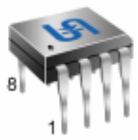
TS3404

PWM Buck Controller

DIP-8



SOP-8

Pin assignment:

1. Out
2. Vcc
3. Comp.
4. FB
5. SCP
6. SS
7. CT
8. Gnd

Supply Voltage Range 3.6V to 27V
Output Driving Current 200mA
Oscillator Frequency up to 300KHz

General Description

The TS3404 integrates Pulse Width Modulation (PWM) control circuit into a single chip, and makes simple work out of implementing a complete control and protection scheme for a DC-DC step-down converter. The TS3404 provides simple feedback loop compensation, 1.25V reference output, error amplifier, adjustable oscillator, soft start, under voltage lock out (UVLO), short circuit protection(SCP) circuitry, and push pull output circuit.
The TS3404 is design for adjustable switching frequency by trimming time capacitor (CT), during low supply voltage situation, the under voltage lock out (UVLO) makes sure that the output are off until the internal circuit operates normally.
The TS3404 is offered in DIP-8 and SOP-8 package.

Features

- ✧ PWM buck control circuit
- ✧ Operating voltage can be up to 27V
- ✧ Under voltage lock out (UVLO) protection
- ✧ Soft start (SS) circuit
- ✧ Short circuit Protection (SCP)
- ✧ Variable oscillator frequency 300KHz (max)
- ✧ 1.25V voltage reference Output

Pin Descriptions

Name	Description
Output	PWM Output
Vcc	Supply Voltage
Comp.	Feedback Loop Compensation
FB	Voltage Feedback
SCP	Short Circuit Protection
SS	Soft Start
CT	Timing Capacitor
Gnd	Ground

Applications

- ✧ LCD Monitor
- ✧ xD-ROM, xDSL product
- ✧ DC to DC converters in computers
- ✧ Backlight inverter

Ordering Information

Part No.	Operating Temp. (Ambient)	Package
TS3404CS	-20 ~ +85 °C	SOP-8
TS3404CD		DIP-8

Absolute Maximum Rating

Supply Voltage	V_{CC}	28	V
Amplifier Input Voltage	V_I	20	V
Collector Output Voltage	V_O	Vcc~1.0V	V
Source Current	I_{SOURCE}	200	mA
Sink Current	I_{SINK}	200	mA
Operating Junction Temperature Range	T_J	-20 ~ +150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
Lead Temperature 1.6mm(1/16") from case for 10Sec.	T_{LEAD}	260	°C

Recommended Operating Conditions

Parameter	Symbol.	Min.	Max.	Unit
Supply voltage	V_{CC}	3.6	27	V
Amplifier input voltage	V_I	1.05	1.45	V
Collector output voltage	V_O		Vcc~1.5	V
Current into feedback terminal	I_{FB}		45	uA
Feedback resistor	R_F	100		KΩ
Timing capacitor	C_T	100	6800	pF
Oscillator frequency	F_{OSC}	10	300	KHz

Electrical Characteristics

(V_{CC} =6V, f = 200KHz, Ta =25°C; unless otherwise specified.)

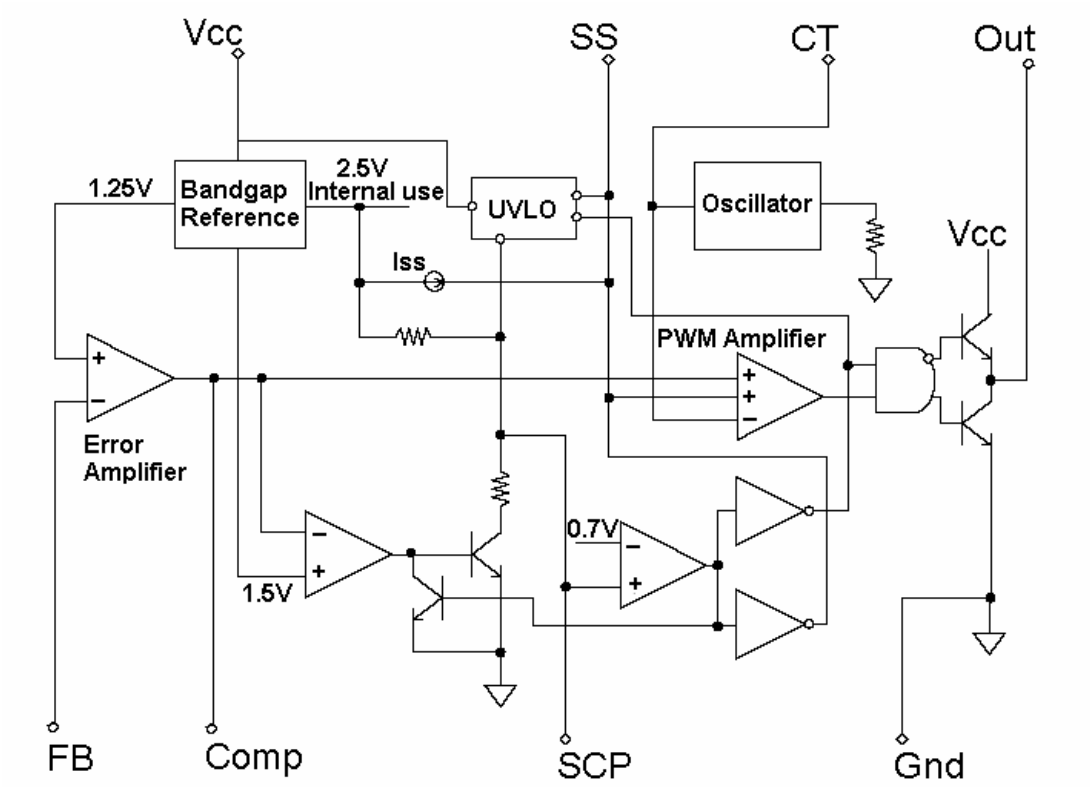
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference						
Comp. Connect to FB	V_{REF}		1.225	1.25	1.275	V
Output voltage change with temperature		Ta= -20°C ~ 25°C		- 0.1	1	%
		Ta= 25°C ~ 85°C		- 0.2	1	
Under voltage lock out (UVLO)						
Upper threshold Voltage	V_{UT}	$I_{O(REF)}$ = 0.1mA, Ta= 25°C		2.9		V
Lower threshold voltage	V_{LWT}			2.4		
Hysteresis	V_{HT}			0.5		
Short circuit protection (SCP)						
Input threshold voltage	V_{IT}	Ta= 25°C	0.60	0.67	0.75	V
Standby voltage	V_{STB}	No pull up	100	130	160	mV
Latched input voltage	V_{LT}	No pull up		50	100	mV
Input (source) current	I_{SCP}	V_I = 0.7V, Ta= 25°C	- 10	- 15	- 20	uA
Comparator threshold voltage	V_{CT}			1.5		V
Oscillator (OSC)						
Frequency	F_{OSC}	C_T = 270pF		200		KHz
Standard deviation of frequency	ΔF_{OSC}	C_T = 270pF		10		%
Frequency change with voltage		V_{CC} = 3.6V ~ 20V		1		
Error Amplifier						
Input offset voltage	V_{IO}	V_O (FB)= 1.25V			± 6	mV
Input offset current	I_{IO}				± 100	nA
Input bias current	I_{IB}			160	500	nA
Common mode input voltage range	V_{CM}	V_{CC} = 3.6V ~ 20V	1.05		1.45	V
Open loop voltage amplification	AV	R_F = 200kΩ	70	80		dB
Unity gain bandwidth	GBW			1.5		MHz
Common mode reject ratio	CMRR		60	80		dB
Max. output voltage	V_{OH}		V_{REF}~0.1			V
Min. output voltage	V_{OL}				1	V
Output (sink) current (Comp)	I_{OI}	V_{ID} = - 0.1V, V_O = 1.25V	0.5	1.6		mA
Output (source) current (Comp)	I_{OO}		- 45	- 70		uA

Electrical Characteristics (Continued)

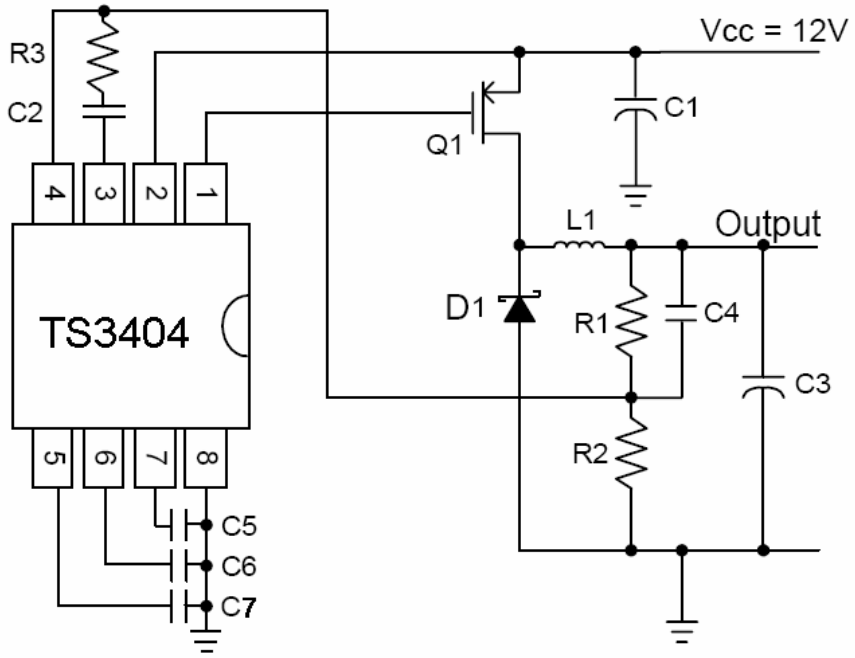
(V_{CC} =6V, f = 200KHz, Ta =25 °C; unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output section						
Leakage current	I_{LEAK}	V_O = 25V			10	uA
Sink current	I_{DRV}	V_{IN} = 20V		200		mA
Source current		V_{IN}= 20V		200		mA
Output saturation voltage	V_{SAT}	I_O = 10mA		1.0	1.5	V
Short circuit output current	I_{SC}	V_O = 6V		120		mA
PWM comparator						
Input threshold voltage at	V_{TO}	CT		0.6	0.7	V
f =10KHz (Comp)	V_{T100}	Maximum duty cycle	1.2	1.3		
Total device						
Average supply current	I_{CCA}	C_T = 270pF		6	10	mA
Soft Start						
Soft start voltage	V_{SS}			2.3		V
Constant charge current	I_{SS}			20		uA

Functional Block Diagram



Typical Application Circuit



Step-Down DC/DC converter

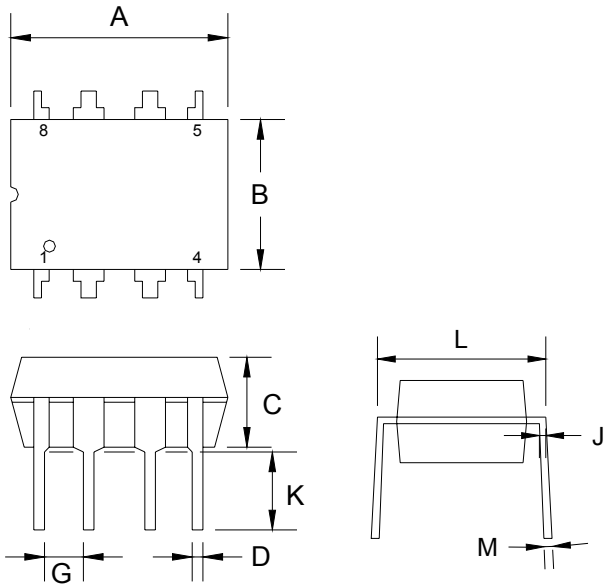
Device	Value	Device	Value
C1	470uF	R1	9K, 1/4W
C2	10nF	R2	3K, 1/4W
C3	470uF	R3	10K, 1/4W
C4	50nF	L1	33uH, 3A
C5	270uF	D1	SK34A
C6	50nF	Q1	TSM2301CX
C7	220nF		

Remark:

* Output = 1.25V * (R1/R2 +1) = 1.25V * (9K/3K + 1) = 5V @ 3A
* SK34A: Taiwan semiconductor, Schottky 3A/40V in SMA package
* TSM2301CX: Taiwan semiconductor, P-Channel MOSFET 4A/20V in SOT-23 package

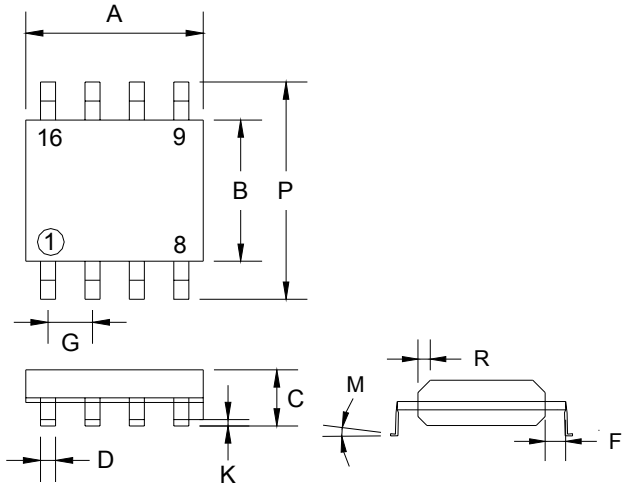
TSC

DIP-8 Mechanical Drawing



DIP-8 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.07	0.32	0.357	0.367
B	6.22	6.48	0.245	0.255
C	3.18	4.43	0.125	0.135
D	0.35	0.49	0.019	0.020
G	2.54 (typ)		0.100 (typ)	
J	0.29	0.31	0.011	0.012
K	3.25	3.35	0.128	0.132
L	7.75	8.00	0.305	0.315
M	-	10^o	-	10^o

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^o	7^o	0^o	7^o
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019