F 13

```
MMM         MMM  TTTTTTTTTTTTTTT  HHH         HHH  RRRRRRRRRRRR     TTTTTTTTTTTTTTT  LLL
MMM         MMM  TTTTTTTTTTTTTTT  HHH         HHH  RRRRRRRRRRRR     TTTTTTTTTTTTTTT  LLL
MMM         MMM  TTTTTTTTTTTTTTT  HHH         HHH  RRRRRRRRRRRR     TTTTTTTTTTTTTTT  LLL
MMMMMM   MMMMMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMMMMM   MMMMMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMMMMM   MMMMMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM   MMM   MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM   MMM   MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM   MMM   MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLL
MMM         MMM        TTT        HHHHHHHHHHHHHHH  RRRRRRRRRRRR           TTT        LLL
MMM         MMM        TTT        HHHHHHHHHHHHHHH  RRRRRRRRRRRR           TTT        LLL
MMM         MMM        TTT        HHHHHHHHHHHHHHH  RRRRRRRRRRRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR   RRR              TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR   RRR              TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR   RRR              TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR      RRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR      RRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR      RRR           TTT        LLL
MMM         MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLLLLLLLLLLLLLL
MMM         MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLLLLLLLLLLLLLL
MMM         MMM        TTT        HHH         HHH  RRR         RRR        TTT        LLLLLLLLLLLLLLL
```

```
**FILE**ID**MTHCGSQRT                                J  5





MM      MM  TTTTTTTTTT  HH      HH    CCCCCCCC    GGGGGGGG    SSSSSSSS    QQQQQQ    RRRRRRRR    TTTTTTTTTT
MM      MM  TTTTTTTTTT  HH      HH    CCCCCCCC    GGGGGGGG    SSSSSSSS    QQQQQQ    RRRRRRRR    TTTTTTTTTT
MMMM  MMMM      TT      HH      HH  CC          GG          SS          QQ      QQ  RR      RR      TT
MMMM  MMMM      TT      HH      HH  CC          GG          SS          QQ      QQ  RR      RR      TT
MM  MM  MM      TT      HH      HH  CC          GG          SS          QQ      QQ  RR      RR      TT
MM  MM  MM      TT      HH      HH  CC          GG          SS          QQ      QQ  RR      RR      TT
MM      MM      TT      HHHHHHHHHH  CC          GG            SSSSSS    QQ      QQ  RRRRRRRR        TT
MM      MM      TT      HHHHHHHHHH  CC          GG            SSSSSS    QQ      QQ  RRRRRRRR        TT
MM      MM      TT      HH      HH  CC          GG  GGGGGG          SS  QQ  QQ  QQ  RR  RR          TT
MM      MM      TT      HH      HH  CC          GG  GGGGGG          SS  QQ  QQ  QQ  RR  RR          TT
MM      MM      TT      HH      HH  CC          GG      GG          SS  QQ    QQ    RR    RR        TT          ....
MM      MM      TT      HH      HH  CC          GG      GG          SS  QQ    QQ    RR    RR        TT          ....
MM      MM      TT      HH      HH    CCCCCCCC    GGGGGG    SSSSSSSS      QQQQ  QQ  RR      RR      TT          ....
MM      MM      TT      HH      HH    CCCCCCCC    GGGGGG    SSSSSSSS      QQQQ  QQ  RR      RR      TT          ....


LL            IIIIII      SSSSSSSS
LL            IIIIII      SSSSSSSS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II        SSSSSS
LL              II        SSSSSS
LL              II              SS
LL              II              SS
LL              II              SS
LL              II              SS
LLLLLLLLLL    IIIIII    SSSSSSSS
LLLLLLLLLL    IIIIII    SSSSSSSS
```

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```
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---
.
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```
0000        .TITLE  MTH$CGSQRT
0000        .IDENT  /1-002/           ; File: MTHCSQRT.MAR  SBL1002
0000
0000  ;
0000  ;****************************************************************************
0000  ;*                                                                          *
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0000  ;*                                                                          *
0000  ;*                                                                          *
0000  ;****************************************************************************
0000  ;
0000  ;
0000  ; FACILITY: MATH LIBRARY
0000  ;++
0000  ; ABSTRACT:
0000  ;       This module contains routine MTH$CGSQRT - compute
0000  ;       G COMPLEX*16 square root.
0000  ;
0000  ;--
0000  ;
0000  ; VERSION: 1
0000  ;
0000  ; HISTORY:
0000  ;
0000  ; AUTHOR:
0000  ;       Steven B. Lionel, 24-July-1979
0000  ;
0000  ; MODIFIED BY:
0000  ;
0000  ;
0000  ;
```

```
0000            .SBTTL  HISTORY         ; Detailed Current Edit History
0000
0000
0000    ; Edit History
0000    ;
0000    ; 1-001 - Adapted from MTH$CSQRT version 1-003.  SBL 24-July-1979
0000    ; 1-002 - Use general mode addressing.  SBL 30-Nov-1981
```

```
        0000            .SBTTL  DECLARATIONS
        0000
        0000    ;
        0000    ; INCLUDE FILES:
        0000    ;
        0000
        0000    ;
        0000    ; EXTERNAL SYMBOLS:
        0000            .DSABL  GBL
        0000            .EXTRN  MTH$CGABS
        0000            .EXTRN  MTH$GSQRT_R5
        0000
        0000    ;
        0000    ; MACROS:
        0000    ;       NONE
        0000
        0000    ;
        0000    ; PSECT DECLARATIONS:
    00000000            .PSECT  _MTH$CODE       PIC, SHR, LONG, EXE, NOWRT
        0000
        0000    ;
        0000    ; EQUATED SYMBOLS:
        0000
        0000    ;
        0000    ; OWN STORAGE:
        0000    ;       NONE
```

```
                   0000         .SBTTL  MTH$CGSQRT - compute G COMPLEX*16 square root
                   0000
                   0000  ;++
                   0000  ; FUNCTIONAL DESCRIPTION:
                   0000  ;
                   0000  ;        The square root of a complex number (r, i) is computed
                   0000  ;        as follows:
                   0000  ;
                   0000  ;        ROOT = SQRT((ABS(r) + CABS((r, i))) / 2)
                   0000  ;        Q = i / (2*ROOT)
                   0000  ;
                   0000  ;
                   0000  ;        r          i          CSQRT((r, i))
                   0000  ;        -          -          -------------
                   0000  ;
                   0000  ;        >=0        any        (ROOT, Q)
                   0000  ;        <0         >=0        (Q, ROOT)
                   0000  ;        <0         <0         (-Q, -ROOT)
                   0000  ;
                   0000  ; CALLING SEQUENCE:
                   0000  ;
                   0000  ;        CALL MTH$CGSQRT (result.wgc.r, arg.rgc.r)
                   0000  ;
                   0000  ; INPUT PARAMETERS:
                   0000  ;
         00000008  0000          arg     = 8                 ; The G COMPLEX*16 argument, passed
                   0000                                      ; by reference.
                   0000  ;
                   0000  ; IMPLICIT INPUTS:
                   0000  ;        NONE
                   0000  ;
                   0000  ; OUTPUT PARAMETERS:
                   0000  ;
         00000004  0000          result  = 4                 ; The G COMPLEX*16 result, passed by
                   0000                                      ; reference.
                   0000  ;
                   0000  ; IMPLICIT OUTPUTS:
                   0000  ;        NONE
                   0000  ;
                   0000  ; COMPLETION CODES:
                   0000  ;        NONE
                   0000  ;
                   0000  ; SIDE EFFECTS:
                   0000  ;
                   0000  ;        SS$_ROPRAND     If either part of argument is reserved operand.
                   0000  ;
                   0000  ;--
                   0000
                   0000
             007C  0000          .ENTRY  MTH$CGSQRT,     ^M<R2, R3, R4, R5, R6>
                   0002          MTH$FLAG_JACKET                 ; flag as math routine
                   0002
6D   00000000'GF   9E  0002          MOVAB   G^MTH$$JACKET_HND, (FP)
                   0009                                          ; set handler address to jacket
                   0009                                          ; handler
                   0009
                   0009
```

```
          52    08 BC 50FD  0009                MOVG    @arg(AP), R2            ; R2-R3 = r
        52   8000 8F    AA  000E                BICW    #^X8000, R2             ; R2-R3 = ABS(r)
                 08 AC  DD  0013                PUSHL   arg(AP)                 ; Put address of arg on stack
     00000000'GF    01  FB  0016                CALLS   #1, G^MTH$CGABS         ; R0-R1 = CABS((r, i))
                 50 52 40FD 001D                ADDG2   R2, R0                  ; R0-R1 = ABS(r) + CABS((r, i))
                 50 00 44FD 0021                MULG2   #0.5, R0                ; R0-R1 = (ABS(r) + CABS((r, i))) / 2
     00000000'GF        16  0025                JSB     G^MTH$GSQRT_R5          ; R0-R1 = ROOT = SQRT(above)
          52    08 AC   D0  002B                MOVL    arg(AP), R2             ; R2 -> (r, i)
                    50 53FD 002F                TSTG    R0                      ; is ROOT zero?
                    04  12  0032                BNEQ    1$                      ; no, go ahead
                    55  7C  0034                CLRG    R5                      ; make zero quotient
                    0A  11  0036                BRB     2$                      ; skip divide
     55    08 A2 50 47FD    0038      1$:       DIVG3   R0, 8(R2), R5           ; R5 = i / ROOT
                 55 00 44FD 003E                MULG2   #0.5, R5                ; R5 = Q = i / (2 * ROOT)
                    82 53FD 0042      2$:       TSTG    (R2)+                   ; if r positive,
                    18  18  0045                BGEQ    RETRN                   ; then return (ROOT, Q)
                 53 50  7D  0047                MOVQ    R0, R3                  ; else switch ROOT and Q
                    62 53FD 004A                TSTG    (R2)                    ; if i positive
                    0A  18  004D                BGEQ    RETRN1                  ; then return (Q, ROOT)
                 50 55 52FD 004F                MNEGG   R5, R0                  ; else negate ROOT anG Q
                 55 53 52FD 0053                MNEGG   R3, R5                  ; and return (-Q, -ROOT)
                    06  11  0057                BRB     RETRN
                            0059
                            0059      RETRN1:
                 50 55  7D  0059                MOVQ    R5, R0                  ; continue to swap ROOT and Q
                 55 53  7D  005C                MOVQ    R3, R5                  ; and return (Q, ROOT)
                            005F      RETRN:
          52    04 AC   D0  005F                MOVL    result(AP), R2          ; result address
                 82 50  7D  0063                MOVQ    R0, (R2)+               ; real part
                 62 55  7D  0066                MOVQ    R5, (R2)                ; imaginary part
                        04  0069                RET
                            006A
                            006A
                            006A                .END
```

```
ARG                 = 00000008
MTH$$JACKET_HND       ********     X     01
MTH$CGABS             ********     X     00
MTH$CGSQRT            00000000 RG        01
MTH$GSQRT_R5          ********     X     00
RESULT              = 00000004
RETRN                 0000005F R         01
RETRN1                00000059 R         01

                                                   +----------------+
                                                   ! Psect synopsis !
                                                   +----------------+

PSECT name                       Allocation          PSECT No.  Attributes
----------                       ----------          ---------  ----------
.  ABS  .                        00000000  (    0.)  00 (  0.)  NOPIC   USR   CON   ABS   LCL NOSHR NOEXE NORD   NOWRT NOVEC BYTE
_MTH$CODE                        0000006A  (  106.)  01 (  1.)    PIC   USR   CON   REL   LCL   SHR   EXE   RD   NOWRT NOVEC LONG

                                                +------------------------+
                                                ! Performance indicators !
                                                +------------------------+

Phase                        Page faults    CPU Time       Elapsed Time
-----                        -----------    --------       ------------
Initialization                        37    00:00:00.08    00:00:00.58
Command processing                   122    00:00:00.64    00:00:04.27
Pass 1                                89    00:00:00.72    00:00:02.57
Symbol table sort                      0    00:00:00.00    00:00:00.00
Pass 2                                45    00:00:00.50    00:00:02.14
Symbol table output                    2    00:00:00.02    00:00:00.23
Psect synopsis output                  2    00:00:00.02    00:00:00.02
Cross-reference output                 0    00:00:00.00    00:00:00.00
Assembler run totals                 299    00:00:01.98    00:00:09.81

The working set limit was 900 pages.
2877 bytes (6 pages) of virtual memory were used to buffer the intermediate code.
There were 10 pages of symbol table space allocated to hold 8 non-local and 2 local symbols.
229 source lines were read in Pass 1, producing 11 object records in Pass 2.
1 page of virtual memory was used to define 1 macro.

                                               +--------------------------+
                                               ! Macro library statistics !
                                               +--------------------------+

Macro library name                             Macros defined
------------------                             --------------
_$255$DUA28:[SYSLIB]STARLET.MLB;2                         0

0 GETS were required to define 0 macros.

There were no errors, warnings or information messages.

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS$:MTHCGSQRT/OBJ=OBJ$:MTHCGSQRT MSRC$:MTHJACKET/UPDATE=(ENH$:MTHJACKET)+MS
```

0258 AH-BT13A-SE
VAX/VMS V4.0

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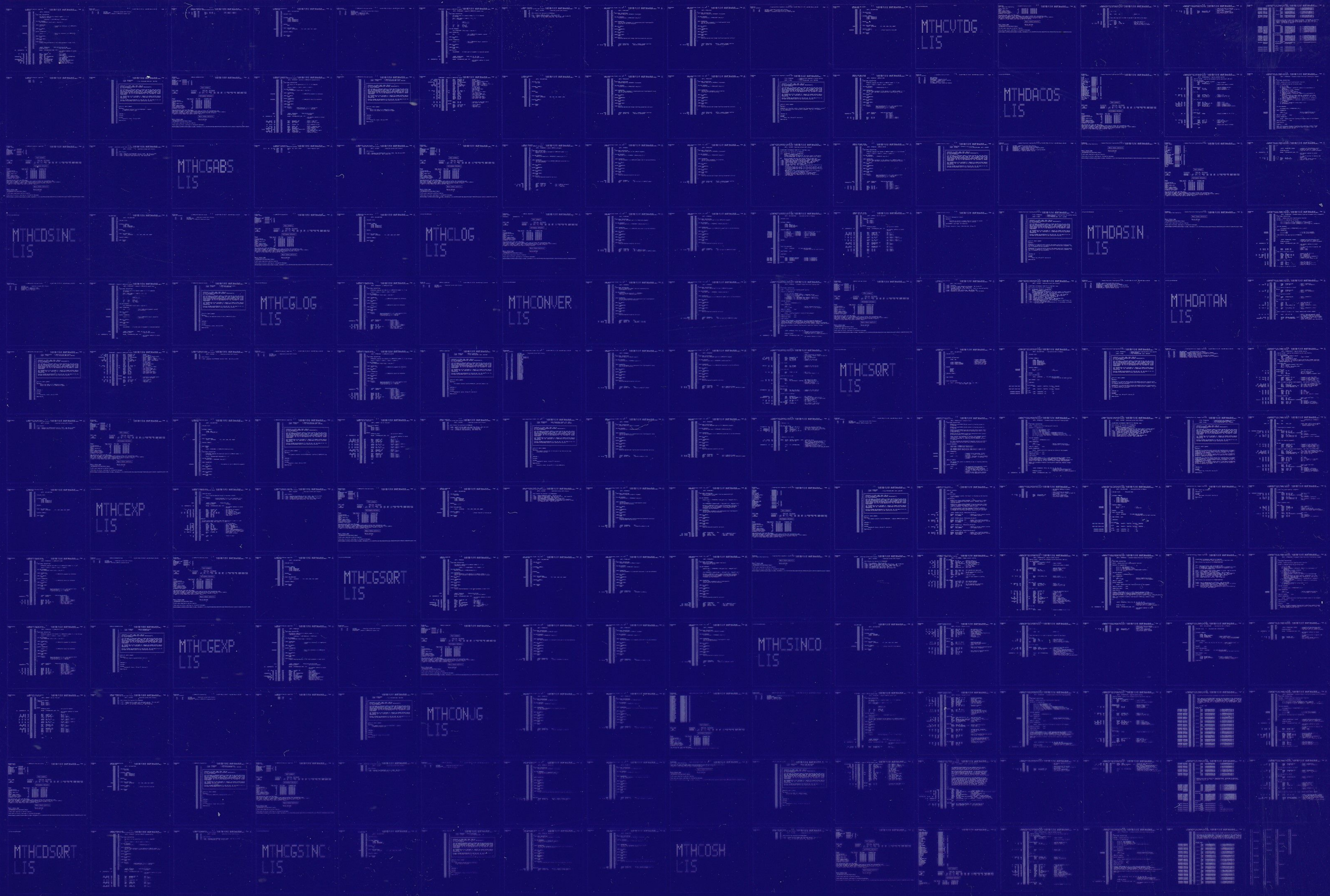

MTHCVTDG
LIS

MTHDACOS
LIS

MTHCGABS
LIS

MTHCDSINC
LIS

MTHCLOG
LIS

MTHDASIN
LIS

MTHCGLOG
LIS

MTHCONVER
LIS

MTHDATAN
LIS

MTHCSQRT
LIS

MTHCEXP
LIS

MTHCGSQRT
LIS

MTHCGEXP
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MTHCSINCO
LIS

MTHCONJG
LIS

MTHCDSQRT
LIS

MTHCGSINC
LIS

MTHCOSH
LIS