(2025.06.28. revised)

Comparison Evaluation of SMD type NTC Thermistor

NTCサーミスタ比較試験結果報告Vol.1

KETI

J Chip Consulting

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Introduction

- **Specimen**: SMD NTC Thermistor

- **Test**:
  - Environmental test
  - Solderability test
  - Electrical characteristic evaluation
  - X-ray analyses
  - Optical microscope analysis
  - (Cross section) SEM analysis

- **Test term:** 2025. 04. 04. ~ 2025. 06. 10.

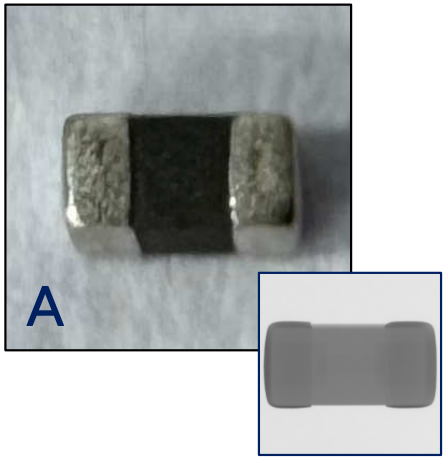
- **Test environment**: (25 ± 5) ℃, Below 75% room humidity

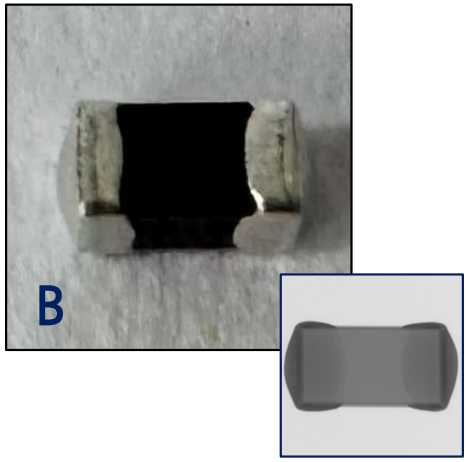
- **Test apparatuses**:
  - Climate chamber (SXN403, ETAC, Japan)
  - Thermal shock chamber (DS-890-2, Daewon sci, Korea)
  - Solderability (Pulsar, Hantec RPS, USA)
  - DATA ACQUISITION SYSTEM (2680A, FLUKE, USA)
  - POWER SUPPLY (PSB-2400L2, GWINSTEK, Korea)
  - X-ray (XT V 160, Nikon, Japan)
  - 3D Digital Optical Microscope (KH-8700, Hirox, Japan)
  - Nanolab Focused Ion Beam (Helios 5 UX, ThermoFisher, USA)

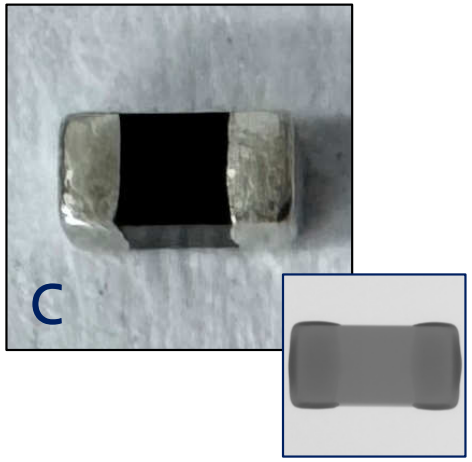
- **Etc**: Blind test

- **Contact**: Lee, Ju Ho ☎ +82-31-789-7282 / leejuho@keti.re.kr

Specimens







Sample	Resistance (Ω @25℃)	Resistance Tolerance	B Constant (B25/85)	Operation Temp. (°C)
A	10k	±1%	3434k	-55 ~ +150
B	10k	±1%	3434k	-55 ~ +150
C	10k	±3%	3435k	-40 ~ +125

· A社 : Murata (日本) (NCU18XH103F6SRB)
· B社 : Vishay (USA) (NTCS0603E3103FLT)
· C社 : JOINSET (韓国) (ECTH160808 103H3435HST)

Introduction

- **Test apparatuses**:
  - Climate chamber (SXN403, ETAC, Japan)

Introduction

- **Test apparatuses**:
  - Thermal shock chamber (DS-890-2, Daewon sci, Korea)

Introduction

- **Test apparatuses**:
  - Solderability (Pulsar, Hantec RPS, USA)

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- **Test apparatuses**:
  - DATA ACQUISITION SYSTEM (2680A, FLUKE, USA)

Introduction

- **Test apparatuses**:
  - POWER SUPPLY (PSB-2400L2, GWINSTEK, Korea)

Introduction

- **Test apparatuses**:
  - X-ray (XT V 160, Nikon, Japan)

Introduction

- **Test apparatuses**:
  -Nanolab Focused Ion Beam (Helios 5 UX, ThermoFisher, USA)

Introduction

- **Test apparatuses**:
  - 3D Digital Optical Microscope (KH-8700, Hirox, Japan)

II. Environmental test

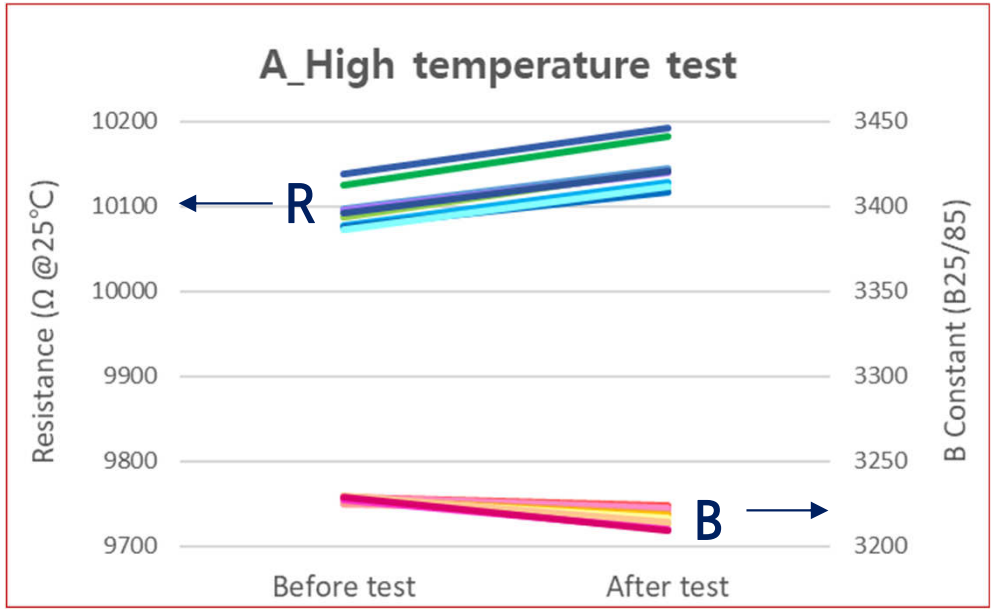
(raw data, graphs)

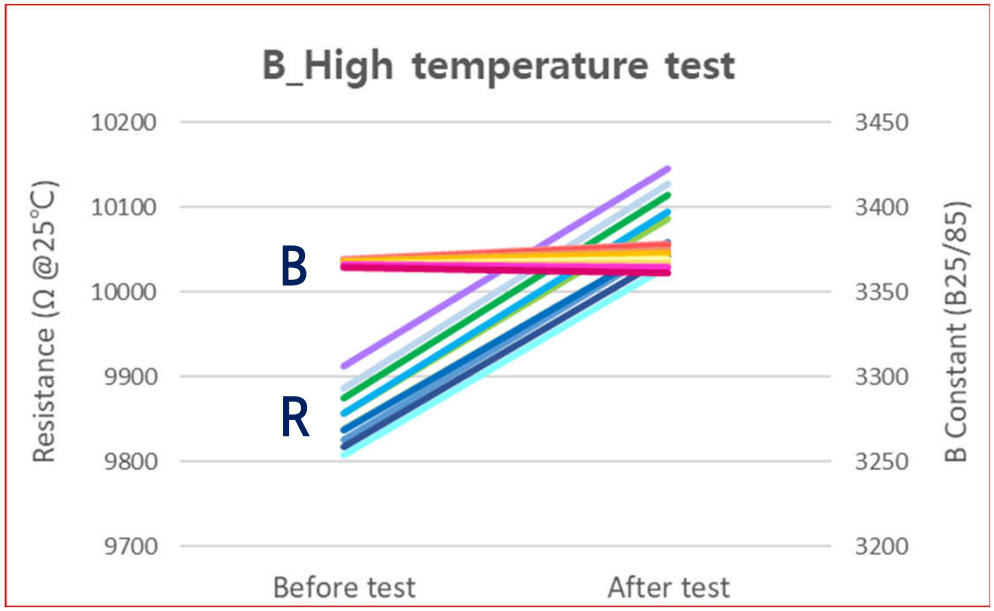
Environmental test conditions

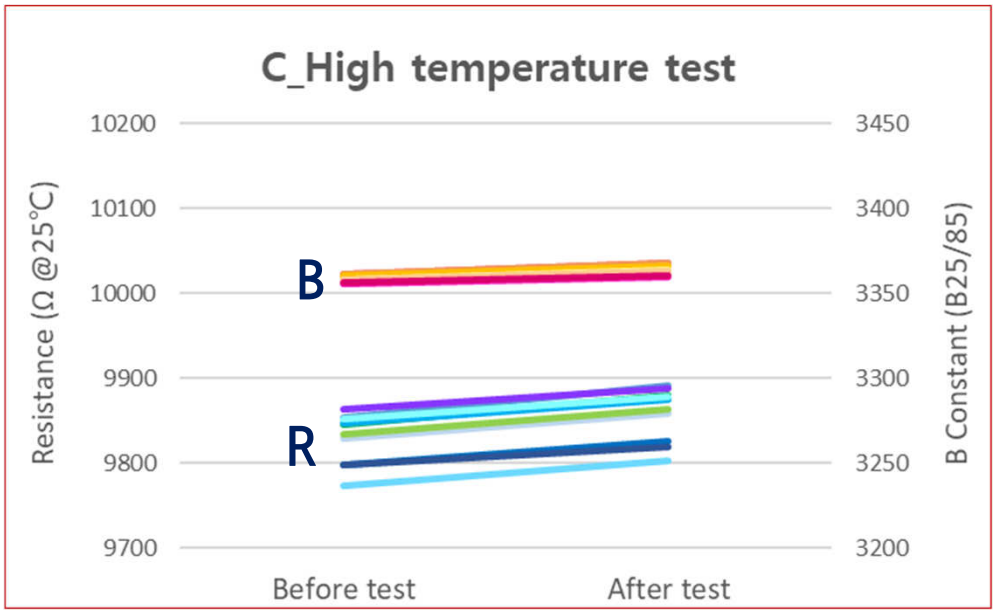
- **Test**:
  - High temperature test: 125 °C, 500 hr
  - Low temperature test: -45 °C, 500 hr
  - High temperature and high humidity test : 85 °C, 85 %R.H., 500 hr
  - Thermal shock test: (-40 ↔ 85) ℃, each 15 min, 200 cycles
  - High temperature and high humidity load test : 85 °C, 85 %R.H., 500 hr,
    * DC 5 V (1.5 hr ON, 0.5 hr OFF)
  - Solderability test : 290 ℃, 3 sec, SAC305

Summary (graph)

High temperature test



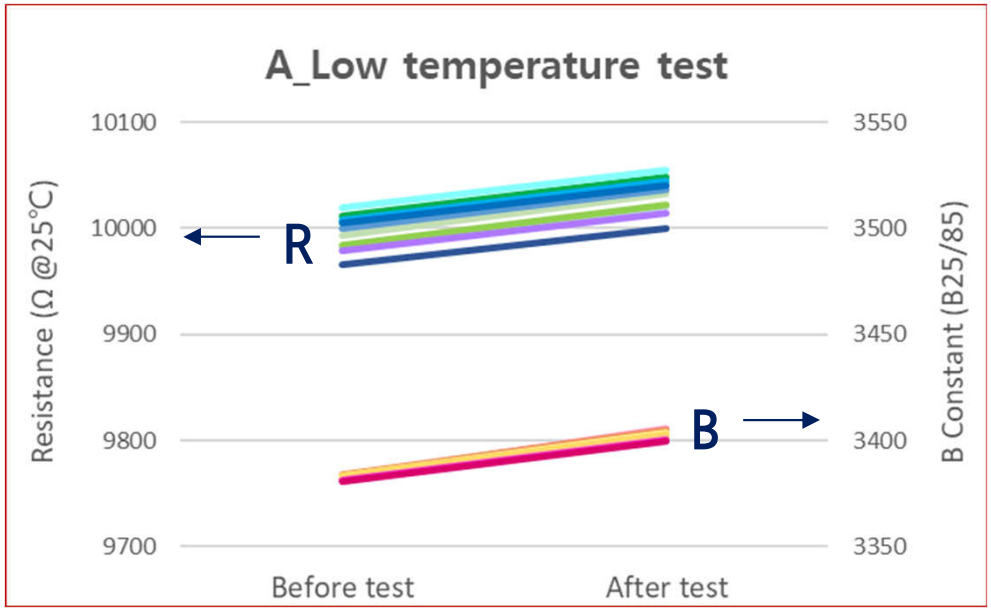


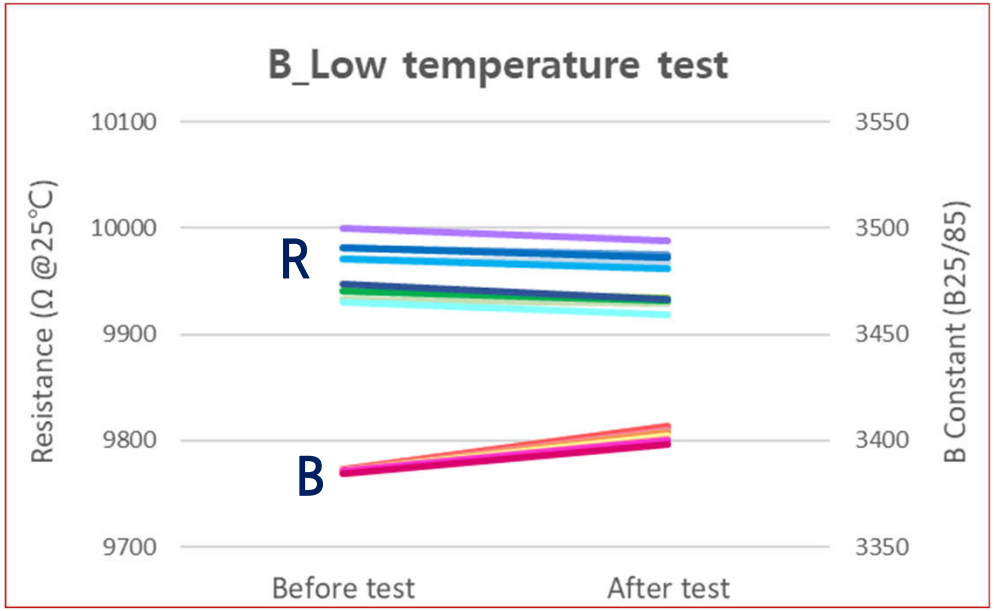


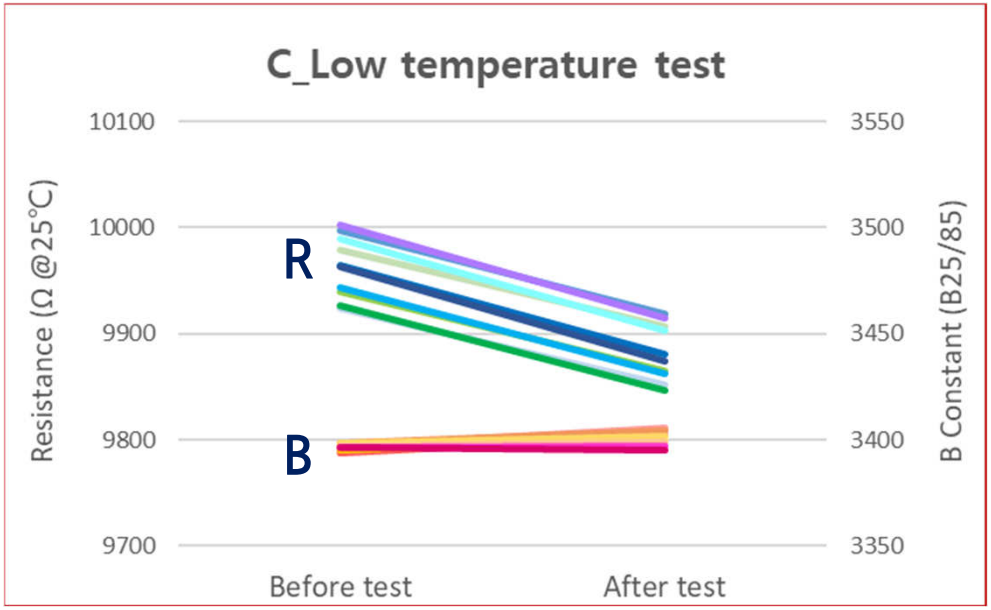
- Average rate of change in resistance :
  KOREA < JAPAN < **USA**
- B Constant Average Rate of Change:
  USA < KOREA < **JAPAN**

Summary (graph)

Low temperature test



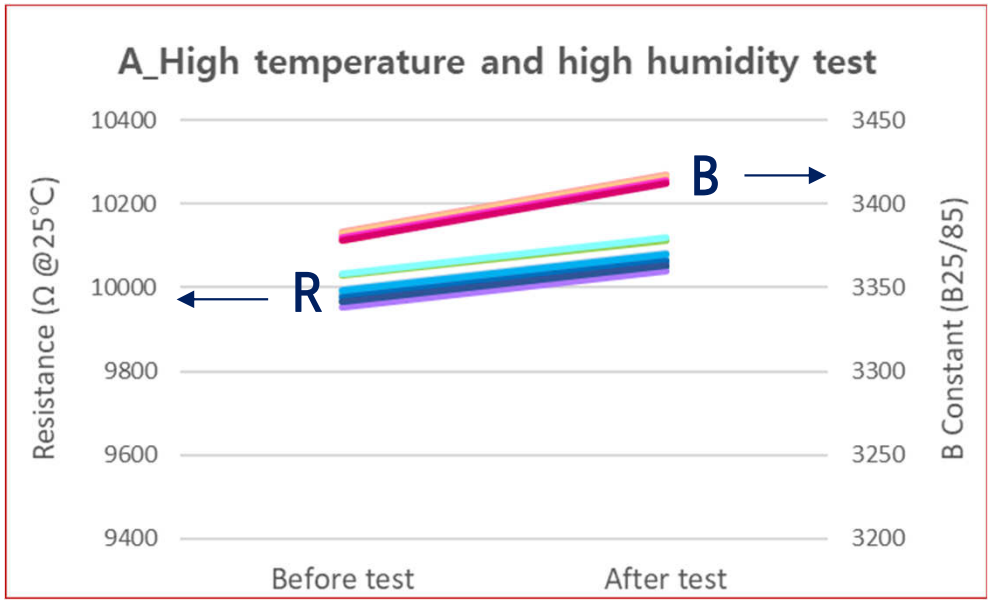


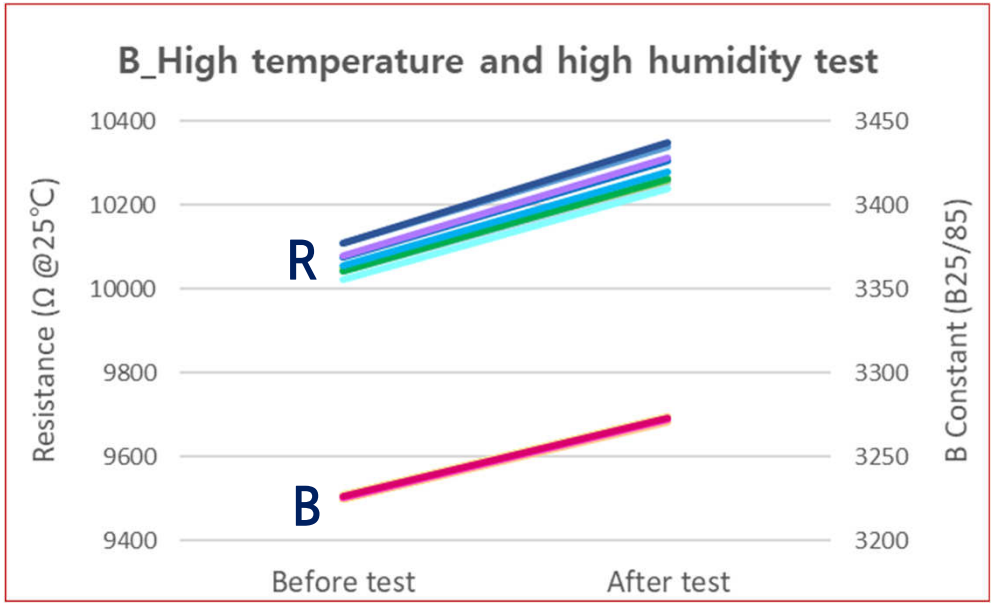


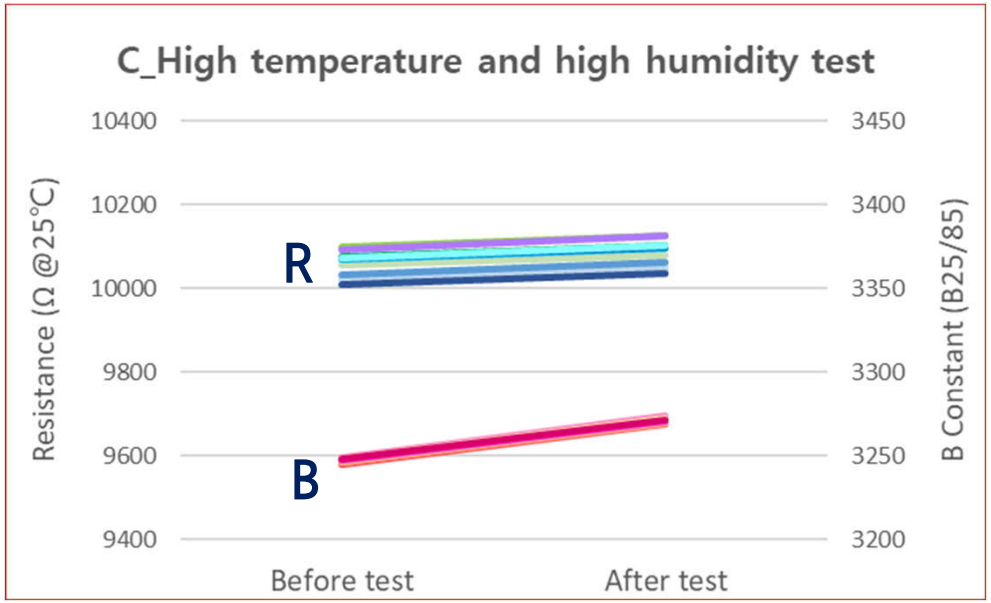
- Average rate of change in resistance :
  USA < JAPAN < **KOREA**
- B Constant Average Rate of Change:
  KOREA < USA < **JAPAN**

Summary (graph)

High temperature and high humidity test



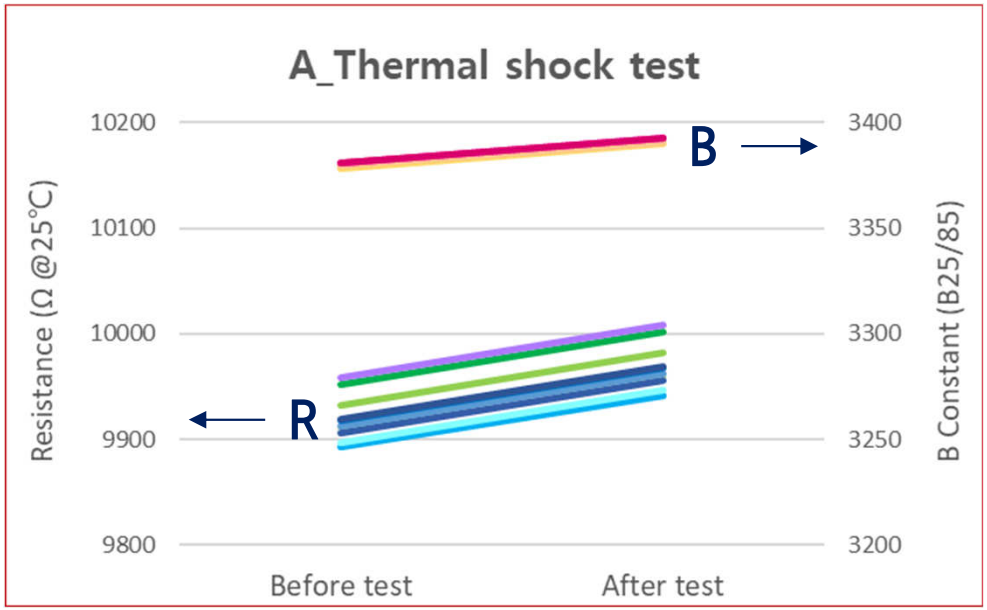


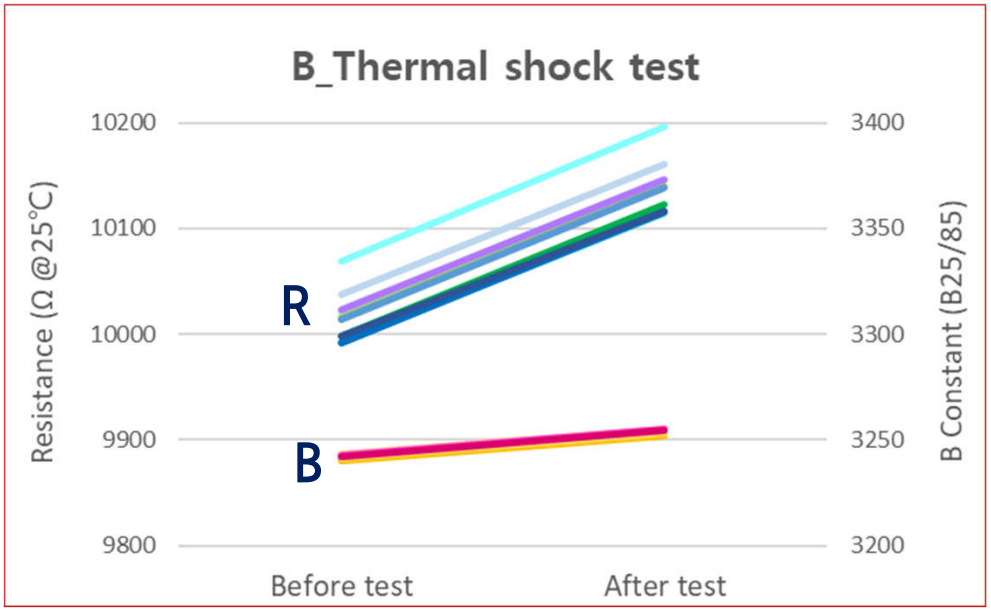


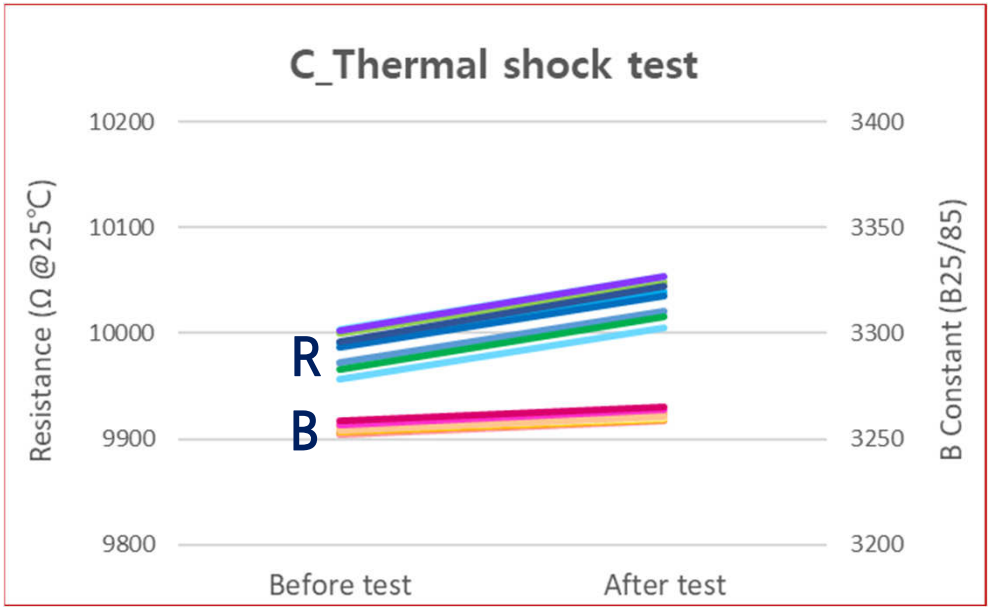
- Average rate of change in resistance :
  KOREA < JAPAN < **USA**
- B Constant Average Rate of Change:
  KOREA < JAPAN < **USA**

Summary (graph)

Thermal shock test



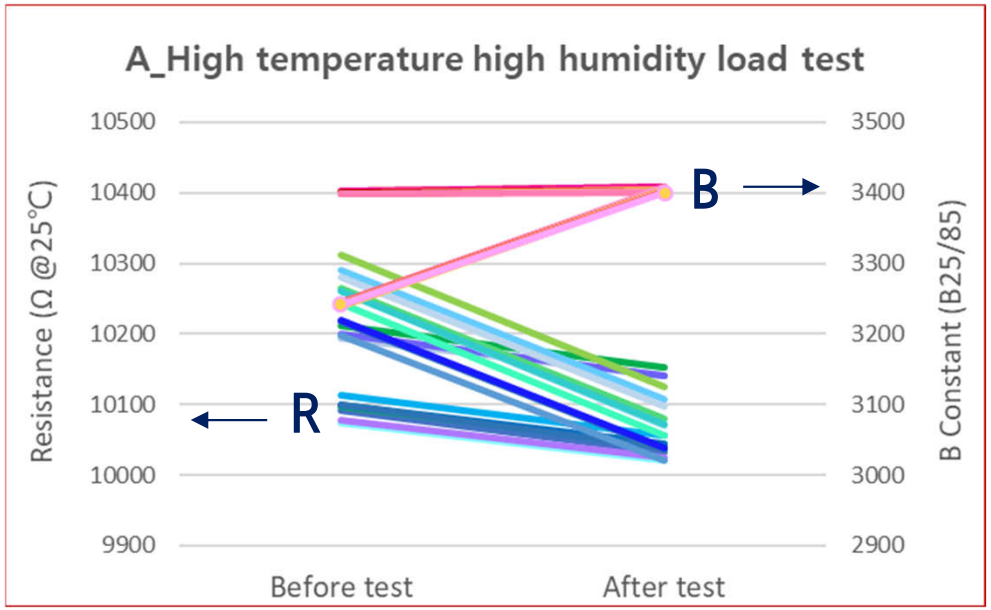


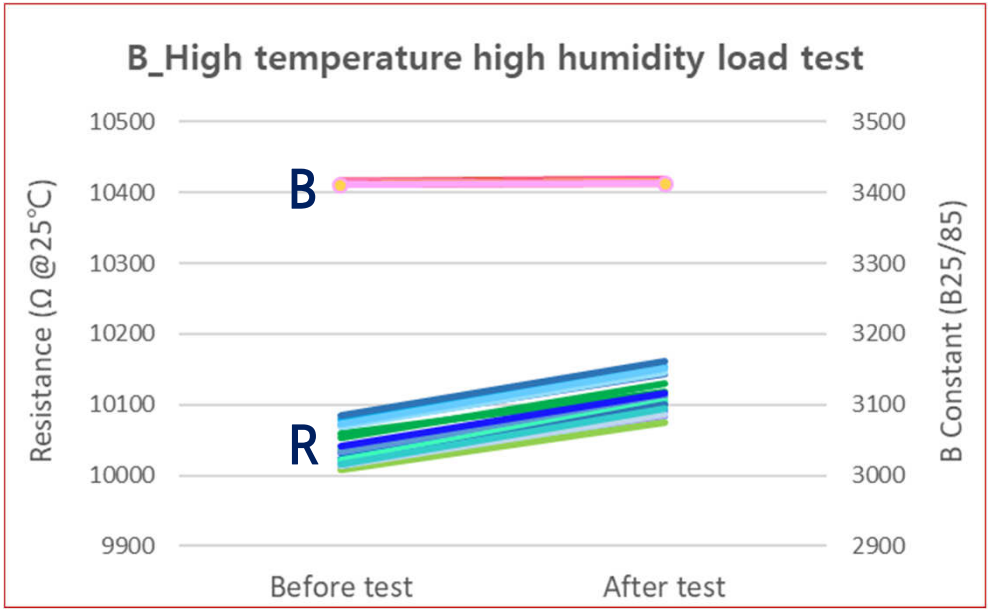


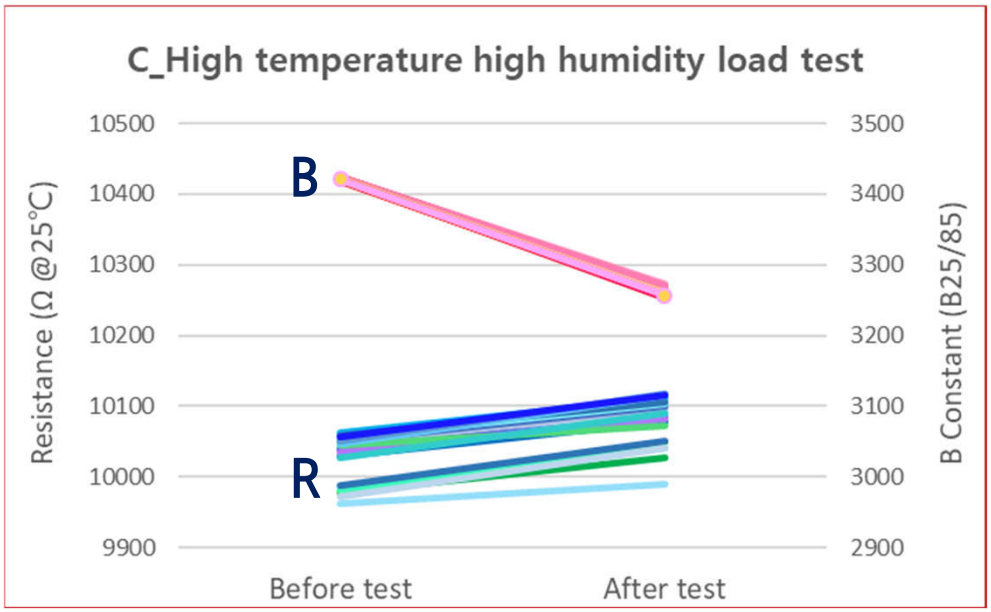
- Average rate of change in resistance :
  KOREA = JAPAN < **USA**
- B Constant Average Rate of Change:
  KOREA < JAPAN < **USA**

Summary (graph)

High temperature and high humidity load test







- Average rate of change in resistance :
  KOREA < USA < **JAPAN**
- B Constant Average Rate of Change:
  USA < JAPAN < **KOREA**

A社

High temperature test

A社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	10074	10121	3225	3221
2	10137	10192	3229	3224
3	10087	10143	3229	3222
4	10097	10145	3228	3219
5	10125	10182	3228	3218
6	10078	10128	3228	3216
7	10076	10117	3228	3214
8	10073	10123	3229	3214
9	10095	10140	3228	3210
10	10091	10141	3229	3209

B社

High temperature test

B社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9838	10058	3369	3378
2	9887	10127	3369	3377
3	9858	10086	3368	3375
4	9826	10056	3368	3374
5	9875	10115	3367	3372
6	9858	10094	3366	3369
7	9837	10058	3366	3367
8	9807	10031	3366	3366
9	9912	10146	3366	3364
10	9818	10041	3365	3361

C社

High temperature test

C社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9773	9803	3359	3366
2	9828	9858	3361	3368
3	9835	9863	3361	3367
4	9854	9891	3361	3368
5	9846	9881	3360	3366
6	9847	9874	3358	3364
7	9798	9826	3357	3363
8	9853	9878	3358	3363
9	9863	9888	3355	3360
10	9798	9820	3357	3360

A社

Low temperature test

A社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9994	10033	3382	3405
2	9982	10020	3382	3405
3	9985	10023	3383	3406
4	9999	10037	3384	3405
5	10012	10049	3382	3402
6	10008	10045	3383	3403
7	10005	10041	3383	3403
8	10019	10055	3381	3401
9	9979	10015	3381	3401
10	9966	10000	3381	3400

B社

Low temperature test

B社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9933	9928	3387	3407
2	9971	9967	3386	3406
3	9941	9934	3386	3405
4	9981	9975	3386	3404
5	9940	9932	3385	3402
6	9971	9962	3386	3402
7	9981	9972	3385	3401
8	9930	9918	3386	3401
9	10000	9988	3386	3400
10	9948	9933	3385	3398

C社

Low temperature test

C社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9979	9907	3397	3405
2	9924	9852	3394	3402
3	9940	9864	3395	3402
4	9997	9919	3398	3404
5	9926	9846	3395	3400
6	9943	9862	3396	3400
7	9965	9881	3398	3401
8	9989	9903	3397	3399
9	10003	9915	3397	3397
10	9963	9873	3396	3395

A社

High temperature and high humidity test

A社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9987	10068	3383	3418
2	9998	10082	3380	3415
3	10029	10114	3382	3417
4	9982	10067	3379	3414
5	9965	10051	3379	3415
6	9993	10078	3379	3414
7	9975	10061	3379	3414
8	10032	10119	3382	3417
9	9954	10039	3380	3414
10	9966	10053	3379	3412

B社

High temperature and high humidity test

B社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	10051	10267	3226	3273
2	10041	10253	3226	3272
3	10049	10260	3226	3272
4	10109	10339	3227	3274
5	10042	10264	3225	3271
6	10057	10280	3227	3274
7	10077	10305	3226	3272
8	10022	10240	3225	3271
9	10081	10311	3226	3272
10	10108	10349	3226	3273

C社

High temperature and high humidity test

C社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	10054	10080	3246	3270
2	10022	10050	3244	3269
3	10097	10125	3249	3274
4	10031	10061	3246	3271
5	10076	10100	3247	3271
6	10070	10097	3248	3272
7	10073	10097	3247	3270
8	10072	10101	3247	3270
9	10092	10127	3247	3271
10	10010	10035	3248	3271

A社

Thermal shock test

A社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9910	9960	3381	3391
2	9906	9955	3380	3391
3	9932	9982	3380	3391
4	9913	9962	3380	3391
5	9951	10002	3381	3392
6	9892	9941	3380	3390
7	9918	9968	3378	3390
8	9897	9947	3379	3391
9	9959	10008	3381	3393
10	9920	9969	3381	3393

B社

Thermal shock test

B社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	10019	10145	3241	3253
2	10038	10160	3241	3252
3	10016	10139	3242	3254
4	10014	10139	3241	3253
5	9998	10123	3240	3252
6	9993	10115	3243	3255
7	9991	10116	3241	3253
8	10070	10197	3243	3255
9	10023	10146	3243	3255
10	9998	10117	3242	3255

C社

Thermal shock test

C社	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	9957	10006	3252	3259
2	9969	10016	3253	3259
3	9999	10048	3256	3262
4	9973	10021	3255	3261
5	9966	10016	3253	3259
6	9990	10039	3254	3260
7	9986	10036	3256	3263
8	10004	10053	3254	3260
9	10002	10054	3257	3264
10	9992	10044	3258	3265

A社

High temperature and high humidity load test

A사	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	10212	10153	3402	3409
2	10195	10140	3397	3404
3	10200	10141	3402	3409
4	10091	10033	3399	3405
5	10098	10042	3399	3403
6	10114	10056	3399	3404
7	10100	10045	3401	3405
8	10074	10021	3399	3403
9	10079	10025	3399	3402
10	10099	10038	3399	3401
11	10260	10069	3238	3402
12	10265	10080	3242	3406
13	10290	10108	3245	3406
14	10312	10126	3244	3409
15	10198	10020	3243	3404
16	10243	10056	3241	3404
17	10217	10036	3239	3403
18	10281	10097	3244	3402
19	10260	10073	3241	3403
20	10219	10038	3241	3400

B社

High temperature and high humidity load test

B사	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	10058	10119	3416	3419
2	10084	10145	3416	3419
3	10031	10091	3416	3418
4	10070	10143	3417	3420
5	10053	10131	3417	3417
6	10080	10153	3416	3416
7	10023	10100	3416	3415
8	10017	10084	3417	3415
9	10020	10085	3417	3414
10	10084	10162	3417	3413
11	10069	10145	3412	3418
12	10037	10107	3411	3417
13	10073	10151	3411	3417
14	10007	10076	3411	3416
15	10034	10113	3411	3416
16	10023	10104	3411	3415
17	10013	10101	3411	3415
18	10015	10087	3411	3414
19	10015	10094	3411	3413
20	10041	10116	3411	3413

C社

High temperature and high humidity load test

C사	Resistance (Ω @25℃)		B Constant (B25/85)	
No.	Initial test	After high temperature test	Initial test	After high temperature test
1	10038	10102	3422	3268
2	10047	10096	3422	3269
3	10039	10085	3423	3271
4	10051	10099	3425	3272
5	9977	10027	3423	3267
6	10062	10112	3422	3267
7	10030	10079	3422	3267
8	10055	10104	3425	3269
9	10035	10083	3420	3265
10	10060	10106	3424	3271
11	9962	9989	3421	3254
12	10046	10073	3421	3253
13	10048	10116	3420	3259
14	9980	10049	3420	3258
15	10051	10118	3419	3257
16	9982	10040	3421	3259
17	9988	10052	3421	3258
18	9972	10040	3422	3257
19	10027	10090	3420	3256
20	10056	10116	3421	3257