LM5070 Design Document

National Semiconductor
LM5070
June 2006

1.0 Design Specifications

Inputs	Outputs #1
VinMin=-57	Vout1=5.0
VinMax=-36	Iout1=1.4

2.0 Design Description

This design utilizes the LM5070 configured in a non-synchronous, flyback topology and operating in continuous conduction mode (CCM), to offer a low-cost, high efficiency solution for Power-over-Ethernet (PoE) applications*. The LM5070 is a dedicated PoE powered device (PD) interface/PWM controller that integrates all the power sequencing, control mode, and fault protection necessary to comply with the IEEE 802.3af specification for power sourcing equipment (PSE).

This non-isolated PoE design operates at 260kHz and uses a custom PoE transformer to convert the input voltage, via flyback action, to an output voltage level of 5V at 1.4A (7W). The primary side bias is derived from an auxiliary winding after successful start-up occurs. The secondary side feedback components are selected appropriately to ensure proper gain and phase margins for stable operation and quick transient response.

* Refer to POWER Designer, No. 104 (http://www.national.com/an/AN/AN-1358.pdf) or the LM5070 Evaluation Board - Application Note 1358 (http://www.national.com/appinfo/power/files/PowerDesigner_104.pdf) for more information on Power Supply Design for PoE Applications.

3.0 Schematic

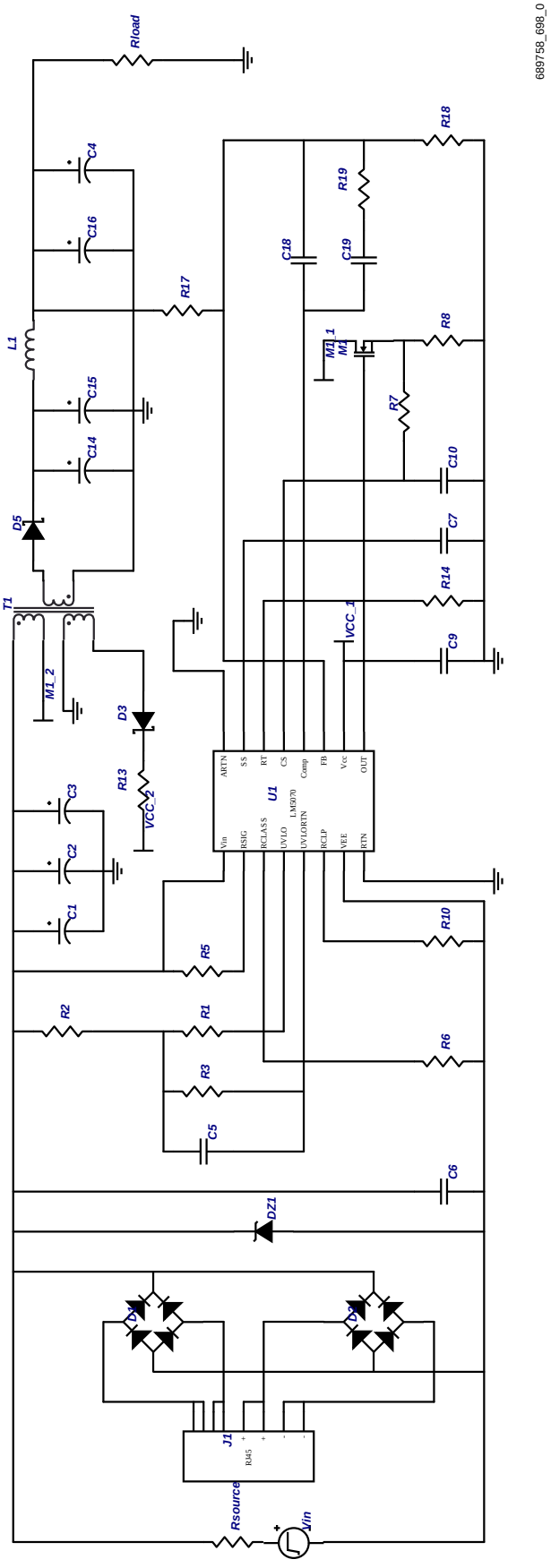
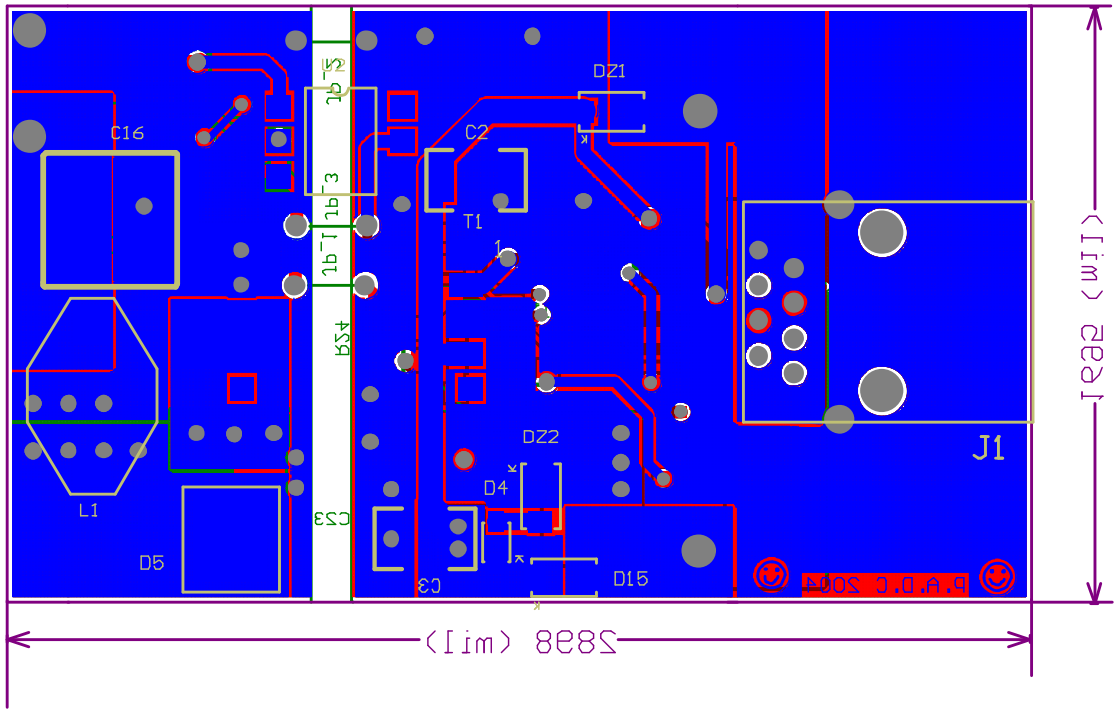

689758_698_0
Rload
R18
C4
C16
R19
C18
C19
R17
L1
M1_1
M1
R8
R7
C15
C14
C10
D5
C7
T1
R14
VCC_1
C9
M1_2
D3
R13
VCC_2
U1
LM5070
ARTN
SS
RT
CS
Comp
FB
Vcc
OUT
Vin
ISNS
RCLASS
UVLO
UVLORTN
RCLP
VEE
RTN
C3
C2
C1
R10
R5
R2
R1
R6
R3
C5
C6
DZ1
D1
D4
J1
RJ45
Rsource
Vin

FIGURE 1. Example Schematic Showing Connection for all Components.

4.0 Bill Of Materials

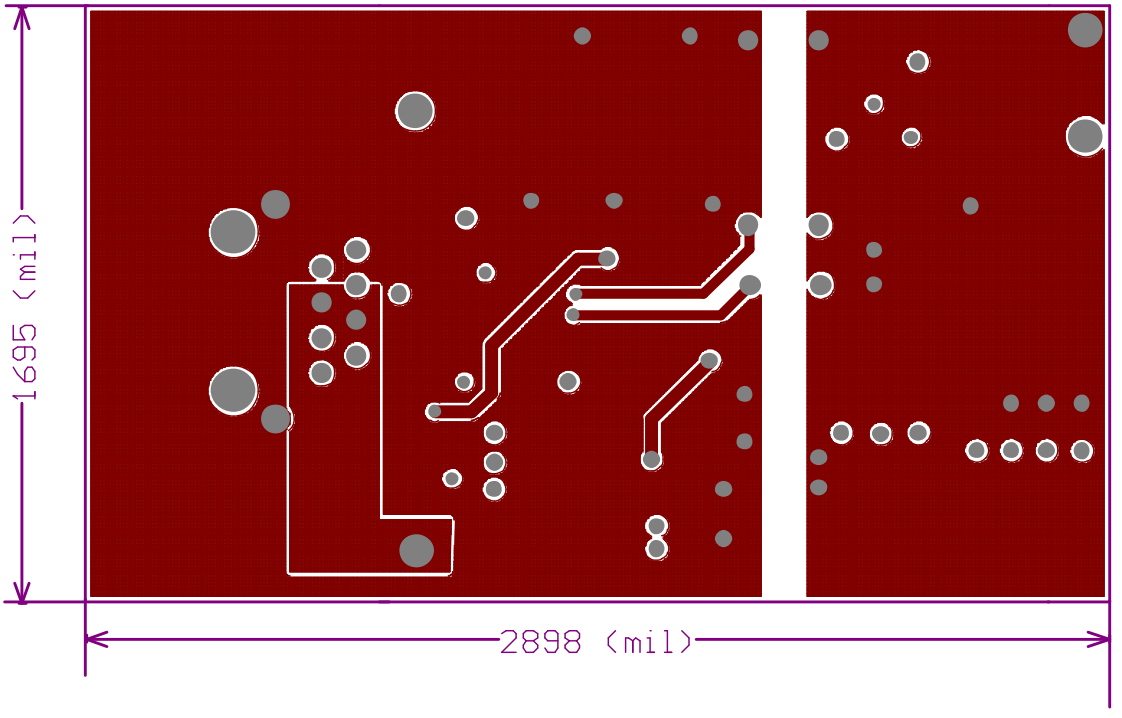
Part	Manufacturer	Part#	Attributes
C1	TDK	C4532X7R2A225	2.2u F
C10	Vitramon	VJ0805A102KXXAT	1n F
C14	TDK	C3216X5R0J106K	10u F
C15	TDK	C3216X5R0J106K	10u F
C16	Sanyo	6CV390EX	390u F
C18	Vitramon	VJ0805A101KXXAT	100p F
C19	Vitramon	VJ0805A222KXAAT	2.2n F
C2	TDK	C4532X7R2A225	2.2u F
C3	TDK	C4532X7R2A225	2.2u F
C4	Vitramon	VJ0805A104KXAAT	0.1u F
C5	Vitramon	VJ0805A224KXAAT	0.22u F
C6	Vitramon	VJ0805A104KXAAT	0.1u F
C7	Vitramon	VJ0805A473KXAAT	47n F
C9	TDK	C2012X5R1A105K	1u F
D1	Diodes	HD01	1 V
D2	Diodes	HD01	1 V
D3	Fairchild	MMSD4148	1 V
D5	IR	12CWQ03	0.47 V
DZ1	Diodes	SMAJ60A	
J1	SAMTEC	MODS-A-8P8C-X	
L1	Coilcraft	DO1813P-181HC	0.18u H, 0.003 Ohms
M1	Vishay	SI4848DY	
R1	Dale	CRCW08051001FRT6	1k Ohms
R10	Dale	CRCW08051073FRT6	107k Ohms
R13	Dale	CRCW080520R0FRT6	20 Ohms
R14	Dale	CRCW08051212FRT6	12.1k Ohms
R17	Dale	CRCW08052212FRT6	22.1k Ohms
R18	Dale	CRCW08057321FRT6	7.32k Ohms
R19	Dale	CRCW08051003FRT6	100k Ohms
R2	Dale	CRCW08055903FRT6	590k Ohms
R3	Dale	CRCW08053322FRT6	33.2k Ohms
R5	Dale	CRCW08052492FRT6	24.9k Ohms
R6	OPEN	OPEN	
R7	Dale	CRCW08051000FRT6	100 Ohms
R8	Dale	CRCW12060R60FRT6	0.6 Ohms
T1	Coilcraft	C1588-A	
U1	National Semiconductor	LM5070	

5.0 Layout



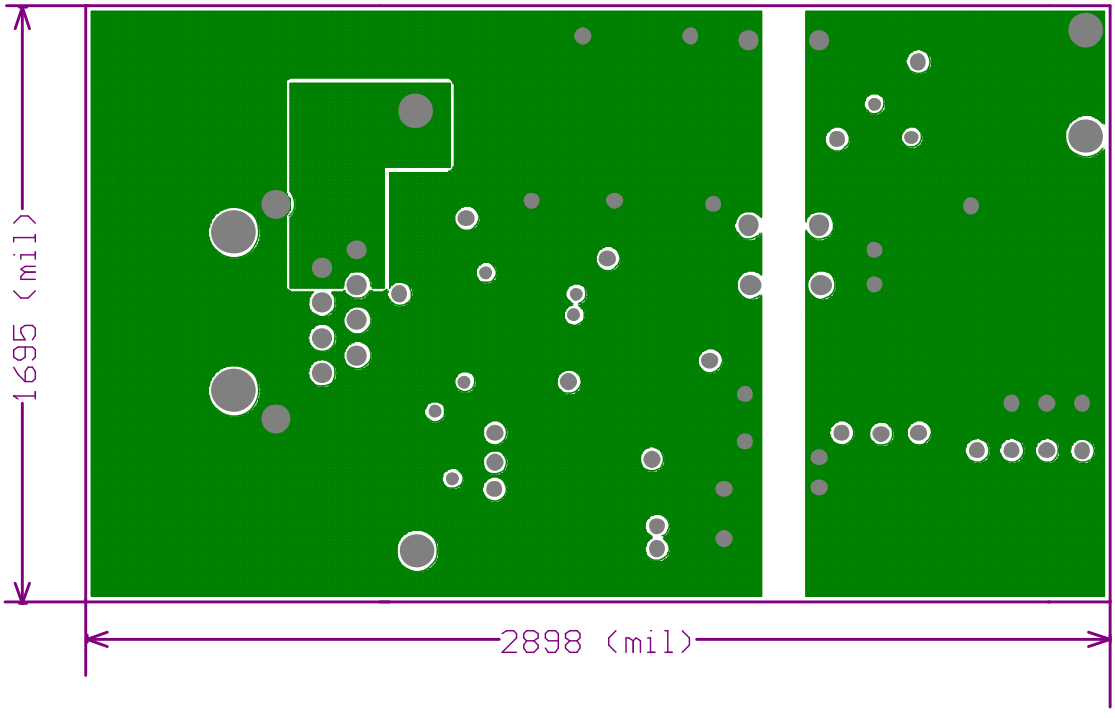
PADC_POE_5V_7W

FIGURE 2. Board's Bottom View



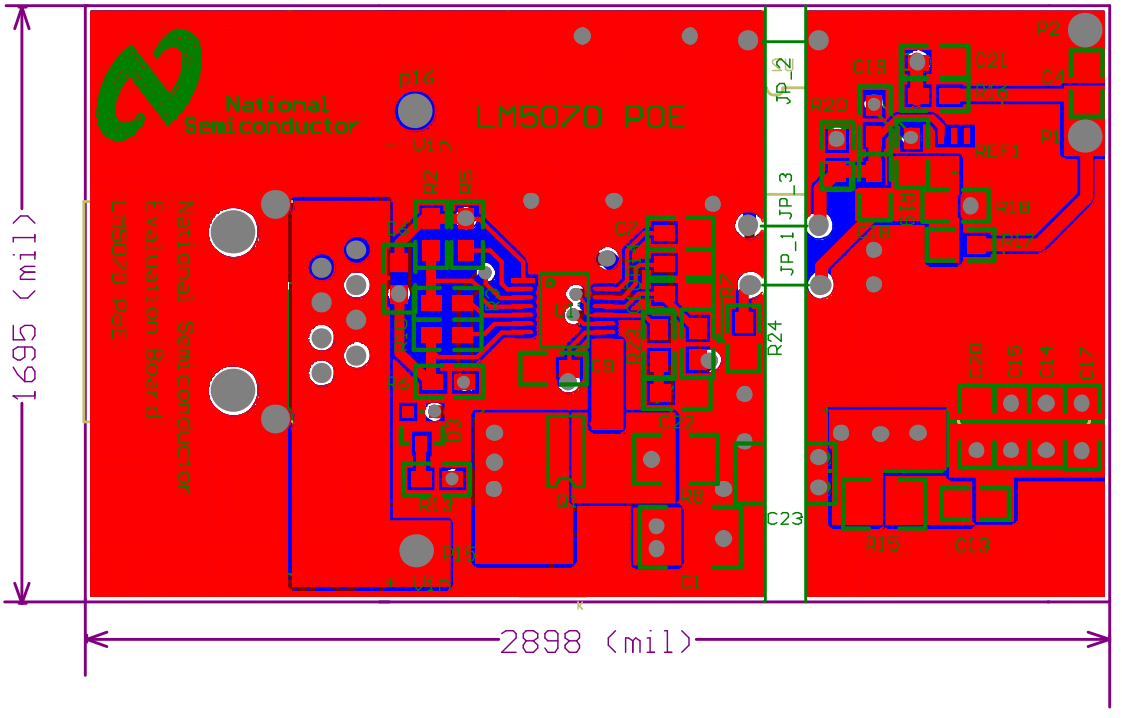
PADC_POE_5V_7W_lo_2

FIGURE 3. LM5070_PoE_pcb_mid1



PADC_POE_5V_7W

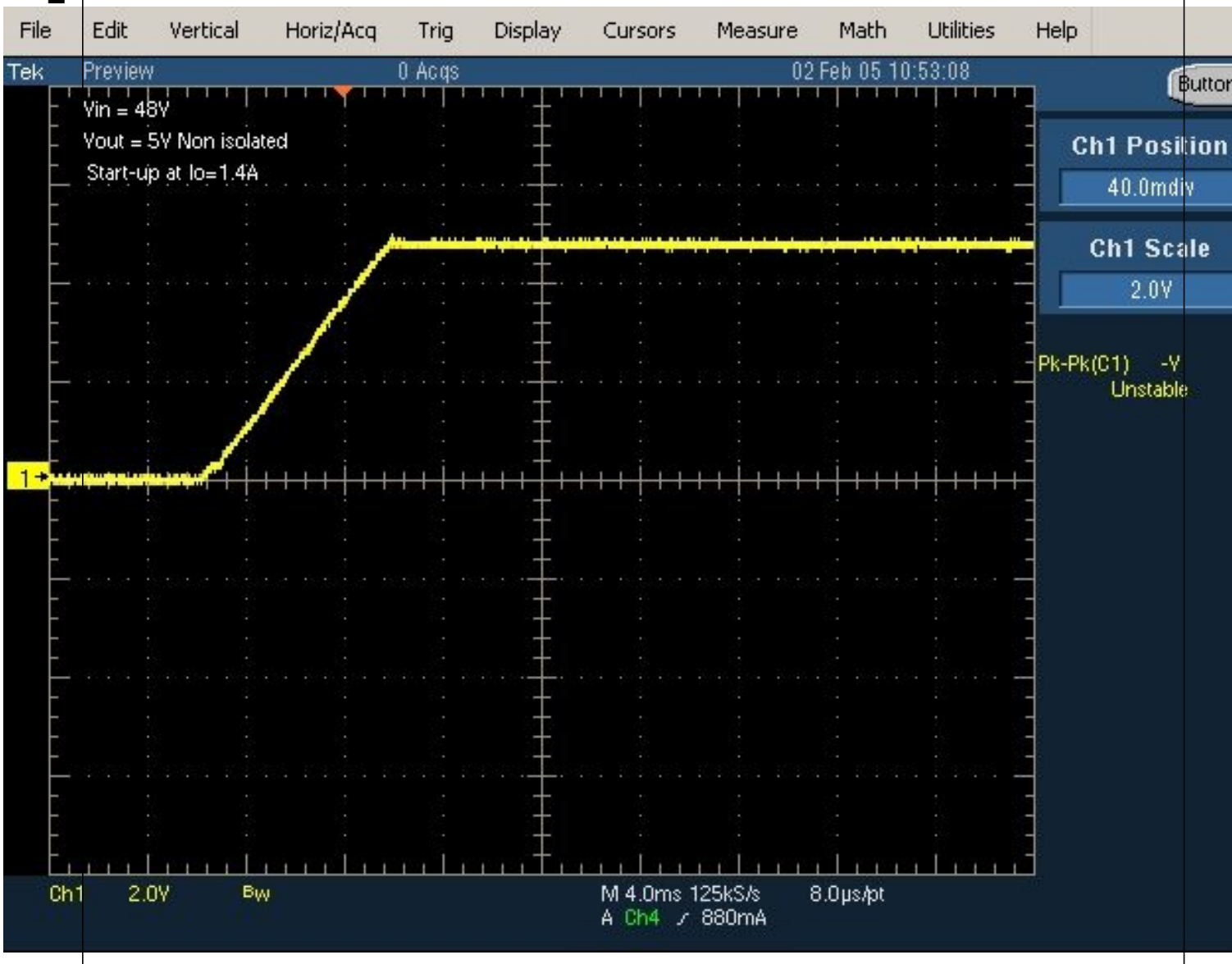
FIGURE 4. LM5070_PoE_pcb_mid2



PADC_POE_5V_7W_lo_4

FIGURE 5. Board's Top View

6.0 Waveforms



PADC_POE_5V_7W

FIGURE 6. Full load start-up

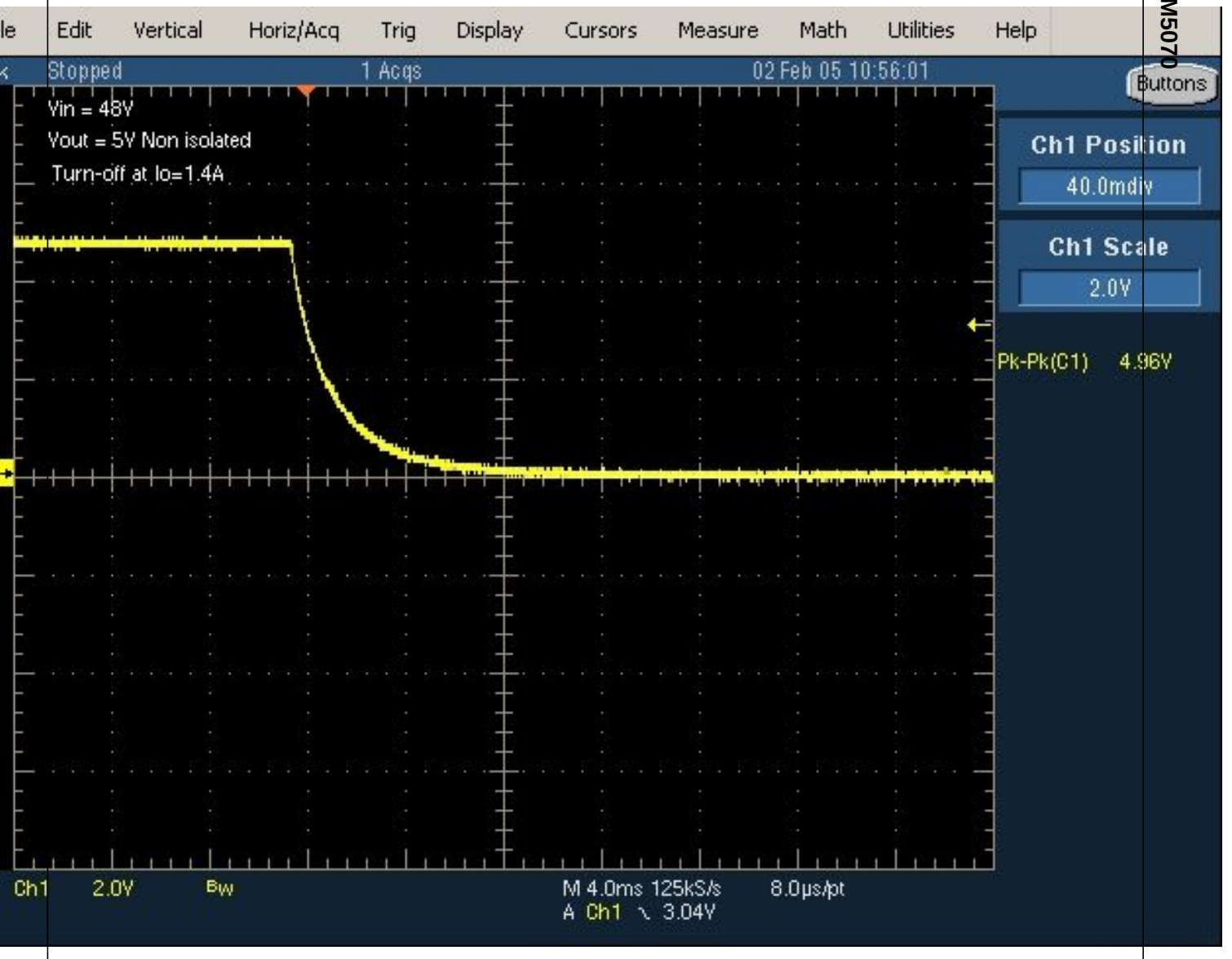


FIGURE 7. Full load turn-off

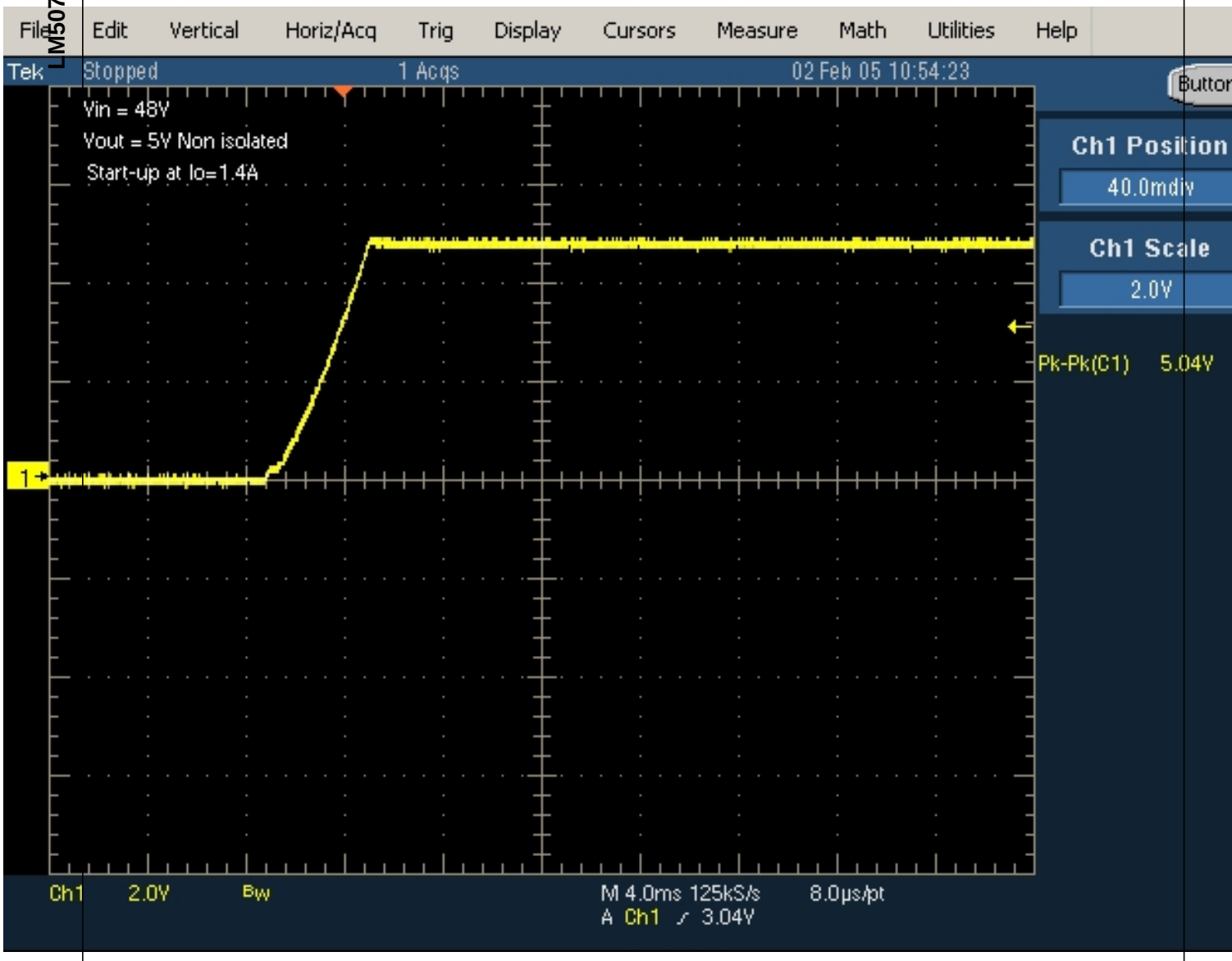
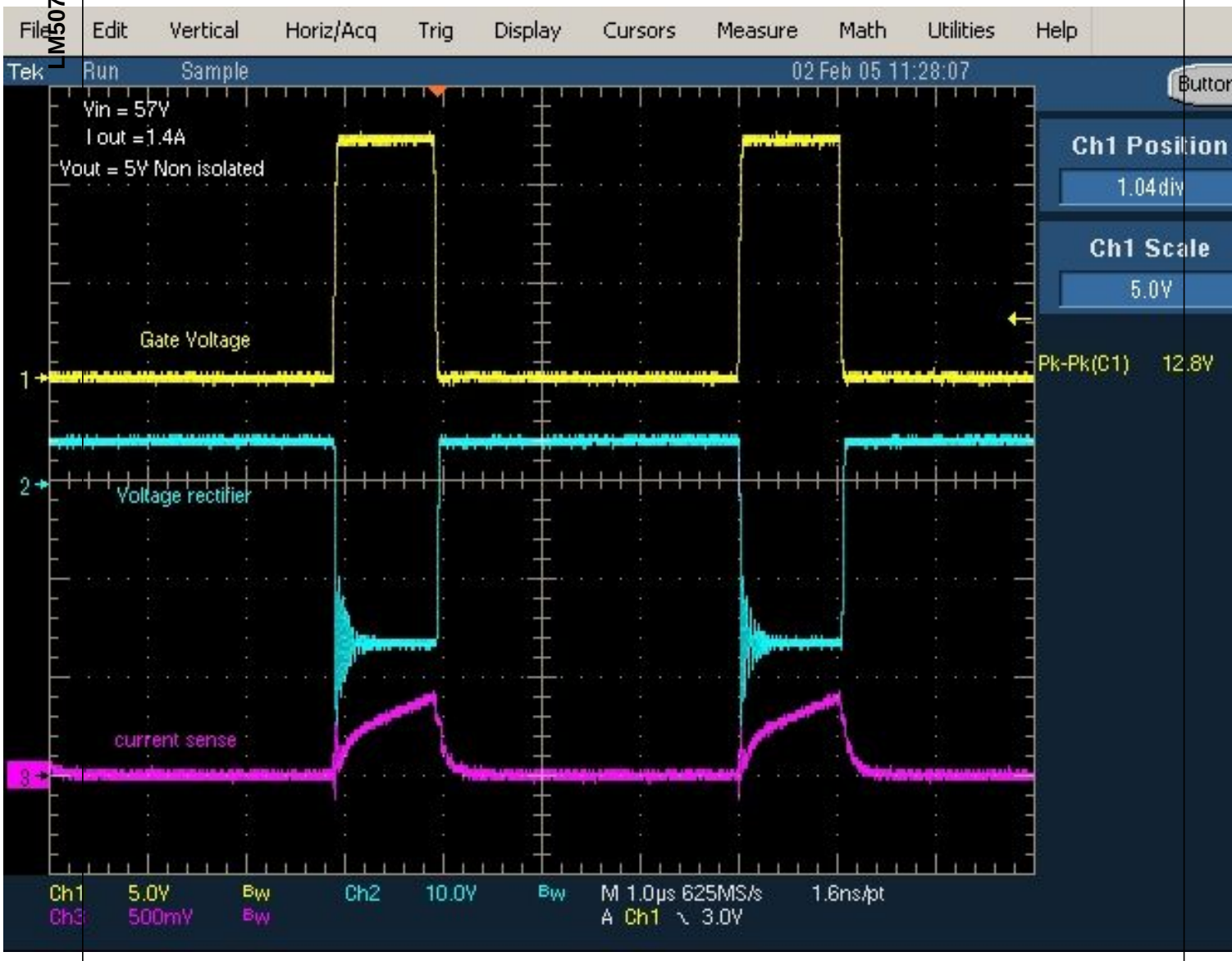


FIGURE 8. No load start-up

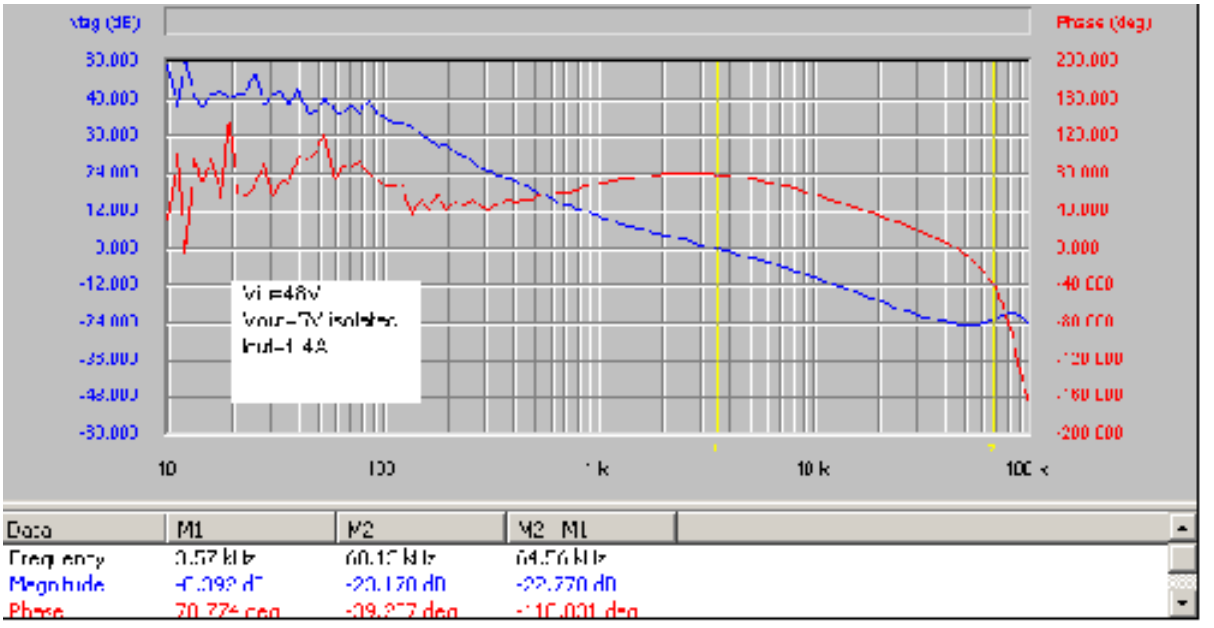
PADC_POE_5V_7W_wf_8

FIGURE 9. Transient response



PADC_POE_5V_7W

FIGURE 10. Vin=57V waveforms



PADC_POE_5V_7W_wf_10

FIGURE 11. Bode plots

Notes

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