

COPPER FOIL MANUFACTURER



PRODUCT CATALOGUE

Living Quality Targeting Excellence

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CIRCUIT FOIL GROUP

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



CIRCUIT FOIL KEY FIGURES









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PRODUCT LINEUP

High quality electrodeposited copper foil

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							
뇌 MSAP PROCESS	DOUBLETHIN-NN DOUBLETHIN-ANP DOUBLETHIN N-TZA						DOUBLETHIN NF
Sets 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							
SI 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				

Roughness decrease

*Arsenic Content



Last revision : November 2021 March 2024

ALL OF THIS TECHNICAL INFORMATION HAS BEEN DETERMINED WITH DUE CARE AND THOROUGHNESS. HOWEVER, BECAUSE THE CONDITIONS OF USE AND PROCESS AND APPLICATION TECHNOLOGIES EMPLOYED CAN SUBSTANTIALLY VARY, THE PROVIDED DATA AND FIGURES CAN ONLY SERVE AS NON-BINDING GUIDELINES. THEY DO NOT CONSTITUTE A GUARANTEE THAT THE PURCHASED ITEM WILL POSSESS CERTAIN ATTRIBUTES. FOR THIS REASON, NO LIABILITY WHATSOEVER CAN BE ASSUMED FOR THEM. THE BUYER IS OBLIGED TO CHECK THE SUITABILITY OF ALL SUPPLIED PRODUCTS.



Certificates: ISO 9001: 2015 / ISO 14001: 2015 / 6σ / Known Consignor / AEO / ISO 45001: 2018

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IC SUBSTRATE/SLP

DOUBLETHIN[™] NF

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



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.

TYPICAL AVERAGE PROPERTIES*





Functional Foil Treated Side





Functional Foil Untreated Side

DOUBLETHIN [™] NF									
MEASURED PARAMETERS		UNITS		PRODUC	T 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 o					
		oz.	3/8 or 1/2		1/2	1/2 or 1			
Functional Foil Treated Side	JIS		≤ 0.90						
Roughness (Rz)	ISO	μιι	≤ 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	≥ 0.4						
Laminate Bond on low loss resin ^[1]		(Lb/in)	(≥ 2.28)						

[1] after galvanic reinforcement up to 20 µm

ALTERNATIVE

For coreless process please consult DOUBLETHIN-CORELESS datasheet.



IC SUBSTRATE / SLP

DOUBLETHIN[™] NF-HT

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

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.



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.

TYPICAL AVERAGE PROPERTIES*



Functional Foil Treated Side





Functional Foil Untreated Side

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 o	r 18	18 0	or 35				
		OZ.	3/8 or 1/2		1/2 or 1					
Functional Foil Treated Side	JIS	118	≤ 0.90							
Roughness (Rz)	ISO	μιι	≤ 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		N/mm	> 0.4							
Laminate Bond on low loss resin ^[1]		(Lb/in)	(≥ 2.28)							

⁽¹⁾ after galvanic reinforcement up to 35 µm

ALTERNATIVE

For coreless process please consult DOUBLETHIN-CORELESS datasheet.



DOUBLETHIN[™] NN

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

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

TYPICAL APPLICATIONS

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

TYPICAL AVERAGE PROPERTIES*

and HDI/SLP ("Substrate Like PCB"). Also convenient for substractive process.



Functional Foil Untreated Side

DOUBLETHIN [™] NN									
MEASURED PARAMETERS		UNITS		PRODUC	T 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 1		18 or 35			
		0Z.	3/8 or 1/2		1/2 or 1				
Functional Foil Treated Side	JIS		≤ 0.90						
Roughness (Rz)	ISO	μm	≤ 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] Peel Strength of Functional Foil Treated Side on BT		N/mm (Lb/in)	≥ 0.5 (≥ 2.9)						

[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.



DOUBLETHIN[™] ANP

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



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.

TYPICAL AVERAGE PROPERTIES*



Functional Foil Untreated Side

DOUBLETHIN [™] ANP									
MEASURED PARAMETERS		UNITS		PRODUC	T 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 1		18 or 35			
		0Z.	3/8 or 1/2		1/2	1/2 or 1			
Functional Foil Treated Side	JIS	um	≤ 1.2						
Roughness (Rz)	ISO	μιι	≤ 1.5						
Preferred Lamination Temperature °C (°F) ≤ 240 °		≤ 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	≥ 0.6						
Peel Strength of Functional Foil Treater	d Side on BT	(Lb/in)		(≥ :	3.4)				

I resin^[1] ^[1] after galvanic reinforcement up to 20 µm

ALTERNATIVE

For a L/S of \sim 10/10 μ m please consult DOUBLETHIN NN and NF datasheet. For coreless process please consult DOUBLETHIN-CORELESS datasheet.



IC SUBSTRATE/SLP

DOUBLETHIN[™] N-TZA

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



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.

TYPICAL AVERAGE PROPERTIES*

Carrier foil Functional foil Ultra flat nodulation treatment



Functional Foil Untreated Side

	DOUBLETHIN [™] N-TZA										
MEASURED PARAMETE	RS	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			18 or 35					
		oz.	3/8 or 1/2		1/2 or 1						
Functional Foil Treated Side	JIS		≤ 1.8								
Roughness (Rz)	ISO	μm	≤2.2								
Preferred Lamination Temperatur	re	°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	≥ 0.6								
Peel Strength of Functional Foil 1	reated Side on BT	(Lb/in)		(≥ :	3.4)						

^[1] after galvanic reinforcement up to 20 µm

ALTERNATIVE

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



DOUBLETHIN[™] - CORELESS

ULTRATHIN CARRIER SUPPORTED COPPER FOIL DESIGNED FOR CORELESS PROCESS.



TYPICAL SUBSTRATES

High Tg epoxy resin systems as sacrificial core.

Substrates and HDI/SLP ("Substrate Like PCB").



Untreated Functional Foil



Carrier Foil Treated Side

DOUBLETHIN [™] -CORELESS									
MEASURED PARAMETER	S	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	JIS	μm	≤ 1.0						
Roughness (Rz)	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	JIS	1172	3.3 - 6.7		4.1	- 8.4			
Roughness (Rz)	ISO	μιι	4 - 8 5			10			
Peel Strength of Carrier Foil Treated Side		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.

* ALL OF THIS TECHNICAL INFORMATION HAS BEEN DETERMINED WITH DUE CARE AND THOROUGHNESS. HOWEVER, BECAUSE THE CONDITIONS OF USE AND PROCESS AND APPLICATION TECHNOLOGIES EMPLOYED CAN SUBSTANTIALLY VARY, THE PROVIDED DATA AND FIGURES CAN ONLY SERVE AS NON-BINDING GUIDELINES. THEY DO NOT CONSTITUTE A GUARANTEE THAT THE PURCHASED ITEM WILL POSSESS CERTAIN ATTRIBUTES. FOR THIS REASON, NO LIABILITY WHATSOEVER CAN BE ASSUMED FOR THEM. THE BUYER IS OBLIGED TO CHECK THE SUITABILITY OF ALL SUPPLIED PRODUCTS.



TYPICAL APPLICATIONS

TYPICAL PROCESSES

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

Coreless / ETS ("Embedding Trace Substrate") process used in IC

TYPICAL AVERAGE PROPERTIES*

DOUBLETHIN [™]-TA

CIRCUIT FOIL'S DOUBLETHINTM 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.

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.

TYPICAL AVERAGE PROPERTIES*





Functional Foil untreated side





Functional Foil Treated Side

DOUBLETHIN [™] - TA									
MEASURED PARAMETER	S	UNITS	PRODUC	T GAUGE					
Nominal Thickness		μm	5	9					
Functional Foil Area Weight		g/m²	45 ± 4	76 ± 4					
Carrier Foil Thickness		μm	35	5					
		OZ.	1						
Functional Foil Treated Side	JIS	μm	1.6 – 3.7	2.0 - 4.1					
Roughness (Rz)	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	Carrier Release Strength After lamination 90min @ 200°C		30 -	100					
Peel Strength of Functional Foil Tre on halogen free high Tg FR-4	ated Side	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.



BF-TZA-PKG

ULTRA FLAT COPPER FOIL FOR FINE LINE PATTERNING.

IPC Grade 10 & 3



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.

TYPICAL APPLICATIONS

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

TYPICAL AVERAGE PROPERTIES*

Untreated Drum Side

BF-TZA-PKG UNITS PRODUCT GAUGE IPC **MEASURED PARAMETERS** 12 18 Specification Test Method μm 9 **Nominal Thickness** 1/4 3/8 IPC-4562A IPC-TM-650 1/2 oz. 79 152 Area Weight g/m² 112 3.4.4 2.2.12 Untreated Side Roughness (Ra) ≤ 0.35 3.5.6 Rz (JIS) ≤ 2.5 2.2.17 μm Treated Side Roughness Rz (ISO) ≤ 3.1 3.4.5 MPa Tensile Strength Transverse (RT) ≥ 276 (≥ 40) 3.5.1 (k.Lb/in²) 2.4.18 4 - 14 5 - 15 7 - 25 Elongation Transverse (RT) % 3.5.3 N/mm ≥ 0.5 ≥ 0.6 Peel Strength BT^[1] (RT) 354 2.4.8 (Lb/in) (≥ 2.9) (≥ 3.4)

I η Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE

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



BFL-NF-HT / BFL-NF-Z

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





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).

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*



Untreated Drum Side

			BFL-N	NF-HT / BF	L-NF-Z				
MEASURED	PARAMETER	S	UNITS	F	RODUCT GAU	GE	IF	IPC	
Nominal Thick	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			≤ 0.25		3.5.6	2.2.17	
Untreated Side Contactless Roughness	Sa	ISO 25178	μm		~ 0.20		-	2.2.22 ^[2]	
Treated Side	Rz	JIS B 601		≤ 0.70	≤ 0.65	≤ 0.60	-	0.0.47	
Roughness	Rz	ISO 4287		≤ 1.0	≤ 0.9	≤ 0.8	3.4.5	2.2.17	
Treated Side	Sa			~ 0.12	~ 0.10	~ 0.08			
Contactless	Sz	ISO 25178		~ 1.6	~ 1.4	~ 1.2	-	2.2.22 ^[2]	
Roughness	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 Ve	ery 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	

construction with thickness ≥ 0.5 mm

^[2] IPC TM 2.2.22 as of May 2020



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.



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).

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*

-	Section Section	and the second s
1		
		- Franking
		20 µm

Untreated Drum Side

	BFL-NN / BFL-NN-HT / BFL-NN-Z										
MEASURED	PARAMETE	RS	UNITS		PRODUC	T GAUGE		IPC			
Nominal Thic	kness		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		≤ 0.25					2.2.17		
Untreated Side Contactless Roughness	Sa	ISO 25178	μm		~ 0		-	2.2.22 [2]			
Treated Side	Rz	JIS B 601		≤ 0.85	≤ 0.70	≤ 0.65	≤ 0.60	-	0.0.47		
Contact Roughness	Rz	ISO 4287		≤ 1.1	≤ 1.0	≤ 0.9	≤ 0.8	3.4.5	2.2.17		
Treated Side	Sa			~ 0).12	~ 0.10	~ 0.08				
Contactless	Sz	ISO 25178		~	1.6	~ 1.4	~ 1.2	-	2.2.22 [2]		
Roughness	Sdr	1	%	~(0.7	~ 0.7	~ 0.7				
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276 (≥ 40)				3.5.1	2 4 18		
Elongation Tran	sverse (RT)		%	4 - 14 5 - 15 7 - 25 10 - 35				3.5.3			
Peel Strength V (RT)	ery Low Loss (PP	E Based Resin) ^[1]	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.



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

ULTRA FLAT COPPER FOIL FOR FINE LINE PATTERNING.





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.

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	PARAMETE	RS	UNITS	PRODUC	T 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	≤ 0.25		3.5.6	2.2.17					
Untreated Side Contactless Roughness	Sa	ISO 25178	μm	~ 0.20		-	2.2.22 ^[2]				
Treated Side	Rz	JIS B 601		≤ 0.85	≤ 0.70	-	0.0.47				
Contact Roughness	Rz	ISO 4287		≤ 1.1	≤ 1.0	3.4.5	2.2.17				
Treated Side	Sa			~ 0.12	~ 0.12						
Contactless	Sz	ISO 25178		~ 1.6	~ 1.6] -	2.2.22 [2]				
Roughness	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 o	n 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 \geq 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.





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



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).

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*



Untreated Drum Side

	BF-NN / BF-NN-HT											
MEASURED	PARAMETER	RS	UNITS		PRODUC	T GAUGE		IF	IPC			
Nominal Thic	kness		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			≤		3.5.6	2.2.17				
Untreated Side Contactless Roughness	Sa	ISO 25178	μm		~ (-	2.2.22 ^[2]					
Treated Side	Rz	JIS B 601		≤ 1.4	≤ 1.2	≤ 1.1	≤ 1.0	-	0.0.47			
Roughness	Rz	ISO 4287		≤ 1.8	≤ 1.6	≤ 1.4	≤ 1.3	3.4.5	2.2.17			
Treated Side	Sa			-	~ 0.18	~ 0.16	~ 0.14					
Contactless	Sz	ISO 25178		-	~ 2.3	~ 1.7	~ 1.5	-	2.2.22 ^[2]			
Roughness	Sdr	1 [%	-	~1.4	~ 1.1	~ 0.8	7				
Tensile Strength	Tensile Strength Transverse (RT)			≥ 276 (≥ 40) 3.5.					2.4.18			
Elongation Trans	Elongation Transverse (RT)			4 - 14	5 - 15	7 - 25	10 - 35	3.5.3				
Peel Strength Ve (RT)	Peel Strength Very Low Loss (PPE Based Resin) ^[1] (RT)			$\geq 0.6^{[3]}$ (≥ 3.4)	≥ 0.35 (≥ 2.0)	≥ 0.4 (≥ 2.3)	≥ 0.5 (≥ 2.9)	3.5.4	2.4.8			
¹¹ Laminate constru	Laminate construction with thickness \geq 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.



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



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).

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*



Untreated Drum Side

BF-NN-Z / BF-NN-HT-Z											
MEASURED	PARAMETE	RS	UNITS		PRODUC	T GAUGE		IF	2c		
Nominal Thic	kness		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			≤		3.5.6	2.2.17			
Untreated Side Contactless Roughness	Sa	ISO 25178	μm			-	2.2.22 [2]				
Treated Side	Rz	JIS B 601		≤ 1.4	≤ 1.2	≤ 1.1	≤ 1.0	-	0.0.47		
Contact Roughness	Rz	ISO 4287		≤ 1.8	≤ 1.6	≤ 1.4	≤ 1.3	3.4.5	2.2.17		
Treated Side	Sa			-	~ 0.18	~ 0.16	~ 0.14				
Contactless	Sz	ISO 25178		-	~ 2.3	~ 1.7	~ 1.5	- 1	2.2.22 [2]		
Roughness	Sdr	1 [%	-	~1.4	~ 1.1	~ 0.8	1			
Tensile Strength	Transverse (RT)		MPa (k.Lb/in²)		≥ 276	3.5.1	2.4.18				
Elongation Tran	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		
¹¹ Laminate constru	¹ / 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.



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.





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).

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	PARAMETER	S	UNITS	PRODUC	T GAUGE	IP	C O					
Nominal Thic	kness		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		2	0.3	3.5.6	2.2.17					
Untreated Side Contactless Roughness	Sa	ISO 25178		~ 0).20	-	2.2.22 [2]					
Treated Side	Rz	JIS B 601	μm	≤ 1.4	≤ 1.2	-	2.2.17					
Contact Roughness	Rz	ISO 4287		≤ 1.8	≤ 1.6	3.4.5						
	Sa			~ 0.18	~ 0.18	-	2.2.22 [2]					
Treated Side Contactless	Sz	ISO 25178		~ 2.3	~ 2.3							
Roughness	Sdr		%	~1.4	~1.4							
Tensile Strength	Transverse (RT)		MPa (k.Lb/in²)	≥ 276	(≥ 40)	3.5.1	2.4.18					
Elongation Tran	sverse (RT)		%	4 - 14	5 - 15	3.5.3						
Peel Strength or	n BT resin ^[1]		N/mm (Lb/in)	≥ 0.30 ^[3] (≥ 1.7)	≥ 0.35 (≥ 2.0)	3.5.4	2.4.8					
[] Laminate construction with thickness ≥ 0.5 mm [2] IPC TM 2.2.22 as of May 2020												

[3] After build-up to 35 µm

<u>ALTERNATIVE</u>

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

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20 J/m

Untreated Drum Side



BF-ANP

ALMOST NO PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES.





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).

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.

ΤΥ

MEASURED P/ Nominal Thickne Area Weight Untreated Side	ARAMETERS		UNITS µm oz.	9	PR	ODUCT GAI	JGE		IP	С
Nominal Thickne Area Weight Untreated Side	255		μm oz.	9	12					
Area Weight Untreated Side				1/4	3/8	18 1/2	35 1	70 2	Specification IPC-4562A	Test Method IPC-TM-650
Untreated Side			g/m²	74	103	146	279	567	3.4.4	2.2.12
Contact Roughness		SO 4287				≤ 0.3			3.5.6	2.2.17
Untreated Side Contactless Roughness	IS	O 25178	µm -				-	2.2.22 ^[2]		
Treated Side Rz	J	IS B 601		≤ 1.6	≤ 1.4	≤ 1.3	≤	1.2	-	
Contact Roughness Rz	l	SO 4287	um	≤ 2.0	≤ 1.8	≤ 1.7	≤	1.5	3.4.5	2.2.17
Treated Side Sa			p	~ 0.25	~ 0.20	~ 0.18	~ ().16		
Contactless Sz	IS	O 25178		~ 3.5	~ 3.0	~ 2.4	~	2.1	-	2.2.22 [2]
Roughness 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	

[3] After build-up to 35 µm

ALTERNATIVE

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





Untreated Drum Side

BF-ANP-PKG

ALMOST NO PROFILE COPPER FOIL FOR REDUCED SIGNAL LOSSES.





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).

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											
MEASURE	D PARAMET	ERS	UNITS	PRODUC	T GAUGE	IP	Э с				
Nominal Thi	ckness		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	ed Ra ISO 4287 iess			≤ 0.3		3.5.6	2.2.17				
Untreated Side Contactless Roughness	Sa	ISO 25178	μm	~ 0	.20	-	2.2.22 ^[2]				
Treated Side	Rz	JIS B 601		≤ 1.6	≤ 1.4	-	0.0.47				
Contact Roughness	Rz	ISO 4287	um	≤ 2.0	≤ 1.8	3.4.5	2.2.17				
Treated Side	Sa		P	~ 0.25	~ 0.20						
Contactless	Sz	ISO 25178		~ 3.5	~ 3.0	- 1	2.2.22 [2]				
Roughness	Sdr		%	~ 3.4	~ 3.1						
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)	≥ 276	(≥ 40)	3.5.1	2.4.18				
Elongation Tra	Elongation Transverse (RT)			4 - 14	5 - 15	3.5.3					
Peel Strength	Peel Strength on BT resin ^[1]			≥ 0.6 ^[3] (≥ 3.4)	≥ 0.35 (≥ 2.0)	3.5.4	2.4.8				
^[1] after galvanic r	einforcement up to 2		^[2] IPC TM 2.2.2	2 as of May 2020							

[1] after galvanic reinforcement up to 20 µm

[3] After build-up to 35 µm

ALTERNATIVE

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

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Untreated Drum Side



ULTRA FLAT COPPER FOIL FOR REDUCED SIGNAL LOSSES.

IPC Grade 10 & 3



BF-TZA

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.



TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

	BF-TZA											
MEASURE	D PARAMET	ERS	UNITS		PR	ODUCT GAI	UGE		IF	°C O		
Nominal Th	ioknoco		μm	9	12	18	35	70	Specification	Test Method		
Nominal III	ICKIIESS		oz.	1/4	3/8	1/2	1	2	IPC-4562A	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				≤ 0.35		•	3.5.6	2.2.17		
Untreated Side Contactless Roughness	Sa	ISO 25178	μm				-	2.2.22 ^[2]				
Treated Side	Rz	JIS B 601			5	≤ 2.0	-					
Contact Roughness	Rz	ISO 4287		≤ 3.1 ≤ 2.5					3.4.5	2.2.17		
Treated Side	Sa			~ 0.42	~ 0.38	~ 0.35	~ 0.31	~ 0.26				
Contactless	Sz	ISO 25178		~ 4.7	~ 4.4	~ 4.1	~ 3.7	~ 3.3	-	2.2.22 ^[2]		
Roughness	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 Tra	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		

⁽³⁾ Laminate construction with thickness ⁽³⁾ After build-up to 35 µm

<u>ALTERNATIVE</u>

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



BF-HFI-LP2

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.



TYPICAL APPLICATIONS

Networking and communication infrastructures including routers, switches and servers.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

BF-HFI-LP2											
MEASURED	PARAMETERS	;	UNITS	P	RODUCT GAU	GE	IF	РС О			
Nominal Thick	iness		μm oz.	12 3/8	18 1/2	35 1	Specification IPC-4562A	Test Method IPC-TM-650			
Area Weight			g/m²	112	152	3.4.4	2.2.12				
Untreated Side Contact Roughness	Ra	ISO 4287			≤ 0.35		3.5.6	2.2.17			
Untreated Side Contactless Roughness	Sa	ISO 25178			~ 0.22		-	2.2.22 ^[2]			
Treated Side	Rz	JIS B 601	μm		≤ 2.5		-	0.0.17			
Roughness	Rz	ISO 4287			≤ 3.1	3.4.5	2.2.17				
Treated Side	Sa			~ 0.38	~ 0.35	~ 0.31					
Contactless	Sz	ISO 25178		~ 4.4	~ 4.1	~ 3.7	-	2.2.22 ^[2]			
Roughness	Sdr		%	~ 11.5	~ 11	~ 10.5					
Tensile Strength	Tensile Strength Transverse (RT)				≥ 276 (≥ 40)		3.5.1	2.4.18			
Elongation Trans	Elongation Transverse (RT)			5 - 15	7 - 25	10 - 35	3.5.3	-			
Peel Strength Ve	Peel Strength Very Low Loss (PPE Based Resin) ^[1] (RT)			≥ 0.45 (≥ 2.6)	≥ 0.5 (≥ 2.9)	≥ 0.6 (≥ 3.4)	3.5.4	2.4.8			
[7] Laminate construction with thickness ≥ 0.5 mm [7] IPC TM 2.2.22 as of May 2020											

Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE

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



REGULAR MLB AND HIGH SPEED DIGITAL

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

TYPICAL SUBSTRATES

TYPICAL PROCESSES

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



Treated Drum Side



TYPICAL APPLICATIONS

Used for servers.

Untreated Electrolyte Side

TYPICAL AVERAGE PROPERTIES*

Used for high speed digital Printed Circuit Board.

TZA-B3										
MEASURED PARAMETER	RS		UNITS	PRODUC	PRODUCT GAUGE		C			
Nominal Thickness	Nominal Thickness			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			
Intreated Side Contact Rz JIS B 601		um	~ 3	~ 5	-					
Roughness	Rz	ISO 4287	μιι	~ 4	~ 6	3.4.5	2 2 17			
Treated Side Contact Roughness	Rz	JIS B 601		≤	2.1	-				
(Rz)	Rz	ISO 4287		5	2.6	3.4.5				
T 1 1011	Sa		μιι	~ 0.23			2.2.22 ^[2]			
Treated Side Contactless Roughness	Sz	ISO 25178		~ 2.7						
Contacticas rouginess	Sdr		%	~ 4.5						
Tensile Strength Transverse (RT)			MPa	≥ 276	(≥ 40)	251				
Tensile Strength Transverse (180	°C)		(k.Lb/in²)	≥ 138	(≥ 20)	5.5.1	2/18			
Elongation Transverse (RT)	Elongation Transverse (RT)			≥ 6	≥ 9	252	2.4.10			
Elongation Transverse (180 °C)	70	≥ 3		3.5.3						
Peel strength TreatedShiny side P	N/mm (Lb/in)	~ 0.5	~ 0.6	3.5.4	2.4.8					

*I*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.

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TZA-B3

REGULAR MLB AND HIGH SPEED DIGITAL

FLAT REVERSE TREATED COPPER FOIL FOR HIGH SPEED DIGITAL APPLICATION.

TYPICAL SUBSTRATES

TYPICAL PROCESSES

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



Treated Drum Side



TYPICAL APPLICATIONS

Used for servers.

Untreated Electrolyte Side

TYPICAL AVERAGE PROPERTIES*

Used for high speed digital Printed Circuit Board.

	TZA-B2											
MEASURED PARAMETE	RS		UNITS	PRODUC	PRODUCT GAUGE		С					
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					
Intreated Side Contact Rz JIS B 601		um	~ 3	~ 5	-							
Roughness	Rz	ISO 4287	μιι	~ 4	~ 6	3.4.5	2217					
Treated Side Contact Roughness	Rz	JIS B 601		≤ 2.5		-	2.2.17					
(Rz)	Rz	ISO 4287		5	3.1	3.4.5						
T	Sa		μιι	~ 0.3								
Treated Side Contactless Roughness	Sz	ISO 25178		~ 3.3			2.2.22 ^[2]					
Contacticas reaginess	Sdr		%	~ 5.7								
Tensile Strength Transverse (RT)			MPa	≥ 276	(≥ 40)	3.5.1						
Tensile Strength Transverse (180	°C)		(k.Lb/in²)	≥ 138	(≥ 20)	5.5.1	2 / 19					
Elongation Transverse (RT)	Elongation Transverse (RT)				≥ 9	252	2.4.10					
Elongation Transverse (180 °C)	/0	≥ 3		5.5.5								
Peel strength TreatedShiny side F	N/mm (Lb/in)	~ 0.5	~ 0.6	3.5.4	2.4.8							

*I*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.







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

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.

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.

TYPICAL APPLICATIONS

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

TYPICAL AVERAGE PROPERTIES*

				Т	ZA-B					
MEASURED PARA	METERS		UNITS		PR	IP	IPC			
Nominal Thickness			μm oz.	12 3/8	18 1/2	35 1	70 2	105 3	Specification IPC-4562A	Test Metho IPC-TM-650
Area weight			g/m²	106	152	283	577	873	3.4.4	2.2.12
Untreated Side Contact	act Rz JIS B 601		um	≤ 4.2	≤ 5.0	≤ 7.5	≤ 9.2	≤ 10.1	-	
Roughness	Rz	ISO 4287	μιιι	≤ 5.1	≤ 6.0	≤ 9.0	≤ 11.0	≤ 12.0	3.4.5	2.2.17
Treated Side Contact	Rz	JIS B 601			•	≤ 4.2		•	-	
Roughness (Rz)	Rz	ISO 4287				≤ 5.1			3.4.5	
	Sa		μm			~ 0.58				
I reated Side	Sz	ISO 25178					2.2.22 [2]			
Contactiess Roughness	Sdr		%			7				
Tensile Strength Transve	rse (RT)		MPa			≥ 276 (≥ 40)			254	
Tensile Strength Transve	rse (180 °C)		(k.Lb/in²)			≥ 138 (≥ 20)			3.5.1	0.4.40
Elongation Transverse (F	RT)		0/	≥ 3	≥ 6	≥ 9	≥ 12	≥ 14	2.5.2	2.4.10
Elongation Transverse (180 °C)			%	≥ 2		2	3		3.5.3	
Peel Strength Treated Shiny Side FR4 halogen free prepreg ^[1] (RT)			N/mm (Lb/in)	$\begin{array}{c c c c c c c c c c c c c c c c c c c $				3.5.4	2.4.8	

^[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.

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Treated Drum Side









BF-HFA

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Arsen

ULTRA FLAT PROFILE COPPER FOIL WITH HIGH PEEL ON FLUOROPOLYMER SUBSTRATES. **ARSENIC FREE ALTERNATIVE TO BF-HFZ.**

TYPICAL SUBSTRATES

Pure or modified fluoropolymer (PTFE) resin systems.



IPC

Grade 10 & 3

Treated Electrolyte Side

TYPICAL PROCESSES

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



TYPICAL APPLICATIONS

Base stations infrastructures and automotive radars.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

BF-HFA											
MEASURED	PARAMETERS		UNITS	P	RODUCT GAU	GE	IF	20			
Nominal Thic	kness		μm oz.	12 3/8	18 1/2	35 1	Specification IPC-4562A	Test Method IPC-TM-650			
Area Weight			g/m²	112	3.4.4	2.2.12					
Untreated Side Contact Roughn	ess (Ra)	ISO 4287			≤ 0.35	3.5.6	2.2.17				
Untreated Side Contactless Roughness	Sa	ISO 25178			~ 0.22		-	2.2.22 ^[2]			
Treated Side	Rz	JIS B 601	μm		≤ 2.5	-	0.0.47				
Roughness	Rz	ISO 4287			≤ 3.1	3.4.5	2.2.17				
Treated Side	Sa			~ 0.38	~ 0.35	~ 0.31					
Contactless	Sz	ISO 25178		~ 4.4	~ 4.1	~ 3.7		2.2.22 ^[2]			
Roughness	Sdr		%	~ 11.5	~ 11	~ 10.5					
Tensile Strength Transverse (RT)			MPa (k.Lb/in²)		≥ 276 (≥ 40)	3.5.1	2.4.18				
Elongation Trans	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				
1/1 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.



HFA-B

HIGH BOND REVERSE TREATED COPPER FOIL ON FLUOROPOLYMER SUBSTRATES. ARSENIC FREE ALTERNATIVE TO HFZ-B.

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).



TYPICAL APPLICATIONS

Base stations infrastructures and automotive radars.

Untreated Electrolyte Side

TYPICAL AVERAGE PROPERTIES*

HFA-B										
MEASURED PARAMETERS		UNITS		PRODUCT GA	UGE	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				
Untracted Side Doughnood (Da)	JIS		≤ 5.0	≤ 7.5	≤ 9.2	-				
ontreated Side Roughness (RZ)	ISO		≤ 6.0	≤ 9.0	≤ 11.0	3.4.5	2.2.17			
Terreted Cide Development (D=)	JIS	μιι		≤ 4.2		-				
Treated Side Roughness (RZ)	ISO			≤ 5.1		3.4.5				
Tensile Strength Transverse (RT)		MPa		≥ 276 (≥ 40)		254				
Tensile Strength Transverse (180 °C)		(k.Lb/in²)		≥ 138 (≥ 20)		3.5.1	0.4.40			
Elongation Transverse (RT)	0/	≥ 6	≥ 9	≥ 12	252	2.4.10				
Elongation Transverse (180 °C)	70	≥ 3			3.5.3					
Peel Strength Treated Shiny Side modified PTFE ^[1] (RT	N/mm (Lb/in)	≥ 1.05 ≥ 1.75 (≥ 6.0) (≥ 10)			3.5.4	2.4.8				

III 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.



HFA-LP

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





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).



TYPICAL APPLICATIONS

Base stations infrastructures and automotive radars.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

	HFA-LP											
MEASURED PA	RAMETERS	UNITS	PRODUC	T GAUGE	IPC							
Nominal Thickness		μm oz.	18 35 1/2 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			≤ 0	.40	3.5.6							
Treated Side	JIS	µm ≤ 5		-	2.2.17							
Roughness (Rz)	ISO		S	6	3.4.5							
Tensile Strength Trar	isverse (RT)	MPa	≥ 276 (≥ 40)		251							
Tensile Strength Trar	nsverse (180 °C)	(k.Lb/in²)	≥ 138 (≥ 20)		3.5.1	0.4.49						
Elongation Transverse (RT)		0/	≥ 6	≥ 9	252	2.4.10						
Elongation Transverse (180 °C)		70	≥	3	3.5.5							
Peel Strength pure PTFE ^[1] (RT)		N/mm (Lb/in)	≥ 1.6 (≥ 9.1)	≥ 2.0 (≥ 11.4)	3.5.4	2.4.8						

In 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.



TWLS-B

HIGH BOND REVERSE TREATED COPPER FOIL ON HYDROCARBON SUBSTRATES.



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.



TYPICAL APPLICATIONS

Base stations infrastructures, automotive radars and digital applications.

Untreated Electrolyte Side

TYPICAL AVERAGE PROPERTIES*

			TWLS	·B				
MEASURED PARA	AMETERS	UNITS	Р	RODUCT GAU	IP	IPC		
Nominal Thickness		μm oz.	18 1/2	35 1	Specification IPC-4562A	Test Method IPC-TM-650		
Area weight		g/m²	157	287	577	3.4.4	2.2.12	
Untreated Matte Side	JIS		≤ 5.0	≤ 7.5	≤ 9.2	-		
Roughness (Rz)	ISO	1100	≤ 6.0	≤ 9.0	≤ 11.0	3.4.5	0.0.17	
Treated Shiny Side	JIS	μιι		≤ 4.2	-	2.2.17		
Roughness (Rz)	ISO	5.1				3.4.5		
Tensile Strength Transve	erse (RT)	MPa		≥ 276 (≥ 40)	251			
Tensile Strength Transve	erse (180 °C)	(k.Lb/in²)		≥ 138 (≥ 20)		3.5.1	2/10	
Elongation Transverse (RT)		≥6 ≥9 ≥12		≥ 12	252	2.4.10		
Elongation Transverse (180 °C)		70		≥ 3		3.5.5		
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	

III 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.



TWLS / TWL-HP

HIGH BOND COPPER FOIL ON HYDROCARBON SUBSTRATES.





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.



TYPICAL APPLICATIONS

Base stations infrastructures, automotive radars and digital applications.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

			Т	WLS / TW	L-HP			
MEASURED I	PARAMETERS	UNITS		PRODUC	IPC	IPC		
Nominal Thick	μm 12 18 35 70 oz. 3/8 1/2 1 2				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 Ro	oughness (Ra)			≤ (0.40		3.5.6	
Treated Side	JIS	μm	3.7 - 5.4	5 - 7.5	5.8 – 10.9	6.7 – 11.8	-	2.2.17
Roughness Rz	ISO		4.5 - 6.5	6 - 9	7 - 13	8 - 14	3.4.5	
Tensile Strength 1	ransverse (RT)	MPa		≥ 276	(≥ 40)			
Tensile Strength 1	Fransverse (180 °C)	(k.Lb/in²)		≥ 138	(≥ 20)		3.5.1	2.4.18
Elongation Transv	verse (RT)	0/	≥ 3	≥ 6	≥ 9	≥ 12	252	
Elongation Transv	verse (180 °C)	70	≥ 2		≥ 3		- 3.5.3	
Peel Strength Fille Resin ^[1] (RT)	$ \begin{array}{c c} \text{Strength Filled Hydrocarbon} \\ \begin{tabular}{ c c c c c c c } $\geq 0.6 \\ ≥ 0.7 \\ (≥ 3.4) \\ (≥ 3.4) \\ (≥ 4.0) \\ (≥ 5.1) \\ \hline \end{tabular} $		0.9 5.1)					
Peel Strength Ver Based Resin) ^[1] (R	y Low Loss (PPE T)	(Lb/in)	≥ 0.85 (≥ 4.8)		≥ 1.0 (≥ 5.7)		3.5.4	2.4.8

^[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.



BF-PLAINSTAINPROOF

SMOOTH PROFILE COPPER FOIL ON BOTH SIDES WITHOUT **BONDING TREATMENT.**



TYPICAL SUBSTRATES

Carbon/graphite coating.



Untreated Electrolyte Side

TYPICAL PROCESSES

Designed for cylindrical, prismatic and pouch cell types.



TYPICAL APPLICATIONS

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

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

		BF-F	PLAINSTAI	NPROOF					
MEASURED PARAMETERS UNITS PRODUCT GAUGE IPC									
Nominal Thickn	iess	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 Roughn	ness (Ra)			≤ 0.35		3.5.6			
Drum Side	JIS			≤ 2.0		-			
Roughness (Rz)	ISO	μm		≤ 2.5		3.4.5	2.2.17		
Electrolyte Side	JIS			-					
Roughness (Rz)	ISO			≤ 2.5		3.4.5			
Tensile Strength Tr	ransverse (RT)								
Tensile Strength Tr after 10 min at 130 Tensile Strength Tr after 1h at 175 °C	ransverse) °C (RT) ransverse (RT)	MPa	MPa ≥ 276 (≥ 40)				2.4.18		
Elongation Transve	erse (RT)								
Elongation Transverse after 10 min at 130 °C (RT)		%	% ≥5 3.5.3						
Elongation Transverse after 1h at 175 °C (RT)									
Resistivity		Ωg/m²	≤ 0.181	≤ 0.	.171	3.8.1.2	2.5.14		
Purity	urity			≥ 99.9		3.8.1.1	2.3.15		
* pre-series									

ALTERNATIVE

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



HIGH TENSILE STRESS RELEASE COPPER FOIL WITHOUT BONDING TREATMENT.



TYPICAL SUBSTRATES

Carbon/graphite coating.

LI-ION BATTERY



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).

TYPICAL APPLICATIONS

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

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

		SR-P	LAINSTAI	NPROOF					
MEASURED PARAMETERS UNITS PRODUCT GAUGE IPC									
Nominal Thickness		μm	6 8 10		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)			≤ 0.35		3.5.6			
Drum Side Roughness	JIS			≤ 2.0		-			
(Rz)	ISO	μm		≤ 2.5		3.4.5	2.2.17		
Electrolyte Side	JIS			≤ 2.0	-				
Roughness (Rz)	ISO			≤ 2.5		3.4.5			
Tensile Strength Transv	erse (RT)			≥ 461 (≥ 67)					
Tensile Strength Transv after 10 min at 130 °C (I	erse RT)	MPa (k.Lb/in²)		≥ 434 (≥ 63)		3.5.1			
Tensile Strength Transv after 1h at 175 °C	erse	≥ 230 (≥ 33)					2.4.18		
Elongation Transverse (RT)								
Elongation Transverse after 10 min at 130 °C (RT)		%	≥ 3	≥ 4	≥ 5	3.5.3			
Elongation Transverse after 1h at 175 °C (RT)				≥ 8					
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.



HTS-PLAINSTAINPROOF

HIGH TENSILE STRENGTH COPPER FOIL WITHOUT BONDING TREATMENT.



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).

TYPICAL APPLICATIONS

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

TYPICAL AVERAGE PROPERTIES*

Untreated Drum Side

		HTS-PLAINS	TAINPR	00F			
MEASURED PARAMETERS		UNITS	PRC	DUCT GA	AUGE	IP	С
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)				≤ 0.35		3.5.6	
Drum Sida Daughnaga (Dz)	JIS			≤ 2.0		-	
Drum Side Roughness (RZ)	ISO	μm		≤ 2.5		3.4.5	2.2.17
Transferd Cide Development (De)	JIS			≤ 2.4		-	
Treated Side Roughness (RZ)	ISO			≤ 3.0		3.4.5	
Tensile Strength Transverse (RT)				≥ 455 (≥ 66)		
Tensile Strength Transverse after 10 min at 130 °C (RT)		MPa (k.Lb/in²)	:	≥ 455 (≥ 66	i)	3.5.1	
Tensile Strength Transverse after 1h at 175 °C (RT)				≥ 450 (≥ 65)		2 4 18
Elongation Transverse (RT)							2.4.10
Elongation Transverse after 10 min at 130 °C (RT)		%		≥ 2		3.5.3	
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

<u>ALTERNATIVE</u>

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





BF-TZA-FX

HIGH DUCTILITY COPPER FOIL FOR 2-LAYER FCCL.

IPC Grade 10 & 3



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).



TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

	BF-TZA-FX										
MEASURED	PARAMETERS	UNITS		C O							
Nominal Thickne	255	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 R	oughness (Ra)			≤	0.35 (≤ 14)			3.5.6			
Treated Side	JIS	μm		≤ 2.5			≤ 2.0	-	2.2.17		
Roughness (Rz)	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 Trans	verse (RT)	%	4 - 14 5 - 15 7 - 25 10 - 35 15 - 40				3.5.3				
Peel Strength FF	R4 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.





SR-TZA-B-FX

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



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).



TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

Untreated Electrolyte Side

TYPICAL AVERAGE PROPERTIES*

	SR-TZA-B-FX											
MEASURED PAR	AMETERS	UNITS	PRODUC	T GAUGE	IP	C						
Nominal Thickness	3	μm oz.	12 18 3/8 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	JIS		≤ ;	2.4	-							
Roughness (Rz)			≤	3.0	3.4.5							
JIS		µm ≤ 2.4		-	2.2.17							
Roughness (Rz)	ISO		≤ :	3.0	3.4.5							
Tensile Strength Trans	verse (RT)		≥ 345 (≥ 50)									
Tensile Strength Transverse after after 2 min at 250°C (RT)		MPa (k.Lb/in²) ≥ 207 (≥ 30)		3.5.1	2 / 18							
Elongation Transverse (RT)			≥ 3	≥ 5		2.4.10						
Elongation Transverse after after 2 min at 250°C (RT)		%	≥ 6	≥ 8	3.5.3							
Peel Strength Treated Shiny Side halogen- free prepreg ^[1] (RT)		N/mm (Lb/in)	≥ (≥	0.7 4.0)	3.5.4	2.4.8						

In Laminate construction with thickness ≥ 0.5 mm

ALTERNATIVE

Please also refer to BF-TZA-FX datasheet.







REVERSE TREATED

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

TYPICAL SUBSTRATES

Polyimide and polyester resin systems.



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Arsen

IPC

Grade 3

Treated Drum Side



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



TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

Untreated Electrolyte Side

TYPICAL AVERAGE PROPERTIES*

			TZA	A-B-FX				
MEASURED PAR	AMETERS	UNITS		PRODUC	IP	IPC		
Nominal Thickness		μm oz.	12 3/8	18 1/2	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	JIS		≤ 4.2	≤ 5.0	≤ 7.5	≤ 9.2	-	
Roughness (Rz) ISC		μm	≤ 5.1	≤ 6.0	≤ 9.0	≤ 11.0	3.4.5	0.0.17
Treated Side	JIS			≤ 4	4.2		-	2.2.17
Roughness (Rz)	ISO	μm		≤ ;	5.1		3.4.5	
Tensile Strength Transv	rerse (RT)	MPa		≥ 276	(≥ 40)		254	
Tensile Strength Transv	verse (180 °C)	(k.Lb/in²)		≥ 138	(≥ 20)		3.5.1	0.4.40
Elongation Transverse	(RT)	0/	≥ 3	≥ 3 ≥ 6 ≥ 9 ≥ 12				2.4.10
Elongation Transverse	(180 °C)	%	≥ 2	≥ 2 ≥ 3			3.5.3	
Peel Strength Treated S FR4 halogen free prepr	Shiny Side eg ^[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.





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





TYPICAL SUBSTRATES

Polyimide and polyester resin systems.



Treated Electrolyte Side



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



TYPICAL APPLICATIONS

Smartphones, tablets, laptops.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

			TZA-F)	(
MEASURED PARAMETE	RS	UNITS	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)				≤ (3.5.6				
Treated Side	JIS	μm	3.3 - 5.8	4.1 – 6.7	5 - 8.4	5.8 - 11	-	2.2.17	
Roughness (Rz)	ISO		4 - 7	5 - 8	6 - 10	7 - 13	3.4.5		
Tensile Strength Transverse (RT)	MPa		≥ 276	(≥ 40)		0.5.4		
Tensile Strength Transverse (18) °C)	(k.Lb/in²)		≥ 138	(≥ 20)		- 3.5.1	0.4.40	
Elongation Transverse (RT)			≥ 3	≥ 6	≥ 9	≥ 12	0.5.0	2.4.18	
Elongation Transverse (180 °C)		%	≥ 2		≥ 3		3.5.3		
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	

*I*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.



HIGH TENSILE AND LOW PROFILE COPPER FOIL.

IPC Grade 3



LPT-NP

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.



TYPICAL APPLICATIONS

Chip cards and IC card modules.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

	LPT-NP										
MEASURED PARAMETER	S	UNITS		IPC							
Nominal Thickness		μm	18	18 29 35 70				Test Method			
Nominal Thickness		oz.	1/2	4/5	1	2	IPC-4562A	IPC-TM-650			
Area weight		g/m²	147	269	325	603	3.4.4	2.2.12			
Untreated Side Roughness (Ra)				≤ (0.40		3.5.6				
Tracted Side Doughnood (DT)	JIS	μm	µm ≤5 - 2.2.								
Treated Side Roughness (RZ)	ISO			5	3.4.5						
Tensile Strength Transverse (RT)		MD- (- +(-2)		≥ 379	(≥ 55)		3.5.1				
Tensile Strength Transverse after 2	h at 160 °C (RT)	MPa (K.LD/In*)		≥ 345	(≥ 50)		-	2.4.18			
Elongation Transverse at RT			≥ 10	≥ 10	≥ 10	≥ 15	3.5.3				
Yield Strength after 2 h at 160 °C (RT)	MPa (k.Lb/in²)	x.Lb/in ²) ≥ 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



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.



TYPICAL APPLICATIONS

Chip cards and IC card modules.

Untreated Drum Side

TYPICAL AVERAGE PROPERTIES*

LPT-YE									
MEASURED PARAMETERS		UNITS		PRODUC	IP	C			
Naminal Thickness		μm	18	18 32 35 70			Specification	Test Method	
Nominal Thickness		oz.	1/2	1	1	2	IPC-4562A	IPC-TM-650	
Area weight		g/m²	152	283	327	603	3.4.4	2.2.12	
Untreated Side Roughness (Ra)				≤ 0	3.5.6				
Tracted Side Deughness (DT)	JIS	μm		3.3 - 5 -					
Treated Side Roughness (R2)	ISO			4 -		3.4.5			
Tensile Strength Transverse (RT)	-	MPa		≥ 379	(≥ 55)		3.5.1		
Tensile Strength Transverse after 2 h at 160	°C (RT)	(k.Lb/in²)		≥ 345	(≥ 50)		-	2.4.18	
Elongation Transverse at RT		%	≥ 8 ≥ 10 ≥ 15		≥ 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 (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







DOUBLE-SIDED TREATED COPPER FOIL.



TYPICAL SUBSTRATES

Carbon epoxy like resin systems.



Treated Electrolyte Side



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



TYPICAL APPLICATIONS

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

Treated Drum Side

TYPICAL AVERAGE PROPERTIES*

TZA-TZA										
MEASURED PARAMETE	UNITS	PROD	UCT GA	UGE	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			≤ 4.2		-	2.2.17			
	ISO			≤ 5.1		3.4.5				
Treated Electrolyte Side Roughness (Rz)	JIS	μm	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	≥ 0.75 (≥ 4.3)	≥ 0.8 (≥ 4.6)	≥ 1.05 (≥ 6.0)	254	24.8			
	Treated ES	(Lb/in)	≥ 1.0 (≥ 5.7)	≥ 1.2 (≥ 6.8)	≥ 1.3 (≥ 7.4)	5.5.4	2.4.0			
Copper resistivity (untreated product)		Ω^*g/m^2	≤ 0.166 ≤ 0.162		3.8.1.2	2.5.14				
Copper purity (untreated product)		%		≥ 99.8		3.8.1.1	2.3.15			

 $^{l\eta}$ Laminate construction with thickness $\geq 0.5~\text{mm}$



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

TYPICAL SUBSTRATES

FR-4 glass epoxy including halogen free resin systems.



IPC

Grade 3

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 PARAM	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	Specificat ion 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)				≤ 0.40								
Treated Side	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	-	2.2.17
Roughness (Rz)	ISO		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)							2 5 1		
Tensile Strength Transverse (180 °C) (k.Lb/in ²)					≥ 138 (≥ 20)							2/18
Elongation Transverse (RT)	0/	≥ 3	≥6	≥9	≥ 12	≥ 14	≥ 16	≥ 18	≥ 19	353	2.4.10
Elongation Transverse (180 °C)		/0	≥2 ≥3						0.0.0			
Peel Strength ^[1] (RT)		N/mm	≥ 1.0		≥ 1.2	≥ 1.3				354	248	
FR4 halogen free		(Lb/in)	(≥ !	5.7)	(≥ 6.8)	(≥ 7.4)					0.0.4	2.4.0

In Laminate construction with thickness ≥ 0.5 mm

<u>ALTERNATIVE</u> For reverse treated type please consult TZA-B datasheet.







www.circuitfoil.com