



```

MM      MM      TTTTTTTTTT  HH      HH      CCCCCCCC  GGGGGGGG  SSSSSSSS  IIIIII  NN      NN      CCCCCCCC
MM      MM      TTTTTTTTTT  HH      HH      CCCCCCCC  GGGGGGGG  SSSSSSSS  IIIIII  NN      NN      CCCCCCCC
MMMM   MMMM    TT            HH      HH      CC          GG          SS          II         NN      NN      CC          CCCCCCCC
MMMM   MMMM    TT            HH      HH      CC          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          SS          II         NNNN   NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          SS          II         NNNN   NN      CC          CCCCCCCC
MM      MM      TT            HHHHHHHHHH  CC          GG          SSSSSS    II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HHHHHHHHHH  CC          GG          SSSSSS    II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG      GGGGGG  SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG      GGGGGG  SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CC          GG          GG          SS          II         NN      NN      CC          CCCCCCCC
MM      MM      TT            HH      HH      CCCCCCCC  GGGGGG  SSSSSSSS  IIIIII  NN      NN      CCCCCCCC
MM      MM      TT            HH      HH      CCCCCCCC  GGGGGG  SSSSSSSS  IIIIII  NN      NN      CCCCCCCC

```

```

LL      IIIIII  SSSSSSSS
LL      IIIIII  SSSSSSSS
LL      II      SS
LL      II      SS
LL      II      SS
LL      II      SS
LL      IIIIII  SSSSSS
LL      IIIIII  SSSSSS
LL      IIIIII  SS
LL      IIIIII  SS
LL      IIIIII  SS
LL      IIIIII  SS
LLLLLLLLLLLL IIIIII  SSSSSSSS
LLLLLLLLLLLL IIIIII  SSSSSSSS

```

(2)	51
(3)	59
(4)	87
(5)	136
(6)	187

HISTORY ; Detailed Current Edit History  
DECLARATIONS  
MTH\$CGSIN - G COMPLEX\*16 SINE  
MTH\$CGCOS - G COMPLEX\*16 Cosine  
WORKER - do all the work

```

0000 1 .TITLE MTHSCGSINCOS G COMPLEX*16 Sine and Cosine
0000 2 .IDENT /1-002/ ; File: MTHCGSINC.MAR Edit: SBL1002
0000 3
0000 4
0000 5 :*****
0000 6 :*
0000 7 :* COPYRIGHT (c) 1978, 1980, 1982, 1984 BY *
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0000 23 :* SOFTWARE ON EQUIPMENT WHICH IS NOT SUPPLIED BY DIGITAL. *
0000 24 :*
0000 25 :*
0000 26 :*****
0000 27 :
0000 28 :
0000 29 :
0000 30 : FACILITY: MATH LIBRARY
0000 31 : ++
0000 32 : ABSTRACT:
0000 33 : Return the SINE of a G COMPLEX*16 number
0000 34 : Return the COSINE of a G COMPLEX*16 number
0000 35 :
0000 36 :
0000 37 : --
0000 38 :
0000 39 : VERSION: 1
0000 40 :
0000 41 : HISTORY:
0000 42 :
0000 43 : AUTHOR:
0000 44 : Steven B. Lionel, 26-July-1979
0000 45 :
0000 46 : MODIFIED BY:
0000 47 :
0000 48 :
0000 49 :

```

0000 51 .SBTTL HISTORY ; Detailed Current Edit History  
0000 52  
0000 53  
0000 54 ; Edit History  
0000 55 :  
0000 56 : 1-001 - Adapted from MTH\$CSINCOS version 1-002. SBL 26-July-1979  
0000 57 : 1-002 - Use MTH\$GEXP\_R6. SBL 14-Dec-1979

MTH  
Sym  
ARG  
MTH  
MTH  
MTH  
MTH  
RES  
RET  
RET  
  
PSE  
---  
\_MT  
  
Pha  
---  
Ini  
Com  
Pas  
Sym  
Pas  
Sym  
Pse  
Cro  
Ass  
  
The  
287  
The  
229  
1 p  
  
Mac  
---  
\_S2  
O C  
The  
MAC

```
0000 59      .SBTTL  DECLARATIONS
0000 60
0000 61  :
0000 62  : INCLUDE FILES:
0000 63  :
0000 64  :
0000 65  :
0000 66  : EXTERNAL SYMBOLS:
0000 67      .DSABL  GBL
0000 68      .EXTRN  MTH$GSIN_R7
0000 69      .EXTRN  MTH$GCOS_R7
0000 70      .EXTRN  MTH$GEXP_R6
0000 71
0000 72  :
0000 73  : MACROS:
0000 74  :
0000 75  :
0000 76  :
0000 77  : PSECT DECLARATIONS:
0000 78      .PSECT  _MTH$CODE      PIC, SHR, LONG, EXE, NOWRT
0000 79
0000 80  :
0000 81  : EQUATED SYMBOLS:
0000 82
0000 83  :
0000 84  : OWN STORAGE:
0000 85  :      NONE
```

```

0000 87      .SBTTL MTH$CGSIN - G COMPLEX*16 SINE
0000 88
0000 89      :++
0000 90      : FUNCTIONAL DESCRIPTION:
0000 91      :
0000 92      : MTH$CGSIN computes the SINE of a G COMPLEX*16 number (r, i) as
0000 93      :
0000 94      : result = (SIN(r) * COSH(i), COS(r) * SINH(i))
0000 95      :
0000 96      : CALLING SEQUENCE:
0000 97      : CALL MTH$CGSIN (result.wgc.r, arg.rgc.r)
0000 98      :
0000 99      :
0000 100     : INPUT PARAMETERS:
0000 101     : arg = 8 ; G COMPLEX*16 argument by reference
0000 102     :
0000 103     : IMPLICIT INPUTS:
0000 104     : NONE
0000 105     :
0000 106     : OUTPUT PARAMETERS:
0000 107     :
0000 108     : result = 4 ; G COMPLEX*16 result by reference
0000 109     :
0000 110     : IMPLICIT OUTPUTS:
0000 111     : NONE
0000 112     :
0000 113     : COMPLETION CODES:
0000 114     : NONE
0000 115     :
0000 116     : SIDE EFFECTS:
0000 117     : Signals: Reserved Operand if r or i are invalid (-0.0)
0000 118     : MTH$ SINSIGLOS if |r| > 2*PI*2**31.
0000 119     : Floating Overflow if i > 88.028.
0000 120     :
0000 121     :--
0000 122
0000 123
0000 124     .ENTRY MTH$CGSIN, ^M<R2,R3,R4,R5,R6,R7>
0002 125     JSB WORKER ; R0-R1 = SIN(r)
0008 126     ; R2-R3 = COS(r)
0008 127     ; R4-R5 = SINH(i)
0008 128     ; R6-R7 = COSH(i)
50 56 44FD 0008 129     MULG2 R6, R0 ; R0-R1 = SIN(r) * COSH(i)
52 54 44FD 000C 130     MULG2 R4, R2 ; R2-R3 = COS(r) * SINH(i)
54 04 AC D0 0010 131     MOVL result(AP), R4 ; get result address
84 50 7D 0014 132     MOVQ R0, (R4)+ ; Store real part
64 52 7D 0017 133     MOVQ R2, (R4) ; Store imaginary part
001A 134     RET

```

```

001B 136      .SBTTL MTH$CGCOS - G COMPLEX*16 Cosine
001B 137
001B 138      :++
001B 139      : FUNCTIONAL DESCRIPTION:
001B 140      :
001B 141      : MTH$CGCOS computes the COSINE of G COMPLEX*16 number (r, i) as follows:
001B 142      :
001B 143      : result = (COS(r) * COSH(i), -SIN(r) * SINH(-i))
001B 144      :
001B 145      : CALLING SEQUENCE:
001B 146      : CALL MTH$CGCOS (result.wgc.r, arg.rgc.r)
001B 147
001B 148      :
00000008 001B 149      : INPUT PARAMETERS:
001B 150      : arg = 8 ; G COMPLEX*16 argument by reference
001B 151      :
001B 152      : IMPLICIT INPUTS:
001B 153      : NONE
001B 154      :
001B 155      : OUTPUT PARAMETERS:
00000004 001B 156      :
001B 157      : result = 4 ; G COMPLEX*16 result by reference
001B 158      :
001B 159      : IMPLICIT OUTPUTS:
001B 160      : NONE
001B 161      :
001B 162      : COMPLETION CODES:
001B 163      : NONE
001B 164      :
001B 165      : SIDE EFFECTS:
001B 166      : Signals: Reserved Operand if r or i are invalid (-0.0)
001B 167      : MTH$ SINSIGLOS if |r| > 2*PI*2**31.
001B 168      : Floating Overflow if i > 88.028.
001B 169      :
001B 170      :--
001B 171
001B 172
0000003E'EF 00FC 001B 173      .ENTRY MTH$CGCOS, ^M<R2,R3,R4,R5,R6,R7>
16 001D 174      JSB WORKER
0023 175      : R0-R1 = SIN(r)
0023 176      : R2-R3 = COS(r)
0023 177      : R4-R5 = SINH(i)
0023 178      : R6-R7 = COSH(i)
56 52 44FD 0023 178      MULG2 R2, R6 : R6-R7 = COS(r) * COSH(i)
50 50 52FD 0027 179      MNEGG R0, R0 : R0-R1 = -SIN(r)
52 54 50 45FD 002B 180      MULG3 R0, R4, R2 : R2-R3 = -SIN(r) * SINH(i)
50 50 56 7D 0030 181      MOVQ R6, R0 : R0-R1 = COS(r) * COSH(i)
54 04 AC 0D 0033 182      MOVL result(AP), R4 : get result address
84 50 7D 0037 183      MOVQ R0, (R4)+ : Store real part
64 52 7D 003A 184      MOVQ R2, (R4) : Store imaginary part
04 003D 185      RET

```



```

003E 187          .SBTTL WORKER - do all the work
003E 188
003E 189      :+
003E 190      : Setup error handler
003E 191      : Compute:
003E 192          R0-R1 = SIN(r)
003E 193          R2-R3 = COS(r)
003E 194          R4-R5 = SINH(i)
003E 195          R6-R7 = COSH(i)
003E 196      :-
003E 197
003E 198 WORKER:
003E 199      MTH$FLAG_JACKET          : set up error handler
6D 00000000'GF 9E 003E          MOVAB  G^MTH$$JACKET_HND, (FP)
0045          : set handler address to jacket
0045          : handler
0045
0045 200          MOVL  arg(AP), R0          : R0 -> (r, i)
0049 201          MOVG  8(R0), R0          : R0-R1 = i
004E 202          JSB   MTH$GEXP R6        : R0-R1 = EXP(i)
52 08 50 47FD 0054 203          DIVG3   R0, #1, R2          : R2-R3 = EXP(-i)
0059 204
0059 205          SUBG3  R2, R0, R4        : R4-R5 = EXP(i) - EXP(-i)
7E 54 00 45FD 005E 206          MULG3   #0.5, R4, -(SP)      : (SP) = SINH(i)
0063 207
0063 208          ADDG3  R2, R0, R4        : R4-R5 = EXP(i) + EXP(-i)
7E 54 00 45FD 0068 209          MULG3   #0.5, R4, -(SP)      : (SP) = COSH(i)
006D 210
006D 211          MOVG  @arg(AP), R0       : R0-R1 = r
0072 212          JSB   MTH$GCOS R7        : R0-R1 = COS(r)
7E 50 7D 0078 213          MOVQ   R0, -(SP)      : (SP) = COS(r)
007B 214
007B 215          MOVQ  @arg(AP), R0       : R0-R1 = r
007F 216          JSB   MTH$GSIN R7        : R0-R1 = SIN(r)
52 8E 7D 0085 217          MOVQ   (SP)+, R2        : R2-R3 = COS(r)
56 8E 7D 0088 218          MOVQ   (SP)+, R6        : R6-R7 = COSH(i)
54 8E 7D 008B 219          MOVQ   (SP)+, R4        : R4-R5 = SINH(i)
008E 220
008E 221          RSB
008F 222
008F 223
008F 224
008F 225          .END

```

```

ARG = 00000008
MTH$$JACKET_HND ***** X 01
MTH$CGCOS 0000001B RG 01
MTH$CGSIN 00000000 RG 01
MTH$GCOS_R7 ***** X 00
MTH$GEXP_R6 ***** X 00
MTH$GSIN_R7 ***** X 00
RESULT = 00000004
WORKER 0000003E 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	000C008F ( 143.)	01 ( 1.)	PIC USR CON REL LCL SHR EXE RD NOWRT NOVEC LONG

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

Phase	Page faults	CPU Time	Elapsed Time
Initialization	37	00:00:00.11	00:00:00.88
Command processing	119	00:00:00.70	00:00:04.47
Pass 1	91	00:00:00.70	00:00:04.44
Symbol table sort	0	00:00:00.00	00:00:00.00
Pass 2	54	00:00:00.61	00:00:01.90
Symbol table output	2	00:00:00.02	00:00:00.02
Psect synopsis output	2	00:00:00.01	00:00:00.01
Cross-reference output	0	00:00:00.00	00:00:00.00
Assembler run totals	307	00:00:02.15	00:00:11.72

The working set limit was 750 pages.  
3610 bytes (8 pages) of virtual memory were used to buffer the intermediate code.  
There were 10 pages of symbol table space allocated to hold 9 non-local and 0 local symbols.  
285 source lines were read in Pass 1, producing 14 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\$:MTHCGSINC/OBJ=OBJ\$:MTHCGSINC MSRC\$:MTHJACKET/UPDATE=(ENH\$:MTHJACKET)+MS



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

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MTHCUTDG LIS													
										MTHDACOS LIS			
		MTHCGABS LIS											
MTHCDSINC LIS				MTHCLOG LIS							MTHDASIN LIS		
			MTHCGLOG LIS		MTHCONVER LIS							MTHDATAN LIS	
									MTHCSORT LIS				
	MTHCEXP LIS												
				MTHCGSORT LIS									
		MTHCGEXP LIS							MTHCSINCO LIS				
				MTHCONJG LIS									
MTHCDSORT LIS			MTHCGSINC LIS					MTHCOSH LIS					