Using the TPS544C20EVM-634 and TPS544B20EVM-634

User's Guide



Literature Number: SLUUAY7A May 2014-Revised June 2014



TPS544C20EVM-634 and TPS544B20EVM-634, Single-Output DC-to-DC Converters with PMBus Interface

The PWR-634EVM evaluation module uses either the TPS544C20 or TPS544B20 devices. The TPS544C20 and TPS544B20 are highly integrated synchronous buck converters that are designed for up to 30-A or 20-A current output, respectively.

1 Description

The PWR-634EVM is designed as a single output DC-DC converter that demonstrates either the TPS544C20 or the TPS544B20 in a typical low-voltage application while providing a number of test points to evaluate the performance. It uses a nominal 12-V input bus to produce a regulated 1.0-V output at up to either 30-A or 20-A of load current, depending on the device installed.

1.1 Typical Applications

- High-Density Power Solutions
- Communications equipment
- Servers and Computing equipment
- Smart Power Systems

1.2 Features

2

- Regulated 1.0-V output up to 30-ADC, steady-state output current
- Output is marginable and trimmable via the PMBus interface.
 - Programmable: UVLO, Soft Start, and Enable via the PMBus interface
 - Programmable overcurrent warning and fault limits and programmable response to faults via the PMBus interface
 - Programmable overvoltage warning and fault limit and programmable response to faults via the PMBus interface
 - Programmable high- and low-output margin voltages with a maximum range of 10%, –20% of nominal output voltage
- Convenient test points for probing critical waveforms



2 Electrical Performance Specifications

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input	Characteristics					
	Voltage range	V _{IN}	8	12	14	V
	Maximum input current	V _{IN} = 8 V, I _O = 30 A,			5	А
	No load input current	V _{IN} = 14 V, I _O = 0 A		100		mA
Outpu	t Characteristics	•				
V _{OUT}	Output voltage	Output current = 10 A		1.0		V
I _{OUT}	Output load current	I _{OUT_min} to I _{OUT_max}	0		30	А
	Output voltage regulation	Line regulation: Input voltage = 8 V to 14 V		0.5%		
	Oulput voltage regulation	Load regulation: Output current = 0 A to I_{OUT_max}		0.5%		
V _{OUT}	Output voltage ripple	$V_{IN} = 12 \text{ V}, \text{ I}_{OUT} = 20 \text{ A}$		30		mVpp
V _{OUT}	Output overcurrent		20			А
Syster	ms Characteristics	·				
	Switching frequency	F _{sw}		500		kHz
V _{OUT}	Peak efficiency	$V_{IN} = 8 \text{ V}, I_{O} = 10 \text{ A}, F_{SW} = 300 \text{ kHz}$		92%		
V _{OUT}	Full-load efficiency	$V_{IN} = 8 V, I_{O} = 10 A, F_{SW} = 300 \text{ kHz}$		90%		
	Operating temperature	T _{oper}			105	°C

Table 1. PWR-634EVM Electrical Performance Specifications

3

Schematic

3 Schematic







4 Test Setup

4.1 Test and Configuration Software

To change any of the default configuration parameters on the EVM, it is necessary to obtain the TI Fusion Digital Power Designer software. This can be downloaded from the TI website.

4.1.1 Description

The Fusion Digital Power Designer is the graphical user interface (GUI) used to configure and monitor the Texas Instruments TPS544B20 or TPS544C20 power converter installed on this evaluation module. The application uses the PMBus protocol to communicate with the controller over serial bus by way of a TI USB adapter (see Figure 3).

4.1.2 Features

Some of the tasks you can perform with the GUI include:

- Turn on or off the power supply output, either through the hardware control line or the PMBus operation command.
- Monitor real-time data. Items such as input voltage, output voltage, output current, temperature, and warnings and faults are continuously monitored and displayed by the GUI.
- Configure common operating characteristics such as VOUT trim and margin, UVLO, soft-start time, warning and fault thresholds, fault response, and ON/OFF.

This software is available for download at http://www.ti.com/tool/fusion_digital_power_designer



Test Setup

6

4.2 Test Equipment

Voltage Source: The input voltage source VIN must be a 0-V to 14-V variable dc source capable of supplying at least 5 Adc. Connect VIN to J2 Figure 2.

Multimeters: It is recommended to use two separate multimeters Figure 2. One meter is used to measure Vin and one to measure Vout.

Output Load: A variable electronic load is recommended for testing Figure 2. It must be capable of 30 A at voltages as low as 0.9 V.

Oscilloscope: An oscilloscope is recommended for measuring output noise and ripple. Output ripple must be measured using a Tip-and-Barrel method or better as shown in Figure 4.The scope must be adjusted to 20-MHz bandwidth, ac coupling at 50 mV/division, and must be set to 1-µs/division.

Fan: During prolonged operation at high loads, it may be necessary to provide forced air cooling with a small fan aimed at the EVM. Temperature of the devices on the EVM must be maintained below 105°C.

USB-to-GPIO Interface Adapter: A communications adapter is required between the EVM and the host computer. This EVM was designed to use the Texas Instruments USB-to-GPIO Adapter (see Figure 3). This adapter can be purchased at http://www.ti.com/tool/usb-to-gpio.

Recommended Wire Gauge: The voltage drop in the load wires must be kept as low as possible in order to keep the working voltage at the load within its operating range. See the following table for recommended wire gauge and length to achieve a voltage drop of no more than 0.2 V at the maximum 30-A load.

AWG Gauge	Ohms per Foot (Ω)	Load Wires Combined Length (Ft)	Each Wire Length (Ft)
12	1.59E-3	6.30	3.15
14	2.53E-3	3.96	1.98
16	4.02E-3	2.49	1.25
18	6.39E-3	1.57	0.78

As an example, if AWG 12 wire is used, no more than 3.15 feet of wire must be used between the EVM and the load.



4.3 The PWR-634EVM

7



Figure 2. PWR-634EVM Overview



Test Setup

8

www.ti.com

4.4 Test Set up and USB Interface Adapter



Figure 3. Complete Test Setup Including Texas Instruments USB-to-GPIO Adapter



Tip and Barrel VOUT **Ripple Measurement** Figure 4. Tip and Barrel Measurement

4.5 List of Test Points

Test Point	Туре	Name	Description
TP1	T-H loop	PGOOD	Power good signal for V _{OUT} .
TP2	T-H loop	ADJ	Output voltage adjust
TP3	T-H loop	SMBALERT	SMB alert signal
TP4	T-H loop	BPEXT	Bypass connect
TP5	T-H loop	V _{OUT} + Sense	
TP6	T-H loop	V _{OUT} – Sense	
TP7	T-H loop	V _{OUT} +	
TP8	T-H loop	V _{IN} +	
TP9	T-H loop	V _{IN} —	
TP10	T-H loop	GND	
TP11	T-H loop	V _{OUT} -	
TP12	T-H loop	CNTL	Control signal

Table 2. The Function of Each Test Point

9



5 EVM Configuration Using the Fusion GUI

The TPS544B20 or TPS544C20 installed on this EVM leave the factory pre-configured. See Table 3 for a short list of key factory configuration parameters as obtained from the configuration file.

ADDRESS HEX	ADDRESS DEC	PART ID			
0x1B	27	TPS544x20			
		GENERAL			
CMD ID WITH PHASE	CMD CODE HEX	ENCODED HEX	DECODED	NUMERIC	COMMENTS
VIN_OFF	0x36	0xF014	5.00 V	5	Turn OFF voltage
VIN_ON	0x35	0xF01C	7.00 V	7	Turn ON voltage
		TPS544B20			COMMENTS
IOUT_CAL_GAIN	0x38	0x8821	1.0071 mΩ	1.0071	DCR of output inductor
IOUT_CAL_OFFSET	0x39	0xE000	0.0000 A	0	Current offset for GUI readout
IOUT_OC_FAULT_LIMIT	0x46	0xF83C	30.0 A	30	OC fault level
IOUT_OC_FAULT_RESPONSE	0x47	0x3C	Restart continuously		Response to OC fault
IOUT_OC_WARN_LIMIT	0x4A	0xF832	25.0 A	25	OC warning level
MFR_04 (VREF_TRIM)	0xD4	0x0000	0.000 V	0	Trim voltage
ON_OFF_CONFIG	0x02	0x02	Mode: always converting		Control signal and operation command not required
OPERATION	0x01	0x00	Unit: immediate off; margin: none		Response to turn OFF trigger
OT_FAULT_LIMIT	0x4F	0x007D	125°C	125	OT fault level
OT_WARN_LIMIT	0x51	0x0064	100°C	100	OT warn level
TON_RISE	0x61	0xE02B	2.6875 ms	2.6875	Soft-start time
		TPS544C20			COMMENTS
IOUT_CAL_GAIN	0x38	0x8821	1.0071 mΩ	1.0071	DCR of output inductor
IOUT_CAL_OFFSET	0x39	0xE000	0.0000 A	0	Current offset for GUI readout
IOUT_OC_FAULT_LIMIT	0x46	0xF832	25.0 A	25	OC fault level
IOUT_OC_FAULT_RESPONSE	0x47	0x3C	Restart continuously		Response to OC fault
IOUT_OC_WARN_LIMIT	0x4A	0xF828	20.0 A	20	OC warning level
MFR_04 (VREF_TRIM)	0xD4	0x0000	0.000 V	0	Trim voltage
ON_OFF_CONFIG	0x02	0x02	Mode: always converting		Control signal and operation command not required
OPERATION	0x01	0x00	Unit: immediate off; margin: none		Response to turn off trigger
OT_FAULT_LIMIT	0x4F	0x007D	125°C	125	OT fault level
OT_WARN_LIMIT	0x51	0x0064	100°C	100	OT warn level
TON_RISE	0x61	0xE02B	2.6875 ms	2.6875	Soft-start time

Table 3. Key Factory Configuration Parameters

If it is desired to configure the EVM to settings other than the factory settings shown in Table 3, the TI Fusion Digital Power Designer software can be used for reconfiguration. It is necessary to have input voltage applied to the EVM prior to launching the software so that the TPS544B20 or TPS544C20 installed is active and able to respond to the GUI and the GUI can recognize the device. The default configuration for the EVM is to start converting at an input voltage of 4.5 V; therefore, to avoid any converter activity during configuration, an input voltage less than 4.5 V must be applied. An input voltage of 4 V is recommended.

5.1 Configuration Procedure

- 1. Adjust the input supply to provide 4 V_{DC} , current limited to 1 A.
- 2. Apply the input voltage to the EVM. See Figure 2 and Figure 3 for connections and test setup.
- 3. Launch the Fusion GUI software. See the screen shots in Section 8 for more information.
- 4. Configure the EVM operating parameters as desired.



6 Test Procedure

6.1 Line/Load Regulation and Efficiency Measurement Procedure

- 1. Set up the EVM as described in Section 4.3 and Figure 2.
- 2. Ensure that the electronic load is set to draw 0 A_{DC}.
- 3. Increase V_{IN} from 0 V to 12 V using the DMM to measure input voltage.
- 4. Use the other DMM to measure output voltage V_{out} .
- 5. Vary the load from 0 A_{DC} to maximum rated output A_{DC} (TPS544B20 = 20 A, TPS544C20 = 30 A) . V_{OUT} must remain in regulation as defined in Table 1.

Test Procedure

- 6. Vary V_{IN} from 8 V to 14 V. V_{OUT} must remain in regulation as defined in Table 1.
- 7. Decrease the load to 0 A.
- 8. Decrease V_{IN} to 0 V.

6.2 Efficiency

To measure the efficiency of the power train on the EVM, it is important to measure the voltages at the correct location. This is necessary because otherwise the measurements will include losses in efficiency that are not related to the power train itself. Losses incurred by the voltage drop in the copper traces and in the input and output connectors are not related to the efficiency of the power train, and they must not be included in efficiency measurements.

TEST POINT	NODE NAME	DESCRIPTION			
TP8	VIN	Measurement point for VIN +VE			
TP9	PGND	Measurement point for VIN –VE			
TP7	VOUT	Measurement point for VOUT +VE			
TP11	PGND	Measurement point for VOUT -VE			

Table 4. List of Test Points for Efficiency Measurements

Input current can be measured at any point in the input wires, and output current can be measured anywhere in the output wires of the output being measured. Using these measurement points result in efficiency measurements that do not include losses due to the connectors and PCB traces.

6.3 Equipment Shutdown

- 1. Reduce the load current on both outputs to 0 A.
- 2. Reduce input voltage to 0 V.
- 3. Shut down the external fan if in use.
- 4. Shut down equipment.



7 **Performance Data and Typical Characteristic Curves**

Figure 5 through Figure 13 present typical performance curves for the PWR-634EVM.

7.1 Efficiency



Figure 5. Efficiency of 1-V Output vs Line and Load



7.2 Load Regulation

Figure 6. Load Regulation of 1-V Output

Copyright © 2014, Texas Instruments Incorporated



Performance Data and Typical Characteristic Curves

7.3 Transient Response



Load Step 10A to 20A







Load Release 20At o 10A

Ch1 = Vout1 at 50mV/division, Ch2 = lout1 at 5A/division





7.4 **Output Ripple**



DC Ripple 1A Load







DC Ripple 20A Load

Ch1 = Vout1 at 20mV/division, Ch2 = SW Node at 10V/division







StartUp from CNTL into 20A







ShutDown from CNTL

Ch1 = Vout2 at 20mV/division, Ch2 = SW Node at 10V/division





Performance Data and Typical Characteristic Curves



50% PreBias Start No Load

Figure 13. 50% PreBias Start, (no load)



8 Screen Shots

8.1 Fusion GUI Screen Shots

Texas Instruments	
Fusion Digital Power Designer Version 1.8.138 [2011-11-15]	
Restoring user preferences and data	
Figure 14. First Window at Fusion Launch	

TEXAS INSTRUME	NTS
Fusion Digital Power Designer Version 1.8.138 [2011-11-15]	
Scanning USB Adapter #1 for devices 1 device found	Device Found

Figure 15. Scan Finds Device Successfully



Screen Shots

i Texas Instruments

Fusion Digital Power Designer

Version 1.8.138 [2011-11-15]

1 device found; continuing with GUI startup ...

Figure 16. Software Launch Continued



Figure 17. Software Launch Continued

- Use this next screen to configure (Figure 18):
- OC fault and OC warn
- OT fault and OT warn
- Power good limits
- Fault response
- UVLO
- On/Off configuration
- Soft-start time
- Margin voltage

onfigure	and a second second second and a second se		175544C20 @ 403460 2/0 - KM #1
Co. Sana	Limits & On/Off Other Test Mode Measurement Debug Al C	Swedg]	
and the second second	Carrent Limits	Temperature Limits	
Auto write on rail or device change	Issuit OC Warn Leasts 20.0 🗄 A	Tenp Warn Limit: 125 🛐 🕫	
David Desper-	Inst OC Fault Lines 25.0 1 A	Temp Fault Linit; 190 🔃 ℃	
Store Config to NM	Voltage & Prover Good Lands		
Restore NVM Corfg			
	Sigut YOUT NORMAL: 1.2 [2] V	UV Fault PGLow PGHgh OV Fault	
	UV Fault: 0.9984 V	(e) -16.80 % -12.50 % +12.50 % +16.80 %	
	OV Fault: L-4016 V	○ -12.00 % -7.00 % +7.00 % +12.00 %	
	PG Loss: 1.05 V	O -28.00 % -22.00 % +7.00 % +12.00 %	
	55 Hohr 1.35 V	○ -42.00 % -36.00 % +7.00 % +12.00 %	
	27077 STO		
	O Do Not Restart The device does not attempt to restart. The subjut remains	doubled until the fault is cleaned.	
	 Do Not Restart The device does not attempt to vestert. The subjust remains Restart Contractory The device goes thready a rormal startup Saft start () canter another fault condition causes the soft to elucidour. 	dualded until the fault is deared. Auxaly, without beliation, until it is commanded off or bas power is removed or	
	Do Not Restart The device does not attained to restart. The subjuct remains (2) Restart Continuously The device goes through a remain startup. Soft start) contin another fault condition causes the unit for shuddown.	dualitiel until the fault is cleaned. Anauly, without bintation, until it is commanded off or bias power is removed or	
	Do Not Restart The divice observat stampt to restart. The subjuct remain De active observation stampt to restart. The subjuct remain De active observative The divice goes frewark a remain startup Soft start() can's another fault condition causes the unit for shuddown. Term Dau/Off	dualded until the fault is cleaned. anauly, without limitation, until it is commanded off or bias power is removed or Phargheting	
	by beck Rester 1. The device does not attaining to rester 1. The budget hermans classing Continuously the device does not attaining to rester 1. The budget herman classing Continuously the device does not attained to rest to device the continuously Term Day/Off the Dev 4.25 2 V wn Off.	dualized until the fault is descent. Ausualy, without leminiture, until it is commanded off an base power is removed or AUS V V 0 V 0.000 V 0.000 V V	
	Do hack Restart The divise data states of to restart. The subject tensor Restart Continuously The divise data states of the restart. The subject tensor Restart Continuously The divise data states of the restart and Soft start () continues The divise data states of the unit to division. Takes Daujoff Win Dis:	dualited until the fault is cleaned. Accusive, without lettelations, until it is commanded off or base power is removed or Accos V Accos V V V V V V V V V V V V V V	
	Do Nack Restart The divise does not attempt to restart. The subjuct tensor De Restart Continuously The divise goes through a remain startup Soft start () conten- another fault condition causes the unit to dividious. Tame Out/Off Win Dec	dualitied until the fault is deared. Auxouity, without lettelation, until it is commanded off or base power is removed or AUXOUVY AUXOU	
·) Configure	Do Nack Restart The divise does not attempt to restart. The subjuct remain De lease does not attempt to restart. The subjuct remain De lease to Contrauculy The divise goes through a remain startup. Boilt start () contra andrear fault condition causes the unit to shuddown. Tares Day/Off If and Day Off More: 4.25 v wn Off. OnyOff Config: 0x02 v Tops & Herits	dualitied until the fault is deared. Auxoury, without lentitiers, until it is commanded off or bala power is removed or AUXOURY INFORMATION INFORMAT	
) Cooligare) Monitor	C be Net Restart The Service deer that stampt to restart. The subjuct memory C bestart Continuously The Service deer Service) a remain startup. Doilt start () canter and feer Seal's condition causes the unit to shuddown. Tares Gau(Off W Drs: 4.25 2 V wn Off. OnyOff Config: 0x02 2 Tops A Vents Here, sor (Xet, Vent J Adult, PC, Listett) (Sead2) Inde Sea Service Values () when you're condition	dualitied until the fault is deared. Auxoury, without limitation, until it is commanded off or bias power is removed or AUXOUV PAragement Intel Responsibility 0.009 (2) V Intel Responsibility 0.009 (2) V Intel Responsibility 0.009 (2) V PROUSLag	
) Configure) Monitor) Status	by bert Reader The output of the second to restore 1. The output tension Bassers Continuously Provide the second of the second to restore 1. The output tension Bassers Continuously Term Dayloff the December 1. The output tension the Decemb	dealed und the fault is describ. Autority, without limitation, will it is connected off or base power is removed or AUTOR V AUTOR V Mediatory and Autor V AUTOR	() () () () () () () () () () () () () (

Figure 18. First Screen After Successful Launch: Configure- Limits & On/Off



Screen Shots

www.ti.com

Use this screen to configure (Figure 19) :

- V_{REF} trim
- I_{OUT} cal gain (DCR of output choke)



Figure 19. Configure- Other

Use this screen to configure all of the configurable parameters (Figure 20). The screen also shows other details like hexadecimal (hex) encoding.

Company C	ADUOT OTHE TEST Mode Measure manual CAL_ONESET OALONESET	Code	g Alconig								
Auto write on rai in Auto write on rai in Auto write on rai in Auto write on rai in Biose dange Store Config to NMM Restore SVM Config Command Cole Command Cole Group by Category WRUTE BIOLOGIE Store Configure Store Configure Stor	mand 	Code	and the second states of the s								1.00
Addres ander dense dange Densel Linere Roose Config to NAM Reations NAM Config Config to NAM Config to N	_CAL_OFFSET 04 (VRUT_TRIPA)		Water, Lot	Hen/Edit	Command		Code	Value/Edit	Hest/Edit		
Borne Config to NMM Store Config to NMM Sectors NVM Code Orgonal Store Command State Command State Command Code Sector Structure Command Code Sector Structure Sector Structur	_CAL_OFFSET				▼ . 0n/0fl Cr	nfiguration					
Store Cardy to NAM Restore Kr/M Cordg Sort Cardy to NAM Sort Parameters Dr Command State Command State Sort Parameters Dr Command State Sort Sort Sort Sort Sort Sort Sort Sort	04 (WREF TRIMO	0.39	A 15 0000.0	6v£000	MFR_05 (STE	P_VIEP_MARGIN_HIGH)	0.05	0.039 🔄 V	0x001f		
Store Config to NMM V Con Restore NVM Config Conversal Name - MPR, 2 Conversal Name - MPR, 2 Conversal Name - MPR, 2 Conversal Code - MPR, 2 Conversal Code - MPR, 2 Conversal Name - MPR, 2 Convers	1.12.111.1.2.2.0.000 · ·	0,04	0.000 🕀 V	0x0000	MFR_06 (STE	P_VREF_MARGIN_LOW)	0.06	4 🗄 eco.0	OVPE2		
Restors Mrth Conlig Int Parameters By: O Command Kine O Command Kine Command Kine	unfiguration				MFR_08 (SEQ	UENCE_TON_TOFF_DELAY)	0.08	Qxde 🖃	0x00		
Set Parameters by (a) Convent Vise (b) Convent Vise (c) Convent Code (c) Convent Code (c) Convent Code (c) Convent Code (c) Convent (c) Con	,13	0.00	4685, 0	0x0304	01_017_001	96	0.02	0x03	0x02		
Lot Parameters by HPR_3 © Convenient Name PRR_2 Convenient Name PRR_2 PRR_2 PRR_2 PRR_2 PRR_2 PRR_2 PRR_3 PRR_2 PRR_3 PRR_	.14	0.06	27724	010404	OPERATION		0.01	0x00 (8w00		
Convent Name Percent Name Convent Code Percent Convent Code Percent Pe	17	0.£1	278d, 0	0x0135	TON_RISE		0.61	2.7 V m	9-6928		
Convention	21 (OPTIONS)	0.65	BN_ADC	0x0004	V Status						
Group by Category WR_4 Wood J WR111 Root _6 Root _6 Root _6	23 (MASK_SMBALERT)	0.07	NOLUY: V	ENG 200	READ_BOUT		D/BC	3.44.6	0-8037		
VEUT	44 (DEVICE_CODE)	BIPC	0x0153	0x5153	READ_TEMPE	RATURE_2	0.00	33 *C	0×0021		
WRATE 10007_0 10007_0 10007_0	MODE	0:20			READ_VOUT		0.08	1.129.9	0x0258		
10017_0 10017_0 10017_0	IL_PROTECT	0:10	0x00 ~	oudo	STATUS_BYT	6	0.78	000000.10	Parti .		
10007_0 10007_0 10007_0	anës				STATUS_CH		0.75	1000000 T	10.00		
BORT_C BORT_C	_OC_FAULT_LIMIT	0.cm	35.0 🖓 A	04646	STATUS_ROU	e.	0.78	00000000	100		
BOUT_C	OC_FAULT_RESPONSE	0×47	Restart	Do.F	STATUS_MER	SPECIFIC	0.00	00000000 =	the state		
19993386	OC_WARN_LIMIT	-0.4A	30.0 (TA	047830	STATUS_TEM	PERATURE	0.70	000000001 []	1411		
24FR_0	07 (PC1_YOUT_FAULT_PG_LIMIT)	0.07	P(2) 000 🖓	0400	STATUS YOU	r	Q.7A	0000000	141		
01_10	AULT_LEMIT	0.4	150 23 *C	0+0096	STATUS WOR	iD .	0:79	00	Darrest .		
OT_WA	WARN, LIMIT	.0.61	125 (El ec	0,0070	Second and	meters	-				
VIN_OF	urr	0.36	4.00 V	047030	MER_00 (FOR	_USER)	0.00	0x0000 (=)	0+0000		
VIN OF	0N	0.05	4.25 (+) V	04011	100000000				Contractor of the second se		
1 THE OWNER	conductorer Info		- Sad								
CAPAB	UTI IN COLUMN	0:19	0400	0.60	1						1.0
61											1
Configure Tou Atte	ients -				1	PHEuslog					
Monitor	44 (DEVICE_CODE) [0xFC]	a mila co									
Status	NAME AND ADDRESS AND DECKING ADDRESS OF A STOCK OF A ST	m 10/10/10	ALC OR YOURS ADD	remain (0006)	6	PMbalog					6
usion Digital Pawer Designer vI. 9.18	18 [2014-02-20] TP\$544C20 @ Address	27.6 1058	Adapter vI 0.11 (PE)	C- 400 VHv1						de trass permanent i ter	and distail here

Figure 20. Configure- All

20

Copyright © 2014, Texas Instruments Incorporated



Screen Shots

Changing the on/off configuration prompts a pop-up window with details of the options Figure 21).

File Device Tools	i Help			TPS544C20 @ Address 37d - Ral #1
Configure	Limits & OnyOH Other Test Mode Measurement Debug	Alcaritg		
detailing in sec.	Carrest Limits	Temperature Limits		
Auto write on rail or device change	Inut OC Warn Linet: 30.0 [2] A	-de ordioria contilitar deservicion di a	133 55 %	
Store Config to NM	Invt OC Pault Line 35.0 任人	Always Converting Unit powers up any time power is present, mgardless of state of the COVITIOL pin or	100 (25 %)	
	Voltage & Power Good Limits	OPERATION command.		
Cost families former	System 12 (1) v UV Faulti 0.9964 v UV Faulti 0.9964 v OV Faulti 1.4036 v PG Law: 1.05 v PG law: 1.35 v	CONTROL PH Day The driving prives the oxfulf portion of the OPEXATD's contract do not and but, Proof a convention with the CONTROL pain. Note: In control to the TeC CONTROL pain. Note: In control to the CONTROL pain.	Fault (30) % 700 % 500 %	
	Over-Current / Under-Volkage Fault Response	- Control Pie Polanty		
	O Do Not Restart The device does not attempt to restart. The output r	Charles Barris and a second		
	Restort Contracutiv The device peers through a normal starkup (Soft start another fault condition oxuant the unit to shuddown.	Central Pie Teen Off Configuration South of a state of the configuration South of a state of the configuration South of the configuration South of the configuration South of the configuration South of the configuration	bac power is removed for	
	Turn Da/Off	Hargining		
	Vin Dis 4.25 V vin Offs	4.00 🐨 V mel Margin Hight Mel Margin Lines	0.038 ()) V -0.039 ()) V	
UN assistances				(2)
Consequen	Fox & Herts		PHDuelog	
J Monitor	Sets the value of the output current, in angeres, that causes the	e overcurrent detector ta indicate an 🛛 🖂		<u>n</u>
🔄 Status		6	PMB/a Log	6 9
Fasion Digital Passet De	esigner v1.9.38 (2014-02-20) TP3544C20 @ Address 27# US8 A	dagter v1.0.11 (PEC: 400 kHz)		💠 Texas Invenuences (tunion digital power
2 O 1	🤹 🙀			• 🕅 🛶 9.29 AM 5/11/214

Figure 21. Configure- Limits and On/Off- On/Off Configuration Pop-up

After a change is selected, orange **U** icon is displayed to offer *Undo Change* option. Change is not retained until either *Write to Hardware* or *Store User Defaults* is selected. When *Write to Hardware* is selected, change is committed to volatile memory and defaults back to previous setting on input power cycle. When *Store User Defaults* is selected, change is committed to nonvolatile memory and becomes the new default (Figure 22).

rie Deute tops r	43						12540422 @-Address 17 - Rail #1	
Configure	Linta & On/Off Other Al Config	3						
Witeschardware	Corrent Lawits	Tenpera	iture Law	ta				6
Auto unita binati di fecisi dirigi Discut Orlange Sont Sien Orlande Restance Use Orlande Restance Use Orlande	Start OC WeeLamit 24.6 Sact OC WeeLamit 26.6 Sact OC Fault Limit 36.3 Voltage B Proser Code 36.3 Oracle Sact Sact OC Fault Limit 36.3 Oracle Sact Sact OC Faul	Control Control Altera Converting Und particular and partited particular and partit		Red #1 000 [0] 123 [0] 124 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0] 125 [0]	Read #2 100 (2) 101 (2) 102 (2) 103 (2) 104 (2) 105 (2) 105 (2) 100 (2) 100 (2) 100 (2) 100 (2) 100 (2) 100 (2) 100 (2) 000 (2) 0000 (2) 0000 (2)	Index framework of starty manded of the inclusion frame 0.000 (20 y 0.000 (20 y		
	Turn On Reas: 2.4875 22 mm	ali 2.6077 🔂 me		andfus Lag				10
Configure 4 Monitor	unes to ren me mission, vour Uncles, as a percentage of nominal.	"ACCURATE (MA) AND ACCURATE (MA) THE						
and the second s			ph.	and the literature				D. C

Figure 22. Configure- Limits and On/Off- On/Off Config Pop-up



Screen Shots

The I_{out} cal gain can be typed in or scrolled to a new value. The range for I_{out} cal gain is 0.244 m Ω to 15.5 m Ω and the resolution step is 30.5 $\mu\Omega$. If a value is typed in that is between the available discrete steps, the typed-in value does not change but the nearest discrete step is retained. The actual step is displayed on relaunch of the Fusion GUI (Figure 23).

ciel frence robe r	93		19540422 @-Address 27 - Raf #1
Configure	Units & Drub# Dfer All Config		
metadamatasan.	Device Constants	Write Protect	
Auge write on relief Sector thange Decent Theorem Spore User Defaults Restore User Defaults Decent Decent Theorem	Device Color: Metersfleer: (USE7 (1954-922)) Revealer: 0:02 Priffien Reveaue: 11.1.1. Fert 1.1. Fert Casolific: Hawkinson Supported Res Speed: 00 Into Packet Core Oracing (PEC) Supported: 11th 9984/1072 are and according to 11th 9884/1072 are and	Oracle al units except to the VARTE_REVECT comment Oracle al units except to the VARTE_REVECT.COMMENT VARTE_REVECT.COMMENTANCE VARTE_REVECT.COMMENTANCE VARTE_REVECT.COMMENTANCE VARTE_REVECT.COMMENTANCE VARTE_REVECT.COMMENTANCE VARTE_REVECT.COMMENTANCE	
	Not # 1 Out # 1 Out # 1 Sam C All # 2 Sam C All # 2 Sam C All # 2 Sam C All # 2 Sam C All # 2 Sam C All # 2 Sam C All # Office: Sam C All # 2 Sam C All # 2	BuyCo,Ch. State #Cocentron OnL_DRC OnL_DRC OnL_DRC OnL_DRC OnL_DRC to the statting or gets drive non-outling the unstatulation for a drivers. The statting for each charved the background to a hyper-walks a strategy rate back.	
	HR SP(CHC 86		
	Tas Sires	246.4 (ap	0
Coofigure	Addy of the voltage at the Current sense pricits the sensed current.		
Monitor			

Figure 23. Configure- Other- Iout Cal Gain Change

On/Off configuration can also be configured from the All configuration screens, and the same process applies (Figure 24).

anfigure	Limits & DruOff Other Test Mode Measur	evient Deb	ag Al Config						
Contraction of the	Command	Code	Value/Edit	Hes/Edd	Command	Code	Value/Edit	Hex/Edd	
Auto write on rail or	• Coldentine				* On/Off Configuration				Ay on one course investering to 2. 😳 🗉 🖬
device change	IDUT_CAL_OFFSET	0.39	0.0000 TA	6v£000	MFR_05 (STEP_VRIF_MARGIN_HIGH)	0.05	0.039 🔁 V	Dv601f	On / Off Control
	MER_04 (VREF_TREM)	0:04	0.000 🕀 V.	SN0000	HER_OS (STEP_VEEF_MARGIN_LOW)	0.06	4 🗄 480.0	0/752	Always Converting:
ra Config to NVM	▼ Configuration				MIR_08 (SEQUENCE_TON_TOFF_DELAY)	0.04	Qx00 -	0x00	regardess of state of the CONTRICK pin or
tors NVM Corfg	MFR_13	0.00	4685, 0 👻	0x0304	ON_ORF_CONTIG	0.02	0x02	0x02	CONTROL DRIVER
	MFR_14	0.06	27710	9x0403	OPERATION	0.01	0x00 (8v00	The device sprores the on/off portion of the
0.100.01245.02.021	MFR_17	0.E1	2566, 0	0x0364	TOP-RISE	0.63	2.7 v m	9-6928	a converted when the CONTROL on a active.
For several to by:	MFR_23 (OPTIONS)	0.65	BUADC. V	0x0004	V Stelan	-			CONTRACTION ONLY De device process the CONTRACt on Prover a
Command Code	MER_23 (MASK_SMBALERT)	8:27	100.00	Dx5 200	READ_DOUT	0.00	3.56 A	0-6039	converted when the onjoff portion of the OPERATION command a on
on an has Category	HFR_44 (DEVICE_CODE)	DIFC	0x0153[w]	0x5153	READ_TEMPERATURE_2	0.00	32 *C	@x0020	C Buth CONTROL PH & OPERATION
net of careford	VOUT_HODE	0:20			READ_VOUT	0.88	5.100 9	0-0250	The CONTROL pin must be active and the on laff portion of the OPERATION command
	WRITE_PROTECT	0x10	0x00 🖓	0450	STATUS_BYTE	0:78	000000 10 🖓		on for the device to convert power.
	Tolenes				STATUS_CHL	0.75	10000000 T	0.00	- Centrol Pin Polarity
	IOUT_OC_FAULT_LIMIT	0.cm	35.0 E A	0.4546	STATUS_JOUT	0:78	00000000 🐨		
	DUT_OC_FAULT_RESPONSE	0x47	Restart	Do#	STATUS_MIR_SPECIFIC	0.00	00000000		In the operation of the second second
	IOUT_OC_WARN_LIMIT	0.4A	30.0 (TA	047830	STATUS_TEMPERATURE	0.70	00000000		- Centrol Pin Turn Off Configuration
	HTR_07 (PC1_VOUT_FARAT_PG_LIMIT)	0xD7	P(2) 000 🖓	0400	STATUS_VOUT	Q.7A	(manane 🕞		And the second s
	OT_FAILT_LIMIT	0.eff	150日代	0~0096	STATUS_WORD	0:79	04		Contract the second and they beachering
	OT_WARN_LIMIT	0.61	125년(~	010040	V. User Parameters				every to the work in list separation
	VIN_OW	0.36	4.00 V	047030	MER_00 (FOR_USER)	0:00	0x0000 []	2x0000	
	VIN_ON	0.05	4.25 (+) V	04011					
	· Plandactorer Jolo			-	(
	CAPABILITY	0:19	0.60	0:60					
	(E).				8				
Configure	Figu & Hints				PMBuslog				
Monitor	10UT_OC_WARR_LINIT [0x4A]								
and a second sec	Sets the verse of the overall current that charges a	n purgluit or	architers reside		13.				

Figure 24. Configure- All Config- On/Off Config Pop-up



After making changes to one or more configurable parameters, the changes can be committed to nonvolatile memory by selecting *Store User Defaults*. This action prompts a *confirm selection* pop-up, and if confirmed, the changes are committed to nonvolatile memory (Figure 25).

Configure	Units & On/Off Other All Config								
and a farmar base to	Command	Code	Yolue/Edit	Hex/Edit	Command	Code	Value/Edit	Hex/Edit	
el la vez atra de la la	California				* Handacturer John				
devia preside	IDUT_CAL_GAIN	0.38	1.0071 [] m2	0+8821	CAPABILITY	1009	0.00	0.60	
	TOUT_CAL_OFFSET	0.09	N.0000 (3.4	0+5000	PHILIS_REVISION	0.98	LLLI-Pert	0111	
Store User Defaults	HER_04 (VR2F_183H)	DiD4	0.000 EBy	0x0000	▼ 0s/0ff Configuration				
Restore User Defails	▼ Configuration				MPR_05 (STEP_VILLF_MARGEN_HIGH)	0.05	0.000 EE v	Gw0000	
Cline Research Roberts	MR_13	0.00	13136	0x0521	MPR_06 (STEP_WREF_MARGIN_LOW)	0.04	6.000 🐨 ¥	(0x000)	
	MR_34	0.0€	1211A(2)	0+0643	MPR_00 (SEQUENCE_TON_TOFF_DELAY)	906	0×00 💷	0×00	
O Gabe Device	MR_17	0,61	2445,0(9)	0x00F4	DN_DPF_CONTIG	0.02	0+02 -	0+02	
Faraneters	MER_21 (OPTIONS)	0.45	BLACC.	0x0004	OPERATION	0.65	3x00 😳	0x00	
C Parameters for the Rail	MPR_44 (DEVICE CODE)	0.#C	0+0072 (~)	0x0073	TON_RESE	0.61	2.6675	0x6028	
Al Parameters	VOUT_HODE	0,29	812-9	0+17	▶ Statan				
Sort Parameters Ru:	WRITE_PROTECT	8:18	0.00	1.00	The David Proceedings				
(Connectione	▼ Limits		Confirm	Stere to Tie	h 🕺	0.00	0x0000 H	0x0000	
Camnand Cade	TOUT_DC_FAULT_LIMIT	Dc46	2 1	The specific	m will store all configuration values to fast-				
🖓 Group by Category	IDUT_OC_FAULT_RESPONSE	8:47	Restart .	mentions and	te 19540422 @ 4dilless 27. Do you with to proceed?				
	IDUT_OC_WARN_LIMIT	Dir4A	22	1	Tes No				
	MIR_07 (PCT_VOUT_FAILT_PG_LIMIT)	D:07	PSJ P		100 (100)	1			
	OT JAULT LIMIT	D.M	125 图 4	0.0070					
	OT_WARN_LEMIT	0.51	100 🖽 🗠	0x0064					
	VD_0/7	0.36	5.00 🗄 v	0(9014					
	VIN_ON	8.05	7.00 EB #	(ownose					
	Too kirima				Pridue Log				
	10UT_CAL_0095ET [0x39,Rad #1]	5.2		10.17					
O Coofigure	Meet when used in conjunction with the SOUT_CAL, current sensing prout.	SA21 com	vent to minimite the e	op of the	F.				
.) Monitor				6					
Status				12	Distantial International Inter				

Figure 25. Configure- Store User Defaults

In the lower left corner, the different view screens can be changed. The view screens can be changed between *Configure*, *Monitor* and *Status* as needed (Figure 26).

File Device Tools P	45				79546422 @ Address 27 - Ral #1
Configure	Lints & On/Off Other (Al Confe)				
	Current Lands	Temperature Las	0		8
Ruto sinte ori rali or stevice charge	Rail #1 Rail #2 Jaur OC Ware Limit 20.0 (2) /	Teng liters und	100 (1) ~	Rad #2	
One Der Celade	Baroc Paulune Barma 200	Teng Fault Lents	19.00 4	13.01 4	
	Voltage & Power Good Limits				
in transformer	Ref #1: Urfait Pices Pices Orfait @ 048.% 023.% +025.% +048.%	Rad #2: U/Fall	10100 PG-901	- <u>01 Faul</u> +36.8 %	
	0 4255 4255 4255 4255	0 -28.0 %		+12.0 % +12.0 %	
	Over-Current / Under-Voltage Fault Response	0 444 4			-
	The device base in at alterning to restart. The auto- mentar diabatic and the fact is descent. (•) Restart Controlución (•) Restart Controlución the device gene shough a roma large-tup Soft to professional and the strategies of the control of the large profession and the soft fault profession bases the unit to shutteen.		he derica does not attend sabled until the fault is de estant Continuously he derica goes through a phrouously, without finite as power to removed or a rit to shutdown.	It to restart. The subjuit remains aneld. normal atomics Goff start() tan, until it is commanded off or other fault condition causes the	
	Turn Os/Off		Hargining		
	Ver On 7.00 UV ver Off. 5.00 UV On Off Carlies And ST Model Wrans Converting Name AV	#2 In Converting	Shef Harger Highs Shef Harger Laws	Kal #1 Com 田平 Com 田平 Com 田平 Com 田平	-
	Turn On Reas: 2.6675 [2] ms. 2.6875	B=+			1
	Tips & Horts	1	Andlus Lag		
· Coofigure	DOUT_CAL_GAIN (0x30,0x8 er) Auto of the voltage at the current sense and to the sensed current.	1			
b Monitor		1.00			

Figure 26. Change View Screen to Monitor Screen

23



When the *Monitor* screen is selected (Figure 27), the screen changes to display real-time data of the parameters that are measured by the controller. This screen provides access to:

- Graphs of V_{OUT} , I_{OUT} , Temperature, and P_{OUT} . As shown, Pout display is turned off.
- Start/Stop polling which turns on or off the real-time display of data.
- Quick access to on/off configuration
- Control pin activation, and operation command. As shown, because the device is configured for *always converting*, these radio buttons are either grayed-out or have no effect.
- Margin control.
- PMBus log which displays activity on the PMBus.
- *Tips and hints* which displays additional information when the cursor is hovered over configurable parameters.

At first GUI launch, faults may occur due to communications during power up. These faults can be cleared once the device is enabled.



Figure 27. Monitor Screen



Selecting System Dashboard from mid-left screen adds a new window which displays system-level information (Figure 28).

File Device Tools	Help									195544C20 @ Add	Hos 37d - Rai #1	
Monitor	Readings)	Vost - Output	Voltage			Sout - Outpe	d Current				1
Show/Hele Rots: Vout Dout Pout[calc @ Temp Fit All Plats on Screen O South State to Screen	Taut L13 Jout L4 Pout(old): 4.0 Tempi 3	8 V 4 A 5 W 6 T	1.20			1.178 V	OC Pault: 40.00	35.00 🕃 A OC V	Varni 30.00 🗄	A [====		
midth	Status Registers/	Layout Devices	eda / annos Digit	tal Power Designer		di ad	1994 - 199 1994 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 19 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 -	- 21 A	18	_		
122 State 1997	Vout: OK	System-Level Action	es and Settings	C					-			
Show Harn & Fault	Temp OK	On/Off Canfig		OPENATION	Pault Management	EEPROM Power-O	on Defaults			-		-
Show Value Labels an Plats	The OK CHL Internet	Always Converting	(wite	eSetting Harping V Turk On 3	mmed Off Cear Fauls	RomUserDe	elauta) (Rea	tore User Defails				
Poling Rate: 500 😳 (ream)	MT. OK SMEALERTH Autor											-
Stop Polleg	0	Rade										3.44 A
Device Oashboard	On/Off Cambo	Device 8	Rad	Yout lout Temp Control Lin	operation (BFU) o		On/Off Config			34:40	35:00	35:20
C Marcanona D	Control Law (USB											
		Status Registers	_						-			
	Marginisg	STATUS_WORD	22%					1				
	Margint @ None	STATUS_VOUT	OK						3			
	Pait Actor: OA	STATUS_LOUT	OK									
	Ut Ctu	STATUS_TEMPERAT	UNE OK									
D) Configure		STATUS_HER_SPEC	BUC OK					-				
									1 I.			
Monitor												
 Monitor Status 	LPHELIN Log Messag								24	vique loperulizione settings Po	Configure, Monitor,	and Status (†
U Honitor U Status Fusion Digital Passer Des	LPHELo Log Henneg signer vL.9.38 (2014-02-								24	visue specultione settings fo 49 to	r Carillgure, Maniter 206 Internations (10	and Status (*

Figure 28. System Dashboard

When the EVM starts converting power, the V_{OUT} graph changes scale to display both the zero and V_{OUT} level. Once the EVM is converting and clear of any faults, selecting *Clear Faults* clears any prior fault flags (Figure 29).





25



Screen Shots

www.ti.com

Selecting *Clear Faults* clears any prior fault flags. Scrolling time window of V_{OUT} will still show any turn-on event (Figure 30).



Figure 30. Faults Cleared



Selecting Status from lower left corner shows the status of the controller (Figure 31).

Figure 31. Status Screen



Selecting the pull-down menu *File- Import Project* from the upper left menu bar can be used to configure all parameters in the device at once with a desired configuration, or even revert back to a *known-good* configuration. This action results in a browse-type sequence where the desired configuration file can be located and loaded (Figure 32).



Figure 32. Import Project / Import Configuration File

Selecting *Store User Configuration to Flash Memory* from the device pull-down menu has the same functionality as the *Store User Defaults* button from within the configure screen. It results in committing the current configuration to nonvolatile memory (Figure 33).





Figure 33. Store Configuration To Memory



Select *Data Logging* (Figure 34), from the Tools drop-down menu. This enables logging of common operating values such as V_{OUT} , I_{OUT} , and temperature. The user is prompted to select a location for the file to be stored as well as the type of file. Select the storage location for the file and the type of file. The file will be a CSV file to be stored in the directory path shown. Logging begins when the *Start Data Logging* button is selected, and stops when it is reselected.

Mentador Men	ert Configuration Compare one one one A Tool Control Tester A Tool Configuration Tester Configuration Tester Configuration Tester - Configuration Tester - Configur	West - 0 129- 100- 0.80- 0.40- 0	Aufgest Voltage	2 40:40	8	41.00	41:20	1.169 V	000 - Outer 00 #adt: 40.00 - 30.00 - 10.00 -	35.00 ⊠ A 00 x	40-46	4100	41:20	3.44 A 42.45
hauha (B) Dong Cano) Publick (D) Dong Cano) Publick (D) Publick Logy Publick (D) Publick Logy Publick (D) Publick (D) Publick Logy Publick Logy Publick (D) Publick (D) Publick (D) Publick Red (D) Publick	ole 3- ing _ A Tost destreaded Tester Awire Stress Tester _ mand Pational Tester _ in Naport Tester _ in Tool _ Coordeas Tool _ St Adapter Termant _ Tester Mader Maker Converting	1.29 - 1.00 - 0.60 - 0.40 -	40:20	40:40	8	41.00	41:20	1.182 V	0.00	25.00 🕃 A - 00. 4	10.00 A	41,00	41:20	3.44 A
Aut. Constraint Constrai		100- 0.80- 0.40- 0.40- 0.20- <u>Tempera</u>	40:20 ature	40:40	\$	41:09	41.20	1.169 ¥	40.00	40.20	40.40	41,00	41:20	3.44.4
ANDERS CONTRACTOR ANDERS CONTRACTON	prg A Tool A Tool A Tool A Tool A Tool A Tool A Tool A Tool A Tool A Congine Tool A - D C Tandition Tool B Adapter Termane Congine Tool A Congine Tool B Adapter Termane Congine Tool B Adapter Termane Congine Tool B Adapter Termane Congine Tool B Adapter Termane	1.00- 0.80- 0.40- 0.30- <u>0.90-</u> <u>(Tempers</u>	40:20 ature	40:40	k	41:09	41:20	41:49	30.00	40.20	40.40	41/00	48:20	3.44 A 41.4
Source Pools In Marker St. Marker	A Tool Goodb Denold Tester 	0.88 - 0.40 - 0.40 - 0.30 - <u>0.30 -</u>	40:20 ature	40:40		41:00	41:20	61:49	30.00	40.20	40.46	41/00	48:20	3.44 A 41.4
3 sor Pion 9 sor Pion 9 core times to 9 core times to 1 EFPCOM The 1 EFPCOM The 1 Core core 1 EFPCOM The 1 Core core 1 Core core	code Decode Tetter //wirk Stress Teste _ 	0.80- 0.60- 0.40- 0.20- 0.00- Temper	40:20 atuer	40:40	k	41:09	41.20	41:40	30.00 20.00 10.00 0.00	40.20	40.40	41/00	48:20	3.44 A 41.4
Device Ready Device	Weite Stream Tester mend Protocol Tester honport Tester h Pool n - D CL Tendistion Teol 18 Adapter Termener Comp Made: Always Converting	0.60- 0.40- 0.20- 0.00-	40:20 attaer	40:40	8	41:00	41.20	41:49	20.09	40.20	40.40	41,00	41:20	344.4
September Sector Cardination Press Sector Cardination Sector C	mand Protocol Tester In Jopot Tester I Tool I Coorgan Tool II > DC Transistion Tool IS Adapter Terment Combg Made: Always Converting	0.60- 0.40- 0.20- 0.00-	40:20 attaer	40:40	8	41:00	41.29	41:40	20.00	40.20	40.40	41/00	41)20	344 A 414
Over Start Same Same Same Same Same Same Same Same	in Import Tester I Tool I Complex Tool IS Adapter Fernieure IS Adapter Fernieure I Combg D Mode: Always Converting	0.40- 0.20- 0.06-	40:20 attay	40:40	ķ	43:00	41:20	41:40	30.00	40.20	40:48	41,00	41:20	344 A 414
Unit Safety de Norman de Norman Service Cashbard Service Cashb	r Tool Compiene Tool us -> DC Translation Tool 18 Adapter Fernieare 19 Made: Aways Converting	0.40- 0.20- 0.06-	40:20 atae	40:40	\$	41.00	41:20	41:40	10.00	40:20	40:40	41,00	41:20	3.44 A 41.4
Searchan Search	r Tool r Company Tool is -> DC Translation Tool 18 Adapter Fernware 19 Made: Always Converting	0.40- 0.20- 0.00-	40:20 atan	40:40	4	41.00	41:20	41:40	10.00	40.20	40-48	41,00	41:20	3.44.4
High State I (Intel) State I State State S	r Complexe Tool n -> DC Translation Tool 16 Adapter Fernware F Config © Mode: Always Converting	6.20- 0.00-	40:20 atur	40:40	6	41.00	41:29	41:40	10.00 0.00	40:20	40:48	41/00	41:20	3.44 A
Terre State	us -> DC Translation Tool 18 Adapter Fernivaire 19 Config 10 Mode: Always Converting	0.20- 0.00-	40:20 atum	40:40	6	41:00	41:20	41:40	0.00	40:20	40:40	41:00	41:20	3.44 A 41.4
Stop Pulan Download US Devise Starboard Section Deathboard Control Operation Control Operation	18 Adapter Firmware	0.00 -	40:20 atum	40:40	6	41:00	41:20	41:40	0.00	40.29	40:40	41/00	41:20	3.44 A 41.4
Stop Frain Denice Crashbard System Dashbard Control Operation	Camily	Tempero	40:20 atum	40:40	6	41/09	41:20	41:40	0.00	40.20	40:40	41.00	41:20	3,44 A
Device Davidoord Over 2014	Canily	Temper	40:20 ature	40:40	6	41:00	41:20	41:40	. 35263	40:20	40:40	41/00	41:20	404
System DasMoard Control	Node: Always Converting	Temper	uture											
Control O risch Operatie		CT Fall							1					
Control Only Operate			and the C	With the second second	244 (V) 24	(*****								
Control Ongh Operato			130 2	Contraction of the second	mar									
Omp	d Lane (USB)	2000	1											
Operation	A Dim													
Operate	C. Law	150.0												
(Cer	taw													
			-			-								
		100.0												
Marginie	ikig		~											
Marght	@None O Low O High													
Fait Act	cton: O Act on Fault	50.0												
	O torore fault					0								
INVESTIGATION		-	1000					33.0 °C						
-> Configure		8.0												
U Monitor			40:20	401	40	41:00	41:20	41:40						
Status 2PHDia	Log Messages Show INDUS Log								-		 Environment 	e ispervisione settings	to Configure, Mont	lor, and Status [
usion Digital Power Designer v1.9.38		Address Tread In	and a dealer of		42							4	Taxas berrausenven	tunion digital pov

Figure 34. Data Logging Details

Common contents of the data log as shown in (Figure 35). The UUT had was running with a modified voltage, at an approx 3.5-A load and room temperature.

	4.9	Ŧ		1000		_	Data	Log-2014.02	11-09.45.27:	TFSSHC20-54	AL Adda2	Las - Mo	out b	icel			_		-		_		0.0	er.See
-	A Cre		int Papela	speak Formulas	Cuts Pariers	View	Add Ins Aires	et.		(84)	1010		_					-	-	1995	F Autolian		0-	9.5
	1 2 Cam		Calibo	· 11 · A A		\$** =>V	Visip Test	General	10000	100	- 12	Normal		Bad		lood		. E	12J		27.00	21	ana 👘	
Pag	J.Form	nat Painter	B 7 U	1 B1 9-4		梁 梁 337	Arrige & Centler *	5 - %	· 54.43	Conditional Formations	i Fornat	reutral		Calculation		Sink Cell		inter	Delete	Format	2 Clear +	Sort &	Find &	
	Cuttours	6 (N		furt:	ni (apprent	0.44	Hum	bei - 14					ityles					Cetta		1.2	ming		
	AL		• (*)))	& Timestamp																				14
U.		8	6	D	12	F	6		1	1	87	100	M	N	0	1.2	0		8	5	T .	U.	V	
1	limestam	Adapter	Part ID	Address R	EAD VOUT	READ IOUT	READ TEMPERA	TURE 2									-							- 19
2	45:28.3	1002	1 TP\$544C20	27	1.178	1.5	32	0.0000																
3	45:28.8		3 TP5544C20	27	1.184	3.4375	33																	- 14
4	45:29.3		1 TP5544C20	27	1.18	3.4375	35																	
3	45:29.8		1 TP5544C20	27	1.178	3,4375	33																	
6	45:30.1		1 TP\$544C20	27	3.18	3.4375	33																	
2	45:30.8		1 TP5544C20	27	1.18	3.4)75	31																	
8	45:31.3		1 TP5544C20	27	1.182	3.5	33																	
9	45:31.8		1 TP5544C20	27	1.178	3,4375	32																	
10	45:32.3		1 TP\$544C20	27	1.178	1.4375	33																	
11	45:32.8		1 TP5544C20	27	1.18	1.4175	33																	
12	45:33.3		1 TP\$544C20	27	1.182	8.4375	33																	
13	45:33.8		1 TP5544C20	.27	1.18	3.4375	33																	
14	45:34.3		1 TP\$544C20	27	1.18	3.4375	38																	
15	45:34.8		1 TP5544C20	27	1.184	3.4375	33																	
16	45:35.3		1 TP5544C20	27	1.182	1.4375	34																	
17	45:35.8		1 TP5544C20	27	1.185	3.4375	32																	
18	45:30.3		3 TP\$544C20.	27	1.182	3.5	37																	
15	45:36.8		3 TP\$544C20	27	1.183	3.4375	32																	
20	45:37.3		1 TP5544C20	27	1.182	1.5	32																	
23	45:37.8		1 TP\$544C20	.27	1.18	3.4375	33																	
22	45:38.1		1 TP55MC20	27	1.18	1.5	32																	
23	45:38.8		1 TP\$544C20.	27	1.18	3.4375	- 54																	
24	45:39.3		1 TP5544C20	27	1.184	8.4375	. 54																	
25	45:39.8		1 TP\$544C20	27	1.184	3.5	33																	
26	45:40.3		1 TP5544C20	27	1,182	3.5	33																	
27	45:40.8		1 TP5544C20	27	1.188	3.5	34																	
25	45:41.3		1 TP5544C20	27	1.182	3.5	33																	
25	45:41.8		1 TP5544C20	27	1.184	1.4375	35																	
30	45:42.3		1 TP\$544C20	27	1.182	1.4375	34																	
31	45:42.8		1 TP5544C20	27	1.184	3.5	35																	
32	45:43.1		1 TP3544C20	27	1.154	1.4175	54																	
	+ + Dut	ta-Log-24	014.05.13-09	.45.27-TP									14										_	+1
Read	ALC: N	-an	- NIC	and the second				_	_	_	_	_		_	_	_	_	_	_	-12	a 🛄 🛄 100	5 (e) ···	-0-	
1	0	1	₩.	X			100								13	1					•	-	9.48 5/13/	AM NEA

Figure 35. Data Log File



Screen Shots

Selecting *PMBus Logging* (Figure 36) from the Tools drop-down menu enables the logging of all PMBus activity in the same way as the datalogging. This includes communications traffic for each polling loop between the GUI and the device. It also includes common operating values such as V_{OUT} , I_{OUT} , and temperature. The user is prompted to select a location for the file to be stored. See next screen (Figure 37).



Figure 36. PMBus Logging



Select the storage location for the file and the type of file. As shown (Figure 37), the file is a CSV file to be stored in the directory path shown. Logging begins when the *Start Logging* button is selected, and stops when it is reselected (as *Stop Logging*). This file can rapidly grow in size, so caution is advised when using this function.

File Device Tools in	49		19546422 & Address 27 - Ref. #1
Monitor	Readings - Red #1	Vent-Rail #1	(lost - Raf #1
heuring Paul and C Jan heuring Paul heuring Paul heuring Paul Anna C Paul heuring Paul Paul Paul Paul Anna C Paul P	Task #1 Kal #2 VNCR 0.031 V 0.004 V Dail 0.00 V 0.004 V Dail 0.00 V 0.00 V Status Registers/Lines Vice #1 00 Dail 0.00 V 0.00 V 0.00 V Status Registers/Lines Vice #1 00 Dail 0.00 V 0.00 V 0.00 V Disc #1 0.00 V 0.00 V 0.00 V Disc #1 0.00 V 0.00 V 0.00 V Disc #1 0.00 V 0.00 V 0.00 V Disc VOT Config- Rad #1 0.00 V 0.00 V 0.00 V Control Line #1 0.00 V 0.00 V 0.00 V Operation - Rad #1 0.00 V 0.00 V 0.00 V Presegesseg-Rad #1 0.00 V 0.00 V 0.00 V	Control C	Construit 20.00 4. Oct training 25.00 4. Imm State 30.00 4. Oct training 4. Oct training 4. Imm State 30.00 4. Oct training 4. Oct training 4. Imm State 30.00 4. Oct training 4. Imm 4. Imm State 30.00 4. Imm 4. Imm 4. Imm State 30.00 4. Imm 4. Imm 4. Imm State 30.00 4. Imm 4. Imm 4. Imm State 30.00 21.00 21.00 21.00 21.00
	Theranic (Oliver: Churren Colline)		
	HER OF STREE LINES HARCIN LONG TO	Protecting (Section 2014)	PRUTER Laster Line 2
🎶 Coofigure	Used to domain the reference voltage by th OPERATION command is set to Margin Low, th by the command.	docked #1) Doctors (decises #1) C rought will decrease by the voltage indicated	Contract, provinces
and the second		17. No. 19. 19. 19. 19. 19. 19. 19. 19. 19. 19	

Figure 37. PMBus Log Details

Data is stored in a CSV file, with date-stamp name (Figure 38).

MBus-Log-2011.12.07-19.21.46.csv	43 KB	Microsoft Office Exc
2		

Figure 38. PMBus Log

9 EVM Assembly Drawing and PCB Layout

Figure 39 through Figure 43 show the design of the PWR-634EVM printed-circuit board (PCB).



Figure 39. PWR-634EVM Top Layer Assembly Drawing (top view)



Figure 40. PWR-634EVM Top Copper





Figure 41. PWR-634EVM Layer 1 (top view)



Figure 42. PWR-634EVM Layer 2 (top view)





Figure 43. PWR-634EVM Layer 3 (top view)



Figure 44. PWR-634EVM Layer 4 (top view)





Figure 45. PWR-634EVM Bottom Copper (top x-ray view)



Figure 46. PWR-634EVM Bottom Assembly (top x-ray view)

10 **List of Materials**

The EVM components list according to the schematic shown in .

NOTE: TPS544C20 version used for this example.

Table 5. PWR091 List of Materials

DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
C2, C17, C21	3	Capacitor, ceramic, 1000 pF, 50 V, ±10%, X7R, 0402	C1005X7R1H102K	TDK
C4	1	Capacitor, ceramic, 0.01 µF, 25 V, ±10%, X7R, 0402	C1005X7R1E103K	TDK
C5	1	Capacitor, ceramic, 4.7 µF, 16 V, ±10%, X5R, 0603	GRM188R61C475KA AJ	MuRata
C6	1	Capacitor, ceramic, 4.7 µF, 10 V, ±20%, X5R, 0402	GRM155R61A475M	MuRata
C7	1	Capacitor, ceramic, 0.1 µF, 10 V, ±10%, X5R, 0402	GRM155R61A104KA0 1D	MuRata
C8, C16	2	Capacitor, ceramic, 0.1 µF, 25 V, ±5%, X7R, 0603	C0603C104J3RACTU	Kemet
C9, C10	2	Capacitor, TA, 560uF, 2 V, +/-10%, 0.005 Ω, SMD	2TPLF560M5	Sanyo
C12, C13, C14, C15	4	Capacitor, ceramic, 10 µF, 25 V, ±10%, X7R, 1206	GRM31CR71E106KA 12L	MuRata
C18, C19, C24, C25	4	Capacitor, ceramic, 47 µF, 6.3 V, ±20%, X5R, 0805	JMK212BJ476MG-T	Taiyo Yuden
C22, C26	2	Capacitor, ceramic, 1 $\mu F,$ 25 V, ±10%, X5R, 0402	C1005X5R1E105K05 0BC	TDK
C23	1	Capacitor, aluminum, 470 $\mu F,$ 16 V, ±20%, ohm, SMD	EMVA160ADA471MH A0G	Nippon Chemi-Con
C1, C3	0	Capacitor, ceramic, 0.01 µF, 25 V, ±10%, X7R, 0402	C1005X7R1E103K	TDK
C11	0	Capacitor, ceramic, 1000 pF, 50 V, ±10%, X7R, 0402	C1005X7R1H102K	TDK
C20	1	Capacitor, ceramic, 120 pF, 50 V, ±5%, C0G/NP0, 0402	C1005C0G1H121J	TDK
C27	0	Capacitor, ceramic, 1000 pF, 50 V, ±10%, X7R, 0402	C1005X7R1H102K	TDK
C28	1	Capacitor, ceramic, 33 pF, 50 V, ±10%, C0G, 0402	C1005X7R1H330K	TDK
FID1, FID2, FID3	0	Fiducial mark. There is nothing to buy or mount.	N/A	N/A
H1, H2, H3, H4	4	Bumpon, hemisphere, 0.44 x 0.20, clear	SJ-5303 (CLEAR)	3M
J1	1	Header (shrouded), 100mil, 5 x 2, gold, TH	5103308-1	TE Connectivity
J2, J3, J4	3	Terminal block 5.08 mm vert 2 pos	ED120/2DS	On-Shore Technology
L1	1	Inductor, Shielded, Composite, 400nH, 36.8A, 0.0004 ohm, SMD	XAL1060-401MEB	Coilcraft
LBL1	1	Thermal transfer printable labels, 0.650" W x 0.200" H - 10,000 per roll	THT-14-423-10	Brady
!PCB	1	Printed circuit board	PWR634	Any
Q1	1	Transistor, NPN, 40 V, 0.2 A, SOT-23	MMBT3904	Fairchild Semiconductor
R1, R17	2	Resistor, 100 kΩ, 1%, 0.063 W, 0402	CRCW0402100KFKE D	Vishay-Dale
R3, R10, R14	3	Resistor, 0 Ω, 5%, 0.063 W, 0402	CRCW04020000Z0E D	Vishay-Dale
R6	1	Resistor, 20.0 kΩ, 1%, 0.063 W, 0402	CRCW040220K0FKE D	Vishay-Dale
R13, R15, R18	3	Resistor, 49.9 Ω, 1%, 0.063 W, 0402	CRCW040249R9FKE D	Vishay-Dale
R9	1	Resistor, 30.1 kΩ, 1%, 0.063 W, 0402	CRCW040230K1FKE D	Vishay-Dale
R2, R4	0	Resistor, 20.0 kΩ, 1%, 0.063 W, 0402	CRCW040220K0FKE D	Vishay-Dale



DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER
R5	0	Resistor, 0 Ω, 5%, 0.063 W, 0402	CRCW04020000Z0E D	Vishay-Dale
R16	0	Resistor, 1.0 Ω, 5%, 0.25 W, 1206	CRCW12061R00JNE A	Vishay-Dale
R8, R11, R12	3	Resistor, 38.3 kΩ, 1%, 0.063 W, 0402	CRCW040238K3FKE D	Vishay-Dale
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP12	11	Test point, miniature, red, TH	5000	Keystone
TP9, TP10, TP11	3	Test point, miniature, black, TH	5001	Keystone
U1	1	TPS544C20 18-V, 30-A PMBus Synchronous Buck Converters, RVF0040A	TPS544C20RVF	Texas Instruments

Table 5. PWR091 List of Materials (continued)

Evaluation Board/Kit Important Notice

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user is not exclusive.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT**, **DEMONSTRATION**, **OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 8 V to 14 V and the output voltage range of 1.2 V to 3.3 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 60° C. The EVM is designed to operate properly with certain components above 60° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2014, Texas Instruments Incorporated



Revision History

Changes from Original (May 2014) to A Revision

Page

•	Added updated PWR-634EVM Schematic drawings.	. 4
•	Added updated EVM Assembly Drawings and PCB Layout drawings	32
•	Added updated EVM Assembly Drawings and PCB Layout drawings.	32
•	Added updated EVM Assembly Drawings and PCB Layout drawings	33
•	Added updated EVM Assembly Drawings and PCB Layout drawings	34
•	Added updated EVM Assembly Drawings and PCB Layout drawings	35
•	Changed List of Materials	36
•	Changed List of Materials	37
		<u> </u>

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have *not* been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		Applications	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	TI E2E Community	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconn	ectivity	

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2014, Texas Instruments Incorporated