1A HIGH ACCURACY, LOW I_Q, SMALL SIZE LDO

FEATURES

- **Input Voltage Range: 1.8V to 6V**
- **Output Current of 1A**
- **Adjustable Output Voltage from 0.55V to 5.5V**
- **Available in Fixed-Output Voltages: 0.6V to 5.35V (50mV Steps)**
- **The accuracy of the output voltage is ±1.5% at full temperature**
- **Low Quiescent Current: 25μA**
- **Foldback Current Limit**
- **Low Dropout Voltage: 160mV (I_{OUT}=1A, V_{OUT}=3.3V)**
- **Operating Junction Temperature Range: -40℃ to +125℃.**

APPLICATIONS

- **Set-Top Boxes and Gaming Consoles**
- **Home Theater and Entertainment**
- **Desktops and Notebooks**
- **White Goods and Appliances**
- **Printers**
- **Servers**
- **Thermostat and Lighting Controls**

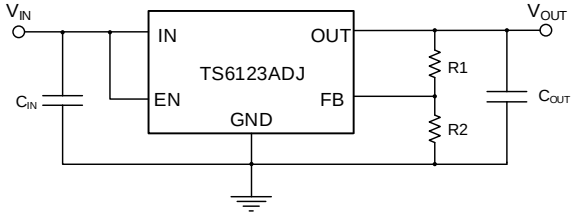
PRODUCT DESCRIPTION

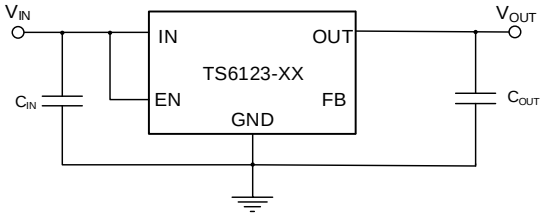
The TS6123 is an adjustable or fixed output 1A low-dropout (LDO) regulator. This device is available in a small, 6-pin, 2mm × 2mm DFN package and consumes very low quiescent current. The TS6123 features an ultra-low dropout of 160mV at 1A that can help improve the power efficiency of the system.

The TS6123 is optimized for a wide variety of applications by supporting an input voltage range from 1.8V to 6.0V. The low output voltage enables this LDO to power the modern microcontrollers with lower core voltages. Additionally, the TS6123 has a low IQ with enable functionality to minimize standby power. This device features an internal soft-start to lower the inrush current, which provides a controlled voltage to the load and minimizes the input voltage drop during start up.

The TS6123 is stable with small ceramic output capacitors allowing for a small overall solution size. A precision band-gap and error amplifier provides a high accuracy of 0.7% max at 25ºC. This device includes integrated thermal shutdown, current limit, and undervoltage lockout (UVLO) features. The TS6123 has an internal foldback current limit that helps reduce the thermal dissipation during short-circuit events.

Typical Application





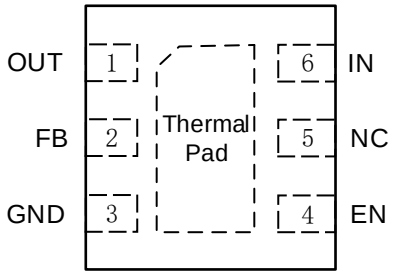
$V_{OUT} = V_{FB} \times (1+R1/R2)$, $V_{FB} = 0.55V$

ORDERING INFORMATION

Model	Part Number	Eco Plan	Package	Output Voltage	Container, Pack Qty
TS6123-18	TS6123-18DFN6LT	RoHS	DFNWB2x2-6L	1.8V	Reel,4000
TS6123-33	TS6123-33DFN6LT	RoHS	DFNWB2x2-6L	3.3V	Reel,4000
TS6123-50	TS6123-50DFN6LT	RoHS	DFNWB2x2-6L	5.0V	Reel,4000
…	…	…	…	…	…
TS6123ADJ	TS6123ADJDFN6LT	RoHS	DFNWB2x2-6L	ADJ, (0.55V~5.5V)	Reel,4000

PIN ASSIGNMENTS

DFNWB2x2-6L
(TOP VIEW)



PIN DESCRIPTIONS

Pin Name	DFNWB2x2-6L	Function
OUT	1	Voltage Output
FB	2	Feedback
GND	3	Ground
EN	4	If $V_{EN} \geq V_{EN\_HI}$, the regulator is enabled. If $V_{EN} \leq V_{EN\_LO}$, the regulator is disabled. If not used, the EN pin should be connected to V_{IN}.
IN	6	Voltage Input
NC	5	Not Connect
Thermal Pad		Connect to large GND plane for improved thermal performance.

ABSOLUTE MAXIMUM RATINGS

Over operating junction temperature range (unless otherwise noted) (1)

Parameter		Min	Max	Unit
V_{IN}	Input Voltage	-0.3	6.5	V
V_{OUT}	Output Voltage	-0.3	V_{IN}+0.3(2)	V
V_{EN}	EN Voltage	-0.3	6.5	V
T_J	Junction Temperature	-40	+150	°C
T_{STG}	Storage Temperature Range	-65	+150	°C
ESD	Human-body Model (HBM)		±4000	V
	Charged-device Model (CDM)		±1500	V

RECOMMENDED OPERATING CONDITIONS

Parameter		Min	Max	Unit
V_{IN}	Input Voltage	1.8	6.0	V
V_{OUT}	Output Voltage(ADJ)	0.55	5.5	V
V_{EN}	EN Voltage	0	6.0	V
I_{OUT}	Output Current	0	1	A
C_{IN}	Input Capacitance	1		μF
C_{OUT}	Output Capacitance	1	220	μF
T_J	Junction Temperature	-40	+125	°C
$R_{\theta JA}$	Junction-to-ambient thermal resistance		81	°C/W

(1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(2) The absolute maximum rating is V_{IN}+0.3V or 6V, whichever is smaller.

ESD CAUTION

ESD (Electrostatic Discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjects to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ELECTRICAL CHARACTERISTICS

V_{IN} = $V_{OUT(NOM)}$ + 0.5V or V_{IN} = 1.8V (whichever is greater), V_{EN} = V_{IN}, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF,T_J = -40˚C to +125˚C, unless otherwise noted (3).

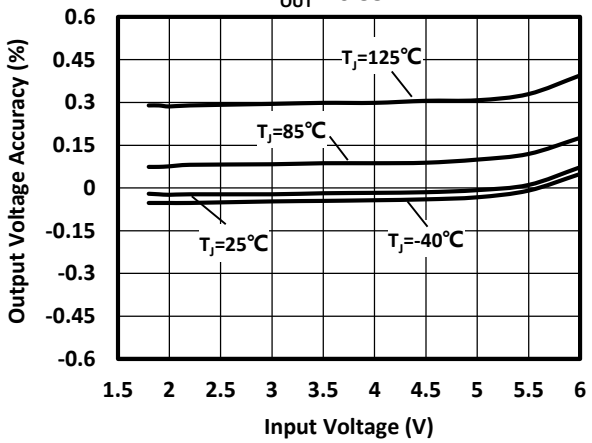
Parameter		Operating Conditions		Min	Typ	Max	Unit
V_{FB}	Feedback Voltage	T_J = 25˚C			0.55		V
	Output Accuracy	T_J = 25˚C		-0.7%		+0.7%	
		T_J = -40˚C to +125˚C		-1.5%		+1.5%	
V_{RLINE}	Line Regulation	V_{IN} = $V_{OUT(NOM)}$ + 0.5V to 6.0V			2	7.5	mV
V_{RLOAD}	Load Regulation	I_{OUT} = 100μA to 1A, V_{IN} ≥ 2.0V			0.03		V/A
I_{GND}	Ground Pin Current	I_{OUT} = 0	T_J = 25˚C	10	25	31	μA
			T_J = -40˚C to +125˚C			35	
I_{SD}	Shutdown Current	V_{EN} = 0V, V_{IN} = 1.8V to 6.0V, T_J = 25˚C			0.1	1	μA
I_{CL}	Current Limit	V_{IN} = $V_{OUT(NOM)}$ + 1.0V	V_{OUT} = $V_{OUT(NOM)}$-0.2V, V_{OUT} < 1.5V	1.22	1.44	1.83	A
			V_{OUT} = 90%*$V_{OUT(NOM)}$, V_{OUT} ≥ 1.5V	1.22	1.44	1.83	
I_{SC}	Short-circuit Current Limit	V_{IN} = $V_{OUT(NOM)}$ + 1.0V, V_{OUT} = 0V			770		mA
V_{DROP}	Dropout Voltage	V_{OUT} = 95% * $V_{OUT(NOM)}$ I_{OUT} = 1A	0.65V ≤ VOUT < 0.8V		910	1200	mV
			0.8V ≤ VOUT < 0.9V		750	1020	
			0.9V ≤ VOUT < 1.0V		650	910	
			1.0V ≤ VOUT < 1.2V		550	780	
			1.2V ≤ VOUT < 1.5V		420	585	
			1.5V ≤ VOUT < 1.8V		305	440	
			1.8V ≤ VOUT < 2.5V		244	360	
			2.5V ≤ VOUT < 3.3V		186	270	
			3.3V ≤ VOUT < 5.5V		160	225	
PSRR	Power-supply Rejection Ratio	V_{IN} = $V_{OUT(NOM)}$ + 1.0V I_{OUT} = 50mA	f = 1kHz		50		dB
			f = 100kHz		35		
			f = 1MHz		30		
V_n	Output Noise Voltage	BW = 10 Hz to 100 kHz, V_{OUT} = 0.9 V			53		$μV_{RMS}$
V_{UVLO}	Undervoltage Lockout	V_{IN} Rising		1.44	1.57	1.70	V
		V_{IN} Falling		1.40	1.52	1.65	
V_{UVLO_HYST}	Undervoltage Lockout Hysteresis	V_{IN} Hysteresis			50		mV
t_{STR}	Startup Time	From EN Low-to-High Transition to V_{OUT} = $V_{OUT(NOM)}$ * 95%			740		μs
V_{EN_HI}	Enable High Level Voltage			1.0			V
V_{EN_LO}	Enable Low Level Voltage					0.3	V
I_{EN}	Enable Pin Current	V_{EN} = V_{IN} = 6.0V			10		nA
I_{FB}	Feedback Pin Current				0.01	0.1	μA
$R_{PULLDOWN}$	Pulldown Resistance	V_{IN} = 6.0V			100		Ω
T_{SD}	Thermal Shutdown	Shutdown, Temperature Increasing			175		ºC
		Reset, Temperature Decreasing			155		ºC

(3) Test time of each parameter is within 5ms. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

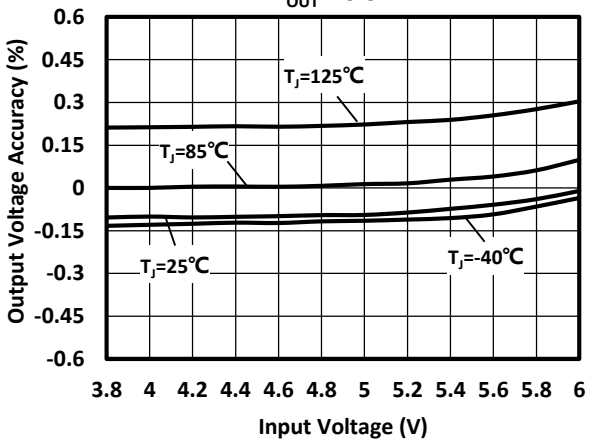
TYPICAL CHARACTERISTICS

V_{IN} = $V_{OUT(NOM)}$ + 0.5V or V_{IN} = 1.8V (whichever is greater), V_{EN} = V_{IN}, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, T_J = 25°C, unless otherwise noted.

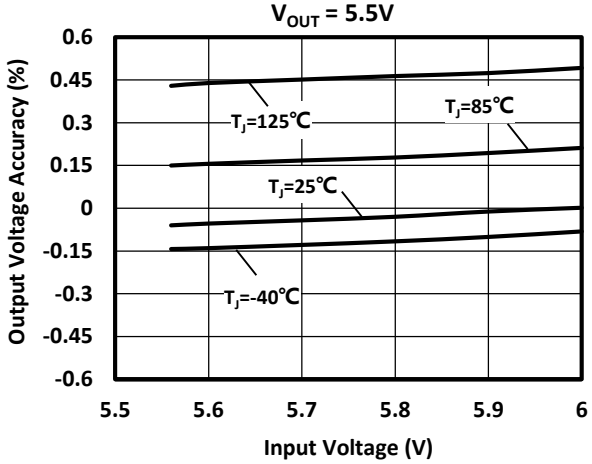
Output Voltage Accuracy vs Input Voltage
V_{OUT} = 0.55V



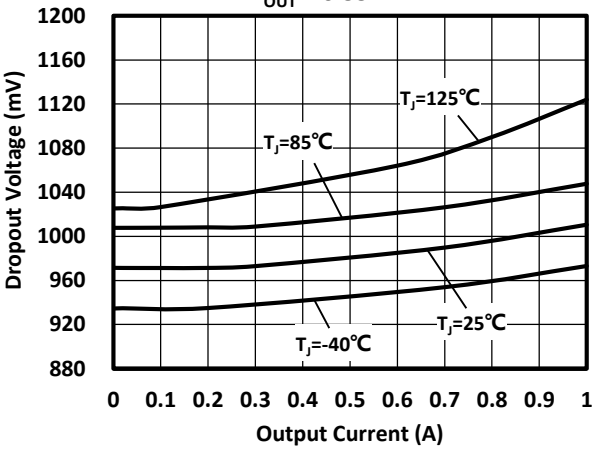
Output Voltage Accuracy vs Input Voltage
V_{OUT} = 3.3V



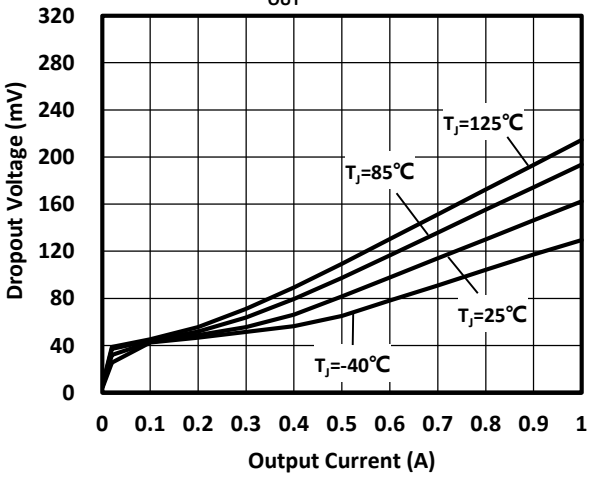
Output Voltage Accuracy vs Input Voltage
V_{OUT} = 5.5V



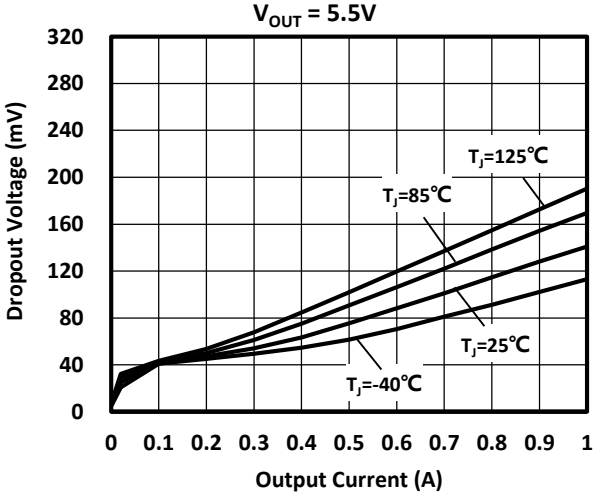
Dropout Voltage vs Output Current
V_{OUT} = 0.55V



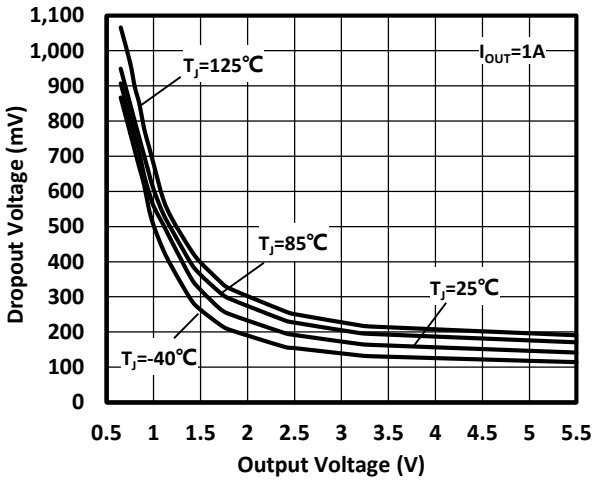
Dropout Voltage vs Output Current
V_{OUT} = 3.3V



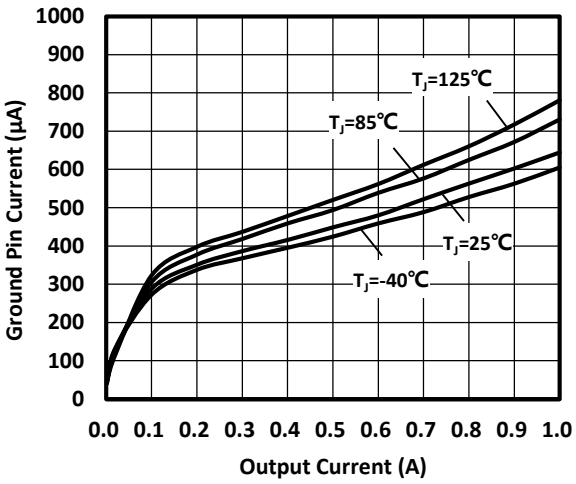
Dropout Voltage vs Output Current
V_{OUT} = 5.5V



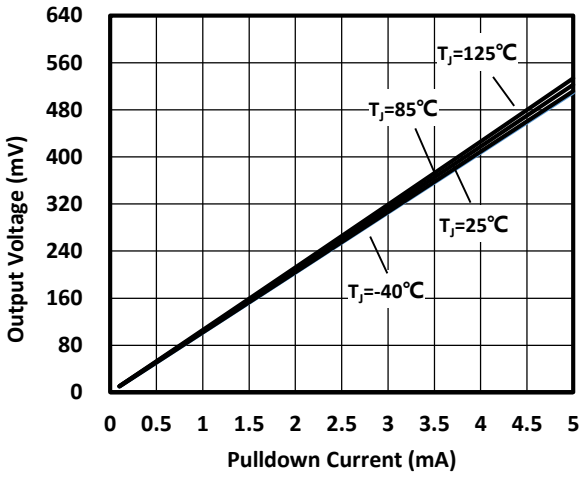
Dropout Voltage vs Output Voltage



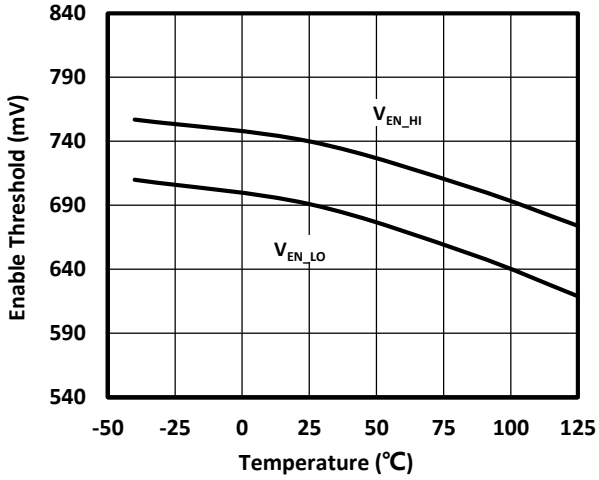
Ground Pin Current vs Output Current



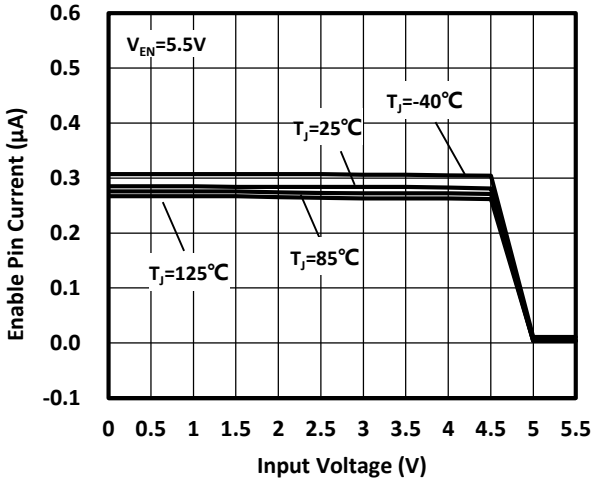
Output Voltage vs Pulldown Current



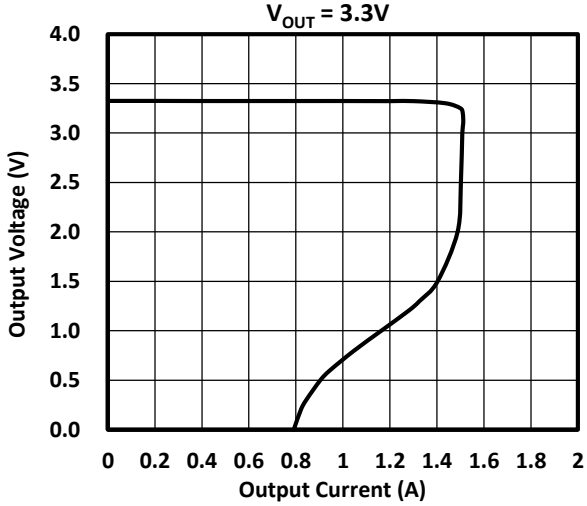
Enable Threshold vs Temperature



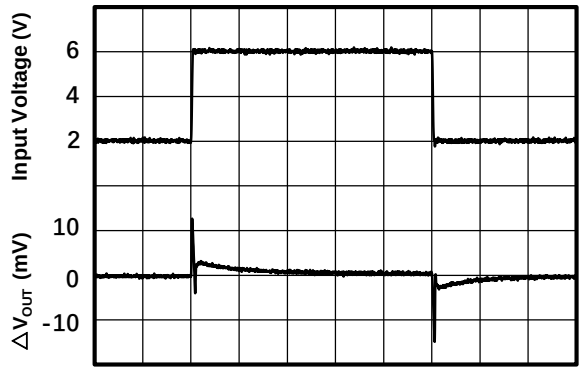
Enable Pin Current vs Input Voltage



Foldback Current Limit vs Output Current
V_{OUT} = 3.3V



Line Transient
V_{OUT}=0.55V,I_{OUT}=1mA,V_{IN} slew rate=1V/μs

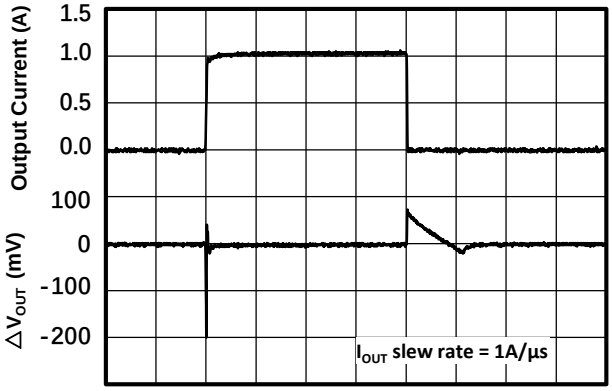


Time (100 μs/div)

Line Transient
V_{OUT}=3.3V,I_{OUT}=1mA,V_{IN} slew rate=1V/μs

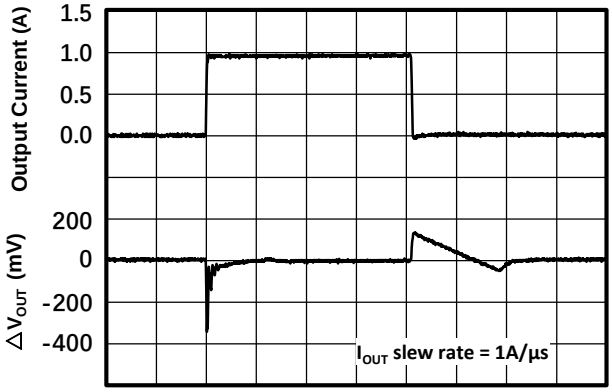
Time (100 μs/div)

Load Transient
V_{IN} = 2V,V_{OUT} = 0.55V



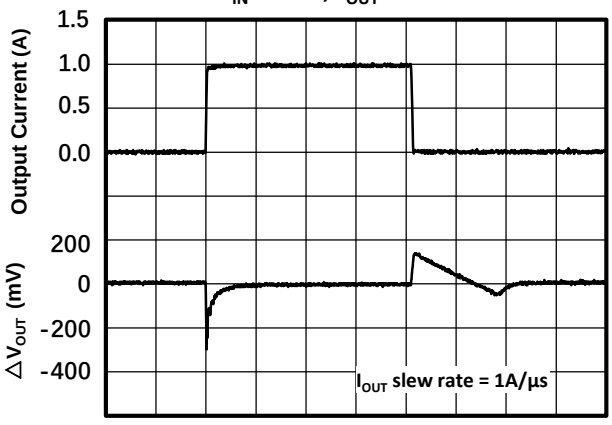
Time (50 μs/div)

Load Transient
V_{IN} = 3.8V,V_{OUT} = 3.3V



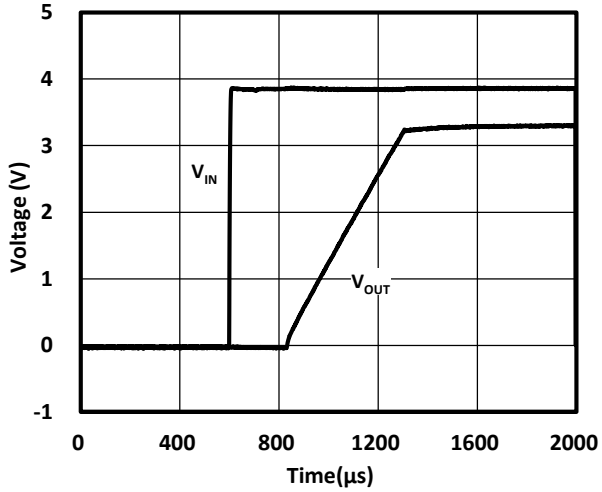
Time (50 μs/div)

Load Transient
V_{IN} = 5.5V,V_{OUT} = 5V



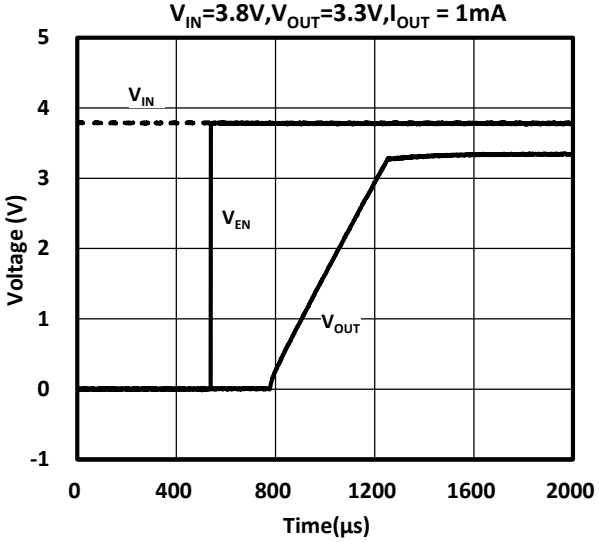
Time (50 μs/div)

V_{IN} Power-Up
V_{IN} = 3.8V,V_{OUT} = 3.3V,I_{OUT} = 1mA

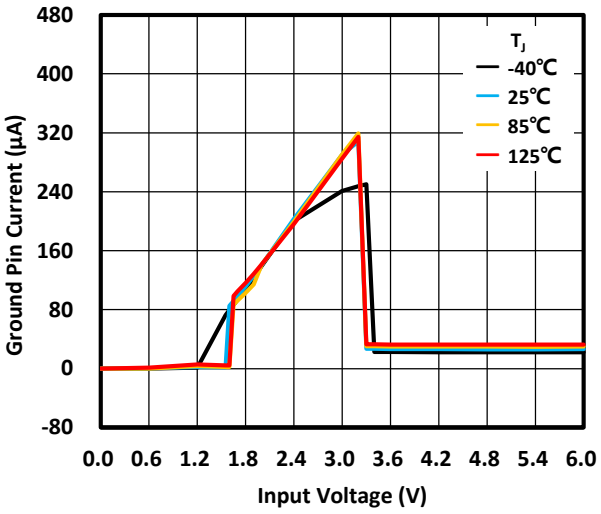


Startup With EN

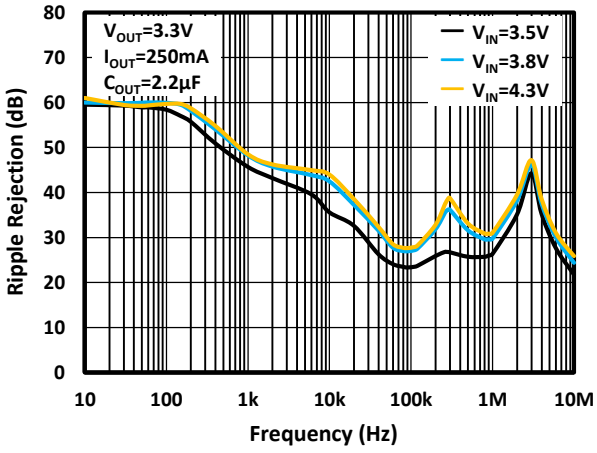
V_{IN}=3.8V,V_{OUT}=3.3V,I_{OUT} = 1mA



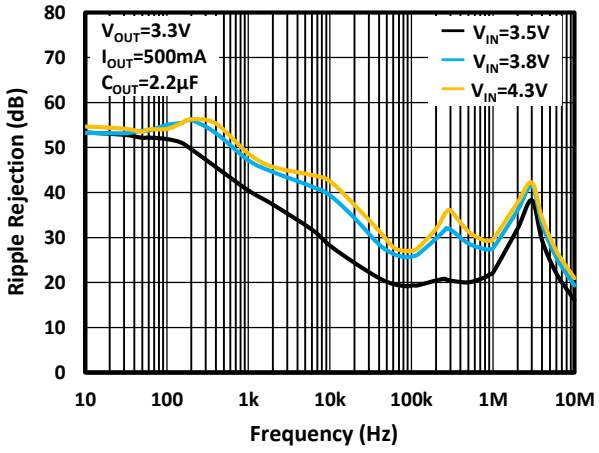
Ground Pin Current vs Input Voltage



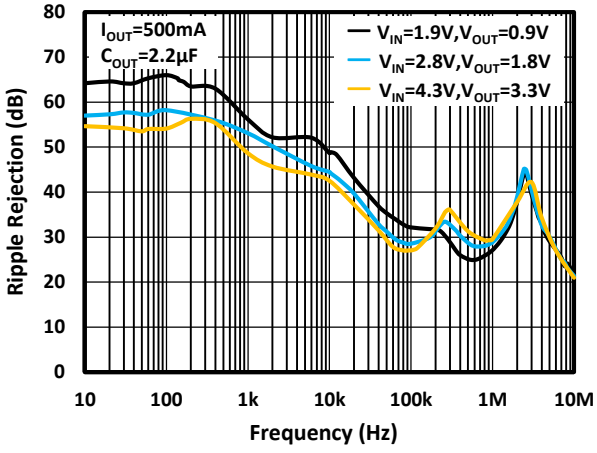
Ripple Rejection vs Frequency



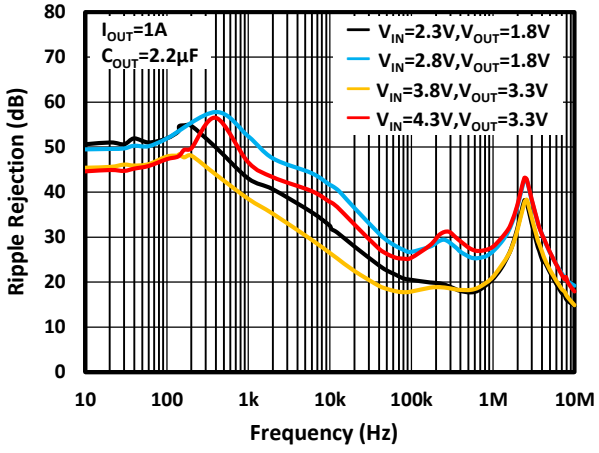
Ripple Rejection vs Frequency

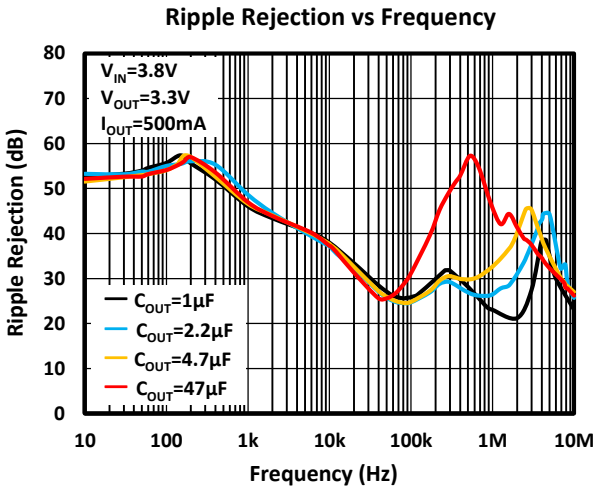


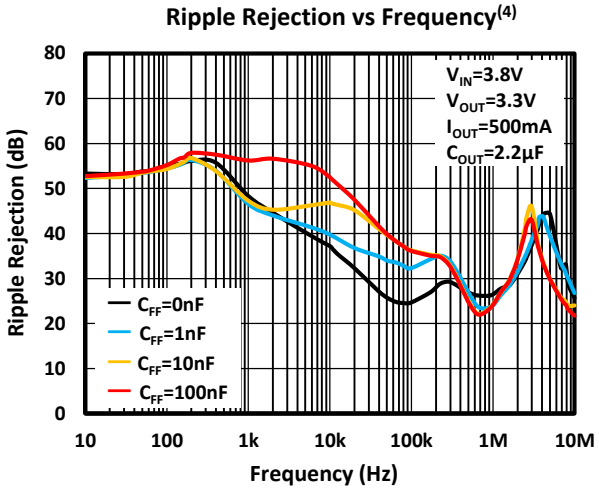
Ripple Rejection vs Frequency

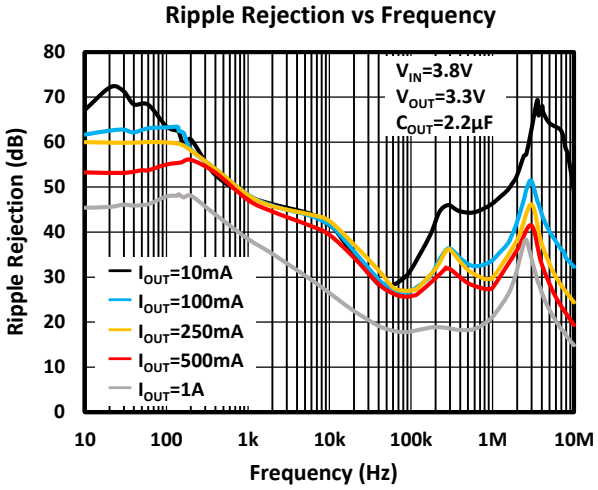


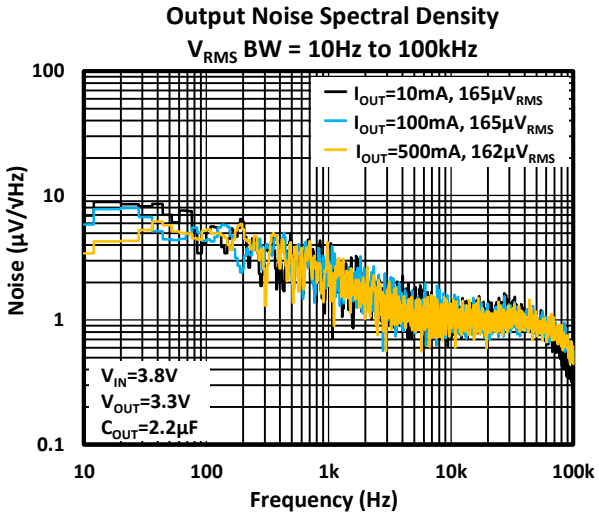
Ripple Rejection vs Frequency



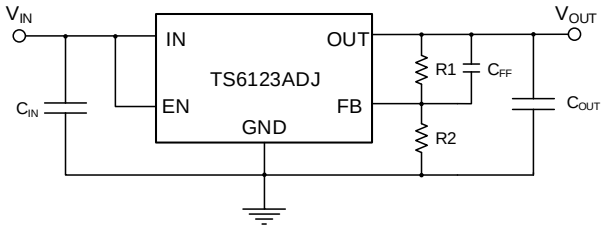






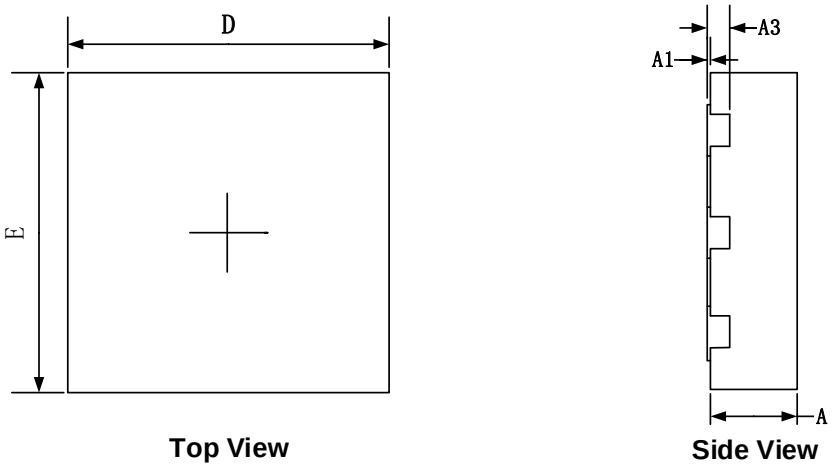


(4) The feed-forward capacitor (C_{FF}) is connected from the OUT pin to the FB pin for the TS6123ADJ device, as shown in the next figure. C_{FF} improves transient, noise and PSRR performance, but is not required for regulator stability.



MECHANICAL DIMENSIONS

DFNWB2x2-6L-AB PACKAGE MECHANICAL DRAWING



Top View

Side View

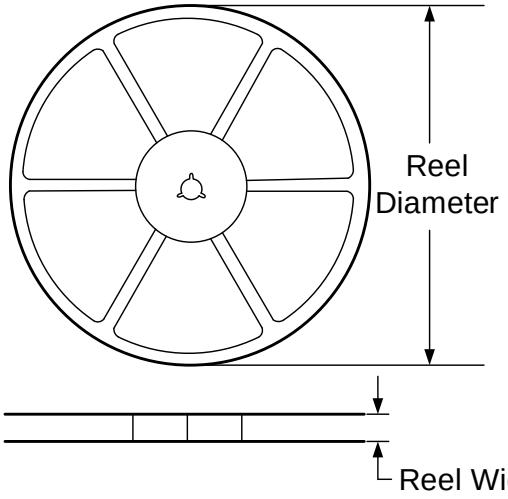
Bottom View

DFNWB2x2-6L PACKAGE MECHANICAL DATA

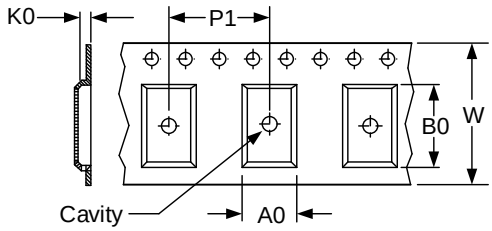
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203 REF		0.008 REF	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	0.900	1.100	0.035	0.043
E1	1.500	1.700	0.059	0.067
k	0.250 REF		0.010 REF	
b	0.250	0.350	0.010	0.014
b1	0.220 REF		0.009 REF	
e	0.650 BSC		0.026 BSC	
L	0.174	0.326	0.007	0.013

TAPE AND REEL INFORMATION

REEL DIMENSIONS

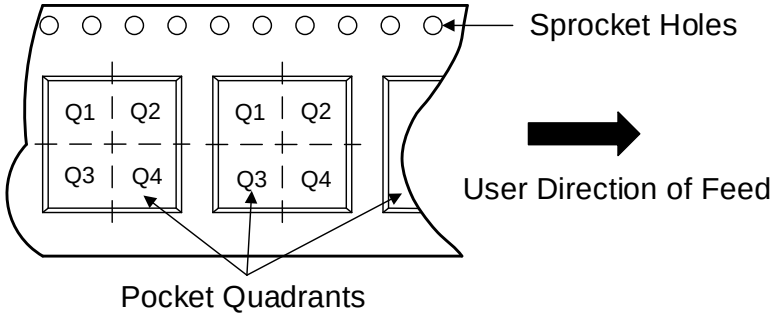


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component width thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS6123-18DFN6LT	DFNWB2x2-6L	6	4000	180	13.1	2.3	2.3	1.1	8	12	Q1
TS6123-33DFN6LT	DFNWB2x2-6L	6	4000	180	13.1	2.3	2.3	1.1	8	12	Q1
TS6123-50DFN6LT	DFNWB2x2-6L	6	4000	180	13.1	2.3	2.3	1.1	8	12	Q1
…	…	…	…	…	…	…	…	…	…	…	…
TS6123ADJDFN6LT	DFNWB2x2-6L	6	4000	180	13.1	2.3	2.3	1.1	8	12	Q1

REVISION HIETORY

NOTE: Page numbers for previous revisions may be different from that of the current version.

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