General Description

The LTP3631 series of CMOS low dropout regulators are designed specifically for portable battery-powered applications which require ultra-low quiescent current. The ultra-low consumption of 0.6μA (typ) ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

The device is available in SOT23-5L and tiny DFN1×1-4L packages.

Features

- Operating Input Voltage Range: 2.2V to 5.5V
- Output Voltage Range: 1.1V to 3.6V at 50mV Steps
- Ultra-Low Quiescent Current: 0.6μA Typically
- Low Dropout: 250mV Typically at 150mA and VOUT=1.8V
- High Output Voltage Accuracy: ±1%
- Stable with Ceramic Capacitors of 1μF
- Over-Current Protection
- Thermal Shut-down Protection
- With Auto Discharge Function at Off-state

Applications

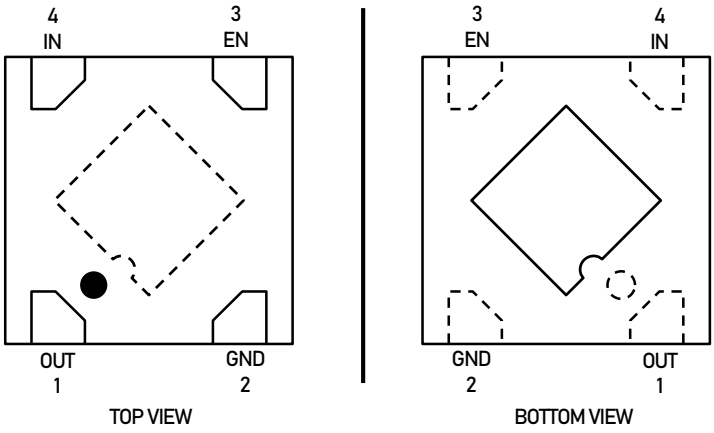
- Battery Powered Equipments
- Portable Communication Equipments
- Cameras, Image Sensors and Camcorders
- Label Information

Order Information

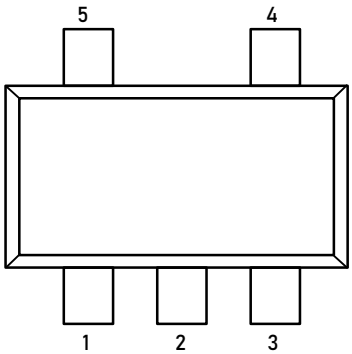
Model	Package	Ordering Number Note1	Packing Option
LTP3631	SOT23-5L	LTP3631-xxYT5	Tape and Reel, 3000
	DFN1x1-4L	LTP3631-xxYT4	Tape and Reel, 10000

Note1: xx stands for output voltage, e.g. if xx = 18, the output voltage is 1.8V; if xx = 30, the output voltage is 3.0V.

Pin Configuration



DFN1×1-4L



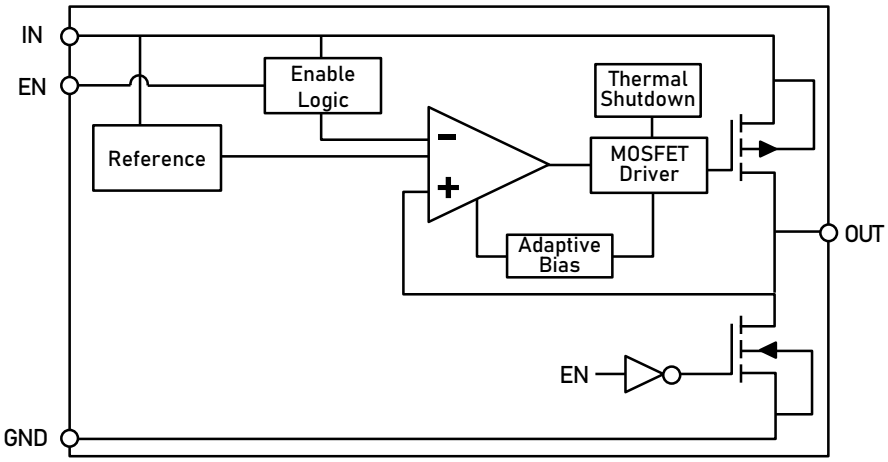
SOT23-5L

Pin Function

Pin No. (DFN1×1-4)	Pin Name	Description
4	IN	Power Supply Input Voltage
3	GND	Power Supply Ground
2	EN	Chip Enable Pin (Active "H")
1	OUT	Output Pin

Pin No. (SOT23-5)	Pin Name	Description
1	IN	Power Supply Input Voltage
2	GND	Power Supply Ground
3	EN	Chip Enable Pin
4	NC	No Connect
5	OUT	Output Pin

Block Diagram



Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V_{IN}	Input Voltage (Note1)	6.0	V
V_{OUT}	Output Voltage	−0.3 to VIN + 0.3	V
V_{CE}	Chip Enable Input	−0.3 to 6.0	V
$T_{J(MAX)}$	Maximum Junction Temperature	150	℃
T_{STG}	Storage Temperature	−55 to 150	℃
ESD_{HBM}	Human Body Model (Note2)	2000	V
CDM	ESD Capability（Note2)	1500	V
Latch up	Current Maximum Rating（Note2)	200	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Refer to ELECTRICAL CHARACTERISTIS and APPLICATION INFORMATION for Safe Operating Area.
2. This device series incorporates ESD protection and is tested by the following methods:
   ESD Human Body Model tested per EIA/JESD22-A114
   CDM tested per JESD22-C101
   Latch up Current Maximum Rating tested per JEDEC78

Thermal Characteristics

Symbol	Rating	Value		Unit
$R_{\theta JA}$	Thermal Characteristics, Thermal Resistance, Junction-to-Air	SOT23-5L	250	°C/W
		DFN1×1-4L	180	
Power Dissipation	Power Dissipation	0.4		W

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.2 to 5.5	V
I_{OUT}	Output Current	0 to 200	mA
Ta	Operating Ambient Temperature	−40 to 85	℃
C_{IN}	Effective Input Ceramic Capacitor Value	0.47 to 4.7	uF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.47 to 4.7	uF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

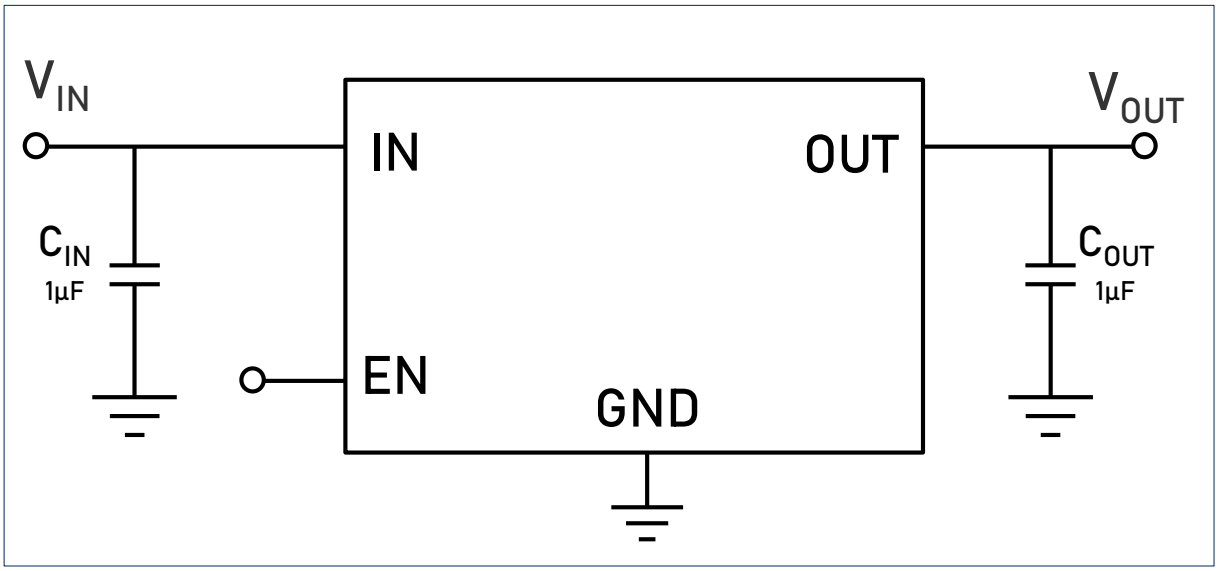
Electrical Characteristics

(V_{IN} = 2.5V; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 3)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Operating Input		2.2		5.5	V
V_{OUT}	Output Voltage	T_A = +25°C	V_{OUT} × 0.99	V_{OUT}	V_{OUT} × 1.013	V
		−40°C ≤ T_A ≤ 85°C	V_{OUT} × 0.97	V_{OUT}	V_{OUT} × 1.027	
$Line_{Reg}$	Line Regulation	2.5V ≤ V_{IN} ≤ 5.5V, I_{OUT} = 1mA		0.05	0.20	%/V
$Load_{Reg}$	Load Regulation	1mA ≤ I_{OUT} ≤ 150mA, V_{IN} = 2.5V		10		mV
V_{DROP}	Dropout Voltage	I_{OUT} = 150mA (Note 4)（Note6）		250		mV
$I_{\_LMT}$	Current Limit		200			mA
I_{SHORT}	Short Circuit Current	V_{OUT} = 0V		170		mA
I_Q	Quiescent Current	I_{OUT} = 0mA		0.6	0.9	μA
I_{Q_OFF}	Standby Current	V_{EN} = 0V, TA = 25°C		0.1	0.5	μA
V_{ENH}	EN Pin Threshold	EN Input Voltage “H”	1.2			V
V_{ENL}	EN Pin Threshold	EN Input Voltage “L”			0.4	V
I_{EN}	EN Pin Current	V_{EN} ≤ V_{IN} ≤ 5.5V		20		nA
PSRR	Power Supply Rejection Ratio	f = 1kHz, VIN = 2.5V + 200mpp Modulation I_{OUT} =150mA(Note 5)		55		dB
e_N	Output Noise Voltage	V_{IN} =2.5V, I_{OUT} = 1mA, f = 10Hz to 100KHz, C_{OUT} = 1μF (Note 5)		55		μVrms

3. Here V_{IN} means internal circuit can work normal. If V_{IN}<V_{OUT},Output voltage follow V_{IN}(I_{OUT}=1mA),circuit is safety.
4. V_{DROP} FT test method: test the V_{out} voltage at V_{set}+$V_{DROPMAX}$ with 150mA output current.
5. Guaranteed by design and characterization. not a FT item.
6. The minimum operating voltage is 2.2V.V_{DROP}=V_{IN}(min)-V_{OUT}。

Application Circuits



Applications Information

General

The LTP3631 is a high performance 150mA Linear Regulator with Ultra Low I_Q. This device delivers low Noise and high Power Supply Rejection Ratio with excellent dynamic performance due to employing the Dynamic Quiescent Current adjustment which assure ultra low I_Q consumption at no-load state. These

parameters make this device very suitable for various battery powered applications.

Input Decoupling (C_{IN})

It is recommended to connect at least a 1µF Ceramic X5R or X7R capacitor between IN and GND pins of the device. This capacitor will provide a low impedance path for any unwanted AC signals or Noise superimposed onto constant Input Voltage. The good input capacitor will limit the influence of input trace inductances and source resistance during sudden load current changes.

Higher capacitance and lower ESR Capacitors will improve the overall line transient response.

Output Decoupling (C_{OUT})

The LTP3631 does not require a minimum Equivalent Series Resistance (ESR) for the output capacitor.The X5R and X7R types have the lowest capacitance variations over temperature thus they are recommended.

There is recommended connect the output capacitor as close as possible to the output pin of the regulator.

Enable Operation

The LTP3631 uses the EN pin to enable /disable its device and to activate /deactivate the active discharge function at devices with this feature. If the EN pin voltage is pulled below 0.4V the device is guaranteed to be disable. The active discharge transistor at the devices with Active Discharge Feature is activated and the output voltage V_{OUT} is pulled to GND through an internal circuitry with effective resistance about 45Ω.

If the EN pin voltage is higher than 1.2V the device is guaranteed to be enabled. The internal active discharge circuitry is switched off and the desired output voltage is available at output pin. In case the Enable function is not required the EN pin should be connected directly to input pin.

Current Limit Protection

When output current at the OUT pin is higher than current limit threshold, the current limit protection will be triggered and clamp the output current to approximately 300mA to prevent over-current and to protect the regulator from damage due to overheating.

Thermal Shutdown

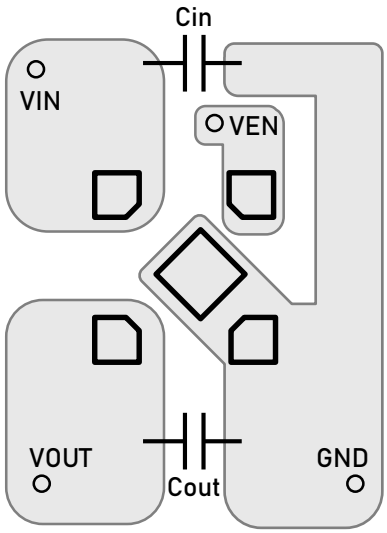
When the die temperature exceeds the Thermal Shutdown point (TSD = 155° C typical) the device goes to disabled state and the output voltage is not delivered until the die temperature decreases to 150° C. The Thermal Shutdown feature provides a protection from a catastrophic device failure at accidental overheating. This protection is not intended to be used as a substitute for proper heat sinking.

Power Dissipation and Heat sinking

The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material and the ambient temperature affect the rate of junction temperature rise for the part. The maximum power dissipation the LTP3631 device can handle is given by:

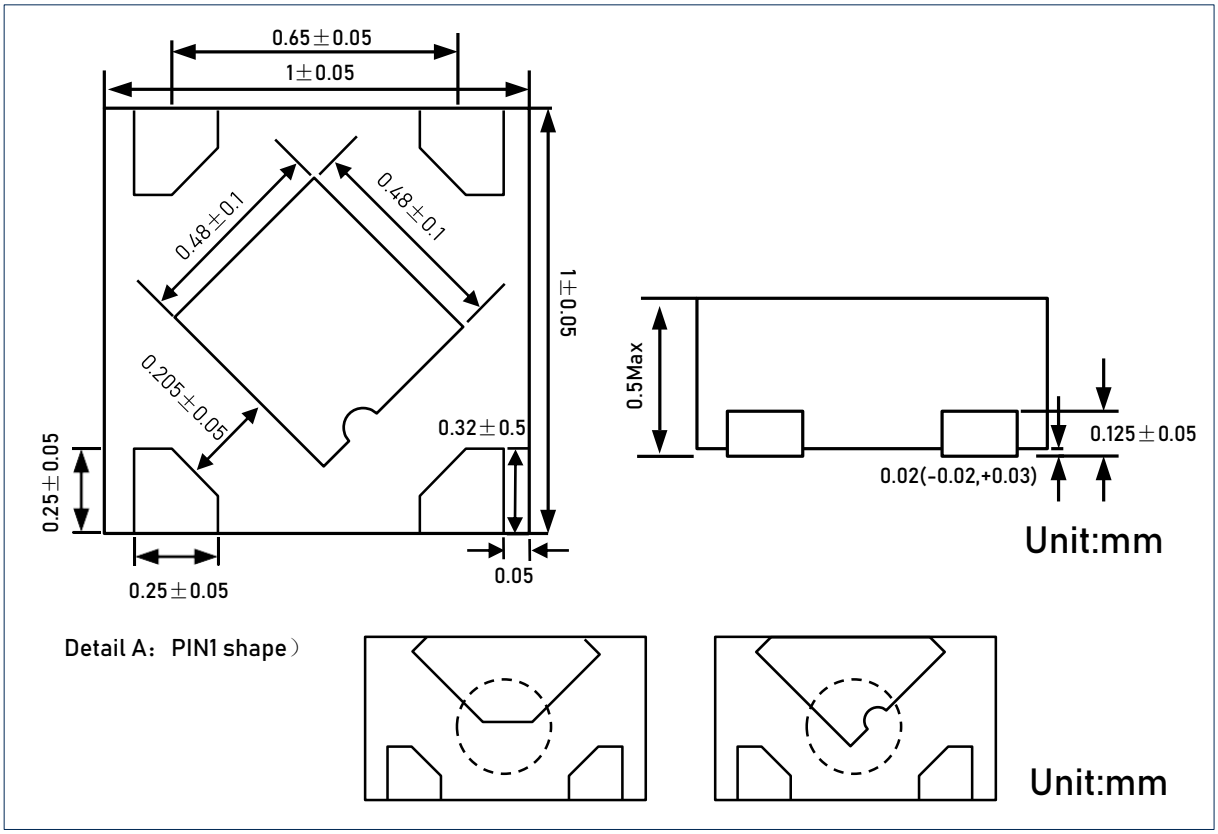
$$P_{D(MAX)} = \frac{\left[T_{J(MAX)} - T_A \right]}{P_{\theta JA}} \qquad \text{(eq.1)}$$

Recommended PCB Layout



Package Dimension

DFN1×1-4L



SOT23-5L