Users' Guide to AIC1569A Demoboard

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Abstract

The modern Personal PC demands fast processors that require low voltage and high current. Conventional synchronous buck converter, such as AIC1569A, is a cost-effective solution for powering most of existing processors that require current less than 20A; however it can not meet the current requirement of advanced processors that consume current more than 20A based on the conventional synchronous buck topology. The High Current AIC1569A Demo Board is designed to meet the power requirement of advanced processors. It also helps to keep the BOM cost low and to save the board space.

Circuit Description of the High Current AIC1569A Demo Board

The AIC1569A (U1) is a high power and high efficiency switching regulator controller that is designed to drive N-channel MOSFETs in the synchronous BUCK topology. The built in 5-bit Digital-to-Analog Converter (DAC) is used to adjust the output voltage from 1.3V to 3..5V. The adjustable over current and short circuit protections are also provided. The on resistance of the upper N-channel MOSFET, $R_{ds(on)}$, is used to sense the voltage drop that proportional to output current, no external low value sense resistor required. The circuit scheme of the high current AIC1569A demo board is as shown in Appendix A and the BOM list is as shown in Appendix B. External high-speed MOSFET drivers using NPN and PNP transistors are used for driving multiple MOSFETs in parallel operation. In order to reduce power dissipation and to increase overall efficiency, MOSFETs should be selected carefully. MOSFET features low $R_{ds(on)}$ and low C_{ISS} are recommended. Regarding the AIC1569A operation details, please refer to the AIC1569A data sheet.

Measurements

The performance of the high current AIC1569A demo board is measured, including temperature on key components, gate drive signals, soft start, transient response, V_{OUT} load regulation, and efficiency, as shown on table 1 and fig.1-fig.13. The test equipment used in the measurement please refers to Appendix C.

1. Temperature on key components

Table 1

MOSFET / Key Component	SIMENS / SPP80N03L (R_{DS-ON} : 6 mΩ-max)		
Output Load	20A	25A	30A
Input Inductor (L1)	37.1	42.3	42.6
PWM IC (AIC1569A)	36.0	40.0	41.3
Up-Side MOSFET (Q1)	48.5	51.8	64.5
Up-Side MOSFET (Q2)	47.6	53.1	63.0
Low-Side MOSFET (Q4)	48.5	51.0	61.5
Low-Side MOSFET (Q5)	48.5	53.0	63.5
Output Inductor (L3)	45.0	48.5	57.0
Output Inductor (L4)	45.0	53	64.0
Schottky Diode (D1)	49.1	58.5	73.0

Unit : °C

Note1: L2 and Q3 were not used in the

measurements

Note2: Additional Schottky diode is recommended to be used in parallel with D1 for improving temperature on D1.

Gate Drive Signals

Fig. 1 U/L Gate Drive Signal

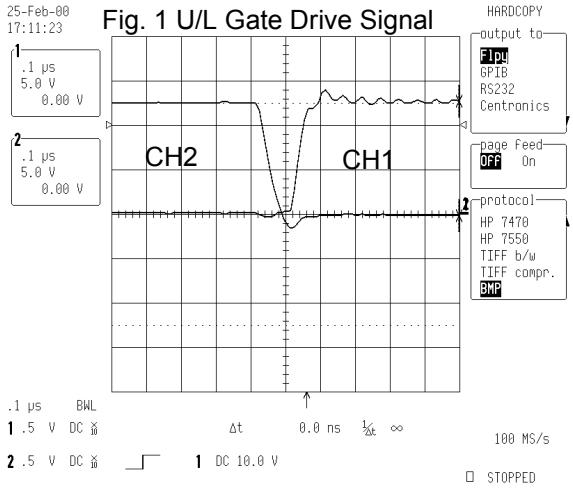
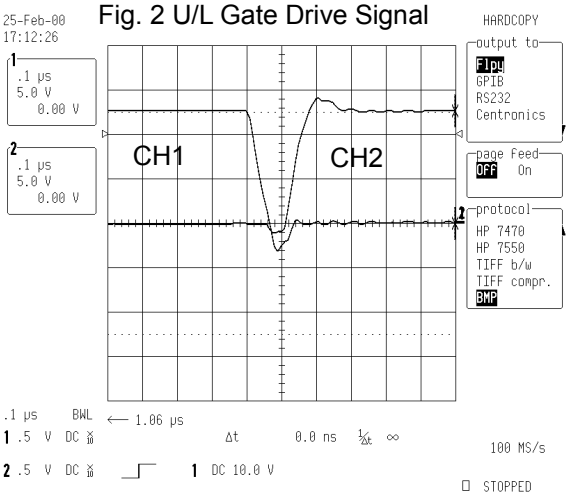


Fig. 2 U/L Gate Drive Signal



CH1:$U_{GATE-GND}$ (Q1) V_{CC} = 12.04V , V_{POWER}=5.02V , V_{CORE}=1.63V
CH2:$L_{GATE-GND}$ (Q4) V_{CORE} Load : 0 A

Fig. 3 U/L Gate Drive Signal

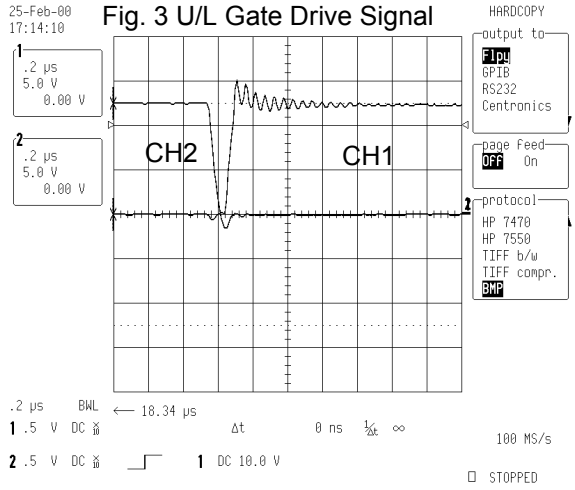
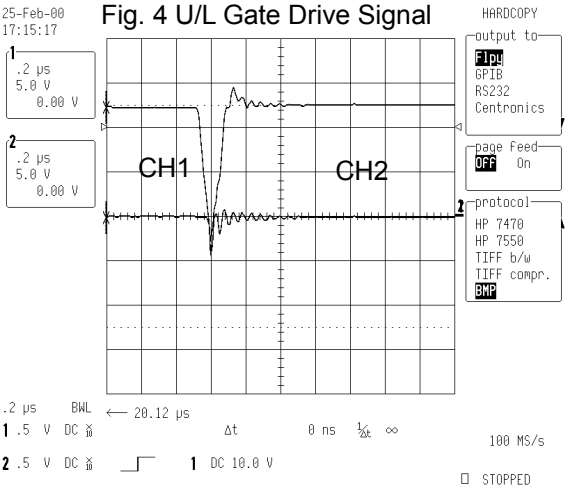


Fig. 4 U/L Gate Drive Signal



CH1 : $U_{GATE-GND}$ (Q1) V_{CC} = 12.04V ,
V_{POWER}=5.02V , V_{CORE}=1.61V

CH2 : $L_{GATE-GND}$ (Q4) V_{CORE} Load : 10 A

Fig. 5 U/L Gate Drive Signal

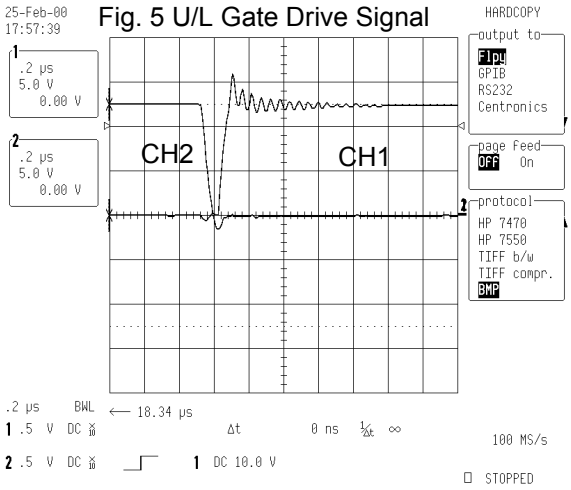
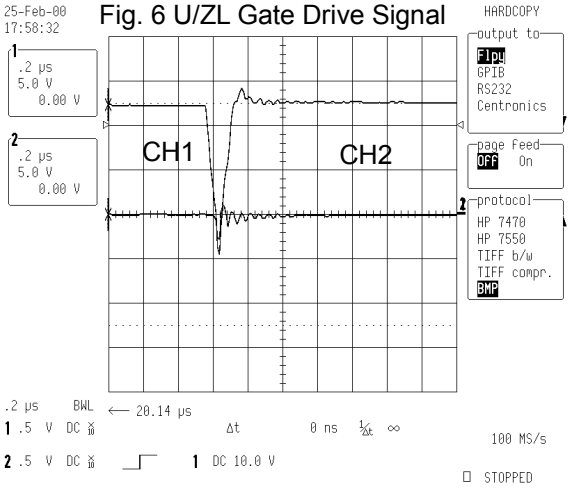


Fig. 6 U/ZL Gate Drive Signal



CH1 : $U_{GATE-GND}$ (Q1) V_{CC} = 12.04V , V_{POWER}=5.02V , V_{CORE}=1.59V
CH2 : $L_{GATE-GND}$ (Q4) V_{CORE} Load : 20 A

Fig. 7 U/L Gate Drive Signal

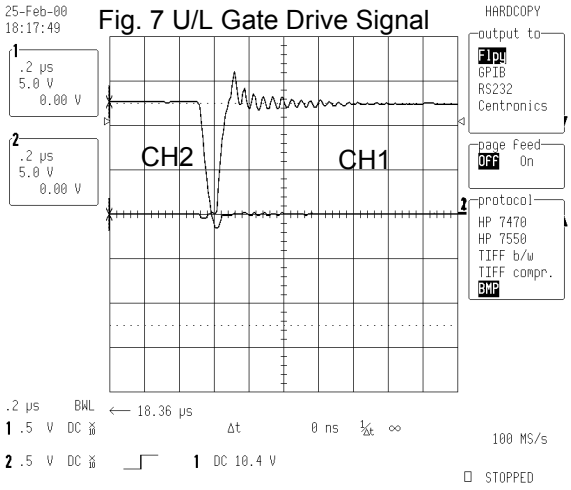
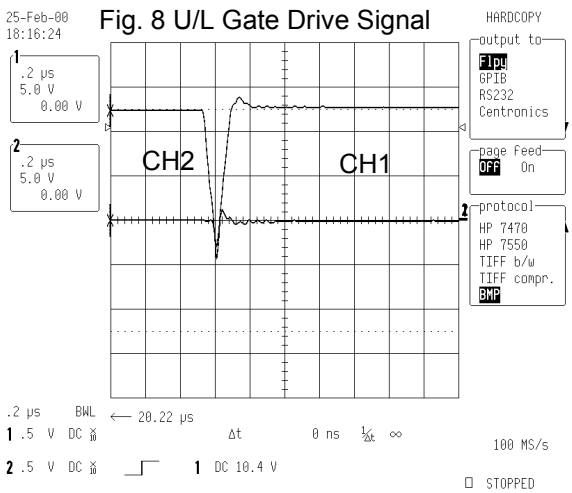


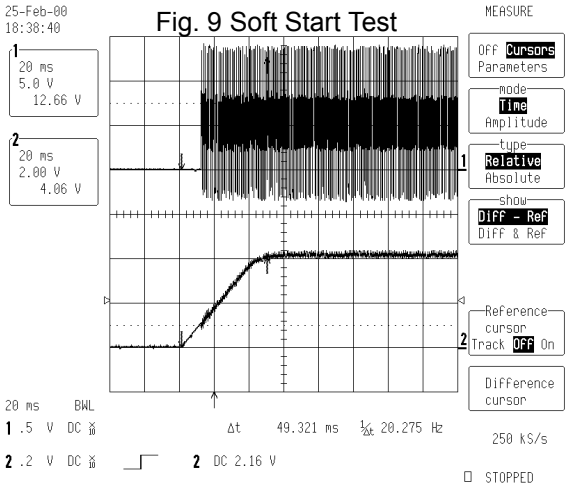
Fig. 8 U/L Gate Drive Signal



CH1 : $U_{GATE-GND}$ (Q1) V_{CC} = 12.04V , V_{POWER}=5.02V , V_{CORE}=1.58V
CH2 : $L_{GATE-GND}$ (Q4) V_{CORE} Load : 30 A

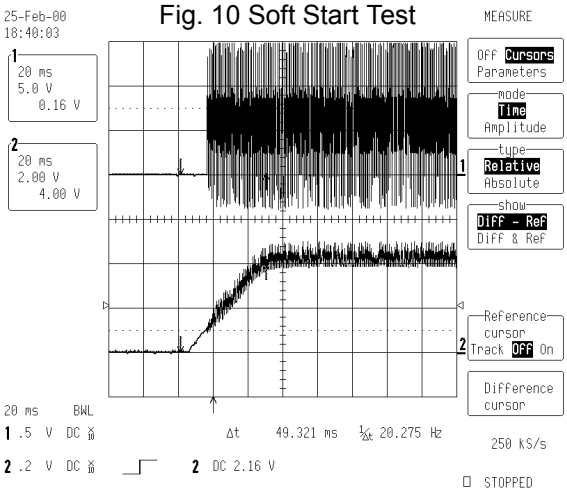
Soft Start

Fig. 9 Soft Start Test



CH1 : $U_{GATE-GND}$ (Q1)
CH2 : SS Pin
V_{CORE} Load : 0 A

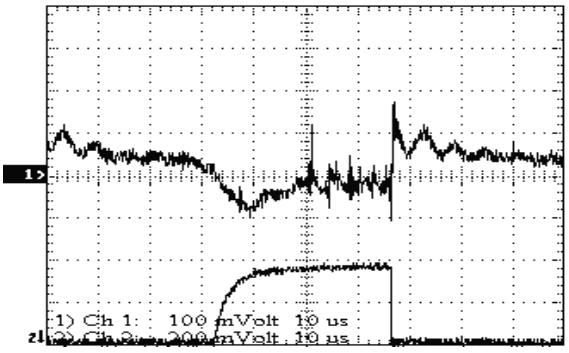
Fig. 10 Soft Start Test



CH1 : $U_{GATE-GND}$ (Q1)
CH2 : SS Pin
V_{CORE} Load : 30 A

Transient Response

Fig. 11 Transient response



CH1: V_{CORE} (100mV/div)

CH2: I_{OUT} (10A/div)

Status:

V_{CORE} =1.6V , I_{OUT} =2A to 20A

V_{OUT} Load Regulation

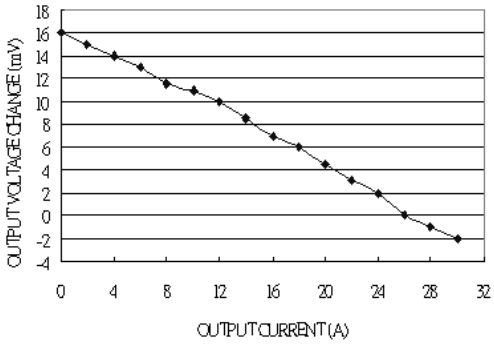


Fig. 12 Constant Load Regulation Waveform

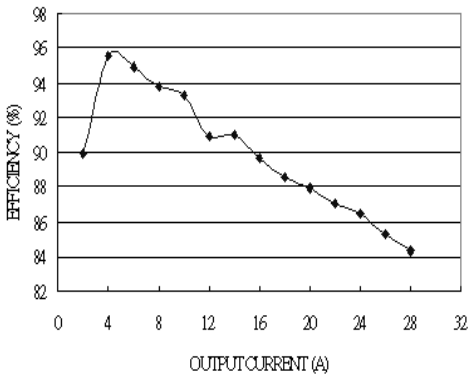
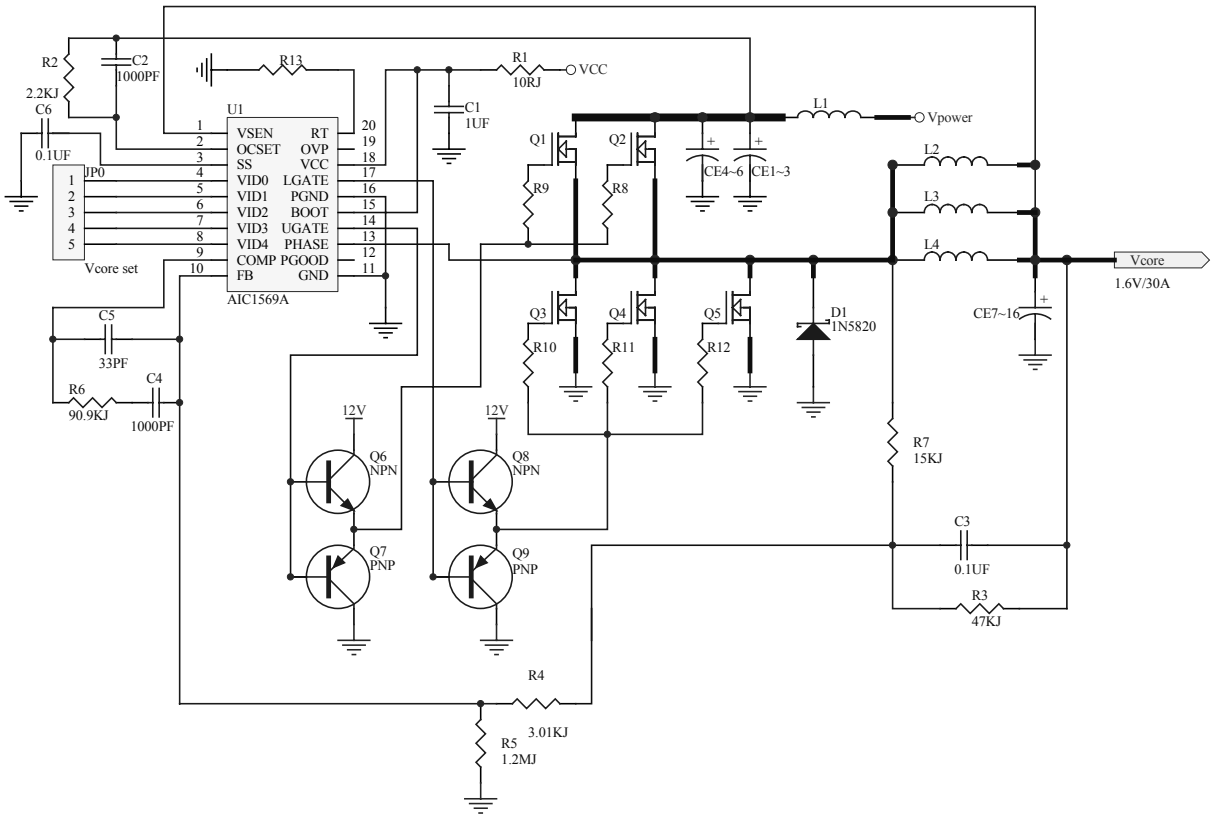


Fig. 13 Efficiency (VOUT=1.6V)

Efficiency (VOUT=1.6V)



Appendix A: Application Circuit of the High Current aic1569A Demo Board

Appendix B: BOM List of the High Current AIC1569A Demo board

Reference	Part Number	QTY	PKG	Manufacturer	Remark
U1	AIC1569A	1pcs	SO20	AIC	
Q1,2,4,5	80N30L	4pcs	TO-263	Simens	N-FET
Q6,Q8	FMMT618	2pcs	SOT23	Zetex	NPN
Q7,Q9	FMMT718	2pcs	SOT23	Zetex	PNP
D1	1N5820	1pcs			*Schottky*
L1	1μH	1pcs			
L3,4	3.5μH	2pcs			
R1	10Ω	1pcs	SMD		
R2	2.2KΩ	1pcs	SMD		
R3	47KΩ	1pcs	SMD		
R4	3.01KΩ	1pcs	SMD		
R5	1.2MΩ	1pcs	SMD		
R6	90.9KΩ	1pcs	SMD		
R7	15 KΩ	1pcs	SMD		
R8,9,11,12	0Ω	4pcs	SMD		
C1	1μF/16V	1pcs	SMD		
C2	1000 PF/16V	1pcs	SMD		
C3	0.1 UF/16V	1pcs	SMD		
C4	1000 PF/16V	1pcs	SMD		
C5	33 PF/16V	1pcs	SMD		
C6	0.1μF/16V	1pcs	SMD		
CE1~6	1000 μF/6.3V	6pcs		SANYO	
CE7~14	1000 μF/6.3V	8pcs		SANYO	
JP0	2.54mm*5	1pcs			

Appendix C: Test Equipment

Oscilloscope: LeCroy 9310C
Electronic load: Chroma 6301
Power Supply: Chroma 6210-40
Current probe: Tektronix AM503B