SEAWARD ELECTRONICS

150mA CMOS Low Noise LDO Voltage Regulator (Preliminary)

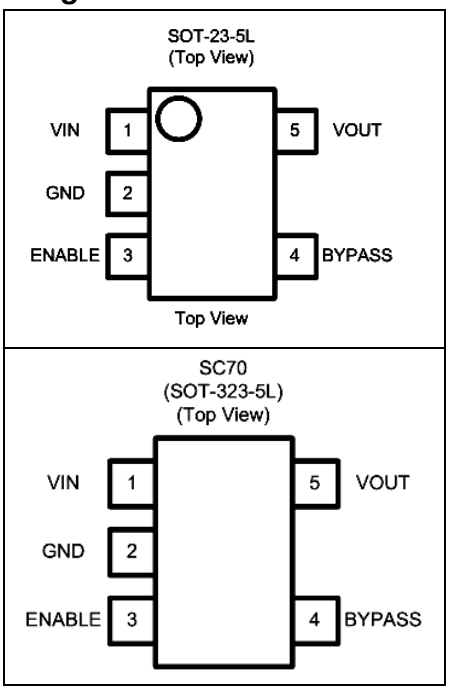
SE5508

Description

The SE5508 series of fixed output low dropout linear regulators are designed for portable battery powered applications, which require low noise environment, fast enable response time, and low dropout voltage. An optional bypass capacitor can be added for better low-noise performance. Each device contains a voltage reference unit, an error amplifier, a PMOS power transistor, and resistors for setting output voltage, and current limit and temperature limit protection circuits.

The SE5508 has been designed to be used with low cost capacitors and requires a minimum output capacitor of 1.0μF. Standard voltage versions are 1.5, 1.8, 2.5, 2.8, 3.0, and 3.3V.

Pin Configuration



Features

- Excellent Noise Rejection at 62 dB.
- Typical Low Dropout Voltage of 200mV at 75mA.
- Fast Enable Turn-On Time of 20μs (Typ.)
- Excellent Line and Load Regulation.
- High Accuracy Output Voltage of 2%.
- Typical Low Ground Current at 50μA
- Typical Disable Current Less than 0.1μA
- Thermal Protection.
- Standard SOT23-5L and SC70 (SOT353) Package.
- Available in Lead-Free Packages.

Applications

- Cellphones.
- Wireless LAN's.
- Hand-Held Instrumentation.
- Portable Video Game Devices.
- Digital Cameras.

Ordering Information

SE5508 ___

Pin (1=>5):
G: V_{IN}/GND/EN/BYPASS/V_{OUT}

Package: L: SOT-23-5L
P: SC70 (SOT353)

Output Voltage: A: V_{OUT} = 3.3V
B: V_{OUT} = 2.8V
C: V_{OUT} = 2.5V
D: V_{OUT} = 1.8V
E: V_{OUT} = 1.5V
F: V_{OUT} = 3.0V

Absolute Maximum Rating (1)

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	6	V
Enable Voltage	V_{EN}	-0.3 to V_{IN}	V
Output Voltage	V_{OUT}	-0.3 to V_{IN}	V
Power Dissipation	P_D	Internally Limited (3)	
Output Short Circuit Duration		Infinite	
Thermal Resistance, Junction-to-Ambient	Θ_{JA}	230	°C/W
Lead Temperature (Soldering, 5 sec.)		260	°C
Junction Temperature	T_J	0 to +150	°C
Storage Temperature	T_S	-40 to +150	°C

Operating Rating (2)

Parameter	Symbol	Value	Units
Supply Input Voltage	V_{IN}	+2.0V to +5.5	V
Junction Temperature	T_J	0 to +125	°C

Electrical Characteristics

V_{IN} = 5V; C_{IN} = 2.2µF; C_{OUT} = 2.21µF; I_{OUT} = 10mA; T_J = 25°C; unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage Accuracy	SE5508 – 1.5	1.470	1.5	1.530	
		SE5508 – 1.8	1.764	1.8	1.836	V
		SE5508 – 2.5	2.450	2.5	2.550	V
		SE5508 – 2.8	2.744	2.8	2.856	V
		SE5508 – 3.0	2.940	3.0	3.060	V
		SE5508 – 3.3	3.234	3.3	3.366	V
ΔV_{OUT}	Line Regulation	V_{IN} = V_{OUT} + 1V to 6V, I_{OUT} = 10mA (V_{OUT} = 3.3V)	--	1	--	%/V
ΔV_{OUT}	Load Regulation (5)	V_{IN} = 5V; I_{OUT} = 10mA to 150mA (V_{OUT} = 3.3V)	--	1	--	%
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	Note 4	--	0.033	--	mV/°C

Electrical Characteristics (Continued)

V_{IN} = 5V; C_{IN} = 2.2µF; C_{OUT} = 2.2µF; I_{OUT} = 10mA; T_J = 25°C; unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{IN} - V_{OUT}$	Dropout Voltage (6)	I_{OUT} = 10mA	--	20	--	mV
		I_{OUT} = 75mA	--	200	--	
		I_{OUT} = 150mA	--	500	--	
$T_{PROTECTION}$	Thermal Protection	Thermal Protection Temperature	--	150	--	°C
		Protection Hysterisys	--	20	--	
PSRR	Ripple Rejection	f = 120 Hz	--	62	--	dB
I_Q	Quiescent Current	V_{EN} = 0V (VOUT = 1.5V)	--	0.1	--	µA
		V_{EN} = $V_{TH(EN)}$; I_{OUT} = 10mA (VOUT = 1.5V)	--	50	--	
$V_{TH(EN)}$	Enable Input Threshold Voltage	Voltage Increasing, Output Turns On, Logic High	1.6	--	--	V
		Voltage Decreasing, Output Turns Off, Logic Low	--	--	0.4	
I_{LIMIT}	Current Limit		300	--	--	mA

Note 1: Exceeding the absolute maximum rating may damage the device.

Note 2: The device is not guaranteed to function outside its operating rating.

Note 3: The maximum allowable power dissipation at any T_A (ambient temperature) is calculated using: $P_{D(MAX)} = (T_{J(MAX)} - T_A)/\Theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown. See "Thermal Consideration" section for details

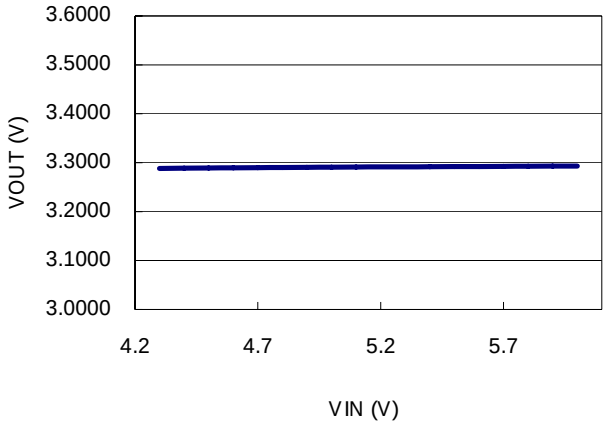
Note 4: Output voltage temperature coefficient is the worst case voltage change divided by the total temperature range.

Note 5: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 150mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

Note 6: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

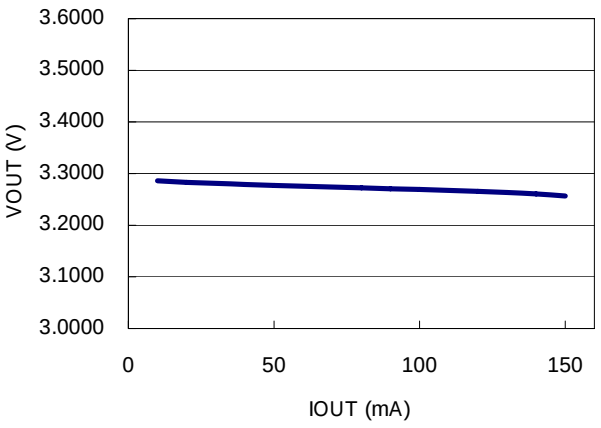
Line Regulation (VOUT = 3.3V)

(VIN = 4.3V to 5V, IOUT = 10mA)



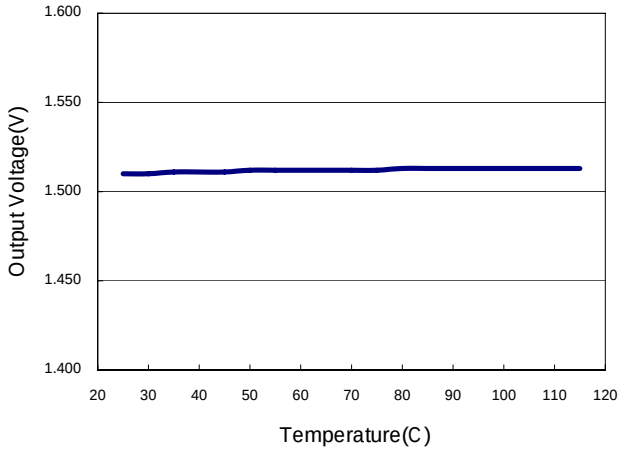
Load Regulation (VOUT = 3.3V)

(VIN = 5V, IOUT = 10mA to 150mA)



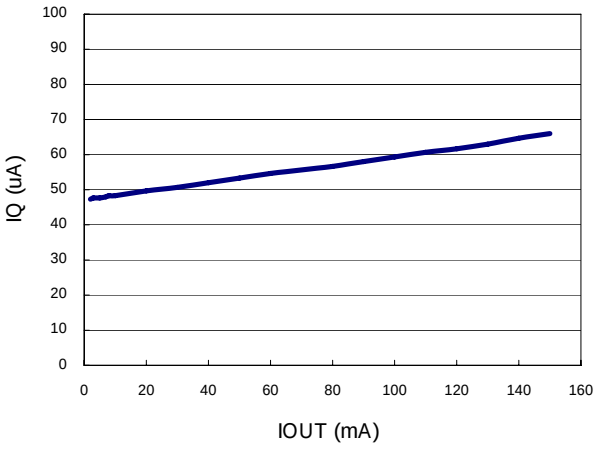
Output Voltage vs Temperature

(VIN = 3.3V, IOUT = 10mA)



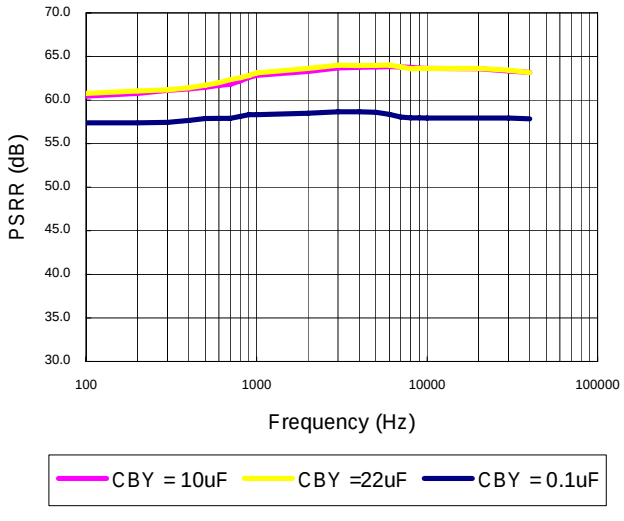
IQ vs IOUT (VOUT = 1.5V)

(VIN = 3.3V, IOUT = 10mA to 150mA)



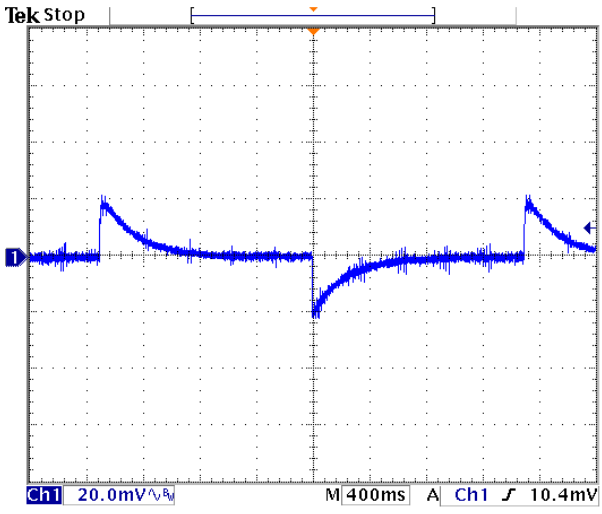
PSRR (VOUT = 3.3V)

(VIN = 5V, VPP = 1V)



Transient Response (VOUT = 3.3V)

(IOUT = 1mA to 40mA)



Application Hints

Like any low dropout regulator, SE5508 requires external capacitors to ensure stability. The external capacitors must be carefully selected to ensure performance.

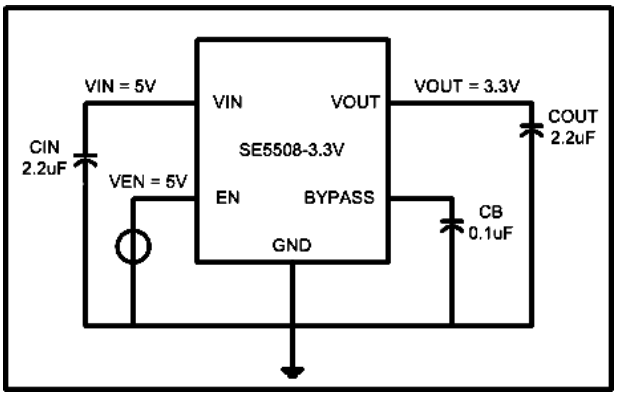
Input Capacitor

An input capacitor of at least 1μF is required. Ceramic or Tantalum can be used. The value can be increase without upper limit.

Output Capacitor

An output capacitor is required for stability. It must be placed no more than 1 cm away from the V_{OUT} pin, and connected directly between V_{OUT} and GND pins. The minimum value is 1μF but may be increase without limit.

Application Diagram



Thermal Considerations

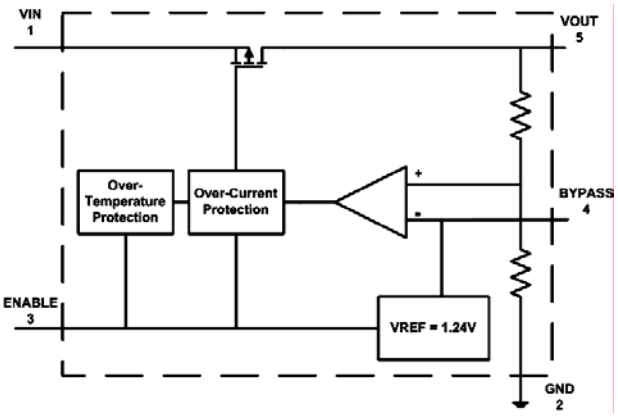
It is important that the thermal limit of the package is not exceeded. The SE5508 has built-in thermal protection. When the thermal limit is exceeded, the IC will enter protection, and V_{OUT} will be pulled to ground. The power dissipation for a given application can be calculated as following:

The power dissipation (P_D) is

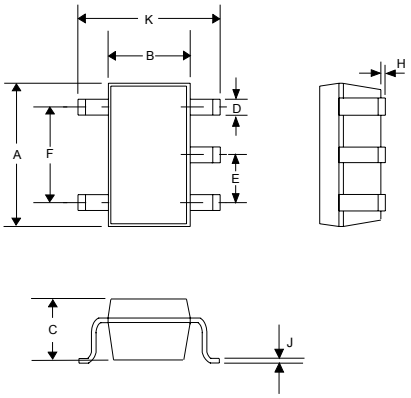
$P_D = I_{OUT} * [V_{IN} – V_{OUT}]$

The thermal limit of the package is then limited to $P_{D(MAX)} = [T_J – T_A]/\Theta_{JA}$ where T_J is the junction temperature, TA is the ambient temperature, and Θ_{JA} is around 230°C/W for SE5508. SE5508 is designed to enter thermal protection at 150°C. For example, if T_A is 25°C then the maximum P_D is limited to about 0.6W. In other words, if $I_{OUT(MAX)}$ = 150mA, then $[V_{IN} – V_{OUT}]$ cannot exceed 3.6V.

Block Diagram

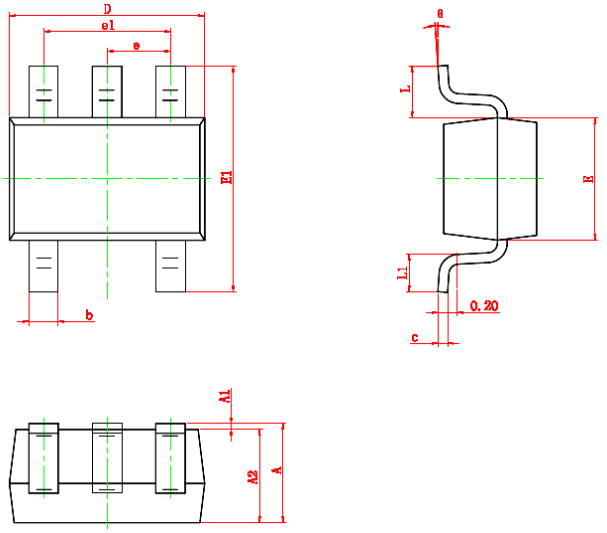


OUTLINE DRAWING SOT-23-5L



DIMENSIONS				
DIM[N]	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.110	0.120	2.80	3.05
B	0.059	0.070	1.50	1.75
C	0.036	0.051	0.90	1.30
D	0.014	0.020	0.35	0.50
E	-	0.037	-	0.95
F	-	0.075	-	1.90
H	-	0.006	-	0.15
J	0.0035	0.008	0.090	0.20
K	0.102	0.118	2.60	3.00

OUTLINE DRAWING SC70 (SOT353)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

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