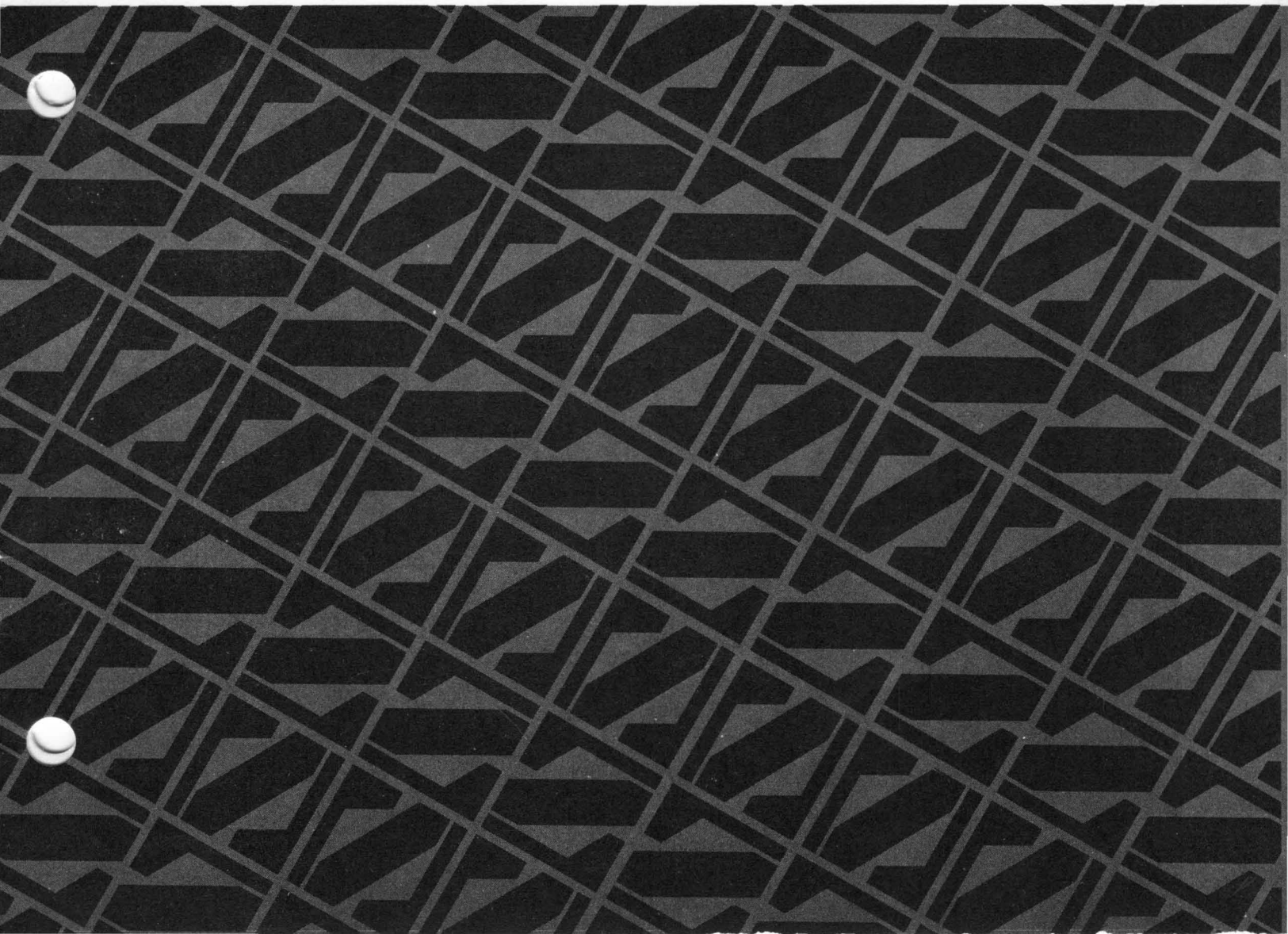


**National Semiconductor**  
Pub. No. 4340137A

# **IMP-16C**

## **ROMDI Listing**



**Integrated MicroProcessor-16C**

**IMP-16C  
ROMDI LISTING**

**PRELIMINARY**

**4 April 1973**

**National Semiconductor Corporation**  
2900 Semiconductor Drive  
Santa Clara, California 95051

## INTRODUCTION

The listing of the Read Only Memory Diagnostic Program (ROMDI) is presented on the following pages.

ROMDI is a compact CPU diagnostic that is written in the IMP-16 Assembler language, whose revision level appears at the top of first page.

ROMDI tests the Central Processing Unit (CPU) on the IMP-16C card on a "go/no-go" basis. If the test indicates a failure, the particular malfunctioning device is not designated. To test individual devices in the IMP-16C CPU, first, it must be assured that all other CPU devices and the other components on the IMP-16C are functioning.

There are four RALUs (Register, Arithmetic, and Logic Units) and one CROM (Control Read-Only Memory) in the IMP-16C CPU. For example, a particular RALU may be tested by first assuring that the CROM and three of the other RALUs on the IMP-16C are functioning. In this case, if the test passes, the RALU under test is functioning; but if the test fails, the RALU under test is malfunctioning.

Instructions for performing ROMDI are given in the listing.

REVISION-C 11/20/72  
 ROMDI 000137A 04/04/73

73095 18531749

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1 0000      ;      -- NO CONCATENATION FOR THIS ASSEMBLY --
2 0000      ;      .TITLE ROMDI,'000137A 04/04/73'
3 0000      ;
4 0000      ;      MAIN PROGRAM IN ROM, X'FE00-X'FFFF, ENTRY POINT X'FFFE
5 0000      ;
6 0000      ;      ROMDI IS A GO-NOGO CPU DIAGNOSTIC DESIGNED FOR THE IMP-16C.
7 0000      ;      THE PROGRAM FITS INTO 4 8X256-BIT PROMS IN THE FOLLOWING
8 0000      ;      MANNER:
9 0000      ;
10 0000     ;
11 0000     ;      ADDRESSES      BITS      PROM      DIAGRAM
12 0000     ;      CO-ORDINATE
13 0000     ;      ROMDI1 RIGHT X'FE00-X'FEFF 0-7      ATZ      3H
14 0000     ;      ROMDI1 LEFT X'FE00-X'FEFF 8-15     AUA      3F
15 0000     ;      ROMDI2 RIGHT X'FF00-X'FFFF 0-7      AUB      3G
16 0000     ;      ROMDI2 LEFT X'FF00-X'FFFF 8-15     AUC      3E
17 0000     ;
18 0000     ;      ENTERING THE PROGRAM AT ADDRESS FFFE TRANSFERS CONTROL TO A
19 0000     ;      PANEL ROUTINE WHICH PERFORMS THE FOLLOWING FUNCTIONS IN
20 0000     ;      RESPONSE TO DEPRESSION OF THE INDICATED SWITCHES:
21 0000     ;
22 0000     ;      SWITCH      FUNCTION
23 0000     ;
24 0000     ;      LOAD ADDRESS  LOADS THE CONTENTS OF THE SWITCH REGISTER
25 0000     ;      INTO ACCUMULATOR 2 AND DISPLAYS THE CONTENTS
26 0000     ;      OF THE MEMORY LOCATION ADDRESSED BY ACCUM-
27 0000     ;      ULATOR 2.
28 0000     ;
29 0000     ;      LOAD DATA   LOADS THE CONTENTS OF THE SWITCH REGISTER
30 0000     ;      INTO ACCUMULATOR 0, STORES ACCUMULATOR 0
31 0000     ;      INTO THE MEMORY LOCATION ADDRESSED BY
32 0000     ;      ACCUMULATOR 2, AND DISPLAYS ACCUMULATOR 0.
33 0000     ;      EXECUTE     TRANSFERS CONTROL TO THE MEMORY LOCATION
34 0000     ;      INDICATED BY THE SWITCH REGISTER.
35 0000     ;
36 0000     ;      UPON ENTRY TO THE PANEL ROUTINE, ACCUMULATORS 0,1,2, AND 3
37 0000     ;      ARE SAVED IN MEMORY LOCATIONS 4,5,6 AND 7, RESPECTIVELY.
38 0000     ;      THE CONTENTS OF AN ACCUMULATOR MAY BE SET BY ALTERING ITS
39 0000     ;      CORRESPONDING MEMORY LOCATION.
40 0000     ;
41 0000     ;      IF JUMP CONDITION 15 IS HIGH WHEN EITHER 'INITIALIZE' OR
42 0000     ;      'EXECUTE' IS DEPRESSED, THE DIAGNOSTIC WILL BE CONTINUOUSLY
43 0000     ;      REEXECUTED UNTIL EITHER THE JUMP CONDITION GOES LOW OR AN
44 0000     ;      ERROR CONDITION IS DETECTED.
45 0000     ;
46 0000     ;      IF THE DIAGNOSTIC EXECUTES SUCCESSFULLY, THE PROGRAM SETS
47 0000     ;      FLAG 8 AND RETURNS CONTROL TO THE PANEL ROUTINE. IF THE
48 0000     ;      PROGRAM DETECTS AN ERROR CONDITION, IT SETS FLAG 15 AND
49 0000     ;      HALTS.
50 0000     ;
51 0000     ;      THE DIAGNOSTIC ENTRY POINT IS X'FE00.
52 0000     ;      .PAGE
53 0000     ;      EQUATES
54 0000     ;
55 0000 0000 A R0 = 0
56 0000 0001 A R1 = 1
57 0000 0002 A R2 = 2
58 0000 0003 A R3 = 3
59 0000      ;
60 0000      ;      ...BRANCH CONDITIONS
61 0000 0008 A STKFL = 8
62 0000 0001 A ZRO = 1
63 0000 0002 A PZRO = 2
64 0000 0003 A ODD = 3
65 0000 0004 A BIT1 = 4
66 0000 0005 A NZERO = 5 ; NOT EQUAL ZERO
67 0000 0009 A INTEN = 9
68 0000 000A A CYOV = 10
69 0000 000B A NZRO = 11 ; NEGATIVE OR ZERO
70 0000      ;
71 0000      ;      ...FLAG ADDRESSES
72 0000 0001 A IENFL = 1
73 0000 0002 A SELX = 2
74 0000      ;
75 0000 FE00 A ROMAD = X'FE00
    
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76 0000 ;
77 0000 000F A ILOC = 15 ; TEST LOC FOR INDIRECT TEST 00000750
78 0000 .PAGE 00000760
79 0000 .ASECT 00000770
80 0000 FFFE A .=ROMAD+X'1FE 00000780
81 FFFE 21E0 A ENTRY: JMP PANEL ;TRANSFER TO PANEL SERVICE ROUTINE 00000790
82 FFFF ; 00000800
83 FFFF ; 00000810
84 FFFF FE00 A .=ROMAD 00000820
85 FE00 ; 00000830
86 FE00 ; TEST REGISTER 0, SKG, SKNE, MEMORY TRANSFERS 00000840
87 FE00 ; 00000850
88 FE00 815C A START: LD R0,MIN1 00000860
89 FE01 F15B A SKNE R0,MIN1 00000870
90 FE02 2101 A JMP .+2 00000880
91 FE03 217E A JMP ERR1 00000890
92 FE04 F159 A SKNE R0,X7FFF 00000900
93 FE05 217C A JMP ERR1 00000910
94 FE06 A00A A ST R0,10 ;INITIALIZE FOR ISZ, DSZ TEST 00000920
95 FE07 E157 A SKG R0,ZERO 00000930
96 FE08 2101 A JMP .+2 00000940
97 FE09 2178 A JMP ERR1 00000950
98 FE0A 4801 A AISZ R0,1 00000960
99 FE0B 215F A JMP ERR 00000970
100 FE0C 1101 A BOC ZR0,+.2 00000980
101 FE0D 2174 A JMP ERR1 00000990
102 FE0E 5000 A CAI R0,0 ;ONE'S COMPLEMENT 00001000
103 FE0F F14D A SKNE R0,MIN1 00001010
104 FE10 2101 A JMP .+2 00001020
105 FE11 2170 A JMP ERR1 00001030
106 FE12 5000 A CAI R0,0 ; ONE'S COMPLEMENT 00001040
107 FE13 F14B A SKNE R0,ZERO 00001050
108 FE14 2101 A JMP .+2 00001060
109 FE15 216C A JMP ERR1 00001070
110 FE16 8149 A LD R0,ONE 00001080
111 FE17 5001 A CAI R0,1 ;TWO'S COMPLEMENT 00001090
112 FE18 F144 A SKNE R0,MIN1 00001100
113 FE19 2101 A JMP .+2 00001110
114 FE1A 2167 A JMP ERR1 00001120
115 FE1B 5001 A CAI R0,1 ;TWO'S COMPLEMENT 00001130
116 FE1C 48FF A AISZ R0,-1 00001140
117 FE1D 2164 A JMP ERR1 00001150
118 FE1E .PAGE 00001160
119 FE1E ; 00001170
120 FE1E ; TEST INDIRECT ADDRESSING 00001180
121 FE1E ; 00001190
122 FE1E 8542 A LD R1,XFACE ;INITIALIZE ILOC 00001200
123 FE1F A40F A ST R1,ILOC 00001210
124 FE20 9146 A LD R0,@INDPNT 00001220
125 FE21 F00F A SKNE R0,ILOC 00001230
126 FE22 2101 A JMP .+2 00001240
127 FE23 215E A JMP ERR1 00001250
128 FE24 4E01 A LI R2,1 00001260
129 FE25 C940 A ADD R2,LINDPT ;ADD ADDRESS OF INDPNT 00001270
130 FE26 8138 A LD R0,XF0F0 00001280
131 FE27 B200 A ST R0,@(R2) 00001290
132 FE28 5001 A CAI R0,1 00001300
133 FE29 C011 A ADD R0,ILOC+2 00001310
134 FE2A 1557 A BOC NZERO,ERR1 00001320
135 FE2B .PAGE 00001330
136 FE2B ; 00001340
137 FE2B ; TEST STACK AND INTERRUPTS 00001350
138 FE2B ; 00001360
139 FE2B 0980 A PFLG IENFL ; DISABLE INTERRUPTS 00001370
140 FE2C 1955 A BOC INTEN,ERR1 00001380
141 FE2D 0900 A SFLG IENFL ; ENABLE INTERRUPTS 00001390
142 FE2E 1901 A BOC INTEN,+.2 00001400
143 FE2F 2152 A JMP ERR1 00001410
144 FE30 8138 A LD R0,IEP ; INITIALIZE INTERRUPT ENTRY ADDRESS 00001420
145 FE31 A001 A ST R0,1 00001430
146 FE32 8137 A LD R0,IEP+1 00001440
147 FE33 A002 A ST R0,2 00001450
148 FE34 4EF0 A LI R2,-16 ; EMPTY STACK 00001460
149 FE35 4400 A PULL R0 00001470
150 FE36 4A01 A AISZ R2,1 00001480
151 FE37 21FD A JMP .-2 00001490
152 FE38 1849 A BOC STKFL,ERR1 00001500
153 FE39 4EF9 A LI R2,-7 ; PUSH X'A5A5 AND X'5A5A ONTO STACK 00001510
154 FE3A 8128 A LD R0,XA5A5 00001520

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155 FE38 8528 A      LD      R1,X5A5A
156 FE3C 4000 A      PUSH   R0
157 FE3D 4100 A      PUSH   R1
158 FE3E 4A01 A      AISZ  R2,1
159 FE3F 21FC A      JMP    -3
160 FE40 4000 A      PUSH   R0
161 FE41 4100 A      PUSH   R1          ; SHOULD FILL STACK, CAUSE INTERRUPT
162 FE42 213F A      JMP    ERR1
163 FE43 1801 A      INENTY: BOC     STKFL,.,+2      ; TEST JUMP CONDITION
164 FE44 213D A      JMP    ERR1
165 FE45 193C A      BOC     INTEN,ERR1
166 FE46 5400 A      XCHRS  R0
167 FE47 4100 A      PUSH   R1
168 FE48 4500 A      PULL   R1          ; INTERRUPTS SHOULD BE DISABLED
169 FE49 1838 A      BOC     STKFL,ERR1
170 FE4A 8120 A      LD      R0,ERR
171 FE4B A002 A      ST      R0,2
172 FE4C 4100 A      PUSH   R1          ;REFILL STACK; ERROR IF INTERRUPT OCCURS
173 FE4D 1801 A      BOC     STKFL,.,+2
174 FE4E 2133 A      JMP    ERR1
175 FE4F 4EF8 A      LI     R2,-8      ; TEST CONTENTS OF STACK
176 FE50 4400 A      PLOOP: PULL  R0
177 FE51 F112 A      SKNE   R0,X5A5A
178 FE52 2101 A      JMP    .+2
179 FE53 212E A      JMP    ERR1
180 FE54 4400 A      PULL   R0
181 FE55 F10D A      SKNE   R0,XA5A5
182 FE56 2101 A      JMP    .+2
183 FE57 212A A      JMP    ERR1
184 FE58 4A01 A      AISZ  R2,1
185 FE59 21F6 A      JMP    PLOOP
186 FE5A 4400 A      PULL   R0          ; STACK SHOULD BE EMPTY
187 FE5B 1526 A      BOC     NZERO,ERR1
188 FE5C 210F A      JMP    SBRTST
189 FE5D FFFF A      MIN1:  .WORD  -1
190 FE5E 7FFF A      X7FFF: .WORD  X'7FFF
191 FE5F 0000 A      ZERO:  .WORD  0
192 FE60 0001 A      ONE:   .WORD  1
193 FE61 FACE A      XFACE: .WORD  X'FACE
194 FE62 F0F0 A      XF0F0: .WORD  X'F0F0
195 FE63 A5A5 A      XA5A5: .WORD  X'A5A5
196 FE64 5A5A A      X5A5A: .WORD  X'5A5A
197 FE65 000F A      I15:  .WORD  15
198 FE66 FE67 A      LINDPT: .WORD  INDPNT
199 FE67 000F A      INDPNT: .WORD  ILOC,ILOC+2
      FE68 0011 A
200 FE69 2500 A      IEP:   JMP     @,+.1      ; TO INITIALIZE LOCS 1 AND 2
201 FE6A FE43 A      .WORD  INENTY      ; MUST BE IN LOC IEP+1
202 FE6B FF8C A      ERR:   .WORD  ERROR
203 FE6C          .PAGE
204 FE6C          ;
205 FE6C          ; TEST SUBROUTINE LINKAGES(JSR, JSR@, RTS, RTI)
206 FE6C          ;
207 FE6C 4F00 A      SBRTST: LI     R3,0
208 FE6D 4300 A      PUSH   R3
209 FE6E 290D A      JSR    SUBR
210 FE6F 480A A      RETN:  AISZ  R3,10
211 FE70 FDF4 A      SKNE   R3,I15
212 FE71 2101 A      JMP    .+2
213 FE72 210F A      JMP    ERR1
214 FE73 4F00 A      LI     R3,0
215 FE74 2D12 A      JSR    @SBRAD
216 FE75 480A A      AISZ  R3,10
217 FE76 FDEE A      SKNE   R3,I15
218 FE77 2101 A      JMP    .+2
219 FE78 2109 A      JMP    ERR1
220 FE79 1901 A      BOC     INTEN,.,+2      ; INTERRUPTS SHOULD BE ENABLED BY RTI
221 FE7A 2107 A      JMP    ERR1
222 FE7B 210D A      JMP    TMWRT

223 FE7C          .SPACE  2
224 FE7C 4500 A      SUBR:  PULL   R1          ; JSR TEST
225 FE7D F50A A      SKNE   R1,RTNAD      ; CHECK THAT RETURN ADDRESS SAVED
226 FE7E 4805 A      AISZ  R3,5
227 FE7F 8508 A      LD      R1,RTNAD      ; ENSURE CORRECT RETURN ADDRESS
228 FE80 4100 A      PUSH   R1
229 FE81 0200 A      RTS

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230 FE82          .SPACE 2          00002290
231 FE82 2500 A ERR1: JMP @,+1      00002300
232 FE83 FF8C A   .WORD ERROR      00002310

233 FE84          .SPACE 2          00002320
234 FE84 4805 A SUBR1: AISZ R3,5      ; FOR JSR" 00002330
235 FE85 0100 A   RTI              00002340
236 FE86 21FB A   JMP ERR1         00002350

237 FE87          .SPACE 2          00002360
238 FE87 FE84 A SBRAD: .WORD SUBR1  00002370
239 FE88 FE6F A RTNAD: .WORD RETN   00002380
240 FE89          .PAGE           00002390
241 FE89          ;                00002400
242 FE89          ; TEST MEMORY WRITE AND INDEXING 00002410
243 FE89          ;                00002420
244 FE89 4E00 A TMWRT: LI R2,0        ;WRITE MEMORY FROM LOC 32 THRU 47 00002430
245 FE8A 4C01 A   LI R0,1          ;WITH INTEGERS 1 THRU 16 00002440
246 FE8B A220 A MLOOP: ST R0,32(R2)  00002450
247 FE8C 4801 A   AISZ R0,1        00002460
248 FE8D 4A01 A   AISZ R2,1        00002470
249 FE8E E978 A   SKG R2,D15      00002480
250 FE8F 21FB A   JMP MLOOP       00002490
251 FE90 4FF0 A   LI R3,-16       ;COMPARE LOCS 32 THRU 47 WITH INTEGERS 00002500
252 FE91 4C01 A   LI R0,1          ;USING NEGATIVE INDEXING 00002510
253 FE92 F330 A CLOOP: SKNE R0,48(R3) 00002520
254 FE93 2101 A   JMP .+2          00002530
255 FE94 21ED A   JMP ERR1         00002540
256 FE95 4801 A   AISZ R0,1        00002550
257 FE96 4801 A   AISZ R3,1        00002560
258 FE97 21FA A   JMP CLOOP       00002570
259 FE98          .PAGE           00002580
260 FE98          ;                00002590
261 FE98          ; TEST REGISTER-TO-REGISTER PLUS AND, XOR FUNCTIONS 00002600
262 FE98          ;                00002610
263 FE98 817C A   LD R0,M1          ;R0=-1 00002620
264 FE99 856E A   LD R1,D1          ;R1=1 00002630
265 FE9A 3400 A   RADD R1,R0        ;R0=0 00002640
266 FE9B 15E6 A   BOC NZERO,ERR1      00002650
267 FE9C 8174 A   LD R0,HA5A5        ;R0=X'A5A5 00002660
268 FE9D 3281 A   RCPY R0,R2        ;R2=X'A5A5 00002670
269 FE9E 3181 A   RCPY R0,R1        ;R1=X'A5A5 00002680
270 FE9F 5200 A   CAI R2,0          ;R2=X'A5A5 00002690
271 FEA0 3882 A   RXOR R2,R0        ;R0=-1 00002700
272 FEA1 4801 A   AISZ R0,1        ;R0=0 00002710
273 FEA2 21DF A   JMP ERR1         00002720
274 FEA3 3983 A   RAND R2,R1        ;R1=0 00002730
275 FEA4 4900 A   AISZ R1,0        00002740
276 FEA5 21DC A   JMP ERR1         00002750
277 FEA6 4FFF A   LI R3,-1          ;R3=-1 00002760
278 FEA7 3C80 A   RXCH R3,R0        ;R3=0,R0=-1 00002770
279 FEA8 3282 A   RXOR R0,R2        ;R2=X'A5A5 00002780
280 FEA9 4801 A   AISZ R0,1        ;R0=0 00002790
281 FEA A 21D7 A   JMP ERR1         00002800
282 FEAB 4800 A   AISZ R3,0        00002810
283 FEAC 21D5 A   JMP ERR1         00002820
284 FEAD F963 A   SKNE R2,HA5A5    00002830
285 FEAE 2101 A   JMP .+2          00002840
286 FEAF 21D2 A   JMP ERR1         00002850
287 FEB0 8D62 A   LD R3,HF0F0      ;R3=X'F0F0 00002860
288 FEB1 4DFF A   LI R1,-1        ;R1=-1 00002870
289 FEB2 3D83 A   RAND R3,R1      ;R1=X'F0F0 00002880
290 FEB3 3782 A   RXOR R1,R3      ;R3=0 00002890
291 FEB4 3881 A   RCPY R2,R0      ;R0=X'A5A5 00002900
292 FEB5 3380 A   RXCH R0,R3      ;R3=X'A5A5,R0=0 00002910
293 FEB6 15CB A   BOC NZERO,ERR1  00002920
294 FEB7 3680 A   RXCH R1,R2      ;R2=X'F0F0,R1=X'A5A5 00002930
295 FEB8 3883 A   RAND R2,R3      ;R3=X'A0A0 00002940
296 FEB9 F056 A   SKNE R3,HA0A0  00002950
297 FEB A 2101 A   JMP .+2          00002960
298 FEBB 21C6 A   JMP ERR1         00002970
299 FEBC          ;                00002980
300 FEBC          ; TEST LOGICAL-OR FUNCTION 00002990
301 FEBC          ;                00003000
302 FEBC 8150 A   LD R0,H5A5A      ;TEST 1V0 AND 0V1 00003010
303 FEBD 6953 A   OR R0,HA5A5     00003020
304 FEBE 4801 A   AISZ R0,1        00003030

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305	FEBF	21C2	A	JMP	ERR1		00003040
306	FEC0	854A	A	LD	R1,H5050	!TEST 0V0 AND 1V1	00003050
307	FEC1	6D51	A	OR	R1,HF0F0		00003060
308	FEC2	F550	A	SKNE	R1,HF0F0		00003070
309	FEC3	2101	A	JMP	.*+2		00003080
310	FEC4	21B0	A	JMP	ERR1		00003090
311	FEC5			.PAGE			00003100
312	FEC5		;				00003110
313	FEC5		;	TEST ARITHMETIC FUNCTIONS			00003120
314	FEC5		;				00003130
315	FEC5	4C01	A	LI	R0,1	!1+(-1)	00003140
316	FEC6	C14E	A	ADD	R0,M1		00003150
317	FEC7	15BA	A	BOC	NZERO,ERR1		00003160
318	FEC8	0A00	A	SFLG	SELX	! TEST FOR OVERFLOW	00003170
319	FEC9	1A88	A	ROC	CYOV,ERR1		00003180
320	FECA	0A80	A	PFLG	SELX	! TEST FOR CARRY	00003190
321	FECB	1A01	A	BOC	CYOV,.*+2		00003200
322	FEC2	21B5	A	JMP	ERR1		00003210
323	FECD	8141	A	LD	R0,H8000	!X'8000-1	00003220
324	FECE	D139	A	SUB	R0,D1		00003230
325	FECF	F13E	A	SKNE	R0,H7FFF		00003240
326	FED0	2101	A	JMP	.*+2		00003250
327	FED1	21B0	A	JMP	ERR1		00003260
328	FED2	1A01	A	BOC	CYOV,.*+2	! TEST FOR CARRY	00003270
329	FED3	21AE	A	JMP	ERR1		00003280
330	FED4	0A00	A	SFLG	SELX	! TEST FOR OVERFLOW	00003290
331	FED5	1A01	A	ROC	CYOV,.*+2		00003300
332	FED6	21AB	A	JMP	ERR1		00003310
333	FED7	8136	A	LD	R0,H7FFF	!X'7FFF+1	00003320
334	FED8	C12F	A	ADD	R0,D1		00003330
335	FED9	F135	A	SKNE	R0,H8000		00003340
336	FEDA	2101	A	JMP	.*+2		00003350
337	FEDB	21A6	A	JMP	ERR1		00003360
338	FEDC	1A01	A	BOC	CYOV,.*+2	! TEST FOR OVERFLOW	00003370
339	FEDD	21A4	A	JMP	ERR1		00003380
340	FEDE	0A80	A	PFLG	SELX	! TEST FOR CARRY	00003390
341	FEDF	1AA2	A	BOC	CYOV,ERR1		00003400
342	FEE0	812D	A	LD	R0,H7FFF	! X'7FFF-X'8000	00003410
343	FEE1	D12D	A	SUB	R0,H8000		00003420
344	FEE2	F132	A	SKNE	R0,M1		00003430
345	FEE3	2101	A	JMP	.*+2		00003440
346	FEE4	219D	A	JMP	ERR1		00003450
347	FEE5	1A9C	A	BOC	CYOV,ERR1	!ANOMALY - NO CARRY GENERATED	00003460
348	FEE6	0A00	A	SFLG	SELX		00003470
349	FEE7	1A01	A	BOC	CYOV,.*+2	!SHOULD HAVE OVERFLOW	00003480
350	FEE8	2199	A	JMP	ERR1		00003490
351	FEE9			.PAGE			00003500
352	FEE9		;				00003510
353	FEE9		;	TEST SKIP IF GREATER			00003520
354	FEE9		;				00003530
355	FEE9	8D1E	A	LD	R3,D1	!1>-1	00003540
356	FEEA	ED2A	A	SKG	R3,M1		00003550
357	FEEB	2196	A	JMP	ERR1		00003560
358	FEEC	ED1A	A	SKG	R3,D0	!1>0	00003570
359	FEED	2194	A	JMP	ERR1		00003580
360	FEED	ED19	A	SKG	R3,D1	!1>1	00003590
361	FEED	2101	A	JMP	.*+2		00003600
362	FEED	2191	A	JMP	ERR1		00003610
363	FEED	ED17	A	SKG	R3,D2	!1>2	00003620
364	FEED	2101	A	JMP	.*+2		00003630
365	FEED	218E	A	JMP	ERR1		00003640
366	FEED	8919	A	LD	R2,H7FFF		00003650
367	FEED	E919	A	SKG	R2,H8000	!X'7FFF>X'8000	00003660
368	FEED	2188	A	JMP	ERR1		00003670
369	FEED	8917	A	LD	R2,H8000	!X'8000>X'7FFF	00003680
370	FEED	E915	A	SKG	R2,H7FFF		00003690
371	FEED	2101	A	JMP	.*+2		00003700
372	FEED	2187	A	JMP	ERR1		00003710
373	FEED	8519	A	LD	R1,M1		00003720
374	FEED	E50A	A	SKG	R1,D0	!-1>0	00003730
375	FEED	2101	A	JMP	.*+2		00003740
376	FEED	2183	A	JMP	ERR1		00003750
377	FEED	3081	A	NOP			00003760
378	FEED	E514	A	SKG	R1,M1	!-1>-1	00003770
379	FEED	2102	A	JMP	.*+3		00003780
380	FEED	2500	A	JMP	@.*+1		00003790
381	FEED	FF8C	A	.WORD	ERROR		00003800
382	FEED	E511	A	SKG	R1,M2	!-1>-2	00003810
383	FEED	21FD	A	JMP	.*-2	!REF .*-2 IN ORDER TO REACH ERR1	00003820
384	FEED	2110	A	JMP	TISZ	!CONTINUE TESTING	00003830



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385 FF07          ;          .PAGE          00003840
386 FF07          ;          00003850
387 FF07          ;          CONSTANTS      00003860
388 FF07          ;          00003870
389 FF07 0000 A D0: .WORD 0          00003880
390 FF08 0001 A D1: .WORD 1          00003890
391 FF09 0002 A D2: .WORD 2          00003900
392 FF0A 000F A D15: .WORD 15         00003910
393 FF0B 5050 A H5050: .WORD X'5050    00003920
394 FF0C 5555 A H5555: .WORD X'5555    00003930
395 FF0D 5A5A A H5A5A: .WORD X'5A5A    ; ALTERNATING ONES 00003940
396 FF0E 7FFF A H7FFF: .WORD X'7FFF    ; MAX POSITIVE VALUE 00003950
397 FF0F 8000 A H8000: .WORD X'8000    ; MAX NEGATIVE VALUE 00003960
398 FF10 A0A0 A HA0A0: .WORD X'A0A0    00003970
399 FF11 A5A5 A HASA5: .WORD X'A5A5    00003980
400 FF12 AAAA A HAAAA: .WORD X'AAAA    00003990
401 FF13 F0F0 A HF0F0: .WORD X'F0F0    00004000
402 FF14 FACE A HFACE: .WORD X'FACE    00004010
403 FF15 FFFF A M1: .WORD -1         00004020
404 FF16 FFFE A M2: .WORD -2         00004030
405 FF17          ;          .PAGE          00004040
406 FF17          ;          00004050
407 FF17          ;          ;...TEST ISZ AND DSZ 00004060
408 FF17 780A A TISZ: ISZ 10          ;TEST VALUE -1 00004070
409 FF18 2173 A     JMP ERROR          00004080
410 FF19 780A A     ISZ 10          ; TEST VALUE 0 00004090
411 FF1A 2101 A     JMP .+2          00004100
412 FF1B 2170 A     JMP ERROR          00004110
413 FF1C 7C0A A     DSZ 10          ;TEST VALUE 1 00004120
414 FF1D 216E A     JMP ERROR          00004130
415 FF1E 7C0A A     DSZ 10          ;TEST VALUE 0 00004140
416 FF1F 2101 A     JMP .+2          ;LOC 10 VALUE = -1 00004150
417 FF20 2168 A     JMP ERROR          00004160
418 FF21          ;          .PAGE          00004170
419 FF21          ;          00004180
420 FF21          ;          TEST FLAGS 00004190
421 FF21          ;          00004200
422 FF21 4CFF A     LI R0,-1          ; TEST VALUE -1 00004210
423 FF22 1169 A     BOC ZR0,ERROR      00004220
424 FF23 1268 A     BOC PZR0,ERROR      00004230
425 FF24 1301 A     BOC ODD,+.2         00004240
426 FF25 2166 A     JMP ERROR          00004250
427 FF26 1401 A     BOC BIT1,+.2        00004260
428 FF27 2164 A     JMP ERROR          00004270
429 FF28 1801 A     BOC NZR0,+.2        00004280
430 FF29 2162 A     JMP ERROR          00004290
431 FF2A 1501 A     BOC NZERO,+.2       00004300
432 FF2B 2160 A     JMP ERROR          00004310
433 FF2C 4801 A     AISZ R0,1          00004320
434 FF2D 215E A     JMP ERROR          ;AISZ FAILED TO SKIP ON ZERO 00004330
435 FF2E 1101 A     BOC ZR0,+.2         ; TEST VALUE 0 00004340
436 FF2F 215C A     JMP ERROR          00004350
437 FF30 1201 A     BOC PZR0,+.2        00004360
438 FF31 215A A     JMP ERROR          00004370
439 FF32 1359 A     BOC ODD,ERROR      00004380
440 FF33 1458 A     BOC BIT1,ERROR      00004390
441 FF34 1801 A     BOC NZR0,+.2        00004400
442 FF35 2156 A     JMP ERROR          00004410
443 FF36 1555 A     BOC NZERO,ERROR      00004420
444 FF37 A000 A     ST R0,0          00004430
445 FF38 4801 A     AISZ R0,1          ;ASSUME CARRY-IN WORKS 00004440
446 FF39 A000 A     ST R0,0          00004450
447 FF3A 7C00 A     DSZ 0          ;TEST IF AISZ CAUSED SKIP 00004460
448 FF3B 2150 A     JMP ERROR          ;AISZ SKIPPED ON NON-ZERO 00004470
449 FF3C 114F A     BOC ZR0,ERROR      ;TEST VALUE 1 00004480
450 FF3D 1201 A     BOC PZR0,+.2        00004490
451 FF3E 214D A     JMP ERROR          00004500
452 FF3F 1301 A     BOC ODD,+.2         00004510
453 FF40 214B A     JMP ERROR          00004520
454 FF41 144A A     BOC BIT1,ERROR      00004530
455 FF42 1849 A     BOC NZR0,ERROR      00004540
456 FF43 1501 A     BOC NZERO,+.2       00004550
457 FF44 2147 A     JMP ERROR          00004560
458 FF45 4801 A     AISZ R0,1          00004570
459 FF46 1345 A     BOC ODD,ERROR      ;TEST VALUE 2 00004580
460 FF47 1401 A     BOC BIT1,+.2        00004590
461 FF48 2143 A     JMP ERROR          00004600
462 FF49          ;          .PAGE          00004610
463 FF49          ;          00004620

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464	FF49	;	TEST IF RALU FLAGS CAN BE SET AND CLEARED VIA STACK. ALSO	00004630
465	FF49	;	TEST CYOV FLAG	00004640
466	FF49	;		00004650
467	FF49	4C00 A	LI R0,0	00004660
468	FF4A	40FF A	LI R1,-1	00004670
469	FF4B	4100 A	PUSH R1	00004680
470	FF4C	0280 A	PULLF	00004690
471	FF4D	4000 A	PUSH R0	00004700
472	FF4E	0080 A	PUSHF	00004710
473	FF4F	4600 A	PULL R2	00004720
474	FF50	F9C4 A	SKNE R2,M1	00004730
475	FF51	2101 A	JMP .+2	00004740
476	FF52	2139 A	JMP ERROR	00004750
477	FF53	0A00 A	SFLG SELX	00004760
478	FF54	1A01 A	BOC CYOV,+.2	00004770
479	FF55	2136 A	JMP ERROR	00004780
480	FF56	0A80 A	PFLG SELX	00004790
481	FF57	1A01 A	BOC CYOV,+.2	00004800
482	FF58	2133 A	JMP ERROR	00004810
483	FF59	;		00004820
484	FF59	;	...TRY TO CLEAR FLAGS	00004830
485	FF59	4000 A	PUSH R0	00004840
486	FF5A	0280 A	PULLF	00004850
487	FF5B	4100 A	PUSH R1	00004860
488	FF5C	0080 A	PUSHF	00004870
489	FF5D	4400 A	PULL R0	00004880
490	FF5E	152D A	BOC NZERO,ERROR	00004890
491	FF5F	0A00 A	SFLG SELX	00004900
492	FF60	1A2B A	BOC CYOV,ERROR	00004910
493	FF61	0A80 A	PFLG SELX	00004920
494	FF62	1A29 A	BOC CYOV,ERROR	00004930
495	FF63		.PAGE	00004940
496	FF63	;		00004950
497	FF63	;	TEST SHIFT WITHOUT LINK	00004960
498	FF63	;		00004970
499	FF63	0A80 A	PFLG SELX	00004980
500	FF64	4C00 A	LI R0,0	00004990
501	FF65	4000 A	PUSH R0	00005000
502	FF66	0280 A	PULLF	00005010
503	FF67	81AD A	LD R0,M1	00005020
504	FF68	5C0F A	SHL R0,15	00005030
505	FF69	F1A5 A	SKNE R0,H8000	00005040
506	FF6A	2101 A	JMP .+2	00005050
507	FF6B	2120 A	JMP ERROR	00005060
508	FF6C	0080 A	PUSHF	00005070
509	FF6D	4400 A	PULL R0	00005080
510	FF6E	1201 A	BOC PZRO,+.2	00005090
511	FF6F	211C A	JMP ERROR	00005100
512	FF70	819E A	LD R0,H8000	00005110
513	FF71	5CF1 A	SHR R0,15	00005120
514	FF72	48FF A	AISZ R0,-1	00005130
515	FF73	2118 A	JMP ERROR	00005140
516	FF74	4CFF A	LI R0,-1	00005150
517	FF75	5CF1 A	SHR R0,15	00005160
518	FF76	48FF A	AISZ R0,-1	00005170
519	FF77	2114 A	JMP ERROR	00005180
520	FF78	;		00005190
521	FF78	;	CHECK ROTATE WITHOUT LINK	00005200
522	FF78	;		00005210
523	FF78	8199 A	LD R0,HAAAA	00005220
524	FF79	5801 A	ROL R0,1	00005230
525	FF7A	F191 A	SKNE R0,H5555	00005240
526	FF7B	2101 A	JMP .+2	00005250
527	FF7C	210F A	JMP ERROR	00005260
528	FF7D	0080 A	PUSHF	00005270
529	FF7E	4500 A	PULL R1	00005280
530	FF7F	758F A	SKAZ R1,H8000	00005290
531	FF80	210B A	JMP ERROR	00005300
532	FF81	58FE A	ROR R0,2	00005310
533	FF82	F189 A	SKNE R0,H5555	00005320
534	FF83	2101 A	JMP .+2	00005330
535	FF84	2107 A	JMP ERROR	00005340
536	FF85	0080 A	PUSHF	00005350
537	FF86	4500 A	PULL R1	00005360
538	FF87	7587 A	SKAZ R1,H8000	00005370
539	FF88	2103 A	JMP ERROR	00005380
540	FF89	5801 A	ROL R0,1	00005390
541	FF8A	F187 A	SKNE R0,HAAAA	00005400
542	FF8B	2105 A	JMP SHLNK	00005410
543	FF8C	;		00005420

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544 FF8C 4CFF A ERROR: LI R0,-1 00005430
545 FF8D 0F00 A SFLG 7 ;NO-GO INDICATOR 00005440
546 FF8E 0000 A HALT ;ERROR OCCURRED 00005450
547 FF8F 2500 A JMP @,+1 ;REEXECUTE FROM BEGINNING 00005460
548 FF90 FFFE A .WORD ENTRY 00005470
549 FF91 .PAGE 00005480
550 FF91 ; 00005490
551 FF91 ; TEST SHIFT WITH LINK 00005500
552 FF91 ; 00005510
553 FF91 0A00 A SHLNK: SFLG SELX ; INCLUDE LINK IN SHIFTS 00005520
554 FF92 4C01 A LI R0,1 00005530
555 FF93 5C10 A SHL R0,16 00005540
556 FF94 1101 A BOC ZR0,+.2 00005550
557 FF95 21F6 A JMP ERROR 00005560
558 FF96 0080 A PUSHF 00005570
559 FF97 4500 A PULL R1 00005580
560 FF98 750F A SKAZ R1,X8000 ; ASSUME SKAZ WORKS 00005590
561 FF99 2101 A JMP .+2 00005600
562 FF9A 21F1 A JMP ERROR 00005610
563 FF9B 5CF0 A SHR R0,16 00005620
564 FF9C F109 A SKNE R0,I1 ; ASSUME SKNE WORKS 00005630
565 FF9D 2101 A JMP .+2 00005640
566 FF9E 21ED A JMP ERROR 00005650
567 FF9F 0080 A PUSHF 00005660
568 FFA0 4400 A PULL R0 00005670
569 FFA1 7106 A SKAZ R0,X8000 00005680
570 FFA2 21E9 A JMP ERROR 00005690
571 FFA3 2106 A JMP ROTLNK 00005700
572 FFA4 .PAGE 00005710
573 FFA4 ; 00005720
574 FFA4 ; TEST ROTATE WITH LINK 00005730
575 FFA4 ; 00005740
576 FFA4 5554 A H5554: .WORD X'5554 00005750
577 FFA5 0555 A HD555: .WORD X'D555 00005760
578 FFA6 0001 A I1: .WORD 1 00005770
579 FFA7 5555 A X5555: .WORD X'5555 00005780
580 FFA8 8000 A X8000: .WORD X'8000 00005790
581 FFA9 AAAA A XAAAA: .WORD X'AAAA 00005800
582 FFAA 89FE A ROTLNK: LD R2,XAAAA 00005810
583 FFAB 4D00 A LI R1,0 ; SET LINK=0 00005820
584 FFAC 4100 A PUSH R1 00005830
585 FFAD 0280 A PULLF 00005840
586 FFAE 5A01 A ROL R2,1 00005850
587 FFAF F9F4 A SKNE R2,H5554 00005860
588 FF80 2101 A JMP .+2 00005870
589 FFB1 21DA A JMP ERROR 00005880
590 FFB2 0080 A PUSHF 00005890
591 FFB3 4400 A PULL R0 00005900
592 FFB4 12D7 A BOC PZRO,ERROR ; LINK SHOULD BE SET 00005910
593 FFB5 5AFE A ROR R2,2 00005920
594 FFB6 F9F0 A SKNE R2,X5555 00005930
595 FFB7 2101 A JMP .+2 00005940
596 FFB8 21D3 A JMP ERROR 00005950
597 FFB9 0080 A PUSHF 00005960
598 FFBA 4400 A PULL R0 00005970
599 FFB8 4800 A AISZ R0,0 00005980
600 FFBC 21CF A JMP ERROR ; LINK SHOULD NOT RE SET 00005990
601 FFB0 5A01 A ROL R2,1 00006000
602 FFB6 F9EA A SKNE R2,XAAAA 00006010
603 FFBF 2101 A JMP .+2 00006020
604 FFC0 21CB A JMP ERROR 00006030
605 FFC1 0080 A PUSHF 00006040
606 FFC2 4400 A PULL R0 00006050
607 FFC3 4800 A AISZ R0,0 00006060
608 FFC4 21CF A JMP ERROR ; LINK SHOULD NOT BE SET 00006070
609 FFC5 4CFF A LI R0,-1 00006080
610 FFC6 4000 A PUSH R0 00006090
611 FFC7 0280 A PULLF ; SET LINK 00006100
612 FFC8 5A01 A ROL R2,1 00006110
613 FFC9 F9DD A SKNE R2,X5555 00006120
614 FFCA 2101 A JMP .+2 00006130
615 FCCB 21C0 A JMP ERROR 00006140
616 FFCC 0080 A PUSHF 00006150
617 FFCD 4400 A PULL R0 00006160
618 FFCE 12BD A BOC PZRO,ERROR ; LINK SHOULD BE SET 00006170
619 FFCF 5AFE A ROR R2,2 00006180
620 FFD0 F9D4 A SKNE R2,HD555 00006190
621 FFD1 2101 A JMP .+2 00006200
622 FFD2 21B9 A JMP ERROR 00006210
623 FFD3 0080 A PUSHF 00006220

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624 FFD4 4400 A      PULL      R0
625 FFD5 71D2 A      SKAZ      R0,X8000
626 FFD6 21B5 A      JMP        ERROR      ; LINK SHOULD BE ZERO
627 FFD7 5A01 A      ROL        R2,1
628 FFD8 F9D0 A      SKNE      R2,XAAAA
629 FFD9 2101 A      JMP        .+2
630 FFDA 21B1 A      JMP        ERROR
631 FFDB 0080 A      PUSHF
632 FFDC 4400 A      PULL      R0
633 FFDD 12AE A      BOC       PZRO,ERROR
634 FFDE 0800 A      SFLG      0      ;INDICATE GOOD RESULTS
635 FFDF A004 A      PANEL:   ST      0,4      ;SAVE REGISTERS
636 FFE0 A405 A      ST      1,5
637 FFE1 A806 A      ST      2,6
638 FFE2 AC07 A      ST      3,7
639 FFE3 9119 A      LD        0,@STADD
640 FFE4 1F10 A      BOC       15,EXIT
641 FFE5 0600 A      ROUT:    ROUT     0
642 FFE6 1C03 A      WAIT:    BOC     12,LA
643 FFE7 1D07 A      BOC     13,LD
644 FFE8 170A A      BOC     7,EX
645 FFE9 21FC A      JMP      WAIT
646 FFEA 1CFF A      LA:      BOC     12,LA
647 FFEB 0400 A      RIN      0
648 FFEC 3281 A      RCPY     0,2
649 FFED 8200 A      LD        0,(2)
650 FFEF 21F6 A      JMP      ROUT
651 FFEF 1DFF A      LD:      BOC     13,LD
652 FFF0 0400 A      RIN      0
653 FFF1 A200 A      ST        0,(2)
654 FFF2 21F2 A      JMP      ROUT
655 FFF3 17FF A      EX:      BOC     7,EX
656 FFF4 0400 A      RIN      0
657 FFF5 4000 A      EXIT:    PUSH     0
658 FFF6 8004 A      LD        0,4
659 FFF7 8405 A      LD        1,5
660 FFF8 8806 A      LD        2,6
661 FFF9 8C07 A      LD        3,7
662 FFFA 0880 A      PFLG     0      ;INITIALIZE RESULT INDICATORS
663 FFFB 0F80 A      PFLG     7
664 FFFC 0200 A      RTS
665 FFFD FE00 A      STADD:   .WORD   START
666 FFFE FFFE A      .END     ENTRY

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\*\*\*\*\* 0 ERRORS IN ASSEMBLY \*\*\*\*\*

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BIT1  CLOOP  CYOV  D0    D1    D15   D2    ENTRY  ERR   ERR1
0004 A FE92 A 000A A FF07 A FF08 A FF0A A FF09 A FFFE A FE6B A FE82 A

ERROR  EX     EXIT  H5050 H5554 H5555 H5A5A H7FFF H8000 HA0A0
FF8C A FFF3 A FFF5 A FF0B A FFA4 A FF0C A FF0D A FF0E A FF0F A FF10 A

HASAS  HAAAA  HD555  HF0F0 HFACE  I1    I15   IENFL  IEP   ILOC
FF11 A FF12 A FFA5 A FF13 A FF14 A FFA6 A FE65 A 0001 A FE69 A 000F A

INDPNT INENTY  INTEN  LA    LD    LINDPT M1    M2    MIN1  MLOOP
FE67 A FE43 A 0009 A FFEA A FFEF A FE66 A FF15 A FF16 A FE5D A FE8B A

NZERO  NZRO   ODD    ONE   PANEL  PLOOP  PZRO  R0    R1    R2
0005 A 000B A 0003 A FE60 A FFDF A FE50 A 0002 A 0000 A 0001 A 0002 A

R3     RETN   ROMAD  ROTLNK  ROUT  RTNAD  SBRAD  SBRTST  SELX  SHLNK
0003 A FE6F A FE00 A FFAA A FFE5 A FE88 A FE87 A FE6C A 0002 A FF91 A

STADD  START  STKFL  SUBR   SUBR1  TISZ   TMWRT  WAIT   X5555  X5A5A
FFFD A FE00 A 0008 A FE7C A FE84 A FF17 A FE89 A FFE6 A FFA7 A FE64 A

X7FFF  X8000  XA5A5  XAAAA  XF0F0  XFACE  ZERO   ZRO
FE5E A FFAB A FE63 A FFA9 A FE62 A FE61 A FE5F A 0001 A

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1E08 F8FE