LOW QUIESCENT CURRENT, LOW INPUT VOLTAGE, 0.55A SWITCH CURRENT BOOST CONVERTER

AWT6722

KEY FEATURES

- Low I_Q, 5.5μA No-load Input Current
- Up to 95% Efficiency at Typical Operating Conditions
- Operating Input Voltage from 0.75V to 5V
- Feedback Voltage 500mV
- 550mA Switching Current Limit
- Adjustable Output Voltage from 1.8V to 5V
- Ultra-Low 0.1μA Shutdown Current
- Minimum Switching Current 200mA
- Input Under Voltage Lockout
- Output Overvoltage Protection
- Over-Temperature Protection
- SOT23-6 Package

APPLICATIONS

- Battery Powered Applications
  - 1 to 3 Cell Alkaline, NiCd or NiMH
  - 1 Cell Li-Ion or Li-Primary
- Handheld Instrument
- Smartphones
- GPS Receiver
- Solar or Fuel Cell Powered Applications
- White or Status LEDs
- Consumer and Portable Medical Products

GENERAL DESCRIPTION

The AWT6722 is a synchronous step-up DC-DC converter, which integrated 280mΩ N-channel MOSFET switch and 360m Ω synchronous rectifier P-Channel MOSFET to provide a high efficiency solution at nearly 95%.The AWT6722 is based on a peak-current control which provides a power-supply solution for products powered by either a single-cell, two-cell, or three-cell alkaline, NiCd or NiMH, or one-cell Li-Ion or Li-polymer battery such as input voltage at 0.75V. The output voltage of the converter can be adjusted by an external resistor divider from 1.8V to 5V. The AWT6722 is available in a space-saving SOT23-6 package.

TYPICAL APPLICATION

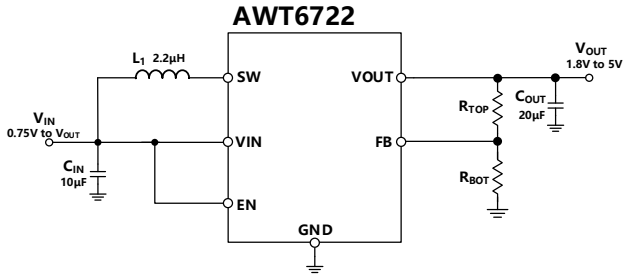

Figure 1. Typical Application Circuit

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TABLE OF CONTENTS

Key Features 1
Applications 1
General Description 1
Typical Application 1
Table of Contents 2
Pin Configuration 4
Specifications 5
Absolute Maximum Ratings 5
Recommended Operating Conditions 5
Electrostatic Discharge (ESD) 6
ESD Caution 6
Thermal Resistance 6
Electrical Specifications 7
Typical Performance Characteristics 8
Functional Block Diagram 11
Product Overview 12
Controller Circuit 12
Synchronous Rectifier 12
Enable and Shutdown 12
Start Up 13
Operation at Inductor Current Limit 13
Undervoltage Lockout (UVLO) 13
Overvoltage Protection (OVP) 13
Overtemperature Protection (OTP) 13
Typical Application Circuit 14
Application Information 14
Output Voltage Setting 14
Inductor Selection 15
Input Capacitor Selection 15
Output Capacitor Selection 15
Thermal Information 16
Layout Recommendation 17
Package Information 18
Package Top marking 18
Tape and Reel Box Information 18
Tape and Reel Information 19

Analogwin Datasheet

Package Outlines 20
Ordering Information 21
Revision History 22

Analogwin Datasheet

PIN CONFIGURATION

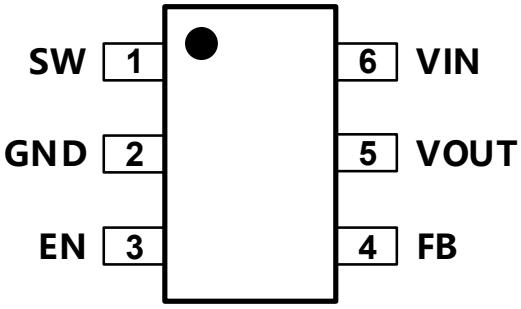

Figure 2. SOT23- 6 Pin configuration (Top View)

Table 1. Pin Function Descriptions

Pin No.	Pin Name	Type[1]	Description
1	SW	I	Rectifying switch input which is connected to inductor.
2	GND	G	Ground pin.
3	EN	A, I	Enable input. Drive EN logic high to turn on the converter; drive EN logic low to turn off the converter.
4	FB	A, I	Feedback node. Connect this pin to the middle point of an external resistor divider from VOUT to GND to set the output voltage.
5	VOUT	P, O	Output voltage pin.
6	VIN	P, I	Input power supply pin.

1 Legend:
A = Analog Pin
P = Power Pin
D = Digital Pin
I = Input Pin
O = Output Pin
G=Ground

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SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Min	Max	Unit
VIN, VOUT, EN, FB	−0.3	6	V
SW Voltage	−0.3	6	V
Continuous Power Dissipation	0.6		W
Junction temperature	−40	150	°C
Storage temperature	−65	150	°C
Lead temperature (soldering, 10sec.)		260	°C

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

RECOMMENDED OPERATING CONDITIONS

Table 3.

Parameters	Min	Typ	Max	Unit
Operating Temperature	−40		85	°C
Continuous Supply Voltage (V_{IN})	0.82		5	V
Output Voltage (V_{OUT})	1.8		5	V
Junction Temperature (T_J)	−40		125	°C

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ELECTROSTATIC DISCHARGE (ESD)

Table 4. ESD Rating

Parameters	Description	Rating	Unit
HBM	Human Body Model ANSI/ESDA/JEDEC JS-001-2024 Classification, Class: 2	±2000	V
CDM	Charged Device Mode ANSI/ESDA/JEDEC JS-002-2025 Classification, Class: C3	±2000	V
Latch-Up	JESD78F.02-2023 Temperature Classification, Class: I	±200	mA

ESD CAUTION

Electrostatic Discharge Sensitive Device.

Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

THERMAL RESISTANCE

Thermal performance is directly linked to printed circuit board (PCB) design and operating environment. Close attention to PCB thermal design is required.

Table 5. Thermal Resistance

Item[1][2]	Description	Value	Unit
θ_{JA}	Junction-to-ambient thermal resistance	195	°C/W
θ_{JC}	Junction-to-case (top) thermal resistance	135	°C/W

(1) The package thermal impedance is calculated in accordance to JESD 51-7.

(2) Thermal Resistances were simulated on a 4-layer, JEDEC board.

Analogwin Datasheet

ELECTRICAL SPECIFICATIONS

Limits apply over the recommended operating junction temperature range of –40°C to +85°C, unless otherwise stated. Minimum and Maximum limits are specified through test, design or statistical correlation. Typical values represent the most likely parametric norm at T_J = 25°C, and are provided for reference purposes only. Unless otherwise stated the following conditions apply: VIN = 1.2V. VOUT is converter output voltage.

Table 6.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DC-DC STAGE						
Minimum Start-up Voltage	V_{ST}	R_{load}≥150Ω, T_J = 25°C			0.75	V
Input Power Range	V_{IN}		0.82		5	V
Output Voltage Range	V_{OUT}	V_{IN} ≤V_{OUT}	1.8		5	V
Undervoltage Lockout(UVLO) Falling threshold	V_{UVLO}	V_{IN} decreasing	0.35	0.55	0.8	V
Shutdown Current from Power Source	I_{SD}	EN=0V		0.1	0.5	μA
Quiescent Current (VIN)	I_Q	V_{EN}=V_{IN}=1.2V, V_{OUT} = 3.3V, Non-switching		2.95	5	μA
Quiescent Current (VOUT)				0.2	1.5	μA
Switch Current limit	I_{LIM}	V_{OUT}=3.3V, V_{IN}=1.2V		0.55		A
Feedback Voltage	V_{FB}		485	500	515	mV
FB Input Bias Current	I_{FB}	V_{FB}=0.5V		0.01	100	nA
NMOS Switch ON Resistance	$R_{DS(ON)}$	V_{OUT}=3.3V		0.28	0.45	Ω
PMOS Switch ON Resistance	$R_{DS(ON)}$	V_{OUT}=3.3V		0.36	0.52	Ω
ENABLE (EN)						
EN Input Low Voltage	V_{IL}	V_{IN} < 1.5V	0.2×VIN			V
EN Input High Voltage	V_{IH}	V_{IN} < 1.5V			0.8×VIN	V
EN Input Low Voltage	V_{IL}	1.5V < V_{IN} < 5V	0.4			V
EN Input High Voltage	V_{IH}	1.5V < V_{IN} < 5V			1.4	V
EN Input Current		EN=GND or V_{IN}		0.01	100	nA
PROTECTIONS						
Over Voltage Protection	V_{OVP}		5.5			V
Over-Temperature Protection	T_{SD}			150		℃
Over-Temperature Hysteresis	T_{SD_HYS}			20		℃

Analogwin Datasheet

TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN} = 1.2V, V_{OUT} = 3.3V, L = 2.2μH(1), C_{OUT} = 2×10μF, T_J = 25°C, unless otherwise noted.

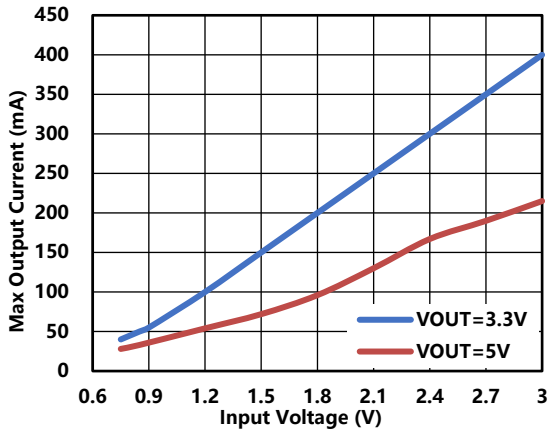

Figure 3. Maximum Output Current vs. Input Voltage

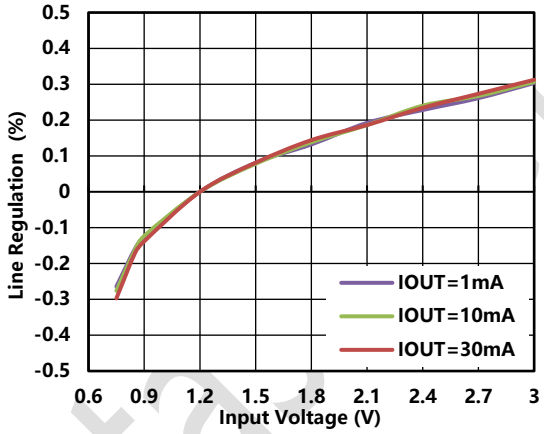

Figure 4. Line Regulation (V_{OUT}=3.3V)

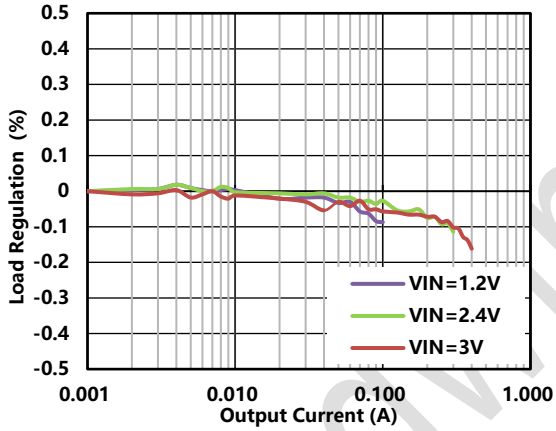

Figure 5. Load Regulation (V_{OUT}=3.3V)

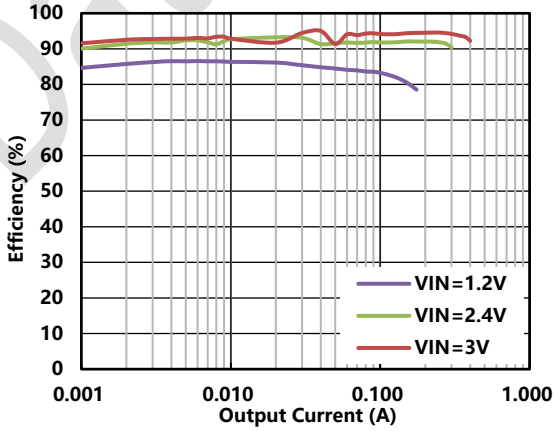

Figure 6. Efficiency vs. Output Current (V_{OUT}=3.3V)

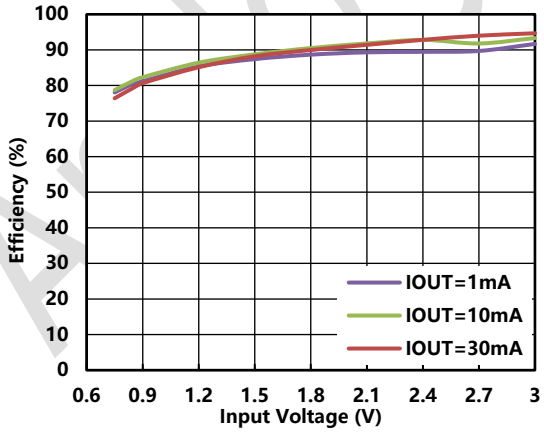

Figure 7. Efficiency vs. Input Voltage (V_{OUT}=3.3V)

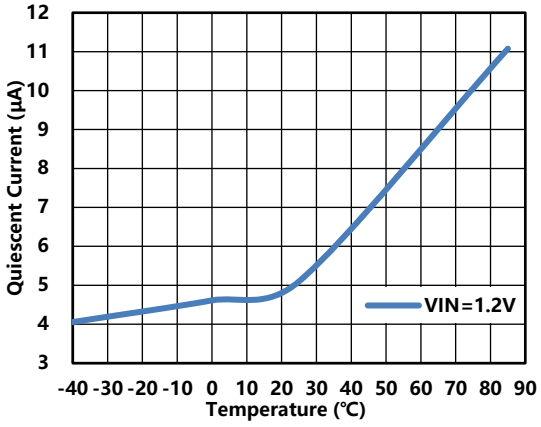

Figure 8. Quiescent current vs. Temperature (V_{OUT}=3.3V)

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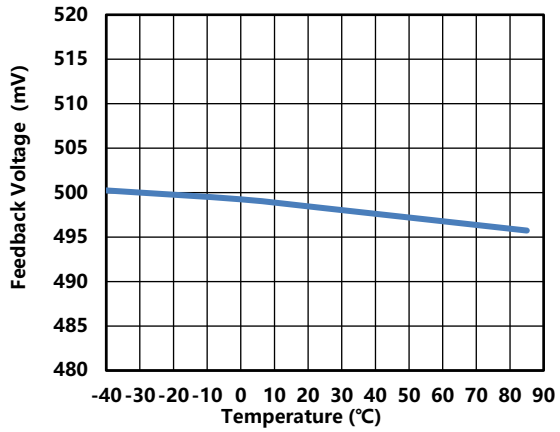

Figure 9. Feedback Voltage vs. Temperature (V_{OUT}=3.3V)

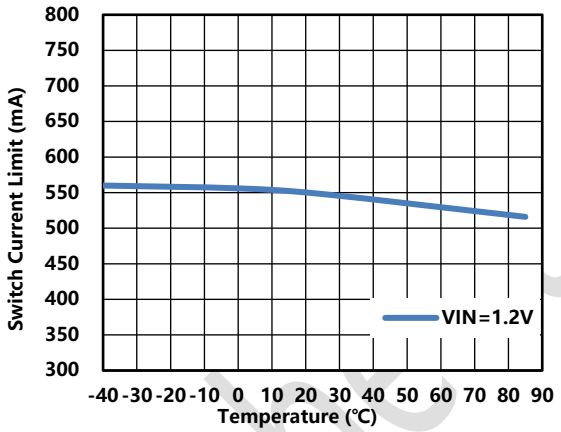

Figure 10. Switch Current Limit vs. Temperature (V_{OUT}=3.3V)

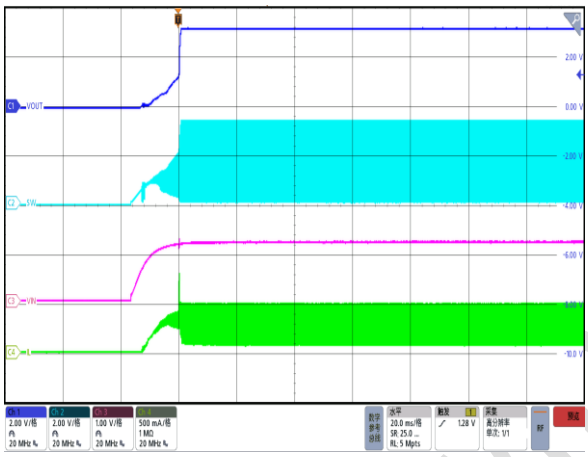

Figure 11. Power On by V_{IN}, V_{IN}=1.2V, V_{OUT}=3.3V, I_{OUT}=90mA

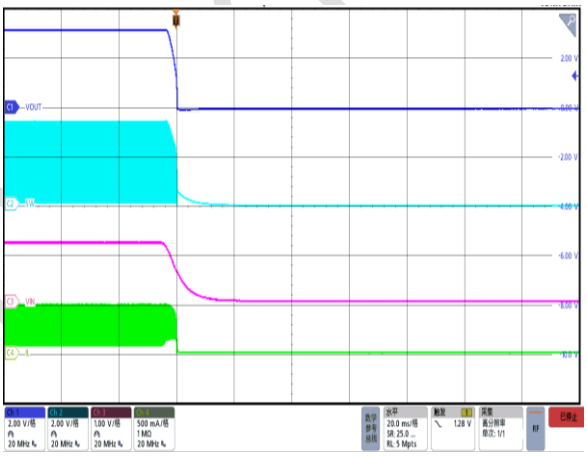

Figure 12. Power Off by V_{IN}, V_{IN}=1.2V, V_{OUT}=3.3V, I_{OUT}=90mA

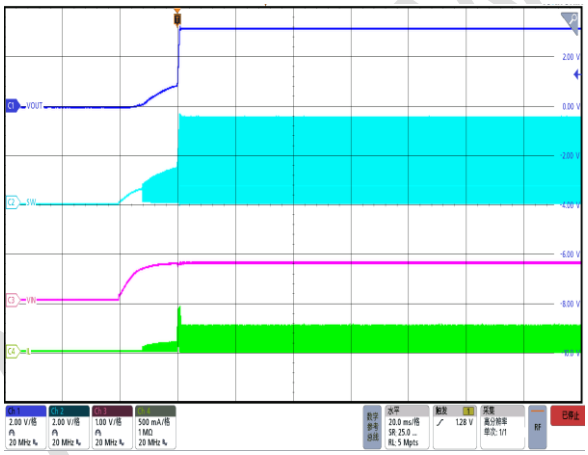

Figure 13. Power On by V_{IN}, V_{IN}=0.75V, V_{OUT}=3.3V, I_{OUT}=5mA

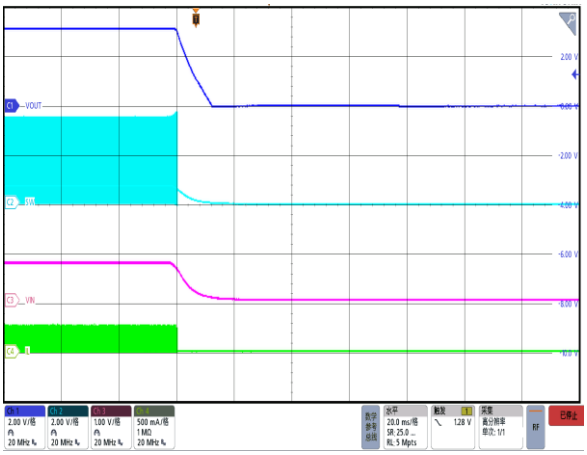

Figure 14. Power Off by V_{IN}, V_{IN}=0.75V, V_{OUT}=3.3V, I_{OUT}=5mA

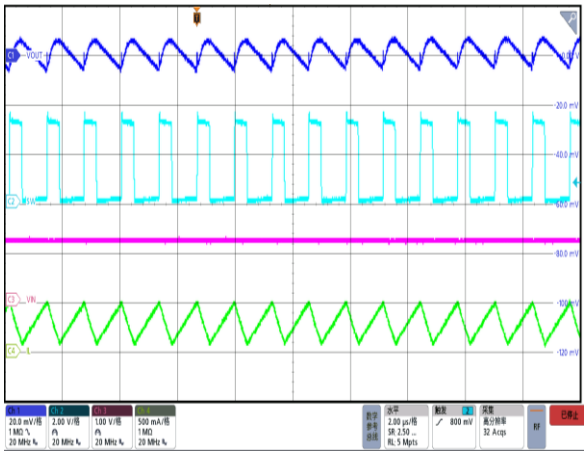

Figure 15. Switching Waveform, V_{IN}=1.2V, V_{OUT}=3.3V, I_{OUT}=90mA

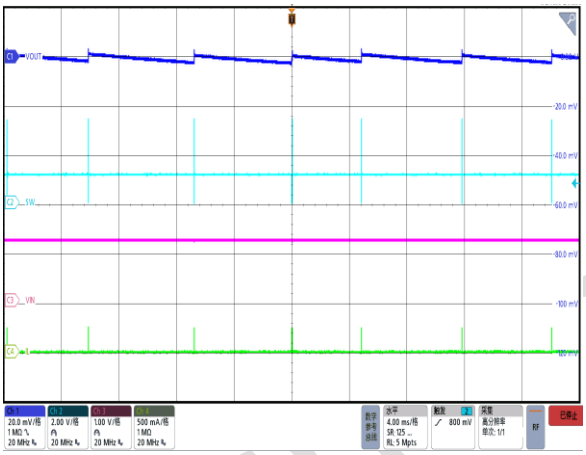

Figure 16. Switching Waveform, V_{IN}=1.2V, V_{OUT}=3.3V, I_{OUT}=0mA

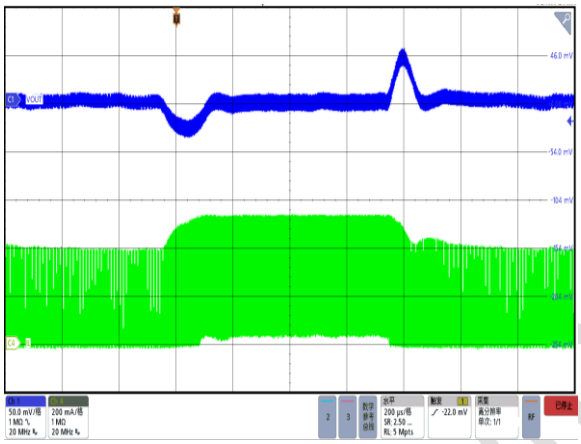

Figure 17. Load Transient, V_{IN}=1.2V, V_{OUT}=3.3V, 20mA to 90mA

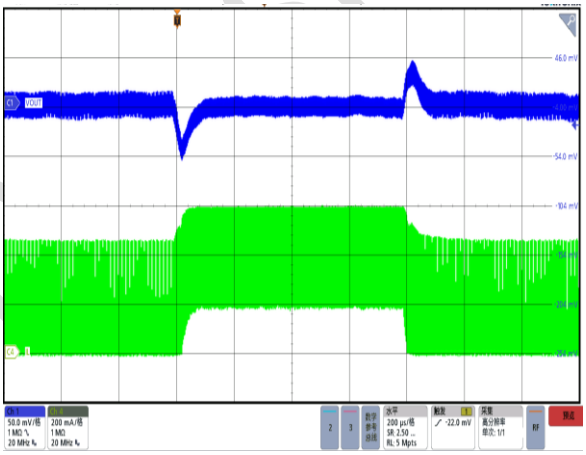

Figure 18. Load Transient, V_{IN}=2.4V, V_{OUT}=3.3V, 60mA to 250mA

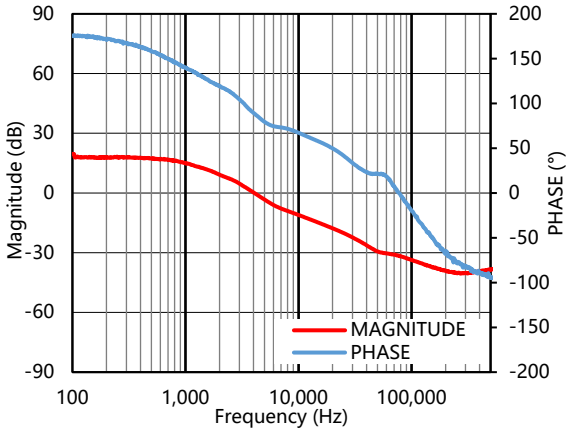

Figure 19. Loop Gain, V_{IN}=1.2V, V_{OUT}=3.3V, I_{OUT}=90mA

Note:

(1) Inductor PN: XAL5030-222MEC; DCR=13.20mΩ.

FUNCTIONAL BLOCK DIAGRAM

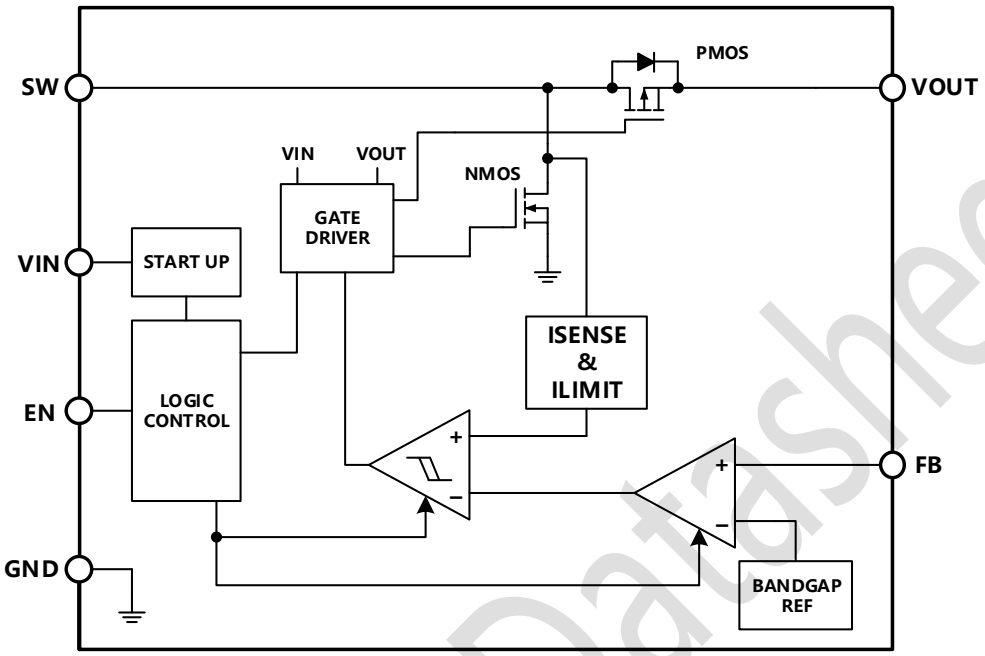

Figure 20. Functional Block Diagram

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PRODUCT OVERVIEW

The AWT6722 is a high performance, highly efficient synchronous boost converter. The device operates with an input voltage from 0.75V to 5V and provides an adjustable output voltage from 1.8V to 5V. With the low quiescent current down to 5.5μA, it is highly adaptable to the products powered by either a single-cell, two-cell, or three-cell alkaline, NiCd or NiMH, or one-cell Li-Ion or Li-polymer battery.

The AWT6722's protection features include undervoltage lockout, output overvoltage protection, over temperature protection.

CONTROLLER CIRCUIT

It employs peak-current-mode control to regulate the output voltage. The AWT6722 is a peak current mode controller boost converter. Its typical maximum peak switch current is 550mA, and the minimum switch current is 200mA when the output voltage exceeds 1.8V. This controller regulates the output voltage by adjusting the peak inductor current based on the load current, thereby achieving precise output voltage regulation. The AWT6722 employs three load-dependent control modes. When the required average input current falls below the average inductor current determined by the minimum switch current (200mA), the converter enters Discontinuous Conduction Mode (DCM), maintaining high efficiency under light loads. If the load current decreases further, it transitions into Burst Mode. In this mode, the boost converter ramps up the output voltage with a switching cycle. Once the output voltage exceeds the set threshold, the controller stops switching and enters a sleep state with quiescent current as low as microamps (μA). The converter resumes the third operating mode (Continuous Conduction Mode, CCM) when the load increases or output voltage drops below the threshold. In CCM, no fixed switching frequency is set. As the load increases, the boost converter actively modulates the output voltage by simultaneously enhancing the peak inductor current and reducing the switching period. The device achieves maximum load capability once the switching frequency reaches the fundamental limit defined by the high-side MOSFET's minimum on-time (t_{onmin}). The regulator is internally compensated and it integrated a slope compensation circuitry to avoid the subharmonic oscillation phenomenon when the duty cycle is above 50%.

SYNCHRONOUS RECTIFIER

The device integrates an N-channel and a P-channel MOSFET transistor to realize a synchronous rectifier. There is no additional Schottky diode required. Because the device uses an integrated low $R_{DS(ON)}$ PMOS switch for rectification, the power conversion efficiency reaches 95%.

ENABLE AND SHUTDOWN

The AWT6722 uses the EN pin to enable and disable the device under normal operating condition. Pull this pin high to enable the device; pull this pin low to shut down the device. In shutdown mode, the regulator stops switching and all internal control circuitry is turned off. In this case the input voltage is connected to the output through the back-gate diode of the rectifying P-Channel MOSFET so that the output voltage is

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always lower than input voltage. If this feature is not needed, connect this pin directly to VIN to start up the device with VIN rising to its internal UVLO threshold.

START UP

When EN is pulled high, the device starts to operate. When VOUT is below 1.8V, the duty cycle is limited in order to avoid high peak currents drawn from the battery. The limit is set internally by the current limit circuit. As soon as the device has built up the output voltage to about 1.8V, high enough for supplying the control circuit, the device switches to its normal peak-current-mode operation. The startup time depends on input voltage and load current.

OPERATION AT INDUCTOR CURRENT LIMIT

If in normal boost operation the inductor current reaches the internal switch current limit threshold the main switch is turned off to stop further increase of the input current. In this case the output voltage will decrease since the device can not provide sufficient power to maintain the set output voltage. If the output voltage drops below the input voltage the backgate diode of the rectifying switch gets forward biased and current starts flow through it. This diode cannot be turned off, so the current finally is only limited by the remaining DC resistances. As soon as the overload condition is removed, the converter resumes providing the set output voltage.

UNDERVOLTAGE LOCKOUT (UVLO)

The AWT6722 features the undervoltage lockout protection for the occurrence of power-on glitch or malfunctioning of the converter. If the V_{IN} drops below the falling threshold, the device shuts down. V_{IN} UVLO is a non-latch protection.

OVERVOLTAGE PROTECTION (OVP)

The AWT6722 output voltage is monitored internally. When the FB pin is accidentally shorted to ground or the output voltage of the AWT6722 exceeds the over-voltage protection threshold of 5.5V, the converter stops switching. The device resumes normal operation until the FB short is removed and the output voltage decreases below 5.5V.

OVERTEMPERATURE PROTECTION (OTP)

The AWT6722 monitors the die temperature. If the junction temperature exceeds 150℃, the internal thermal shutdown circuitry turns off the regulator, stops the MOSFET switching. Overtemperature Protection is a non-latch protection, when the junction temperature falls below to 130℃, the parts resumes normal operation automatically.

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TYPICAL APPLICATION CIRCUIT

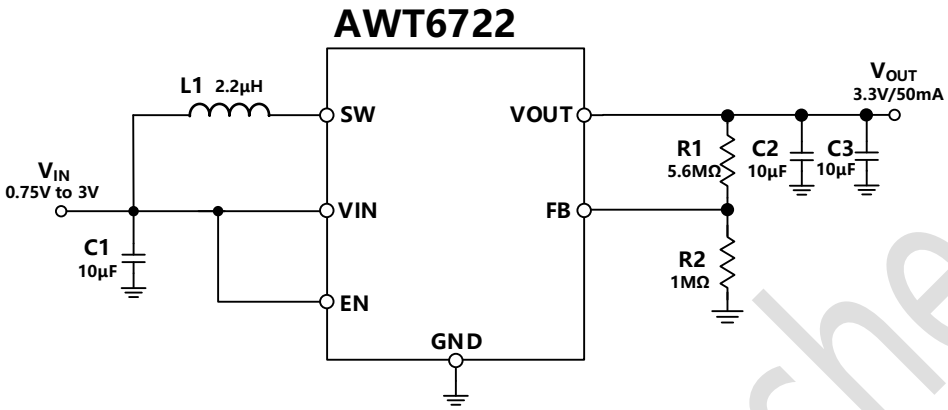

Figure 21. Typical Application Circuit

APPLICATION INFORMATION

Component selection steps are described in this section based on the example specifications listed in Table 7. The schematic of this design example is showed in Figure 21. Typical Application Circuit

Table 7. Parameter of Design Example

Parameter	Description
Input Voltage	V_{IN}=0.75V to 3V
Output Voltage	V_{OUT}=3.3V
Output Current	I_{OUT}=50mA

OUTPUT VOLTAGE SETTING

The output voltage of the AWT6722 is set by the external resistor divider showed in Figure 21. Typical Application Circuit. When the output voltage is regulated properly, the typical voltage value at the FB pin is 500 mV. The maximum recommended value for the output voltage is 5 V. The current through the resistive divider should be about 100 times greater than the current into the FB pin. The typical current into the FB pin is 0.01μA, and the voltage across the resistor between FB and GND, R2, is typically 500 mV. Based on those two values, the recommended value for R2 is in the range of 1MΩ. Use the following equation to calculate resistor value of resistor R1,

$$R1 = \frac{(V_{OUT} - V_{FB}) \times R2}{V_{FB}} = 5.6M\Omega$$

where:

V_{OUT}=3.3V, R2=1MΩ.

Analogwin Datasheet

INDUCTOR SELECTION

The inductor value is determined by the switching frequency, input voltage, output voltage, and inductor ripple current. The performance of the inductor affects the transient behavior, efficiency, loop stability. For AWT6722, the Inductor values of 2.2μH show good performance over the whole input and output voltage range.

Use the following equation to choose other inductance values:

$$L = \frac{V_{IN}}{\Delta I_L \times f_{SW}} \times (1 - \frac{V_{IN}}{V_{OUT}})$$

Using a larger inductor value than 2.2μH reduces the output ripple current and then reduces the output voltage ripple, and also leads to better efficiency, but it leads to slower transient behavior. A smaller inductor value offers a fast transient behavior, but it leads to larger inductor ripple current and then decreases efficiency. Using inductor values below 2.2 μH is not recommended.

INPUT CAPACITOR SELECTION

At least a 10 μF input capacitor is recommended to improve transient behavior of the regulator and EMI behavior of the total power supply circuit. To filter the high frequency switching noise, it is recommended that use a lower value capacitor(0.1uF) with 0603 package size. Place the input capacitor as close as possible to the Vin pin.

OUTPUT CAPACITOR SELECTION

The major parameter necessary to define the output capacitor is the maximum allowed output voltage ripple of the converter. The selection of the output capacitor is based on two parts. One is determined by the inductor ripple current going through the ESR of the output capacitors, and the other is determined by the inductor current ripple charging and discharging the output capacitor. Using the following equation to calculate the minimum capacitance needed for the defined ripple, supporting that the ESR is zero:

$$C_{OUT} = \frac{I_{OUT}(V_{OUT} - V_{IN})}{f \times \Delta V_{OUT_RIPPLE} \times V_{OUT}}$$

The total ripple is larger due to the ESR of the output capacitor. Using the following equation to calculate the output capacitor ripple:

$$\Delta V_{OUT_ESR} = \Delta I_L \times R_{ESR}$$

So ceramic capacitors with low ESR are strongly recommended for their small size and low output voltage ripple, which is recommended to place as close as possible to the VOUT and GND pins of the IC.

A minimum capacitance value of 10 μF should be used, 20 μF are recommended. To compensate for the capacitance loss in ceramic capacitors under bias voltage, a capacitor with a voltage rating at least twice the maximum applied voltage should be selected.

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THERMAL INFORMATION

The maximum junction temperature (T_J) of the AWT6722 devices is recommended to 150°C. The thermal resistance of the SOT23-6 package is θ_{JA}=195°C/W. Specified regulator operations are assured to ambient temperature (T_A) of 25°C. Therefore, the maximum power dissipation is about 600mW. More power can be dissipated if the maximum ambient temperature of the application is lower.

$$P_{D_MAX} = \frac{T_{J_MAX} - T_A}{\theta_{JA}}$$

Analogwin Datasheet

LAYOUT RECOMMENDATION

The quality of the PCB layout is essential for the performance of the AWT6722. Bad PCB layout can degrade the output regulation, the EMI and EMC performance. For the best performance the AWT6722, refer to the following guidelines.

1. Place the input capacitor, inductor, and output capacitor as close as possible to the IC, and use the short trace.

2. Keep the switching loop as small as possible.

4. Keep VIN, VOUT, GND paths as short and wide as possible.

5. Place the feedback divider as close as possible to the FB pin to prevent noise pickup.

6. Place enough PCB area for proper heat sinking.

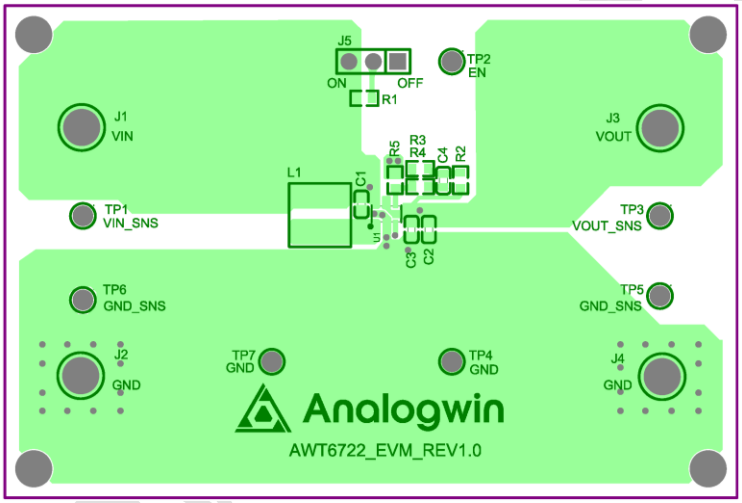

Figure 22. EVM TOP Layer

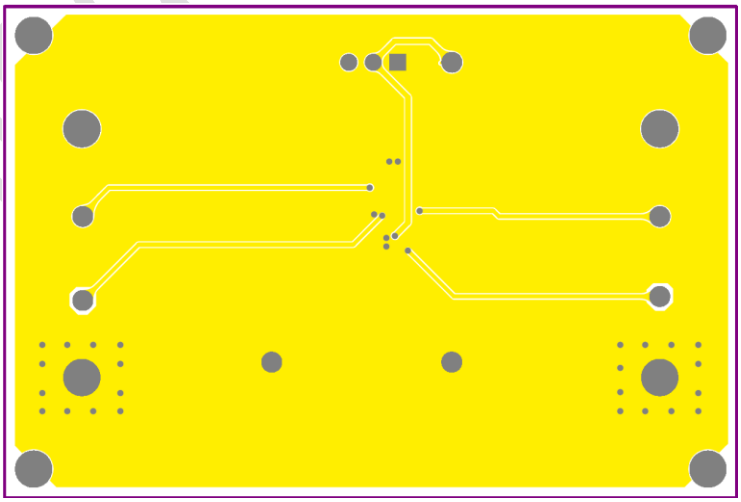

Figure 23. EVM BOTTOM Layer

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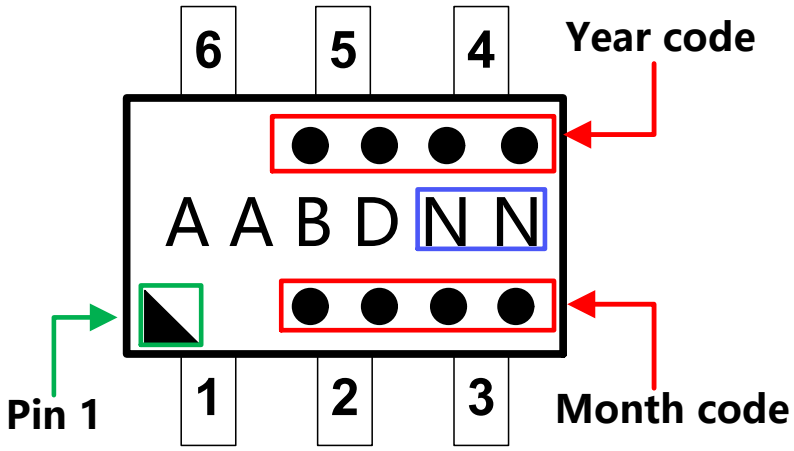
PACKAGE INFORMATION

PACKAGE TOP MARKING



AAB---Internal Code

D---Day code

Year Code---According with Year code Rule

Month Code---According with Month code Rule

NN---Serial No.

Figure 24. Package Top Marking

TAPE AND REEL BOX INFORMATION

DEVICE	PACKAGE TYPE	PACKAGE DRAWING	PINS	SPQ
AWT6722	SOT23-6	SA	6	3000

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TAPE AND REEL INFORMATION

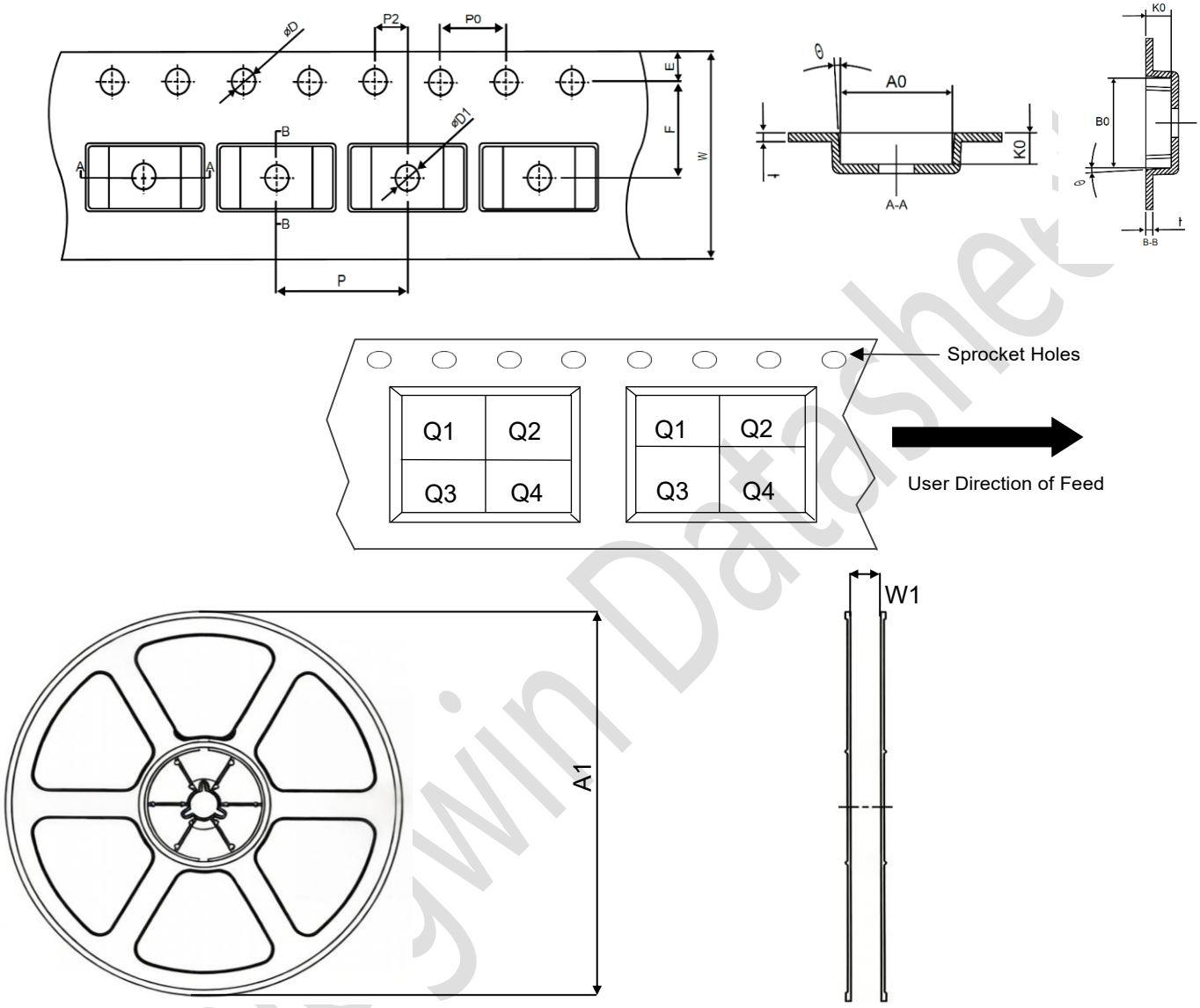

Figure 25. TAPE and Reel Information

DIMENSIONS AND PIN1 ORIENTATION

Device	Package Type	E (mm)	F (mm)	P2 (mm)	D (mm)	D1 (mm)	P0 (mm)	W (mm)	W1 (mm)	P (mm)	A0 (mm)	A1 (mm)	B0 (mm)	K0 (mm)	t (mm)	Pin1 Quadrant	Quantity
AWT6722SAR	SOT23-6	1.75	3.50	2.00	1.50	1.05	4.00	8.00	8.60	4.00	3.26	180.0	3.30	1.40	0.20	Q3	3000

All dimensions are nominal

Analogwin Datasheet

PACKAGE OUTLINES

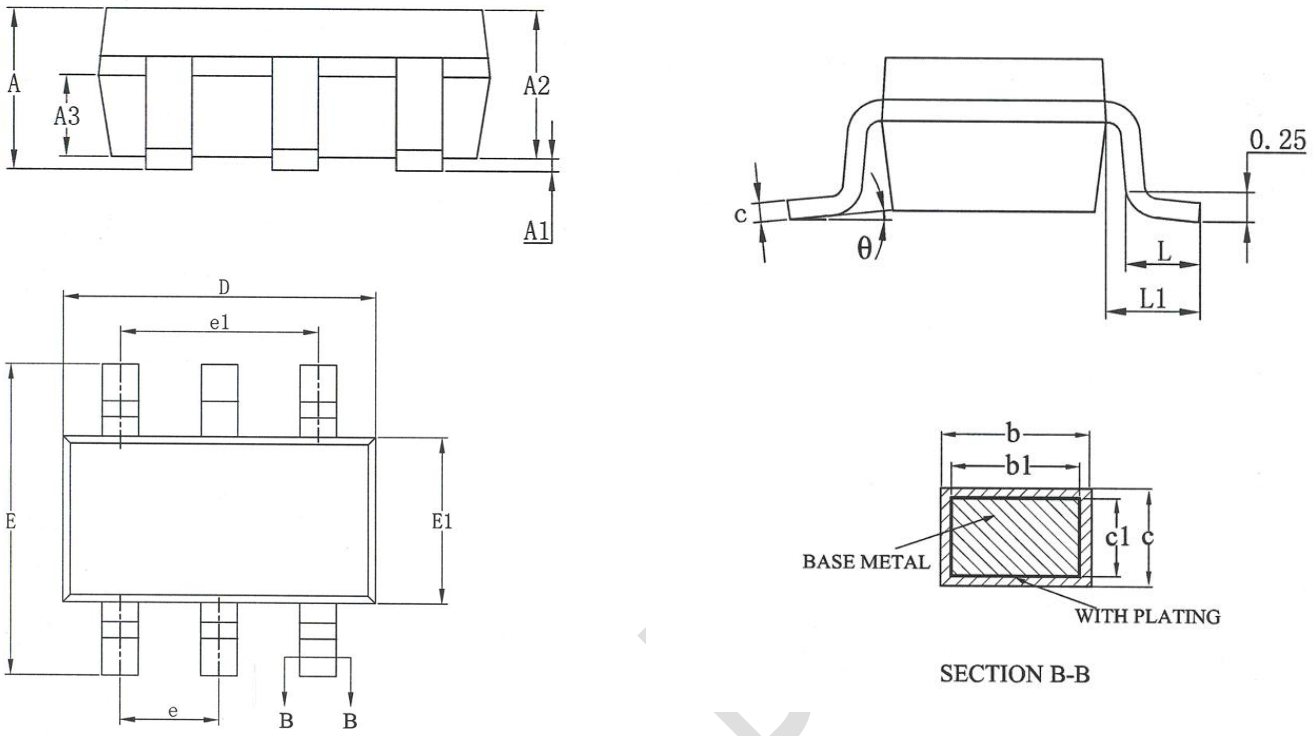

Figure 26. SOT23-6 Package

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	——	——	1.25
A1	0.03	——	0.11
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	——	0.41
b1	0.32	0.35	0.38
c	0.13	——	0.17
c 1	0.12	0.13	0.14
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
L	0.30	——	0.60
L1	0.60REF		
θ	0	——	8^o

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ORDERING INFORMATION

Device	Order Part No.	Package	QTY
AWT6722	AWT6722SAR	SOT23-6, Pb-Free	3000/Reel

Analogwin Datasheet

REVISION HISTORY

Version	Date	Descriptions
Rev. 1.0	10/2025	Initial version
Rev. 1.1	11/2025	1. Update the minimum Feedback Voltage from 480mV to 485mV，the maximum Feedback Voltage from 520mV to 515mV. 2. Update the maximum EN Input High Voltage when 1.5V < V_{IN} < 5V from 1.3V to 1.4V.
Rev.1.2	12/2025	1. Update PACKAGE TOP MARKING. 2. Update TAPE AND REEL INFORMATION. 3. Update Figure 9. Feedback Voltage vs. Temperature (V_{OUT}=3.3V) 4. Update the description about Overvoltage Protection (OVP) 5. Update Thermal Information 6. Update the description about ESD Rating

Analogwin Datasheet

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