

Futaba[®]

Futaba Corporation of America Schaumburg, IL

DRAWING TITLE:

PRODUCT SPECIFICATION

PART NUMBER:

NAELW2106AA & NAELW2106BA

CUSTOMER NAME / PART NUMBER:

STANDARD PRODUCT

FILE NAME:

NAELW2106AA_BA_revA_02Apr2020.docx

CUSTOMER APPROVAL:

N/A

DATE PRINTED:

02Apr20

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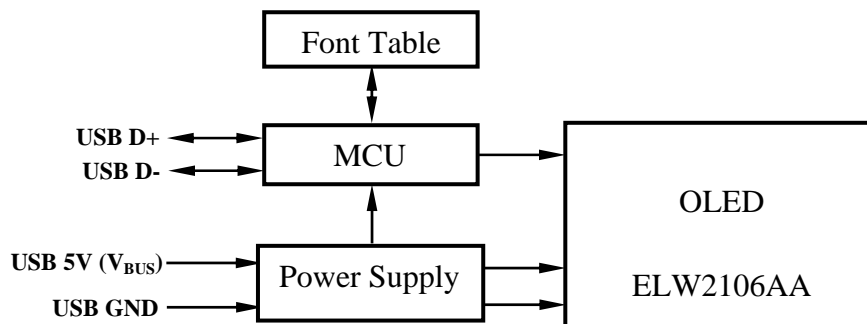
1.0 GENERAL DESCRIPTION

This graphical 256 x 64 dot matrix organic light emitting diode (OLED) module is capable of displaying both graphics and text using built-in font tables. The module contains the OLED, driver circuitry, microcontroller, DC-DC converter and a USB 2.0 interface. The connector provides USB communication and power connections.

2.0 APPLICABLE DOCUMENTS

- Futaba OLED Specification ELW2106AA
- Futaba America Engineering Standard FAES 801, Printed Circuit Board Markings
- Hirose connector drawing ZX62-B-5PA(33)
- FCI connector drawing 10114830-11105LF
- Kinetis Flash Tool User's Guide, NXP document number KFLASHTOOLUG

3.0 SYSTEM BLOCK DIAGRAM



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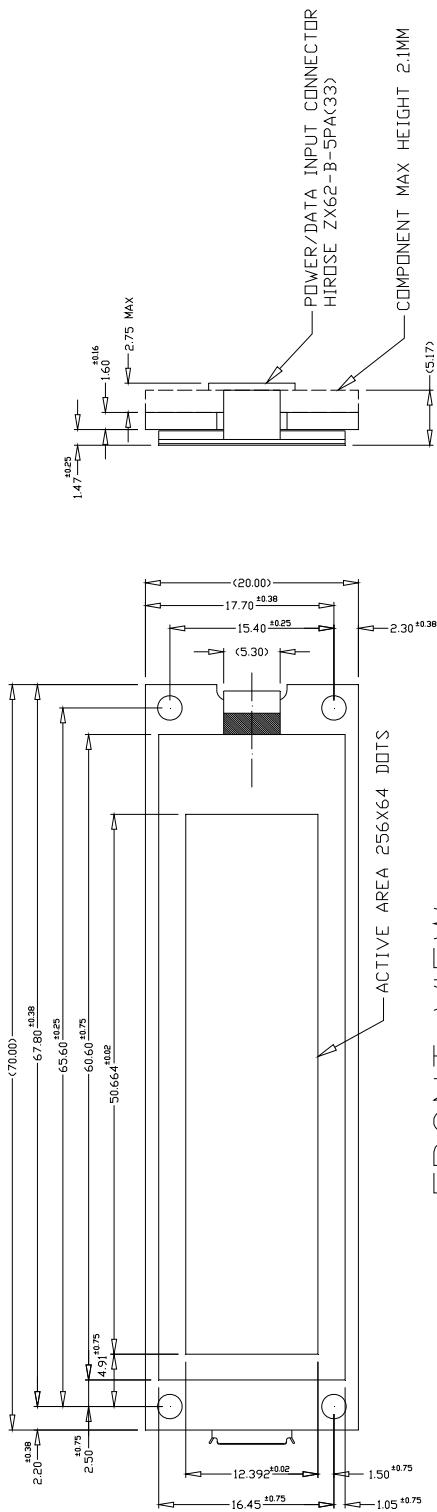
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4.0 MECHANICAL DRAWING

4.1 NAELW2106AA (HIROSE CONNECTOR)



NOTE:
ALL DIMENSIONS IN () FOR REFERENCE ONLY

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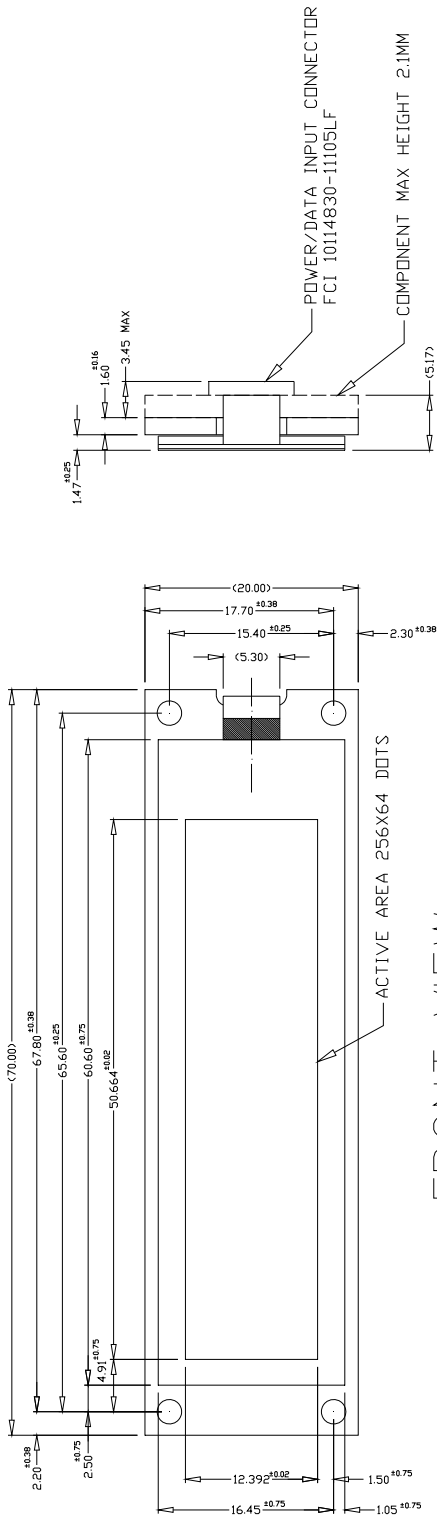
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4.2 NAELW2106BA (FCI CONNECTOR)



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5.0 SPECIFICATIONS

5.1 ENVIRONMENTAL SPECIFICATIONS

Item	Symbol	Min.	Max.	Unit	Comment
Operating Temperature	Topr	-20	+75	°C	
Storage Temperature	Tstg	-40	+85	°C	
Operating Humidity	Hopr	–	60	%RH	without condensation
Storage Humidity	Hstg	–	60	%RH	without condensation
Vibration (non-operating)	–	–	4	G	total amplitude: 1.5mm freq: 10 ~ 55 Hz sine wave sweep time: 1 min / cycle duration: 2 hrs / axis (X, Y, Z)
Shock (non-operating)	–	–	40	G	duration: 11ms waveform: half sine wave 3 times / axis (X, Y, Z, -X, -Y, -Z)

5.2 ABSOLUTE MAXIMUM ELECTRICAL SPECIFICATIONS

Item	Symbol	Min.	Max.	Unit
Supply Voltage	V _{BUS}	-0.3	6.0	V
Input Signal Voltage	V _{IS}	-0.3	6.0	V

5.3 NORMAL ELECTRICAL SPECIFICATIONS

V_{BUS} = 5.0V, -20 to +75C

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V _{BUS}	4.75	5.0	5.25	V
Supply Current	I _{BUS}	-	120	210	mA
Supply Current (Power Saver Mode)	I _{BUS}	-	8	-	mA
Supply Current (USB Suspend State)	I _{BUS}	-	600	-	uA
High Level Input (USB)	V _{IH}	2.0	-	3.6	V
Low Level Input (USB)	V _{IL}	-0.3	-	0.8	V
Differential Input Sensitivity (D+)-(D-)	V _{DI}	0.2	-	-	V

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5.4 GENERAL OLED DISPLAY SPECIFICATIONS

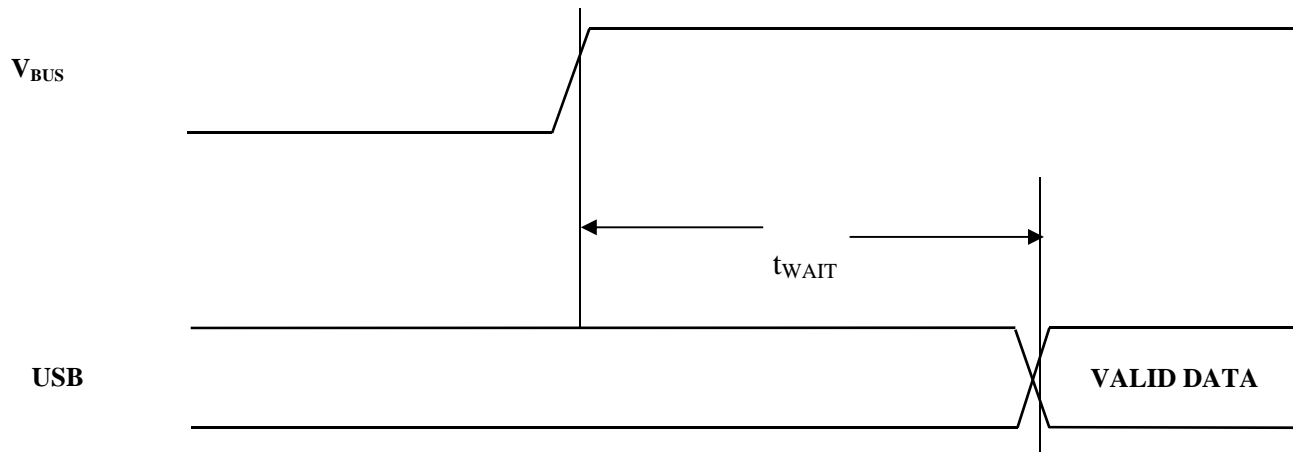
Item	Value	Unit
Number of pixels	256 columns x 64 rows	-
Active Area	50.664 x 12.392	mm
Pixel Size	0.174 x 0.170	mm
Pixel Pitch	0.198 x 0.194	mm
Chromaticity x	x = 0.26 – 0.34	-
Chromaticity y	y = 0.29 – 0.37	-
Contrast Ratio	10,000 : 1	-
Luminance (all pixels on)	200 (min.), 250 (typ.), --- (max.)	Cd/m ²

5.5 RESET TIMING SPECIFICATIONS

Item	Symbol	Min.	Max.	Unit
Delay time after power-up reset	t _{WAIT}	-	10	ms

Notes:

1) All timing is specified using 20% and 80% of V_{CC} as the reference points.



The module resets automatically at power-up and initializes to the same conditions as after the Reset Command.

5.6 NON-VOLATILE FLASH ENDURANCE

The non-volatile Flash is capable of 100,000 erase-write cycles with 20 year retention.

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6.0 FUNCTIONAL DESCRIPTION

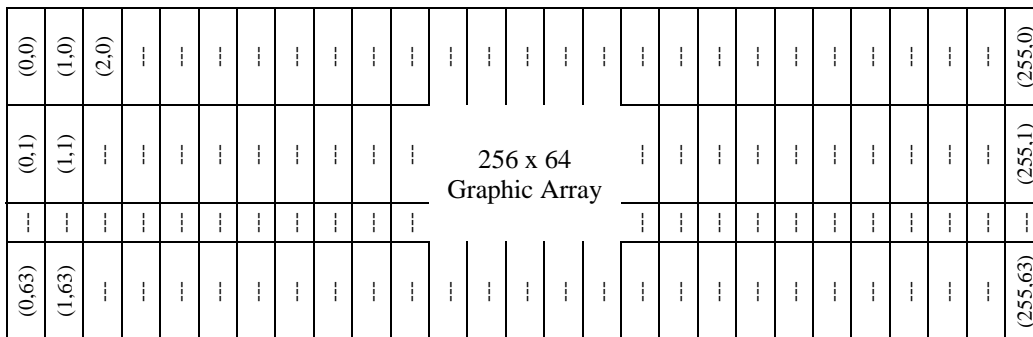
The module's OLED contains an array of 256 x 64 pixels that displays graphics and/or multiple lines of internal font table characters. The number of character lines and number of characters per line depends on the font size selected. Additionally, memory is provided for the user to create 16 user-defined characters that are stored in volatile RAM and an entire 224 character font table for each character size in non-volatile Flash.

The user sends character and graphical data to the module via its USB interface using simple command and data instructions. The display supports sixteen greyscale levels.

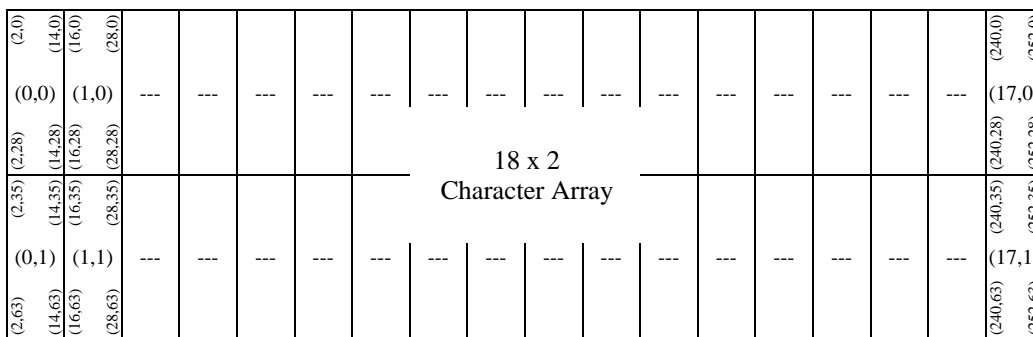
6.1 IMAGE MEMORY VS. OLED MEMORY

Image Memory consists of 256 x 32 (8192) bytes of RAM stored in the module's microcontroller which mirrors 8192 bytes of OLED Memory stored in the OLED driver IC. Data written to Image Memory transfers to OLED Memory using the Update OLED command. Each OLED display pixel requires 4-bits of data to set it to 1 of 16 greyscale levels (0 thru 15). Image Memory is addressed using either the Graphical Cursor or the Character Cursor.

The Graphical Cursor addresses each greyscale nibble using a (column, row) scheme starting from the upper leftmost pixel of the 256 x 64 array.



Likewise, the 13 x 29 Character Cursor addresses for each of the 18 x 2 characters use a (column, row) scheme starting from the upper leftmost character. The addresses vary depending on font size selected.



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The number of characters in the character array differs depending on Font Size as follows:

Font Size	Character Array	Columns Between Characters	Starting Column
5 x 8	42 x 8	1	2
10 x 16	23 x 4	1	2
13 x 29	18 x 2	1	2
16 x 16	16 x 4	0	0
32 x 32	8 x 2	0	0

6.2 COMMANDS AND CHARACTERS

The user sends commands to the module as single-byte or multi-byte commands and characters are sent to the module as single or double bytes. All data is sent to the display via USB. Command codes range from 00h to 0Fh, UDF character codes from 10h to 1Fh and character codes from 20h to FFh. An ‘x’ indicates a “don’t care” bit in all commands.

Command Byte 1								Command Byte 2								---								Command Byte N							
8-bit Command								8-bit Command Data								8-bit Command Data								8-bit Command Data							
C7	C6	C5	C4	C3	C2	C1	C0	D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0

CMD Code	Description
00h	Reset / Initialize
01h	Clear Image Memory and/or Update OLED Memory
02h	Set Cursor Position
03h	Select Font
04h	Define UDF Character
05h	Graphical Image Memory Write – Greyscale
06h	Graphical Image Memory Write – Monochrome
07h	Select Greyscale Level
08h	Select Power Saver Mode
09h	Image Memory Storage
0Ah	Select Fade Mode
0Bh	
0Ch	
0Dh	
0Eh	
0Fh	Reserved for factory use
10h~1Fh	Write UDF Character to Image Memory
20h~FFh	Write Font Table Character to Image Memory

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6.2.1 RESET / INITIALIZE

This three-byte command resets the module to the conditions listed below which are the same as at power-up. This command is also used to erase non-volatile Flash memory and select display orientation.

Command Byte 1	Command Byte 2	Command Byte 3
8-bit Command 00h	8-bit Command Validation Byte	8-bit Command Validation Byte
0 | 0 | 0 | 0 | 0 | 0 | 0 | 0	V15|V14|V13|V12|V11|V10|V9|V8	V7|V6|V5|V4|V3|V2|V1|V0

Reset / Initialize (V15:V8) = A5h, (V7:V0) = 5Ah:

- Image Memory and OLED Memory cleared
- Graphical Cursor Position and Character Cursor Position set to location 0,0
- Font set to CP437 / 13 x 29 font size
- User Defined Font characters stored in volatile RAM cleared
- Sets Character Grayscale Level to 100%
- OLED driver set to Normal Display Mode
- Power Saver Mode set to “on” (module’s switching power supply is on)
- Display Orientation set to Normal
- Disable Fade Mode

Erase Non-Volatile Flash Memory (V15:V8) = EEh:

- Erase Font Table from non-volatile Flash.
- Valid (V7:V4) Font Size, (V3:V0) Font Table values are: (0,0), (1,0), (2,0), (3,0), (4,0)

Display Orientation Normal (V15:V8) = D0h, (V7:V0) = 2Fh:

- Display Orientation set so that USB connector is at left end of module when image right-side up.

Display Orientation Upside Down (V15:V8) = D1h, (V7:V0) = 2Eh:

- Display Orientation set so that USB connector is at right end of module when image is right-side up.

Note: If Command Byte 2 is invalid the command is terminated, if Command Byte 3 is invalid the command is ignored.

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6.2.2 CLEAR IMAGE MEMORY AND/OR UPDATE OLED MEMORY

This two-byte command clears the Image Memory (stored in the microcontroller’s RAM) and/or copies it to the OLED Memory (stored in the OLED’s driver). This command is also used to access a few internal OLED driver functions. A typical sequence would be to clear Image Memory, send character and/or graphical data to Image Memory, then update OLED Memory with the Image Memory data.

Command Byte 1	Command Byte 2
8-bit Command 01h	8-bit Command Data
0 | 0 | 0 | 0 | 0 | 0 | 0 | 1	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0

8-bit Command Data (D7:D0):

- 0: Clear Image Memory without updating OLED Memory and set both cursors to 0,0
- 1: Clear OLED Memory without affecting Image Memory
- 2: Copy Image Memory to OLED Memory without affecting Image Memory
- 3: Clear both Image Memory and OLED Memory and set both cursors to 0,0
- 4: Set OLED driver to Normal Display Mode (does not affect Image or OLED Memory)
- 5: Set OLED driver to All On Display Mode (does not affect Image or OLED Memory)
- 6: Set OLED driver to All Off Display Mode (does not affect Image or OLED Memory)
- 7: Set OLED driver to Inverse Mode (does not affect Image or OLED Memory)

Note: If Command Byte 2 is invalid the command is ignored.

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6.2.3 SET CURSOR POSITION

This three-byte command sets either the Graphical Cursor Position or the Character Cursor Position depending on the GC bit. Graphical Cursor Position 0,0 is the upper left corner of the 256 x 64 display and Character Cursor Position 0,0 is in the upper left character of the display.

Command Byte 1								Command Byte 2								Command Byte 3								
8-bit Command 02h								8-bit Cursor Column								1-bit GC		6-bit Cursor Row						
0	0	0	0	0	0	0	1	0	C7	C6	C5	C4	C3	C2	C1	C0	GC	x	R5	R4	R3	R2	R1	R0

8-bit Cursor Column (C7:C0):

Valid Graphical Cursor Position columns are: $0 \leq (C7:C0) \text{ value} \leq 255$

Valid Character Cursor Position columns depend on current Font Size setting:

- Font Size 5 x 8: $0 \leq (C7:C0) \text{ value} \leq 41$
- Font Size 10 x 16: $0 \leq (C7:C0) \text{ value} \leq 22$
- Font Size 13 x 29: $0 \leq (C7:C0) \text{ value} \leq 17$
- Font Size 16 x 16: $0 \leq (C7:C0) \text{ value} \leq 15$
- Font Size 32 x 32: $0 \leq (C7:C0) \text{ value} \leq 7$

6-bit Cursor Row (R5:R0):

Valid Graphical Cursor Position rows are: $0 \leq (R5:R0) \text{ value} \leq 63$

Valid Character Cursor Position columns depend on current Font Size setting:

- Font Size 5 x 8: $0 \leq (R5:R0) \text{ value} \leq 7$
- Font Size 10 x 16: $0 \leq (R5:R0) \text{ value} \leq 3$
- Font Size 13 x 29: $0 \leq (R5:R0) \text{ value} \leq 1$
- Font Size 16 x 16: $0 \leq (R5:R0) \text{ value} \leq 3$
- Font Size 32 x 32: $0 \leq (R5:R0) \text{ value} \leq 1$

1-bit Graphical / Character Select (GC) :

GC = 0: Character Cursor Position is selected

GC = 1: Graphical Cursor Position is selected

Note: After Command Bytes 2 and 3 are both received, invalid values cause the command to be ignored.

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6.2.4 SELECT FONT

This two-byte command selects the Font Size and Font Table. The Character Cursor Position is set to 0,0 when the Font Size is changed.

Command Byte 1								Command Byte 2							
8-bit Command 03h								4-bit Font Size				4-bit Font Table			
0	0	0	0	0	0	1	1	S3	S2	S1	S0	T3	T2	T1	T0

4-bit Font Size (S3:S0), 4-bit Font Table (T3:T0):

0,0: 5 x 8 UDF 1,0: 10 x 16 UDF 2,0: 13 x 29 UDF 3,0: 16 x 16 UDF 4,0: 32 x 32 UDF
 0,1: 5 x 8 CP437 1,1: 10 x 16 CP437 2,1: 13 x 29 CP437 3,1: 16 x 16 Kanji 4,1: 32 x 32 Kanji
 0,2: 5 x 8 CP852 1,2: 10 x 16 CP852 2,2: 13 x 29 CP852
 0,3: 5 x 8 CP858 1,3: 10 x 16 CP858 2,3: 13 x 29 CP858
 0,4: 5 x 8 CP866 1,4: 10 x 16 CP866 2,4: 13 x 29 CP866
 0,5: 5 x 8 CP932 1,5: 10 x 16 CP932 2,5: 13 x 29 Katakana

Note: If Command Byte 2 is invalid the command is ignored.

6.2.5 DEFINE UDF CHARACTER

This multi-byte command defines a User Defined Font (UDF) character. Up to 16 UDF characters, of various Font Sizes, can be stored in volatile RAM and up to 224 UDF characters of each Font Size can be stored in non-volatile Flash. After erasing an entire UDF Table from Flash, up to 224 UDF characters can be defined, re-defining any one UDF within a table requires first erasing the entire UDF Table.

Command Byte 1								Command Byte 2								Command Byte 3				Command Byte 4											
8-bit Command 04h								8-bit UDF Number								4-bit Font Size				4-bit Font Table				8-bit UDF Pixel Data Byte 1							
0	0	0	0	0	0	1	0	U7	U6	U5	U4	U3	U2	U1	U0	S3	S2	S1	S0	T3	T2	T1	T0	P7	P6	P5	P4	P3	P2	P1	P0

---								Command Byte N+3							
8-bit UDF Pixel Data Byte								8-bit UDF Pixel Data Byte N							
P7	P6	P5	P4	P3	P2	P1	P0	P7	P6	P5	P4	P3	P2	P1	P0

8-bit UDF Number (U7:U0):

10h <= (U7:U0) value <= 1Fh: UDF Character stored in volatile RAM ((T3:T0) = don't care)
 20h <= (U7:U0) value <= FFh: UDF Character stored in non-volatile Flash

4-bit Font Size (S3:S0):

0 <= (S3:S0) value <= 4: Same Font Sizes as defined in Select Font command

4-bit Font Table (T3:T0):

(T3:T0) value = 0: Select UDF Table in non-volatile Flash

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8-bit UDF Pixel Data Bytes (P7:P0):

The LSB of each pixel byte represents the upper pixel. The first byte sent represents the upper left most character pixels followed by the pixel bytes for the remainder of the column (unless 5 x 8) and then byte(s) for each additional column.

The number of bytes required depends on Font Size (S3:S0) value:

- Font Size 5 x 8: 5 bytes required per UDF character
- Font Size 10 x 16: 20 bytes
- Font Size 13 x 29: 52 bytes (The MSBs of Pixel Bytes 4, 8, 12,... and 52 are don't care)
- Font Size 16 x 16: 32 bytes
- Font Size 32 x 32: 128 bytes

Example for 13 x 29 UDF Character:

Pixel Byte 1	Pixel Byte 2	Pixel Byte 3	Pixel Byte 4
Pixel Byte 5	Pixel Byte 6	Pixel Byte 7	Pixel Byte 8
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
---	---	---	---
Pixel Byte 49	Pixel Byte 50	Pixel Byte 51	Pixel Byte 52

To define all 224 UDF characters of the 13 x 29 UDF Font Table in non-volatile Flash, send the following 12,323 bytes to erase then re-program:

00h, EEh, 2Fh,
 04h, 20h, 2Fh, Pixel Byte 1, Pixel Byte 2,... Pixel byte 52,
 04h, 21h, 2Fh, Pixel Byte 1, Pixel Byte 2,... Pixel byte 52,

 04h, FFh, 2Fh, Pixel Byte 1, Pixel Byte 2,... Pixel byte 52

Note: If Command Byte 2 is invalid the command is terminated, if Command Byte 3 is invalid the command is ignored.

6.2.6 GRAPHICAL IMAGE MEMORY WRITE - GREYSCALE

This multi-byte command writes graphical data to Image Memory. Each pixel is represented by a nibble that determines its greyscale level from 0h to Fh. Since one nibble represents one pixel, each byte sent to the display represents two pixels (last byte may only contain a meaningful lower nibble).

Command Byte 1	Command Byte 2	---	Command Byte N+2
8-bit Command 05h	8-bit Number of Nibbles - 1	8-bit Pixel Greyscale Data	8-bit Pixel Greyscale Data N
0 | 0 | 0 | 0 | 0 | 1 | 0 | 1	N7 | N6 | N5 | N4 | N3 | N2 | N1 | N0	G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0	G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0

Nibbles are stored in Image Memory, lower nibble first, starting at the Graphical Cursor Position as they are received. The Graphical Cursor Position column is incremented after each nibble is written by 1. If the rightmost end of a row is reached the Graphical Cursor Position row is incremented by 1 and the column set to 0. The Graphical Cursor Position is set to 0,0 after the lower rightmost pixel is written.

8-bit Number of Nibbles - 1 (N7:N0):

00h <= (N7:N0) value <= FFh: Number of nibbles minus 1 to follow (00h = 1 nibble, FFh = 256 nibbles).

8-bit Pixel Greyscale Data (G7:G0):

(G3:G0): The greyscale level of the first pixel written per byte.

(G7:G4): The greyscale level of the second pixel written per byte. This nibble is ignored in the last byte if the Number of Nibbles is odd (i.e. (N7-N0) value even).

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6.2.7 GRAPHICAL IMAGE MEMORY WRITE - MONOCHROME

This multi-byte command writes graphical data to Image Memory. Each pixel is represented by a bit that determines its greyscale level based on the current Greyscale Level setting. Since one bit represents one pixel, each byte sent to the display represents eight pixels (last byte may contain fewer meaningful bits).

Command Byte 1								Command Byte 2								---								Command Byte N+2							
8-bit Command 06h								8-bit Number of Pixels - 1								8-bit Pixel Monochrome Data								8-bit Pixel Monochrome Data N							
0	0	0	0	0	1	1	0	N7	N6	N5	N4	N3	N2	N1	N0	M7	M6	M5	M4	M3	M2	M1	M0	M7	M6	M5	M4	M3	M2	M1	M0

Bits are stored in Image Memory, lower bit first, starting at the Graphical Cursor Position as they are received. The Graphical Cursor Position column is incremented after each bit is written by 1. If the rightmost end of a row is reached the Graphical Cursor Position row is incremented by 1 and the column set to 0. The Graphical Cursor Position is set to 0,0 after the lower rightmost pixel is written.

8-bit Number of Bits - 1 (N7:N0):

00h <= (N7:N0) value <= FFh: Number of bits minus 1 to follow (00h = 1 bit, FFh = 256 bits).

8-bit Pixel Monochrome Data (M7:M0):

(M7:M0): Mx = 0; pixel off, Mx = 1; pixel on at current Greyscale Level setting. Extra bits are ignored.

6.2.8 SELECT GREYSCALE LEVEL

This two-byte command sets the greyscale level of subsequent characters written to Image Memory to one of 15 levels. The greyscale level of characters already in Image Memory is not affected.

Command Byte 1								Command Byte 2							
8-bit Command 07h												4-bit Luminance Level			
0	0	0	0	0	1	1	1	x	x	x	x	L3	L2	L1	L0

4-bit Luminance Level (L3:L0):

0000: 0%	0001: 0%	0010: 13.3%	0011: 20%
0100: 26.7%	0101: 33.3%	0110: 40%	0111: 46.7%
1000: 53.3%	1001: 60%	1010: 66.7%	1011: 73.3%
1100: 75%	1101: 86.7%	1110: 93.3%	1111: 100%

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6.2.9 SELECT POWER SAVER MODE

This two-byte command selects the Power Saver Mode.

Command Byte 1								Command Byte 2								
8-bit Command 08h																
0	0	0	0	1	0	0	0	x	x	x	x	x	x	x	x	M0

1-bit Mode (M0):

- 0: Turns off the module's switching power supply (OLED Display will go blank)
- 1: Turns on the module's switching power supply (OLED will display previous image)

6.2.10 IMAGE MEMORY STORAGE

This two-byte command copies Image Memory to non-volatile Flash or vice versa. Up to 16 images can be stored and retrieved.

Command Byte 1								Command Byte 2							
8-bit Command 09h								4-bit Image Number				2-bit Sub-Command			
0	0	0	0	1	0	0	1	I3	I2	I1	I0	x	x	S1	S0

4-bit Image Number (I3:I0):

0h <= (I3:I0) value <= Fh: Image Number to be stored/restored

2-bit Sub-Command (S1:S0):

- 0: Copy Image Memory to non-volatile Flash location specified by Image Number I3:I0 (neither Image Memory nor OLED Memory are affected)
- 1: Copy non-volatile Flash location specified by Image Number I3:I0 to Image Memory (OLED Memory is not affected)
- 2: See Demo Mode Section
- 3: See Demo Mode Section

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6.2.10.1 DEMO MODE

This two-byte/multi-byte command sets the timing values for the Demo Mode sequence. When the Demo Mode is enabled, the module will sequentially display each stored image that has a non-default timing value associated with it for the appropriate amount of time. If all of the timing values are set to the default value, the Demo Mode is disabled. The Demo Mode is terminated by either removing power or by receipt of the first USB byte.

Command Byte 1								Command Byte 2				Command Byte 3							---												
8-bit Command 09h								4-bit Don't Care				2-bit Sub-Command		1-bit Ori	7-bit Time Value of Image 0							1-bit Ori	7-bit Time Value of Image N								
0	0	0	0	1	0	0	1	x	x	x	x	x	x	S1	S0	O0	T6	T5	T4	T3	T2	T1	T0	O0	T6	T5	T4	T3	T2	T1	T0

Command Byte 18							
1-bit Ori	7-bit Time Value of Image 15						
O0	T6	T5	T4	T3	T2	T1	T0

2-bit Sub-Command (S1:S0):

- 0: See Image Memory Storage Section
- 1: See Image Memory Storage Section
- 2: Erase all 16 time values from non-volatile Flash, Demo Mode disabled (2-byte command)
- 3: Store all 16 time values in non-volatile Flash (18-byte command)

1-bit Demo Mode Image Orientation (O0):

- 0: Display associated stored image with upside down orientation during Demo Mode
- 1: Display associated stored image with normal orientation during Demo Mode

7-bit Demo Mode Time Value (T6:T0):

- (T6:T0) value = 7Fh: Default value, associated image is not displayed in the Demo Mode sequence
- 0h <= (T6:T0) value <= 7Eh: Associated image displayed for approximately 64 ms times value+1

If enabled, the Demo Mode sequence begins after a slight delay at power-up in order for enumeration with the USB host to complete. This delay allows the USB host to set the USB port's maximum power consumption to the value in the configuration descriptor exchanged during enumeration before demo screens are displayed. If a 5 volt supply without USB capability or a slow USB host is used to power the module, the Demo Mode sequence will begin after the delay without completing enumeration. However, the module will continue to try to enumerate throughout the Demo Mode sequence. Because the Demo Mode ignores USB sleep requests (no SOF packets for 3 ms), the USB host needs to maintain the USB port's maximum power consumption setting during the Demo Mode sequence. If the USB host cannot maintain the maximum power consumption setting, the Demo Mode should not be used in order to abide by the USB specification.

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6.2.11 SELECT FADE MODE

This two-byte command selects the Fade Mode and its associated time interval.

Command Byte 1								Command Byte 2							
8-bit Command 0Ah								2-bit Fade Mode				4-bit Time Interval			
0	0	0	0	1	0	1	0	*	*	F1	F0	T3	T2	T1	T0

2-bit Sub-Command (F1:F0):

- 00: Disable Fade Mode, luminance set to current Greyscale Command level (T3:T0 ignored)
- 01: Enable Fade In Mode, display luminance will gradually increase from the current level to level set by the Greyscale Command at the rate set by the Time Interval
- 10: Enable Fade Out Mode, display luminance will gradually decrease from the current level to zero at the rate set by the Time Interval
- 11: Enable Blinking Mode, display luminance will gradually fade in and out between zero and the level set by the Greyscale Command at the rate set by the Time Interval

4-bit Time Interval (T3:T0):

The number of frames per fade step equals the ((T3:T0) value plus 1) time 8 frames

6.2.12 WRITE CHARACTER

This single-byte or two-byte command writes the specified character to the Image Memory at the current Character Cursor Position. When the right end of a character row is reached, characters continue on the left side of next character row. When the bottom row is filled, characters restart at the left of the top row.

Command Byte 1							
8-bit Single Byte Character 10h to FFh							
C7	C6	C5	C4	C3	C2	C1	C0

Writing characters from Font Tables 3,1 (16 x 16 Kanji) or 4,1 (32 x 32 Kanji) requires two bytes.

Command Byte 1								Command Byte 2							
8-bit Two Byte Character - First Byte 81h to 84h, 87h to 9Fh, E0 to EAh								8-bit Two Byte Character - Second Byte 40h to FFh							
F7	F6	F5	F4	F3	F2	F1	F0	S7	S6	S5	S4	S3	S2	S1	S0

Note: If Command Byte 2 is invalid the command is ignored.

The 16 UDF characters between 10h and 1Fh are written to the Image Memory in the currently selected Font Size regardless of how they are defined. For example just the upper left 5 x 8 portion of a 32 x 32 defined UDF is written if the current Font Size is 5 x 8, similarly, a 5 x 8 defined UDF would be written in the upper left portion if Font Size 32 x 32 is selected along with pseudo-random data for the remainder of the 32 x 32 character's pixels.

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7.0 FONT TABLES

7.1 CODE PAGE 437 --- 5 X 8, 10 X 16 AND 13 X 29

	2xH	3xH	4xH	5xH	6xH	7xH	8xH	9xH	AxH	BxH	CxH	DxH	ExH	FxH
x0H		0	@P	'	p	Ç	É	á			L	ll	α	≡
x1H	!	1	AQ	aq	ü	æ	í				l	τ	β	±
x2H	”	2	BR	br	é	é	ó				τ	τ	Γ	≥
x3H	#	3	C	S	s	â	ô	ú			l	l	π	κ
x4H	\$	4	D	T	dt	ä	ö	ñ			-	l	Σ	ƒ
x5H	%	5	E	U	eu	à	ò	Ñ			+	ƒ	σ	∫
x6H	&	6	F	V	vu	å	û	°			l	ƒ	μ	÷
x7H	'	7	G	W	gw	ç	ù	°			π	l	τ	≈
x8H	(	8	H	X	hx	ê	ÿ	¿			l	+	φ	°
x9H	)	9	I	Y	iy	ë	ö	-			l	l	θ	•
xAH	*	:	J	Z	jz	è	ü	-			l	l	Ω	·
xBH	+	;	K	[k	(ï	ç	½		l	l	δ	∫
xCH	,	<	L	\	l	l	î	€	¼		l	l	∞	ⁿ
xDH	-	=	M]	m)	ï	¥	ï		=	l	φ	²
xEH	.	>	N	^	n	~	Ä	Å	¼		+	l	€	■
xFH	/	?	O	_	o	Δ	Å	f	>		l	l	∩	

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7.2 CODE PAGE 852 --- 5 X 8, 10 X 6 AND 13 X 29

	2xH	3xH	4xH	5xH	6xH	7xH	8xH	9xH	AxH	BxH	CxH	DxH	ExH	FxH
x0H		0	@P	'	p	Ç	É	á			L	d	ó	-
x1H	!	1	AQ	aq	ü	í					±	Ð	ß	'
x2H	"	2	BR	br	é	í	ó				±	Ď	ô	¸
x3H	#	3	C	S	ç	â	ô	ú	|	|	±	È	Ë	¸
x4H	\$	4	D	T	d	t	ä	ö	Ä	Ö	±	-	d	ñ
x5H	%	5	E	U	e	u	ů	ř	á	†	±	Ñ	ň	š
x6H	&	6	F	U	f	u	ó	ř	ž	Â	±	Ā	İ	š
x7H	'	7	G	W	g	w	ç	š	ž	Ě	±	ä	İ	š
x8H	(	8	H	X	h	x	ł	ś	Ŕ	Ŗ	±	Ě	Ŕ	ó
x9H)	9	I	Y	i	y	ë	ö	ę	†	±	Ŕ	Ŗ	ú
xAH	*	:	J	Z	j	z	ó	ü	-		±	Ŕ	Ŗ	¸
xBH	+	;	K	[k	(ö	ř	ž	†	±	■	Ú	ú
xCH	,	<	L	\	l		î	č	„	†	±	■	Ÿ	ř
xDH	-	=	M]	m)	ž	ł	ś	Ź	±	±	Ÿ	ř
xEH	.	>	N	^	n	~	Ä	x	«	ž	±	±	Ÿ	ř
xFH	/	?	O	_	o	o	č	č	»	†	±	■	'	

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7.3 CODE PAGE 858 --- 5 X 8, 10 X 16 AND 13 X 29

	2xH	3xH	4xH	5xH	6xH	7xH	8xH	9xH	AxH	BxH	CxH	DxH	ExH	FxH
x0H		0	@P	'	pçÉá						L	öó	-	
x1H	!	1	AQ	aq	üæ	í					±	±	±	±
x2H	"	2	BR	br	éÉ	ó					±	±	±	±
x3H	#	3	C	S	cs	âô	ú				±	±	±	±
x4H	\$	4	D	T	dt	äö	ñ				±	±	±	±
x5H	%	5	E	U	eu	àò	Ñ	Á	±	±	±	±	±	±
x6H	&	6	F	U	fu	å	ú	°	À	Ã	Í	µ	÷	
x7H	'	7	G	W	gw	ç	ù	°	À	Ã	Í	µ	÷	
x8H	(8	H	X	hx	ê	ÿ	¿	®	±	±	±	±	±
x9H)	9	I	Y	iy	ë	Ö	®	±	±	±	±	±	±
xAH	*	:	J	Z	jz	è	Ü	-	±	±	±	±	±	±
xBH	+	;	K	[k	(ï	ø	½	±	±	±	±	±
xCH	,	<	L	\	l		î	€	¼	±	±	±	±	±
xDH	-	=	M]	m)	ì	Ø	ì	¢	=	±	±	±
xEH	.	>	N	^	n	~	Ä	x	«	¥	±	±	±	±
xFH	/	?	O	_	o	o	Å	f	>	±	±	±	±	±

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7.4 CODE PAGE 866 --- 5 X 8, 10 X 16 AND 13 X 29

	2xH	3xH	4xH	5xH	6xH	7xH	8xH	9xH	AxH	BxH	CxH	DxH	ExH	FxH
x0H		0	@P	'	p	A	P	a			Л	Ц	р	Ё
x1H	!	1	AQ	aq	Б	С	б	с			Л	т	с	ё
x2H	"	2	B	R	b	r	В	Т	в		т	т	т	Е
x3H	#	3	C	S	c	s	Г	У	г	|	Г	л	у	е
x4H	\$	4	D	T	d	t	Д	Ф	д	†	-	ф	і	
x5H	%	5	E	U	e	u	Е	Х	е	†	†	г	х	ї
x6H	&	6	F	V	f	v	Ж	Ц	ж	†	†	г	ц	у
x7H	'	7	G	W	g	w	З	Ч	з	†	†	ч	у	
x8H	(	8	H	X	h	x	И	Ш	и	†	†	ш	о	
x9H	)	9	I	Y	i	y	Й	Щ	й	†	†	щ	о	
xAH	*	:	J	Z	j	z	К	Ь	к		†	г	ь	.
xBH	+	;	K	[k	(Л	Ы	л	†	†	ы	л	
xCH	,	<	L	\	l		М	Ь	м	†	†	ь	№	
xDH	-	=	M]	m)	Н	Э	н	†	†	э	я	
xEH	.	>	N	^	n	~	О	Ю	о	†	†	ю	.	
xFH	/	?	O	_	o	o	П	Я	п	†	†	я		

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7.5 CODE PAGE 932 --- 5 X 8 AND 10 X 16

	2xH	3xH	4xH	5xH	6xH	7xH	8xH	9xH	AxH	BxH	CxH	DxH	ExH	FxH
x0H		0	a	P	`	P	┌	└	┌	└	┌	└	┌	└
x1H	!	1	A	Q	a	q	┌	└	┌	└	┌	└	┌	└
x2H	"	2	B	R	b	r	┌	└	┌	└	┌	└	┌	└
x3H	#	3	C	S	c	s	┌	└	┌	└	┌	└	┌	└
x4H	\$	4	D	T	d	t	┌	└	┌	└	┌	└	┌	└
x5H	%	5	E	U	e	u	┌	└	┌	└	┌	└	┌	└
x6H	&	6	F	V	f	v	┌	└	┌	└	┌	└	┌	└
x7H	'	7	G	W	g	w	┌	└	┌	└	┌	└	┌	└
x8H	<	8	H	X	h	x	┌	└	┌	└	┌	└	┌	└
x9H	>	9	I	Y	i	y	┌	└	┌	└	┌	└	┌	└
xAH	*	:	J	Z	j	z	┌	└	┌	└	┌	└	┌	└
xBH	+	;	K	C	k	c	┌	└	┌	└	┌	└	┌	└
xCH	,	<	L	Y	l	y	┌	└	┌	└	┌	└	┌	└
xDH	-	=	M	I	m	i	┌	└	┌	└	┌	└	┌	└
xEH	.	>	N	^	n	^	┌	└	┌	└	┌	└	┌	└
xFH	/	?	_	0	o	o	┌	└	┌	└	┌	└	┌	└

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7.6 KATAKANA --- 13 X 29

	2xH	3xH	4xH	5xH	6xH	7xH	8xH	9xH	AxH	BxH	CxH	DxH	ExH	FxH
x0H		0	@P	'	p0	月	=	ク	タ	ハ	ム	ヰ		
x1H	!	1	AQ	aq	1	火	ア	ケ	チ	ハ	メ	エ		
x2H	”	2	BR	br	2	木	ア	ゲ	チ	ヒ	モ	ヨ		
x3H	#	3	CS	cs	3	木	イ	コ	シ	ヒ	ヤ	ン		
x4H	\$	4	DT	dt	4	金	イ	コ	シ	ヒ	ヤ	ウ		
x5H	%	5	EU	eu	5	土	ウ	サ	ジ	フ	ユ	カ		
x6H	&	6	FU	fu	6	日	ウ	ザ	テ	ブ	ユ	ク		
x7H	'	7	GW	gw	7	年	エ	シ	デ	ラ	ヨ	ウ		
x8H	(	8	HX	hx	8	分	エ	シ	ト	ヘ	ヨ	ヰ		
x9H	)	9	IY	iy	9		オ	ス	ト	ヘ	ラ	エ		
xAH	*	:	JZ	jz	T		オ	ス	ナ	ヘ	リ	ヲ		
xBH	+	;	K	[k	(人	大	カ	セ	ニ	ホ	ル	.	
xCH	,	<	L	\		↑	中	ガ	セ	ヌ	ホ	レ	ー	
xDH	-	=	M]m	}	→	小	キ	ソ	ネ	ホ	ロ	\	
xEH	.	>	N	^n	~	↓	¥	キ	ソ	ノ	マ	ウ	\	
xFH	/	?	O	_o	o	←	計	ク	タ	ハ	ミ	ウ	7	

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7.7 KANJI --- 16 X 16 AND 32 X 32

81	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH		、	。	，	・	∴	∵	？	！	”	。					
5xH		、	、	、	、	〃	全	々	〆	〇	一	一	一	一	一	一
6xH	～	||	|	…	…	“	”	( )	[ ]	[ ]	{					
7xH	}	<	>	《	》	「	」	『	』	【	】	+	-	±	×	
8xH	÷	=	≠	<	>	≦	≧	∞	∴	♂	♀	°	'	”	°C	¥
9xH	\$	¢	£	%	#	&	*	@	§	☆	★	○	●	◎	◇	◆
AxH	□	■	△	▲	▽	▼	※	〒	→	←	↑	↓	=			
BxH									∈	∋	⊆	⊇	⊂	⊃	∪	∩
CxH									∧	∨	∩	⇒	⇔	∇	∃	
DxH									∠	⊥	∧	∂	∇	≡		
ExH	≡	≪	≫	√	∞	∞	∴	∴	∴	∴						
FxH	Å	%	#	b	♪	†	‡	¶					○			

82	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH																0
5xH	1	2	3	4	5	6	7	8	9							
6xH	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
7xH	Q	R	S	T	U	V	W	X	Y	Z						
8xH	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	
9xH	p	q	r	s	t	u	v	w	x	y	z					あ
AxH	あ	い	い	う	う	え	え	お	お	か	か	き	ぎ	く	ぐ	け
BxH	げ	こ	こ	さ	さ	し	じ	ず	ず	せ	ぜ	そ	ぞ	た	だ	ち
CxH	ち	っ	つ	づ	て	で	と	ど	な	に	ぬ	ね	の	は	ば	ぱ
DxH	ひ	び	び	ふ	ぶ	ぶ	へ	べ	べ	ほ	ぼ	ぼ	ま	み	む	め
ExH	も	ゃ	や	ゅ	ゆ	よ	ら	り	る	れ	ろ	わ	わ	ゐ	ゑ	
FxH	を	ん														

83	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	ァ	ア	ィ	イ	ゥ	ウ	ェ	エ	ォ	オ	カ	ガ	キ	ギ	ク	グ
5xH	ヶ	ゲ	ゴ	ゴ	サ	ザ	シ	ジ	ス	ズ	セ	ゼ	ソ	ゾ	タ	ダ
6xH	チ	ヂ	ッ	ツ	ヅ	テ	デ	ト	ド	ナ	ニ	ヌ	ネ	ノ	ハ	バ
7xH	パ	ヒ	ピ	ピ	フ	ブ	フ	ヘ	ベ	ペ	ホ	ボ	ポ	マ	ミ	
8xH	ム	メ	モ	ヤ	ユ	ユ	ヨ	ヨ	ラ	リ	ル	レ	ロ	ワ	ワ	
9xH	キ	エ	ヨ	ン	ヴ	カ	ケ									Α
AxH	Β	Γ	Δ	Ε	Ζ	Η	Θ	Ι	Κ	Λ	Μ	Ν	Ξ	Ο	Π	Ρ
BxH	Σ	Τ	Υ	Φ	Χ	Ψ	Ω									α
CxH	β	γ	δ	ε	ξ	η	θ	ι	κ	λ	μ	ν	ξ	ο	π	ρ
DxH	σ	τ	υ	φ	χ	ψ	ω									
ExH																
FxH																

84	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	Α	Β	Γ	Δ	Ε	Ζ	Ι	Κ	Λ	Μ	Ν	Ο				
5xH	Π	Ρ	Σ	Τ	Υ	Φ	Χ	Ψ	Ω	Ϊ	Ϋ	Ϝ	ϝ	Ϟ	ϟ	Ϡ
6xH	Я															
7xH	а	б	в	г	д	е	ё	ж	з	и	й	к	л	м	н	
8xH	о	п	р	с	т	у	ф	х	ц	ч	ш	щ	ъ	ы	ь	э
9xH	ю	я														
AxH																
BxH																
CxH																
DxH																
ExH																
FxH																

87	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯
5xH	⑰	⑱	⑲	⑳	I	II	III	IV	V	VI	VII	VIII	IX	X		ミ
6xH	キ	ロ	セ	メ	グ	ラ	ト	アル	ヘ	タル	リ	ツ	カ	ロ	ド	ル
7xH	cm	km	mg	kg	cc	m ²										平成
8xH	”	”	No.	K.K.	TEL	Ⓢ	Ⓜ	Ⓣ	Ⓝ	Ⓡ	Ⓣ	Ⓝ	Ⓡ	Ⓣ	Ⓝ	明治 大正 昭和
9xH	≡	≡	∫	∫	∑	√	⊥	∠	∠	∠	∠	∠	∠	∠	∠	∠
AxH																
BxH																
CxH																
DxH																
ExH																
FxH																

88	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH																
5xH																
6xH																
7xH																
8xH																
9xH																亜
AxH	唾	娃	阿	哀	愛	挨	始	逢	葵	茜	穉	惡	握	渥	旭	葦
BxH	芦	鯨	梓	庄	幹	扱	宛	姐	虻	飴	絢	綾	鮎	或	粟	裕
CxH	安	庵	按	暗	案	闇	鞍	杏	以	伊	位	依	偉	困	夷	委
DxH	威	尉	惟	意	慰	易	椅	為	畏	異	移	維	緯	胃	萎	衣
ExH	謂	違	遺	医	井	亥	域	育	郁	磯	一	壹	溢	逸	稻	茨
FxH	芋	鯛	允	印	咽	員	因	姻	引	飲	淫	胤	蔭			



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8G	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	院	陰	隱	韻	吋	右	宇	烏	羽	迂	雨	卯	鵝	窺	丑	確
5xH	白	涸	噓	頌	鬱	蔚	鰻	姥	厥	浦	瓜	閏	粵	云	運	雲
6xH	荏	飢	叢	營	嬰	影	映	曳	榮	永	泳	洩	瑛	盈	穎	穎
7xH	英	衛	詠	銳	液	疫	益	馭	悅	謁	越	閱	覆	厭	門	
8xH	園	堰	奄	宴	延	怨	掩	援	沿	演	炎	焰	煙	燕	猿	緣
9xH	艷	苑	菌	遠	鉛	鴛	塩	於	汚	甥	凹	央	奧	往	庀	押
AxH	旺	橫	欧	段	王	翁	襖	鶯	鷗	黃	岡	冲	荻	億	屋	憶
BxH	臆	桶	牡	乙	俺	卸	恩	温	穩	音	下	化	佞	何	伽	伽
CxH	佳	加	可	嘉	夏	嫁	家	寡	科	暇	果	架	歌	河	火	珂
DxH	禍	禾	稼	箇	花	苛	茄	荷	華	菓	蝦	課	嘩	貨	迥	過
ExH	霞	蚊	俄	峨	我	牙	画	臥	芽	蛾	賀	雅	餓	駕	介	會
FxH	解	回	塊	壞	迴	快	怪	悔	恢	懷	戒	拐	改			

8A	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	魁	晦	械	海	灰	界	皆	繪	芥	蟹	開	階	貝	凱	効	外
5xH	咳	害	崖	慨	概	涯	碍	蓋	街	該	鑑	骸	涇	馨	蛙	垣
6xH	柿	蚶	鈎	劃	嚇	各	廓	括	挽	格	核	殼	獲	確	穫	覺
7xH	角	赫	較	郭	閣	隔	革	學	岳	樂	額	顎	掛	笠	檉	
8xH	櫃	梃	鯁	漚	割	喝	恰	括	活	渴	滑	葛	褐	轄	且	鯉
9xH	叶	栳	樺	樺	靴	兜	竈	蒲	釜	鎌	勸	卷	喚	堪	茅	萱
AxH	刈	苜	瓦	乾	侃	冠	寒	刊	勘	勸	卷	喚	堪	姦	完	官
BxH	寬	干	幹	患	感	慣	憾	換	敢	柑	桓	棺	款	歡	汗	漢
CxH	澗	灌	環	甘	監	看	竿	管	簡	緩	缶	翰	肝	艦	莞	觀
DxH	諫	貫	還	鑑	間	閑	閑	陷	韓	館	丸	含	岸	巖	玩	奇
ExH	癌	眼	岩	翫	賈	雁	頑	顏	願	企	仗	危	喜	器	基	奇
FxH	嬉	寄	岐	希	幾	忌	揮	机	旗	既	期	棋	棄			

8B	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	機	歸	毅	氣	汽	畿	祈	季	稀	紀	徽	規	記	貴	起	軌
5xH	輝	飢	騎	鬼	龜	偽	儀	妓	宜	戲	技	擬	欺	犧	疑	祇
6xH	義	蟻	誼	議	掬	菊	鞠	吉	吃	喫	桔	橘	詰	砧	杵	黍
7xH	却	客	脚	虐	逆	丘	久	仇	休	及	吸	宮	弓	急	救	
8xH	朽	求	汲	泣	灸	球	究	窮	笈	級	糾	給	旧	牛	去	居
9xH	巨	拒	扱	挈	渠	虛	許	距	鋸	漁	禦	魚	亨	亨	京	供
AxH	俠	橋	兇	競	共	凶	協	匡	卿	叫	香	境	峽	強	疆	怯
BxH	恐	恭	挾	教	橋	況	狂	狹	矯	胸	脅	興	薺	鄉	鏡	響
CxH	饗	驚	仰	凝	堯	曉	業	局	曲	極	玉	桐	秆	僅	勤	均
DxH	巾	錦	斤	欣	欽	琴	禁	禽	筋	緊	芹	菌	衿	襟	謹	近
ExH	金	吟	銀	九	俱	句	區	狗	玖	矩	苦	躬	驅	駢	駒	具
FxH	愚	虞	喰	空	偶	寓	遇	隅	串	櫛	櫛	屑	屈			

8C	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	掘	窟	沓	靴	轡	窪	熊	隈	條	栗	縑	桑	鍬	勳	君	薰
5xH	訓	群	軍	郡	卦	袞	係	傾	刑	兄	啓	圭	圭	珪	型	契
6xH	形	徑	惠	慶	慧	憇	揭	携	敬	景	桂	溪	畦	稽	系	經
7xH	繼	繫	野	荊	荊	蚩	計	詣	警	輕	頸	鷄	芸	迎	鯨	
8xH	劇	載	擊	激	際	斲	傑	欠	決	潔	穴	結	血	訣	月	件
9xH	俟	倦	健	兼	券	劍	喧	圈	堅	嫌	建	憲	懸	拳	捲	檢
AxH	權	牽	犬	獻	研	硯	絹	梟	肩	見	謙	賢	軒	遣	鍵	險
BxH	顯	驗	顛	元	原	嚴	幻	弦	減	源	玄	現	絃	骸	言	諺
CxH	限	乎	個	古	呼	固	姑	孤	己	庫	弧	戶	故	枯	湖	狐
DxH	糊	袴	股	胡	菰	虎	誇	跨	鈞	履	顧	鼓	五	互	伍	鯉
ExH	吳	吾	娛	後	御	悟	梧	檣	湖	暮	語	誤	護	向		
FxH	交	佼	候	候	倅	光	公	功	効	効	厚	口	向			

8D	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	后	喉	坑	垢	好	孔	孝	宏	工	巧	巷	幸	庑	康	弘	浩
5xH	恒	慌	抗	拘	控	攻	昂	晃	更	杭	校	梗	構	江	洪	浩
6xH	港	溝	甲	皇	硬	稿	糠	紅	絃	絞	綱	耕	考	肯	肱	腔
7xH	膏	航	荒	行	衡	講	貢	購	郊	醇	鉞	砒	鋼	閣	降	
8xH	項	香	高	鴻	剛	劫	号	壕	拷	濠	豪	轟	翹	克	刻	刻
9xH	告	國	穀	酷	鵠	黑	獄	澆	腰	甌	忽	惚	骨	狽	込	此
AxH	頃	今	困	坤	壑	婚	恨	懇	昏	昆	根	梱	混	痕	紺	良
BxH	魂	些	佐	又	唆	嵯	左	差	查	沙	瑤	砂	詐	鎖	綰	坐
CxH	座	挫	債	催	再	最	哉	塞	妻	宰	彩	才	採	裁	歲	濟
DxH	災	采	犀	碎	砦	祭	齋	細	菜	裁	載	劑	在	材	罪	罪
ExH	財	冚	坂	阪	堺	榭	肴	咲	崎	埼	碕	作	削	咋		
FxH	昨	朔	柵	窄	策	索	錯	櫻	鮭	筴	匙	冊	刷			

8E	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	察	撈	撮	擦	札	殺	薩	雜	阜	鯖	捌	鏽	鮫	皿	晒	三
5xH	傘	參	山	慘	撒	散	棧	燦	珊	產	算	纂	蚕	讚	贊	酸
6xH	餐	斬	暫	殘	仕	仔	伺	使	刺	司	史	嗣	四	士	始	姉
7xH	姿	子	屍	市	師	志	思	指	支	攷	斯	施	旨	枝	止	
8xH	死	氏	獅	社	私	糸	紙	紫	肢	脂	至	視	詞	詩	試	誌
9xH	諮	資	賜	雌	飼	齒	事	似	侍	兒	字	寺	慈	持	時	次
AxH	滋	治	爾	璽	痔	磁	示	而	耳	自	蒔	辭	汐	鹿	式	識
BxH	鳴	竺	軸	穴	雲	七	叱	執	失	嫉	室	悉	濕	漆	疾	質
CxH	實	蔀	篠	偲	柴	芝	屢	蕊	邪	借	勺	尺	杓	灼	斜	煮
DxH	社	紗	者	謝	車	遮	蛇	邪	借	勺	尺	杓	灼	爵	酌	積
ExH	錫	若	寂	弱	惹	主	取	守	手	殊	狩	珠	種	腫	趣	趣
FxH	酒	首	儒	受	呪	壽	授	樹	綬	需	囚	収	周			

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8F	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	宗	就	州	修	愁	拾	洲	秀	秋	終	繡	習	臭	舟	蒐	衆
5xH	襲	讐	蹴	輯	週	酉	酬	集	醜	什	住	充	十	從	戎	柔
6xH	汁	洪	獸	縱	重	銃	叔	夙	宿	淑	祝	縮	肅	塾	熟	出
7xH	術	述	俊	峻	春	瞬	竣	舜	駿	准	循	旬	楮	殉	淳	
8xH	準	潤	盾	純	巡	遵	醇	順	処	初	所	暑	曙	渚	庶	緒
9xH	署	書	薯	諸	助	叙	女	序	徐	恕	鋤	將	小	少	尚	庄
AxH	匠	升	召	哨	商	唱	嘗	獎	妾	娼	宵	將	小	少	尚	庄
BxH	床	廠	彰	承	抄	招	掌	捷	昇	昌	昭	晶	松	稍	樟	樵
CxH	沼	消	涉	湘	燒	焦	照	症	省	硝	礁	祥	稱	章	笑	粧
DxH	紹	肖	莒	蔣	蕉	衝	裳	訟	証	詔	詳	象	賞	醫	鈺	鍾
ExH	鐘	障	鞞	上	丈	承	乘	冗	剩	城	場	壤	孃	常	情	擾
FxH	条	杖	淨	狀	置	穰	蒸	讓	釀	錠	囑	埴	飾			

90	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	拭	植	殖	燭	織	職	色	觸	食	蝕	辱	尻	伸	信	侵	唇
5xH	振	寢	審	心	慎	振	新	晉	森	榛	浸	深	申	疹	真	神
6xH	秦	紳	臣	芯	薪	親	診	身	辛	進	針	震	人	仁	刃	塵
7xH	千	尋	甚	盡	腎	訊	迅	陣	韌	筈	諷	須	酢	囟	厨	
8xH	逗	吹	垂	帥	推	水	炊	睡	粹	翠	衰	遂	醉	錐	隨	
9xH	瑞	髓	崇	嵩	數	樞	趨	雛	据	杉	相	營	頗	雀	澄	
AxH	摺	寸	世	瀨	畝	是	淒	制	勢	姓	征	性	成	政	整	星
BxH	晴	棲	栖	正	清	性	脆	隻	席	惜	威	斥	昔	析	積	
CxH	逝	醒	青	靜	齊	稅	脆	隻	席	惜	威	斥	昔	析	積	
DxH	籍	績	脊	責	赤	跡	蹟	碩	切	拙	接	掇	折	設	竊	節
ExH	說	雪	絕	舌	蟬	仙	先	千	占	宣	專	尖	川	戰	扇	撰
FxH	栓	梅	泉	淺	洗	染	潛	煎	煽	旋	穿	箭	線			

91	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	緘	羨	腺	舛	船	薦	詮	賤	踐	選	遷	錢	銑	閃	鮮	前
5xH	善	漸	然	全	禪	繕	膳	噉	塑	岨	措	曾	曾	楚	狙	
6xH	疏	疎	礎	祖	粗	素	組	蘇	訴	阻	遡	鼠	僧	創	雙	
7xH	叢	倉	喪	壯	奏	爽	宋	層	匣	惣	想	搜	掃	搔		
8xH	操	早	曹	巢	槍	槽	漕	燥	爭	瘦	相	窞	糟	綜	聰	臟
9xH	草	莊	葬	蒼	藻	裝	走	送	遭	鎗	霜	騷	像	增	憎	賊
AxH	葳	贈	造	促	側	則	即	息	捉	束	測	足	速	俗	屬	賊
BxH	族	統	卒	袖	其	掬	存	孫	尊	損	村	遜	他	多	太	汰
CxH	訖	詔	唾	墮	妥	惰	打	柁	舵	檣	陀	馱	驂	體	堆	對
DxH	岱	帶	待	怠	態	戴	替	泰	滯	胎	腿	苔	袋	貸	退	逮
ExH	隊	黛	鯛	代	台	大	第	醍	題	鷹	滝	龍	卓	啄	宅	托
FxH	扞	拓	沢	濯	琢	託	鐸	濁	諾	茸	風	蜻	只			

92	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	叩	但	達	辰	奪	脫	巽	豎	迪	棚	谷	狸	鱈	樽	誰	丹
5xH	單	嘆	坦	担	探	旦	歎	淡	湛	炭	短	端	筭	綻	耽	弛
6xH	蛋	誕	鍛	团	壇	彈	斷	暖	檀	段	男	談	值	知	地	
7xH	恥	智	池	痴	稚	置	致	蜘	遲	馳	畜	竹	筑	蓄		
8xH	逐	秩	窒	茶	嫡	着	中	仲	宙	忠	抽	昼	柱	注	虫	衷
9xH	註	耐	铸	駐	樗	瀦	猪	芋	著	貯	丁	兆	凋	喋	寵	帖
AxH	帳	疔	弔	張	彫	微	懲	挑	暢	朝	潮	牒	町	眺	聽	張
BxH	腸	蝶	調	課	超	跳	銚	長	頂	烏	勅	抄	直	朕	沈	珍
CxH	賃	鎮	陳	津	墜	椎	槌	迫	鎚	痛	通	塚	柁	楓	佃	耐
DxH	漬	柘	辻	蔦	綴	鏢	椿	潰	坪	壺	婦	紬	爪	吊	釣	鶴
ExH	亭	低	停	偵	剃	貞	呈	堤	定	帝	底	庭	廷	弟	悌	
FxH	挺	提	梯	汀	碇	禎	程	締	艇	訂	諦	蹄	逵			

93	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	邸	鄭	釘	鼎	泥	擢	敵	滴	的	笛	適	鏞	溺	哲	徹	点
5xH	撤	轍	迭	鉄	典	填	天	展	店	添	纏	甜	貼	軫	顛	
6xH	佖	殿	澱	田	電	兎	吐	堵	塗	妬	屠	徒	斗	杜	渡	登
7xH	菟	賭	途	都	鍍	砥	砺	努	度	土	奴	怒	倒	党	冬	
8xH	凍	刀	唐	塔	塘	套	宕	島	嶋	悼	投	搭	東	桃	棒	棟
9xH	盜	淘	湯	涛	燈	當	痘	禱	等	答	筒	糖	統	到	董	
AxH	蕩	藤	討	騰	豆	踏	逃	透	燈	陶	頭	騰	閏	働	動	同
BxH	堂	導	撞	撞	洞	瞳	童	桐	苟	道	銅	峠	錫	匿	得	德
CxH	澆	特	督	禿	篤	毒	独	誦	柝	橡	凸	突	椽	届	鳶	苦
DxH	寅	酉	滯	噸	屯	惇	敦	沌	豚	遁	頓	吞	曇	鈍	奈	那
ExH	內	乍	風	雍	謎	灘	捺	鍋	櫛	馴	繩	纈	南	楠	軟	難
FxH	汝	二	尼	弑	迓	賑	肉	虹	廿	日	乳	入				

94	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	如	尿	菲	任	妊	忍	認	濡	襴	祢	寧	葱	貓	熱	年	念
5xH	捻	燃	粘	乃	迺	之	之	楚	囊	惱	濃	納	能	腦	農	農
6xH	視	蚤	巴	把	播	霸	杷	波	派	琶	破	婆	罵	芭	馬	俳
7xH	廢	拜	排	敗	杯	盃	牌	背	肺	輩	配	倍	培	媒	梅	
8xH	煤	煤	狽	買	壳	陪	陪	這	蠅	秤	矧	菽	伯	剝	博	拍
9xH	柏	泊	白	箔	粕	舶	薄	迫	曝	漠	爆	縛	莫	駁	麥	函
AxH	箱	裕	箸	筭	筭	櫨	幡	肌	焜	阜	八	伴	判	髡	髡	髮
BxH	伐	罰	拔	筏	閱	鳩	嘶	塙	蛤	隼	繁	般	藩	販	範	帆
CxH	搬	斑	板	汜	汎	版	犯	班	畔	繁	匪	卑	否	妃	庇	悲
DxH	頒	飯	挽	晚	番	盤	磬	蕃	蛮	匪	卑	否	妃	庇	悲	費
ExH	扉	批	披	斐	比	泌	疲	皮	碑	秘	毘	毘	眉	美		
FxH	避	非	飛	樋	篋	備	尾	微	枇	毘	毘	眉	美			

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95	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	鼻	柶	稗	匹	疋	髭	彦	膝	菱	肘	弼	必	畢	筆	逼	松
5xH	姬	媛	紐	百	謬	佞	彪	標	水	漂	瓢	票	表	評	豹	廟
6xH	描	病	秒	苗	錨	蒜	蛭	鯨	品	彬	斌	浜	瀕	貧	賓	
7xH	頻	敏	瓶	不	付	埠	夫	婦	富	富	布	府	扶	敷		
8xH	斧	普	浮	父	符	腐	膚	芙	譜	負	賦	赴	阜	附	侮	撫
9xH	武	舞	葡	蕪	部	封	楓	風	葺	蔘	伏	副	復	幅	服	福
AxH	腹	復	覆	淵	弗	扌	沸	仏	物	鮒	分	吻	噴	墳	憤	扮
BxH	焚	奮	粉	糞	紛	雰	文	聞	丙	併	兵	堀	幣	平	弊	柄
CxH	並	蔽	閉	陸	頁	僻	壁	癖	碧	別	警	蔑	篋	偏	變	
DxH	片	篇	編	辺	返	遍	便	勉	婉	弁	鞭	保	舖	鋪	圃	捕
ExH	步	甫	補	輔	穗	募	慕	戊	暮	母	簿	菩	倣	俸	包	
FxH	呆	報	奉	宝	峰	峯	崩	庖	抱	捧	放	方	朋			

96	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	法	泡	烹	砲	縫	胞	芳	萌	蓬	蜂	褒	訪	豐	邦	鋒	飽
5xH	鳳	鵬	乏	亡	傍	剖	坊	妨	帽	忘	忙	房	暴	望	某	棒
6xH	冒	紡	肪	膨	謀	貌	貿	鉢	防	吠	頰	北	僕	卜	墨	撲
7xH	朴	牧	睦	穆	釘	勃	沒	殆	堀	幌	奔	本	翻	凡	盆	
8xH	摩	磨	魔	麻	埋	妹	味	枚	每	哩	禎	幕	膜	枕	鮪	枉
9xH	鱒	樹	亦	侯	又	抹	末	沫	迄	俚	繭	磨	萬	慢	滿	漫
AxH	蔓	味	未	魅	已	箕	岬	密	蜜	湊	蓑	稔	脈	妙	耗	民
BxH	眠	務	夢	無	牟	矛	霧	鷓	椋	婿	娘	冥	名	命	明	盟
CxH	迷	銘	鳴	姪	牝	滅	免	棉	綿	緬	面	麵	摸	模	茂	妄
DxH	孟	毛	猛	盲	網	耗	蒙	儲	木	默	目	李	勿	餅	尤	戾
ExH	粗	貫	問	悶	紋	門	匆	也	冶	夜	爺	耶	野	弥	矢	厄
FxH	役	約	藥	訊	躍	靖	柳	數	鏈	愉	愈	油				

97	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	論	輪	唯	佑	優	勇	有	幽	悠	憂	揖	有	袖	湧	涌	譽
5xH	猶	猷	由	祐	裕	誘	遊	邑	郵	雄	融	夕	予	余	與	譽
6xH	輿	預	傭	幼	妖	容	庸	揚	搖	擁	曜	楊	樣	洋	溶	熔
7xH	用	窯	羊	耀	葉	蓉	要	謡	踊	遙	陽	養	慾	抑	欲	
8xH	沃	浴	翌	翼	淀	羅	螺	裸	來	萊	賴	雷	洛	絡	落	酪
9xH	乱	卵	嵐	欄	濫	藍	蘭	覽	利	吏	履	李	梨	理	璃	痢
AxH	裏	裡	里	離	陸	律	率	立	律	掠	略	劉	流	溜	琉	留
BxH	硫	粒	隆	龍	侶	慮	旅	虜	了	亮	僚	兩	凌	寮	寮	料
CxH	梁	涼	獺	療	瞭	稜	糧	良	諒	遼	量	陵	領	力	綠	倫
DxH	厘	林	淋	麟	臨	輪	麟	麟	璫	瑩	淚	累	麗	類	令	曆
ExH	伶	例	冷	勵	嶺	玲	禮	苓	鈴	隸	零	靈	麗	齡		
FxH	歷	列	劣	烈	裂	廉	戀	憐	漣	煉	鍊	練	聯			

98	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	蓮	連	鍊	呂	魯	魯	魯	魯	魯	魯	魯	魯	魯	魯	魯	魯
5xH	榔	浪	漏	牢	狼	籠	老	聾	蠟	郎	六	婁	廊	弄	朗	樓
6xH	倭	和	話	歪	賄	脇	惑	梓	驚	互	巨	鯨	廊	弄	朗	樓
7xH	灣	碗	腕													
8xH																
9xH																式
AxH	丐	丕	个	非	、	井	丿	乂	乖	乘	亂	丁	豫	事	舒	式
BxH	于	亞	亟	一	亢	京	毫	亶	从	仍	仄	仆	仆	仗	仗	仗
CxH	仟	价	伉	佚	估	佛	佝	佗	佇	佻	侏	侏	侏	侏	侏	侏
DxH	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏
ExH	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏	侏
FxH	會	偕	偕	偕	偕	偕	偕	偕	偕	偕	偕	偕	偕	偕	偕	偕

99	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	僉	僊	僊	僊	僊	僊	僊	僊	僊	僊	僊	僊	僊	僊	僊	僊
5xH	儕	儕	儕	儕	儕	儕	儕	儕	儕	儕	儕	儕	儕	儕	儕	儕
6xH	僉	僉	僉	僉	僉	僉	僉	僉	僉	僉	僉	僉	僉	僉	僉	僉
7xH	冪	冪	冪	冪	冪	冪	冪	冪	冪	冪	冪	冪	冪	冪	冪	冪
8xH	凰	凰	凰	凰	凰	凰	凰	凰	凰	凰	凰	凰	凰	凰	凰	凰
9xH	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓
AxH	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓	劓
BxH	匆	匆	匆	匆	匆	匆	匆	匆	匆	匆	匆	匆	匆	匆	匆	匆
CxH	卮	卮	卮	卮	卮	卮	卮	卮	卮	卮	卮	卮	卮	卮	卮	卮
DxH	厰	厰	厰	厰	厰	厰	厰	厰	厰	厰	厰	厰	厰	厰	厰	厰
ExH	吭	吭	吭	吭	吭	吭	吭	吭	吭	吭	吭	吭	吭	吭	吭	吭
FxH	咀	咀	咀	咀	咀	咀	咀	咀	咀	咀	咀	咀	咀	咀	咀	咀

9A	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	咫	晒	咤	咤	咤	咤	咤	咤	咤	咤	咤	咤	咤	咤	咤	咤
5xH	哇	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣
6xH	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣	啣
7xH	噴	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔	嘔
8xH	噫	噫	噫	噫	噫	噫	噫	噫	噫	噫	噫	噫	噫	噫	噫	噫
9xH	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼	嚼
AxH	國	圍	圍	圍	圍	圍	圍	圍	圍	圍	圍	圍	圍	圍	圍	圍
BxH	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠
CxH	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠	垠
DxH	墟	墟	墟	墟	墟	墟	墟	墟	墟	墟	墟	墟	墟	墟	墟	墟
ExH	壘	壘	壘	壘	壘	壘	壘	壘	壘	壘	壘	壘	壘	壘	壘	壘
FxH	夸	夸	夸	夸	夸	夸	夸	夸	夸	夸	夸	夸	夸	夸	夸	夸

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9B	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	奸	妲	姤	佞	佞	妣	妲	媧	媧	姜	妍	姘	姚	娥	娟	娑
5xH	娜	娉	娉	娉	娉	娉	娉	娉	娉	娉	娉	娉	娉	娉	娉	娉
6xH	媽	媽	媽	媽	媽	媽	媽	媽	媽	媽	媽	媽	媽	媽	媽	媽
7xH	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖	嬖
8xH	它	它	它	它	它	它	它	它	它	它	它	它	它	它	它	它
9xH	寶	寶	寶	寶	寶	寶	寶	寶	寶	寶	寶	寶	寶	寶	寶	寶
AxH	屏	屏	屏	屏	屏	屏	屏	屏	屏	屏	屏	屏	屏	屏	屏	屏
BxH	崢	崢	崢	崢	崢	崢	崢	崢	崢	崢	崢	崢	崢	崢	崢	崢
CxH	崑	崑	崑	崑	崑	崑	崑	崑	崑	崑	崑	崑	崑	崑	崑	崑
DxH	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠	嶠
ExH	厄	厄	厄	厄	厄	厄	厄	厄	厄	厄	厄	厄	厄	厄	厄	厄
FxH	幣	幣	幣	幣	幣	幣	幣	幣	幣	幣	幣	幣	幣	幣	幣	幣

9C	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	廖	廣	廡	廡	廡	廡	廡	廡	廡	廡	廡	廡	廡	廡	廡	廡
5xH	弃	弃	弃	弃	弃	弃	弃	弃	弃	弃	弃	弃	弃	弃	弃	弃
6xH	彖	彖	彖	彖	彖	彖	彖	彖	彖	彖	彖	彖	彖	彖	彖	彖
7xH	徘	徘	徘	徘	徘	徘	徘	徘	徘	徘	徘	徘	徘	徘	徘	徘
8xH	估	估	估	估	估	估	估	估	估	估	估	估	估	估	估	估
9xH	協	協	協	協	協	協	協	協	協	協	協	協	協	協	協	協
AxH	俊	俊	俊	俊	俊	俊	俊	俊	俊	俊	俊	俊	俊	俊	俊	俊
BxH	愠	愠	愠	愠	愠	愠	愠	愠	愠	愠	愠	愠	愠	愠	愠	愠
CxH	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨
DxH	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨
ExH	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨
FxH	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨	愨

9D	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	戛	戛	戛	戛	戛	戛	戛	戛	戛	戛	戛	戛	戛	戛	戛	戛
5xH	抉	抉	抉	抉	抉	抉	抉	抉	抉	抉	抉	抉	抉	抉	抉	抉
6xH	拜	拜	拜	拜	拜	拜	拜	拜	拜	拜	拜	拜	拜	拜	拜	拜
7xH	挾	挾	挾	挾	挾	挾	挾	挾	挾	挾	挾	挾	挾	挾	挾	挾
8xH	振	振	振	振	振	振	振	振	振	振	振	振	振	振	振	振
9xH	攝	攝	攝	攝	攝	攝	攝	攝	攝	攝	攝	攝	攝	攝	攝	攝
AxH	擒	擒	擒	擒	擒	擒	擒	擒	擒	擒	擒	擒	擒	擒	擒	擒
BxH	擴	擴	擴	擴	擴	擴	擴	擴	擴	擴	擴	擴	擴	擴	擴	擴
CxH	收	收	收	收	收	收	收	收	收	收	收	收	收	收	收	收
DxH	斷	斷	斷	斷	斷	斷	斷	斷	斷	斷	斷	斷	斷	斷	斷	斷
ExH	杏	杏	杏	杏	杏	杏	杏	杏	杏	杏	杏	杏	杏	杏	杏	杏
FxH	晰	晰	晰	晰	晰	晰	晰	晰	晰	晰	晰	晰	晰	晰	晰	晰

9E	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	曄	曄	曄	曄	曄	曄	曄	曄	曄	曄	曄	曄	曄	曄	曄	曄
5xH	霸	霸	霸	霸	霸	霸	霸	霸	霸	霸	霸	霸	霸	霸	霸	霸
6xH	杼	杼	杼	杼	杼	杼	杼	杼	杼	杼	杼	杼	杼	杼	杼	杼
7xH	拆	拆	拆	拆	拆	拆	拆	拆	拆	拆	拆	拆	拆	拆	拆	拆
8xH	梳	梳	梳	梳	梳	梳	梳	梳	梳	梳	梳	梳	梳	梳	梳	梳
9xH	梵	梵	梵	梵	梵	梵	梵	梵	梵	梵	梵	梵	梵	梵	梵	梵
AxH	棧	棧	棧	棧	棧	棧	棧	棧	棧	棧	棧	棧	棧	棧	棧	棧
BxH	輪	輪	輪	輪	輪	輪	輪	輪	輪	輪	輪	輪	輪	輪	輪	輪
CxH	棟	棟	棟	棟	棟	棟	棟	棟	棟	棟	棟	棟	棟	棟	棟	棟
DxH	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞
ExH	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞
FxH	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞	樞

9F	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩
5xH	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩	槩
6xH	戲	戲	戲	戲	戲	戲	戲	戲	戲	戲	戲	戲	戲	戲	戲	戲
7xH	彈	彈	彈	彈	彈	彈	彈	彈	彈	彈	彈	彈	彈	彈	彈	彈
8xH	麾	麾	麾	麾	麾	麾	麾	麾	麾	麾	麾	麾	麾	麾	麾	麾
9xH	汾	汾	汾	汾	汾	汾	汾	汾	汾	汾	汾	汾	汾	汾	汾	汾
AxH	泛	泛	泛	泛	泛	泛	泛	泛	泛	泛	泛	泛	泛	泛	泛	泛
BxH	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓
CxH	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓	涓
DxH	渙	渙	渙	渙	渙	渙	渙	渙	渙	渙	渙	渙	渙	渙	渙	渙
ExH	游	游	游	游	游	游	游	游	游	游	游	游	游	游	游	游
FxH	溟	溟	溟	溟	溟	溟	溟	溟	溟	溟	溟	溟	溟	溟	溟	溟

EO	x0H	x1H	x2H	x3H	x4H	x5H	x6H	x7H	x8H	x9H	xAH	xBH	xCH	xDH	xEH	xFH
4xH	漾	漾	漾	漾	漾	漾	漾	漾	漾	漾	漾	漾	漾	漾	漾	漾
5xH	漚	漚	漚	漚	漚	漚	漚	漚	漚	漚	漚	漚	漚	漚	漚	漚
6xH	濮	濮	濮	濮	濮	濮	濮	濮	濮	濮	濮	濮	濮	濮	濮	濮
7xH	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾	瀾
8xH	烙	烙	烙	烙	烙	烙	烙	烙	烙	烙	烙	烙	烙	烙	烙	烙
9xH	煩	煩	煩	煩	煩	煩	煩	煩	煩	煩	煩	煩	煩	煩	煩	煩
AxH	耀	耀	耀	耀	耀	耀	耀	耀	耀	耀	耀	耀	耀	耀	耀	耀
BxH	牴	牴	牴	牴	牴	牴	牴	牴	牴	牴	牴	牴	牴	牴	牴	牴
CxH	貉	貉	貉	貉	貉	貉	貉	貉	貉	貉	貉	貉	貉	貉	貉	貉
DxH	獎	獎	獎	獎	獎	獎	獎	獎	獎	獎	獎	獎	獎	獎	獎	獎
ExH	珥	珥	珥	珥	珥	珥	珥	珥	珥	珥	珥	珥	珥	珥	珥	珥
FxH	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩	瑩

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8.0 CONNECTOR INTERFACE

8.1 NAELW2106AA

The hardware interface to the module is via a 5-position USB micro-B connector (J3).

Pin	Function
1	5V
2	USB D-
3	USB D+
4	NC
5	GND

Connector: Hirose p/n ZX62-B-5PA(33)
(shield connected to ground via ferrite bead)

8.2 NAELW2106BA

The hardware interface to the module is via a 5-position connector (J1).

Pin	Function
1	5V
2	GND
3	GND
4	USB D-
5	USB D+

Connector: FCI p/n 10114830-11105LF

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9.0 USB CONFIGURATION

9.1 STANDARD DEVICE DESCRIPTOR

Offset	Field	Description	Size	Value	Comment
0	bLength	Size of descriptor in bytes	1	12h	
1	bDescriptorType	Device descriptor type	1	01h	
2, 3	bcdUSB	USB release number in BCD	2	0200h	rev 2.0
4	bDeviceClass	Class code	1	00h	
5	bDeviceSubClass	Subclass code	1	00h	
6	bDeviceProtocol	Protocol code	1	00h	
7	bMaxPacketSize	Max packet size for endpoints	1	40h	64 bytes
8, 9	idVendor	Vendor ID	2	1008h	Futaba
10, 11	idProduct	Product ID	2	103Bh	
12, 13	bcdDevice	Device release number in BCD	2	6549h	FW version
14	iManufacturer	Index of string descriptor describing manufacturer	1	01h	Futaba
15	iProduct	Index of string descriptor describing product	1	02h	NAELW2106xx
16	iSerialNumber	Index of string descriptor describing device serial number	1	00h	
17	bNumConfigurations	Number of possible configurations	1	01h	

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9.2 STANDARD CONFIGURATION DESCRIPTOR

Offset	Field	Description	Size	Value	Comment
0	bLength	Size of descriptor in bytes	1	09h	
1	bDescriptorType	Configuration descriptor type	1	02h	
2, 3	bTotalLength	Total length of data returned for this configuration	2	0029h	41 bytes
4	bNumInterfaces	Number of interfaces supported by this interface	1	01h	
5	bConfigurationValue	Value to use as an argument	1	01h	
6	bConfiguration	Index of string descriptor describing this configuration	1	03h	OLED
7	bmAttributes	Configuration characteristics	1	80h	Bus powered Disable Remove Wakeup
8	bMaxPower	Maximum power consumption	1	69h	210mA

9.3 INTERFACE DESCRIPTOR

Offset	Field	Description	Size	Value	Comment
0	bLength	Size of descriptor in bytes	1	09h	
1	bDescriptorType	Interface descriptor type	1	04h	
2	bInterfaceNumber	Number of this interface	1	00h	
3	bAlternateSetting	Value used to select this alternate setting	1	00h	
4	bNumEndpoints	Number of endpoints used by this interface	1	02h	IN, OUT
5	bInterfaceClass	Class code	1	03h	HID
6	bInterfaceSubClass	Subclass code	1	00h	
7	bInterfaceProtocol	Protocol code	1	00h	
8	iInterface	Index of string descriptor describing this interface	1	04h	OLED control

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9.4 IN ENDPOINT DESCRIPTOR

Offset	Field	Description	Size	Value	Comment
0	bLength	Size of this descriptor in bytes	1	07h	
1	bDescriptorType	Endpoint descriptor type	1	05h	
2	bEndpointAddress	The address of the endpoint on the USB device described by this descriptor	1	81h	EP1, IN
3	bmAttributes	The endpoint's attributes	1	03h	Interrupt transfer
4	wMaxPacketSize	Maximum packet size of this endpoint	1	40h	64 Bytes
5	bInterval	Interval for polling endpoint data transfers	1	FFh	255 mS

9.5 OUT ENDPOINT DESCRIPTOR

Offset	Field	Description	Size	Value	Comment
0	bLength	Size of this descriptor in bytes	1	07h	
1	bDescriptorType	Endpoint descriptor type	1	05h	
2	bEndpointAddress	The address of the endpoint on the USB device described by this descriptor	1	01h	EP1, OUT
3	bmAttributes	The endpoint's attributes	1	03h	Interrupt transfer
4	wMaxPacketSize	Maximum packet size of this endpoint	1	40h	64 Bytes
5	bInterval	Interval for polling endpoint data transfers	1	01h	1 mS

9.6 HID CLASS DESCRIPTOR

Offset	Field	Description	Size	Value	Comment
0	bLength	Size of HID descriptor	1	09h	
1	bDescriptorType	HID descriptor type	1	21h	
2, 3	bcdHID	HID class specification	2	0110h	HID rev 1.10
4	bCountryCode	Country code of localized hardware	1	00h	
5	bNumDescriptors	Number of class descriptors	1	01h	
6	bDescriptorType	Type of class descriptor	1	22h	
7, 8	bDescriptorLength	Descriptor length	2	002Fh	47 bytes

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9.7 HID CLASS REPORT DESCRIPTOR

Main Item Type	Value	Description
Usage Page	06h, 00h, FFh	Vendor defined
Usage	09h, 00h	OLED control
Collection	A1h, 01h	Application
Usage	09h, 02h	Data input
Logical Minimum	15h, 00h	0
Logical Maximum	26h, FFh, 00h	255
Report Size	75h, 08h	8 bits
Report Count	95h, 40h	64 bytes
Input	81h, 02h	Data, variable, absolute
Usage	09h, 03h	Data output
Logical Minimum	15h, 00h	0
Logical Maximum	26h, FFh, 00h	255
Report Size	75h, 08h	8 bits
Report Count	95h, 40h	64 bytes
Output	91h, 02h	Data, variable, absolute
Usage	09h, 04h	Feature
Logical Minimum	15h, 00h	0
Logical Maximum	26h, FFh, 00h	255
Report Size	75h, 08h	8 bits
Report Count	95h, 40h	64 bytes
Feature	B1h, 02h	Data, variable, absolute
End Collection	C0h	End collection

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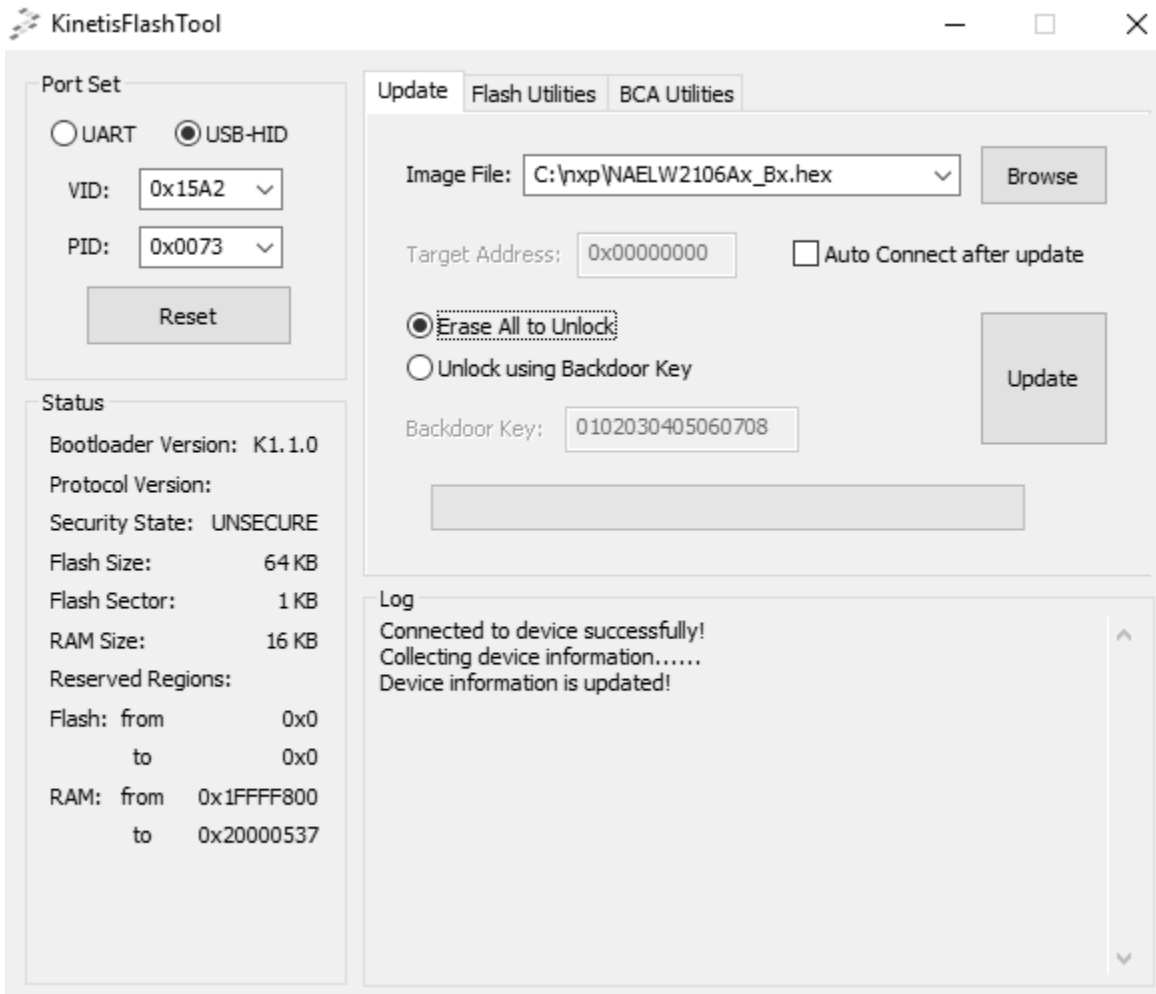
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10.0 SOFTWARE BOOTLOADER

The built-in bootloader allows the module’s software to be updated over USB using NXP’s Kinetis Flash Tool (or equivalent). The USB bootloader is enabled for 1/2 second at power up using VID 0x15A2 and PID 0x0073, afterwards normal USB operation begins with VID 0x1008 and PID 0x103B. See the Kinetis Flash Tool User’s Guide for details.



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