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*****
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*
*      EB  MODULE      *
*
*      REVISION  C    *
*
*      October 29, 1984  *
*
*****
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Profile: ABC - C 10.22.84
          DEF - C 10.22.84
          GHI - C 10.22.84
          JKL - C 10.22.84
          MNO - C 10.22.84
          PQR - C 10.22.84
          STU - C 10.22.84
          VWX - C 10.22.84
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 EB module - General Description

The EB module provides the interface between the foreground processor channel and the common memory port.

The connector pin population is distributed as follows.

64 inputs data from IA module (ia,ib,ic,id)
 31 inputs memory error address from QA module (ie,if) Q- ★
 8 inputs memory syndrome data from TD module (ig)
 3 inputs memory arrival code from TD module (ih)
 1 input single bit error from TD module (iia)
 1 input double bit error from TD module (iib)
 1 input go write data from IB module (ija)
 1 input end sequence from IB module (ijb)
 16 inputs channel data (ik)
 1 input channel call pulse (ikq)
 1 input channel function pulse (ikr)
 1 input channel data pulse (iks)
 1 input channel response pulse (ikt)
 1 input dead start signal (ima) from EA
 3 inputs Refresh active (ina, inb, inc) from other processors EB's
 1 input Enable DMOS Memory (ind) from EB
 1 input clock (izz)

64 outputs data to TB module (oa,ob,oc,od)
 32 outputs address to TA module (oe,of) T- ★
 6 outputs length to IB module (og)
 1 output external reference to IB module (oha)
 1 output read mode to IB module (ohb)
 1 output Set memory Busy (ohc) to IB
 3 outputs Refresh active (ohd, ohe, ohf) to other EBs
 1 output ~~force one~~ (ohg) Enable DMOS memory to EB (internal)
 16 outputs channel data (ok)
 1 output channel call pulse (okq)
 1 output channel function pulse (okr)
 1 output channel data pulse (oks)
 1 output channel response pulse (okt)
 8 outputs indicator lights (ol)

 273 total pins

★ = module type dependent on common memory used

---- Glossary of Boolean Trigraphs

aa- first rank channel data
 ab- second rank channel data
 b-- foreground processor access register
 c-- first rank channel data
 da- first ~~quadrant~~ buffer address *bank*
 db- second ~~quadrant~~ buffer address *bank*
 dc- third ~~quadrant~~ buffer address *bank*
 dd- fourth ~~quadrant~~ buffer address *bank*
 e-- common memory error address
 f-- buffer bypass data path
 g-- common memory reference address
 h-- delayed channel data
 j-- static translations
 k-- interrupt address
 la- original length
 lb- word counter
 lc- group counter
 m-- common memory readout pointer
 n-- merge channel data
 p-- buffer readout data
 q-- control latches
 r-- buffer register chips
 s-- status register
 t-- transmission control
 u-- buffer address slaves
 v-- write strobe
 w-- buffer write data
 x-- refresh counter

---- Channel Functions

The EB module responses to channel function requests for the following codes.

Function 20 - Memory refresh - (qu)

This function generates 256 memory vectors with a length of 32 elements. The length is specified in the function parameter field. The common memory address must include the refresh bit.

Function 21 - Enter interrupt address and status - (qb)

This function enters the status register with two mode bits from the sub-function field. The remainder of the status register is cleared. The interrupt address is entered from the function parameter field.

Function 22 - Read N words from parameter address - (qc)

This function reads a block of data from common memory and transmits the data over the foreground channel. The block length is determined by the low order ten bits of the function word. The common memory address is specified by the following parameter word.

Function 23 - Write N words into parameter address - (qd)

This function writes a block of data into common memory. The data is received over the foreground channel. The block length is determined by the low order ten bits of the function word. The common memory address is specified by the following parameter word.

Function 24 - Read status register - (qe)

This function causes a response with the content of the status register.

Function 25 - Read error address - (qf)

This function causes a response with the content of the error address register.

Function 26 - read single word to foreground register - (qg)

This function reads a single word from common memory into the foreground processor access register. The common memory address is specified by the parameter word.

Function 27 - write single word from foreground register - (qh)

This function writes a single word into common memory from the foreground processor access register. The common memory address is specified by the parameter word.

Function 30 - Read upper access register - (qi)

This function causes a response with the upper 32 bits of the access register.

Function 31 - Read lower access register - (qj)

This function causes a response with the lower 32 bits of the access register.

Function 32 - Enter upper access register - (qk)

This function enters the upper 32 bits of the access register with data from the function parameter word.

Function 33 - Enter lower access register - (ql)

This function enters the lower 32 bits of the access register with data from the function parameter word.

---- Status Register

The EB module contains a 12 bit status register for the common memory port. The bit assignments from lowest to higher order bits are as follows.

Eight bits syndrome data
One bit single error
One bit double error
One bit interrupt on single error
One bit interrupt on double error

---- Error Address Register

The EB module contains a 31 bit error address register for the common memory port. This register is loaded concurrent with the arrival of the syndrome data from the TD module on a single or double bit memory error. A double bit error supersedes a single bit error. A second single bit error is ignored.

---- Foreground Access Register

The EB module contains a 64 bit register for single word references in common memory from the foreground processor.

---- Interrupt Address Register

The EB module contains a 16 bit interrupt address register for response to a channel call when a common memory error has occurred.

----- Buffer Registers

The EB module buffer registers ^{banks} can hold 64 common memory words of data. This buffer is organized into four ~~quadrants~~ quadrants of 16 words each. The buffer is used in both directions. Data is loaded from the channel and then dumped into common memory. Data is loaded from common memory and then dumped over the channel. Boolean equations to illustrate the buffer circuits are as follows.

AAR RAA RAI RBA RBI = WAA WAI WBA WBI ; UAA UAB UAC UAD ; *** VAA .

BGP WAA = IAA TEA + HAA TFA . (write data)

JBL uaa = daa .

ABL vaa = qna .

TOJ TEA = QAD .

BSJ TFA = QQB .

ACX PAA = RAA TAA + REA TBA + RIA TCA + RMA TDA + FAA . (readout data)

CDL oaa = paa .

AHJ FAA = BAA QTA .

BIJ taa = qpa .

EIJ tba = qpb .

HIJ tca = qpc .

KIJ tda = qpd .

DRM DAA = DAA jaa tia + daa JAA .

DVM DAB = DAB jab tia + dab JAB .

D2M DAC = DAC jac tia + dac JAC .

D6M DAD = DAD jad tia + dad JAD .

DJH JAA = QMA .

DJH JAB = QMA DAA .

DNH JAC = QMA DAA DAB .

DNH JAD = QMA DAA DAB DAC .

M8J TIA = QQA .

B1M QPA = QPA tqc + QPD TQA + TQB . (qpe)

E1M QPB = QPB tqc tqb + QPA TQA . (qpf)

H1M QPC = QPC tqc tqb + QPB TQA . (qpg)

K1M QPD = QPD tqc tqb + QPC TQA . (qph)

NUI tqa = qao qae .

NUI tqb = qqa .

QUI tqc = qao qae qhc .

DFM QMA = QPE TQD + MDA .

GFM QMB = QPF TQD + MDB .

PFM QMC = QPG TQD + MDC .

SFM QMD = QPH TQD + MDD .

NCM QNA = QPE QDH + MDA .

QCM QNB = QPF QDH + MDB .

TCM QNC = QPG QDH + MDC .

WCM QND = QPH QDH + MDD .

bant
(~~quadrant~~ zero address)

bant
(~~quadrant~~ pointer)

(advance address)

(write strobe)

----- Foreground Processor Access Register

The 64 bit foreground processor access register allows the foreground processor to address common memory on a half word basis. Boolean equations to illustrate these circuits are as follows.

ALP baa = waa TKA + haa TLA + baa TMA .
 APP bba = wba TKB + hba TLB + bba TMB .
 ATP bca = wca TKC + haa TLC + bca TMC .
 AXP bda = wda TKD + hba TLD + bda TMD .

COL aaa = ika .
 BML haa = aaa .
 BML hba = haa .
 TNJ tka = qge .
 TNJ tkb = qge .
 TNJ tkc = qge .
 TNJ tkd = qge .
 WRJ tla = qld .
 WRJ tlb = qld .
 WRJ tlc = qld .
 WRJ tld = qld .
 WNJ TMA = qle qge .
 WNJ TMB = qle qge .
 WNJ TMC = qke qge .
 WNJ TMD = qke qge .

----- Merge Data to Channel

Data from the EB module is transmitted over the 16 bit channel by merging the register data in several steps. The merging network is illustrated below.

CPX OKA = IKA THA + NAA + NBA + NCA + NDA .

CIP NAA = PAA TJA + PBA TJB + PCA TJC .

CMP NBA = PDA TJD + BAA TJE + BBA TJF .

CQP NCA = BCA TJG + BDA TJH + SAA TJI .

CUP NDA = EAA TJJ + EBA TJK + KAA TJL .

ONJ THA = qan qqd .

NHI tja = qcn .

NHI tjb = qcm .

NLI tjc = qcl .

NLI tjd = qck .

H4I TJE = QJB .

H4I TJF = QJA .

E4I TJG = QIB .

E4I TJH = QIA .

N4I TJI = QEB .

R1I TJJ = QFB .

R1I TJK = QFA .

N4I TJL = QAM .

----- Interrupt on Channel Call

The EB module responds to a channel call when an interrupt condition exists in the module. This is the case if an error has occurred in common memory and the proper mode has been selected. Boolean equations for these circuits are as follows.

CXL	$okq = ikq .$	(channel call)
CSL	$qaa = ikq .$	
CVP	$QAM = QAP IKQ .$	
CVP	$QAN = QAP IKQ + QAM .$	
CLM	$QAP = SAI SAK + SAJ SAL .$	(interrupt condition)
XWI	$jma = qat qaa .$	(clear control)
X8L	$QAT = IMA .$	(dead start)
ONJ	$THA = qan qqd .$	(clear channel)
N4I	$TJL = QAM .$	(gate interrupt)

Latch (qan) clears the channel data for two clock periods. This blocks response from any lower priority nodes on the channel. Latch (qam) gates the interrupt address on the channel. A timing chart for these events is as follows.

```
(IKQ)
(QAM) (QAN) (TJL) (tha) (KA) (OKQ)
      (QAN)      (tha) (ND) (ok)
                          (OK)
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----- Function 21 - Enter Interrupt Address

This function enters the status register with two bits of mode selection as well as entering the interrupt address register. The remainder of the status data is cleared. Boolean equations for these functions are as follows.

FVP	QBA = JKB JJA .	(go function 21)
TSL	qoa = jja .	(go any function)
F1L	QBB = QBA .	
URH	JJA = QAB cap cao CAN .	
FRH	JKB = cam cal cak CAJ .	
XOL	QAB = AAR .	
XOL	aar = ikr .	
BXP	KAA = KAA toa + ABA TOA .	(interrupt address)
CKP	SAA = SAA TSA + IGA TSC .	(status register)
IWP	SAK = SAK tsb + ABA TSB .	(status register mode)
CGP	EAA = EAA tna + IEA TNA .	(error register)
CRI	tna = qag .	
FNI	TOA = QBB .	
FNI	TSA = qak qal qba .	
FEI	tsb = qba .	
FNI	tsc = qak qal .	
CWM	QAG = IIA sai saj + IIB saj .	
CNP	qak = iia + SAI + SAJ .	
CNP	qal = iib + SAJ .	
OWH	jna = qcr qgf qhe qbb qea qfa .	
OWH	jnb = qia qja qka qla .	
UWX	QQB = IKT + QDA + JNA + JNB + QUF .	
NVL	QQC = QQB .	
NRM	QQD = QQD qqc jma + QOA .	(clear channel)
UWX	OKT = IKT + QDA + JNA + JNB + QUF .	(function pulse)

The function pulse (okt) is followed by blank data. Timing for this function is as follows.

(IKR)				
(AAR)		(IK)		
(QAB) (JJA) (JKB)		(AA) (CA)		
(QBA)	(tsa) (TSB)	(AB)		(QOA)
(QBB) (JNA) (TOA)		(SA)		(QQD)
(QQB)	(KA)		(OKT)	(QQD)
(QQC)			(ok)	(QQD)
			(ok)	(qqd)

----- Function 22 - Read N Words from Common Memory

This function reads a block of data from common memory and transmits it over the channel to a receiving node. The block length is determined by the lowest order 10 bits of the function word. The common memory address is specified by the following parameter word.

Data is read from common memory in blocks of 64 word length. An odd block is read at the end of the group. Each 64 word group is transmitted on the channel in a contiguous 256 parcel field. A data pulse precedes each group. The receiving node responds with a data pulse when it is ready for the next group.

The ten bit length designator is read into register (1a). The highest order four bits are copied into register (1c). The lowest order six bits are copied into register (1b) if the content of (1c) is zero. The (1b) register is cleared if (1c) is nonzero.

The common memory reference is made using the 32 bit parameter address. The parameter address (g) is advanced by 64 counts for the next group reference. The 64 word buffer in the EB module is loaded from common memory. The word count (1b) is reduced as each word arrives.

The EB module then transmits the block data over the channel in parcel form. The (1b) counter is used again for counting the words as they leave. The EB module then waits for a data pulse from the receiving node.

The group counter (1c) is reduced by one count. If the previous value was zero the EB module begins the exit sequence. If the previous value was one and the lower six bits of (1a) are zero, the EB module begins the exit sequence. The exit sequence sends a blank function response to the foreground processor.

If the exit sequence is not selected the (1b) counter is reset from (1a) and the next block is processed.

--- Boolean equations for function 22 sequence control are as follows.

IVP	QCA = JKC JJA .	
HNP	QCB = QCA .	
HOL	QCC = QCB .	
ERM	QCE = QCE qmh jma + QCC + QCT .	(wait common memory)
HNP	QCF = QCE QMH .	(begin channel data)
HEL	QCG = QCF .	
HEL	QCH = QCG .	
HEL	QCI = QCH .	
HOL	QCJ = QCI .	
HSP	QCK = QCJ + QCN jeg .	(word loop)
HOL	QCL = QCK .	
HOL	QCM = QCL .	
HLL	QCN = QCM .	
HRM	QCO = QCO qac jma + QCN JEG .	(wait data pulse)
HSP	QCP = QCO QAC .	<i>From common memory</i>
HLL	QCQ = QCP .	
HLL	QCR = QCQ .	
HLL	QCS = QCR .	
HHP	QCT = qmj QCS .	(next group)
HHP	QCU = QMJ QCS .	(exit)

In addition to the above specific timing signals the function uses the general startup sequence as listed below.

TSL qoa = jja .
 TSL qob = qoa .
 TLL qoc = qob .

A timing chart for the initial function setup is as follows.

(IKR)						
(AAR)						
(QAB) (JJA)	(AA)					
(QOA)	(AB)	(QCA) (TIE)				
(QOB) (QOD) (tha)	(AA)	(QCB) (LA) (TIG)				
(QOC) (oks) (ok)	(TPC) (AB)	(QCC)	(LC) (JG)			(JLB)
	(GA) (GB)		(QMI) (JF)	(OHA) (OHB)		(QQA)
						(LB)

A timing chart for data arrival from the common memory is as follows.

(IH)						
(MA)						
(MB)						
(MC)						
(MD)						
(QMA) (QME) (JA)	(JE)	(QNA)	(QAD) (TEA) (IA)			(JEG)
	(DA)	(LB) (VA)		(W)		(QMH)
	(U)					(QCF) (qce)

----- Function 23 - Write N Words into Common Memory

This function assembles a block of data from another channel node and writes it into common memory. The block length is determined by the lowest order ten bits of the function word. The common memory address is specified by the following parameter word.

Data is transmitted over the channel in bursts of 256 parcels. Each group is processed in the EB module and written into common memory as a 64 word block. An odd portion of a block is processed last. Each block is preceded over the channel by a data pulse. The EB module responds with a resume pulse when the common memory reference is complete.

The ten bit length designator is read into register (1a). The highest order four bits are copied into register (1c). The lowest order six bits are copied into register (1b) if the content of (1c) is zero. The (1b) register is cleared if (1c) is nonzero.

The EB module waits for a data pulse on the channel from the transmitting node. It then assembles the data block in its buffer. A common memory reference stores the data and advances the common memory address by 64 counts. A resume is sent to the transmitting node.

The EB module sends an immediate function response when the function is received. It sends a resume to the transmitting node at the end of every memory reference. A test is made to determine last block in the same manner as for the 22 instruction. The EB module returns to an idle mode after the last resume. Boolean equations for function 23 sequence control are as follows.

LVP	QDA = JKD JJA .	
KHL	QDB = QDA .	
KHL	QDC = QDB .	
BRM	QDD = QDD qac jma + QDC + QDO .	(wait data pulse)
KOP	QDE = QDD QAC + qmf QDH .	(read channel)
KHL	QDF = QDE .	
KHL	QDG = QDF .	
KLL	QDH = QDG .	
KOP	QDI = QMF QDH .	
KRM	QDJ = QDJ qaf jma + QDI .	(wait memory)
KSP	QDK = QDJ QAF .	
KLL	QDL = QDK .	
KLL	QDM = QDL .	
KLL	QDN = QDM .	
KNP	QDO = qmj QDN .	(next group)

*
 * EB Module - Boolean Reconstruction
 * Revision C
 *

COL	aaa = ika .	1st rank channel data
FOL	aab = ikb .	
IOL	aac = ikc .	
LOL	aad = ikd .	
OOL	aae = ike .	
ROL	aaf = ikf .	
UOL	aag = ikg .	
XOL	aah = ikh .	
CSL	aai = iki .	
FSM	aaj = ikj .	
ISM	aak = ikk .	
LSM	aal = ikl .	
OSM	aam = ikm .	
RSM	aan = ikn .	
USM	aao = iko .	
XSL	aap = ikp .	
XOL	aar = ikr .	Channel function pulse
COL	aba = aaa .	2nd rank channel data
FOL	abb = aab .	
IOL	abc = aac .	
LOL	abd = aad .	
OOL	abe = aae .	
ROL	abf = aaf .	
UOL	abg = aag .	
XOL	abh = aah .	
COL	abi = aai .	
FOL	abj = aaj .	
IOL	abk = aak .	
LOL	abl = aal .	
OOL	abm = aam .	
ROL	abn = aan .	
UOL	abo = aao .	
XSL	abp = aap .	
ALP	baa = waa TKA + haa TLA + baa TMA . 2(0)	Foreground processor
DLP	bab = wab TKA + hab TLA + bab TMA .	Access register
GLP	bac = wac TKA + hac TLA + bac TMA .	(lower 32 bits)
JLP	bad = wad TKA + had TLA + bad TMA .	
MLP	bae = wae TKA + hae TLA + bae TMA .	
PLP	baf = waf TKA + haf TLA + baf TMA .	
SLP	bag = wag TKA + hag TLA + bag TMA .	
VLP	bah = wah TKA + hah TLA + bah TMA .	
ALP	bai = wai TKA + hai TLA + bai TMA .	
DLP	baj = waj TKA + haj TLA + baj TMA .	
GLP	bak = wak TKA + hak TLA + bak TMA .	
JLP	bal = wal TKA + hal TLA + bal TMA .	
MLP	bam = wam TKA + ham TLA + bam TMA .	
PLP	ban = wan TKA + han TLA + ban TMA .	
SLP	bao = wao TKA + hao TLA + bao TMA .	
VLP	bap = wap TKA + hap TLA + bap TMA . 2(15)	

APP	bba = wba	TKB + hba	TLB + bba	TMB . 2(16)	Lower 32 bits of f p access register
DPP	bbb = wbb	TKB + hbb	TLB + bbb	TMB .	
GPP	bbc = wbc	TKB + hbc	TLB + bbc	TMB .	
JPP	bbd = wbd	TKB + hbd	TLB + bbd	TMB .	
MPP	bbe = wbe	TKB + hbe	TLB + bbe	TMB .	
PPP	bbf = wbf	TKB + hbf	TLB + bbf	TMB .	
SPP	bbg = wbg	TKB + hbg	TLB + bbg	TMB .	
VPP	bbh = wbh	TKB + hbh	TLB + bbh	TMB .	
APP	bbi = wbi	TKB + hbi	TLB + bbi	TMB .	
DPP	bbj = wbj	TKB + hbj	TLB + bbj	TMB .	
GPP	bbk = wbk	TKB + hbk	TLB + bbk	TMB .	
JPP	bbk = wbl	TKB + hbl	TLB + bbl	TMB .	
MPP	bbm = wbm	TKB + hbm	TLB + bbm	TMB .	
PPP	bbn = wbn	TKB + hbn	TLB + bbn	TMB .	
SPP	bbo = wbo	TKB + hbo	TLB + bbo	TMB .	
VPP	bbp = wbp	TKB + hbp	TLB + bbp	TMB . 2(31)	
ATP	bca = wca	TKC + haa	TLC + bca	TMC . 2(0)	Upper 32 bits of foreground processor Access register
DTP	ccb = wcb	TKC + hab	TLC + ccb	TMC .	
GTP	bcc = wcc	TKC + hac	TLC + bcc	TMC .	
JTP	bcd = wcd	TKC + had	TLC + bcd	TMC .	
MTP	bce = wce	TKC + hae	TLC + bce	TMC .	
PTP	bcf = wcf	TKC + haf	TLC + bcf	TMC .	
STP	bcg = wcg	TKC + hag	TLC + bcg	TMC .	
VTP	bch = wch	TKC + hah	TLC + bch	TMC .	
ATP	bci = wci	TKC + hai	TLC + bci	TMC .	
DTP	bcj = wcj	TKC + haj	TLC + bcj	TMC .	
GTP	bck = wck	TKC + hak	TLC + bck	TMC .	
JTP	bcl = wcl	TKC + hal	TLC + bcl	TMC .	
MTP	bcm = wcm	TKC + ham	TLC + bcm	TMC .	
PTP	bcn = wcn	TKC + han	TLC + bcn	TMC .	
STP	bco = wco	TKC + hao	TLC + bco	TMC .	
VTP	bcp = wcp	TKC + hap	TLC + bcp	TMC .	
AXP	bda = wda	TKD + hba	TLD + bda	TMD .	
DXP	bdb = wdb	TKD + hbb	TLD + bdb	TMD .	
GXP	bdc = wdc	TKD + hbc	TLD + bdc	TMD .	
JXP	bdd = wdd	TKD + hbd	TLD + bdd	TMD .	
MXP	bde = wde	TKD + hbe	TLD + bde	TMD .	
PXP	bdf = wdf	TKD + hbf	TLD + bdf	TMD .	
SXP	bdg = wdg	TKD + hbg	TLD + bdg	TMD .	
VXP	bdh = wdh	TKD + hbh	TLD + bdh	TMD .	
AXP	bdi = wdi	TKD + hbi	TLD + bdi	TMD .	
DXP	bdj = wdj	TKD + hbj	TLD + bdj	TMD .	
GXP	bdk = wdk	TKD + hbk	TLD + bdk	TMD .	
JXP	bdl = wdl	TKD + hbl	TLD + bdl	TMD .	
MXP	bdm = wdm	TKD + hbm	TLD + bdm	TMD .	
PXP	bdn = wdn	TKD + hbn	TLD + bdn	TMD .	
SXP	bdo = wdo	TKD + hbo	TLD + bdo	TMD .	
VXP	bdp = wdp	TKD + hbp	TLD + bdp	TMD . 2(31)	

FSM caj = ikj .
 ISM cak = ikk .
 LSM cal = ikl .
 OSM cam = ikm .
 RSM can = ikn .
 USM cao = iko .
 XSL cap = ikp .
 FSM cbj = ikj .
 ISM cbk = ikk .
 LSM cbl = ikl .
 OSM cbm = ikm .

DRM DAA = DAA jaa tia + daa JAA .
 DVM DAB = DAB jab tia + dab JAB .
 D2M DAC = DAC jac tia + dac JAC .
 D6M DAD = DAD jad tia + dad JAD .

GRM DBA = DBA jba tib + dba JBA .
 GVM DBB = DBB jbb tib + dbb JBB .
 G2M DBC = DBC jbc tib + dbc JBC .
 G6M DBD = DBD jbd tib + dbd JBD .

PRM DCA = DCA jca tic + dca JCA .
 PVM DCB = DCB jcb tic + dcb JCB .
 P2M DCC = DCC jcc tic + dcc JCC .
 P6M DCD = DCD jcd tic + dcd JCD .

SRM DDA = DDA jda tid + dda JDA .
 SVM DDB = DDB jdb tid + ddb JDB .
 S2M DDC = DDC jdc tid + ddc JDC .
 S6M DDD = DDD jdd tid + ddd JDD .

CGP EAA = EAA tna + IEA TNA . 2(0)
 FGP EAB = EAB tna + IEB TNA .
 IGP EAC = EAC tna + IEC TNA .
 LGP EAD = EAD tna + IED TNA .
 OGP EAE = EAE tna + IEE TNA .
 RGP EAF = EAF tna + IEF TNA .
 UGP EAG = EAG tna + IEG TNA .
 XGP EAH = EAH tna + IEH TNA .
 CGP EAI = EAI tna + IEI TNA .
 FGP EAJ = EAJ tna + IEJ TNA .
 IGP EAK = EAK tna + IEK TNA .
 LGP EAL = EAL tna + IEL TNA .
 OGP EAM = EAM tna + IEM TNA .
 RGP EAN = EAN tna + IEN TNA .
 UGP EAO = EAO tna + IEO TNA .
 XGP EAP = EAP tna + IEP TNA .
 C3P EBA = EBA tnb + IFA TNB .
 F3P EBB = EBB tnb + IFB TNB .
 I3P EBC = EBC tnb + IFC TNB .
 L3P EBD = EBD tnb + IFD TNB .
 O3P EBE = EBE tnb + IFE TNB .
 R3P EBF = EBF tnb + IFF TNB .
 U3P EBG = EBG tnb + IFG TNB .
 X3P EBH = EBH tnb + IFH TNB . 2(23)

1st rank channel data

Bank
Quad 0 buffer address

Bank
Quad 1 buffer address

Bank
Quad 2 buffer address

Bank
Quad 3 buffer address

Common memory error
address register

C3P EBI = EBI tnb + IFI TNB . 2(24)
 F3P EBJ = EBJ tnb + IFJ TNB .
 I3P EBK = EBK tnb + IFK TNB .
 L3P EBL = EBL tnb + IFL TNB .
 O3P EBM = EBM tnb + IFM TNB .
 R3P EBN = EBN tnb + IFN TNB .
 U3P EBO = EBO tnb + IFO TNB .
 X3P EBP = EBP tnb . 2(31)

Common memory error
address register

AHJ FAA = BAA QTA .
 DHJ FAB = BAB QTA .
 GHJ FAC = BAC QTA .
 JHJ FAD = BAD QTA .
 MHJ FAE = BAE QTA .
 PHJ FAF = BAF QTA .
 SHJ FAG = BAG QTA .
 VHJ FAH = BAH QTA .
 AHJ FAI = BAI QTA .
 DHJ FAJ = BAJ QTA .
 GHJ FAK = BAK QTA .
 JHJ FAL = BAL QTA .
 MHJ FAM = BAM QTA .
 PHJ FAN = BAN QTA .
 SHJ FAO = BAO QTA .
 VHJ FAP = BAP QTA .

Buffer bypass
data path

AHJ FBA = BBA QTB .
 DHJ FBB = BBB QTB .
 GHJ FBC = BBC QTB .
 JHJ FBD = BBD QTB .
 MHJ FBE = BBE QTB .
 PHJ FBF = BBF QTB .
 SHJ FBG = BBG QTB .
 VHJ FBH = BBH QTB .
 AHJ FBI = BBI QTB .
 DHJ FBJ = BBJ QTB .
 GHJ FBK = BBK QTB .
 JHJ FBL = BBL QTB .
 MHJ FBM = BBM QTB .
 PHJ FBN = BBN QTB .
 SHJ FBO = BBO QTB .
 VHJ FBP = BBP QTB .

A4J FCA = BCA QTC .
 D4J FCB = BCB QTC .
 G4J FCC = BCC QTC .
 J4J FCD = BCD QTC .
 M4J FCE = BCE QTC .
 P4J FCF = BCF QTC .
 S4J FCG = BCG QTC .
 V4J FCH = BCH QTC .
 A4J FCI = BCI QTC .
 D4J FCJ = BCJ QTC .
 G4J FCK = BCK QTC .
 J4J FCL = BCL QTC .
 M4J FCM = BCM QTC .
 P4J FCN = BCN QTC .
 S4J FCO = BCO QTC .
 V4J FCP = BCP QTC .

A4J FDA = BDA QTD .
 D4J FDB = BDB QTD .
 G4J FDC = BDC QTD .
 J4J FDD = BDD QTD .
 M4J FDE = BDE QTD .
 P4J FDF = BDF QTD .
 S4J FDG = BDG QTD .
 V4J FDH = BDH QTD .
 A4J FDI = BDI QTD .
 D4J FDJ = BDJ QTD .
 G4J FDK = BDK QTD .
 J4J FDL = BDL QTD .
 M4J FDM = BDM QTD .
 P4J FDN = BDN QTD .
 S4J FDO = BDO QTD .
 V4J FDP = BDP QTD .

Buffer bypass
 data path

BPP GAA = GAA TPA + AAA TPC + GAB TPE .
 EPP GAB = GAB TPA + AAB TPC + GAC TPE .
 HPP GAC = GAC TPA + AAC TPC + GAD TPE .
 KPP GAD = GAD TPA + AAD TPC + GAE TPE .
 NPP GAE = GAE TPA + AAE TPC + GAF TPE .
 QPP GAF = GAF TPA + AAF TPC + GAG TPE .
 TPP GAG = GAG TPA + AAG TPC + GAH TPE .
 WPP GAH = GAH TPA + AAH TPC + GAI TPE .
 BPP GAI = GAI TPA + AAI TPC + GAJ TPE .
 EPP GAJ = GAJ TPA + AAJ TPC + GAK TPE .
 HPP GAK = GAK TPA + AAK TPC + GAL TPE .
 KPP GAL = GAL TPA + AAL TPC + GAM TPE .
 NPP GAM = GAM TPA + AAM TPC + GAN TPE .
 QPP GAN = GAN TPA + AAN TPC + GAO TPE .
 TPP GAO = GAO TPA + AAO TPC + GAP TPE .
 WPP GAP = GAP TPA + AAP TPC + GBA TPE .
 BTP GBA = GBA TPB + ABA TPD + GBB TPF .
 ETP GBB = GBB TPB + ABB TPD + GBC TPF .
 HTP GBC = GBC TPB + ABC TPD + GBD TPF .
 KTP GBD = GBD TPB + ABD TPD + GBE TPF .
 NTP GBE = GBE TPB + ABE TPD + GBF TPF .
 QTP GBF = GBF TPB + ABF TPD + GBG TPF .
 TTP GBG = GBG TPB + ABG TPD + GBH TPF .
 WTP GBH = GBH TPB + ABH TPD + GBI TPF .
 BTP GBI = GBI TPB + ABI TPD + GBJ TPF .
 ETP GBJ = GBJ TPB + ABJ TPD + GBK TPF .
 HTP GBK = GBK TPB + ABK TPD + GBL TPF .
 KTP GBL = GBL TPB + ABL TPD + GBM TPF .
 NTP GBM = GBM TPB + ABM TPD + GBN TPF .
 QTP GBN = GBN TPB + ABN TPD + GBO TPF .
 TTP GBO = GBO TPB + ABO TPD + GBP TPF .
 WTP GBP = GBP TPB + ABP TPD + JQA TPF .

Common memory
 reference address

CFP GCA = GCA tpg + GAA TPG .
 FFP GCB = GCB tpg + GAB TPG .
 IFP GCC = GCC tpg + GAC TPG .
 LFP GCD = GCD tpg + GAD TPG .
 OFP GCE = GCE tpg + GAE TPG .
 RFP GCF = GCF tpg + GAF TPG .
 UFP GCG = GCG tpg + GAG TPG .
 XFP GCH = GCH tpg + GAH TPG .
 CFP GCI = GCI tpg + GAI TPG .
 FFP GCJ = GCJ tpg + GAJ TPG .
 IFP GCK = GCK tpg + GAK TPG .
 LFP GCL = GCL tpg + GAL TPG .
 OFP GCM = GCM tpg + GAM TPG .
 RFP GCN = GCN tpg + GAN TPG .
 UFP GCO = GCO tpg + GAO TPG .
 XFP GCP = GCP tpg + GAP TPG .
 C2P GDA = GDA tpi + GBA TPI .
 F2P GDB = GDB tpi + GBB TPI .
 I2P GDC = GDC tpi + GBC TPI .
 L2P GDD = GDD tpi + GBD TPI .
 O2P GDE = GDE tph + GBE TPH .
 R2P GDF = GDF tph + GBF TPH .
 U2P GDG = GDG tph + GBG TPH .
 X2P GDH = GDH tph + GBH TPH .
 C2P GDI = GDI tpi + GBI TPI .
 F2P GDJ = GDJ tpi + GBJ TPI .
 I2P GDK = GDK tpi + GBK TPI .
 L2P GDL = GDL tpi + GBL TPI .
 O2P GDM = GDM tph + GBM TPH .
 R2P GDN = GDN tph + GBN TPH .
 U2P GDO = GDO tph + GBO TPH .
 X2P GDP = GDP tph + GBP TPH .

C M reference address
 Holding register

BML haa = aaa .
 EML hab = aab .
 HML hac = aac .
 KML had = aad .
 NML hae = aae .
 QML haf = aaf .
 TML hag = aag .
 WML hah = aah .
 BQL hai = aai .
 EQL haj = aaj .
 HQL hak = aak .
 KQL hal = aal .
 NQL ham = aam .
 QQL han = aan .
 TQL hao = aao .
 WQL hap = aap .

Channel data
 1st delay

BML hba = haa .
EML hbb = hab .
HML hbc = hac .
KML hbd = had .
NML hbe = hae .
QML hbf = haf .
TML hbg = hag .
WML hbh = hah .
BQL hbi = hai .
EQL hbj = haj .
HQL hbk = hak .
KQL hbl = hal .
NQL hbm = ham .
QQL hbn = han .
TQL hbo = hao .
WQL hbp = hap .

2nd delay

BML hca = hba .
EML hcb = hbb .
HML hcc = hbc .
KML hcd = hbd .
NML hce = hbe .
QML hcf = hbf .
TML hcg = hbg .
WML hch = hbh .
BQL hci = hbi .
EQL hcj = hbj .
HQL hck = hbk .
KQL hcl = hbl .
NQL hcm = hbm .
QQL hcn = hbn .
TQL hco = hbo .
WQL hcp = hbp .

3rd delay

BML hda = hca .
EML hdb = hcb .
HML hdc = hcc .
KML hdd = hcd .
NML hde = hce .
QML hdf = hcf .
TML hdg = hcg .
WML hdh = hch .
BQL hdi = hci .
EQL hdj = hcj .
HQL hdk = hck .
KQL hdl = hcl .
NQL hdm = hcm .
QQL hdn = hcn .
TQL hdo = hco .
WQL hdp = hcp .

4th delay

DJH JAA = QMA .
DJH JAB = QMA DAA .
DNH JAC = QMA DAA DAB .
DNH JAD = QMA DAA DAB DAC .

Bank
Quad 0

GJH JBA = QMB .
GJH JBB = QMB DBA .
GNH JBC = QMB DBA DBB .
GNH JBD = QMB DBA DBB DBC.

Bank
Quad 1

PJH JCA = QMC .
PJH JCB = QMC DCA .
PNH JCC = QMC DCA DCB .
PNH JCD = QMC DCA DCB DCC .

Bank
Quad 2

SJH JDA = QMD .
SJH JDB = QMD DDA .
SNH JDC = QMD DDA DDB .
SNH JDD = QMD DDA DDB DDC .

Bank
Quad 3

CAH JEA = QME .
FAH JEB = QME lba .
IAH JEC = QME lba lbb .
LAH JED = QME lba lbb lbc .
OAH JEE = QME lba lbb lbc lbd .
RAH JEF = QME lba lbb lbc lbd lbe .
UAH JEG = LBA lbb lbc lbd lbe lbf .

Word length counter

word length = 1

CAH JFA = LAA QMI .
FAH JFB = LAB QMI .
IAH JFC = LAC QMI .
LAH JFD = LAD QMI .
OAH JFE = LAE QMI .
RAH JFF = LAF QMI .

Original word length
and (group counter=0)

XCI JGA = QMG .
XCI JGB = QMG lca .
XCI JGC = QMG lca lcb .
XBH JGD = QMG lca lcb lcc .
XBH JGE = lca lcb lcc lcd .

XNH JGG = laa lab lac lad lae laf .

Group length counter

group length = 0

Word length = 0

BAH JHA = QVA .
EAH JHB = QVA xaa .
HAH JHC = QVA xaa xab .
KAH JHD = QVA xaa xab xac .

Refresh
word decrement

NAH JHE = QVB .
QAH JHF = QVB xae .
TAH JHG = QVB xae xaf .
WAH JHH = QVB xae xaf xag .
KAH JIA = xaa xab xac xad .
WAH JIB = xae xaf xag xah .

Refresh
group decrement

URH JJA = QAB cap cao CAN .

Function pulse

Function control decode

RRH	JKA = cbm cbl cbk cbj .	20
FRH	JKB = cam cal cak CAJ .	21
IRH	JKC = cam cal CAK caj .	22
LRH	JKD = cam cal CAK CAJ .	23
ORH	JKE = cam CAL cak caj .	24
RRH	JKF = cam CAL cak CAJ .	25
URH	JKG = cam CAL CAK caj .	26
XRH	JKH = cam CAL CAK CAJ .	27
FRH	JKI = CAM cbl cbk cbj .	30
IRH	JKJ = CAM cbl cbk CBJ .	31
LRH	JKK = CAM cbl CBK cbj .	32
ORH	JKL = CAM cbl CBK CBJ .	33
C7I	jla = qqd qdd .	Block ch or 23 control
H4I	jlb = qcc qcf qcr .	Function 22 control
K4I	jlc = qdc qdi qdo .	Function 23 control
QUI	jld = qhc quc .	Functions 27,20 control
XWI	jma = qat qaa .	Clear control
XWI	jmb = qat qaa .	Deadstart/channel call
OWH	jna = qcu qgf qhe qbb qea qfa .	Function complete
OWH	jnb = qia qja qka qla .	
X5I	JOA = QHD .	Enable buffer bypass
NHI	job = qcl qdg .	^{BANK} Qd pnter for func 22-3
BLQ	JQA = QAJ gaa qrg + qaj GAA qrg + qaj gaa QRG + QAJ GAA QRG .	
BLQ	jqb = QAJ gaa qrg + qaj GAA qrg + qaj gaa QRG + qaj gaa qrg .	
BXP	KAA = KAA toa + ABA TOA .	Interrupt address
EXP	KAB = KAB toa + ABB TOA .	
HXP	KAC = KAC toa + ABC TOA .	
KXP	KAD = KAD toa + ABD TOA .	
NXP	KAE = KAE toa + ABE TOA .	
QXP	KAF = KAF toa + ABF TOA .	
TXP	KAG = KAG toa + ABG TOA .	
WXP	KAH = KAH toa + ABH TOA .	
BXP	KAI = KAI toa + ABI TOA .	
EXP	KAJ = KAJ toa + ABJ TOA .	
HXP	KAK = KAK toa + ABK TOA .	
KXP	KAL = KAL toa + ABL TOA .	
NXP	KAM = KAM toa + ABM TOA .	
QXP	KAN = KAN toa + ABN TOA .	
TXP	KAO = KAO toa + ABO TOA .	
WXP	KAP = KAP toa + ABP TOA .	

CJP	LAA = LAA tie + AAA TIE .	Original word length
FJP	LAB = LAB tie + AAB TIE .	
IJP	LAC = LAC tie + AAC TIE .	
LJP	LAD = LAD tie + AAD TIE .	
OJP	LAE = LAE tie + AAE TIE .	
RJP	LAF = LAF tie + AAF TIE .	
UJP	LAG = LAG tie + AAG TIE .	
XJP	LAH = LAH tie + AAH TIE .	
CJP	LAI = LAI tie + AAI TIE .	
FJP	LAJ = LAJ tie + AAJ TIE .	
BDM	LBA = LBA jea tif + JEA lba + JFA TIF .	Word counter
EDM	LBB = LBB jeb tif + JEB lbb + JFB TIF .	
HDM	LBC = LBC jec tif + JEC lbc + JFC TIF .	
KDM	LBD = LBD jed tif + JED lbd + JFD TIF .	
NDM	LBE = LBE jee tif + JEE lbe + JFE TIF .	
QDM	LBF = LBF jef tif + JEF lbf + JFF TIF .	
BDM	LBI = LBA jea tif + JEA lba + JFA TIF .	
EDM	LBJ = LBB jeb tif + JEB lbb + JFB TIF .	
HDM	LBK = LBC jec tif + JEC lbc + JFC TIF .	
KDM	LBL = LBD jed tif + JED lbd + JFD TIF .	
NDM	LBM = LBE jee tif + JEE lbe + JFE TIF .	
QDM	LBN = LBF jef tif + JEF lbf + JFF TIF .	
WDM	LCA = LCA jga tig + JGA lca + LAG TIG .	Group counter
XAM	LCB = LCB jgb tig + JGB lcb + LAH TIG .	
WHM	LCC = LCC jgc tig + JGC lcc + LAI TIG .	
XEM	LCD = LCD jgd tig + JGD lcd + LAJ TIG .	
UHL	MAA = IHA .	Common memory
UHL	MAB = IHB .	readout pointer (TD)
UHL	MAC = IHC .	Go bit
UCL	MBA = MAA .	
UCL	MBB = MAB .	
UCL	MBC = MAC .	
UBL	MCA = MBA .	
UBL	MCB = MBB .	
UBL	MCC = MBC .	
TDP	mda = mcc + MCB + MCA .	
TDP	mdb = mcc + MCB + mca .	
THP	mdc = mcc + mcb + MCA .	
THP	mdd = mcc + mcb + mca .	
UBL	MDE = MCC .	
CIP	NAA = PAA TJA + PBA TJB + PCA TJC .	Channel data merge
FIP	NAB = PAB TJA + PBB TJB + PCB TJC .	
IIP	NAC = PAC TJA + PBC TJB + PCC TJC .	
LIP	NAD = PAD TJA + PBD TJB + PCD TJC .	
OIP	NAE = PAE TJA + PBE TJB + PCE TJC .	
RIP	NAF = PAF TJA + PBF TJB + PCF TJC .	
UIP	NAG = PAG TJA + PBG TJB + PCG TJC .	
XIP	NAH = PAH TJA + PBH TJB + PCH TJC .	

Channel data merge

CIP NAI = PAI TJA + PBI TJB + PCI TJC .
 FIP NAJ = PAJ TJA + PBJ TJB + PCJ TJC .
 IIP NAK = PAK TJA + PBK TJB + PCK TJC .
 LIP NAL = PAL TJA + PBL TJB + PCL TJC .
 OIP NAM = PAM TJA + PBM TJB + PCM TJC .
 RIP NAN = PAN TJA + PBN TJB + PCN TJC .
 UIP NAO = PAO TJA + PBO TJB + PCO TJC .
 XIP NAP = PAP TJA + PBP TJB + PCP TJC .

CMP NBA = PDA TJD + BAA TJE + BBA TJF .
 FMP NBB = PDB TJD + BAB TJE + BBB TJF .
 IMP NBC = PDC TJD + BAC TJE + BBC TJF .
 LMP NBD = PDD TJD + BAD TJE + BBD TJF .
 OMP NBE = PDE TJD + BAE TJE + BBE TJF .
 RMP NBF = PDF TJD + BAF TJE + BBF TJF .
 UMP NBG = PDG TJD + BAG TJE + BBG TJF .
 XMP NBH = PDH TJD + BAH TJE + BBH TJF .
 CMP NBI = PDI TJD + BAI TJE + BBI TJF .
 FMP NBJ = PDJ TJD + BAJ TJE + BBJ TJF .
 IMP NBK = PDK TJD + BAK TJE + BBK TJF .
 LMP NBL = PDL TJD + BAL TJE + BBL TJF .
 OMP NBM = PDM TJD + BAM TJE + BBM TJF .
 RMP NBN = PDN TJD + BAN TJE + BBN TJF .
 UMP NBO = PDO TJD + BAO TJE + BBO TJF .
 XMP NBP = PDP TJD + BAP TJE + BBP TJF .

CQP NCA = BCA TJG + BDA TJH + SAA TJI .
 FQP NCB = BCB TJG + BDB TJH + SAB TJI .
 IQP NCC = BCC TJG + BDC TJH + SAC TJI .
 LQP NCD = BCD TJG + BDD TJH + SAD TJI .
 OQP NCE = BCE TJG + BDE TJH + SAE TJI .
 RQP NCF = BCF TJG + BDF TJH + SAF TJI .
 UQP NCG = BCG TJG + BDG TJH + SAG TJI .
 XQP NCH = BCH TJG + BDH TJH + SAH TJI .
 CQP NCI = BCI TJG + BDI TJH + SAI TJI .
 FQP NCJ = BCJ TJG + BDJ TJH + SAJ TJI .
 IQP NCK = BCK TJG + BDK TJH + SAK TJI .
 LQP NCL = BCL TJG + BDL TJH + SAL TJI .
 OQP NCM = BCM TJG + BDM TJH .
 RQP NCN = BCN TJG + BDN TJH .
 UQP NCO = BCO TJG + BDO TJH .
 XQP NCP = BCP TJG + BDP TJH .

CUP NDA = EAA TJJ + EBA TJK + KAA TJL .
 FUP NDB = EAB TJJ + EBB TJK + KAB TJL .
 IUP NDC = EAC TJJ + EBC TJK + KAC TJL .
 LUP NDD = EAD TJJ + EBD TJK + KAD TJL .
 OUP NDE = EAE TJJ + EBE TJK + KAE TJL .
 RUP NDF = EAF TJJ + EBF TJK + KAF TJL .
 UUP NDG = EAG TJJ + EBG TJK + KAG TJL .
 XUP NDH = EAH TJJ + EBH TJK + KAH TJL .
 CUP NDI = EAI TJJ + EBI TJK + KAI TJL .
 FUP NDJ = EAJ TJJ + EBJ TJK + KAJ TJL .
 IUP NDK = EAK TJJ + EBK TJK + KAK TJL .
 LUP NDL = EAL TJJ + EBL TJK + KAL TJL .
 OUP NDM = EAM TJJ + EBM TJK + KAM TJL .
 RUP NDN = EAN TJJ + EBN TJK + KAN TJL .
 UUP NDO = EAO TJJ + EBO TJK + KAO TJL .
 XUP NDP = EAP TJJ + EBP TJK + KAP TJL .

CDL oaa = paa .
FDL oab = pab .
IDL oac = pac .
LDL oad = pad .
ODL oae = pae .
RDL oaf = paf .
UDL oag = pag .
XDL oah = pah .
CDL oai = pai .
FDL oaj = paj .
IDL oak = pak .
LDL oal = pal .
ODL oam = pam .
RDL oan = pan .
UDL oao = pao .
XDL oap = pap .

CLL oba = pba .
FLL obb = pbb .
ILL obc = pbc .
LLL obd = pbd .
OLL obe = pbe .
RLL obf = pbf .
ULL obg = pbg .
XLL obh = pbh .
CLL obi = pbi .
FLL obj = pbj .
ILL obk = pbk .
LLL obl = pbl .
OLL obm = pbm .
RLL obn = pbn .
ULL obo = pbo .
XLL obp = pbp .

CXL oca = pca .
FXL ocb = pcb .
IXL occ = pcc .
LXL ocd = pcd .
OXL oce = pce .
RXL ocf = pcf .
UXL ocg = pcg .
XXL och = pch .
CXL oci = pci .
FXL ocj = pcj .
IXL ock = pck .
LXL ocl = pcl .
OXL ocm = pcm .
RXL ocn = pcn .
UXL oco = pco .
XXL ocp = pcp .

Output data to TB

C8L oda = pda .
F8L odb = pdb .
I8L odc = pdc .
L8L odd = pdd .
O8L ode = pde .
R8L odf = pdf .
U8L odg = pdg .
X8L odh = pdh .
C8L odi = pdi .
F8L odj = pdj .
I8L odk = pdk .
L8L odl = pdl .
O8L odm = pdm .
R8L odn = pdn .
U8L odo = pdo .
X8L odp = pdp .

CDL oea = gca .
FDL oeb = gcb .
IDL oec = gcc .
LDL oed = gcd .
ODL oee = gce .
RDL oef = gcf .
UDL oeg = gcg .
XDL oeh = gch .
CLL oei = gci .
FLL oej = gcj .
ILL oek = gck .
LLL oel = gcl .
OLL oem = gcm .
RLL oen = gcn .
ULL oeo = gco .
XLL oep = gcp .
CXL ofa = gda .
FXL ofb = gdb .
IXL ofc = gdc .
LXL ofd = gdd .
OXL ofe = gde .
RXL off = gdf .
UXL ofg = gdg .
XXL ofh = gdh .
C8L ofi = gdi .
F8L ofj = gdj .
I8L ofk = gdk .
L8L ofl = gdl .
O8L ofm = gdm .
R8L ofn = gdn .
U8L ofo = gdo .
X8L ofp = gdp .

Address to T-
TA/TE

CHP	OGA = LBI + THC .	V length to IB
FHP	ogb = lbj + THC .	
IHP	ogc = lbk + THC .	
LHP	ogd = lbl + THC .	
OHP	oge = lbn + THC .	
RHP	ogf = lbn + THC .	
LNX	OHA = QCC + QCT + QDI + QGC + JLD .	External ref to IB
LHP	OHB = QCC + QCT + QGC .	Read mode to IB
RNX	OHC = QUG QUH + INA QUH + INB QUH + INC QUH .	Block-CPU-Mem-ref
	<i>Set memory busy</i>	during Refresh (to IB)
O4L	OHD = QUG .	Refresh active to
O4L	OHE = QUG .	other processors (EBs)
O4L	OHF = QUG .	
OLL	OHG = *** .	Refresh Enable Dmos
		memory (internal)
CPX	OKA = IKA THA + NAA + NBA + NCA + NDA .	Channel data
FPX	OKB = IKB THA + NAB + NBB + NCB + NDB .	
IPX	OKC = IKC THA + NAC + NBC + NCC + NDC .	
LPX	OKD = IKD THA + NAD + NBD + NCD + NDD .	
OPX	OKE = IKE THA + NAE + NBE + NCE + NDE .	
RPX	OKF = IKF THA + NAF + NBF + NCF + NDF .	
UPX	OKG = IKG THA + NAG + NBG + NCG + NDG .	
XPX	OKH = IKH THA + NAH + NBH + NCH + NDH .	
CTX	OKI = IKI THB + NAI + NBI + NCI + NDI .	
FTX	OKJ = IKJ THB + NAJ + NBJ + NCJ + NDJ .	
ITX	OKK = IKK THB + NAK + NBK + NCK + NDK .	
LTX	OKL = IKL THB + NAL + NBL + NCL + NDL .	
OTX	OKM = IKM THB + NAM + NBM + NCM + NDM .	
RTX	OKN = IKN THB + NAN + NBN + NCN + NDN .	
UTX	OKO = IKO THB + NAO + NBO + NCO + NDO .	
XTX	OKP = IKP THB + NAP + NBP + NCP + NDP .	
CXL	okq = ikq .	Call pulse
XXL	OKR = IKR .	Function pulse
C4P	OKS = jla IKS + QAQ + QDN .	Data pulse
UWX	OKT = IKT + QDA + JNA + JNB + QUF .	Response pulse
	To indicator lights	
L6M	OLA = QAI qsp jmb + QAH .	Function 20,22-3,26,27
FLL	olb = qce .	Function 22
IXL	olc = qco .	
FXL	old = qdd .	Function 23
LOL	ole = qdj .	
U6M	OLF = QGD qad jmb + QGC .	Function 26
X6M	OLG = QHD qaf jmb + QHC .	Function 27
RXL	olh = qud .	Function 20

Buffer readout data

ACX	PAA = RAA TAA + REA TBA + RIA TCA + RMA TDA + FAA .
DCX	PAB = RAB TAA + REB TBA + RIB TCA + RMB TDA + FAB .
GCX	PAC = RAC TAA + REC TBA + RIC TCA + RMC TDA + FAC .
JCX	PAD = RAD TAA + RED TBA + RID TCA + RMD TDA + FAD .
MCX	PAE = RAE TAA + REE TBA + RIE TCA + RME TDA + FAE .
PCX	PAF = RAF TAA + REF TBA + RIF TCA + RMF TDA + FAF .
SCX	PAG = RAG TAA + REG TBA + RIG TCA + RMG TDA + FAG .
VCX	PAH = RAH TAA + REH TBA + RIH TCA + RMH TDA + FAH .
AGX	PAI = RAI TAB + REI TBB + RII TCB + RMI TDB + FAI .
DGX	PAJ = RAJ TAB + REJ TBB + RIJ TCB + RMJ TDB + FAJ .
GGX	PAK = RAK TAB + REK TBB + RIK TCB + RMK TDB + FAK .
JGX	PAL = RAL TAB + REL TBB + RIL TCB + RML TDB + FAL .
MGX	PAM = RAM TAB + REM TBB + RIM TCB + RMM TDB + FAM .
PGX	PAN = RAN TAB + REN TBB + RIN TCB + RMN TDB + FAN .
SGX	PAO = RAO TAB + REO TBB + RIO TCB + RMO TDB + FAO .
VGX	PAP = RAP TAB + REP TBB + RIP TCB + RMP TDB + FAP .
AKX	PBA = RBA TAC + RFA TBC + RJA TCC + RNA TDC + FBA .
DKX	PBB = RBB TAC + RFB TBC + RJB TCC + RNB TDC + FBB .
GKX	PBC = RBC TAC + RFC TBC + RJC TCC + RNC TDC + FBC .
JKX	PBD = RBD TAC + RFD TBC + RJD TCC + RND TDC + FBD .
MKX	PBE = RBE TAC + RFE TBC + RJE TCC + RNE TDC + FBE .
PKX	PBF = RBF TAC + RFF TBC + RJF TCC + RNF TDC + FBF .
SKX	PBG = RBG TAC + RFG TBC + RJG TCC + RNG TDC + FBG .
VKX	PBH = RBH TAC + RFH TBC + RJH TCC + RNH TDC + FBH .
AOX	PBI = RBI TAD + RFI TBD + RJI TCD + RNI TDD + FBI .
DOX	PBJ = RBJ TAD + RFJ TBD + RJJ TCD + RNJ TDD + FBJ .
GOX	PBK = RBK TAD + RFK TBD + RJK TCD + RNK TDD + FBK .
JOX	PBL = RBL TAD + RFL TBD + RJL TCD + RNL TDD + FBL .
MOX	PBM = RBM TAD + RFM TBD + RJM TCD + RNM TDD + FBM .
POX	PBN = RBN TAD + RFN TBD + RJN TCD + RNN TDD + FBN .
SOX	PBO = RBO TAD + RFO TBD + RJO TCD + RNO TDD + FBO .
VOX	PBP = RBP TAD + RFP TBD + RJP TCD + RNP TDD + FBP .
ASX	PCA = RCA TAE + RGA TBE + RKA TCE + ROA TDE + FCA .
DSX	PCB = RCB TAE + RGB TBE + RKB TCE + ROB TDE + FCB .
GSX	PCC = RCC TAE + RGC TBE + RKC TCE + ROC TDE + FCC .
JSX	PCD = RCD TAE + RGD TBE + RKD TCE + ROD TDE + FCD .
MSX	PCE = RCE TAE + RGE TBE + RKE TCE + ROE TDE + FCE .
PSX	PCF = RCF TAE + RGF TBE + RKF TCE + ROF TDE + FCF .
SSX	PCG = RCG TAE + RGG TBE + RKG TCE + ROG TDE + FCG .
VSX	PCH = RCH TAE + RGH TBE + RKH TCE + ROH TDE + FCH .
AWX	PCI = RCI TAF + RGI TBF + RKI TCF + ROI TDF + FCI .
DWX	PCJ = RCJ TAF + RGJ TBF + RKJ TCF + ROJ TDF + FCJ .
GWX	PCK = RCK TAF + RGK TBF + RKK TCF + ROK TDF + FCK .
JWX	PCL = RCL TAF + RGL TBF + RKL TCF + ROL TDF + FCL .
MWX	PCM = RCM TAF + RGM TBF + RKM TCF + ROM TDF + FCM .
PWX	PCN = RCN TAF + RGN TBF + RKN TCF + RON TDF + FCN .
SWX	PCO = RCO TAF + RGO TBF + RKO TCF + ROO TDF + FCO .
VWX	PCP = RCP TAF + RGP TBF + RKP TCF + ROP TDF + FCP .

A3X	PDA = RDA TAG + RHA TBG + RLA TCG + RPA TDG + FDA .	Buffer readout
D3X	PDB = RDB TAG + RHB TBG + RLB TCG + RPB TDG + FDB .	
G3X	PDC = RDC TAG + RHC TBG + RLC TCG + RPC TDG + FDC .	
J3X	PDD = RDD TAG + RHD TBG + RLD TCG + RPD TDG + FDD .	
M3X	PDE = RDE TAG + RHE TBG + RLE TCG + RPE TDG + FDE .	
P3X	PDF = RDF TAG + RHF TBG + RLF TCG + RPF TDG + FDF .	
S3X	PDG = RDG TAG + RHG TBG + RLG TCG + RPG TDG + FDG .	
V3X	PDH = RDH TAG + RHH TBG + RLH TCG + RPH TDG + FDH .	
A7X	PDI = RDI TAH + RHI TBH + RLI TCH + RPI TDH + FDI .	
D7X	PDJ = RDJ TAH + RHJ TBH + RLJ TCH + RPJ TDH + FDJ .	
G7X	PDK = RDK TAH + RHK TBH + RLK TCH + RPK TDH + FDK .	
J7X	PDL = RDL TAH + RHL TBH + RLL TCH + RPL TDH + FDL .	
M7X	PDM = RDM TAH + RHM TBH + RLM TCH + RPM TDH + FDM .	
P7X	PDN = RDN TAH + RHN TBH + RLN TCH + RPN TDH + FDN .	
S7X	PDO = RDO TAH + RHO TBH + RLO TCH + RPO TDH + FDO .	
V7X	PDP = RDP TAH + RHP TBH + RLP TCH + RPP TDH + FDP .	
CSL	qaa = ikq .	Call pulse
XOL	QAB = AAR .	Function pulse
C4P	QAC = IKS .	Data pulse
TSL	QAD = MDE .	<i>+ the write data</i> Gate WD from IB CM data via IA module
NSL	QAE = IJA .	Go write from IB
LXL	QAF = IJB .	End sequence from IB
CWM	QAG = IIA sai saj + IIB saj .	Enter error addr reg
LNX	QAH = QCC + QCT + QDI + QGC + JLD .	
L6M	QAI = QAI qsp jmb + QAH .	
BOP	QAJ = JQB QAI .	
CNP	qak = iia + SAI + SAJ .	Enter new error add
CNP	qal = iib + SAJ .	
qVP	QAM = QAP IKQ .	Int on channel call
CVP	QAN = QAP IKQ + QAM .	
NSL	QAO = JOB .	<i>Bank</i> Qd pnter for func 22-3
C1M	QAP = SAI SAK + SAJ SAL .	Single err/double err
BNL	qaq = qcj .	
X8L	QAT = IMA .	Dead start
FVP	QBA = JKB JJA .	Function 21
F1L	QBB = QBA .	

IVP QCA = JKC JJA .
 HNP QCB = QCA .
 HOL QCC = QCB .
 ERM QCE = QCE qmh jma + QCC + QCT .
 HNP QCF = QCE QMH .
 HEL QCG = QCF .
 HEL QCH = QCG .
 HEL QCI = QCH .
 HOL QCJ = QCI .
 HSP QCK = QCJ + QCN jeg .
 HOL QCL = QCK .
 HOL QCM = QCL .
 HLL QCN = QCM .
 HRM QCO = QCO qac jma + QCN JEG .
 HSP QCP = QCO QAC .
 HLL QCQ = QCP .
 HLL QCR = QCQ .
 HLL QCS = QCR .
 HHP QCT = qmj QCS .
 HHP QCU = QMJ QCS .

Function 22

LVP QDA = JKD JJA .
 KHL QDB = QDA .
 KHL QDC = QDB .
 BRM QDD = QDD qac jma + QDC + QDO .
 KOP QDE = QDD QAC + qmf QDH .
 KHL QDF = QDE .
 KHL QDG = QDF .
 KLL QDH = QDG .
 KOP QDI = QMF QDH .
 KRM QDJ = QDJ qaf jma + QDI .
 KSP QDK = QDJ QAF .
 KLL QDL = QDK .
 KLL QDM = QDL .
 KLL QDN = QDM .
 KNP QDO = QDN qmj .

Function 23

OVP QEA = JKE JJA .
 OIL QEB = QEA .

Function 24

RVP QFA = JJA JKF .
 RVP QFB = QFA .

Function 25

UVP QGA = JKG JJA .
 U1L QGB = QGA .
 U1L QGC = QGB .
 U6M QGD = QGD qad jmb + QGC .
 TRM QGE = QGD QAD .
 TRM QGF = QGD QAD .

Function 26

XVP QHA = JJA JKH .
 X1L QHB = QHA .
 X1L QHC = QHB .
 X6M QHD = QHD qaf jmb + QHC .
 XVP QHE = QHD QAF .

Function 27

FVP	QIA = JKI JJA .	Function 30
F1L	QIB = QIA .	
IVP	QJA = JKJ JJA .	Function 31
I1L	QJB = QJA .	
LVP	QKA = JKK JJA .	Function 32
W7L	QKB = QKA .	
W7L	QKC = QKB .	
WSL	QKD = QKC .	
WOL	QKE = QKC .	
OVP	QLA = JKL JJA .	Function 33
W7L	QLB = QLA .	
W7L	QLC = QLB .	
WSL	QLD = QLC .	
WOL	QLE = QLC .	
DFM	QMA = QPE TQD + MDA .	Buffer reg address
GFM	QMB = QPF TQD + MDB .	advance
PFM	QMC = QPG TQD + MDC .	
SFM	QMD = QPH TQD + MDD .	
TEP	qme = tqd mde .	
TLL	QMF = JEG .	Word length = 1
KSP	QMG = QCP + QDK .	Decrement group cntr
UEP	qmh = qme + jeg .	
WOL	QMI = JGE .	Group counter = 0
WLM	QMJ = QMI + JGE JGG .	Group and word len = 0
NCM	QNA = QPE QDH + MDA .	Buffer register
QCM	QNB = QPF QDH + MDB .	write strobe
TCM	QNC = QPG QDH + MDC .	
WCM	QND = QPH QDH + MDD .	
TSL	qoa = jja .	Go function
TSL	qob = qoa .	
TLL	qoc = qob .	
T4L	QOD = QOB .	
B1M	QPA = QPA tqc + QPD TQA + TQB .	Bank
E1M	QPB = QPB tqc tqb + QPA TQA .	Quadrant pointer
H1M	QPC = QPC tqc tqb + QPB TQA .	
K1M	QPD = QPD tqc tqb + QPC TQA .	
B1M	QPE = QPA tqc + QPD TQA + TQB .	
E1M	QPF = QPB tqc tqb + QPA TQA .	
H1M	QPG = QPC tqc tqb + QPB TQA .	
K1M	QPH = QPD tqc tqb + QPC TQA .	
N1P	QQA = JLB + JLC + QUC .	
UWX	QQB = IKT + QDA + JNA + JNB + QUF .	Response pulse
NSL	QQC = QQB .	
NRM	QQD = QQD qqc jma + QOA .	Block ch during func

BNL QQE = QDH .

Function 23

K7L QRA = QAH .

Delay chain for
functions 20,22-3,26-7

K7L QRB = QRA .

K7L QRC = QRB .

K7L QRD = QRC .

B7L QRE = QRD .

B7L QRF = QRE .

BOP QRG = QRF .

B7L QRH = QRG .

B7L QRI = QRH .

B8L QRJ = QRI .

B8L QRK = QRJ .

B8L QRL = QRK .

B8L QRM = QRL .

C5L QRN = QRM .

C5L QRO = QRN .

C5L QRP = QRO .

C5L QSA = QRP .

E7L QSB = QSA .

E7L QSC = QSB .

E7L QSD = QSC .

E7L QSE = QSD .

E8L QSF = QSE .

E8L QSG = QSF .

E8L QSH = QSG .

E8L QSI = QSH .

F5L QSJ = QSI .

F5L QSK = QSJ .

F5L QSL = QSK .

F5L QSM = QSL .

K8L QSN = QSM .

K8L QSO = QSN .

K8L QSP = QSO .

WEL QTA = JOA .

Buffer bypass enable
for function 27

WEL QTB = JOA .

W1L QTC = JOA .

W1L QTD = JOA .

UVP QUA = JKA JJA .

Function 20

QIL QUB = QUA .

QOP QUC = QUB + QUE .

QRM QUD = QUD qaf jma + QUC .

QSP que = qud + qaf + QVC .

QSP quf = qud + qaf + qvc .

QOP QUG = QUC + QUE + QUD .

RLL QUH = IND .

Refresh enable

QIL QVA = QUC .

Refresh decrement

QEP QVB = QUC JIA .

QEP QVC = JIB JIA .

Buffer register chips

Bank
Quad 0

AAR RAA RAI RBA RBI = WAA WAI WBA WBI ; UAA UAB UAC UAD ; *** VAA .
 DAR RAB RAJ RBB RBJ = WAB WAJ WBB WBJ ; UAA UAB UAC UAD ; *** VAA .
 GAR RAC RAK RBC RBK = WAC WAK WBC WBK ; UAA UAB UAC UAD ; *** VAA .
 JAR RAD RAL RBD RBL = WAD WAL WBD WBL ; UAA UAB UAC UAD ; *** VAA .
 MAR RAE RAM RBE RBM = WAE WAM WBE WBM ; UAE UAF UAG UAH ; *** VAB .
 PAR RAF RAN RBF RBN = WAF WAN WBF WBN ; UAE UAF UAG UAH ; *** VAB .
 SAR RAG RAO RBG RBO = WAG WAO WBG WBO ; UAE UAF UAG UAH ; *** VAB .
 VAR RAH RAP RBH RBP = WAH WAP WBH WBP ; UAE UAF UAG UAH ; *** VAB .
 AQR RCA RCI RDA RDI = WCA WCI WDA WDI ; UAI UAJ UAK UAL ; *** VAC .
 DQR RCB RCJ RDB RDJ = WCB WCJ WDB WDJ ; UAI UAJ UAK UAL ; *** VAC .
 GQR RCC RCK RDC RDK = WCC WCK WDC WDK ; UAI UAJ UAK UAL ; *** VAC .
 JQR RCD RCL RDD RDL = WCD WCL WDD WDL ; UAI UAJ UAK UAL ; *** VAC .
 MQR RCE RCM RDE RDM = WCE WCM WDE WDM ; UAM UAN UAO UAP ; *** VAD .
 PQR RCF RCN RDF RDN = WCF WCN WDF WDN ; UAM UAN UAO UAP ; *** VAD .
 SQR RCG RCO RDG RDO = WCG WCO WDG WDO ; UAM UAN UAO UAP ; *** VAD .
 VQR RCH RCP RDH RDP = WCH WCP WDH WDP ; UAM UAN UAO UAP ; *** VAD .

Bank
Quad 1

AER REA REI RFA RFI = WAA WAI WBA WBI ; UBA UBB UBC UBD ; *** VBA .
 DER REB REJ RFB RFJ = WAB WAJ WBB WBJ ; UBA UBB UBC UBD ; *** VBA .
 GER REC REK RFC RFK = WAC WAK WBC WBK ; UBA UBB UBC UBD ; *** VBA .
 JER RED REL RFD RFL = WAD WAL WBD WBL ; UBA UBB UBC UBD ; *** VBA .
 MER REE REM RFE RFM = WAE WAM WBE WBM ; UBE UBF UBG UBH ; *** VBB .
 PER REF REN RFF RFN = WAF WAN WBF WBN ; UBE UBF UBG UBH ; *** VBB .
 SER REG REO RFG RFO = WAG WAO WBG WBO ; UBE UBF UBG UBH ; *** VBB .
 VER REH REP RFH RFP = WAH WAP WBH WBP ; UBE UBF UBG UBH ; *** VBB .
 AUR RGA RGI RHA RHI = WCA WCI WDA WDI ; UBI UBJ UBK UBL ; *** VBC .
 DUR RGB RGJ RHB RHJ = WCB WCJ WDB WDJ ; UBI UBJ UBK UBL ; *** VBC .
 GUR RGC RGK RHC RHK = WCC WCK WDC WDK ; UBI UBJ UBK UBL ; *** VBC .
 JUR RGD RGL RHD RHL = WCD WCL WDD WDL ; UBI UBJ UBK UBL ; *** VBC .
 MUR RGE RGM RHE RHM = WCE WCM WDE WDM ; UBM UBN UBO UBP ; *** VBD .
 PUR RGF RGN RHF RHN = WCF WCN WDF WDN ; UBM UBN UBO UBP ; *** VBD .
 SUR RGG RGO RHG RHO = WCG WCO WDG WDO ; UBM UBN UBO UBP ; *** VBD .
 VUR RGH RGP RHH RHP = WCH WCP WDH WDP ; UBM UBN UBO UBP ; *** VBD .

Bank
Quad 2

AIR RIA RII RJA RJI = WAA WAI WBA WBI ; UCA UCB UCC UCD ; *** VCA .
 DIR RIB RIJ RJB RJJ = WAB WAJ WBB WBJ ; UCA UCB UCC UCD ; *** VCA .
 GIR RIC RIK RJC RJK = WAC WAK WBC WBK ; UCA UCB UCC UCD ; *** VCA .
 JIR RID RIL RJD RJL = WAD WAL WBD WBL ; UCA UCB UCC UCD ; *** VCA .
 MIR RIE RIM RJE RJM = WAE WAM WBE WBM ; UCE UCF UCG UCH ; *** VCB .
 PIR RIF RIN RJF RJN = WAF WAN WBF WBN ; UCE UCF UCG UCH ; *** VCB .
 SIR RIG RIO RJG RJO = WAG WAO WBG WBO ; UCE UCF UCG UCH ; *** VCB .
 VIR RIH RIP RJH RJP = WAH WAP WBH WBP ; UCE UCF UCG UCH ; *** VCB .
 AIR RKA RKI RLA RLI = WCA WCI WDA WDI ; UCI UCJ UCK UCL ; *** VCC .
 DIR RKB RKJ RLB RLJ = WCB WCJ WDB WDJ ; UCI UCJ UCK UCL ; *** VCC .
 GIR RKC RKK RLC RLK = WCC WCK WDC WDK ; UCI UCJ UCK UCL ; *** VCC .
 JIR RKD RKL RLD RLL = WCD WCL WDD WDL ; UCI UCJ UCK UCL ; *** VCC .
 MIR RKE RKM RLE RLM = WCE WCM WDE WDM ; UCM UCN UCO UCP ; *** VCD .
 PIR RKF RKN RLF RLN = WCF WCN WDF WDN ; UCM UCN UCO UCP ; *** VCD .
 SIR RKG RKO RLG RLO = WCG WCO WDG WDO ; UCM UCN UCO UCP ; *** VCD .
 VIR RKH RKP RLH RLP = WCH WCP WDH WDP ; UCM UCN UCO UCP ; *** VCD .

AMR RMA RMI RNA RNI = WAA WAI WBA WBI ; UDA UDB UDC UDD ; *** VDA .
 DMR RMB RMJ RNB RNJ = WAB WAJ WBB WBJ ; UDA UDB UDC UDD ; *** VDA .
 GMR RMC RMK RNC RNK = WAC WAK WBC WBK ; UDA UDB UDC UDD ; *** VDA .
 JMR RMD RML RND RNL = WAD WAL WBD WBL ; UDA UDB UDC UDD ; *** VDA .
 MMR RME RMM RNE RNM = WAE WAM WBE WBM ; UDE UDF UDG UDH ; *** VDB .
 PMR RMF RMN RNF RNN = WAF WAN WBF WBN ; UDE UDF UDG UDH ; *** VDB .
 SMR RMG RMO RNG RNO = WAG WAO WBG WBO ; UDE UDF UDG UDH ; *** VDB .
 VMR RMH RMP RNH RNP = WAH WAP WBH WBP ; UDE UDF UDG UDH ; *** VDB .
 A5R ROA ROI RPA RPI = WCA WCI WDA WDI ; UDI UDJ UDK UDL ; *** VDC .
 D5R ROB ROJ RPB RPJ = WCB WCJ WDB WDJ ; UDI UDJ UDK UDL ; *** VDC .
 G5R ROC ROK RPC RPK = WCC WCK WDC WDK ; UDI UDJ UDK UDL ; *** VDC .
 J5R ROD ROL RPD RPL = WCD WCL WDD WDL ; UDI UDJ UDK UDL ; *** VDC .
 M5R ROE ROM RPE RPM = WCE WCM WDE WDM ; UDM UDN UDO UDP ; *** VDD .
 P5R ROF RON RPF RPN = WCF WCN WDF WDN ; UDM UDN UDO UDP ; *** VDD .
 S5R ROG ROO RPG RPO = WCG WCO WDG WDO ; UDM UDN UDO UDP ; *** VDD .
 V5R ROH ROP RPH RPP = WCH WCP WDH WDP ; UDM UDN UDO UDP ; *** VDD .

Status register

CKP SAA = SAA TSA + IGA TSC .
 FKP SAB = SAB TSA + IGB TSC .
 IKP SAC = SAC TSA + IGC TSC .
 LKP SAD = SAD TSA + IGD TSC .
 OKP SAE = SAE TSA + IGE TSC .
 RKP SAF = SAF TSA + IGF TSC .
 UKP SAG = SAG TSA + IGG TSC .
 XKP SAH = SAH TSA + IGH TSC .

Syndrome data

CKP SAI = SAI TSA + QAK .
 FKP SAJ = SAJ TSA + QAL .
 IWP SAK = SAK tsb + ABA TSB .
 LWP SAL = SAL tsb + ABB TSB .

1 bit single error
 1 bit double error
 1 bit int single error
 1 bit int double error

BIJ taa = qpa .
 BIJ tab = qpa .
 BIJ tac = qpa .
 BIJ tad = qpa .
 BUJ tae = qpe .
 BUJ taf = qpe .
 BUJ tag = qpe .
 BUJ tah = qpe .

Bank
Output Quad 0

EIJ tba = qpb .
 EIJ tbb = qpb .
 EIJ tbc = qpb .
 EIJ tbd = qpb .
 EUJ tbe = qpf .
 EUJ tbf = qpf .
 EUJ tbg = qpf .
 EUJ tbh = qpf .

Bank
Output Quad 1

HIJ tca = qpc .
HIJ tcb = qpc .
HIJ tcc = qpc .
HIJ tcd = qpc .
HUJ tce = qpg .
HUJ tcf = qpg .
HUJ tcg = qpg .
HUJ tch = qpg .

Output ^{Bank} Quad 2

KIJ tda = qpd .
KIJ tdb = qpd .
KIJ tdc = qpd .
KIJ tdd = qpd .
KUJ tde = qph .
KUJ tdf = qph .
KUJ tdg = qph .
KUJ tdh = qph .

Output ^{Bank} Quad 3

TOJ TEA = QAD .
TOJ TEB = QAD .
TOJ TEC = QAD .
TOJ TED = QAD .

^{write data}
Gate WD from IA
CM data via

BSJ TFA = QQE .
BSJ TFB = QQE .
BSJ TFC = QQE .
BSJ TFD = QQE .

Gate delayed channel
data to WD register
function 23 ^{write data}

ONJ THA = qan qgd .
ONJ THB = qan qgd .
UNI thc = qgd qhd .

Clear channel

M8J TIA = QQA .
M8J TIB = QQA .
M8J TIC = QQA .
M8J TID = QQA .

Disable D terms

FEI tie = qca qda qua .
NUI tif = qqa .
OEI tig = qcb qdb qub .

Gate length counter

NHI tja = qcn .
NHI tjb = qcm .
NLI tjc = qcl .
NLI tjd = qck .
H4I TJE = QJB .
H4I TJF = QJA .
E4I TJG = QIB .
E4I TJH = QIA .
N4I TJI = QEB .
R1I TJJ = QFB .
R1I TJK = QFA .
N4I TJL = QAM .

Gate chan data merge

TNJ	tka = qge .	Gate WD to access reg
TNJ	tkb = qge .	
TNJ	tkc = qge .	
TNJ	tkd = qge .	
WRJ	tla = qld .	
WRJ	tlb = qld .	
WRJ	tlc = qkd .	
WRJ	tld = qkd .	
WNJ	TMA = qle qge .	Hold data access reg
WNJ	TMB = qle qge .	
WNJ	TMC = qke qge .	
WNJ	TMD = qke qge .	
CRI	tna = qag .	Enter error add reg
CRI	tnb = qag .	
FNI	TOA = QBB .	
LLJ	TPA = qai qod .	Hold reference address
LLJ	TPB = qai qod .	
IEJ	TPC = QOC .	Gate reference address
IEJ	TPD = QOC .	
LLJ	TPE = QAI .	
LLJ	TPF = QAI .	
LEJ	tpg = qah .	Gate reference add to
LEJ	tph = qah .	holding register
LEJ	tpi = qah .	
LEJ	tpj = qah .	
NUI	tqa = qao qae .	<i>Bank</i>
NUI	tqb = qqa .	Quadrant pointer
QUI	tqc = qao qae qhc .	
TUI	tqd = qao qae .	
FNI	TSA = qak qal qba .	Clear "S"
FEI	tsb = qba .	
FNI	tsc = qak qal .	
QNI	TTA = QUB .	Clear counter
JBL	uaa = daa .	Buffer address slaves
JBL	uab = dab .	Quad 0
JBL	uac = dac .	<i>Bank</i>
JBL	uad = dad .	
MBL	uae = daa .	
MBL	uaf = dab .	
MBL	uag = dac .	
MBL	uah = dad .	
JFL	uai = daa .	
JFL	uaj = dab .	
JFL	uak = dac .	
JFL	ual = dad .	
MFL	uam = daa .	
MFL	uan = dab .	
MFL	uao = dac .	
MFL	uap = dad .	

JJL uba = dba .
JJL ubb = dbb .
JJL ubc = dbc .
JJL ubd = dbd .
MJL ube = dba .
MJL ubf = dbb .
MJL ubg = dbc .
MJL ubh = dbd .
JNL ubi = dba .
JNL ubj = dbb .
JNL ubk = dbc .
JNL ubl = dbd .
MNL ubm = dba .
MNL ubn = dbb .
MNL ubo = dbc .
MNL ubp = dbd .

Bank
quad 1

JRL uca = dca .
JRL ucb = dcb .
JRL ucc = dcc .
JRL ucd = dcd .
MRL uce = dca .
MRL ucf = dcb .
MRL ucg = dcc .
MRL uch = dcd .
JVL uci = dca .
JVL ucj = dcb .
JVL uck = dcc .
JVL ucl = dcd .
MVL ucm = dca .
MVL ucn = dcb .
MVL uco = dcc .
MVL ucp = dcd .

Bank
quad 2

J2L uda = dda .
J2L udb = ddb .
J2L udc = ddc .
J2L udd = ddd .
M2L ude = dda .
M2L udf = ddb .
M2L udg = ddc .
M2L udh = ddd .
J6L udi = dda .
J6L udj = ddb .
J6L udk = ddc .
J6L udl = ddd .
M6L udm = dda .
M6L udn = ddb .
M6L udo = ddc .
M6L udp = ddd .

Bank
quad 3

ABL vaa = qna .
VBL vab = qna .
ARL VAC = QNA .
VRL VAD = QNA .

Write strobe
Quad 0
Bank

AFL vba = qnb .
VFL vbb = qnb .
AVL VBC = QNB .
VVL VBD = QNB .

Quad 1
Bank

AJL vca = qnc .
VJL vcb = qnc .
A2L VCC = QNC .
V2L VCD = QNC .

Quad 2
Bank

ANL vda = qnd .
VNL vdb = qnd .
A6L VDC = QND .
V6L VDD = QND .

Quad 3
Bank

BGP WAA = IAA TEA + HAA TFA .
EGP WAB = IAB TEA + HAB TFA .
HGP WAC = IAC TEA + HAC TFA .
KGP WAD = IAD TEA + HAD TFA .
NGP WAE = IAE TEA + HAE TFA .
QGP WAF = IAF TEA + HAF TFA .
TGP WAG = IAG TEA + HAG TFA .
WGP WAH = IAH TEA + HAH TFA .
BGP WAI = IAI TEA + HAI TFA .
EGP WAJ = IAJ TEA + HAJ TFA .
HGP WAK = IAK TEA + HAK TFA .
KGP WAL = IAL TEA + HAL TFA .
NGP WAM = IAM TEA + HAM TFA .
QGP WAN = IAN TEA + HAN TFA .
TGP WAO = IAO TEA + HAO TFA .
WGP WAP = IAP TEA + HAP TFA .

Buffer write data

BKP WBA = IBA TEB + HBA TFB .
EKP WBB = IBB TEB + HBB TFB .
HKP WBC = IBC TEB + HBC TFB .
KKP WBD = IBD TEB + HBD TFB .
NKP WBE = IBE TEB + HBE TFB .
QKP WBF = IBF TEB + HBF TFB .
TKP WBG = IBG TEB + HBG TFB .
WKP WBH = IBH TEB + HBH TFB .
BKP WBI = IBI TEB + HBI TFB .
EKP WBJ = IBJ TEB + HBJ TFB .
HKP WBK = IBK TEB + HBK TFB .
KKP WBL = IBL TEB + HBL TFB .
NKP WBM = IBM TEB + HBM TFB .
QKP WBN = IBN TEB + HBN TFB .
TKP WBO = IBO TEB + HBO TFB .
WKP WBP = IBP TEB + HBP TFB .

BWP WCA = ICA TEC + HCA TFC .
 EWP WCB = ICB TEC + HCB TFC .
 HWP WCC = ICC TEC + HCC TFC .
 KWP WCD = ICD TEC + HCD TFC .
 NWP WCE = ICE TEC + HCE TFC .
 QWP WCF = ICF TEC + HCF TFC .
 TWP WCG = ICG TEC + HCG TFC .
 WWP WCH = ICH TEC + HCH TFC .
 BWP WCI = ICI TEC + HCI TFC .
 EWP WCJ = ICJ TEC + HCJ TFC .
 HWP WCK = ICK TEC + HCK TFC .
 KWP WCL = ICL TEC + HCL TFC .
 NWP WCM = ICM TEC + HCM TFC .
 QWP WCN = ICN TEC + HCN TFC .
 TWP WCO = ICO TEC + HCO TFC .
 WWP WCP = ICP TEC + HCP TFC .

Buffer write data

B3P WDA = IDA TED + HDA TFD .
 E3P WDB = IDB TED + HDB TFD .
 H3P WDC = IDC TED + HDC TFD .
 K3P WDD = IDD TED + HDD TFD .
 N3P WDE = IDE TED + HDE TFD .
 Q3P WDF = IDF TED + HDF TFD .
 T3P WDG = IDG TED + HDG TFD .
 W3P WDH = IDH TED + HDH TFD .
 B3P WDI = IDI TED + HDI TFD .
 E3P WDJ = IDJ TED + HDJ TFD .
 H3P WDK = IDK TED + HDK TFD .
 K3P WDL = IDL TED + HDL TFD .
 N3P WDM = IDM TED + HDM TFD .
 Q3P WDN = IDN TED + HDN TFD .
 T3P WDO = IDO TED + HDO TFD .
 W3P WDP = IDP TED + HDP TFD .

ADM XAA = XAA tta jha + xaa JHA .
 DDM XAB = XAB tta jhb + xab JHB .
 GDM XAC = XAC tta jhc + xac JHC .
 JDM XAD = XAD tta jhd + xad JHD .
 MDM XAE = XAE tta jhe + xae JHE .
 PDM XAF = XAF tta jhf + xaf JHF .
 SDM XAG = XAG tta jhg + xag JHG .
 VDM XAH = XAH tta jhh + xah JHH .

Refresh counter

KJW ZYA = IZZ / izz .
 NJW ZYA = IZZ / izz .
 KJW ZYB = IZZ / izz .
 NJW ZYB = IZZ / izz .
 KJW ZYC = IZZ / izz .
 NJW ZYC = IZZ / izz .
 KJW ZYD = IZZ / izz .
 NJW ZYD = IZZ / izz .
 KJW ZYE = IZZ / izz .
 NJW ZYE = IZZ / izz .
 KJW ZYF = IZZ / izz .
 NJW ZYF = IZZ / izz .

BBW	ZZA = ZYA / zya .
EBW	ZZA = ZYA / zya .
HBW	ZZA = ZYA / zya .
KBW	ZZA = ZYA / zya .
NBW	ZZA = ZYA / zya .
QBW	ZZA = ZYA / zya .
TBW	ZZA = ZYA / zya .
WBW	ZZA = ZYA / zya .
BFW	ZZB = ZYB / zyb .
EFW	ZZB = ZYB / zyb .
HFW	ZZB = ZYB / zyb .
KFW	ZZB = ZYB / zyb .
NFW	ZZB = ZYB / zyb .
QFW	ZZB = ZYB / zyb .
TFW	ZZB = ZYB / zyb .
WFW	ZZB = ZYB / zyb .
BJW	ZZC = ZYC / zyc .
EJW	ZZC = ZYC / zyc .
HJW	ZZC = ZYC / zyc .
QJW	ZZC = ZYC / zyc .
TJW	ZZC = ZYC / zyc .
WJW	ZZC = ZYC / zyc .
BVW	ZZD = ZYD / zyd .
EVW	ZZD = ZYD / zyd .
HVW	ZZD = ZYD / zyd .
KVW	ZZD = ZYD / zyd .
QVW	ZZD = ZYD / zyd .
TVW	ZZD = ZYD / zyd .
WVW	ZZD = ZYD / zyd .
B2W	ZZE = ZYE / zye .
E2W	ZZE = ZYE / zye .
H2W	ZZE = ZYE / zye .
K2W	ZZE = ZYE / zye .
N2W	ZZE = ZYE / zye .
Q2W	ZZE = ZYE / zye .
T2W	ZZE = ZYE / zye .
W2W	ZZE = ZYE / zye .
B6W	ZZF = ZYF / zyf .
E6W	ZZF = ZYF / zyf .
H6W	ZZF = ZYF / zyf .
K6W	ZZF = ZYF / zyf .
N6W	ZZF = ZYF / zyf .
Q6W	ZZF = ZYF / zyf .
T6W	ZZF = ZYF / zyf .
W6W	ZZF = ZYF / zyf .
CRI	ZZO = *** .
E4I	ZZO = *** .
I5I	ZZO = *** .
K4I	ZZO = *** .
N4I	ZZO = *** .
R1I	ZZO = *** .
TUI	ZZO = *** .
XWI	ZZO = *** .

AAR RAA RAI RBA RBI	ABL vaa --- ---	ACX PAA --- ---	ADM XAA --- ---	BAH JHA --- ---	BBW ZZA ZZA ZZA ZZA	---	BDM LBA LBI ---	CAH JEA JFA ---	---	---	CDL oaa oai oea ---
AER REA REI RFA RFI	AFL vba --- ---	AGX PAI --- ---	AHJ FAA FAI FBA FBI	---	BFW ZZB ZZB ZZB ZZB	BGP WAA WAI ---	---	---	CFP GCA GCI ---	OGP EAA EAI ---	CHP OGA --- ---
AIR RIA RII RJA RJI	AJL vca --- ---	AKX PBA --- ---	ALP baa bai ---	BLJ taa tab tac tad	BJW ZZC ZCZ ZZC ZCZ	BKP WBA WBI ---	BLQ JQA jqb ---	CIP NAA NAI ---	CJP LAA LAI ---	CKP SAA SAI ---	CLL oba obi oei ---
AMR RMA RMI RNA RNI	ANL vda --- ---	AOX PBI --- ---	APP bba bbi ---	BML haa hba hca hda	BNL QQE qaq ---	BOP QAJ QRG ---	BPP GAA GAI ---	CMP NBA NBI ---	CNP qak qal ---	COL aaa aba abi ---	CPX OKA --- ---
AQR RCA RCI RDA RDI	ARL VAC --- ---	ASX PCA --- ---	ATP bca bci ---	BQL hai hbi hci hdi	BRM QDD --- ---	BSJ TFA TFB TFC TFD	BTP GBA GBI ---	CQP NCA NCI ---	CRI tna tnb zzo ---	CSL aai qaa ---	CTX OKI --- ---
AUR RGA RGI RHA RHI	AVL VBC --- ---	AWX PCI --- ---	AXP bda bdi ---	BUJ tae taf tag tah	BVW ZZD ZZD ZZD ZZD	BWP WCA WCI ---	BXP KAA KAI ---	CUP NDA NDI ---	CVP QAM QAN ---	CWM QAG --- ---	CXL oca oci ofa okq
A1R RKA RKI RLA RLI	A2L VCC --- ---	A3X PDA --- ---	A4J FCA FCI FDA FDI	B1M QPA QPE ---	B2W ZZE ZZE ZZE ZZE	B3P WDA WDI ---	---	C1M QAP --- ---	C2P GDA GDI ---	C3P EBA EBI ---	C4P QAC OKS ---
A5R ROA ROI RPA RPI	A6L VDC --- ---	A7X PDI --- ---	---	---	B6W ZZF ZZF ZZF ZZF	B7L QRE QRF QRH QRI	B8L QRJ QRK QRL QRM	C5L QRN QRO QRP QSA	---	C7I jla --- ---	C8L oda odi ofi ---

DAR	---	DCX	DDM	EAH	EBW	---	EDM	FAH	---	---	FDL
RAB RAJ	---	PAB ---	XAB ---	JHB ---	ZZA ZZA	---	LBB LBJ	JEB JFB	---	---	oab oaj
RBB RBJ	---	---	---	---	ZZA ZZA	---	---	---	---	---	oeb ---
DER	DFM	DGX	DHJ	---	EFW	EGP	---	FEI	FFP	FGP	FHP
REB REJ	QMA ---	PAJ ---	FAB FAJ	---	ZZB ZZB	WAB WAJ	---	tie ---	GCB GCJ	EAB EAJ	ogb ---
RFB RFJ	---	---	FBB FBJ	---	ZZB ZZB	---	---	tsb ---	---	---	---
DIR	DJH	DKX	DLP	ELJ	EJW	EKP	---	FIP	FJP	FKP	FLL
RIB RLJ	JAA JAB	PBB ---	bab baj	tba tbb	ZZC ZYC	WBB WBJ	---	NAB NAJ	LAB LAJ	SAB SAJ	obb obj
RJB RJJ	---	---	---	tbc tbd	ZZC ZYC	---	---	---	---	---	oej olb
DMR	DNH	DOX	DPP	EML	---	---	EPP	FMP	FNI	FOL	FPX
RMB RMJ	JAC JAD	PBJ ---	bbb bbj	hab hbb	---	---	GAB GAJ	NBB NBJ	TSA TOA	aab abb	OKB ---
RNB RNJ	---	---	---	hcb hdb	---	---	---	---	tsc ---	abj ---	---
DQR	DRM	DSX	DTP	EQL	ERM	---	ETP	FQP	FRH	FSM	FTX
RCB RCJ	DAA ---	PCB ---	bcj bcj	haj hbj	QCE ---	---	GBB GBJ	NCB NCJ	JKB JKI	aaaj caj	OKJ ---
RDB RDJ	---	---	---	hcj hdj	---	---	---	---	---	cbj ---	---
DUR	DVM	DWX	DXP	EUJ	EVW	EWP	EXP	FUP	FVP	---	FXL
RGB RGJ	DAB ---	PCJ ---	bdb bdj	tbe tbf	ZZD ZYD	WCB WCJ	KAB KAJ	NDB NDJ	QBA QIA	---	ocb ocj
RHB RHJ	---	---	---	tbg tbh	ZZD ZYD	---	---	---	---	---	ofb old
D1R	D2M	D3X	D4J	E1M	E2W	E3P	E4I	F1L	F2P	F3P	---
RKB RKJ	DAC ---	PDB ---	FCB FCJ	QPB QPF	ZZE ZZE	WDB WDJ	TJG TJH	QBB QIB	GDB GDJ	EBB EBJ	---
RLB RLJ	---	---	FDB FDJ	---	ZZE ZZE	---	zzo ---	---	---	---	---
D5R	D6M	D7X	---	---	E6W	E7L	E8L	F5L	---	---	F8L
ROB ROJ	DAD ---	PDJ ---	---	---	ZZF ZZF	QSB QSC	QSF QSG	QSJ QSK	---	---	odb odj
RPB RPJ	---	---	---	---	ZZF ZZF	QSD QSE	QSH QSI	QSL QSM	---	---	ofj ---

GAR	---	GCX	GDM	HAH	HBW	---	HDM	IAH	---	---	IDL
RAC RAK	---	PAC ---	XAC ---	JHC ---	ZZA ZZA	---	LBC LBK	JEC JFC	---	---	oac oak
RBC RBK	---	---	---	---	ZZA ZZA	---	---	---	---	---	oec ---
GER	GFM	GGX	GHJ	HEL	HFW	HGP	HHP	IEJ	IFP	IGP	IHP
REC REK	QMB ---	PAK ---	FAC FAK	QCG QCH	ZZB ZZB	WAC WAK	QCT QCU	TPC TPD	GCC GCK	EAC EAK	ogc ---
RFC RFK	---	---	FBC FBK	QCI ---	ZZB ZZB	---	---	---	---	---	---
GIR	GJH	GKX	GLP	HLJ	HJW	HKP	HLL	IIP	IJP	IKP	ILL
RIC RIK	JBA JBB	PBC ---	bac bak	tca tcb	ZZC ZYC	WBC WBK	QQQ QCR	NAC NAK	LAC ---	SAC ---	obc obk
RJC RJK	---	---	---	tcc tod	ZZC ZYC	---	QCS QCN	---	---	---	oek ---
GMR	GNH	GOX	GPP	HML	HNP	HOL	HPP	IMP	---	IOL	IPX
RMC RMK	JBC JBD	PBK ---	bbc bbk	hac hbc	QCB QCF	QCC QCJ	GAC GAK	NBC NBK	---	aac abc	OKC ---
RNC RNK	---	---	---	hcc hdc	---	QCL QCM	---	---	---	abk ---	---
GQR	GRM	GSX	GTP	HQL	HRM	HSP	HTP	IQP	IRH	ISM	ITX
RCC RCK	DBA ---	PCC ---	bcc bck	hak hbk	QOO ---	QCK QCP	GBC GBK	NOC NCK	JKC JKJ	aak cak	OKK ---
RDC RDK	---	---	---	hck hdk	---	---	---	---	---	cbk ---	---
GUR	GVM	GWX	GXP	HUJ	HVW	HWP	HXP	IUP	IVP	IWP	IXL
RGC RGK	DBB ---	PCK ---	bdc bdk	tce tcf	ZZD ZZD	WCC WCK	KAC KAK	NDC NDK	QCA QJA	SAK ---	occ ock
RHC RHK	---	---	---	tog tch	ZZD ZZD	---	---	---	---	---	ofc olc
G1R	G2M	G3X	G4J	HIM	H2W	H3P	H4I	I1L	I2P	I3P	---
RKC RKK	DBC ---	PDC ---	FCC FCK	QPC QPG	ZZE ZZE	WDC WDK	jlb TJE	QJB ---	GDC GDK	EBC EBK	---
RLC RLK	---	---	FDC FDK	---	ZZE ZZE	---	TJF ---	---	---	---	---
G5R	G6M	G7X	---	---	H6W	---	---	I5I	---	---	I8L
ROC ROK	DBD ---	PDK ---	---	---	ZZF ZZF	---	---	ZZO ---	---	---	odc odk
RPC RPK	---	---	---	---	ZZF ZZF	---	---	---	---	---	ofk ---

JAR RAD RAL RBD RBL	JBL uaa uab uac uad	JCX PAD --- --- ---	JDM XAD --- --- ---	KAH JHD JIA --- ---	KBW ZZA ZZA ZZA ZZA	--- --- --- --- ---	KDM LBD LBL --- ---	LAH JED JFD --- ---	--- --- --- --- ---	--- --- --- --- ---	LDL oad oal oed ---
JER RED REL RFD RFL	JFL uai uaj uak ual	JGX PAL --- --- ---	JHJ FAD FAL FBD FBL	--- --- --- --- ---	KFW ZZB ZZB ZZB ZZB	KGP WAD WAL --- ---	KHL QDB QDC QDF QDG	LEJ tpi tpj tpg tph	LFP GCD GCL --- ---	LGP EAD EAL --- ---	LHP ogd OHB --- ---
JIR RID RIL RJD RJL	JJL uba ubb ubc ubd	JKX PBD --- --- ---	JLP bad bal --- ---	KIJ tda tdb tdc tdd	KJW ZYB ZYC ZYF ZYD	KKP WBD WBL --- ---	KLL QDH QDL QDM QDN	LIP NAD NAL --- ---	LJP LAD --- --- ---	LKP SAD --- --- ---	LLL obd obl oel ---
JMR RMD RML RND RNL	JNL ubi ubj ubk ubl	JOX PBL --- --- ---	JPP bbd bbl --- ---	KML had hbd hcd hdd	KNP QDO --- --- ---	KOP QDE QDI --- ---	KPP GAD GAL --- ---	LMP NBD NBL --- ---	LNK QAH OHA --- ---	LOL aad abd abl ole	LPX OKD --- --- ---
JQR RCD RCL RDD RDL	JRL uca ucb ucc ucd	JSX PCD --- --- ---	JTP bod bcl --- ---	KQL hal hbl hcl hdl	KRM QDJ --- --- ---	KSP QDK QMG --- ---	KTP GBD GBL --- ---	LQP NCD NCL --- ---	LRH JKD JKK --- ---	LSM aal cal cbl ---	LTX OKL --- --- ---
JUR RGD RGL RHD RHL	JVL uci ucj uck ucl	JWX PCL --- --- ---	JXP bdd bdl --- ---	KUJ tde tdf tdg tdh	KVW ZZD ZZD ZZD ZZD	KWP WCD WCL --- ---	KXP KAD KAL --- ---	LUP NDD NDL --- ---	LVP QDA QKA --- ---	LWP SAL --- --- ---	LXL ood ocl ofd QAF
J1R RKD RKL RLD RLL	J2L uda udb udc udd	J3X PDD --- --- ---	J4J FCD FCL FDD FDL	K1M QPD QPH --- ---	K2W ZZE ZZE ZZE ZZE	K3P WDD WDL --- ---	K4I jlc zzo --- ---	LLJ TPE TPF TPA TPB	L2P GDD GDL --- ---	L3P EBD EBL --- ---	--- --- --- --- ---
J5R ROD ROL RPD RPL	J6L udi udj udk udl	J7X PDL --- --- ---	--- --- --- --- ---	--- --- --- --- ---	K6W ZZF ZZF ZZF ZZF	K7L QRA QRB QRC QRD	K8L QSN QSO QSP ---	--- --- --- --- ---	L6M QAI OLA --- ---	--- --- --- --- ---	L8L odd odl ofl ---

MAR	MBL	MCX	MDM	NAH	NBW	NCM	NDM	OAH	---	---	ODL
RAE RAM	uae uaf	PAE ---	XAE ---	JHE ---	ZZA ZZA	QNA ---	LBE LBM	JEE JFE	---	---	oea oam
RBE REM	uag uah	---	---	---	ZZA ZZA	---	---	---	---	---	oee ---
MER	MFL	MGX	MHJ	---	NFW	NGP	NHI	OEI	OFP	OGP	OHP
REE REM	uam uan	PAM ---	FAE FAM	---	ZZB ZZB	WAE WAM	tja tjb	tig ---	GCE GCM	EAE EAM	oge ---
RFE RFM	uao uap	---	FBE FBM	---	ZZB ZZB	---	job ---	---	---	---	---
MIR	MJL	MKX	MLP	---	NJW	NKP	NLI	OIP	OJP	OKP	OLL
RIE RIM	ube ubf	PBE ---	bae bam	---	ZYB ZYC	WBE WBM	tjc tjd	NAE NAM	LAE ---	SAE ---	obe obm
RJE RJM	ubg ubh	---	---	---	ZYF ZYD	---	---	---	---	---	oem OHG
MMR	MNL	MOX	MPP	NML	---	---	NPP	OMP	ONJ	OOL	OPX
RME RMM	ubm ubn	PBM ---	bbe bbm	hae hbe	---	---	GAE GAM	NBE NBM	THA THB	aae abe	OKE ---
RNE RNM	ubo ubp	---	---	hce hde	---	---	---	---	---	abm ---	---
MQR	MRL	MSX	MTP	NQL	NRM	NSL	NTP	OQP	ORH	OSM	OTX
RCE RCM	uce ucf	PCE ---	bce bcm	ham hbm	---	QAE QAO	GBE GBM	NCE NCM	JKE JKL	aam cam	OKM ---
RDE RDM	ucg uch	---	---	hcm hdm	QOD ---	QOC ---	---	---	---	cbm ---	---
MUR	MVL	MWX	MXP	NUI	---	NWP	NXP	OUP	OVP	OWH	OXL
RGE RGM	ucm ucn	PCM ---	bde bdm	tqa tqb	---	WCE WCM	KAE KAM	NDE NDM	QEA QLA	jna jnb	oce ocm
RHE RHM	uco ucp	---	---	tif ---	---	---	---	---	---	---	ofe ---
MLR	M2L	M3X	M4J	N1P	N2W	N3P	N4I	O1L	O2P	O3P	O4L
RKE RKM	ude udf	PDE ---	FCE FCM	QQA ---	ZZE ZZE	WDE WDM	TJI TJL	QEB ---	GDE GDM	EBE EBM	OHD OHE
RLE RLM	udg udh	---	FDE FDM	---	ZZE ZZE	---	zzo ---	---	---	---	OHF ---
M5R	M6L	M7X	M8J	---	N6W	---	---	---	---	---	O8L
ROE ROM	udm udn	PDM ---	TIA TIB	---	ZZF ZZF	---	---	---	---	---	ode odm
RPE RPM	udo udp	---	TIC TID	---	ZZF ZZF	---	---	---	---	---	ofm ---

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PAR RAF RAN RBF REN	--- --- ---	PCX PAF ---	PDM XAF ---	QAH JHF ---	QBW ZZA ZZA ZZA ZZA	QCM QNB ---	QDM LBF LBN	RAH JEF JFF	--- --- ---	--- --- ---	RDL oaf oan oef ---
PER REF REN RFF RFN	PFM QMC ---	PGX PAN ---	PHJ FAF FAN FBF FBN	QEP QVB QVC	QFW ZZB ZZB ZZB ZZB	QGP WAF WAN	---	--- --- ---	RFP GCF GCN	RGP EAF EAN	RHP ogf ---
PIR RIF RIN RJF RJN	PJH JCA JCB	PKX PBF ---	PLP baf ban	QIL QVA QUB	QJW ZZC ZCZ ZZC ZCZ	QKP WBF WBN	---	RIP NAF NAN	RJP LAF ---	RKP SAF ---	RLL obf obn oen QUH
PMR RMF RMN RNF RNN	PNH JCC JCD	POX PEN ---	PPP bbf bbn	QML haf hbf hcf hdf	QNI TTA ---	QOP QUC QUG	QPP GAF GAN	RMP NBF NBN	RNX OHC ---	ROL aaf abf abn ---	RFX OKF ---
PQR RCF RCN RDF RDN	PRM DCA ---	PSX PCF ---	PTP bcf bcn	QQL han hbn hcn hdn	QRM QUD ---	QSP que quf	QTP GBF GBN	RQP NCF NCN	RRH JKF JKA	RSM aan can	RTX OKN ---
PUR RGF RGN RHF RHN	PVM DCB ---	PWX PCN ---	PXP bdf bdn	QUI tqc jld	QVW ZZD ZZD ZZD ZZD	QWP WCF WCN	QXP KAF KAN	RUP NDF NDN	RVP QFA QFB	---	RXL ocf ocn off olh
P1R RKF RKN RLF RLN	P2M DCC ---	P3X PDF ---	P4J FCF FCN FDF FDN	---	Q2W ZZE ZZE ZZE ZZE	Q3P WDF WDN	---	R1I TJJ TJK ZZO ---	R2P GDF GDN	R3P EBF EBN	---
P5R ROF RON RPF RPN	P6M DCD ---	P7X PDN ---	---	---	Q6W ZZF ZZF ZZF ZZF	---	---	---	---	---	R8L odf odn ofn ---

VAR RAH RAP RBH RBP	VBL vab --- --- ---	VCX PAH --- --- ---	VDM XAH --- --- ---	WAH JHH JIB --- ---	WEW ZZA ZZA ZZA ZZA	WCM QND --- --- ---	WDM LCA --- --- ---	XAM LCB --- --- ---	XBH JGD JGE --- ---	XCI JGC JGB JGA ---	XDL oah oap oeh ---
VER REH REP RFH RFP	VFL vbb --- --- ---	VGX PAP --- --- ---	VHJ FAH FAP FBH FBP	WEL QTA QTB --- ---	WFW ZZB ZZB ZZB ZZB	WGP WAH WAP --- ---	WHM LCC --- --- ---	XEM LCD --- --- ---	XFP GCH GCP --- ---	XGP EAH EAP --- ---	--- --- --- --- ---
VIR RIH RIP RJH RJP	VJL vcb --- --- ---	VKX PBH --- --- ---	VLP bah bap --- ---	--- --- --- --- ---	WJW ZZC ZCZ ZZC ZCZ	WKP WBH WBP --- ---	WLM QMJ --- --- ---	XIP NAH NAP --- ---	XJP LAH --- --- ---	XKP SAH --- --- ---	XLL obh obp oep ---
VMR RMH RMP RNH RNP	VNL vdb --- --- ---	VOX PBP --- --- ---	VPP bbh bbp --- ---	WML hah hbh hch hdh	WNJ TMA TMB TMC TMD	WOL QLE QMI --- QKE	WPP GAH GAP --- ---	XMP NBH NBP --- ---	XNH JGG --- --- ---	XOL aah abh aar QAB	XPX OKH --- --- ---
VQR RCH RCP RDH RDP	VRL VAD --- --- ---	VSX PCH --- --- ---	VTP bch bcp --- ---	WQL hap hbp hcp hdp	WRJ tla tlb tlc tld	WSL QKD QLD --- ---	WTP GBH GBP --- ---	XQP NCH NCP --- ---	XRH JKH --- --- ---	XSL aap cap abp ---	XTX OKP --- --- ---
VUR RGH RGP RHH RHP	VVL VBD --- --- ---	VWX PCP --- --- ---	VXP bdh bdp --- ---	--- --- --- --- ---	WW ZZD ZZD ZZD ZZD	WWP WCH WCP --- ---	WXP KAH KAP --- ---	XUP NDH NDP --- ---	XVP QHA QHE --- ---	XWI jma zzo jmb ---	XXL och ocp ofh OKR
V1R RKH RKP RLH RLP	V2L VCD --- --- ---	V3X PDH --- --- ---	V4J FCH FCP FDH FDP	W1L QTC QTD --- ---	W2W ZZE ZZE ZZE ZZE	W3P WDH WDP --- ---	--- --- --- --- ---	X1L QHB QHC --- ---	X2P GDH GDP --- ---	X3P EBH EBP --- ---	--- --- --- --- ---
V5R ROH ROP RPH RPP	V6L VDD --- --- ---	V7X PDP --- --- ---	--- --- --- --- ---	--- --- --- --- ---	W6W ZZF ZZF ZZF ZZF	W7L QKB QKC QLB QLC	--- --- --- --- ---	X5I JOA --- --- ---	X6M QHD OLG --- ---	--- --- --- --- ---	X8L odh odp ofp QAT

*
* EB module - Connector Definitions
*

ZAA ZAB - OAA .
ZAC ZAD - OAI .
ZAE ZAF - OEA .
ZAG ZAH - IEA .

ZAI ZAJ - IAA .
ZAK ZAL - IAI .
ZAM ZAN - IBA .
ZAO ZAP - IBI .

ZAQ ZAR - IEI .
ZAS ZAT - OBA .
ZAU ZAV - OBI .
ZAW ZAX - OEI .

ZBA ZBB - OGA .
ZBC ZBD - IIA .
ZBE ZBF - IIB .
ZBG ZBH - IGA .

ZBI ZBJ - IKA .
ZBK ZBL - OKA .
ZBM ZBN - IKI .
ZBO ZBP - OKI .

ZBQ ZBR - OKQ .
ZBS ZBT - IKQ .
ZBU ZBV - IKS .
ZBW ZBX - OKS .

ZCA ZCB - OCA .
ZCC ZCD - OCI .
ZCE ZCF - OFA .
ZCG ZCH - IFA .

ZCI ZCJ - ICA .
ZCK ZCL - ICI .
ZCM ZCN - IDA .
ZCO ZCP - IDI .

ZCQ ZCR - IFI .
ZCS ZCT - ODA .
ZCU ZCV - ODI .
ZCW ZCX - OFI .

ZDA ZDB - OAB .
 ZDC ZDD - OAJ .
 ZDE ZDF - OEB .
 ZDG ZDH - IEB .

ZDI ZDJ - IAB .
 ZDK ZDL - IAJ .
 ZDM ZDN - IBB .
 ZDO ZDP - IBJ .

ZDQ ZDR - IEJ .
 ZDS ZDT - OBB .
 ZDU ZDV - OBJ .
 ZDW ZDX - OEJ .

ZEA ZEB - OGB .
 ZEC ZED - OLB .
 ZEE ZEF - *** .
 ZEG ZEH - IGB .

ZEI ZEJ - IKB .
 ZEK ZEL - OKB .
 ZEM ZEN - IKJ .
 ZEO ZEP - OKJ .

ZEQ ZER - *** .
 ZES ZET - *** .
 ZEU ZEV - *** .
 ZEW ZEX - OLD .

ZFA ZFB - OCB .
 ZFC ZFD - OCJ .
 ZFE ZFF - OFB .
 ZFG ZFH - IFB .

ZFI ZFJ - ICB .
 ZFK ZFL - ICJ .
 ZFM ZFN - IDB .
 ZFO ZFP - IDJ .

ZFQ ZFR - IFJ .
 ZFS ZFT - ODB .
 ZFU ZFV - ODJ .
 ZFW ZFX - OFJ .

ZGA ZGB - OAC .
 ZGC ZGD - OAK .
 ZGE ZGF - OEC .
 ZGG ZGH - IEC .

ZGI ZGJ - IAC .
 ZGK ZGL - IAK .
 ZGM ZGN - IBC .
 ZGO ZGP - IBK .

ZGQ ZGR - IEK .
 ZGS ZGT - OBC .
 ZGU ZGV - OBK .
 ZGW ZGX - OEK .

ZHA ZHB - OGC .
 ZHC ZHD - *** .
 ZHE ZHF - *** .
 ZHG ZHH - IGC .

ZHI ZHJ - IKC .
 ZHK ZHL - OKC .
 ZHM ZHN - IKK .
 ZHO ZHP - OKK .

ZHQ ZHR - *** .
 ZHS ZHT - *** .
 ZHU ZHV - *** .
 ZHW ZHX - OLC .

ZIA ZIB - OCC .
 ZIC ZID - OCK .
 ZIE ZIF - OFC .
 ZIG ZIH - IFC .

ZII ZIJ - ICC .
 ZIK ZIL - ICK .
 ZIM ZIN - IDC .
 ZIO ZIP - IDK .

ZIQ ZIR - IFK .
 ZIS ZIT - ODC .
 ZIU ZIV - ODK .
 ZIW ZIX - OFK .

ZJA ZJB - OAD .
 ZJC ZJD - OAL .
 ZJE ZJF - OED .
 ZJG ZJH - IED .

ZJI ZJJ - IAD .
 ZJK ZJL - IAL .
 ZJM ZJN - IBD .
 ZJO ZJP - IBL .

ZJQ ZJR - IEL .
 ZJS ZJT - OBD .
 ZJU ZJV - OBL .
 ZJW ZJX - OEL .

ZKA ZKB - OGD .
 ZKC ZKD - OHA .
 ZKE ZKF - OHB .
 ZKG ZKH - IGD .

ZKI ZKJ - IKD .
 ZKK ZKL - OKD .
 ZKM ZKN - IKL .
 ZKO ZKP - OKL .

ZKQ ZKR - IZZ .
 ZKS ZKT - OLE .
 ZKU ZKV - OLA .
 ZKW ZKX - IJB .

ZLA ZLB - OCD .
 ZLC ZLD - OCL .
 ZLE ZLF - OFD .
 ZLG ZLH - IFD .

ZLI ZLJ - ICD .
 ZLK ZLL - ICL .
 ZLM ZLN - IDD .
 ZLO ZLP - IDL .

ZLQ ZLR - IFL .
 ZLS ZLT - ODD .
 ZLU ZLV - ODL .
 ZLW ZLX - OFL .

ZMA ZMB - OAE .
 ZMC ZMD - OAM .
 ZME ZMF - OEE .
 ZMG ZMH - IEE .

ZMI ZMJ - IAE .
 ZMK ZML - IAM .
 ZMM ZMN - IBE .
 ZMO ZMP - IBM .

ZMQ ZMR - IEM .
 ZMS ZMT - OBE .
 ZMU ZMV - OBM .
 ZMW ZMX - OEM .

ZNA ZNB - OGE .
 ZNC ZND - OHG .
 ZNE ZNF - *** .
 ZNG ZNH - IGE .

ZNI ZNJ - IKE .
 ZNK ZNL - OKE .
 ZNM ZNN - IKM .
 ZNO ZNP - OKM .

ZNQ ZNR - OHD .
 ZNS ZNT - OHE .
 ZNU ZNV - OHF .
 ZNW ZNX - IJA .

ZOA ZOB - OCE .
 ZOC ZOD - OCM .
 ZOE ZOF - OFE .
 ZOG ZOH - IFE .

ZOI ZOJ - ICE .
 ZOK ZOL - ICM .
 ZOM ZON - IDE .
 ZOO ZOP - IDM .

ZOQ ZOR - IFM .
 ZOS ZOT - ODE .
 ZOU ZOV - ODM .
 ZOW ZOY - OFM .

ZPA ZPB - OAF .
 ZPC ZPD - OAN .
 ZPE ZPF - OEF .
 ZPG ZPH - IEF .

ZPI ZPJ - IAF .
 ZPK ZPL - IAN .
 ZPM ZPN - IBF .
 ZPO ZPP - IBN .

ZPQ ZPR - IEN .
 ZPS ZPT - OBF .
 ZPU ZPV - OBN .
 ZPW ZPX - OEN .

ZQA ZQB - OGF .
 ZQC ZQD - IND .
 ZQE ZQF - OHC .
 ZQG ZQH - IGF .

ZQI ZQJ - IKF .
 ZQK ZQL - OKF .
 ZQM ZQN - IKN .
 ZQO ZQP - OKN .

ZQQ ZQR - INA .
 ZQS ZQT - INB .
 ZQU ZQV - INC .
 ZQW ZQX - OLH .

ZRA ZRB - OCF .
 ZRC ZRD - OCN .
 ZRE ZRF - OFF .
 ZRG ZRH - IFF .

ZRI ZRJ - ICF .
 ZRK ZRL - ICN .
 ZRM ZRN - IDF .
 ZRO ZRP - IDN .

ZRQ ZRR - IFN .
 ZRS ZRT - ODF .
 ZRU ZRV - ODN .
 ZRW ZRX - OFN .

ZSA ZSB - OAG .
 ZSC ZSD - OAO .
 ZSE ZSF - OEG .
 ZSG ZSH - IEG .

ZSI ZSJ - IAG .
 ZSK ZSL - IAO .
 ZSM ZSN - IBG .
 ZSO ZSP - IBO .

ZSQ ZSR - IEO .
 ZSS ZST - OBG .
 ZSU ZSV - OBO .
 ZSW ZSX - OEO .

ZTA ZTB - IHA .
 ZTC ZTD - IHB .
 ZTE ZTF - IHC .
 ZTG ZTH - IGG .

ZTI ZTJ - IKG .
 ZTK ZTL - OKG .
 ZTM ZTN - IKO .
 ZTO ZTP - OKO .

ZTQ ZTR - *** .
 ZTS ZTT - OLF .
 ZTU ZTV - IKT .
 ZTW ZTX - OKT .

ZUA ZUB - OCG .
 ZUC ZUD - OCO .
 ZUE ZUF - OFG .
 ZUG ZUH - IFG .

ZUI ZUJ - ICG .
 ZUK ZUL - ICO .
 ZUM ZUN - IDG .
 ZUO ZUP - IDO .

ZUQ ZUR - IFO .
 ZUS ZUT - ODG .
 ZUU ZUV - ODO .
 ZUW ZUX - OFO .

ZVA ZVB - OAH .
ZVC ZVD - OAP .
ZVE ZVF - OEH .
ZVG ZVH - IEH .

ZVI ZVJ - IAH .
ZVK ZVL - IAP .
ZVM ZVN - IBH .
ZVO ZVP - IBP .

ZVQ ZVR - IEP .
ZVS ZVT - OBH .
ZVU ZVV - OBP .
ZVW ZVX - OEP .

ZWA ZWB - *** .
ZWC ZWD - *** .
ZWE ZWF - *** .
ZWG ZWH - IGH .

ZWI ZWJ - IKH .
ZWK ZWL - OKH .
ZWM ZWN - IKP .
ZWO ZWP - OKP .

ZWQ ZWR - *** .
ZWS ZWT - OLG .
ZWU ZWV - IKR .
ZWW ZWX - OKR .

ZXA ZXB - OCH .
ZXC ZXD - OCP .
ZXE ZXF - OFH .
ZXG ZXH - IFH .

ZXI ZXJ - ICH .
Z XK ZXL - ICP .
ZXM Z XN - IDH .
ZXO ZXP - IDP .

ZXQ ZXR - IMA .
ZXS ZXT - ODH .
ZXU ZXV - ODP .
ZXW ZXX - OFP .

*
 * EB Module - Drawn Path Lengths
 *

aaa	2.28	AAA	1.81	aab	2.39	AAB	1.85	aac	2.29	AAC	1.80
aad	2.29	AAD	1.81	aae	2.45	AAE	1.83	aaf	2.31	AAF	1.91
aag	2.25	AAG	1.83	aah	2.30	AAH	1.81	aai	2.37	AAI	2.00
aaj	2.34	AAJ	2.01	aak	2.34	AAK	1.60	aal	2.35	AAL	1.59
aam	2.36	AAM	1.60	aan	2.37	AAN	1.58	aao	2.36	AAO	1.59
aap	2.33	AAP	1.58	aar	1.10	AAR	1.43	aba	1.10	ABA	2.20
abb	1.10	ABB	2.24	abc	1.10	ABC	1.72	abd	1.10	ABD	1.77
abe	1.10	ABE	1.73	abf	1.10	ABF	1.75	abg	1.10	ABG	1.74
abh	1.10	ABH	1.73	abi	1.10	ABI	1.96	abj	1.10	ABJ	1.97
abk	1.10	ABK	1.92	abl	1.10	ABL	1.92	abm	1.10	ABM	1.98
abn	1.10	ABN	1.95	abo	1.10	ABO	1.95	abp	1.10	ABP	1.86
baa	1.21	BAA	2.06	bab	1.21	BAB	2.10	bac	1.21	BAC	2.09
bad	1.21	BAD	2.07	bae	1.21	BAE	2.08	baf	1.21	BAF	2.12
bag	1.21	BAG	2.07	bah	1.21	BAH	2.10	bai	1.27	BAI	2.05
baj	1.28	BAJ	2.13	bak	1.28	BAK	2.13	bal	1.28	BAL	2.13
bam	1.29	BAM	2.12	ban	1.31	BAN	2.11	bao	1.31	BAO	2.12
bap	1.27	BAP	2.07	bba	1.21	BBA	2.10	bbb	1.21	BBB	2.16
bbc	1.21	BBC	2.15	bbd	1.21	BBD	2.17	bbe	1.21	BBE	2.16
bbf	1.21	BBF	2.17	bbg	1.21	BBG	2.14	bbh	1.21	BBH	2.11
bbi	1.28	BBI	2.28	bbj	1.28	BBJ	2.35	bbk	1.28	BBK	2.30
bbk	1.28	BBK	2.28	bbm	1.28	BBM	2.36	bbn	1.28	BBN	2.31
bbm	1.28	BBM	2.36	bbp	1.27	BBP	2.28	bca	1.21	BCA	2.35
bbp	1.27	BBP	2.28	bcc	1.21	BCC	2.32	bcd	1.21	BCD	2.39
bbc	1.21	BBC	2.15	bcb	1.21	BCC	2.32	bce	1.21	BCE	2.33
bbf	1.21	BBF	2.17	bcb	1.21	BCC	2.32	bch	1.21	BCH	2.34
bbi	1.28	BBI	2.28	bci	1.28	BCI	2.17	bck	1.28	BCK	2.18
bbk	1.28	BBK	2.30	bcl	1.28	BCL	2.28	bcn	1.28	BCN	2.18
bbm	1.28	BBM	2.36	bcl	1.28	BCL	2.28	bda	1.21	BDA	2.16
bbn	1.28	BBN	2.31	bco	1.28	BCO	2.18	bdd	1.21	BDD	2.26
bbp	1.27	BBP	2.28	bdb	1.21	BDB	2.16	bdg	1.21	BDG	2.12
bca	1.21	BCA	2.35	bde	1.21	BDE	2.18	bdj	1.28	BDJ	2.16
bcd	1.21	BCD	2.39	bdh	1.21	BDH	2.16	bdm	1.30	BDM	1.99
bce	1.21	BCE	2.33	bdi	1.30	BDI	2.04	bdp	1.30	BDP	2.04
bch	1.21	BCH	2.34	bdl	1.28	BDL	2.08	cal	1.68	CAL	1.96
bck	1.28	BCK	2.18	bdo	1.28	BDO	2.01	cao	1.30	CAO	1.10
bcn	1.28	BCN	2.18	bdp	1.30	BDP	2.04	cbk	1.81	CBK	1.54
bda	1.21	BDA	2.16	bdq	1.28	BDQ	2.04	daa	2.54	DAA	1.92
bdb	1.21	BDB	2.16	bdr	1.28	BDR	2.04	dad	2.83	DAD	1.30
bdc	1.21	BDC	2.16	bds	1.28	BDS	2.04	dbc	2.41	DBC	1.75
bde	1.21	BDE	2.18	bdt	1.28	BDT	2.04	dcb	2.05	DCB	1.78
bdh	1.21	BDH	2.16	bdu	1.28	BDU	2.04	dda	2.36	DDA	1.91
bdi	1.30	BDI	2.04	bdv	1.28	BDV	2.04	ddd	2.21	DDD	1.29
bdl	1.28	BDL	2.08	bew	1.10	BDE	2.18	eac	1.10	EAC	1.91
bdo	1.28	BDO	2.01	bex	1.10	BDE	2.18	eaf	1.10	EAF	1.92
bdp	1.30	BDP	2.04	bey	1.10	BDE	2.18	eai	1.10	EAI	1.87
cal	1.68	CAL	1.96	bfa	1.10	BDE	2.18	eal	1.10	EAL	1.88
cao	1.30	CAO	1.10	bfb	1.10	BDE	2.18	eao	1.10	EAO	1.87
cbk	1.81	CBK	1.54	bfc	1.10	BDE	2.18	ebb	1.10	EBB	1.68
daa	2.54	DAA	1.92	bfd	1.10	BDE	2.18	ebe	1.10	EBE	1.69
dad	2.83	DAD	1.30	bfe	1.10	BDE	2.18	ebh	1.10	EBH	1.66
dbc	2.41	DBC	1.75	bff	1.10	BDE	2.18				
dcb	2.05	DCB	1.78	bfg	1.10	BDE	2.18				
dda	2.36	DDA	1.91	bfg	1.10	BDE	2.18				
ddd	2.21	DDD	1.29	bfg	1.10	BDE	2.18				
eac	1.10	EAC	1.91	bfg	1.10	BDE	2.18				
eaf	1.10	EAF	1.92	bfg	1.10	BDE	2.18				
eai	1.10	EAI	1.87	bfg	1.10	BDE	2.18				
eal	1.10	EAL	1.88	bfg	1.10	BDE	2.18				
eao	1.10	EAO	1.87	bfg	1.10	BDE	2.18				
ebb	1.10	EBB	1.68	bfg	1.10	BDE	2.18				
ebe	1.10	EBE	1.69	bfg	1.10	BDE	2.18				
ebh	1.10	EBH	1.66	bfg	1.10	BDE	2.18				

ebk	1.10	EBK	1.61	ebl	1.10	EBL	1.63	ebm	1.10	EBM	1.69
ebn	1.10	EBN	1.62	ebo	1.10	EBO	1.64	ebp	1.10	EBP	1.62
faa	3.11	FAA	3.35	fab	3.11	FAB	3.39	fac	3.11	FAC	3.34
fad	3.11	FAD	3.34	fae	3.11	FAE	3.40	faf	3.11	FAF	3.35
fag	3.11	FAG	3.34	fah	1.97	FAH	2.20	fai	3.11	FAI	3.32
faj	3.11	FAJ	3.33	fak	3.11	FAK	3.33	fal	3.11	FAL	3.36
fam	3.11	FAM	3.36	fan	3.11	FAN	3.32	fao	3.11	FAO	3.34
fap	1.97	FAP	2.18	fba	3.05	FBA	3.34	fbf	3.05	FBB	3.38
fbc	3.05	FBC	3.36	fbd	3.05	FBD	3.41	fbe	3.05	FBE	3.37
fbf	3.05	FBF	3.37	fbg	3.05	FBG	3.36	fbh	2.01	FBH	2.30
fbi	3.05	FBI	3.42	fbj	3.05	FBJ	3.46	fbk	3.05	FBK	3.45
fbl	3.05	FBL	3.45	fbm	3.05	FBM	3.44	fbn	3.05	FBN	3.41
fbo	3.05	FBO	3.43	fbp	2.01	FBP	2.38	fca	3.05	FCA	3.38
fcb	3.05	FCB	3.46	fcc	3.05	FCC	3.41	fcd	3.05	FCD	3.37
fce	3.05	FCE	3.38	fcf	3.05	FCF	3.41	fcg	3.05	FCG	3.38
fch	2.01	FCH	2.33	fci	3.05	FCI	3.39	fcj	3.05	FCJ	3.36
fck	3.05	FCK	3.35	fcl	3.05	FCL	3.40	fcm	3.10	FCM	3.45
fcn	3.05	FCN	3.34	fco	3.05	FCO	3.40	fcp	2.03	FCP	2.37
fda	3.03	FDA	3.24	fdb	3.03	FDB	3.26	fdc	3.03	FDC	3.24
fdd	3.03	FDD	3.29	fde	3.03	FDE	3.26	fdf	3.03	FDF	3.26
fdg	3.03	FDG	3.25	fdh	1.96	FDH	2.18	fdi	3.03	FDI	3.28
fdj	3.03	FDJ	3.34	fdk	3.03	FDK	3.28	fdl	3.03	FDL	3.34
fdm	3.03	FDM	3.33	fdn	3.03	FDN	3.32	fdo	3.03	FDO	3.32
fdp	1.96	FDP	2.22	gaa	1.30	GAA	1.84	gab	1.10	GAB	2.47
gac	1.10	GAC	2.44	gad	1.10	GAD	2.41	gae	1.10	GAE	2.41
gaf	1.10	GAF	2.35	gag	1.10	GAG	2.40	gah	1.10	GAH	2.35
gai	1.10	GAI	2.38	gaj	1.10	GAJ	2.15	gak	1.10	GAK	2.10
gal	1.10	GAL	2.13	gam	1.10	GAM	2.16	gan	1.10	GAN	2.11
gao	1.10	GAO	2.11	gap	1.10	GAP	2.21	gba	1.10	GBA	2.42
gbb	1.10	GBB	2.32	gbc	1.10	GBC	2.31	gbd	1.10	GBD	2.60
gbe	1.10	GBE	2.28	gbf	1.10	GBF	2.33	gbg	1.10	GBG	2.31
gbh	1.10	GBH	2.24	gbi	1.10	GBI	2.42	gbj	1.10	GBJ	2.15
gbk	1.10	GBK	2.15	gbl	1.10	GBL	2.17	gbm	1.10	GBM	2.16
gbn	1.10	GBN	2.13	gbo	1.10	GBO	2.15	gbp	1.10	GBP	2.11
gca	1.50	GCA	1.27	gcb	1.54	GCB	1.27	gcc	1.54	GCC	1.27
gcd	1.54	GCD	1.27	gce	1.55	GCE	1.27	gcf	1.53	GCF	1.27
gcg	1.57	GCG	1.27	gch	1.55	GCH	1.27	gci	1.52	GCI	1.22
gcj	1.55	GCJ	1.22	gck	1.51	GCK	1.22	gcl	1.53	GCL	1.22
gcm	1.52	GCM	1.22	gcn	1.53	GCN	1.22	gco	1.55	GCO	1.22
gcp	1.53	GCP	1.22	gda	1.54	GDA	1.27	gdb	1.57	GDB	1.27
gdc	1.56	GDC	1.27	gdd	1.55	GDD	1.27	gde	1.56	GDE	1.27
gdf	1.53	GDF	1.27	gdg	1.55	GDG	1.27	gdh	1.54	GDH	1.27
gdi	1.53	GDI	1.22	gdj	1.54	GDJ	1.22	gdk	1.51	GDK	1.22
gdl	1.51	GDL	1.22	gdm	1.51	GDM	1.22	gdn	1.55	GDN	1.22
gdo	1.53	GDO	1.22	gdp	1.53	GDP	1.22	haa	1.97	HAA	1.66
hab	2.03	HAB	1.76	hac	2.01	HAC	1.69	had	1.94	HAD	1.67
hae	2.06	HAE	1.69	haf	1.95	HAF	1.68	hag	2.01	HAG	1.68
hah	1.99	HAH	1.66	hai	2.05	HAI	1.65	haj	2.13	HAJ	1.69
hak	2.01	HAK	1.65	hal	2.01	HAL	1.65	ham	2.18	HAM	1.65
han	2.02	HAN	1.66	hao	2.04	HAO	1.65	hap	2.04	HAP	1.67
hba	1.96	HBA	1.78	hbb	1.91	HBB	1.58	hbc	2.03	HBC	1.53
hbd	1.94	HBD	1.56	hbe	1.98	HBE	1.56	hbf	1.97	HBF	1.55
hbg	1.97	HBG	1.55	hbh	1.93	HBH	1.56	hbi	2.00	HBI	1.69
hbj	2.09	HBJ	1.76	hbk	2.05	HBK	1.59	hbl	2.03	HBL	1.53
hbm	2.11	HBM	1.56	hbn	2.05	HBN	1.52	hbo	2.06	HBO	1.54

hbp	1.99	HBP	1.49	hca	1.47	HCA	1.56	hcb	1.46	HCB	1.57
hcc	1.46	HCC	1.56	hcd	1.49	HCD	1.57	hce	1.46	HCE	1.57
hcf	1.48	HCF	1.57	hcg	1.44	HCG	1.59	hch	1.47	HCH	1.57
hci	1.40	HCI	1.47	hcj	1.41	H CJ	1.48	hck	1.48	HCK	1.46
hcl	1.41	HCL	1.52	hcm	1.47	HCM	1.49	hcn	1.42	HCN	1.51
hco	1.46	HCO	1.47	hcp	1.47	HCP	1.47	hda	1.10	HDA	1.68
hdb	1.10	HDB	1.71	hdc	1.10	HDC	1.73	hdd	1.10	HDD	1.76
hde	1.10	HDE	1.73	hdf	1.10	HDF	1.73	hdg	1.10	HDG	1.76
hdh	1.10	HDH	1.69	hdi	1.10	HDI	1.65	hdj	1.10	HDJ	1.64
hdk	1.10	HDK	1.64	hdl	1.10	HDL	1.70	hdm	1.10	HDM	1.65
hdn	1.10	HDN	1.67	hdo	1.10	HDO	1.63	hdp	1.10	HDP	1.62
iaa	0.10	IAA	0.78	iab	0.10	IAB	0.78	iac	0.10	IAC	0.79
iad	0.10	IAD	0.80	iae	0.10	IAE	0.78	iaf	0.10	IAF	0.79
iag	0.10	IAG	0.78	iah	0.10	IAH	0.80	iai	0.10	IAI	0.86
iaj	0.10	IAJ	0.88	iak	0.10	IAK	0.87	ial	0.10	IAL	0.87
iam	0.10	IAM	0.87	ian	0.10	IAN	0.87	iao	0.10	IAO	0.87
iap	0.10	IAP	0.86	iba	0.10	IBA	0.78	ibb	0.10	IBB	0.83
ibc	0.10	IBC	0.85	ibd	0.10	IBD	0.84	ibe	0.10	IBE	0.83
ibf	0.10	IBF	0.79	ibg	0.10	IBG	0.83	ibh	0.10	IBH	0.78
ibi	0.10	IBI	0.85	ibj	0.10	IBJ	0.91	ibk	0.10	IBK	0.90
ibl	0.10	IBL	0.93	ibm	0.10	IBM	0.93	ibn	0.10	IBN	0.88
ibo	0.10	IBO	0.91	ibp	0.10	IBP	0.87	ica	0.10	ICA	0.81
icb	0.10	ICB	0.86	icc	0.10	ICC	0.84	icd	0.10	ICD	0.85
ice	0.10	ICE	0.85	icf	0.10	ICF	0.82	icg	0.10	ICG	0.85
ich	0.10	ICH	0.81	ici	0.10	ICI	0.84	icj	0.10	ICJ	0.90
ick	0.10	ICK	0.88	icl	0.10	ICL	0.87	icm	0.10	ICM	0.89
icn	0.10	ICN	0.90	ico	0.10	ICO	0.90	icp	0.10	ICP	0.84
ida	0.10	IDA	0.79	idb	0.10	IDB	0.82	idc	0.10	IDC	0.81
idd	0.10	IDD	0.82	ide	0.10	IDE	0.80	idf	0.10	IDF	0.80
idg	0.10	IDG	0.79	idh	0.10	IDH	0.79	idi	0.10	IDI	0.83
idj	0.10	IDJ	0.85	idk	0.10	IDK	0.85	idl	0.10	IDL	0.85
idm	0.10	IDM	0.85	idn	0.10	IDN	0.83	ido	0.10	IDO	0.85
idp	0.10	IDP	0.83	iea	0.10	IEA	0.37	ieb	0.10	IEB	0.37
iec	0.10	IEC	0.36	ied	0.10	IED	0.36	iee	0.10	IEE	0.37
ief	0.10	IEF	0.37	ieg	0.10	IEG	0.38	ieh	0.10	IEH	0.37
iei	0.10	IEI	0.42	iej	0.10	IEJ	0.42	iek	0.10	IEK	0.41
iel	0.10	IEL	0.42	iem	0.10	IEM	0.42	ien	0.10	IEN	0.43
ieo	0.10	IEO	0.43	iep	0.10	IEP	0.42	ifa	0.10	IFA	0.36
ifb	0.10	IFB	0.36	ifc	0.10	IFC	0.38	ifd	0.10	IFD	0.37
ife	0.10	IFE	0.38	iff	0.10	IFF	0.37	ifg	0.10	IFG	0.36
ifh	0.10	IFH	0.36	ifi	0.10	IFI	0.42	ifj	0.10	IFJ	0.41
ifk	0.10	IFK	0.41	ifl	0.10	IFL	0.41	ifm	0.10	IFM	0.42
ifn	0.10	IFN	0.43	ifo	0.10	IFO	0.41	iga	0.10	IGA	0.41
igb	0.10	IGB	0.48	igc	0.10	IGC	0.48	igd	0.10	IGD	0.48
ige	0.10	IGE	0.48	igf	0.10	IGF	0.48	igg	0.10	IGG	0.48
igh	0.10	IGH	0.41	iha	0.10	IHA	0.43	ihb	0.10	IHB	0.37
ihc	0.10	IHC	0.43	iia	0.45	IIA	0.50	iib	0.54	IIB	0.52
ija	0.10	IJA	0.88	ijb	0.10	IJB	0.31	ika	0.45	IKA	0.24
ikb	0.43	IKB	0.24	ikc	0.42	IKC	0.24	ikd	0.44	IKD	0.24
ike	0.43	IKE	0.24	ikf	0.42	IKF	0.24	ikg	0.43	IKG	0.24
ikh	0.44	IKH	0.24	iki	0.44	IKI	0.29	ikj	0.36	IKJ	0.30
ikk	0.36	IKK	0.29	ikl	0.36	IKL	0.31	ikm	0.36	IKM	0.32
ikn	0.36	IKN	0.30	iko	0.35	IKO	0.31	ikp	0.54	IKP	0.29
ikq	0.55	IKQ	0.55	ikr	0.51	IKR	0.32	iks	0.10	IKS	0.40
ikt	0.10	IKT	0.41	ima	0.10	IMA	0.32	ina	0.10	INA	0.57

inb	0.10	INB	0.60	inc	0.10	INC	0.68	ind	0.10	IND	0.40
izz	1.30	IZZ	1.30	jaa	2.16	JAA	2.23	jab	2.81	JAB	2.78
jac	2.86	JAC	2.92	jad	2.95	JAD	3.00	jba	2.17	JBA	2.18
jbb	2.83	JBB	2.85	jbc	2.77	JBC	2.82	jbd	2.76	JBD	2.80
jca	2.15	JCA	2.17	jcb	2.77	JCB	2.79	jcc	2.88	JCC	2.89
jcd	2.79	JCD	2.80	jda	2.17	JDA	2.20	jdb	2.85	JDB	2.90
jdc	2.76	JDC	2.77	jdd	2.68	JDD	2.71	jea	3.24	JEA	3.19
jeb	3.15	JEB	3.08	jec	3.12	JEC	3.08	jed	3.15	JED	3.08
jee	3.16	JEE	3.12	jef	3.15	JEF	3.08	jeg	3.57	JEG	3.55
jfa	3.24	JFA	3.56	jfb	3.13	JFB	3.45	jfc	3.13	JFC	3.45
jfd	3.13	JFD	3.45	jfe	3.13	JFE	3.50	jff	3.13	JFF	3.44
jga	3.37	JGA	3.32	jgb	3.40	JGB	3.38	jgc	3.25	JGC	3.32
jgd	2.72	JGD	2.74	jge	2.36	JGE	3.11	jgg	2.14	JGG	2.51
jha	2.80	JHA	2.69	jhb	2.65	JHB	2.57	jhc	2.66	JHC	2.61
jhd	2.68	JHD	2.62	jhe	2.54	JHE	2.46	jhf	2.51	JHF	2.44
jhg	2.54	JHG	2.46	jhh	2.69	JHH	2.59	jia	2.58	JIA	2.84
jib	2.53	JIB	2.88	jja	2.48	JJA	3.29	jka	2.71	JKA	3.05
jkb	2.89	JKB	3.08	jkc	2.89	JKC	3.08	jkd	2.89	JKD	3.08
jke	2.43	JKE	2.63	jkf	2.89	JKF	3.12	jkg	2.89	JKG	3.08
jkh	3.01	JKH	3.25	jki	2.59	JKI	2.83	jkj	2.59	JKJ	2.83
kkk	2.21	KKK	2.50	jkl	2.59	JKL	2.82	jla	3.31	JLA	3.05
jlb	2.30	JLB	2.82	jlc	2.33	JLC	2.85	jld	2.45	JLD	3.43
jma	3.90	JMA	2.19	jmb	2.74	JMB	2.09	jna	2.54	JNA	2.85
jnb	2.09	JNB	2.37	joa	1.84	JOA	3.33	job	2.12	JOB	2.56
jqa	2.57	JQA	3.10	jqb	2.57	JQB	2.75	kaa	1.10	KAA	1.41
kab	1.10	KAB	1.42	kac	1.10	KAC	1.41	kad	1.10	KAD	1.42
kae	1.10	KAE	1.41	kaf	1.10	KAF	1.41	kag	1.10	KAG	1.41
kah	1.10	KAH	1.41	kai	1.10	KAI	1.49	kaj	1.10	KAJ	1.50
kak	1.10	KAK	1.49	kal	1.10	KAL	1.50	kam	1.10	KAM	1.50
kan	1.10	KAN	1.49	kao	1.10	KAO	1.50	kap	1.10	KAP	1.49
laa	1.54	LAA	1.56	lab	1.54	LAB	1.61	lac	1.48	LAC	1.61
lad	1.42	LAD	1.61	lae	1.39	LAE	1.62	laf	1.44	LAF	1.62
lag	1.10	LAG	1.76	lah	1.10	LAH	1.73	lai	1.10	LAI	1.81
laj	1.10	LAJ	1.73	lba	2.09	LBA	1.64	lbb	2.09	LBB	1.29
lbc	1.90	LBC	1.29	lbd	1.82	LBD	1.30	lbe	1.76	LBE	1.29
lbf	1.50	LBF	1.29	lbi	1.10	LBI	1.68	lbj	1.83	LBJ	1.10
lbk	1.70	LBK	1.10	lbl	1.85	LBL	1.10	lbm	1.71	LBM	1.10
lbn	1.72	LBN	1.10	lca	2.05	LCA	1.29	lcb	1.78	LCB	1.31
lcc	1.76	LCC	1.29	lcd	1.57	LCD	1.29	maa	1.10	MAA	1.40
mab	1.10	MAB	1.42	mac	1.10	MAC	1.41	mba	1.10	MBA	1.41
mbb	1.10	MBB	1.41	mbc	1.10	MBC	1.46	mca	1.61	MCA	1.70
mcb	1.48	MCB	1.42	mcc	1.65	MCC	1.44	mda	1.10	MDA	2.13
mdb	1.10	MDB	2.11	mdc	1.10	MDC	2.16	mdd	1.10	MDD	2.59
mde	1.81	MDE	1.86	naa	1.10	NAA	1.67	nab	1.10	NAB	1.70
nac	1.10	NAC	1.66	nad	1.10	NAD	1.69	nae	1.10	NAE	1.68
naf	1.10	NAF	1.68	nag	1.10	NAG	1.68	nah	1.10	NAH	1.69
nai	1.10	NAI	1.73	naj	1.10	NAJ	1.74	nak	1.10	NAK	1.70
nal	1.10	NAL	1.72	nam	1.10	NAM	1.73	nan	1.10	NAN	1.71
nao	1.10	NAO	1.72	nap	1.10	NAP	1.73	nba	1.10	NBA	1.59
nbb	1.10	NBB	1.60	nbc	1.10	NBC	1.59	nbd	1.10	NBD	1.61
nbe	1.10	NBE	1.58	nbf	1.10	NBF	1.58	nbg	1.10	NBG	1.58
nbh	1.10	NBH	1.59	nbi	1.10	NBI	1.61	nbj	1.10	NBJ	1.68
nbk	1.10	NBK	1.61	nbl	1.10	NBL	1.60	nbm	1.10	NBM	1.68
nbn	1.10	NBN	1.60	nbo	1.10	NBO	1.63	nbp	1.10	NBP	1.60
nca	1.10	NCA	1.60	ncb	1.10	NCB	1.66	ncc	1.10	NCC	1.60

ncd	1.10	NCD	1.61	nce	1.10	NCE	1.61	ncf	1.10	NCF	1.60
ncg	1.10	NCG	1.61	nch	1.10	NCH	1.60	nci	1.10	NCI	1.53
ncj	1.10	NCJ	1.54	nck	1.10	NCK	1.53	nc1	1.10	NCL	1.55
ncm	1.10	NCM	1.54	ncn	1.10	NCN	1.55	nco	1.10	NCO	1.55
ncp	1.10	NCP	1.53	nda	1.10	NDA	1.69	ndb	1.10	NDB	1.81
ndc	1.10	NDC	1.72	ndd	1.10	NDD	1.73	nde	1.10	NDE	1.73
ndf	1.10	NDF	1.73	ndg	1.10	NDG	1.72	ndh	1.10	NDH	1.69
ndi	1.10	NDI	1.62	ndj	1.10	NDJ	1.70	ndk	1.10	NDK	1.67
ndl	1.10	NDL	1.65	ndm	1.10	NDM	1.86	ndn	1.10	NDN	1.66
ndo	1.10	NDO	1.67	ndp	1.10	NDP	1.65	oaa	1.32	OAA	1.32
oab	1.34	OAB	1.35	oac	1.33	OAC	1.33	oad	1.34	OAD	1.34
oae	1.38	OAE	1.37	oaf	1.34	OAF	1.35	oag	1.33	OAG	1.33
oah	1.32	OAHA	1.32	oai	1.25	OAI	1.26	oaj	1.24	OAJ	1.26
oak	1.24	OAK	1.26	oal	1.24	OAL	1.26	oam	1.25	OAM	1.26
oan	1.24	OAN	1.26	oao	1.24	OAO	1.26	oap	1.25	OAP	1.26
oba	1.33	OBA	1.33	obb	1.35	OBB	1.35	obc	1.35	OBC	1.35
obd	1.35	OBD	1.37	obe	1.36	OBE	1.36	obf	1.37	OBF	1.34
obg	1.35	OBG	1.36	obh	1.33	OBH	1.33	obi	1.25	OBI	1.27
obj	1.26	OBJ	1.28	obk	1.25	OBK	1.27	obl	1.26	OBL	1.30
obm	1.28	OBM	1.28	obn	1.26	OBN	1.27	obo	1.26	OBO	1.28
obp	1.25	OBP	1.27	oca	1.32	OCA	1.32	ocb	1.34	OCB	1.34
occ	1.32	OCC	1.33	ocd	1.34	OCD	1.34	oce	1.32	OCE	1.35
ocf	1.35	OCF	1.34	ocg	1.32	OCG	1.33	och	1.32	OCH	1.32
oci	1.25	OCI	1.26	ocj	1.24	OCJ	1.26	ock	1.24	OCK	1.26
ocl	1.24	OCL	1.26	ocm	1.25	OCM	1.26	ocn	1.24	OCN	1.26
oco	1.25	OCO	1.26	ocp	1.25	OCP	1.26	oda	1.33	ODA	1.33
odb	1.34	ODB	1.35	odc	1.35	ODC	1.35	odd	1.35	ODD	1.36
ode	1.35	ODE	1.36	odf	1.35	ODF	1.35	odg	1.36	ODG	1.36
odh	1.33	ODH	1.33	odi	1.25	ODI	1.27	odj	1.26	ODJ	1.27
odk	1.25	ODK	1.27	odl	1.27	ODL	1.30	odm	1.25	ODM	1.27
odn	1.25	ODN	1.27	odo	1.25	ODO	1.30	odp	1.25	ODP	1.27
oea	1.29	OEA	1.27	oeb	1.32	OEB	1.27	oec	1.28	OEC	1.27
oed	1.32	OED	1.28	oee	1.32	OEE	1.27	oef	1.32	OEF	1.27
oeg	1.32	OEG	1.28	oeh	1.28	OEHA	1.27	oei	1.27	OEI	1.25
oej	1.31	OEJ	1.30	oek	1.27	OEK	1.25	oel	1.31	OEL	1.26
oem	1.28	OEM	1.26	oen	1.31	OEN	1.30	oeo	1.30	OEO	1.26
oep	1.27	OEP	1.25	ofa	1.28	OFA	1.27	ofb	1.32	OFB	1.30
ofc	1.29	OFC	1.27	ofd	1.32	OFD	1.30	ofe	1.28	OFE	1.27
off	1.28	OFF	1.29	ofg	1.32	OFG	1.28	ofh	1.28	OFH	1.27
ofi	1.27	OFI	1.25	ofj	1.31	OFJ	1.30	ofk	1.27	OFK	1.25
ofl	1.31	OFL	1.26	ofm	1.32	OFM	1.26	ofn	1.31	OFN	1.30
ofo	1.28	OFO	1.27	ofp	1.27	OFP	1.26	oga	1.40	OGA	1.40
ogb	1.46	OGB	1.43	ogc	1.44	OGC	1.40	ogd	1.48	OGD	1.42
oge	1.46	OGE	1.43	ogf	1.46	OGF	1.43	oha	1.58	OHA	1.55
ohb	1.46	OHB	1.43	ohc	1.56	OHC	1.57	ohd	1.48	OHD	1.49
ohc	1.42	OHE	1.44	ohf	1.37	OHF	1.35	ohg	0.38	OHG	0.37
oka	1.33	OKA	1.31	okb	1.33	OKB	1.32	okc	1.33	OKC	1.32
okd	1.33	OKD	1.32	oke	1.35	OKE	1.33	okf	1.35	OKF	1.31
okg	1.35	OKG	1.34	okh	1.33	OKH	1.31	oki	1.31	OKI	1.33
okj	1.32	OKJ	1.33	okk	1.31	OKK	1.33	okl	1.32	OKL	1.33
okm	1.32	OKM	1.33	okn	1.32	OKN	1.33	oko	1.32	OKO	1.35
okp	1.31	OKP	1.33	okq	1.33	OKQ	1.34	okr	1.31	OKR	1.30
oks	1.41	OKS	1.40	okt	1.44	OKT	1.47	ola	1.78	OLA	1.77
olb	1.39	OLB	1.38	olc	1.31	OLC	1.31	old	1.31	OLD	1.31
ole	1.57	OLE	1.52	olf	1.78	OLF	1.78	olg	1.71	OLG	1.72

olh	1.31	OLH	1.31	paa	2.15	PAA	1.98	pab	2.19	PAB	2.04
pac	2.15	PAC	2.06	pad	2.17	PAD	2.10	paе	2.17	PAE	2.04
paf	2.15	PAF	2.02	pag	2.18	PAG	2.04	pah	2.18	PAH	1.98
pai	2.21	PAI	1.88	paj	2.27	PAJ	1.98	pak	2.26	PAK	1.95
pal	2.32	PAL	1.97	pam	2.33	PAM	1.99	pan	2.25	PAN	1.90
pao	2.26	PAO	1.93	pap	2.22	PAP	1.89	pba	2.17	PBA	1.92
pbb	2.17	PBB	1.93	pbc	2.17	PBC	1.92	pbd	2.18	PBD	1.98
pbe	2.18	PBE	1.96	pbf	2.18	PBF	1.95	pbg	2.19	PBG	1.94
pbh	2.18	PBH	1.93	pbi	2.24	PBI	1.89	pbj	2.30	PBJ	1.95
pbk	2.31	PBK	1.88	pbl	2.32	PBL	1.96	pbm	2.36	PBM	1.97
pbn	2.28	PBN	1.91	pbo	2.27	PBO	1.91	pbp	2.25	PBP	1.89
pca	2.27	PCA	2.08	pcb	2.23	PCB	2.07	pcc	2.25	PCC	2.04
pcd	2.30	PCD	2.11	pce	2.25	PCE	2.10	pcf	2.22	PCF	2.06
pcg	2.31	PCG	2.05	pch	2.27	PCH	2.08	pci	2.24	PCI	2.10
pcj	2.28	PCJ	2.15	pck	2.25	PCK	2.10	pcl	2.24	PCL	2.14
pcm	2.28	PCM	2.15	pcn	2.24	PCN	2.16	pco	2.26	PCO	2.15
pcp	2.25	PCP	2.11	pda	2.24	PDA	2.16	pdb	2.24	PDB	2.23
pdc	2.24	PDC	2.18	pdd	2.24	PDD	2.20	pde	2.20	PDE	2.28
pdf	2.22	PDF	2.18	pdg	2.20	PDG	2.23	pdh	2.23	PDH	2.17
pdi	2.23	PDI	2.13	pdj	2.28	PDJ	2.20	pdk	2.19	PDK	2.18
pdl	2.25	PDL	2.17	pdm	2.20	PDM	2.22	pdn	2.23	PDN	2.19
pdo	2.21	PDO	2.17	pdp	2.23	PDP	2.15	qaa	1.59	QAA	1.10
qab	1.10	QAB	1.39	qac	2.17	QAC	2.09	qad	1.76	QAD	1.62
qae	1.70	QAE	1.10	qaf	3.35	QAF	2.82	qag	1.50	QAG	1.10
qah	1.68	QAH	2.26	qai	1.52	QAI	2.19	qaj	1.41	QAJ	1.46
qak	1.46	QAK	1.42	qal	1.47	QAL	1.51	qam	1.10	QAM	1.88
qan	1.66	QAN	1.10	qao	1.76	QAO	1.10	qap	1.10	QAP	1.60
qaq	1.10	QAQ	2.03	qat	1.49	QAT	1.10	qba	1.78	QBA	1.58
qbb	1.80	QBB	1.67	qca	1.56	QCA	1.75	qcb	1.84	QCB	1.43
qcc	1.59	QCC	2.53	qce	2.02	QCE	1.56	qcf	1.70	QCF	1.50
qcg	1.10	QCG	1.46	qch	1.10	QCH	1.41	qci	1.10	QCI	1.65
qcj	1.39	QCJ	1.42	qck	1.51	QCK	1.41	qcl	1.77	QCL	1.50
qcm	1.51	QCM	1.40	qcn	1.40	QCN	1.65	qco	1.91	QCO	1.58
qcp	1.10	QCP	1.94	qcq	1.10	QCQ	1.44	qcr	1.55	QCR	1.41
qcs	1.10	QCS	1.41	qct	1.10	QCT	3.00	qcu	1.93	QCU	1.10
qda	1.64	QDA	2.65	qdb	1.45	QDB	1.43	qdc	1.68	QDC	1.71
qdd	2.45	QDD	1.74	qde	1.10	QDE	1.53	qdf	1.10	QDF	1.41
qdg	1.33	QDG	1.41	qdh	1.10	QDH	3.43	qdi	1.63	QDI	2.10
qdj	2.03	QDJ	1.51	qdk	1.10	QDK	1.85	qdl	1.10	QDL	1.45
qdm	1.10	QDM	1.40	qdn	1.10	QDN	2.75	qdo	1.73	QDO	1.38
qea	1.55	QEA	1.48	qeb	1.10	QEB	1.27	qfa	1.44	QFA	1.63
qfb	1.10	QFB	1.34	qga	1.10	QGA	1.43	qgb	1.10	QGB	1.46
qgc	1.10	QGC	2.55	qgd	1.58	QGD	2.07	qge	1.77	QGE	1.10
qgf	1.94	QGF	1.10	qha	1.10	QHA	1.41	qhb	1.10	QHB	1.47
qhc	2.00	QHC	1.46	qhd	1.64	QHD	1.74	qhe	1.41	QHE	1.10
qia	1.49	QIA	1.94	qib	1.10	QIB	1.32	qja	1.49	QJA	1.60
qjb	1.10	QJB	1.34	qka	1.46	QKA	1.85	qkb	1.10	QKB	1.46
qkc	1.10	QKC	1.74	qkd	1.25	QKD	1.10	qke	1.40	QKE	1.10
qla	1.44	QLA	1.68	qlb	1.10	QLB	1.45	qlc	1.10	QLC	1.70
qld	1.37	QLD	1.10	qle	1.43	QLE	1.10	qma	1.10	QMA	1.84
qmb	1.10	QMB	1.82	qmc	1.10	QMC	1.86	qmd	1.10	QMD	1.82
qme	1.70	QME	2.45	qmf	1.38	QMF	1.49	qmg	1.10	QMG	2.53
qmh	1.93	QMH	1.81	qmi	1.10	QMI	2.64	qmj	2.13	QMJ	1.43
qna	2.09	QNA	2.44	qnb	2.21	QNB	2.47	qnc	2.25	QNC	2.62
qnd	2.31	QND	2.60	qoa	1.48	QOA	1.30	qob	1.48	QOB	1.42

qoc	1.10	QOC	1.47	god	1.47	QOD	1.10	qpa	1.71	QPA	1.49
qpb	1.73	QPB	1.51	qpc	1.72	QPC	1.61	qpd	1.76	QPD	1.73
qpe	1.49	QPE	2.78	qpf	1.51	QPF	2.84	qpg	1.49	QPG	2.81
qph	1.49	QPH	2.77	qqa	1.48	QQA	1.54	qqb	1.10	QQB	2.16
qqc	1.41	QQC	1.10	qqd	2.45	QQD	1.25	qqe	1.10	QQE	1.51
qra	1.10	QRA	1.45	qrb	1.10	QRB	1.42	qrc	1.10	QRC	1.41
qrd	1.10	QRD	1.36	qre	1.10	QRE	1.48	qrf	1.10	QRF	1.59
qrg	1.44	QRG	2.09	qrh	1.10	QRH	1.47	qri	1.10	QRI	1.42
qrj	1.10	QRJ	1.46	qrk	1.10	QRK	1.47	qrl	1.10	QRL	1.42
qrm	1.10	QRM	1.42	qrn	1.10	QRN	1.46	qro	1.10	QRO	1.44
qrp	1.10	QRP	1.42	qsa	1.10	QSA	1.52	qsb	1.10	QSB	1.44
qsc	1.10	QSC	1.45	qsd	1.10	QSD	1.48	qse	1.10	QSE	1.41
qsf	1.10	QSF	1.48	qsg	1.10	QSG	1.49	qsh	1.10	QSH	1.43
qsi	1.10	QSI	1.40	qsj	1.10	QSJ	1.45	qsk	1.10	QSK	1.44
qsl	1.10	QSL	1.47	qsm	1.10	QSM	1.40	qsn	1.10	QSN	1.41
qso	1.10	QSO	1.44	qsp	1.41	QSP	1.10	qta	1.10	QTA	2.51
qtb	1.10	QTB	2.45	qtc	1.10	QTC	2.45	qtd	1.10	QTD	2.43
qua	1.78	QUA	1.98	qub	1.85	QUB	1.64	quc	1.58	QUC	3.02
qud	2.07	QUD	1.58	que	1.10	QUE	1.40	quf	1.10	QUF	1.92
qug	1.10	QUG	2.57	quh	1.10	QUH	1.96	qva	1.10	QVA	1.91
qvb	1.10	QVB	1.80	qvc	1.77	QVC	1.67	RAA	1.51	RAB	1.53
RAC	1.52	RAD	1.56	RAE	1.54	RAF	1.53	RAG	1.53	RAH	1.51
RAI	1.60	RAJ	1.61	RAK	1.60	RAL	1.65	RAM	1.60	RAN	1.61
RAO	1.61	RAP	1.61	RBA	1.63	RBB	1.68	RBC	1.63	RBD	1.66
RBE	1.63	RBF	1.63	RBG	1.65	RBH	1.63	RBI	1.68	RBJ	1.73
RBK	1.71	RBL	1.76	RBM	1.72	RBN	1.73	RBO	1.74	RBP	1.68
RCA	1.50	RCB	1.55	RCC	1.53	RCD	1.56	RCE	1.54	RCF	1.53
RCG	1.55	RCH	1.51	RCI	1.60	RCJ	1.65	RCK	1.60	RCL	1.61
RCM	1.65	RCN	1.61	RCO	1.64	RCP	1.60	RDA	1.64	RDB	1.73
RDC	1.65	RDD	1.65	RDE	1.64	RDF	1.62	RDG	1.65	RDH	1.64
RDI	1.73	RDJ	1.72	RDK	1.74	RDL	1.76	RDM	1.71	RDN	1.74
RDO	1.72	RDP	1.73	REA	1.56	REB	1.58	REC	1.55	RED	1.55
REE	1.55	REF	1.57	REG	1.54	REH	1.56	REI	1.48	REJ	1.47
REK	1.47	REL	1.47	REM	1.49	REN	1.48	REO	1.50	REP	1.48
RFA	1.47	RFB	1.56	RFC	1.50	RFD	1.54	RFE	1.51	RFF	1.50
RFG	1.49	RFH	1.47	RFI	1.57	RFJ	1.58	RFK	1.58	RFL	1.56
RFM	1.62	RFN	1.60	RFO	1.64	RFP	1.57	RGA	1.55	RGB	1.57
RGC	1.58	RGD	1.53	RGE	1.55	RGF	1.55	RGG	1.56	RGH	1.55
RGI	1.48	RGJ	1.48	RGK	1.47	RGL	1.49	RGM	1.48	RGN	1.47
RGO	1.50	RGP	1.48	RHA	1.50	RHB	1.50	RHC	1.49	RHD	1.49
RHE	1.49	RHF	1.53	RHG	1.50	RHH	1.50	RHI	1.58	RHJ	1.58
RHK	1.59	RHL	1.60	RHM	1.61	RHN	1.59	RHO	1.58	RHP	1.58
RIA	1.63	RIB	1.66	RIC	1.66	RID	1.63	RIE	1.66	RIF	1.63
RIG	1.67	RIH	1.63	RII	1.53	RIJ	1.56	RIK	1.54	RIL	1.56
RIM	1.53	RIN	1.53	RIO	1.53	RIP	1.53	RJA	1.41	RJB	1.40
RJC	1.41	RJD	1.41	RJE	1.40	RJF	1.41	RJG	1.41	RJH	1.41
RJI	1.46	RJJ	1.54	RJK	1.45	RJL	1.48	RJM	1.50	RJN	1.48
RJO	1.47	RJP	1.46	RKA	1.64	RKB	1.66	RKC	1.66	RKD	1.63
RKE	1.63	RKF	1.64	RKG	1.67	RKH	1.64	RKI	1.53	RKJ	1.55
RKK	1.54	RKL	1.55	RKM	1.56	RKN	1.54	RKO	1.53	RKP	1.53
RLA	1.41	RLB	1.41	RLC	1.41	RLD	1.41	RLE	1.41	RLF	1.41
RLG	1.40	RLH	1.41	RLI	1.49	RLJ	1.47	RLK	1.47	RLL	1.48
RLM	1.48	RLN	1.47	RLO	1.48	RLP	1.49	RMA	1.66	RMB	1.66
RMC	1.59	RMD	1.69	RME	1.69	RMF	1.66	RMG	1.67	RMH	1.66
RMI	1.55	RMJ	1.56	RMK	1.52	RML	1.57	RMM	1.56	RMN	1.55

RMO	1.56	RMP	1.55	RNA	1.43	RNB	1.46	RNC	1.41	RND	1.47
RNE	1.42	RNF	1.41	RNG	1.43	RNH	1.43	RNI	1.36	RNJ	1.36
RNK	1.36	RNL	1.37	RNM	1.40	RNN	1.36	RNO	1.35	RNP	1.35
ROA	1.61	ROB	1.75	ROC	1.71	ROD	1.70	ROE	1.68	ROF	1.68
ROG	1.66	ROH	1.62	ROI	1.51	ROJ	1.57	ROK	1.56	ROL	1.58
ROM	1.57	RON	1.55	ROO	1.56	ROP	1.51	RPA	1.43	RPB	1.47
RPC	1.42	RPD	1.42	RPE	1.41	RPF	1.43	RPG	1.43	RPH	1.43
RPI	1.35	RPJ	1.36	RPK	1.35	RPL	1.35	RPM	1.35	RPN	1.36
RPO	1.36	RPP	1.35	saa	1.10	SAA	1.79	sab	1.10	SAB	1.81
sac	1.10	SAC	1.79	sad	1.10	SAD	1.83	sae	1.10	SAE	1.81
saf	1.10	SAF	1.80	sag	1.10	SAG	1.83	sah	1.10	SAH	1.79
sai	1.47	SAI	1.96	saj	1.64	SAJ	2.54	sak	1.10	SAK	1.90
sal	1.10	SAL	1.95	taa	2.15	TAA	3.68	tab	2.15	TAB	3.66
tac	2.31	TAC	3.83	tad	2.31	TAD	3.83	tae	1.93	TAE	3.44
taf	1.93	TAF	3.44	tag	2.09	TAG	3.66	tah	2.09	TAH	3.65
tba	2.17	TBA	3.71	tbb	2.17	TBB	3.65	tbc	2.33	TBC	3.78
tbd	2.33	TBD	3.77	tbe	1.95	TBE	3.43	tbf	1.95	TBF	3.38
tbg	2.11	TBG	3.55	tbh	2.11	TBH	3.67	tca	2.16	TCA	3.83
tcb	2.16	TCB	3.77	tcc	2.32	TCC	3.83	tcd	2.32	TCD	3.83
tce	1.92	TCE	3.50	tcf	1.92	TCF	3.45	tcg	2.09	TCG	3.66
tch	2.09	TCH	3.68	tda	2.20	TDA	3.85	tdb	2.20	TDB	3.80
tdc	2.36	TDC	3.87	tdd	2.36	TDD	3.87	tde	1.92	TDE	3.51
tdf	1.92	TDF	3.45	tdg	2.09	TDG	3.70	tdh	2.09	TDH	3.77
tea	2.03	TEA	3.54	teb	2.03	TEB	3.43	tec	1.86	TEC	3.38
ted	1.86	TED	3.46	tfa	1.95	TFA	3.42	tfb	1.95	TFB	3.39
tfc	2.11	TFC	3.50	tfd	2.11	TFD	3.55	tha	2.28	THA	3.80
thb	2.28	THB	3.83	thc	2.24	THC	3.65	tia	3.15	TIA	2.14
tib	3.20	TIB	2.14	tic	3.02	TIC	1.98	tid	2.90	TID	1.98
tie	3.90	TIE	3.76	tif	3.84	TIF	3.79	tig	3.76	TIG	3.32
tja	2.00	TJA	3.46	tjb	2.11	TJB	3.55	tjc	2.37	TJC	3.76
tjd	2.11	TJD	3.63	tje	1.94	TJE	3.53	tjf	2.05	TJF	3.73
tjg	1.92	TJG	3.55	tjh	2.14	TJH	3.65	tji	1.87	TJI	3.43
tjj	1.94	TJJ	3.32	tjk	2.23	TJK	3.61	tjl	2.48	TJL	3.98
tka	1.89	TKA	3.42	tkb	1.89	TKB	3.42	tkc	2.05	TKC	3.64
tkd	2.05	TKD	3.66	tla	1.97	TLA	3.43	tlb	1.97	TLB	3.41
tlc	1.85	TLC	3.29	tld	1.85	TLD	3.30	tma	2.37	TMA	3.88
tmb	2.37	TMB	3.88	tmc	2.20	TMC	3.72	tmd	2.20	TMD	3.76
tna	3.54	TNA	3.43	tnb	3.69	TNB	3.54	toa	4.00	TOA	3.79
tpa	2.07	TPA	3.70	tpb	2.12	TPB	3.63	tpc	2.07	TPC	3.45
tpd	2.07	TPD	3.57	tpe	2.21	TPE	3.82	tpf	2.21	TPF	3.79
tpg	3.68	TPG	3.69	tph	3.58	TPH	3.55	tpi	3.67	TPI	3.60
tpj	2.11	TPJ	2.11	tqa	2.06	TQA	2.73	tqb	2.43	TQB	2.20
tqc	3.30	TQC	2.60	tqd	2.88	TQD	3.90	tsa	2.06	TSA	3.52
tsb	3.38	TSB	3.44	tsc	2.07	TSC	3.51	tta	3.71	TTA	1.97
uaa	1.10	UAA	2.03	uab	1.10	UAB	2.03	uac	1.10	UAC	2.03
uad	1.10	UAD	2.03	uae	1.10	UAE	2.03	uaf	1.10	UAF	2.03
uag	1.10	UAG	2.03	uah	1.10	UAH	2.02	uai	1.10	UAI	2.03
uaj	1.10	UAJ	2.05	uak	1.10	UAK	2.16	ual	1.10	UAL	2.05
uam	1.10	UAM	2.03	uan	1.10	UAN	2.10	uao	1.10	UAO	2.15
uap	1.10	UAP	2.13	uba	1.10	UBA	2.03	ubb	1.10	UBB	2.04
ubc	1.10	UBC	2.03	ubd	1.10	UBD	2.03	ube	1.10	UBE	2.03
ubf	1.10	UBF	2.04	ubg	1.10	UBG	2.03	ubh	1.10	UBH	2.02
ubi	1.10	UBI	2.03	ubj	1.10	UBJ	2.08	ubk	1.10	UBK	2.08
ubl	1.10	UBL	2.03	ubm	1.10	UBM	2.03	ubn	1.10	UBN	2.04
ubo	1.10	UBO	2.08	ubp	1.10	UBP	2.02	uca	1.10	UCA	2.03

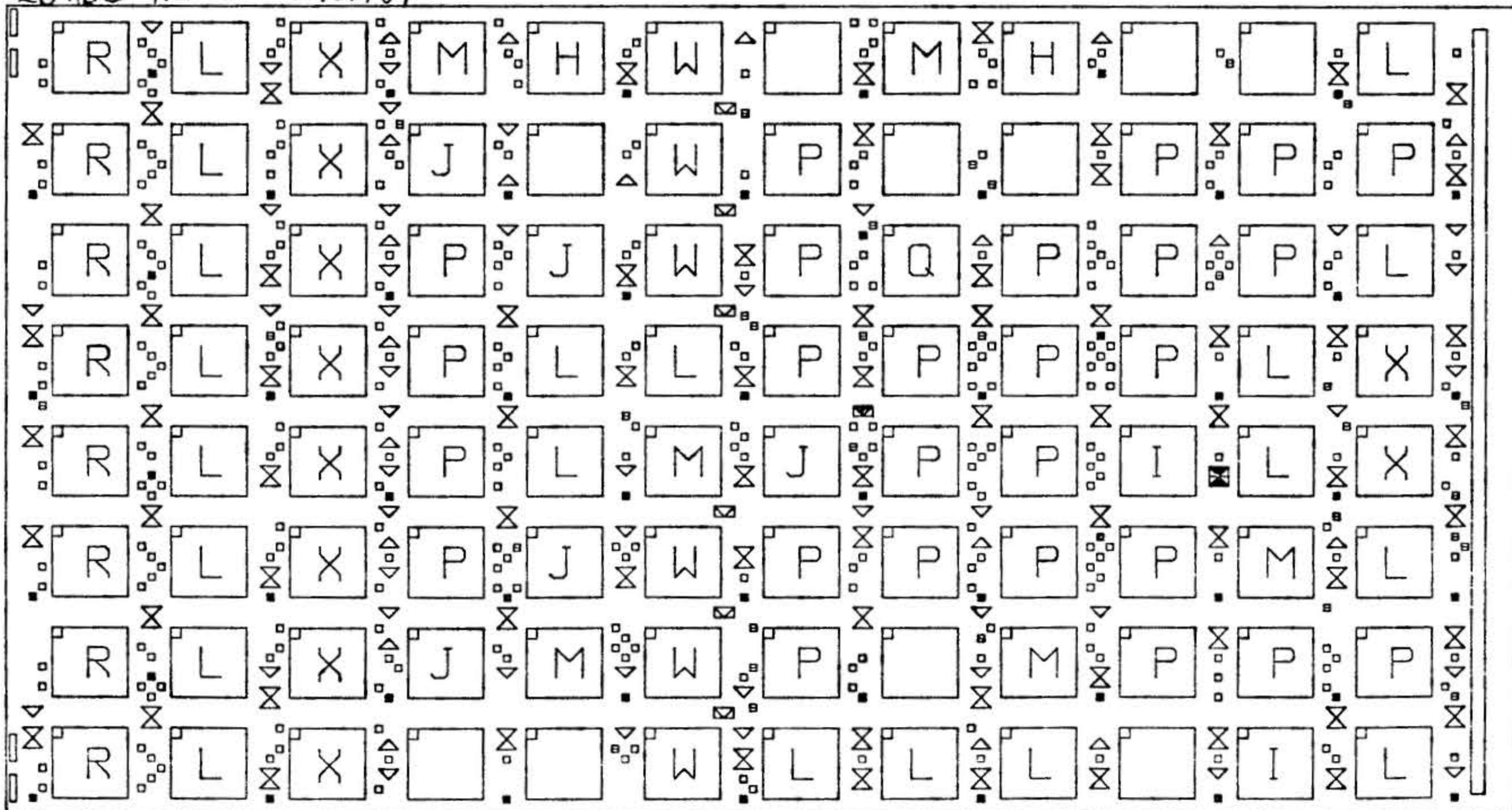
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uch	1.10	UCH	2.02	uci	1.10	UCI	2.03	ucj	1.10	UCJ	2.03
uck	1.10	UCK	2.03	ucl	1.10	UCL	2.03	ucm	1.10	UCM	2.03
ucn	1.10	UCN	2.03	uco	1.10	UCO	2.03	ucp	1.10	UCP	2.02
uda	1.10	UDA	2.03	udb	1.10	UDB	2.11	udc	1.10	UDC	2.06
udd	1.10	UDD	2.02	ude	1.10	UDE	2.08	udf	1.10	UDF	2.09
udg	1.10	UDG	2.04	udh	1.10	UDH	2.03	udi	1.10	UDI	2.02
udj	1.10	UDJ	2.04	udk	1.10	UDK	2.03	udl	1.10	UDL	2.02
udm	1.10	UDM	2.03	udn	1.10	UDN	2.04	udo	1.10	UDO	2.03
udp	1.10	UDP	2.02	vaa	1.10	VAA	1.70	vab	1.10	VAB	1.70
vac	1.10	VAC	1.70	vad	1.10	VAD	1.70	vba	1.10	VBA	1.70
vbb	1.10	VBB	1.70	vbc	1.10	VBC	1.70	vbd	1.10	VBD	1.70
vca	1.10	VCA	1.70	vcb	1.10	VCB	1.70	vcc	1.10	VCC	1.70
vcd	1.10	VCD	1.70	vda	1.10	VDA	1.70	vdb	1.10	VDB	1.70
vdc	1.10	VDC	1.70	vdd	1.10	VDD	1.70	waa	1.53	WAA	2.41
wab	1.54	WAB	2.56	wac	1.52	WAC	2.42	wad	1.54	WAD	2.48
wae	1.54	WAE	2.53	waf	1.55	WAF	2.41	wag	1.53	WAG	2.46
wah	1.53	WAH	2.41	wai	1.61	WAI	2.45	waj	1.84	WAJ	2.56
wak	1.60	WAK	2.53	wal	1.66	WAL	2.57	wam	1.66	WAM	2.57
wan	1.61	WAN	2.48	wao	1.60	WAO	2.55	wap	1.61	WAP	2.45
wba	1.53	WBA	2.45	wbb	1.55	WBB	2.47	wbc	1.53	WBC	2.50
wbd	1.54	WBD	2.51	wbe	1.54	WBE	2.50	wbf	1.55	WBF	2.49
wbg	1.53	WBG	2.48	wbh	1.53	WBH	2.44	wbi	1.59	WBI	2.40
wbj	1.61	WBJ	2.46	wbk	1.58	WBK	2.43	wbl	1.60	WBL	2.50
wbm	1.61	WBM	2.50	wbn	1.60	WBN	2.48	wbo	1.60	WBO	2.43
wbp	1.57	WBP	2.39	wca	1.55	WCA	2.42	wcb	1.58	WCB	2.53
wcc	1.55	WCC	2.46	wcd	1.60	WCD	2.53	wce	1.59	WCE	2.50
wcf	1.54	WCF	2.41	wcg	1.55	WCG	2.45	wch	1.54	WCH	2.42
wci	1.60	WCI	2.47	wcj	1.62	WCJ	2.55	wck	1.58	WCK	2.53
wcl	1.61	WCL	2.55	wcm	1.63	WCM	2.58	wcn	1.58	WCN	2.48
wco	1.57	WCO	2.51	wcp	1.60	WCP	2.47	wda	1.55	WDA	2.41
wdb	1.60	WDB	2.53	wdc	1.55	WDC	2.49	wdd	1.57	WDD	2.51
wde	1.55	WDE	2.50	wdf	1.55	WDF	2.50	wdg	1.55	WDG	2.48
wdh	1.53	WDH	2.41	wdi	1.57	WDI	2.38	wdj	1.69	WDJ	2.48
wdk	1.56	WDK	2.44	wdl	1.61	WDL	2.48	wdm	1.59	WDM	2.50
wdn	1.57	WDN	2.55	wdo	1.60	WDO	2.46	wdp	1.57	WDP	2.38
xaa	1.98	XAA	1.28	xab	1.86	XAB	1.29	xac	1.63	XAC	1.29
xad	1.50	XAD	1.28	xae	1.93	XAE	1.29	xaf	1.82	XAF	1.33
xag	1.60	XAG	1.29	xah	1.54	XAH	1.29				

4.00 was largest path length found.

SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY	SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY
	5103-0000	60-60 OHM RESISTOR	1502		0118-2100	I.C. G-A U	
	5168-2200	12-12 OHM MICRO-TEE			0118-2200	I.C. G-A W	47
	5168-2201	15-15 OHM MICRO-TEE	48		0119-5300	I.C. G-A X	83
	5103-1900	CAPACITOR (LOGIC)	32		5103-0100	BLANK CHIP	96
	5103-5200	JUMPER- STARTER	544			MEMORY CHIP	
	5103-5300	JUMPER- PASS-THRU	2034		5102-0840	P.C. BOARD (ABC)	
	5103-5400	JUMPER- TERMINATOR	544		THRU	THRU	
	— — —	JUMPER GROUND	— — —		5102-0847	P.C. BOARD (VWX)	8
	— — —	VIA	— — —				
	5103-1300	CONNECTORS	8		5103-4900	LEADLESS MOS	
	0118-0200	I.C. G-A A			0110-0001	180-120 RES	
	0118-0300	I.C. G-A B			0118-6400	SMT TRANS	
	0118-0400	I.C. G-A C			5168-2300	PNP TRANS	
	0118-0500	I.C. G-A D			5103-5500	CAP	
	0118-0600	I.C. G-A E			5168-2202	30-180 OHM MICRO-TEE	21
	0118-0700	I.C. G-A F					
	0118-0800	I.C. G-A G					
	0118-0900	I.C. G-A H	33				
	0118-1000	I.C. G-A I	21				
	0118-1100	I.C. G-A J	34				
	0118-1200	I.C. G-A K			5101-0840	P.C. BOARD ASSEM. (ABC)	
	0118-1300	I.C. G-A L	123		THRU	THRU	
	0118-1400	I.C. G-A M	65		5101-0847	P.C. BOARD ASSEM. (VWX)	8
	0118-1500	I.C. G-A N					
	0118-1600	I.C. G-A O					
	0118-1700	I.C. G-A P	201				
	0118-1800	I.C. G-A Q	1				
	0118-3200	I.C. G-A R	64				
	0118-1900	I.C. G-A T					
	0118-2000	I.C. G-A U					
					MODULE ASSEMBLY PART NO. 5100-0105	CRAY RESEARCH RIVERSIDE PROJECT	
					RELEASE DATE: 10/31/84	EB MODULE ASSEMBLY REVISION C	

SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY	SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY
	5103-0000	60-60 OHM RESISTOR	211		0118-2100	I.C. G-A U	6 10 10 1
	5168-2200	12-12 OHM MICRO-TEE	6		0118-2200	I.C. G-A W	
	5168-2201	15-15 OHM MICRO-TEE	4		0119-5300	I.C. G-A X	
	5103-1900	CAPACITOR (LOGIC)	343		5103-0100	BLANK CHIP	
	5103-5200	JUMPER-STARTER			5102-0840	P.C. BOARD	
	5103-5300	JUMPER-PASS-THRU				MEMORY CHIP	
	5103-5400	JUMPER-TERMINATOR					
		JUMPER GROUND					
		VIA					
		VIA					
	5103-1300	CONNECTOR	1			LEADLESS MOS	3
	0118-0200	I.C. G-A A			0110-0001	180-120 RES	
	0118-0300	I.C. G-A B			0118-6400	SMT TRANS	
	0118-0400	I.C. G-A C			5168-2300	PNP TRANS	
	0118-0500	I.C. G-A D			5103-5500	CAP	
	0118-0600	I.C. G-A E			5168-2202	30-180 OHM MICRO-TEE	
	0118-0700	I.C. G-A F					
	0118-0800	I.C. G-A G					
	0118-0900	I.C. G-A H	2				
	0118-1000	I.C. G-A I	2				
	0118-1100	I.C. G-A J	5				
	0118-1200	I.C. G-A K					
	0118-1300	I.C. G-A L	20				
	0118-1400	I.C. G-A M	6				
	0118-1500	I.C. G-A N					
	0118-1600	I.C. G-A O					
	0118-1700	I.C. G-A P	26				
	0118-1800	I.C. G-A Q	1				
	0118-3200	I.C. G-A R	8				
	0118-1900	I.C. G-A T					
	0118-2000	I.C. G-A U					
				BOARD ASSEMBLY PART NO. 5101-0840		CRAY RESEARCH RIVERSIDE PROJECT	
				RELEASE DATE: 10/31/84		MODULE BOARD REV. EB ABC C	

EB ABC Rev-C 10/31/84



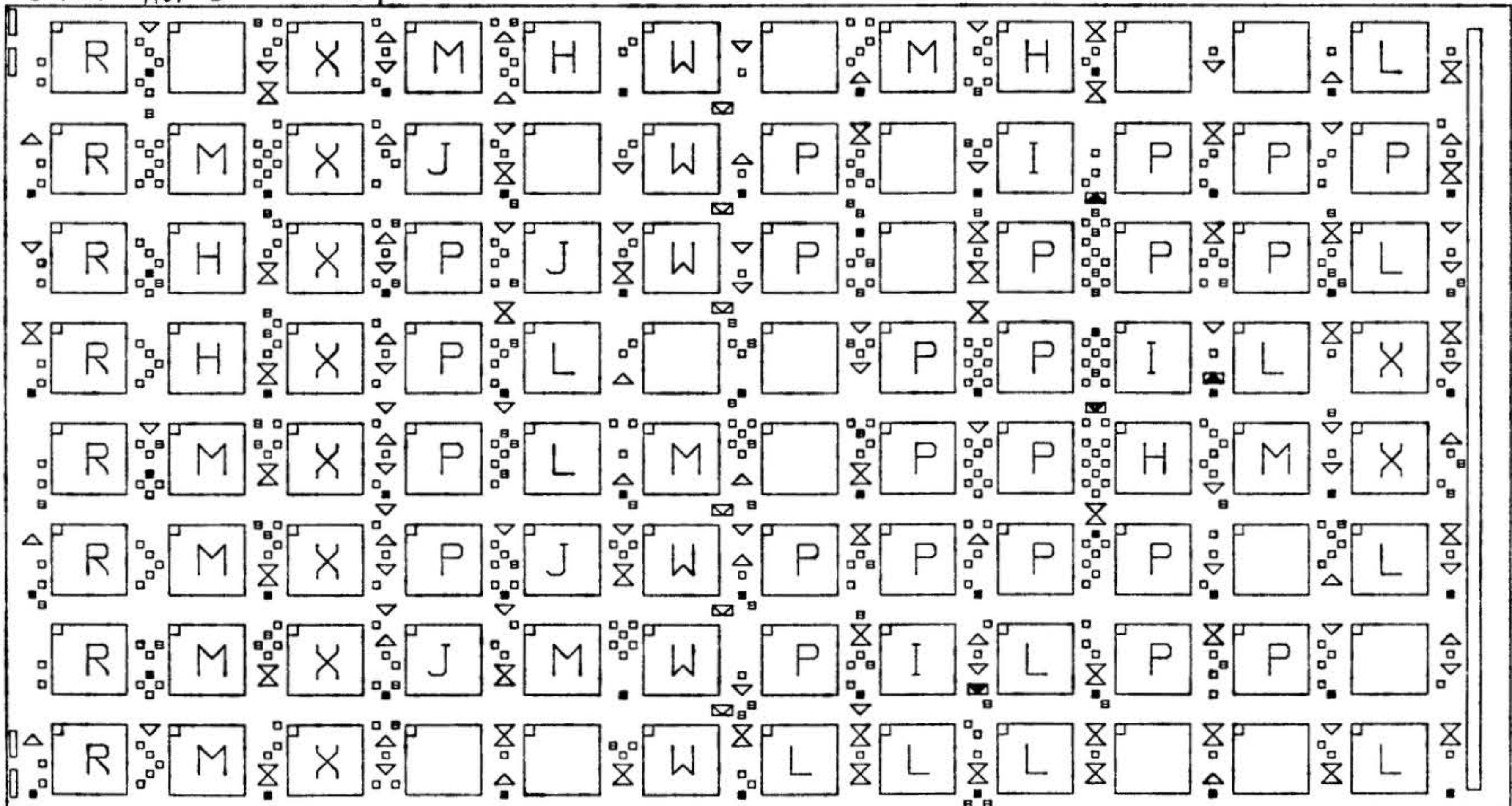
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△	5103-0000	60-60 OHM RESISTOR	164	☑	0118-2100	I.C. G-A U	6 10 16 1
⊗	5168-2200	12-12 OHM MICRO-TEE	6	☑	0118-2200	I.C. G-A W	
⊗	5168-2201	15-15 OHM MICRO-TEE	4	☑	0119-5300	I.C. G-A X	
○	5103-1900	CAPACITOR (LOGIC)	42	□	5103-0100	BLANK CHIP	
○	5103-5200	JUMPER- STARTER	331	☑	5102-0841	P.C. BOARD	
○	5103-5300	JUMPER- PASS-THRU	12	☑		MEMORY CHIP	
○	5103-5400	JUMPER- TERMINATOR	1				
○	5103-5400	JUMPER GROUND	1				
○	5103-5400	VIA	1				
○	5103-1300	CONNECTOR	1				
⊠	0118-0200	I.C. G-A A	5 3 4	☐	0110-0001	LEADLESS MOS	4
⊠	0118-0300	I.C. G-A B		△	0118-6400	180-120 RES	
⊠	0118-0400	I.C. G-A C		△	5168-2300	SMT TRANS	
⊠	0118-0500	I.C. G-A D		⊠	5103-5500	PNP TRANS	
⊠	0118-0600	I.C. G-A E		⊠	5168-2202	CAP	
⊠	0118-0700	I.C. G-A F		⊠		30-180 OHM MICRO-TEE	
⊠	0118-0800	I.C. G-A G					
⊠	0118-0900	I.C. G-A H					
⊠	0118-1000	I.C. G-A I					
⊠	0118-1100	I.C. G-A J					
⊠	0118-1200	I.C. G-A K	11				
⊠	0118-1300	I.C. G-A L	10				
⊠	0118-1400	I.C. G-A M	23				
⊠	0118-1500	I.C. G-A N	8				
⊠	0118-1600	I.C. G-A O					
⊠	0118-1700	I.C. G-A P					
⊠	0118-1800	I.C. G-A Q					
⊠	0118-3200	I.C. G-A R					
⊠	0118-1900	I.C. G-A S					
⊠	0118-2000	I.C. G-A T					
⊠	0118-2000	I.C. G-A U					

BOARD ASSEMBLY
PART NO.
5101-0841
RELEASE DATE:
10/31/84

CRAY RESEARCH
RIVERSIDE PROJECT

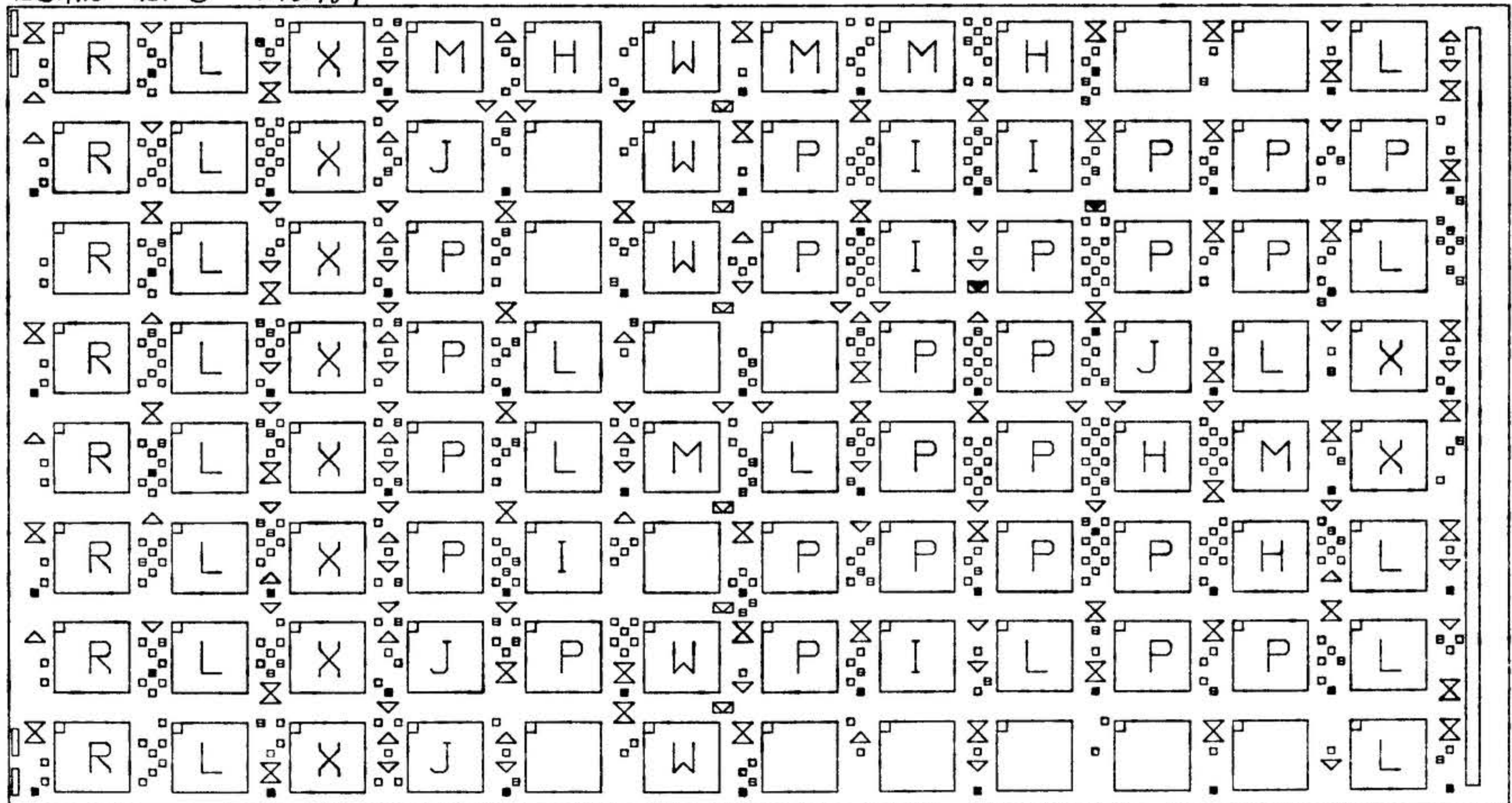
MODULE	BOARD	REV.
EB	DEF	C

EBDEF Rev-C 10/31/84



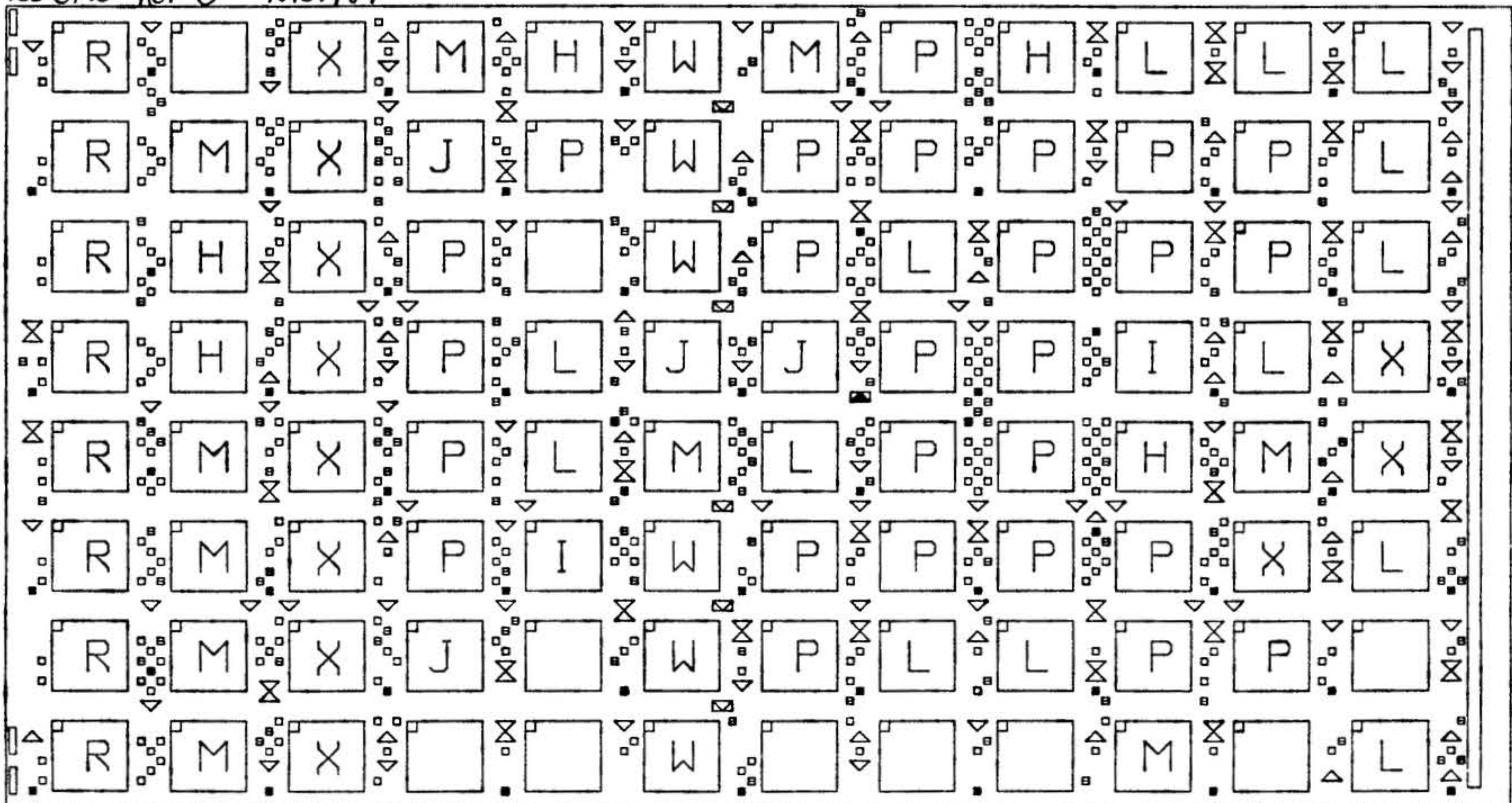
SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY	SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY	
	5103-0000	60-60 OHM RESISTOR	196		0118-2100	I.C. G-A U	5 10 13 1	
	5168-2200	12-12 OHM MICRO-TEE	6		0118-2200	I.C. G-A W		
	5168-2201	15-15 OHM MICRO-TEE	4		0119-5300	I.C. G-A X		
	5103-1900	CAPACITOR (LOGIC)	66		5103-0100	BLANK CHIP		
	5103-5200	JUMPER-STARTER	322		5102-0844	P.C. BOARD		
	5103-5300	JUMPER-PASS-THRU	40			MEMORY CHIP		
	5103-5400	JUMPER-TERMINATOR						
		JUMPER GROUND						
		UJA						
	5103-1300	CONNECTOR	1					
	0118-0200	I.C. G-A A				LEADLESS MOS		
	0118-0300	I.C. G-A B			0110-0001	180-120 RES		2
	0118-0400	I.C. G-A C			0118-6400	SMT TRANS		
	0118-0500	I.C. G-A D			5168-2300	PNP TRANS		
	0118-0600	I.C. G-A E			5103-5500	CAP		
	0118-0700	I.C. G-A F			5168-2202	30-180 OHM MICRO-TEE		
	0118-0800	I.C. G-A G	4					
	0118-0900	I.C. G-A H	5					
	0118-1000	I.C. G-A I	4					
	0118-1100	I.C. G-A J	4					
	0118-1200	I.C. G-A K	18					
	0118-1300	I.C. G-A L	5					
	0118-1400	I.C. G-A M	5					
	0118-1500	I.C. G-A N						
	0118-1600	I.C. G-A O	24					
	0118-1700	I.C. G-A P	8					
	0118-1800	I.C. G-A Q						
	0118-3200	I.C. G-A R						
	0118-1900	I.C. G-A T						
	0118-2000	I.C. G-A U						
				BOARD ASSEMBLY PART NO. 5101-0844		CRAY RESEARCH RIVERSIDE PROJECT		
				RELEASE DATE: 10/31/84		MODULE BOARD REV. EB MNO C		

EBMNO Rev-C 10/31/84



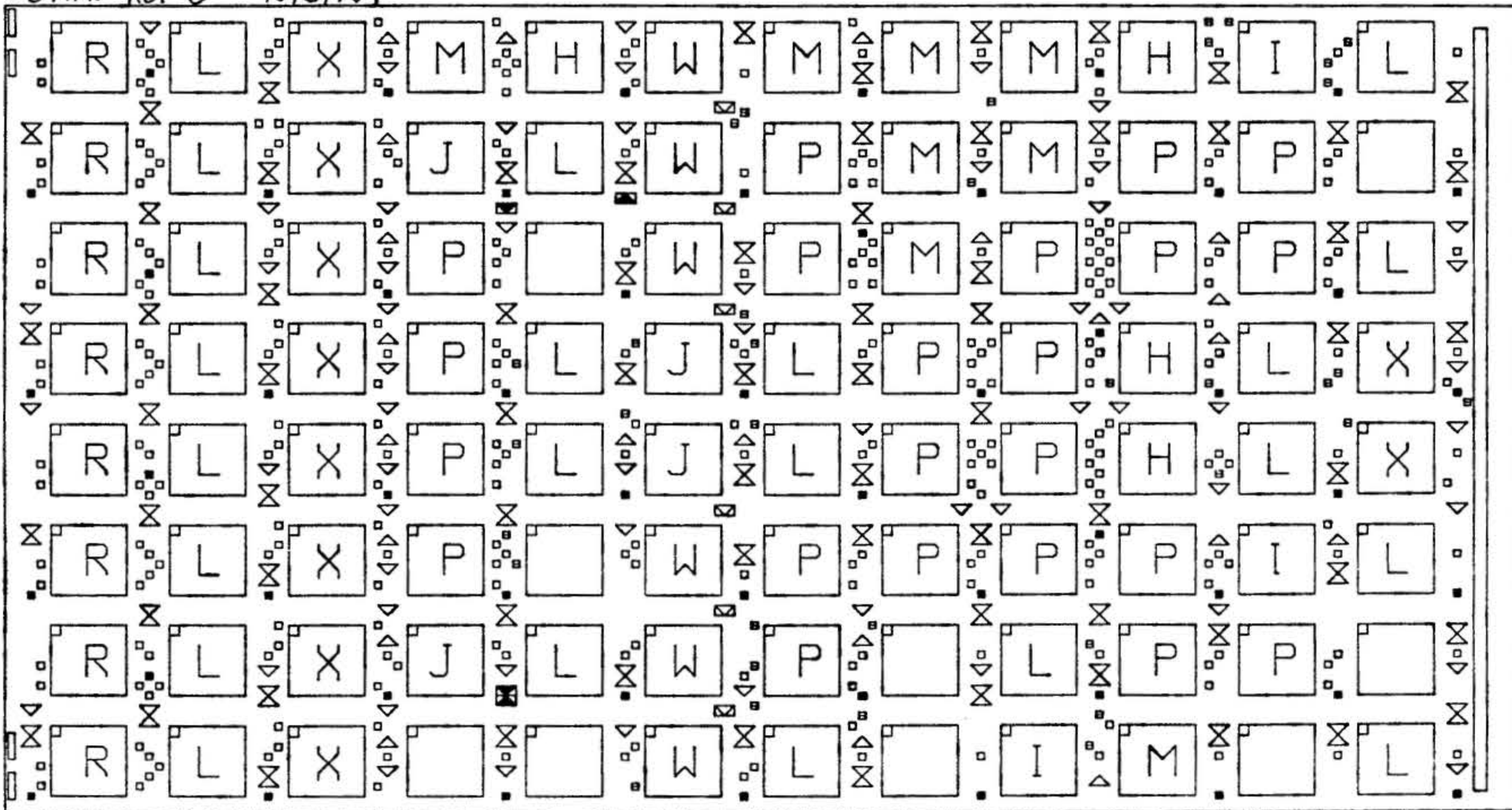
SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY	SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY	
△	5103-0000	60-60 OHM RESISTOR	171	□	0118-2100	I.C. G-A U	6 11 10 1	
△	5168-2200	12-12 OHM MICRO-TEE	6	□	0118-2200	I.C. G-A W		
△	5168-2201	15-15 OHM MICRO-TEE		4	□	0119-5300		I.C. G-A X
○	5103-1900	CAPACITOR (LOGIC)	11	□	5103-0100	BLANK CHIP		
○	5103-5200	JUMPER- STARTER	331	□	5102-0846	P.C. BOARD		
○	5103-5300	JUMPER- PASS-THRU	45	□		MEMORY CHIP		
○	5103-5400	JUMPER- TERMINATOR						
○		JUMPER GROUND						
○		VIA						
○		CONNECTOR	1					
□	0118-0200	I.C. G-A A	5	□		LEADLESS MOS	1	
□	0118-0300	I.C. G-A B			△	0110-0001		180-120 RES
□	0118-0400	I.C. G-A C			△	0118-6400		SMT TRANS
□	0118-0500	I.C. G-A D			△	5168-2300		PNP TRANS
□	0118-0600	I.C. G-A E			△	5103-5500		CAP
□	0118-0700	I.C. G-A F			△	5168-2202		30-180 OHM MICRO-TEE
□	0118-0800	I.C. G-A G		2				
□	0118-0900	I.C. G-A H		4				
□	0118-1000	I.C. G-A I		14				
□	0118-1100	I.C. G-A J		10				
□	0118-1200	I.C. G-A K	26					
□	0118-1300	I.C. G-A L						
□	0118-1400	I.C. G-A M						
□	0118-1500	I.C. G-A N						
□	0118-1600	I.C. G-A O						
□	0118-1700	I.C. G-A P						
□	0118-1800	I.C. G-A Q						
□	0118-3200	I.C. G-A R		8				
□	0118-1900	I.C. G-A T						
□	0118-2000	I.C. G-A U						
				BOARD ASSEMBLY PART NO. 5101-0846		CRAY RESEARCH RIVERSIDE PROJECT		
				RELEASE DATE: 10/31/84		MODULE BOARD REV. EB STU C		

EBSTU Rev-C 10/31/84

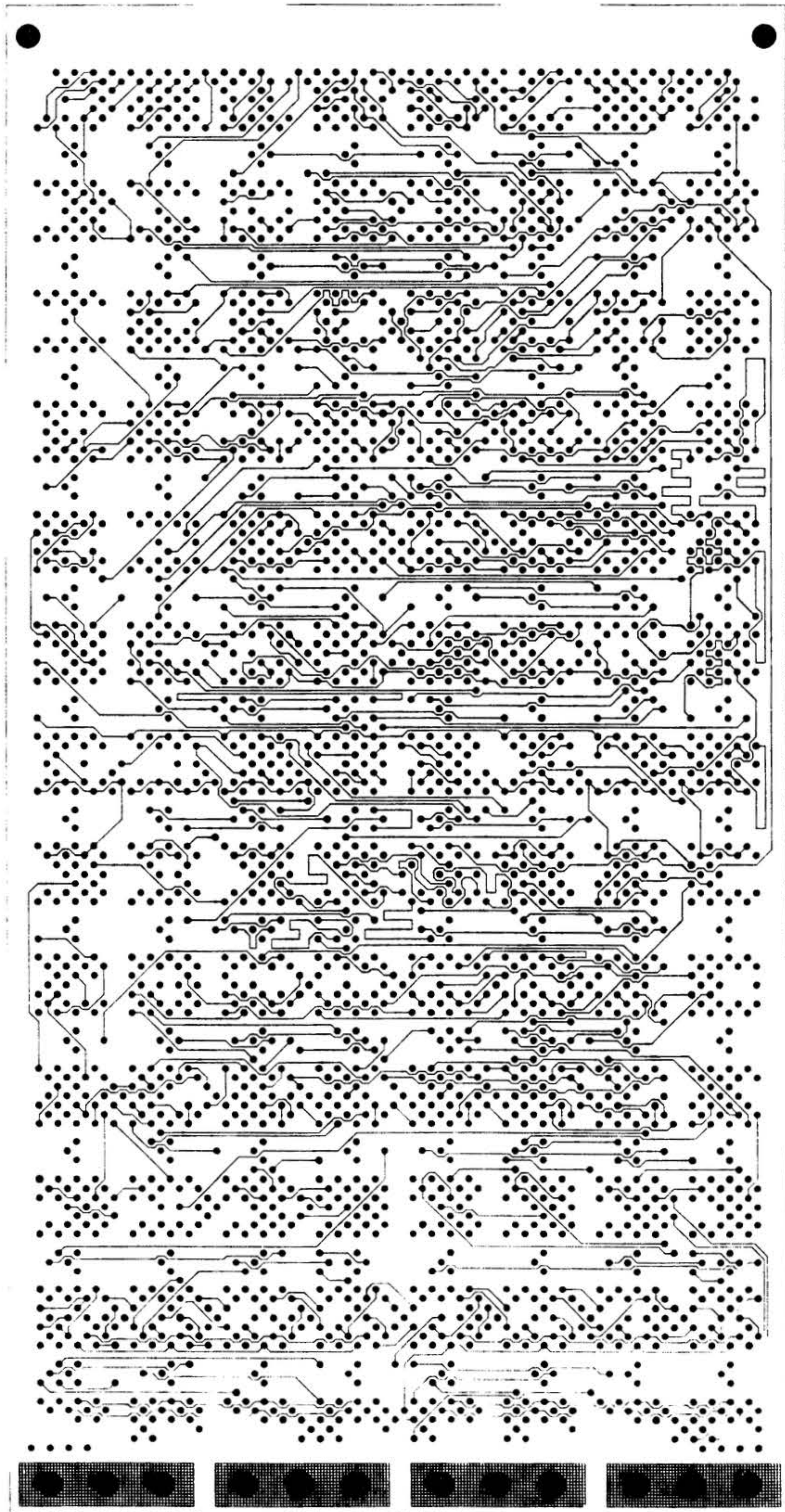


SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY	SYMBOL	PART NO.	PART DESCRIPTION	QUANTITY
	5103-0000	60-60 OHM RESISTOR	222		0118-2100	I.C. G-A U	6 10 9 1
	5168-2200	12-12 OHM MICRO-TEE	6		0118-2200	I.C. G-A W	
	5168-2201	15-15 OHM MICRO-TEE	4		0119-5300	I.C. G-A X	
	5103-1900	CAPACITOR (LOGIC)			5103-0100	BLANK CHIP	
	5103-5200	JUMPER-STARTER	342		5102-0847	P.C. BOARD	
	5103-5300	JUMPER-PASS-THRU				MEMORY CHIP	
	5103-5400	JUMPER-TERMINATOR					
		VIA	1				
	5103-1300	CONNECTOR					
	0118-0200	I.C. G-A A				LEADLESS MOS	
	0118-0300	I.C. G-A B			0110-0001	180-120 RES	4
	0118-0400	I.C. G-A C			0118-6400	SMT TRANS	
	0118-0500	I.C. G-A D			5168-2300	PNP TRANS	
	0118-0600	I.C. G-A E			5103-5500	CAP	
	0118-0700	I.C. G-A F			5168-2202	30-180 OHM MICRO-TEE	
	0118-0800	I.C. G-A G					
	0118-0900	I.C. G-A H	4				
	0118-1000	I.C. G-A I	3				
	0118-1100	I.C. G-A J	4				
	0118-1200	I.C. G-A K					
	0118-1300	I.C. G-A L	22				
	0118-1400	I.C. G-A M	8				
	0118-1500	I.C. G-A N					
	0118-1600	I.C. G-A O					
	0118-1700	I.C. G-A P	22				
	0118-1800	I.C. G-A Q					
	0118-3200	I.C. G-A R	8				
	0118-1900	I.C. G-A T					
	0118-2000	I.C. G-A U					
				BOARD ASSEMBLY PART NO. 5101-0847		CRAY RESEARCH RIVERSIDE PROJECT	
				RELEASE DATE: 10/31/84		MODULE BOARD REV. EB VWX C	

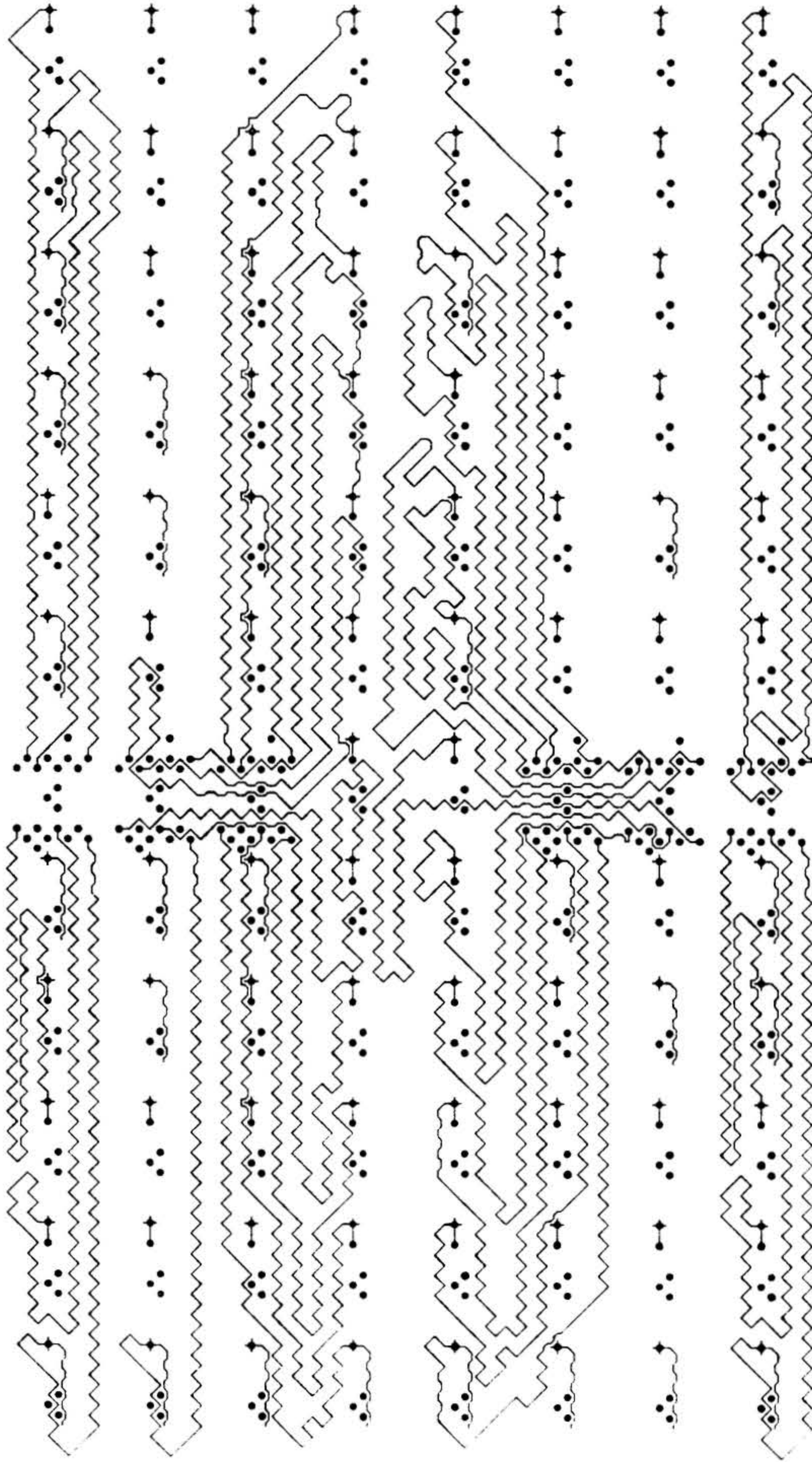
EBVWX Rev-C 10/31/84



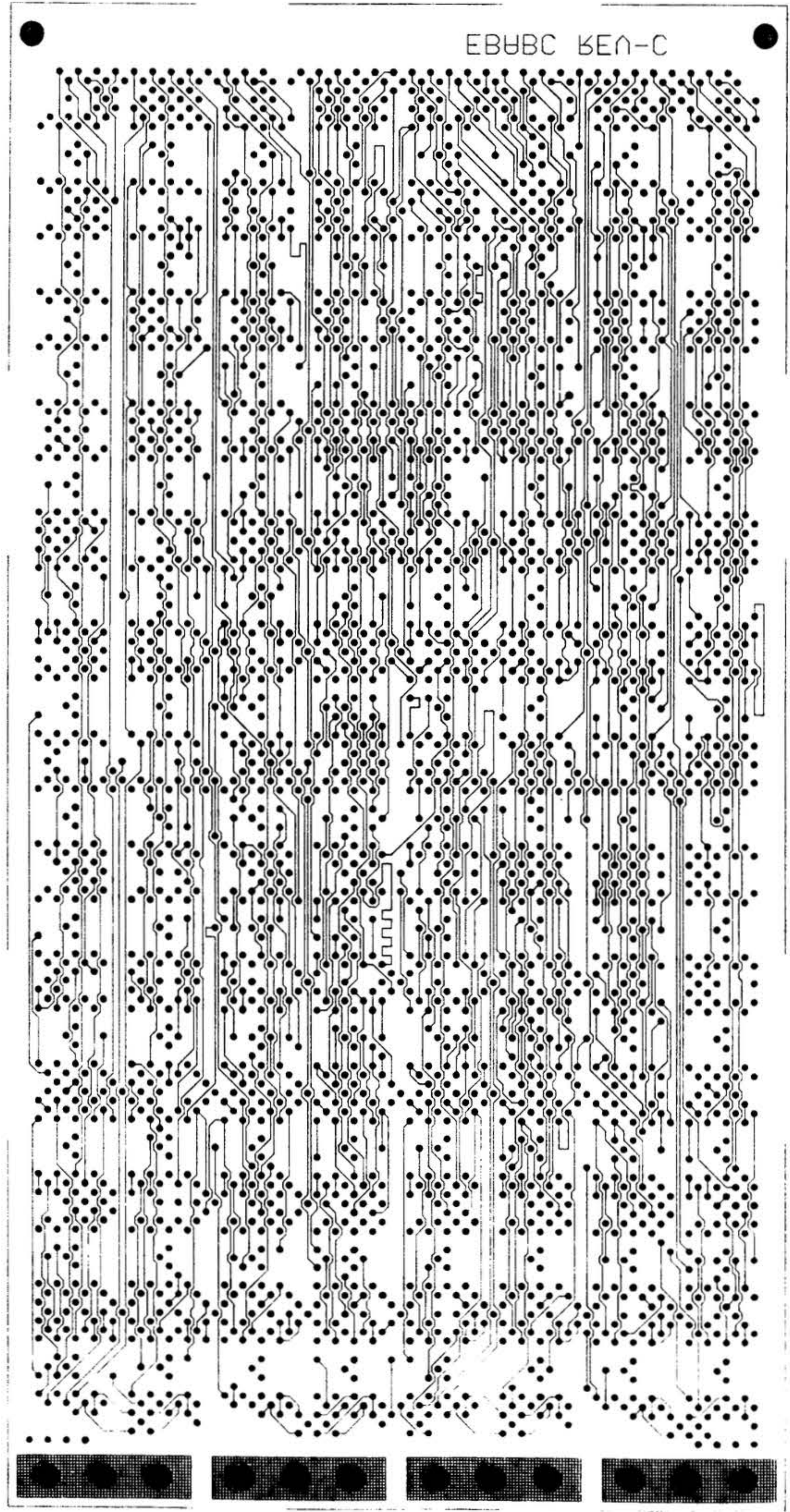
1 FBABC REU-C



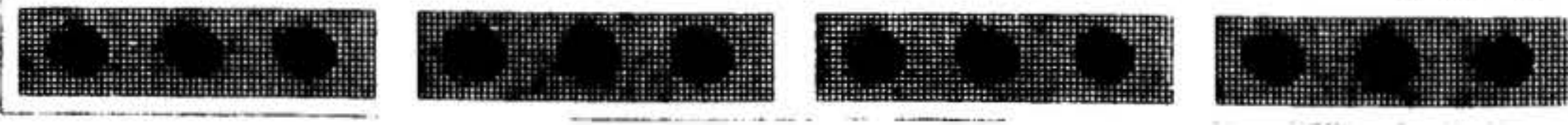
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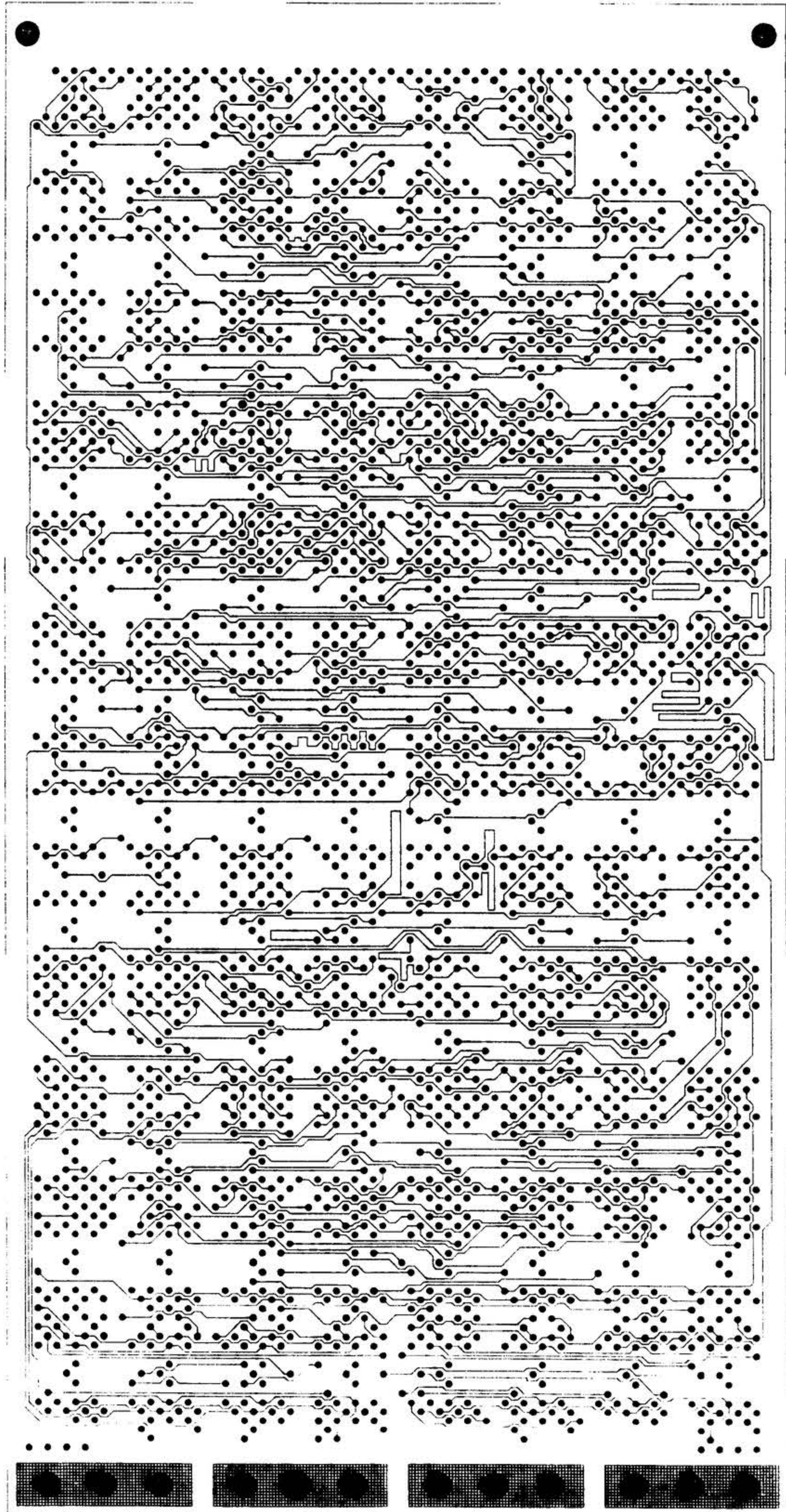
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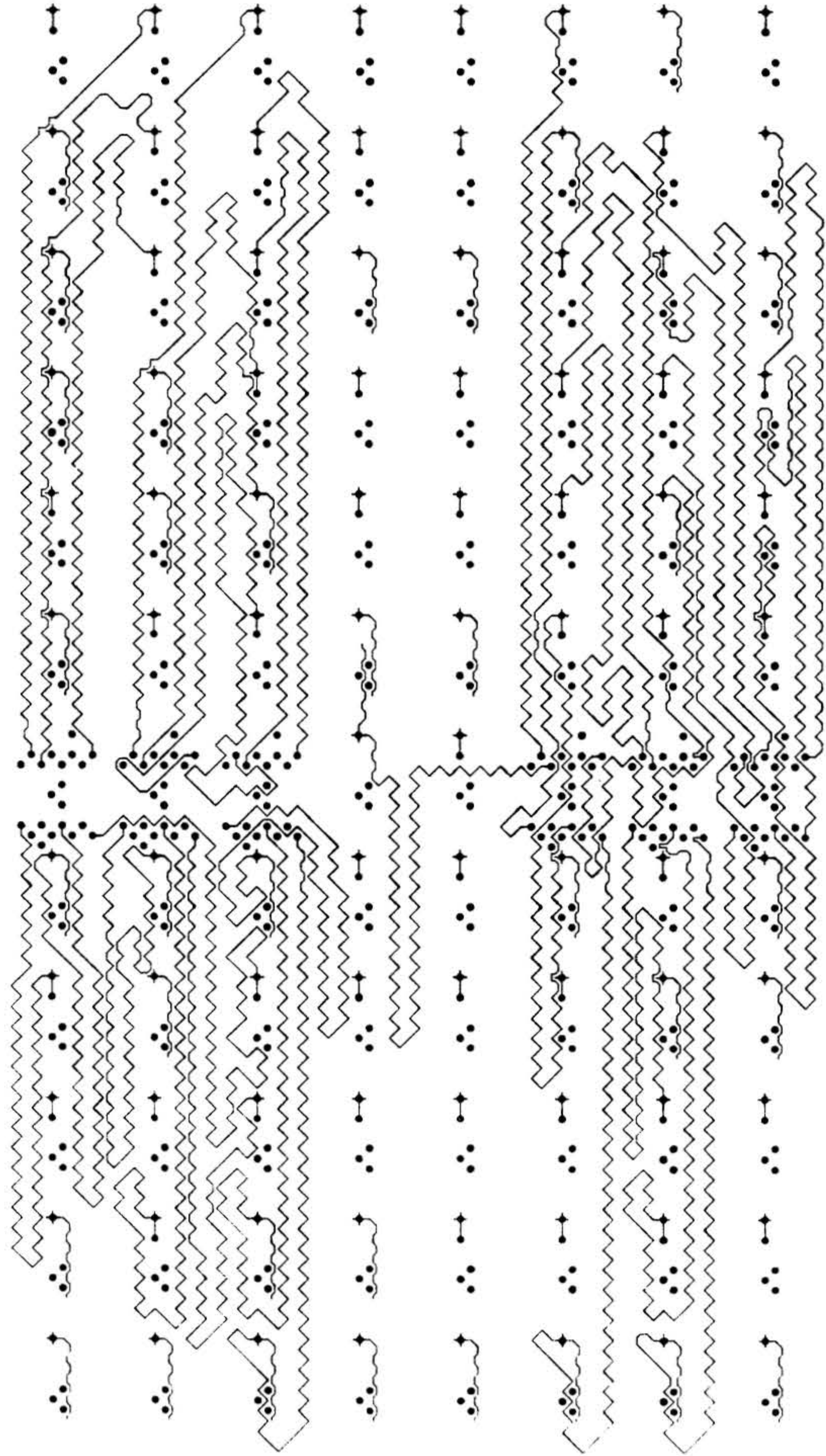
6 EBABC REV-C



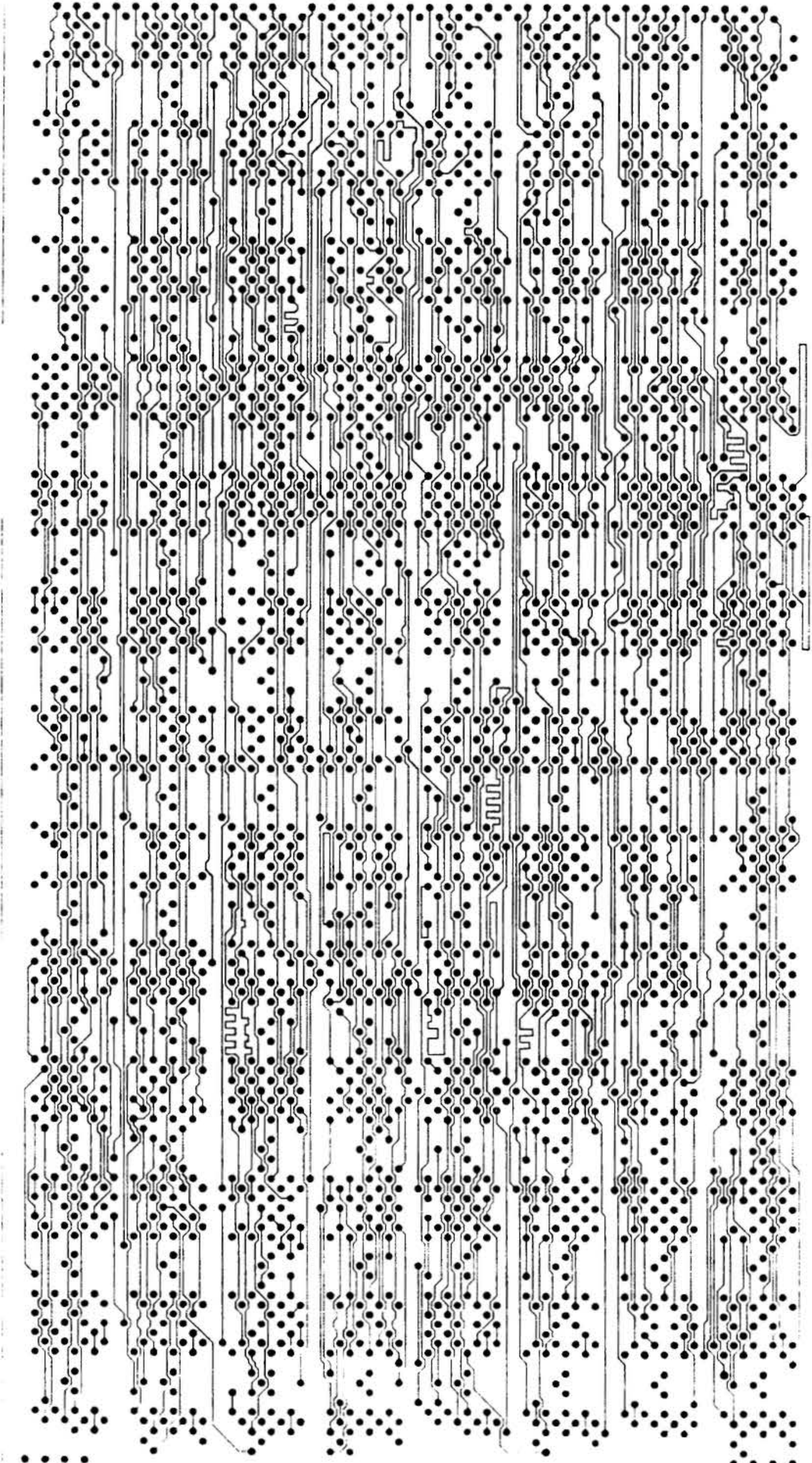
3 EBDEF REV-C



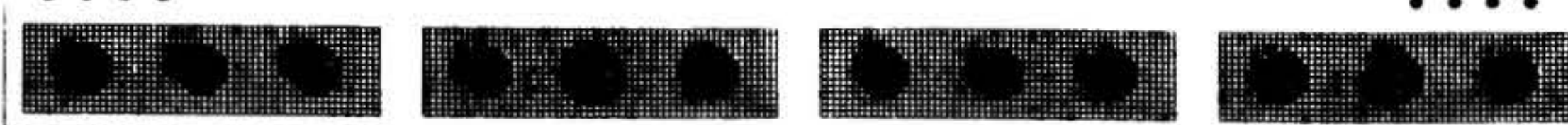
4 4300FF PEU-C



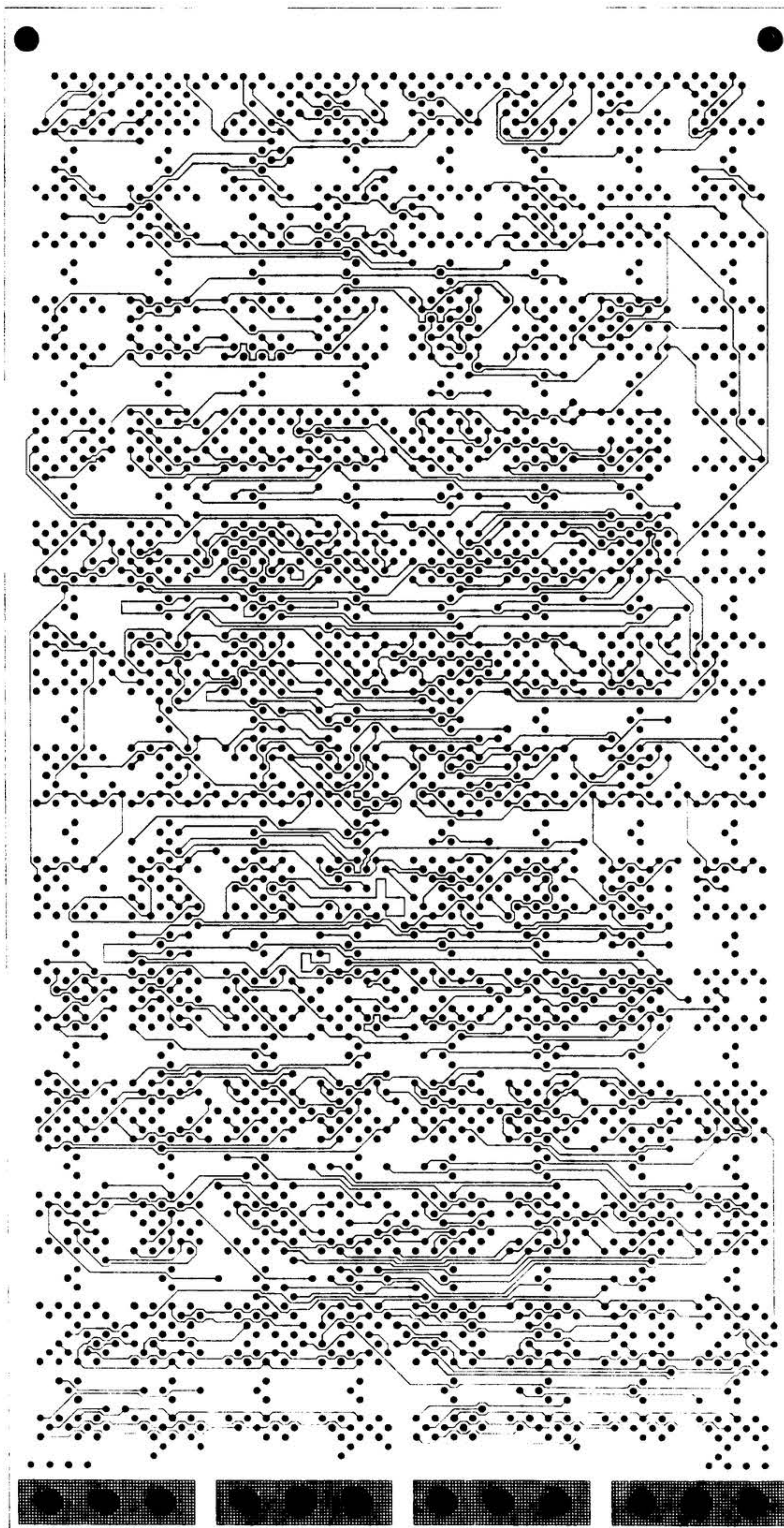
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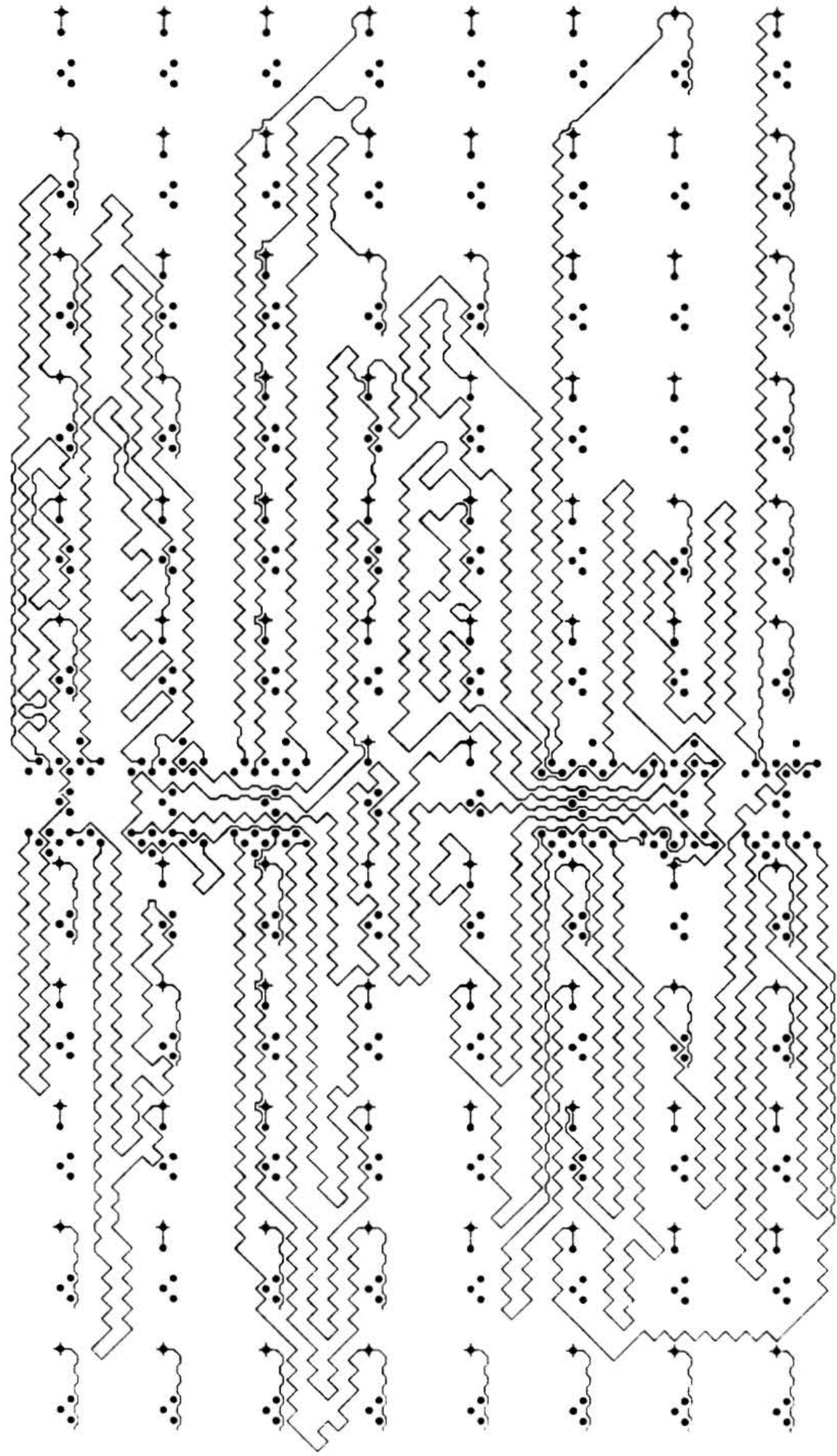
3 EBDEF REV-C



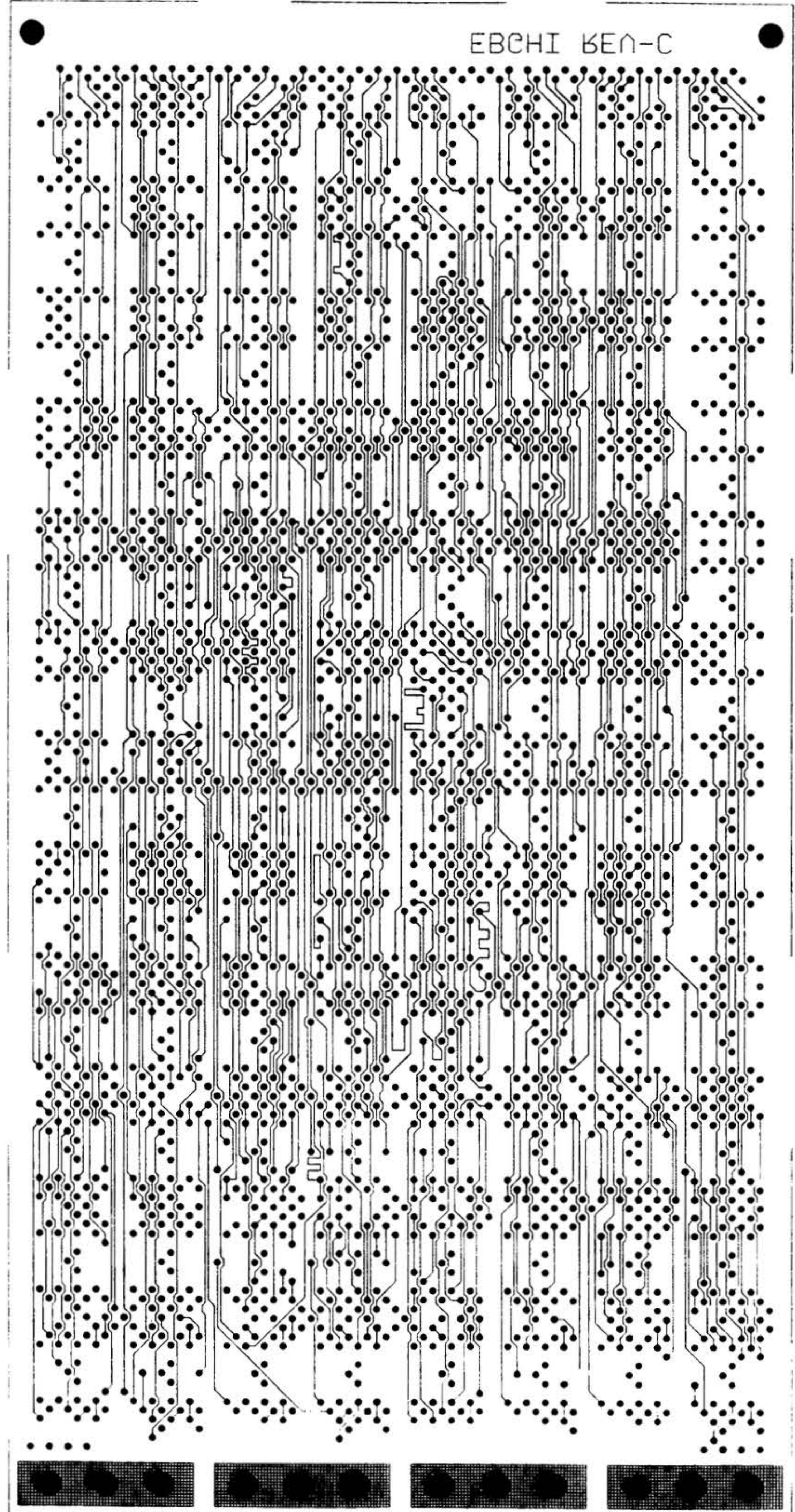
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3 FBGHI REV-C

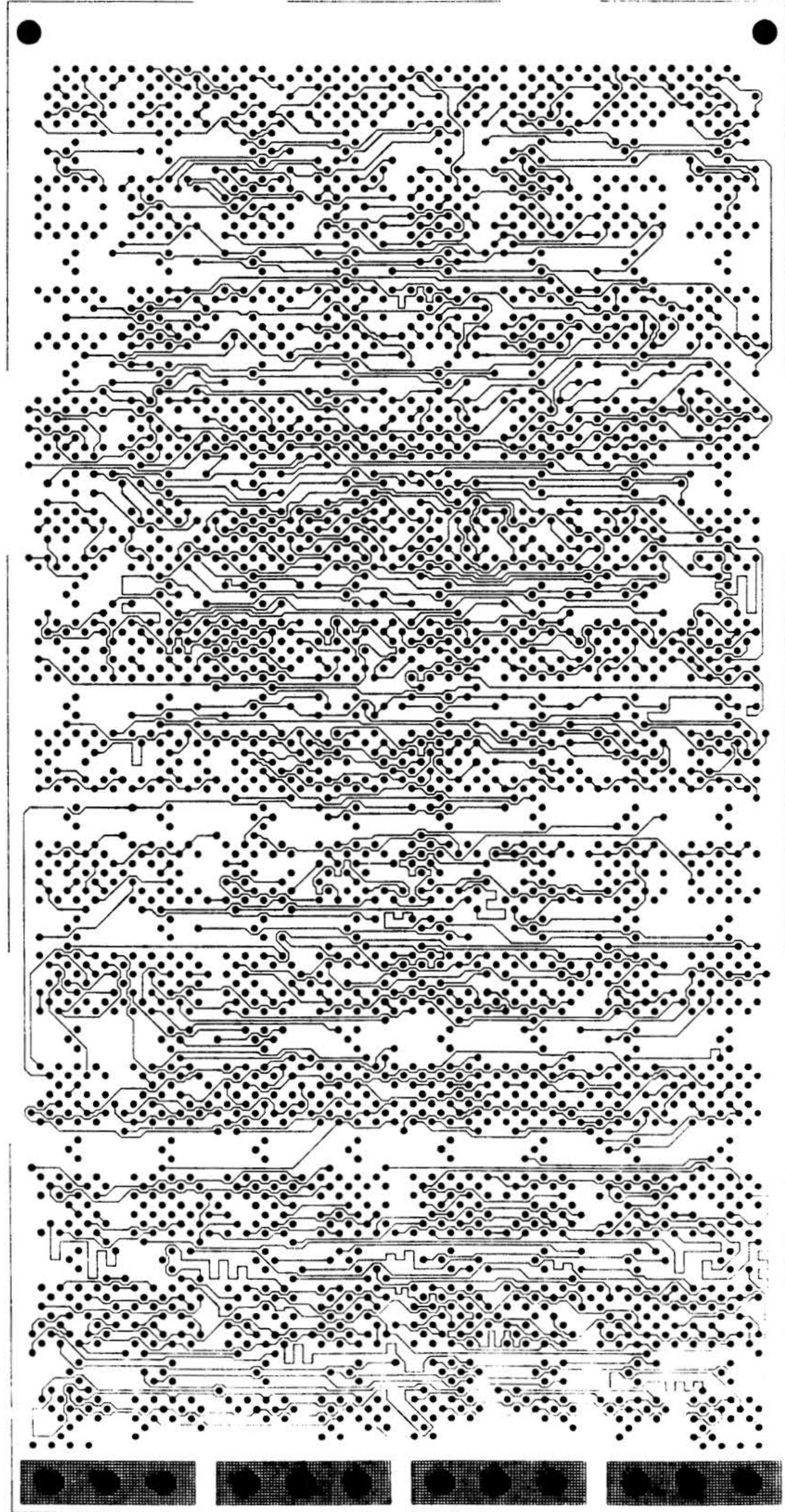


EBCHI 6E1-C

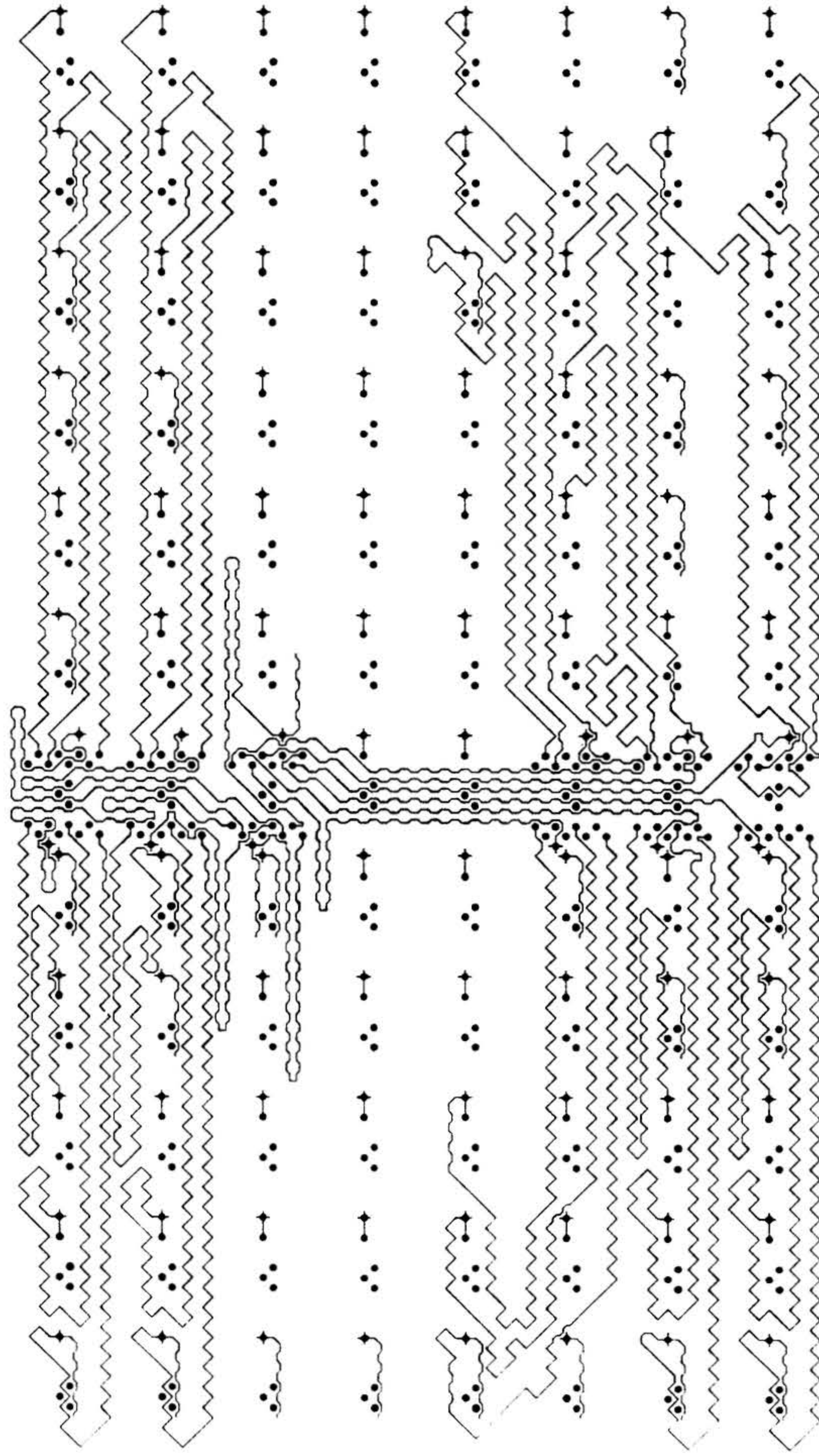


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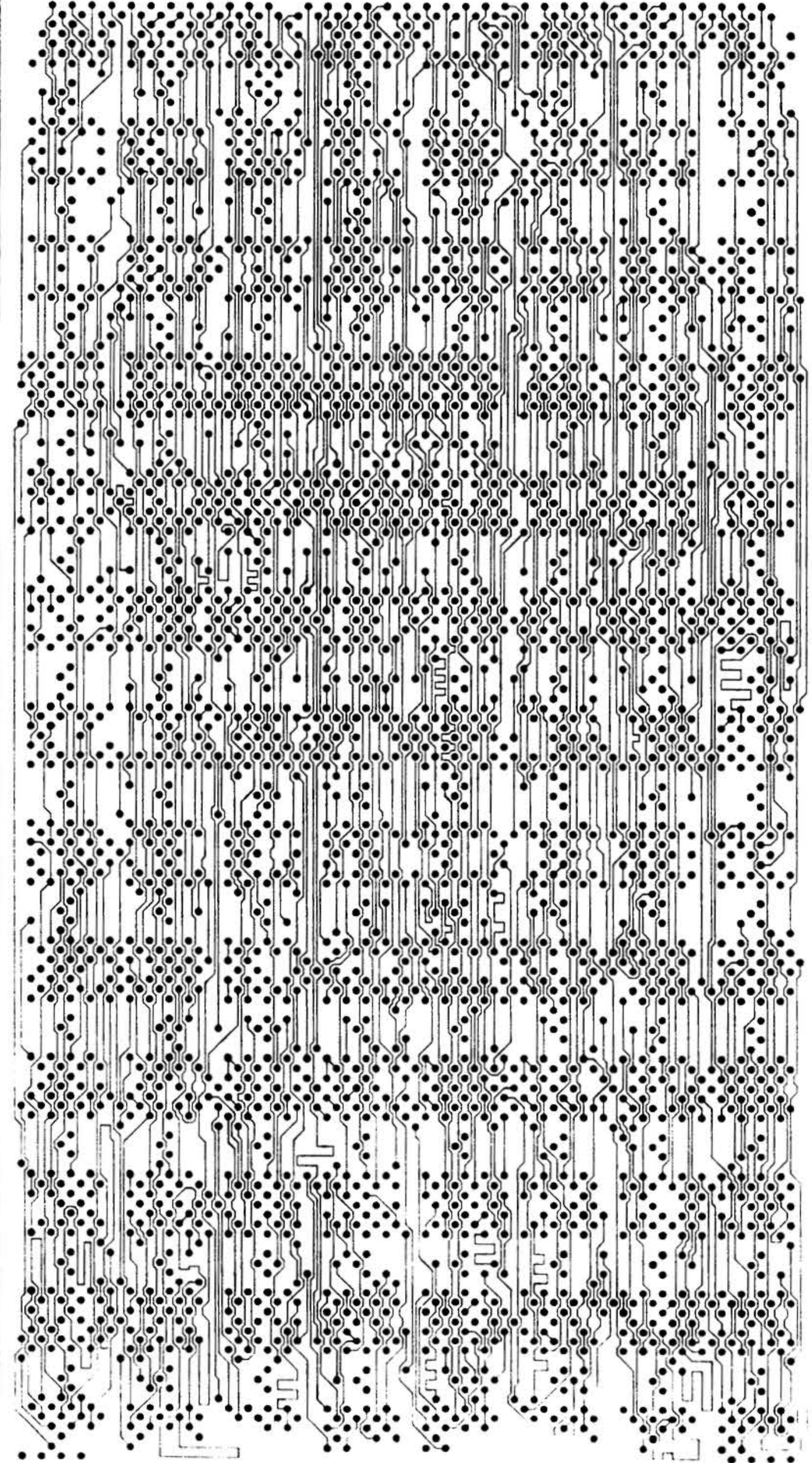
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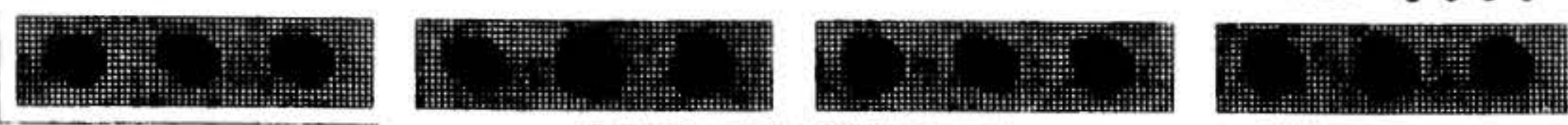
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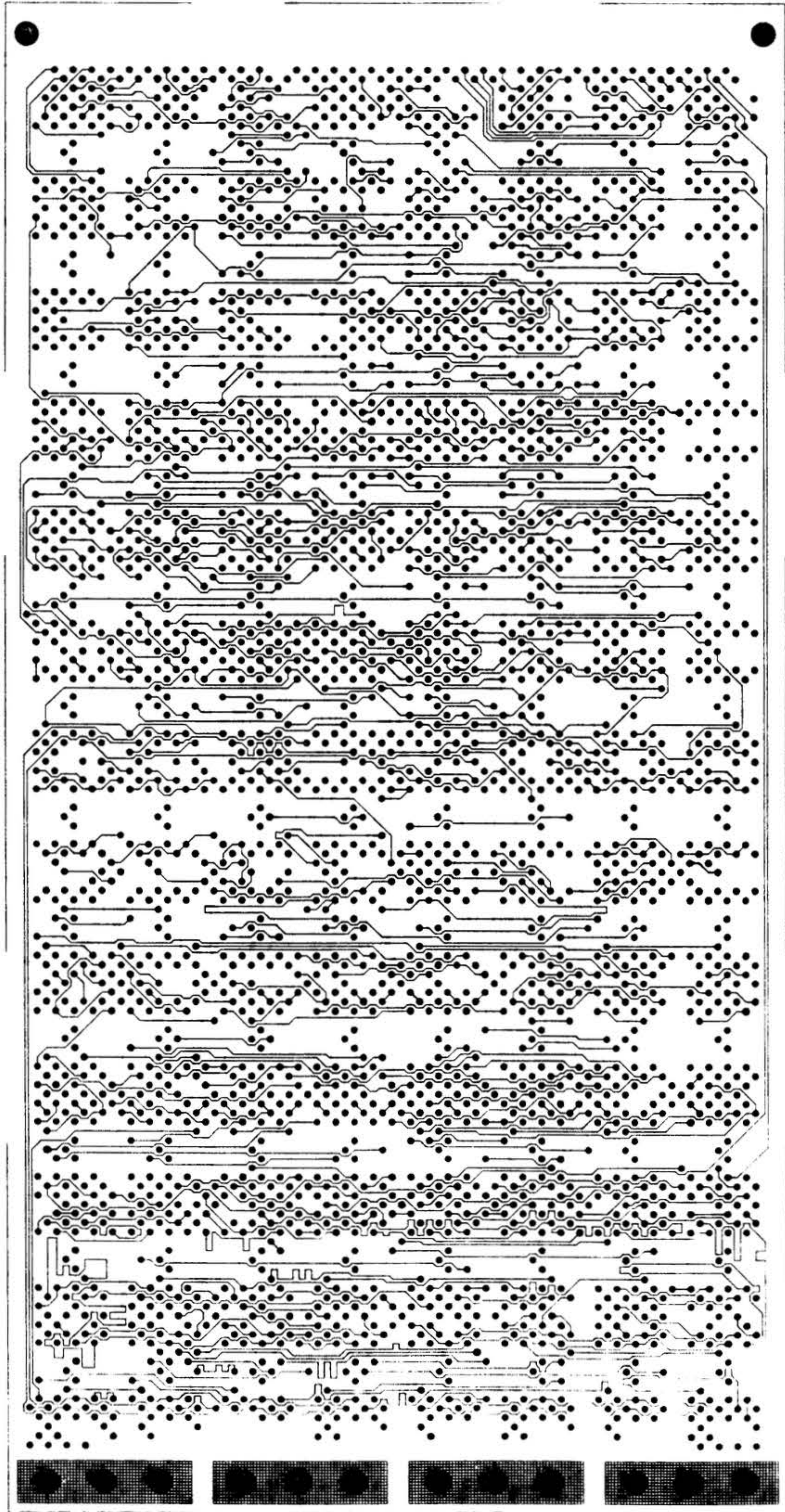
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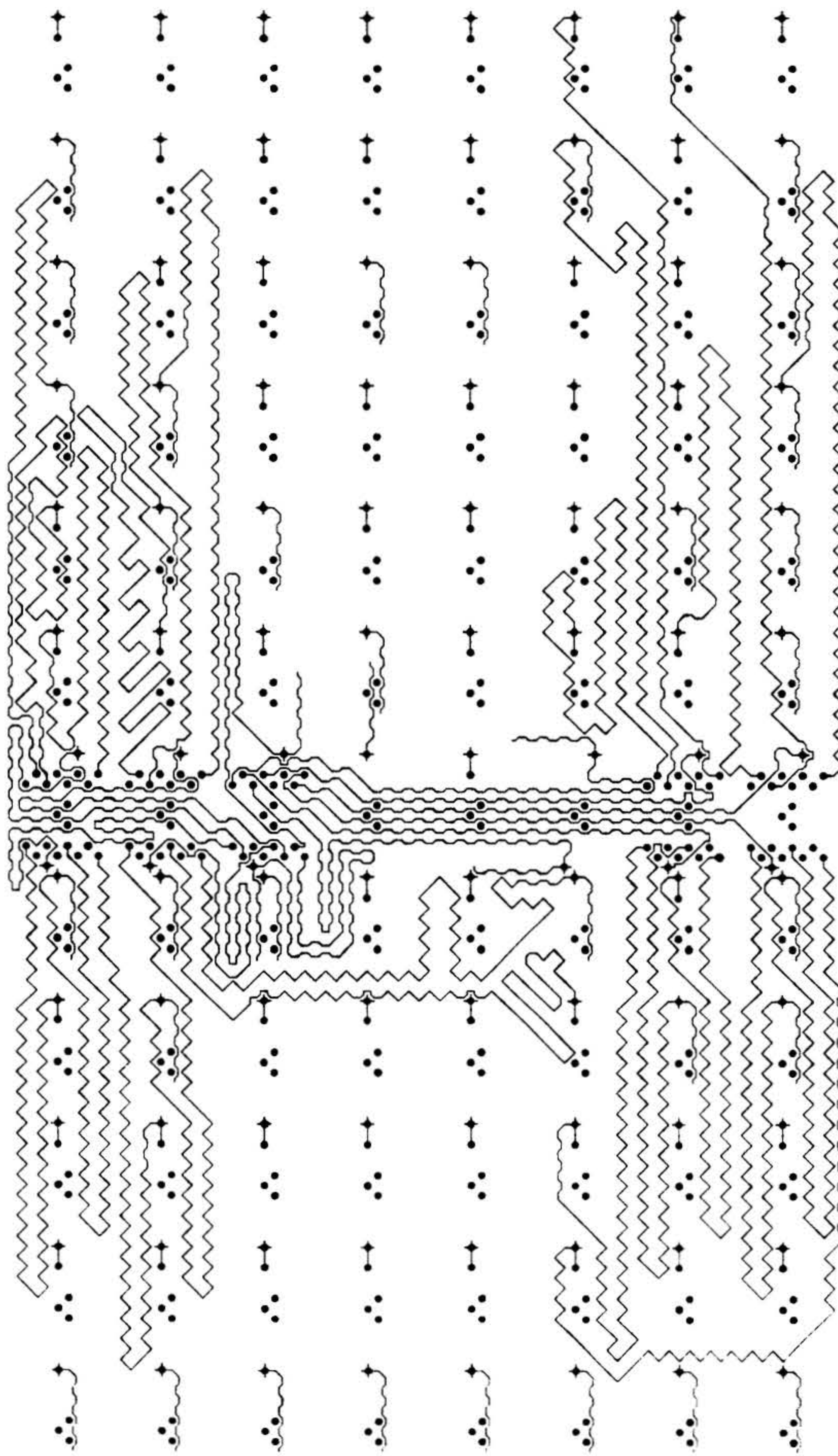
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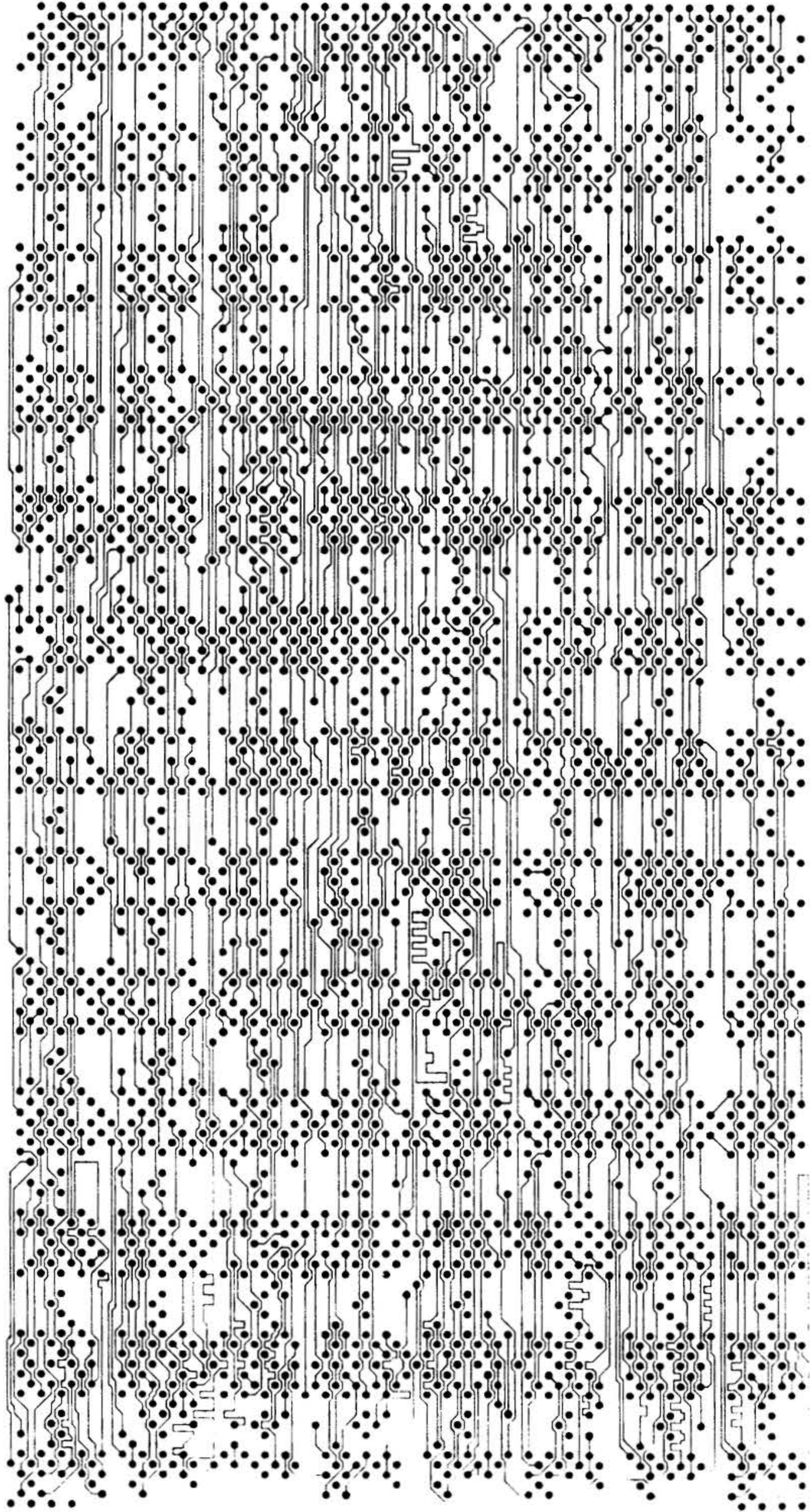
4 EBMD REU-C



3 EBMNO REV-C



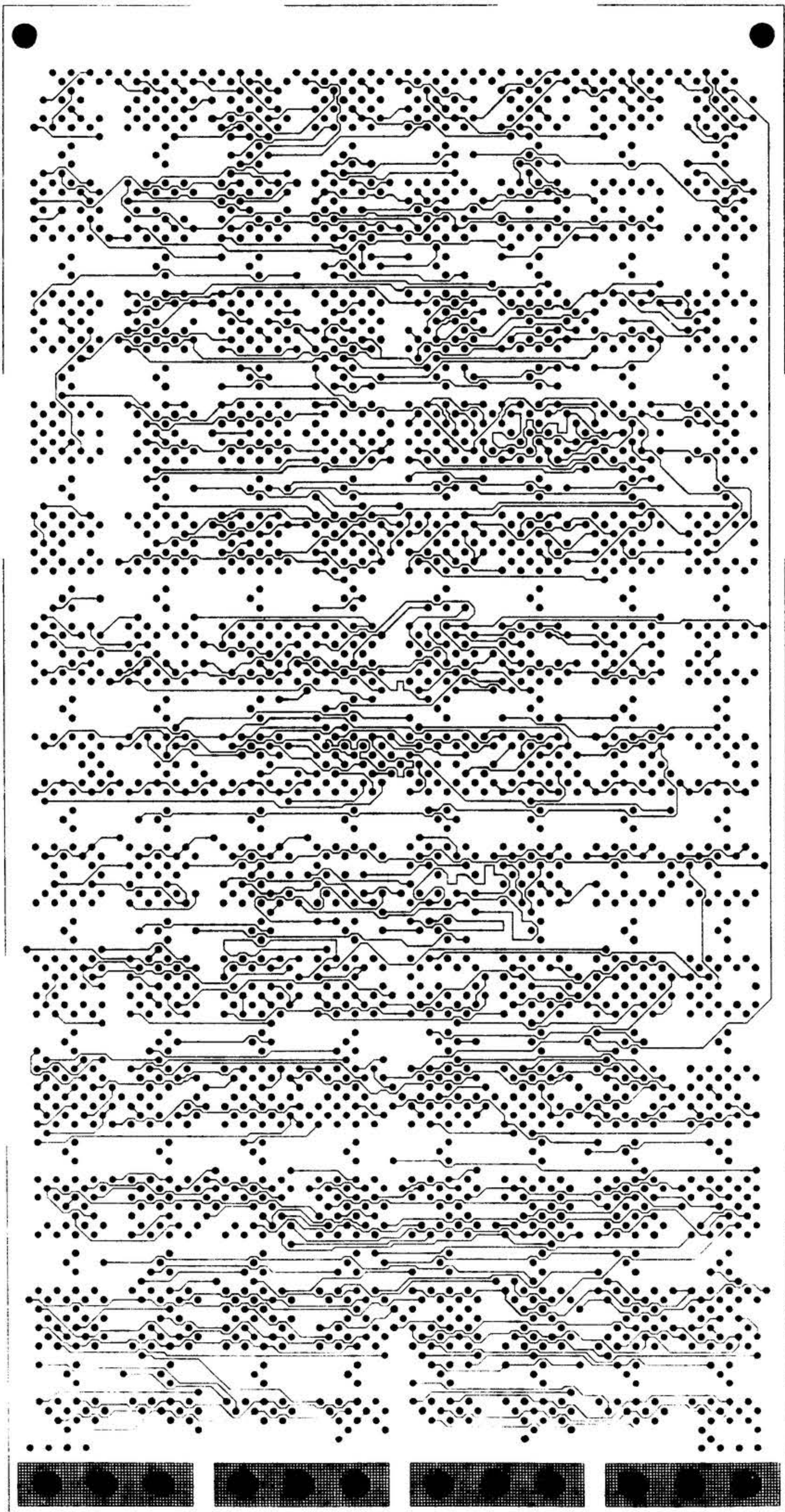
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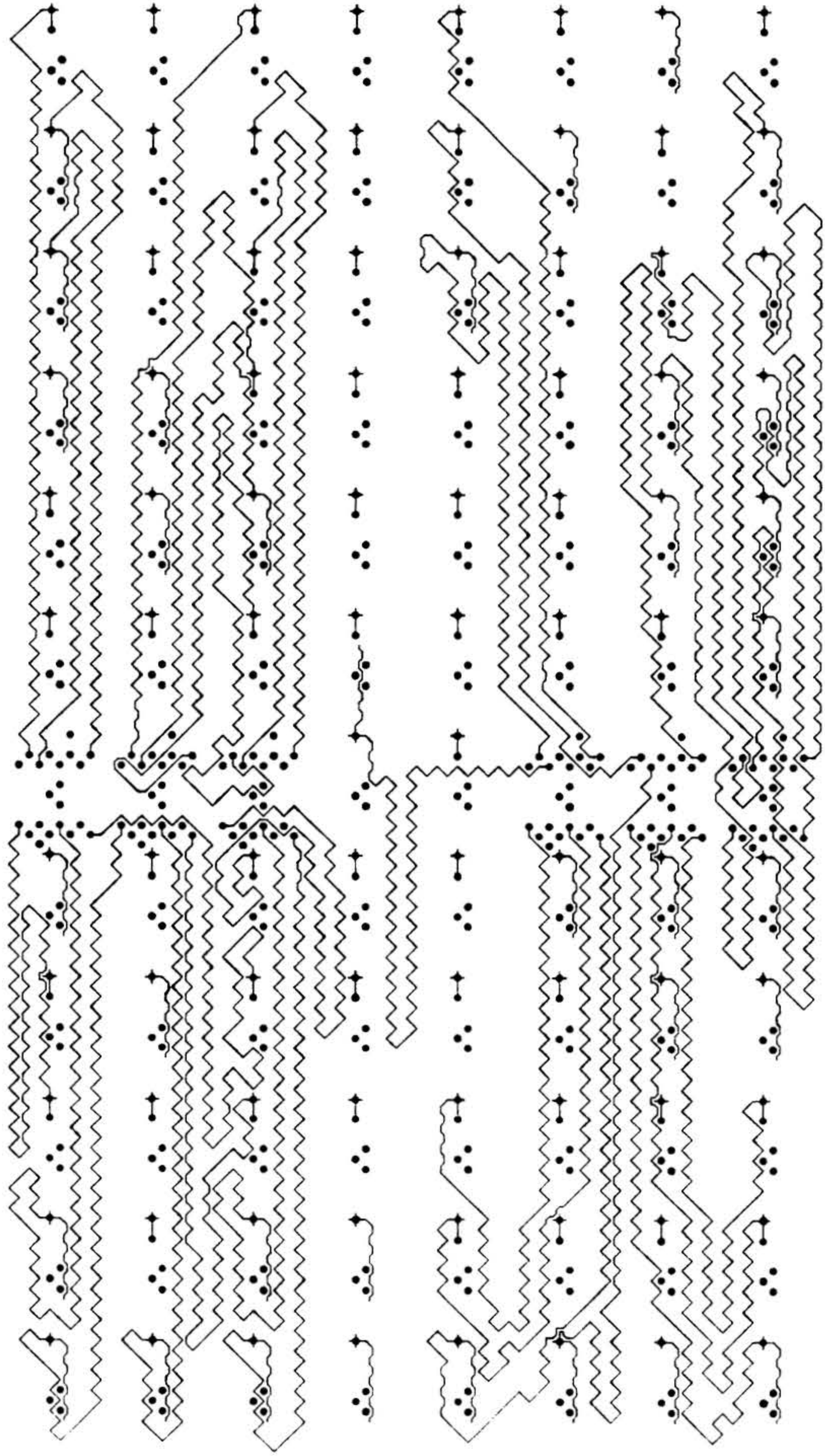
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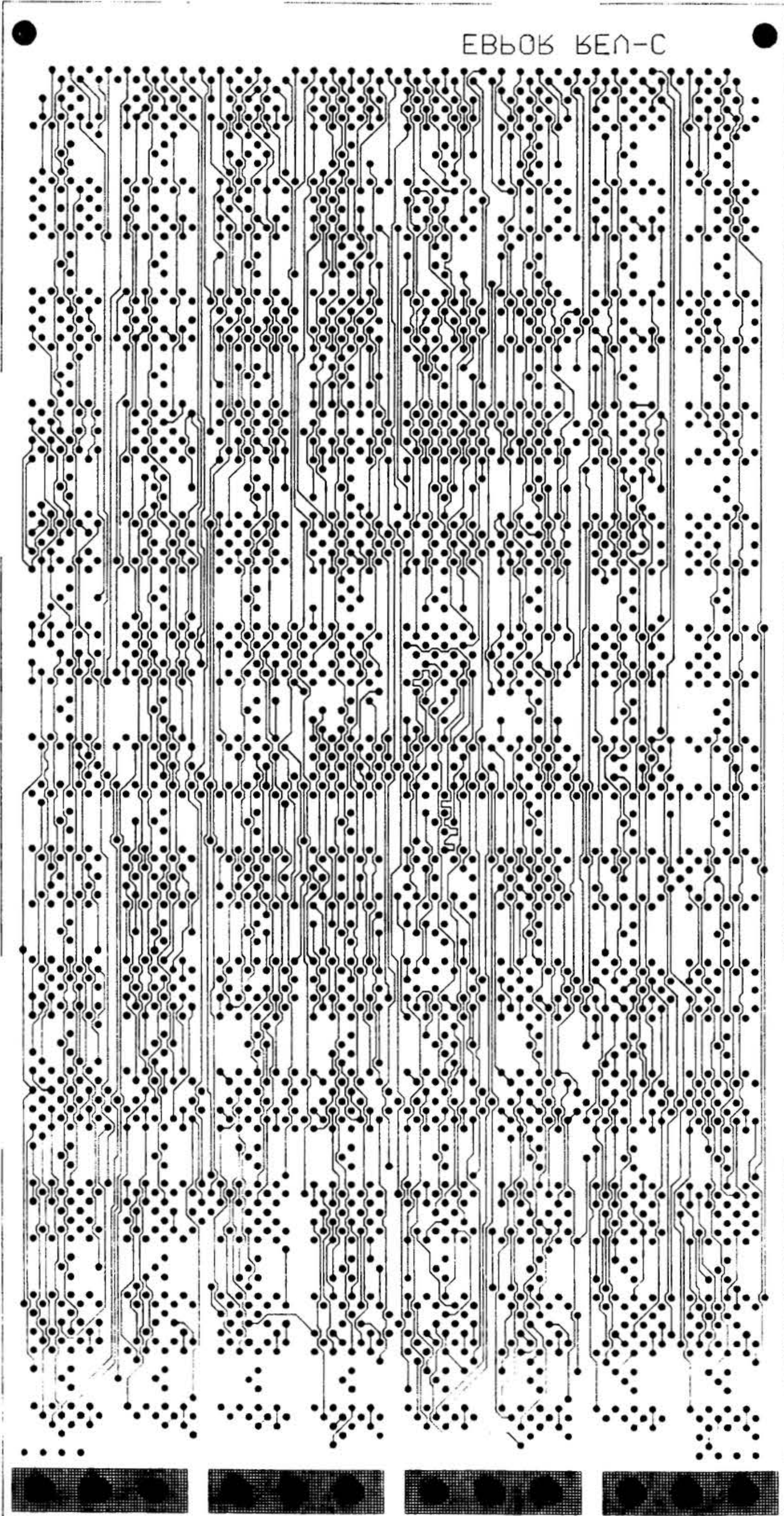
1 EBPOR REV-C



3 FBQR PEU-C

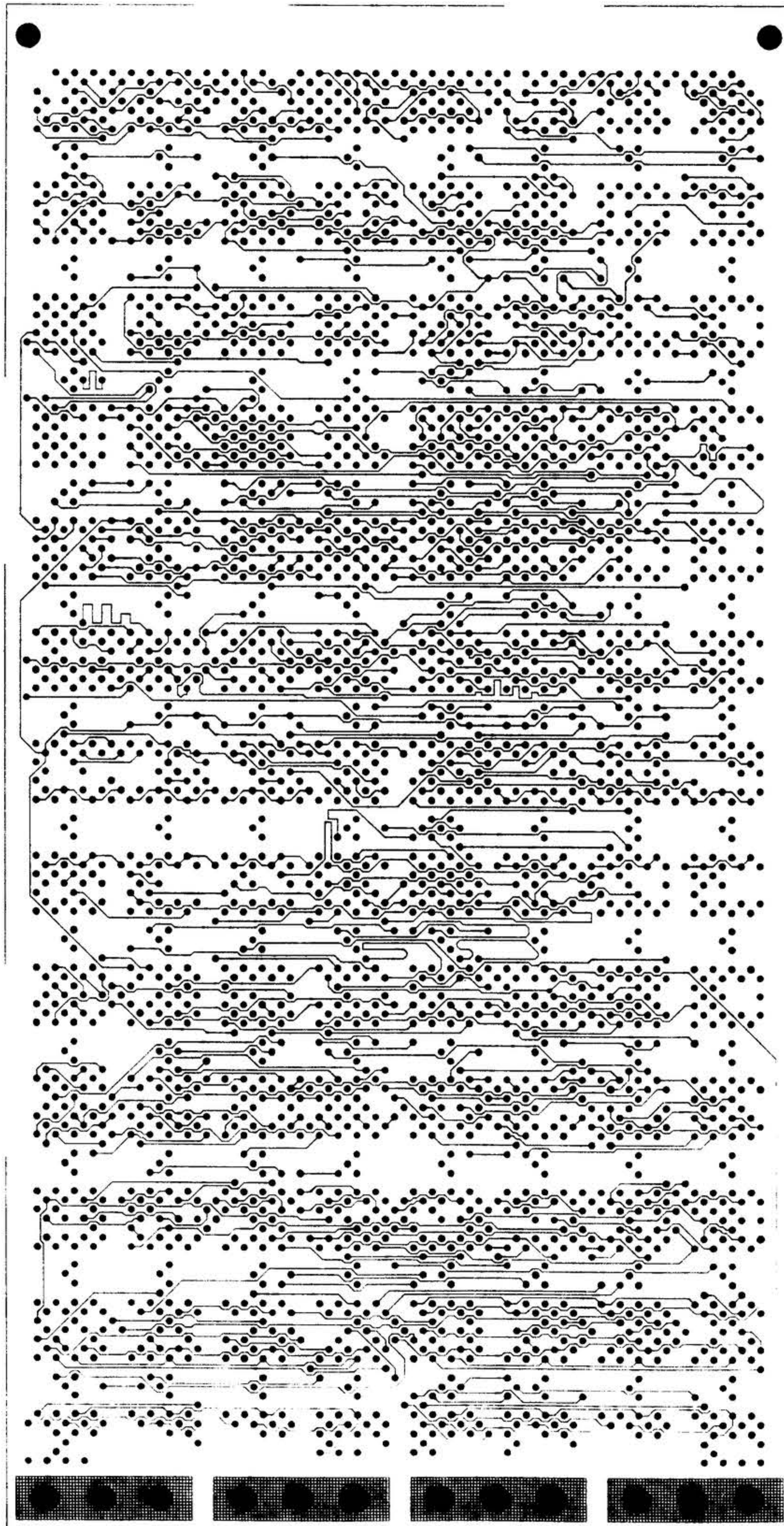


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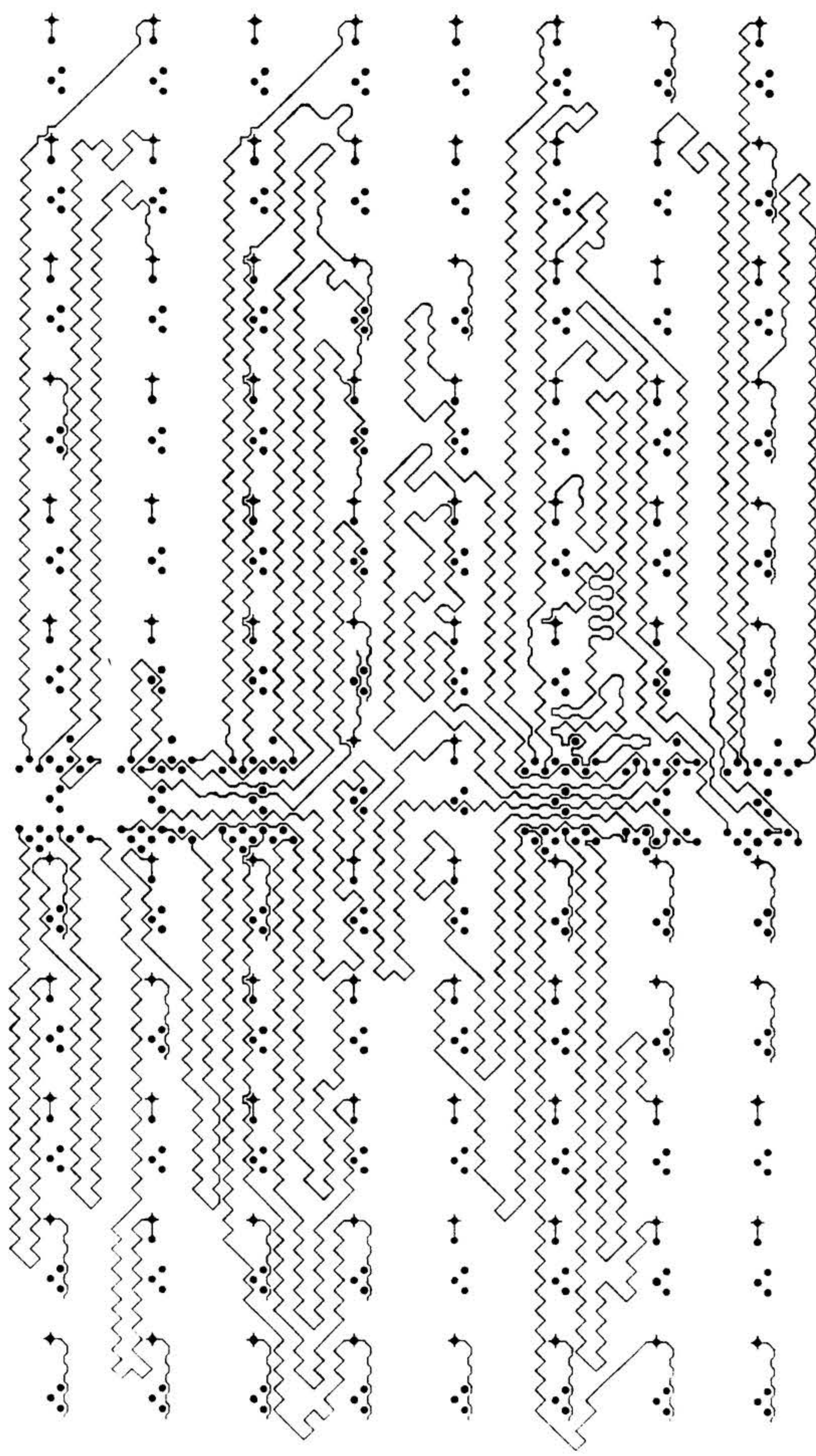


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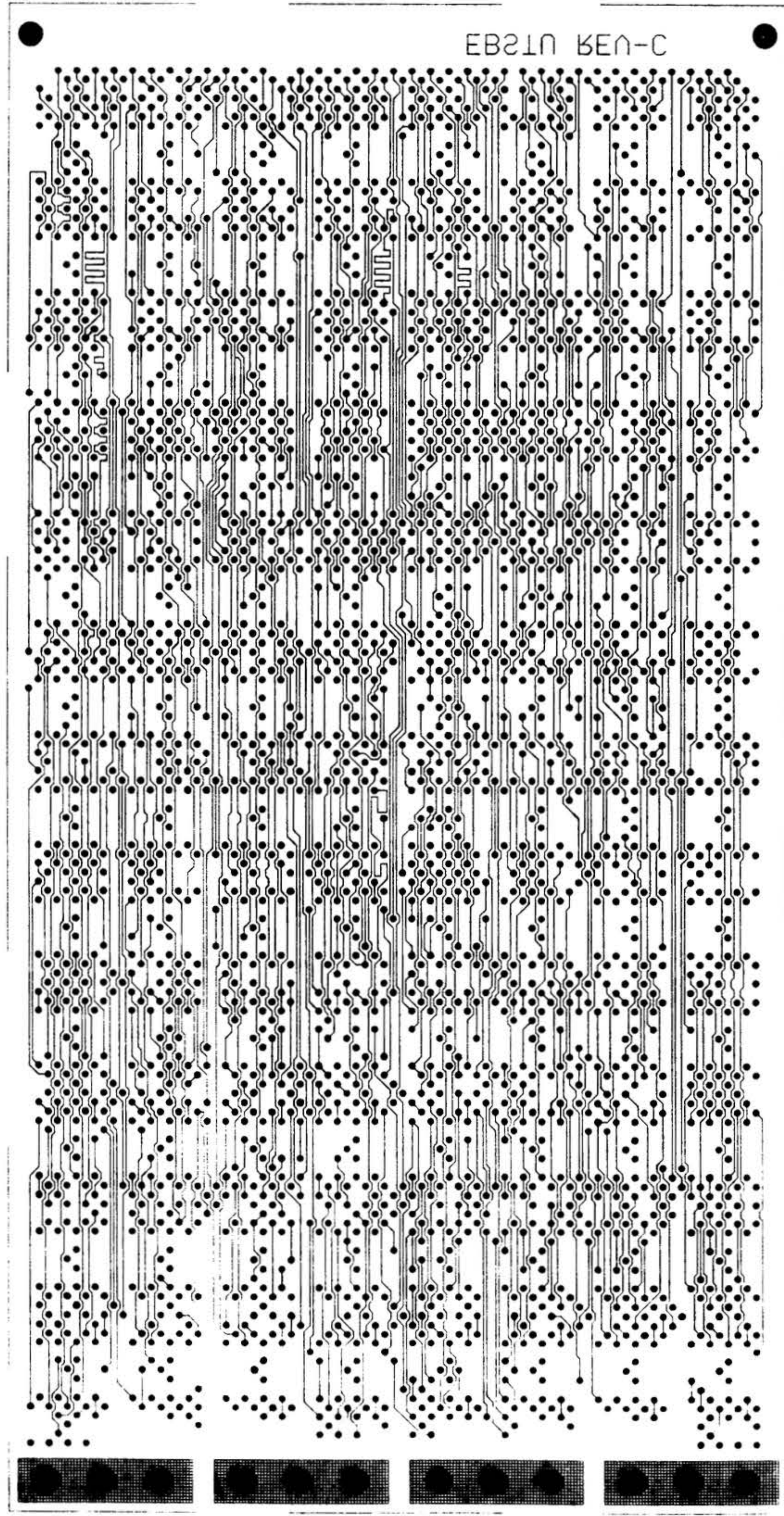
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3 5 B 9 T 1 1 P E U - C

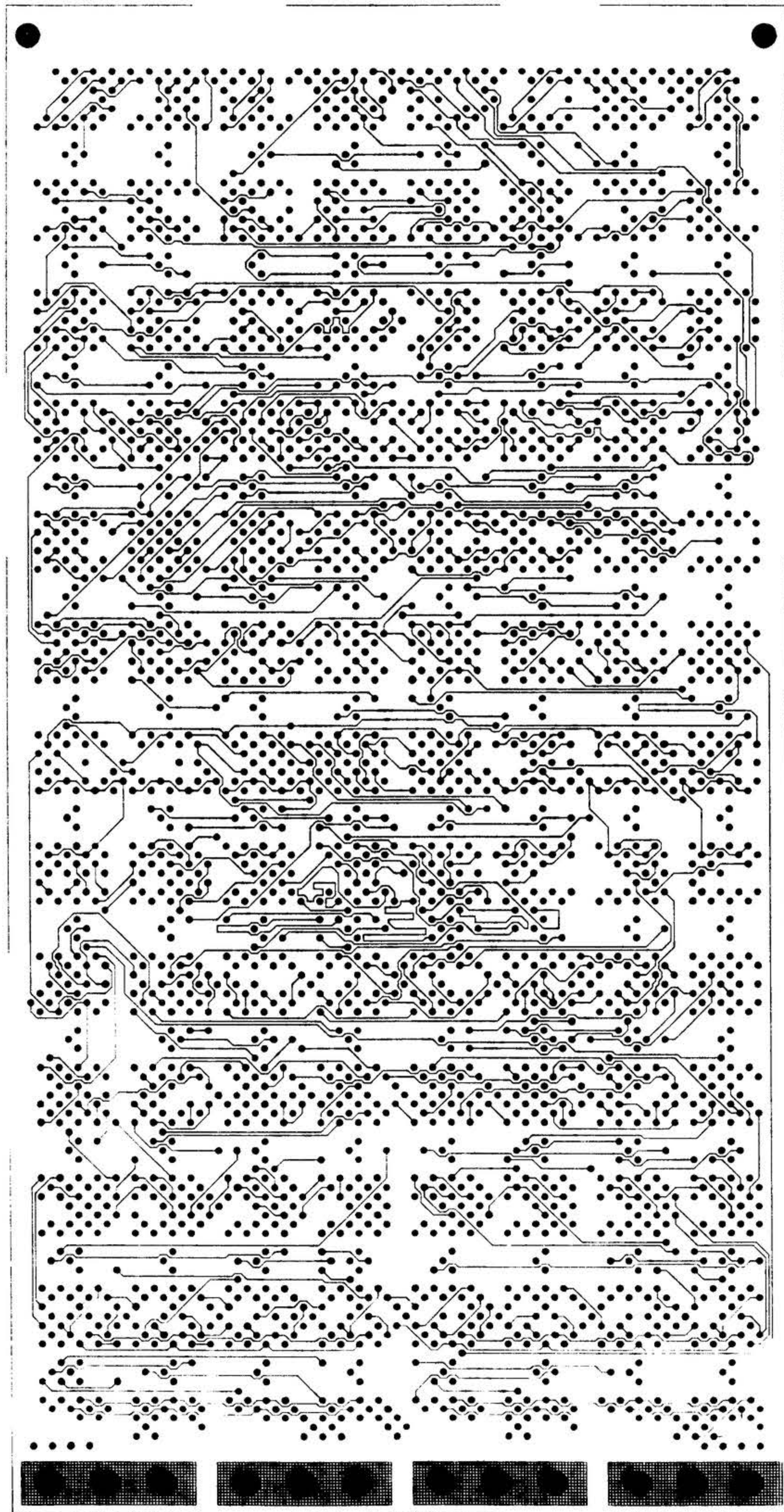


EB210 BEU-C

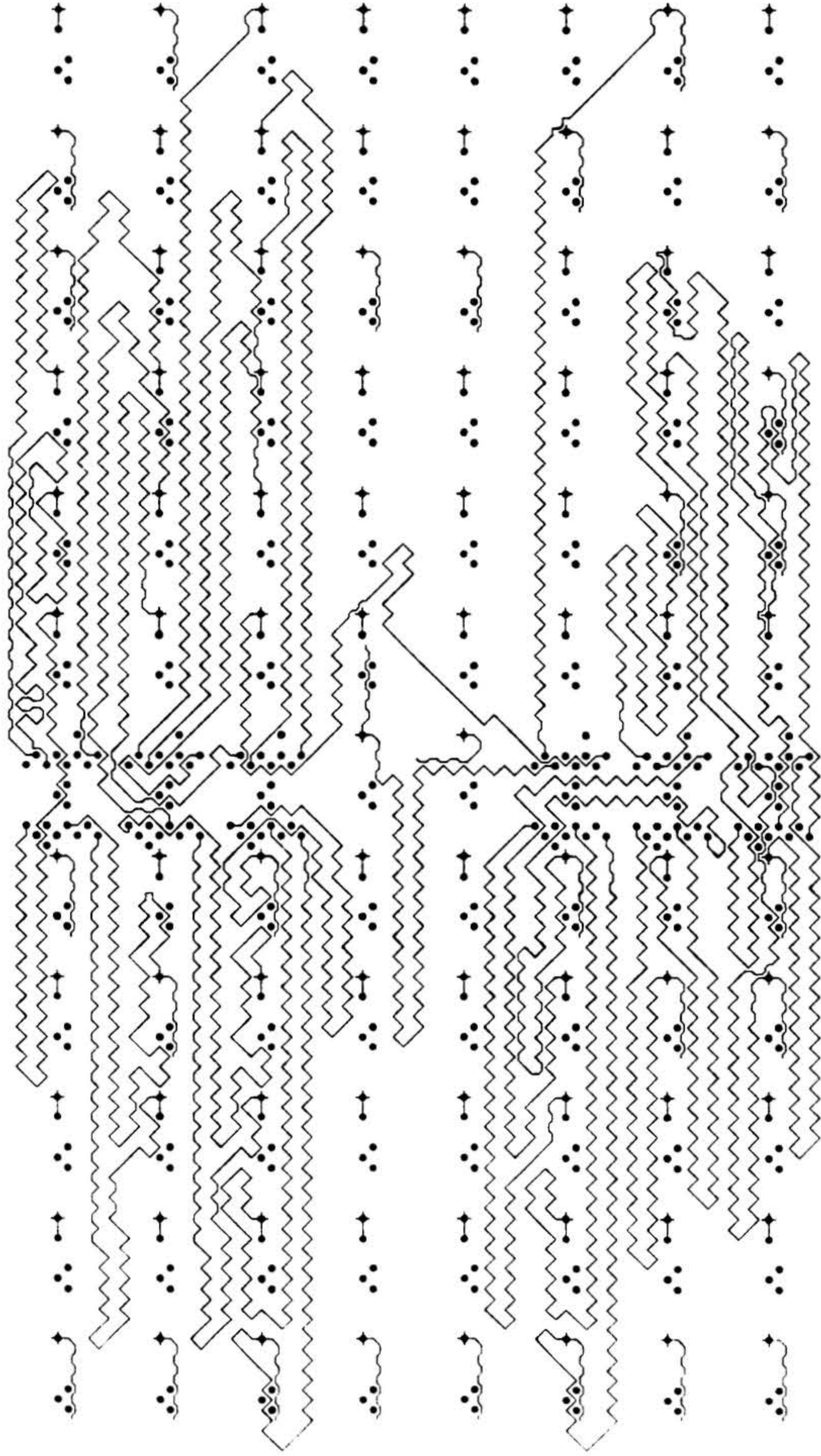


6 EB210 BEU C

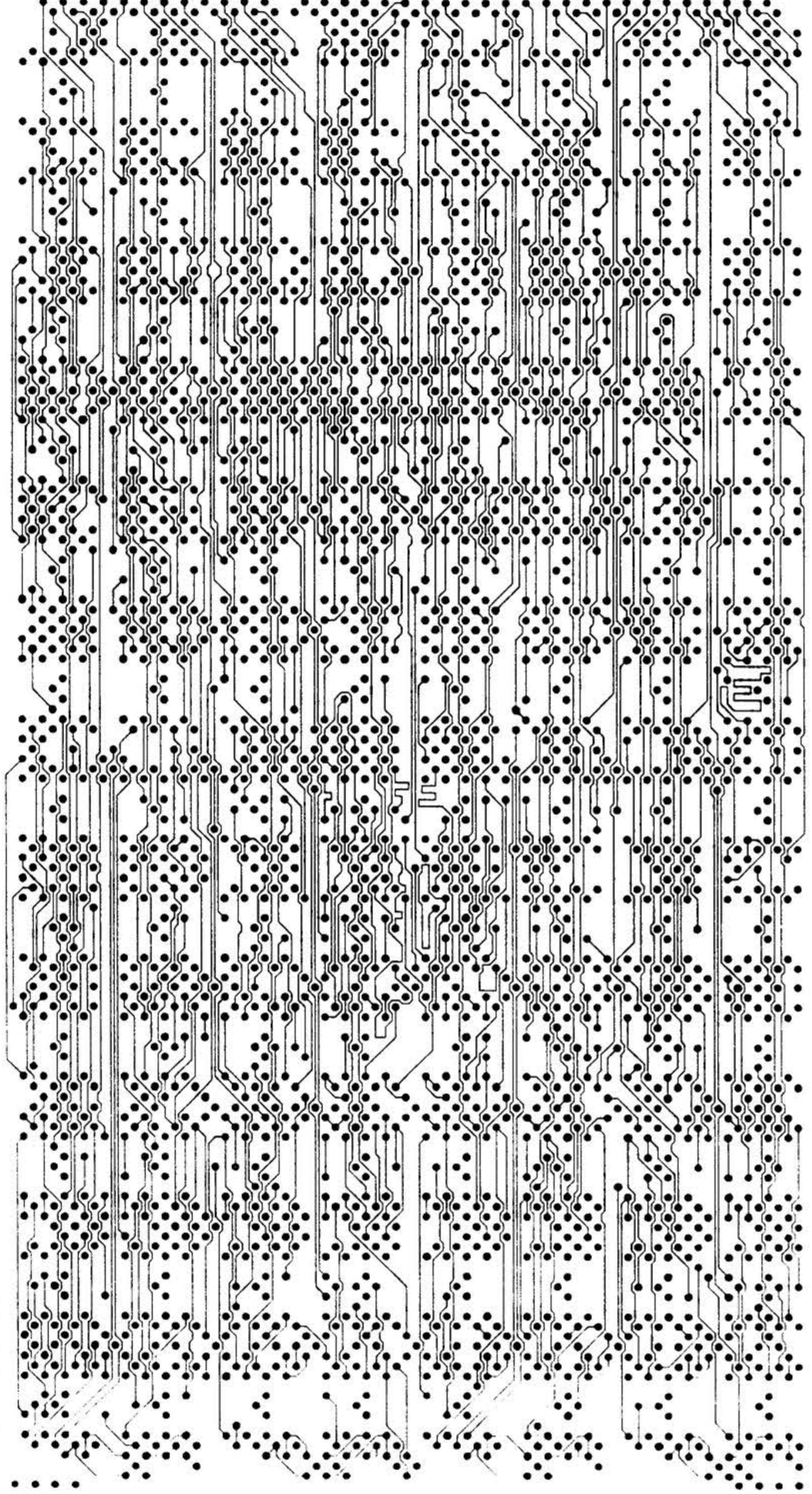
2. FBUX PEU-C



3 ERUJX REU-C



EBUMX BEU-C



EBUMX BEU-C

