RT9193

General Description

The RT9193 is designed for portable RF and wireless applications with demanding performance and space requirements. The RT9193 performance is optimized for battery-powered systems to deliver ultra low noise and low quiescent current. A noise bypass pin is available for further reduction of output noise. Regulator ground current increases only slightly in dropout, further prolonging the battery life. The RT9193 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The RT9193 consumes less than 0.01µA in shutdown mode and has fast turn-on time less than 50µs. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio. Available in the SC-70-5, SOT-23-5, TSOT-23-5, WDFN-6L 2x2 and MSOP-8 packages.

Ordering Information

RT9193-☐☐☐☐

└─ Package Type
U5 : SC-70-5
B : SOT-23-5
J5 : TSOT-23-5
QW : WDFN-6L 2x2 (W-Type)
F : MSOP-8

└─ Lead Plating System
P : Pb Free
G : Green (Halogen Free and Pb Free)

└─ Output Voltage
15 : 1.5V
16 : 1.6V
:
49 : 4.9V
50 : 5.0V
1H : 1.85V
2H : 2.85V
4G : 4.75V
(1.5V to 5V with 0.1V step is available)

Features

- **Ultra Low Noise for RF Application**
- **Ultra Fast Response in Line/Load Transient**
- **Quick Start-Up (Typically 50µs)**
- **<0.01µA Standby Current When Shutdown**
- **Low Dropout : 220mV @ 300mA**
- **Wide Operating Voltage Ranges : 2.5V to 5.5V**
- **TTL-Logic-Controlled Shutdown Input**
- **Low Temperature Coefficient**
- **Current Limiting Protection**
- **Thermal Shutdown Protection**
- **Only 1µF Output Capacitor Required for Stability**
- **High Power Supply Rejection Ratio**
- **Custom Voltage Available**
- **RoHS Compliant and 100% Lead (Pb)-Free**

Applications

- CDMA/GSM Cellular Handsets
- Battery-Powered Equipment
- Laptop, Palmtops, Notebook Computers
- Hand-Held Instruments
- PCMCIA Cards
- Portable Information Appliances

Marking Information

For marking information, contact our sales representative directly or through a Richtek distributor located in your area.

Typical Application Circuit

RT9193
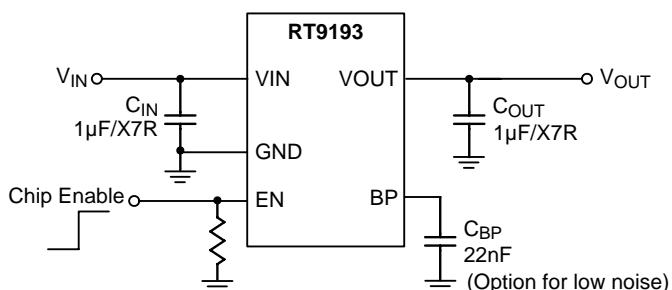
Pin Configurations

(TOP VIEW)

VOUT BP
5   4
2   3
VIN GND EN

SC-70-5/SOT-23-5/TSOT-23-5

EN 1   6 BP
GND 2   7 5 NC
VIN 3   4 VOUT

WDFN-6L 2x2

NC   1   8 NC
VIN 2   7 EN
NC   3   6 BP
VOUT 4   5 GND

MSOP-8
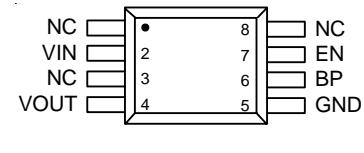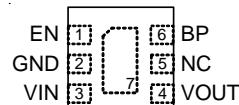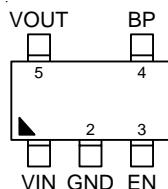
Functional Pin Description

Pin Name	Pin Function
EN	Chip Enable (Active High). Note that this pin is high impedance. There should be a pull low 100kΩ resistor connected to GND when the control signal is floating.
BP	Reference Noise Bypass. This pin can be floating. For lowest noise performance, connect a 22nF capacitor between the BP and GND pins.
GND	Ground.
VOUT	Output Voltage.
VIN	Power Input Voltage.

Function Block Diagram

RT9193
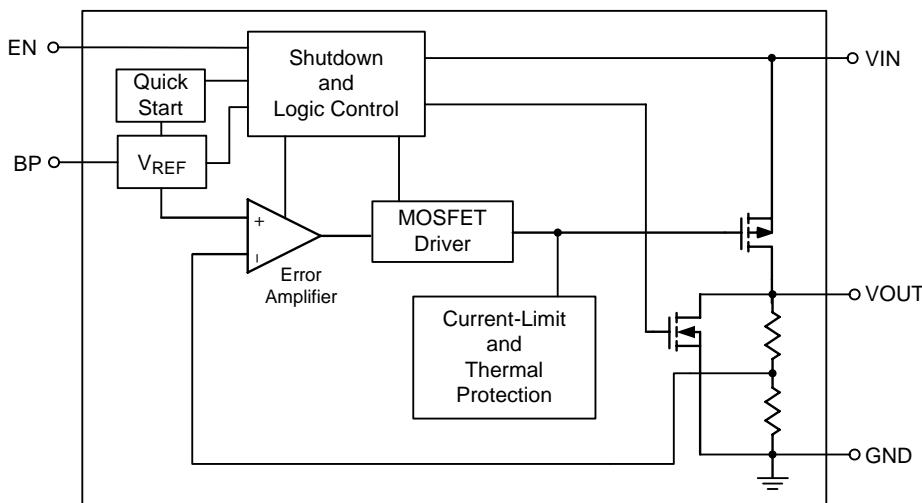
Absolute Maximum Ratings   (Note 1)

- Supply Input Voltage --- 6V
- Power Dissipation, P_D @ $T_A = 25°C$
  - SC-70-5 --- 300mW
  - TSOT-23-5/SOT-23-5 -- 400mW
  - WDFN-6L 2x2 -- 606mW
  - MSOP-8 --- 625mW
- Package Thermal Resistance   (Note 2)
  - SOT-70-5, θ_{JA} -- 333°C/W
  - TSOT-23-5/SOT-23-5, θ_{JA} -- 250°C/W
  - TSOT-23-5/SOT-23-5, θ_{JC} -- 25°C/W
  - WDFN-6L 2x2, θ_{JA} --- 165°C/W
  - WDFN-6L 2x2, θ_{JC} --- 20°C/W
  - MSOP-8 θ_{JA} -- 160°C/W
  - MSOP-8 θ_{JC} -- 55°C/W
- Junction Temperature -- 150°C
- Lead Temperature (Soldering, 10 sec.) --- 260°C
- Storage Temperature Range -- −65°C to 150°C
- ESD Susceptibility   (Note 3)
  - HBM (Human Body Model) -- 2kV
  - MM (Machine Model) --- 200V

Recommended Operating Conditions   (Note 4)

- Supply Input Voltage --- 2.5V to 5.5V
- EN Input Voltage --- 0V to 5.5V
- Junction Temperature Range -- −40°C to 125°C
- Ambient Temperature Range --- −40°C to 85°C

Electrical Characteristics

($V_{IN} = V_{OUT} + 1V$, $C_{IN} = C_{OUT} = 1\mu F$, $C_{BP} = 22nF$, $T_A = 25°C$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage Accuracy	ΔV_{OUT}	$I_{OUT} = 1mA$	−2	--	2	%
Current Limit	I_{LIM}	$R_{LOAD} = 1\Omega$	360	400	--	mA
Quiescent Current	I_Q	$V_{EN} \geq 1.2V$, $I_{OUT} = 0mA$	--	90	130	μA
Dropout Voltage (Note 5)	V_{DROP}	$I_{OUT} = 200mA$, $V_{OUT} > 2.8V$		170	200	mV
		$I_{OUT} = 300mA$, $V_{OUT} > 2.8V$	--	220	300	
Line Regulation	ΔV_{LINE}	$V_{IN} = (V_{OUT} + 1V)$ to 5.5V, $I_{OUT} = 1mA$	--	--	0.3	%
Load Regulation	ΔV_{LOAD}	$1mA < I_{OUT} < 300mA$	--	--	0.6	%
Standby Current	I_{STBY}	$V_{EN} = GND$, Shutdown	--	0.01	1	μA

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Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
EN Input Bias Current		I_{IBSD}	V_{EN} = GND or VIN	--	0	100	nA
EN Threshold Voltage	Logic-Low	V_{IL}	V_{IN} = 3V to 5.5V, Shutdown	--	--	0.4	V
	Logic-High	V_{IH}	V_{IN} = 3V to 5.5V, Start-Up	1.2	--	--	
Output Noise Voltage		e_{NO}	10Hz to 100kHz, I_{OUT} = 200mA C_{OUT} = 1µF	--	100	--	µV$_{RMS}$
Power Supply Rejection Rate	f = 100Hz	PSRR	C_{OUT} = 1µF, I_{OUT} = 10mA	--	−70	--	dB
	f = 10kHz			--	−50	--	
Thermal Shutdown Temperature		T_{SD}		--	165	--	°C
Thermal Shutdown Temperature		∆TSD		--	30	--	°C

Note 1. Stresses beyond those listed "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and 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 may affect device reliability.

Note 2. $θ_{JA}$ is measured at T_A = 25°C on a low effective thermal conductivity single-layer test board per JEDEC 51-3.

Note 3. Devices are ESD sensitive. Handling precaution is recommended.

Note 4. The device is not guaranteed to function outside its operating conditions.

Note 5. The dropout voltage is defined as V_{IN} − V_{OUT}, which is measured when V_{OUT} is $V_{OUT(NORMAL)}$ − 100mV.