

General Description

The TD1202 is a powerful synchronous stepdown converter that operates over a wide input voltage range from 4.5V to 18V, stably outputting a current of up to 2A. Its excellent load regulation and input voltage regulation ensure a precise and stable output voltage, even in complex environments.

The TD1202 employs advanced current mode control to achieve rapid transient response, optimizing system dynamic performance and significantly improving efficiency in light load mode.

The TD1202 features comprehensive fault protection mechanisms, including current limiting, overvoltage protection, short circuit protection, undervoltage lockout, and thermal shutdown, ensuring safe and stable system operation.

The TD1202 is available in a SOT23-6 package.

Features

- Continuous Maximum Output Current: 2A
- Input Range: 4.5V~18V
- Efficiency Up to 96%
- Excellent Light Load Performance
- Cycle-by-Cycle Overcurrent Protection
- Built-in SCP, OVP, UVLO, and TSD
- SOT23-6 Package

Package Types

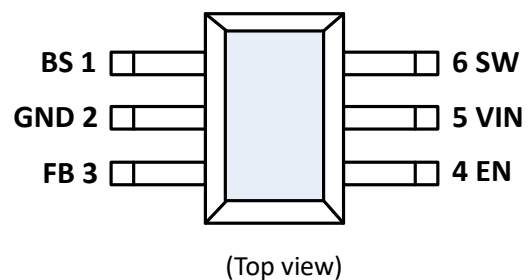


SOT23-6

Applications

- Set-top Box
- Solid State Drive (SSD)
- Television
- Personal Medical Devices
- Toys

Pin Configurations



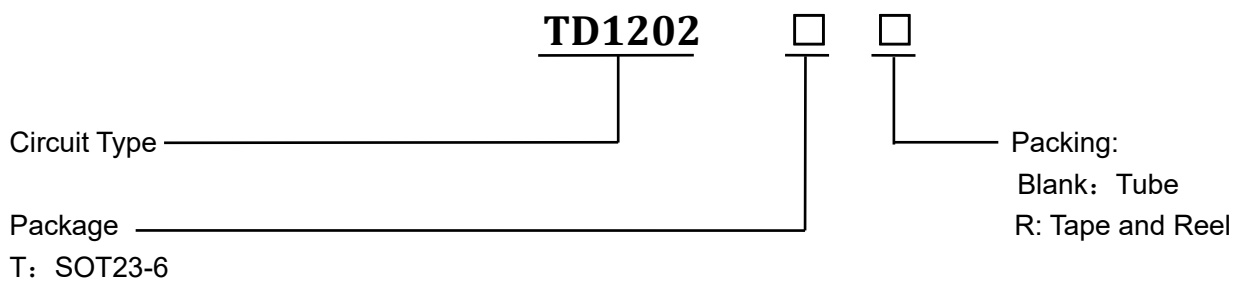
18V, 2A, 500kHz synchronous Buck Converter

TD1202

Pin Description

Pin Number	Pin Name	Description
1	BS	Boost input for high-side gate driver (connected to bootstrap capacitor)
2	GND	Ground pin.
3	FB	Output voltage feedback.
4	EN	Enable pin.
5	VIN	Power supply input.
6	SW	SW pin, connected to inductor.

Ordering Information



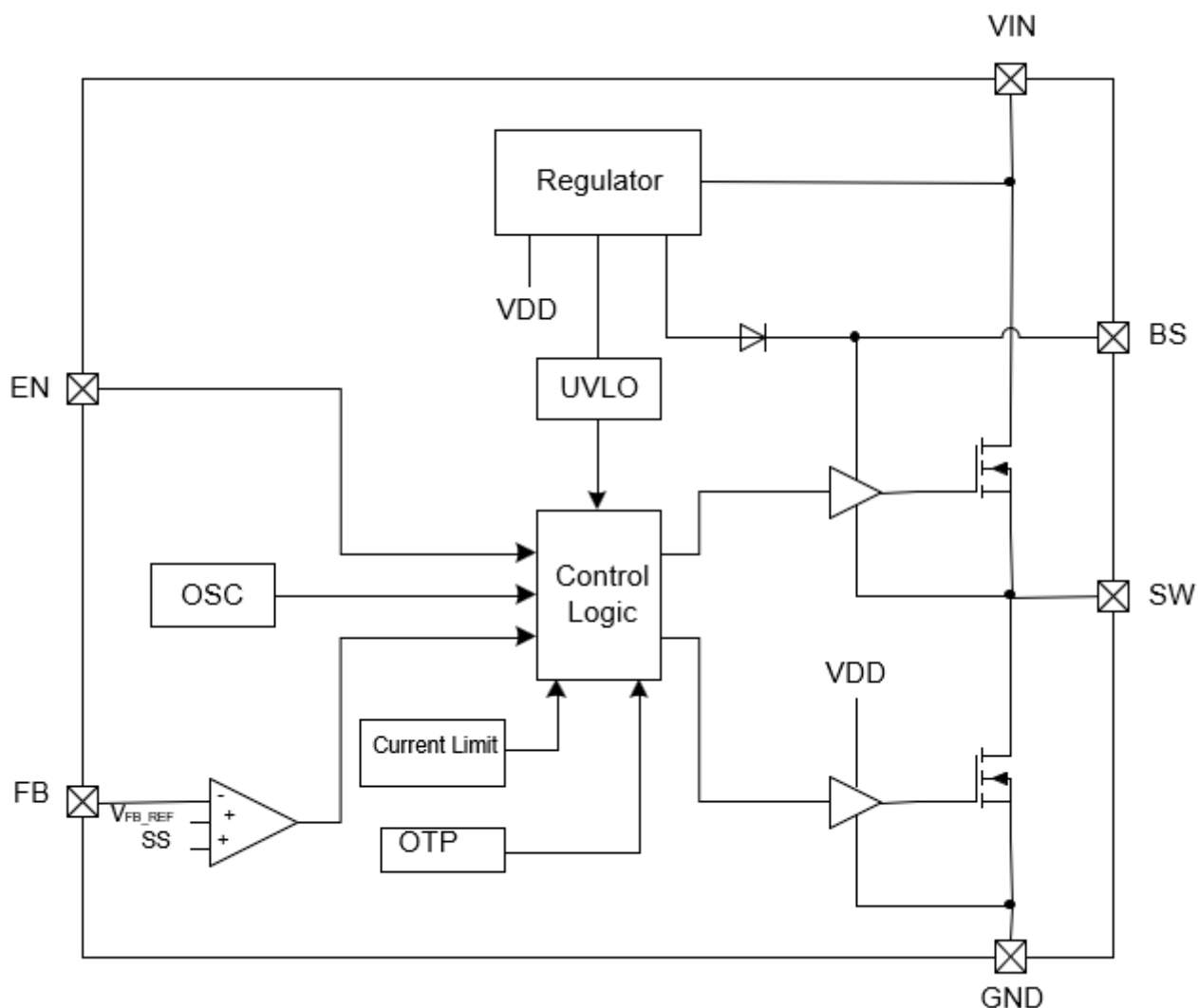
Functional Block

Figure1 Functional Block Diagram of TD1202

18V, 2A, 500kHz synchronous Buck Converter

TD1202

Absolute Maximum Ratings (Note1)

Symbol	Parameter	Rating	Unit
V _{IN}	VIN Supply Voltage	-0.3 ~ 19	V
V _{SW}	SW to GND Voltage	-0.3 ~ 19	V
V _{BS}	BS to GND Voltage	-0.3 ~ V _{SW} +6	V
V _{EN}	EN voltage range	-0.3 ~ 19	V
V _{FB}	FB voltage range	-0.3 ~ 6	V
T _J	Junction Temperature	150	°C
T _{STG}	Storage Temperature	-55 ~ 150	°C
T _{SDR}	Maximum Lead Soldering Temperature (10 Seconds)	260	°C

Note1: 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 under "recommended operating conditions" is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Thermal Characteristics

Symbol	Parameter	Typical Value	Unit
θ _{JA}	Junction-to-Ambient Resistance in free air (Note 2) SOT-23-6	220	°C/W

Note 2: θ_{JA} is measured with the component mounted on a high effective thermal conductivity test board in free air.

Recommended Operation Conditions (Note3)

Symbol	Parameter	Range	Unit
V _{IN}	VIN Supply Voltage	4.5 ~ 18	V
T _{OPA}	Operating ambient temperature range	-40 ~ 85	°C
T _J	Operating junction temperature range	-40 ~ 125	°C

Note 3: Refer to the typical application circuit

18V, 2A, 500kHz synchronous Buck Converter

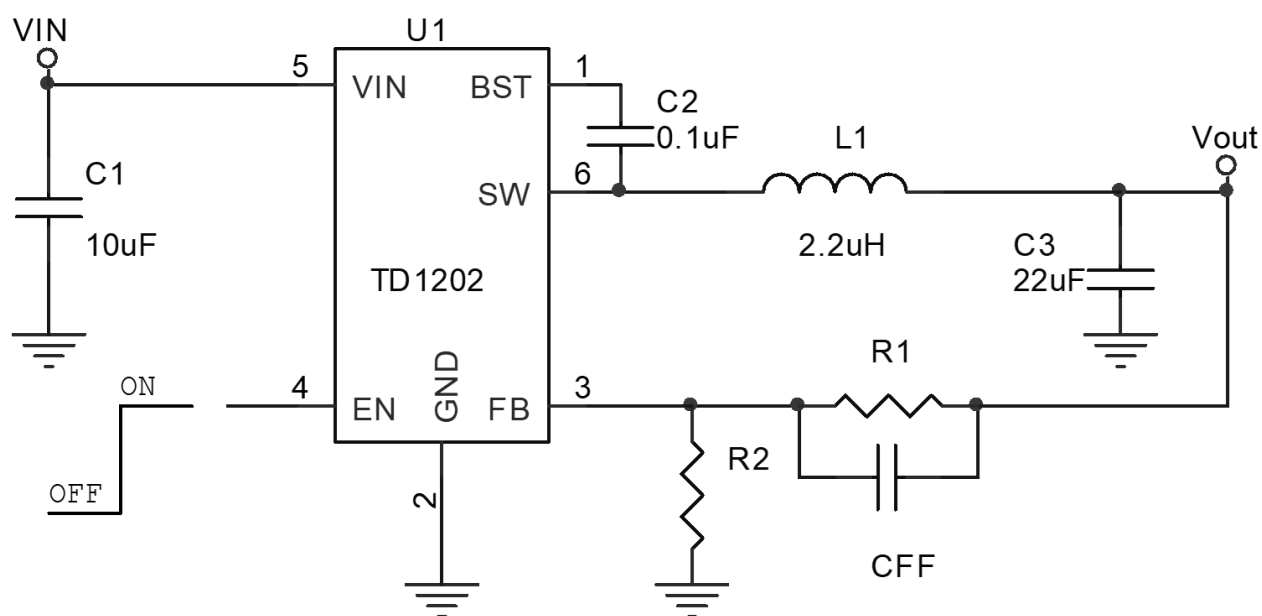
TD1202

Electrical Characteristics

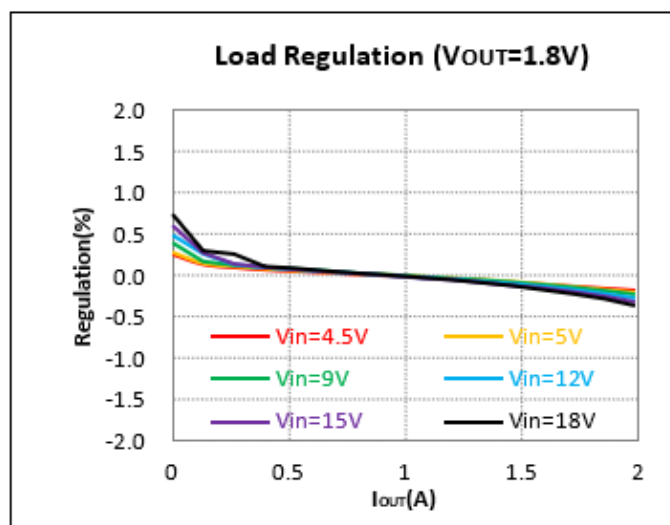
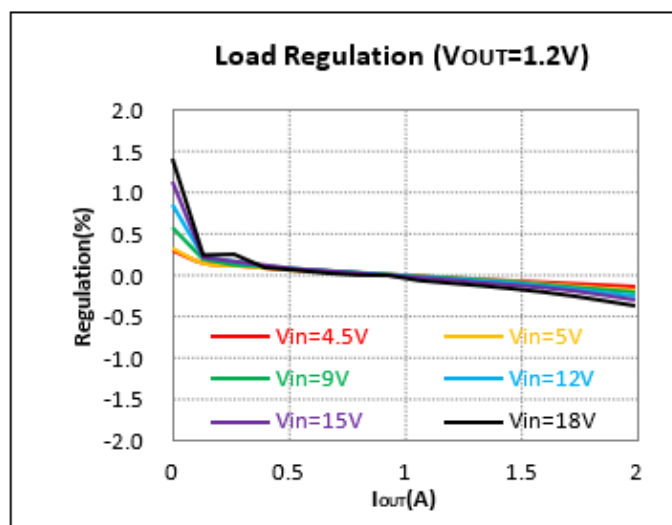
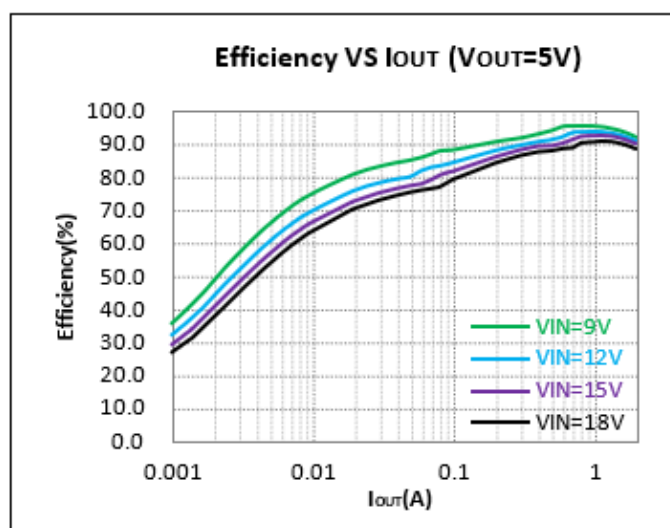
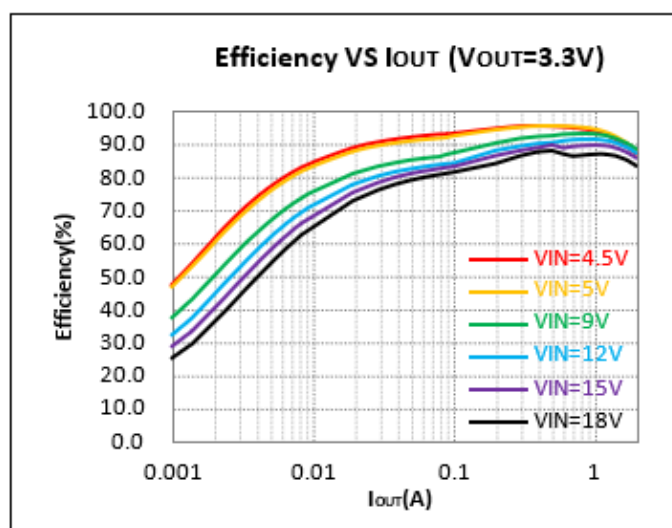
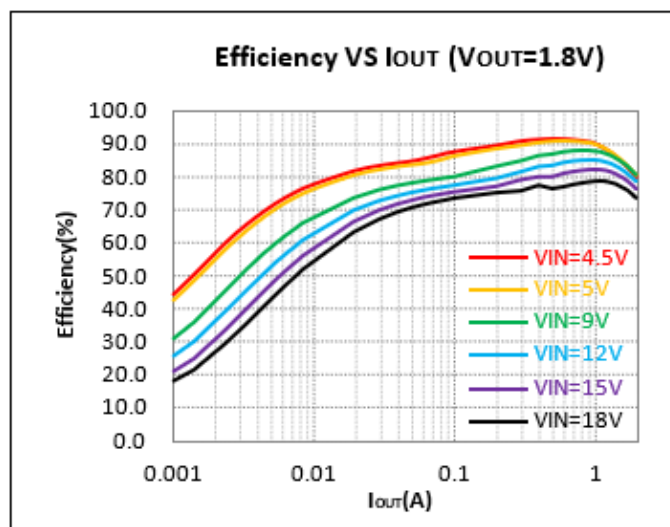
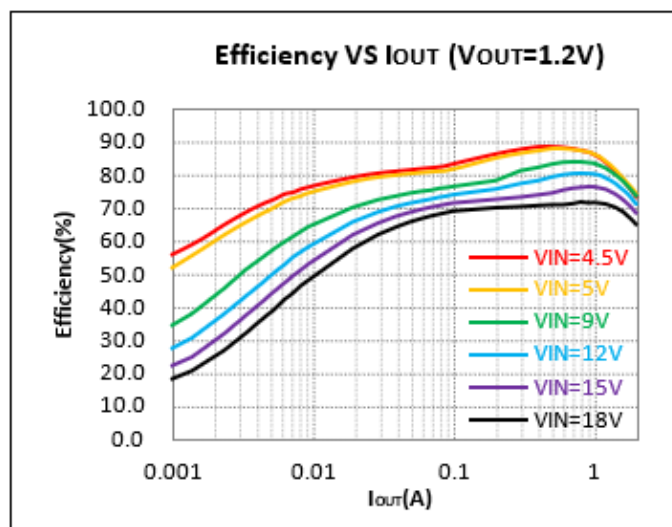
(Unless otherwise specified, $V_{IN}=12V$, $V_{OUT}=3.3V$, $L=4.7\mu H$, $C_{OUT}=22\mu F$, $I_{LOAD}=1A$, $T_A=25^\circ C$).

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
Input supply voltage and current						
V_{IN}	Input voltage range		4.5	-	18	V
V_{UVLO}	UVLO threshold	VIN rise	-	4.2	4.5	V
V_{UVLO_HYS}	UVLO hysteresis	VIN fall	-	0.3	-	V
I_Q	Quiescent current	$I_{OUT}=0$; $V_{FB}=0.63V$	-	370	-	μA
I_{SD}	Shutdown current	$V_{EN}=0V$	-	2	-	μA
Enable						
V_{ENH}	EN turn-on threshold		1.5	-	-	V
V_{ENL}	EN turn-off threshold		-	-	0.4	V
I_{EN}	EN leakage current	$V_{EN}=2V$	-	-	1	μA
Feedback						
V_{FB_REF}	FB reference voltage		0.588	0.600	0.612	V
Oscillator						
F_{OSC}	Operating frequency		400	500	600	kHz
D_{MAX}	Maximum duty cycle		-	95	-	%
Power MOSFET						
R_{DS_ONH}	On-resistance of high-side power MOSFET		-	150	-	m Ω
R_{DS_ONL}	On-resistance of low-side power MOSFET		-	90	-	m Ω
I_{LIM}	Current limitation of high-side power MOSFET		2.4	3.0	-	A
Thermal protection						
T_{SD}	Over temperature protection shutdown			150		$^\circ C$
T_{SD_HYS}	Over temperature protection hysteresis		-	20	-	$^\circ C$

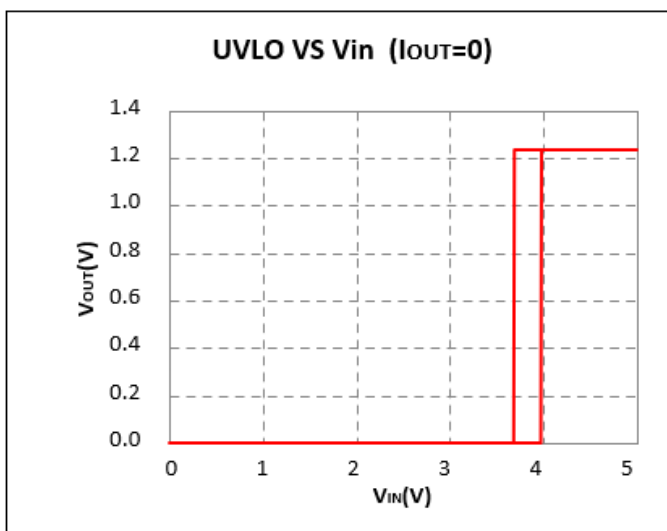
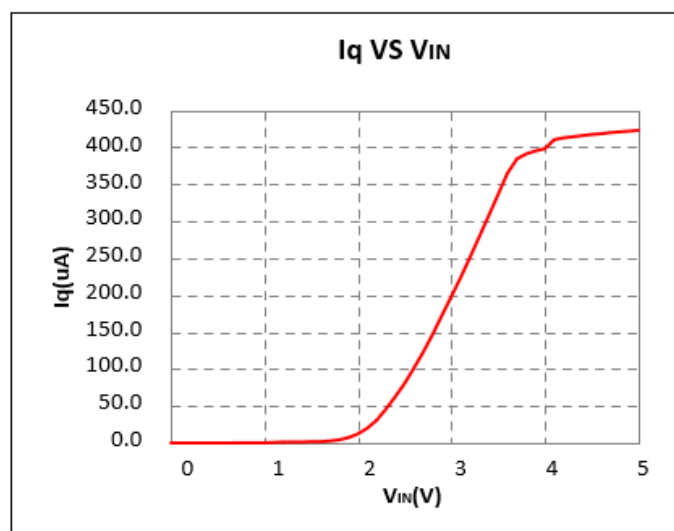
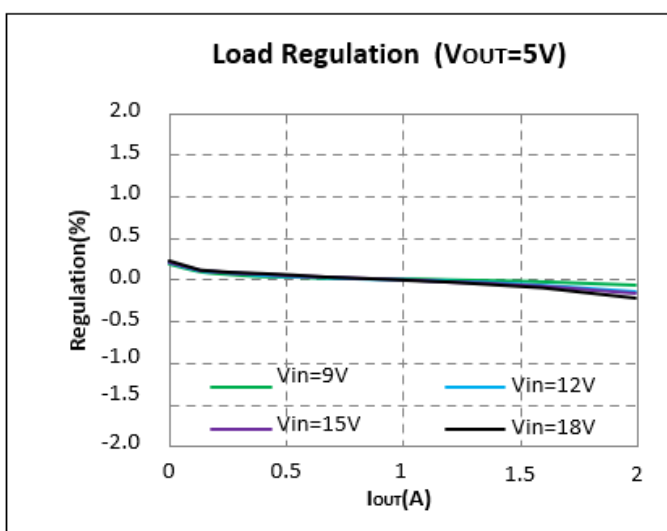
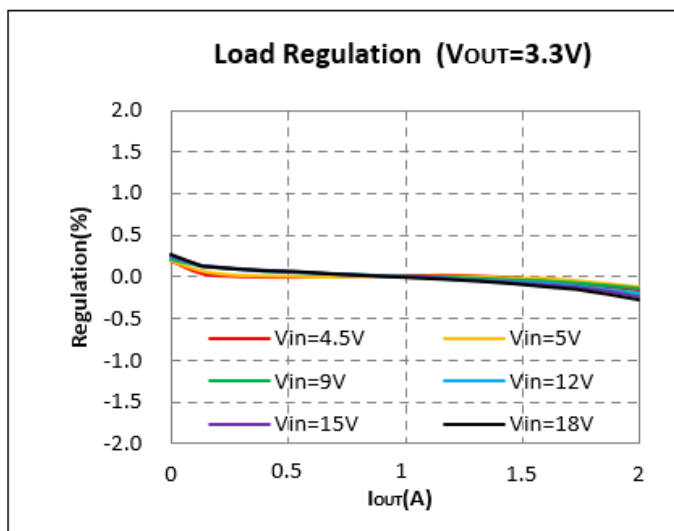
Typical Application Circuit



Typical characteristic curves



Typical characteristic curves(Continued)



Operation description

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Enable Control

The EN pin controls the turn-on and turn-off of the chip. When the voltage at the EN pin is above the turn-on threshold, the chip begins to operate; conversely, when the voltage at the EN pin is below the turn-off threshold, the chip ceases operation. The default state of the EN pin is low level.

Efficient Operation at Light Loads

The TD1202 maintains high efficiency under light loads. When the output transitions from heavy to light loads, the inductor current decreases accordingly. When the minimum inductor current drops to zero, the MOSFET in the TD1202 turns off, entering discontinuous conduction mode. If the load continues to decrease, the chip skips cycles, reducing the switching frequency, thereby maintaining high efficiency at light loads.

UVLO Protection

When the internal regulator voltage of the chip falls below the UVLO (Under Voltage Lock Out) threshold voltage, the chip turns off. Subsequently, the chip enters a restart state.

Thermal Shutdown

If the junction temperature of the chip exceeds the threshold value (typically 150°C), the overheat protection is triggered, and the chip turns off. When the junction temperature decreases to the recovery threshold, the chip enters a restart state.

Application Information

Output Voltage Setting

In the DC-DC conversion system of the TD1202, the output voltage is given by the following formula:

$$V_{OUT} = V_{FB} \cdot \left(1 + \frac{R1}{R2}\right)$$

Where:

V_{OUT} : Output voltage

V_{FB} : Feedback voltage reference, typically 0.6V

$R1$: FB pull-up resistor, connected between the FB pin and the output

$R2$: FB pull-down resistor, connected between the FB pin and GND

Capacitor Selection

To ensure stable operation of the TD1202 chip and effectively reduce noise interference and withstand current surges, at least one 10uF multilayer ceramic capacitor (MLCC) should be placed between each of the V_{IN} (input voltage) and V_{OUT} (output voltage) pins and GND (ground). It is recommended to install two 10uF MLCCs in parallel. This configuration can significantly enhance the circuit's noise suppression and current handling capabilities, thereby protecting the chip from transient voltage and current fluctuations.

Furthermore, it is crucial that these input and output capacitors be placed as close as possible to the V_{IN} and V_{OUT} pins of the TD1202. By shortening the connection path between the capacitors and the chip pins, parasitic inductance can be minimized, improving the filtering effect and ensuring the purity and stability of the power signal. Such layout optimization is vital for enhancing the overall circuit performance and reliability.

Inductor Selection

Inductors should be selected based on the following factors:

1. Choose an appropriate inductor based on the ripple current of the maximum output current. Taking 40% ripple

current as an example, the inductor calculation is as follows:

$$L = \frac{V_{OUT} \cdot \left(1 - \frac{V_{OUT}}{V_{IN_MAX}}\right)}{F_{SW} \cdot I_{OUT_MAX} \cdot 40\%}$$

Where:

L : Inductance

V_{OUT} : Output voltage

V_{IN_MAX} : Maximum input voltage

F_{SW} : Operating frequency, typically 500kHz

I_{OUT_MAX} : Maximum output current

2. Select an inductor with an appropriate saturation current rating.

$$I_{SAT_MIN} > I_{OUT_MAX} + I_{RIPPLE}$$

Where:

I_{SAT_MIN} : Inductor saturation current rating

I_{RIPPLE} : Ripple current

I_{OUT_MAX} : Maximum output current

3. The DCR (DC resistance) and core losses of the inductor must be sufficiently low to reduce power consumption and meet efficiency requirements. It is recommended to choose an inductor with $DCR < 50m\Omega$.

Thermal Considerations

Although the TD1202 is an efficient DC/DC converter, some power loss will always occur during the conversion process, most of which will be converted into heat, raising the junction temperature. Therefore, it is important to ensure a well-ventilated PCB design. In PCB design, make the grounding copper foil of the PCB large enough to dissipate the heat generated by the chip.

PCB Layout

When laying out the PCB, the loop area needs to be considered, and key peripheral components such as input capacitors, output capacitors, and inductors need to be placed reasonably.

1.CIN must be close to the VIN and GND pins. The loop area formed by CIN and GND must be minimized.

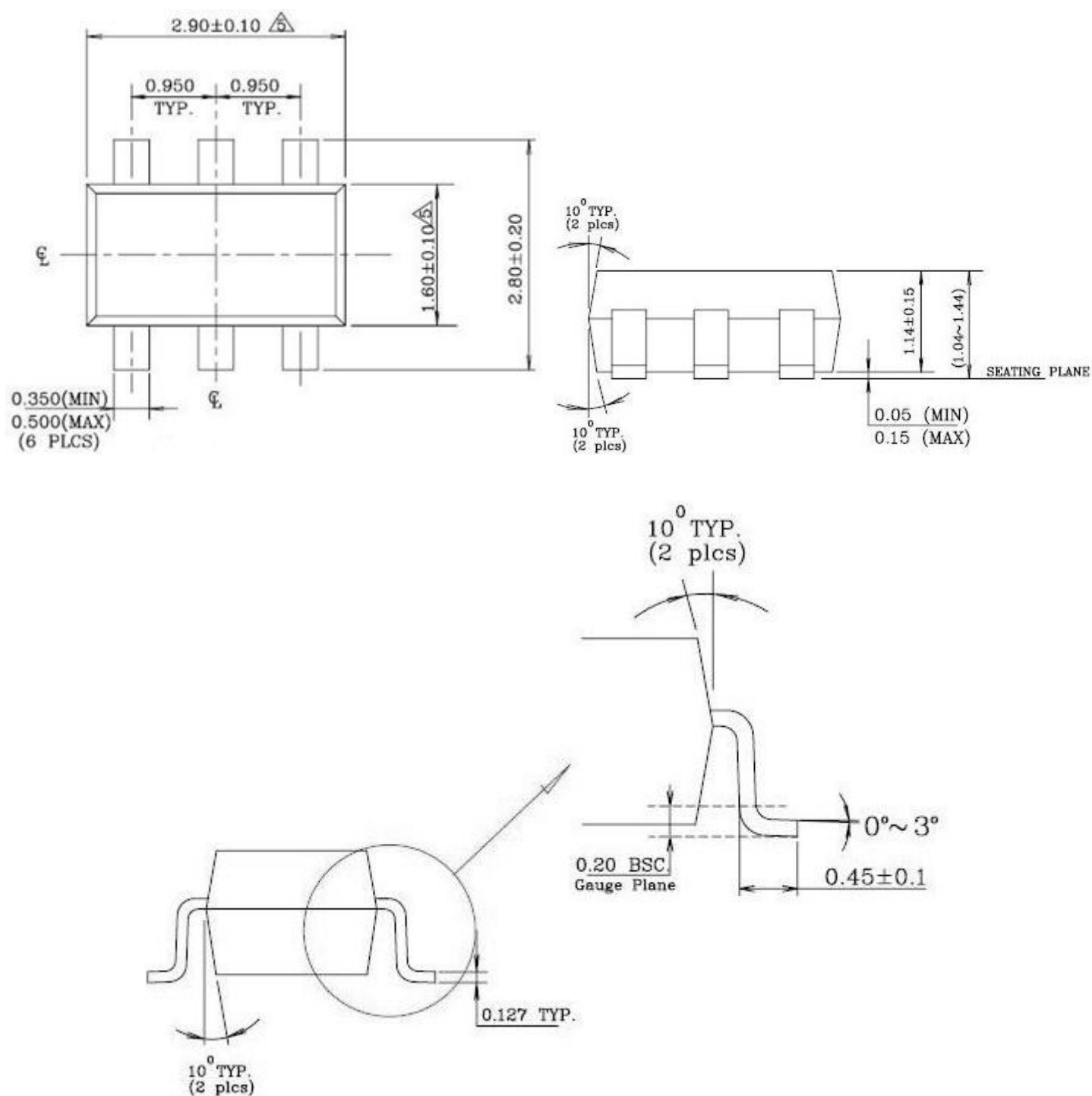
2.The copper area on the PCB connected to the SW pin must be minimized to avoid potential noise issues.

3.The FB pin, FB pull-up resistor, and FB pull-down resistor must be kept away from the switching node to avoid interference.

4.If the system chip interfacing with the EN pin has a high-impedance state in shutdown mode and the IN pin is directly connected to a power source such as a lithium-ion battery, it is advisable to add a pull-down 1MΩ resistor between the EN and GND pins to prevent noise from accidentally triggering the regulator to turn on in shutdown mode.

Package Information

SOT23-6 Package Outline Dimensions



Design Notes