How to use CFormat Ver1.2

2019/6/1 http://www.lpb-forum.com/



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What's New

2019/2/28:

- The CFormat Library for ceramic capacitors has been released by Murata Manufacturing Co., Ltd. . https://www.murata.com/ja-jp/tool/c-format
- EDA tool can read C-Format file directory, and you can convert the CFormat to ANSYS/Siwave, CADENCE/Sigrit libraries using LPB DesignKit (C-HUB).





PURPOSE OF LPB FORMAT



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Challenges in the design

Due to advances in computer speed and algorithms, CAD / EDA processing is getting faster every year. However, a period of time spent collecting design information and configuring EDA tools is still a bottleneck as it relies on human resources.



To shorten the development period, it is necessary to improve the efficiency of the part relying on human resources.



Purpose of LPB Format

Recent design styles have shifted to horizontal international specialization. In this style, a system is designed by several design houses having own design culture. We should adjust manually the following differential of design house's culture.

- Difference in form of design specification.
- Difference in file format of EDA tool to use.
- Difference of technical terms

The ratio of such kind of work that dependent on human resources is increasing year by year.



LPB Format is a standard to improve the efficiency of parts relied on human resources.



Effects of using LPB Format





LPB Format reduces the troubles of data exchange.

LPB Format improves the efficiency of EDA setting.

As for case study, please see the following URL. <u>http://www.jeita-sdtc.com/jeita-edatc/wg_lpb/home/docs/eds11nov_sp02.pdf</u>



LPB FORMAT OVERVIEW



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What is LPB Format?

LPB Format is a data format to improve the efficiency of work relied on human resources. It is standardized by IEC and IEEE.

Preview

https://www.techstreet.com/products/preview/1908285

http://jeita-sdtc.com/publishedmaterials/lpbformatv3_preview_download/

Sample

http://jeita-sdtc.com/publishedmaterials/lpbformat_download/

IEC 63055:2016

Format for LSI-Package-Board Interoperable design

https://webstore.iec.ch/publication/26181

IEEE2401-2015

IEEE Standard Format for LSI-Package-Board Interoperable Design

https://www.techstreet.com/standards/ieee-2401-2015?product_id=1908285



LPB Format Adoption Status

- More than 13 CAD/EDA vendors adopte LPB Format as an interface (see left figure).
- Referenced board design data are published by LPB Format
 - Toshiba Electronic Devices & Storage Corporation etc.
- Parts libraries are published byLPB Format.
 - Murata Manufacturing Co., Ltd.
 - Toshiba Electronic Devices & Storage Corporation etc.





LPB Format Configuration

LPB Format consists of the following five data formats.

- <u>M-Format</u> : Project Management
- **<u>N-Format</u>** : Netlist. Define connection information between parts
- <u>C-Format</u> : The component definition. Define design constraints, parts footprints and simulation model.
- <u>R-Format</u> : Design rules. Define the layer stack-up and rules such as line & space.
- <u>G-Format</u>: Geometry. Graphic data representing layer stack-up structure (2D) such as printed circuit board and IC package





WHAT CAN I DO WITH LPB C-FORMAT?



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How do I use C-Format?

Case studies using LPB Format are published in the URL below. <u>http://jeita-sdtc.com/publishedmaterials/lpbforum_documents/</u>

This notebook mainly explains the use of CFormat. CFormat contains the following information:

- Geometrical information of parts such as outer shape, foot-print and terminal name etc.
- Cross reference part's terminal with simulation models such as SPICE and IBIS.
- Design constraints such as skew, impedance and delay conditions etc.
- Layout information such as floor plans and part coordinates etc.



Basic form of CFormat

The most basic form of CFormat is a container of foot-print and simulation models.



Cross-reference the part's terminal with the I/O node of simulation model is defined in CFormat.



The CFormat provided by Murata Manufacturing Co., Ltd is also of this form.



What can I do with CFormat?

Since the physical shape and simulation model have been integrated, the simulation tool can be set up efficiently. We have published the following case studies.

- PI analysis using LPB format and IBIS5.0 http://jeita-sdtc.com/download/lpbforum/20170310 LPB-Forum/6 PI analysis with LPB Format and IBIS5.pdf
- Reduced turn around time for capacitor optimization using CFormat. http://jeita-sdtc.com/download/lpbforum/20160311_LPB-Forum/6a_DecupingOptimizationByCFoomat.pdf
- Efficient simulation using Cformat
 http://jeita-sdtc.com/download/lpbforum/20160311_LPB-Forum/6b_LPBSimulationByScripting.pdf



What can I do with CFormat?

CFormat provided by the part vendor can be converted into libraries of EDA tool using LPB design kit(%). It eliminates the hassle of preparing EDA libraries.



JEITA is encouraging various parts vendors to provide CFormat. At the present (2019/1), CFormat of capacitor component have been provided by Murata Manufacturing Co., Ltd.

(*) The following EDA can import the CFormat directory:

- <u>http://jeita-sdtc.com/download/lpbforum/20150319_LPB-Forum/3-2_DesignForce_Zuken.pdf</u>
- <u>http://gemdt.com/gempackage/</u>



What can I do with CFormat?

Some EDA tools can read CFormat directory for tool setup(\times). And

CFormat can be converted into libraries of EDA tool using LPB design kit. It eliminates the hassle of preparing EDA libraries.



JEITA is encouraging various parts vendors to provide CFormat. At the present (2019/1), CFormat of capacitor component have been provided by Murata Manufacturing Co., Ltd.

(%) The following EDA can import the CFormat directory:

- Mentor/HyperLynx
- ZUKEN/CR8000
- Gem Design Tech./GemPackage

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How do I convert CFormat to EDA library?

The design kit provided by JEITA has a function to convert CFormat (Condenser) into ANSYS / SIwave and CADENCE / Sigrity library. It shows an example of library conversion and BOM management.

http://jeita-sdtc.com/lpb-open-source-project/download/



Since CFormat is defined in XML(X), development of utility tools is easy. The source code is available for the design kit, so please refer to it.

(X) XML : <u>https://www.google.com/search?q=XML</u>



Other case study

LPB Format is a royalty-free data format. You can use it to build internal design infrastructure.

For example

Micro soft Excel is often used for design specifications. However, it is difficult to create the interface of EDA tool with Excel file because the form of Excel file is different for each design site. LPB Format can be solved this kind of problem. You can use LPB Format as a central HUB to build tool chain. A simple program is enough to convert Excel to CFormat.The LPB Design Kit (*) includes this kind of reference program.





LPB DESIGN KIT HOW TO USE "CHUB"



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What is CHUB?

CHUB is a tool in LPB DesignKit. It converts CFofrmat file for capacitor into library files of ANSYS/SIWave and CADENCE/Sigrity.



In additionally it has the following functions.

- Change parts name and family name to internal code name for internal management.
- Change the footprint provided by parts vendor to internal one according to the production rule.



Installation of LPB DesignKit

Please request DesignKit from the following URL.

http://jeita-sdtc.com/en/lpb-open-source-project/download/

- The download URL will be sent back to your email address.
- Extract the downloaded zip file into any folder (e.g. LPBDK).



Installation of LPB CFormat

1. The CFormat Library for ceramic capacitors has been released by Murata Manufacturing Co., Ltd. .

https://www.murata.com/ja-jp/tool/c-format

CFormat files are packed in ZIP format for each series. Download as many as you need.

 Extract the downloaded ZIP file into any folder (e.g. LIBTOP as shown III on the left figure).
 The downloaded ZIP file includes CFormat file, SPICE model file and S-Parameter file.



Series name Family name



Launch CHUB

Double-click on cformat_hub.exe (e.g. LPBDK/cformat_hub.exe) to launch CHUB.



Look & feel of CHUB



Convert CFormat to EDA library

Converting CFormat to EDA library is very simple. It takes only two steps as shown in the flow chart on the left.







Import CFormat files

File -> New project



- FootPrint Library (optional): Enter the file name of footprint library if you want to replace the footprint contained in the CFormat file with another one.
- Base CFormat Dir: Enter the name of the top folder where the CFormat files are saved (.e.g. LIBTOP).
- SPICE model Dir, SParameter model Dir : Automatically filled in when you enter "Base CFormat Dir".

IEITA/CFormat HUB – – X File Convert Validate Window Help	New Project
	FootPrint Library Browse
	Base CFormat Dir ATA_LIB¥TEST_20180820 Browse
	SPICE model Dir ATA_LIB¥TEST_20180820 Browse
Mercanes @ X Progress @ X	SParameter model Dir ATA_LIB¥TEST_20180820 Browse
	OK Cancel



Import CFormat files (cont.)

Press "OK" button to start importing CFormat files.

It will take times to import if the number of files is huge. It took about 20 minutes with Core 2 Duo T7250 (notebook PC about 10 years ago) when import all CFormat files delivered from Murata Manufacturing Co., Ltd. at once.

"Done" dialog will be displayed when finished. Press "YES" to close it.

	JEITA/CFormat HUB					- 0	×	×	
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			2						
020	11_008004 02052	015008 0402_01	1005 0603_0201 1005_0	402 1608_0603 201	2_0805 3216_120	6 3225_1210	4 ◀ ▶		
	Category	Family	File	Module	InHouseName	FootPrint	^	Dent liet erees	
1	0201_008004	GRM	GRM0115C1C5R2CE01.xml	GRM0115C1C5R2CE01		~		Part list area:	
2	0201_008004	GRM	GRM0115C1E7R0BE01.xml	GRM0115C1E7R0BE01		~			
3	0201_008004	GRM	GRM0112C1E4R8CE01.xml	GRM0112C1E4R8CE01		~	K	All parts will be listed here	
4	0201_008004	GRM	GRM0115C1C6R3BE01.xml	GRM0115C1C6R3BE01		~			
5	0201_008004	GRM	GRM0115C1E8R6DE01.xml	GRM0115C1E8R6DE01		~		after importing CFormat files	
6	0201_008004	GRM	GRM0115C1C8R4CE01.xml	GRM0115C1C8R4CE01		~			
7	0201_008004	GRM	GRM0115C1C9R3BE01.xml	GRM0115C1C9R3BE01		~			
8	0201_008004	GRM	GRM0112C1E6R9WE01.xml	GRM0112C1E6R9WE01		~			
9	0201_008004	GRM	GRM0112C1E9R4CE01.xml	GRM0112C1E9R4CE01		~			
10	0201 008004	GRM	GRM0115C1E4R2WE01.xml	GRM0115C1E4R2WE01		~	~	✓	
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20	18-12-02 13:36:	20: INFO : 0] 31: INFO : 0]	pen 0402_01005 pen 0603_0201						
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Con	vert LPB CFormat file								



Convert CFormat to Slwave library

Convert -> SIwave Lib 📑

Select a folder to save the Slwave library. If you do not have the desired folder, press "New Folder" to create a new folder.

	EITA/CFormat HUI	3			- 0	×		Select folder to save SIWave library files.		×	1	
File G	E Convert Valida	ite Window Hel	p 2					← → ✓ ↑ ≪ ForJEVeC2018 → demo	✓ ひ demoの検索	م		
322	_1210 1608_06	03 02052_015008	5750_2220	3216_1206 4520	0_1808 2012_0805	4 ⊴)►		整理 ▼ 新しいフォルダー		= • ?		
	Category	Family	File	Module	InHouseName	F ^		eclispe_workspace	^ 名前 ^			💵 SIWave Library 🛛 🎖 🛛 🔀 🖉
1	3225_1210	GRM	GRM32D7U3A2	GRM32D7U3A2	D1			Env34	SiWave			
2	3225_1210	GRM	GRM32E7U2J15	GRM32E7U2J15	D2			Env 37	Sirrave			
3	3225_1210	GRM	GRM32RR61C47	GRM32RR61C47	. D3		N N	EVENTECT				Library Name Local LIB
4	3225_1210	GRM	GRM32A7U2J22	GRM32A7U2J22	. D4			- EVENTEST			\parallel	
5	3225_1210	GRM	GRM32Q7U3A1	GRM32Q7U3A1	D5		∟ /	tuga-icon			15/	
6	3225_1210	GRM	GRM32ER71A47	GRM32ER71A47	. D6			HP HP			'	OK Cancel
7	3225_1210	GRM	GRM32DC81E10	GRM32DC81E10	. D7			BIS IBIS				OK Odnoor
8	3225 1210	GRM	GRMR2DR71C1	GRM32DR71C1	DR	~		JeitaLPB-Branch				
-								Leital PB-Master				
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: 20. : [''	''] 8-12-02 16:07 :/Users/aokiw 1/WC&'1	:53: INFO : Be /Development/MUF	use CFormat Dis WATA_LIB/LPB_20	r 018091				フォルダー:	フォルダーの選択	キャンセル		

• Library Name: Library name displayed in Slwave. Please enter any name. The default is Local_LI B.

Press OK button to start conversion.



Convert CFormat to Sigrity library

Convert -> Sigrity Lib

Select a folder to save the Sigrity library. If you do not have the desired folder, press "New Folder" to create a new folder.

EITA/CFormat HUB – 🗆 🗙	1	Select folder to save sigrity library files.		×			
File Convert Validate Window Help				0			
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Category Family File Module InHouseName File 1 2825_1210 GRM GRM3207U3A2 GRM3207U3A2 D1 File D1 2 3225_1210 GRM GRM3207U3A2 GRM3267U215 D2 D1 3 3225_1210 GRM GRM3267U215 GRM3267U215 D2 D2 4 3225_1210 GRM GRM3207U3A1 GRM3267U2122 D4 D4 5 3225_1210 GRM GRM3207U3A1 GRM3207U3A1 D5 D4 6 3225_1210 GRM GRM3207U3A1 GRM3207U3A1 D5 7 3225_1210 GRM GRM3207D3A1 GRM3207D3A1 D7 7 3225_1210 GRM GRM3207D31C1 GRM3207D31C1 D8 8 2325_1210 GRM GRM3207D31C1 D8 A	\Box	 □ (1) □ 30オガジェクト ◆ ダウンロード ■ デスクトラブ ■ ドキュメント ■ ビラオ ■ ビラオ ■ ビラオ ■ エージック □ エーカルド ディスク (C.) ■ DVD RW ドライブ (D) 	名司 LP8 MURATA_UPDATE Siglity SWWve testlib	更引 201 201 201 201 201 201	\Box	Library Name Version Size Code Split library by family name	Local_LIB 1.0 JIS V
Messages & X Progress & X : [''] 2018-12-02 16:07:53: INFO : Base CFormat Dir		USB ドライブ (F:) 〒 ライブラリ C# フォルダー:	v (>			
['C:/Users/aokiw/Development/MURATA_LIB/LPB_2018091			フォルダーの選択	キヤンセル			

- Library Name: Library name displayed in Sigrity. Please enter any name. The default is Local_LI B.
- Version: Version number for library management. Please enter your desired version number.



Convert CFormat to Sigrity library (cont.)

- Size Code: Typ is f size code managed by Sigrity. Please select either JIS or EIA.
- Split library by family name: Check this box to separate library files by series. By default all series are managed in one library file.

Press OK button to start conversion.



BOM management

In most designs, parts are managed by internal code name that are registered in the BOM. Therefore, need to change the part name to internal code name before entering a model file into EDA tool.

CHUB can replace the part name to internal code name when converting CFormat to EDA tool library.

CHUB exports a template file for tool setting in Excel format. You add internal code name to this setup file and feed it to CHUB.

The flow chart on the left shows the steps to replace the part name to internal code name.





Export setup file from CHUB

File -> Export Setup file



Export a template file (Excel file) for tool settings. This file contains all the parts listed in the CFormat files.

The template file includes following sheets.



- FamilyName : This sheet shows the name of the folder storing CFormat as the series name (family name).
- Category(size code): Sheets other than FamlyName one are named by size code of SMD. All parts are classified by the size code.



Modify the setup file

FamilyName :

If you want to replace the series name (family name) which provided from part vendor to another one, enter the any name in this sheet.

	A		В	С		D	E	F	G	
1	# 2018/12/	24.1	3:46:55						-	
2	//base_cfor	iC:¥t	Jsers¥aokiw¥Dev	ve lo pme n	l If	[:] vou w	ant to r	eplace	the se	eries name.
3	//footprint_	lib				<i>j</i> =			T I	
4	//spice_dir	C:¥l	Jsers¥aokiw¥De	ve lo pme n	e	enter the	e any r	name n	ere. I	ne series name
5	//spara_dir	C:¥L	Jse rs¥ao kiw¥ K ej	<u>ve</u> lopmen [.]	i	s not ch	anded	if the a	cell is h	olank
6	#Vendor		#InHouse				lungeu			
7	GA2									
8	GA3									
9	GC3									
10	GCD									
11	GCE									
12	GCH									
13	GCJ									
14	GCM									
15	GCQ									
16	GGD									
17	IGGM									



Modify the setup file (cont.)

Part name :

The sheet named part size contains the parts of that size. If you want to replace the part name to internal code name, enter the internal code name in the #InHouseName column.

# 2018/12/02 1	3:52:57								
//base_cformat	C:¥Users¥aokiw¥E	Development¥MURATA_LIB¥L	PB_20180910_v1¥GRM						
//footprint_lib	//footprint_lib C:¥Users¥aokiw¥Development¥JeitaLPB-Branch								
//spice_dir	C:¥Users¥aokiw¥E	Development¥MURATA_LIB¥L	PB_20180910_v1¥GRM						
//spara_dir	C:¥Users¥aokiw¥E	Development¥MURATA_LIB¥L	PB_20180910_v1¥GRM						
#Category	#Family	#File	#Module	#InHouseName	FootPrint				
<u>5750_2220</u>	GRM	GRM55DR72J224KW01.xml	GRM55DR72J224KW01						
5750_2220	GRM	GRM55ER72A475KA01.xml	GRM55ER72A475KA01						
<u>5750_2220</u>	GRM	GRM55RB11H105KA01.xml	GRM55RB11H105KA01						
5750 <u>2220</u>	GRM	GRM55DR72H334KW10.xml	GRM55DR72H334KW10						
5750 <u>2220</u>	GRM	GRM55DR73A683KW01.xml	GRM55DR73A683KW01						
5750_2220	GRM	GRM55D7U2H473JW31.xml	GRM55D7U2H473JW31						
5750 <u>222</u> 0	GRM	GRM55DR72E334KW01.xml	GRM55DR72E334KW01						
5750_2220	GRM	GRM55RR11H105KA01.xml	GRM55RR11H105KA01		T				
5750_2220	GRM	GRM55EB11H475KA01.xml	GRM55EB11H475KA01						
5750_2220	GRM	GRM55DR72E105KW01.xml	GRM55DR72E105KW01						
5750_2220	GRM	GRM55D7U3A103JW31.xml	GRM55D7U3A103JW31						
5750_2220	GRM	GRM55DR72J154KW01.xml	GRM55DR72J154KW01						
5750 <u>222</u> 0	GRM	GRM55DR61H106KA88.xml	GRM55DR61H106KA88						
5750_2220	GRM	GRM55ER61H475KA01.xml	GRM55ER61 H475KA01						
5750_2220	GRM	GRM55RR71H105KA01.xml	GRM55RR71H105KA01						
5750_2220	GRM	GRM55DR11E106KA01.xml	GRM55DR11E106KA01						
5750_2220	GRM	GRM55D7U2J473JW31.xml	GRM55D7U2J473JW31						
E2E0 0000		000000000000000000000000000000000000000	004550030013144404						

Fill internal code name in #InHouseName column if you want to replace the part name.



Import the modified setup file

File -> Import Setup file

Launch CHUB again if you already quit it and import the modified setup file.

II JI	EITA/CFormat HUB					-		
File	Convert Validate	e Window Help	0					
0	8 8 E	6 🛱 🙀	2					
3225	1210 1608_0603	3 02052_015008	5750_2220	3216_1206 4520	_1808	2012_0	1805 4 🔹 🕨	
	Category	Family	File	Module	InHo	ouseNam	ie F ^	
1	3225_1210	GRM	GRM32D7U3A2	GRM32D7U3A2	D1			
2	3225_1210	GRM	GRM32E7U2J15	GRM32E7U2J15	D2			
3	3225_1210	GRM	GRM32RR61C47	GRM32RR61C47	D3			
4	3225_1210	GRM	GRM32A7U2J22	GRM32A7U2J22	D4			
5	3225_1210	GRM	GRM32Q7U3A1	GRM32Q7U3A1	D5			
6	3225_1210	GRM	GRM32ER71A47	GRM32ER71A47	D6			
7	3225_1210	GRM	GRM32DC81E10	GRM32DC81E10	D7			
8	3225 1210	GRM	GRM32DR71C1	GRM32DR71C1	D8		×	
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201_0	02052	015008 0402_010	105 0603_0201 1005_0	402 1608_0603 201	2_0805 8216_1206	8225_1210	4 1
	Category	Family	File	Module	InHouseName	FootPrint	^
	0201_008004	GRM	GRM0115C1C5R2CE01.xml	GRM0115C1C5R2CE01		~	
	0201_008004	GRM	GRM0115C1E7R0BE01.xml	GRM0115C1E7R0BE01		~	
	0201_008004	GRM	GRM0112C1E4R8CE01.xml	GRM0112C1E4R8CE01		~	
	0201_008004	GRM	GRM0115C1C6R3BE01.xml	GRM0115C1C6R3BE01		~	
•	0201_008004	GRM	GRM0115C1E8R6DE01.xml	GRM0115C1E8R6DE01		~	
-	0201_008004	GRM	GRM0115C1C8R4CE01.xml	GRM0115C1C8R4CE01		~	
	0201_006004	GRM	GRM0115C1C9R38E01.xml	GRM0115C1C9R3BE01		~	
- 1	0201_008004	GRM	GRM0112C1E6R9WE01.xml	GRM0112C1E6R9WE01		~	
-	0201_008004	GRM	GRM0112C1E9R4CE01.xml	GRM0112C1E9R4CE01		~	
0	0201 008004	GRM	GRM0115C1E4R2WE01.xml	GRM0115C1E4R2WE01		~	~
ssag	jes			ē ×	Progress		8 :
018	-12-02 13:36:	25: INF0 : Op	en 02052_015008	^			
018	-12-02 13:36:	26: INFO : Op 31: INFO : Op	en 0402_01005 en 0603_0201				
018	-12-02 13:36: -12-02 13:36: -12-02 13:36:	31: INF0 : Op 39: INF0 : Op	en 0603_0201 en 1005_0402				

The internal code names listed in the setup files are displayed here.



EXAMPLE OF SIMPLE C-FORMAT



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Example of a simple CFormat

Let's see a Cformat file delivered from Murata Manufacturing Co., Ltd. . (please see next page)

GRM21BB30J226ME38

💋 形状

	L寸法	2.0 ±0.15mm
	W寸法	1.25 ±0.15mm
	T寸法	1.25 ±0.15mm
	外部電極寸法e	0.2~0.7mm
	外部電極間距離e	0.7mm min.
	サイズコード mm	2012M



GRM21BB30J226ME38

```
<?xml version="1.0" ?>
<LPB CFORMAT version="2020">
<header company="MURATA" date="Wednesday Dec. 19 2018"
    design revision="1.0" project="GRM"/>
<global>
  <unit>
    <distance unit="mm"/>
    <capacitance unit="uF"/>
    <resistance unit="ohm"/>
    <inductance unit="nH"/>
  </iinit>
<shape>
  <rectangle height="1.25" id="1" width="2"/>
  <rectangle height="1.25" id="2" width="0.45"/>
</shape>
<padstack def>
  <padstack id="1">
   <ref shape shape id="2" x="0" y="0" pad layer="BOTTOM"/>
  </padstack>
</padstack def>
</global>
<module name="GRM21BB30J226ME38" shape id="1" thickness="0"
type="C" x="0" y="0">
  <size code imperial="0805" metric="2012"/>
  <socket name="socket">
    <default>
      <port shape padstack id="1"/>
    </default>
    <port id="1" x="-0.775" y="0.0"/>
    <port id="2" x="0.775" y="0.0"/>
  </socket>
<specification>
  <capacitance typ="22"/>
</specification>
```

```
<reference xmlns:spice="http://www.jeita.or.jp/LPB/spice"
    reffile = "GRM21BB30J226ME38.mod"
    format="SPICE" >
  <connection socket name="socket" port id="1">
    <spice:ref port subckt="GRM21BB30J226ME38" portid="1"/>
 </connection>
  <connection socket name="socket" port id="2">
   <spice:ref port subckt="GRM21BB30J226ME38" portid="2"/>
  </connection>
</reference>
<reference
xmlns:touchstone="http://www.jeita.or.jp/LPB/touchstone"
    reffile = "GRM21BB30J226ME38.s2p"
    format="TOUCHSTONE" >
 <connection socket name="socket" port id="1">
    <touchstone:ref port portid="1"/>
  </connection>
  <connection socket name="socket" port id="2">
    <touchstone:ref port portid="2"/>
  </connection>
</reference>
</module>
</LPB CFORMAT>
```

形状





XML

M-Format, C-Format and R-Format use the World Wide Web Consortium standard for the XML version 1.0.

The element of XML is enclosed in triangular brackets < >.

```
<element_name>
```

An element can contain multiple elements as its children. An element start with <element_name> and end with </element_name> if the element contains children.

<element_name>....</element_name>

If an element does not contain children, the element simply expresses
as <element_name/>.

An element can have one or more attributes. An attribute is represented by name, and value enclosed in double quotation.

```
attribute_name="attribute_value"
```



C-Format configuration

<?xml version="1.0" ?>





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<header> element

<header

/>

```
company="MURATA"
date="Wednesday Dec. 19 2018"
design_revision="1.0"
project="GRM"
```

project

Specifies the name of the project (required).

design_revision

Specifies the revision number for the design (required).

company

Specifies the name of organization delivering this CFormat file (optional).

data

Delivered date (optional).



<global> element

<global></global>	
<unit></unit>	
:	<unit> element</unit>
<shape></shape>	
:	<pre><shape> element</shape></pre>
<padstack_def></padstack_def>	
:	<pre><padstack def=""> element</padstack></pre>

The <global> element defines the unit system, basic shapes and padstack to be used throughout the CFormat files. The scope of the defined variables is limited to the file in which it is declared. The content of the <global> element consists of one <unit> element and one or zero <shape> and <padstack_def> elements.



<unit> element

<unit>

<distance unit="mm"/>
 <capacitance unit="uF"/>
 <resistance unit="ohm"/>
 <inductance unit="nH"/>
</unit>

The <unit> element defines the unit system to be used in CFormat. Left example defines the unit system of length, capacitance, resistance and inductance.



<shape> element



The <shape> element defines basic shapes those are referenced by other attributes and elements, such as a <padstack_def> element. id

Specifies the unique identifier that is used to reference the shape from other attributes and elements.

width

Specifies the width of the rectangle.

height

Specifies the height of the rectangle.

<padstack_def> element



The <padstack_def> element use to define pad stacks. Via and pin are defined by pad stacks.

shape_id :

Specifies the identifier of the predefined shape that is defined at the <shape> element.

х, у:

Specifies the location of the reference point of the shape with respect to the local origin.

pad_layer :

Specifies the placement side of the shape. In case of pin of SMD, it should be BOTTOM.



<module> element

<module< th=""><th>name="GRM21BB30J</th><th>226ME38"</th></module<>	name="GRM21BB30J	226ME38"
	shape id="1"	
	thickness="0"	
	type="C"	
	x="0" y="0">	
<size< td=""><td>_code/></td><td><size_code> element</size_code></td></size<>	_code/>	<size_code> element</size_code>
<socke< td=""><td>et></td><td></td></socke<>	et>	
:		<socket> element</socket>
<td>ket></td> <td></td>	ket>	
<spec:< td=""><td>ification></td><td></td></spec:<>	ification>	
:		<pre><specification> element</specification></pre>
<td>cification></td> <td></td>	cification>	
<refe< td=""><td>rence></td><td></td></refe<>	rence>	
:		<pre><reference> element</reference></pre>
<td>erence></td> <td></td>	erence>	
/		

</module>

The module is the basic design unit of items such as a die or LSI package. The <module> element encapsulates the geometry information, design constraints, I/O interface, and electrical model of a module.



<module> element (cont.)



name

Specifies the module name or part name.

type

Specifies the module type. C means capacitor.t.

shape_id

Specifies the identifier of the predefined shape to define the boundary shape of the module. The above example refers the shape of id=1.

х, у

Specify the location of the reference point of the shape with respect to the local origin.

thickness

Specifies the thickness of module.



<size_code> element

<size_code imperial="0805"
 metric="2012"/>

The <size_code> element defines the size of SMD. It's given in imperial or metric units.

metric

Specifies the size code given metric unit (JIS). imperial

Specifies the size code given imperial unit (EIA).



<socket> element

<socket name="socket">

<default></default>	
<port_shape padstack_id="1"></port_shape>	<default> element</default>
<port id="1" x="-0.775" y="0.0"></port>	charts alamant
<port id="2" x="0.775" y="0.0"></port>	<pon> element</pon>

</socket>

The <socket> element defines the I/O ports. The port definition includes not only geometrical information but also logical information. Above example includes only geometrical information.

name

Specifies the socket name that is used to reference the socket from other attributes and elements.



<default> element



The <default> element is used to define the shape of ports if shape of all ports are same. If each ports have different shape, the shape is defined in <port> element.

padstack_id

Specifies the identifier of the predefined padstack that is used to define the default pad shape. Above example referes the padstack of id=1.



<port> element



The <port> element defines the logical and geometry information for a port of the module. In above example, only geometry information (shape and location) is defined. More over , shape of port is defined by <default> element cause of all ports have same shape.

id

Specifies the unique identifier that is used to reference the port from other attributes and elements.

x, y

Specify the location of the reference point of the referenced padstack with respect to the local origin of the module.

<specification> element

<specification>
 <capacitance typ="12.5"/>
</specification>

The <specification> element defines the specifications of the module itself, such as power consumption, resistance or capacitance etc. In this example, only capacity value (typical value) are defined.



<reference> element



The <reference> element is used to make a relationship between the module and electrical, thermal or geometrical model file. . In this example, SPICE and S-Parameter (or TOUCHSTONE) model are related with the module.



<reference> element (cont.)



xmlns:

The namespace of XML are fixed by referenced model.

format

Specifies the model type of reference file.

reffile

Specifies the name of a file with which to make a relationship.



<connection> element

```
<connection socket_name="socket"
port_id="1">
:
</connection>
```

The <connection> element defines the relationship between a <port> that is defined in the <socket> element and the I/O node of a reference model file.

```
socket_name
Specifies the name of a socket .
port_id
Specifies the identifier of a port.
```

The above example refers <port> of id="1" which included in <socket> named "socket".





<connection> for SPICE model

```
<connection socket_name="socket" port_id="1">
   <spice:ref_port subckt="GRM21BB30J226ME38" portid="1"/>
   </connection>
   <spice:ref_port subckt="socket" port_id="2">
   <spice:ref_port subckt="GRM21BB30J226ME38" portid="2"/>
   </connection>
```

In the case of SPICE, a relationship is created by the combination of the sub-circuit name and order of I/O node description.

subckt

Specifies the name of a sub-circuit (.subckt) in the reference SPICE file.

portid

Specifies the order of I/O nodes in the .subckt line. The value shall be an integer of 1 or more.



<reference> for SPICE model

<module name="GRM21BB30J226ME38" ... > <socket name="socket"> <port id="1" x="-0.775" y="0.0"/> <port id="2" x="0.775" y="0.0"/> /socket> <reference xmlns:spice="http://www.jeita.or.jp/LPB/spice" format="SPICE" reffile = "GRM21BB30J226ME38.mod" > <connection socket name="socket" port id="1"> <spice:ref port subckt="GRM21BB30J226ME38" portid="1"/> </connection> <connection socket name="socket" port id="2"> <spice:ref port subckt="GRM21BB30J226ME38" portid="2"/> </connection> /reference>

The first node of subckt "GRM21BB30J226EM38" is related with the port of id="1". And 2nd node is related with port of id="2".



<connection> for S-Parameter model

In the case of S-Parameter, a relationship is created by the order of I/O node description.

portid

Specifies the order of I/O nodes in S-Parameter file (TOUCHSTONE). The value shall be an integer of 1 or more.



<reference> for S-Parameter model

<module name="GRM21BB30J226ME38" ... > <socket name="socket"> <port id="1" x="-0.775" y="0.0"/>< <port id="2" x="0.775" y="0.0"/> </socket> <reference xmlns:touchstone="http://www.jeita.or.jp/LPB/touchstone" reffile = "GRM21BB30J226ME38.s2p" format="TOUCHSTONE" > <connection socket name="socket" port id="1"> <touchstone:ref port portid="1"/> </connection> <connection socket name="socket" port id="2"> <touchstone:ref port portid="2"/> </connection> </reference>

The first node S-Parameter model is related with the port of id="1". And 2nd node is related with port of id="2".

