MicroSpire – Capability Approval

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PRESENTATION OF MICROSPIRE

Microspire has a long heritage of more than 25 years in the design and production of space grade inductors and transformers. We are recognized by our customers as experts in the world of magnetics, in the design of components and the understanding of the applications. Our success is based on already qualified technological solutions which allow us to meet to customer's specific requirements. Microspire has in its portfolio European Space Component Coordination (ESCC) qualified products (Qualified Part List and European Preferred Part List) (Fig.1) :

- Smd Energy Storage Inductor (SESI) (Fig.1)
- Common Mode Chokes (CMC) (Fig.1)
- Miniature Space Chip Inductor (MSCI) (Fig.2)
- Data Bus Isolating Transformer (DBIT) (Fig.3)

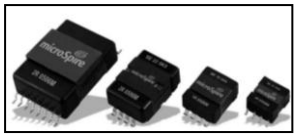


Fig.1 SESI and CMC

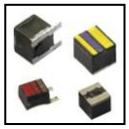


Fig.2 MSCI

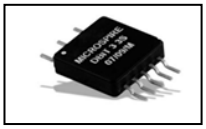


Fig.3 DBIT

Now Microspire wishes to go one step further, qualifying two technologies of components, the Chameleon Concept Magnetics (CCM) and Toroidal Transfer Moulded (TT) technologies through the Capability Approval. These technologies allow to provide a large offer of passive magnetic components: inductors and transformers. They have been developed to meet especially the aerospace requirements, but are adapted to other markets. Thanks to its technologies range Microspire can offer optimized design of functions (flyback, push-pull …). The optimization takes into account the size, power density, dielectric withstanding test voltage, mechanical constraints…

CAPABILITY APPROVAL

The ESCC Capability Approval is a status agreed to a manufacturer for a specific device technology. The purpose of this status is to ensure that this specific device technology is in accordance with the rules of the European Space Component Coordination Specification System, and the test results are certified by ESCC Executive. Thus the components that will use this technology (device design methodology, physical design, tests) are qualified to be used in ESA and other European spacecraft and Space segment hardware in accordance with the requirements defined in the ESCC Q-ST-60C, Space Product Assurance – Electrical Electronic and Electromechanical Components.

Qualifying a technology allow a large family of components to be ready to be sued in the aerospace segment without qualifying test of each variant or additional lot validation (Lot Acceptance Test), saving time and money. Today, each custom component is qualified one by one, which makes this process expensive and long. In particular, a large number of components must be manufactured only for the qualification test and will never be used.

To summarise, to get this agreement, first a specific capability domain must be defined. This one has to describe in details the scope and extent of the Capability Approval in terms of the boundaries of technologies, performance, design rules, assembly processes and materials, packages, in-line testing and inspection etc. The description must define precisely all necessary elements such that there can be no uncertainties regarding the extent what is to be qualified.

Secondly, a set of products is defined, manufactured and has to go through a thermal shocks, mechanical and durability tests then they are inspected to be approved or not after testing.

OBTAINING CAPABILITY APPROVAL

Evaluation Phase – over 200 components manufactured

To get the capability approval, products have to pass extreme environmental and electrical testings that they can meet in real conditions. Obviously these tests will be pushed over the real conditions to over-rate components. In this purpose, we defined one evaluation phase including:

- Temperature evaluation(Fig.4), where we will make temperature rise measurements at 80°C and 125°C temperature into atmosphere then in vacuum

- Dielectric evaluation (Fig.5) a dielectric withstanding voltage test to failure will be done after all components have been submitted to stress tests as thermal shocks, burn-in, mechanical tests…

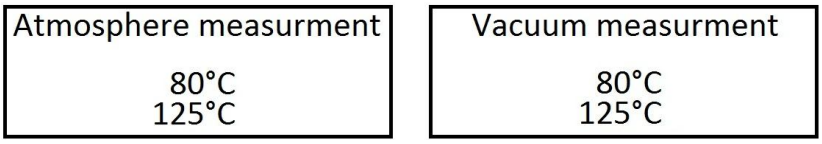


Fig.4 Temperature Evaluation

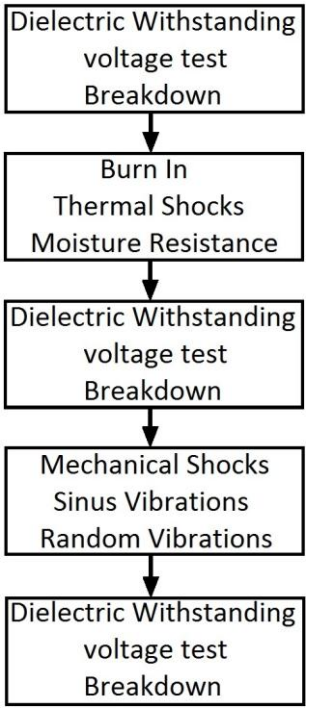


Fig.5 Dielectric Evaluation

Qualification Phase – Over 400 components manufactured

After this evaluation phase we will qualify the components as described on Fig.6.

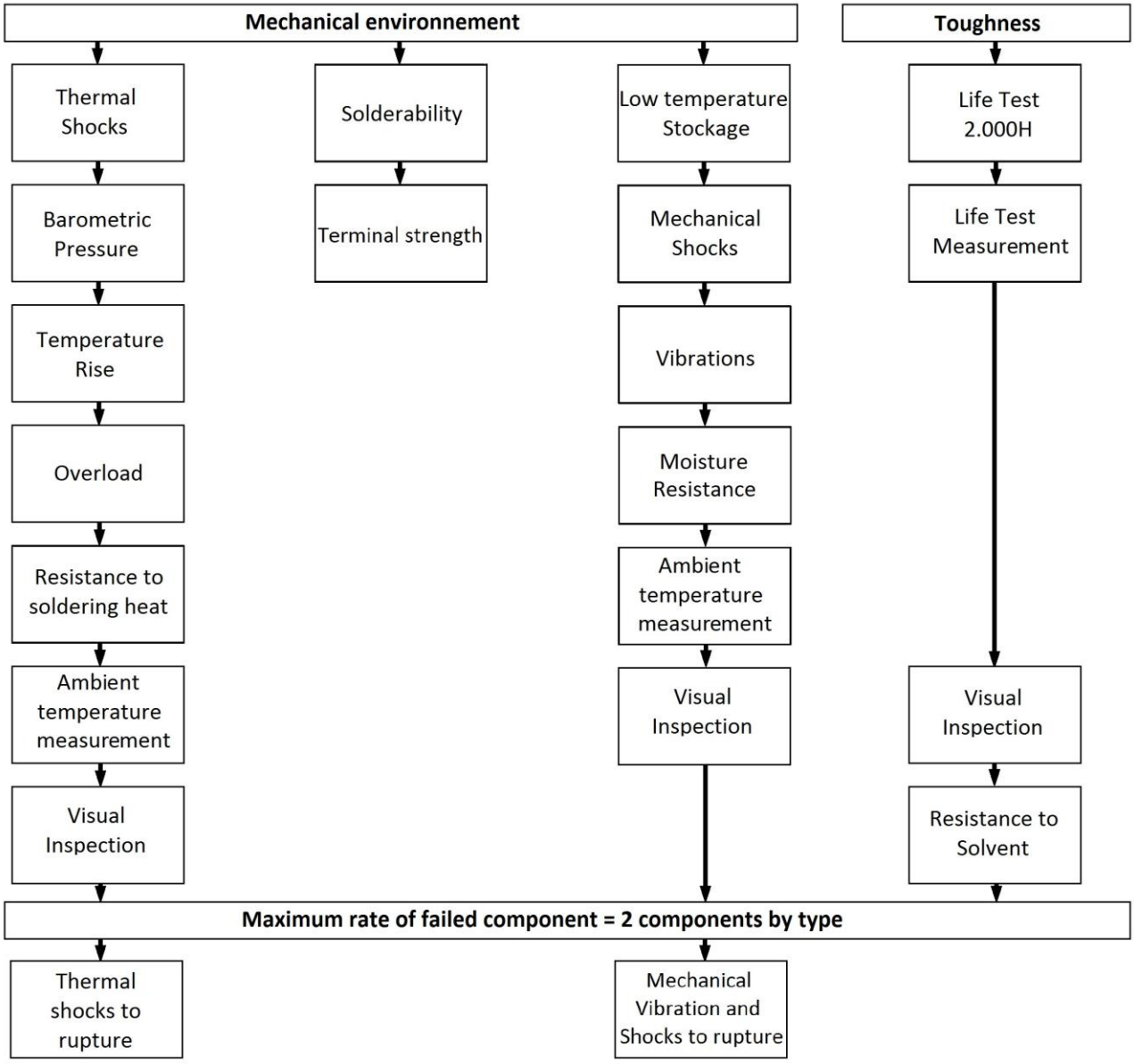


Fig.6 Qualification Phase

QUALIFIED PRODUCTS

TT Technology

(Toroïdal Transfert Moulded)

The Toroïdal technology is well known and already widely used for space application. Microspire will run a capability approval on the most used packages, single or multiple stacked toroïds.
In order to offer the possibility to design a large range of functions, single and stacked transfer moulded will be qualified.
One of the advantages to have multiple toroïds in the same component (Fig.7) is that one can have a different electrical function than the other one.

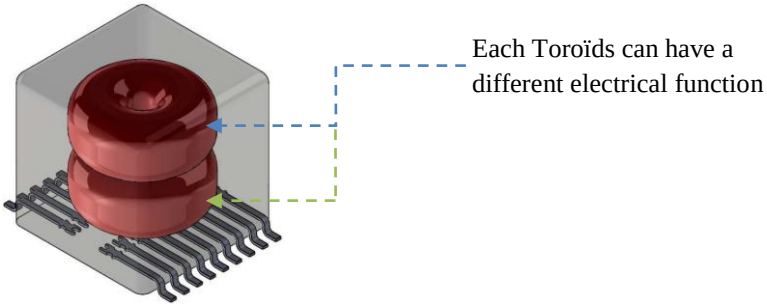


Fig.7 Stacked Toroïds into the same component

Features

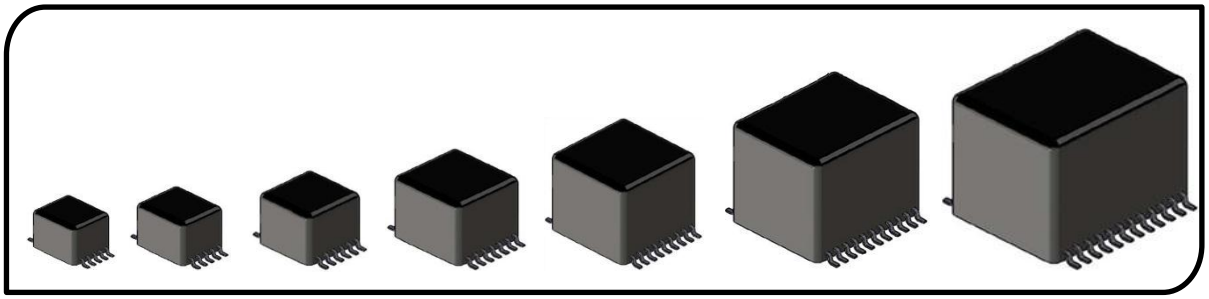
- ✓ Strong space and aerospace heritage
- ✓ Better thermal dissipation than standard toroidal magnetics mounted on baseplate
- ✓ Electrical design rules already validated for this technology
- ✓ Trays or tape and reel packaging

Benefits

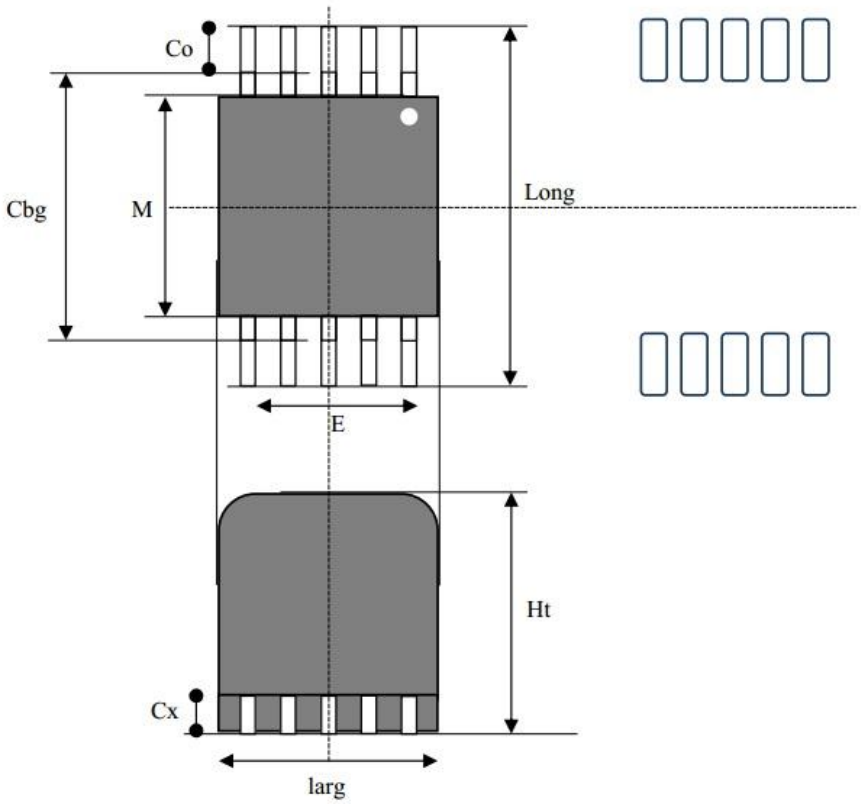
- ✓ Large temperature range : -55°C - + 125°C
- ✓ Withstand high shocks and vibration (MIL STD 202 Method 213 &214)

Overview of the Electrical functions fitting in the TT technology

Current transformers
Gate Drive transformers
Flyback transformers
Forward transformers
Push-Pull transformers
Common Mode Chokes
SMD Filtering Chokes
…



DIMENSIONS (mm) *Caractéristiques mécaniques*

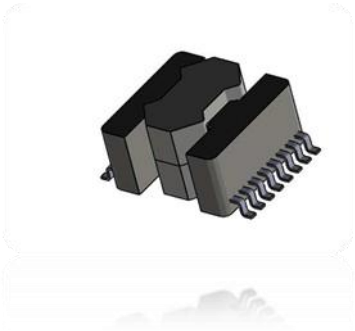


		Lg	Larg	Ht	E	M	Cbg	Co	Cx	W*th	pins
TO10	17x10,2x11,5	17	10,5	11,5	2,032	10,5	13	2	1,75	0,7x0,3	2x5
TO12	19x12,5x13,8	19	12,5	13,8	2,54	12,5	15	2	1,9	0,9x0,3	2x5
TO16	22,5x16x17,6	22,5	16	17,6	2,54	16	18,5	2	2	0,9x0,3	2x6
TO20	26,5x20x21	26,5	20	21	2,54	20	22,5	2	2,2	1x0,3	2x7
TO25	32,4x25,4x25,4	32,4	25,4	25,4	2,54	25,4	28	2	2,4	1x0,4	2x9
TO30	37x30x30	37	30	30	2,54	30	33	2	2,7	1,2x04	2x11
TO36	43x36x36	43	36	36	2,54	36	39	2	3	1,2x04	2x12

CCM Technology

(Chameleon Concept Magnetics)

Microspire has developed a new technology to answer to the growing demand requirements of the aeronautics, space, downhole,.. markets. This technology comes timely with the increasing need for optimized component footprint, flexibility, high temperatures, low weight and compact designs.



Features

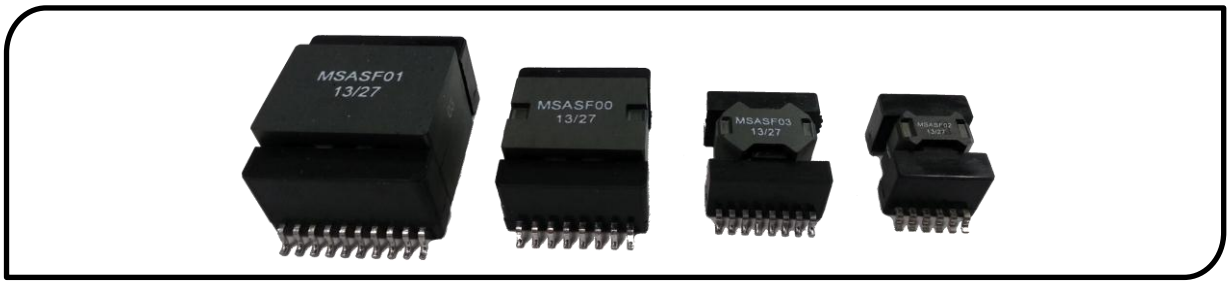
- ✓ Designed to withstand severe environment as space, aeronautics
- ✓ Bobbin winding Technology using standard profiles (RM, EQ...)
- ✓ Epoxy Transfer molding technology
- ✓ SMD package
- ✓ Multiple pins
- ✓ Ferrite core External assembly

Benefits

- ✓ Large temperature range : -55°C - + 125°C
- ✓ Withstand high shocks and vibration (MIL STD 202 Method 213 & 214)
- ✓ Good repeatability of electrical characteristics, better regulation of multiple outputs power supply
- ✓ Higher power density + 15% Vs similar profiles (better Rth)
- ✓ Easy to pick and place
- ✓ Flexibility of use
- ✓ No stress on the Ferrite

Overview of the Electrical functions fitting in the CCM technology

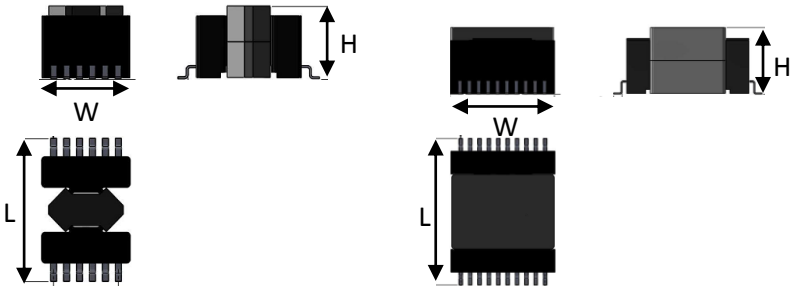
Common mode chokes
SMD filtering chokes
PFC chokes
Current transformers
Gate Drive transformers
Flyback transformers
Forward transformers
…



Microspire can design custom magnetics in the standard packages CCM4, CCM5, CCM20 and CCM25.

Typical dimensions

	W	H	L
CCM4	13.3	11.0	21.3
CCM5	17.0	11.0	23.1
CCM20	21.0	13.0	29.1
CCM25	25.4	16.5	36.0



Indicative electrical data

	Inductor Range (I_{DC} + 20% ripple)			Transformer for SMPS*
CCM4	18mH/50mA	→	3µH/6A	Up to 18W
CCM5	29mH/80mA	→	4.2µH/8A	Up to 40W
CCM20	240mH/30mA	→	2.6µH/21A	Up to 120W
CCM25	480mH/40mA	→	4µH/25A	Up to 150W

*based on a push pull architecture, at f = 200kHz @85°C without cooling

AKNOWLEDGEMENT

A part of the Capability Approval (Evaluation Phases) has been realised with the founding of the European Space Agency under Research and Technology Program.