Description

The SE5168 series of fixed output low dropout linear regulators are designed for portable battery powered applications, which require low dropout voltage and low ground current. 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 SE5168 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.

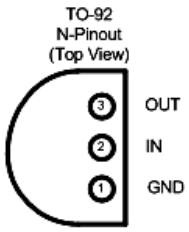
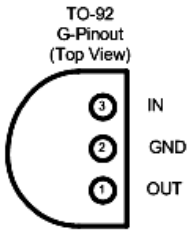
Features

- Typical Low Dropout Voltage of 200mV at 75mA.
- Guaranteed 150mA output over the full operating temperature range.
- Excellent Line and Load Regulation.
- High Accuracy Output Voltage of 2%.
- Typical Low Ground Current at 50μA
- Current Limiting and Thermal Protection.
- Standard SOT-23-3L, TO-92, and SC70 (SOT-323-3L) Package.

Applications

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

Ordering/Marking Information

Package	Ordering Information		Marking Information	
	3.3V	SE5168AHN	SE5168AHN YYWW	YY: year code WW: week code.
	2.8V	SE5168BHN	SE5168BHN YYWW	
	2.5V	SE5168CHN	SE5168CHN YYWW	
	1.8V	SE5168DHN	SE5168DHN YYWW	
	1.5V	SE5168EHN	SE5168EHN YYWW	
	3.0V	SE5168FHN	SE5168FHN YYWW	
	3.3V	SE5168AHG	SE5168AHG YYWW	
	2.8V	SE5168BHG	SE5168BHG YYWW	
	2.5V	SE5168CHG	SE5168CHG YYWW	
	1.8V	SE5168DHG	SE5168DHG YYWW	
	1.5V	SE5168EHG	SE5168EHG YYWW	
	3.0V	SE5168FHG	SE5168FHG YYWW	

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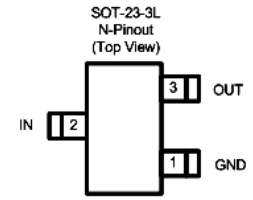
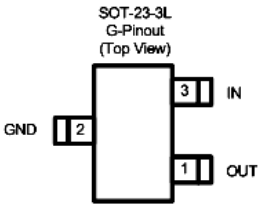
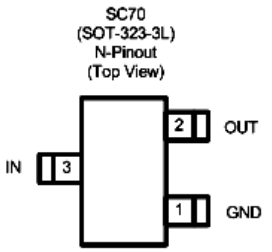
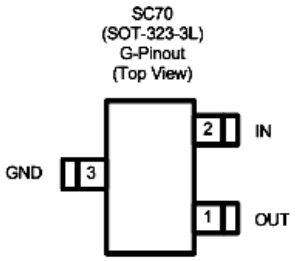
Ordering/Marking Information (Continued)

Package		Ordering Information		Marking Information	
	3.3V	SE5168ALN	168AN_	Starting with 1, a bar on top of 1 is for production year 2001, and underlined 1 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)
	2.8V	SE5168BLN	168BN_		
	2.5V	SE5168CLN	168CN_		
	1.8V	SE5168DLN	168DN_		
	1.5V	SE5168ELN	168EN_		
	3.0V	SE5168FLN	168FN_		
	3.3V	SE5168ALG	168AG_		
	2.8V	SE5168BLG	168BG_		
	2.5V	SE5168CLG	168CG_		
	1.8V	SE5168DLG	168DG_		
	1.5V	SE5168ELG	168EG_		
	3.0V	SE5168FLG	168FG_		
	3.3V	SE5168APN	6AN		
	2.8V	SE5168BPN	6BN		
	2.5V	SE5168CPN	6CN		
	1.8V	SE5168DPN	6DN		
	1.5V	SE5168EPN	6EN		
	3.0V	SE5168FPN	6FN		
	3.3V	SE5168APG	6AG		
	2.8V	SE5168BPG	6BG		
	2.5V	SE5168CPG	6CG		
	1.8V	SE5168DPG	6DG		
	1.5V	SE5168EPG	6EG		
	3.0V	SE5168FPG	6FG		

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Absolute Maximum Ratings[1]

Supply Input Voltage (V_{IN}) .....+6V

Power Dissipation (P_D) ..... Internally Limited [3]

Junction Temperature (T_J) .....150°C

Lead Temperature (soldering, 5 sec.) ..... 260°C

Storage Temperature (T_S) ..... -40°C to +150°C

Operating Ratings[2]

Supply Input Voltage (V_{IN}) ..... +2.0V to +5.5V

Junction Temperature (T_J) ..... 0°C to +125°C

Package Thermal Resistance

160°C/W (TO-92)

230°C/W (SOT-23-3L)

250°C/W (SC70)

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage Accuracy	SE5168 – 1.5V(V_{IN}=1.8V,I_{OUT}=1mA)	1.470	1.5	1.530	V
		SE5168 – 1.8V(V_{IN}=3.3V,I_{OUT}=10mA)	1.764	1.8	1.836	V
		SE5168 – 2.5V	2.450	2.5	2.550	V
		SE5168 – 2.8V	2.744	2.8	2.856	V
		SE5168 – 3.0V	2.940	3.0	3.060	V
		SE5168 – 3.3V	3.234	3.3	3.366	V
ΔV_{OUT}	Line Regulation	V_{IN} = (V_{OUT} + 1)V to 5.5V	--	1	--	%/V
ΔV_{OUT}	Load Regulation [5]	V_{IN} =(V_{OUT} + 1)V or 2.7V I_{OUT} = 10mA to 150mA	--	1	--	%
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	Note 4	--	0.033	--	mV/°C
$V_{IN} - V_{OUT}$	Dropout Voltage [6] (V_{OUT}>2V)	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	--	57	--	dB
I_Q	Quiescent Current	I_{OUT} = 10mA	--	50	--	μA
I_{LIMIT}	Current Limit		--	200	--	mA

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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

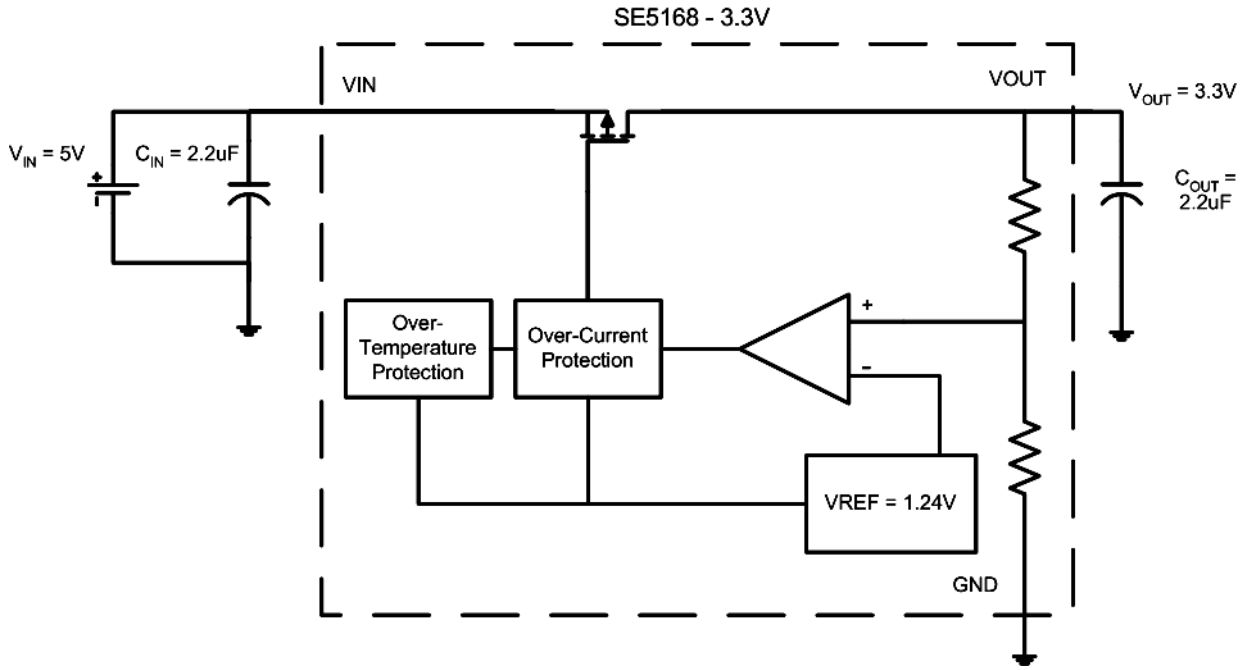
Note 4: Output voltage temperature coefficient is the worst case voltage change divided by the total temperature range.

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.

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

Typical Application



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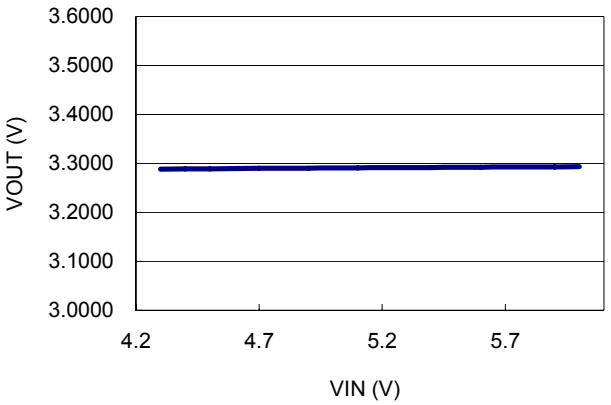
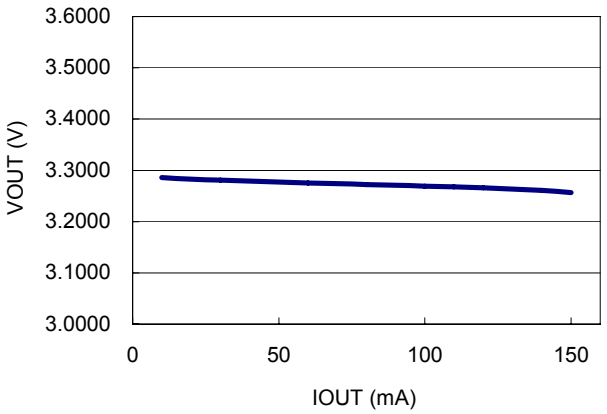
Line Regulation (VOUT = 3.3V)

(VIN = 4.3V to 5V, IOUT = 1mA)



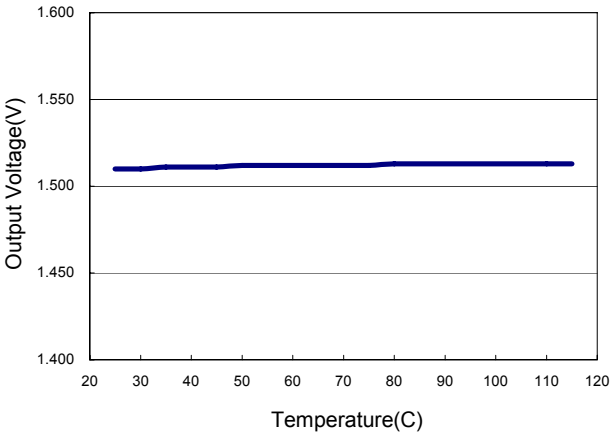
Load Regulation (VOUT = 3.3V)

(VIN = 5V, IOUT = 1mA to 150mA)



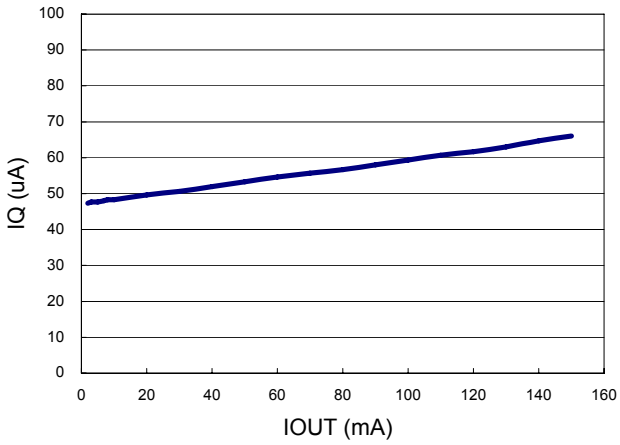
Output Voltage vs Temperature

(VIN = 3.3V, IOUT = 10mA)



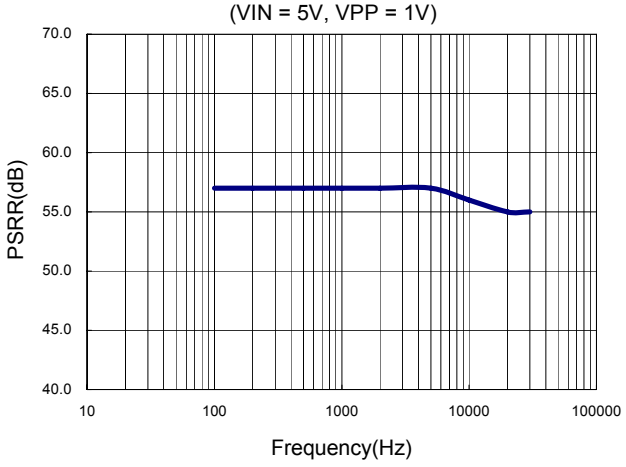
IQ vs IOUT (VOUT = 1.5V)

(VIN = 3.3V, IOUT = 1mA to 150mA)



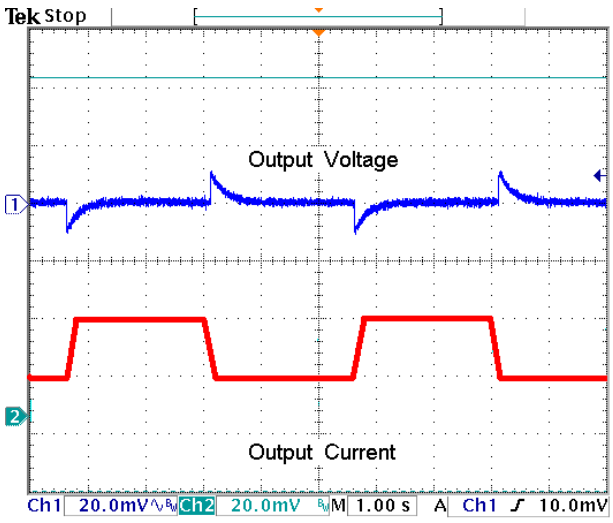
Power Supply Rejection Ratio (PSRR)

(VIN = 5V, VPP = 1V)



Transient Response (V_{OUT} = 1.5V)

(I_{OUT} = 1mA to 50mA)



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Application Hints

Like any low dropout regulator, SE5168 requires external capacitors to ensure stability. The external capacitors must be carefully selected to ensure performance.

Input Capacitor

An input capacitor of at least 2.2μF 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 2.2μF but may be increased without limit.

Thermal Considerations

It is important that the thermal limit of the package is not exceeded. The SE5168 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, T_A is the ambient temperature, and Θ_{JA} is around 250°C/W for SE5168. SE5168 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 0.5W. In other words, if $I_{OUT(MAX)}$ = 150mA, then $[V_{IN} – V_{OUT}]$ cannot exceed 3.33V.

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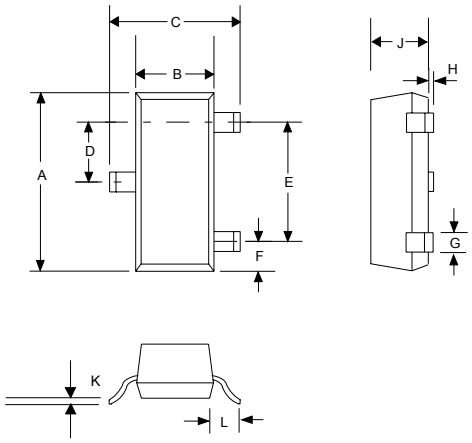
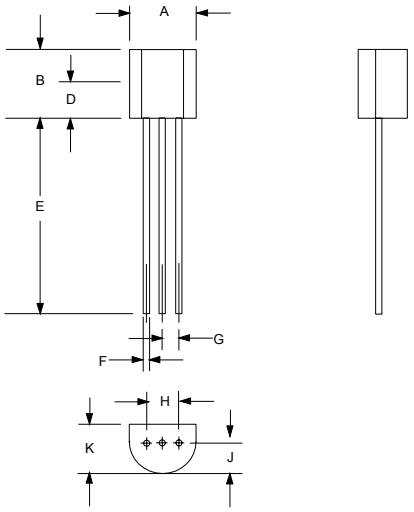
OUTLINE DRAWING SOT-23-3L (SC-59)



DIMENSIONS				
DIM[N]	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.110	0.120	2.80	3.04
B	0.047	0.055	1.20	1.40
C	0.083	0.104	2.10	2.64
D	0.035	0.040	0.89	1.03
E	0.070	0.080	1.78	2.05
F	0.018	0.024	0.45	0.60
G	0.015	0.020	0.37	0.51
H	0.0005	0.004	0.013	0.10
J	0.034	0.040	0.887	1.02
K	0.003	0.007	0.085	0.18
L	-	0.027	-	0.69

OUTLINE DRAWING TO-92



DIMENSIONS				
DIM[N]	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.445	5.207
B	0.170	0.210	4.318	5.334
E	0.500	0.610	12.70	15.50
F	0.016	0.021	0.407	0.533
G	0.045	0.055	1.143	1.397
H	0.095	0.105	2.413	2.667
J	0.080	0.105	2.032	2.667
K	0.125	0.165	3.175	4.191

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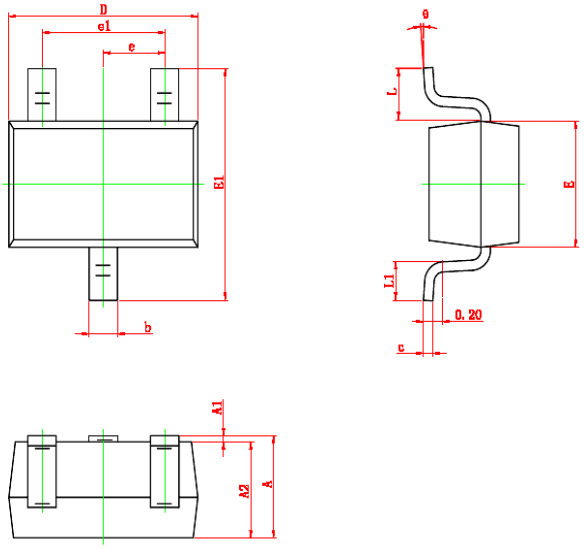
OUTLINE DRAWING SC70 (SOT-323-3L)



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	0.200	0.400	0.008	0.016
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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