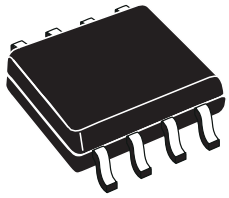
ST2051

Enhanced power switch

Features

- 90mΩ high-side MOSFET switch
- 500mA continuos 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



SO-8

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

Figure 1. Schematic diagram

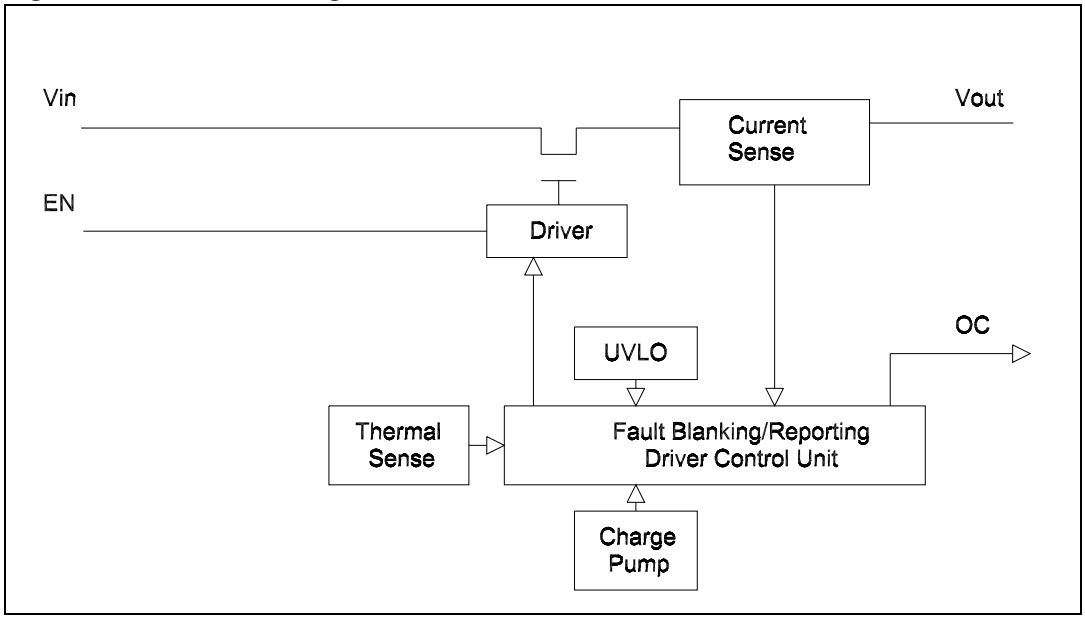


Figure 2. Pin connections (top view)

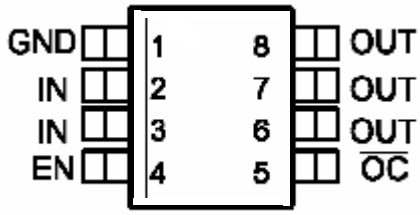


Table 1. Pin functions

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-(Vi+0.3)	V
Vienx	EN Input voltage range	-0.3-6.0	V
Io	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°C, V_I = 5.0V)

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

1. Not tested in production, specified by design

Table 5. Current limit characteristics
(V_I = 5.5V, I_O = rated current, T_J = 25°C, unless otherwise specified.)

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

Table 6. Supply current characteristics
(V_I = 5.5V, I_O = rated current, T_J = 25°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°C			10	µA
I_{ON}	Switch turned ON	No load		70	90	µA
		No load; -40 < T_J < 125°C			100	µA
$I_{leakage}$	Output leakage current	Output grounded, switch is OFF			10	µA
		Output grounded, switch is OFF; -40 < T_J < 125°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

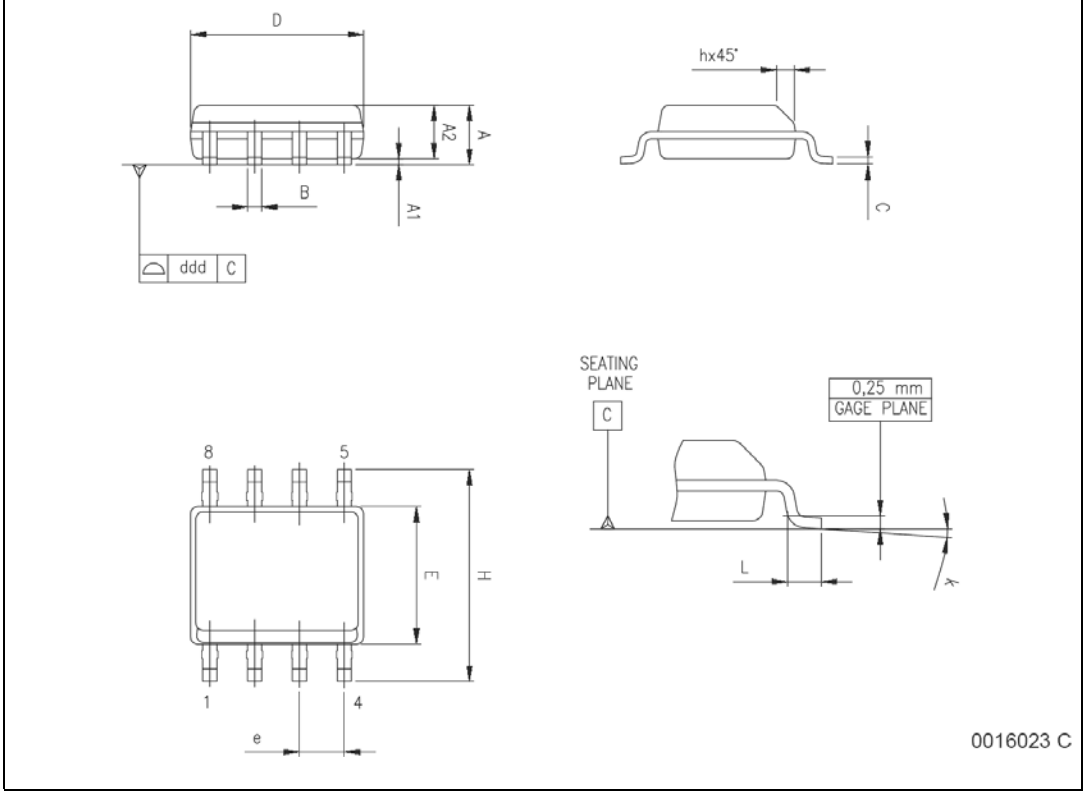
5 Package mechanical data

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

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