Elektronische Bauelemente

SSC2138

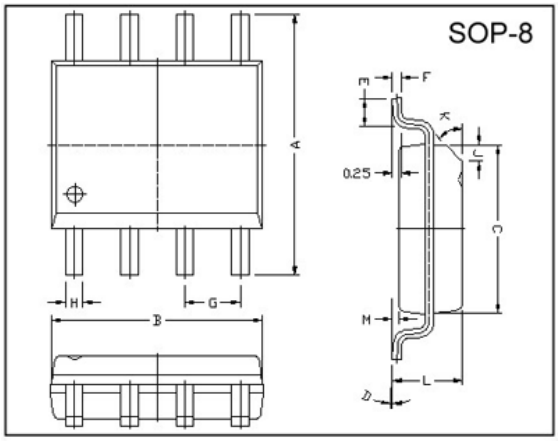
1.5A CMOS

Low Dropout Voltage Regulator

RoHS Compliant Product

Description

The SSC2138 positive,linear regulators feature low quiescent current (45μA typ.) with low dropout voltage, making them ideal for battery applications. Output voltage are set at the factory and trimmed to 1.5% accuracy.These rugged devices have both Thermal Shutdown and Current Fold-back to prevent device failure under the "Worst" of operating conditions.The SSC2138 is stable with an output capacitance of 4.7μF or greater.



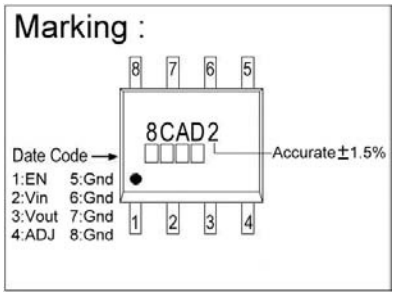
Features

* Low Temperature Coefficient
* Over-Temperature Shutdown
* Adjustable Version
* Very Low Dropout Voltage
* High Accurate ±1.5%
* Short Circuit Current Fold-back
* Guaranteed 1.5A output
* Current Limiting
* Power-Saving Shutdown Mode

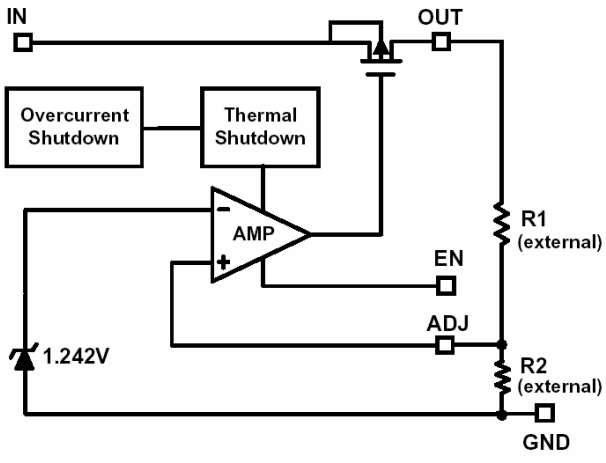
REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	5.80	6.20	M	0.10	0.25
B	4.80	5.00	H	0.35	0.49
C	3.80	4.00	L	1.35	1.75
D	0°	8°	J	0.375 REF.	
E	0.40	0.90	K	45°	
F	0.19	0.25	G	1.27 TYP.	

Applications

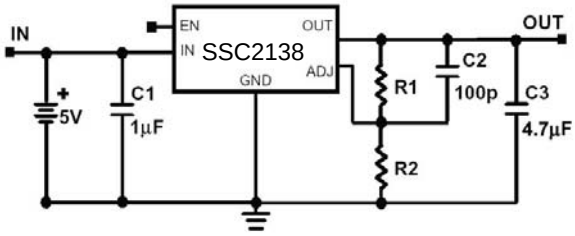
* PC Peripherals
* Wireless Devices
* Portable Electronics
* Battery Powered Widgets
* Instrumentation



Functional Block Diagram



Typical Application Circuit



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SSC2138

1.5A CMOS

Low Dropout Voltage Regulator

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Input Voltage	V_{IN}	8	V
Output Current	I_{OUT}	$P_D/(V_{IN}-V_O)$	mA
Output Voltage	V_{OUT}	Gnd-0.3 to V_{IN}+0.3	V
Operating Ambient Temperature	Topr	-40~+85	°C
Junction Temperature	Tj	-40~+125	°C
Max. Junction Temperature	Tj Max.	150	°C
Power Dissipation (△ T=100°C)	P_D	810	mW
EDS Classification		B	

Electrical Characteristics Ta=25℃ unless otherwise noted ($V_{IN}=V_{OUT}(T)+2V, V_{EN}=V_{IN}$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition	
Output Voltage	$V_{OUT}(E)$[1]	-1.5%	$V_{OUT}(T)$[2]	1.5%	V	$V_{EN}=V_{EN}$min, I_O=1mA	
Output Current	I_O	1.5	–	–	A	V_O>1.2V	
Current Limit	I_{LIM}	1.5	2.0	–	A	V_O>1.2V	
Load Regulation	REG_{LOAD}	-1	0.2	1	%	I_O=1mA~1.5A	
Dropout Voltage	$V_{DROPOUT}$	–	–	1300	mV	1.5V<$V_{OUT}(T)$≤2.0V	Io=1.5A Vo=$V_{OUT}(E)$-2%
		–	–	800		2.0V<$V_{OUT}(T)$≤2.8V	
		–	–	600		2.8V<$V_{OUT}(T)$	
Ground Pin Current	I_{GND}	–	45	–	uA	I_O=1mA~1.5A	
Line Regulation	REG_{LINE}	-0.15	–	0.15	%	$V_{OUT}(T)$< 2.0V	Io=1mA $V_{IN}=V_{OUT}(T)+1$ to $V_{OUT}(T)+2$
		-0.1	0.02	0.1		2.0V≤$V_{OUT}(T)$<4.0V	
		-0.4	–	0.4		4.0V≤$V_{OUT}(T)$	
Input Voltage	V_{IN}	Note[3]	–	7	V		
Over Temperature Shutdown	O_{TS}	–	150	–	℃		
Over Temperature Hystersis	O_{TH}	–	30	–	℃		
Output Voltage Temperature Coefficient	T_C	–	30	–	ppm/℃		
Short Circuit Current	I_{SC}	–	750	–	mA	V_{OUT}<0.4V	
Power Supply Rejection	PSRR	–	50	–	dB	f=1kHz	Io=100mA Co=4.7uF (ceramic)
		–	20	–		f=10kHz	
Output Voltage Noise	eN	–	30	–	uVrms	f=10Hz~100kHz, Io=10mA C_O=4.7uF	
EN Input Threshold	V_{EH}	2	–	V_{IN}	V	V_{IN}=2.7V to 7V	
	V_{EL}	0	–	0.4			
EN Input Bias Current	I_{EH}	–	–	0.1	uA	V_{IN}= 7V	
	I_{EL}	–	–	0.5		V_{EN}=0V, V_{IN}= 7V	
Shutdown Supply Current	I_{SD}	–	0.5	2	uA	V_{IN}=5V, V_{OUT}=0V, V_{EN}=0V	
ADJ Input Bias Current	I_{ADJ}	–	1	–	uA	V_{IN}=5V, V_{ADJ}=1.242V	
Min. Load Current	I_{MIN}	1	–	–	mA		
ADJ Reference Voltage	V_{REF}	1.223	1.242	1.261	V		

Note 1: V_{OUT} (E) =Effective Output Voltage (i.e. the output voltage when "V_{OUT} (T) +2.0V" is provided at the VIN pin while maintaining a certain I_{OUT} value).

2: V_{OUT} (T) =Specified Output Voltage

3: $V_{IN\ (MIN)}$ =V_{OUT}+$V_{DROPOUT}$

Ordering Information(contd.)

Part Number	Marking	Output Voltage	Part Number	Marking	Output Voltage
SSC2138-AD	8CAD2 XXXX	Adjustable			

Detailed Description

The SSC2138 of COMS regulators contain a PMOS pass transistor,voltage reference, error amplifier,over-current protection and thermal shutdown.The P-channel pass transistor receives data from the error amplifier, over-current shutdown, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds140^{o}C, or the current exceeds 2.2A. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120^{o}C.The SSC2138 behaves like a current source when the load reaches 2.2A. However, if the load impedance drops below 0.3 Ω , the current drops back to 600mA to prevent excessive power dissipation. Normal operation is restored when the load resistance exceeds of 0.75 Ω .

External Capacitors

The SSC2138 is stable with an output capacitance to ground of 4.7uF or greater. Ceramic capacitors have the lowest ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the highest ESR, resulting in the poorest AC response. Unfortunately, large value ceramic capacitors are comparatively expensive. One option is to parallel a 0.1uF ceramic capacitor with a 10uF Aluminum Electrolytic. The benefit is low ESR, high capacitance, and low overall cost. A second capacitor is recommended between the input and ground to stabilize V_{IN}. The input capacitor should be at least 0.1uF to have a beneficial effect. All capacitors should be placed in closed proximity to the pins. A "Quiet" ground termination is desirable. This can be achieved with a "Star" connection.

Enable

When EN pin is pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 2uA. This pin behaves much like an electronic switch. 100KΩ resistor is necessary between V_{EN} source and EN pin when V_{EN} is higher than V_{IN}. (Note: There is no internal pull-up for EN pin.)

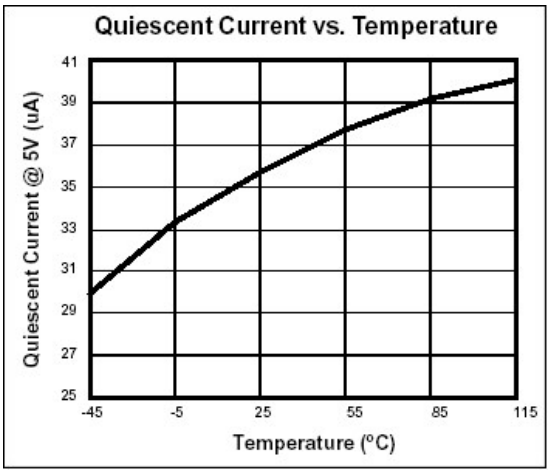
Adjustable Version

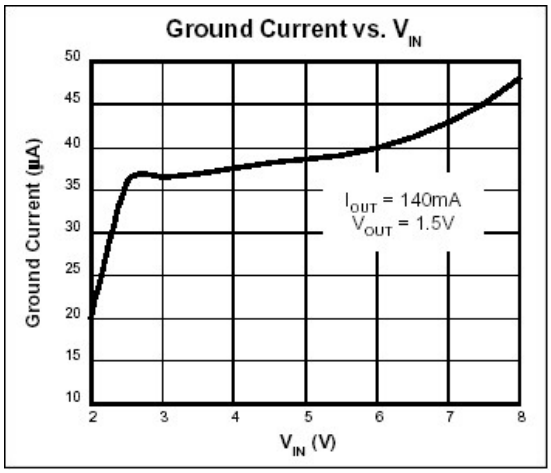
The adjustable version uses external feedback resistors to generate an output voltage anywhere from 1.5V to 5.0V. Vadj is trimmed to 1.242V and Vout is given by the equation:

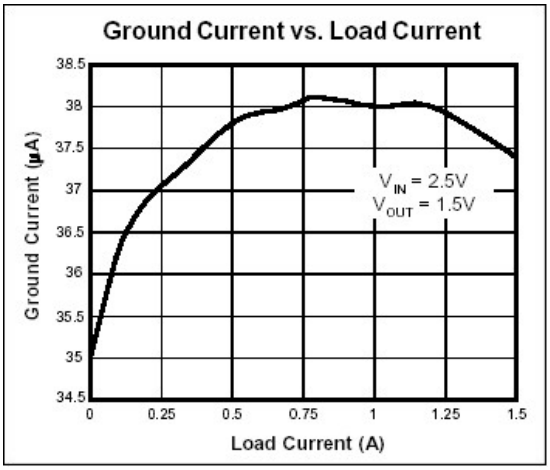
$$V_{OUT}=Vadj*(1+R1/R2)$$

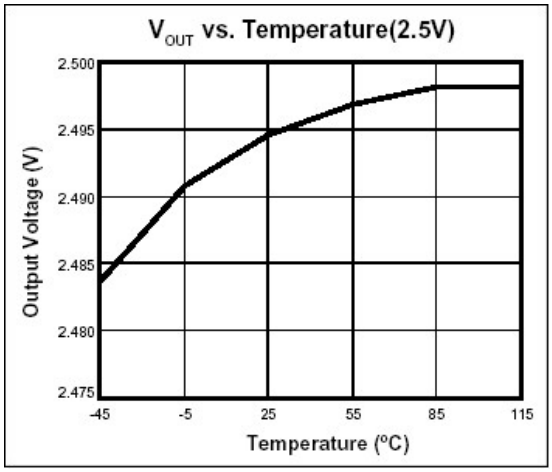
Feedback resistors R1 and R2 should be high enough to keep quiescent current low, but increasing R1+R2 will reduce stability. In general, R1 and R2 in the 10's of kΩ will produce adequate stability, given reasonable layout precautions. To improve stability characteristics, keep parasitic on the ADJ pin to min., and lower R1 and R2 values.

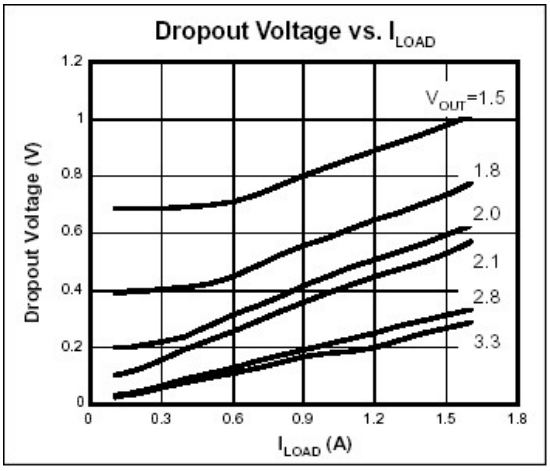
Characteristics Curve

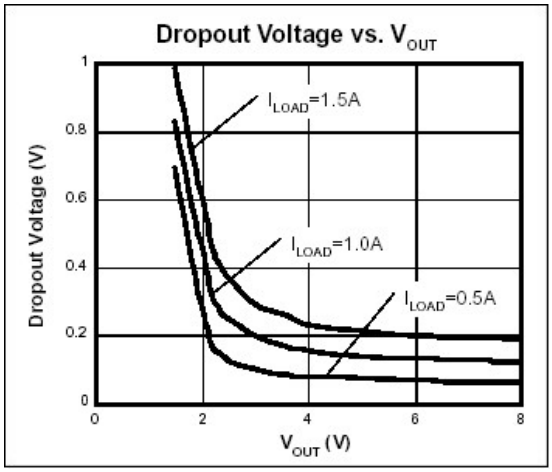


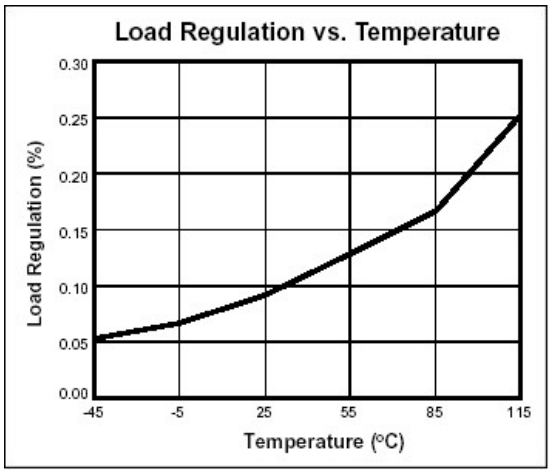


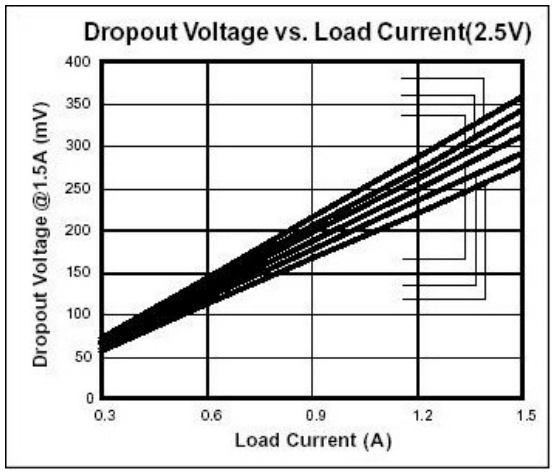


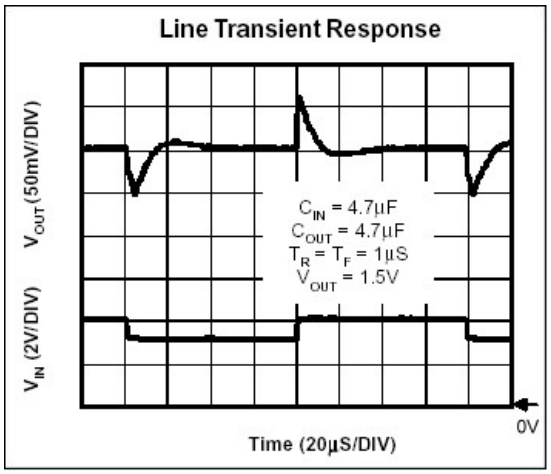


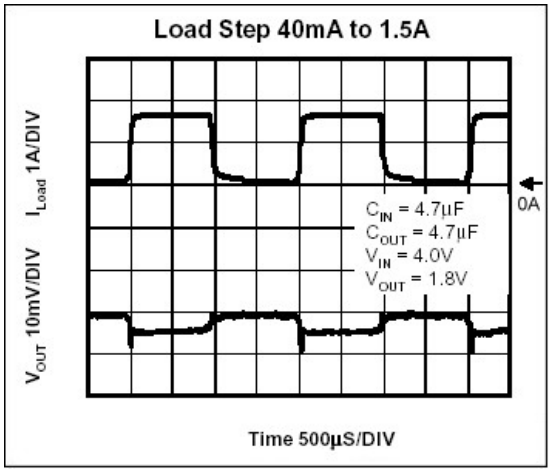


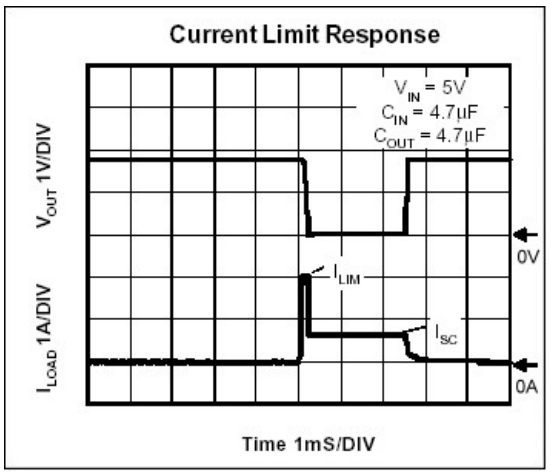


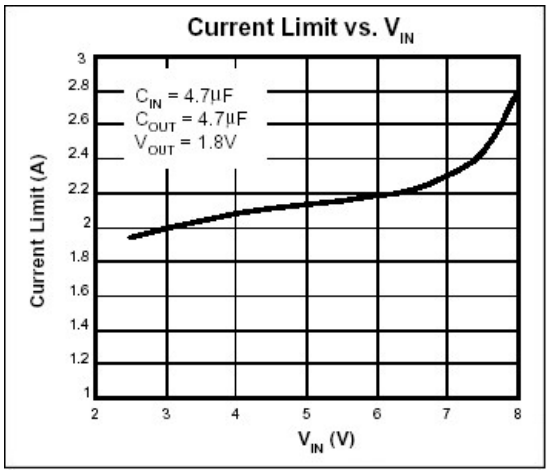

Load Regulation vs. Temperature
Load Regulation (%)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-45
-5
25
55
85
115
Temperature (°C)

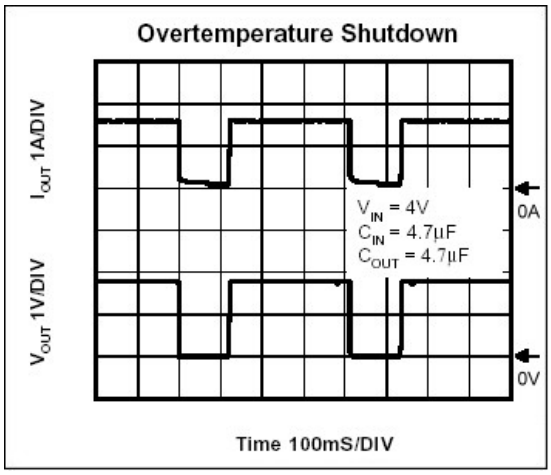

Dropout Voltage vs. Load Current(2.5V)
Dropout Voltage @1.5A (mV)
400
350
300
250
200
150
100
50
0
0.3
0.6
0.9
1.2
1.5
Load Current (A)

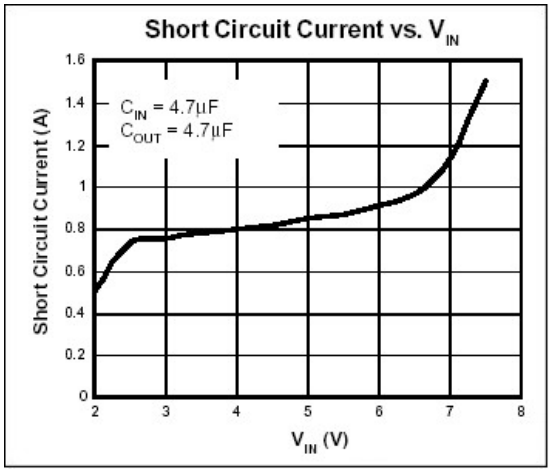

Line Transient Response
V_OUT (50mV/DIV)
V_IN (2V/DIV)
C_IN = 4.7µF
C_OUT = 4.7µF
T_R = T_F = 1µS
V_OUT = 1.5V
0V
Time (20µS/DIV)

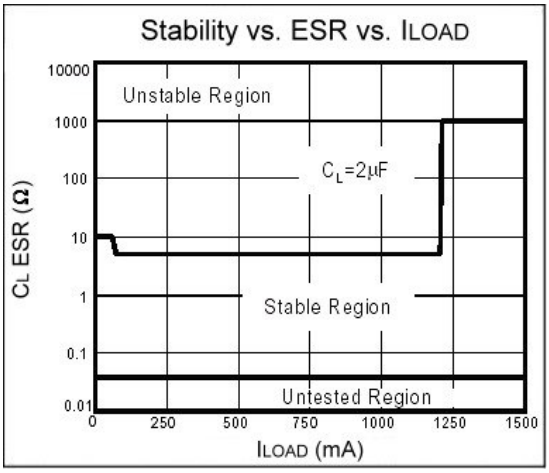

Load Step 40mA to 1.5A
I_Load 1A/DIV
V_OUT 10mV/DIV
C_IN = 4.7µF
C_OUT = 4.7µF
V_IN = 4.0V
V_OUT = 1.8V
0A
Time 500µS/DIV

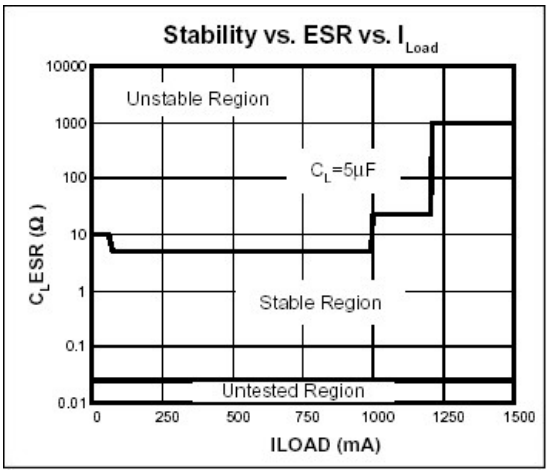

Current Limit Response
V_OUT 1V/DIV
I_LOAD 1A/DIV
V_IN = 5V
C_IN = 4.7µF
C_OUT = 4.7µF
I_LIM
I_SC
0V
0A
Time 1mS/DIV

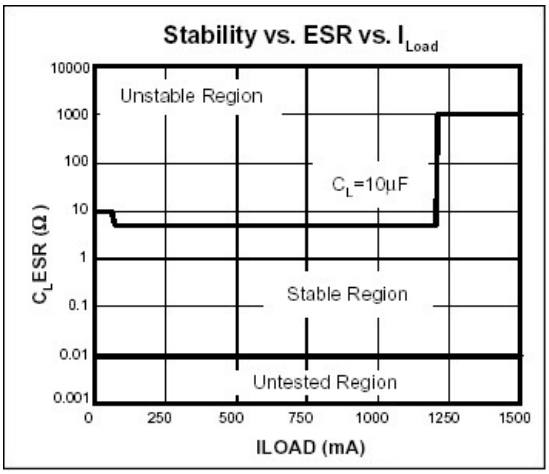

Current Limit vs. V_IN
Current Limit (A)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
2
3
4
5
6
7
8
V_IN (V)
C_IN = 4.7µF
C_OUT = 4.7µF
V_OUT = 1.8V

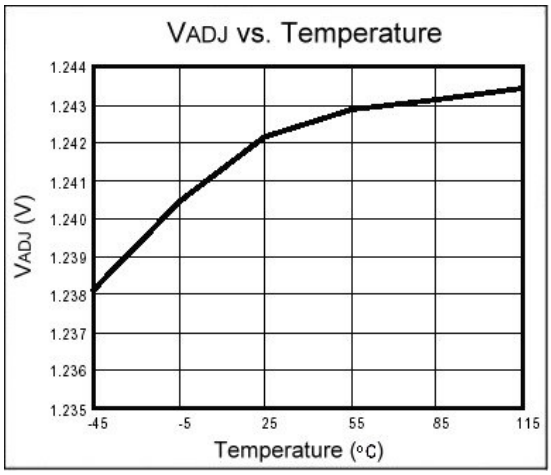

Overtemperature Shutdown
I_{OUT} 1A/DIV
V_{OUT} 1V/DIV
V_{IN} = 4V
C_{IN} = 4.7µF
C_{OUT} = 4.7µF
0A
0V
Time 100mS/DIV


Short Circuit Current vs. V_{IN}
C_{IN} = 4.7µF
C_{OUT} = 4.7µF
Short Circuit Current (A)
V_{IN} (V)


Stability vs. ESR vs. ILOAD
Unstable Region
C_L=2µF
Stable Region
Untested Region
C_L ESR (Ω)
ILOAD (mA)


Stability vs. ESR vs. I_{Load}
Unstable Region
C_L=5µF
Stable Region
Untested Region
C_L ESR (Ω)
ILOAD (mA)


Stability vs. ESR vs. I_{Load}
Unstable Region
C_L=10µF
Stable Region
Untested Region
C_L ESR (Ω)
ILOAD (mA)


VADJ vs. Temperature
VADJ (V)
Temperature (°C)

External Resistor Divider Table

R1(kΩ)	1	2	5	10	20	50
VOUT	R2(kΩ)=(1.242*R1(kΩ))/(VOUT-1.242)					
1.30	21.41	42.83	107.07	214.14	428.28	1070.7
1.35	11.50	23.00	57.50	115.00	230.00	575.00
1.40	7.86	15.72	39.30	78.61	157.22	393.04
1.45	5.97	11.94	29.86	59.71	119.42	298.56
1.50	4.81	9.63	24.07	48.14	96.28	240.70
1.55	4.03	8.06	20.16	40.32	80.65	201.62
1.60	3.47	6.94	17.35	34.69	68.39	173.46
1.65	3.04	6.09	15.22	30.44	60.88	152.21
1.70	2.71	5.42	13.56	27.12	54.24	135.59
1.75	2.44	4.89	12.22	24.45	48.90	122.24
1.80	2.23	4.45	11.13	22.26	44.52	111.29
1.85	2.04	4.09	10.21	20.43	40.86	102.14
1.90	1.89	3.78	9.44	18.88	37.75	94.38
1.95	1.75	3.51	8.77	17.54	35.08	87.71
2.00	1.64	3.28	8.19	16.39	32.77	81.93
2.05	1.54	3.07	7.69	15.37	30.74	76.86
2.10	1.45	2.90	7.24	14.48	28.95	72.38
2.15	1.37	2.74	6.84	13.68	27.36	68.39
2.20	1.30	2.59	6.48	12.96	25.93	64.82
2.25	1.23	2.46	6.16	12.32	24.65	61.61
2.30	1.17	2.35	5.87	11.74	23.48	58.70
2.35	1.12	2.24	5.60	11.21	22.42	56.05
2.40	1.07	2.15	5.36	10.73	21.45	53.63
2.45	1.03	2.06	5.14	10.28	20.56	51.41
2.50	0.99	1.97	4.94	9.87	19.75	49.36
2.55	0.95	1.90	4.75	9.50	18.99	47.48
2.60	0.91	1.83	4.57	9.15	18.29	45.73
2.65	0.88	1.76	4.41	8.82	17.64	44.11
2.70	0.85	1.70	4.26	8.52	17.04	42.59
2.75	0.82	1.65	4.12	8.24	16.47	41.18
2.80	0.80	1.59	3.99	7.97	15.94	39.86
2.85	0.77	1.54	3.86	7.72	15.45	38.62
2.90	0.75	1.50	3.75	7.49	14.98	37.45
2.95	0.73	1.45	3.64	7.27	14.54	36.36
3.00	0.71	1.41	3.53	7.06	14.13	35.32
3.05	0.69	1.37	3.43	6.87	13.74	34.35
3.10	0.67	1.34	3.34	6.68	13.37	33.42
3.15	0.65	1.30	3.25	6.51	13.02	32.55

R1(kΩ)	1	2	5	10	20	50
VOUT	R2(kΩ)=(1.242*R1(kΩ))/(VOUT-1.242)					
3.20	0.63	1.27	3.17	6.34	12.69	31.72
3.25	0.62	1.24	3.09	6.19	12.37	30.93
3.30	0.60	1.21	3.02	6.03	12.07	30.17
3.35	0.59	1.18	2.95	5.89	11.78	29.46
3.40	0.58	1.15	2.88	5.76	11.51	28.78
3.45	0.56	1.13	2.81	5.63	11.25	28.13
3.50	0.55	1.10	2.75	5.50	11.00	27.50
3.55	0.54	1.08	2.69	5.38	10.76	26.91
3.60	0.53	1.05	2.63	5.27	10.53	26.34
3.65	0.52	1.03	2.58	5.16	10.32	25.79
3.70	0.51	1.01	2.53	5.05	10.11	25.26
3.75	0.50	0.99	2.48	4.95	9.90	24.76
3.80	0.49	0.97	2.43	4.86	9.71	24.28
3.85	0.48	0.95	2.38	4.76	9.52	23.81
3.90	0.47	0.93	2.34	4.67	9.35	23.36
3.95	0.46	0.92	2.29	4.59	9.17	22.93
4.00	0.45	0.90	2.25	4.50	9.01	22.52
4.05	0.44	0.88	2.21	4.42	8.85	22.12
4.10	0.43	0.87	2.17	4.35	8.69	21.73
4.15	0.43	0.85	2.14	4.27	8.54	21.35
4.20	0.42	0.84	2.10	4.20	8.40	20.99
4.25	0.41	0.83	2.06	4.13	8.26	20.64
4.30	0.41	0.81	2.03	4.06	8.12	20.31
4.35	0.40	0.80	2.00	4.00	7.99	19.98
4.40	0.39	0.79	1.97	3.93	7.87	19.66
4.45	0.39	0.77	1.94	3.87	7.74	19.36
4.50	0.38	0.76	1.91	3.81	7.62	19.06
4.55	0.38	0.75	1.88	3.75	7.51	18.77
4.60	0.37	0.74	1.85	3.70	7.40	18.49
4.65	0.36	0.73	1.82	3.64	7.29	18.22
4.70	0.36	0.72	1.80	3.59	7.18	17.96
4.75	0.35	0.71	1.77	3.54	7.08	17.70
4.80	0.35	0.70	1.75	3.49	6.98	17.45
4.85	0.34	0.69	1.72	3.44	6.88	17.21
4.90	0.34	0.68	1.70	3.40	6.79	16.98
4.95	0.33	0.67	1.67	3.35	6.70	16.75
5.00	0.33	0.66	1.65	3.30	6.61	16.52

Note: Small load (greater than 2mA) is necessary as R1 or R2 is larger than 50kΩ. Otherwise, output voltage probably can not be pulled down to 0V on disable mode.