RS7200

250mA Linear Regulator with Enable

General Description

The RS7200 series is a group of positive voltage output, three-pin regulators, that provide a high current even when the input/output voltage differential is small. Low power consumption and high accuracy is achieved through CMOS and programmable fuse technologies. Output voltage: 2.0V to 6.0V

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The RS7200 consists of a high-precision voltage reference, an error correction circuit, and a current limited output driver. Transient response to load variations have improved in comparison to the existing series.

With good transient responses, output remains stable even during load changes. The CE input enables the output to be turned off , resulting in reduced power consumption.

SOT-25 (150mW) package is available. With regards to the CE function, as well as the positive logic RS7200-XXGR series, a negative logic RS7200-XXGP series is also available.

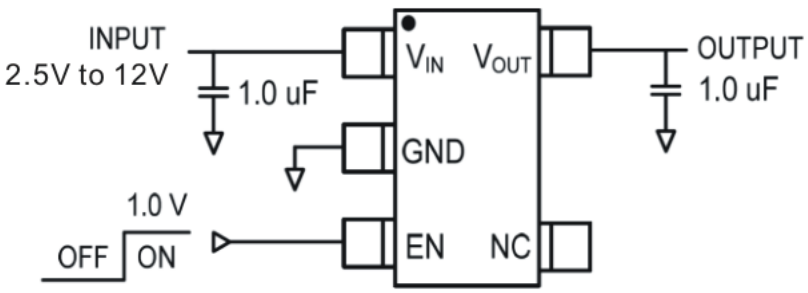
Features

- 19μA Quiescent Current (Typ.)
- Operating Voltages Range：+2.5V to +12V
- Output Voltages Range：+2.0V to +6.0V with 100mV Increment
- Maximum Output Current：250mA
- Low Dropout: 380mV@150mA (V_{OUT}≧2.5V)
- High Accuracy of Output Voltage：
  ±2.0% : V_{OUT}≧2.5 V
  ±50mV : V_{OUT}≦2.5 V
- High Ripple Rejection：60dB
- Output Current Limit Protection (500mA)
- Short Circuit Protection (200mA)
- Thermal Overload Shutdown Protection
- Low ESR Capacitor Compatible
- SOT-25 Package
- RoHS Compliant and 100% Lead (Pb)-Free and Green (Halogen Free with Commercial Standard)

Applications

- Battery-powered equipment
- Voltage regulator for microprocessor
- Voltage regulator for LAN cards
- Wireless Communication equipment
- Audio/Video equipment
- Post Regulator for Switching Power
- Home Electric/Electronic Appliance

Application Circuits

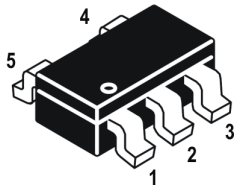


This integrated circuit can be damaged by ESD. Orister Corporation recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Pin Assignment

SOT-25



PACKAGE	PIN	SYMBOL	DESCRIPTION
SOT-25	1	VIN	Regulator Input Pin
	2	GND	Ground Pin
	3	EN	Chip Enable Pin
	4	NC	No Connection
	5	VOUT	Regulator Output Pin

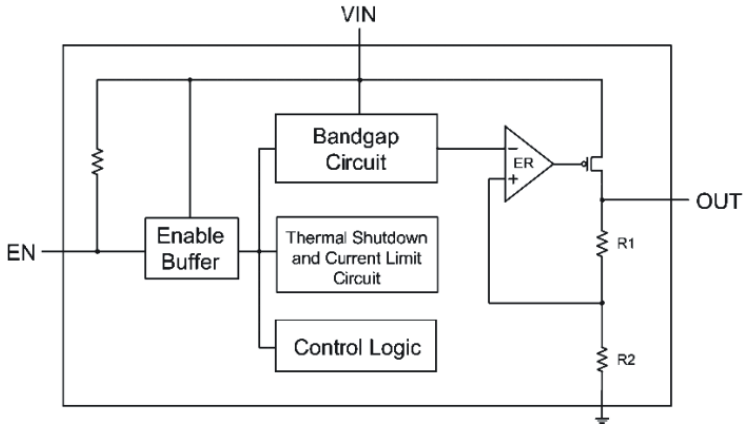
Ordering Information

DEVICE	DEVICE CODE
RS7200-XX EE YY Z	**XX** is nominal output voltage (for example, 20 = 2.0V, 33 = 3.3V, 285 = 2.85V). **EE** is CE Input Logic, Internal Pull-Up / Down Resistor : **(see CE Functions Table)** **YY** is package designator : NE: SOT-25 **Z** is Lead Free designator : P: Commercial Standard, Lead (Pb) Free and Phosphorous (P) Free Package G: Green (Halogen Free with Commercial Standard)

CE Input Logic Functions

EE Code	CE	Operational State
GR	**H**	**ON**
	L	**OFF**
GP	**H**	**OFF**
	L	**ON**

Block Diagram



Absolute Maximum Ratings

Parameter		Symbol	Ratings	Units
Input Voltage V_{IN} to GND		V_{IN}	12	V
Output Current Limit, $I_{(LIMIT)}$		I_{LIMIT}	500	mA
Junction Temperature		T_J	+155	°C
Thermal Resistance	SOT-25	θ_{JA}	250	°C/W
Power Dissipation	SOT-25	P_D	150	mW
Operating Ambient Temperature		T_{OPR}	-40 ~ +85	°C
Storage Temperature		T_{STG}	-55~+150	°C
Lead Temperature (soldering, 10sec)		-	+260	°C

NOTE: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and function operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum–rated conditions for extended periods may affect device reliability.

Electrical Characteristics (T_A=25°C, unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage	-	2.0	-	10	V
V_{OUT}	Output Voltage	$V_{IN}=V_{OUT}+1.0V$, I_{OUT}=40mA	-2%	V_{OUT}	+2%	V
I_{MAX}	Output Current (see NOTE 1)	-	150	-	-	mA
I_{LIMIT}	Current Limit	-	-	0.5	-	A
I_{SC}	Short Circuit Current	V_{IN}= V_{EN}=5V, V_{OUT}=0V	-	100	-	mA
I_Q	Ground Pin Current	V_{IN}= V_{EN}=5V=V_{OUT}+1.0V	-	-	19	uA
I_{SD}	Shutdown Current	$V_{IN}=V_{OUT}+1.0V$, V_{EN}=0V, No Load	-	0.1	1.0	uA
V_{IH}	EN Pin Input Voltage "H"	(see NOTE 2)	1.5	-	-	V
V_{IL}	EN Pin Input Voltage "L"	(see NOTE 2)	-	-	0.25	V
I_{EN}	EN Pin Leakage Current	-	-	-	0.1	uA
V_{DROP}	Dropout Voltage	V_{OUT}＞2.5V, I_{OUT}=160mA		380		mV
		2.0V＜V_{OUT}≦2.5V, I_{OUT}=160mA		550		
		V_{OUT}≦2.0V, I_{OUT}=160mA		900		
ΔV_{LINE}	Line Regulation	I_{OUT}=40mA, (V_{OUT}+1V)＜V_{IN}＜10V	-	0.2	0.3	%/V
ΔV_{LOAD}	Load Regulation	$V_{IN}=V_{OUT}+1V$, 1mA≦I_{OUT}≦80mA, C_{OUT}=1uF	-	0.02	0.04	%/mA
e_N	Output Noise	I_{OUT}=50mA , F=1KHz, C_{OUT}=1uF	-	40	-	$uV_{(rms)}$
PSRR	Ripple Rejection	$V_{IN}=V_{OUT}+1V$, I_{OUT}=30mA, F=10KHz, Vripple=$1V_{P-P}$	-	70	-	dB
T_{SD}	Thermal Shutdown Temperature	-	-	160	-	°C
T_{HYS}	Thermal Shutdown Hysteresis	-	-	10	-	°C

NOTES：

1. Measured using a double sided board with 1"x 2" square inches of copper area connected to the GND pins for "heat spreading".
2. EN pin input voltage must be always less than or equal to input voltage.

Detail Description

The RS7200 is a low quiescent current LDO linear regulator. The device provides preset 2.0V, 2.5V and 3.3V output voltages for output current up to 500mA. Other mask options for special output voltages from 2.0V to 6.0V with 100mV increment are also available. As illustrated in function block diagram, it consists of a 2.0V voltage, error amplifier, a P-channel pass transistor, an ON/OFF control logic, and an internal feedback voltage divider.

The 2.0V bandgap reference is connected to the error amplifier, which compares this reference with the feedback voltage and amplifies the voltage difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled
lower, which allows more current to pass to the output pin and increases the output voltage. If the feedback voltage is too high, the pass-transistor gate is pulled up to decrease the output voltage.

The output voltage is feedback through an internal resistive divider connected to V_{OUT} pin. Additional blocks include with output current limiter and shutdown logic.

Internal P-channel Pass Transistor
The RS7200 features a P-channel MOSFET pass transistor. Unlike similar designs using PNP pass transistors, P-channel MOSFETs require no base drive, which reduces quiescent current. PNP–based regulators also waste considerable current in dropout conditions when the pass transistor saturates, and use high base-drive currents under large loads. The RS7200 does not suffer from these problems and consumes only19μA (Typical) of current consumption under light loads.

Enable Function
EN pin starts and stops the regulator. When the EN pin is switched to the power off level, the operation of all internal circuit stops, the build-in P-channel MOSFET output transistor between pins V_{IN} and V_{OUT} is switched off, allowing current consumption to be drastically reduced. The V_{OUT} pin enters the GND level due to the several MΩ resistance of the feedback voltage divider between V_{OUT} and GND pins.

Output Voltage Selection
The RS7200 output voltage is preset at an internally trimmed voltage 2.5V or 3.3V. The output voltage also can be mask-optioned from 2.0V to 5.0V with 100mV increment by special order. The first two digits of part number suffix identify the output voltage (see ***Ordering Information***). For example, RS7200-33 has a preset 3.3V output voltage.

Current Limit
The RS7200 also includes a fold back current limiter. It monitors and controls the pass-transistor's gate voltage, estimates the output current, and limits the output current within 350mA.

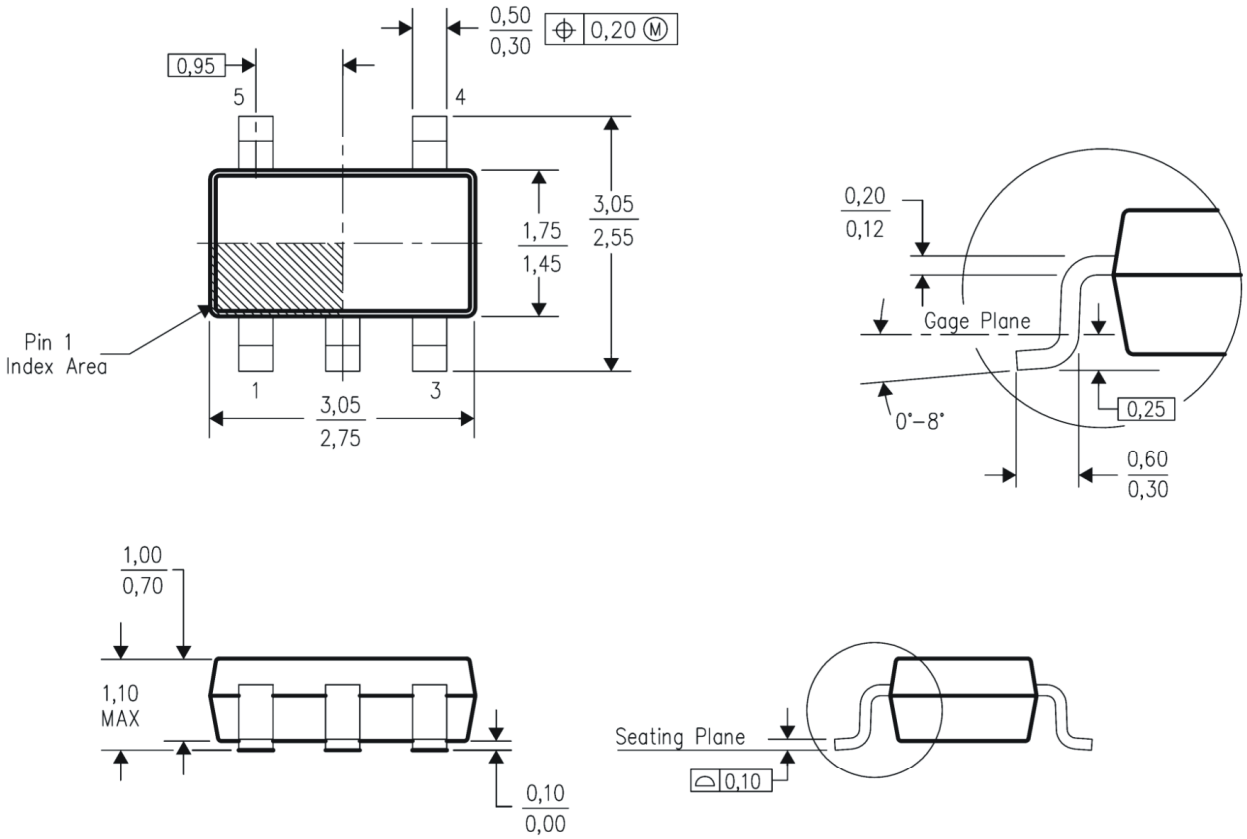
Thermal Overload Protection
Thermal overload protection limits total power dissipation in the RS7200. When the junction temperature exceeds T_J=+155°C, a thermal sensor turns off the pass transistor, allowing the IC to cool down. The thermal sensor turns the pass transistor active again after the junction temperature cools down by 10°C, resulting in a pulsed output during continuous thermal overload conditions.

Thermal overload protection is designed to protect the RS7200 in the event of fault conditions. For continuous operation, the maximum operating junction temperature rating of T_J=+125°C should not be exceeded.

Dropout Voltage
A regulator's minimum input-output voltage differential, or dropout voltage, determines the lowest usable supply voltage. In battery-powered systems, this will determine the useful end-of-life battery voltage. The RS7200 uses a P-channel MOSFET pass transistor, its dropout voltage is a function of drain-to-source on-resistance ($R_{DS(ON)}$) multiplied by the load current.

$$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS(ON)} \times I_{OUT}$$

SOT-25 Dimension



NOTES:

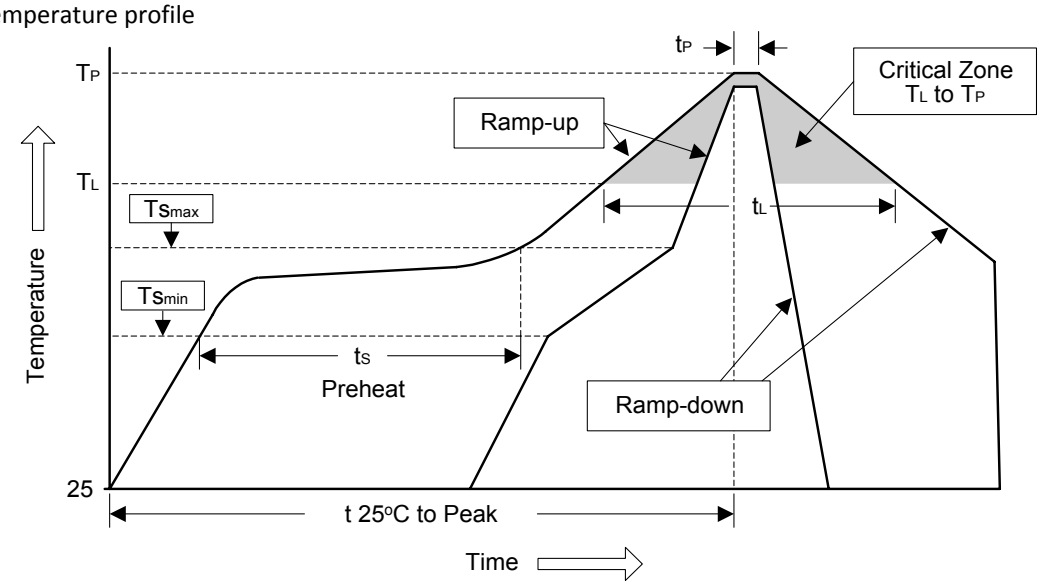
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO-193 variation AB (5 pin).

Soldering Methods for Orister's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat - Temperature Min (Ts_{min}) - Temperature Max (Ts_{max}) - Time (min to max) (ts)	 100°C 150°C 60~120 sec	 150°C 200°C 60~180 sec
Tsmax to T_L - Ramp-up Rate	 <3°C/sec	 <3°C/sec
Time maintained above: - Temperature (T_L) - Time (t_L)	 183°C 60~150 sec	 217°C 60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

Important Notice: