

DESCRIPTION

The LX8610 family are positive very low dropout regulators. They are designed to provide a power supply for very low headroom applications, such as 3.3V–2.5V.

BiCMOS technology allows an effective series pass element resistance, $R_{DS(ON)}$ of 250m Ω resulting in a typical dropout voltage of 250mV at 1A.

Low Quiescent Current and Logic-Controlled Shutdown help conserve battery life and increase system efficiency. Typical quiescent current is under 400 μ A irrespective of

load current, while the shutdown current is only 10 μ A. The device will enter shutdown mode when the $\overline{SHDN}$ pin is pulled low.

Thermal & Short-Circuit Current Limiting: the LX8610 limits the current when the output is shorted, so protecting sensitive load circuits. The device will also turn off if the junction temperature exceeds 155°C.

Available in small outline SOT-223 and 8-pin SOIC: Adjustable versions use the 8-pin SOIC and fixed output voltage devices are supplied in the 3-lead SOT-223.

KEY FEATURES

- Dropout Voltage Typically 250mV At 1A And 50mV At 10mA
- Low Quiescent Current, Under 400 μ A, Irrespective Of Load
- Shutdown Current 10 μ A
- Adjustable Output Version In 8-pin SOIC Package
- Fixed Outputs Of 2.5V, 3.3V Available In 3-Pin SOT-223 Package
- Low Reverse Leakage Current
- Short-Circuit And Thermal Shutdown Protection

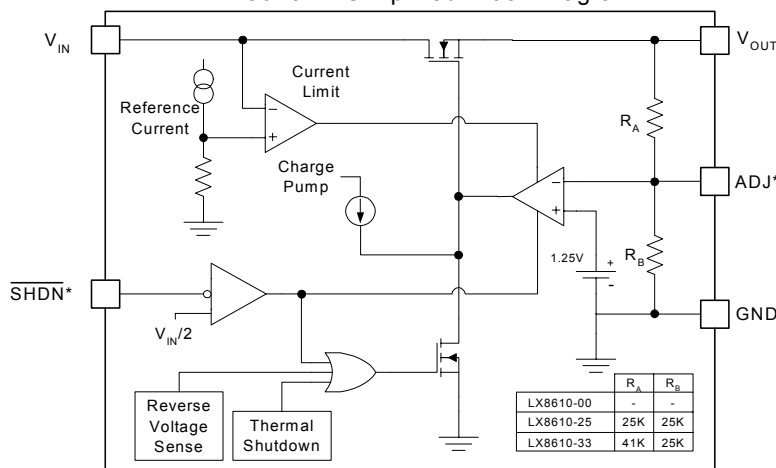
APPLICATIONS/BENEFITS

- 3.3V & 2.5V Supplies For Memory, Microprocessors, Clock Circuits, Etc.
- Portable Equipment

IMPORTANT: For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

PRODUCT HIGHLIGHT

LX8610-xx Simplified Block Diagram



* Adjustable version in 8 lead package only.

PACKAGE ORDER INFO

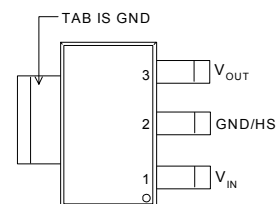
T_J (°C)	OUTPUT VOLTAGE	ST PLASTIC SOT-223 3-PIN	DM Plastic Power SOIC 8-PIN
0 to 125°C	3.3	LX8610-33CST	LX8610-33CDM
	2.5	LX8610-25CST	LX8610-25CDM
	ADJ (00)	—	LX8610-00CDM

Note: Available in Tape & Reel.
Append the letter "T" to the part number. (i.e. LX8610CDMT)

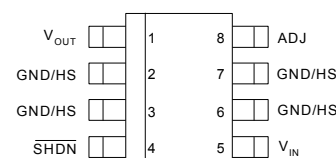
ABSOLUTE MAXIMUM RATINGS

Input Voltage (V_{IN}).....	6.5V
SHDN Pin.....	-0.3V to $V_{IN}+0.3V$
Output Current	1A
Operating Junction Temperature Plastic (ST & DM) Packages.....	125°C
Storage Temperature.....	-65°C to 150°C
Lead Temperature (Soldering, 10 Seconds).....	300°C

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

PACKAGE PIN OUT


ST PACKAGE
(Top View)



DM PACKAGE
(Top View)

THERMAL DATA
ST Plastic SOT-223 Package 3-Pin

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	15°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	150° C/W

DM Plastic SOIC Package 8-Pin

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	30° C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	90° C/W

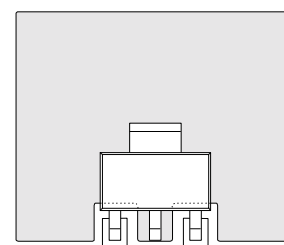
Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.

The θ_{JA} numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

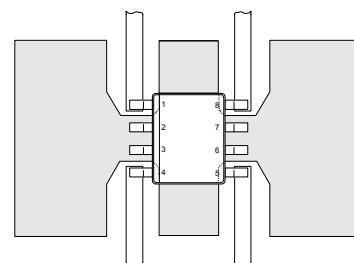
θ_{JA} can be improved with package soldered copper area over backside ground plane or internal power plane. θ_{JA} can vary from 45°C/W > 75°C/W depending on mounting technique. See table below for thermal resistance guidelines:

Copper Area (Topside)*	Copper Area (Backside)*	Board Area	Thermal Resistance (θ_{JA})
ST (SOT-223)			
2.0 sq" (1290mm ²)	1.0 sq" (645 mm ²)	2.0 sq" (1290mm ²)	45°C/W
1.0 sq" (645 mm ²)	0.5 sq" (323 mm ²)	1.0 sq" (645 mm ²)	50°C/W
0.5 sq" (323 mm ²)	0.1 sq" (65 mm ²)	0.5 sq" (323 mm ²)	60°C/W
0.25 sq" (161 mm ²)	0.1 sq" (65 mm ²)	0.25 sq" (161 mm ²)	70°C/W
DM (SOIC)			
2.0 sq" (1290mm ²)	1.0 sq" (645 mm ²)	2.0 sq" (1290mm ²)	60°C/W
1.0 sq" (645 mm ²)	0.5 sq" (323 mm ²)	1.0 sq" (645 mm ²)	67°C/W
0.5 sq" (323 mm ²)	0.1 sq" (65 mm ²)	0.5 sq" (323 mm ²)	70°C/W
0.25 sq" (161 mm ²)	0.1 sq" (65 mm ²)	0.25 sq" (161 mm ²)	75°C/W

*Tab of device attached to topside copper, or leads 2,3,5,6 of SOIC package

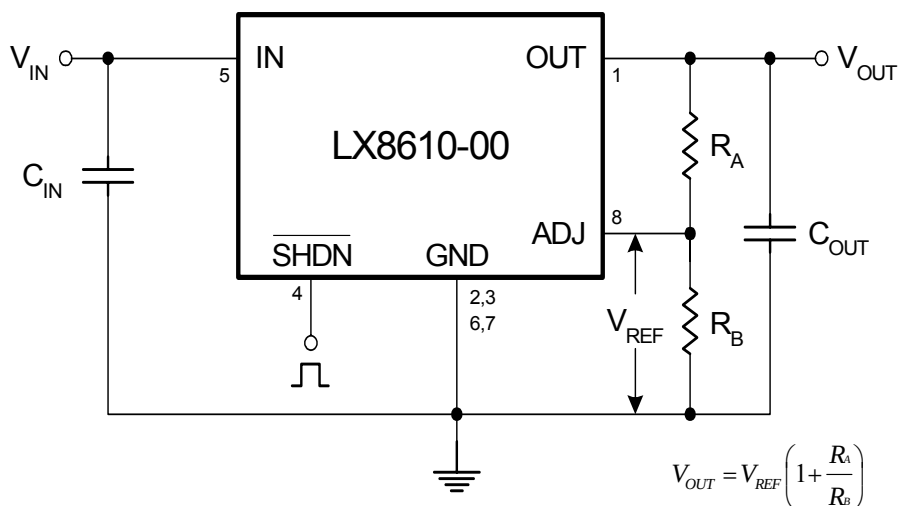
HEAT SINK APPROACH


Possible Heat Sink Approaches
using PCB Copper



FUNCTIONAL PIN DESCRIPTION

PIN NAME	DESCRIPTION
V_{IN}	Positive supply input for the regulator. Bypass to GND with at least 2.2 μ F of low ESR, ESL capacitance if supply source is further than 1 inch from the device.
V_{OUT}	Output for the regulator. It is recommended to bypass to GND with at least 10 μ F although this is not required for regulation, rather it is needed for transient response. Size your output capacitor to meet the transient loading requirement. If you have a very dynamic load, a larger capacitor will improve the response to these load steps.
GND/HS	Reference ground. The input and output bypass capacitors should be connected to this pin. In addition the tab on the SOT-223 package and pins 2,3,6, and 7 on the SOIC package are also used for heat sinking the device.
ADJ	Feedback pin for the regulator. For the LX8610-00, the output voltage can be set by two external resistors with the following relationship: $V_{OUT} = 1.25V * (1 + R_A / R_B)$ where R_A is the resistor connected between V_{OUT} and ADJ, and R_B is the resistor connected between ADJ and GND.
$\overline{SHDN}$	Shutdown input. This pin has a threshold of about $V_{IN} / 2$, it should be actively pulled high to enable the regulator. This can be accomplished with a resistive pull-up. When low, it turns off the regulator and puts the device in a low current shutdown state.

TYPICAL APPLICATION

Figure 1 – Typical Application

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	LX8610			Units
		Min	Typ	Max	
Input Voltage	V_{IN}	3.1		5.5	V
Load Current (with adequate heatsinking)		10		1000	mA
Input Capacitor (V_{IN} to GND)		2.2	10		μ F
Output Capacitor (V_{OUT} to GND)		10	22*		μ F

* Size your output capacitor to meet the transient loading requirement. If you have a very dynamic load, a larger capacitor will improve the response to these load steps.

ELECTRICAL CHARACTERISTICS

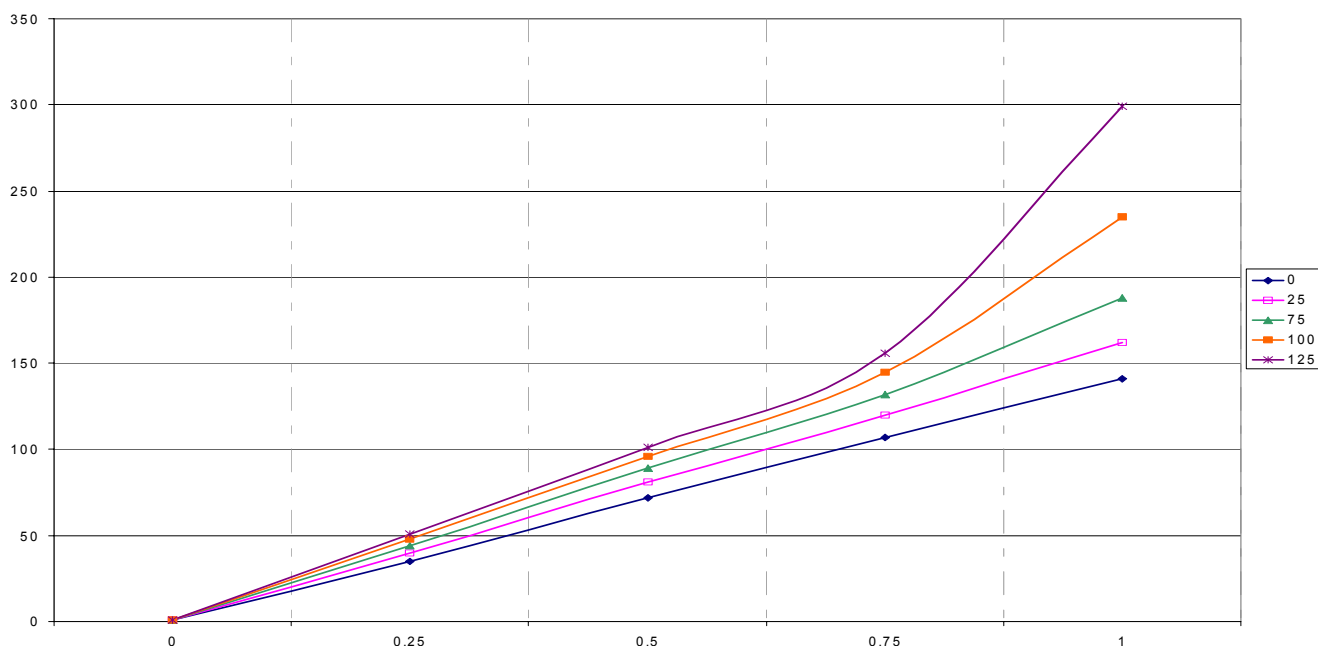
Unless otherwise specified, the following specifications apply over the operating ambient temperature $0^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$ except where otherwise noted. Test conditions: $V_{IN} = V_{OUT} + 1.5\text{V}$; $I_{OUT} = 10\text{mA}$; $C_{IN} = 10\mu\text{F}$; $C_{OUT} = 22\mu\text{F}$; $T_J = T_A$.

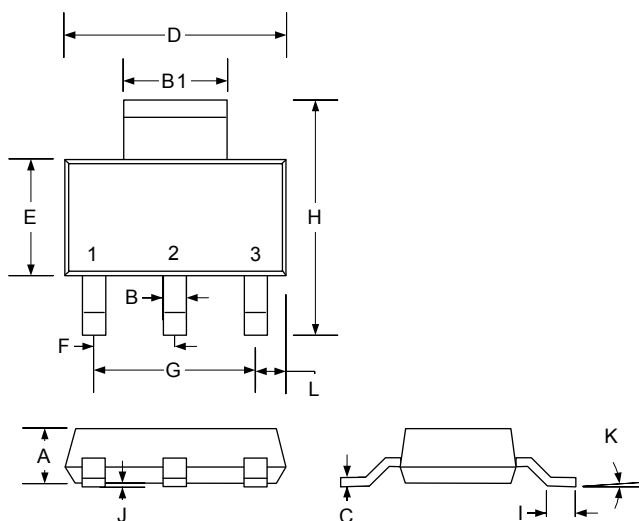
Parameter	Symbol	Test Conditions	LX8610-xx			Units
			Min	Typ	Max	
▶ LX8610-33 FIXED 3.3V, 1A						
Output Voltage	V _{OUT}	T _J = 25°C V _{IN} = 3.8 to 5.5V, I _{OUT} = 10mA to 1A	3.25 3.22	3.3	3.35 3.38	V
Line Regulation	V _{REG}	V _{IN} = 3.45V to 5.5V		4	8	mV
Load Regulation	I _{REG}	I _{OUT} = 10mA to 1A		5	10	mV
Dropout Voltage (V _{DO} = V _{IN} -V _{OUT})	V _{DO}	I _{OUT} = 1A, V _{OUT} = ΔV _{OUT} -1%		0.25	0.45	V
		I _{OUT} = 0.5A, V _{OUT} = ΔV _{OUT} - 1%		0.15	0.25	
		I _{OUT} = 10mA, V _{OUT} = ΔV _{OUT} - 1%		0.05	0.15	
Short Circuit Current	I _{SC}	V _{OUT} = 0V		1.25	1.7	A
Quiescent Current	I _Q	I _{OUT} = 10mA to 1A		400	600	μA
		V _{IN} = 4.8V; V _{SHDN} < 0.8V		1	40	
Reverse Leakage Current	I _{REV}	0V < V _{IN} < V _{OUT} , V _{OUT} <3.4V (at V _{OUT}) 0V < V _{IN} < V _{OUT} , V _{OUT} <3.4V (at V _{IN})	-50	400 0	650	μA mA
Shutdown Threshold *	V _{SHDN}	V _{SHDN} falling	0.8	(V _{IN} / 2)		V
		V _{SHDN} rising		(V _{IN} / 2)		
SHDN Bias Current *	I _{SHDN}	V _{SHDN} < 0.8V		-2		μA
		V _{SHDN} = 3V		-1		
▶ LX8610-25 FIXED 2.5V, 1A						
Output Voltage	V _{OUT}	T _J = 25°C V _{IN} = 3.1V, I _{OUT} = 10mA to 1A	2.46 2.44	2.5	2.54 2.56	V
Line Regulation	V _{REG}	V _{IN} = 3.1V to 5.5V, I _{OUT} = 10mA		4	8	mV
Load Regulation	I _{REG}	I _{OUT} = 10mA to 1A		5	10	mV
Dropout Voltage (V _{DO} = V _{IN} -V _{OUT})	V _{DO}	I _{OUT} = 1A, V _{OUT} = ΔV _{OUT} -1%		0.25	0.45	V
		I _{OUT} = 0.5A, V _{OUT} = ΔV _{OUT} - 1%		0.15	0.25	
		I _{OUT} = 10mA, V _{OUT} = ΔV _{OUT} - 1%		0.05	0.15	
Short Circuit Current	I _{SC}	V _{OUT} = 0V		1.25	1.7	A
Quiescent Current	I _Q	I _{OUT} = 10mA to 1A		300	600	μA
		V _{IN} = 4.8V; V _{SHDN} < 0.8V		1	40	
Reverse Leakage Current	I _{REV}	0V < V _{IN} < V _{OUT} , V _{OUT} <2.6V (at V _{OUT}) 0V < V _{IN} < V _{OUT} , V _{OUT} <2.6V (at V _{IN})	-50	400 0	650	μA mA
Shutdown Threshold *	V _{SHDN}	V _{SHDN} falling	0.8	V _{IN} / 2		V
		V _{SHDN} rising		(V _{IN} / 2)		
SHDN Bias Current *	I _{SHDN}	V _{SHDN} < 0.8V		-2		μA
		V _{SHDN} = 3V		-1		

ELECTRICAL CHARACTERISTICS (CONTINUED)

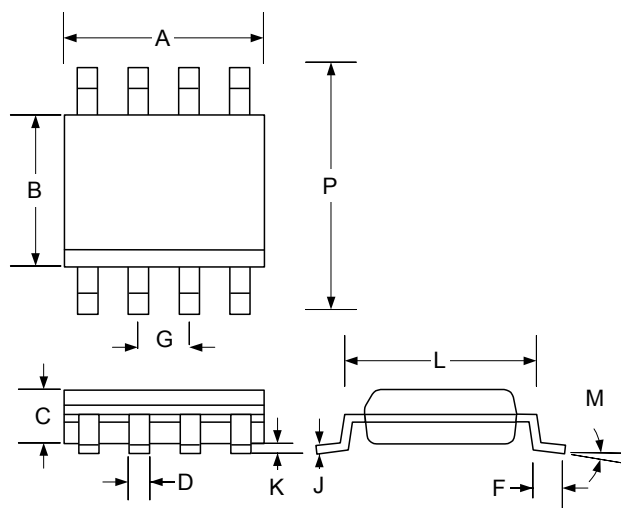
Parameter	Symbol	Test Conditions	LX8610-xx			Units
			Min	Typ	Max	
▶ LX8610-00 ADJUSTABLE OUTPUT, 1A						
Reference Voltage	V _{REF}	T _J = 25°C V _{IN} = 3.1V, I _{OUT} = 10mA to 1A	1.23 1.22	1.22 1.25	1.27 1.28	V
Line Regulation	V _{REG}	V _{IN} = 3.1V to 5.5V, I _{OUT} = 10mA		4	8	mV
Load Regulation	I _{REG}	I _{OUT} = 10mA to 1A		7	15	mV
Short Circuit Current	I _{SC}	V _{OUT} = 0V		1.25	1.7	A
Dropout Voltage (V _{DO} = V _{IN} –V _{OUT})	V _{DO}	I _{OUT} = 1A, V _{IN} > 4V		0.25	0.45	V
		I _{OUT} = 0.5A, V _{IN} > 3V		0.15	0.25	
		I _{OUT} = 10mA, V _{IN} > 3V		0.05	0.15	
Quiescent Current	I _Q	I _{OUT} = 10mA to 1A, V _{IN} = 5.5V		400	600	µA
Quiescent Current in Shutdown		V _{IN} = 4.8V; V _{SHDN} < 0.8V		1	40	
Reverse Leakage Current	I _{REV}	0V < V _{IN} < V _{OUT} , V _{OUT} < 5.5V (at V _{OUT})		400	650	µA
		0V < V _{IN} < V _{OUT} , V _{OUT} <5.5V (at V _{IN})	-50	0		mA
Bias Current at ADJ Pin	I _{BIAS}			100		nA
Shutdown Threshold *	V _{SHDN}	V _{SHDN} falling	0.8	(V _{IN} / 2)		V
		V _{SHDN} rising		(V _{IN} / 2)		
SHDN Bias Current *	I _{SHDN}	V _{SHDN} < 0.8V		-2		µA
		V _{SHDN} = 3V		-1		

* Note: Shutdown Threshold and Shutdown Bias Current apply only to 8-Pin SOIC package outline versions

DROPOUT VOLTAGE VS. OUTPUT CURRENT
LX8610 Dropout vs. Load vs. Temp

FIGURE 2 – Dropout Voltage Vs. Output Current (Typical – LX8610-25CST)

MECHANICAL DIMENSIONS
ST 3-Pin Plastic SOT-223


Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.55	1.80	0.061	0.071
B	0.65	0.85	0.026	0.033
B1	2.95	3.15	0.116	0.124
C	0.25	0.35	0.010	0.014
D	6.30	6.70	0.248	0.264
E	3.30	3.70	0.130	0.146
F	2.30 BSC		0.0905 BSC	
G	4.60 BSC		0.181 BSC	
H	6.71	7.29	0.264	0.287
I	—	0.91	—	0.036
J	0.02	0.10	.0008	.004
K	10° MAX		10° MAX	
L	.084	1.04	0.033	0.041

DM 8-Pin Plastic SOIC


Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.00	0.190	0.197
B	3.81	3.94	0.150	0.155
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
F	—	0.77	—	0.030
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.007	0.010
K	0.13	0.25	0.005	0.010
L	4.80	5.21	0.189	0.205
M	—	8°	—	8°
P	5.79	6.20	0.228	0.244
*LC	—	0.10	—	0.004

*Lead Coplanarity

Note: Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.



LINFINITY

A MICROSEMI COMPANY

LX8610-xx

1A BiCMOS Very Low Dropout Regulators

PRODUCTION DATASHEET

NOTES

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