CRYSTAL OSCILLATORS, CLASS 2,
4MHz TO 100MHz, AHCMOS COMPATIBLE
OUTPUT, RAD-HARD

BASED ON TYPE RK135

ESCC Detail Specification No. 3503/001

Issue 1	November 2015

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DOCUMENTATION CHANGE NOTICE

(Refer to https://escies.org for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION

TABLE OF CONTENTS

1   GENERAL

1.1   SCOPE
This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2   APPLICABLE DOCUMENTS
The following documents form part of this specification and shall be read in conjunction with it:

(a)   ESCC Generic Specification No. 3503.

1.3   TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS
For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply.

1.4   THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1   The ESCC Component Number
The ESCC Component Number shall be constituted as follows:

Example: 350300101R100M000000

- Detail Specification Reference: 3503001
- Component Type Variant Number: 01 (as required)
- Total Dose Radiation Level Letter (100kRAD(Si)): R (as required)
- Characteristic code: Nominal Frequency (100MHz): 100M000000 (as required)

1.4.2   Characteristics Codes
Characteristics to be codified as part of the ESCC Component Number shall be as follows:

(a)   Nominal Frequency expressed by means of the following codes. The unit quantity shall be MHz:

Nominal Frequency f_{Nom} (MHz)	Code
X.XXXXXX	XMXXXXXX
XX.XXXXXX	XXMXXXXXX
XXX.XXXXXX	XXXMXXXXXX

1.4.3   Component Type Variants

The component type variants applicable to this specification are as follows:

Variant Number	Nominal Output Frequency f_{Nom} (MHz)	Case	Nominal Supply Voltage V_{CCNom} (V)	Terminal Material and Finish	Weight max g	Total Dose Radiation Level Letter
01	4 to 100	FP1	3.3	D2	5	R [100kRAD(Si)]
02	4 to 100	FP2	3.3	D2	5	R [100kRAD(Si)]
03	4 to 100	FP3	3.3	D2	5	R [100kRAD(Si)]
04	4 to 100	FP4	3.3	D2	5	R [100kRAD(Si)]
05	4 to 100	DIL1	3.3	G2	5	R [100kRAD(Si)]
06	4 to 100	JL2	3.3	D2	2	R [100kRAD(Si)]
07	4 to 100	FP1	5	D2	5	R [100kRAD(Si)]
08	4 to 100	FP2	5	D2	5	R [100kRAD(Si)]
09	4 to 100	FP3	5	D2	5	R [100kRAD(Si)]
10	4 to 100	FP4	5	D2	5	R [100kRAD(Si)]
11	4 to 100	DIL1	5	G2	5	R [100kRAD(Si)]
12	4 to 100	JL2	5	D2	2	R [100kRAD(Si)]

The terminal material and finish shall be in accordance with the requirements of ESCC Basic Specification No. 23500.

Total dose radiation level letters are defined in ESCC Basic Specification No. 22900. If an alternative radiation test level is specified in the Purchase Order the letter shall be changed accordingly.

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Supply Voltage	V_{cc}	-0.5 to +7	V	Note 1
Load Impedance	C_L	50	pF	Note 2
Operating Temperature Range	T_{op}	-55 to +125	°C	T_{amb}
Storage Temperature Range	T_{stg}	-55 to +125	°C	
Soldering Temperature	T_{sol}	+260	°C	Note 3

NOTES:
1. Device is functional as follows:
   - Variants 01 to 06: $2.97V \leq V_{CC} \leq 3.63V$ (where nominal V_{CC}, V_{CCNom} = 3.3V)
   - Variants 07 to 12: $4.5V \leq V_{CC} \leq 5.5V$ (where nominal V_{CC}, V_{CCNom} = 5V)

2. Device is functional as follows:
   - Variants 01 to 06:
     - For $4MHz \leq f_{Nom} < 80MHz$: $C_{LMin} = 13pF \leq C_L \leq C_{LMax} = 18pF$ (load in parallel with $R_L = 1k\Omega$) (where nominal C_L, C_{LNom} = 15pF)
     - For $80MHz \leq f_{Nom} \leq 100MHz$: $C_{LMin} = 8.2pF \leq C_L \leq C_{LMax} = 11pF$ (load in parallel with $R_L = 1k\Omega$) (where nominal C_L, C_{LNom} = 10pF)
   - Variants 07 to 12: $C_{LMin} = 13pF \leq C_L \leq C_{LMax} = 18pF$ (load in parallel with $R_L = 1k\Omega$)) (where nominal C_L, C_{LNom} = 15pF)

3. Hand soldering: duration 10 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

1.6   PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.6.1   Flat Package (FP1) – 14 leads
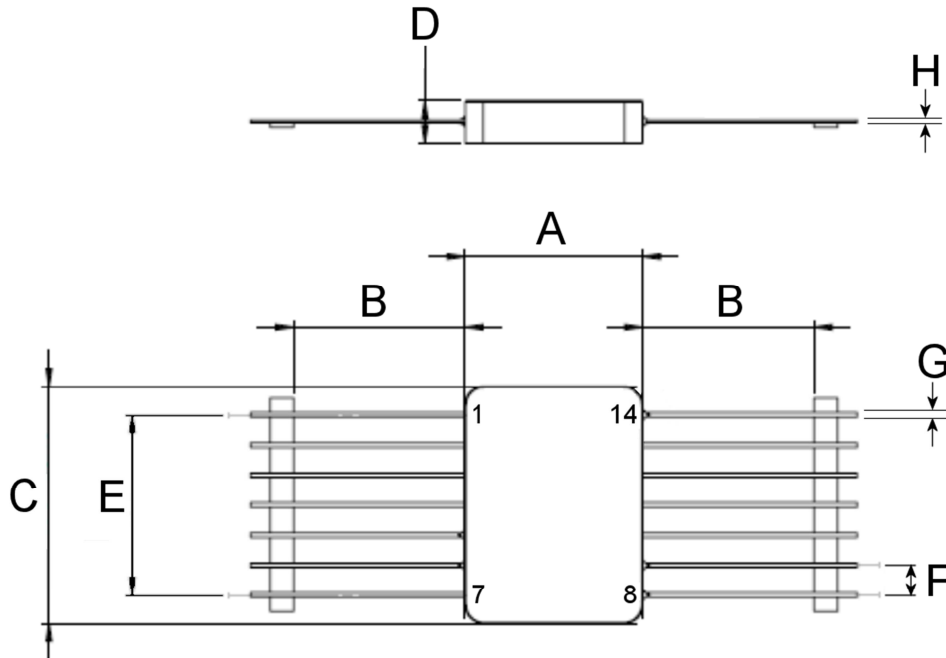
Symbols	Dimensions mm		Notes
	Min	Max	
A	14.86	15.12	
B	14	15	
C	19.94	20.2	
D	-	3.71	
E	15.24 BSC		2 places
F	2.54 BSC		All leads
G	0.28	0.48	All leads
H	0.15	0.35	All leads

NOTES:
1.   The terminal identification is specified by marking of the terminal number on the lid as shown.
      See Functional Diagram for the terminal connections.

1.6.2   Flat Package (FP2) – 20 leads
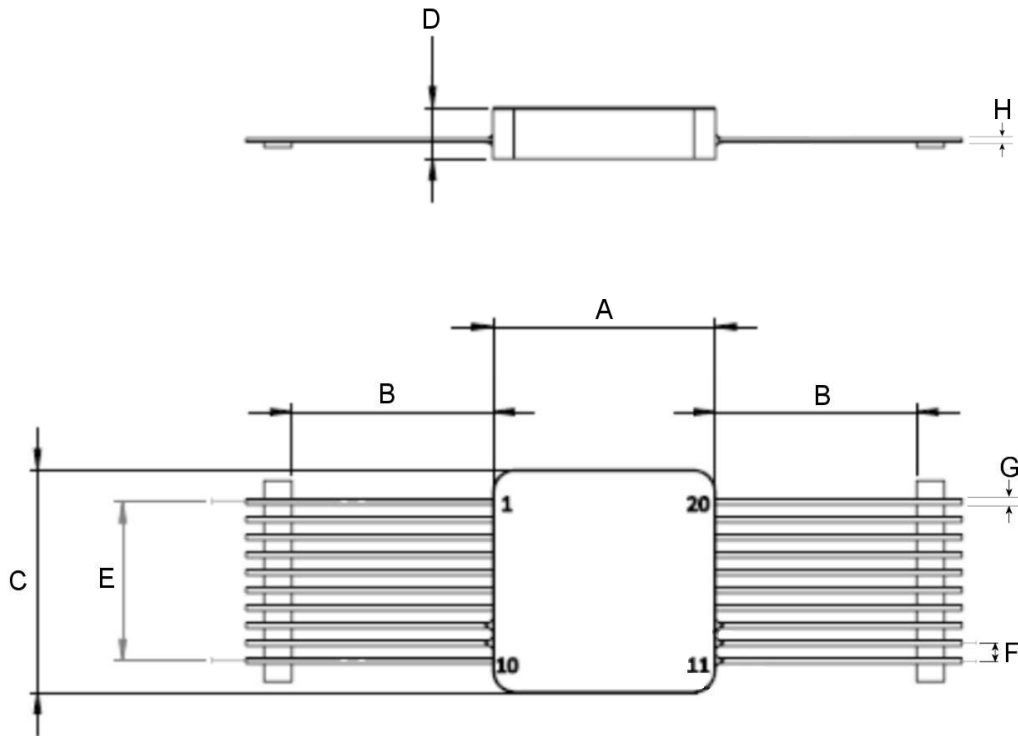
Symbols	Dimensions mm		Notes
	Min	Max	
A	15.75	16.01	
B	14	15	
C	15.75	16.01	
D	-	3.83	
E	11.43 BSC		2 places
F	1.27 BSC		All leads
G	0.28	0.48	All leads
H	0.15	0.35	All leads

NOTES:
1.   The terminal identification is specified by marking of the terminal number on the lid as shown.
    See Functional Diagram for the terminal connections.

1.6.3   Flat Package (FP3) – 12 leads
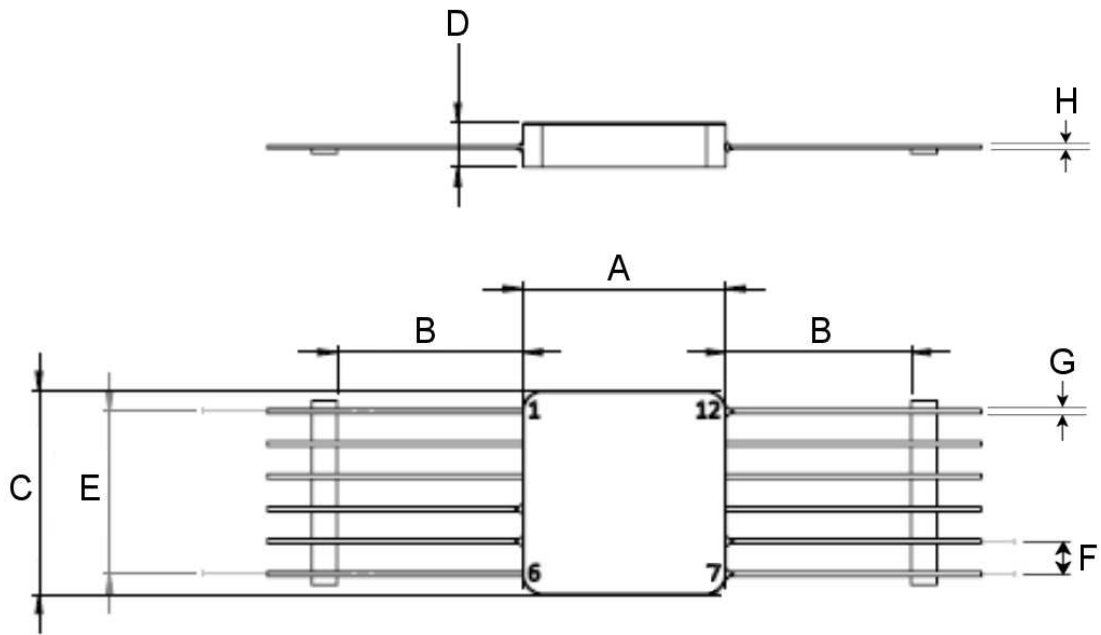
Symbols	Dimensions mm		Notes
	Min	Max	
A	15.75	16.01	
B	14	15	
C	15.75	16.01	
D	-	3.58	
E	12.7 BSC		2 places
F	2.54 BSC		All leads
G	0.28	0.48	All leads
H	0.15	0.35	All leads

NOTES:
1.   The terminal identification is specified by marking of the terminal number on the lid as shown. See Functional Diagram for the terminal connections.

1.6.4   Flat Package (FP4) – 16 leads
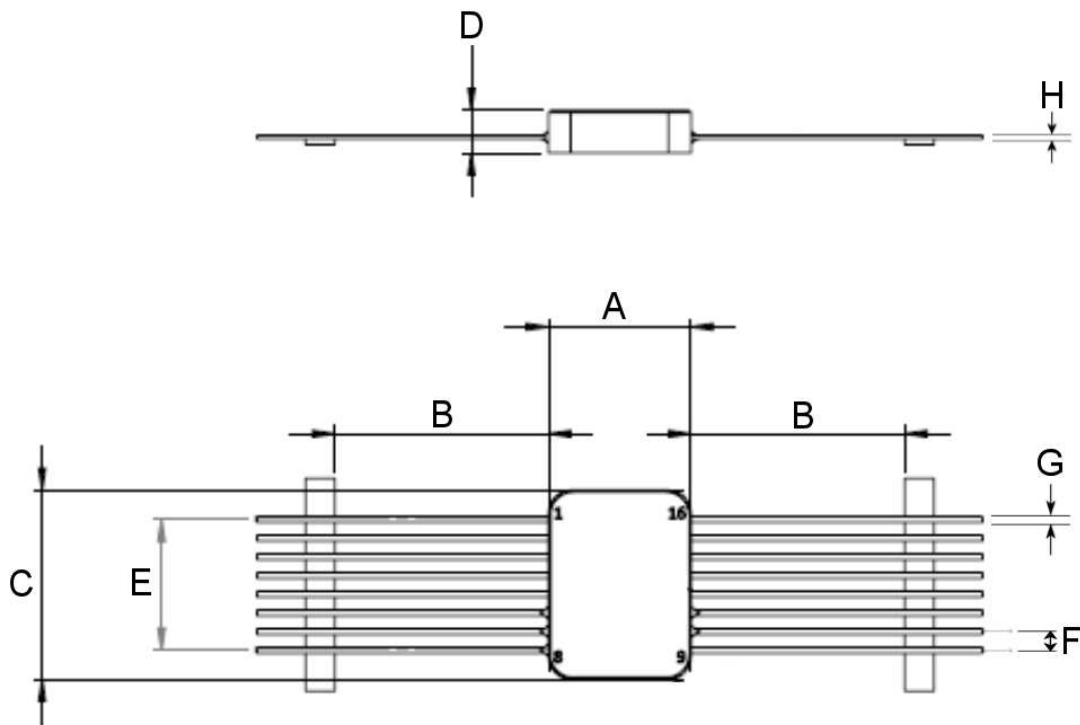
Symbols	Dimensions mm		Notes
	Min	Max	
A	-	9.66	
B	13.9	15.1	
C	-	12.83	
D	-	3.1	
E	8.89 BSC		2 places
F	1.27 BSC		All leads
G	0.28	0.48	All leads
H	0.15	0.35	All leads

NOTES:
1.   The terminal identification is specified by marking of the terminal number on the lid as shown.
      See Functional Diagram for the terminal connections.

1.6.5   Dual-in–Line Package (DIL1) – 14 leads
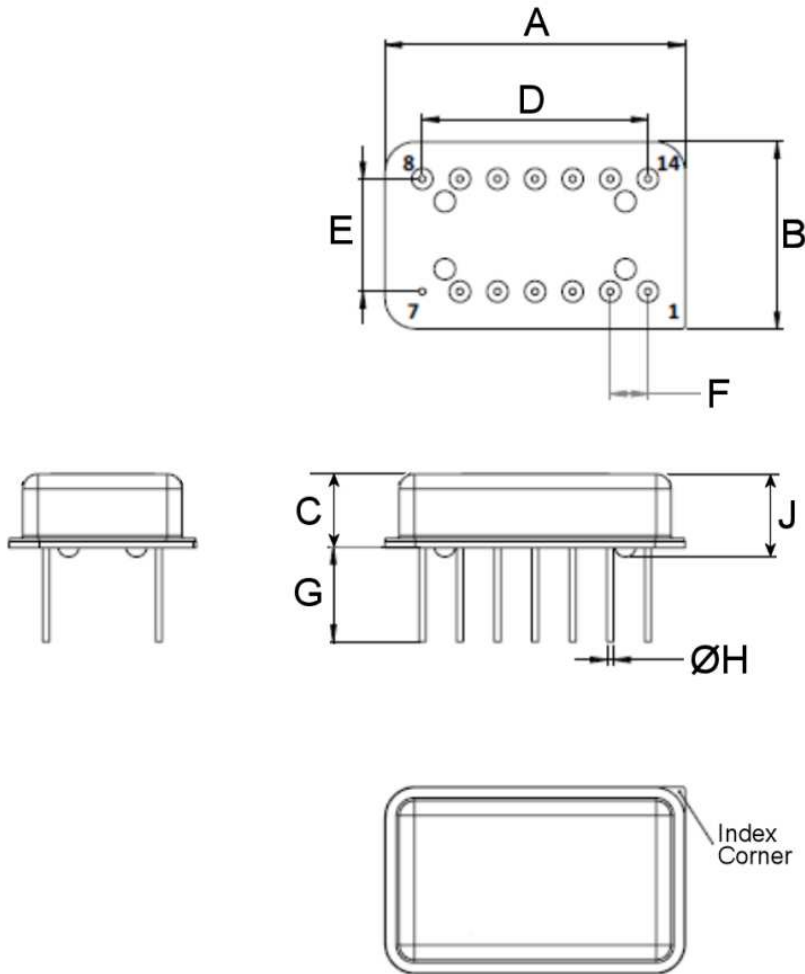
Symbols	Dimensions mm		Notes
	Min	Max	
A	-	20.7	
B	-	13.1	
C	-	5.45	
D	15.24 BSC		2 places
E	7.62 BSC		All leads
F	2.54 BSC		All leads
G	6.22	6.48	All leads
ØH	0.25	0.65	All leads
J	-	6	4 places

NOTES:
1.   The terminal identification is specified by reference to the index corner as shown. See Functional Diagram for the terminal connections.

1.6.6   J-Lead Package (JL2) – 4 leads

Index Corner
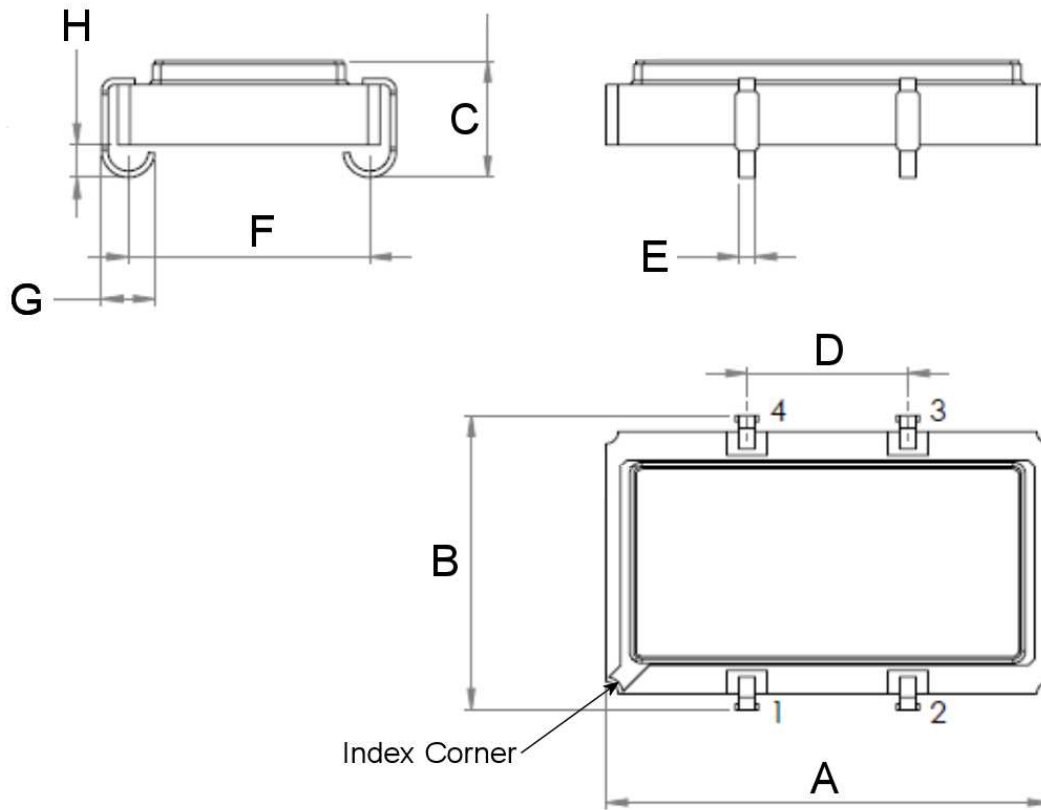
| | Dimensions mm | | Notes |
Symbols	Min	Max	
A	13.72	14.22	
B	8.8	9.8	2 places
C	-	4.2	All leads
D	4.93	5.23	2 places
E	0.46	0.56	All leads
F	7.42	7.82	All leads
G	1.58	1.78	All leads
H	0.89	1.15	All leads

NOTES:
1.   The terminal identification is specified by reference to the index corner as shown. See Functional Diagram for the terminal connections.
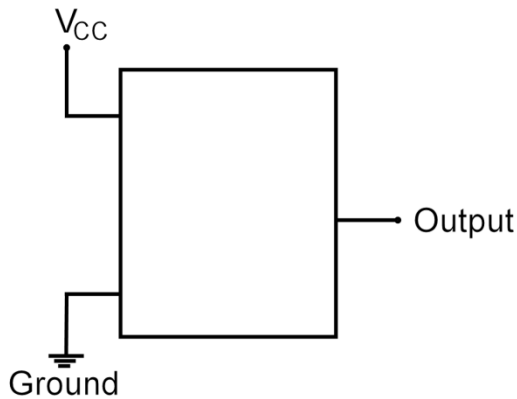
1.7   FUNCTIONAL DIAGRAM

Variant Number	Case	Terminal Number				Notes
		Output	V_{CC}	Ground	Not Connected	
01, 07	FP1	8	14	1, 2, 3, 4, 7, 10, 11, 12, 13	5, 6, 9	1, 2
02, 08	FP2	11	13	1, 2, 3, 4, 5, 6, 7, 10, 14, 15, 16, 17, 18, 19, 20	8, 9, 12	1, 2
03, 09	FP3	7	12	1, 2, 3, 6, 9, 10, 11	4, 5, 8	1, 2
04, 10	FP4	10	8	1, 2, 3, 4, 5, 9, 12, 13, 14, 15, 16	6, 7, 11	1, 2
05, 11	DIL1	8	14	7	1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13	1, 2
06, 12	JL2	3	4	2	1	1, 2

NOTES:
1.   The case is connected to Ground.
2.   Not connected pins must be connected to a potential (e.g. Ground)

1.8   MATERIALS AND FINISHES
        Materials and finishes shall be as follows:

        (a)   Case
              The FP1, FP2, FP3, FP4 and DIL1 cases shall be hermetically sealed, and have a metal
              body with hard glass seals and a seam sealed metal lid.

              The JL2 case shall be hermetically sealed, and have a ceramic body with brazed leads and a
              seam sealed lid.

        (b)   Terminals
              As specified in Component Type Variants.

2   REQUIREMENTS

2.1   GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1   Oscillator Class

The components specified herein shall satisfy the requirements Class 2 Oscillators in accordance with the Generic Specification.

2.1.2   Deviations from the Generic Specification

None.

2.2   MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

(a)   Terminal identification.
(b)   The ESCC Qualified Component symbol (for ESCC qualified components only).
(c)   The ESCC Component Number.
(d)   Traceability information.

2.3 <u>ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES</u>
Electrical measurements shall be performed at room, high and low temperatures. Consolidated notes are given after the tables.

2.3.1 <u>Room Temperature Electrical Measurements</u>

Characteristics	Symbols	Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Input Current	I_{IN}	ESCC No. 24200	For 4MHz ≤ f_{Nom} < 20MHz: For 20MHz ≤ f_{Nom} < 50MHz: For 50MHz ≤ f_{Nom} ≤ 100MHz:	- - -	20 25 30	mA
Output Waveform	-	ESCC No. 24200		Symmetrical Square Wave		-
Output Voltage High Level Variants 01 to 06: Variants 07 to 12:	V_{OH}	ESCC No. 24200		2.4 4.5	- -	V
Output Voltage Low Level Variants 01 to 06: Variants 07 to 12:	V_{OL}	ESCC No. 24200		- -	0.4 0.5	V
Frequency Accuracy	$\Delta f/f_{Nom}$	ESCC No. 24200	At T_{amb} = +25 ±1°C Referred to f_{Nom}	-	±25	ppm
Frequency-Voltage Tolerance Variants 01 to 06: Variants 07 to 12:	$\Delta f/f(V)$	ESCC No. 24200	At T_{amb} = +25 ±1°C Referred to f at V_{CCNom} For 2.97V, 3.3V & 3.63V: For 4.5V, 5V & 5.5V:	 - -	 ±3 ±3	ppm
Frequency-Load Tolerance	$\Delta f/f(L)$	ESCC No. 24200	At T_{amb} = +25 ±1°C For C_L = C_{LMin}, C_{LNom} & C_{LMax}, R_L = 1kΩ, Referred to f at C_{LNom}	-	±5	ppm
Startup Time	t_{su}	ESCC No. 24200		-	10	ms
Rise Time	t_r	ESCC No. 24200	For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz:	- -	10 5	ns
Fall Time	t_f	ESCC No. 24200	For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz:	- -	10 5	ns
Duty Cycle	DC	ESCC No. 24200		45	55	%
Ageing Analysis	$\Delta f/f$	ESCC No. 3503	Ageing Period = 1 year Note 3	-	±5	ppm

2.3.2   High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Input Current	I_{IN}	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +125 (+0 -5)°C For 4MHz ≤ f_{Nom} < 20MHz: For 20MHz ≤ f_{Nom} < 50MHz: For 50MHz ≤ f_{Nom} ≤ 100MHz:	- - -	20 25 30	mA
Output Waveform	-	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +125 (+0 -5)°C	Symmetrical Square Wave		-

Output Voltage High Level
   Variants 01 to 06:
   Variants 07 to 12:
	V_{OH}	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +125 (+0 -5)°C	
				
				2.4
				4.5
					
					-
					-
						V

Output Voltage Low Level
   Variants 01 to 06:
   Variants 07 to 12:
	V_{OL}	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +125 (+0 -5)°C	
				
				-
				-
					
					0.4
					0.5
						V

Frequency-Temperature Stability	$\Delta f/f(T)$	ESCC No. 24200	At T_{amb} = -55 (+1 -0)°C to +125 (+0 -1)°C. Note 2 Referred to f at T_{amb} = +25 ±1°C	-	50	ppm

Frequency-Voltage Tolerance
   Variants 01 to 06:
   Variants 07 to 12:
	$\Delta f/f(V)$	ESCC No. 24200	At T_{amb} = -55 (+1 -0)°C and +125 (+0 -1)°C
			Referred to f at V_{CCNom}
			      For 2.97V, 3.3V & 3.63V:
			      For 4.5V, 5V & 5.5V:
				
				-
				-
					
					±3
					±3
						ppm

Startup Time	t_{su}	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +125 (+0 -5)°C		10	ms
Rise Time	t_r	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +105 (+0 -5)°C For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz: At T_{amb} = +125 (+0 -5)°C For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz:	 - - - -	 10 5 10 7	ns
Fall Time	t_f	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +105 (+0 -5)°C For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz: At T_{amb} = +125 (+0 -5)°C For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz:	 - - - -	 10 5 10 7	ns
Duty Cycle	DC	ESCC No. 24200	At T_{amb} = -55 (+5 -0)°C and +125 (+0 -5)°C	45	55	%

2.3.3   Notes to Room, High and Low Electrical Measurements
1.   Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3°C and the component under test shall be operated at V_{CCNom} with an output load of C_{LNom} in parallel with R_L = 1kΩ. V_{CCNom} and C_{LNom} are specified in Maximum Ratings.
2.   Frequency-Temperature Stability shall be measured at a minimum of 10 equally spaced increments over the specified temperature range.
3.   All measurements aquired during Frequency Ageing shall be taken into account when performing Ageing Analysis.

2.4   PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits			Units
		Drift Value Δ	Absolute		
			Min	Max	

Input Current
    For 4MHz ≤ f_{Nom} < 20MHz:
    For 20MHz ≤ f_{Nom} < 50MHz:
    For 50MHz ≤ f_{Nom} ≤ 100MHz:
	I_{IN}	±5%
		±5%
		±5%
			-
			-
			-
				20
				25
				30
					mA

Frequency Accuracy	$\Delta f/f_{Nom}$	±10	- -	±15 (1) ±25 (2)	ppm

NOTES:
1.   Initial measurement.
2.   Final measurement.

2.5   INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3 °C.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements or High and Low Temperatures Electrical Measurements as follows.

The drift values (Δ) shall not be exceeded for each characteristic specified. Unless otherwise specified, the corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Test Conditions	Limits			Units
			Drift Value Δ	Absolute		
				Min	Max	
Input Current For 4MHz ≤ f_{Nom} < 20MHz: For 20MHz ≤ f_{Nom} < 50MHz: For 50MHz ≤ f_{Nom} ≤ 100MHz:	I_{IN}	As per Room Temperature Electrical Measurements	- - -	- - -	20 25 30	mA
Output Waveform	-	As per Room Temperature Electrical Measurements	-	Symmetrical Square Wave		-
Output Voltage High Level Variants 01 to 06: Variants 07 to 12:	V_{OH}	As per Room Temperature Electrical Measurements	- -	2.4 4.5	- -	V
Output Voltage Low Level Variants 01 to 06: Variants 07 to 12:	V_{OL}	As per Room Temperature Electrical Measurements	- -	- -	0.4 0.5	V
Frequency Accuracy	$\Delta f/f_{Nom}$	As per Room Temperature Electrical Measurements	±8.5 (1)	-	±25 (2)	ppm
Frequency-Temperature Stability	$\Delta f/f(T)$	As per High and Low Temperatures Electrical Measurements		-	50	ppm
Rise Time For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz:	t_r	As per Room Temperature Electrical Measurements	- -	- -	10 5	ns
Fall Time For 4MHz ≤ f_{Nom} < 16MHz: For 16MHz ≤ f_{Nom} ≤ 100MHz:	t_r	As per Room Temperature Electrical Measurements	- -	- -	10 5	ns
Duty Cycle	DC	As per Room Temperature Electrical Measurements	-	45	55	%

NOTES:
1.   Drift value (Δ) is only applicable to testing during the Endurance Subgroup.
2.   Absolute limit is only applicable to testing during the Environmental/Mechanical Subgroup.

2.6   BURN-IN CONDITIONS
The test conditions for Burn-in, tested as specified in the ESCC Generic Specification, shall be as follows:

(a)   Ouptut Load: C_{LNom} in parallel with R_L = 1kΩ. C_{LNom} is specified in Maximum Ratings.

2.7   FREQUENCY AGEING CONDITIONS
The test conditions for Frequency Ageing, tested as specified in the ESCC Generic Specification, shall be as follows:

(a)   Ouptut Load: C_{LNom} in parallel with R_L = 1kΩ. C_{LNom} is specified in Maximum Ratings.

2.8   OPERATING LIFE CONDITIONS
The test conditions for Operating Life, tested as specified in the ESCC Generic Specification, shall be as follows:

(a)   Ouptut Load: C_{LNom} in parallel with R_L = 1kΩ. C_{LNom} is specified in Maximum Ratings.

2.9   TOTAL DOSE RADIATION TESTING
All lots shall be irradiated in accordance with ESCC Basic Specification No. 22900, low dose rate (window 2: 36RAD to 360RAD per hour).

2.9.1   Bias Conditions and Total Dose Level for Total Dose Radiation Testing
The following bias condition (worst-case) shall be used for Total Dose Radiation Testing at T_{amb} = +22 ±3°C:

With Supply Voltage:
- Variants 01 to 06: V_{CC} = 3.63V during irradiation.
- Variants 07 to 12: V_{CC} = 5.5V during irradiation.

The total dose level applied shall be as specified in the component type variant information herein or in the Purchase Order.

2.9.2   Electrical Measurements for Total Dose Radiation Testing
Prior to irradiation testing the devices shall have successfully met Room Temperature Electrical Measurements specified herein.

Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3°C.

Unless otherwise specified, the test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The parameters to be measured during irradiation testing, on completion of irradiation testing, after 24 hours anneal at Room Temperature and after 168 hours anneal at T_{amb} = +100 ±3°C are shown below.

Characteristics	Symbols	Limits		Units
		Absolute		
		Min	Max	

Input Current
    For 4MHz ≤ f_{Nom} < 20MHz:
    For 20MHz ≤ f_{Nom} < 50MHz:
    For 50MHz ≤ f_{Nom} ≤ 100MHz:
	I_{IN}	-
		-
		-
			20
			25
			30
				mA

Output Waveform	-	Symmetrical Square Wave		-

Output Voltage High Level
    Variants 01 to 06:
    Variants 07 to 12:
	V_{OH}	2.4
		4.5
			-
			-
				V

Output Voltage Low Level
    Variants 01 to 06:
    Variants 07 to 12:
	V_{OL}	-
		-
			0.4
			0.5
				V

Frequency Accuracy	$\Delta f/f_{Nom}$	-	±25	ppm

Rise Time
    For 4MHz ≤ f_{Nom} < 16MHz:
    For 16MHz ≤ f_{Nom} ≤ 100MHz:
	t_r	-
		-
			10
			5
				ns

Fall Time
    For 4MHz ≤ f_{Nom} < 16MHz:
    For 16MHz ≤ f_{Nom} ≤ 100MHz:
	t_f	-
		-
			10
			5
				ns

Duty Cycle	DC	45	55	%