ALPHA
SEMICONDUCTOR
Excellence in Analog Power Products

AS2720/21/22/23

2A High Current Low Dropout Voltage Regulator Adjustable & Fixed Output, Fast Response

(ADVANCED INFORMATION)

FEATURES

- Adjustable Output Down To 1.2V
- 1% output accuracy @ 3.3V, 5.0V
- Output Current of 2A
- Low Dropout Voltage 370mV(Typ.) @ 2A.
- Extremely Tight Load And Line Regulation
- Extremely Fast Transient Response
- Standard 3-Terminal Low Cost TO-220, TO-263
- Reverse-battery and "Load Dump" Protection
- Zero-Current Shutdown Mode (5-Pin Versions)
- Error Flag Signal Output Out-of-Regulation (5-Pin Versions)

APPLICATIONS

- Powering VGA & Sound Card
- Power PC™Supplies
- SMPS Post-Regulator
- High Efficiency "Green" Computer Systems
- High Efficiency Linear Power Supplies
- Portable Instrumentation
- Constant Current Regulators
- Adjustable Power Supplies
- Battery charger

PRODUCT DESCRIPTION

The ALPHA Semiconductor AS2720/21/22/23 is a 2A high accuracy, low dropout voltage regulator (350mV(Typ.)@2A). The AS2720/21/22/23 is designed for low voltage applications that requires lower dropout voltage and faster transient response. This device is an excellent choice for use in powering low voltage microprocessor that require a lower dropout, faster transient response to regulate from +2.5V to 3.8V supplies and as a post regulator for switching supplies applications.

The AS2720/21/22/23 offers full protection against over-current faults, reversed input polarity, reversed load insertion, and positive and negative transient voltage. On-Chip trimming adjusts the reference voltage to 1%. Features such as enable pin, Error flag pin are also included in the 5 pin packages.

The AS2720/21/22/23 are offered in a 3 & 5-pin TO-220 & TO-263 packages compatible with other 3 terminal regulators. For a 3A low dropout regulator refer to the AS2730 data sheet.

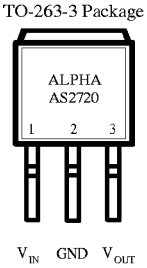
ORDERING INFORMATION

TO-220 3-PIN	TO-220 5-PIN	TO-263 3-PIN	TO-263 5-PIN	OPER.TEMP. RANGE
AS2720U-X	AS2721/22/23U-X	AS2720T-X	AS2721/22/23T-X	-45 to +125°C

X = Output Voltage (3.0V, 5.0V)
Consult with factory for other fixed output voltages.

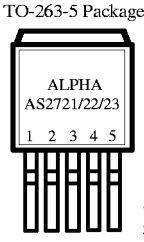
PIN CONNECTIONS

TO-263-3 Package



V_{IN} GND V_{OUT}
Front View

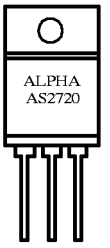
TO-263-5 Package



Top View

AS2721	AS2722	AS2723
1) ENABLE	1) ENABLE	1) FLAG
2) INPUT	2) INPUT	2) INPUT
3) GND	3) GND	3) GND
4) OUTPUT	4) OUTPUT	4) OUTPUT
5) FLAG	5) ADJUST	5) ADJUST

TO-220-3 Package



V_{IN} GND V_{OUT}
Front View

TO-220-5 Package

1 2 3 4 5
Top View

AS2721	AS2722	AS2723
1) ENABLE	1) ENABLE	1) FLAG
2) INPUT	2) INPUT	2) INPUT
3) GND	3) GND	3) GND
4) OUTPUT	4) OUTPUT	4) OUTPUT
5) FLAG	5) ADJUST	5) ADJUST

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Rev.12/3/98

ABSOLUTE MAXIMUM RATINGS

Lead Temp. (Soldering, 5 Seconds) ..... 260°C
Storage Temperature Range..... -65° to +150°C
Operating Junction Temperature Range
AS2720/21/22/23 Control Section ..... -45°C +125°C
AS2720/21/22/23 Power Transistor.....-45°C +150°C

Input Voltage 16V

ELECTRICAL CHARACTERISTICS (NOTE 1) at I_{OUT} = 10mA, T_a=25°C, unless otherwise specified.

PARAMETER	CONDITIONS	Typ	AS2720/21/22/23 Min	Max	Units
3.3V Version					
Output Voltage (Note 2)	I_{OUT} = 10mA 10mA ≤I_{OUT}≤ 2A, 4.75V≤V_{IN} ≤16V	3.3 3.3	3.270 3.240	3.330 3.360	V
5.0V Version					
Output Voltage (Note 2)	I_{OUT} = 10mA 10mA ≤I_{OUT}≤ 2A, 5.5V≤V_{IN} ≤16V	5.0 5.0	4.95 4.90	5.05 5.10	V
All Voltage Options					
Reference Voltage		1.240	1.228 1.215	1.252 1.265	V
Reference Voltage	(Note 8)`		1.203	1.277	V
Line Regulation	I_O = 10mA, (V_{OUT} + 1V) ≤ V_{IN}≤ 16V	0.06		0.5	%
Load Regulation	V_{IN} = V_{OUT} + 5V, 10mA ≤ I_{OUT}≤ $I_{FULLLOAD}$ (Note 2, 6)	0.2		1	%
$\frac{\Delta V_O}{\Delta T}$	Output Voltage (Note 6) Temperature Coef.	20		100	ppm/°C
Dropout Voltage	I_O = 100mA	80		175	mV
	I_O = 1.5A	250			
	I_O = 2A	370		600	
Ground Current	I_O = 1.5A, V_{IN} = V_{OUT}, +1V I_O = 2A	10 37		35	mA
I_{GNDDO} Ground Pin Current at Dropout	V_{IN} = 0.5V less than specified V_{OUT} I_{OUT} = 10mA	0.9			mA
Current Limit	V_{OUT} = 0V (Note 4)	4.5	3.0		A
Output Noise Voltage (10Hz to 100kHz) I_L = 100mA	C_L = 10µF C_L = 33µF	400 260			V_{RMS}
Adjust Pin Bias Current		40		80 120	nA
Reference Voltage Temperature Coefficient	(Note 7)	20			ppm/°C
Adjust Pin Bias Current Temperature Coefficient		0.1			nA/°C
Flag Output (Error Comparator) AS2721/AS2723					
Output Leakage Current	V_{OH} = 16V	0.01		1.00 2.00	µA
Output Low Voltage	Device set for 5V. V_{IN} = 4.5V I_{OL} = 250µA	220		300 400	mV

(Cont.)

Upper Threshold Voltage	Device set for 5V (Note 9)	60	40 25		mV
Lower Threshold Voltage	Device set for 5V (Note 9)	75		95 140	mV
Hysteresis	Device set for 5V (Note 9)	15			mV
ENABLE Input AS2721/AS2722					
Input Logic Voltage Low (OFF) High (ON)			 2.4	0.8	V
Enable Pin Input Current	V_{EN} = 16V	100		600 750	V
	V_{EN} = 0.8V			1 2	µA
Regulator Output Current in Shutdown	(Note 10)	10		 500	µA

The Bold specifications apply to the full operating temperature range.

Note 1: Maximum positive supply voltage of 60V must be of limited duration (<100msec) and duty cycle.) The maximum continuous supply voltage is 16V.

Note 2: Full load current (I_{FL}) is defined as 1.5A for the

Note 3: Dropout voltage is defined as the input-to output differential when the output voltage drops to 99% of its nominal value with V_{OUT} + 1V applied to V_{IN}.

Note 4: $V_{IN} = V_{OUT\ (NOMINAL)}$ +1V. For example, use V_{IN}= 4.3V for a3.3V regulator. Employ pulse-testing procedures to minimize temperature rise.

Note 5: Ground pin current is the regulator quiescent current. The total current drawn from the source is the sum of the load current to the ground current.

Note 6: Output voltage temperature coefficient is defined as the worst case voltage changed divided by the total temperature range.

Note 7: Thermal regulation is defined as the change in the output voltage at a time T after a change in power dissipation is applied, excluding load or line regulation effects. Specifications are for a 200mA load pulse as V_{IN} = 20V (a 4W pulse) for T = 10ms.

Note 8: $V_{REF} \le V_{OUT} \le (V_{IN} - 1)$, $2.3V \le V_{IN} \le 16V$, $10mA < IL \le I_{FL}$, $TJ \le T_{JMAX}$

Note 9: Comparator threshold is expressed in terms of a voltage differential at the Adjust terminal below the nominal reference voltage measured a 6V input. To express these thresholds in terms of output voltage change, multiply the error amplifier gain = V_{OUT}/V_{REF} = (R1 + R2)R2. For example, at a programmable output voltage of 5V, the Error output is guaranteed to go low when the output drops by 95mVx 5V/ 1.240V = 38mV. Threshold remain constant as a percent of V_{OUT} as V_{OUT} is varied, with the dropout warning occurring at typically 5% below nominal, 7.7% guaranteed.

Note 10: $V_{EN} \le 0.8V$ and $V_{IN} \le 16V$, $V_{OUT} = 0$.

APPLICATION HINTS

The ALPHA Semiconductor AS2720/21/22/23 incorporates protection against over-current faults, reversed load insertion, over temperature operation, and positive and negative transient voltage. However, the use of an output capacitor is required in order to insure the stability and the performances.

Thermal Consideration

Although the AS2720/21/22/23 offers some limiting circuitry for overload conditions, it is necessary not to exceed the maximum junction temperature, and therefore to be careful about thermal resistance. The heat flow will follow the lowest resistance path, which is the Junction-to-case thermal resistance. In order to insure the best thermal flow of the component, a proper mounting is required. Note that the case of the device is electrically connected to the output. In case the case has to be electrically isolated, a thermally conductive spacer can be used. However do not forget to consider its contribution to thermal resistance.

Assuming:
V_{IN} = 10V, V_{OUT} = 5V, I_{OUT} = 1.5A, T_A = 90°C, θ_{CASE}= 1°C/W (no external heat sink, no wind)

Power dissipation under these conditions
$P_D = (V_{IN} - V_{OUT}) * I_{OUT}$ = 7.5W

Junction Temperature
$T_J = T_A + P_D * (\theta_{CASE} + \theta_{JC})$

For the Control Section
T_J = 90°C + 7.5W*(1°C/W + 0.6°C/W) = 102°C
102°C < $T_{JUNCTION\ MAX}$ for the control section.

For the Power Section
T_J = 90°C + 7.5W*(1°C/W + 1.6°C/W) = 104.5°C
104.5°C < $T_{JUNCTION\ MAX}$ for the power transistor.

In both case reliable operation is insured by adequate junction temperature.

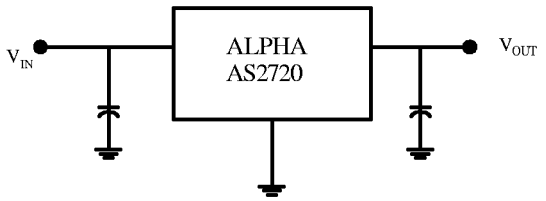

Fig.2 Basic Fixed Regulator

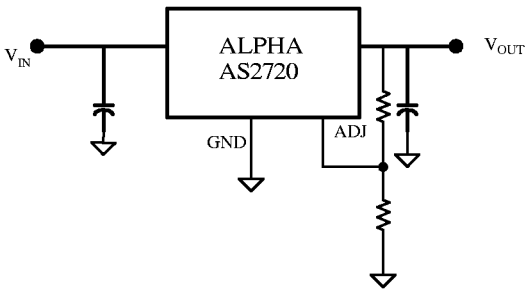

Fig.2 Basic Adjustable Regulator