CIRCUIT FOIL

HIGH QUALITY ELECTRODEPOSITED
COPPER FOIL MANUFACTURER

PRODUCT CATALOGUE

Living Quality
Targeting Excellence

CIRCUIT FOIL IS PROUD TO STAY AT THE FOREFRONT OF NEW TECHNOLOGIES

CIRCUIT FOIL KEY FIGURES

50+ DELIVERED COUNTRIES

20+ FOIL TYPES

60 YEARS OF EXPERIENCE

3 SERVICE CENTERS

CIRCUIT FOIL Luxembourg
Headquarter
Slitting and Sheeting Center
Sales Office

6, Salzbaach
L-9559 Wiltz
G.D. of Luxembourg

CIRCUIT FOIL Trading Inc.
Sales Office

115 East Glenside Avenue/Suite 12
Glenside PA 19038 – USA

CIRCUIT FOIL Amérique du Nord
Slitting and Sheeting Center

654, rue Bernard
Granby, Québec
J2J 0H6 – Canada

CIRCUIT FOIL Asia Pacific Ltd.
Sales Office

Flat O, 8/F, International Industrial Centre
2-8 Kwei Tei Street, Fotan, N.T.,
Hong Kong.

CIRCUIT FOIL Asia Pacific Co. Ltd.
Slitting and Sheeting Center
Sales Office

1/F, Block A, 8 GuangDong Road,
Free Trade Zone Zhangjiagang,
Jiangsu Province
215 634 People's Republic of China

CIRCUIT FOIL

PRODUCT LINEUP

High quality electrodeposited copper foil

Roughness decrease

FOIL TYPES	ULTRATHIN	MATTE SIDE TREATED	REVERSE TREATED	MATTE SIDE TREATED			NODULE FREE
APPLICATION	DOUBLETHIN™	STD AND LOW PROFILE	VERY LOW PROFILE	ULTRA FLAT PROFILE (HVLP)	ALMOST NO PROFILE (HVLP 2)	SUPER FLAT PROFILE (HVLP 3/4)	
IC SUBSTRATE/SLP							
↘ MSAP PROCESS	DOUBLETHIN-NN DOUBLETHIN-ANP DOUBLETHIN N-TZA						DOUBLETHIN NF
↘ ETS PROCESS	DOUBLETHIN-CL						
↘ SUBSTRACTIVE PROCESS	DOUBLETHIN-NN DOUBLETHIN-ANP DOUBLETHIN N-TZA			BF-TZA-PKG			DOUBLETHIN NF
HIGH DENSITY INTERCONNECT	DOUBLETHIN-NN DOUBLETHIN-ANP DOUBLETHIN N-TZA			BF-TZA			DOUBLETHIN NF
HIGH SPEED DIGITAL & LOW LOSS			TZA-B with reduced Rz TZA-B	BF-TZA	BF-ANP	BFL-NN BF-NN	BFL-NF
HIGH FREQUENCY							
↘ FLUOROPOLYMER SUBSTRATE		HFA-LP	HFA-B	BF-HFA	BF-ANP	BFL-NN BF-NN	BFL-NF
↘ HYDROCARBON SUBSTRATE		TWLS/TWL-HP	TWLS-B				
LI-ION BATTERY							BF-PLSP SR-PLSP HTS-PLSP
FLEXIBLE							
↘ 2-LAYERS FCCL			BF-TZA-B-FX SR-TZA-B-FX	BF-TZA-FX			
↘ 3-LAYERS FCCL		TZA-FX	TZA-B-FX				
SMART CARD		LPT-YE*					
AEROSPACE		TZA-TZA					
REGULAR MLB		TZA	TZA-B				

*Arsenic Content

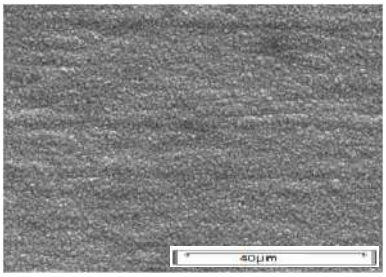
Last revision : November 2021
March 2024

DOUBLETHIN™ NF

ULTRATHIN AND VERY SMOOTH CARRIER SUPPORTED COPPER FOIL DESIGNED FOR MSAP PROCESS (L/S BELOW 10/10 µM).

TYPICAL SUBSTRATES

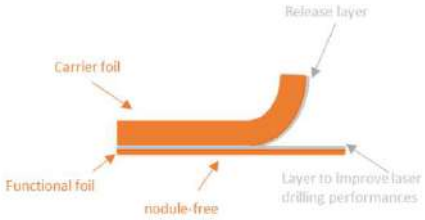
Bismaleimide-Triazine (BT) and halogen-free high Tg epoxy resin systems.
Also convenient for low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.



Functional Foil Treated Side

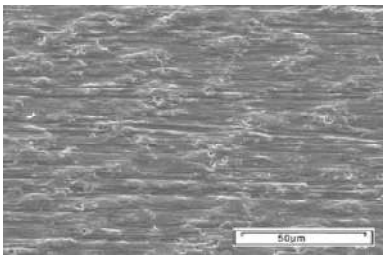
TYPICAL PROCESSES

MSAP process (using copper build-up followed by differential “flash etching” and CO2 laser direct ablation for via holes) used in IC Substrates and HDI/SLP ("Substrate Like PCB").
Also convenient for substractive process.



TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.



Functional Foil Untreated Side

*TYPICAL AVERAGE PROPERTIES**

DOUBLETHIN™ NF						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			
Nominal Thickness		**µm**	**1.5**	**2**	**3**	**5**
Functional Foil Area Weight		g/m²	18 ± 2	20 ± 3	29 ± 3	40 ± 4
Carrier Foil Thickness		µm	12 or 18 or 35			18 or 35
		oz.	3/8 or 1/2		1/2 or 1	
Functional Foil Treated Side Roughness (Rz)	JIS	µm	≤ 0.90			
	ISO		≤ 1.2			
Preferred Lamination Temperature		°C (°F)	≤ 240 °C (464 °F)			
Carrier Release Bond (after 2h @ 220 °C)		-	Easy manual peeling			
Peel Strength of Functional Foil Treated Side on halogen free High Tg FR-4[1]		N/mm (Lb/in)	≥ 0.4 (≥ 2.28)			
Laminate Bond on low loss resin[1]						

[1] after galvanic reinforcement up to 20 µm

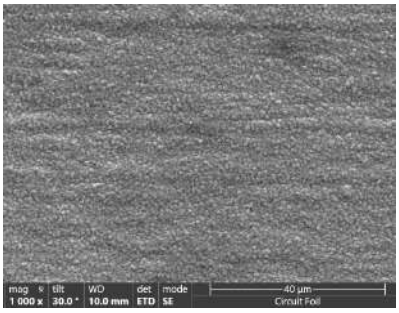
ALTERNATIVE For coreless process please consult DOUBLETHIN-CORELESS datasheet.

CIRCUIT FOIL

DOUBLETHIN ™ NF-HT

ULTRATHIN AND VERY SMOOTH CARRIER SUPPORTED COPPER FOIL DESIGNED FOR MSAP PROCESS (L/S BELOW 10/10 µM).

33 As Arsenic 74.92



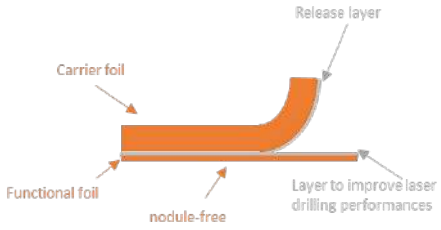
Functional Foil Treated Side

TYPICAL SUBSTRATES

Bismaleimide-Triazine (BT) and halogen-free high Tg epoxy resin systems.
Also convenient for low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.

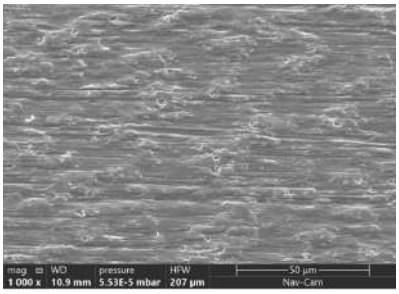
TYPICAL PROCESSES

MSAP process (using copper build-up followed by differential “flash etching” and CO2 laser direct ablation for via holes) used in IC Substrates and HDI/SLP ("Substrate Like PCB").
Also convenient for substractive process.



TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.



Functional Foil Untreated Side

*TYPICAL AVERAGE PROPERTIES**

DOUBLETHIN™ NF-HT						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			
Nominal Thickness		**µm**	**1.5**	**2**	**3**	**5**
Functional Foil Area Weight		g/m²	18 ± 2	20 ± 3	29 ± 3	45 ± 4
Carrier Foil Thickness		µm	12 or 18		18 or 35	
		oz.	3/8 or 1/2		1/2 or 1	
Functional Foil Treated Side Roughness (Rz)	JIS	µm	≤ 0.90			
	ISO		≤ 1.2			
Preferred Lamination Temperature		°C (°F)	≤ 240 °C (464 °F)			
Carrier Release Bond (after 2h @ 220 °C)		-	Easy manual peeling			
Peel Strength of Functional Foil Treated Side on halogen free High Tg FR-4[1]		N/mm (Lb/in)	≥ 0.4 (≥ 2.28)			
Laminate Bond on low loss resin[1]						

[1] after galvanic reinforcement up to 35 µm

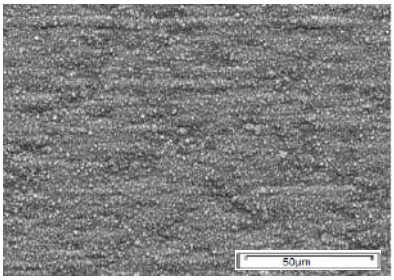
ALTERNATIVE For coreless process please consult DOUBLETHIN-CORELESS datasheet.

CIRCUIT FOIL

DOUBLETHIN ™ NN

ULTRATHIN AND VERY SMOOTH CARRIER SUPPORTED COPPER FOIL DESIGNED FOR MSAP PROCESS (L/S BELOW 10/10 µM).

33 As Arsenic 74.92



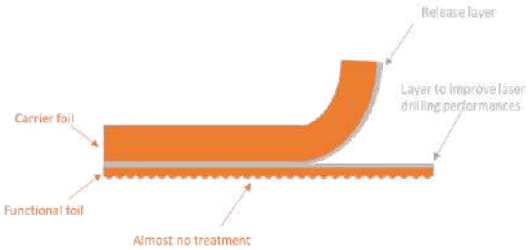
Functional Foil Treated Side

TYPICAL SUBSTRATES

Bismaleimide-Triazine (BT) and halogen free high Tg epoxy resin systems.

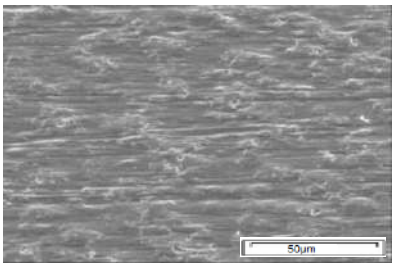
TYPICAL PROCESSES

MSAP process (using copper build-up followed by differential “flash etching” and CO2 laser direct ablation for via holes) used in IC Substrates and HDI/SLP ("Substrate Like PCB").
Also convenient for substractive process.



TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.



Functional Foil Untreated Side

*TYPICAL AVERAGE PROPERTIES**

DOUBLETHIN™ NN						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			
Nominal Thickness		**µm**	**1.5**	**2**	**3**	**5**
Functional Foil Area Weight		g/m²	18 ± 2	20 ± 2	29 ± 2	42 ± 2
Carrier Foil Thickness		µm	12 or 18 or 35			18 or 35
		oz.	3/8 or 1/2		1/2 or 1	
Functional Foil Treated Side Roughness (Rz)	JIS	µm	≤ 0.90			
	ISO		≤ 1.2			
Preferred Lamination Temperature		°C (°F)	≤ 240 °C (464 °F)			
Carrier Release Bond (after 2h @ 220 °C)		-	Easy manual peeling			
Peel Strength of Functional Foil Treated Side on halogen free High Tg FR-4[1]		N/mm (Lb/in)	≥ 0.5 (≥ 2.9)			
Peel Strength of Functional Foil Treated Side on BT resin[1]						

[1] after galvanic reinforcement up to 20 µm

ALTERNATIVE For a L/S below 10/10 µm please consult DOUBLETHIN NF datasheet.
For coreless process please consult DOUBLETHIN-CORELESS datasheet.

CIRCUIT FOIL

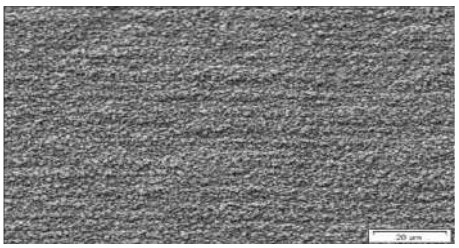
DOUBLETHIN™ ANP

ULTRATHIN AND SMOOTH CARRIER SUPPORTED COPPER FOIL DESIGNED FOR MSAP PROCESS (L/S OF ~15/15 µM).

33 As Arsenic 74.92

TYPICAL SUBSTRATES

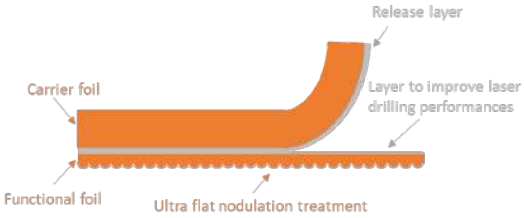
Bismaleimide-Triazine (BT) and halogen free high Tg epoxy resin systems.



Functional Foil Treated Side

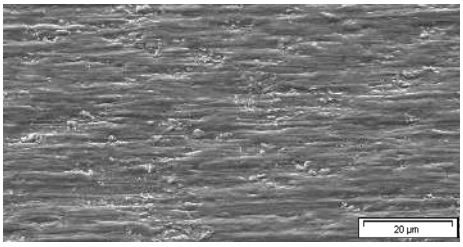
TYPICAL PROCESSES

MSAP process (using copper build-up followed by differential “flash etching” and CO2 laser direct ablation for via holes) used in IC Substrates and HDI/SLP ("Substrate Like PCB").
Also convenient for substractive process.



TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.



Functional Foil Untreated Side

*TYPICAL AVERAGE PROPERTIES**

DOUBLETHIN™ ANP						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			
Nominal Thickness		**µm**	**1.5**	**2**	**3**	**5**
Functional Foil Area Weight		g/m²	18 ± 2	20 ± 3	29 ± 3	45 ± 4
Carrier Foil Thickness		µm	12 or 18 or 35			18 or 35
		oz.	3/8 or 1/2		1/2 or 1	
Functional Foil Treated Side Roughness (Rz)	JIS	µm	≤ 1.2			
	ISO		≤ 1.5			
Preferred Lamination Temperature		°C (°F)	≤ 240 °C (464 °F)			
Carrier Release Bond (after 2h @ 220 °C)		-	Easy manual peeling			
Peel Strength of Functional Foil Treated Side on halogen free High Tg FR-4[1]		N/mm (Lb/in)	≥ 0.6 (≥ 3.4)			
Peel Strength of Functional Foil Treated Side on BT resin[1]						

[1] after galvanic reinforcement up to 20 µm

ALTERNATIVE For a L/S of ~10/10 µm please consult DOUBLETHIN NN and NF datasheet. For coreless process please consult DOUBLETHIN-CORELESS datasheet.

CIRCUIT FOIL

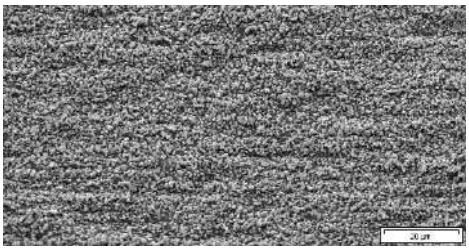
DOUBLETHIN™ N-TZA

ULTRATHIN CARRIER SUPPORTED COPPER FOIL DESIGNED FOR MSAP PROCESS (L/S OF ~ 25/25 µM).

33 As Arsenic 74.92

TYPICAL SUBSTRATES

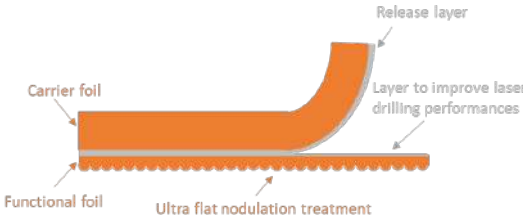
Bismaleimide-Triazine (BT) and halogen free high Tg epoxy resin systems.



Functional Foil Treated Side

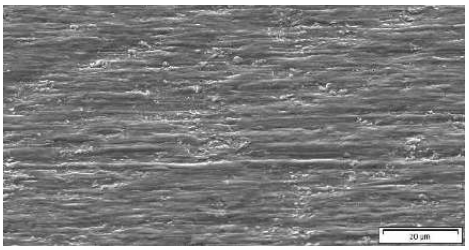
TYPICAL PROCESSES

MSAP process (using copper build-up followed by differential “flash etching” and CO2 laser direct ablation for via holes) used in IC Substrates and HDI/SLP ("Substrate Like PCB").
Also convenient for substractive process.



TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.



Functional Foil Untreated Side

*TYPICAL AVERAGE PROPERTIES**

DOUBLETHIN™ N-TZA						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			
Nominal Thickness		**µm**	**1.5**	**2**	**3**	**5**
Functional Foil Area Weight		g/m²	18 ± 2	20 ± 3	29 ± 3	45 ± 4
Carrier Foil Thickness		µm	12 or 18 or 35			18 or 35
		oz.	3/8 or 1/2		1/2 or 1	
Functional Foil Treated Side Roughness (Rz)	JIS	µm	≤ 1.8			
	ISO		≤ 2.2			
Preferred Lamination Temperature		°C (°F)	≤ 240 °C (464 °F)			
Carrier Release Bond (after 2h @ 220 °C)		-	Easy manual peeling			
Peel Strength of Functional Foil Treated Side on halogen free High Tg FR-4[1]		N/mm (Lb/in)	≥ 0.6 (≥ 3.4)			
Peel Strength of Functional Foil Treated Side on BT resin[1]						

[1] after galvanic reinforcement up to 20 µm

ALTERNATIVE For a L/S ≤ 15/15 µm please consult DOUBLETHIN ANP, DOUBLETHIN NN and NF
For coreless process please consult DOUBLETHIN-CORELESS datasheet.

CIRCUIT FOIL

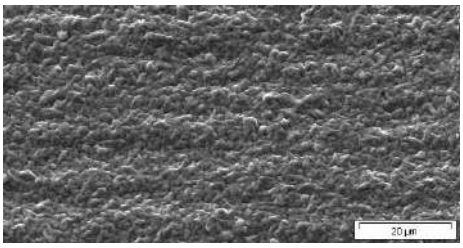
DOUBLETHIN™ - CORELESS

ULTRATHIN CARRIER SUPPORTED COPPER FOIL DESIGNED FOR CORELESS PROCESS.

33 As Arsenic 74.92

TYPICAL SUBSTRATES

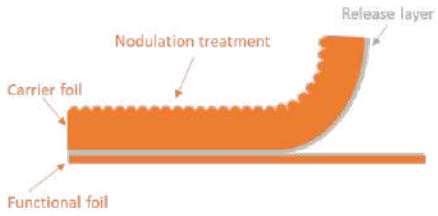
High Tg epoxy resin systems as sacrificial core.



Untreated Functional Foil

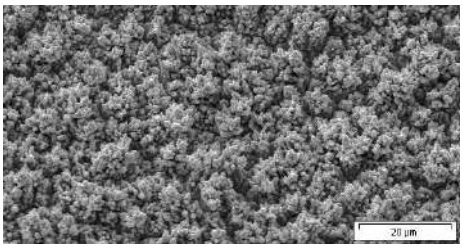
TYPICAL PROCESSES

Coreless / ETS ("Embedding Trace Substrate") process used in IC Substrates and HDI/SLP ("Substrate Like PCB").



TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.



Carrier Foil Treated Side

*TYPICAL AVERAGE PROPERTIES**

DOUBLETHIN™-CORELESS						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			
Nominal Thickness		**µm**	**1,5**	**2**	**3**	**5**
Functional Foil Area Weight		g/m²	14 ± 2	16 ± 3	25 ± 3	40 ± 4
Carrier Foil Thickness		µm	12 or 18 or 35			18 or 35
		oz.	3/8 or 1/2		1/2 or 1	
Functional Foil Untreated Side Roughness (Rz)	JIS	µm	≤ 1.0			
	ISO	µm	≤ 1.3			
Preferred Lamination Temperature		°C (°F)	≤ 240 °C (464 °F)			
Carrier Release Bond after multiple lamination and wet process cycles		-	Easy manual peeling			
Carrier Foil Treated Side Roughness (Rz)	JIS	µm	3.3 – 6.7		4.1 - 8.4	
	ISO		4 - 8		5 - 10	
Peel Strength of Carrier Foil Treated Side on halogen free high Tg FR-4		N/mm (Lb/in)	≥ 0.8 (≥ 4.6)			

ALTERNATIVE For MSAP process please consult DOUBLETHIN N-TZA, DOUBLETHIN ANP, DOUBLETHIN NN and DOUBLETHIN NF datasheets.

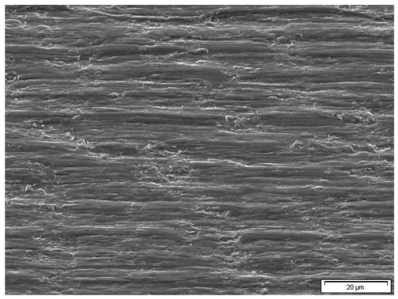
CIRCUIT FOIL

DOUBLETHIN™-TA

CIRCUIT FOIL'S DOUBLETHIN™ PRODUCTS ARE DESIGNED FOR FINE LINE AND HIGH-DENSITY MULTILAYER BOARDS.

TYPICAL SUBSTRATES

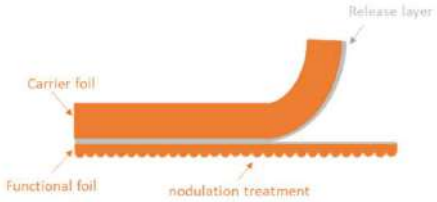
Hydrocarbon, Epoxy based, Polyimide based, high Tg and highly filled resin systems.



Functional Foil untreated side

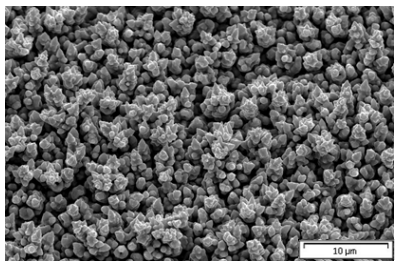
TYPICAL PROCESSES

The presence of an ED copper carrier protects the functional layer from any adverse damage and contamination.
Well adapted for mechanical drilling through the carrier and the functional foil.
Suitable for UV laser direct ablation for via holes.



TYPICAL APPLICATIONS

Typical applications are High Density multilayers and fine line applications. Mobile communication device. Medical, military and aerospace PCB's.



Functional Foil Treated Side

*TYPICAL AVERAGE PROPERTIES**

DOUBLETHIN™- TA				
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**	
Nominal Thickness		**µm**	**5**	**9**
Functional Foil Area Weight		g/m²	45 ± 4	76 ± 4
Carrier Foil Thickness		µm	35	
		oz.	1	
Functional Foil Treated Side Roughness (Rz)	JIS	µm	1.6 – 3.7	2.0 – 4.1
	ISO	µm	2.0 – 4.5	2.5 – 5.0
Preferred Lamination Temperature		°C (°F)	≤ 180°C (356 °F)	
Carrier Release Strength After lamination 90min @ 200°C		N/m	30 - 100	
Peel Strength of Functional Foil Treated Side on halogen free high Tg FR-4		N/mm (Lb/in)	≥ 1.2 (≥ 6.9)	

ALTERNATIVE DTH N TZA (lower CB) For MSAP process please consult DOUBLETHIN N-TZA, DOUBLETHIN ANP, DOUBLETHIN NN and DOUBLETHIN NF datasheets.

CIRCUIT FOIL

BF-TZA-PKG

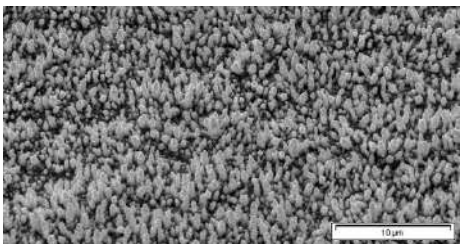
ULTRA FLAT COPPER FOIL FOR FINE LINE PATTERNING.

IPC *Grade 10 & 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

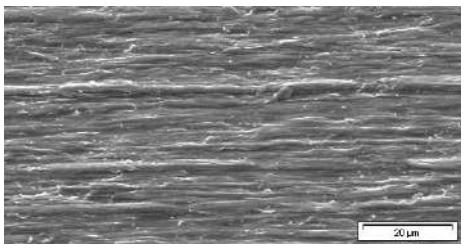
Bismaleimide-Triazine (BT) resin and halogen free high Tg epoxy resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Subtractive process used in IC substrates and HDI/SLP ("Substrate Like PCB") including for inner layer of ETS (“Embedding Trace Substrate”) structure.
Available down to ¼ oz. Reliable alternative to half-etching.



Untreated Drum Side

TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.

*TYPICAL AVERAGE PROPERTIES**

BF-TZA-PKG

MEASURED PARAMETERS		UNITS	PRODUCT GAUGE			IPC	
Nominal Thickness		**µm oz.**	**9 1/4**	**12 3/8**	**18 1/2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	79	112	152	3.4.4	2.2.12
Untreated Side Roughness (Ra)		µm	≤ 0.35			3.5.6	2.2.17
Treated Side Roughness	Rz (JIS)		≤ 2.5			-	
	Rz (ISO)		≤ 3.1			3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)			3.5.1	2.4.18
Elongation Transverse (RT)		%	4 - 14	5 - 15	7 - 25	3.5.3	
Peel Strength BT[1] (RT)		N/mm (Lb/in)	≥ 0.5 (≥ 2.9)	≥ 0.6 (≥ 3.4)		3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE For MSAP process please consult DOUBLETHIN N-TZA, DOUBLETHIN ANP, DOUBLETHIN NN and DOUBLETHIN NF datasheets.

CIRCUIT FOIL

BFL-NF-HT / BFL-NF-Z

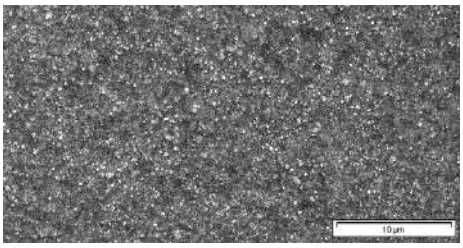
NO PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES.
BFL-NF-Z VERSION HAS NON-METALLIC PASSIVATION.

IPC Grade 10 & 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

Ultra low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.
Also convenient for pure or modified fluoropolymer (PTFE) resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital Printed Circuit Boards.
The extremely flat profile surface structure helps mitigating the impact of the skin effect.
The pure copper treatment supports reducing the passive intermodulation (PIM).

Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers especially for 5G. Z version is designed for higher frequency applications.
Also used for base stations infrastructures and 77 GHz automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BFL-NF-HT / BFL-NF-Z

MEASURED PARAMETERS			UNITS	PRODUCT GAUGE			IPC	
Nominal Thickness			**µm oz.**	**12 3/8**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	100	143	277	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.25			3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.20			-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601		≤ 0.70	≤ 0.65	≤ 0.60	-	2.2.17
	Rz	ISO 4287		≤ 1.0	≤ 0.9	≤ 0.8	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178		~ 0.12	~ 0.10	~ 0.08	-	2.2.22 [2]
	Sz			~ 1.6	~ 1.4	~ 1.2		
	Sdr		%	~ 0.1	~ 0.1	~ 0.1		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)			3.5.1	2.4.18
Elongation Transverse (RT)			%	5 - 15	7 - 25	10 - 35	3.5.3	
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			N/mm (Lb/in)	≥ 0.35 (≥ 2.0)	≥ 0.4 (≥ 2.3)	≥ 0.5 (≥ 2.9)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

CIRCUIT FOIL

BFL-NN
BFL-NN-HT / BFL-NN-Z

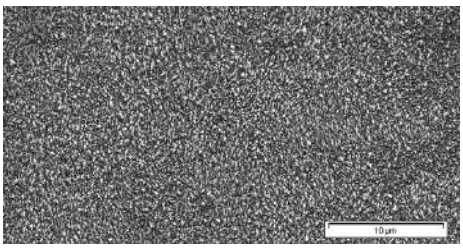
EXTREMELY FLAT PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES. BFL-NN-HT AND BFL-NN-Z VERSIONS WITH HIGHER THERMAL RELIABILITY ARE AVAILABLE. BFL-NN-Z HAS NON-METALLIC PASSIVATION.

IPC Grade 10 & 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

Ultra low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.
Also convenient for pure or modified fluoropolymer (PTFE) resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital Printed Circuit Boards.
The extremely flat profile surface structure helps mitigating the impact of the skin effect.
The pure copper treatment supports reducing the passive intermodulation (PIM).

Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers especially for 5G. Z version is designed for higher frequency applications.
Also used for base stations infrastructures and 77 GHz automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BFL-NN / BFL-NN-HT / BFL-NN-Z									
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**				**IPC**	
Nominal Thickness			**µm oz.**	**9 1/4**	**12 3/8**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	71	100	143	277	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.25				3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.20				-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601	µm	≤ 0.85	≤ 0.70	≤ 0.65	≤ 0.60	-	2.2.17
	Rz	ISO 4287	µm	≤ 1.1	≤ 1.0	≤ 0.9	≤ 0.8	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.12		~ 0.10	~ 0.08	-	2.2.22 [2]
	Sz		µm	~ 1.6		~ 1.4	~ 1.2		
	Sdr		%	~0.7		~ 0.7	~ 0.7		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)				3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	7 - 25	10 - 35	3.5.3	
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			N/mm (Lb/in)	≥ 0.3 (≥ 1.71)	≥ 0.35 (≥ 2.0)	≥ 0.4 (≥ 2.3)	≥ 0.5 (≥ 2.9)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE For reduced conductor losses please consult BFL-NF datasheet.

CIRCUIT FOIL

BFL-NN-PKG
BFL-NN-HT-PKG / BFL-NN-Z-PKG

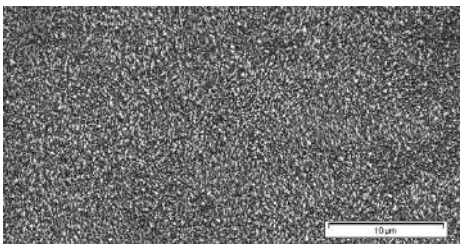
ULTRA FLAT COPPER FOIL FOR FINE LINE PATTERNING.

IPC Grade 10 & 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

Bismaleimide-Triazine (BT) resin and halogen free high Tg epoxy resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Subtractive process used in IC substrates and HDI/SLP ("Substrate Like PCB") including for inner layer of ETS ("Embedding Trace Substrate") structure.
Available down to ¼ oz. Reliable alternative to half-etching.

Untreated Drum Side

TYPICAL APPLICATIONS

Mobile communication devices (like smartphones and tablets) and laptops.

*TYPICAL AVERAGE PROPERTIES**

BFL-NN-PKG / BFL-NN-HT-PKG / BFL-NN-Z-PKG							
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**		**IPC**	
Nominal Thickness			**µm oz.**	**9 1/4**	**12 3/8**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	71	100	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.25		3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.20		-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601		≤ 0.85	≤ 0.70	-	2.2.17
	Rz	ISO 4287		≤ 1.1	≤ 1.0	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178		~ 0.12	~ 0.12	-	2.2.22 [2]
	Sz			~ 1.6	~ 1.6		
	Sdr		%	~0.7	~0.7		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)		3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	3.5.3	
Peel Strength on BT resin[1]			N/mm (Lb/in)	≥ 0.35 (≥ 2.0)	≥ 0.40 (≥ 2.0)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

ALTERNATIVE For MSAP process please consult DOUBLETHIN N-TZA, DOUBLETHIN ANP and DOUBLETHIN NN datasheets.

CIRCUIT FOIL

BF-NN / BF-NN-HT

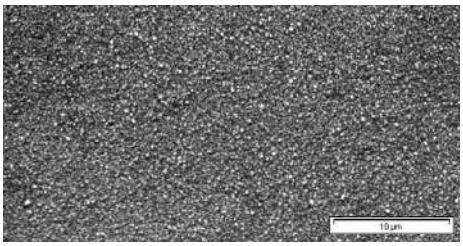
SUPER FLAT PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES. BF-NN-HT VERSION WITH HIGHER THERMAL RELIABILITY IS ALSO AVAILABLE.

IPC Grade 10 & 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

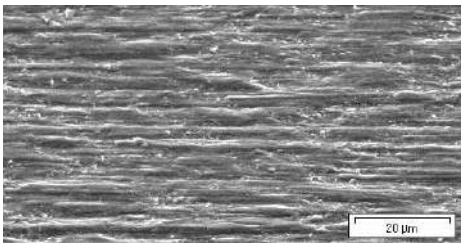
Ultra low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.
Also convenient for pure or modified fluoropolymer (PTFE) resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital Printed Circuit Boards.
The super flat profile surface structure helps mitigating the impact of the skin effect.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers especially for 5G.
Also used for base stations infrastructures and 77 GHz automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BF-NN / BF-NN-HT

MEASURED PARAMETERS			UNITS	PRODUCT GAUGE				IPC	
Nominal Thickness			**µm oz.**	**9 1/4**	**12 3/8**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	71	100	143	277	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.3				3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.20				-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601	µm	≤ 1.4	≤ 1.2	≤ 1.1	≤ 1.0	-	2.2.17
	Rz	ISO 4287	µm	≤ 1.8	≤ 1.6	≤ 1.4	≤ 1.3	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178	µm	-	~ 0.18	~ 0.16	~ 0.14	-	2.2.22 [2]
	Sz		µm	-	~ 2.3	~ 1.7	~ 1.5		
	Sdr		%	-	~1.4	~ 1.1	~ 0.8		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)				3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	7 - 25	10 - 35	3.5.3	
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			N/mm (Lb/in)	≥ 0.6[3] (≥ 3.4)	≥ 0.35 (≥ 2.0)	≥ 0.4 (≥ 2.3)	≥ 0.5 (≥ 2.9)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

[3] After build-up to 35 µm

ALTERNATIVE For reduced conductor losses please consult BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

BF-NN-Z / BF-NN-HT-Z

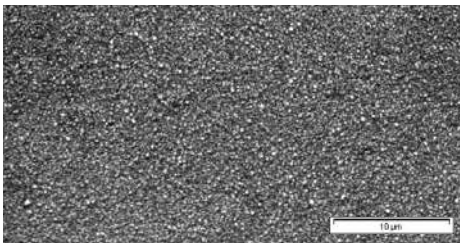
SUPER FLAT PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES. BF-NN-HT VERSION WITH HIGHER THERMAL RELIABILITY IS ALSO AVAILABLE.

IPC *Grade 10 & 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

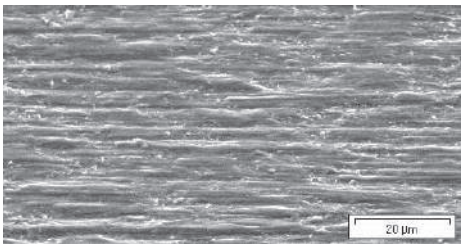
Ultra low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.
Also convenient for pure or modified fluoropolymer (PTFE) resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital Printed Circuit Boards.
The super flat profile surface structure helps mitigating the impact of the skin effect.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers especially for 5G.
Also used for base stations infrastructures and 77 GHz automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BF-NN-Z / BF-NN-HT-Z

MEASURED PARAMETERS			UNITS	PRODUCT GAUGE				IPC	
Nominal Thickness			**µm oz.**	**9 1/4**	**12 3/8**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	71	100	143	277	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.3				3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.20				-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601	µm	≤ 1.4	≤ 1.2	≤ 1.1	≤ 1.0	-	2.2.17
	Rz	ISO 4287	µm	≤ 1.8	≤ 1.6	≤ 1.4	≤ 1.3	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178	µm	-	~ 0.18	~ 0.16	~ 0.14	-	2.2.22 [2]
	Sz		µm	-	~ 2.3	~ 1.7	~ 1.5		
	Sdr		%	-	~1.4	~ 1.1	~ 0.8		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)				3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	7 - 25	10 - 35	3.5.3	
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			N/mm (Lb/in)	≥ 0.6[3] (≥ 3.4)	≥ 0.35 (≥ 2.0)	≥ 0.4 (≥ 2.3)	≥ 0.5 (≥ 2.9)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

[3] After build-up to 35 µm

ALTERNATIVE For reduced conductor losses please consult BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

BF-NN-Z-PKG / BF-NN-HT-Z-PKG

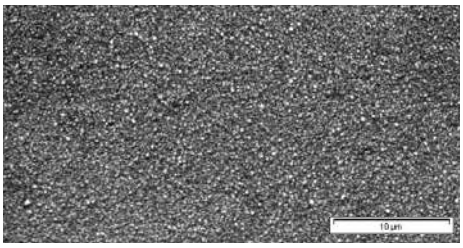
SUPER FLAT PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES. BF-NN-HT VERSION WITH HIGHER THERMAL RELIABILITY IS ALSO AVAILABLE.

IPC *Grade 10 & 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

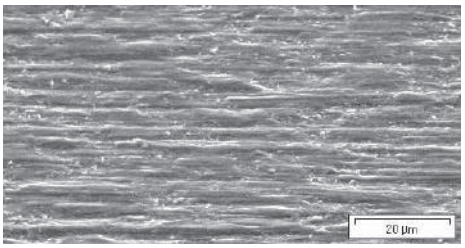
Bismaleimide-Triazine (BT) resin and halogen free high Tg epoxy resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital Printed Circuit Boards.
The super flat profile surface structure helps mitigating the impact of the skin effect.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers especially for 5G.
Also used for base stations infrastructures and 77 GHz automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BF-NN-Z-PKG / BF-NN-HT-Z-PKG							
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**		**IPC**	
Nominal Thickness			**µm oz.**	**9 1/4**	**12 3/8**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	71	100	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.3		3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.20		-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601		≤ 1.4	≤ 1.2	-	2.2.17
	Rz	ISO 4287		≤ 1.8	≤ 1.6	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178		~ 0.18	~ 0.18	-	2.2.22 [2]
	Sz			~ 2.3	~ 2.3		
	Sdr		%	~1.4	~1.4		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)		3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	3.5.3	
Peel Strength on BT resin[1]			N/mm (Lb/in)	≥ 0.30[3] (≥ 1.7)	≥ 0.35 (≥ 2.0)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm
[3] After build-up to 35 µm

[2] IPC TM 2.2.22 as of May 2020

ALTERNATIVE For reduced conductor losses please consult BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

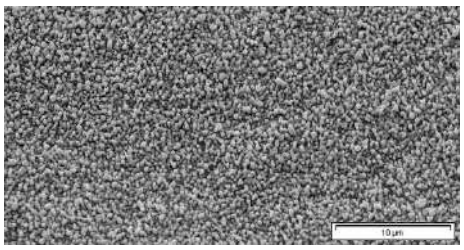
ALMOST NO PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES.

IPC *Grade 10 & 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

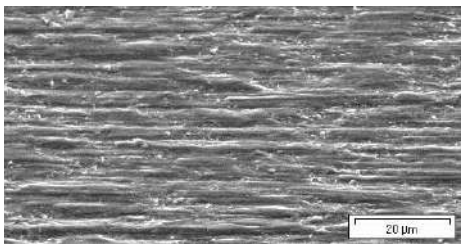
Ultra low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.
Also convenient for pure or modified fluoropolymer (PTFE) resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital Printed Circuit Boards.
The almost no profile surface structure helps mitigating the impact of the skin effect.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers especially for 5G.
Also used for base stations infrastructures and 77 GHz automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BF-ANP

MEASURED PARAMETERS			UNITS	PRODUCT GAUGE					IPC	
Nominal Thickness			µm oz.	9 1/4	12 3/8	18 1/2	35 1	70 2	Specification IPC-4562A	Test Method IPC-TM-650
Area Weight			g/m²	74	103	146	279	567	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.3					3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.20					-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601	µm	≤ 1.6	≤ 1.4	≤ 1.3	≤ 1.2		-	2.2.17
	Rz	ISO 4287		≤ 2.0	≤ 1.8	≤ 1.7	≤ 1.5		3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178		~ 0.25	~ 0.20	~ 0.18	~ 0.16		-	2.2.22 [2]
	Sz			~ 3.5	~ 3.0	~ 2.4	~ 2.1			
	Sdr		%	~ 3.4	~ 3.1	~ 2.8	~ 2.6			
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)					3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	7 - 25	10 - 35	15 - 40	3.5.3	
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			N/mm (Lb/in)	≥ 0.6[3] (≥ 3.4)	≥ 0.35 (≥ 2.0)	≥ 0.4 (≥ 2.3)	≥ 0.5 (≥ 2.9)	≥ 0.7 (≥ 4.0)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

[3] After build-up to 35 µm

ALTERNATIVE For reduced conductor losses please consult BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

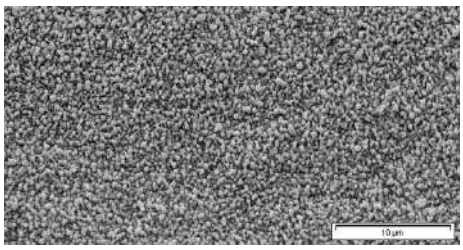
ALMOST NO PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES.

IPC Grade 10 & 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

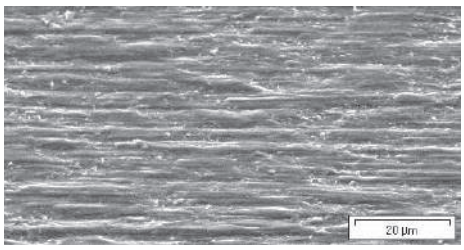
Bismaleimide-Triazine (BT) resin and halogen free high Tg epoxy resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital Printed Circuit Boards.
The almost no profile surface structure helps mitigating the impact of the skin effect.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers especially for 5G.
Also used for base stations infrastructures and 77 GHz automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BF-ANP-PKG							
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**		**IPC**	
Nominal Thickness			**µm oz.**	**9 1/4**	**12 3/8**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	74	103	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.3		3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.20		-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601	µm	≤ 1.6	≤ 1.4	-	2.2.17
	Rz	ISO 4287		≤ 2.0	≤ 1.8	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.25	~ 0.20	-	2.2.22 [2]
	Sz			~ 3.5	~ 3.0		
	Sdr		%	~ 3.4	~ 3.1		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)		3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	3.5.3	
Peel Strength on BT resin[1]			N/mm (Lb/in)	≥ 0.6[3] (≥ 3.4)	≥ 0.35 (≥ 2.0)	3.5.4	2.4.8

[1] after galvanic reinforcement up to 20 µm

[2] IPC TM 2.2.22 as of May 2020

[3] After build-up to 35 µm

ALTERNATIVE For reduced conductor losses please consult BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

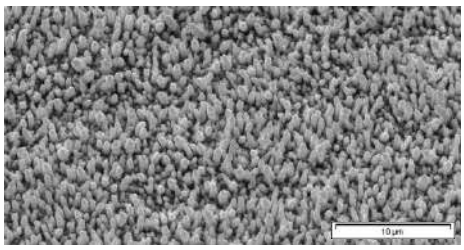
ULTRA FLAT COPPER FOIL FOR REDUCED SIGNAL LOSSES.

IPC *Grade 10 & 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

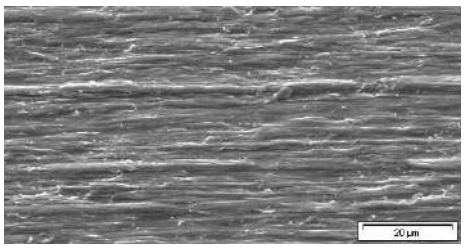
Very low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

High speed digital Printed Circuit Board.
The ultra flat profile surface structure helps mitigating the impact of the skin effect.



Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers.

*TYPICAL AVERAGE PROPERTIES**

BF-TZA										
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**					**IPC**	
Nominal Thickness			**µm oz.**	**9 1/4**	**12 3/8**	**18 1/2**	**35 1**	**70 2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	79	112	152	285	574	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.35					3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.22					-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601		≤ 2.5				≤ 2.0	-	2.2.17
	Rz	ISO 4287		≤ 3.1				≤ 2.5	3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178		~ 0.42	~ 0.38	~ 0.35	~ 0.31	~ 0.26	-	2.2.22 [2]
	Sz			~ 4.7	~ 4.4	~ 4.1	~ 3.7	~ 3.3		
	Sdr		%	~ 12	~ 11.5	~ 11	~ 10.5	~ 10		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)					3.5.1	2.4.18
Elongation Transverse (RT)			%	4 - 14	5 - 15	7 - 25	10 - 35	15 - 40	3.5.3	
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			N/mm (Lb/in)	≥ 0.6[3] (≥ 3.4)	≥ 0.45 (≥ 2.6)	≥ 0.5 (≥ 2.9)	≥ 0.6 (≥ 3.4)	≥ 0.7 (≥ 4.0)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm
[2] IPC TM 2.2.22 as of May 2020
[3] After build-up to 35 µm

ALTERNATIVE For reduced conductor losses please consult BF-ANP, BF-NN, BFL-NN and BFL-NF datasheets.

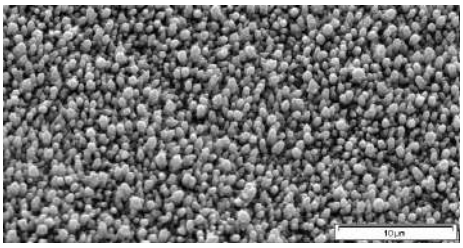
CIRCUIT FOIL

ULTRA FLAT COPPER FOIL FOR REDUCED SIGNAL LOSSES.

IPC
Grade 10 & 3

TYPICAL SUBSTRATES

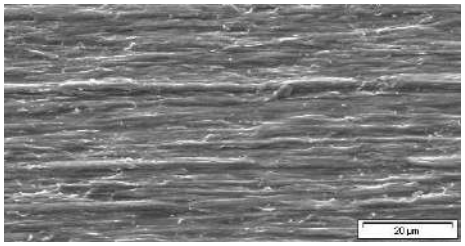
Very low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

High speed digital Printed Circuit Board.
The ultra flat profile surface structure helps mitigating the impact of the skin effect.



Untreated Drum Side

TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers.

*TYPICAL AVERAGE PROPERTIES**

BF-HFI-LP2

MEASURED PARAMETERS			UNITS	PRODUCT GAUGE			IPC	
Nominal Thickness			**µm oz.**	**12 3/8**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	112	152	285	3.4.4	2.2.12
Untreated Side Contact Roughness	Ra	ISO 4287	µm	≤ 0.35			3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.22			-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601		≤ 2.5			-	2.2.17
	Rz	ISO 4287		≤ 3.1			3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178		~ 0.38	~ 0.35	~ 0.31	-	2.2.22 [2]
	Sz			~ 4.4	~ 4.1	~ 3.7		
	Sdr		%	~ 11.5	~ 11	~ 10.5		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)			3.5.1	2.4.18
Elongation Transverse (RT)			%	5 - 15	7 - 25	10 - 35	3.5.3	
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			N/mm (Lb/in)	≥ 0.45 (≥ 2.6)	≥ 0.5 (≥ 2.9)	≥ 0.6 (≥ 3.4)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

ALTERNATIVE For reduced conductor losses please consult BF-ANP, BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

ULTRA FLAT REVERSE TREATED COPPER FOIL FOR HIGH SPEED DIGITAL APPLICATION.

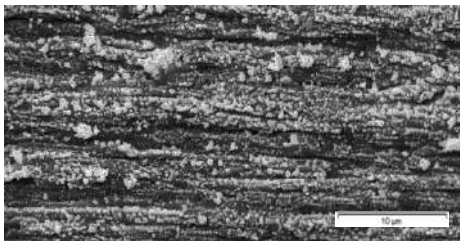
IPC Grade 3

33 As Arsenic 74.92

REVERSE TREATED RTF

TYPICAL SUBSTRATES

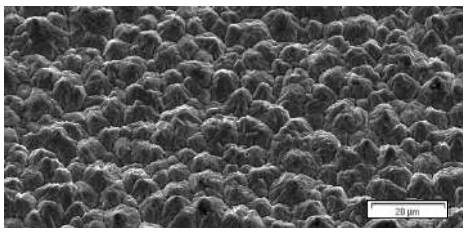
Low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.



Treated Drum Side

TYPICAL PROCESSES

Used for high speed digital Printed Circuit Board.



Untreated Electrolyte Side

TYPICAL APPLICATIONS

Used for servers.

*TYPICAL AVERAGE PROPERTIES**

TZA-B3								
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**		**IPC**	
Nominal Thickness			**µm oz.**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight			g/m²	143	276	3.4.4	2.2.12
Untreated Side Contact Roughness	Rz	JIS B 601	µm	~ 3	~ 5	-	2.2.17
	Rz	ISO 4287		~ 4	~ 6	3.4.5	
Treated Side Contact Roughness (Rz)	Rz	JIS B 601	µm	≤ 2.1		-	
	Rz	ISO 4287		≤ 2.6		3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.23		-	2.2.22 [2]
	Sz			~ 2.7			
	Sdr		%	~ 4.5			
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)		3.5.1	2.4.18
Tensile Strength Transverse (180 °C)				≥ 138 (≥ 20)			
Elongation Transverse (RT)			%	≥ 6	≥ 9	3.5.3	
Elongation Transverse (180 °C)				≥ 3			
Peel strength TreatedShiny side PPE prepreg[1] (RT)			N/mm (Lb/in)	~ 0.5	~ 0.6	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

ALTERNATIVE For reduced signal losses please consult BF-TZA, BF-ANP, BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

FLAT REVERSE TREATED COPPER FOIL FOR HIGH SPEED DIGITAL APPLICATION.

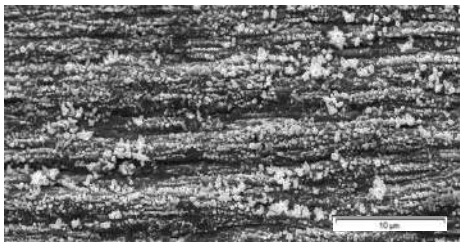
IPC Grade 3

33 As Arsenic 74.92

REVERSE TREATED RTF

TYPICAL SUBSTRATES

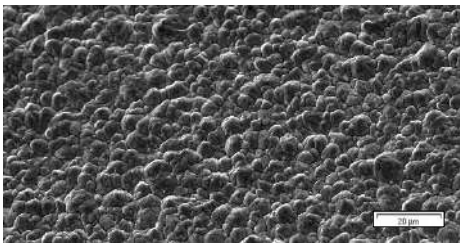
Low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.



Treated Drum Side

TYPICAL PROCESSES

Used for high speed digital Printed Circuit Board.



Untreated Electrolyte Side

TYPICAL APPLICATIONS

Used for servers.

*TYPICAL AVERAGE PROPERTIES**

TZA-B2								
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**		**IPC**	
Nominal Thickness			**µm oz.**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight			g/m²	143	276	3.4.4	2.2.12
Untreated Side Contact Roughness	Rz	JIS B 601	µm	~ 3	~ 5	-	2.2.17
	Rz	ISO 4287		~ 4	~ 6	3.4.5	
Treated Side Contact Roughness (Rz)	Rz	JIS B 601	µm	≤ 2.5		-	
	Rz	ISO 4287		≤ 3.1		3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.3		-	2.2.22 [2]
	Sz			~ 3.3			
	Sdr		%	~ 5.7			
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)		3.5.1	2.4.18
Tensile Strength Transverse (180 °C)				≥ 138 (≥ 20)			
Elongation Transverse (RT)			%	≥ 6	≥ 9	3.5.3	
Elongation Transverse (180 °C)				≥ 3			
Peel strength TreatedShiny side PPE prepreg[1] (RT)			N/mm (Lb/in)	~ 0.5	~ 0.6	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

ALTERNATIVE For reduced signal losses please consult TZA-B3, BF-TZA, BF-ANP, BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

REVERSE TREATED COPPER FOIL FOR GENERAL USE WITH EXCELLENT ADHESION TO A BROAD RANGE OF SUBSTRATES.

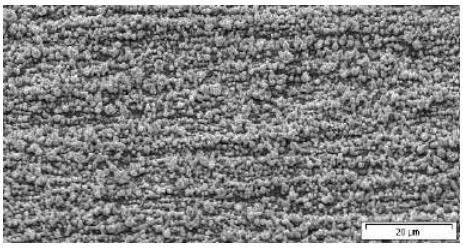
IPC Grade 3

33 As Arsenic 74.92

REVERSE TREATED RTF

TYPICAL SUBSTRATES

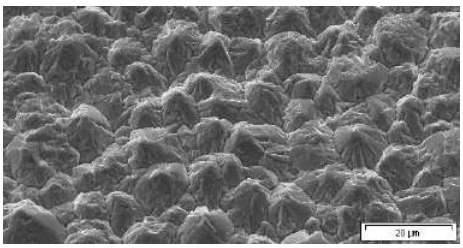
FR-4 glass epoxy including halogen free resin systems.
Also used on low loss substrates including Polyphenylene Ether/Oxide (PPE / PPO) based resin systems.



Treated Drum Side

TYPICAL PROCESSES

Rigid lamination.
Dedicated to inner layers as the already roughened untreated matte surface eliminates the need of chemical micro-etching prior to oxide processing.
Also used for high speed digital Printed Circuit Board.



Untreated Electrolyte Side

TYPICAL APPLICATIONS

For all standard multilayer Printed Circuit Boards.
Also used for networking and communication infrastructures including routers, switches and servers.

*TYPICAL AVERAGE PROPERTIES**

TZA-B

MEASURED PARAMETERS			UNITS	PRODUCT GAUGE					IPC	
Nominal Thickness			**µm oz.**	**12 3/8**	**18 1/2**	**35 1**	**70 2**	**105 3**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight			g/m²	106	152	283	577	873	3.4.4	2.2.12
Untreated Side Contact Roughness	Rz	JIS B 601	µm	≤ 4.2	≤ 5.0	≤ 7.5	≤ 9.2	≤ 10.1	-	2.2.17
	Rz	ISO 4287		≤ 5.1	≤ 6.0	≤ 9.0	≤ 11.0	≤ 12.0	3.4.5	
Treated Side Contact Roughness (Rz)	Rz	JIS B 601	µm	≤ 4.2					-	
	Rz	ISO 4287		≤ 5.1					3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178	µm	~ 0.58					-	2.2.22 [2]
	Sz			~ 5.8						
	Sdr		%	~ 28						
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)					3.5.1	2.4.18
Tensile Strength Transverse (180 °C)				≥ 138 (≥ 20)						
Elongation Transverse (RT)			%	≥ 3	≥ 6	≥ 9	≥ 12	≥ 14	3.5.3	
Elongation Transverse (180 °C)				≥ 2	≥ 3					
Peel Strength Treated Shiny Side FR4 halogen free prepreg[1] (RT)			N/mm (Lb/in)	≥ 0.7 (≥ 4.0)	≥ 0.75 (≥ 4.3)	≥ 0.8 (≥ 4.6)			3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

ALTERNATIVE For reduced signal losses please consult TZA-B3, TZA-B2, BF-TZA, BF-ANP, BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

ULTRA FLAT PROFILE COPPER FOIL WITH HIGH PEEL ON FLUOROPOLYMER SUBSTRATES.

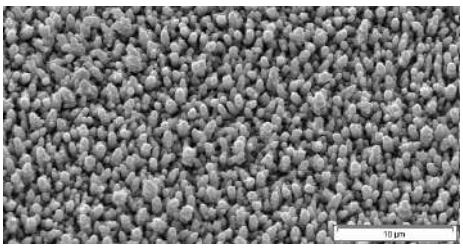
ARSENIC FREE ALTERNATIVE TO BF-HFZ.

IPC *Grade 10 & 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

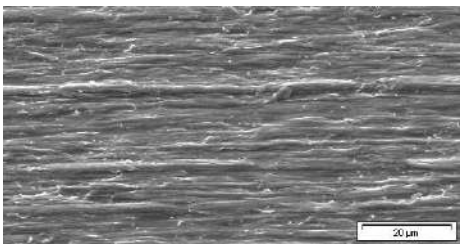
Pure or modified fluoropolymer (PTFE) resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency and microwave Printed Circuit Board.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Drum Side

TYPICAL APPLICATIONS

Base stations infrastructures and automotive radars.

*TYPICAL AVERAGE PROPERTIES**

BF-HFA								
MEASURED PARAMETERS			**UNITS**	**PRODUCT GAUGE**			**IPC**	
Nominal Thickness			**µm oz.**	**12 3/8**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight			g/m²	112	152	285	3.4.4	2.2.12
Untreated Side Contact Roughness (Ra)		ISO 4287	µm	≤ 0.35			3.5.6	2.2.17
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0.22			-	2.2.22 [2]
Treated Side Contact Roughness	Rz	JIS B 601		≤ 2.5			-	2.2.17
	Rz	ISO 4287		≤ 3.1			3.4.5	
Treated Side Contactless Roughness	Sa	ISO 25178		~ 0.38	~ 0.35	~ 0.31	-	2.2.22 [2]
	Sz			~ 4.4	~ 4.1	~ 3.7		
	Sdr		%	~ 11.5	~ 11	~ 10.5		
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)			3.5.1	2.4.18
Elongation Transverse (RT)			%	5 - 15	7 - 25	10 - 35	3.5.3	
Peel Strength modified PTFE[1] (RT)			N/mm (Lb/in)	≥ 1.2 (≥ 6.7)			3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

[2] IPC TM 2.2.22 as of May 2020

ALTERNATIVE For application at higher frequencies please consult BF-ANP, BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

HIGH BOND REVERSE TREATED COPPER FOIL ON FLUOROPOLYMER SUBSTRATES.

ARSENIC FREE ALTERNATIVE TO HFZ-B.

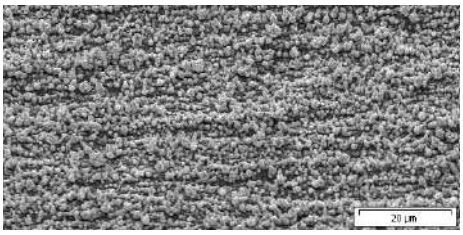
IPC Grade 3

33 As Arsenic 74.92

REVERSE TREATED RTF

TYPICAL SUBSTRATES

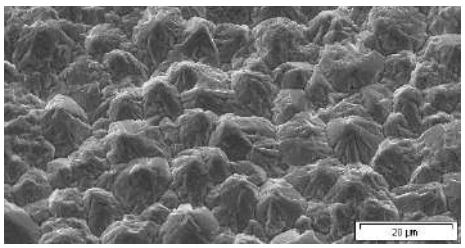
Pure or modified fluoropolymer (PTFE) resin systems.



Treated Drum Side

TYPICAL PROCESSES

Radio frequency and microwave Printed Circuit Boards.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Electrolyte Side

TYPICAL APPLICATIONS

Base stations infrastructures and automotive radars.

*TYPICAL AVERAGE PROPERTIES**

HFA-B

MEASURED PARAMETERS		UNITS	PRODUCT GAUGE			IPC	
Nominal Thickness		**µm oz.**	**18 1/2**	**35 1**	**70 2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight		g/m²	152	282	576	3.4.4	2.2.12
Untreated Side Roughness (Rz)	JIS	µm	≤ 5.0	≤ 7.5	≤ 9.2	-	2.2.17
	ISO		≤ 6.0	≤ 9.0	≤ 11.0	3.4.5	
Treated Side Roughness (Rz)	JIS		≤ 4.2			-	
	ISO		≤ 5.1			3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)			3.5.1	2.4.18
Tensile Strength Transverse (180 °C)			≥ 138 (≥ 20)				
Elongation Transverse (RT)		%	≥ 6	≥ 9	≥ 12	3.5.3	
Elongation Transverse (180 °C)			≥ 3				
Peel Strength Treated Shiny Side modified PTFE[1] (RT)		N/mm (Lb/in)	≥ 1.05 (≥ 6.0)	≥ 1.75 (≥ 10)		3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE For application at higher frequencies please consult BF-HFA, BF-ANP, BF-NN, BFL-NN and BFL-NF datasheets.

CIRCUIT FOIL

HFA-LP

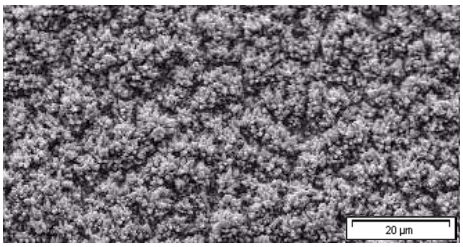
HIGH BOND COPPER FOIL ON FLUOROPOLYMER SUBSTRATES.
ARSENIC FREE ALTERNATIVE TO HFZ-LP.

IPC *Grade 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

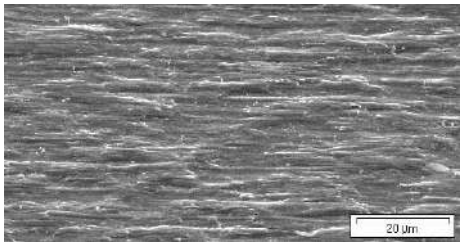
Pure or modified fluoropolymer (PTFE) resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency and microwave Printed Circuit Boards.
The pure copper treatment supports reducing the passive intermodulation (PIM).



Untreated Drum Side

TYPICAL APPLICATIONS

Base stations infrastructures and automotive radars.

*TYPICAL AVERAGE PROPERTIES**

HFA-LP						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**		**IPC**	
Nominal Thickness		**µm oz.**	**18 1/2**	**35 1**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight		g/m²	151	288	3.4.4	2.2.12
Untreated Side Roughness Ra		µm	≤ 0.40		3.5.6	2.2.17
Treated Side Roughness (Rz)	JIS	µm	≤ 5		-	2.2.17
	ISO	µm	≤ 6		3.4.5	2.2.17
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)		3.5.1	2.4.18
Tensile Strength Transverse (180 °C)		MPa (k.Lb/in²)	≥ 138 (≥ 20)		3.5.1	2.4.18
Elongation Transverse (RT)		%	≥ 6	≥ 9	3.5.3	2.4.18
Elongation Transverse (180 °C)		%	≥ 3		3.5.3	2.4.18
Peel Strength pure PTFE[1] (RT)		N/mm (Lb/in)	≥ 1.6 (≥ 9.1)	≥ 2.0 (≥ 11.4)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE

For reverse treated type please consult HFA-B datasheet.
For application at higher frequencies please consult BF-HFA, BF-ANP, BF(L)-NN and BFL-NF.

CIRCUIT FOIL

HIGH BOND REVERSE TREATED COPPER FOIL ON HYDROCARBON SUBSTRATES.

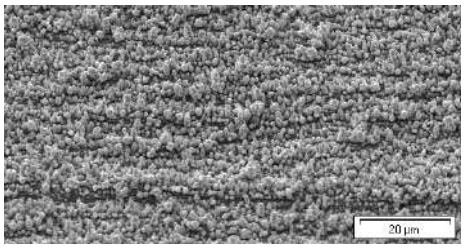
IPC Grade 3

33 As Arsenic 74.92

REVERSE TREATED RTF

TYPICAL SUBSTRATES

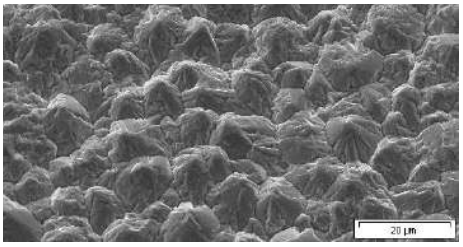
Hydrocarbon, Polyphenylene Ether/Oxide (PPE / PPO) based, high Tg and highly filled resin systems.



Treated Drum Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital multilayer Printed Circuit Boards.



Untreated Electrolyte Side

TYPICAL APPLICATIONS

Base stations infrastructures, automotive radars and digital applications.

*TYPICAL AVERAGE PROPERTIES**

TWLS-B							
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			**IPC**	
Nominal Thickness		**µm oz.**	**18 1/2**	**35 1**	**70 2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight		g/m²	157	287	577	3.4.4	2.2.12
Untreated Matte Side Roughness (Rz)	JIS	µm	≤ 5.0	≤ 7.5	≤ 9.2	-	2.2.17
	ISO		≤ 6.0	≤ 9.0	≤ 11.0	3.4.5	
Treated Shiny Side Roughness (Rz)	JIS		≤ 4.2			-	
	ISO		≤ 5.1			3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)			3.5.1	2.4.18
Tensile Strength Transverse (180 °C)			≥ 138 (≥ 20)				
Elongation Transverse (RT)		%	≥ 6	≥ 9	≥ 12	3.5.3	
Elongation Transverse (180 °C)			≥ 3				
Peel Strength Filled Hydrocarbon Resin[1] (RT)		N/mm (Lb/in)	≥ 0.5 (≥ 2.9)	≥ 0.6 (≥ 3.4)		3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE

For matte-side treated type please consult TWLS datasheet.
For fluoropolymer resin system please consult HFA-B datasheet.

CIRCUIT FOIL

TWLS / TWL-HP

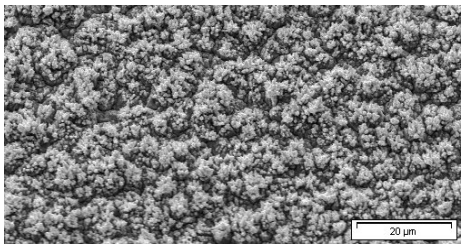
HIGH BOND COPPER FOIL ON HYDROCARBON SUBSTRATES.

IPC Grade 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

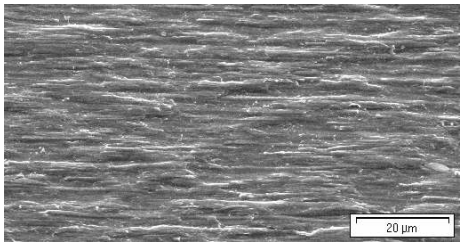
Hydrocarbon, Polyphenylene Ether/Oxide (PPE / PPO) based, high Tg and highly filled resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Radio frequency, microwave and high speed digital multilayer Printed Circuit Boards.



Untreated Drum Side

TYPICAL APPLICATIONS

Base stations infrastructures, automotive radars and digital applications.

*TYPICAL AVERAGE PROPERTIES**

TWLS / TWL-HP

MEASURED PARAMETERS		UNITS	PRODUCT GAUGE				IPC	
Nominal Thickness		µm oz.	12 3/8	18 1/2	35 1	70 2	Specification IPC-4562A	Test Method IPC-TM-650
Area weight		g/m²	108	157	283	577	3.4.4	2.2.12
Untreated Side Roughness (Ra)		µm	≤ 0.40				3.5.6	2.2.17
Treated Side Roughness Rz	JIS		3.7 - 5.4	5 - 7.5	5.8 – 10.9	6.7 – 11.8	-	
	ISO		4.5 - 6.5	6 - 9	7 - 13	8 - 14	3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)				3.5.1	2.4.18
Tensile Strength Transverse (180 °C)			≥ 138 (≥ 20)					
Elongation Transverse (RT)		%	≥ 3	≥ 6	≥ 9	≥ 12	3.5.3	
Elongation Transverse (180 °C)			≥ 2	≥ 3				
Peel Strength Filled Hydrocarbon Resin [1] (RT)		N/mm (Lb/in)	≥ 0.6 (≥ 3.4)	≥ 0.7 (≥ 4.0)	≥ 0.9 (≥ 5.1)		3.5.4	2.4.8
Peel Strength Very Low Loss (PPE Based Resin)[1] (RT)			≥ 0.85 (≥ 4.8)	≥ 1.0 (≥ 5.7)				

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE

For reverse treated type please consult TWLS-B datasheet.
For fluoropolymer resin system please consult HFA-LP datasheet.

CIRCUIT FOIL

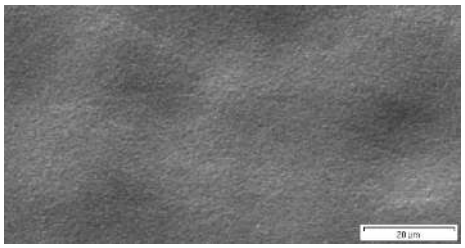
BF-PLAINSTAINPROOF

SMOOTH PROFILE COPPER FOIL ON BOTH SIDES WITHOUT BONDING TREATMENT.

33 As Arsenic 74.92

TYPICAL SUBSTRATES

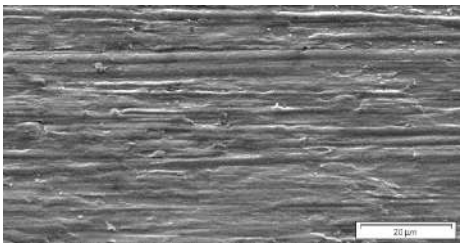
Carbon/graphite coating.



Untreated Electrolyte Side

TYPICAL PROCESSES

Designed for cylindrical, prismatic and pouch cell types.



Untreated Drum Side

TYPICAL APPLICATIONS

Used as current collector for the anode of Li-Ion batteries.

*TYPICAL AVERAGE PROPERTIES**

BF-PLAINSTAINPROOF							
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			**IPC**	
Nominal Thickness		**µm**	**6***	**8**	**10**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	54	72	89	3.4.4	2.2.12
Drum Side Roughness (Ra)		µm	≤ 0.35			3.5.6	2.2.17
Drum Side Roughness (Rz)	JIS		≤ 2.0			-	
	ISO		≤ 2.5			3.4.5	
Electrolyte Side Roughness (Rz)	JIS		≤ 2.0			-	
	ISO		≤ 2.5			3.4.5	
Tensile Strength Transverse (RT)		MPa	≥ 276 (≥ 40)			3.5.1	2.4.18
Tensile Strength Transverse after 10 min at 130 °C (RT)							
Tensile Strength Transverse after 1h at 175 °C (RT)							
Elongation Transverse (RT)		%	≥ 5			3.5.3	
Elongation Transverse after 10 min at 130 °C (RT)							
Elongation Transverse after 1h at 175 °C (RT)							
Resistivity		Ωg/m²	≤ 0.181	≤ 0.171		3.8.1.2	2.5.14
Purity		%	≥ 99.9			3.8.1.1	2.3.15

* pre-series

ALTERNATIVE Please also refer to SR-PLAINSTAINPROOF and HTS-PLAINSTAINPROOF datasheets.

CIRCUIT FOIL

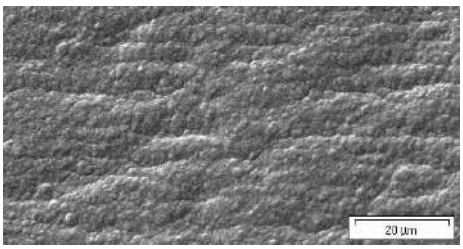
SR-PLAINSTAINPROOF

HIGH TENSILE STRESS RELEASE COPPER FOIL WITHOUT BONDING TREATMENT.

33 As Arsenic 74.92

TYPICAL SUBSTRATES

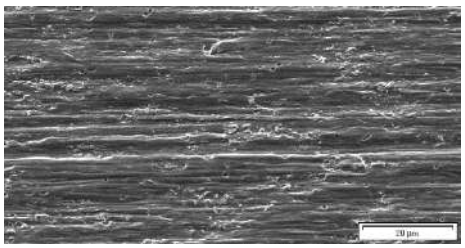
Carbon/graphite coating.



Untreated Electrolyte Side

TYPICAL PROCESSES

Designed for cylindrical and prismatic cell types as high elongation properties will allow stress release during winding of the electrode. High Tensile Strength at room temperature allows the use of thinner foil and the load of more active material during the coating process (improved manufacturing yield).



Untreated Drum Side

TYPICAL APPLICATIONS

Used as current collector for the anode of Li-Ion batteries.

*TYPICAL AVERAGE PROPERTIES**

SR-PLAINSTAINPROOF							
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			**IPC**	
Nominal Thickness		**µm**	**6**	**8**	**10**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight		g/m²	54	72	89	3.4.4	2.2.12
Drum Side Roughness (Ra)		µm	≤ 0.35			3.5.6	2.2.17
Drum Side Roughness (Rz)	JIS	µm	≤ 2.0			-	2.2.17
	ISO	µm	≤ 2.5			3.4.5	2.2.17
Electrolyte Side Roughness (Rz)	JIS	µm	≤ 2.0			-	2.2.17
	ISO	µm	≤ 2.5			3.4.5	2.2.17
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 461 (≥ 67)			3.5.1	2.4.18
Tensile Strength Transverse after 10 min at 130 °C (RT)		MPa (k.Lb/in²)	≥ 434 (≥ 63)			3.5.1	2.4.18
Tensile Strength Transverse after 1h at 175 °C		MPa (k.Lb/in²)	≥ 230 (≥ 33)			3.5.1	2.4.18
Elongation Transverse (RT)		%	≥ 3	≥ 4	≥ 5	3.5.3	2.4.18
Elongation Transverse after 10 min at 130 °C (RT)		%	≥ 3	≥ 4	≥ 5	3.5.3	2.4.18
Elongation Transverse after 1h at 175 °C (RT)		%	≥ 8			3.5.3	2.4.18
Resistivity		Ωg/m²	≤ 0.181	≤ 0.171		3.8.1.2	2.5.14
Purity		%	≥ 99.9			3.8.1.1	2.3.15

ALTERNATIVE Please also refer to BF-PLAINSTAINPROOF and HTS-PLAINSTAINPROOF datasheets.

CIRCUIT FOIL

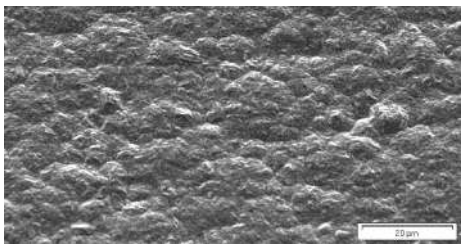
HTS-PLAINSTAINPROOF

HIGH TENSILE STRENGTH COPPER FOIL WITHOUT BONDING TREATMENT.

33 As Arsenic 74.92

TYPICAL SUBSTRATES

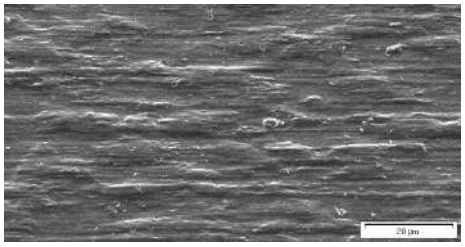
Carbon/graphite coating.



Untreated Electrolyte Side

TYPICAL PROCESSES

Designed for pouch cell type as high tensile properties will avoid deformation for cells with higher number of stacks.
High tensile strength at room temperature allows the use of thinner foil and the load of more active material during the coating process (improved manufacturing yield).



Untreated Drum Side

TYPICAL APPLICATIONS

Used as current collector for the anode of Li-Ion batteries.

*TYPICAL AVERAGE PROPERTIES**

HTS-PLAINSTAINPROOF								
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			**IPC**	
Nominal Thickness		**µm**	**6***	**8**	**10**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	54	72	89	3.4.4	2.2.12
Drum Side Roughness (Ra)		µm	≤ 0.35			3.5.6	2.2.17
Drum Side Roughness (Rz)	JIS		≤ 2.0			-	
	ISO		≤ 2.5			3.4.5	
Treated Side Roughness (Rz)	JIS		≤ 2.4			-	
	ISO		≤ 3.0			3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 455 (≥ 66)			3.5.1	2.4.18
Tensile Strength Transverse after 10 min at 130 °C (RT)			≥ 455 (≥ 66)				
Tensile Strength Transverse after 1h at 175 °C (RT)			≥ 450 (≥ 65)				
Elongation Transverse (RT)		%	≥ 2			3.5.3	
Elongation Transverse after 10 min at 130 °C (RT)							
Elongation Transverse after 1h at 175 °C (RT)							
Resistivity		Ωg/m²	≤ 0.181	≤ 0.171		3.8.1.2	2.5.14
Purity		%	≥ 99.9			3.8.1.1	2.3.15

*pre-series

ALTERNATIVE Please also refer to BF-PLAINSTAINPROOF and SR-PLAINSTAINPROOF datasheets.

CIRCUIT FOIL

BF-TZA-FX

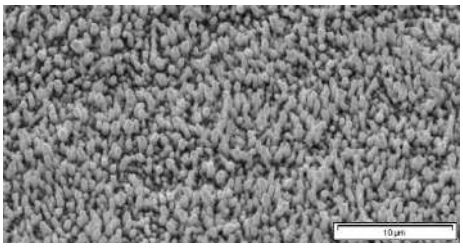
HIGH DUCTILITY COPPER FOIL FOR 2-LAYER FCCL.

IPC *Grade 10 & 3*

33 As Arsenic 74.92

TYPICAL SUBSTRATES

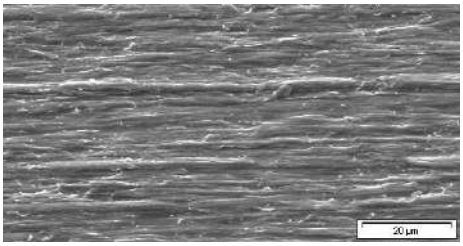
Polyimide resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Lamination on a polyimide film to form a 2-layer flexible copper clad laminate (adhesiveless with a greater flexibility compared to 3-layer FCCL).



Untreated Drum Side

TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

*TYPICAL AVERAGE PROPERTIES**

BF-TZA-FX									
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**					**IPC**	
Nominal Thickness		**µm oz.**	**9 1/4**	**12 3/8**	**18 1/2**	**35 1**	**70 2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	79	112	152	285	574	3.4.4	2.2.12
Untreated Side Roughness (Ra)		µm	≤ 0.35 (≤ 14)					3.5.6	2.2.17
Treated Side Roughness (Rz)	JIS		≤ 2.5				≤ 2.0	-	
	ISO		≤ 3.1				≤ 2.5	3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)					3.5.1	2.4.18
Elongation Transverse (RT)		%	4 - 14	5 - 15	7 - 25	10 - 35	15 - 40	3.5.3	
Peel Strength FR4 halogen-free[1] (RT)		N/mm (Lb/in)	≥ 0.7 (≥ 4.0)					3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE Please also refer to SR-TZA-B-FX datasheet.

CIRCUIT FOIL

SR-TZA-B-FX

HIGH DUCTILITY REVERSE TREATED COPPER FOIL FOR 2-LAYER FCCL.

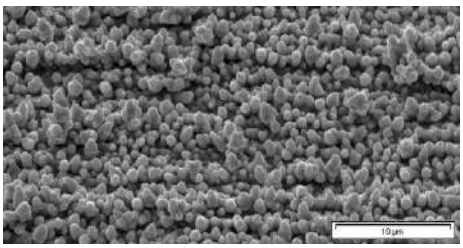
IPC Grade 2

33 As Arsenic 74.92

REVERSE TREATED RTF

TYPICAL SUBSTRATES

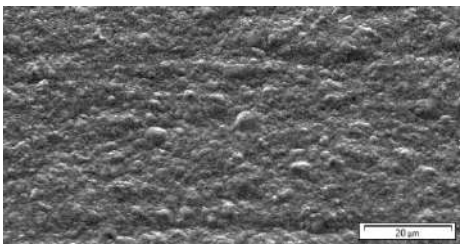
Polyimide resin systems.



Treated Drum Side

TYPICAL PROCESSES

Lamination on a polyimide film to form a 2-layer flexible copper clad laminate (adhesiveless with a greater flexibility compared to 3-layer FCCL).



Untreated Electrolyte Side

TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

*TYPICAL AVERAGE PROPERTIES**

SR-TZA-B-FX						
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**		**IPC**	
Nominal Thickness		**µm oz.**	**12 3/8**	**18 1/2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area weight		g/m²	105	154	3.4.4	2.2.12
Untreated Matte Side Roughness (Rz)	JIS	µm	≤ 2.4		-	2.2.17
	ISO		≤ 3.0		3.4.5	
Treated Side Roughness (Rz)	JIS		≤ 2.4		-	
	ISO		≤ 3.0		3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 345 (≥ 50)		3.5.1	2.4.18
Tensile Strength Transverse after after 2 min at 250°C (RT)			≥ 207 (≥ 30)			
Elongation Transverse (RT)		%	≥ 3	≥ 5	3.5.3	
Elongation Transverse after after 2 min at 250°C (RT)			≥ 6	≥ 8		
Peel Strength Treated Shiny Side halogen-free prepreg[1] (RT)		N/mm (Lb/in)	≥ 0.7 (≥ 4.0)		3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE Please also refer to BF-TZA-FX datasheet.

CIRCUIT FOIL

TZA-B-FX

REVERSE TREATED COPPER FOIL WITH AN EXCELLENT BOND ON A BROAD RANGE OF FLEXIBLE SUBSTRATES FOR 3-LAYER FCCL.

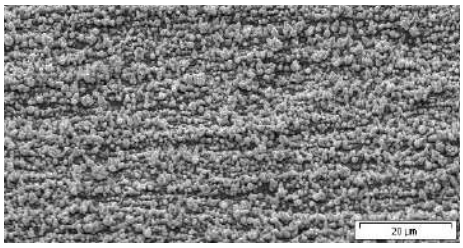
IPC Grade 3

33 As Arsenic 74.92

REVERSE TREATED RTF

TYPICAL SUBSTRATES

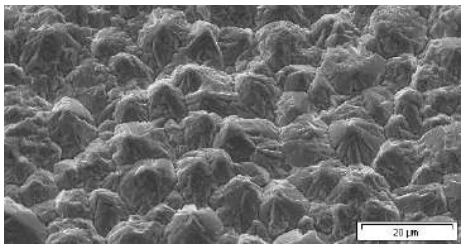
Polyimide and polyester resin systems.



Treated Drum Side

TYPICAL PROCESSES

Lamination on a polyimide or polyester film coated with an adhesive to form a 3-layer flexible copper clad laminate.



Untreated Electrolyte Side

TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

*TYPICAL AVERAGE PROPERTIES**

TZA-B-FX								
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**				**IPC**	
Nominal Thickness		**µm oz.**	**12 3/8**	**18 1/2**	**35 1**	**70 2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	106	152	283	577	3.4.4	2.2.12
Untreated Matte Side Roughness (Rz)	JIS	µm	≤ 4.2	≤ 5.0	≤ 7.5	≤ 9.2	-	2.2.17
	ISO		≤ 5.1	≤ 6.0	≤ 9.0	≤ 11.0	3.4.5	
Treated Side Roughness (Rz)	JIS	µm	≤ 4.2				-	
	ISO		≤ 5.1				3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)				3.5.1	2.4.18
Tensile Strength Transverse (180 °C)			≥ 138 (≥ 20)					
Elongation Transverse (RT)		%	≥ 3	≥ 6	≥ 9	≥ 12	3.5.3	
Elongation Transverse (180 °C)			≥ 2	≥ 3				
Peel Strength Treated Shiny Side FR4 halogen free prepreg[1] (RT)		N/mm (Lb/in)	≥ 0.7 (≥ 4.0)	≥ 0.75 (≥ 4.3)	≥ 0.8 (≥ 4.6)		3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE For 2-layer FCCL (greater flexibility) please consult SR-TZA-B-FX and BF-TZA-FX datasheets.

CIRCUIT FOIL

TZA-FX

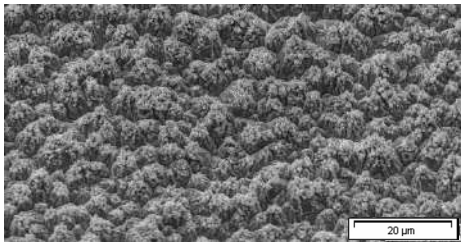
COPPER FOIL WITH AN EXCELLENT BOND ON A BROAD RANGE OF FLEXIBLE SUBSTRATES FOR 3-LAYER FCCL.

IPC Grade 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

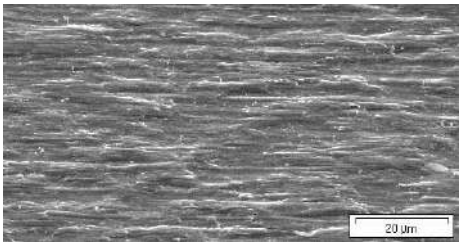
Polyimide and polyester resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Lamination on a polyimide or polyester film coated with an adhesive to form a 3-layer flexible copper clad laminate.



Untreated Drum Side

TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

*TYPICAL AVERAGE PROPERTIES**

TZA-FX								
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**				**IPC**	
Nominal Thickness		**µm oz.**	**12 3/8**	**18 1/2**	**35 1**	**70 2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	106	152	283	577	3.4.4	2.2.12
Untreated Side Roughness (Ra)		µm	≤ 0.40				3.5.6	2.2.17
Treated Side Roughness (Rz)	JIS		3.3 - 5.8	4.1 – 6.7	5 - 8.4	5.8 - 11	-	
	ISO		4 - 7	5 - 8	6 - 10	7 - 13	3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)				3.5.1	2.4.18
Tensile Strength Transverse (180 °C)			≥ 138 (≥ 20)					
Elongation Transverse (RT)		%	≥ 3	≥ 6	≥ 9	≥ 12	3.5.3	
Elongation Transverse (180 °C)			≥ 2	≥ 3				
Peel Strength FR4 halogen-free[1] (RT)		N/mm (Lb/in)	≥ 1.0 (≥ 5.7)		≥ 1.2 (≥ 6.8)	≥ 1.3 (≥ 7.4)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE For 2-layer FCCL (greater flexibility) please consult SR-TZA-B-FX and BF-TZA-FX datasheets.

CIRCUIT FOIL

LPT-NP

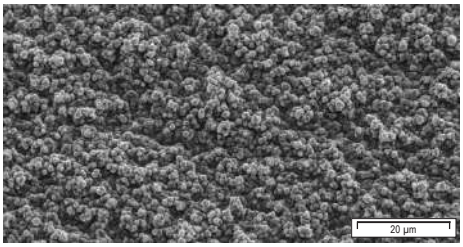
HIGH TENSILE AND LOW PROFILE COPPER FOIL.

IPC Grade 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

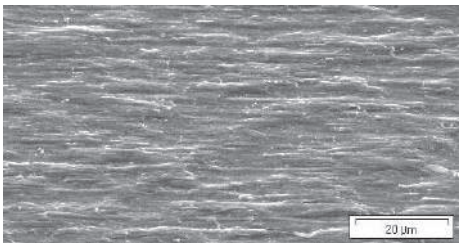
Carrier substrates.



Treated Electrolyte Side

TYPICAL PROCESSES

Reel-To-Reel colamination process.
High mechanical properties ensure a perfect flatness of the foil inside the chip window.



Untreated Drum Side

TYPICAL APPLICATIONS

Chip cards and IC card modules.

*TYPICAL AVERAGE PROPERTIES**

LPT-NP									
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**				**IPC**	
Nominal Thickness		**µm**	**18**	**29**	**35**	**70**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
		oz.	**1/2**	**4/5**	**1**	**2**		
Area weight		g/m²	147	269	325	603	3.4.4	2.2.12
Untreated Side Roughness (Ra)		µm	≤ 0.40				3.5.6	2.2.17
Treated Side Roughness (Rz)	JIS		≤ 5				-	
	ISO		≤ 6				3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 379 (≥ 55)				3.5.1	2.4.18
Tensile Strength Transverse after 2 h at 160 °C (RT)			≥ 345 (≥ 50)				-	
Elongation Transverse at RT		%	≥ 10	≥ 10	≥ 10	≥ 15	3.5.3	
Yield Strength after 2 h at 160 °C (RT)		MPa (k.Lb/in²)	≥ 250 (≥ 36)				-	
Peel Strength FR4[1] (RT)		N/mm	~ 1.0	~ 1.5	~ 1.7	~ 1.9	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

CIRCUIT FOIL

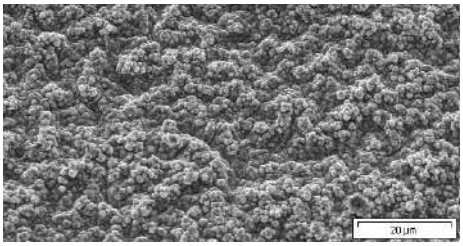
LPT-TZA

HIGH TENSILE AND LOW PROFILE COPPER FOIL.

IPC
Grade 3

TYPICAL SUBSTRATES

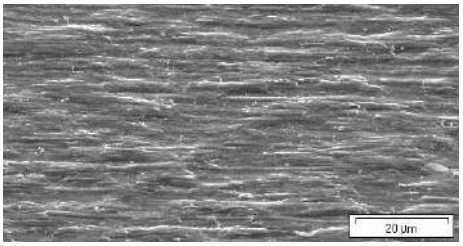
Carrier substrates.



Treated Electrolyte Side

TYPICAL PROCESSES

Reel-To-Reel colamination process.
High mechanical properties ensure a perfect flatness of the foil inside the chip window.



Untreated Drum Side

TYPICAL APPLICATIONS

Chip cards and IC card modules.

*TYPICAL AVERAGE PROPERTIES**

LPT-YE

MEASURED PARAMETERS		UNITS	PRODUCT GAUGE				IPC	
Nominal Thickness		µm	18	32	35	70	Specification IPC-4562A	Test Method IPC-TM-650
		oz.	1/2	1	1	2		
Area weight		g/m²	152	283	327	603	3.4.4	2.2.12
Untreated Side Roughness (Ra)		µm	≤ 0.40				3.5.6	2.2.17
Treated Side Roughness (Rz)	JIS	µm	3.3 - 5				-	2.2.17
	ISO	µm	4 - 6				3.4.5	2.2.17
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 379 (≥ 55)				3.5.1	2.4.18
Tensile Strength Transverse after 2 h at 160 °C (RT)		MPa (k.Lb/in²)	≥ 345 (≥ 50)				-	2.4.18
Elongation Transverse at RT		%	≥ 8	≥ 10		≥ 15	3.5.3	2.4.18
Yield Strength after 2 h at 160 °C (RT)		MPa (k.Lb/in²)	≥ 250 (≥ 36)				-	
Peel Strength FR4[1] (RT)		N/mm (Lb/in)	≥ 1.0 (≥ 5.7)	≥ 1.4 (≥ 8.0)		≥ 1.6 (≥ 9.1)	3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

CIRCUIT FOIL

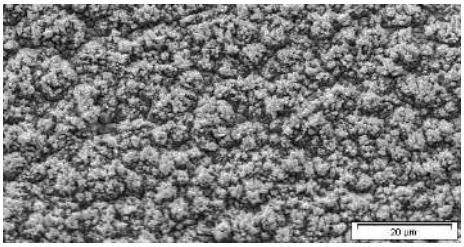
DOUBLE-SIDED TREATED COPPER FOIL.

IPC Grade 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

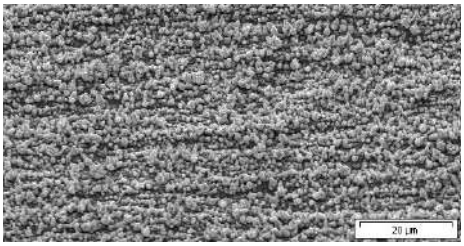
Carbon epoxy like resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Pre-impregnated mesh/perforated copper with high peel on both sides.



Treated Drum Side

TYPICAL APPLICATIONS

Electrical shielding and lightning protection in aerospace and wind power engines.

*TYPICAL AVERAGE PROPERTIES**

TZA-TZA							
MEASURED PARAMETERS		**UNITS**	**PRODUCT GAUGE**			**IPC**	
Nominal Thickness		**µm oz.**	**18 1/2**	**35 1**	**70 2**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	159	290	585	3.4.4	2.2.12
Treated Drum Side Roughness (Rz)	JIS	µm	≤ 4.2			-	2.2.17
	ISO		≤ 5.1			3.4.5	
Treated Electrolyte Side Roughness (Rz)	JIS		4.1 – 6.7	5 - 8.4	5.8 - 11	-	
	ISO		5 - 8	6 - 10	7 - 13	3.4.5	
Tensile Strength Transverse (RT)		MPa (k.Lb/in²)	≥ 276 (≥ 40)			3.5.1	2.4.18
Elongation Transverse (RT)		%	≥ 6	≥ 9	≥ 12	3.5.3	
Peel Strength FR4 halogen free [1] (RT)	Treated DS	N/mm (Lb/in)	≥ 0.75 (≥ 4.3)	≥ 0.8 (≥ 4.6)	≥ 1.05 (≥ 6.0)	3.5.4	2.4.8
	Treated ES		≥ 1.0 (≥ 5.7)	≥ 1.2 (≥ 6.8)	≥ 1.3 (≥ 7.4)		
Copper resistivity (untreated product)		Ω*g/m²	≤ 0.166	≤ 0.162		3.8.1.2	2.5.14
Copper purity (untreated product)		%	≥ 99.8			3.8.1.1	2.3.15

[1] Laminate construction with thickness ≥ 0.5 mm

CIRCUIT FOIL

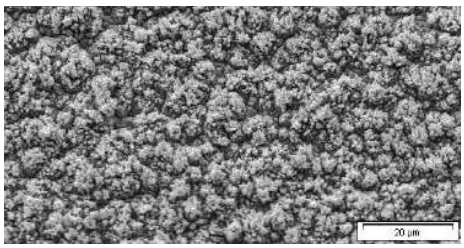
MATTE-SIDE TREATED COPPER FOIL FOR GENERAL USE WITH EXCELLENT ADHESION TO A BROAD RANGE OF SUBSTRATES.

IPC Grade 3

33 As Arsenic 74.92

TYPICAL SUBSTRATES

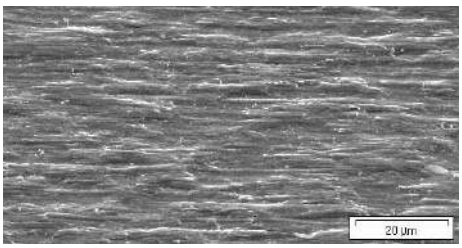
FR-4 glass epoxy including halogen free resin systems.



Treated Electrolyte Side

TYPICAL PROCESSES

Rigid lamination.



Untreated Drum Side

TYPICAL APPLICATIONS

Standard multilayer Printed Circuit Boards.
Thick foils available for power/ground planes or high current applications.

*TYPICAL AVERAGE PROPERTIES**

TZA

MEASURED PARAMETERS		UNITS	PRODUCT GAUGE								IPC	
Nominal Thickness		**µm oz.**	**12 3/8**	**18 1/2**	**35 1**	**70 2**	**105 3**	**140 4**	**175 5**	**210 6**	**Specification IPC-4562A**	**Test Method IPC-TM-650**
Area Weight		g/m²	106	152	283	577	873	1183	1481	1780	3.4.4	2.2.12
Untreated Side Roughness (Ra)		µm	≤ 0.40								3.5.6	2.2.17
Treated Side Roughness (Rz)	JIS	µm	3.3 - 5.8	4.1 – 6.7	5 - 8.4	5.8 - 11	6.7 - 13.5	6.7 - 14.3	7.5 - 15.2	7.5 - 16	-	
	ISO	µm	4 - 7	5 - 8	6 - 10	7 - 13	8 - 16	8 - 17	9 - 18	9 - 19	3.4.5	
Tensile Strength Transverse (RT)		MPa	≥ 276 (≥ 40)								3.5.1	2.4.18
Tensile Strength Transverse (180 °C)		(k.Lb/in²)	≥ 138 (≥ 20)									
Elongation Transverse (RT)		%	≥ 3	≥ 6	≥ 9	≥ 12	≥ 14	≥ 16	≥ 18	≥ 19	3.5.3	
Elongation Transverse (180 °C)		%	≥ 2	≥ 3								
Peel Strength[1] (RT) FR4 halogen free		N/mm (Lb/in)	≥ 1.0 (≥ 5.7)		≥ 1.2 (≥ 6.8)	≥ 1.3 (≥ 7.4)					3.5.4	2.4.8

[1] Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE For reverse treated type please consult TZA-B datasheet.

CIRCUIT FOIL

CIRCUIT FOIL

www.circuitfoil.com