

SOP-8EP

Pin Definition:

1. GND	8. EN
2. FB	7. POK
3. VOUT	6. VCNTL
4. VOUT	5. VIN

General Description

The TS9230 is a 3A ultra low dropout voltage regulator. This product is specifically designed to provide well supply voltage for front-side-bus termination on motherboards and NB applications. The IC needs two supply voltages, a control voltage for the circuitry and a main supply voltage for power conversion, to reduce power dissipation and provide extremely low dropout. The TS9230 integrates multi-functions. A Power-On-Reset (POR) circuit monitors both supply voltages to prevent wrong operations. A thermal shutdown and current limit functions protect the device against thermal and current over-loads. A POK indicates the output status with time delay which is set internally. It can control other converter for power sequence. The TS9230 can be enabled by other power system. Pulling and holding the EN pin below 0.4V shuts off the output.

Features

- Ultra Low Dropout 200mV(typ) @ $I_{OUT}=3A$
- Suit for Low ESR Output Capacitor (MLCC)
- 0.5V Reference Voltage
- Fast Transient Response
- Adjustable Output Voltage
- Power-On-Reset for VCNTL and VIN Pins
- Internal Soft-Start
- Under-Voltage Protection
- Current-Limit Protection
- Thermal Shutdown Protection
- Power-OK Output with a Delay Time

Ordering Information

Part No.	Package	Packing
TS9230CS RLG	SOP-8EP	2.5Kpcs / 13" Reel

Note: "G" denote for Halogen Free Product

Application

- Telecommunication
- Notebook
- Mother Board

Absolute Maximum Rating

Parameter	Symbol	Limit	Unit	
V_{CNTL} Supply Voltage	V_{CNTL}	-0.3 to 7	V	
V_{IN} Supply Voltage	V_{IN}	-0.3 to 6	V	
EN and FB Pin Voltage	$V_{I/O}$	-0.3 to $V_{CNTL}+0.3$	V	
Power good Voltage	V_{POK}	-0.3 to 7	V	
Power Dissipation	SOP-8EP	PD	2.5	W
Storage Temperature Range	T_{ST}	-65 to +150	°C	
Junction Temperature Range	T_J	-40 to 125	°C	
Operating Temperature Range	T_{OP}	-40 to +85	°C	
Thermal Resistance from Junction to case	SOP-8EP	θ_{JC}	15	°C/W
Thermal Resistance from Junction to ambient	SOP-8EP	θ_{JA}	40	°C/W

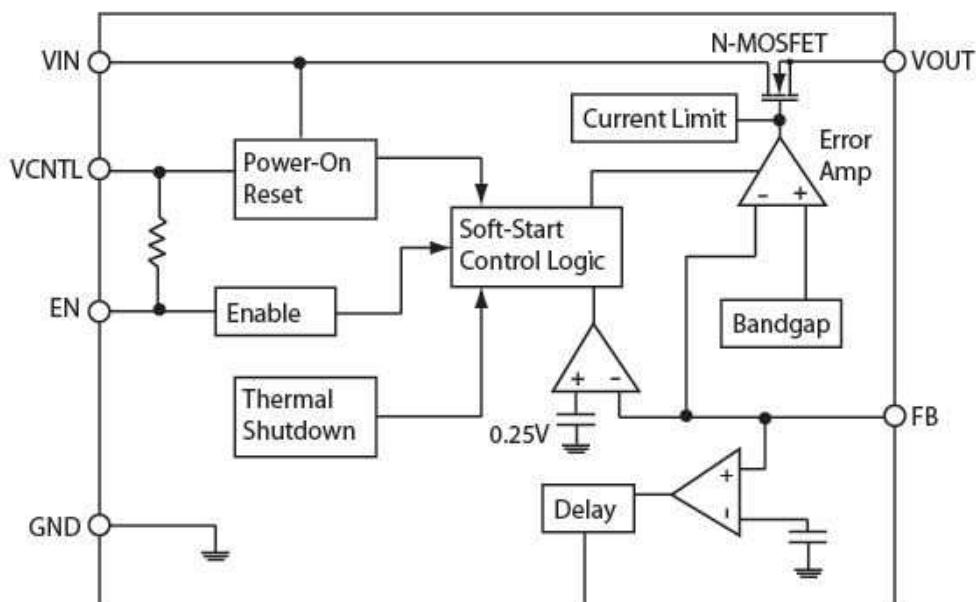
Recommended Operating Condition

Parameter	Symbol	Conditions	Limit	Unit
V_{CNTL} Supply Voltage	V_{CNTL}		3 to 5.5	V
V_{IN} Supply Voltage	V_{IN}		0.9 to 3.65	V
Output Voltage	V_{OUT}	$V_{\text{CNTL}} - V_{\text{OUT}} > 1.9\text{V}$	0.6 to $V_{\text{IN}} - V_{\text{DROP}}$	V
Output Current	I_{OUT}		0 to 3	A

Electrical Specifications
 $(V_{\text{CNTL}}=5\text{V}, V_{\text{IN}}=1.5\text{V}, V_{\text{OUT}} = 1.2\text{V}, T_A=25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	
V_{CNTL} POR Threshold	V_{CNTL}		2.5	2.7	2.9	V	
V_{CNTL} POR Hysteresis	$V_{\text{CNTL(hys)}}$		--	0.5	--	V	
V_{IN} POR Threshold	V_{IN}		0.6	0.7	0.8	V	
V_{IN} POR Hysteresis	$V_{\text{IN(hys)}}$		--	0.4	--	V	
V_{CNTL} Nominal Supply Current	I_{CNTL}	$\text{EN}=V_{\text{CNTL}}$	--	1	1.8	mA	
V_{CNTL} Shutdown Current	I_{SD}	$\text{EN}=0\text{V}$	--	15	30	uA	
Feedback Voltage	V_{FB}	$V_{\text{CNTL}}=5\text{V}, I_{\text{OUT}}=10\text{mA}$	0.49	0.5	0.51	V	
Load Regulation		$I_{\text{OUT}}=0\text{A} \sim 3\text{A}$	--	0.2	0.6	%	
Line Regulation		$V_{\text{CNTL}}=V_{\text{EN}}=5\text{V}$ $V_{\text{IN}}=V_{\text{OUT}} + 0.5\text{V} \sim 5\text{V}$ $I_{\text{OUT}}=10\text{mA}$	--	0.01	0.1	%/V	
Dropout Voltage	V_{DROP}	$I_{\text{OUT}} = 3\text{A}, V_{\text{CNTL}}=5\text{V}$	--	0.20	0.28	V	
V_{OUT} Pull Low Resistance		$\text{EN}=0\text{V}$	--	85	--	Ω	
Soft Start Time	T_{SS}		--	2	4	mS	
EN Pin Logic High threshold voltage	V_{ENH}	Enable	1.2	--	--	V	
	V_{ENL}	Disable	--	--	0.4		
EN Hysteresis			--	50	--	mV	
EN Pin Pull-Up Current	I_{EN}	$\text{EN}=\text{GND}$	--	10	--	uA	
Current Limit	I_{LIM}	$V_{\text{CNTL}}=3\sim 5.5\text{V}$ $T_J = -40 \sim 125^\circ\text{C}$	4.2	--	--	A	
Ripple Rejection	V_{IN}	PSRR	$F=120\text{Hz}, I_{\text{OUT}}=100\text{mA}$	--	65	--	dB
	V_{CNTL}			--	65	--	
Under-Voltage Threshold		VFB Falling	--	0.25	--	V	
POK Threshold Voltage for Power OK	V_{POK}	VFB Rising	90%	93%	96%	VFB	
POK Threshold Voltage for Power Not OK	V_{PNOK}	VFB Falling	82%	85%	88%	VFB	
POK Low Voltage		POK sinks 5mA	--	0.25	0.4	V	
POK Delay Time	T_{DELAY}		0.8	2	4	mS	
Thermal shutdown Temp	T_{SD}		--	160	--	°C	
Thermal Shutdown Hysteresis	T_{SH}		--	50	--	°C	

Block Diagram

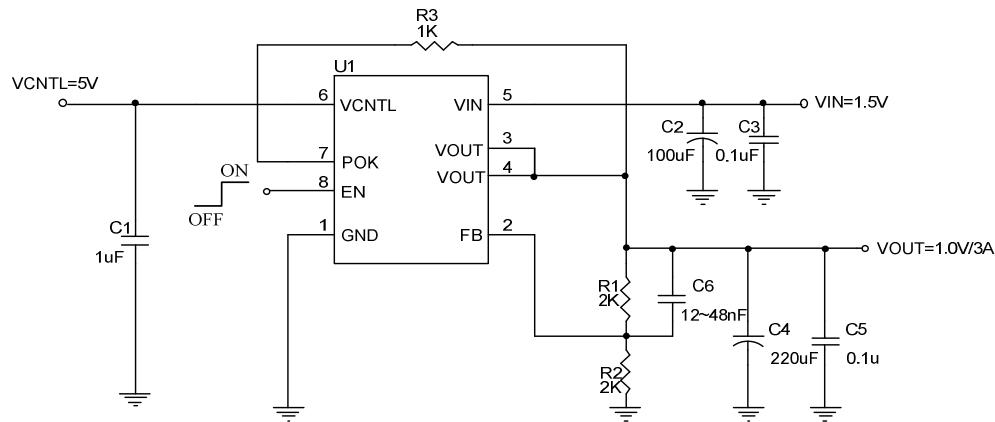


Pin Function Description

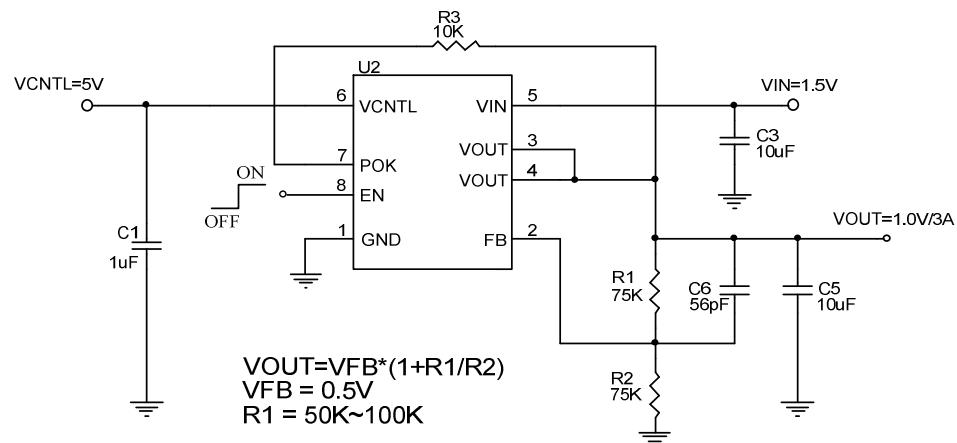
Pin Name	Pin Description
VIN	Main supply input pins for power conversions. The voltage at this pin is monitored for Power-On Reset purpose
VCNTL	Power input pin of the control circuitry. Connecting this pin to a +5V (recommended) supply voltage provides the bias for the control circuitry. The voltage at this pin is monitored for Power-On Reset purpose.
GND	Ground Pin.
POK	Power-OK signal output pin. This pin is an open-drain output used to indicate status of output voltage by sensing FB voltage. This pin is pulled low when the rising FB voltage is not above the V_{POK} threshold or the falling FB voltage is below the V_{POK} threshold, indicating the output is not OK
EN	Enable control pin. Pulling and holding this pin below 0.4V shuts down the output. When re-enabled, the IC undergoes a new soft-start cycle. Left this pin open, this pin is internally pulled up to V_{CNTL} voltage, enabling the regulator.
FB	Connecting this pin to an external resistor divider receives the feedback voltage of the regulator. The output voltage set by the resistor divider is determined by: $V_{OUT} = 0.5 \times \left(1 + \frac{R_1}{R_2}\right)(V)$ Where R_1 is connected from V_{OUT} to FB with Kelvin sensing and R_2 is connected from FB to GND. A bypass capacitor may be connected with R_1 in parallel to improve load transient response. The recommended R_2 and R_1 are in the range of 1K~100KΩ.

Typical Application Circuit

Using an Output Capacitor with $ESR \geq 20m\Omega$



Using an MLCC as the Output Capacitor (SOP-8EP)



Function Description

Power-On-Reset

A Power-On-Reset (POR) circuit monitors both input voltages at VCNTL and VIN pins to prevent wrong logic controls. The POR function initiates a soft-start process after the two supply voltages exceed their rising POR threshold voltages during powering on. The POR function also pulls low the POK pin regardless the output voltage when the VCNTL voltage falls below its falling POR threshold.

Internal Soft-Start

An internal soft-start function controls rise rate of the output voltage to limit the current surge at start-up. The typical soft-start interval is about 2mS.

Output Voltage Regulation

An error amplifier working with a temperature compensated 0.5V reference and an output NMOS regulates output to the preset voltage. The error amplifier designed with high bandwidth and DC gain provides very fast transient response and less load regulation. It compares the reference with the feedback voltage and amplifies the difference to drive the output NMOS which provides load current from VIN to VOUT.

Current Limit

The TS9230 monitors the current via the output NMOS and limits the maximum current to prevent load and TS9230 from damages during overload or short circuit conditions.

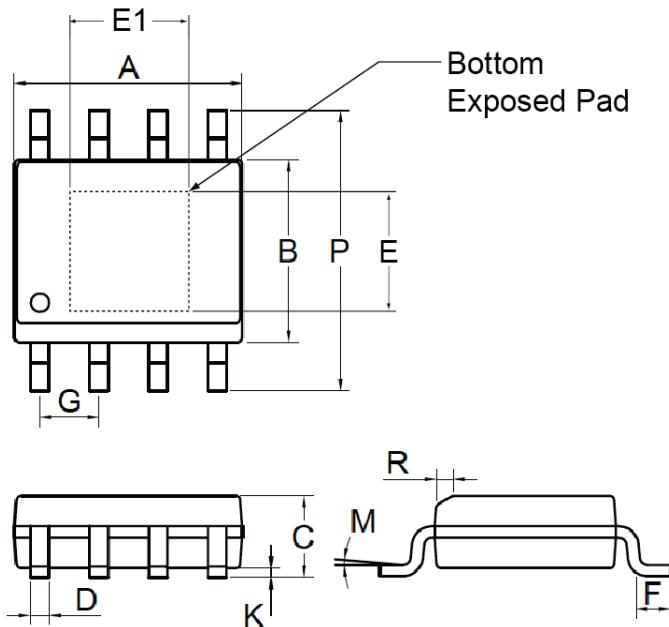
Under Voltage Protection

The TS9230 monitors the voltage on FB pin after soft-start process is finished. Therefore the UVP is disabling during soft-start. When the voltage on FB pin falls below the under-voltage threshold, the UVP circuit shuts off the output immediately. After a while, the TS9230 starts a new soft-start to regulate output.

Thermal Shutdown

A thermal shutdown circuit limits the junction temperature of TS9230. When the junction temperature exceeds +160°C, a thermal sensor turns off the output NMOS, allowing the device to cool down. The regulator regulates the output again through initiation of a new soft-start cycle after the junction temperature cools by 50°C, resulting in a pulsed output during continuous thermal overload conditions. The thermal shutdown designed.

SOP-8EP Mechanical Drawing



SOP-8EP 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
E	2.05	2.41	0.081	0.095
E1	2.82	3.30	0.111	0.130
F	0.40	1.25	0.016	0.049
G	1.27BSC		0.05BSC	
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

Notice

Specifications of the products displayed herein are subject to change without notice. TSC or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, to any intellectual property rights is granted by this document. Except as provided in TSC's terms and conditions of sale for such products, TSC assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of TSC products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify TSC for any damages resulting from such improper use or sale.