Elektronische Bauelemente

S5U2189

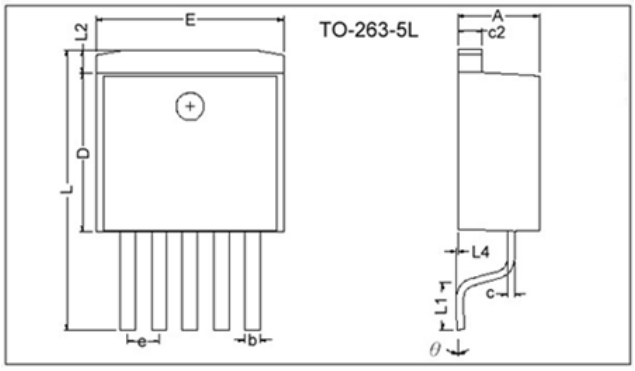
1.55A CMOS

Low Dropout Voltage Regulator

RoHS Compliant Product

Description

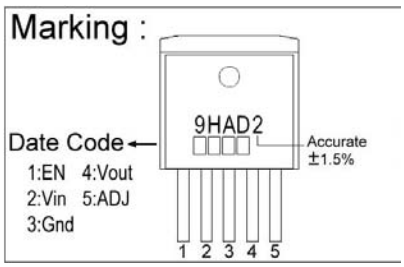
The S5U2189 of positive,linear regulators feature low quiescent current (45μA typ.) with low dropout voltage, making them ideal for battery applications. Output voltage are set at the factory and trimmed to 1.5% accuracy.These rugged devices have both Thermal Shutdown and Current Fold-back to prevent device failure under the "Worst" of operating conditions.The S5U2189 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%
* Guaranteed 1.55 A output
* Current Limiting
* Power-Saving Shutdown Mode

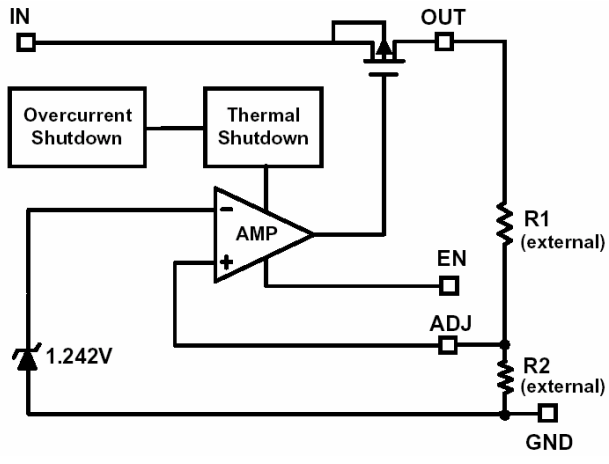
REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	4.40	4.80	c2	1.25	1.45
b	0.66	0.91	L2	1.27 REF.	
L4	0.00	0.30		8.6	9.0
c	0.36	0.5	e	1.70 REF.	
L1	2.29	2.79	L	14.6	15.8
E	9.80	10.4	θ	0˚	8˚



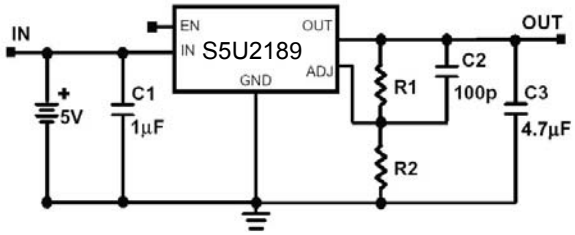
Applications

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

Functional Block Diagram



Typical Application Circuit



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Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Input Max Voltage	V_{IN}	8	V
Output Current	I_{OUT}	$P_D/(V_{IN}- V_O)$	A
Output Voltage	V_{OUT}	Gnd-0.3 to V_{IN}+0.3	V
Operating Ambient Temperature	Topr	-40 ~ +85	℃
Junction Temperature	Tj	-40 ~ +125	℃
Maximum Junction Temperature	Tj Max	150	℃
Thermal Resistance	θjc	5	℃/W
Internal Power Dissipation(△T=100℃)	PD	3.0	W
EDS Classification		B	

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

Parameter	Symbol	Condition		Min	TYP	Max	Unit
Output Voltage	$V_{OUT}(E)$ (Note1)	I_O=1mA		-1.5%	$V_{OUT}(T)$ (Note2)	1.5%	V
Output Current	I_O	V_{OUT}>1.2V		1.55	-	-	A
Current Limit	I_{LIM}	V_{OUT}>1.2V		1.55	2.0	-	A
Load Regulation	REG_{LOAD}	I_O=1mA to 1.5A		-1	0.2	1	%
Dropout Voltage	$V_{DROPOUT}$	I_O=1.55A $V_O=V_{OUT}(E)$-2%	1.5V<$V_{OUT}(T)$≦2.0V	-	-	1000	mV
			2.0V<$V_{OUT}(T)$≦2.8V	-	-	800	
			2.8V<$V_{OUT}(T)$	-	-	600	
Ground Pin Current	I_{GND}	I_O=1mA~1.5A		-	45	-	μA
Line Regulation	REG_{LINE}	I_O=1mA $V_{IN}=V_{OUT}$ $V_{OUT}(T)$+2	$V_{OUT}(T)$<2.0V	-	-	0.15	%
			2.0V≦$V_{OUT}(T)$	-	0.02	0.1	
Input Voltage	V_{IN}			Note3	-	7	V
Over Temperature Shutdown	OTS			-	150	-	℃
Over Temperature Hysterisis	OTH			-	30	-	℃
Output Voltage Temperature Coefficient	TC			-	30	-	ppm/℃
ADJ Input Bias Current	I_{ADJ}	V_{IN}=5V, V_{ADJ}=1.242V		-	1	-	μA
ADJ Reference Voltage	V_{REF}			1.223	1.242	1.261	V
Power Supply Rejection	PSRR	Io=100mA Co=4.7μF ceramic	f=1kHz	-	50	-	dB
			f=10kHz	-	20	-	
			f=100kHz	-	15	-	
Output Voltage Noise	eN	f=10Hz~100kHz Io=10mA	Co=4.7μF	-	30	-	μVrms
EN Input Threshold	V_{EH}	V_{IN}=2.7V to 7V		2.0	-	V_{IN}	V
	V_{EL}	V_{IN}=2.7V to 7V		0	-	0.4	V
EN Input Bias Current	I_{EH}	$V_{EN}=V_{IN}$, V_{IN}=2.7V to 7V		-	-	0.1	μA
	I_{EL}	V_{EN}= 0V, V_{IN}=2.7V to 7V		-	-	0.5	μA
Shutdown Supply Current	I_{SD}	V_{IN}=5.0V, V_O=0, $V_{EN}<V_{EL}$		-	30	-	μA
		V_{IN}=2.5V, V_O=0, $V_{EN}<V_{EL}$		-	0.5	2	μA

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

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Ordering Information(contd.)

Part Number	Marking	Output Voltage	Part Number	Marking	Output Voltage
S5U 2189-AD	9HAD2 XXXX	Adjustable			

Detailed Description

The S5U2189 of COMS regulator contains 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 exceeds 140℃, 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℃.

External Capacitors

The S5U2189 is stable with an output capacitance to ground of 4.7μF 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 0.1μF ceramic capacitor with a 10μF 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 Vin. The input capacitor should be at least 0.1μF to have a beneficial effect.

All capacitors should be placed in close proximity to the pins. A “Quiet” ground termination is desirable. This can be achieved with a “Star” connection.

Enable

When pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 1μA. This pin behaves much like an electronic switch.

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 minimum, and lower R1 and R2 values.

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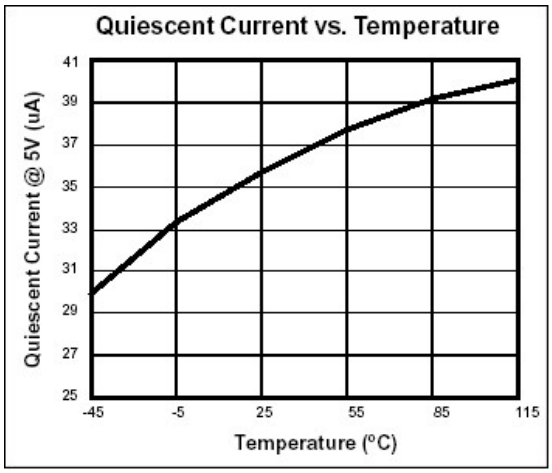
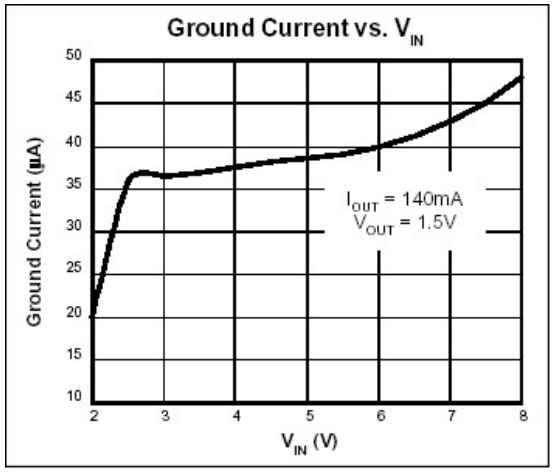
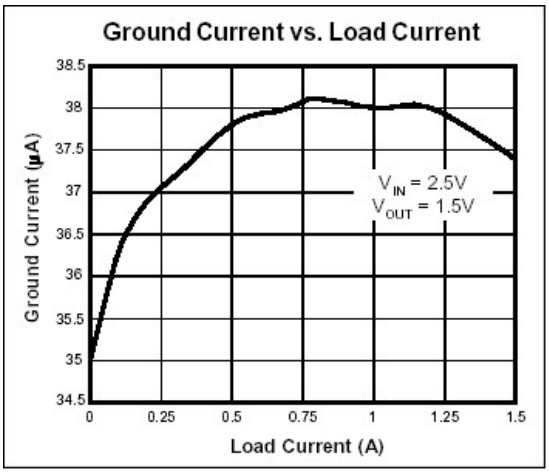
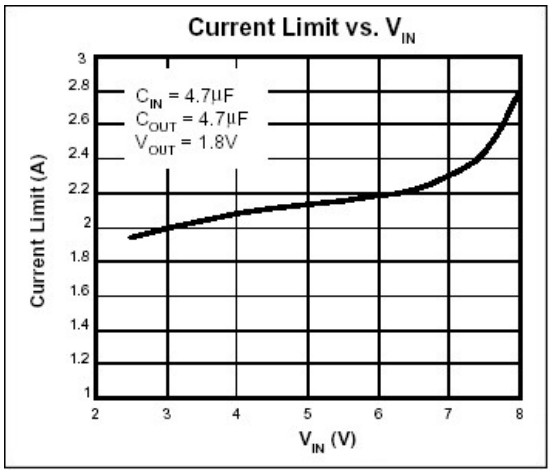
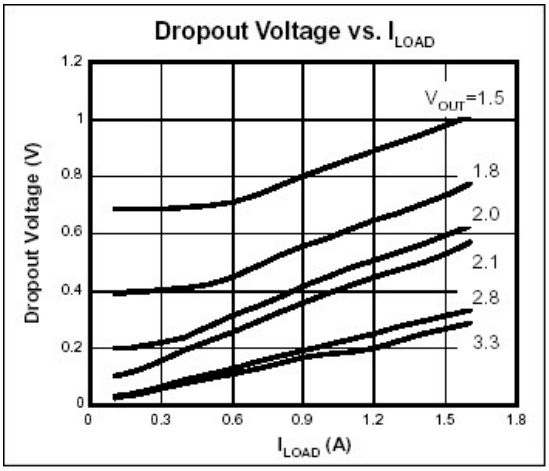
Characteristics Curve

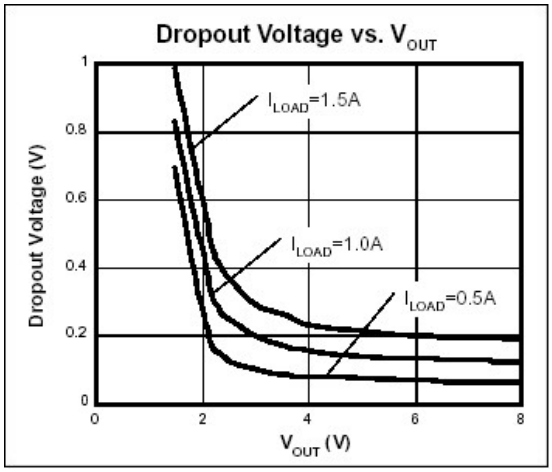












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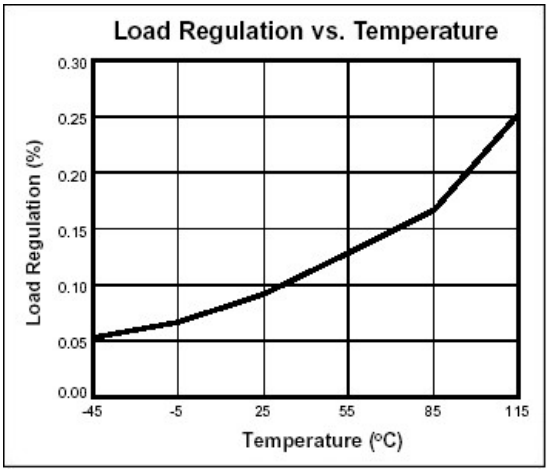

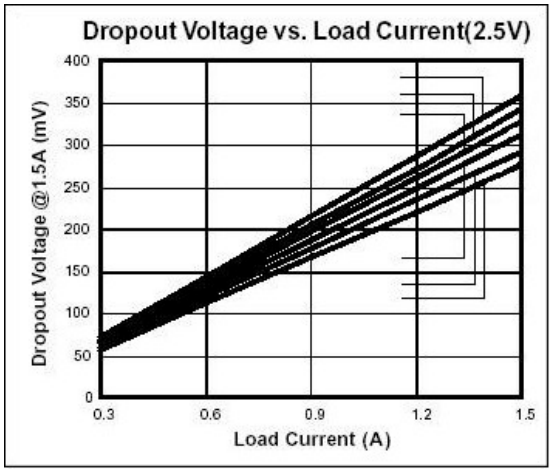

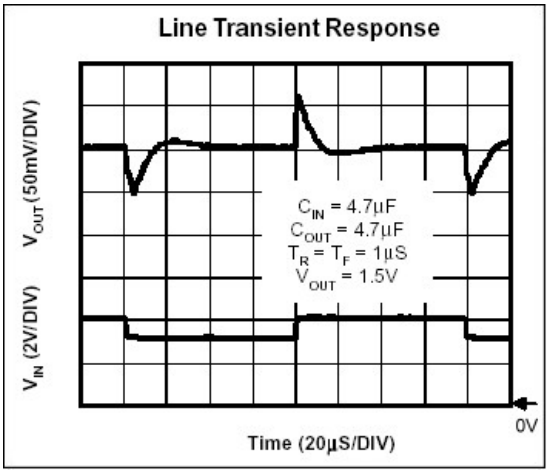

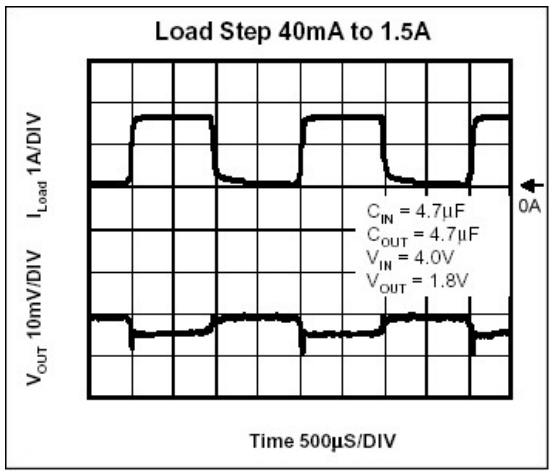

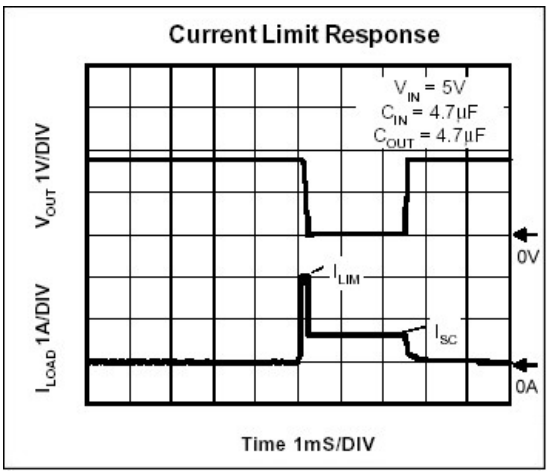

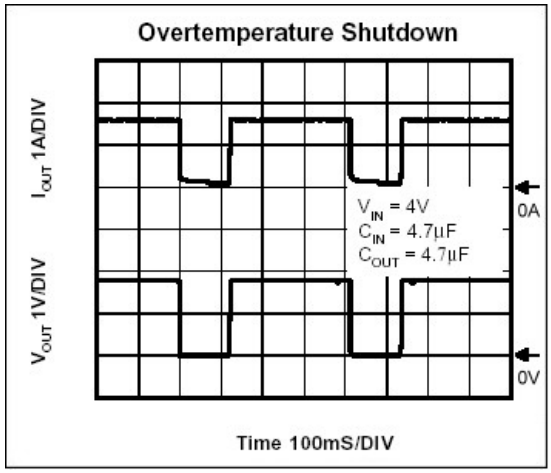

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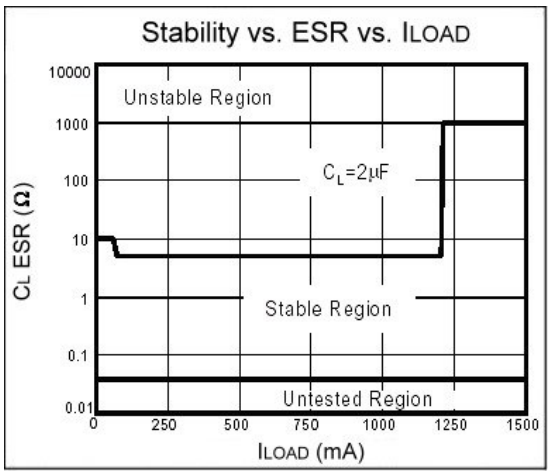

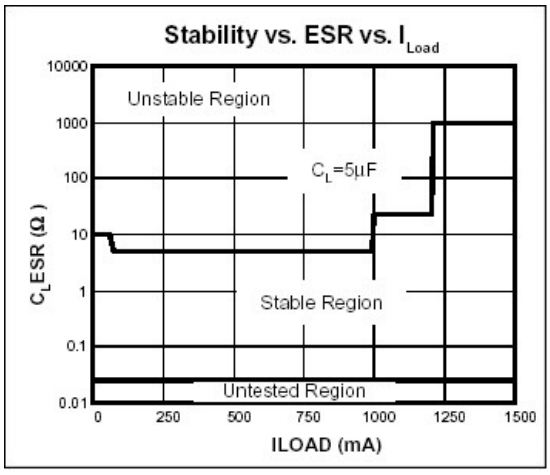

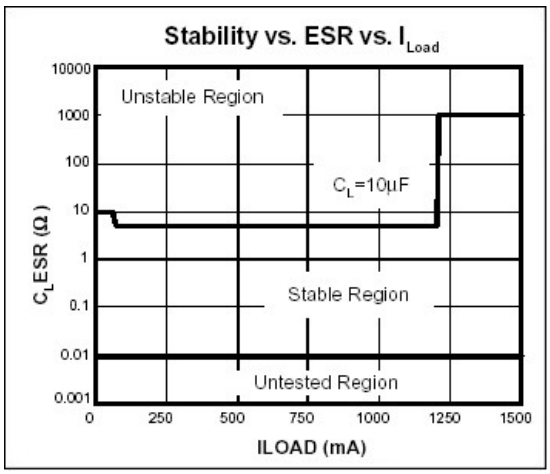

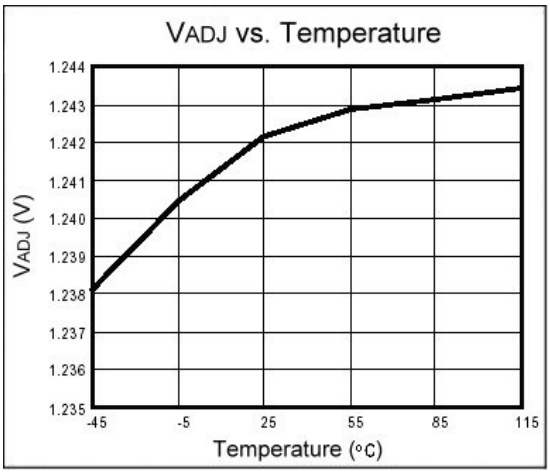

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External Resistor Divider Table

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.