GETELEC

We protect your electronics

OUR SOLUTIONS FOR AERONAUTICAL INDUSTRIES

www.getelec.com

INTRODUCTION

Due to the critical nature of aviation applications for security, embedded electronic components and systems must operate reliably for extended periods of time under extremely harsh environmental conditions. Electromagnetic compatibility needs to be rigorously addressed as part of the design process to avoid any risk of malfunction of individual components or complete modules caused by interference from other sources.

Appropriate thermal management measures will help the electronic components to be kept at optimum operating temperature and thus ensure stable performance.

For more than 50 years, GETELEC has been offering products, technical know-how and customer support related to the aerospace sector, both in terms of electronic subassemblies and technical sealing.

NAVIGATION & CONTROLE

Aircraft are equipped with electronic aids to navigation, communication and collision avoidance. Our range of EMI shielding seals offers a reliable, powerful and lightweight solution for the design of compact electronic equipment. Typical applications may include display systems, identification systems (IFF), control units or antennas.

In addition to our EMI conductive seals, we offer solutions to heat dissipation and technical sealing problems in harsh environments.

CABIN INTERIOR

The new generation of on-board multimedia system (IFE) used for commercial flights includes many services such as touch screens, audio and video services, internet access and even the telephone. However, these systems require special treatment in the management of problems related to emissions / receptions of electromagnetic interference and in the management of heat dissipation.

STRUCTURE & ENGINE

Electromagnetic interference (EMI) seals on aircraft structures call for strict specifications, in which reliability and safety are mandatory, especially when it comes to exposure to very harsh environments.

The concept of corrosion resistance is a subject on which GETELEC responds with a range of bi-material anticorrosive conductive seals.

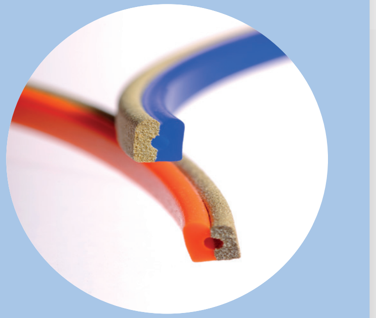
RANGE OF PRODUCTS

EMI CONDUCTIVE SILICONE GASKETS

GETELEC develops its own conductive mixtures meeting the requirements of standards MIL G 83528, MIL STD 285, GAM EG-13. Our EMC experts are at your disposal to assist you in the definition of your projects. All of these seals are available as molded, cut flat, extruded and overmolded parts.

Volume Resistivity of 0.0016 Ω.cm to 2.7 Ω.cm

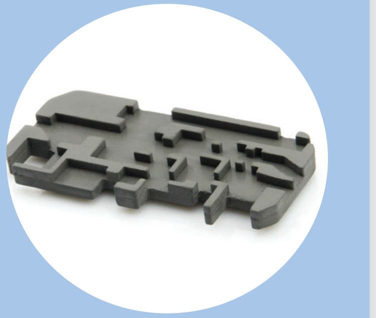
Shielding effectiveness between 80dB to 140dB (20MHz - 10GHz)



EMI CONDUCTIVE CORROSION-RESISTANT SILICONE GASKETS

Bi-material seals are an effective solution to the corrosion problems encountered by using conductive gaskets while they are in contact with different electrolytic agents, salt spray or acid medium. Composed of a conductive silicone part and an environmental sealing part, all joined in one gasket by a principle of co-extrusion, they generate a gain in terms of size in yourequipment.

Volume resistivity from 0.016 Ω.cm to 2.7 Ω.cm
Shielding effectiveness between 80dB and 140dB (20 MHz - 10GGHz)

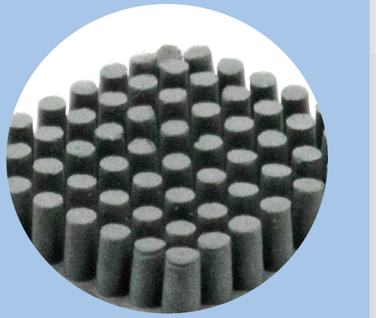


MICROWAVE ABSORBERS

Microwave absorbers consists of flexible silicone materials filled of magnetic particles. These materials ensure an excellent attenuation performance over given frequency bands, which can reach an attenuation greater than 20 dB of the incident wave.

Our laboratory has developed several formulations composed of epoxy type rigid microwave absorbers, silicone-based flexible microwave absorbers and foams of different thicknesses.

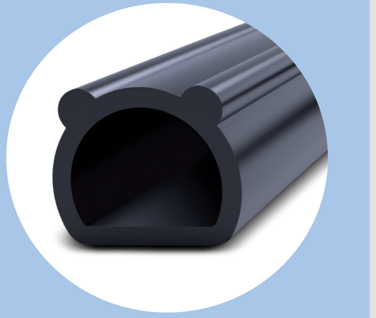
Thermal conductivity of our products is between 1 and 7 W/m.K



THERMAL INTERFACE MATERIALS

Positioned between the power component and the cooler, thermal pads are designed to optimize the heat dissipation and thus reduce the thermal resistance of your equipment. Our complete range consists of high flexible thermally conductive gap fillers, thermally conductive electrical insulators, both electrical and thermal conductive silicones.

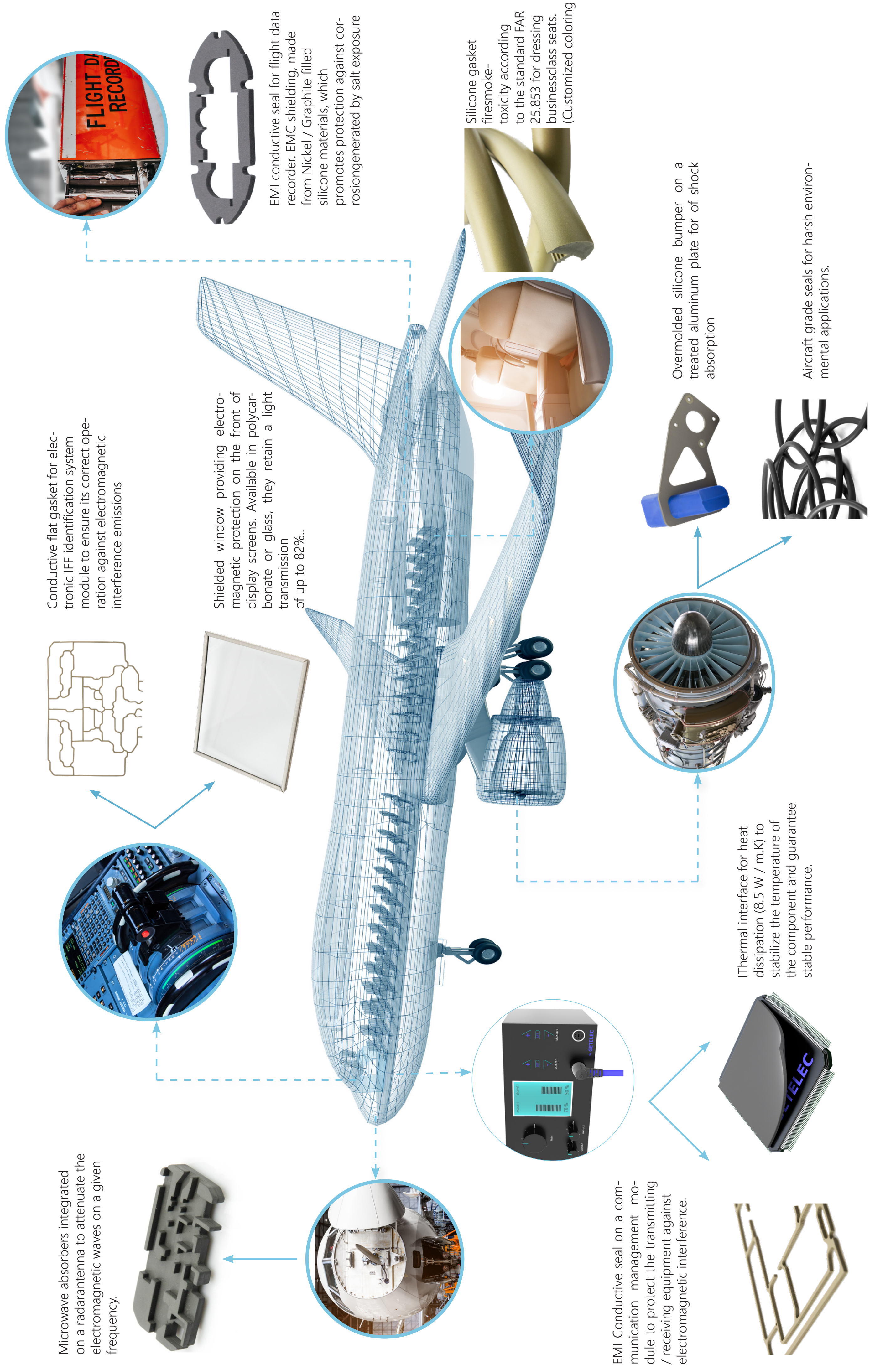
Thermal conductivity of our products is between 1 and 8.5 W/m.K



ENVIRONMENTAL SEALING GASKETS

GETELEC formulates its own silicone mixtures and masters the transformation, allowing it to offer a tailor-made solution to its customers. Our specific silicone grades allow us to offer you a complete range of aircraft grade seals available at **hardnesses between 20 Shore A and 90 Shore A and complies with the requirements of the fire standard | Smoke | Toxicity FAR 25.853.**

EMI CONDUCTIVE SILICONE INDUSTRY



EMI conductive seal for flight data recorder. EMC shielding, made from Nickel / Graphite filled silicone materials, which promotes protection against corrosiongenerated by salt exposure

Silicone gasket firesmoke-toxicity according to the standard FAR 25.853 for dressing businessclass seats. (Customized coloring

Overmolded silicone bumper on a treated aluminum plate for of shock absorption

Aircraft grade seals for harsh environmental applications.

Conductive flat gasket for electronic IFF identification system module to ensure its correct operation against electromagnetic interference emissions

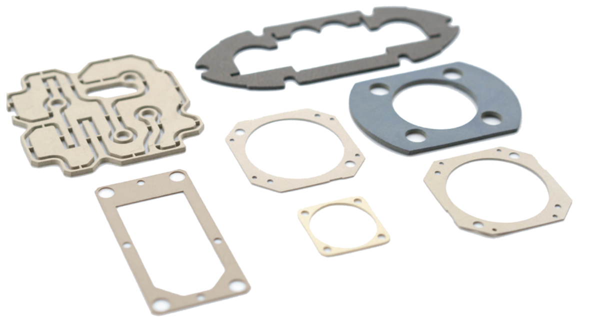
Shielded window providing electromagnetic protection on the front of display screens. Available in polycarbonate or glass, they retain a light transmission of up to 82%..

IThermal interface for heat dissipation (8.5 W / m.K) to stabilize the temperature of the component and guarantee stable performance.

Microwave absorbers integrated on a radarantenna to attenuate the electromagnetic waves on a given frequency.

EMI Conductive seal on a communication management module to protect the transmitting / receiving equipment against electromagnetic interference.

EMI CONDUCTIVE SILICONE GASKETS



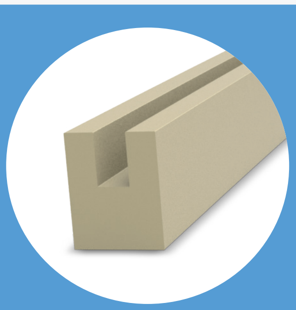
Our conductive materials are developed in every respect by our chemical engineers. From the selection of raw materials to the final transformation, they make specific formulations for each application and master all the processes of development.

This mastery allows us to define the material according to your equipment, in order to offer you a bespoke solution adapted to your needs.

Properties	Standards	GT 1000	GT 2020	GT 5000	GT 5200
Type MIL G 83528		K		B	
Elastomer		Silicone	Silicone	Silicone	EPDM
Conductive filler		Silver-plated copper	Pure silver	Silver-plated aluminum	Silver-plated aluminum
Volume resistivity Ω.cm	MIL G 83528	< 0.005	< 0.006	< 0.0054	< 0.015
Hardness Shore A	ASTM D 2240	82	75	65	70
Density g/cm^3	ASTM D 792 Method A	3.40	3.90	1.90	2.00
Break resistance (Mpa)	ASTM D 412 Method A C	2.80	4.61	1.89	1.70
Elongation at break (%)	ASTM D 412 Method A C	250	355	286	470
Tear strength(N/mm)	ASTM D 624 Method C	13.44	13.73	8.43	12.00
Residual deformation after 70 hours at 100°C (%)	ASTM D 395 Method B	17.50	33.12	17.30	40
Working temperature (°C)		-55 °C to +125°C	-55°C to +160°C	-55°C to +160°C	-45°C to +160°C
Shielding performance 20 MHz 100 MHz 500 MHz 2 GHz 10 GHz		 130 dB 140 dB 120 dB 120 dB 120 dB	 110 dB 110 dB 110 dB 110 dB 110 dB	 128 dB 137 dB 133 dB 122 dB 104 dB	 128 dB 137 dB 133 dB 122 dB 104 dB
Color		Grey	Light beige	Grey	Grey

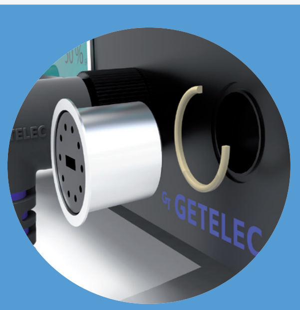
All these products may be available in fluorinated version on demand.

AVAILABLE FORMATS :



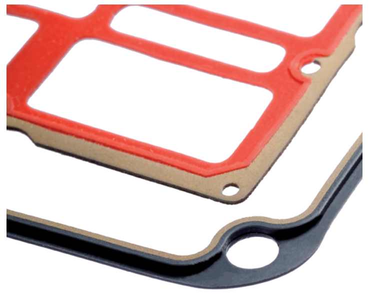
Extruded

Cut



Molded

EMI CONDUCTIVE CORROSION-RESISTANT SILICONE GASKETS



By separating the EMI shielding function from the environmental sealing function, the seal becomes more resistant to extreme environments. Resistant to water and pressure, these bi-material seals offer a longer service life than a conductive mono-material seal.

Our expertise in silicone mixtures offers a range of materials with EMC performance characteristics, hardness and multi-contaminant behavior.

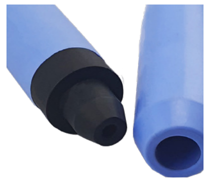
Properties	Standard	GT 1040	GT 1060	GT 5040	GT 5060
Elastomer		Silicone		Silicone	
Conductive filler		Silver-plated copper		Silver-plated aluminum	
Volume resistivity Ω.cm	MIL G 83528	< 0.005		< 0.0054	
Hardness Shore A ± 7	ASTM D 2240	82		65	
Density g/cm^3	ASTM D 7992 Method A	3.40		1.90	
Break resistance (Mpa)	ASTM D 412 Method AC	2.20		1.89	
Elongation at break (%)	ASTM D 412 Method AC	250		286	
Tear strength (Kg/cm)	ASTM D 624 Method C	13.70		8.60	
Residual deformation after 70 hours at 100°C (%)	ASTM D 395 Method B	17.50		17.30	
Shielding performance 20 MHz 100 MHz 500 MHz 2 GHz 10 GHz		 130 dB 140 dB 120 dB 120 dB 120 dB		 128 dB 137 dB 133 dB 122 dB 104 dB	
Working temperature (°C)		-55°C to+125°C		-55°C to +160°C	
Color		Beige		Beige	
Environmental sealing component					
Density g/cm^3	ASTM D 792	1.10	1.27	1.10	1.27
Hardness shore A ± 7	ASTM D 2240	40	60	40	60
Tensile strength Psi Mpa	ASTM D 412	 1000 6.80	 950 6.55	 1000 6.80	 950 6.55
Elongation (%)	ASTM D 412	500	300	500	300
Residual deformation after 70 hours at 100°C (%)	ASTM D 395 Method B	30	33	30	33
Color		Orange	Blue	Orange	Blue

All these products may be available in fluorinated version on demand.

AVAILABLE FORMATS :

Extruded

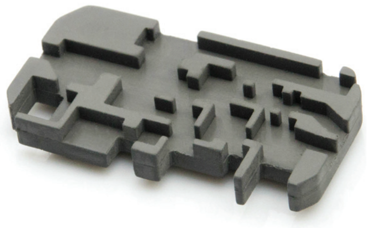
Cut



Molded

MICROWAVE ABSORBERS

Flexible silicone microwave absorbers



GT602 range have narrowband performance but also high-power density performance (> 1W / cm2) for positioning on antennas or high-power equipment. Thanks to its low degassing properties, our GT602 range is suitable for space applications. These absorbers are frequently used with adhesives for simplified implementation. Homogeneity is ensured by a complex mixture developed internally by GETELEC.

Our entire product range is available in sheet form or custom cut pieces.

Attenuation Guide

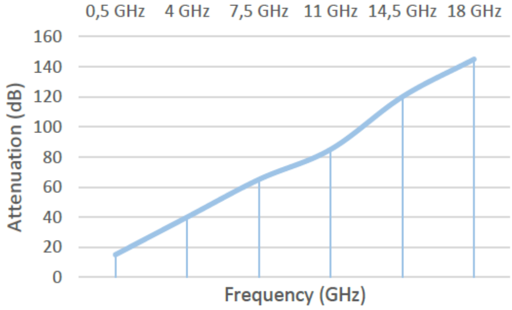
Attenuation	Percentage absorbed
- 5 dB	68.38 %
-10 dB	90.00 %
-15 dB	96.84 %
-20 dB	99.00 %
-40 dB	99.99 %

GETELEC material reference	Thickness (mm)	Resonance frequency
GT 602 R90	4.5	1 GHz
GT 602 R90	3.2	2 GHz
GT 602 R90	2.4	3 GHz
GT 602 R90	2.2	4 GHz
GT 602 R88	2	5 GHz
GT 602 R85	2	6 GHz
GT 602 R85	1.8	7 GHz
GT 602 R85	1.6	8 GHz
GT 602 R85	1.5	9 GHz
GT 602 R85	1.3	10 GHz
GT 602 R74	1.7	11 GHz
GT 602 R71	1.6	12 GHz
GT 602 R71	1.5	13 GHz
GT 602 R71	1.45	14 GHz
GT 602 R71	1.4	15 GHz
GT 602 R71	1.3	16 GHz
GT 602 R65	1.2	17 GHz
GT 602 R65	1.15	18 GHz
GT 602 R64	1.1	24 GHz
GT 602 R63	0.95	28 GHz
GT 602 R62	1.1	35 GHz

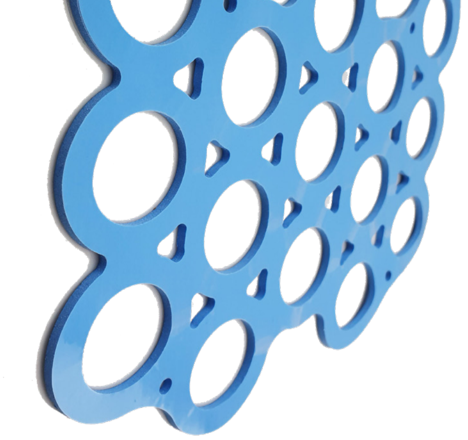
Sheets or finished parts are available, on request, in versions with or without adhesive.

Rigid microwave absorber - Epoxy

Properties	Standards	GT 502
Material		Epoxy
Hardness shore D	ASTM D 2240	95
Density g/cm3	ASTM D 792 Method A	4.57
Tensile strength Mpa	NF EN ISO 527-1	56
Elongation at break %	NF EN ISO 527-1	2.4
Working temperature °C		-180 °C to + 200°C



THERMAL INTERFACE MATERIALS



The GTG range includes highly conductive thermal mattresses ideal for applications requiring high thermal conductivity. Its specific formulations developed by our laboratory, as well as its loads, give these silicone elastomers an exceptional thermal conductivity.

Thanks to their great flexibility, their flexibility and their ease of installation, they marry the surface irregularities between the power component and the cooler as soon as they are assembled. This promotes heat dissipation and thus protects your equipment.

Thermal conductivity	Reference	Color	Hardness Shore 00	Thickness mm	Flame retardant	RoHs	Working temperature (°C)	Density g/cm3	Elongation %	Thermal conductivity W/m.k	Dielectric strength kV/mm	Breakdown voltage kV/mm	Volume resistivity Ohm.m	Dielectric constant @1Mhz	Dissipation factor @1MHz
Standard			**ASTM D2240**		**UL 94**			**ASTM D792**	**ASTM D412**	**ASTM D 7984 Modified transient plane source(MTPS)**	**ASTM D149**	**ASTM D149**	**ASTM D257**	**ASTM D150**	**ASTM D150**
1 W/m.K	GTG 1-40	Grey	40 ± 2	0.5 to 20 mm	V0	Yes	-60°C to +200°C	2.6	< 200	1 ± 0.1	11	17	10^{13}	4	0.006
	GTG 1.3-45*		45 ± 2							1.3 ± 0.1	5	18			
	GTG 1-60		60 ± 2							1 ± 0.1	11	17			
	GTG 1-75		75 ± 2						200						
	GTG 1-85		85 ± 2												
2 W/m.K	GTG 2-40	Blue	40 ± 2	0.5 to 20 mm	V0	Yes	-45 °C to +200°C	2.7	< 100	2 ± 0.1	14	17	10^{12}	4.2	0.005
	GTG 2.5-50		50 ± 2					2.75		2.5 ± 0.1	18	16			
	GTG 2-60		60 ± 2					2.7		2 ± 0.1	14	17			
	GTG 2-75		75 ± 2						100						
	GTG 2-85		85 ± 2												
3 W/m.K	GTG 3-35	Light blue	35 ± 2	0.5 to 20 mm	V0	Yes	-40°C to + 200 °C	2.9	< 100	3 ± 0.1	11	15	10^{11}	5.5	0.005
	GTG 3-40		40 ± 2												
	GTG 3.5-50		50 ± 2					2.95		3.5 ± 0.1					
	GTG 3-60		60 ± 2					2.9	100	3 ± 0.1					
	GTG 3-75		75 ± 2												
	GTG 3-85		85 ± 2												
4 W/m.K	GTG 4-40	Green	40 ± 2	0.5 to 20 mm	V0	Yes	-40°C to + 200 °C	3.09	< 100	4 ± 0.1	16	18	10^{11}	7	0.008
	GTG 4-60		60 ± 2												
	GTG 4-75		75 ± 2						100						
	GTG 4-85		85 ± 2												
5 W/m.K	GTG 5-40	Green	40 ± 2	0.5 to 20 mm	V0	Yes	-40°C to +200°C	3.12	< 50	5 ± 0.1	15	18	10^{11}	7.5	0.006
	GTG 5-60		60 ± 2												
	GTG 5-75		75 ± 2						50						
	GTG 5-85		85 ± 2												
6 W/m.K	GTG 6-40	Green	40 ± 2	0.8 to 20 mm	V0	Yes	-40°C to +200°C	3.23	< 50	6 ± 0.1	14	17	10^{11}	8.1	0.007
	GTG 6-55		55 ± 2												
	GTG 6-75		75 ± 2						50						
	GTG 6-85		85 ± 2												
7 W/m.K	GTG 7.5-35	Light grey	35 ± 2	0.8 to 20 mm	V0	Yes	-40°C to +200°C	3.22	< 40	7.5 ± 0.1	10	16	10^{11}	7.9	0.013
	GTG 7.5-55		55 ± 2												
	GTG 7.5-75		75 ± 2						40						
	GTG 7.5-85		85 ± 2												
8 W/m.K	GTG 8-65	Light Grey	65 ± 2	1 to 20 mm	V0	Yes	-40°C to +200°C	3.3	< 30	8 ± 0.1	8	14	10^{11}	7	0.02
	GTG 8.5-80		80 ± 5	1.5 to 10 mm	V0	Yes	-40°C to +150°C	3.02	> 20	8.6 ± 0.1	11	17	$1*10^{11}$	8.1	0.014

THERMAL GAP FILLER PAD
GTS 8-65

The GTS 8-65 is ideal for aerospace applications requiring high thermal conductivity. It's specific formulations developed by our laboratory, as well as load, give these silicone elastomers and exceptional thermal conductivity.

- **ECSS-ST-70-02C compliance**
- **French bespoke solutions**
- **High thermal conductivity**
- **Great flexibility**
- **Follow the surface irregularities**
- **Ready to use**

Thanks to a spatial qualification according to the ESA-ECSS-Q-ST-70-02C TML RML (<1%) et CVCM (<0.1%), the GTS 8-65 is suitable for **aerospace applications.**

PROPERTIES	Standards - Tests	GTS 8-65
Hardness (Shore 00)	ASTM D 2240	65 ± 5
Density (g/cm^3)	ASTM D 792	3.02 ± 0.01
Elongation at break (%)	ASTM D 412	> 20
Thermal conductivity (W.m^{-1}.K^{-1}) Modified Transient Plane Source (MTPS)	ASTM D 7984	8.2 ± 0.1
Volume resistivity (Ω.m^{-1})	ASTM D 257	1*10^{11}
Dielectric strength (kV.mm^{-1})	ASTM D 149	10
Breakdown voltage (kV.mm^{-1})		16
Dielectric Constant (f=1 MHz)		7.9
Dissipation factor (f= 1MHz)		0.013
TML (%)	ECSS-ST-70-02C	0.04
RML (%)	ECSS-ST-70-02C	0.04
CVCM (%)	ECSS-ST-70-02C	0.02
Color		Grey
Working temperature		-120°C to +300°C
Thickness		1.5 mm to 10 mm

AVAILABLE FORMATS :

- Sheet : 150x150 mm
- Cut

ENVIRONMENTAL SEALING SILICONE

Using specific silicone grades, forming the basis of our formulations, has allowed us to develop two main product families: Fluorinated silicones and non-fluorinated silicones, within our complete range of environmental sealing silicones.

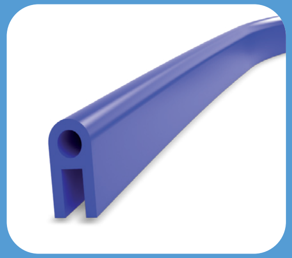
The family of fluorinated silicones : FVMQ type (ASTM D1418), these elastomers offer excellent resistance to solvents, fuels, organic oils and silicone oils, while maintaining their mechanical properties over a wide range of temperatures (-60°C to + 230°C).

The family of non-fluorinated silicones : Of the VMQ type (ASTM D 1418), these elastomers allow the production of molded parts, extruded joints, flat seals cut or adhesively vulcanized. They retain their mechanical properties over a wide range of temperatures (-73°C to + 232°C).

Properties	Standards	GT 20	GT 40	GT 47	GT 50	GT 57	GT 60	GT 67	GT 70	GT 77
Elastomer		Silicone	Silicone	Fluoro-silicone	Silicone	Fluoro-silicone	Silicone	Fluoro-silicone	Silicone	Fluoro-silicone
Hardness shore A ±5	ASTM D 2240	25	40	40	50	50	60	60	70	70
Specific mass at 25°C (g/cm3)	ASTM D 792	1.10	1.10	1.43	1.19	1.44	1.27	1.46	1.35	1.48
Tensile resistance PSI MPa	ASTM D 412	870 6	1000 6.80	1250 8.60	980 6.75	1200 8.45	950 6.55	1200 8.30	1000 6.89	1250 8.60
Elongation(%)	ASTM D 412	950	500	400	380	350	300	300	180	300
Resifual deformation after 22 hours at 177°C (%)	ASTM D 395 Mthod B	20	30	20	32	25	33	25	34	25
Color		Red*	Orange *	Blue *	Red *	Blue *	Blue*	Blue*	Red*	Blue*

*Customizable color on request

AVAILABLE FORMATS :



Extruded

Cut

Molded

AERONAUTICAL QUALITY SILICONE

Our 70 Shore A hardness silicone elastomer blends have been developed for applications requiring excellent fire resistance. All of the parts that we produce in standard and tailor-made format comply with the requirements of the aeronautical standards **FAR 25.853** and **AIRBUS ABD0031.**

Compliance with these standards allows all our products to guarantee :

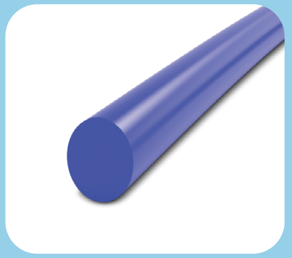
- Low flame spread
- Low smoke emission
- Low emission of toxic gases

Examples of applications of our products meeting aeronautical standards :

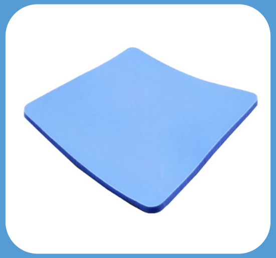
- Finishing business class airplane seats
- Rugged computer
- Embedded electronics systems
- Electronic management of braking controls

Properties	Standards	GT 70 E RF-2	GT 70 M RF-2	GT 70 E RF-4
Density (g/cm3)	ASTM D 792	1.35 ± 0.05	1.35 ± 0.05	1.39
Hardness (Shore A)	ASTM D 2240	70 ± 5	70 ± 5	71
Break resistance (MPa)	ASTM D 412	> 6	> 6	8.2
Tear strength (kN/m)	ASTM D 624	> 10	> 10	34.1
Elongation at break (%)	ASTM D 412	> 180	> 180	376
Residual deformation after 70 hours at 150°C	ASTM D 395	< 50		
Working temperature (°C)		-60 ° C to + 200°C (up to +230 °C)		
Color		On demand		

AVAILABLE FORMATS :



Extruded



Cut

Molded

AERONAUTICAL QUALITY FORMULATIONS

ACRYLONITRILE-BUTADIENNE (NBR-Perbunan-Krynac-Hycar)			
Material reference	Standards	Hardness (shore A)	Extreme working temperature (°C)
20 A5	NFL17-120	50	-30°C to +140°C
20A6		60	
20A7		70	
20A8		80	
20 B5	NFL17-120	50	-50°C to +120°C
20 B6		60	
20 B7		70	
20 B8		80	
21 A6	NFL17-121	60	-20°C to +140°C
21 A7		70	
21 A8		80	
21 B4	NFL17-121	40	-40°C to +120°C
21 B6		60	
21 B8		80	
23 B7	NFL17-123	70	-50°C to +120°C
24 B7	NFL17-124	70	-50°C to +120°C
FLUOROCARBON (Viton, fluorel, technoflon)			
60 C7	NFL17-160	75	-20°C to +260°C
60 C9		90	-15°C to +260°C
64 C6	NFL17-164	60	-20°C to +260°C
64 C8		80	
FLUOROSILICONE (FMVQ, Silastic)			
61 D6	NFL17-161	60	-50°C to +200°C
61 D8		80	
SILICONE (VMP – PVMQ-Silastic- Rhodorsil)			
50 D5	NFL17-150	50	-55°C to +260°C
50 D6		60	
50 D7		70	
53 D5	NFL17-153	50	-70°C to +225°C
ETHYLENE – PROPYLENE -EPDM			
41 B8	NFL17-141	80	-55°C to +140°C
POLYCHLOROPRENE - NEOPRENE			
31 B3	NFL17-131	30	-40°C to +120°C
31 B4		40	
31 B5		50	
31 B6		60	
31 B7		70	
31 B8		80	

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