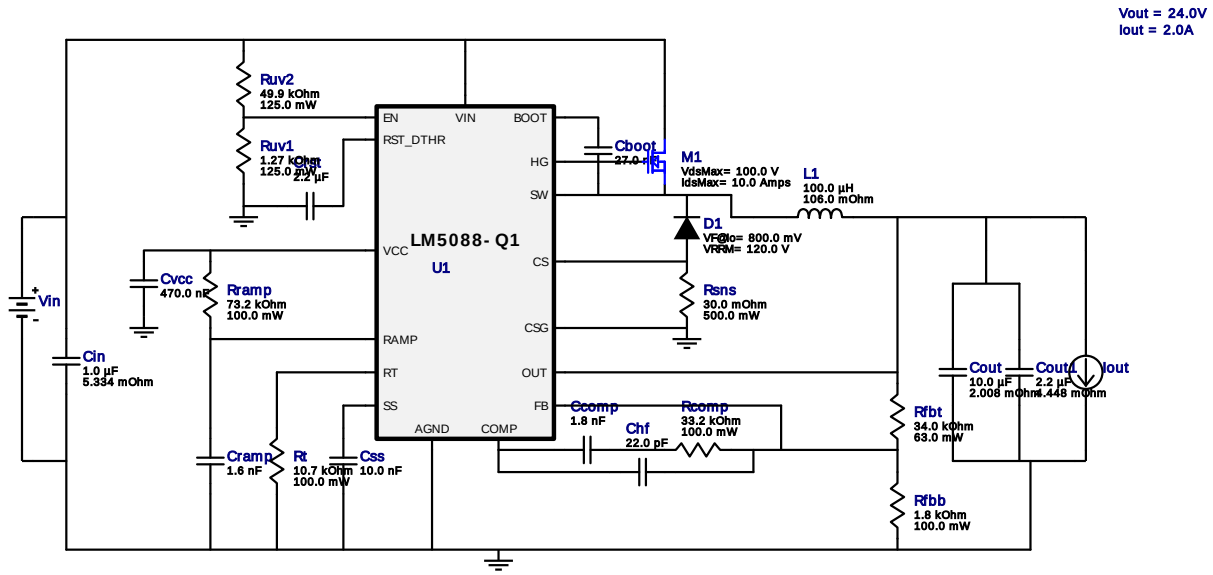
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 60.0V
VinMax = 72.0V
Vout = 24.0V
Iout = 2.0A

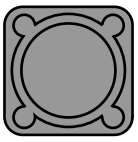
Device = LM5088QMHX-2/NOPB
Topology = Buck
Created = 5/29/16 10:20:11 PM
BOM Cost = $4.19
BOM Count = 22
Total Pd = 2.39W

Design : 4058737/160 LM5088QMHX-2/NOPB
LM5088QMHX-2/NOPB 60.0V-72.0V to 24.00V @ 2.0A

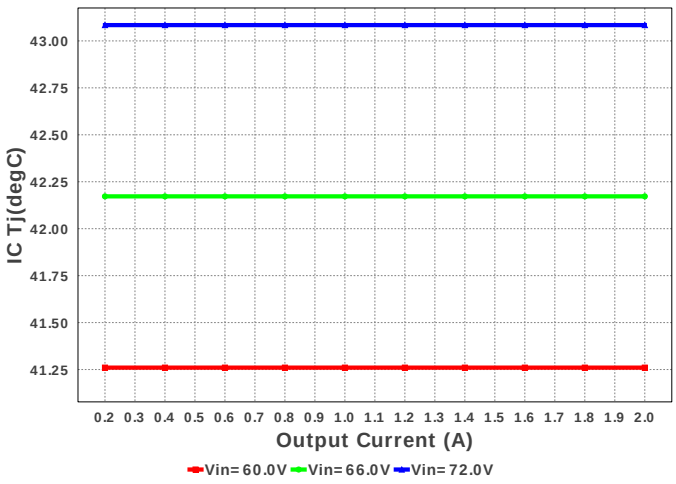


Electrical BOM

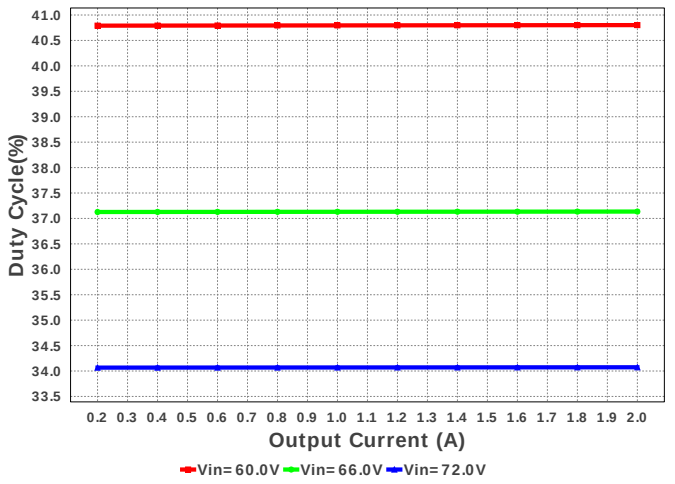
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM188R71C273KA01D Series= X7R	Cap= 27.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0603 5 mm²
2.	Ccomp	MuRata	GRM1885C1H182JA01J Series= C0G/NP0	Cap= 1.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
3.	Chf	Kemet	C0603C220K3GACTU Series= C0G/NP0	Cap= 22.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
4.	Cin	MuRata	GRM31CR72A105KA01L Series= X7R	Cap= 1.0 uF ESR= 5.334 mOhm VDC= 100.0 V IRMS= 1.55432 A	1	$0.11	1206_190 11 mm²
5.	Cout	MuRata	GRM32ER7YA106KA12L Series= X7R	Cap= 10.0 uF ESR= 2.008 mOhm VDC= 35.0 V IRMS= 4.6772 A	1	$0.22	1210_280 15 mm²
6.	Cout1	MuRata	GRM31CR71H225KA88L Series= X7R	Cap= 2.2 uF ESR= 4.448 mOhm VDC= 50.0 V IRMS= 2.2252 A	1	$0.05	1206_190 11 mm²
7.	Cramp	MuRata	GRM1885C1H162JA01D Series= C0G/NP0	Cap= 1.6 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
8.	Crst	Kemet	C0603C225K9PACTU Series= X5R	Cap= 2.2 uF VDC= 6.3 V IRMS= 0.0 A	1	$0.02	0603 5 mm²
9.	Css	Kemet	C0603C103J5RACTU Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvcc	Kemet	C0603C474K4RACTU Series= X7R	Cap= 470.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0603 5 mm²
11.	D1	Vishay-Semiconductor	V12P12-M3/86A	VF@Io= 800.0 mV VRRM= 120.0 V	1	$0.40	 TO-277A 56 mm²
12.	L1	Coilcraft	MSS1210-104KEB	L= 100.0 µH DCR= 106.0 mOhm	1	$0.81	 MSS1210 204 mm²
13.	M1	Texas Instruments	CSD19534Q5A	VdsMax= 100.0 V IdsMax= 10.0 Amps	1	$0.68	 TRANS_NexFET_Q5A 55 mm²
14.	Rcomp	Vishay-Dale	CRCW060333K2FKEA Series= CRCW..e3	Res= 33.2 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
15.	Rfbb	Yageo America	RC0603FR-071K8L Series= ?	Res= 1.8 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
16.	Rfbt	Vishay-Dale	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
17.	Rramp	Vishay-Dale	CRCW060373K2FKEA Series= CRCW..e3	Res= 73.2 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
18.	Rsns	Stackpole Electronics Inc	CSR1206FK30L0 Series= ?	Res= 30.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	 1206 11 mm²
19.	Rt	Vishay-Dale	CRCW060310K7FKEA Series= CRCW..e3	Res= 10.7 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
20.	Ruv1	Panasonic	ERJ-6ENF1271V Series= ERJ-6E	Res= 1.27 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
21.	Ruv2	Panasonic	ERJ-6ENF4992V Series= ERJ-6E	Res= 49.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
22.	U1	Texas Instruments	LM5088QMHX-2/NOPB	Switcher	1	$1.65	 MXA16A 59 mm²

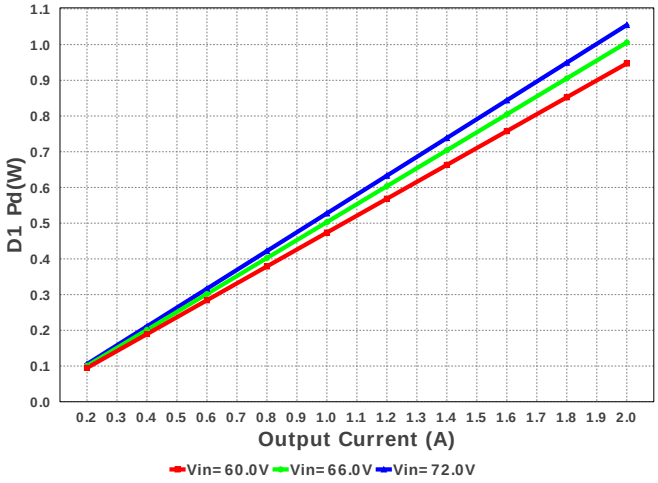
IC Tj



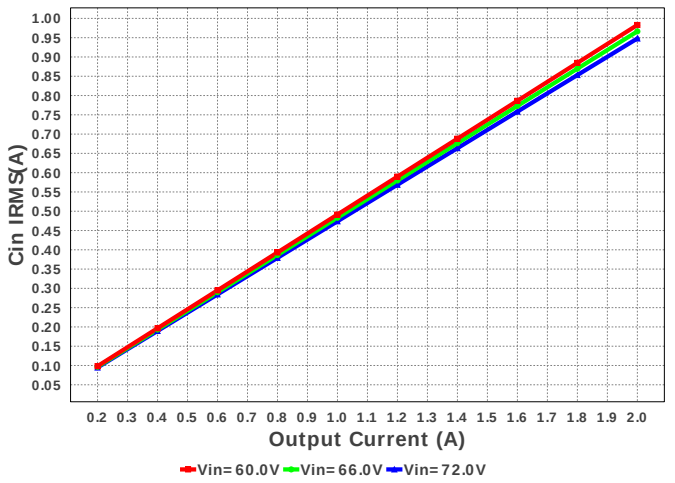
Duty Cycle



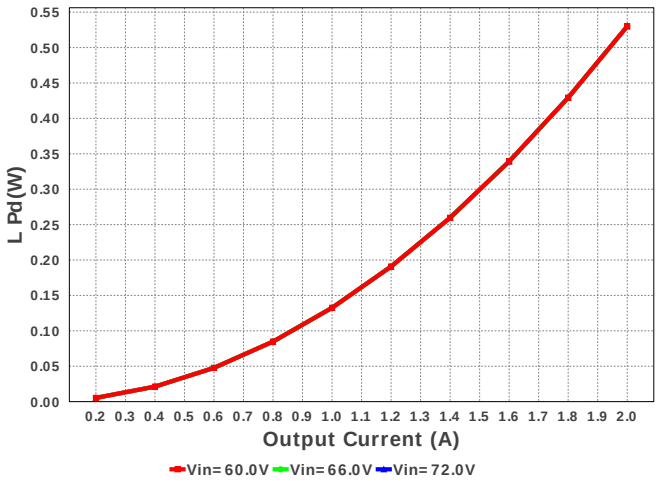
D1 Pd



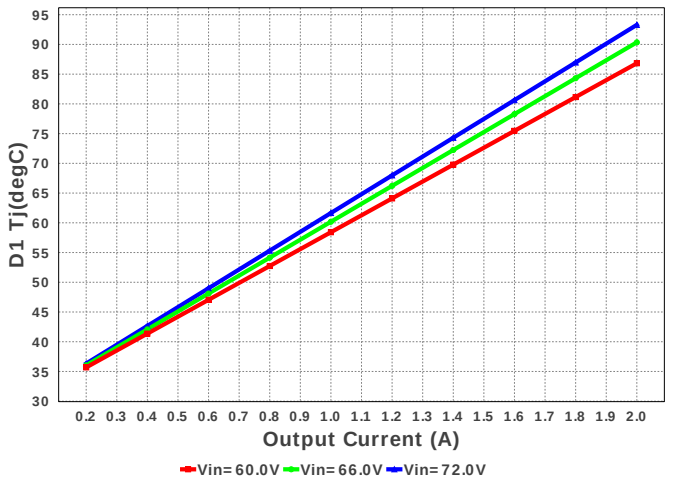
Cin IRMS



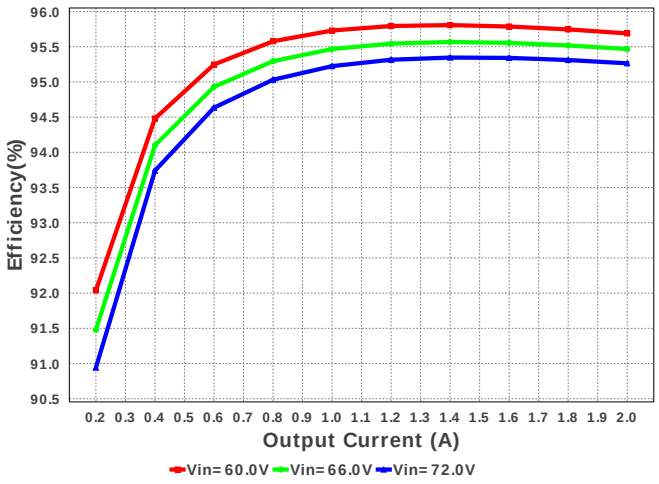
L Pd



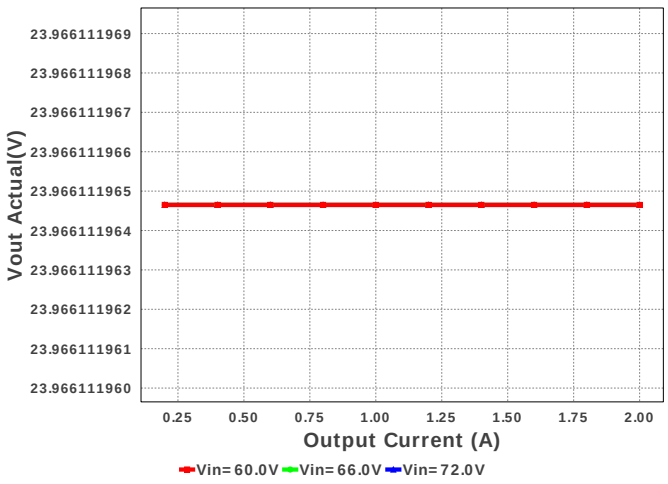
D1 Tj



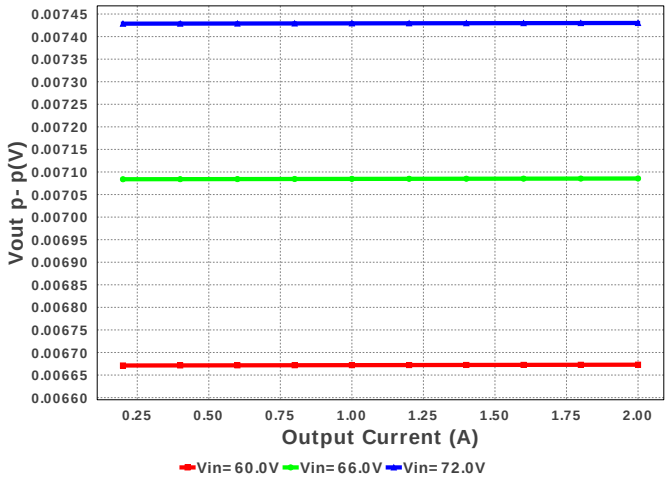
Efficiency



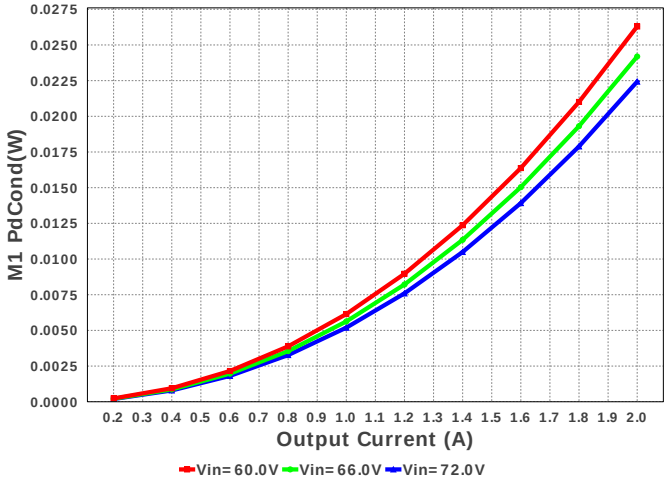
Vout Actual



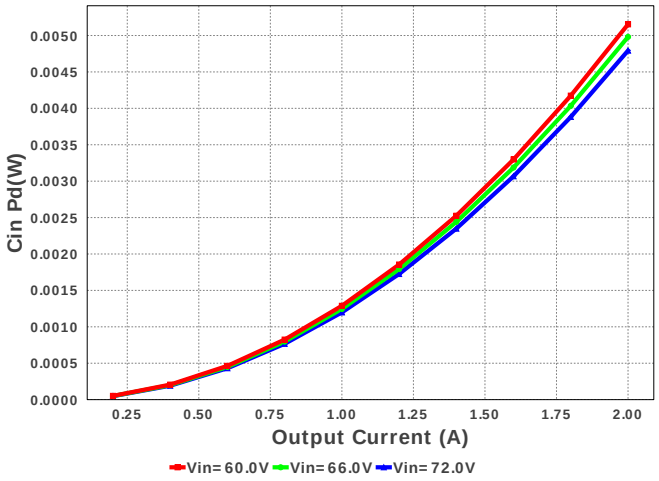
Vout p- p



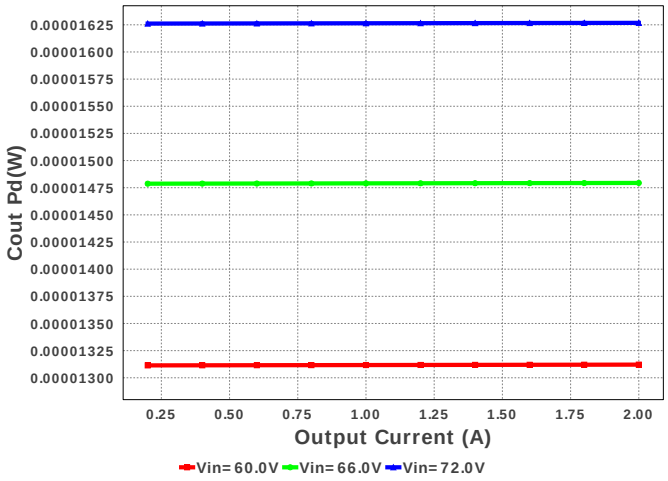
M1 PdCond

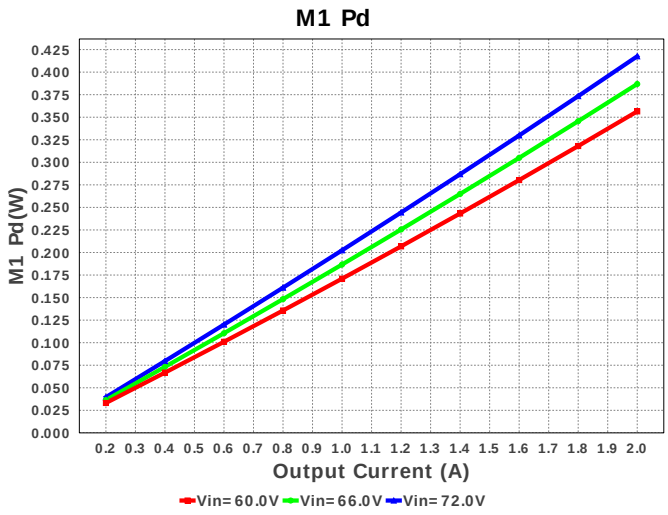


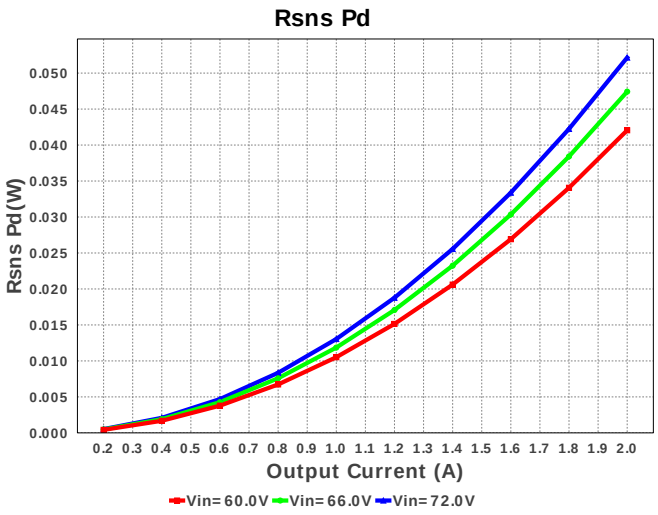
Cin Pd

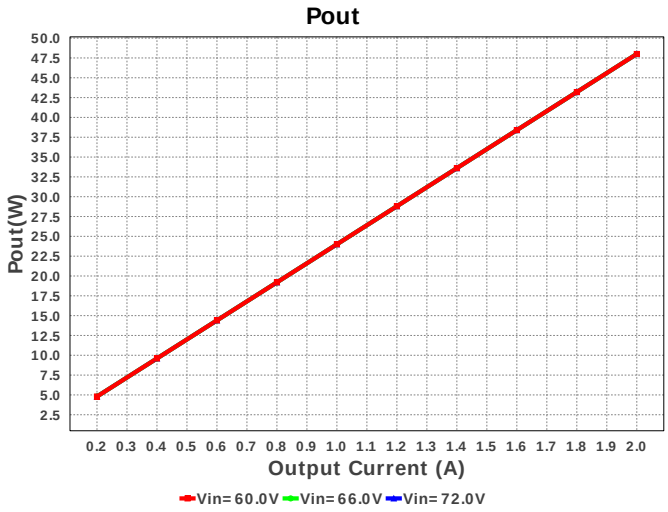


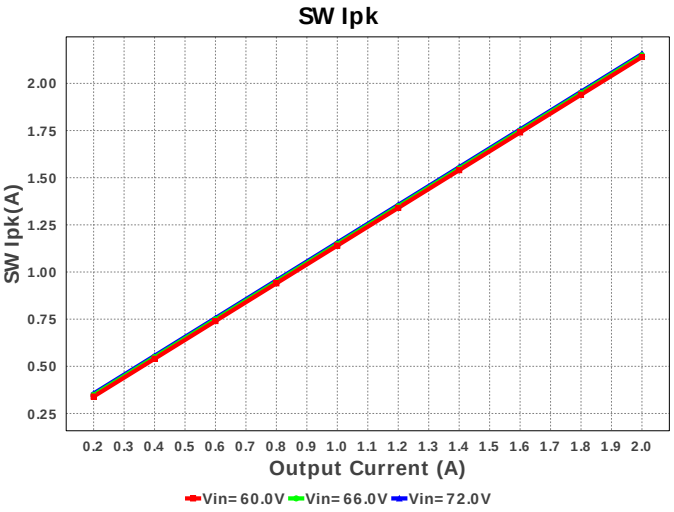
Cout Pd

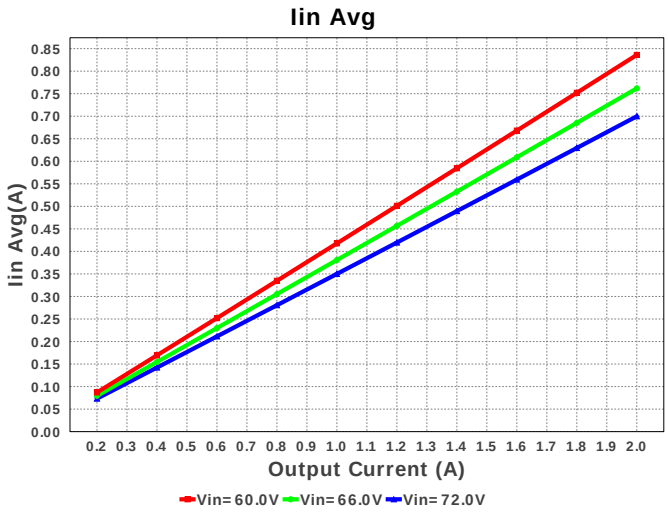


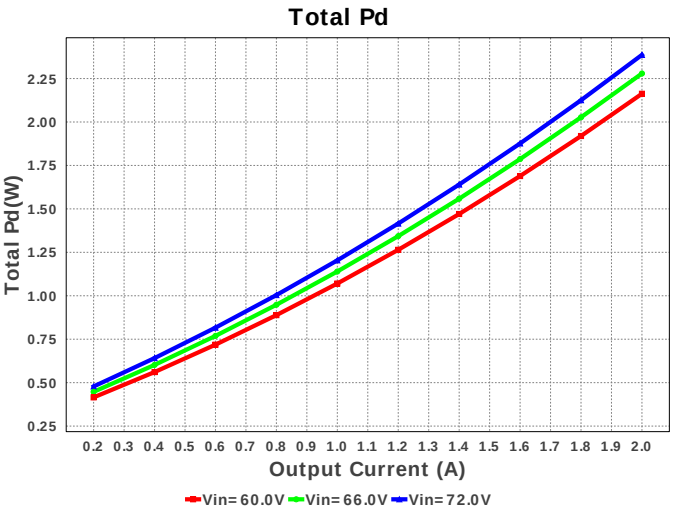


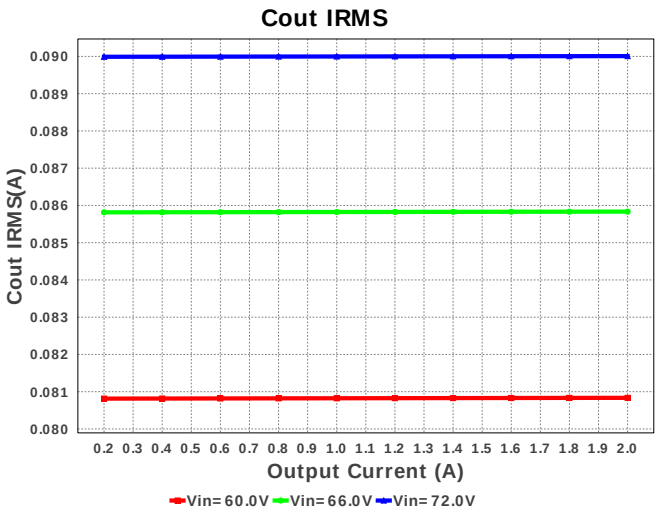


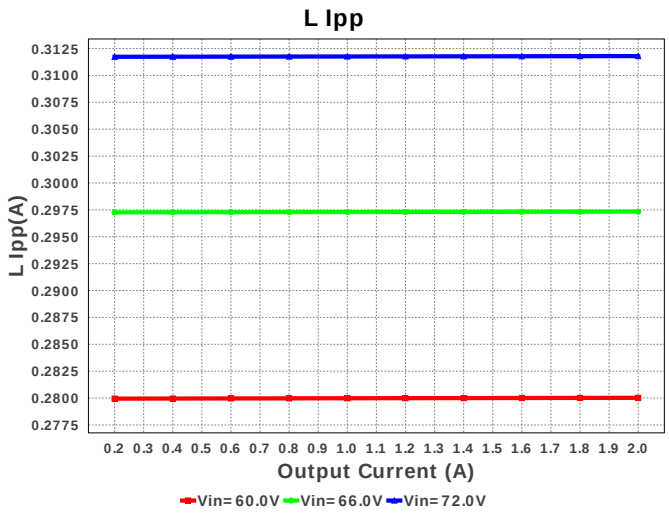


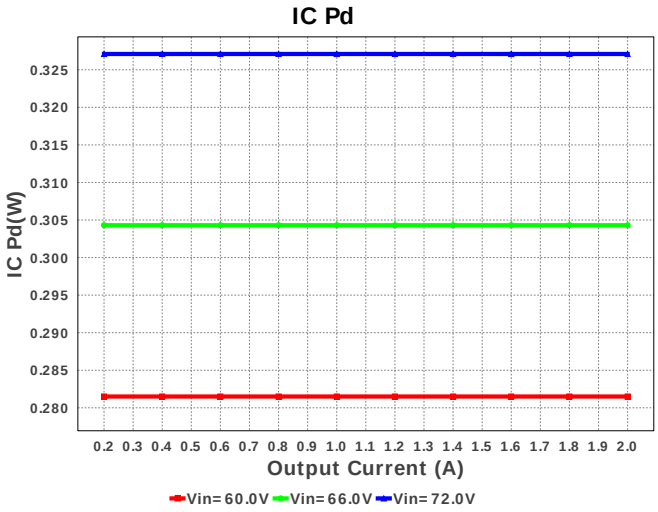


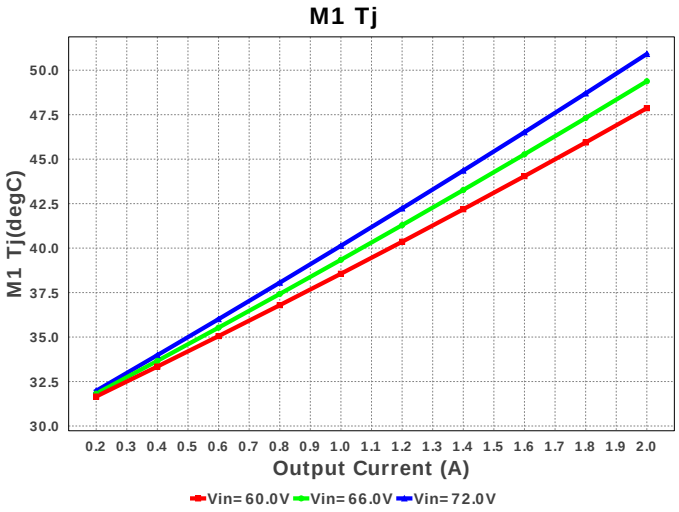


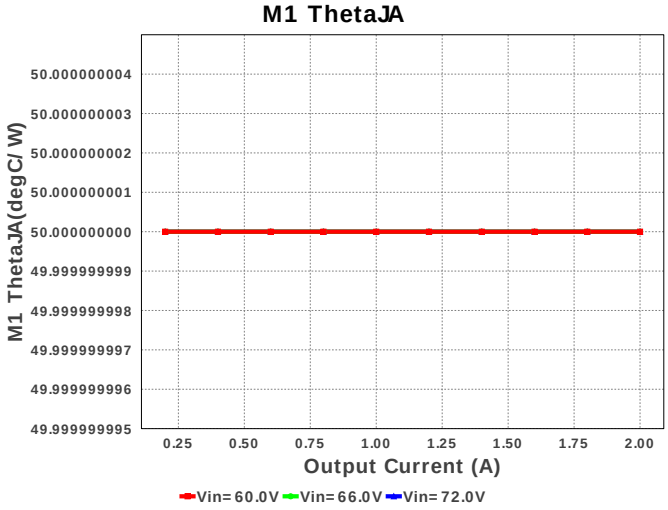


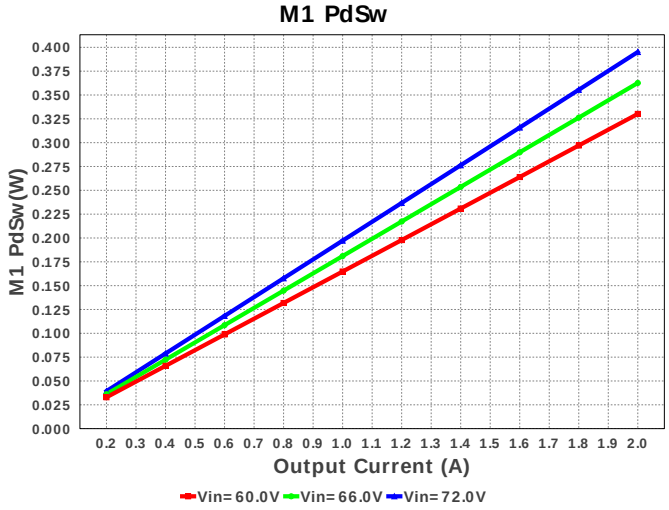


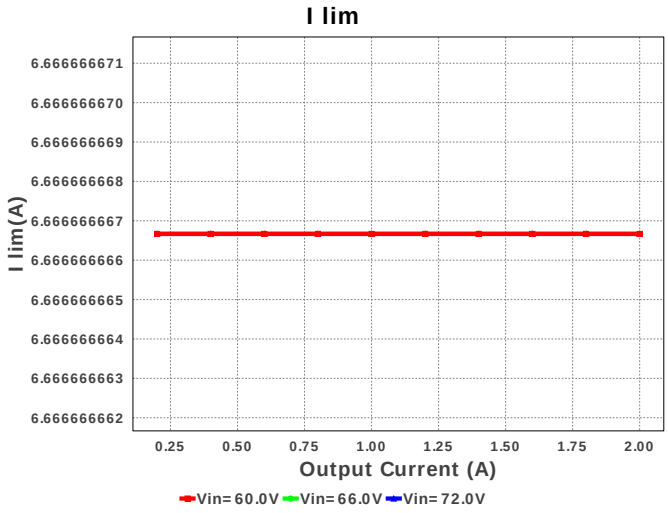












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	947.914 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	89.931 mA	Current	Output capacitor RMS ripple current
3.	I lim	6.667 A	Current	Current limit threshold
4.	Iin Avg	699.81 mA	Current	Average input current
5.	L Ipp	311.53 mA	Current	Peak-to-peak inductor ripple current
6.	SW Ipk	2.156 A	Current	Peak switch current
7.	BOM Count	22	General	Total Design BOM count
8.	FootPrint	490.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	524.549 kHz	General	Switching frequency
10.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
11.	M1 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
12.	Pout	48.0 W	General	Total output power
13.	Total BOM	$4.19	General	Total BOM Cost
14.	D1 Tj	93.289 degC	Op_Point	D1 junction temperature
15.	Vout Actual	23.966 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Duty Cycle	34.074 %	Op_point	Duty cycle
17.	Efficiency	95.264 %	Op_point	Steady state efficiency
18.	IC Tj	43.084 degC	Op_point	IC junction temperature
19.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	2.0 A	Op_point	Iout operating point
21.	M1 Tj	50.912 degC	Op_point	M1 MOSFET junction temperature
22.	VIN_OP	72.0 V	Op_point	Vin operating point
23.	Vout p-p	7.424 mV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	4.793 mW	Power	Input capacitor power dissipation
25.	Cout Pd	16.24 µW	Power	Output capacitor power dissipation
26.	D1 Pd	1.055 W	Power	Diode1 power dissipation
27.	IC Pd	327.104 mW	Power	IC power dissipation
28.	L Pd	530.0 mW	Power	Inductor power dissipation
29.	M1 Pd	417.537 mW	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	22.433 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	395.104 mW	Power	M1 MOSFET switching losses
32.	Rsns Pd	52.155 mW	Power	Current Limit Sense Resistor Power Dissipation
33.	Total Pd	2.386 W	Power	Total Power Dissipation
34.	Vout Tolerance	3.441 %		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	72.0	Maximum input voltage
3.	VinMin	60.0	Minimum input voltage
4.	Vout	24.0	Output Voltage
5.	base_pn	LM5088-Q1	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. LM5088-Q1 Product Folder : http://www.ti.com/product/LM5088%2DQ1 : contains the data sheet and other resources.