500mA CMOS LDO Voltage Regulator (Preliminary)

SE5218

Description

The SE5218 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. Each device contains a bandgap voltage reference, an error amplifier, a PMOS power transistor, and resistors for setting output voltage, and current limit and temperature limit protection circuits.

The SE5218 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.

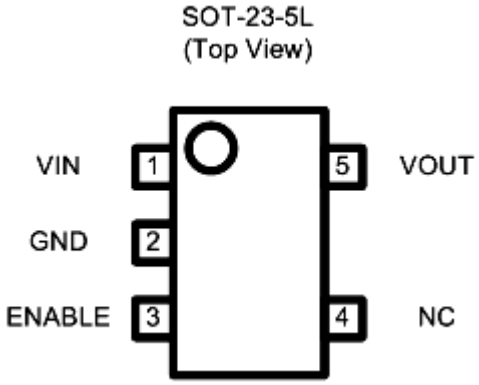
Features

- Typical 175mV Dropout Voltage at 150mA.
- Fast Enable Turn-On Time of 20μs (Typ.)
- Excellent Line and Load Regulation.
- High Accuracy Output Voltage of 2%.
- Ultra-Low Ground Current at 65μA (Typ.)
- Disable Current Less than 0.3μA (Typ.)
- Thermal Protection.
- Standard SOT-23-5L Packages.

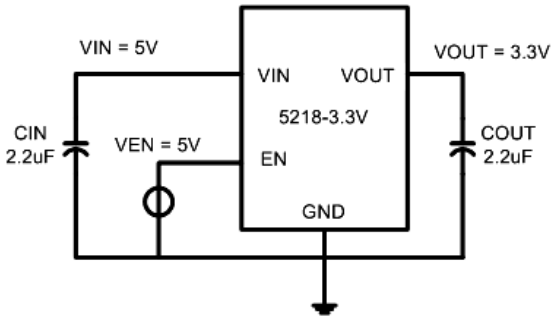
Applications

- USB removable devices
- MPEG4 devices
- Wireless LAN's
- Hand-Held Instrumentation.
- Portable DVD players
- Digital camera

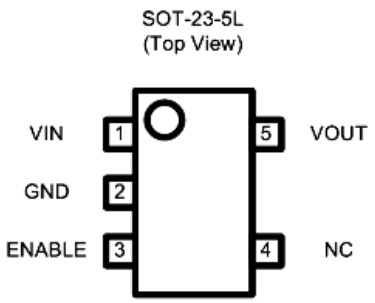
Pin Configuration



Application Diagram



Ordering/Marking Information

Package	Ordering Information		Marking Information	
	3.3V	SE5218ALG-LF	218AIz●	Starting with 5, a bar on top of 5 is for production year 2001, and underlined 5 is for year 2002. The next character is marked on top for 2003, and underlined for 2004. The naming pattern continues with consecutive characters for later years. The last character is the week code. (A-Z: 1-26, a-z: 27-52) A dot on top right corner is for lead-free process.
	2.8V	SE5218BLG-LF	218BLz●	
	2.5V	SE5218CLG-LF	218CLz●	
	1.8V	SE5218DLG-LF	218DLz●	
	1.5V	SE5218ELG-LF	218ELz●	
	3.0V	SE5218FLG-LF	218FLz●	

Absolute Maximum Rating (1)

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	6	V
Enable Voltage	V_{EN}	-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 (SOT-23-5L)	°C/W
Lead Temperature (Soldering, 5 sec.)		260	°C
Junction Temperature	T_J	+150	°C
Storage Temperature	T_S	-40 to +150	°C

Operating Rating (2)

Parameter	Symbol	Value	Units
Supply Input Voltage	V_{IN}	+2.8V to +5.5	V
Junction Temperature	T_J	0 to +125	°C

Electrical Characteristics

V_{IN} =5V; V_{EN}=V_{IN}; C_{IN} = 2.2μF; C_{OUT} = 2.2μF（Electrolytic capacitor）; I_{OUT} = 10mA; T_J = 25°C; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage Accuracy	SE5218 – 1.5(V_{IN}=3.3V) SE5218 – 1.8(V_{IN}=3.3V) SE5218 – 2.5 SE5218 – 2.8 SE5218 – 3.0 SE5218 – 3.3		1.470 1.764 2.450 2.744 2.940 3.234	1.5 1.8 2.5 2.8 3.0 3.3	1.530 1.836 2.550 2.856 3.060 3.366	V
ΔV_{OUT}	Line Regulation	V_{IN} = (V_{OUT}+1)V to 5.5V		--	1.0	--	%/V
ΔV_{OUT}	Load Regulation (5)	V_{IN} = (V_{OUT}+0.8)V or 2.5V	I_{OUT} = 10mA to 250mA	--	1.0	--	%
			I_{OUT} = 10mA to 500mA	--	1.5	--	
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	Note 4		--	0.025	--	mV/°C
$V_{IN} - V_{OUT}$	Dropout Voltage (6)	I_{OUT} = 10mA		15			mV
		I_{OUT} = 150mA		175			
		I_{OUT} = 250mA		320			
		I_{OUT} = 400mA		600			
$T_{PROTECTION}$	Thermal Protection	Thermal Protection Temperature		--	150	--	°C
		Protection Hysterisys		--	20	--	
PSRR	Ripple Rejection	f = 120 Hz		--	59	--	dB
I_Q	Quiescent Current	V_{EN} = 0.4V		--	0.3	--	μA
		V_{EN} = V_{IN}		--	65	--	
$V_{TH(EN)}$	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			--	800	--	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

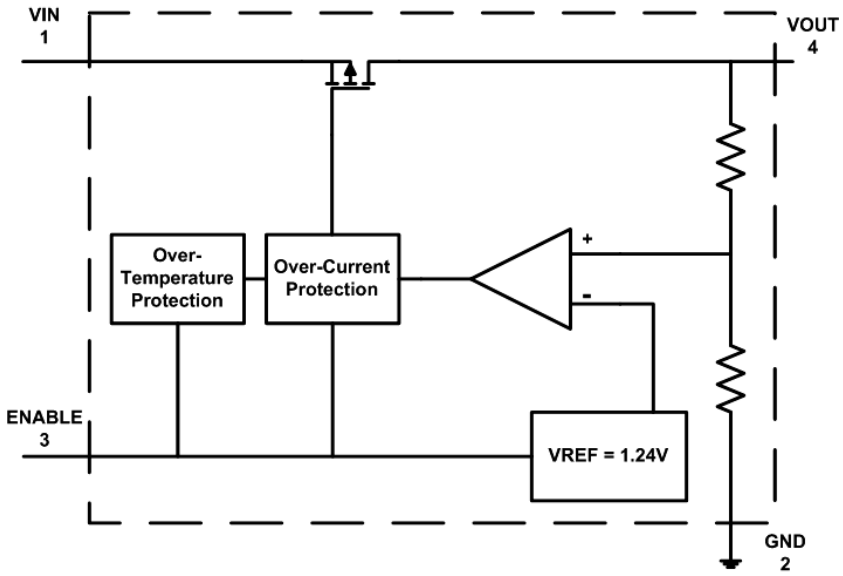
Note 4: Output voltage temperature coefficient is the worst case voltage change divided by the total temperature range.

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 10mA to 500mA. 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.

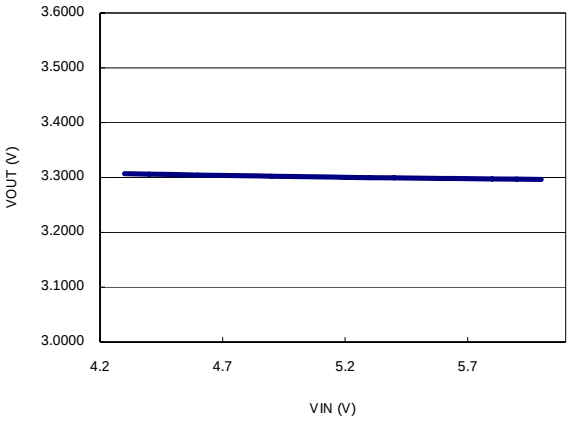
Note 7: The Cin or Cout should be chosen carefully. Please refer to the Application Hints

Block Diagram



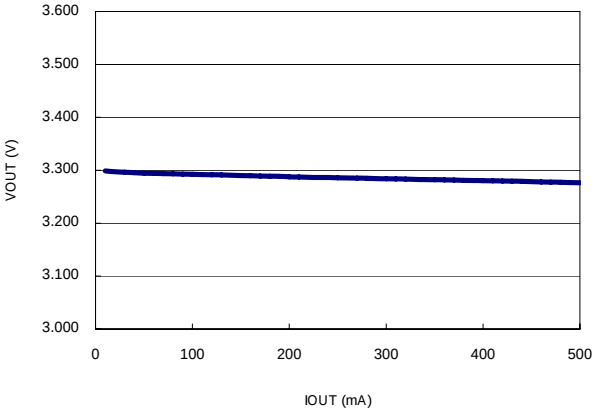
Line Regulation (VOUT = 3.3V)

(VIN = 4.3V to 6V, IOUT = 10mA)



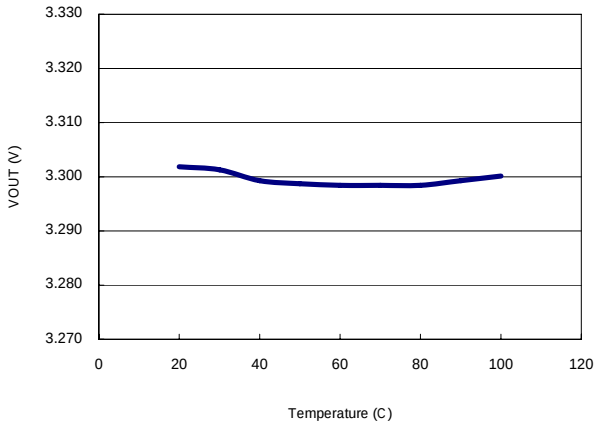
Load Regulation (VOUT = 3.3V)

(VIN = 5V, IOUT = 10mA to 500mA)



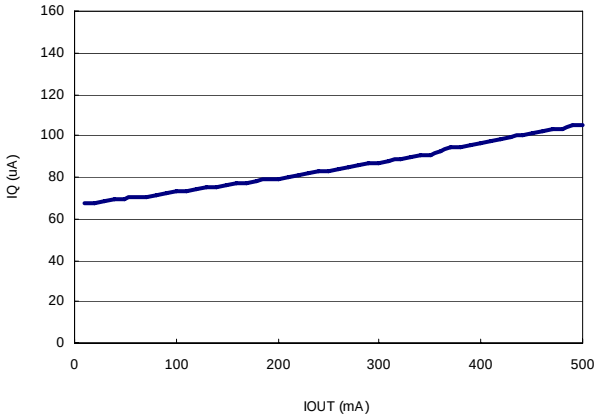
Output Voltage vs Temperature

(VIN = 5V, IOUT = 10mA)



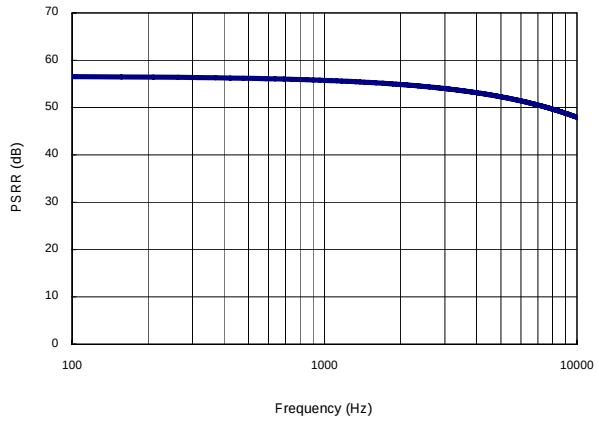
IQ vs IOUT

(VIN = 5V, IOUT = 10mA to 500mA)



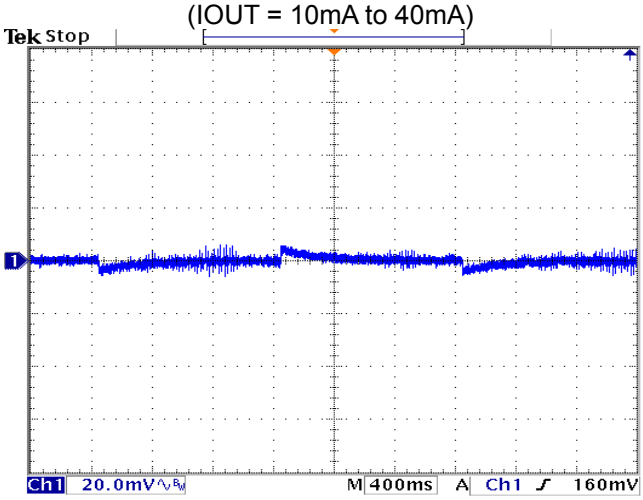
PSRR (VOUT = 3.3)

(VIN = 5V, VPP = 1V)



Transient Response (VOUT = 3.3V)

(IOUT = 10mA to 40mA)



Application Hints

Like any low dropout regulator, SE5218 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. The inexpensive Electrolytic capacitor is preferred. The value can be increased 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 inexpensive Electrolytic capacitor is recommended. The minimum value is 1μF but may be increased without limit.

Thermal Considerations

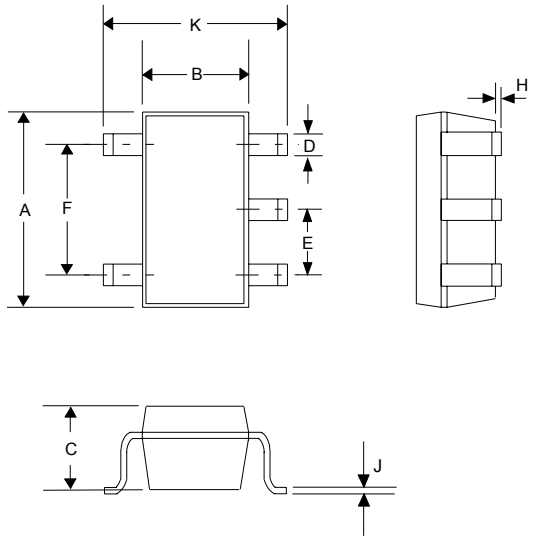
It is important that the thermal limit of the package is not exceeded. The SE5218 has built-in thermal protection. When the thermal limit is exceeded, the IC will enter protection, and V_{OUT} will be pulled to ground. The power dissipation for a given application can be calculated as following:

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} for SOT-23-5L is around 230°C/W for SE5218. SE5218 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 $I_{OUT(MAX)}$ = 400mA, then [V_{IN} – V_{OUT}] cannot exceed 1.5V.

Outline Drawing SOT-23-5L



DIMENSIONS				
DIM	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

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