

eSA/ eSB/ eSC Feature & capacity Application Notes

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Supported Chips : **eSA015 ~ eSA120;
eSB015 ~ eSB320;
eSC015 ~ eSC320**

Applicable Software : **eSA/eSB/eSC IDE,
version 3.42 & later**



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1.0 eSA / eSB / eSC serial Feature compare:

Item	eSA	eSB	eSC
Voice channel	4	2	1
Melody channel	4	---	---
Envelope control	Yes	---	---
Channel Mixer	Yes	---	---
Voice algorithm	PCM/ ADPCM	8b-PCM/ 10b-PCM eDPCM-5b/ eDPCM-6b	8b-PCM/ 10b-PCM eDPCM-5b/ eDPCM-6b
Voice advance	ADPCM+	Support All	Support All
Voice volume	0~127 by H/W	0~6 by S/W Default is 5	0~6 by S/W Default is 6
Oscillator type	R/Crystal	R/Crystal	R/Crystal
Osc. Frequency	3.58M/4M	6M/4M/3.58M	6M/4M/3.58M
Instruction cycle	Fosc	Fosc/2	Fosc/2
RAM	3 page, 192 nibble	2 page, 128 nibble	2 page, 128 nibble
Interrupt::	6	4	4
Speech INT	4	1	1
High resolution timer	(4)	1	1
Timer INT	1	1	1
External INT	1	1	1
I/O	4 I/P, 12 I/O, 4 O/P	4 I/P, 12 I/O, 4 O/P	4 I/P, 12 I/O, 4 O/P
Port1 (Input)	all body	all body	all body
Port2,3 (I/O)	all body	all body	all body
Port4 (I/O)	all body	eSB065 ~ eSB320	eSC065 ~ eSC320
Port5 (Output)	eSA100, eSA120	eSB100 ~ eSB320	eSC100 ~ eSC320
Out Sink/Drive current	3.0/3.5 mA at 3V	5.0/6.0 mA at 3V	5.0/6.0 mA at 3V
IR In/Out	Y	Y	Y
IRout carry	38KHz	56.9KHz for 6M Fosc 38KHz for 4M/3.58M Fosc	56.9KHz for 6M Fosc 38KHz for 4M/3.58M Fosc

2.0 eSB/ eSC Play Speech the sample rate limits:

The eSA/eSB/eSC IDE support the wave file's Sample rate is

Include Wave file: 2K ~ 48K for PCM or ADPCM format.

Advance(+) Effect: Only Support form 5.5K ~ 32.5K.

EASY format support Play rate: 4K ~ 32.5K

But base on the CPU resource, The speech play sample rate limit is show in the table.

2.0.1 eSB serial :

OSC = 6MHz^{*1}

Wave algorithm	Sample rate limit (support volume change, S1vol/S2Vol= 5) ^{*2}
eDPCM-6b	6KHz ≤ (Ch1+Ch2) ≤ 21KHz
eDPCM-5b	6KHz ≤ (Ch1+Ch2) ≤ 21KHz
10b-PCM	6KHz ≤ (Ch1+Ch2) ≤ 30KHz
8b-PCM	6KHz ≤ (Ch1+Ch2) ≤ 34KHz

OSC = 4MHz

Wave algorithm	Sample rate limit (support volume change, S1vol/S2Vol= 5) ^{*2}
eDPCM-6b	(Ch1+Ch2) ≤ 14KHz
eDPCM-5b	(Ch1+Ch2) ≤ 14KHz
10b-PCM	(Ch1+Ch2) ≤ 20KHz
8b-PCM	(Ch1+Ch2) ≤ 22KHz

OSC = 3.58MHz

Wave algorithm	Sample rate limit (support volume change, S1vol/S2Vol= 5) ^{*2}
eDPCM-6b	(Ch1+Ch2) ≤ 12KHz
eDPCM-5b	(Ch1+Ch2) ≤ 12KHz
10b-PCM	(Ch1+Ch2) ≤ 18KHz
8b-PCM	(Ch1+Ch2) ≤ 20KHz

^{*1} In 6MHz Fosc, the IRout pin not support 38K carry, only support 56.9K.

^{*2} At the Speech Volume is 5 (S1vol/S2Vol= 5).

^{*3} In EASY format, The Play rate only support form 4KHz to 32.5KHz

2.0.2 eSC serial :

OSC = 6MHz^{*1}

Wave algorithm	Sample rate limit (support volume change, S1vol/S2Vol= 6) ^{*2}
eDPCM-6b	≤ 25KHz
eDPCM-5b	≤ 25KHz
10b-PCM	≤ 36KHz
8b-PCM	≤ 44KHz

OSC = 4MHz

Wave algorithm	Sample rate limit (support volume change, S1vol/S2Vol= 6) ^{*2}
eDPCM-6b	≤ 16KHz
eDPCM-5b	≤ 16KHz
10b-PCM	≤ 25KHz
8b-PCM	≤ 30KHz

OSC = 3.58MHz

Wave algorithm	Sample rate limit (support volume change, S1vol/S2Vol= 6) ^{*2}
eDPCM-6b	≤ 15KHz
eDPCM-5b	≤ 15KHz
10b-PCM	≤ 22KHz
8b-PCM	≤ 28KHz

^{*1} In 6MHz Fosc, the IRout pin not support 38K carry, only support 56.9K.

^{*2} At the Speech Volume is 6 (S1vol/S2Vol= 6).

^{*3} In EASY format, The Play rate only support form 4KHz to 32.5KHz

2.0.3 eSA serial :

About eSA serial detailed data please refer application notes : AP-eSA-0015

OSC = 4MHz

Wave algorithm	Sample rate limit (support volume change)
ADPCM /ADPCM+	$(Ch1+Ch2+Ch3+Ch4) \leq 32KHz$
PCM	$(Ch1+Ch2+Ch3+Ch4) \leq 72KHz$

OSC = 3.58MHz

Wave algorithm	Sample rate limit (support volume change)
ADPCM /ADPCM+	$(Ch1+Ch2+Ch3+Ch4) \leq 28KHz$
PCM	$(Ch1+Ch2+Ch3+Ch4) \leq 64KHz$

2.1 PWM Play Speech the sample rate limits:

When using the PWM format for playing speech, the following sample rate must be used:

OSC= 3.58 MHz	OSC= 4MHz	OSC= 6MHz
3496	3906	5859
3995	4464	6696
4661	5208	7812
5594	6250	9375
6992	7812	11719
9323	10416	15625
13984	15625	23438

* 6MHz not support for eSA series.

If you use EASY format with the “Auto sample rate adjustment” function enabled, the IDE will auto adjust the Speech playing sample rate you have entered to comply with the above table values.

If you use ASM format or had the “Auto sample rate adjustment” function in EASY disabled, you must select the correct sample rate by yourself.

3.0 Voice capacity for difference format at eSA/ eSB & eSC:

The eSA/eSB/eSC serial is dynamic compress by ADPCM, So the compression ratio is base on the Voice character, not is fixed . each body's Voice capacity is see the store voice & select compress type .

$$\text{Voice capacity} = [(\text{ROM size} - \text{program size}) * 16 / \text{compression bits}] / \text{Sample Rate}$$

The table is reference for normally application at 6K sample rate :

eSA serial :

Body	ROM size	PCM	ADPCM/ ADPCM+
Compression bits		8	4.1 ~ 4.5
eSA015	24 Kw	7	13
eSA020	32 Kw	10	18
eSA030	48 Kw	16	28
eSA040	64 Kw	21	38
eSA065	104 Kw	35	64
eSA080	128 Kw	43	79
eSA100	160 Kw	54	99
eSA120	192 Kw	65	119

eSB & eSC serial :

Body		ROM size	eDPCM-5b	eDPCM-6b	8b-PCM	10b-PCM
Compression bits			4.1 ~ 4.5	4.4 ~ 6	8	10
eSB015	eSC015	28 Kw	14	12	8	7
eSB020	eSC020	32 Kw	17	14	10	8
eSB030	eSC030	56 Kw	32	27	19	15
eSB040	eSC040	64 Kw	37	31	21	17
eSB065	eSC065	108 Kw	65	54	36	29
eSB080	eSC080	128 Kw	78	65	43	34
eSB100	eSC100	168 Kw	103	86	57	46
eSB120	eSC120	192 Kw	118	99	65	52
eSB170	eSC170	280 Kw	174	146	95	76
eSB200	eSC200	320 Kw	199	167	109	87
eSB270	eSC270	432 Kw	270	227	147	118
eSB320	eSC320	512 Kw	321	269	174	149