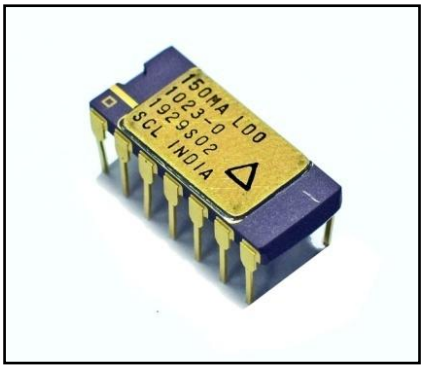
LDO Linear Voltage Regulator 1.8V/150mA

(SC1023-0)



DATASHEET

Version 1.0, Oct 2020

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PRODUCT DESCRIPTION:

This LDO provides a fixed output voltage of 1.8 V, 150mA full load current. The LDO is stable with an external capacitor not lower than 4.7uF of ESR 1 ohm to 10 ohm. It supplies a nominal voltage of 1.8V to a circuit or load. The output voltage of the voltage regulator is regulated by the internal circuitry of the regulator to be relatively independent of the current drawn by the load, the supply or line voltage, and the ambient temperature. In order to protect voltage regulator from excessive temperatures or accidental short circuit, Over-temperature and Over-current protection circuit are included in this chip. Power good pin indicates whether output is within range of +/- 10% of nominal output. The LDO can operate over a large temperature (T_A) range of -55°C to +125°C.

FEATURES:

- **Nominal V_{OUT}: 1.8V**
- **Maximum output current: 150mA**
- **Dropout Voltage: < 400mV at 150mA load**
- **Initial voltage accuracy: ± 3%**
- **Voltage accuracy over line and load: <±0.5%**
- **Both upper and lower Power Good feature**
- **Over temperature shut down mechanism**
- **Short circuit current limiting feature**
- **Quiescent current (I_{GND}): 10mA at 150mA load**
- **SCL 0.18µ CMOS technology**

APPLICATION:

- Integrated solutions for analog and digital chips

DEVICE SUMMARY:

Table 1: Device Summary

DEVICE	PACKAGE	PINS	DESCRIPTION	TEMPERATURE RANGE
SC1023-0	DIP	14	Engineering Model	-55°C to +125°C

BLOCK DIAGRAM:

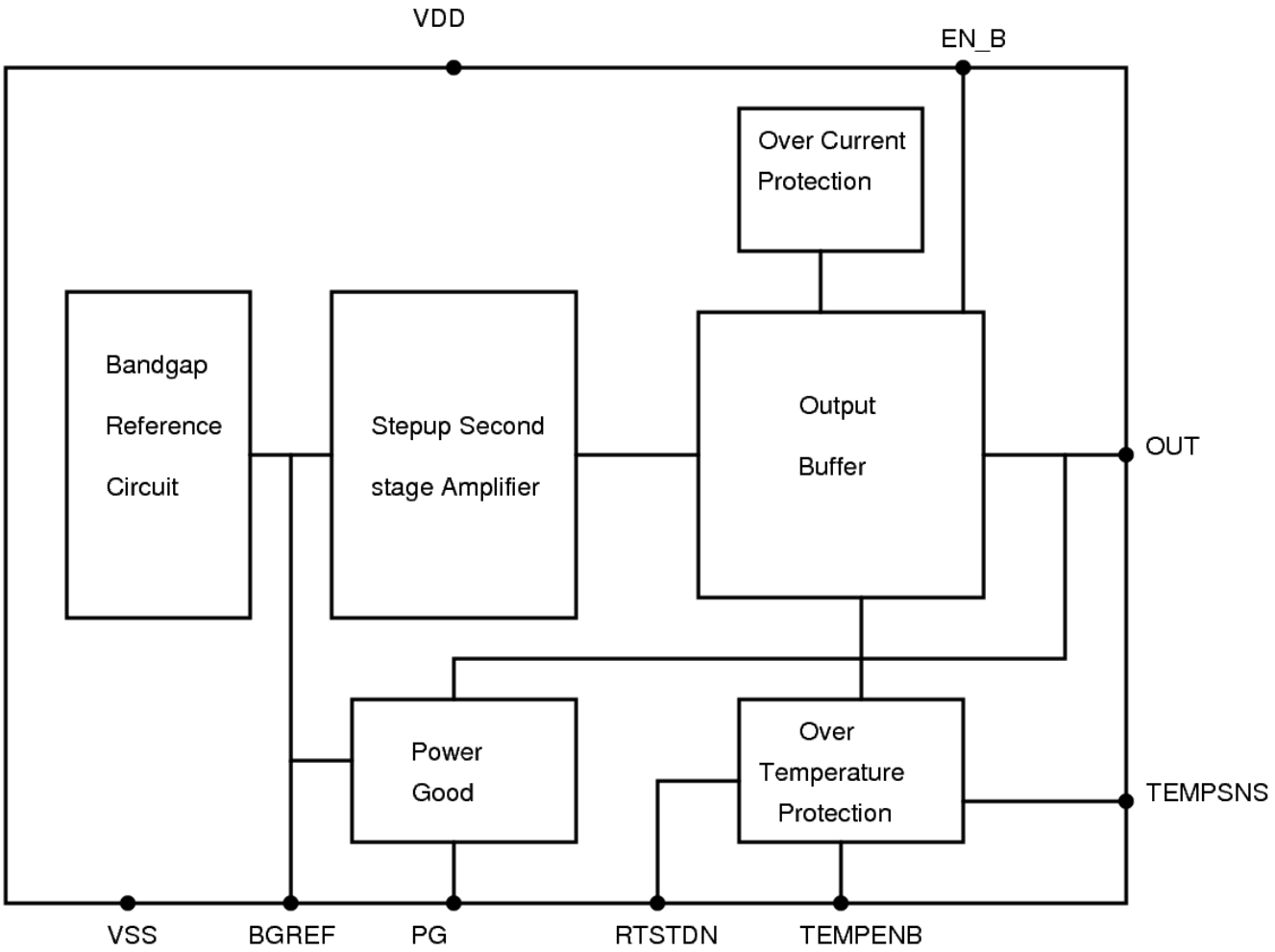


Figure 1: Block Diagram

PIN LAYOUT (14 Pin DIP)

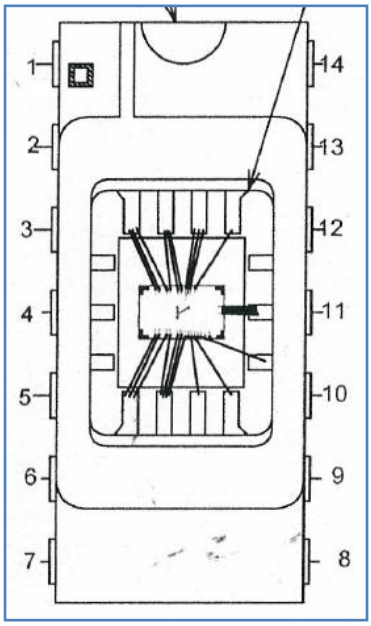


Figure 2: Pin Configuration

PIN DESCRIPTION

Table 2: Pin Details

PIN NO	PIN NAME	PIN DESCRIPTION
1	VIN	LDO Input Voltage
2	VIN	LDO Input Voltage
3	NC	-
4	NC	-
5	NC	-
6	VOUT	LDO Output Voltage
7	VOUT	LDO Output Voltage
8	ENB	Logic 1 (3.3V) for disabling LDO otherwise Logic 0 (0V)
9	TMPENB	Logic 1 (3.3V) for disabling over temperature shutdown circuit otherwise Logic 0 (0V)
10	TMSNS	Output of BJT based temperature sensor
11	VSS	LDO ground
12	NC	-
13	PG	Logic 0 (0V) when LDO output voltage goes below 5% and above 10% of nominal value, otherwise logic 1 (3.3V)
14	VDD	LDO Input Voltage

ABSOLUTE MAXIMUM RATING (1):

Over operating free-air temperature range (unless otherwise noted),

Table 3: Absolute Maximum Rating

PARAMETER	WITH RESPECT TO	MIN.	MAX.	UNIT
VDD	AVSS	-0.3	4.3	V
Storage Temperature	+	-65	150	℃
ESD Tolerance (HBM)	+	1000	-	V
Operating Ambient Temperature Range	+	-55	125	℃

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS:

Table 4: Recommended Operating Conditions

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{IN}	Supply voltage	2.6	3.3	3.6	V
I_{LOAD}	Output drive current	-	-	150	mA
T_A	Ambient temperature range	-55	-	+125	ºC

DC ELECTRICAL SPECIFICATIONS

Test condition: All Specifications: V_{IN} =3.3V, C_{IN} = 1uF, C_{OUT} = 4.7µF, T_A = -55°C to +125°C, TMPENB pin = logic 1 (disable over temperature shutdown feature); unless otherwise specified. Full Load (FL) = 150mA

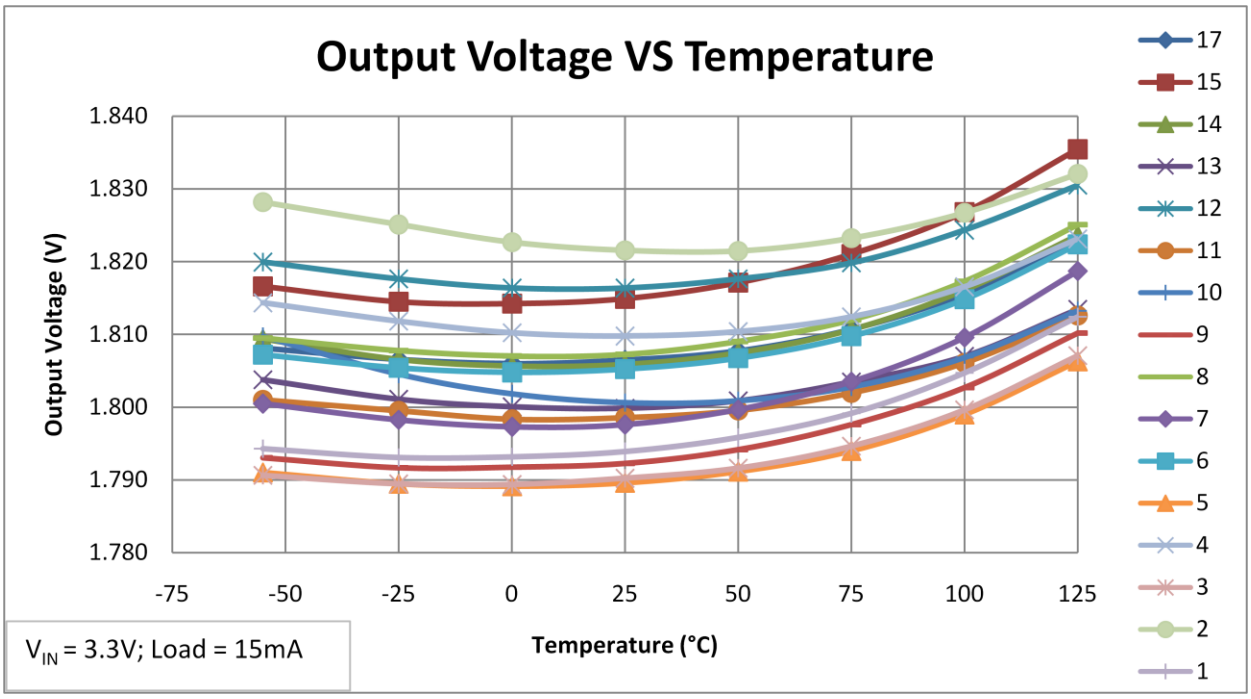
Table 5: DC Electrical Specification

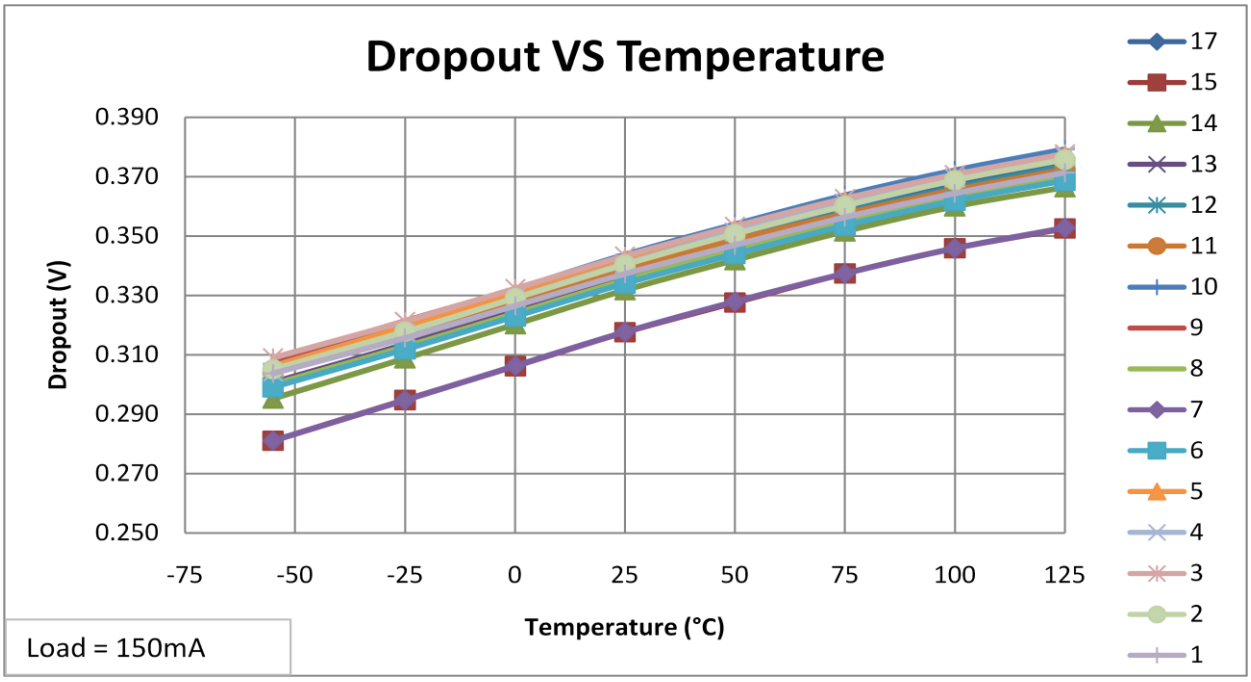
PARAMETER	TEST CONDITIONS		SC1023-0			UNITS
			MIN	TYP	MAX	
Nominal Voltage	(I_{LOAD}=10% of FL		1.75	1.8	1.84	V
	Vin = 3.6V, I_{LOAD}=10% of FL		1.75	1.801	1.85	
Initial Accuracy	I_{LOAD}=10% of FL		-2.8	-	2.8	%
Temperature Coefficient	I_{LOAD}=10% of FL		32	53.7	70	ppm/°C
Load Regulation	10% of FL ≤ I_{LOAD} ≤ 100% of FL		-	0.07	0.5	%
Line Regulation	3.0V ≤ V_{IN} ≤ 3.6V,	I_{LOAD}=10% of FL	-	0.05	0.3	%
		I_{LOAD}=50% of FL	-	0.06	0.4	
		I_{LOAD}=100% of FL	-	0.07	0.5	
Dropout Voltage	I_{LOAD}=10% of FL		0.05	0.07	0.1	V
	I_{LOAD}=50% of FL		0.15	0.18	0.25	
	I_{LOAD}=100% of FL		0.27	0.35	0.4	
Quiescent Current	I_{LOAD}=10% of FL		6.5	7	8	mA
	I_{LOAD}=50% of FL		7	7.7	9	
	I_{LOAD}=100% of FL		8	8.5	10	
Temp Sense Out	I_{LOAD}= No Load		1.35	1.62	1.85	V
			-2.37	-2.48	-2.51	mV/°C
Temperature Shutdown	I_{LOAD} = No Load TMPENB = logic 0 (0V)		103	107	115	°C
Power Good	Vin= 2.4V, I_{LOAD} = Incremental		±10			%

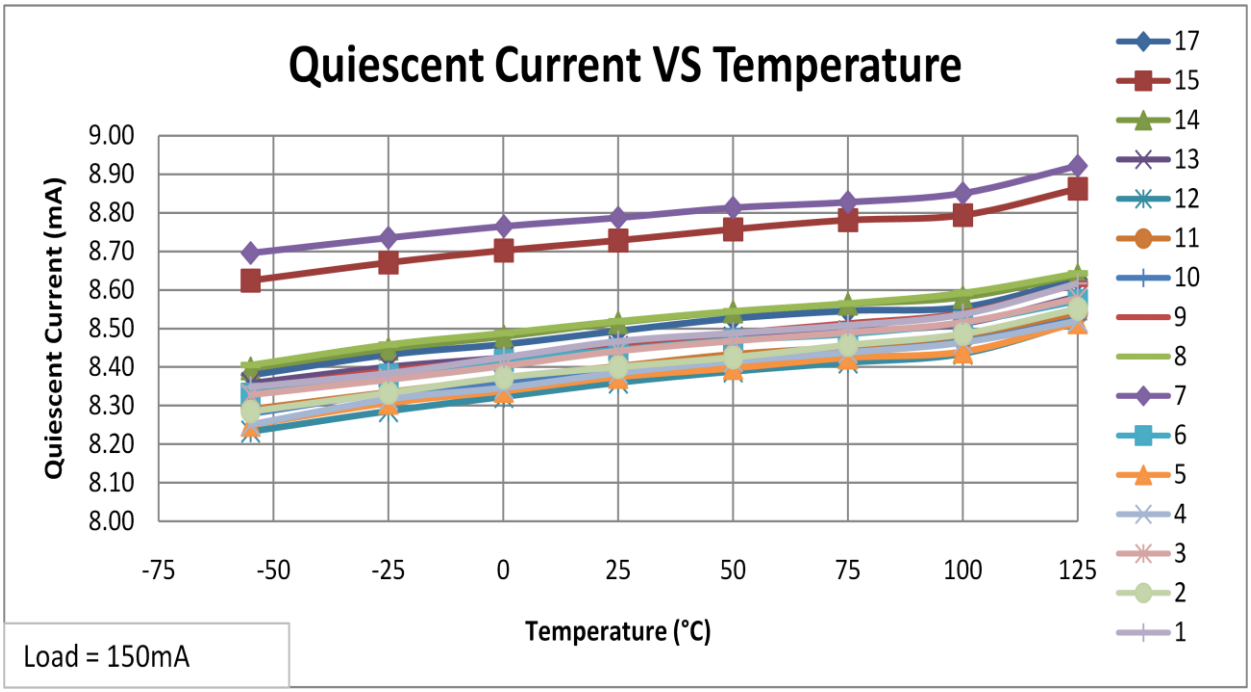
Note: All parameters are calculated by using V_{NOM} at V_{IN} = 3.3V at 10% Load, i.e., 15mA.
Power Good feature (±) was verified at 2.4V input (In order to reduce the power dissipation)

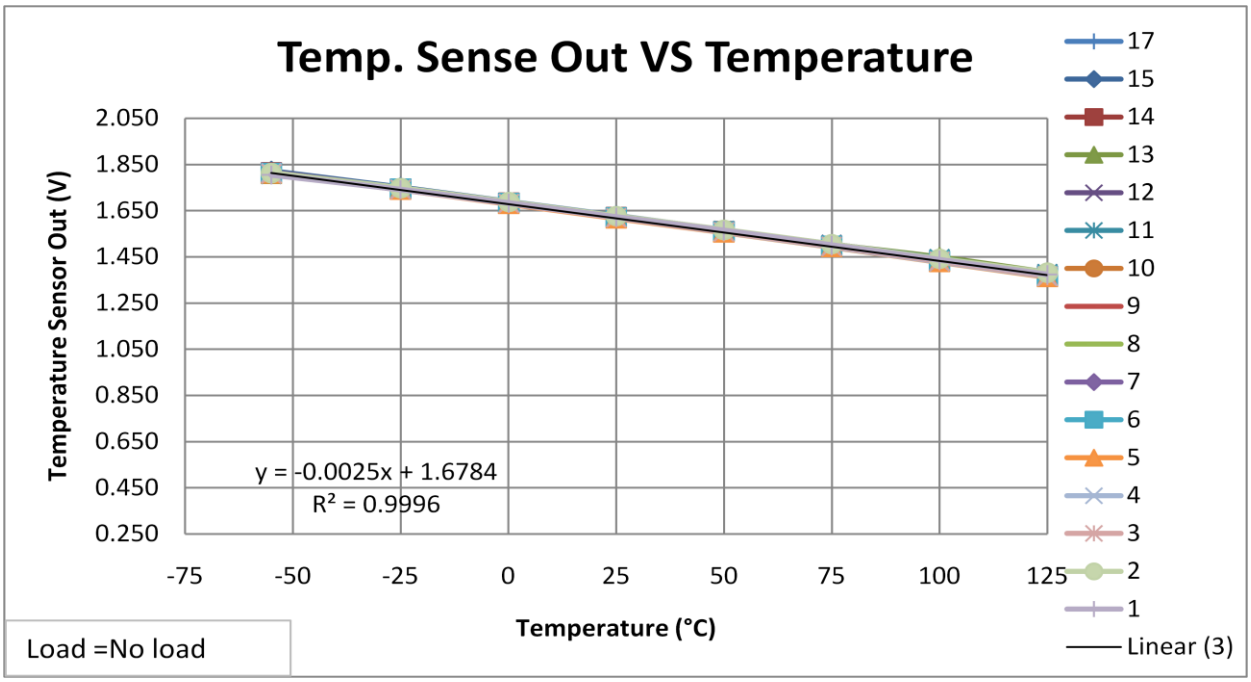
TYPICAL CHARACTERISTICS

V_{IN} =3.3V-3.6V, C_{IN} = 1µF, C_{OUT} = 4.7µF, T_A = -55°C to +125°C, TMPENB = logic 1 (disable over temperature shutdown feature); unless otherwise specified. Full Load (FL) = 150mA

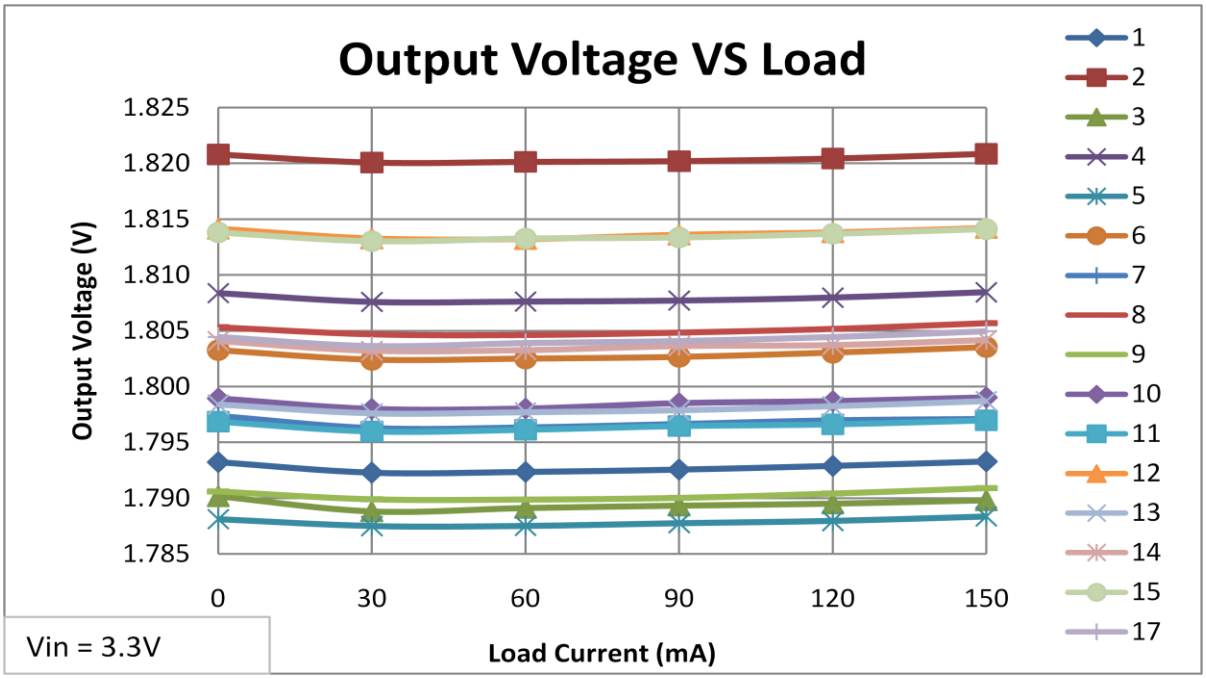


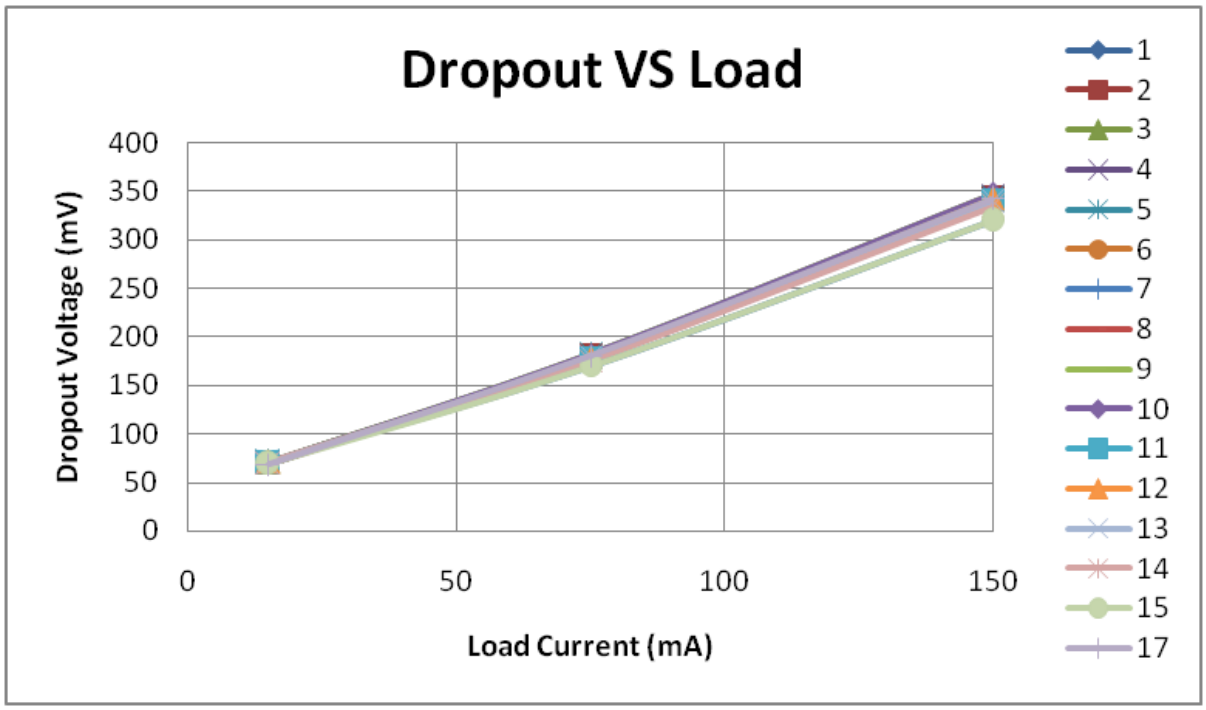



Quiescent Current VS Temperature
Quiescent Current (mA)
9.00
8.90
8.80
8.70
8.60
8.50
8.40
8.30
8.20
8.10
8.00
-75
-50
-25
0
25
50
75
100
125
Temperature (°C)
17
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Load = 150mA


Temp. Sense Out VS Temperature
Temperature Sensor Out (V)
2.050
1.850
1.650
1.450
1.250
1.050
0.850
0.650
0.450
0.250
y = -0.0025x + 1.6784
R² = 0.9996
-75
-50
-25
0
25
50
75
100
125
Temperature (°C)
17
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Linear (3)
Load =No load

V_{IN} =3.3V-3.6V, C_{IN} = 1uF, C_{OUT} = 4.7µF, T_A = 23±2°C, TMPENB = logic 1 (disable over temperature shutdown feature); unless otherwise specified. Full Load (FL) = 150mA





KEY TERMS:

i) Load Regulation

It measures the ability of the regulator to maintain the specified output voltage under different load conditions. It is specified as the percentage change in the output voltage relative to the nominal output voltage (V_{NOM}).

$$\text{Load Regulation} = \frac{\Delta Vout}{Vnom} 100\ \%$$

ii) Line Regulation

It measures the ability of the regulator to maintain the specified output voltage over a range of input voltages. It is specified as percentage per Volt change in the output voltage as the input line voltage changes over its largest allowable range.

$$\text{Line Regulation} = \frac{\Delta Vout}{\Delta Vin} \text{ X } \frac{100}{Vnom} \frac{\%}{\text{V}}$$

iii) Temperature Coefficient

It measures the ability of the regulator to maintain the specified output voltage over a range of temperature. It is specified as ppm per °C change in the input voltage over its full allowable temperature range.

$$\text{TC} \equiv \frac{\Delta Vout}{\Delta T} \text{ X } \frac{10^6}{Vnom} \frac{\text{ppm}}{^{\circ}\text{C}}$$

iv) Dropout Voltage

It is the minimum voltage drop between input line voltage and output voltage, until the output voltage remains within 1% of its nominal value.

v) Bias current or Quiescent Current Test

It is the total bias current (different from load current) consumed by different blocks of voltage regulator for their operation.

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