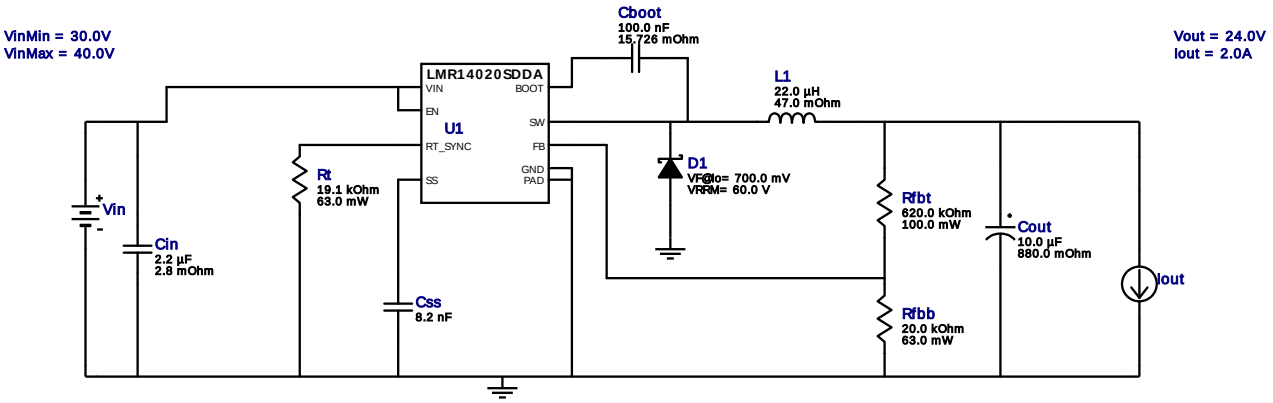
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 30.0V
VinMax = 40.0V
Vout = 24.0V
Iout = 2.0A

Device = LMR14020SDDAR
Topology = Buck
Created = 7/15/15 6:21:21 PM
BOM Cost = $2.26
Footprint = 438.0 mm²
BOM Count = 10
Total Pd = 2.48W

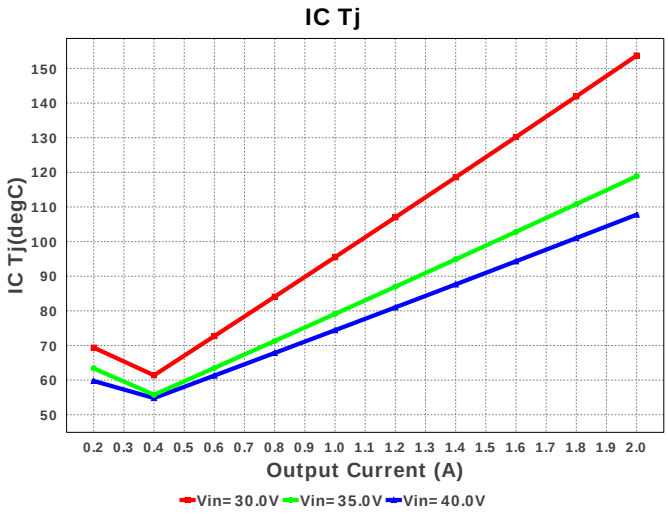
Design : 4407031/14 LMR14020SDDAR
LMR14020SDDAR 30.0V-40.0V to 24.00V @ 2.0000375A

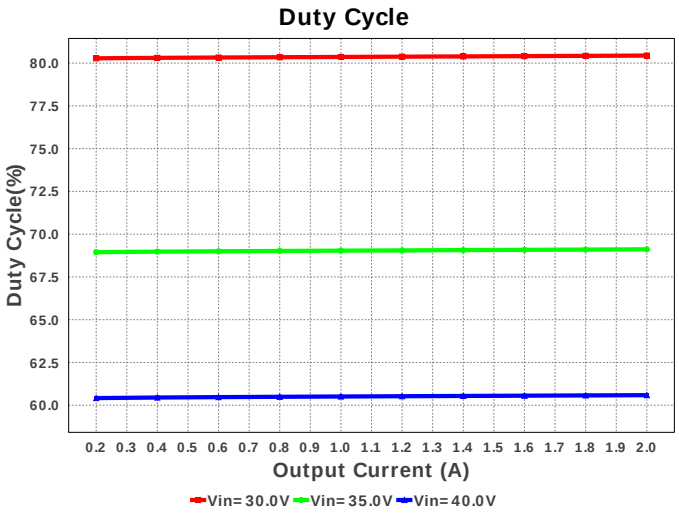


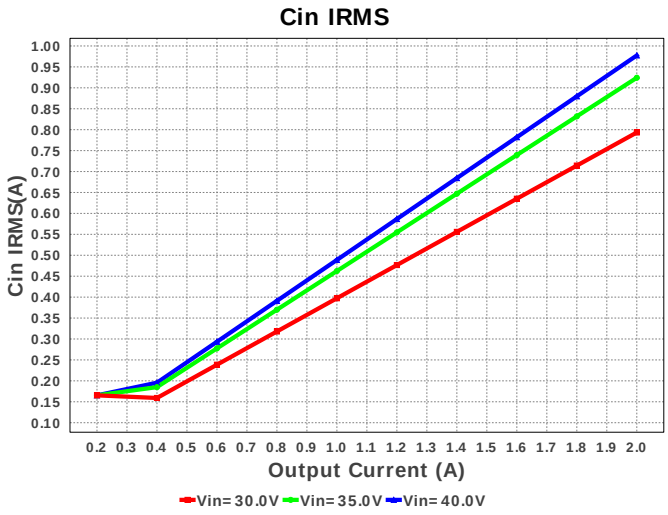
Electrical BOM

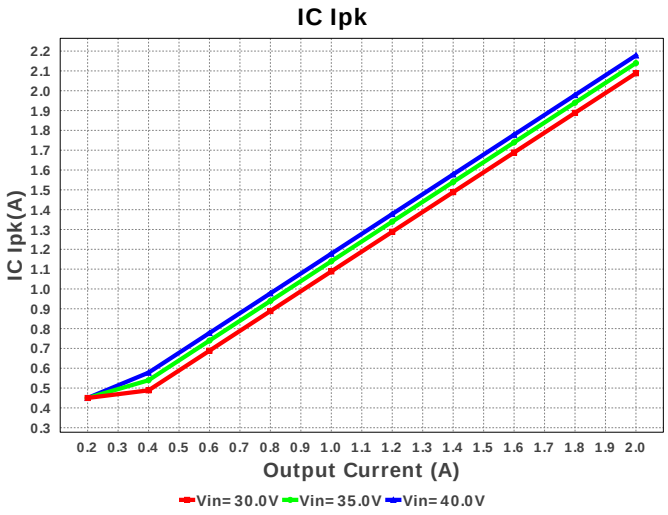
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	TDK	C2012X7R2A104K Series= X7R	Cap= 100.0 nF ESR= 15.726 mOhm VDC= 100.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
2.	Cin	TDK	C3225X7R2A225K230AB Series= X7R	Cap= 2.2 uF ESR= 2.8 mOhm VDC= 100.0 V IRMS= 9.8247 A	1	$0.19	1210 15 mm²
3.	Cout	Nichicon	UUD1H100MCL1GS Series= uD	Cap= 10.0 uF ESR= 880.0 mOhm VDC= 50.0 V IRMS= 165.0 mA	1	$0.10	SM_RADIAL_6.3AMM 80 mm²
4.	Css	MuRata	GRM155R71C822KA01D Series= X7R	Cap= 8.2 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
5.	D1	Diodes Inc.	B260A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.09	SMA 37 mm²
6.	L1	Bourns	SDR1307-220ML	L= 22.0 µH DCR= 47.0 mOhm	1	$0.35	SDR1307 227 mm²
7.	Rfbb	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
8.	Rfbt	Susumu Co Ltd	RR1220P-624-D Series= RR12	Res= 620.0 kOhm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	0805 7 mm²
9.	Rt	Vishay-Dale	CRCW040219K1FKED Series= CRCW..e3	Res= 19.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

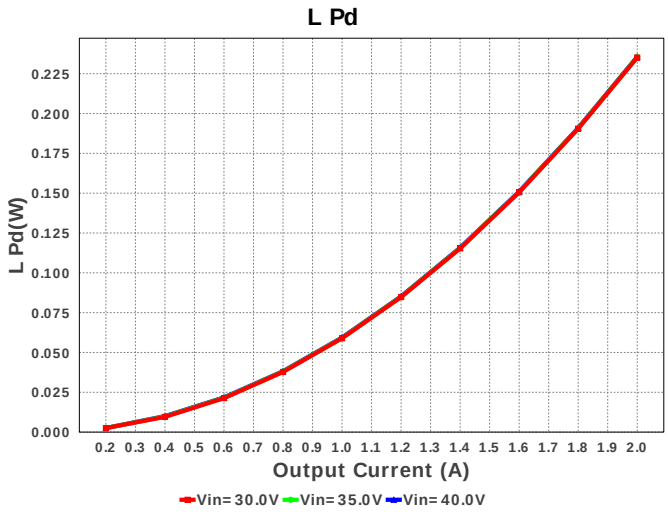
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	U1	Texas Instruments	LMR14020SDDAR	Switcher	1	$1.46	DDA0008E 57 mm^2

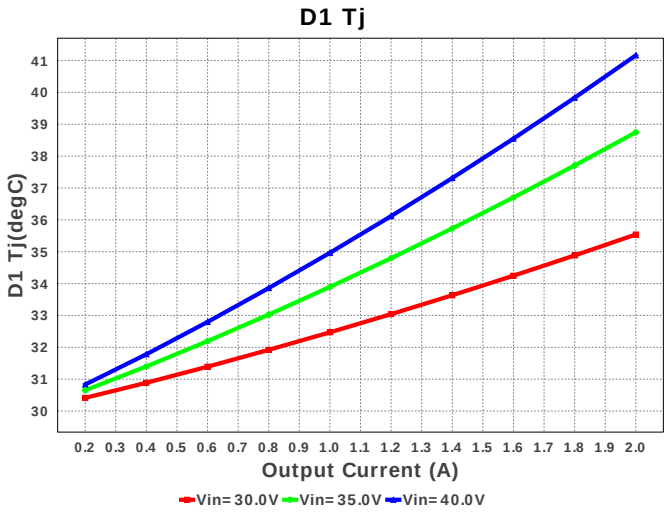


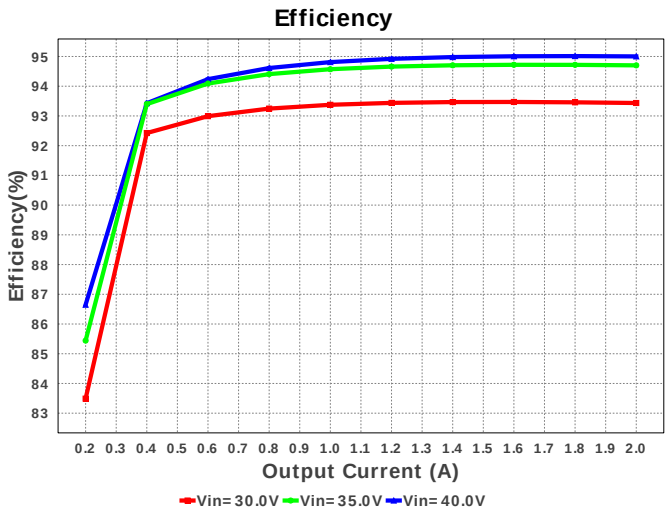


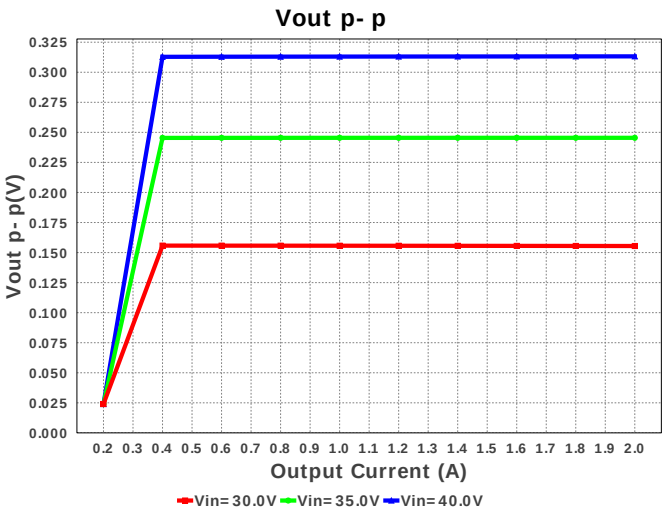


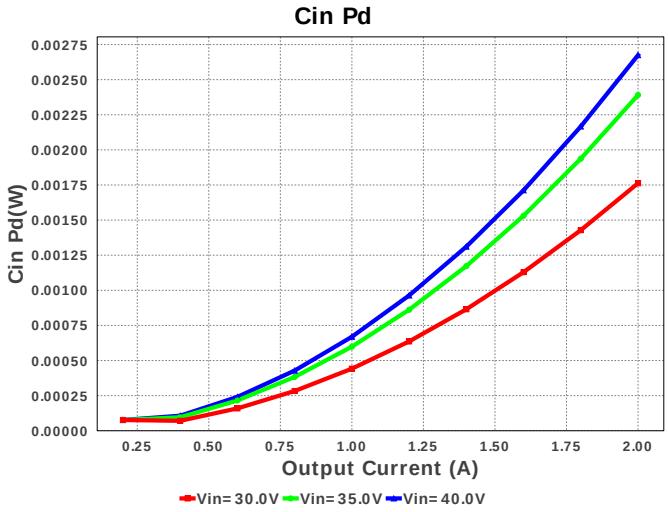


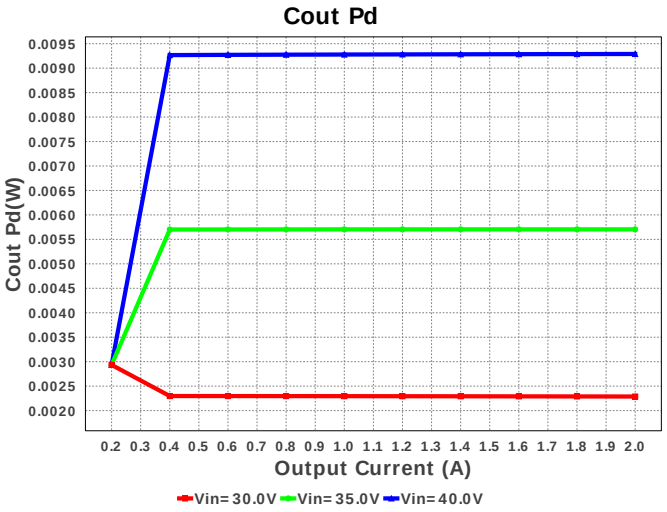


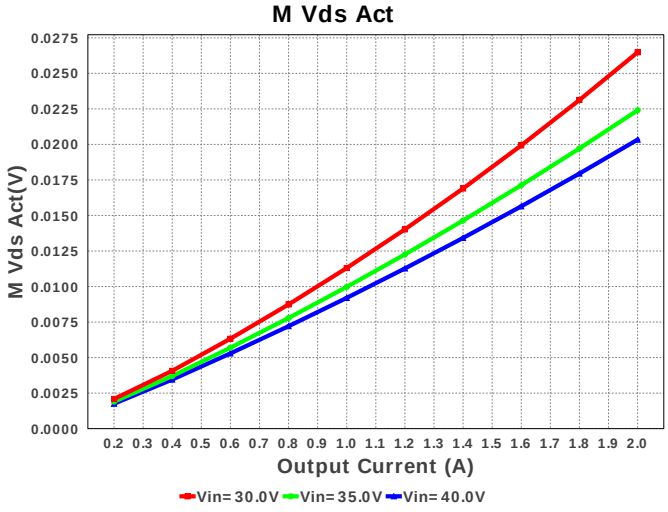


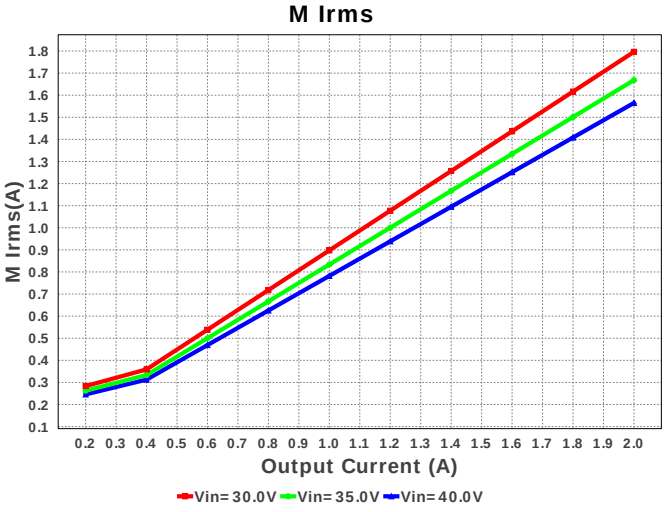


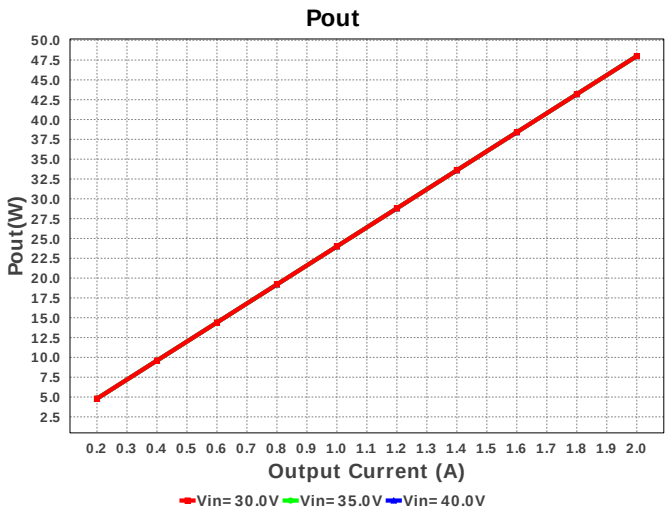


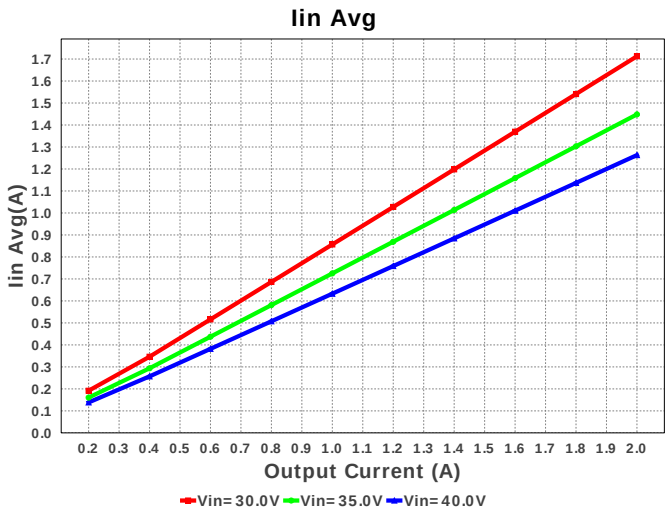


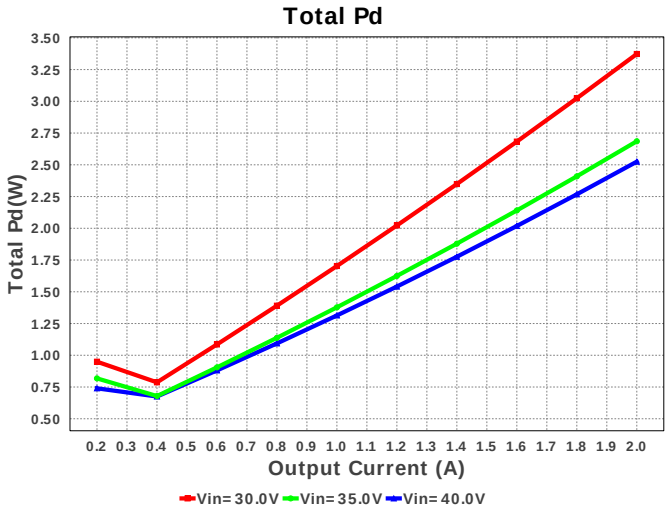


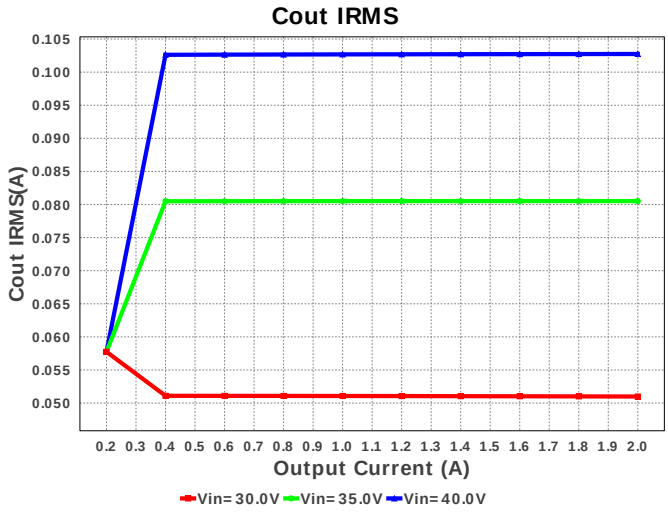


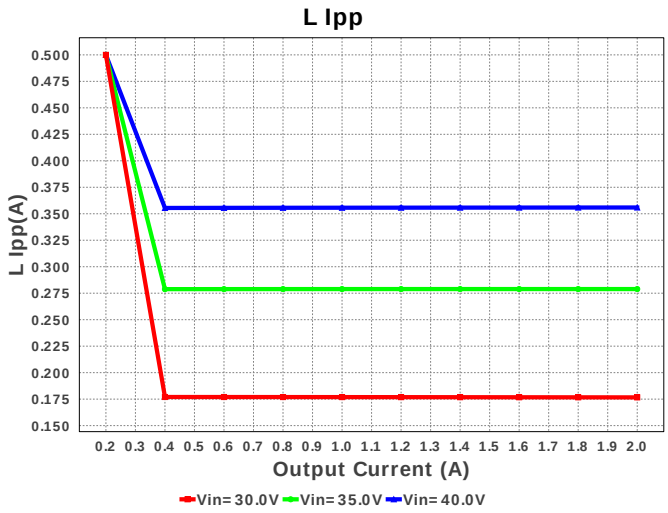


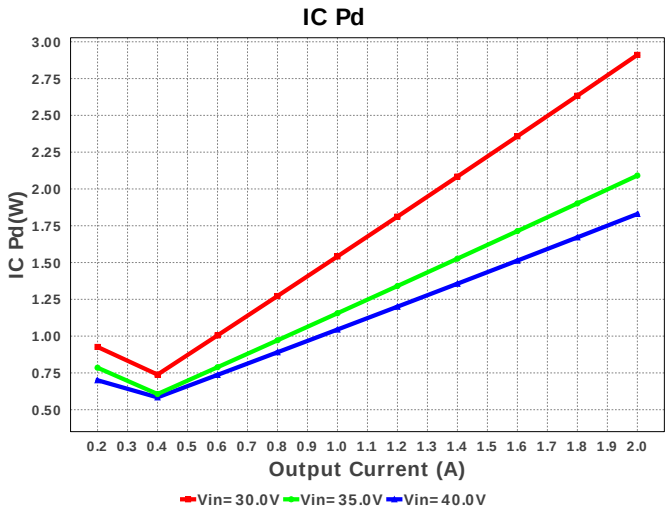


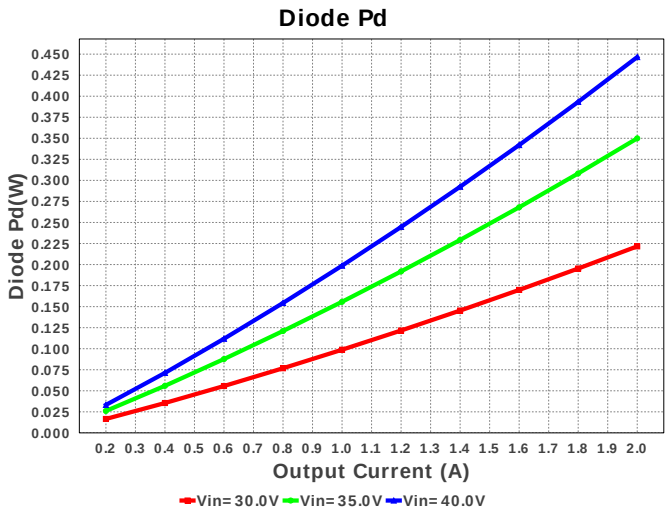


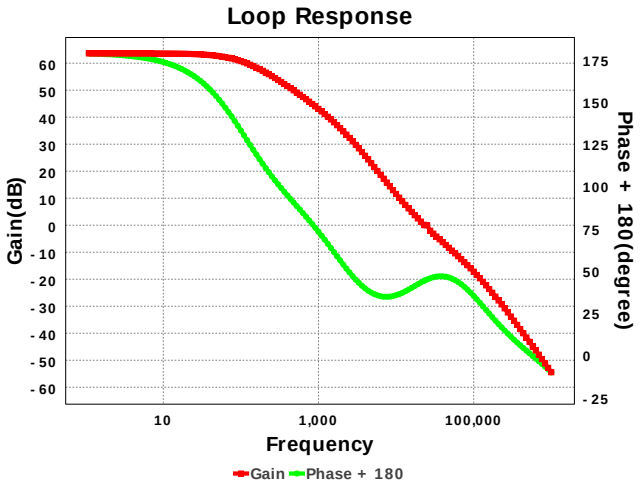


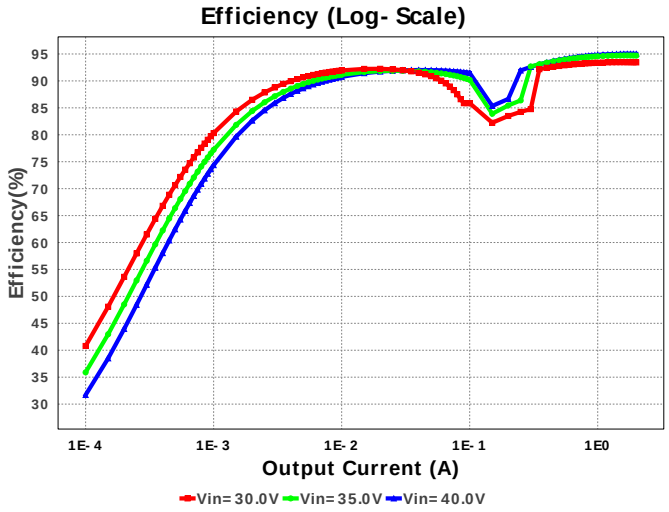












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	977.584 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	102.646 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	2.178 A	Current	Peak switch current in IC
4.	Iin Avg	1.262 A	Current	Average input current
5.	L Ipp	355.58 mA	Current	Peak-to-peak inductor ripple current
6.	M Irms	1.564 A	Current	MOSFET RMS current
7.	BOM Count	10	General	Total Design BOM count
8.	FootPrint	438.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	1.237 MHz	General	Switching frequency
10.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	20.268 mV	General	Voltage drop across the MosFET
12.	Pout	48.0 W	General	Total output power
13.	Total BOM	$2.26	General	Total BOM Cost
14.	D1 Tj	40.017 degC	Op_Point	D1 junction temperature
15.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
16.	Cross Freq	23.254 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	60.532 %	Op_point	Duty cycle
18.	Efficiency	95.093 %	Op_point	Steady state efficiency
19.	IC Tj	106.762 degC	Op_point	IC junction temperature
20.	ICThetaJA	42.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	2.0 A	Op_point	Iout operating point
22.	Phase Marg	44.792 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	40.0 V	Op_point	Vin operating point
24.	Vout p-p	312.928 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	2.676 mW	Power	Input capacitor power dissipation
26.	Cout Pd	9.272 mW	Power	Output capacitor power dissipation
27.	Diode Pd	400.695 mW	Power	Diode power dissipation
28.	IC Pd	1.828 W	Power	IC power dissipation
29.	L Pd	235.628 mW	Power	Inductor power dissipation
30.	Total Pd	2.477 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	Iout1	2.0	Output Current #1
3.	VinMax	40.0	Maximum input voltage
4.	VinMin	30.0	Minimum input voltage
5.	Vout	24.0	Output Voltage
6.	Vout1	24.0	Output Voltage #1
7.	base_pn	LMR14020S	Texas Instruments Base Part Number
8.	source	DC	Input Source Type
9.	ta	30.0	Ambient temperature

Design Assistance

1. LMR14020S Product Folder : http://www.ti.com/product/LMR14020 : contains the data sheet and other resources.