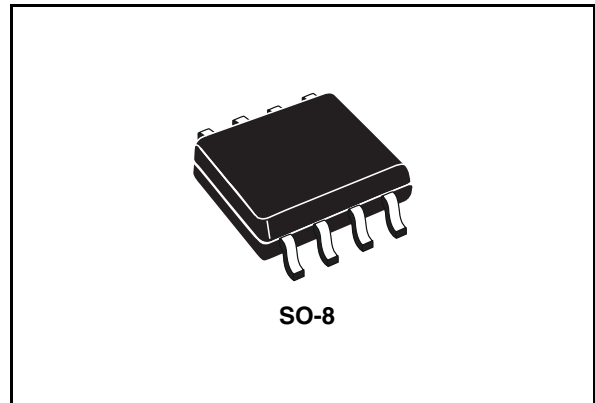


Enhanced power switch

Features

- 90mΩ high-side MOSFET switch
- 500mA continuous current per channel
- Thermal and short-circuit protection with overcurrent logic output
- Operating range from 2.7V to 5.5V
- CMOS- and TTL-compatible enable inputs
- 2.5ms typical rise time
- Under voltage lock out
- 10μA Maximum standby supply current
- Ambient temperature range, 0°C to 85°C
- 2kV ESD protection
- Fault-blanking



Description

The ST2051 power distribution switch is intended for applications where heavy capacitive loads and short circuits are likely to be encountered. These devices incorporate 90mΩ N-channel MOSFET high-side power switches for power-distribution. The switch is controlled by a logic enable input. Gate drive is provided by an internal charge pump designed to control the power-switch rise times and fall times to minimize current surges during switching. The charge pump requires no external components and allows operation from supplies as low as 2.7V.

When the output load exceeds the current-limit threshold or a short is present, the device limits the output current to a safe level by switching into a constant-current mode, pulling the overcurrent logic output low. When continuous heavy overloads and short circuits increase the power dissipation in the switch, causing the junction temperature to rise, a thermal protection circuit shuts off the switch to prevent damage. Recovery from a thermal shutdown is automatic once the device has cooled sufficiently. Internal circuitry ensures the switch remains off until valid input voltage is present.

Order codes

Part number	Package	Packaging
ST2051BDR	SO-8	Tape and reel

Contents

1	Schematic diagram and pin connections	3
2	Functional descriptions	4
2.1	Fault blanking	4
2.2	Overcurrent/over-temperature protection	4
2.3	Under voltage lock out (UVLO)	4
3	Electrical ratings	5
3.1	Absolute maximum ratings	5
3.2	Recommended operating conditions	5
4	Electrical characteristics	6
5	Package mechanical data	8
6	Revision history	10

1 Schematic diagram and pin connections

Figure 1. Schematic diagram

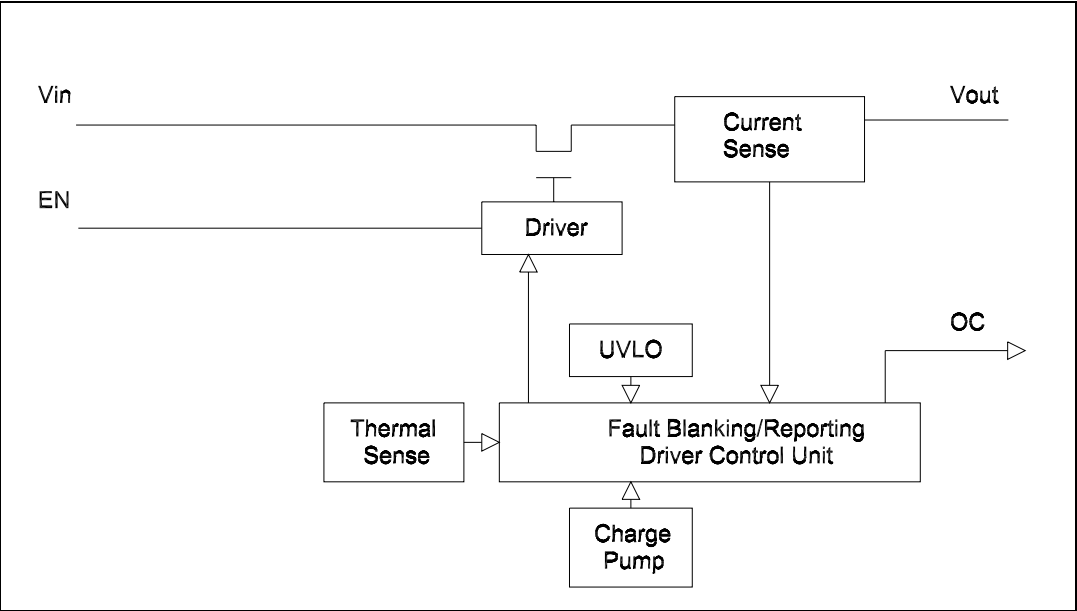


Figure 2. Pin connections (top view)

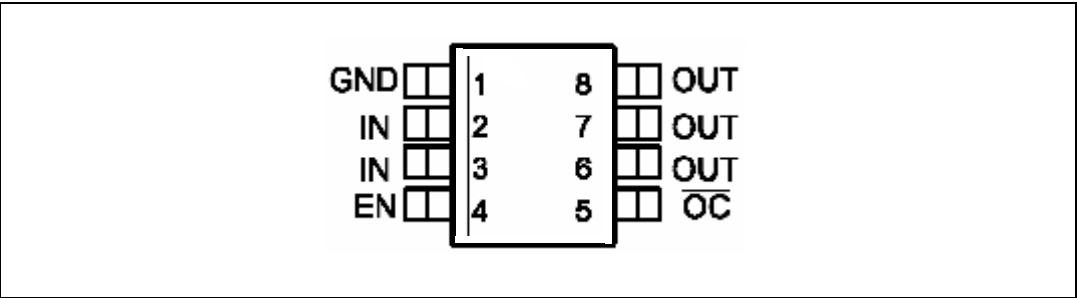


Table 1. Pin functions

Pin	Name	Type	Description
1	GND	-	Ground
2	IN1	-	V _{CC} input, 2.7-5.5V
3	IN2	-	V _{CC} input, 2.7-5.5V
4	EN	I	Enable (Active Hi)
5	OC	O	Open drain output for fault indication
6	OUT3	-	Output
7	OUT2	-	Output
8	OUT1	-	Output

2 Functional descriptions

2.1 Fault blanking

ST devices feature a 10ms fault blanking. Fault blanking allows current-limit faults, including momentary short-circuit faults that occur when hot-swapping a capacitive load, and also ensures that no fault is issued during power-up. When a load transient causes the device to enter current limit, an internal counter starts. If the load fault persists beyond the 10ms fault-blanking time-out, the FAULT output asserts low. Load-transient faults less than 10ms (typical) will not cause a FAULT output assertion. Only current-limit faults are blanked. Die over-temperature faults and input voltage droops below the Under voltage lock out (UVLO) threshold will cause an immediate fault output.

2.2 Overcurrent/over-temperature protection

In overcurrent or short-circuit condition, the switch limits the current at 500mA. If temperature of die goes above limit value, the switch turns OFF

2.3 Under voltage lock out (UVLO)

When input voltage drops below critical value, the power switch turns OFF to prevent improper operation due to low voltage.

3 Electrical ratings

3.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	Input voltage range	-0.3-6.0	V
V_O	Output voltage range	-0.3-($V_I+0.3$)	V
Vienx	EN Input voltage range	-0.3-6.0	V
I_O	Continuous output current	Internally limited	
ESD	ESD protection level	2	kV
T_J	Junction operating temperature	-40 to 125	°C
T_{STG}	Storage temperature	-55 to 150	°C

3.2 Recommended operating conditions

Table 3. Recommended operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_I	Input voltage	2.7	5.0	5.5	V
V_O	Output voltage	0	5.0	5.5	V
I_O	Continuous output current	0	-	500	mA

4 Electrical characteristics

Table 4. Electrical characteristics ($T_J = 25^\circ\text{C}$, $V_I = 5.0\text{V}$)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static Drain-Source ON-State Resistance	$V_I = 3.3\text{V}; -40 < T_J < 125^\circ\text{C}$		100	145	$\text{m}\Omega$
		$V_I = 5.0\text{V}; -40 < T_J < 125^\circ\text{C}$		90	135	
		$V_I = 3.3\text{V}; T_J = 25^\circ\text{C}$		90	130	
		$V_I = 5.0\text{V}; T_J = 25^\circ\text{C}$		80	110	
t_r	Output rise time ⁽¹⁾	$V_I = 5.5\text{V}, R_L = 10\Omega, C_L = 1\mu\text{F}$		2.5		ms
		$V_I = 2.7\text{V}, R_L = 10\Omega, C_L = 1\mu\text{F}$		3		ms
t_f	Output fall time ⁽¹⁾	$V_I = 5.5\text{V}, R_L = 10\Omega, C_L = 1\mu\text{F}$		0.3		ms
		$V_I = 2.7\text{V}, R_L = 10\Omega, C_L = 1\mu\text{F}$		0.2		ms
T_{ON}	Turn-ON time ⁽¹⁾	$R_L = 10\Omega, C_L = 100\mu\text{F}$			20	ms
T_{OFF}	Turn-OFF time ⁽¹⁾	$R_L = 10\Omega, C_L = 100\mu\text{F}$			40	ms

1. Not tested in production, specified by design

Table 5. Current limit characteristics

($V_I = 5.5\text{V}$, $I_O = \text{rated current}$, $T_J = 25^\circ\text{C}$, unless otherwise specified.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{OS}	Short circuit output current	$V_I = 5\text{V}$, OUT Connected to GND, device enabled into short circuit	0.7	1.0	1.3	A

Table 6. Supply current characteristics

($V_I = 5.5\text{V}$, $I_O = \text{rated current}$, $T_J = 25^\circ\text{C}$, unless otherwise specified.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{OFF}	Switch turned OFF	No load		1.0	5.0	μA
		No load; $-40 < T_J < 125^\circ\text{C}$			10	μA
I_{ON}	Switch turned ON	No load		70	90	μA
		No load; $-40 < T_J < 125^\circ\text{C}$			100	μA
$I_{leakage}$	Output leakage current	Output grounded, switch is OFF			10	μA
		Output grounded, switch is OFF; $-40 < T_J < 125^\circ\text{C}$			20	μA

Table 7. Thermal characteristics(V_I = 5.5V, I_O = rated current, T_J = 25°C, unless otherwise specified.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T1	Thermal shutdown threshold		135			°C
T2	Recovery from thermal shutdown		125			°C
Hyst	Hysteresis			10		°C

Table 8. UVLO characteristics(V_I = 5.5V, I_O = rated current, T_J = 25°C, unless otherwise specified.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{UVLO}	Undervoltage lockout threshold		2.0		2.5	V
Hyst	Hysteresis			100		mV

Table 9. OC pin characteristics(V_I = 5.5V, I_O = rated current, T_J = 25°C, unless otherwise specified.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
OC Blanking	OCx assertion and de-assertion (1)		4	8	15	mS
V _O	Output low voltage				0.4	V
I _{OFF}	OFF current				1.0	μA

1. Not tested in production, specified by design

Table 10. EN pin characteristics(V_I = 5.5V, I_O = rated current, T_J = 25°C, unless otherwise specified.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{IH}	High level input voltage	V _I = 2.7V to 5.5V	2.0			V
V _{IL}	Low level input voltage	V _I = 4.5V to 5.5V			0.8	V
		V _I = 2.7V to 4.5V			0.4	V
I _I	Input current	VIENX = 0V or V _I	-0.5		0.5	μA

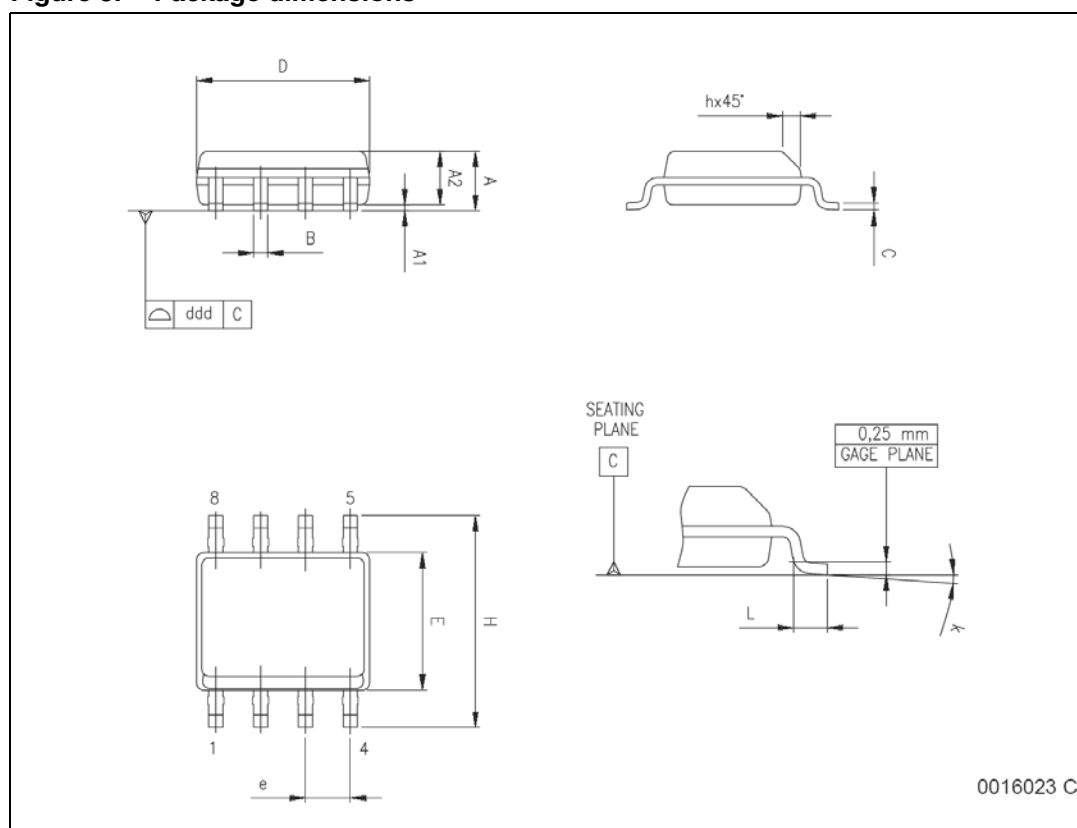
5 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

Table 11. SO-8 Mechanical data

Dim.	mm.			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.004		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.15		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.10			0.004

Figure 3. Package dimensions



6 Revision history

Table 12. Revision history

Date	Revision	Changes
02-Aug-2006	1	First release

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2006 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com