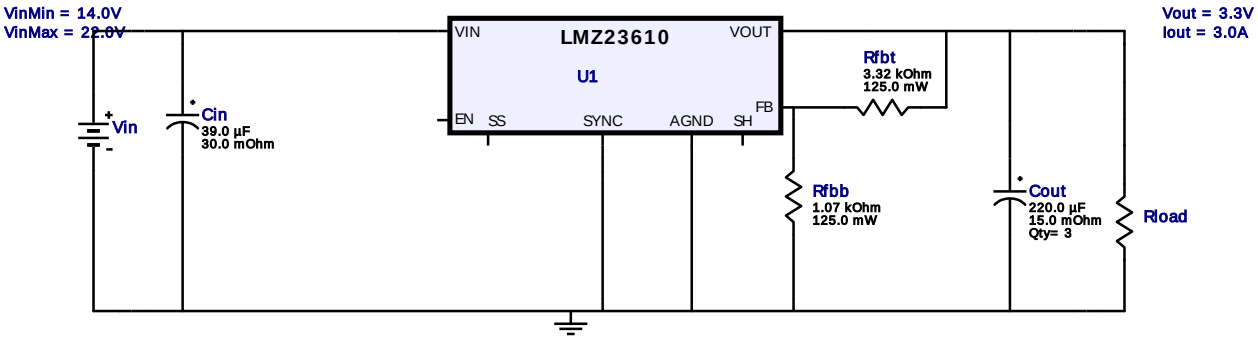
WEBENCH® Design Report

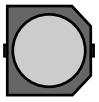
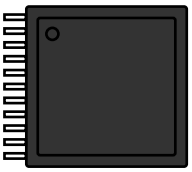
VinMin = 14.0V
VinMax = 22.0V
Vout = 3.3V
Iout = 3.0A

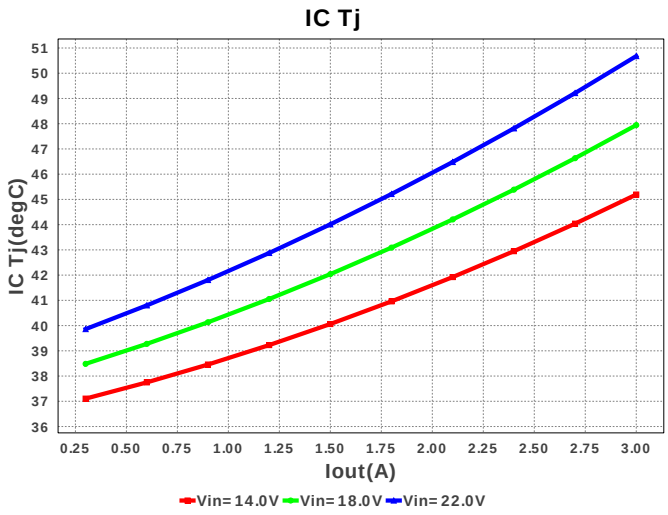
Device = LMZ23610TZ/NOPB
Topology = Buck
Created = 6/4/14 6:13:06 PM
BOM Cost = $16.04
Footprint = 621.0mm2
BOM Count = 7
Total Pd = 2.11W

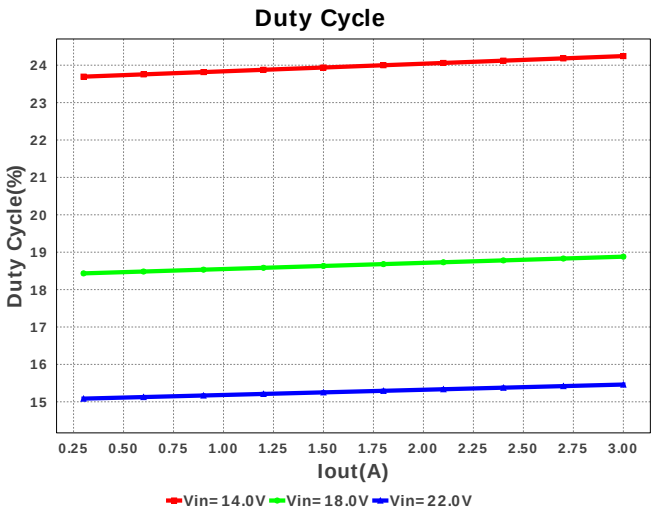
Design : 3981718/220 LMZ23610TZ/NOPB
LMZ23610TZ/NOPB 14.0V-22.0V to 3.3V @ 3.0A

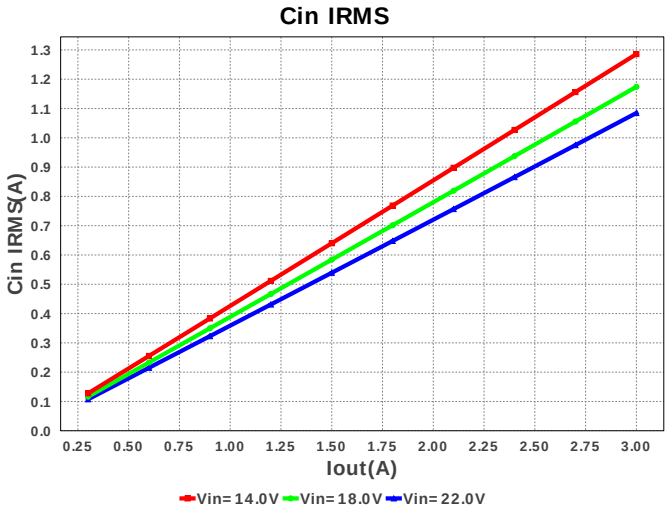


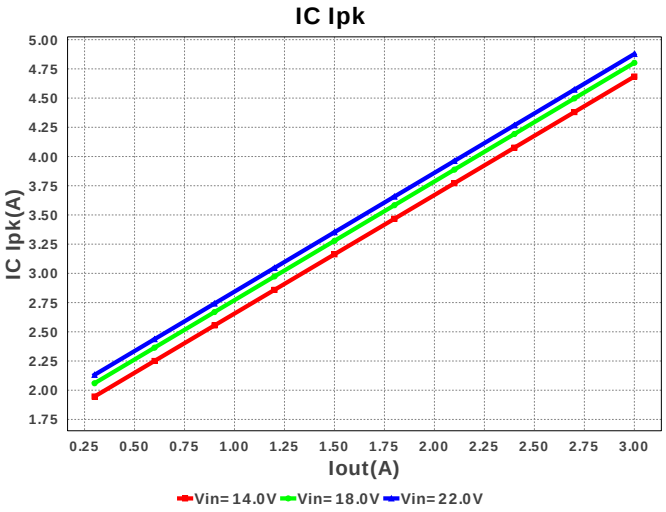
Electrical BOM

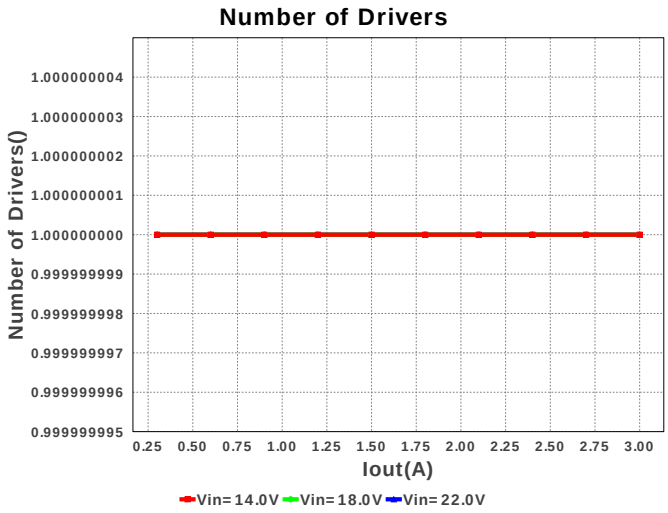
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	Panasonic	35SVPF39M Series= 1273	Cap= 39.0 µF ESR= 30.0 mOhm VDC= 35.0 V IRMS= 2.8 A	1	$0.50	 CAPSMT_62_E7 106mm2
2.	Cout	Panasonic	6SVPE220MW Series= 259	Cap= 220.0 µF ESR= 15.0 mOhm VDC= 6.3 V IRMS= 3.15 A	3	$0.14	 CAPSMT_62_E61 53mm2
3.	Rfbb	Panasonic	ERJ-6ENF1071V Series= 225	Res= 1.07 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7mm2
4.	Rfbt	Panasonic	ERJ-6ENF3321V Series= 225	Res= 3.32 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7mm2
5.	U1	Texas Instruments	LMZ23610TZ/NOPB	Switcher	1	$15.10	 TZA011A 342mm2

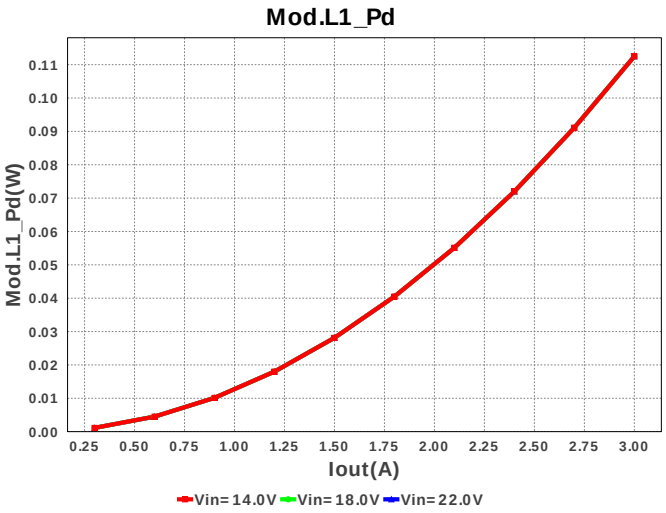


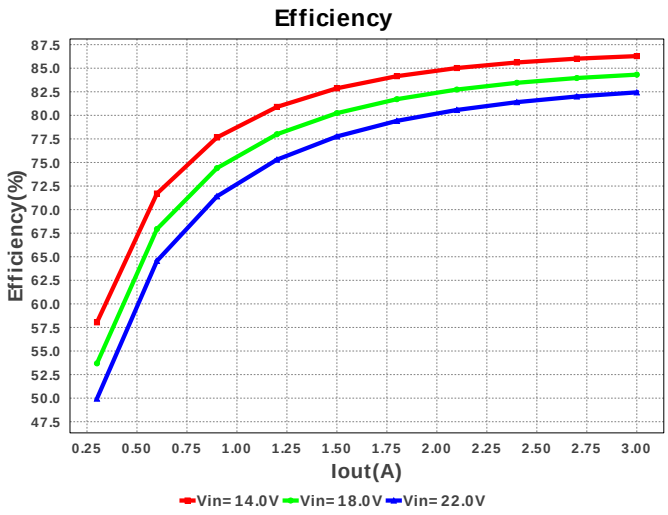


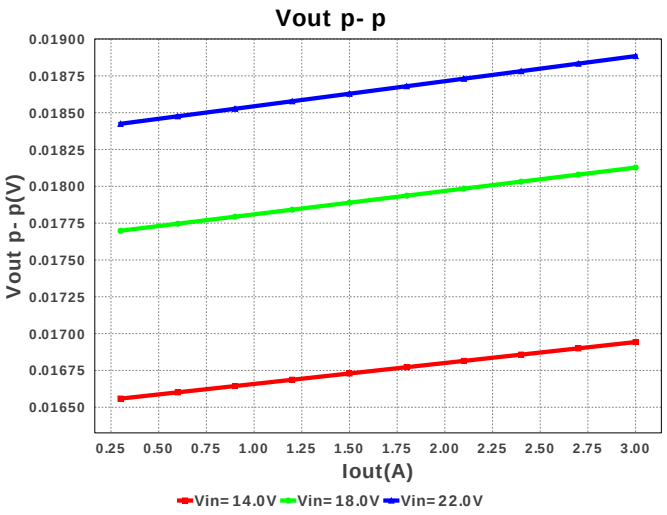


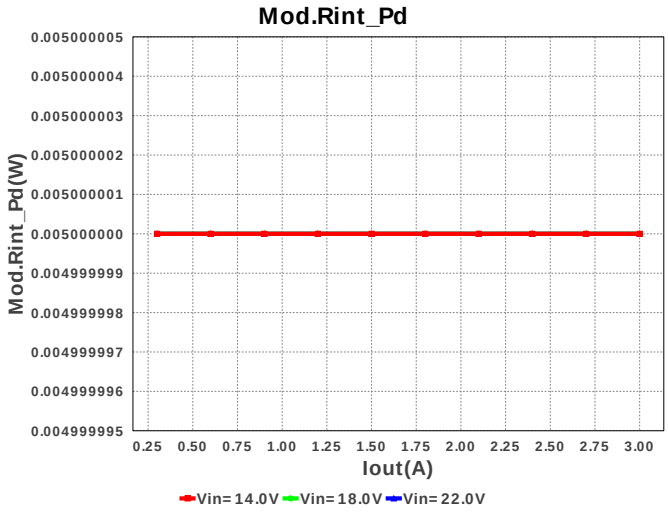


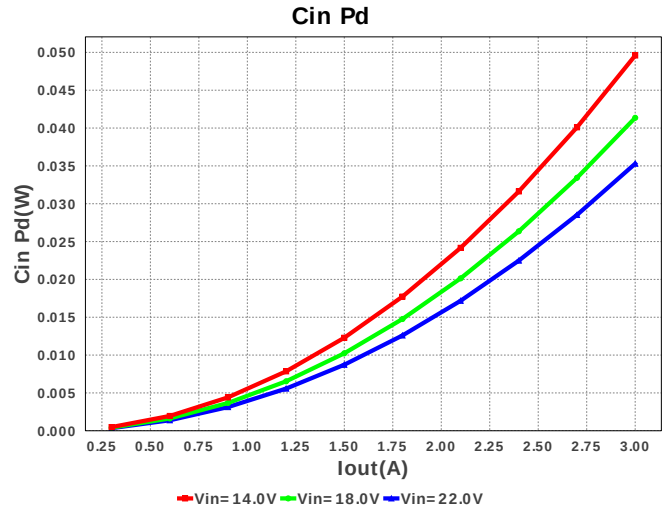


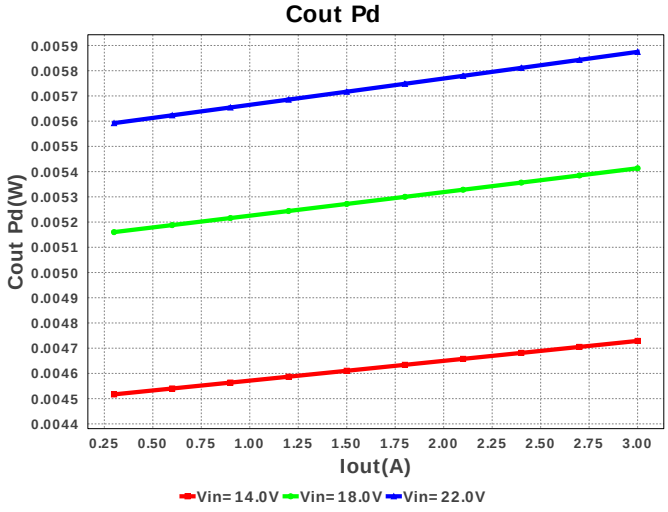


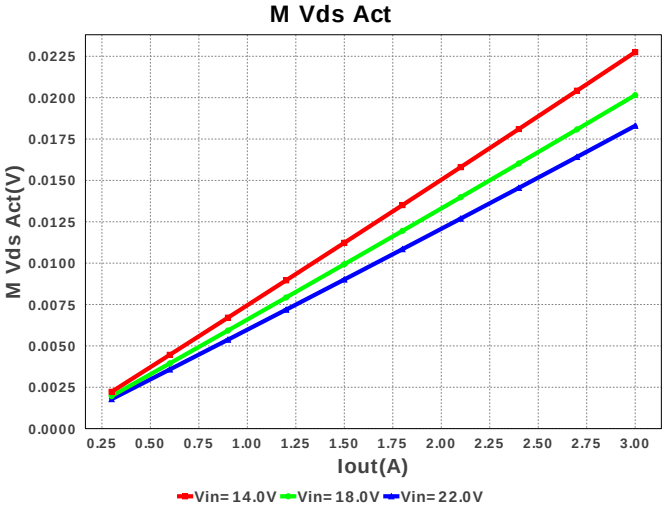


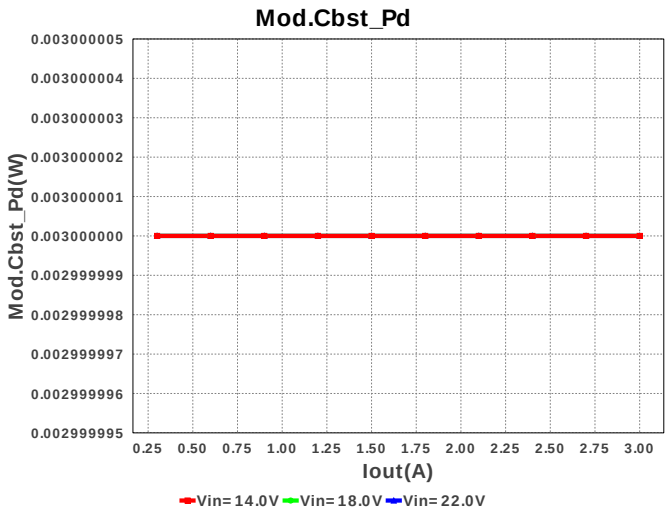


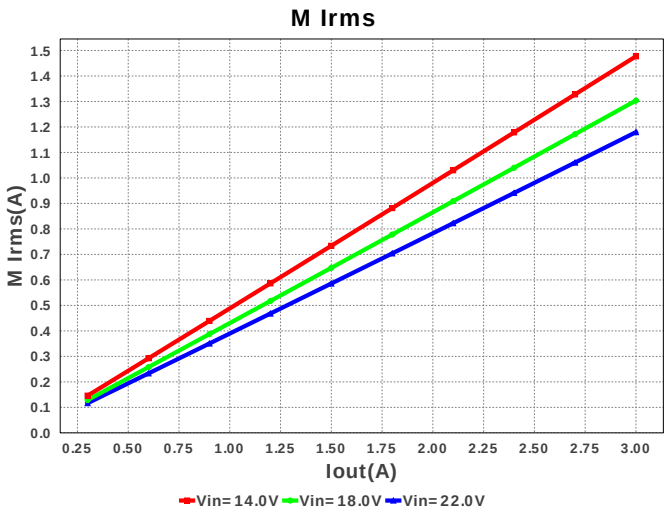


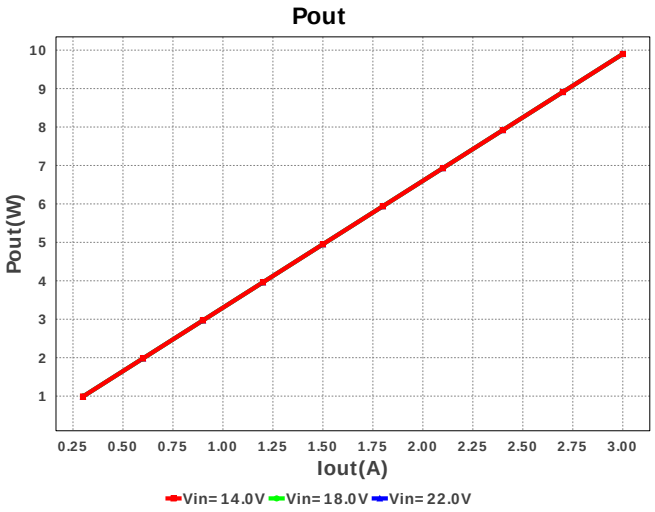


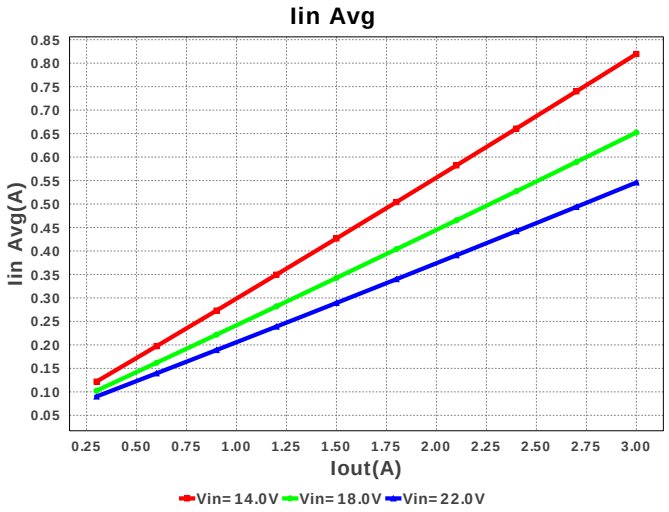


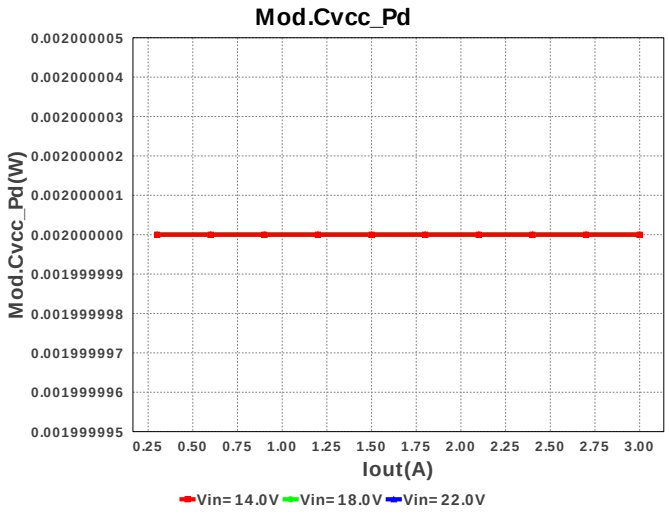


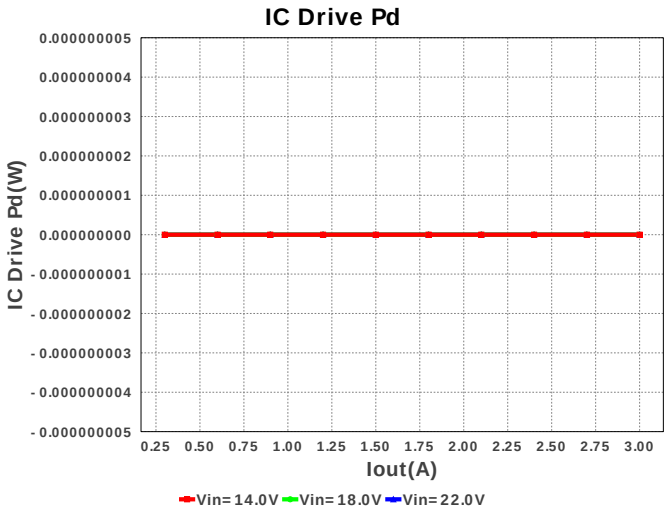


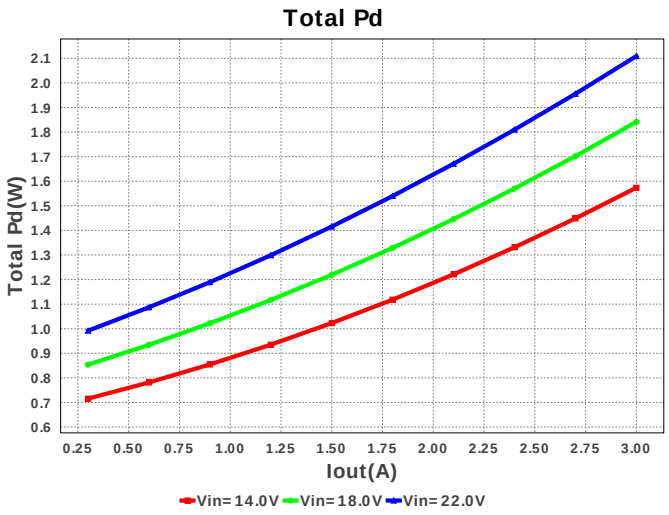


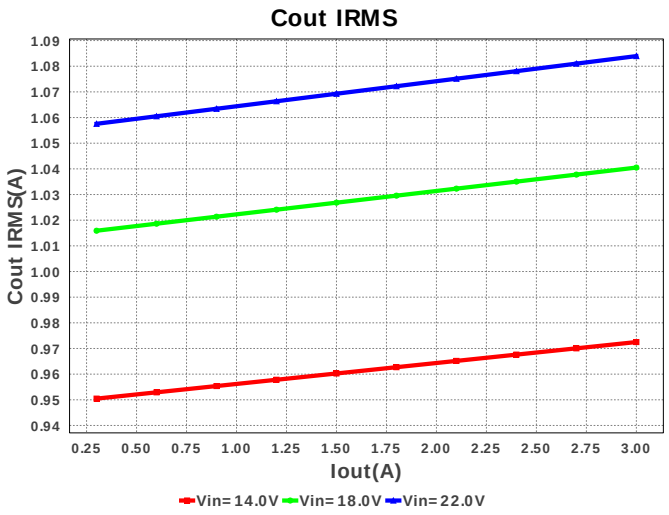


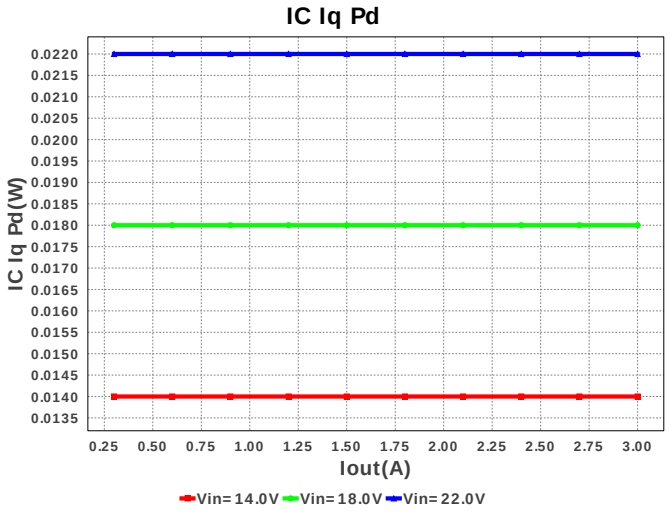


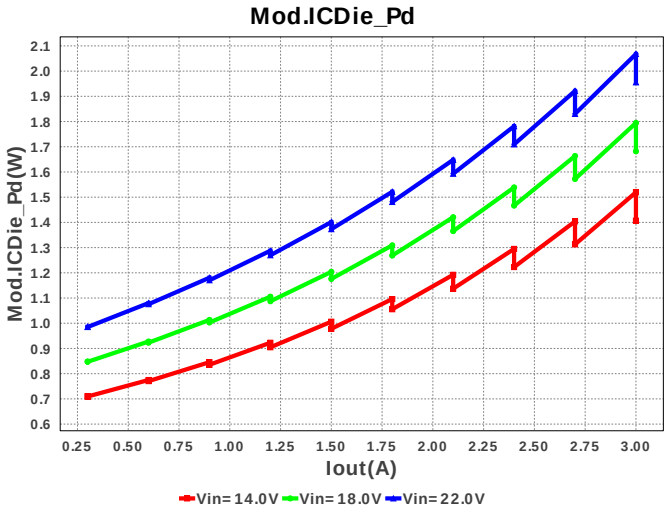












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.085 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.084 A	Current	Output capacitor RMS ripple current
3.	IC Ipk	4.877 A	Current	Peak switch current in IC
4.	Iin Avg	545.87 mA	Current	Average input current
5.	M Irms	1.18 A	Current	MOSFET RMS current
6.	BOM Count	7	General	Total Design BOM count
7.	FootPrint	621.0 mm2	General	Total Foot Print Area of BOM components
8.	Frequency	350.0 kHz	General	Switching frequency
9.	IC Tolerance	20.0 mV	General	IC Feedback Tolerance
10.	M Vds Act	18.3 mV	General	Voltage drop across the MosFET
11.	Pout	9.9 W	General	Total output power
12.	Total BOM	$16.04	General	Total BOM Cost
13.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
14.	Cross Freq	9.175 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	15.461 %	Op_point	Duty cycle
16.	Efficiency	82.438 %	Op_point	Steady state efficiency
17.	IC Tj	50.679 degC	Op_point	IC junction temperature
18.	ICThetaJA	10.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	3.0 A	Op_point	Iout operating point
20.	Phase Marg	50.178 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	22.0 V	Op_point	Vin operating point
22.	Vout p-p	18.884 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	35.291 mW	Power	Input capacitor power dissipation
24.	Cout Pd	5.875 mW	Power	Output capacitor power dissipation
25.	IC Drive Pd	0.0 W	Power	Driver power dissipation
26.	IC Iq Pd	22.0 mW	Power	IC Iq Pd
27.	Total Pd	2.109 W	Power	Total Power Dissipation
28.	Number of Drivers	1.0	Unknown	Number of drivers in current sharing mode.

Design Inputs

#	Name	Value	Description
1.	Iout	3.0 A	Maximum Output Current
2.	Iout1	3.0 Amps	Output Current #1
3.	VinMax	22.0 V	Maximum input voltage
4.	VinMin	14.0 V	Minimum input voltage
5.	Vout	3.3 V	Output Voltage
6.	Vout1	3.3 Volt	Output Voltage #1
7.	base_pn	LMZ23610	Texas Instruments Base Part Number
8.	source	DC	Input Source Type
9.	ta	30.0 degC	Ambient temperature

Design Assistance

1. The Modules are very easy to use and just need a basic design using a resistor divider at the feedback and input and output caps to work. To design for UVLO you could click on the drop down menu in the 'Change Inputs' menu and select the 'UVLO Enabled Design'. The internal softstart time is set at 1.6mSec. If a longer softstart time is desired, you could change the preset to the desired amount and click on 'Submit'. Webench will then add an external softstartcap to the schematic. For designs requiring more than 10A of load current, multiple LMZ23610 ICs can be used by connecting their 'SH' pins together. The 'Master' LMZ23610is set by connecting the resistor divider from feedback to the output. The slaves have their feedback pins open. Airflow There should be airflow of about 225LFM provided for the maximum input voltage of 36V and full load requirement. Without airflow the IC will heat up and has a chance of thermal failure.

2. LMZ23610 Product Folder : http://www.ti.com/product/lmz23610 : contains the data sheet and other resources.