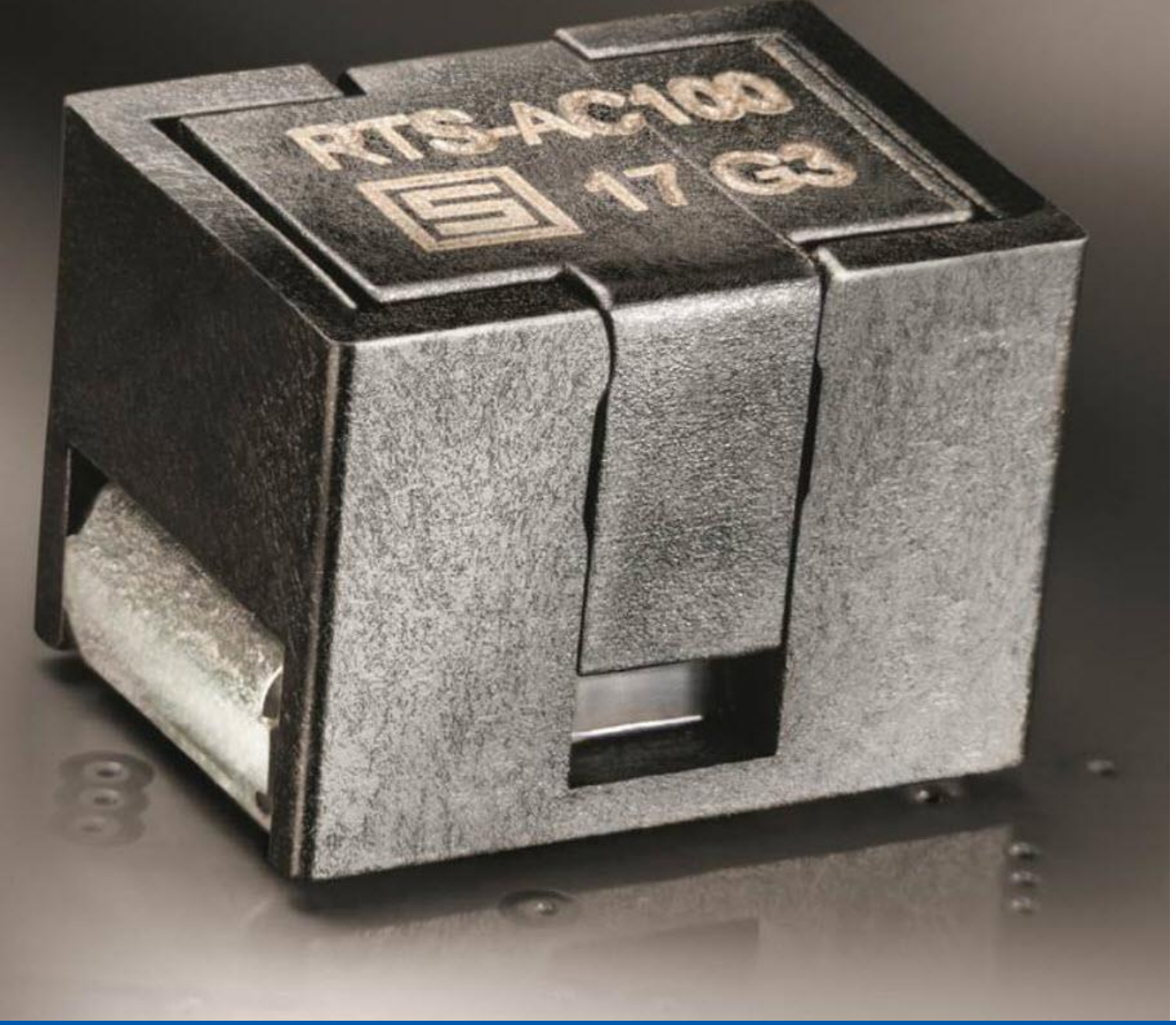


RTS

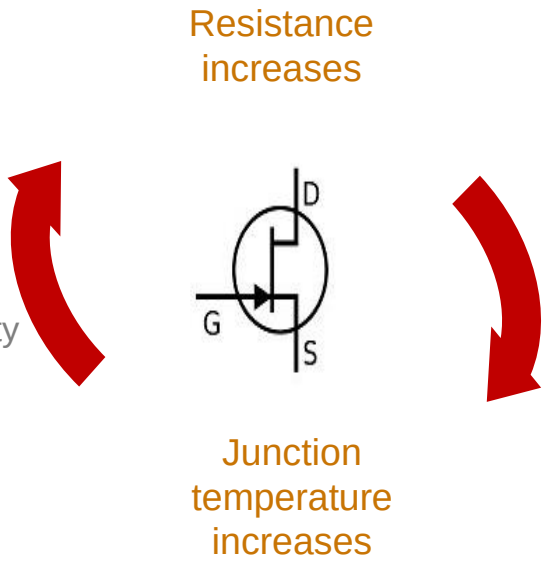
Reflowable
Thermal
Switch

The solution against “Thermal Runaway”

SCHURTER
ELECTRONIC COMPONENTS

RTS – Problem: Thermal Runaway

Thermal Runaway can happen to power semiconductors that exceed their regular operation. A simplified explanation is: higher temperature causes higher resistance which again causes higher temperatures....



What are the causes?

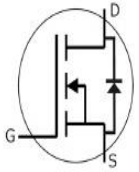
> **Miniaturization & high power applications** cause implemented safety measures, like IC regulators, to fail from time to time.

> Additionally, harsh environments may cause cracked, rusty or fatigued components, which increase the risk for a thermal runaway.

→ *For those rare cases, a protection based on the basic laws of physics is needed*

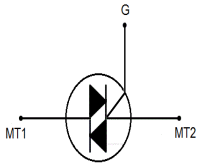
RTS – Problem: Thermal Runaway

Generally thermal runaway may happen in harsh environments where high energy applications (high currents) have to be controlled. The following components can therefore generate a thermal runaway:



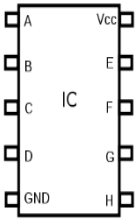
MOSFETs

Metal Oxide Semiconductor Field-Effect Transistor



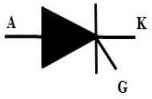
TRIACs

Triode for Alternating Current



ICs

Integrated Circuits



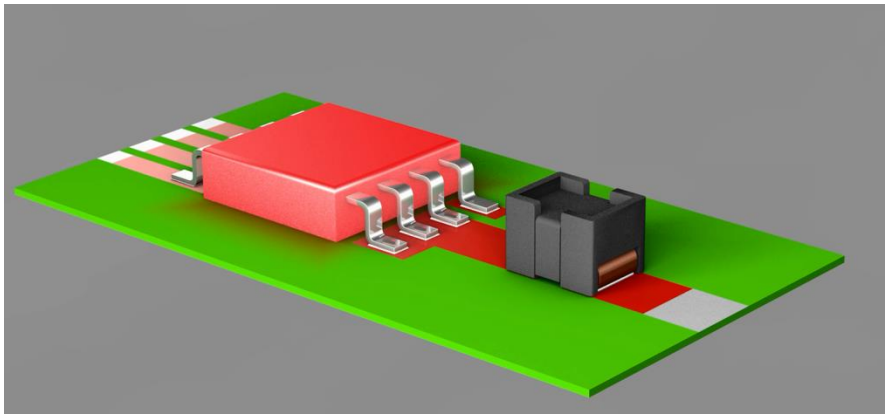
SCRs (Thyristors)

Silicon Controlled Rectifier

IGBTs

Insulated-Gate Bipolar Transistor

RTS – Why a thermal fuse?



What happens without a thermal fuse?

> Standard solder paste has a melting point: **217°C to 230°C**
> The excessive temperature can cause components to randomly melt away
> The whole electrical potential becomes out of control should such a meltdown occur!

Why not use an electronic fuse?

> An electronic fuse cuts off the current through a power transistor
> This means there is nothing safeguarding the transitor of the fuse

Why not use an overcurrrent fuse?

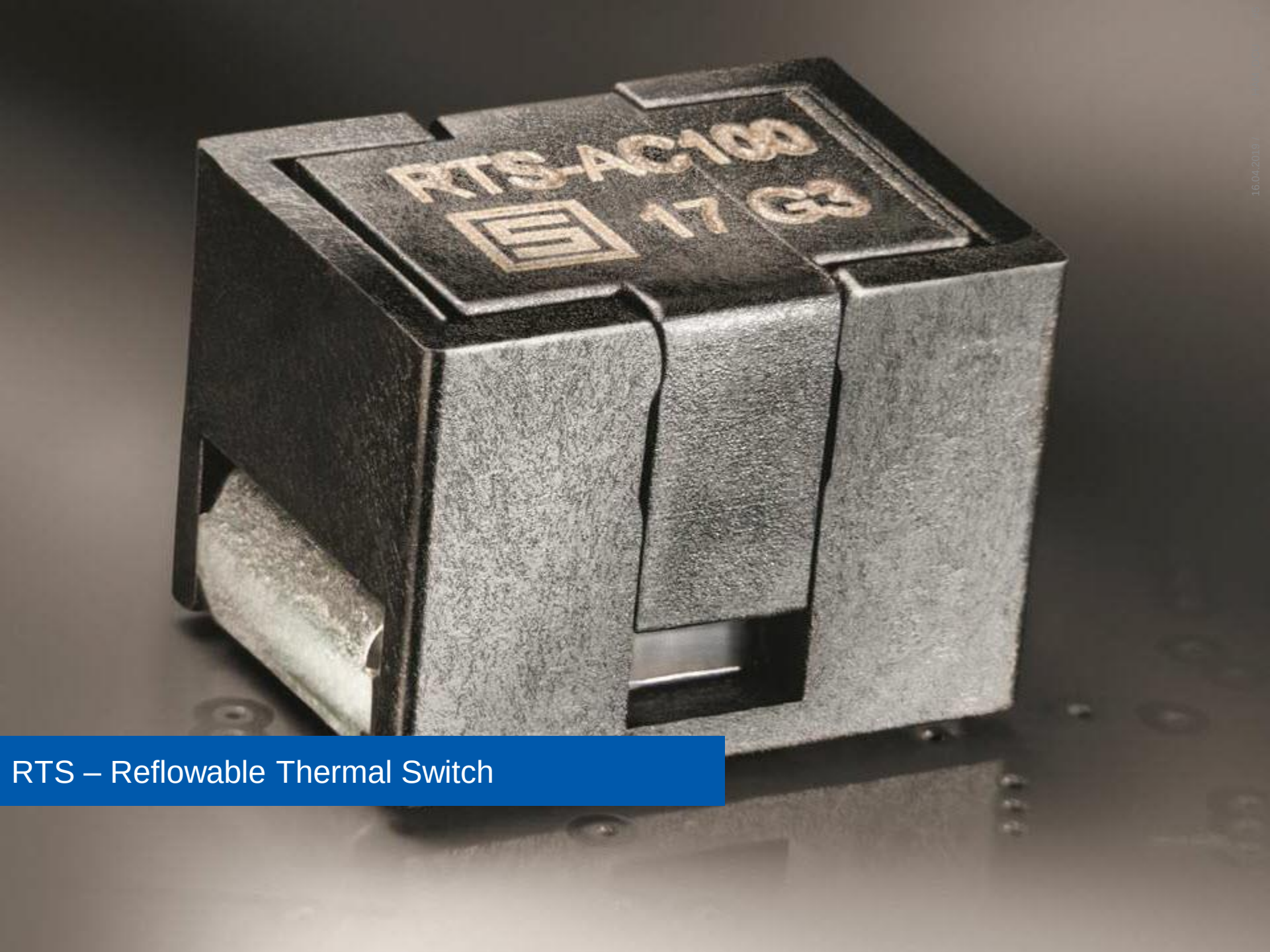
> Thermal runaway can happen without an overcurrent condition
> Temperature is mainly transferred over PCB traces

Why not use an overcurrrent fuse?

> Thermal runaway can happen without an overcurrent condition
> Temperature is mainly transferred over PCB traces

This is why we need a thermal fuse...

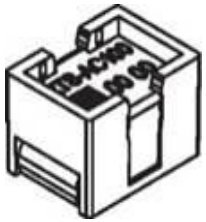
→ *...shuts down the system before other parts become compromised*
→ *...it is dependent on the basic law of physics, not just a logic circuit*
→ *…only a thermal fuse can ensure galvanic separation*



RTS – Reflowable Thermal Switch

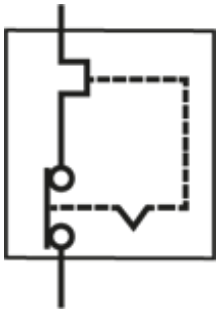
RTS – Reflowable Thermal Switch

Before Reflow



Activation
After Reflow

Circuit Diagram:



Production cost reduction:

> The RTS can be **reflow soldered** @ **260°C** after which it is **mechanically activated** and can still effectively **trip at** 210°C.

> Optimized for standard SMD processes like pick and place

Unmatched electrical values:

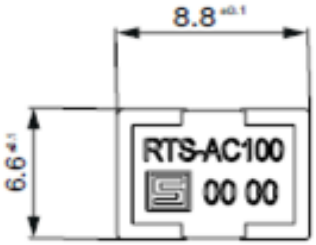
> High operating current up to 100 A

> High rated voltage **60 VDC** → competition is limited to 16 VDC

> Low resistance: 120µOhm

> Very high Breaking Capacity

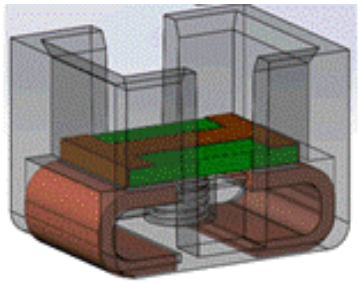
RTS – Reflowable Thermal Switch



Smallest dimensions:

> Small footprint 6.6 x 8.8 mm soldering dimensions

> Just two contacts are needed on the PCB



Version with integrated shunt:

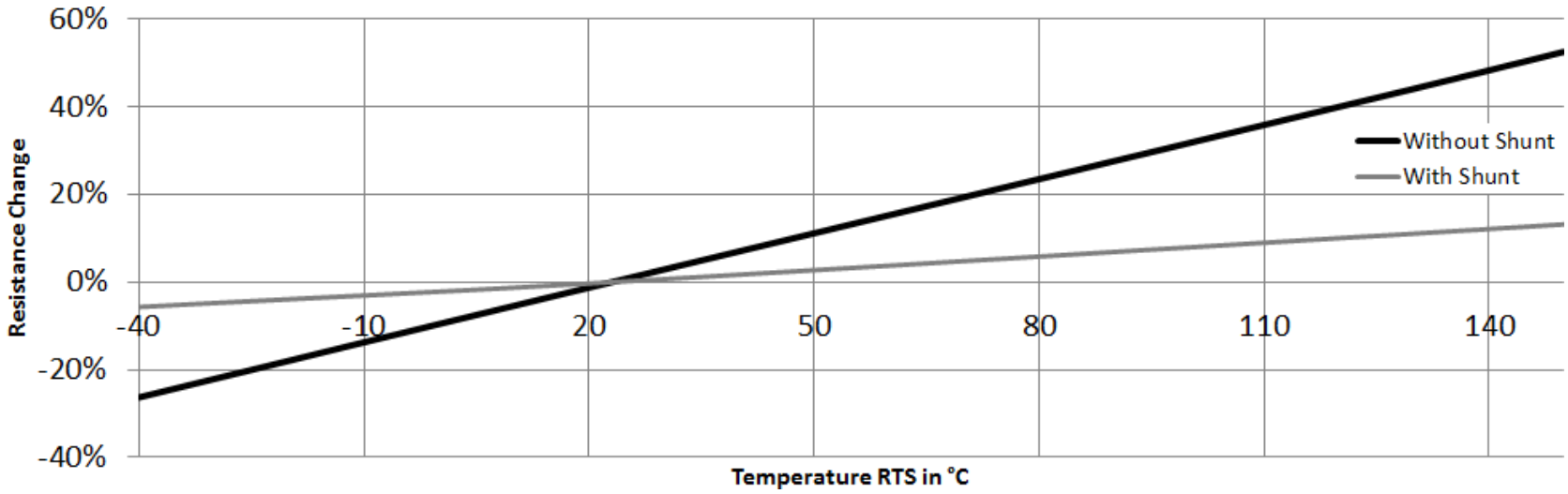
> Integrated into the part shunt / fuse → less space on PCB

> No cost for additional part and its mounting

> An additional overcurrent fuse can be integrated on customer request

Measuring current with a integrated shunt

The Shunt is nothing else than a resistance which value gets less affected by temperature. The less affected the resistance is from heat, the more precise the actual current can be measured.



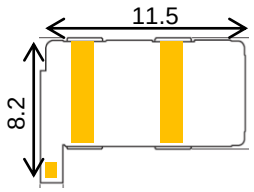
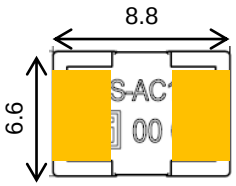
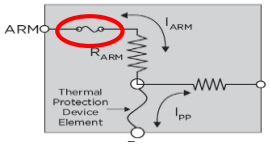
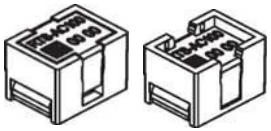
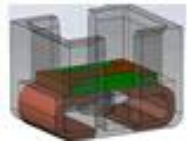
RTS – Extensive AEC-Q200 Testings

AEC

Q200

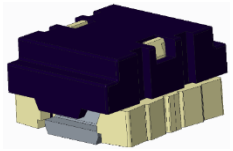
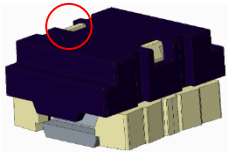
Based Humidity	MIL-STD-202, Method 103
Thermal Shock	MIL-STD-202, Method 107
Operational Life	MIL-STD-202, Method 108, Condition: D
High Frequency Vibration	MIL-STD-202, Method 204, Condition: D
Mechanical Shock	MIL-STD-202, Method 213, Condition: B
Resistance to Solvents	MIL-STD-202, Method 215
Solderability	JESD22-B102E, Method 1
Temperature Cycling	JESD22 Method JA-104 Test Conditions: G
Resistance to soldering heat	JEDEC J-STD-020
Flame Retardance	AEC-Q200-001 + SAG Specification
Board Flex	AEC-Q200-005
Terminal Strength	AEC-Q200-006

RTS – Competitor Differentiation

	 **RTP** by Littlefuse (former TE)	 **RTS** by SCHURTER
Dimensions & Soldering pad	 • 3 contacts necessary • Bigger in footprint	 • Just 2 contacts • Small footprint
Visibility of Activation	 Electrical activation: Activation not visible	 Mechanical activation: Visible by the installer's eye
Add ons	None	 To further optimize PCB space, there are versions with integrated shunt (ampere meter) and/or fuse
Operating Current	90 A	100 A
Rated Voltage	16 VDC	60 VDC
Breaking Capacity	No BC rating above 16 VDC	170 A @ 60 VDC 200 A @ 50 VDC 400 A @ 24 VDC

SCHURTER ELECTRONIC COMPONENTS

RTS – Competitor Differentiation

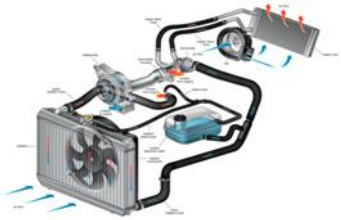
	 **HCRTP-mini** by Littlefuse (former TE)	 **RTS** by SCHURTER
Rated Voltage	**Max. 16VDC**	**Up to 60VDC**
Soldering Joint	The solder joint is made by the customer. The type of solder paste and how much is applied has an influence on the cut off function.	The soldering joint is inside the housing, is well designed and tested by SCHURTER .
Electric Arc	The cut off occurs between fuse and PCB: Electrical arcs can therefore affect the PCB directly. → very high risk for fire	Any electrical arcs happen inside the housing. Electrical arcs are therefore well separated from the PCB
Harsh Environments	 The functionality of this fuse is dependent on two 0.125 mm3 plastic clasps, which may weaken with aging	Solid construction is proven to withstand harsh environments such as 210°C temperature of the PCB trace, vibrations, humidity and aging...
Summary	**Less cost**	**High reliability**

SCHURTER
ELECTRONIC COMPONENTS

RTS – Automotive applications

Fulfilling the AEC-Q200 Standard, the RTS is most suited for use in harsh environments such as those found in the automotive vehicles. Automotive applications where **high currents have to be controlled** using, for example, MOSFET's are:

ABS power steering

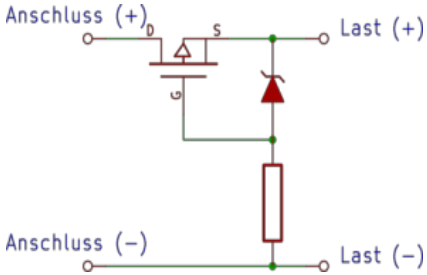


Engine cooling fans

Electrical oil pump

Diesel fuel heaters

Glow plugs



Reverse polarity protection

RTS – Other applications

There are many other applications where high currents are controlled by power electronics. Depending on the customer's demand for safety, the RTS might be a great added value for:

Battery protection

Lighting ballasts

High ambient temperatures

Where DC motors need to be able to run forwards and backwards (Robotics)

H-Bridge circuits

Motor drivers

...

- **Fully automated** production with integrated solder joint testing on each single RTS piece.
- With our actual setup we are ready for high volume projects.

RTS – Market Position

Strategic Positioning

> Patented innovative reflow compatible solution designed to protect against “thermal runaway”

Applications

> Automotive: ABS, Fans, Glow plug, Fuel heater
> Battery protection, Motor drives, Lighting ballasts, H-Bridge Circuits

Competitors

> RTP from Littelfuse (acquired by TE)

Price Position

> Exceptional value for reasonable price

USP (Customer focus)

> 60 VDC is an industry wide unique rating applied to this type of product
> 260°C Reflow compatible @ 210°C tripping point
> Simple and small solder footprint - only two contacts
> Version with integrated shunt saves cost and space
> Can also integrate additional overcurrent fuse

Additional Information

RTS Data Sheet
RTS Video
Thermal Protection Landing page

- Website enables quick access to sales and marketing materials
- Click on Partner Services to download:
  - Latest press releases
  - Training presentations
  - Price lists
  - High and low resolution product photos
- Samples can be ordered from the standard product inventory

Technical Assistance

- For general product questions, contact your Inside Sales Representative.
- For technical assistance or specific design configurations, contact

Nikila Kareesan at:
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