## User's Guide TPS544x20 Step-Down Converter Evaluation Module User's Guide

# TEXAS INSTRUMENTS

#### ABSTRACT

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.

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## 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

- 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 <sub>IN</sub>	8	12	14	V
	Maximum input current	V <sub>IN</sub> = 8 V, I <sub>O</sub> = 30 A,			5	А
	No load input current	V <sub>IN</sub> = 14 V, I <sub>O</sub> = 0 A		100		mA
Outpu	t Characteristics					
V <sub>OUT</sub>	Output voltage	Output current = 10 A		1.0		V
I <sub>OUT</sub>	Output load current	I <sub>OUT_min</sub> to I <sub>OUT_max</sub>	0		30	А
	Output voltage regulation	Line regulation: Input voltage = 8 V to 14 V		0.5%		
	Output voltage regulation	Load regulation: Output current = 0 A to I <sub>OUT_max</sub>		0.5%		
V <sub>OUT</sub>	Output voltage ripple	V <sub>IN</sub> = 12 V, I <sub>OUT</sub> = 20 A		30		mVpp
V <sub>OUT</sub>	Output overcurrent		20			А
Syster	ns Characteristics					
	Switching frequency	F <sub>SW</sub>		500		kHz
V <sub>OUT</sub>	Peak efficiency	V <sub>IN</sub> = 8 V, I <sub>O</sub> = 10 A, F <sub>SW</sub> = 300 kHz		92%		
V <sub>OUT</sub>	Full-load efficiency	V <sub>IN</sub> = 8 V, I <sub>O</sub> = 10 A, F <sub>SW</sub> = 300 kHz		90%		
	Operating temperature	T <sub>oper</sub>			105	°C

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## **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 4-2).

#### 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

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### 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 4-1.

**Multimeters:** It is recommended to use two separate multimeters Figure 4-1. One meter is used to measure Vin and one to measure Vout.

**Output Load:** A variable electronic load is recommended for testing Figure 4-1. 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 4-3. 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 4-2). 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	Ω 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



Figure 4-1. PWR-634EVM Overview

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### 4.4 Test Set up and USB Interface Adapter



Figure 4-2. Complete Test Setup Including Texas Instruments USB-to-GPIO Adapter



Tip and Barrel V<sub>OUT</sub> Ripple Measurement

Figure 4-3. Tip and Barrel Measurement



#### Test Setup

#### 4.5 List of Test Points

Table 4-1. The Function of Each Test Point					
TEST POINT	TYPE	NAME	DESCRIPTION		
TP1	T-H loop	PGOOD	Power good signal for V <sub>OUT</sub> .		
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 <sub>OUT</sub> + Sense			
TP6	T-H loop	V <sub>OUT</sub> – Sense			
TP7	T-H loop	V <sub>OUT</sub> +			
TP8	T-H loop	V <sub>IN</sub> +			
TP9	T-H loop	V <sub>IN</sub> -			
TP10	T-H loop	GND			
TP11	T-H loop	V <sub>OUT</sub> -			
TP12	T-H loop	CNTL	Control signal		

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## **5 EVM Configuration Using the Fusion GUI**

The TPS544B20 or TPS544C20 installed on this EVM leave the factory pre-configured. See Table 5-1 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		

Tahlo	5_1	Kov	Factory	Configuration	Daramotors
lable	<b>J-I</b> .	ney	гастогу	Configuration	Farameters

If it is desired to configure the EVM to settings other than the factory settings shown in Table 5-1, 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<sub>DC</sub>, current limited to 1 A.
- 2. Apply the input voltage to the EVM. See Figure 4-1 and Figure 4-2 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 4-1.
- 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<sub>DC</sub> to maximum rated output A<sub>DC</sub> (TPS544B20 = 20 A, TPS544C20 = 30 A). V<sub>OUT</sub> must remain in regulation as defined in Table 2-1.
- 6. Vary V<sub>IN</sub> from 8 V to 14 V. V<sub>OUT</sub> must remain in regulation as defined in Table 2-1.
- 7. Decrease the load to 0 A.
- 8. Decrease  $V_{\text{IN}}$  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 6-1. 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 7-1 through Figure 7-9 present typical performance curves for the PWR-634EVM.

### 7.1 Efficiency





### 7.2 Load Regulation



Figure 7-2. Load Regulation of 1-V Output



### 7.3 Transient Response



Load Step 10A to 20A

Ch1 = VOUT1 at 50-mV/division, Ch2 = IOUT1 at 5-A/division





Load Release 20At o 10A

Ch1 = VOUT1 at 50-mV/division, Ch2 = IOUT1 at 5-A/division





## 7.4 Output Ripple



DC Ripple 1A Load







DC Ripple 20A Load

Ch1 = VOUT1 at 20-mV/division, Ch2 = SW Node at 10-V/division







StartUp from CNTL into 20A







ShutDown from CNTL

Ch1 = VOUT2 at 20-mV/division, Ch2 = SW Node at 10-V/division







50% PreBias Start No Load

Figure 7-9. 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 8-1. First Window at Fusion Launch

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

Figure 8-2. Scan Finds Device Successfully





Fusion Digital Power Designer

Version 1.8.138 [2011-11-15]

1 device found; continuing with GUI startup ...





Figure 8-4. Software Launch Continued



Use this next screen to configure the following (Figure 8-5):

- OC fault and OC warn
- OT fault and OT warn
- Power good limits
- Fault response
- UVLO
- On/Off configuration
- Soft-start time
- Margin voltage

P	TPS544C20 @ Address 27d - Rail #1			
Limits & On-DFF Cother:    Test Mode    Measurement Debug    All Config				
Current Limits Temperature Limits				
Sout OC Warn Limit: 30.0 🕃 A Temp Warn Limit:	125 💮 ve			
Inut OC Fault Limit: 35.0 🗄 A Temp Fault Limit:	150 🐑 🕫			
Yoltage & Power Good Limits				
Short YOUT NOMBIAL: 12 2 V UV Pault PG Law PG High OV P	ur.			
UV Fault: 0.9984 V () -16.80 % -12.50 % +12.50 % +16	10%			
OV Fault 1.4016 y O -12.00 % -7.00 % +7.00 % +12.	30 %			
PGLow: L05 V O -28.00 % -22.00 % +7.00 % +12	10 N			
PG High: 1.35 V -42.00 % -36.00 % +7.00 % +12.	20 %			
O Do Not Restart				
Do Not Restart     The divice does not attempt to restart. The subjut remains disabled until the fault is cleared.     Sessit (Crossnosily     The divice gets through a normal startup (Soft start) continuously, without limitation, until it is commanded off or t     another fault condition causes the unit to shuddown.				
Do Net Restart     The druce does not attempt to restart. The subjut remains disabled until the fault is cleared.     Sessart Continuouly     The druce gene through a normal startup (Daft start) continuously, without initiation, until it is commanded off or t     another fault condition causes the unit to shubborn.     Tees Oa/Off     Plangining				
On het Restart     The divice does not attempt to restart. The subjuct remains disabled until the fault is cleared.     Sestart Continuouly     The divice gree through a normal starts (Def start) antihusually, without initiation, until it is commanded off or t     another fault condition causes the unit to shuddown.     Tees Oa/Off     You Continuous	as power is removed or			
On best Restart     The device does not attempt to restart. The subjust remains disabled until the fault is cleared.     Sessart Continuously     The device gene through a normal site typ (2nd tard) antimuously, without initiation, until it is commanded off or t     avoitive fault condition causes the unit to shuddown.      Teres Ox/Off     Win On:	as power is removed or 0.009 🕃 V 0.009 🕃 V			
On bet Restart     The device does not attempt to restart. The subjust remains disabled until the fault is cleared.     Sestart Continuouly     The device gree through a normal starts (Def stard) antihusually, without limitation, until it is commanded off or t     another fault condition causes the unit to shuddown.  Teres Oe/Off We On:     4-20 V We Off,     4-00 V We friengen high:     We friende does not be able to be	Log (1997)			
Or bet Restart     The device does not attempt to restart. The subjust remains disabled until the fault is cleared.     Sestart Continuouly     the device gene through a normal site to [Cont start] continuously, without initiation, until it is commanded off or t     another fault condition causes the unit to shuddown.     Tees On/Off     We On:	Log Cost & V			
On bet Restart     The device does not attempt to restart. The subjust remains disabled until the fault is cleared.     Sestart Commonly     the device gene through a normal site typ (2nd tard) antibuously, without initiation, until it is commanded off or t     another fault condition causes the unit to shuddown.     Tees On/Off     Wn On: 4-23 V Wn Off, 4-00 V     We friege high:     Wn On: 4-23 V Wn Off, 4-00 V     We friege high:     Wn On: 4-23 V Wn Off, 4-00 V     We friege high:     We frie				

Figure 8-5. First Screen After Successful Launch: Configure- Limits & On/Off

Use this screen to configure the following (Figure 8-6) :

- V<sub>REF</sub> trim
- I<sub>OUT</sub> cal gain (DCR of output choke)

Configure	(unit & County)   Addam   Tourstands   Marcon and Data or Viti		TPSS44C20 @ Address 27d - Ral #1
Webs to Hardware	Device Constants	MFR 21 (AIX & Dead Time)	(A)
Auto write on rail or device change	Device Code: Identifier: 0x015 (175544C20) Revision: 0x3 PMDus Revision: 1x0,11-Part1: 1x0,Part Catability: Maximum Supported Bus Second	To the ADC operation	
Restore Config to NVM	Updatery: reacting supported and special works Packet free Checking (P(C) Supported: Tes SHBALER18 Supported: Yes Whether the device has an SHBALER19 in and support the SHBALER19 in and support the SHBALER19 is and support the SHBALER19 is and support the	Tes (MR, 23 (MASKS_SMBALERT)	
		Yes Havk SHBALERT due to status setting of: Oned. Al VBLUM: VBLUM	
	Calibration	PG000_Z1 Power Good	
	WeefTran: 0.000 문 V Sout Cal Offset: 0.0005 문 A	OVF:         Over Voltage Ruik:           OOIN:         Over Current Warn           OOF:         Over Current Ruik:           OOF:         Over Current Ruik:           OOF:         Over Temperature Warn	
	Write Protect	OTF: Over Temperature Fault	
	Diable all writes except to the WRITE_PROTECT command     Diable all writes except to the WRITE_PROTECT,     OPERATION and PAC commands     Diable all writes except to the WRITE_PROTECT,     OPERATION, MARL, OK, OFF, CONFER and     VOLT, COMMAND commands     Or brudle writes to all commands	DPL/LITO_BAX     CBR/CH backs (pluved)       MON:     Menory Paul Education       PECI     PAdet Envo Oreck       TOD     Drukel/bracported Data       TVC     Drukel/bracported Data       SMB_TO_EBRI:     Drukel SMB_AUXT due to SMB Trenout       MRTD_EBRI:     Drukel SMB_AUXT due to SMB Trenout       OTTP:     Over Temperature Fault External	
	MFR_SPECIFIC_00		
	User Scratch Pad: 0x0000 0 0 0 0 0 0 0 0 0	7 6 5 4 3 2 1 0   0 0 0 0   0 0 0	[w
() Configure	Tips & Hints	Phosing	
	10UT_OC_FAULT_RESPONSE [0x47]	e o met MCh fa B er VDIT under.	
5 Status		Protoco and a second se	<b>P</b> O <b>S</b>
union Dimital Rower De	sinner v1.9.18 (2014-02-20) TP5544C20 @ Address 27.6 USB Adams	v1.0.11 (PEC: 400 kHz)	- Traves bermanerers I factor diotal power

Figure 8-6. Configure – Other

Use this screen to configure all of the configurable parameters (Figure 8-7). The screen also shows other details, like hexadecimal (hex) encoding.

Device Tools	Help								TPS544C20 @ Address 27d - Rail #1	_
gure	Limits & On/Off Other Test Mode Measur	rement Debu	g Al Config							
	Command	Code	Value/Edit	Hex/Edit	Command	Code	Value/Edit	Hex/Edit		1
As write on rail or	▼ Calibration	-		11111	▼ On/Off Configuration		-	CONTRACTOR OF THE OWNER.		
ocerd Charges	DUT_CAL_OFFSET	0x39	0.0000 🗄 A	Dx8000	MFR_OS (STEP_WREF_MARGIN_HIGH)	0.05	0.059 🔁 V	0x0012E		
	MFR_04 (VREF_TRIM)	0:04	0.000 🕀 V	0x0000	MER_06 (STEP_VREF_MARGIN_LOW)	0x06	-0.059 😳 V	049922		
re Config to NVM	▼ Configuration		Sofalala Chi	and and and	MFR_08 (SEQUENCE_TON_TOFF_DELAY)	0.00	0x00 🖵	0x00		
Itore NVM Config	MFR_13	0.00	4680, 0	0.0304	ON_OFF_CONFIG	0x02	0x02 🖂	0x02		
e Restors Astron	MFR_14	0.0E	27726 🕑	0x0AD4	OPERATION	0x00	0x00 🖵	0×00		
	MFR_17	0x£3	2786, 0 💽	Dv0155	TON_RESE	0x61	2.7 - ms	0+6028		
Command Name	MFR_21 (OPTIONS)	0xES	EN_ADC	Dx0004	V Status					
Command Code	MFR_23 (MASK_SMBALERT)	0x£7	VPN_UV:	Dw0300	READ_DOUT	0x8C	3.44 A	0xE037		
and her Calendary	MFR_44 (DEVICE_CODE)	0.dFC	0x0153 🕑	0x0153	READ_TEMPERATURE_2	0×8E	33 *C	0x0021		
nd) ny campo y	VOUT_MODE	0x20	107-4		READ_VOUT	0.68	1.178 V	0x0258		- 1
	WRITE_PROTECT	0×10	0x00 🐨	0x00	STATUS_BYTE	0.78	00000010	netz .		
	▼ LimEs				STATUS_CML	0x7E	30000000	Finance 1991		
	DUT_OC_FAULT_LIMIT	0x46	35.0 🕀 A	Dx#846	STATUS_IOUT	0x78	00000000	8000		
	IDUT_OC_FAULT_RESPONSE	0x47	Restart	0.7	STATUS_MPR_SPECIFIC	0x80	00000000 💌	I make		
	BOUT_OC_WARN_LIMIT	0x4A	30.0 🔂 A	DIFEIC	STATUS_TEMPERATURE	0x70	00000000	0.00		
	MFR_07 (PCT_VOUT_FAULT_PG_LIMIT)	0.07	PGL: 000 😪	0x00	STATUS_YOUT	0x7A	00000000	A STATE OF THE OWNER		
	OT_FAULT_LIMIT	0x4F	150 🗄 °C	0x0096	STATUS_WORD	0.79	0d. 🖓	Trends .		
	OT_WARN_LIMIT	0.51	125 🕀 🔨	0x0070	▼ UserParameters	-				
	VIN_OFF	0x36	4.00 V V	04/030	MFR_00 (FOR_USER)	0:00	0x0000 🐨	@w00000		
	VIN_ON	0x35	4.25 V	0.0011	-					- 1
	▼ Hanufacturer Info		And in case of the local division of	A STREET, STRE	1					
	CAPABILITY	0x19	0x80 🐨	0:60	1					
	<[.									×
onfigure	Tips & Hints				PMBus Log					
Aonitor	MER_44 (DEVICE_CODE) [0xFC]									10
	Device type and revision. Bits 15:4 is a 12 bit unig	ue ID for a p	wt. 8/8 2/0 # a 4 bit	revision code.	E and a los					-
Latus					an December of					40



#### Changing the on/off configuration prompts a pop-up window with details of the options Figure 8-8).

File Device Tools	Help			TPS544C20 @ Address 27d - Rail #1
Configure	Limits & On/Off Other Test Mode Measurement Debug	Al Config		
Weite the tier tier of	Current Limits	Temperature Limits		(*)
Auto write on rail or device change	Sout OC Warn Limit: 30.0 😨 A Iout OC Pault Limit: 35.0 😨 A	On / Off Control     On / Off Control     On / Off Control	125 (E) % 150 (E) %	
Store Config to NVM		Unit powers up any time power is present, repardless of state of the CONTROL pin or CONTROL processing		
Reson NH Codg	Provide Volter Foreit California  Provide Volter Foreit California  Provide Volter Voltage Pault Response  Over-Carrent / Under Voltage Pault Response  Ove	CONTRUE Pre CMP     The device proves the enable" portions of the     Control CMP proves the enable" portions of the     Control CMP proves the enable" portion of the     Control CMP proves the CONTROL, priv. Power is     Control CMP proves the CONTROL, priv. Power is     Control CMP, priv. Power is     control CMP proves the CONTROL, priv. Power is     control CMP, priv. Po	Paul: A0 % 200 % 200 % 200 % bas power is removed or	8
	Term On/Off           Vin On:         4.25 ··· V           On/Off Canifig:         0x02 ···	4.00 V V Vef Hargining	v (2) 000.0 v (2) 000.0	
	Too & Hints		PAthation	1
J Monitor	IOUT_OC_FAULT_LIMIT [0x46]		(	
5 Status	sets the value of the output current, in amperes, that causes the	e overcurrent detector to indicate an	PMBusLog	6
Corine Directed Rowert Deriv	1 0 10 10 10 10 10 10 10 10 10 10 10 10	Austral A D 11 (DDC) AND MAIN		
03		adares around factor and scale		• R = 4 • \$23 AM

Figure 8-8. Configure- Limits and On/Off- On/Off Configuration Pop-up

After a change is selected, an orange **U** icon is displayed to offer the *Undo Change* option. The change is not retained until either *Write to Hardware* or *Store User Defaults* is selected. When *Write to Hardware* is selected, the change is committed to volatile memory and defaults back to the previous setting on the input power cycle. When *Store User Defaults* is selected, the change is committed to the nonvolatile memory and becomes the new default (Figure 8-9).

Fusion Digital Power	Designer - 1P540422 @ Address 22 - Rail #1 - Texas Instruments		
File Device Tools H	40		17540422 @ Address 27 - Rai #1
Configure	Linits & On/Off Other All Config		
Write to Mardware	Current Limits Tema	erature Limits	<
Abu Ante en al el ence direce Annae Boscard Changen Rom Vier Certaubi Restore Uner Certaubi Cone Vier Technine Cone Vier Technine	Rad     Image: Second Sec	Ball # 1         Red # 2           writ:         000 00 00 00 00 00 00 00 00 00 00 00 00	•
	Tes & Hots HVR 07 (PCT VOUT FAILST PG LEMIT) [0x07.8ail #1]	PHBLacog	E
<ul> <li>Configure</li> <li>Monitor</li> </ul>	Used to set the PODDD, VOUT_URDEL_VOUTAGE (UV) and VOUT_OVER_VOUTAGE (OV as a percentage of nominal.	Line a	
1) Status		Phalm .	P. C
- John Status			6.0,

Figure 8-9. Configure- Limits and On/Off- On/Off Config Pop-up

The I<sub>OUT</sub> cal gain can be typed in or scrolled to a new value. The range for I<sub>OUT</sub> cal gain is 0.244 m $\Omega$  to 15.5 m $\Omega$  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 8-10).

Presion Digital Power	Designer - TPS40422 @ Address 22 - Rail #1 - Tecas Instruments		2 # <b>2</b>
File Device Tools F	40		7P\$40422 @ Address 27 - Ral #1
Configure	Sunta & On/Off Other Al Config		
Witztante-bases	Device Constants	Write Protect	
Auto ante on nal or dence d'ange     Innuel Comps     Sone User Delfada     Restore User Delfada     One Techno fürben	Device Code:         Extention:         0x007 (19549422)           Revision:         0x3           PMBus Revision:         1x1.1-Pert1 1.1, Pert           Capability:         Haximum Supported Bos Specific:         400 IVIC           Pracket Lines-Checking (PKC) Supported:         Yes         SHBALLET's Supported:         Yes           Understein:         SHBALLET's Supported:         Yes         Yes           Visual: Notic:         EXP 4         EXP 4         Yes	Dadde all writes except to the     SRITE_RFOTECT commend     Dadde all writes except to the     WRITE_RFOTECT, OFRATION and PAGE     Sommarks     Dadde all writes except to the     WRITE_RFOTECT, OFRATION, AND,     ON_OPE_COMPLiant VICE_COMMAND     commands     @ Brudde writes to all commands	
	Calibration	ADC & Dead Time	
	Rail #1         Rail #2           Iver Tram.         0.00 🗄 v         0.000 🗟 v           Iout Cal Gam.         0.00 🗟 v         0.00 🗟 v           Iout Cal Gam.         0.00 🗟 A         0.00 🗟 A	Bulloc,ctt.     Strable ACC operation     Onl_ptic     Onl_ptic	
	HFR_SPECIFIC_00         15         14         12         11         10         9         8         7         6           User Soratch Red:         0x0000         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	5 4 <u>7 2 1 0</u> 7 <b>10 10 10 10</b>	
	Tas Svink Nover CAL CANV (novel884/ #1)	P98410g	(E)
4) Configure	Ratio of the voltage at the current sense pris to the sensed current.		
.) Monitor		147	
.0 Status		Pretos Log	6 9
Fusion Digital Power Design	A er v L.8. 138 [2011-11-15] [79540422 @ Address 27   US8 Adapter v L.0. 11 [950; 400	are]	49 Texas Instrumenters   Ingion digital power

Figure 8-10. Configure- Other- IOUT Cal Gain Change

The On/Off configuration can also be configured from the All configuration screens, where the same process applies (Figure 8-11).

le Device Tools	Help									TPS544C20 @ Addr	ress 27d - Rail #1
nfigure	Limits & On/Off Other Test Mode Measur	ement Debu	Al Config		_						
	Command	Code	Value/Edit	Hex/Edit	Command		Code	Value/Edit	Hex/Edit		
Auto write on rail or device change	▼ Calibration			1111120	▼ 0n/0ffC	onfiguration			TAXABLE IN	4) ок. от сонта - техниске в 2 🛫 🖻 🔀	
Discort Charges	DOUT_CAL_OFFSET	0x39	0.0000 🗄 A	0x6000	MFR_05 (ST	P_VREF_MARGIN_HIGH)	0.05	0.059 🗄 V	0x00 sE	On / Off Control	
	MFR_04 (VREF_TRIM)	0.04	0.000 🗄 V	Ew0000	MFR_06 (ST	P_VREF_MARGIN_LOW)	0x06	-0.059 🔁 V	OWFFE2	Always Converting	
tore Config to NVM	▼ Configuration		bohababatika		MFR_00 (St)	QUENCE_TON_TOFF_DELAY)	0.06	0x00 🖵	0x00	repardless of state of the CONTROL pin or CONTRATION command	
estore NVM Config	MFR_13	0.00	4680, 0	0.0204	ON_OFF_COM	FIG	0x02	0x02 🕞	0x02	O CONTROL PIN ONly	
ar Restline Action	MFR_14	0.0E	27716	Ov0AD3	OPERATION		0x01	0x00 🖵	0×00	The device ignores the on/off portion of the OPERATION command from serial hum. Power	
Provide State	MFR_17	0.£1	3566, 0 🖂	0x0354	TON_RESE		0x61	2.7 - ms	0+6028	is converted when the CONTROL pin is active.	
Command Name	MFR_21 (OPTIONS)	0xES	EN_ADC	Dv0004	V Status					O OPERATION Only The device ignores the CONTROL on, Power is	
Command Code	MFR_23 (MASK_SMBALERT)	0x#7	VINUUV:	Dv0 300	READ_DOUT		0x8C	3.56 A	0+6039	converted when the on/off portion of the OPERATION command is on.	
and by Calendar	MFR_44 (DEVICE_CODE)	0.dFC	0x0153 ~	0x0153	READ_TEMP	RATURE_2	0×8E	32 *C	0x0020	O Both CONTROL Pin & OPERATION	
and boy calledory	VOUT_HODE	0.20	207-4		READ_VOUT		0x80	1.180 V	0x025C	The CONTROL on must be active and the on/off portion of the OPERATION command	
	WRITE_PROTECT	0×10	0x00 ~	0x00	STATUS_BY	τ	0.78	00000010		on for the device to convert power.	
	▼ Links				STATUS_CM		0x7E	30000000		Control Pin Polarity	
	IOUT_OC_FAULT_LIMIT	0x46	35.0 🕀 A	Dx#846	STATUS_IOL	π	0x78	00000000		Concernence of the product of the series	
	TOUT_OC_FAULT_RESPONSE	0x47	Restart	0.3	STATUS_MP	SPECIFIC	0x80	00000000		C. Active her that her to start the and	
	IDUT_OC_WARN_LIMIT	0x4A	30.0 🔁 A	DIFESC	STATUS_TEP	PERATURE	0x70	00000000		- Control Pin Turn Off Configuration	
	MFR_07 (PCT_VOUT_FAULT_PG_LIMIT)	0.07	PGL: 000 -	0x00	STATUS_VO	п	0x7A	00000000 [~]		10 Use the hain all block configured by 100% (05.47 and hid line configured by	
	OT_FAULT_LIMIT	0x4F	150 2 ~ ~	0x0096	STATUS WO	RD	0,79	04.2		TOP PAL	
	OT_WARN_LIMIT	0.51	125 🕀 🗠	0.0070	V UserPar	ameters	-	State of the local division of the	-	energy to the scend as fast as pusible	
	VIN_OFF	0x36	4.00 V	0.000	MFR_00 (FO	r_user)	0:00	0x0000 🐨	C+0000		
	VIN_ON	0x35	4.25 V	0.0011						£1	
	▼ Manufacturer Info		And in case of the local division of the loc	-	í						
	CAPABILITY	0:19	0x80 🐨	0:60	1						
	<										
Configure	Tips & Hints					PMBus Log					
Monitor	IOUT_OC_WARN_LIHIT [0x4A]										
Chalant	Sets the value of the output current that causes a	n output ov	ercurrent warring.		E B	and a los					
Status					40	Prove Log					

Figure 8-11. 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 8-12).

Configure	Limits & On/Off Other All Config								
	Command	Code	Volue/Edit	Hen/Edit	Command	Code	Value/Edit	Hex/Edit	
Auto write on rail or	▼ Calibration				▼ Handacturer Info				
Device change	IOUT_CAL_GAIN	0:38	1.0071 🔂 m2	048825	CAPABILITY	0:19	0x80 🗸	0x80	
	IOUT_CAL_OFFSET	0:39	0.0000 🕀 A	0x6000	PHEUS_REVISION	0.98	1.1.1.1-Pert	0x33	
Store User Defaults	MFR_04 (VREF_TRIM)	0:04	0.000 EF v	Cw0000	▼ On/Off Configuration				
Restore User Defauts	▼ Configuration				MFR_OS (STEP_WREF_MARGIN_HIGH)	0.05	0.000 🗄 ¥	0x0000	
	MR_13	00:00	13136, 🐨	0x0521	MFR_06 (STEP_VREF_MARGIN_LOW)	0.06	0.000 문 ¥	0x0000	
	MR_14	0.06	2211d 💌	Dx08A3	MFR_00 (SEQUENCE_TON_TOFF_DELAY)	0.08	0x00 🐨	0x00	
C Gabel Device	MFR_17	0:£1	2446, 0	0x00F4	ON_OFF_CONFIG	0.02	0x02 V	0x02	
Parameters	MFR_21 (OPTIONS)	0.45	5N,ADC	0x0004	OPERATION	0.01	0x00 🐨	0x00	
<ul> <li>Paraneters for this Rail</li> </ul>	MFR_44 (DEVICE CODE)	0.FC	0x0073 (*)	Dx0073	TON_RESE	0.61	2.6875 🗄 ms	0x6028	
All Parameters	VOUT_MODE	0:20	512-9	0x17	► Status				
ort Parameters By:	WRITE_PROTECT	0×10	Cup C		• the Persenters		-		
Command Name	▼ Limits		Confirm	Stone to Flas	ь — — — — — — — — — — — — — — — — — — —	0.00	0x0000 w	0x0000	
Command Code	IOUT_OC_FAULT_LIMIT	0x46	× .	The operation	n will store all configuration values to Resh				
Group by Category	10UT_OC_FAULT_RESPONSE	0x47	Restart	memory on 2	re 1PS40422 @ Address 27. Do you wish to proceed?				
	IOUT_OC_WARN_LIMIT	0x4A	25	1	Yes No				
	MFR_07 (PCT_VOUT_FAULT_PG_LIMIT)	0.07	POL: O						
	OT_FAULT_LIMIT	0x4P	125 🗄 <	0x0070					
	OT_WARN_LIMIT	0:51	100 EB *c	Cx0064					
	VIN_OFF	0.36	5.00 🗄 v	0,0014					
	VIN_ON	0x35	7.00 🗄 V	069030					
	Tipe & Hinte				PHBus Log				
Configure	DOUT_CAL_OVESET [0x39,Rail #1] Most often used in conjunction with the IOUT_CAL current sensing dircuit.	GAIN com	nand to minimize the e	nor of the					
Monitor									
and an and a state of the				1.00					

Figure 8-12. 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 8-13).



Figure 8-13. Change View Screen to Monitor Screen



When the *Monitor* screen is selected (Figure 8-14), 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<sub>OUT</sub>, I<sub>OUT</sub>, Temperature, and P<sub>OUT</sub>. As shown, P<sub>OUT</sub> 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 can occur due to communications during power up. These faults can be cleared once the device is enabled.



Figure 8-14. Monitor Screen



Selecting *System Dashboard* from the mid-left screen adds a new window which displays system-level information (Figure 8-15).

Monitor	a contraction of the second se							_					INDOAR'	20 ip Address 27d - H	36.91
	Readings	Voet - Or	utput Voltage						lout - Outp	ut Current					
how/Hide Plots: 2 Yout 2 Iout 2 Pout(calc 2 Temp	Vout: 1.176 V Jout: 3.44 A Pout(calc): 4.05 W	1.20-			1		1.17	v	OC Fault: 40.00 -	35.00 🔂 A	OC Warn	30.00 🕀 A	(wee)		
Fit All Plots on Screen	Tempi 36 °C										-		-		
Scale Plots to Screen Viidth	A Sector De	hourd - During	District Dessers De	- Notes					_						
negra: 200 🗄	Status Registers/ Launat Devic	and the second		10040005											
4001	Vout OK System-Level	tions and Set	Titles												
Show Warn & Fault	Term OK contracts			OPERATION		Read Management	and I support to		Pada da						
Show Value Labels on Plots	Input OK CML Innut Always Convert	• • (	Write Setting	Harging C Tum	0n Immed Off	ClearFack	s Storet	Joer Defi	ND R	store User Defai					
ling Rate: 500 🕃 msec)	ME- OK SMEALERTH Asse												No.		
Stop Polling	Ci Rails														3.4
Device Dashboard	Device	Rell	Vout	Jout Temp (	Control Line (USB)	Operation		0	n/Off Config			3	4:40	35:00	35
	Costrol Line (USB) O High O L Operation Operation														
	Control Liner (USB) Origin Of Operation Operation Status Regist														
	Costrul Line (USB) Origh O Operation Coperation Flargining Status Registric Status Registric														
	Control Line (USB Original Control Line (USB) Operation Operation Control Line (USB) Status Registric Hargining Status Registric Status Registric Status Registric Status Status, WOR Margin: Ohore (Status, VOR)	s OK													
	Costrol Line (USB) Origin Ori Operation Operation Fargining Margin: O store Fault Actor: O Ar	5 08 08													
	Costrul Line (USB) Original Line (USB) Operation Dependent Farguing Margin: © hare FairLine, sour FairLine, Startus, Lour FairLine, Startus, Lour Startus, Startus, S	S OK BATURE OK													
) Configure	Costrul Line (USB)           High         O           Operation         Status Registric           Pagining         Status Registric           Margin:         Status Status, NOR           Pair:         Operation           Status Registric         Status Status, NOR           Pair:         Operation           Status, Status, NOR         Status, NOR           Status, S	S OK BATURE OK PPTCIPIC OK	s webs Command												
> Configure > Monitor	Costrul Line (USB) > High ① Operation Margin: ① III Margin: ② IIII Margin: ③ IIII Pail: Actor: ○ Ac STATUS, OR STATUS, OR STATUS, OR STATUS, OR STATUS, OR STATUS, OR	S CM OK BATUBE OK PRCIFIC OK	R. C. L. L. L. L. L. L. L. L. L. L. L. L. L.												
<ul> <li>Configure</li> <li>Monitor</li> <li>Status</li> </ul>	Costrul Line (USB) > High © Concession Concession Margin: © Hone Margin: © Hone Pault Actor: ○ A STATUS, UNR STATUS, OR STATUS, O	S CRI BATURE OK PPCEFIC OK	R I I I I I I I I I I I I I I I I I I I									(c) Una	ve open/dose se	rangs for Configure,	Monitor, and Stat
Configure Monitor Status Son Digital Power De	Control Line (USB Operation Deration Deration Pault Actor: Ork Pault Actor: Ork TATUS, VOR Pault Actor: Ork STATUS, CHL STATUS, CHL STATUS	S OK BATURZ OK BATURZ OK	N C C C C C C C C C C C C C C C C C C C									2 Ung	ve opervådose sø	enings for Carligure.	Monitor, and Sta

Figure 8-15. 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 8-16).



Figure 8-16. Display Change on Power Up

Selecting *Clear Faults* clears any prior fault flags. Scrolling time window of V<sub>OUT</sub> will still show any turn-on event (Figure 8-17).



#### Figure 8-17. Faults Cleared

Selecting Status from lower left corner shows the status of the controller (Figure 8-18).







Selecting the pulldown 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 8-19).



Figure 8-19. Import Project / Import Configuration File

Selecting *Store User Configuration to Flash Memory* from the device pulldown 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 8-20).





Select *Data Logging* (Figure 8-21), 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.



Figure 8-21. Data Logging Details

Common contents of the data log as shown in (Figure 8-22). The UUT had was running with a modified voltage, at an approximate 3.5-A load and room temperature.

PH.	X Cut		A		-					1841	1440	-		and a				-	100	E AutoSum	- A.F	40	-
0	La Copy -		Calibra	- 11 - A A		4. <u> </u>	Avrap Text	General	0.000	120		Norma	1	640	G	000		<b>ii</b> (	r 🛄	Fitt -	ZI I	ana 👘	
Paste	Format	Painter	B / U -			律律 田	Merge & Center +	5 . %	. 14 .3	Formatting	al Format	Neutra	u	Calculation		beck crolls		Incert D	elete Format	2 Clear +	Sort & # Filter * S	Find &	
	Ipboard	14	For	a		Alignment		Nu	nber G				5	Styles				1 70	els .	1	dting		
	AL		(- f.	Timestamp																			
4	A	8	c	D	E.	F	G	н	1	1	ĸ	1.5	M	N	0	p	0	8	5	T	U	V	T
1 Ter	estamA	dapter	Part ID	Address READ	VOUT I	READ HOUT	READ TEMPERA	TURE 2				-											1
2 4	15:28.3	1	TP\$544C20	27	1.178	3.5	32	100															
3	5:28.8	1	TP5544C20	27	1.184	3,4175	33																ΞL.
4 4	5:29.3	1	TP5544C20	27	1.18	3.4375	35																
5 4	15:29.8	1	TP5544C20	27	1.178	3.4375	33																
6 4	15:30.3	1	TP5544C20	27	1.18	3.4375	33																
7 4	15:30.8	1	TP5544C20	27	1.18	3.4375	31																
8	5:31.3	1	TP5544C20	27	1.182	3.5	33																
9	15:31.8	1	TP5544C20	27	1.178	3.4375	32																
10 4	15:32.3	1	TP5544C20	27	1.178	3.4375	33																
11 4	15:32.8	1	TP5544C20	27	1.18	1.4375	33																
12 4	15:33.3	1	TP5544C20	27	1.182	3.4375	33																
3	5:33.8	1	TP\$544C20	27	1.18	3.4375	33																
4	15:34.3	1	TP5544C20	27	1.18	3.4375	38																
5 4	5:34.8	1	TP5544C20	27	1.184	3.4375	33																
16 4	15:35.3	1	TP5544C20	27	1.182	3.4375	34																
17	15:35.8	1	TP\$544C20	27	1.186	3.4375	32																
18	15:36.3	1	TP\$544C20	27	1.182	3.5	37																
	15:36.8	1	TP\$544C20	27	1.182	3.4375	32																
10 4	5:37.3	1	TP5544C20	27	1.182	3.5	32																
1	5:37.8	1	TP\$544C20	27	1.18	3.4375	33																
12	15:38.3	1	TP\$544C20	27	1.18	3.5	32																
13 4	15:38.8	1	TP5544C20	27	1.18	3.4375	34																
14 4	15:39.3	1	TP5544C20	27	1.184	3.4375	34																
15 4	15:39.8	1	TP5544C20	27	1.184	3.5	33																
16	15:40.3	1	TP5544C20	27	1.182	3.5	33																
7 4	15:40.8	1	TP5544C20	27	1.188	3.5	34																
18 4	15:41.3	1	TP5544C20	27	1.182	3.5	33																
19 4	5:41.8	1	TP5544C20	27	1.184	3.4375	35																
0	15:42.3	1	TP\$544C20	27	1.182	3.4375	34																
1	15:42.8	1	TP5544C20	27	1.184	2.5	35																
12 4	15:43.3	1	TP5544C20	27	1.184	3.4375	34																
	HI Data	Log 20	14.05.13-09.45.	27-TP / 2									11									1	۶E
Ready	22.1																			B 20 20 100	/% ()		

Figure 8-22. Data Log File

Selecting *PMBus Logging* (Figure 8-23) 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 the next screen (Figure 8-24).



Figure 8-23. PMBus Logging



Select the storage location for the file and the type of file. As shown (Figure 8-24), 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.

eadags - Rail #1	(Foot - Rail #1     (0.04     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (0.02     (	Control Priting Logging     Control Priting Logging     Control     Description     Descr	שלא איז איז איז איז איז איז איז איז איז אי	A Data of the second seco	et - Raif #1 C Fm/tt 35.00 25.00 25.00 20.00 15.00 5.00 0.00 20:00	10.00 🔛 A OC H	iemi 25.00 (	₹ 4 (mm)	21:40	0.00 A 22:00
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onz View Know Converting	140.00 120.00 80.00 60.00 40.00	Constant Co	ed discretion (Mr. C.) (all of the set of second) and the set of second) and the set of second)	Select						
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Figure 8-24. PMBus Log Details

Data is stored in a CSV file, with a date-stamp name (Figure 8-25).

PMBus-Log-2011.12.07-19.21.46.csv	43 KB	Microsoft Office Exc
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Figure 8-25. PMBus Log



## 9 EVM Assembly Drawing and PCB Layout

Figure 9-1 through Figure 9-5 show the design of the PWR-634EVM printed-circuit board (PCB).



Figure 9-1. PWR-634EVM Top Layer Assembly Drawing (Top View)



Figure 9-2. PWR-634EVM Top Copper





Figure 9-3. PWR-634EVM Layer 1 (Top View)



Figure 9-4. PWR-634EVM Layer 2 (Top View)





Figure 9-5. PWR-634EVM Layer 3 (Top View)



Figure 9-6. PWR-634EVM Layer 4 (Top View)





Figure 9-7. PWR-634EVM Bottom Copper (Top X-ray View)







## **10 List of Materials**

Table 10-1 lists the EVM components list according to Figure 3-1.

Note

The TPS544C20 version is used for this example.

DES	ΟΤΥ	DESCRIPTION		MANUFACTURER
	2			
02, 017, 021	3	Capacitor, ceramic, 1000 pF, 50 V, ±10%, X7R, 0402	C1005X7R1H102K	TDK
C4	1	Capacitor, ceramic, 0.01 $\mu$ F, 25 V, ±10%, X7R, 0402	C1005X7R1E103K	
C5	1	Capacitor, ceramic, 4.7 µF, 16 V, ±10%, X5R, 0603	GRM188R61C475KAA J	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 $\mu\text{F},$ 25 V, ±10%, X7R, 1206	GRM31CR71E106KA1 2L	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 µF, 25 V, ±10%, X5R, 0402	C1005X5R1E105K050 BC	TDK
C23	1	Capacitor, aluminum, 470 $\mu\text{F},$ 16 V, ±20%, $\Omega,$ 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 × 0.20, clear	SJ-5303 (CLEAR)	3M
J1	1	Header (shrouded), 100 mil, 5 × 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, 400 nH, 36.8A, 0.0004 $\Omega,$ 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



	Table 10-1. PWR091 List of Materials (continued)										
DES	QTY	DESCRIPTION	PART NUMBER	MANUFACTURER							
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	CRCW04020000Z0ED	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							
R5	0	Resistor, 0 Ω, 5%, 0.063 W, 0402	CRCW04020000Z0ED	Vishay-Dale							
R16	0	Resistor, 1.0 Ω, 5%, 0.25 W, 1206	CRCW12061R00JNEA	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							



## **11 Revision History**

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

Changes from Revision A (June 2014 August 2021) to Revision B ()		Page
•	Changed user's guide title Updated the numbering format for tables, figures, and cross-references throughout the document	2
-		Z
С	hanges from Revision * (May 2014) to Revision A (June 2014)	Page

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