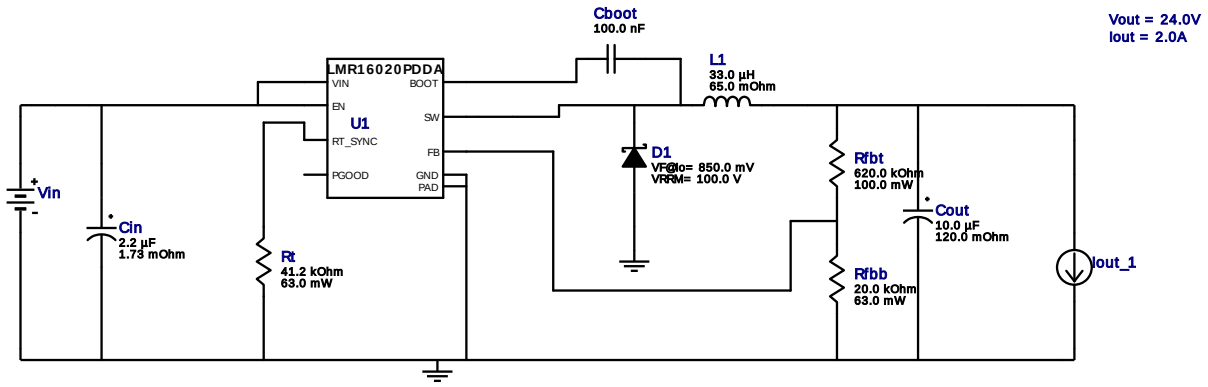
TEXAS INSTRUMENTS

WEBENCH® Design Report

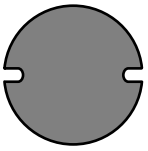
VinMin = 45.0V
VinMax = 55.0V
Vout = 24.0V
Iout = 2.0A

Device = LMR16020PDDAR
Topology = Buck
Created = 7/16/16 6:39:33 PM
BOM Cost = $3.03
BOM Count = 10
Total Pd = 2.19W

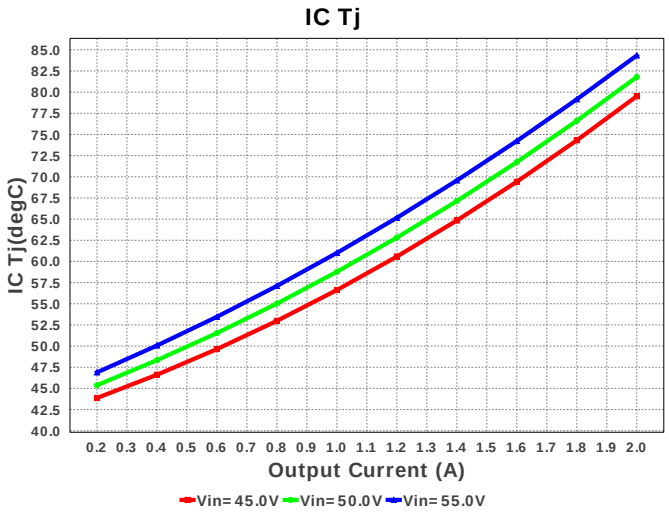
Design : 906020/2252 LMR16020PDDAR
LMR16020PDDAR 45.0V-55.0V to 24.00V @ 2.0001124999999997A

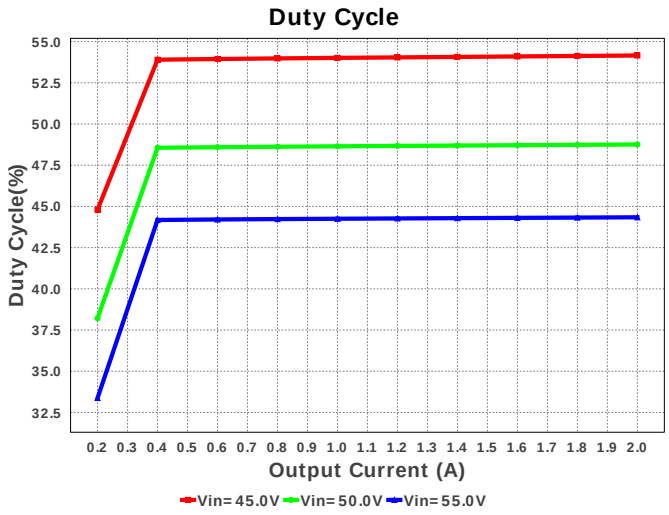


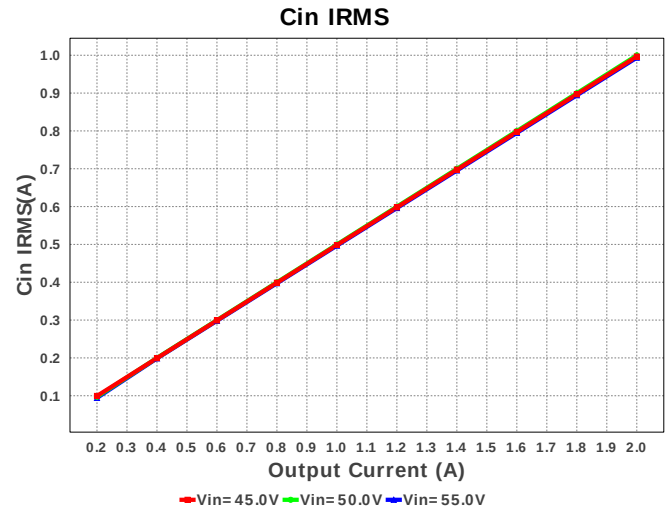
Electrical BOM

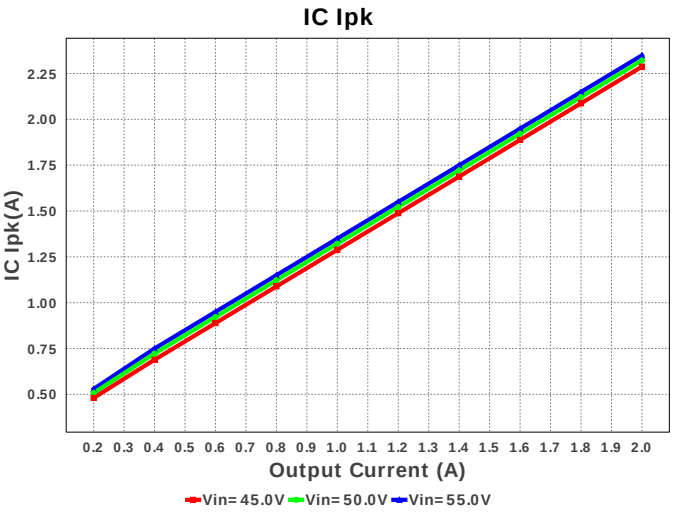
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Taiyo Yuden	HMK212B7104KG-T Series= X7R	Cap= 100.0 nF VDC= 100.0 V IRMS= 0.0 A	1	$0.03	 0805 7 mm²
2.	Cin	TDK	C3225X7R2A225K230AB Series= X7R	Cap= 2.2 uF ESR= 1.73 mOhm VDC= 100.0 V IRMS= 5.5932 A	1	$0.19	 1210_250 15 mm²
3.	Cout	Panasonic	EEHZA1H100R Series= ?	Cap= 10.0 uF ESR= 120.0 mOhm VDC= 50.0 V IRMS= 750.0 mA	1	$0.46	 SM_RADIAL_5MM 58 mm²
4.	D1	Micro Commercial Components	SK310A-TP	VF@Io= 850.0 mV VRRM= 100.0 V	1	$0.10	 SMA 37 mm²
5.	L1	Bourns	SDR1307-330KL	L= 33.0 µH DCR= 65.0 mOhm	1	$0.35	 SDR1307 227 mm²
6.	Rfbb	Vishay-Dale	CRCW040220K0FKED Series= CRCW..e3	Res= 20.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
7.	Rfbt	Yageo America	RC0603FR-07620KL Series= ?	Res= 620.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
8.	Rt	Vishay-Dale	CRCW040241K2FKED Series= CRCW..e3	Res= 41.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	U1	Texas Instruments	LMR16020PDDAR	Switcher	1	$1.82	DDA0008E_N 57 mm²

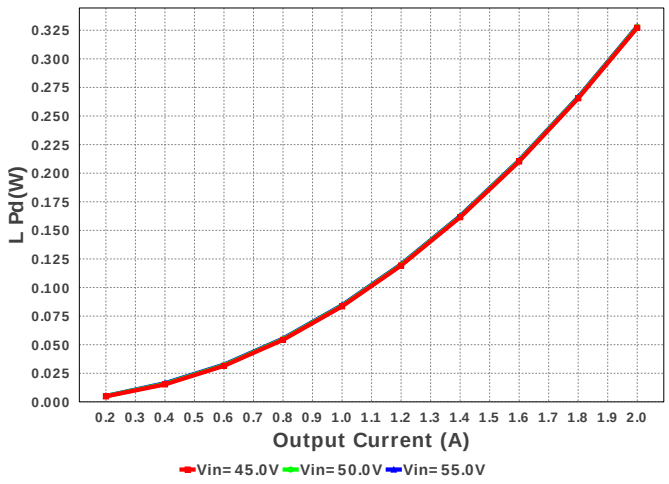




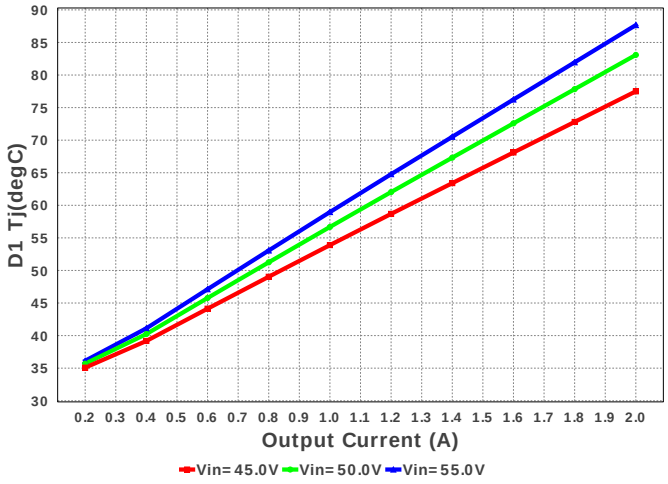




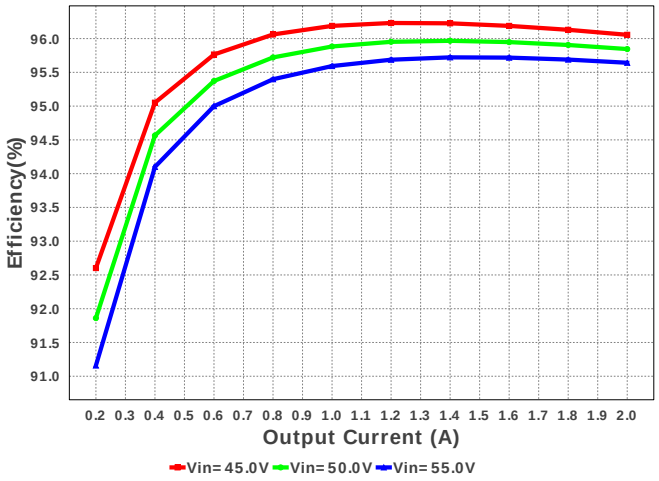
L Pd



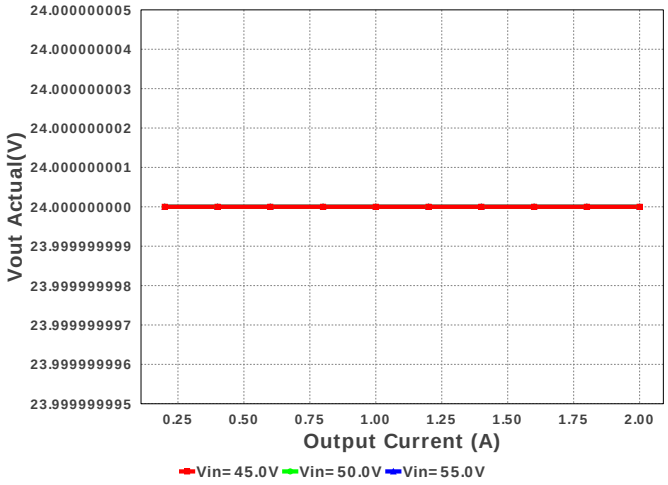
D1 Tj



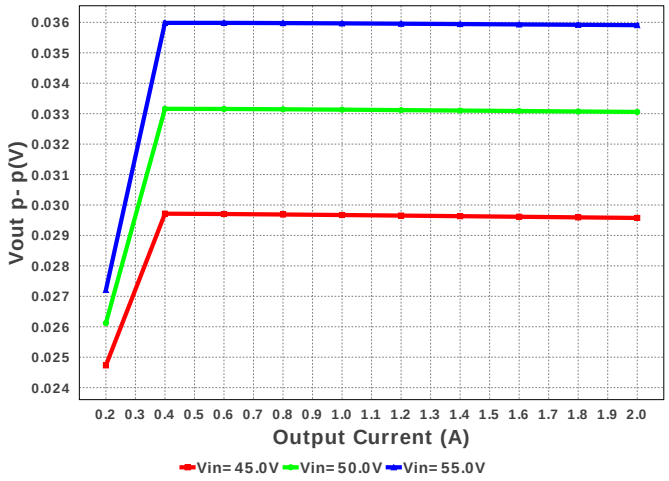
Efficiency



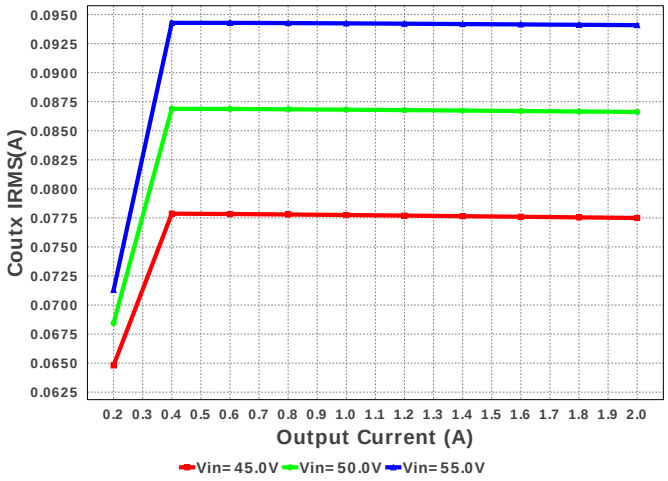
Vout Actual

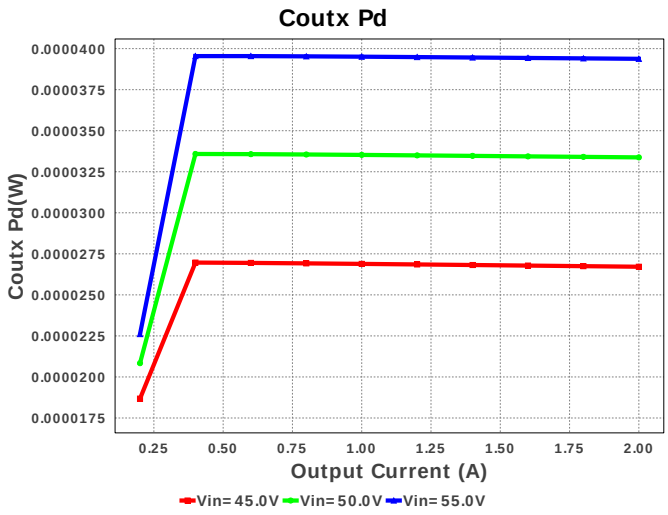


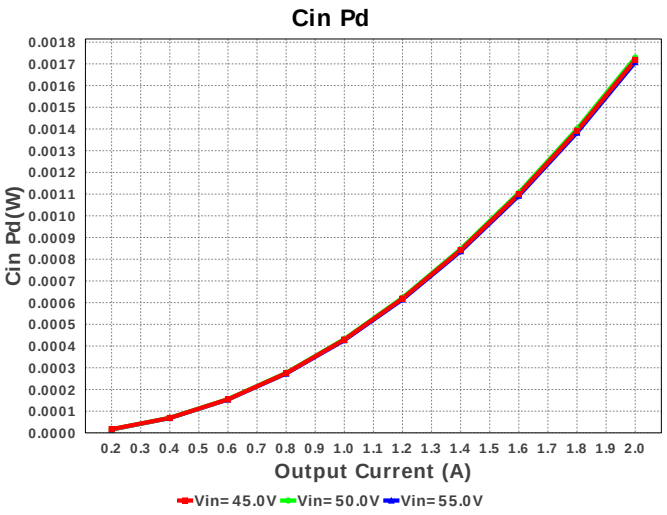
Vout p- p

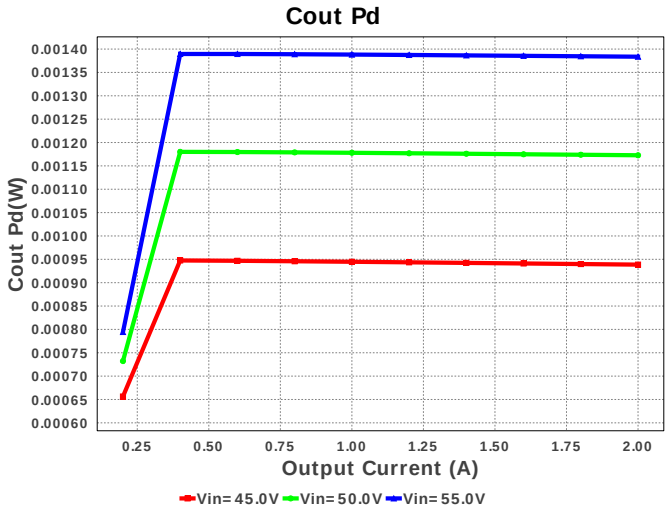


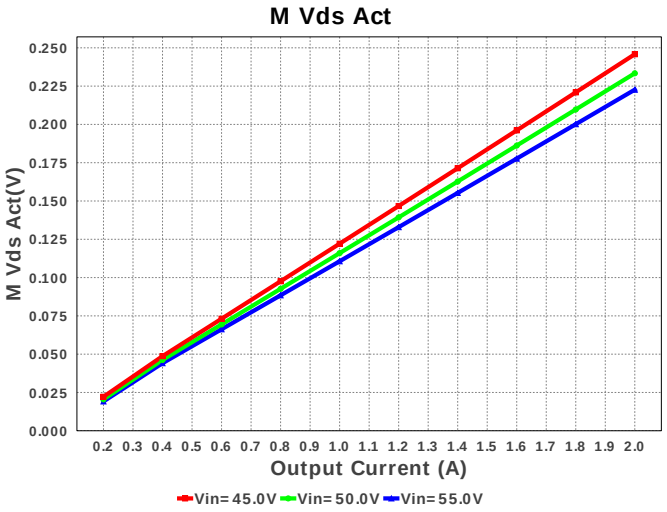
Coutx IRMS

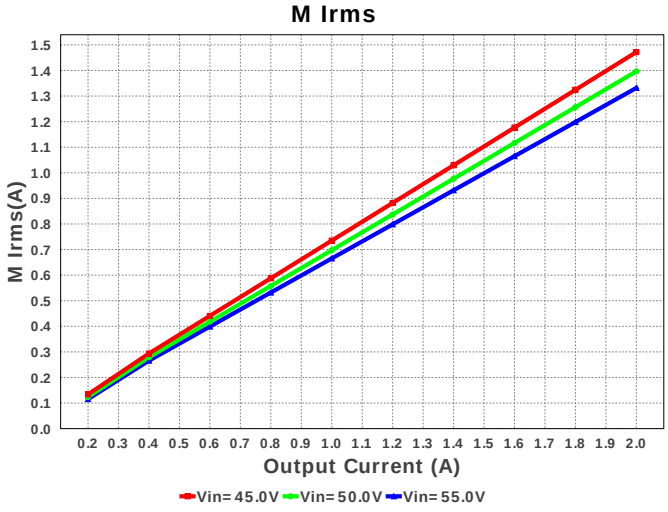


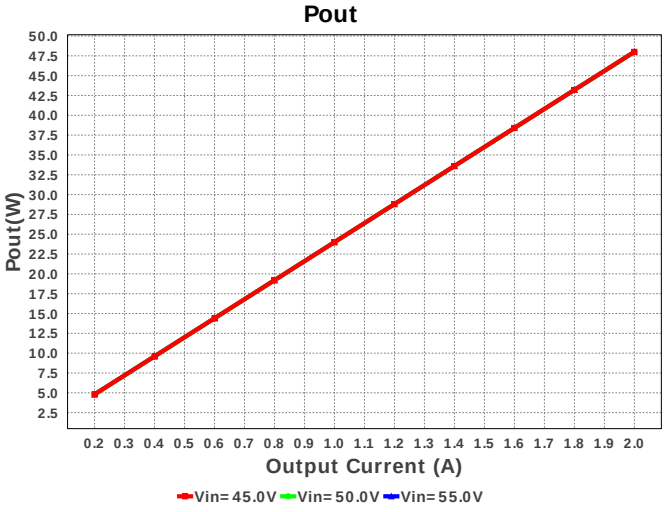


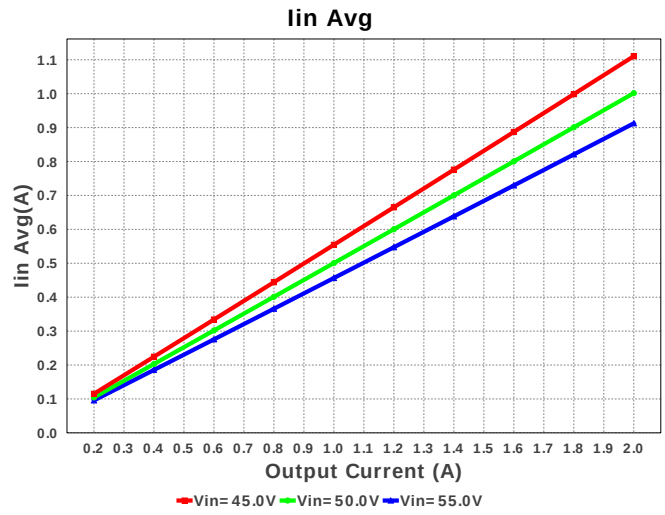


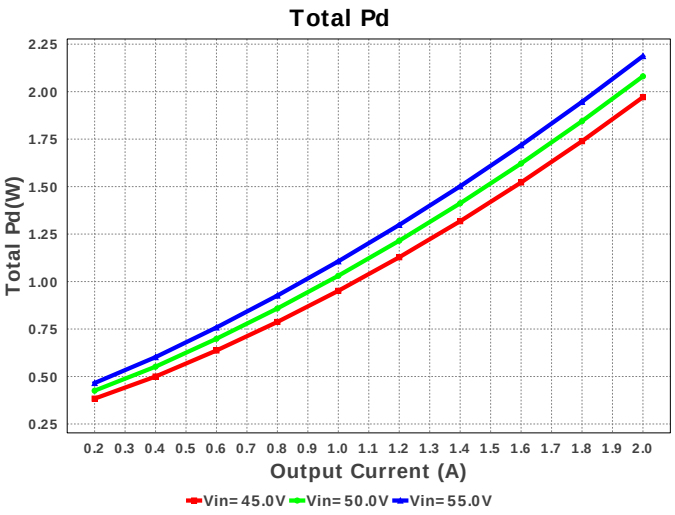


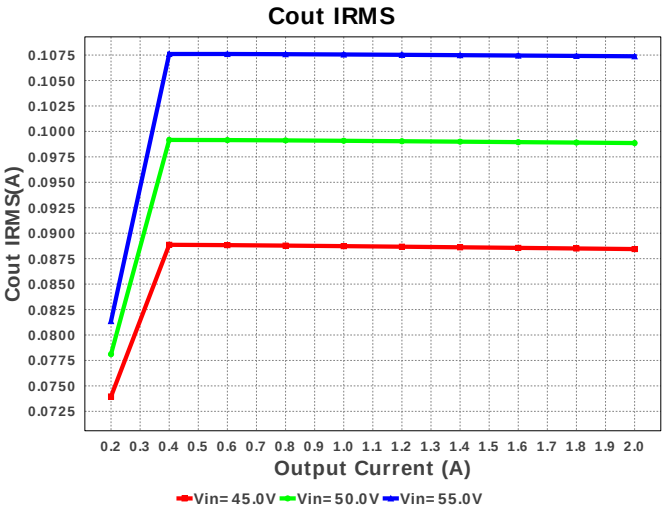


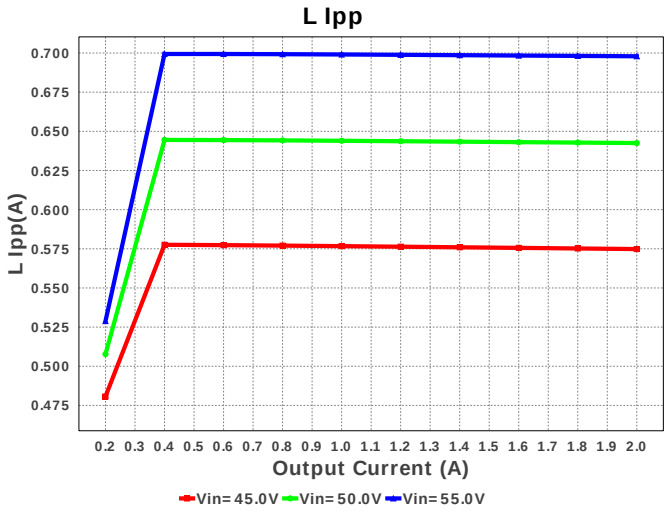


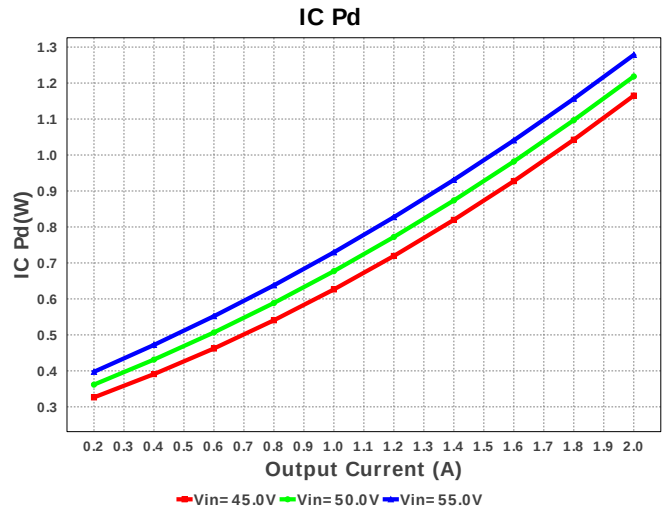


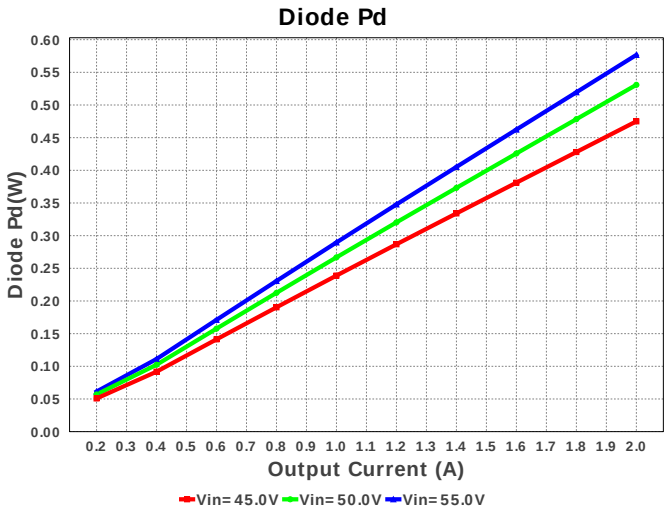


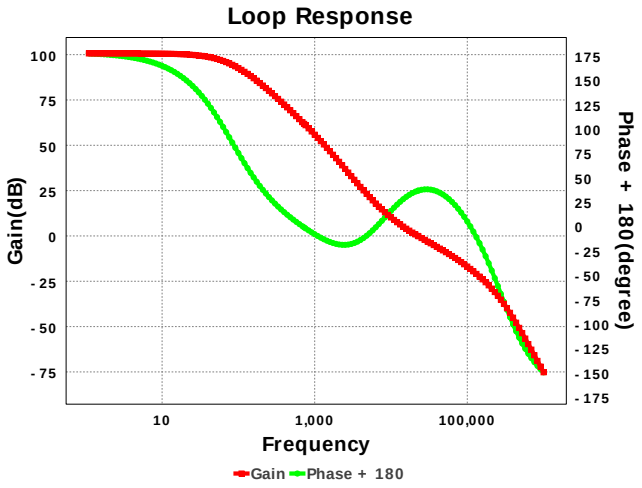












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	993.591 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	201.472 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	2.349 A	Current	Peak switch current in IC
4.	Iin Avg	912.58 mA	Current	Average input current
5.	L Ipp	697.92 mA	Current	Peak-to-peak inductor ripple current
6.	M Irms	1.332 A	Current	MOSFET RMS current
7.	BOM Count	10	General	Total Design BOM count
8.	FootPrint	423.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	592.527 kHz	General	Switching frequency
10.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	222.638 mV	General	Voltage drop across the MosFET
12.	Pout	48.0 W	General	Total output power
13.	Total BOM	$3.03	General	Total BOM Cost
14.	D1 Tj	87.666 degC	Op_Point	D1 junction temperature
15.	Vout Actual	24.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
17.	Cross Freq	24.349 kHz	Op_point	Bode plot crossover frequency
18.	Duty Cycle	44.34 %	Op_point	Duty cycle
19.	Efficiency	95.635 %	Op_point	Steady state efficiency
20.	IC Tj	83.689 degC	Op_point	IC junction temperature
21.	ICThetaJA	42.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	2.0 A	Op_point	Iout operating point
23.	Phase Marg	36.056 deg	Op_point	Bode Plot Phase Margin
24.	VIN_OP	55.0 V	Op_point	Vin operating point
25.	Vout p-p	85.035 mV	Op_point	Peak-to-peak output ripple voltage
26.	Cin Pd	1.708 mW	Power	Input capacitor power dissipation
27.	Cout Pd	4.871 mW	Power	Output capacitor power dissipation
28.	Diode Pd	576.656 mW	Power	Diode power dissipation
29.	IC Pd	1.278 W	Power	IC power dissipation
30.	L Pd	328.31 mW	Power	Inductor power dissipation
31.	Total Pd	2.191 W	Power	Total Power Dissipation
32.	Vout Tolerance	4.404 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	55.0	Maximum input voltage
3.	VinMin	45.0	Minimum input voltage
4.	Vout	24.0	Output Voltage
5.	base_pn	LMR16020P	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. LMR16020P Product Folder : http://www.ti.com/product/LMR16020 : contains the data sheet and other resources.