APPLICATION NOTE

17 inch 70kHz CRT monitor demo set featuring SAA4848/SAA4849

AN10280_1

Philips Semiconductors

TP97035.3/W97

PHILIPS

Purchase of Philips I²C components conveys a license under the I²C patent to use the components in the I²C system, provided the system conforms to the I²C specifications defined by Philips.

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17 inch 70kHz CRT monitor demo set featuring SAA4848/SAA4849

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Keywords

autosync monitor
geometry control
CRT monitor
I2C-bus control
Deflection controller & Microcontroller

Number of pages: 66

Date: 2004-01-05

Summary

This application note includes a bief description of the 17" demo monitor featuring the combined micro controller and deflection controller SAA4848/SAA4849.

Some of the 17" demo monitor specification points are:

1) Universal auto sync design capable of driving 17" picture tubes
2) Global mains supply 90 ~ 264V
3) Horizontal deflection 30 ~ 70kHz
4) Vertical deflection 50 ~ 200Hz
5) Combined deflection & EHT
6) DDC controlled

In this application note is described:

1) electrical circuit diagram
2) bill of material
3) embedded software description

CONTENTS

1 INTRODUCTION

This document describes the SAA4848PS demo monitor. You will find in this document:

- Block diagrams;
- Schematics;
- Bill of material;
- Embedded software description;
- I2C software description for PC.

1.1 Key components

SAA4848/49	Digital CMOS deflection controller plus microcontroller
TDA4867J	Full bridge current driven vertical deflection booster, 2.5App up to 200Hz
BU4525AX	Silicon diffused transistor for horizontal deflection stages
BYM537X	Power combi diode, flyback diode and EW modulator diode in one package
M41FJB523X140/T404BA	Philips 17" High resolution Cybertube™ , high contrast picture tube assembly
TEA1507	Greenchip II, SMPS control IC
TDA4887PS	160MHz I2C controlled video preamplifier
PHP3055E	N-channel standard level field-effect transistor for east-west amplifier
PHP18NQ20T	N-channel PowerMOS ransistor for linearity capacitor switching

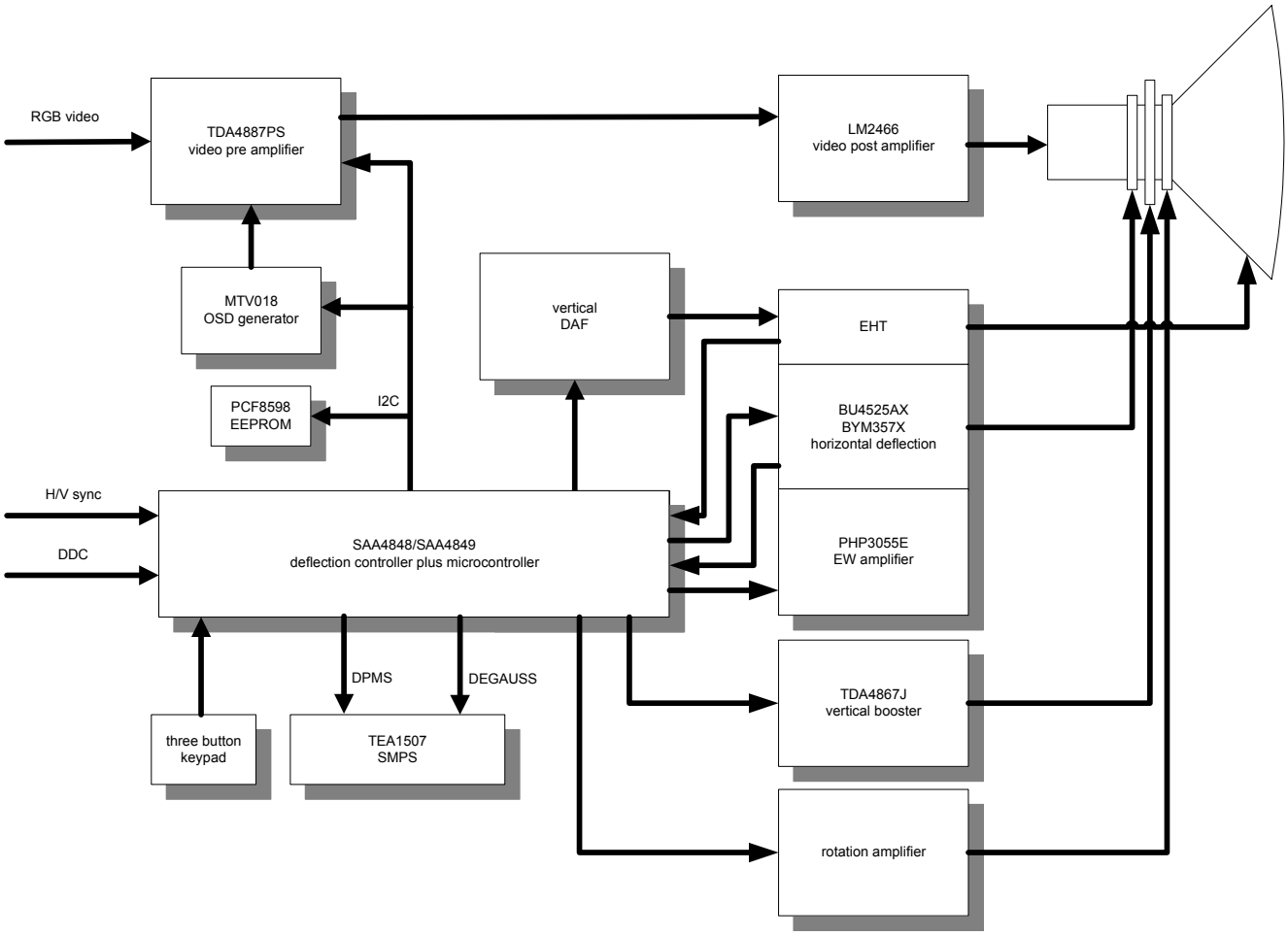
Table 1 Key components

1.2 Specification

GENERAL	Mains Voltage	90-264 Vac
	Mains Frequency	50-60 Hz
	Power Consumption	Typical < 75W
	Standby Power	< 1.0 W
	Weight	20 kg
	Dimensions	423 x 426 x 405 mm^3
PICTURE TUBE	Type	M41FJB523x140/T404BA
	Dot Triplet Pitch	0.25 mm
	Recommended Active Screen Area	312 x 234 mm
	Anode Voltage	26.0 kV
	Horizontal Deflection Inductance	125 uH
	Maximum Advised Horizontal Frequency	72 kHz
	Vertical Deflection Coil Inductance	6.3 mH
	Vertical Deflection Coil Resistance	6.3 Ohm
VIDEO	Maximum Pixel Rate	120 MHz
	Input Connector	VGA
	Input Signal	0.7 Vpp linear
	Input Impedance	75 ohm
SYNC SIGNALS	Level	TTL
	Polarity	Positive or negative
	Horizontal Frequency	30 to 70 kHz
	Vertical Frequency	50 to 200 Hz
	Sync Input	Seperate H+V and composite on H
USER INTERFACE	Keypad	Three button keypad
	On Screen Display	Graphical indication of settings
CONTROL	Keypad	In monitor cabinet
	DDC	Via VGA cable
	I2C (Demo Purpose Only)	External I2C connector connected with interface card to PC with I2C Menu software

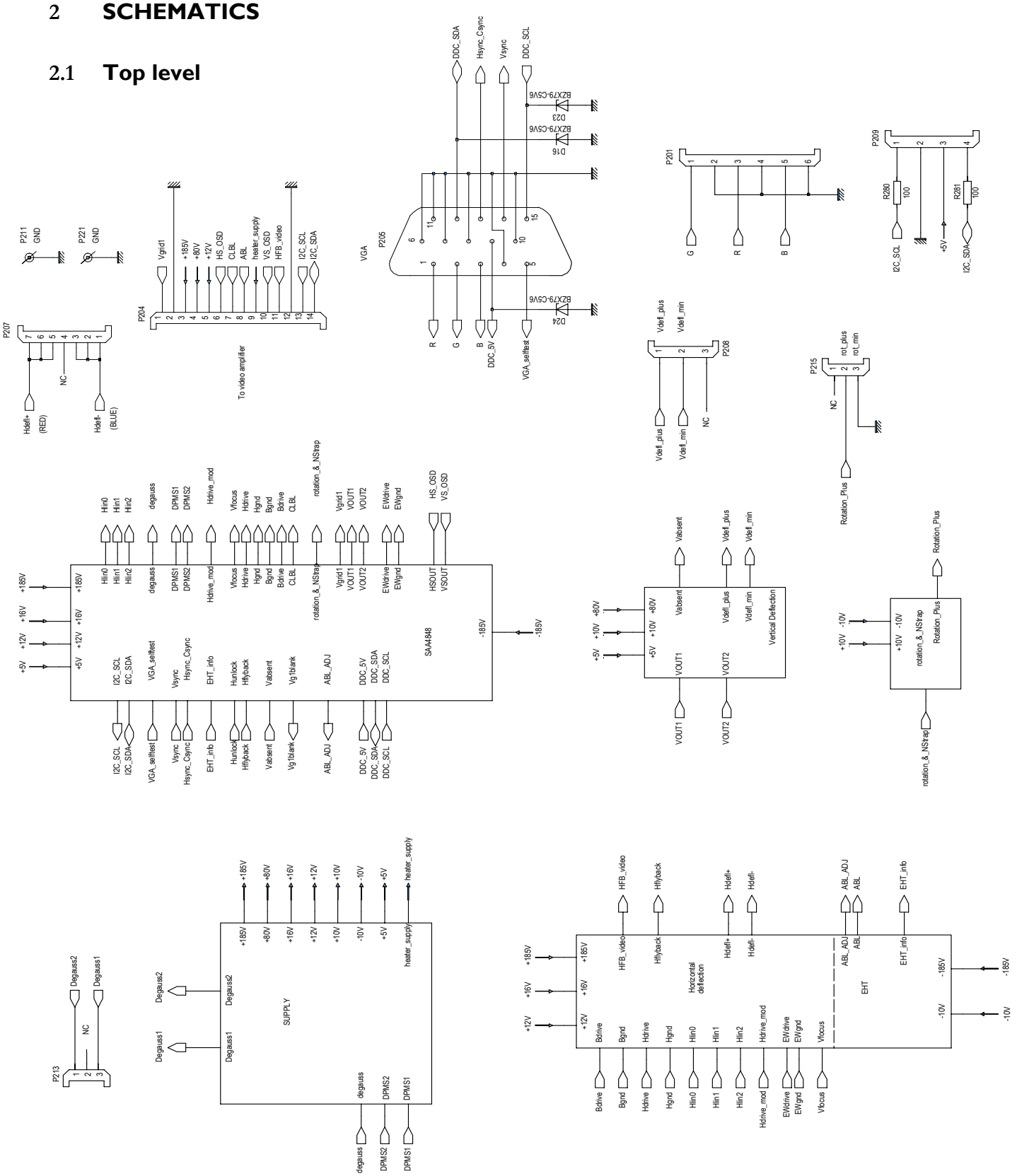
TABLE 2 SPECIFICATION

1.3 Block diagram

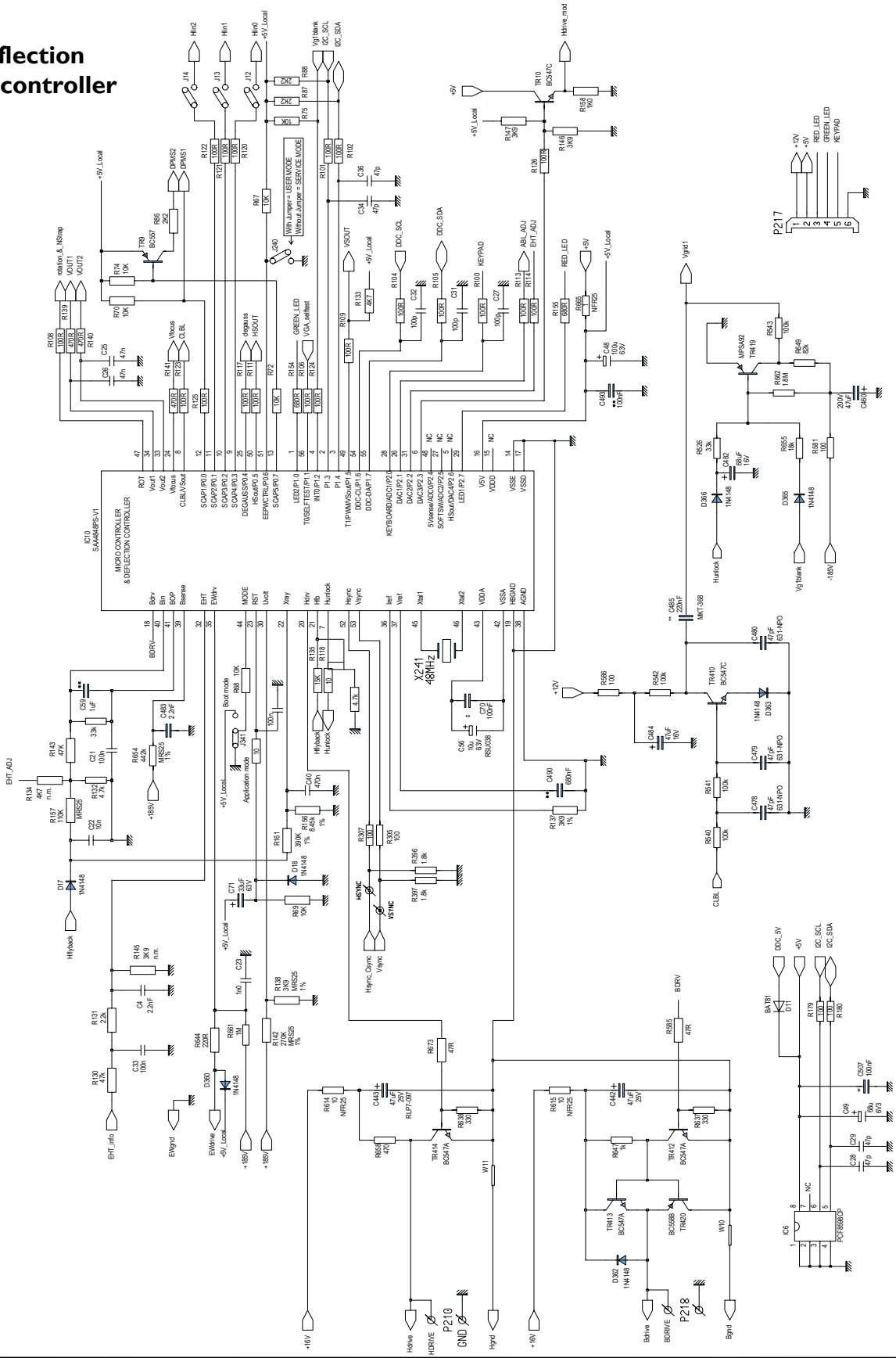


2 SCHEMATICS

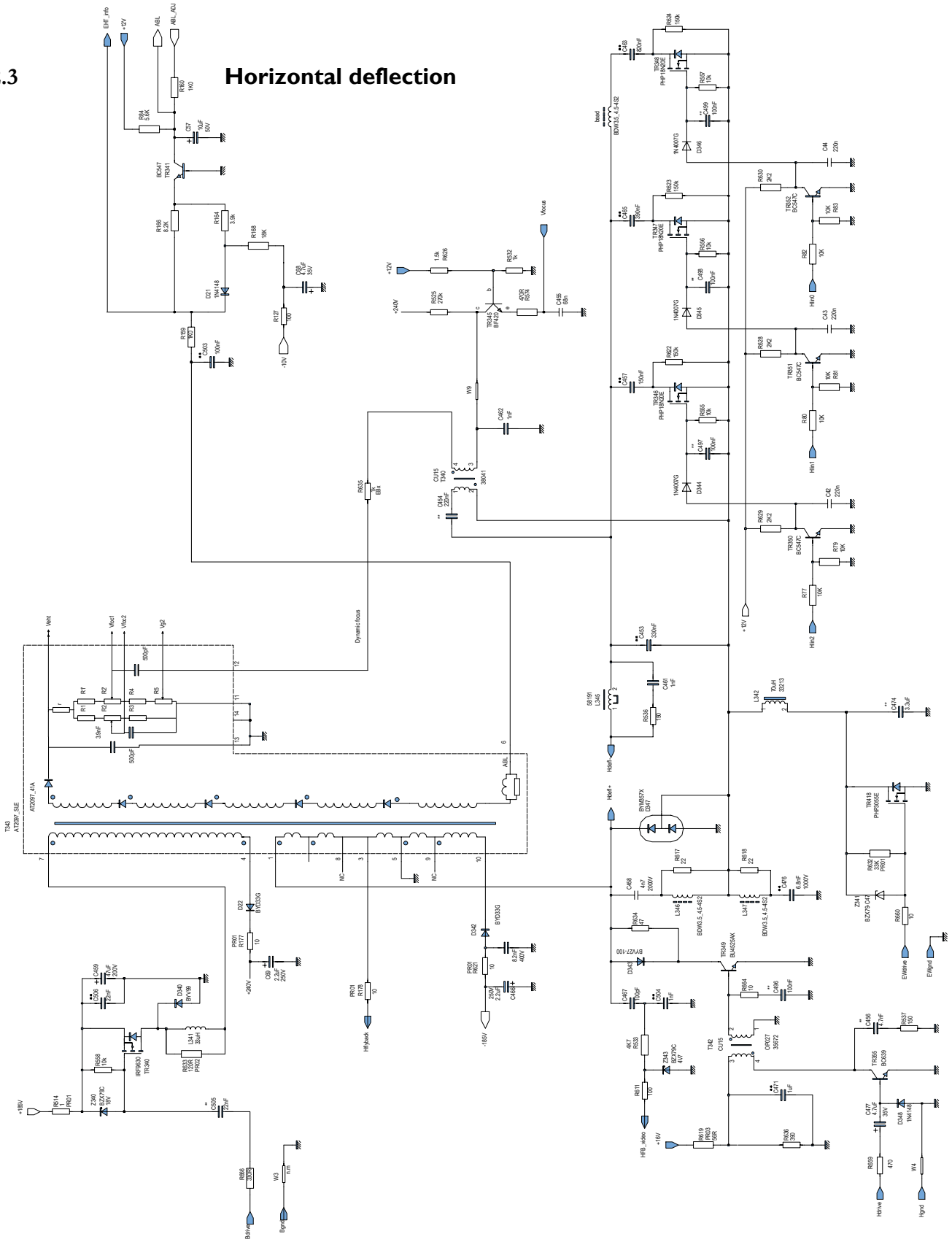
2.1 Top level



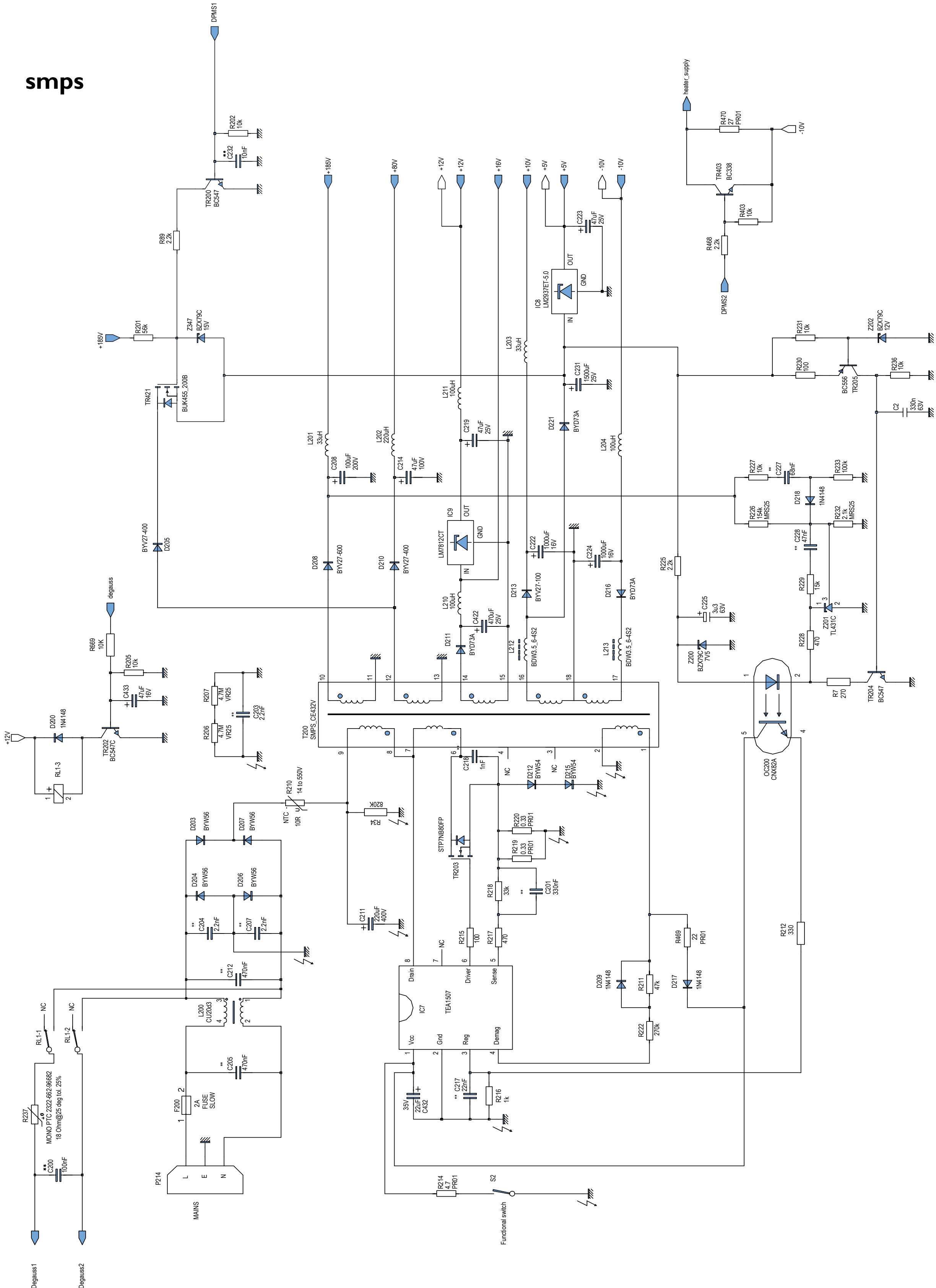
2.2 Deflection & microcontroller



2.3 Horizontal deflection



2.4 smps


DPMS1
R202
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C232
10nF
TR200
BC547
R89
2.2k
+185V
R201
56k
Z347
BZX79C
15V
TR421
BUK455_200B
BYV27-400
D205
degauss
R669
10K
R205
10k
C433
47uF
16V
D200
1N4148
+12V
TR202
BC547C
RL1-3
+185V
+80V
+12V
+12V
+16V
+10V
+5V
+5V
-10V
-10V
C223
47uF
25V
IC8
LM2937ET-5.0
OUT
GND
IN
L203
33uH
C231
1500uF
25V
D221
BYD73A
L211
100uH
C219
47uF
25V
L201
33uH
L202
220uH
C208
100uF
200V
C214
47uF
100V
L204
100uH
IC9
LM7812CT
D208
BYV27-600
D210
BYV27-400
C222
1000uF
16V
C224
1000uF
16V
D213
BYV27-100
D216
BYD73A
L210
100uH
C422
470uF
25V
D211
BYD73A
L212
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BDW3.5_6-4S2
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VR25
R206
4.7M
VR25
C203
2.2nF
R210
14 to 550V
NTC
10R
820K
R34
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D212
BYW54
D215
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PR01
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220uF
400V
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BYW56
D207
BYW56
D204
BYW56
D206
BYW56
C204
2.2nF
C207
2.2nF
C212
470nF
L200
CU20d3
C205
470nF
F200
2A
FUSE
SLOW
P214
MAINS
R215
100
R217
470
IC7
TEA1507
Drain
Driver
Sense
Vcc
Gnd
Reg
Demag
C432
22uF
35V
C217
22nF
R216
1k
R214
4.7
PR01
S2
Functional switch
R469
22
PR01
D209
1N4148
R211
47k
D217
1N4148
R222
270k
R212
330
OC200
CNX82A
R237
MONO PTC 2322-662-96682
18 Ohm@25 deg tol. 25%
C200
100nF
RL1-1
RL1-2
NC
Degauss1
Degauss2
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-10V
TR403
BC338
R403
10k
R468
2.2k
DPMS2
R231
10k
Z202
BZX79C
12V
R230
100
BC556
TR205
R236
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C2
330n
63V
R227
10k
C227
68nF
R233
100k
R226
154k
MRS25
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1N4148
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2.1k
MRS25
C228
47nF
R225
2.2k
C225
3u3
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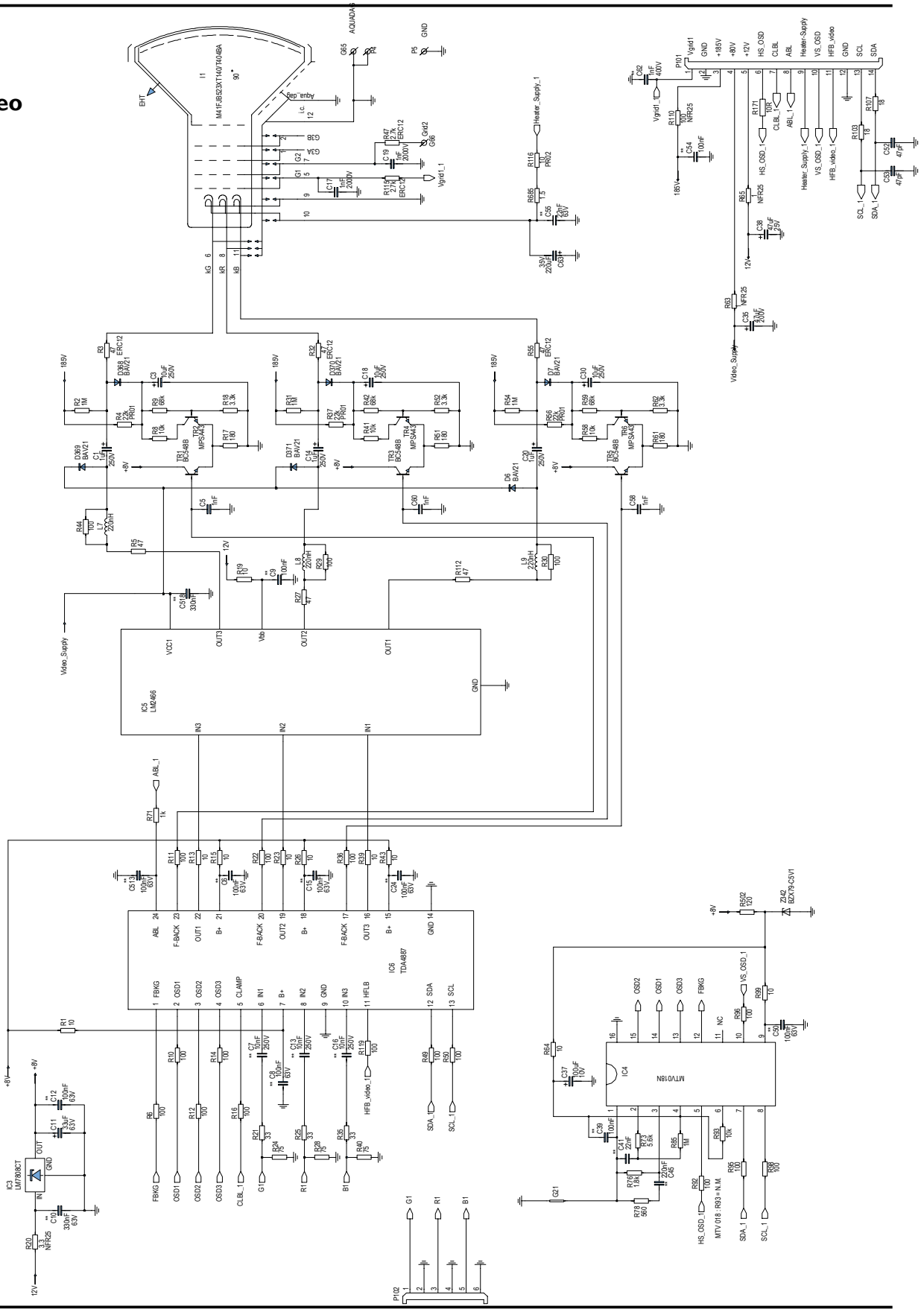
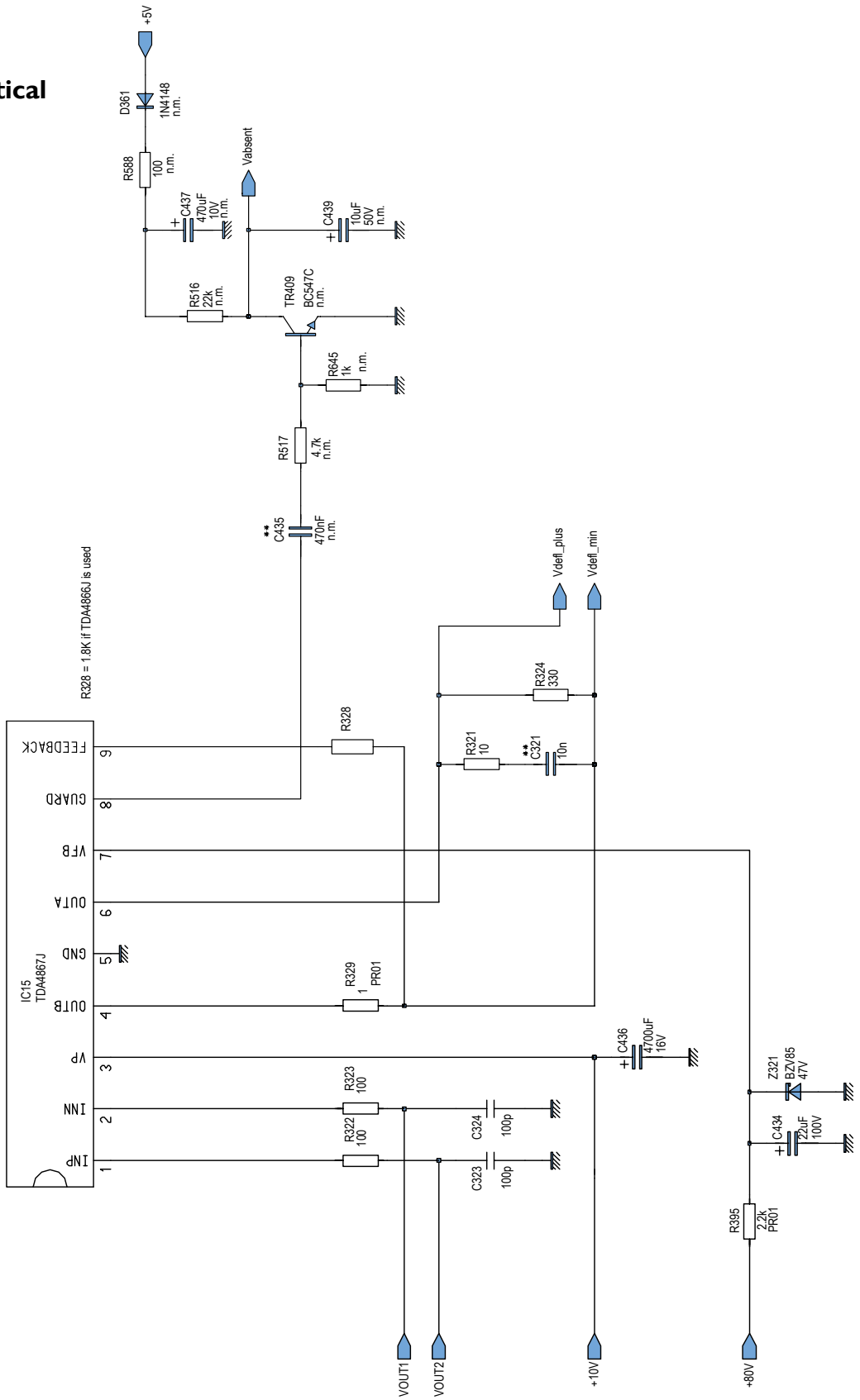
270
TR204
BC547

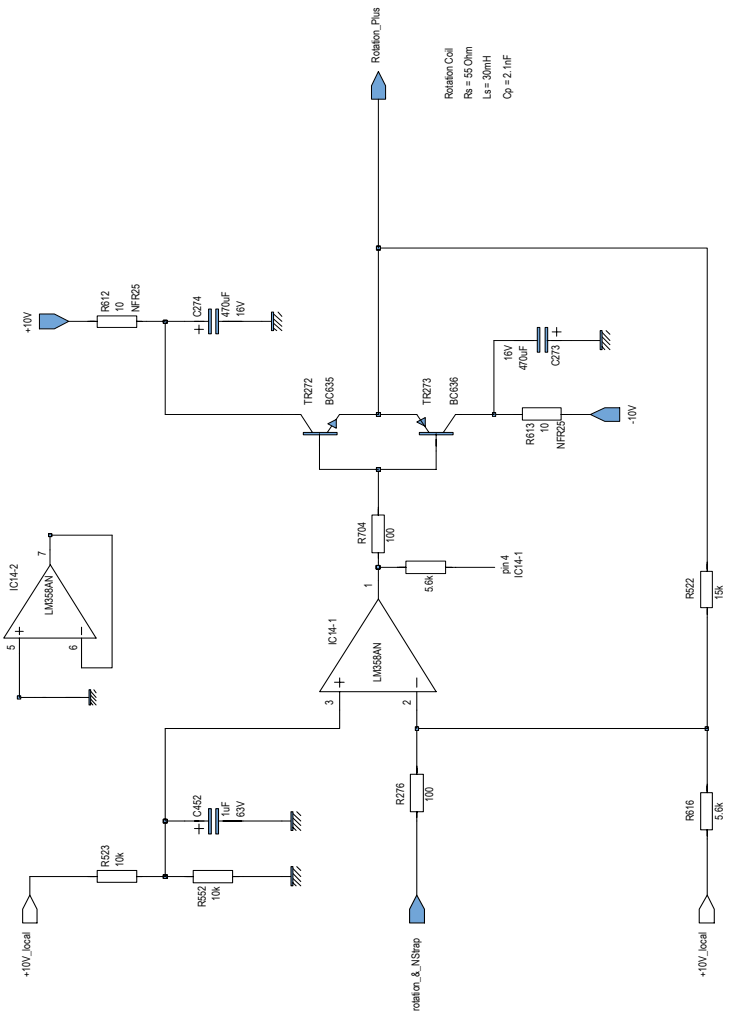
2.5 video



2.6 vertical


+5V
D361
1N4148
n.m.
R588
100
n.m.
Vabsent
C437
470uF
10V
n.m.
C439
10uF
50V
n.m.
R516
22k
n.m.
TR409
BC547C
n.m.
R645
1k
n.m.
R517
4.7k
n.m.
**
C435
470nF
n.m.
R328 = 1.8K if TDA4866J is used
Vdefl_plus
Vdefl_min
R324
330
R328
R321
10
**
C321
10n
IC15
TDA4867J
FEEDBACK
GUARD
VFB
OUTA
GND
OUTB
VP
INN
INP
9
8
7
6
5
4
3
2
1
R329
1
PR01
C436
4700uF
16V
Z321
BZV85
47V
R323
100
R322
100
C324
100p
C323
100p
C434
22uF
100V
R395
2.2k
PR01
VOUT1
VOUT2
+10V
+80V

2.7 rotation


Rotation_Plus
Rotation Coil
Rs = 55 Ohm
Ls = 30mH
Cp = 2.1nF
+10V
R612
10
NFR25
C274
470uF
16V
TR272
BC635
TR273
BC636
C273
16V
470uF
R613
10
NFR25
-10V
R704
100
5.6k
pin 4
IC14-1
IC14-2
LM358AN
IC14-1
LM358AN
R522
15k
C452
1uF
63V
R523
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R552
10k
R276
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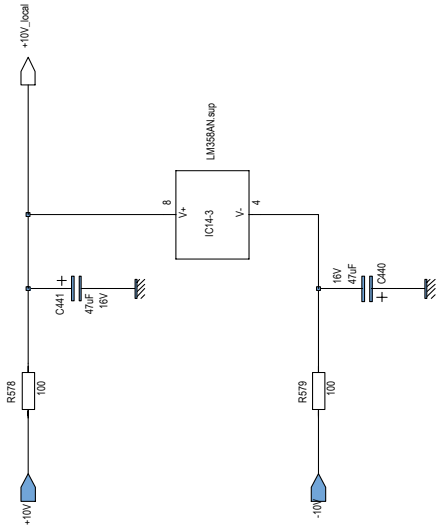
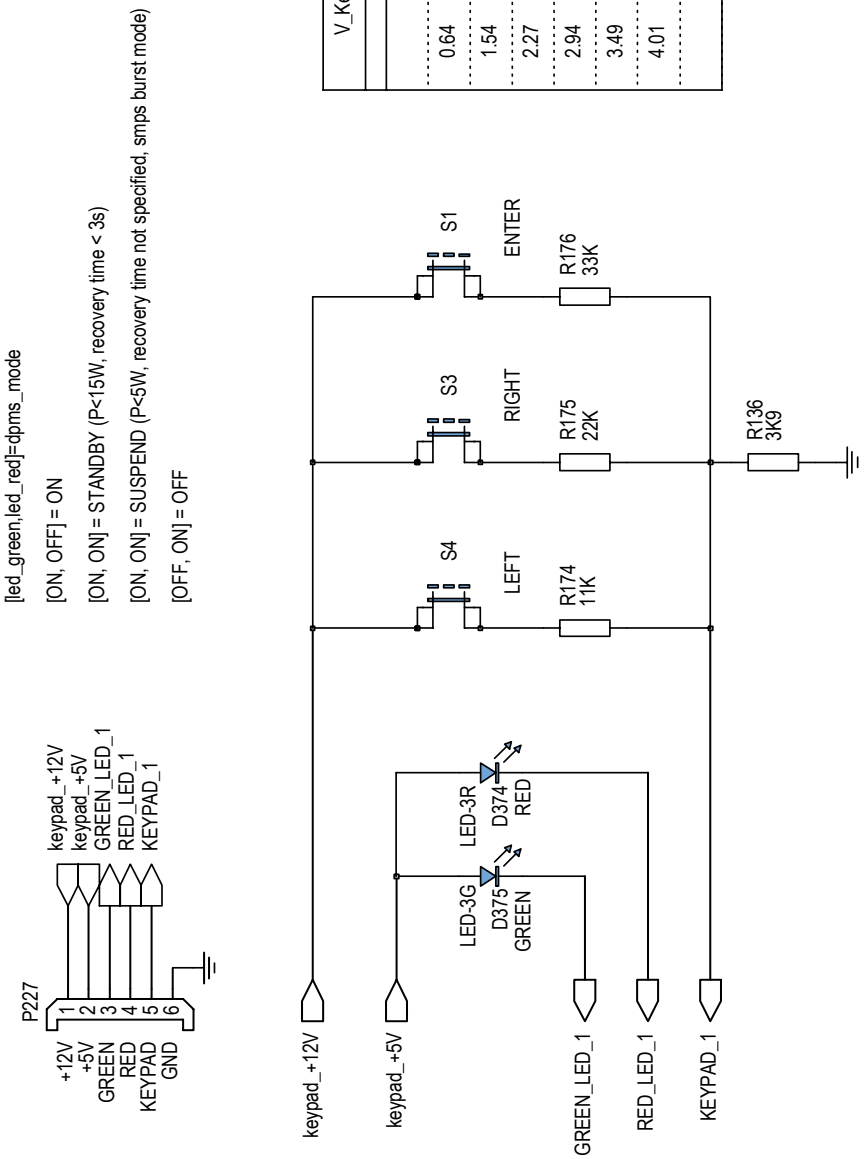
R616
5.6k
+10V_local
rotation_&_NStep
+10V_local


+10V_local
LM358AN.sup
IC14-3
V+
V-
8
4
C441
47uF
16V
16V
47uF
C440
R578
100
R579
100
+10V
-10V

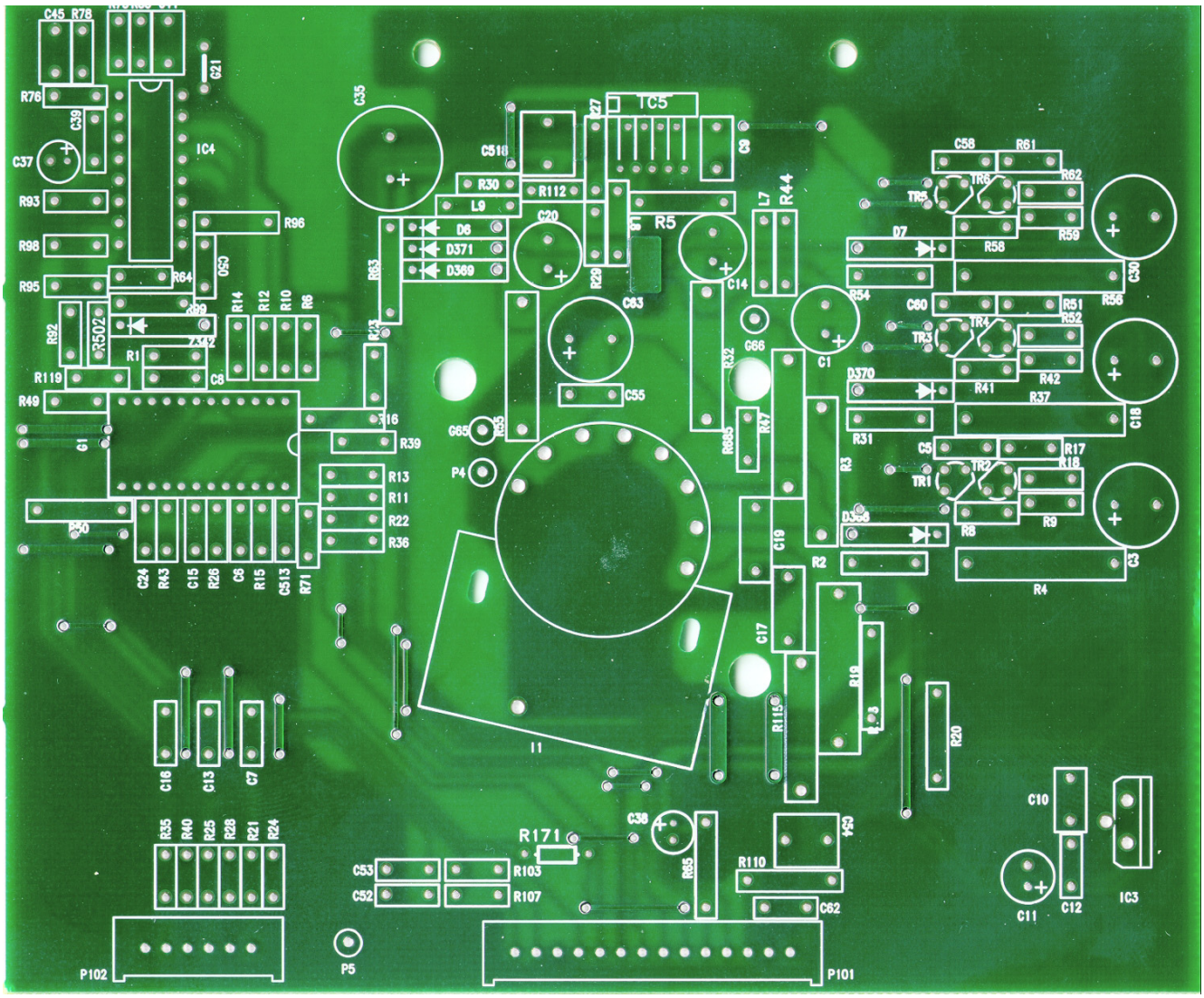
2.8 keypad

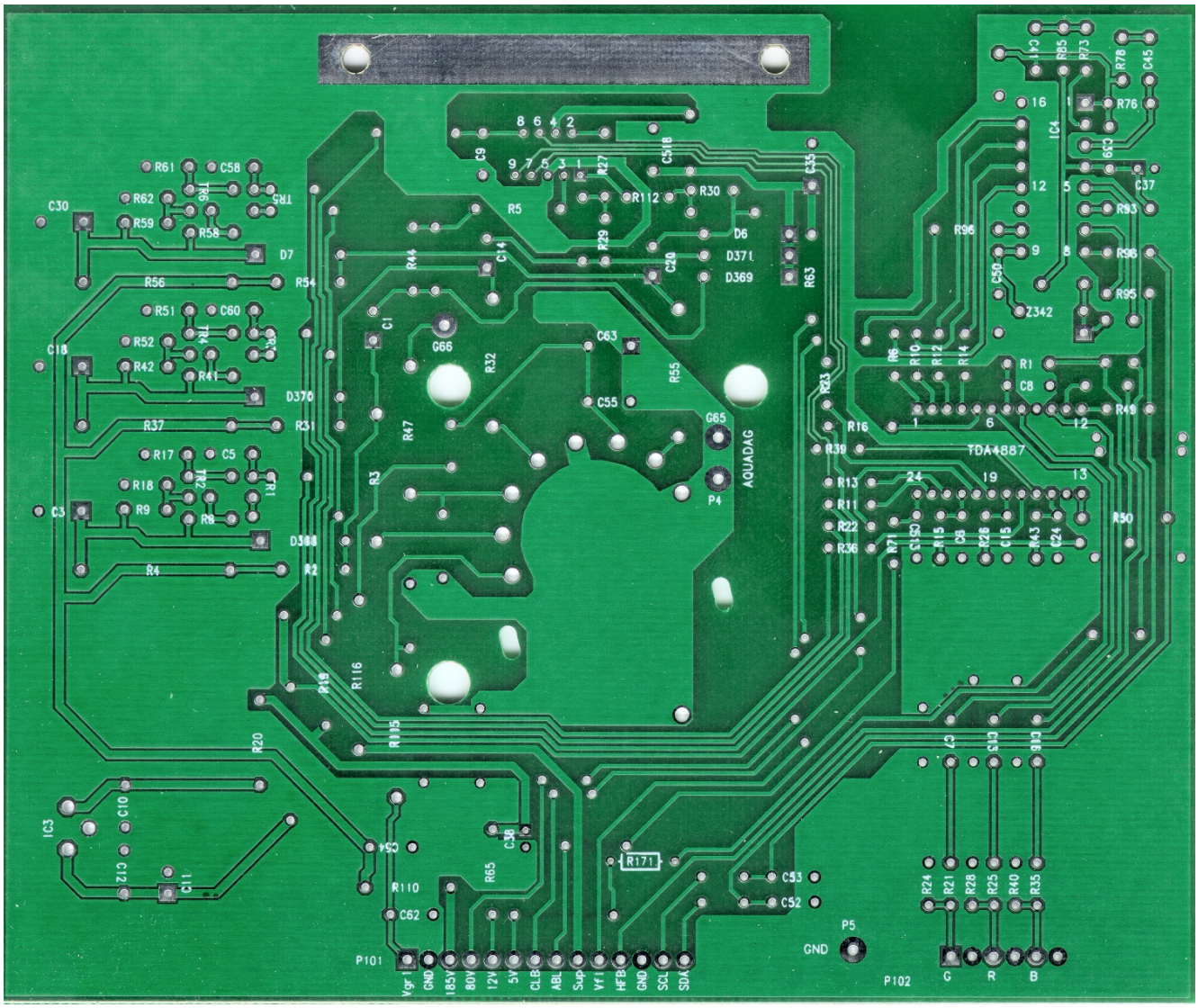
V_Keypad				L	R	E
	V	0.64		0	0	0
0.64	< V <	1.54		0	0	1
1.54	< V <	2.27		0	1	0
2.27	< V <	2.94		0	1	1
2.94	< V <	3.49		1	0	0
3.49	< V <	4.01		1	0	1
4.01	< V <	4.45		1	1	0
	V >	4.45		1	1	1



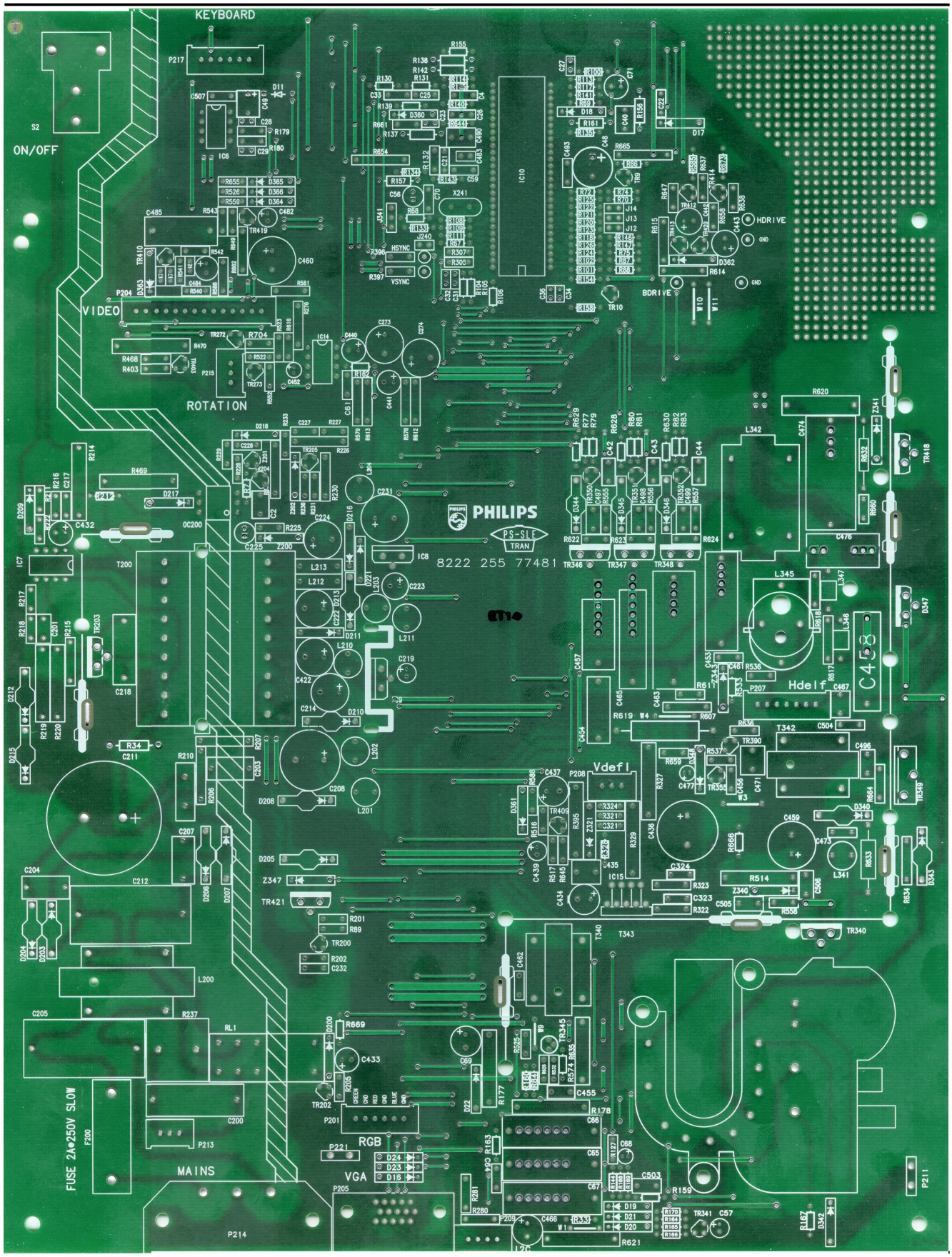
3 PCB LAYOUT

3.1 video board





3.2 main board


KEYBOARD
ON/OFF
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ROTATION
PHILIPS
8222 255 77481
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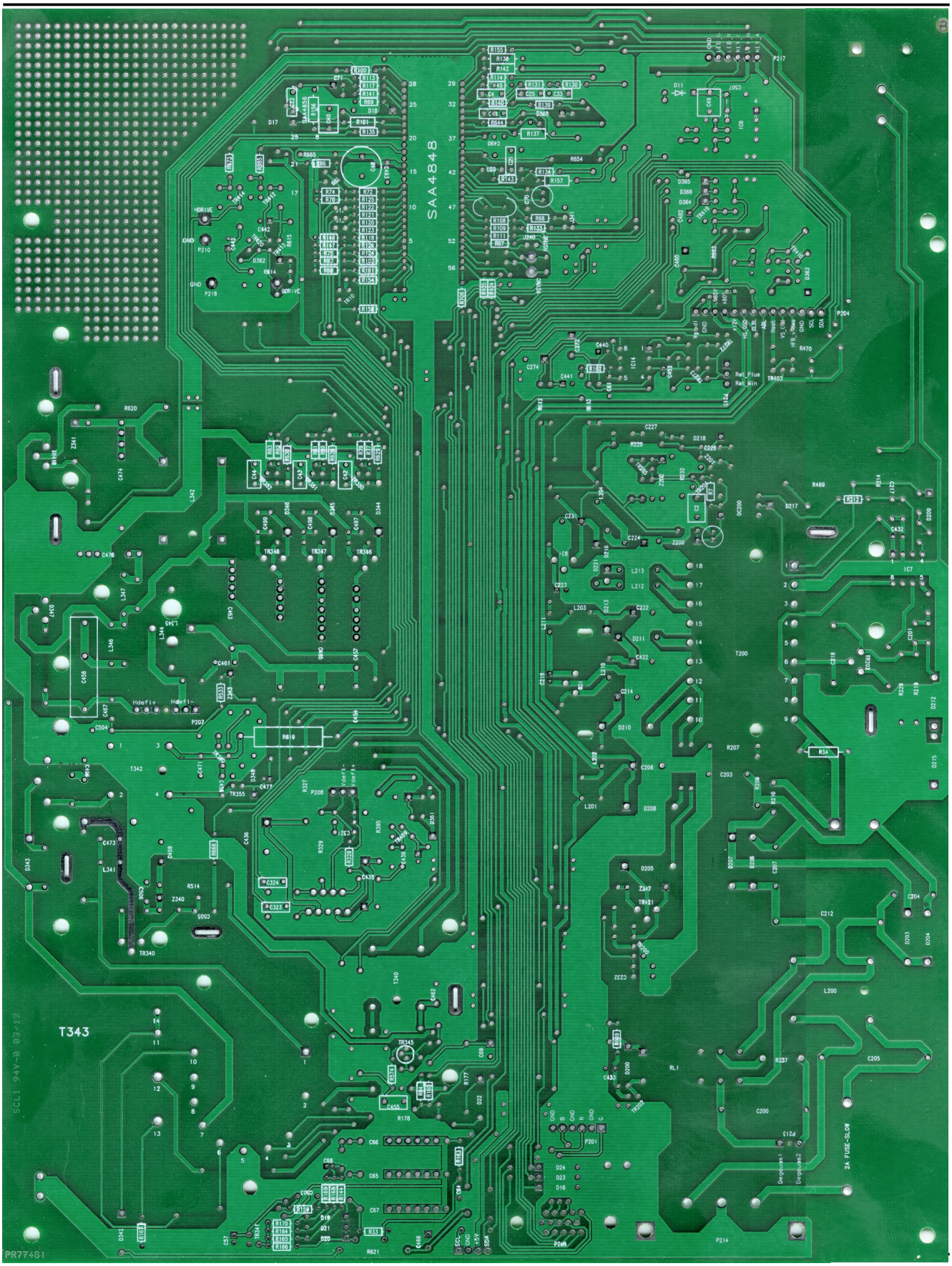
BDRIVE
HSYNC
VSYNC
Vdefl
Hdefl
RGB
VGA
MAINS
FUSE 2A 250V SLOW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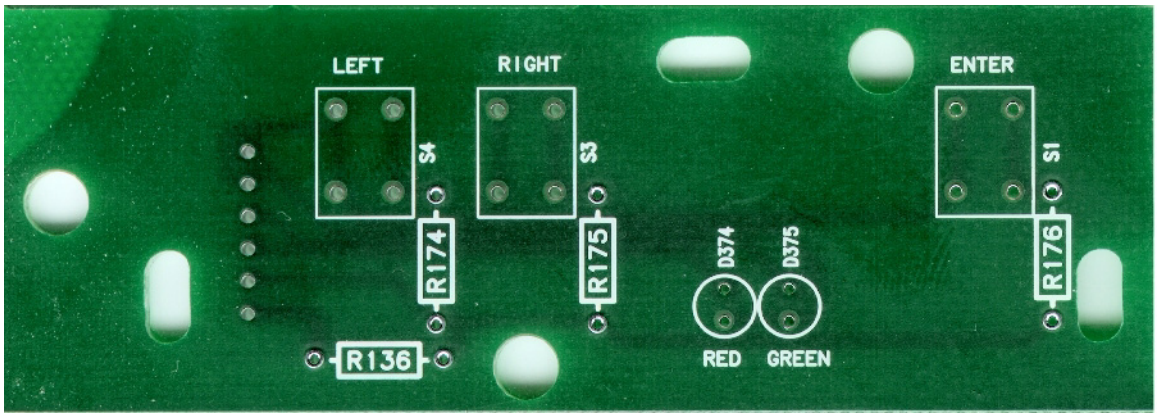
3.3 keypad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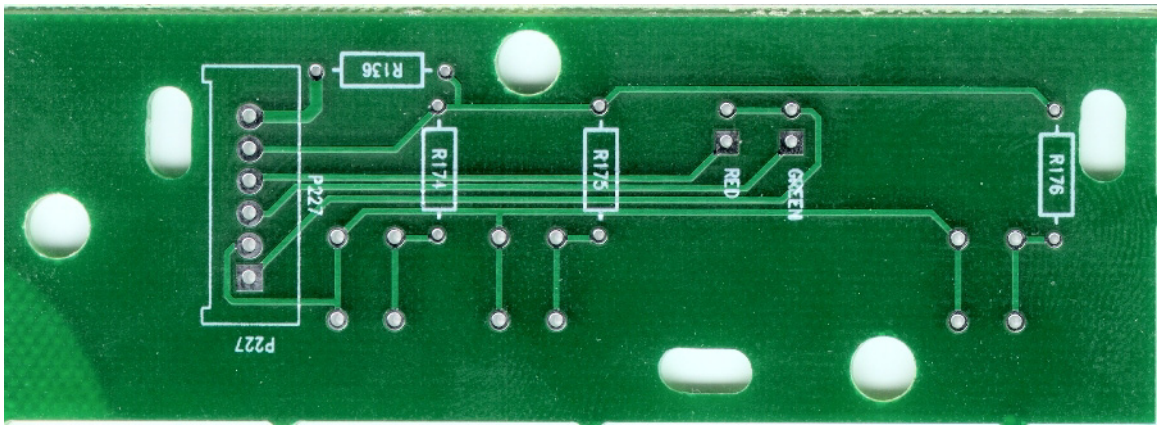
D375
RED
GREEN


R136
R174
R175
RED
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4 BILL OF MATERIALS

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
C1	2222-044-90502	CASE_R13	CAP, 1uF	video
C10	2222-370-11334	C370_B	CAP, 330nF	video
C11	2222-037-90074	CASE_R12	CAP, 33uF	video
C12	2222-370-11104	C370_A	CAP, 100nF	video
C13	2222-370-41103	C_B2.5_L7.2_P5mm0	8 CAP, 10nF	video
C14	2222-044-90502	CASE_R13	CAP, 1uF	video
C15	2222-370-11104	C370_A	CAP, 100nF	video
C16	2222-370-41103	C_B2.5_L7.2_P5mm0	8 CAP, 10nF	video
C17	DE0807102K	CER3_1	CAP, 1nF	video
C18	2222-044-63109	CASE_R16	CAP, 10uF	video
C19	DE0807102K	CER3_1	CAP, 1nF	video
C2	2222-370-11334	fc72_45_2e	CAP_STND, 330n	smps
C20	2222-044-90502	CASE_R13	CAP, 1uF	video
C200	2222-378-64104	C_B8.5_L26_P22mm5	CAP, 100nF	smps
C201	2222-370-11334	C370_B	CAP, 330nF	smps
C203	2222-336-60222	C_B6_L12.5_P10mm	CAP, 2.2nF	smps
C204	2222-336-60222	C_B6_L12.5_P10mm	CAP, 2.2nF	smps
C205	2222-336-10474	C_B15_L31_P27mm5	CAP, 470nF	smps
C207	2222-336-60222	C_B6_L12.5_P10mm	CAP, 2.2nF	smps
C208	2222-151-62101	CASE_R20	CAP, 100uF	smps
C21	2222-370-41103	fc72_25_2e	CAP_STND, 10n	saa4848
C21			CAP, 100nF	saa4848
C211	2222-057-36221	CASE_3050	CAP, 220uF	smps
C212	2222-336-10474	C_B15_L31_P27mm5	CAP, 470nF	smps
C214	2222-037-69479	CASE_R16	CAP, 47uF	smps
C217	2222-370-21223	C370_A	CAP, 22nF	smps
C218	2222-375-44102	C_B6_L18.5_P15mm	CAP, 1nF	smps
C219	2222-037-56479	CASE_R11_m	CAP, 47uF	smps
C22	2222-370-41103	fc72_25_2e	CAP_STND, 10n	saa4848
C222	2222-037-65102	CASE_R16	CAP, 1000uF	smps
C223	2222-097-56479	CASE_R74_m	CAP, 47uF	smps
C224	2222-037-65102	CASE_R16	CAP, 1000uF	smps
C225	2222-03758338	e_55_2mm0	CEP_STND, 3u3	smps
C227	2222-370-11683	C370_A	CAP, 68nF	smps
C228	2222-370-21473	C370_A	CAP, 47nF	smps
C23	2222-630-01102	cc39_20_1e	CAP_STND, 1n0	saa4848
C231	2222-037-66152	CASE_R18	CAP, 1500uF	smps
C232	2222-370-41103	C_B2.5_L7.2_P5mm0	8 CAP, 10nF	smps
C24	2222-370-11104	C370_A	CAP, 100nF	video
C25	2222-370-21473	fc72_25_2e	CAP_STND, 47n	saa4848
C26	2222-370-21473	fc72_25_2e	CAP_STND, 47n	saa4848
C27	2222-680-10101	cc51_23_1e	CAP_STND, 100p	saa4848

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
C273	2222-037-65471	CASE_R14	CAP, 470uF	rotation
C274	2222-037-65471	CASE_R14	CAP, 470uF	rotation
C28	2222-680-10479	cc39_23_1e	CAP_STND, 47p	saa4848
C29	2222-680-10479	cc39_23_1e	CAP_STND, 47p	saa4848
C3	2222-044-63109	CASE_R16	CAP, 10uF	video
C30	2222-044-63109	CASE_R16	CAP, 10uF	video
C31	2222-680-10101	cc51_23_1e	CAP_STND, 100p	saa4848
C32	2222-680-10101	cc51_23_1e	CAP_STND, 100p	saa4848
C321		C370_A	CAP, 100nF	vertical
C323		fc72_25_2e	CAP_STND, 100p	vertical
C324		fc72_25_2e	CAP_STND, 100p	vertical
C33	2222-370-41682	fc72_25_2e	CAP_STND, 100n	saa4848
C34	2222-680-10479	cc39_23_1e	CAP_STND, 47p	saa4848
C35	2222-044-32479	CASE_R18	CAP, 47uF	video
C36	2222-680-10479	cc39_23_1e	CAP_STND, 47p	saa4848
C37	2222-037-54101	CASE_R11_m	CAP, 100uF	video
C38	2222-037-56479	CASE_R11_m	CAP, 47uF	video
C39	2222-370-11104	C370_A	CAP, 100nF	video
C4	2222-370-52222	C370_A	CAP, 2.2n	saa4848
C40	2222-37011474	fc72_50_2e	CAP_STND, 470n	saa4848
C41	2222-370-41223	C370_B	CAP, 22nF	video
C42	2222-37011224	fc72_35_2e	CAP_STND, 220n	horizontal
C422	2222-136-66471	CASE_R16	CAP, 470uF	smps
C43	2222-37011224	fc72_35_2e	CAP_STND, 220n	horizontal
C432	2222-134-50229	CASE_R55_CA	CAP, 22uF	smps
C433	2222-134-55479	CASE_R55_CA	CAP, 47uF	smps
C434	2222-037-69229	CASE_R13_m	CAP, 22uF	vertical
C436	2222-136-65472	CASE_R20	CAP, 4700uF	vertical
C44	2222-37011224	fc72_35_2e	CAP_STND, 220n	horizontal
C440	2222-134-55479	CASE_R55_CA	CAP, 47uF	rotation
C441	2222-134-55479	CASE_R55_CA	CAP, 47uF	rotation
C442	2222-097-56479	CASE_R74_m	CAP, 47uF	saa4848
C443	2222-097-56479	CASE_R74_m	CAP, 47uF	saa4848
C45	2222-370-11224	C370_B	CAP, 220nF	video
C452	2222-097-58108	CASE_R71_m	CAP, 1uF	rotation
C453	2222-379-54334	C_B8.5_L26_P22mm5	CAP, 330nF	horizontal
C454	2222-379-44224	C_B6_L17.5_P15mm	CAP, 220nF	horizontal
C455	2222-37021683	fc72_35_2e	CAP_STND, 68n	horizontal
C456	2222-370-41472	C370_A	CAP, 4.7nF	horizontal
C457	2222-379-54154	C_B8.5_L17.5_P15m	m CAP, 150nF	horizontal
C458	2222-37692472	fc260_70_9e	CAP_STND, 4n7	horizontal
C459	2222-151-62479	CASE_R18	CAP, 47uF	horizontal
C460	2222-151-62479	CASE_R18	CAP, 47uF	saa4848

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
C461	2222-655-03102	CER2_2B	CAP, 1nF	horizontal
C462	2222-655-03102	CER2_2B	CAP, 1nF	horizontal
C463	2222-379-54824	C_B11_L31_P27mm5	CAP, 820nF	horizontal
C465	2222-379-54394	C_B7_L26_P22mm5	CAP, 390nF	horizontal
C466	2222-044-90015	CASE_R13	CAP, 2.2uF	horizontal
C467	2222-693-09101	C693	CAP, 100pF	horizontal
C47	2222-37011105	fc72_60_2e	CAP_STND, 1u0	horizontal
C471	2222-370-11105	C370_D	CAP, 1uF	horizontal
C474	2222-479-34335	C_B13_L30_P27mm5	CAP, 3.3uF	horizontal
C476		C376_C	CAP, 6.8nF	horizontal
C477	2222-097-50478	CASE_R71_m	CAP, 4.7uF	horizontal
C478	2222-680-10479	CER1_2A	CAP, 47pF	saa4848
C479	2222-680-10479	CER1_2A	CAP, 47pF	saa4848
C48	2222-03758101	e_105_2e	CEP_STND, 100u	saa4848
C480	2222-680-10479	CER1_2A	CAP, 47pF	saa4848
C482	2222-037-58108	CASE_R11_m	CAP, 68uF	saa4848
C483	2222-630-08222	CER1_2B	CAP, 2.2nF	saa4848
C484	2222-097-55479	CASE_R73_m	CAP, 47uF	saa4848
C485	2222-368-45224	C368_F	CAP, 220nF	saa4848
C49	2222-12253689	e_60_2e	CEP_STND, 68u	saa4848
C490	2222-370-11684	C370_C	CAP, 680nF	saa4848
C493	2222-370-11104	C370_A	CAP, 100nF	saa4848
C496	2222-370-21104	C370_B	CAP, 100nF	horizontal
C497	2222-370-21104	C370_B	CAP, 100nF	horizontal
C498	2222-370-21104	C370_B	CAP, 100nF	horizontal
C499	2222-370-21104	C370_B	CAP, 100nF	horizontal
C5	2222-629-03102	CER2_1	CAP, 1nF	video
C50	2222-370-11104	C370_A	CAP, 100nF	video
C503	2222-370-21104	C370_B	CAP, 100nF	horizontal
C504	2222-693-09102	C693	CAP, 1nF	horizontal
C505	2222-370-41223	C370_B	CAP, 22nF	horizontal
C506	2222-370-41223	C370_B	CAP, 22nF	horizontal
C507	2222-370-11104	C370_A	CAP, 100nF	saa4848
C513	2222-370-11104	C370_A	CAP, 100nF	video
C518	2222-370-21334	C370_D	CAP, 330nF	video
C52	2222-638-10479	CER2_2A	CAP, 47pF	video
C53	2222-638-10479	CER2_2A	CAP, 47pF	video
C54	2222-370-41104	C370_D	CAP, 100nF	video
C55	2222-629-03223	CER2_4	CAP, 22nF	video
C56	2222-03858109	e_55_2mm0	CEP_STND, 10u	saa4848
C57	2222-037-51109	CASE_R11_m	CAP, 10uF	horizontal
C58	2222-629-03102	CER2_1	CAP, 1nF	video
C59	2222-370-51332	C370_A	CAP, 3.3nF	saa4848

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
C6	2222-370-11104	C370_A	CAP, 100nF	video
C60	2222-629-03102	CER2_1	CAP, 1nF	video
C62	2222-370-51102	C370_A	CAP, 1nF	video
C63	2222-037-60221	CASE_R14	CAP, 220uF	video
C68	2222-097-50478	CASE_R71_m	CAP, 4.7uF	horizontal
C69	2222-044-90015	CASE_R13	CAP, 2.2uF	horizontal
C7	2222-370-41103	C_B2.5_L7.2_P5mm0	8 CAP, 10nF	video
C70	2222-370-11104	C370_A	CAP, 100nF	saa4848
C71	2222-037-90074	CASE_R12	CAP, 33uF	saa4848
C8	2222-370-11104	C370_A	CAP, 100nF	video
C9	2222-370-21104	C370_B	CAP, 100nF	video
Cxx1			CAP, 1uF	saa4848
Cxx2			CAP, 100nF	saa4848
CRT	M41FJB523XT140/T404BA		M41FJB523XT140/T404BA	video
D11	BAT81	sod68	DIO_SCHOTTKY	saa4848
D16	9331-17730153	sod27	DIO_ZENER	top level
D17	9330-839-90153	sod27	1N4148	saa4848
D18	9330-839-90153	sod27	1N4148	saa4848
D200	9330-839-90153	sod27	1N4148	smps
D203	BYW56	sod57	BYW56	smps
D204	BYW56	sod57	BYW56	smps
D205	9340-366-90133	sod57	BYV27-400	smps
D206	BYW56	sod57	BYW56	smps
D207	BYW56	sod57	BYW56	smps
D208	9340-418-70113	sod57	BYV27-600	smps
D209	9330-839-90153	sod27	1N4148	smps
D21	9330-839-90153	sod27	1N4148	horizontal
D210	9340-366-90133	sod57	BYV27-400	smps
D211	9337-537-40113	SOD81	BYD73A	smps
D212	9333-636-10113	sod57	BYW54	smps
D213	9335-435-00133	sod57	BYV27-100	smps
D215	9333-636-10113	sod57	BYW54	smps
D216	9337-537-40113	SOD81	BYD73A	smps
D217	9330-839-90153	sod27	1N4148	smps
D218	9330-839-90153	sod27	1N4148	smps
D22	9337-234-10113	SOD81	BYD33G	horizontal
D221	9337-537-40113	SOD81	BYD73A	smps
D23	9331-17730153	sod27	DIO_ZENER	top level
D24	9331-17730153	sod27	DIO_ZENER	top level
D340	9340-215-20113	sod57	BYV99	horizontal
D342	9337-234-10113	SOD81	BYD33G	horizontal
D343	9335-435-00133	sod57	BYV27-100	horizontal
D344	1N4007G	sod57	1N4007G	horizontal

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
D345	1N4007G	sod57	1N4007G	horizontal
D346	1N4007G	sod57	1N4007G	horizontal
D347	9340-560-30127	SOT186A	BYM357X	horizontal
D348	9330-839-90153	sod27	1N4148	horizontal
D360	9330-839-90153	sod27	1N4148	saa4848
D362	9330-839-90153	sod27	1N4148	saa4848
D363	9330-839-90153	sod27	1N4148	saa4848
D365	9330-839-90153	sod27	1N4148	saa4848
D366	9330-839-90153	sod27	1N4148	saa4848
D368	9331-892-10153	sod27	BAV21	video
D369	9331-892-10153	sod27	BAV21	video
D370	9331-892-10153	sod27	BAV21	video
D371	9331-892-10153	sod27	BAV21	video
D374	LED-3R	sod53	LED, LED-3R	keypad
D375	LED-3G	sod53	LED, LED-3G	keypad
D6	9331-892-10153	sod27	BAV21	video
D7	9331-892-10153	sod27	BAV21	video
F200	2412-086-28239	FUSEHOLDER_CAP	FUSE, 2A	smps
G1	DIL24SHR	SOT234_s	SOT234	
G21	7322-043-01040	JUMPER_2e	JUMPER	
I1	CVT3280-2202	CVT3280_crt	CVT3280_CRT	
IC10	SAA4848PS	sot_400_1	SAA4848PS	saa4848
IC14	9336-415-70602	SOT97_s	LM358AN	rotation
IC15	TDA4867_J	SOT523_heat._c	TDA4867J	video
IC3	PN-LM7808CT	TO220_vc	LM7808CT	video
IC4	MTV018	SOT38_s	MTV018	video
IC5	PN-LM2466T	TA09A	LM2466	video
IC6	9350-646-00112	SOT97_s	PCF8598CP	saa4848
IC7	TEA1507	SOT97_s	TEA1507	smps
IC8	LM2937ET-5.0	TO220_vc	LM2937ET-5.0	smps
IC9	PN-LM7812CT	TO220_vc	LM7812CT	smps
J12	2422-021-98731	JUMPER_2p	JUMPER_2p	saa4848
J13	2422-021-98731	JUMPER_2p	JUMPER_2p	saa4848
J14	2422-021-98731	JUMPER_2p	JUMPER_2p	saa4848
J240	2422-021-98731	JUMPER_2p	JUMPER_2p	saa4848
J341	2422-021-98731	JUMPER_3p	JUMPER_3p	saa4848
L200	3112-338-31902	CU20d3	CU20d3, value	smps
L201	TSL0709-33K1R9	TSL0707_2e	CHOKE, 33uH	smps
L202	TSL0709RA-221KR44	TSL0707_5mm0	CHOKE, 220uH	smps
L203	TSL0709-33K1R9	TSL0707_2e	CHOKE, 33uH	smps
L204	TSL0709-101KR66	TSL0707_5mm0	CHOKE, 100uH	smps
L210	TSL0709-101KR66	TSL0707_5mm0	CHOKE, 100uH	smps
L211	TSL0709-101KR66	TSL0707_5mm0	CHOKE, 100uH	smps

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
L212	4330-030-38741	BDW_bead	BDW3.5_6-4S2	smps
L213	4330-030-38741	BDW_bead	BDW3.5_6-4S2	smps
L341	TSL0709-33K1R9	TSL0707_2e	CHOKE, 33uH	horizontal
L342	3128-138-33213	AT4043_13	AT4043_13	horizontal
L345	3122-138-58191	uChoke_6e	Linearity corrector	horizontal
L346	4330-030-38731	BDW_bead_4E	BDW3.5_4.5-4S2	horizontal
L347	4330-030-38731	BDW_bead_4E	BDW3.5_4.5-4S2	horizontal
L7	LAL03NAR22M	uChoke_3e	CHOKE, 220nH	video
L8	LAL03NAR22M	uChoke_3e	CHOKE, 220nH	video
L9	LAL03NAR22M	uChoke_3e	CHOKE, 220nH	video
OC200	9338-846-80127	SOT231	CNX82A	smps
P101	MKS3744-1-0-1414	MKS3730_14p	MKS3730_14p	video
P102	MKS3736-1-0-606	MKS3730_6p	MKS3730_6p	video
P201	MKS3736-1-0-606	MKS3730_6p	MKS3730_6p	top level
P204	MKS3744-1-0-1414	MKS3730_14p	MKS3730_14p	top level
P205	210-535	VGA_BUS_15p_sqr	VGA_BUS_15p_sqr	top level
P207	MKS3737-1-0-707	MKS3730_7p	MKS3730_7p	top level
P208	MKS3733-1-0-303	MKS3730_3p	MKS3730_3p	top level
P209	MKS3734-1-0-404	MKS3730_4p	MKS3730_4p	top level
P213	MKS3733-1-0-303	MKS3730_3p	MKS3730_3p	top level
P214	PCB-EXP-GEOM	EXP_GEOM_3p	EXP_SYMBOL_3p	smps
P215	MKS3733-1-0-303	MKS3730_3p	MKS3730_3p	top level
P227	MKS3736-1-0-606	MKS3730_6p	MKS3730_6p	keypad
R1	2322-180-73109	SFR16T	RES, 10	video
R10	2322-180-73101	SFR16T	RES, 100	video
R100	2322-18753101	r_19_3e	RES, 100	saa4848
R101	2322-18753101	r_19_3e	RES, 100	saa4848
R102	2322-18753101	r_19_3e	RES, 100	saa4848
R103	2322-187-53189	SFR16	RES, 18	video
R104	2322-18753101	r_19_3e	RES, 100	saa4848
R105	2322-18753101	r_19_3e	RES, 100	saa4848
R106	2322-18753101	r_19_3e	RES, 100	saa4848
R107	2322-187-53189	SFR16	RES, 18	video
R108	2322-18753101	r_19_3e	RES, 100	saa4848
R109	2322-18753101	r_19_3e	RES, 100	saa4848
R11	2322-180-73101	SFR16T	RES, 100	video
R110	2322-205-13101	SFR25H	RES, 100	video
R111	2322-18753101	r_19_3e	RES, 100	saa4848
R112	2322-180-73479	SFR16T	RES, 47	video
R113	2322-18753101	r_19_3e	RES, 100	saa4848
R115	ERC12GJ272C	ERC12	RES, 2K7	video
R116	2322-194-13109	PR02	RES, 10	video
R117	2322-18753101	r_19_3e	RES, 100	saa4848

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
R118	2322-18753101	r_19_3e	RES, 10	saa4848
R119	2322-187-53101	SFR16	RES, 100	video
R12	2322-180-73101	SFR16T	RES, 100	video
R120	2322-18753101	r_19_3e	RES, 100	saa4848
R121	2322-18753101	r_19_3e	RES, 100	saa4848
R122	2322-18753101	r_19_3e	RES, 100	saa4848
R123	2322-18753101	r_19_3e	RES, 100	saa4848
R124	2322-18753101	r_19_3e	RES, 100	saa4848
R125	2322-18753101	r_19_3e	RES, 100	saa4848
R126	2322-18753101	r_19_3e	RES, 100	saa4848
R127	2322-187-53101	SFR16	RES, 100	horizontal
R13	2322-180-73109	SFR16T	RES, 10	video
R130	2322-18753472	r_19_3e	RES, 47K	saa4848
R131	2322-18753472	r_19_3e	RES, 2K2	saa4848
R132	2322-187-53472	SFR16	RES, 4K7	saa4848
R133	2322-18753472	r_19_3e	RES, 4K7	saa4848
R135	2322-18753153	r_19_3e	RES, 15K	saa4848
R136	2322-15613902	r_25_4e	RES, 3K9	keypad
R137	2322-15613902	r_25_4e	RES, 3K9	saa4848
R138	2322-15613902	r_25_4e	RES, 3K9	saa4848
R139	2322-18753471	r_19_3e	RES, 470	saa4848
R14	2322-180-73101	SFR16T	RES, 100	video
R140	2322-18753471	r_19_3e	RES, 470	saa4848
R141	2322-18753471	r_19_3e	RES, 470	saa4848
R142	2322-15612704	r_25_4e	RES, 270K	saa4848
R143	2322-18753473	r_19_3e	RES, 47K	saa4848
R146	2322-18753392	r_19_3e	RES, 3K9	saa4848
R147	2322-18753392	r_19_3e	RES, 3K9	saa4848
R15	2322-180-73109	SFR16T	RES, 10	video
R154	2322-18753681	r_19_3e	RES, 680	saa4848
R155	2322-18753681	r_19_3e	RES, 680	saa4848
R156	2322-15616802	r_25_4e	RES, 8K45	saa4848
R157	2322-15611104	r_25_4e	RES, 110K	saa4848
R158	2322-18753102	r_19_3e	RES, 1K0	saa4848
R159	2322-18753102	r_19_3e	RES, 1K0	horizontal
R16	2322-180-73101	SFR16T_3e	RES, 100	video
R160	2322-18753102	r_19_3e	RES, 1K0	horizontal
R161	2322-15613904	r_25_4e	RES, 390K	saa4848
R164	2322-18753393	r_19_3e	RES, 3k9	horizontal
R166	2322-18753393	r_19_3e	RES, 8.2k	horizontal
R168	2322-18753183	r_19_3e	RES, 18K	horizontal
R17	2322-180-73181	SFR16T	RES, 180	video
R171	2322-18753109	r_19_3e	RES, 10	video

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
R174	2322-15611103	r_25_4e	RES, 11K	keypad
R175	2322-15612203	r_25_4e	RES, 22K	keypad
R176	2322-15613303	r_25_4e	RES, 33K	keypad
R177	2322-193-13109	PR01	RES, 10	horizontal
R178	2322-193-13109	PR01	RES, 10	horizontal
R179	2322-187-53101	SFR16	RES, 100	saa4848
R18	2322-180-73332	SFR16T	RES, 3K3	video
R180	2322-187-53101	SFR16	RES, 100	saa4848
R19	2322-180-73109	SFR16T_4e	RES, 10	video
R2	2322-180-73105	SFR16T_3e	RES, 1M	video
R20	2322-205-13338	SFR25H	RES, 3.3	video
R201	2322-187-53563	SFR16	RES, 56K	smps
R202	2322-187-53103	SFR16	RES, 10K	smps
R205	2322-187-53103	SFR16	RES, 10K	smps
R206	2322-241-13475	VR25	RES, 4.7M	smps
R207	2322-241-13475	VR25	RES, 4.7M	smps
R21	2322-180-73339	SFR16T	RES, 33	video
R210	2322-594-XXXXX	VDR_594 10 Ohm	RES, 10 Ohm/14to550V	smps
R211	2322-187-53473	SFR16	RES, 47K	smps
R212	2322-18753331	r_19_3e	RES, 330	smps
R214	2322-193-13478	PR01	RES, 4.7	smps
R215	2322-187-53101	SFR16_4e	RES, 100	smps
R216	2322-187-53102	SFR16	RES, 1K	smps
R217	2322-187-53471	SFR16	RES, 470	smps
R218	2322-187-53333	SFR16	RES, 33K	smps
R219	2322-193-90051	PR01	RES, 0.33	smps
R22	2322-180-73101	SFR16T	RES, 100	video
R220	2322-193-90051	PR01	RES, 0.33	smps
R222	2322-187-53274	SFR16	RES, 270K	smps
R225	2322-187-53222	SFR16	RES, 2K2	smps
R226	2322-156-11544	MRS25	RES, 154K	smps
R227	2322-187-53103	SFR16	RES, 10K	smps
R228	2322-187-53471	SFR16	RES, 470	smps
R229	2322-187-53153	SFR16	RES, 15K	smps
R23	2322-180-73109	SFR16T	RES, 10	video
R230	2322-187-53101	SFR16_4e	RES, 100	smps
R231	2322-187-53103	SFR16	RES, 10K	smps
R232	2322-156-12102	MRS25	RES, 2K1	smps
R233	2322-187-53104	SFR16	RES, 100K	smps
R236	2322-187-53103	SFR16	RES, 10K	smps
R237	2322-662-96682	MONO_PTC	RES, MONO_PTC_18E/25deg_25	smps
R24	2322-180-73759	SFR16T	RES, 75	video
R25	2322-180-73339	SFR16T	RES, 33	video

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
R26	2322-180-73109	SFR16T	RES, 10	video
R27	2322-180-73479	SFR16T_3e	RES, 47	video
R276	2322-187-53101	SFR16_4e	RES, 100	rotation
R28	2322-180-73759	SFR16T	RES, 75	video
R280	2322-187-53101	SFR16_3e	RES, 100	top level
R281	2322-187-53101	SFR16_3e	RES, 100	top level
R29	2322-180-73101	SFR16T	RES, 100	video
R3	ERC12GJ470C	ERC12	RES, 47	video
R30	2322-180-73101	SFR16T	RES, 100	video
R305	2322-187-53101	SFR16	RES, 100	saa4848
R307	2322-187-53101	SFR16	RES, 100	saa4848
R31	2322-180-73105	SFR16T_3e	RES, 1M	video
R32	ERC12GJ470C	ERC12	RES, 47	video
R321	2322-187-53121	SFR16	RES, 10	vertical
R322	2322-187-53101	SFR16_3e	RES, 100	vertical
R323	2322-187-53101	SFR16_3e	RES, 100	vertical
R324	2322-187-53122	SFR16	RES, 330	vertical
R328	2322-18753182	r_19_3e	RES, 3K3	vertical
R329	2322-193-13108	PR01	RES, 1	vertical
R34	2322-241-13824	r_25_5e	RES, 820K	smps
R35	2322-180-73339	SFR16T	RES, 33	video
R36	2322-180-73101	SFR16T	RES, 100	video
R37	2322-193-13223	PR01	RES, 22K	video
R39	2322-180-73109	SFR16T	RES, 10	video
R395	2322-193-13222	PR01	RES, 2K2	vertical
R396	2322-187-53182	SFR16	RES, 1K8	saa4848
R397	2322-187-53182	SFR16	RES, 1K8	saa4848
R4	2322-193-13223	PR01	RES, 22K	video
R40	2322-180-73759	SFR16T	RES, 75	video
R403	2322-187-53103	SFR16	RES, 10K	smps
R41	2322-180-73103	SFR16T	RES, 10K	video
R42	2322-180-73683	SFR16T	RES, 68K	video
R43	2322-180-73109	SFR16T	RES, 10	video
R44	2322-180-73101	SFR16T_3e	RES, 100	video
R468	2322-187-53222	SFR16	RES, 2K2	smps
R469	2322-193-13229	PR01	RES, 22	smps
R47	ERC12GJ272C	ERC12	RES, 2K7	video
R470	2322-193-13279	PR01	RES, 27	smps
R49	2322-180-73101	SFR16T	RES, 100	video
R5	2322-180-73479	SFR16T_4e	RES, 47	video
R50	2322-180-73101	SFR16T_4e	RES, 100	video
R502	2322-187-53121	SFR16	RES, 120	video
R51	2322-180-73181	SFR16T	RES, 180	video

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
R514	2322-193-13108	PR01	RES, 1	horizontal
R52	2322-180-73332	SFR16T	RES, 3K3	video
R522	2322-187-53153	SFR16	RES, 15K	rotation
R523	2322-187-53103	SFR16	RES, 10K	rotation
R525	2322-187-53274	SFR16	RES, 270K	horizontal
R526	2322-187-53333	SFR16	RES, 33K	saa4848
R532	2322-187-53102	SFR16	RES, 1K	horizontal
R533	2322-18753472	r_19_3e	RES, 4K7	horizontal
R536	2322-187-53151	SFR16	RES, 150	horizontal
R537	2322-187-53151	SFR16	RES, 150	horizontal
R54	2322-180-73105	SFR16T_3e	RES, 1M	video
R540	2322-187-53104	SFR16	RES, 100K	saa4848
R541	2322-187-53104	SFR16	RES, 100K	saa4848
R542	2322-187-53104	SFR16	RES, 100K	saa4848
R543	2322-187-53104	SFR16	RES, 100K	saa4848
R55	ERC12GJ470C	ERC12	RES, 47	video
R552	2322-187-53103	SFR16	RES, 10K	rotation
R555	2322-187-53103	SFR16	RES, 10K	horizontal
R556	2322-187-53103	SFR16	RES, 10K	horizontal
R557	2322-187-53103	SFR16	RES, 10K	horizontal
R558	2322-187-53103	SFR16	RES, 10K	horizontal
R56	2322-193-13223	PR01	RES, 22K	video
R574	2322-18753471	r_19_3e	RES, 470	horizontal
R578	2322-187-53101	SFR16_4e	RES, 100	rotation
R579	2322-187-53101	SFR16_4e	RES, 100	rotation
R58	2322-180-73103	SFR16T	RES, 10K	video
R581	2322-187-53101	SFR16_3e	RES, 100	saa4848
R585	2322-18753479	r_19_3e	RES, 47	saa4848
R586	2322-187-53101	SFR16_3e	RES, 100	saa4848
R59	2322-180-73683	SFR16T	RES, 68K	video
R6	2322-180-73101	SFR16T	RES, 100	video
R61	2322-180-73181	SFR16T	RES, 180	video
R611	2322-187-53101	SFR16	RES, 100	horizontal
R612	2322-205-13109	SFR25H	RES, 10	rotation
R613	2322-205-13109	SFR25H	RES, 10	rotation
R614	2322-205-13109	SFR25H	RES, 10	saa4848
R615	2322-205-13109	SFR25H	RES, 10	saa4848
R616	2322-187-53562	SFR16	RES, 5K6	rotation
R617	2322-187-53229	SFR16_4e	RES, 22	horizontal
R618	2322-187-53229	SFR16_3e	RES, 22	horizontal
R619	2322-19513569	r_52_10e_1mm0	RES, 56	horizontal
R62	2322-180-73332	SFR16T	RES, 3K3	video
R621	2322-193-13109	PR01	RES, 10	horizontal

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
R622	2322-187-53154	SFR16	RES, 150K	horizontal
R623	2322-187-53154	SFR16	RES, 150K	horizontal
R624	2322-187-53154	SFR16	RES, 150K	horizontal
R626	2322-187-53152	SFR16	RES, 1K5	horizontal
R628	2322-18753222	r_19_3e	RES, 2K2	horizontal
R629	2322-18753222	r_19_3e	RES, 2K2	horizontal
R63	2322-205-13108	SFR25H	RES, 1	video
R630	2322-18753222	r_19_3e	RES, 2K2	horizontal
R632	2322-19313333	r_25_7e_0mm8	RES, 33K	horizontal
R633	2322-19413121	r_39_7e_1mm0	RES, 120	horizontal
R634	2322-187-53479	SFR16_4e	RES, 47	horizontal
R635	AB-EB1025	BRADLEY	RES, 1K	horizontal
R637	2322-187-53331	SFR16	RES, 330	saa4848
R638	2322-187-53331	SFR16	RES, 330	saa4848
R64	2322-187-53109	SFR16	RES, 10	video
R644	2322-18753221	r_19_3e	RES, 220	saa4848
R647	2322-187-53102	SFR16	RES, 1K	saa4848
R649	2322-187-53823	SFR16	RES, 82K	saa4848
R65	2322-205-13108	SFR25H	RES, 1	video
R654	2322-156-14424	MRS25	RES, 442K	saa4848
R655	2322-187-53183	SFR16	RES, 18K	saa4848
R658	2322-187-53471	SFR16	RES, 470	saa4848
R659	2322-187-53471	SFR16	RES, 470	horizontal
R660	2322-187-53109	SFR16	RES, 10	horizontal
R661	2322-187-76185	SFR16	RES, 1M	saa4848
R662	2322-186-76185	SFR25H	RES, 1M8	saa4848
R664	2322-187-53109	SFR16_3e	RES, 10	horizontal
R665	2322-205-13108	SFR25H_5e	RES, 1	saa4848
R666	2322-187-53331	r_19_3e	RES, 330	horizontal
R669	2322-187-53103	r_19_3e	RES, 10K	smps
R67	2322-18753103	r_19_3e	RES, 10K	saa4848
R673	2322-187-53479	r_19_3e	RES, 47	saa4848
R68	2322-18753103	r_19_3e	RES, 10K	saa4848
R685	2322-187-53158	SFR16	RES, 1.5	video
R69	2322-18753103	r_19_3e	RES, 10K	saa4848
R7	2322-18753271	r_19_3e	RES, 270	smps
R70	2322-18753103	r_19_3e	RES, 10K	saa4848
R704	2322-187-53101	SFR16	RES, 100	rotation
R71	2322-180-73102	SFR16T	RES, 1K	video
R72	2322-18753103	r_19_3e	RES, 10K	saa4848
R73	2322-180-73562	SFR16T	RES, 5K6	video
R74	2322-18753103	r_19_3e	RES, 10K	saa4848
R75	2322-18753103	r_19_3e	RES, 10K	saa4848

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
R76	2322-180-73182	SFR16T	RES, 1.8k	video
R77	2322-18753103	r_19_3e	RES, 10K	horizontal
R78	2322-180-73561	SFR16T	RES, 560	video
R79	2322-18753103	r_19_3e	RES, 10K	horizontal
R8	2322-180-73103	SFR16T	RES, 10k	video
R80	2322-18753103	r_19_3e	RES, 10K	horizontal
R81	2322-18753103	r_19_3e	RES, 10K	horizontal
R82	2322-18753103	r_19_3e	RES, 10K	horizontal
R83	2322-18753103	r_19_3e	RES, 10K	horizontal
R84	2322-18753103	r_19_3e	RES, 5K6	horizontal
R85	2322-180-73105	SFR16T	RES, 1M	video
R86	2322-18753222	r_19_3e	RES, 2K2	saa4848
R87	2322-18753222	r_19_3e	RES, 2K2	saa4848
R88	2322-18753222	r_19_3e	RES, 2K2	saa4848
R89	2322-187-53222	SFR16	RES, 2K2	smps
R9	2322-180-73683	SFR16T	RES, 68K	video
R92	2322-187-53101	SFR16	RES, 100	video
R95	2322-180-73101	SFR16T	RES, 100	video
R96	2322-180-73101	SFR16T_3e	RES, 100	video
R98	2322-180-73101	SFR16T	RES, 100	video
R99	2322-187-53109	SFR16_3e	RES, 10	video
RL1	625-589	RTE24_RELAIS	RTE24-COIL	smps
Rxx1			RES, 100	saa4848
Rxx2			RES, 4K7	saa4848
Rxx3			RES, 33K	saa4848
Rxx4			RES, 390	horizontal
Rxx5			RES, 5K6	
S1	RODELCO-4972-964	MINI_MATRIX_h	SKHHAK	keypad
S2	SDDLB16100	SDDL_type_B	POWER_SWITCH	smps
S3	RODELCO-4972-964	MINI_MATRIX_h	SKHHAK	keypad
S4	RODELCO-4972-964	MINI_MATRIX_h	SKHHAK	keypad
T200	8228-001-35653	CE422v	SMPS_CE432V	smps
T340	8228-001-38041	CU15	CU15_geom	horizontal
T342	3128-138-35672	CU15	CU15_geom	horizontal
T343	32521-001-53203	AT2097_33B	AT2097_33B	horizontal
TR1	9331-976-60112	TO92	BC548B	video
TR10	9332-377-90112	TO92	BC547C	saa4848
TR2	9335-354-70116	TO92	MPSA43	video
TR200	9331-976-10112	TO92	BC547	smps
TR202	9332-377-90112	TO92	BC547C	smps
TR203	STP7NB80FP	TO220	STP7NB80FP	smps
TR204	9331-976-10112	TO92	BC547	smps
TR205	9332-055-40112	TO92	BC556	smps

REFERENCE	COMPANY PART NO.	GEOMETRY	DESCRIPTION	SHEET
TR272	9332-219-20112	TO92	BC635	rotation
TR273	9332-219-50112	TO92	BC636	rotation
TR3	9331-976-60112	TO92	BC548B	video
TR340	PN-IRF9630	TO220	IRF9630	horizontal
TR341	9331-976-10112	TO92	BC547	horizontal
TR345	BF420	to92_3	BF420	horizontal
TR346	9340-500-00127	TO220	PHP18N20E	horizontal
TR347	9340-500-00127	TO220	PHP18N20E	horizontal
TR348	9340-500-00127	TO220	PHP18N20E	horizontal
TR349	PN-BU4525AX	SOT399_vc	BU4525AX	horizontal
TR350	9332-377-90112	TO92	BC547C	horizontal
TR351	9332-377-90112	TO92	BC547C	horizontal
TR352	9332-377-90112	TO92	BC547C	horizontal
TR355	9332-219-40112	TO92	BC639	horizontal
TR4	9335-354-70116	TO92	MPSA43	video
TR403	9331-492-10112	TO92	BC338	smps
TR410	9332-377-90112	TO92	BC547C	saa4848
TR412	9331-976-20112	TO92	BC547A	saa4848
TR413	9331-976-20112	TO92	BC547A	saa4848
TR414	9331-976-20112	TO92	BC547A	saa4848
TR418	9340-500-50127	TO220	PHP3055E	horizontal
TR419	9334-311-90116	TO92	MPSA92	saa4848
TR420	9331-977-50112	TO92	BC558B	saa4848
TR421	9339-551-10127	TO220	BUK455_200B	smps
TR5	9331-976-60112	TO92	BC548B	video
TR6	9335-354-70116	TO92	MPSA43	video
TR9	9331-977-10112	TO92	BC557	saa4848
VSYNC	4022-007-45420	SOLDER_PIN_large	SOLDER-PIN_large	
W10	7322-043-01040	JUMPER_4e	JUMPER	saa4848
W11	7322-043-01040	JUMPER_4e	JUMPER	saa4848
W3	7322-043-01040	JUMPER_4e	JUMPER	horizontal
W4	7322-043-01040	JUMPER_4e	JUMPER	horizontal
W9	7322-043-01040	JUMPER_3e	JUMPER	horizontal
X241	NMP-480	HC49_L	CRYSTAL, 48MHz	saa4848
Z200	9331-177-60153	sod27	BZX79C	smps
Z201	TL431C	TO226AA	TL431C	smps
Z202	9331-178-10153	sod27	BZX79C	smps
Z321	9335-008-10113	SOD66	BZV85	vertical
Z340	9331-178-50153	sod27	BZX79C	horizontal
Z341	9331-17950153	sod27	DIO_ZENER	horizontal
Z342	9331-17720153	sod27	DIO_ZENER	video
Z343	9331-177-10153	sod27	BZX79C	horizontal
Z347	9331-178-30153	sod27	BZX79C	smps

4.1 Obsolete parts

Video processor TDA4887, replacement type is TDA4886 (pin compatible)

M41FJB523XT140/T404BA, 17" high resolution, ezFlat, colour monitor tube assembly

5 ALIGNMENT

All values are noted in decimal format, unless indicated with Hxx for Hexadecimal values.

For starting the monitor without micro controller, first:

- P1.2 (pin 4 of SAA4848) = LOW (function: Vg1Blank=OFF)
- P0.0 (pin 12 of SAA4848) = HIGH (function: DPMS1 / switch mode supply is ON)
- P0.7 (pin 13 of SAA4848) = LOW (function: DPMS2 / heater voltage is normal)
- Remove the jumpers J12, J13, J14 (function: safe linearity capacitor settings)

5.1 EHT voltage

Power switch: Switch monitor off

Wait until high voltage capacitor has discharged (at least 10 seconds)

Connect GROUND of high voltage meter to ground of monitor

Connect high voltage meter to EHT

Power switch: Switch monitor on

I2C menu: Write value H00 into I2C register ONEMINP: `H8C,H20,H00`

I2C menu: Increase values in the ONEMINP register (H20) until the high voltage meter is reading 26.0kV

I2C pc software: Change all NVM values containing ONEMINP setting for all frequencies (see chapter I2C tools program).

5.2 Video

Video generator: Select video mode 68kHz/85Hz

- Video generator: Display 1 nit block (w x h=10 cm x 7 cm approximate) in centre of screen

OSD menu: Select 6500K colour temperature

5.2.1 Grid 2

I2C menu / OSD menu:

- Set RGB reference levels to `HC0`
- Set feedback polarity to `positive`
- Set contrast to `HFF`
- Set brightness to `HC0`
- Set pedestal blanking level to `-5%`
- Set brightness mode to `internal control (with greyscale tracking)`

```
H88,H00,H08 // control

H88,H01,HC0 // brightness

H88,H02,Hff // contrast

H88,H03,H0E // osd contrast (MAX=0E)

H88,H04,H40 // gain green

H88,H05,H40 // gain red

H88,H06,H40 // gain blue

H88,H07,HC0  // cutoff green

H88,H08,HC0  // cutoff red

H88,H09,HC0  // cutoff blue

H88,H0a,H00 // black level ac coupling

H88,H0b,H01 // pedestal blanking depth
```

Set ABL_ADJ to HFF in eeprom with I2C bus: `HA2,HC0,HFF`

Set ABL_ADJ to HFF in SAA4848 with I2C bus: `H8C,HE8,HFF`

Use lower potentiometer on FBT (Screen) to make raster just visible with grid2 voltage level.

5.2.2 RGB Black levels coarse setup

I2C menu / OSD menu:

- Set the Red black level until just visible
- Set the Green black level until just visible
- Set the Blue black level until just visible

5.2.3 RGB Gain

Video generator:

- Display 100 nit block (w x h=10 cm x 7 cm approximate) in centre of screen

Use colour analyser to measure colour temperature & light output

I2C menu / OSD menu (`contrast=HFF, brightness=HC0`):

- Set the red, green, blue gains for the correct colour temperature and 150 nit light output

5.2.4 RGB Black levels fine setup

Video generator:

- Display 1 nit block (w x h=10 cm x 7 cm approximate) in centre of screen

I2C menu / OSD menu:

- Set the red, green, blue black levels until correct colour temperature and 1.5 nit light output

Repeat RGB gain and RGB black level adjustments until they are correct.

5.3 Static XY focus

5.3.1 Static focus

Video generator: Display focus testpattern

OSD menu: Set V-focus to HCA in OSD menu

Middle potentiometer for static x focus (Vfoc2)

Upper potentiometer for static y focus (Vfoc1)

5.4 Hgain adjustment

Adjust HGAIN for sufficient pincushion range: `H8C,H97,Hxx`

5.5 Linearity corrector

Video generator: display video mode with horizontal frequency of 33kHz

Video generator: display video pattern with equidistant blocks/vertical lines

Use special tool to adjust linearity corrector (L345) for same linearity on left and right side of screen

5.6 Generating the recall settings

The EEPROM PCF8598B is filled with the monitor setting. The I2C address of the EEPROM are HA0, HA2, HA4, HA6.

The procedure described below described how to copy the aligned values into the factory recall addresses. The addresses as shown below are offset values, when reading/write to the EEPROM the absolute address is for:

0 ≤ position < 256 → `address,position,value` = `HA0,position,value`
256 ≤ position < 512 → `address,position,value` = `HA2,position-256,value`
512 ≤ position < 768 → `address,position,value` = `HA4,position-512,value`
768 ≤ position < 1024 → `address,position,value` = `HA6,position-768,value`

Copy aligned nvn to factory recall:

1) copy block 92-251 to 477-637 (mode dependend)

2) copy block 433-463 to 640-670 (mode independend)

5.7 Serial number

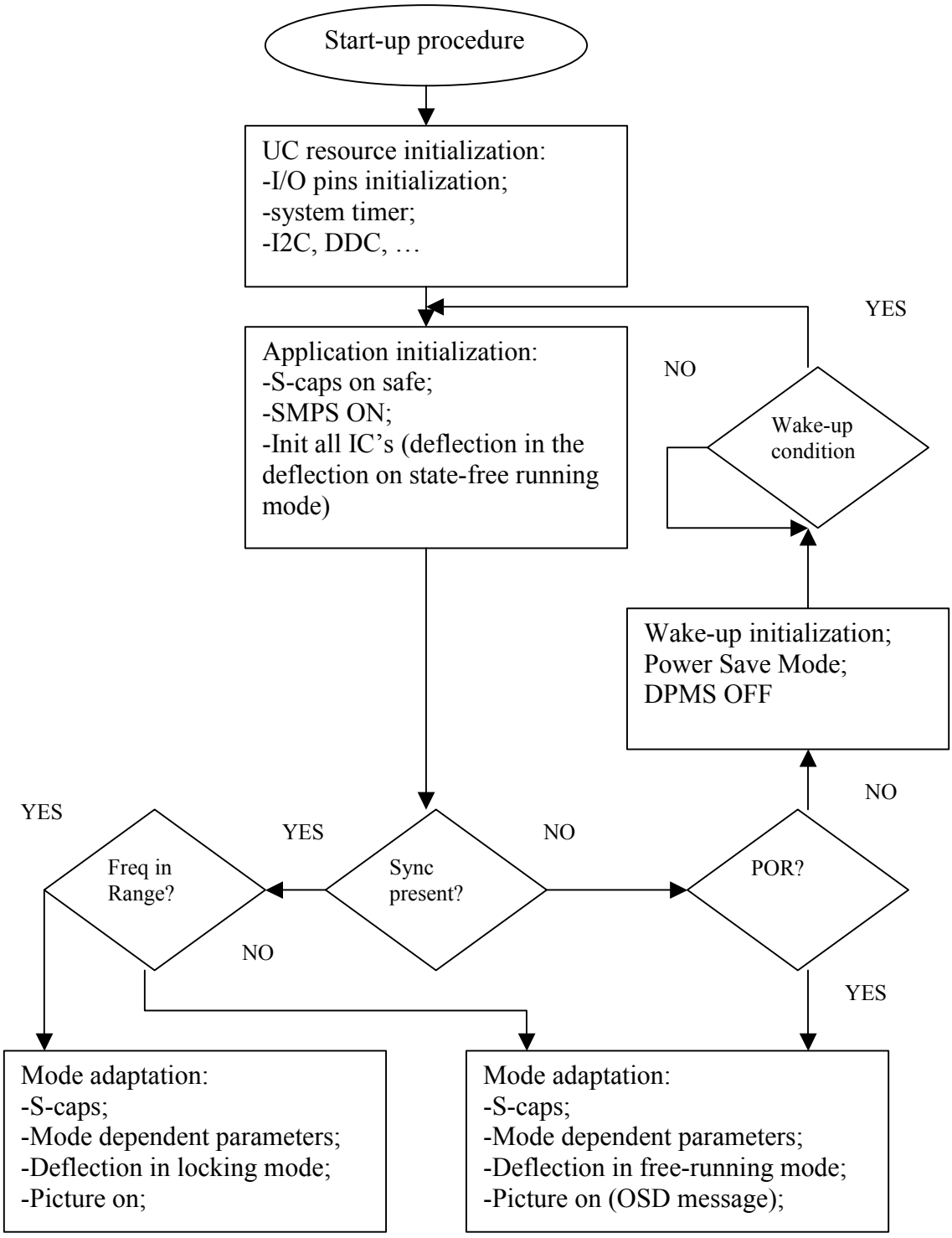
Changing the serial number in the NVM with I2C bus: `HA2,HDC,#`

6 EMBEDDED SOFTWARE

The embedded software takes care of the following:

- Start-up the monitor;
- Master I2C SW, for controlling of all on-board ICs with I2C interface (deflection controller, video pre-amplifier, OSD controller, NVM and I/O's like DPMS, Scaps);
- DDC interface;
- Automatic adaptation to a new video mode, by checking the horizontal and vertical sync frequencies and polarities;
- Storage of 10 factory predefined and 10 free programmable video modes;
- 3 key keyboard and OSD menu based user interface;

6.1 Start-up procedure


Start-up procedure
UC resource initialization:
-I/O pins initialization;
-system timer;
-I2C, DDC, …
Application initialization:
-S-caps on safe;
-SMPS ON;
-Init all IC's (deflection in the deflection on state-free running mode)
YES
NO
Wake-up condition
Wake-up initialization;
Power Save Mode;
DPMS OFF
NO
POR?
YES
NO
Sync present?
YES
Freq in Range?
NO
YES
Mode adaptation:
-S-caps;
-Mode dependent parameters;
-Deflection in locking mode;
-Picture on;
Mode adaptation:
-S-caps;
-Mode dependent parameters;
-Deflection in free-running mode;
-Picture on (OSD message);

6.2 Mode change procedure

The basic principles of the mode change procedure implemented in the demo set are described below:

In case of a mode change, the SAA4848 keeps the old horizontal frequency until the uC does allow slewing to the new one. This means that H –linearity settings is not a hard timing requirement any more. Polling of the SAA4856 flags and registers, which gives the full HWMD information, could perform the mode change detection; though the mode change detection is based on the mode change interrupt. The following Figure 1 presents both, mode change detection based on the interrupt and on the polling mechanism.

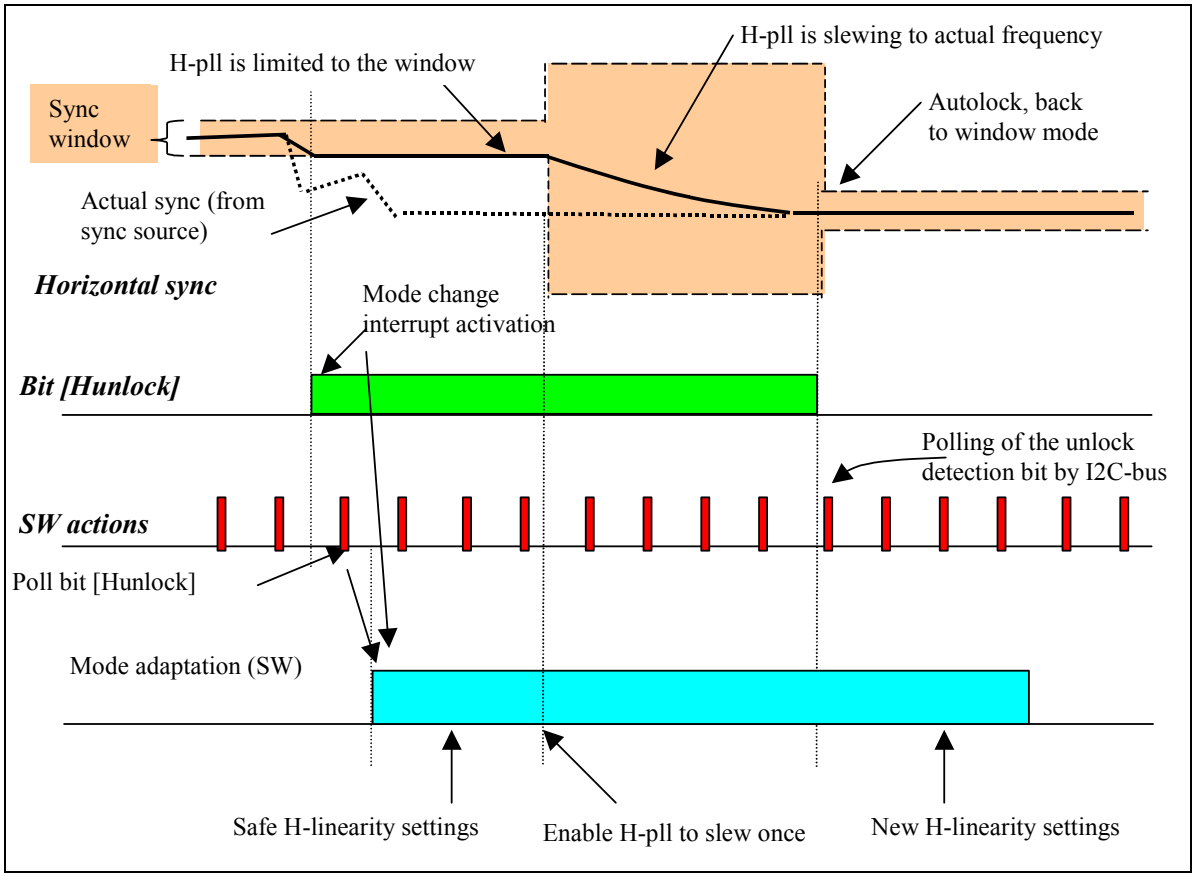


Figure 1 Mode change procedure

The combined DFD and CFD diagrams of the mode change procedure are given on Figure 2. In case of the implementation by the polling mechanism, P1 task would be triggered by the periodical self-triggering task, which would perform polling if any mode change condition has happened.

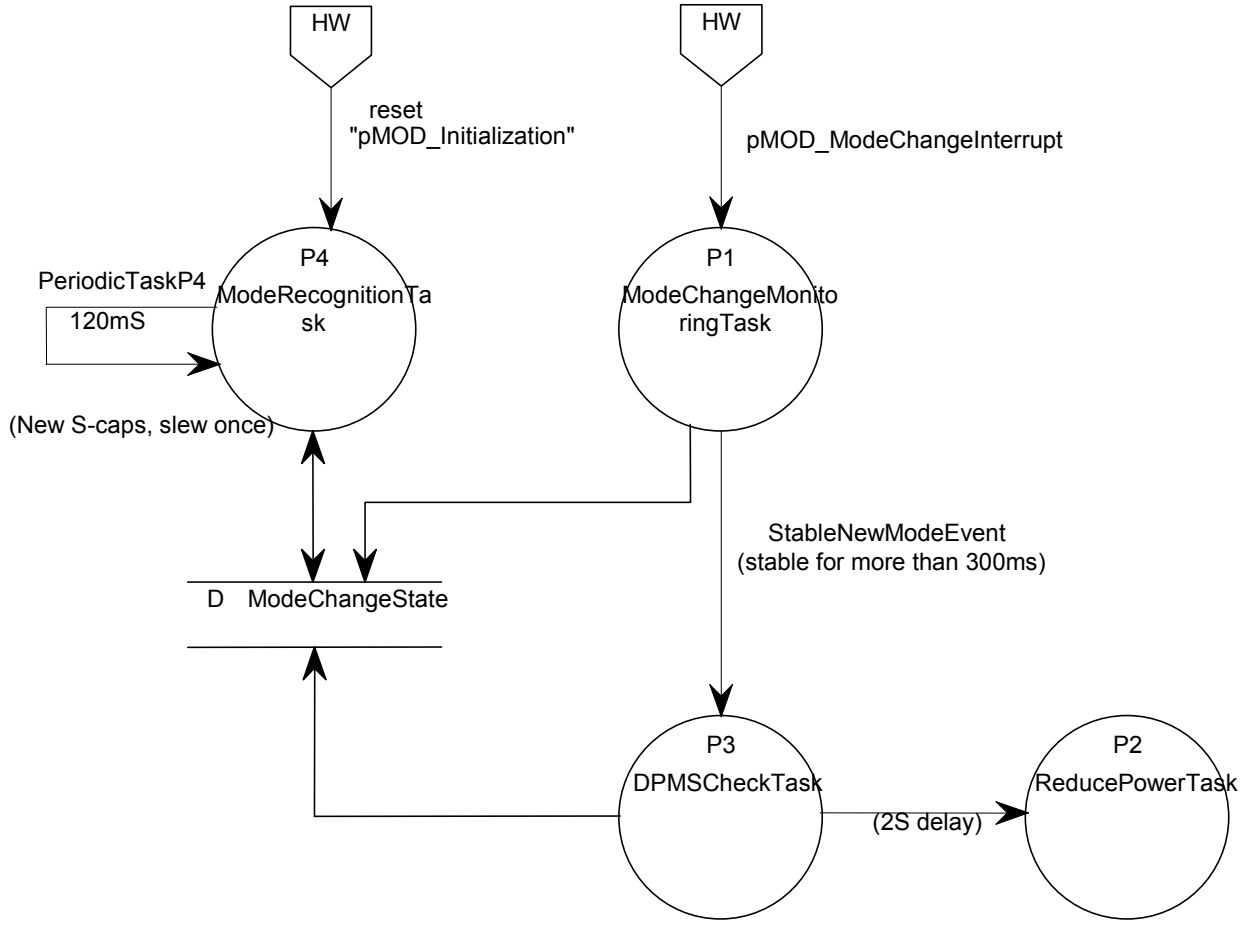


Figure 2 Comparing of CFD, DFD diagrams of two different approaches

All HWMD information are now available from the SAA4848 by I2C bus, but not as an internal uC registers, as it was before. This affects only the low-level driver functions, which has to fetch this information, but on the high-level this difference is not noticeable.

6.3 Video mode adaptation

Automatic mode adaptation to a new incoming video mode includes the following:

- Horizontal sync frequencies from 28 kHz up to 72 kHz;
- Vertical sync frequencies from 50 Hz up to 200 Hz;
- Horizontal and vertical sync polarity detection;
- Full VESA DPMS switching, supporting the modes: on, standby, suspend and off;
- Storage of:
  - 10 factory predefined video modes. The frequencies must be pre-programmed into the NVM. (Horizontal, vertical frequency and polarities);

- 10 free programmable video modes, the user list. In case a video mode is detected which is not in the list of pre-programmed video modes, it will be placed in the user list. When a new video mode is detected and the list is full, the software will overwrite the oldest entry in the list (FIFO).

- The following controls are stored for each video mode:
  - Horizontal position and size;
  - Vertical position and size;
  - Horizontal and vertical moire;
  - Horizontal pincushion and pincushion-balance;
  - Horizontal top corner and bottom corner correction;
  - Horizontal top corner and bottom corner correction balance;
  - Bplus adjustment (OneMinP);

6.4 OSD status messages

The following OSD status messages are displayed:

- "**No Sync Input**": monitor is switched on while no sync signals present. This message is shown together with the monitor status:
  - SW compilation date and version number;
  - Monitor serial number;
- "**No VGA Cable**": monitor is switched on when no VGA cable connected. This message is shown together with the monitor status:
  - SW compilation date and version number;
  - Monitor serial number;
- "**Sync Out Of Range**": the current video mode is not valid, the horizontal and/or vertical frequencies are/is not valid;

While displaying a status message the monitor is set to a free running frequency of 38 kHz@60 Hz.

6.5 User interface and OSD menu control

The user interface consists of 3-menu selection and adjust keys, see Table 3 below.

Key: / Menu status:	Menu	Select / Adjust	
		Down	Up
OSD menu is not active	Activate OSD menu	Contrast down	Contrast up
OSD menu is active	Select next menu; Activate current menu item, e.g. degauss; Toggle current menu item between the select and adjust mode;	In select mode: Select previous menu item	Select next menu item
		In adjust mode: Adjust selected menu item up	Adjust selected menu item down

Table 3 Key functions

A jumper to select between "user" and "service" mode:

- User mode:
  - A limited set of controls is accessible;
  - Automatic (every 5 seconds) update of I2C-bus registers;
  - OSD menu timeout of 10 seconds;
- Service mode:
  - An extensive set of controls is accessible;
  - Regular update of I2C-bus registers is disabled. This allows the usage of an external PC with windows based software to control the I2C-bus IC's in the monitor.
  - No OSD menu timeout;

Pressing the keys "menu" and "select/adjust up" can invert the jumper selection of the mode simultaneously during switching on the set. This can be useful during e.g. road shows, by keeping the set in "user" mode, but to demonstrate a specific control, the set can be temporary set to "service". After finishing the demonstration, the set has to be switched-off and on again to "user" mode, without opening the cabinet.

Debug mode:

Regardless if a monitor works in "user" or "service" mode, the uC fully occupies the I2C bus. For debugging or promotion purpose, sometimes is necessary to take over control of the I2C bus by an external PC I2C SW. Pressing of all three keys at the same time is the command for uC to fully release I2C bus. Some other conditions have to be fulfilled as well for activation of this command:

- Monitor runs in a valid mode;
- There is no OSD menu;
- Monitor is in a service mode.

After receiving this command the uC puts the SAA4856 in free-running mode, H-linearity capacitors in a safe state, releases I2C lines, and freeze all outputs. The monitor is ready to be controlled by the external PC I2C SW.

Another possibility of coming into the debug mode is the pressing of the enter button during the power on reset of the monitor. In that case, the uC will release the I2C bus and go the IDLE mode (uC only).

6.5.1 OSD menu layout

The OSD menu consists of 5 lines, displaying the following information:

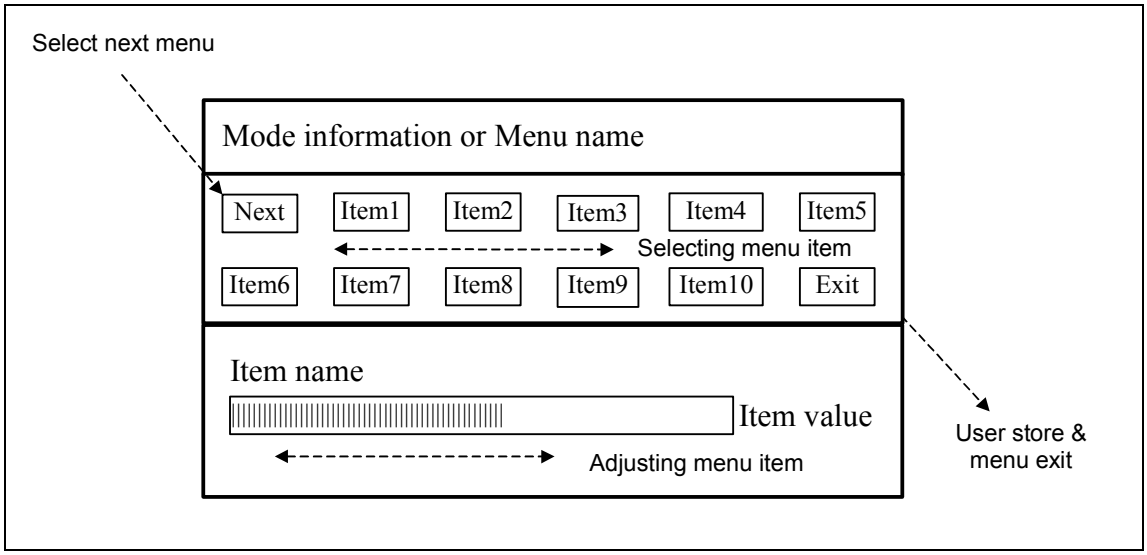


Figure 3 OSD menu structure

OSD user menu

Item nr:	Menu item:
Main menu:	
Next	Select Colour menu
1	Brightness
2	Contrast
3	H position
4	H size
5	V position
6	V size
7	H pincushion
8	H top corner
9	H bottom corner
10	H pincushion balance
Exit	User store & exit
Miscellaneous menu:	
Next	**Select Main menu**
1	Degauss on
2	H moiré
3	V moiré
4	Rotation
5	Colour Temperature User (CT)
6	OSD contrast (minimal value = 4)
7	OSD H position
8	OSD V position
9	User recall
10	Factory recall
Exit	User store & exit
SAA4848 user menu:	
Next	**Select Main menu**
1	H S-wave
2	H corner top balance
3	H corner bottom balance

Item nr:	Menu item:
4	Rotation balance
5..10	-
Exit	User store & exit

OSD service menu

Item nr:	Menu item:
Main menu:	
Next	**Select Colour menu**
1	Brightness
2	Contrast
3	H position
4	H size
5	V position
6	V size
7	H pincushion
8	H top corner
9	H bottom corner
10	H pincushion balance
Exit	User store & exit
Colour menu:	
Next	**Select Miscellaneous menu**
1	Colour temperature Alignment (CT)
2	Red gain
3	Green gain
4	Blue gain
5	Colour Temperature User (CT)
6	Black level for AC coupling (Note: only for the TDA4887)
7	Depth of pedestal blanking (Note: only for the TDA4887)
8	Red bias
9	Green bias
10	Blue bias
Exit	User store & exit

Item nr:	Menu item:
Miscellaneous menu:	
Next	**Select Horizontal menu**
1	Degauss on
2	H moiré
3	V moiré
4	Tilt
5	V focus
6	OSD contrast (minimal value = 4)
7	OSD H position
8	OSD V position
9	User recall
10	Factory recall
Exit	User store & exit
Horizontal menu:	
Next	**Select Vertical menu**
1	H position
2	H size
3	H trapezium
4	H parallelogram
5, 6	-
7	H pincushion
8	H top corner
9	H bottom corner
10	H pincushion balance
Exit	User store & exit
Vertical menu:	
Next	**Select Main menu**
1	V position
2	V size
3	V linearity
4	V linearity balance
5, 6	-

Item nr:	Menu item:
7	V offset
8	V gain
9, 10	-
Exit	User store & exit
SAA4848 menu 1:	
Next	**Select Main menu**
1	H gain
2	H size range
3	H S-wave
4	H S-wave balance
5	H corner top balance
6	H corner bottom balance
7..10	-
Exit	User store & exit
SAA4848 menu 2:	
Next	**Select Main menu**
1	H moiré range
2	V moiré range
3	V EHT shift
4	V EHT offset
5	V EHT gain
6	H EHT gain
7	EHT compensation current
8	Rotation balance
9	B+ adjustment (1-p)
10	H sub-size range
Exit	User store & exit

6.5.2 Menu item descriptions

The sections below describe some OSD menu items in more detail.

User store & exit

The modified controls are stored into the NVM and the OSD menu is cancelled. This function will also be executed:

- automatically in user mode after the OSD menu timeout;
- when pressing the menu key on a main menu item which is intended to be adjusted, e.g. pressing the menu key while brightness is selected or adjusted;

User recall

A user recall fetches, (and updates the IC's), the previous stored user settings from the NVM.

Factory recall

A factory recall fetches, (and updates the IC's), the settings from the NVM which are stored during pre-programming the NVM.

Colour Temperature (CT) selection

A selection can be made out of 3 settings:

- Fixed settings: 6500K and 9300K;
- User modifiable setting;

It is a must to store & exit the menu during adjusting the R-/G-/B-gain and/or R-/G-/B-bias for each CT setting. This due to the fact that only one set of these settings, (R-/G-/B-gain, R-/G-/B-bias), is stored into the micro-controller, and selection of another CT setting will override the just modified settings.

6.6 External interface control

The full DDC interface is implemented.

6.6.1 NVM memory map layout

The NVM mapping layout is given in the table below and must be used to pre-program the NVM. The size of the NVM is 1024 bytes, divided into 4 banks of 256 byes.

<table>
<tr><th>Sub-address (decimal)</th><th>Contents</th><th>Remarks</th></tr>
<tr><td>0 .. 39</td><td>H- and V-sync frequencies of the factory pre-defined video modes 0 to 9</td><td>The horizontal and vertical frequencies of the factory pre-defined video modes are used during the mode adaptation sequence to check if the new mode is already stored into the NVM. This data must be pre-programmed into the NVM.
The frequencies are stored in groups of 4 bytes:
Index 0: horizontal-high;
Index 1: horizontal-low;
Index 2: vertical-high;
Index 3: vertical-low;
Example of the frequency coding:
31.50 kHz: 3150 (dec) = 0C4E (hex), H-high=0C; H-low=4E
120.5 Hz: 12050 (dec) = 2F12 (hex), V-high=2F; V-low=12
Sub-address mapping:
Sub-address 0: factory mode 0;
Sub-address 4: factory mode 1;
::
Sub-address 36: factory mode 9;</td></tr>
<tr><td>40 .. 79</td><td>H- and V-sync frequencies of the user programmable video modes 0 to 9</td><td>The horizontal and vertical frequencies of the user programmable video modes are used during the mode adaptation sequence to check if the new mode is already stored into the NVM.
For the coding see: “H- and V-sync frequencies of the factory pre-defined video modes 0 to 9”.
Sub-address mapping:
Sub-address 40: user mode 0;
Sub-address 44: user mode 1;
::
Sub-address 76: user mode 9;</td></tr>
<tr><td>80 .. 89</td><td>Sync polarity for the factory pre-defined video modes 0 to 9 and user programmable video modes 0 to 9</td><td>The horizontal and vertical sync polarities of the factory pre-defined and user programmable video modes are used during the mode adaptation sequence to check if the new mode is already stored into the NVM. The data belonging to the factory pre-programmed video modes must be pre-programmed into the NVM.
<table>
<tr><td>Bit:</td><td>7</td><td>6</td><td>5</td><td>4</td><td>Even modes (0,2,4..)</td></tr>
<tr><td></td><td>3</td><td>2</td><td>1</td><td>0</td><td>Odd modes (1,3,5..)</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Sub-address (decimal)</th><th>Contents</th><th>Remarks</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>value</td><td>0</td><td>0</td><td>0</td><td>0</td><td>H & V negative polarity</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td>H negative; V positive</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>0</td><td>H positive; V negative</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td>H & V positive polarity</td></tr>
<tr><td></td><td>0</td><td>1</td><td>x</td><td>x</td><td>H & V polarity is don’t care</td></tr>
</table>
Sub-address mapping:
sub-address 80: factory mode 0 & 1;
::
sub-address 84: factory mode 8 & 9;
sub-address 85: user mode 0 & 1;
::
sub-address 89: user mode 8 & 9;
</td></tr>
<tr><td>90</td><td>spare</td><td>To be filled with 0</td></tr>
<tr><td>91 .. 251</td><td>Mode dependent settings for the factory pre-defined video modes 0 to 9</td><td>
The following 13 controls (16Bytes) are stored for each video mode:
index 0: H size; (max value: 1023)
index 1: H position; (max value: 1023)
index 2: V size; (max value: 255)
index 3: V position; (max value: 255)
index 4: H moire; (max value: 255)
index 5: V moire; (max value: 255)
index 6: H pincushion (max value: 255)
index 7: H pincushion balance (max value: 255)
index 8: H top corner (max value: 255)
index 9: H bottom corner (max: value: 255)
index 10: H top corner balance (max value: 255)
index 11: H bottom corner balance (max value: 255)
index 12: Bplus adjustment (max value: 63)

Sub-address mapping (mode offset=16):
sub-address 91: factory mode 0;
sub-address 107: factory mode 1;
::
sub-address 235: factory mode 9;
</td></tr>
</table>

Sub-address (decimal)	Contents	Remarks
251 .. 262	Spare	To be filled with 0
263 .. 460	Mode dependent settings for the user programmable video modes 0 to 9	The 13 controls are stored for each video mode. For the coding see: "Mode dependent settings for the factory pre-defined video modes 0 to 9". Sub-address mapping (mode offset=16): sub-address 263: user mode 0; sub-address 279: user mode 1; :: sub-address 407: user mode 9;
423 .. 432	Spare	To be filled with 0
433 .. 463	Mode independent settings	The following 30 controls (31Bytes) are stored independent for each video mode: index 0: Brightness; (max value: 255) index 1: Contrast; (max value: 255) index 2: H trapezium; (max value: 255) index 3: H parallelogram; (max value: 255) index 4: tilt; (max value: 255) index 5: V linearity; (max value: 255) index 6: V linearity balance; (max value: 255) index 7: V focus; (max value: 255) index 8: V gain; (max value: 255) index 9; V offset; (max value: 255) index 10: H gain; (max value: 1023) index 11: H size range; (max value: 255) index 12: H s-wave; (max value: 255) index 13: EHT adjustment; (max value: 255) index 14: ABL adjustment; (max value: 255) index 15: H s-wave balance; (max value: 255) index 16: H moire range; (max value: 3) index 17: V moire range; (max value: 3) index 18: V EHT shift; (max value: 255) index 19: V EHT offset; (max value: 255) index 20: V EHT gain; (max value: 255) index 21: H EHT gain; (max value: 255) index 22: EHT compensation curve; (max value: 255) index 23: tilt balance; (max value: 255)

Sub-address (decimal)	Contents	Remarks
		index 24: OSD contrast; (max value: 15) index 25: OSD H position; (max value: 100) index 26: OSD V position; (max value: 100) index 27: DAC_DEFLECT_4; (max value: 255) index 28: H subsize range; (max value: 255) index 29: Basedrive; (max value: 255)
464 .. 466	R-/G-/B-gain settings for the user CT settings	sub-address 464, 465& 466: R-/G-/B-gain for user setting (max value for gain: 255)
467 .. 469	Spare	To be filled with 0
470 .. 471	SW version	470=SW_VERSION_HIGH; (max value: 100) 471=SW_VERSION_LOW; (max value: 100) SW_VERSION=SW_VERSION_HIGH.SW_VERSION_LOW
472	Current mode number	The mode number of the current video mode: 0 to 9 for factory mode 0 to 9; 10 to 19 for user mode 0 to 9;
473	New user mode index	This index is used to store a new detected user video mode. The index wraps around from 9 to 0. This means that a new one will overwrite the oldest mode, in case 10 user modes are used.
474	Colour temperature index	Index to select the CT setting: value 0: 9300K; value 1: 6500K; value 2: user setting;
475	Spare	To be filled with 0
476	Serial number	The monitor serial number, value from 0 to 255
477 .. 636	Mode dependent settings for the factory pre-defined video modes 0 to 9 which are used during factory recall	Contains the 13 mode dependent controls (16Bytes), which are used during a factory recall from the OSD menu. This data must be pre-programmed. Sub-address mapping: sub-address 477: factory mode 0; sub-address 493: factory mode 1; :: sub-address 621: factory mode 9;
637 .. 639	Spare	To be filled with 0
640 .. 670	Mode independent settings which are used during factory recall	The 30 controls (31Bytes) which are stored independent for each video mode, see also “Mode independent settings”

Sub-address (decimal)	Contents	Remarks
671 .. 679	Spare	To be filled with 0
680 .. 685	R-/G-/B-gain for pre-defined CT settings	sub-address 680, 681 & 682: R-/G-/B-gain for 9300K sub-address 683, 684 & 685: R-/G-/B-gain for 6500K (max value for gain: 255)
686 .. 688	R-/G-/B-bias settings	The bias settings are independent from the selected CT. sub-address 686: R-bias sub-address 687: G-bias sub-address 688: B-bias (max value for bias: 255)
689 .. 704	Mode dependent settings which are used when a new user mode is detected	Contains the 13 mode dependent controls (16 Bytes), which are used when a new user mode is detected. This data must be pre-programmed.
705 .. 706	Spare	To be filled with 0
710	Specific settings for the TDA4887	Contains the specific TDA4887 controls: Black level for AC coupling, bits 2, 1, and 0; Depth of pedestal blanking, bits 5 and 4;

6.7 DPMS control

Depending upon the status of the incoming sync signals the proper power management mode will be chosen according the next table:

Vsync	Hsync	Monitor state	DPMS1 output (supplies off/on-except 5V)	DPMS2 output (reduce heater supply)	Remarks
Present	Present	On	High	Low	Monitor in operating state
Present	Not present	Stand-by	High	High	Video will be blanked & deflection controller in stand-by state
Not present	Present	Suspend	High	High	Video will be blanked & deflection controller in stand-by state
Not present	Not present	Off	Low	High	Video will be blanked, deflection controller in stand-by state & the SMPS is set into burst mode

6.8 Horizontal linearity capacitors

The switching characteristics of the horizontal linearity capacitors, H_lin0, H_lin1 and H_lin2, are given in the table below. (The output level of the micro-controller pins H_lin0/1/2 is given)

Horizontal frequency	H_lin0 820nF	H_lin1 390nF	H_lin2 150nF
f<= 31 kHz (also the safe setting)	Low	Low	Low
31 kHz < f<= 33 kHz	Low	Low	High
33 kHz < f<= 35 kHz	Low	High	Low
35 kHz < f<= 39 kHz	Low	High	High
39 kHz < f<= 44 kHz	High	Low	Low
44 kHz < f<= 50 kHz	High	Low	High
50 kHz < f<= 61 kHz	High	High	Low
61 kHz < f<= 70 kHz (max horizontal frequency)	High	High	High

6.9 NVM related items

6.9.1 Factory pre-programmed video modes

The pre-programmed video modes are listed in the table below:

Factory mode	VESA mode	Vertical frequency	Horizontal frequency
0	640 x 480	60 Hz	31.5 kHz
1	640 x 480	72 Hz	37.9 kHz
2	640 x 480	85 Hz	43.3 kHz
3	800 x 600	60 Hz	37.9 kHz
4	800 x 600	75 Hz	46.9 kHz
5	800 x 600	85 Hz	53.7 kHz
6	1024 x 768	60 Hz	48.4 kHz
7	1024 x 768	75 Hz	60.0 kHz
8	1024 x 768	85 Hz	68.7 kHz
9	640 x 480	75 Hz	37.5 kHz

7 I2C CONTROL SOFTWARE RUNNING ON WINDOWS PC

7.1 In system programming

For the in-system programming special windows based PC software is written. This software allows the used to re-program the microcontroller via the DDC channel.

In order to switch to the programming mode, send via DDC the I2C commands 6E,51,81,00,BE (hex)

7.2 I2C tools program

This windows based PC software can send any I2C command to the I2C bus. It can handle scripts like shown below.

Script example for changing all ONEMINP values at once:

```
// Write all 1-p at once in nvm

// 1-p is stored as freq dependend

//#ValueFormat = HEX

// all values should be the same (incl new mode)

#WaitBetweenCommandLines = 20   //msec

#Variable $temp = 1

#showallvariables

//factory mode 0 h6a

ha0,h6a,$temp

//factory mode 1 h7a

ha0,h7a,$temp

//factory mode 2 h8a

ha0,h8a,$temp

//factory mode 3 h9a

ha0,h9a,$temp

//factory mode 4 haa

ha0,haa,$temp

//factory mode 5 hba

ha0,hba,$temp

//factory mode 6 hca

ha0,hca,$temp
```

```
//factory mode 7 hda

ha0,hda,$temp

//factory mode 8 hea

ha0,hea,$temp

//factory mode 9 hfa

ha0,hfa,$temp

//use mode 0 h116

ha2,h16,$temp

//use mode 1 h126

ha2,h26,$temp

//use mode 2 h136

ha2,h36,$temp

//use mode 3 h146

ha2,h46,$temp

//use mode 4 h156

ha2,h56,$temp

//use mode 5 h166

ha2,h66,$temp

//use mode 6 h176

ha2,h76,$temp

//use mode 7 h186

ha2,h86,$temp

//use mode 8 h196

ha2,h96,$temp

//use mode 9 h1a6

ha2,ha6,$temp

//new mode h2c0

ha4,hc0,$temp
```

7.3 DEMIC I2C & SFR control software

This software can control the I2C bus for the SAA4858 and the SFR registers via the DDC bus (for SFR register control, a special firmware version needs to be programmed).

8 LIST OF ABBREVIATIONS

AC	alternating current
ADC	analog to digital converter
B	blue
CMOS	complementary metal-oxide semiconductor
CPU	central processing unit
CRC	cyclic redundancy check
CRT	cathode ray tube
CT	colour temperature
DAC	digital to analog converter
DC	direct current
DDC	display data channel
DPMS	display power management signalling
EHT	extreme high tension
G	green
H	horizontal
HWMD	hardware mode detector
I2C	inter IC connect
IC	integrated circuit
LED	light emitting diode
NVM	non-volatile memory
OSD	on screen display
PC	personal computer
PWM	pulse width modulation
R	red
RAM	random access memory
ROM	read only memory
SCL	serial clock line
SDA	serial data line
SFR	special function register
SW	software
uC or μC	microprocessor
V	vertical
VESA	video electronics standard association
WOR	write once registers

9 REFERENCES

9.1 Datasheets

Device	Description	Version	Date
SAA4848PS/SAA4849PS/ SAA4847PS	I2C-bus autosync CMOS deflection controller and microcontroller for CRT monitors	Version 1.6	jun-2003
TDA4856PS	I2C-bus controlled autosync deflection controller for PC monitors		13-jul-2003
TDA4841PS	I2C-bus controller autosync deflection controller for PC monitors		21-jun-1999
TDA4867J	Full bridge current driven vertical deflection booster		29-aug-2000

9.2 Application notes

Number	Description	Version	Date
AN00032	User manual of I2C-bus control software		
AN00033	CCM433 autosync monitor – 85kHz separate deflection/EHT		17-may-2000
AN00040	Vertical deflection booster TDA4863AJ/TDA4863J		
AN00042	Failure mechanisms of the line output transistor		
AN00057	ECO monitor – 70kHz combined deflection/EHT		8-nov-2000

9.3 Web references

Description	URL
I2C general	http://www.semiconductors.philips.com/buses/i2c/index.html
I2C FAQ	ftp://ftp.uni.paderborn.de/elrad/020/ or http://www.ping.be/~ping0751/i2c.htm
Philips Semiconductors datasheets	http://www.semiconductors.com