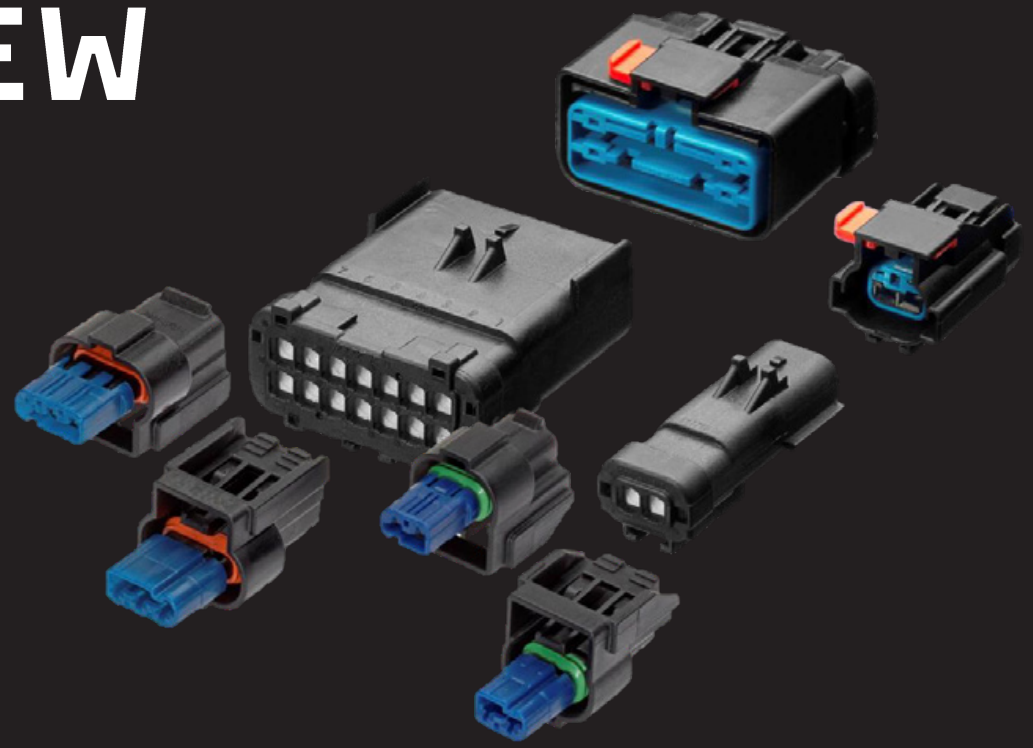
May 2019

AVNET ABACUS

APEX CONNECTION SYSTEM FAMILY OVERVIEW



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AVNET ABACUS

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The Challenge

- Higher current carrying capacity requirements
- Higher operating temperature and vibration
- Higher performance ergonomically designed connections are needed

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The Solution

Presenting the APEX connection system family.
Our time-tested high performance and ergonomic solution delivering the industry's highest current rating.

Robust features, meaningful benefits

AVNET ABACUS

Heavy-duty performance

- High vibration and temperature rating
- Industry's severe application standard for the past 25 years
- Raised duel rib contact surface and spring protection for resistance against stress relaxation
- Optional wire dress / back shells
- Terminals are stamped using 100% in die process monitoring

Highest current rating

- High conductivity copper alloy
- Multiple plating options available: Tin-Silver, Silver, Gold
- Low stress relaxation spring for high temperature operation

Ergonomic design

- ErgoMate™ axial mechanical assist mating feature for ergonomic mating available on 24-way (55-way in development)
- Pre-assembled for efficient harness assembly
- Serviceable according to USCAR-12 design guidelines
- Provide the only mat seal 2.8mm terminal solution for more compact packaging

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Versatility of application

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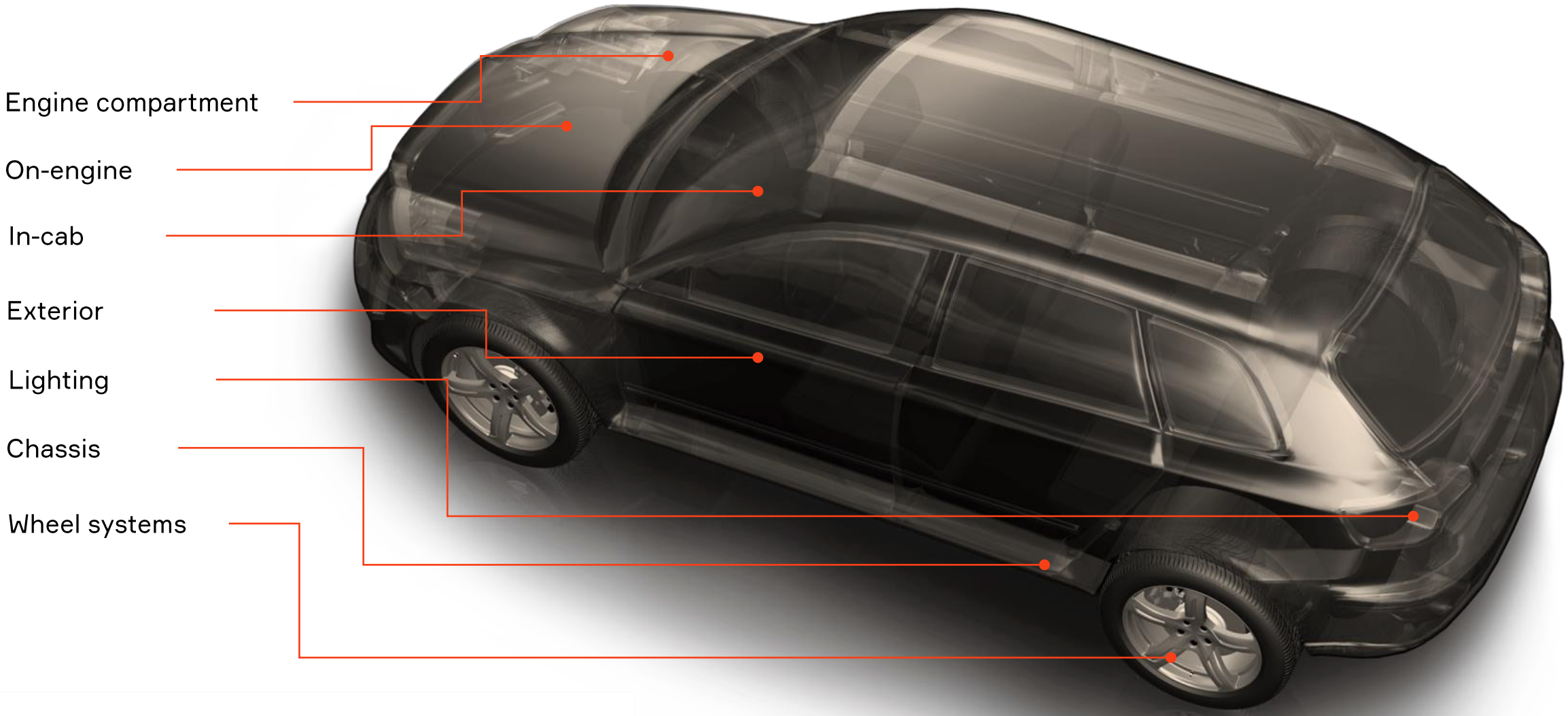

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A wide family range

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Connectors
- Inline and device applications
- 2 through 57 way configurations
- Standard, SensoMate, Mixed, and ErgoMate series

Terminals
- Box & blade solution
- Two-piece terminal system
- 1.2mm, 1.5mm, 2.8mm, 6.35mm, 9.5mm
- Tin, tin-silver, silver, or gold plating

Accessories
- 180˚ or 90˚ back shells
- Clips

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APEX® housing range

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1.2 SensoMate™ Series	2.8 SensoMate™ Series	150 USCAR Series	2.8 Unsealed Series	2.8 Sealed Series	ErgoMate™ Series	Halogen bulb Series	Mixed Series
1.2 mm	2.8 mm	1.5 mm	2.8 mm	2.8 mm	1.5 / 2.8 mm	2.8 mm	1.5 / 2.8 mm
up to 30 G	up to 20 G	up to 20 G	up to 3 G	up to 12 G	up to 20 G	up to 3 G	up to 20 G
up to 150 °C	up to 125 °C	up to 125 °C	up to 125 °C	up to 150 °C	up to 125 °C	up to 150 °C	up to 125 °C
On-engine sensors	On-engine sensors	USCAR inline applications	Inline and device applications	Inline and device applications	High density inline applications	Halogen lamp applications	Inline and device applications
							

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APEX® 1.2 SensoMate™ Series

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Housing family

Application: on-engine sensors

Key features & benefits

- APEX® terminal technology and performance in our smallest package
- Single wire seal design
- 4.0 mm terminal center line spacing
- SensoMate 1.2 connectors mate to AK and USCAR 1.2 device interfaces
- Compliant with USCAR design guidelines and performance standards
- Heavy Duty - for diesel engine vibration and temperature duty cycles
- Superior single-piece housing construction
- Terminal Position Assurance (TPA) to detect partially installed terminals
- CPA available

Performance characteristics

Sealing protection (up to)	IP 69k
Temperature range (up to)	-40°C to +150°C
Vibration performance (up to)	30 G
Terminal retention force (up to)	> 80 N
Terminal insertion force (up to)	< 30 N
Connector mating force	< 45 N
Available cavity configurations	2, 3, 4 way

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APEX® 2.8 SensoMate™ Series

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Housing family

Application: on-engine sensors

Key features & benefits

- APEX® terminal technology and performance in our smallest package
- Single wire seal design
- 5 mm terminal center line spacing
- Compliant with USCAR design guidelines and performance standards
- Heavy Duty - for Diesel engine vibration and temperature duty cycles
- Superior single-piece housing construction
- Terminal Position Assurance (TPA) to detect partially installed terminals

Performance characteristics	
Sealing protection (up to)	IP 69k
Temperature range (up to)	-40°C to +125°C
Vibration performance (up to)	20 G
Terminal retention force (up to)	> 90 N
Terminal insertion force (up to)	< 15 N
Connector mating force	< 75 N
Available cavity configurations	2, 3, 4 way

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APEX® 150 Sealed Series

Housing family

Application: inline, door latch, safety power windows, and other sealed applications

Key features & benefits

- Waterproof application with grommet seal
- Fully protected by interface seal
- 3.5 mm terminal center line spacing
- Easy to engage and disengage
- Compliant with USCAR design guidelines and performance standards
- USCAR footprint compatible
- Front Terminal Position Assurance (TPA)
- Mechanical polarization
- CPA available

Performance characteristics	
Sealing protection (up to)	IP 69k
Temperature range (up to)	-40°C to +125°C
Vibration performance (up to)	20 G
Terminal retention force (up to)	> 70 N
Terminal insertion force (up to)	< 30 N
Connector mating force	< 75 N
Available cavity configurations	10, 16 way

APEX® 2.8 Unsealed Series

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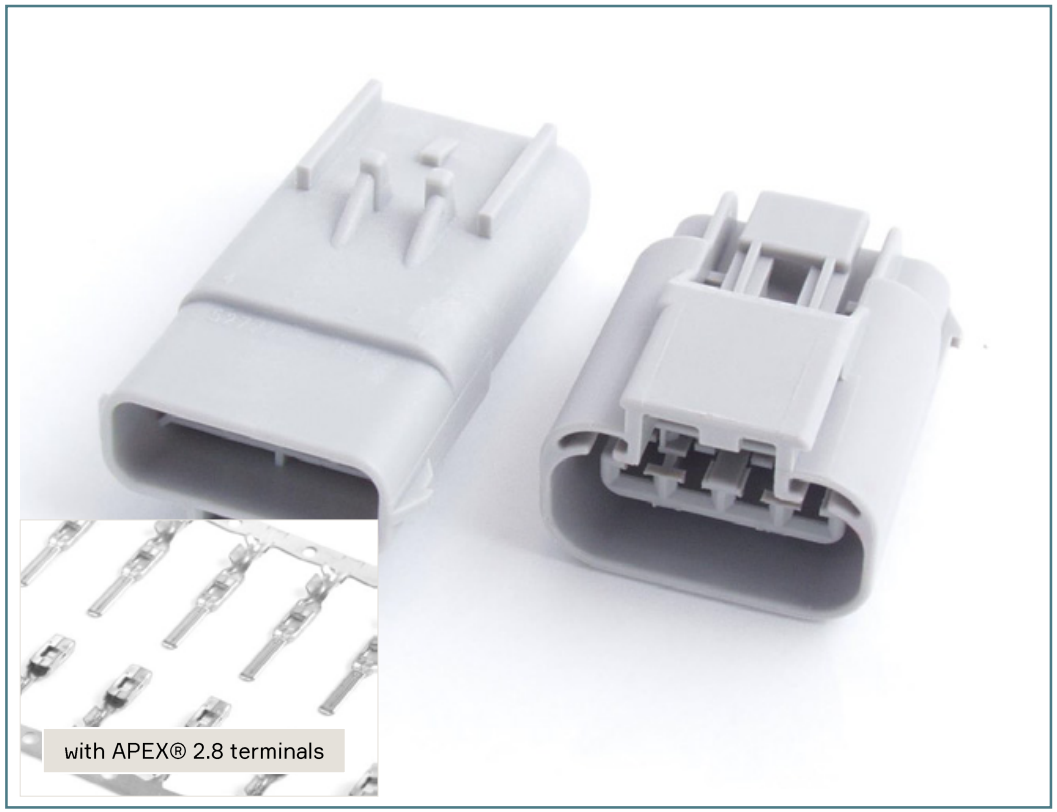
Housing family



Application: unsealed inline applications

Key features & benefits

- Robust APEX® terminal technology and performance
- 5.25 mm terminal center line spacing
- Meets or exceeds USCAR performance standards and GMW3191
- Wire accommodation range - 0.35 mm² (22 AWG) to 5 mm² (10 AWG)
- Fully assembled connector for ease of use
- Terminal Position Assurance (TPA) to detect partially installed terminals
- CPA available
- Up to 7 mechanical polarizations available

Performance characteristics	
Sealing protection (up to)	IP 40
Temperature range (up to)	-40°C to +125°C
Vibration performance (up to)	3 G
Terminal retention force (up to)	> 90 N
Terminal insertion force (up to)	< 15 N
Connector mating force	< 90 N
Available cavity configurations	2, 3, 4, 5, 6, 10, 14 way

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APEX® 2.8 Sealed Series

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Housing family

Application: inline, power windows, fuel pump, fuel tank, and other sealed applications

Key features & benefits

- Most compact 2.8 mm system in the industry
- Fully protected interface seal
- Mat seal design
- 5.25 mm terminal center line spacing
- Easy to engage & disengage by locking lever on small area
- Meets or exceeds USCAR performance standards and GMW3191
- Compliant with USCAR and ES design guidelines and performance standards
- Heavy Duty connectors for demanding environments
- Wire accommodation range - 0.75 mm2 (20 AWG) to 4 mm2 (10 AWG)
- Front Terminal Position Assurance (TPA)
- Mechanical polarization

Performance characteristics	
Sealing protection (up to)	IP 68
Temperature range (up to)	-40°C to +150°C
Vibration performance (up to)	12 G
Terminal retention force (up to)	> 90 N
Terminal insertion force (up to)	< 30 N
Connector mating force	< 75-142 N
Available cavity configurations	2, 3, 4, 5, 6, 10, 14 way

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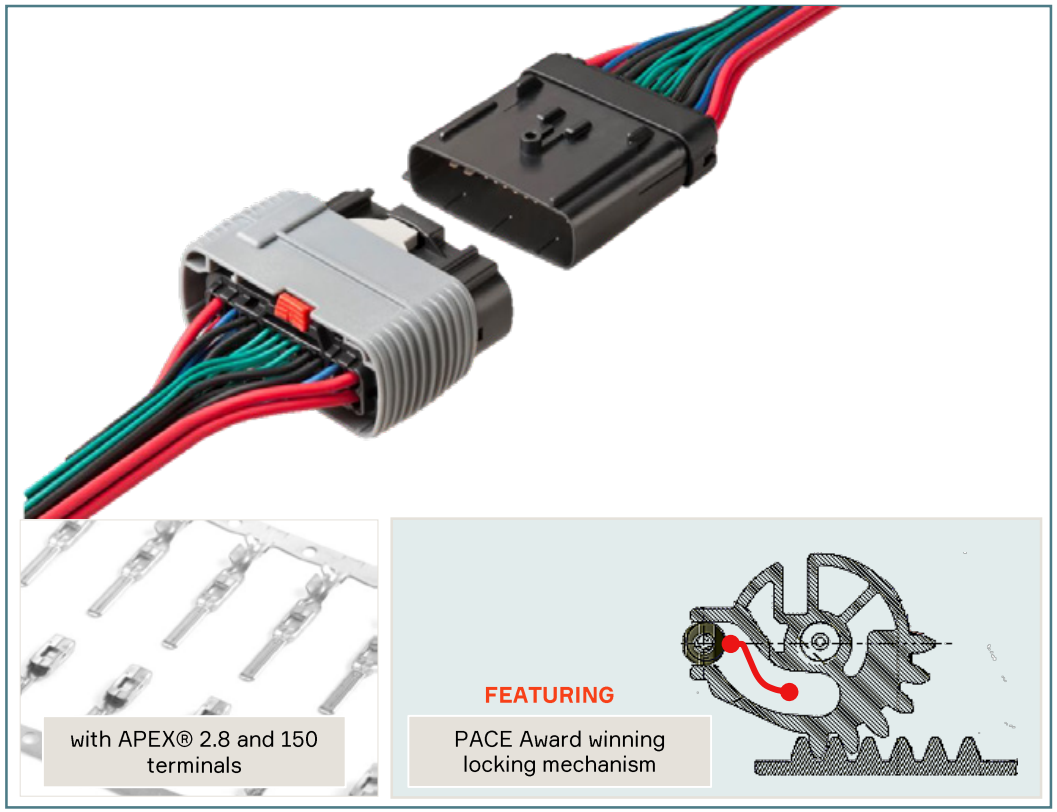
APEX® ErgoMate™ Series

Housing family



Application: sealed inline applications

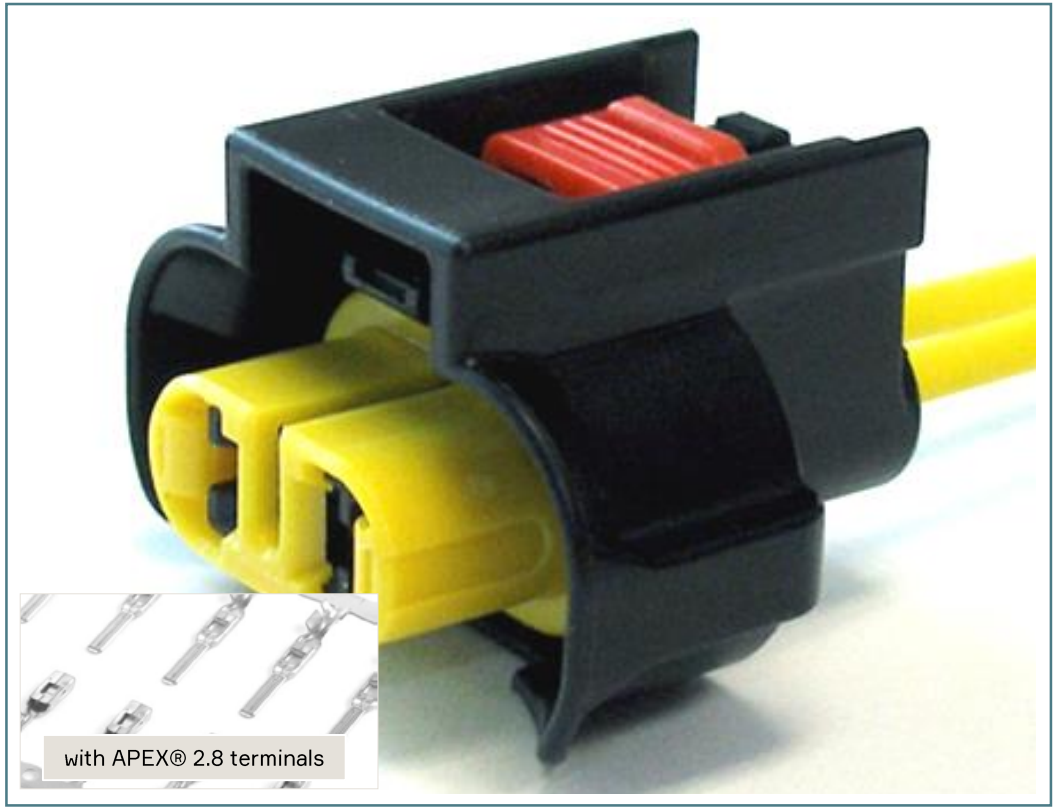
Key features & benefits

- High reliability one-handed mating
- Simplified engagement system reduces the possibility of missmating the connection system
- Unique geared cam and slider system is fully self-contained and provides a 3:1 mechanical advantage
- Mixed 150 and 2.8 configuration
- Compact packaging
- A lower-profile ergonomically friendly alternative to traditional lever assist
- Mat seal design

Performance characteristics	
Sealing protection (up to)	IP 69k
Temperature range (up to)	-40°C to +125°C
Vibration performance (up to)	20 G
Terminal retention force (up to)	>70 N / > 90 N
Terminal insertion force (up to)	< 30 N
Connector mating force	~ 55 N
Available cavity configurations	24 way

APEX® Halogen Bulb Series

Housing family



Application: halogen bulbs

Key features & benefits

- Robust APEX® 2.8 two-piece terminal system
- Single wire seal design
- Meets USCAR-12 & USCAR-25 design & ergonomic guidelines:
  - Ergonomic large thumb latch provide ease of de-latching with a gloved hand
  - Optional axial mate CPA feature reduces missmating frequency
  - Axial PLR device secures locking of female terminal in connector housing
- Footprint defined by ISO specification IEC60061-1

Performance characteristics	
Sealing protection (up to)	IP 69k
Temperature range (up to)	-40°C to +150°C
Vibration performance (up to)	3 G
Terminal retention force (up to)	> 90 N
Terminal insertion force (up to)	< 30 N
Connector mating force	< 75 N
Available cavity configurations	2 way

APEX® Mixed Series

Housing family

with APEX® 2.8 and 150 terminals

Application: sealed inline applications

Key features & benefits

- Mixed 150 and 2.8 configuration
- Mat seal design
- Wide wire gage range
- Primary Lock Reinforcement (PLR)
- CPA available

Performance characteristics	
Sealing protection (up to)	IP 69k
Temperature range (up to)	-40°C to +125°C
Vibration performance (up to)	20 G
Terminal retention force (up to)	>70 N / > 90 N
Terminal insertion force (up to)	< 30 N
Connector mating force	< 75 N
Available cavity configurations	14 way

APEX® terminal range

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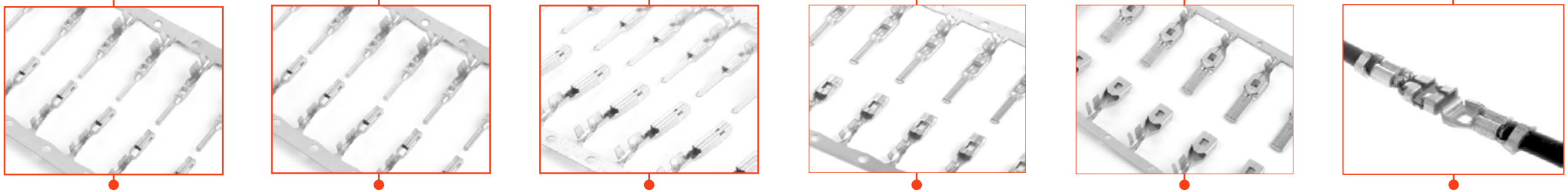
1.2 Series	1.5 Series	150 Series	2.8 Series	6.35 Series	950 Series
1.2 mm	1.5 mm	1.5 mm	2.8 mm	6.35 mm	9.5 mm
up to 20 A	up to 20 A	up to 25 A	up to 40 A	up to 50 A	up to 188 A



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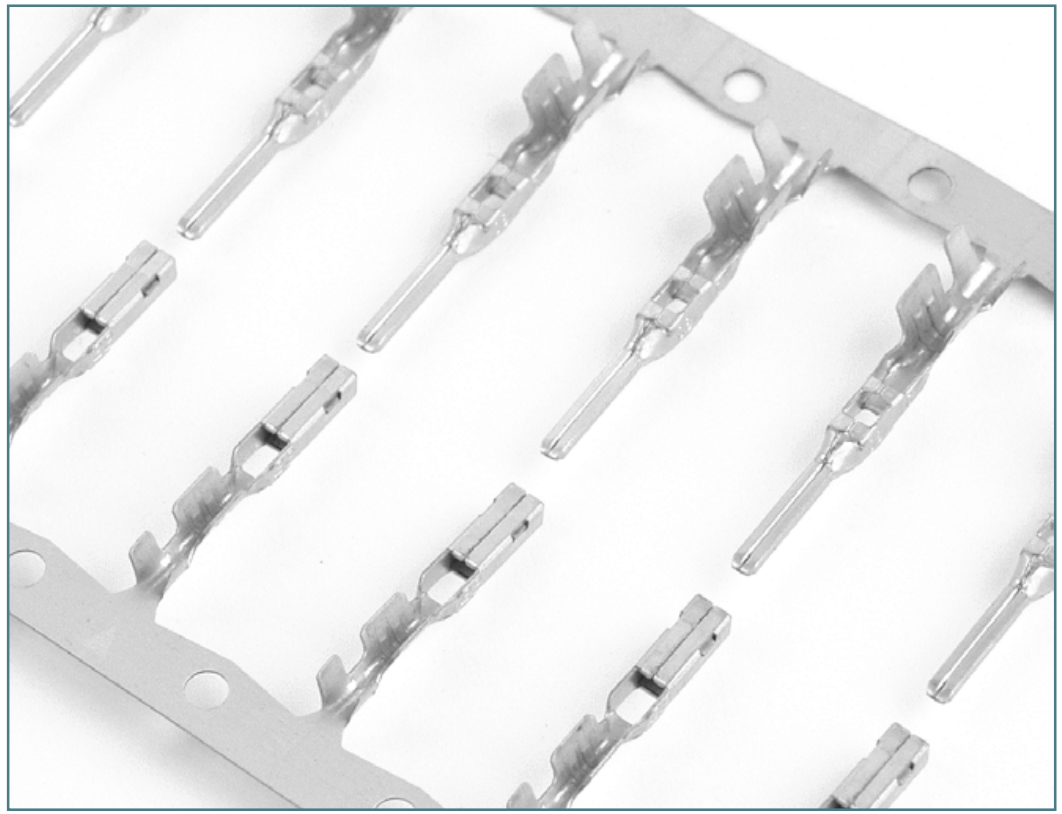
APEX® 1.2 Series

Terminal family



Key features & benefits

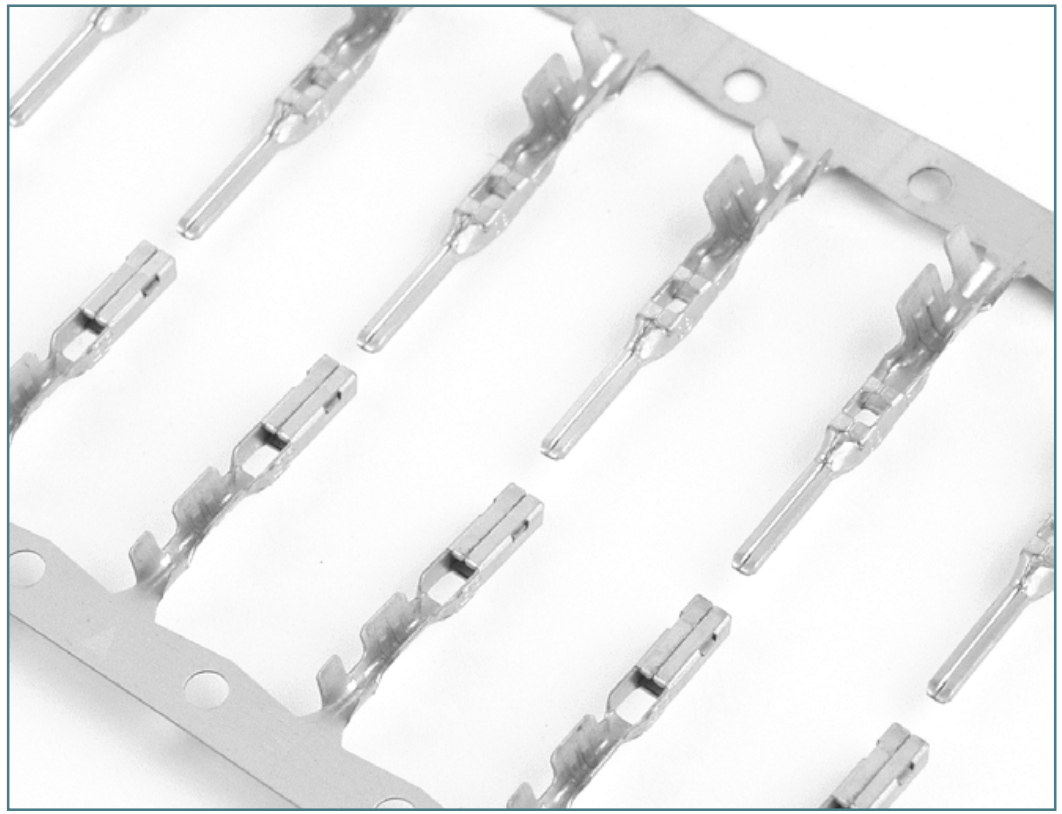
- High current carrying capacity
- APEX® technology
- Design compatible with a wide range of connector sealing technologies (single wire sealing, mat seal)
- Suitable for secondary lock
- Tin, tin-silver, silver, and selective gold-plated versions available

Performance characteristics

Contact resistance	< 0.5 mΩ
Contact mating force	< 5 N
Contact unmating force	< 1 N
Range of wire gauge	22-16 AWG / 0.35-1.5mm²
Current carrying capacity	
at 23°C up to approx. :	20 A
at 85°C up to approx. :	16 A
at 100°C up to approx. :	12 A
at 125°C up to approx. :	10 A

APEX® 1.5 Series

Terminal family



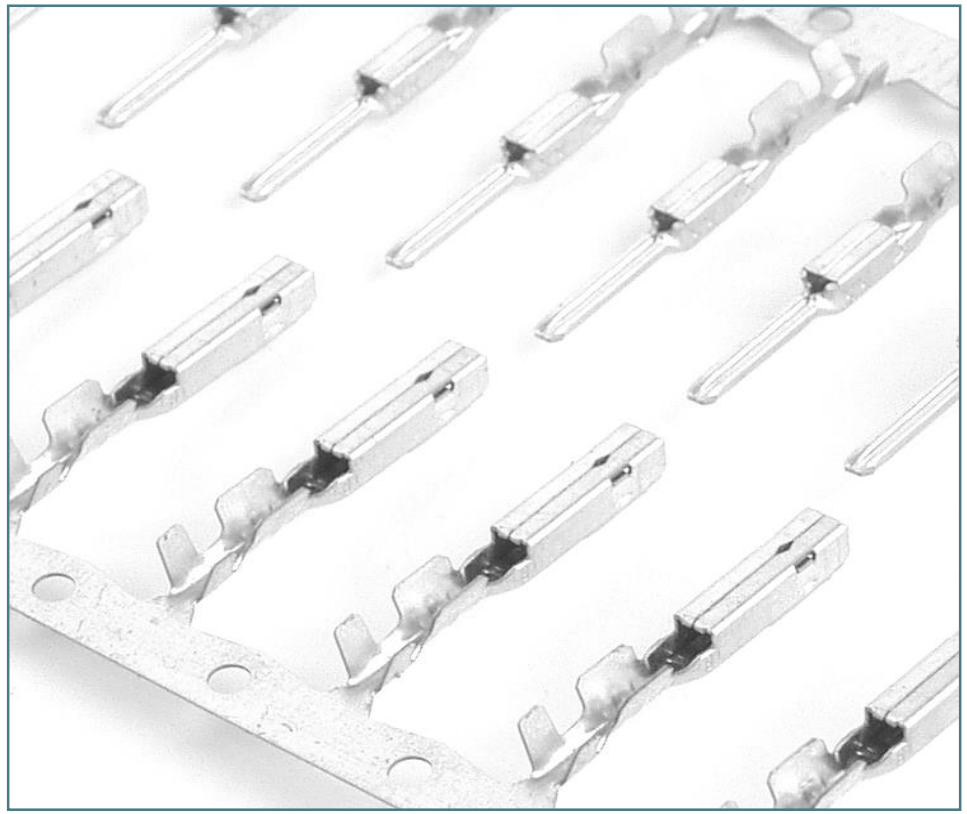
Key features & benefits

- High current carrying capacity
- APEX® technology
- Design compatible with a wide range of connector sealing technologies (single wire sealing, mat seal)
- Suitable for secondary lock
- Tin, selective gold-plated versions available

Performance characteristics	
Contact resistance	< 0.5 mΩ
Contact mating force	< 5 N
Contact unmating force	< 1 N
Range of wire gauge	22-16 AWG / 0.35-1.0mm²
Current carrying capacity	
at 23°C up to approx. :	20 A
at 85°C up to approx. :	16 A
at 100°C up to approx. :	12 A
at 125°C up to approx. :	10 A

APEX® 150 Series (USCAR)

Terminal family



Key features & benefits

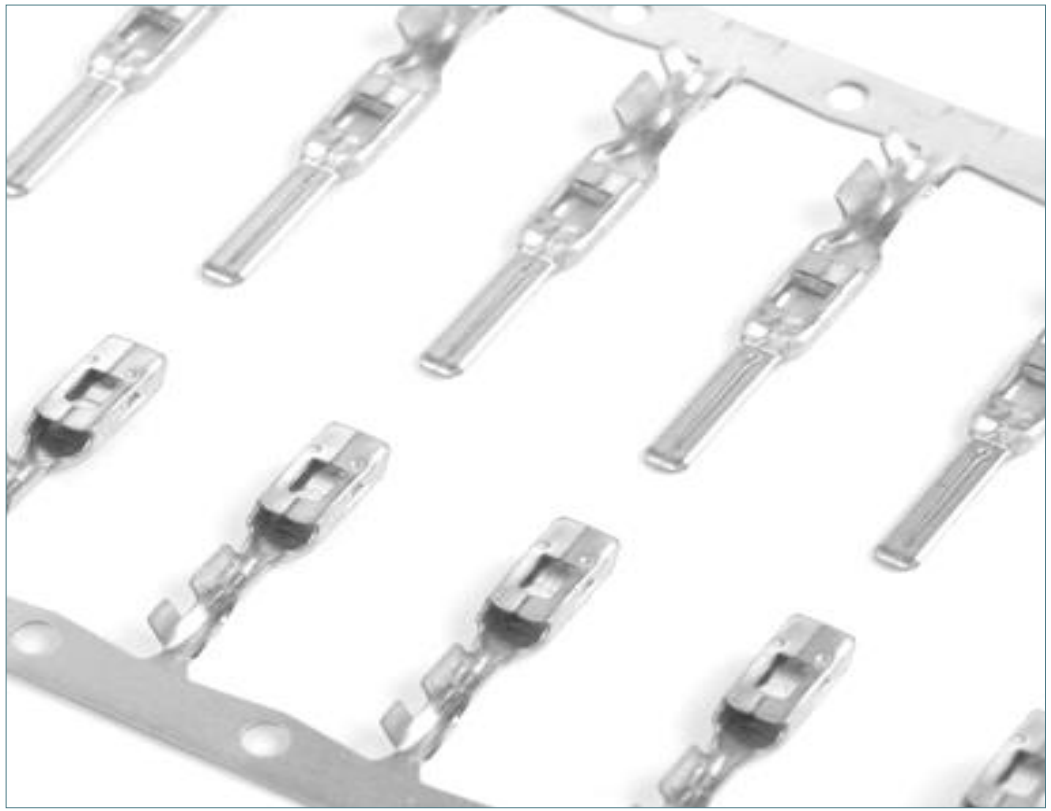
- High current carrying capacity
- APEX® technology
- Heavy duty applications
- High temperature applications
- High vibration applications
- Tin, selective gold-plated versions available
- Meets or exceeds USCAR

Performance characteristics

Contact resistance	< 0.5 mΩ
Contact mating force	< 3.5 N
Contact unmating force	< 1 N
Maximum insulation	1.93 mm
Range of wire gauge	22-16 AWG / 0.35-1.0mm²
Current carrying capacity	
at 23°C up to approx. :	25 A
at 85°C up to approx. :	25 A
at 100°C up to approx. :	22 A
at 125°C up to approx. :	12 A

APEX® 2.8 Series

Terminal family



Key features & benefits

- High current carrying capacity
- APEX® technology
- Low contact mating force
- Design compatible with a wide range of connector sealing technologies (single wire sealing, mat seal)
- Suitable for secondary lock
- Tin, silver, selective gold-plated versions available

Performance characteristics

Contact resistance	< 2 mΩ
Contact mating force	< 5 N
Contact unmating force	< 2 N
Range of wire gauge	20-10 AWG / 0.5-5mm²
Current carrying capacity	
at 23°C up to approx. :	40 A
at 85°C up to approx. :	30 A
at 100°C up to approx. :	18 A
at 125°C up to approx. :	10 A

APEX® 6.35 Series

Terminal family

Key features & benefits

- High current carrying capacity
- APEX® technology
- Compatible with single wire sealing
- Suitable for secondary lock
- Tin, tin-silver, silver

Performance characteristics

Contact resistance	< 2 mΩ
Contact mating force	< 10 N
Contact unmating force	< 5 N
Range of wire gauge	20-8 AWG / 0.5-8.0mm²
Current carrying capacity	
at 23°C up to approx. :	50 A
at 85°C up to approx. :	38 A
at 100°C up to approx. :	28 A
at 125°C up to approx. :	20 A

APEX® 950 Series

Terminal family

Key features & benefits

- High current carrying capacity
- APEX® technology
- Compatible with single wire sealing
- Suitable for secondary lock
- Tin

Performance characteristics

Contact resistance	< 1 mΩ
Contact mating force	< 30 N
Contact unmating force	< 20 N
Range of wire gauge	16-25mm²
Current carrying capacity	
at 23°C up to approx. :	188 A

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Connector design overview

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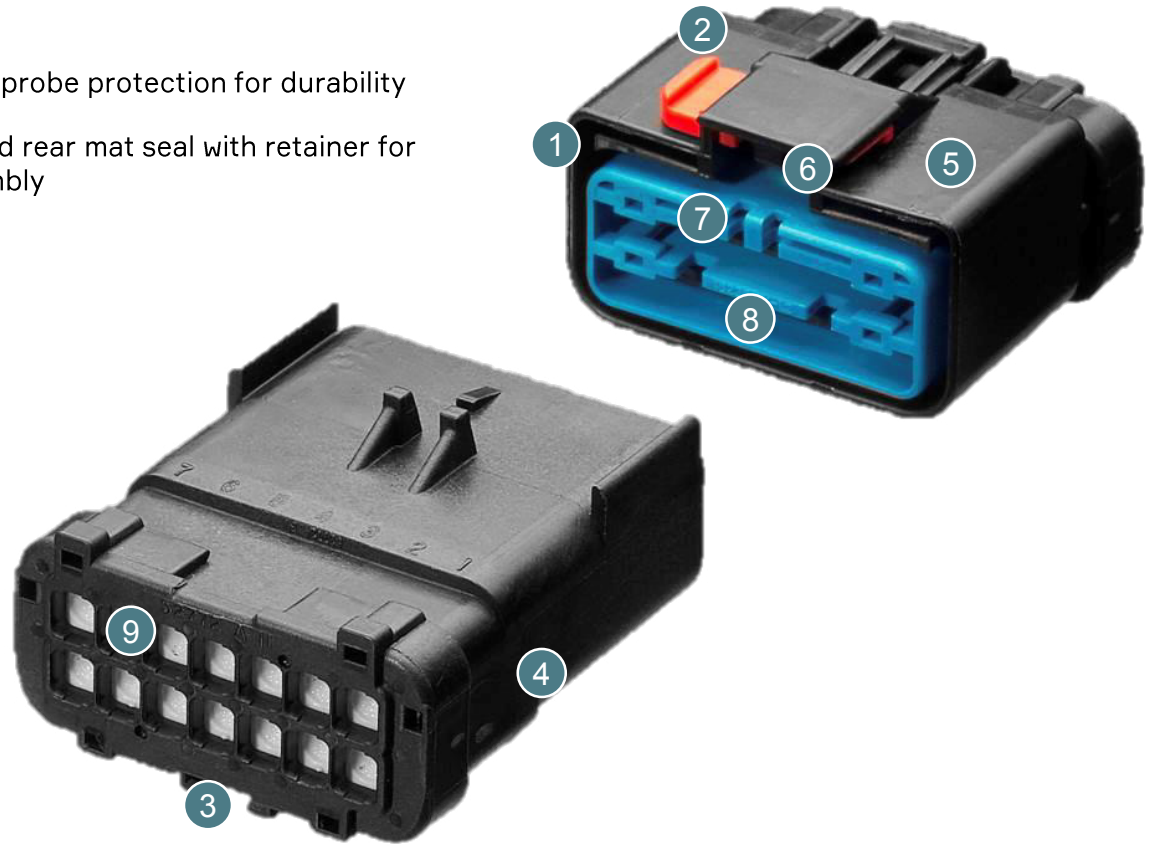
Benefits

- Application flexibility
- Ease of assembly and service
- Compact packaging

Design features

1. Polarization molded-in, up to 4 indexes, scoop proof
2. Pre-assembled integrated Connector Position Assurance (CPA) for ease of assembly
3. Clip slot on male connectors for mounting flexibility
4. Plastic is molded with smooth well-rounded corners for ergonomic assembly
5. Double shroud design, protected interface seal for better durability and handling protection
6. Primary connector lock, audible, tactile, one-hand operation
7. Pre-assembled integrated Terminal Position Assurance (TPA) for ease of assembly
8. Blade lead-in/probe protection for durability
9. Pre-assembled rear mat seal with retainer for ease of assembly



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Terminal design overview

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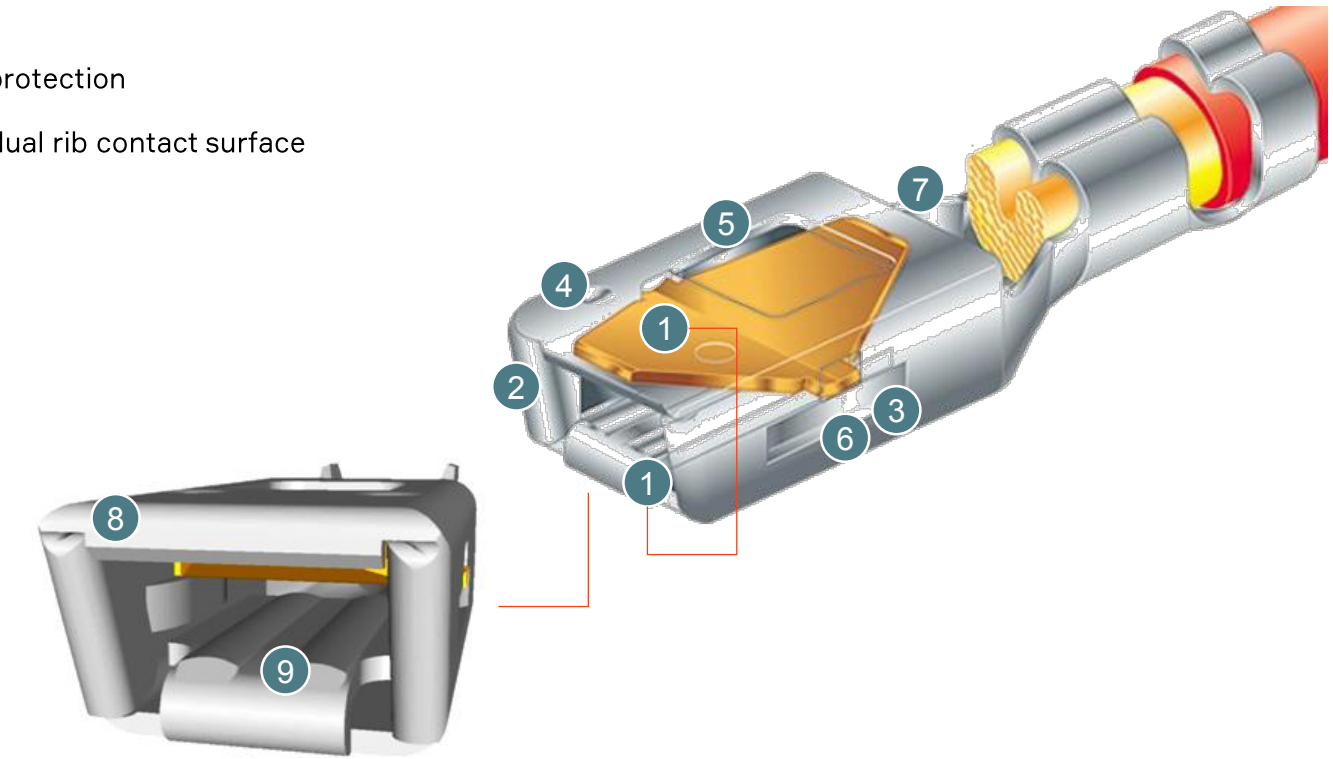
Benefits

- Two-piece construction with an integrated floating spring made of beryllium copper or copper nickel silicon
- Terminal designed to have high currant carrying capacity

Design features

1. Optimized contact function with:
   - Two stable contact lines
   - One contact point with the spring
2. Fully protected front entry with rounded corners in the four directions:
   - Resistant to probe damage
   - Guides mating blade
3. Protected contact area with a closed box
4. Dimples provide overstress protection of the spring
5. Two symmetrical locking areas:
   - Positive retention achieved in the housing with a vulnerable locking lance
   - Reversibility at 180°
6. Box material is a highly conductive copper alloy for exceptional current rating
7. Coined edges eliminate the potential to tear the rear mat seal
8. Spring protection
9. Raised dual rib contact surface



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APEX® terminal technology

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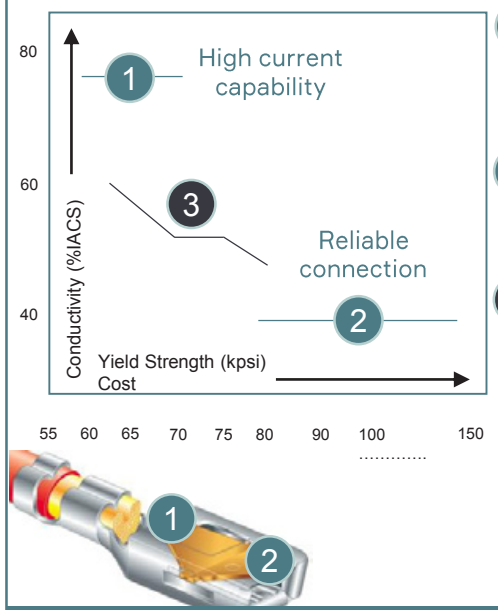
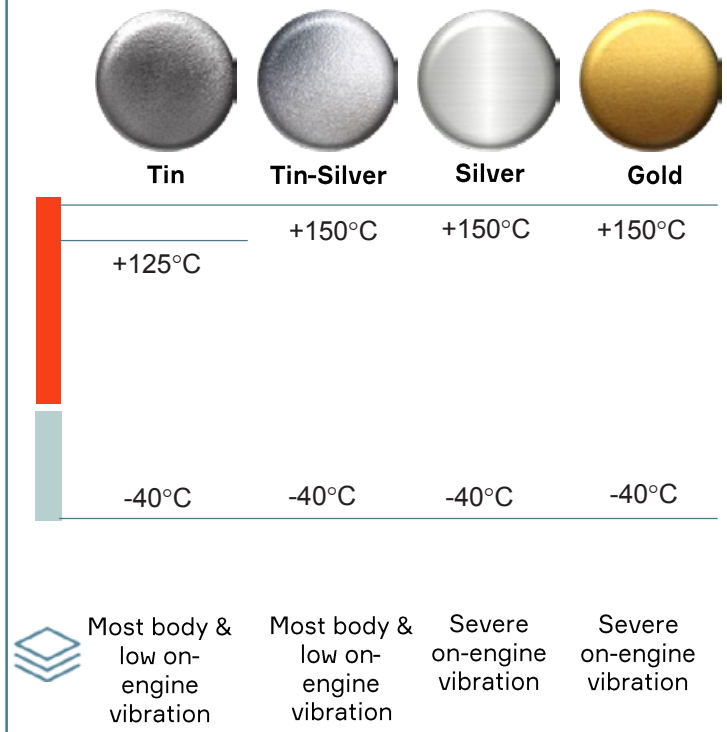
Two-piece material design



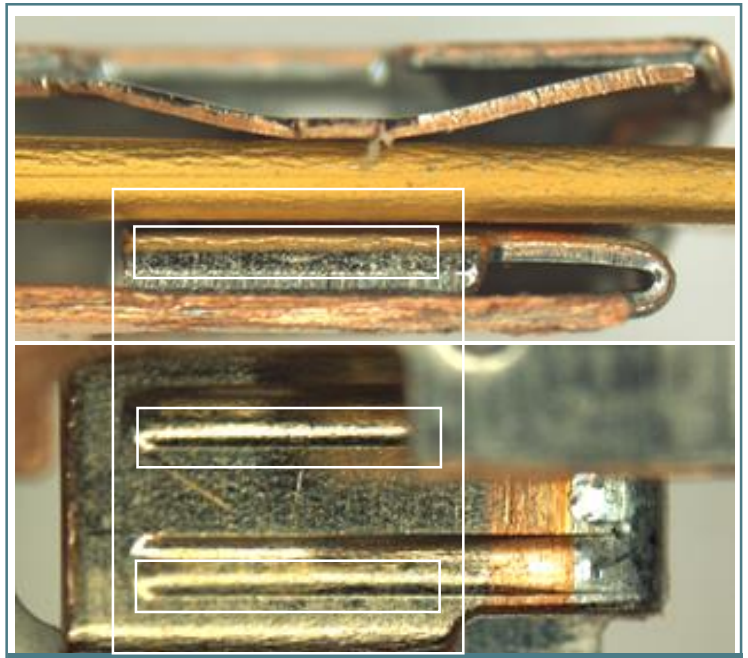
1. Highly conductive 0.305mm thick Copper Alloy
2. Low stress relaxation spring
3. Choosing material for a one-piece terminal usually requires compromise

APEX® terminals utilize a stress relaxation resistant high force spring and a highly conductive body material

Plating applications



2.8 Gold inlay contact surface



Dual rib contact floor in the gold inlay region provides mechanical stability for vibration performance

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Housings sample part numbers

APEX® 1.2 SensoMate™

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APEX® 1.2 SensoMate™	Cavity Count	Blade Size (mm)	Gender	Index	Part Number	Other Available Indexes
	2	1.2	F	A (w/o CPA)	13806231	B, C
	3	1.2	F	A (w/o CPA)	13578335	B, C, D
	4	1.2	F	A (w/o CPA)	13820427	B

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Housings sample part numbers

APEX® 2.8 SensoMate™

APEX® 2.8 SensoMate™	Cavity Count	Blade Size (mm)	Gender	Index	Part Number	Other Available Indexes
	2	2.8	F	A	13821046	B
	3	2.8	F	A	13791661	B
	4	2.8	F	A	33513154	

Housings sample part numbers

APEX® 150 Sealed Series

APEX® 150 Sealed Series	Cavity Count	Blade Size (mm)	Gender	Index	Part Number	Other Available Indexes
	10	1.5	F	A	13737245	B
	10	1.5	M	A	13763996	B, D
	16	1.5	F	A	13625159	B, C, D
	16	1.5	M	A	13625160	B, C

Housings sample part numbers

APEX® 2.8 Unsealed Series

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APEX® 2.8 Unsealed Series	Cavity Count	Blade Size (mm)	Gender	Index	Part Number	Other Available Indexes
	2	2.8	F	A	13869306	B, C, D
	2	2.8	M	A	33500082	B, C, D
	3	2.8	F	A	13576040	B
	3	2.8	M	A	33500093	B
	4	2.8	F	A	33517234	B
	4	2.8	M	A	33500099	B
	5	2.8	F	A	33513166	B
	6	2.8	F	A	15441804	B
	6	2.8	M	A	33500104	B
	10	2.8	F	A	15492288	B
	10	2.8	M	A	33500112	B, C
	14	2.8	F	A	13582973	B, D
	14	2.8	M	A	13581869	B

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Housings sample part numbers

APEX® 2.8 Sealed Series

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APEX® 2.8 Sealed Series	Cavity Count	Blade Size (mm)	Gender	Index	Part Number	Other Available Indexes
	2	2.8	F	A	10757672	B, C, D
	2	2.8	M	A	15488574	B, C, D
	3	2.8	F	A	10757671	B, C, D
	3	2.8	M	A	15394689	B, C, D
	4	2.8	F	A	15425692	B, C, D
	4	2.8	M	A	15489820	B, C, D
	5	2.8	F	A	33513170	B, C, D
	6	2.8	F	A	15419838	B, C, D
	6	2.8	M	A	15430633	B, C, D
	10	2.8	F	A	15316895	B, C, D
	10	2.8	M	A	15425612	B, C, D
	14	2.8	F	A	10763414	B, C, D
	14	2.8	M	A	10757674	B, C, D

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Housings sample part numbers

APEX® ErgoMate™ Series

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APEX® ErgoMate™ Series	Cavity Count	Blade Size (mm)	Gender	Index	Part Number	Other Available Indexes
	24	1.5	F	A	13795018	B, D, E
	24	1.5	M	A	13672210	B, D, E

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Housings sample part numbers

APEX® Mixed Series

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APEX® Mixed Series	Cavity Count	Blade Size (mm)	Gender	Index	Part Number	Other Available Indexes
	14	1.5	F	A	13878050	B, C, D, E, F
	14	1.5	M	A	13694022	B, C, D, E, F

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Terminal sample part numbers

APEX® 1.2, 150, 2.8, 9.5

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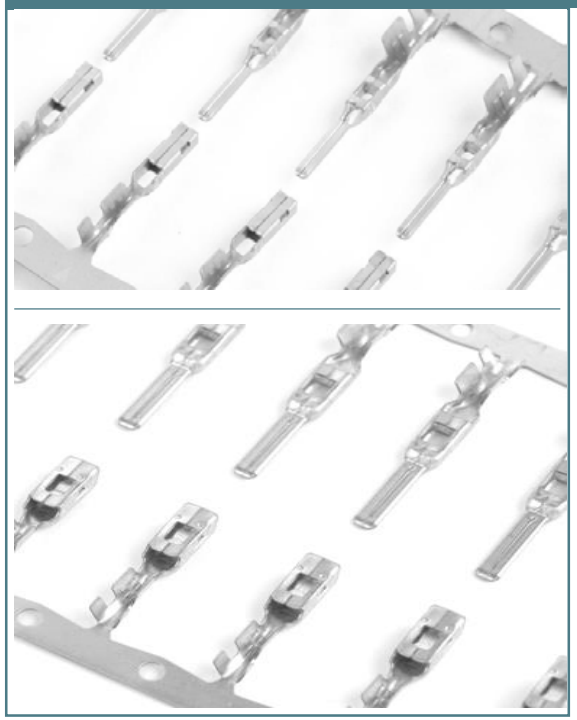

Blade Size (mm)	Gender	Plating	Wire Size Range	Part Number	Other Available Platings
1.2	F	Tin	AWG 18-20 (0.8 mm²)	13576990	Silver, Gold
1.5	F	Tin	AWG 16-18 (1.5 mm²)	13613157	Gold
1.5	F	Tin	AWG 20-22 (0.5 mm²)	13624983	Gold
1.5	M	Tin	AWG 16-18 (1.5 mm²)	13630404	Gold
1.5	M	Tin	AWG 20-22 (0.5 mm²)	13624759	Gold
2.8	F	Tin	AWG 10-12 (4-3 mm²)	10762802	Gold
2.8	F	Tin	AWG 12 (3 mm²)	15422738	Gold
2.8	F	Tin	AWG 14-16 (2 mm²)	10762803	Gold
2.8	F	Tin	AWG 18-20 (0.8 mm²)	10757690	Gold
2.8	F	Tin	AWG 22 (0.35 mm²)	10757691	Gold
2.8	F	SWS, Tin	AWG 12 (3 mm²)	10810733	Gold
2.8	F	SWS, Tin	AWG 16 (2 mm²)	13627267	Gold
2.8	F	SWS, Tin	AWG 18-20 (0.8 mm²)	10810375	Gold

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Terminal sample part numbers

APEX® 1.2, 150, 2.8, 9.5

	Blade Size (mm)	Gender	Plating	Wire Size Range	Part Number	Other Available Platings
	2.8	M	Tin	AWG 10-12 (4-3 mm²)	10762774	
	2.8	M	Tin	AWG 14-16 (2 mm²)	10757692	Gold
	2.8	M	Tin	AWG 18-20 (0.8 mm²)	10762775	Gold
	2.8	M	Tin	AWG 22 (0.35 mm²)	10762776	Gold
	9.5	F	Tin	16-25 mm²	13862251	

Why APEX?

AVNET ABACUS

Heavy-duty
performance

High current
capacity

Ergonomic
design

Our highest current capacity high performance solution with user-friendly ergonomic design

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