carrier

An on-chip video test pattern generator with an audio test signal is included. The MC44BC374T is designed to operate as a B/G standard modulator. High frequency BiCMOS technology allows integration of the UHF tank circuit and certain filtering functions.

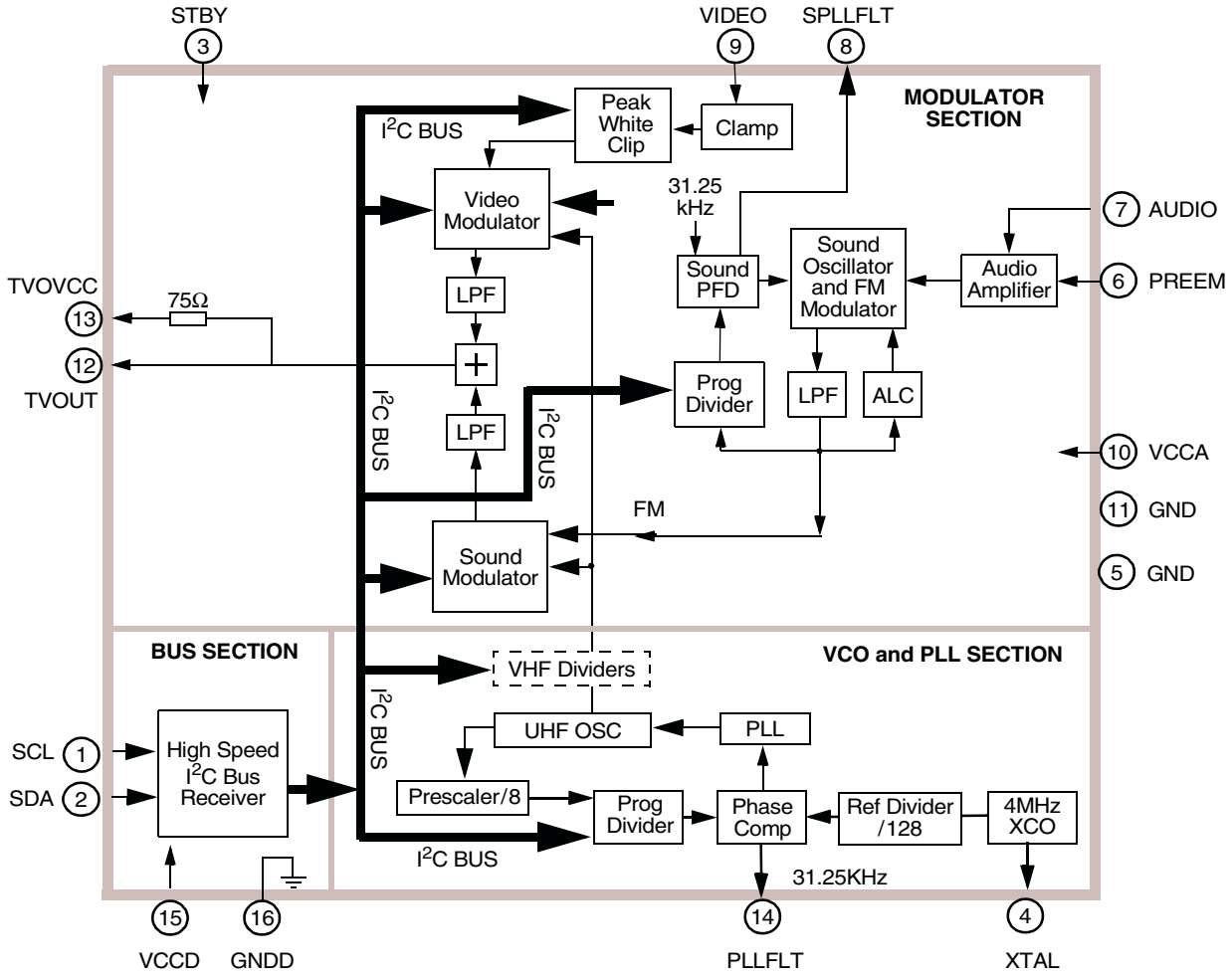


Figure 2. MC44BC374T Simplified Block Diagram

3 Maximum Ratings

Sym	Parameter	Value	Unit
Vcc	Supply voltage	6	V
Tamin	Minimum operating ambient temperature	–20	°C
Tamax	Maximum operating ambient temperature	85	°C
Tstgmin	Minimum storage temperature	–65	°C
Tstgmax	Maximum storage temperature	150	°C
Tj	Junction Temperature	150	°C

This device contains protection circuitry to guard against damage due to high static voltage or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation, input and output voltages should be constrained to the ranges indicated in the Recommended Operating Conditions.

aximum ratings are those values beyond which damage to the device may occur. For functional peration, values should be restricted to the Recommended Operating Condition.

eets Moisture Sensitivity Level 1, no dry pack required

4 Thermal Ratings

Sym	Parameter	Value	Unit
R_{thja}	Thermal resistance from Junction to Ambient	140	°C/W

5 Electrostatic Discharge

Electrostatic Discharge (ESD) tests are done on all pins.

Sym	Parameter	Min	Typ	Unit
ESD	MM (Machine Model) - MIL STD 883C method 3015-7	200	500	V
ESD	HBM (Human Body Model) - MIL STD 883C method 3015-7	4000	6000	V

6 Electrical Characteristics

- A = 100% Tested
- B = 100% Correlation tested
- C = Characterized on samples
- D = Design parameter

6.1 Specification Conditions

Unless otherwise stated: V_{cc}=5.0V, Ambient Temperture=25°C, Video Input $1V_{p-p}$, 10-step grayscale. RF output into 75Ohm load. SPECIFICATIONS ONLY VALID FOR ENVELOPE DEMODULATION.

Parameter	Min	Typ	Max	Unit	Notes	Type
Operating supply voltage range	4.5	5.0	5.5	V		B
Total supply current	44	52	60	mA	All sections active	A
Total standby mode supply current	3	6	9	mA	Bus Section active	A
Test pattern sync pulse width	3	4.7	6.5	µS		B
Sound comparator charge pump current						
During locking	7	10	12	µA		A
When locked	0.7	1	1.5	µA		A
RF comparator charge pump current	60	100	150	µA		A
Crystal oscillator stability—negative resistance	1	—	—	KΩ		D
STBY pin DC current						
Force 5V to STBY pin	—	—	1	µA		A
Force 0V to STBY pin	—	—	-10	µA		A

7 I²C Bit Mapping

WRITE MODE	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	ACK
CA—CHIP ADDRESS	1	1	0	0	1	0	1	0	ACK
C1—High Order Bits	1	0	SO	0	PS	X3	X2	0	ACK
C0—Low Order Bits	PWC	OSC	ATT	SFD1	SFD0	0	X5	X4	ACK
FM—High Order Bits	0	TPEN	N11	N10	N9	N8	N7	N6	ACK
FL—Low Order Bits	N5	N4	N3	N2	N1	N0	X1	X0	ACK

Bit Name	Description
PWC	Peak White Clip enable/disable
OSC	UHF oscillator ON/OFF
ATT	Modulator output attenuated—sound and video modulators ON/OFF
SFD0, 1	Sound subcarrier frequency control bits
SO	Sound Oscillator ON/OFF
PS	Picture-to-sound carrier ratio
TPEN	Test pattern enable—picture and sound
X5…X0	Test mode bits—All bits are 0 for normal operation (see Test Mode tables, page 6 & page 7) except “OSC” bit (normal mode is “1”)
N0…N11	UHF frequency programming bits, in steps of 250 kHz

8 I²C Programming

Sound

SFD1	SFD0	Sound Subcarrier Freq (MHz)
0	0	4.5
0	1	5.5
1	0	6.0
1	1	6.5

PS	Picture-to-Sound Ratio (dB)
0	12
1	16

SO	Sound Oscillator
0	Sound oscillator ON (Normal mode)
1	Sound oscillation disabled (oscillator and PLL

Standby Mode

OSC	SO	ATT	Combination of 3-bits
0	1	1	Modulator standby mode .

UHF

OSC	UHF Oscillator
1	Normal operation
0	UHF oscillator disabled (oscillator and PLL sections bias turned OFF)

ATT	Modular Output Attenuation
0	Normal operation
1	Modulator output attenuation (sound and video modulators sections bias turned OFF.

Video

PWC	Peak White Clip
0	Peak White Clip ON
1	Peak White Clip OFF

TPEN	Test Pattern Signal
0	Test pattern signal OFF (normal operation)
1	Test pattern signal ON (picture and sound)

WRITE MODE: Test Mode 1 and VHF Range

X2	X1	X0	State	Description
0	0	0	1.a	Normal operation
0	0	1	1.b	RF frequency divided for low frequency testing or VHF range: RF/2
0	1	0	1.c	RF/4
0	1	1	1.d	RF/8
1	0	0	1.e	RF/16
1	0	1	1.f	DC drive applied to modulators: Non-inverted video at TVOUT
1	1	0	1.g	DC drive applied to modulators: Inverted video at TVOUT
1	1	1	1.h	Transient output inhibit disabled During this speed-up test mode, ATT=0 forces sound current source to 1μA, and ATT=1 forces it to 10μA.

WRITE MODE: Test Mode 2

X5	X4	X3	State	Description
0	0	0	2.a	Normal operation
0	0	1	2.b	Test pattern generator DC verification (Test pattern DC test mode available)
0	1	0	2.c	Programmable divider test (UHF prog. div. on PLLFILT and sound prog. div. on SPLLFIL pin)
0	1	1	2.d	Reference divider test (UHF reference divider on PLLFILT pin)
1	0	0	2.e	UHF phase comparator, upper source on PLLFILT pin Sound phase comparator 10µA upper source on SPLLFIL (Only valid during transcient output inhibit)
1	0	1	2.f	UHF phase comparator, lower source on PLLFILT pin Sound phase comparator 10µA lower source on SPLLFIL (Only valid during transcient output inhibit)
1	1	0	2.g	Sound phase comparator 1µA upper source on SPLLFIL (Not valid during transcient output inhibit)
1	1	1	2.h	Sound phase comparator 1µAlower source on SPLLFIL (Not valid during transcient output inhibit)

NOTE:

Test modes 1 and 2 are intended for manufacturing test purpose only and cannot be used for normal application, except for VHF range (states 1.b to 1.e)

9 Modulator High Frequency Characteristics

Unless otherwise stated: V_{cc}=5.0V, Ambient Temperture=25°C, Video Input 1V_{p-p}, 10-step grayscale. RF inputs/outputs into 75Ohm load. SPECIFICATIONS ONLY VALID FOR ENVELOPE DEMODULATION.

Parameter	Test Conditions	Min	Typ	Max	Unit	Type
TVOUT output level	Output signal from modulator section See Figure . See Note 2	73	74.5	77	dBµV	B
UHF oscillator frequency		460	—	880	MHz	A
VHF range	From UHF oscillator internally divided	45	—	460	MHz	B
TVOUT output attenuation	During transient output inhibit, or when ATT bit is set to 1. See Figure . See Note 2	50	60	—	dBc	B
Sound subcarrier harmonics (Fp+n∗Fs)	Reference picture carrier. See Note 2	—	63	58	dBc	C
Second harmonic of chroma subcarrier	Using red EBU bar. See Note 2	—	—	65	dBc	C
Chroma/Sound intermodulation: Fp+(Fsnd−Fchr)	Using red EBU bar .See Note 2	—	—	65	dBc	C
Fo (picture carrier) harmonics	2nd harmonic: CH21 3rd harmonic: CH21 Other channels: See Figure . See NOTE 1. See Note 2	— —	35 26	30 22	dBc	C
Out band (picture carrier) spurious	1/2∗Fo−1/4∗Fo−3/2∗Fo−3/4∗Fo From 40MHz to 1GHz . See Note 2	—	0	10	dBµV	C
In band spurious (Fo±5MHz)	No video sound modulation.See Note 2	—	—	60	dBc	C

Note: 1: Picture carrier harmonics are highly dependant on PCB layout and decoupling capacitors.

Note: 2: See “Characterization Measurement Conditions” on page 12.

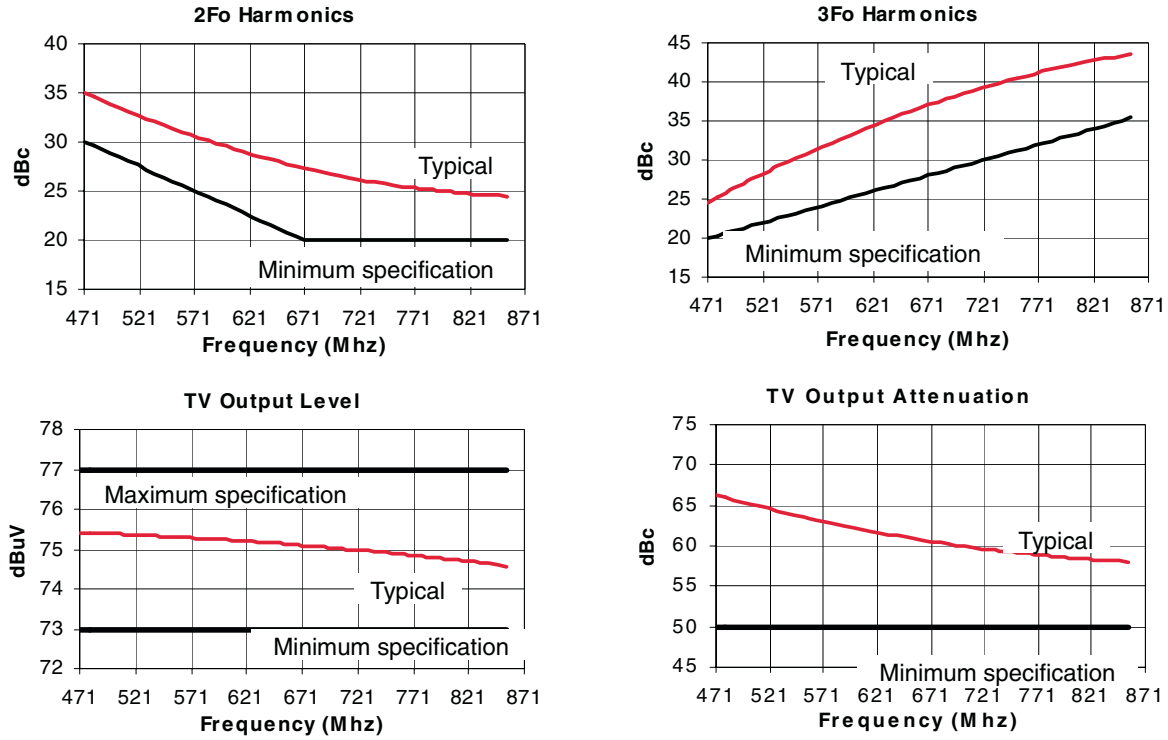


Figure 3. Typical Performance

10 Video Characteristics

Unless otherwise stated: V_{cc}=5.0V, Ambient Temperture=25°C, Video Input 1V_{p-p}, 10-step grayscale. RF inputs/outputs into 75Ohm load. SPECIFICATIONS ONLY VALID FOR ENVELOPE DEMODULATION.

Parameter	Test Conditions	Min	Typ	Max	Unit	Type
Video bandwidth	Reference 0dB at 100kHz, measured at 5MHz. See Note 2	–1.5	–0.8	—	dB	C
Video input level	75Ohm load	—	—	1.5	Vcvbs	D
Video input current		—	0.2	1	µA	A
Video input impedance		500	—	—	KΩ	A
Peak White Clip	PWC bit set to 1, see PWC section. See Note 2	110	114	118	%	A
Video S/N	No sound modulation,100% white video					
	Using CCIR Rec.567 weighting filter See Figure 4. See Note 2	50	53	—	dB	C
	Unweighted . See Note 2	45	—	—		C
Differential Phase	CCIR Test Line 330, worst case from the first 4 steps out of 5 . See Note 2	–5	—	5	deg	C
Differential Gain	CCIR Test Line 310, worst case from the first 4 steps out of 5. See Note 2	–5	—	5	%	C
Luma/Sync ratio	Input ratio 7.0:3.0	6.8/ 3.2	—	7.2/ 2.8	—	B
Video modulation depth	See Figure 4 .See Note 2	75	81	88	%	B

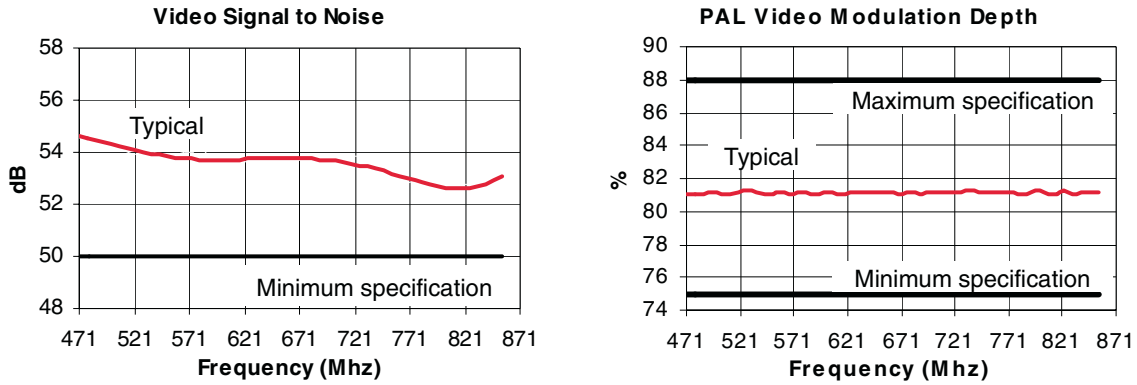


Figure 4. Typical performances

11 Audio Characteristics

Unless otherwise stated: V_{cc}=5.0V, Ambient Temperture=25°C, Video Input $1V_{p-p}$, 10-step grayscale. RF output into 75Ohm load. SPECIFICATIONS ONLY VALID FOR ENVELOPE DEMODULATION.

Parameter	Test Conditions	Min	Typ	Max	Unit	Type
Picture-to-Sound ratio	PS bit set to 0 PS bit set to 1	13 9	16 12	19 15	dB	B
Audio modulation depth	Using specific pre-emphasis circuit, audio input level=205mVrms−audio frequency=1kHz					
	FM modulation: Fs=5.5, 6 or 6.5MHz 100% modulation=±50kHz FM deviation	—	80	—	%	B
	FM modulation: NTSC Fs=4.5MHz 100% modulation=±25kHz FM deviation	—	80	—	%	B
Audio input resistance		45	53	61	KΩ	A
Audio Frequency response	Reference 0dB at 1kHz, using specified pre-emphasis circuit, measure from 50Hz to 15kHz	−2.5	—	+2	dB	C
Audio Distortion FM (THD only)	at 1kHz, 100% modulation (±50kHz) No video	—	0.4	2	%	C
Audio S/N with Sync Buzz FM	See Figure 5.	48	53	—	dB	C

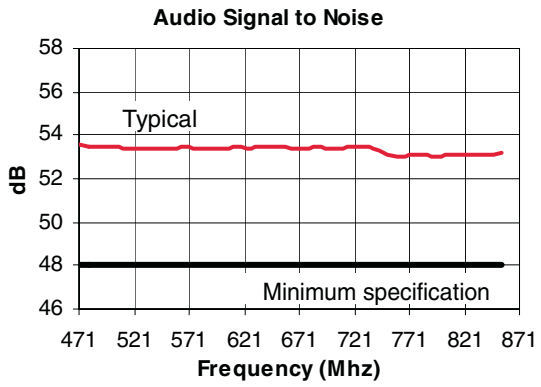


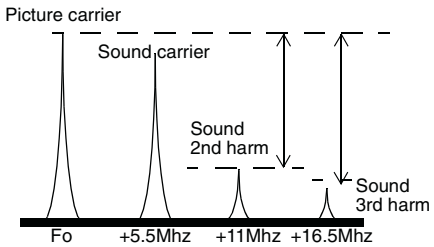
Figure 5. Typical performances

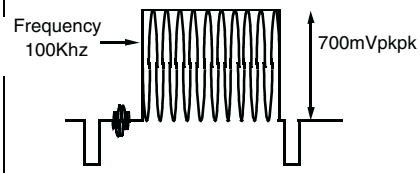
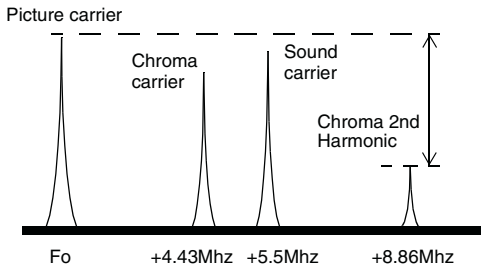
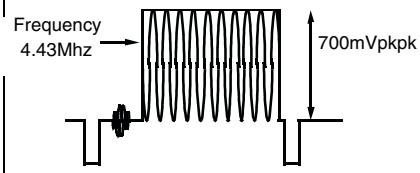
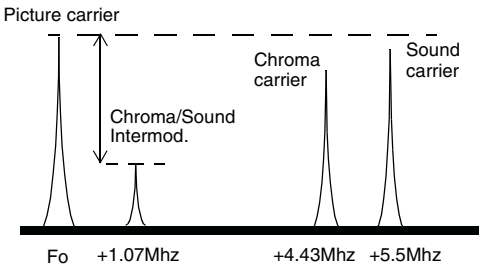
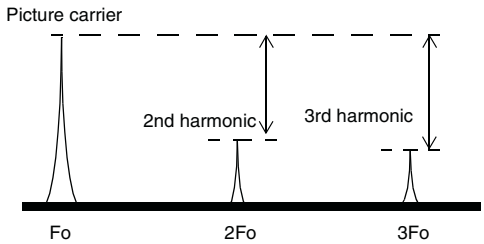
12 Characterization Measurement Conditions

Device default configuration unless otherwise specified:

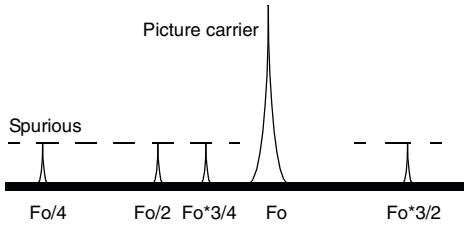
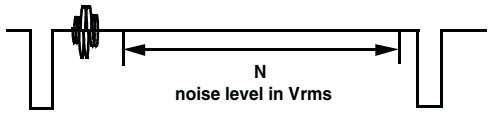
- Peak White Clip enable
- UHF oscillator ON
- Sound and video modulators ON
- Sound subcarrier frequency = 5.5Mhz
- Sound Oscillator ON
- Picture-to-sound carrier ratio = 12dB
- Test pattern disabled
- All test mode bits are ‘0’
- Frequency from channel 21 to 69

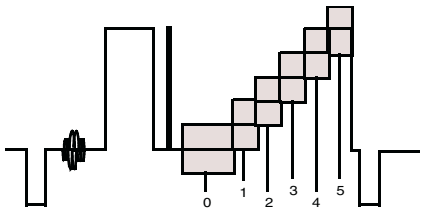
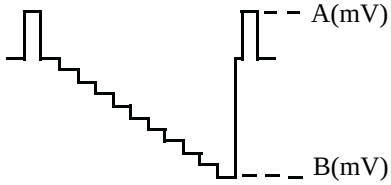
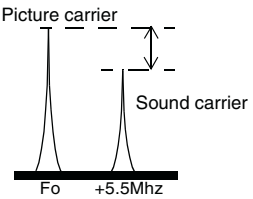
RF Inputs/Output into 75ohm Load using a 75 to 50 ohm transformation. Video Input 1V pk-pk. Audio pre-emphasis circuit engaged

Device and Signals Set-up	Measurement Set-up
TVOUT output level	
Video : 10 steps grey scale No audio	Measured picture carrier in dBuV with the HP8596E Spectrum Analyser using a 75 to 50 ohm transformation, all cables losses and transformation pads having been calibrated. Measurement used as a reference for other tests :TVout_Ref
TVOUT output attenuation	
“ATT” bit = 1 No Video signal No Audio signal	Measure in dBc picture carrier at “ATT”=”1” with reference to picture carrier at “ATT”=”0”.
Sound Subcarrier Harmonics	
Video : 10 steps grey scale No Audio signal	Measure in dBc second and third sound harmonics levels in reference to picture carrier (TVout_Ref). 

Device and Signals Set-up	Measurement Set-up
Second Harmonics of Chroma subcarrier	
No audio Video : a 700mVpk-pk 100Khz sinusoidal signal is inserted on the black level of active video area. 	Measure in dBc, in reference to picture carrier (TVout_Ref), second harmonic of chroma at channel frequency plus 2 times chroma frequency, resulting in the following spectrum 
Chroma/Sound intermodulation	
No audio signal Video : 700mVpk-pk 100Khz sinusoidal signal inserted on the black level of active video area.This is generated using a Rohde & Schwarz Video Generator SAF and inserting the required frequency from a RF Signal generator. 	Measure in dBc, in reference to picture carrier (TVout_Ref), intermodulation product at channel frequency plus the sound carrier frequency (+5,5Mhz) minus the chroma frequency (-4,43Mhz), resulting in the following spectrum. Intermodulation product is at the channel frequency +1,07Mhz. 
Picture Carrier Harmonics	
No Video signal No Audio signal	Measure in dBc, in reference to picture carrier (TVout_Ref), second and third harmonic of channel frequency, resulting in the following spectrum. 

Characterization Measurement Conditions

Device and Signals Set-up	Measurement Set-up
Out of Band Spurious	
No Video signal No Audio signal	Measure in dBuV spurious levels at 0.25, 0.5, 0.75 and 1.5 times channel frequency, resulting in the following spectrum Measure from 40Mhz to 1Ghz. 
In Band Spurious	
No Video signal No Audio signal	Measure in dBc, in reference to picture carrier (TVout_Ref), spurious levels falling into video bandwith Fo+/-5Mhz.
Video Bandwidth	
No audio Video : 600mVpk-pk sinusoidal signal inserted on the black level of active video area.	The Video signal is demodulated on the spectrum analyser, and the peak level of the 100Khz signal is measured as a reference. The frequency is then swept from 100Khz to 5Mhz, and then the difference in dBc from the 100Khz reference level is measured.
Peak White Clip	
No Audio signal. Video : 10 step grey scale	The video modulation depth is measured for 1.0VCVBS input level, giving modulation depth MDA. Then the same measurement is carried out for an input level of 1.4VCVBC, giving modulation depth MDB. The Peak White Clip is defined as 100*MDB/MDA.
Weighted Video Signal to Noise	
Video : 100% White video signal - 1Vpk-pk. No Audio signal This is measured using a Rohde & Schwarz AMFS UHF Demodulator in B/G (using a CCIR Rec. 567 weighting network, 100kHz to 5MHz band with sound trap and enveloppe detection, and a Rohde & Schwarz UAF Video Analyser.	The Video Analyser measures the ratio between the amplitude of the active area of the video signal (700mV) and the noise level in Vrms on a video black level which is show below. VideoS/N is calculated as 20 x log(700 /N) in dB 
Unweighted Video Signal to Noise	
Same as above with CCIR filter disabled.	Same as above.
Video Differential Phase	
Video : 5 step Grey Scale- 1Vpk-pk. No Audio signal This is measured using a Rohde & Schwarz AMFS UHF Demodulator in B/G (using a CCIR Rec. 567 weighting network, 100kHz to 5MHz band with sound trap, and eveloppe detection, and a Rohde & Schwarz UAF Video Analyser.	On line CCIR 330, the video analyser DP measure consists of calculating the difference of the Chroma phase at the black level and the different chroma subcarrier phase angles at each step of the greyscale. The largest positive or negative difference indicates the distortion. $\text{DIFF PHASE} = \frac{\text{the largest positive or negative difference}}{\text{the phaseat position 0}} * 100\%$ The video analyser method takes the worst step from the first 4 steps.

Device and Signals Set-up	Measurement Set-up
Video Differential Gain	
Video : 5 step Grey Scale- 1Vpk-pk. No Audio signal This is measured using a Rohde & Schwarz AMFS UHF Demodulator in B/G (using a CCIR Rec. 567 weighting network, 100kHz to 5MHz band with sound trap and enveloppe detection, and a Rohde & Schwarz UAF Video Analyser.	On line CCIR 330 shown below, the video analyser DG measure consists of calculating the difference of the Chroma amplitude at the black level and the different amplitudes at each step of the greyscale. The largest positive or negative difference indicates the distortion.  5-step Greyscale with Chroma subcarrier superimposed (not to scale), line CCIR 330. $\text{DIFF GAIN} = \frac{\text{the largest positive or negative difference}}{\text{the amplitude at position 0}} * 100\%$ The video analyser method takes the worst step from the first 4 steps.
Video Modulation Depth	
No Audio signal Video : 10 step grey scale	This is measured using a HP8596E Spectrum Analyser with a TV Trigger option, allowing demodulation and triggering on any specified TV Line. The analyser is centred on the maximum peak of the Video signal and reduced to zero Hertz span in Linear mode to demodulate the Video carrier..  TV Line Demodulated by Spectrum Analyser-BG standard The Modulation Depth is calculated as (A-B)/A x 100 in %
Picture to Sound ratio	
No Video signal No Audio Signal "PS" bit set to 0 and 1	Measure in dBc sound carrier in reference to picture carrier (TVout_Ref) for "PS" bit=0 (PS=12dB typical) and for "PS" bit=1 (PS=16dB), 
Audio Modulation Depth - FM Modulation	
Video Black Level Audio signal : 1Khz, 205mVrms. This is measured using a Rohde & Schwarz AMFS Demodulator in B/G and a HP8903A Audio Analyser at 1kHz	The audio signal 205mV at 1kHz is supplied by the Audio Analyser , and the FM demodulated signal deviation is indicated on the Demodulator in Khz peak. This value is then converted in % of FM deviation, based on specified standards.

Characterization Measurement Conditions

Device and Signals Set-up	Measurement Set-up
Audio Frequency response	
Video Black Level Audio signal : 50Hz to 15KHz, 100mV$_{rms}$ This is measured using a Rohde & Schwarz AMFS Demodulator in B/G and a HP8903A .	The audio signal 1KHz 100mV$_{rms}$ is supplied by the Audio Analyser, demodulated by the Demodulator and the audio analyser measures the AC amplitude of this demodulated audio signal : this value is taken as a reference (0dB). The audio signal is then swept from 50Hz to 15KHz, and demodulated AC amplitude is measured in dB relative to the 1KHz reference. Audio pre-emphasis and de-emphasis circuits are engaged, all audio analyser filters are switched OFF.
Audio Distorsion FM	
Audio : 1Khz, adjustable level Video Black Level This is measured using a Rohde & Schwarz AMFS UHF Demodulator in B/G and a HP8903A Audio Analyser at 1kHz . The output level of the Audio analyser is varied to obtain a deviation of 50kHz indicated on the Demodulator.	The input rms detector of the Audio Analyser converts the ac level of the combined signal + noise + distortion to dc. It then removes the fundamental signal (1kHz) after having measured the frequency. The output rms detector converts the residual noise + distortion to dc. The dc voltmeter measures both dc signals and calculates the ratio in % of the two signals. $ADist = (Distorsion + Noise)/(Distorsion + Noise + Signal)$
Audio Signal to Noise	
Audio : 1Khz, adjustable level Video : EBU Color Bars This is measured using a Rohde & Schwarz AMFS Demodulator in B/G and a HP8903A Audio Analyser at 1kHz . The output level of the Audio analyser is varied to obtain a Modulation Deviation of 25kHz indicated on the AMFS Demodulator.	The Audio Analyser alternately turns ON and OFF it's internal audio source to make a measure of the Audio signal plus noise and then another measure of only the noise. The measurement is made using the internal CCIR468-2 Filter of the Audio Analyser together with the internal 30+/-2kHz (60dB/decade) Lowpass filters. The AMFS demodulator uses a quasi-parallel demodulation as is the case in a normal TV set. In this mode the Nyquist filter is bypassed and the video carrier is used without added delay to effectuate intercarrier conversion. In this mode the phase noise information fully cancels out and the true S/N can be measured $ASN(dB) = 20 \times \log(Signal + Noise)/(Noise)$

13 Modulator Functional Description

13.1 Power ON Settings

At power-ON, the MC44BC374T configuration is as follows:

WRITE MODE	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	ACK
C1—High Order Bits	1	0	0	0	0	0	0	0	ACK
C0—Low Order Bits	0	1	0	0	1	0	0	0	ACK
FM—High Order Bits	0	0	N11	N10	N9	N8	N7	N6	ACK
FL—Low Order Bits	N5	N4	N3	N2	N1	N0	0	0	ACK
Note: N0 to N11 are set to have UHF oscillator on channel 36 (591.25MHz).									
Note: Peak White Clip is ON.									
Note: Sound frequency is 5.5MHz.									
Note: Picture to sound ratio is 12dB.									

NOTE:

This power-ON configuration is not available when modulator is switched ON from STBY pin.

13.2 Power Supply

The three device Vccs (pins 10, 13, 15) must be applied at the same time to ensure all internal blocks are correctly biased. All other pins must not be biased before Vcc is applied to device (except STBY pin during hardware standby mode).

13.3 Standby Modes

During standby mode, the modulator is switched to low power consumption : the sound oscillator, UHF oscillator, video and sound modulator sections bias are internally turned OFF.
The IIC bus section remains active.

Modulator can be switched in standby mode in 2 cases :

- Software standby mode : combination of 3 bits of IIC message :OSC=0, SO=1 and ATT=1
- Hardware standby mode : STBY pin is set to LO state

13.3.1 Hardware/Software Standby Modes

There is an internal logical “OR” function between the hardware and software standby modes:

Hardware Standby Mode	Normal	Normal	Standby	Standby
Software Standby Mode	Normal	Standby	Normal	Standby
Modulator Mode	Normal	Standby	Standby	Standby

NOTE:

When switching from STBY=LO to STBY=HI, the modulator configuration is not guaranteed. An IIC message has to be sent to program the modulator.

13.3.2 STBY Pin Levels

Modulator Mode	Normal	Standby
STBY pin state	HI	LO
STBY pin level	+5V or high impedance	0V

A pull down resistor may be used on STBY pin in order to force an “high impedance” condition into a LO state (ie standby mode condition).

13.4 Transient Output Inhibit

To minimize the risk of interference to other channels while the UHF PLL is acquiring a lock on the desired frequency, the Sound and Video modulators are turned OFF for each of the following three cases:

1. Power-ON from zero (i.e., all Vcc is switched from 0V to 5V).
2. UHF oscillator power-ON from OFF state (i.e., OSC bit is switched from 0 to 1)
3. STBY pin switched from LO state to HI state

There is a time-out of 263ms until the output is enabled. This lets the UHF PLL settle to its programmed frequency. During the 263ms time-out, the sound PLL current source is set to 10µA typical to speed up the locking time. After the 263ms time-out, the current source is switched to 1µA. Use care when selecting loop filter components, to ensure the loop transient does not exceed this delay.

For test purposes, it is possible to disable the 263ms delay using Test Mode1–State1.h.

13.5 Video Section - Peak white clip

The modulator requires:

- A composite video input with negative going sync pulses
- A nominal level of 1Vp-p

This signal is AC-coupled to the video input where the sync tip level is clamped. The video signal is then passed to a Peak White Clip circuit. The PWC circuit function is to soft-clip the top of the video waveform if the “sync tip amplitude” to “peak white clip” goes too high. This method avoids carrier over-modulation by the video. Clipping can be disabled by software.

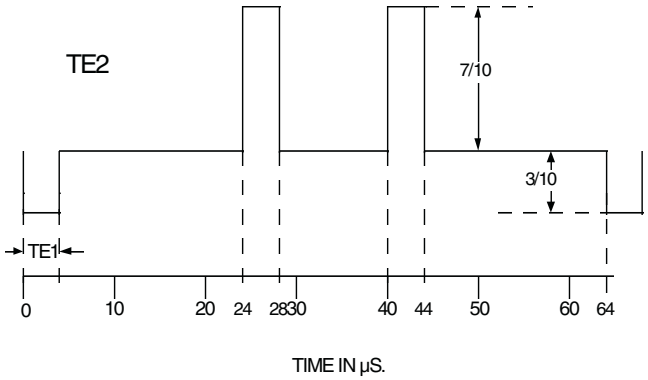
13.6 Sound Section

The multivibrator oscillator is fully integrated and does not require any external components. An internal low-pass filter and matched structure give a very low harmonics level.

The sound modulator system consists of an FM modulator incorporating the sound subcarrier oscillator. The audio input signal is AC-coupled into the amplifier, which then drives both types of modulator. The audio pre-emphasis circuit is a high-pass filter with an external capacitor and an internal resistor (100kOhms). The recommended capacitor value (470pF) is for BG standard; time constant is 50µs.

13.7 Test Pattern Generator

The IC generates a simple test pattern, which can be switched under bus control to permit a TV receiver to easily tune to the modulator output. The pattern consists of two white vertical bars on a black background and a 976Hz audio test signal.



13.8 PLL Section

The reference divider is a fixed divide-by-128, resulting in a reference frequency of 31.25KHz with a 4.0MHz crystal. The 31.25KHz reference frequency is used for both UHF and Sound PLLs.

The prescaler is a fixed divide-by-8 and is permanently engaged. The programmable divider division-ratio is controlled by the state of control bits N0 to N11. The divider-ratio N for a desired frequency F (in MHz) is given by:

$$N = \frac{F}{8} \times \frac{128}{4}$$

with:

$$N = 2048 \times N11 + 1024 \times N10 + \ldots\ldots + 4 \times N2 + 2 \times N1 + N0$$

13.9 UHF Oscillator—VHF range

The UHF oscillator is fully integrated and does not require any external components.

For low frequency testing or VHF range operation (test mode 1, states 1.b to 1.c), the UHF oscillator can be internally divided by: 2, 4, 8, or 16.

13.10 Differences from MC44BC374C device

- “OSC” bit programmation is inverted
- Hardware standby mode is added
- Logic Output Port is not available
- “TB1” bit is not available (limited software compatibility with the MC44355 device)
- Read Mode is not available

14 High Speed I²C Compatible Bus

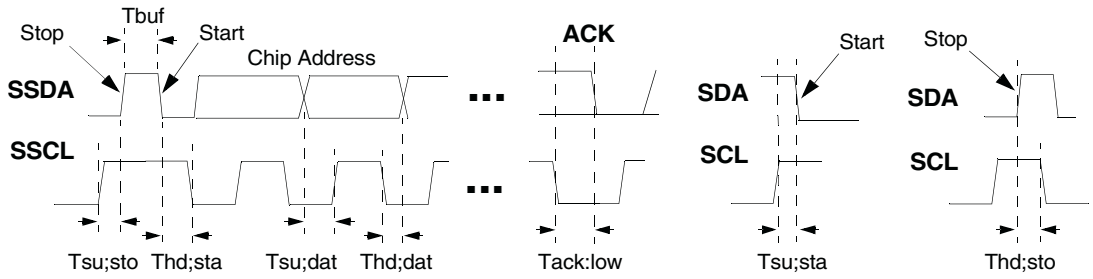
14.1 Specification Conditions

Unless otherwise specified, Vcc1=5.0V, TA=25°C.

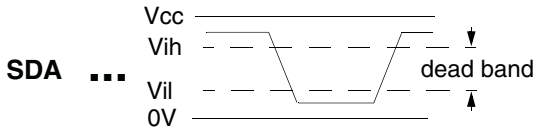
Electrical Characteristics	Min	Typ	Max	Unit	Type
SDA / SCL output current at 0V	—	—	10	μA	A
SDA / SCL low input level	—	—	1.5	V	B
SDA / SCL high input level	3.0	—	—	V	B
SDA/SCL input current for input level from 0.4V to 0.3Vcc	−5	—	5	μA	C
SDA/SCL input level	0	—	Vcc+0,3	V	D
SDA/SCL capacitance	—	—	10	pF	C
ACK low output level (sinking 3mA)	—	0,3	1	V	A
ACK low output level (sinking 15mA)	—	—	1.5	V	C

Timing Characteristics	Min	Typ	Max	Unit	Type
Bus clock frequency	0	—	800	kHz	C
Bus free time between stop and start	200	—	—	ns	C
Setup time for start condition	500	—	—	ns	C
Hold time for start condition	500	—	—	ns	C
Data setup time	0	—	—	ns	C
Data hold time	0	—	—	ns	C
Setup time for stop condition	500	—	—	ns	C
Hold time for stop condition	500	—	—	ns	C
Acknowledge propagation delay	—	—	300	ns	C
SDA fall time at 3ma sink I and 130pF load	—	—	50	ns	C
SDA fall time at 3ma sink I and 400pF load	—	—	80	ns	C
SDA rise time	—	—	300	ns	C
SCL fall/rise time	—	—	300	ns	C
Pulse width of spikes suppressed by the input filter	—	—	50	ns	C

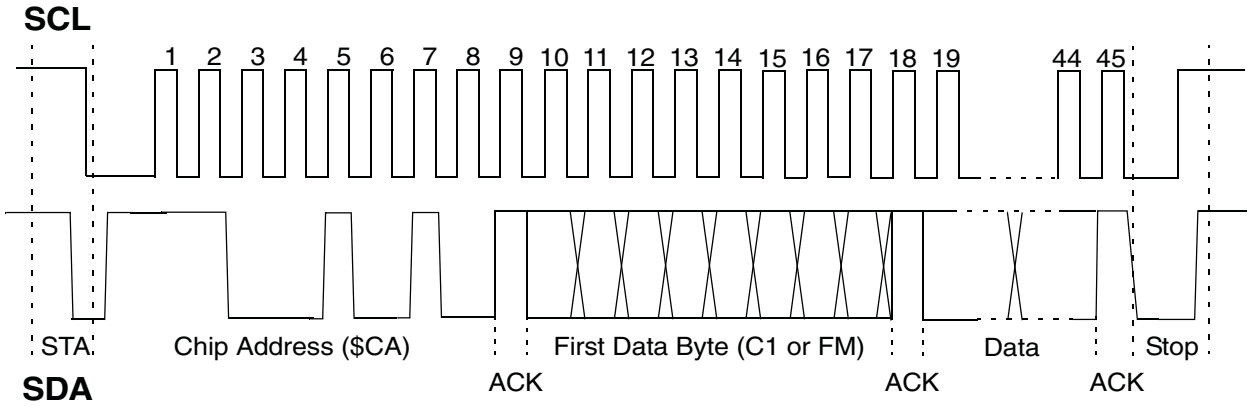
14.2 Timings Definition



14.3 Levels Definition



14.4 High Speed I²C Compatible Bus Format



14.5 I²C Write Mode Format and Bus Receiver

The bus receiver operates the I²C compatible data format. The chip address (I²C bus) is:

1 1 0 0 1 0 1 0 (ACK) = $CA (hex) in write mode

In write mode, each ninth data bit (bits 9, 18, 27, 36, and 45) is an acknowledge bit (ACK) during which the MCU sends a logic 1 and the Modulator circuit answers on the data line by pulling it low. Besides the chip address, the circuit needs two (2) or four (4) data bytes for operation. The following sequences of data bytes are the permitted incoming information:

Example 1	STA	CA	C1	C0	STO		
Example 2	STA	CA	FM	FL	STO		
Example 3	STA	CA	C1	C0	FM	FL	STO
Example 4	STA	CA	FM	FL	C1	C0	STO

With:

STA = Start condition
CA = Chip Address
FM = Frequency information, high order bits
FL = Frequency information, low order bits
C1 = Control information, high order bits
CO = Control information, low order bits
STO = Stop condition

After the chip address, two (2) or four (4) data bytes may be received.

- If three (3) data bytes are received, the third one is ignored.
- If five (5) or more data bytes are received, the fifth and following ones are ignored, and the last ACK pulse is sent at the end of the fourth data byte.

The first and third data bytes contain a function bit, which lets the IC distinguish between frequency information and control information. If the function bit is a logic 1, the two following bytes contain control information. The first data byte after the chip address, may be byte CO or byte FM. The two bytes of frequency information are preceded by a logic 0.

15 Pin Circuit Schematics

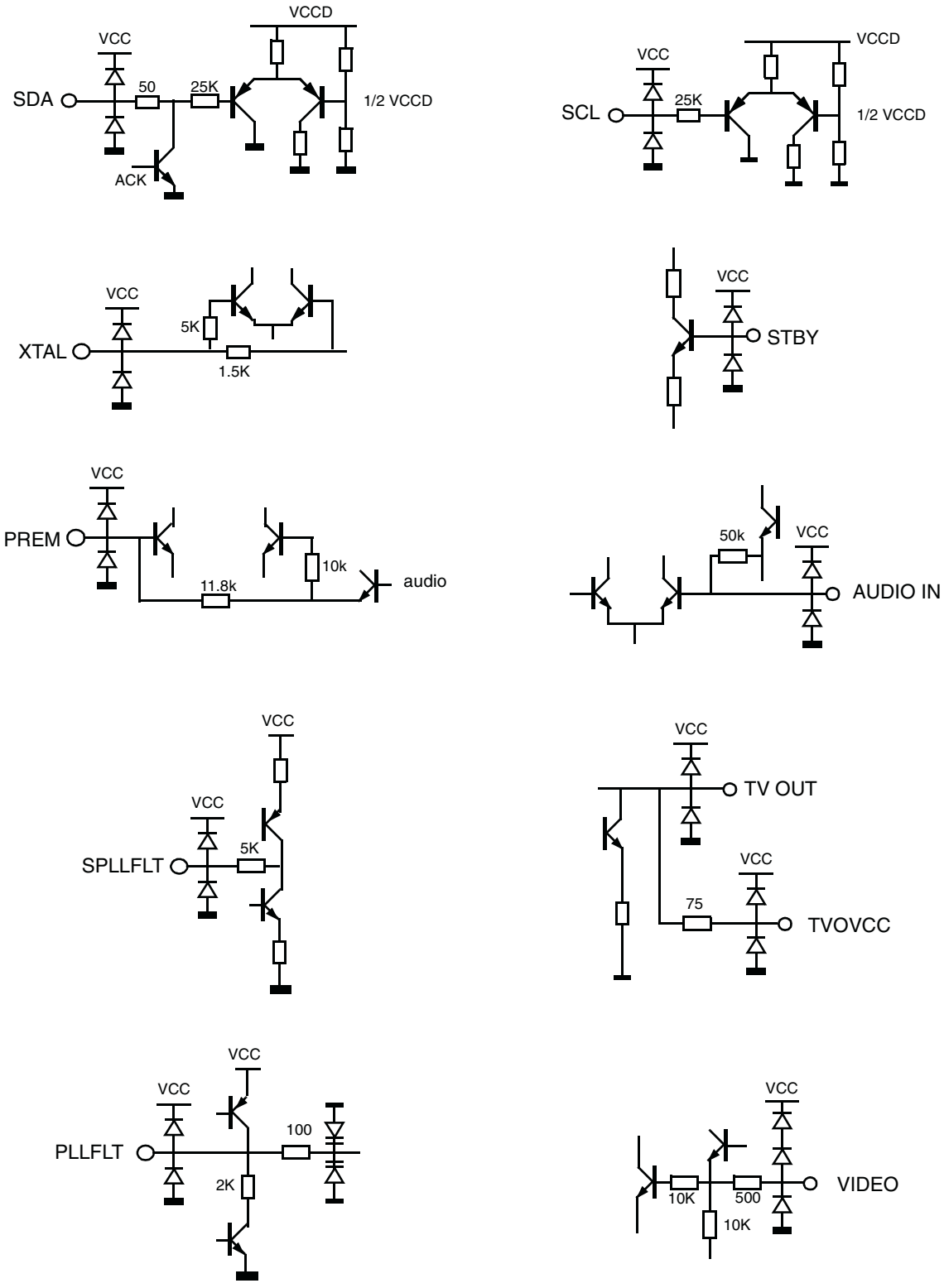
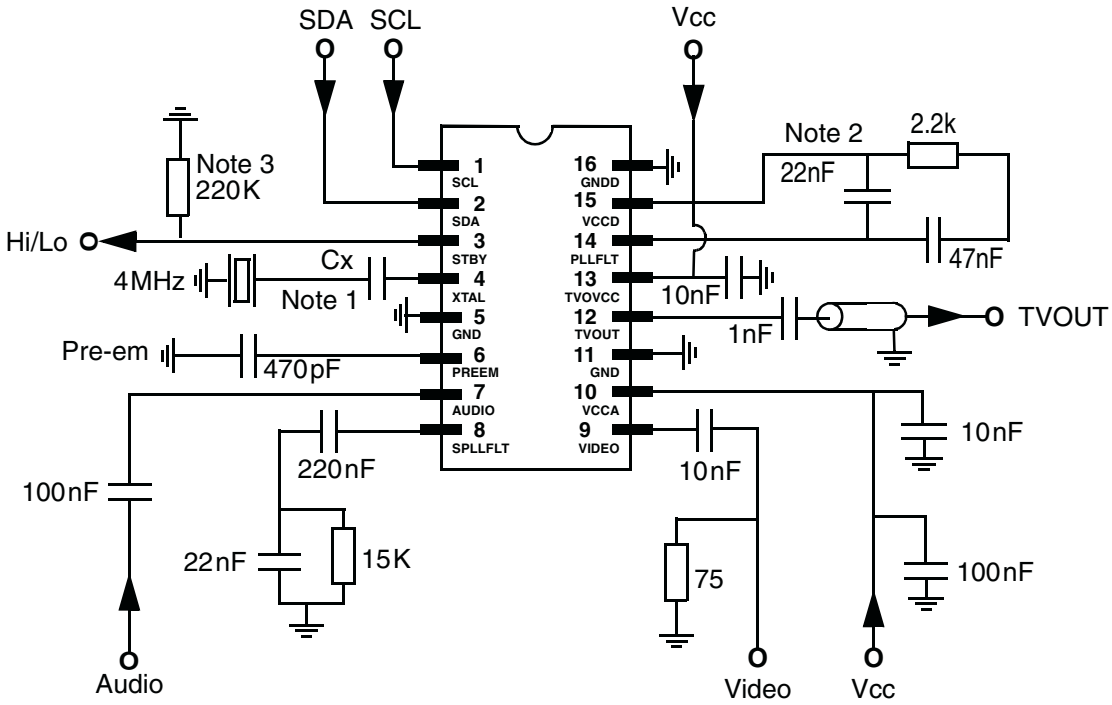


Figure 6. Pin Circuit Schematics

16 Application and Case Diagrams

16.1 Proposed BiCMOS Modulator Application

This document contains information on a new product under development.
Motorola reserves the right to change or discontinue this product without notice.

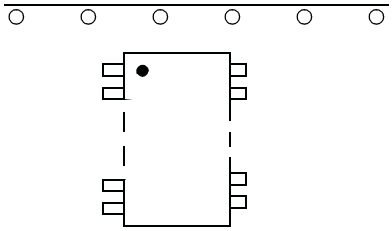


Note 1: Cx value depends on crystal characteristics; Cx = 27pF on Motorola application board.
Note 2: Loop Filter components must be as close as possible to pins 14 and 15
Note 3: The 220K pull down resistor set the STBY pin “open” condition to “standby mode”.
If not connected, the “open” condition is “normal mode”

Figure 7. Proposed MC44BC374T Application Schematic

16.2 Packaging Instructions

Tape and reel packaging per 12MRH00360A with the following conditions applicable for Dual In-Line SOP (SOIC) package.



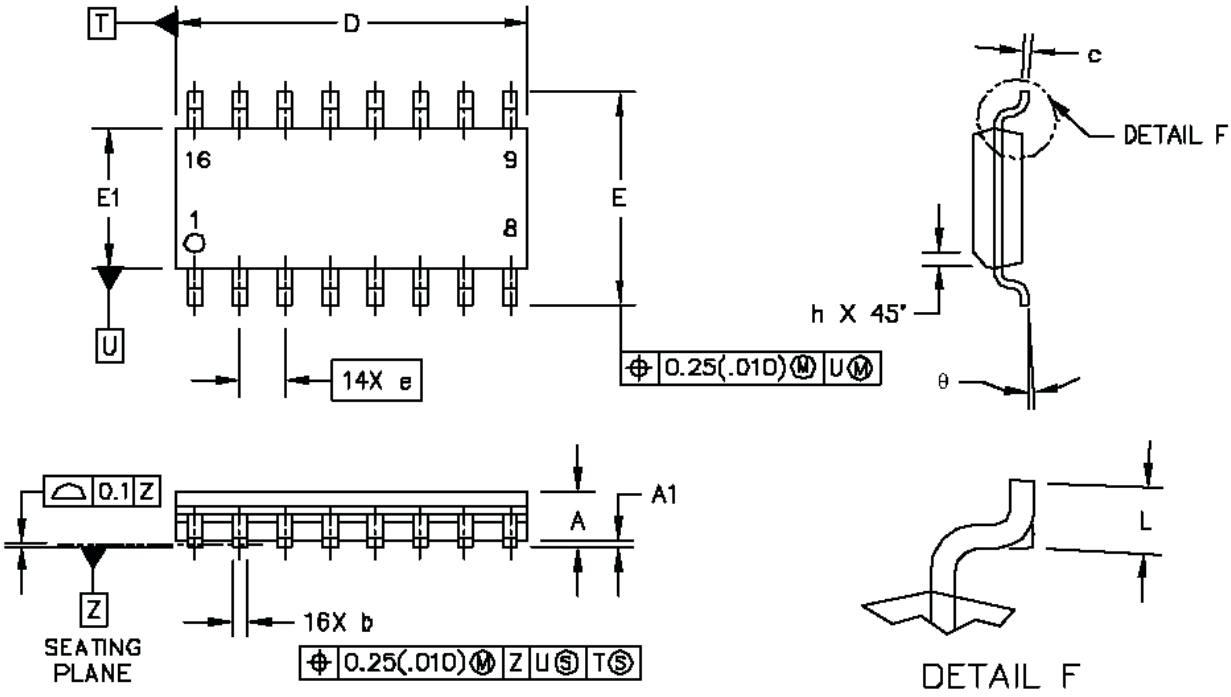
Component Orientation: Arrange parts with the pin 1 side closest to the tape's round sprocket holes on the tape's trailing edge.

16.3 Marking Instructions

SO16NB Package

Bar marked part way accross Pin 1 end of package. Bar width 10 to 20 mils, length to be at least four times Bar width. Bar placement may extend across chamfer and dimple areas.

- 1st line: **44BC374T** for MC44BC374T device (Part number coded on 10 digits)
- 2nd line:
  Assembly site code AW (2 digits) followed by the
  wafer lot code L (1 digit),
  year Y (1 digit) and
  work week WW (2 digits)



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	1.35	1.75	0.054	0.068
A1	0.1	0.25	0.004	0.009
D	9.8	10	0.385	0.393
E	5.8	6.2	0.229	0.244
E1	3.8	4	0.150	0.157
b	0.35	0.49	0.014	0.019
c	0.19	0.25	0.008	0.009
e	1.27 BSC		0.050 BSC	
L	0.4	1.25	0.016	0.049
h	0.25	0.5	0.010	0.019
Q	0^o	7^o	0^o	7^o

Note: 1. Dimensioning and Tolerancing per ASME Y14.5M, 1994.

Note: 2. Controlling dimension: Millimeters.

Note: 3. Dimension D and E1 do not include mold protrusion.

Note: 4. Maximum mold protrusion 0.15 (0.006) per side.

Note: 5. Dimension b does not include Dambar protrusion. Allowable Dambar protrusion shall be 0.127 (0.005) total in excess of the b dimension at maximum material condition.

Figure 8. SO16NB Package

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