ARCAM

ALPHA ONE
CD PLAYER
SERVICE MANUAL

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TECHNICAL SPECIFICATION

Laser pick-up	3 beam
Number of D/A converters	2
Conversion system	Multi-Level Delta Sigma
Effective resolution	16 bits
Dynamic Range	96dB
Signal to noise ratio (CCIR)	>105dB
Harmonic distortion (0dB, 1kHz)	<0.005%
Frequency response (-0.5dB)	20Hz - 20kHz
Output level (0dB)	2.4 Vrms
Output impedance	50Ω
Minimum recommended load	5kΩ
Digital output connection	75Ω co-axial
Power consumption	12VA max
Size W/D/H mm.	430x254x76
Weight	3.6kg nett. 4.6kg packed

Circuit Description

The following notes describe the operation of the Alpha 'One' CD player. They include the circuitry on the main and display PCB but not that on the servo PCB attached to the mechanism.

Power Supplies

The mains input is fitted with capacitors C201 & C202 and inductors L201& L202 to filter electromagnetic interference coming out of the player.
Mains transformer TX201 has two secondary windings supplying two separate power supplies:

Analogue Supply

Bridge rectifier D201/4 and reservoir capacitors C209-C212 produce unregulated split rails of about +/-25V.
Z201 and Z203 provide regulated outputs of +15V and -15V respectively that power the opamps in the audio output stage.
Since there is no power switch on this secondary, the analogue supplies are always connected.

Digital Supply

Switch SW201-A disconnects the digital secondary winding when the 'Power' switch is out.
An unregulated supply of about 12V is produced by the bridge rectifier D205/8 and reservoir capacitor C207.
Z204 and its associated components provide a 7V regulated supply to the KSK-1220A CD module. The peak current taken by this device is almost 1A although it consumes closer to 150mA when playing a disc.
The digital 5V supply to the KSK-1220A, CXD2500BQ decoder and CXP1021Q controller is provided by Z205. This regulator has to output about 150mA maximum.
Z209, along with series diodes D214 and D215, creates a DC supply of around 6.2V that is used to power the LED backlight on the display PCB.

The digital supply also power the DAC, via R247, C252 & Z202 and the clock oscillator via Z211.

Muting

When the unit is turned off SW201-B makes, turning on Q202. Since this circuit is powered by the 15V analogue rail, which is always on, a 10V mute signal is generated and passed to the output mute transistors Q1 & Q101.

If the unit is switched on Q202 is turned off. Then the mute transistors are biased off by the resulting -15V control signal.

During operation the controller (Z208) will send out a mute signal when moving between tracks, when 'Pause' is active and when the disc is stopped. This signal switches on Q201, producing an active low signal to mute the DAC, Z207 at pin 25.

Clock Generator

The system clock is generated by a discrete oscillator based around Q203 and 16.9344MHz oscillator X201. The output of Q203 is amplified by inverter Z210-E and sent to the clock input of the DAC. Z210-D outputs a buffered system clock to the decoder Z206.

DAC & Audio Outputs

The DAC is a Delta-Sigma design from Burr Brown, the PCM1710U.
The serial digital data from the decoder Z206 is input to pins 1 to 3. The system clock is input to pin 5.
The DAC is muted by bringing pin 25 low and digital deemphasis enabled by bringing pins 26 and 27 high.
The DAC is powered entirely from one 5V supply, although it is split and decoupled between the analogue and digital sections of the device.
The analogue outputs from each channel are processed identically. Two poles of filtering are provided by the active filter based around Z1-A (Z101-A).
Muting is provided by turning on Q1 and Q101.

Disc Transport Module

The KSK-1220A module comprises the disc loading mechanism, laser assembly, RF amplifier and analogue signal processing. All the servo control and motor drive circuits are also included.
NOTE: There are no user serviceable parts in this module and faulty units should be returned to Arcam for repair.

Digital Signal Processor

The digital signal processor CXD2500BQ (Z206) is controlled by the system controller Z208 via a serial bus (CLOK, XLAT & DATA) into pins 74, 72 & 71. These signals 'daisy-chain' out to the KSK-1220A module via pins 77 to 79 (DATO, XLTO & CLKO).

The EFM signal into pin 24 of Z206 is a digital version of the RF signal picked up from the

disc. A comparator in the servo amplifier chip (CXA1372AQ in the KSK-1220A module) converts the analogue signal into high and low logic signals.
However it is not possible for this circuit to correct for variations in disc output by itself i.e. the switching level may vary. The Auto-Asymmetry Correction circuit counters this by processing a buffered EFM signal - ASYO from pin 27 of Z206 - through LPF R230/1 & C244/5. This is used to control the reference value of the comparator in the servo amplifier.
The Mirror signal is an input from the servo amplifier chip generated by holding the bottom and peak levels of the RF signal. It goes high between tracks and when a defect is detected and is used when jumping 16 or more tracks.

Digital Audio Data is output to the DAC (Z207) via a three-wire serial bus:
LRCK (pin 32) is the left/right clock, frequency 44.1kHz.

SD48 (pin 34) is the serial data, output MSB first with 24 bit clock cycles per data word. The MSB is valid for the first nine clock cycles.

BCLK48 (pin 35) is the bit clock output, frequency 2.12MHz.

The Master PLL requires an external filter that is connected to FILO, FILI, PCO & CLTV (pins 18-20 & 22).

The turntable motor speed is controlled by a digital spindle servo giving Constant Linear Velocity (CLV). The speed required is ascertained from the sub code and an output PWM motor control signal is sent to the mechanism via MDP (pin 4).

Sub-code data is output to Z208 via SQSO (pin 66). The clock required to read the data is input from the controller at SQCK (pin 67).

The FOK signal generates a timing window to enable the focus servo from a focus search condition.

The SENS signal outputs a variety of signals from the decoder to the microcontroller.

Lock goes high when the sampled GFS signal is low 8 or more times in succession.

A digital output complying to the SPDIF standard is enabled by pulling pin 59 high and output from pin 60. The correct level and impedance output to an external DAC is provided by the circuit around transformer L401.

System Controller

The CXP1021Q system controller (Z208) is a combined CD player controller, keyboard scanner and LCD display driver. It's clock is generated by 4.19MHz resonator CR201.
The reset signal for this device and the rest of the system is set by R238, C243 and D216.

The laser diode control signal LDON is inoperative in the CXP1021Q. Therefore the circuit of R242/3 & Q204 is used to switch on the laser only when the drawer is closed, as detected by the 'IN' switch on the mechanism.

The controller detects the position of the disc drawer from the status of two microswitches, disc in/disc out, on the mechanism.

Control lines, Load (pin 39) and Unload (pin 40), control the operation of the disc loading drawer. Normally these lines are high. When Load goes low the drawer is drawn in . When Unload is low the drawer is driven out. These control signals will never go low at the same time!
Sub-code data is input from Z206 via SUBQ (pin 46). The clock required to read the data is output from the controller at SQCK (pin 44).

A mute signal (pin 42) is sent to the DAC whenever the drawer is open, the mechanism is stationary or between tracks. This signal is active high.

A deemphasis signal (EMPH pin 41) is sent to the DAC when the sub-code data indicates that the disc has been recorded with pre-emphasis. This signal is active high.

If the player is turned on while the test button is pressed, it will enter Test mode (See page 6 for details of the checks that can be made in this mode).

A keyboard is connected as a matrix between the Keyin inputs (pins 51-54) and Keyscan outputs (pins 61 - 66). A further matrix of diodes is connected between the Keyin pins and Custscan outputs (pins 55-58) that defines the Custom Code to be recognised by the remote control input.

The signal from the remote control receiver is input to RMC (pin 28). The NEC format remote control signal contains a field for a customer-specific Custom Code. This code is assigned by NEC to manufacturers for them to use on their products. It is set by means of diodes D221 to D229.

R234 to R237 control the drive circuitry for the LCD display.

Display PCB

The only active parts on the display PCB are the LCD display, LED backlight, remote control receiver and LED 'Power' indicator.
The keyboard connects as a matrix to the system controller Z208.

Test Mode

To enter 'Test Mode' turn off the CD player and hold down the 'TEST' button on the main board while turning the unit back on again.

The tray can be opened with the 'Open' button. Once the tray has closed the system will enter focus search mode.

At this point focus search will be executed repeatedly. If a disc is present the focus, CLV-A and tracking sled servos will be turned on. Mute is disabled and playback starts.

If there is no disc, the lens will move up and down with a period of around one second.

Running Checks

With a disc loaded the following operations may be carried out.

Press...

'Stop'	All servos turned off
'Play', 'Pause'	Repeat focus search. When a disc is present the
system will	enter play mode.
'Next'	CLV-P, Tracking on, Sled on
'Prev'	Tracking off, Sled off
'>>'	Jump 200 tracks forward (during play only)
'<<'	Jump 200 tracks backward (during play only)

N.B. During '<<' & '>>' the current track number will be displayed.

Connection Descriptions

SK/PL201	Display drive from microcontroller to LCD
SK/PL202	Misc. signals to/from display PCB
SK201	Flex foil connection to KSK-1220A
LDON	Laser Diode control signal. High=Laser On. This signal is controlled by the INSw signal. When the tray is in, the low INSw signal is inverted to provide this signal.
LODin	Tray loading motor control. LODIn High, LODOut Low : Tray Close
LODout	LODIn Low, LODOut High: Tray Open N.B. These signals assume active high outputs from the microcontroller. However the CXP1021Q has active low outputs therefore correct operation is achieved by reversing these connections.
INSw	Switch connects to ground when the tray is fully in.
OUTSw	Switch connects to ground when the tray is fully out
FOK	Focus OK input to CXD2500Q pin 1.
MIRR	Mirror signal to CXD2500Q pin 80 and micro.
CLK	Clock - Microprocessor interface to CXD2500Q
XLT	Latch
DATA	Data
CNIN	Output to CXD2500Q pin 76. Track number count signal output.
SENS	Output from Servo Signal Processor to CXD2500Q pin 75.
XRST	System reset (active low)

DFTSw	Defect switch output from CXA1372. Not used.
MDP	Motor control line from CXD2500Q pin 4.
LOCK	Connects to CXD2500Q pin 6 Prevents sled runaway by turning off the sled servo.
+5V	Power supply
GND	Ground
ASY	Aymmetry correction output from CXD2500Q through LPF. Used to correct the symmetry of the RF signal
EFM	The EFM signal is the digital version of the RF signal.
GND	Ground for motor driver
+7V	Power supply for motor driver

Test Points (Marked on printed circuit board)

KSK-1220A Module PCB

1. VC	Vcc / 2 half supply rail bias
2. FE	Focus error signal input (from laser)
3. FEI	Focus error signal input (at CXA1372)
4. RFO	RF Signal Input
5. TE	Tracking error signal input
6. PLCK	EFM PLL Clock (inverted)

Main PCB

TPA +15V	+15V analogue power supply
TPB -15V	-15V analogue power supply
TPC AGND	Analogue ground
TPD 5VAN	+5V analogue power supply
TPE 5VDG	+5V digital power supply
TPF 7V	+7V digital power supply
TPG DGND	Digital ground
TPH 11V	+11V unregulated
TPI	+25V+25V unregulated

TPJ -25V	-25V unregulated
TPK	MUTE
TPL	EFM
TPM	LRCK
TPN	DATA
TPO	BCLK
TPP	XSYS

Test Points (Marked on circuit diagrams only)

TP	Name	Description
1	LIVE	Mains Live input
2	NEUT	Mains Neutral input
3	EARTH	Mains Earth
4	P20VUN	Analogue power supply +ve unregulated
5	N20VUN	Analogue power supply -ve unregulated
6	P10VUN	Digital power supply unregulated
7	DGND	Digital supply ground
8	AGND	Analogue supply ground
9	P15V	+15V analogue supply regulated
10	N15v	-15V analogue supply regulated
11	P15VAN	+5V analogue supply regulated
12	P8V	+8V digital supply regulated
13	P5VDIG	+5V digital supply regulated
14	MUTE	Mute signal to DAC (active high)
15	DEEM	Deemphasis signal to DAC (active high)
16	LRCK	Digital audio left/right input to DAC
17	DATA	Digital audio data input to DAC
18	BCLK	Digital audio bit clock input to DAC
19	XSYS	System clock 16.9 MHz from DAC
20	OUTL0	Audio O/P from DAC left channel
21	OUTR0	Audio O/P from DAC right channel
22	OUTL1	O/P from first stage left
23	OUTR1	O/P from first stage right
24	OUTL2	O/P from second stage left
25	OUTR2	O/P from second stage right
26	LHC	Left hand channel output
27	RHC	Right hand channel output
28	AGND2	Audio output ground
29	XRST	System reset (active low)
30	REM	Remote signal input
31	TEST	Test input
32	SWA	Power switch input
33	SWB	Power switch output
34	DOUT	Digital output (not required)
35	DOUTG	Digital output ground (not required)
36	LEDBL	LED backlight supply
37	VCLK	Clock power supply

Disassembly For Service

CAUTION: ANTI STATIC PRECAUTIONS MUST BE OBSERVED

1. Remove the top cover by removing the 4 side screws and 4 rear panel screws (two along the top edge & one at each end). Slide the cover backwards and up.

2. Remove the 4 side screws holding the front panel onto the chassis. Remove one screw from the centre of the front panel accessed from inside the unit. The front should now pull off and be put in a safe place to prevent any damage.

3. Remove 1 screw from each of the digital and audio output sockets .

4. Remove 1 screw from each side of the audio output sockets and two screws from the bottom edge of the rear panel.

5. Remove 1 screw from each side of the mains inlet socket.

   The rear panel is now free and should be stored in a safe place to prevent damage.

6. The display board must be removed to get the main board out of the unit. The board is removed by squeezing the tops of the 2 pcb pillars and then pulling the board off its 2 connectors. These connectors will be tight and you may need to gently lever the board upwards and forwards to clear the pcb pillars.

7. Remove 2 screws from the right hand side of the main board securing the board to the chassis. Pull the flexifoil from the mechanism out of the socket SK201. The main board can now be removed by squeezing the top of the 2 pcb pillars and pulling the board upwards.

To remove the mechanism remove the top cover (step 1 above) and then carry out the following procedures.

1. Locate the 4 small black plastic "snap rivets" on the base of the unit.

2. Pull the centre pin out of each of these and then remove the remaining part of these rivets from the unit.

3. Remove one screw from the centre of the front panel to release the flying lead to the mechanism.

The mechanism is now loose and can be removed from the unit once the flexifoil is disconnected from the main board.

Change Of Mains Voltage

WARNING - the unit **must** be unplugged from the mains when replacing the fuse as the mains inlet and fuse are at mains potential even with the unit switched off.

The Alpha One CD can be set for use on 230v or 115v mains supplies.

There are 2 mains fuseholders in the unit - one marked 230v & the other 115v and the fuseholder with the fuse fitted to it determines the working voltage.

To change voltage remove the fitted fuse and fit the correct value fuse to the other fuseholder.

The correct fuses are: 160mA antisurge for 230v
250mA antisurge for 115v

NOTE: ONLY FIT ONE FUSE AT A TIME

List Of Circuit Diagrams
Power Supplies, DAC, System Clock, Audio Outputs
Digital Signals Processor, System Controller
Display Board

Note 1 L204, C6 and C106 not fitted

Note 2 D250 & D231 do not need top be fitted from issue 9

Analogue Supplies

Mute Circuit

DAC

Audio Data

System Clock

9	CAH	28-11-95	C218 was 100U L & R swapped via R1 & R101	95/121
8	WAF	14-6-95	C253 FROM 100U TO 22U OSCON	95/065
7	CAH	11-11-94	F203 added	94/127
ISSUE	INITIALS	DATE	DESCRIPTION	ECO No.

ARCAM
A & R CAMBRIDGE
WATERBEACH
CAMBRIDGE
CB5 9PB

DRAWING TITLE
Alpha 1 CD Player
Circuit Diagram

DRAWING TYPE Circuit Diagram

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

ORIGINAL SCALE

DRAWN BY CAH DATE 12-1-94

CHECKED BY DATE

TOLERANCES

SHT 1 OF 3

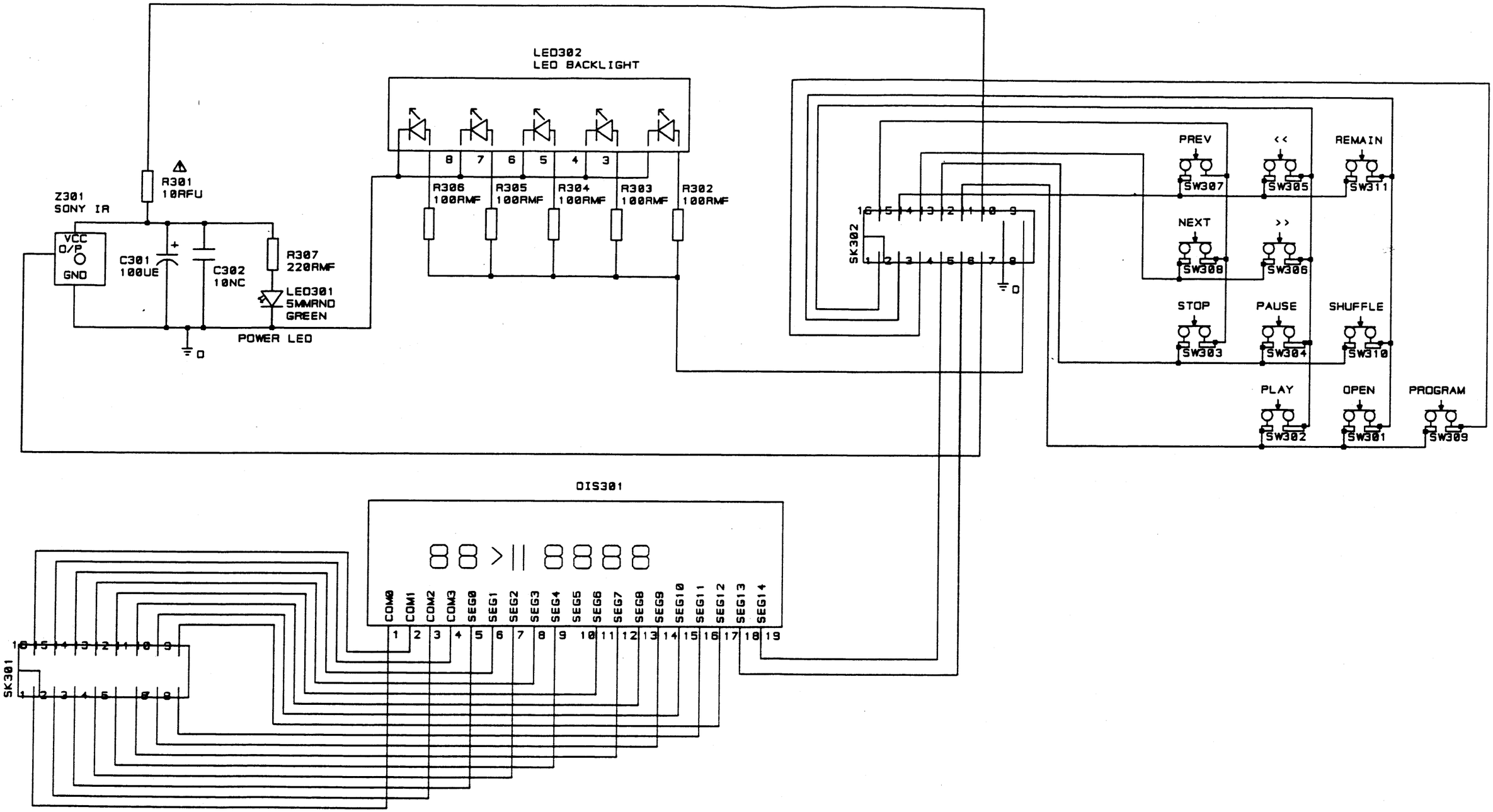
PART/ORD No. L801CT

Flexfoil to KSK-1220A

Digital Output

8h (1000)	CUST0	D221 1N4148, D222 1N4148, D223 1N4148
5h (0101)	CUST1	D224 1N4148, D225 1N4148
1h (0001)	CUST2	D226 1N4148, D227 1N4148, D228 1N4148
7h (0111)	CUST3	D229 1N4148

ARCAM	DRAWING TITLE	ISSUE	INITIALS	DATE	DESCRIPTION	ECO No.
A & R CAMBRIDGE WATERBEACH CAMBRIDGE CB5 9PB	Alpha "One" CD Player Circuit Diagram	9	CAH	28-11-95	C219 WAS 180U L & R SWAPPED VIA R1 & R181	95/121
		8	WAF	14-6-95	C253 FROM 180U ELST TO 22U OSCON	95/065
		7	CAH	11-11-94	F263 added	94/127
	DRAWING TYPE Circuit Diagram					
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED	ORIGINAL SCALE	DRAWN BY CAH	DATE 12-1-94	CHECKED BY	DATE	
TOLERANCES		SHT 2	OF 3	PART/ORD No. L801CT		



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A & R CAMBRIDGE LTD.
WATERBEACH
CAMBRIDGE
CB5 9PB

DRAWING TITLE

Alpha "One" CD Player

Display PCB

Circuit Diagram

ISSUE	INITIALS	DATE	DESCRIPTION OF CHANGE	ECO No
9	CAH	20-11-95	C218 WAS 100U L & R SWAPPED VIA R1 & R101	95/12
8	WAF	14-6-95	C253 FROM 100U ELST TO 22U OSCON	95/065
7	CAH	11-11-94	F203 added	94/127

DRAWING TYPE Circuit Diagram

DRAWN WITH REFERENCE TO BS 308

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

ORIGINAL SCALE

DRAWN BY CAH DATE 12-1-94

CHECKED BY DATE

TOLERANCES

SHT 3 OF 3

PART/ORG No. L801CT