LX8630-xx

3A BiCMOS Very Low Dropout Regulators

PRELIMINARY DATA SHEET

DESCRIPTION

The LX8630 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 or 2.5V - 1.8V conversion.

BiCMOS technology allows an effective series pass element resistance, $R_{DS(ON)}$ of 150mΩ resulting in a typical dropout voltage of 450mV at 3A.

Low Quiescent Current and Logic-Controlled Shutdown help conserve battery life and increase system efficiency. Typical quiescent current is under 400µA irrespective of load current, while the shutdown current is only 10µA. The device will enter shutdown mode when the ENABLE pin is pulled low.

Thermal and Short-Circuit Current Limiting: the LX8630 limits the current when the output is shorted, protecting sensitive load circuits. The device will also turn off if the junction temperature exceeds 150°C.

Available in Popular TO-220 and TO-263 Power Packages: adjustable versions have five leads, and fixed output voltage devices are supplied in three lead packages.

NOTE: For current data & package dimensions, visit our web site: **http://www.linfinity.com**.

KEY FEATURES

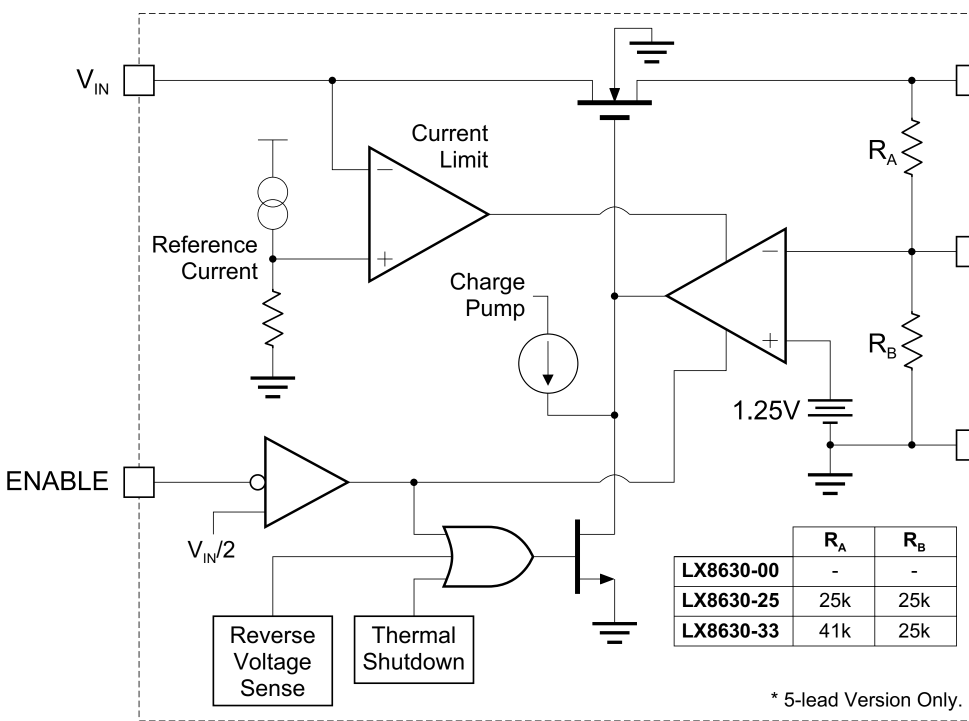
- Dropout Voltage Typically 450mV at 3A and 50mV at 10mA
- Low Quiescent Current, Typically Under 400µA, irrespective of Load
- Shutdown Current 10µA
- Adjustable Output Version in 5-Pin TO-220 & TO-263 Packages
- Fixed Outputs of 2.5V and 3.3V Available in 3-Pin TO-220 & TO-263 Packages
- Low Reverse Leakage Current
- Short-Circuit and Thermal Shutdown Protection

APPLICATIONS

- 1.8V & 2.5V Supplies for Memory, Microprocessors, Clock Circuits, Etc.
- Portable Equipment

PRODUCT HIGHLIGHT

LX8630-xx Block Diagram



PACKAGE ORDER INFORMATION

T_A (°C)	Output Voltage	P Plastic TO-220 3-pin	P Plastic TO-220 5-pin	DD Plastic TO-263 3-pin	DD Plastic TO-263 5-pin
0 to 125	3.3	LX8630-33CP	—	LX8630-33CDD	—
	2.5	LX8630-25CP	—	LX8630-25CDD	—
	ADJ (00)	—	LX8630-00CP	—	LX8630-00CDD

Note: All surface-mount packages are available in Tape & Reel, append the letter "T" to part number. (i.e. LX8630-xxCDDT)

ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Voltage (V_{IN}) 6.5V
Enable Pin .... -0.3V to V_{IN}+0.3V
Operating Junction Temperature
  Plastic (P & DD Packages) .... 150°C
Storage Temperature Range .... -65°C to 150°C
Lead Temperature (Soldering, 10 seconds) .... 300°C

Note 1. Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

THERMAL DATA

P PACKAGE: (3-Pin)

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.7°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W

P PACKAGE: (5-Pin)

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.7°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W

DD PACKAGE: (3-Pin)

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.7°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W*

DD PACKAGE: (5-Pin)

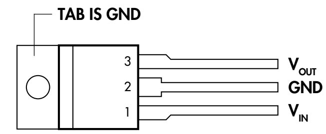
THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.7°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W

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.

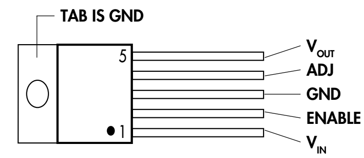
* θ_{JA} can be improved with package soldered to 0.5IN^2 copper area over backside ground plane or internal power plane. θ_{JA} can vary from 20°C/W to > 40°C/W depending on mounting technique.

PACKAGE PIN OUTS

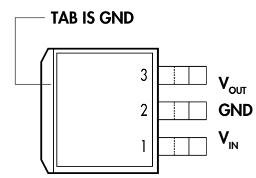
(All packages are Top View)



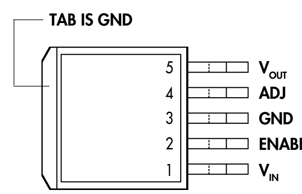
P PACKAGE (3-Pin)



P PACKAGE (5-Pin)



DD PACKAGE (3-Pin)



DD PACKAGE (5-Pin)

FUNCTIONAL PIN DESCRIPTION

Pin Designator	Description
V_{IN}	Positive supply input for the regulator. Bypass to GND with at least 2.2µF 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 10µF although this is not required for regulation, rather its 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	Reference ground. The input and output decoupling capacitors should be connected to this pin. In addition the tab on the TO-220 and TO-263 packages along with the ground pin are also used for heatsinking the device.
ADJ	Feedback pin for the regulator. For the LX8630-00, the output voltage can be set by two external resistors with the following relationship: V_{OUT} = 1.25V * (1+R2/R1) where R1 is the resistor connected between V_{OUT} and ADJ, and R2 is the resistor connected between ADJ and GND pin.
ENABLE	Enable 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 or controlled by a logic gate. When low, it turns off the regulator and puts the device in a low current shutdown state.

LINFINITY MICROELECTRONICS

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Recommended Operating Conditions			Units
		Min.	Typ.	Max.	
Input Voltage	V_{IN}	2.5		5.5	V
Load Current (with adequate heatsinking)		0.01		3	A
Input Capacitor (V_{IN} to GND)		10			µF
Output Capacitor (V_{OUT} to GND)		22			µF

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for the LX8630-xxC with 0°C ≤ T_A ≤ 125°C; V_{IN} = V_{OUT} + 1.5V; I_{OUT} = 10mA; C_{IN} = 10µF; C_{OUT} = 22µF; T_J = T_A. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

LX8630-33 Fixed 3.3V, 3A

Parameter	Symbol	Test Conditions	LX8630-33			Units
			Min.	Typ.	Max.	
Output Voltage	V_{OUT}	T_J = 25°C	3.25	3.3	3.35	V
		Over Temperature	3.22		3.38	V
Line Regulation	V_{REG}	V_{IN} = 3.9V to 5.5V		2	8	mV
Load Regulation	I_{REG}	I_{OUT} = 10mA to 3A		18	40	mV
Dropout Voltage (V_{DO} = V_{IN} - V_{OUT})	V_{DO}	I_{OUT} = 3A, ΔV_{OUT} = -1%		0.4	0.6	V
		I_{OUT} = 1.5A, ΔV_{OUT} = -1%		0.3	0.4	V
		I_{OUT} = 10mA, ΔV_{OUT} = -1%		0.05	0.15	V
Short Circuit Current	I_{SC}	V_{OUT} = 0V	4	5	6	A
Current Limit	I_{CL}	V_{OUT} = V_{OUT} - 1%	3	4	5	A
Quiescent Current	I_Q	I_{OUT} = 10mA to 3A		400	600	µA
Reverse Leakage Current	I_{REV}	0V < V_{IN} < V_{OUT}, V_{OUT} < 3.4V (at V_{OUT})		50	650	µA
		0V < V_{IN} < V_{OUT}, V_{OUT} < 3.4V (at V_{IN})	-50	0		mA

LX8630-25 Fixed 2.5V, 3A

Parameter	Symbol	Test Conditions	LX8630-25			Units
			Min.	Typ.	Max.	
Output Voltage	V_{OUT}	T_J = 25°C	2.46	2.5	2.54	V
		Over Temperature	2.44	2.5	2.56	V
Line Regulation	V_{REG}	V_{IN} = 3.1V to 5.5V		2	6	mV
Load Regulation	I_{REG}	I_{OUT} = 10mA to 3A		14	30	mV
Dropout Voltage (V_{DO} = V_{IN} - V_{OUT})	V_{DO}	I_{OUT} = 3A, ΔV_{OUT} = -1%		0.4	0.6	V
		I_{OUT} = 1.5A, ΔV_{OUT} = -1%		0.3	0.45	V
		I_{OUT} = 10mA, ΔV_{OUT} = -1%		0.05	0.15	V
Short Circuit Current	I_{SC}	V_{OUT} = 0V	4	5	6	A
Current Limit	I_{CL}	V_{OUT} = V_{OUT} - 1%	3	4	5	A
Quiescent Current	I_Q	I_{OUT} = 10mA to 3A		400	600	µA
Reverse Leakage Current	I_{REV}	0V < V_{IN} < V_{OUT}, V_{OUT} < 2.6V (at V_{OUT})		50	650	µA
		0V < V_{IN} < V_{OUT}, V_{OUT} < 2.6V (at V_{IN})	-50	0		mA

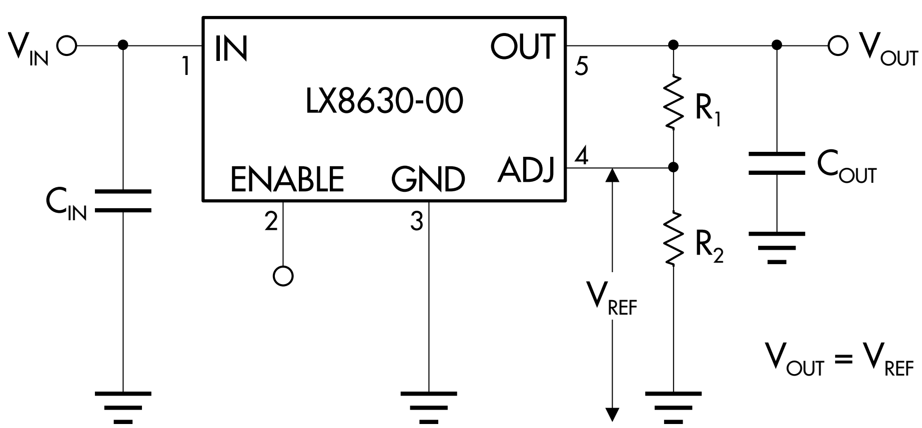
ELECTRICAL CHARACTERISTICS (Continued)

LX8630-00 Adjustable Output, 3A

Parameter	Symbol	Test Conditions	LX8630-00			Units
			Min.	Typ.	Max.	
Reference Voltage	V_{REF}	T_J = 25°C	1.23	1.25	1.27	V
		Over Temperature	1.22	1.25	1.28	V
Line Regulation	V_{REG}	V_{IN} = (V_O + 0.6V) to 5.5V @ ADJ Pin (Note 1)		2	4	mV
Load Regulation	I_{REG}	I_{OUT} = 10mA to 3A @ ADJ Pin		7	15	mV
Dropout Voltage (V_{DO} = V_{IN} - V_{OUT})	V_{DO}	I_{OUT} = 3A, V_{IN} > 3V, ΔV_{OUT} ±1%		0.4	0.6	V
		I_{OUT} = 1.5A, V_{IN} > 3V, ΔV_{OUT} ±1%		0.3	0.4	V
		I_{OUT} = 10mA, V_{IN} > 3V, ΔV_{OUT} ±1%		0.05	0.15	V
Short Circuit Currnet	I_{SC}	V_{OUT} = 0V	4	5	6	A
Current Limit	I_{CL}	V_{OUT} = V_{OUT} - 1V	3	4	5	A
Quiescent Current	I_Q	I_{OUT} = 10mA to 3A		400	600	µA
Reverse Leakage Current	I_{REV}	0V < V_{IN} < V_{OUT}, V_{OUT} < 5.5V (at V_{OUT})		50	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_{SD}		0.8	(V_{IN}/2)		V
Shutdown Current	I_{SD}	V_{ENABLE} < 0.8V		10	25	µA

Note 1. V_{IN} min. ≥ 2.5V.

TYPICAL APPLICATION



$$V_{OUT} = V_{REF}\left(1 + \frac{R_1}{R_2}\right)$$

FIGURE 1 — Typical Application

CHARACTERISTIC CURVES

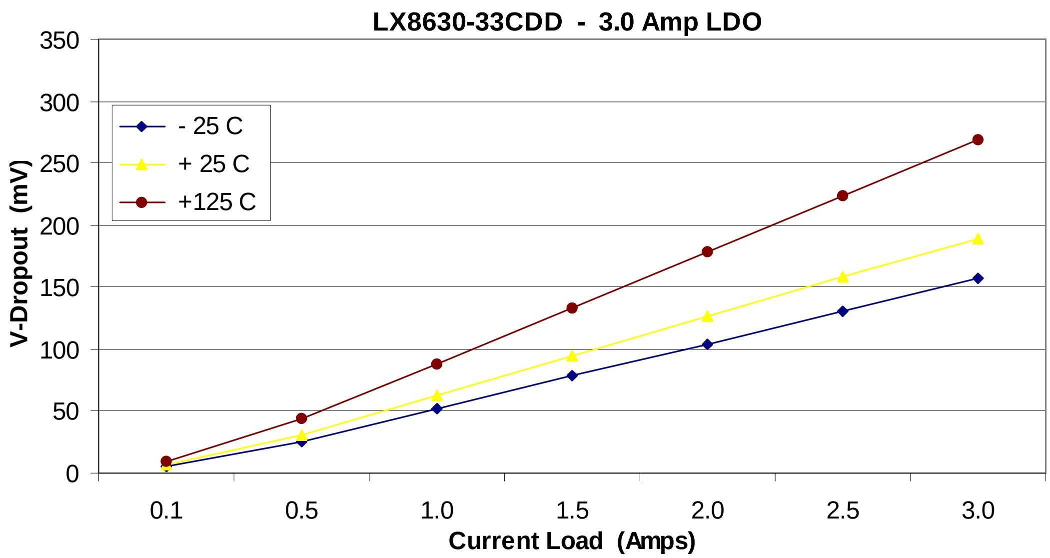
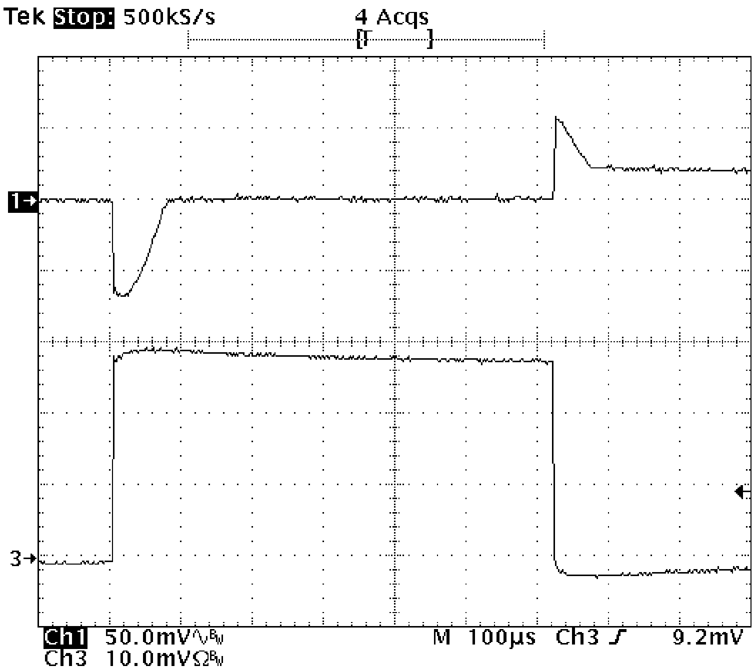
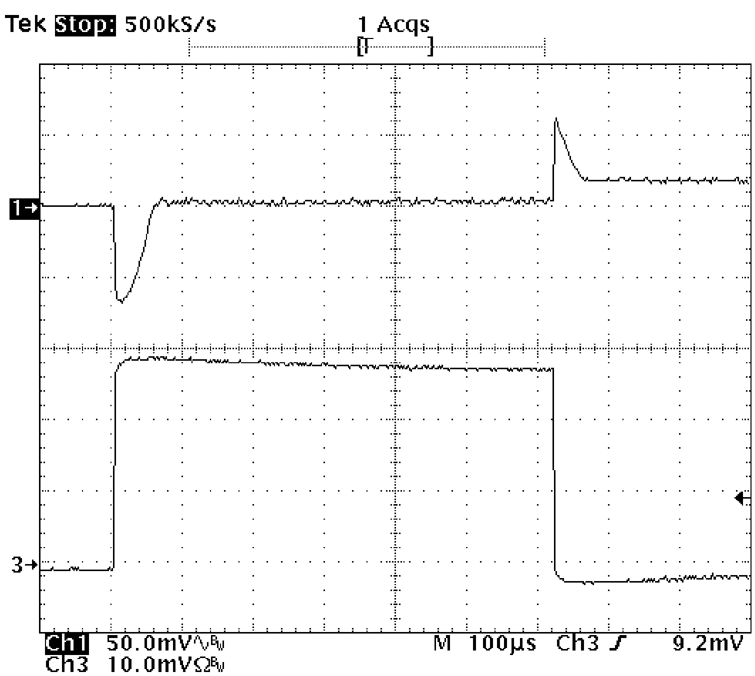


FIGURE 2 — Dropout Voltage vs. Output Current (Typical - LX8630-33CDD)

CHARACTERISTIC CURVES



V_{IN} = 3.3V
CHAN 1 (top trace) : V_{OUT} 50mV/DIV at 2.5VDC
CHAN 3 (lower trace): I_{OUT} 1A/DIV
w/ 10mA preload current
Input Cap: 1 6MVGX 1500µF Sanyo Cap
Output Caps: 2 6MVGX 1500µF Sanyo Cap



V_{IN} = 5.0V
CHAN 1 (top trace) : V_{OUT} 50mV/DIV at 2.5VDC
CHAN 3 (lower trace): I_{OUT} 1A/DIV
w/ 10mA preload current
Input Cap: 1 6MVGX 1500µF Sanyo Cap
Output Caps: 2 6MVGX 1500µF Sanyo Cap

FIGURE 4 — LX8630-00CDD Transient Response