Charging Photo-Flash Capacitors Using the TPS65552A

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ABSTRACT

The TPS6555x family of devices are highly integrated flyback converters used to charge photo-flash capacitors. This document contains a reference design and an example of a PCB design using the TPS65552A.

1   Features

- Highly Integrated Solution to Reduce Components
- Integrated 50-V Power Switch,
  $R_{(ON)}$ = 200 mΩ Typical
- Integrated IGBT Driver
- High Efficiency
- Programmable Peak Current, 0.95 A ~ 1.8 A
- Input Voltage of 1.8 V to 12 V
- Optimized Control Loop for Fast Charge Time
- Sensing All Trigger From Primary Side
- 10-Pin MSOP/16-Pin QFN Package
- Protection
  - MAX On Time
  - Over V_{DS} Shutdown
  - Thermal Monitor

2   TPS65552A Reference Design

The Texas Instruments TPS6555xEVM-097 evaluation module (EVM) helps designers evaluate the operation and performance of the TPS6555x family of devices. These devices are highly integrated flyback converters used to charge photo-flash capacitors.

The reference design in Figure 1 contains one fully functional photo-flash charger capable of charging a photo-flash capacitor to 300 V from a battery with voltage between 1.8 V and 12 V. It also provides a flash lamp and trigger circuit to help evaluate charging characteristics.
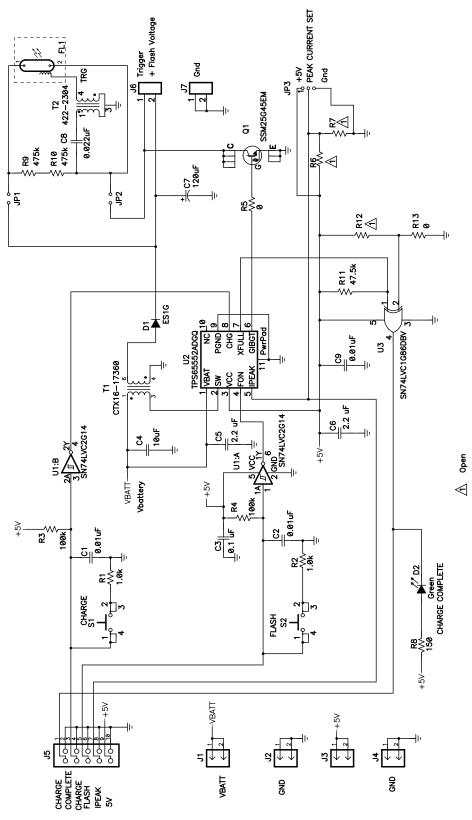
3   Schematic and Bill of Materials

This section provides the TPS6555xEVM-097 schematic (see Figure 1) and bill of materials.

3.1 Schematic

Figure 1. TPS6555xEVM-097 Schematic

3.2 Bill of Materials

Table 3.3. TPS6555xEVM-097 Bill of Materials

COUNT	Ref Des	DESCRIPTION	SIZE	MFR	PART NUMBER
3	C1, C2, C9	Capacitor, Ceramic, 0.01-uF, 50-V, X7R, 10%	0603	TDK	C1608X7R1H103KT
1	C3	Capacitor, Ceramic, 0.1-uF, 50-V, X7R, 10%	0603	TDK	C1608X7R1H104K
1	C4	Capacitor, Ceramic, 10-uF, 16-V, X7R, 10%	1206	TDK	C3216X7R1C106KT
2	C5, C6	Capacitor, Ceramic, 2.2-uF, 16-V, X7R, 10%	0805	TDK	C2012X7R1C225KT
1	C7	Capacitor, Aluminum, 120-uF, 330-VDC, ±20%	13 x 28 mm	Rubycon	330 FW 120A
1	C8	Capacitor, Ceramic, 0.022-uF, 630-V, X7R, 10%	1206	TDK	C3216X7R2J223KT
1	D1	Diode, Rectifier, 1-A, 400-V	SMA	Diodes Inc.	ES1G
1	D2	Diode, LED, Green, Gullwing, GW Type, 20ma, 7.5 mcd typ.	0.120 x 0.087	Panasonic	LN1361CTR
1	FL1	Flash Tube, 400v Max	2.126 x 0.157	Xicon	36FT050
4	J1 - J4	Header, 2-pin, 100mil spacing, (36-pin strip)	0.100 x 2	Sullins	PTC36SAAN
1	J5	Header, 2x5-pin, 100mil spacing (36-pin strip)	0.100 x 5 X 2	Sullins	PTC36SAAN
2	J6, J7	Terminal Block, 2-pin, 15-A, 5.1mm	0.40 x 0.35	OST	ED1609
2	JP1, JP2	Header, 2-pin, 100mil spacing, (36-pin strip)	0.100 x 2	Sullins	PTC36SAAN
1	JP3	Header, 3-pin, 100mil spacing, (36-pin strip)	0.100 x 3	Sullins	PTC36SAAN
1	Q1	Trans, NChan Insulated-Gate Bipolar, 450V, 150A	SO-8	Silicon Standard	SSM25G45EM
1	R1, R2	Resistor, Chip, 1.0k-Ohms, 1/16-W, 1%	0603	Std	Std
1	R11	Resistor, Chip, 47.5k-Ohms, 1/16-W, 1%	0603	Std	Std
2	R3, R4	Resistor, Chip, 100k-Ohms, 1/16-W, 1%	0603	Std	Std
2	R5, R13	Resistor, Chip, 0-Ohms, 1/16-W, 5%	0603	Std	Std
0	R6, R7, R12	Resistor, Chip, xx-Ohms, 1/16-W, 1%	0603		
1	R8	Resistor, Chip, 150-Ohms, 1/16-W, 1%	0603	Std	Std
2	R9, R10	Resistor, Chip, 475k-Ohms, 1/8W, 1%	1206	Std	Std
2	S1, S2	Switch, SPST, PB Momentary, Sealed Washable	0.245 X 0.251	C & K	KT11P2JM
1	T1	Transformer, Flyback, 1:10.2	0.300 x 0.240	Coiltronics	CTX16-17360
1	T2	Transformer, Trigger	0.197 Dia	Xicon	422-2304
1	U1	IC, Dual Schmitt-Trigger Inverter	SOT23-6	TI	SN74LVC2G14DBV
1	U2	IC, Photo Flash Charger and IGBT Driver	DGQ10	TI	TPS65552ADGQ
1	U3	Single 2-Input X-OR Gate	SOT-25	TI	SN74LVC1G86DBV
1	--	PCB, 4.4 In x 4.2 In x 0.062 In		Any	HPA097
3	--	Shunt, 100-mil, Black	0.100	3M	929950-00
4	--	Bumpon, Transparent	0.44" x 0.2"	3M	SJ5303

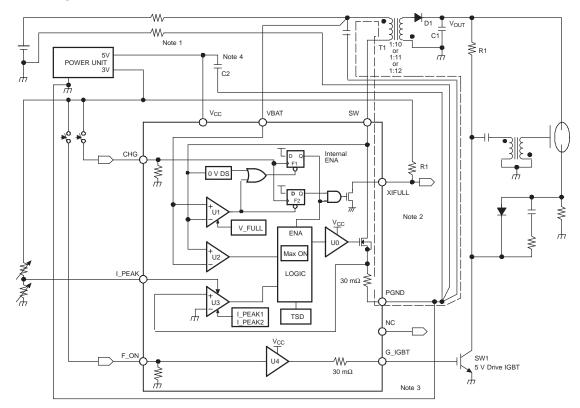## 4   PCB Design With the TPS65552A

Figure 2. PCB Design Guideline

4.1   Advantages to the TPS65552A

1. These devices can be designed into a smaller area, and require few external components because of the integrated IGBT driver.
2. The peak current on the primary-side inductor can be set to a maximum of 1.8 A by external voltage reference. This makes it possible to control battery life, to protect against system shutdown by large currents, and to change the charging time.
3. By selecting the proper external components, it is possible to achieve 70% or greater efficiency and charging time less than 4 seconds with a battery voltage of 4.2 V and the voltage on the I_PEAK pin more than 1.4 V.

To maximize TPS65552A performance:

1. Choose a diode with the best Trr speed, and select a transformer with the best coefficient of coupling . These affect charging time and efficiency.
2. Good system layout of the PCB can result in enhanced performance.

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