Features

- Cell Balance Controller for Multi-Cell Li-ion Battery
- 1% Voltage Difference
- On/Off Control
- Programmable Working Voltage
- Over Temperature Protection
- 5.5~10.0V Input Voltage
- 210uA Max. Quiescent Current
- ~0 uA Shut Down Current
- 200mA Max. Programmable Balancing Current
- TSOT-23-6 / SOT-23-6 Package

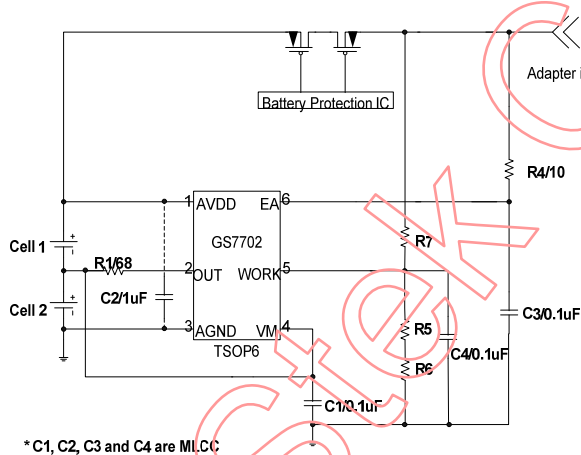## Applications

- Multi-cell Li-ion battery

General Description

The GS7702 is a cell balance controlled IC that can manage 1 % voltage difference in two Li-ion cells when Li-ion battery during operation.

Internal switches and an external resistor is across the two Li-ion cells, when one of internal switches is turn on, the maximum current (balancing current) that can be drawn from or bypassed from the cell is 200mA.

Programmable working voltage help user to define the proper voltage range for cell balance function to optimize the efficiency of whole battery system. The EA pin may be used to shut down the IC when necessary.

Typical Application

Application 1. Typical application of GS7702
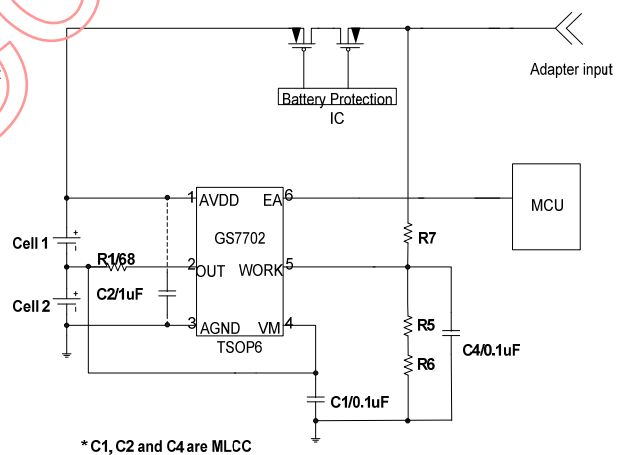
Application 2. Typical application of GS7702 with EA control

Figure 1 Typical Application Circuit of GS7702

*. Patent pending
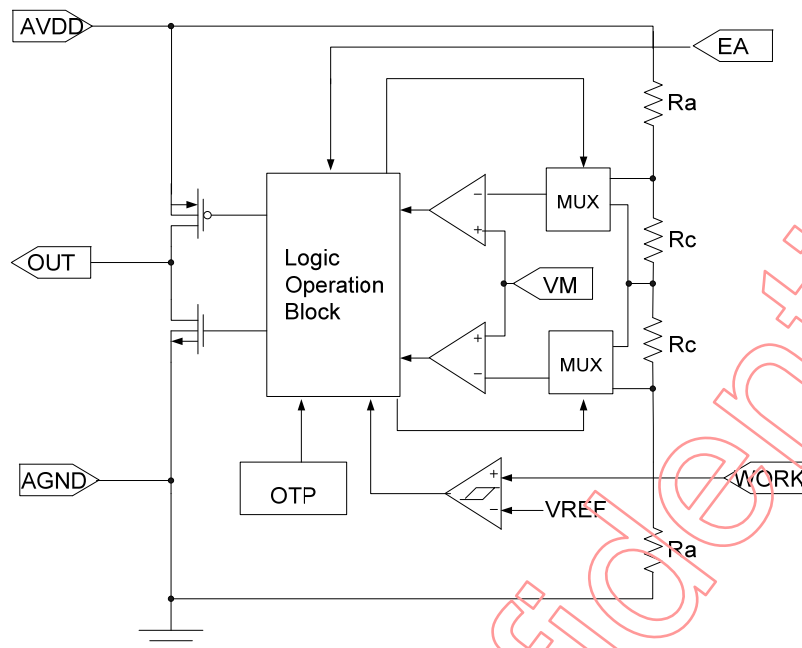
Function Block Diagram

Figure 2 Function Block Diagram

Pin Configuration
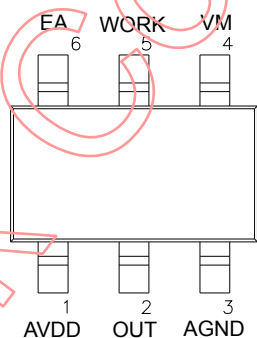
TSOT-23-6/SOT-23-6

Pin Descriptions

Pin No.		Name	I/O type	Pin Function
TSOT-23-6	SOT-23-6			
1	1	AVDD	I	Power supply pin
2	2	OUT	O	Output pin
3	3	AGND	O	Ground pin
4	4	VM	I	Middle voltage of series cells
5	5	WORK	I	Voltage Input for starting balancing function
6	6	EA	I	Enable pin

Ordering Information

GS7702PP- R

Package ← → Shipping

No	Item	Contents
1	Package	TP: TSOT-23-6
		ST: SOT-23-6
2	Shipping	R: Tape & Reel

Example: GS7702 SOT-23-6 Tape & Reel ordering information is "GS7702ST-R"

Absolute Maximum Rating (Note 1)

Parameter	Symbol	Limits	Units
Input Voltage	AVDD	-0.3< AVDD<11	V
Input voltage of Enable pin	EA	-0.3 <EA<11	V
Current pass through OUT pin	$I_{\_OUT}$	0<$I_{\_OUT}$<220	mA
Package Power Dissipation at Ta ≦25°C	$P_{D\_SOT-23-6}$	400	mW
Package Power Dissipation at Ta ≦25°C	$P_{D\_TSOT-23-6}$	455	mW
Junction Temperature	T_j	- 45 ~ 150	°C
Storage Temperature	T_{STG}	- 65 ~ 150	°C
Lead Temperature (Soldering) 10S	T_{LEAD}	260	°C
ESD (Human Body Mode) (Note 2)	V_{ESD_HBM}	2K	V
ESD (Machine Mode) (Note 2)	V_{ESD_MM}	200	V

Thermal Information

Parameter	Symbol	Limits	Units
Thermal Resistance Junction to Ambient	θja $_{SOT-23-6}$	250	°C/W
Thermal Resistance Junction to Ambient	θja $_{TSOT-23-6}$	220	°C/W

Recommend Operating Condition (Note 3)

Parameter	Symbol	Limits	Units
Input Voltage	AVDD	5.5~10	V
Junction Temperature	T_J	- 40 ~ 125	°C

Electrical Characteristics

(AVDD = 8.4V , AGND=0V, T_A = 25°C , no used cell balance function, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage Section						
AVDD Operation Voltage	AVDD		5.5		10	V
IC Operation Current (Note 4)	I_{OP}	EA=8.4V	-	180	210	uA
IC Off Current	I_{OFF}	EA=0V	-	40	-	nA
Switches for Cell Balance						
Output Current Capability	I_{OUT}	Balanced current			200	mA
Turn on resistor	R_{ON_N}	VM=5V		5	15	Ohm
	R_{ON_P}	VM=3V		6	18	Ohm
Difference in voltage of two cells	$V_{\_BAL}$	The difference in voltage of two cell is less than $V_{\_BAL}$ when finished balance function		5	25	mV
	$V_{\_UNBAL}$	When the difference in voltage of two cell is greater than $V_{\_UNBAL}$, the cell balance function is starting.			70	mV
Programmable Working Voltage						
Working Voltage Threshold	V_{WK}	When the user defined voltage is greater than V_{WK}, the cell balance function is starting.	1.196	1.22	1.244	V
Hysteresis	V_{WKHYS}		-	20	-	mV
EA, On/Off control						
Turn on threshold	V_{ON}		2			V
Turn off threshold	V_{OFF}				0.8	V
Thermal Shut Down						
Thermal Shut Down Temperature Threshold	T_{SDTH}	Thermal shutdown the cell balance function	-	150	-	°C
Thermal Shut Down Temperature Hysteresis	T_{SDHYS}		-	30	-	°C

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2. Devices are ESD sensitive. Handling precaution recommended.

Note 3. The device is not guaranteed to function outside its operating conditions.

Note 4. Iop does not include current drawn from or bypassed from the cell.

Note 5. Recommended using at least three resistors to set working voltage

Functional Description

Programmable Working Voltage

GS7702 provides the programmable working voltage function. User may define the turn on supply voltage of GS7702. GS7702 performs the balance function when the supply voltage is larger than the defined working voltage and disable the cell balance function when supply voltage less than the user defined supply voltage. User may set this voltage through the external resistor string. The equation of working voltage is

$$AVDD * (\frac{R5+R6}{R5+R6+R7}) \cong Vref$$. For example,

R5=470k, R6=150k and R7=3300K，The cell balance function is performed when supply voltage ≥7.71V.

Such setting allows the system performs cell balancing function mostly during "charging phase".

EA, On/Off Control

GS7702 EA pin may shut down the chip with ~ 0 uA consumption current when EA < 0.8V.

Switches for Cell Balance

In typical application, the build-in PMOS switch connects to an upper cell and the NMOS switch is connected to a lower cell. The GS7702 measure the average voltage of the cells string and turns on the PMOS when the voltage of the upper cell is larger than the average voltage GS7702 turns on the NMOS when the voltage of the lower cell is larger than the average voltage. The current pass through the NMOS or PMOS switches are set by an external resistor between the OUT and VM pin.

The switch and resistor provides an extra current consumption path to reduce the voltage of the cell with higher voltage.

GS7702 allows user to set the max. 200mA current to perform the balance function.
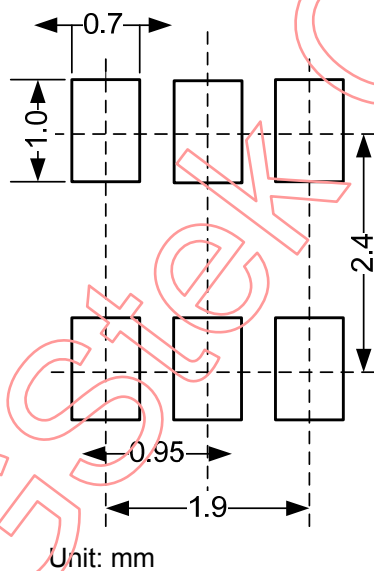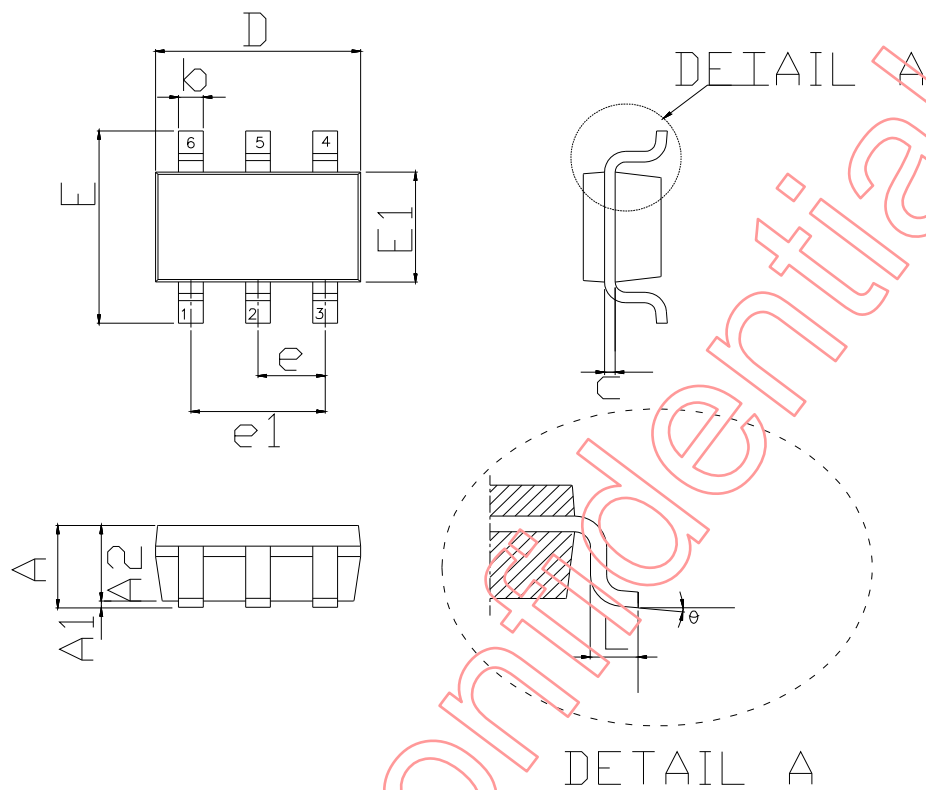
Package Dimensions, SOT-23-6
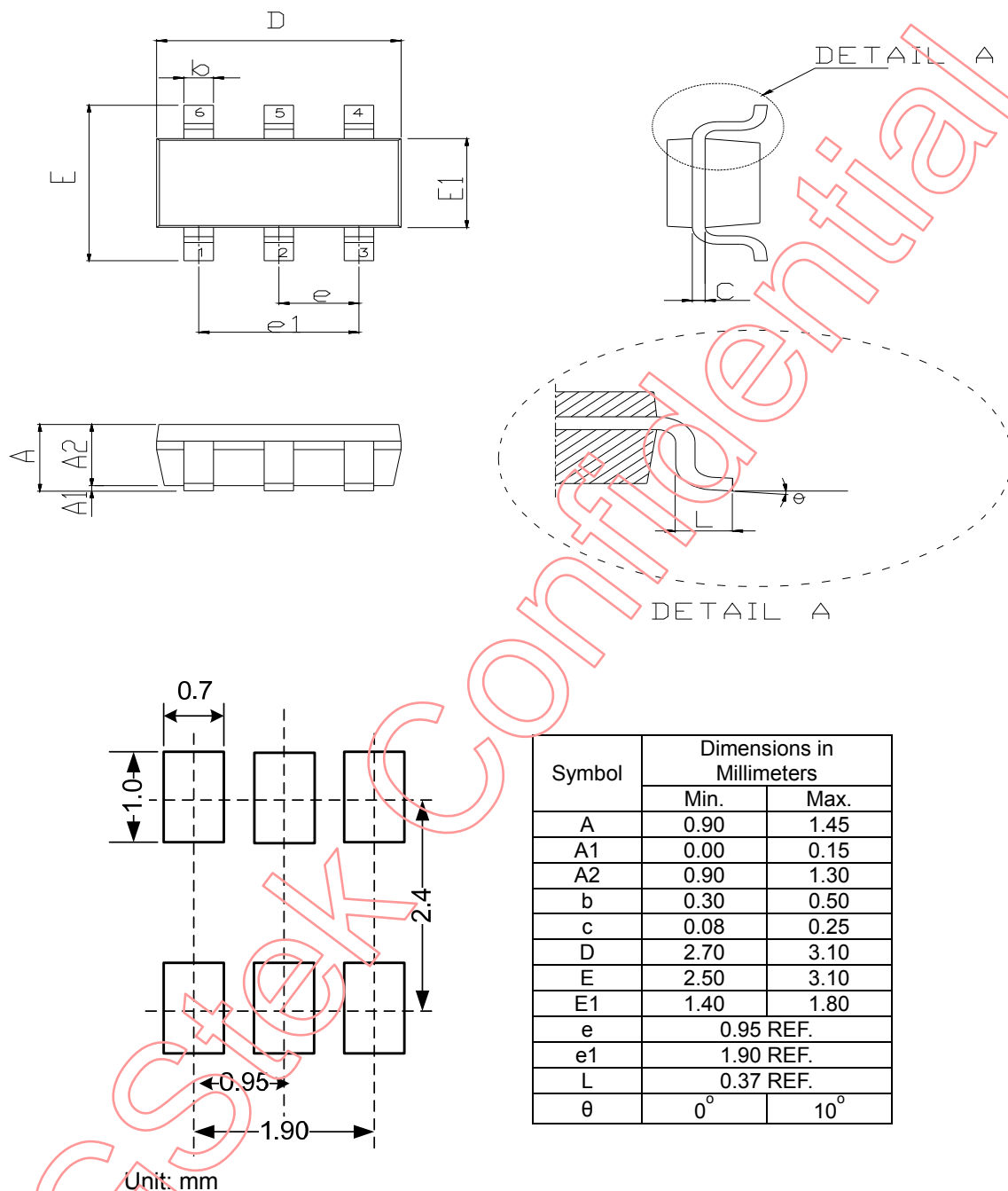
Symbol	Dimensions in Millimeters	
	Min.	Max.
A	0.90	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.25
D	2.70	3.10
E	2.50	3.10
E1	1.40	1.80
e	0.95 REF.	
e1	1.90 REF.	
L	0.37 REF.	
θ	0°	10°

Unit: mm

Note

1.Min.: Minimum dimension specified.

2.Max.: Maximum dimension specified.

3.REF.: Reference. Normal/Regular dimension specified for reference.

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