DUAL 150mA LDO REGULATOR WITH PROGRAMMABLE RESET

SC1452

PRELIMINARY - August 7, 2000
TEL:805-498-2111 FAX:805-498-3804 WEB:http://www.semtech.com

DESCRIPTION

The SC1452 is a state of the art device intended to provide maximum performance and flexibility in battery operated systems. It has been designed specifically to fully support a single Li-Ion battery and its external charger voltages.

The SC1452 contains two independently enabled, ultra low dropout voltage regulators (ULDOs). It operates from an input voltage range of 2.5V to 6.5V, and a wide variety of output voltage options are available which are designed to provide an initial tolerance of ±1% and ±2% over temperature.

Each regulator has an associated active-low reset signal which is asserted when the voltage output declines below the preset threshold. Once the output recovers, the reset continues to be asserted (delayed) for a predetermined time, 50ms for reset A and 150ms for reset B. In the case of regulator B, the delay time may be reduced by the addition of an external capacitor.

The SC1452 has a bypass pin to enable the user to capacitively decouple the bandgap reference for very low output noise (down to 50µVrms).

The devices utilize CMOS technology to achieve very low operating currents (typically 150µA with both outputs supplying 150mA). The dropout voltage is typically 165mV at 150mA, helping to prolong battery life. In addition, the devices are guaranteed to provide 400mA of peak current for applications which require high initial inrush current. They have been designed to be used with low ESR ceramic capacitors to save cost and PCB area.

The SC1452 comes in the low profile 10-lead MSOP package.

FEATURES

- Up to 150mA per regulator output
- Low quiescent current
- Low dropout voltage
- Wide selection of output voltages
- Stable operation with ceramic caps
- Tight load and line regulation
- Current and thermal limiting
- Reverse input polarity protection
- <1uA off-mode current
- Logic controlled electronic enable
- Programmable reset
- Full industrial temperature range

APPLICATIONS

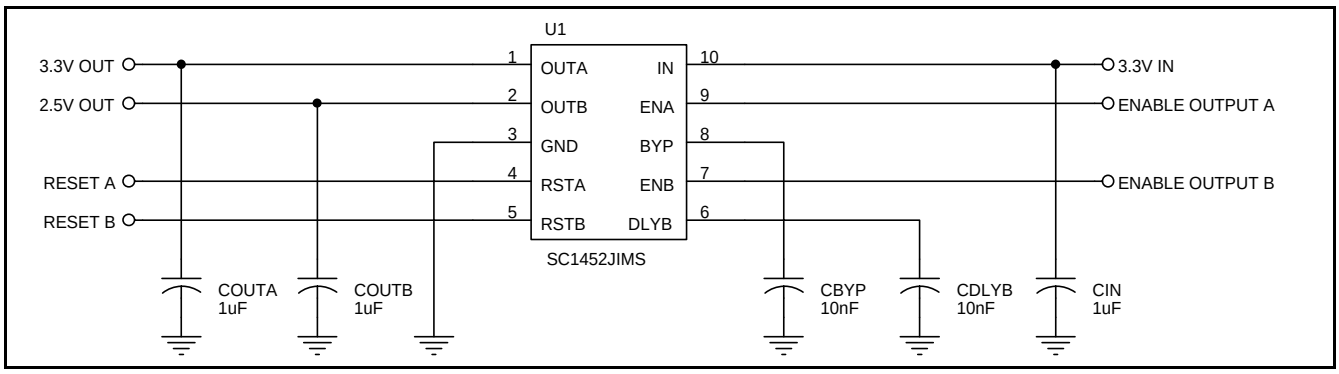
- Cellular telephones
- Palmtop/Laptop computers
- Battery-powered equipment
- Bar code scanners
- SMPS post regulator/dc to dc modules
- High efficiency linear power supplies

ORDERING INFORMATION

Part Numbers	Package
SC1452XIMSTR[(1)(2)]	MSOP-10

Notes:
(1) Where X denotes voltage options - see table on page 5.
(2) Only available in tape and reel packaging. A reel contains 2500 devices.

TYPICAL APPLICATION



652 MITCHELL ROAD NEWBURY PARK CA 91320

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ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Maximum	Units
Input Supply Voltage	V_{IN}	-5 to +7	V
Enable Input Voltage	V_{EN}	-5 to +V_{IN}	V
Operating Ambient Temperature Range	T_A	-40 to +85	°C
Operating Junction Temperature Range	T_J	-40 to +125	°C
Storage Temperature	T_{STG}	-60 to +150	°C
Thermal Resistance Junction to Ambient	θ_{JA}	113	°C/W
Thermal Resistance Junction to Case	θ_{JC}	42	°C/W
ESD Rating (Human Body Model)	ESD	2	kV

ELECTRICAL CHARACTERISTICS

Unless specified: T_A = 25°C, V_{IN} = V_{OUT} + 1V, I_{OUTA} = I_{OUTB} = 1mA, C_{OUT} = 1.0 µF, V_{ENA} = V_{ENB} = V_{IN}. Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Condition	Min	Typ	Max	Units
IN						
Input Supply Voltage	V_{IN}		**2.5**		**6.5**	V
Quiescent Current	I_Q	V_{ENA} = 0V, V_{ENB} = V_{IN}, I_{OUTB} = 150mA or		90	150	µA
		V_{ENB} = 0V, V_{ENA} = V_{IN}, I_{OUTA} = 150mA			**200**	
		V_{ENA} = V_{ENB} = V_{IN}, I_{OUTA} = I_{OUTB} = 150mA		150	240	µA
					300	
		V_{ENA} = V_{ENB} = 0V (OFF)		0.5	1	µA
					2	
OUTA, OUTB						
Output Voltage	V_{OUT}	I_{OUT} = 1mA	-1%	V_{OUT}	+1%	V
		0mA ≤ I_{OUT} ≤ 150mA, V_{OUT} +1V ≤ V_{IN} ≤ 5.5V	**-2%**		**+2%**	
Line Regulation	$REG_{(LINE)}$	V_{OUT} + 1V ≤ V_{IN} ≤ 5.5V, I_{OUT} = 1mA		5	10	mV
					12	
Load Regulation	$REG_{(LOAD)}$	0.1mA ≤ I_{OUT} ≤ 150mA		-5	-15	mV
					-30	
Dropout Voltage	V_D	I_{OUT} = 1mA		1.1		mV
		I_{OUT} = 50mA		55	75	mV
					120	
		I_{OUT} =150mA		165	250	mV
					300	
Current Limit	I_{LIM}		**400**			mA

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ELECTRICAL CHARACTERISTICS (Cont.)

Unless specified: T_A = 25°C, V_{IN} = V_{OUT} + 1V, I_{OUTA} = I_{OUTB} = 1mA, C_{OUT} = 1.0 µF, V_{ENA} = V_{ENB} = V_{IN}. Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Condition	Min	Typ	Max	Units
OUTA, OUTB (Cont.)						
Ripple Rejection	PSRR	f = 120Hz, C_{BYP} = 10nF		60		dB
Output Voltage Noise	e_n	f = 10Hz to 99kHz, I_{OUT} = 50mA, C_{BYP} = 10nF, C_{OUT} = 2.2µF		50		μV_{RMS}
BYP						
Start-up Rise Time	t_r	C_{BYP} = 10nF		1.5		ms
ENABLE (ENA, ENB)						
Enable Input Threshold	V_{IH}		**1.6**			V
	V_{IL}				**0.4**	
Enable Input Current	I_{EN}				**0.2**	µA
RSTA, RSTB						
Reset Threshold	V_{TH}	V_{OUT} falling	**88**	90	**92**	$\%V_{OUT}$
		V_{OUT} rising	**90**	92	**94**	
Reset A Delay	t_{RSTA}		**30**	50	**70**	ms
Reset B Delay	t_{RSTB}	V_{DLYB} = 0V	**90**	150	**210**	ms
Reset A, B Output Voltage(1)	V_{OH}	I_{SOURCE} = 0.5mA	**80**			$\%V_{OUT}$
	V_{OL}	I_{SINK} = 1.2mA			**0.3**	V
DLYB						
Delay Voltage Threshold	V_{DLYB}		**1.225**	1.250	**1.275**	V
Delay Source Current	I_{DLYB}	$V_{OUTB} < V_{TH}$	**2.1**	3.0	**3.9**	µA
OVER TEMPERATURE PROTECTION						
High Trip Level	T_{HI}			150		°C
Hysteresis	T_{HYST}			20		°C

NOTE:
(1) V_{OHA} will be a percentage of V_{OUTA}, and V_{OHB} will be a percentage of V_{OUTB}.

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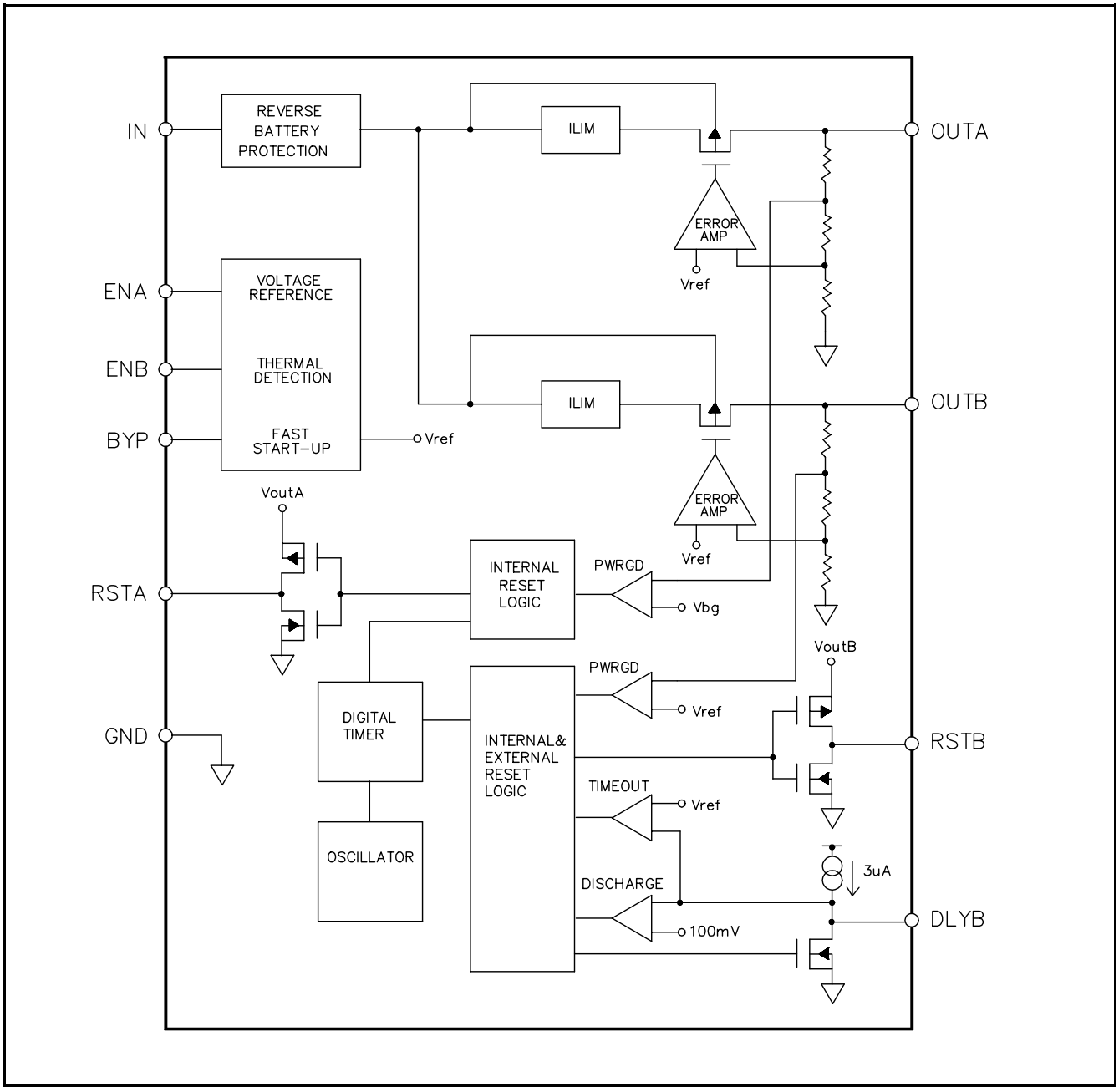
BLOCK DIAGRAM



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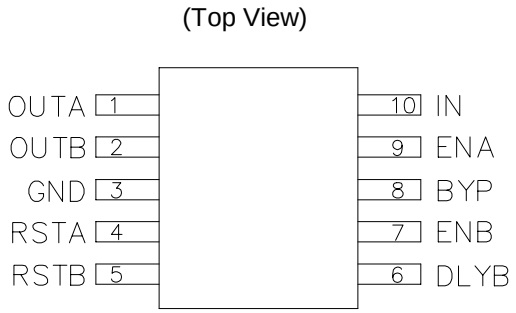
PIN CONFIGURATION



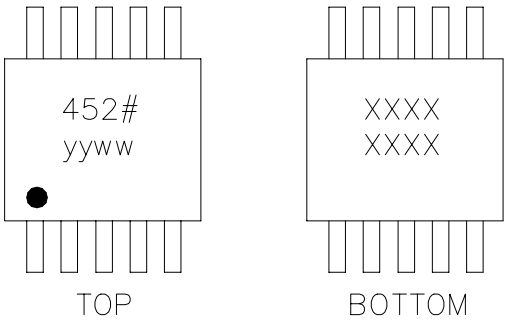
MSOP-10

VOLTAGE OPTIONS

Replace X in the part number (SC1452XIMS) by the letter shown below for the corresponding voltage option:

X	V_{OUTA} (V)	V_{OUTB} (V)
A	1.8	1.8
B	2.5	2.5
C	2.8	2.8
D	3.0	3.0
E	3.3	3.3
F	3.0	2.5
G	3.0	1.8
H	3.0	2.8
J	3.3	2.5
K	3.3	2.8

MARKING INFORMATION



# = Voltage options (Example: 452F)
yyww = Datecode (Example: 0008)
XXXX = Lot Number (Example: E01102)

PIN DESCRIPTIONS

Pin #	Pin Name	Pin Function
1	OUTA	Regulator A output.
2	OUTB	Regulator B output.
3	GND	Ground pin.
4	RSTA	Power on reset for regulator A. Active low when OUTA is below the reset threshold.
5	RSTB	Power on reset for regulator B. Active low when OUTB is below the reset threshold.
6	DLYB	Programmable delay for RESETB. Delay time can be set by connecting a capacitor, C_{DLYB}, between this pin and ground. Ground this pin if using the default delay time.
7	ENB	Active high enable pin for output B. CMOS compatible input. Connect to IN if not being used.
8	BYP	Bypass pin for bandgap reference. Connect a 10nF capacitor, C_{BYP}, between this pin and ground for low noise operation.
9	ENA	Active high enable pin for output A. CMOS compatible input. Connect to IN if not being used.
10	IN	Input pin for both regulators.

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APPLICATIONS INFORMATION

Adjusting RSTB Delay Time

RSTB, the power on reset for regulator B, can be *reduced* externally by connecting a capacitor to the delay time set pin DLYB. If DLYB is connected to ground, the internally controlled delay time of 150ms (typ.) will apply.

Referring to the block diagram, as the output of regulator B (V_{OUTB}) rises and reaches the reset threshold voltage (92% $V_{OUTB(NOM)}$), two things happen:
1) the internal 150ms timer starts;
2) the 3µA current source turns on, charging C_{DLYB} (if connected).

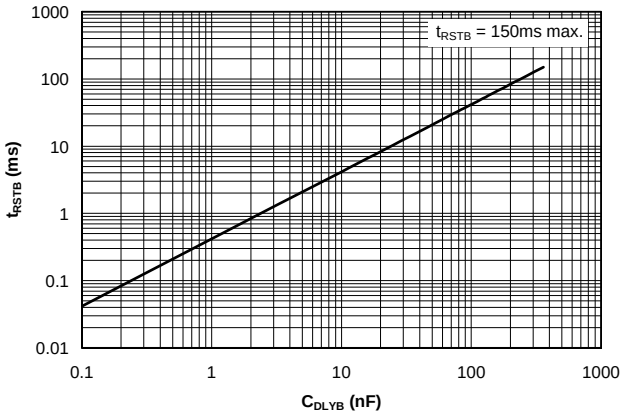
If DLYB is connected to ground, RSTB goes high 150ms after V_{OUTB} crosses the threshold voltage. If a capacitor is connected between DLYB and ground, the voltage at DLYB can be described by the following equation:

$$V_{DLYB} = \frac{3 \bullet 10^{-6} \bullet t}{C_{DLYB}}$$

An internal comparator compares this voltage to a 1.25V reference, and triggers the reset high once this voltage is reached. The delay time can be calculated by rearranging the above equation, solving for t:

$$t_{RSTB} = \frac{C_{DLYB} \bullet 1.25}{3 \bullet 10^{-6}} = 416{,}667 \bullet C_{DLYB}$$

Note that the *maximum* delay time is 150ms, as RSTB goes high when either the internal timer or externally set timer times out, so if t_{RSTB} is set externally for 200ms, the reset delay will still be 150ms. Thus for a 150ms delay, DLYB should be grounded, and for a delay time *less* than 150ms, C_{DLYB} can be calculated using the equation above, or read from the chart below.



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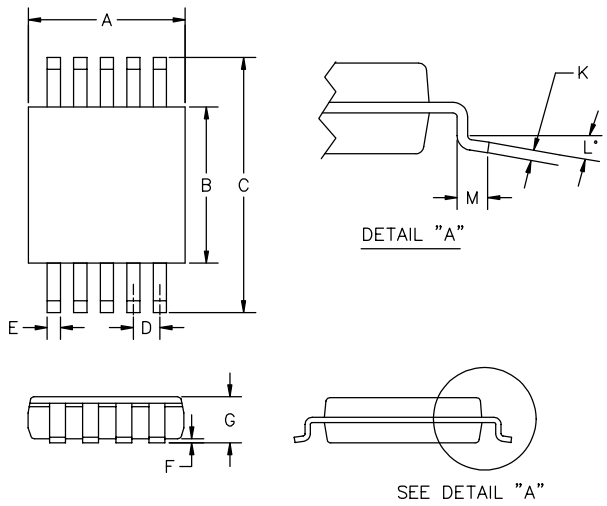
DEVICE OUTLINE - MSOP-10



DIMENSIONS					
DIM"	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.114	.122	2.90	3.10	
B	.114	.122	2.90	3.10	
C	.187	.199	4.75	5.05	
D	.020 BSC		.50 BSC		
E	.006	.012	.15	.30	
F	.002	.006	.05	.15	
G	–	.043	–	1.10	
K	.005	.009	.13	.23	
L	0°	6°	0°	6°	
M	.016	.028	.40	.70	

[2] PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH AND METAL BURR.

[1] CONTROLLING DIMENSIONS: MILLIMETERS.

LAND PATTERN - MSOP- 10 - DRAWING PENDING

ECN 00-1247