B4 6H O@ J8

%\%j%e!<% '2D;k2=MQJBNs
%"%/%;%i%l!<%?**VoViAc**$N
DL?.$H%b%K%?$N8!F$$H<B8=

;a L> !'CfEh7rFs
3X@RHV9f !'2210940236-6
;XF3650w !';3:j>!9065<x
Ds=P F| !'1998G/27n20F|

N)L?4[Bg3XM}9)3XIt>pJs3X2J

FbMF9<35

K\O@J8GO!"%\%j%e!<%`!&0%i%U%#%/%9$r2D;k2=$9$k%l%$!&%-%c%9%F%#%s%0=hM}$r9bB.=hM}$9$k!"#3<!85%H!<%i%97?$N@\B3LV$r;}$DVoViAc%"!<%-%F%/%A%c$N$?$a$NDL?.$H%b%K%?$K$D$$$F=R$Y$k!#VoViAc$rA`:n@-$N9b$$%[%9%H%3%s%T%e!<%?>e$G1?MQ$9k?aK$O%b%K%?5!G=$,I,MWIT2D7gG"$k!#%[%9%H%3%s%T%e!<%?$+iN;X<(Kh$jVoViAc$N<B9T$r@)8f$7!"$^$?%[%9%H%3%s%T%e!<%?$+$iVoViAc$N%a%b%j$d%l%8%9%?>e$XMF0W$K%G!<%?$N=q$-9~$_!&FI$_=P7,G-kh$&$KJk3H$G!"%W%m%0%i%`$N:n@.$d%G%P%C%0$,MF0WKJ$k!#$^$?!"%b%K%?5!G=$r<B8=9k$?$aKO%[%9%H%3%s%T%e!<%?$HVoViAc$H$NDL?.$,IT2D7g$G!"$=N?aK%7%j%"%kDL?.K*$$$FD4JbF14|<0G*3J$$!"RS232C$N9600%\!<%l!<%H!"%G!<%?8%S%C%H!"%9%?!<%H%S%C%H1%S%C%H!"%9%H%C%W%S%C%H1%S%C%H!"%Q%j%F%#%S%C%HL5$7$H$$$&DL?.%U%)!<%^%C%H$rMQ$$$k!#$=$7$F!"J#?t%G!<%?$NAw<u?.$r9T$&$?$a$K!"%0%s%I%7%'%$%/@)8f$rMQ$$$FDL?.$NF14|$r<h$k!#

%W%m%0%i%`:n@.KO!"%[%9%H%3%s%T%e!<%?>e$GC8@8l!"VoViAc>e$G%"%;%s%V%j8@8l$rMQ$$$k!#

L\<!

?^L\<!

I=L\<!

1 O8aK

%\%j%e!<%`!&0%i%U%#%/%9$O#3<!856u4V$r%a%C%7%e$K6h@Z$j!"$=$N8D!9$K?'CM$dF)L@EYEy$NB0@-$rG[CV$7$?%G!<%?$N$3$H$G$"$k!#$=$18N>pJs$NL$,B?$/#2<!85F02h$HF1MM$K>iD9@-$,9b$$H?LL!"2hA|$NJ#;($5$K$h$i$J$$=hM}$,$G$-$k$h$&$K$J$C$?$j!"A4$F$N#3<!857O$r%7%_%e%l!<%7%g%s$9$k$3$H$,2DG=$K$J$kEy!9$NL%NO$,$"$k!#%\%j%e!<%`!&0%i%U%#%/%9$O#3<!856u4V$rI=8=9k:G$b<+M3EY$N9b$$I=8=7ABVG"$j!"%]%j%4%s!&0%i%U%#%/%9$N<!$N%9%?%s%@!<%I$KJk$H9M$(il$k!#

DL>o$NC`<!7?7W;;5!$G$O%\%j%e!<%`%G!<%?$r#1<!85$N%a%b%j$K3JG<7F$$$kNG!"@^$j>v$s$G3JG<$7$?%G!<%?$G$O<eE@$HJk;k@~$NJ}8~$,I,$:@8$8F7$^$&$?$a!"%\%j%e!<%`!&%0%i%U%#%/%9$r2D;k2=$9k?aK$O@lMQ$N%"!<%-%F%/%A%c$r9=C[$7J1lPJi$J$$!#

%\%j%e!<%`!&0%i%U%#%/%9O3l^$G0eNEMQ%0%i%U%#%/%9$H7F<j=Q%7%_%e%l!<%7%g%s$KMQ$$$ilF$-$?!#$^$?!"%O!<%I%&%'%"$N7W;;G=NO$,Dc$+$C$?$?$a?'>pJs$H7F#2CMNbNrBP>]H7$?$bN,B?$$!#$=$lKBP7$F!":G6aEP>l$7$?%"!<%-%F%/%A%c$O2J3X5;=Q7W;;$N7k2L$rI=<(9kbN$rBP>]$K9kbN,B?$/!"7W;;G=NO$,9b$/$JCF$-$?3Hb"$j!"8&5f$,5+sKJCF-$F$$$k!#7+$7!"$I$N%"!<%-%F%/%A%c$b0lD90lC;$G7hDjE*$JbN$OB8:_$7$F$$$J$$!#$^$?%3%9%H%Q%U%)!<%^%s%9$r0z$-=P9?aK$O!"2hA|$N>iD9@-$rMxMQ$7$F>JN,$9kJIN7W;;NL$N:o8:$r9ToJ1l$P!"%\%j%e!<%`=hM}$NKDBg5KBP=h9k3H$OF‘q$7$$!#

0J>eNh$&$JGX7J$+$i!"%\%j%e!<%`!&0%i%U%#%/%9$r2D;k2=$9$k%1%$!&-%C%9%F%#%s%0=hM}$r9bB.=hM}$9$k#3<!85%H!<%i%97?$N@\B3LVrb$D%"!<%-%F%/%A%cVoViAc(Volume Visualizaton Accelerator) $rK\8&5f<<1996 G/EY=$N;$N;3:j637<;a$,Ds0F$7!"@_7W$r9TC?[1]!#

VoViAc $N3F PE(Processing Element) $O%W%m%;%C%5$H%\%j%e!<%`%a%b%j!"$*$h$S%k!<%?$r#1%;%C%HK7$F9=@.$5lk!#9bB.$JIbF0>.?tE@1i;;$,I,MWG"k?$a!"%W%m%;%C%5$K$O DSP(Digital Signal Processer) $,:NMQ$5lF$$$k!#$^$?3F PE $r@\B3$9$k%k!<%?$O!"VoViAc $KEk:\$5lF$$$k FPGA(Field Programmable Gate Array) $rMQ$$$k3H$G<B8=$G$-$kh&$K@_7W$5lF$$$k!#FPGA $OFbIt$N2sO)@\B3>pJs$r30It$+iN%G%#%8%?%k?.9f$N7A$GM?$(!"FbIt9=B$$rJQ$($k3HNG$-$k=8@Q2sO)N3HG$"$k!#VoViAc $O#3<!85%H!<%i%9@\B3$H$$$&%9%1%$%i%S%j%F%#$N9b$$@\B37ABVrHk3HG!"Bg7?7W;;5!>e$G#3<!85%7%_%e%l!<%7%g%s$5l?Bg7?%\%j%e!<%`$N9bB.$J2D;k2=$+$i%o!<%/%9%F!<%7%g%s%l%Y%k$G$N>.7?%\%j%e!<%`$N2D;k2=$^$G9-HO$J1~MQ$KBP1~$9k3H,=PMh$k!#

:rG/EY$G VoViAc %O!<%I%&%'%"$N PE #8Bf$,<B:]$K@=:n5l!"$=$l$>$lKD$$$FG[@~8!::$H=i4|F0:n$N3NG'$,9T$olF$$$k!"K\8&5fGO%\%j%e!<%`!&0%i%U%#%/%9$r2D;k2=$9$k%=%U%H%&%'%"$r@=:n!&B9T$9$k2aDx$G!"$I$&$7$F$bI,MW$H$J$C$F$/$k VoViAc $H%[%9%H%3%s%T%e!<%?4VDL?.$N<B8=!"5Z$S VoViAc $rA`:n9k$?$aKI,MWHJk%b%K%?5!G=$N8!F$$H<B

8=$rL\;X$7$?!#%[%9%H%3%s%T%e!<%?$K$ONEC PC9801RX $rMQ$$!"%W%m%0%i%`8@81$O%[%9%H$G$OC 8@81$rVoViAc GO%"%;%s%V%i$rMQ$$$?!#$^$?!"%[%9%H%3%s%T%e!<%?$HVoViAc K*1kDL?.KODSP K*1k%P%C%U%!!&*!<%P!<%U%m!<rKI0$?$a!"DL?.$NF14|$,<h1kh&$K%O%s%I%7%'%$%/@)8f$rMQ$$$?!#DL?.B.EY$O!"%[%9%H%3%s%T%e!<%?$K$*$$$F8B3&CMG"$k9600 %\!<%1!<%H$K@_Dj$7!"DL?.J}K!$O#1%S%C%H$:$DAw<u?.9k%7%j%"%kDL?.$rMQ$$$?!#%b%K%?$N5!G=$H7FVoViAc K*1k%"%W%j%1!<%7%g%s%W%m%0%i%`$r%G%P%C%0$9$k:]$KI,MW$H$J$kRead-Register %3%^%s%I!"Read-Memory %3%^%s%I!"Change-Register %3%^%s%I!"Change-Memory %3%^%s%I!"5Z$SLoad-Program %3%^%s%I$N<B8=$rL\;X$7!"%W%m%0%i%`$r%m!<%I$7!"%1%8%9%?$d%a%b%j$NCM$r4QB,$7$?$jJQ$($k3H$,$G$-$kh&K9k3HrL\I8H7$?!#$^$?!"%"%W%j%1!<%7%g%s%W%m%0%i%`$N>\:Y$J%G%P%C%0$,$G$-$kh&!"Save-Program %3%^%s%I!"Run-Program %3%^%s%I!"Stop-Program %3%^%s%I!"Block-Run %3%^%s%I!"Step-Run %3%^%s%I!"5Z$SBreak-Run %3%^%s%I$K$D$$$F$N8!F$$b9TC?!#

:G=i$K%[%9%H%3%s%T%e!<%?$N%7%j%"%k%]!<%H$rMxMQ$7$?DL?.$r9T$$!"$=$N8eVoViAc $N<B9T$r@)8f9k%b%K%?5!G=KD$$$F$N8&5f$r9TC?!#

K\O@J8GO!"#2>OGO%\%j%e!<%`!&0%i%U%#%/%9$rVoViAc GINh$&$K=hM}7F$$$/$+$r8+$F$$$/!##3>OGODL?.5!G=$r%O%s%I%7%'%$%/@)8f$rMQ$$$FINh&$K<B8=$9k+@bL@9k!##4>OGO%b%K%?5!G=KD$$$F3F%3%^%s%I$N>\:Y$H%3%^%s%I=hM}$NN.$1KD$$$F$N@bL@$r9T$$!":n@.7?$$$/D+$N%3%^%s%I$K$D$$$F$N%F%9%H7k2L$r<($9!#

2 %\%j%e!<%`2D;k2=MQJBNs%"%/%;%i%l!<%?VoViAc

2.1 %\%j%e!<%`!&0%i%U%#%/%9

%\%j%e!<%`!&0%i%U%#%C%/%9HO#3<!856u4V$r%a%C%7%e>u$K6h@Z$j!"$=$N8D!9$K?'CM$dF)L@EYEy$NB0@-$rG[CV$7$?%G!<%?$N3HG"$k!#

$^$?!"%l%$!&%-%c%9%F%#%s%0$OH>F)L@BN$r8w$,DL$jH4$1kH$-$K5/3k8=>]$r??;w$?<jK!$G!"%\%j%e!<%`!&0%i%U%#%C%/%9$+$iX@~<L??Nh$&$J2hA|$rF@$k3H$,$G$-$k!#G$0U$NLL$G%/%j%C%T%s%0$9k3HKhC$F!"@ZCGLL$rI=<(9k3H$,2DG=$G!"3Nh&$J1i;;$O!"=>Mh!"<j=Q;~$N%7%_%e%l!<%7%g%s$rL\E*H7$FB?$/MQ$$$ilF$-$?!#%3%s%T%e!<%?$N2J3X5;=Q7W;;G=NO$,8~>e$7!"#3<!857W;;$KBQ$(F@$kbNKJCF$-$?$?$a!"$=$NI=<(KBP7FNI,MW@-$,:#8e=P$F$/$kbN$H;W$olk!#

VoViAc GO%l%$!&-%c%9%F%#%s%0$KhC$F%\%j%e!<%`!&0%i%U%#%/%9$r9bB.$K2D;k2=$9$k!#$=$N$?$a$K$O!"%\%j%e!<%`%G!<%?$r2sE>$7!"%l%$?J9TJ}8~$N%G!<%?0MB8$r2r>C7D$DJBNsF0:n$,2DG=GJ1lPJiJ$$!#

- JBNs2=

  %\%j%e!<%`7W;;$NJBNs2=$K$O%\%/%;%kJ,3d!"%T%/%;%kJ,3d!"%\%j%e!<%`J,3d$N#3$D$NJ}K!$,$"$k!#3liO$=$l$>$l!"#1<!85!"#2<!85!"#3<!85J,3d$H9M$(k3H,G-$k!#<!85?t$NJQ49r7$J$$>l9g!"%W%m%;%C%5KO3NJ,3d<!85?t$HF1$8$@$1JBNs$K%\%j%e!<%`%G!<%?$rAw$j9~$^J1lPJi$J$$!#b7$=$l0J>e$N<!85?t$rMQ0U7?>l9g$O!"2?$i$+$N=hM}$r9bB.$K9T$&$?aK;H$&$3H,2DG=KJ$k!#

- %G!<%?0MB8@-

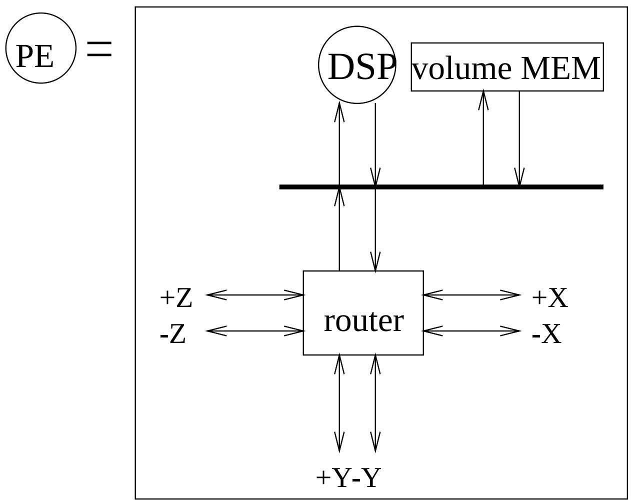
  %l%$!&-%c%9%F%#%s%0K!$GH>F)L@=hM}$r9T$&>l9g!"%l%$$N?J9TJ}8~$K0MB84X78$,@8$8$k!#$=$N$?$a!"3NJ}8~$KJBNs2=$r9T$&>l9g!"0MB8$9$k%W%m%;%C%5$XDL?.9k$+!"%O!<%I%&%'%"$rB?=E2=9k3HKhCF2r7h7J1lPJiJ$$!#

- G$0UJ}8~$+iN2D;k2=

  VoViAc GO!"G$0UJ}8~$+iN2D;k2=$r#3<g<4J}8~$+iN2D;k2=$H#4#5EY0J2<$NG$0U$N<P$aJ}8~$+iN2D;k2=$NN>J}$r<B8=9k3HKhCF9T$&!#

  A0<T$O%\%j%e!<%`%G!<%?$r%M%C%H%o!<%/$GJQ7A$9$kJ}K!!"0MB84X78$K$"$k%G!<%?rI,MWH9k%W%m%;%C%5$XDL?.$9$kJ}K!!"$*hS%O!<%I%&%'%"$rB?=E2=$9$kJ}K!$,$"$k!#8e<T$O<g<4$KBP7F2#J}8~$d=DJ}8~$K%7%U%HG-lPh/!"3l$bA0<T$HF1MM$NA*Br;h$,$"$k!#

0J>e$NMWAG$N$=$l$>$l$NJ}<0$NAH9g$;$N?t$@$1<B8=J}K!$,B8:_$7!"3liNCf$+$il s6aK!$dH>F)L@=hM}!"Jd4V=hM}!"%/%j%C%T%s%0$H$$$C$?2D;k2=$K5aailk=hM}$r9bB.<B9T2DG=



?^1: VoViAc 3FPE $N9=@.

$J%O!<%I%&%'%"$,%\%j%e!<%`8~1N%O!<%I%&%'%"HJ$k!#

VoViAc GO!"%\%/%;%kJ,3d$H%T%/%;%kJ,3d$NN>J}$rMQ$$$F!"7W;;ESCf7k2L$rDL?.$9kH $$$&A*Brr7$?7k2L!"#3<!85%H!<%i%99=B$$r;}$D%O!<%I%&%'%"$,DsO F$5$1$?[1][5]!#

2.2 %O!<%I%&%'%"9=@.

2.2.1 PE $N9=@.

VoViAc $N3FPE $O%W%m%;%C%5$H%\%j%e!<%`!&%a%b%j!"$=$7$F%k!<%?$G9=@.$5$1$k!#3FPE $N9=@.$r?^#1$K<($9[2]!#

%W%m%;%C%5KO7W;;KI,MWH$5$1$k=hM}A4HL$,?tCM1i;;=hM}G"k3H+$i!"DSP(Degital Signal Processor) $r:NMQ$7$F$$$k!#K\8&5fGO!"DSP H7$FTI<R$NTMS320C31[6] $rMQ $$$?!#TMS320C31 $O!"IbF0>.?tE@MQ$N%W%m%;%C%5$G0J2<$Nh&$JFCD'$r;}CF$$$k!#

- @Q;;4o$H2C;;4o$rF1;~$K;HMQ2DG=$J%Q%i%l%k!&$%s%9%H%i%/%7%g%s
- %5!<%-%e%i!<!&"%I%l%C%7%s%0
- 1K word !_2(2K byte !_2) $NFbIt%a%b%j
- #2DNFHN)7?%?%$%^
- B?MM$JJ,4tL?Na
- >r7oBeF~L?Na

- %W%m%0%i%^%V%k !&&%'%$%H !&3%s%H%m!<%i

- %V!<%H !&m!<%@5 !G=

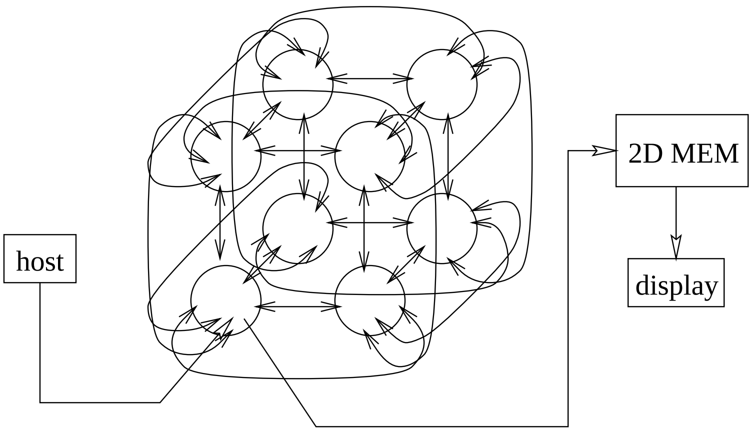
%Q%i%l%k !&$%s%9%H%i%/%7%g%s$OL?Na%U%#!<%k%INCfK#2L?Na$r; }$DL?Na$G!"@Q; ;4o$H2C; ;4o$rF1; ~$K; HMQ2DG=G"$k!#%$%s%/%j%a%s%H !&"%I%l%C%7%s%0$,; HMQ$G$-$kNG!"%G%#%8%?%k?.9f=hM}$K5a$ailk3HNB?$$@QOB7W; ;$rC10lL?Na !DL>o$O#2L?Na0J>e!K$G<B8=$9k3H,G-$k!#%5!<%-%e!<%i!<!&"%I%l%C%7%s%0$O!"%G%#%8%?%k?.9f=hM}$GI,MWH5lk3H$NB?$$FIFO $r9bB.$K<B8=9k3H$,2DG=$G!"%Q%i%l%k !&$%s%9%H%i%/%7%g%s$HAH$_9g$o$;$k3H$G!"C10lL?Na$GFIFO $N%j!<%I$d%i%$%H$r9T$&$3H,G-$k!#VoViAc GO%j%s%/$+iN%G!<%?F~NO$r0l<!J]; }9kNKMQ$$$k!#

TMS320C31 $OFbIt$K1K word $N#1%5%$%/%k$K#22s$:$D%"%/%;%92DG=$J%a%b%j#2DrbC$F$$$F!"$&$^$/@)8f$9k3HG!"#22sL\$N%G!<%?!&U%'%C%A$HL?Na%U%'%C%A!"DMA %"%/%;%9$r%&%'%$%HJ7$K%"%/%;%9$G$-$k!#>/J/Hb2K word $N%a%b%j$O$[$HsI$N%"%k%4%j%:%`$GL?Na%U%'%C%A$r8+$($J$$$h$&$K9k3H$,2DG=$G$"$k!#

#2DNFHN)7?%?%$%^$O%=%U%H%&%'%"$G; HMQ$9k3HO$J$$$,!"$=$N#1DOFPGA $NF0:n%/%m%C%/$r:nkNKI,MWG$"$k!#

TMS320C31 $OCY1dJ,4t!"%V%m%C%/!&j%T!<%HL?Na!"C10l%j%T!<%HL?Na!">r7oIU$-%G%/%j%a%s%HJ,4t!"%3!<%kL?Na$H$$$C$?$[HsINJ,4t9=B$$r; }CF$$$k!#L?Na<B9T$,%Q%$%W%i%$%s2=$5lF$$$k$?$a!"C1=c$JJ,4tL?Na$O#4L?Na%5%$%/%k$rI,MWH9k,!"CY1dJ,4t!"%V%m%C%/!&j%T!<%H!"C10l%j%T!<%HL?Na$rMQ$$$k3H$G!"J,4t$Khk%m%9rJ$/$9$3$H$,2DG=$G$"$k!#DSP $N>l9g!"%j%"%k%?%$%`@)8f$K; HMQ$5$l$k$3$H$,B?$/!"C1=c$J7+$jJV$71i; ;$,B?$$$?$a!"J,4t$K$O$5$^$6$^$J$b$N$rMQ0U$7$F$$$k!#$7$+$7!"$3$N$3$H$O!"9b5i8@8l$K$H$C$F$OM>$jNI$$$3$H$G$O$J$$!#%W%m%0%i%`@)8fL?Na$r:GE,2=$9$k%*%W%F%#%^%$%6$r:n$kNOFq7/!"C1=cJbN7$+; HMQ$G$-$J$$!#$=$N$?$a!"9b5i8@8l$rMQ$$$F$b%/%j%F%#%+%k$JItJ,$O%"%;%s%V%j8@8l$G=q$/I,MW$,$"$k!#>r7oBeF~L?Na$bJ,4t9=B$$r:GE,2=9kNKMQ$$$ilk!#DL>o!"<B9T5l$kA4BN$NJ,4tL?Na?t$O:GE,2=$7Fb$[$HsIJQoi$J$$!#3NL?Na$rMQ$$$k3H$G!"J,4tL?Na$r:o8:9k3H$,2DG=$G$"$k!#

%W%m%0%i%^%V%k !&&%'%$%H !&3%s%H%m!<%i$O!"3FPE $N30IU$12sO)$r>/$J$/$9kN$KHs>o$KLrN)GF$$$k!#DSP $+$i8+$F!"EEPROM $OHs>o$KCY$/!"#5%&%'%$%HI,MW$G!"S-RAM $O#0%&%'%$%H!"FPGA $O2sO)@_7W$KhC$F%&%'%$%H?t$,JQ$o$k!#$3li$N%&%'%$%H?t$O%W%m%0%i%`$+$iJQ99$9$k$3$H$b2DG=$@$,!"JQ99$K$O; ~4V$,$+$+$k$N$G!"30It$N%"%/%N%j%C%8?.9f$K$h$C$F$bJQ992DG=$G$"$k!#EEPROM $O5/F0; ~$K$N$_; HMQ$9$k$N$G!"=i4|CJ3,$G$O#5%&%'%$%H$G%W%m%0%i%`$r%m!<%I9k!#30It$N%"%/%N%j%C%8$r%"%I%l%9$N23 HV%T%s$K@\B3$7!"%4!<%9%H$r=P7F%W%m%0%i%`$+$i#0%&%'%$%H$+!"%W%m%0%i%`7?%&%'%$%H?t$K9k$+$rA*Br9k!#D^$j!"%"%I%l%9$NA0H>ItJ,$G%"%/%;%9$9lP!"IiO@M}?.9fG"$k%"%/%N



?^2: VoViAc $NA4BN9=@. !#8Bf!K

%j%C%8$,$+$+$j#0%&%'%$%H$KJj!"8eH>$G%"%/%;%9$9$1$P!"%"%/%N%j%C%8$,$+$+$i$J$$$N$G%W%m%0%i%`$7$?%&%'%$%H?t$K$J$k!#$3$N$h$&$K%W%m%0%i%`>e$G%3%s%H%m!<%k9kJ}K!$G%&%'%$%H%3%s%H%m!<%k2sO)$=$NbNrJ$/$9$3$H$K@.8y$7$F$$$k!#$^$?!"TMS320C31 KO%V!<%H!&%m!<%@5!G=$,$"kN$G!"$3$1$rMxMQ7FEEPROM $+$iFbItRAM $X%W%m%0%i%`$rE>Aw9k!#K\8&5fGOL?Na<B9T%5%$%/%k$,20MHz $NDSP $rMQ$$$k!#%Q%i%1%k!&%$%s%9%H%i%/%7%g%s$rMQ$$$F2C;;4o$H@Q;;4o$rF1;~$K;HMQ$7$?$H$-$KH/@8$9$k@-G=$N%T!<%/CM$O40Mflops G"$k!#

%\%j%e!<%`!&%a%b%j$K$O1byte/voxel $N%\%j%e!<%`%G!<%?$d3DDDA %F!<%V%k!"#2<!85Ej<M%G!<%?$r3JG<$9$k!#1PE $"$?$j128K word(512K byte) $Gno wait $N9bB.S-RAM $rMQ$$$?!#F~=PNO%P%s%II}$O20M word/sec(80M byte/sec) G"$k[5][8]!#

2.2.2 8PE $N@\B39=@.

VoViAc $O#3<!85%H!<%i%97?$N@\B3LV$r;}$C$F$$$k!#3N3HONc($P64 Bf$d512 Bf$KPE $NBf?t$,JQ2=7FbJQoiJ$$!##8Bf9=@.$NVoViAc $NA4BN9=@.$r?^#2$K<($9[2]!#

3FPE $r@\B3$9$k%k!<%?$OFPGA(Field-Programmable Gate Array) $G9T$&!#FPGA KOXilinx <R$NXC4010D $rMQ$$$F$$$k!#3NFPGA $O!"10,000 %2!<%HAjEv$NbN$G!"%2!<%HCY1d$,5ns G"$k!#%T%s?t$,160 %T%s$"$j!"$=$N$[$HsI$,EE8;$H%3%s%U%#%.%e%l!<%7%g%s2DG=$J%T%s$K3d$j?6$ilF$$$k!#DSP $H16bit $G@\B3$7!"B>PE $HB>%W%m%;%C%5$H11K\(8bit !\3 @)8f?.9f) $G@\B3$9$k%j%s%/$,#6K\!"FbIt>uBV$rI=<($9$kI=<(AuCV$r@\B3$7$?$j!"%[%9%H!&3%s%T%e!<%?$H$N@\B3$N$?$a$K%j%s%/$HF1MM$N11 K\$N%T%s$r;HMQ$7$F$$$k!#10,000 %2!<%HNbNrMQ$$$F$$$k$,!"$3$1$OFPGA $,!"%2!<%H?t$N;HMQN($,9b$/Jk$HF0:nB.EY$,Dc2<9k3H$+$iM>M5$r;}$?$;$k$?$a$G!"<B:]$O$=$N?tJ,$N#1$7$+;HMQ$7$F$$

$J$$! #TI <RKoTMS320C4x %7%j! <%:$,$"$j! "$3$1$O! "#6K\$N%Q%i%1%k%j%s%/$r; }$D%W%m %;%C%5G"$k! ##6$D$NDMA KhCF%j%s%/$+iN%G! <%?$r%a%b%j$XE>Aw$9k3H,2DG= $@$,! "%j%s%/$NA4$F$,; HMQ$5$1$k3HKJkH! "%W%m%;%C%5$N%a%b%j6%9g$,B?$/$J$k! #%= %U%H%&%'%"$G%k! <%F%#%s%0b5$;$J$1$1PJiJ$$N$G! "$=$N%*! <%P! <%X%C%I$r9MN8$7$F FPGA Kh$k%k! <%?$rMQ0U9k@_7WKJCF$$$k! #

2.3 %=%U%H%&%'%"35MW

2.3.1 DSP %"%;%s%V%i

VoViAc 3F PE $N%W%m%;%C%5$H7FMQ$$$i1F$$$k TMS320C31 $N%"%;%s%V%j8@81L?Na %;%C%H$O?tCM; X8~$N?.9f=hM}$*$h$SHFMQE*1~MQ$r%5%]! <%H7F$$$k! #L?Na$O! "%m! <%I ! &%9 %H%"L?Na! "#2%*%Z%i%s%I5Z$S#3%*%Z%i%s%I; ;=Q! ?O@M}L?Na! "JBNs%*%Z%1! <%7%g%sL?Na! "%W %m%0%i%`@)8fL?Na! "$=$7$F%$%s%?! <%m%C%/%*%Z%1! <%7%g%sL?NaJI$N%0%k! <%W$Ko+1F 9=@.$5$1$F$$$k! #

$^$?! "%a%b%j! "%1%8%9%?$*$h$SL?Na%o! <%I$+iN%G! <%?$r%"%/%;%9$9k?aK! "%1%8%9 %?! "D>@\! "4V@\! "%7%g! <%H ! &$%_%G%# (%$%H! "%m%s%0 ! &$%_%G%# (%$%H! "PC A jBP$N#6%?%$%W $N%"%I%1%C%7%s%0$,$"$k! #5iK"$k%?%$%W$N%"%I%1%C%7%s%0$O$"$kF CD j$NL?Na72$N$_$K ; HMQ$5$1! "$=$10J30$NL?Na$K$O; HMQ$5$1$J$$! #3N$?$a! "$3$1$i#6%?%$%W$N%"%I%1%C%7%s %0$N%?%$%W$O! "%<%M%i%k ! &"%I%1%C%7%s%0 ! &b! <%I! "#3%*%Z%i%s%I ! &"%I%1%C%7%s%0 ! &b! < %I! "JBNs%"%I%1%C%7%s%0 ! &b! <%I! "%m%s%0 ! &$%_%G%# (%$%H ! &"%I%1%C%7%s%0 ! &b! <%I! "> r 7oJ,4t%"%I%1%C%7%s%0 ! &b! <%I$N#5$D$N%"%I%1%C%7%s%0 ! &b! <%I$N%0%k! <%W$r7A@.7F$$ $k! #%"%I%1%C%7%s%0$H%"%I%1%C%7%s%0 ! &b! <%I$N4X78$rI=#1$K< ($9! #

TMS320C31 $NL?Na%;%C%H$Nb&0lDNFCD'$OLDFcond Nh$&$J>r7oJ,4tL?Na$,10 8D $"$j! "INL?NaGb20 <o$"$k>r7o%3! <%IN&A+iG0U$N%3! <%I$r; HMQ9k3H$,$G$- $k! #>r7o%3! <%I$N0lMw$rI=#2$K< ($9! #

3Nh&$K TMS320C31 $OFCJL$J%G%#%8%?%k?.9f=hM}MQ$NL?Na%;%C%H$r; }D3HKhC $F! "%W%m%;%C%5$N9bB.@-$H=@Fp@-$r<B8=7F$$$k! #[8][9]

2.3.2 TMS320C3x %7%_%e%1! <%?

%7%_%e%1! <%?$OTMS320C3x $rHs<B; ~4VF0:n$G%7%_%e%1! <%H9k%=%U%H%&%'%" ! &W%m%0 %i%`$G! "%W%m%;%C%5$N>uBV3NG'$d4QB,$,G-$k! #%/%m%9 ! &"%;%s%V%i! ?%j%s%+Kh$j=PNO $5$1$?DSP %*%V%8%'%/%H$r<B9T7F%W%m%;%C%5$N>uBV3NG'$d%G%P%C%0$,$G$-$k! #

%7%_%e%1! <%?$NFCD'$r0J2<$K< ($9! #[8]

I=1: %"%I%l%C%7%s%0$H%"%I%l%C%7%s%0!&b!<%I

%"%I%l%C%7%s%0!&b!<%I	%"%I%l%C%7%s%0					
	%l%8%9%?	D>@\	4V@\	%7%g!<%H	%m%s%0	PC AjBP
%<%M%i%k!& %"%I%l%C%7%s%0!&b!<%I	!;	!;	!;	!;	!]	!]
#3%*%Z%i%s%I!& %"%I%l%C%7%s%0!&b!<%I	!;	!]	!;	!]	!]	!]
JBNs!& %"%I%l%C%7%s%0!&b!<%I	!;	!]	!;	!]	!]	!]
%m%s%0!&$%_%G%#%(%$%H!& %"%I%l%C%7%s%0!&b!<%I	!]	!]	!]	!]	!;	!]
>r7oJ,4t!& %"%I%l%C%7%s%0!&b!<%I	!;	!]	!]	!]	!]	!;

- <g$J<~JU5!G=!DMA!"%?%$%^!"%7%j%"%k!&]!<%H!"%3%_%e%K%1!<%7%g%s!&]!<%HJI!K$N%7%_%e%l!<%7%g%s
- %a%K%e!<7A<0$N%-!<A`:n!J%a%K%e!<!&b!<%I!KKt$O%P%C%A!&U%!%$%k!J%i%$%s!&b!<%I!K$Khk%3%^%s%IF~NO
- %f!<%6!&+%9%?%^%$%:2DG=$JI8=`F~=PNO
- =$@55Z$S%=!<%95-=R$N:F%"%;%s%V%k$r2DG=K9$k5U%"%;%s%V%i
- A4%9%/%j!<%s!&b!<%IKBP9$k%X%k%W!&a%K%e!<
- %a%b%jFbMF$r16?J?t%G!<%?5Z$S%"%;%s%V%i!&=!<%9$GF1;~$KI=<(2DG=
- %7%s%0%k!&9%F%C%W!"until!"while!"for!"$=$7$F%V%l!<%/!&]%$%s%HKt$O%f!<%6Dd;_$^GN<B9T$r4^$`MM!9$J<B9T%b!<%I
- %5%$%/%k?t7W;;
- %-%&%C%7%e;HMQ$N%7%_%e%l!<%7%g%s

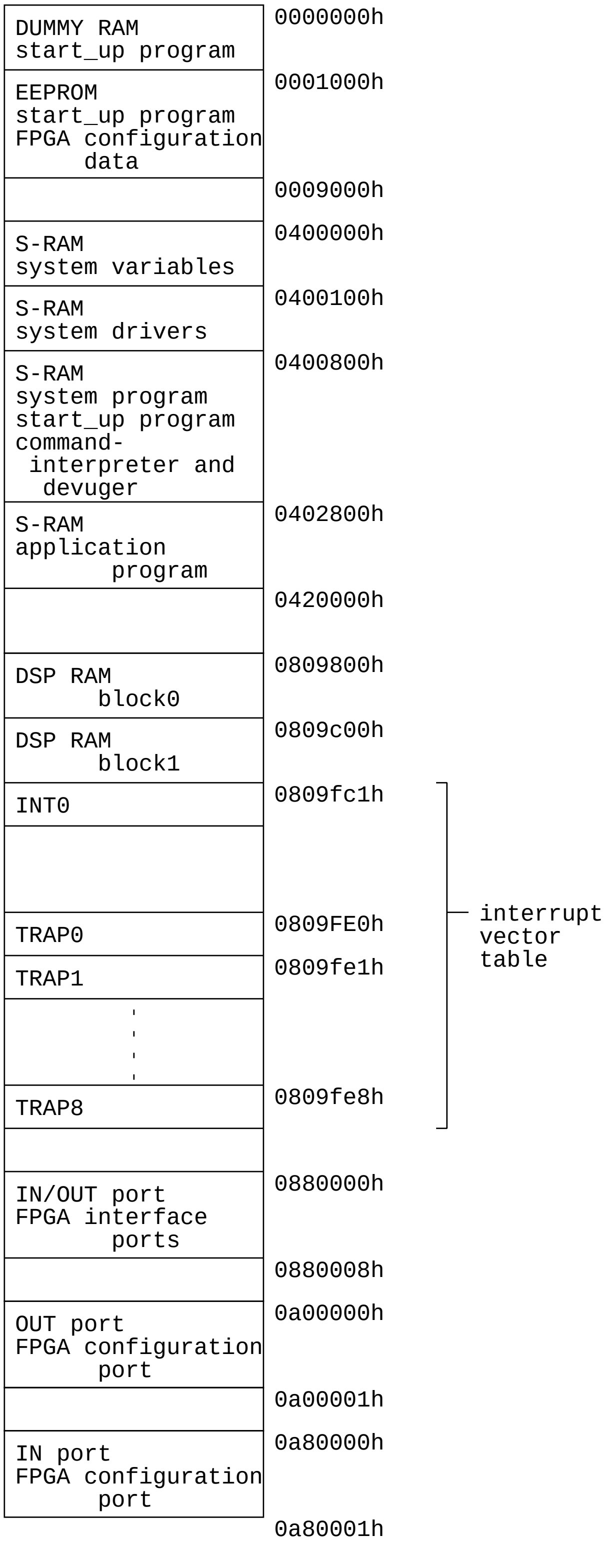
I=2: >r7o%3!<%I$*$h$S%U%i%0

>r7o	%3!<%I	@bL@	%U%i%0
L5>r7oH f3S			
U	00000	L5>r7o	L5;k
Id9fJ7H f3S			
LO	00001	hj>.	C
LS	00010	0J2<	C $^$?$oZ
HI	00011	hjBg	!AC $*$h$S!AZ
HS	00100	0J>e	!AC
EQ	00101	Ey$7$$	Z
NE	00110	Ey7/$J$$	!AZ
Id9fIU$-H f3S			
LT	00111	hj>.	N
LE	01000	0J2<	N $^$?$oZ
GT	01001	hjBg	!AN $*$h$S!AZ
GE	01010	0J>e	!AN
EQ	00101	Ey$7$$	Z
NE	00110	Ey7/$J$$	!AZ
%<%mHNH f3S			
Z	00101	%<%m	Z
NZ	00110	Hs%<%m	!AZ
P	01001	@5	!AN $*$h$S!AZ
N	00111	Ii	N
NN	01010	HsIi	!AN
>r7o%U%i%0HNH f3S			
N	00111	Ii	N
NZ	00110	Hs%<%m	!AZ
Z	00101	%<%m	Z
NV	01100	%*!<%P!<%U%m!<J7	!AV
V	01101	%*!<%P!<%U%m!<	V
NUF	01110	%"%s%@!<%U%m!<J7	!AUF
UF	01111	%"%s%@!<%U%m!<	UF
NC	00100	%-%c%j!<J7	!AC
C	00001	%-%c%j!<	C
NLV	10000	%i%C%A%*!<%P!<%U%m!<J7	!ALV
LV	10001	%i%C%A%*!<%P!<%U%m!<	LV
NLUF	10010	%i%C%AIbF0>.?tE@%"%s%@!<%U%m!<J7	!ALUF
LUF	10011	%i%C%AIbF0>.?tE@%"%s%@!<%U%m!<	LUF
ZUF	10100	%<%m$^$?$OIbF0>.?tE@%"%s%@!<%U%m!<	Z $^$?$oUF

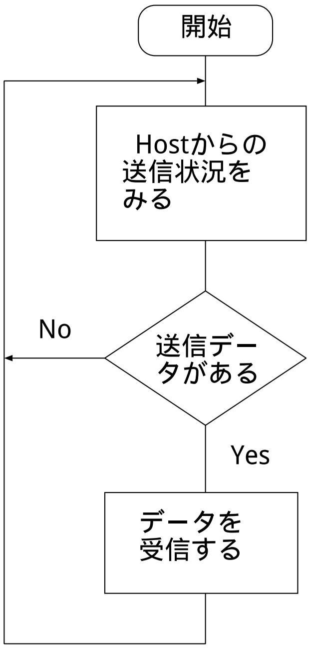
2.3.3 %a%b%j9=@.

TMS320C31 $NA4%a%b%j6u4V$O16M !J4K|!K32 %S%C%H!&o!<%IG"$k!#%W%m%0%i%`!"%G!<%?!"$*$h$SI/O 6u4V$O$3$N16M %o!<%I$N%"%I%l%96u4V$K4^$^$l$k!#$3$N$?$a!"%F!<%V%k!"78?t!"%W%m%0%i%`!&3!<%I!"$"$k$$$O%G!<%?$rRAM $+ROM $N$$$:lK$b%9%H%"$9k3H,G-!"%a%b%j$N;HMQ8zN($O:GBg2=5l!"$+$D%a%b%j6u4V$r<+M3$K3djEvFk3H,G-$k!#$=N?aKVoViAc GODSP FbIt$N%a%b%j$H30It%a%b%j$rE}0l$7$?%a%b%j%^%C%W$r0l0U$K7hDj$9k3H,G-!"3l$OVoViAc $N%7%9%F%`@_7WCJ3,$G7hDj7F$$$k!#

VoViAc K*1k%a%b%j%^%C%W$r?^#3$K<($9!#



?^ 3: VoViAc $N%a%b%j%^%C%W



?^4: VoViAc K*1k#1%P%$%H<u?.

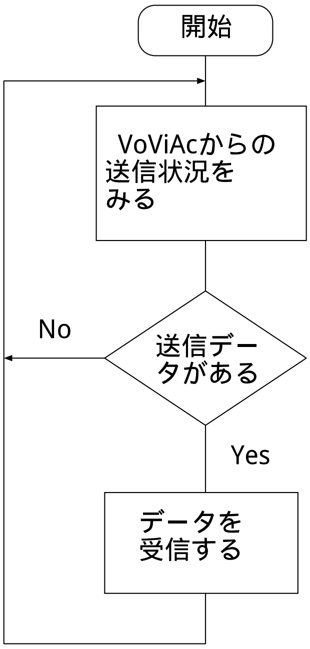
3 DL?.5!G=$N<B8=

3.1 DL?.$N=i4|@_Dj

DL?.$O%7%j%"%kDL?.$K$*$$$FD4JbF14|<0$G9T$$!"RS232C $N9600 %\!<%1!<%H!"%G!<%?8 %S%C%H!"%9%?!<%H%S%C%H1!"%9%H%C%W%S%C%H1!"%Q%j%F%#%S%C%HJ7$H$$$&DL?.%U%)!<%^%C %H$rMQ$$$k3HK7$?!#

3.2 **VoViAc-Host** 4VK*1k1%P%$%HAw<u?.

VoViAc-Host 4VK*$$$FAw<u?.$5$1$k%G!<%?$N4pK\C10L$O#1%P%$%HG"$k!#$^$:!"Host $+$i VoViAc $K#1%P%$%HAw?.9k>l9gKD$$$F@bL@9k!#:G=i!"VoViAc $O%G!<%?$r<u?. 9k$?$a$K%G!<%?BT$A>uBVG"$k!#$=7F!"Host $+$i#1%P%$%HAw?.$5lF$/$k$H<u?.$r 3+;O9k!#<u?.$r4ON;$9kH$^$?!"%G!<%?BT$A>uBV$K0\$k!#3NN.lr?^#4$K<($9!#<!$K VoViAc $+$i Host $K#1%P%$%HAw?.9k>l9gKD$$$F@bL@9k!#:G=i!"Host $O%G!<%?BT$A>u BVG"$k!#VoViAc $O Host $,<u?.2DG=$G$"$k3H$r3NG'$7$?>e$G!"Aw?.$r3+;O$9$k!#Host OAwilF$-$?#1%P%$%H$r<u?.$7!"$^$?%G!<%?BT$A>uBV$K0\$k!#3NN.lr?^#5$K<($9!#



?^5: Host K*1k#1%P%$%H<u?.

3.3 VoViAc-Host 4V%G!<%?DL?.

VoViAc $N%W%m%;%C%5DSP K*1k#1L?Na$N<B9TB.EY$O1/40M ICG"$k!##1%P%$%H$N<u?.=hM}$K$OLs#5L?NaI,MW$G$"$kNG!"<u?.=hM}KO5/40M ICI,MWG"$k!#$^$?!"VoViAc K*1kDL?.B.EY$O9600 %\!<%l!<%HG"$kNG!"#1%P%$%H$NAw<u?.KO10/9600 ICI,MWG"$k!#VoViAc $N%k!<%?$K$*$1$k<u?.%P%C%U%!$O#2%P%$%HJ,MQ0U$7F"k?$a!"=hM}B.EY$+i_$FDSP $O2?$NLdBjbJ$/<u?.=hM}$r9T$($=$&$G$"$k!#

7+$7!"DSP $N=hM}$O<u?.$@$1GO$J$$$?$a!"Host $+$i$N%G!<%?Aw?.$N:]$K%k!<%?$N<u?.%P%C%U%!K*$$$F!"%P%C%U%!!&*!<%P%U%m!<$,H/@8$9$k2DG=@-$,$"$k!#%*!<%P!<%U%m!<$,5/$3kH!"%G!<%?$,%*!<%P!<!&i%$%H5lF7$^$&!#

$=$3$G!"DL?.$NF14 |$r<h$kI,MW$,$GF/$k!#$=$N<jCJ$H7F%O%s%I%7%'%$%/@)8f$,5s2ilk!#%O%s%I%7%'%$%/@)8f$G$O!"Host $+$iVoViAc $K%O%s%I%7%'%$%/%9%F!<%?%9%P%$%H$rAw?.$7!"VoViAc GO<u?.2DG=KJlP!"<u?.2DG=$N%a%C%;!<%8$rHost $KAw?.$9$k!#Host GOAwilF-$?%a%C%;!<%8$r<u$1<hC?i9$0$K!"%Q%C%1!<%8%s%0$5l?%G!<%?$rAw?.9k!#3N%Q%C%1!<%8KO%9%?!<%H%P%$%H$,@hF,$KIU2C5lF*$j!"VoViAc GO3N%9%?!<%H%P%$%H$r3NG'7?>e$G!"<u?.$r3+;O9k!#?^#6$K%O%s%I%7%'%$%/@)8fKh$kDL?.$NMM;R$r<($9!#3NH-!"%Q%C%1!<%8$ND9$5$OE}0l$5lF$*$j!"VoViAc GO0lDj$N%G!<%??t$r<u?.9lPh$$$3HKJk!#3N%Q%C%1!<%8$ND9$5r"$^$jKbD9$$$bNK7F7^

$&$H!"$$$/$iDSP $N=hM}B.EY$HDL?.B.EY$K:9$,$"$k$H8@$(Ib!"%k!<%?$N%P%C%U%!!&*!<%P!<%U%m!<$,H/@8$9$k$?$a5$$rIU1J1lPJiJ$$!#?^#7$K%Q%C%1!<%8$N4pK\7A$r<($9!#VoViAc GO!"%O%s%I%7%'%$%/@)8f$rMQ$$$?DL?.$r9T$&:]$N@_Dj$r0J2<Nh$&$KDja?!#

- 0xE8 !%O%s%I%7%'%$%/%9%F!<%?%9%P%$%H
- 0xE9 !<u?.2DG=%a%C%;!<%8
- 0xEA !%Q%C%1!<%8$N%9%?!<%H%P%$%H
- 0xEB !VoViAc $+$iHost $XAw?.$9$k%G!<%?$N%(%s%I%P%$%H
- 0xFF !%G!<%??t$,%Q%C%1!<%8$ND9$5$r1[$($J$$>19g$NIU2C%P%$%H

$^$?!"%Q%C%1!<%8$ND9$5$O20 %P%$%HH7$?!#

3.4 DL?.$N<B83

- #1%P%$%HAw<u?.

  %[%9%H%3%s%T%e!<%?$HVoViAc $rRS232C %1!<%V%k$G@\B3$9$k!#

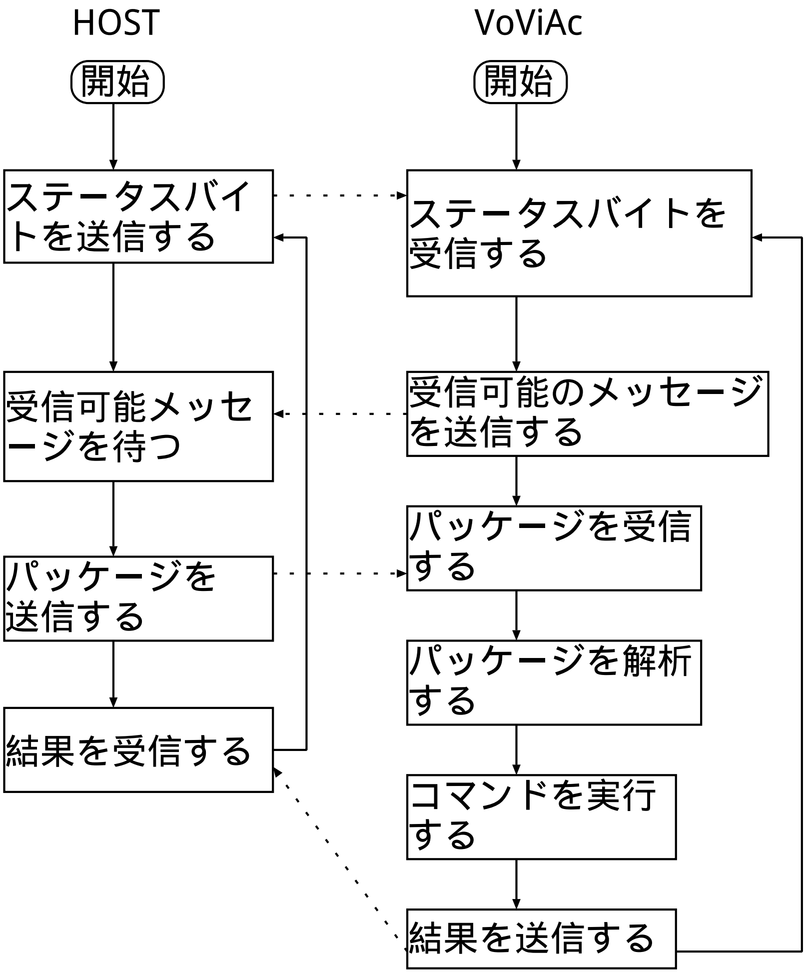
  Host $+$iVoViAc $X#1J8;zAw?.$9$kVoViAc GO!"AwilF-$?J8;z$r<u?.7F$=lrHost $KAw?.$9$k!#

- %G!<%?DL?.

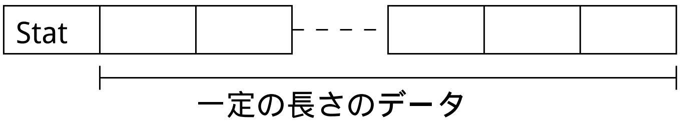
  Host $+$iVoViAc $K%O%s%I%7%'%$%/%9%F!<%?%9%P%$%H$rAw?.9k!#%O%s%I%7%'%$%/%9%F!<%?%9%P%$%H$r<u?.$7$?VoViAc $O<u?.2DG=$G$"$l$P!"<u?.2DG=%a%C%;!<%8$rHost $KAw?.$9$k!#<u?.2DG=%a%C%;!<%8$r<u?.7?Host $O%Q%C%1!<%8%s%0$5l?%G!<%?$rVoViAc $KAw?.$9$k!#%G!<%?$r<u?.7?VoViAc $O%Q%C%1!<%8$N%9%?!<%H%P%$%H$N<!KAwilF$/$k20 %P%$%H$N%G!<%?$r%a%b%j$K3JG<9k!#<!$K!"VoViAc $+$i%a%b%j$K3JG<$5l?%G!<%?rFI_=P$7!"Host $KAw?.$9$k!#

#1%P%$%HAw<u?.$N<B83$r9T$C$?7k2L!"FC$K2?$NLdBj$bJ/Host $O!"Aw?.$7$?J8;z$r<u?.7?!#

%G!<%?DL?.$N<B83$K$*$$$F$O!"%O%s%I%7%'%$%/@)8f$r9T$&A0$O!"%k!<%?$N<u?.%P%C%U%!K*$$$F!"%P%C%U%!!&*!<%P!<%U%m!<$,H/@8$9k?$a%G!<%?$,%*!<%P!<!&i%$%H$5$l!"DL?.$,$&$^$/9T$(J+C?!#7+$7!"%O%s%I%7%'%$%/@)8f$rMQ$$$k3HKhCF!"DL?.$,$&$^$/9T$($kh&KJC?!#



?^6: %O%s%I%7%'%$%/@)8f$KhkDL?.$NMM;R



?^7: %Q%C%1!<%8$N4pK\7A

4 %b%K%?5 !G=$N8 !F $$H<B8=

4.1 %b%K%?$N5 !G=

VoViAc $rA `:n@-$N9b$$% [%9%H%3%s%T%e!<%?>e$G1 ?MQ$9$k$?$a$K$O! "%b%K%?5 !G=$,I,MW $G$"$k! #% [%9%H%3%s%T%e!<%?$+$i$N; X< ($K$h$j VoViAc $N<B9T$r@)8f$7! "$^$?% [%9%H%3%s %T%e!<%?$+$i VoViAc $N%1%8%9%?$d! "%a%b%j>e$X%G!<%?$N=q$-9~$_ !&FI$_=P$7$,$G$-$k$h $&$K$J$k$3$H$G! "%W%m%0%i% `$N:n@.$d%G%P%C%0$,MF0WKJ$k! #%b%K%?5 !G=$H7FI,MW$JMW AG$r0J2<$K< ($9! #

- % [%9%H%3%s%T%e!<%?>e$GVoViAc $N<B9T@)8f! #
- %1%8%9%?! "%a%b%j$N%G!<%?FI$_=P$7 !&=q$-9~$_5 !G=! #
- FI$_=P$7$?%1%8%9%?! "%a%b%j$N%G!<%?$NI=<(5 !G=! #
- %W%m%0%i% `$N%m!<%I! "%9%H%"5 !G=

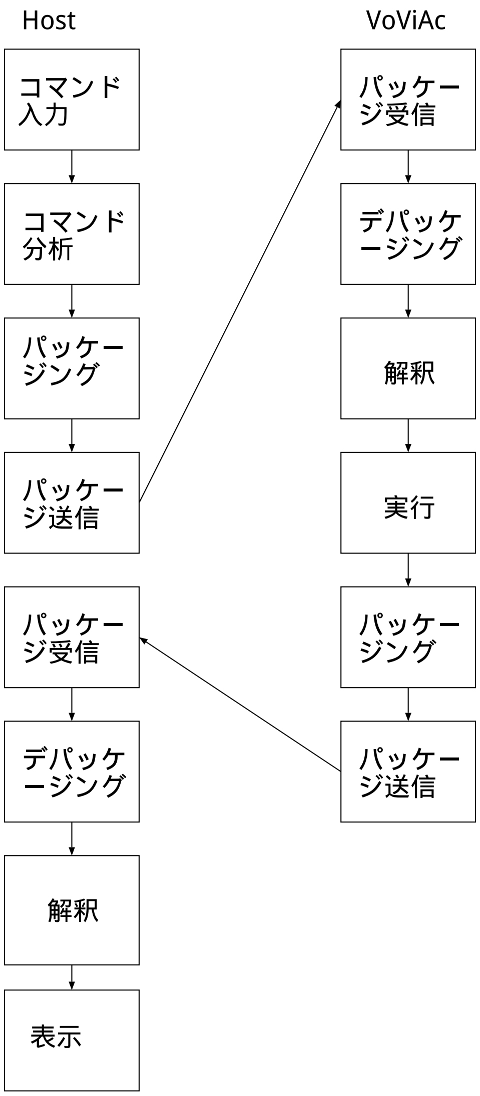
4.2 %G%P%C%0%3%^%s%I

4.2.1 %G%P%C%0$NN.$1

Host %3%s%T%e!<%?$+$i VoViAc $rA `:n$9k?aK! "11 8D$N%G%P%C%0%3%^%s%I$rMQ0U$7 $?! #Host %3%s%T%e!<%?$+$i%3%^%s%I$rF~NO7?H-$NN.$1$r@bL@$9$k! #$^$:! "Host $K%3 %^%s%I$,F~NO$5$1kH! "Host $O%3%^%s%I$rJ,@O7F%Q%C%1!<%8%s%0$7! "VoViAc $KAw?.$9 $k! #VoViAc GO! "%Q%C%1!<%8$r<u?.$7$F%G%Q%C%1!<%8%s%0$7! "2r<a7F<B9T9k! #B3$1 $F! "VoViAc $O! "<B9T$7$?7k2L$r%Q%C%1!<%8%s%0$7! "Host $KAw?.$9$k! #Host GOAwi1$F $-$?%Q%C%1!<%8$r<u?.$7$F%G%Q%C%1!<%8%s%0$7! "2r<a7FF@i1$?7k2L$r%G%#%9%W%1%$$K I=<(9k! #3N%G%P%C%0$NN.$1$r?^#8$K<($9! #

4.2.2 %G%P%C%0%3%^%s%I0 lMw

%G%P%C%0%3%^%s%IKO! "; XD j% "%I%1%9$K%W%m%0%i% `$r%m!<%I$9$k LOAD %3%^%s%I! "; XD j $9$k%W%m%0%i% `$rJ]B8$9$k SAVE %3%^%s%I! "%W%m%0%i% `$r<B9T$9$k$?$a$N RUN %3%^%s%I! " <B9TCf$N%W%m%0%i% `$r; _$a$k STOP %3%^%s%I! "%W%m%0%i% `$r; XD j$9k"$k% "%I%1%9$+i" $k% "%I%1%9$^$G<B9T$9$k BLOCK %3%^%s%I! "0 lL?Na<B9TN?aN STEP %3%^%s%I! "; XD j$9 $k% "%I%1%9$^$G<B9T$9$k BREAK %3%^%s%I! "; XD j9k%1%8%9%?NCMr4QB,9k RR %3%^%s %I! "; XD j9k% "%I%1%9NCMr4QB,9k RM %3%^%s%I! "; XD j9k%1%8%9%?NCMrJQ$($k CR


Host
VoViAc
コマンド入力
コマンド分析
パッケージング
パッケージ送信
パッケージ受信
デパッケージング
解釈
表示
パッケージ受信
デパッケージング
解釈
実行
パッケージング
パッケージ送信

?^8: %G%P%C%0$NN.$l

I=3: %G%P%C%0%3%^%s%I0 1Mw

LOAD	Load Program	;XDj%"%I%1%9$K %W%m%0%i%'$r%m!<%I9k
SAVE	Save Program	;XDj9k%W%m%0%i%'$r J]B8$9$k
RUN	Run Program	%W%m%0%i%'$r<B9T$9$k
STOP	Stop Program	<B9TCf$N%W%m%0%i%'$r;_ak
BLOCK	Block Run	%W%m%0%i%'$r;XDj$9k"$k%"%I%1%9$+$i $"$k%"%I%1%9$^$G<B9T9k
STEP	Step Run	01L?Na<B9T
BREAK	Break Run	;XDj9k%"%I%1%9$^$G<B9T9k
RR	Read Register	;XDj9k%1%8%9%?NCMr4QB,9k
RM	Read Memory	;XDj9k%"%I%1%9NCMr4QB,9k
CR	Change Register	;XDj9k%1%8%9%?NCMrJQ$($k
CM	Change Memory	;XDj9k%"%I%1%9NCMrJQ$($k

%3%^%s%I!"5Z$S;XDj$9$k%"%I%1%9$NCMrJQ($k CM %3%^%s%I$,$"$k!#I=#3$K%G%P%C%0%3%^%s%I$N0 1Mw$r<($9!#

4.3 %b%K%?$N<B8=$H%F%9%H

<B:]$K!"11 8D$"$k%G%P%C%0%3%^%s%I$N$&$A#48D$N%3%^%s%I!"RR %3%^%s%I!"RM %3%^%s%I!"CR %3%^%s%I!"5Z$S CM %3%^%s%I$K$D$$$F%W%m%0%i%'$r:n@.$7!"<B83$r9T$C$?!#

VoViAc K*1k RR %3%^%s%I!"RM %3%^%s%I!"CR %3%^%s%I!"5Z$S CM %3%^%s%I$K$D$$$F$N%W%m%0%i%'$O@5$7$/F0:n7?!#$3$1$O!"CR %3%^%s%I$KhC$F%1%8%9%?$K=q$-9~$s$@%G!<%?$r RR %3%^%s%IKhCFFI$'$3HH!"CM %3%^%s%IKhCF%a%b%j$K=q$-9~s@%G!<

%?$rRM %3%^%s%I$KhCFFI‘3HKhCF3NG’G-$?!#$3NH$-!"Host $+$iAw?.9k %G!<%?$O:G=i$+$i%Q%C%1!<%8%s%0$5l?%G!<%?$rAw?.$7$?!#

7+$7!"Host K*1k%W%m%0%i%‘$OOCR %3%^%s%IKhCF=q$-9~s@%G!<%?$,RR %3%^ %s%I$KhCFFI‘$H0cC?CM$,JVCF$/$k3H$H!"CM %3%^%s%IKhCF=q$-9~s@%G!< %?$,RM %3%^%s%I$KhCFFI‘$H0cC?CM$,JVCF$/$k3H$+$i@5$7$/F0:n7F$$$J$$$H 9M$($ilk!#3l$O!"Host K*$$$FF~NO5l$?%3%^%s%I$,J,@O5l%Q%C%1!<%8%s%0$5$l$k :]$K!"Jsi+$N%P%0$,H/@8$9$k$?$a$H9M$(il$k!#

5 $*$ojK

K\8&5fGO!"%\%j%e!<%`!&%0%i%U%#%/%9$r2D;k2=$9$k VoViAc %"!<%-%F%/%A%c$K$D$$$F@bL@9k$H6&$K!"Host %3%s%T%e!<%?!&VoViAc 4VDL?.$N<B8=!"Host %3%s%T%e!<%?$K$*$1$k%b%K%?5!G=$N8!F$$H<B8=KD$$$F9M$($?!#

:#8e$O!"<B8=$5$1$?Host %3%s%T%e!<%?!&VoViAc 4V$NDL?.$rMQ$$$k3HKhCF!"%b%K%?5!G=$r=<<B$7$?$bNK7F$$$+J1lPJi$J$$!#8=:_!"DL?.$,2DG=$KJC$?$3HKhC$F!"RR %3%^%s%I!"RM %3%^%s%I!"CR %3%^%s%I!"CM %3%^%s%I!"5Z$S LOAD %3%^%s%I$K$D$$$F%W%m%0%i%`$r:n@.$7!"%G%P%C%0Cf$G$"$k!#$^$?!"$=$l$i$N%3%^%s%I$,40@.$9$l$P!"%\%j%e!<%`!&%0%i%U%#%/%9$N%=%U%H%&%'%"$b<B9T2DG=KJkN$G!"%=%U%H%&%'%"$N3+H/Kb<hj+$+$k3H$,$G$-$k!#

8=;~E@GO!"Host %3%s%T%e!<%?$H VoViAc 01Bf$H$NDL?.$@1KHI$^$C$F$$$kNG!" VoViAc $NBf?t$r#2Bf!"#3Bf$HA}2C$5$;$?H-$NDL?.$d!"%b%K%?5!G=KD$$$F$b8!F$$H<B8=$,I,MW$G$"$k!#

<U<-

K\8&5f$N5!2q$rM?$($F$/$@5j!"J*$+$D?t!9$N8f=u8@$rD:$-$^7?;3:j>!9065<x$K?<$/46<U$N0U$rI=7^$9!#$^$?!"$3l^$G?t!9$N8f=u8@$rD:$-$^$7$?8&5f<<$N3'MM$K46<U$$$?7^$9!#

5i$K!"$*K;$7$$$CfMM!9$J<ALd$KEz$($F$/$@5C$?3A>B42G7@hGZ!"Tran So Cong @hGZ$K?<$/46<U$$$?7^$9!#

;29MJ88%

[1] ;3:j637<!&%\%j%e!<%`2D;k2=MQJBNs%"%/%;%i%l!<%?VoViAc $N%"!<%-%F%/%A%c$N8!F$$H<B8=!"N)L?4[Bg3XBg3X1!M}9)3X8&5f2J=$;NO@J8!"1996.

[2] ;3:j637<!";3:j>!90!&%\%j%e!<%`2D;k2=MQJBNs%"%/%;%i%l!<%?$N8!F$!">pJs=hM}3X2qBh51 2sA49qBg2q!"4S-11,1995.

[3] Tran So Cong!"Kenji Nakajima,Katsuhiro Yamazaki!'Message in VoViAc System:Structure,Routing and Handle!"J?@.9G/EE5$4X783X2q4X@>;YItO"9gBg2q!"1997.

[4] Tran So Cong!'The Message Routing Mechanism And Kernel System Of Parallel Graphics Accelerator!">pJs=hM}3X2qBh56 2sA49qBg2q!"9V1iHV9f1N-05!"1998.

[5] 3A>B42G7!&%\%j%e!<%`2D;k2=MQJBNs%"%/%;%i%l!<%?VoViAc $N%O!<%I%&%'%"@=:n!"N)L?4[Bg3XM}9)3XIt>pJs3X2JB46HO@J8!"1997.

[6] 9bLnJ8CK!&%\%j%e!<%`2D;k2=MQJBNs%"%/%;%i%l!<%?VoViAc $N%b%K%?$N8!F$$H<B8=!"N)L?4[Bg3XM}9)3XIt>pJs3X2JB46HO@J8!"1997.

[7] @%C+7<2p!&%G%#%8%?%k?.9f=hM}$N%-!<%G%P%$%9DSP %W%m%0%i%_%s%0F~Lg=iHG!"F|4)9)6H?7J9<R!"1996.

[8] F|K\%F%-%5%9!&$%s%9%D%k%a%s%D!'TMS320C3x %G%#%8%?%k!&7%0%J%k!&%W%m%;%C%5%f!<%6!<%:!&%^%K%e%"%k Bh3 HG!"F|K\%F%-%5%9!&$%s%9%D%k%a%s%D!"1996.

[9] F|K\%F%-%5%9!&$%s%9%D%k%a%s%D!'TMS320C3x/C4x %"%;%s%V%j8@8l%D!<%k%f!<%6!<%:!&%^%K%e%"%k!"F|K\%F%-%5%9!&$%s%9%D%k%a%s%D!"1997.

[10] F|K\%F%-%5%9!&$%s%9%D%k%a%s%D!'TMS320C3x/C4x %3!<%I@8@.%D!<%kGetting Started %j%j!<%95.00!"1997.

[11] E15~M}2JBg3XEIC !'PC-9801 %W%m%0%i%^!<%:Bible Bh2 HG!"5;=QI>O@<R!"1994.

[12] G~C+IY9@!'D4JbF14|<ODL?.$HF14|<ODL?.!"%H%i%s%8%9%?5;=Q Bh29 4, Bh338 9f!"CQ=PHG<R!"pp.258-264!"1992.

[13] 2O@>D+M:!'Ver.5.1MicrosoftC =i5i%W%m%0%i%_%s%0F~Lg(>e)(2<) Bh8 HG!"5;=QI>O@<R!"1990.

[14] I~It>;Gn!'RS232C $HDL?.%W%m%H%3%k$r3X$V?M$N$?$a$NC 8@8l$H%G!<%?DL?. Bh5 HG!"9)3X?^=q3t<02q<R!"1996.