TIPA: a System for Processing Phonetic Symbols in LaTeX

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1 Introduction

TIPA[1] is a system for processing IPA (International Phonetic Alphabet) symbols in LaTeX. It is based on TSIPA[2] but both METAFONT source codes and LaTeX macros have been thoroughly rewritten so that it can be considered as a new system.

Among many features of TIPA, the following are the new features as compared with TSIPA or any other existing systems for processing IPA symbols.

- A new 256 character encoding for phonetic symbols ('T3'), which includes all the symbols and diacritics found in the recent versions of IPA and some non-IPA symbols.
- Complete support of LaTeX 2_ε.
- Roman, slanted, bold, bold extended and sans serif font styles.
- Easy input method in the IPA environment.
- Extended macros for accents and diacritics.[3]
- A flexible system of macros for 'tone letters'.

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[1] TIPA stands for *TEX IPA* or *Tokyo IPA*. The primary ftp site in which the latest version of TIPA is placed is ftp://tooyoo.L.u-tokyo.ac.jp/pub/TeX/tipa, and also it is mirrored onto the directory fonts/tipa of the CTAN archives.

[2] TSIPA was made in 1992 by Kobayashi Hajime, Fukui Rei and Shirakawa Shun. It is available from a CTAN archive.

One problem with TSIPA was that symbols already included in OT1, T1 or Math fonts are excluded, because of the limitation of its 128 character encoding. As a result, a string of phonetic representation had to be often composed of symbols from different fonts, disabling the possibility of automatic inter-word kerning. And also too many symbols had to be realized as macros.

[3] These macros are now defined in a separate file called 'exaccent.sty' in order for the authors of other packages to be able to make use of them. The idea of separating these macros from other ones was suggested by Frank Mittelbach.

- An optional package (`vowel.sty`) for drawing vowel diagrams.[4]
- A slightly modified set of fonts that go well when used with Times Roman and Helvetica fonts.

2 TIPA Encoding

2.1 Selection of symbols

The selection of TIPA phonetic symbols[5] was made based on the following works.

- *Phonetic Symbol Guide* [9] (henceforth abbreviated as *PSG*).
- The official IPA charts of '49, '79, '89 and '93 versions.
- Recent articles published in the *JIPA*[6], such as "Report on the 1989 Kiel Convention" [6], "Further report on the 1989 Kiel Convention" [7], "Computer Codes for Phonetic Symbols" [3], "Council actions on revisions of the IPA" [8], etc.
- An unpublished paper by J. C. Wells: "Computer-coding the IPA: a proposed extension of SAMPA" [10].
- Popular textbooks on phonetics.

More specifically, TIPA contains all the symbols, including diacritics, defined in the '79, '89 and '93 versions of IPA. And in the case of the '49 version of IPA, which is described in the *Principles* [5], there are too many obsolete symbols and only those symbols that had had some popularity at least for some time or for some group of people are included.

Besides IPA symbols, TIPA also contains symbols that are useful for the following areas of phonetics and linguistics.

- Symbols used in the American phonetics (e.g. æ, ᴇ, ɑ, λ, etc.).
- Symbols used in the historical study of Indo-European languages (e.g. þ, ƿ, ƕ, ʒ, ь, ъ, and accents such as ǽ, ě, etc.).
- Symbols used in the phonetic description of languages in East Asia (e.g. ɿ, ʅ, ɖ, ȵ, ȶ, etc.).
- Diacritics used in 'extIPA Symbols for Disordered Speech' [4] and 'VoQS (Voice Quality Symbols)' [1] (e.g. n̪̈, f̪, m̋, etc).

It should be also noted that TIPA includes all the necessary elements of 'tone letters', enabling all the theoretically possible combinations of the tone letter system. In the recent publication of the International Phonetic Association tone letters are admitted as an official way of representing tones but the treatment of tone letters is quite insufficient in that only a limited number of combination is allowed. This is apparently due to the fact that there has been no 'portable' way of combining symbols that can be used across various computer environments.

[4] This package (`vowel.sty`) can be used independently from the TIPA package. Documentation is also made separately in '`vowel.tex`' so that no further mention will be made here.

[5] In the case of TSIPA, the selection of symbols was based on "Computer coding of the IPA: Supplementary Report" [2].

[6] *Journal of the International Phonetic Association.*

<table>
<tr><th></th><th>'0</th><th>'1</th><th>'2</th><th>'3</th><th>'4</th><th>'5</th><th>'6</th><th>'7</th></tr>
<tr><td>'00x

'04x</td><td colspan="8">Accents and diacritics</td></tr>
<tr><td>'05x</td><td colspan="8">Punctuation marks</td></tr>
<tr><td>'06x</td><td colspan="8">Basic IPA symbols I (vowels)</td></tr>
<tr><td>'07x</td><td colspan="3"></td><td colspan="5">Diacritics, etc.</td></tr>
<tr><td>'10x

'13x</td><td colspan="4">Basic IPA symbols II</td><td colspan="4">Diacritics, etc.</td></tr>
<tr><td>'14x</td><td>Punct.</td><td colspan="7" rowspan="2">Basic IPA symbols III
(lowercase letters)</td></tr>
<tr><td>'17x</td><td colspan="6"></td><td>Diacritics</td></tr>
<tr><td>'20x

'23x</td><td colspan="8">Tone letters and other suprasegmentals</td></tr>
<tr><td>'24x

'27x</td><td colspan="8">Old IPA, non-IPA symbols</td></tr>
<tr><td>'30x

'33x</td><td colspan="7">Extended IPA symbols</td><td>Germanic</td></tr>
<tr><td>'34x

'37x</td><td colspan="7">Basic IPA symbols IV</td><td>Germanic</td></tr>
</table>

Table 1: Layout of the T3 encoding

Therefore TEX's productive system of macro is an ideal tool for handling a system like tone letters.

In the process of writing METAFONT source codes for TIPA phonetic symbols there have been many problems besides the one with the selection of symbols. One of such problems was that sometimes the exact shape of a symbol was unclear. For example, the shapes of the symbols such as ʗ (Stretched C), ɟ (Curly-tail J) differ according to sources. This is partly due to the fact that the IPA has been continuously revised for the past few decades, and partly due to the fact that different ways of computerizing phonetic symbols on different systems have resulted in the diversity of the shapes of phonetic symbols.

Although there is no definite answer to such a problem yet, it seems to me that it is a privilege of those working with METAFONT to have a systematic way of controlling the shapes of phonetic symbols.

2.2 Encoding

The 256 character encoding of TIPA is now officially called the 'T3' encoding.[7] In deciding this new encoding, care is taken to harmonize with existing other encodings, especially with the T1 encoding. Also the easiness of inputting phonetic symbols is taken into consideration in such a way that frequently used symbols can be input with small number of keystrokes.

Table 1 shows the layout of the T3 encoding.

The basic structure of the encoding found in the first half of the table (character codes '000-'177) is based on normal text encodings (ASCII, OT1 and T1) in that sectioning of this area into several groups such as the section for accents and diacritics, the section for punctuation marks, the section for numerals, the sections for uppercase and lowercase letters is basically the same with these encodings.

Note also that the T3 encoding contains not only phonetic symbols but also usual punctuation marks that are used with phonetic symbols, and in such cases the same codes are assigned as the normal text encodings. However it is a matter of trade-off to decide which punctuation marks are to be included. For example ':' and ';' might have been preserved in T3 but in this case ':' has been traditionally used as a substitute for the length mark 'ː' so that I decided to exclude ':' in favor of the easiness of inputting the length mark by a single keystroke.

The encoding of the section for accents and diacritics is closely related to T1 in that the accents commonly included in T1 and T3 have the same encoding.

The sections for numerals and uppercase letters are filled with phonetic symbols that are used frequently in many languages, because numerals and uppercase letters are usually not used as phonetic symbols. And the assignments made here are used as the 'shortcut characters', which will be explained in the section entitled "Ordinary phonetic symbols" (page 8).

As for the section for uppercase letters in the usual text encoding, a series of discussion among the members of the ling-tex mailing list revealed that there seem to be a certain amount of consensus on what symbols are to be assigned to each code. For example they were almost unanimous for the assignments such as ɑ for A, β for B, ð for D, ʃ for S, θ for T, etc. For more details, see table 2.

The encoding of the section for numerals was more difficult than the above case. One of the possibilities was to assign symbols based on the resemblance of shapes. One can easily think of assignments such as ɜ for 3 ɓ for 6, etc. But the resemblance of shape alone does not serve as a criteria for all the assignments. So I decided to assign basic vowel symbols to this section.[8] Fortunately the resemblance of shape is to some extent maintained as is shown in table 2.

The encoding of the section for lowercase letters poses no problem since they are all used as phonetic symbols. Only one symbol, namely 'g', needs some attention because its shape should be 'g', rather than 'g', as a phonetic symbol.[9]

The second half of the table (character codes '200-'377) is divided into four sections. The first section is devoted to the elements of tone letters and other suprasegmental symbols.

[7] In a discussion with the LaTeX 2ε team it was suggested that the 128 character encoding used in WSUIPA would be refered to as the OT3 encoding.

[8] This idea was influenced by the above mentioned article by J. C. Wells [10].

[9] But the alternative shape 'g' is preserved in other section and can be used as \textg.

ASCII	:	;	"							
TIPA	ː	ˑ	ˈ							
ASCII	0	1	2	3	4	5	6	7	8	9
TIPA	ʉ	ɨ	ʌ	ɜ	ɥ	ɐ	ɒ	ɤ	ɵ	ɘ
ASCII	@	A	B	C	D	E	F	G	H	I
TIPA	ə	ɑ	β	ɕ	ð	ɛ	ɸ	ɣ	ɦ	ɪ
ASCII	J	K	L	M	N	O	P	Q	R	S
TIPA	ɟ	ʁ	ʎ	ɱ	ŋ	ɔ	ʔ	ʕ	ɾ	ʃ
ASCII	T	U	V	W	X	Y	Z	|		
TIPA	θ	ʊ	ʋ	ɯ	χ	ʏ	ʒ	|		

Table 2: TIPA shortcut characters

Among the remaining three sections the last section `'340-'377` contains more basic symbols than the other two sections. This is a result of assigning the same character codes as latin-1 (ISO8859-1) and T1 encodings to the symbols that are commonly included in TIPA, latin-1 and T1 encoded fonts.[10] These are the cases of æ, ø, œ, ç and þ. And within each section symbols are arraneged largely in alphabetical order.

For a table of the `T3` encoding, see Appendix C (page 41).

3 Installation

First, copy all the package and font description files (`tipa.sty`, `tone.sty`, `vowel.sty`, `*.fd`, `*.def`) to a directory which TEX programs can find. In an ordinary Unix environment, it is recommended to create a directory such as `/usr/local/lib/texmf/tex/tipa` and copy all these files into this directory.

```
mkdir /usr/local/lib/texmf/tex/tipa
cp tipa.sty tone.sty vowel.sty /usr/local/lib/texmf/tex/tipa
cp *.fd *.def /usr/local/lib/texmf/tex/tipa
```

Next, copy all the `TFM` files to a directory which TEX and device driver programs can find.

```
mkdir /usr/local/lib/texmf/fonts/public/tipa
mkdir /usr/local/lib/texmf/fonts/public/tipa/tfm
cp *.tfm /usr/local/lib/texmf/fonts/public/tipa/tfm
```

It is also recommended to copy all the METAFONT source files into an appropriate directory.

```
mkdir /usr/local/lib/texmf/fonts/public/tipa/src
cp *.mf /usr/local/lib/texmf/fonts/public/tipa/src
```

The final step of installation is that of `PK` font files. This procedure may differ according to the user's computer environment.

[10] This is based on a suggestion by Jörg Knappen.

Magnification	*font name*
(mag=1)	tipa8, tipa9, tipa10, tipa12, tipasl8, tipasl9, tipasl10, tipasl12, tipabx8, tipabx9, tipabx10, tipabx12, tipass8, tipass9, tipass10, tipass12
mag=5/8	tipa8, tipasl8, tipabx8, tipass8
mag=6/8	tipa8, tipasl8, tipabx8, tipass8
mag=7/8	tipa8, tipasl8, tipabx8, tipass8
mag=magstep.5	tipa10, tipasl10, tipabx10, tipass10
mag=magstep1	tipa12, tipasl12, tipabx12, tipass12
mag=magstep2	tipa12, tipasl12, tipabx12, tipass12
mag=magstep3	tipa12, tipasl12, tipabx12, tipass12
mag=magstep4	tipa12, tipasl12, tipabx12, tipass12

Table 3: Full set of TIPA fonts

For users unfamiliar with running METAFONT programs, it is possible to get pre-compiled PK font files from ftp sites. In this case, just copy them to an appropriate directory.

```
mkdir /usr/local/lib/texmf/fonts/public/tipa/pk
mkdir /usr/local/lib/texmf/fonts/public/tipa/pk/your_mode_name
cp *pk /usr/local/lib/texmf/fonts/public/tipa/pk/your_mode_name
```

If you make PK fonts by yourself, generate fonts shown in table 3 by the METAFONT program.

The bold font tipab10 and fonts of xipa family are not included in this table. Make PK files for these fonts by yourself if you need them.

In the Unix environment, all these fonts can be automatically generated by running the shell script makepk1.sh. And a set of xipa family fonts can be generated by running the shell script makepk2.sh.

Also, if you are using MakeTeXPK, it is not necessary to generate all these size variations at once.

4 TIPA fonts

This version of TIPA includes two families of IPA fonts, tipa and xipa. The former family of fonts is for normal use with LaTeX, and the latter family is intended to be used with 'times.sty'(PSNFSS). They all have the same T3 encoding as explained in the previous section.

- tipa

  Roman: tipa8, tipa9, tipa10, tipa12, tipa17

  Slanted: tipasl8, tipasl9, tipasl10, tipasl12

  Bold extended: tipabx8, tipabx9, tipabx10, tipabx12

  Sans serif: tipass8, tipass9, tipass10, tipass12, tipass17

  Bold: tipab10

- `xipa`

  Roman: `xipa10`
  Slanted: `xipasl10`
  Bold: `xipab10`
  Sans serif: `xipass10`

All these fonts are made by METAFONT, based on the Computer Modern font series. In the case of the `xipa` series, parameters are adjusted so as to look fine when used with Times Roman (in the cases of `xipa10`, `xipasl10`, `xipab10`) and Helvetica (in the case of `xipass10`).

5 Usage

5.1 Declaration of TIPA package

In order to use TIPA, first declare TIPA package at the preamble of a document.

```
\documentclass{article}
\usepackage{tipa}
```

5.2 Encoding options

The above declaration uses `OT1` as the default text encoding. If you want to use TIPA symbols with `T1`, specify the option '`T1`'.

```
\documentclass{article}
\usepackage[T1]{tipa}
```

If you want to use a more complex form of encoding, declare the use of `fontenc` package by yourself and specify the option '`noenc`'. In this case the option '`T3`', which represents the TIPA encoding, must be included as an option to the `fontenc` package. For example, if you want to use TIPA and the University Washington Cyrillic (`OT2`) with the `T1` text encoding, the following command will do this.

```
\documentclass{article}
\usepackage[T3,OT2,T1]{fontenc}
\usepackage[noenc]{tipa}
```

By default, TIPA includes the `fontenc` package internally but the option `noenc` suppresses this.

5.3 Using TIPA with PSNFSS

In order to use TIPA with `times.sty`, declare the use of `times.sty` before declaring `tipa` packages.

```
\documentclass{article}
\usepackage{times}
\usepackage{tipa}
```

Font description files `T3ptm.fd` and `T3phv.fd` are automatically loaded by the above declaration.

5.4 Other options

TIPA can be extended by the options `tone`, `extra`.

If you want to use the optional package for 'tone letters', add '`tone`' option to the `\usepackage` command that declares `tipa` package.

```
\usepackage[tone]{tipa}
```

And if you want to use diacritics for extIPA and VoQS, specify '`extra`' option.

```
\usepackage[extra]{tipa}
```

Finally there is one more option called '`safe`', which is used to suppress definitions of some possibly 'dangerous' commands of TIPA.

```
\usepackage[safe]{tipa}
```

More specifically, the following commands are suppressed by declaring the `safe` option. Explanation on the function of each command will be given later.

- `\s` (equivalent to `\textsyllabic`)
- `\*` (already defined in plain TEX)
- `\|`, `\:`, `\;`, `\!` (already defined in LATEX)

6 Input Commands for Phonetic Symbols

6.1 Ordinary phonetic symbols

TIPA phonetic symbols can be input by the following two ways.

(1) Input macro names in the normal text environment.

(2) Input macro names or *shortcut characters* within the follwoing groups or environment.

- `\textipa{...}`[11]
- `{\tipaencoding ...}`
- `\begin{IPA} ... \end{IPA}`

(These groups and environment will be henceforth refered to as the *IPA environment*.)

A shortcut character refers to a single character that is assigned to a specific phonetic symbol and that can be directly input by an ordinary keyboard. In TIPA fonts, the character codes for numerals and uppercase letters in the normal ASCII encoding are assigned to such shortcut characters, because numerals and uppercase letters are usually not used as phonetic symbols. And additional shortcut characters for symbols such as æ, œ, ø may also be used if you are using a T1 encoded font and an appropriate input system for it.

The following pair of examples show the same phonetic transcription of a English word that are input by the above mentioned two input methods.

[11] I personally prefer a slightly shorter name like `\ipa` rather than `\textipa` but this command was named after the general convention of LATEX 2_ε. The same can be said to all the symbol names beginning with `\text`.

Symbol name	*Macro name*	*Symbol*
Turned A	`\textturna`	ɐ
Glottal Stop	`\textglotstop`	ʔ
Right-tail D	`\textrtaild`	ɖ
Small Capital G	`\textscg`	ɢ
Hooktop B	`\texthtb`	ɓ
Curly-tail C	`\textctc`	ɕ
Crossed H	`\textcrh`	ħ
Old L-Yogh Ligature	`\textOlyoghlig`	ƹ
Beta	`\textbeta`	β

Table 4: Naming of TIPA symbols

Input 1:
```
[\textsecstress\textepsilon kspl\textschwa
\textprimstress ne\textsci\textesh\textschwa n]
```

Output 1: [ˌɛksplə'neɪʃən]

Input 2:
```
\textipa{[""Ekspl@"neIS@n]}
```

Output 2: [ˌɛksplə'neɪʃən]

It is apparent that inputting in the IPA environment is far easier than in the normal text environment. Moreover, although the outputs of the above examples look almost the same, they are *not* identical, exactly speaking. This is because in the IPA environment automatic kerning between symbols is enabled, as is illustrated by the following pair of examples.

Input 1:
```
v\textturnv v w\textsca w y\textturny y [\textesh]
```

Output 1: vʌv wʌw yʎy [ʃ]

Input 2:
```
\textipa{v2v w\textsca w yLy [S]}
```

Output 2: vʌv wʌw yʎy [ʃ]

Table 2 shows most of the shortcut characters together with the corresponding characters in the ASCII encoding.

6.2 Naming of phonetic symbols

Every TIPA phonetic symbol has a unique symbol name, such as *Turned A*, *Hooktop B*, *Schwa*.[12] Also each symbol has a corresponding control sequence name, such as `\textturna`, `\texthtb`, `\textschwa`. The name used as a control sequence is usually an abbreviated form of the corresponding symbol name with a prefix `\text`. The conventions used in the abbreviation are as follows.

- Suffixes and endings such as '-ive', '-al', '-ed' are omitted.
- 'right', 'left' are abbreviated to `r`, `l` respectively.
- For 'small capital' symbols, prefix `sc` is added.

[12] The naming was made based on the literature listed in the section entitled "Selection of Symbols" (page 2). And users of TSIPA should be careful because TIPA's naming is slightly modified from that of TSIPA.

- A symbol with a hooktop is abbreviated as `ht`...
- A symbol with a curly-tail is abbreviated as `ct`...
- A 'crossed' symbol is abbreviated as `cr`...
- A ligature is abbreviated as ...`lig`.
- For an old version of a symbol, prefix `O` is added.

Note that the prefix `O` (old) should be given in uppercase letter.

Table 4 shows some examples of correspondence between symbol names and control sequence names.

6.3 Ligatures

Just like the symbols such as “, ”, –, —, fi, ff are realized as ligatures by inputting ``, '', `--`, `---`, `fi`, `ff` in TEX, two of the TIPA symbols, namely *Secondary Stress* and *Double Pipe*, and double quotation marks[13] can be input as ligatures in the IPA environment.

Input: `\textipa{" "" | || `` ''}`

Output: ˈ ˌ | ‖ “ ”

6.4 Special macros *, \;, \: and \!

TIPA defines `\*`, `\;`, `\:` and `\!` as special macros in order to easily input phonetic symbols that do not have a shortcut character explained above. Before explaining how to use these macros, it is necessary to note that these macros are primarily intended to be used by linguists who usually do not care about things in math mode. And they can be 'dangerous' in that they override existing LATEX commands used in the math mode. So if you want to preserve the original meaning of these commands, daclare the option '`safe`' at the preamble.

The macro `\*` is used in three different ways. First, when this macro is followed by one of the letters f, k, r, t or w, it results in a turned symbol.[14]

Input: `\textipa{\*f \*k \*r \*t \*w}`

Output: ɟ ʞ ɹ ʇ ʍ

Secondly, when this macro is followed by one of the letters j, n, h, l or z, it results in a frequently used symbol that has otherwise no easy way to input.

Input: `\textipa{\*j \*n \*h \*l \*z}`

Output: ɟ ɲ ħ ɬ ɮ

Thirdly, when this macro is followed by letters other than the above cases, they are turned into the symbols of the default text font. This is useful in the IPA environment to select symbols temporarily from the normal text font.

Input: `\textipa{\*A dOg, \*B k\ae{}t, ma\super{\*{214}}}`

[13] Although TIPA fonts do not include the symbols “ and ”, a negative value of kerning is automatically inserted between ` and ', ' and ', so that the same results can be obtained as in the case of the normal text font.

[14] This idea was pointed out by Jörg Knappen.

Output: A dɔg, B kæt, ma^{214}

The remaining macros `\;`, `\:` and `\!` are used to make small capital symbols, retroflex symbols, and implosives or clicks, respectively.

Input: `\textipa{\;B \;E \;A \;H \;L \;R}`

Output: ʙ ᴇ ᴀ ʜ ʟ ʀ

Input: `\textipa{\:d \:l \:n \:r \:s \:z}`

Output: ɖ ɭ ɳ ɽ ʂ ʐ

Input: `\textipa{\!b \!d \!g \!j \!G \!o}`

Output: ɓ ɗ ɠ ʄ ɢ ʘ

6.5 Punctuation marks

The following punctuation marks and text symbols that are normally included in the text encoding are also included in the `T3` encoding so that they can be directly input in the IPA environment.

Input:
```
\textipa{! ’ ( ) * + , - .\ / = ?
  [ ] ‘}
```

Output: ! ’ ( ) * + , - . / = ? [ ] ‘

All the other punctuation marks and text symbols that are not included in `T3` need to be input with a prefix `\*` explained in the last section when they appear in the IPA environment.

Input: `\textipa{\*; \*: \*@ \*\# \*\$ \*\& \*\% \*\{ \*\}}`

Output: ; : @ # $ & % { }

6.6 Accents and diacritics

Table 5 shows how to input accents and diacritics in TIPA with some examples. Here again, there are two kinds of input methods; one for the normal text environment, and the other for the IPA environment.

In the IPA environment, most of the accents and diacritics can be input more easily than in the normal text environment, especially in the cases of subscript symbols that are normally placed over a symbol and in the cases of combined accents, as shown in the table.

As can be seen by the above examples, most of the accents that are normally placed over a symbol can be placed under a symbol by adding an `*` to the corresponding accent command in the IPA environment.

The advantage of IPA environment is further exemplified by the all-purpose accent `\|`, which is used as a macro prefix to provide shortcut inputs for the diacritics that otherwise have to be input by lengthy macro names. Table 6 shows examples of such accents. Note that the macro `\|` is also ‘dangerous’ in that it has been already defined as a math symbol of LaTeX. So if you want to preserve the original meaning of this macro, declare ‘`safe`’ option at the preamble.

Finally, examples of words with complex accents that are input in the IPA environment are shown below.

Input in the normal text environment	*Input in the IPA environment*	*Output*
`\'a`	`\'a`	á
`\"a`	`\"a`	ä
`\ a`	`\~a`	ã
`\r{a}`	`\r{a}`	å
`\textsyllabic{m}`	`\s{m}`	m̩
`\textsubumlaut{a}`	`\"*a`	a̤
`\textsubtilde{a}`	`\~*a`	a̰
`\textsubring{a}`	`\r*a`	ḁ
`\textdotacute{e}`	`\.'e`	ė́
`\textgravedot{e}`	`\`.e`	ė̀
`\textacutemacron{a}`	`\'=a`	ā́
`\textcircumdot{a}`	`\^.a`	â̇
`\texttildedot{a}`	`\~.a`	ã̇
`\textbrevemacron{a}`	`\u=a`	a̍̆

Table 5: Examples of inputting accents

Input in the normal text environment	*Input in the IPA environment*	*Output*
`\textsubbridge{t}`	`|[t`	t̪
`\textinvsubbridge{t}`	`|]t`	t̺
`\textsublhalfring{a}`	`|(a`	a̜
`\textsubrhalfring{a}`	`|)a`	a̝
`\textroundcap{k}`	`|c{k}`	k̟
`\textsubplus{o}`	`|+o`	o̟
`\textraising{e}`	`|'e`	e̝
`\textlowering{e}`	`|`e`	e̞
`\textadvancing{o}`	`|<o`	o̠
`\textretracting{a}`	`|>a`	a̠
`\textovercross{e}`	`|x{e}`	e̽
`\textsubw{k}`	`|w{k}`	k̫
`\textseagull{t}`	`|m{t}`	t̼

Table 6: Examples of the accent prefix `\|`

Input: `\textipa{*\|c{k}\r*mt\'om *bhr\'=at\=er}`

Output: *k̂m̥tóm *bhrā́tēr

For a full list of accents and diacritics, see Appendix A

6.7 Superscript symbols

In the normal text environment, superscript symbols can be input by a macro called `\textsuperscript`, which has been newly introduced in the recent version of LaTeX 2_ε. This macro takes one argument which can be either a symbol or a string of symbols, and can be nested.

Since the name of this macro is too long, TIPA provides an abbreviated form of this macro called `\super`.

Input 1:
```
t\textsuperscript h k\textsuperscript w
a\textsuperscript{bc}
a\textsuperscript{b\textsuperscript{c}}
```

Output 1: t^h k^w a^{bc} a^{b^c}

Input 2:
```
\textipa{t\super{h} k\super{w}
  a\super{bc} a\super{b\super{c}}}
```

Output 2: t^h k^w a^{bc} a^{b^c}

These macros automatically select the correct size of superscript font no matter what size of the text font is used.

6.8 Tone letters

TIPA provides a flexible system of macros for 'tone letters'. A tone letter is represented by a macro called '`\tone`', which takes one argument consisting of a string of numbers ranging from 1 to 5. These numbers denote pitch levels, 1 being the lowest and 5 the highest. Within this range, any combination is allowed and there is no limit in the length of combination.

As an example of the usage of tone letter macro, the four tones of Chinese are show below.

Input:
```
\tone{55}ma ``mother'', \tone{35}ma ``hemp'',
\tone{214}ma ``horse'', \tone{51}ma ``scold''
```

Output: ˥ma "mother", ˧˥ma "hemp", ˨˩˦ma "horse", ˥˩ma "scold"

7 How easy to input phonetic symbols?

Let us briefly estimate here how much easy (or difficult) to input phonetic symbols with TIPA in terms of the number of keystrokes.

The following table shows statistics for all the phonetic symbols that appear in the '93 version of IPA chart (diacritics and symbols for suprasegmentals excluded). It is assumed here that each symbol is input within the IPA environment and the `safe` option is not specified.

Roman	`\textipa{f@"nEtIks}`	fəˈnɛtɪks
Slanted	`\textipa{\slshape f@"nEtIks}`	*fəˈnɛtɪks*
or	`\textipa{\textsl{f@"nEtIks}`	*fəˈnɛtɪks*
or	`\textsl{\textipa{f@"nEtIks}`	*fəˈnɛtɪks*
Bold extended	`\textipa{\bfseries f@"nEtIks}`	**fəˈnɛtɪks**
or	`\textipa{\textbf{f@"nEtIks}`	**fəˈnɛtɪks**
or	`\textbf{\textipa{f@"nEtIks}`	**fəˈnɛtɪks**
Sans serif	`\textipa{\sffamily f@"nEtIks}`	fəˈnɛtɪks
or	`\textipa{\textsf{f@"nEtIks}`	fəˈnɛtɪks
or	`\textsf{\textipa{f@"nEtIks}`	fəˈnɛtɪks

Table 7: Examples of font switching

keystrokes	*number*	*examples*
1	65	a, b, ə, ɑ, β, etc.
2	2	ø, ‖
3	30	æ, ʈ, ʁ, ɓ, etc.
5	1	ç
more than 5	7	ɷ, ʔ, ǂ, ɯ̨, etc.

As is shown in the table, about 92% of the symbols can be input within three keystrokes.

8 Changing font styles

This version of TIPA includes five styles of fonts, i.e. roman, slanted, bold, bold extended and sans serif. These styles can be switched in much the same way as in the normal text fonts (see table 7).

The bold fonts are usually not used within the standard LaTeX class packages so that if you want to use them, it is necessary to use low-level font selection commands of LaTeX 2_ε.

Input: `{\fontseries{b}\selectfont abcdefg \textipa{ABCDEFG}}`

Output: **abcdefg ɑβɕðɛɸɣ**

Note also that slanting of TIPA symbols should correctly work even in the cases of combined accents and in the cases of symbols made up by macros.

Input: `\textsl{\textipa{\'{\"{\u*{e}}}}}`

Output: $\ddot{\underset{\frown}{\acute{e}}}$

Input: `\textsl{\textdoublebaresh}`

Output: $\sharp\!\!\!\sharp$ (This symbol is composed by a macro.)

9 Internal commands

Some of the internal commands of TIPA are defined without the letter `@` in order to allow a user to extend the capability of TIPA.

9.1 \ipabar

Some TIPA symbols such as \textbarb ƀ, \textcrtwo ƻ are defined by using an internal macro command \ipabar. This command is useful when you want to make barred or crossed symbols not defined in TIPA.

This command requires the following five parameters to control the position of the bar.

- #1 the symbol to be barred
- #2 the height of the bar (in dimen)
- #3 bar width
- #4 left kern added to the bar
- #5 right kern added to the bar

Parameters #3, #4, #5 are to be given in a scaling factor to the width of the symbol, which is equal to 1 if the bar has the same width with the symbol in question. For example, the following command states a barred b (ƀ) of which the bar position in the y-coordinate is .5ex and the width of the bar is slightly larger than that of the letter b.

```
% Barred B
\newcommand\textbarb{%
  \ipabar{{\tipaencoding b}}{.5ex}{1.1}{}{}}
```

Note that the parameters #4 and #5 can be left blank if the value is equal to 0.

And the next example declares a barred c (ȼ) of which the bar width is a little more than half as large as the letter c and it has the same size of kerning at the right.

```
% Barred C
\newcommand\textbarc{%
  \ipabar{{\tipaencoding c}}{.5ex}{.55}{}{.55}}
```

More complex examples with the \ipabar command are found in T3enc.def.

9.2 \tipaloweraccent, \tipaupperaccent

These two commands are used in the definitions of TIPA accents and diacritics. They are special forms of the commands \loweraccent and \upperaccent that are defined in exaccent.sty. The difference between the commands with the prefix tipa and the ones without it is that the former commands select accents from a T3 encoded font while the latter ones do so from the current text font.

These commands take two parameters, the code of the accent (in decimal, octal or hexadecimal number) and the symbol to be accented, as shown below.

Input: `\tipaupperaccent{0}{a}`

Output: à

Optionally, these commands can take a extra parameter to adjust the vertical position of the accent. Such an adjustment is sometimes necessary in the definition of a nested accent. The next example shows TIPA's definition of the 'Circumflex Dot Accent' (e.g. å).

```
% Circumflex Dot Accent
\newcommand\textcircumdot[1]{\tipaupperaccent[-.2ex]{2}%
  {\tipaupperaccent[-.1ex]{10}{#1}}}
```

This definition states that a dot accent is placed over a symbol thereby reducing the vertical distance between the symbol and the dot by `.1ex` and a circumflex accent is placed over the dot and the distance between the two accents is reduced by `.2ex`.

If you want to make a combined accent not included in TIPA, you can do so fairly easily by using these two commands together with the optional parameter. For more examples of these commands, see `tipa.sty` and `extraipa.sty`.

9.3 `\tipaLoweraccent, \tipaUpperaccent`

These two commands differ from the two commands explaind above in that the first parameter should be a symbol (or any other things, typically an `\hbox`), rather than the code of the accent. They are special cases of the commands `\Loweraccent` and `\Upperaccent` and the difference between the two pairs of commands is the same as before.

The next example makes a schwa an accent.

Input:
```
\tipaUpperaccent[.2ex]%
  {\lower.8ex\hbox{\textipa{\super@}}}{a}
```

Output: å

10 Acknowledgments

First of all, many thanks are due to the co-authors of TSIPA, Kobayashi Hajime and Shirakawa Shun. Kobayashi Hajime was the main font designer of TSIPA. Shirakawa Shun worked very hard in deciding encoding, checking the shapes of symbols and writing the Japanese version of document. TIPA was impossible without TSIPA.

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[8] IPA. Council actions on revisions of the IPA. *Journal of the International Phonetic Association*, 23(1):32–34, 1993.

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Appendix

A Annotated List of TIPA Symbols

For each symbol, a large scale image of the symbol is displayed with a frame. Within the frame, horizontal lines that indicate `asc_height`, `x_height`, baseline, and `desc_depth` are also shown. At the left of a frame, two numbers are given. The one at the top of the symbol indicates serial number, and the other at the bottom is the octal code of the symbol in TIPA fonts.

Next, the following informations are shown at the right of each symbol in this order: (1) the name of the symbol, (2) explanation on its usage with some examples, (3) input method in typewriter style, (4) the shapes of the symbol in four TIPA styles in normal size (i.e. roman, slanted, bold extended, sans serif), and finally (5) sources or references.

Sometimes the input method is displayed in the form of *Input1: xxx, Input2: yyy*. In such cases *Input1* indicates the one used in the normal text environment and *Input2* the one used in the IPA environment.

The following abbreviations are used in the examples of usage and explanations in the footnote.

extIPA = *extIPA Symbols for Disordered Speech*
VoQS = *Voice Quality Symbols*
PSG = *Phonetic Symbol Guide* [9]
JIPA = *Journal of the International Phonetic Association*
IE Indo-European
OHG Old High German
OCS Old Church Slavic

A.1 Vowels and Consonants

1 ɐ '141
Lower-case A, *IPA usage:* open front unrounded vowel
Input: `a`
Styles: a *a* **a** a, *Sources: IPA '49–'93*

2 ɐ '065
Turned A, *IPA usage:* open-mid–open central unrounded vowel
Input1: `\textturna`, *Input2:* `5`
Styles: ɐ *ɐ* **ɐ** ɐ, *Sources: IPA '49–'93*

3 ɑ '101
Script A, *IPA usage:* open back unrounded vowel
Input1: `\textscripta`, *Input2:* `A`
Styles: ɑ *ɑ* **ɑ** ɑ, *Sources: IPA '49–'93*

4 ɒ '066
Turned Script A, *IPA usage:* open back rounded vowel
Input1: `\textturnscripta`, *Input2:* `6`
Styles: ɒ *ɒ* **ɒ** ɒ, *Sources: IPA '49–'93*

5 æ '346
Ash, *IPA usage:* open-mid–open front unrounded vowel
Input: `\ae`
Styles: æ *æ* **æ** æ, *Sources: IPA '49–'93*

6 A '300
Small Capital A[15], Usage: open central unrounded vowel
Input1: `\textsca`, *Input2:* `\;A`
Styles: ᴀ *ᴀ* **ᴀ** ᴀ, *Sources:*

[15] This symbol is fairly common among Chinese phoneticians.

7
'062

Turned V[16], *IPA usage:* open-mid back unrounded vowel
Input1: `\textturnv`, *Input2:* `2`
Styles: ʌ *ʌ* **ʌ** ʌ, *Sources: IPA '49–'93*

8
'142

Lower-case B, *IPA usage:* voiced bilabial plosive
Input: `b`
Styles: b *b* **b** b, *Sources: IPA '49–'93*

9
'272

Soft Sign, Usage: as in *OCS* ognь 'fire'.
Input: `\textsoftsign`
Styles: ь *ь* **ь** ь, *Sources:*

10
'273

Hard Sign, Usage: as in *OCS* gradъ 'town'.
Input: `\texthardsign`
Styles: ъ *ъ* **ъ** ъ, *Sources:*

11
'341

Hooktop B, *IPA usage:* voiced bilabial implosive
Input1: `\texthtb`, *Input2:* `\!b`
Styles: ɓ *ɓ* **ɓ** ɓ, *Sources: IPA '49–'93*

12
'340

Small Capital B, *IPA usage:* voiced bilabial trill
Input1: `\textscb`, *Input2:* `\;B`
Styles: ʙ *ʙ* **ʙ** ʙ, *Sources: IPA '89, '93*

13
'240

Crossed B
Input: `\textcrb`
Styles: b *b* **ƀ** ƀ, *Sources:*

14
Macro

Barred B
Input: `\textbarb`
Styles: ~~b~~ *~~b~~* **~~b~~** ~~b~~, *Sources:*

15
'102

Beta, *IPA usage:* voiced bilabial fricative
Input1: `\textbeta`, *Input2:* `B`
Styles: β *β* **β** β, *Sources: IPA '49–'93*

16
'143

Lower-case C, *IPA usage:* voiceless palatal plosive
Input: `c`
Styles: c *c* **c** c, *Sources: IPA '49–'93*

17
Macro

Barred C
Input: `\textbarc`
Styles: ~~c~~ *~~c~~* **~~c~~** ~~c~~, *Sources:*

18
'301

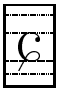
Hooktop C, *IPA usage:* voiceless palatal implosive
Input: `\texthtc`
Styles: *ƈ* *ƈ* **ƈ** ƈ, *Sources: IPA '89*

19
Macro

C Wedge, Usage: equivalent to IPA ʧ
Input: `\v{c}`
Styles: č *č* **č** č, *Sources:*

20
'347

C Cedilla, *IPA usage:* voiceless palatal fricative
Input: `\c{c}`
Styles: ç *ç* **ç** ç, *Sources: IPA '49–'93*

21 
'103

Curly-tail C, *IPA usage:* voiceless alveolo-palatal fricative
Input1: `\textctc`, *Input2:* `C`
Styles: ɕ *ɕ* **ɕ** ɕ, *Sources: IPA '49–'93*

[16] In *PSG* this symbol is called 'Inverted V' but it is apparently a mistake.

22
'302

Stretched C[17], *IPA usage:* postalveolar click
Input: `\textstretchc`
Styles: ʗ *ʗ* **ʗ** ʗ, *Sources: IPA '49, '79*

23
'144

Lower-case D, *IPA usage:* voiced dental/alveolar plosive
Input: `d`
Styles: d *d* **d** d, *Sources: IPA '49–'93*

24
'241

Crossed D
Input: `\textcrd`
Styles: đ *đ* **đ** đ, *Sources:*

25
Macro

Barred D
Input: `\textbard`
Styles: ᵭ *ᵭ* **ᵭ** ᵭ, *Sources:*

26
'342

Hooktop D, *IPA usage:* voiced dental/alveolar implosive
Input1: `\texthtd`, *Input2:* `\!d`
Styles: ɗ *ɗ* **ɗ** ɗ, *Sources: IPA '49–'93*

27
'343

Right-tail D, *IPA usage:* voiced retroflex plosive
Input1: `\textrtaild`, *Input2:* `\:d`
Styles: ɖ *ɖ* **ɖ** ɖ, *Sources: IPA '49–'93*

28
'242

Curly-tail D, Usage: voiced alveolo-palatal plosive
Input: `\textctd`
Styles: ᶑ *ᶑ* **ᶑ** ᶑ, *Sources:*

29
Macro

D-Z Ligature
Input: `\textdzlig`
Styles: ʣ *ʣ* **ʣ** ʣ, *Sources:*

30
Macro

D-Curly-tail Z Ligature
Input: `\textdctzlig`
Styles: ʥ *ʥ* **ʥ** ʥ, *Sources:*

31
'303

D-Yogh Ligature, *IPA usage:* voiced alveolar lateral fricative
Input: `\textdyoghlig`
Styles: ʤ *ʤ* **ʤ** ʤ, *Sources: IPA '49–'93*

32
Macro

Curly-tail D-Curly-tail Z Ligature
Input: `\textctdctzlig`
Styles: ʥ *ʥ* **ʥ** ʥ, *Sources:*

33
'104

Eth, *IPA usage:* voiced dental fricative
Input1: `\dh`, *Input2:* `D`
Styles: ð *ð* **ð** ð, *Sources: IPA '49–'93*

34
'145

Lower-case E, *IPA usage:* colse-mid front unrounded vowel
Input: `e`
Styles: e *e* **e** e, *Sources: IPA '49–'93*

35
'100

Schwa, *IPA usage:* mid central unrounded vowel
Input1: `\textschwa`, *Input2:* `@`
Styles: ə *ə* **ə** ə, *Sources: IPA '49–'93*

[17] The shape of this symbol differs according to the sources. In *PSG* and recent articles in *JIPA*, it is 'stretched' toward both the ascender and descender regions and the whole shape looks like a thick staple. In the old days, however, it was streched only toward the ascender and the whole shape looked more like a stretched c.

36
'304

Right-hook Schwa, *IPA usage:* r-colored ə
Input: `\textrhookschwa`
Styles: ɚ *ɚ* **ɚ** ɚ, *Sources: IPA '49, '79*

37
'071

Reversed E, *IPA usage:* close-mid central unrounded vowel
Input1: `\textreve`, *Input2:* `9`
Styles: ɘ *ɘ* **ɘ** ɘ, *Sources: IPA '49–'93*

38
'243

Small Capital E
Input1: `\textsce`, *Input2:* `\;E`
Styles: ᴇ *ᴇ* **ᴇ** ᴇ, *Sources:*

39
'105

Epsilon, *IPA usage:* open-mid front unrounded vowel
Input1: `\textepsilon`, *Input2:* `E`
Styles: ɛ *ɛ* **ɛ** ɛ, *Sources: IPA '49–'93*

40
'305

Closed Epsilon, *IPA usage:* open-mid central rounded vowel
Input: `\textcloseepsilon`
Styles: ɞ *ɞ* **ɞ** ɞ, *Sources: IPA '93*

41
'063

Reversed Epsilon, *IPA usage:* open-mid central unrounded vowel
Input1: `\textrevepsilon`, *Input2:* `3`
Styles: ɜ *ɜ* **ɜ** ɜ, *Sources: IPA '49–'93*

42
'307

Right-hook Reversed Epsilon, *IPA usage:* r colored ɜ
Input: `\textrhookrevepsilon`
Styles: ɝ *ɝ* **ɝ** ɝ, *Sources:*

43
'306

Closed Reversed Epsilon
Input: `\textcloserevepsilon`
Styles: ɜ *ɜ* **ɜ** ɞ, *Sources:*

44
'146

Lower-case F, *IPA usage:* voiceless labiodental fricative
Input: `f`
Styles: f *f* **f** f, *Sources: IPA '49–'93*

45
'147

Lower-case G, *IPA usage:* voiced velar plosive
Input1: `\textg`, *Input2:* `g`
Styles: g *g* **g** g, *Sources: IPA '49–'93*

46
Macro

Barred G
Input: `\textbarg`
Styles: ɡ̶ *ɡ̶* **ɡ̶** ɡ̶, *Sources:*

47
Macro

Crossed G
Input: `\textcrg`
Styles: g̠ *g̠* **g̠** g̠, *Sources:*

48
'344

Hooktop G, *IPA usage:* voiced velar implosive
Input1: `\texthtg`, *Input2:* `\!g`
Styles: ɠ *ɠ* **ɠ** ɠ, *Sources: IPA '49–'93*

49
'244

Text G
Input1: g, *Input2:* `\textg`
Styles: g *g* **g** g, *Sources:*

50
'345

Small Capital G, *IPA usage:* voiced uvular plosive
Input1: `\textscg`, *Input2:* `\;G`
Styles: ɢ *ɢ* **ɢ** ɢ, *Sources: IPA '49–'93*

51
'311

Hooktop Small Capital G, *IPA usage:* voiced uvular implosive
Input1: `\texthtscg`, *Input2:* `\!G`
Styles: ɢ̓ *ɢ̓* **ɢ̓** ɢ̓, *Sources: IPA '89, '93*

52 '107

Gamma, *IPA usage:* voiced velar fricative
Input1: `\textgamma`, *Input2:* `G`
Styles: ɣ *ɣ* **ɣ** ***ɣ***, *Sources: IPA '49–'93*

53 '310

Baby Gamma, *IPA usage:* close-mid back unrounded vowel
Input: `\textbabygamma`
Styles: ɤ *ɤ* **ɤ** ***ɤ***, *Sources: IPA '49, '79*

54 '067

Ram's Horns, *IPA usage:* close-mid back unrounded vowel
Input1: `\textramshorns`, *Input2:* `7`
Styles: ɤ *ɤ* **ɤ** ***ɤ***, *Sources: IPA '89, '93*

55 '150

Lower-case H, *IPA usage:* voiceless glottal fricative
Input: `h`
Styles: h *h* **h** ***h***, *Sources: IPA '49–'93*

56 '377

H-V Ligature, Usage: as in *Gothic* ƕas 'what'.
Input: `\texthvlig`
Styles: ƕ *ƕ* **ƕ** ***ƕ***, *Sources:*

57 '350

Crossed H, *IPA usage:* voiceless pharyngeal fricative
Input: `\textcrh`
Styles: ħ *ħ* **ħ** ***ħ***, *Sources: IPA '49–'93*

58 '110

Hooktop H, *IPA usage:* voiced glottal fricative
Input1: `\texthth`, *Input2:* `H`
Styles: ɦ *ɦ* **ɦ** ***ɦ***, *Sources: IPA '49–'93*

59 '312

Hooktop Heng, *IPA usage:* simultaneous ʃ and x
Input: `\texththeng`
Styles: ɧ *ɧ* **ɧ** ***ɧ***, *Sources: IPA '49–'93*

60 '064

Turned H, *IPA usage:* voiced labial-palatal approximant
Input1: `\textturnh`, *Input2:* `4`
Styles: ɥ *ɥ* **ɥ** ***ɥ***, *Sources: IPA '49–'93*

61 '313

Small Capital H, *IPA usage:* voiceless epiglottal fricative
Input1: `\textsch`, *Input2:* `\;H`
Styles: ʜ *ʜ* **ʜ** ***ʜ***, *Sources: IPA '89, '93*

62 '151

Lower-case I, *IPA usage:* close front unrounded vowel
Input: `i`
Styles: i *i* **i** ***i***, *Sources: IPA '49–'93*

63 '031

Undotted I
Input: `\i`
Styles: ɪ *ɪ* **ɪ** ***ɪ***, *Sources:*

64 '061

Barred I, *IPA usage:* close central unrounded vowel
Input1: `\textbari`, *Input2:* `1`
Styles: ɨ *ɨ* **ɨ** ***ɨ***, *Sources: IPA '49–'93*

65 '314

Iota
Input: `\textiota`
Styles: ɩ *ɩ* **ɩ** ***ɩ***, *Sources: IPA '49, '79*

66 '245

Left-hooktop I[18]
Input: `\textlhti`
Styles: ɭ *ɭ* **ɭ** ***ɭ***, *Sources:*

[18] The four symbols ɹ, ɻ, ɺ and ɽ are mainly used among Chinese linguists. These symbols are based on "det svenska landsmålsalfabetet" and introduced to China by Bernhard Karlgren. The original shapes of these symbols were in italic as was always the case with "det svenska landsmålsalfabetet". It seems that the Chinese linguists who wanted to continue to use these symbols in IPA changed their shapes upright.

67
'246
Left-hooktop Long I
Input: `\textlhtlongi`
Styles: ɭ *l* **ɭ** ɭ, *Sources:*

68
'247
Viby I[19]
Input: `\textvibyi`
Styles: ɻ *l* **ɻ** ɻ, *Sources:*

69
Macro
Raised Viby I
Input: `\textraisevibyi`
Styles: ɻ *l* **ɻ** ɻ, *Sources:*

70
'111
Small Capital I, *IPA usage:* close–close-mid front unrounded vowel
Input1: `\textsci`, *Input2:* `I`
Styles: ɪ *ɪ* **ɪ** ɪ, *Sources: IPA '89, '93*

71
'152
Lower-case J, *IPA usage:* voiced palatal approximant
Input: `j`
Styles: j *j* **j** j, *Sources: IPA '49–'93*

72
'032
Undotted J
Input: `\j`
Styles: ȷ *ȷ* **ȷ** ȷ, *Sources:*

73
'112
Curly-tail J[20], *IPA usage:* voiced palatal fricative
Input1: `\textctj`, *Input2:* `J`
Styles: ʝ *ʝ* **ʝ** ʝ, *Sources: IPA '89, '93*

74
'250
Small Capital J
Input1: `\textscj`, *Input2:* `\;J`
Styles: ᴊ *ᴊ* **ᴊ** ᴊ, *Sources:*

75
Macro
J Wedge, Usage: equivalent to IPA ʤ
Input: `\v{\j}`
Styles: ǰ *ǰ* **ǰ** ǰ, *Sources:*

76
'351
Barred Dotless J, *IPA usage:* voiced palatal plosive
Input: `\textbardotlessj`
Styles: ɟ *ɟ* **ɟ** ɟ, *Sources: IPA '89, '93*

77
'315
Old Barred Dotless J, *IPA usage:* voiced palatal plosive
Input: `\textObardotlessj`
Styles: ɟ *ɟ* **ɟ** ɟ, *Sources: IPA '49, '79*

78
'352
Hooktop Barred Dotless J[21], *IPA usage:* voiced palatal implosive
Input1: `\texthtbardotlessj`, *Input2:* `\!j`
Styles: ʄ *ʄ* **ʄ** ʄ, *Sources: IPA '89, '93*

79
'153
Lower-case K, *IPA usage:* voiceless velar plosive
Input: `k`
Styles: k *k* **k** k, *Sources: IPA '49–'93*

80
'316
Hooktop K, *IPA usage:* voiceless velar inplosive
Input: `\texthtk`
Styles: ƙ *ƙ* **ƙ** ƙ, *Sources: IPA '89*

[19] I call this symbol 'Viby I', based on the following description by Bernhard Karlgren: "Une voyelle très analogue à ɻ se rencontre dans certains dial. suédois; on l'appelle 'i de Viby'."(*Études sur la phonologie chinoise*, 1915–26, p. 295)

[20] In the official IPA charts of '89 and '93, this symbol has a dish serif on top of the stem, rather than the normal sloped serif found in the letter j. I found no reason why it should have a dish serif here, so I changed it to a normal sloped serif.

[21] In *PSG* the shape of this symbol slightly differs. Here I followed the shape found in IPA '89, '93.

81
'251

Turned K
Input1: `\textturnk`, *Input2:* `\*k`
Styles: ɻ *ɻ* **ɻ** ɻ, *Sources:*

82
'154

Lower-case L, *IPA usage:* alveolar lateral approximant
Input: `l`
Styles: l *l* **l** l, *Sources: IPA '49–'93*

83
'353

L with Tilde
Input1: `\textltilde`, *Input2:* `\|~l`
Styles: ɬ *ɬ* **ɬ** ɬ, *Sources: IPA '49–'93*

84
'252

Barred L
Input: `\textbarl`
Styles: ɬ *ɬ* **ɬ** ɬ, *Sources:*

85
'354

Belted L, *IPA usage:* voiceless alveolar lateral fricative
Input: `\textbeltl`
Styles: ɮ *ɮ* **ɮ** ɮ, *Sources: IPA '49–'93*

86
'355

Right-tail L, *IPA usage:* retroflex lateral approximant
Input1: `\textrtaill`, *Input2:* `\:l`
Styles: ɭ *ɭ* **ɭ** ɭ, *Sources: IPA '49–'93*

87
'320

L-Yogh Ligature, *IPA usage:* voiced alveolar lateral fricative
Input: `\textlyoghlig`
Styles: ɮ *ɮ* **ɮ** ɮ, *Sources: IPA '89, '93*

88
'254

Old L-Yogh Ligature, *IPA usage:* voiced alveolar lateral fricative
Input: `\textOlyoghlig`
Styles: ɮ *ɮ* **ɮ** ɮ, *Sources: IPA '49, '79*

89
'317

Small Capital L, *IPA usage:* velar lateral approximant
Input1: `\textscl`, *Input2:* `\;L`
Styles: ʟ *ʟ* **ʟ** ʟ, *Sources: IPA '89, '93*

90
'253

Lambda
Input: `\textlambda`
Styles: λ *λ* **λ** λ, *Sources:*

91
Macro

Crossed Lambda
Input: `\textcrlambda`
Styles: ƛ *ƛ* **ƛ** ƛ, *Sources:*

92
'155

Lower-case M, *IPA usage:* bilabial nasal
Input: `m`
Styles: m *m* **m** m, *Sources: IPA '49–'93*

93
'115

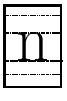
Left-tail M (at right), *IPA usage:* labiodental nasal
Input1: `\textltailm`, *Input2:* `M`
Styles: ɱ *ɱ* **ɱ** ɱ, *Sources: IPA '49–'93*

94
'127

Turned M, *IPA usage:* close back unrounded vowel
Input1: `\textturnm`, *Input2:* `W`
Styles: ɯ *ɯ* **ɯ** ɯ, *Sources: IPA '49–'93*

95
'356

Turned M, Right Leg, *IPA usage:* velar approximant
Input: `\textturnmrleg`
Styles: ɯ *ɯ* **ɯ** ɯ, *Sources: IPA '79, '89, '93*

96 
'156

Lower-case N, *IPA usage:* dental/alveolar nasal
Input: `n`
Styles: n *n* **n** n, *Sources: IPA '49–'93*

97 '256
N, Right Leg
Input: `\textnrleg`
Styles: ɳ *ɳ* **ɳ** ɳ, *Sources: IPA '49*

98 *Macro*
N with Tilde
Input: `\~n`
Styles: ñ *ñ* **ñ** ñ, *Sources:*

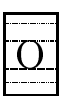
99 '361
Left-tail N (at left), *IPA usage:* palatal nasal
Input: `\textltailn`
Styles: ɲ *ɲ* **ɲ** ɲ, *Sources: IPA '49–'93*

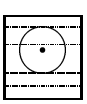
100 '116
Eng, *IPA usage:* velar nasal
Input1: `\ng`, *Input2:* `N`
Styles: ŋ *ŋ* **ŋ** ŋ, *Sources: IPA '49–'93*

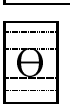
101 '357
Right-tail N, *IPA usage:* retroflex nasal
Input1: `\textrtailn`, *Input2:* `\:n`
Styles: ɳ *ɳ* **ɳ** ɳ, *Sources: IPA '49–'93*

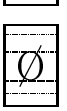
102 '255
Curly-tail N, Usage: alveolo-palatal nasal
Input: `\textctn`
Styles: ɳ *ɳ* **ɳ** ɳ, *Sources:*

103 '360
Small Capital N, *IPA usage:* uvular nasal
Input1: `\textscn`, *Input2:* `\;N`
Styles: ɴ *ɴ* **ɴ** ɴ, *Sources: IPA '49–'93*

104 '157 
Lower-case O, *IPA usage:* close-mid back rounded vowel
Input: `o`
Styles: o *o* **o** o, *Sources: IPA '49–'93*

105 '362 
Bull's Eye, *IPA usage:* bilabial click
Input1: `\textbullseye`, *Input2:* `\!o`
Styles: ⊙ *⊙* **⊙** ⊙, *Sources: IPA '79, '89, '93*

106 '070 
Barred O, *IPA usage:* close-mid central rounded vowel
Input1: `\textbaro`, *Input2:* `8`
Styles: ɵ *ɵ* **ɵ** ɵ, *Sources: IPA '49–'93*

107 '370 
Slashed O, *IPA usage:* close-mid front rounded vowel
Input: `\o`
Styles: ø *ø* **ø** ø, *Sources: IPA '49–'93*

108 '367
O-E Ligature, *IPA usage:* open-mid front rounded vowel
Input: `\oe`
Styles: œ *œ* **œ** œ, *Sources: IPA '49–'93*

109 '327
Small Capital O-E Ligature, *IPA usage:* open front rounded vowel
Input1: `\textscoelig`, *Input2:* `\OE`
Styles: œ *œ* **œ** œ, *Sources: IPA '79, '89, '93*

110 '117
Open O, *IPA usage:* open-mid back rounded vowel
Input1: `\textopeno`, *Input2:* `O`
Styles: ɔ *ɔ* **ɔ** ɔ, *Sources: IPA '49–'93*

111 '257
Turned C(Open O)-E Ligature
Input: `\textturncelig`
Styles: ɞ *ɞ* **ɞ** ɞ, *Sources:*

112 '260
Omega
Input: `\textomega`
Styles: ω *ω* **ω** ω, *Sources:*

113
'261

Small Capital Omega
Input: `\textscomega`
Styles: ɷ *ɷ* **ɷ** ɷ, *Sources:*

114
'321

Closed Omega
Input: `\textcloseomega`
Styles: ɷ *ɷ* **ɷ** ɷ, *Sources: IPA '49, '79*

115
'160

Lower-case P, *IPA usage:* voiceless bilabial plosive
Input: `p`
Styles: p *p* **p** p, *Sources: IPA '49–'93*

116
'337

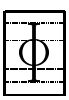
Wynn
Input: `\textwynn`
Styles: p *p* **p** p, *Sources:*

117
'376

Thorn
Input1: `\textthorn`, *Input2:* `\th`
Styles: þ *þ* **þ** þ, *Sources:*

118
'322

Hooktop P, *IPA usage:* voiceless bilabial implosive
Input: `\texthtp`
Styles: ƥ *ƥ* **ƥ** ƥ, *Sources: IPA '89*

119 
'106

Phi, *IPA usage:* voiceless bilabial fricative
Input1: `\textphi`, *Input2:* `F`
Styles: ɸ *ɸ* **ɸ** ɸ, *Sources: IPA '49–'93*

120
'161

Lower-case Q, *IPA usage:* voiceless uvular plosive
Input: `q`
Styles: q *q* **q** q, *Sources: IPA '49–'93*

121
'323

Hooktop Q, *IPA usage:* voiceless uvular implosive
Input: `\texthtq`
Styles: ʠ *ʠ* **ʠ** ʠ, *Sources: IPA '89*

122
'262

Small Capital Q[22], Usage: voiceless pharyngeal plosive
Input1: `\textscq`, *Input2:* `\;Q`
Styles: ʠ *ʠ* **ʠ** ʠ, *Sources:*

123
'162

Lower-case R, *IPA usage:* alveolar trill
Input: `r`
Styles: r *r* **r** r, *Sources: IPA '49–'93*

124
'122

Fish-hook R, *IPA usage:* alveolar tap or flap
Input1: `\textfishhookr`, *Input2:* `R`
Styles: ɾ *ɾ* **ɾ** ɾ, *Sources: IPA '49–'93*

125
'324

Long-leg R, *IPA usage:* alveolar fricative trill
Input: `\textlonglegr`
Styles: ɾ *ɾ* **ɾ** ɾ, *Sources: IPA '49, '79*

126
'363

Right-tail R, *IPA usage:* retroflex tap or flap
Input1: `\textrtailr`, *Input2:* `\:r`
Styles: ɽ *ɽ* **ɽ** ɽ, *Sources: IPA '49–'93*

[22]Suggested by Prof S. Tsuchida for Austronesian languages in Taiwan. In *PSG* 'Female Sign' and 'Uncrossed Female Sign'(pp. 110–111) are noted for pharyngeal stops, as proposed by Trager (1964). Also I'm not sure about the difference between an epiglottal plosive and a pharyngeal stop.

127
'364

Turned R, *IPA usage:* alveolar approximant
Input1: `\textturnr`, *Input2:* `\*r`
Styles: ɹ *ɹ* **ɹ** ɹ, *Sources: IPA '49–'93*

128
'365

Turned R, Right Tail, *IPA usage:* retroflex approximant
Input1: `\textturnrrtail`, *Input2:* `\:R`
Styles: ɻ *ɻ* **ɻ** ɻ, *Sources: IPA '49–'93*

129
'325

Turned Long-leg R, *IPA usage:* alveolar lateral flap
Input: `\textturnlonglegr`
Styles: ɺ *ɺ* **ɺ** ɺ, *Sources: IPA '49–'93*

130
'366

Small Capital R, *IPA usage:* uvular trill
Input1: `\textscr`, *Input2:* `\;R`
Styles: ʀ *ʀ* **ʀ** ʀ, *Sources: IPA '49–'93*

131
'113

Inverted Small Capital R, *IPA usage:* voiced uvular fricative
Input1: `\textinvscr`, *Input2:* `K`
Styles: ʁ *ʁ* **ʁ** ʁ, *Sources: IPA '49–'93*

132
'163

Lower-case S, *IPA usage:* voiceless alveolar fricative
Input: `s`
Styles: s *s* **s** s, *Sources: IPA '49–'93*

133
Macro

S Wedge, Usage: equivalent to IPA ʃ
Input: `\v{s}`
Styles: š *š* **š** š, *Sources:*

134
'371

Right-tail S (at left), *IPA usage:* voiceless retroflex fricative
Input1: `\textrtails`, *Input2:* `\:s`
Styles: ʂ *ʂ* **ʂ** ʂ, *Sources: IPA '49–'93*

135
'123

Esh, *IPA usage:* voiceless postalveolar fricative
Input1: `\textesh`, *Input2:* `S`
Styles: ʃ *ʃ* **ʃ** ʃ, *Sources: IPA '49–'93*

136
Macro

Doube-barred Esh
Input: `\textdoublebaresh`
Styles: ʄ *ʄ* **ʄ** ʄ, *Sources:*

137
'263

Curly-tail Esh, *IPA usage:* palatalized ʃ
Input: `\textctesh`
Styles: ʃ *ʃ* **ʃ** ʃ, *Sources: IPA '49, '79*

138
'164

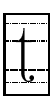
Lower-case T, *IPA usage:* voiceless dental/alveolar plosive
Input: `t`
Styles: t *t* **t** t, *Sources: IPA '49–'93*

139
'326

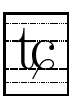
Hooktop T, *IPA usage:* voiceless dental/alveolar implosive
Input: `\texthtt`
Styles: ƫ *ƫ* **ƫ** ƫ, *Sources: IPA '89*

140
'264

Left-hook T, *IPA usage:* palatalized t
Input: `\textlhookt`
Styles: ƭ *ƭ* **ƭ** ƭ, *Sources:*

141 
'372

Right-tail T, *IPA usage:* voiceless retroflex plosive
Input1: `\textrtailt`, *Input2:* `\:t`
Styles: ʈ *ʈ* **ʈ** ʈ, *Sources: IPA '49–'93*

142 
Macro

T-Curly-tail C Ligature
Input: `\texttctclig`
Styles: ʨ *ʨ* **ʨ** ʨ, *Sources:*

143
'266

T-S Ligature
Input: `\texttslig`
Styles: ʦ *ʦ* **ʦ** ʦ, *Sources:*

144
'331

T-Esh Ligature
Input: `\textteshlig`
Styles: ʧ *ʧ* **ʧ** ʧ, *Sources: IPA '49–'93*

145
'330

Turned T, *IPA usage:* dental click
Input1: `\textturnt`, *Input2:* `\*t`
Styles: ɬ *ɬ* **ɬ** ɬ, *Sources: IPA '49, '79*

146
'265

Curly-tail T, Usage: voiceless alveolo-palatal plosive
Input: `\textctt`
Styles: ƫ *ƫ* **ƫ** ƫ, *Sources:*

147
Macro

Curly-tail T-Curly-tail C Ligature
Input: `\textcttctclig`
Styles: ʨ *ʨ* **ʨ** ʨ, *Sources:*

148
'124

Theta, *IPA usage:* voiceless dental fricative
Input1: `\texttheta`, *Input2:* `T`
Styles: θ *θ* **θ** θ, *Sources: IPA '49–'93*

149
'165

Lower-case U, *IPA usage:* close back rounded vowel
Input: `u`
Styles: u *u* **u** u, *Sources: IPA '49–'93*

150
'060

Barred U, *IPA usage:* close central rounded vowel
Input1: `\textbaru`, *Input2:* `0`
Styles: ʉ *ʉ* **ʉ** ʉ, *Sources: IPA '49–'93*

151
'125

Upsilon, *IPA usage:* close–close-mid back rounded vowel
Input1: `\textupsilon`, *Input2:* `U`
Styles: ʊ *ʊ* **ʊ** ʊ, *Sources: IPA '89, '93*

152
'366

Small Capital U, Usage: equivalent to IPA ʊ
Input1: `\textscu`, *Input2:* `\;U`
Styles: ᴜ *ᴜ* **ᴜ** ᴜ, *Sources: IPA '49–'93*

153
'166

Lower-case V, *IPA usage:* voiced labiodental fricative
Input: `v`
Styles: v *v* **v** v, *Sources: IPA '49–'93*

154
'126

Script V, *IPA usage:* labiodental approximant
Input1: `\textscriptv`, *Input2:* `V`
Styles: ʋ *ʋ* **ʋ** ʋ, *Sources: IPA '49–'93*

155
'167

Lower-case W, *IPA usage:* voiced labio-velar approximant
Input: `w`
Styles: w *w* **w** w, *Sources: IPA '49–'93*

156
'373

Turned W, *IPA usage:* voiceless labio-velar approximant
Input1: `\textturnw`, *Input2:* `\*w`
Styles: ʍ *ʍ* **ʍ** ʍ, *Sources: IPA '49–'93*

157
'170

Lower-case X, *IPA usage:* voiceless velar fricative
Input: `x`
Styles: x *x* **x** x, *Sources: IPA '49–'93*

158
'130

Chi, *IPA usage:* voiceless uvular fricative
Input1: `\textchi`, *Input2:* `X`
Styles: χ *χ* **χ** χ, *Sources: IPA '49–'93*

159
'171

Lower-case Y, *IPA usage:* close front rounded vowel
Input: `y`
Styles: y *y* **y** y, *Sources: IPA '49–'93*

160
'114

Turned Y, *IPA usage:* palatal lateral approximant
Input1: `\textturny`, *Input2:* `L`
Styles: ʎ *ʎ* **ʎ** ʎ, *Sources: IPA '49–'93*

161
'131

Small Capital Y, *IPA usage:* close–close-mid front rounded vowel
Input1: `\textscy`, *Input2:* `Y`
Styles: ʏ *ʏ* **ʏ** ʏ, *Sources: IPA '49–'93*

162
'267

Viby Y[23]
Input: `\textvibyy`
Styles: ʯ *ʯ* **ʯ** ʯ, *Sources:*

163
'172

Lower-case Z, *IPA usage:* voiced alveolar fricative
Input: `z`
Styles: z *z* **z** z, *Sources: IPA '49–'93*

164
'336

Comma-tail Z, Usage: as in *OHG* ëẓẓan 'to eat'.
Input: `\textcommatailz`
Styles: ʐ *ʐ* **ʐ** ʐ, *Sources:*

165
Macro

Z Wedge, Usage: equivalent to IPA ʒ
Input: `\v{z}`
Styles: ž *ž* **ž** ž, *Sources:*

166
'375

Curly-tail Z, *IPA usage:* voiced alveolo-palatal fricative
Input: `\textctz`
Styles: ʑ *ʑ* **ʑ** ʑ, *Sources: IPA '49–'93*

167
'271

Reversed Yogh
Input: `\textrevyogh`
Styles: ɛ *ɛ* **ɛ** ɛ, *Sources:*

168
'374

Right-tail Z, *IPA usage:* voiced retroflex fricative
Input1: `\textrtailz`, *Input2:* `\:z`
Styles: ʐ *ʐ* **ʐ** ʐ, *Sources: IPA '49–'93*

169
'132

Yogh, *IPA usage:* voiced postalveolar fricative
Input1: `\textyogh`, *Input2:* `Z`
Styles: ʒ *ʒ* **ʒ** ʒ, *Sources: IPA '49–'93*

170
'270

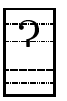
Curly-tail Yogh, *IPA usage:* palatalized ʒ
Input: `\textctyogh`
Styles: ʒ *ʒ* **ʒ** ʒ, *Sources: IPA '49, '79*

171
Macro

Crossed 2
Input: `\textcrtwo`
Styles: ƻ *ƻ* **ƻ** ƻ, *Sources: IPA '49*

172
'120

Glottal Stop
Input1: `\textglotstop`, *Input2:* `P`
Styles: ʔ *ʔ* **ʔ** ʔ, *Sources: IPA '49–'93*

173 
'274

Superscript Glottal Stop
Input: `\textraiseglotstop`
Styles: ˀ *ˀ* **ˀ** ˀ, *Sources:*

[23] See explanations in footnote 19.

174
'334

Barred Glottal Stop, *IPA usage:* epiglottal plosive
Input: `\textbarglotstop`
Styles: ʡ ʡ ʡ ʡ, *Sources: IPA '89, '93*

175
'333

Inverted Glottal Stop, *IPA usage:* alveolar lateral click
Input: `\textinvglotstop`
Styles: ʖ ʖ ʖ ʖ, *Sources: IPA '49, '79*

176
Macro

Crossed Inverted Glottal Stop
Input: `\textcrinvglotstop`
Styles: ʖ ʖ ʖ ʖ, *Sources: IPA '49*

177
'121

Reversed Glottal Stop, *IPA usage:* voiced pharyngeal fricative
Input1: `\textrevglotstop`, *Input2:* `Q`
Styles: ʕ ʕ ʕ ʕ, *Sources: IPA '49–'93*

178
'335

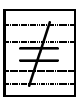
Barred Reversed Glottal Stop, *IPA usage:* voiced epiglottal fricative
Input: `\textbarrevglotstop`
Styles: ʢ ʢ ʢ ʢ, *Sources: IPA '89, '93*

179
'174

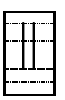
Pipe, *IPA usage:* dental click
Input1: `\textpipe`, *Input2:* `|`
Styles: | | | |, *Sources: IPA '89, '93*

180
'175

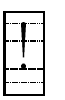
Double-barred Pipe, *IPA usage:* palatoalveolar click
Input: `\textdoublebarpipe`
Styles: ǂ ǂ ǂ ǂ, *Sources: IPA '89, '93*

181 
Macro

Double-barred Slash, Usage: a variant of ǂ
Input: `\textdoublebarslash`
Styles: ≠ ≠ ≠ ≠, *Sources:*

182 
'177

Double Pipe, *IPA usage:* alveolar lateral click
Input1: `\textdoublepipe`, *Input2:* `||`
Styles: ‖ ‖ ‖ ‖, *Sources: IPA '89, '93*

183 
'041

Exclamation Point, *IPA usage:* (post)alveolar click
Input: `!`
Styles: ! ! ! !, *Sources: IPA '89, '93*

A.2 Suprasegmentals

184
'042

Vertical Stroke (Superior), *IPA usage:* primary stress
Input1: `\textprimstress`, *Input2:* `"`
Styles: ˈ ˈ ˈ ˈ, *Sources: IPA '49–'93*

185
'177

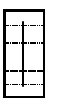
Vertical Stroke (Inferior), *IPA usage:* secondary stress
Input1: `\textsecstress`, *Input2:* `""`
Styles: ˌ ˌ ˌ ˌ, *Sources: IPA '49–'93*

186
'072

Length Mark, *IPA usage:* long
Input1: `\textlengthmark`, *Input2:* `:`
Styles: ː ː ː ː, *Sources: IPA '49–'93*

187
'073

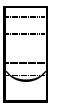
Half-length Mark, *IPA usage:* half-long
Input1: `\texthalflength`, *Input2:* `;`
Styles: ˑ ˑ ˑ ˑ, *Sources: IPA '49–'93*

188 
'222

Vertical Line, *IPA usage:* minor (foot) group
Input: `\textvertline`
Styles: | | | |, *Sources: IPA '89, '93*

189
'223

Double Vertical Line, *IPA usage:* major (intonation) group
Input: `\textdoublevertline`
Styles: ‖ ‖ ‖ ‖, *Sources: IPA '89, '93*

190 
'074

Bottom Tie Bar, *IPA usage:* linking (absence of a break)
Input1: `\textbottomtiebar`, *Input2:* `\t*{}`
Styles: ‿ ‿ ‿ ‿, *Sources: IPA '89, '93*

191
'224

Downward Diagonal Arrow, *IPA usage:* global fall
Input: `\textglobfall`
Styles: ↘ ↘ ↘ ↘, *Sources: IPA '89, '93*

192
'225

Upward Diagonal Arrow, *IPA usage:* global rise
Input: `\textglobrise`
Styles: ↗ ↗ ↗ ↗, *Sources: IPA '89, '93*

193
'226

Down Arrow[24], *IPA usage:* downstep
Input: `\textdownstep`
Styles: ↓ ↓ ↓ ↓, *Sources: IPA '89, '93*

194
'227

Up Arrow, *IPA usage:* upstep
Input: `\textupstep`
Styles: ↑ ↑ ↑ ↑, *Sources: IPA '89, '93*

A.3 Accents and Diacritics

195
'000

Grave Accent, *IPA usage:* low tone
Input: `\‘e`
Styles: è è **è** è, *Sources: IPA '49–'93*

196
'001

Acute Accent, *IPA usage:* high tone
Input: `\’e`
Styles: é é **é** é, *Sources: IPA '49–'93*

197
'002

Circumflex Accent, *IPA usage:* falling tone
Input: `\^e`
Styles: ê ê **ê** ê, *Sources: IPA '49–'93*

198
'003

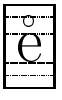
Tilde, *IPA usage:* nasalized
Input: `\~e`
Styles: ẽ ẽ **ẽ** ẽ, *Sources: IPA '49–'93*

199
'004

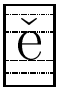
Umlaut, *IPA usage:* centralized
Input: `\"e`
Styles: ë ë **ë** ë, *Sources: IPA '49–'93*

200
'005

Double Acute Accent, *IPA usage:* extra high tone
Input: `\H{e}`
Styles: ő ő **ő** ő, *Sources: IPA '89, '93*

201 
'006

Ring
Input: `\r{e}`
Styles: å å **å** å, *Sources:*

202 
'007

Wedge, *IPA usage:* rising tone
Input: `\v{e}`
Styles: ě ě **ě** ě, *Sources: IPA '49–'93*

[24] The shapes of `\textdownstep` and `\textupstep` differ according to sources. Here I followed the shapes found in the recent IPA charts.

203
'010

Breve, *IPA usage:* extra short
Input: `\u{e}`
Styles: ĕ *ĕ* **ĕ** ĕ, *Sources: IPA '49–'93*

204
'011

Macron
Input: `\=e`
Styles: ē *ē* **ē** ē, *Sources:*

205
'012

Dot
Input: `\.e`
Styles: ė *ė* **ė** ė, *Sources:*

206
'013

Cedille
Input: `\c{e}`
Styles: ę *ę* **ę** ę, *Sources:*

207
'014

Polish Hook (Ogonek Accent)
Input1: `\textpolhook{e}`, *Input2:* `\k{e}`
Styles: ę *ę* **ę** ę, *Sources:*

208
'015

Double Grave Accent, *IPA usage:* extra low tone
Input1: `\textdoublegrave{e}`, *Input2:* `\H*e`
Styles: è ë **ë** è, *Sources: IPA '89, '93*

209
'016

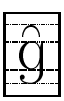
Subscript Grave Accent, *IPA usage:* low falling tone
Input1: `\textsubgrave{e}`, *Input2:* `\‘*e`
Styles: ẹ *ẹ* **ẹ** ẹ, *Sources: IPA '49, '79*

210
'017

Subscript Acute Accent, *IPA usage:* low rising tone
Input1: `\textsubacute{e}`, *Input2:* `\’*e`
Styles: ẹ *ẹ* **ẹ** ẹ, *Sources: IPA '49, '79*

211
Macro

Subscript Circumflex Accent
Input1: `\textsubcircum{e}`, *Input2:* `\^*e`
Styles: ẹ *ẹ* **ẹ** ẹ, *Sources:*

212 
'020

Round Cap
Input1: `\textroundcap{g}`, *Input2:* `\|c{g}`
Styles: ĝ *ĝ* **ĝ** ĝ, *Sources:*

213
Macro

Acute Accent with Macron
Input1: `\textacutemacron{a}`, *Input2:* `\’=a`
Styles: á́ *á́* **á́** á́, *Sources:*

214
'234

Vertical Bar Accent
Input: `\textvbaraccent{a}`
Styles: ȧ *ȧ* **ȧ** ȧ, *Sources:*

215
'235

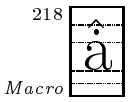
Double Vertical Bar Accent
Input: `\textdoublevbaraccent{a}`
Styles: a̋ *a̋* **a̋** a̋, *Sources:*

216
'236

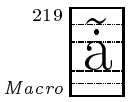
Grave Dot Accent
Input1: `\textgravedot{e}`, *Input2:* `\‘.e`
Styles: è *ė* **ė̀** ė̀, *Sources:*

217
'237

Dot Acute Accent
Input1: `\textdotacute{e}`, *Input2:* `\’.e`
Styles: ė́ *ė́* **ė́** ė́, *Sources:*

218 
Macro

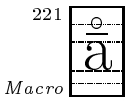
Circumflex Dot Accent
Input1: `\textcircumdot{a}`, *Input2:* `\^.a`
Styles: å å **å** å, *Sources:*

219 
Macro

Tilde Dot Accent
Input1: `\texttildedot{a}`, *Input2:* `\~.a`
Styles: ã ã **ã** ã, *Sources:*

220
Macro

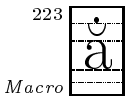
Breve Macron Accent
Input1: `\textbrevemacron{a}`, *Input2:* `\u=a`
Styles: ă̄ ă̄ **ă̄** ă̄, *Sources:*

221 
Macro

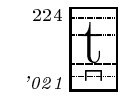
Ring Macron Accent
Input1: `\textringmacron{a}`, *Input2:* `\r=a`
Styles: å̄ å̄ **å̄** å̄, *Sources:*

222
Macro

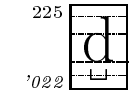
Acute Wedge Accent
Input1: `\textacutewedge{s}`, *Input2:* `\v's`
Styles: ś ś **ś** ś, *Sources:*

223 
Macro

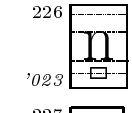
Dot Breve Accent
Input: `\textdotbreve{a}`
Styles: ă̇ ă̇ **ă̇** ă̇, *Sources:*

224 
'021

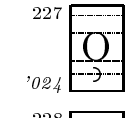
Subscript Bridge, *IPA usage:* dental
Input1: `\textsubbridge{t}`, *Input2:* `\|[t`
Styles: t̪ t̪ **t̪** t̪, *Sources: IPA '49–'93*

225 
'022

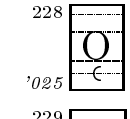
Inverted Subscript Bridge, *IPA usage:* apical
Input1: `\textinvsubbridge{d}`, *Input2:* `\|]t`
Styles: d̪ d̪ **d̪** d̪, *Sources: IPA '89, '93*

226 
'023

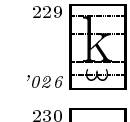
Subscript Square, *IPA usage:* laminal
Input: `\textsubsquare{n}`
Styles: n̻ n̻ **n̻** n̻, *Sources: IPA '89, '93*

227 
'024

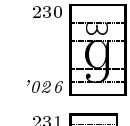
Subscript Right Half-ring[25], *IPA usage:* more rounded
Input1: `\textsubrhalfring{o}`, *Input2:* `\|)o`
Styles: o̹ o̹ **o̹** o̹, *Sources: IPA '49–'93*

228 
'025

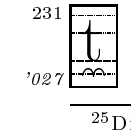
Subscript Left Half-ring, *IPA usage:* less rounded
Input1: `\textsublhalfring{o}`, *Input2:* `\|(o`
Styles: o̜ o̜ **o̜** o̜, *Sources: IPA '49–'93*

229 
'026

Subscript W, *IPA usage:* labialized
Input1: `\textsubw{k}`, *Input2:* `\|w{k}`
Styles: k̫ k̫ **k̫** k̫, *Sources: IPA '79*

230 
'026

Over W, Usage: labialized
Input: `\textoverw{g}`
Styles: g̈ g̈ **g̈** g̈, *Sources:*

231 
'027

Seagull, *IPA usage:* linguolabial
Input1: `\textseagull{t}`, *Input2:* `\|m{t}`
Styles: t̼ t̼ **t̼** t̼, *Sources: IPA '89, '93*

[25] Diacritics `\textsubrhalfring` and `\textsublhalfring` can be placed after a symbol by inputting, for example, `[e\textsubrhalfring{}]` [e.].

232
'030

Over-cross, *IPA usage:* mid-centralized
Input1: `\textovercross{\e}`, *Input2:* `\|x{e}`
Styles: e͗ e͗ e͗ e͗, *Sources: IPA '49–'93*

233
'033

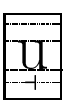
Subscript Plus[26], *IPA usage:* advanced
Input1: `\textsubplus{\textopeno}`, *Input2:* `\|+O`
Styles: ɔ̟ ɔ̟ ɔ̟ ɔ̟, *Sources: IPA '49–'93*

234
'034

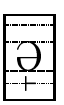
Raising Sign, *IPA usage:* raised
Input1: `\textraising{\textepsilon}`, *Input2:* `\|'E`
Styles: ɛ̝ ɛ̝ ɛ̝ ɛ̝, *Sources: IPA '49–'93*

235
'035

Lowering Sign, *IPA usage:* lowered
Input1: `\textlowering{e}`, *Input2:* `\|‘e`
Styles: e̞ e̞ e̞ e̞, *Sources: IPA '49–'93*

236 
'036

Advancing Sign, *IPA usage:* advanced tongue root
Input1: `\textadvancing{u}`, *Input2:* `\|<u`
Styles: u̘ u̘ u̘ u̘, *Sources: IPA '49–'93*

237 
'037

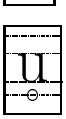
Retracting Sign, *IPA usage:* retracted tongue root
Input1: `\textretracting{\textschwa}`, *Input2:* `\|>@`
Styles: ə̙ ə̙ ə̙ ə̙, *Sources: IPA '49–'93*

238
'003

Subscript Tilde, *IPA usage:* creaky voiced
Input1: `\textsubtilde{e}`, *Input2:* `\~*e`
Styles: ḛ ḛ ḛ ḛ, *Sources: IPA '89, '93*

239
'004

Subscript Umlaut, *IPA usage:* breathy voiced
Input1: `\textsubumlaut{e}`, *Input2:* `\"*e`
Styles: e̤ e̤ e̤ e̤, *Sources: IPA '79, '89, '93*

240 
'006

Subscript Ring, *IPA usage:* voiceless
Input1: `\textsubring{u}`, *Input2:* `\r*u`
Styles: u̥ u̥ u̥ u̥, *Sources: IPA '49–'93*

241
'007

Subscript Wedge, *IPA usage:* voiced
Input1: `\textsubwedge{e}`, *Input2:* `\v*e`
Styles: e̬ e̬ e̬ e̬, *Sources: IPA '49–'93*

242
'011

Subscript Bar, *IPA usage:* retracted
Input1: `\textsubbar{e}`, *Input2:* `\=*e`
Styles: e̲ e̲ e̲ e̲, *Sources: IPA '49–'93*

243
'012

Subscript Dot, Usage: retroflex
Input1: `\textsubdot{e}`, *Input2:* `\.*e`
Styles: e̤ e̤ e̤ e̤, *Sources:*

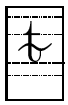
244
'020

Subscript Arch, *IPA usage:* non-syllabic
Input: `\textsubarch{e}`
Styles: e̯ e̯ e̯ e̯, *Sources:*

245
'042

Syllabicity Mark, *IPA usage:* syllabic
Input1: `\textsyllabic{m}`, *Input2:* `\s{m}`
Styles: m̩ m̩ m̩ m̩, *Sources: IPA '49–'93*

[26] The diacritics such as `\textsubplus`, `\textraising`, `\textlowering` `\textadvancing` and `\textretracting` can be placed after a symbol by inputting `[e\textsubplus{}]` [e+], for example.

246 
'046

Superimposed Tilde, *IPA usage:* velarized or pharyngealized
Input1: `\textsuperimposetilde{t}`, *Input2:* `\|~{t}`
Styles: t̴ *t̴* **t̴** **t̴**, *Sources: IPA '49–'93*

247
'136

Corner, *IPA usage:* no audible release
Input: `t\textcorner`
Styles: t˥ *t˥* **t˥** **t˥**, *Sources: IPA '89, '93*

248
'137

Open Corner, Usage: release/burst
Input: `t\textopencorner`
Styles: tˤ *tˤ* **tˤ** **tˤ**, *Sources:*

249
'176

Rhoticity, *IPA usage:* rhoticity
Input: `\textschwa\rhoticity`
Styles: ə˞ *ə˞* **ə˞** **ə˞**, *Sources: IPA '89, '93*

250
'040

Celtic Palatalization Mark, Usage: as in *Irish* b′an 'woman'.
Input: `b\textceltpal`
Styles: b′ *b′* **b′** **b′**, *Sources:*

251
'275

Left Pointer
Input: `k\textlptr`
Styles: kˊ *kˊ* **kˊ** **kˊ**, *Sources:*

252
'276

Right Pointer
Input: `k\textrptr`
Styles: kˋ *kˋ* **kˋ** **kˋ**, *Sources:*

253
'277

Rectangle[27], Usage: equivalent to IPA ˥ (Corner)
Input: `p\textrectangle`
Styles: p˺ *p˺* **p˺** **p˺**, *Sources:*

254
'076

Top Tie Bar, *IPA usage:* affricates and double articulations
Input1: `\texttoptiebar{gb}`, *Input2:* `\t{gb}`
Styles: g͡b *g͡b* **g͡b** **g͡b**, *Sources:*

255
'047

Apostrophe, *IPA usage:* ejective
Input: `'`
Styles: ' ' **'** **'**, *Sources: IPA '49–'93*

256
'134

Reversed Apostrophe, *IPA usage:* aspirated
Input: `\textrevapostrophe`
Styles: ‘ ‘ **‘** **‘**, *Sources: IPA '49, '79*

257
'056

Period, *IPA usage:* syllable break as in [ɹi.ækt]
Input: `.`
Styles: . . **.** **.**, *Sources: IPA '89, '93*

258
'043

Hooktop
Input: `\texthooktop`
Styles: ˁ ˁ **ˁ** **ˁ**, *Sources:*

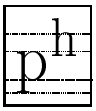
259
'044

Right Hook
Input: `\textrthook`
Styles: ˕ ˕ **˕** **˕**, *Sources:*

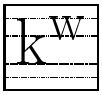
[27] This symbol is used among Japanese linguists as a diacritical symbol indicating no audible release (IPA ˥), because the symbol ˥ is used to indicate pitch accent in Japanese.

260
'045

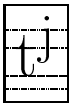
Palatalization Hook
Input: `\textpalhook`
Styles: ˛ ˛ ˛ ˛, *Sources:*

261 
Macro

Superscript H, *IPA usage:* aspirated
Input1: `p\textsuperscript{h}`, *Input2:* `p\super h`
Styles: p^{h} p^{h} $\mathbf{p^{h}}$ $\mathtt{p^{h}}$, *Sources: IPA '49–'93*

262 
Macro

Superscript W, *IPA usage:* labialized
Input1: `k\textsuperscript{w}`, *Input2:* `k\super w`
Styles: k^{w} k^{w} $\mathbf{k^{w}}$ $\mathtt{k^{w}}$, *Sources: IPA '49–'93*

263 
Macro

Superscript J, *IPA usage:* palatalized
Input1: `t\textsuperscript{j}`, *Input2:* `t\super j`
Styles: t^{j} t^{j} $\mathbf{t^{j}}$ $\mathtt{t^{j}}$, *Sources: IPA '49–'93*

264
Macro

Superscript Gamma, *IPA usage:* velarized
Input1: `t\textsuperscript{\textgamma}`, *Input2:* `t\super G`
Styles: t^{γ} t^{γ} $\mathbf{t^{\gamma}}$ $\mathtt{t^{\gamma}}$, *Sources: IPA '89, '93*

265
Macro

Superscript Reversed Glottal Stop, *IPA usage:* pharyngealized
Input1: `d\textsuperscript{\textrevglotstop}`, *Input2:* `d\super Q`
Styles: $d^{\text{ʕ}}$ $d^{\text{ʕ}}$ $\mathbf{d^{\text{ʕ}}}$ $\mathtt{d^{\text{ʕ}}}$, *Sources: IPA '89, '93*

266
Macro

Superscript N, *IPA usage:* nasal release
Input1: `d\textsuperscript{n}`, *Input2:* `d\super n`
Styles: d^{n} d^{n} $\mathbf{d^{n}}$ $\mathtt{d^{n}}$, *Sources: IPA '89, '93*

267
Macro

Superscript L, *IPA usage:* lateral release
Input1: `d\textsuperscript{l}`, *Input2:* `d\super l`
Styles: d^{l} d^{l} $\mathbf{d^{l}}$ $\mathtt{d^{l}}$, *Sources: IPA '89, '93*

A.4 Tone letters

The tones illustrated here are only a representative sample of what is possible. For more details see the section entitled "Tone Letters" (page 13).

268
Macro

Extra High Tone
Input: `\tone{55}`
Styles: ˥ ˥ ˥ ˥, *Sources: IPA '89, '93*

269
Macro

High Tone
Input: `\tone{44}`
Styles: ˦ ˦ ˦ ˦, *Sources: IPA '89, '93*

270
Macro

Mid Tone
Input: `\tone{33}`
Styles: ˧ ˧ ˧ ˧, *Sources: IPA '89, '93*

271
Macro

Low Tone
Input: `\tone{22}`
Styles: ˨ ˨ ˨ ˨, *Sources: IPA '89, '93*

272
Macro

Extra Low Tone
Input: `\tone{11}`
Styles: ˩ ˩ ˩ ˩, *Sources: IPA '89, '93*

273
Macro

Falling Tone
Input: `\tone{51}`
Styles: ˥ ˧ ˥ ˩, *Sources: IPA '89, '93*

274
Macro

Rising Tone
Input: `\tone{15}`
Styles: ˩ ˧ ˩ ˥, *Sources: IPA '89, '93*

275
Macro

High Rising Tone
Input: `\tone{45}`
Styles: ˦ ˧ ˦ ˥, *Sources: IPA '89, '93*

276
Macro

Low Rising Tone
Input: `\tone{12}`
Styles: ˨ ˧ ˨ ˩, *Sources: IPA '89, '93*

277
Macro

High Rising Falling Tone
Input: `\tone{454}`
Styles: ˦˥ ˧˥ ˦˩ ˥˩, *Sources: IPA '89, '93*

A.5 Diacritics for extIPA, VoQS

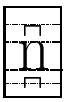
In order to use diacritics listed in this section, it is necessary to specify the option '`extra`' at the preamble (See the section entitled "Other options" on page 8). Note also that some of the diacritics are defined by using symbols from fonts other than TIPA so that they may not look quite satisfactory and/or may not be slanted (e.g. `\whistle{s}` s͡↑).

278
Macro

Left Right Arrow, Usage: labial spreading
Input: `\spreadlips{s}`
Styles: s͍ s͍ **s͍** s͍, *Sources: extIPA '94*

279
Macro

Overbridge, Usage: dentolabial
Input: `\overbridge{v}`
Styles: v̎ v̎ **v̎** v̎, *Sources: extIPA '94*

280 
Macro

Bibridge, Usage: interdental/bidental
Input: `\bibridge{n}`
Styles: n̪̎ n̪̎ **n̪̎** n̪̎, *Sources: extIPA '94*

281
Macro

Subscript Double Bar, Usage: alveolar
Input: `\subdoublebar{t}`
Styles: t͇ t͇ **t͇** t͇, *Sources: extIPA '94*

282
Macro

Subscript Double Vertical Line, Usage: strong articulation
Input: `\subdoublevert{f}`
Styles: f͈ f͈ **f͈** f͈, *Sources: extIPA '94*

283
Macro

Subscript Corner, Usage: weak articulation
Input: `\subcorner{v}`
Styles: v̗ v̗ **v̗** v̗, *Sources: extIPA '94*

284
Macro

Up Arrow, Usage: whistled Articulation
Input: `\whistle{s}`
Styles: s͡↑ s͡↑ **s͡↑** s͡↑, *Sources: extIPA '94*

285
Macro

Right Arrow, Usage: sliding articulation
Input: `\sliding{\ipa{Ts}}`
Styles: $\underset{\rightarrow}{\theta}$s $\underset{\rightarrow}{\theta}$*s* $\underset{\rightarrow}{\boldsymbol{\theta}}$**s** $\underset{\rightarrow}{\theta}$s, *Sources: extIPA '94*

286
Macro

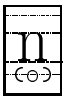
Crossed tilde, Usage: denasal
Input: `\crtilde{m}`
Styles: m̸ *m̸* **m̸** m̸, *Sources: extIPA '94*

287
Macro

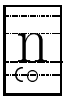
Dotted Tilde, Usage: nasal escape
Input: `\dottedtilde{a}`
Styles: ä̰ *ä̰* **ä̰** ä̰, *Sources: extIPA '94*

288
Macro

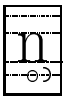
Double Tilde, Usage: velopharyngeal friction
Input: `\doubletilde{s}`
Styles: s̰̃ *s̰̃* **s̰̃** s̰̃, *Sources: extIPA '94*

289 
Macro

Parenthesis + Ring, Usage: partial voiceless
Input: `\partvoiceless{n}`
Styles: $\underset{\circ}{\underset{)}{\text{n}}}$ $\underset{\circ}{\underset{)}{n}}$ $\underset{\circ}{\underset{)}{\mathbf{n}}}$ $\underset{\circ}{\underset{)}{\text{n}}}$, *Sources: extIPA '94*

290 
Macro

Parenthesis + Ring, Usage: initial partial voiceless
Input: `\inipartvoiceless{n}`
Styles: $\underset{\circ}{\underset{)}{\text{n}}}$ $\underset{\circ}{\underset{)}{n}}$ $\underset{\circ}{\underset{)}{\mathbf{n}}}$ $\underset{\circ}{\underset{)}{\text{n}}}$, *Sources: extIPA '94*

291 
Macro

Parenthesis + Ring, Usage: final partial voiceless
Input: `\finpartvoiceless{n}`
Styles: $\underset{\circ}{\underset{)}{\text{n}}}$ $\underset{\circ}{\underset{)}{n}}$ $\underset{\circ}{\underset{)}{\mathbf{n}}}$ $\underset{\circ}{\underset{)}{\text{n}}}$, *Sources: extIPA '94*

292
Macro

Parenthesis + Subwedge, Usage: partial voicing
Input: `\partvoice{s}`
Styles: $\underset{\backsim}{\underset{)}{\text{s}}}$ $\underset{\backsim}{\underset{)}{s}}$ $\underset{\backsim}{\underset{)}{\mathbf{s}}}$ $\underset{\backsim}{\underset{)}{\text{s}}}$, *Sources: extIPA '94*

293
Macro

Parenthesis + Subwedge, Usage: initial partial voicing
Input: `\inipartvoice{s}`
Styles: $\underset{\backsim}{\underset{)}{\text{s}}}$ $\underset{\backsim}{\underset{)}{s}}$ $\underset{\backsim}{\underset{)}{\mathbf{s}}}$ $\underset{\backsim}{\underset{)}{\text{s}}}$, *Sources: extIPA '94*

294
Macro

Parenthesis + Subwedge, Usage: final partial voicing
Input: `\finpartvoice{s}`
Styles: $\underset{\backsim}{\underset{)}{\text{s}}}$ $\underset{\backsim}{\underset{)}{s}}$ $\underset{\backsim}{\underset{)}{\mathbf{s}}}$ $\underset{\backsim}{\underset{)}{\text{s}}}$, *Sources: extIPA '94*

295
'275

Subscript Left Pointer, Usage: right offset jaw voice
Input: `\sublptr{J}`
Styles: $\underset{<}{\text{J}}$ $\underset{<}{J}$ $\underset{<}{\mathbf{J}}$ $\underset{<}{\text{J}}$, *Sources: VoQS '94*

296
'276

Subscript Right Pointer, Usage: left offset jaw voice
Input: `\subrptr{J}`
Styles: $\underset{>}{\text{J}}$ $\underset{>}{J}$ $\underset{>}{\mathbf{J}}$ $\underset{>}{\text{J}}$, *Sources: VoQS '94*

B Symbols not included in TIPA

There are about 40 symbols that appear in *PSG* but are not included or defined in TIPA (ordinary capital letters, Greek letters and punctuation marks excluded). Most of such symbols are the ones that have been proposed by someone but never or rarely been followed by other people.

Some of such symbols can be realized by writing appropriate macros, while some others cannot be realized without resorting to the Metafont.

This section discusses these problems by classifying such symbols into three categories, as shown below.

(1) Symbols that can be realized by TEX's macro level and/or by using symbols from other fonts.

(2) Symbols that can be imitated by TEX's macro level and/or by using symbols from other fonts (but may not look quite satisfactory).

(3) Symbols that cannot be realized at all, without creating a new font.

The following table shows symbols that belong to the first category. For each symbol, an example of input method and its output is also given. Note that barred or crossed symbols can be easily made by TIPA's `\ipabar` macro.

Script Lowe-case F	`{\itshape f}`	*f*
Barred Small Capital I	`\ipabar{\textsci}{.5ex}{1.1}{}{}`	ɨ
Barred J	`\ipabar{j}{.5ex}{1.1}{}{}`	ɟ
Crossed K	`\ipabar{k}{1.2ex}{.6}{}{.4}`	ꝁ
Barred Open O	`\ipabar{\textopeno}{.5ex}{.6}{.4}{}`	ɔ
Barred Small Capital Omega	`\ipabar{\textscomega}{.5ex}{1.1}{}{}`	ɷ
Barred P	`\ipabar{p}{.5ex}{1.1}{}{}`	ꝑ
Half-barred U	`\ipabar{u}{.5ex}{.5}{}{.5}`	ʉ
Barred Small Capital U	`\ipabar{\textscu}{.5ex}{1.1}{}{}`	ᵾ
Null Sign	`$\emptyset$`	∅
Double Slash	`/\kern-.25em/`	//
Triple Slash	`/\kern-.25em/\kern-.25em/`	///
Pointer (Upward)	`k\super{\tiny$\wedge$}`	k^
Pointer (Downward)	`k\super{\tiny$\vee$}`	k$^{\vee}$
Superscript Arrow	`k\super{\super{$\leftarrow$}}`	k$^{\leftarrow}$

Symbols that belong to the second category are shown below. Note that slashed symbols can be in fact easily made by a macro. For example, a slashd b i.e. ɓ can be made by `\ipaclap{b}{/}`. The reason why slashed symbols are not included in TIPA is as follows: first, a simple overlapping of a symbol and a slash does not always result in a good shape, and secondly, it doesn't seem significant to devise fine-tuned macros for symbols which were created essentialy for typewriters.

Right-hook A	a̡
Slashed B	ɓ
Slashed C	ȼ
Slashed D	đ

Small Capital Delta	ᐃ
Right-hook E	ɛ̢
Right-hook Epsilon	ɛ̢
Small Capital F	ꜰ
Female Sign	
Uncrossed Female Sign	
Right-hook Open O	
Slashed U	ʉ̸
Slashed W	ⱳ̸

And finally, symbols that cannot be realized at all are as follows.

- Reversed Turned Script A
- A-O Ligature
- Inverted Small Capital A
- Small Capital A-O Ligature
- D with Upper-left Hook
- Hooktop H with Rightward Tail
- Heng
- Hooktop J
- Front-bar N
- Inverted Lower-case Omega
- Reversed Esh with Top Loop
- T with Upper Left Hook
- Turned Small Capital U
- Bent-tail Yogh
- Turned 2
- Turned 3

C Layout of TIPA fonts

C.1 tipa10

	´0	´1	´2	´3	´4	´5	´6	´7	
´00x	ˋ	ˊ	ˆ	˜	¨	˝	°	ˇ	˝0x
´01x	˘	¯	˙	˛	˚	˟	ˋ	ˊ	
´02x	ˆ	ˍ	ˎ	ˏ	ː	ˑ	˒	˓	˝1x
´03x	ˣ	ˡ	˩	˨	˧	˦	˥	˔	
´04x	ˊ	!	ˈ	ˋ	ˌ	˛	˜	˝	˝2x
´05x	(	)	*	+	,	-	.	/	
´06x	ʉ	ɨ	ʌ	ɜ	ɥ	ɐ	ɒ	ɤ	˝3x
´07x	ɵ	ɘ	ː	ˑ	‿	=	⁀	?	
´10x	ə	ɑ	β	ɕ	ð	ɛ	ɸ	ɣ	˝4x
´11x	ɦ	ɪ	ʝ	ʁ	ʎ	ɱ	ŋ	ɔ	
´12x	ʔ	ʕ	ɾ	ʃ	θ	ʊ	ʋ	ɯ	˝5x
´13x	χ	ʏ	ʒ	[	ˁ	]	˥	˦	
´14x	‘	a	b	c	d	e	f	g	˝6x
´15x	h	i	j	k	l	m	n	o	
´16x	p	q	r	s	t	u	v	w	˝7x
´17x	x	y	z	‖	ǀ	ǂ	˞	ˌ	
´20x	ˍ	ˎ	ˋ	ˊ	ˋ	ˊ	ˊ	ˊ	˝8x
´21x	ˊ	ˍ	ˎ	ˋ	ˋ	ˋ	ˊ	ˊ	
´22x	ˊ	ˊ	ˈ	ˌ	↓	↑	↗	↘	˝9x
´23x	˘	˘	˘	˜	ˈ	˝	˘	˝	
´24x	ƀ	đ	ɖ	ᴇ	g	ɿ	ɿ	ʅ	˝Ax
´25x	ɟ	ɣ	ɬ	ʎ	ɮ	ɲ	ɳ	æ	
´26x	ω	ɑ	ɑ	ʃ	ʧ	ʨ	ʦ	ʥ	˝Bx
´27x	ʒ	ɛ	ь	ъ	ʔ	˂	˃	˚	
´30x	ᴀ	ɕ	ʗ	ʤ	ɚ	ɔ	ɞ	ɝ	˝Cx
´31x	ɤ	ɢ	ɧ	ʜ	ɩ	ɟ	ɦ	ʟ	
´32x	ɮ	ɷ	ɓ	ɖ	ɽ	ɺ	ɾ	œ	˝Dx
´33x	ɻ	ʧ	ʊ	ʖ	ʡ	ʢ	ʐ	ɲ	
´34x	ʙ	ɓ	ɗ	ɖ	ɠ	ɢ	æ	ç	˝Ex
´35x	ħ	ɟ	ʄ	ɬ	ɬ	ɭ	ɰ	ɳ	
´36x	ɴ	ɲ	⊙	ɽ	ɹ	ɻ	ʀ	œ	˝Fx
´37x	ø	ʂ	ʈ	ʍ	ʐ	ʑ	þ	ʅ	
	˝8	˝9	˝A	˝B	˝C	˝D	˝E	˝F	

C.2 tipasl10

	´0	´1	´2	´3	´4	´5	´6	´7	
´00x	ˋ	ˊ	ˆ	˜	¨	˝	°	˘	˝0x
´01x	˘	¯	˙	˛	˛	˝	ˋ	ˊ	
´02x	ˆ	ˌ	ˍ	ˎ	ˏ	ˎ	ˍ	ˎ	˝1x
´03x	ˣ	ˡ	˩	˨	˧	˦	˨	˨	
´04x	ˊ	!	ˈ	ˈ	˛	˛	˜	˛	˝2x
´05x	(	)	*	+	,	-	.	/	
´06x	ʉ	ɨ	ʌ	ɜ	ɥ	ɐ	ɒ	ɤ	˝3x
´07x	ɵ	ɘ	ː	ˑ	‿	=	⌒	?	
´10x	ə	ɑ	β	ɕ	ð	ɛ	ɸ	ɣ	˝4x
´11x	ɦ	ɪ	ʝ	ʁ	ʎ	ɱ	ŋ	ɔ	
´12x	ʔ	ʕ	ɾ	ʃ	θ	ʊ	ʋ	ɯ	˝5x
´13x	χ	ʏ	ʒ	[	ˈ	]	˥	˦	
´14x	‘	a	b	c	d	e	f	g	˝6x
´15x	h	i	j	k	l	m	n	o	
´16x	p	q	r	s	t	u	v	w	˝7x
´17x	x	y	z	‖	|	‡	˜	ˌ	
´20x	_	ˎ	ˋ	ˋ	ˋ	ˊ	ˊ	ˊ	˝8x
´21x	/	_	ˋ	ˋ	ˋ	ˋ	ˊ	ˊ	
´22x	ˊ	/	|	‖	↓	↑	↗	↘	˝9x
´23x	˘	˘	˘	˜	ˈ	˝	˘	˝	
´24x	ƀ	đ	ɖ	ᴇ	g	ɿ	ɿ	ɿ	˝Ax
´25x	ɟ	ɣ	ɬ	ʎ	ɮ	ɲ	ɳ	æ	
´26x	ω	ɑ	ɑ	ʃ	ʈ	ʈ	ʦ	ɥ	˝Bx
´27x	ʒ	ɛ	ь	ъ	ʔ	<	>	ˈ	
´30x	ᴀ	ɕ	ʗ	ʤ	ɚ	ɔ	ɞ	ɝ	˝Cx
´31x	ɤ	ɢ	ɧ	ʜ	ɩ	ɟ	ɦ	ʟ	
´32x	ɮ	ɷ	ɓ	ɖ	ɾ	ɺ	ɬ	œ	˝Dx
´33x	ɿ	ʧ	ʊ	ɔ	ʔ	ʕ	ʐ	ɒ	
´34x	ʙ	ɓ	ɗ	ɖ	ɠ	ɢ	æ	ç	˝Ex
´35x	ħ	ɟ	ʃ	ɬ	ɬ	ɭ	ɰ	ɳ	
´36x	ɴ	ɲ	⊙	ɽ	ɹ	ɻ	ʀ	œ	˝Fx
´37x	ø	ʂ	ʈ	ʍ	ʐ	ʑ	þ	ʋ	
	˝8	˝9	˝A	˝B	˝C	˝D	˝E	˝F	

C.3 tipabx10

	´0	´1	´2	´3	´4	´5	´6	´7	
´00x	ˋ	ˊ	ˆ	˜	¨	˝	°	˘	˝0x
´01x	˘	¯	˙	˛	˛	˝	ˋ	ˊ	
´02x	ˆ	ˍ	ˍ	ˍ	˃	˂	ˍ	ˎ	˝1x
´03x	ˣ	ɪ	ɟ	˞	˞	˞	˞	˞	
´04x	ˊ	!	ˈ	ˈ	ˌ	ˌ	˜	ˈ	˝2x
´05x	(	)	*	+	,	-	.	/	
´06x	ʉ	ɨ	ʌ	ɜ	ɥ	ɐ	ɒ	ɤ	˝3x
´07x	ɵ	ɘ	ː	ˑ	‿	=	⌒	?	
´10x	ə	ɑ	β	ɕ	ð	ɛ	ɸ	ɣ	˝4x
´11x	ɦ	ɪ	ʝ	ʁ	ʎ	ɱ	ŋ	ɔ	
´12x	ʔ	ʕ	ɾ	ʃ	θ	ʊ	ʋ	ɯ	˝5x
´13x	χ	ʏ	ʒ	[	˛	]	˥	˦	
´14x	‘	a	b	c	d	e	f	g	˝6x
´15x	h	i	j	k	l	m	n	o	
´16x	p	q	r	s	t	u	v	w	˝7x
´17x	x	y	z	‖	ǀ	ǂ	˜	ˌ	
´20x	_	ˎ	ˋ	ˋ	ˋ	ˊ	ˊ	ˊ	˝8x
´21x	/	_	ˎ	ˋ	ˋ	ˋ	ˊ	ˊ	
´22x	ˊ	/	ǀ	‖	↓	↑	↗	↘	˝9x
´23x	ˊ	ˋ	ˋ	˜	'	"	˝	˝	
´24x	ƀ	đ	ɖ	ᴇ	g	ɿ	ɿ	ʅ	˝Ax
´25x	ɟ	ɣ	ɬ	ʎ	ɮ	ɳ	ɳ	æ	
´26x	ω	ɑ	ɑ	ʃ	ʈ	ʈ	ʦ	ɥ	˝Bx
´27x	ʒ	ɛ	ь	ъ	ʔ	<	>	▫	
´30x	ᴀ	ɕ	ʗ	ʤ	ɚ	ɔ	ɞ	ɝ	˝Cx
´31x	ɤ	ɢ	ɧ	ʜ	ɩ	ɟ	ɦ	ʟ	
´32x	ɮ	ɷ	ɓ	ɖ	ɼ	ɺ	ɽ	œ	˝Dx
´33x	ɻ	ʧ	ʊ	ʖ	ʡ	ʢ	ʐ	ɒ	
´34x	ʙ	ɓ	ɗ	ɖ	ɠ	ɢ	æ	ç	˝Ex
´35x	ħ	ɟ	ʃ	ɬ	ɬ	ɭ	ɰ	ɳ	
´36x	ɴ	ɲ	⊙	ɽ	ɹ	ɻ	ʀ	œ	˝Fx
´37x	ø	ʂ	ʈ	ʍ	ʐ	ʑ	þ	ʉ	
	˝8	˝9	˝A	˝B	˝C	˝D	˝E	˝F	

C.4 tipass10

	´0	´1	´2	´3	´4	´5	´6	´7	
´00x	`	´	ˆ	˜	¨	˝	°	ˇ	˝0x
´01x	˘	¯	˙	˛	˛	˝	`	´	
´02x	ˆ	¬	˘	˙	˛	˂	˘	˜	˝1x
´03x	ˣ	ˡ	˩	˧	˨	˦	˧	˦	
´04x	´	!	ˈ	ˎ	ˏ	˩	~	ˈ	˝2x
´05x	(	)	*	+	,	-	.	/	
´06x	ʉ	ɨ	ʌ	ɜ	ɥ	ɐ	ɒ	ɤ	˝3x
´07x	ɵ	ɘ	ː	ˈ	‿	=	⌒	?	
´10x	ə	ɑ	β	ɕ	ð	ɛ	ɸ	ɣ	˝4x
´11x	ɦ	ɪ	ʝ	ʁ	ʎ	ɱ	ŋ	ɔ	
´12x	ʔ	ʕ	ɾ	ʃ	θ	ʊ	ʋ	ɯ	˝5x
´13x	χ	ʏ	ʒ	[	'	]	˥	˦	
´14x	‘	a	b	c	d	e	f	g	˝6x
´15x	h	i	j	k	l	m	n	o	
´16x	p	q	r	s	t	u	v	w	˝7x
´17x	x	y	z	‖	|	‡	˞	ˌ	
´20x	_	ˎ	ˋ	ˋ	ˋ	ˏ	ˊ	ˊ	˝8x
´21x	/	_	ˋ	ˋ	ˋ	ˋ	ˏ	ˊ	
´22x	ˊ	ˊ	ˈ	ˈˈ	↓	↑	↗	↘	˝9x
´23x	˗	˘	˜	˜	'	"	˘	˝	
´24x	ƀ	đ	ɖ	ᴇ	g	ɿ	ɿ	ʅ	˝Ax
´25x	ɟ	ɣ	ɫ	ʎ	ɮ	ȵ	ɳ	æ	
´26x	ω	ɑ	ɑ	ʃ	ʈ	ʈ	ʦ	ʅ	˝Bx
´27x	ʒ	ɛ	ь	ъ	ʔ	˂	˃	˙	
´30x	ᴀ	ɕ	ʗ	ʤ	ɚ	ɔ	ɞ	ɝ	˝Cx
´31x	ɤ	ɢ	ɧ	ʜ	ɩ	ɟ	ɦ	ʟ	
´32x	ɮ	ɷ	ɓ	ɖ	ɾ	ɺ	ɽ	œ	˝Dx
´33x	ɻ	ʧ	ʊ	ʖ	ʡ	ʢ	ʐ	ɲ	
´34x	ʙ	ɓ	ɗ	ɖ	ɠ	ɢ	æ	ç	˝Ex
´35x	ħ	ɟ	ʄ	ɬ	ɬ	ɭ	ɰ	ɳ	
´36x	ɴ	ɲ	ʘ	ɽ	ɹ	ɻ	ʀ	œ	˝Fx
´37x	ø	ʂ	ʈ	ʍ	ʐ	ʑ	þ	ʉ	
	˝8	˝9	˝A	˝B	˝C	˝D	˝E	˝F	