Panasonic

■ General properties <Typical values>

As of August, 2021

Item		Test method	Condition	Unit	Multi-layer circuit board materials																	
					-	-	MEGTRON7	MEGTRON7	MEGTRON7	Halogen-free MEGTRON6	Halogen-free MEGTRON6	MEGTRON6	MEGTRON6	MEGTRON4	MEGTRON4S	MEGTRONM	Halogen-free MEGTRON2	Halogen-free MEGTRON2E	HiPERV	Halogen-free	HiPERD	HiPERM	HiPERE
Product number					R-5515	R-5575	R-5785(GN)	R-5785(N)	R-5785(GE)	R-5375(N)	R-5375(E)	R-5775(N)	R-5775	R-5725	R-5725S	R-5735	R-1577	R-1577E	R-1755V	R-1566S	R-1755D	R-1755M	R-1755E
Glass Transition Temp. (Tg)		DSC	A	℃	-	-	200	200	200	-	-	185	185	176	200	195	170	173	173	175	163	153	133
		TMA			170	205	190	-	190	210	210	-	-	170	190	185	165	170	165	170	154	150	133
		DMA			200	245	210	210	210	250	250	210	210	210	215	210	190	190	190	195	185	175	153
Thermal Decomposition Temp.(Td)		TGA	A	℃	410	440	400	400	400	435	435	410	410	360	360	360	380	385	350	355	345	355	370
Time to Delam (T288)	Without Cu	IPC-TM-650 2.4.24.1	A	min	(>120)	＞120	>120	>120	>120	>120	>120	>120	>120	>120	>120	120	>120	>120	>120	>120	-	110	>120
	With Cu				(>120)	>120	>120	>120	>120	>120	>120	>120	>120	30	50	35	25	25	20	10	15	18	25
CTE：α1	X - axis	IPC-TM-650 2.4.24	A	ppm /℃	19-21	13-16	14-16	14-16	14-16	14-16	14-16	14-16	14-16	12-14	12-14	12-15	14-16	14-16	11-13	11-13	10-12	11-13	11-13
	Y - axis				19-21	13-16	14-16	14-16	14-16	14-16	14-16	14-16	14-16	13-15	13-15	12-15	14-16	14-16	13-15	13-15	12-14	13-15	13-15
	Z - axis	IPC-TM-650 2.4.24			(50)	20	42	42	42	39	39	45	45	35	32	31	34	35	44	40	43	40	42
CTE：α2	Z - axis	IPC-TM-650 2.4.24	A	ppm /℃	(300)	155	280	280	280	200	200	260	260	265	250	240	200	210	255	180	236	240	250
Thermal Conductivity		Laser Flash	25℃	W/m･K	(0.35)	0.60	0.40	0.40	0.40	0.37	0.37	0.42	0.42	0.60	0.60	-	0.50	0.50	0.53	0.62	0.63	0.57	0.55
Volume Resistivity		IPC-TM-650 2.5.17.1	C-96/35/90	MΩ･cm	(1 x 10^9)	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	-	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9	1 x 10^9
Surface Resistivity		IPC-TM-650 2.5.17.1	C-96/35/90	MΩ	(1 x 10^8)	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	-	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8	1 x 10^8
Dielectric Constant (Dk)	@ 1GHz	IPC-TM-650 2.5.5.9	C-24/23/50	-	-	3.7	3.4	3.4	3.6	3.4	3.7	3.4	3.7	3.8	3.8	3.9	4.1	4.2	4.4	4.7	4.4	4.6	4.6
	@ 10GHz	IPC-TM-650 2.5.5.5			(3.0*1)	-	-	-	-	-	-	-	-	3.8	3.8	3.9	4.0	4.1	4.3	4.6	-	4.4	4.5
	@ 12GHz	Balanced-type circular disk resonator			3.1	3.7	3.4	3.4	3.6	3.4	3.7	3.4	3.6	-	-	-	-	-	-	-	-	-	-
Dissipation Factor (Df)	@ 1GHz	IPC-TM-650 2.5.5.9	C-24/23/50	-	-	0.002	0.001	0.001	0.002	0.001	0.002	0.002	0.002	0.005	0.005	0.005	0.010	0.010	0.016	0.011	0.016	0.014	0.013
	@ 10GHz	IPC-TM-650 2.5.5.5			(0.002*1)	-	-	-	-	-	-	-	-	0.007	0.007	0.007	0.013	0.013	0.020	0.016	-	0.019	0.019
	@ 12GHz	Balanced-type circular disk resonator			0.002	0.004	0.002	0.002	0.003	0.003	0.004	0.004	0.004	-	-	-	-	-	-	-	-	-	-
Water Absorption		IPC-TM-650 2.6.2.1	D-24/23	%	0.19	0.23	0.06	0.06	0.06	0.23	0.22	0.14	0.14	0.14	0.14	0.14	0.14	-	0.12	0.18	0.11	0.11	0.11
Flexural Modulus	Warp/MD	JIS C 6481	A	GPa	9.3	-	19	19	20	20	19	19	20	25	25	25	25	25	24	24	23	24	24
	Fill/TD				10	-	18	18	19	19	18	18	19	23	23	23	23	23	22	22	21	22	22
Peel Strength	1oz	IPC-TM-650 2.4.8	A	kN/m (lb/inch)	0.6(3.4) (Cu:H-VLP2 Hoz)	0.8(4.6) (Cu:RT)	0.8(4.6) (Cu:H-VLP2)	0.8(4.6) (Cu:H-VLP)	0.8(4.6) (Cu:H-VLP2)	0.6(3.4) (Cu:H-VLP2)	0.6(3.4) (Cu:H-VLP2)	0.8(4.6) (Cu:H-VLP)	0.8(4.6) (Cu:H-VLP)	1.1(6.3) (Cu:RT)	1.3(7.4) (Cu:RT)	1.3(7.4) (Cu:RT)	1.3(7.4)	1.3(7.4)	1.5(8.6)	1.6(9.1)	1.3(7.4)	1.5(8.6)	1.6(9.1)
Flammability		UL	C-48/23/50	-	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0 equivalent	94V-0 equivalent	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0
The Sample thickness					0.13mm (0.50mm)	0.5mm	0.75mm	0.75mm	0.75mm	0.75mm	0.75mm	0.75mm	0.75mm	0.8mm	0.8mm	0.8mm	0.8mm	0.8mm	0.8mm	0.8mm	0.8mm	0.8mm	0.8mm

*1 Test method: Cavity resonance

Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others.
The above data are typical values and not guaranteed values.

Panasonic Corporation Industrial Solutions Company
Electronic Materials Business Division

Panasonic

■ General properties <Typical values>

As of August, 2021

					Multi-layer circuit board materials				IC substrate materials									Double sided circuit board materials	Flexible circuit board materials		
					Halogen-free	Halogen-free	Halogen-free	Glass epoxy multi	LEXCM GX									ecool	FELIOS LCP	FELIOS FRCC	FELIOS
Product number					R-A555(W)	R-1566(W)	R-1566(WN)	R-1766(GH)	R-G545L	R-G545E	R-G525T	R-G525F	R-G535S	R-G535E	R-1515E	R-1515W	R-1515A	R-1787	R-F705S	R-FR10	R-F775
Item		Test method	Condition	Unit																	
Glass Transition Temp. (Tg)		DSC	A	℃	-	148	148	140	-	-	-	-	-	-	-	-	-	140	-	-	-
		TMA			160	145	145	140	190	190	240	240	210	210	240*3	220	180	140	-	190 (Ad)	-
		DMA			200	170	170	150	230*4	230*4	270*4	270*4	260	260	270*4	250	205	155	-	210*4 (Ad)	>340*4 (TPI 240)
Thermal Decomposition Temp.(Td)		TGA	A	℃	380	350	355	315	420	420	365	365	365	365	390	390	390	345	482	-	577
Time to Delam (T288)	Without Cu	IPC-TM-650 2.4.24.1	A	min	>60	>120	>120	5	-	-	>120	>120	-	-	>120	>120	>120	-	-	-	-
	With Cu				>60	3	10	1	-	-	>60	>60	-	-	>120	>120	>120	-	-	-	-
CTE : α1	X - axis	IPC-TM-650 2.4.24	A	ppm /℃	11-13	11-13	11-13	11-13	10*2	10*2	3-5*2	5-7*2	4-6	7-8	8-10*2	8-10	11-13	18-23	17-19	80 (Ad)	18-20
	Y - axis				13-15	13-15	13-15	13-15	10*2	10*2	3-5*2	5-7*2	4-6	7-8	8-10*2	8-10	11-13	20-25	17-19	80 (Ad)	16-19
	Z - axis	IPC-TM-650 2.4.24			41	40	40	65	22	22	35	35	20	20	22	22	30	50	-	80 (Ad)	-
CTE : α2	Z - axis	IPC-TM-650 2.4.24	A	ppm /℃	270	180	180	270	120	120	160	160	100	100	95	97	140	240	-	580 (Ad)	-
Thermal Conductivity		Laser Flash	25℃	W/m・K	0.40	0.62	0.62	0.38	0.52	0.52	0.4	0.4	0.55	0.55	0.7	0.7	0.7	1.10	0.40	-	0.16
Volume Resistivity		IPC-TM-650 2.5.17.1	C-96/35/90	MΩ・cm	1×10^9	1×10^9	1×10^9	1×10^9	-	-	1×10^9	1×10^9	1×10^8	1×10^8	1×10^9	1×10^9	1×10^9	-	-	1×10^8 *7	-
Surface Resistivity		IPC-TM-650 2.5.17.1	C-96/35/90	MΩ	1×10^8	1×10^8	1×10^8	1×10^8	-	-	1×10^8	1×10^8	1×10^8	1×10^8	1×10^8	1×10^8	1×10^8	-	-	3×10^8 *8	-
Dielectric Constant (Dk)	@ 1GHz	IPC-TM-650 2.5.5.9	C-24/23/50	-	3.4 (RC:70%)	4.6	4.6	4.3	3.6	4.1	4.3	4.5	4.4	4.6	4.7	4.8	4.8	4.8	-	3.0(Ad)/3.3(PI)	3.2
	@ 10GHz	IPC-TM-650 2.5.5.5			3.2 (RC:70%)	4.6	4.6	4.2	-	-	4.0	4.3	-	-	-	-	-	-	3.3*5	-	3.2*5
	@ 12GHz	Balanced-type circular disk resonator			-	-	-	-	3.5	4.0	4.0	4.3	-	-	-	-	-	-	2.9 (14GHz)	-	3.1 (14GHz)
Dissipation Factor (Df)	@ 1GHz	IPC-TM-650 2.5.5.9	C-24/23/50	-	0.008 (RC:70%)	0.010	0.010	0.016	0.002	0.002	0.015	0.015	0.015	0.015	0.011	0.015	0.015	0.008	-	0.019(Ad)/0.010(PI)	0.002
	@ 10GHz	IPC-TM-650 2.5.5.5			0.011 (RC:70%)	0.016	0.016	0.019	-	-	0.016	0.016	-	-	-	-	-	-	0.002*5	-	0.006*5
	@ 12GHz	Balanced-type circular disk resonator			-	-	-	-	0.003	0.004	0.016	0.016	-	-	-	-	-	-	0.002 (14GHz)	-	0.006 (14GHz)
Water Absorption		IPC-TM-650 2.6.2.1	D-24/23	%	0.07	0.14	0.14	0.14	0.06	0.06	-	-	0.15-0.20	0.15-0.20	0.3	0.12	0.12	-	0.04*6	1.2*9	0.9*6
Flexural Modulus	Warp/MD	JIS C 6481	A	GPa	26	24	24	23	-	-	20	17	33	29	35	35	29	18	-	-	-
	Fill/TD				24	22	22	21	-	-	19	16	32	28	33	33	27	17	-	-	-
Peel Strength	1oz	IPC-TM-650 2.4.8	A	kN/m (lb/inch)	-	1.8(10.3)	1.8(10.3)	2.0(11.4)	0.5-0.6(2.9-3.4) (12μm)	0.5-0.6(2.9-3.4) (12μm)	0.5-0.6(2.9-3.4) (12μm)	0.5-0.6(2.9-3.4) (12μm)	0.6(3.4) (12μm)	0.6(3.4) (12μm)	0.9(5.1) (12μm)	1.2(6.9)	1.3(7.4)	-	0.8(4.6) (ED:18μm)	0.8(4.6) (ED:12μm)	1.3(7.4) (ED:18μm)
Flammability		UL	C-48/23/50	-	94V-0	94V-0	94V-0	94V-0	94V-0	94V-0	-	-	-	-	94V-0	94V-0	94V-0	94V-0	94VTM-0	94VTM-0*10	94V-0
The Sample thickness					0.8mm	0.8mm	0.8mm	0.8mm	The sample thickness is depending on the test method.									1.6mm	0.05mm	0.032mm (Cu:12μm,Pi:5μm,Ad:15μm)	0.025mm

*2 Test method: TMA
*3 Glass transition temp.(TMA)
Measurement in tensile mode. Others: Measurement in compression mode.
*4 Glass transition temp.(DMA)
Measurement in tensile mode. Others: Measurement in bending mode.

*5 Test method: Cavity resonance
*6 Test method: Internal method
*7 Condition: C-96/20/65, Unit:MΩ・m
*8 Condition: C-96/20/66
*9 Condition: E-24/50+D-24/23
*10 Measured by R-FR10/R-F775 25μm/ R-FR10 construction

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