

# **TFT LCD Display Power Supply Solutions Using the TPS65100 Triple Output Supply**

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## **ABSTRACT**

The reference design and application examples shown in this document highlight the typical applications for the TPS65100 in TFT LCD displays for notebooks and monitors. The TPS65100 offers a compact and small power supply solution that provides all three voltages required by TFT LCD displays. The auxiliary linear regulator controller can be used to generate a 3.3-V logic power rail for systems powered by a 5-V supply rail only. Additionally, the TPS65100 has an integrated VCOM buffer to power the LCD backplane and a linear regulator for LCD panels powered by 5-V only to provide a regulated 3.3-V output.

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## **1 Features**

- 2.7-V to 5.8-V Input Voltage Range
- 1.6-MHz Fixed Switching Frequency
- 3 Independent Adjustable Outputs
- Main Output of up to 15 V With < 1% Output Voltage Accuracy
- Virtual Synchronous Converter Technology
- Negative Regulated Charge Pump Driver  $V_{O2}$
- Positive Charge Pump Converter  $V_{O3}$
- Integrated VCOM Buffer
- Auxiliary 3.3-V Linear Regulator Controller
- Internal Soft Start
- Internal Power-On Sequencing
- Fault Detection of all Outputs (TPS65100/05)
- No Fault Detection (TPS65101)
- Thermal Shutdown
- Available in TSSOP-24 and QFN-24 PowerPAD™ Packages

## **2 TPS65100 Reference Design**

The reference design shown in Figure 1 contains a TPS65100 triple output LCD supply IC with a linear regulator controller and VCOM buffer. It provides three power rails and the linear regulator controller provides 3.3 V.

### **2.1 TPS65100 Schematic and Bill of Materials**

#### **2.1.1 Bill of Materials and Schematic**

This chapter provides the TPS65120EVM and TPS65124EVM bill of materials and schematic.

**2.1.1.1 Bill of Materials**

This chapter provides the TPS65100EVM-030 bill of materials and schematics.

**Table 1. Bill of Materials for VIN = 3.3 V and VOUT1 = 10 V**

Count	RefDes	Description	Size	MFR	Part Number
1	C1	Capacitor, ceramic, 22 $\mu$ F, 16-V, X5R, 10%	1210	TDK	C3225X5R1C226KT
0	C13	Capacitor, ceramic, xx $\mu$ F, xx-V	603		
1	C15	Capacitor, ceramic, 0.22 $\mu$ F, 50-V, X7R, 10%	805	TDK	C2012X5R1H224KT
1	C16	Capacitor, ceramic, 4.7 $\mu$ F, 6.3-V, X5R, 10%	805	TDK	C2012X5R0J475KT
1	C2	Capacitor, ceramic, 22 $\mu$ F, 6.3-V, X5R, 10%	1206	TDK	C3216X5R0J226KT
2	C3, C12	Capacitor, ceramic, 1.0 $\mu$ F, 10-V, X5R, 10%	603	TDK	C1608X5R1A105KT
0	C4	Capacitor, ceramic, xx $\mu$ F, vv-V	1210		
1	C5	Capacitor, ceramic, 6.8 pF, 50-V, C0G, 5%	603	AVX	06035A6R8CAT2A
2	C6, C11	Capacitor, ceramic, 1000 pF, 50-V, X7R, 10%	603	TDK	C1608X7R1H102KT
5	C7–C10, C14	Capacitor, ceramic, 0.22 $\mu$ F, 25-V, X5R, 10%	603	TDK	C1608X5R1E224KT
1	D1	Diode, Schottky, 1A, 20 V	457-04	On Semi	MBRM120
1	D2	Diode, Dual Schottky, 200-mA, 30-V	SOT23	Zetex	BAT54S
13	J1–J13	Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 $\times$ 2	Sullins	PTC36SAAN
1	JP1	Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 $\times$ 2	Sullins	PTC36SAAN
2	JP2, JP3	Header, 3-pin, 100 mil spacing, (36-pin strip)	0.100 $\times$ 3	Sullins	PTC36SAAN
1	L1	Inductor, SM Toroid, 4.2 $\mu$ H, 2.2-A, 31 m $\Omega$	74480	Sullins	CDRH5D28-4R2
1	Q1	Transistor, NPN general purpose amplifier, VCE 20V, VCB 30V, VEB 5V, IC 1A	SOT223	Fairchild	BCP68
2	R1, R4	Resistor, chip, 511 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R2	Resistor, chip, 432 k $\Omega$ , 1/16-W, 1%	603	Std	Std
2	R3, R6	Resistor, chip, 56.2 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R5	Resistor, chip, 1.00 M $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R7	Resistor, chip, 15.0 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R8	Resistor, chip, 150 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R9	Resistor, chip, 619 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	U1	IC, (TFT) LCD supply	HTSSOP 24	TI	TPS65100PWP
1	—	PCB, 2.45 In $\times$ 2.1 In $\times$ 0.062 In		Any	HPA030
3	—	Shunt, 100 mil, black	0.100	3M	929950-00

**Table 2. Bill of Materials for VIN = 5 V and VOUT1 = 13.5 V**

Count	RefDes	Description	Size	MFR	Part Number
1	C1	Capacitor, ceramic, 22 $\mu$ F, 16-V, X5R, 10%	1210	TDK	C3225X5R1C226KT
0	C13	Capacitor, ceramic, xx $\mu$ F, xx-V	603		
1	C15	Capacitor, ceramic, 0.22 $\mu$ F, 50-V, X7R, 10%	805	TDK	C2012X5R1H224KT
1	C16	Capacitor, ceramic, 4.7 $\mu$ F, 6.3-V, X5R, 10%	805	TDK	C2012X5R0J475KT
1	C2	Capacitor, ceramic, 22 $\mu$ F, 6.3-V, X5R, 10%	1206	TDK	C3216X5R0J226KT
2	C3, C12	Capacitor, ceramic, 1.0 $\mu$ F, 10-V, X5R, 10%	603	TDK	C1608X5R1A105KT
0	C4	Capacitor, ceramic, xx $\mu$ F, vv-V	1210		
1	C5	Capacitor, ceramic, 3.3 pF, 50-V, C0G, 5%	603	AVX	06035A6R8CAT2A
2	C6, C11	Capacitor, ceramic, 2200 pF, 50-V, X7R, 10%	603	TDK	C1608X7R1H102KT
5	C7–C10, C14	Capacitor, ceramic, 0.22 $\mu$ F, 25-V, X5R, 10%	603	TDK	C1608X5R1E224KT
1	D1	Diode, Schottky, 1A, 20 V	457-04	On Semi	MBRM120
1	D2	Diode, Dual Schottky, 200-mA, 30-V	SOT23	Zetex	BAT54S
13	J1–J13	Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 $\times$ 2	Sullins	PTC36SAAN
1	JP1	Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 $\times$ 2	Sullins	PTC36SAAN
2	JP2, JP3	Header, 3-pin, 100 mil spacing, (36-pin strip)	0.100 $\times$ 3	Sullins	PTC36SAAN
1	L1	Inductor, SM Toroid, 4.2 $\mu$ H, 2.2-A, 31 m $\Omega$	74480	Sullins	CDRH5D28-4R2
1	Q1	Transistor, NPN general purpose amplifier, VCE 20V, VCB 30V, VEB 5V, IC 1A	SOT223	Fairchild	BCP68
2	R1, R4	Resistor, chip, 511 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R2	Resistor, chip, 825 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R3	Resistor, chip, 80.6 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R6	Resistor, chip, 56.2 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R5	Resistor, chip, 1.00 M $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R7	Resistor, chip, 4.32 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R8	Resistor, chip, 130 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	R9	Resistor, chip, 750 k $\Omega$ , 1/16-W, 1%	603	Std	Std
1	U1	IC, (TFT) LCD supply	HTSSOP 24	TI	TPS65100PWP
1	—	PCB, 2.45 In $\times$ 2.1 In $\times$ 0.062 In		Any	HPA030
3	—	Shunt, 100 mil, black	0.100	3M	929950-00

2.1.1.2 Schematic

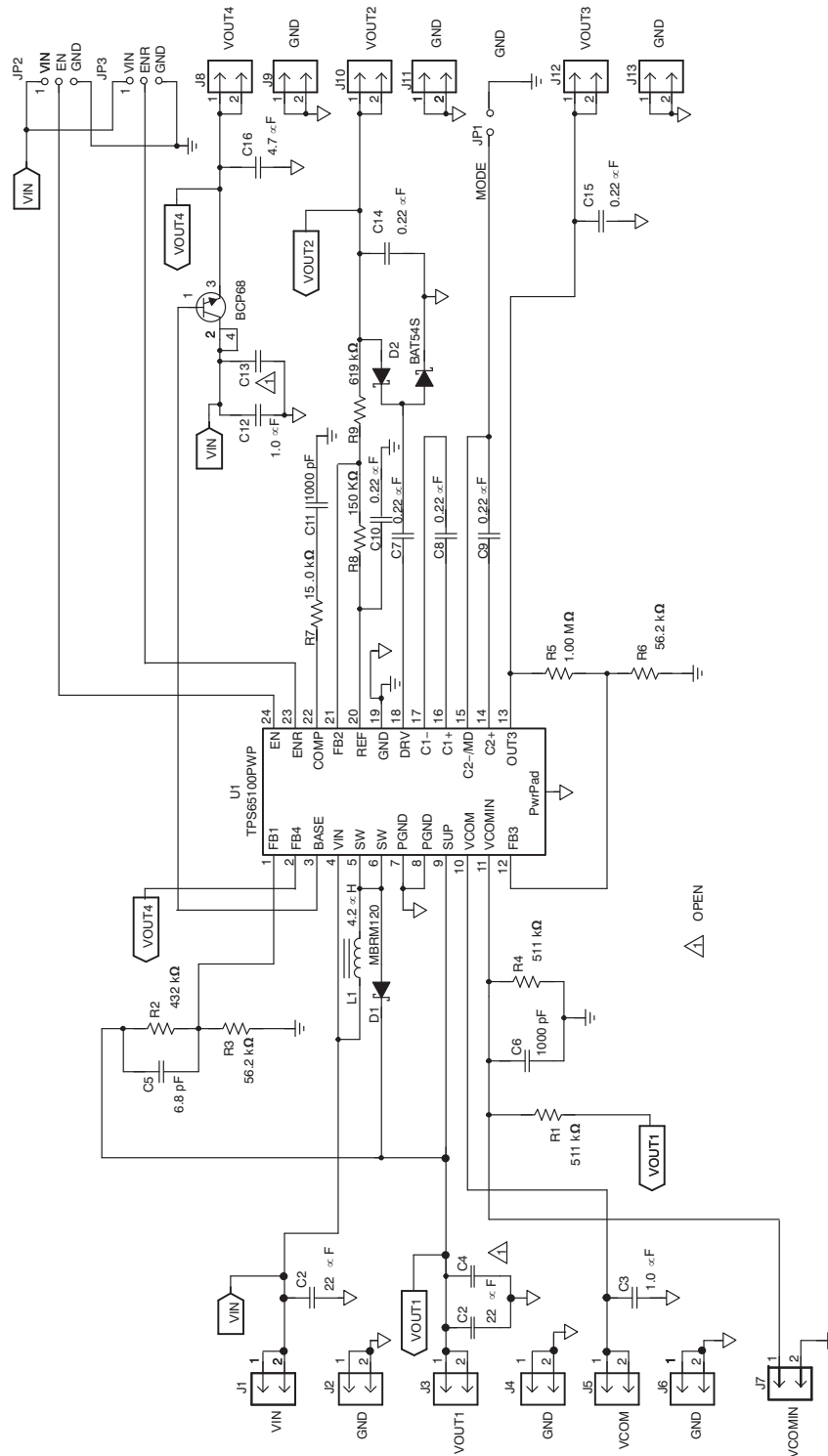


Figure 1. TPS65100EVM-030 Schematic for VIN = 3.3 V and VOUT1 = 10 V

## 2.2 Application Examples Using the TPS65100 for Notebook and Monitor Supplies

With slight modification to the reference designs, the following example applications can be constructed.

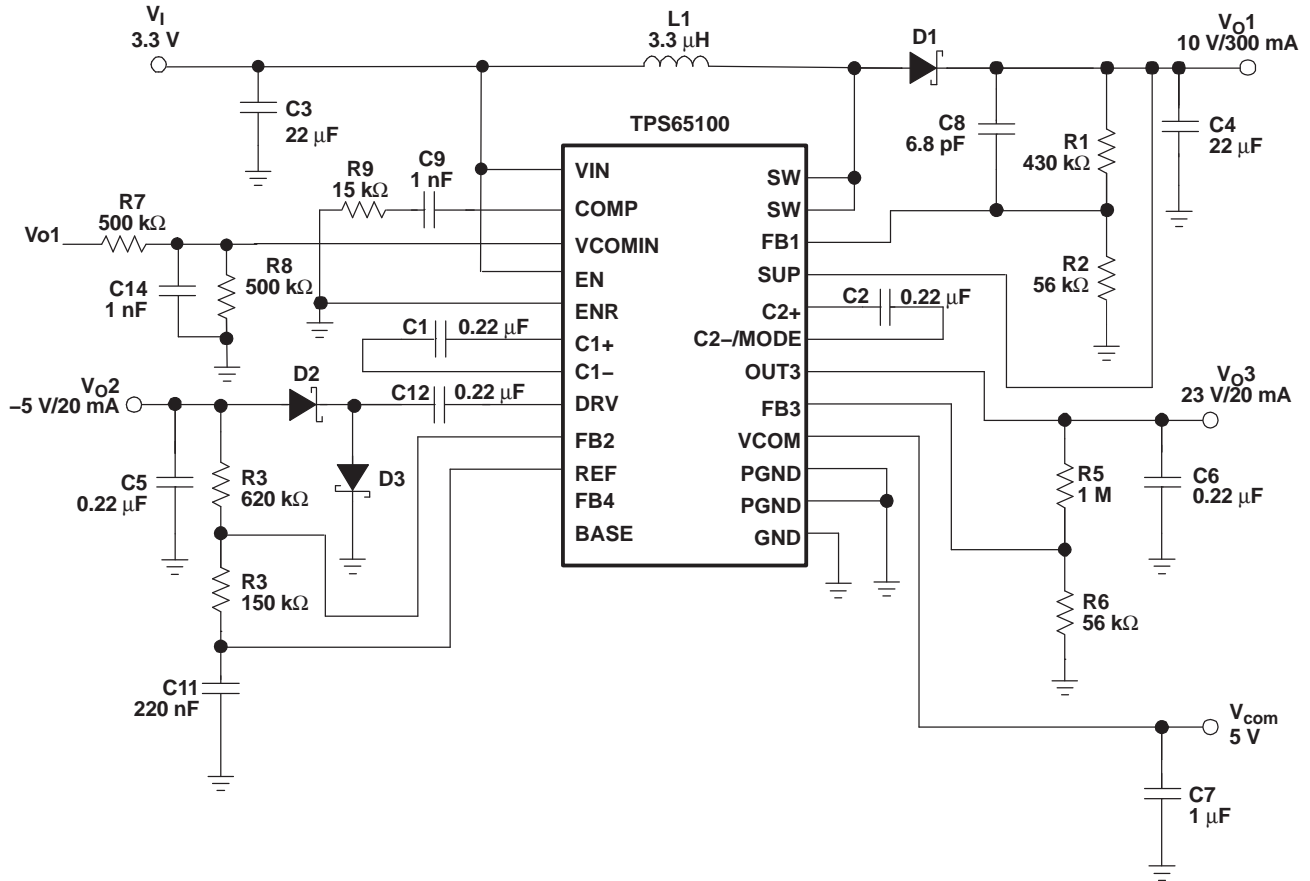


Figure 2. Typical Application, Notebook supply

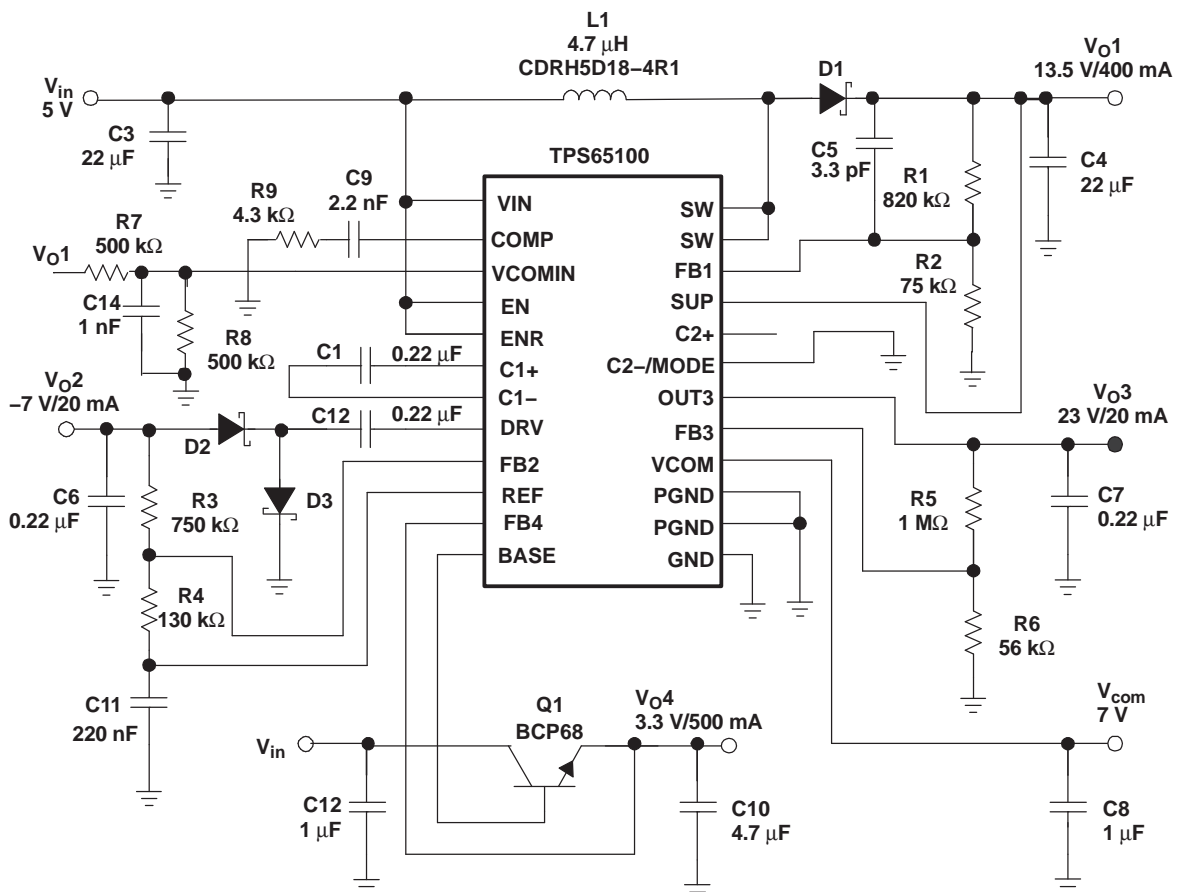


Figure 3. Typical Application, Monitor Supply

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Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
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