TRANSPORTATION SOLUTIONS GUIDE

Featured Automotive products engineered to meet the unique design requirements of today’s transportation market & beyond.

CONNECTIVITY THAT MOVES THE WORLD

The rapidly evolving world of transportation demands cutting-edge solutions that can keep pace with its unique and complex design requirements. From compact electric vehicles to robust heavy-duty trucks, the industry calls for components that are more advanced, versatile, and durable than ever before.

This guide highlights a curated selection of innovative automotive products designed to meet these challenges head-on. Whether you're in need of miniaturized components for streamlined designs, high-voltage systems for electric mobility, water-resistant materials for harsh environments, or heavy-duty solutions capable of withstanding extreme conditions, this guide offers expert insights and technical advancements that meet the demands of today's transportation applications and beyond.

Dive into this comprehensive overview and discover TE Connectivity`s (TE) products that define the future of automotive engineering.

P **Personalized,** offering a customized digital-life-integrated experience

A **Autonomous,** providing greater safety, comfort and convenience

C **Connected,** smartly interacting with the surrounding environment and other vehicles

E **Electrified and sustainable** for CO2 reduction and environmental responsibility

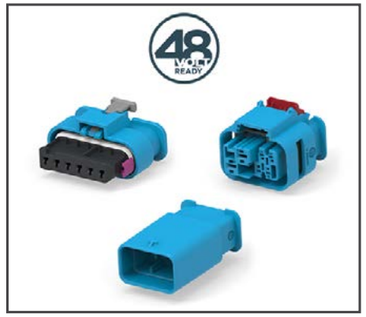
S **Shared mobility** business models for efficiency and convenience

LOW-VOLTAGE SIGNAL AND POWER CONNECTIVITY SOLUTIONS

TE brings you low-voltage signal and power products and technologies that drive robust and reliable automotive design solutions. As power requirements vary depending on the application, TE helps solve your signal and power challenges by taking the guess work out of the equation by providing a variety of products with key design characteristics. With our wide variety of solutions and advanced design capabilities, you will find the right match for your unique application.





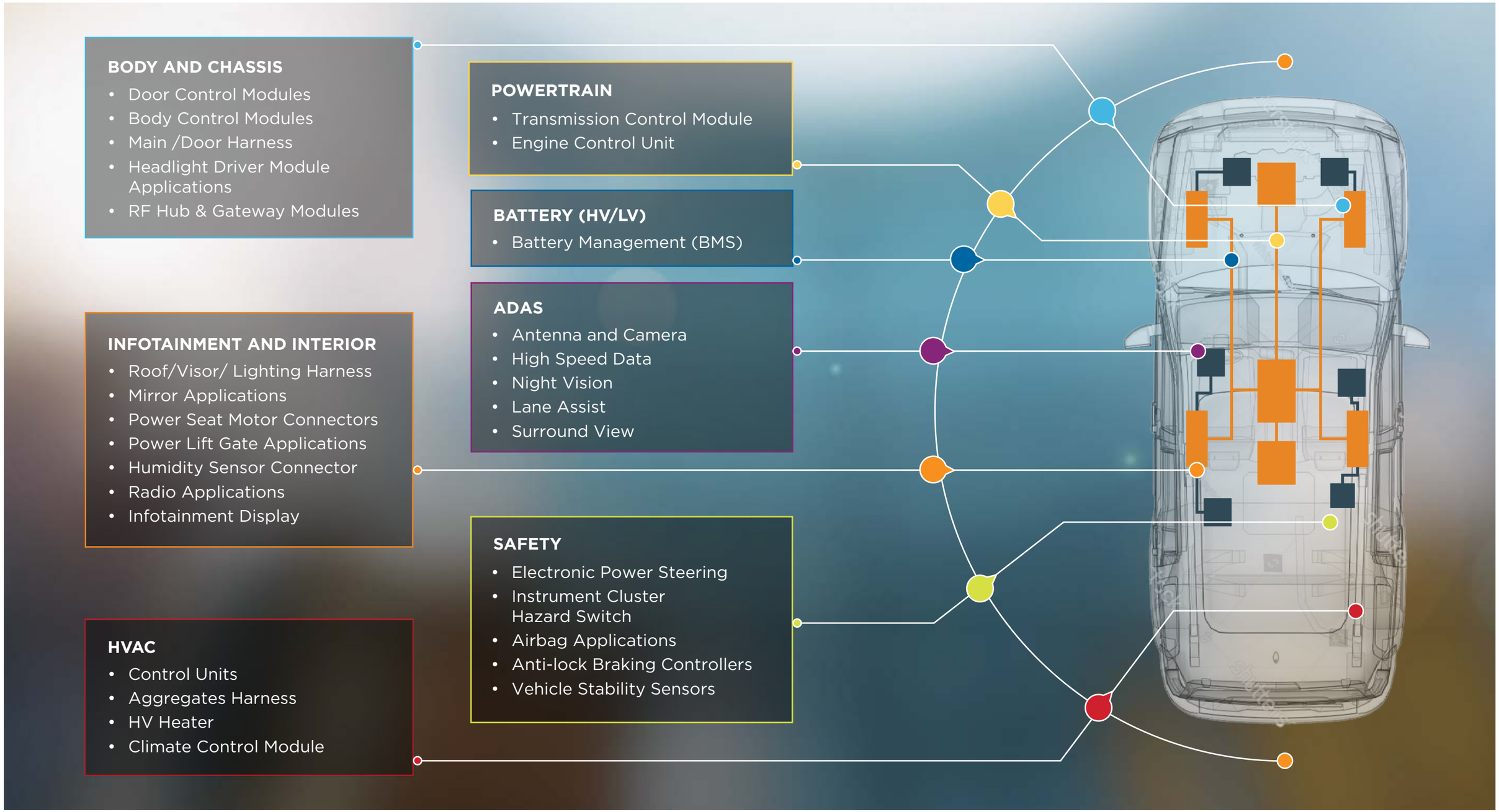



Low-Voltage Signal and Power Connectivity Solutions

Product Family				Terminals									
	Terminal Size	Product Family	Connection Type (W2B, W2W, W2D, B2B)	Terminal Form (Flat or Round)	Terminal Type (LL, CB or Mono)	Minimum Pitch	Max Current @ 80°C	Maximum Vibration Class	Termination Type (Crimped, FFC, Weld Tab)	Validated Wire Sizes (mm^2)	Sealed Available	OEM Specifiction	Male Terminal Available
Signal (Miniaturized)	0.5mm	PicoMQS	W2D	Flat	LL	1.27 mm	4A	SG2	Crimped	0.08-0.13 (onrequest) 0.22 FLU available	No	LV214 / VW75174	In development
	0.5mm	NanoMQS	W2D	Flat	LL	1.8 mm	6A	SG4	Crimped and FFC	0.13-0.35	Yes	LV214/USCAR (ongoing)	Yes
	0.5mm	MCON 0.50	W2D	Flat	CB	1.8 mm	3A	SG4	Crimped	0.13-0.35	Yes	LV214/USCAR (ongoing)	No
	0.5mm	Generation 50	W2D/ W2B	Flat	LL/CB	1.8 mm	4A	V1	Crimped	0.13-0.35	Yes	USCAR	No
	0.5mm	0.50 Series	W2D	Flat	LL	1.5 mm	5A	V1	Crimped	0.13-0.35	Yes	Japanese OEMs	No
Signal	0.63mm	MQS	W2B/ W2W/ W2D	Flat	LL, CB	2.54 mm	7.5A	SG3	Crimped	0.08, 0.2, 0.35, 0.5, 0.75	Yes	LV214/USCAR	Yes
	0.64mm	Generation Y	W2B/ W2W/ W2D	Flat	CB	2.2/2.54 mm	10.5A	V3	Crimped	0.13 - 0.75	Yes	USCAR/ Japanese OEMs	Yes
	0.64mm	GET	W2B/ W2W/ W2D	Flat	CB	2.54 mm	9A	USCAR for entire engine compartment body	Crimped	0.13 - 1.0	Yes	USCAR	Yes
	0.64mm	MULTILOCK	W2B/ W2W	Flat	LL	2.2 mm	3A	USCAR	Crimped	0.13 – 0.75	No	USCAR	Yes
	0.64mm	TH/ .025	TH 0.25 Terminal W2B	Flat	LL, CB	2.2 mm	5A	V3	Crimped	0.2, 0.35, 0.5, 0.75, 1.0	No	French/ Japanese OEMs	
	1.0mm	MULTILOCK	W2B/ W2W	Flat	LL	2.5 mm	5A	USCAR	Crimped	0.20 – 0.85	No	USCAR	Yes
Low Power	1.2mm	MCON	W2W/ W2D	Flat	LL, CB	2.5 mm	17A	SG4	Crimped	0.5, 0.75, 1.0, 1.5	Yes	LV214/USCAR	Yes
	1.2mm	HPF	W2B/W2W/ W2D	Flat	LL	2.5 mm	17A	SG6	Crimped	0.5, 0.75, 1.0, 1.5	Yes	LV214/USCAR	Yes
	1.5mm	AMP MCP	W2B/ W2W	Flat	LL, CB	4 mm	18A	30g	Crimped	0.2, 0.35, 0.5, 0.75, 1.0, 1.5, 2.5, 4.0	Yes	LV214/USCAR	Yes
	1.5mm	MQS	W2B / W2D/ W2W	Flat	LL, CB	2.54 mm	10A	SG3	Crimped	0.35, 0.5, 0.75, 1.0,1.5	Yes	LV214/USCAR	
	1.5mm	SUPERSEAL	W2B/ W2D	Flat	NA	2.54 mm	14A	20g	Crimped	0.35, 0.50, 0.75, 1.50, 2.5,	Yes	LV214/USCAR	Yes
	1.8mm	MULTILOCK	W2B/ W2W	Flat	LL	3.5 mm	10A	SG3	Crimped	0.20, 0.30, 1.25, 2.0	Yes	LV214/USCAR	Yes
	2.3mm	MULTILOCK	W2B/ W2W	Flat	LL	3.5 mm	15A	SG3	Crimped	0.20, 0.30, 1.25, 2.0	Yes	LV214/USCAR	Yes
	2.8mm	MPQ	W2B / W2D/ W2W	Flat	LL,CB	5 mm	26A	SG4/20g	Crimped	0.35, 0.5, 0.75, 1.0, 1.5, 2.0, 2.5, 4.0	Yes	LV214/USCAR	
	2.8mm	AMP MCP	W2B/ W2W	Flat	LL	5 mm	40A	30g	Crimped	0.35, 0.5, 0.75, 1.0, 1.5, 2.5, 4.0	Yes	LV214/USCAR	Yes
	2.8mm	Timer	W2B/ W2W/ W2D	Flat	LL	5 mm	23A	15g	Crimped	0.35, 0.5, 0.75, 1.0, 1.5, 2.5	Yes	LV214/USCAR	Yes
	5.2mm	MQS			LL	5.5 mm	37A	SG2	Crimped	0.35, 0.50, 0.75, 1.0, 1.5, 2.5, 4.0	Yes	LV214/USCAR	
	6.3mm	NG	W2W	Flat	CB	11.6 mm	45A	15g	Crimped	2.5, 4.0, 6.0	Yes	French OEMs	Yes
	6.3mm	AMP MCP	W2W	Flat	LL	8 mm (unsealed)	52A	30g	Crimped	0.35, 0.5, 0.75, 1.0, 1.5, 2.0, 2.5, 4.0, 6.0	Yes	LV214/USCAR	Yes
	6.3mm	Timer	W2B/ W2W	Flat	LL	7.5 mm	33A	20g	Crimped	0.35, 0.5, 0.75, 1.0, 1.5, 2.5, 4.0	Yes	LV214/USCAR	Yes
Medium Power	8mm	MCON	W2D	Flat	LL	15.7 mm	109A	SG3	Crimped	2.5, 3.0, 4.0, 5.0, 6.0, 8.0, 10, 12, 16	Yes	LV214	No
	8mm	NG	W2B/ W2W	Flat	CB	8.4 mm	90A	25g	Crimped/ Welded	2.5, 4.0, 6.0	No	French OEMs	Yes
	9.5mm	AMP MCP	W2W	Flat	LL	12.5 mm (unsealed)/ 16.5 mm (sealed)	78A	Class 1	Crimped	0.2, 0.35, 0.50, 0.75, 1.0, 1.5, 2.5, 4.0. 6.0	Yes	LV214/USCAR	Yes
	9.5mm	Timer	W2B/ W2W	Flat		11.5 mm	55A	20G	Crimped	2.5, 4.0, 6.0, 10,	Yes	LV214/USCAR	Yes
	9.5mm	MCON	W2W/ W2D	Flat	LL	16.5 mm	78A	SG4	Crimped/ Welded	2.5, 3.0, 4.0, 5.0, 6.0, 8.0, 10	Yes	US OEMs	Yes
	12mm	MCON	W2W/ W2D	Flat	LL	15.7 mm	179A	Class 1	Crimped/ Welded	6.0, 8.0, 10, 12, 16, 20, 25, 30, 35	Yes	LV214/USCAR	Yes

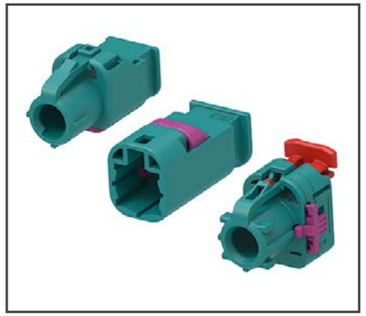
Low-Voltage Signal and Power Connectivity Solutions

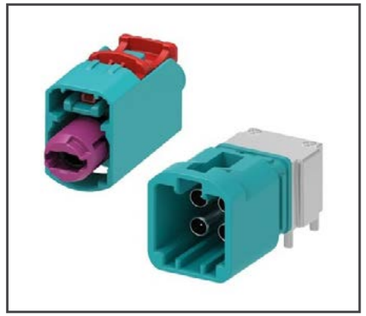
Product Family					Connectors						Application Examples	Headers			
	Terminal Size	Product Family	Minimum Pitch	Max Current @ 80°C	Housing (Rec / Tab)	Sealed Available	CPA	Number of Positions	Keying Options	Mixed or Hybrid (Y/N)		Termination Method (SMD, Through-Hole, Press-Fit, Pin-in-Paste)	Orientation (90° or 180°)	Max Current @ 80°C	Number of positions
Signal (Miniaturized)	0.5mm	PicoMQS	1.27 mm	4A	Rec	No	No	2 to 22	Yes	Yes	Headlamps/Indicators, Battery Management System, Steering Wheel Controls, Front and Rear Cameras, Switches, Sensors, Roof Control, Antenna Module, Wire Harness/Electrical Systems, HVAC	SMD	90°	4A	2 to 22
	0.5mm	NanoMQS	1.8 mm	6A	Rec/Tab	Yes	Yes	1 or 2-row, 2-40 (CPA option up to 28), 8, 20 & 32 (FFC)	No	Yes	Battery/Cell Control Modules, Engine Control Units and Airbags, Blackbox applications with extreme Space Constraints (Headlamps, Steering Wheel, Mirrors, Doors, Cameras, Audio Systems)	Through Hole/ Pin-in Paste/ SMD/PressFit	90° & 180°	6A	4 to 32
	0.5mm	MCON 0.50	1.8 mm	3A	Rec/Tab	Yes	Yes	3, 4 & 6 (1-row), 4-12 (2-row)	Yes	No	Sealed Applications (Engine Control Units), Safety-Critical, Sealed, High Vibration Applications – Airbag ECU, Engine Room Sensors, Camera, Body Control Unit	NA	NA	NA	NA
	0.5mm	Generation 50	1.8 mm	4A	Rec	No	Yes	2 to 20	Yes	Yes	Seat switches, Power steering, Door handle modules, Steering Wheel Controls, Headlamps, Cameras, Sensors, Unsealed control units	Through-Hole/SMD/ PressFit	90° & 180°	4A	2 to 28
	0.5mm	0.50 Series	1.5 mm	5A	Rec	No	No	24 to 60	Yes	Yes	Body Control Unit, Smart key, Air Conditioning, Navigation, Headlight Leveling, Power Management, Data Communication Module, Driving Support System, Rear Door System, Meter, Front/Rear Camera, Rudder Angle	Through-Hole/SMD	90° & 180°	5A	16 to 40
Signal	0.63mm	MQS	2.54 mm	7.5A	Rec/ Tab	Yes	Yes	2 to 200	Yes	Yes	HVAC, Headlights, Steering Wheel, Door Harness, Main Harness, Airbag, Engine/Zonal Control Unit, ADAS, Battery Pack, ABS Sensors and Controllers, Autopilot Modules, Power Seat Motor Controllers, Battery Back-Up Systems, Refrigeration Units, Bus & Truck Applications, Motorcycle Low Current Applications, Marine Low Current Applications.	Through Hole/ Pin-in Paste/ SMD/ PressFit	90° & 180°	7.5A	2 to 134
	0.64mm	Generation Y	2.2/2.54 mm	10.5A	Rec/ Tab	Yes	Yes	2 to 112	Yes	Yes	- Unsealed Wire-to-Device applications, such as Power Lift Gate Modules, Seat Modules, Sensors, and Switches - Sealed Connector applications, such as Smart Window Motors, Engine/Transmission Control Modules, and Anti-Lock Braking Systems - Unsealed Wire-to-Board applications such as Multi-Media Modules, Door Control Modules, and Climate Control Modules - Wire-to-Wire inline connections (including hybrid) for body harnesses, ADAS/Radar, and Camera Applications	Through Hole/ SMD/ PressFit	90° & 180°	10.5A	10 to 40
	0.64mm	GET	2.54 mm	9A	Rec/ Tab	Yes	Yes	2 to 96	Yes	Yes	Airbag Restraint Modules, Electronic Power Steering, Instrument Panel, Audio, Mirrors, Inverter, Seatbelt Tensioning, Door Control Modules, Headlights	Through Hole/ PressFit	90°	9A	2, 66
	0.64mm	MULTILOCK	2.2 mm	3A	Rec/ Tab	Yes	NA		Yes	Yes	Interior Lighting, Seat Connectors, Radio Applications, Mirror, Anti-theft Devices, Instrument Cluster, Airbag, Speed Control Unit, Engine/Powertrain Control Unit, HVAC, Door and Body Control Modules, Blackbox Applications	Through Hole	180°	7A	6 to 147
	0.64mm	TH/.025	2.2 mm	5A	Rec/ Tab	Yes	Yes	2 to 40	Yes	Yes	W2W, W2B & ECU Applications - Mirror, Multimedia, Display Screens, Airbag ECU/Safety Applications, Switches, Handfree Cell Phone, Immobilizer, Dashboard, Safety, Electrically Controlled Trunk Lid Latch, Tire Pressure Monitoring System, Body Controller Management, Display and Audio Modules	Through Hole/ Pin-in Paste/ SMD	90° & 180°	5A	4 to 75
	1.0mm	MULTILOCK	2.5 mm	5A	Rec/ Tab	Yes	NA	2 to 104	Yes	Yes	Interior Lighting, Seat Connectors, Radio Applications, Mirror, Anti-Theft Devices, Instrument Cluster, Airbag, Speed Control Unit, Engine/Powertrain Control Unit, HVAC, Door and Body Control Modules, Blackbox Applications	Through-Hole	90° & 180°	5A	2 - 122
Low Power	1.2mm	MCON	2.5 mm	17A	Rec/ Tab	Yes	Yes	2 to 12	Yes	Yes	Suspension Control, Transmission Control, Window/Roof Motors, Signal/Sensing applications in engine bay, Exhaust System, Wheels, Lighting, 48V Applications (AC compressor, Starter, Active Stabilization, Electronic Power Steering, Braking System, Catalytic Converter, Start/Stop/Heated Seats), Low Voltage inline Connector Systems (Primary Body Harness, Rear Axle Harness, Door Harness, Headlight Cable Harness, Interior Lighting Harness, Bumper Harness), Next Gen E/E Architectures	Through Hole/ Press-Fit	90°	12A	5
	1.2mm	HPF	2.5 mm	17A	Rec	Yes	Yes	2 to 5	Yes	No	Engine Bay/High Vibration Connector Applications (Position Sensors, Ignition Coils, Coolant/Oil Temp Sensors, Valves and Actuators, High Pressure Field Injectors)	NA	NA	NA	NA
	1.5mm	AMP MCP	4 mm	18A	Rec	Yes	Yes	3 to 14	Yes	Yes	Suited for Harsh Environment Applications requiring support in Vibration, Elevated Temperatures, High-Currant Capabilities, W2W, W2B & W2D	Through Hole	90° & 180°	18A	36 - 92
	1.5mm	MQS	2.54 mm	10A	Rec/Tab	Yes	Yes	6 to 94	Yes	Yes	HVAC, Headlights, Steering Wheel, Door Harness, Main Harness, Airbag, Engine/Zonal Control Unit, ADAS, Battery Pack, ABS Sensors and Controllers, Autopilot modules, Power Seat Motor Controllers, Battery Back-Up Systems, Refrigeration Units, Bus & Truck Applications, Motorcycle Low Current Applications, Marine Low Current Applications.	Press-Fit	90° & 180°	15A	2 to 116
	1.5mm	SUPERSEAL	2.54 mm	14A	Tab	Yes	No	1 to 6	Yes	No	W2W and ECU Applications, Under Hood / Engine Mounting or any Location where sealing is required.	NA	NA	NA	NA
	1.8mm	MULTILOCK	3.5 mm	10A	Rec/Tab	Yes	Yes	2 to 42	Yes	Yes	Interior Lighting, Seat Connectors, Radio Applications, Mirror, Anti-theft Devices, Instrument Cluster, Airbag, Speed Control Unit, Engine/Powertrain Control Unit, HVAC, Door and Body Control Modules, Blackbox Applications	Through Hole	90° & 180°	10A	20 - 30
	2.3mm	MULTILOCK	3.5 mm	15A	Rec/Tab	Yes	No	1 to 76	yes	Yes		Through Hole	180°	16A	16
	2.8mm	MPQ	5 mm	26A	Rec/Tab	Yes	No	2 to 5	Yes	Yes	Headlight Driver Module, Anti-lock Braking Controllers, Vehicle Stability Sensors, Instrument Cluster, Electronic Power Steering, Power Lift Gate, Humidity Sensor Connector, Power Seat Motor Connectors, Roof/Visor/ Lighting Harness	NA	NA	NA	NA
	2.8mm	AMP MCP	5 mm	40A	Rec	Yes	Yes	1 to 69	Yes	Yes	Suited for Harsh Environment applications requiring support in Vibration, Elevated Temperatures, High-Currant Capabilities, W2W, W2B & W2D	Through Hole	90° & 180°	40A	4-16
	2.8mm	Timer	5 mm	23A	Rec/ Tab	Yes	Yes	1 to 102	Yes	Yes	Mirrors, Seat Connectors, Power Lift Gate, Radio, Electronic Power Steering, Engine/Powertrain Control Unit, HVAC, Door and Body Control Modules, Main/Door Harness, Transmission Control Unit, Wind Turbine Boards, Automation Control Equipment, Air Compressors, Refrigeration, Motion Control, Appliances	Through Hole	90° & 180°	23A	4 - 69
	5.2mm	MQS	5.5 mm	37A	Rec/Tab	Yes	No				Ventilation System (HVAC), Headlights, Engine, Steering Wheel, ADAS, Door Harness, Main Harness, Airbag, Engine/Zone Control Unit	NA	NA	NA	NA
	6.3mm	NG	11.6 mm	45A	Rec/ Tab	No	No	1 to 5	Yes	No	Protection and Switching Box, Fan Cooling, Fuse and Relay Holder, Electric Pump, Electric Power Steering, Additional Heating (PTC), Enine Power Supply Unit	Through Hole	180°	52A	2
	6.3mm	AMP MCP	8 mm (unsealed)	52A	Rec/ Tab	Yes	Yes	2 to 4	Yes	Yes	Suited for Harsh Environment Applications requiring support in Vibration, Elevated Temperatures, High-Currant Capabilities, W2W, W2B & W2D	Pannel Mount	180°	52A	5
	6.3mm	Timer	7.5 mm	33A	Rec/ Tab	Yes	Yes	2 to 26	Yes	Yes	Mirrors, Seat Connectors, Power Lift Gate, Radio, Electronic Power Steering, Engine/Powertrain Control Unit, HVAC, Door and Body Control Modules, Main/Door Harness, Transmission Control Unit, Wind Turbine Boards, Automation Control Equipment, Air Compressors, Refrigeration, Motion Control, Appliances	NA	NA	NA	NA
Medium Power	8mm	MCON	15.7 mm	109A	Rec	Yes	Yes	1	Yes	No	Suspension Control, Transmission Control, Window/Roof Motors, Signal/Sensing applications in Engine Bay, Exhaust System, Wheels, Lighting, 48V Applications (AC compressor, Starter, Active Stabilization, Electronic Power Steering, Braking System, Catalytic Converter, Start/Stop/Heated Seats), Low voltage inline Connector Systems (primary Body Harness, Rear Axle Harness, Door Harness, Headlight Cable Harness, Interior Lighting Harness, Bumper Harness), Next Gen E/E Architectures	NA	NA	NA	NA
	8mm	NG	8.4 mm	90A	Rec/ Tab	Yes	No	1 to 2	Yes	No	Protection and Switching Box, Fan Cooling, Fuse and Relay Holder, Electric Pump, Electric Power Steering, Additional Heating (PTC), Enine Power Supply Unit	NA	NA	NA	NA
	9.5mm	AMP MCP	12.5 mm (unsealed)/ 16.5 mm (sealed)	78A	Rec/ Tab	Yes	Yes	1 to 2	Yes	No	Suited for Harsh Environment Applications requiring support in Vibration, Elevated Temperatures, High-Currant Capabilities, W2W, W2B & W2D	NA	NA	NA	NA
	9.5mm	Timer	11.5 mm	55A	Rec/ Tab	Yes	No	1 to 102	Yes	No	Mirrors, Seat Connectors, Power Lift Gate, Radio, Electronic Power Steering, Engine/Powertrain Control Unit, HVAC, Door and Body Control Modules, Main/Door Harness, Transmission Control Unit, Wind Turbine Boards, Automation Control Equipment, Air Compressors, Refrigeration, Motion Control,	Through-Hole	90° & 180°	78A	2 – 6
	9.5mm	MCON	16.5 mm	78A	Rec/ Tab	Yes	Yes	4	Yes	Yes	Suspension Control, Transmission Control, Window/Roof Motors, Signal/Sensing Applications in Engine Bay, Exhaust System, Wheels, Lighting, 48V Applications (AC Compressor, Starter, Active Stabilization, Electronic Power Steering, Braking System, Catalytic Converter, Start/Stop/Heated Seats), Low Voltage Inline Connector Systems (Primary Body Harness, Rear Axle Harness, Door Harness, Headlight Cable Harness, Interior Lighting Harness, Bumper Harness), Next Gen E/E Architectures	Through-Hole	180° & Inclined (170°)	60-75A	2 – 3
	12mm	MCON	15.7 mm	179A	Rec/ Tab	Yes	Yes	2	Yes	Yes	Suspension Control, Transmission Control, Window/Roof Motors, Signal/Sensing Applications in Engine Bay, Exhaust System, Wheels, Lighting, 48V Applications (AC compressor, Starter, Active Stabilization, Electronic Power Steering, Braking System, Catalytic Converter, Start/Stop/Heated Seats), Low Voltage Inline Connector Systems (Primary Body Harness, Rear Axle Harness, Door Harness, Headlight Cable Harness, Interior Lighting Harness, Bumper Harness), Next Gen E/E Architectures	NA	NA	NA	NA

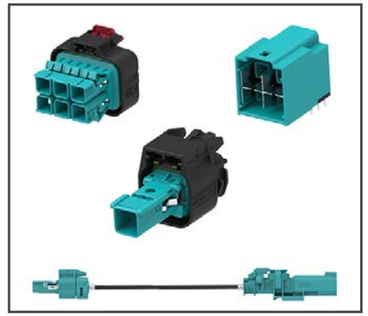

BODY AND CHASSIS
• Door Control Modules
• Body Control Modules
• Main /Door Harness
• Headlight Driver Module Applications
• RF Hub & Gateway Modules
POWERTRAIN
• Transmission Control Module
• Engine Control Unit
BATTERY (HV/LV)
• Battery Management (BMS)
ADAS
• Antenna and Camera
• High Speed Data
• Night Vision
• Lane Assist
• Surround View
INFOTAINMENT AND INTERIOR
• Roof/Visor/ Lighting Harness
• Mirror Applications
• Power Seat Motor Connectors
• Power Lift Gate Applications
• Humidity Sensor Connector
• Radio Applications
• Infotainment Display
SAFETY
• Electronic Power Steering
• Instrument Cluster Hazard Switch
• Airbag Applications
• Anti-lock Braking Controllers
• Vehicle Stability Sensors
HVAC
• Control Units
• Aggregates Harness
• HV Heater
• Climate Control Module

DATA CONNECTIVITY SYSTEMS

TE's data connectivity has extensive coaxial, differential and hybrid portfolio for current and next generation applications. Designed to meet the increasing performance demands of autonomous driving, connected vehicle and user experience, TE's data connectivity products have automotive grade robustness for lifetime performance with the data transmission up to 56 Gbps. In addition to that, TE's data connectivity have miniaturized, multi-hybrid and customized products and solutions to enable enhanced mobility experiences.







Data Connectivity Systems

Data Connectivity Systems													
	Product Family	Media	Bandwidth	Transmission Speed	Protocols	Sealed Available	Female Housing	Male Housing	Orientation	CPA Available	Headers	Header Orientations	Example Applications
Coaxial	MATE-AX	Coaxial	9 GHz	12 Gbps (NRZ), 24Gbps (PAM4)	SerDes: GMSL2/3, FPD-Link IV, APIX3, MIPI; analog (antennas)	Yes	1,2,4 ports	1,2,4 ports	90° / 180°	Yes	1,2,4	90° / 180°	• Cameras: Surround View, Lane Assist, High Beam Assist, Blind Spot Detection, Traffic Sign Recognition, Rear View, Driver Monitoring, Gesture Control, Night Vision, Mirror Replacement • Antennas: 4G, LTE, Smart 5G, Keyless entry, remote parking, Bluetooth, WLAN (Hotspot), V2X, DSRC, C-V2X
	FAKRA	Coaxial	6 GHz	6 Gbps	SerDes: GMSL2/3, APIX3, MIPI, analog (antennas)	Yes	1,2 ports	1,2 ports	90° / 180°	Yes	1,2	90° / 180°	• Autonomous driving: 4KADCAM, Night Vision, e-Mirror, Lane Assist, front view cameras, interior cameras, surrounding cameras, rear-view cameras • Connected vehicle: TCU, 4G/5G, V2X, Bluetooth Low Energy, Wi-Fi/ Bluetooth, GPS/GNSS, SDARS • Infotainment: FM, DAB, Gesture
	Camera Connectivity	Coaxial	6 GHz	6 Gbps	FPD-Link III/IV, GMSL, 2/3, MIPI, ASA, GVIF				90° / 180°				Front Camera (Mono Camera / Stereo Camera) Satellite camera (Remote / surrounding Camera) Interior Camera
Differential	HSD differential connector system	Star Quad Wire	2 GHz	6 Gbps	SerDes: GMSL1, FPDIII, APIX2, USB 2.0	Yes	1,2,4 ports	1,2,4 ports	90° / 180°	yes	1,2	90° / 180°	Head units Cameras Displays & head-up displays Instrument clusters Rear seat entertainment
	MATEnet	Twisted pair	1 GHz	1 Gbps	**Automotive Ethernet:** 100BASE-T1, 1000BASE-T1 **Others:** A2B, HDBaseT	Yes	1,2,3,4,5,6 ports	1,2,3,4,5,6 ports	90° / 180°	Yes	1,2,3,4,5,6 ports	90° / 180°	**Autonomous Driving** LiDARs Radars **Connected vehicle** High performance computer Domain ECU (ADAS, infotainment) Zonal controller **Infotainment** 4K Displays
	GEMnet	Twisted pair	15GHz	Up to 56 Gbps	**Automotive Ethernet:** 100BASE-T1, 1000BASE-T1, 2.5/5/10GBASE-T1 **SerDes:** GMSL, APIX, GVIF, FPD-Link, ASA Motion Link, MiPi, HDBase-T **Others:** USB, PCIe	Yes	1, 2, 4, 6 port	1, 2, 4, 6 port	90° / 180°	Yes	1, 2, 4, 6 port	90° / 180°	**Autonomous Driving** LiDARs Radars **Connected vehicle** High performance computer Domain ECU (ADAS, infotainment) Zonal controller **Infotainment** 4K Displays; 8K/High-resolution displays USB

E-MOBILITY

It's an exciting time to be in the automotive industry! Electric vehicles have gone mainstream, offering faster acceleration, instant torque, and an improved driving experience. But the intricacies of electrification make product design inherently more complex.

Don't go it alone. TE Connectivity (TE) has been one of the leaders in the electrification charge since the beginning. We work with virtually every automotive OEM and tier-one supplier around the world to build high-voltage connectivity solutions that are the electrical foundation for safe and reliable zero-emission cars. TE achieves this at scale by making the deep domain knowledge of our more than 2,000 automotive engineers available to you. Together, we can create a better future for generations to come.

Our products cover nearly the complete spectrum of EV energy transfer, providing safe, reliable, durable, and efficient electrical systems connectivity that meets the increased power ratings and higher thermal and vibration requirements that design engineers demand.

E-mobility

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	Product Family	**Position**	**Terminal Size**	**Wire size**	**Wire Type**	**Voltage Rating**	**Continuous Current at 85° C**	**Shielding/ EMC Resistance**	**Features**	**Applications**
Interconnection Systems	HVA 280	2-position	AMP MCP 2.8 mm, Crimped	2 mm^2 to 4 mm^2	Single-core or multi-core copper	600 to 1000 VDC	40 A (4 mm^2)	Shielded, 10 µΩ	HVIL, CPA, HB, USCAR-2 V1, LV 215-1 SG 2, IP67, IP6K9K, Automation ready	• DC-to-DC Converter • HV Heating Unit or Heat Pump • HV Air Conditioner Compressor • Onboard Charger
	HVA 280	3-position	AMP MCP 2.8 mm, Crimped	2 mm^2 to 4 mm^2	Multi-core copper	850 VDC	40 A (4 mm^2)	Shielded, 10 µΩ	HB, USCAR-2 V1, LV 215-1 SG 2, IP67, IP6K9K, Automation ready	• DC-to-DC Converter • HV Heating Unit or Heat Pump • HV Air Conditioner Compressor • Onboard Charger
	HVA 280	2-position	AMP MCP 2.8 mm, Crimped	2 mm^2 to 4 mm^2	Single-core copper	1000 VDC	40 A (4 mm^2)	Unshielded	CPA, HB, LV 215-1 SG 3, IP67, IP6K9K, Automation ready	• DC-to-DC Converter • HV Heating Unit or Heat Pump • HV Air Conditioner Compressor • Onboard Charger
	HVA 630	2-position & 5-position	AMP MCP 6.3mm	2.5 mm^2-6 mm^2	Single-core or multi-core copper	850 V	up to 40 A (6 mm^2)	Shielded 10µΩ	IP67, IP6K9K, IP2xb, LV215-1, RoHS	• xEV high-voltage auxiliary systems
	HC-STAK 25	2-position	2.5 mm double-ended forks	25, 35, or 50 mm	Single-Core / Copper & Aluminum	1000 VDC	247A (50 mm^2)	Shielded	IP6K7, IP6K9K, IP2XB, USCAR-2 Class V1	Fully electric, hybrid, and plug-in hybrid vehicle drivetrains: • HV battery to inverter • Power distribution to e-motor
EVC High-Voltage Contactors	**Product Family**	**Voltage Rating**	**Continuous Current**	**Wire Size**	**Breaking Capability**	**Short Circuit Capability**				**Applications**
	Mini K HV Precharge Relay	450 VDC	20A	Plug-in or PCB	20 A	200A				• Pre-charge state (car in charge mode)
	EVC 80	450 VDC	80A	Plug-in	400A	900A				• Auxiliary load systems (high-voltage, low-current)
	EVC 135	450 VDC	135A	35 mm^2	700A	2000A				• Main drivetrain circuit (traction path)
	EVC 175 P	450 VDC	200A	50 mm^2	1500A	5000A				• Main drivetrain circuit (traction path)
	EVC 175	450 VDC	330A	100 mm^2	1500A	5000A				• Main drivetrain circuit (traction path)
	EVC 250	450 VDC	340A	101 mm^2	2000A	6000A				• Main drivetrain circuit (traction path)
	EVC 250-800	800 VDC	340A	102 mm^2	700A	6000A				• Main drivetrain circuit (traction path -- 800-volt architectures)
	EVC 500	450 VDC	500A	214 mm^2	1500A	3500A				• Main drivetrain circuit (traction path)
	EVC 500 L	450 VDC	500A	214 mm^2	1500A	3500A				• Main drivetrain circuit (traction path)
AMP+ Automotive Charging Inlets	**Product Family**	**AC Current Max**	**AC Voltage Max**	**AC Charge Power Max**	**DC Current Max**	**DC Voltage Max**	**DC Charge Power Max**			**Applications**
	CI 32 Series: Type 1 Americas/ Japan/ Korea	48A	250V	12 kW						• AC-only charging (in-home), Americas, Japan, Korea
	CI 32 Series: Type 2 Europe/ ROW	32A	480V / 250V	22 kW						• AC-only charging (in-home), Europe, ROW
	CI 200 Series: CCS Type 1 Americas / Korea	48 A	250 V	22 kW	200 A	600 V	120 kW			• AC charging (in-home) and DC fast charging (at publicly available charging stations), Americas, Korea
	CI 200 Series: CCS Type 2 Europe / ROW	32 A	480 V / 250 V	22 kW	200 A	1000 V	200 kW			• AC charging (in-home) and DC fast charging (at publicly available charging stations), Europe, ROW
High-Voltage Terminals	**Product Family**	**AC Current Max**	**AC Voltage Max**	**AC Charge Power Max**	**Terminal Size**	**Terminal Style / Shape**	**Vibration Rating**	**Mating Directions Available**		**Applications**
	PCON 12 Terminals	1000 VDC	114 A	5 to 16 mm^2	12 mm x 1.2 mm	Flat receptacle, crimped	LV215 SG2 USCAR-37 V1	90° / 180°		• Auxiliary load systems (high-voltage, low- to medium-current
	PCON 18 Terminals	1000 VDC	200 A	12 to 35 mm^2	18 mm x 1.8 mm	Flat receptacle, crimped	LV215 SG2 USCAR-37 V1	90° / 180°		• Main drivetrain circuit (traction path)
	PCON 21 Terminals	1000 VDC	372 A	25 to 95 mm^2	21 mm x 3.0 mm	Flat receptacle, crimped	LV215 SG2 USCAR-37 V1	90° / 180°		• Main drivetrain circuit (traction path)

PERFORMANCE MATERIALS

Heat Shrink Tubing Solutions :
TE's heat-shrink products are in service throughout the world in automotive, telecommunications, power distribution, aerospace, defence, industrial and commercial applications. Produced using state-of-the-art manufacturing facilities and processes. TE's tubing products are made from uniquely formulated materials that have been enhanced by radiation crosslinking. These easy-to-use products provide cost effective, proven solutions in a wide range of automotive applications from sealing and protecting electrical splices to providing mechanical protection for fluid management systems in harsh environments.

The single wall tubing products have a wide range of characteristics. They can be used wherever reliable insulation, strain relief and protection from mechanical abrasion and chemical abuse is needed. They are a suitable way to identify or code components or simply use them to enhance aesthetics.

The adhesive-lined range shows its strength where sealing and encapsulation are critical requirements, as well as demonstrating many of the features of the single wall products. The inner adhesive can deliver a true seal against moisture and fluid ingress.

VOLINSU tubing line provides cable termination insulation, wire grouping and jacketing, battery pack sealing and protection for systems up to 2500V.

Heat Shrink Tubing - 6 Key Functionalities

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Single Wall	CGPE-105	-70 to 105 [-40 to 257]	Black 110 [230]; All Others 100 [212]	2:1	Flexible, brightly colored, non-flame-retardant polyolefin tubing	Bright, shiny appearance; UV resistance; clear offers exceptional clarity. Easily hot stamped.	1.2 to 50.8 [0.046 to 2.000]	Black, white, clear, red, blue, yellow, green and violet	CGPE-105 SCD	N/A	Insulation and protection of components and wires. Color-coding and identification. Clear tubing is well-suited for protecting marked surfaces.	Americas Asia Pacific
	CGPT	-40 to 135 [-40 to 275]	120 [248]	2:1 3:1	Single wall, flame-retardant polyolefin tubing	Tough and flexible with good chemical resistance. Flame-retardant (except clear).	2:1: 1.2 to 102.0 [0.046 to 4.016] 3:1: 1.5 to 39.0 [0.059 to 1.540]	Standard: Black, white, red, blue, yellow, brown, gray, clear (nonflame-retardant), yellow/green (limited size range); Nonstandard: Orange, green, violet (2: 1 sizes 1.2 through 51.0 only)	RW-2059, UL 224/CSA	ASTM D2671, Procedure B (not clear)	Suitable for a wide range of applications including electrical insulation, strain relief, able bundling, color-coding, and mechanical protection.	Europe Asia Pacific
	CRN	-55 to 135 [-67 to 275]	135 [275]	2:1	Semirigid polyolefin tubing	High abrasion resistance. Transfers flex stress away from typically weak points. Excellent chemical and solvent resistance properties.	1.2 to 19.1 [0.046 to 0.750]	Standard: Black; Nonstandard: Clear	RT-360; AS23053/6, Cl. 1 & 2; UL 224/CSA (Black only, sizes 1/8 through 3/4)	ASTM D2671, Proc. B (Black only); UL 224/CSA All Tubing Flame Test (Black only)	Strain relief, insulation and mechanical protection of soldered or crimped connections, wire splices and terminations.	Americas Europe Asia Pacific
	DCPT	-55 to 135 [-67 to 275]	120 [248]	2:1 3:1	Flexible, flame-retardant, dualcolor polyolefin tubing	Dual colors (yellow/green) for instant identification. Color permanence that exceeds to conventional ink marking.	2:1: 3.0 to 51.0 [0.118 to 2.000]; 3:1: 3.0 to 39.0 [0.118 to 1.535]	Yellow/green stripe	RW-2056; UL 224/CSA	UL 224/CSA All Tubing Flame Test	Identification of ground on wires and cables.	Americas Europe Asia Pacific
	LSTT	-40 to 125 [-40 to 257]	110 [230]	2:1	Low-shrink-temperature single wall, non-flame-retardant polyolefin tubing	Low shrink temperature for fast recovery. Meets FMVSS 302 standard for flammability. Flexible.	1.6 to 52.0 [0.063 to 2.047]	Standard: Black, red, blue, yellow; Nonstandard: Green, gray, white, clear	RW-2051	FMVSS 302	Electrical insulation, color-coding, covering of temperature-sensitive devices, cosmetic coverings and mechanical protection.	Europe Asia Pacific
	NETM 1000/ NETM 2000	NETM1000 -55 to 135 [-67 to 275]; NETM2000 -55 to 150 [-67 to 302]	N/A	N/A	Cross-linked, non-heatshrinkable, flame-retardant	NETM1000 is more flexible allowing it to be easily routed through tight spaces. NETM2000 has greater mechanical strength and abrasion resistance.	NETM1000: 3.0 to 14.0 [0.118 to 0.551]; NETM2000: 6.0 to 12.0 [0.236 to 0.500]	Black	NETM1000 SCD NETM2000 SCD	NETM1000: ASTM D2671, Proc. C	Bundling and routing of wires in automotive applications.	Americas Europe Asia Pacific
	RNF-100	-55 to 135 [-67 to 275]	121 [250]	2:1	Flexible, flame-retardant, general purpose polyolefin tubing	Offers advanced abrasion and solvent resistance relative to many polyolefin tubings.	1.2 to 127.0 [0.046 to 5.000]	Standard: Black (all sizes); White, blue, yellow, and clear (sizes 3/64 through 3); Nonstandard: White, red, blue, yellow, and clear (sizes 4 and 5); Brown, green, violet, orange and gray (all sizes)	RT-350, RK-6001; AS23053/5, Cl. 1 & 2, Def. Stan. 59-97 Type 2B (Colors only), VG 95343 Pt 5 Type B (Clear only); UL 224/CSA (Colors only)	ASTM D2671, Proc. B (Colors only); UL 224/CSA All Tubing Flame Test (Colors only)	Insulation and strain relief of wire terminations and connections. Jacketing wire bundles and harnesses where superior abrasion resistance is a plus. Color-coding and identification. Protection of wire markers (clear).	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Single Wall	RNF-3000	-55 to 135 [-67 to 275]	120 [248]	3:1	Flexible, high-shrink-ratio, flame-retardant, general purpose polyolefin tubing	3:1 shrink ratio easily accommodates irregular shapes. Few sizes cover a wide range of diameters. Flame-retardant (Colors only).	1.5 to 39.0 [0.060 to 1.534]	Standard: Black (All Regions); White, red, blue, yellow, and clear (non-flame-retardant) (EMEA only); Nonstandard: Green, violet, and gray (all Regions)	RW-2053; UL 224/CSA	UL 224/CSA All Tubing Flame Test (Colors only)	Insulation and strain relief of wire terminations and electrical connections. Electrical and mechanical protection of components with irregular dimensions.	Americas Europe Asia Pacific
	RP-4800	-55 to 135 [-67 to 275]	121 [250]	4:1	Flexible, high-shrink-ratio, flameretardant polyolefin tubing	Conforms well to highly variable substrate dimensions. Excellent physical, chemical and electrical properties.	19.1 to 114.3 [0.750 to 4.500]	Standard: Black; Nonstandard: White, red, blue, yellow, green, brown, orange, violet, and gray	RT-1112; AS23053/5, Cl.1 Overexpanded; UL 224 (Black only)	ASTM D2671, Proc. B, UL 224/CSA All Tubing Flame Test (Black only)	Repair of harness and cable jackets; will pass over large-diameter connectors or transitions then shrink tightly on harnesses and cables. Provides abrasion and fluid resistance required in many harness applications.	Americas Europe Asia Pacific
	RT-3	-55 to 135 [-67 to 275]	135 [275]	2.5:1	Semirigid, flame-retardant polyolefin tubing	Excellent mechanical properties; transfers flex stress away from typically weak points. Tightly controlled expanded diameters; well suited for semiautomated installation.	6.1 to 12.3 [0.240 to 0.485]	Black	RT-360; UL 224/ CSA	UL 224/CSA All Tubing Flame Test	Strain relief, insulation and mechanical protection of soldered or crimped connections, wire splices and terminations. Mechanical protection of delicate components.	Americas Europe Asia Pacific
	TUGA-GP	-55 to 125 [-67 to 275]	110 [230]	2:1	Single wall, non-flame-retardant polyolefin tubing	Glossy finish. Semiflexible, non-flame-retardant and halogen-free. Easily hot stamped.	1.2 to 38.0 [0.046 to 1.496]	Black	RW-2201	FMVSS 302	Electrical insulation, mechanical protection and beautification.	Europe Asia Pacific
	RW-125	-55C to +150C (-67F to +302F)	150C (302F)	2:1	Single Wall, flame-resistant, moisture protection, flexible	2:1 shrink ratio, tough and flexible with excellent clarity and stability. High-temp performance with good chemical resistance	12.7 to 31.8 (0.500 to 1.25)	Clear	TEC 108-120005	ASTM D2671, Proc.C,	Agriculture LED lighting, lighting whip and antennas, interior and exterior use on everything from boats and vehicles to storage and safety area	Americas Europe Asia Pacific
	VERSAFIT	-55 to 135 [-67 to 275]	90 [194]	2:1	Highly flame-retardant, very flexible, low-shrink-temperature polyolefin tubing	Meets AS23053/5, Cl. 3 as well as UL 224 and CSA C22.2 No. 198.1 standards. UL 224/CSA VW-1 flame rating. Low shrink temperature for fast installation.	1.2 to 101.6 [0.046 to 4.000]	Standard: Black, white, red, blue, and yellow; Nonstandard: Brown, orange, green, violet and gray	RW-3009; AS23053/5, Cl. 1 & 3; UL 224/CSA VW-1	ASTM D2671, Proc. C; UL 224/CSA VW-1	Insulation and protection of in-line components, wire splices and terminations. Very flexible light-duty military and commercial harnessing. Use where a UL 224/ CSA VW-1 flame rating is needed. Use where rapid installation is desirable.	Americas Europe Asia Pacific
	VERSAFIT-3X	-55 to 135 [-67 to 275]	90 [194]	3:1	Highly flame-retardant, very flexible, high-shrink-ratio, lowshrink-temperature overexpanded polyolefin tubing	UL 224/CSA VW-1 flame rating. Low shrink temperature for fast installation. 3:1 shrink ratio easily accommodates irregular shapes. Few sizes cover a wide range of diameters.	3.2 to 25.4 [0.125 to 1.00]	Standard: Black; Nonstandard: White, red, blue, yellow, green, brown, orange, violet, and gray	RW-3009	RW-3009 UL 224/CSA VW-1	Insulation and protection of in-line components, wire splices and terminations. Very flexible light duty harnessing. Use where larger expansion ratio and UL 224/ CSA VW-1 rating are needed.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Single Wall	VERSAFIT V2	-30 to 125 [-22 to 257]	90 [194]	2:1	Highly flame-retardant, very flexible, low-shrink-temperature metric-sized polyolefin tubing	Many sizes to cover a wide variety of applications. UL 224/CSA VW-1 flame rating. Low shrink temperature for fast installation.	0.8 to 30.0 [0.032 to 1.181]	Standard: Black; Nonstandard: White, red, blue, yellow, green, brown, orange, violet, and gray	RW-3023; UL 224/CSA VW-1	UL 224/ CSA VW-1	Insulation and protection of in-line components, wire splices and terminations. Very flexible light-duty harnessing. Use where a UL 224/ CSA VW-1 flame rating is needed. Use where rapid installation is desirable	Americas Europe Asia Pacific
	VERSAFIT V4	-30 to 125 [-22 to 257]	90 [194]	2:1	Very-thin-wall, very flexible, highly flame-retardant, low-shrinktemperature imperial and metricsized polyolefin tubing	Very thin wall and low shrink temperature for fast installation and space savings. UL 224/CSA VW-1 flame rating.	Imperial: 1.2 to 25.4 [0.046 to 1.000]; Metric: 1.0 to 10.0 [0.039 to 0.394]	Standard: Black; other colors available upon request	RW-3023; UL 224/CSA VW-1	UL 224/ CSA VW-1	Insulation of in-line components, wire splices and terminations. Especially suited for covering temperature sensitive components and wires. Strain relief on high-density connectors.	Americas Europe Asia Pacific
Dual Wall	AP-2000	-40 to 80 [-40 to 176]	110 [230]	1.3:1 to 2.9:1	Flexible, adhesive-lined non-flame-retardant	Sized for use on specific standard sizes of metal pipe. Provides environmental and mechanical protection for automotive brake and fuel lines. Flexibility allows pipes to be bent after tubing has been installed.	6.0 to 30.0 [0.236 to 1.182]	Black	RW-1001	N/A	Protecting automotive brake and fuel lines from damage in areas exposed to mechanical abuse and moisture which can cause corrosion. Sized for use on specific standard sizes of metal pipe.	Americas Europe Asia Pacific
	ATUM	-55 to 110 [-67 to 230]	110 [230]	3:1 & 4:1	High-shrink-ratio, adhesive-lined polyolefin tubing	3:1 and 4:1 shrink ratios allow for connector-to-cable sealing. Medium wall provides increased mechanical protection. ATUM adhesive bonds to a wide variety of materials.	3:1: 3.0 to 40.0 [0.118 to 1.570]; 4:1: 4.0 to 52.0 [0.158 to 2.050]	Standard: Black; Nonstandard: Clear (non-flameretardant); other colors available upon request	RW-2063 (Black), RK-6024 (Clear and colors); AS23053/4, Cl. 3 (specific 3:1 sizes in Black only); UL 224 (Black only, except sizes 3/1 and 4/1)	ASTM D2671, Proc. B (Black only)	Sealing and protection of connector backshells, breakouts and connectorto- cable transitions. High shrink ratio allows for repair of damaged cable jackets without removing connectors.	Americas Europe Asia Pacific
	CGAT	-30 to 80 [-22 to 176]	115 [239]	3:1	Adhesive-lined, flexible polyolefin tubing	General purpose adhesive-lined tubing for the commercial marketplace. Offers good adhesive bonding to a variety of substrates to provide environmental sealing.	3.0 to 39.0 [0.118 to 1.535]	Black, Clear (non-flameretardant)	RW-2050	FMVSS 302	Environmental protection of electrical components. Sealing of wire breakouts and cable jackets.	Europe Asia Pacific
	DSPL	-40 to 125 [-40 to 257]	135 [275]	4:1	High-shrink-ratio, adhesive-lined semirigid polyolefin tubing	4:1 shrink ratio allows a few sizes to cover a wide range of applications. Excellent environmental sealing. Mechanically tough providing protection from flexing and abrasion. Flame-retardant (except clear).	5.7 to 17.5 [0.224 to 0.689]	Black, Clear (non-flameretardant)	RK-6755	ASTM D2671, Procedure B (Black only)	Environmental sealing, electrical insulation and mechanical protection of wire splices, terminals and other components.	Europe

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Dual Wall	DWFR	-40 to 110 [-40 to 230]	110 [230]	3:1 & 4:1	Highly flame-retardant, highshrink-ratio, adhesive-lined polyolefin tubing	UL 224 VW-1 flame rating. 3:1 and 4:1 shrink ratios allow for connector-to-cable sealing. Medium wall provides increased mechanical protection. DWFR adhesive bonds to a wide variety of materials.	3:1: 3.0 to 40.0 [0.118 to 1.570]; 4:1: 4.0 to 52.0 [0.158 to 2.050]	Black	DWFR SCD; UL 224 VW-1	UL 224 VW-1	Sealing and protection of connector backshells, breakouts and connectorto-cable transitions. High shrink ratio allows for repair of damaged cable jackets without removing connectors.	Americas Europe Asia Pacific
	DWP-125	-40 to 110 [-40 to 230]	125 [257]	3:1	Flexible, high-shrink-ratio, adhesive-lined polyolefin tubing	3:1 shrink ratio allows for insulation and sealing of irregular shapes. Medium wall provides increased mechanical protection while maintaining flexibility when installed. Adhesive bonds to a wide variety of materials.	3.2 to 50.8 [0.125 to 2.000]	Standard: Black; Nonstandard: White, red, blue, yellow, green and clear (non-flame-retardant); other colors available upon request	DWP-125 SCD; UL 224/CSA	UL 224/CSA All Tubing Flame Test (Colors only)	Sealing and protection of wire splices, break-outs and connector-to-cable transitions. Suited for applications where a UL recognized/CSA certified adhesive-lined tubing is required.	Americas Asia Pacific
	DWTC	-55 to 75 [-67 to 167]	100 [212]	4:1	Clear adhesive-lined polyolefin tubing	Limited number of sizes cover a full range of irregular shapes and widely varying dimensions. Clear tubing offers excellent clarity for protection of substrates needing inspection during service.	4.0 to 16.0 [0.157 to 0.630]	Clear	RK-6204	N/A	Environmental sealing of components where mechanical toughness or split resistance are needed.	Americas Europe Asia Pacific
	ES1000	-40 to 130 [-40 to 266]	135 [275]	4:1	Clear, high-shrink-ratio, adhesive-lined semirigid polyolefin tubing	4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters. Mechanically tough providing strain relief and abrasion protection.	5.72 to 17.78 [0.225 to 0.700]	Clear	RT-1113; UL 224	N/A	Specially designed for environmental sealing and electrical insulation of wire splices, terminations and components where see through inspection is required.	Americas Asia Pacific
	ES2000	-40 to 130 [-40 to 266]	135 [275]	4:1	Flame-retardant, high-shrinkratio, adhesive-lined semirigid polyolefin tubing	4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters. Flame-retardant and mechanically tough providing strain relief and abrasion protection.	5.72 to 17.78 [0.225 to 0.700]	Black	RT-1112; UL 224	ASTM D2671, Procedure B	Specially designed for environmental sealing and electrical insulation of wire splices, terminations and components.	Americas Asia Pacific
	FL2500	-40 to 135 [-40 to 275]	135 [275]	4:1	Fully flame-retardant, highshrink-ratio, adhesive-lined semirigid polyolefin tubing	4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters. Flame-retardant jacket and adhesive.	7.62 to 17.79 [0.300 to 0.700]	Black	FL2500 SCD	SAE J1128, Note 5	Fully flame-retardant and mechanically tough to provide strain relief and abrasion protection of wire splices, terminals, fuse links and in-line components.	Americas Europe Asia Pacific
	HTAT	-55 to 125 [-67 to 275]	110 [230]	4:1	Semiflexible, high-shrink-ratio, adhesive-lined polyolefin tubing	4:1 shrink ratio allows for connector-to-cable sealing. Medium wall provides increased mechanical protection. High-temperature adhesive forms a strong bond to a variety of materials.	4.0 to 48.0 [0.158 to 1.890]	Blackq	RW-2052	ASTM D2671, Procedure B	Sealing and protection of connector backshells, breakouts and connector-to-cable transitions at elevated temperatures. High shrink ratio allows HTAT to provide enhanced environmental protection to a wide range of shapes with irregular dimensions.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Dual Wall	QSZH	-40 to 125 [-40 to 257]	135 [275]	4:1	High-shrink-ratio, adhesivelined semirigid polyolefin tubing	4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters. Mechanically tough providing strain relief and abrasion protection. Seals quick for efficient installation. No added halogens.	5.75 to 18.3 [0.226 to 0.720]	Clear jacket, Black adhesive	RK-6771	N/A	Specially designed for environmental sealing and electrical insulation of wire splices, terminations and components.	Americas Europe Asia Pacific
	RBK - ILS	-40 to 125 [-40 to 257]	135 [275]	4:1	Flame-retardant, high-shrinkratio, adhesive-lined semirigid polyolefin tubing	4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters. Mechanically tough providing strain relief and abrasion protection. Flame retardant.	5.75 to 18.3 [0.226 to 0.720]	Black	RK-6638	ISO6722, Clause 4.5	Specially designed for environmental sealing and electrical insulation of wire splices, terminations and components.	Americas Europe Asia Pacific
	RBK - VWS	-40 to 125 [-40 to 257]	135 [275]	4:1	Clear, high-shrink-ratio, adhesive-lined semirigid polyolefin tubing	4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters. Mechanically tough providing strain relief and abrasion protection. Permits inspection of substrate after application.	5.70 to 17.78 [0.224 to 0.700]	Clear	RK-6640 (sizes 1-3) RT-1113 (size 4)	N/A	Specially designed for environmental sealing and electrical insulation of wire splices, terminations and components where seethrough inspection is required.	Americas Europe Asia Pacific
	RPPM	-40 to 85 [-40 to 185]	80 [176]	4:1	Flexible, low-shrinktemperature, adhesive-lined polyolefin tubin	Tough outer jacket offers excellent mechanical strength. High shrink ratio allows use on a range of substrate diameters. Black has a high gloss finish. Clear has excellent optical clarity allowing inspection of substrates after installation.	4.0 to 16.0 [0.157 to 0.630]	Black and Clear	RK-6214	N/A	Use the black for cosmetic applications where a high gloss finish is desired. Use the clear where optical clarity is desired for later inspection.	Americas Europe Asia Pacific
	SCL	-55 to 110 [-67 to 230]	135 [275]	3:1	Semirigid, encapsulant-lined polyolefin tubing	Splash-resistant, moisture-resistant covering. Provides rugged protection against abrasion, vibration and flexing.	3.2 to 25.4 [0.125 to 1.000]	Black plus one additional color per size (except 1)	RT-1301; AS23053/4, Cl. 1; UL 224	N/A	Encapsulation of components, splices and terminations where splash resistance and mechanical protection are required.	Americas Europe Asia Pacific
	SCT	-40 to 150 [-40 to 302]	135 [275]	4:1	Flame-retardant, adhesivelined semirigid polyolefin tubing (extended temperature range)	4:1 shrink ratio allows a few sizes to cover a wide range of splice and component diameters. Flame-retardant and mechanically tough. Adhesive wall forms a barrier against fluids and moisture at an extended temperature range.	7.6 to 17.8 [0.300 to 0.700]	Black	SCT SCD	ASTM D2671, Procedure B	Specially designed for insulation, strain relief and sealing of automotive wire splices and components in an underhood automotive environment.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Dual Wall	TAT-125	-55 to 110 [-67 to 230]	121 [250]	2:1	Flexible, adhesive-lined polyolefin tubing	Flexible adhesive lining and tubing jacket. Thin adhesive lining to seal simple constructions. Good mechanical strength and cut-through resistance. Adhesive bonds to a wide variety of materials.	3.2 to 101.6 [0.125 to 4.000]	Standard: Black; Nonstandard: White, red, blue, yellow, green, brown, orange, violet, gray, and clear (non-flame-retardant).	TAT-125 SCD; RW-3032; AS23053/4, Cl. 2; UL 224	ASTM D2671, Procedure B	Sealing and protection of simple in-line splices, bimetallic joints, and components from fluids, moisture, and corrosion. Repair damaged wire insulation, especially where flexibility is required.	Americas Asia Pacific
	TECT	-40 to 80 [-40 to +176]	135 [275]	3:1	Semiconductive, adhesivelined polyolefin tubing	Semi-conductive polyolefin jacket lined with semiconductive adhesive.	13.5 [0.531] One size only	Black	RW-2080	N/A	Electrical grounding of coated automotive fuel lines.	Europe
Heavy Duty	BSTS/ BSTS-FR	-55 to 90 [-67 to 194]	121 [250]	3:1	Rugged, thick wall, general purpose polyolefin tubing	Excellent thick wall insulation and abrasion protection. BSTS-FR is flame-retardant.	7.62 to 114.30 [0.300 to 4.500]	Standard: Black; Nonstandard: Red, white, and clear (non-flame-retardant)	RW-2017; ABS	ASTM D2671, Proc.C (Flame-retardant version only); ASTM D635	Used in demanding applications where insulation, abrasion resistance and strain relief are required. Resists moisture, fungus and weathering.	Americas Europe Asia Pacific
	HF	-55 to 90 [-67 to 194]	121 [250]	3:1	High-flex, heavy wall polyolefin tubing	Offers high flexibility. Provides excellent insulation and abrasion protection. Flame-retardant.	10.16 to 68.58 [0.400 to 2.700]	Black	RW-2023; ABS	ASTM D2671, Procedure C	Excellent for jacketing cables where sharp bends or turns are required. Also suited for applications where the cable is subject to motion.	Americas Europe Asia Pacific
	HRHF/ HRNF/ HRSR	-55 to 90 [-67 to 194]	121 [250]	5.6:1	High-ratio, durable heavy wall polyolefin tubing	Excellent insulation and abrasion protection. Available in flame-retardant material. Available with factory-applied sealants.	15.24 to 101.60 [0.600 to 4.000]	Standard: Black; Nonstandard: Clear (nonflame-retardant; HRHF only)	RW-2013; ABS	ASTM D2671, Procedure C (Flame-retardant version only)	Designed to accommodate large size differences between cable diameters and cable connectors and backshells to simplify cable repair and protection.	Americas Europe Asia Pacific
	HRHT	-55 to 135 [-67 to 275]	150 [302]	As high as 6:1	High-ratio, high-temperature polyolefin tubing	Shrink ratios as high as 6:1. Specially formulated for thick wall insulation, strain relief, and abrasion protection. Designed to conform to odd shapes and shrink over large transitions. Available with optional adhesive lining.	19.05 to 114.30 [0.750 to 4.500]	Black	HRHT SCD	ASTM D635	Recovery over odd shapes and large cable transitions. Sealing the back end of a connector or reparing the damaged outer insulation of a cable.	Americas Europe Asia Pacific
	RHW	-40 to 110 [-40 to 230]	125 [257]	4:1	Rugged, heavy wall, adhesive-lined polyolefin tubing	Highly resistant to impact, flexing and abrasion for increased product reliability. Resistant to chemicals, moisture and oils. Provides a moisture-proof seal to prevent corrosion. Halogen-free and UV resistant jacket.	12.0 to 390.0 [0.472 to 15.354]	Black	RHW SCD; UL 224 (sizes 12/3 through 70/20 only)	N/A	Insulation, protection and sealing of electrical connections and joints in low voltage cables. Combines maximum reliability and product performance with simplified installation.	Americas Europe Asia Pacific
	RMW	-40 to 110 [-40 to 230]	125 [257]	3:1	Medium wall, general purpose polyolefin tubing	Withstands mechanical abuse for increased product reliability. Highly resistant to impact and abrasion. Resistant to chemicals and moisture. Adhesive-lined version provides a moisture-proof seal to prevent corrosion.	10.0 to 180.0 [0.394 to 7.087]	Black	RMW SCD	N/A	Insulation and protection of cable joints as well as cable repair. Uncoated RMW provides insulation and strain relief. Adhesive-lined RMW also provides an environmental seal.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Heavy Duty	SST/ SST-FR	-55 to 90 [-67 to 194]	121 [250]	3:1	Thick wall, adhesive-lined polyolefin tubing	Thick wall insulation, strain relief and abrasion protection. Thick adhesive liner forms a barrier against fluids and moisture. SST-FR is flame-retardant.	7.62 to 114.30 [0.300 to 4.500]	Standard: Black; Nonstandard: Red, white, and clear (non-flameretardant)	RW-2011; AS23503/15, Cl. 1 and 2 (flame-retardant version with /97 coating only);	ASTM D2671, Proc. C (Flame-retardant version only)	Insulation, strain relief and sealing of splices in wire harnesses. Environmental protection in wet or underground applications.	Americas Europe Asia Pacific
	URHT	-55 to 135 [-67 to 275]	150 [302]	As high as 8:1	Ultra-high-ratio, flameretardant polyolefin tubing	Shrink ratios as high as 8:1. Specially formulated for thick wall insulation, strain relief, and abrasion protection. Designed to conform to odd shapes and shrink over large transitions. Optional adhesive lining provides environmental sealing.	50.8 to 76.2 [2.000 to 3.000]	Black	URHT SCD	ASTM D635	Recovery over odd shapes and large cable transitions. Sealing the back end of a connector or repairing the damaged outer insulation of a cable.	Americas Europe Asia Pacific
Special Purpose	DR-25	-75 to 150 [-103 to 302]	175 [347]	2:1	Flexible, chemical and abrasion resistant tubing	Long-term fluid and heat resistance. Resistance to aviation and diesel fuels, and hydraulic fluids. Flexible, flame-retardant.	3.2 to 76.0 [0.125 to 3.000]	Black	RT-1116, RK-6008/1; AS 23053/16, VG95343 Part 5 Type D, VDE 0341/ Pt 9005, Def. Stan. 59-97 Issue 3 type 6B,BS 4G-198 Part 3 10A	ASTM D2671, Procedure B	Particularly suitable as a jacketing material for cables and harnesses on military ground vehicles and race cars.	Americas Europe Asia Pacific
	ES Caps	-40 to 105 [-40 to 221]	135 [275]	4:1	High-shrink-ratio, adhesivelined semirigid polyolefin caps	4:1 shrink ratio allows a few sizes to cover a wide range of splice diameters. Mechanically tough jacket provides strain relief and abrasion protection. Flame-retardant jacket (black only).	5.72 to 10.85 [0.225 to 0.427]	Black and Clear (non-flame-retardant)	RW-3006; UL 224	ASTM D2671, Procedure B (Black only)	Specially designed to provide mechanical and environmental protection of stub splices in electrical harnesses. Clear caps allow see-through inspection.	Americas Europe Asia Pacific
	HCTE	-55 to 200 [-67 to 392]	N/A	N/A	Irradiated, modified ETFE helical convolex conduit	Helical construction with excellent flexibility and high crush resistance. Highly flame-retardant. Highly fluid resistant.	4.6 to 49.2 [0.181 to 1.937]		RT-1162; VG 96936 Part 6	ASTM D876	Mechanical protection for electrical wiring systems in applications requiring flexibility, high temperature performance, and good solvent resistance.	Americas Europe Asia Pacific
	HFT5000	-40 to 125 [-40 to 257] for 3,000 hours; -40 to 150 [-40 to 302] for 1,000 hours	110 [230]	2:1	Heat-shrinkable fabric tubing	Highly flexible for easy installation on a variety of substrates. Outstanding abrasion resistance over a wide temperature range. Heat-shrinkable to grip tightly. Resistant to harsh environments. Halogen-free.	12.0 to 100.0 [0.472 to 3.937]	Black	RW-2060; UL 224	FMVSS 302	Abrasion protection for rubber hoses, plastic pipes, and harness wire bundles. Provides outstanding abrasion, chafing and cut-through resistance even at high temperatures.	Americas Europe Asia Pacific
	HT-200	-70 to 200 [-94 to 392]	130 [266]	2:1	High-clarity, high flameresistant, very flexible fluoropolymer tubing	Very flexible, very thin wall insulation. Highly flame resistant. High temperature performance. Resistant to most solvents, fuels and chemicals. Clarity allows visual inspection of covered components such as downhole sensors.	1.2 to 25.4 [0.046 to 1.000]	Clear	RW-1200; AS 23053/18, Class 3	ATSM D2671, Procedure C	Insulation of delicate electrical connections and terminations. Allows visual inspection of terminations, connections and covered components such as sensors. Offers high temperature performance and advanced chemical and solvent resistance.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Special Purpose	NT-MIL	-70 to 121 [-94 to 250]	135 [275]	1.8:1	Flexible, rugged, modified elastomeric tubing	Remains flexible at temperatures as low as -70°C [-94°F]. Excellent resistance to abrasion and physical abuse. Resistant to most fluids and solvents, including fuels and oils.	3.2 to 101.6 [0.125 to 4.000]	Black	RW-3030; AS23053/1, Cl. 1 & 2	ASTM D2671, Procedure A	Insulation, strain relief and abrasion protection on cable harnesses and wire bundles in the military and aerospace industries. Applications requiring exposure to fluids and solvents.	Americas Europe Asia Pacific
	PD Caps	-55 to 110 [-67 to 230]	135 [275]	3:1	Semirigid, encapsulant-lined polyolefin caps	End cap with meltable encapsulant inner wall for splash resistance. Permanent or temporary method to terminate wires.	3.2 to 12.7 [0.125 to 0.500]	Black	PD Caps SCD; UL 224	ASTM D635	Insulation and encapsulation of crimped electrical connections, especially stub splices, providing rugged protection against abrasion, vibration and flexing.	Americas Europe Asia Pacific
	RayBlock 85	-40 to 85 [-40 to 185]	110 [230]	4:1	Heat-shrinkable water blocking system	Environmentally seals and provides strain relief to wire bundles of up to 20 wires. Withstands excursions to 105°C [221°F].	12.0 to 32.0 [0.472 to 1.260]	Black	RayBlock 85 SCD; RW-2101	N/A	Sealing of cable bundles and the back of connectors.	Americas Europe Asia Pacific
	RayBlock 105	-40 to 105 [-40 to 221]	110 [230]	4:1	High-temperature heat-shrinkable water blocking system	Environmentally seals and provides strain relief to wire bundles of up to 20 wires. Withstands excursions to 120°C [248°F].	12.0 to 32.0 [0.472 to 1.260	Black	RayBlock 105 SCD; RW-2102	N/A	Sealing of cable bundles and the back of connectors.	Americas Europe Asia Pacific
	Rayrim	-67 to 80 [-40 to 176]	150 [302]	N/A	Commercial protective self adhering, Vshaped polyolefin edging material	Flexible and self-adhering to allow for protection of curved and straight edges. Rapid installation to both internal and external radii. Operating temperature range offers protection in demanding environments.	5 sizes to cover thicknesses 0.31 to 5.38 [0.012 to 0.212]	Black	RK-6182	N/A	Protection of metal, wood and glass edges.	Americas Europe Asia Pacific
	RaySpool	See individual product families	See individual product families	2:1 & 3:1	CGPT (2:1 & 3:1), LSTT and CGAT	Selected heat-shrinkable tubings supplied in a convenient dispensing system.	See individual product families	See individual product families	See individual product families	See individual product families	See individual product families.	Europe Asia Pacific
	RNF-150	-55 to 150 [-67 to 302]	150 [302]	2:1	High-performance, flame-resistant, flexible fluoropolymer tubing	Thinner wall than most general purpose polyolefin tubings. Highly flameresistant. Excellent physical and electrical properties after exposure to many chemicals and solvents at 50°C [122°F].	1.2 to 25.4 [0.046 to 1.000]	Standard: Black; Nonstandard: White	RT-370; AS23053/18, Cl. 2; UL 224 VW-1	ASTM D2671, Proc. C; UL 224 VW-1	Jacketing and bundling wires to form light-duty harnesses, especially where a low profile, abrasion resistance, and flexibility are needed. Insulation and strain relief of electrical connections and wire terminations.	Americas Europe Asia Pacific
	RT-375	-55 to 150 [-67 to 302]	150 [302]	2:1	Clear, flame-resistant, flexible fluoropolymer tubing	Exceptional clarity and clarity stability. Highly flame-resistant. Toughness, chemical resistance, and high temperature performance.	1.2 to 50.8 [0.046 to 2.000]	Clear	RT-375; AS23053/18, Cl. 2; UL 224/ CSA VW-1	ASTM D2671, Proc. C; UL 224/CSA VW-1	Protection of components and wire markers subject to extreme abuse while permitting full identification and inspection.	Americas Europe Asia Pacific
	RT555	-65 to 200 [-85 to 392]	220 [428]	2:1	Fluid-resistant, chemicalresistant, fluoropolymer tubing with extended temperature range	Resistant to high temperatures, solvents, corrosive chemicals, hydrocarbons, and radiation. Highly flame-retardant. Low outgassing	3.2 to 50.8 [0.125 to 2.000]	Black	RT-555; AR70-75; UL 224	ASTM D2671, Procedure C	Applications requiring resistance to high temperatures and resistance to a variety of chemicals and fluids. Insulation and strain relief on appliances. Protection of delicate electronic instruments.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Special Purpose	RW-175	-55 to 175 [-67 to 347]	175 [347]	2:1	High-temperature, chemicalresistant polyvinylidene fluoride tubing	Tough, semirigid, very thin wall insulation. Highly flame-resistant. High temperature performance. Resistant to most solvents, fuels, and chemicals.	1.2 to 50.8 [0.046 to 2.000]	Standard: Translucent; Nonstandard: Black	RW-3029/2; AS23053/8 (Translucent only); UL 224/CSA VW-1	ASTM D2671, Proc. C; UL 224/ CSA VW-1	Insulation and strain relief of delicate electrical connections and terminations. Offers high temperature performance, outstanding abrasion and cut-through resistance, and superior chemical and solvent resistance.	Americas Europe Asia Pacific
	RW-175-E	-55 to 175 [-67 to 347]	175 [347]	2:1	High-temperature, chemicalresistant polyvinylidene fluoride tubing	Tough, semirigid, very thin wall insulation. Highly flame-resistant. High temperature performance. Resistant to most solvents, fuels, and chemicals.	1.2 to 38.1 [0.046 to 1.500]	Standard: Translucent; Nonstandard: Black	RW-3029/1; VG95343 Part 5 Type F, VDE 0341/Pt 9005; UL 224/CSA VW-1	ASTM D2671, Proc. C; UL 224/ CSA VW-1	Insulation and strain relief of delicate electrical connections and terminations. Offers high temperature performance, outstanding abrasion and cut-through resistance, and advanced chemical and solvent resistance.	Europe Asia Pacific
	RW-200	-40 to 200 [-40 to 392]	175 [347]	2:1	Chemical-resistant, high-temperature fluoroelastomer tubing	Outstanding performance in severe chemical and thermal environments. High resistance to impact and abrasion.	3.2 to 50.8 [0.125 to 2.000]	Black	RW-3037; AS23053/13	ASTM D2671, Proc. A; ASTM D876	Insulation and protection of cables and components exposed to high temperatures and/or solvents, fuels, hydraulic fluids, lubricants, and acids. Suitable for use in engine compartments.	Americas Europe Asia Pacific
	RW-200-E	-40 to 200 [-40 to 392]	175 [347]	2:1	Heavy wall, chemicalresistant, high-temperature fluoroelastomer tubing	Outstanding performance in severe chemical and thermal environments. Heavy wall provides increased protection against mechanical abuse.	3.2 to 50.8 [0.125 to 2.000]	Black	RW-3037; MIL-PRF-46846 Type III Cl. 1, Def. Stan. 59-97Issue 3 Type 4A, VG95343 Part 5 Type E, VDE 0341/Pt9005, BS 4G-198 Part 3 12A	ASTM D876	Especially suitable for the most demanding harnessing requirements in aircraft, missiles, satellite systems and chemical plants.	Americas Europe Asia Pacific
	SAS/ SASR/ TSAS	-80 to 125 [-112 to 257] (See individual product families)	Minimum sealing temperature will depend on the adhesive type and application	N/A	Slit adhesive sleeves made of selected adhesives	N/A For use with single and dual wall tubings to provide additional adhesive in applications where it is needed.	1.4 to 9.5 [0.055 to 0.375]	Amber, Black or Gray	See individual product families	N/A	Use under single wall tubing to create a seal around a wire or splice. Use under dual wall tubing where additional adhesive is needed for consistent sealing. Use several on individual wires to create a water block at the back of a connector.	Americas Europe Asia Pacific
	SFR	-75 to 180 [-103 to 356]	175 [347]	1.75:1	Very flexible, flame-retardant, silicone elastomer tubing	Outstanding low-temperature flexibility. Resistance to hydraulic fluids, fuel, and lubricating oil. Very good ablative characteristics.	6.4 to 50.8 [0.250 to 2.000]	Black	RT-1140; AS23053/10; MIL-PRF-46846 Type II Cl. 1	ASTM D2671, Procedure B	Cable harness protection where maximum flexibility in temperature extremes is required. Strain relief for electronic components, semiconductor leads, and wire splices.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Special Purpose	SRFR	-75 to 200 [-102 to 392]	175 [392]	1.5:1	Highly flexible silicone rubber tubing	Highly flexible. Resistant to high and low temperatures and medical sterilization. SRFR is non-burning with outstanding ablative properties.	2.9 to 51.0 [0.114 to 2.008]	Gray	RT-1142, RW-2057; UL 224 VW-1	ASTM 2671, Procedure B; UL 224 VW-1	Used in medical equipment where flexibility and the ability to withstandsterilization are needed. Thyristor power cable insulation, heating element and bus bar insulation, fiber optic bundle sheathing, and rocketry support cable protection.	Americas Europe Asia Pacific
	SWFR X2	-30 to 125 [-22 to 257]	90 [194]	2:1	Very flexible, low-shrink temperature, highly flameretardant, polyolefin tubing with no added halogens	Low shrink temperature for fast installation. Environmentally friendly tubing with no added halogens emits minimal amounts of toxic or acid gasses during combustion. 600V rating. UL 224/CSA VW-1 flame rating.	1.0 to 30.0 [0.039 to 1.181]	Black	SWFR X2 SCD; UL 224/CSA VW-1	UL 224/ CSA VW-1	Insulation and protection of inline components, wire splices and terminations. Very flexible light-duty harnessing. Use where a nonhalogenated product with a UL 224/CSA VW-1 rating is needed. Use where rapid installation is desirable.	Americas Europe Asia Pacific
	SWFR X4	-30 to 125 [-22 to 257]	90 [194]	2:1	Very-thin-wall, very flexible, low-shrink-temperature, highly flame-retardant, polyolefin tubing with no added halogens	Very thin wall and low shrink temperature for fast installation and space savings. Environmentally friendly material with no added halogens emits minimal amounts of toxic or acid gasses during combustion. 300V rating. UL 224/CSA VW-1 flame rating.	0.8 to 25.0 [0.032 to 0.984]	Black	SWFR X4 SCD; UL 224/CSA VW-1	UL 224/ CSA VW-1	Insulation and protection of inline components, wire splices and terminations. Especially suited for covering temperature-sensitive components where a non-halogenated product is needed. Strain relief on highdensity connectors.	Americas Europe Asia Pacific
	TC Caps	-55 to 135 [-67 to 275]	135 [275]	2:1	Semirigid, flame-retardant polyolefin end caps	Single wall caps provide permanent or temporary insulation and termination. Vibration and abrasion resistant.	1.6 to 6.4 [0.063 to 0.250]	White, red and gray (One standard color per size)	TC Caps SCD; UL 224	UL 224 All Tubing Flame Test (Material)	Widely used for wire terminations because of light weight, small size and durability.	Americas Europe Asia Pacific
	TFE/TFER	-67 to 250 [-89 to 482]	340 [644]	1.8:1 to 3.2:1	High-temperature, chemically inert modified PTFE tubing	Provides insulation and mechanical protection in severe chemical and thermal environments. High mechanical strength and an extremely low coeffcient of friction.	0.8 to 32.0 [0.031 to 1.260]	Clear	RK-2055 and RK-2054	ASTM D876 15 sec max.	Covering hydraulic hose and couplings to prevent contamination and corrosion. The high mechanical strength and extremely low coeffcient of friction make it good for reducing damage to bearing shafts and similar applications.	Europe Asia Pacific
	Tubing Kits & MiniSpools	See individual product families	See individual product families	2:1 to 4:1	VERSAFIT, RNF-100, DWP-125 and ES1000	Smaller packaging options for our most popular sizes of select single wall and adhesive-lined products.	See individual product families	See individual product families	See individual product families	See individual product families	See individual product families	Americas Europe Asia Pacific
	Versaflex/ Versaflex-FR	-50 to 150 [-58 to 302]	N/A	N/A	Expandable, Braided Polyester Tubing	Suitable for mechanical protection of wire harnesses where exceptional flexibility combined with excellent abrasion and cut-through resistance is required. Will not trap heat or moisture. Expands easily over irregular shapes. Available in non-flameretardant or flame-retardant versions.	3.0 to 50.0 [0.118 to 2.000] Nominal	Black & Gray. Flameretardant version has white tracer.	RK-6772	N/A	Mechanical protection of wire harnesses, hoses, and other substrates where exceptional flexibility is needed Wire bundling without trapping heat and moisture. Provides additional abrasion and cut-through resistance where required.	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
Special Purpose	XFFR	-55 to 105 [-67 to 221]	121 [250]	3:1	No added halogens, flameretardant tubing	Tubing with no added halogens emits minimal amounts of toxic or acid gases during combustion.	7.62 to 76.20 [0.300 to 3.000]	Black	RW-2016; MIL-C-24643 (Cable jacket flame performance); NES 713; NES 711; ABS	MIL-C-24643	Harnessing, rejacketing and repair of cable in enclosed areas requiring a halogen-free, flame-retardant environment.	Americas Europe Asia Pacific
	ZH-100	-30 to 105 [-22 to 221]	120 [248]	2:1	Flexible, thin-wall, low-firehazard tubing	Low smoke emissions. Flexible, flameretardant. No added halogens.	3.2 to 51.0 [0.125 to 2.000]	Black	RW-2031	ASTM D876	Jacketing wire bundles and light-duty harnesses for use in areas where lowfire-hazard materials are required.	Americas Europe Asia Pacific
	ZHTM	-30 to 105 [-22 to 221]	121 [250]	2:1	Flexible, thick-wall tubing with low toxicity for fire safety applications	Low smoke emissions. Flexible, flame-retardant.	3.0 to 50.0 [0.118 to 1.969]	Black	RW-2058	ASTM D2671, Procedure B (Sizes 12/6 & below); ASTM D876 (Sizes 18/9 and larger)	Insulation and protection of cables, harnesses, and electrical and electronic components in enclosed spaces, such as in ships, mass transit systems and offshore installations.	Americas Europe Asia Pacific
VOLINSU	EVSW	–55°C to 135°C [-67°F to 275°F]	90°C [194°F]	2:1	EVSW has been designed from a flame retardant material with excellent electrical properties, alongside excellent insulation combined with the benefits of a heat shrink tube to allow use over both simple and intricate shapes. Based on other automotive applications the materials selected have proven use in many applications, creating a strong performance base to create a dedicated solution for the electric vehicle market.	• High level safety • High volume resistivity • Testing conducted in accordance to ASTM D2671 • Improved thermal and copper stability • Excellent color stability • No cracking • Competitor tested EV heat shrink, discolors and cracks • Better softness and flexibility	10.00 (0.394) - 25.00 (0.984)	Orange (RAL-2003)	ASTM D2671	UL224		Americas Europe Asia Pacific
	EVDW	–40°C to 105°C [-40°F to 221°F]	110°C [230°F]	3:1	The VOLINSU electric vehicle dual wall (EVDW) heat shrink tubing has been designed from a flame-retardant material with excellent electrical properties and excellent insulation and allows use over both simple and intricate shapes. Electric vehicles (EV) require components to operate at high temperatures and high voltage, not propagate burning, and help with the identification of HV circuitry	• High dielectric strength, withstand in harsh environment tests of high conditional reliability following abrasion, heat ageing, and water immersion • Good thermal stability. Electrical and mechanical properties are uncompromised after 168hrs at 158°C (in accordance with ASTM D2671) • Provides good bonding strength to substrates incl. aluminum, copper, XLPE, and PVC • Ease of use: large shrink ratio and good flexibility enable quicker assembly	9.00 (0.354) - 40.00 (1.575)	Orange (RAL-2003)	ASTM D2671	UL224	• Charge Inlet • Electric Control Unit • Electric Driving System • Harness in Charge Station	Americas Europe Asia Pacific

Product Category	Product Name	Operating Temperature °C[°F]	Minimum Full Recovery Temperature °C[°F]	Shrink Ratio	Product Description	Features/Benefits	Standard Size Range (Inside Diameter as supplied) mm [In.]	Colors	Applicable Specifications	Flammability Rating	Typical Applications	Available in
VOLINSU	EVFX	–40°C to 125°C [-40°F to 257°F]	125°C [257°F]	3:1	VOLINSU Tubing EVFX heat shrink has been designed from a halogen-free material with excellent electrical properties, and excellent insulation combined with the benefits of a heat shrink tube to allow use over simple and intricate corrugated fixing. EVFX delivers improved insulation and protection over traditional electric tape. EVFX is designed as a more robust alternative to insulate and protect in high voltage conditions, protect against breakdown while offering lightweight design required in electric vehicle (EV) and Hybrid vehicle design applications	• Provide excellent mechanical protection against wear and tear, friction and rubbing. • Orange color to match the RAL2003 (nominal) standard for high voltage circuits. • Manufactured from material with high dielectric strength to provide high levels of insulation, while also offering a relatively thin wall. • Ability to shrink over complex shapes to provide insulated surfaces.	27.00 (1.063)	Orange (RAL-2003)	ASTM D2671		Electric & Hybrid Automotive Vehicle Commercial and Industrial Transportation Mechanical corrugated fixing High voltage wire harness	Americas Europe Asia Pacific
	EVBB	–40°C to 125°C [-40°F to 257°F]	90°C [194°F]	2:1	The VOLINSU electric vehicle busbar (EVBB) heat shrink tubing has been engineered for the use within the vehicle electrification market. EVBB heat shrink tubing has been designed from a flame-retardant material with excellent electrical properties, alongside excellent insulation combined with the benefits of a heat shrink tube to allow use over both simple and intricate shapes. Based on other automotive applications the materials selected have proven use in many applications, creating a strong performance base to create a dedicated solution for the electric vehicle market.	• Orange color (RAL-2003 color) to meet EV visual requirements • Suitable for high current busbar application • Reduce water vapor and avoid electrochemical corrosion of copper rows • Busbars covered with electric vehicle busbar EVBB can effectively improve insulation capabilities • Does not propagate burning to support vehicle operators and passengers' safety • Achieve lightweight requirements • Deliver reliable thermal stability, electrical resistivity, and high voltage performance	20.00 (1.969) - 50.00 (1.969)	Orange (RAL-2003)	ASTM D2671		Battery disconnect unit Elstric Control Battery cell	Americas Europe Asia Pacific

Product Type	UL file	CSA file	AS23053*		MIL-PRF-46846		Raychem Specification
			Sheet	Class	Type	Class	
AP-2000							RW-1001
ATUM	E85381**		/4	3			RW-2063 (Black) RK-6024 (Colors & Clear)
BSTS							RW-2017
BSTS-FR							RW-2017
CGPE-105							CGPE-105 SCD
CGAT	E85381						RW-2050
CGPT	E35586	LR31929					RW-2059
CRN Type 1 (Black)	E35586†	LR31929†	/6	1			RT-360, Type 1
CRN Type 2 (Clear)			/6	2			RT-360, Type 2
DCPT	E35586	LR31929					RW-2056
DR-25			/16				RT-1116, RK-6008/1
DSPL							RK-6755
DWFR	E35586 VW-1						DWFR SCD
DWP-125	E35586	LR31929					DWP-125 SCD
DWTC							RK-6204
ES1000	E85381						RT-1113
ES2000	E85381						RT-1112
ES Caps	E85381						RW-3006
FL2500							FL2500 SCD
HCTE							RT-1162
HF							RW-2023
HFT5000	E199379						RW-2060
HRHF							RW-2013
HRHT							HRHT SCD
HRNF							RW-2013
HRSR							RW-2013
HT-200			/18	3			RW-1200
HTAT							RW-2052
LSTT							RW-2051
NETM1000							NETM1000 SCD
NETM2000							NETM2000 SCD
NT-MIL			/1	1 & 2			RW-3030
PD Caps	E85381						PD Caps SCD

Product Type	UL file	CSA file	AS23053*		MIL-PRF-46846		Raychem Specification
			Sheet	Class	Type	Class	
QSZH							RK-6771
RayBlock 85							RW-2101
RayBlock 105							RW-2102
Rayrim							RK-6182
RaySpool							Various
RBK - ILS							RK-6638
RBK - VWS							RK-6640 (sizes 1-3), RT-1113 (size 4)
RHW	E91151†††						RHW SCD
RMW							RMW SCD
RNF-100 Type 1 (Colors)	E35586	LR31929	/5	1			RT-350, Type 1
RNF-100 Type 2 (Clear)			/5	2			RT-350, Type 2
RNF-150	E35586 VW-1		/18	2			RT-370
RNF-3000	E35586	LR31929					RW-2053
RP-4800	E35586		/5	1††			RT-1122
RPPM							RK-6214
RT-3	E35586	LR31929†					RT-360††††
RT-375	E35586 VW-1	LR31929 VW-1	/18	2			RT-375
RT555	E85381						RT-555
RW-175/ RW-175-E	E35586 VW-1	LR31929 VW-1	/8				RW-3029/1 & 2
RW-200/ RW-200-E			/13		III	1	RW-3037
SAS							Various
SASR							SASR SCD
SCL	E85381		/4	1			RT-1301
SCT							SCT SCD
SFR			/10		II	1	RT-1140
SRFR	E85381 VW-1						RT-1142/ RW-2057
SST							RW-2011
SST-FR			/15	1 & 2			RW-2011
SWFR X2	E35586 VW-1	LR31929 VW-1					SWFR X2 SCD
SWFR X4	E35586 VW-1	LR31929 VW-1					SWFR X4 SCD
TAT-125 Type 1 (Colors)	E85381		/4	2			RW-3032
TAT-125 Type 2 (Clear)							RW-3032

Product Type	UL file	CSA file	AS23053*		MIL-PRF-46846		Raychem Specification
			Sheet	Class	Type	Class	
TC Caps	E85381						TC Caps SCD
TECT							TECT SCD
TFE/TFER							RW-2054, RW-2055
TSAS							TSAS SCD
Tubing Kits/ MiniSpools							Various
TUGA-GP							RW-2201
URHT							URHT SCD
VERSAFIT	E35586 VW-1	LR31929 VW-1	/5	1 & 3			RW-3009
VERSAFIT 3X	E35586 VW-1	LR31929 VW-1					RW-3009
VERSAFIT V2	E35586 VW-1	LR31929 VW-1					RW-3023
VERSAFIT V4	E85381 VW-1	LR31929 VW-1					RW-3023
VERSAFLEX/ VERSAFLEX-FR							RK-6772
XFFR							RW-2016
ZH-100							RW-2031
ZHTM							RW-2058

* Formerly MIL-I-23053 and MIL-DTL-23053 and AMS-DTL-23053

** Black only, except sizes 3/1 and 4/1

† Black only, sizes 1/8 through 3/4

†† Overexpanded

††† Sizes 12/3 through 70/20 only.

†††† With exception to dimensions and longitudinal change.

Electromagnetic Compatibility & Performance Considerations

Electromagnetic Compatibility (EMC): The ability of a device, equipment, or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbance to anything in that environment.

Here are some of the factors affecting electromagnetic compatibility:

Design for EMC: Consider EMC early in the design process, from careful layout of PCB's and components supporting good signal integrity. Design with the accommodation of EMI gaskets for enclosure seams and covers, I/O connections, doors etc. Retrofit is expensive.

Mechanical: Closure forces of gaskets vary dependant on material, profile, and size. Enclosure panel rigidity will dictate the minimum number of fixings. Compression limits should be used to protect the gasket from damage caused by over compression/deflection.

RFI/EMI Shielding: The basis of RFI/EMI shielding to make a faraday cage of the enclosure and ensure good grounding, this can be at PCB level for discreet components, modular and the final enclosure. Enclosures can vary in size from small handheld devices up to large cabinets and architectural rooms/buildings.

Shielding Effectiveness: To ensure good shielding effectiveness, low contact resistance is required between the gasket and the mating surface of the enclosure. For optimum shielding it is best to ensure metal to metal contact by using gaskets in grooves or incorporate labyrinth designs.

Environmental: Dust and moisture sealing is often a requirement alongside the EMC needs. Electrically conductive elastomers (ECE) provide this up to IP66 and above if the design is to achieve this. ECE fluorosilicones will seal against fuels, oils etc. For very harsh environments non-conductive seals can be incorporated in the design.

Chemical or Galvanic Compatibility: Two dissimilar metals in the presence of an electrolyte e.g. salt fog will act as a battery and create a flow of electric current. This effect can cause corrosion of the less noble material and will increase contact resistance between the gasket and enclosure causing a reduction in shielding effectiveness.

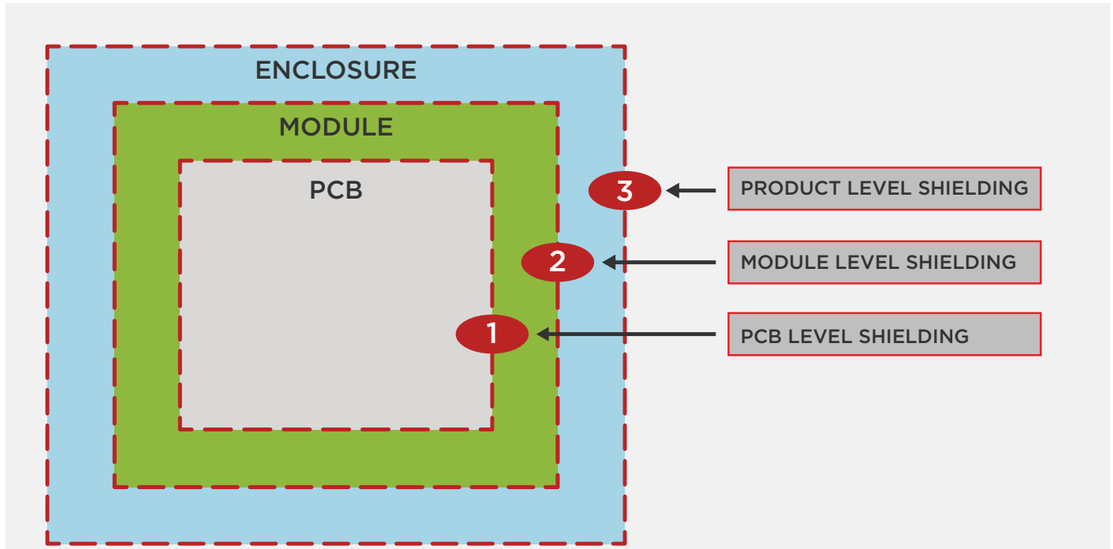
Electromagnetic Fields: When shielding magnetic fields generally the requirement is 10 kHz and above, high permeability metal type gaskets are needed these gaskets have a high current carrying capacity and are suitable for EMP protection. High frequency electric field 1 GHz and above require highly conductive more noble materials such as conductive elastomers with silver plated particles.

EMI Shielding Solutions:
Electronics engineers are very familiar with the need for electromagnetic interference or EMI protection and will consider in their design good board layout, filtering, grounding, signal integrity etc. to try resolving EMI at its source. However, shielding of the enclosure is just as important and solves the problem of radiated emissions and susceptibility. Shielding is a mechanical fix for an electrical problem and the enclosure design engineer should be aware of the types of gaskets available and their different attributes and ensure there is enough land area on the enclosure seams, doors etc. to fit the gasket. TE offers comprehensive EMI products and EMI solutions providing consistent protection to achieve Electromagnetic Compatibility.

Levels of EMI Shielding

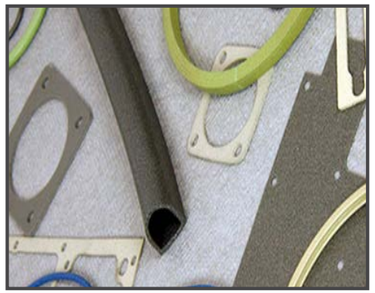
From a design engineering perspective, EMI shielding should be considered at all levels — from the enclosure to the module to the PCB. A Faraday cage, or a protective structure that prevents electromagnetic radiation from entering or exiting an area, is an important component in EMI shielding at these different levels.

- **Enclosure level:** EMI shielding of enclosures at all levels involves a Faraday cage to attenuate signals from within the enclosure. This minimizes signals escaping and causing interference to other equipment within the environment and can prevent outside interference from penetrating the enclosure.
- **Module level:** Module-level shielding is the shielding of active components, such as drives, displays, etc., within the electronics enclosure to protect those components from internal interference.
- **PCB level:** Shielding at the PCB level consists of shielding of individual components, such as integrated circuits, with shielding cans, for example, making a small Faraday cage for those components.



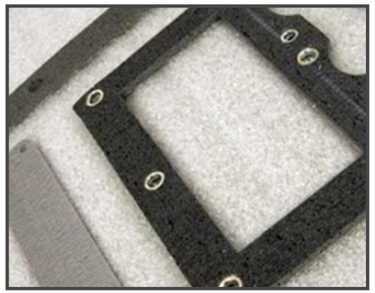
Conductive Elastomer

Electrically conductive elastomers come in a range of materials for various applications. These materials include silver-plated aluminum, copper, or glass in silicone or fluorosilicone and nickel-coated graphite or pure nickel in silicone or fluorosilicone. Each of these materials offer excellent temperature range, resistance to compression set delivering high performance at all frequencies. These materials also provide resistance to fuel oils and solvents



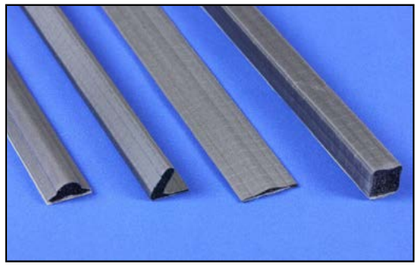
Form in Place

Form in place conductive elastomers consist of a conductive silicone in liquid form that can be dispensed directly into enclosure hardware. Materials include nickel-coated graphite in silicone and silver-plated aluminum, copper, or nickel in silicone. Form in place conductive elastomers also are available in nonconductive silicone. Form in place conductive elastomers can be well suited for small enclosures with minimum gasket land area and provide a dust and moisture seal.



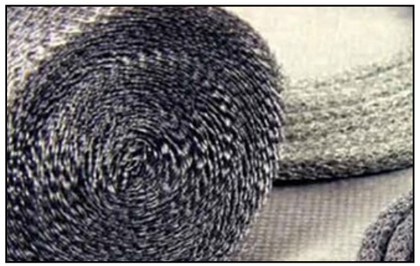
Oriented Wire:

Oriented wire in silicone is a flat, silicone sheet material embedded with vertically oriented Monel or aluminum wires. Oriented wire in silicone is a great shielding option for electromagnetic pulse and provides an environmental seal. Variants include solid closed cell silicone, soft solid silicone, sponge silicone, and solid fluorosilicone and different wire counts.



Conductive fabric over foam:

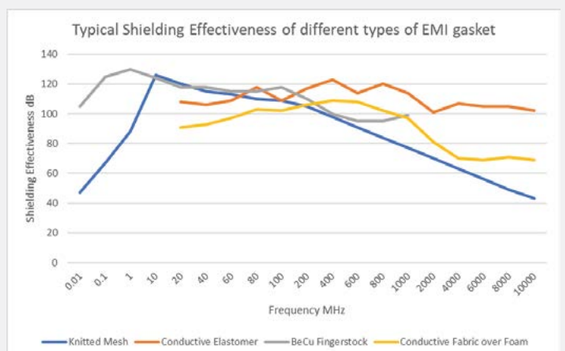
This type of EMI shielding consists of conductive nickel/copper or silverplated polyester or nylon fabric over a soft polyether polyurethane foam core. Conductive fabric over foam is available in many different forms, making it useful for a wide range of applications, including commercial uses. Conductive fabric over foam offers effective shielding up to 10GHz. While this type of shielding provides no water seal, it does offer a limited dust seal.



Knitted Wire Mesh:

The monofilament interlocking loop construction gives strength while allowing it to confirm to almost any size or shape. Excellent radio frequency interference (RFI)/electromagnetic interference (EMI) shield between two metallic surfaces. Delivers good galvanic match with mating flanges, thereby limiting the possibility of corrosion between gasket and flange. A selection of elastomer cores are available to meet conditions such as temperature range, compression set, compression force.

SHIELDING EFFECTIVENESS



KNITTED WIRE MESH

H field (magnetic) shielding 62dB @ 10Khz achievable. SE falls off after 1GHz

CONDUCTIVE ELASTOMERS

Shielding with wide frequency range, >100dB upto 10GHz E field.

FABRIC OVER FOAM

Shielding with wide frequency range, >100dB upto 10GHz E field.

BERYLLIUM COPPER FINGERS

Shielding with wide frequency range, >100dB upto 10GHz E field.

TRUSTED CONNECTIONS COUNT

75
Years partnering with customers

44
Global test labs

7500+
Engineers globally

TE is a system-knowledgeable connectivity solutions supplier with electronics architecture and physical integration know-how. We speak our customers' technical language. As mobility solutions become more connected, automated, and electrified, in-vehicle component connectivity challenges intensify. TE's team of engineers and scientists engage closely with customers to ensure their success, providing robust solutions tailored to their specific needs and architectures for the harshest of environments. From concept to design, and through manufacturing to field support, TE leverages over 75 years of expertise and know-how to support our customers every step of the way. Because trusted connections count.

Connect With Us

We make it easy to connect with our experts and are ready to provide all the support you need.
Visit **te.com/support** to chat with a Product Information Specialist.

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