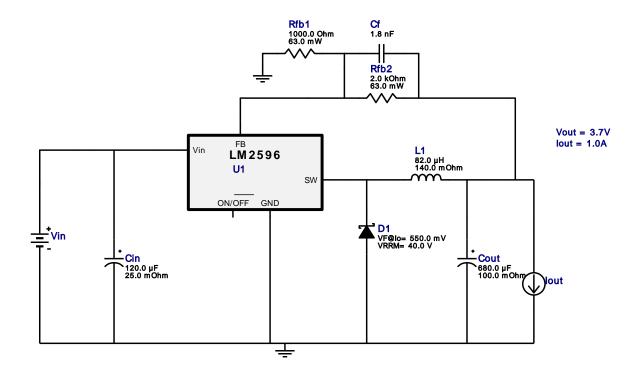
VinMin = 11.0V VinMax = 13.0V Vout = 3.7V Iout = 1.0A Device = LM2596T-ADJ/NOPB Topology = Buck Created = 2022-01-06 10:18:01.374 BOM Cost = \$5.74 BOM Count = 8 Total Pd = 0.99W

WEBENCH® Design Report

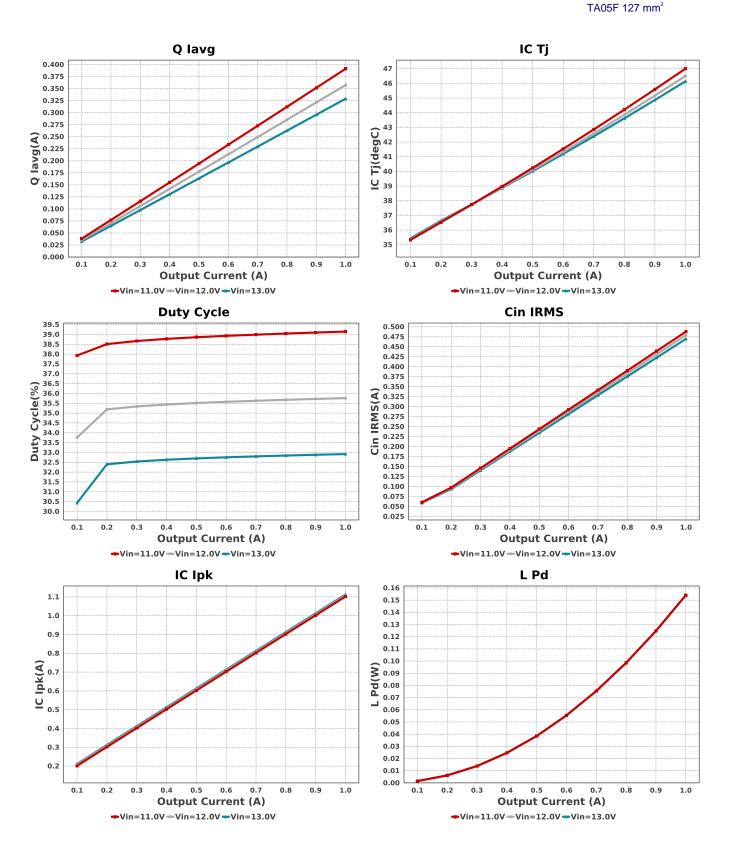
Design: 532 LM2596T-ADJ/NOPB LM2596T-ADJ/NOPB 11V-13V to 3.30V @ 2.5A

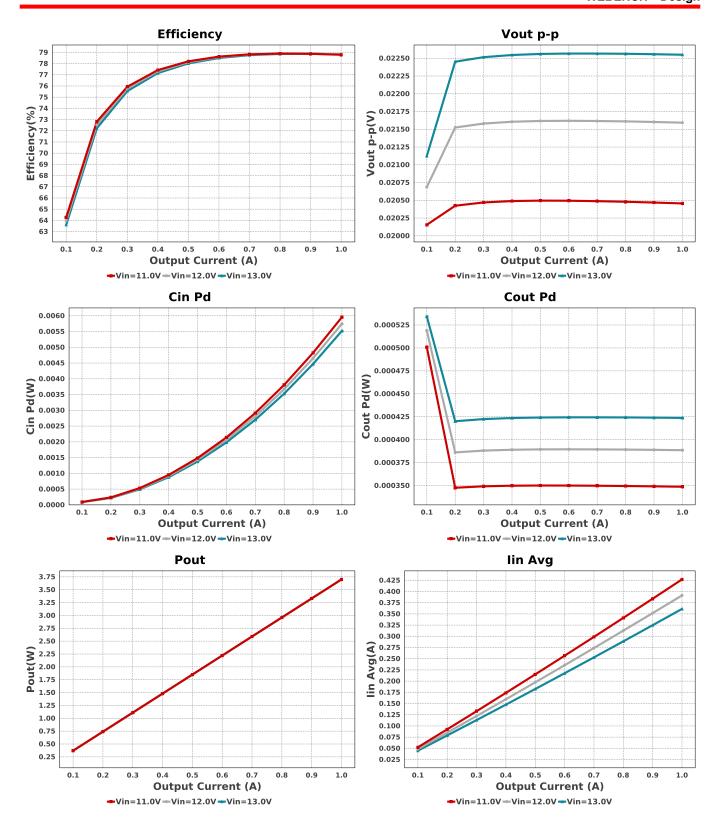


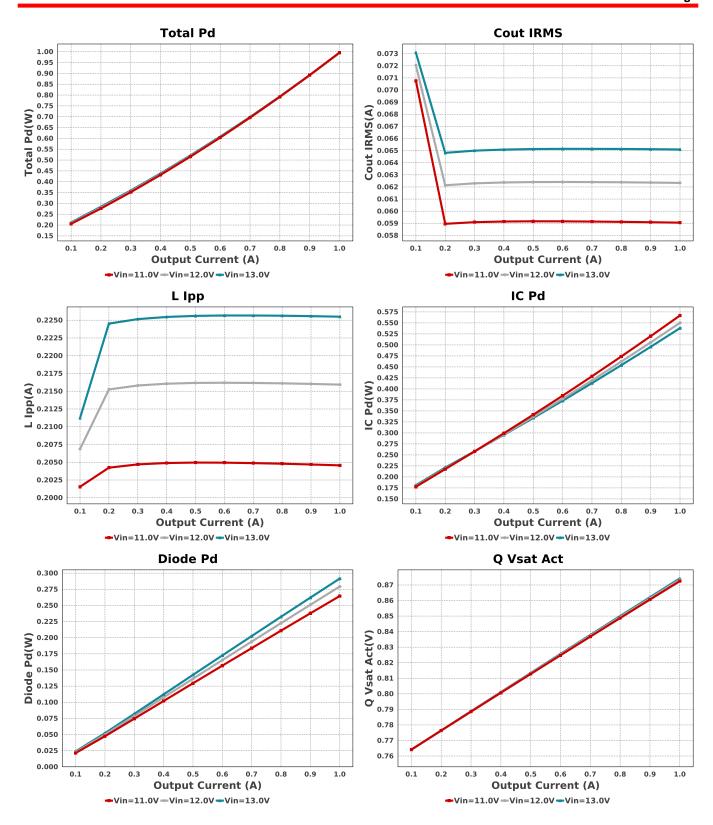
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cf	TDK	C2012C0G1H182K060AA Series= C0G/NP0	Cap= 1.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.04	0805 7 mm ²
Cin	Panasonic	20SVPF120M Series= SVPF	Cap= 120.0 uF ESR= 25.0 mOhm VDC= 20.0 V IRMS= 3.2 A	1	\$0.44	CAPSMT_62_F61 74 mm ²
Cout	Chemi-Con	EMVH350GDA681MMH0S Series= MVH	Cap= 680.0 uF ESR= 100.0 mOhm VDC= 35.0 V IRMS= 1.2 A	1	\$2.60	CAPSMT_62_MH0 441 mm²
D1	Fairchild Semiconductor	SS14FL	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.04	SOD-123F 12 mm ²
L1	Bourns	SDR1307-820KL	L= 82.0 μH 140.0 mOhm	1	\$0.42	SDR1307 226 mm ²
Rfb1	Vishay-Dale	CRCW04021K00FKED Series= CRCWe3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rfb2	Vishay-Dale	CRCW04022K00FKED Series= CRCWe3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
U1	Texas Instruments	LM2596T-ADJ/NOPB	Switcher	1	\$2.18	







Operating Values

	#	Name	Value	Category	Description
Т	1.	Cin IRMS	469.915 mA	Capacitor	Input capacitor RMS ripple current
	2.	Cin Pd	5.52 mW	Capacitor	Input capacitor power dissipation
	3.	Cout IRMS	65.095 mA	Capacitor	Output capacitor RMS ripple current
	4.	Cout Pd	423.73 μW	Capacitor	Output capacitor power dissipation
	5.	Diode Pd	291.55 mW	Diode	Diode power dissipation
	6.	IC lpk	1.113 A	IC	Peak switch current in IC
	7.	IC Pd	538.06 mW	IC	IC power dissipation
	8.	IC Tj	46.142 degC	IC	IC junction temperature
	9.	IC Tolerance	0.0 V	IC	IC Feedback Tolerance
	10.	ICThetaJA	30.0 degC/W	IC	IC junction-to-ambient thermal resistance
	11.	lin Avg	361.09 mA	IC	Average input current

Name			V/ 1	2 .	
13. L Pád 154.0 mW Inductor of Q lavg					<u>'</u>
14. Q lavg 329.178 mA Mosfet Cin Pd 5.52 mW Power Input capacitor power dissipation Output capacitor power dissipation (IC power diss					
15. Čin Pd	_				•
16. Cout Pd					•
17. Diode Pd 291.55 mW Power IC power dissipation (C power dissipation (_				
18. IC Pd 538.06 mW Power IC power dissipation 19. L Pd 154.0 mW Power Inductor power dissipation 20. Total Pd 994.131 mW Power Total Power Dissipation 21. BOM Count 8 System Information Total Design BOM count 22. Cross Freq 6.31 kHz System Information Bode plot crossover frequency 23. Duty Cycle 32.918 % System Information System Steady state efficiency 24. Efficiency 78.822 % System Information System System Total Foot Print Area of BOM components 25. FootPrint 893.0 mm² System Information System Out operating point 26. Frequency 150.0 kHz System Information System Information 27. Iout 1.0 A System Information Conduction Mode 28. Mode CCM System Information System Information 30. Pout 3.7 W System Information Total BOM Cost 31. Total BOM \$5.74 System Information Yin operating point 32. Vin 13.0 V System Information Vin operating point 33. Vout Actual 3.69 V			•		
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Design Inputs

Name	Value	Description	
lout	1.0	Maximum Output Current	
VinMax	13.0	Maximum input voltage	
VinMin	11.0	Minimum input voltage	
Vout	3.7	Output Voltage	
base_pn	LM2596	Base Product Number	
source	DC	Input Source Type	
Та	30.0	Ambient temperature	

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

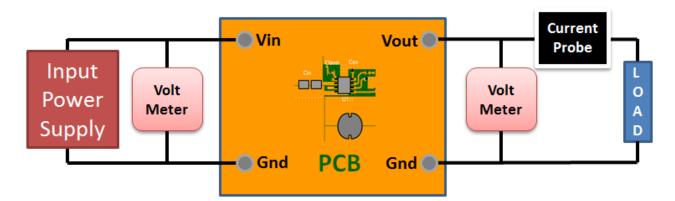
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 11.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum lout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

- 1. Master key: 40EE3F1E021441DB[v1]
- 2. LM2596 Product Folder: http://www.ti.com/product/LM2596: contains the data sheet and other resources.

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