DATA SHEET

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1876

US MTS DECODER

DESCRIPTION

The μPC1876 is an integrated circuit for US MTS (Multi Channel Television Sound) system. All functions for US MTS system are provided on one chip. The μPC1876 has built-in SAP (Sub Audio Program) discrimination error protection circuit.

FEATURES

- BTSC (USA) standard demodulator (Stereo demodulation and TV-dbx noise reduction)
- Only four adjustments (2 separation, 1 stereo VCO, 1 filter)
- Supply voltage: 8 V to 10 V
- Circuit current: 27 mA TYP. (Supply voltage: 9 V)
- Input and output level (L+R, 100% modulation)
  Input level: 0.42 V_{p-p}
  Output level: 1.41 V_{p-p}

APPLICATION

- TV sets and VCRs for North America

ORDERING INFORMATION

Part Number	Package
μPC1876GT	42-pin plastic SSOP (9.53 mm (375))

The μPC1876 is available only to licensees of THAT Corporation.
Please contact: (03) 5790-5391 (Japan)
(508) 229-2500 (USA)

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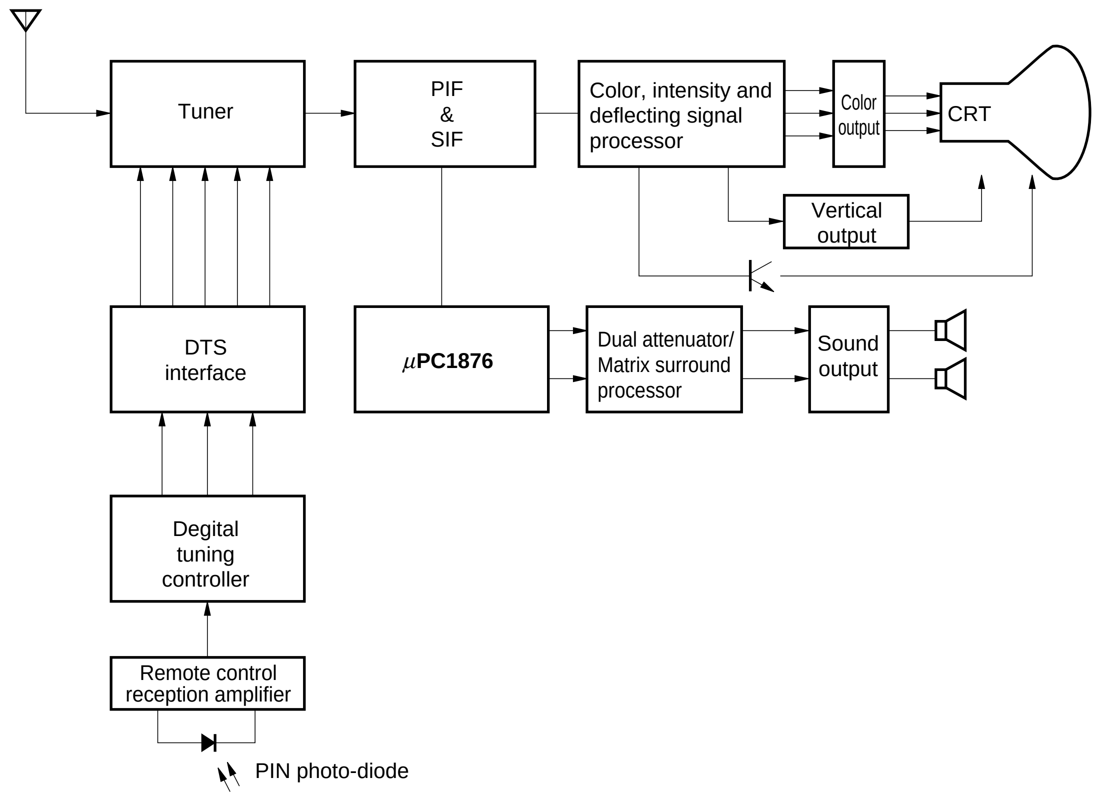
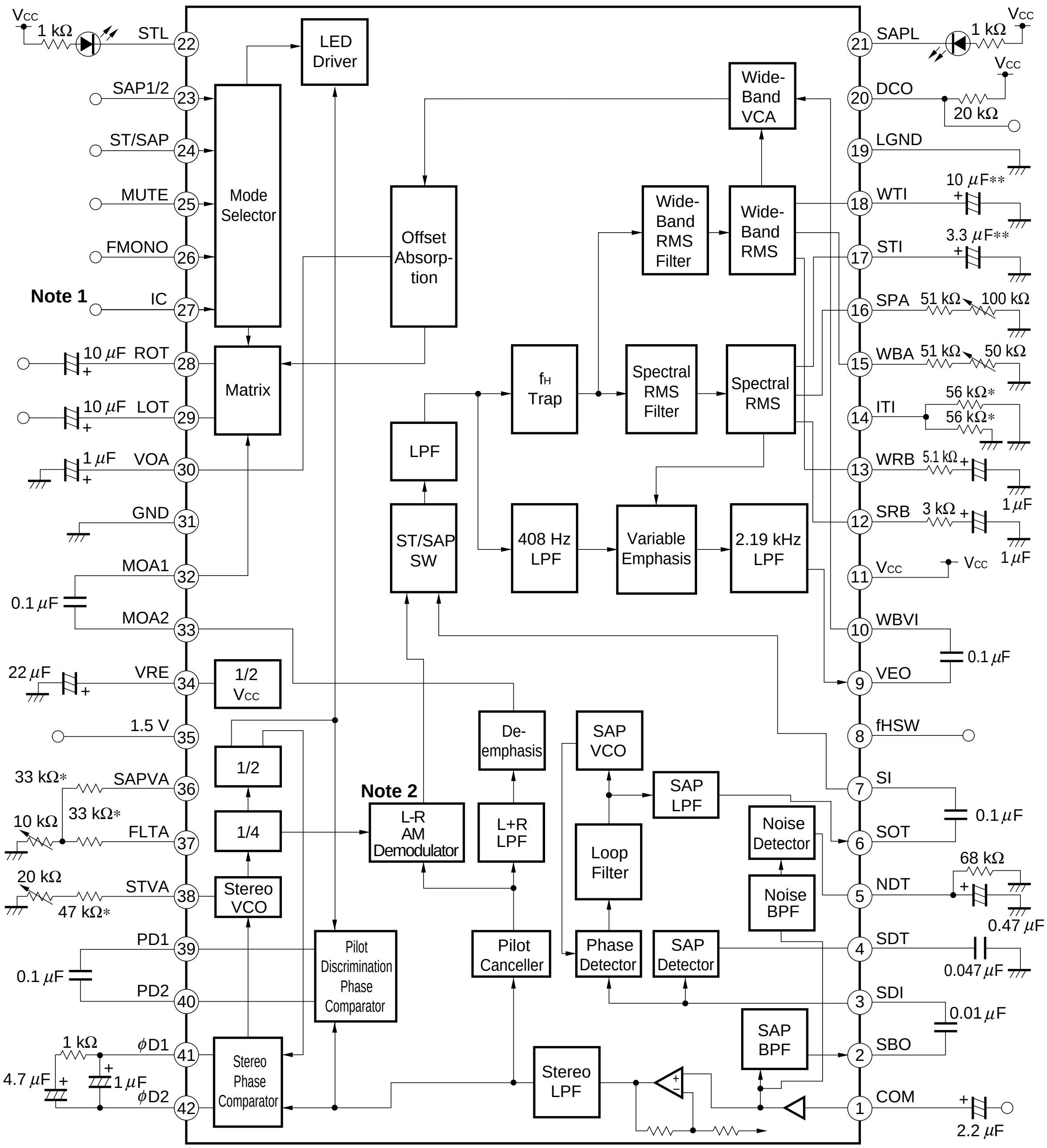
The mark ★ shows major revised points.

SYSTEM BLOCK DIAGRAM (TV)



BLOCK DIAGRAM



Notes 1. Do not leave the Internally Connected (IC) pin open because it is a base-open pin. Connect this pin to Vcc or GND.

2. Am: Amplitude modulation (Carrier frequency is 31.5 kHz (2fH))

Remark Use the following for external parts.

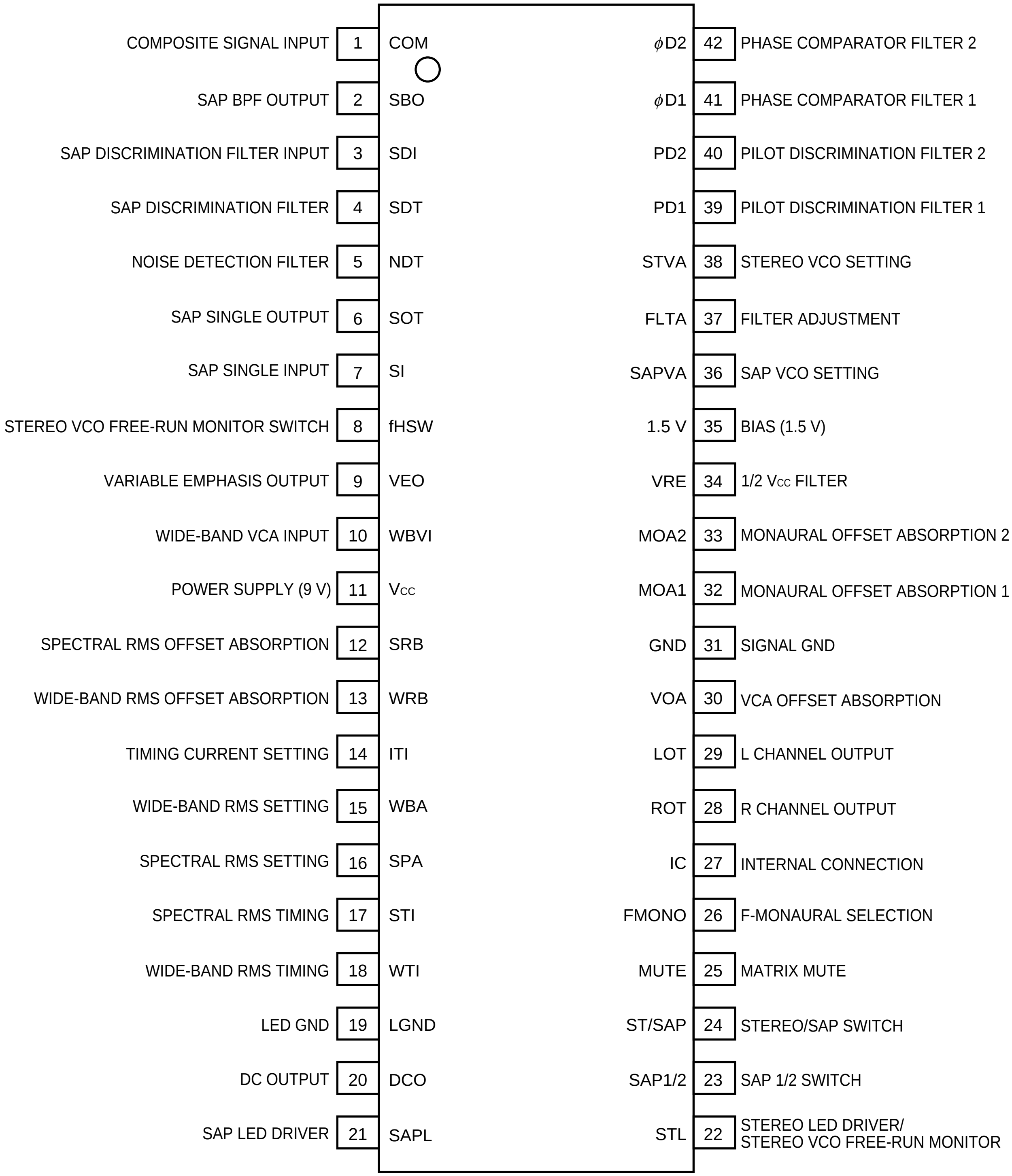
Resistor (*) : Metal film resistor (±1%). Unless otherwise specified; ±5%

Capacitors (**) : Tantalum capacitor (±10%). Unless otherwise specified; ±20%

Variable resistors: ±10%

PIN CONFIGURATION (Top View)

42-pin plastic SSOP (9.53 mm (375))



CONTENTS

1. INTERNAL EQUIVALENT CIRCUITS

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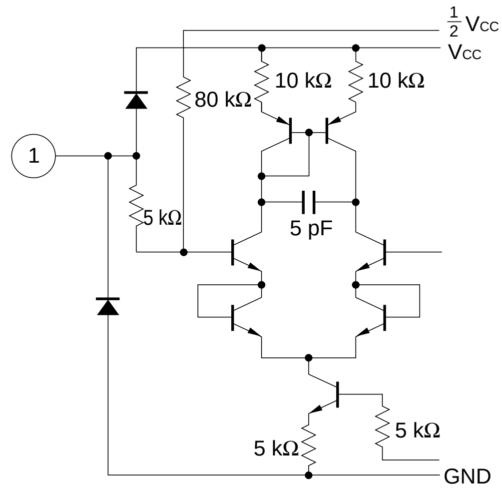
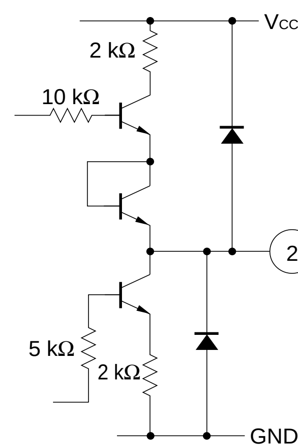
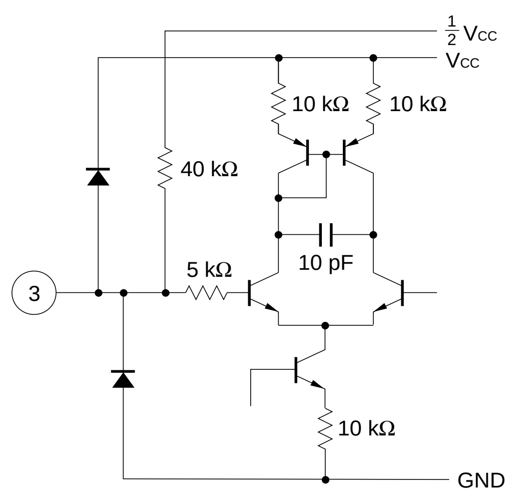
<table>
<tr><th>Pin Number</th><th>Pin Name</th><th>Symbol</th><th>Internal Equivalent Circuit</th></tr>
<tr><td>1</td><td>COMPOSITE SIGNAL INPUT</td><td>COM</td><td></td></tr>
<tr><td>2</td><td>SAP BPF OUTPUT</td><td>SBO</td><td></td></tr>
<tr><td>3</td><td>SAP DISCRIMINATION FILTER INPUT</td><td>SDI</td><td></td></tr>
</table>

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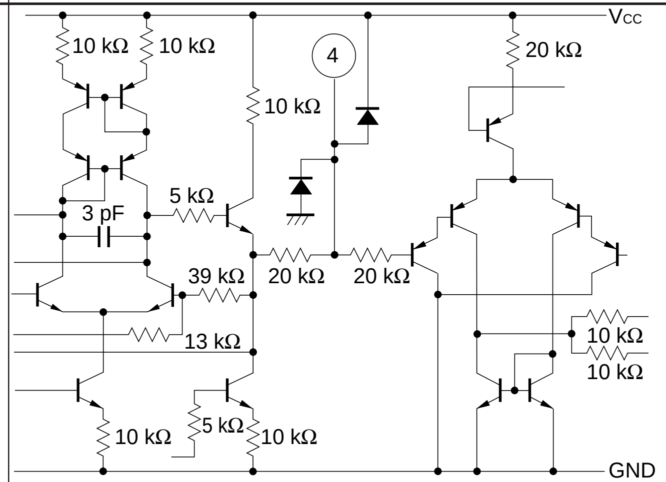
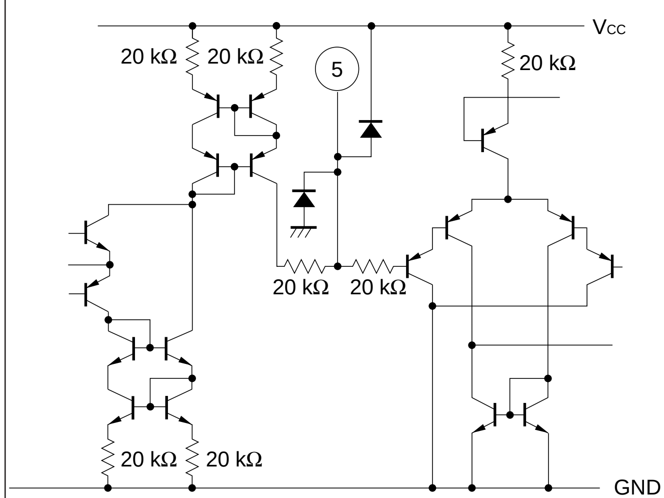
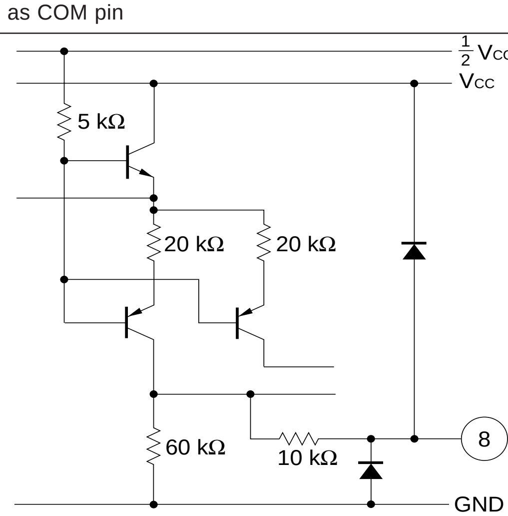
Pin Number	Pin Name	Symbol	Internal Equivalent Circuit
4	SAP DISCRIMINATION FILTER	SDT	
5	NOISE DETECTION FILTER	NDT	
6	SAP SINGLE OUTPUT	SOT	Same as SBO pin
7	SAP SINGLE INPUT	SI	Same as COM pin
8	STEREO VCO FREE-RUN MONITOR SWITCH	fHSW	
9	VARIABLE EMPHASIS OUTPUT	VEO	Same as SBO pin
10	WIDE-BAND VCA INPUT	WBVI	Same as COM pin
11	POWER SUPPLY (9 V)	Vcc	

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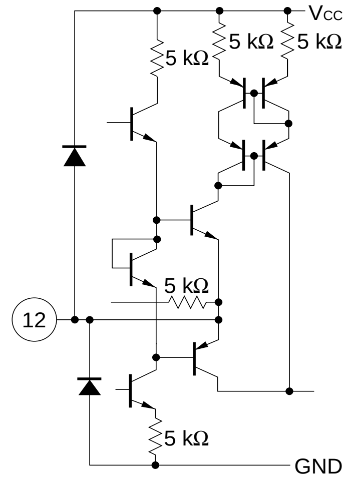
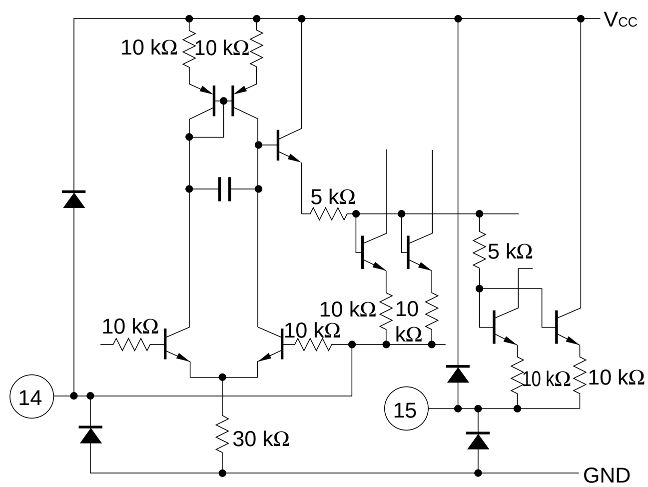
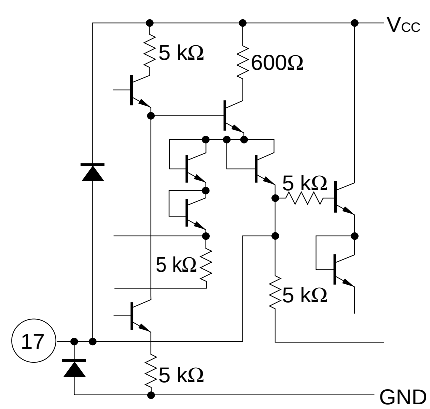
Pin Number	Pin Name	Symbol	Internal Equivalent Circuit
12 13	SPECTRAL RMS OFFSET ABSORPTION WIDE-BAND RMS OFFSET ABSORPTION	SRB WRB	Pin 13 is the same as pin 12. 
14 15 16	TIMING CURRENT SETTING WIDE-BAND RMS SETTING SPECTRAL RMS SETTING	ITI WBA SPA	Pin 16 is the same as pin 15. 
17	SPECTRAL RMS TIMING	STI	
18	WIDE-BAND RMS TIMING	WTI	Same as STI pin

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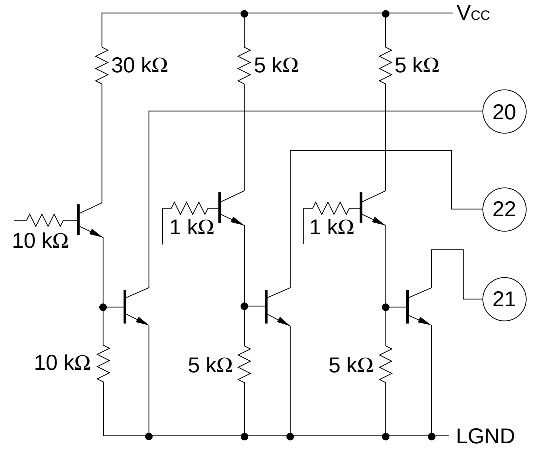
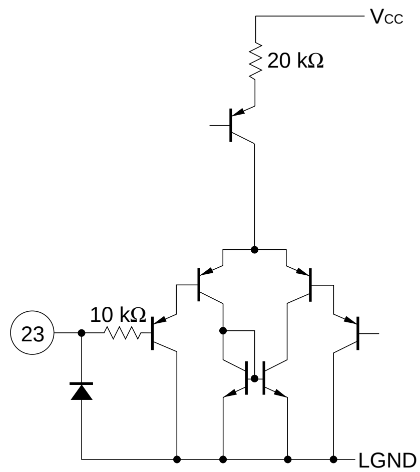
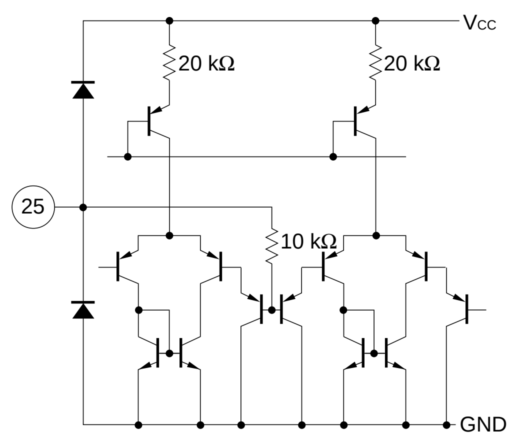
Pin Number	Pin Name	Symbol	Internal Equivalent Circuit
19	LED GND	LGND	
20 21 22	DC OUTPUT SAP LED DRIVER STEREO LED DRIVER/ STEREO VCO FREE-RUN MONITOR	DCO SAPL STL	
23	SAP1/2 SWITCH	SAP1/2	
24	STEREO/SAP SWITCH	ST/SAP	Same as SAP1/2 pin
25	MATRIX MUTE	MUTE	
26	F-MONAURAL SELECTION	FMONO	Same as MUTE pin
27	INTERNAL CONNECTION	IC	Same as MUTE pin[Note]

Note Do not leave the Internally Connected (IC) pin open because it is a base-open pin. Connect this pin to V_{CC} or GND.

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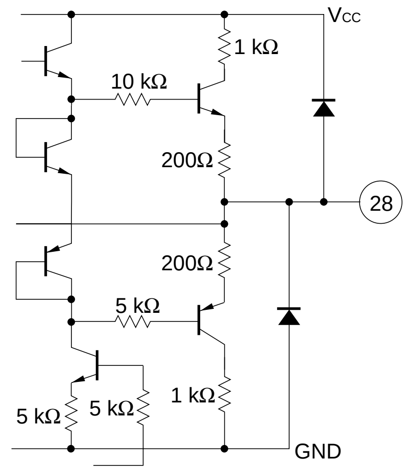
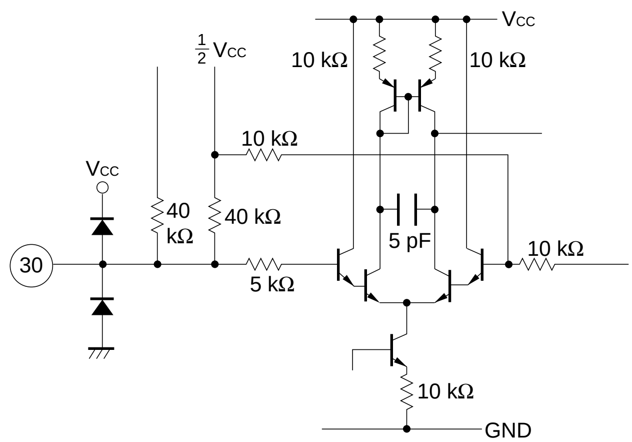
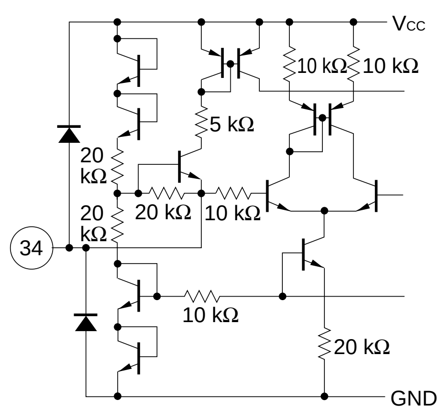
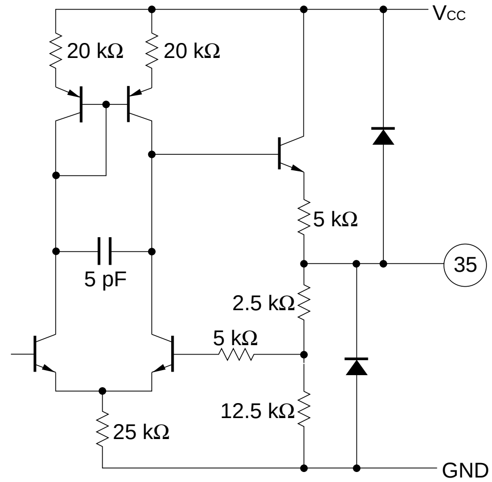
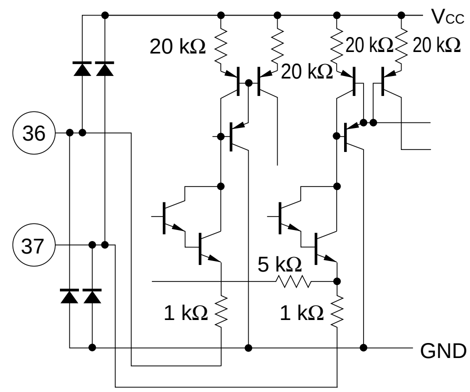
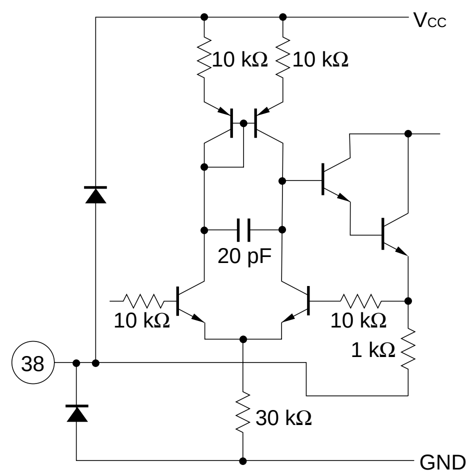
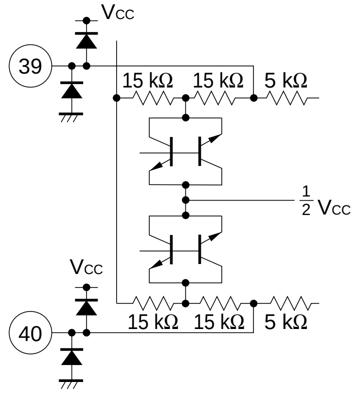
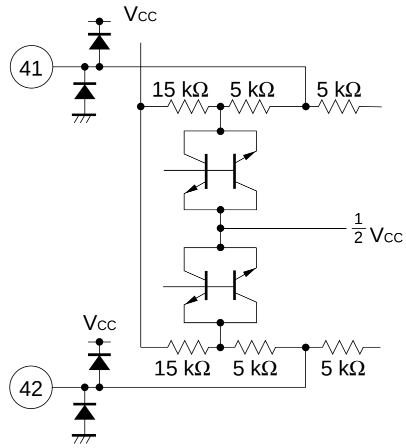
Pin Number	Pin Name	Symbol	Internal Equivalent Circuit
28	R CHANNEL OUTPUT	ROT	
29	L CHANNEL OUTPUT	LOT	Same as ROT pin
30	VCA OFFSET ABSORPTION	VOA	
31	SIGNAL GND	GND	
32	MONAURAL OFFSET ABSORPTION 1	MOA1	Same as COM pin
33	MONAURAL OFFSET ABSORPTION 2	MOA2	Same as SBO pin
34	1/2 VCC FILTER	VRE	

(6/7)

Pin Number	Pin Name	Symbol	Internal Equivalent Circuit
35	BIAS (1.5 V)	1.5 V	
36 37	SAP VCO SETTING FILTER ADJUSTMENT	SAPVA FLTA	
38	STEREO VCO SETTING	STVA	

(7/7)

Pin Number	Pin Name	Symbol	Internal Equivalent Circuit
39 40	PILOT DISCRIMINATION FILTER 1 PILOT DISCRIMINATION FILTER 2	PD1 PD2	
41 42	PHASE COMPARATOR FILTER 1 PHASE COMPARATOR FILTER 2	φD1 φD2	

2. FUNCTION OF EACH BLOCK

In the US, TV audio signals are broadcast in FM modulation. The stereo (L–R), Sub Audio Program (SAP) and telemetry signals are multiplexed in a higher frequency band than the monaural (L+R) signal (50 Hz to 15 kHz).

The US MTS system base-band spectrum is described before:

Figure 2-1. US MTS System Base-Band Spectrum

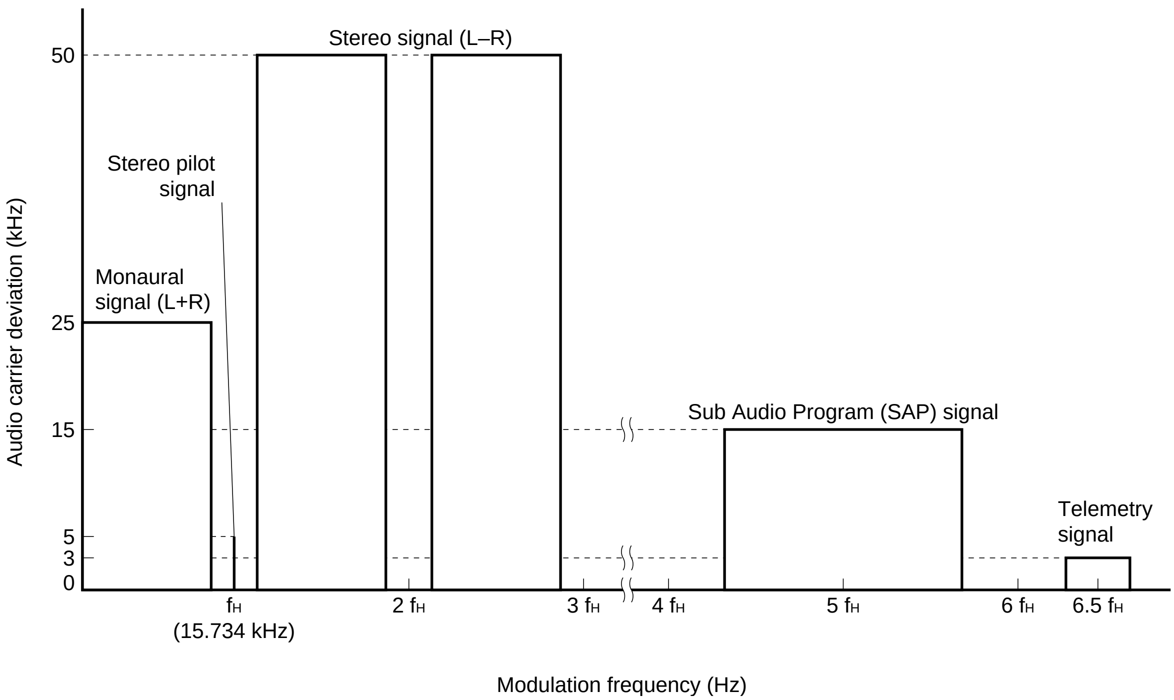


Table 2-1. US MTS System Base-Band Spectrum

		Signal frequency band	Signal processing system	Maximum audio carrier deviation (kHz)
Monaural signal (L+R)		50 Hz to 15 kHz		25
Stereo pilot signal		15.734 kHz	Only stereo broadcasting	5
Stereo signal (L–R)		50 Hz to 15 kHz	AM modulation (carrier frequency 2 f_H), dbx noise reduction processing	50
Sub Audio Program (SAP) signal		50 Hz to 10 kHz	FM modulation (carrier frequency 5 f_H, maximum frequency deviation 10 kHz) dbx noise reduction processing	15
Telemetry signal	Audio	0 to 3.4 kHz	FM modulation (carrier frequency 6.5 f_H, maximum frequency deviation 3 kHz)	3
	Data	0 to 1.5 kHz		

2.1 Stereo Demodulation Block

(1) Stereo LPF

Filter eliminates the Sub Audio Program (SAP) signal (5 f_H) and telemetry signal (6.5 f_H) residing anywhere around 5 to 6 f_H.

The internal L–R demodulator, which uses the double-balanced circuit, demodulates L–R signal by multiplication of L–R signal with the signal at L–R carrier frequency (2 f_H). The L–R signal tends to be interfered by the 6 f_H signal because a square waveform is used as the switching carrier in this method. To eliminate the interference, the μPC1876 incorporates 5 f_H and 6 f_H traps.

Adjust the current value output from the FLTA pin for the filter response.

(2) Stereo phase comparator

The 8 f_H signal generated at the stereo VCO is divided by 8 (4×2) and then multiplies it with the pilot signal passed through the stereo LPF. The two signals differ from each other by 90 degrees in terms of phase.

The resistor and capacitor connected to the ϕD1 and ϕD2 pins form a filter which smoothes the phase error signal output from the phase comparator, converting the error signal to the DC voltage. When the voltage difference between the ϕD1 and ϕD2 pins becomes 0 V (strictly speaking, not 0 V by the internal offset voltage), the stereo VCO runs at 8 f_H.

The lag/lead filter externally connected to the ϕD1, ϕD2 pins determines the capture range.

(3) Stereo VCO

Runs at 8 f_H with the internal capacitor. Adjust the current value output from the STVA pin for the frequency.

(4) Divider (Flip-flop)

Produces the inphase f_H signal and the f_H signal which is different 90 degrees from the input pilot signal by dividing the 8 f_H frequency by 4×2 from the stereo VCO.

(5) Pilot discrimination phase comparator (Level detector)

Multiplies the pilot signal from the COM pin with the inphase f_H signal from the divider. The produced signal is applied to the external filter connected to the PD1, PD2 pins. The signal is smoothed out to make DC voltage for judging whether to turn on or off the stereo LED.

(6) Pilot canceller

The f_H signal from the divider is added in the stereo signal at the resistor matrix depending on the level of the input pilot signal to cancel the pilot signal.

(7) L+R LPF

This LPF, having traps at f_H and 24 kHz each, allows only the monaural signal to pass through. The filter response is adjusted by the current value output from the FLTA pin.

(8) De-emphasis

75 μs de-emphasis filter for the monaural signal. The filter response is adjusted by the current value output from the FLTA pin.

(9) L–R AM demodulator

Demodulates the L–R AM-DSB modulated signal by multiplying with the 2f_H signal which is synchronized to the pilot signal. The 2 f_H square wave is used as the switching carrier.

2.2 SAP Demodulation Block

(1) SAP BPF

Picks up the SAP signal by the 50 kHz and 102 kHz traps, and response peak at 5 f_H.
Adjust the current value output from the FLTA pin for the filter response.

(2) Noise BPF

The μPC1876 monitors signals picked up by noise BPF ($f_O \cong$ 180 kHz), and distinguish noises from signals. By this method, the μPC1876 prevents misoperating on SAP detection in a weak electric field.
Adjust the current value output from the FLTA pin for the filter response.

(3) Noise detector

Performs full-wave rectification of noise which has passed through noise BPF to change it to the DC voltage and input it to comparator. When the noise level exceeds the reference level, the stereo LED and SAP LED are turned off, and the stereo and SAP demodulation are stopped.
Adjust the value of the resistor and capacitor connected to the NDT pin for the sensitivity and time constant of the noise detection circuit.

(4) SAP detector

Performs synchronized detection of the SAP signal which has passed through the SAP BPF, and smoothes it with the SDT pin and input it to the comparator. When receiving the SAP signal, the SAP LED is turned on.

(5) SAP demodulator

The SAP demodulator consists of the phase detector, loop filter, and SAP VCO (PLL detection circuit).
The SAP VCO oscillates at 10 f_H, and performs phase comparison between the signal divided by 2 of the SAP VCO frequency and the SAP signal to make the PLL loop. Adjust the current value output from the SAPVA pin for the frequency of the SAP VCO.

(6) SAP LPF

Eliminates the SAP carrier and higher frequency buzz. The filter consists of a secondary LPF and f_H trap filter.
Adjust the current value output from the FLTA pin for the filter response.

2.3 dbx Noise Reduction Block

All the filters required for the TV-dbx noise reduction are incorporated. Adjust the current value output from the FLTA pin for these filter responses.

(1) LPF

The LPF has traps at f_H and 24 kHz each. The f_H trap filter minimizes interference to the dbx noise reduction by the f_H signal which is not synchronized with the pilot signal (e.g. leakage of the synchronous idle and buzz from the video signal).

(2) 408 Hz LPF

A de-emphasis filter. The transfer function is as follows:

$$T(f) = \frac{1 + j\dfrac{f}{5.23\ k}}{1 + j\dfrac{f}{408}}$$

(3) Variable emphasis

Also called spectral VCA and controlled by the spectral RMS. The transfer function is as follows:

$$S^{-1}(f,\ b) = \frac{1 + j\dfrac{f}{20.1\ k}\cdot\dfrac{1+51\ b}{b+1}}{1 + j\dfrac{f}{20.1\ k}\cdot\dfrac{1+51}{b+1}}$$

b: Variable transferred from the spectral RMS for controlling

(4) Wide band VCA

A VCA whose operating frequency range is mainly low to mid frequencies and controlled by the wide band RMS. The transfer function is as follows:

$$W^{-1}(a) = a$$

a: Variable transferred from the wide-band RMS for controlling

(5) 2.19 kHz LPF

A de-emphasis filter. The transfer function is as follows:

$$T(f) = \frac{1 + j\dfrac{f}{6.25\ k}}{1 + j\dfrac{f}{2.19\ k}}$$

(6) Spectral RMS filter

A filter that limits the band width of the signal input to the RMS which controls the variable emphasis. The transfer function is as follows:

$$T(f) = \frac{\left(j\dfrac{f}{7.66\ k}\right)^2}{1 + j\dfrac{f}{7.31\ k} + \left(j\dfrac{f}{7.66\ k}\right)^2}\cdot\frac{j\dfrac{f}{3.92\ k}}{1 + j\dfrac{f}{3.92\ k}}$$

(7) Wide-band RMS filter

A filter that limits the band width of the signal input to the wide-band RMS which controls the wide band VCA. The transfer function is as follows:

$$T(f) = \frac{1}{1 + j\dfrac{f}{2.09\ k}}$$

(8) Spectral RMS

Detects the RMS value of the signal which has passed through the spectral RMS filter and converts the signal to the DC voltage. The timing (release time) is determined by the current inside the μPC1876 (I_T) and the capacitance of the external capacitor connected to the STI pin. Set I_T by the current value output from ITI pin.

(9) Wide band RMS

Detects the RMS value of the signal which has passed through the wide band RMS filter and converts the signal to the DC voltage. The timing (release time) is determined by the current inside the μPC1876 (I_T) and the capacitance of the external capacitor connected to the WTI pin. Set I_T by the current value output from ITI pin for the setting of I_T.

2.4 Matrix Block

(1) Matrix

Adds L+R signal and L–R signal to output L signal and subtracts L+R signal from L–R signal to output R signal.

(2) Mode selector

Selects the user selected mode among the monaural, stereo, SAP signals, and mute, and outputs it from the ROT and LOT pins.

3. EXPLANATION OF EACH FUNCTION

Caution Apply bias voltage to the F-MONAURAL SELECTION pin, the MATRIX MUTE pin, the SAP 1/2 pin and the STEREO/SAP SWITCH pin. Don't leave those pins unconnected because those pins are base open. Loss current is 0.1 μA or less.

Mode matrix table is shown in 3.1, and functions of mode switch pins are explained in 3.2 to 3.5.

3.1 Mode Matrix Table

L, R SIGNAL OUTPUT pin matrix table

<table>
<tr><th rowspan="2">Broadcasting mode</th><th colspan="3">Control pin</th><th colspan="2">Output</th><th colspan="2">LED ON/OFF</th><th rowspan="2">DC OUTPUT</th></tr>
<tr><th>F-MONAURAL SELECTION</th><th>STEREO/SAP SWITCH</th><th>SAP1/2 SWITCH</th><th>L CHANNEL OUTPUT</th><th>R CHANNEL OUTPUT</th><th>STEREO LED</th><th>SAP LED</th></tr>
<tr><td>Monaural</td><td>–</td><td>–</td><td>–</td><td colspan="2">L + R</td><td>OFF</td><td>OFF</td><td>L</td></tr>
<tr><td rowspan="3">Stereo</td><td>H</td><td>–</td><td>–</td><td>L</td><td>R</td><td>ON</td><td rowspan="3">OFF</td><td rowspan="3">L</td></tr>
<tr><td>M</td><td>–</td><td>–</td><td colspan="2" rowspan="2">L + R</td><td>OFF</td></tr>
<tr><td>L</td><td>–</td><td>–</td><td>ON</td></tr>
<tr><td rowspan="5">Monaural + SAP</td><td rowspan="3">H</td><td>H</td><td>–</td><td colspan="2">L + R</td><td rowspan="5">OFF</td><td rowspan="3">ON</td><td rowspan="3">H</td></tr>
<tr><td rowspan="2">L</td><td>H</td><td>L + R</td><td>SAP</td></tr>
<tr><td>L</td><td colspan="2">SAP</td></tr>
<tr><td>M</td><td>–</td><td>–</td><td colspan="2" rowspan="2">L + R</td><td>OFF</td><td>L</td></tr>
<tr><td>L</td><td>–</td><td>–</td><td>ON</td><td>H</td></tr>
<tr><td rowspan="5">Stereo + SAP</td><td rowspan="3">H</td><td>H</td><td>–</td><td>L</td><td>R</td><td rowspan="3">ON</td><td rowspan="3">ON</td><td rowspan="3">H</td></tr>
<tr><td rowspan="2">L</td><td>H</td><td>L + R</td><td>SAP</td></tr>
<tr><td>L</td><td colspan="2">SAP</td></tr>
<tr><td>M</td><td>–</td><td>–</td><td colspan="2" rowspan="2">L + R</td><td>OFF</td><td>OFF</td><td>L</td></tr>
<tr><td>L</td><td>–</td><td>–</td><td>ON</td><td>ON</td><td>H</td></tr>
</table>

Remark When the noise detector detects noise, both the stereo and the SAP demodulation circuit stop.
The noise detector of the μPC1876 detects noise near 180 kHz that is 30 $mV_{r.m.s.}$ (TYP.) or higher.

3.2 MATRIX MUTE Pin

The MATRIX MUTE pin controls muting of each output pin at muting operation.

Input signal level of the MATRIX MUTE	R CHANNEL OUTPUT L CHANNEL OUTPUT	SAP LED STEREO LED
H	Mute is ON	OFF
L	Mute is OFF	ON

3.3 F-MONAURAL SELECTION Pin

When the F-MONAURAL SELECTION is ON, the R CHANNEL OUTPUT and L CHANNEL OUTPUT output monaural (L+R) signal regardless of broadcasting mode.

The μPC1876 varies in pin function of the F-MONAURAL SELECTION.

Output pin / Input signal level of the F-MONAURAL SELECTION	R CHANNEL OUTPUT L CHANNEL OUTPUT
H	OFF
M	ON
L	

3.4 STEREO/SAP SWITCH Pin

Selecton pin of the L CHANNEL OUTPUT and R CHANNEL OUTPUT (Stereo signal/SAP signal).

Output pin / Input signal level of the STEREO/SAP SWITCH	R CHANNEL OUTPUT L CHANNEL OUTPUT
H	Stereo signal
L	SAP signal

3.5 SAP 1/2 SWITCH Pin

Selection pin of the L CHANNEL OUTPUT and R CHANNEL OUTPUT (SAP 1 mode/SAP 2 mode) when the STEREO/SAP SWITCH is L level (SAP signal is selected).

Input signal level of the SAP 1/2 SWITCH	Mode	L CHANNEL OUTPUT	R CHANNEL OUTPUT
H	SAP2	L + R signal	SAP signal
L	SAP1	SAP signal	

4. PRECAUTIONS

4.1 Impedance of Input Pins and Output Pins

Each impedance of input and output pins are the following.

	Pin name	Impedance
Input	COMPOSITE SIGNAL INPUT	80 kΩ
	SAP DISCRIMINATION FILTER INPUT	40 kΩ
	SAP SINGLE INPUT	80 kΩ
	WIDE BAND VCA INPUT	80 kΩ
	MONAURAL OFFSET ABSORPTION 1	80 kΩ
Output	SAP BPF OUTPUT	360 Ω
	SAP SINGLE OUTPUT	360 Ω
	VARIABLE EMPHASIS OUTPUT	360 Ω
	MONAURAL OFFSET ABSORPTION 2	360 Ω
	R CHANNEL OUTPUT	15 Ω
	L CHANNEL OUTPUT	15 Ω

Scattering rate of impedance is about ±30%.

4.2 Output Load Impedance

If the L CHANNEL OUTPUT pin and the R CHANNEL OUTPUT pin are connected to GND through 10 kΩ resistor, they can drive 700 Ω load impedance.

And, when connecting a load capacitance over 100 pF to the L/R CHANNEL OUTPUT pins, parasitic oscillation can cause. In this case, insert a resistor between the L/R CHANNEL OUTPUT pins and the load capacitance. Note that the load capacitance changes by printed-wiring pattern of set.

Caution To insert the DC load resistor (R_L) between the L/R CHANNEL OUTPUT pins and GND, the R_L should be equal or more than 3 kΩ. Note that the DC current increments 4.5/R_L [A] per one output pin when inserting the R_L, because the medium potential is 4.5 V (V_{CC} = 9 V).
If the R_L is less than 3 kΩ, the distortion rate may become worse extremely.

4.3 Cautions on External Components

For stable temperature characteristics of stereo VCO, SAP VCO and filter, use the following for external components.

Pin name	External parts
SAP VCO SETTING	Metal film resistor (±1%), Cermet (Variable resistor) (±10%)
FILTER ADJUSTMENT	
STEREO VCO SETTING	

According to the license contract with THAT Corporation, use the following for external components.

★ With regard to the use of other external components, please contact to THAT Corporation.

Pin name	External parts
TIMING CURRENT SETTING	Metal film resistor (±1%)
WIDE BAND RMS TIMING	Tantalum capacitor (±10%)
SPECTRAL RMS TIMING	

4.4 Change of Electrical Characteristics Depending on External Components

- SAP sensitivity can be down by inserting a resistor between the SAP DISCRIMINATION FILTER pin and GND.
- Stereo sensitivity can be down by inserting a resistor between the STEREO VCO FREE-RUN MONITOR SWITCH pin and GND.
- Noise sensitivity can be changed by changing a resistor between the NOISE DETECTION FILTER pin and GND.
- Capture range can be changed by changing capacitor between the PHASE COMPARATOR FILTER pins ϕD1 and ϕD2. The smaller capacitor is, the wider capture range is, and the larger capacitor is, the narrower capture range is. Please be careful because stereo distortion rate become worse if capacitor is too small.
- In case noise detection circuit doesn't operate with stereo, it is necessary that capacitor between the PILOT DISCRIMINATION FILTER pins is about 2.2 μF (Protection for miss operation in the weak electric field). The time for changing to stereo, become longer if capacitor is too large.

4.5 BIAS (1.5 V) Pin

The BIAS (1.5 V) pin is the bias pin when adjusting the SAP VCO SETTING, the FILTER ADJUSTMENT, the STEREO VCO SETTING, the WIDE BAND RMS SETTING, and the SPECTRAL RMS SETTING pins with laser-trimming.

5. ADJUSTMENT PROCEDURE

Precise alignment of the dbx decoder is absolutely critical for optimum performance. Where possible, the alignment should be performed after the μPC1876 is mounted in the chassis and with the video system active.

5.1 Stereo VCO Adjustment

Perform this adjustment with no signal applied.

(1) Set the STEREO VCO FREE-RUN MONITOR SWITCH pin "H" by connecting it to the V_{CC}.
(2) Measure the frequency of the STEREO LED DRIVER/STEREO VCO FREE-RUN MONITOR pin with a frequency counter, and adjust the variable resistor connected to the STEREO VCO SETTING pin for a measured frequency of 15.734 kHz ±50 Hz.
(3) Set the STEREO VCO FREE-RUN MONITOR SWITCH pin unconnected.

5.2 Filter Adjustment

Perform this adjustment with the MATRIX MUTE pin "L" and the STEREO VCO FREE-RUN MONITOR SWITCH pin unconnected.

(1) Short the capacitor across the PILOT DISCRIMINATION FILTER (PD1 and PD2) pins by connecting these pins together directly.
(2) Apply a 15.734 kHz sin wave signal to the COMPOSITE SIGNAL INPUT pin at a level greater than 30 $mV_{r.m.s.}$ (100 $mV_{r.m.s.}$ is recommended).
(3) Adjust the variable resistor connected to the FILTER ADJUSTMENT pin so that the AC output level at the RMS OFFSET ABSORPTION pin is minimized. This signal is best monitored through a band-pass filter (15.734 kHz). A recommended circuit is shown in **7. MEASURING CIRCUIT**.
(4) Disconnect the short circuit across the PILOT DISCRIMINATION FILTER (PD1 and PD2) pins after adjustment.

5.3 Separation Adjustment

Perform this adjustment with the MATRIX MUTE pin "L", the STEREO VCO FREE-RUN MONITOR SWITCH pin unconnected, and the F-MONAURAL SELECTION pin "H".

Verify that a L+R signal (100% modulation, 300 Hz, without noise reduction, pilot signal off) results in approximately 150 $mV_{r.m.s.}$ at the COMPOSITE SIGNAL INPUT pin, and that a pilot-only signal results in approximately 30 $mV_{r.m.s.}$ at the COMPOSITE SIGNAL INPUT pin.

(1) Apply a composite signal (30% modulation, 300 Hz, L-only, with noise reduction) to the COMPOSITE SIGNAL INPUT pin.
(2) Adjust the variable resistor connected to the WIDE-BAND RMS SETTING pin so that the output at the R CHANNEL OUTPUT pin is minimized.
(3) Apply a composite signal (30% modulation, 3 kHz, L-only, with noise reduction) to the COMPOSITE SIGNAL INPUT pin.
(4) Adjust the variable resistor connected to the SPECTRAL RMS SETTING pin so that the output at the R CHANNEL OUTPUT pin is minimized.
(5) Repeat steps (1) and (2).

Caution Be sure to perform step (5).

5.4 SAP VCO Adjustment

Perform this adjustment with the filter unless otherwise recommended.

Be sure to adjust SAP VCO after **5.2. Filter adjustment**.

Usually, the filter and SAP VCO are adjusted simultaneously. For this reason, when this adjustment is performed, the applications of the SAP VCO SETTING pin and the FILTER ADJUSTMENT pin are modified to add variable resistor.

(1) Input no signal to the COMPOSITE SIGNAL INPUT pin and measure the DC voltage of the SAP SINGLE OUTPUT pin.

(2) Input SAP signal (5 f_H, no modulation) to the COMPOSITE SIGNAL INPUT pin. Adjust the variable resistor connected to the SAP VCO SETTING pin so that the DC voltage of the SAP SINGLE OUTPUT pin may match with the DC voltage measured in step (1).

5.5 List of Pin Settings in Adjustment

Adjustment \ Pin Name	SAP1/2	ST/SAP	MUTE	FMONO
Stereo VCO Adjustment	–	–	–	–
Filter Adjustment	–	–	L (OFF)	–
Separation Adjustment	–	–	L (OFF)	H (OFF)
SAP VCO Adjustment	–	–	L (OFF)	–

Remark –: Don’t care.

6. ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings (T_A = +25°C)

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		11	V
LED driver current	I_D	Current fed into SAPL and STL pins	30	mA
Control pin voltage	V_{cont}	Voltage applied to fHSW, SAP1/2, ST/SAP, MUTE and FMONO pins	V_{CC} + 0.2	V
Input signal voltage	V_{in}	Voltage applied to COM pin	V_{CC}	V
Power dissipation	P_D	T_A = 75°C, in using the Universal (10 × 10 cm^2) Glass Epoxy Board	500	mW
Operating ambient temperature	T_A	V_{CC} = 9 V	–20 to +75	°C
Storage temperature	T_{stg}		–40 to +125	°C

Caution If any of the parameters exceeds the absolute maximum ratings, even momentarily, the device reliability may be impaired. The absolute maximum ratings are values that may physically damage the product. Be sure to use the product within the ratings.

Recommended Operating Conditions

Parameter	Symbol	Conditions		MIN.	TYP.	MAX.	Unit
Supply voltage	V_{CC}			8.0	9.0	10.0	V
LED driver current	I_D	Current fed into SAPL and STL pins				25	mA
Output load impedance 1	R_{L1}	A.C. load impedance which can drive output from ROT and LOT pins. (at 100% modulation)		2			kΩ
Output load impedance 2	R_{L2}	A.C. load impedance which can drive output from SOT pin. (at 100% modulation)		10			kΩ
Input signal voltage	V_{in}	Signal voltage applied to COM pin	L + R signal (100% modulation)		0.424		V_{p-p}
			L – R signal (100% modulation)		0.848		V_{p-p}
			Pilot signal		0.0848		V_{p-p}
			SAP signal		0.254		V_{p-p}
Control pin voltage 1 (High)	V_{contH1}	SAP1/2, ST/SAP and MUTE pins		3.5		V_{CC}	V
Control pin voltage 1 (Low)	V_{contL1}			0		0.8	V
Control pin voltage 2 (High)	V_{contH2}	FMONO pin		3.5		V_{CC}	V
Control pin voltage 2 (Mid.)	V_{contM2}			1.5		2.5	V
Control pin voltage 2 (Low)	V_{contL2}			0		0.8	V

Electrical Characteristics (T_A = +25°C, RH ≤ 70%, V_{CC} = 9.0 V unless otherwise specified)

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Parameter	Symbol	Test conditions	MIN.	TYP.	MAX.	Unit
Supply current	I_{CC}	No signal	19	27	38	mA
Stereo detection input sensitivity	ST_{SENSE}	f = 15.734 kHz, sine wave Input stereo pilot signal only	9	13	18	$mV_{r.m.s.}$
Stereo detection hysteresis	ST_{HY}		5.0	7.5	10.0	dB
Stereo detection capture range	CC_H	V_{in} = 30 $mV_{r.m.s.}$ Input stereo pilot signal only	2.5	4.0	5.5	%
	CC_L		–5.5	–4.0	–2.5	%
SAP detection input sensitivity	SAP_{SENSE}	f = 78.67 kHz, 0% modulation Input SAP carrier only	17	23	30	$mV_{r.m.s.}$
SAP detection hysteresis	SAP_{HY}	f = 78.67 kHz, 0% modulation Input SAP carrier only	3.3	4.8	6.3	dB
Noise detection input sensitivity	NO_{SENSE}	Input sine wave Frequency: noise BPF peak point	21	30	40	$mV_{r.m.s.}$
Noise detection hysteresis	NO_{HY}	Input sine wave Frequency: noise BPF peak point	1.0	2.0	3.0	dB
Monaural total output voltage	V_{OMO}	f = 300 Hz, 100% modulation	450	500	550	$mV_{r.m.s.}$
Stereo total output voltage	V_{OST}	f = 300 Hz, 100% modulation	450	500	550	$mV_{r.m.s.}$
SAP total output voltage	V_{OSAP1}	f = 300 Hz, 100% modulation	400	500	600	$mV_{r.m.s.}$
SAP single output voltage	V_{OSAP2}	f = 300 Hz, 100% modulation Noise reduction : OFF	450	500	550	$mV_{r.m.s.}$
Difference between monaural L and R output voltage	V_{OLR}	f = 300 Hz, 100% modulation	–0.5	0	+0.5	dB
Monaural total frequency characteristics 1	V_{OMO1}	f = 1 kHz, 30% modulation (f = 300 Hz : 0 dB)	–0.5	0	+0.5	dB
Monaural total frequency characteristics 2	V_{OMO2}	f = 3 kHz, 30% modulation (f = 300 Hz : 0 dB)	–0.5	0	+0.5	dB
Monaural total frequency characteristics 3	V_{OMO3}	f = 8 kHz, 30% modulation (f = 300 Hz : 0 dB)	–0.8	0	+0.8	dB
Monaural total frequency characteristics 4	V_{OMO4}	f = 12 kHz, 30% modulation (f = 300 Hz : 0 dB)	–3.0	–1.5	–0.5	dB
Stereo total frequency characteristics 1	V_{OST1}	f = 1 kHz, 30% modulation (f = 300 Hz : 0 dB)	–0.5	0	+0.5	dB
Stereo total frequency characteristics 2	V_{OST2}	f = 3 kHz, 30% modulation (f = 300 Hz : 0 dB)	–0.5	0	+0.5	dB
Stereo total frequency characteristics 3	V_{OST3}	f = 8 kHz, 30% modulation (f = 300 Hz : 0 dB)	–1.7	–0.8	+0.1	dB
Stereo total frequency characteristics 4	V_{OST4}	f = 12 kHz, 30% modulation (f = 300 Hz : 0 dB)	–6.0	–4.0	–2.5	dB
SAP total frequency characteristics 1	V_{OSAP11}	f = 1 kHz, 30% modulation (f = 300 Hz : 0 dB)	–1.2	+0.3	+1.2	dB
SAP total frequency characteristics 2	V_{OSAP12}	f = 3 kHz, 30% modulation (f = 300 Hz : 0 dB)	–0.6	+0.5	+1.6	dB
SAP total frequency characteristics 3	V_{OSAP13}	f = 8 kHz, 30% modulation (f = 300 Hz : 0 dB)	–2.5	–0.5	+1.5	dB

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Parameter	Symbol	Test conditions	MIN.	TYP.	MAX.	Unit
SAP single frequency characteristics 1	V_{OSAP21}	f = 1 kHz, 30% modulation (f = 300 Hz : 0 dB) Noise reduction : OFF	–0.5	0	+0.5	dB
SAP single frequency characteristics 2	V_{OSAP22}	f = 3 kHz, 30% modulation (f = 300 Hz : 0 dB) Noise reduction : OFF	–0.5	0	+0.5	dB
SAP single frequency characteristics 3	V_{OSAP23}	f = 8 kHz, 30% modulation (f = 300 Hz : 0 dB) Noise reduction : OFF	–1.0	0	+1.0	dB
Stereo channel separation 1	Sep_1	f = 300 Hz, 30% modulation	27	32	–	dB
Stereo channel separation 2	Sep_2	f = 1 kHz, 30% modulation	25	30	–	dB
Stereo channel separation 3	Sep_3	f = 3 kHz, 30% modulation	27	35	–	dB
Monaural total distortion rate	THD_{MO}	f = 1 kHz, 100% modulation	–	0.1	0.5	%
Stereo total distortion rate 1	THD_{ST1}	f = 1 kHz, 100% modulation	–	0.3	1.5	%
Stereo total distortion rate 2	THD_{ST2}	f = 8 kHz, 30% modulation	–	0.8	1.8	%
SAP total distortion rate	THD_{SAP1}	f = 1 kHz, 100% modulation	–	0.5	2.0	%
SAP single distortion rate	THD_{SAP2}	f = 1 kHz, 100% modulation, Noise reduction : OFF	–	0.7	2.0	%
Cross talk 1 SAP → stereo	CT_1	SAP: f = 3 kHz, 30% modulation Stereo: L-only, f = 800 Hz, 30% modulation	–	–60	–50	dB
Cross talk 2 stereo → SAP	CT_2	SAP: f = 800 Hz, 30% modulation Stereo: L-only, f = 3 kHz, 30% modulation	–	–60	–50	dB
Total muting level	Mute	f = 1 kHz, 100% modulation	60	70	–	dB
LED driver saturation voltage	V_{OSAT}	I_D = 10 mA	–	0.1	0.3	V
dbx timing current	I_T	Current flowing into STI, WTI pins	7.1	7.5	7.9	μA
Inter-mode DC offset 1	V_{DOF1}	Mute → Monaural No signals	–50	0	+50	mV
Inter-mode DC offset 2	V_{DOF2}	Mute → Stereo Input pilot signal only	–50	0	+50	mV
Inter-mode DC offset 3	V_{DOF3}	Mute → SAP1 Input 5f_H signal only	–50	0	+50	mV
Monaural total S/N	S/N_{MO}	f = 300 Hz, 100% modulation Pre-emphasis : ON	65	68	–	dB
Stereo total S/N	S/N_{ST}	f = 300 Hz, 100% modulation Noise reduction : ON	65	68	–	dB
SAP total S/N	S/N_{SAP}		70	80	–	dB
Reference voltage	V_{ref}	1.5 V pin	1.35	1.50	1.65	V
DC output saturation voltage	V_{OSAT2}	DCO pin, I = 1 mA	–	0.1	0.3	V

Electrical Characteristics Measurement List (T_A = +25°C, RH ≤ 70%, V_{CC} = 9.0 V)

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Parameter	Symbol	Measurement
Supply current	I_{CC}	Current flowing to V_{CC} pin (no signal).
Stereo detection input sensitivity	ST_{SENSE}	Input signal (f = 15.734 kHz) to COM pin. Raise input voltage gradually until stereo LED turns ON. Then measure input voltage of COM pin.
Stereo detection hysteresis	ST_{HY}	Input signal (f = 15.734 kHz) to COM pin for stereo LED to be ON. Lower input voltage gradually until stereo LED turns OFF. Then assume input voltage "V". $ST_{HY} = 20 \log \frac{ST_{SENSE}}{V}$
Stereo detection capture range	CC	Input signal (f = 14.5 kHz, V_{in} = 0.0848 V_{p-p} [30 $mV_{r.m.s.}$]) to COM pin. Raise input frequency gradually until stereo LED turns ON. Then assume input frequency "f_{in1}". $CC = \frac{15.734\ [kHz] - f_{in1}}{15.734\ [kHz]}$ Next, input signal (f = 17.0 kHz, V_{in} = 0.0848 V_{p-p} [30 $mV_{r.m.s.}$]) to COM pin. Lower input frequency gradually until stereo LED turns ON. Then assume input frequency "f_{in2}". $CC = \frac{f_{in2} - 15.734\ [kHz]}{15.734\ [kHz]}$
SAP detection input sensitivity	SAP_{SENSE}	Input signal (f = 78.67 kHz, no modulation) to COM pin. Raise input voltage gradually until SAP LED turns ON. Then measure input volage of COM pin.
SAP detection hysteresis	SAP_{HY}	Input signal (f = 78.67 kHz, no modulation) to COM pin for SAP LED to be ON. Lower input voltage gradually until SAP LED turns OFF. Then assume input voltage "V". $SAP_{HY} = 20 \log \frac{SAP_{SENSE}}{V}$
Noise detection input sesitivity	NO_{SENSE}	Apply 6.0 V to SDT pin. Input signal (f = 160 kHz, V_{in} = 10 $mV_{r.m.s.}$) to COM pin. Raise frequency and measure the DC voltage of NDT pin. At maximum voltage, raise input voltage gradually until SAP LED turns OFF. Then measure input voltage of COM pin.
Noise detection hysteresis	NO_{HY}	Apply 6.0 V to SDT pin. Input signal (f = 160 kHz, V_{in} = 90 $mV_{r.m.s.}$) to COM pin. Raise frequency and measure the DC voltage of NDT pin. At maximum voltage, lower input voltage gradually until SAP LED turns ON. Then assume input voltage of COM pin "V". $NO_{HY} = 20 \log \frac{NO_{SENSE}}{V}$
Monaural total output voltage	V_{OMO}	Set MUTE and FMONO pins to "L". Input monaural signal (100% modulation, f = 300 Hz) to COM pin. Measure output voltage of ROT pin. Execute the same operation for LOT pin.
Stereo total output voltage	V_{OST}	Set ST/SAP and FMONO pins to "H" and MUTE pin to "L". Input L-only signal (100% modulation, f = 300 Hz) to COM pin. Measure output voltage of LOT pin. Execute the same operation for ROT pin (R-only signal).
SAP total output voltage	V_{OSAP1}	Set FMONO pin to "H" and SAP1/2, ST/SAP, MUTE pins to "L". Input SAP signal (100% modulation, f = 300 Hz) to COM pin. Measure output voltage of ROT pin. Execute the same operation for LOT pin.
SAP single output voltage	V_{OSAP2}	Set FMONO pin to "H" and SAP1/2, ST/SAP, MUTE pins to "L". Input SAP signal (100% modulation, f = 300 Hz) to COM pin. Measure output voltage of SOT pin. (Noise reduction : OFF)

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Parameter	Symbol	Measurement
Difference between monaural L and R output voltage	V_{OLR}	Set MUTE and FMONO pin to "L". Input monaural signal (100% modulation, f = 300 Hz) to COM pin. Measure output voltage of ROT and LOT pin. Assume the output voltage of ROT pin "V_{ROT}" and the output voltage of LOT pin "V_{LOT}". $V_{OLR} = 20 \log \frac{V_{ROT}}{V_{LOT}}$
Monaural total frequency characteristics 1	V_{OMO1}	Set MUTE and FMONO pins to "L". Input monaural signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of ROT pin "$V_{300(MO)}$". Input monaural signal (30% modulation, f = 1 kHz) to COM pin. Assume output voltage of ROT pin "$V_{1k(MO)}$". $V_{OMO1} = 20 \log \frac{V_{1k(MO)}}{V_{300(MO)}}$ Execute the same operation for LOT pin.
Monaural total frequency characteristics 2	V_{OMO2}	Set MUTE and FMONO pins to "L". Input monaural signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of ROT pin "$V_{300(MO)}$". Input monaural signal (30% modulation, f = 3 kHz) to COM pin. Assume output voltage of ROT pin "$V_{3k(MO)}$". $V_{OMO2} = 20 \log \frac{V_{3k(MO)}}{V_{300(MO)}}$ Execute the same operation for LOT pin.
Monaural total frequency characteristics 3	V_{OMO3}	Set MUTE and FMONO pins to "L". Input monaural signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of ROT pin "$V_{300(MO)}$". Input monaural signal (30% modulation, f = 8 kHz) to COM pin. Assume output voltage of ROT pin "$V_{8k(MO)}$". $V_{OMO3} = 20 \log \frac{V_{8k(MO)}}{V_{300(MO)}}$ Execute the same operation for LOT pin.
Monaural total frequency characteristics 4	V_{OMO4}	Set MUTE and FMONO pins to "L". Input monaural signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of ROT pin "$V_{300(MO)}$". Input monaural signal (30% modulation, f = 12 kHz) to COM pin. Assume output voltage of ROT pin "$V_{12k(MO)}$". $V_{OMO4} = 20 \log \frac{V_{12k(MO)}}{V_{300(MO)}}$ Execute the same operation for LOT pin.
Stereo total frequency characteristics 1	V_{OST1}	Set ST/SAP, FMONO pins to "H" and MUTE pin to "L". Input L-only signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of LOT pin "$V_{300(ST)}$". Input L-only signal (30% modulation, f = 1 kHz) to COM pin. Assume output voltage of LOT pin "$V_{1k(ST)}$". $V_{OST1} = 20 \log \frac{V_{1k(ST)}}{V_{300(ST)}}$ Execute the same operation for ROT pin (R-only signal).
Stereo total frequency characteristics 2	V_{OST2}	Set ST/SAP, FMONO pins to "H" and MUTE pin to "L". Input L-only signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of LOT pin "$V_{300(ST)}$". Input L-only signal (30% modulation, f = 3 kHz) to COM pin. Assume output voltage of LOT pin "$V_{3k(ST)}$". $V_{OST2} = 20 \log \frac{V_{3k(ST)}}{V_{300(ST)}}$ Execute the same operation for ROT pin (R-only signal).

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Parameter	Symbol	Measurement
Stereo total frequency characteristics 3	V_{OST3}	Set ST/SAP, FMONO pins to “H” and MUTE pin to “L”. Input L-only signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of LOT pin “$V_{300(ST)}$”. Input L-only signal (30% modulation, f = 8 kHz) to COM pin. Assume output voltage of LOT pin “$V_{8k(ST)}$”. $V_{OST3} = 20 \log \frac{V_{8k(ST)}}{V_{300(ST)}}$ Execute the same operation for ROT pin (R-only signal).
Stereo total frequency characteristics 4	V_{OST4}	Set ST/SAP, FMONO pins to “H” and MUTE pin to “L”. Input L-only signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of LOT pin “$V_{300(ST)}$”. Input L-only signal (30% modulation, f = 12 kHz) to COM pin. Assume output voltage of LOT pin “$V_{12k(ST)}$”. $V_{OST4} = 20 \log \frac{V_{12k(ST)}}{V_{300(ST)}}$ Execute the same operation for ROT pin (R-only signal).
SAP total frequency characteristics 1	V_{OSAP11}	Set FMONO pin to “H” and SAP1/2, ST/SAP, MUTE pins to “L”. Input SAP signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of LOT pin “$V_{300(SAP)}$”. Input SAP signal (30% modulation, f = 1 kHz) to COM pin. Assume output voltage of LOT pin “$V_{1k(SAP)}$”. $V_{OSAP11} = 20 \log \frac{V_{1k(SAP)}}{V_{300(SAP)}}$ Execute the same operation for ROT pin.
SAP total frequency characteristics 2	V_{OSAP12}	Set FMONO pin to “H” and SAP1/2, ST/SAP, MUTE pins to “L”. Input SAP signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of LOT pin “$V_{300(SAP)}$”. Input SAP signal (30% modulation, f = 3 kHz) to COM pin. Assume output voltage of LOT pin “$V_{3k(SAP)}$”. $V_{OSAP12} = 20 \log \frac{V_{3k(SAP)}}{V_{300(SAP)}}$ Execute the same operation for ROT pin.
SAP total frequency characteristics 3	V_{OSAP13}	Set FMONO pin to “H” and SAP1/2, ST/SAP, MUTE pins to “L”. Input SAP signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of LOT pin “$V_{300(SAP)}$”. Input SAP signal (30% modulation, f = 8 kHz) to COM pin. Assume output voltage of LOT pin “$V_{8k(SAP)}$”. $V_{OSAP13} = 20 \log \frac{V_{8k(SAP)}}{V_{300(SAP)}}$ Execute the same operation for ROT pin.
SAP single frequency characteristics 1	V_{OSAP21}	Input SAP signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of SOT pin “$V_{300(SAP)}$”. Input SAP signal (30% modulation, f = 1 kHz) to COM pin. Assume output voltage of SOT pin “$V_{1k(SAP)}$”. $V_{OSAP21} = 20 \log \frac{V_{1k(SAP)}}{V_{300(SAP)}}$ (Noise reduction OFF)

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Parameter	Symbol	Measurement
SAP single frequency characteristics 2	V_{OSAP22}	Input SAP signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of SOT pin "$V_{300(SAP)}$". Input SAP signal (30% modulation, f = 3 kHz) to COM pin. Assume output voltage of SOT pin "$V_{3k(SAP)}$". $V_{OSAP22} = 20 \log \frac{V_{3k(SAP)}}{V_{300(SAP)}}$ (Noise reduction OFF)
SAP single frequency characteristics 3	V_{OSAP23}	Input SAP signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of SOT pin "$V_{300(SAP)}$". Input SAP signal (30% modulation, f = 8 kHz) to COM pin. Assume output voltage of SOT pin "$V_{8k(SAP)}$". $V_{OSAP23} = 20 \log \frac{V_{8k(SAP)}}{V_{300(SAP)}}$ (Noise reduction OFF)
Stereo channel separation 1	Sep_1	Set ST/SAP, FMONO pins to "H" and MUTE pin to "L". Input L-only signal (30% modulation, f = 300 Hz) to COM pin. Assume output voltage of ROT pin "V_{ROT}" and output voltage of LOT pin "V_{LOT}". $Sep_1 = 20 \log \frac{V_{LOT}}{V_{ROT}}$ Execute the same operation for R-only signal. (Sound multiplex signal generator: 465Z (manufactured by EIDEN Co. Ltd.))
Stereo channel separation 2	Sep_2	Set ST/SAP, FMONO pins to "H" and MUTE pin to "L". Input L-only signal (30% modulation, f = 1 kHz) to COM pin. Assume output voltage of ROT pin "V_{ROT}" and output voltage of LOT pin "V_{LOT}". $Sep_2 = 20 \log \frac{V_{LOT}}{V_{ROT}}$ Execute the same operation for R-only signal. (Sound multiplex signal generator: 465Z (manufactured by EIDEN Co. Ltd.))
Stereo channel separation 3	Sep_3	Set ST/SAP, FMONO pins to "H" and MUTE pin to "L". Input L-only signal (30% modulation, f = 3 kHz) to COM pin. Assume output voltage of ROT pin "V_{ROT}" and output voltage of LOT pin "V_{LOT}". $Sep_3 = 20 \log \frac{V_{LOT}}{V_{ROT}}$ Execute the same operation for R-only signal. (Sound multiplex signal generator: 465Z (manufactured by EIDEN Co. Ltd.))
Monaural total distortion rate	THD_{MO}	Set MUTE and FMONO pins to "L". Input monaural signal (100% modulation, f = 1 kHz) to COM pin. Measure output distortion rate of ROT and LOT pin.
Stereo total distortion rate 1	THD_{ST1}	Set ST/SAP, FMONO pins to "H" and MUTE pin to "L". Input L-only signal (100% modulation, f = 1 kHz) to COM pin. Measure output distortion rate of LOT pin. Execute the same operation for R-only signal (ROT pin).
Stereo total distortion rate 2	THD_{ST2}	Set ST/SAP, FMONO pins to "H" and MUTE pin to "L". Input L-only signal (100% modulation, f = 8 kHz) to COM pin. Measure output distortion rate of LOT pin. Execute the same operation for R-only signal (ROT pin).
SAP total distortion rate	THD_{SAP1}	Set FMONO pin to "H" and SAP1/2, ST/SAP, MUTE pins to "L". Input SAP signal (100% modulation, f = 1 kHz) to COM pin. Measure output distortion rate of ROT and LOT pin.

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Parameter	Symbol	Measurement
SAP single distortion rate	THD_{SAP2}	Set FMONO pin to “H” and SAP1/2, ST/SAP, MUTE pins to “L”. Input SAP signal (100% modulation, f = 1 kHz) to COM pin. Measure output distortion rate of SOT pin. (nosie reduction OFF)
Cross talk 1 SAP → stereo	CT_1	Set ST/SAP, FMONO pins to “H” and MUTE pin to “L”. Input L-only signal (f = 800 Hz, 30% modulation) and SAP signal (f = 3 kHz, 30% modulation) to COM pin. Assume output voltage of the LOT pin “V_{LOT}”. Connect LOT pin to 3 kHz BPF (gain = 0 dB at f = 3 kHz, –80 dB or more at f = 800 Hz) to LOT pin. Assume output voltage of BPF “V_{LOTCT1}”. $CT_1 = 20 \log \frac{V_{LOTCT1}}{V_{LOT}}$
Cross talk 2 stereo → SAP	CT_2	Set SAP1/2, ST/SAP pins to “L” and FMONO pin to “H”. Input L-only signal (f = 3 kHz, 30% modulation) and SAP signal (f = 800 Hz, 30% modulation) to COM pin. Assume output voltage of the LOT pin “V_{LOT}”. Connect LOT pin to 3 kHz BPF (gain = 0 dB at f = 3 kHz, –80 dB or more at f = 800 Hz) to LOT pin. Assume output voltage of BPF “V_{LOTCT2}”. $CT_2 = 20 \log \frac{V_{LOTCT2}}{V_{LOT}}$
Total muting level	Mute	Set MUTE and FMONO pins to “L”. Input monaural signal (100% modulation, f = 1 kHz) to COM pin. Assume output voltage of ROT pin “V_{OMO}”. Set FMONO pin to “H”. Assume output voltage of ROT pin “V_{MUTE}”. $\text{Mute} = 20 \log \frac{V_{OMO}}{V_{MUTE}}$ Execute the same operation for LOT and NOT pins.
LED driver saturation voltage	V_{OSAT}	Apply current (10 mA) to SAPL, STL pins, and measure input voltage of the pin.
dbx timing current	I_T	Input DC voltage (6 V) to STI and WTI pins, and measure current of the pin.
Inter-mode DC offset 1 mute → monaural	V_{DOF1}	Set FMONO pin to “L”. Apply DC 1 V to fHSW pin and DC 6 V to SDT pin. Set MUTE pin to “H”. Assume output voltage of ROT pin “V_{MU}”. Next, input no signal to COM pin to change MUTE pin to “L”. Assume output voltage of ROT pin “V_{MO}”. $V_{DOF1} = V_{MO} - V_{MU}$ Execute the same operation for LOT pin.
Inter-mode DC offset 2 mute → stereo	V_{DOF2}	Set ST/SAP, FMONO pins to “H”. Apply DC 1 V to fHSW pin and DC 6 V to SDT pin. Set MUTE pin to “H”. Assume output voltage of ROT pin “V_{MU}”. Next, input pilot signal to COM pin to change MUTE pin to “L”. Assume output voltage of ROT pin “V_{ST}”. $V_{DOF2} = V_{ST} - V_{MU}$ Execute the same operation for LOT pin.
Inter-mode DC offset 3 mute → SAP	V_{DOF3}	Set FMONO pin to “H” and SAP1/2, ST/SAP pins “L”. Apply DC 1 V to fHSW pin and DC 6 V to SDT pin. Set MUTE pin to “H”. Assume output voltage of ROT pin “V_{MU}”. Next, input $5f_H$ signal to COM pin to change MUTE pin to “L”. Assume output voltage of ROT pin “V_{SAP}”. $V_{DOF3} = V_{SAP} - V_{MU}$ Execute the same operation for LOT pin.

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Parameter	Symbol	Measurement
Monaural total S/N	S/N_{MO}	Set MUTE and FMONO pins to “L”. Input no signal to COM pin, and assume output voltage of ROT pin “V_{NMO}”. Input monaural signal (100% modulation, f = 300 Hz) to COM pin, and assume output voltage of ROT pin “V_{SMO}”. $S/N_{MO} = 20 \log \frac{V_{SMO}}{V_{NMO}}$ Execute the same operation for LOT pin.
Stereo total S/N	S/N_{ST}	Set ST/SAP, FMONO pins to “H” and MUTE pin to “L”. Input pilot signal to COM pin, and assume output voltage of ROT pin “V_{NST}”. Input stereo signal (100% modulation, f = 300 Hz) to COM pin, and assume output voltage of ROT pin “V_{SST}”. $S/N_{ST} = 20 \log \frac{V_{SST}}{V_{NST}}$ Execute the same operation for LOT pin.
SAP total S/N	S/N_{SAP}	Set FMONO pin to “H” and SAP1/2, ST/SAP pins to “L”. Input $5f_H$ signal to COM pin, and assume output voltage of ROT pin “V_{NSAP}”. Input SAP signal (100% modulation, f = 300 Hz) to COM pin, and assume output voltage of ROT pin “V_{SSAP}”. $S/N_{SAP} = 20 \log \frac{V_{SSAP}}{V_{NSAP}}$ Execute the same operation for LOT pin.
Reference voltage	V_{ref}	Measure DC voltage of 1.5 V pin.
DC saturation voltage	V_{OSAT2}	Apply flowing current (1 mA) to DCO pin and measure DC voltage of DCO pin.

Measuring Circuit Mode Table

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Item	User Mode[Note] S1 / S2	ST / SA	Mute	F-Monaural	Measuring Equipment	SG/MODE
Supply current	–	–	–	–	DC ammeter	No signal
Stereo detection input sensitivity	–	ST	OFF	OFF	AC voltmeter	Pilot
Stereo detection hysteresis	–	ST	OFF	OFF		
Stereo detection capture range	–	ST	OFF	OFF	AC voltmeter f-counter	Sin wave SG
SAP detection input sensitivity	–	SA	OFF	OFF	AC voltmeter	SAP
SAP detection hysteresis	–	SA	OFF	OFF		
Noise detection input sensitivity	–	SA	OFF	OFF	AC voltmeter DC voltmeter	Sin wave SG
Noise detection hysteresis	–	SA	OFF	OFF		
Monaural total output voltage	–	–	OFF	–	AC voltmeter	Monaural
Stereo total output voltage	–	ST	OFF	OFF		Stereo
SAP total output voltage	S1	SA	OFF	OFF		SAP
SAP single output voltage	–	SA	OFF	OFF		SAP (NR OFF)
Difference between monaural L and R output voltages	–	–	OFF	–		Monaural
Monaural total frequency characteristics 1	–	–	OFF	–	AC voltmeter	Monaural
Monaural total frequency characteristics 2	–	–	OFF	–		
Monaural total frequency characteristics 3	–	–	OFF	–		
Monaural total frequency characteristics 4	–	–	OFF	–		
Stereo total frequency characteristics 1	–	ST	OFF	OFF	AC voltmeter	L-only R-only
Stereo total frequency characteristics 2	–	ST	OFF	OFF		
Stereo total frequency characteristics 3	–	ST	OFF	OFF		
Stereo total frequency characteristics 4	–	ST	OFF	OFF		
SAP total frequency characteristics 1	S1	SA	OFF	OFF	AC voltmeter	SAP
SAP total frequency characteristics 2	S1	SA	OFF	OFF		
SAP total frequency characteristics 3	S1	SA	OFF	OFF		
SAP single frequency characteristics 1	–	SA	OFF	OFF	AC voltmeter	SAP (NR OFF)
SAP single frequency characteristics 2	–	SA	OFF	OFF		
SAP single frequency characteristics 3	–	SA	OFF	OFF		
Stereo channel separation 1	–	ST	OFF	OFF	AC voltmeter	L-only R-only
Stereo channel separation 2	–	ST	OFF	OFF		
Stereo channel separation 3	–	ST	OFF	OFF		
Monaural total distortion rate	–	–	OFF	–	Distortion meter	Monaural
Stereo total distortion rate 1	–	ST	OFF	OFF		Stereo
Stereo total distortion rate 2	–	ST	OFF	OFF		
SAP total distortion rate	S1	SA	OFF	OFF		SAP
SAP single distortion rate	–	SA	OFF	OFF		SAP (NR OFF)

Note ST: Stereo, SA: SAP, S1: SAP1, S2: SAP2, –: free

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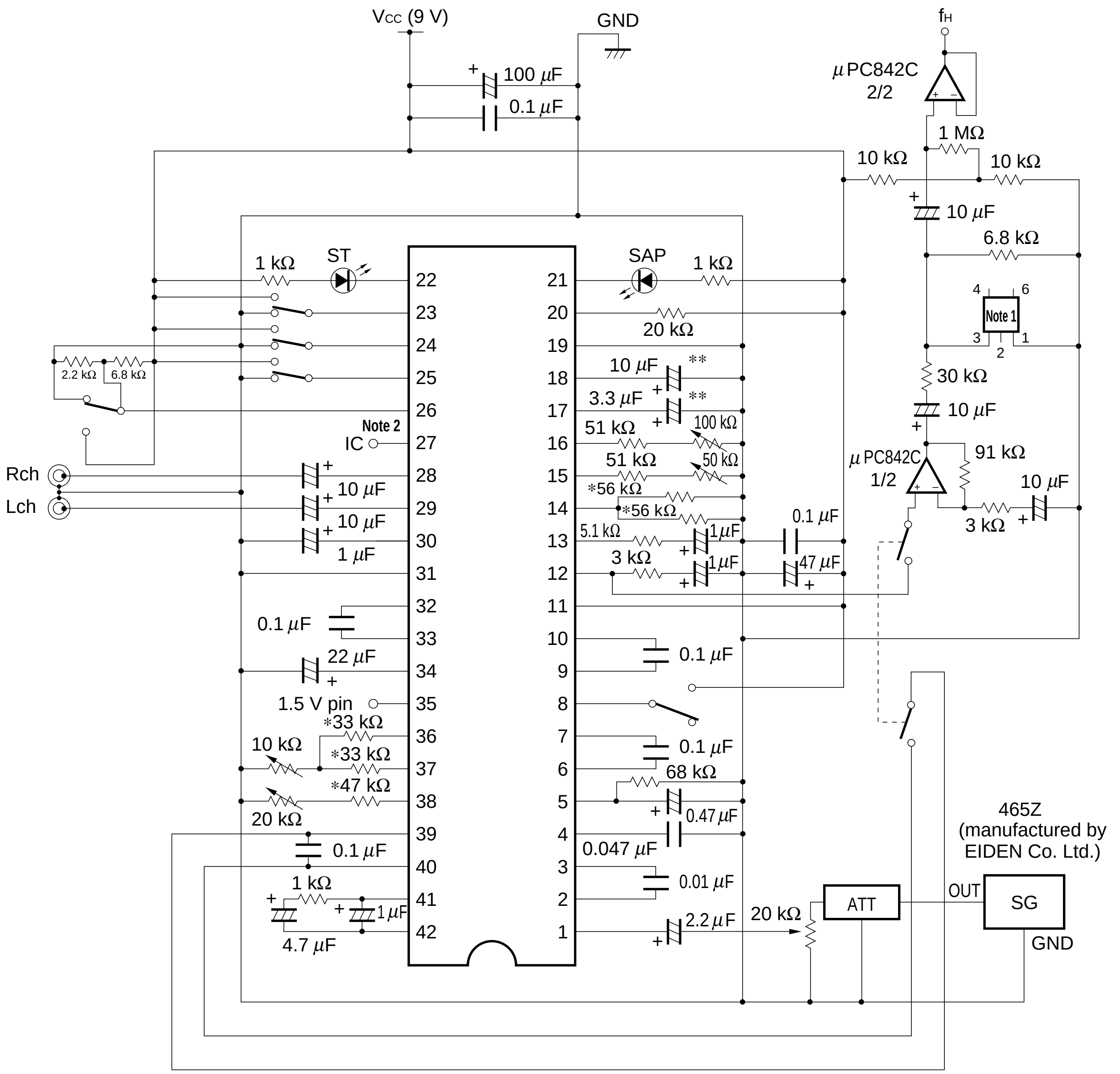
Item	User Mode[Note]				Measuring Equipment	SG/MODE
	S1 S2	ST SA	Mute	F-Monaural		
Cross talk 1 SAP → Stereo	–	ST	OFF	OFF	AC voltmeter	Stereo SAP
Cross talk 2 Stereo → SAP	S1	SA	OFF	OFF		
Total muting level	–	–	ON OFF	–	AC voltmeter	Monaural
LED driver saturation voltage	–	–	OFF	OFF	DC voltmeter	Stereo SAP
dbx timing current	–	–	OFF	OFF	DC ammeter	No signal
Inter-mode DC offset 1 Mute → monaural	–	–	ON OFF	–	DC voltmeter	No signal
Inter-mode DC offset 2 Mute → stereo	–	ST	ON OFF	OFF		Pilot
Inter-mode DC offset 3 Mute → SAP	S1	SA	ON OFF	OFF		$5f_H$ signal
Monaural total S/N	–	–	OFF	–	AC voltmeter	No signal
Stereo total S/N	–	ST	OFF	OFF		Pilot
SAP total S/N	S1	SA	OFF	OFF		SAP

Note ST: Stereo, SA: SAP, S1: SAP1, S2: SAP2, –: free

7. MEASURING CIRCUIT



Notes 1. Filter: 126XGS-7990Z, manufactured by Toko Co. Ltd.

2. Do not leave the Internally Connected (IC) pin open because it is a base-open pin. Connect this pin to Vcc or GND.

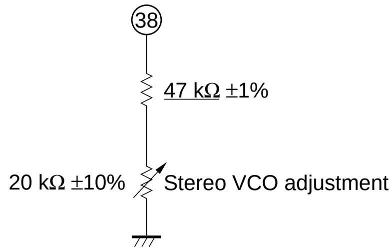
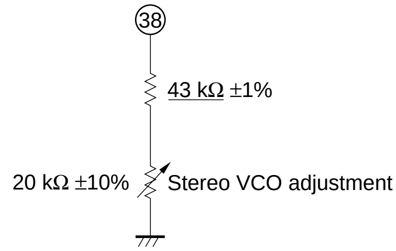
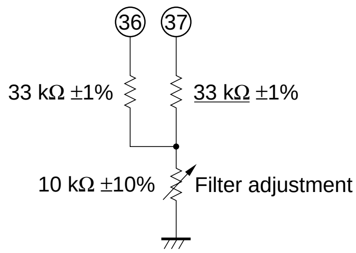
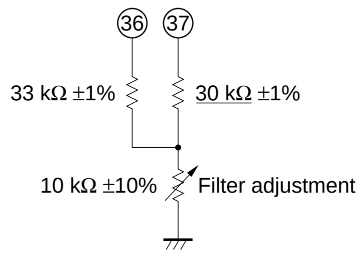
Remark Use the following for external parts.

Resistor (*) : Metal film resistor (±1%). Unless otherwise specified; ±5%

Capacitors (**) : Tantalum capacitor (±10%). Unless otherwise specified; ±20%

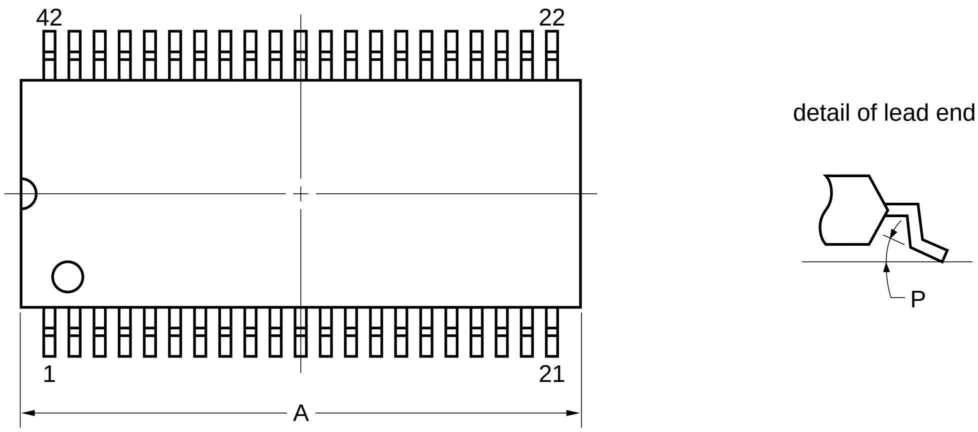
Variable resistors: ±10%

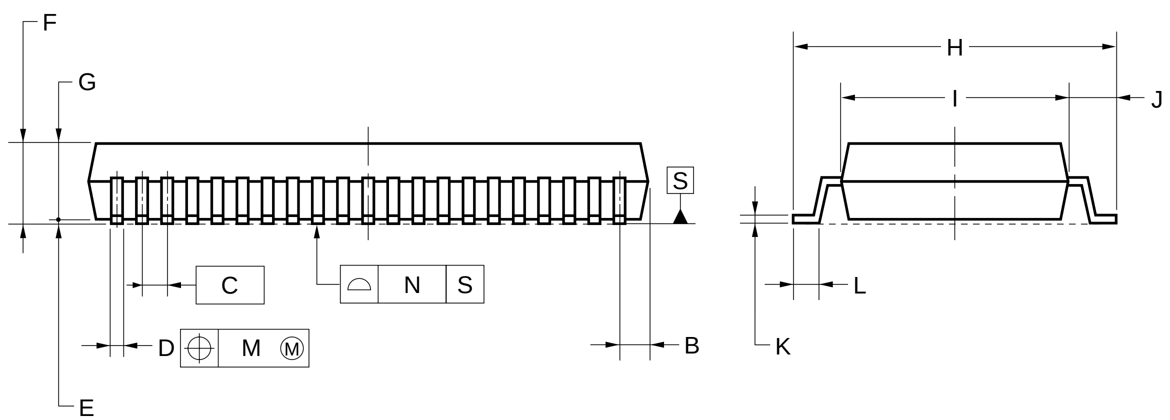
8. DIFFERENCES BETWEEN THE μPC1876GT AND μPC1872GT

	μPC1876GT				μPC1872GT			
Stereo VCO adjustment external resistor								
Filter adjustment input frequency	15.734 kHz (= f_H)				16.5 kHz			
Filter adjustment external resistor								
	MIN.	TYP.	MAX.	Unit	MIN.	TYP.	MAX.	Unit
Stereo total frequency chatacteristics 3 At f = 8 kHz	–1.7	–0.8	+0.1	dB	–0.9	0.0	+0.9	dB
Stereo total frequency chatacteristics 4 At f = 12 kHz	–6.0	–4.0	–2.5	dB	–5.0	–2.5	–1.0	dB
SAP total frequency chatacteristics 2 At f = 3 kHz	–0.6	+0.5	+1.6	dB	–0.3	+0.8	+1.9	dB
SAP total frequency chatacteristics 3 At f = 8 kHz	–2.5	–0.5	+1.5	dB	–1.0	+1.0	+3.0	dB

9. PACKAGE DRAWING

42-PIN PLASTIC SSOP (9.53 mm (375))





NOTE

Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	18.16 MAX.
B	1.13 MAX.
C	0.8 (T.P.)
D	$0.35^{+0.10}_{-0.05}$
E	0.125±0.075
F	2.9 MAX.
G	2.5±0.2
H	10.3±0.3
I	7.15±0.2
J	1.6±0.2
K	$0.15^{+0.10}_{-0.05}$
L	0.8±0.2
M	0.10
N	0.10
P	$3°^{+7°}_{-3°}$

S42GT-80-375B-2

10. RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the conditions recommended in the table below.

For details of recommended soldering conditions, refer to the information document **Semiconductor Device Mounting Technology Manual (C10535E)**.

For soldering methods and conditions other than those recommended below, contact an NEC sales representative.

Table 10-1. Surface Mounting Type Soldering Conditions

μPC1876GT: 42-pin plastic SSOP (9.53 mm (375))

Soldering Method	Soldering Conditions	Symbol
Infrared reflow	Package peak temperature: 235°C, Duration: 30 sec. max. (at 210°C or above), Number of times: 3 times max.	IR35-00-3
VPS	Package peak temperature: 215°C, Duration: 40 sec. max. (at 200°C or above), Number of times: 3 times max.	VP15-00-3
Wave soldering	Solder bath temperature: 260°C max., Duration: 10 sec. max., Number of times: Once, Preliminary heat temperature: 120°C max. (package surface temperature)	WS60-00-1
Partial heating	Pin temperature: 300°C max., Duration: 3 sec. max. (per pin row)	—

Caution Do not use different soldering methods together (except in the case of partial heating).

[MEMO]