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**RESISTANCE TEMPERATURE DETECTOR
THIN FILM PLATINUM SENSOR, PTC
RANGE 100 TO 2000 OHMS AT 0°C, WITH
A TEMPERATURE RANGE OF -200°C TO +200°C**

ESCC Detail Specification No. 4006/015

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1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2 APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

- (a) ESCC Generic Specification No. [4006](#), Thermistors (Thermally Sensitive Resistors).

1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. [21300](#) shall apply.

1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted and marked as follows:

Example: 400601501

- Detail Specification Reference: 4006015
- Component Type Variant Number: 01 (as required)

1.4.2 Component Type Variants and Range of Components

Variant Number	Based on Type (Article Number)	Nominal R_z (Ω) (at 0°C)	Operating Temperature Range T_{op} (°C)	Maximum Operating Current I_{OP} (mA) (Notes 1, 2)	Maximum Rated Current I_{MAX} (mA)
01	P0K1.232.7W (010.02991)	100	-50 to +150	1	4
02	P0K1.232.7W (010.02992)	100	-200 to +200	1	4
03	P0K2.232.7W (010.02993)	200	-50 to +150	0.7	2.8
04	P0K2.232.7W (010.02994)	200	-200 to +200	0.7	2.8
05	P0K5.232.7W (010.02995)	500	-50 to +150	0.45	1.3
06	P0K5.232.7W (010.02996)	500	-200 to +200	0.45	1.3
07	P1K0.232.7W (010.02997)	1000	-50 to +150	0.3	1.3
08	P1K0.232.7W (010.02998)	1000	-200 to +200	0.3	1.3
09	P2K0.232.7W (010.02998)	2000	-50 to +150	0.2	0.9
10	P2K0.232.7W (010.03000)	2000	-200 to +200	0.2	0.9

RESISTANCE vs. TEMPERATURE LIMITS

Variant Number		R_z (Ω) Over T_{op} (Note 2)							
		-200°C	-100°C	-50°C	0°C	+50°C	+100°C	+150°C	+200°C
01	Min	-	-	80.087	99.882	119.185	138.202	156.932	-
	Max	-	-	80.524	100.117	119.608	138.808	157.717	-
02	Min	17.957	59.931	80.087	99.882	119.185	138.202	156.932	175.377
	Max	19.081	60.58	80.524	100.117	119.608	138.808	157.717	176.333
03	Min	-	-	160.174	199.764	238.37	276.404	313.864	-
	Max	-	-	161.048	200.234	239.216	277.616	315.434	-
04	Min	35	119.86	160.174	199.764	238.37	276.404	313.864	350.754
	Max	38.162	121.168	161.048	200.234	239.216	277.616	315.434	352.666
05	Min	-	-	400.435	499.41	595.925	691.01	784.66	-
	Max	-	-	402.62	500.585	598.04	694.04	788.585	-
06	Min	89.785	299.655	400.435	499.41	595.925	691.01	784.66	876.885
	Max	95.405	302.93	402.62	500.585	598.04	694.04	788.585	881.665
07	Min	-	-	800.87	998.82	1191.85	1382.02	1569.32	-
	Max	-	-	805.24	1001.17	1196.08	1388.08	1577.17	-
08	Min	179.571	599.315	800.87	998.82	1191.85	1382.02	1569.32	1753.77
	Max	190.811	605.86	805.24	1001.17	1196.08	1388.08	1577.17	1763.33
09	Min	-	-	1601.74	1997.64	2383.7	2764.04	3138.64	-
	Max	-	-	1610.48	2002.34	2392.16	2776.16	3154.34	-
10	Min	359.143	1198.62	1601.74	1997.64	2383.7	2764.04	3138.64	3507.54
	Max	381.623	1211.61	1610.48	2002.34	2392.16	2776.16	3154.34	3526.66

NOTES:

- Operating current is limited by self-heating. Mounting details have a major influence on self-heating.
- For test purposes, when zero power is dissipated (i.e. $\leq I_{OP}$) and the ambient temperature is held as specified and measured with tolerance $\pm 0.01^\circ\text{C}$, the value is referred to as R_z (Zero Power Resistance).

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

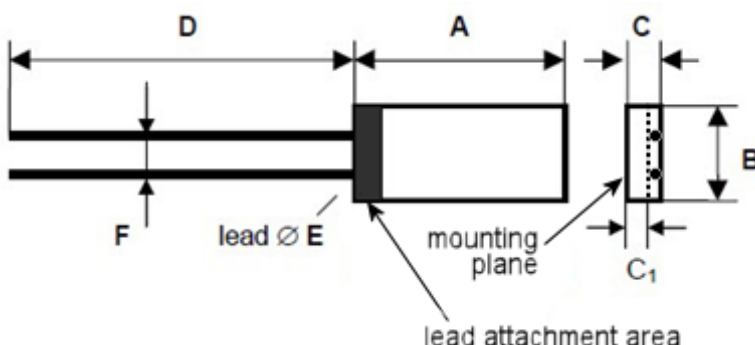
Characteristics	Symbols	Maximum Ratings	Units	Remarks
Maximum Rated Current	I_{MAX}	See Para. 1.4.2	mA	
Power Dissipation	P_D	20	mW	
Operating Temperature Range	T_{op}	See Para. 1.4.2	°C	
Storage Temperature Range	T_{stg}	-200 to +200	°C	

1.6 HANDLING PRECAUTIONS

These components are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, shipment and any handling.

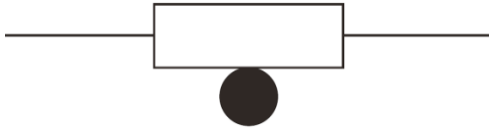
These components are categorised as Class 2 per ESCC Basic Specification No. 23800 with a Minimum Critical Path Failure Voltage of 2000 Volts.

1.7 PHYSICAL DIMENSIONS



Symbol	Dimensions (mm)		Remarks
	Min	Max	
A	2.1	2.4	
B	1.8	2.2	
C	0.9	1.3	total thickness of the lead attachment area
C ₁	0.55	0.85	substrate thickness excluding the lead attachment area
D	9	10.7	
ØE	0.18	0.22	lead diameter
F	0.75	1.25	

1.8 FUNCTIONAL DIAGRAM



1.9 MATERIALS AND FINISHES

1.9.1 Body

Thin film Platinum printed on an Al_2O_3 substrate, covered with a transparent, glass passivation layer. The area of lead attachment on the substrate is also covered with a transparent, glass passivation layer.

1.9.2 Lead Material and Finish

Platinum wire.

1.10 WEIGHT

350mg maximum.

2 REQUIREMENTS

2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

2.1.1.1 *Deviations from Special In-Process Controls – Chart F2*

- (a) Pre-Encapsulation (internal Visual) Inspection: shall not be performed.

2.1.1.2 *Deviations from Screening Tests – Chart F3*

- (a) Radiographic Inspection: shall not be performed.

2.1.1.3 *Deviations from Qualification and Periodic Tests - Chart F4*

- (a) Shock (Specified Pulse): shall not be performed.
- (b) Vibration: shall not be performed.
- (c) Resistance to Soldering Heat: not applicable.
- (d) Dissipation Constant: shall not be performed.
- (e) Thermal Time Constant: shall not be performed.
- (f) Solderability: not applicable.
- (g) Short Time Load: E_{TH} and I_{TH} shall be as specified in Para. 2.7 in the Detail Specification. Zero Power Resistance shall be measured before and after the test and Change in Zero Power Resistance shall be calculated; the limits specified in Para. 2.7 in the Detail Specification shall apply.

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component or the primary package shall be:

- (a) The ESCC Qualified Component Symbol (for ESCC qualified components only).
- (b) The ESCC Component Number (see Para. 1.4.1).
- (c) Traceability information.
- (d) Sensitivity to Electrostatic Discharge Symbol.

2.3 THERMAL SHOCK

Thermal Shock shall be performed as specified in the ESCC Generic Specification. The Test Condition shall be C with an exposure time of 10 minutes at each temperature extreme.

2.4 TERMINAL STRENGTH

The test conditions for Terminal Strength, tested as specified in the ESCC Generic Specification, shall be as follows:

- Test Condition: A
- Method of Holding: The component body shall be glued to the test fixture.
- Applied Force: 2 (+0.5 -0)N. The force shall be applied gradually to both terminals together and then maintained for a period of 5 seconds minimum.

2.5 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures.

2.5.1 Room Temperature Electrical Measurements

Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Zero Power Resistance at 0°C	R_z	ESCC No. 4006, Note 1	Note 2		
Insulation Resistance	R_i	ESCC No. 4006, Note 3	100	-	MΩ

NOTES:

1. Zero Power Resistance shall be measured at $T_{amb} = +25 \pm 0.01^{\circ}\text{C}$ and $+85 \pm 0.01^{\circ}\text{C}$ with I_{OP} test conditions as specified in Para. 1.4.2. The resistance value at 0°C shall be calculated using the measured values and the following equation:

$$R_0 = R_T \div (1 + AT + BT^2)$$

Where:

- R_0 : calculated Zero Power Resistance at 0°C
- R_T : measured Zero Power Resistance at $T_{amb} = T$ (in °C)
- $A = 3.9156 \times 10^{-3}$
- $B = -6.4413 \times 10^{-7}$

All measurements and calculations shall be recorded against serial number.

2. See Para. 1.4.2 for R_z limits.
3. The measurements shall be performed on a sample of 5 components with 0 failures permitted. In the event of any failure a 100% inspection may be performed.

2.5.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Zero Power Resistance over T_{op}	R_z	ESCC No. 4006, Note 1	Note 2		

NOTES:

1. Zero Power Resistance shall be measured at the following temperatures, each with an accuracy of $\pm 0.01^\circ\text{C}$, and with I_{OP} test conditions as specified in Para. 1.4.2:

- For Variants 01, 03, 05, 07, 09, $T_{amb} = (\text{in } ^\circ\text{C})$:
0, +10, +20, +30, +40, +50, +60, +70, +80, +90, +100
- For Variants 02, 04, 06, 08, 10, $T_{amb} = (\text{in } ^\circ\text{C})$:
-196, 0, +10, +20, +30, +40, +50, +60, +70, +80, +90, +100

The resistance value at each temperature specified in Para. 1.4.2 shall be calculated using the measured values and the equation given in Para. 2.5.1 Note 1. All measurements and calculations shall be recorded against serial number.

2. See Para. 1.4.2 for R_z limits at each specified temperature.

2.6 PARAMETER DRIFT VALUES

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1 Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits			Units
		Drift Value (Δ)	Absolute		
			Min	Max	
Zero Power Resistance at 0°C	R _Z	±0.1%	See Para. 2.5.1		

2.7 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1 Room Temperature Electrical Measurements.

Test Reference per ESCC No. 4006	Characteristics	Symbols	Limits		Units
			Min	Max	
Moisture Resistance Initial Measurements	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		%
Final Measurements	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	
	Insulation Resistance	R _i	100	-	
Terminal Strength Initial Measurements (Note 1)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		%
Final Measurements	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	
Short Time Load (P _D = Note 2) Initial Measurements (Note 1)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		%
Final Measurements	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	
Low Temperature Storage Initial Measurements (Note 3)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		%
Final Measurements	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	
Operating Life Initial Measurements (Note 3)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		%
Intermediate Measurements (1000 hours)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	
	Insulation Resistance	R _i	100	-	
Final Measurements (2000 hours)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		%
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	
	Insulation Resistance	R _i	100	-	

Test Reference per ESCC No. 4006	Characteristics	Symbols	Limits		Units
			Min	Max	
High Temperature Storage Initial Measurements (Note 3)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		%
Intermediate Measurements (1000 hours)	Zero Power Resistance at 0°C	R _z	See Para. 2.5.1		
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	
Final Measurements (2000 hours)	Zero Power Resistance	R _z	See Para. 2.5.1		%
	Change in Zero Power Resistance at 0°C	ΔR _z /R _z	-	±0.1	

NOTES:

- Zero Power Resistance values recorded during Room Temperature Electrical Measurements during Chart F3 may be used as initial measurements.
- E_{TH} and I_{TH} shall be adjusted to provide Maximum Rated Current as specified in Para. 1.5.
- Zero Power Resistance values recorded during the final measurements of the previous test may be used as initial measurements.

2.8

BURN-IN CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	$+150 \pm 10$	°C
Test Current	I_{TEST}	$2 \times I_{OP}$ (Note 1)	mW

NOTES:

- See Para. 1.4.2 for I_{OP} values.

2.9

OPERATING LIFE CONDITIONS

The conditions shall be as specified for Burn-in.

APPENDIX 'A'**AGREED DEVIATIONS FOR INNOVATIVE SENSOR TECHNOLOGY IST AG (CH)**

Items Affected	Description of Deviations
Para. 2.1.1, Deviations from the Generic Specification	Paras. 9.1.3(b), 9.1.4, 9.2(e), 9.6, Data Documentation: The relevant delivered data documentation for the components of the delivery lot, shall not be traceable to component serial number.
Para. 2.1.1.1, Deviations from Special In-Process Controls – Chart F2 Para. 2.1.1.2, Deviations from Screening Tests – Chart F3 Para. 2.1.1.3, Deviations from Qualification and Periodic Tests – Chart F4	Para. 8.5, External Visual Inspection: shall be performed in accordance with ESCC No. 2054000 , and the Manufacturer's visual inspection procedure as specified in the PID.
Para. 2.1.1.3, Deviations from Qualification and Periodic Tests – Chart F4	Para. 8.19, Permanence of Marking: shall not be performed.
Para. 2.2, Marking	The serial numbers of the components of the delivery lot shall not be marked on the components nor on the packaging.