



# TS650

## Buck Switching Regulator

SOP-8



Pin assignment:

1. Out
2. P.Gnd
3. CT
4. Gnd
5. FB
6. Vcc
7. Comp.
8. Enable

**Supply Voltage Range 3 V to 30V**  
**Output Driving Current 500mA**  
**Oscillator Frequency up to 100KHz**

### General Description

The TS650 is a monolithic buck switching regulator, it is consist of an voltage reference, error amplifier, current limited set by an external resistor, power forward modular controller and switching frequencies up to 100KHz are set by an external capacitor.

Additionally, a chip enable feature is provided to power down reducing the supply current, and with a minimum number of external components, the TS650 offer a simple and cost effective solution.

The TS650 is offered in SOP-8 package.

### Features

- ◇ Power forward control circuit
- ◇ Operating voltage form 3V to 30V
- ◇ Low standby current
- ◇ Current limit adjustable
- ◇ Output switch current up to 500mA
- ◇ Variable oscillator frequency up to 100KHz (max)
- ◇ Shut down control
- ◇ 1.25V voltage reference Output

### Pin Descriptions

Name	Description
Output	PWM Output
P.Gnd	Power Ground
CT	Oscillator Control
Gnd	Ground
FB	Voltage Feedback
Vcc	Power Supply
Comp.	Feedback Compensation
Enable	ON/OFF control

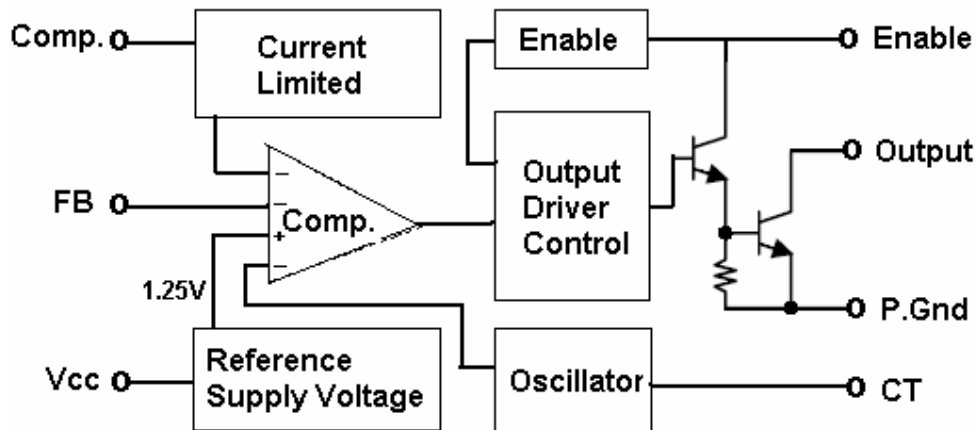
### Applications

- ◇ Charger
- ◇ xD-ROM, xDSL product
- ◇ DC to DC converter s

### Ordering Information

Part No.	Operating Temp.	Package
TS650CS	-20 ~ +85 °C	SOP-8

### Block Diagram



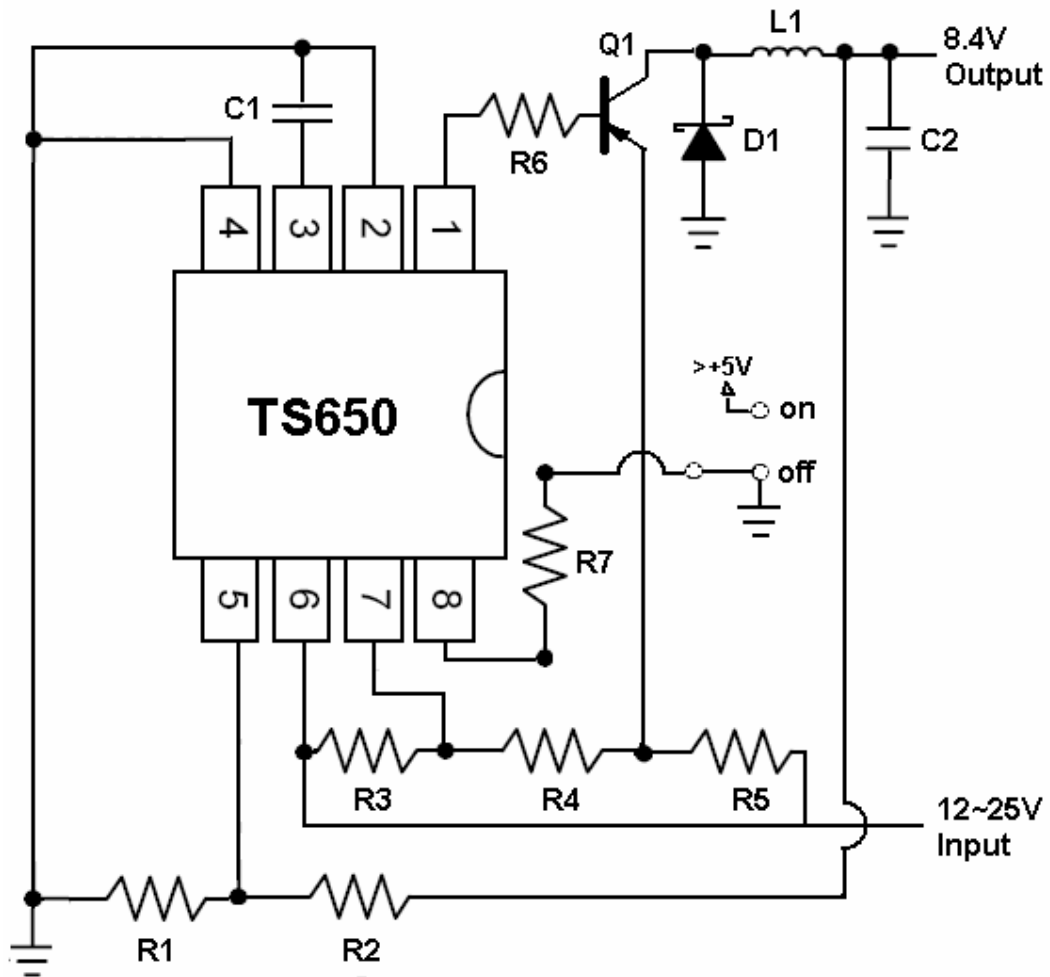


Absolute Maximum Rating			
Supply Voltage	$V_{CC}$	30	V
Comparator Input Voltage Range	$V_{FB}$	- 0.3 ~ 30	V
Collector Output Voltage	$V_{C(SW)}$	30	V
Collector to Emitter Voltage	$V_{CE(SW)}$	30	V
Output Switching Current	$I_{SW}$	500	mA
Operating Junction Temperature Range	$T_J$	-20 ~ +125	°C
Storage Temperature Range	$T_{STG}$	-65 ~ +150	°C
Lead Temperature 1.6mm(1/16") from case for 10Sec.	$T_{LEAD}$	260	°C

Electrical Characteristics						
(V <sub>CC</sub> =5V, Ta =25 °C; unless otherwise specified.)						
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Reference</b>						
Comp. Connect to FB	$V_{REF}$		1.23	1.25	1.27	V
Output voltage change with temperature		Ta= -20 °C ~ 25 °C		- 0.1	1	%
		Ta= 25 °C ~ 85 °C		- 0.2	1	
Line regulation	RegLine	V <sub>CC</sub> = 5V ~ 30V			5	mV
<b>Output switch (note1)</b>						
Saturation Voltage	$V_{CE(SAT)}$	$I_{SW} = 0.5A$		1.0	1.2	V
DC current gain	$H_{FE}$	$I_{SW} = 1A, V_{ce} = 0.5V$		75		--
Collector off-state current	$I_{C(OFF)}$	V <sub>ce</sub> =30V		40	100	uA
<b>Oscillator (OSC)</b>						
Frequency	$F_{OSC}$	C <sub>T</sub> = 1nF, V <sub>pin5</sub> =0V	24	33	42	KHz
Charge Current	$I_{CHARGE}$	V <sub>CC</sub> = 5V ~ 30V		35		uA
Discharge Current	$I_{DISCHARGE}$	V <sub>CC</sub> = 5V ~ 30V		220		uA
Discharge to Charge current ratio	$I_{DISCHARGE} / I_{CHARGE}$	Pin7 to V <sub>cc</sub>		6.5		--
Current Limit Sense Voltage	$V_{IPK(SENSE)}$	$I_{DISCHARGE} = I_{CHARGE}$	250		350	mV
<b>ON/OFF driver control</b>						
ON driver voltage	V <sub>on</sub>	V <sub>CC</sub> = 3V ~ 30V	4		5	V
OFF driver voltage	V <sub>off</sub>				1	V
ON driver current	I <sub>on</sub>				100	mA
<b>Total device</b>						
supply current	$I_{CC}$	V <sub>CC</sub> = 5V ~ 30V, C <sub>T</sub> = 1nF, pin7=V <sub>cc</sub> , pin5>V <sub>th</sub> , pin2=Gnd, remaining pins open		3	5	mA
Input bias current	$I_{IB}$	V <sub>in</sub> =0V			-400	nA

Note 1: Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature.

### Typical Application Circuit



Device	Value	Device	Value
R1	5.6K, 1/8W	C1	470pF, 16V
R2	1K, 1/8W	C2	470uF, 16V
R3	100ohm, 1/4W	L1	180uH, 2A
R4	100ohm, 1/4W	D1	SK34A
R5	0.33ohm, 1W	Q1	TSB1386CY
R6	300ohm, 1/2W		
R7	300ohm, 1/2W		

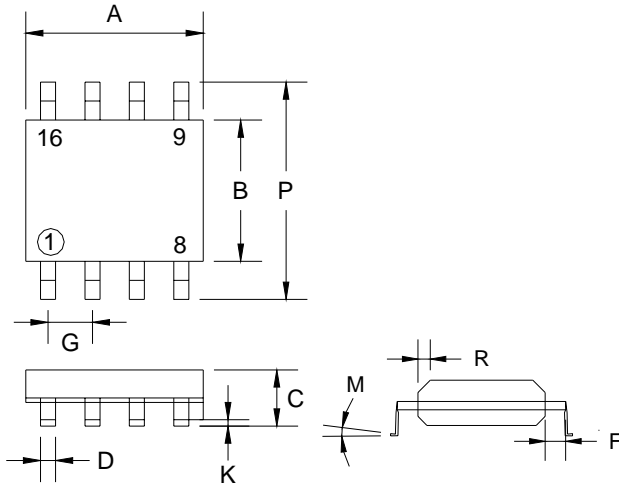
**Remark:**

\* Output = 1.25V \* (R1/R2 + 1) = 1.25V \* (5.6K/1K + 1) = 8.25V @ 3A

\* SK34A: Taiwan semiconductor, Schottky 3A/40V in SMA package

\* TSB1386CY: Taiwan semiconductor, PNP transistor 5A/20V in SOT-89 package

## SOP-8 Mechanical Drawing



SOP-8 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 (typ)		0.05 (typ)	
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019