ESCC Qualified Magnetics Off The Shelf

By Technology Flow Qualification

FLUX

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magnetics for power solutions.

Charles Thillemann Hemmingsen

Electrical Design Engineer, MSc. E. E
Defence and Space

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magnetics for power solutions.

Flux A/S - ESA Qualified Manufacturer by Technology Flow Approval – ESA Certificate 364

ESCC3201/013
“CUSTOMISED MAGNETICS (INDUCTORS, TRANSFORMERS) BASED ON TYPE FT”

- Single or multi-coupled inductors
- Common mode chokes / Differential
- Power transformers (flyback, forward, push-pull, half/full bridge, specific architectures)
- Signal transformers
- Pulse transformers
- Current/voltage measurement transformers
- Specific magnetic functions within environment and thermal requirements
- Integrated Magnetics
- Spike Killer
- High Frequency
- High Voltage
- Other specific magnetic function (Magnetorquer, Solenoid, Combined Magnetics…)

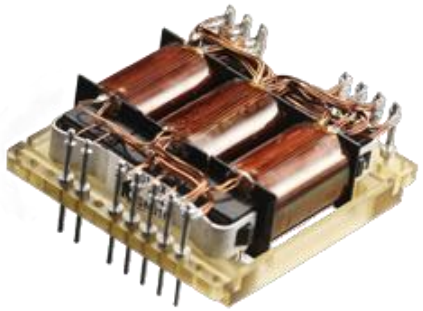
Power level up to 5kW per unit
Current level up to 62.5 AMP
Frequency up to 10 MHz
Operating and storage Temperature -55ºC – 130ºC (derated)
RoHS and non-RoHS solder methods available



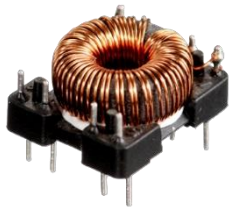
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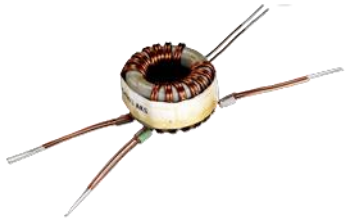
FLUX A/S coil, choke and transformer manufacturing lines:

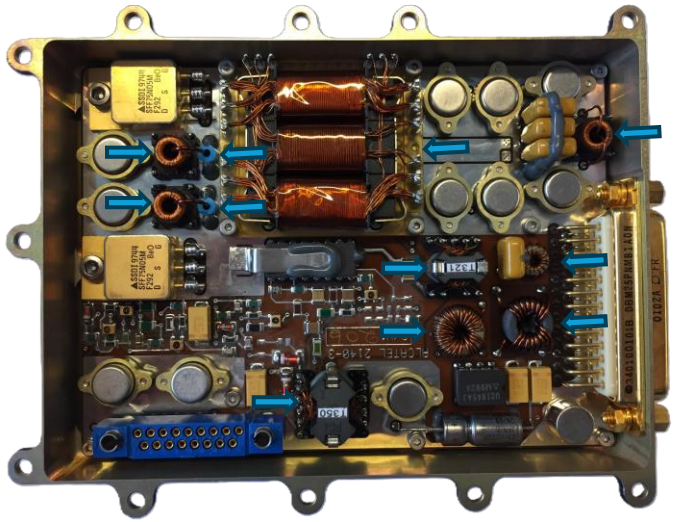
Industry	Space (EU)	Space (EU)	Space (US)	Space (US)	HiRel	e-Mobility	Industry
Category	ESA Qualified (EPPL 1)	Enhanced Grade (EPPL 2)	Class B, Non-critical Flight	Class S, Critical Flight	Military	Automotive	Industrial
Certification	ESA Technology Flow	Qualified Manufacturer	AS9100	AS9100	ISO9001	IATF-16949	ISO9001
Performance standard	ESCC3201	ESCC27500	MIL-PRF-27	MIL-PRF-27	IPC-A610 Class III	Q-200	IPC-A610 Class II
Design baseline	ESCC3201/013	ESCC3201/013	MIL-STD-981	MIL-STD-981	MIL-STD-981	Industrial	Industrial
Design	Denmark	Denmark	Denmark	Denmark	Denmark	Denmark	Thailand
Production	Denmark	Denmark	Denmark	Denmark	Denmark/Thailand	Denmark	Thailand
Screening	Denmark	Denmark	Denmark	Denmark	Denmark - optional	N/A	N/A
Traceability	Yes	Yes	Yes	Yes	Yes	N/A	N/A
Typical quantities	1-200	5-500	1-200	1-200	500-10.000 (ITAR Compliant option DK)	5.000 -100.000	10.000-1.000.000











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Flux A/S (1980)

Industrivangen 5

4550 Asnaes

Denmark

Flux International Ltd. (2004)

BLK C 5, 41/27 Bangna-Trad KM 16.5

Bangchalong, Banplee

Bangkok, Thailand

- Defence & Space (ISO9001, AS9100, ESA 364)
- ESCC3201/013, MIL-STD-981, IPC-A610 Class III

- Industrial (ISO 9001, 14001, 45001)
- Automotive (IATF16949)
- Defence and Commercial Space (IPC)

space@flux.dk

Tel. +45 5965 0089

www.flux.dk

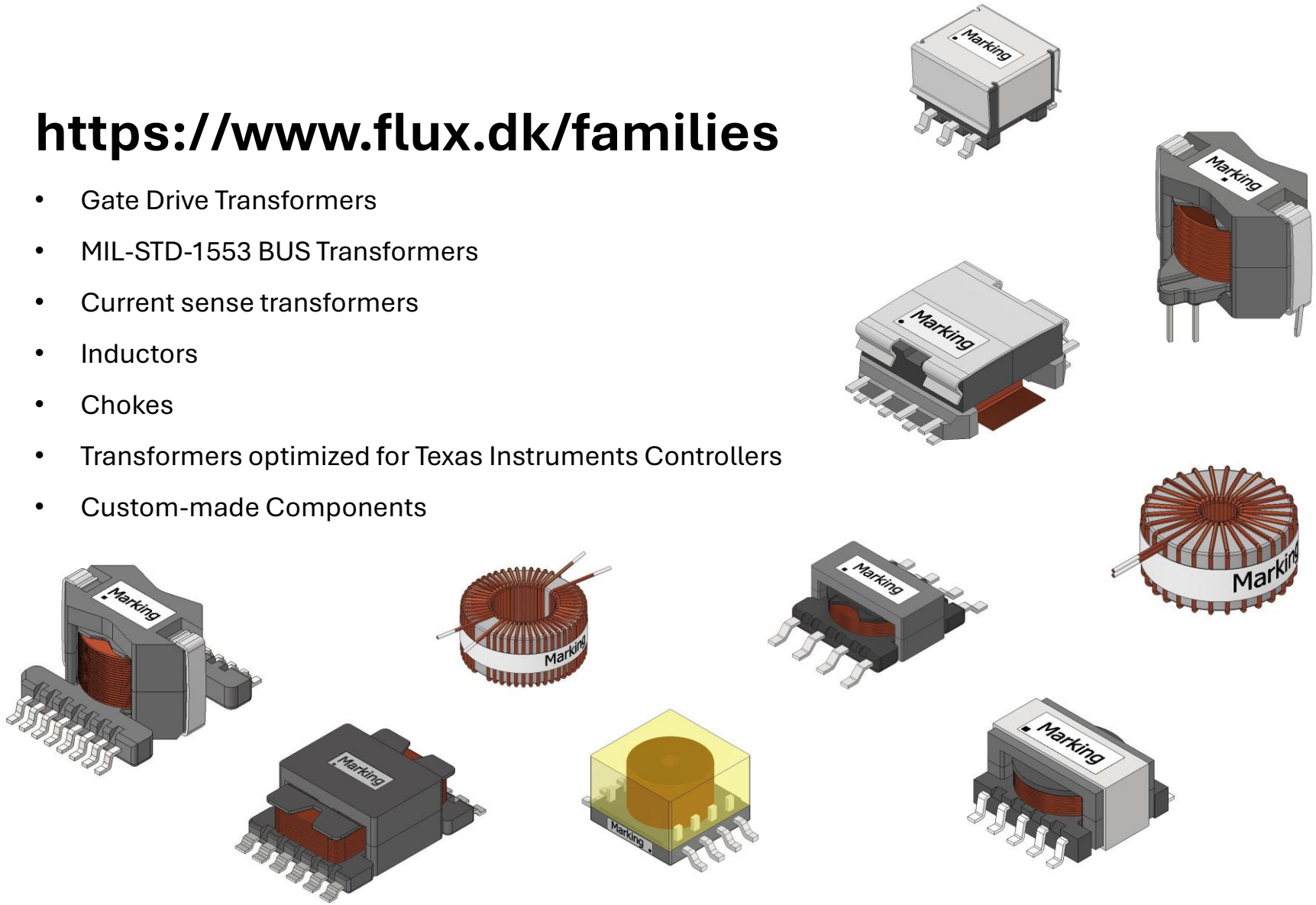


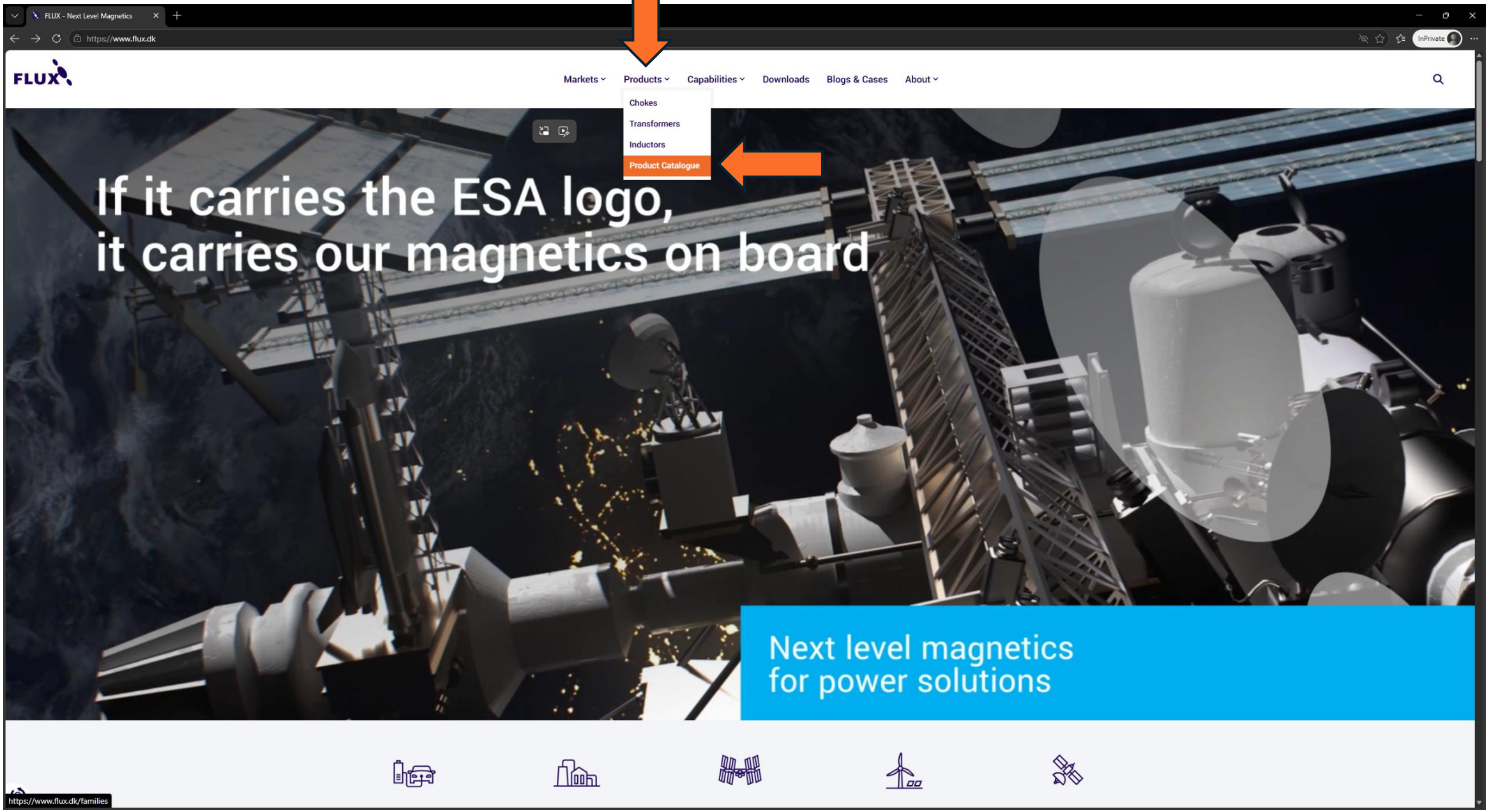
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https://www.flux.dk/families

- Gate Drive Transformers
- MIL-STD-1553 BUS Transformers
- Current sense transformers
- Inductors
- Chokes
- Transformers optimized for Texas Instruments Controllers
- Custom-made Components




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it carries our magnetics on board
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Standard Magnetic Components Database

Welcome to our Defences & Space standard magnetic components library. While Flux is known for custom designs, we also produce high-volume standard parts for better pricing and stock availability.

Common items include gate drive transformers, MIL-STD-1553 bus transformers, current sense transformers, inductors, and chokes.

Make intelligent design choices for your next project
Get access to the .stp files for all our standard magnetic components below and transfer the components you need directly into your PCB design.

As an ESA-qualified supplier, all of our components are ESCC-qualified, providing our customers with components of the highest industry standards.

Custom-made components
Do you need a different standard component? Do not hesitate to request and we will explore the possibility of adding that component to our standard range. If your need is adopted for catalog, Flux will sponsor related non-recurrent engineering.

Gate Drive Transformers



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MIL-STD-1553 BUS Transformers



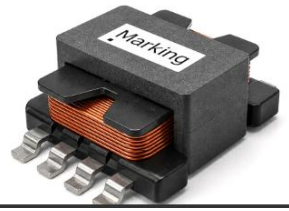
VIEW FAMILY

Current sense transformers

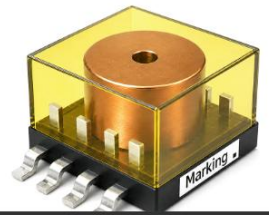


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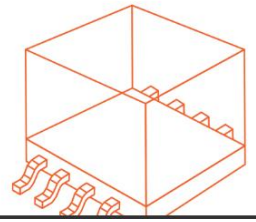
Inductors

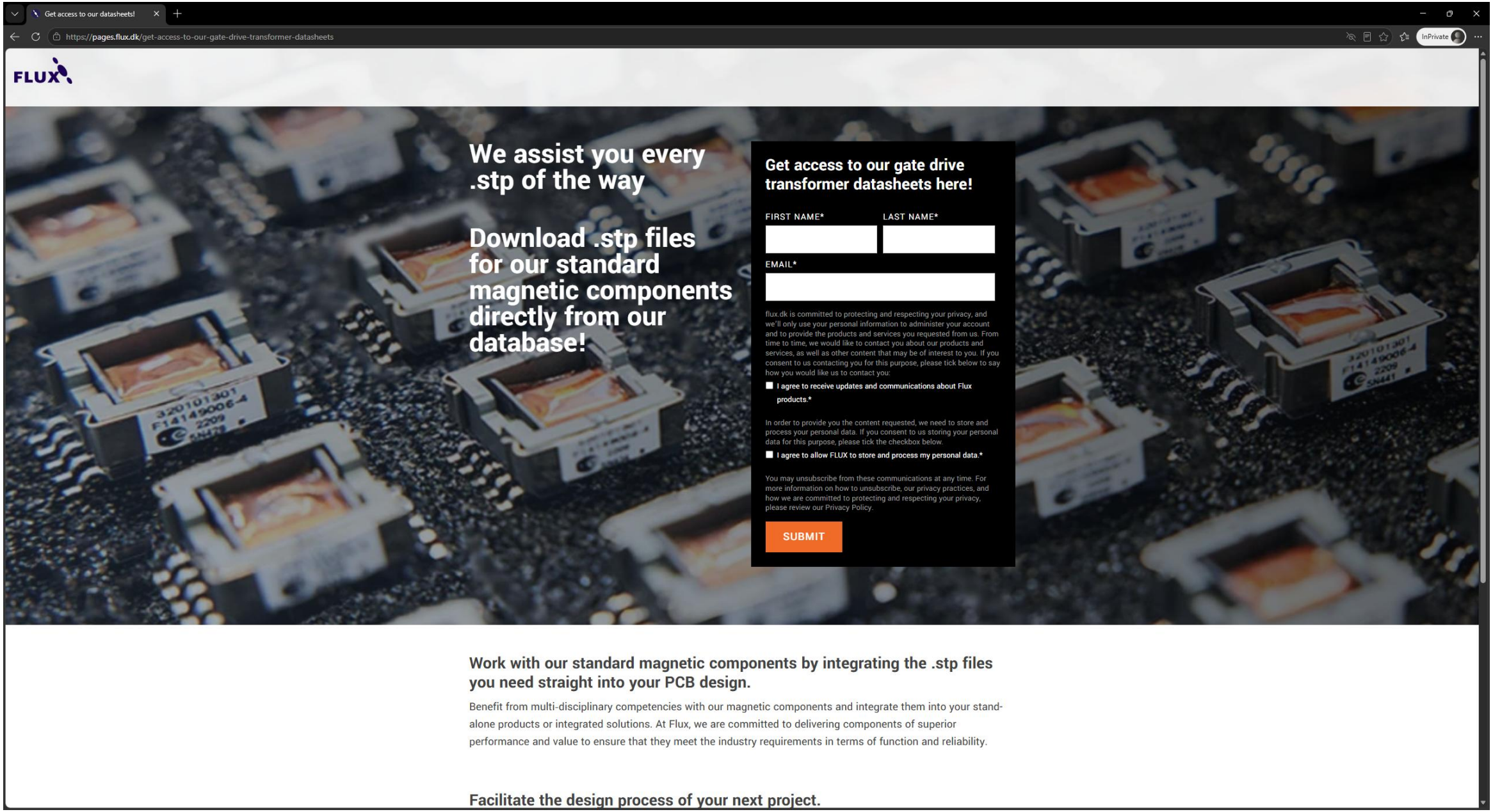


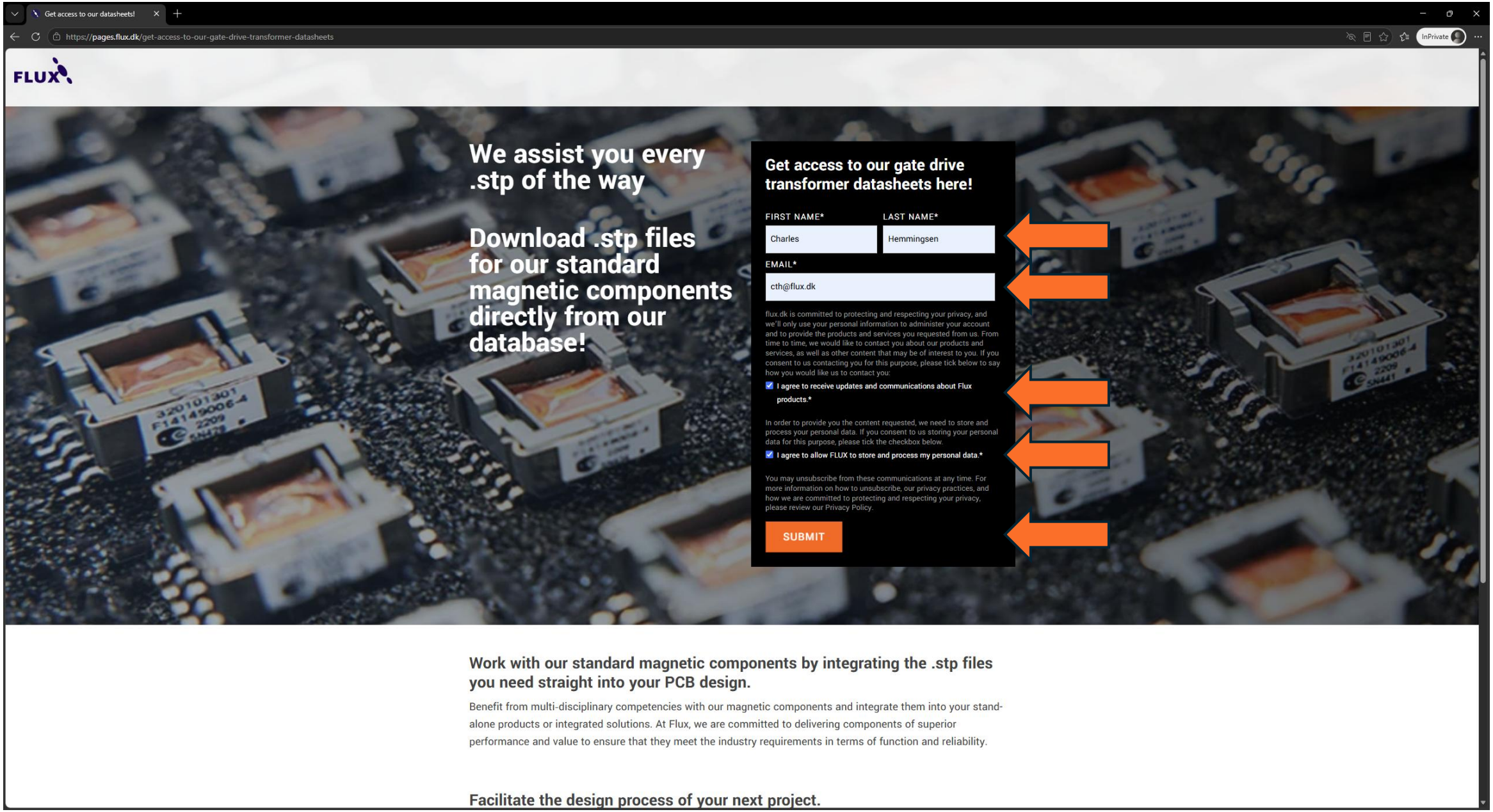
Chokes



Custom-made Components




Get access to our datasheets!
https://pages.flux.dk/get-access-to-our-gate-drive-transformer-datasheets
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We assist you every .stp of the way
Download .stp files for our standard magnetic components directly from our database!
Get access to our gate drive transformer datasheets here!
FIRST NAME*
LAST NAME*
EMAIL*
flux.dk is committed to protecting and respecting your privacy, and we'll only use your personal information to administer your account and to provide the products and services you requested from us. From time to time, we would like to contact you about our products and services, as well as other content that may be of interest to you. If you consent to us contacting you for this purpose, please tick below to say how you would like us to contact you:
I agree to receive updates and communications about Flux products.*
In order to provide you the content requested, we need to store and process your personal data. If you consent to us storing your personal data for this purpose, please tick the checkbox below.
I agree to allow FLUX to store and process my personal data.*
You may unsubscribe from these communications at any time. For more information on how to unsubscribe, our privacy practices, and how we are committed to protecting and respecting your privacy, please review our Privacy Policy.
SUBMIT
Work with our standard magnetic components by integrating the .stp files you need straight into your PCB design.
Benefit from multi-disciplinary competencies with our magnetic components and integrate them into your stand-alone products or integrated solutions. At Flux, we are committed to delivering components of superior performance and value to ensure that they meet the industry requirements in terms of function and reliability.
Facilitate the design process of your next project.



Work with our standard magnetic components by integrating the .stp files you need straight into your PCB design.

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Facilitate the design process of your next project.

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Inductors



Flux 1290-50 Toroid Inductor Series

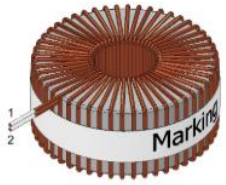
The 1290-50 (11.4µH/20A - 452.5µH/2.12A) Toroid Inductor Series offers a space economic solution by direct horizontal or vertical mounting.



Flux 1290-51 Toroid Inductor Series

The 1290-51 Toroid Inductor Series with QPL status combines the need for the highest International Standards for Space Grade with the need for minimal height or PCB area consumption by horisontal or vertical mounting.

VIEW PRODUCT



Flux 1290-52 Toroid Inductor Series

The 1290-52 Toroid Inductor Series with QPL status combines the need for the highest International Standards for Space Grade with the need for minimal height or PCB area consumption by horisontal or vertical mounting.

VIEW PRODUCT



Flux 1291 ER14.5L Inductor Series

The 1291 ER14.5L Planar SMD inductor Series with QPL status combines the need for the highest International Standards for Space Grade with the need for low building height. This series features side to side winding.

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https://www.flux.dk/productss/?productName=Flux 1290-51 Toroid Inductor Series&tableId=28518...

Product | Flux

https://www.flux.dk/productss/?productName=Flux%201290-50%20Toroid%20Inductor%20Series&tableId=28518414

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Flux 1290-50 Toroid Inductor Series

The 1290-50 (11.4µH/20A - 452.5µH/2.12A) Toroid Inductor Series offers a space economic solution by direct horizontal or vertical mounting.

Flux designs and manufactures in accordance with ESCC3201 and MIL-STD-981. The product represented in this data sheet is ESA Qualified (QPL) and will be delivered with an extensive ESCC data package containing test results by serial number. Products are manufactured, tested and inspected by ESA certified staff.

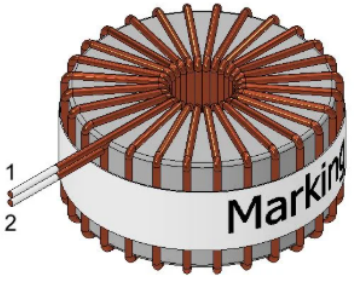


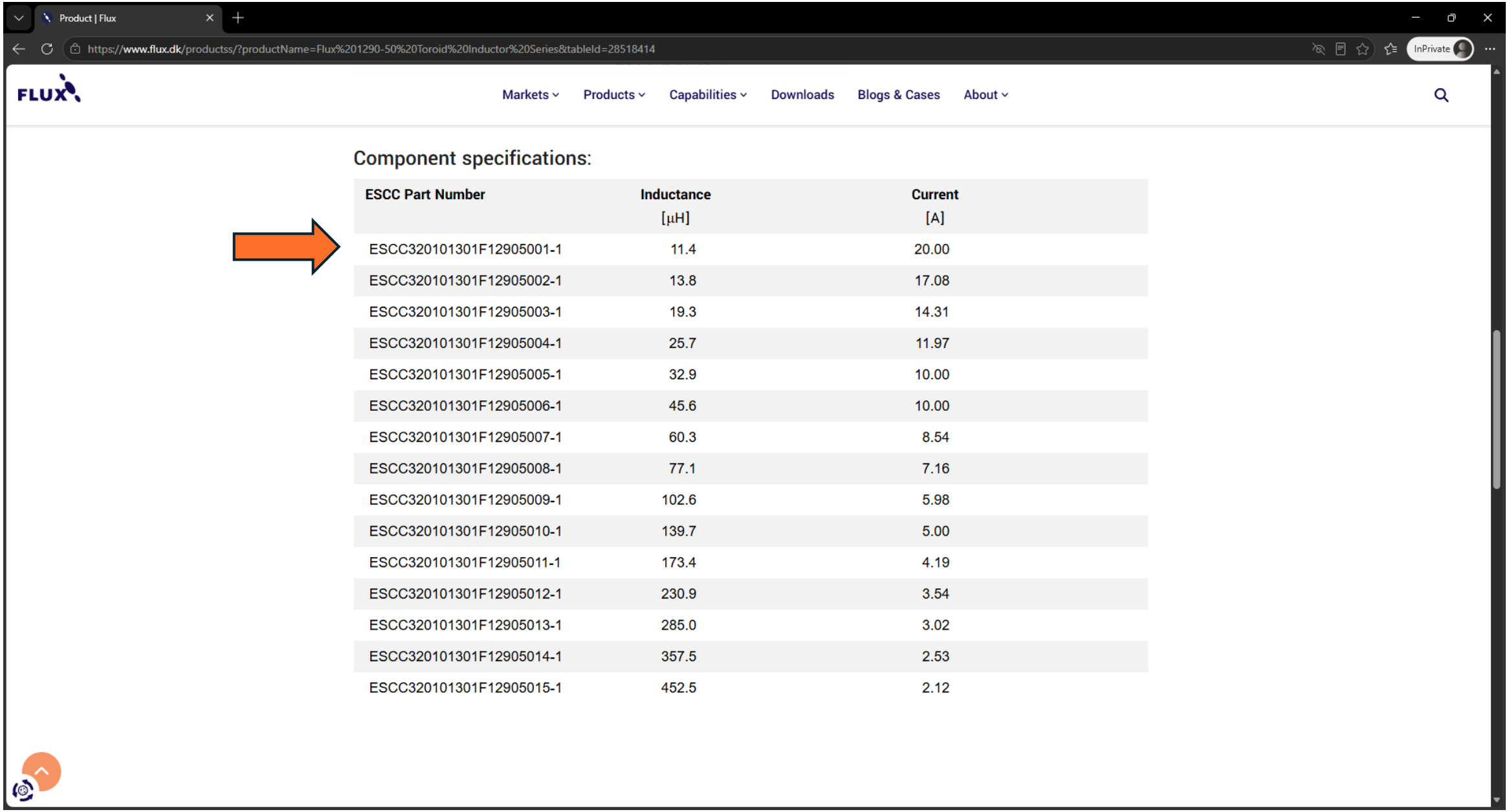
DOWNLOAD 3D FILE

ESCC320101301F12905008-1 Qualified part

Benefits	Quality Levels
Platformless	**ESCC3201/013**
Simple construction	MIL-STD-981 Class S
Flying leads	MIL-STD-981 Class B
Up to 1 mHz	HiRel/MIL IPC-A610 III
Surface Sn63Pb37	

Included	Additional
ESA Qualified (QPL)	X-Ray Inspection
ESCC Inspection	Lot Acceptance Test





Component specifications:

ESCC Part Number	Inductance [µH]	Current [A]
ESCC320101301F12905001-1	11.4	20.00
ESCC320101301F12905002-1	13.8	17.08
ESCC320101301F12905003-1	19.3	14.31
ESCC320101301F12905004-1	25.7	11.97
ESCC320101301F12905005-1	32.9	10.00
ESCC320101301F12905006-1	45.6	10.00
ESCC320101301F12905007-1	60.3	8.54
ESCC320101301F12905008-1	77.1	7.16
ESCC320101301F12905009-1	102.6	5.98
ESCC320101301F12905010-1	139.7	5.00
ESCC320101301F12905011-1	173.4	4.19
ESCC320101301F12905012-1	230.9	3.54
ESCC320101301F12905013-1	285.0	3.02
ESCC320101301F12905014-1	357.5	2.53
ESCC320101301F12905015-1	452.5	2.12

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Flux 1290-50 Toroid Inductor Series

Print data sheet

The 1290-50 (11.4µH/20A - 452.5µH/2.12A) Toroid Inductor Series offers a space economic solution by direct horizontal or vertical mounting.

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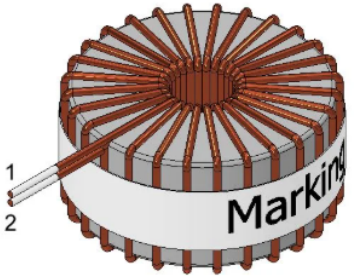


DOWNLOAD 3D FILE

ESCC320101301F12905001-1 Qualified part

Benefits	Quality Levels
Platformless Simple construction Flying leads Up to 1 mHz Surface Sn63Pb37	**ESCC3201/013** MIL-STD-981 Class S MIL-STD-981 Class B HiRel/MIL IPC-A610 III

Included	Additional
ESA Qualified (QPL) ESCC Inspection ESCC Magnetic Sheet ESCC Certificate Test Data	X-Ray Inspection Lot Acceptance Test Qualification test

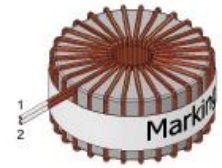


Flux 1290-50 Toroid Inductor Series

The 1290-50 (11.4µH/20A - 452.5µH/2.12A) Toroid Inductor Series offers a space economic solution by direct horizontal or vertical mounting.

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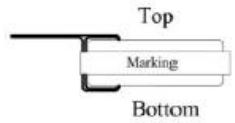
ESCC320101301F12905001-1 Qualified part

Benefits	Quality Levels
Platformless	ESCC3201/013
Simple construction	MIL-STD-981 Class S
Flying leads	MIL-STD-981 Class B
Up to 1 mHz	HiRel/MIL IPC-A610 III
Surface Sn63Pb37	

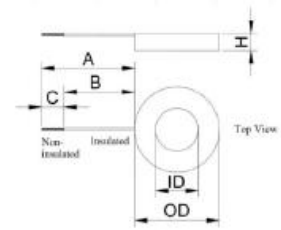
Included	Additional
ESA Qualified (QPL)	X-Ray Inspection
ESCC Inspection	Lot Acceptance Test
ESCC Magnetic Sheet	Qualification test
ESCC Certificate	
Test Data	

Inductance Room Temp	±8%
Inductance -55°C to +125°C	±10%
Wire max. current	ESCC-Q-ST-30-11

Pin	A	B
1, 2	30±2	20±2



OD max	22 mm
ID min	5 mm
H max	11 mm
M max	13,5 g



Specifications

Inductance [µH]	Max Wire Current [A rms]	DCR at 22° C [mOhm]
11.4	20.00	5,6

Mechanical Meassures

Total lead length A [mm]	Isolated lead length A [mm]	Outer diameter OD Max [mm]	Inner diameter ID Min [mm]	Height H Max [mm]
30±2	20±2	22	5	11

Flux AIS - part of discoverIE Group plc
Industrivangen 5
DK-4550 Asnaes, Denmark
+45 5965 0089 · flux@flux.dk

Flux.dk

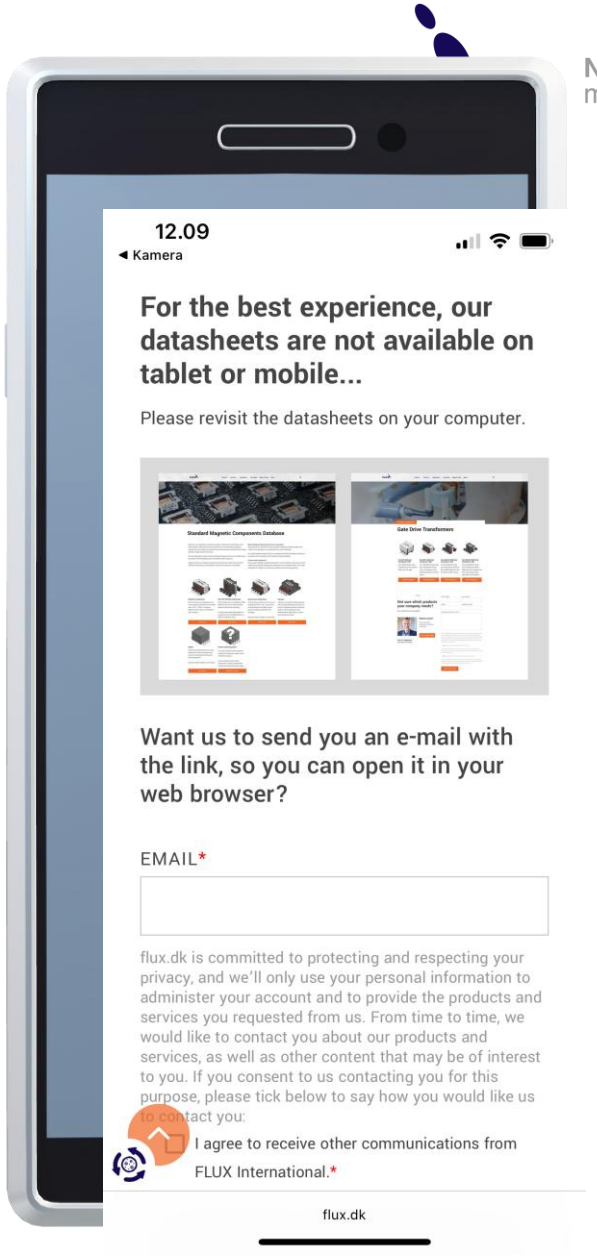
14/10/2026, 12:24
All data subject to change without prior notice.

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Thank you!

Come meet us at Booth 8 in Einstein.

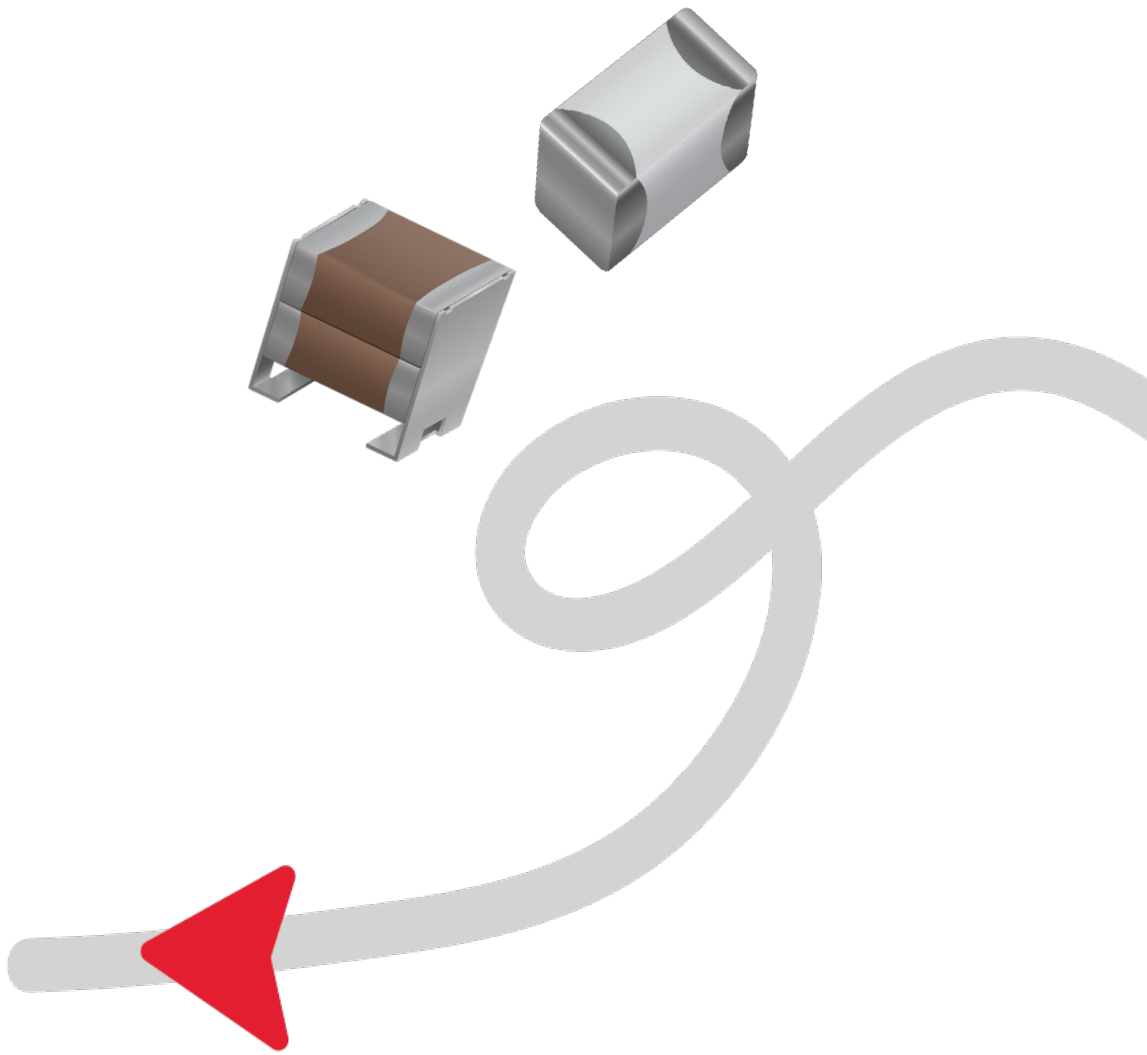


High Reliability Ceramics

Michael Conway

Senior Product Marketing Manager

KYOCERA AVX



Ceramic Product Solutions Overview

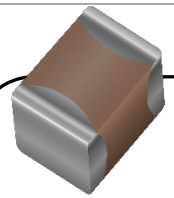
Space / Mil Level	Product Series	Comments
Mil / Space BME MLCC	M32535 X7R NP0, ESCC 3009 , NASA P838, DSCC 25007 Mini BME stacks	Excess stock , short lead times. High CV
Mil PME MLCC	CDR01-06, CDR11-14, CDR31-35, M123	
Mil Ceramic Leaded	M39014	
Ceramic DLA MLCCs	03028, 03029 , 05002 , 05006 , 05007,06022 ,06019	Extend DLA range
Mil / Space PME Stacks	M49470 / ESCC 3001	

CECC / COTS PLUS	Product Series	Comments
Ceramic PME Stacked	CH ,RH, SM, RM	Additional Screening possible ,
Ceramic PME Radial	CV, BR , SK , SV	
Ceramic BME Stacked: High	RH, MH , ST	High Capacitance
COTS+ \ CECC MLCC	AP , AN	Additional Screening possible , with Pb term
CECC Radial	BR	

All Product Series Have Full Traceability.

© KYOCERA AVX Components Corporation

Mil & Space MLCCs Road Maps



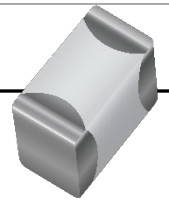
QPL X7R Range Extension

Mil	M3253502					M3253503					M3253504					M3253505					M3253506					M3253507				M3253508			
Case Sizes	0402					0603					0805					1206					1210					1812				2220			
Code	Value	10v	16v	25v	50v	100v	10v	16v	25v	50v	100v	10v	16v	25v	50v	100v	10v	16v	25v	50v	100v	10v	16v	25v	50v	100v	16v	25v	50v	100v	16v	25v	50v	100v
222	2.2nf																																	
272	2.7nf																																	
332	3.3nf																																	
392	3.9nf																																	
472	4.7nf																																	
562	5.6nf																																	
682	6.8nf																																	
822	8.2nf																																	
103	10nf																																	
123	12nf																																	
153	15nf																																	
183	18nf																																	
223	22nf																																	
273	27nf																																	
333	33nf																																	
393	39nf																																	
473	47nf																																	
563	56nf																																	
683	68nf																																	
823	82nf																																	
104	100nf																																	
124	120nf																																	
154	150nf																																	
184	180nf																																	
224	220nf																																	
274	270nf																																	
334	330nf																																	
394	390nf																																	
474	470nf																																	
564	560nf																																	
684	680nf																																	
824	820nf																																	
105	1uf																																	
125	1.2uf																																	
155	1.5uf																																	
185	1.8uf																																	
225	2.2uf																																	
275	2.7uf																																	
335	3.3uf																																	
395	3.9uf																																	
475	4.7uf																																	
565	5.6uf																																	
685	6.8uf																																	
825	8.2uf																																	
106	10uf																																	
126	12uf																																	
156	15uf																																	
186	18uf																																	
226	22uf																																	
336	33uf																																	

Existing Qualified Range

Estimated Qual Dates

Q4 CY 27
Q3 CY 27
Q1 CY 28
Q2 CY 28



QPL NP0 BME Range

Mil	M3253502						M3253503						M3253504						M3253505						M3253506					
Case Sizes	0402						0603						0805						1206						1210					
Code	Value	Cap Tol	4-10 V	16 V	25 V	50 V	100 V	4-10 V	16 V	25 V	50 V	100 V	4-10 V	16 V	25 V	50 V	100V	4-10 V	16 V	25 V	50 V	100V	4-10 V	16 V	25 V	50 V	100V
680	68 pF	F,G,J,K																											
820	82 pF	F,G,J,K																											
101	100 pF	F,G,J,K																											
121	120 pF	F,G,J,K																											
161	160 pF	F,G,J,K																											
181	180 pF	F,G,J,K																											
221	220 pF	F,G,J,K																											
271	270 pF	F,G,J,K																											
331	330 pF	F,G,J,K																											
391	390 pF	F,G,J,K																											
471	470 pF	F,G,J,K																											
681	680 pF	F,G,J,K																											
831	830 pF	F,G,J,K																											
821	820 pF	F,G,J,K																											
102	1000pF	F,G,J,K																											
122	1200pF	F,G,J,K																											
162	1600pF	F,G,J,K																											
182	1800pF	F,G,J,K																											
202	2000pF	F,G,J,K																											
222	2200pF	F,G,J,K																											
272	2700pF	F,G,J,K																											
332	3300pF	F,G,J,K																											
392	3900pF	F,G,J,K																											
472	4700pF	F,G,J,K																											
682	6800pF	F,G,J,K																											
822	8200pF	F,G,J,K																											
802	8000pF	F,G,J,K																											
822	8200pF	F,G,J,K																											
103	10000pF	F,G,J,K																											
123	12000pF	F,G,J,K																											
163	16000pF	F,G,J,K																											
183	18000pF	F,G,J,K																											
223	22000pF	F,G,J,K																											
273	27000pF	F,G,J,K																											
333	33000pF	F,G,J,K																											
393	39000pF	F,G,J,K																											
473	47000pF	F,G,J,K																											
683	68000pF	F,G,J,K																											
823	82000pF	F,G,J,K																											
104	100000pF	F,G,J,K																											

Existing Qualified Range
Due to the qualified from Q3 CY27

© KYOCERA AVX Components Corporation

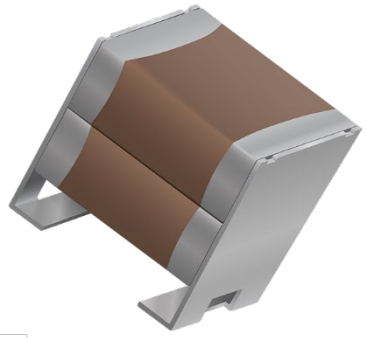
Stacked Mil BME X7R Road Maps

	DSCC 25007 Mini BME Stack Series		
	Voltage Ratings		
Cap u F M Tol	10/16/25	50	100
8.2			X2 (H only) J, L, G, H
10			X2 (H only) J, L, G, H
14			X3[2] (H, V[4])
18		X2 (H only) J, L, G, H	
20		X2 (H only) J, L, G, H	
22		X2 (H, V) J, L, G, H	X5 (V)
27	X2 (H only) J, L, G, H	X3[2] (H, V[4])	
30	X2 (H only) J, L, G, H	X3[2] (H, V[4])	
33	X2 (H only) J, L, G, H		
44	X2 (H only) J, L, G, H		
47	X2 (H only) J, L, G, H	X5 (V)	X10 (V)
54	X3[2] (H, V[4])		
66	X3[2] (H, V[4])		
82		X10 (V)	
100			
120	X5 (V)		
150			
180			
220	X10 (V)		

Key	
Qualified to DSCC 25007	In qualification to DSCC 25007
X2 = 2 X 2220 Stack	

Note 2, X3 Horizontal with J, L, P Lead Frame.
X3/5/10 Vertical with J, L only

Tape and reel available for the 2 chip Horizontal Stack



From DSCC 25007 Initial Approved Range Below

DLA Weapons Support (Columbus) drawing PIN 1/	Capacitance (µF)	Rated voltage (V_{dc})	Capacitance tolerance	Maximum H dimension 2/ (inch (mm))
25007B825M - -	8.2	100	M	.295 (7.5)
25007B106M - -	10	100	M	.295 (7.5)
25007B146M - -	14	100	M	.414 (10.5)
25007A156M - -	15	50	M	.295 (7.5)
25007A186M - -	18	50	M	.295 (7.5)
25007A206M - -	20	50	M	.295 (7.5)
25007A226M - -	22	50	M	.295 (7.5)
25007A306M - -	30	50	M	.414 (10.5)
25007Z276M - -	27	25	M	.295 (7.5)
25007Z336M - -	33	25	M	.295 (7.5)
25007Z476M - -	47	25	M	.295 (7.5)
25007Z666M - -	66	25	M	.414 (10.5)

1/ The complete PIN (see 1.2) shall include additional symbols to indicate configuration and group B testing option.

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APS COTS PLUS



HOW TO ORDER

AP03	5	A	104	K	Q	T	2	A
Size	**Voltage**	**Dielectric**	**Capacitance Code (In pF)**	**Capacitance Tolerance**	**Failure Rate**	**Terminations**	**Packaging**	**Special Code**
AP03=0603 AP05=0805 AP06=1206 AP10=1210 AP12=1812 AP20=2220	10V = Z 16V = Y 25V = 3 50V = 5 100V = 1 200V = 2 250V = V 500V = 7	NP0 = A X7R = C X8R = F X8L = L	2 Sig. Digits + Number of Zeros e.g. 10 F = 106	J = ±5% K = ±10% M = ±20%	Q = APS	T = Plated Ni and Sn Z = FLEXITERM®*** B = 10% min lead X = FLEXITERM® with 10% min lead Z,X for X7R only **RoHS compliant	2 = 7" Reel 4 = 13" Reel	A = Std.Product

Features & Benefits

Additional testing as standard

- 100% Visual Inspection
- DPA • IR, DF, Cap, DWV
- Maverick Lot Review
- Thermal Shock , 85/85 Testing
- Additional Life Testing
- C of C with every Order
- Quarterly Data Package

FEATURES •

• The APS range has been extensively reliability tested as standard resulting in an ultralow failure rate, ≤1ppb

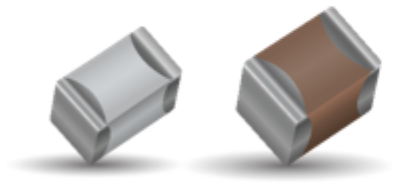
• The APS range is available with Flexiterm® that deliver's high thermo-mechanical stress resistance.

• High CV range enabling board space saving requirements

Military/Aerospace - APS Series | KYOCERA AVX

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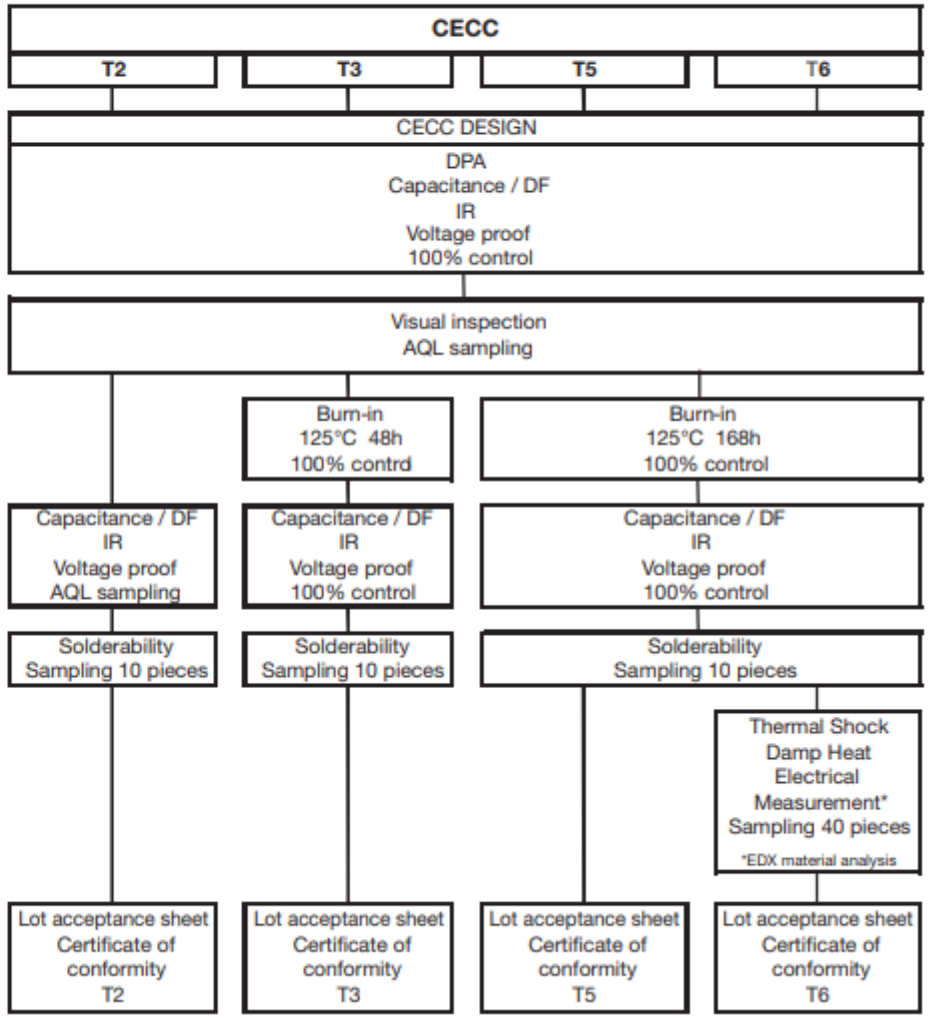
CECC MLCC PME

	CECC	
	NP0/C0G	X7R
		
Qualification	CECC/COTS+	CECC/COTS+
Testing	0 to 168 Hrs Voltage Cond.	0 to 168 Hrs Voltage Cond.
Termination	Sn/SnPb/PdPt	Sn/SnPb/PdPt
Temperature	-55°C to +125°C	-55°C to +125°C
Voltage Rating	25 - 500 V	25 - 500 V
0805	4.7pf – 1.8 nf	330 pf – 100 nf
1206	12 pf – 4.7 nf	1 nf – 220 nf
1210	15 pf – 10 nf	2.2nf – 470 nf
1812	100 pf - 15 nf	2.7 nf – 1 uf
2220	470pf – 39 nf	4.7 nf 2.2 uf

CECC Range

- CECC above commercial and can have extended 100 % testing
- Wide voltage range and terms

RELIABILITY LEVELS DESCRIPTION



CECC PME Multi-Layer Ceramic Capacitor Series | KYOCERA AVX

© KYOCERA AVX Components Corporation

THANK YOU.

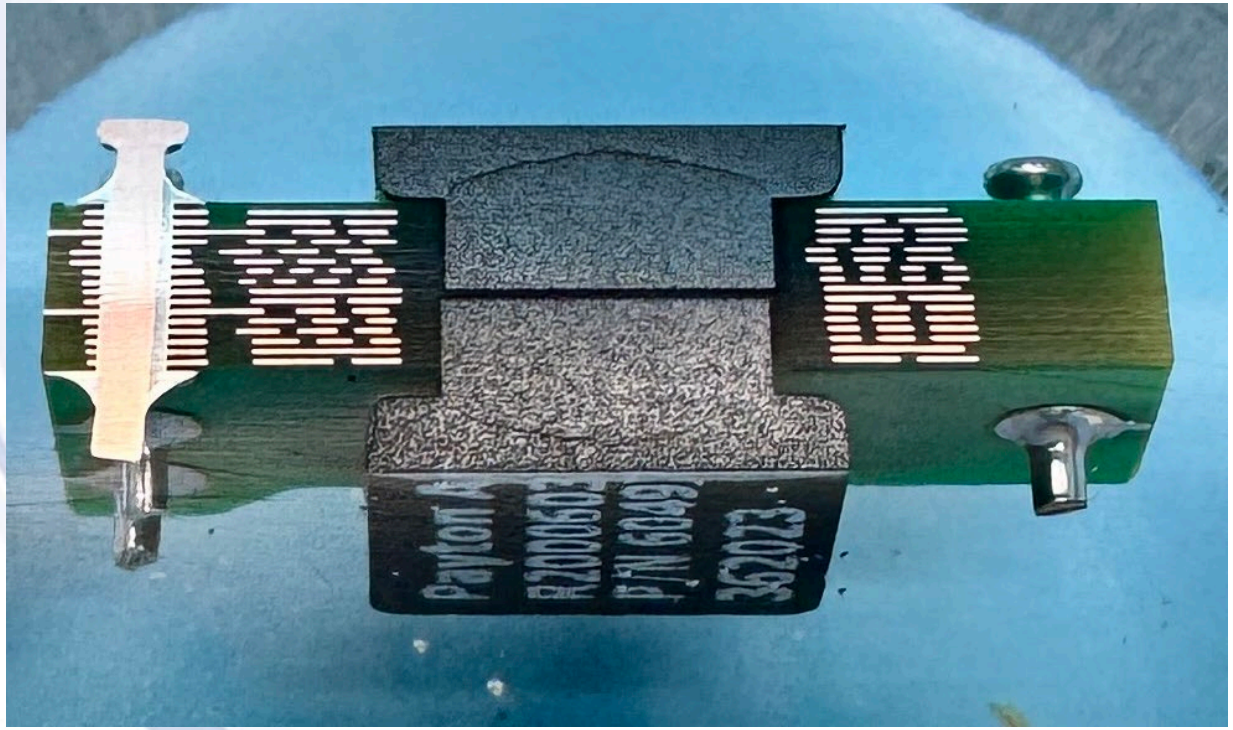
KYOCERA AVX®

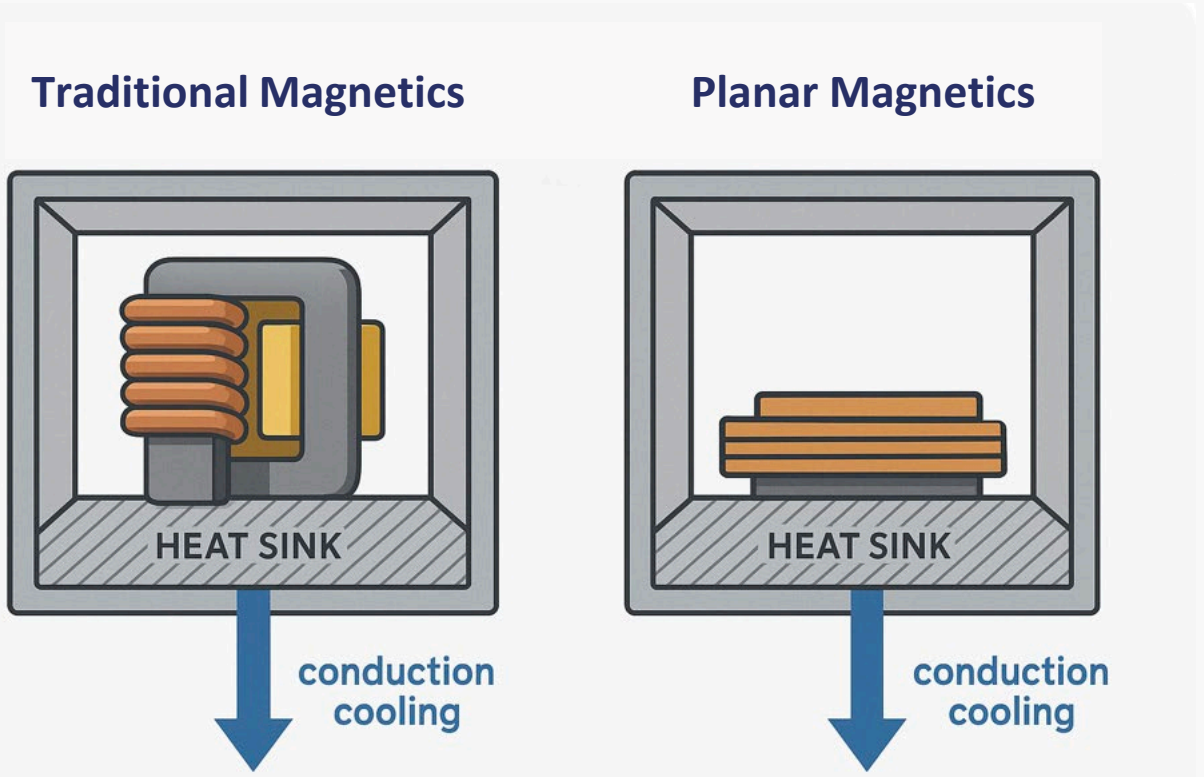
KYOCERA-AVX.com

Planar Magnetics for Space Applications

ESA Space Passive Component Days 2026, Noordwijk the Netherlands.

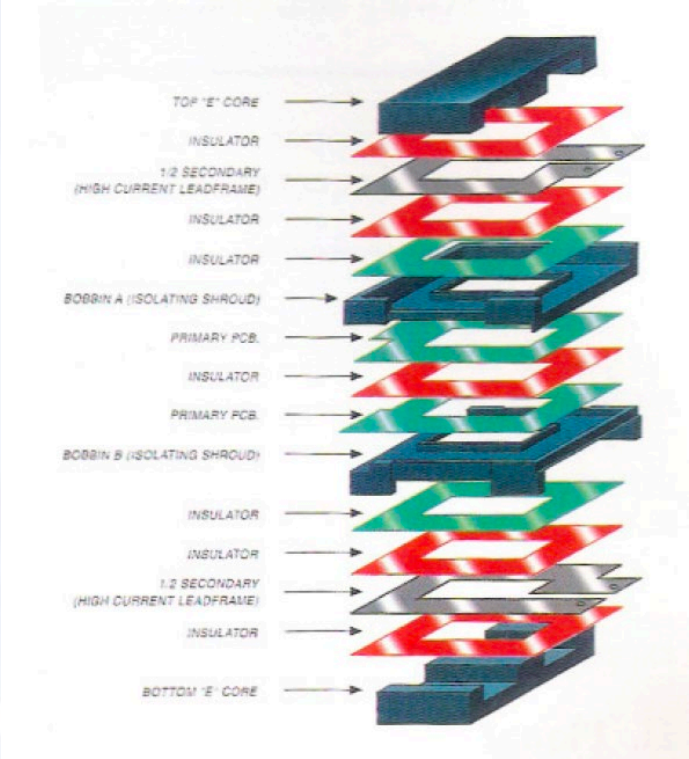
Jim Marinos, EVP Engineering Jim@paytongroup.com

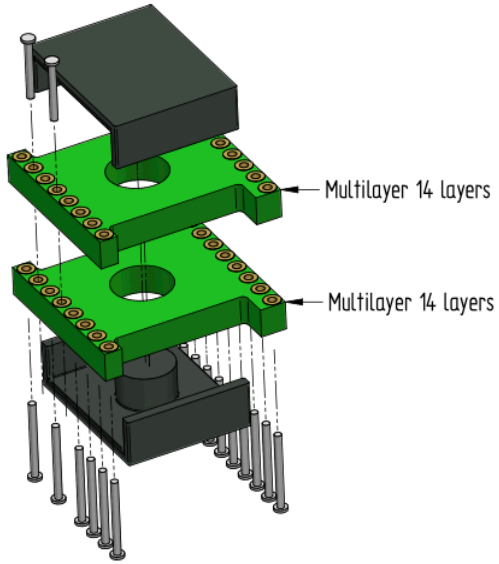


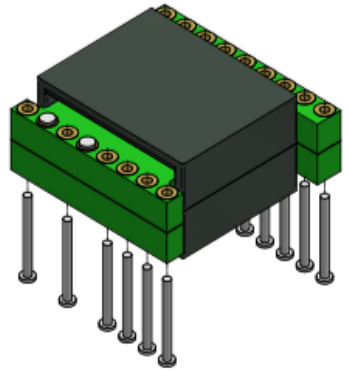


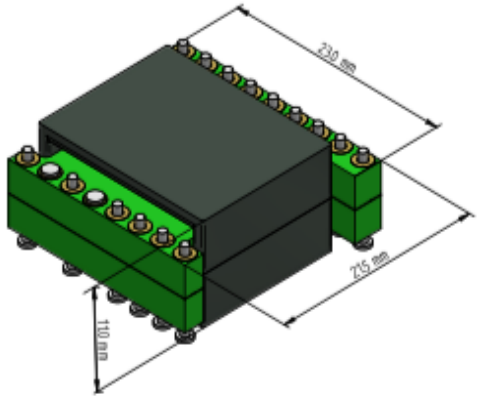
PLANAR
Innovation • Design • Performance

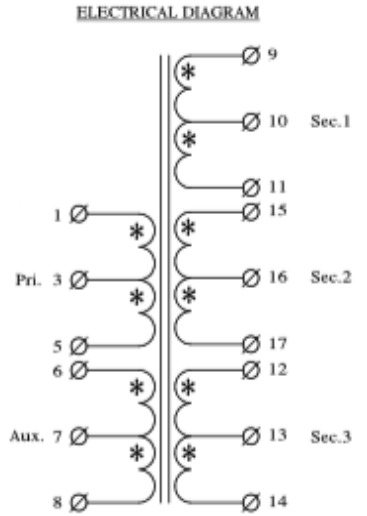
Simple Construction













PAYTON PLANAR
Innovation • Design • Performance

Payton Planar Magnetics In Space for over 28 years

Why Planar for Space

- Reduced Size and Weight
- High Reliability & Repeatability based on few parts
- Simple Construction
- High efficiency up to 5MHz
- Thermal management system, conduction cooling
- Screening per EEE-INST-002, Mil-Std-981 & MIL-STD-1580
- Partial Discharge designs up to 20kVrms with detection level to 1pC

Key Planar points

- simple construction
- Build in layers- high reliability and repeatability
- Easy to control the electrical parameters such as leakage and capacitance



PAYTON PLANAR
Innovation • Design • Performance

Payton Planar Magnetics

Size • Weight • Reliability • Producibility • Efficiency • Cooling





PLANAR
Innovation • Design • Performance

What Makes a Reliable Planar Design

1. Material Selection
2. Thermal Management
3. Mechanical Robustness
4. Electrical Integrity
5. Manufacturability
6. MIL-SPEC compliance

A reliable planar design balances performance with rugged construction. It’s not just about layout. It’s about selecting the right materials and ensuring robust thermal paths, maintaining mechanical stability and designing for consistent, repeatable manufacturing.

PAYTON PLANAR
Innovation • Design • Performance

Management Of Parasitics In Planar Magnetics

1. Minimizing Leakage Inductance
2. Managing Interwinding Capacitance
3. Controlled Impedance Design
4. Parasitic Modeling and Simulation
5. Layout of the windings
6. MIL-SPEC compliance

Managing parasitics in planar magnetics is *critical* to ensure efficiency, EMI performance, and reliability - especially in high-frequency and high-reliability environments like aerospace.

The key parasitics are leakage inductance and interwinding capacitance, and both can be managed through careful design choices.

PAYTON PLANAR
Innovation • Design • Performance

Lifetime Prediction of Planar Magnetics for Harsh Environments

Inductance

Multilayer Boards

Laminates and Prepregs,

Tg, Td, Thermal, Moisture

Ferrite Cores MnZn

Ferrite glue

Partial discharge

PAYTON PLANAR

Innovation • Design • Performance

Thank You

Jim@paytongroup.com

www.paytongroup.com

SPCD
SPACE PASSIVE COMPONENT DAYS

Zi Zoppas Industries
Heating Element Technologies

Beyond Components: Zoppas Industries (RICA) QML Milestone and Next-Gen Space Thermal Solutions

ZOPPAS INDUSTRIES HEATING ELEMENT TECHNOLOGIES

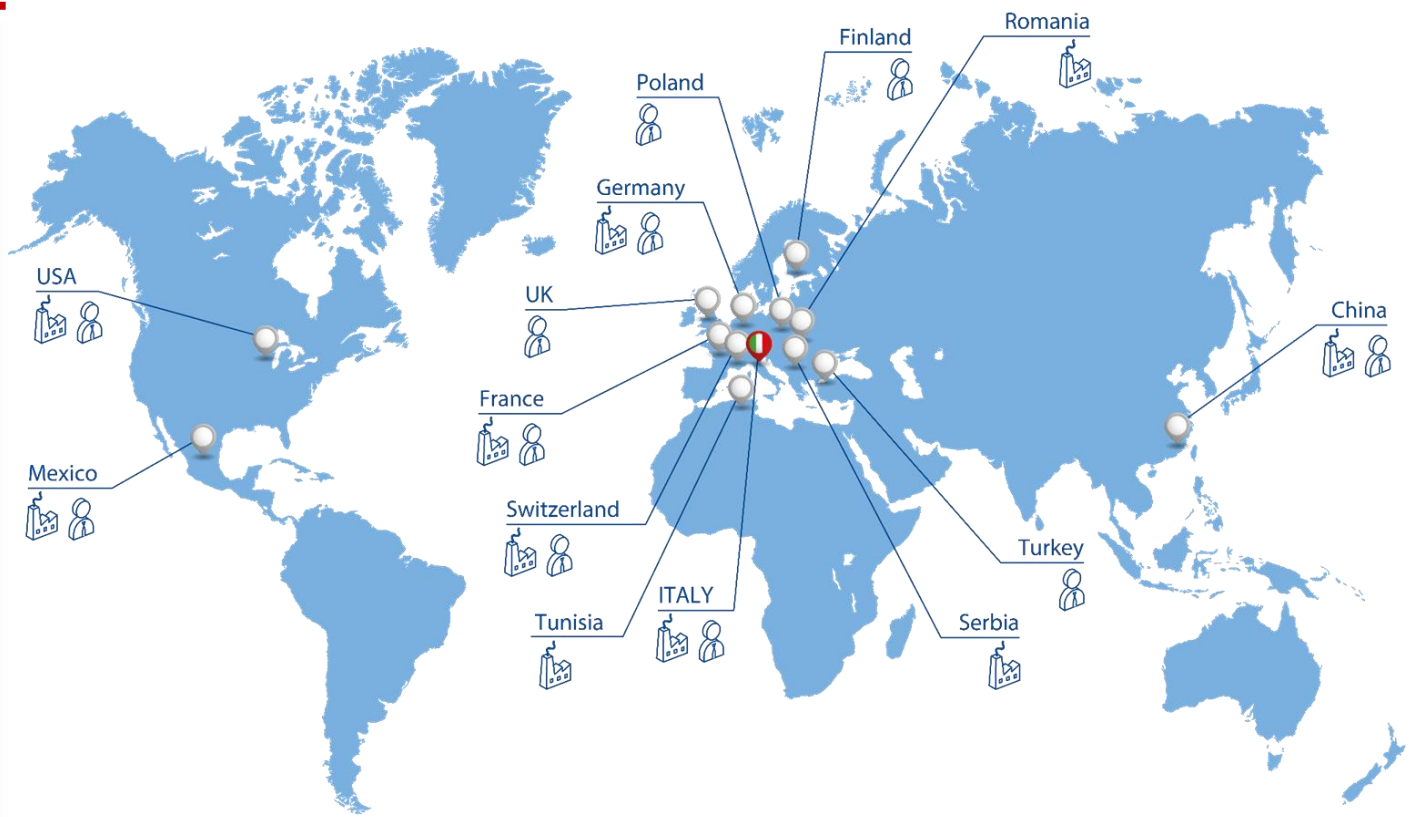
60+
Years of experience in design and production of heating systems

8000
Employees worldwide

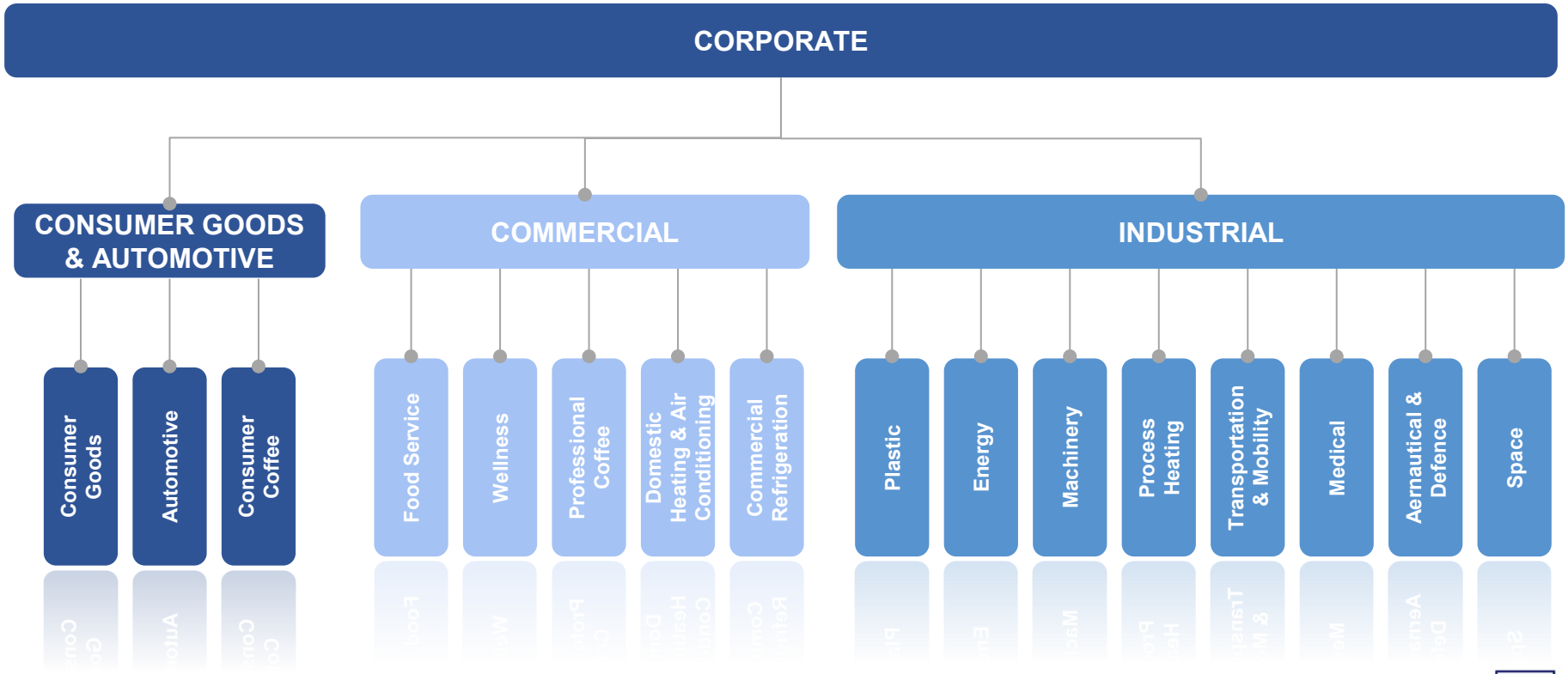
15
Countries with **offices**

12
Countries with **production sites**

200
Market sectors served with heating solutions



MARKET APPROACH



ZOPPAS INDUSTRIES HEATING ELEMENT TECHNOLOGIES

QUALIFICATION LEVELS - ESCC FRAMEWORK

QPL since 1992

Qualified Parts List:

- **Polyimide FEP**
  Max 200°C (ESCC 4009/002)
- **Polyimide Acrylic**
  Max 150°C (ESCC 4009/004)
- **NEW!! Pure Polyimide**
  Max 250°C (ESCC 4009/005, on going)

NEW!! QML

Qualified Manufacturers List:

- Embedded temperature sensor
- Heater + space qualified connector

NEW!! ENHANCED GRADE

Components manufactured by a QML company, per an ESCC-approved PID, guaranteed by ESCC Executive as EPPL2

NEW!! QPL: PURE POLYIMIDE HEATER (PPH)

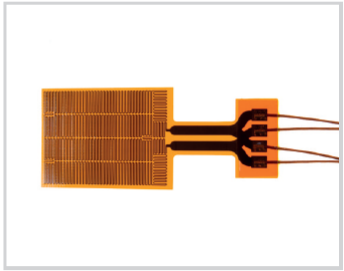
The **PPH (Pure Polyimide Heater)** is currently the highest-performing flexible heater for space applications. It features exceptional radiation resistance, high resistance density, and the capability to reach ultra-high operating temperatures.

Key Benefits & Technical Specifications

- **Resin-Free Construction**: built without additional internal resins.
- **High Temperature**: max qualified operating temperature up to 250°C with high power density up to 0.82 W/cm^2 in still air at 25°C.
- **Resistance Density**: high resistance density up to 330 Ω/cm^2.
- **Ultra-Thin & Lightweight:** overall thickness starting from just 100 µm.

PURE POLYIMIDE HEATER

The pure polyimide heater (PPH) is the nowadays most performing product among the flexible heaters for space. It is able to reach high temperatures, and offers a coexistence of high resistive density and generated thermal power, which translates into the possibility of having rather fine and dense tracks on a very thin material, with a quicker decrease of temperature gradient with the heatsink.
Moreover, it has the characteristic of being very resistant to radiations.
The PPH can be provided with PSA (3M 966 Pressure-Sensitive Adhesive), in single or double layer configurations (primary and redundant).
It can be also supplied with temperature sensors and/or connectors embedded.
Pure polyimide heater is under ESA qualification: ESCC 4009/005.



The product can moreover have different qualification levels, from ESA qualified to "Enhanced Grade":

Qualification Level	Description
ESA qualified Pure Polyimide Heater (ESCC)	Fully ESA-qualified Space Pure Polyimide Heater, involving only ESCC-qualified parts, and produced covering all the inspections, controls and tests foreseen by the applicable ESCC specification.
Enhanced Grade (EG) Pure Polyimide Heater	These heaters are produced in full compliance with the qualified process used for the ESCC production, but the heaters can be EG or COTS, and the validation test campaign will be tuned accordingly and in accordance with the applicable ESA EG specification and the Customer requirements.

MAIN BENEFITS

- Very low thermal mass and thickness (minimum 100 microns overall)
- Solution without any additional internal resin
- Max qualified temperature up to 250 °C, and high power density up to 0.82 W/cm² (suspended in still air at 25°C)
- High resistance density (up to 330 Ω/cm²)
- Customized shapes, up to 300 x 300 mm

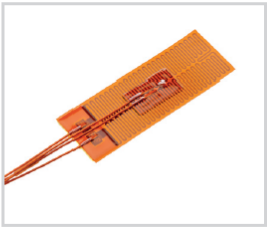
NEW!! QML SENSORIZED HEATER

The **Sensorized Flexible Heater** integrates a high-precision temperature sensor directly into the flexible heater assembly.
This all-in-one subassembly enables accurate, real-time temperature detection at Thermal Reference Points (TRPs) and provides active derating control during heating phases.

Integration options

- **Sensor standalone**, integrated within Kapton layers, with an optional adhesive layer.
- **Sensor embedded with a heater in the cold area**, to measure heatsink at the TRP.
- **Sensor embedded with a heater over the track**, to measure the heater for derating control.

SENSORIZED HEATERS



The integration of a temperature sensor (e.g. RTD) with the flexible heater is ideal to detect temperature in areas where accuracy and fast response are required.

In this perspective, the thermistor takes measurements at the TRPs (Thermal Reference Points) and can, at the same time, control the derating parameter to be respected by the heater, during active heating phases.

The thermistor can have different configurations, depending on the Customer requirements and application, for example:

- For ground testing: to correctly apply the ECSS derating rule;
- For flight usage: all-in-one integration and positioning of the heater+temperature sensor, thus reducing AIT costs.

The subassembly can moreover have different qualification levels, from ESA qualified to "Enhanced Grade":

Qualification Level	Description
ESA qualified Sensorized Heater (ESCC)	Fully ESA-qualified Space Sensorized Heater, involving only ESCC-qualified parts, and assembled covering all the inspections, controls and tests foreseen by the applicable ESCC specification.
Enhanced Grade (EG) Sensorized Heater	These heaters are assembled in full compliance with the qualified process used for the ESCC assemblies, but the parts can be EG or COTS, and the validation test campaign will be tuned accordingly and in accordance with the applicable ESA EG specification and the Customer requirements.

MAIN BENEFITS

- Easy integration and possibility to have all-ESCC certified parts and assembly
- Already tested for characterization

INTEGRATION METHODS

- Hot sealing with Polyimide Polymer/FEP (space qualified)
- Hot sealing with Polyimide Film/Acrylic Adhesive (space qualified)
- Embedded sensor integrated with acrylic resin (space qualified)

POSSIBLE CONFIGURATIONS

The sensor can be integrated to all RICA space heaters (4009/002, 4009/004, 4009/005, Enhanced Grade) including the connectorized ones:

- Over the hot area (additional derating control) see Fig.1
- In the cold area (TRP measurements) see Fig. 2

NEW!! QML CONNECTORIZED HEATER

The **Connectorized Flexible Heater** features an integrated space-grade connector designed for fast, simple, and reliable "plug-and-play" integration during Assembly, Integration, and Test (AIT) phases. Connection choices can be agreed upon with the customer and delivered as either potted or crimped assemblies

Key Benefits

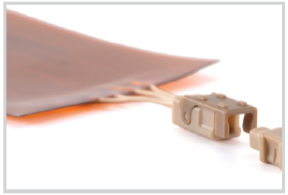
- **Time Savings & Efficiency:** Dramatically speeds up interconnection activities during Thermal Control System (TCS) AIT phases, especially for series manufacturing.
- **Plug-and-Play Reliability:** Enables fail-safe, fast-locking connection and disconnection operations, making it easy to exchange integrated panels between different assembly phases or facilities.
- **Simplified Supply Chain:** Consolidates procurement into a single subassembly supplier, optimizing the vendor database.

CONNECTORIZED HEATER

RICA offers a heater with an integrated space-grade connector, for easy and quick integration. The connector's choice is agreed with the Customer, and can be either potted or crimped.

In the latter case, RICA offers a verticalized integration, thanks to its ECSS-Q-ST-70-26C crimping process' qualification.

The subassembly can have different qualification levels, from ESA qualified to "Enhanced Grade":



Qualification Level	Description
ESA qualified Connectorized Heater (ESCC)	Fully ESA-qualified Space Connectorized Heater, involving only ESCC-qualified parts, and assembled covering all the inspections, controls and tests foreseen by the applicable ESCC specification.
Enhanced Grade (EG) Connectorized Heater	These heaters are assembled in full compliance with the qualified process used for the ESCC assemblies, but the parts can be EG or COTS, and the validation test campaign will be tuned in accordance with the applicable ESA EG specification and the Customer requirements.

MAIN BENEFITS

- Time saving for interconnection activities during TCS AIT phases, especially for in-series integration, allowing fail safe connection/disconnection operations thanks to a plug and play solution, with fast locking connectors
- Suppliers' database optimization with an unique heater subassembly provider
- To simplify the swift exchange of integrated panels among different assembly phases or locations
- Customizable connectors with various sizes (according to ESCC 3401), down to 2/4 pin connectors

NEW!! ENHANCED GRADE QUALIFICATION

In addition to ESCC-qualified flexible heaters, ZIHET also offers more commercial qualification levels:

- **EG2 (Qualification Model)**
- **EG1 (Proto-Flight Model)**

Ensuring compliance for in-flight use while allowing faster response and market competitiveness for the vast New Space Economy: institutional or commercial programs, Cubesats, Nanosats, Constellations and ground test facilities.

- **Same product, same process, same manufacturing lines**
- **Reduced set of testing**
- **Currently under ESA certification as “Enhanced Grade” Space Products**

Zoppas Industries
Heating Element Technologies

GET IN TOUCH WITH US

space@zoppas.com

6TH SPACE PASSIVE COMPONENT DAYS - SPCD 2026

Technical Introduction of Components (TICs)

Development of HDI PCBs using low loss materials

14th October, 2026

OKI Circuit Technology Co.,Ltd
Sayaka Iwamiya, Yasuhisa Togashi

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Company Profile

Head Office Location:
1-15-68 Takarada, Tsuruoka-shi, Yamagata, 997-0011, Japan
Number of Employees: 716
Foundation: 1980





- High Speed HDI
- Solution for Heat Dissipation
- JAXA Certifications
- One-Stop Service







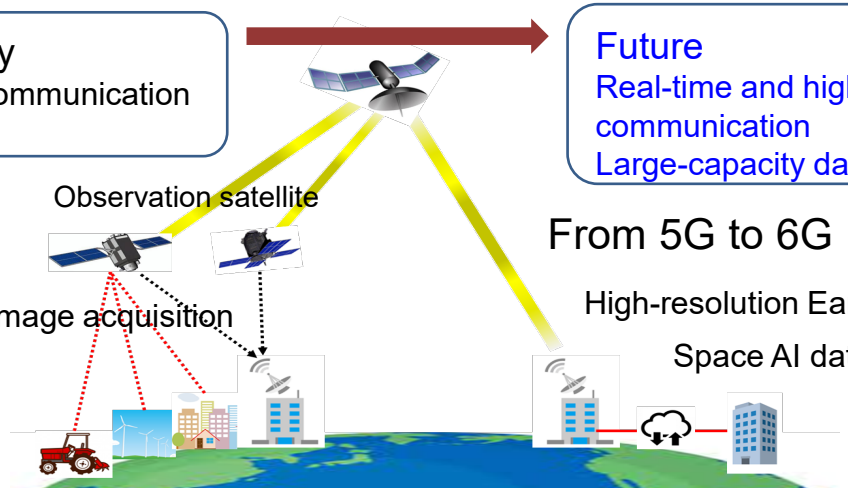


Latest Trend in Space Components

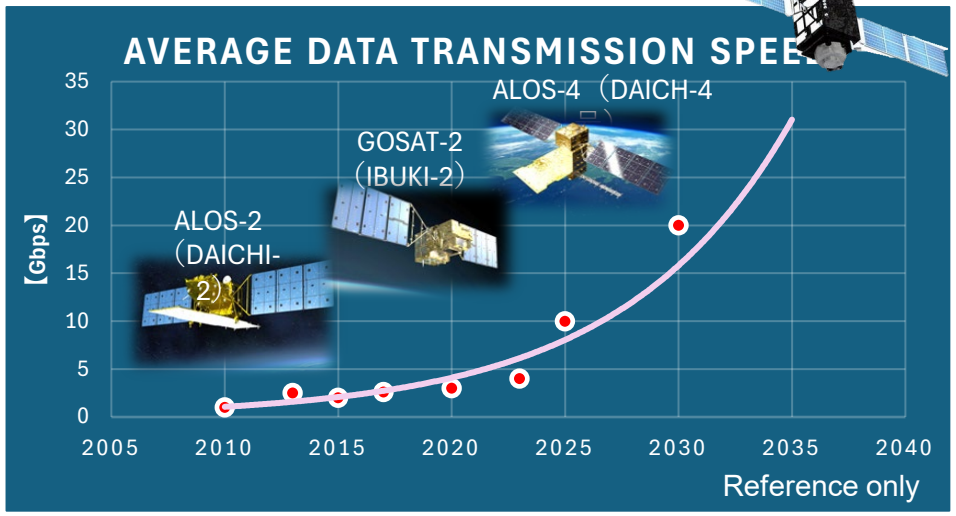
Increase data capacity of satellites

Currently
Limited communication capacity

Future
Real-time and high-speed communication
Large-capacity data transfer



Data-transmission speed



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Material Property Table

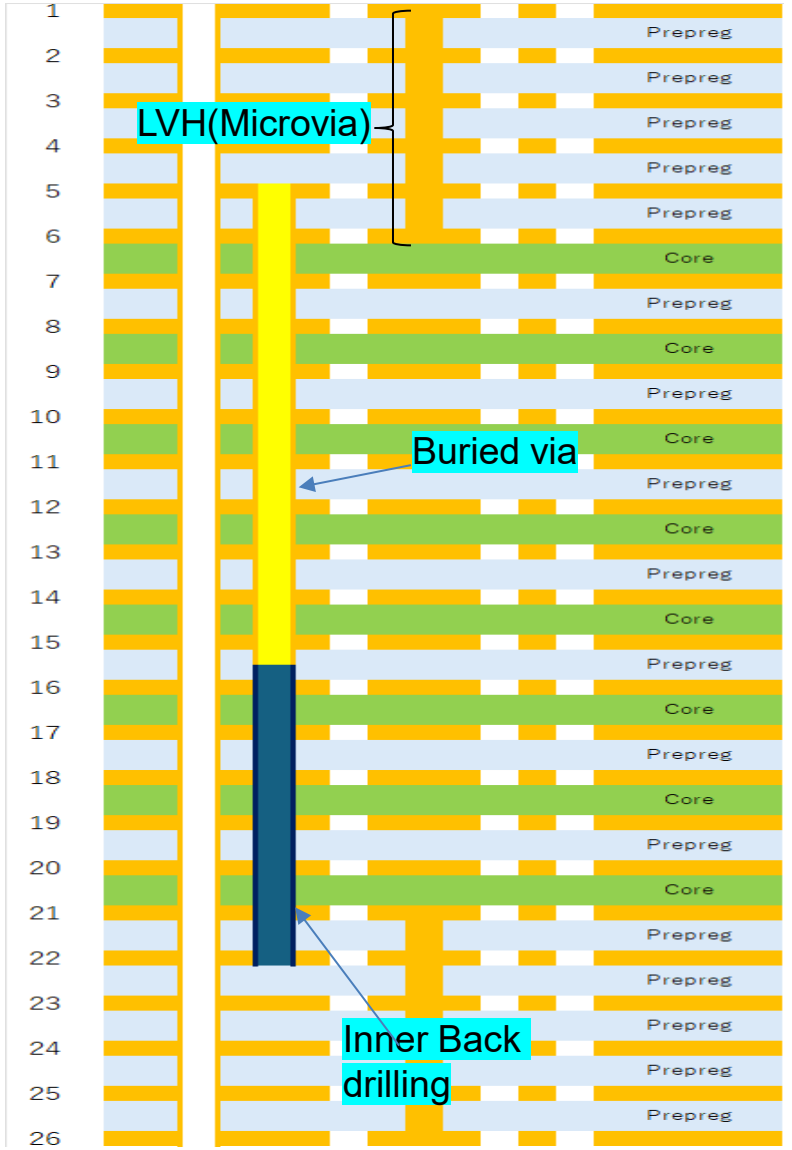
Material manufacturers			Panasonic				DOOSAN	**isola**
Material name			Megtron6(K) (R-5775K)	Megtron6(N) (R-5775N)	Megtron7(GN) (R-578YGN)	Megtron8S(U) (R-579YS(U)	DS-7409DJG(N)	**Tachyon 100G**
Tier class			Tier5 (for 10Gbps)	Tier5 (for 10Gbps)	Tier6 (for 25-50Gbps)	Tier6 (Up to 56Gbps)	Tier6 (for 25-50Gbps)	**Tier6 (for 25-50Gbps)**
Types of glass cloth			E- glass	Low-Dk glass	Low-Dk glass	Ultra Low-Dk glass	Low-Dk glass	Low-Dk glass
Dk, Permittivity	1GHz	-	3.5	3.4	3.4	-	3.6	3.04
	10GHz	-	3.4	3.4	3.3	3.1	3.2	**3.02**
Df, Loss Tangent	1GHz	-	0.0020	0.0015	0.0010	-	0.0014	0.0021
	10GHz	-	0.0030	0.0030	0.0020	0.0012	0.0028	**0.0021**
CTE	X	ppm/℃	14～16	14～16	14～16	-	12	15
	Y		14～16	14～16	14～16	-	12	15
	Z（α1）		45	45	42	50	35	45
	Z（α2）		260	260	280	270	200	250
Glass Transition Temperature (Tg)	DMA	℃	210	210	220	220	220	230
Peel Strength	18μm	kN/m	1.1	0.5	0.5	-	1.0	0.79
Time to Delaminate	260℃	sec	>120	>120	>120	>120	-	>60
OTC Performance	Prototype/ Mass production	–	Yes/Yes	Yes/Yes	Yes/Yes	Yes/FY26.2Q onwards	FY26.3Q onwards	FY26.3Q onwards

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Example Requirements Specification

- Material：Tachyon100G（isola）
- Number of layers：26L (5+16+5)
- Board thickness：3.6mm (141.7mil)
- Inner Back Drilling : 22L to 16L (must cut)
- Surface treatment：ENEPIG
- LVH Via filling： Filled by copper
- LVH (Microvia) is stacked
  Offset from the core via LVH is mixed in the core layer.
- Standard：IPC-6012 Class 3

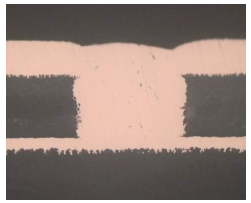
＜Stack up: 26L (5+16+5)＞



LVH & Inner back drilling condition check

【LVH Evaluation specifications】

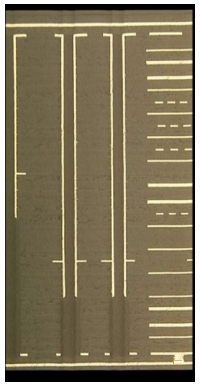
Item	Spec
LVH Dia.	Φ0.10, Φ0.125, Φ0.15 (mm)
Interlayer thickness	60μm



X-section(EVA board)
LVH (Φ0.10mm)

【Inner Back drilling Evaluation specifications】

Item	Spec
Drilled hole Dia. (Buried via)	Φ0.15mm
Drilled hole Dia. (Back Drilling)	Φ0.25mm
Stub length	300μm
Tolerance	+/-200μm

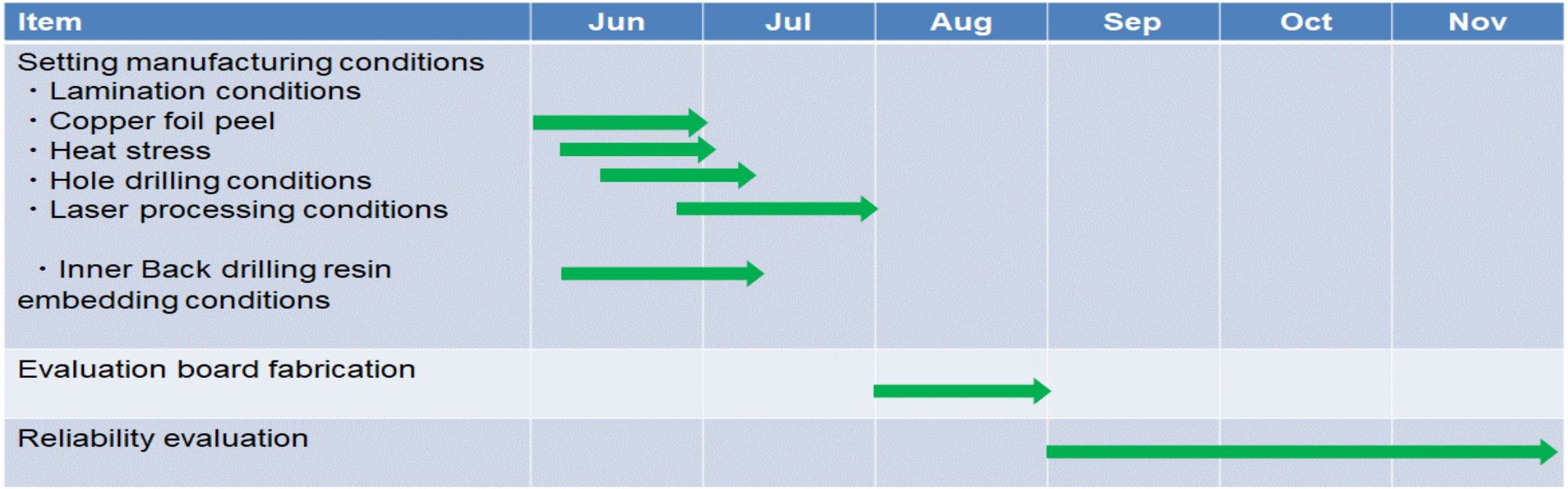


(X-section(EVA board))
Inner Back Drilling

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Schedule

We plan to complete the evaluation by Sep.,2026, and finish all reliability test by end of Nov.,2026



Summary & Further Challenges for the Future

By developing complex HDI substrates using low-dielectric materials (Tachyon100G) that are used globally in space satellite equipment, we will provide customers in the global market with PCB products that meet the future technological trends of the space satellite market.

We will proceed with the development of the technology roadmap. Develop the PCBs for higher data transmission speeds ⇒Investigation of next-generation high-speed materials

	Megtron9 (Panasonic)	DS-7409DQN (Doosan)	ASTRA MT77 (Isola)	ELL 302 (AGC)
Dk	3.0	3.14	3.0	3.08
Df	0.0007	0.0014	0.0017	0.0008

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We will continue to develop and supply the most advanced printed circuit boards for the safety, security, and dreams of mankind.



Open up your dreams

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