

EPSON[®]
EXCEED YOUR VISION

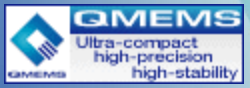


EPSON ELECTRONICS AMERICA

MICRO DEVICES

Product Configuration

Guide



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Epson's standard product offering is compliant with EU RoHS directive.

Please refer to the 2018 Crystal Master (pp. 160 ~ 163) for a complete list of products that are RoHS compliant (with Pb exemption) and/or Pb Free and its associated terminal materials.

Product Configuration Guide

CRYSTALS



- 32.768kHz Crystals
- Standard kHz Crystals
- MHz Crystals



EPSON

June 2018

NOTE: Use this updated PCS for all NEW crystal part numbers from May 2016



**NEW CRYSTAL
MICRO DEVICES**
Product Configuration
Guide

EPSON

June 2018



Product Configuration System

32.768 kHz Crystal Unit

FCXXXXXX

1

Model

32.768K

2

Frequency

90NN50KD5

3

4

5

6

7

8

Tape & Reel

Drive level

ESR unit (K = kΩ)

ESR

Frequency tolerance

Load capacitance

1

Model

FCXXXXXX

2

Frequency

32.768kHz

3

Load Cap

C5 = 12.5 pF
90 = 9.0 pF
70 = 7.0 pF

4

Frequency Tolerance

NN = +/-20 ppm
AA = +/- 10 ppm

5

ESR

A5 = 150 kΩ
90 = 90 kΩ
70 = 70 kΩ
50 = 50 kΩ

6

ESR Unit

K = kΩ

7

Drive level

A = 0.1 μW
B = .25 μW
C = 0.5 μW
D = 1.0 μW

8

Tape & Reel

B = Bulk
3 = 250pcs/reel
0 = 1000pcs/reel
5 = 3000pcs/reel



June 2018

NOTES:

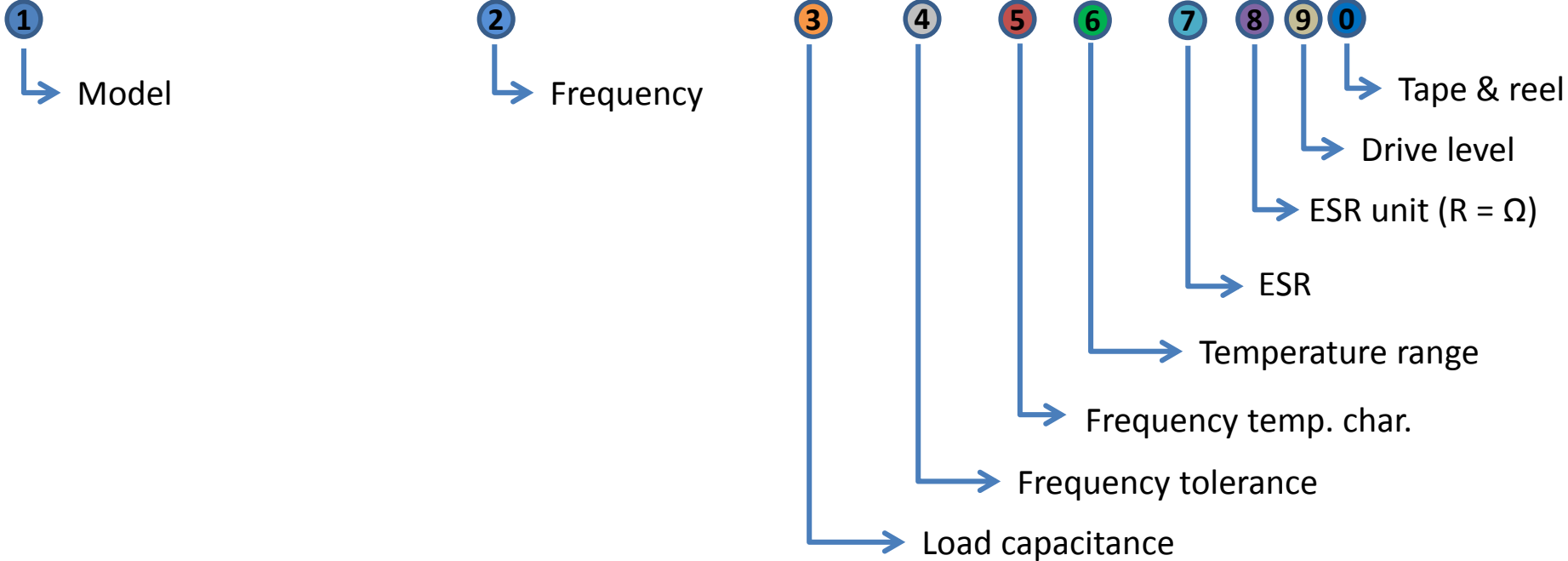
The values listed above are common/standard values for kHz crystals; some combinations are not possible depending the specific model. Please contact you EEA representative for assistance to verify the part configuration or inquire about a certain value that is not listed above.

Product Configuration System



MHz Range Crystal Units

FAXXXXXX 38.40M – 60NNYYBA0RE5



1 Model	3 Load cap	4 Frequency tolerance	5 Freq. temp. char.	6 Temp. range	7 8 ESR = Ω	9 Drive level	0 Tape & reel
FAXXXXXX	J0 = 18 pF	bb = +/-50 ppm	bb = +/-50 ppm	U = -20 to +75C	B0 = 200 Ω	E = 100 μW	B = Bulk
	C5 = 12.5 pF	NN = +/-20 ppm	NN = +/-20 ppm	N = -30 to +85C	A0 = 100 Ω	G = 200 μW	3 = 250pcs/reel
2 Frequency	A0 = 10 pF	FF = +/-15 ppm	FF = +/-15 ppm	G = -40 to +85C	80 = 80 Ω		0 = 1000pcs/reel
12 ~ 60 MHz	90 = 9.0 pF	AA = +/- 10 ppm	AA = +/- 10 ppm	H = -40 to 105C	60 = 60 Ω		5 = 3000pcs/reel
	70 = 7.0 pF						8 = 6000 pcs/reel

NOTES: The values listed above are common/standard values for MHz crystals; some combinations are not possible depending the specific model. Please contact you EEA representative for assistance to verify the part configuration or inquire about a certain value that is not listed above.

NOTE: This PCS applies to crystal part numbers before May 2016



The title page features a dark blue rectangular frame with a lighter blue circular background in the center. The text is white with a slight drop shadow. The main title is split into three lines: 'LEGACY CRYSTAL', 'MICRO DEVICES', and 'Product Configuration Guide'.

LEGACY CRYSTAL MICRO DEVICES Product Configuration Guide

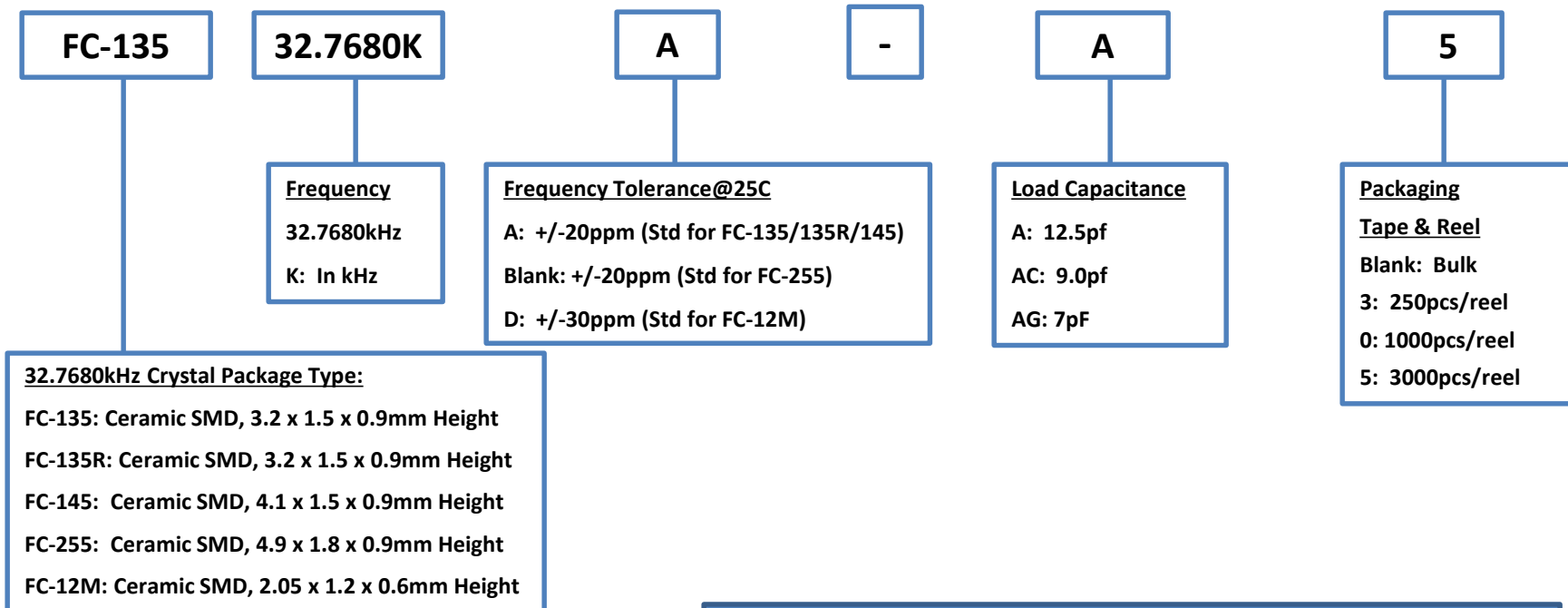
EPSON

June 2018

Product Configuration System



kHz Range Crystal Units



NOTES:

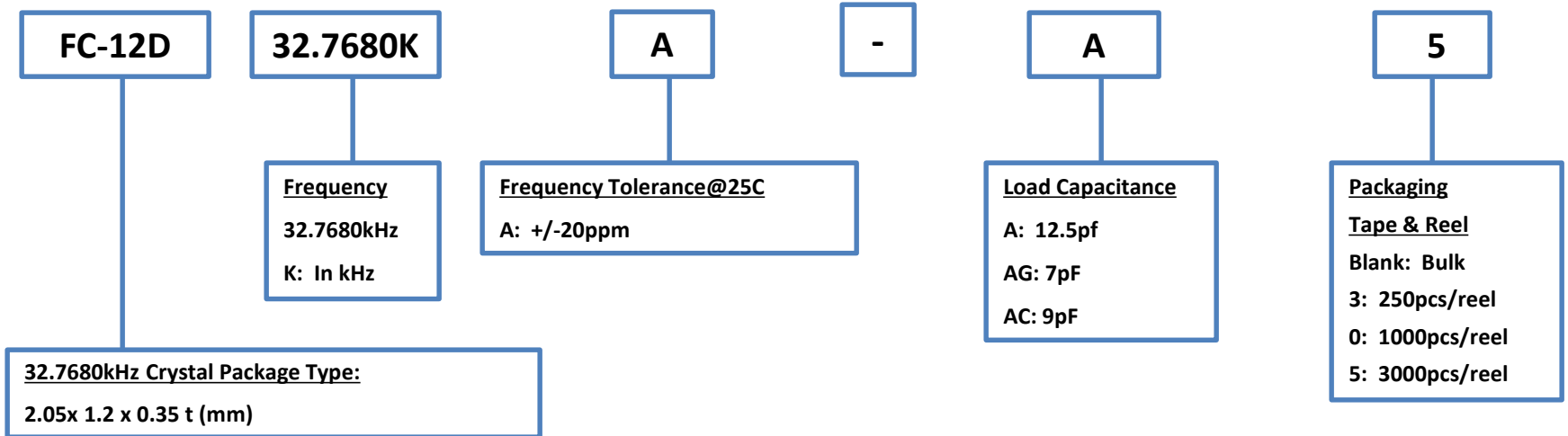
- 1) This product configuration guide is applicable only to 32.7680kHz Crystals. For other frequencies, please reference the Standard kHz Crystal Product Configuration System.
- 2) If you require a load capacitance other than the above listed, please contact your EEA representative for assistance.





Product Configuration System

32.768 kHz Crystal Unit with 0.35mm height for Smart Card



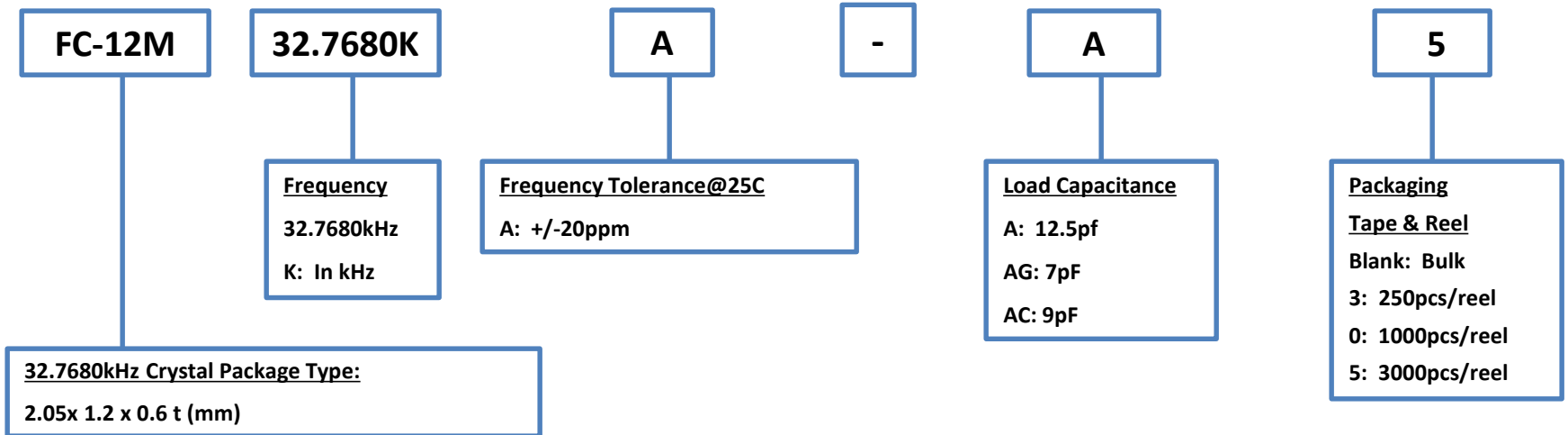
NOTES:

- 1) If your application for this part is not a Smart Card, please contact your EEA representative for assistance.
- 2) If you require a load capacitance other than the above listed, please contact your EEA representative for assistance.



Product Configuration System

kHz Range Crystal Units



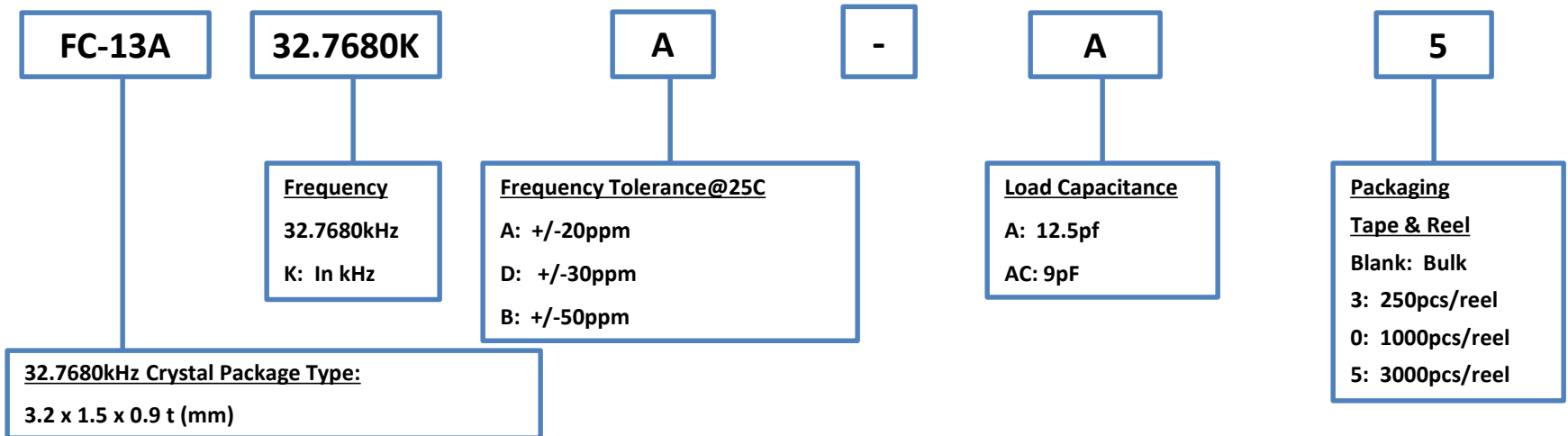
NOTES:

- 1) If you require a frequency or tolerance other than the above listed, please contact your EEA representative for assistance.

Product Configuration System



kHz Range Crystal Units



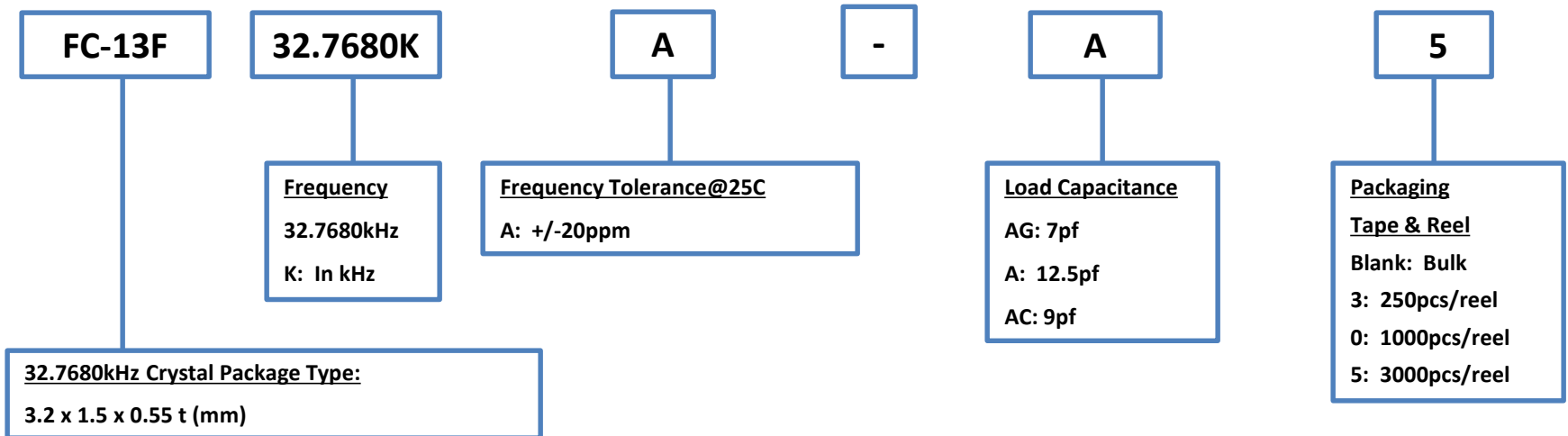
NOTES:

- 1) This product configuration guide is applicable only to 32.7680kHz Crystals. For other frequencies, please reference the Standard kHz Crystal Product Configuration System.
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Product Configuration System



kHz Range Crystal Units



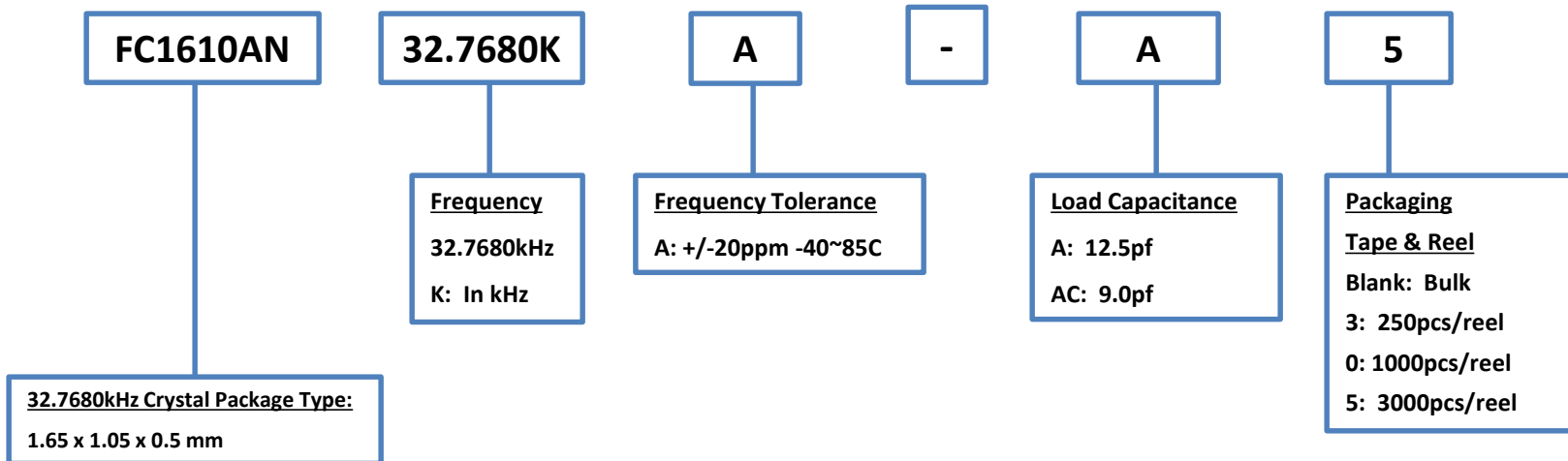
NOTES:

- 1) If you require a frequency or tolerance other than the above listed, please contact your EEA representative for assistance.

Product Configuration System



kHz Range Crystal Unit



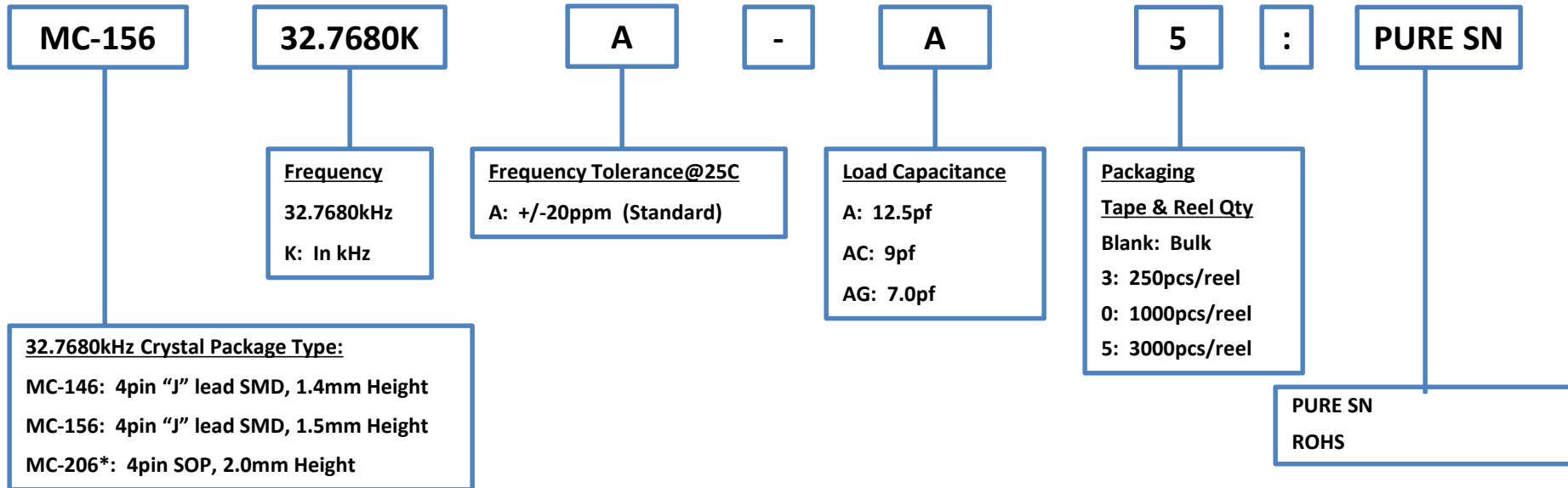
NOTES:

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Product Configuration System



kHz Range Crystals Units



MC-206:
Not Recommended for New Designs

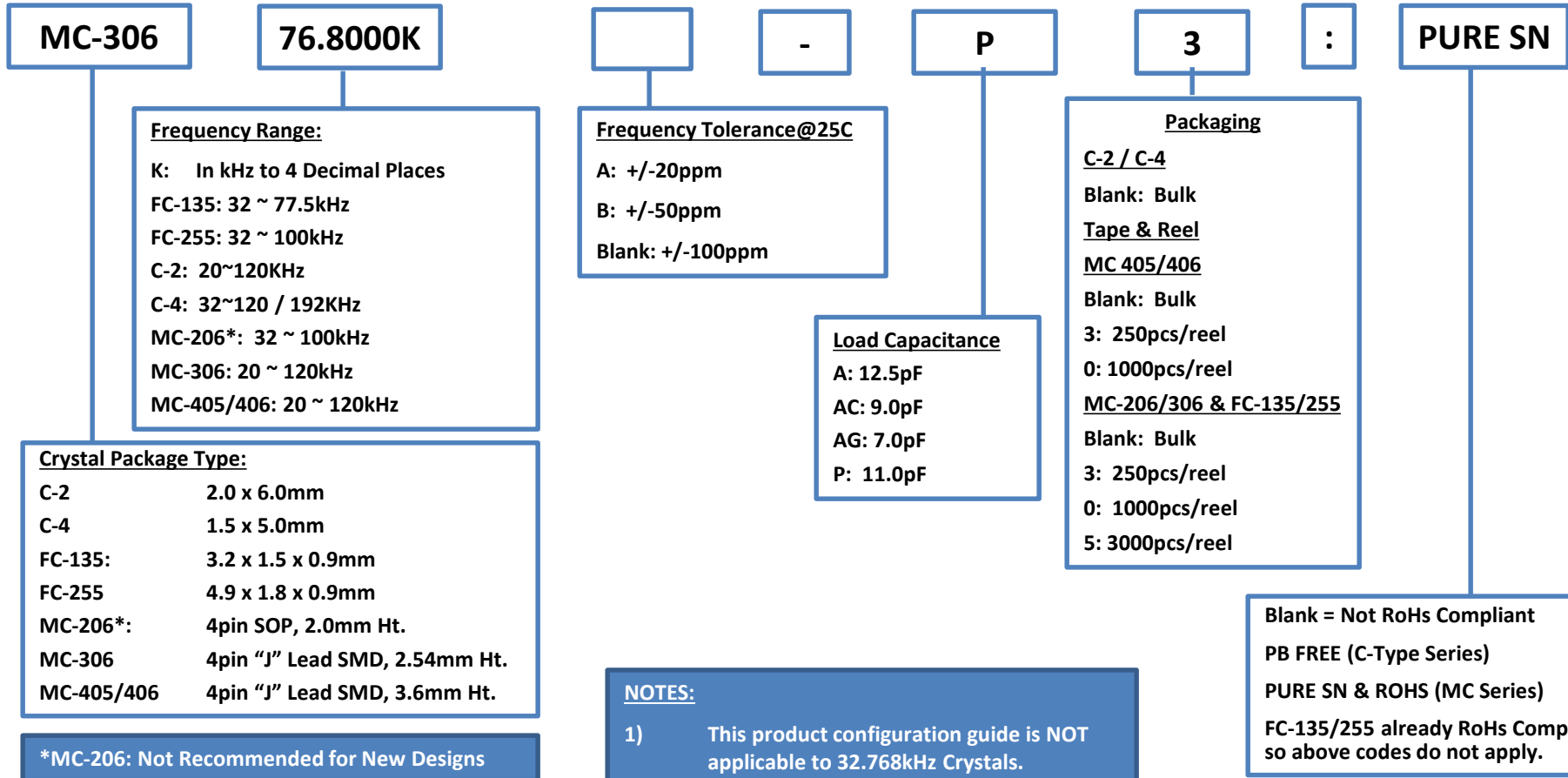
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Product Configuration System

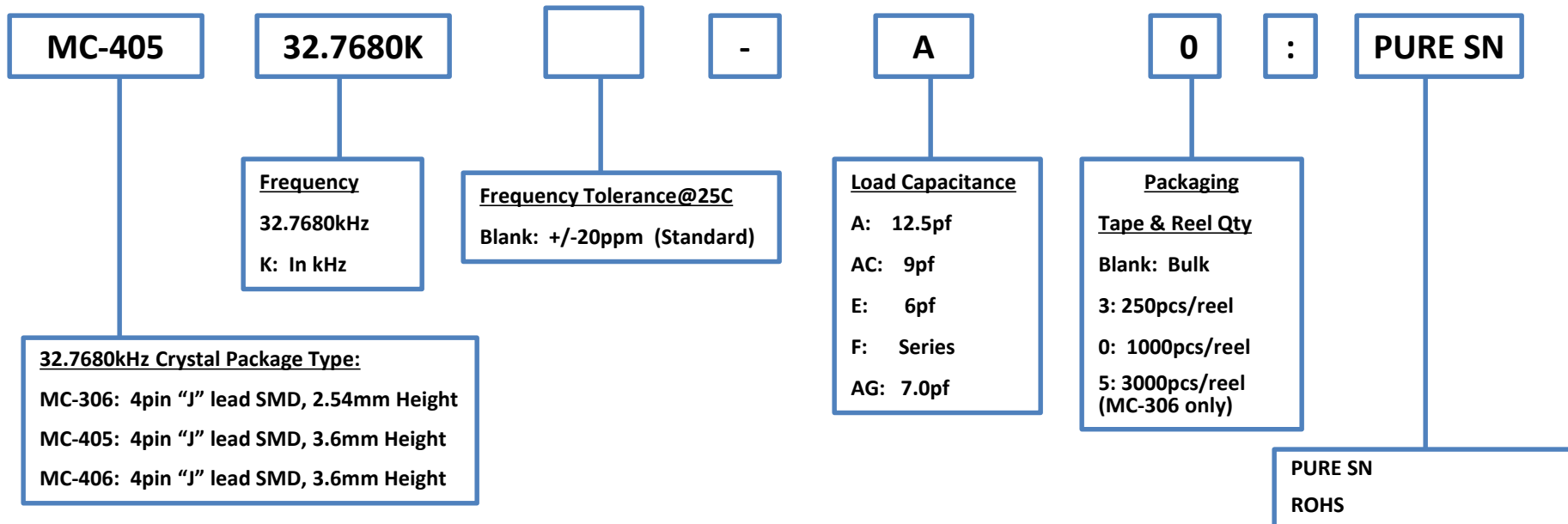
kHz Range Crystals Units



Product Configuration System



kHz Range Crystals Units



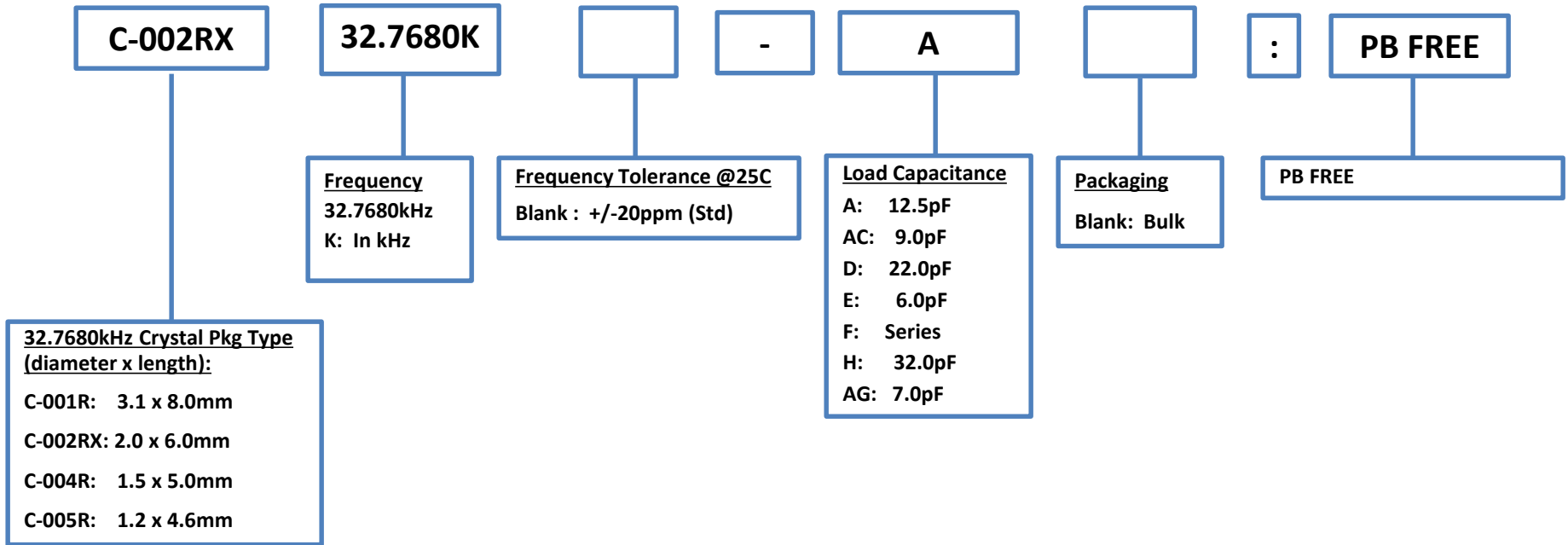
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Product Configuration System



kHz Range Crystals Units



NOTES:

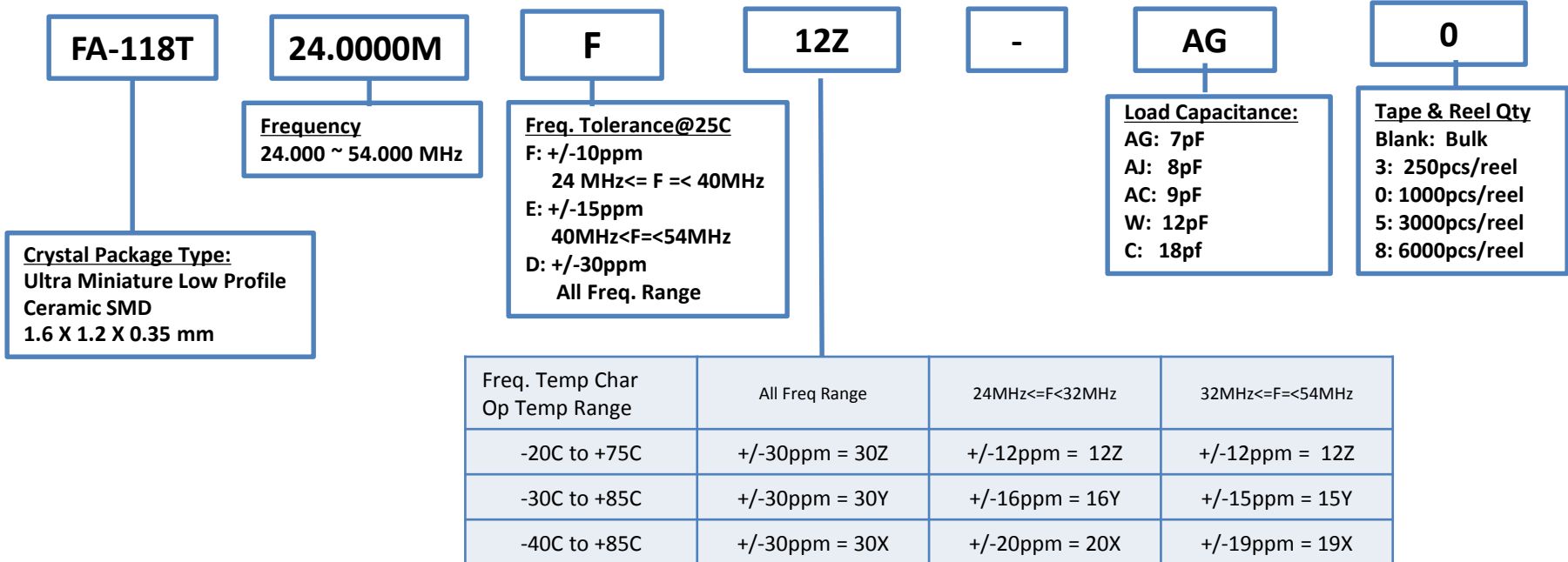
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- 2) If you require a load capacitance other than the above listed, please contact your EEA representative for assistance.



Product Configuration System



MHz Range Crystals Units



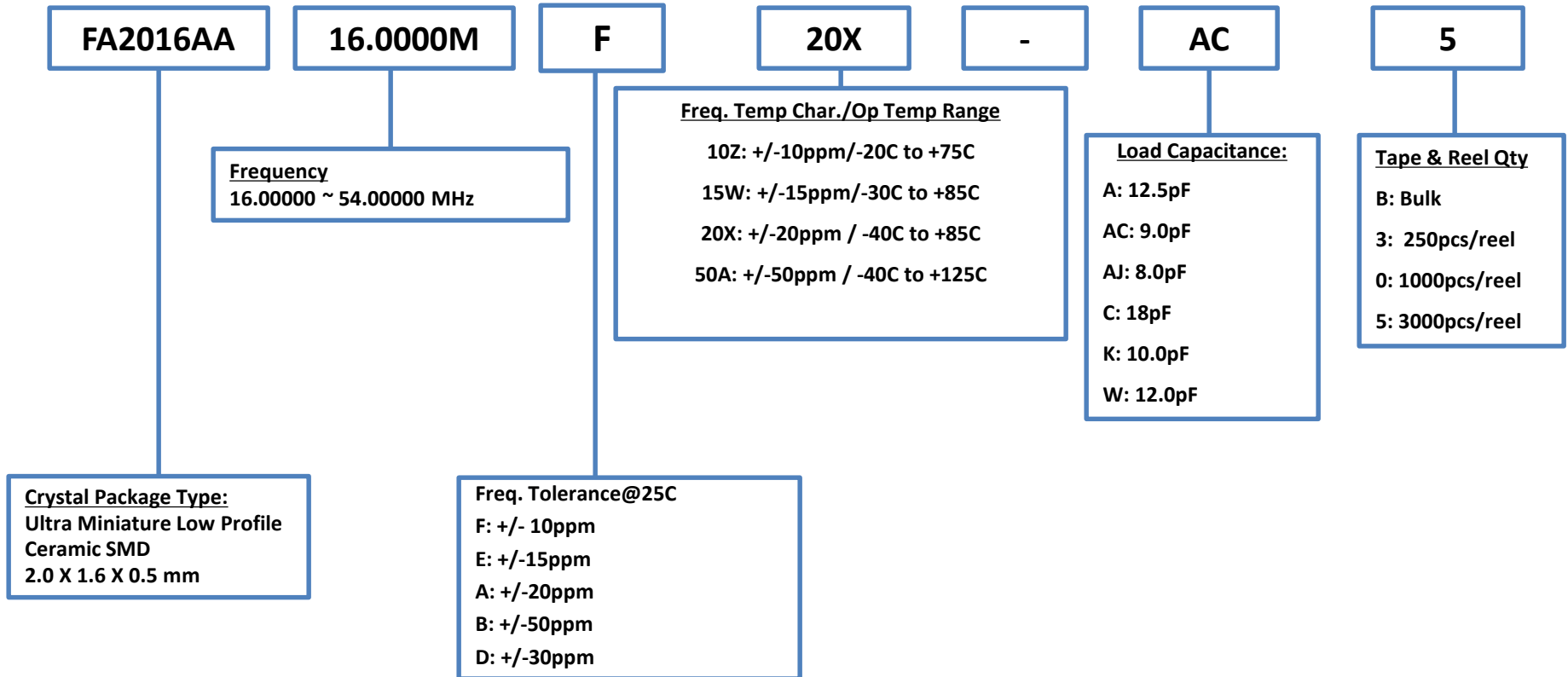
NOTES:

- 1) If you require frequency, tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.

Product Configuration System



MHz Range Crystal Units



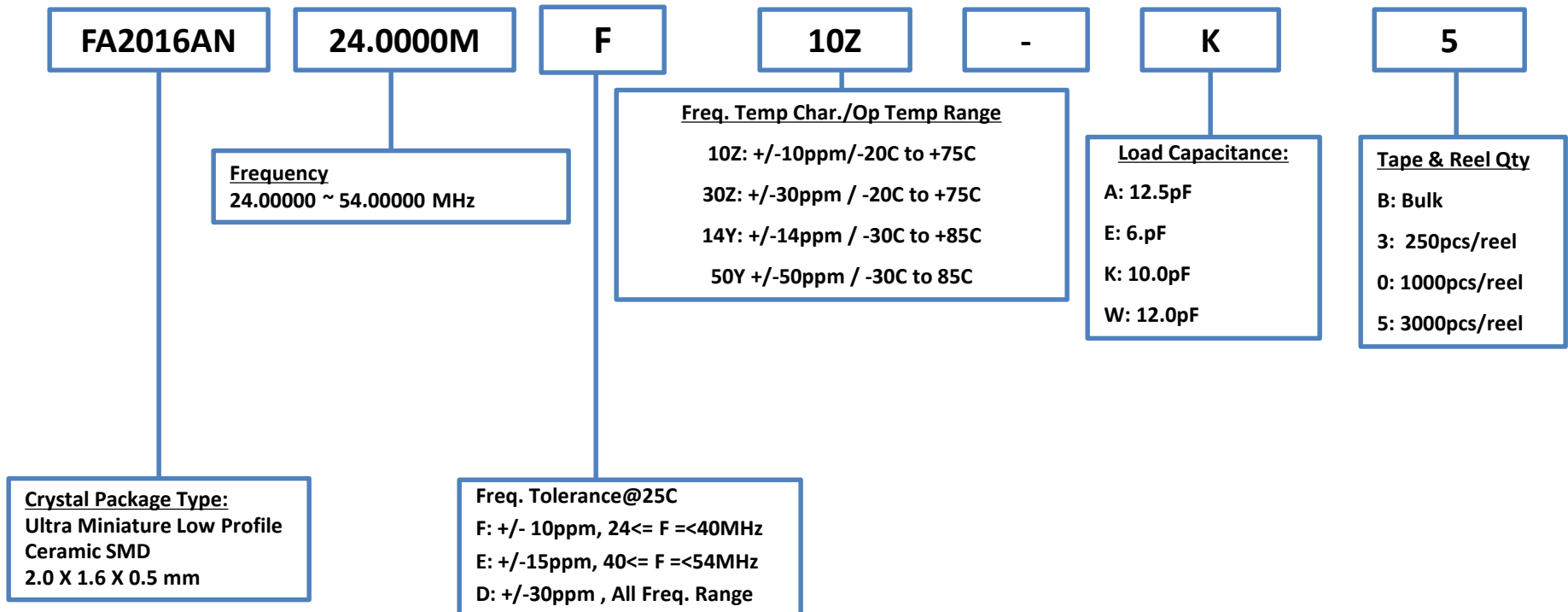
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Product Configuration System



MHz Range Crystal Units



NOTES:

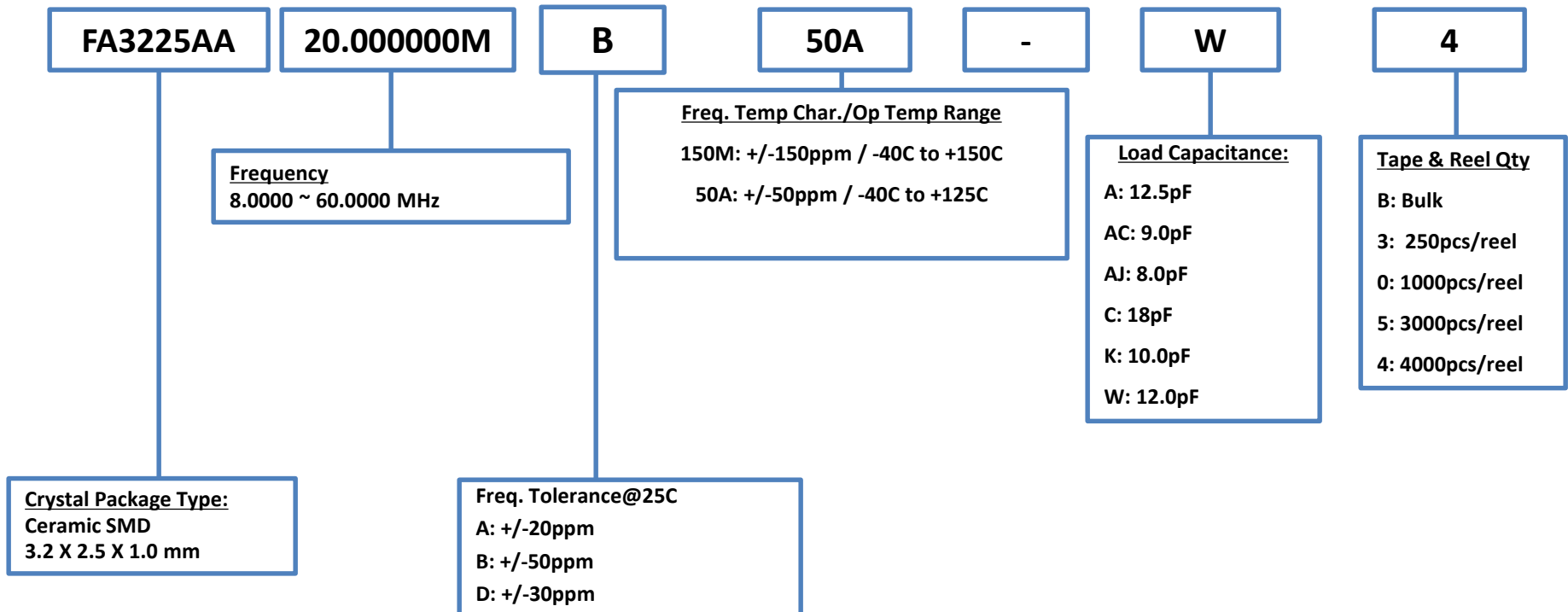
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Product Configuration System



MHz Range Crystal Units



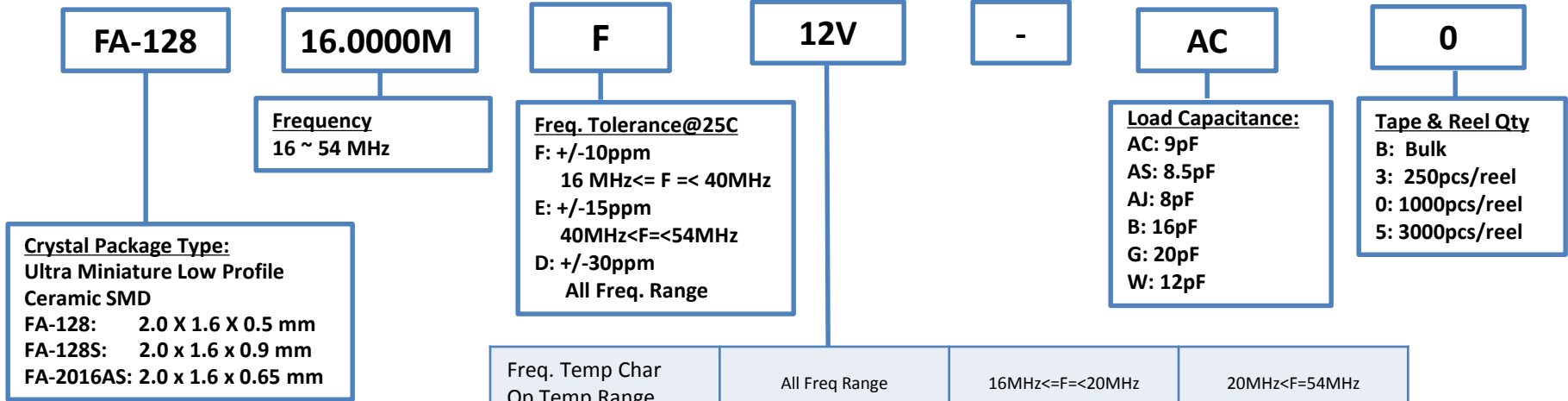
NOTES:

- 1) If you require frequency, tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.

Product Configuration System



MHz Range Crystals Units



Freq. Temp Char Op Temp Range	All Freq Range	16MHz<=F=<20MHz	20MHz<F=54MHz
-20C to +75C	+/-20ppm = 20Z	+/-12ppm = 12Z	+/-10ppm = 10Z
-20C to +80C	+/-20ppm = 20K	+/-12ppm = 12K	+/-10ppm = 10K
-20C to +85C	+/-20ppm = 20P	+/-12ppm = 12P	+/-12ppm = 12P
-30C to +70C	+/-28ppm = 28R	+/-17ppm = 17R	+/-14ppm = 14R
-30C to +75C	+/-28ppm = 28E	+/-17ppm = 17E	+/-14ppm = 14E
-30C to +80C	+30ppm = 30W	+/-17ppm = 17W	+/-14ppm = 14W
-30C to +85C	+/-30ppm = 30Y	+/-17ppm = 17Y	+/-14ppm = 14Y
-30C to +85C	+/-50ppm = 50Y	+/-17ppm = 17Y	+/-14ppm = 14Y
-40C to +85C	+/-40ppm = 40X	+/-22ppm = 22X	+/-20ppm = 20X

NOTE: 81Z = +8/-10ppm / -20C to +75C

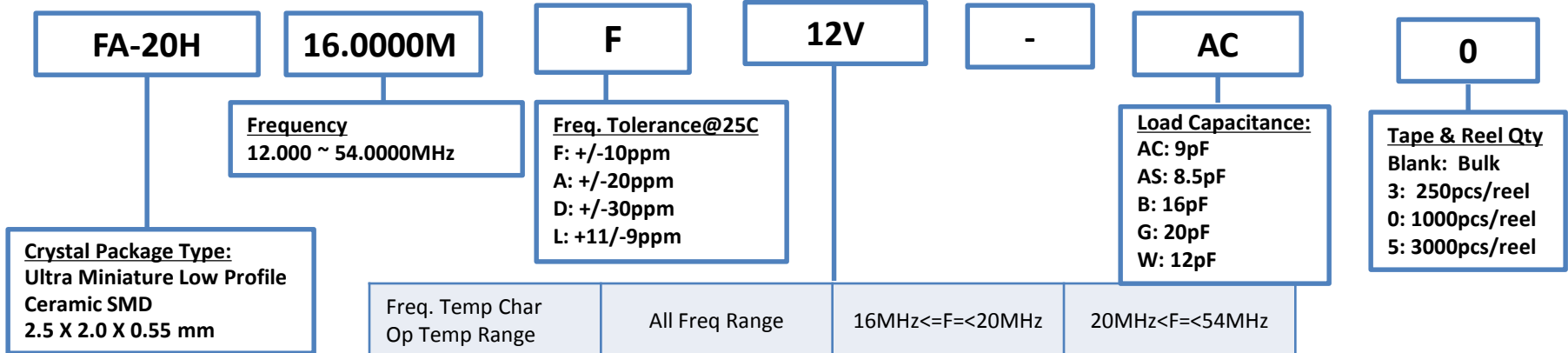


NOTES:
1) If you require frequency, tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.

Product Configuration System



MHz Range Crystals Units



Freq. Temp Char Op Temp Range	All Freq Range	16MHz<=F<20MHz	20MHz<F<54MHz
-20C to +70C	+/-20ppm = 20V	+/-12ppm = 12V	+/-10ppm = 10V
-20C to +70C	+/-30ppm = 30V	+/-12ppm = 12V	+/-10ppm = 10V
-20C to +75C	+/-20ppm = 20Z	+/-12ppm = 12Z	+/-10ppm = 10Z
-20C to +80C	+/-20ppm = 20K	+/-12ppm = 12K	+/-10ppm = 10K
-20C to +85C	+/-20ppm = 20P	+/-12ppm = 12P	+/-12ppm = 12P
-30C to +70C	+/-28ppm = 28R	+/-17ppm = 17R	+/-14ppm = 14R
-30C to +75C	+/-28ppm = 28E	+/-17ppm = 17E	+/-14ppm = 14E
-30C to +80C	+30ppm = 30W	+/-17ppm = 17W	+/-14ppm = 14W
-30C to +85C	+/-30ppm = 30Y	+/-17ppm = 17Y	+/-14ppm = 14Y
-30C to +85C	+/-50ppm = 50Y	+/-17ppm = 17Y	+/-14ppm = 14Y
-40C to +85C	+/-40ppm = 40X	+/-22ppm = 22X	+/-20ppm = 20X

NOTE: 81Z = +8/-10ppm / -20C to +75C

NOTES:

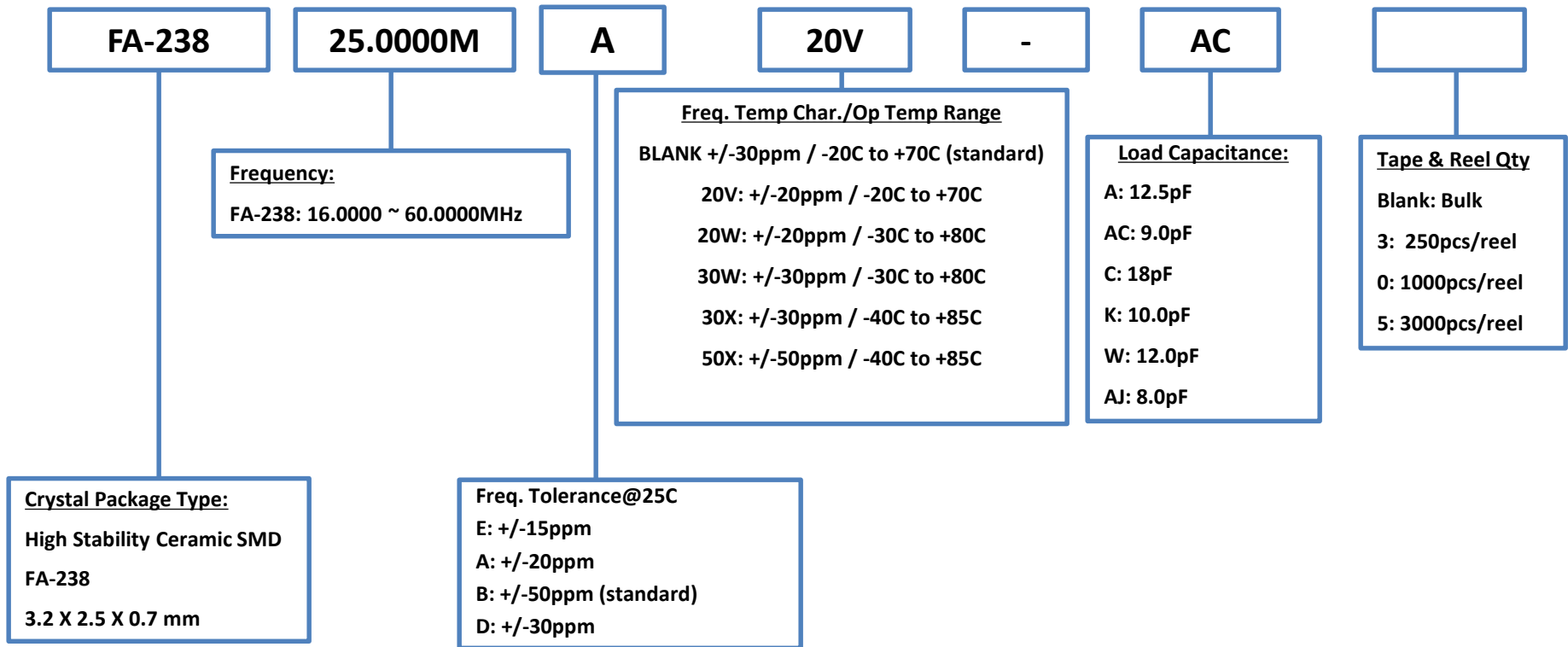
1) If you require frequency, tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.



Product Configuration System



MHz Range Crystal Units



NOTES:

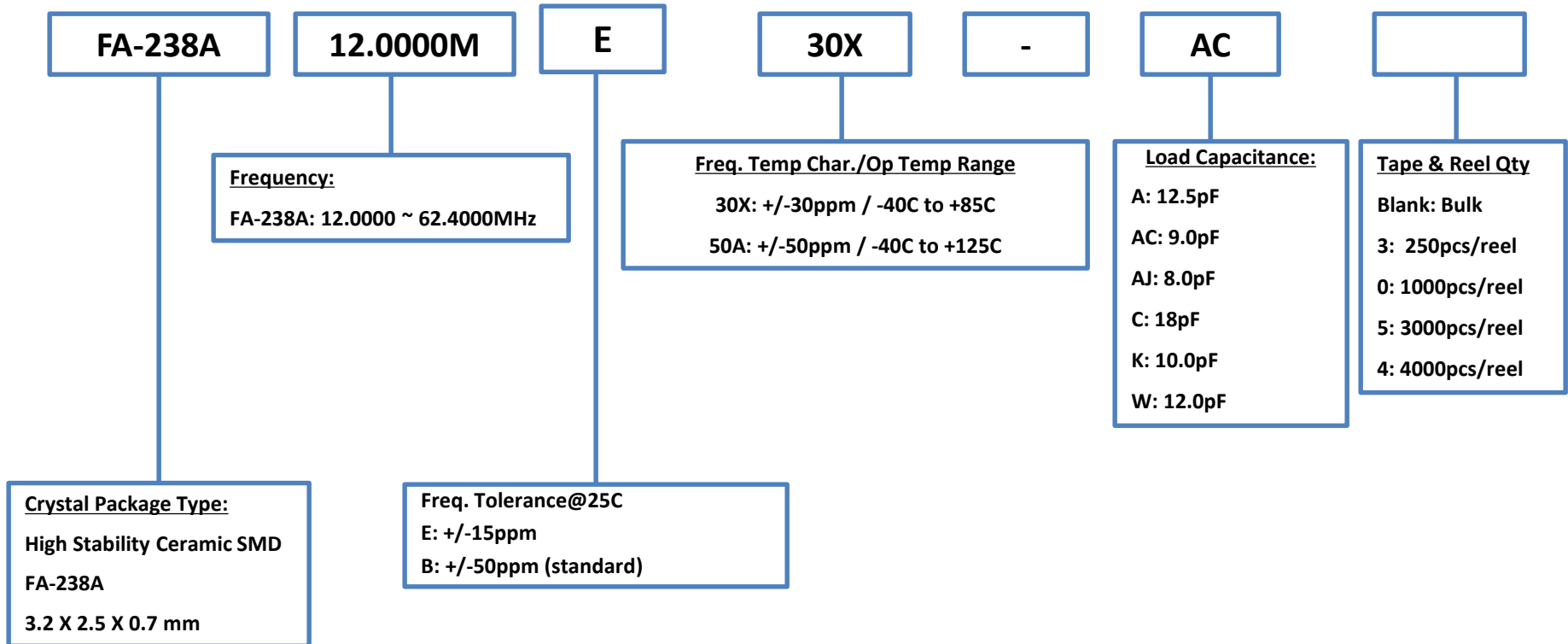
1) If you require frequency , tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.



Product Configuration System



MHz Range Crystal Units



NOTES:

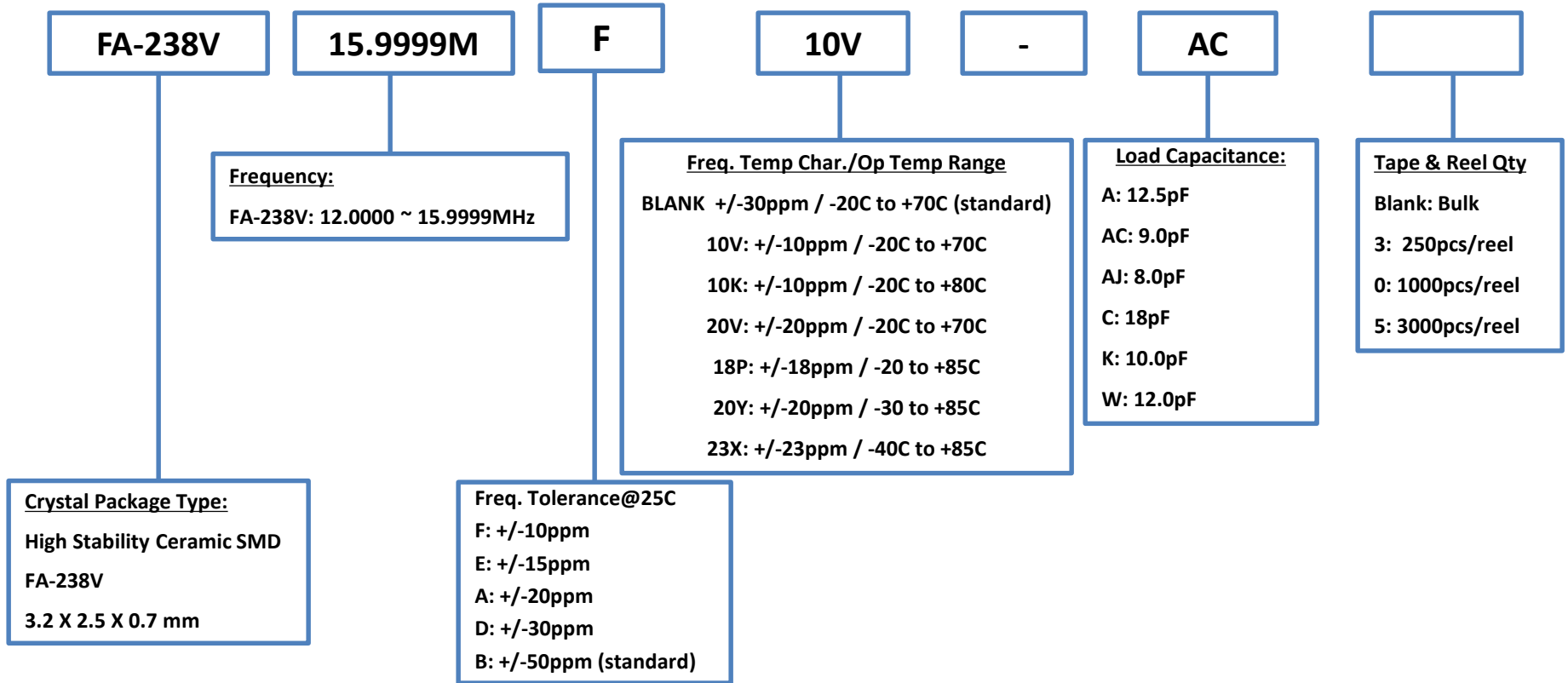
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Product Configuration System



MHz Range Crystal Units



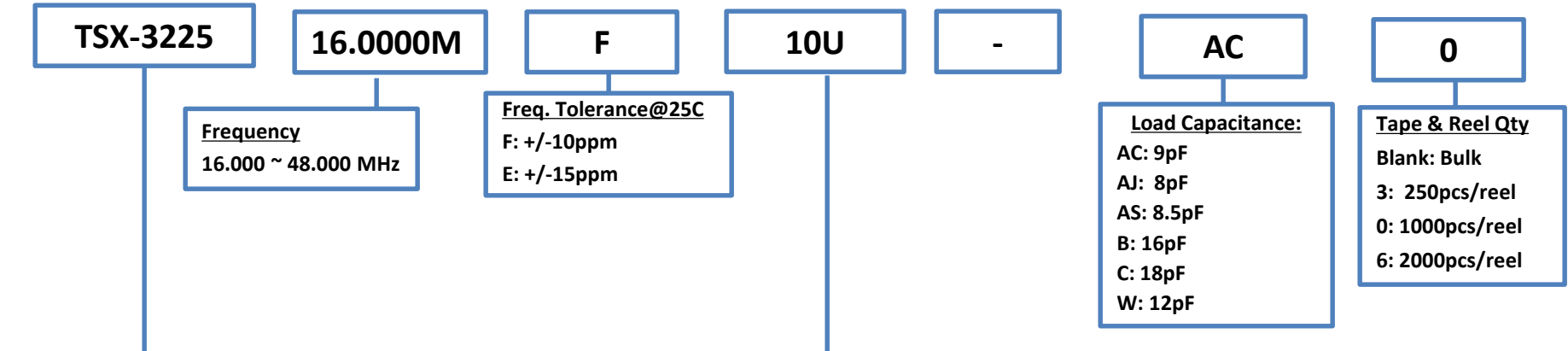
NOTES:
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Product Configuration System



MHz Range Crystal Units



Crystal Package Type:
Miniature Size Low Profile Ceramic SMD
3.2 X 2.5 X 0.6 mm

Freq. Temp Char Op Temp Range	16MHz<=F=<26.99MHz	27MHz<F=<48MHz
-10C to 60C	+/-10ppm = 10U	+/-10ppm = 10U
-20C to +75C	+/-9ppm = 09Z	+/-9ppm = 09Z (for <40MHz)
-20C to +75C	+/-10ppm = 10Z	+/-10ppm = 10Z
-20C to +85C	+/-10ppm = 10P	+/-10ppm = 10P
-30C to +85C	+/-13ppm = 13Y	+/-15ppm = 15Y
-40C to +85C	+/-18ppm = 18X	+/-18ppm = 18X
-40C to +105C	+/-20ppm = 20G (for 20MHz and 24MHz only)	

NOTES:

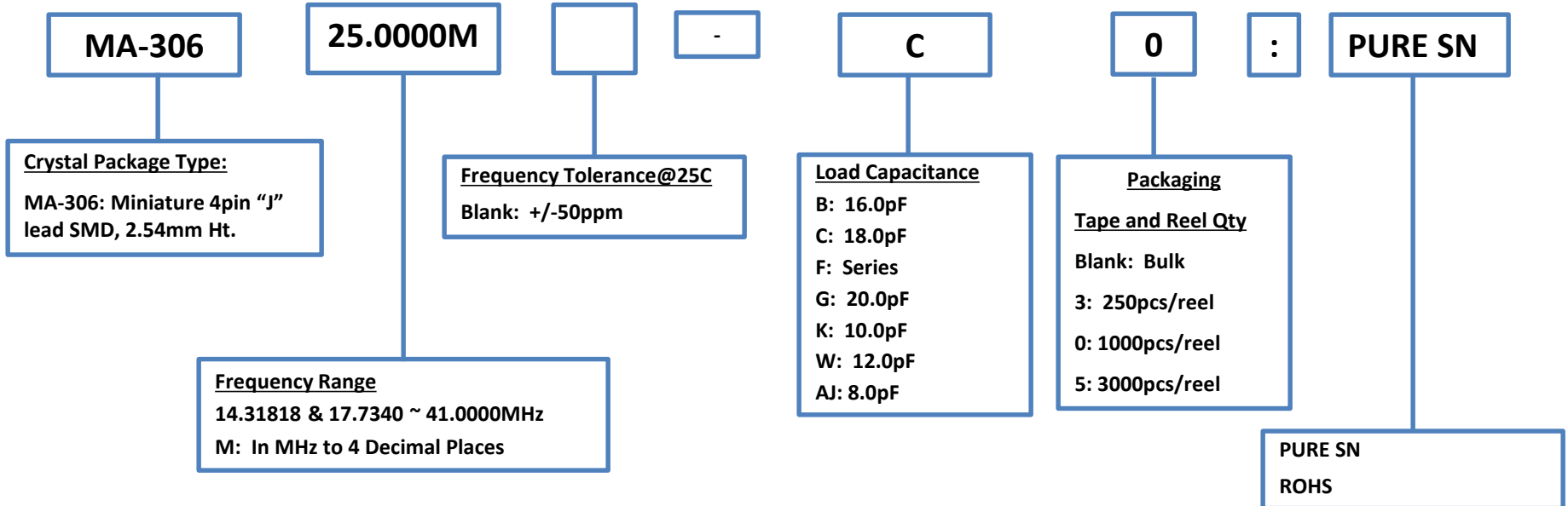
- 1) If you require frequency, tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.



Product Configuration System



MHz Range Crystal Units



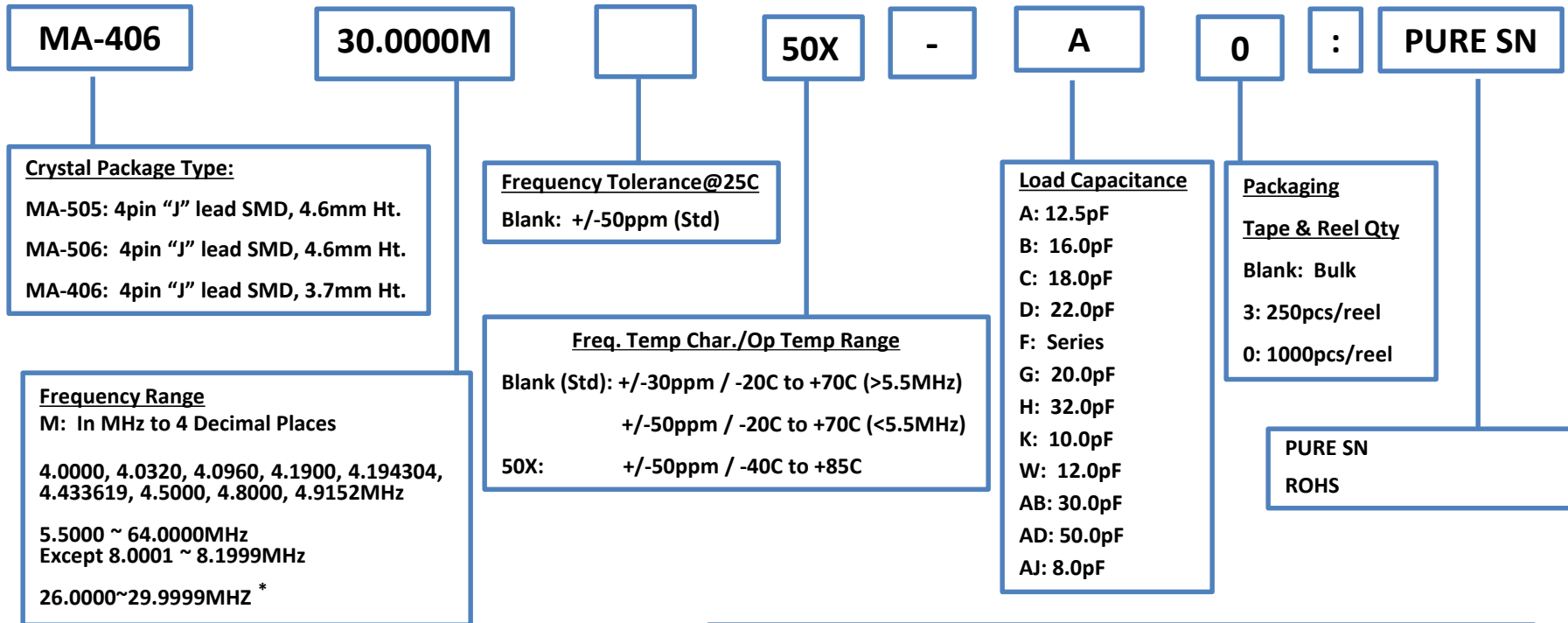
NOTES:

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Product Configuration System



MHz Range Crystal Units



NOTES:

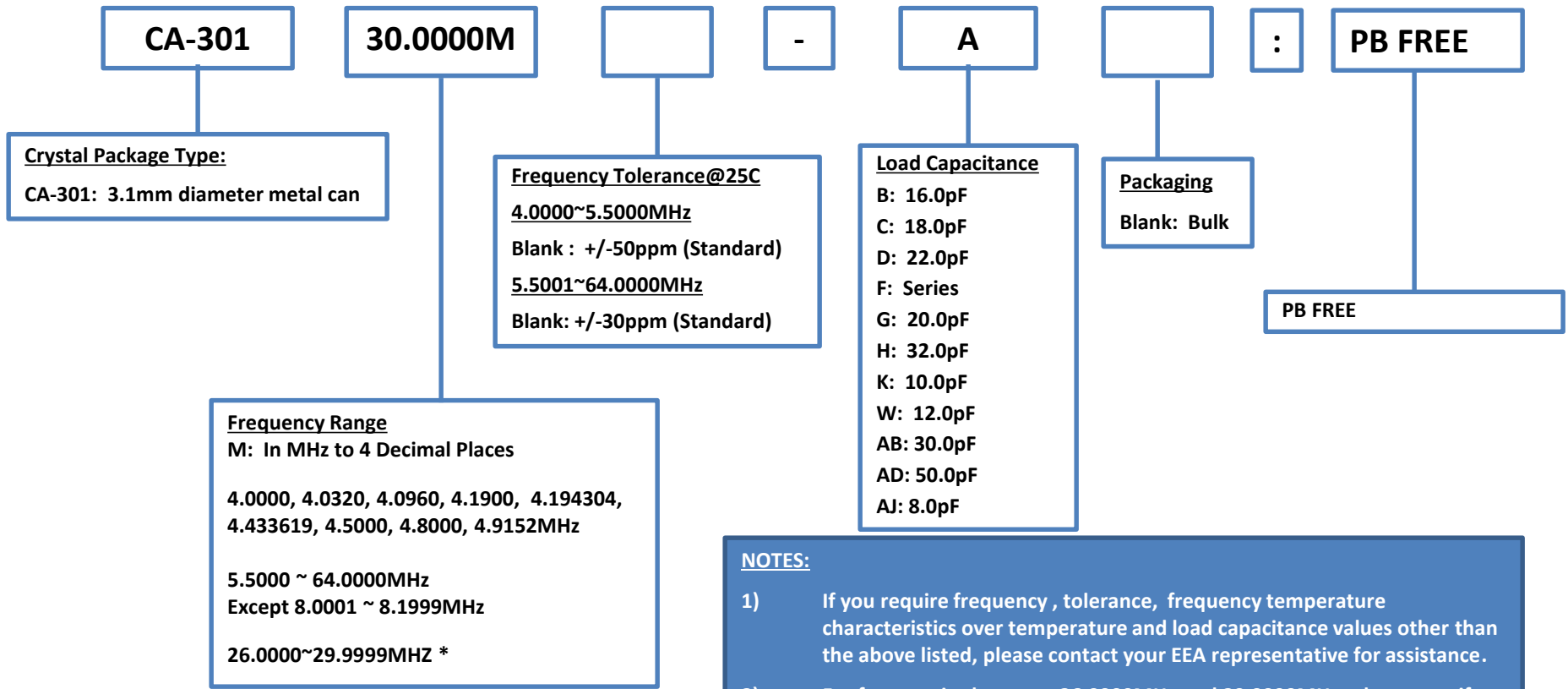
- 1) If you require frequency, tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.
- 2) For frequencies between 26.0000MHz and 29.9999MHz, please specify "(FUND)" at end of part number if fundamental mode required. Otherwise, 3rd Overtone is default.



Product Configuration System



MHz Range Crystal Units



NOTES:

- 1) If you require frequency, tolerance, frequency temperature characteristics over temperature and load capacitance values other than the above listed, please contact your EEA representative for assistance.
- 2) For frequencies between 26.0000MHz and 29.9999MHz, please specify "(FUND)" at end of part number if fundamental mode required. Otherwise, 3rd Overtone is default.



Product Configuration System

Crystal Units Load Cap Codes and Values (as of March 2014)

Load Cap Code	Load Cap Value
AZ	3.5
VJ	4.0
EE	4.4
AT	4.8
X	5.0
JJ	5.4
E	6.0
FF	6.4
DD	6.5
VC	6.7
AG	7.0
AR	7.1
JK	7.4
VB	7.6
AN	7.8
AJ	8.0
AS	8.5
CC	8.7
GG	8.8
AC	9.0
AM	9.2

Load Cap Code	Load Cap Value
AL	9.5
S	9.6
VF	9.8
K	10.0
HH	10.4
AK	10.5
AP	10.7
P	11.0
AY	11.2
AW	11.5
W	12.0
A	12.5
T	13.0
N	13.5
Y	14.0
VH	14.5
R	15.0
B	16.0
AV	17.0
C	18.0
L	18.3

Load Cap Code	Load Cap Value
J	18.5
AQ	19.0
G	20.0
AF	21.5
D	22.0
AU	22.5
AE	22.9
AH	23.0
V	24.0
AI	25.0
Z	26.0
AA	27.0
Q	28.0
AB	30.0
H	32.0
I	33.0
U	47.0
AD	50.0
M	100.0
F	Series

Product Configuration Guide

OSCILLATORS



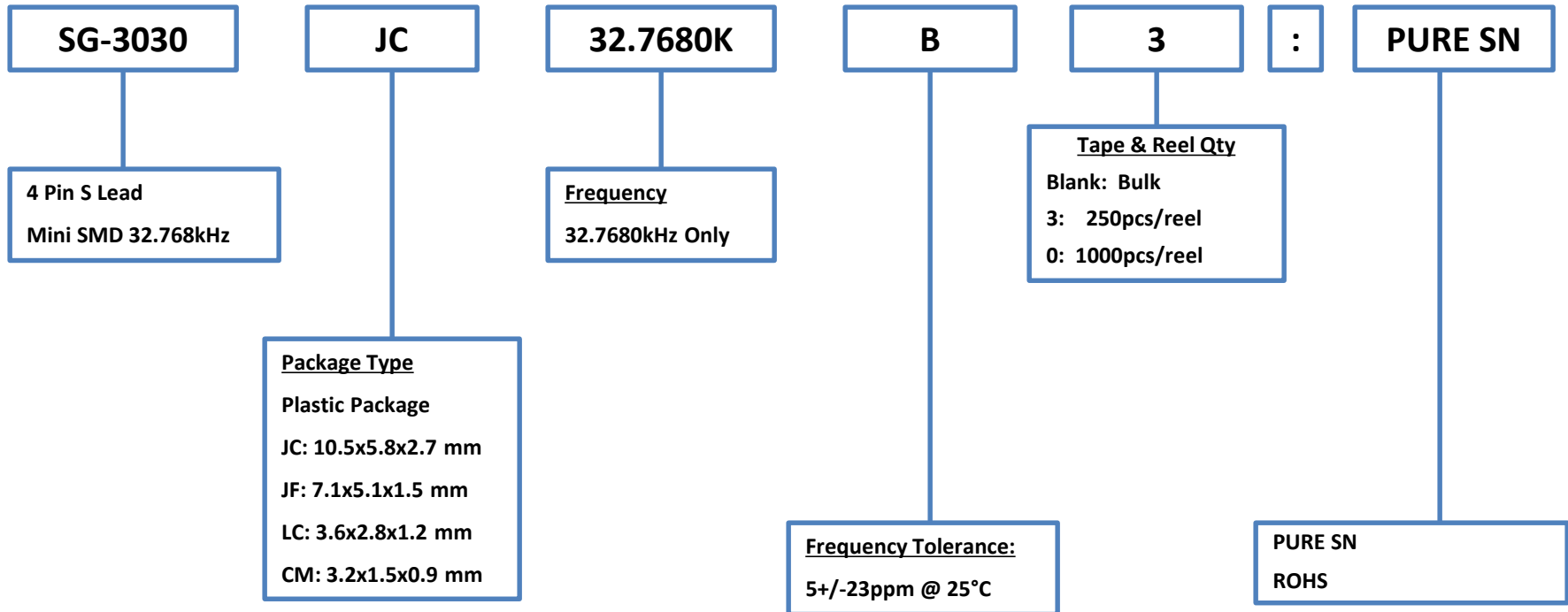
- SPXO
- Programmable
- Spread Spectrum
- High Stability



Product Configuration System



Crystal Oscillators - SPXO

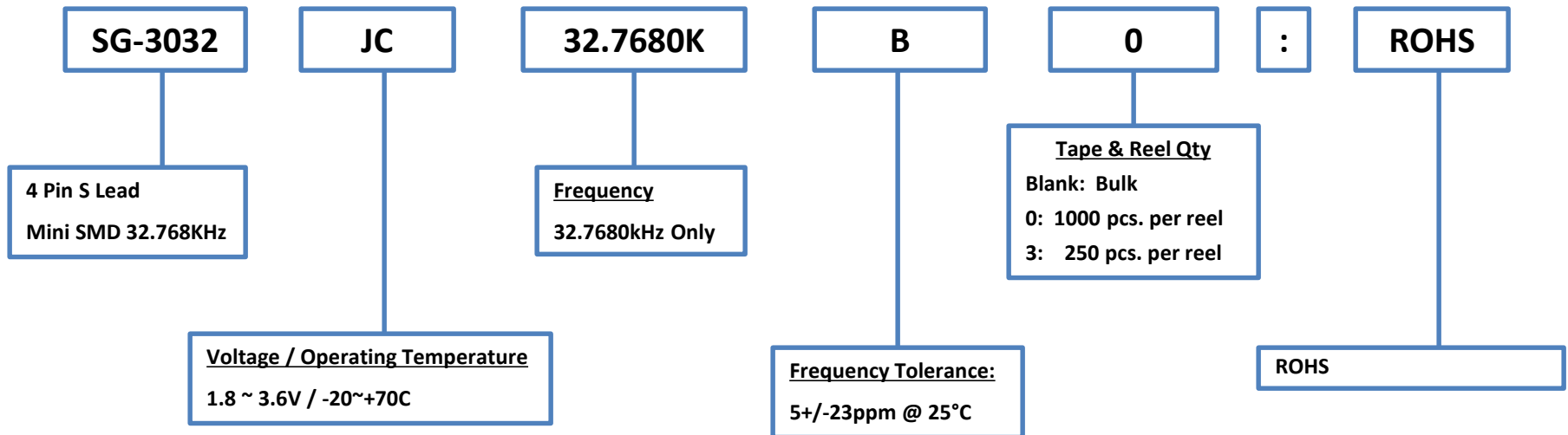


Note: All LC packages are RoHS Compliant, Pure SN

Product Configuration System



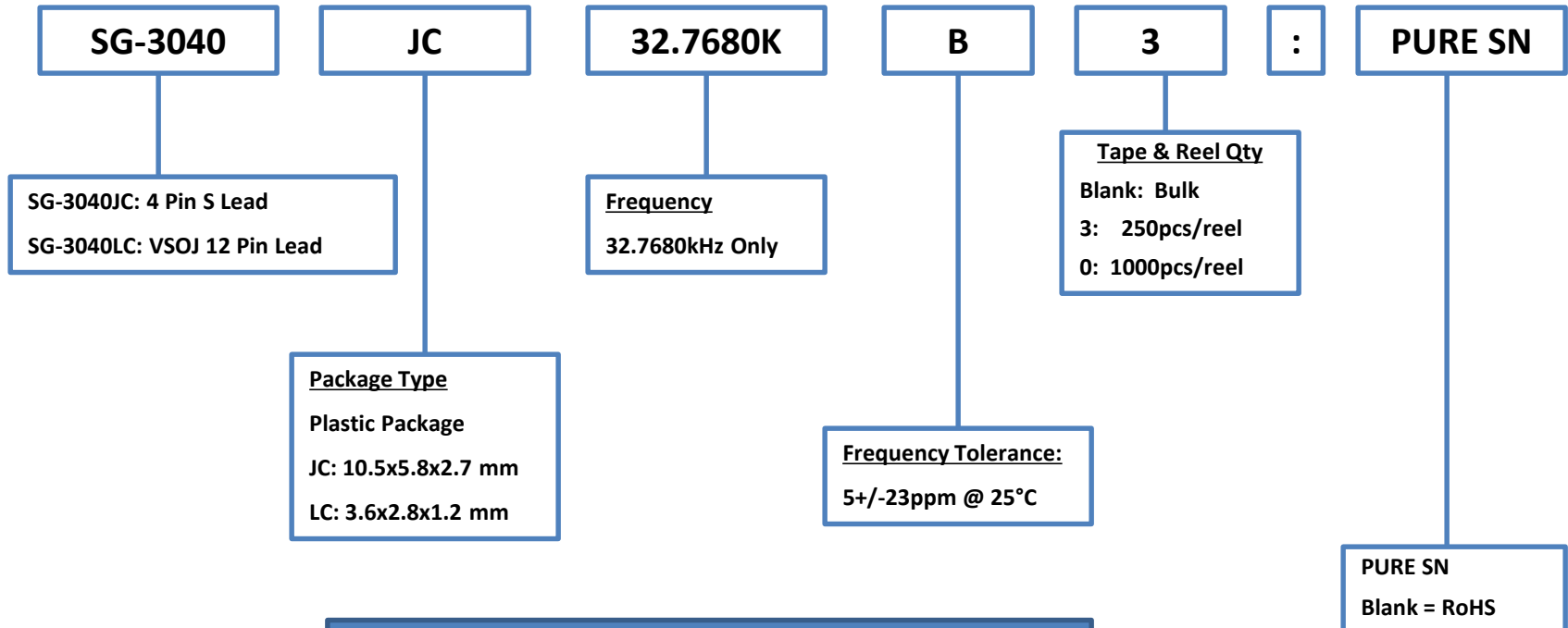
Crystal Oscillators - SPXO



Product Configuration System



Crystal Oscillators - SPXO

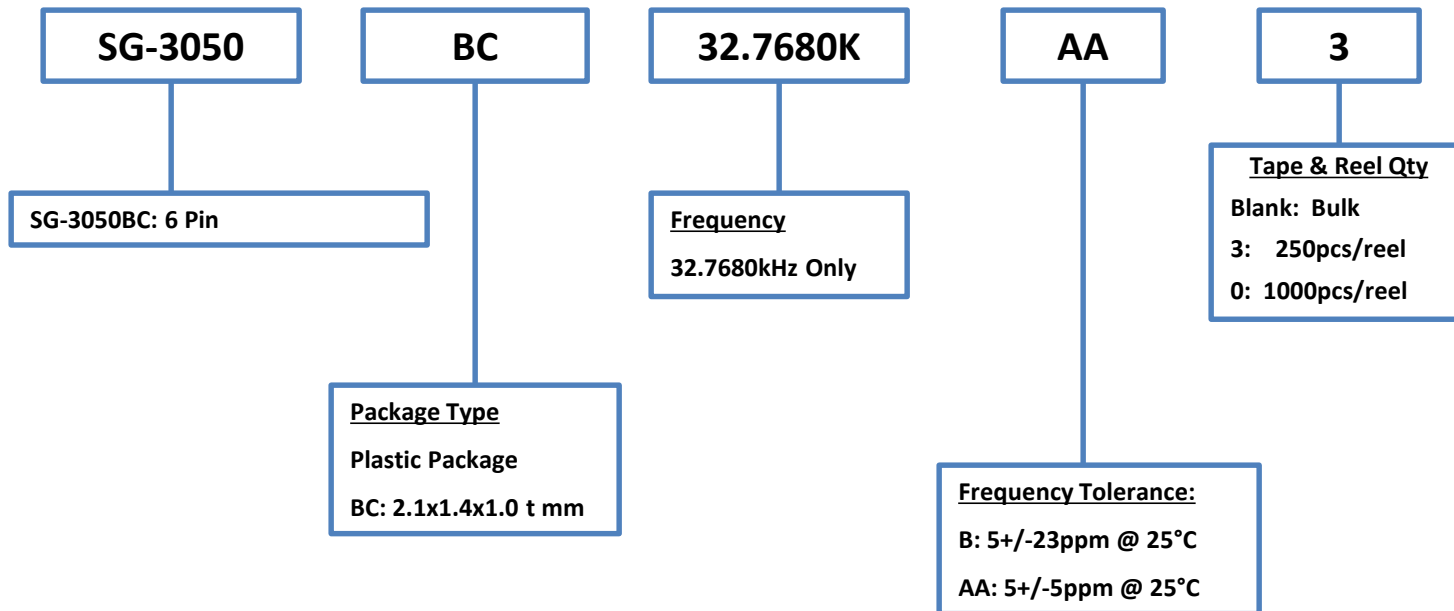


Note: All LC packages are RoHS Compliant, Pure SN

Product Configuration System



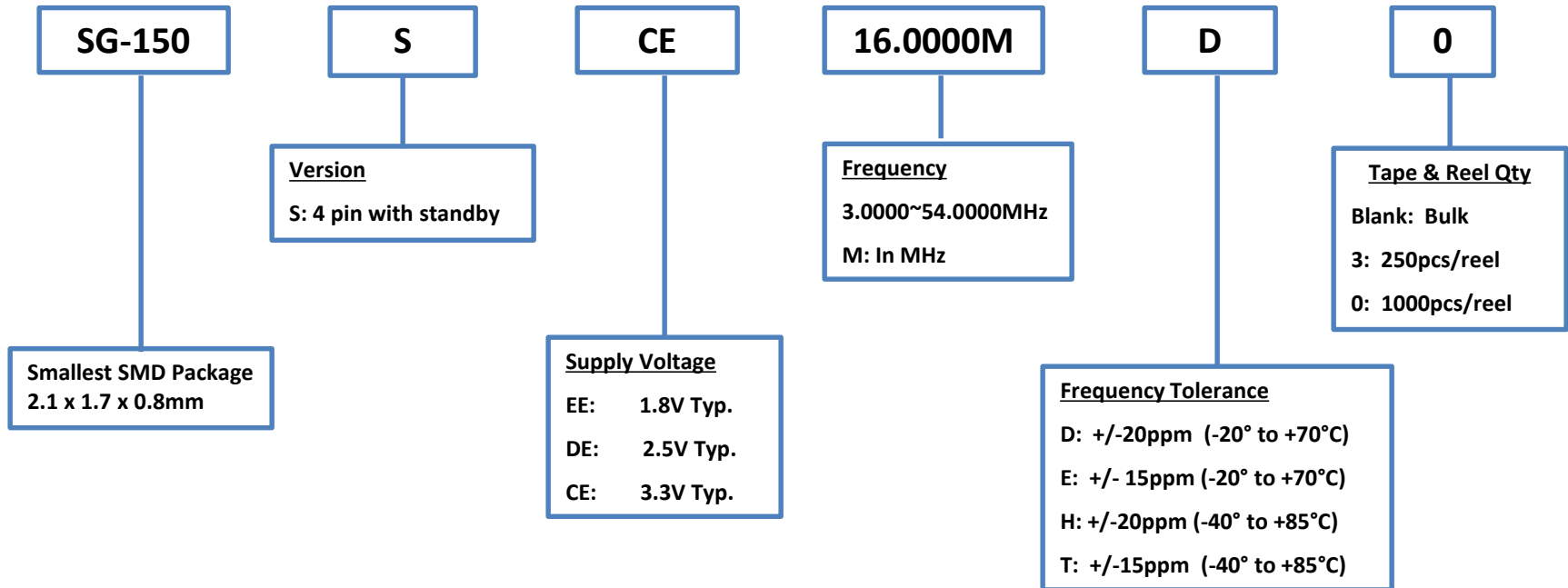
Crystal Oscillators - SPXO



Product Configuration System



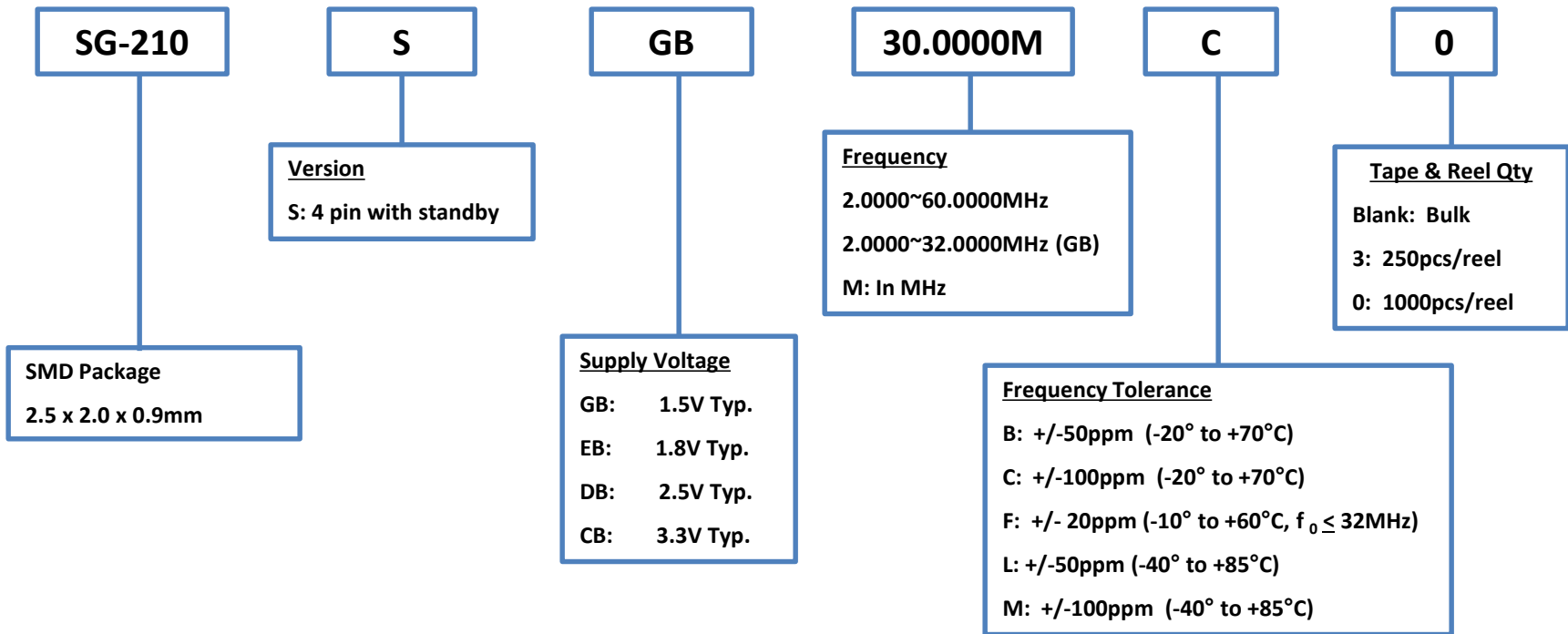
Crystal Oscillators - SPXO



Product Configuration System



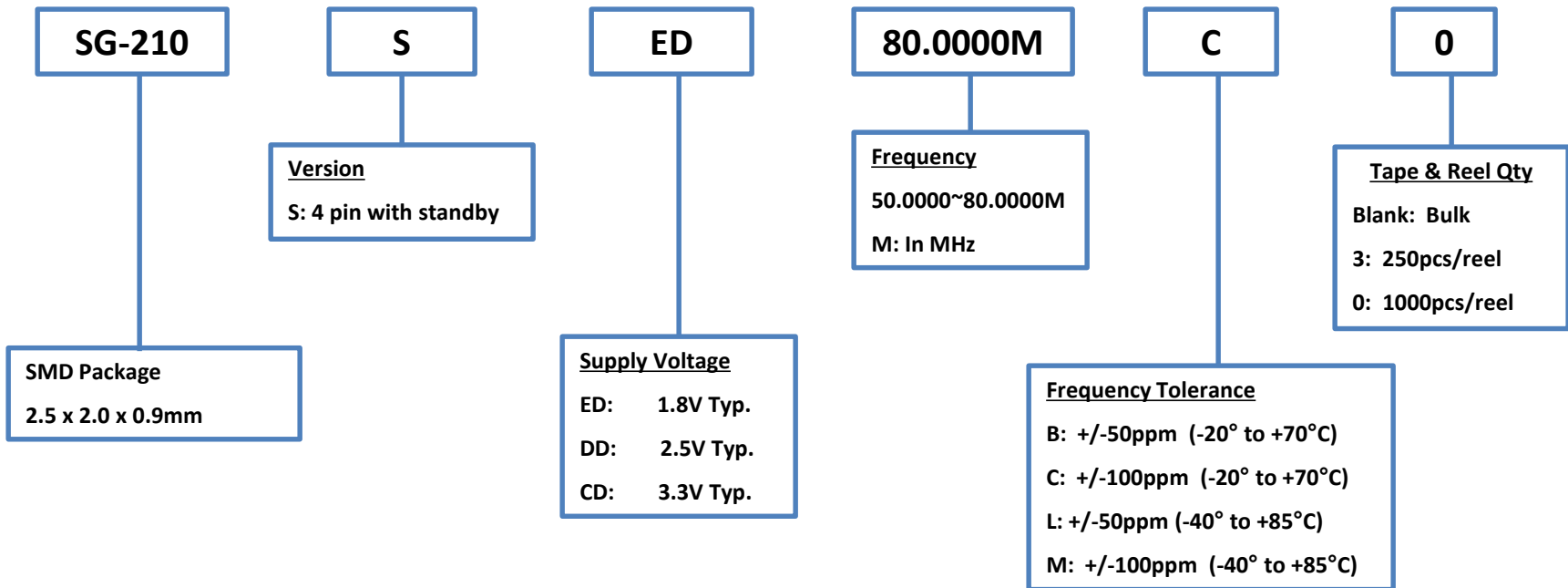
Crystal Oscillators - SPXO



Product Configuration System



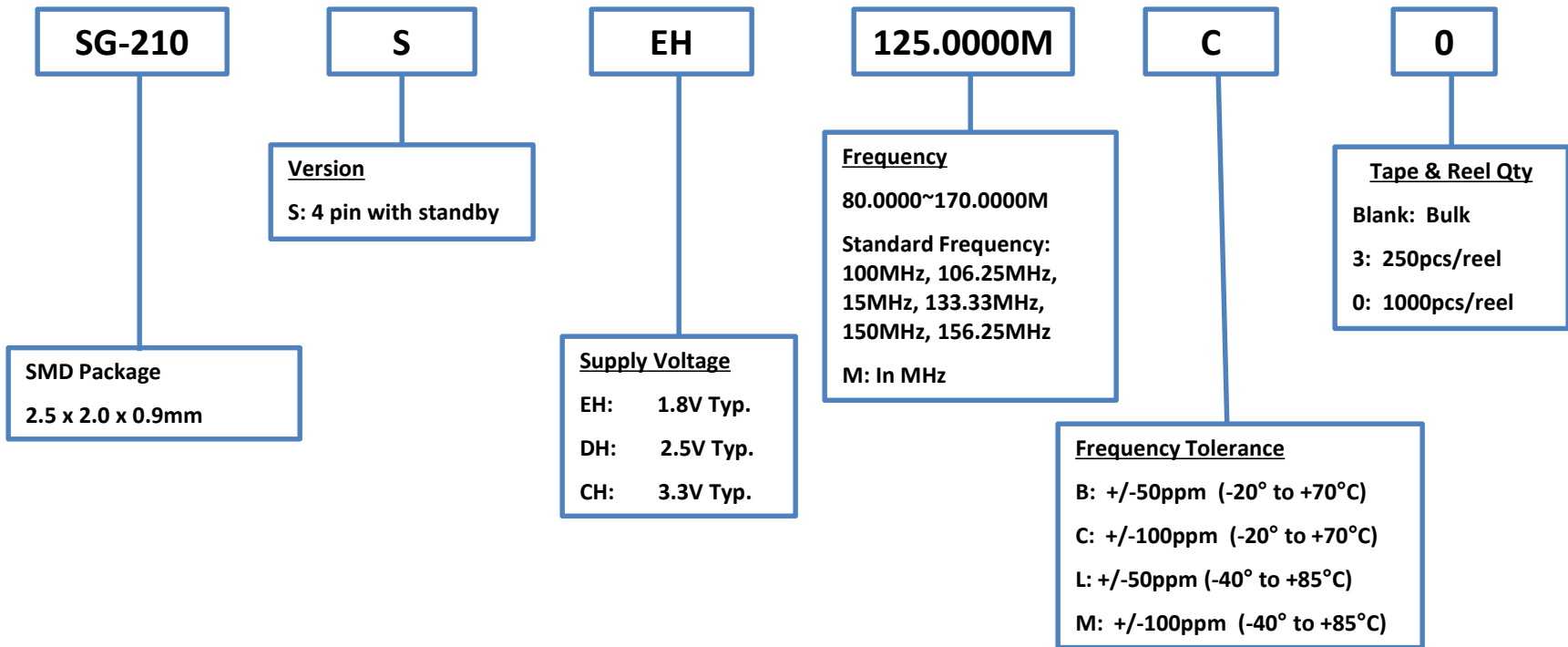
Crystal Oscillators - SPXO



Product Configuration System



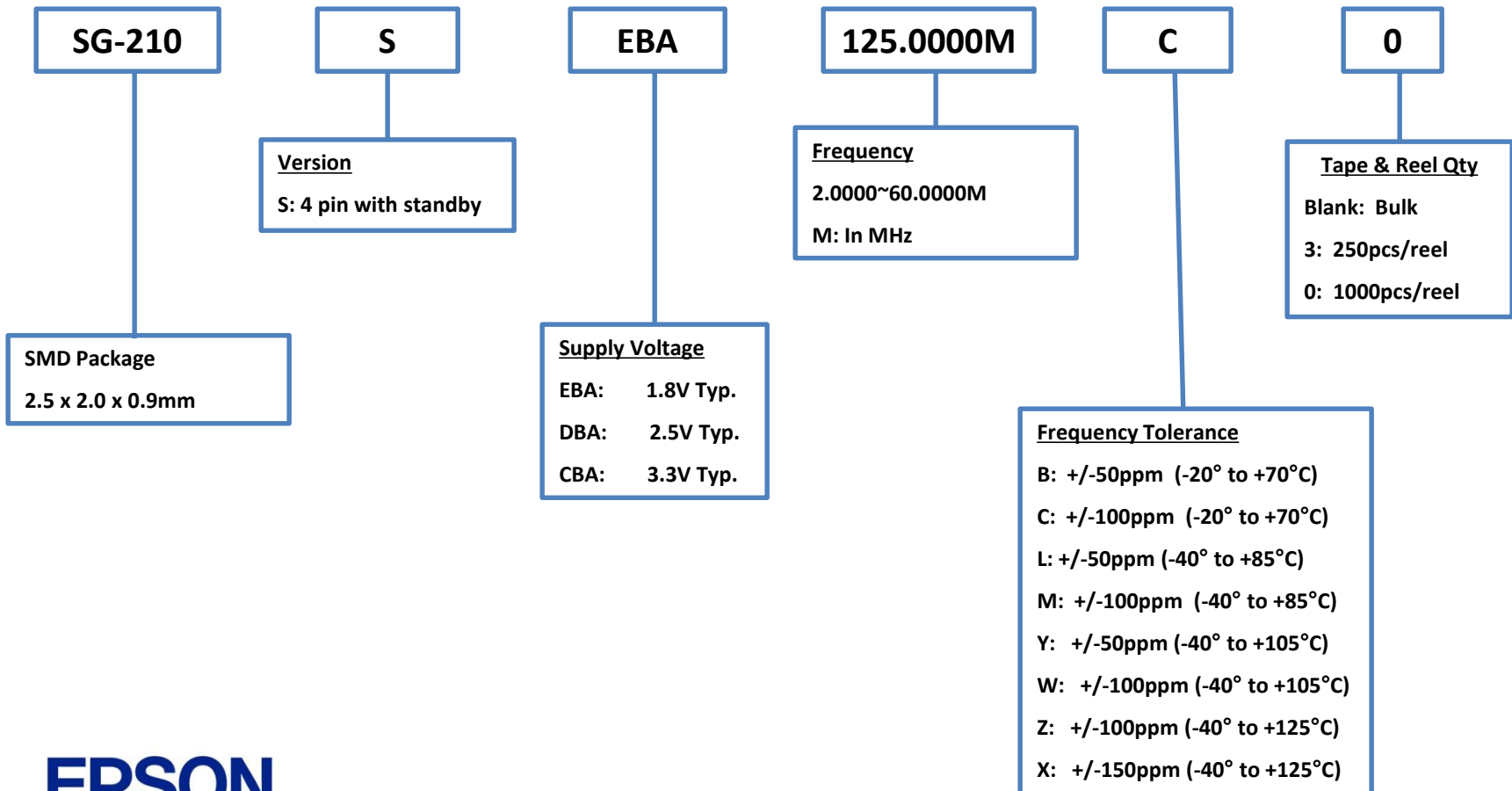
Crystal Oscillators - SPXO



Product Configuration System



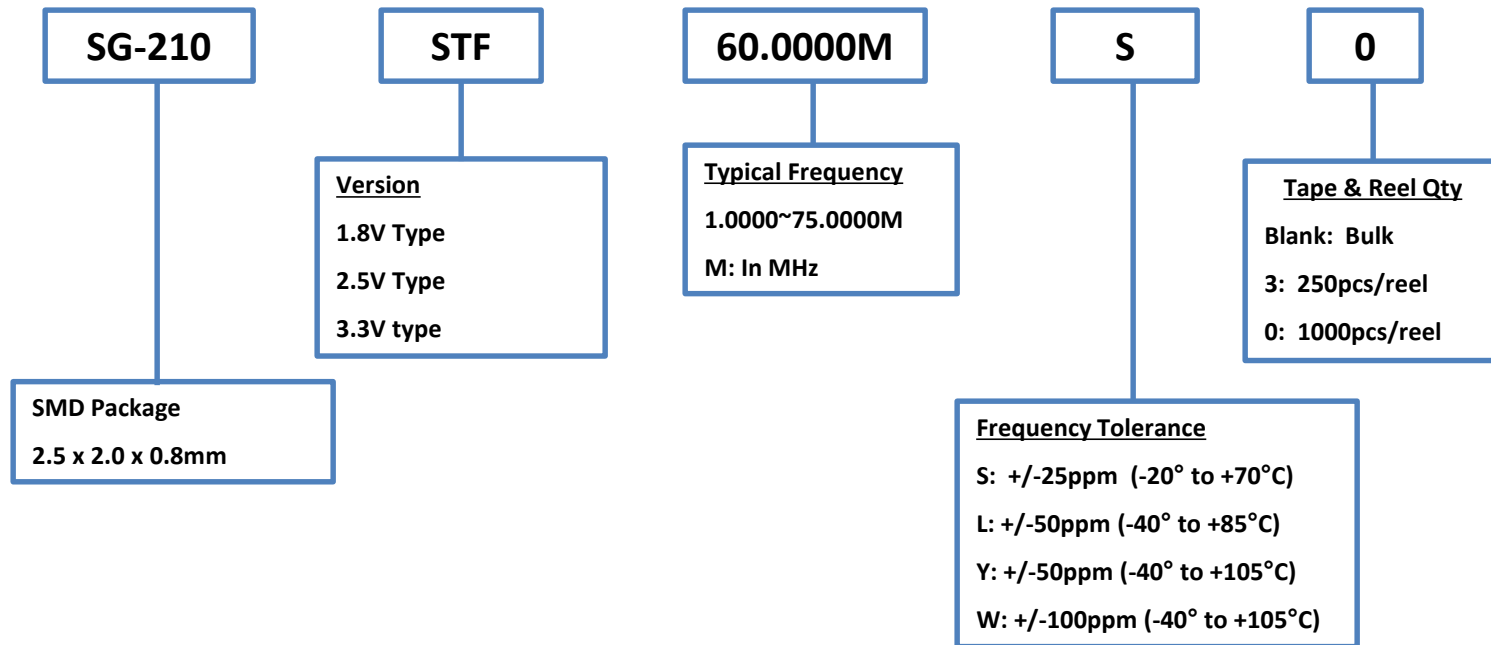
Crystal Oscillators - SPXO



Product Configuration System



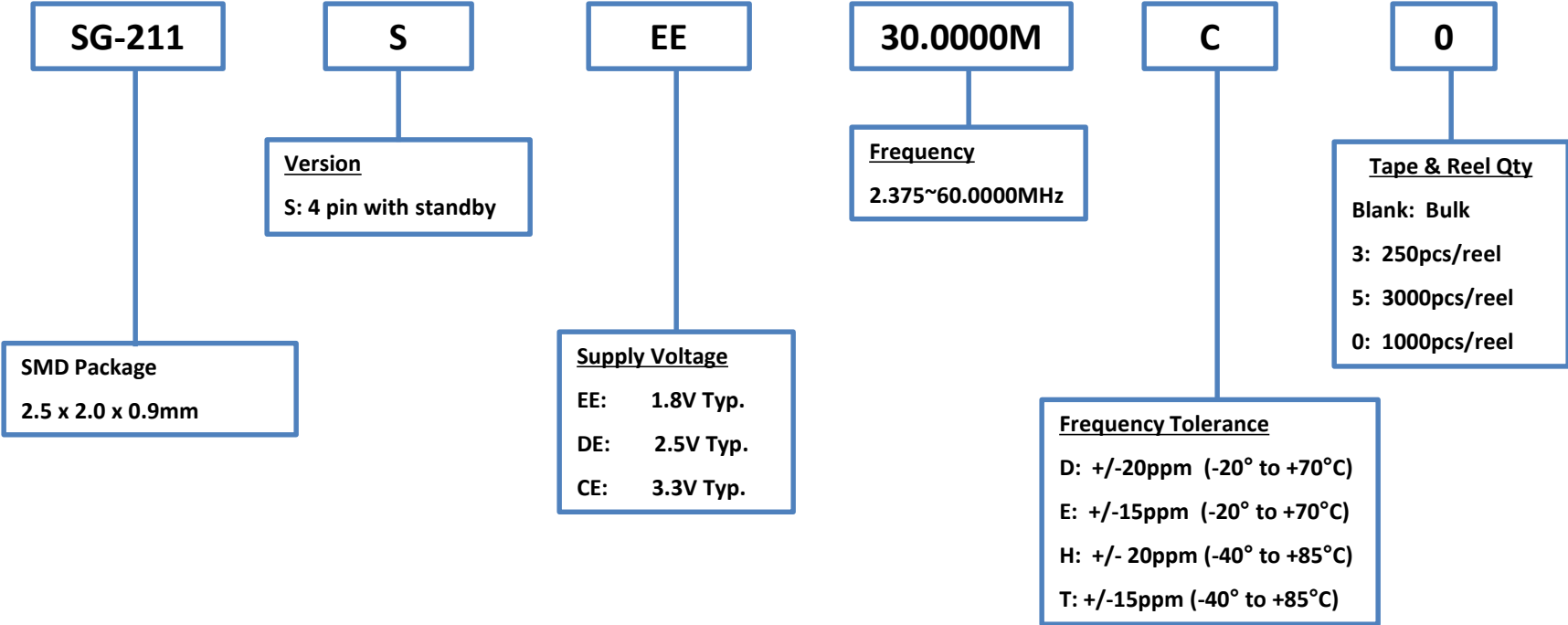
Crystal Oscillators - SPXO





Product Configuration System

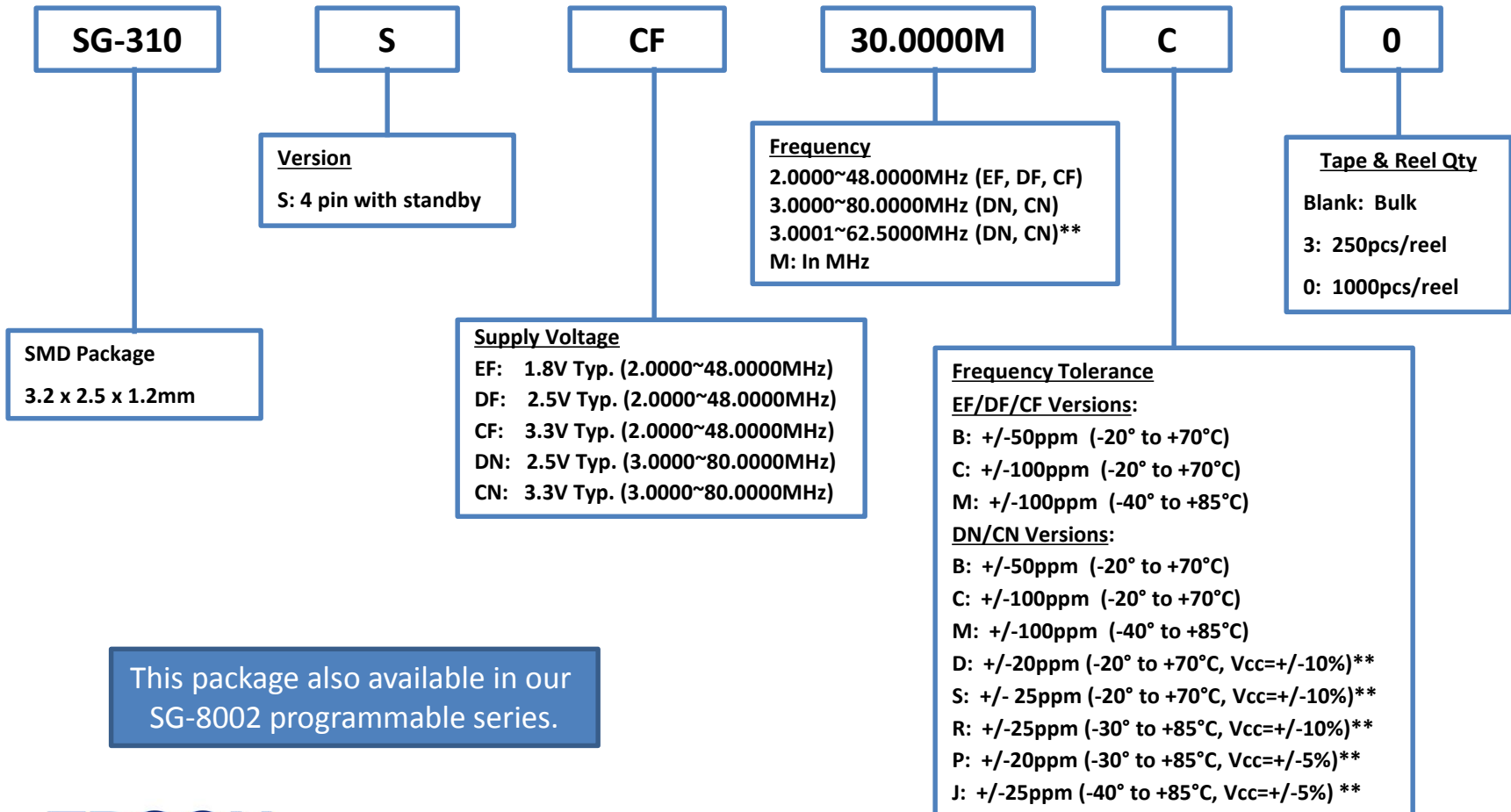
Crystal Oscillators - SPXO



Product Configuration System



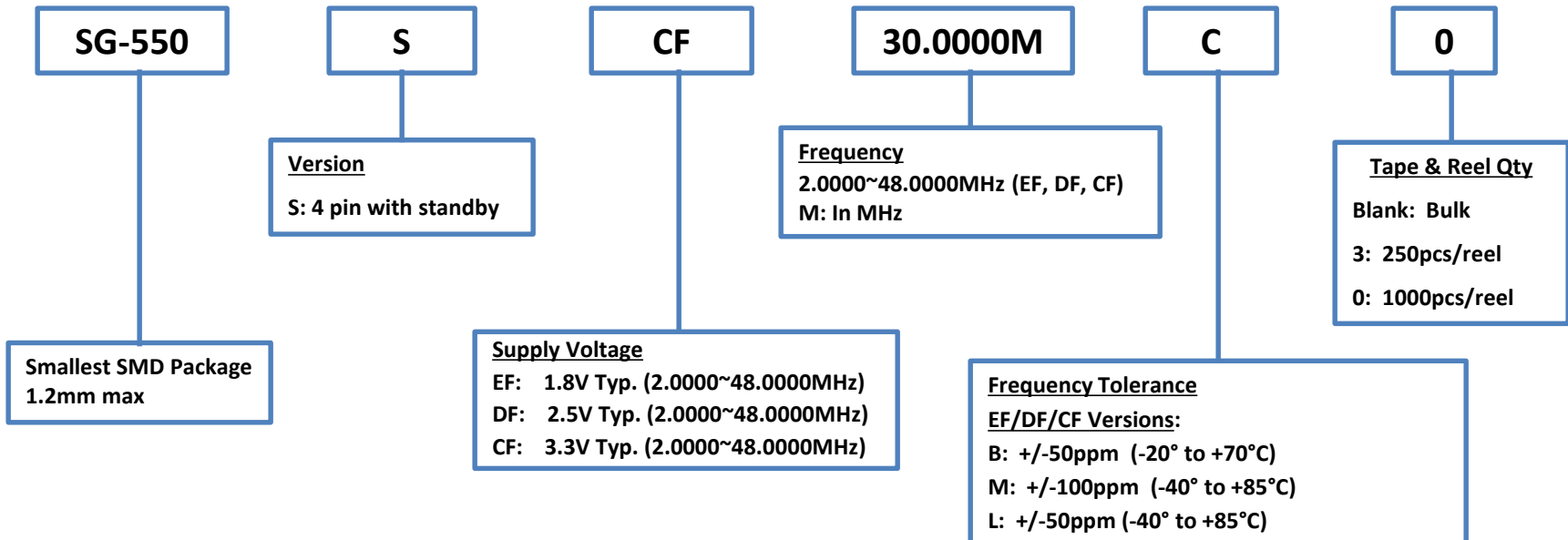
Crystal Oscillators - SPXO



Product Configuration System



Crystal Oscillators - SPXO



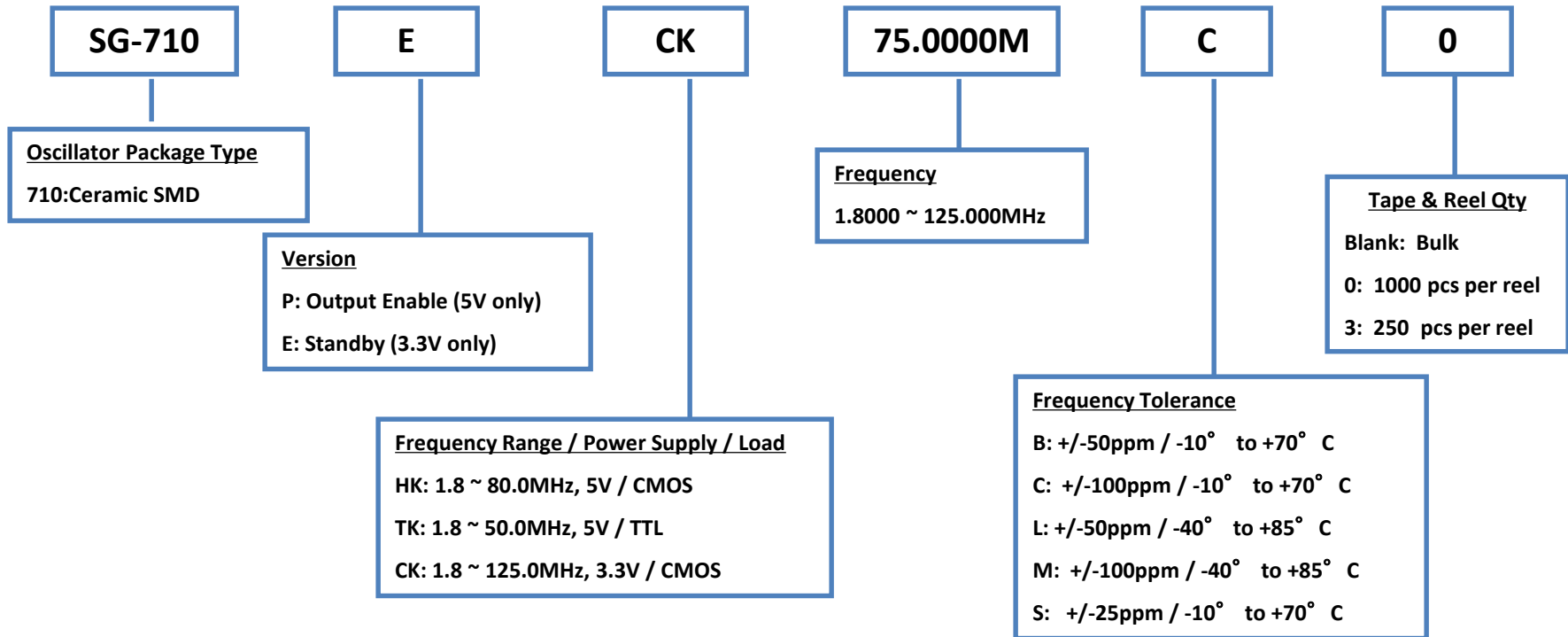
This package also available in our SG-8002LB programmable series.



Product Configuration System



Crystal Oscillators - SPXO

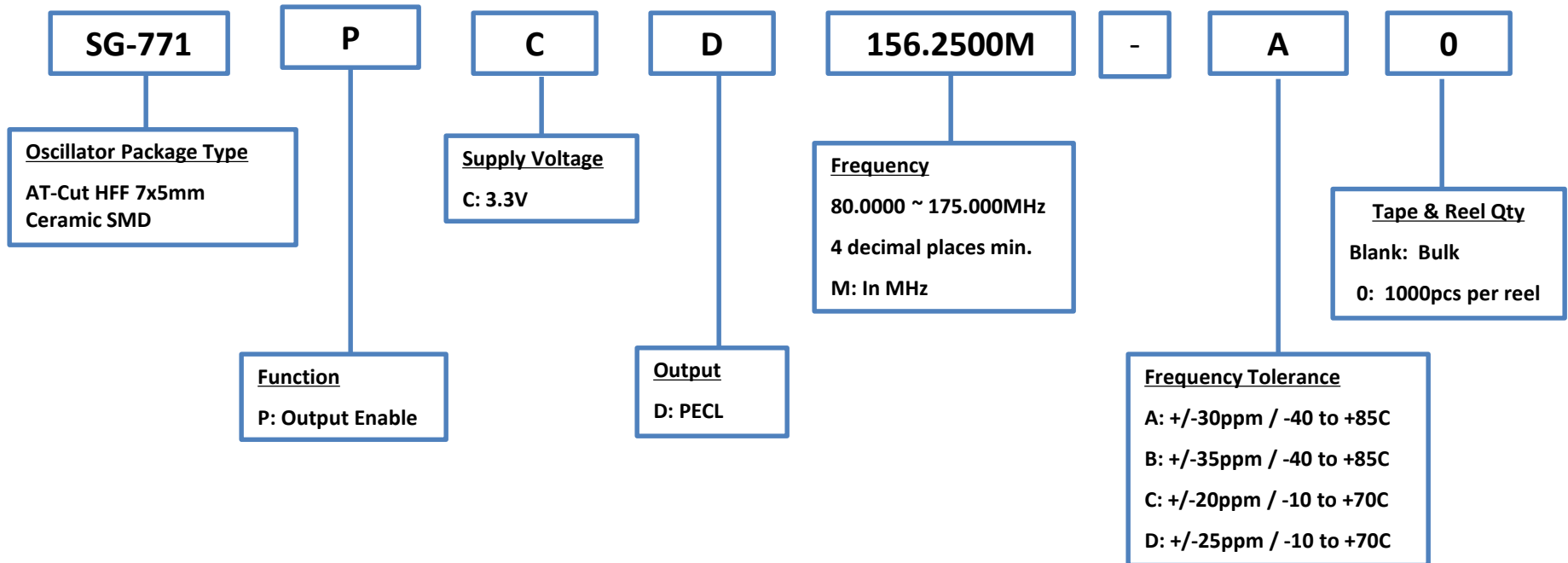


These packages also available in our SG-8002 programmable series.

Product Configuration System



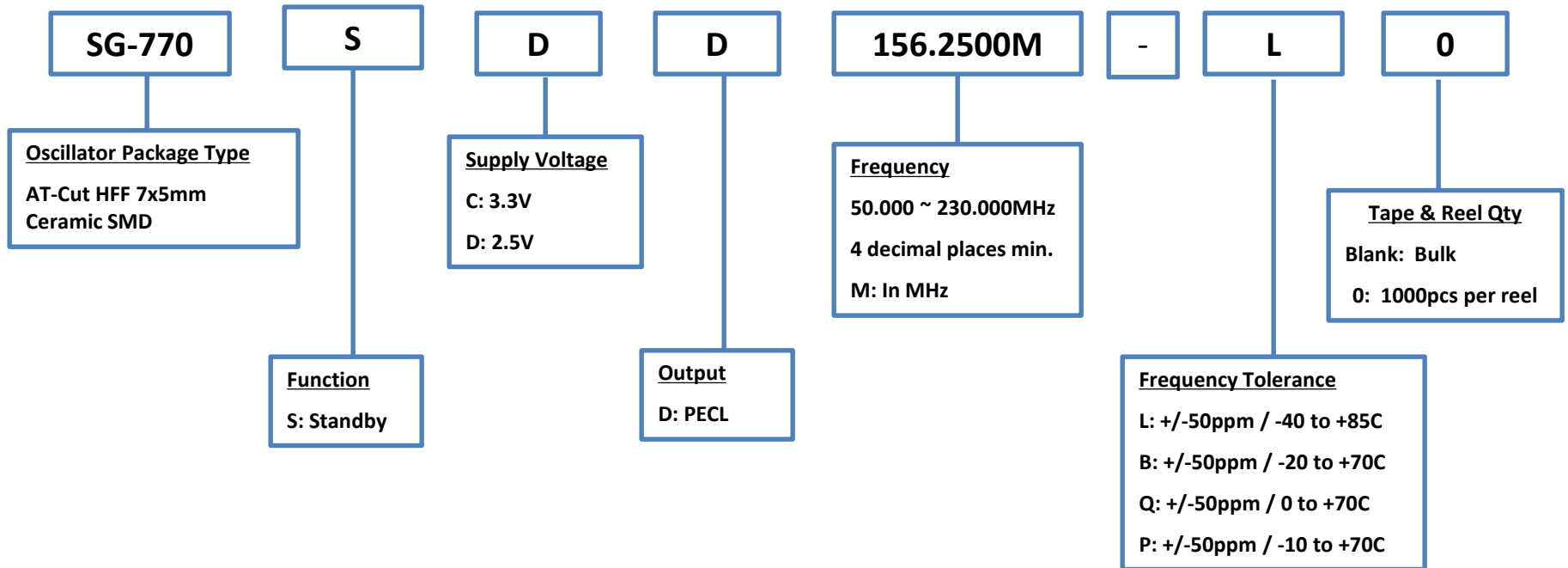
Crystal Oscillators - SPXO



Product Configuration System



Crystal Oscillators - SPXO

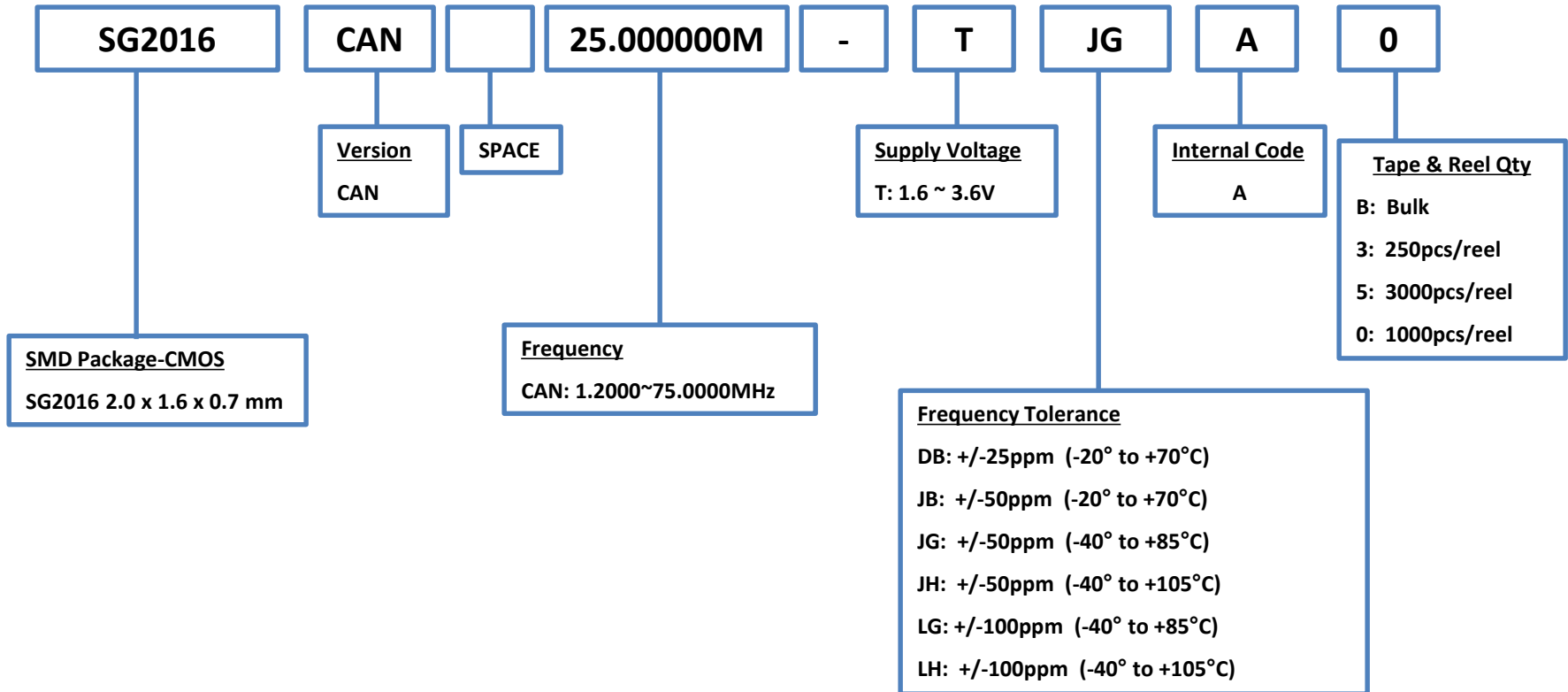


Replaces TCO-7116H1A



Product Configuration System

Crystal Oscillators - SPXO



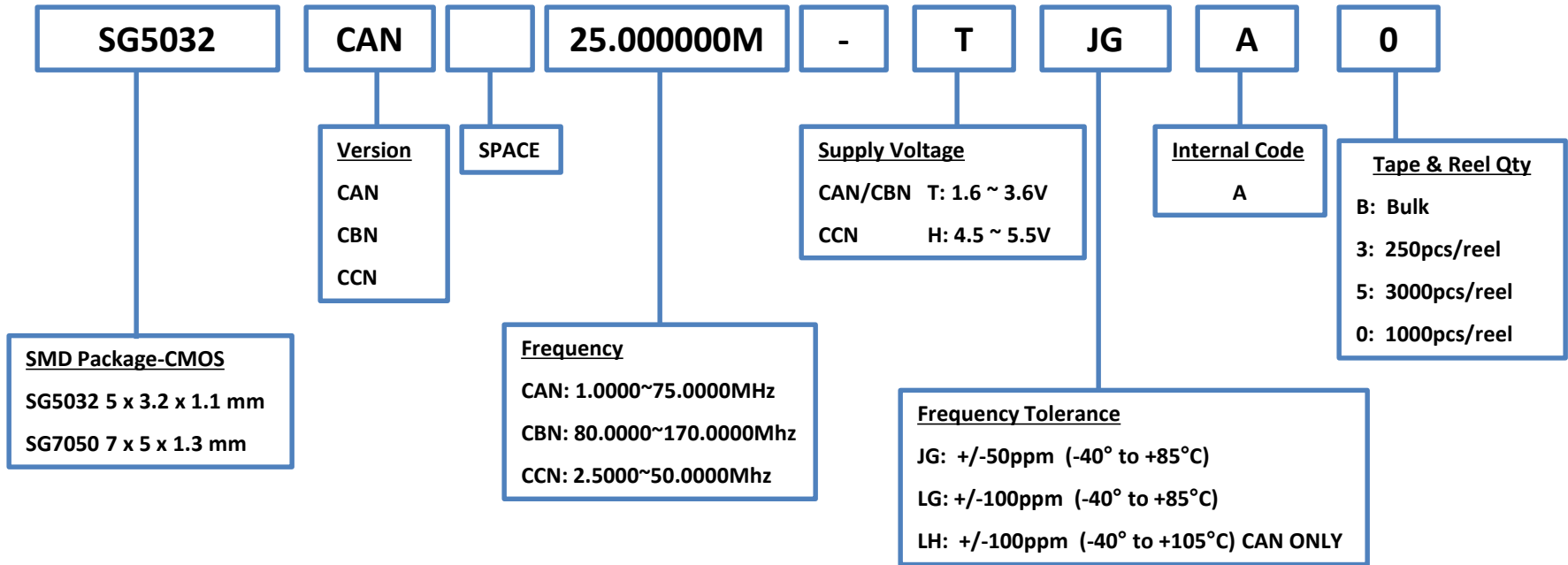
Example: SG2016CAN 25.0000M-TJGA
Please contact us about available frequencies





Product Configuration System

Crystal Oscillators - SPXO



Example: SG5032CAN 25.0000M-TJGA

JH is not available
Please contact us about available frequencies

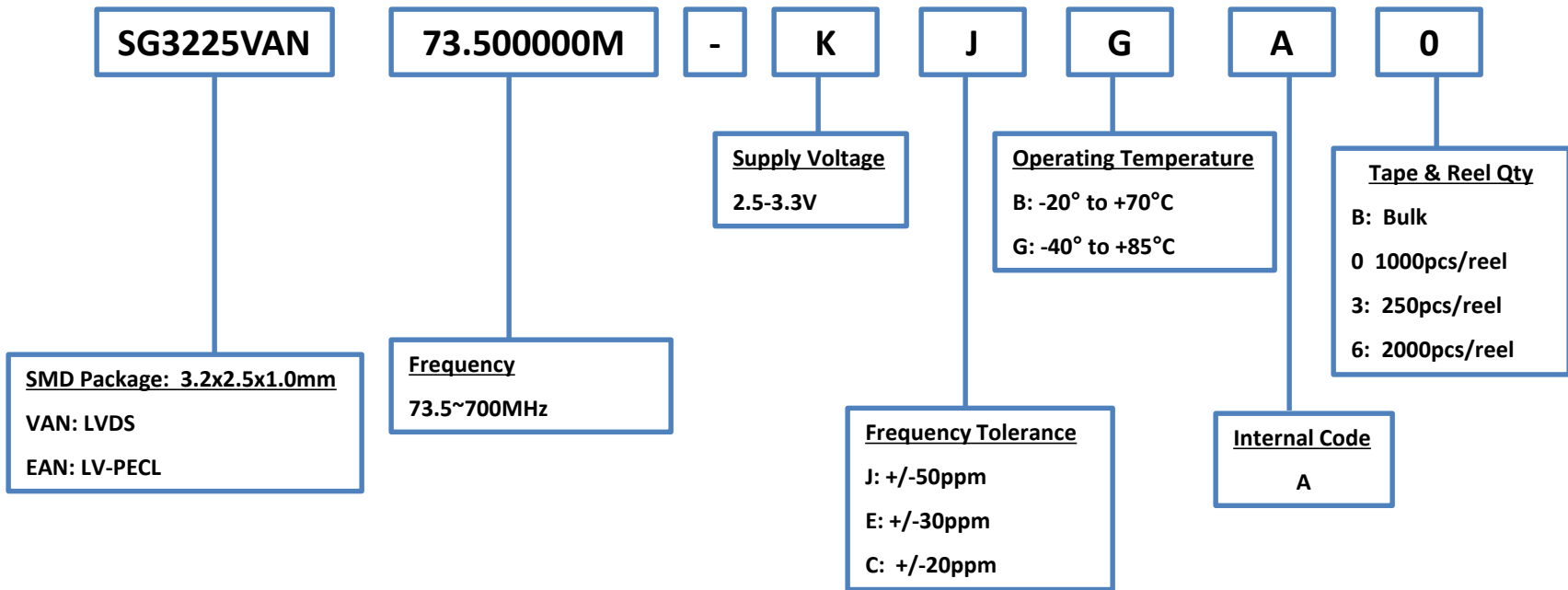




Product Configuration System

Crystal Oscillators – SPXO

Output : LV-PECL, LVDS



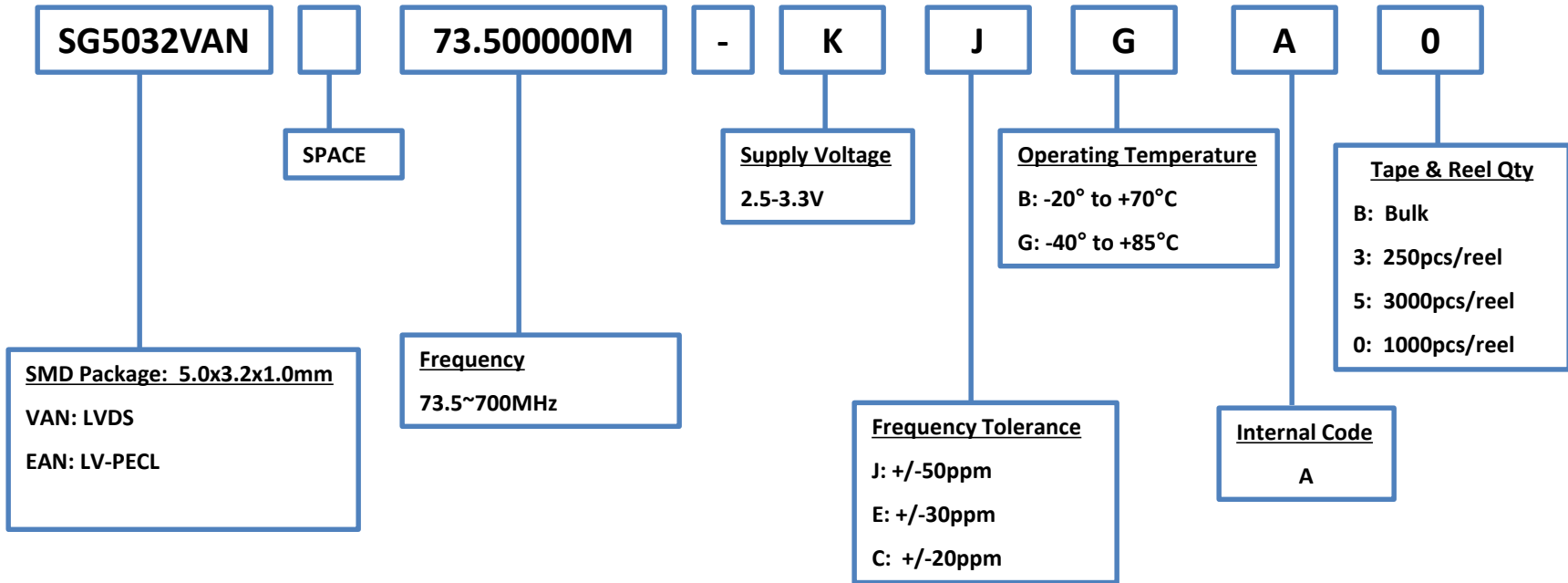
Example: SG3225VAN 73.500000M-KJGA
CG is not available



Product Configuration System

Crystal Oscillators – SPXO

Output : LV-PECL, LVDS

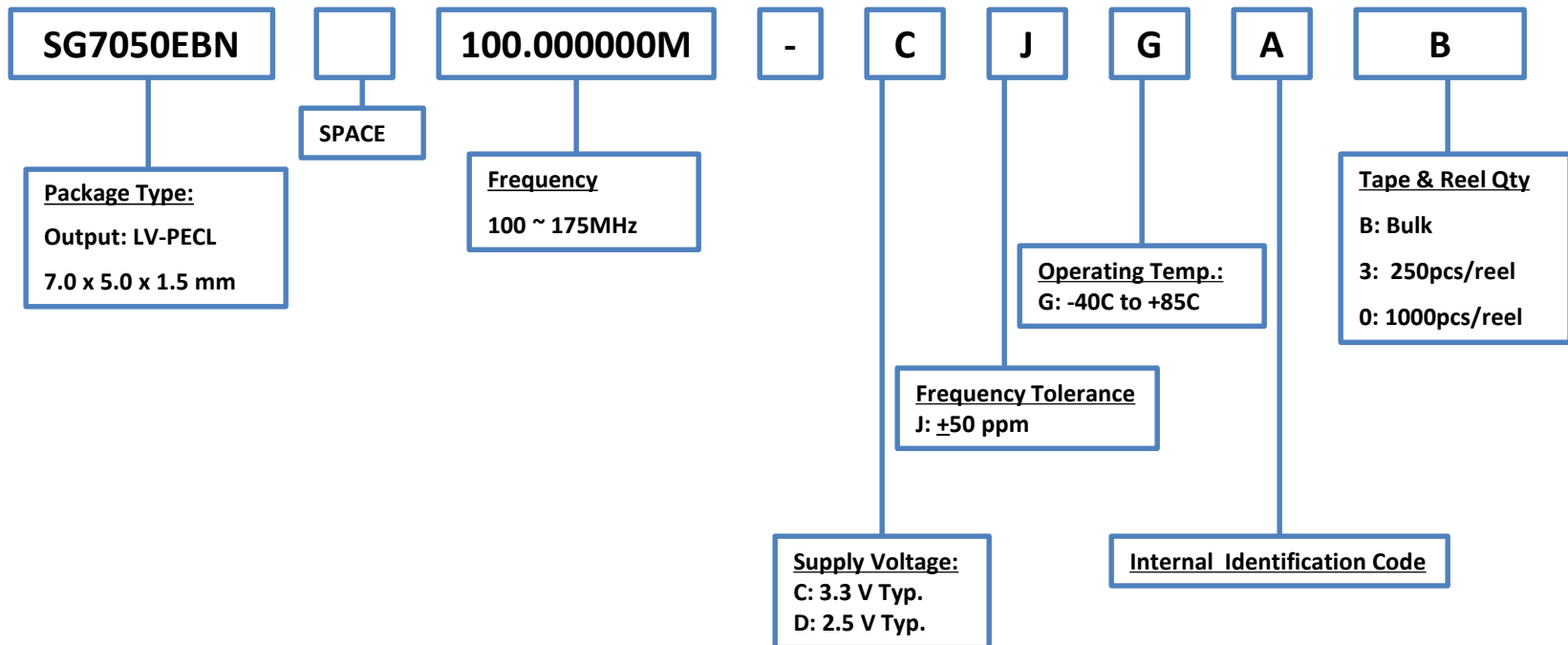


Example: SG5032VAN 73.500000M-KJGA
CG is not available

Product Configuration System



Crystal Oscillator - SPXO



NOTE:

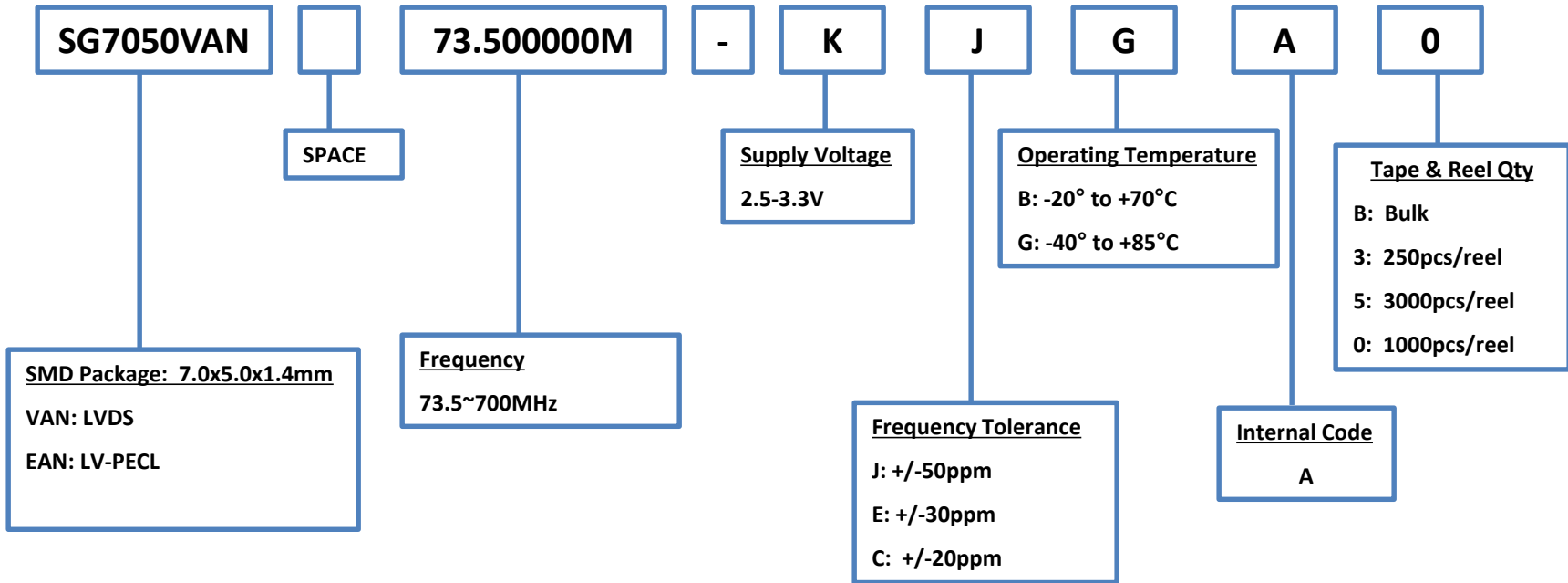
Please contact us for requirements not listed in this specification.



Product Configuration System

Crystal Oscillators – SPXO

Output : LV-PECL, LVDS

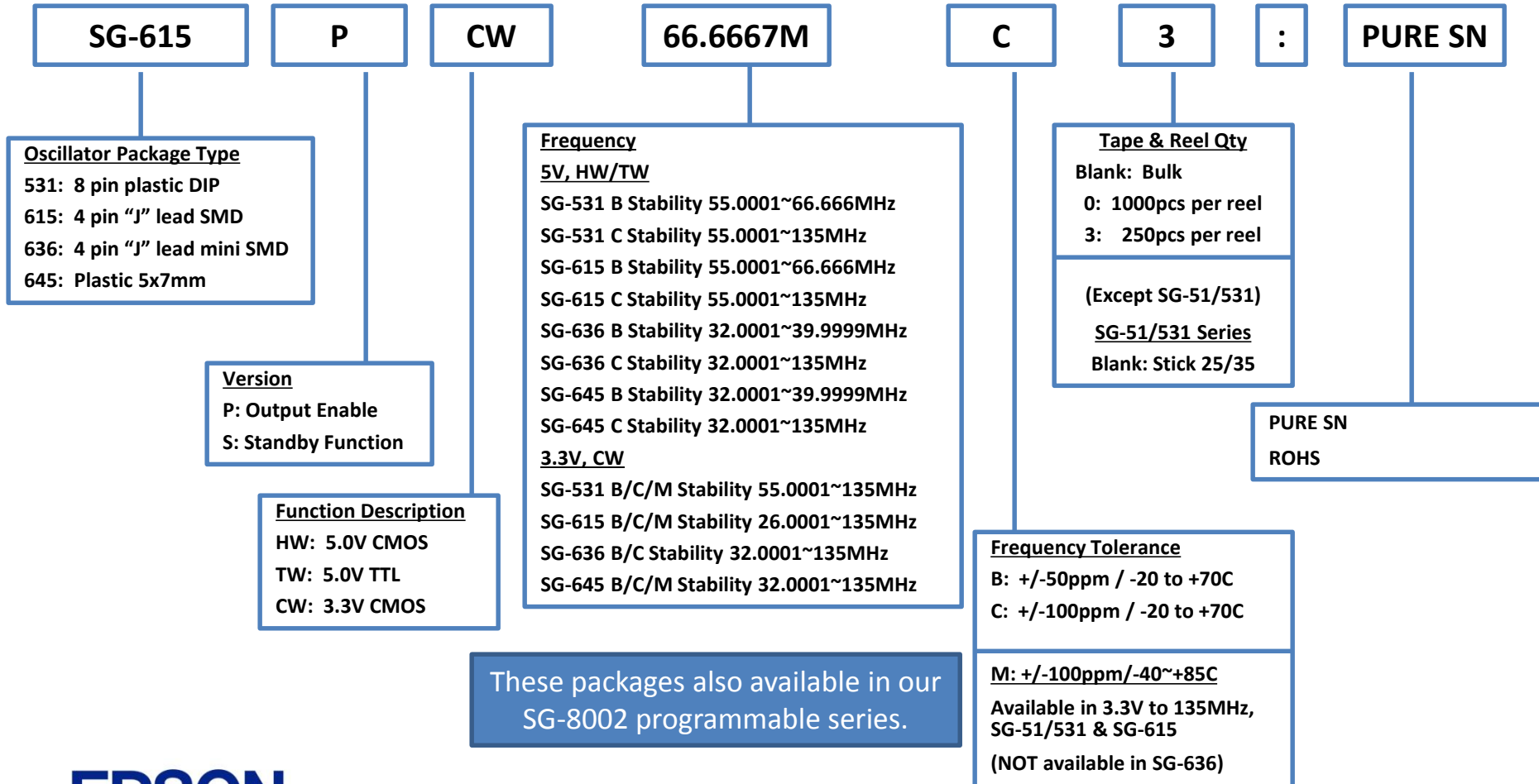


Example: SG7050VAN 73.500000M-KJGA
CG is not available

Product Configuration System



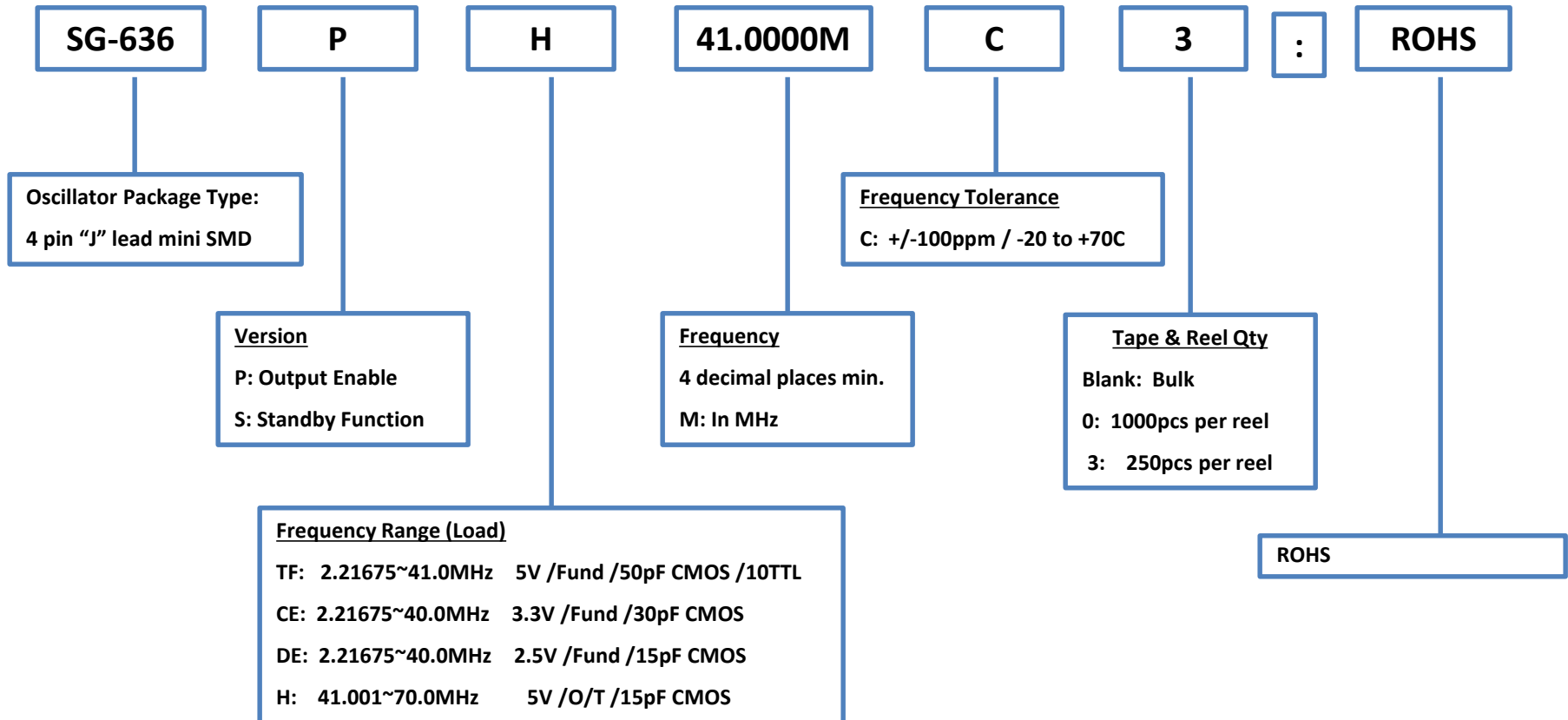
Crystal Oscillators - SPXO



Product Configuration System



Crystal Oscillators - SPXO

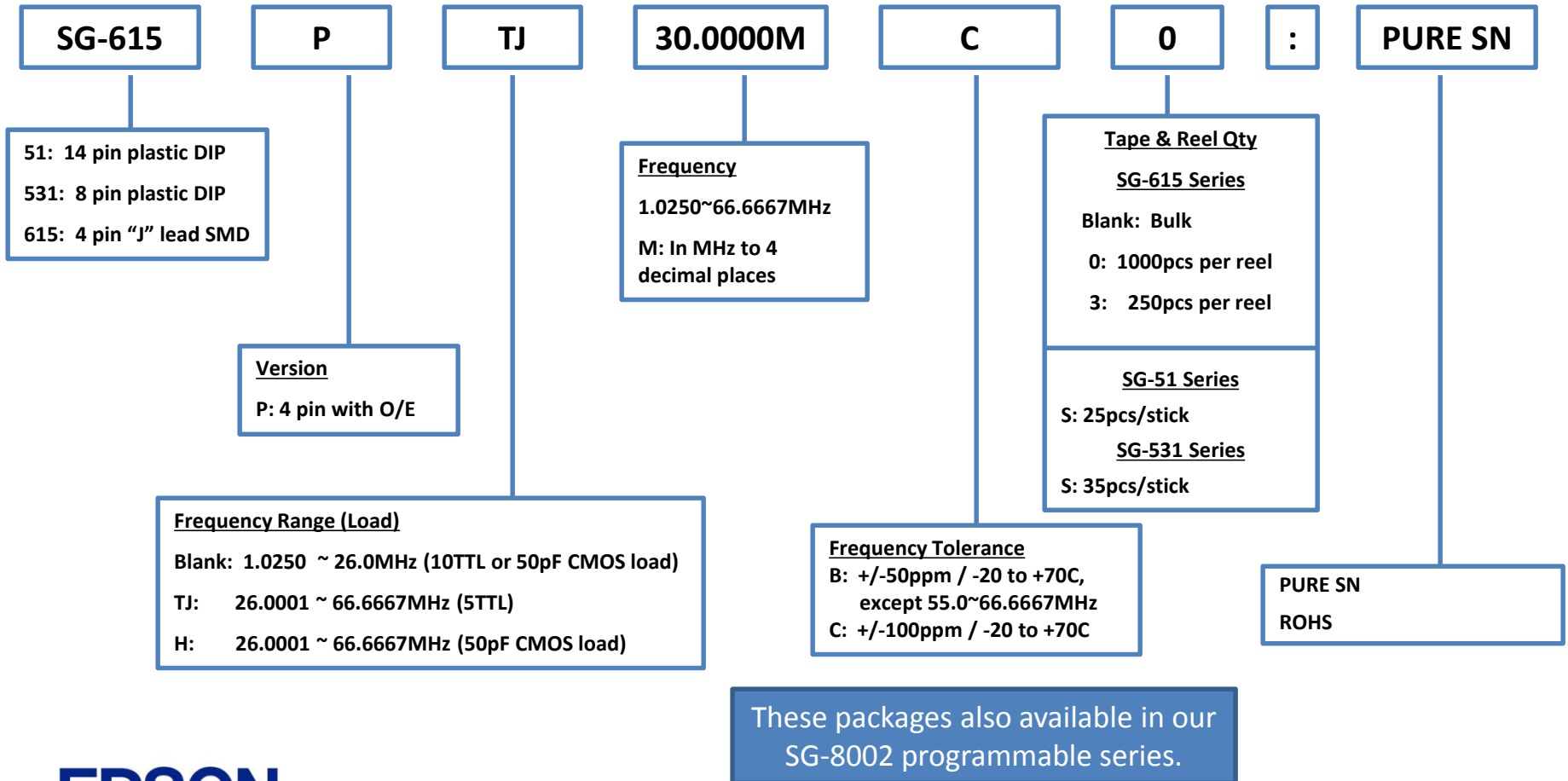


These packages also available in our SG-8002 programmable series.

Product Configuration System



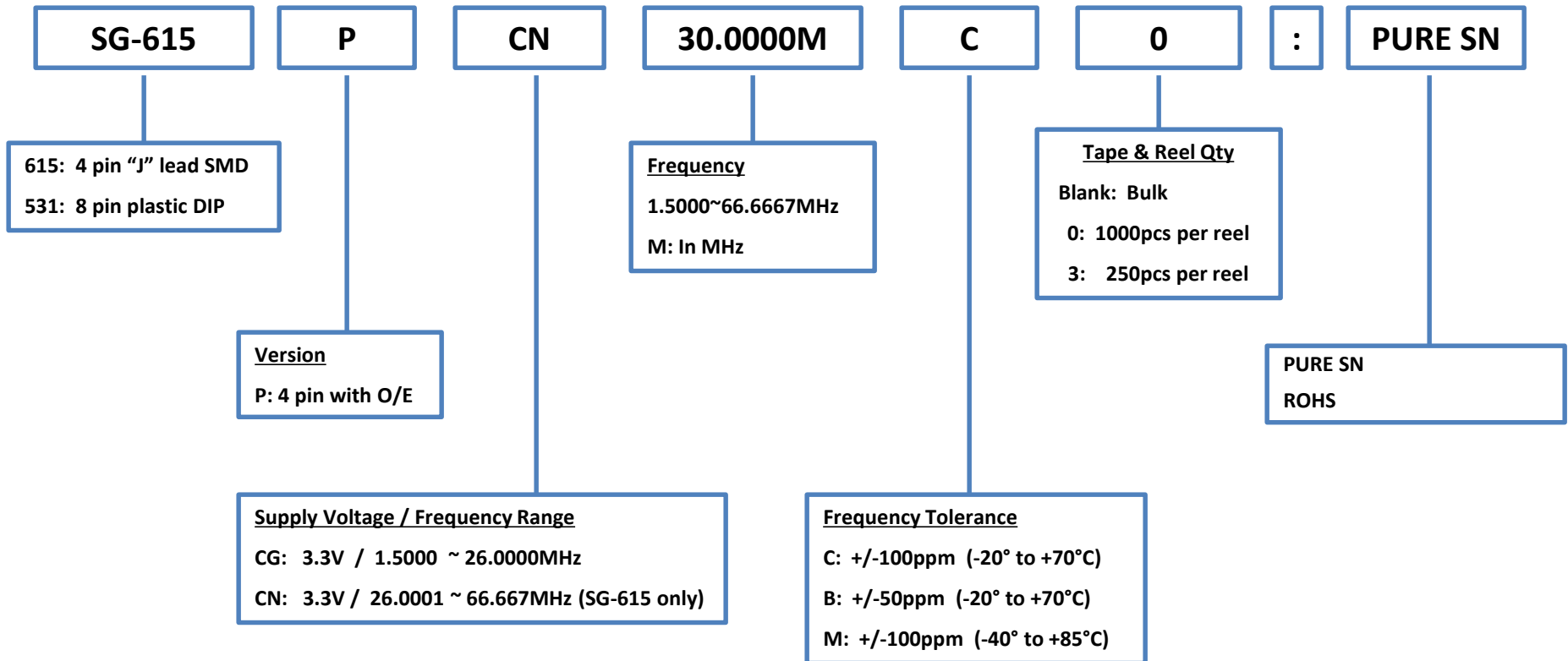
Crystal Oscillators - SPXO



Product Configuration System



Crystal Oscillators - SPXO

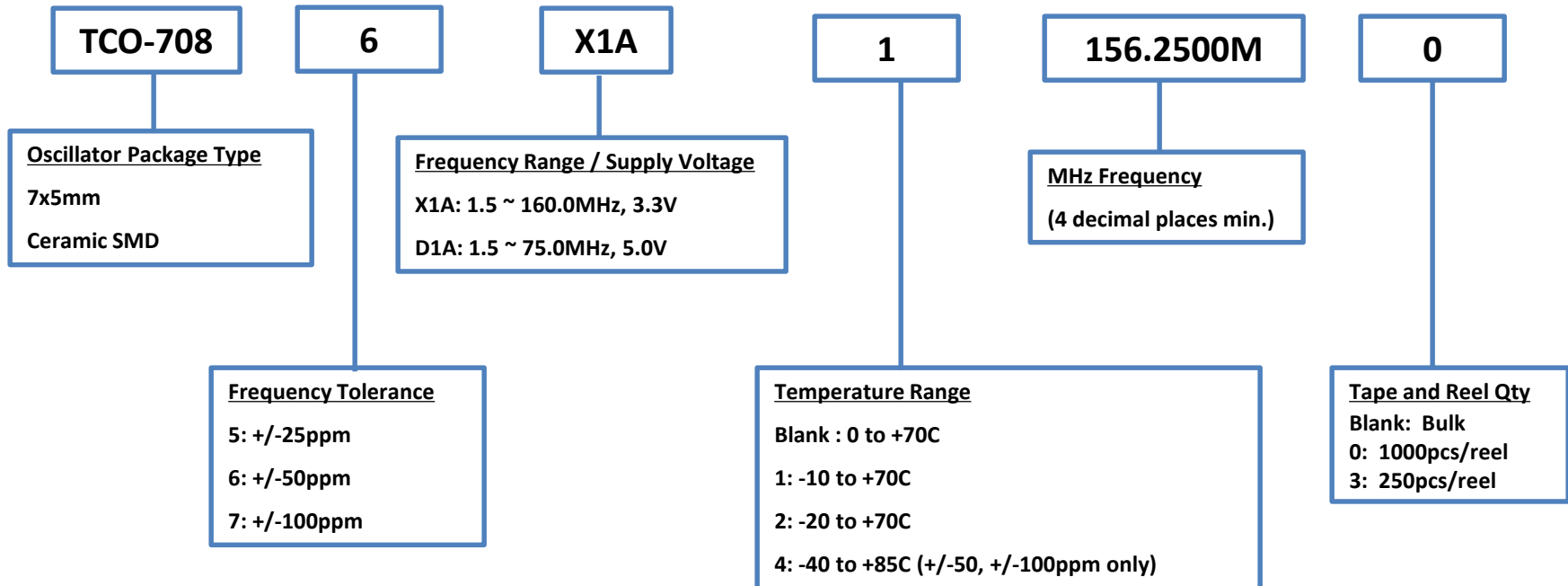


These packages also available in our SG-8002 programmable series.

Product Configuration System



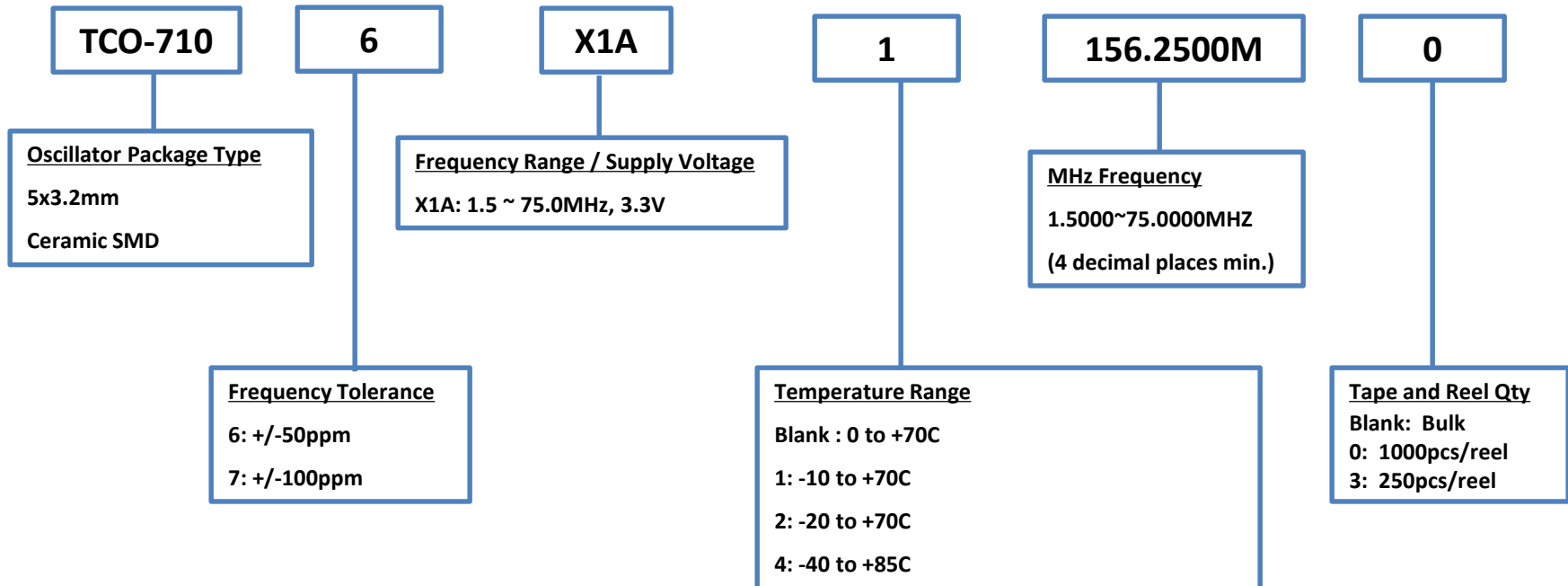
Crystal Oscillators - SPXO



Product Configuration System



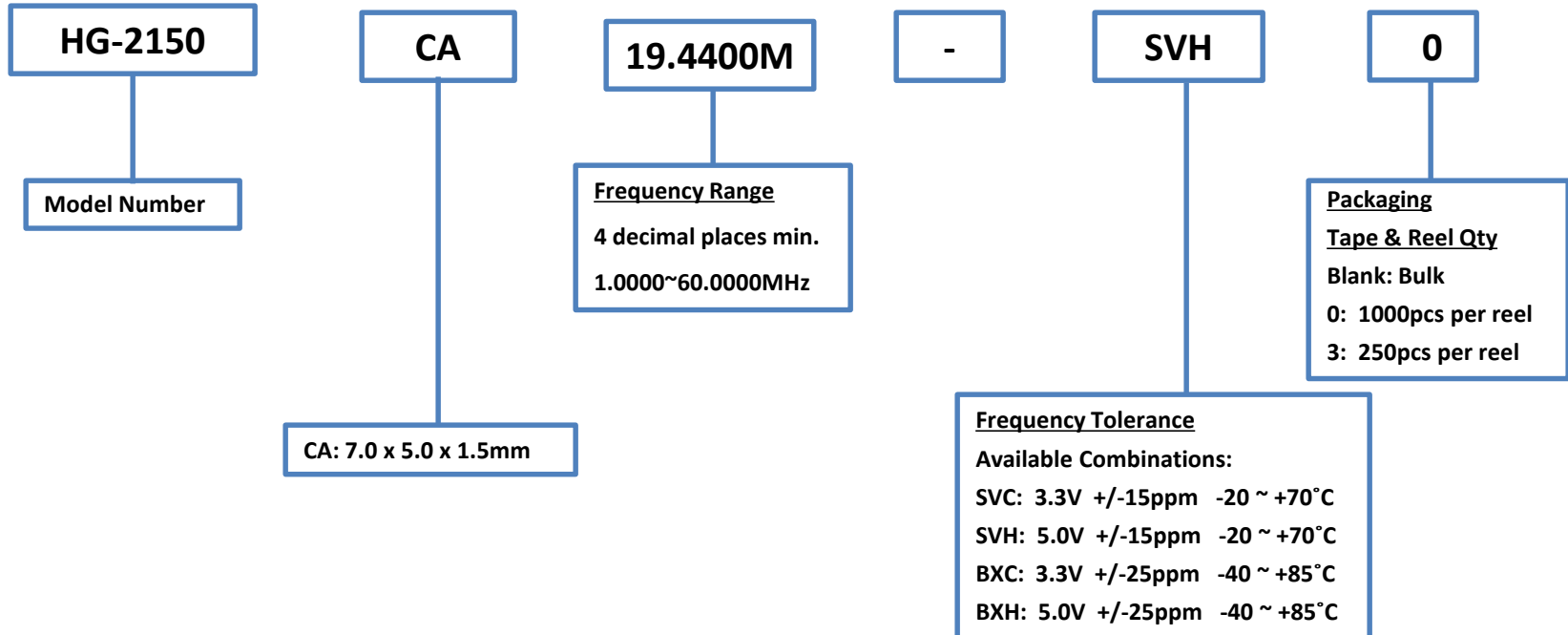
Crystal Oscillators - SPXO



Product Configuration System

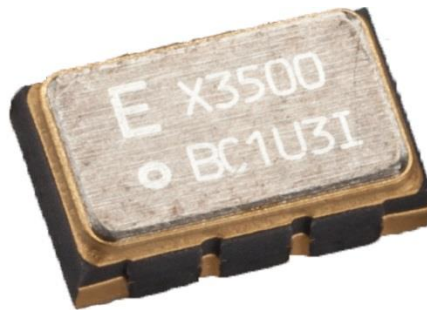


Crystal Oscillators - High Stability



Product Configuration Guide

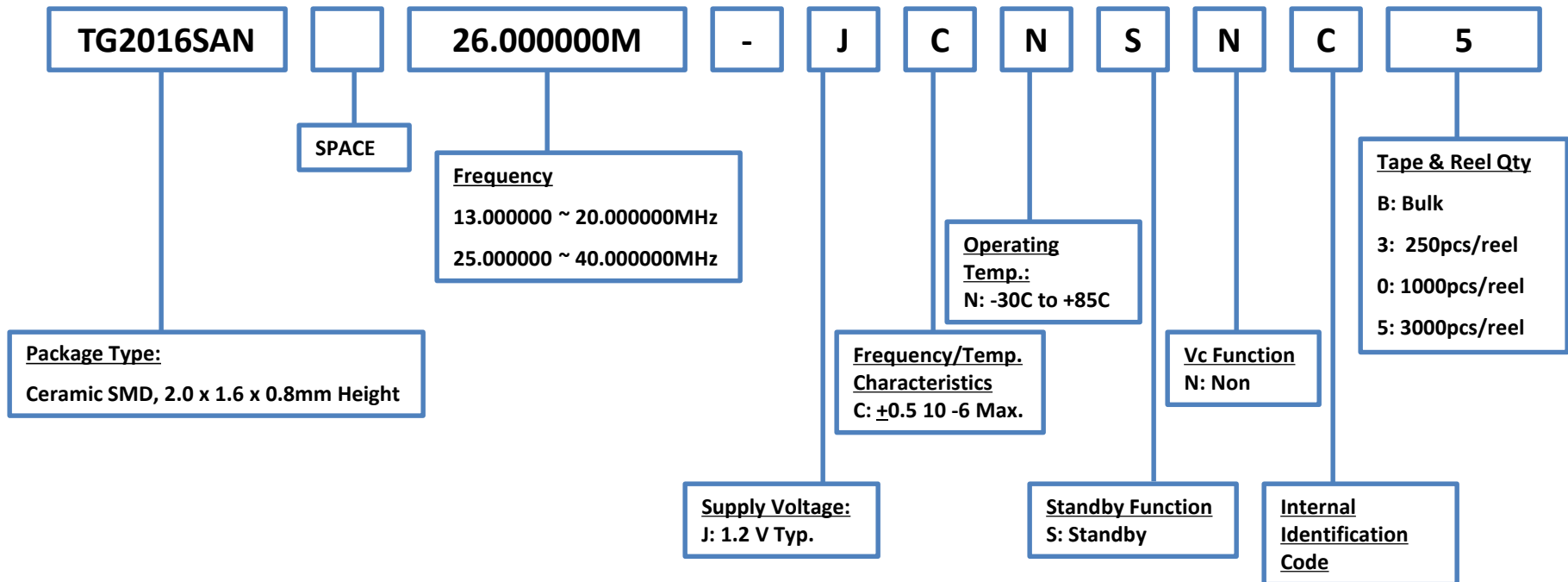
TCXO



Product Configuration System



TCXO



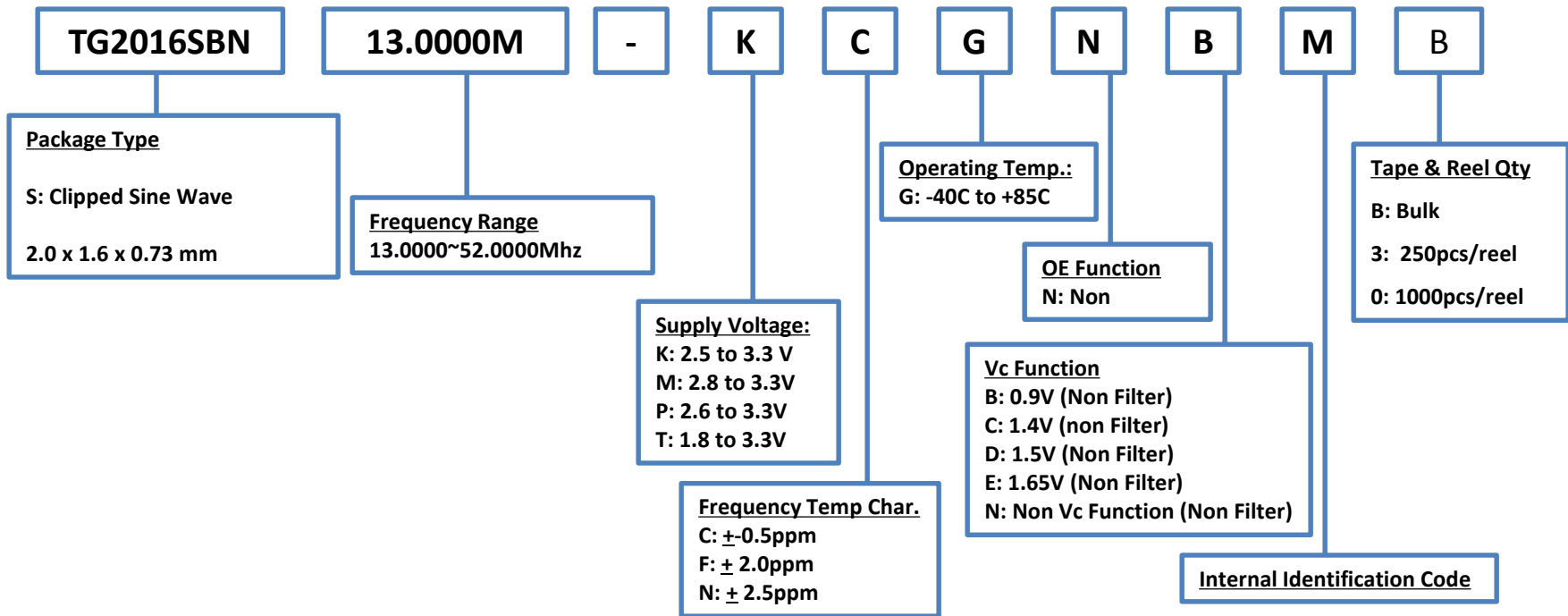
NOTE:

Please contact us for requirements not listed in this specification.

Product Configuration System



TCXO/VC-TCXO High Stability



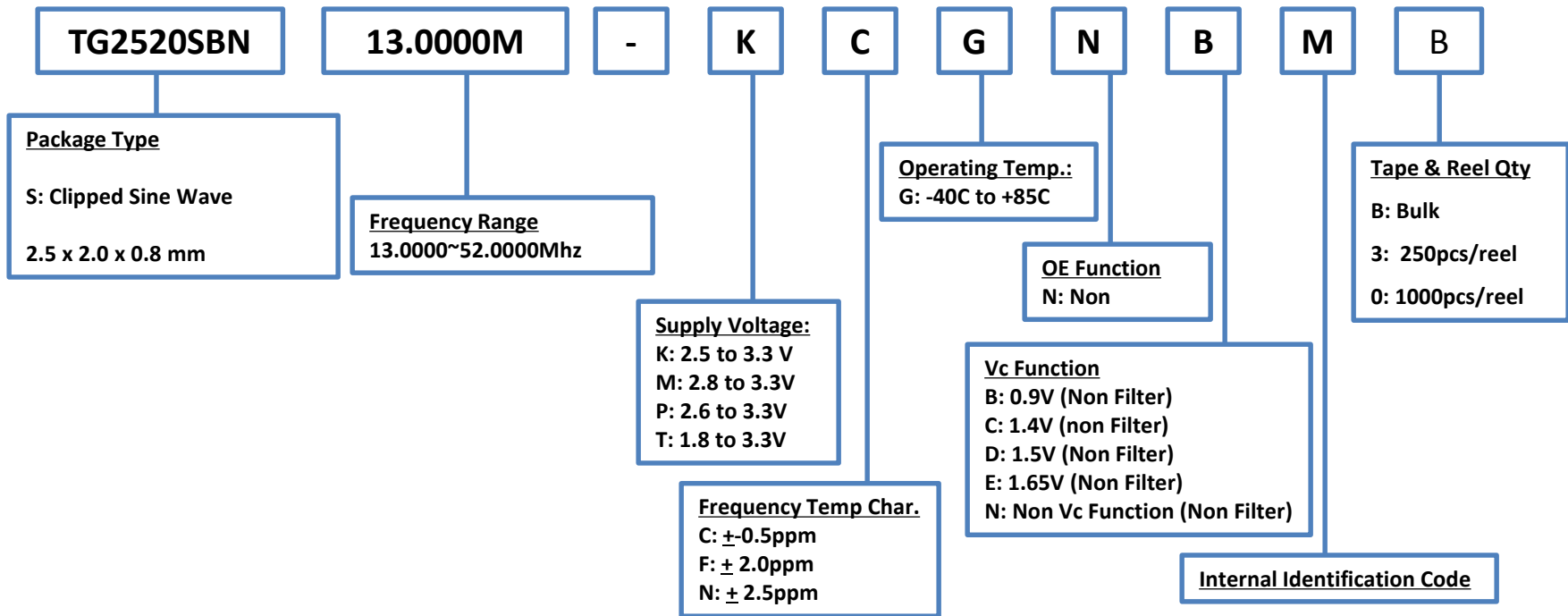
NOTE:

Please contact us for requirements not listed in this specification.

Product Configuration System



TCXO/VC-TCXO High Stability

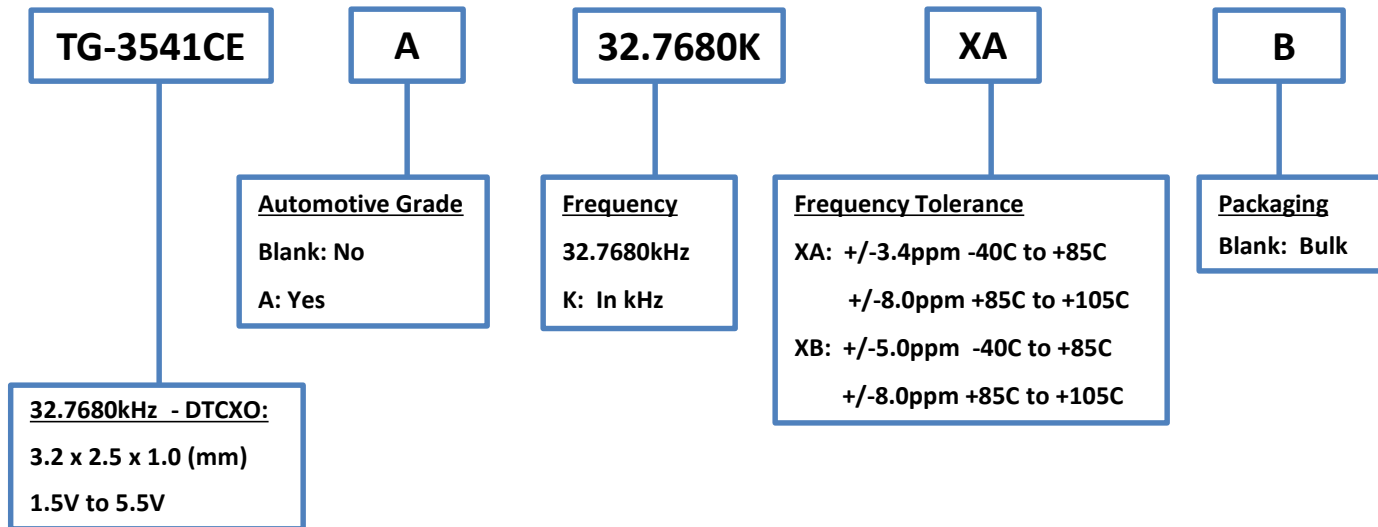


NOTE:
Please contact us for requirements not listed in this specification.



Product Configuration System

32.7680kHz TCXO



NOTES:

1) If you require a frequency or tolerance other than the above listed, please contact your EEA representative for assistance.

Product Configuration System



TCXO

TG-5006CJ

-

xxx

19.2000MHz

Package Type:

TG-5006CJ - 2.0 X 1.6 X 0.8 mm
TG-5006CG - 2.5 X 2.0 X 0.9 mm
TG-5006CE - 3.2 X 2.5 X 1.0 mm

TG-5035CJ - 2.0 X 1.6 X 0.8 mm
TG-5035CG - 2.5 X 2.0 X 0.9 mm
TG-5035CE - 3.2 X 2.5 X 1.0 mm

TG-5031CJ - 2.0 X 1.6 X 0.8 mm
TG-5021CG - 2.5 X 2.0 X 0.9 mm
TG-5021CE - 3.2 X 2.5 X 1.0 mm

Specification Code:

Issued by Epson after reviewing customer requirements

Frequency

TG-5006CJ/CG/CE: 13 ~ 52MHz
STD Freqs: 16.367667, 16.368, 16.369, 19.2, 26, 38.4MHz

TG-5035CE: 10 ~ 40 MHz
TG-5035CJ/CG/: 13 ~ 52MHz
STD Freqs: 13, 16.368, 16.369, 19.2, 26, 38.4MHz

TG-5031CJ/TG-5021CG: 13 ~ 52MHz
TG-5021CE: 10 ~ 40MHz
STD Freqs: 13, 19.2, 26, 38.4MHz

EPSON

June 2018

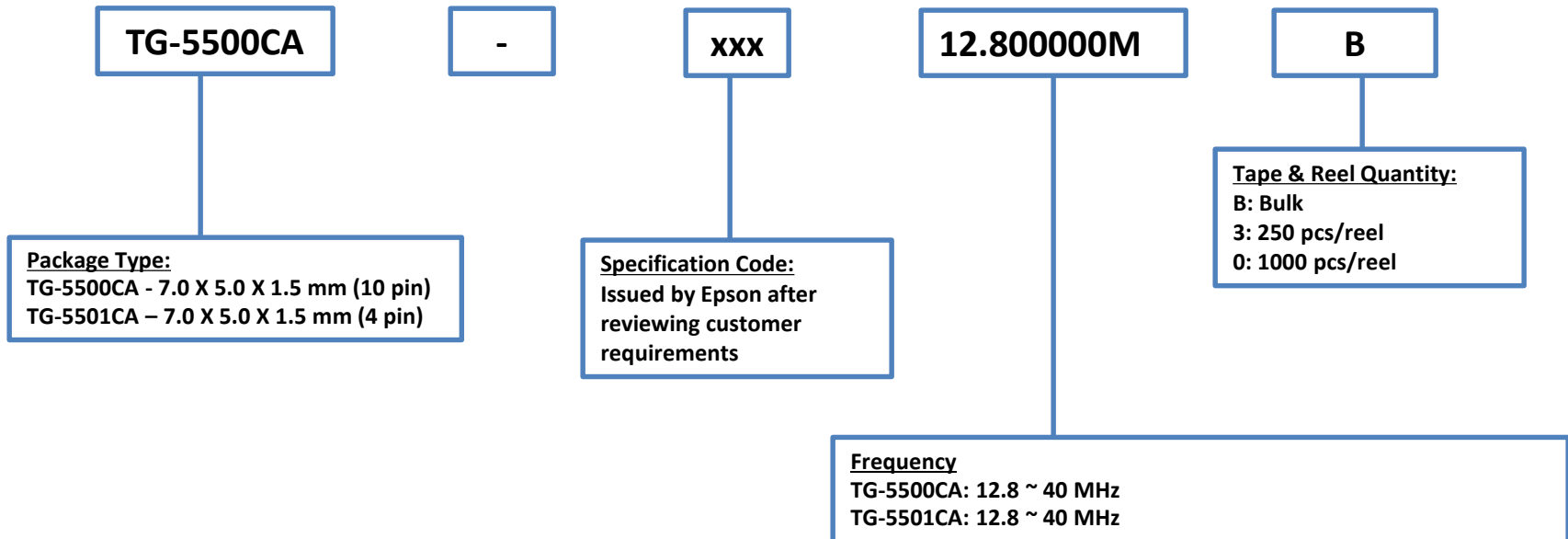
NOTE:

Please contact us for requirements not listed in this specification.

Product Configuration System



TCXO/VC-TCXO Ultra High Stability



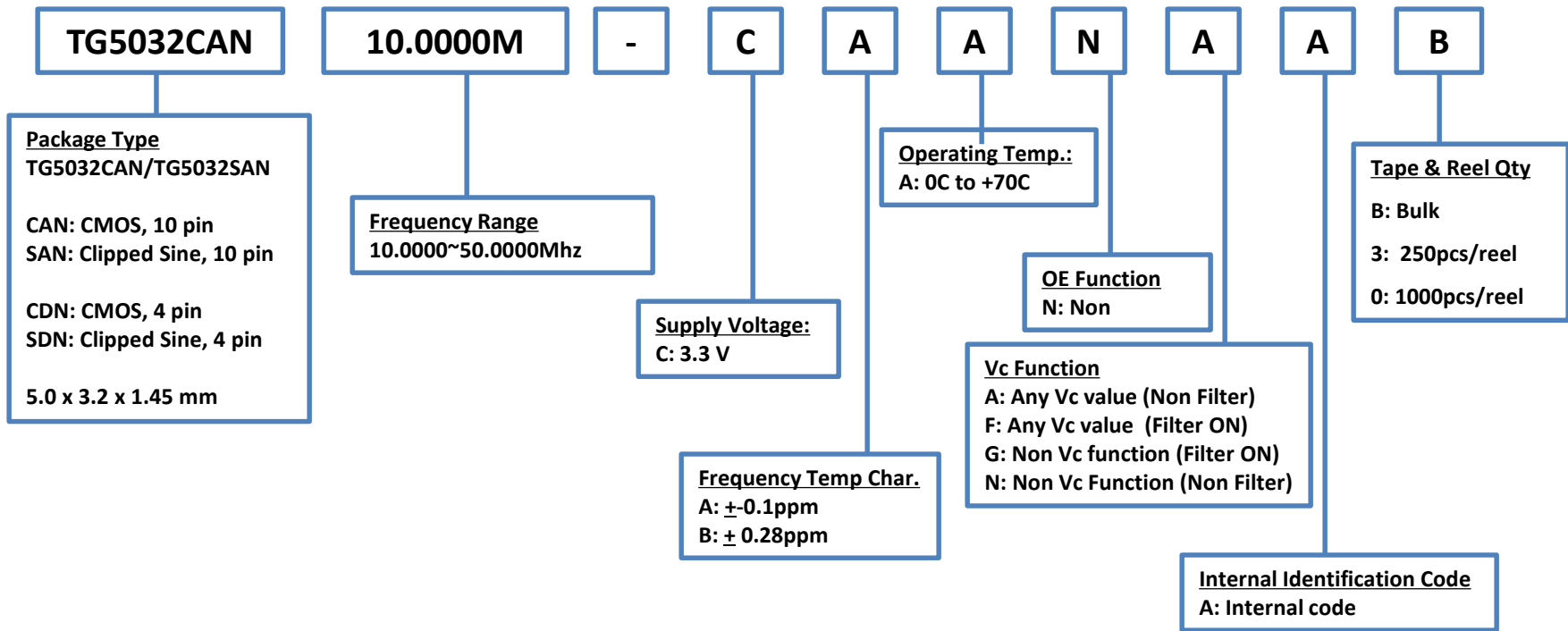
NOTE:

Please contact us for requirements not listed in this specification.

Product Configuration System



TCXO/VC-TCXO Ultra High Stability



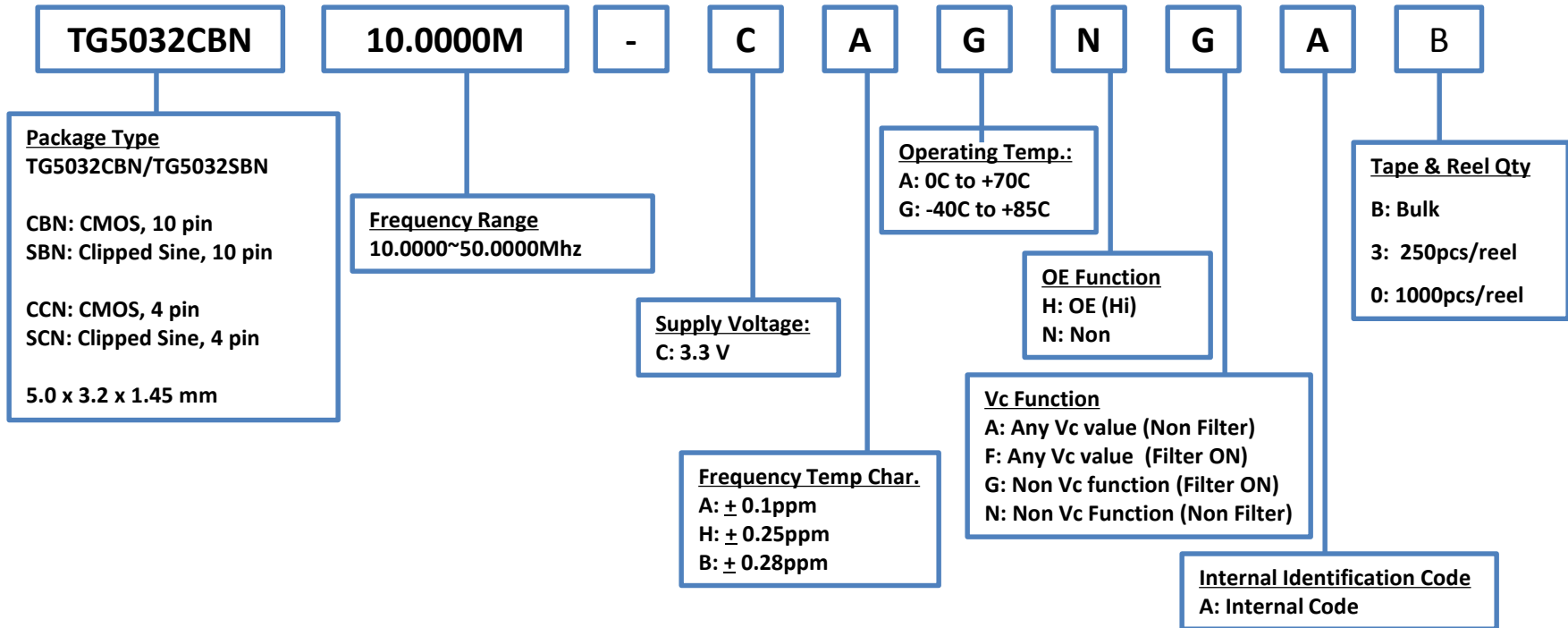
NOTE:

Please contact us for requirements not listed in this specification. 69

Product Configuration System



TCXO/VC-TCXO Ultra High Stability

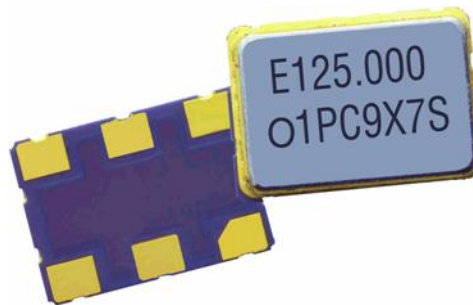


NOTE:

Please contact us for requirements not listed in this specification. 70

Product Configuration Guide

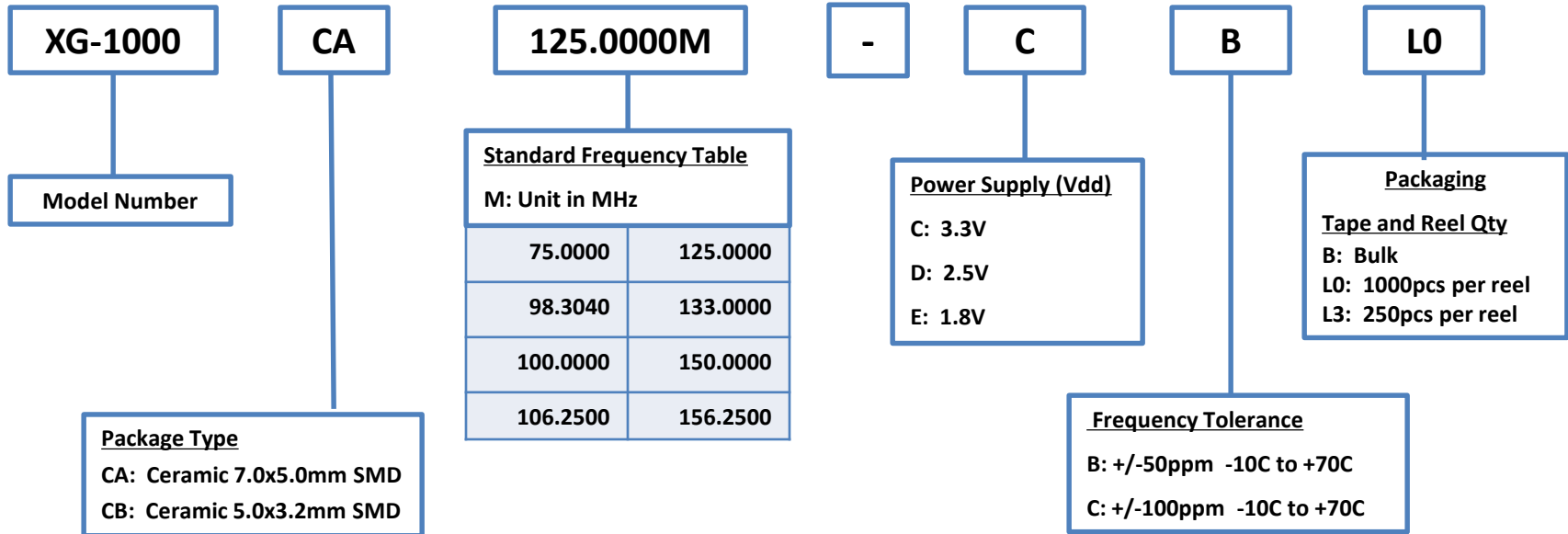
SAW OSCILLATORS



Product Configuration System



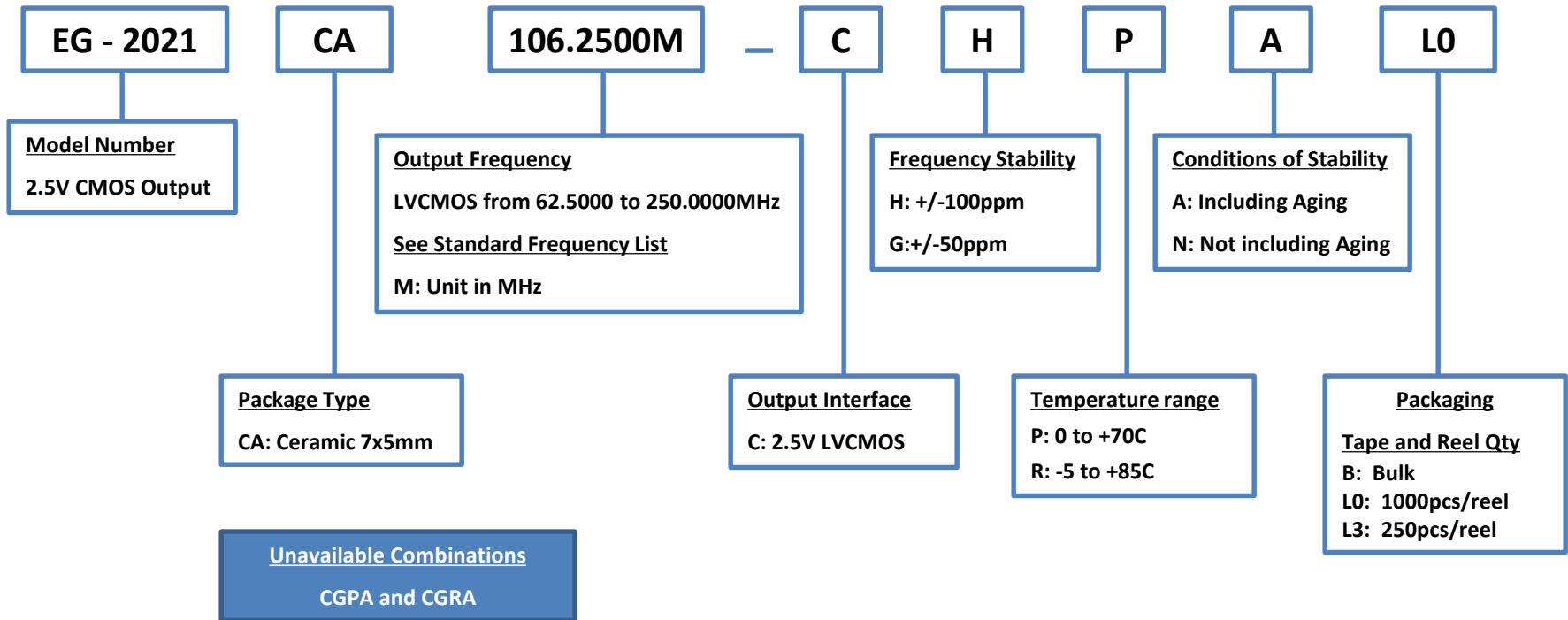
Crystal Oscillators – Low Jitter (SAW)





Product Configuration System

Crystal Oscillators – Low Jitter (SAW)



Standard Frequencies

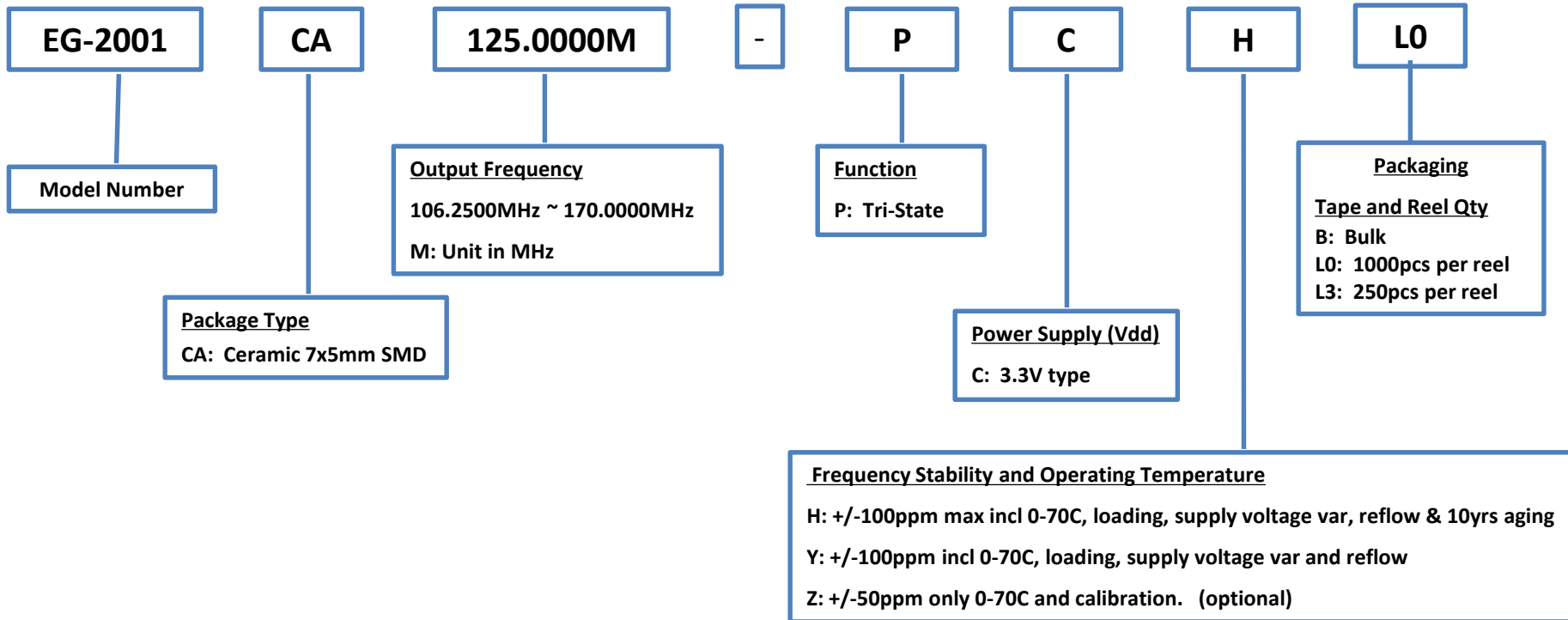
EG-2021CA (2.5V CMOS)

62.5000	125.0000
66.5000	133.0000
75.0000	150.0000
78.1250	156.2500
90.0000	250.0000
98.3040	
100.0000	
106.2500	
108.0000	
124.4160	

Product Configuration System



Crystal Oscillators – Low Jitter (SAW)



Standard Frequencies

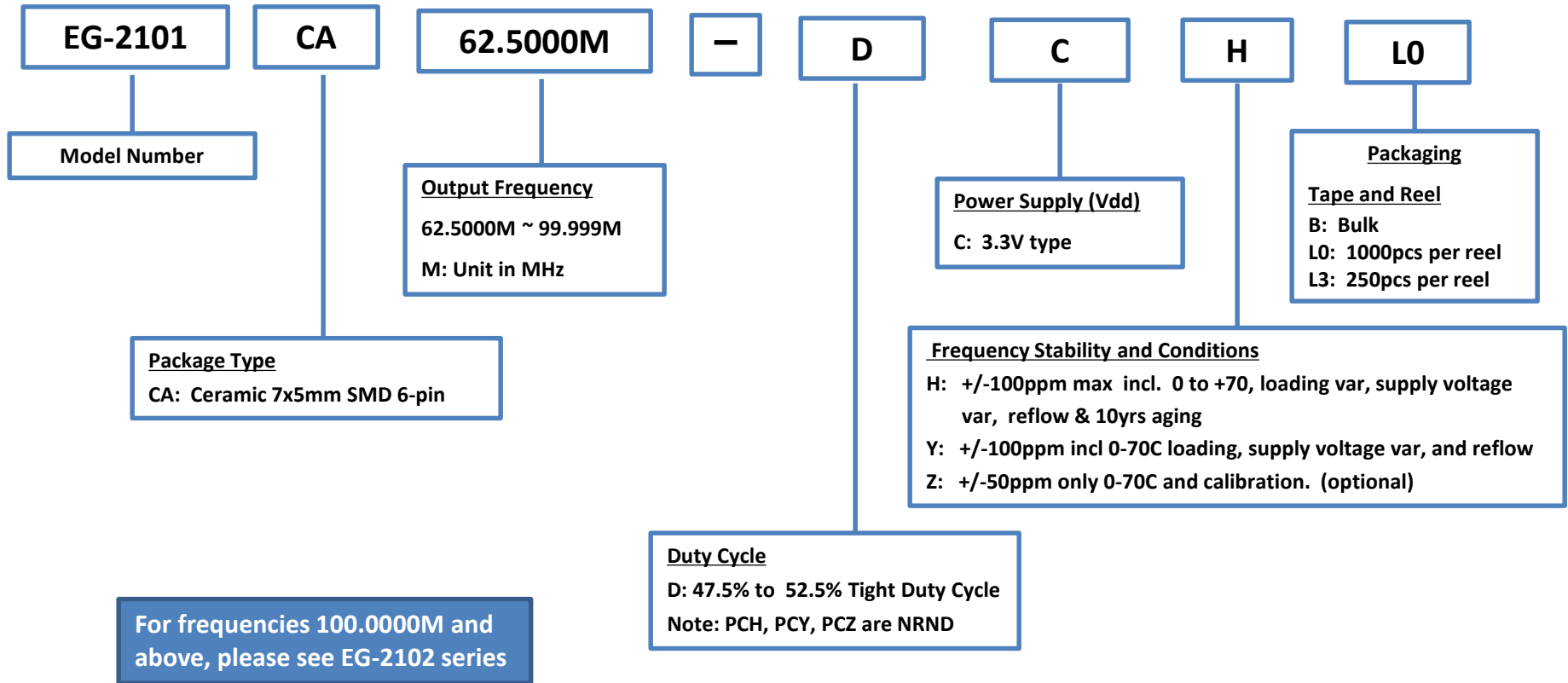
EG-2001 (3.3V CMOS)

106.2500	155.5200
108.0000	156.2500
125.0000	159.3750
128.0000	160.0000
132.8125	161.1328
133.0000	166.0000
133.3333	166.6285
135.0000	166.6667
143.0000	167.3316
150.0000	

Product Configuration System



Crystal Oscillators – Low Jitter (SAW)



Standard Frequencies

EG-2101

EG-2101CA DCx	
62.5000	79.6875
64.0000	80.0000
66.4063	80.5664
66.5000	83.0000
66.6667	83.3143
67.5000	83.3333
71.5000	83.6658
75.0000	87.5000
77.7600	90.0000
78.1250	

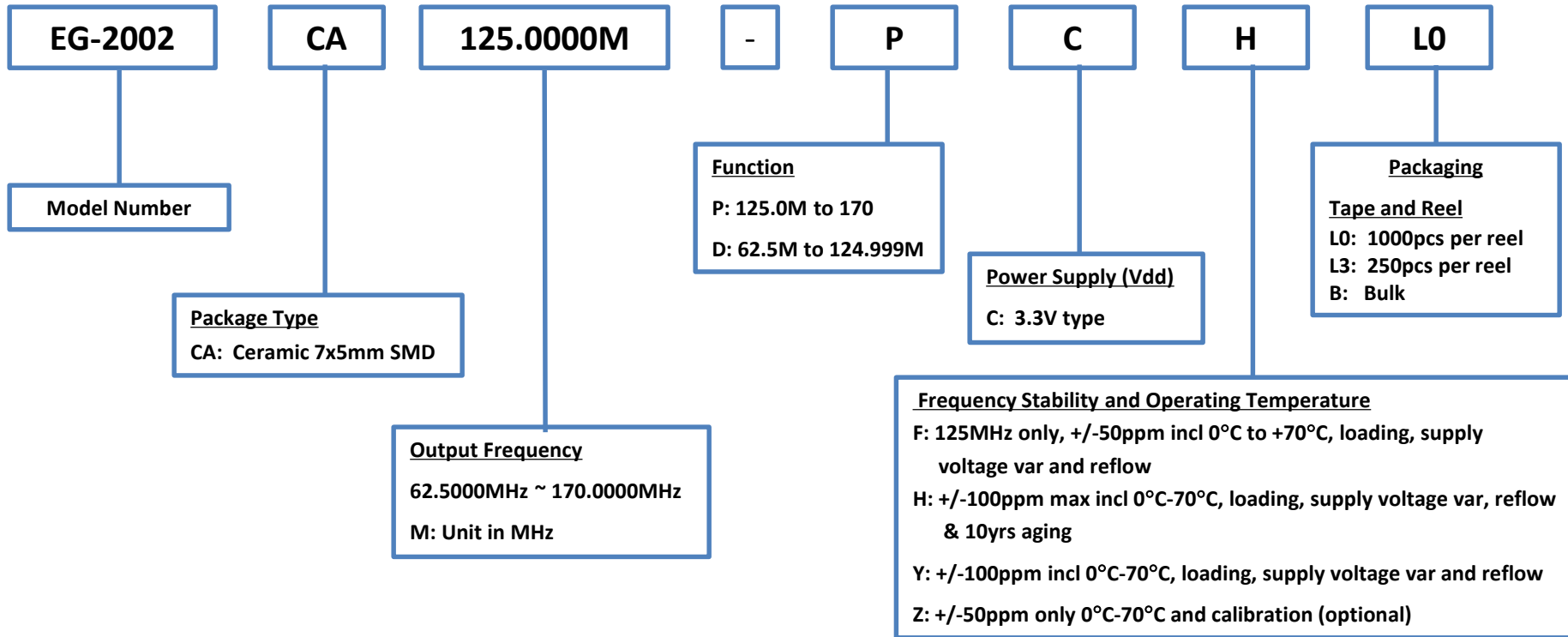
For frequencies 100.0000M and above, please see EG-2102 series



Product Configuration System



Crystal Oscillators – Low Jitter (SAW)



Standard Frequencies

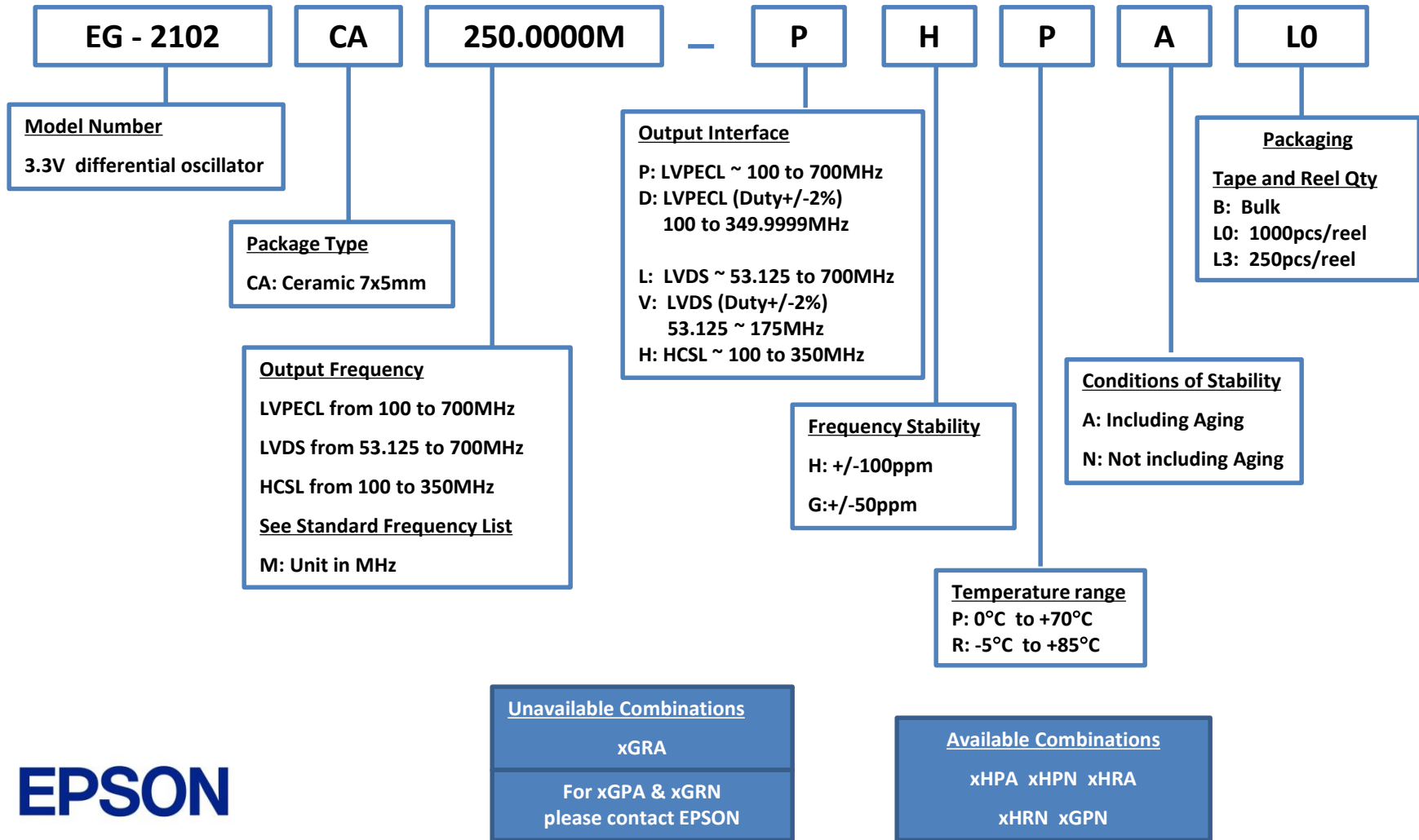
EG-2002 (LVTTL)

EG-2002CA DCx		EG-2002CA PCx	
62.5000	80.5664	125.0000	161.1328
64.0000	83.0000	128.0000	166.0000
66.4063	83.3143	132.8125	166.6286
66.5000	83.3333	133.0000	166.6667
66.6667	83.6658	133.3333	167.3316
67.5000	87.5000	135.0000	
71.5000	90.0000	143.0000	
75.0000	100.0000	150.0000	
77.7600	106.2500	155.5200	
78.1250		156.2500	
79.6875		159.3750	
80.0000		160.0000	

Product Configuration System



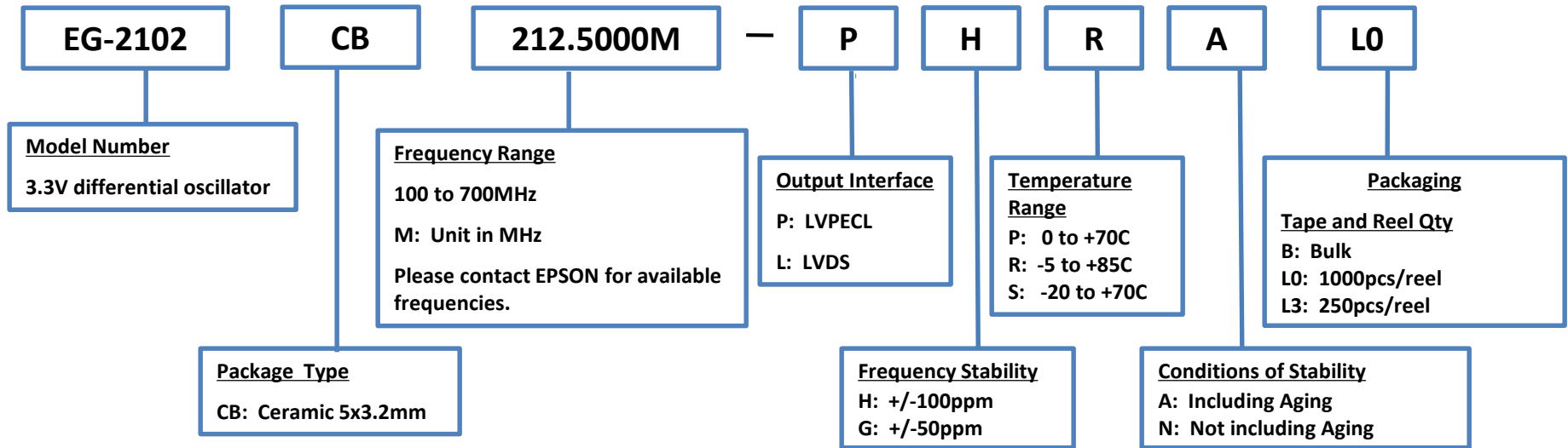
Crystal Oscillators – Low Jitter (SAW)



Product Configuration System



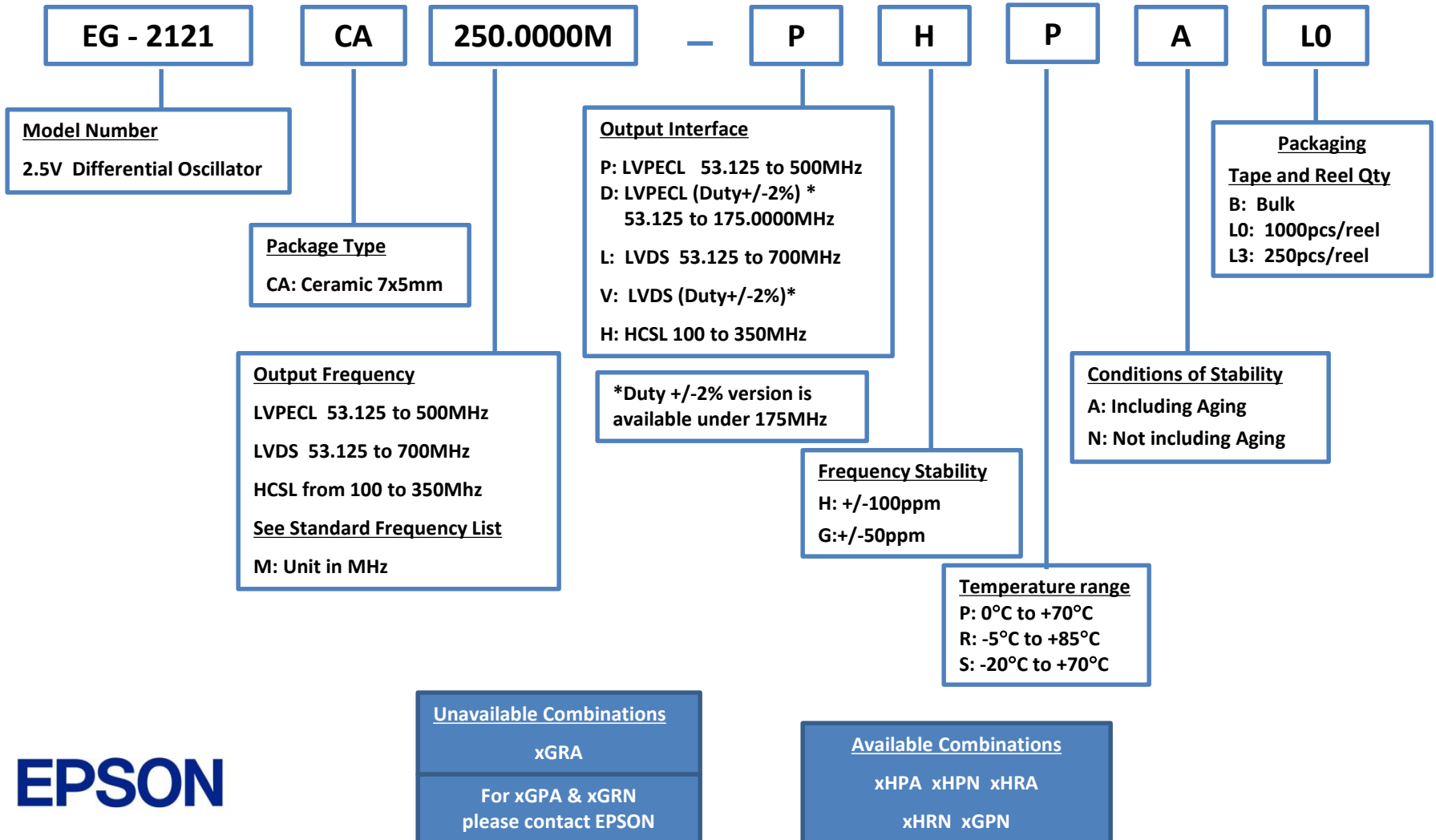
Crystal Oscillators – Low Jitter (SAW)



Product Configuration System



Crystal Oscillators – Low Jitter (SAW)



Standard Frequencies

EG-2121 P (LVPECL)

53.1250 *	97.6563	195.3125	390.6250
62.5000 *	98.3040	196.6080	393.2160
66.6667 *	100.0000	200.0000	400.0000
75.0000 *	106.2500	212.5000	425.0000
78.1250 *	124.4160	248.8320	497.6640
79.6875 *	125.0000	250.0000	500.0000
80.0000 *	132.8125	265.6250	
87.5000 *	133.0000	266.0000	
	148.3517	296.7033	
	150.0000	300.0000	
	150.8072	301.6144	
	155.5200	311.0400	
	156.2500	312.5000	
	159.3750	318.7500	
	161.1328	322.2657	
	164.3555	328.7110	
	166.6286	333.2572	
	167.3317	334.6633	
	173.3708	346.7415	
	175.0000	350.0000	
* Frequency only available for xHPA and xHPN			

Standard Frequencies

EG-2121 L (LVDS)

53.1250 *	97.6563	195.3125	390.6250
62.5000 *	98.3040	196.6080	393.2160
66.6667 *	100.0000	200.0000	400.0000
75.0000 *	106.2500	212.5000	425.0000
78.1250 *	124.4160	248.8320	497.6640
79.6875 *	125.0000	250.0000	500.0000
80.0000 *	132.8125	265.6250	531.2500
87.5000 *	133.0000	266.0000	532.0000
	148.3517	296.7033	593.4066
	150.0000	300.0000	600.0000
	150.8072	301.6144	603.2288
	156.2500	312.5000	625.0000
	159.3750	318.7500	637.5000
	161.1328	322.2656	644.5313
	164.3555	328.7109	657.4219
	166.6286	333.2571	666.5143
	167.3316	334.6633	669.3266
	173.3707	346.7415	693.4830
	175.0000	350.0000	700.0000
* Frequency only available for xHPA and xHPN			

Standard Frequencies

EG-2121 (HCSL)

-	195.3125
-	196.6080
100.0000	200.0000
106.2500	212.5000
124.4160	248.8320
125.0000	250.0000
132.8125	265.6250
133.0000	266.0000
148.3517	296.7033
150.0000	300.0000
150.8072	301.6144
155.5200	311.0400
156.2500	312.5000
159.3750	318.7500
161.1328	322.2656
164.3555	328.7109
166.6286	333.2571
167.3316	334.6633
173.3707	346.7415
175.0000	350.0000

Standard Frequencies

EG-2102P (LVPECL)

-	195.3125	390.6250
-	196.6080	393.2160
100.0000	200.0000	400.0000
106.2500	212.5000	425.0000
124.4160	248.8320	497.6640
125.0000	250.0000	500.0000
132.8125	265.6250	531.2500
133.0000	266.0000	532.0000
148.3517	296.7033	593.4066
150.0000	300.0000	600.0000
150.8072	301.6144	603.2288
155.5200	311.0400	622.0800
156.2500	312.5000	625.0000
159.3750	318.7500	637.5000
161.1328	322.2656	644.5313
164.3555	328.7109	657.4219
166.6286	333.2571	666.5143
167.3316	334.6633	669.3266
173.3707	346.7415	693.4830
175.0000	350.0000	700.0000

Standard Frequencies

EG-2102 L (LVDS)

53.1250 *	97.6563	195.3125	390.6250
62.5000 *	98.3040	196.6080	393.2160
66.6667 *	100.0000	200.0000	400.0000
75.0000 *	106.2500	212.5000	425.0000
78.1250 *	124.4160	248.8320	497.6640
79.6875 *	125.0000	250.0000	500.0000
80.0000 *	132.8125	265.6250	531.2500
87.5000 *	133.0000	266.0000	532.0000
	148.3517	296.7033	593.4066
	150.0000	300.0000	600.0000
	150.8072	301.6144	603.2288
	155.5200	311.0400	622.0800
	156.2500	312.5000	625.0000
	159.3750	318.7500	637.5000
	161.1328	322.2656	644.5313
	164.3555	328.7109	657.4219
	166.6286	333.2571	666.5143
	167.3316	334.6633	669.3266
	173.3707	346.7415	693.4830
	175.0000	350.0000	700.0000
* Frequency only available for xHPA and xHPN			

Standard Frequencies

EG-2102P (HCSL)

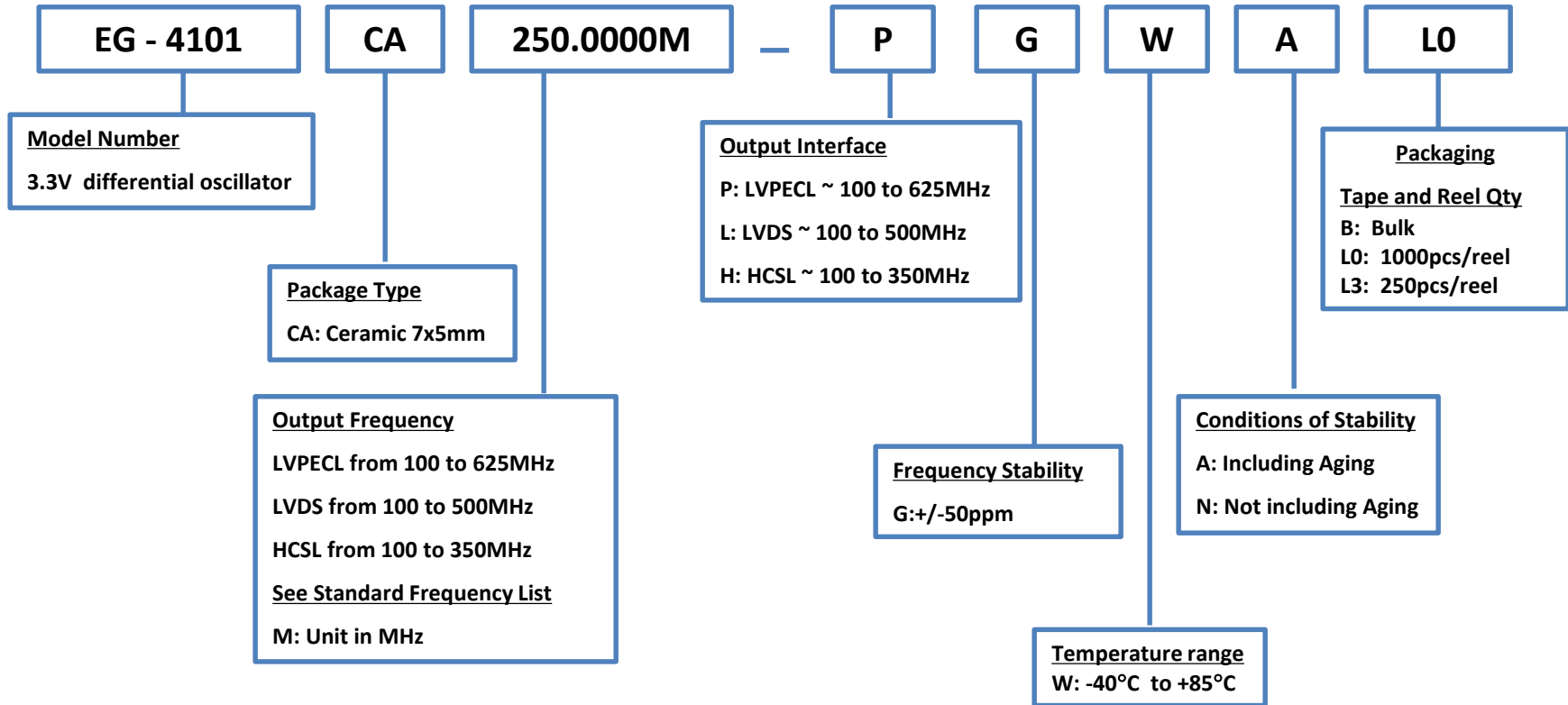
-	195.3125
-	196.6080
100.0000	200.0000
106.2500	212.5000
124.4160	248.8320
125.0000	250.0000
132.8125	265.6250
133.0000	266.0000
148.3517	296.7033
150.0000	300.0000
150.8072	301.6144
155.5200	311.0400
156.2500	312.5000
159.3750	318.7500
161.1328	322.2656
164.3555	328.7109
166.6286	333.2571
167.3316	334.6633
173.3707	346.7415
175.0000	350.0000



Product Configuration System



Crystal Oscillators – Low Jitter (SAW)



Standard Frequencies

EG-4101 (LVPECL)

100.0000	400.0000	
106.2500	425.0000	
121.1090	484.4360	
133.0000	532.0000	
140.0000	560.0000	
140.6665	562.6660	
156.2500	625.0000	
161.1320		
168.0407		
170.0000		
200.0000		
212.5000		
242.2180		
266.0000		
280.0000		
281.3330		
312.5000		
322.2640		
336.0814		
340.0000		



Standard Frequencies

EG-4101 (LVDS)

100.0000	400.0000	
106.2500	425.0000	
121.1090	484.4360	
133.0000		
140.0000		
140.6665		
156.2500		
161.1320		
168.0407		
170.0000		
200.0000		
212.5000		
242.2180		
266.0000		
280.0000		
281.3330		
312.5000		
322.2640		
336.0814		
340.0000		



Standard Frequencies

EG-4101 (HC SL)

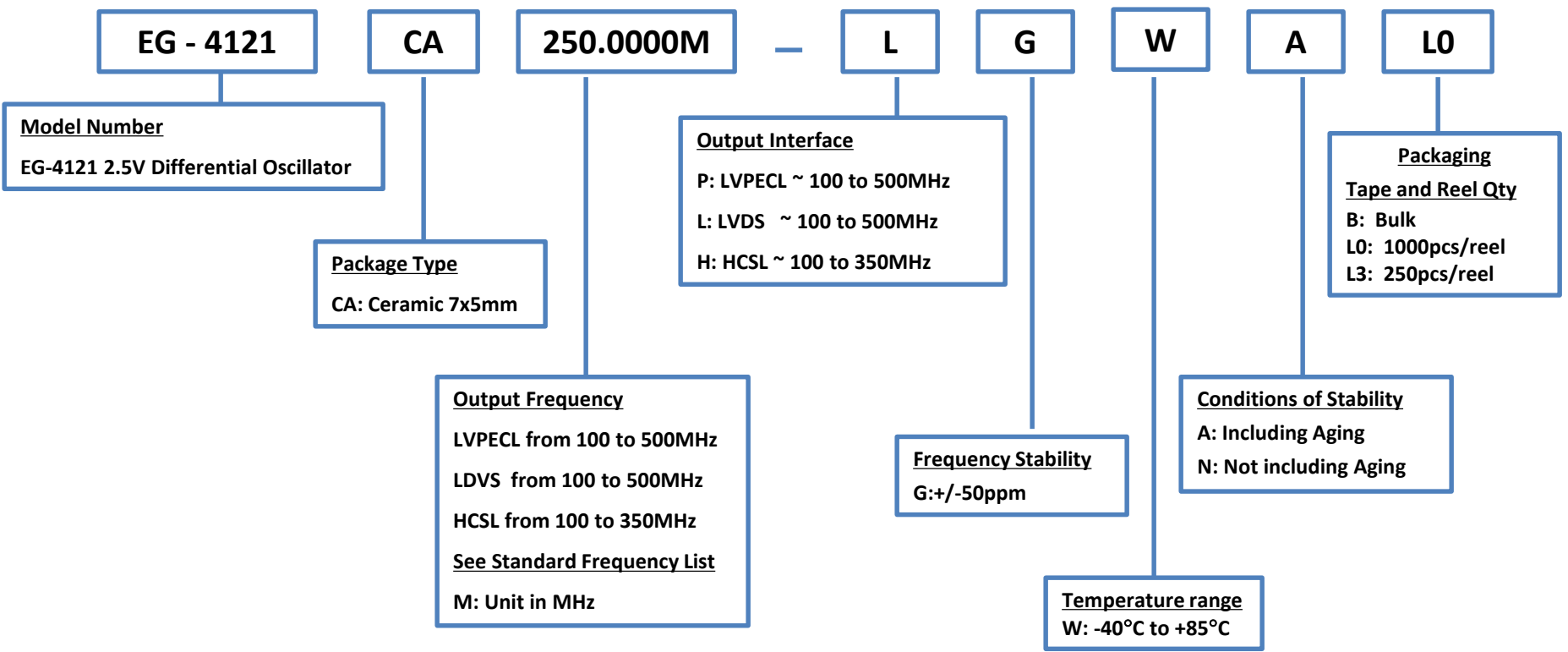
100.0000		
106.2500		
121.1090		
133.0000		
140.0000		
140.6665		
156.2500		
161.1320		
168.0407		
170.0000		
200.0000		
212.5000		
242.2180		
266.0000		
280.0000		
281.3330		
312.5000		
322.2640		
336.0814		
340.0000		



Product Configuration System



Crystal Oscillators – Low Jitter (SAW)



Standard Frequencies

EG-4101 (LVPECL)

100.0000	400.0000	
106.2500	425.0000	
121.1090	484.4360	
133.0000		
140.0000		
140.6665		
156.2500		
161.1320		
168.0407		
170.0000		
200.0000		
212.5000		
242.2180		
266.0000		
280.0000		
281.3330		
312.5000		
322.2640		
336.0814		
340.0000		



Standard Frequencies

EG-4101 (LVDS)

100.0000	400.0000	
106.2500	425.0000	
121.1090	484.4360	
133.0000		
140.0000		
140.6665		
156.2500		
161.1320		
168.0407		
170.0000		
200.0000		
212.5000		
242.2180		
266.0000		
280.0000		
281.3330		
312.5000		
322.2640		
336.0814		
340.0000		



Standard Frequencies

EG-4101 (HC SL)

100.0000		
106.2500		
121.1090		
133.0000		
140.0000		
140.6665		
156.2500		
161.1320		
168.0407		
170.0000		
200.0000		
212.5000		
242.2180		
266.0000		
280.0000		
281.3330		
312.5000		
322.2640		
336.0814		
340.0000		



High-Frequency Applications for SAW Oscillators

- 75.000M Serial ATA/SAS
- 98.304M 1394b
- 100.000M PCI-Express, Serial ATA
- 106.250M Fibre Channel
- 125.000M 1GbEthernet; iSCSI, Infiniband, Hypertransport, PCI-express
- 133.000M Bus/Mem Clock, CPU
- 133.333M FB DIMM
- 150.000M Serial ATA, Serial SCSI
- 155.520M SONET OC-48
- 156.250M 10GbEthernet XAUI
- 159.375M 10GbFibre Channel XAUI
- 161.132M 10GbEthernet SERDES
- 164.355M 10GbFibre Channel SERDES
- 166.000M Bus/Mem Clock
- 200.000M Bus/Mem Clock
- 212.500M 4G Fibre Channel, 8Gb Fibre Channel, FCoE
- 250.000M Infiniband, High Speed Bus
- 312.500M 10GbE
- 500.000M High Speed Bus
- 622.080M SONET OC-192
- 625.000M 10GbEthernet XAUI, High Speed Bus
- 644.531M 10GbEthernet SERDES
- 669.326M SONET OC-192 Digital Wrapper

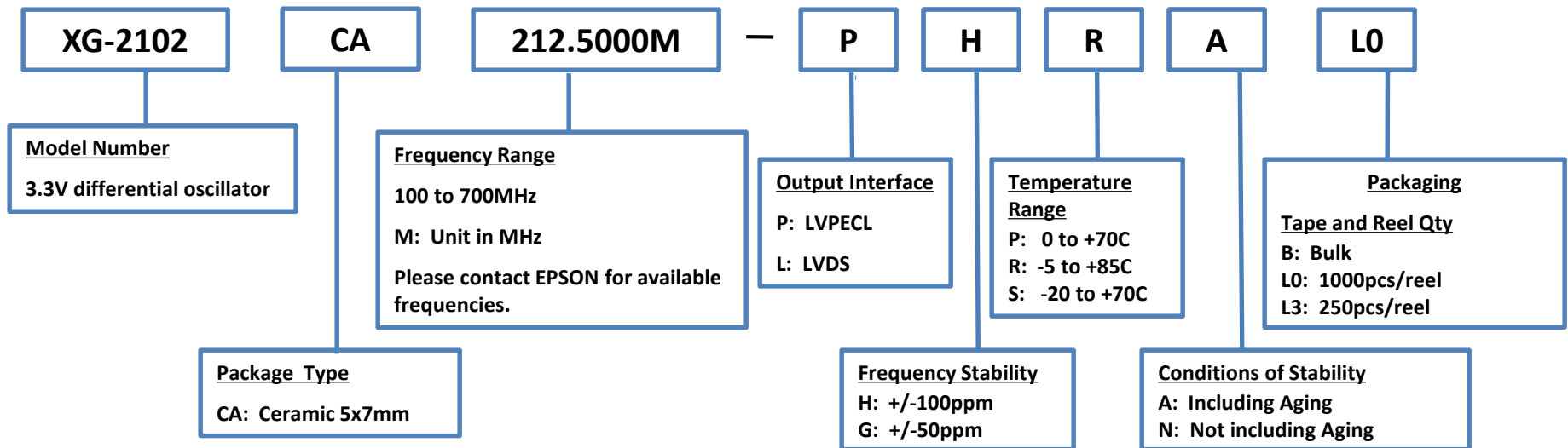
High Frequency Oscillator Applications

XO / SO (MHz)			VCXO / VCXO (MHz)		
Fibre Channel	FC-2	106.2	SONET	OC-3/12	19.44*
	FC-4/-8	212.5 / 425		OC-3/12	38.88*
	FC-10	159.375		OC-3/12/48	77.76*
Ethernet	GigE	125		OC-3	155.52*
	10 GigE/Infiniband	125 / 250		w/ FEC	166.6286
	XAU1	156.25		w/ FEC	167.3316
	XAU2	312.5		OC-6	311.04*
	10 GigE PHY	161.1328 322.2656 644.5312		w/ FEC	333.2572 334.6632
PCI-Express	Phase 1	100		OC-12	622.08
	Phase 2	200		w/ FEC	666.5144
	Phase 3	400	w/ FEC	669.3264	
Storage	SATA 1	75 / 150	OC-48	2488.32	
	SATA 2	150 / 300			
	SAS 1	75 / 150			
	SAS 2	150 / 300			
Computer	Bus / Mem Clock	100 / 125 / 133.33 /			
		166.66			
		200 / 266.67		* XO / SO also	

Product Configuration System



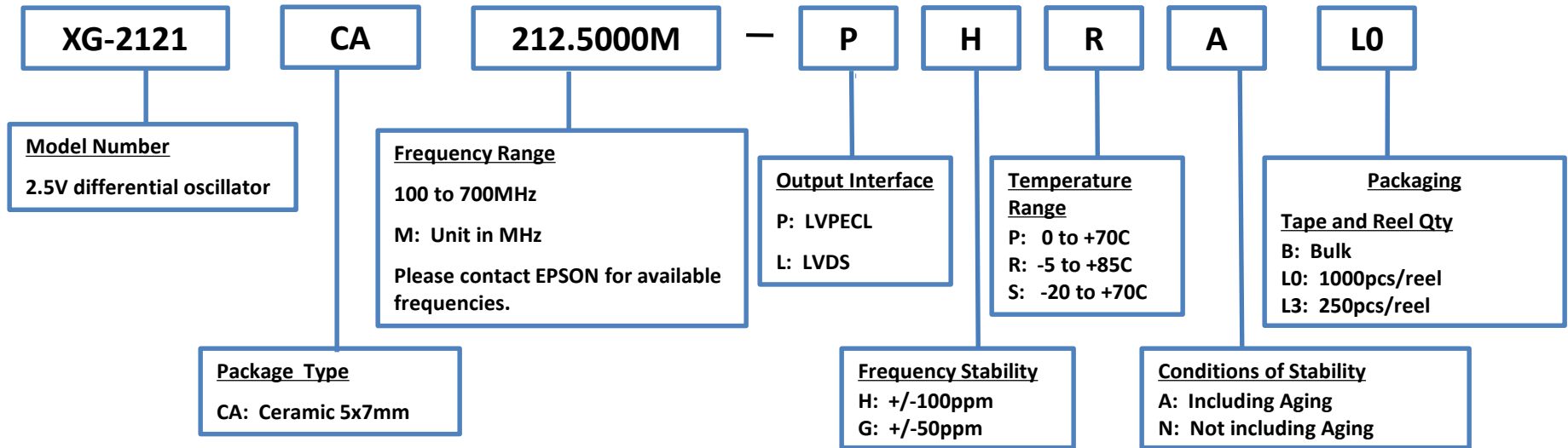
Crystal Oscillators – Low Jitter (SAW)



Product Configuration System



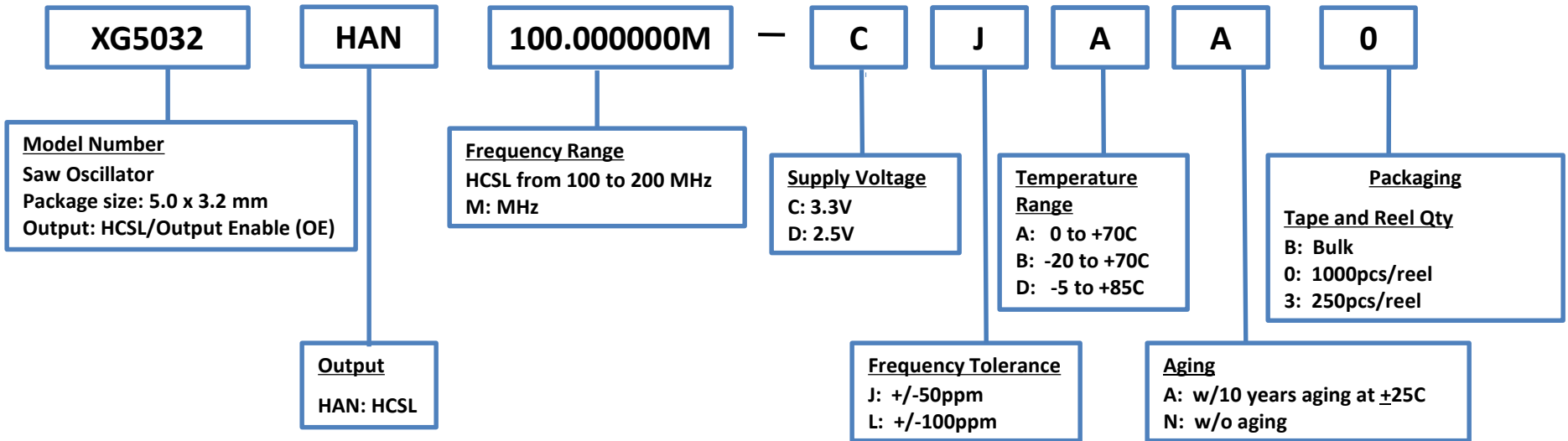
Crystal Oscillators – Low Jitter (SAW)



Product Configuration System



Low-Jitter SAW Oscillator (SPSO)



Unavailable Combinations
JDA and JBA

Product Configuration Guide

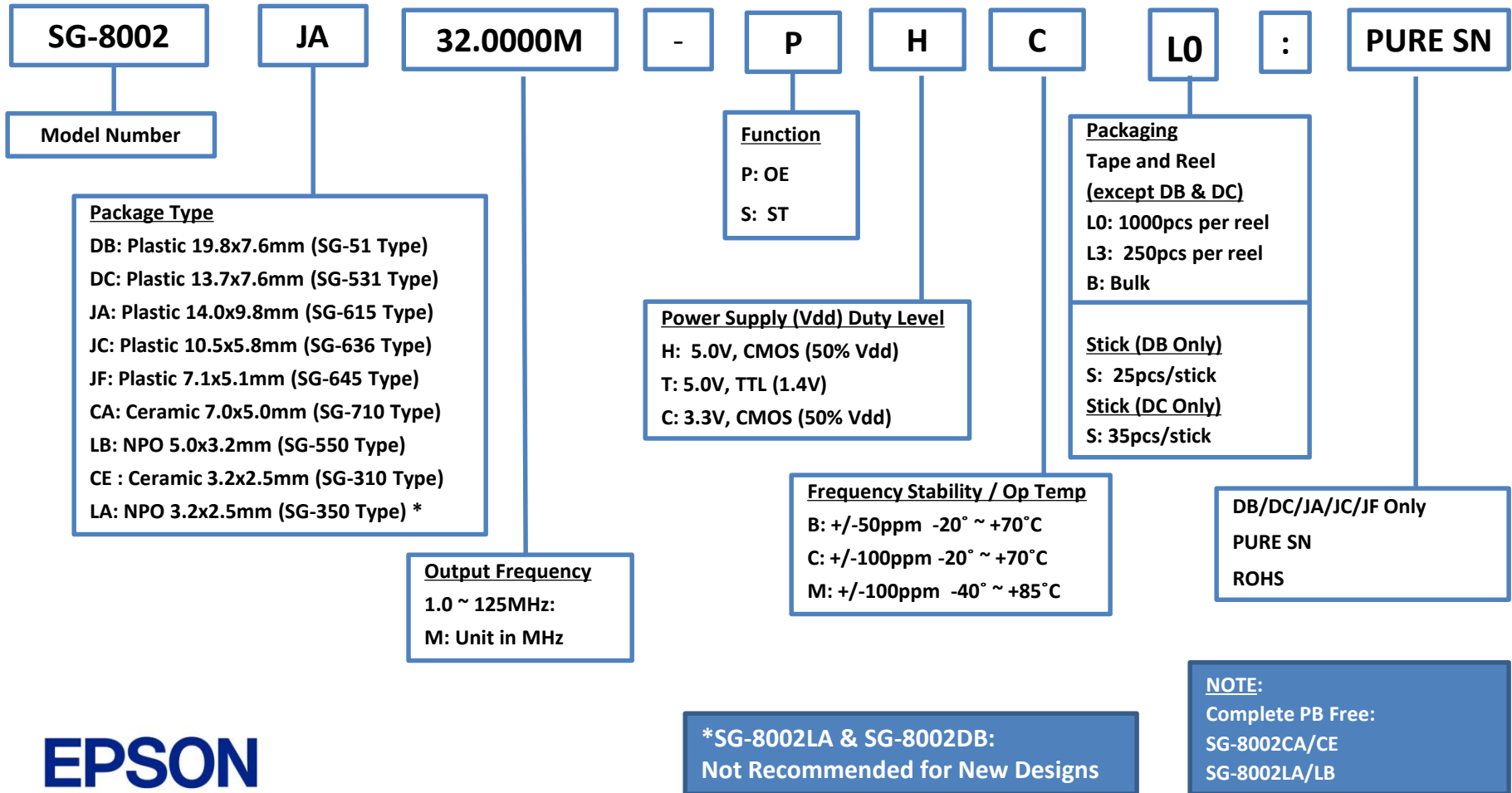
Programmable Oscillators



Product Configuration System



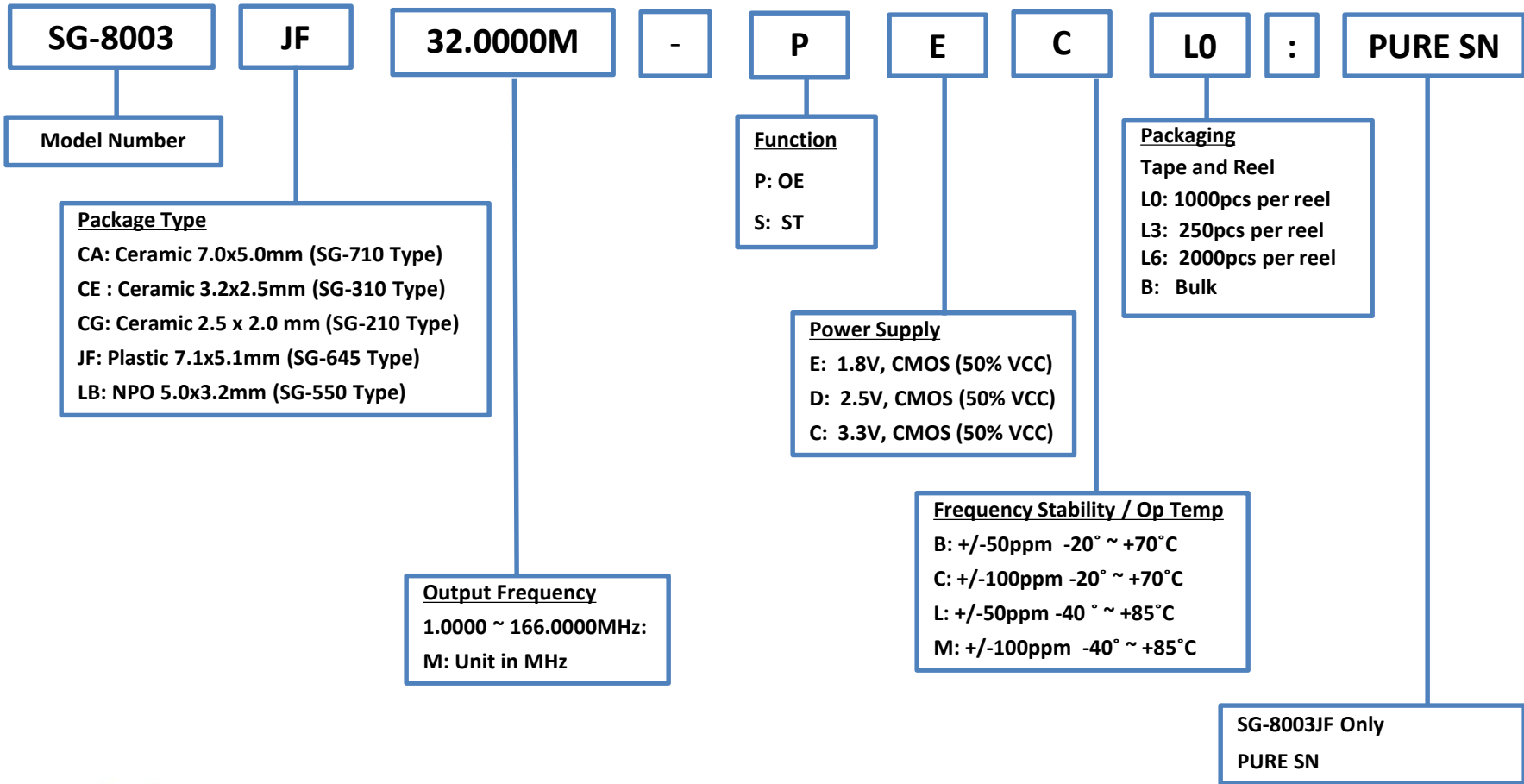
Crystal Oscillators - Programmable



Product Configuration System



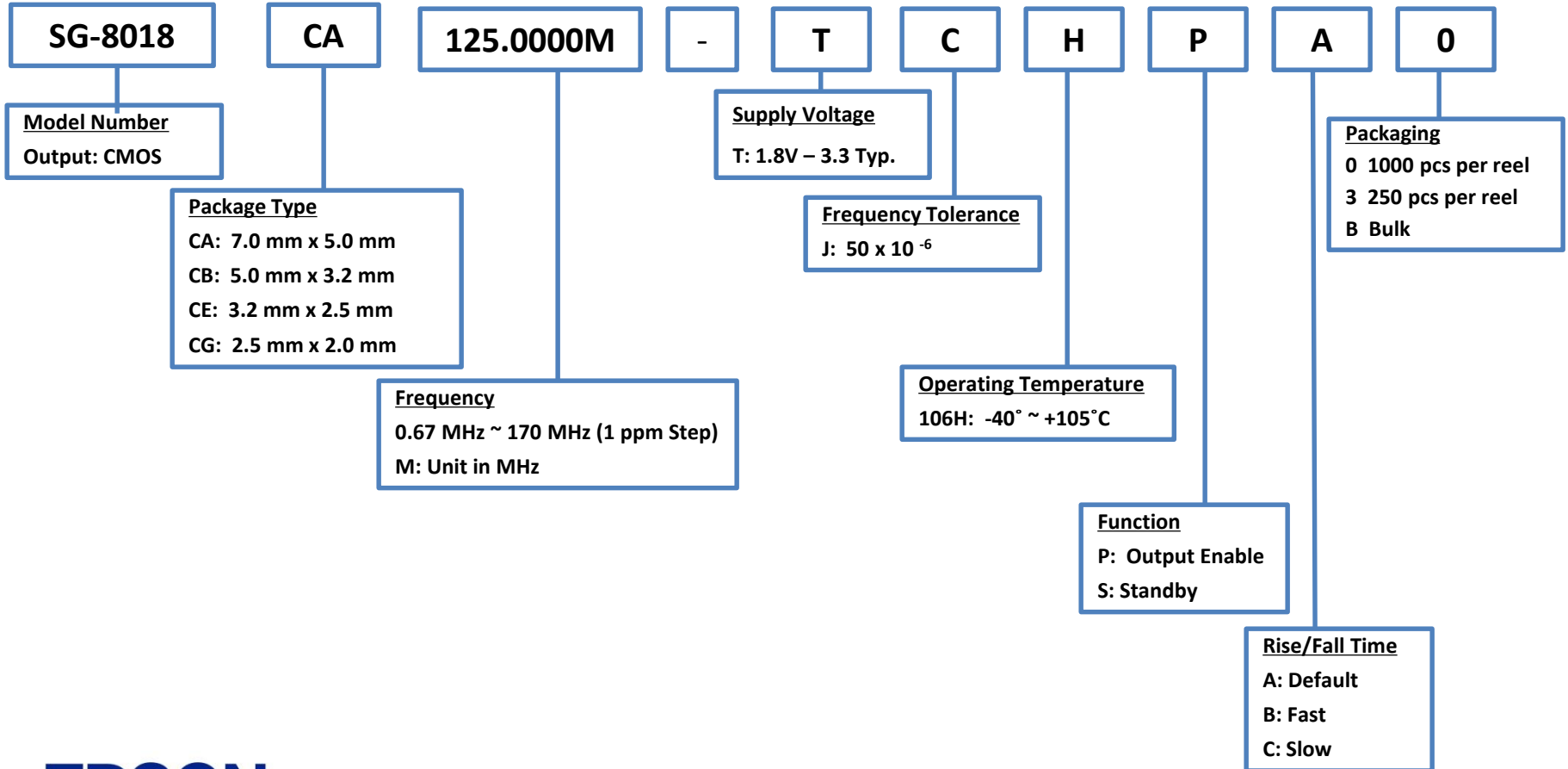
Crystal Oscillators - Programmable



Product Configuration System



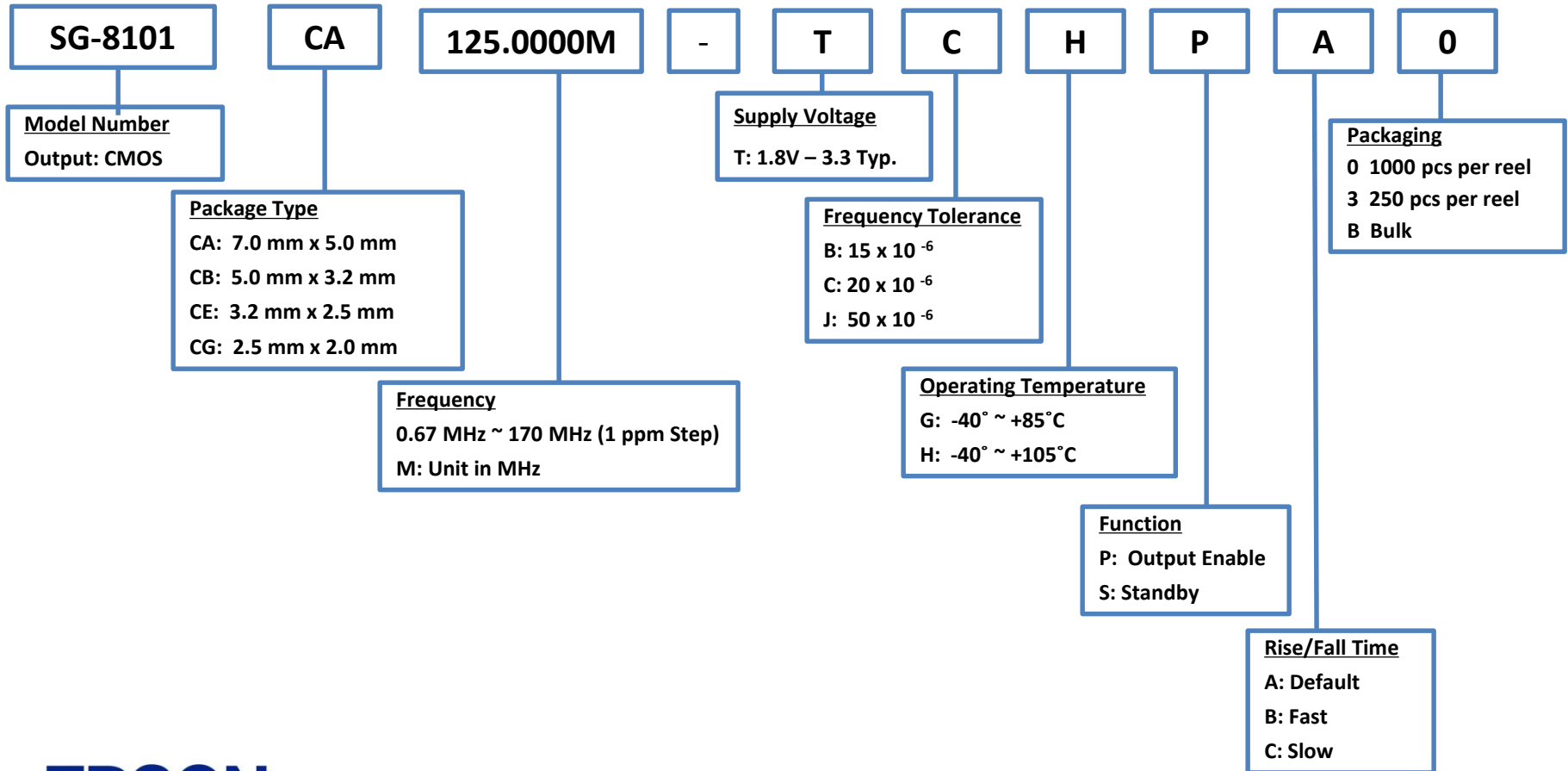
Crystal Oscillator (SPXO) – Programmable



Product Configuration System



Crystal Oscillator (SPXO) – Programmable, High Performance



Product Configuration System



Crystal Oscillator (SPXO) – Programmable, High Performance

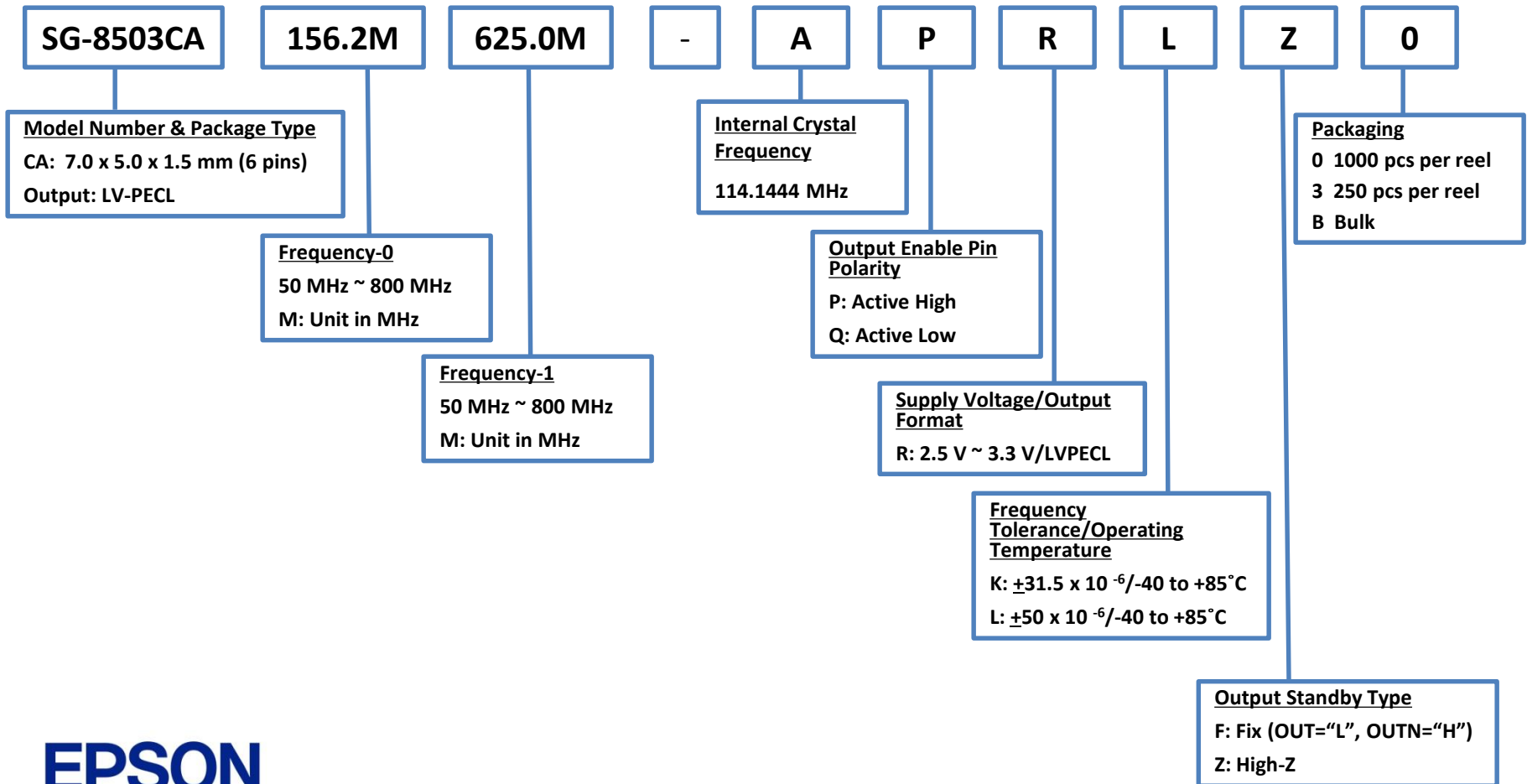
SG-8101 Available Combinations

Available combination		CA: 7.0 mm x 5.0 mm			CB: 5.0 mm x 3.2 mm			CE: 3.2 mm x 2.5 mm			CG: 2.5 mm x 2.0 mm		
Frequency tolerance		B: 15 x 10 ⁻⁶	C: 20 x 10 ⁻⁶	J: 50 x 10 ⁻⁶	B: 15 x 10 ⁻⁶	C: 20 x 10 ⁻⁶	J: 50 x 10 ⁻⁶	B: 15 x 10 ⁻⁶	C: 20 x 10 ⁻⁶	J: 50 x 10 ⁻⁶	B: 15 x 10 ⁻⁶	C: 20 x 10 ⁻⁶	J: 50 x 10 ⁻⁶
Operating temperature	G: -40 °C ~ +85 °C	✓			✓			✓			✓		
	H: -40 °C ~ +105 °C		✓	✓		✓	✓		✓	✓		✓	✓

Product Configuration System



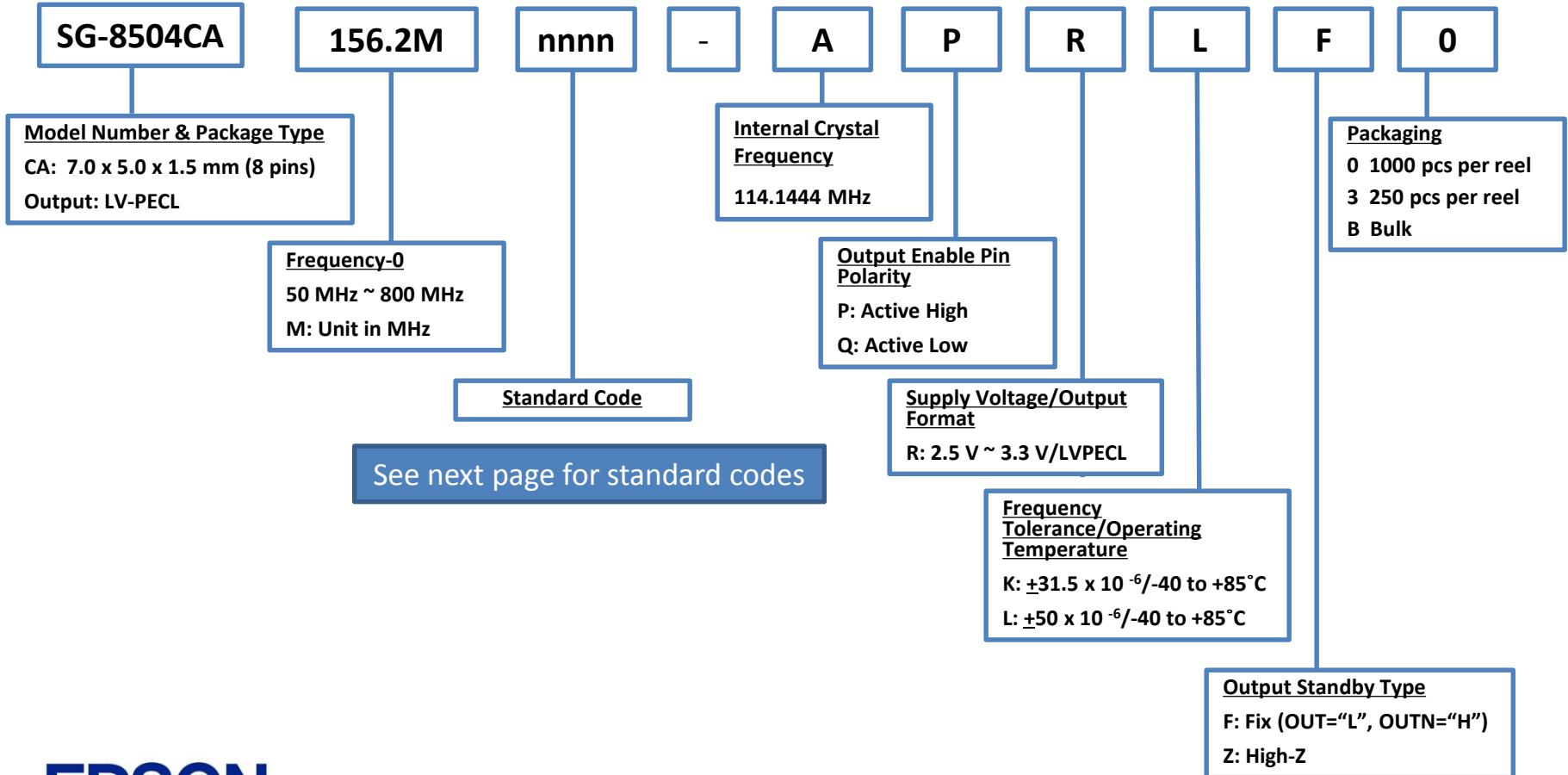
Dual Selectable Crystal Oscillator (SPXO) Programmable (Dual Frequencies Available)



Product Configuration System



Quad Selectable Crystal Oscillator (SPXO) Programmable (Quad Frequencies Available)



Product Configuration System



Quad Selectable Crystal Oscillator (SPXO) Programmable (Quad Frequencies Available)

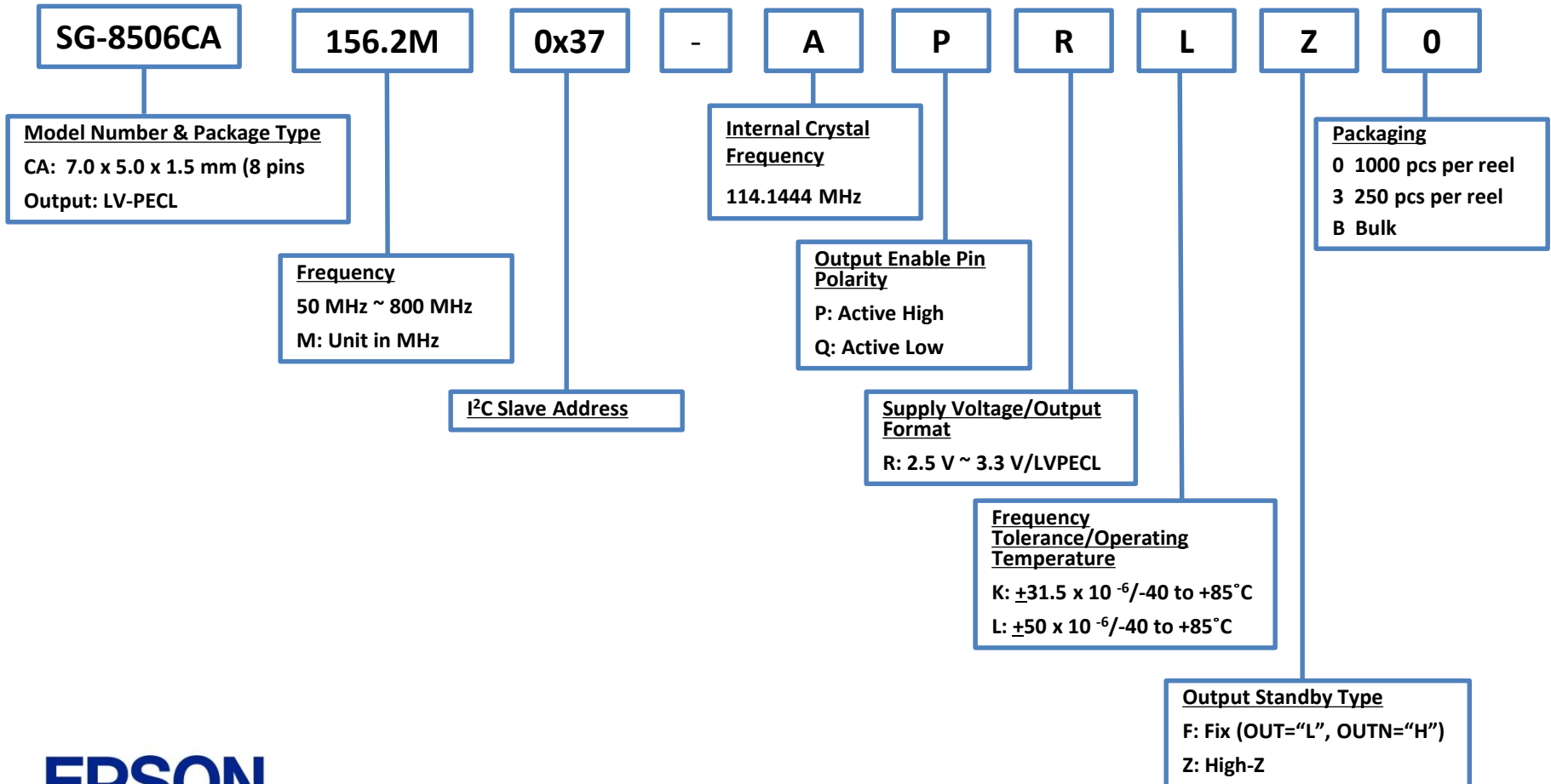
SG-8504 Standard Codes

Standard Code (‘nnnn’)	Frequency 0	Frequency 1	Frequency 2	Frequency 3
0007	75.00000	100.00000	150.00000	250.00000
0008	62.50000	125.00000	156.25000	250.00000
0009	106.25000	159.37500	212.50000	425.00000
0010	100.00000	133.33333	166.66666	200.00000
0011	100.00000	125.00000	156.25000	312.50000

Product Configuration System



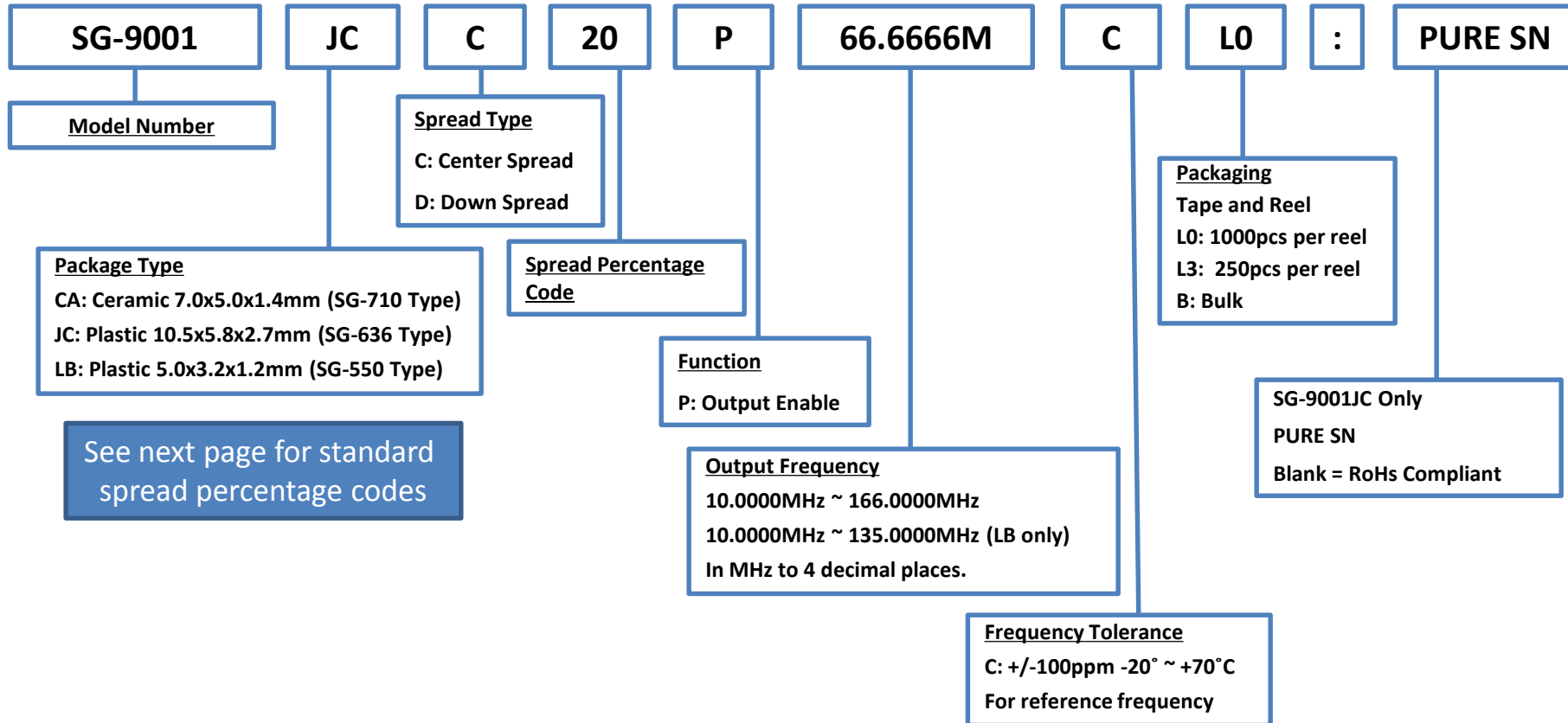
User Programmable I²C Crystal Oscillator (SPXO)



Product Configuration System



Crystal Oscillators - Spread Spectrum



NOTES:

SG-9001CA & SG-9001LB: Complete PB FREE
SG-9001JC: RoHS COMPLIANT

Spread Rate Options

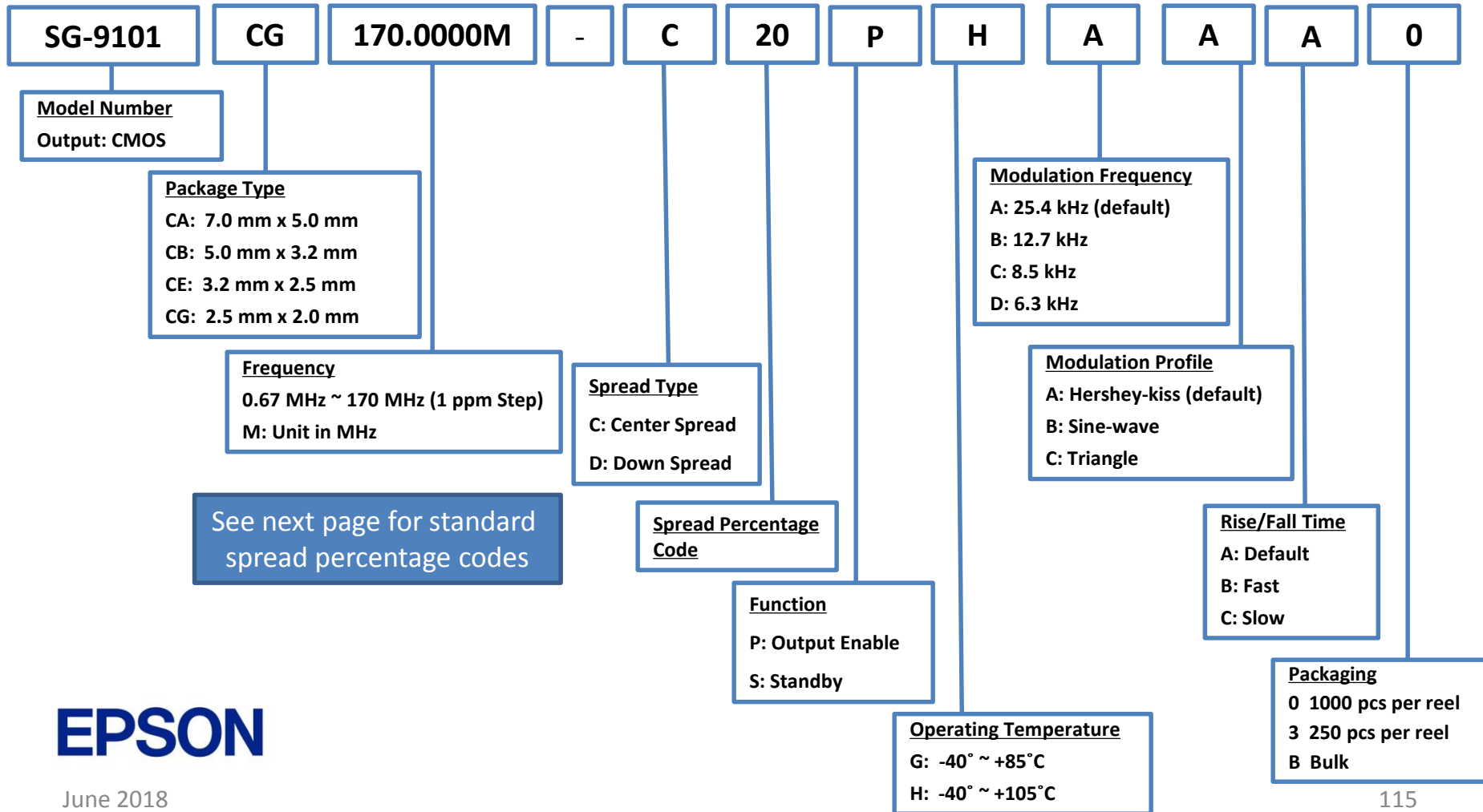
SG-9001

Center Spread		Down Spread	
Product Configuration Code	Spread Rate %	Product Configuration Code	Spread Rate %
C02	+/- 0.25	D05	- 0.5
C05	+/- 0.5	D10	- 1.0
C07	+/- 0.75	D15	- 1.5
C10	+/- 1.0	D20	- 2.0
C15	+/- 1.5	D30	- 3.0
C20	+/- 2.0	D40	- 4.0

Product Configuration System



Crystal Oscillator (SPXO) – Programmable, Spread Spectrum



Spread Rate Options

SG-9101

Center Spread		Down Spread	
Product Configuration Code	Spread Rate %	Product Configuration Code	Spread Rate %
C02	+/- 0.25	D05	- 0.5
C05	+/- 0.5	D10	- 1.0
C07	+/- 0.75	D15	- 1.5
C10	+/- 1.0	D20	- 2.0
C15	+/- 1.5	D30	- 3.0
C20	+/- 2.0	D40	- 4.0

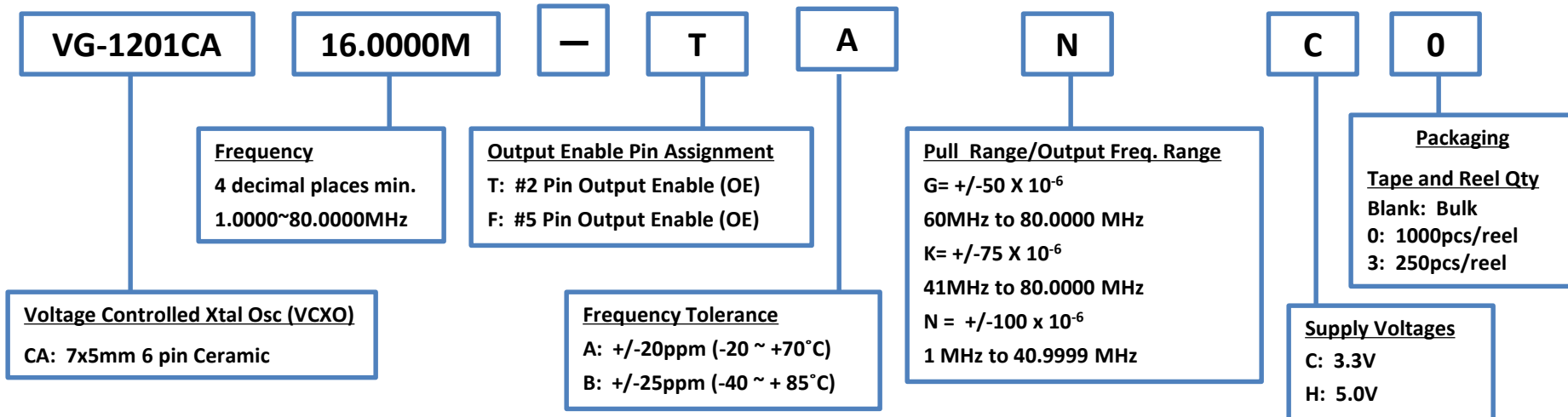
Product Configuration Guide

VOLTAGE CONTROLLED OSCILLATORS



Product Configuration System

Oscillators - VCXO

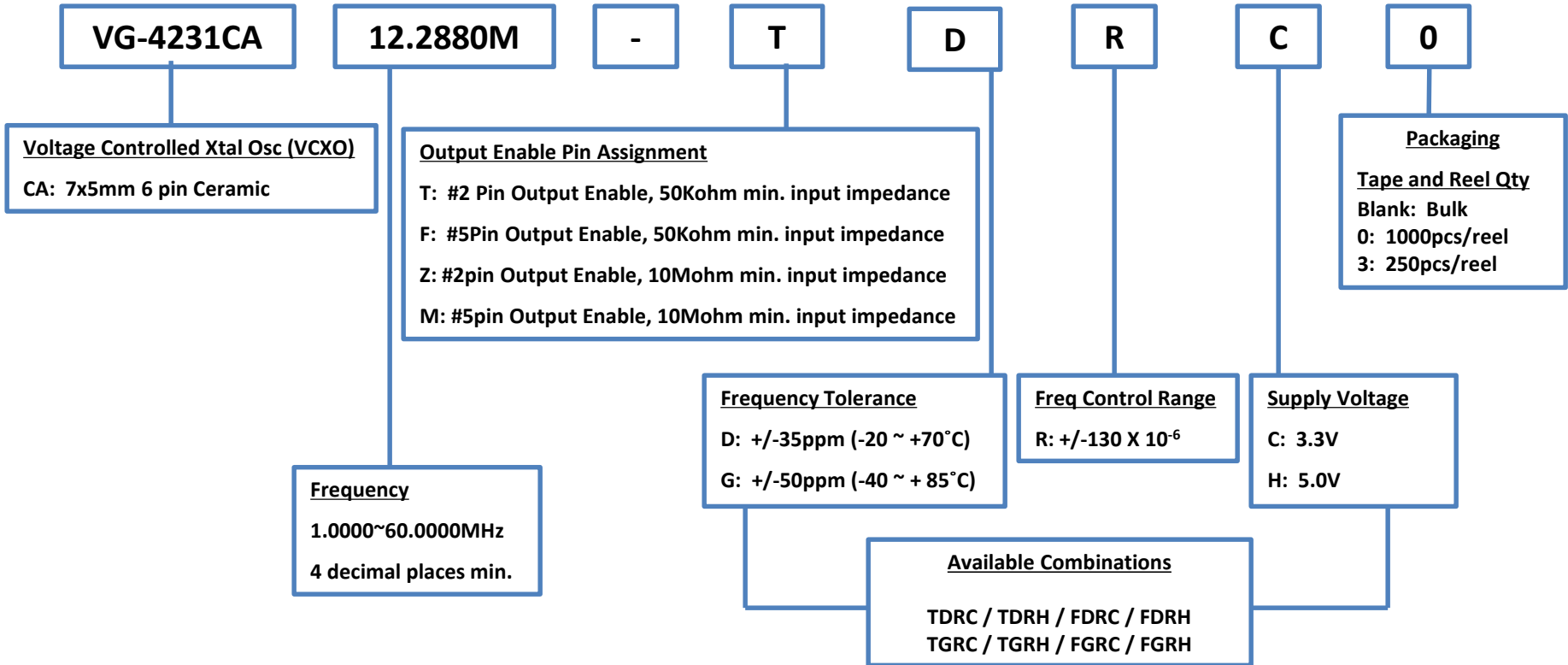


CODE	STABILITY	OPERATING TEMP.	PULL RANGE	OUTPUT FREQ.
ANC / ANH	+/-20PPM	-20C to +70°C	+/-100PPM	1MHz to 40.9999MHz
AKC / AKH	+/-20PPM	-20C to +70°C	+/-75PPM	41MHz to 80.0000MHz
BNC / BNH	+/-25PPM	-40C to +85°C	+/-100PPM	1MHz to 40.9999MHz
BKC / BKH	+/-25PPM	-40C to +85°C	+/-75PPM	41MHz to 80.0000MHz

Product Configuration System



Oscillators - VCXO



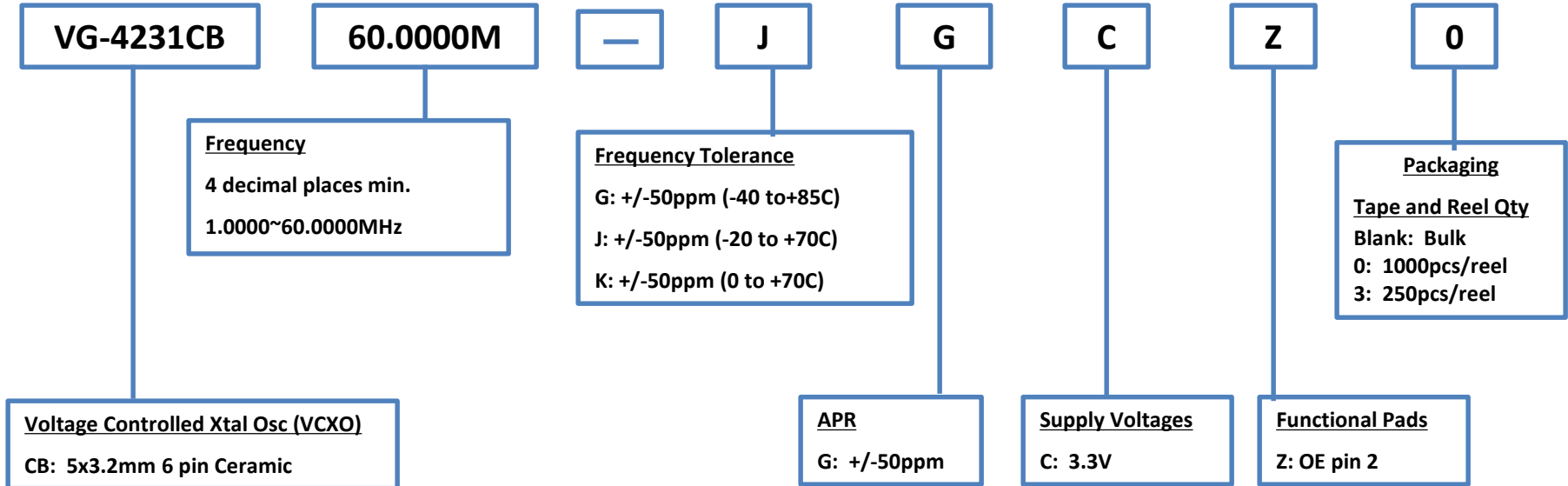
NOTE:

Output Enable Pin Assignment Z and M are not available with Supply Voltage H (5.0V)



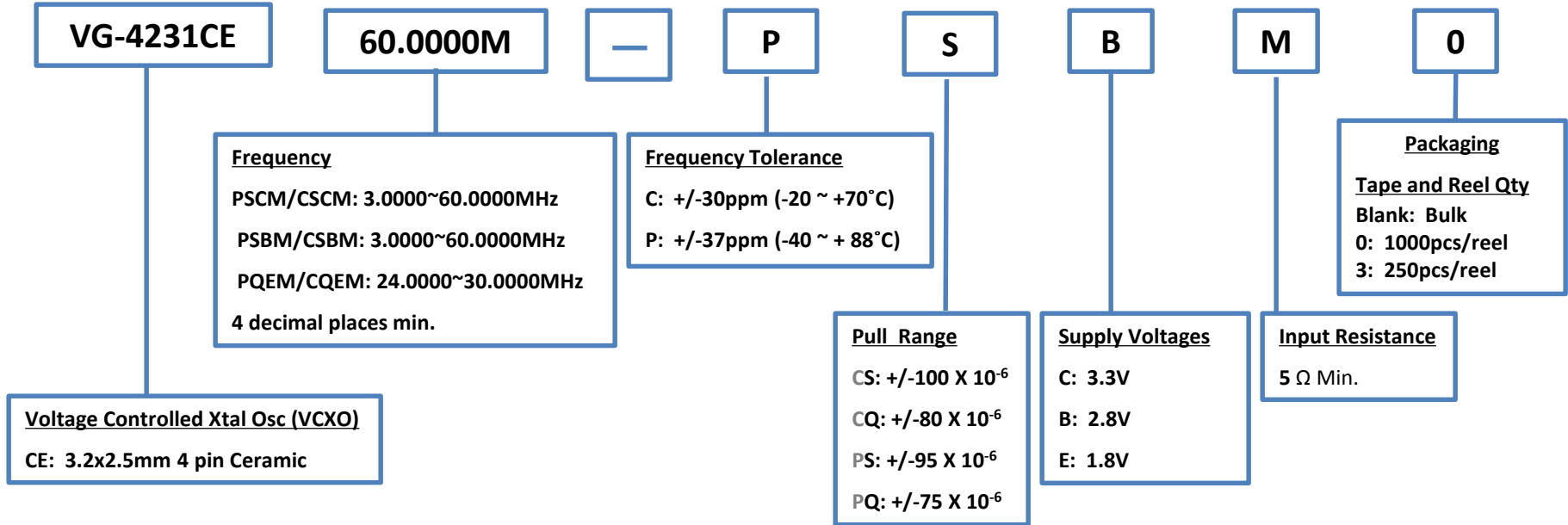
Product Configuration System

Oscillators - VCXO



Product Configuration System

Oscillators - VCXO



CODE		Frequency Tolerance	Temperature Range	Absolute Pull Range
CSCM / CSBM/CQEM	C	+/-30 x 10 ⁻⁶	-20 °C to + 70°C	S : +/-100 x 10 ⁻⁶ / Q : +/-80 x 10 ⁻⁶
PSCM/PSBM/PQEM	P	+/-37 X 10 ⁻⁶	-40°C to + 85°C	S : +/-95 x 10 ⁻⁶ / Q : +/-75 x 10 ⁻⁶

Product Configuration System



Oscillators - VCXO

VG-4232CA

Voltage Controlled Xtal Osc (VCXO)
CA: 7x5mm 6 pin Ceramic

61.4400M

Frequency
60.0001~80.0000MHz
4 decimal places min.

-

T

Output Enable Pin Assignment
T: #2 Pin Output Enable, 50Kohm min. input impedance
F: #5Pin Output Enable, 50Kohm min. input impedance
Z: #2pin Output Enable, 10Mohm min. input impedance
M: #5pin Output Enable, 10Mohm min. input impedance

G

Frequency Tolerance
G: +/-50ppm (-40 ~ +85°C)
J: +/-50ppm (-20 ~ +70°C)
K: +/-50ppm (-0 ~ +70°C)

G

Absolute Pull Range
G: +/-50 X 10⁻⁶

C

Supply Voltage
C: 3.3V
H: 5.0V

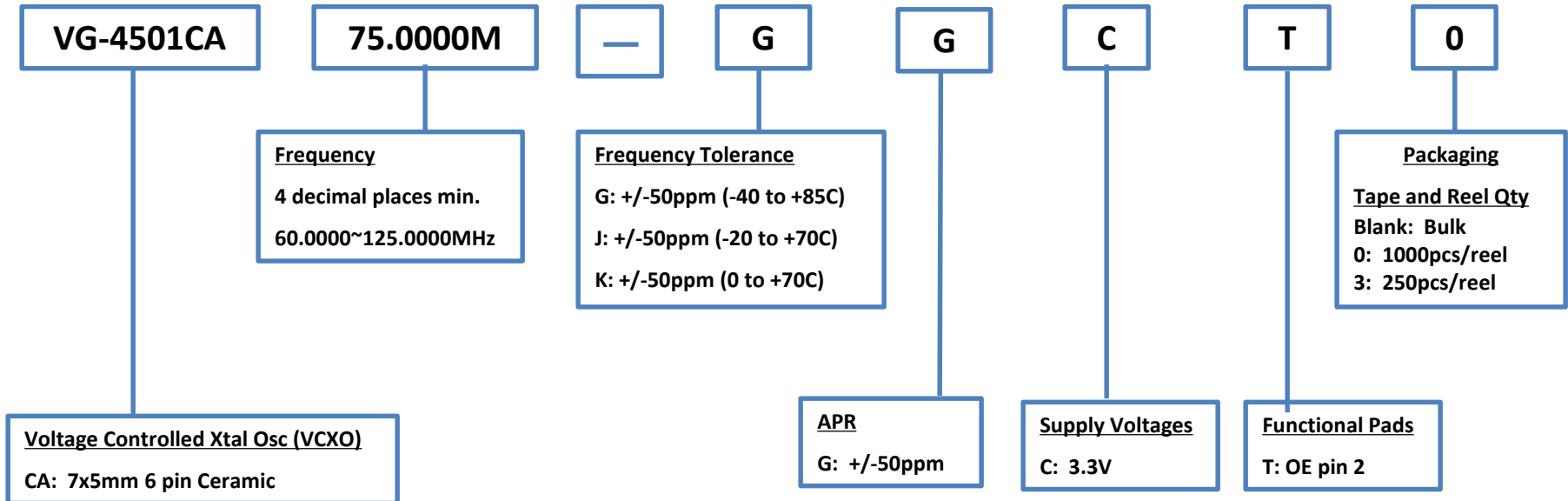
0

Packaging
Tape and Reel Qty
Blank: Bulk
0: 1000pcs/reel
3: 250pcs/reel



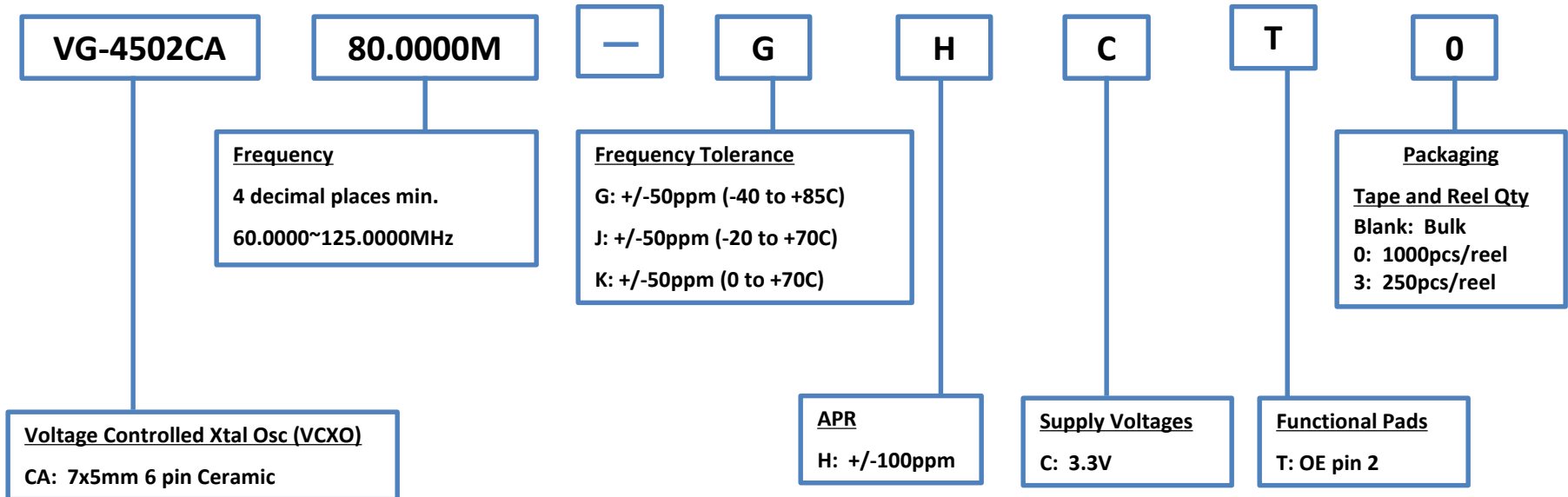
Product Configuration System

Oscillators - VCXO



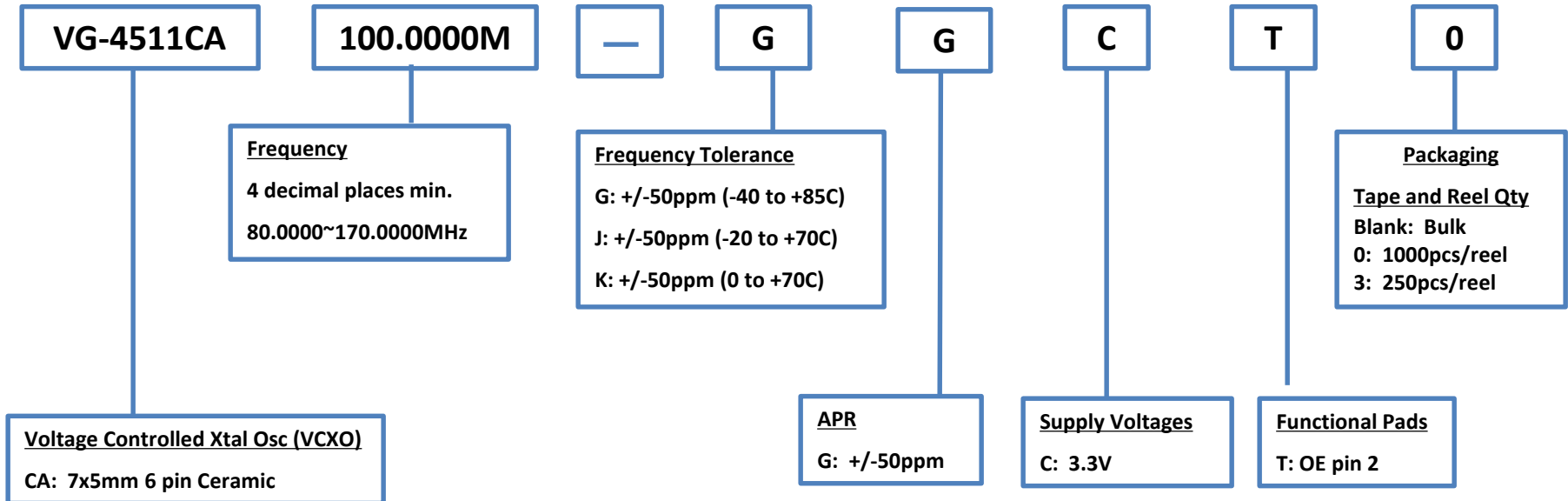
Product Configuration System

Oscillators - VCXO



Product Configuration System

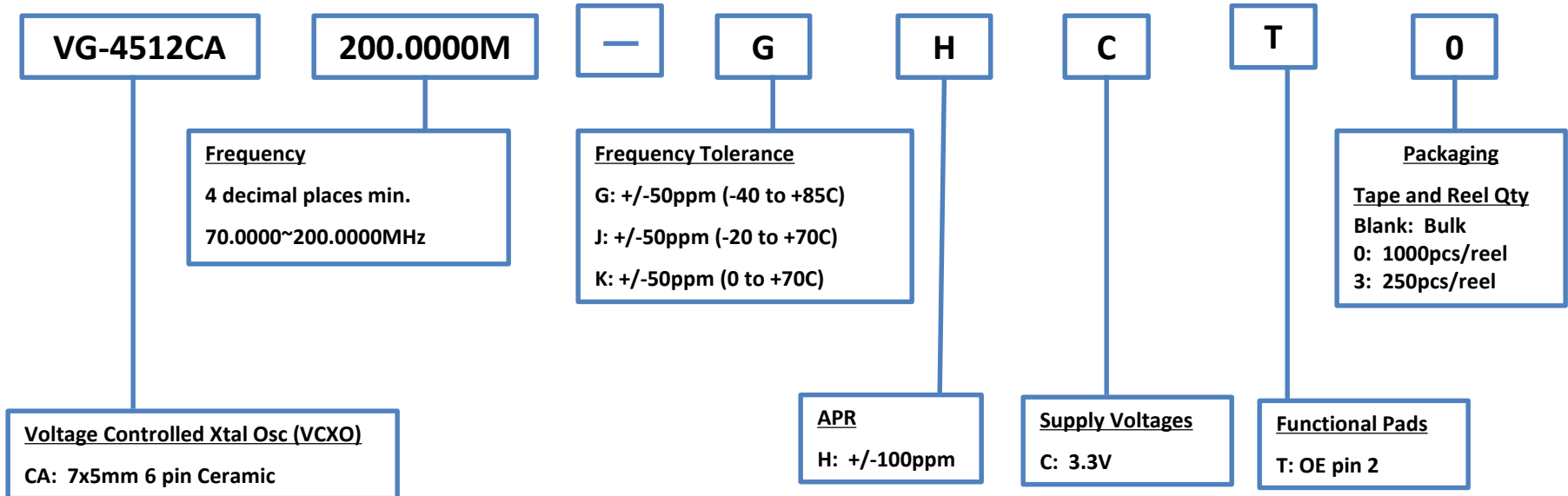
Oscillators - VCXO





Product Configuration System

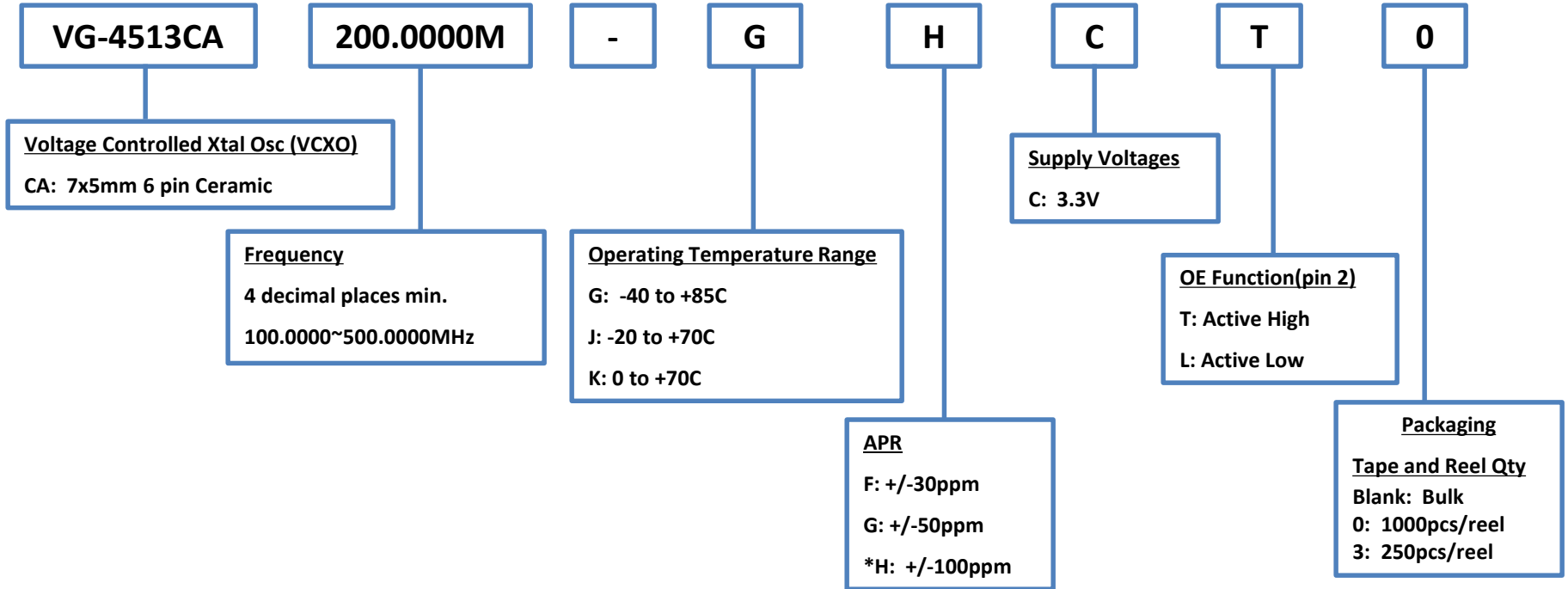
Oscillators - VCXO





Product Configuration System

Oscillators - VCXO



*Only 120MHz ≤ f₀ ≤ 200MHz are available

NOTE:

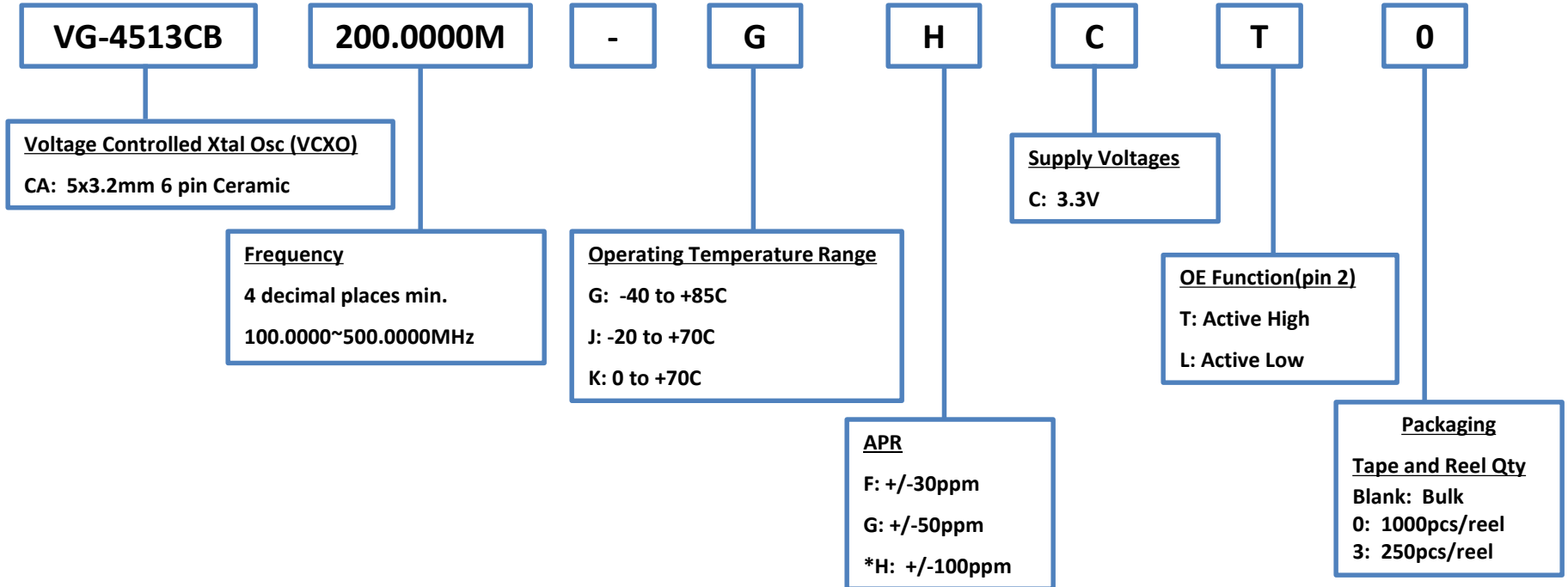
Standard Frequencies Offered: 100M, 122.88M, 125M, 148.351M, 148.5M, 153.6M, 155.52M, 156.25M, 200M

Please contact us for requirements not listed in this specification.



Product Configuration System

Oscillators - VCXO



*Only 120MHz ≤ f₀ ≤ 200MHz are available

NOTE:

Standard Frequencies Offered: 122.88M, 153.6M

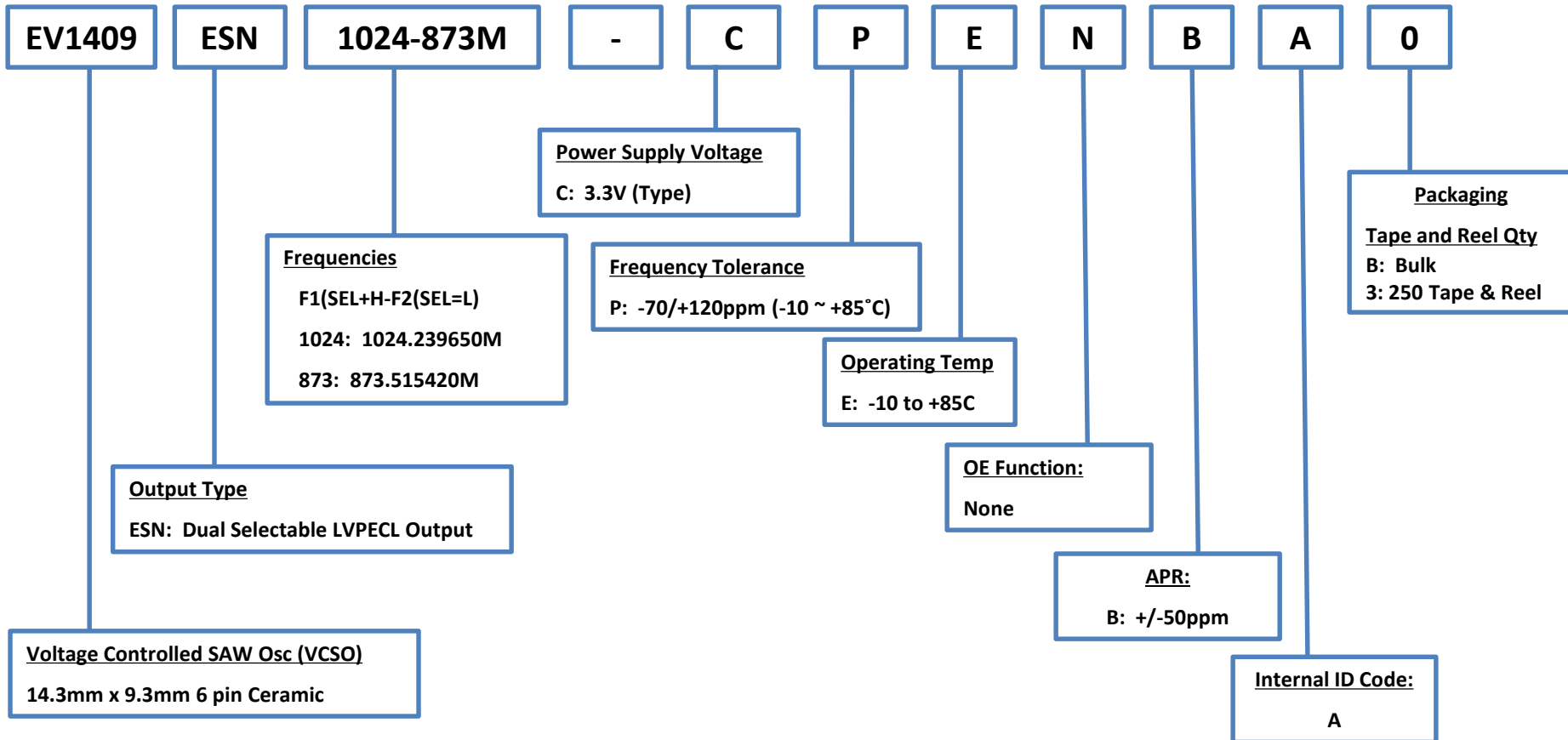
Please contact us for requirements not listed in this specification.



Product Configuration System



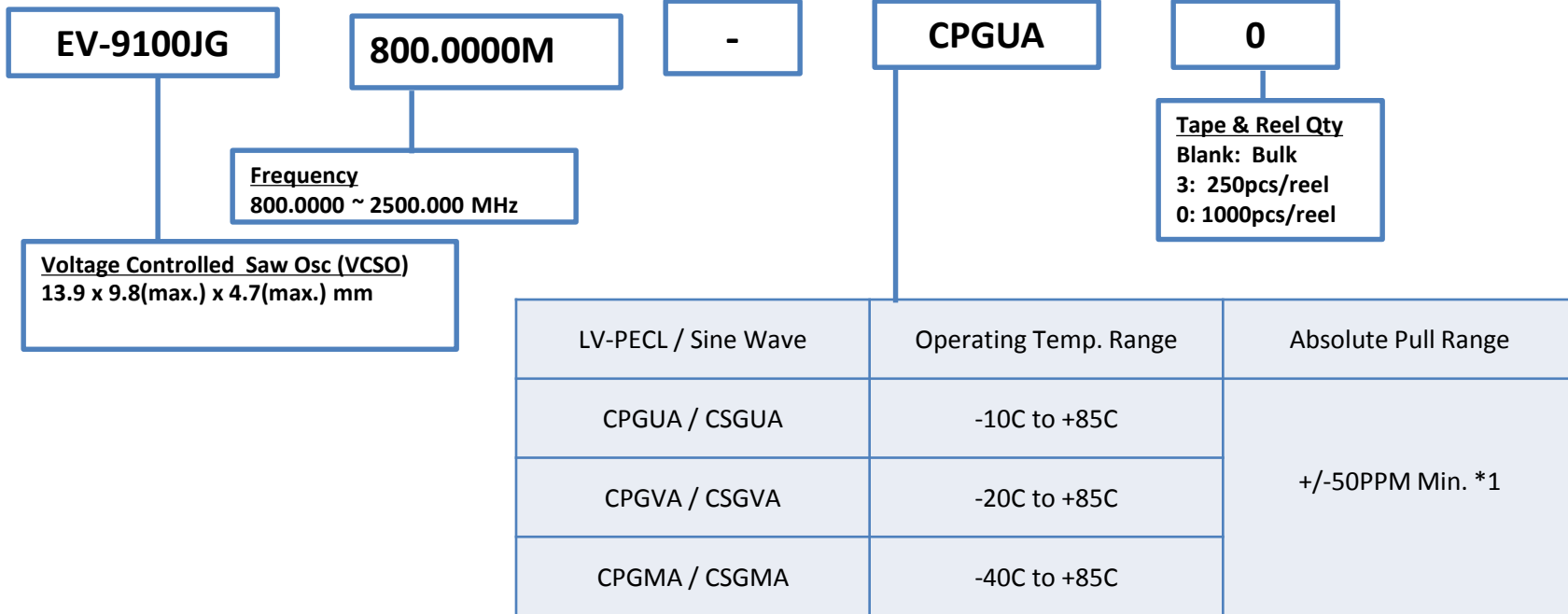
Oscillators - VCSO



Product Configuration System



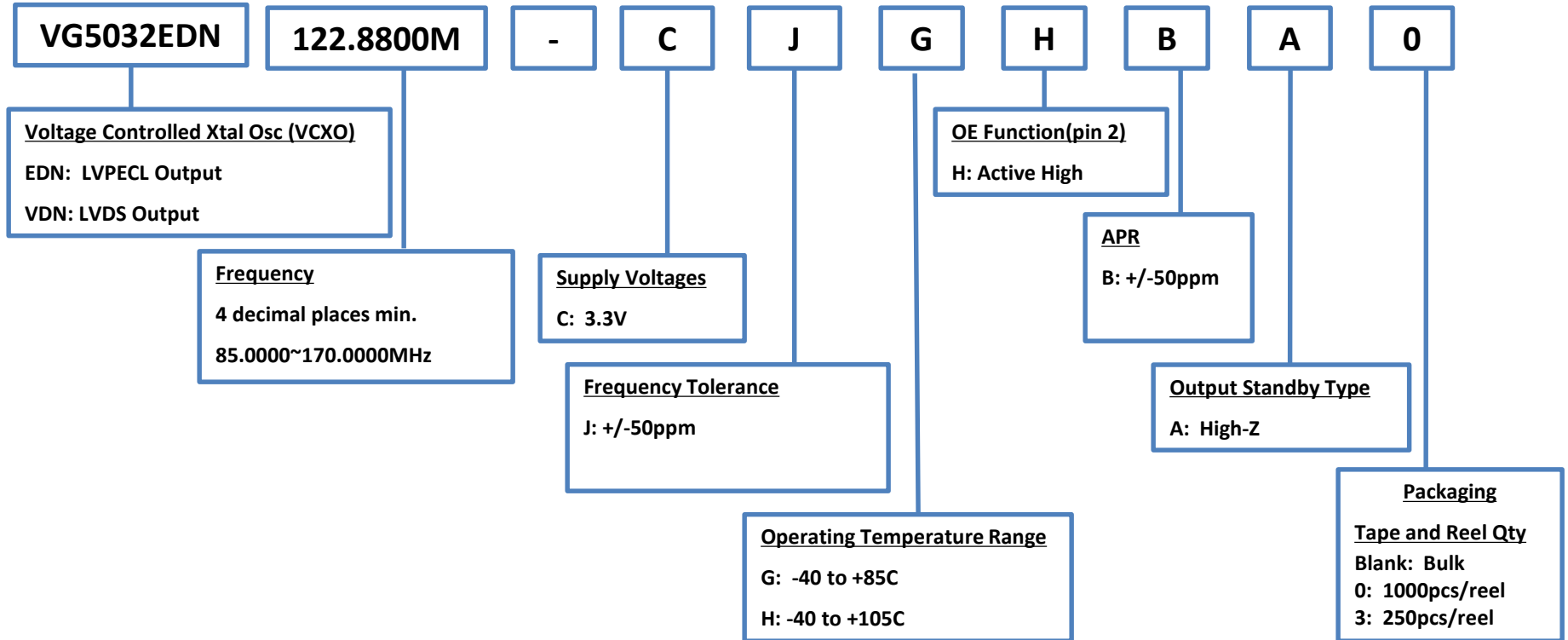
Oscillators - VCISO



***1 NOTE:** Absolute Pull Range = Frequency Control Range – Frequency Tolerance

Product Configuration System

Oscillators - VCXO



NOTE:

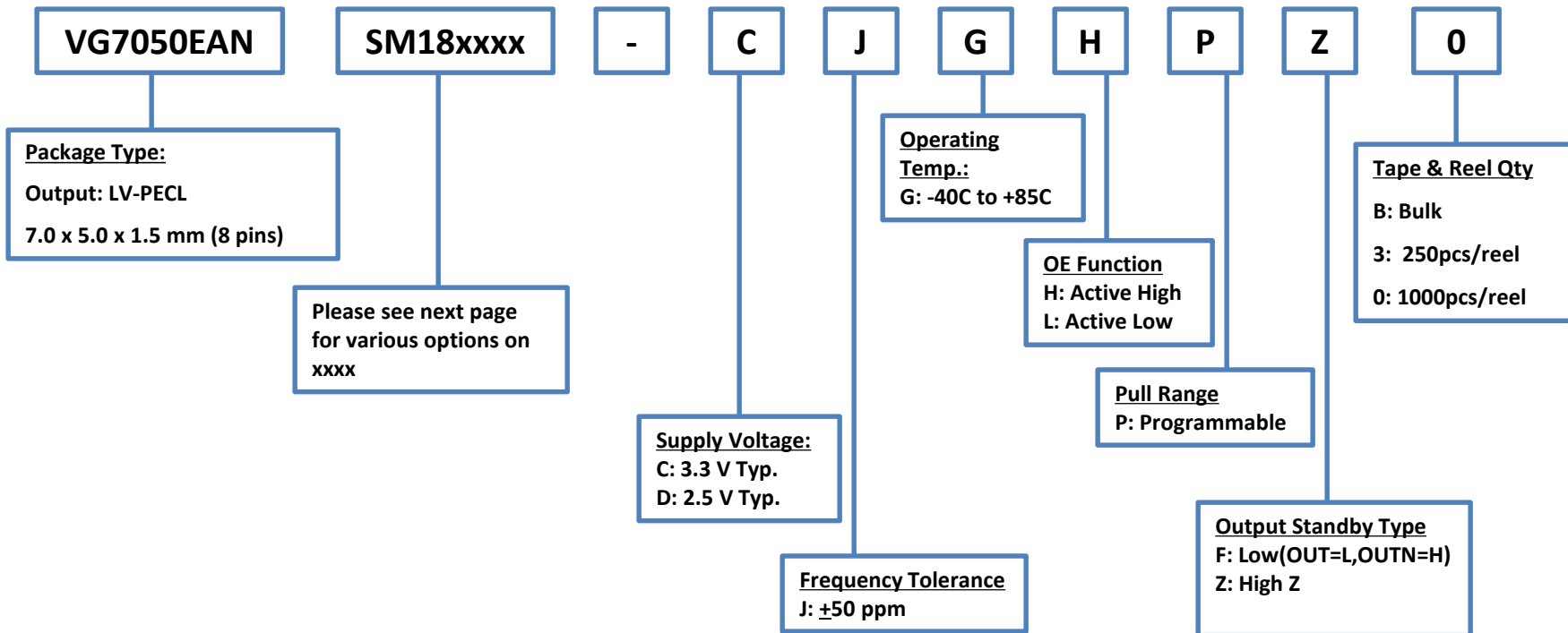
Standard Frequencies Offered: 122.88M

Please contact us for requirements not listed in this specification.

Product Configuration System



Programmable Voltage Controlled Oscillator (VCXO)



NOTE:

Frequency Range: 50~800MHz

Please contact us for requirements not listed in this specification.

Product Configuration System



Programmable Voltage Controlled Oscillator (VCXO)

VG7050EAN

Part Number	Start-up frequency [MHz]	APR			Supply Voltage	OE function	Output Standby Type	
		Max	Initial	Vc range				
VG7050EAN-SM18T001-CJGHPZ	622.080000	180	100	1.65+/-1.25	3.3V	Active high	Hi-Z	
VG7050EAN-SM18T002-DJGHPZ				1.25+/-1.00	2.5V			
VG7050EAN-SM18T003-CJGLPZ				1.65+/-1.35	3.3V	Active low		
VG7050EAN-SM18T004-DJGLPZ				1.25+/-1.00	2.5V			
VG7050EAN-SM18T005-CJGHPF				1.65+/-1.35	3.3V	Active high		Low (OUT=L,OUTN=H)
VG7050EAN-SM18T006-DJGHPF				1.25+/-1.00	2.5V			
VG7050EAN-SM18T007-CJGLPF				1.65+/-1.35	3.3V	Active low		
VG7050EAN-SM18T008-DJGLPF				1.25+/-1.00	2.5V			
VG7050EAN-SM18T009-CJGHPZ	156.250000	180	100	1.65+/-1.25	3.3V	Active high	Hi-Z	
VG7050EAN-SM18T010-DJGHPZ				1.25+/-1.00	2.5V			

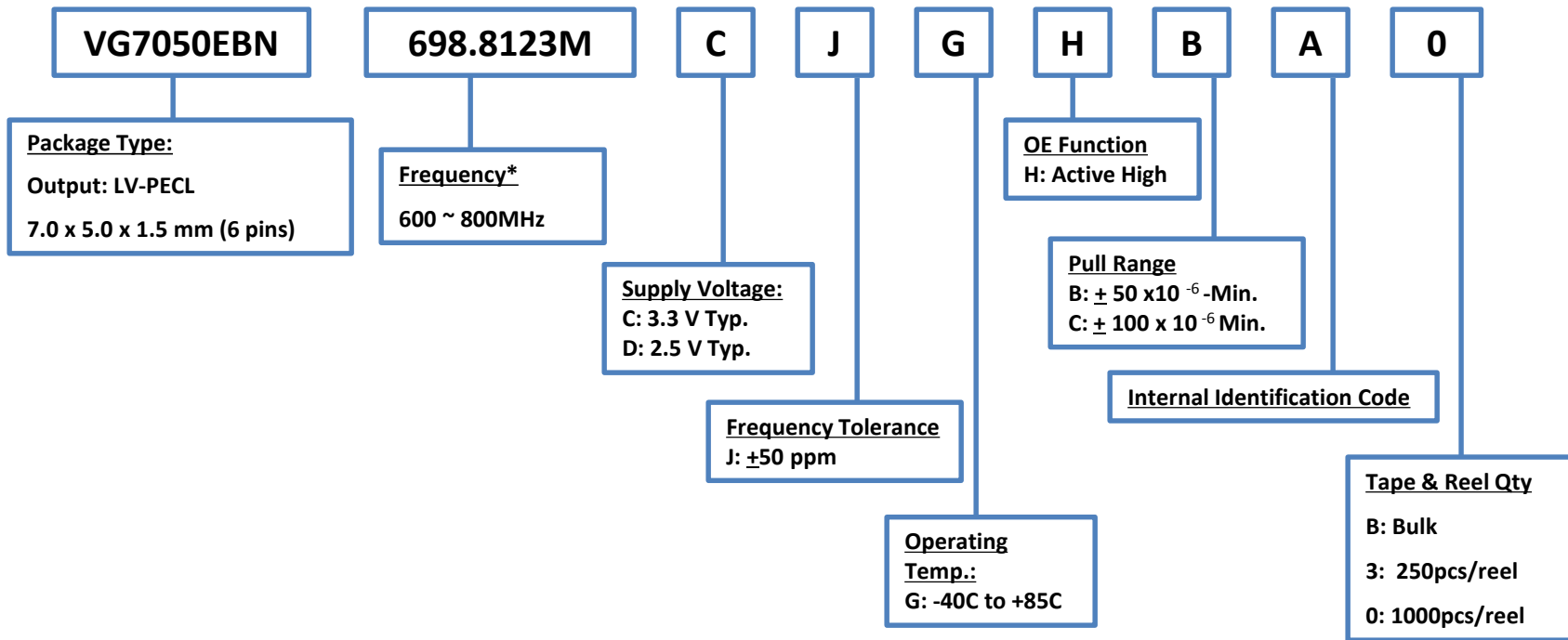
-If customer wants startup frequency other than 622.08MHz or 156.25MHz, please contact us for a custom part.

-Customer can always change the output frequency with the I2C (from 50MHz to 800MHz)

Product Configuration System



Programmable Voltage Controlled Oscillator (VCXO)



NOTE:

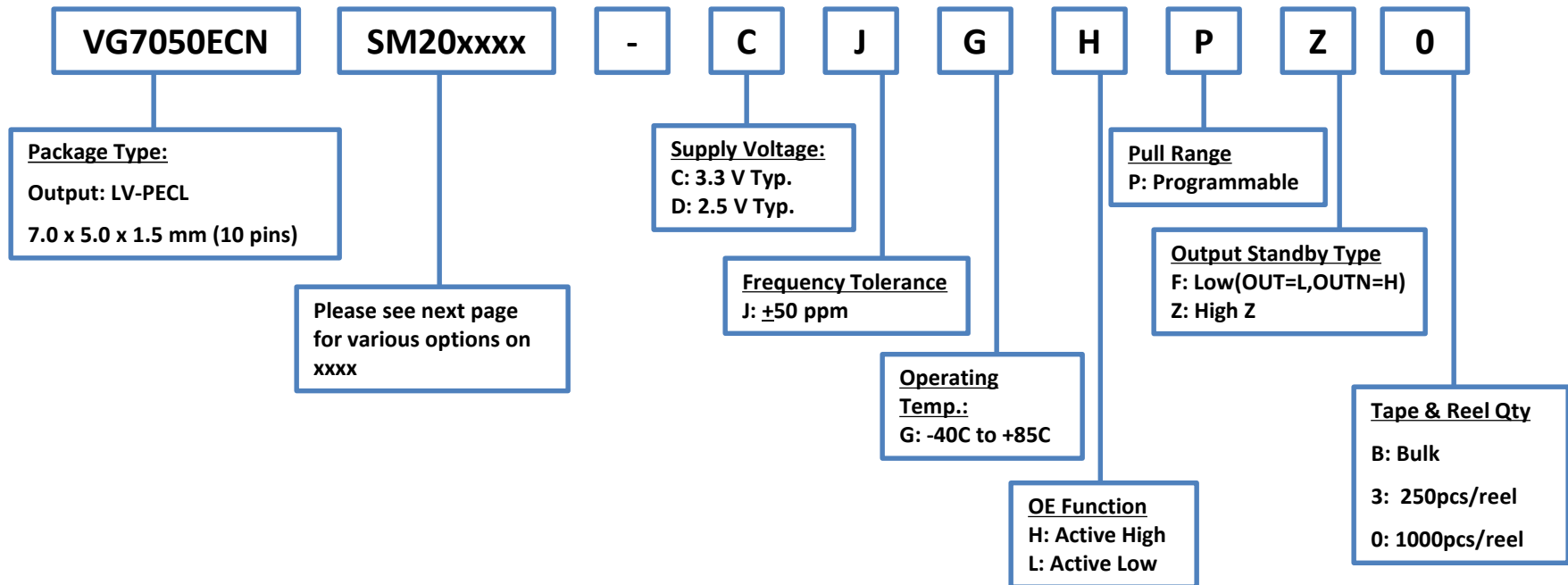
Standard Frequencies: 698.8123MHz, 753.6211MHz, 794.7278MHz

Please contact us for requirements not listed in this specification.

Product Configuration System



Programmable Voltage Controlled Oscillator (VCXO)



NOTE:

Frequency Range: 50~800MHz

Please contact us for requirements not listed in this specification.

Product Configuration System



Programmable Voltage Controlled Oscillator (VCXO)

VG7050ECN

Part Number	Start-up frequency [MHz]				APR			Supply Voltage	OE function	Output	
	frequency 1	frequency 2	frequency 3	frequency 4	Max	Initial	Vc range			Standby	Type
VG7050ECN-SM20T001-CJGHPZ	622.080000	644.531250	669.326582	693.482991	180	100	1.65+/-1.25	3.3V	Active high	Hi-Z	
VG7050ECN-SM20T002-DJGHPZ							1.25+/-1.00	2.5V			
VG7050ECN-SM20T003-CJGLPZ							1.65+/-1.35	3.3V	Active low		
VG7050ECN-SM20T004-DJGLPZ							1.25+/-1.00	2.5V			
VG7050ECN-SM20T005-CJGHPP							1.65+/-1.35	3.3V	Active high		Low (OUT=L,OUTN=H)
VG7050ECN-SM20T006-DJGHPP							1.25+/-1.00	2.5V			
VG7050ECN-SM20T007-CJGLPF							1.65+/-1.35	3.3V	Active low		
VG7050ECN-SM20T008-DJGLPF							1.25+/-1.00	2.5V			

-If customer wants different startup frequencies, please contact us for a custom part.

-Customer can always change the output frequencies with the I2C (from 50MHz to 800MHz)

Product Configuration Guide

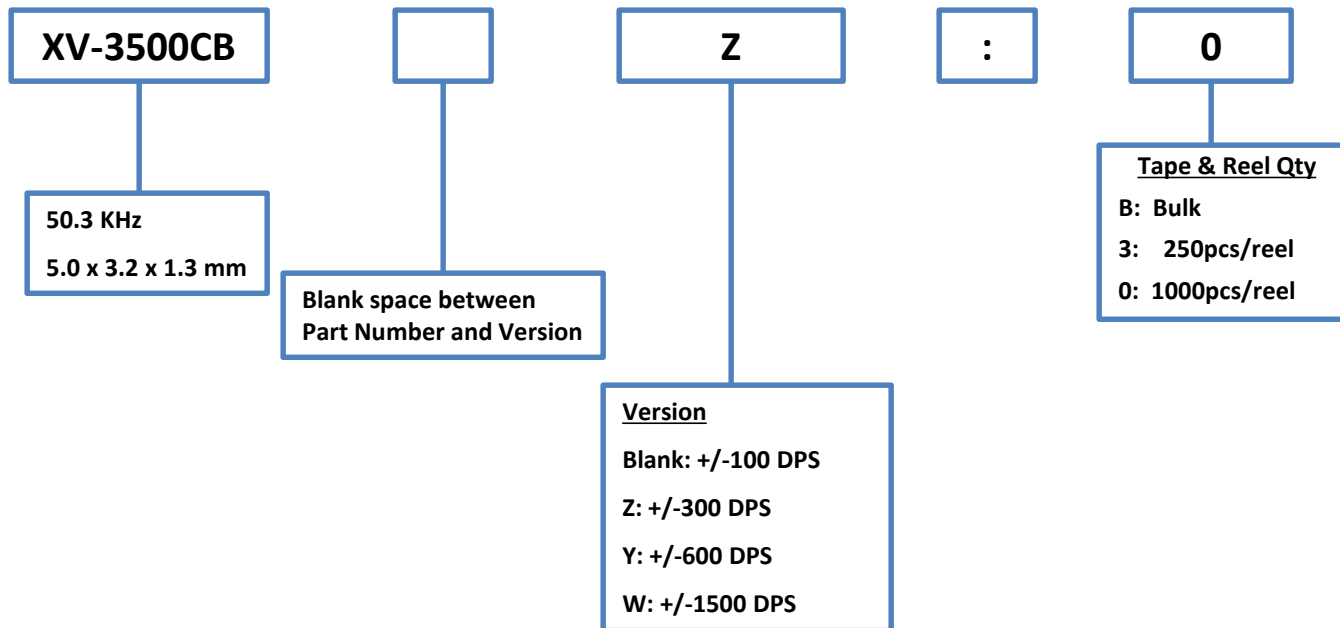
SENSING DEVICES



Product Configuration System

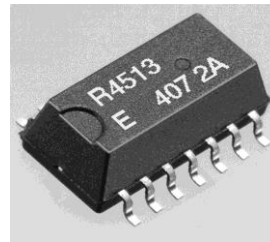
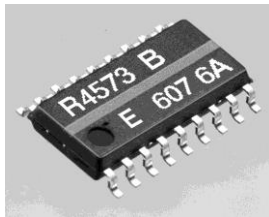


Gyro Sensor



Product Configuration Guide

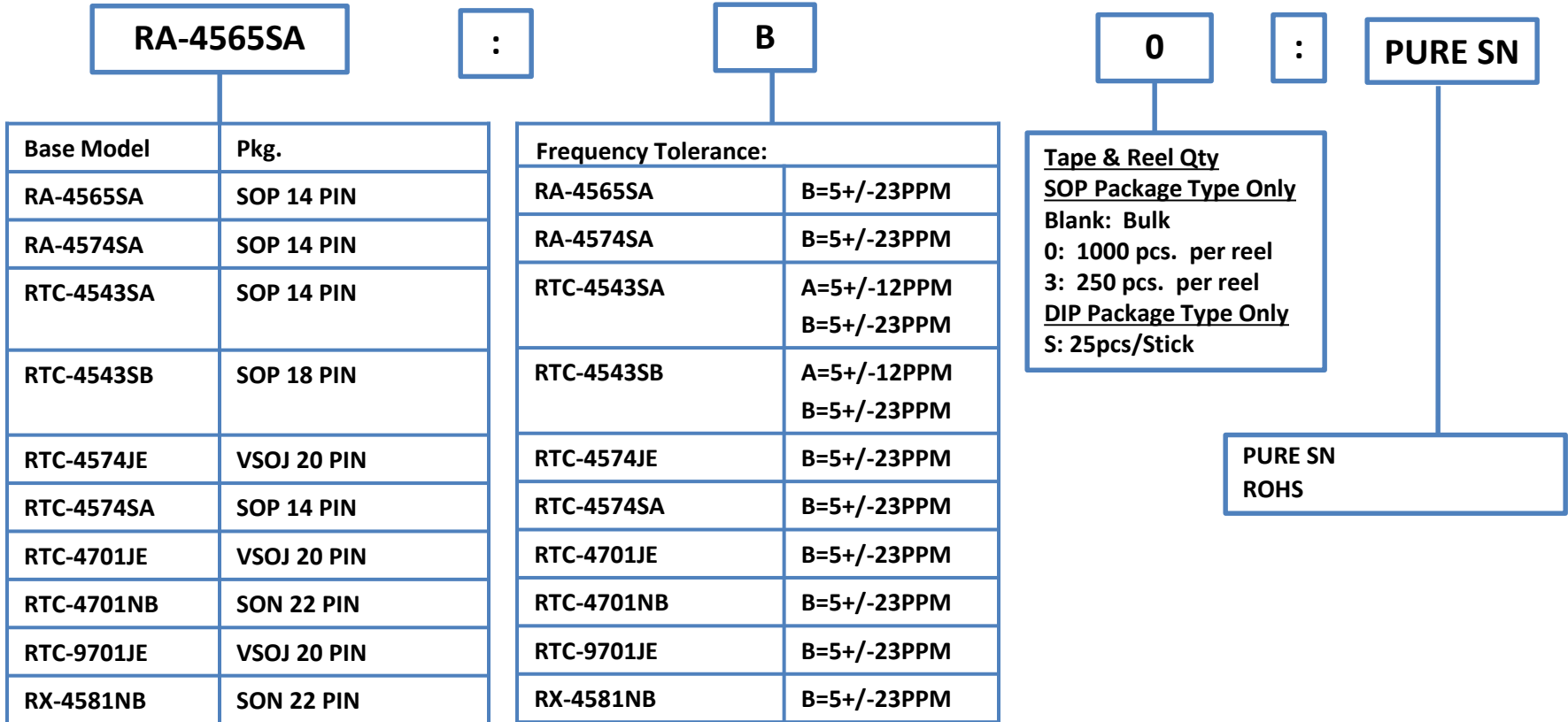
REAL TIME CLOCKS



Product Configuration System



Real Time Clock Modules – Serial (3 Wire & 4 Wire)



Note:
 SA, SB and NB packages are available as RoHS Compliant "ROHS" or PURE SN
 JE packages are available as RoHS Compliant "ROHS" or PURE SN only



Product Configuration System



Real Time Clock Modules – Serial (3 Wire & 4 Wire)

RX-4571SA

:

B

0

:

PURE SN

Base Model	Pkg.
RTC-4574NB	SON 22 PIN
RX-4045NB	SON 22 PIN
RX-4045SA	SOP 14 PIN
RX-4574LC	VSOJ 12 PIN
RX-4575LC	VSOJ 12 PIN
RX-4571LC	VSOJ 12 PIN
RX-4571NB	SON 22 PIN
RX-4571SA	SOP 14 PIN
RX-4801SA	SOP 14 PIN
RX-4803SA	SOP 14 PIN
RX-4803LC	VSOJ 12 PIN

Frequency Tolerance (Ta =+25 °C):	
RTC-4574NB	B=5+/-23PPM
RX-4045NB, RX-4045SA	AA=5+/-5PPM AC=0+/-5PPM
RX-4574LC	B=5+/-23PPM
RX-4575LC	B=5+/-23PPM
RX-4571LC	B=5+/-23PPM
RX-4571NB	B=5+/-23PPM
RX-4571SA	B=5+/-23PPM
RX-4801SA	Over -40 to +85 °C UB=+/-5PPM
RX-4803SA, RX-4803LC	Over -40 to +85 °C UA=+/-3.4PPM UB=+/-5PPM

Tape & Reel Qty
SOP Package Type Only
 Blank: Bulk
 0: 1000 pcs. per reel
 3: 250 pcs. per reel
DIP Package Type Only
 S: 25pcs/Stick

PURE SN
 Blank : Already RoHS Compliant



Note:

All LC packages are already RoHS Compliant with "PURE SN"
 *RX-4575LC - Sn-Ag Plating NOT PURE SN

Product Configuration System



Real Time Clock Modules – I²C-Bus

RX-8581SA

:

B

0

:

PURE SN

Base Model	Pkg.
RA-8565SA	SOP 14 PIN
RX-8025NB	SON 22 PIN
RX-8025SA	SOP 14 PIN
RX-8564LC	VSOJ 12 PIN
RX-8571SA	SOP 14 PIN
RX-8571NB	SON 22 PIN
RX-8571LC	VSOJ 12 PIN
RX-8581JE	VSOJ 20 PIN
RX-8581NB	SON 22 PIN
RX-8581SA	SON 14 PIN
RX-8731LC	VSOJ 12 PIN

Frequency Tolerance:	
RA-8565SA	B=5+/-23PPM
RX-8025NB	AA=5+/-5PPM
RX-8025SA	AA=5+/-5PPM
RX-8564LC	B=5+/-23PPM
RX-8571SA	B=5+/-23PPM
RX-8571NB	B=5+/-23PPM
RX-8571LC	B=5+/-23PPM
RX-8581JE	B=5+/-23PPM
RX-8581NB	B=5+/-23PPM
RX-8581SA	B=5+/-23PPM
RX-8731LC	B=5+/-23PPM

0

Tape & Reel Qty
SOP Package Type Only
 Blank: Bulk
 0: 1000 pcs. per reel
 3: 250 pcs. per reel
DIP Package Type Only
 S: 25pcs/Stick

PURE SN
 Blank : Already RoHS Compliant

Note:
 All LC packages are already RoHS Compliant with “PURE SN”



Product Configuration System



Real Time Clock Modules – I²C-Bus

RA-8581SA

Base Model	Pkg.
RA-8581SA	SOP 14 PIN
RTC-8564JE	VSOJ 20 PIN
RTC-8564NB	SON 22 PIN
RX8010SJ	SOP 8 PIN
RA4803SA	SOP 14 PIN
RA8803SA	SOP 14 PIN
RX8900SA	SOP 14 PIN
RA8900SA	
RX8900CE	3.2x2.5mm
RA8900CE	10 PIN Ceramic

:

B

Frequency Tolerance:	
RA-8581SA	B=5+/-23PPM
RTC-8564JE	B=5+/-23PPM
RTC-8564NB	B=5+/-23PPM
RX8010SA	B=5+/-23PPM
RX4803SA and RX8803SA	UA= +/-3.4PPM -40°C to 85°C UB= +/-5.0PPM -40°C to 85°C UC= +/- 5PPM -30°C to 70°C AA=5+/-5PPM 25°C
RX8900SA RA8900SA and RX8900CE RX8900CE	UA= +/-3.4PPM -40°C to 85°C UB= +/-5PPM -40°C to 85°C UC= +/-5PPM -30°C to 70°C

0

:

PURE SN

Tape & Reel Qty
SOP Package Type Only
 B: Bulk
 0: 1000 pcs. per reel
 3: 250 pcs. per reel

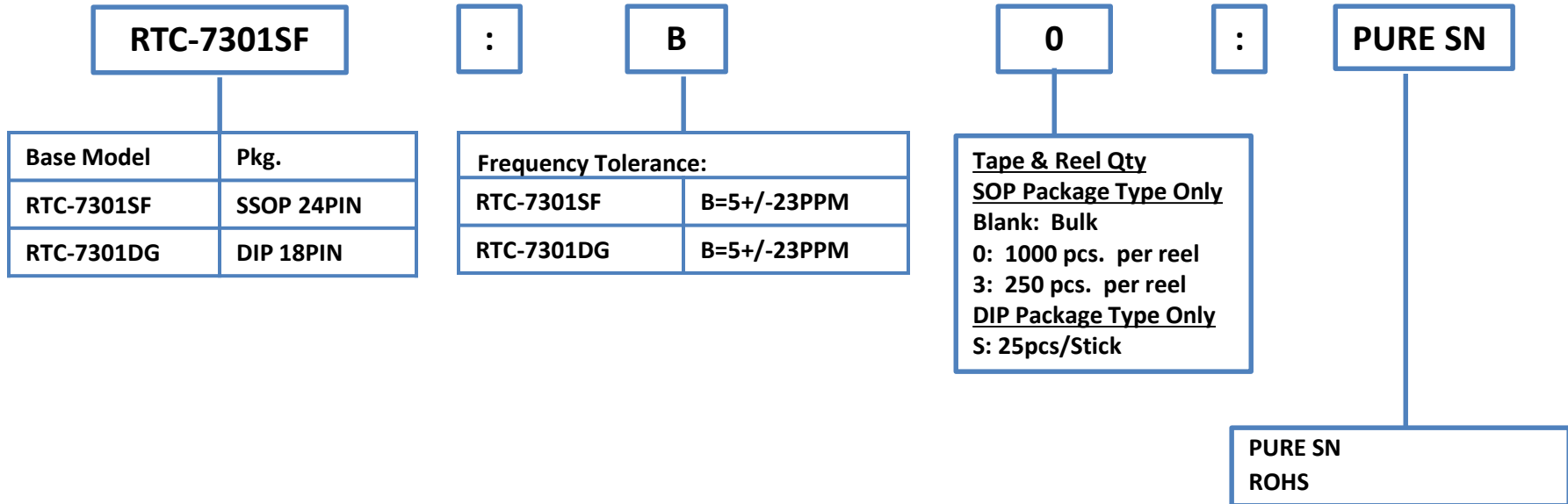
Blank : CE Package
 RX8010SJ: PURE SN
 RA4803SA: PURE SN
 RX8803SA: PURE SN
 RX8900SA: PURE SN
 RA-8581SA: ROHS or PURE SN
 RTC-8564JE: ROHS
 RTC-8564NB: ROHS or PURE SN



Product Configuration System



Real Time Clocks – Parallel 4-bit



Product Configuration System



Real Time Clocks – Parallel 4-bit

RTC-72423A

Base Model	Pkg.	Freq. Tolerance
RTC-62421A	DIP 18PIN	+/-10ppm
RTC-62421B	DIP 18PIN	+/-50ppm
RTC-72421A	DIP 18PIN	+/-10ppm
RTC-72421B	DIP 18PIN	+/-50ppm
RTC-72423A	SSOP 24PIN	+/-20ppm
RTC-72423B	SSOP 24PIN	+/-50ppm

0

:

PURE SN

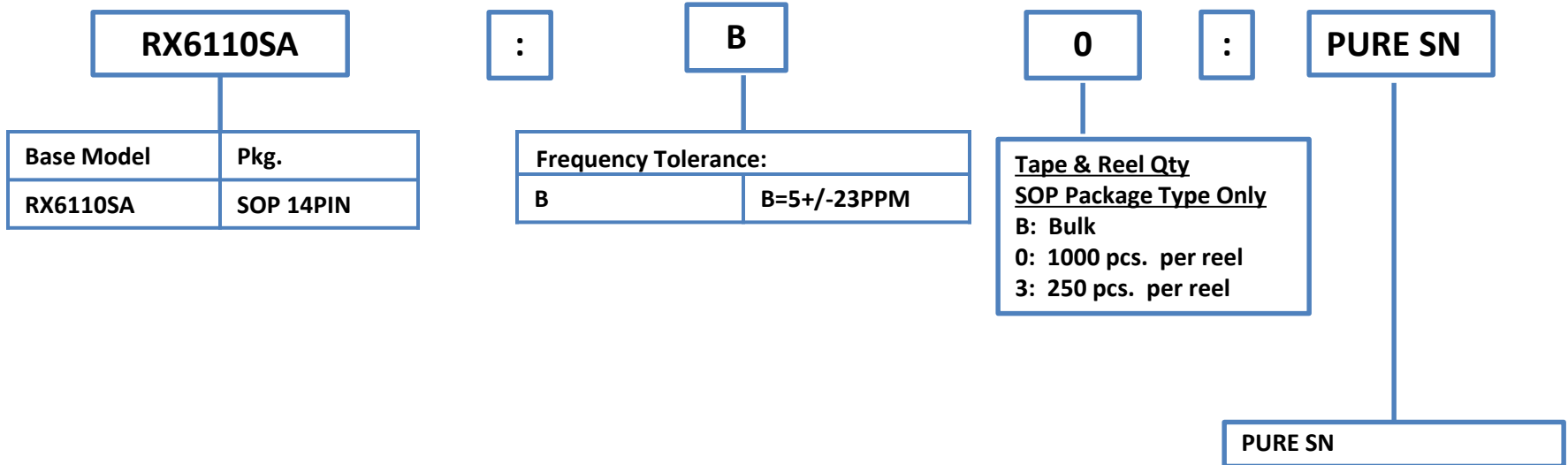
Tape & Reel Qty
SOP Package Type Only
Blank: Bulk
0: 1000 pcs. per reel
3: 250 pcs. per reel
DIP Package Type Only
S: 25pcs/Stick

PURE SN
ROHS

Product Configuration System



Real Time Clock Modules – I²C-Bus and SPI



Product Configuration Guide

Appendix

Product Configuration System

Crystal Units Load Cap Codes and Values

Load Cap Code	Load Cap Value
AZ	3.5
VJ	4.0
EE	4.4
AT	4.8
X	5.0
JJ	5.4
E	6.0
FF	6.4
DD	6.5
VC	6.7
AG	7.0
AR	7.1
JK	7.4
VB	7.6
AN	7.8
AJ	8.0
AS	8.5
CC	8.7
GG	8.8
AC	9.0
AM	9.2

Load Cap Code	Load Cap Value
AL	9.5
S	9.6
VF	9.8
K	10.0
HH	10.4
AK	10.5
AP	10.7
P	11.0
AY	11.2
AW	11.5
W	12.0
A	12.5
T	13.0
N	13.5
Y	14.0
VH	14.5
R	15.0
B	16.0
AV	17.0
C	18.0
L	18.3

Load Cap Code	Load Cap Value
J	18.5
AQ	19.0
G	20.0
AF	21.5
D	22.0
AU	22.5
AE	22.9
AH	23.0
V	24.0
AI	25.0
Z	26.0
AA	27.0
Q	28.0
AB	30.0
H	32.0
I	33.0
U	47.0
AD	50.0
M	100.0
F	Series