INDUSTRY STANDARD FOR DIGITAL CONTENTS

BOPOMOFO TYPOGRAPHY IN DIGITAL CONTENTS

tion : 2019-11-

Contents

Disclaimer 1
Preface 1
1. Scope of Application 2
2. Normative Reference 2
3. Terminology 3
3.1 Bopomofo(zhuyin fuhao) 3
3.2 Bopomofo for dialect 3
3.3 Entering tone coda 3
3.4 Character 4
3.5 Glyph 4
3.6 Unicode Encoding 4
3.7 General Category 4
3.8 OpenType 5
3.9 OpenType Layout 5
3.10 OpenType Tables 5
3.11 Registered OpenType feature tags 5
3.12 Alternative glyph 6
3.13 vert 6
3.14 salt 6
3.15 hist 7
3.16 ccmp 7
3.17 vmtx 7
3.18 Unicode Annex 50 7
4. Description of data structure and layout rules of Bopomofo symbols 8
4.1 Symbols of Bopomofo 8
4.2 Bopomofo basic layout in vertical writing 8
4.3 Bopomofo basic layout in horizontal writing 10
4.4 Bopomofo inline layout 11
4.5 Current Bopomofo layout in digital content 12
5. UCS code points 15
5.1 Bopomofo symbols 15
5.2 Coda symbols 17
5.3 Normal tone marks 18

5.4 Light tone mark (Mandarin, front) 19
5.5 Light tone mark (Min-Nan, side) 19
6. Requirement for implement of OpenType Layout 20
6.1 Default form in horizontal writing 20
6.2 ccmp feature 20
6.3 vert feature 21
6.4 salt feature 22
6.5 hist feature 22
Appendix A. Layout rule for Bopomofo in horizontal and 23
Appendix B. Recommendation for glyph design 24
Appendix C. Sample for OpenType font implement 25
Appendix D. Method to force tone mark upright on web 32

Disclaimer

This standard is reviewed by National Standards Review Committee and published by competent authority as National Standard of Republic of China in accordance with Standard Act.

According to Art.4 of Standard Act, National Standard is voluntary. But all or a part of the standard is quoted by competent authority as Law should be mandatory. Content itself as Law should be mandatory.

The standard do not recommend all possible concern about safety. Before using this standard please establish process for safety and follow laws and regulations.

Part of this standard may infringe rights of patents, copyright and trademarks. competent authority and standard authority are not responsible for identifying any or all of rights of patents, copyright and trademarks.

Preface

This standard is to use international open standard for font: OpenType to adjust positions of tone marks of Mandarin Bopomofo and Min-Nan Bopomofo, to complete the layout requirement by Ministry of Education.

1. Scope of Application

This standard applied to:

- Bopomofo string encoded in CNS 14649 (as Universal Coded Character Set, UCS) encode.
- Text render and layout engine supports OpenType technology, such as: DirectWrite by Microsoft, CoreText by Apple, and open source project harfbuzz.
- Web browsers, text processing applications, desktop publishing applications, and ebook reading systems
- String follows rules of Bopomofo symbols and tone marks order by this standard.

Note 1: This standard is only for adjustment of tone marks position with Bopomofo symbols, do not include the function to put Bopomofo aside to Han Character.

Note 2: This standard do not involve font design and layout details in aesthetic aspect.

2. Normative Reference

Standards listed below is referred by this standard to be a part of it. Normative Reference is up-to-date version (with its appendix and amendment).

CNS 11643	CSIC, Chinese Standard Interchange Code
CNS 14649	Universal multiple - Octet coded character Set (UCS)
ISO/IEC 10646:2017	Universal Coded Character Set (UCS)
Microsoft Typography	OpenType specification version 1.8.3
Ministry of Education	The Manual of the Phonetic Symbols of Mandarin Chinese Bopomofo System of Dialect

3. Terminology

The following terminology and definition applied to this standard

3.1 Bopomofo(zhuyin fuhao)

A phonetic system for Mandarin published by Ministry of Education, used for language learning in basic education.

Note: Main reference is “The Manual of the Phonetic Symbols of Mandarin Chinese” published by Ministry of Education in 2000.

3.2 Bopomofo for dialect

A supplement for Mandarin Bopomofo system, majorly applied for pronunciation and spelling in dialect Min-nan.

Note: Ministry of Education published “Phonetic System for Dialect” in document “台(87)語字 87000577” is supplement for Bopomofo System to expand support for Min-nan spelling. But the document only listed symbols and pronunciations, did not provide sample for layout as “The Manual of the Phonetic Symbols of Mandarin Chinese”. This standard referred “國臺對照活用辭典”(2000, Taipei, Yuan-Liou publishing), edited by Prof. Soli Wu, department of Chinese literature, National Taiwan University, for layout of Bopomofo for dialect.

3.3 Entering tone coda

Entering tone coda is short stop consonant tone in Min-Nan. Usually marked with small tone marks as ㄣ(p)、ㄉ(d)、ㄎ(k)、ㄏ(h)、ㄍ(k). If Entering tone only show by tone marks is ying-entering (fourth tone), with a dot above is yang-entering (eighth tone).

3.4 Character

Character is a member of character set, used for organize, control or display textual data.

Note: A character's glyph can be displayed by one or several coded characters.

3.5 Glyph

Glyph is a pictograph for display character's shape in a font file. A character could have several glyphs for replace (e.g. for horizontal writing or for vertical writing). Replacement defines in 3.10 GSUB tables.

3.6 Unicode Encoding

CNS 14649 encoded all characters of all languages in U+XXXX or U+XXXXXX format (X is a hexadecimal digit), also included Han characters and symbols. In this standard, Characters use Unicode Encoding that equals to CNS 14649.

3.7 General Category

A value assigned to each UCS code point determines major category of the code point, such as: letter, punctuation, and symbol.

3.8 OpenType

A format of digital font, formed and published by Microsoft and Adobe in 1996, and became international standard ISO/IEC 14496-22 in 1997. OpenType uses Unicode Encoding and supported by many operation systems.

3.9 OpenType Layout

Extend function for layout in OpenType specification, it is used for adjusting position of tone marks.

3.10 OpenType Tables

Tables are used to register control information in OpenType font format. OpenType Layout function could use those information to adjust.

Note: Tables related to this standard listed below:

(a) GPOS (The Glyph Positioning Table)
When text need placed in complex layout, this function can provide precisely position adjustment, to fit language's layout requirement and writing habit.

(b) GSUB (The Glyph Substitution Table)
In some language, when a text follows other text or in a special sequence, it should be displayed by alternative glyph, this function can provide substitution information for replacement.

3.11 Registered OpenType feature tags

Features defined in GPOS, GSUB tables in OpenType font, it's tag in 4 letters, and registered with its usage in OpenType feature. Some registered OpenType feature are alternative on, some should be turned on manually. Besides its tag, there are full name,

proposed organization, function, sample, description and limitation in document maintained by Microsoft and Adobe.

Note: feature list referred to:
https://docs.microsoft.com/en-us/typography/opentype/spec/featurelist。

3.12 Alternative glyph

Glyphs in OpenType related to GSUB table and feature. Way to name the glyph is using the character's unicode code plus a dot and feature name. For example, substitution glyph for U+02D9 for vert feature can be named as "02D9.vert" .

3.13 vert

One of registered OpenType feature, full name is substitution glyph for vertical writing, applied for east asian languages. It uses GSUB table to substitute glyphs for vertical writing. This feature is default on.

3.14 salt

One of registered OpenType feature, full name is alternative style, applied for all languages. It uses GSUB table to provide alternative style for character. This feature should be turned on manually.

3.15 hist

One of registered OpenType feature, full name is historical form , applied for all languages. It uses GSUB table to provide historical form that a character used to be. This feature should be turned on manually.

3.16 ccmp

One of registered OpenType feature, full name is glyph composition/decomposition , applied for all languages. It recommends to use GSUB table to combine multiple sequential characters to one character or to divide one character to multiple characters. This feature is default on, and prior to other features in implement.

3.17 vmtx

A vertical metrics table in OpenType font to provide value of reference lines, such as glyph height, for alignment and other purposes.

3.18 Unicode Annex 50

This document’s purpose is for Chinese and Japanese, to adjust character’s display form in vertical writing. It provides several values for adjustment in vertical writing:

U: keep the character upright.

R: turn 90 degree clockwise.

Tu: display by substitute glyph, if not available, keep upright

Tr: display by substitute glyph, if not available, turn 90 degree

4. Description of data structure and layout rules of Bopomofo symbols

4.1 Symbols of Bopomofo

All symbols that used by Bopomofo, including Bopomofo symbol, coda and tone marks listed as table 1.

TABLE 1 SYMBOLS USED BY BOPOMOFO SYSTEM

		Mandarin Chinese	Dialect expansion
Bopomofo (zhuyin fuhao)		ㄅㄆㄇㄈㄉㄊㄋㄌㄍㄎㄏㄐㄑㄒㄓㄔㄕㄖㄗㄘㄙㄧㄨㄩㄚㄛㄜㄝㄞㄟㄠㄡㄢㄣㄤㄥㄦ	ㄫㄬㄭㄮㄯ㄰ㄱㄲㄳㄴㄵㄶㄷㄸㄹㄺㄻㄼㄽㄾㄿㅀㅁㅂㅃㅄㅅㅆㅇㅈㅉㅊㅋㅌㅍㅎ
Coda symbols		N/A	ㄅㄉㄍ(ㄎ)ㄏㄅㄉㄍ(ㄎ)ㄏ
marks	Normal tone marks	ˊ ˇ ˋ	ㄴ ㅏ
	Light tone mark (Mandarin, front)	•	N/A
	Light tone mark (Min-Nan, side)	N/A	•

Note: first tone displayed as blank, do not occupy space in layout.

4.2 Bopomofo basic layout in vertical writing

Bopomofo Layout follows rule of “The Manual of the Phonetic Symbols of Mandarin Chinese” by Ministry of Education.

A syllable of Mandarin Bopomofo is composed with one to three Bopomofo symbols. **Normal tone marks** are marked on right side upper to last symbol (fig.1), its size is smaller than Bopomofo symbol, and do not occupied space inline.

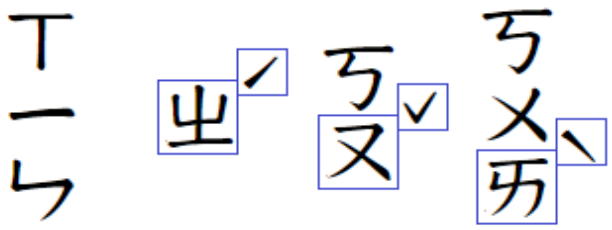

FIGURE 1 NORMAL TONE MARK POSITION IN VERTICAL WRITING

Light tone mark is marked on top of first symbol (fig.2), occupied propositional space inline.

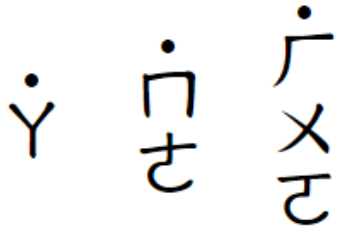

FIGURE 2 LIGHT TONE MARK POSITION IN VERTICAL WRITING

Bopomofo for Min-Nan may with coda symbol. Coda symbol is marked on right side lower to last symbol and aligned bottom edge, do not occupied space inline. Coda symbol may have a light tone mark attached above (fig.3).

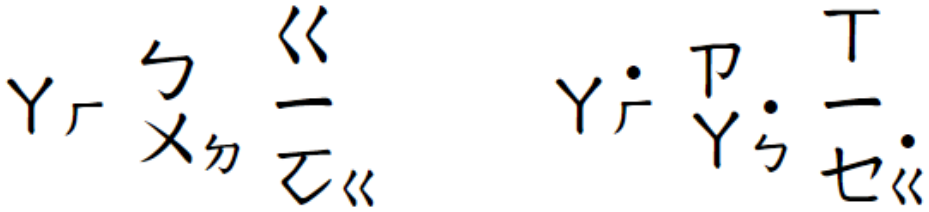

FIGURE 3 CODA SYMBOL POSITION IN VERTICAL WRITING

There's another light tone mark for Bopomofo for Min-Nan, marked on right side upper to last symbol. (fig. 4)

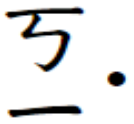

FIGURE 4 LIGHT TONE MARK (MIN-NAN) POSITION IN VERTICAL WRITING

4.3 Bopomofo basic layout in horizontal writing

A syllable of Mandarin Bopomofo is composed with one to three Bopomofo symbols.

Normal tone marks are marked on upper right to last symbol (fig.5), its size is smaller than Bopomofo symbol, and do not occupied space inline.

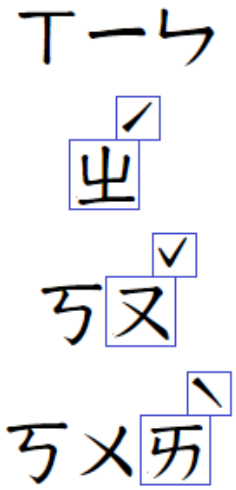

FIGURE 5 NORMAL TONE MARK POSITION IN HORIZONTAL WRITING

Light tone mark is marked before first symbol (fig.6), occupied propositional space inline.

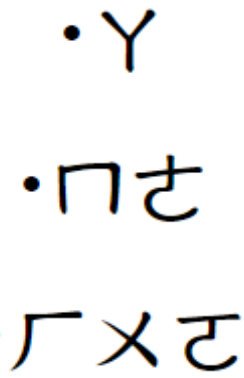

FIGURE 6 LIGHT TONE MARK POSITION IN HORIZONTAL WRITING

Bopomofo for Min-Nan may with **coda symbol**. **Coda symbol** is marked on right side lower to last symbol and aligned bottom edge, occupied propositional space inline. Coda symbol may have a **light tone mark** attached above (fig.7).

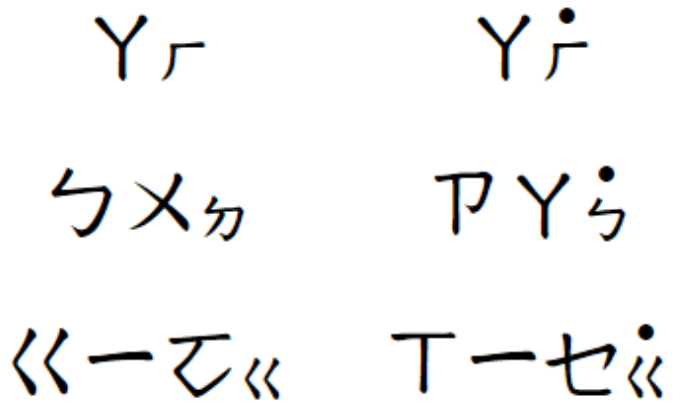

FIGURE 7 CODA SYMBOL POSITION IN HORIZONTAL WRITING

Traditionally, Bopomofo symbol “ㄧ ” and “ㆴ” in horizontal writing shall displayed in form as “ | ” and “ ㇴ ”. With time changing, Ministry of Education had changed the rule to recommend use “ㄧ ” and “ㆴ” in horizontal writing.

Light tone mark for Min-Nan does have any layout reference in horizontal writing.

4.4 Bopomofo inline layout

Bopomofo symbols are usually marked on right or upper side of Han character, but also appealed inline with Han character as well. Because they are not attached and divide by Han character, space should be placed between syllables to divide (fig. 8).

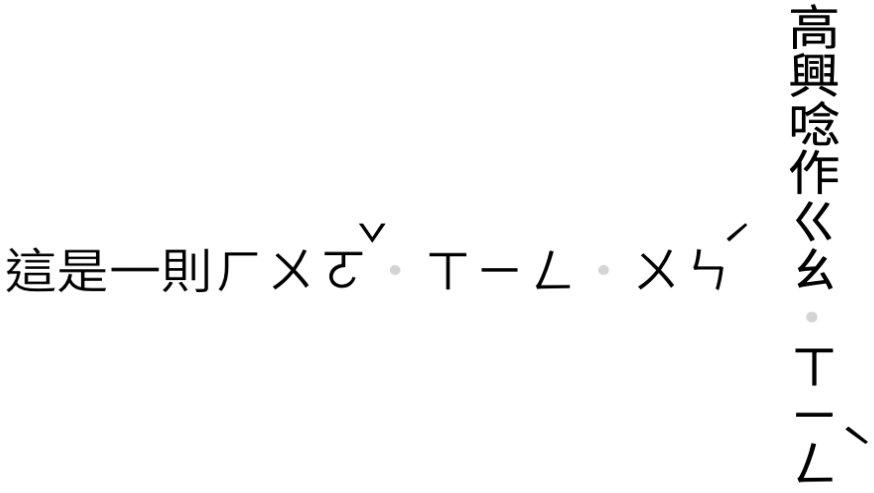

FIGURE 8 BOPOMOFO INLINE LAYOUT (GRAY DOT IS SPACE)

If syllables are not divided, they perhaps to be read as one syllable, also effect data sequence used by this standard to display inaccurate layout (fig. 9).

FIGURE 9 BOPOMOFO INLINE COULD BE READ AS ONE SYLLABLE WITHOUT SPACE

4.5 Current Bopomofo layout in digital content

Due to historical reasons, Bopomofo layout hardly to find a way to display in digital content. Currently people use three alternative ways listed below to let Bopomofo symbols and tone marks in horizontal writing to be aligned similar to rules.

To be specified, most of Chinese fonts do not include Bopomofo symbols for dialect, so there are no usage for Bopomofo for Min-Nan.

Bopomofo in vertical writing, “Bopomofo font” that combine Han character and it’s Bopomofo symbols and tone mark as a glyph, is frequently used. So there are no alternative way for layout.

Case 1. Traditional Chinese font with fullwidth tone marks, without style adjusted

Most Traditional Chinese fonts' (e.g. Microsoft Windows’ system fonts: MingLiU, BiauKai, and well known Chinese fonts made by Arphic, dynacomware…) tone marks follow the design in early 1990. There are fullwidth and their glyphs in the middle. The size is equal to Bopomofo symbol. In layout, doing nothing to its position, just placed after (before for **light tone mark**) Bopomofo symbol(s) (fig.10).

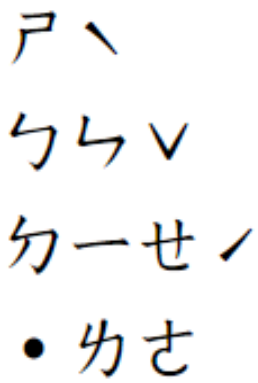

FIGURE 10 CASE 1: FULLWIDTH WITHOUT STYLE ADJUSTMENT

Case 2. Traditional Chinese font with fullwidth tone marks, with superscript

Some users applied superscript style on fonts in case 1. In text processing application like Microsoft Word, it's superscript style function; on web, it's <sup> tag. To let tone marks to be smaller and placed on right side upper. Because in this way, tone marks still occupied place, so it's not ideal for horizontal writing. (fig.11)

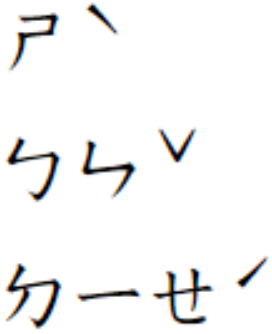

FIGURE 11 CASE 2: FULLWIDTH WITH SUPERSCRIPT STYLE

Case 3. Tone marks in proportional Latin form, glyph on upper side

In Unicode chart, tone marks are share same code points with Latin tone marks. Some new system fonts' (e.g. Microsoft ZhengHei for Microsoft Windows, PingFang for Apple's macOS and iOS, Noto CJK for Android) are designed in Latin form. On Web, due to font

fallback mechanism, tone marks sometimes display in Latin font as well. The glyphs inLatin form are obviously smaller than Bopomofo symbols and on upper side, their width also vary from fullwidth to proportional.

In this case, those glyphs cause inaccurate layout, the “ ´ “ is different with Bopomofo tone mark’s shape. They are too small for read. the only good is the position on the right side upper (fig 12).

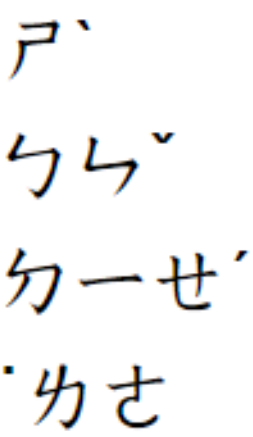

FIGURE 12 CASE 3: PROPORTIONAL LATIN FORM

5. UCS code points

5.1 Bopomofo symbols

Bopomofo symbols encoded in ISO/IEC 10646 (UCS) listed below as table 2.

Theoretically not all Bopomofo symbols can be followed by normal tone marks. In table 2, we made a column for that. But it is allowed to let normal tone marks follow all Bopomofo symbols and be placed on upper right.

TABLE 2 CODE POINTS OF BOPOMOFO SYMBOLS

symbol	UCS Code point	UCS name	Followed with normal tone maks	usage
ㄅ	U+3105	BOPOMOFO LETTER B		Mandarin, Min-Nan
ㄆ	U+3106	BOPOMOFO LETTER P		Mandarin, Min-Nan
ㄇ	U+3107	BOPOMOFO LETTER M		Mandarin, Min-Nan
ㄈ	U+3108	BOPOMOFO LETTER F		Mandarin
ㄉ	U+3109	BOPOMOFO LETTER D		Mandarin, Min-Nan
ㄊ	U+310A	BOPOMOFO LETTER T		Mandarin, Min-Nan
ㄋ	U+310B	BOPOMOFO LETTER N		Mandarin, Min-Nan
ㄌ	U+310C	BOPOMOFO LETTER L		Mandarin, Min-Nan
ㄍ	U+310D	BOPOMOFO LETTER G		Mandarin, Min-Nan
ㄎ	U+310E	BOPOMOFO LETTER K		Mandarin, Min-Nan
ㄏ	U+310F	BOPOMOFO LETTER H		Mandarin, Min-Nan
ㄐ	U+3110	BOPOMOFO LETTER J		Mandarin, Min-Nan
ㄑ	U+3111	BOPOMOFO LETTER Q		Mandarin, Min-Nan
ㄒ	U+3112	BOPOMOFO LETTER X		Mandarin, Min-Nan
ㄓ	U+3113	BOPOMOFO LETTER ZH	V	Mandarin
ㄔ	U+3114	BOPOMOFO LETTER CH	V	Mandarin
ㄕ	U+3115	BOPOMOFO LETTER SH	V	Mandarin
ㄖ	U+3116	BOPOMOFO LETTER R	V	Mandarin
ㄗ	U+3117	BOPOMOFO LETTER Z	V	Mandarin, Min-Nan
ㄘ	U+3118	BOPOMOFO LETTER C	V	Mandarin, Min-Nan
ㄙ	U+3119	BOPOMOFO LETTER S	V	Mandarin, Min-Nan
ㄚ	U+311A	BOPOMOFO LETTER A	V	Mandarin, Min-Nan

ㄛ	U+311B	BOPOMOFO LETTER O	V	Mandarin
ㄜ	U+311C	BOPOMOFO LETTER E	V	Mandarin, Min-Nan
ㄝ	U+311D	BOPOMOFO LETTER EH	V	Mandarin
ㄞ	U+311E	BOPOMOFO LETTER AI	V	Mandarin, Min-Nan
ㄟ	U+311F	BOPOMOFO LETTER EI	V	Mandarin
ㄠ	U+3120	BOPOMOFO LETTER AU	V	Mandarin, Min-Nan
ㄡ	U+3121	BOPOMOFO LETTER OU	V	Mandarin
ㄢ	U+3122	BOPOMOFO LETTER AN	V	Mandarin, Min-Nan
ㄣ	U+3123	BOPOMOFO LETTER EN	V	Mandarin, Min-Nan
ㄤ	U+3124	BOPOMOFO LETTER ANG	V	Mandarin, Min-Nan
ㄥ	U+3125	BOPOMOFO LETTER ENG	V	Mandarin, Min-Nan
ㄦ	U+3126	BOPOMOFO LETTER ER	V	Mandarin
ㄧ	U+3127 (1)	BOPOMOFO LETTER I	V	Mandarin, Min-Nan
ㄨ	U+3128	BOPOMOFO LETTER U	V	Mandarin, Min-Nan
ㄩ	U+3129	BOPOMOFO LETTER IU	V	Mandarin
ㆡ	U+312A	BOPOMOFO LETTER V		Wu
ㆢ	U+312B	BOPOMOFO LETTER NG		Mandarin, Min-Nan
ㆣ	U+312C	BOPOMOFO LETTER GN		Wu
ㆤ	U+312D	BOPOMOFO LETTER IH	V	Description for pronunciation
ㆥ	U+312E	BOPOMOFO LETTER O WITH DOT ABOVE	V	old ㄜ form
ㆦ	U+312F	BOPOMOFO LETTER NN	V	Description for pronunciation
ㆧ	U+31A0	BOPOMOFO LETTER BU		Min-Nan
ㆨ	U+31A1	BOPOMOFO LETTER ZI		Min-Nan
ㆩ	U+31A2	BOPOMOFO LETTER JI		Min-Nan
ㆪ	U+31A3	BOPOMOFO LETTER GU		Min-Nan
ㆫ	U+31A4	BOPOMOFO LETTER EE	V	Min-Nan
ㆬ	U+31A5	BOPOMOFO LETTER ENN	V	Min-Nan
ㆭ	U+31A6	BOPOMOFO LETTER OO	V	Min-Nan
ㆮ	U+31A7	BOPOMOFO LETTER ONN	V	Min-Nan
ㆯ	U+31A8	BOPOMOFO LETTER IR	V	Min-Nan
ㆰ	U+31A9	BOPOMOFO LETTER ANN	V	Min-Nan
ㆱ	U+31AA (2)	BOPOMOFO LETTER INN	V	Min-Nan
ㆲ	U+31AB	BOPOMOFO LETTER UNN	V	Min-Nan
ㆳ	U+31AC	BOPOMOFO LETTER IM	V	Min-Nan

ㄫ	U+31AD	BOPOMOFO LETTER NGG	V	Min-Nan
ㆭ	U+31AE	BOPOMOFO LETTER AINN	V	Min-Nan
ㆮ	U+31AF	BOPOMOFO LETTER AUNN	V	Min-Nan
ㆯ	U+31B0	BOPOMOFO LETTER AM	V	Min-Nan
ㆰ	U+31B1	BOPOMOFO LETTER OM	V	Min-Nan
ㆱ	U+31B2	BOPOMOFO LETTER ONG	V	Min-Nan
ㆲ	U+31B3 (2)	BOPOMOFO LETTER INNN	V	Min-Nan

Note (1): "ー" in both horizontal and vertical writing should be displayed as "ー". For some reason author want to let it displayed as " | ", we recommend to used OpenType feature 'hist' to switch the glyph in horizontal writing. And it should be revert to "ー" in vertical writing.

Note(2): " ㆲ " is traditional horizontal writing form of "ㅡ". However we recommend to follow "ー" rule to let "ㅡ" as "ㅡ" in both horizontal and vertical writing. Author should use U+31AA. Font should let " ㆲ " to be substituted by "ㅡ" in vertical writing.

5.2 Coda symbols

Coda symbols encoded in ISO/IEC 10646 (UCS) listed below as table 3. Coda symbols only used in Min-Nan. The design of coda symbols refers to Appendix B.

TABLE 3 CODE POINTS OF CODA SYMBOLS

symbol	UCS Code point	UCS name
ㆴ	U+31B4	BOPOMOFO FINAL LETTER P
ㆵ	U+31B5	BOPOMOFO FINAL LETTER T
ㆻ	U+31BB (*)	BOPOMOFO FINAL LETTER G
ㆶ	U+31B7	BOPOMOFO FINAL LETTER H
ㆷ	U+31B6	BOPOMOFO FINAL LETTER K

Note *: U+31BB will be publish in Unicode version 13.

Coda symbols with dot above encoded in sequential way, add U+02D9 to code points in table 3.

TABLE 4 CODE POINT SEQUENCES OF CODA SYMBOLS WITH DOT ABOVE

Symbol	UCS code point
ㄣ	U+31B4 U+02D9
ㄥ	U+31B5 U+02D9
ㄻ	U+31BB U+02D9
ㄧ	U+31B7 U+02D9
ㄤ	U+31B6 U+02D9

5.3 Normal tone marks

Normal tone marks usage and code points listed as table 5. Normal tone mark usually be placed on upper right of last Bopomofo symbol, upper side right when in horizontal writing and right side upper in vertical writing, the position is slightly different (refers to 4.2 and 4.3). The design of normal tone mark refers to Appendix B.

TABLE 5 CODE POINTS OF NORMAL TONE MARKS

Tone mark	UCS code point	General Category	usage
ˊ	U+02CA	Lm	Mandarin 2nd tone (YangEven) Min-Nan 5th tone (YangEven)
ˇ	U+02C7	Lm	Mandarin 3rd tone (departing)
ˋ	U+02CB	Lm	Mandarin 4th tone (departing) Min-Nan 2nd tone (YingRising)
˪	U+02EA	Sk	Min-Nan 3rd tone (YingDeparting)
˫	U+02EB	Sk	Min-Nan 7th tone (YangDeparting)

5.4 Light tone mark (Mandarin, front)

Light tone mark for Mandarin's code point in table 6. It should be placed before Bopomofo symbols and occupied space.

TABLE 6 CODE POINT OF LIGHT TONE MARK FOR MANDARIN

Tone mark	UCS code point
•	U+02D9

5.5 Light tone mark (Min-Nan, side)

Light tone mark for Min-Nan's code point in table 7. It should be placed after Bopomofo symbols and on upper right of last symbol. (fig.4)

It share same code point with 5.2 Coda symbols sequence and 5.4 Light tone mark for Mandarin. It should be dealt as Light tone mark for Min-Nan only when "after" Bopomofo symbols.

TABLE 7 CODE POINT OF LIGHT TONE MARK FOR MIN-NAN

Tone mark	UCS code point
•	U+02D9

6. Requirement for implement of OpenType Layout

This chapter describe expected behavior for each feature on implement of OpenType font. This standard do not restrict how to imply. Appendix C provides a sample of implementation as a sample.

6.1 Default form in horizontal writing

To avoid making change to current document, **normal tone marks** do **not** turn on OpenType feature by default in horizontal writing.

Coda symbols and **Light tone mark** for Min-Nan are better to be turned on by default.

Default form in horizontal writing as figure 13, doing nothing to normal tone marks, but **coda symbols** and **light tone mark** for Min-Nan are in right position.

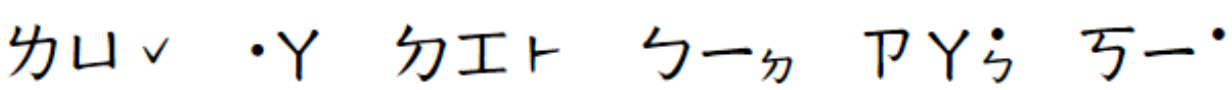

FIGURE 13 DEFAULT FORM IN HORIZONTAL WRITING

6.2 ccmp feature

Coda symbols with a dot above is defined in 5.2 in a sequential way, so that should be combined in advance. When U+02D9 appeals after any of 5 **coda symbols**, ccmp should be active to combine them to **coda symbols** with dot above as figure 14.

FIGURE 14 COMBINE CODA SYMBOLS WITH DOT ABOVE

Light tone mark for Min-Nan defined in 5.5 should be replaced too. When U+02D9 appeals after any of Bopomofo symbols, it should be combined as dot on upper right side as figure 15.

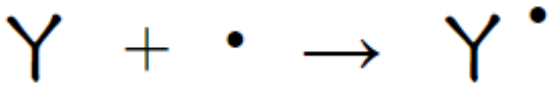

FIGURE 15 SUBSTITUTION OF LIGHT TONE MARK FOR MIN-NAN

6.3 vert feature

In vertical writing, Light tone mark for mandarin should be replaced by vertical glyph as figure 16.

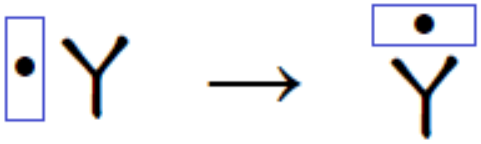

FIGURE 16 REPLACE LIGHT TONE MARK FOR MANDARIN IN VERTICAL WRITING

Normal tone marks' position should be adjusted in vertical writing as figure 17.

Code point combination: [Bopomofo symbols] + [Normal tone mark]

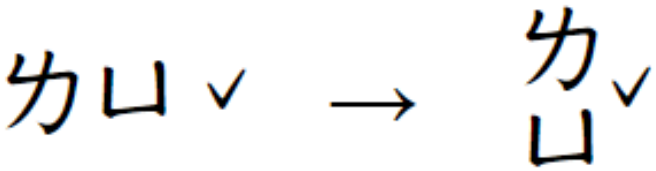

FIGURE 17 REPLACE NORMAL TONE MARK IN VERTICAL WRITING

And coda symbols' position should be adjusted to right side of last Bopomofo symbol in vertical writing as figure 18.

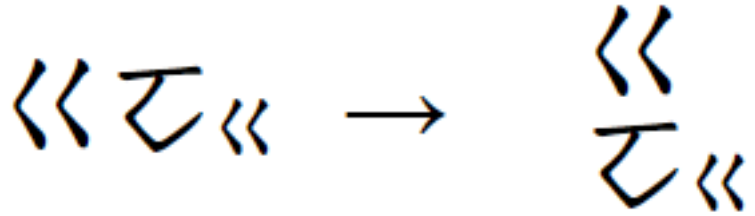

FIGURE 18 REPLACE CODA SYMBOL IN VERTICAL WRITING

6.4 salt feature

If salt be turn on by default, it could change current document's layout (for example, with <sup> or superscript style, adjusted twice to let tone mark higher than line-height) to be trouble for users. So in this standard we recommend to design tone mark as 4.5 case 1: fullwidth and glyph in the middle.

In horizontal writing, author can manually turn on OpenType feature 'salt' to let tone mark's position fit the layout rule, as figure 19.

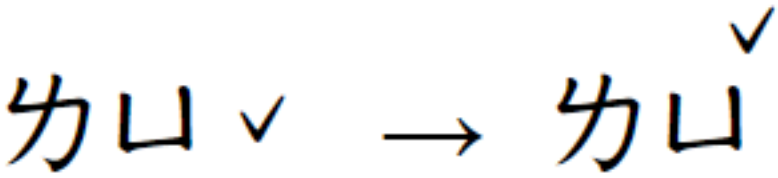

FIGURE 19 REPLACE TONE MARK IN HORIZONTAL WRITING WITH SALT FEATURE

6.5 hist feature

As mentioned in 4.3 and 5.1, "一" and "𠂤" whether in horizontal or vertical writing, should keep in this style. But it is optional to provide their historical form (" 丨 " and " 𠃌 ") in horizontal writing by OpenType 'hist' feature.

Appendix A. Layout rule for Bopomofo in horizontal and vertical writing

Bopomofo layout in horizontal and vertical writing for Mandarin and Min-Nan listed as table A.1.

TABLE A.1 BOPOMOFO LAYOUT BY WRITING MODE AND TONES FOR MANDARIN AND MIN-NAN

國語 Mandarin		
	橫排	直排
輕聲	·ㄇㄚ 嘛	嘛 ·ㄇㄚ
一聲 (陰平)	ㄇㄚ 媽	媽 ㄇㄚ
二聲 (陽平)	ㄇㄚˊ 麻	麻 ㄇㄚˊ
第三聲 (上聲)	ㄇㄚˇ 馬	馬 ㄇㄚˇ
第四聲 (去聲)	ㄇㄚˋ 罵	罵 ㄇㄚˋ

閩南語 Min-nan		
	橫排	直排
輕讀	ㄎㄧˋ· 去	去 ㄎㄧˋ·
第一聲 (陰平)	ㄉㄨㄥ 東	東 ㄉㄨㄥ
第二聲 (陰上)	ㄉㄨㄥˋ 黨	黨 ㄉㄨㄥˋ
第三聲 (陰去)	ㄉㄨㄥㄣ 棟	棟 ㄉㄨㄥㄣ
第四聲 (陰入)	ㄉㄛㄍ 督	督 ㄉㄛㄍ
第五聲 (陽平)	ㄉㄨㄥˊ 同	同 ㄉㄨㄥˊ
第七聲 (陽去)	ㄉㄨㄥㄢ 洞	洞 ㄉㄨㄥㄢ
第八聲 (陽入)	ㄉㄛㄍ˙ 毒	毒 ㄉㄛㄍ˙

Appendix B. Recommendation for glyph design

We recommend to design tone marks and coda symbols in following proportion to get best result with this standard.

B.1 Normal tone marks are fullwidth and smaller than Bopomofo symbols

Normal tone marks should be full width with its glyph in the middle. Considering to align with Bopomofo symbols, it's size should be around two-thirds(2/3) of Bopomofo symbols, as figure B.1.

FIGURE B.1 DESIGN SAMPLE FOR NORMAL TONE MARKS

B.2 Coda symbols are halfwidth and aligned to bottom

Coda symbols (refers to table 4) should be half width and the glyph in the bottom. It's size should be half of Bopomofo symbols as figure B.2.

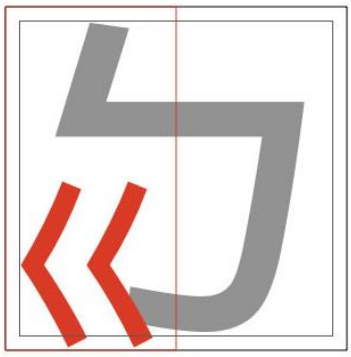

FIGURE B.2 DESIGN SAMPLE FOR CODA SYMBOLS

Appendix C. Sample for OpenType font implement

This appendix provides an implement sample that fits requirement in chapter 6.

OpenType Layout syntax used AFDKO (Adobe Font Development Kit for OpenType) format. Currently most of environments highly support GSUB, but not stable for GPOS. So that this sample only use GSUB for tone mark position adjustment.

To use GSUB, multiple substitutional glyphs should be defined and all of them are outside (the glyphs are placed out of Ideographic character face). A known issue is that positioning depends on design of substitutional glyph, in normal situation i.e. letter-spacing = 0, tone mark will be in right space. But when letter=spacing is not 0 or in some situation that a paragraph justified to add some space between letters, the tone mark position will be slightly away.

In figure C.1 and C.2, metrics of sample glyphs are width in horizontal writing (i.e. hmtx of OpenType), and the glyphs used in vertical writing (with a .v after) , their metrics are with in vertical writing (vmtx of OpenType).

C.1 Samples of glyph design

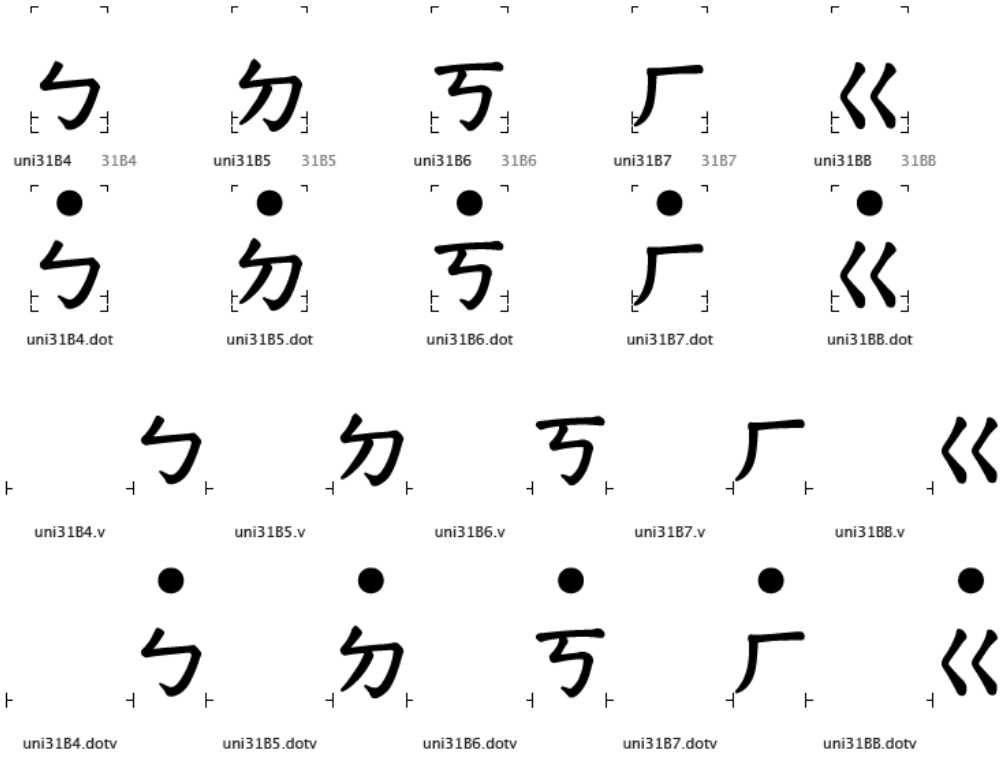

FIGURE C.1 DESIGN SAMPLE FOR CODA SYMBOLS

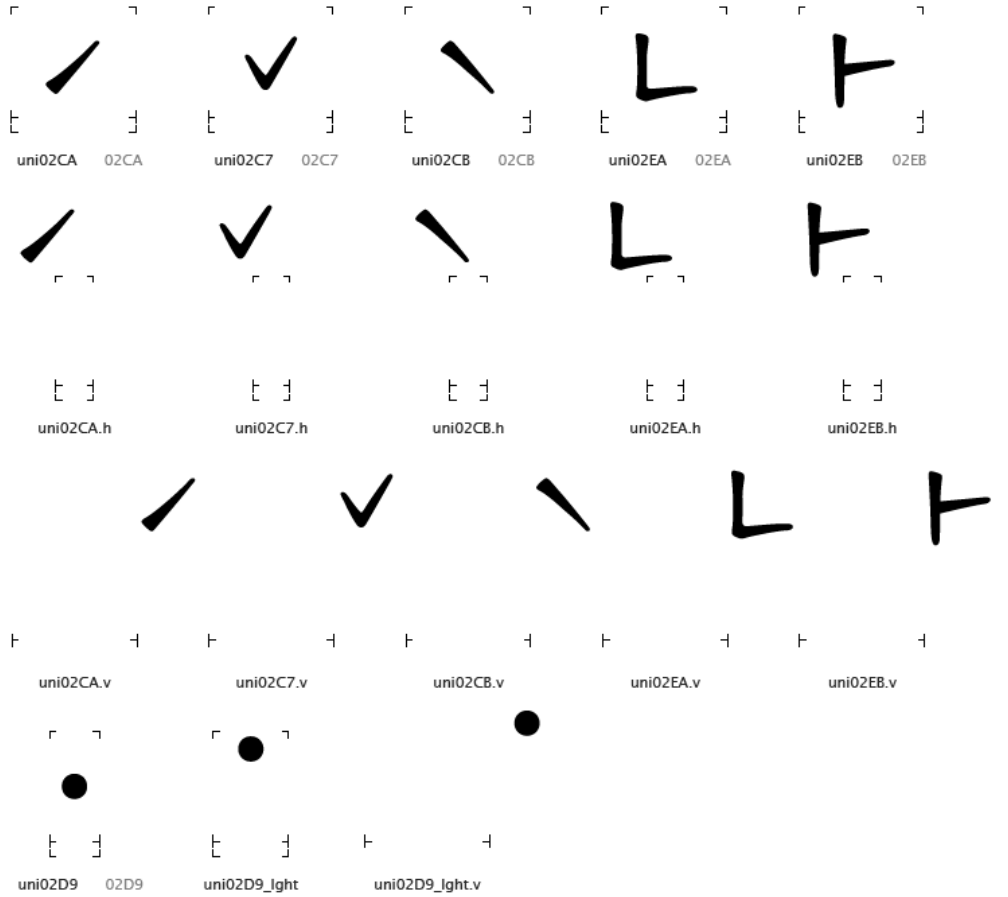

FIGURE C.2 DESIGN SAMPLE FOR TONE MARKS

U+02D9 for light tone mark should define both hmtx and vmtx to let it in the middle when in vertical writing, not necessary to use vert for replacement.

Coda symbols and vertical substitutional glyphs for tone marks do not occupy space inline, theoretically their height should be 0. But Chromium need the value to 1 to show as intend.

Here listed vmtx for reference

```
table vmtx {
    VertOriginY  uni02D9 640;
    VertAdvanceY uni02D9 400;
    VertAdvanceY uni02D9_lght.v 1;
    VertAdvanceY uni31B4.v 1;
    VertAdvanceY uni31B5.v 1;
    VertAdvanceY uni31B6.v 1;
    VertAdvanceY uni31B7.v 1;
    VertAdvanceY uni31BB.v 1;
    VertAdvanceY uni31B4.dotv 1;
    VertAdvanceY uni31B5.dotv 1;
    VertAdvanceY uni31B6.dotv 1;
    VertAdvanceY uni31B7.dotv 1;
    VertAdvanceY uni31BB.dotv 1;
    VertAdvanceY uni02CA.v 1;
```

```
    VertAdvanceY uni02C7.v 1;
    VertAdvanceY uni02CB.v 1;
    VertAdvanceY uni02EA.v 1;
    VertAdvanceY uni02EB.v 1;
} vmtx;
```

C.2 Definition for glyph groups

```
# Bopomofo Symbols

@Bopomofos = [
    uni3105 uni3106 uni3107 uni3108 uni3109 uni310A uni310B
    uni310C uni310D uni310E uni310F uni3110 uni3111 uni3112
    uni3113 uni3114 uni3115 uni3116 uni3117 uni3118 uni3119
    uni311A uni311B uni311C uni311D uni311E uni311F uni3120
    uni3121 uni3122 uni3123 uni3124 uni3125 uni3126 uni3127
    uni3128 uni3129 uni312A uni312B uni312C uni312D uni312E
    uni312F uni31A0 uni31A1 uni31A2 uni31A3 uni31A4 uni31A5
    uni31A6 uni31A7 uni31A8 uni31A9 uni31AA uni31AB uni31AC
    uni31AD uni31AE uni31AF uni31B0 uni31B1 uni31B2 uni31B3
    uni3127.hist
];
# Coda symbols
```

```
@YunWei_H = [uni31B4 uni31B5 uni31B6 uni31B7 uni31BB];

@YunWei_V = [uni31B4.v uni31B5.v uni31B6.v uni31B7.v uni31BB.v];

# Coda symbols with dot above


@YunWeiDot_H = [uni31B4.dot uni31B5.dot uni31B6.dot

        uni31B7.dot uni31BB.dot];

@YunWeiDot_V = [uni31B4.dotv uni31B5.dotv uni31B6.dotv

        uni31B7.dotv uni31BB.dotv];


# tone marks


@ToneSpacing = [uni02CA uni02C7 uni02CB uni02EA uni02EB];

@ToneComb_H = [uni02CA.h uni02C7.h uni02CB.h uni02EA.h uni02EB.h];

@ToneComb_V = [uni02CA.v uni02C7.v uni02CB.v uni02EA.v uni02EB.v];
```

C.3 Implement of OpenType features.

```
feature ccmp {

    # replace U+02D9 after Bopomofo symbols to light tone mark for Min-Nan

    sub @Bopomofos uni02D9' by uni02D9_lght;


    # replace coda symbol and U+02D9 to coda symbols with dot above

    sub uni31B4 uni02D9 by uni31B4.dot;

    sub uni31B5 uni02D9 by uni31B5.dot;

    sub uni31B6 uni02D9 by uni31B6.dot;
```

```
    sub uni31B7 uni02D9 by uni31B7.dot;
    sub uni31BB uni02D9 by uni31BB.dot;

    #hack for Apple's Safari browser
    # Safari in vertical writing do not process OpenType feature in ccmp->vert
    # but vert->ccmp
    sub uni31B4.v uni02D9 by uni31B4.dotv;
    sub uni31B5.v uni02D9 by uni31B5.dotv;
    sub uni31B6.v uni02D9 by uni31B6.dotv;
    sub uni31B7.v uni02D9 by uni31B7.dotv;
    sub uni31BB.v uni02D9 by uni31BB.dotv;
} ccmp;
feature hist {    # historical form for Bopomofo symbol ㄧ
    sub uni3127 by uni3127.hist;
    sub uni31AA by uni31B3;
} hist;

feature salt {    # basic layout for horizontal writing(manual)
    sub @ToneSpacing by @ToneComb_H;
} salt;

feature vert {    #vertical writing
    # turn historical form of ㄧ back to normal form
```

```
    sub uni3127.hist by uni3127;
    sub uni31B3 by uni31AA;
    # replace with substitutional glyphs for vertical writing
    sub @ToneSpacing by @ToneComb_V;     #normal tone marks
    sub uni02D9_lght by uni02D9_lght.v;  #light tone mark for Min-Nan (side)
    sub @Bopomofos uni02D9' by uni02D9_lght.v;  #hack for Safari

    # replace coda symbols with vertical glyphs
    sub @YunWei_H by @YunWei_V;
    sub @YunWeiDot_H by @YunWeiDot_V;
} vert;
```

Appendix D. Method to force tone mark upright on web content

In UAX#50, tone marks are defined as R (rotate 90 degree clockwise by default), it will let ‘vert’ feature inactivate. This standard recommend to send proposal to UTC (Unicode Technical Committee) to let tone marks be U (upright) of Tr (use substitute glyph, if not available , rotate as R).

Currently we can force tone marks upright by CSS to let ‘vert’ works as intend.

CSS: text-orientation: upright