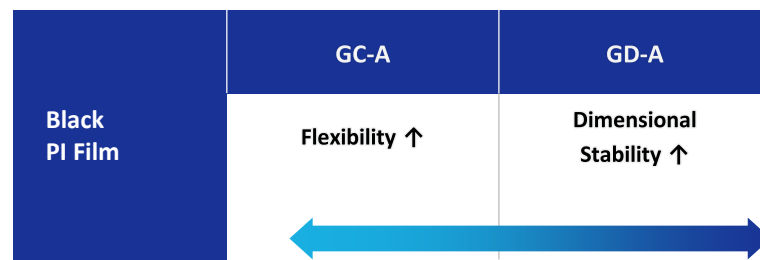
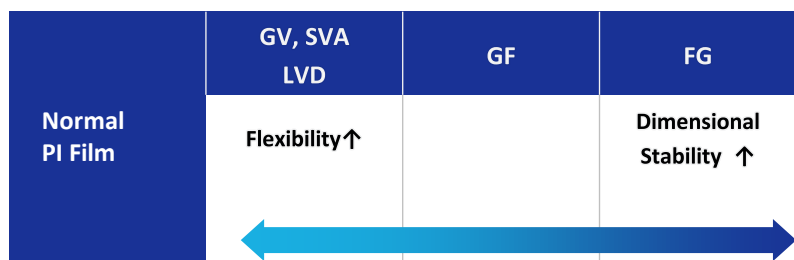


## PI Film Line-up



Type		Thickness(μm)											Main Usage	
		4	5	7.5	9	12.5	16	25	34/ 38	50	62.5 / 68.7 5	75		100 ↑
Amber	GF	△	○	○		◎		◎		◎		◎		FCCL, CVL, Stiffener, Tape
	GV					△		◎		◎		○		Coverlay, Stiffener, Tape
	SVA												○	Synthetic G/S, Industrial
	LVD								◎	◎	◎			Synthetic G/S
Black	GDA		○	○		◎		○		○		○		Black Coverlay Black Stiffener
	GCA					○		○		△		△		
High Modulus	XT			△	△	△			△					FCCL, CVL
	FG		△	△		△	△	○	△	△				FCCL, Coverlay, Stiffener for high frequency FPCB

◎ regular production, ○ periodic production campaign, △ irregular production

※ Various thicknesses available for the customers' requirements

# ZENIMID™

## Amber Polyimide Film



### PI Advanced Materials Co., Ltd.

Type	<b>GF (Matching with CTE of Cu)</b>								
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	Property	Unit	GF							Test Method	
<b>General</b>	Nominal Thickness	μm	4	5	7.5	12.5	25	50	75		
<b>Mechanical</b>	Tensile Strength	MPa	MD	327	325	330	310	296	270	262	ASTM D882*
			TD	333	330	335	315	295	273	262	
	Elongation at Break	%	MD	59	62	67	75	78	74	77	
			TD	57	58	65	72	82	75	80	
	Modulus	GPa	MD	3.8	3.7	3.6	3.5	3.4	3.3	3.5	
			TD	3.8	3.7	3.6	3.5	3.4	3.3	3.4	
<b>Thermal</b>	Heat Shrinkage (200°C x 2hr)	%	MD	0.08	0.10	0.08	0.06	0.04	0.05	0.03	IPC TM650 2.2.4A
			TD	0.01	0.01	0.01	0.01	0.00	0.01	0.00	
	Coefficient of Thermal Expansion	ppm /°C	MD	12	12	13	14	16	18	16	TMA Method (100~200°C)
			TD	16	16	16	16	17	17	17	
<b>Electric</b>	Volume Resistivity	Ω·cm	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	ASTM D 257	
	Dielectric Strength	kV/mm	300	300	310	328	345	231	208	ASTM D 149	
<b>Optical</b>	Haze	%	2.0	2.3	2.7	3.8	7.5	13.0	18.7	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

Note1. The data provided above is not intended to be relied on by third parties for any business decision or legal determination.

Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

### PI Advanced Materials Co., Ltd.

Type	GV (Low Modulus, High Flexibility)							
	Property	Unit	GV				Test Method	
<b>General</b>	Nominal Thickness	μm	12.5	25	50	75		
<b>Mechanical</b>	Tensile Strength	MPa	MD	285	265	243	207	ASTM D882*
			TD	295	270	245	212	
	Elongation at Break	%	MD	105	115	125	113	
			TD	104	117	128	115	
	Modulus	GPa	MD	2.4	2.4	2.4	2.4	
			TD	2.4	2.4	2.4	2.4	
<b>Thermal</b>	Heat Shrinkage (200°C x 2hr)	%	MD	0.08	0.05	0.04	0.03	IPC TM650 2.2.4A
			TD	0.01	0.01	0.01	0.01	
	Coefficient of Thermal Expansion	ppm /°C	MD	33	33	33	33	TMA Method (100~200°C)
			TD	35	35	35	34	
<b>Electric</b>	Volume Resistivity	Ω·cm	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	ASTM D 257	
	Dielectric Strength	kV/mm	325	332	308	250	ASTM D 149	
<b>Optical</b>	Haze	%	3.5	5.7	10.0	13.5	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

Note1. The data provided above is not intended to be relied on by third parties for any business decision or legal determination.  
 Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

### PI Advanced Materials Co., Ltd.

Type	SVA (Ultra Thickness for Synthetic Graphite Sheet)								
	Property	Unit	SVA					Test Method	
General	Nominal Thickness	μm	100	125	145	150	160		
Mechanical	Tensile Strength	MPa	MD	204	218	180	176	174	ASTM D882*
			TD	206	216	181	176	178	
	Elongation at Break	%	MD	161	130	120	138	141	
			TD	164	124	120	136	143	
	Modulus	GPa	MD	2.7	2.5	2.9	3.0	3.0	
			TD	2.6	2.5	2.9	3.0	3.0	
Thermal	Heat Shrinkage (200°C x 2hr)	%	MD	0.06	0.03	0.04	0.10	0.08	IPC TM650 2.2.4A
			TD	-0.01	-0.03	-0.03	0.01	0.01	
	Coefficient of Thermal Expansion	ppm /°C	MD	31	30	29	32	30	TMA Method (100~200°C)
			TD	30	28	28	29	29	
Electric	Volume Resistivity	Ω·cm	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	ASTM D 257	
	Dielectric Strength	kV/mm	203	182	162	151	143	ASTM D 149	
Optical	Haze	%	2.9	4.1	5.0	3.8	4.2	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

Note1. The data provided above is not intended to be relied on by third parties for any business decision or legal determination.  
 Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

### PI Advanced Materials Co., Ltd.

Type	LVD (For Synthetic Graphite Sheet)							
	Property	Unit	LVD				Test Method	
General	Nominal Thickness	μm	38	50	62.5	68.75		
Mechanical	Tensile Strength	MPa	MD	200	191	195	228	ASTM D882*
			TD	203	193	198	231	
	Elongation at Break	%	MD	114	112	115	119	
			TD	116	115	116	121	
	Modulus	GPa	MD	3.1	2.7	2.8	2.5	
			TD	3.0	2.7	2.8	2.5	
Thermal	Heat Shrinkage (200°C x 2hr)	%	MD	0.09	0.04	0.06	0.00	IPC TM650 2.2.4A
			TD	0.03	-0.01	0.01	-0.01	
	Coefficient of Thermal Expansion	ppm /°C	MD	34	34	36	33	TMA Method (100~200°C)
			TD	34	35	34	33	
Electric	Volume Resistivity	Ω·cm	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	ASTM D 257	
	Dielectric Strength	kV/mm	310	268	240	218	ASTM D 149	
Optical	Haze	%	9	11	12	14	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

Note1. The data provided above is not intended to be relied on by third parties for any business decision or legal determination.  
 Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

# ZENIMID™

## Black Polyimide Film



### PI Advanced Materials Co., Ltd.

Type	<b>GDA (Black, Matching with CTE of Cu)</b>							
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	Property	Unit	GDA						Test Method	
<b>General</b>	Nominal Thickness	μm	5	7.5	12.5	25	50	75		
<b>Mechanical</b>	Tensile Strength	MPa	MD	192	203	212	220	218	205	ASTM D882*
			TD	190	205	217	223	225	208	
	Elongation at Break	%	MD	40	48	63	70	73	63	
			TD	35	45	58	68	70	63	
	Modulus	GPa	MD	2.9	3.2	3.2	3.1	3.1	3.1	
			TD	2.9	3.2	3.2	3.1	3.1	3.1	
<b>Thermal</b>	Heat Shrinkage (200°C x 2hr)	%	MD	0.09	0.08	0.05	0.04	0.03	0.02	IPC TM650 2.2.4A
			TD	-0.01	0.01	0.01	0.01	0.01	0.01	
	Coefficient of Thermal Expansion	ppm /°C	MD	17	17	19	20	20	20	TMA Method (100~200°C)
			TD	19	20	20	20	20	20	
<b>Electric</b>	Volume Resistivity	Ω·cm	>10 <sup>15</sup>	>10 <sup>15</sup>	>10 <sup>15</sup>	>10 <sup>15</sup>	>10 <sup>15</sup>	>10 <sup>15</sup>	ASTM D 257	
	Dielectric Strength	kV/mm	67	88	122	192	160	120	ASTM D 149	
<b>Optical</b>	Gloss	GU	39	37	22	22	23	23	ASTM D523	
	Transmittance	%	8.5	2.3	0.0	0.0	0.0	0.0	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

Note1. The data provided above is not intended to be relied on by third parties for any business decision or legal determination.  
 Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

### PI Advanced Materials Co., Ltd.

Type	<b>GCA (Black, Low Modulus)</b>					
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	Property	Unit	GCA				Test Method	
<b>General</b>	Nominal Thickness	$\mu\text{m}$	12.5	25	50	75		
<b>Mechanical</b>	Tensile Strength	MPa	MD	190	192	182	180	ASTM D882*
			TD	196	197	190	185	
	Elongation at Break	%	MD	76	85	95	99	
			TD	73	82	90	94	
	Modulus	GPa	MD	2.4	2.6	2.5	2.6	
			TD	2.5	2.6	2.5	2.6	
<b>Thermal</b>	Heat Shrinkage (200°C x 2hr)	%	MD	0.08	0.05	0.03	0.02	IPC TM650 2.2.4A
			TD	0.01	0.01	0.01	0.01	
	Coefficient of Thermal Expansion	ppm /°C	MD	33	35	35	35	TMA Method (100~200°C)
			TD	36	36	35	35	
<b>Electric</b>	Volume Resistivity	$\Omega\text{-cm}$	$>10^{15}$	$>10^{15}$	$>10^{15}$	$>10^{15}$	ASTM D 257	
	Dielectric Strength	kV/mm	120	180	140	112	ASTM D 149	
<b>Optical</b>	Gloss	GU	23	22	23	24	ASTM D523	
	Transmittance	%	0.0	0.0	0.0	0.0	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

Note1. The data provided above is not intended to be relied on by third parties for any business decision or legal determination.

Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

# ZENIMID™

## High Modulus Polyimide Film



### PI Advanced Materials Co., Ltd.

Type		XT (High Modulus for FCCL, CVL)						
Property	Unit	XT				Test Method		
<b>General</b>	Nominal Thickness	μm	7.5	9	12.5	18		
<b>Mechanical</b>	Tensile Strength	MPa	MD	300	300	300	300	ASTM D882*
			TD	300	300	300	300	
	Elongation at Break	%	MD	40	45	40	45	
			TD	40	45	40	45	
	Modulus	GPa	MD	6.5	6.5	6.0	6.0	
			TD	6.5	6.5	6.0	6.0	
<b>Thermal</b>	Heat Shrinkage (200°C x 2hr)	%	MD	0.05	0.04	0.04	0.04	IPC TM650 2.2.4A
			TD	0.01	0.01	0.01	0.01	
	Coefficient of Thermal Expansion	ppm /°C	MD	12	12.5	12.5	12.5	TMA Method (100~200°C)
			TD	11	11	11.5	11.5	
<b>Electric</b>	Volume Resistivity	Ω·cm	>1016	>1016	>1016	>1016	ASTM D 257	
	Dielectric Strength	kV/mm	400	380	380	365	ASTM D 149	
<b>Optical</b>	Haze	%	3.3	3.3	2.2	5.3	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

Note1. The data provided above is not intended to be relied on by third parties for any business decision or legal determination.

Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

### PI Advanced Materials Co., Ltd.

Type		FG (Low Df for High Frequency FPCB)								
Property	Unit	FG								Test Method
<b>General</b>	Nominal Thickness	μm	7.5	12.5	16	25	34	50		
<b>Mechanical</b>	Tensile Strength	MPa	MD	315	320	340	340	340	345	ASTM D882*
			TD	345	330	335	345	330	340	
	Elongation at Break	%	MD	35	45	50	55	55	50	
			TD	30	40	50	55	55	55	
	Modulus	GPa	MD	11.0	11.0	10.5	9.5	9.5	9.5	
			TD	12.0	11.0	10.5	9.5	9.5	9.5	
<b>Thermal</b>	Heat Shrinkage (200°C x 2hr)	%	MD	0.04	0.04	0.03	0.03	0.03	0.02	IPC TM650 2.2.4A
			TD	-0.01	-0.01	-0.01	0.01	0.01	-0.01	
	Coefficient of Thermal Expansion	ppm /°C	MD	10	10	10.5	10.5	10	8.5	TMA Method (100~200°C)
			TD	8	10.5	11.5	9.5	11.5	10.5	
<b>Dielectric</b>	Dk [25°C, 45%RH]	-	3.5	3.5	3.5	3.5	3.6	3.5	SPDR 10Ghz	
	Df [25°C, 45%RH]	-	0.0039	0.0035	0.0037	0.0038	0.0038	0.0037	SPDR 10Ghz	
<b>Optical</b>	Haze	%	4.5	9	11	16.5	22.5	26.5	ASTM D1003	

\* Grip separation 50mm, Speed 200mm/min

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 Note2. Actual data may vary for a variety of reasons, including but not limited to improvements to the product and protocol used for testing the product.

**ZENIMID™**