SPOC+ – SPI Power Controller

The Benchmark in Integration and Modularity

www.infineon.com/spoc

Introduction

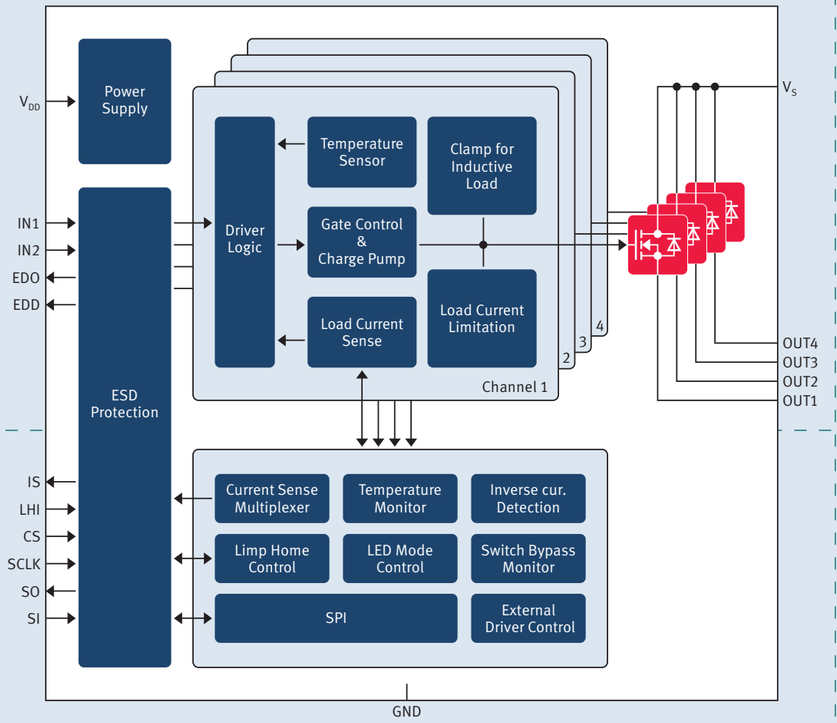
The complexity and density of electronic modules is constantly increasing as more and more loads and functions keep on being implemented. Car manufacturers , automotive suppliers and also industry players are looking for modular and scalable solutions to be able to adapt to a variety of options and re-use the developed electronics for further projects. At the same time, the modules need to be optimized in terms of size and weight.

The SPOC+ family, scaled by number of channels and added features, addresses these trends by implementing smart high-side drivers together with added intelligence inside one package. Full scalability is provided through the footprint and software compatibility of all SPOC+ devices. Integration helps reducing the complexity of the electronics, allowing board space reduction and decreasing the need for external components. Control, configuration and diagnosis are carried out via a Serial Peripheral Interface (SPI), which saves I/Os on the microcontroller and provides flexibility for the solution. Furthermore, fail safe modes are supported, which enhance safety in operation.

SPOC+ provides decisive advantages on system level and for a wide range of applications.

SPOC+ Product Concept

Example: BTS54220-LBE

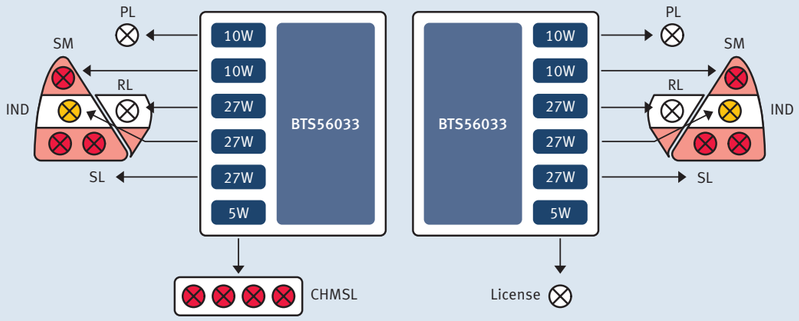


System Partitioning

Example: Automotive Lighting System

Applications Overview

- For 12V grounded high-side loads
- Qualified for automotive and industrial applications, such as lighting, heating, motor driving, energy and power distribution
- Capacitive loads such as lamps with high inrush current, together with specific mode for LEDs and adapted diagnosis
- Resistive loads, such as heating streamer
- Inductive loads, such as motors and solenoids
- Replacement of electromechanical relays and fuses
- Replacement of discrete smart high side chip sets



Pin Description

Pin Name	Function
VDD	Logic supply (5V)
INx	Input signal of channel x
EDO	External driver output
EDD	External driver diagnosis enable
IS	Multiplexed current sense output
LHI	Limp home mode activation
CS, SCLK, SO, SI	SPI signals
GND	Ground connection
OUTx	Power output of channel x
VS	Power supply (12V)

Key Features and Benefits

Basic Features

- 8-bit serial peripheral interface (daisy chain capable SPI) for control and diagnosis
- CMOS compatible parallel input pins for four channels
- Selectable AND-/OR-combination for parallel inputs
- PWM driving possible through direct inputs or via SPI
- Load type configuration via SPI(bulbs or LEDs) for optimized load control
- Very low stand-by current
- Fail safe activation via limp home pin and configuration via input pins only
- Device ground independent from load ground
- AEC Qualified

Protection Features

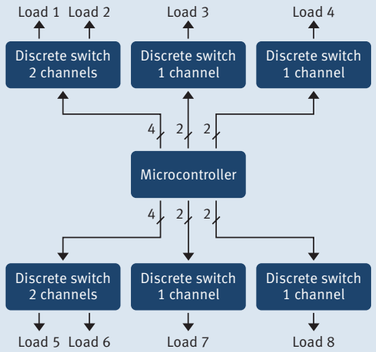
- Current limitation
- Short-circuit protection, robust against repetitive events
- Thermal shutdown with latch and dynamic temperature sensor and limited retries
- Reverse battery protection (with external diode and resistor)
- Undervoltage shutdown
- Loss of ground and loss of battery protection
- Fast inductive energy demagnetization

Diagnostic Features

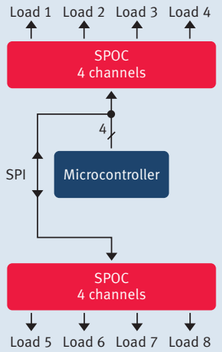
- Multiplexed proportional load current sense signals
- High accuracy of current sense signal at wide load current range
- Current sense ratio (k_{ILIS}) configurable for LEDs or bulbs
- Latching feedback on over temperature via SPI
- Diagnosis using PWM with small duty cycle possible

System Level Benefits

8-channels System Example: need for GPIOs



With Discrete Solution: 16 GPIO
8 Channels Output, 8 Diagnostic enable



With SPOC: 4 GPIO (1 x SPI)

System Level Benefits

Valuable advantages for the whole system

- PCB
  - Simplified layout
  - Less PCB area
  - Less external components
- Microcontroller
  - Less I/O and AD channels need
  - PWM optimized solution
  - PWM operation over SPI
- Diagnosis via SPI
  - Feedback on overload and overtemperature
  - Sense current feedback multiplexing
- Assembly and logistics
  - Reduced bill of material
  - Less pick and place costs
  - Less testing
- Quality improvement
  - Simplified design
  - Less parts to solder
  - Pre-tested “system on a chip”

Product Portfolio Overview

4-channels Devices

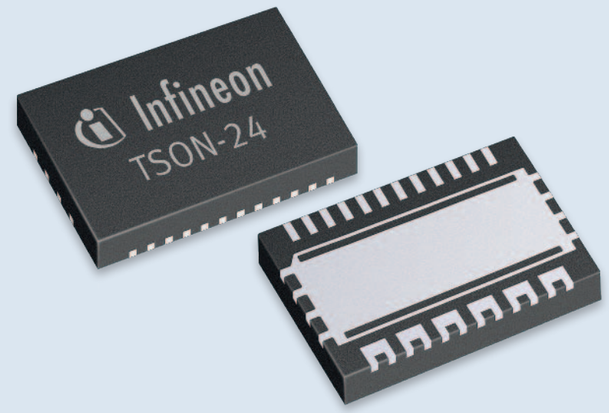
Product Name	65W	27W	10W	Ext. Driver
BTS54220-LBA	2 x 9mΩ	2 x 27mΩ	0	no
BTS54220-LB**E**	2 x 9mΩ	2 x 27mΩ	0	**yes**
BTS54040-LBA	0	4 x 39mΩ	0	no
BTS54040-LB**E**	0	4 x 39mΩ	0	**yes**

5 and 6-channels Devices

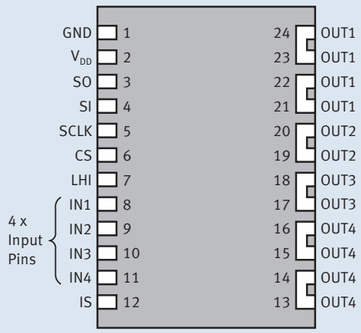
Product Name	65W	27W	10W	Ext. Driver
BTS55032-LBA	0	3 x 39mΩ	2 x 110mΩ	no
BTS56033-LBA	0	3 x 39mΩ	3 x 110mΩ	no

Package Information

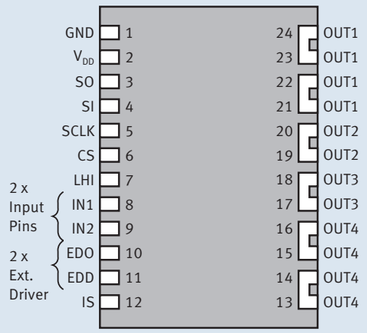
TSON-24: Leadless package with smallest form factor



BTS54220-LBA
W/O External Driver



BTS54220-LBE
W/ External Drive



Channel Main Parameters

Feature	65W	27W (BTS54220)	27W (others)	10W
$R_{DS(on)}$	9mΩ	27mΩ	39mΩ	110mΩ
Max $R_{DS(on)}$ @ 150°C	18mΩ	55mΩ	78mΩ	220mΩ
Current Limitation (min)	66A	25 (32)A	25A	9A
k_{ILIS} (typical)	4500	2000	2000	1000
LED Mode Available	no	**yes**	**yes**	no
LED Mode Factor	–	3.5	3.5	–

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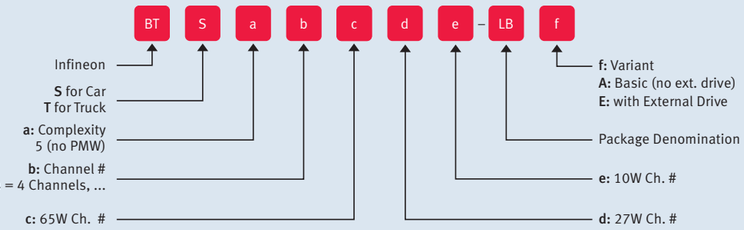
Package Information

Pin	BTS54220-LBA	BTS54220-LBE	BTS54040-LBA	BTS54040-LBE	BTS56033-LBA	BTS55032-LBA
24	OUT1/65W	OUT1/65W	N.C.	N.C.	OUT1/10W	OUT1/10W
23			N.C.	N.C.		
22	OUT1/65W	OUT1/65W	OUT1/27W	OUT1/27W	OUT2/27W	OUT2/27W
21						
20	OUT2/27W	OUT2/27W	OUT2/27W	OUT2/27W	OUT3/27W	OUT3/27W
19						
18	OUT3/27W	OUT3/27W	OUT3/27W	OUT3/27W	OUT4/27W	OUT4/27W
17						
16	OUT4/65W	OUT4/65W	OUT4/27W	OUT4/27W	OUT5/10W	OUT5/10W
15						
14	OUT4/65W	OUT4/65W	N.C.	N.C.	OUT6/10W	N.C.
13			N.C.	N.C.		N.C.

Product Naming System



Green All products are available in green.