AS3729

5A Power Stage

General Description

The AS3729 is a companion power stage, intended to be used with AS372x products. It cannot be used without a DCDC controller. It contains the power FETs for 2 phases and is capable to handle output currents of 2.5A per phase.

Ordering Information and Content Guide appear at end of datasheet.

Key Benefits & Features

The benefits and features of AS3729, 5A Power Stage are listed below:

Figure 1:
Added Value of Using AS3729

Benefits	Features
Support for single or dual phase operation	• 2 phases with separate control input
2 x 2.5A output stages are running on 3MHz	• Separate power NMOS & PMOS for 2.5A per phase • Separate coil current feedback per phase • Stand-alone zero-crossing operation
Over-temperature protection	• Integrated temperature monitoring
Cost effective, small package	• 16-pin WL-CSP: 1.615mm x 1.615mm, 0.4mm pitch

Applications

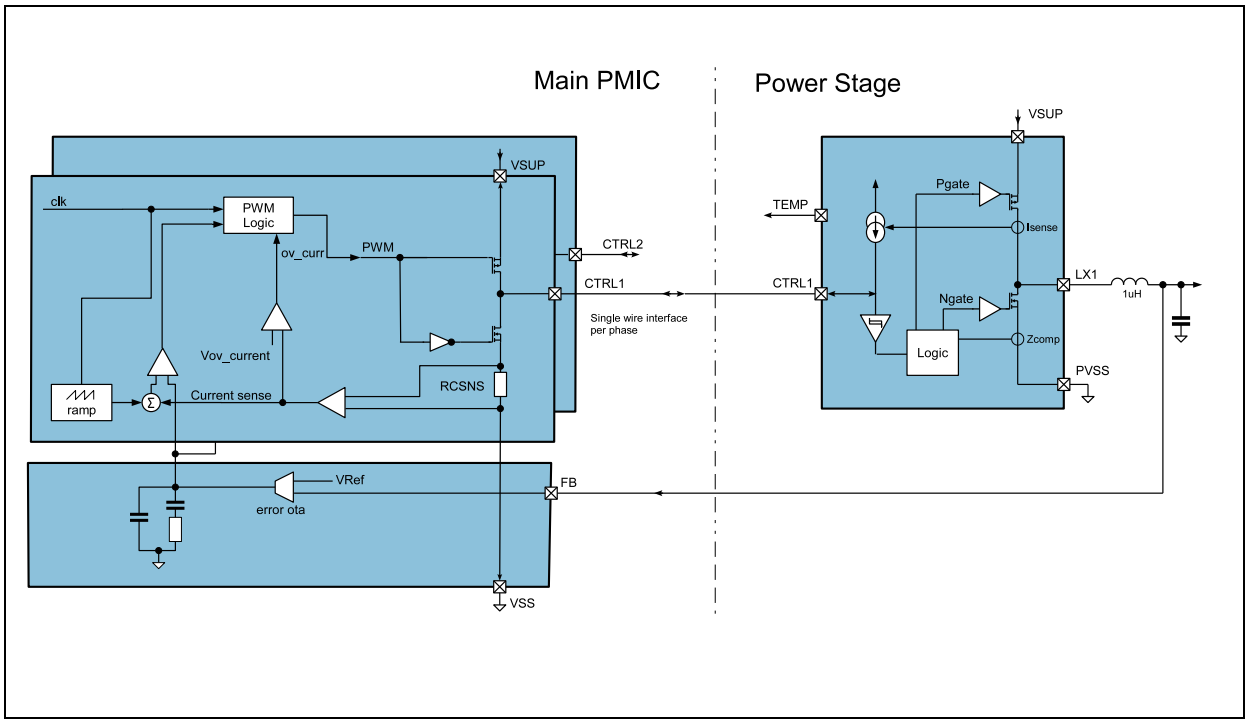
The device is a high current dual-phase DCDC and ideal for:

- Mobile phones
- Tablets
- Notebooks

Block Diagram

The functional blocks of this device for reference are shown below:

Figure 2:
AS3729 Block Diagram



AS3729 Block Diagram: This figure shows the block diagram of the DCDC controller inside the Main PMIC and the AS3729 Power Stage with all relevant system components.

Pin Assignment

Figure 3:
Pin Diagram

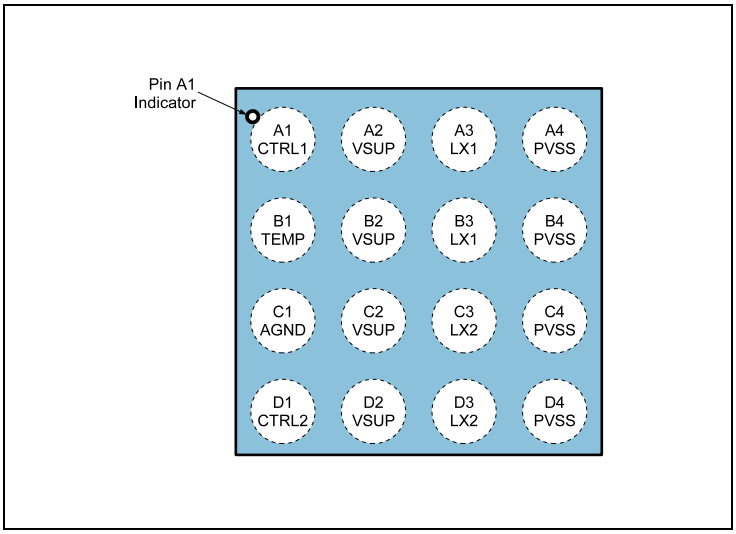


Figure 4:
Pin Description

Pin Number	Pin Name	Description
A1	CTRL1	Control IO for phase 1
B1	TEMP	ON/OFF control and temperature feedback
C1	AGND	Analog ground
D1	CTRL2	Control IO for phase 2
A2, B2	VSUP	Phase 1 positive supply terminal
C2, D2	VSUP	Phase 2 positive supply terminal
A3, B3	LX1	Phase 1 switching output to coil
C3, D3	LX2	Phase 2 switching output to coil
A4, B4	PVSS	Phase 1 negative supply terminal
C4, D4	PVSS	Phase 2 negative supply terminal

Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated under Electrical Characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Figure 5:
Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Units	Comments
Electrical Parameters					
	Supply voltage to ground 5V pins	-0.5	7.0	V	Applicable for pins VSUPx, LXx, CTRLx
	Supply voltage to ground 3V pins	-0.5	5.0	V	Applicable for pin TEMP
	Voltage difference between ground terminals	-0.5	0.5	V	Applicable for pins PVSS, AGND
	Input current (latch-up immunity)	-100	100	mA	Norm: JEDEC JESD78
Continuous Power Dissipation (T_A = 70°C)					
P_T	Continuous power dissipation		1	W	P_T (1) for WL-CSP16 package (R_{THJA} ~ 55K/W)
Electrostatic Discharge					
ESD	Electrostatic discharge HBM	±1.5		kV	Norm: JEDEC JESD22-A114F
Temperature Ranges and Storage Conditions					
T_A	Operating temperature	-40	85	°C	
R_{THJA}	Junction to ambient thermal resistance			°C/W	R_{THJA} typical 55K/W
T_J	Junction temperature		125	°C	
T_{Strg}	Storage temperature range	-55	125	°C	
T_{BODY}	Package body temperature		260	°C	Norm IPC/JEDEC J-STD-020 (2)
RH_{NC}	Relative humidity (non-condensing)	5	85	%	
MSL	Moisture sensitivity level	1			Represents an unlimited floor life time

Note(s) and/or Footnote(s):

1. Depending on actual PCB layout and PCB used.
2. The reflow peak soldering temperature (body temperature) is specified according IPC/JEDEC J-STD-020 "Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices".

Electrical Characteristics

Typical values are at VSUP = 3.8V, T_A = 25°C (unless otherwise specified). All limits are guaranteed. The parameters with Min and Max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

Figure 6:
Step Down DCDC Power Stage Parameters

Symbol	Parameter	Comments	Min	Typ	Max	Units
V_{IN}	Input voltage	Pin VSUPx	2.5		5.5	V
		Pin CTRLx	0		5.5	V
		Pin TEMP	0		3.6	V
I_{LIMIT}	Peak coil current limit	Single phase			4	A
I_{LOAD}	Load current	Continuous load current	0		2.5	A
		Peak load current			3 (1)	
R_{PMOS}	P-switch On resistance (2)	Single phase		40	70	mΩ
R_{NMOS}	N-switch On resistance (2)	Single phase		30	50	mΩ
f_{SW}	Switching frequency	Supplied by DCDC controller		2.7	3	MHz
$I_{Q\_force\_PWM}$	Quiescent current PWM	TEMP pin high, force PWM mode active		6.2		mA
$I_{Q\_low\_power}$	Quiescent current LP	TEMP pin high, low power mode active		21		µA
I_{power_off}	Power-Off current	No current into pin TEMP		±1		µA
$R_{discharge}$	active discharge	Single phase		16		Ω

Note(s) and/or Footnote(s):

1. Maximum value only for pulsed peak current.
2. MOS transistor only without package parasitics.

Figure 7:
Step Down DCDC Power Stage External Components

Symbol	Parameter	Min	Typ	Max	Units	Note
External Components Per Phase						
C_{FB}	Output capacitor	40	47		µF	Ceramic X5R or X7R, high performance
		20	22		µF	Ceramic X5R or X7R, cost optimized
C_{VSUP}	Input capacitor	6	10		µF	Ceramic X5R or X7R
L	Inductor	0.3	0.47		µH	3A rated, 3MHz operation, low R_{ON}

Parameters

Figure 8:
3.7V Efficiency vs. Output Current Combined Mode

AS3729 Step Down DCDC: Shows the Efficiency of AS3729 with VSUP = 3.7V, 1.5MHz operation, T_A = 25°C and Coilcraft XAL5030-601MEB coil

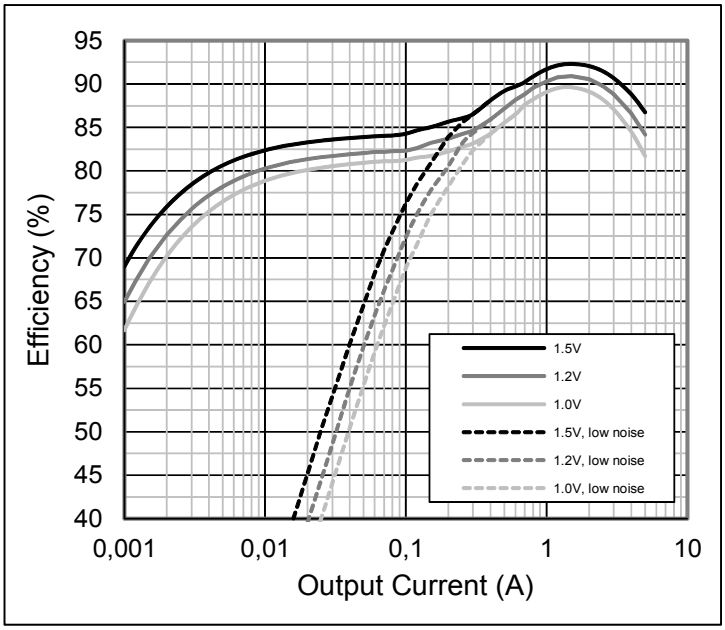


Figure 9:
3.7V Efficiency vs. Output Current Coil Comparison

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 for different coils @ 1.0V with VSUP=3.7V, 1.5MHz operation and T_A=25°C.

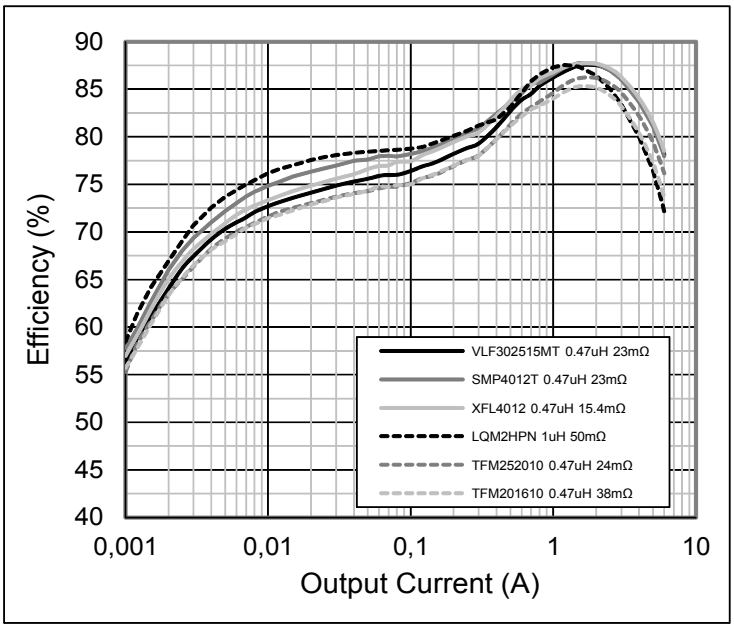


Figure 10:
3.7V Efficiency vs. Output Current Coil Comparison Combined Mode

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 for different coils @ 1.0V with VSUP=3.7V, 1.5MHz operation and T_A=25°C.

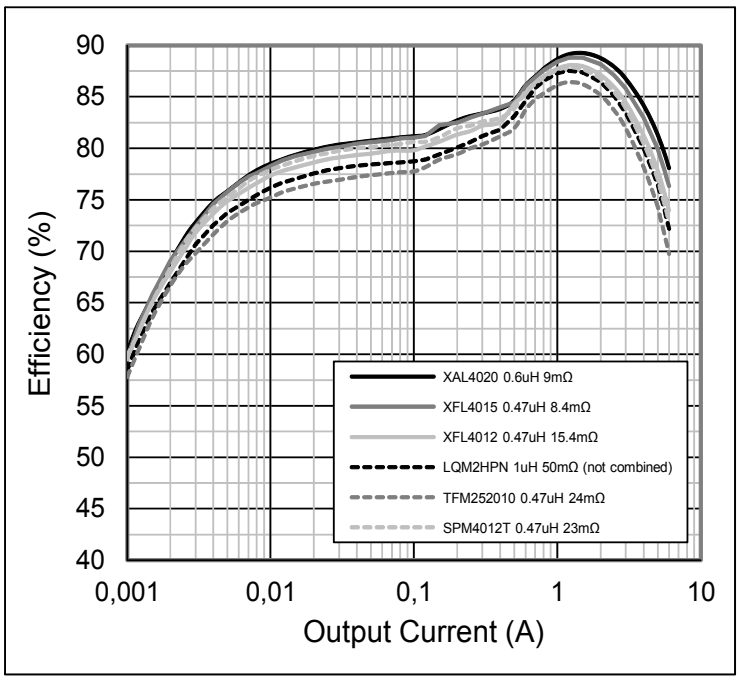


Figure 11:
5.0V Efficiency vs. Output Current Coil Comparison

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 for different coils @ 1.0V with VSUP=5.0V, 1.5MHz operation and T_A=25°C.

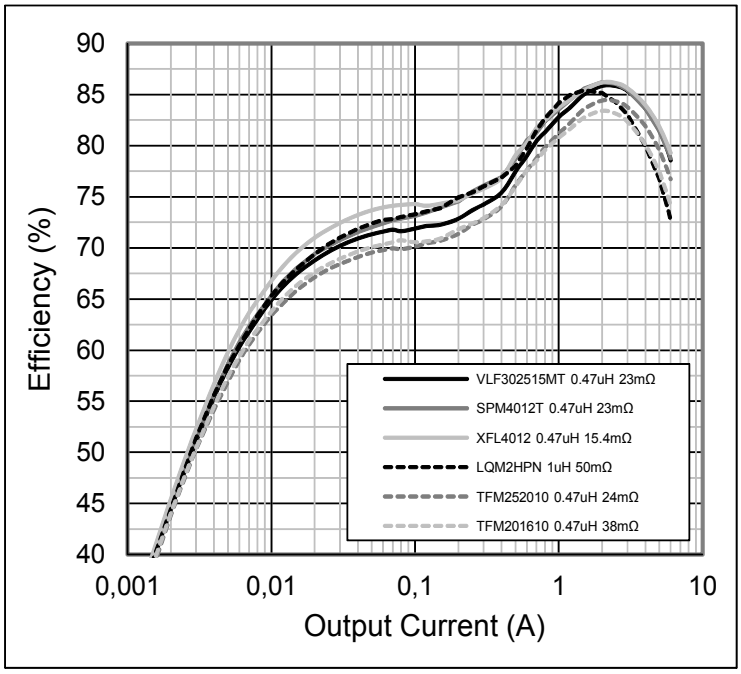


Figure 12:
5.0V Efficiency vs. Output Current Coil Comparison Combined Mode

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 for different coils @ 1.0V with VSUP=5.0V, 1.5MHz operation and T_A=25°C.

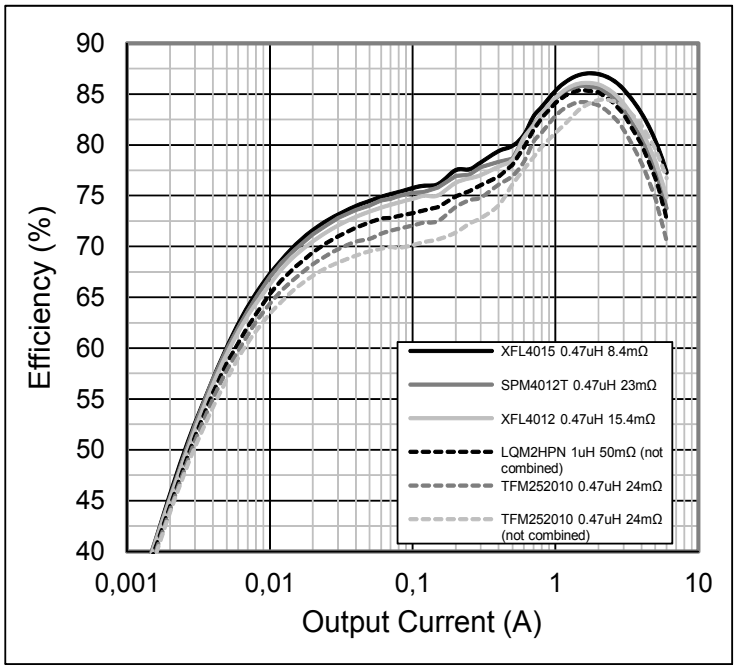


Figure 13:
3.7V Efficiency vs. Output Current XFL4012 Mode Comparison

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 in dual, combined and single phase mode @ 1.0V with VSUP=3.7V, 1.5MHz operation, T_A=25°C and Coilcraft XFL4012-471MEB coil.

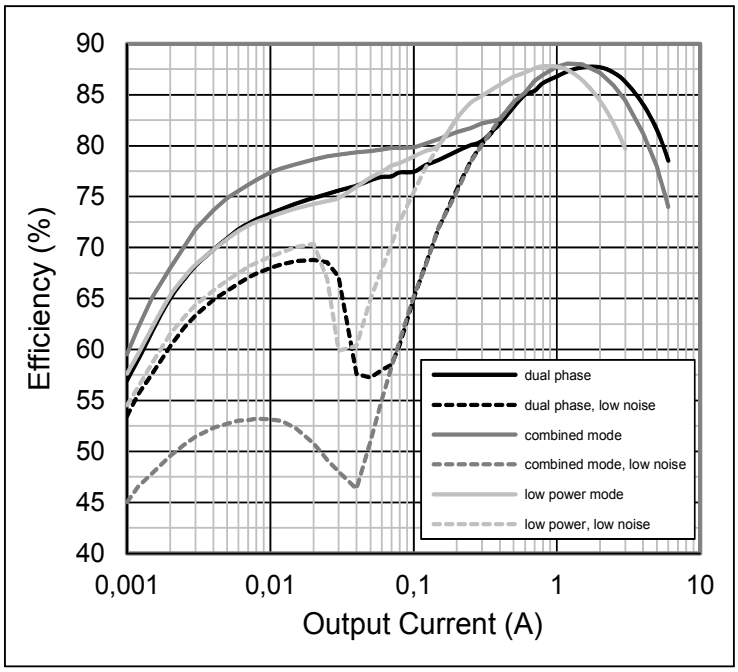


Figure 14:
3.7V Efficiency vs. Output Current SPM4012T Mode Comparison

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 in dual, combined and single phase mode @ 1.0V with VSUP=3.7V, 1.5MHz operation, T_A=25°C and TDK SPM4012T-R47M coil.

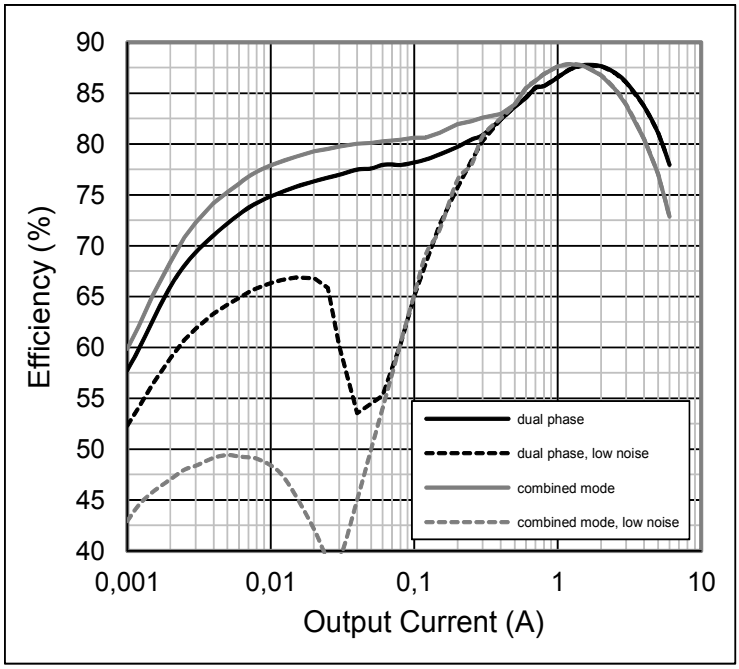


Figure 15:
3.7V Efficiency vs. Output Current TFM252010 Mode Comparison

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 in dual, combined and single phase mode @ 1.0V with VSUP=3.7V, 1.5MHz operation, T_A=25°C and TDK TFM252010A-R47M coil.

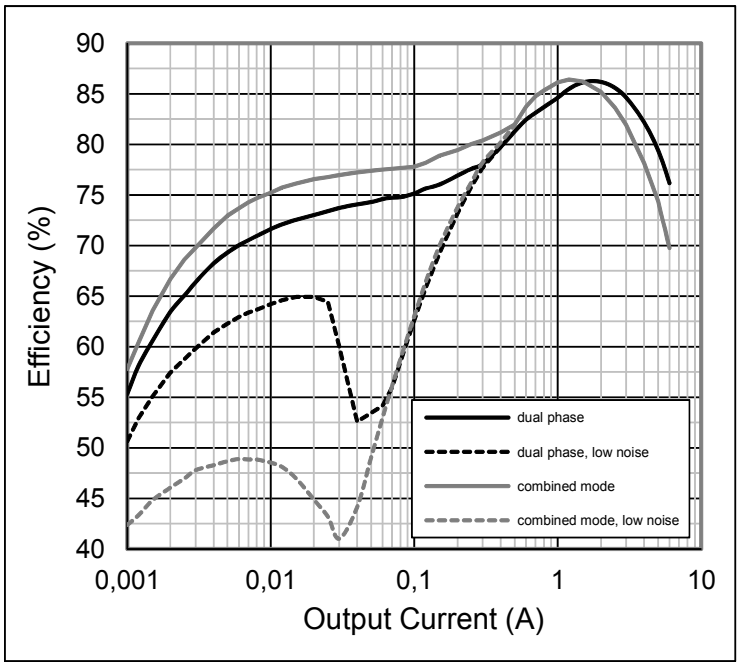


Figure 16:
3.7V Efficiency vs. Output Current XFL4012 Frequency Comparison

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 in dual phase mode @ 1.0V with VSUP=3.7V, T_A=25°C and Coilcraft XFL4012-471MEB coil.

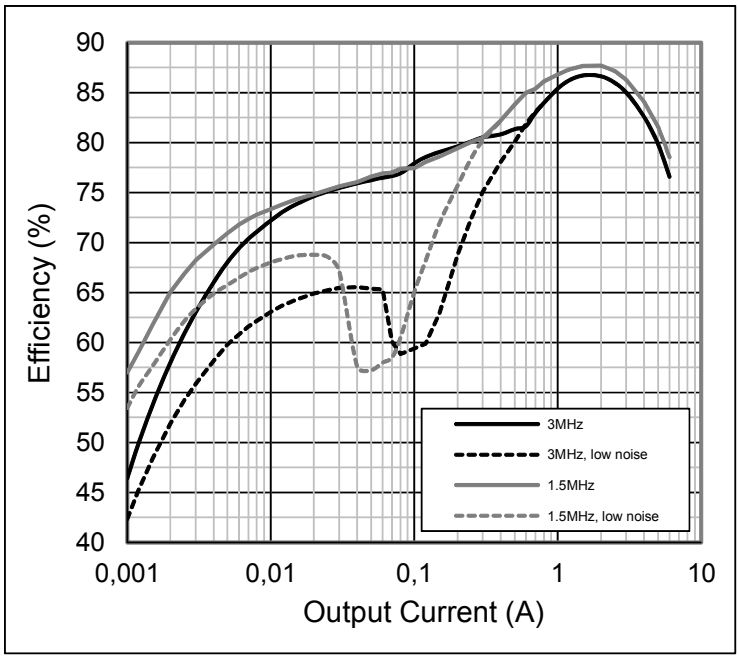
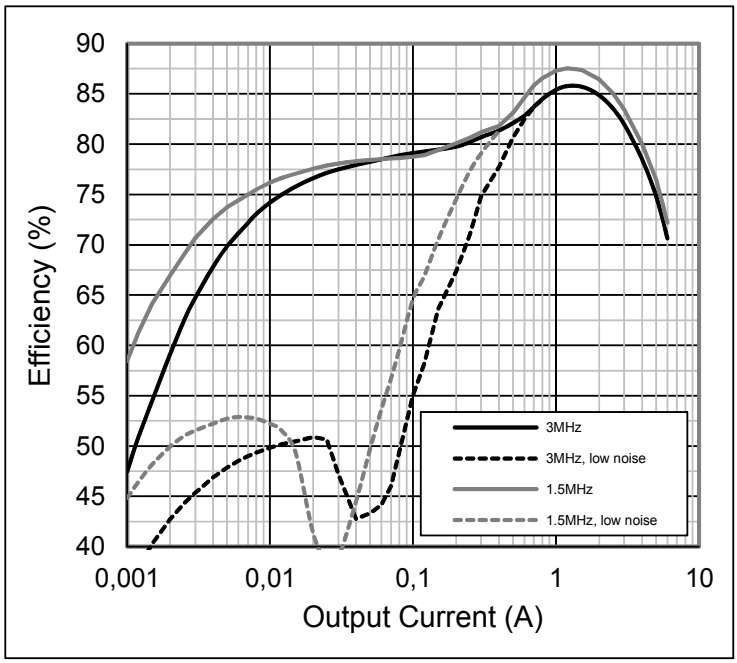


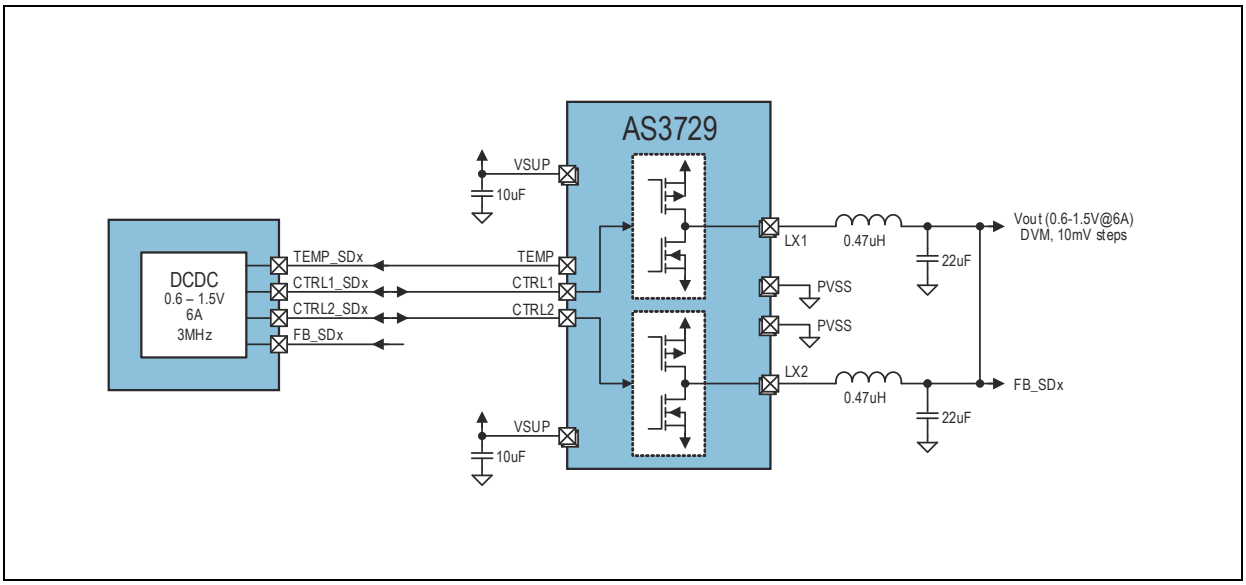
Figure 17:
3.7V Efficiency vs. Output Current LQMHPN Frequency Comparison

AS3729 Step Down DCDC: Shows the Efficiency of the AS3729 in dual phase mode @ 1.0V with VSUP=3.7V, T_A=25°C and Murata LQM2HPN1R0MJH coil.



Application Information

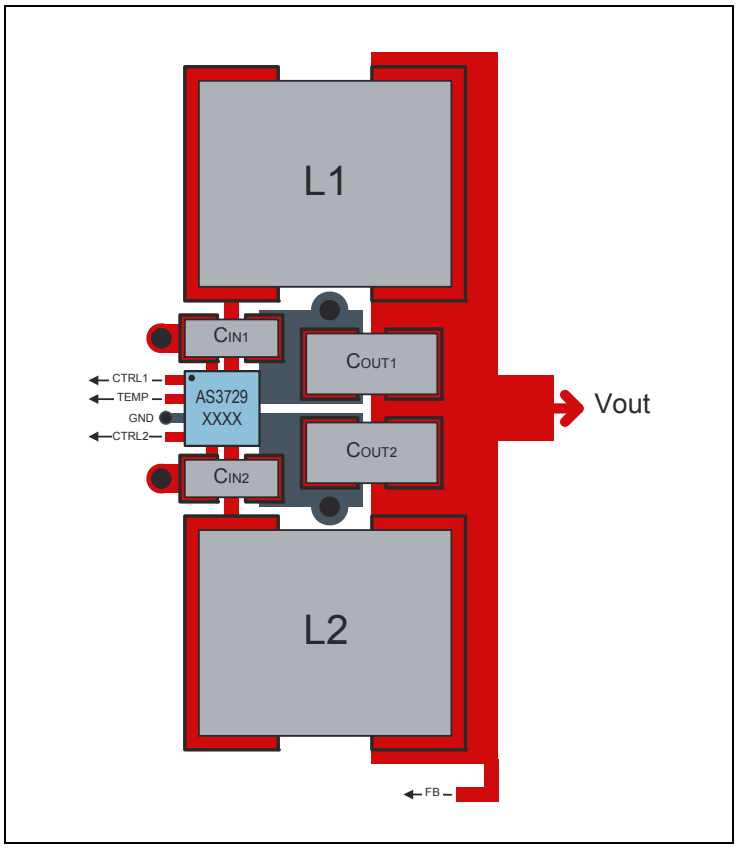
Figure 18:
Typical Application Circuit



AS3729 Typical Application: This figure shows the connection of the DCDC controller and the AS3729 Power Stage.

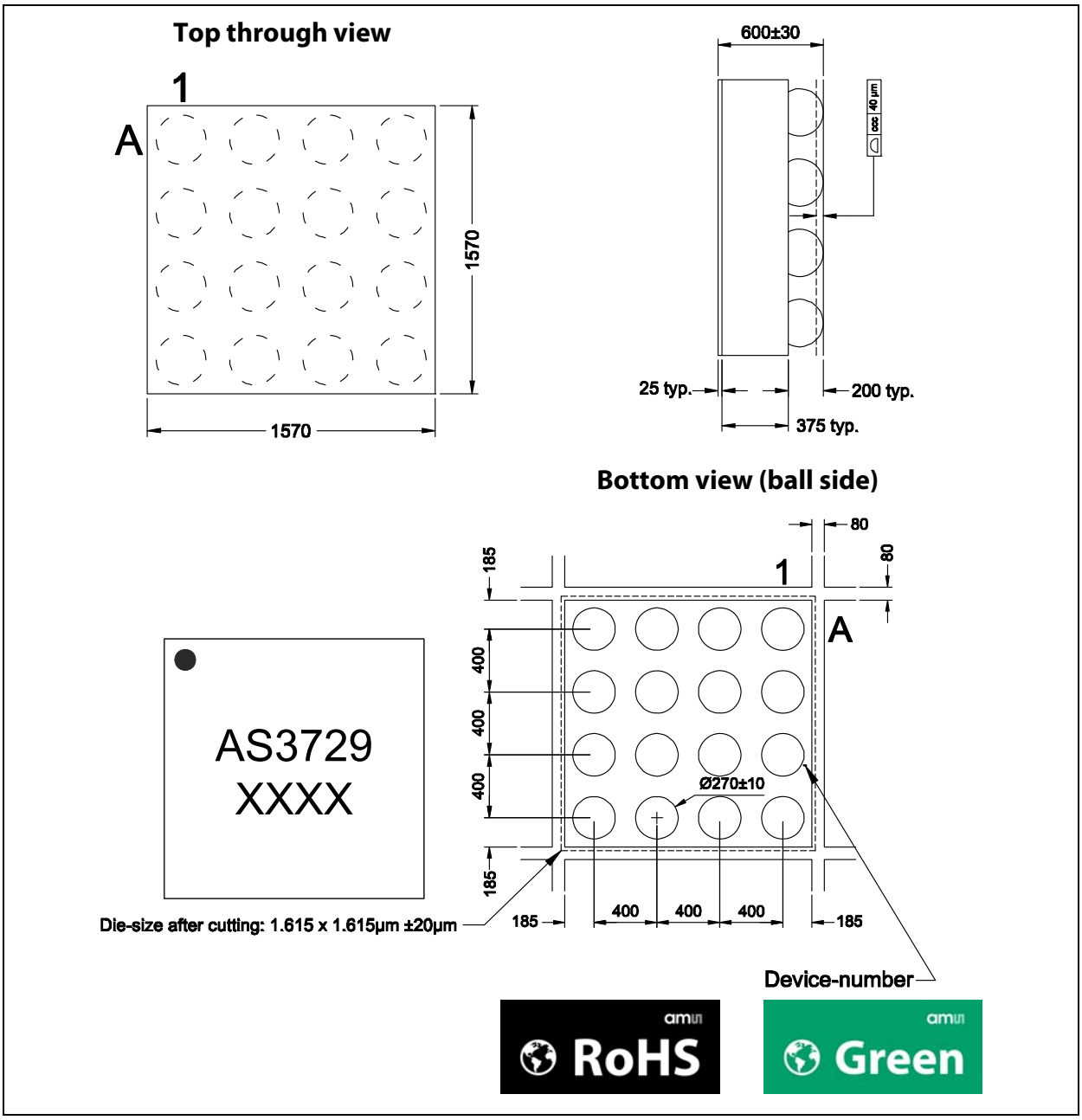
Figure 19:
Layout Guidelines

Layout Guidelines: This figure shows the recommended layout and placement of the external components for the 2-phase AS3729 Power Stage



Package Drawings & Markings

Figure 20:
16-pin WL-CSP with 0.4mm Pitch



Note(s) and/or Footnote(s):

1. ccc Coplanarity.
2. All dimensions in µm.

Figure 21:
Package Code

XXXX
Tracecode

Ordering & Contact Information

Figure 22:
Ordering Information

Ordering Code	Description	Delivery Form	Package	Delivery Quantity
AS3729-BWLT	Power stage for multi-phase DCDC	Tape & Reel	16-pin WL-CSP	12000
AS3729-BWLM	Power stage for multi-phase DCDC	Tape & Reel	16-pin WL-CSP	500

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Document Status	Product Status	Definition
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Revision Information

Changes from 1-22 (2013-Aug) to current revision 1-24 (2015-Aug-13)	Page
1-22 (2013-Aug) to 1-23 (2015-Aug-11)	
Content was updated to the latest **ams** design	
Updated Figure 5	4
Updated Figure 6	5
Updated Figure 7	6
Updated titles of figures 8, 10, 12, 13 & 17	6 - 11
Updated Figure 18	12
Updated Figure 22	14
1-23 (2015-Aug-11) to 1-24 (2015-Aug-13)	
Updated Figure 21	13

Note(s) and/or Footnote(s):

1. Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
2. Correction of typographical errors is not explicitly mentioned.

Content Guide

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