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0930      .LIST OFF
0940 ;-----
0950 ;   DOS 3.3 BOOT ROM
0960 ;
0970 ;   APPLE ASSEMBLY LINE
0980 ;   V1N10P17, AUG 1981
0990 ;
1000 ;-----
1010 ;   DOS 3.3 BOOT ROM $C600-$C6FF
1020 ;   BOB SANDER-CEDERLOF   4/7-81
1030 ;-----
1040 ;           DISK CONTROLLER ADDRESSES
1050 ;-----
1060 PHASE.OFF          .EQ $C080
1070 PHASE.ON          .EQ $C081
1080 MOTOR.OFF         .EQ $C088
1090 MOTOR.ON          .EQ $C089
1100 ENABLE.DRIVE.1    .EQ $C08A
1110 ENABLE.DRIVE.2    .EQ $C08B
1120 Q6L               .EQ $C08C
1130 Q6H               .EQ $C08D
1140 Q7L               .EQ $C08E
1150 Q7H               .EQ $C08F
1160 ;
1170 ;           Q6   Q7   USE OF Q6 AND Q7 LINES
1180 ;           ---   ---   -----
1190 ;           LOW  LOW   READ (DISK TO SHIFT REGISTERS)
1200 ;           LOW  HIGH  WRITE (SHIFT REGISTER TO DISK)
1210 ;           HIGH LOW   SNESE WRITE PROTECT
1220 ;           HIGH HIGH  LOAD SHIFT REGISTER FROM DATA BUS
1230 ;-----
1240 BUF.PNTR          .EQ $26,27
1250 SLOT16           .EQ $2B   SLOT*16
1260 SECTOR            .EQ $3D
1270 TRACK             .EQ $41
1280 STACK             .EQ $100
1290 POST.NYBBLE.CODES .EQ $2D6
1300 LITTLE.BUFFER     .EQ $300
1310 MON.RTS           .EQ $FF58
1320 MON.WAIT          .EQ $FCA8
1330 ;-----
1340           .OR $C600
1350           .TO
1360 ;-----
1370 BOOT.3.3
1380           LDX #$20   REDUNDANT INSTRUCTION, USED
1390 ;                   TO IDENTIFY CONTROLLER CARD
1400 ;-----
1410 ;           GENERATE POST-NYBBLE CONVERSION TABLE
1420 ;           FILLS IN THOSE SLOTS WHOSE INDEX
1430 ;           RELATIVE TO POST.NYBBLE.CODES IS
1440 ;           A VALID NYBBLE CODE. (VALID CODES
1450 ;           HAVE AT MOST ONE PAIR OF ADJACENT
1460 ;           0-BITS, AND AT LEAST ONE PAIR OF
1470 ;           ADJACENT 1-BITS IN BITS 0-6.)
1480 ;-----
1490           LDY #0

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1500      LDX #3      COULD BE ANY VALUE FROM 0 TO $16
1510 ;           3 USED FOR CONTROLLER ID
1520 .1     STX $3C   CHECK CODE FOR VALID NYBBLE
1530      TXA
1540      ASL
1550      BIT $3C    TEST (X .AND. 2*X)
1560      BEQ .3     NO ADJACENT 1-BITS, NO GOOD
1570      ORA $3C    TEST ADJACENT 0-BITS
1580      EOR #$FF   CHANGE 1'S FOR TEST
1590      AND #$7E   DON'T CARE ABOUT BIT 7
1600 .2     BCS .3   NOT VALID NYBBLE CODE
1610      LSR
1620      BNE .2
1630      TYA
1640      STA POST.NYBBLE.CODES+$80,X
1650      INY
1660 .3     INX
1670      BPL .1
1680 ;-----
1690      JSR MON.RTS GET THIS LOCATION ON STACK
1700      TSX        FIND PAGE BYTE ON STACK
1710      LDA STACK,X
1720      ASL        ISOLATE SLOT #
1730      ASL        AND MULTIPLY BY 16
1740      ASL
1750      ASL
1760      STA SLOT16  SLOT # TIMES 16
1770      TAX
1780      LDA Q7L,X   SET UP TO READ DRIVE
1790      LDA Q6L,X
1800      LDA ENABLE.DRIVE.1,X
1810      LDA MOTOR.ON,X
1820 ;-----
1830 ;       MOVE TO TRACK 0 (ASSUME WORST CASE
1840 ;       INITIAL POSITION OF TRACK 40)
1850 ;-----
1860      LDY #80     80 HALF-TRACKS
1870 .4     LDA PHASE.OFF,X STEPPER MOTOR PHASE OFF
1880      TYA        COMPUTE NEXT PHASE
1890      AND #3     YIELDS 3,2,1,0
1900      ASL        YIELDS 6,4,2,0
1910      ORA SLOT16  MERGE WITH SLOT*16
1920      TAX
1930      LDA PHASE.ON,X STEPPER MOTOR PHASE ON
1940      LDA #86    WAIT 19.2 MILLISECONDS
1950      JSR MON.WAIT NO CHANGE TO X OR Y, A=0
1960      DEY
1970      BPL .4
1980 ;-----
1990 ;       A=0, X=SLOT*16
2000 ;-----
2010      STA BUF.PNTR ($00 -> LOW BYTE OF PNTR)
2020      STA SECTOR
2030      STA TRACK
2040      LDA #8     BUFFER AT $800
2050      STA BUF.PNTR+1 ($08 -> HI-BYTE OF PNTR)
2060 ;-----

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2070 READ.SECTOR
2080 .1      CLC          FLAG CLEAR, LOOK FOR $D5 AA 96
2090 .2      PHP          SAVE FLAG ON STACK
2100 .3      LDA Q6L,X    READ DISK
2110          BPL .3
2120 .4      EOR #$D5
2130          BNE .3      NO
2140 .5      LDA Q6L,X    READ DISK
2150          BPL .5
2160          CMP #$AA
2170          BNE .4
2180          NOP
2190 .6      LDA Q6L,X    READ DISK
2200          BPL .6
2210          CMP #$96
2220          BEQ .7      FOUND ADDRESS MARK: $D5 AA 96
2230          PLP          RETRIEVE FLAG
2240          BCC .1      LOOKING FOR ADDRESS HEADER
2250          EOR #$AD    LOOKING FOR DATA HEADER
2260          BEQ FILL.BUFFER
2270          BNE .1      START ALL OVER
2280 ;-----
2290 .7      LDY #3      READ VOLUME, TRACK, SECTOR
2300 .8      STA $40
2310 .9      LDA Q6L,X    READ DISK
2320          BPL .9
2330          ROL          SAVE UPPER SLICE
2340          STA $3C
2350 .10     LDA Q6L,X    READ DISK
2360          BPL .10
2370          AND $3C     MERGE SLICES
2380          DEY          3RD BYTE YET?
2390          BNE .8      NO, GET ANOTHER
2400          PLP          THROW AWAY FLAG
2410          CMP SECTOR  CORRECT SECTOR?
2420          BNE .1      NO
2430          LDA $40     CORRECT TRACK?
2440          CMP TRACK
2450          BNE .1      NO
2460          BCS .2      YES, SET FLAG FOR DATA HEADER
2470 ;          AND BRANCH BACK ALWAYS
2480 ;-----
2490 ;          A=0 ON ENTRY
2500 ;-----
2510 FILL.BUFFER
2520          LDY #86     READ 86 BYTES
2530 .1      STY $3C
2540 .2      LDY Q6L,X    READ BYTE
2550          BPL .2
2560          EOR POST.NYBBLE.CODES,Y  DECODE BYTE
2570          LDY $3C
2580          DEY
2590          STA LITTLE.BUFFER,Y
2600          BNE .1
2610 ;-----
2620 .3      STY $3C      Y=0
2630 .4      LDY Q6L,X    READ BYTE

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2640      BPL .4
2650      EOR POST.NYBBLE.CODES,Y  DECODE BYTE
2660      LDY $3C
2670      STA (BUF.PNTR),Y
2680      INY
2690      BNE .3
2700 .5    LDY Q6L,X  READ CHECKSUM BYTE
2710      BPL .5
2720      EOR POST.NYBBLE.CODES,Y
2730 .6    BNE READ.SECTOR  BAD CHECKSUM, START OVER
2740 ;-----
2750      LDY #0
2760 .7    LDX #86      PATCH THE 6+2 BACK TOGETHER
2770 .8    DEX
2780      BMI .7      FINISHED A TRIP
2790      LDA (BUF.PNTR),Y
2800      LSR LITTLE.BUFFER,X
2810      ROL
2820      LSR LITTLE.BUFFER,X
2830      ROL
2840      STA (BUF.PNTR),Y
2850      INY
2860      BNE .8
2870 ;-----
2880      INC BUF.PNTR+1  POINT AT NEXT PAGE
2890      INC SECTOR  POINT AT NEXT SECTOR
2900      LDA SECTOR
2910      CMP $0800  SEE IF HAVE READ ENUF SECTORS
2920      LDX SLOT16
2930      BCC .6      NOT ENUF SECTORS YET
2940      JMP $0801  GOTO REST OF BOOT
2950 ;-----
2960      .HS 0000000000

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