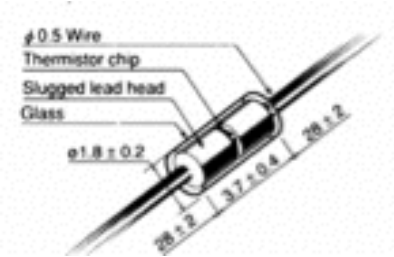


NTC THERMISTORS

World Markets, Technologies & Opportunities: 2021-2026



Paumanok Publications, Inc.



PASSIVECOMPONENT
INDUSTRY

Paumanok Publications, Inc.

Cary, NC 27513 USA

info@paumanokgroup.com

www.paumanokgroup.com

190 Pages

37 Tables and Graphs

Published August 2021

Price: \$2500.00

ISBN # 1-893211-22-3 (NTC2021)



Table Of Contents:

NTC Thermistors: 2021-2026 Global Market Outlook:	12
1.0 Introduction To NTC Thermistor Markets, Technologies & Opportunities: 2021-2026	12
1.1 About The Author	12
1.2 Scope of Report Coverage:	13
1.3 Research Methodology Employed:	13
1.4 The Paumanok Research Methodology: 27 Years Studying Passive Component Markets.....	14
1.3.1 Government Data Collection and Resources:	14
1.3.2 Secondary Published Sources:	15
1.3.3 Primary Intelligence Gathering:	15
1.4 The Passive Component Supply Chain:	15
1.4.1 Mining of Raw Materials:	16
1.4.2 Raw Materials Processing:	17
1.4.3 Component Manufacturing:	17
1.4.4 Component Distribution:	17
1.4.5 End-Market Consumption:	18
1.4.6 Recycling of Critical Materials:	18
1.5 Financial Considerations With Respect To This Report:	19
1.5.1 Fiscal Year Reporting	19
1.5.2 Currency Translation	19
2.0 Introduction and NTC Product Description:	19
2.1 Recent Changes In The Global NTC Thermistor Markets:	20
2.2 Lasting Affects of The Tohoku Quake on The NTC Thermistor Supply Chain	20
2.3 Lasting Affects of The Thailand Flooding on The Thermistor Supply Chain.....	20
2.4 Automotive Manufacturers Encourage More Market Entrants Into The NTC Thermistor Supply Chain	21
2.5 Important Impact of Recent Acquisitions on the NTC Thermistor Markets Worldwide:	21
2.5.1 Historical Merger and Acquisition Activity Impacting The NTC Thermistor Markets:	21
2.6 NTC Thermistor Product Descriptions:	22



2.6.1	Leaded Thermistors:	22
2.6.1 (A)	<u>NTC THERMISTOR RADIAL LEADED, GLASS ENCAPSULATED:</u>	22
2.6.1 (B)	<u>NTC THERMISTOR RADIAL LEADED, EPOXY ENCAPSULATED:</u>	23
2.6.1 (C)	<u>NTC THERMISTOR RADIAL LEADED, INRUSH CURRENT LIMITING:</u>	23
2.6.1 (D)	<u>NTC THERMISTOR RADIAL LEADED, THIN FILM DESIGN:</u>	24
2.6.1 (E)	<u>NTC THERMISTOR RADIAL LEADED, COMMODITY DISC:</u>	24
2.6.1 (F)	<u>NTC THERMISTOR AXIAL LEADED, GLASS ENCAPSULATED:</u>	25
2.6.2	Surface Mount Thermistors:	25
	<i>The NTC Thermistor Chip</i>	25
2.6.2 (A)	<u>NTC THERMISTOR CHIP:</u>	25
2.6.2 (B)	<u>NTC THERMISTOR MELF DESIGN:</u>	26
2.6.2 (C)	<u>NTC THERMISTOR LEADLESS NAKED CHIP:</u>	26
2.6.2 (D)	<u>NTC THERMISTOR LEADLESS DISC:</u>	27
2.7	Value-Added Module, Probes and Probe Assemblies:	27
2.8	Summary of NTC Thermistor Configurations: 2021	28
2.8	NTC Thermistor Production Process:	30
2.9	Raw Material Usage & Supply (Cr, Mn, Fe, Co and Ni):	31
2.10	NTC Thermistors: Circuit Applications: 2021	31
2.11	Temperature Sensing Markets:	31
2.11.1	NTC Thermistor Usage Volume Per Application for Temperature Sensing (Auto, Appliance, Specialty)	32
2.12	Temperature Compensation Markets:	32
2.12.1	NTC Thermistor Usage Volume Per Application for Temperature Compensation (Digital Electronics):	32
2.13	Inrush Current Limiting Markets:	33
2.13.1	NTC Thermistor Usage Volume Per Application for Inrush Current Limiters (Industrial and Digital Electronics)	33
3.0	End-Use Market Segment Overview for NTC Thermistors: 2021	33
3.1	AUTOMOTIVE:	33
3.1.1	Applications for NTC Thermistors in Automotive Electronic Subassemblies:	33
3.2	HOME APPLIANCES:	34
3.2.1	Applications for NTC Thermistors in Home Appliances:	34
3.3	DIGITAL ELECTRONICS:	34
3.3.1	Applications for NTC Thermistors in Digital Electronics:	34



3.4 INDUSTRIAL ELECTRONICS:	35
3.4.1 Applications for NTC Thermistors in Industrial Electronics:.....	35
3.5 SPECIALTY ELECTRONICS:.....	36
3.5.1 Applications for NTC Thermistors in Medical and Defense Electronics:.....	36
4.0 NTC Thermistors: World Markets: 2021.....	38
4.1 Global Value, Volume and Average Unit Pricing for NTC Thermistors: 2021, 2022 and 2026 Forecasts	38
4.1.1 Global Consumption Value for NTC Thermistors: 1998-2008-2021; FY 2022 Forecast.....	38
4.1.2 Global Consumption Volume for NTC Thermistors: 1998-2008-2021; FY 2022 Forecast.....	40
4.1.3 Global Average Unit Selling Price for NTC Thermistors: 1998-2008-2021; FY 2022 Forecast.....	42
5.0 NTC Thermistors: End-Use Markets: 2021	44
5.1 Global Market Breakdown for NTC Thermistors: 2021- 2022	44
5.1.1 NTC Thermistor Consumption Value and Volume By End-Use Market Segment: Global Market Summary: 2021-2022	44
5.2 Automotive Markets For NTC Thermistors: 2021 Update, 2022 Outlook and 2026 Forecast	46
5.2.1 Applications for NTC Thermistors in Automotive Electronic Subassemblies:.....	46
5.2.2 Automotive Sensing Markets:.....	46
5.2.3 Solar Sensor Markets:	48
5.2.4 Ambient Temperature Sensor Markets:.....	48
5.2.5 Interior Temperature Sensor Markets:	48
5.2.6 Coolant temperature sensor Markets:	49
5.2.7 Evaporator sensor Markets:	49
5.2.8 Automotive OE Climate Control System Markets:	49
5.2.9 Automotive OE Liquid Control Markets:	49
5.2.10 Battery Temperature Sensor Markets:	52
5.2.11 Electronic Fuel Injection Markets:.....	52
5.2.12 Heated Seat Temperature.....	52
5.2.13 Automatic Defrost Systems	53
5.2.15 Catalytic Converter Pre-Heat:.....	53
5.2.16 Theft-Protection Devices:	53
5.2.17 NTC Thermistors and Shift Control Systems:.....	53
5.2.18 Changes In The Global Automotive Markets- Impact on NTC Thermistor Demand	54
5.2.18.3 NTC Thermistor Consumption Value and Volume By Automotive Subassembly: 2021 Forecasts.....	56



5.2.18.4 FORECASTS: NTC Thermistor Consumption Value and Volume By Automotive Subassembly: 2021 -2026 Forecasts	58
5.3 Home Appliance Markets For NTC Thermistors: : 2021 Update, 2022 Outlook and 2026 Forecast	59
5.3.1 Cooking Appliance Control System Applications for Thermistors	59
5.3.2 Refrigerator Temperature Control Applications for Thermistors	60
5.3.3 Washing & Drying Appliance Temperature Control Applications for Thermistors (Clothes and Dishes):	60
5.3.4 Small Home Appliance Markets: 2021	60
5.3.5 Heat & Humidity Sensors in Small Home Appliances:	61
5.3.7 Value and Volume of NTC Thermistor Consumption By Appliance Type: 2021	61
5.3.7 FORECAST-Value and Volume of NTC Thermistor Consumption By Appliance Type: 2021-2026 Forecasts	62
5.4 Digital Electronics Markets For NTC Thermistors: 2021 Update, 2022 Outlook and 2026 Forecast	63
5.4.1 Power Supplies & DC/DC Converters:	64
5.4.2 Computer/Business Machines	64
5.4.3 Telecommunications	64
5.4.4 Other Applications-Battery Chargers (Temperature Control):	64
5.4.4 (A) Value and Volume of NTC Thermistor Consumption By Product Type in Digital Electronics: 2021	65
5.3.7 FORECAST-Value and Volume of NTC Thermistor Consumption By Key Products in Digital Electronics): 2021-2026 Forecasts	65
5.5 Industrial Electronics Market For NTC Thermistors: 2021 Update, 2022 Outlook and 2026 Forecast	66
5.5.1 Industrial Systems:	66
5.5.2 Electronic Ballasts	66
5.2.3 Battery Chargers (Temperature Control):	66
5.2.4 Instrumentation & Control:	67
5.2.5 Industrial Electronics End-Markets For NTC Thermistors: 2021	68
5.3.7 FORECAST-Value and Volume of NTC Thermistor Consumption By Key Products in Industrial Electronics): 2021-2026 Forecasts	69
5.6 Medical Electronics Markets for NTC Thermistors: 2021 Update, 2022 Outlook and 2026 Forecast	69
5.7 Defense and Specialty Electronics Markets for NTC Thermistors: 2021 Update, 2022 Outlook and 2026 Forecast	71
5.8 Additional Electronics Markets For NTC Thermistors:	71
6.0 NTC Thermistors: World Regions: 2021	72
6.1 NTC Thermistor Sales By World Region: 2021	72



6.1.1 Global Consumption Value for NTC Thermistors by World Region (Asia-Pacific, Americas, Europe): 2021 Estimates.	73
6.1.1 (A) Asia-Pacific Markets For NTC Thermistors: 2021	73
6.1.1 (B) American Markets for NTC Thermistors: 2021	74
6.1.1 (C) European Markets for NTC Thermistors: 2021.....	74
6.2 NTC Thermistor Sales By World Region: 2021-2026 Outlook	74
7.0 NTC Thermistors: Markets By Configuration: 2021.....	75
7.1 Global Consumption Value for NTC Thermistors By Component Configuration: 2021.....	75
7.1.1 Radial Leded and Disc NTC Thermistor Component Markets Versus SMD Chips: 2021	75
7.1.2 NTC Thermistor Consumption Value and Volume By Configuration (Throughole Versus SMD Chip): 2021	76
7.1.3 Consumption of Radial Leded NTC Thermistors By Type: 2021	77
7.1.3 (A) Epoxy Molded, Thin Lead NTC Thermistor Markets: 2021.....	77
7.1.3 (B) Inrush Current Limiter Markets: 2021.....	77
7.1.3 (C) Glass Hermetic Sealed, Thin Lead NTC Thermistor Markets: 2021	77
7.1.3 (D) Commodity Disc Thermistors: 2021 Markets.....	77
7.1.3 (E) Thin Film Radial Leded NTC Thermistors: 2021 Markets.....	77
7.1.4 SMD Chip Thermistor Market Volume and Value: 2021	79
7.1.4 (A) Consumption of SMD NTC Thermistor Chips By Case Size: 2021	79
7.1.5 NTC Thermistors: Conversion Markets In Probe Assemblies: 2021	81
7.1.5 (A) Automotive, Large Home Appliance and Specialty Probe Assembly Markets: 2021	81
8.0 NTC Thermistors: Competition: 2021	83
8.1 NTC Thermistor Competitive Environment: 2021	83
8.1.1 NTC Thermistor Vendors by Component Configuration (Chip, Disc, Leadless, ICL, Axial, Thin Film, Hi-Rel and Probe Assembly): 2021	83
8.1.2 Radial Leded NTC Thermistors: Competition by Type: 2021.....	85
8.1.2 Radial Leded NTC Thermistors: Competition by Type: 2021.....	86
8.1.3 NTC Thermistor Chips: Competition By Case Size: 2021	88
8.1.4 NTC Thermistor Competitive Environment By Market Sub-Category (Product Markets For NTC Thermistors By Vendor): 2021.....	90
8.1.5 NTC Thermistor Suppliers: FY 2021 Sales and Market Shares	92
8.2 Competitive Environment: Key Takeaways by Manufacturer	94
8.2.1 Shibaura	94



8.2.2 Amphenol Sensors	94
8.2.3 TDK Electronics	94
8.2.4 Ishizuka Semitec	95
8.2.5 Tateyama	95
8.2.6 Vishay	95
8.3 Important NTC Thermistor Vendor + Distributor Relationships: FY 2021	96
8.3.1 NTC Thermistor Distributors – Largest Supporters of Sensor and Inrush Technologies.....	96
8.3.2 NTC Thermistor Distributors – Vendor Strategies.....	96
8.3.3 Vertical Integration of the NTC Product Line:	96
9.0 NTC Thermistors: World Market Forecasts: 2021-2026.....	98
9.1 NTC Thermistor Global Market Forecasts: 2021-2026 (Value, Volume and Pricing)	98
9.1.1 NTC Thermistors: Global Market Forecasts for Value, Volume and Prices: 2021-2026	99
9.2 NTC Thermistors: Changes In Global Consumption By End-Use Market Segment: 2021-2022 Forecasts.....	99
9.2.1 NTC Thermistor Consumption Value By End-Use Market Segment: 2021-2022 NEAR TERM TACTICAL	
.....	100
9.2 NTC Thermistors: Changes In Global Consumption By End-Use Market Segment: 2021-2026 Long-Term Forecasts	101
10.0 NTC Thermistors: Producer Profiles	103
10.1 Introduction To The World’s Top NTC Thermistor Manufacturers:	103
Ametherm	103
Abrakon.....	104
Amphenol-GE Sensing.....	104
API Technologies.....	108
Banner	109
BetaTHERM	109
Cantherm.....	110
EI Sensor.....	111
Crouzet.....	112
E WAY.....	113
ELSCOTT.....	114
ESKA	115
EXSENSE.....	117



FENG HUA	118
GlobTek	119
Hitech.....	120
Honeywell.....	122
Huichang Electronics.....	123
Huichang Sensor	124
Hongzhi.....	125
Hyper-Sense.....	127
Ishizuka (SemiTec).....	128
KOA.....	130
Kyocera AVX.....	132
Latron.....	134
Littelfuse	135
Maida	138
MINGJIA	140
Mitsubishi	141
Murata	142
Northstar	145
Ohizumi.....	146
NTE.....	147
Ohmite.....	148
Panasonic	150
Quality Thermistor.....	151
Rittal.....	152
SEN TECH.....	153
Sensor Scientific	154
Shibaura	154
Shiheng	156
SinoChip:	157
Sunlord.....	158



Susumu.....	159
TE Connectivity.....	161
TA-I.....	162
TAYAO.....	164
Taiyo Yuden.....	165
Tateyama.....	166
TDK.....	167
TEWA.....	171
Thinking Electronic.....	172
Tonze Electron.....	173
UNIX TECH.....	173
Uppermost.....	174
US Sensor.....	175
Vatronics.....	176
Vishay.....	177
Walsin.....	179
Wayon.....	181
Western Electronic.....	183
Zeitgeist.....	184
Zhengli Group.....	185

List of Figures

Figure 1: Paumanok Research Methodology.....	14
Figure 2: The Passive Electronic Component Supply Chain.....	16
Figure 3: Summary of Available NTC Thermistor Components By Configuration: 2021.....	30
Figure 4: NTC Thermistors for Temperature Sensing: Average Content In Primary End-Products: 2021.....	32
Figure 5: NTC Thermistors for Temperature Compensation: Average Content in Primary End-Products: 2021.....	32
Figure 6: NTC Thermistors for Inrush Current Limiting: Average Unit Content Per Product Market: 2021.....	33
Figure 7: Global Consumption Value for NTC Thermistors:1998- 2008-2021; 2022F.....	39
Figure 8: Global Consumption Volume for NTC Thermistors: 1998-2021; 2022 Forecast.....	41
Figure 9: Global Average Unit Pricing for NTC Thermistors: 1998-2021; 2022 Forecast.....	43



Figure 10: Global Value, Volume and Average Unit Pricing for NTC Thermistors by End-Use Market Segment for 2021 and FY 2022 Forecast 44

Figure 11: Global Value of Consumption for NTC Thermistors by End-Use Market Segment for 2021 and FY 2022 Forecast 45

Figure 12: Automotive Applications For NTC Thermistors: 2021 47

Figure 13: Under The Hood Applications for NTC Thermistors: FY 2021 (Fossil Fuel Electronics) 51

Figure 14: Global Car and Lite Truck Production: FY 2011-2021; FY 2022 Forecasts 55

Figure 15: NTC Thermistor Consumption Value and Volume by Automotive Electronic Sub-assembly: 2021 57

Figure 16: FORECASTS: Global Value and Volume of NTC Thermistor Consumption in Automotive Electronic Subassemblies: 2021-2019 58

Figure 17: Global Consumption Value and Volume for NTC Thermistors in The Home Appliance Market: 2021 61

Figure 18: Global Consumption Value and Volume for NTC Thermistors in The Home Appliance Market: 2021 62

Figure 19: Global Consumption Value and Volume for NTC Thermistors in Digital Electronics Market: 2021 65

Figure 20: Global Consumption Value and Volume for NTC Thermistors in The Home Appliance Market: 2021-2026 66

Figure 21: Industrial Electronics Markets For NTC Thermistors: 2021 68

Figure 22: Global Consumption Value and Volume for NTC Thermistors in The Home Appliance Market: 2021-2026 69

Figure 23: Global Consumption Value For NTC Thermistors by World Region: 2021 73

Figure 24: Global Consumption Value, Volume and Pricing for NTC Thermistors by Component Configuration: 2021 76

Figure 25: Global Consumption Value for Radial Leded Type NTC Thermistors By Sub-Type: 2021 78

Figure 26: SMD NTC Thermistors: Global Value of Demand Estimates by Case Size; 2021 80

Figure 27: NTC Thermistors: Global Value of Demand Estimates for Probe Assemblies by End-Market: FY 2021 82

Figure 28: Competitive Environment in NTC Thermistors: 2021 84

Figure 29: Competitive Environment in NTC Thermistor Sales by Type and Configuration: 2021 85

Figure 30: Radial Leded NTC Thermistor Components: Competition by Sub-type: 2014 87

Figure 31: NTC Thermistor Chip Vendors by Case Size: 2021 88

Figure 32: NTC Thermistor Vendors By The Product Markets They Serve: 2021 89

Figure 33: NTC Thermistor Vendors: 2021 Estimated Worldwide Market Shares 93

Figure 34: NTC Thermistor Vendor + Distributor Relationships: FY 2021 97

Figure 35: Forecasted Unit Growth in Key End Markets: FY 2021-2026 98

Figure 36: Value, Volume and Average Unit Pricing Forecasts for NTC Thermistors: 2021-2026 99

Figure 37: Value, Volume and Average Unit Pricing Forecasts for NTC Thermistors by End-Use Market Segment (Near Term Tactical): 2021-2026 .. 100



NTC Thermistors: 2021-2026 Global Market Outlook:

1.0 Introduction To NTC Thermistor Markets, Technologies & Opportunities: 2021-2026

1.1 About The Author

Mr. Zogbi is president and CEO of Paumanok Publications, Inc., a market research company located in Cary, North Carolina specializing in market research studies, consulting, mergers and acquisitions, conferences and seminars with emphasis upon passive electronic components. Mr. Zogbi has 300 customers worldwide in the field of market research on capacitors, resistors, inductors, circuit protection and electronic materials. Mr. Zogbi also owns Passive Component Industry Magazine with global circulation of 14,000. Mr. Zogbi engages in single client research related to new product development, due diligence for mergers and acquisitions and for establishing business growth for passive component companies worldwide.

Dennis M. Zogbi

Paumanok Publications, Inc.

(919) 468-0384

info@paumanokgroup.com



TO PURCHASE THIS REPORT- *GO TO-*

www.paumanokgroup.com

1.2 Scope of Report Coverage:

This study focuses on NTC Thermistors in various types and configurations, with emphasis upon chip, radial disc, thin film, axial leaded and probe assembly. With NTC thermistors, resistance *decreases* as temperature rises; usually due to an increase in conduction electrons bumped up by thermal agitation from valency band. An NTC is commonly used as a temperature sensor, or in series with a circuit as an inrush current limiter.

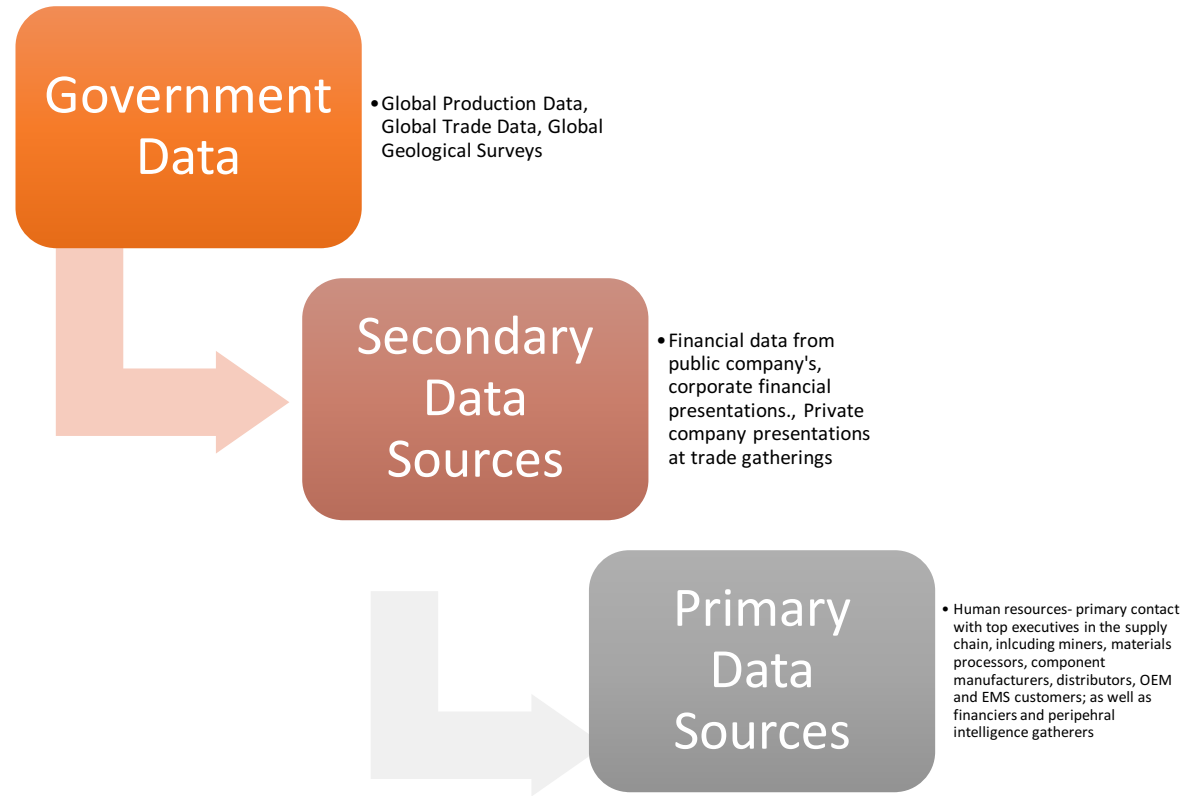
1.3 Research Methodology Employed:

The methodology employed to do this study combines secondary and primary data sources, including government data; company financial data and primary human intelligence resources to draw conclusions. This is called a “legacy” of data that is designed to make sure that all pieces of the market “puzzle” fit together. Also we have the unique capability to benchmark the markets we study with previous studies under the same title produced in the past two decades. This enables us to establish the “Delphi -Method” which suggests that the trend of sales over time will support a similar rate of growth in the future. We caveat this approach by also employing “Box-Jenkins” methods of market research which adjust forecasts based upon our knowledge of current events and their impact on the supply chain, and how that might impact future forecasts.



1.4 The Paumanok Research Methodology: 27 Years Studying Passive Component Markets

Figure 1: Paumanok Research Methodology



©2021 Paumanok Publications, Inc. All Rights Reserved

1.3.1 Government Data Collection and Resources:

There are many government resources that we apply to research on the electronic components industry. Our primary use of

