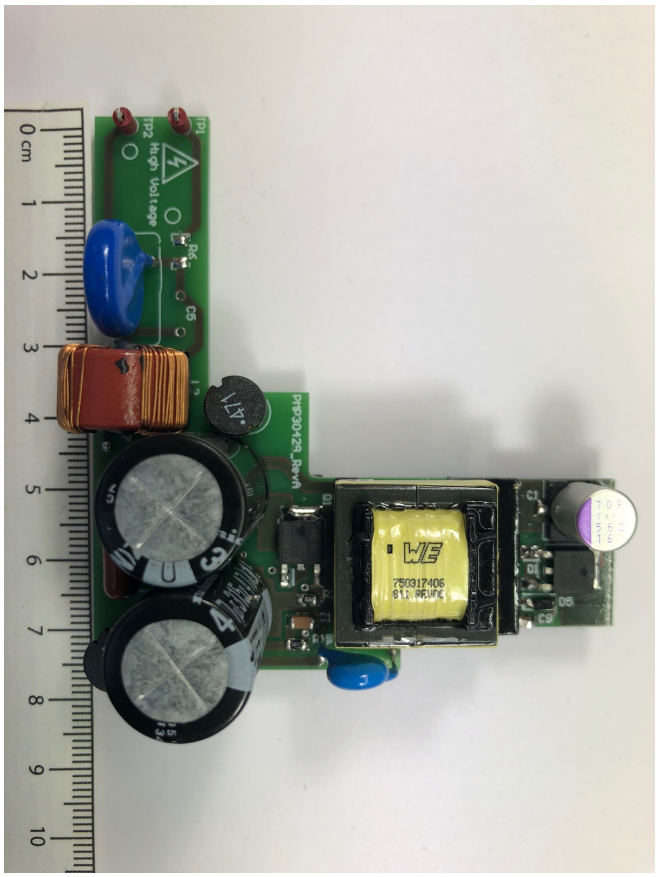
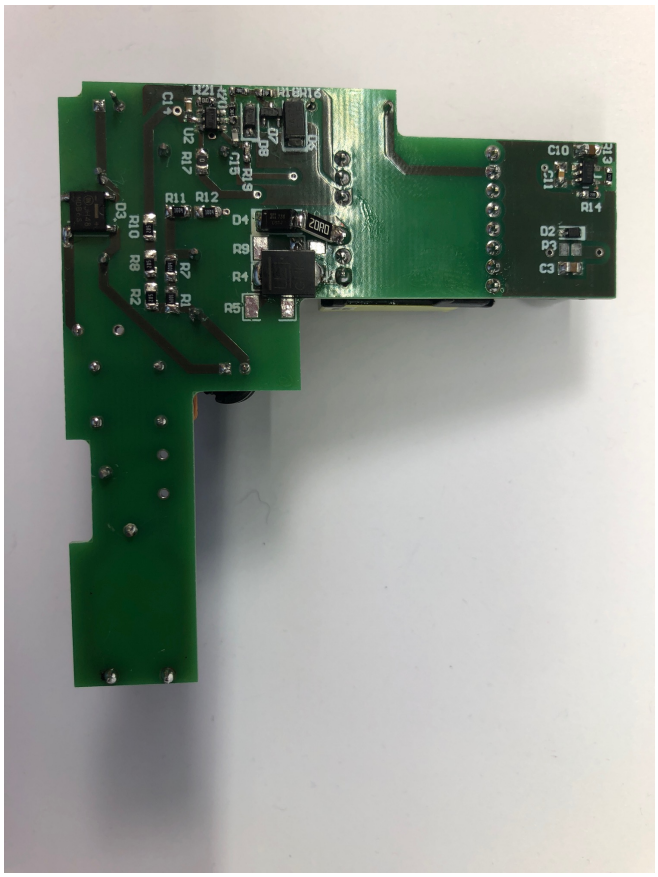
Test Report: PMP30428

85-VAC - 400-VAC Input Multiple Output Flyback Reference Design

Description

The PMP30428_RevB reference design uses the UCC28700 valley switching flyback controller to generate 12V@1.1A. The controller provides accurate voltage and constant current regulation with primary-side feedback, eliminating the need for opto-coupler feedback circuits.





An IMPORTANT NOTICE at the end of this TI reference design addresses authorized use, intellectual property matters and other important disclaimers and information.

1 Test Prerequisites

1.1 Voltage and Current Requirements

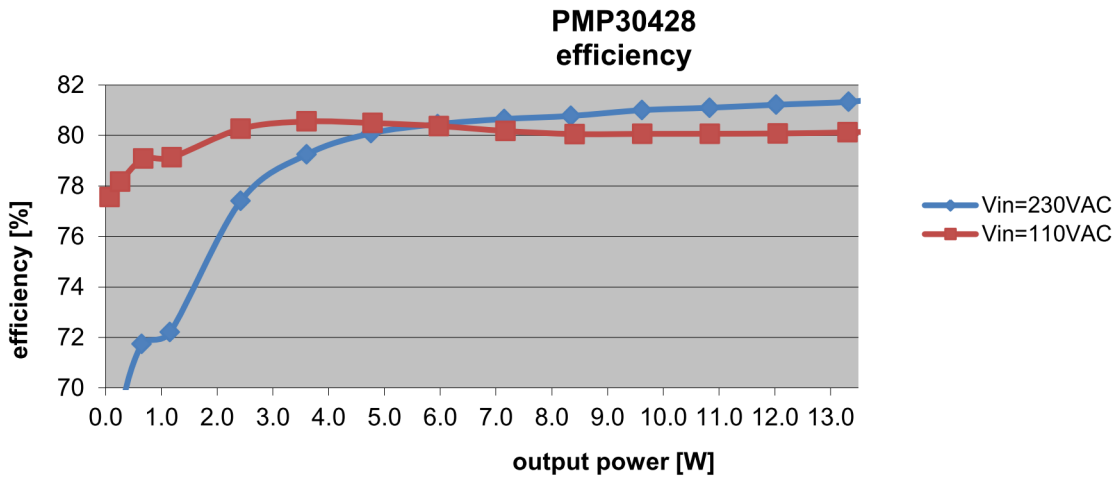
Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
V_{IN}	85VAC-400VAC
V_{OUT}	12V@1.1A; -3.3V@10mA
Nominal switching frequency	90kHz

2 Testing and Results

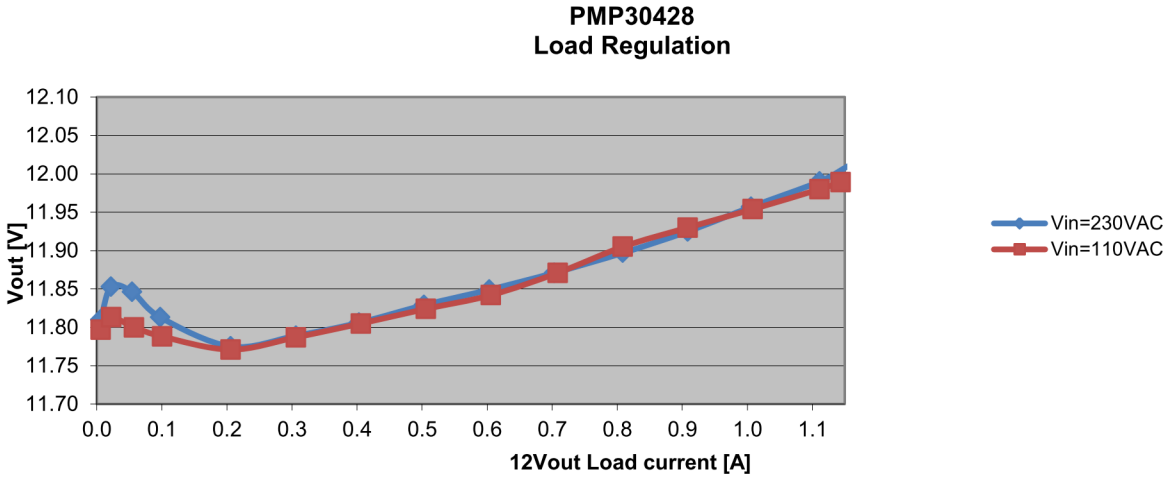
2.1 Efficiency Graphs

Figure 1. Efficiency



2.2 Load Regulation

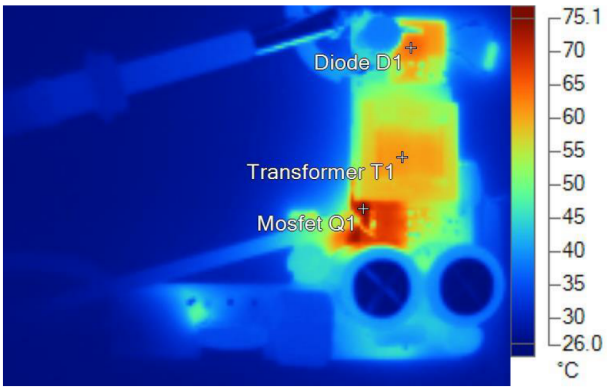
Figure 2. Load Regulation 12Vout



2.3 Thermal Images

The images below show the infrared images taken from the FlexCam after 15min at full load output power.

Figure 3. Thermal Pic Top View



Name	Temperature	
Mosfet Q1	75.1°C	
Diode D1	64.8°C	
Transformer T1	61.1°C	

110VAC I_12Vout=1.1A I_3.3Vout=10mA Top.is2

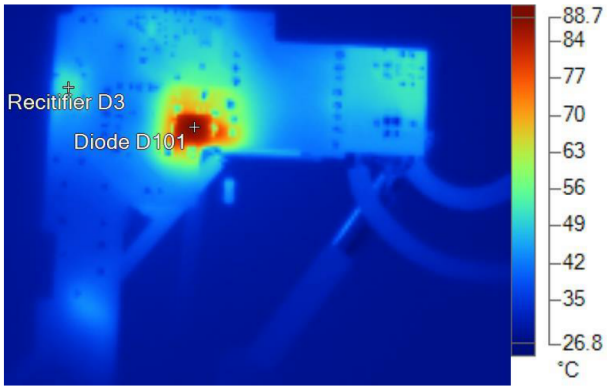
Input voltage = 110VAC

Output power = full load

Ambient temperature = 25°C

No heatsink, no airflow

Figure 4. Thermal Pic Bottom View

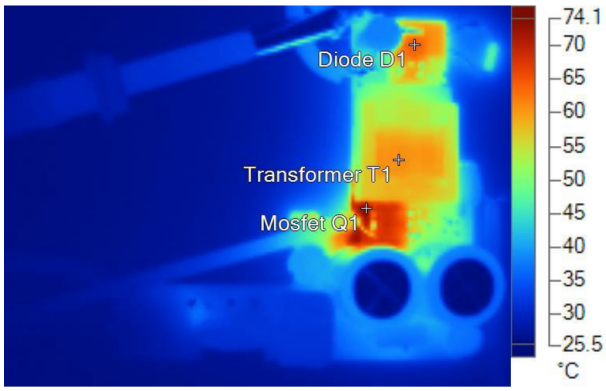


Name	Temperature	
Diode D101	88.6°C	
Recitifier D3	52.1°C	

110VAC I_12Vout=1.1A I_3.3Vout=10mA Bottom.is2

Input voltage = 110VAC
Output power = full load
Ambient temperature = 25°C
No heatsink, no airflow

Figure 5. Thermal Pic Top View

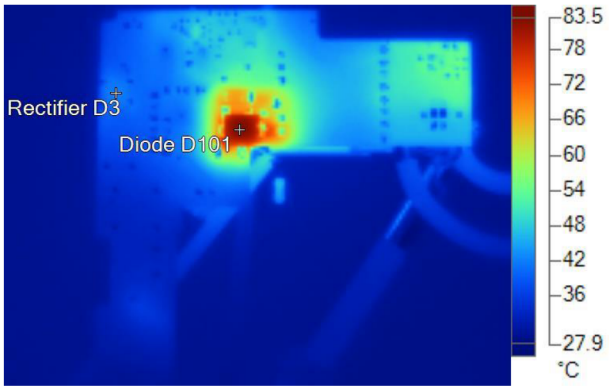


Name	Temperature	
Transformer T1	60.9°C	
Diode D1	64.3°C	
Mosfet Q1	74.1°C	

230VAC I_12Vout=1.1A I_3.3Vout=10mA Top.is2

Input voltage = 230VAC
Output power = full load
Ambient temperature = 25°C
No heatsink, no airflow

Figure 6. Thermal Pic Bottom View



Name	Temperature	
Diode D101	83.4°C	
Rectifier D3	42.3°C	

230VAC I_12Vout=1.1A I_3.3Vout=10mA Bottom.is2

Input voltage = 230VAC

Output power = full load

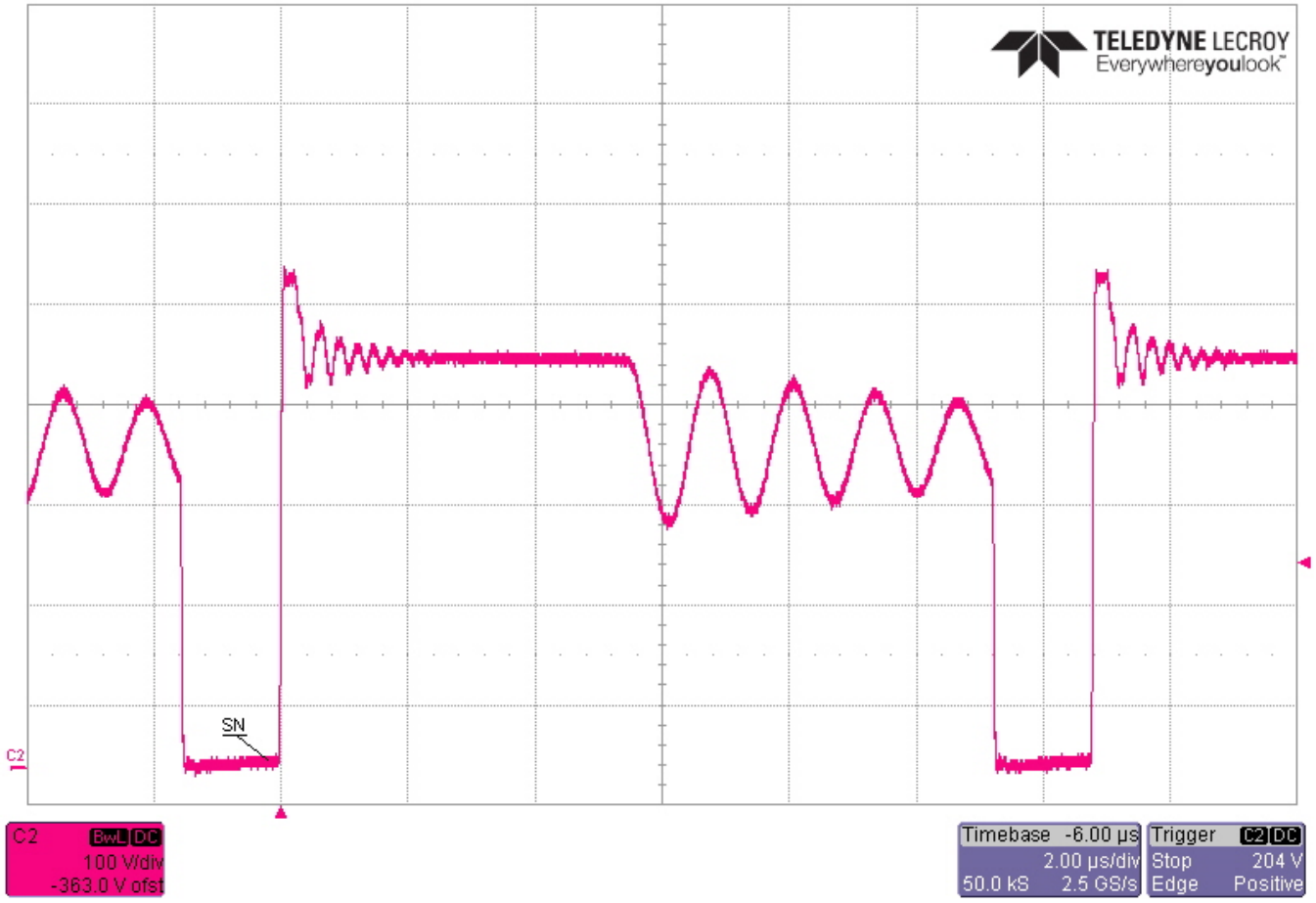
Ambient temperature = 25°C

No heatsink, no airflow

3 Waveforms

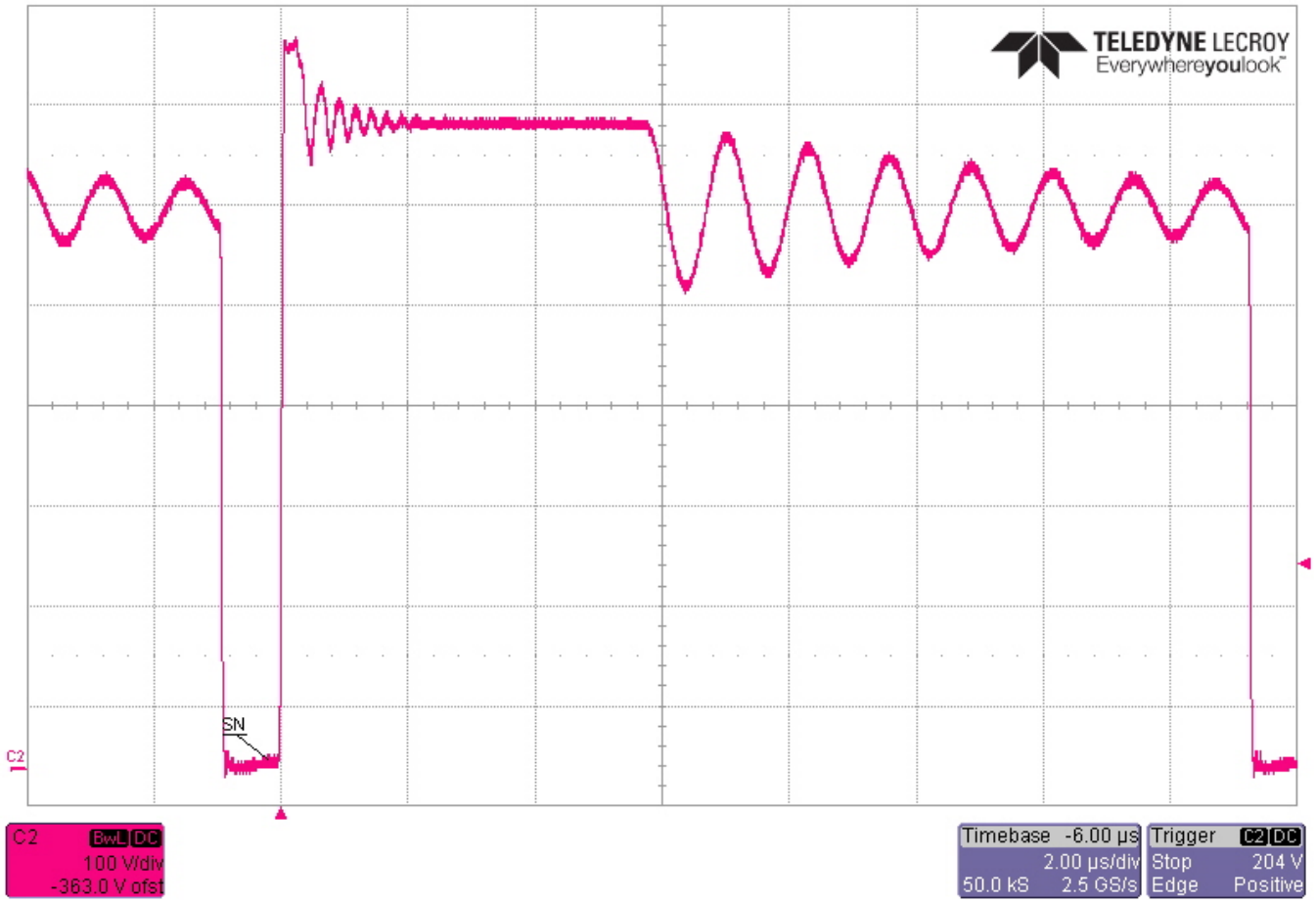
3.1 Switching

Figure 7. Switchnode



Input voltage = 325VDC
Output power = full load

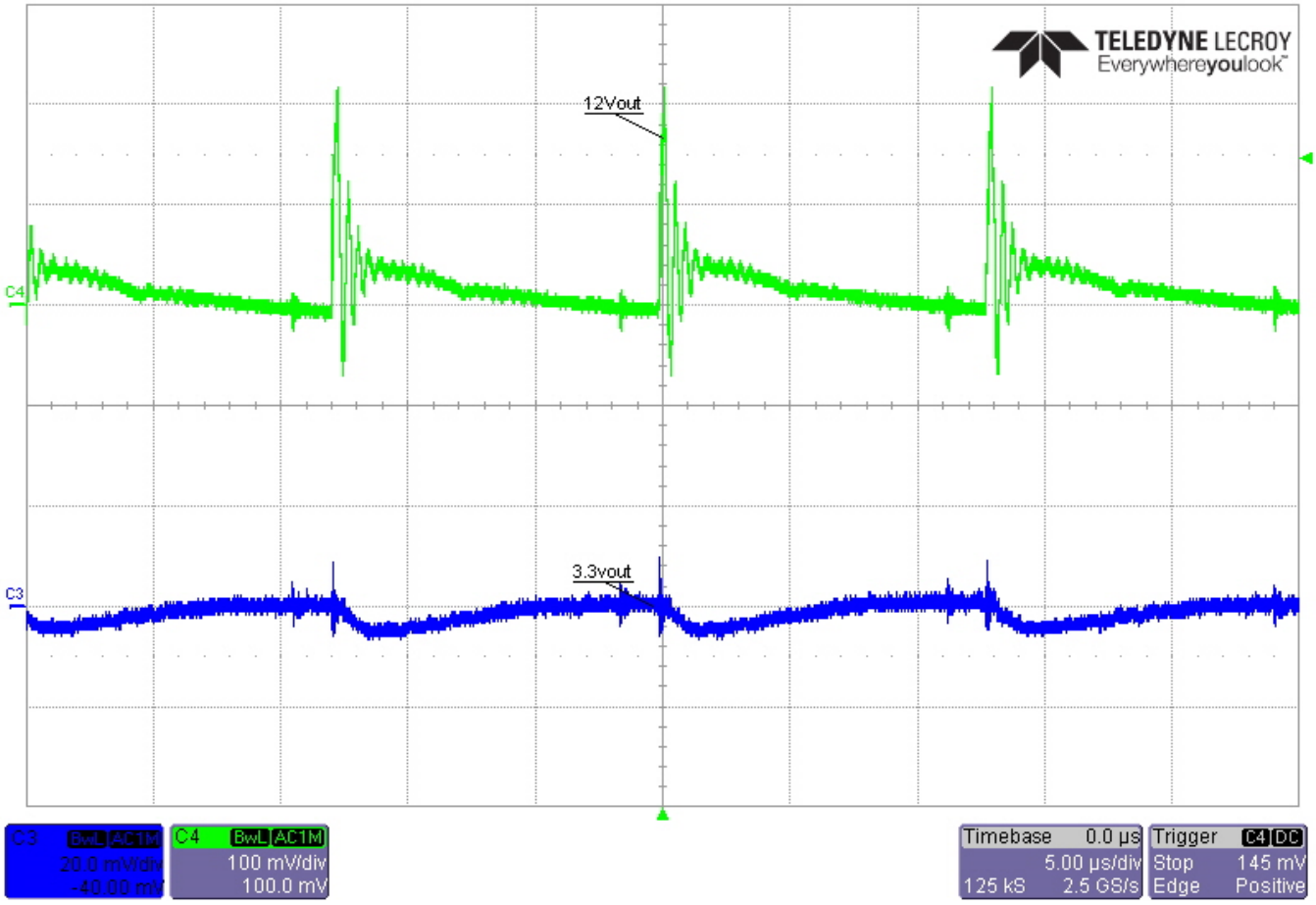
Figure 8. Switchnode



Input voltage = 565VDC
Output power = full load

3.2 Output Voltage Ripple*

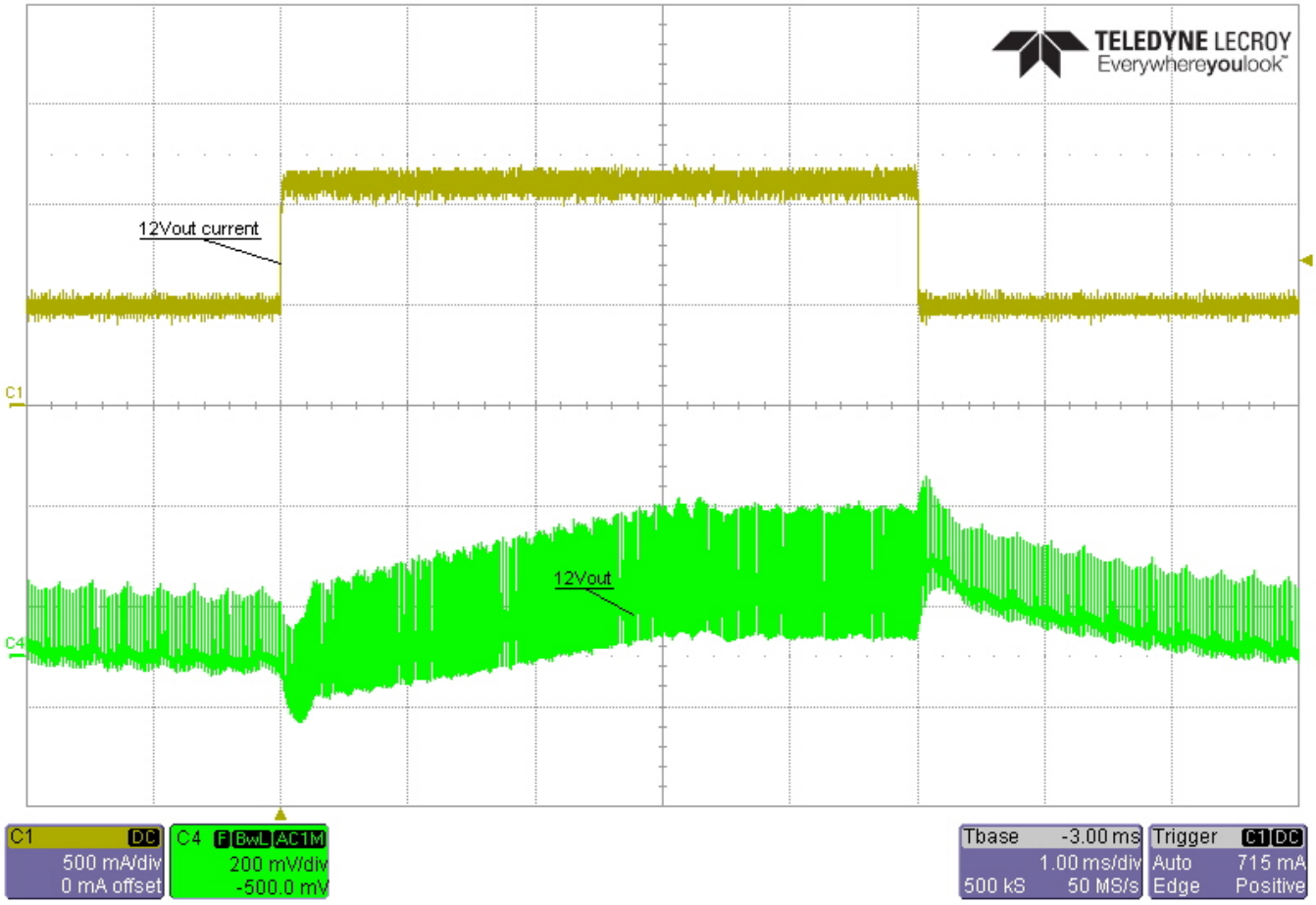
Figure 9. Output Voltage Ripple



Input voltage = 325VDC
Load current 12Vout = 1.1A
Load current -3.3V = 10mA

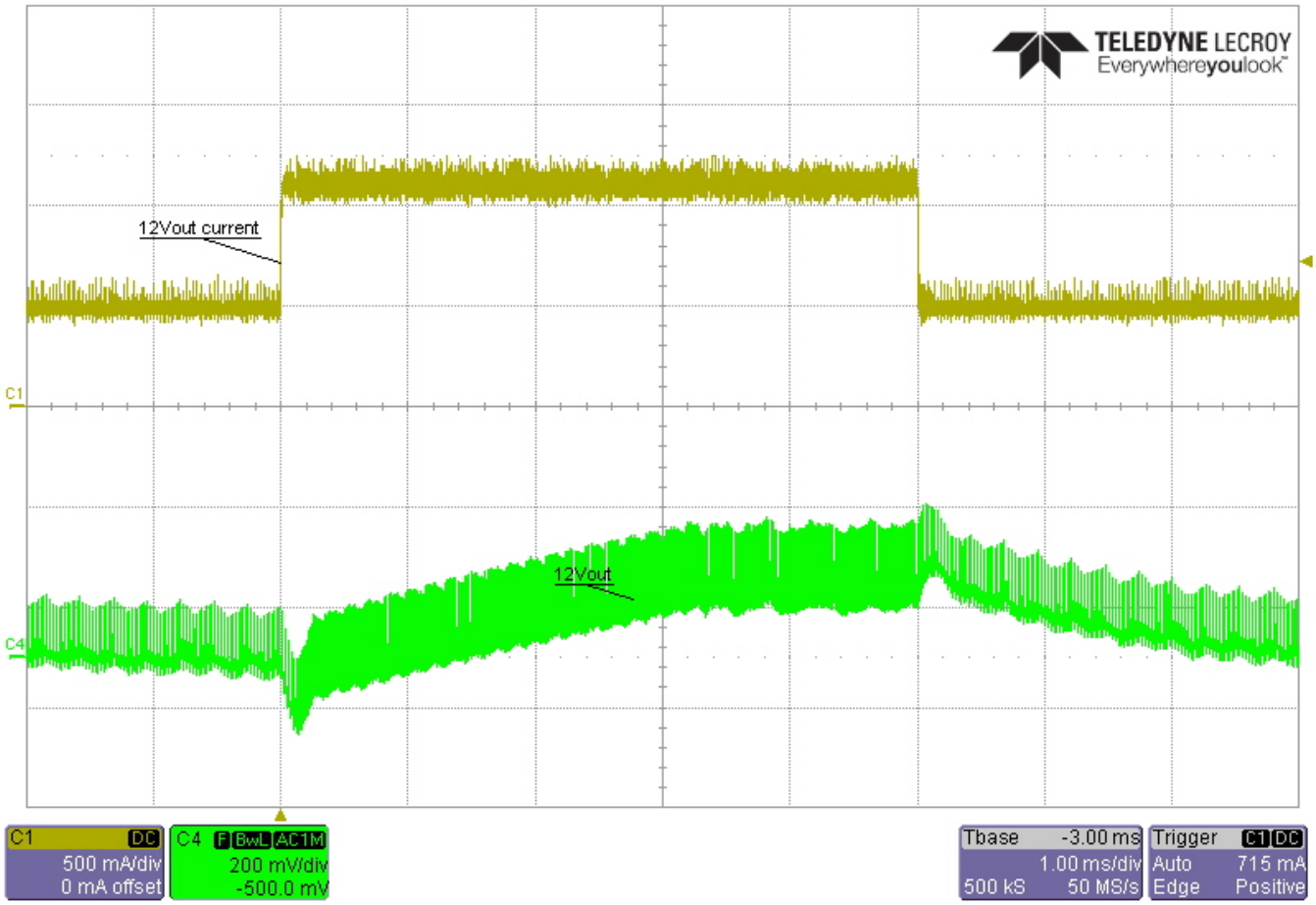
3.3 Load Transients

Figure 10. Load Transient Response 12Vout



Input voltage = 110VAC
Load current 12Vout = 0.5A to 1.1A

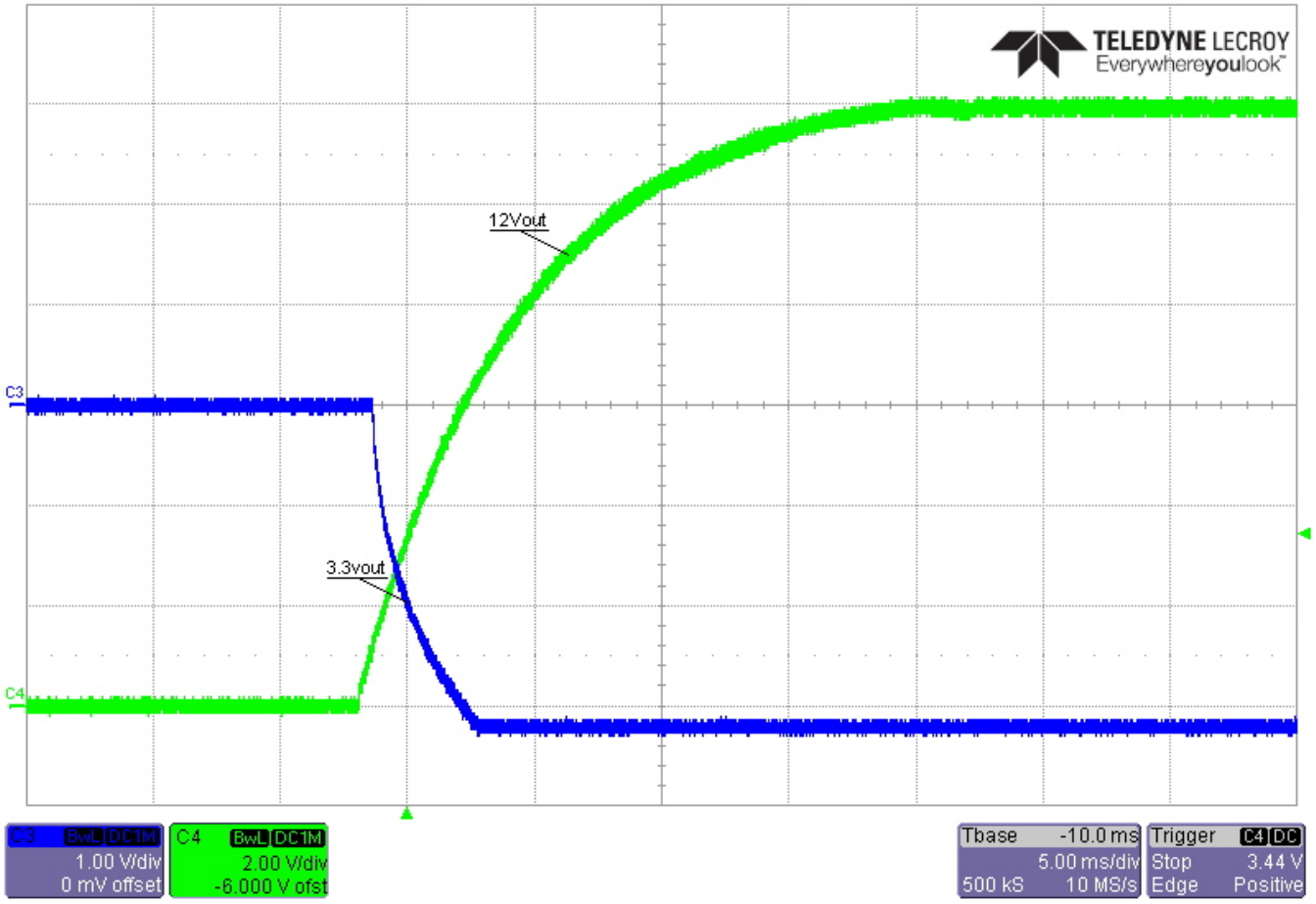
Figure 11. Load Transient Response 12Vout



Input voltage = 230VAC
Load current 12Vout = 0.5A to 1.1A

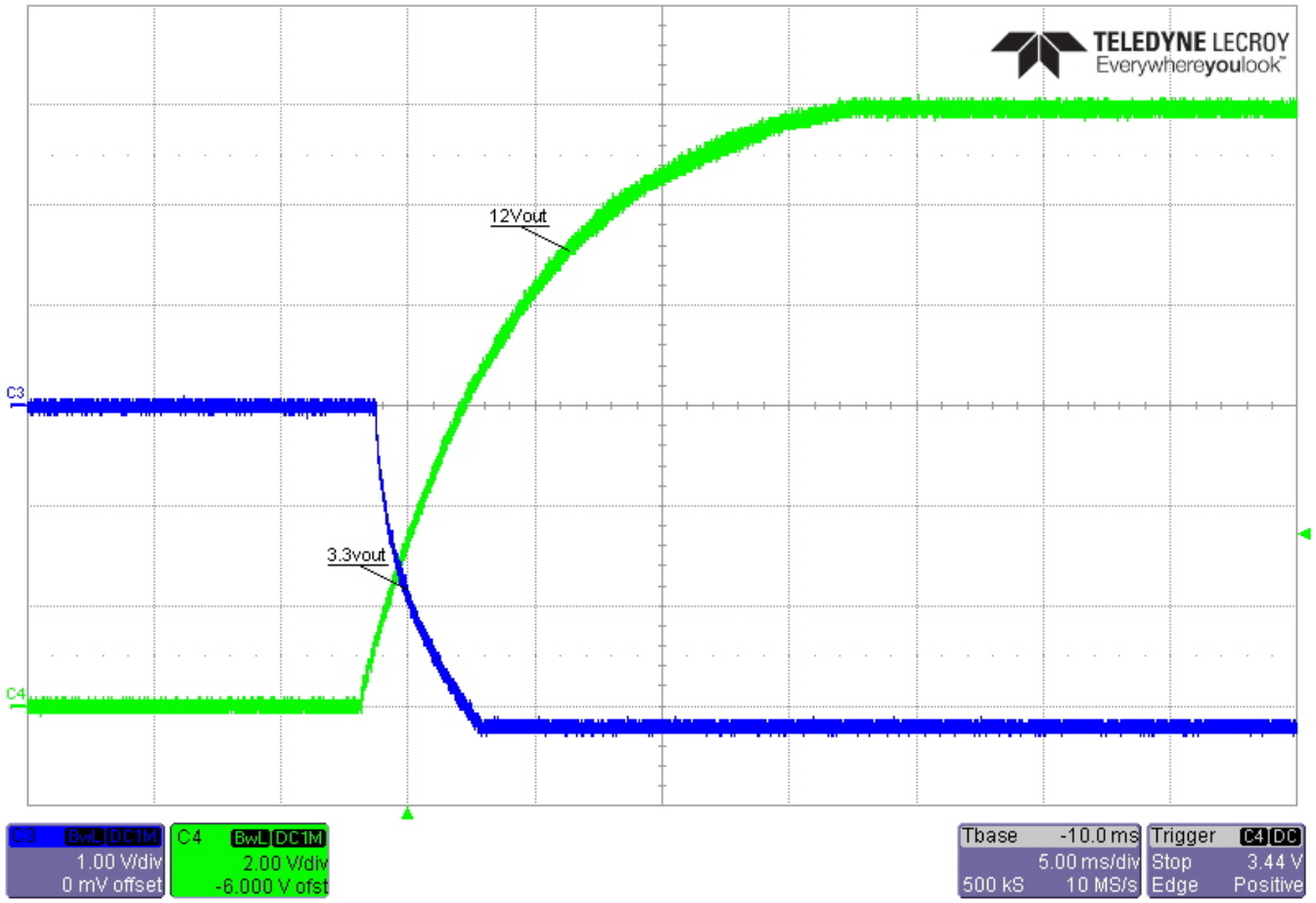
3.4 Start-up Sequence

Figure 12. Start-up



Input voltage = 85VAC
Load current 12Vout = 1.1A
Load current -3.3V = 10mA

Figure 13. Start-up

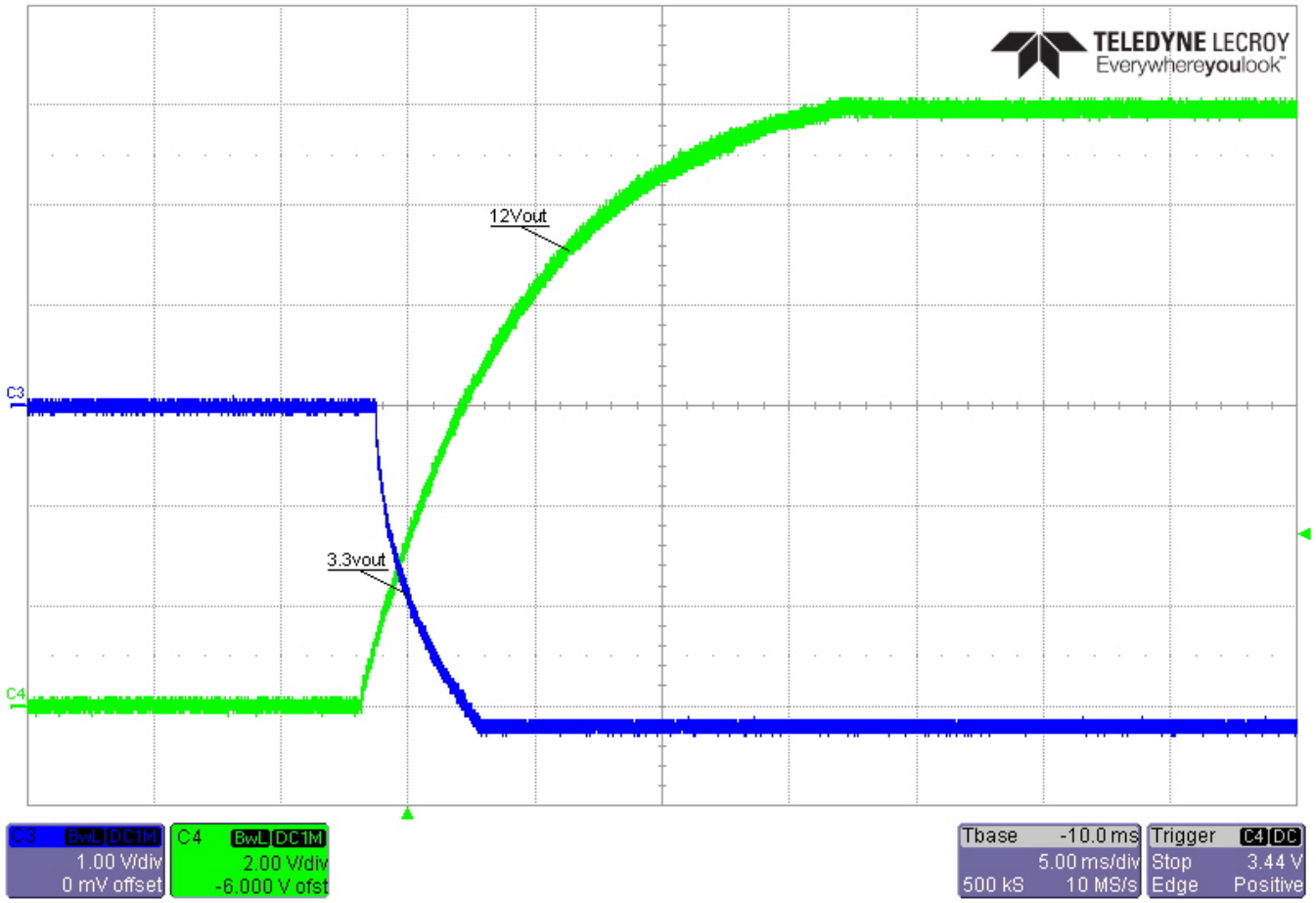


Input voltage = 273VAC

Load current 12Vout = 1.1A

Load current -3.3V = 10mA

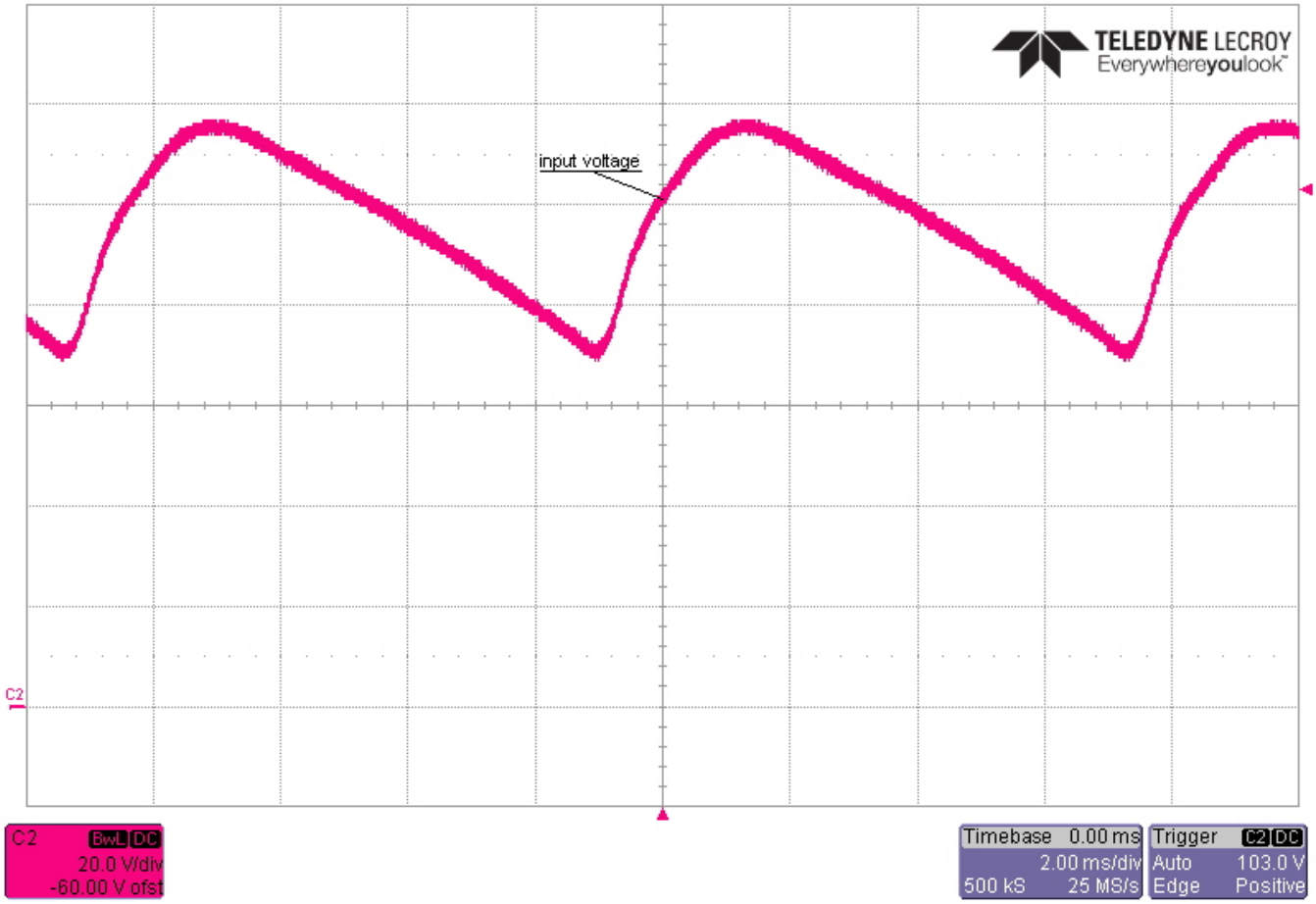
Figure 14. Start-up



Input voltage = 565VDC
Load current 12Vout = 1.1A
Load current -3.3V = 10mA

3.5 Input Ripple

Figure 15. Input Bulk Voltage



Input voltage = 85VAC
Load current 12Vout = 1.1A
Load current -3.3V = 10mA

3.6 Short Circuit Recovery

Figure 16. Short Circuit Test

input		output		
voltage [VAC]		12Vout [V]	I_12Vout[A]	power [W]
230		12.01	1.154	13.86
230		10.94	1.165	12.75
230		8.52	1.176	10.02
230		7.35	1.179	8.66
230		5.58	1.181	6.59
230		0.01	>1.19	
110		11.99	1.144	13.71
110		11.50	1.149	13.21
110		9.59	1.160	11.12
110		7.32	1.168	8.55
110		5.60	1.171	6.55
110		0.01	>1.18	

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (https:www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265