ISH® INLINE CONNECTOR

Test Report

0	RS0942	June 14, 2023	Y. Nishimura	J. Mukunoki	J. Tateishi
Rev.	ECN	Date	Prepared by	Checked by	Approved by

1. Purpose

To evaluate performance of ISH Connector.

2. Specimen

Items shown in Table 1 were evaluated.

Table 1. Test samples

Pole	TYPE		PARTS No.				Test result
	LOCK	KEY-CODING	MALE HOUSING	MALE TERMINAL	FEMALE HOUSING	FEMALE TERMINAL	
3P	Normal	-	**V0112-91003-01**	**VT010-01**	**V0113-91003-01**	**VT009-01**	Initial：Sheet 3 Durability test：Sheet 4~6

3. Test condition

In compliance with Product Specification【PSS-0033】

4. Result

All test items were satisfied.

- For detail of the test results see of Table1.
- For resistance monitoring during durability test, see Graphs 1 and 2.

Table 2. List of results: Initial properties (3P)

	Item Number	Measurement item		Requirements	Set	n	Unit	Data					Judgement
								Avg.	Max.	Min.	s	Avg.±3s	
Initial Characteristics	1	Terminal appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
	2	Terminal outer dimension		Satisfy drawing dimension	5	5	-	Satisfies drawing dimension					✓
	3	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
	4	Housing outer dimension		Satisfy drawing dimension	5	5	-	Satisfies drawing dimension					✓
	5	Feeling (insertion/removal)		No discomfort	5	5	-	No discomfort					✓
	6	Connector mating force		17.0N MAX.	5	5	N	9.49	10.0	8.8	0.40	10.69	✓
	7	Connector unmating force		12.0N MAX.	5	5	N	6.02	7.0	5.5	0.64	7.94	✓
	8	Connector retention force	Direction 1	90N MIN.	5	5	N	106.18	107.8	103.9	1.55	101.53	✓
			Direction 2		5	5	N	156.46	157.4	155.6	0.77	154.15	✓
			Direction 3		5	5	N	155.26	178.1	136.1	17.26	103.48	✓
			Direction 4		5	5	N	148.46	173.0	114.4	22.5	80.96	✓
	9	Unlocking force		50N MAX.	5	5	N	18.52	22.7	17.1	2.35	25.57	✓
	10	Insulation resistance		100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
	11	Withstanding voltage		No insulation breakdown or errosion	5	5	-	No insulation breakdown					✓
	12	Temperature rise	Single pin	⊿T=50℃ MIN.	5	5	℃	25.02	27.2	21.5	2.19	31.59	✓
			All pin	⊿T=50℃ MIN.	5	5	℃	27.90	31.9	24.6	2.89	36.57	✓
	13	Leak current		1mA MAX.	5	5	-	1μA MAX.					✓
	14	Audible click		60dB MIN.	5	5	db	66.42	67.5	63.9	1.44	62.10	✓
	15	Terminal crimp strength	MALE	70N MIN.	5	5	N	80.58	82.8	77.8	1.92	74.82	✓
			FEMALE		5	5	N	79.24	80.8	77.9	1.27	75.43	✓
	16	Terminal insertion force		0.5N～3.0N	5	5	N	1.628	1.87	1.40	0.174	2.150	✓
												1.106	✓
	17	Terminal removal force		0.5N～3.0N	5	5	N	1.455	1.71	1.17	0.161	1.938	✓
												0.972	✓
	18	Terminal contact force		3N MIN.	5	5	N	3.58	3.73	3.33	0.15	3.13	✓
	19	Voltage drop		10mV/A MAX.	5	15	mV/A	1.355	2.09	1.09	0.271	2.168	✓
	20	Dry circuit resistance		10mΩ MAX.	5	15	mΩ	1.951	2.88	1.20	0.551	3.604	✓
	21	MALE Terminal retention force	With secondary lock	49N MIN.	2	6	N	65.57	69.8	60.1	3.31	55.64	✓
			Without secondary loc	20N MIN.	2	6	N	47.68	52.8	44.0	3.95	35.83	✓
	22	FEMALE Terminal retention force	With secondary lock	49N MIN.	2	6	N	83.88	85.4	80.7	1.71	78.75	✓
			Without secondary loc	20N MIN.	2	6	N	43.12	45.2	40.8	1.41	38.89	✓
	23	Terminal to housing insertion force	MALE	10N MAX.	2	6	N	2.40	2.8	2.0	0.30	3.30	✓
			FEMALE	10N MAX.	2	6	N	1.91	2.2	1.6	0.17	2.42	✓
	24	Retainer insertion/removal force	MALE Insertion force	29.4N MAX.	5	5	N	17.34	18.1	16.4	0.63	19.23	✓
			MALE Removal force	5.5N MIN.	5	5	N	22.64	26.8	17.5	4.08	10.40	✓
			EMALE Insertion forc	29.4N MAX.	5	5	N	17.34	18.1	16.4	0.63	19.23	✓
			EMALE Removal forc	14.7N MIN.	5	5	N	22.64	26.8	17.5	4.08	10.40	✓
	25	Housing lock strength without terminals		49N MIN.	5	5	N	98.86	102.6	94.5	3.72	87.70	✓
	26	Sn whisker		125μm MAX.	5	5	-	No whisker					✓
	27	Connector clip insertion force		50N MAX.	5	5	N	41.48	42.8	39.5	1.2	45.08	✓
	28	Connector clip retention force	F1	90N MAX.	5	5	N	168.71	171.2	166.6	1.69	163.64	✓
			F2		5	5	N	189.18	191.6	188	1.42	184.92	✓
			F3		5	5	N	96.98	100.7	95.1	2.24	90.26	✓
			F1'		5	5	N	96.26	97.2	95.7	0.58	94.52	✓
			F2'		5	5	N	110.86	119.1	100.8	6.89	90.19	✓
			F3'		5	5	N	109.14	111.9	106.2	2.2	102.54	✓

Table 3. List of results: Properties after endurance tests – Ⅰ (3P)

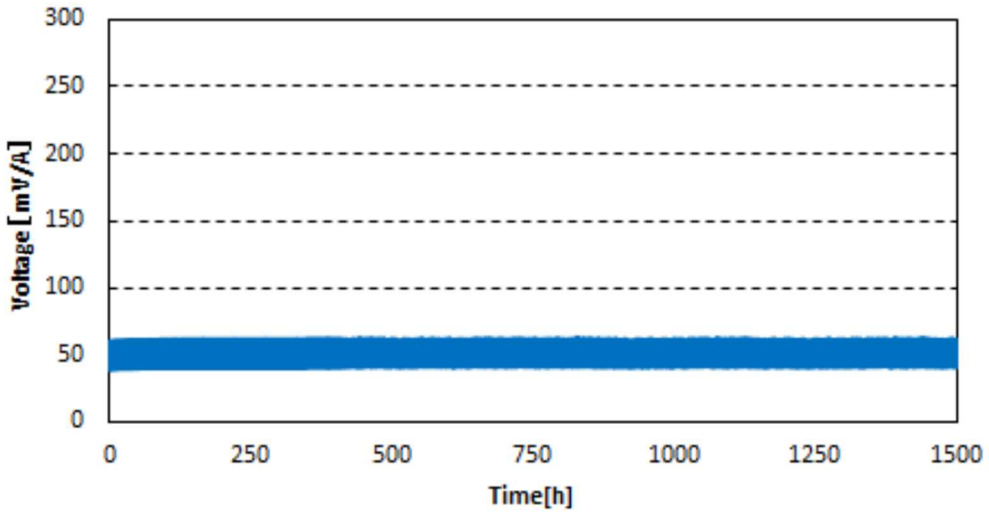
Item Number	Measurement item			Requirements	Set	n	Unit	Data					Judgement
								Avg.	Max.	Min.	s	Avg.±3s	
1	Repeated insertion/removal	Connector mating force	After 5 repeat	17.0N MAX.	5	5	N	8.03	8.8	7.4	0.58	9.77	✓
			After test	17.0N MAX.	5	5	N	6.17	7.0	5.3	0.61	8.00	✓
		Connector unmating force	After 5 repeat	12.0N MAX.	5	5	N	5.07	5.2	4.8	0.17	5.58	✓
			After test	12.0N MAX.	5	5	N	4.85	4.9	4.7	0.08	5.10	✓
		Voltage drop	Initial	10mV/A MAX.	5	15	mV/A	1.941	2.32	1.10	0.355	3.006	✓
			After test	20mV/A MAX.	5	15	mV/A	2.323	2.72	1.45	0.352	3.379	✓
2	Resistance to forced-mating	Connector mating force		17.0N MAX.	5	5	N	6.79	7.1	6.5	0.26	7.58	✓
		Connector unmating force		12.0N MAX.	5	5	N	5.89	6.2	5.6	0.27	6.70	✓
		Voltage drop	Initial	10mV/A MAX.	5	15	mV/A	2.039	2.31	1.55	0.415	3.284	✓
			After test	20mV/A MAX.	5	15	mV/A	2.095	2.51	1.53	0.290	2.965	✓
3	High temperrature aging	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
		Feeling (insertion/removal)		No discomfort	5	5	-	No discomfort					✓
		Connector retention force	Direction 1	90N MIN.	5	5	N	102.74	104.6	101.2	1.27	98.93	✓
		Terminal crimp strength	MALE	70N MIN.	5	5	N	80.30	81.8	77.4	1.23	76.61	✓
			FEMALE	70N MIN.	5	5	N	78.90	80.3	76.2	1.40	74.70	✓
		Dry circuit resistance	Initial	10mΩ MAX.	5	15	mΩ	2.940	3.42	2.14	0.382	1.794	✓
			After test	20mΩ MAX.	5	15	mΩ	3.187	4.32	2.20	0.487	1.726	✓
		MALE Terminal retention force	With secondary lock	49N MIN.	2	6	N	61.87	64.4	59.2	2.15	55.42	✓
			Without secondary lock	20N MIN.	2	6	N	44.82	46.5	43.3	1.21	41.19	✓
		FEMALE Terminal retention force	With secondary lock	49N MIN.	2	6	N	82.73	84.4	80.9	1.14	79.31	✓
			Without secondary lock	20N MIN.	2	6	N	47.68	50.3	44.7	1.84	42.16	✓
		Housing lock strength without terminals		49N MIN.	5	5	N	100.90	110.2	96.9	5.37	84.79	✓
		Connector clip retention force	F1	90N MAX.	5	5	N	187.93	193.6	179.5	5.47	171.52	✓
			F2		5	5	N	147.68	149.7	144.2	2.32	140.72	✓
			F3		5	5	N	108.48	112.5	98.3	5.77	91.17	✓
			F1'		5	5	N	103.09	108.7	102.3	0.50	101.59	✓
			F2'		5	5	N	145.51	148.3	142.6	2.10	139.21	✓
			F3'		5	5	N	102.42	104.9	98.4	2.94	93.60	✓
4	Low temprature aging	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
		Feeling (insertion/removal)		No discomfort	5	5	-	No discomfort					✓
		Dry circuit resistance	Initial	10mΩ MAX.	5	15	mΩ	2.660	2.85	2.37	0.146	2.222	✓
			After test	20mΩ MAX.	5	15	mΩ	2.960	4.01	2.53	0.380	1.820	✓
		MALE Terminal retention force	With secondary lock	49N MIN.	2	6	N	72.60	74.3	70.7	1.48	68.16	✓
			Without secondary lock	20N MIN.	2	6	N	45.41	46.0	44.8	0.40	44.21	✓
		FEMALE Terminal retention force	With secondary lock	49N MIN.	2	6	N	82.98	84.2	79.4	1.83	77.49	✓
			Without secondary lock	20N MIN.	2	6	N	47.67	50.3	44.7	1.83	42.18	✓
		Housing lock strength without terminals		49N MIN.	5	5	N	98.84	99.8	97.8	0.73	96.65	✓
		Connector clip retention force	F1	90N MAX.	5	5	N	179.26	210.9	167.3	18.06	125.08	✓
			F2		5	5	N	158.06	177.8	140.3	14.87	113.45	✓
			F3		5	5	N	104.76	105.9	103.4	0.92	102.00	✓
			F1'		5	5	N	98.35	101.0	95.7	1.97	92.44	✓
			F2'		5	5	N	130.72	135.0	128.1	2.60	122.92	✓
			F3'		5	5	N	105.16	106.4	104.1	0.88	102.52	✓
5	Thermal shock	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
		Feeling (insertion/removal)		No discomfort	5	5	-	No discomfort					✓
		Connector retention force	Direction 1	90N MIN.	5	5	N	97.84	98.9	96.8	0.87	95.23	✓
		Terminal crimp strength	MALE	70N MIN.	5	5	N	76.70	80.4	73.4	2.10	70.40	✓
			FEMALE	70N MIN.	5	5	N	75.32	79.6	71.6	2.33	68.33	✓
		Dry circuit resistance	Initial	10mΩ MAX.	5	5	mΩ	2.750	2.90	2.54	0.112	2.414	✓
			After test	20mΩ MAX.	5	15	mΩ	3.204	4.37	2.45	0.646	1.266	✓
		MALE Terminal retention force	With secondary lock	49N MIN.	5	15	N	70.12	78.0	62.7	6.58	50.38	✓
			Without secondary lock	20N MIN.	2	6	N	48.78	50.3	48.2	0.74	46.56	✓
		FEMALE Terminal retention force	With secondary lock	49N MIN.	2	6	N	83.24	84.5	82.7	0.71	81.11	✓
			Without secondary lock	20N MIN.	2	6	N	46.58	51.8	41.1	3.50	36.08	✓
		Connector clip retention force	F1	90N MAX.	2	6	N	199.41	206.5	179.6	11.28	165.57	✓
			F2		5	5	N	164.28	178.3	154.0	9.61	135.45	✓
			F3		5	5	N	110.93	117.3	99.3	6.82	90.47	✓
			F1'		5	5	N	104.31	105.0	103.6	0.60	102.51	✓
			F2'		5	5	N	142.09	144.3	137.8	2.55	134.44	✓
			F3'		5	5	N	109.05	113.3	103.5	3.83	97.56	✓

Table 4. List of results: Properties after endurance tests – Ⅱ (3P)

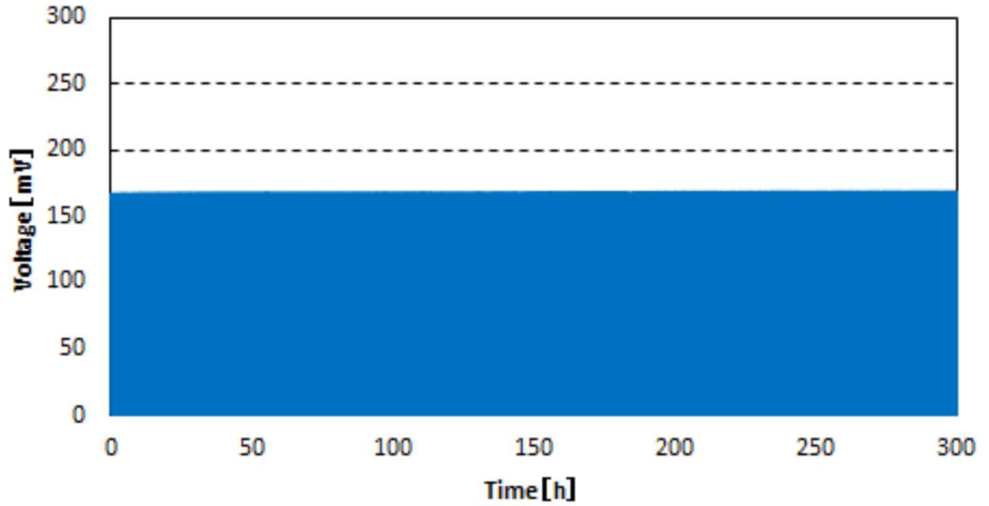
Item Number	Measurement item		Requirements	Set	n	Unit	Data					Judgement
							Avg.	Max.	Min.	s	Avg.±3s	
6	Temperature /humidity cycle	Housing appearance	No detrimental deformation	5	5	-	No detrimental deformation					✓
		Feeling (insertion/removal)	No discomfort	5	5	-	No discomfort					✓
		Insulation resistance	100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
		Withstanding voltage	No insulation	5	5	-	No insulation breakdown					✓
		Leak current	1mA MAX.	5	5	-	1μA MAX.					✓
		Dry circuit resistance Initial	10mΩ MAX.	5	15	mΩ	1.897	2.35	1.37	0.307	0.976	✓
		Dry circuit resistance After test	20mΩ MAX.	5	15	mΩ	2.247	2.85	1.56	0.349	1.200	✓
		MALE Terminal retention force With secondary lock	49N MIN.	2	6	N	65.75	72.4	61.6	3.94	53.93	✓
		MALE Terminal retention force Without secondary lock	20N MIN.	2	6	N	44.88	46.5	43.2	1.35	40.83	✓
		FEMALE Terminal retention force With secondary lock	49N MIN.	2	6	N	85.33	85.6	84.5	0.42	84.07	✓
		FEMALE Terminal retention force Without secondary lock	20N MIN.	2	6	N	46.58	49.7	43.8	2.50	39.08	✓
		Connector clip retention force F1	90N MAX.	5	5	N	190.17	199.7	177.0	10.75	157.92	✓
		Connector clip retention force F2		5	5	N	146.20	158.2	123.6	14.95	101.35	✓
		Connector clip retention force F3		5	5	N	99.97	104.4	95.4	3.19	90.40	✓
		Connector clip retention force F1'		5	5	N	101.78	102.0	101.4	0.22	101.12	✓
		Connector clip retention force F2'		5	5	N	143.07	145.0	141.6	1.26	139.29	✓
		Connector clip retention force F3'		5	5	N	108.09	111.1	102.8	3.29	98.22	✓
7	Resistance to humidity	Housing appearance	No detrimental deformation	5	5	-	No detrimental deformation					✓
		Connector retention force Direction 1	100N MIN.	5	5	N	113.90	116.0	113.0	1.24	110.19	✓
		Insulation resistance	100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
		Withstanding voltage	No insulation breakdown or errosion	5	5	-	No insulation breakdown					✓
		Leak current	1mA MAX.	5	5	-	1μA MAX.					✓
		Dry circuit resistance Initial	10mΩ MAX.	5	15	mΩ	2.332	2.72	2.00	0.249	3.08	✓
		Dry circuit resistance After test	20mΩ MAX.	5	15	mΩ	2.335	2.96	1.61	0.395	3.52	✓
		MALE Terminal retention force With secondary lock	49N MIN.	2	6	N	65.21	71.80	58.30	4.800	79.61	✓
		MALE Terminal retention force Without secondary lock	20N MIN.	2	6	N	46.39	48.8	43.3	1.53	50.98	✓
		FEMALE Terminal retention force With secondary lock	49N MIN.	2	6	N	84.36	84.9	83.2	0.56	86.04	✓
		FEMALE Terminal retention force Without secondary lock	20N MIN.	2	6	N	47.05	50.3	44.5	1.96	52.93	✓
		Connector clip retention force F1	90N MAX.	5	5	N	200.27	203.0	194.1	3.68	211.31	✓
		Connector clip retention force F2		5	5	N	156.12	160.8	145.8	6.00	174.12	✓
		Connector clip retention force F3		5	5	N	100.91	105.3	97.0	3.34	110.93	✓
		Connector clip retention force F1'		5	5	N	101.21	101.7	100.6	0.46	102.59	✓
		Connector clip retention force F2'		5	5	N	143.83	145.4	140.5	1.97	149.74	✓
		Connector clip retention force F3'		5	5	N	105.29	110.3	99.7	5.04	120.41	✓
8	Resistance to abrasion	Housing appearance	No detrimental deformation	5	5	-	No detrimental deformation					✓
		Feeling (insertion/removal)	No discomfort	5	5	-	No discomfort					✓
		Voltage drop Initial	10mV/A MAX.	5	15	mV/A	2.562	2.98	1.84	0.260	3.342	✓
		Voltage drop After test	20mV/A MAX.	5	15	mV/A	2.850	3.25	2.58	0.189	3.418	✓
9	Corrosion gas	Terminal appearance	No detrimental deformation	5	5	-	No detrimental deformation					✓
		Housing appearance	No detrimental deformation	5	5	-	No discomfort					✓
		Terminal crimp strength MALE	70N MIN.	5	5	N	82.99	83.5	82.4	0.39	81.82	✓
		Terminal crimp strength FEMALE	70N MIN.	5	5	N	80.57	82.1	78.3	1.98	74.63	✓
		Voltage drop Initial	10mV/A MAX.	5	5	mV/A	2.038	2.19	1.91	0.075	1.814	✓
		Voltage drop After test	20mV/A MAX.	5	15	mV/A	2.849	3.41	2.22	0.376	1.720	✓
10	Condensation	Terminal appearance	No detrimental deformation	5	15	-	No detrimental deformation					✓
		Housing appearance	No detrimental deformation	5	5	-	No detrimental deformation					✓
		Insulation resistance	100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
		Withstanding voltage	No insulation breakdown or errosion	5	5	-	No insulation breakdown					✓
		Leak current	1mA MAX.	5	5	-	1μA MAX.					✓
		Dry circuit resistance Initial	10mΩ MAX.	5	5	mΩ	2.582	3.24	1.95	0.470	1.171	✓
		Dry circuit resistance After test	20mΩ MAX.	5	15	mΩ	2.733	4.41	1.42	0.891	0.058	✓

Table 5. List of results: Properties after endurance tests –Ⅲ (3P)

Item Number	Measurement item			Requirements	Set	n	Unit	Data					Judgement
								Avg.	Max.	Min.	s	Avg.±3s	
11	Dump heat cycle	Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
		Leak current		1mA MAX.	5	5	-	1μA MAX.					✓
		Insulation resistance	250h	100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
			500h	100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
			750h	100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
			1000h	100MΩ MIN.	5	5	-	1,000MΩ MIN.					✓
		Migration		No migration	5	5	-	No migration					✓
12	Current cycle	Temperature rise		△T=50℃ MAX.	5	5	℃	34.12	37.5	32.5	2.09	27.84	✓
		Voltage drop	Initial	10mV/A MAX.	5	5	mV/A	2.341	2.58	2.17	0.109	2.014	✓
			After test	20mV/A MAX.	5	15	mV/A	2.357	3.46	1.84	0.423	1.089	✓
13	Shock	Voltage drop	Initial	10mV/A MAX.	5	15	mV/A	1.595	1.91	1.27	0.210	0.964	✓
			After test	20mV/A MAX.	5	15	mV/A	1.676	2.00	1.43	0.163	1.186	✓
		Microcut		1μsMIN.7ΩMAX.	5	5	-	No microcut					✓
14	Vibration	Temperature rise		△T=50℃ MAX.	5	5	℃	33.92	37.7	31.1	2.83	25.44	✓
		Voltage drop	Initial	10mV/A MAX.	5	5	mV/A	2.518	2.88	2.23	0.176	1.990	✓
			After test	20mV/A MAX.	5	15	mV/A	2.831	3.68	2.39	0.367	1.730	✓
		Dry circuit resistance	Initial	10mΩ MAX.	5	15	mΩ	2.571	2.74	1.80	0.232	1.875	✓
			After test	20mΩ MAX.	5	15	mΩ	2.581	3.30	1.90	0.446	1.241	✓
		Microcut		No exceed 1μs and 7Ω	5	5	-	No microcut					✓
15	Vibration with temperature change	Terminal appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
		Housing appearance		No detrimental deformation	5	5	-	No detrimental deformation					✓
		Terminal contact force		3N MIN.	5	5	N	3.380	3.44	3.32	0.044	3.248	✓
		Voltage drop	Initial	10mV/A MAX.	5	5	mV/A	2.469	2.68	2.20	0.101	2.166	✓
			After test	20mV/A MAX.	5	15	mV/A	5.110	8.20	3.46	1.034	2.007	✓
		Dry circuit resistance	Initial	10mΩ MAX.	5	15	mΩ	2.667	2.83	2.43	0.085	2.412	✓
			After test	20mΩ MAX.	5	15	mΩ	4.672	6.56	3.26	0.836	2.164	✓
		Microcut		No exceed 1μs and 7Ω	5	5	-	No microcut					✓



Graph 1 . Thermal shock Resistance Monitor



Graph 2. Vibration with temperature change Resistance Monitor