

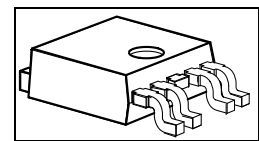
Smart Power High-Side-Switch One Channel: 1 x 200mΩ

Features

- Short-circuit protection
- Current limitation
- Overload protection
- Overvoltage protection (including load dump)
- Undervoltage shutdown with autorestart and hysteresis
- Switching inductive loads
- Clamp of negative voltage at output with inductive loads
- Thermal shutdown with restart
- ESD - Protection
- Loss of GND and loss of V_{bb} protection
- Reverse battery protection with external resistor
- **Improved electromagnetic compatibility (EMC)**

Product Summary

		BTS 4501D	BTS 4141D	
Overvoltage protection	$V_{bb(AZ)}$	47	47	V
Operating voltage	$V_{bb(on)}$	12...35	12... 45	V
On-state resistance	R_{ON}	200	200	mΩ



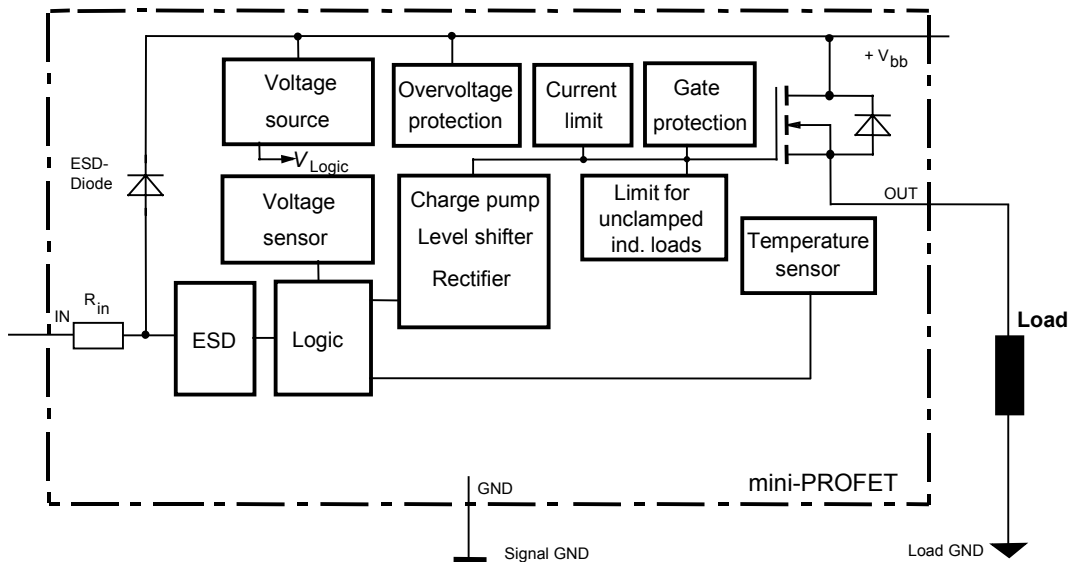
Application

- All types of resistive, inductive and capacitive loads
- Current controlled power switch for 12 V and 24 V DC applications
- Replaces electromechanical relays and discrete circuits

General Description

N channel vertical power MOSFET with charge pump ground referenced CMOS compatible input, monolithically integrated in Smart SIPMOS technology. Fully protected by embedded protection functions.

Block Diagram



Pin	Symbol	Function
1	OUT	Output to the load
2	NC	not connected
3	Vbb	connected with TAB
4	GND	Logic ground
4	IN	Input, activates the power switch in case of logic high signal
TAB	Vbb	Positive power supply voltage

Maximum Ratings

BTS4501D

BTS 4141D

Parameter	Symbol	Values	Values	Unit
at $T_j = 25^\circ\text{C}$, unless otherwise specified				
Supply voltage	V_{bb}	-0,3...48	-0,3...48	V
Load current (Short-circuit current, see page 6)	I_L	self limited	self limited	A
Continuous input voltage	V_{IN}	-5,0... V_{bb}	-5,0... V_{bb}	V
Maximum current through the input pin (DC)	I_{IN}	± 5	± 5	mA
Inductive load switch-off energy dissipation ¹⁾²⁾ single pulse	E_{AS}	8	tbd	J
Operating temperature range	T_j	-40 ...+ 125	-40 ...+ 125	$^\circ\text{C}$
Storage temperature range	T_{sig}	-55 ...+150	-55 ...+ 150	
Max. power dissipation (DC) ¹⁾	P_{tot}	1.4	1.4	W
Electrostatic discharge voltage (Human Body Model) according to ANSI EOS/ESD – S5.1 – 1993	E_{AS}			KV
ESD STM5.1 – 1998				
Input pin		± 1	± 1	
All other pins		± 1	± 5	
Thermal resistance				
	junction – case: R_{thJC}	3	3	K/W
	junction - ambient: ¹⁾ R_{thJA}	60	60	

¹⁾ Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70µm thick) copper area for V_{bb} connection. PCB is vertical without blown air.

²⁾ not tested, specified by design

Electrical Characteristics

Parameter and Conditions	Symbol	BTS 4501D			BTS 4141D			Unit
		min	typ	max	min	typ	max	
at $T_j = 25^\circ\text{C}$, $V_{bb} = 24\text{ V}$ unless otherwise specified								

Load Switching Capabilities and Characteristics

On-state resistance								
$T_j = 25^\circ\text{C}$, $I_L = 0,5\text{ A}$	R_{ON}	--	0,16	0,2	--	0,15	0,2	Ω
$T_j = 125^\circ\text{C}$		--	--	0,38	--	0,27	0,32	
Nominal load current								
Device on PCB ¹⁾	$I_{L(nom)}$	--	--	--	0,7	--	--	A
Turn-on time	t_{on}	--	60	100	--	50	100	μs
Turn-off time	t_{off}	--	90	150	--	75	150	
Slew rate on	dV/dt_{on}	--	2	4	--	1	2	V/ μs
10 to 30% V_{OUT}			$T_j = -40\dots 125^\circ\text{C}$					
Slew rate off	$-dV/dt_{off}$	--	2	4	--	1	2	V/ μs
70 to 40% V_{OUT}			$T_j = -40\dots 125^\circ\text{C}$					

¹⁾ Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm thick) copper area for V_{bb} connection. PCB is vertical without blown air.

Electrical Characteristics

BTS 4501D

BTS 4141D

Parameter and Conditions	Symbol	Values			Values			Unit
		min	typ	max	min	typ	max	

at $T_j = 25\text{ °C}$, $V_{bb} = 24\text{ V}$ unless otherwise specified

Protection Functions

Initial peak short circuit current limit	$I_{L(\lim)}$	--	--	1,8	--	--	1,9	A
$T_j = -40\text{ °C}$		--		--	--		--	
$T_j = 25\text{ °C}$		0,7	1,4	--	0,7	1,5	--	
$T_j = 125\text{ °C}$			--	--		--	--	
Output clamp (inductive load switch off) at $V_{out} = V_{bb} - V_{ON(CL)}$	$V_{ON(CL)}$	47	53	60	47	53	60	V
Overvoltage protection	$V_{bb(AZ)}$	47	--	--	47	--	--	V
$T_j = -40\text{...}+125\text{ °C}$								
Thermal overload trip temperature	T_{tr}	135	150	--	135	--	--	°C
Thermal hysteresis	ΔT_{tr}	--	10	--	--	10	--	K

Electrical Characteristics

BTS 4501D

BTS 4141D

Parameter and Conditions	Symbol	Values			Values			Unit
		min	typ	max	min	typ	max	

at $T_j = 25\text{ °C}$, $V_{bb} = 24\text{ V}$ unless otherwise specified

Input

Continuous input voltage	V_{IN}	-3,0	--	V_{bb}	-3,0	--	V_{bb}	V
$T_j = -40\dots 125\text{ °C}$								
Input turn-on threshold voltage	$V_{IN(T+)}$	--	--	2,6	--	--	3,0	V
$T_j = -40\dots 125\text{ °C}$								
Input turn-off threshold voltage	$V_{IN(T-)}$	1,82	--	--	1,82	--	--	V
$T_j = -40\dots 125\text{ °C}$								
Input threshold hysteresis	$\Delta V_{IN(T)}$	--	0,1	--	--	0,3	--	V
Off state input current	$I_{N(off)}$	20	--	--	20	--	--	μA
$T_j = -40\dots 125\text{ °C}$								
On state input current	$I_{N(on)}$	--	--	110	--	--	110	μA
$T_j = -40\dots 125\text{ °C}$								
Input resistance	R_I	--	--	--	--	3	--	$\text{k}\Omega$

Reverse Battery

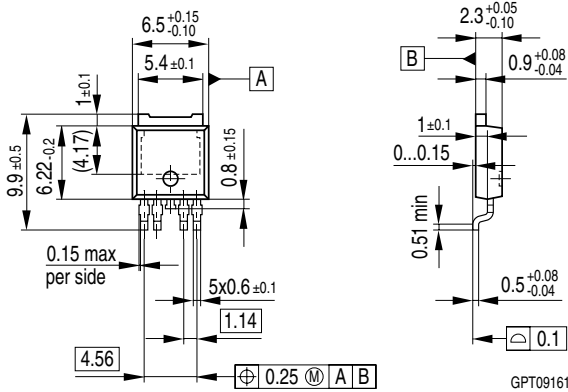
Reverse battery ¹⁾	$-V_{bb}$	--	--	--	--	--	tbd	V
Continuous reverse drain current	I_S	--	--	1	--	--	tbd	A
Drain source diode voltage	$-V_{ON}$	--	--	1,2	--	0,6	--	V

¹⁾ Requires 150 Ω resistor in GND connection. Reverse load current (through intrinsic drain-source diode) is normally limited by the connected load.

Package:

all dimensions in mm.

SOT 223:



All metal surfaces tin plated, except area of cut.

Published by
Infineon Technologies AG,
Bereichs Kommunikation
St.-Martin-Strasse 76,
D-81541 München
© Infineon Technologies AG 1999
All Rights Reserved.

Attention please!

The information herein is given to describe certain components and shall not be considered as warranted characteristics.

Terms of delivery and rights to technical change reserved.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

Infineon Technologies is an approved CECC manufacturer.

Information

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office in Germany or our Infineon Technologies Representatives worldwide (see address list).

Warnings

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.