

**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 |

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V ₄₀ max		9	V
	V ₄₅ max		9	V
Maximum supply current	I ₂₄ max		16	mA
FBP input current	I ₂₆ max		5	mA
	I ₃₂ max		10	mA
FBP input voltage	I ₂₆ min		-5	V
Allowable power dissipation	P _d max	Ta ≤ 65°C When mounted on a printed circuit board*	1.3	W
Operating temperature	T _{opr}		-10 to +65	°C
Storage temperature	T _{stg}		-55 to +150	°C

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

Operating Conditions at Ta = 25°C

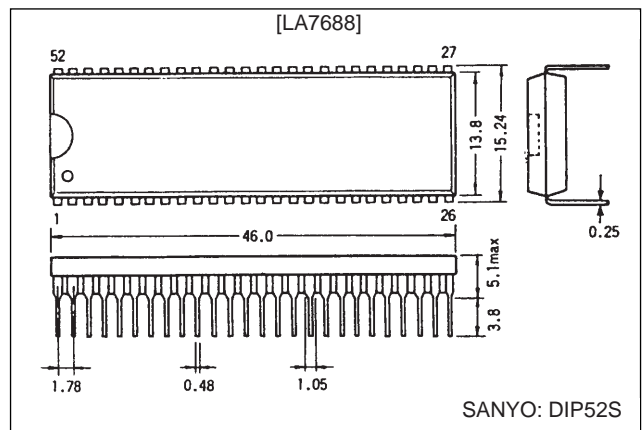
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V ₄₀		7.6	V
	V ₄₅		7.6	V
Recommended supply current	I ₂₄		12	mA
Operating voltage range	V ₄₀ op		7 to 8.2	V
	V ₄₅ op		7 to 8.2	V
Operating current range	I ₂₄ op		10 to 16	mA

- | | |
|------------------|--|
| [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



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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 μ
AGC range	GR		56	60		dB
Maximum allowable input	$V_{IN\ max}$		95	100		dB μ
Quiescent video output voltage	V_8		4.1	4.4	4.7	V
Synchronizing signal tip voltage	V_{8tip}		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	Sf		10	15	20	mV/kHz
VIF input resistance	Ri	$f = 38.9\text{ MHz}$	1.0	1.3	1.6	k Ω
VIF input capacitance	Ci	$f = 38.9\text{ MHz}$	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	Δf_{U1}		0.8	2.0		MHz
	Δf_{L1}			-2.0	-0.8	MHz
SIF signal level	S_{OUT}		110	140	170	mVrms
VCO1 control sensitivity	β		2.4	4.8	9.6	kHz
[SIF Block]						
SIF limiting sensitivity	V_i (lim)		40	46	52	dB μ
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	ΔV_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 _{AF}			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 _{9OPN}	f _{SC} = 4.43 MHz	3.3	3.8	4.3	V
S input threshold	V _{9TH}		1.5	2.0	2.5	V
C-TRAP	G _{TRAP}		-20	-26	-32	dB
C-BPF1	G _{BPF1}		-5	-3	-1	dB
C-BPF2	G _{BPF2}		-2	-1	0	dB
C-BPF3	G _{BPF3}		-6	-4	-2	dB
Y-DL TIME1	T _{dy1}	PAL	400	450	500	ns
Y-DL TIME2	T _{dy2}	NTSC	410	460	510	ns
Y-DL TIME3	T _{dy3}	S (PAL)	230	280	330	ns
Y-DL TIME4	T _{dy4}	SECAM	510	560	610	ns
[Video Block]						
Contrast center	E _{CEN}		1.0	1.2	1.4	Vp-p
Contrast variation range	d _{GC}		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 _{GSOFT}		-6.0	-4.0	-2.0	dB
Sharp control characteristics	d _{GSHARP}		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 _{VAPL}			100		%
Black expansion threshold	BS _{TH}		40	50	60	IRE
Black expansion maximum gain	BS _{max}		-20	-13	-6	IRE
[Chrominance Common]						
R-Y output DC voltage	V _{39DC}		3.6	4.0	4.4	V
R-Y output AC voltage	E _{39AC}		0.45	0.60	0.75	Vp-p
B-Y output DC voltage	V _{38DC}		3.6	4.0	4.4	V
B-Y output AC voltage	E _{38AC}		0.35	0.5	0.65	Vp-p
R-Y input DC voltage	V _{37DC}		4.2	4.6	5.0	V
R-Y input AC voltage	E _{37AC}		0.45	0.60	0.75	Vp-p
R-Y input AC range	E _{37ALC}		160	200	250	mVp-p
B-Y input DC voltage	V _{36DC}		4.2	4.6	5.0	V
B-Y input AC voltage	E _{36AC}		0.35	0.5	0.65	Vp-p
B-Y input AC range	E _{36ALC}		160	200	250	mVp-p
Residual color	E _{CMIN}				200	mVp-p
Contrast color amplitude characteristics	d _{GCC}		30	35	40	dB
RGB output DC difference voltage	d _{VC}	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 _{car}				0.2	Vp-p
RGB output residual carrier level	e _{car}	With no chrominance signal input			0.3	Vp-p
f _{SC} output pin DC voltage	V _{27OPN}		4.5	5.0	5.3	V
f _{SC} output level P	V _{27ACP}	PAL	0.14	0.2	0.26	Vp-p
f _{SC} output level N	V _{27ACN}	NTSC	0.19	0.26	0.33	Vp-p
DEF COIN-L	V _{27LO}		1.0	1.3	1.6	V
Crystal switching threshold	V _{27TH}			400		μA
PAL switching threshold	V _{18PTH}				0.6	V
NT switching threshold	V _{18NTH}		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 _{OSD}	Standard input, 100% white level		0.7		Vp-p
OSD input DC voltage	V _{OSD}	With no signal	2.9	3.2	3.5	V
F-BLK input threshold level	V _{28TH}		0.8	1.0	1.2	V
OSD output pedestal level difference	V _{OSDC}		-0.3	0	+0.3	Vp-p
OSD output maximum	E _{OSDmax}		4.3	4.8	5.3	Vp-p
OSD output minimum	E _{OSDmin}		0.3	0.6	0.9	Vp-p
Character signal output frequency characteristics	BW _{OSD}		5	7		MHz
TV-OSD crosstalk (C-Y)	CT _{TVC}		50			dB
OSD-TV crosstalk (C-Y)	CT _{OSDC}		40			dB
Character signal inter-character crosstalk	CT _{OSD}		30			dB
[DEF Block]						
Vertical free-running period 50	TV _{FREE50}		312.0	312.5	313.0	H
Vertical free-running period 60	TV _{FREE60}		262.0	262.5	263.0	H
Vertical synchronization maximum period 50	TV _{max50}	Horizontal synchronizing signal only	356.5	357.0	357.5	H
Vertical synchronization maximum period 60	TV _{max60}	Horizontal synchronizing signal only	296.5	297.0	297.5	H
Vertical synchronization minimum period 50	TV _{min50}		268.5	269.0	269.5	H
Vertical synchronization minimum period 60	TV _{min60}		224.5	225.0	225.5	H
Vertical blanking peak value	V _{HVBL}			0.6	1.0	V
Vertical blanking pulse width 50	PW _{BLK50}		23	23.5	24	H
Vertical blanking pulse width 60	PW _{BLK60}		19	19.5	20	H
Vertical output pulse width	PW _{VOU}		8.0	8.5	9.0	H
Vertical output voltage H	V _{OUTH}		5.3	5.6	5.9	V
Vertical output voltage M	V _{OUTM}		4.0	4.3	4.6	V
Vertical output voltage L	V _{OUTL}				0.3	V

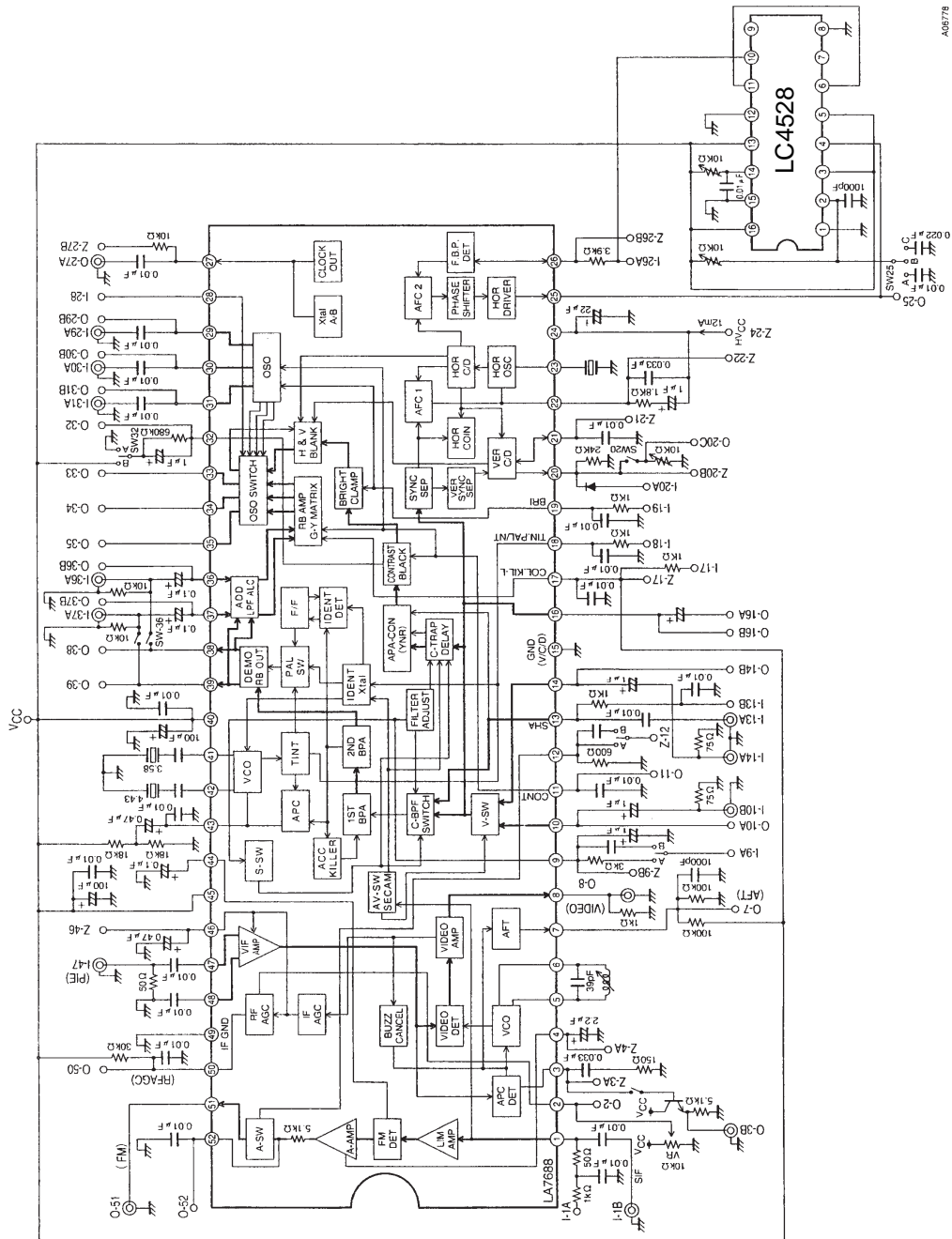
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Vertical external trigger load resistance	RTR		3.0	4.7		k Ω
Vertical automatic synchronization stop voltage	V _{SAS}			1.4	1.9	V
Horizontal AFC gate release voltage	V _{GS}			2.0	2.5	V
Vertical output start V _{CC} voltage	SVV			4.2	4.7	V
Horizontal free-running deviation	Δf_H		-150	0	+150	Hz
Horizontal free-running frequency V _{CC} dependence	$\Delta f_H/V_{CC}$			2		Hz
Horizontal pull-in range	f _{HPLL}		± 450			Hz
Horizontal output start V _{CC} voltage	S _{HV}			4.8	5.2	V
AFC2 FBP peak value H	F _{BPH}		6.0	6.5	7.0	V
AFC2 FBP peak value M	F _{BPM}		3.2	3.7	4.2	V
AFC2 FBP peak value L	F _{BPL}		-0.3	+0.2	+0.7	V
Horizontal output pulse width	P _{WHOUT}		21.8	23.8	25.8	μ s
Horizontal output phase maximum	HP _{max}		14	17		μ s
Horizontal output phase center	HP _{cen}		4.8	5.8	6.8	μ s
Horizontal output phase minimum	HP _{min}			3.8	4.8	μ s
Burst gate pulse width	PW _{BGP}		3	4	5	μ s
Burst gate pulse phase	T _{dBGP}		-0.2	+0.3	+0.8	μ s
50/60 Hz output voltage 50	V ₅₀			1.1	1.5	V
50/60 Hz output voltage 60	V ₆₀		3.8	4.1		V
50/60 Hz input voltage 50	V _{IN50}		0.5			V
50/60 Hz input voltage 60	V _{IN60}				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

Test Circuit



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