



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# mikroPascal PRO for dsPIC™

## Manual

*mikroPascal PRO for dsPIC30/33 and PIC24 is a full-featured compiler for dsPIC30, dsPIC33 and PIC24 MCUs from Microchip. It is designed for developing, building and debugging dsPIC30/33 and PIC24-based embedded applications. This development environment has a wide range of features such as: easy-to-use IDE, very compact and efficient code, many hardware and software libraries, comprehensive documentation, software simulator, COFF file generation, SSA optimization (up to 30% code reduction) and many more. Numerous ready-to-use and well-explained examples will give a good start for your embedded project.*

# Compiler

 **MikroElektronika**

SOFTWARE AND HARDWARE SOLUTIONS FOR EMBEDDED WORLD ...making it simple

# Table of Contents

<b>CHAPTER 1</b>	<b>32</b>
<b>INTRODUCTION</b>	<b>32</b>
Introduction to mikroPascal PRO for dsPIC30/33 and PIC24	33
Features	33
Where to Start	33
What's new in mikroPascal PRO for dsPIC30/33 and PIC24	34
Compiler Changes	34
IDE Changes	34
Software License Agreement	35
mikroElektronika Associates License Statement and Limited Warranty	35
IMPORTANT - READ CAREFULLY	35
LIMITED WARRANTY	35
HIGH RISK ACTIVITIES	36
GENERAL PROVISIONS	36
Technical Support	37
How to Register	37
Who Gets the License Key	37
How to Get License Key	37
After Receiving the License Key	39
<b>CHAPTER 2</b>	<b>41</b>
<b>mikoPascal PRO for dsPIC30/33 and PIC24 Environment</b>	<b>41</b>
Main Menu Options	42
File	43
File Menu Options	43
Edit	44
Edit Menu Options	44
Find Text	45
Replace Text	45
Find In Files	46
Go To Line	46
Regular expressions option	46
View	47
View Menu Options	47
Project	49
Project Menu Options	49
Build	50
Build Menu Options	50
Run	51
Run Menu Options	51
Tools	52
Tools Menu Options	52

Help	53
Help Menu Options	53
mikroPascal PRO for dsPIC30/33 and PIC24 IDE	54
IDE Overview	54
Code Editor	55
Editor Settings	55
Auto Save	56
Highlighter	56
Spelling	56
Comment Style	56
Code Folding	56
Code Assistant	57
Parameter Assistant	57
Bookmarks	57
Go to Line	57
Column Select Mode	58
Editor Colors	58
Auto Correct	59
Auto Complete (Code Templates)	60
Code Explorer	62
Routine List	63
Project Manager	63
Project Settings	65
Library Manager	66
Managing libraries using Package Manager	67
Routine List	68
Statistics	68
Memory Usage Windows	68
RAM Memory Usage	69
Used RAM Locations	69
SFR Locations	70
ROM Memory Usage	70
ROM Memory Constants	71
Functions	71
Functions Sorted By Name Chart	72
Functions Sorted By Size Chart	72
Functions Sorted By Addresses	73
Function Tree	73
Memory Summary	74
Messages Window	75
Quick Converter	76
Macro Editor	76
Image Preview	77
Toolbars	79

File Toolbar	80
Edit Toolbar	80
Advanced Edit Toolbar	81
Find/Replace Toolbar	81
Project Toolbar	82
Build Toolbar	82
Debug Toolbar	83
Styles Toolbar	83
Tools Toolbar	84
View Toolbar	84
Layout Toolbar	85
Help Toolbar	85
Customizing IDE Layout	86
Docking Windows	86
Saving Layout	87
Auto Hide	87
Options	88
Code editor	88
Tools	88
Output settings	89
Integrated Tools	91
Active Comments Editor	91
ASCII Chart	92
EEPROM Editor	93
Filter Designer	93
Graphic Lcd Bitmap Editor	94
HID Terminal	95
Lcd Custom Character	96
Seven Segment Editor	97
UDP Terminal	97
USART Terminal	98
Active Comments	99
New Active Comment	99
Renaming Active Comment	106
Deleting Active Comment	107
Export Project	108
Jump To Interrupt	109
Regular Expressions	110
Introduction	110
Simple matches	110
Escape sequences	110
Character classes	110
Metacharacters	111
<b>Metacharacters - Line separators</b>	111
Metacharacters - Predefined classes	112
Metacharacters - Word boundaries	112

Metacharacters - Iterators	112
Metacharacters - Alternatives	113
Metacharacters - Subexpressions	113
Metacharacters - Backreferences	113
Keyboard Shortcuts	114
<b>CHAPTER 3</b>	<b>116</b>
<b>mikroPascal PRO for dsPIC30/33 and PIC24 Command Line Options</b>	<b>116</b>
<b>CHAPTER 4</b>	<b>118</b>
<b>mikroICD (In-Circuit Debugger)</b>	<b>118</b>
Introduction	118
mikroICD Debugger Options	120
Debugger Options	120
mikroICD Debugger Example	121
mikroICD Debugger Windows	125
Debug Windows	125
Breakpoints Window	125
Watch Values Window	125
RAM Window	127
Stopwatch Window	127
EEPROM Watch Window	128
Code Watch Window	129
<b>CHAPTER 5</b>	<b>130</b>
<b>Software Simulator Overview</b>	<b>130</b>
Software Simulator	131
Software Simulator Debug Windows	132
Debug Windows	132
Breakpoints Window	132
Watch Values Window	132
RAM Window	134
Stopwatch Window	134
EEPROM Watch Window	135
Code Watch Window	136
Software Simulator Debugger Options	137
Debugger Options	137
<b>CHAPTER 6</b>	<b>138</b>
<b>mikroPascal PRO for dsPIC30/33 and PIC24 Specifics</b>	<b>138</b>
GOTO Table	139
Predefined Globals and Constants	140
Predefined project level defines	140
Accessing Individual Bits	141
sbit type	142
at keyword	143
bit type	143

Interrupts	144
Function Calls from Interrupt	144
Interrupt Handling	144
Interrupt Example	145
Linker Directives	146
Directive absolute	146
Directive org	146
Directive orgall	147
Built-in Routines	148
Lo	149
Hi	149
Higher	150
Highest	150
LoWord	151
HiWord	151
Inc	152
Dec	152
Chr	152
Ord	153
SetBit	153
ClearBit	153
TestBit	154
Delay_us	154
Delay_ms	154
Vdelay_ms	155
VDelay_advanced_ms	155
Delay_Cyc	156
Delay_Cyc_Long	156
Clock_kHz	156
Clock_MHz	157
Get_Fosc_kHz	157
Get_Fosc_Per_Cyc	157
Reset	158
ClrWdt	158
DisableContextSaving()	158
SetFuncCall	159
SetOrg	159
GetDateTime	160
DoGetVersion	160
Code Optimization	161
Constant folding	161
Constant propagation	161
Copy propagation	161
Value numbering	161
"Dead code" elimination	161
Stack allocation	161

Local vars optimization	161
Better code generation and local optimization	161
<b>Single Static Assignment Optimization</b>	<b>162</b>
Introduction	162
Proper Coding Recommendations	163
Asm code and SSA optimization	164
Debugging Notes	164
Warning Messages Enhancement	164
<b>Common Object File Format (COFF)</b>	<b>165</b>
COFF File Format	165
COFF File Generation	165
<b>CHAPTER 7</b>	<b>167</b>
<b>dsPIC30/33 and PIC24 Specifics</b>	<b>167</b>
Types Efficiency	168
Nested Calls Limitations	168
Limits of Indirect Approach Through PSV	168
Limits of Pointer to Function	168
Variable, constant and routine alignment	168
<b>dsPIC Memory Organization</b>	<b>169</b>
Program Memory (ROM)	169
Data Memory (RAM)	170
SFR Memory Space	170
X and Y Data RAM	170
DMA RAM	171
Unimplemented Memory Space	171
<b>Memory Type Specifiers</b>	<b>172</b>
code	172
data	172
rx	172
sfr	172
xdata	173
ydata	173
dma	173
<b>Memory Type Qualifiers</b>	<b>174</b>
Near Memory Qualifier	174
Far Memory Qualifier	174
<b>Read Modify Write Problem</b>	<b>175</b>
<b>CHAPTER 8</b>	<b>179</b>
<b>mikroPascal PRO for dsPIC30/33 and PIC24 Language Reference</b>	<b>179</b>
<b>Lexical Elements Overview</b>	<b>181</b>
<b>Whitespace</b>	<b>182</b>
Newline Character	182
Whitespace in Strings	182
<b>Comments</b>	<b>183</b>



Tokens	183
Token Extraction Example	184
Literals	184
Integer Literals	184
Floating Point Literals	185
Character Literals	185
String Literals	185
Keywords	187
Identifiers	190
Case Sensitivity	190
Uniqueness and Scope	190
Identifier Examples	190
Punctuators	190
Brackets	191
Parentheses	191
Comma	191
Semicolon	191
Colon	192
Dot	192
Program Organization	192
Organization of Main Module	192
Organization of Other Units	193
Scope and Visibility	194
Scope	194
Visibility	195
Name Spaces	195
Units	196
Uses Clause	196
Main Unit	196
Other Units	197
Variables	198
External Modifier	198
Variables and dsPIC30/33 and PIC24	199
Constants	200
Labels	200
Functions and Procedures	201
Functions	201
Procedures	202
Forward declaration	203
Functions reentrancy	204
Types	204
Type Categories	204
Simple Types	205
Derived Types	205

Arrays	205
Array Declaration	205
Constant Arrays	206
Multi-dimensional Arrays	206
Strings	207
String Concatenating	207
Pointers	208
Pointers and memory spaces	209
Function Pointers	209
@ Operator	210
Pointer Arithmetic	211
Assignment and Comparison	211
Pointer Addition	212
Pointer Subtraction	212
Records	213
Accessing Fields	214
Types Conversions	215
Implicit Conversion	215
Explicit Conversion	216
Conversions Examples	216
Typedef Specifier	217
Type Qualifiers	217
Qualifier const	217
Qualifier volatile	217
Operators	218
Operators Precedence and Associativity	218
Arithmetic Operators	218
Division by Zero	219
Unary Arithmetic Operators	219
Relational Operators	219
Relational Operators Overview	219
Relational Operators in Expressions	219
Bitwise Operators	220
Bitwise Operators Overview	220
Logical Operations on Bit Level	220
Unsigned and Conversions	221
Signed and Conversions	221
Bitwise Shift Operators	221
Boolean Operators	222
Unary Operators	222
Unary Arithmetic Operator	222
Unary Bitwise Operator	222
Address and Indirection Operator	223
Sizeof Operator	223

Sizeof Applied to Expression	223
Sizeof Applied to Type	223
Expressions	224
Expression Evaluation	224
Statements	225
Assignment Statements	226
Compound Statements (Blocks)	226
Conditional Statements	226
If Statement	227
Nested if statements	227
Case Statement	227
Nested Case Statements	228
Iteration Statements	229
For Statement	229
Endless Loop	229
While Statement	230
Repeat Statement	230
Jump Statements	231
Break and Continue Statements	231
Break Statement	231
Continue Statement	231
Exit Statement	232
Goto Statement	232
asm Statement	233
Accessing variables	233
Asm code and SSA optimization	234
With Statement	234
Directives	235
Compiler Directives	235
Directives #DEFINE and #UNDEFINE	235
Directives #IFDEF, #IFNDEF, #ELSE and #ENDIF	235
Include Directive \$I	236
Linker Directives	237
Directive absolute	237
Directive org	237
<b>CHAPTER 9</b>	<b>239</b>
<b>mikoPascal PRO for dsPIC30/33 and PIC24 Libraries</b>	<b>239</b>
Hardware Libraries	240
Digital Signal Processing Libraries	240
Miscellaneous Libraries	241
Hardware Libraries	242
ADC Library	242

Library Routines	243
ADCx_Init	243
ADCx_Init_Advanced	244
ADCx_Get_Sample	245
ADCx_Read	245
ADC_Set_Active	246
Library Example	246
HW Connection	247
<b>CAN Library</b>	<b>248</b>
Library Routines	248
CANxSetOperationMode	249
CANxGetOperationMode	249
CANxInitialize	250
CANxSetBaudRate	251
CANxSetMask	252
CANxSetFilter	253
CANxRead	254
CANxWrite	255
CAN Constants	256
CAN_OP_MODE Constants	256
CAN_CONFIG_FLAGS Constants	256
CAN_TX_MSG_FLAGS Constants	257
CAN_RX_MSG_FLAGS Constants	258
CAN_MASK Constants	258
CAN_FILTER Constants	259
Library Example	259
HW Connection	262
<b>CANSPI Library</b>	<b>263</b>
Library Dependency Tree	263
External dependencies of CANSPI Library	264
Library Routines	264
CANSPISetOperationMode	264
CANSPIGetOperationMode	265
CANSPIInit	265
CANSPISetBaudRate	267
CANSPISetMask	268
CANSPISetFilter	269
CANSPIRead	270
CANSPIWrite	271
CANSPI Constants	271
CANSPI_OP_MODE Constants	271
CANSPI_TX_MSG_FLAGS Constants	273
CANSPI_RX_MSG_FLAGS Constants	273
CANSPI_MASK Constants	274
CANSPI_FILTER Constants	274
Library Example	275
HW Connection	278

Compact Flash Library	279
Library Dependency Tree	279
External dependencies of Compact Flash Library	280
Library Routines	281
Cf_Init	282
Cf_Detect	283
Cf_Enable	283
Cf_Disable	283
Cf_Read_Init	284
Cf_Read_Byte	284
Cf_Write_Init	284
Cf_Write_Byte	285
Cf_Read_Sector	285
Cf_Write_Sector	285
Cf_Fat_Init	286
Cf_Fat_QuickFormat	286
Cf_Fat_Assign	287
Cf_Fat_Reset	288
Cf_Fat_Read	288
Cf_Fat_Rewrite	289
Cf_Fat_Append	289
Cf_Fat_Delete	289
Cf_Fat_Write	290
Cf_Fat_Set_File_Date	290
Cf_Fat_Get_File_Date	291
Cf_Fat_Get_File_Date_Modified	291
Cf_Fat_Get_File_Size	292
Cf_Fat_Get_Swap_File	292
Library Example	294
HW Connection	299
ECAN Library	300
Library Routines	300
ECANxDmaChannelInit	301
ECANxSetOperationMode	301
ECANxGetOperationMode	302
ECANxInitialize	303
ECANxSelectTxBuffers	304
ECANxFilterDisable	304
ECANxFilterEnable	305
ECANxSetBufferSize	305
ECANxSetBaudRate	306
ECANxSetMask	307
ECANxSetFilter	308
ECANxRead	309
ECANxWrite	310
ECAN Constants	311

ECAN_OP_MODE Constants	311
ECAN_CONFIG_FLAGS Constants	311
ECAN_TX_MSG_FLAGS Constants	312
ECAN_RX_MSG_FLAGS Constants	312
ECAN_MASK Constants	313
ECAN_FILTER Constants	313
ECAN_RX_BUFFER Constants	314
Library Example	315
HW Connection	319
<b>EEPROM Library</b>	<b>319</b>
Library Routines	319
EEPROM_Erase	320
EEPROM_Erase_Block	320
EEPROM_Read	320
EEPROM_Write	321
EEPROM_Write_Block	321
Library Example	321
<b>Epson S1D13700 Graphic Lcd Library</b>	<b>323</b>
External dependencies of the Epson S1D13700 Graphic Lcd Library	323
Library Routines	324
S1D13700_Init	325
S1D13700_Write_Command	326
S1D13700_Write_Parameter	327
S1D13700_Read_Parameter	327
S1D13700_Fill	327
S1D13700_GrFill	328
S1D13700_TxtFill	328
S1D13700_Display_GrLayer	328
S1D13700_Display_TxtLayer	329
S1D13700_Set_Cursor	329
S1D13700_Display_Cursor	330
S1D13700_Write_Char	330
S1D13700_Write_Text	331
S1D13700_Dot	331
S1D13700_Line	332
S1D13700_H_Line	332
S1D13700_V_Line	333
S1D13700_Rectangle	333
S1D13700_Box	334
S1D13700_Rectangle_Round_Edges	334
S1D13700_Rectangle_Round_Edges_Fill	335
S1D13700_Circle	335
S1D13700_Circle_Fill	336
S1D13700_Image	336
S1D13700_PartialImage	337
<b>Flash Memory Library</b>	<b>338</b>

dsPIC30:	338
PIC24 and dsPIC33:	338
24F04KA201 and 24F16KA102 Family Specifics:	339
Library Routines	339
dsPIC30 Functions	339
PIC24 and dsPIC33 Functions	339
dsPIC30 Functions	340
FLASH_Erase32	340
FLASH_Write_Block	340
FLASH_Write_Compact	341
FLASH_Write_Init	341
FLASH_Write_Loadlatch4	342
FLASH_Write_Loadlatch4_Compact	343
FLASH_Write_DoWrite	344
FLASH_Read4	344
FLASH_Read4_Compact	345
PIC24 and dsPIC33 Functions	345
FLASH_Erase	345
FLASH_Write	346
FLASH_Write_Compact	346
FLASH_Read	347
FLASH_Read_Compact	347
Library Example	347
Graphic Lcd Library	349
External dependencies of Graphic Lcd Library	349
External dependencies of Graphic Lcd Library	350
Library Routines	351
Glcd_Init	351
Glcd_Set_Side	353
Glcd_Set_X	353
Glcd_Set_Page	353
Glcd_Read_Data	354
Glcd_Write_Data	354
Glcd_Fill	355
Glcd_Dot	355
Glcd_Line	355
Glcd_V_Line	356
Glcd_H_Line	356
Glcd_Rectangle	357
Glcd_Rectangle_Round_Edges	357
Glcd_Rectangle_Round_Edges_Fill	358
Glcd_Box	358
Glcd_Circle	359
Glcd_Circle_Fill	359
Glcd_Set_Font	360
Glcd_Write_Char	361
Glcd_Write_Text	361

Glcd_Image	362
Glcd_PartialImage	362
Library Example	363
HW Connection	365
<b>I<sup>2</sup>C Library</b>	<b>366</b>
Library Routines	366
I2Cx_Init	366
I2Cx_Start	367
I2Cx_Restart	367
I2Cx_Is_Idle	368
I2Cx_Read	368
I2Cx_Write	369
I2Cx_Stop	369
Library Example	370
HW Connection	370
<b>Keypad Library</b>	<b>371</b>
External dependencies of Keypad Library	371
Library Routines	371
Keypad_Init	371
Keypad_Key_Press	372
Keypad_Key_Click	372
Library Example	373
HW Connection	374
<b>Lcd Library</b>	<b>375</b>
Library Dependency Tree	375
External dependencies of Lcd Library	375
Library Routines	375
Lcd_Init	376
Lcd_Out	377
Lcd_Out_Cp	377
Lcd_Chr	377
Lcd_Chr_Cp	378
Lcd_Cmd	378
Available Lcd Commands	378
Library Example	379
<b>Manchester Code Library</b>	<b>381</b>
External dependencies of Manchester Code Library	381
Library Routines	382
Man_Receive_Init	382
Man_Receive	383
Man_Send_Init	383
Man_Send	384
Man_Synchro	384
Man_Break	385
Library Example	386
Connection Example	388



Multi Media Card Library	389
Secure Digital Card	389
Secure Digital High Capacity Card	389
Library Dependency Tree	390
External dependencies of MMC Library	390
Library Routines	390
Mmc_Init	391
Mmc_Read_Sector	392
Mmc_Write_Sector	392
Mmc_Read_Cid	393
Mmc_Read_Csd	393
Mmc_Fat_Init	394
Mmc_Fat_QuickFormat	395
Mmc_Fat_Assign	396
Mmc_Fat_Reset	397
Mmc_Fat_Read	397
Mmc_Fat_Rewrite	398
Mmc_Fat_Append	398
Mmc_Fat_Delete	398
Mmc_Fat_Write	399
Mmc_Fat_Set_File_Date	399
Mmc_Fat_Get_File_Date	400
Mmc_Fat_Get_File_Date_Modified	401
Mmc_Fat_Get_File_Size	401
Mmc_Fat_Get_Swap_File	402
Library Example	403
HW Connection	408
OneWire Library	409
Library Routines	409
Ow_Reset	409
Ow_Read	410
Ow_Write	410
Library Example	411
HW Connection	413
Peripheral Pin Select Library	414
Library Routines	414
Unlock_IOLOCK	414
Lock_IOLOCK	414
PPS_Mapping	415
Direction Parameters	415
Input Functions	415
Output Functions	416
Port Expander Library	418
Library Dependency Tree	418
External dependencies of Port Expander Library	418
Library Routines	418

Expander_Init	419
Expander_Init_Advanced	420
Expander_Read_Byte	420
Expander_Write_Byte	421
Expander_Read_PortA	421
Expander_Read_PortB	422
Expander_Read_PortAB	422
Expander_Write_PortA	423
Expander_Write_PortB	423
Expander_Write_PortAB	424
Expander_Set_DirectionPortA	424
Expander_Set_DirectionPortB	425
Expander_Set_DirectionPortAB	425
Expander_Set_PullUpsPortA	425
Expander_Set_PullUpsPortB	426
Expander_Set_PullUpsPortAB	426
HW Connection	428
<b>PS/2 Library</b>	<b>429</b>
External dependencies of PS/2 Library	429
Library Routines	429
Ps2_Config	430
Ps2_Key_Read	430
Special Function Keys	431
Library Example	432
HW Connection	433
<b>PWM Library</b>	<b>433</b>
Library Routines	433
PWM_Init	434
PWM_Set_Duty	434
PWM_Start	435
PWM_Stop	435
Library Example	435
HW Connection	437
<b>PWM Motor Control Library</b>	<b>437</b>
Library Routines	437
PWMx_Mc_Init	438
PWMx_Mc_Set_Duty	439
PWMx_Mc_Start	439
PWMx_Mc_Stop	440
HW Connection	441
<b>RS-485 Library</b>	<b>441</b>
Library Dependency Tree	442
External dependencies of RS-485 Library	442
Library Routines	442
RS485Master_Init	442
RS485Master_Receive	443

RS485Master_Send	443
RS485Slave_Init	444
RS485Slave_Receive	445
RS485Slave_Send	445
Library Example	446
HW Connection	449
Message format and CRC calculations	450
<b>Software I<sup>2</sup>C Library</b>	<b>451</b>
External dependencies of Software I <sup>2</sup> C Library	451
Library Routines	451
Soft_I2C_Init	452
Soft_I2C_Start	452
Soft_I2C_Read	453
Soft_I2C_Write	453
Soft_I2C_Stop	453
Soft_I2C_Break	454
Library Example	455
<b>Software SPI Library</b>	<b>457</b>
External dependencies of Software SPI Library	457
Library Routines	457
Soft_SPI_Init	458
Soft_SPI_Read	458
Soft_SPI_Write	459
Library Example	459
<b>Software UART Library</b>	<b>461</b>
Library Routines	461
Soft_UART_Init	461
Soft_UART_Read	462
Soft_UART_Write	462
Soft_UART_Break	463
Library Example	464
<b>Sound Library</b>	<b>465</b>
Library Routines	465
Sound_Init	465
Sound_Play	465
Library Example	466
HW Connection	468
<b>SPI Library</b>	<b>469</b>
Library Routines	469
SPIx_Init	470
SPIx_Init_Advanced	471
SPIx_Read	473
SPIx_Write	473
SPI_Set_Active	474
Library Example	474
HW Connection	475

SPI Ethernet Library	476
Library Dependency Tree	476
External dependencies of SPI Ethernet Library	477
Library Routines	477
SPI_Ethernet_Init	478
SPI_Ethernet_Enable	480
SPI_Ethernet_Disable	481
SPI_Ethernet_doPacket	482
SPI_Ethernet_putByte	482
SPI_Ethernet_putBytes	483
SPI_Ethernet_putConstBytes	483
SPI_Ethernet_putString	484
SPI_Ethernet_putConstString	484
SPI_Ethernet_getByte	484
SPI_Ethernet_getBytes	485
SPI_Ethernet_UserTCP	485
SPI_Ethernet_UserUDP	486
SPI_Ethernet_setUserHandlers	486
SPI_Ethernet_getIpAddress	487
SPI_Ethernet_getGwIpAddress	487
SPI_Ethernet_getDnsIpAddress	488
SPI_Ethernet_getIpMask	488
SPI_Ethernet_confNetwork	489
SPI_Ethernet_arpResolve	490
SPI_Ethernet_sendUDP	490
SPI_Ethernet_dnsResolve	491
SPI_Ethernet_initDHCP	492
SPI_Ethernet_doDHCPLeaseTime	492
SPI_Ethernet_renewDHCP	493
Library Example	493
HW Connection	500
SPI Ethernet ENC24J600 Library	501
Library Dependency Tree	501
External dependencies of SPI Ethernet ENC24J600 Library	502
Library Routines	503
SPI_Ethernet_24j600_Init	504
SPI_Ethernet_24j600_Enable	506
SPI_Ethernet_24j600_Disable	507
SPI_Ethernet_24j600_doPacket	508
SPI_Ethernet_24j600_putByte	508
SPI_Ethernet_24j600_putBytes	509
SPI_Ethernet_24j600_putConstBytes	509
SPI_Ethernet_24j600_putString	510
SPI_Ethernet_24j600_putConstString	510
SPI_Ethernet_24j600_getByte	510
SPI_Ethernet_24j600_getBytes	511

SPI_Ethernet_24j600_UserTCP	511
SPI_Ethernet_24j600_UserUDP	512
SPI_Ethernet_24j600_setUserHandlers	512
SPI_Ethernet_24j600_getIpAddress	513
SPI_Ethernet_24j600_getGwIpAddress	513
SPI_Ethernet_24j600_getDnsIpAddress	513
SPI_Ethernet_24j600_getIpMask	514
SPI_Ethernet_24j600_confNetwork	514
SPI_Ethernet_24j600_arpResolve	515
SPI_Ethernet_24j600_sendUDP	515
SPI_Ethernet_24j600_dnsResolve	516
SPI_Ethernet_24j600_initDHCP	517
SPI_Ethernet_24j600_doDHCPLeaseTime	517
SPI_Ethernet_24j600_renewDHCP	518
Library Example	519
<b>SPI Graphic Lcd Library</b>	<b>520</b>
Library Dependency Tree	520
External dependencies of SPI Lcd Library	520
Library Routines	520
SPI_Glcd_Init	521
SPI_Glcd_Set_Side	522
SPI_Glcd_Set_Page	522
SPI_Glcd_Set_X	522
SPI_Glcd_Read_Data	523
SPI_Glcd_Write_Data	523
SPI_Glcd_Fill	523
SPI_Glcd_Dot	524
SPI_Glcd_Line	524
SPI_Glcd_V_Line	525
SPI_Glcd_H_Line	525
SPI_Glcd_Rectangle	526
SPI_Glcd_Rectangle_Round_Edges	526
SPI_Glcd_Rectangle_Round_Edges_Fill	527
SPI_Glcd_Box	527
SPI_Glcd_Circle	528
SPI_Glcd_Circle_Fill	528
SPI_Glcd_Set_Font	529
SPI_Glcd_Write_Char	530
SPI_Glcd_Write_Text	530
SPI_Glcd_Image	531
SPI_Glcd_PartialImage	531
Library Example	532
HW Connection	534
<b>SPI Lcd Library</b>	<b>535</b>
Library Dependency Tree	535
External dependencies of SPI Lcd Library	535

Library Routines	535
SPI_Lcd_Config	536
SPI_Lcd_Out	536
SPI_Lcd_Out_Cp	537
SPI_Lcd_Chr	537
SPI_Lcd_Chr_Cp	537
SPI_Lcd_Cmd	538
Available SPI Lcd Commands	538
Library Example	539
Default Pin Configuration	539
<b>SPI Lcd8 (8-bit interface) Library</b>	<b>541</b>
Library Dependency Tree	541
External dependencies of SPI Lcd Library	541
Library Routines	541
SPI_Lcd8_Config	542
SPI_Lcd8_Out	542
SPI_Lcd8_Out_Cp	543
SPI_Lcd8_Chr	543
SPI_Lcd8_Chr_Cp	543
SPI_Lcd8_Cmd	544
Available SPI Lcd8 Commands	544
Library Example	545
<b>SPI T6963C Graphic Lcd Library</b>	<b>547</b>
Library Dependency Tree	547
External dependencies of SPI T6963C Graphic Lcd Library	547
Library Routines	548
SPI_T6963C_config	549
SPI_T6963C_writeData	550
SPI_T6963C_writeCommand	550
SPI_T6963C_setPtr	551
SPI_T6963C_waitReady	551
SPI_T6963C_fill	551
SPI_T6963C_dot	552
SPI_T6963C_write_char	552
SPI_T6963C_write_text	553
SPI_T6963C_line	553
SPI_T6963C_rectangle	554
SPI_T6963C_rectangle_round_edges	554
SPI_T6963C_rectangle_round_edges_fill	555
SPI_T6963C_box	555
SPI_T6963C_circle	556
SPI_T6963C_circle_fill	556
SPI_T6963C_image	556
SPI_T6963C_PartialImage	557
SPI_T6963C_sprite	557
SPI_T6963C_set_cursor	558

SPI_T6963C_clearBit	558
SPI_T6963C_setBit	558
SPI_T6963C_negBit	559
SPI_T6963C_displayGrPanel	559
SPI_T6963C_displayTxtPanel	559
SPI_T6963C_setGrPanel	560
SPI_T6963C_setTxtPanel	560
SPI_T6963C_panelFill	560
SPI_T6963C_grFill	561
SPI_T6963C_txtFill	561
SPI_T6963C_cursor_height	561
SPI_T6963C_graphics	562
SPI_T6963C_text	562
SPI_T6963C_cursor	562
SPI_T6963C_cursor_blink	563
Library Example	563
HW Connection	567
<b>T6963C Graphic Lcd Library</b>	<b>568</b>
Library Dependency Tree	568
External dependencies of T6963C Graphic Lcd Library	569
Library Routines	570
T6963C_init	571
T6963C_writeData	572
T6963C_writeCommand	573
T6963C_setPtr	573
T6963C_waitReady	573
T6963C_fill	574
T6963C_dot	574
T6963C_write_char	575
T6963C_write_text	576
T6963C_line	576
T6963C_rectangle	577
T6963C_rectangle_round_edges	577
T6963C_rectangle_round_edges_fill	578
T6963C_box	578
T6963C_circle	578
T6963C_circle_fill	579
T6963C_image	579
T6963C_PartialImage	580
T6963C_sprite	580
T6963C_set_cursor	581
T6963C_displayGrPanel	581
T6963C_displayTxtPanel	581
T6963C_setGrPanel	582
T6963C_setTxtPanel	582
T6963C_panelFill	582
T6963C_grFill	583

T6963C_txtFill	583
T6963C_cursor_height	583
T6963C_graphics	584
T6963C_text	584
T6963C_cursor	584
T6963C_cursor_blink	585
Library Example	585
HW Connection	589
<b>TFT Library</b>	<b>590</b>
External dependencies of TFT Library	590
Library Routines	591
TFT_Init	592
TFT_Set_Index	593
TFT_Write_Command	593
TFT_Write_Data	593
TFT_Set_Active	594
TFT_Set_Font	595
TFT_Write_Char	596
TFT_Write_Text	596
TFT_Fill_Screen	597
TFT_Dot	598
TFT_Set_Pen	599
TFT_Set_Brush	600
TFT_Line	602
TFT_H_Line	603
TFT_V_Line	603
TFT_Rectangle	603
TFT_Rectangle_Round_Edges	604
TFT_Circle	604
TFT_Image	604
TFT_Partial_Image	605
TFT_Image_Jpeg	605
TFT_RGBToColor16bit	606
TFT_Color16bitToRGB	606
HW Connection	607
<b>Touch Panel Library</b>	<b>608</b>
Library Dependency Tree	608
External dependencies of Touch Panel Library	608
Library Routines	608
TP_Init	609
TP_Set_ADC_Threshold	609
TP_Press_Detect	610
TP_Get_Coordinates	610
TP_Calibrate_Bottom_Left	611
TP_Calibrate_Upper_Right	611
TP_Get_Calibration_Consts	611



TP_Set_Calibration_Consts	612
Library Example	612
<b>Touch Panel TFT Library</b>	<b>616</b>
Library Dependency Tree	616
External dependencies of Touch Panel TFT Library	616
Library Routines	616
TP_TFT_Init	617
TP_TFT_Set_ADC_Threshold	617
TP_TFT_Press_Detect	618
TP_TFT_Get_Coordinates	619
TP_TFT_Calibrate_Min	619
TP_TFT_Calibrate_Max	619
TP_TFT_Get_Calibration_Consts	620
TP_TFT_Set_Calibration_Consts	620
HW Connection	621
<b>UART Library</b>	<b>622</b>
Library Routines	622
UARTx_Init	623
UARTx_Init_Advanced	624
UARTx_Data_Ready	625
UARTx_Tx_Idle	626
UARTx_Read	626
UARTx_Read_Text	627
UARTx_Write	628
UARTx_Write_Text	628
UART_Set_Active	629
Library Example	630
HW Connection	631
<b>USB Library</b>	<b>632</b>
USB HID Class	632
Library Routines	632
HID_Enable	633
HID_Read	633
HID_Write	633
HID_Disable	634
USB_Interrupt_Proc	634
USB_Polling_Proc	634
Gen_Enable	635
Gen_Read	635
Gen_Write	635
Library Example	636
HW Connection	636
<b>Digital Signal Processing Libraries</b>	<b>637</b>
Digital Signal Processing Libraries	637
<b>FIR Filter Library</b>	<b>638</b>
Library Routines	638

FIR_Radix	638
IIR Filter Library	639
Library Routines	639
IIR_Radix	639
FFT Library	640
Library Dependency Tree	640
FFT	640
Twiddle Factors:	641
TwiddleCoeff_64	641
TwiddleCoeff_128	641
TwiddleCoeff_256	641
TwiddleCoeff_512	642
Bit Reverse Complex Library	644
Library Routines	644
BitReverseComplex	644
Vectors Library	645
Library Routines	645
Vector_Set	645
Vector_Power	646
Vector_Subtract	646
Vector_Scale	647
Vector_Negate	647
Vector_Multiply	648
Vector_Min	648
Vector_Max	649
Vector_Dot	649
Vector_Correlate	650
Vector_Convolve	651
Vector_Add	651
Matrix Library	652
Matrices Library	652
Library Routines	652
Matrix_Transpose	652
Matrix_Subtract	653
Matrix_Scale	653
Matrix_Multiply	654
Matrix_Add	655
Miscellaneous Libraries	656
Button Library	656
Library Routines	656
Button	657
C Type Library	658
Library Functions	658
isalnum	658
isalpha	658