



Smart high / low side switches for BCM & Heating applications

Infineon's virtual show 2020



Agenda

1

Body Control Module: Introduction

2

Low-side switches up to 10A: HITFET+ 12V

3

High-side switches up to 32A: PROFET+2 12V

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High-side switches up to 40A: Power PROFET

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High-side switches with SPI up to 15A: SPOC+2

6

G2M support material

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G2M support material



The **Body Control Module (BCM)** is an Electronic Control Unit (ECU) specialized for **actuating, monitoring and controlling the Vehicle Body Functions** and related ECUs.

The **BCM communicates** with other car functions via the **vehicle bus system** and can include a **Gateway** function.

BCM – Continuous Trends & Disruptive Changes will be answered by the new generation of Body Switches

Bulb and LED loads still represent a high share of latest BCM designs but...

...BCM architectures underlie disruptive changes

Number of BCM loads is increasing drastically

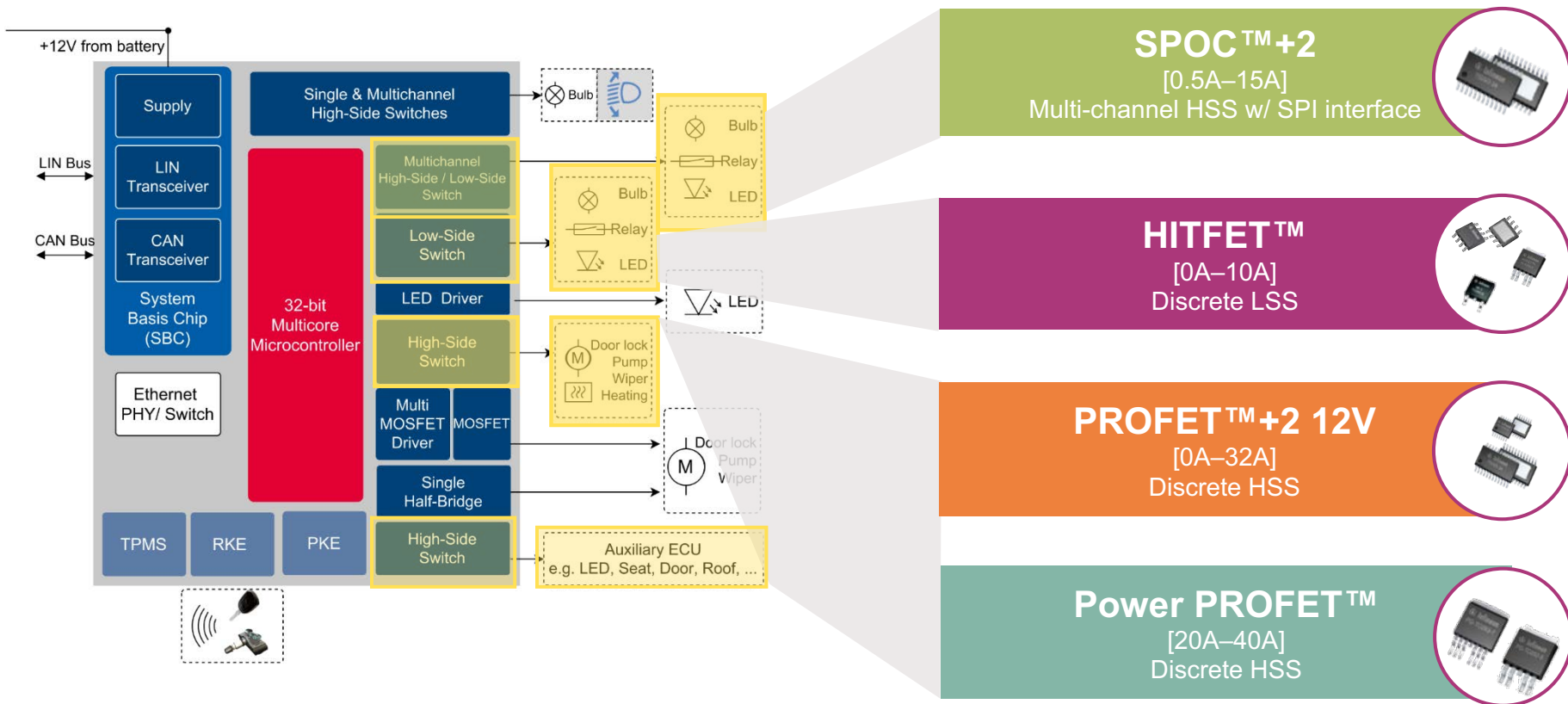
Increasing share of **"non"**-bulb loads at BCMs

Relay functions are replaced by semiconductor switches in the BCM

Partially & fully decentralized light architectures with BCM and LED ECUs appear @ Premium cars



Infineon's offering for Body Control Module



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


6

G2M support material

HITFET™+ 12V:

New "12V" low side switch portfolio overview



	BTF3050TE	BTS3xxxTF	BTS3xxxEJ	BTF3xxxEJ	BTS3011TE
	fully featured	standard	standard	fully featured	fully featured
Package	DPAK-5 	DPAK-3 	TDSO-8 	TDSO-8 	DPAK-5 
1 Channel – Auto-restart					
11 mΩ					BTS3011TE
35 mΩ		BTS3035TF	BTS3035EJ	BTF3035EJ	
50 mΩ	BTF3050TE	BTS3050TF	BTS3050EJ	BTF3050EJ	
80 mΩ		BTS3080TF	BTS3080EJ	BTF3080EJ	
125 mΩ		BTS3125TF	BTS3125EJ	BTF3125EJ	
Switching speed	20kHz	1kHz	1kHz	50kHz	1kHz
Diagnosis pin	SRP		STATUS	STATUS	STATUS
Over-current protection	trigger/limitation	limitation	limitation	trigger/limitation	trigger/limitation
Over-temp protection	OT / DT	OT	OT	OT / DT	OT / DT

On the innovation road: From Classic HITFET™ 12V to HITFET™+ 12V

- 1 The new **SPS technology** offers a **cost effective** solution
- 2 **HITFET™+ 12V** portfolio can replace HITFET™ Classic 12V for applications in low and medium $R_{DS(on)}$ range (10mOhm – 200mOhm)
- 3 HITFET™+ provides three devices as a **1-to-1 replacement for Classic HITFET™**
- 4 HITFET™+ devices offers a **new current limitation concept** and improving short circuit robustness for **higher reliability**
- 5 HITFET™+ introduces a dedicated latching **status pin** for **clear fault indication** and a **supply pin** enabling a **stable $R_{DS(on)}$ across varying battery voltages**
- 6 With the new portfolio we are targeting benchmark **high speed switching applications** (e.g. up to 20kHz) with slew rate control

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PROFET™+2 12V – flexibility & efficiency to drive loads with protection and diagnosis

Load current	Single Channel	Load current	Dual/Quad Channel
32A	BTS70012-1ESP	SOP Q2 2021 <i>Samples & Demoboards already available!</i>	
28A	BTS70015-1ESP		
24A	BTS70020-1ESP		
21A	BTS7002-1EPP		
15A	BTS7004-1EPP		
13A	BTS7006-1EPP		
10–11 A	BTS7008-1EPP		
10–11 A	BTS7008-1EPA	7–7.5 A	BTS7008-2EPA
8–9 A	BTS7010-1EPA	6–6.5 A	BTS7010-2EPA
8–9 A	BTS7012-1EPA	6–6.5 A	BTS7012-2EPA
		5–5.5 A	BTS7020-2EPA
		4–4.5 A	BTS7030-2EPA
4–4.5 A	BTS7040-1EPA	3–3.5 A	BTS7040-2EPA
		3–3.5 A	BTS7080-2EPA
		2–2.5 A	BTS7120-2EPA
		1–1.5 A	BTS7200-2EPA BTS7200-2EPC
		1–1.5 A	BTS7200-4EPA



Interested in learning more about switches & drivers in Power Distribution? [Click here](#)

Key applications: Heating and Power Distribution

- › Nominal load currents up to 32A.
- › Current trip with latch.
- › Over temperature protection.
- › ReverseON and inverse mode capability.
- › Current sense diagnosis with failure signal up to I_{TRIP} level.
- › Optimized turn-on and turn-off slew rates for high currents.

Key application: Lighting and Body

- › Current trip with intelligent restart control.
- › Low-mid currents (1.0-11A).
- › Over temperature protection.
- › Partially with ReverseON.
- › Current sense diagnostics up to $2 \times I_{NOM}$.

PROFET™+2 12V offer the best current sense accuracy at low and nominal current range on the market

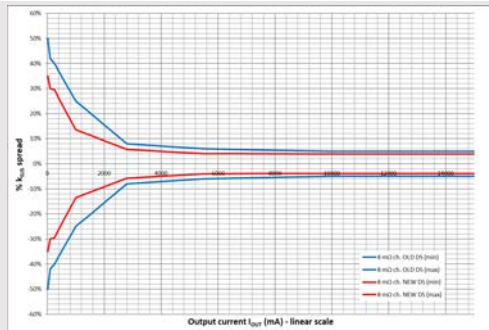
Portfolio with improved k_{ILIS}

Current	Single Channel	Current	Dual/Quad Channel
10–11 A	BTS7008-1EPA	7–7.5 A	BTS7008-2EPA
8–9 A	BTS7010-1EPA	6–6.5 A	BTS7010-2EPA
8–9 A	BTS7012-1EPA	6–6.5 A	BTS7012-2EPA
		5–5.5 A	BTS7020-2EPA
		4–4.5 A	BTS7030-2EPA
4–4.5 A	BTS7040-1EPA	3–3.5 A	BTS7040-2EPA
		3–3.5 A	BTS7080-2EPA
		2–2.5 A	BTS7120-2EPA
		1–1.5 A	BTS7200-2EPA BTS7200-2EPC
		1–1.5 A	BTS7200-4EPA

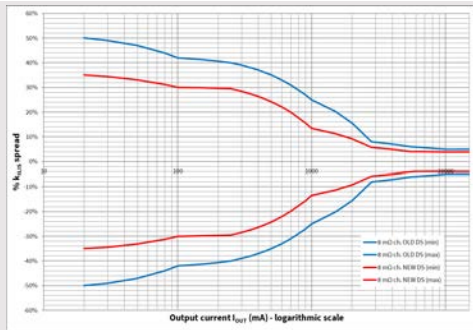
Benefits of tighter current sense accuracy

- › **Fulfillment of OEM requirements** e.g. Open Load in ON detection
- › Enablement of a **more precise device and load measurement**
- › Thanks to the k_{ILIS} tightening the PROFET™+2 12V represents **the best accuracy at low and nominal current range**
- › k_{ILIS} accuracy can be found under chapter 9.6 in the PROFET+2 12V datasheets.

Example: Comparison of **old** k_{ILIS} tolerance vs. **new** k_{ILIS} tolerance for BTS7008-2EPA



Linear Scale



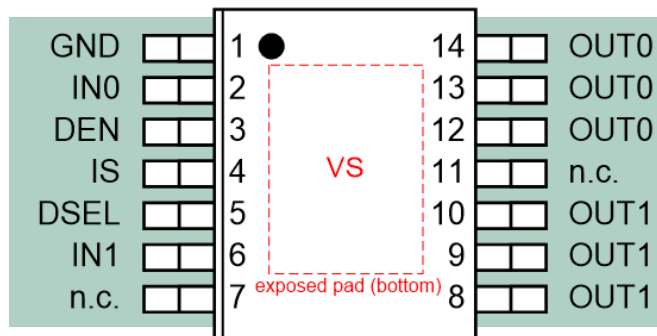
Logarithmic Scale (zoom in low current)

BTS7008-xEPA		OLD DS		NEW DS
A	TYP	[%]	TYP	[%]
0.02	5500	50.0%	5400	35.0%
0.1	5500	42.0%	5400	30.0%
0.25	5500	40.0%	5400	29.5%
1	5500	25.0%	5400	13.5%
2.8	5500	8.0%	5400	5.8%
5.5	5500	6.0%	5400	4.0%
10	5500	5.0%	5400	3.9%

PROFET™+2 12V key facts and benefits

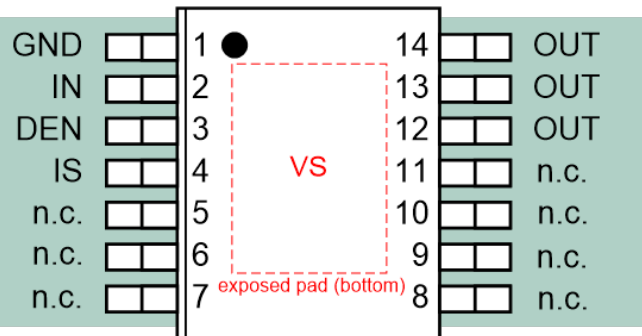
Features	PROFET™+2 12V	Customer benefit
Operating Range	3.1 V – 28 V	Extended operating range operation during cranking
Current consumption	< 2 mA/ch.	Significant decreased operative current consumption
Overcurrent Protection	Tripping	Optimized overcurrent detection to support bulb & module supply inrush
Pinout / Package	TSDSO-14	1 package for all 1ch and 2ch products

*PROFET™+2 12V **dual channel** package layout*



PinOut_PROFET2ch.emf

*PROFET™+2 12V **single channel** package layout*



PinOut_PROFET1ch.emf

PROFET™+2 12V TSDSO-24 family (-1ESP)

High end feature set up to 32A!



Why PROFET™-2 12V?

- › **Lowest power losses** thanks to technology shrinking
- › **Advanced diagnosis** thanks to improved current sense accuracy
- › **Scalable family concept** (pin and function compatible) for high design flexibility



Applications in focus

- › Power Distribution and Heating



PG-TSDSO-24

Basic feature-set

- › High-Side Switch with diagnosis and embedded protection

Pin2pin compatibility

- › **High design flexibility** thanks to the footprint and function compatibility with PROFET™+2 in TSDSO-14

Capacitive Load Switching Mode

- › Switching capacitive loads in the safe operating area
- › Enables to switch big capacitors

Cost optimized solution

- › Load driving capability up to 32A & still within a monolithic chip!

NEW

Samples and demoboards already available!

SOP: Q2 2021

I _{L(NOM)}	Single Channel
32A	BTS70012-1ESP
28A	BTS70015-1ESP
24A	BTS70020-1ESP

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Robust & high power capable: Power PROFET™

Power PROFET™ Portfolio		
Current Load	DPAK	D ² PAK
1.0mΩ		BTS50010-1TAD
1.5mΩ		BTS50015-1TAD
2.5mΩ	BTS50025-1TEA	BTS50025-1TAD

Lowest on-resistance with **enhanced energy** and **thermal capability** on the market

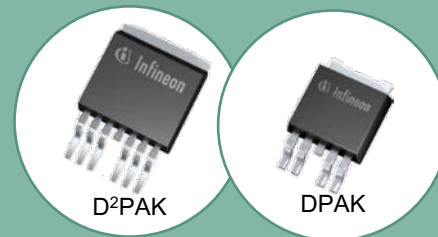
BTS50010-1TAD

Lowest Ohmic smart switch on the market

BTS50025-1TEA

Best compromise between small footprint, low $R_{DS(on)}$ & high energy capability





NEW



- › **Benchmark current capability** (40A DC)
- › **Benchmark energy capability** (EAR 550mJ @33A DC, Grade A AEC-Q100)

Nominal Load Current [A]

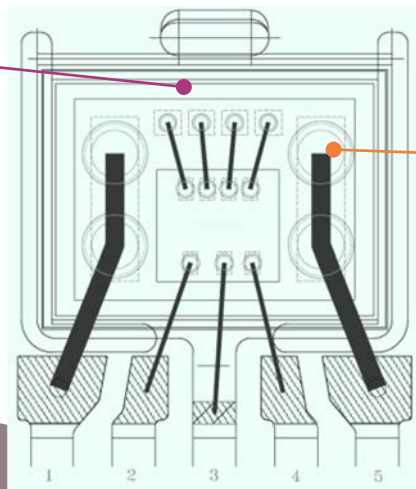
Overview electrical and mechanical parameter

	BTS50010-1TAD	BTS50015-1TAD	BTS50025-1TAD	BTS50025-1TEA
	 D²PAK	 D²PAK	 D²PAK	 DPAK
Footprint	15mm x 10mm	15mm x 10mm	15mm x 10mm	9.9mm x 6.5mm
R_{THJA}	20K/W	20K/W	20K/W	22K/W
R_{DS_ON} (typ @ 25°C)	1.0mΩ	1.5mΩ	2.5mΩ	2.5mΩ
R_{DS_ON} (max @ 150°C)	2.0mΩ	3.0mΩ	5.0mΩ	5.0mΩ
I_{NOM}	40A	33A	25A	24A
I_{TRIP} (min)	150A	135A	70A	60A
E_{AS} @ I_{NOM}	3000mJ	3000mJ	1050mJ	400mJ
E_{AR} @ I_{NOM}	460mJ	550mJ	120mJ	-

BTS50025-TEA: the best compromise between small footprint, low $R_{DS(ON)}$ & energy capability

Package

- › **DAK -57% footprint shrink** compared to D²PAK
- › Excellent thermal capability (R_{THJA} **22K/W**)



Power Chip

- › **Lowest ohmic protected switch** in the market (2.5m Ω) in DPAK
- › **Outstanding energy capability up to 400mJ @ 20A (single pulse)**

Customer Benefits

- › Low R_{TH} : fast heat dissipation
- › 16% lower price than D²PAK counterpart
- › Able to drive bigger inrush currents than PROFETTM+2 12V

The three key features and benefits

Key Feature	Description	Benefit
Benchmark Current Capability	The Power PROFET™ is the only protected device family capable to replace relays & fuses from 20A up to 40A DC	Integrated turn-key solution enabling fast time to market
Benchmark Energy Capability	The Power PROFET™ family offers the highest energy ratings ever specified for a PROFET™ and allowed repetitive clamping	Up to 0.20€ savings by removing the need for free wheeling diode for many application
Short Circuit Grade A (AEC-Q100) >1Million Cycles	The Power PROFET™ achieved the highest rating for short circuit performance under the AEC-Q100 test conditions	The safest solution to replace relays and fuses

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SPOC™+2 with SPI and multichannel integration enables reduction of external components while reducing space and cost on PCB

SPOC™+2 SPI solution

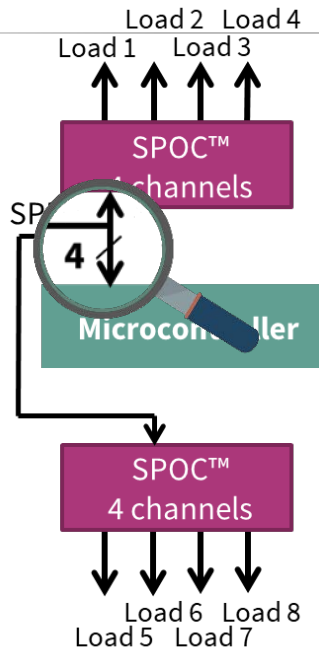
Discrete solution (like PROFET™+2 12V)

Daisy chain implementation

Benefits

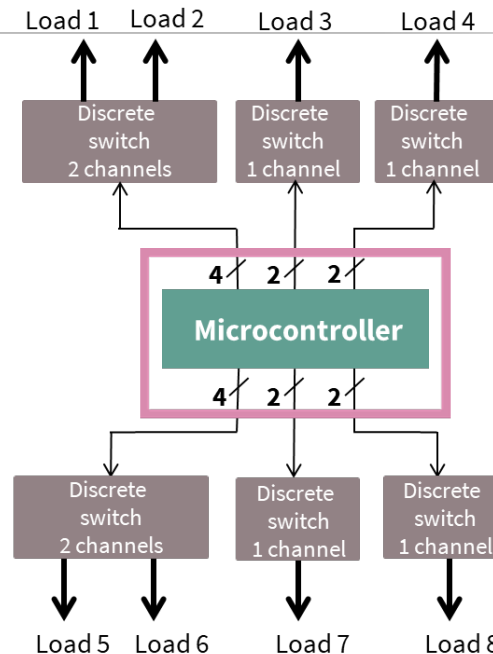
SPI: Less traces on PCB

Multichannel integration: Reduction of external components



-12 GPIOs

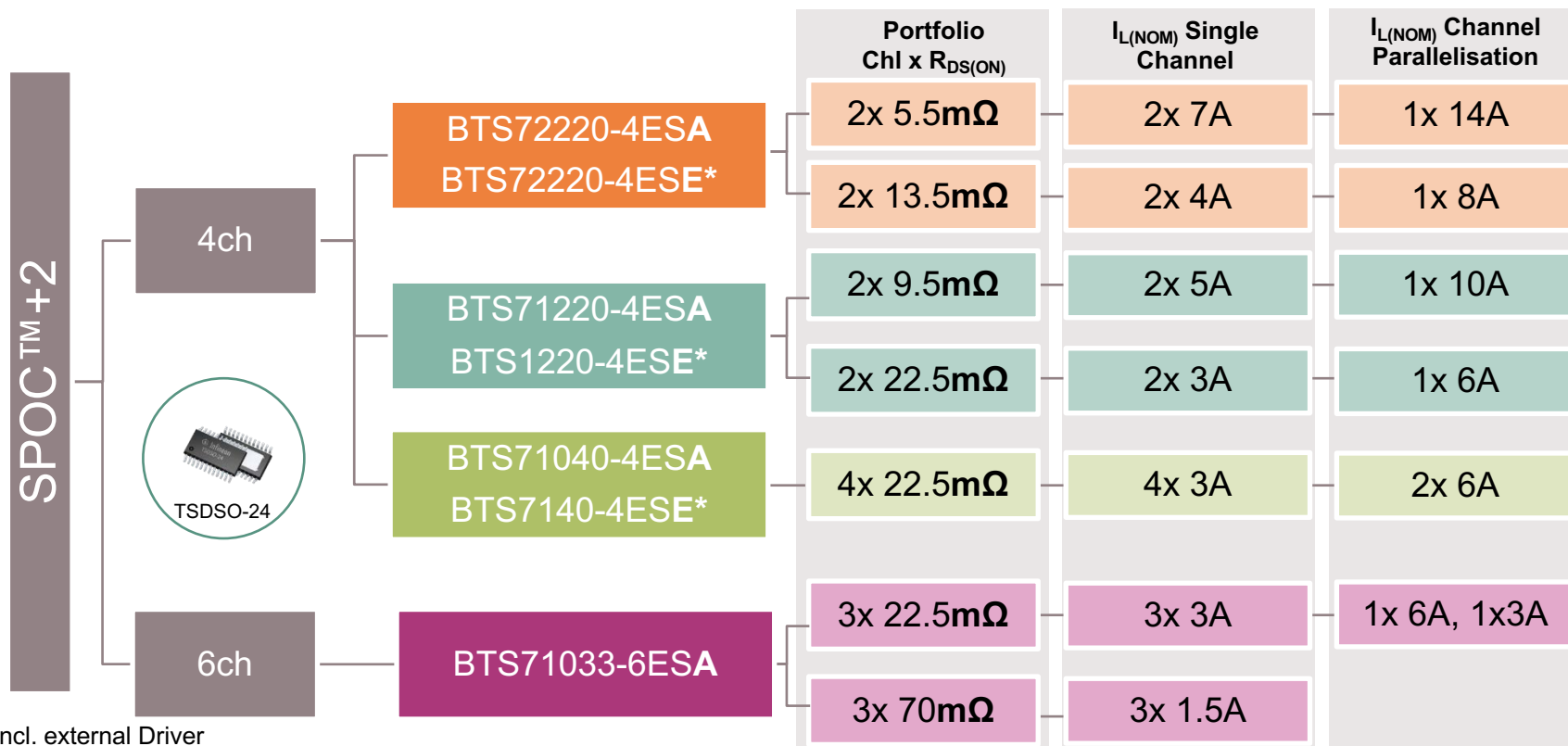
- › Save μ C I/O & board space
- › Smaller microcontroller
- › Cost and PCB area savings



2 connections:
channel +
diagnosis

**16
output
pins**

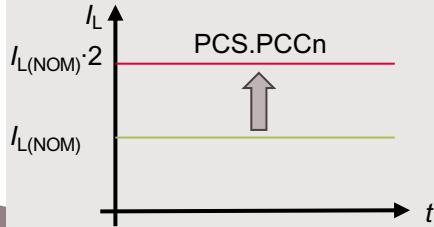
SPOC+2 Portfolio Overview



* E= incl. external Driver

SPOC™+2 offers an advanced feature-set with high flexibility programmable via SPI

Parallel Channel Configuration

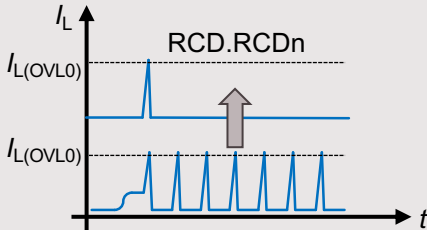


SPOC™+2 offers **high flexibility with configurable features** to support the trend of **intelligent power distribution**

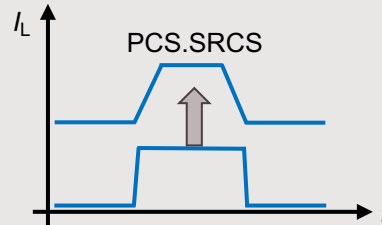
SPI Check sum

Check sum data communication to support functional safety

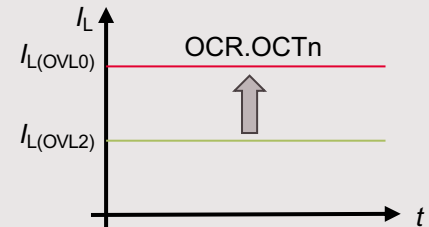
Restart Strategy for Channel n



Slew Rate control for Channel n



Overcurrent threshold adjustment



If you want to learn more about SPOC™+2:

[Getting Started with SPOC™+2 Evaluation Kit](#) & [Explore the possibilities of the SPOC™+2 PSPIICE model and learn how to configure it](#)

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Download our Application Notes:

- › [Sense Accuracy & Calibration](#) of PROFET™+2 12V
- › [Thermal Behavior](#) of PROFET™+2 12V in PG-TSDSO-14



Learn more on our Body Control Module
[Application Page](#)



Related videos on the Body Control Module Application Page:

- › [Discover the full potential of the new PROFET+2 12V Arduino Shield](#)
- › [PROFET+2 12V / SPOC+2 Product Training](#)
- › [Getting Started with SPOC™+2 Evaluation Kit](#)
- › [How to size the current capability of a PROFET™ while taking its environment \(PCB\) into account](#)
- › [Power PROFET™, Infineon's automotive high-side switches](#)
- › And many more ...



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