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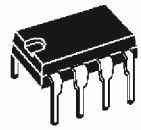
SGS-THOMSON MICROELECTRONICS

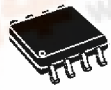
TSM101/A

VOLTAGE AND CURRENT CONTROLLER

- 1.24V SERIES VOLTAGE REFERENCE WITH 10MA OUTPUT CURRENT AND 1% PRECISION (TSM101A)
- TWO OPERATIONAL AMPLIFIERS WITH ORED OUTPUT AND 1MHZ GAIN BANDWIDTH PRODUCT
- BUILT-IN CURRENT GENERATOR WITH ENABLE/DISABLE FUNCTION
- 4.5 TO 32V SUPPLY VOLTAGE RANGE
- SO8 OR DIP8 PACKAGES



N
DIP8
(Plastic Package)



D
SO8
(Plastic Micropackage)

ORDER CODES

Part Number	Temperature Range	Package	
		N	D
TSM101	-20, +70°C	•	•
TSM101A	-20, +70°C	•	•

DESCRIPTION

The TSM101/TSM101A integrated circuit incorporates a high stability series band gap voltage reference, two ORed operational amplifiers and a current source.

This IC compares the DC voltage and the current level at the output of a switching power supply to an internal reference. It provides a feedback through an optocoupler to the PWM controller IC in the primary side.

The controlled current generator can be used to modify the level of current limitation by offsetting the information coming from the current sensing resistor.

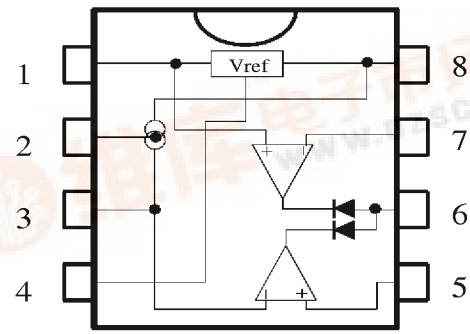
APPLICATIONS

This circuit is designed to be used in battery chargers with a constant voltage and a limited output current.

It can be used in every types of application requiring a precision voltage regulation and current limitation.

Other applications include voltage supervisors, over voltage protection...

PIN CONNECTIONS



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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage - (note 1)	36	V
I_{out}	Output Current - (note 2)	20	mA
P_d	Power Dissipation	200	mW
V_{in}	Input Voltage - (note 3)	-0.3, V_{CC} -1.5	V
I_{in}	Input Current	±1	mA
T_{stg}	Storage Temperature	-40 to +125	°C

Notes : 1. All voltages values, except differential voltage are with respect to network ground terminal
2. The voltage reference is not protected against permanent short circuit
3. The magnitude of input and output voltages must never exceed -0.3V or V_{CC} -1.5V.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	4.5 to 32	V
T_{oper}	Operating Free Air Temperature Range	-20 to +70	°C

ELECTRICAL CHARACTERISTICS

T_{amb} = 25°C, V_{CC} = 15V (unless otherwise specified)

OPERATIONAL AMPLIFIER : TSM101, TSM101A

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CC}	Total Supply Current	V_{CC} = 15V			2	mA
V_i	Input Voltage Range		0		V_{CC} -1.5V	V
V_{io}	Input Offset Voltage	25°C -20<T_{amb}<70°C	-5 -7	1	5 7	mV
I_{ib}	Input Bias Current @ V_{in} = 1.2V on pin 7 and V_{in} = 0V on pin 5	25°C -20<T_{amb}<70°C	-700 -1000	-300	0 0	nA
I_{sink}	Output Sink Current, V_{ol} = 2.5V	25°C -20<T_{amb}<70°C	 8	15		mA
A_{vo}	Large Signal Voltage Gain	R_L = 2kΩ -20<T_{amb}<70°C	 15			V/mV
SVR	Supply Voltage Rejection Ratio	-20<T_{amb}<70°C	65	90		dB
CMR	Common Mode Rejection Ratio	-20<T_{amb}<70°C		80		dB
GBP	Gain Bandwidth Product	V_{CC} = 15V, F = 100kHz V_{in} = 10mV, RL = 2kΩ C_L = 100pF		1		MHz
I_{oh}	Output Leakage Current	25°C -20<T_{amb}<70°C			2 7	µA

ELECTRICAL CHARACTERISTICS

T_{amb} = 25°C, V_{CC} = 15V (unless otherwise specified)

VOLTAGE REFERENCE : TSM101

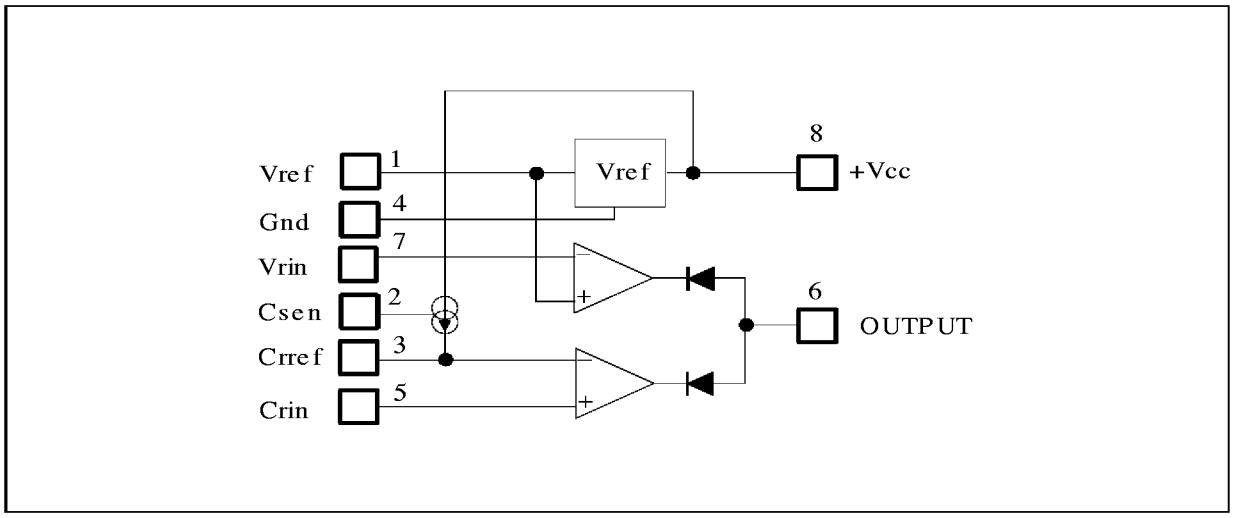
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{ref}	Reference Voltage	I_{out} = 1mA, $T_{amb.}$ = 25°C	1.21	1.24	1.27	V
K_{vt}	Temperature Stability	-20 < $T_{amb.}$ < 70°C		30	100	ppm/°C
R_{eglo}	Load Regulation	1 < I_{out} < 10mA		5	15	mV
R_{egli}	Line Regulation	5 < V_{in} < 32V		3.5	10	mV

VOLTAGE REFERENCE : TSM101A

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{ref}	Reference Voltage	I_{out} = 1mA, $T_{amb.}$ = 25°C	1.227	1.24	1.252	V
K_{vt}	Temperature Stability	-20 < $T_{amb.}$ < 70°C		30	100	ppm/°C
R_{eglo}	Load Regulation	1 < I_{out} < 10mA		5	15	mV
R_{egli}	Line Regulation	5 < V_{in} < 32V		3.5	10	mV

CURRENT GENERATOR : TSM101, TSM101A

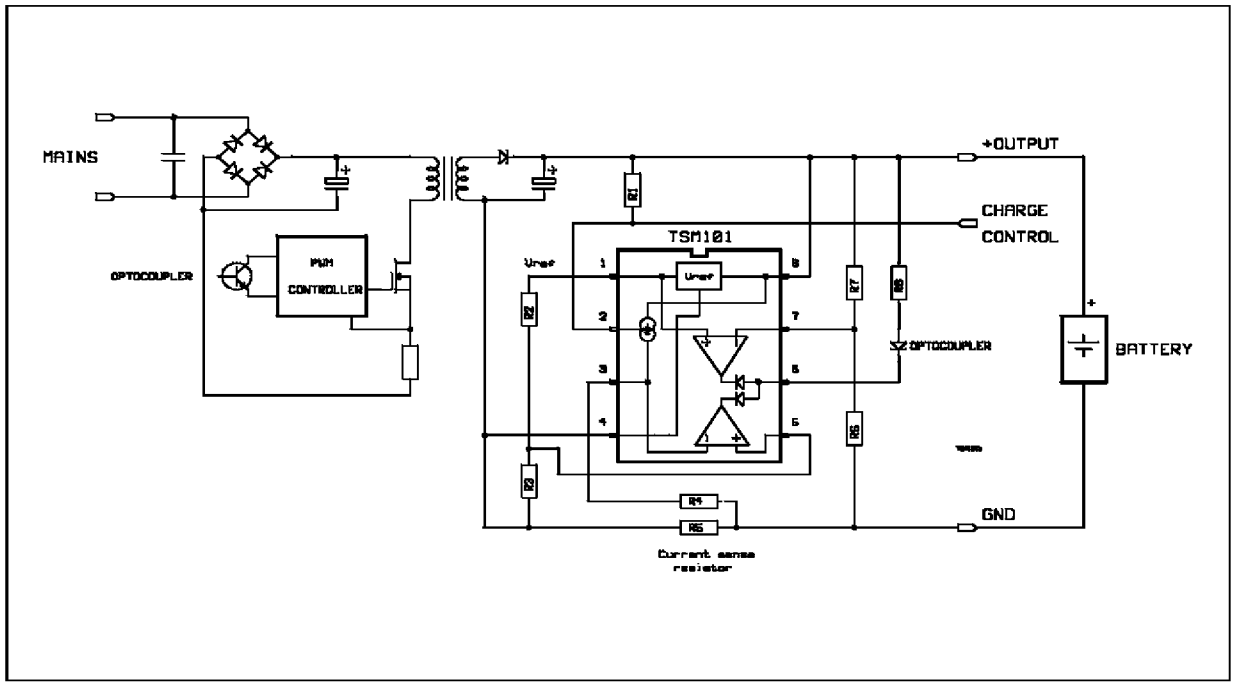
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_o	Current Source			1.4		mA
K_{cgt}	Temperature Stability	-20 < $T_{amb.}$ < 70°C		500		ppm/°C
C_{glir}	Line Regulation	4.5 < V_{CC} < 32V		0.003	0.03	mA
V_{csen}	Voltage at the enable pin to have I_O = 1mA	-20 < $T_{amb.}$ < 70°C			0.6	V
V_{csdis}	Voltage at the enable pin to have I_O = 0mA	-20 < $T_{amb.}$ < 70°C	2			V
I_{csen}	Input Current on the C_{sen} pin	-20 < $T_{amb.}$ < 70°C			30	µA
I_{csleak}	Leakage Current	V_{cs} = 2V -20 < $T_{amb.}$ < 70°C		0.5	2	µA



DESCRIPTION

Name	Pin	Type	Function
V_{ref}	1	OUTPUT	Voltage Reference Output 1.24V, 10mA max. Do not short circuit
V_{rin}	7	INPUT	Voltage Regulation Loop Input
C_{rin}	7	INPUT	Current Limitation Loop Input, connected to the sense resistor
C_{rref}	3	INPUT	Current Limitation Reference Input
C_{sen}	2	INPUT	Current source enable input. This current source can be used to offset the voltage measurement on the sense resistor and therefore to modify the charge current. The current source is enabled when the input voltage on pin 2 is lower than 0.8V.
OUTPUT	6	OUTPUT	Output pin common to the voltage regulation and current limitation loops. This output can drive the primary side (LED) of an optocoupler.
V_{CC}	8	INPUT	Power Supply Input (4.5 to 32VDC)
GND	4	INPUT	Ground

TYPICAL APPLICATION : Battery Charger



In the following application schematic, the TSM101A is used to control the voltage and the current output of a flyback converter in order to charge a battery.

The current limitation is performed by sensing the voltage across the low ohmic value resistor R5 and comparing it to a fixed value set by the bridge composed by R2 and R3. When the voltage on R5 is higher than the voltage on R3 the output of the current loop operational amplifier decreases. The optocoupler current increases and tends to reduce the output voltage by the way of the PWM controller.

The voltage regulation is done by comparing a part of the output voltage (resistor bridge R6 and R7) to the voltage reference (1.24V).

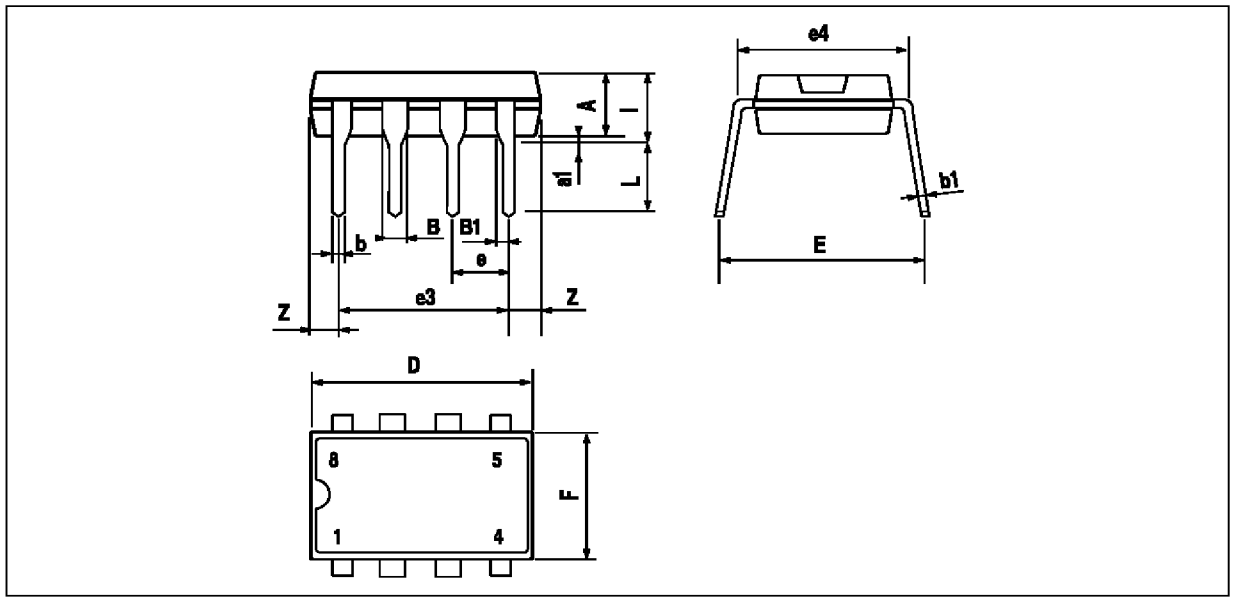
If this part is higher than 1.24V, the output of the voltage loop operational amplifier decreases. The optocoupler current increases and tends to reduce the output voltage by the way of the PWM controller.

By enabling the TSM101A current source (pin 2) it is possible to offset the current sensing by a voltage equal to :

- V_{off} # 1.4 R4 (V_{off} in Volt and R4 in kΩ)

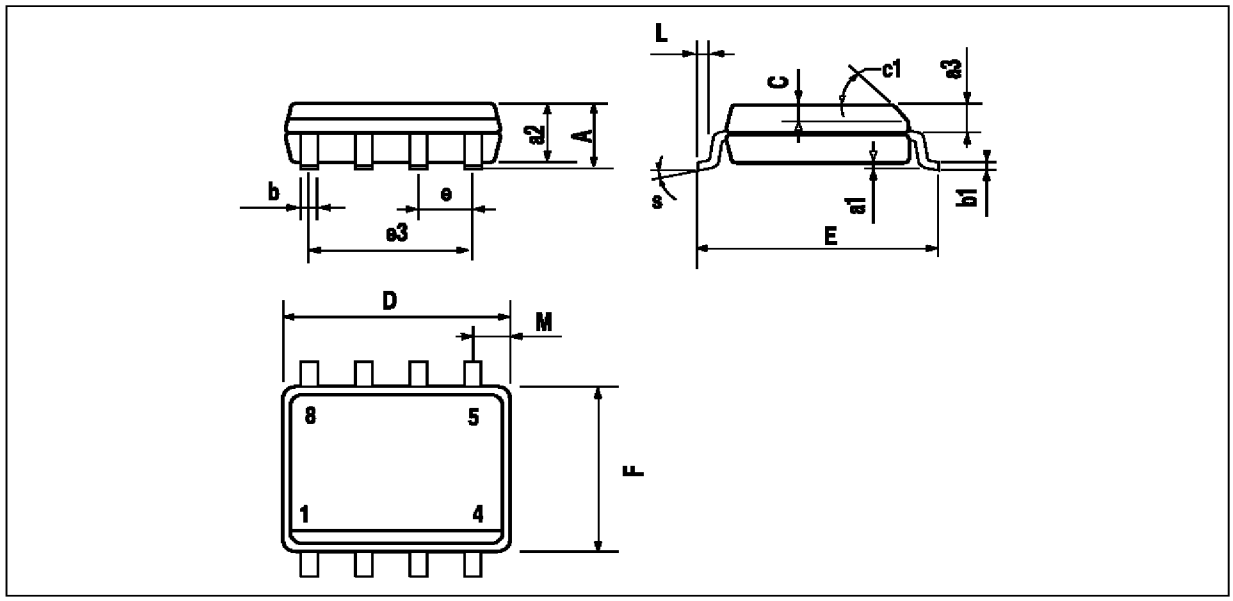
This offset lowers the output charge current and this function can be used to charge two types of batteries having different capacities. The current source is enabled by connecting pin 2 to ground.

PACKAGE MECHANICAL DATA
8 PINS - PLASTIC DIP



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

PACKAGE MECHANICAL DATA
8 PINS - PLASTIC MICROPACKAGE (SO)



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

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