



# LA7688

## Single-Chip CTV Signal-Processing Circuit for PAL and NTSC Formats

### Overview

The LA7688 integrates VIF, SIF, video, chrominance, and deflection processing circuits for PAL/NTSC format TV sets on a single chip and is provided in a 52-pin shrink package.

The VIF and SIF circuits achieve semi-adjustment-free operation, and are adjustment-free except for the VCO coil and the RF AGC circuit. The chrominance circuit can be made adjustment-free by using the LC89950 1H delay line IC. All the signal processing required for a multi-format color TV can be implemented by combining this product with the LA7642 SECAM decoder IC.

### Features

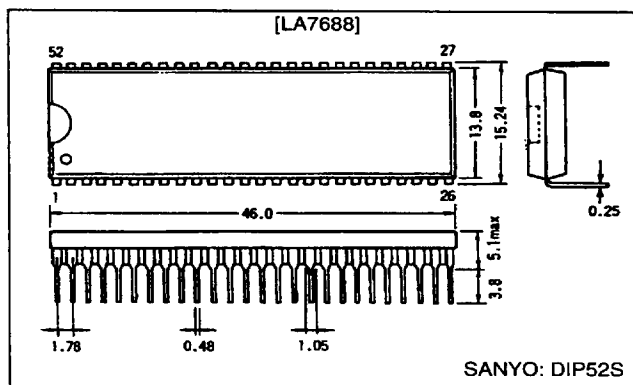
- [VIF] • PLL detector • Buzz canceller
- [SIF] • PLL detector • Audio switch
- [VIDEO] • Built-in trap • Built-in DL
- Aperture control
- Video switch (SVO output)
- Black expansion
- [CHROMA] • PAL/NT • Base band processing (adjustment free)
- Built-in bandpass filter

- [OSD] • Analog OSD
- [DEF] • Automatic 50/60 Hz discrimination
- Fixed vertical size • Double AFC
- Built-in sync separator circuit
- [Other features] • Sandcastle pulse (for the 1H delay line)
- fsc output (for SECAM systems)
- Primary color output

### Package Dimensions

unit: mm

3218-DIP52S



### Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>40</sub> max		9	V
	V <sub>45</sub> max		9	V
Maximum supply current	I <sub>24</sub> max		16	mA
	I <sub>26</sub> max		5	mA
FBP input current	I <sub>32</sub> max		10	mA
	I <sub>26</sub> min		-5	V
FBP input voltage	I <sub>26</sub> min		-5	V
Allowable power dissipation	Pd max	Ta ≤ 65°C When mounted on a printed circuit board*	1.3	W
Operating temperature	Topr		-10 to +65	°C
Storage temperature	Tstg		-55 to +150	°C

Note : \* Printed circuit board size: 83 × 86 × 1.5 mm, material: Bakelite

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V <sub>40</sub>		7.6	V
	V <sub>45</sub>		7.6	V
Recommended supply current	I <sub>24</sub>		12	mA
Operating voltage range	V <sub>40</sub> op		7 to 8.2	V
	V <sub>45</sub> op		7 to 8.2	V
Operating current range	I <sub>24</sub> op		10 to 16	mA

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Operating Characteristics at  $T_a = 25^\circ\text{C}$ ,  $V_{CC40, 45} = 7.8\text{ V}$ ,  $I_{24} = 12\text{ mA}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Circuit Voltages and Currents]						
Horizontal power-supply voltage	$V_{CCH}$	Deflection system ( $V_{24}$ )	6.4	6.9	7.4	V
Current drain	$I_{40}$		78	90	100	mA
	$I_{45}$		34	40	48	mA
[VIF Block]						
RF AGC maximum voltage	$V_{50H}$		7.5	7.8	7.8	V
RF AGC minimum voltage	$V_{50L}$			0.2	0.6	V
Input sensitivity	$V_i$			39	45	dB $\mu$
AGC range	GR		56	60		dB
Maximum allowable input	$V_{IN\max}$		95	100		dB $\mu$
Quiescent video output voltage	$V_B$		4.1	4.4	4.7	V
Synchronizing signal tip voltage	$V_{8tp}$		1.7	2.0	2.3	V
Video output amplitude	$V_O$		1.7	2.0	2.3	Vp-p
Black noise threshold voltage	$V_{BTH}$		1.0	1.3	1.7	V
Black noise clamp voltage	$V_{BCL}$		2.7	3.0	3.3	V
Output signal-to-noise ratio	S/N		48	52		dB
1.07 MHz beat level	C/S		40	44		dB
Frequency characteristics	$f_C$		6	9		MHz
Differential gain	DG			5	10	%
Differential phase	DP			6	10	deg
Quiescent AFT voltage	$V_7$		3.6	3.9	4.2	V
Maximum AFT voltage	$V_{7H}$		7.3	7.6	7.8	V
Minimum AFT voltage	$V_{7L}$		0	0.3	0.7	V
AFT detection sensitivity	$S_f$		10	15	20	mV/kHz
VIF input resistance	$R_i$	$f = 38.9\text{ MHz}$	1.0	1.3	1.6	k $\Omega$
VIF input capacitance	$C_i$	$f = 38.9\text{ MHz}$	2	3	5	pF
APC pull-in range (U)	$f_{PU}$		0.8	2.0		MHz
APC pull-in range (L)	$f_{PL}$			-2	-0.8	MHz
VCO1 maximum variation range	$\Delta f_{U1}$		0.8	2.0		MHz
	$\Delta f_{L1}$			-2.0	-0.8	MHz
SIF signal level	$S_{OUT}$		110	140	170	mVrms
VCO1 control sensitivity	$\beta$		2.4	4.8	9.6	kHz
[SIF Block]						
SIF limiting sensitivity	$V_i$ (lim)		40	46	52	dB $\mu$
FM detector output voltage	$V_O$ (FM)		390	500	710	mVrms
AMR	AMR		40	60		dB
Total harmonic distortion	THD			0.3	1.0	%
SIF S/N	S/N (SIF)		55	62		dB
FM detector range (L)	$W_{FML}$			2.5	4.0	MHz
FM detector range (H)	$W_{FMH}$		7.0	8.0		MHz
FM detector output variability	$\Delta V_O$		0	2.0	3.0	dB
[INT/EXT Switching Block]						
AFT EXT gain	$G_{AF}$		-0.7	-0.2	+0.3	dB
AFT EXT distortion	THD <sub>AF</sub>			0.03	0.5	%
System switch I-SE	$V_{1TH1}$	Notes: I = INT, E = EXT P/N = PAL/NTSC SE = SECAM	0		1.2	V
System switch I-P/N	$V_{1TH2}$		1.7		2.6	V
System switch E-P/N	$V_{1TH3}$		2.9		3.8	V
System switch E-SE	$V_{1TH4}$		4.1		5	V
[Video Switching Block]						
Video signal input 1 DC voltage	$V_{10DC}$		3.2	3.5	3.8	V
Video signal input 1 AC voltage	$V_{10AC}$			1.0		Vp-p
Video signal input 2 DC voltage	$V_{14DC}$		3.2	3.5	3.8	V
Video signal input 2 AC voltage	$V_{14AC}$			1.0		Vp-p
SVO pin DC voltage	$V_{16DC}$		2.5	2.8	3.1	V
SVO pin AC voltage	$V_{16AC}$		1.7	2.0	2.3	Vp-p

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Filter Block]						
Filter automatic adjustment open voltage	V <sub>90PN</sub>	f <sub>SC</sub> = 4.43 MHz	3.3	3.8	4.3	V
S input threshold	V <sub>9TH</sub>		1.5	2.0	2.5	V
C-TRAP	G <sub>TRAP</sub>		-20	-26	-32	dB
C-BPF1	G <sub>BPF1</sub>		-5	-3	-1	dB
C-BPF2	G <sub>BPF2</sub>		-2	-1	0	dB
C-BPF3	G <sub>BPF3</sub>		-6	-4	-2	dB
Y-DL TIME1	T <sub>dy1</sub>	PAL	400	450	500	ns
Y-DL TIME2	T <sub>dy2</sub>	NTSC	410	460	510	ns
Y-DL TIME3	T <sub>dy3</sub>	S (PAL)	230	280	330	ns
Y-DL TIME4	T <sub>dy4</sub>	SECAM	510	560	610	ns
[Video Block]						
Contrast center	E <sub>CCEN</sub>		1.0	1.2	1.4	Vp-p
Contrast variation range	d <sub>GC</sub>		18	22	26	dB
Brightness minimum (0.5 V)	VB min		0.4	0.7	1.0	V
Brightness typical (2.5 V)	VB typ		1.9	2.2	2.5	V
Brightness maximum (4.5 V)	VB max		3.4	3.7	4.0	V
Soft control characteristics	d <sub>GSOFT</sub>		-6.0	-4.0	-2.0	dB
Sharp control characteristics	d <sub>GSHARP</sub>		4.5	7.5	10.5	dB
Y signal frequency characteristics (1)	BW1	S-VHS	3.9	4.4	4.9	MHz
Y signal frequency characteristics (2)	BW2	PAL	3.0	3.35	3.7	MHz
Y signal frequency characteristics (3)	BW3	NTSC	2.5	2.85	3.2	MHz
DC transmission ratio	d <sub>VAPL</sub>			100		%
Black expansion threshold	BS <sub>TH</sub>		40	50	60	IRE
Black expansion maximum gain	BS <sub>max</sub>		-20	-13	-6	IRE
[Chrominance Common]						
R-Y output DC voltage	V <sub>39DC</sub>		3.6	4.0	4.4	V
R-Y output AC voltage	E <sub>39AC</sub>		0.45	0.60	0.75	Vp-p
B-Y output DC voltage	V <sub>38DC</sub>		3.6	4.0	4.4	V
B-Y output AC voltage	E <sub>38AC</sub>		0.35	0.5	0.65	Vp-p
R-Y input DC voltage	V <sub>37DC</sub>		4.2	4.6	5.0	V
R-Y input AC voltage	E <sub>37AC</sub>		0.45	0.60	0.75	Vp-p
R-Y input AC range	E <sub>37ALC</sub>		160	200	250	mVp-p
B-Y input DC voltage	V <sub>36DC</sub>		4.2	4.6	5.0	V
B-Y input AC voltage	E <sub>36AC</sub>		0.35	0.5	0.65	Vp-p
B-Y input AC range	E <sub>36ALC</sub>		160	200	250	mVp-p
Residual color	E <sub>CMIN</sub>				200	mVp-p
Contrast color amplitude characteristics	d <sub>GCC</sub>		30	35	40	dB
RGB output DC difference voltage	d <sub>VC</sub>	With no chrominance signal input	-0.3	0	+0.3	V
RGB output DC voltage temperature characteristics	∂VC/∂T	With no chrominance signal input		0		mV/°C
RGB output residual high-frequency level	E <sub>car</sub>				0.2	Vp-p
RGB output residual carrier level	e <sub>car</sub>	With no chrominance signal input			0.3	Vp-p
f <sub>SC</sub> output pin DC voltage	V <sub>27OPN</sub>		4.5	5.0	5.3	V
f <sub>SC</sub> output level P	V <sub>27ACP</sub>	PAL	0.14	0.2	0.26	Vp-p
f <sub>SC</sub> output level N	V <sub>27ACN</sub>	NTSC	0.19	0.26	0.33	Vp-p
DEF COIN-L	V <sub>27LO</sub>		1.0	1.3	1.6	V
Crystal switching threshold	V <sub>27TH</sub>			400		μA
PAL switching threshold	V <sub>18PTH</sub>				0.6	V
NT switching threshold	V <sub>18NTH</sub>		0.9			V

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Chrominance System PAL Block]						
ACC amplitude characteristics 1	ACC1p		-2	+1	+4	dB
ACC amplitude characteristics 2	ACC2p		-4	0	+2	dB
Killer operating point	E KILp		-37	-30	-25	dB
Killer hysteresis	dE KILp		1	3	7	dB
RGB output level	E Bp	Chrominance: 50%, color: typical	4.1	4.6	5.1	Vp-p
Maximum RGB output	EBmaxp	Chrominance: 50%, color: maximum	5.4	5.9	6.4	Vp-p
APC pull-in range +	df scp+		500			Hz
APC pull-in range -	df scp-				-500	Hz
Demodulated output ratio B/R	B/Rp		1.50	1.78	2.00	double
Demodulated output ratio G/R	G/Rp	With no B-Y signal	-0.56	-0.51	-0.46	double
Demodulated output ratio G/B	G/Bp	With no R-Y signal	-0.21	-0.91	-0.17	double
Demodulation angle	RBp		85	90	95	deg
[Chrominance System NTSC Block]						
ACC amplitude characteristics 1	ACC1n		-2	+1	+4	dB
ACC amplitude characteristics 2	ACC2n		-4	0	+2	dB
ACC phase characteristics 1	PCC1n		-3	0	+3	deg
ACC phase characteristics 2	PCC2n		-5	0	+5	deg
Killer operating point	E KILn		-40	-34	-29	dB
Killer hysteresis	dE KILn		1	4	8	dB
RGB output level	E Bn	Chrominance: 50%, color: typical	3.4	3.9	4.4	Vp-p
Maximum RGB output	EBmaxn	Chrominance: 50%, color: maximum	5.0	5.5	6.0	Vp-p
APC pull-in range +	df scn+		350			Hz
APC pull-in range -	df scn-				-350	Hz
Tint control variation range	dP TI		-33		+50	deg
Demodulated output ratio R	R/Bn		0.81	0.90	0.99	double
Demodulated output ratio G	G/Bn		0.24	0.30	0.36	double
Demodulation angle RB	RBn		95	105	115	deg
Demodulation angle GB	GBn		-130	-120	-110	deg
[RGB Block]						
OSD input level	E <sub>OSD</sub>	Standard input, 100% white level		0.7		Vp-p
OSD input DC voltage	V <sub>OSD</sub>	With no signal	2.9	3.2	3.5	V
F-BLK input threshold level	V <sub>28TH</sub>		0.8	1.0	1.2	V
OSD output pedestal level difference	V <sub>OSDC</sub>		-0.3	0	+0.3	Vp-p
OSD output maximum	E <sub>OSDmax</sub>		4.3	4.8	5.3	Vp-p
OSD output minimum	E <sub>OSDmin</sub>		0.3	0.6	0.9	Vp-p
Character signal output frequency characteristics	BW <sub>OSD</sub>		5	7		MHz
TV-OSD crosstalk (C-Y)	CT <sub>TVC</sub>		50			dB
OSD-TV crosstalk (C-Y)	CT <sub>OSDC</sub>		40			dB
Character signal inter-character crosstalk	CT <sub>OSD</sub>		30			dB
[DEF Block]						
Vertical free-running period 50	TV <sub>FREE50</sub>		312.0	312.5	313.0	H
Vertical free-running period 60	TV <sub>FREE60</sub>		262.0	262.5	263.0	H
Vertical synchronization maximum period 50	TV <sub>max50</sub>	Horizontal synchronizing signal only	356.5	357.0	357.5	H
Vertical synchronization maximum period 60	TV <sub>max60</sub>	Horizontal synchronizing signal only	296.5	297.0	297.5	H
Vertical synchronization minimum period 50	TV <sub>min50</sub>		268.5	269.0	269.5	H
Vertical synchronization minimum period 60	TV <sub>min60</sub>		224.5	225.0	225.5	H
Vertical blanking peak value	V <sub>HVBL</sub>			0.6	1.0	V
Vertical blanking pulse width 50	PW <sub>BLK50</sub>		23	23.5	24	H
Vertical blanking pulse width 60	PW <sub>BLK60</sub>		19	19.5	20	H
Vertical output pulse width	PW <sub>VOU</sub>		8.0	8.5	9.0	H
Vertical output voltage H	V <sub>OUTH</sub>		5.3	5.6	5.9	V
Vertical output voltage M	V <sub>OUTM</sub>		4.0	4.3	4.6	V
Vertical output voltage L	V <sub>OUTL</sub>				0.3	V

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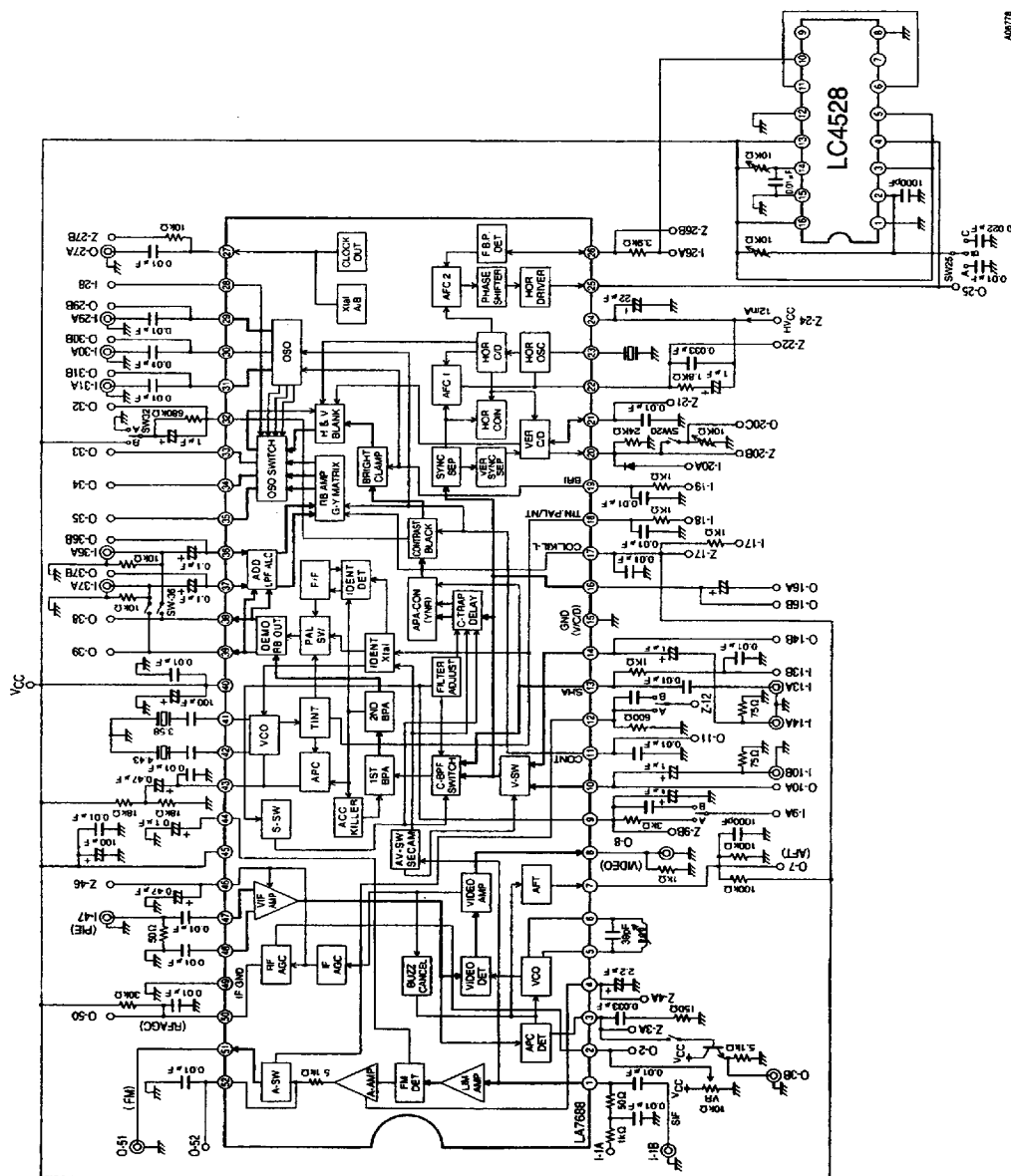
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Vertical external trigger load resistance	RTR		3.0	4.7		kΩ
Vertical automatic synchronization stop voltage	V <sub>SAS</sub>			1.4	1.9	V
Horizontal AFC gate release voltage	V <sub>GS</sub>			2.0	2.5	V
Vertical output start V <sub>CC</sub> voltage	SVV			4.2	4.7	V
Horizontal free-running deviation	Δf <sub>H</sub>		-150	0	+150	Hz
Horizontal free-running frequency V <sub>CC</sub> dependence	Δf <sub>H</sub> /V <sub>CC</sub>			2		Hz
Horizontal pull-in range	f <sub>HPLL</sub>		±450			Hz
Horizontal output start V <sub>CC</sub> voltage	S <sub>HV</sub>			4.8	5.2	V
AFC2 FBP peak value H	F <sub>BPH</sub>		6.0	6.5	7.0	V
AFC2 FBP peak value M	F <sub>BPM</sub>		3.2	3.7	4.2	V
AFC2 FBP peak value L	F <sub>BPL</sub>		-0.3	+0.2	+0.7	V
Horizontal output pulse width	P <sub>WHOUT</sub>		21.8	23.8	25.8	μs
Horizontal output phase maximum	HP <sub>max</sub>		14	17		μs
Horizontal output phase center	HP <sub>cen</sub>		4.8	5.8	6.8	μs
Horizontal output phase minimum	HP <sub>min</sub>			3.8	4.8	μs
Burst gate pulse width	P <sub>WBGP</sub>		3	4	5	μs
Burst gate pulse phase	T <sub>dBGP</sub>		-0.2	+0.3	+0.8	μs
50/60 Hz output voltage 50	V <sub>50</sub>			1.1	1.5	V
50/60 Hz output voltage 60	V <sub>60</sub>		3.8	4.1		V
50/60 Hz input voltage 50	V <sub>IN50</sub>		0.5			V
50/60 Hz input voltage 60	V <sub>IN60</sub>				7.0	V
SECAM V pulse peak value	SVH		1.8	2.2	2.6	V
SECAM V pulse width	SVW		11.0	11.5	12.0	H

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Test Circuit



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