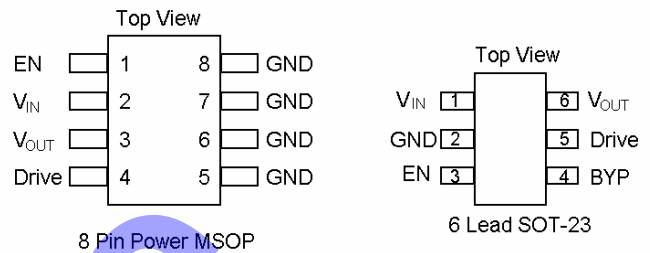


# Micropower, 500mA / 3.3V SmartOR™ Regulator with Drive

## Features

- 3.3V regulated output up to 500mA in MSOP-8 package (150mA in SOT-23-6 package)
- Automatic Detection of  $V_{IN}$  Input Supply
- Drive Output Logic to Control External PFET Switch
- <1 A quiescent current when  $V_{IN}$  not present
- “Zero” current in Shutdown mode
- Built-In Hysteresis during Supply Selection
- Thermal Overload Protection
- Current Limiting Protection
- Controller operates from either  $V_{IN}$  or  $V_{OUT}$

## Pin Diagram



## Applications

- USB bus-powered handheld devices
- PCI Adapter Cards

## Product Description

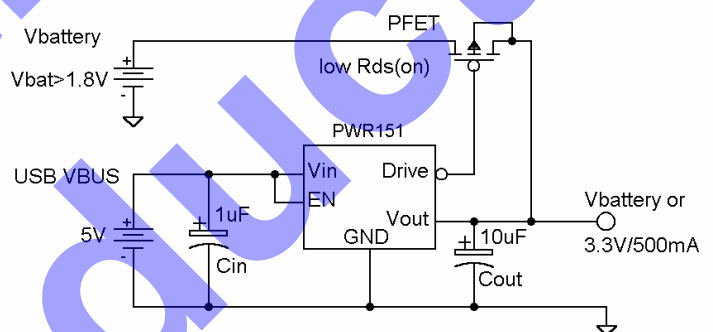
The SmartOR™ CM3151 is a low dropout regulator that delivers up to 500mA of load current in the MSOP-8 package at a fixed 3.3V output. Continuous output current is only limited by the package and the layout (150mA max current in the SOT-23-6 package). An internal threshold level (typically 3.9V) is used to prevent the regulator from being operated below dropout voltage. The device continuously monitors the input supply and will automatically disable the regulator when  $V_{IN}$  falls below the threshold level. When the regulator is disabled, the control signal “Drive” (Active Low) is enabled, which allows an external PMOS switch to power the load from a battery. When  $V_{IN}$  is not present, the device only draws less than 1 A from the output preventing from discharging the battery.

When  $V_{IN}$  is restored to a level above the select threshold, the control signal for the external PMOS switch is disabled and the regulator is once again enabled.

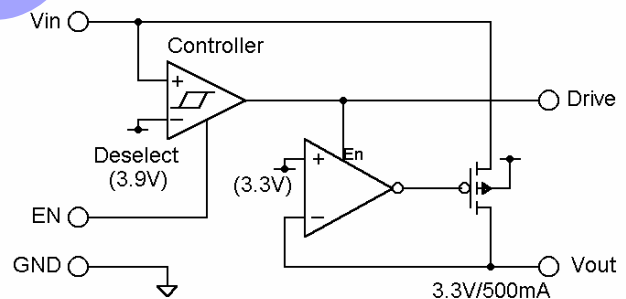
The Enable input allows to shutdown the regulator as well as sets the Drive signal “High” disabling the external PMOS switch.

The CM3151 is available in an 8-pin MSOP thermally enhanced package, or 6-pin SOT23 ideal for space critical applications.

## Typical Application Circuit (for MSOP-8)



## Simplified Electrical Schematic



## STANDARD PART ORDERING INFORMATION

Package		Ordering Part Number		
Pins	Style	Tubes	Tape & Reel	Part Marking
8	Power MSOP-8			
6	SOT-23-6			



Absolute Maximum Ratings		
Parameter	Rating	Unit
ESD Protection (HBM)	2000	V
V <sub>CC</sub> Input Voltage	+ 6.0, Gnd - 0.5	V
Drive Logic Voltage	V <sub>CC</sub> + 0.5, Gnd - 0.5	V
Temperature: Storage	- 40 to +150	- C
Operating Ambient	0 to +70	
Operating Junction	0 to +125	
Power Dissipation (MSOP-8) <sup>1</sup> (SOT23-6)	Internally limited	W

Operating Conditions		
Parameter	Range	Unit
V <sub>CC</sub>	5.0 ± 0.5	V
Temperature (Ambient)	0 to +70	C
Load Current	0 to 500	mA
C <sub>EXT</sub>	10 ± 20%	F

Electrical Operating Characteristics (over operating conditions unless specified otherwise)						
Symbol	Parameter	Conditions	MIN	TYP	MAX	UNIT
V <sub>OUT</sub>	Regulator Output Voltage	500mA > I <sub>LOAD</sub> > 0mA	3.135	3.30	3.465	V
V <sub>CCSEL</sub>	Select Voltage	Regulator Enabled		4.30	4.40	V
V <sub>CCDES</sub>	Deselect Voltage	Regulator Disabled	3.80	3.90		
V <sub>CCHYST</sub>	Hysteresis Voltage	Hysteresis <sup>2</sup>		0.40		
I <sub>SC</sub>	Short Circuit Output Current	V <sub>CC</sub> = 5V, V <sub>OUT</sub> = 0V		700		mA
I <sub>RCC</sub>	V <sub>CC</sub> Pin Reverse Leakage	V <sub>OUT</sub> = 3.3V, V <sub>CC</sub> = 0V		5	50	A
V <sub>RLOAD</sub>	Load Regulation	V <sub>CC</sub> = 5V, I <sub>LOAD</sub> = 50mA to 500mA		75		mV
V <sub>RLINE</sub>	Line Regulation	V <sub>CC</sub> = 4.5V to 5.5V, I <sub>LOAD</sub> = 5mA		2		mV
I <sub>GND</sub>	Ground Current <sup>3</sup>	EN = low (Disabled mode) EN = high and V <sub>CC</sub> < V <sub>OUT</sub> V <sub>CC</sub> = 5V, I <sub>LOAD</sub> = 1mA V <sub>CC</sub> = 5V, I <sub>LOAD</sub> = 500mA		0.5 120 130	1 1	A
R <sub>OH</sub>	Drive pull-up resistance	R <sub>PULLUP</sub> to V <sub>CC</sub> , V <sub>CC</sub> > V <sub>CCSEL</sub>		100	400	
R <sub>OL</sub>	Drive pulldown resistance	R <sub>PULLDOWN</sub> to GND, V <sub>CCDES</sub> > V <sub>CC</sub>		200	400	
t <sub>DH</sub>	Drive High Delay	C <sub>DRIVE</sub> = 1nF, V <sub>CC</sub> t <sub>RISE</sub> < 100ns		1.0		s
t <sub>DL</sub>	Drive Low Delay	C <sub>DRIVE</sub> = 1nF, V <sub>CC</sub> t <sub>FALL</sub> < 100ns		0.2		
T <sub>DISABLE</sub>	Shutdown temperature			150		C
T <sub>HYST</sub>	Thermal hysteresis			20		

Note 1: The SOIC package used is thermally enhanced through the use of a fused integral leadframe. The power rating is based on a printed circuit board heat spreading capability equivalent to 2 square inches of copper connected to the GND pins. Typical multi-layer boards using power plane construction will provide this heat spreading ability without the need for additional dedicated copper area. (Please consult with factory for thermal evaluation assistance)

Note 2: The hysteresis defines the maximum level of acceptable disturbance on V<sub>CC</sub> during switching. It is recommended that the V<sub>CC</sub> source impedance be kept below 0.25 to ensure the switching disturbance remains below the hysteresis during select/deselect transitions. An input capacitor may be required to help minimize the switching transient.

Note 3: Ground pin current consists of controller current and regulator current if enabled. The controller always draws current from either V<sub>CC</sub> or V<sub>OUT</sub>, whichever is greater. All regulator current is supplied exclusively from V<sub>CC</sub>.

## Interface Signals

**V<sub>CC</sub>** is the power source for the internal regulator and is monitored continuously by an internal controller circuit.

Whenever **V<sub>CC</sub>** exceeds **V<sub>CCSEL</sub>** (4.30V typically), the internal regulator will be enabled and deliver a fixed 3.3V at **V<sub>OUT</sub>**. When **V<sub>CC</sub>** falls below **V<sub>CCDES</sub>** (3.90V typically) the regulator will be disabled.

During a **V<sub>CC</sub>** power up sequence, there will be an effective step increase in **V<sub>CC</sub>** line current when the regulator is enabled. The amplitude of this step increase will depend on the dc load current and any necessary current required for charging/discharging the load capacitance. This line current transient will cause a voltage disturbance at the **V<sub>CC</sub>** pin. The magnitude of the disturbance will be directly proportional to the effective power supply source impedance being delivered to the **V<sub>CC</sub>** input.

To prevent chatter during Select and Deselect transitions, a built-in hysteresis voltage of 250mV has been incorporated. It is recommended that the power supply connected to the **V<sub>CC</sub>** input should have a source resistance of less than 0.5  $\Omega$  to minimize the event of chatter during the enabling/disabling of the regulator.

An input filter capacitor in close proximity to the **V<sub>CC</sub>** pin will reduce the effective source impedance and help minimize any disturbances. If the **V<sub>CC</sub>** pin is within a few inches of the main input filter, a capacitor may not be necessary. Otherwise an input filter capacitor in the range of 1 $\mu$ F to 10 $\mu$ F will ensure adequate filtering.

**GND** is the negative reference for all voltages.

**V<sub>OUT</sub>** is the regulator output voltage connection used to power the load. An output capacitor of ten microfarads is used to provide the necessary phase compensation, thereby preventing oscillation. The capacitor also helps to minimize the peak output disturbance during power supply changeover.

When **V<sub>CC</sub>** falls below **V<sub>OUT</sub>**, then **V<sub>OUT</sub>** will be used to provide the necessary quiescent current for the internal reference circuits. This ensures excellent start-up characteristics for the regulator.

**Drive** is an active LOW logic output intended to be used as the control signal for driving an external PFET whenever the regulator is disabled. This allows the voltage at **V<sub>OUT</sub>** to be powered from an auxiliary supply voltage (3.3V).

The Drive pin is pulled High to **V<sub>CC</sub>** whenever the regulator is enabled, this ensures the auxiliary remains isolated during normal regulator operation.

**EN** is the enable input. When set to a logic High, the regulator is enabled. When set to a logic Low, the regulator is disabled and the Drive signal is set to a high level, which turns off the external PFET switch. Therefore when Enable is set low (disabled mode), both the regulator and the switch are turned off.

**BYP** is the bypass capacitor input pin. This pin is only available in the SOT23-6 package version. It allows to connect an external capacitor (typically 10nF) to further reduce the noise on the regulator output.

Pin Functions	
Symbol	Description
<b>V<sub>CC</sub></b>	Positive Supply input for the regulator. When <b>V<sub>CC</sub></b> falls below 3.9V the regulator is disabled.
<b>GND</b>	Negative reference for all voltages.
<b>V<sub>OUT</sub></b>	Regulator voltage output (3.3V) regulator when <b>V<sub>CC</sub></b> is present. When <b>V<sub>CC</sub></b> is not present, the voltage on <b>V<sub>OUT</sub></b> is used to bias the internal references.
<b>Drive</b>	CMOS Logic Output intended to control external PMOS switch for selecting an auxiliary voltage supply when <b>V<sub>CC</sub></b> is not present.
<b>EN</b>	Enable input for the regulator.
<b>BYP</b>	Bypass capacitor input for the regulator (only available in the SOT23-6 package version).