

# AN5819K

Sound multiplex demodulator IC for TV in the North American market

■ Overview

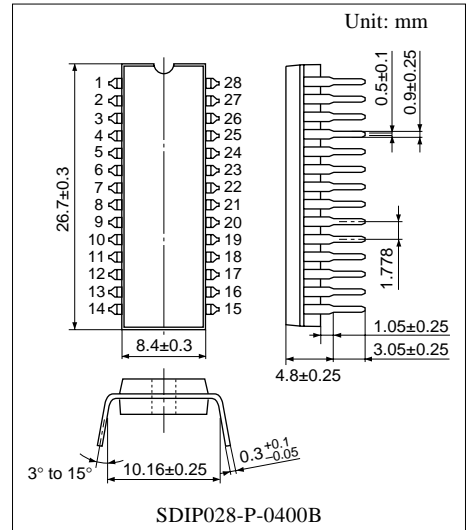
The AN5819K is a single chip IC, which includes a sound multiplex demodulator for Zenith TV system and the dbx TV sound noise reduction function.

■ Features

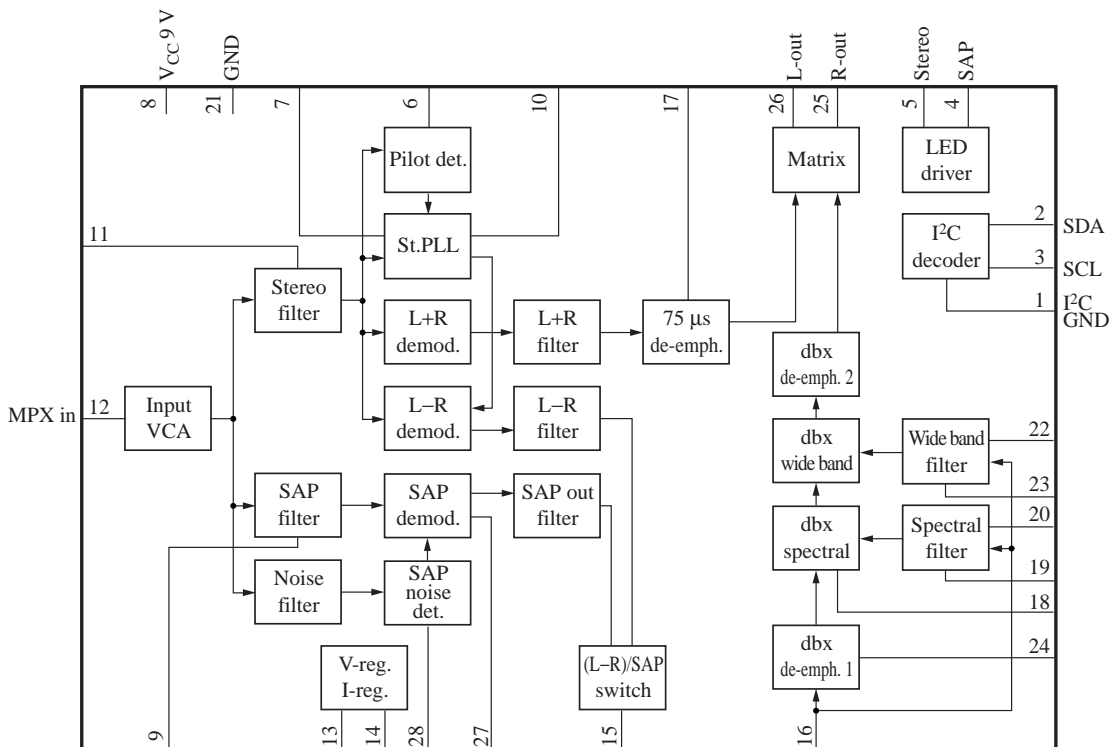
- Stereo demodulation, SAP demodulation and dbx noise reduction are integrated into a single chip
- Enabling various kinds of adjustment and mode changeover thanks to I<sup>2</sup>C bus
- Built-in input volume (I<sup>2</sup>C control) for interface with intermediate frequency processing IC

■ Applications

- TV and VCR for the North American market  
(A licensing agreement with THAT Corporation is necessary in order to use this IC with built-in dbx-TV noise reduction function.)



■ Block Diagram



### ■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	I <sup>2</sup> C GND	15	(L-R)/SAP demodulation output
2	SDA	16	dbx input
3	SCL	17	(L+R) demodulation output offset cancel
4	SAP LED	18	Spectral level adjustment
5	Stereo LED	19	Spectral timing
6	Pilot signal detection	20	Spectral level sensor input
7	Stereo PLL filter	21	GND
8	V <sub>CC</sub>	22	Wide band level sensor input
9	SAP trap filter	23	Wide band timing
10	Quasi sine-wave filter	24	dbx offset cancel
11	Stereo filter offset cancel	25	R output
12	Composite input	26	L output
13	dbx timing current	27	SAP carrier detection
14	Reference voltage source filter	28	SAP noise level detection

### ■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	11.0	V
Supply current	I <sub>CC</sub>	75	mA
LED drive current *3	I <sub>LED</sub>	10	mA
Power dissipation *2	P <sub>D</sub>	1 143	mW
Operating ambient temperature *1	T <sub>opr</sub>	-20 to +75	°C
Storage temperature *1	T <sub>stg</sub>	-55 to +150	°C

Note) \*1: Except for the operating ambient temperature and storage temperature, all ratings are for T<sub>a</sub> = 25°C.

\*2: Power dissipation shown is for the IC package in free air at T<sub>a</sub> = 70°C

\*3: LED drive currents are the currents flowing into pin 4 and pin 5.

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V <sub>CC</sub>	8.5 to 9.5	V

■ Electrical Characteristics at  $V_{CC} = 9.0 \text{ V}$ ,  $T_a = 25^\circ\text{C}$

- Stereo PLL VCO adjustment:  $15.734 \text{ kHz} \pm 50 \text{ Hz}$
- Input level (at 100% modulation)
  - L+R:  $0.424 \text{ V[p-p]}$  (pre-emphasis off)
  - L-R:  $0.848 \text{ V[p-p]}$  (dbx noise reduction off)
  - Pilot:  $0.084 \text{ V[p-p]}$
  - SAP:  $0.254 \text{ V[p-p]}$  (dbx noise reduction off)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Total circuit current	$I_{CC}$	No signal	35	55	75	mA
Mono output level	$V_{0(MON)}$	$f = 1 \text{ kHz}$ , (mono) 100% mod.	480	530	580	mV[rms]
Mono frequency characteristics-1	$V_{1(MON)}$	$f = 300 \text{ Hz}$ , (mono) 30% mod.	-0.5	0	+0.5	dB
Mono frequency characteristics-2	$V_{2(MON)}$	$f = 8 \text{ kHz}$ , (mono) 30% mod.	-1.5	-0.4	+0.4	dB
Mono distortion ratio	$THD_{(MON)}$	$f = 1 \text{ kHz}$ , (mono) 100% mod.	—	—	0.7	%
Mono noise level	$V_{N(MON)}$	Input short-circuit, BPF (A curve)	—	—	-60	dBV
(L), (R) output voltage difference	$V_{LR(MON)}$	$f = 1 \text{ kHz}$ , (mono) 100% mod.	-0.5	0	+0.5	dB
Stereo output level	$V_{0(ST)}$	$f = 1 \text{ kHz}$ , (L(R)-only) 100% mod.	420	520	620	mV[rms]
Stereo frequency characteristics-1	$V_{1(ST)}$	$f = 300 \text{ Hz}$ , (L(R)-only) 30% mod.	-0.7	0	+0.7	dB
Stereo frequency characteristics-2	$V_{2(ST)}$	$f = 3 \text{ kHz}$ , (L(R)-only) 30% mod.	-1	0	+1	dB
Stereo frequency characteristics-3	$V_{3(ST)}$	$f = 8 \text{ kHz}$ , (L(R)-only) 30% mod.	-2.5	-0.5	+1.5	dB
Stereo distortion ratio	$THD_{(ST)}$	$f = 1 \text{ kHz}$ , (L(R)-only) 100% mod.	—	—	1	%
Stereo noise level	$V_{N(ST)}$	$f = 15.73 \text{ kHz}$ , ( $f_H$ ), $V = 0.084 \text{ V[p-p]}$ , BPF	—	—	-60	dBV
Stereo discrimination level	$V_{TH(ST)}$	$f = 15.73 \text{ kHz}$ ( $f_H$ )	9	17	26	mV[rms]
Stereo discrimination hysteresis	$V_{HY(ST)}$	$f = 15.73 \text{ kHz}$ ( $f_H$ )	-6	—	-0.5	dB
SAP output level	$V_{0(SAP)}$	$f = 1 \text{ kHz}$ , (SAP) 100% mod.	350	500	700	mV[rms]
SAP frequency characteristics-1	$V_{1(SAP)}$	$f = 300 \text{ Hz}$ , (SAP) 30% mod.	-1.0	0	+1.0	dB
SAP frequency characteristics-2	$V_{2(SAP)}$	$f = 3 \text{ kHz}$ , (SAP) 30% mod.	-3	-1.5	+0.5	dB
SAP distortion ratio	$THD_{(SAP)}$	$f = 1 \text{ kHz}$ , (SAP) 100%	—	—	1.5	%
SAP noise level	$V_{N(SAP)}$	$f = 78.7 \text{ kHz}$ , ( $5f_H$ ), $V = 0.42 \text{ V[p-p]}$ , BPF	—	—	-65	dBV
SAP discrimination level	$V_{TH(SAP)}$	$f = 78.7 \text{ kHz}$ , ( $5f_H$ )	22	—	53	mV[rms]
SAP discrimination hysteresis	$V_{HY(SAP)}$	$f = 78.7 \text{ kHz}$ , ( $5f_H$ )	-4	—	-0.5	dB
SAP → Stereo crosstalk	$CT_1$	(SAP) $1 \text{ kHz}$ , 100% mod. (Stereo) pilot-signal	—	—	-50	dB
Stereo → SAP crosstalk	$CT_2$	(Stereo) $1 \text{ kHz}$ , 100% mod. (SAP) carrier-signal	—	—	-50	dB
Noise discrimination level	$V_{TH(NOI)}$	Pin 27: $f = 240 \text{ kHz}$ at $5 \text{ V}$ applied	38	—	84	mV[rms]
Noise discrimination hysteresis	$V_{HY(NOI)}$	Pin 27: $f = 240 \text{ kHz}$ at $5 \text{ V}$ applied	-5.5	—	-0.3	dB

**■ Electrical Characteristics at  $V_{CC} = 9.0\text{ V}$ ,  $T_a = 25^\circ\text{C}$  (continued)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>I<sup>2</sup>C interface</b>						
Sink current at ACK	$I_{ACK}$	Maximum pin-2 sink current at ACK	2.0	10	20	mA
SCL, SDA signal input high level	$V_{IHI}$	—	3.5	—	5.0	V
SCL, SDA signal input low level	$V_{ILO}$	—	0	—	0.9	V
Input available maximum frequency	$f_{IMAX}$	—	—	—	100	kbit/s

**• Design reference data**

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Stereo separation (30%)-1	Sep <sub>30-1</sub>	f = 300 Hz, (L(R)-only) 30%mod.	22	30	—	dB
Stereo separation (30%)-2	Sep <sub>30-2</sub>	f = 1 kHz, (L(R)-only) 30%mod.	22	30	—	dB
Stereo separation (30%)-3	Sep <sub>30-3</sub>	f = 3 kHz, (L(R)-only) 30%mod.	22	30	—	dB
Stereo separation (30%)-4	Sep <sub>30-4</sub>	f = 8 kHz, (L(R)-only) 30%mod.	12	18	—	dB
Stereo separation (100%)-1	Sep <sub>100-1</sub>	f = 300 Hz, (L(R)-only) 100%mod.	20	30	—	dB
Stereo separation (100%)-2	Sep <sub>100-2</sub>	f = 1 kHz, (L(R)-only) 100%mod.	20	25	—	dB
Stereo separation (100%)-3	Sep <sub>100-3</sub>	f = 3 kHz, (L(R)-only) 100%mod.	20	30	—	dB
Stereo separation (100%)-4	Sep <sub>100-4</sub>	f = 8 kHz, (L(R)-only) 100%mod.	8	11	—	dB
Stereo separation (10%)-1	Sep <sub>10-1</sub>	f = 300 Hz, (L(R)-only) 10%mod.	20	30	—	dB
Stereo separation (10%)-2	Sep <sub>10-2</sub>	f = 1 kHz, (L(R)-only) 10%mod.	20	30	—	dB
Stereo separation (10%)-3	Sep <sub>10-3</sub>	f = 3 kHz, (L(R)-only) 10%mod.	20	30	—	dB
Stereo separation (10%)-4	Sep <sub>10-4</sub>	f = 8 kHz, (L(R)-only) 10%mod.	12	18	—	dB
SAP → Mono crosstalk	CT <sub>3</sub>	(SAP) 1 kHz, 100% mod. (Mono) 1 kHz, 0% mod.	—	—	-53	dB
Mono → SAP crosstalk	CT <sub>4</sub>	(SAP) 1 kHz, 0% mod. (Mono) 1 kHz, 100% mod.	—	—	-56	dB

**I<sup>2</sup>C interface**

Bus free before start	$t_{BUF}$	—	4.0	—	—	μs
Start condition set-up time	$t_{SU,STA}$	—	4.0	—	—	μs
Start condition hold time	$t_{HD,STA}$	—	4.0	—	—	μs
Low period SCL, SDA	$t_{LO}$	—	4.0	—	—	μs
High period SCL	$t_{HI}$	—	4.0	—	—	μs
Rise time SCL, SDA	$t_r$	—	—	—	1.0	μs
Fall time SCL, SDA	$t_f$	—	—	—	0.35	μs
Data set-up time (write)	$t_{SU,DAT}$	—	0.25	—	—	μs
Data hold time (write)	$t_{HD,DAT}$	—	0	—	—	μs

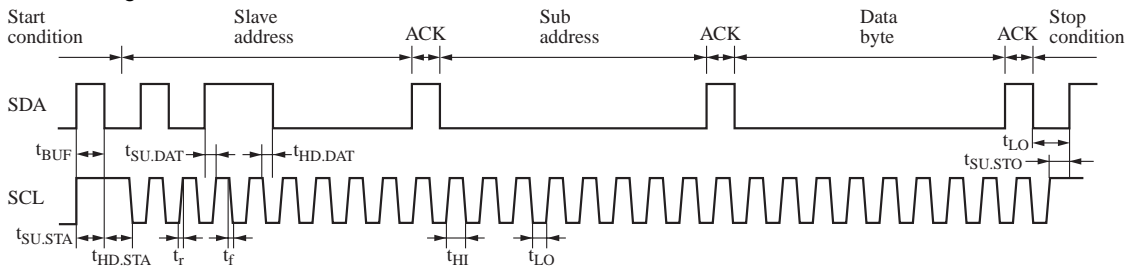
■ Electrical Characteristics at  $V_{CC} = 9.0\text{ V}$ ,  $T_a = 25^\circ\text{C}$  (continued)

• Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
I <sup>2</sup> C interface (continued)						
Acknowledge set-up time	$t_{SU,ACK}$	—	—	—	3.5	$\mu\text{s}$
Acknowledge hold time	$t_{HD,ACK}$	—	0	—	—	$\mu\text{s}$
Stop condition set-up time	$t_{SU,STO}$	—	4.0	—	—	$\mu\text{s}$
DAC						
6-bit DAC DNLE	$L_6$	$1\text{LSB} = (\text{data (max.)} - \text{data (00)})/63$	0.1	1.0	1.9	$\frac{\text{LSB}}{\text{Step}}$

• DAC timing chart



■ Terminal Equivalent Circuits

Pin No.	Equivalent circuit	Description	Voltage (V)
1	—	I <sup>2</sup> C GND: • I <sup>2</sup> C bus DAC GND pin	0
2		SDA: • I <sup>2</sup> C bus data input pin	—
3		SCL: • I <sup>2</sup> C bus clock input pin	—

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage (V)
4		<p>SAP LED:</p> <ul style="list-style-type: none"> <li>• SAP LED connection pin</li> </ul>	—
5		<p>Stereo LED:</p> <ul style="list-style-type: none"> <li>• Stereo LED connection pin</li> </ul>	—
6		<p>Pilot signal detection:</p> <ul style="list-style-type: none"> <li>• Stereo pilot signal detection pin</li> </ul>	$\frac{V_{CC}}{2}$
7		<p>Stereo PLL filter:</p> <ul style="list-style-type: none"> <li>• Stereo PLL low-pass filter connection pin</li> </ul>	2.8
8	—	<p><math>V_{CC}</math>:</p> <ul style="list-style-type: none"> <li>• <math>V_{CC}</math> pin</li> </ul>	$V_{CC}$
9		<p>SAP trap filter:</p> <ul style="list-style-type: none"> <li>• SAP trap filter</li> </ul>	$\frac{V_{CC}}{2}$

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage (V)
10		<p>Quasi sine-wave filter:</p> <ul style="list-style-type: none"> <li>• Low-pass filter pin in quasi-sine wave circuit</li> </ul>	$\frac{V_{CC}}{2}$
11		<p>Stereo filter offset cancel:</p> <ul style="list-style-type: none"> <li>• Offset cancel pin for stereo filter output</li> </ul>	$\frac{V_{CC}}{2}$
12		<p>Composite input:</p> <ul style="list-style-type: none"> <li>• Composite signal input pin</li> </ul>	$\frac{V_{CC}}{2}$
13		<p>dbx timing current:</p> <ul style="list-style-type: none"> <li>• Timing current setting pin for dbx RMS detection</li> </ul>	1.3
14		<p>Reference:</p> <ul style="list-style-type: none"> <li>• Reference power supply stabilization pin</li> </ul>	$\frac{V_{CC}}{2}$

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage (V)
15		(L-R)/SAP demodulation output: • (L-R)/SAP demodulation signal output pin	$\frac{V_{CC}}{2} - 0.7$
16		dbx input: • Input signal of (L-R)/SAP signal to dbx NR	$\frac{V_{CC}}{2}$
17		(L+R) demodulation output offset cancel: • (L+R) demodulation signal offset cancel pin	$\frac{V_{CC}}{2}$
18		Spectral level adjustment: • Variable emphasis level adjustment pin	$\frac{V_{CC}}{2}$
19		Spectral timing: • RMS detection recovery time setting pin for variable emphasis	0.2



■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage (V)
20		Spectral level sensor input: • RMS detection circuit input pin for variable emphasis	$\frac{V_{CC}}{2}$
21	—	GND: • GND pin	0
22		Wideband level sensor input: • RMS detection circuit input pin for wide band expander	$\frac{V_{CC}}{2}$
23		Wideband timing: • RMS detection recovery time setting pin for wide band expander	0.2
24		dbx offset cancel: • dbx NR output offset cancel pin	$\frac{V_{CC}}{2}$
25		R output: • R line-out output pin	$\frac{V_{CC}}{2}$

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage (V)						
26		L output: • L line-out output pin	$\frac{V_{CC}}{2}$						
27		SAP carrier detection: • SAP signal carrier level detection pin	$\frac{V_{CC}}{2}$						
28	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>SW</td> </tr> <tr> <td><math>V_{28} &gt; V_{27}</math></td> <td>a</td> </tr> <tr> <td><math>V_{28} &lt; V_{27}</math></td> <td>b</td> </tr> </table>		SW	$V_{28} > V_{27}$	a	$V_{28} < V_{27}$	b	SAP noise level setting: • Noise detection pin for SAP malfunction prevention circuit (Mute SAP demodulation at detecting noise)	$\frac{V_{CC}}{2}$
	SW								
$V_{28} > V_{27}$	a								
$V_{28} < V_{27}$	b								

■ Application Circuit Example

