



High Efficiency Single Inductor Auto Buck-Boost Converter

General Description

The HX68313 is a high efficiency single inductor Buck-Boost converter which can supply the load current up to 1.5A. It provides auto-transition between Buck and Boost Mode.

The HX68313 operates at 2.4MHz switching frequency in CCM. DC/DC converter operates at Pulse-Skipping Mode at light load. The output voltage is programmable using an external resistor divider, or is fixed to 3.3V internally. The load is disconnected from the VIN during shutdown.

The HX68313 is available in TDFN3X3-10 package.

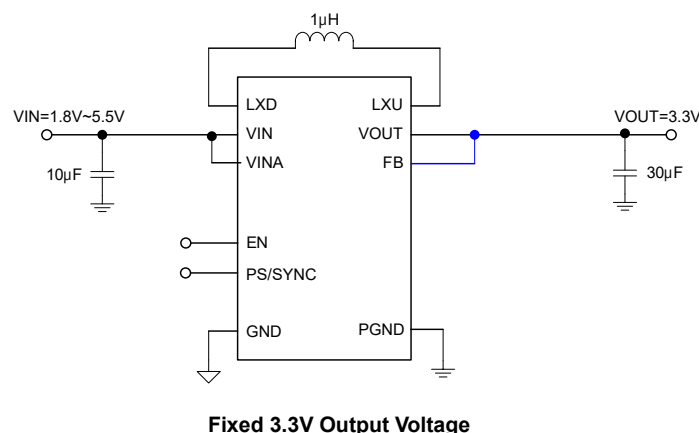
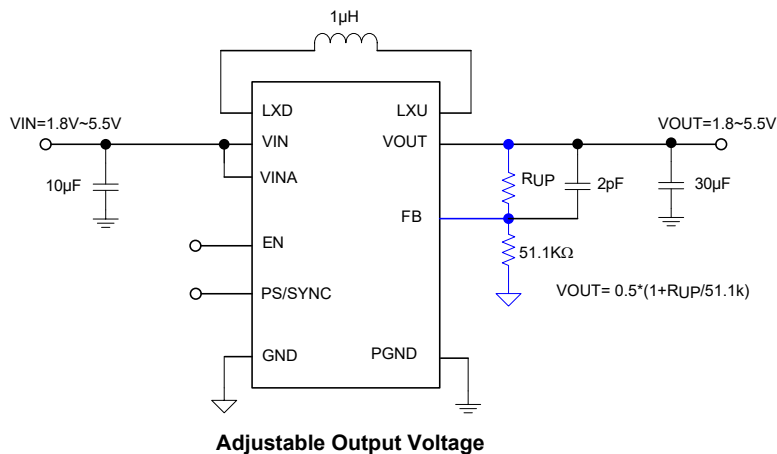
Features

- 1.8V ~ 5.5V Input Voltage Operation
- Adjustable Output Voltage from 1.8V to 5.5V
- 95% Efficiency DC/DC Converter
- 1.5A Output Current at 3.3V for VIN > 3.6V
- Auto-Transition Between Buck and Boost Mode
- Pulse-Skipping Mode at light load for Efficiency
- DC/DC Converter can be set to lower quiescent current at light load
- Fixed 2.4MHz Frequency and Synchronization Possible 4.8MHz
- Soft-Start and Pre-Biased Soft-Start
- Built-In Cycle-by Cycle Current Limit
- Built-In Thermal Shutdown Function

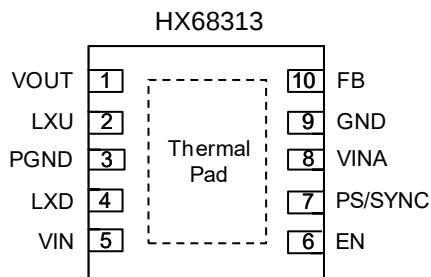
Applications

- Mobile Handsets
- Smart Phone
- Optical Modules

Typical Application Circuit



Pin Configuration



TDFN3X3-10

Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

Pin Description

PIN	NAME	Function
1	VOUT	Power Output of Buck-Boost Converter
2	LXU	Inductor Switch Node
3	PGND	Power Ground of Buck-Boost Converter. The exposed pad must be soldered to a large PCB and connected to PGND for maximum power dissipation.
4	LXD	Inductor Switch Node
5	VIN	Power Input of Buck-Boost Converter
6	EN	Enable PIN (1 Enabled, 0 Disabled), must not be left open.
7	PS/SYNC	Enable/Disable Power Save Mode (1 Disabled, 0 Enabled, clock signal for synchronization), must not be left open.
8	VINA	IC Power Supply Input
9	GND	Chip Analog Ground
10	FB	Voltage Feedback of adjustable version, and connected to VOUT on fixed output voltage version.

Ordering Information

Part Number	Package	TEMP.RANGE	Quantity/ Reel
HX68313	TDFN3X3-10	-40°C~+85°C	3000

HX68313 devices are Pb-free and RoHS compliant.



Absolute Maximum Ratings^(Note)

VIN, VOUT, VINA -0.3V to +6.5V
LXD, LXU -0.3V to +6.5V
EN, PS/SYNC, FB -0.3V to +6.5V
Thermal Resistance Junction to Ambient, (θ_{JA})
TDFN3X3-10 49.5°C/W
Continuous Power Dissipation ($T_A=25^\circ\text{C}$)
TDFN3X3-10 2.5W

Thermal Resistance Junction to Case, (θ_{JC})
TDFN3X3-10. 57.7°C/W
Operating Ambient Temperature -35°C to 85°C
Storage Temperature Range. -55°C to +150°C
Reflow Temperature (soldering, 10 sec) 260°C
EDS Susceptibility (Human Body Mode) 2kV
EDS Susceptibility (Machine Mode) 200V

Note (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 in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note (2): Device is ESD sensitive. Handling precaution recommended. The Human Body model is a 100pF capacitor discharged through a 1.5K Ω resistor into each pin.

Electrical characteristics

(VIN=VINA=3.6V, $T_A=25^\circ\text{C}$, unless otherwise specified)

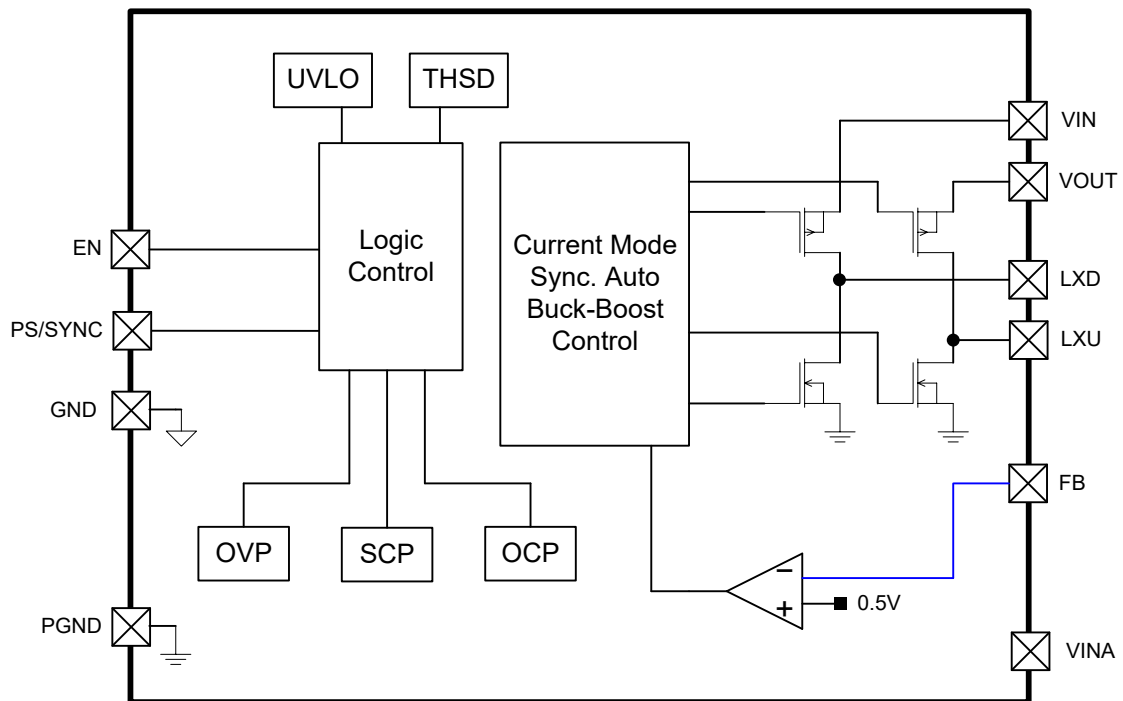
The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
GENERAL						
VIN minimum Startup Voltage	V _{IN,ST}		---	---	1.7	V
VIN Operating Voltage	V _{IN}		1.8	---	5.5	V
Output Voltage Range	V _{OUT}		1.8	---	5.5	V
Under Voltage Lockout Threshold	V _{UVLO,R}	V _{INA} voltage rising	---	1.7	---	V
	V _{UVLO,F}	V _{INA} voltage falling	---	1.6	---	V
Quiescent Current	I _Q	V _{EN} =V _{IN} =V _{INA} =3.6V, I _{OUT} =0A (PSM)	---	40	65	μA
Shutdown Current	I _{SD}	V _{EN} =0V, V _{IN} =V _{INA} =3.6V	---	0.1	1	μA
OSCILLATOR						
Oscillator Frequency	F _{OSC}		2.2	2.4	2.6	MHz
Frequency range for Synchronization	F _{SYN}		4.4	4.8	5.2	MHz
DCDC Converter						
Soft-Start Internal	SS	V _{IN} =V _{INA} =3.6V	---	0.5	---	ms
Feedback voltage	V _{FB}	Adjustable Output	495	500	505	mV
Line Regulation	$\Delta V_{OUT,LINE}$	PWM	---	0.5	---	%
Load Regulation	$\Delta V_{OUT,LOAD}$	PWM	---	0.5	---	%
Maximum Duty Cycle	D _{MAX,D}	LXD	---	100	---	%
	D _{MAX,U}	LXU	90	93	96	%
FB Leakage Current	I _{FB,LK}	Adjustable Mode	---	---	1	μA
VOUT Leakage Current	I _{VO,LK}	V _{LXU} =0V, V _{OUT} =5V	---	1	5	μA
LXD, LXU Leakage Current	I _{LXD,LK} , I _{LXU,LK}	V _{LXD} =V _{LXU} =5V	---	1	5	μA
Switch ON Resistance	R _{ON,P}	V _{IN} =V _{INA} =3.6V	---	150	---	m Ω
	R _{ON,N}	V _{IN} =V _{INA} =3.6V	---	130	---	
Peak Current Limit	I _{LIM}	V _{IN} =V _{INA} =3.6V	---	2	---	A
Valley Current Limit (FPWM)	I _{LIM,VALLEY}	V _{IN} =V _{INA} =3.6V	---	-0.8	---	A
Maximum Output Load Capability	I _{OD_MAX}	V _{IN} $\geq$ 3.3V, V _O =3.3V	1.5			A
	I _{OU_MAX}	V _{IN} =1.8V, V _O =3.3V	500			mA
Protection						
Short Circuit Protection threshold	%V _{SCP}	Ratio=V _{SCP} /V _{OUT} , V _{OUT} voltage falling	---	20	---	%
Thermal Shutdown Protection	T _{SD}		---	150	---	$^\circ\text{C}$
Thermal Shutdown Hysteresis	ΔT_{SD}		---	20	---	$^\circ\text{C}$
Control Signal						
EN, PS/SYNC Input Voltage	V _{TH}	High Threshold	1.2	---	---	V
	V _{TL}	Low Threshold	---	---	0.4	V
EN, PS/SYNC Leakage Current	I _{EN,LK}	EN=V _{INA} or 0V			1	μA

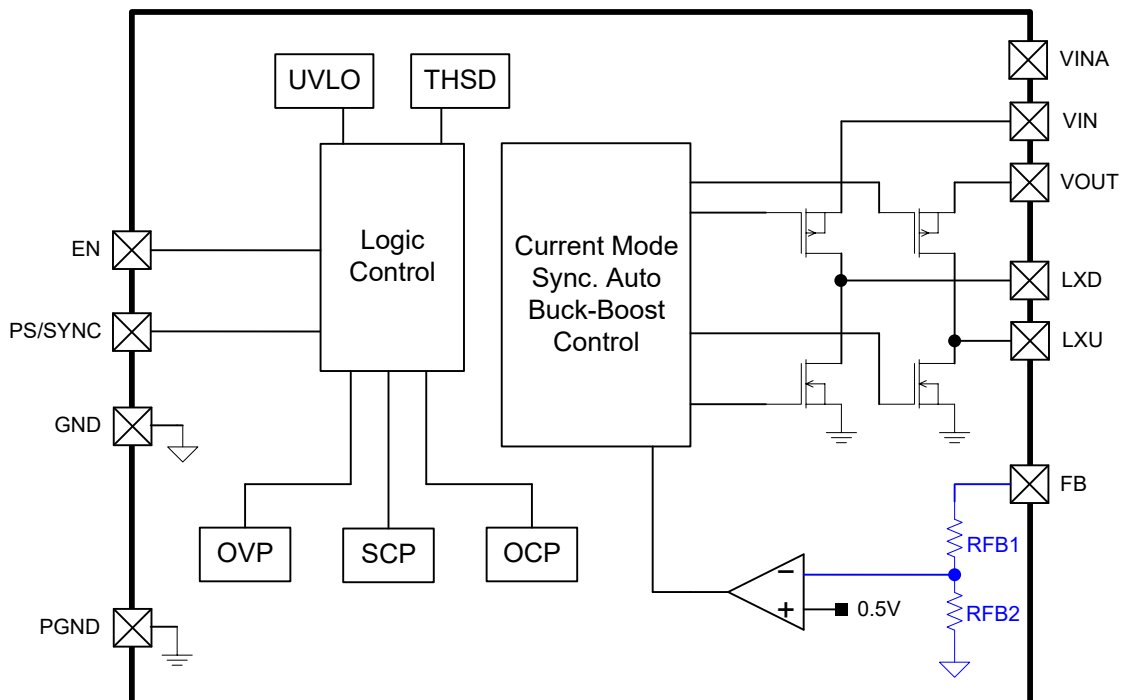


Functional Block Diagram

Adjustable Output Voltage Version



Fixed Output Voltage Version



Function Description

The HX68313 includes a DC/DC Converter.

	Topology	Default V _{OUT}	V _{OUT} range	Current rating
DCDC	2.4MHz Sync. Auto Buck-Boost Converter	3.3V	Adjustable Mode: 1.8V to 5.5V Fixed Mode: 3.3V	1.5A

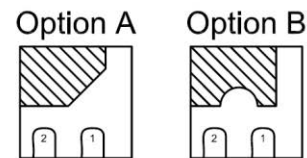
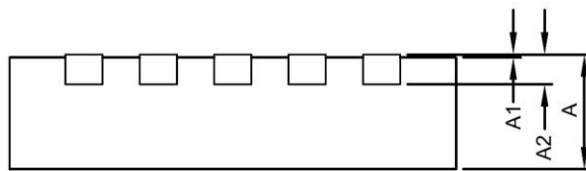
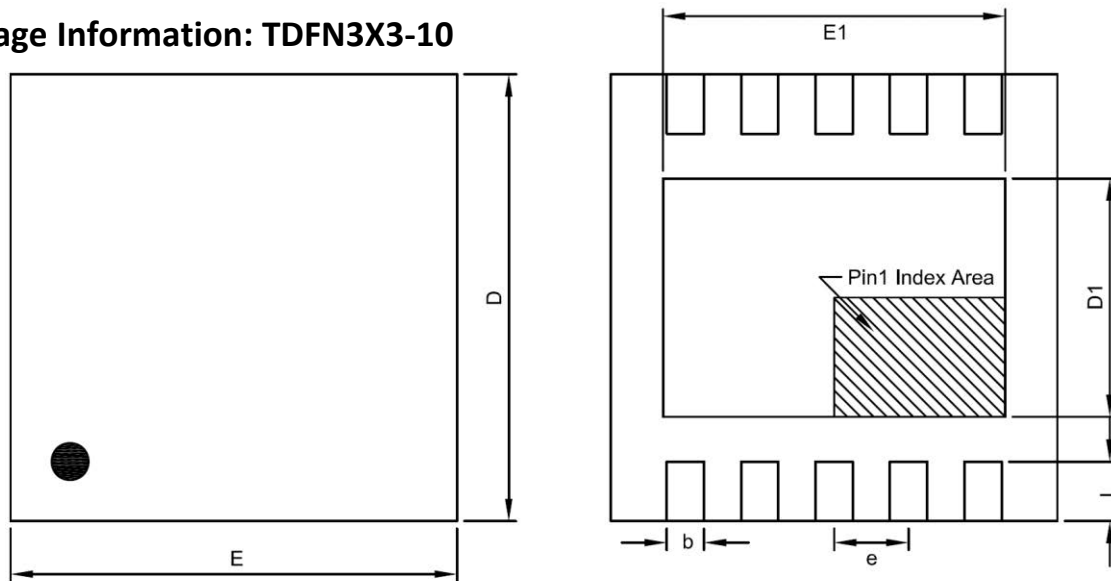
Fault Protection

HX68313 provides VIN under-voltage lockout protection, over-current protection, VOUT over-voltage protection, VOUT short-circuit protection, and thermal shutdown protection to achieve complete protection.

	Protection Type	Threshold	Protection methods	Reset Method
VIN	UVLO	VIN < 1.6V	DCDC shutdown	VIN > 1.7V
DCDC Buck-Boost	Peak Current Limit	Peak Inductor current > 2A	Buck Mode: PMOS Off, NMOS on Boost Mode: NMOS Off, PMOS on	Automatic Reset at next cycle
	Valley Current Limit (FPWM)	Valley Inductor current < 0.8A	Buck Side: NMOS off	Valley Inductor current > 0.8A
	SCP	VOUT < 20% * VOUT _{SET}	Current Limit = 1A OSC Frequency = 1.2MHz	VOUT > 30% * VOUT _{SET}
Thermal	TSD	Junction Temp. > 150°C	DCDC shutdown	Junction Temp. < 130°C



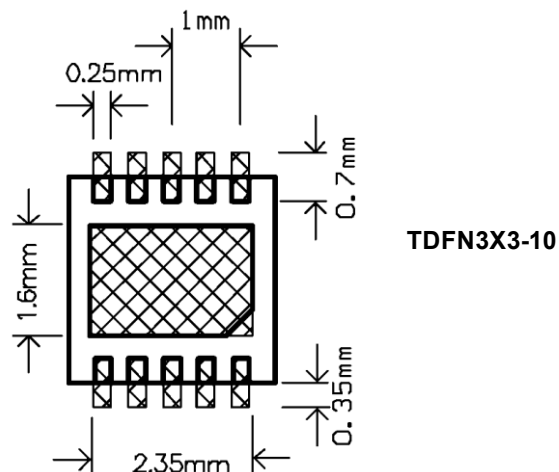
Package Information: TDFN3X3-10



Pin1 Index

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.20 REF			0.0079 REF		
D	2.95	3.00	3.05	0.1161	0.1181	0.1201
E	2.95	3.00	3.05	0.1161	0.1181	0.1201
D1	1.50	1.60	1.75	0.0591	0.0630	0.0689
E1	2.20	2.60	2.70	0.0866	0.1024	0.1063
b	0.18	0.25	0.30	0.0071	0.0098	0.0118
e	0.50 BSC			0.0197 BSC		
L	0.30	0.40	0.50	0.0118	0.0157	0.0197

Minimum Footprint PCB Layout Section



TDFN3X3-10