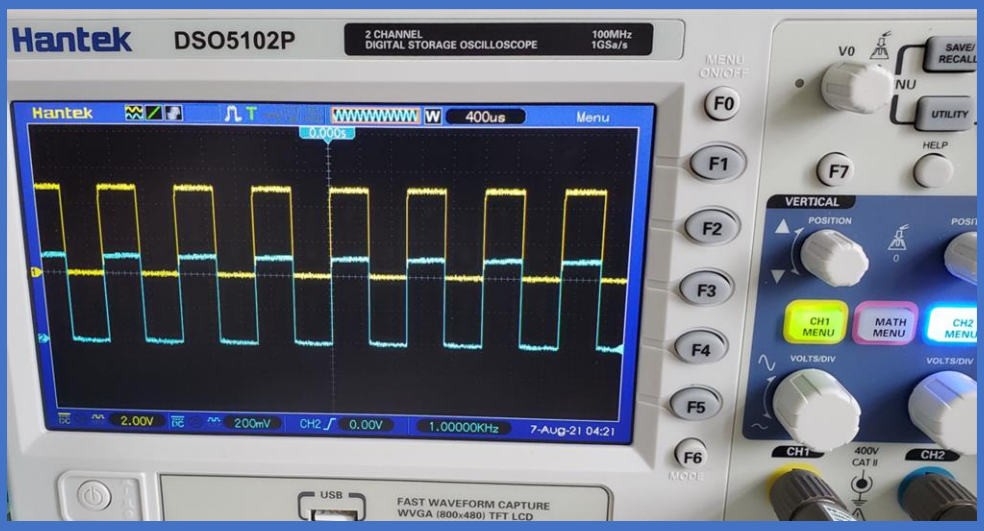
Rudy's Retro Intelligence



Commodore 64 Personal Computer Diagnostics and Repair Manual

Version 1.9.4 Created in June 2024

Created by Rudy's Retro Intel

The purpose of this manual is help diagnose and repair these retro computers and is based on my work from over the years of repairs and input from others. Future versions will be available as more information is collected, tested and verified.

Included is the diagnostic section with suggested repairs based on the conditions present. Diagrams and pinouts may also be provided. Schematics for this computer itself can be found online and are ***not*** included here as there are some differences between revisions of the motherboard. Diagnosis should work on these computers; however, you need to do some additional research.

For the latest version of this document and other retro computer diagnostics, can be found using the links below.
https://github.com/RudyRetroIntel/Vintage-Computer-Diagnostics

You can find my video on the monitoring board here.
https://www.youtube.com/@RudysRetroIntel

"Sharing knowledge, we can ensure that the retro computers can be repaired and enjoyed now and into the future. Rudy's Retro Intel"

***** This document is based on the work I have performed on my retro computer and is provided "as is". I\we do not take any responsibility for errors and\or damages that may occur when repairing your retro\vintage computer. This is information is provided freely to all retro computer owners. Please ensure you know how to perform electronics\electrical work. If not, please contact someone who has these skills before starting. *****

Manufacturer	Commodore 1982 - 1993
Processor	MOS Technology 6510/8500
Speed	PAL = 0.985 MHz NTSC = 1.023 MHz
ROM	20KB
Onboard RAM	64KB
Max RAM	64KB
Number of slots	1
Operating System	Commodore BASIC V2.0 \ GEOS
Max video resolution	320 x 200 16 colour
Input\Output	Serial and Parallel
Speaker	No build in speaker
Diagnostic Software	Cartridge and some software

Dead Test Cartridge - Rev 781220 Flash Codes				
Number of Flashes	C64 Rev A/B	C64 Rev B-3	C64 Rev E	Data BIT
1	U12	U9	U11	7
2	U24	U9	U11	6
3	U11	U9	U11	5
4	U23	U9	U11	4
5	U10	U10	U10	3
6	U22	U10	U10	2
7	U9	U10	U10	1
8	U21	U10	U10	0

Commodore 64C

Commodore released the 64C computer, which is functionally identical to the original. The exterior design was remodeled in the sleeker style of the Commodore 128. The 64C uses new versions of the SID, VIC, and I/O chips being deployed, with the core voltage reduced from 12V to 9V. Models with the C64E board had the graphic symbols printed on the top of the keys, instead of the normal location on the front. The sound chip (SID) was changed to use the MOS 8580 chip. The most significant changes include different behavior in the filters and in the volume control, which result in some music/sound effects sounding differently than intended, and in digitally-sampled audio being almost inaudible, respectively (though both of these can mostly be corrected-for in software). The 64 KB RAM memory went from eight chips to two chips. BASIC and the KERNAL went from two separate chips into one 16 KB ROM chip. The PLA chip and some TTL chips were integrated into a DIL 64-pin chip. The "252535-01" PLA integrated the color RAM as well into the same chip. The smaller physical space made it impossible to put in some internal expansions like a floppy-speeder. In the United States, the 64C was often bundled with the third-party GEOS graphical user interface (GUI)-based

C64 Symptom(s)	Boot	Power Light	Screen	Floppy Drive	Cassette	Cartridge	Diagnosis	IC Location	Rev
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	PLA (Program Logic Array)	U17	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	RAM - 4164	U9-U12, U21-U24	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	74LS257	U13, U25	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	74LS629N	U31	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	74LS74	U29	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	74LS193	U30	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	MC4044	U32	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	VIC-II	U19	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	NE556N Timer	U20	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	BASIC ROM	U3	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	Kernal ROM	U4	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	Character ROM	U5	
Power light on, no display	No	Yes	No	Unknown	Unknown	Unknown	Fuse - 1 AMP Fast blow		
Power light on and garbage on screen	Yes	Yes	Garbage	Unknown	Unknown	Unknown	ROM KERNAL	U4	
Power light on and garbage on screen	Yes	Yes	Garbage	Unknown	Unknown	Unknown	SID (Sound Interface Device)	U18	
Power light on and garbage on screen	Yes	Yes	Garbage	Unknown	Unknown	Unknown	MPU (Micro Processing Unit)	U7	
Power light on and garbage on screen	Yes	Yes	Garbage	Unknown	Unknown	Unknown	PLA (Program Logic Array)	U17	
Power light on and garbage on screen	Yes	Yes	Garbage	Unknown	Unknown	Unknown	74LS139	U15	

Power light on and garbage on screen	Yes	Yes	Garbage	Unknown	Unknown	Unknown	74LS257	U13	
Power light, screen OK, keyboard will not work	Yes	Yes	Yes	Unknown	Unknown	Unknown	Bad keyboard		
Power light, screen OK, keyboard will not work	Yes	Yes	Yes	Unknown	Unknown	Unknown	Bad keyboard cable		
Power light, screen OK, keyboard will not work	Yes	Yes	Yes	Unknown	Unknown	Unknown	CIA#1	U1	
Power light, screen OK, keyboard will not work	Yes	Yes	Yes	Unknown	Unknown	Unknown	74LS139	U15	
Power on, screen OK and cartridge will not work	Yes	Yes	Yes	Yes	Unknown	No	Bad cartridge		
Power on, screen OK and cartridge will not work	Yes	Yes	Yes	Yes	Unknown	No	Bad connector		
Power on, screen OK and cartridge will not work	Yes	Yes	Yes	Yes	Unknown	No	PLA (Program Logic Array)	U17	
Computer will lock up while running program	Yes	Yes	Yes	Yes	Yes	Yes	Bad program	Motherboard	
Computer will lock up while running program	Yes	Yes	Yes	Yes	Yes	Yes	Bad keyboard		
Computer will lock up while running program	Yes	Yes	Yes	Yes	Yes	Yes	Bad keyboard cable		
Computer will lock up while	Yes	Yes	Yes	Yes	Yes	Yes	PLA (Program Logic Array)	U17	

running program									
Computer will lock up while running program	Yes	Yes	Yes	Yes	Yes	Yes	6510	U7	
Computer will lock up while running program	Yes	Yes	Yes	Yes	Yes	Yes	RAM 4164	U9-U12, U21-U24	
Load program OK, will not run	Yes	Yes	Yes	No	No	No	Bad program		
Load program OK, will not run	Yes	Yes	Yes	No	No	No	PLA (Program Logic Array)	U17	
Load program OK, will not run	Yes	Yes	Yes	No	No	No	RAM - 4164	U9-U12, U21-U24	
Load program OK, will not run	Yes	Yes	Yes	No	No	No	ROM BASIC	U3	
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	Bad video cable		
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	Bad monitor		
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	VIC-II	U19	
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	RF Modulator		
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	Transistor	Q4	
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	Diode	CR4	
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	PLA (Program Logic Array)	U17	
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	6510	U7	
No video	Unknown	Unknown	No	Unknown	Unknown	Unknown	RAM 4164	U9-U12, U21-U24	
Screen OK but no colour	Yes	Yes	No colour	Unknown	Unknown	Unknown	Color RAM	U6	
Screen OK but no colour	Yes	Yes	No colour	Unknown	Unknown	Unknown	74LS08	U27	
Screen OK but no colour	Yes	Yes	No colour	Unknown	Unknown	Unknown	VIC-II	U19	
Screen OK but no colour	Yes	Yes	No colour	Unknown	Unknown	Unknown	74LS139	U15	
Screen OK but no colour	Yes	Yes	No colour	Unknown	Unknown	Unknown	Transited	Q5, Q6	
No horizontal sync, no vertical sync	Yes	Yes	Unknown	Unknown	Unknown	Unknown	VIC-II	U19	
No horizontal	Yes	Yes	Unknown	Unknown	Unknown	Unknown	Transistor	Q4	

sync, no vertical sync									
No horizontal sync, no vertical sync	Yes	Yes	Unknown	Unknown	Unknown	Unknown	Resister - 500 ohms	R19	
No horizontal sync, no vertical sync	Yes	Yes	Unknown	Unknown	Unknown	Unknown	Diode	CR3	
No cursor or bad cursor	Yes	Yes	Cursor wrong	Unknown	Unknown	Unknown	Character ROM	U5	
No cursor or bad cursor	Yes	Yes	Cursor wrong	Unknown	Unknown	Unknown	CIA#2	U2	
No cursor or bad cursor	Yes	Yes	Cursor wrong	Unknown	Unknown	Unknown	RAM 4164	U9-U12, U21-U24	
Bad inverse characters shown	Yes	Yes	Bad characters	Unknown	Unknown	Unknown	key - no contact	Keyboard	
Bad inverse characters shown	Yes	Yes	Bad characters	Unknown	Unknown	Unknown	CIA#2	U2	
No text is being shown	Yes	Yes	No text	Unknown	Unknown	Unknown	VIC-II	U19	
No text is being shown	Yes	Yes	No text	Unknown	Unknown	Unknown	Character ROM	U5	
No text is being shown	Yes	Yes	No text	Unknown	Unknown	Unknown	ROM BASIC	U3	
Wrong characters displayed	Yes	Yes	Bad Characters	Unknown	Unknown	Unknown	Character ROM	U5	
Wrong characters displayed	Yes	Yes	Bad Characters	Unknown	Unknown	Unknown	CIA#1	U1	
Wrong characters displayed	Yes	Yes	Bad Characters	Unknown	Unknown	Unknown	Bad keyboard		
Wrong characters displayed	Yes	Yes	Bad Characters	Unknown	Unknown	Unknown	Bad keyboard cable	Keyboard	
Wrong colour tint and\or screen jitters	Yes	Yes	Tint	Unknown	Unknown	Unknown	Colour Trim	R25	
Bad bit map graphics	Yes	Yes	Bad bit map	Unknown	Unknown	Unknown	VIC-II	U19	
No or bad sprites	Yes	Yes	Bad sprites	Unknown	Unknown	Unknown	VIC-II	U19	

Floppy drive read OK will not write	Yes	Yes	Yes	No write	Unknown	Unknown	Bad diskette		
Floppy drive read OK will not write	Yes	Yes	Yes	No write	Unknown	Unknown	Bad floppy drive		
Floppy drive read OK will not write	Yes	Yes	Yes	No write	Unknown	Unknown	Bad floppy drive head		
Floppy drive read OK will not write	Yes	Yes	Yes	No write	Unknown	Unknown	Bad IC on floppy drive	7406 - U8	
Floppy drive read OK will not write	Yes	Yes	Yes	No write	Unknown	Unknown	Bad IC on Motherboard	7406 - U8	
Floppy drive will not read, get I/O error message	Yes	Yes	Yes	No read	Unknown	Unknown	Bad diskette		
Floppy drive will not read, get I/O error message	Yes	Yes	Yes	No read	Unknown	Unknown	Bad floppy drive		
Floppy drive will not read, get I/O error message	Yes	Yes	Yes	No read	Unknown	Unknown	Bad IC on Motherboard	7406 - U8	
Floppy drive will not read, get I/O error message	Yes	Yes	Yes	No read	Unknown	Unknown	CIA#2	U2	
Floppy drive will not read, get I/O error message	Yes	Yes	Yes	No read	Unknown	Unknown	Bad IC on floppy drive	7414	
Cassette tape will not load, will not write	Yes	Yes	Yes	Unknown	No read or write	Unknown	Bad cassette drive		
Cassette tape will not load, will not write	Yes	Yes	Yes	Unknown	No read or write	Unknown	Bad cassette tape		
Cassette tape will not load, will not write	Yes	Yes	Yes	Unknown	No read or write	Unknown	Transistors	Q1-Q3	
Cassette tape will not load, will not write	Yes	Yes	Yes	Unknown	No read or write	Unknown	MPU (Micro Processing Unit) - 6510	U7	
Cassette tape will not load, will not write	Yes	Yes	Yes	Unknown	No read or write	Unknown	Bad cassette cable		

Game controller will not work	Yes	Yes	Yes	Yes	Yes	Yes	Bad joystick		
Game controller will not work	Yes	Yes	Yes	Yes	Yes	Yes	bad cable		
Game controller will not work	Yes	Yes	Yes	Yes	Yes	Yes	MC4066	U28	
Game controller will not work	Yes	Yes	Yes	Yes	Yes	Yes	CIA#1	U1	
Game controller will not work	Yes	Yes	Yes	Yes	Yes	Yes	SID (Sound Interface Device)	U18	
Printer port will not work	Yes	Yes	Yes	Yes	Yes	Yes	Bad printer		
Printer port will not work	Yes	Yes	Yes	Yes	Yes	Yes	Bad cable		
Printer port will not work	Yes	Yes	Yes	Yes	Yes	Yes	74LS139	U15	
Printer port will not work	Yes	Yes	Yes	Yes	Yes	Yes	CIA#2	U2	
Joystick not working	Yes	Yes	Yes	Yes	Yes	Yes	CIA#2	U2	C64
Joystick not working	Yes	Yes	Yes	Yes	Yes	Yes	CIA#1	U1	
Joystick not working	Yes	Yes	Yes	Yes	Yes	Yes	SID		64-C

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