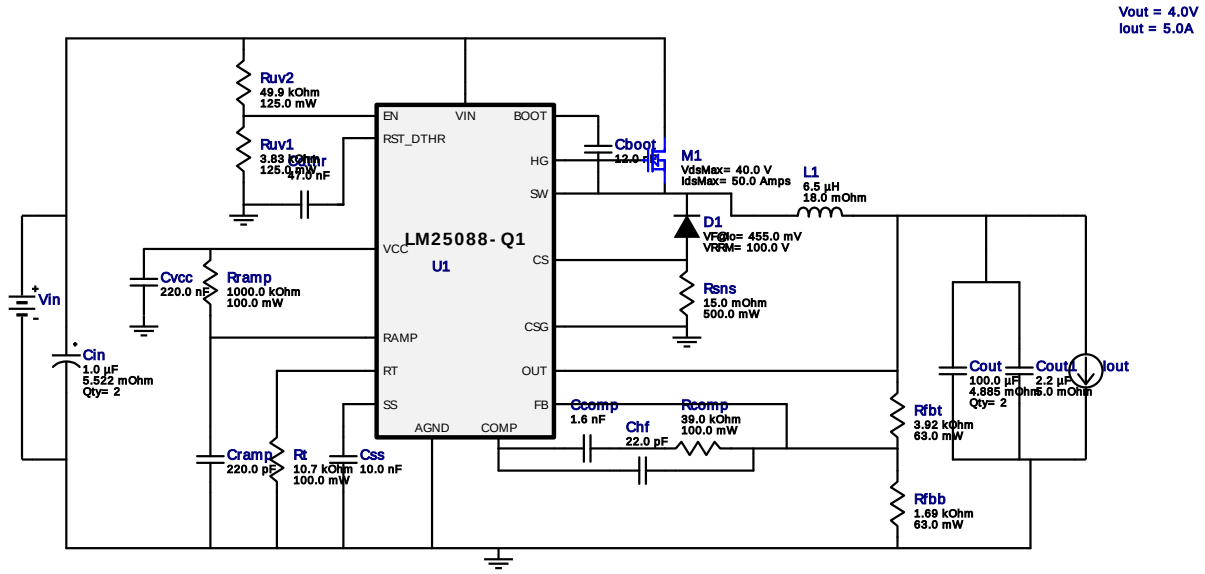
WEBENCH® Design Report

VinMin = 21.0V
VinMax = 25.0V
Vout = 4.0V
Iout = 5.0A

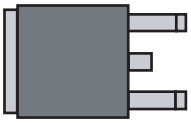
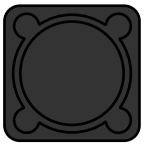
Device = LM25088QMHX-1/NOPB
Topology = Buck
Created = 8/9/16 2:16:51 AM
BOM Cost = $4.18
BOM Count = 24
Total Pd = 3.15W

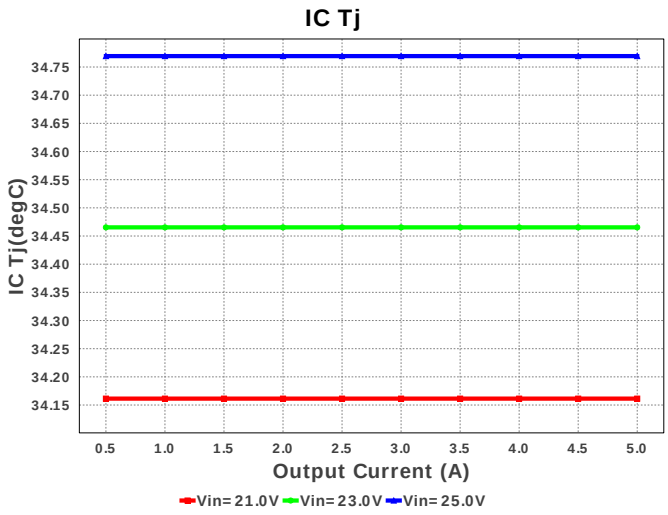
Design : 4763576/2 LM25088QMHX-1/NOPB
LM25088QMHX-1/NOPB 21.0V-25.0V to 4.00V @ 5.0A

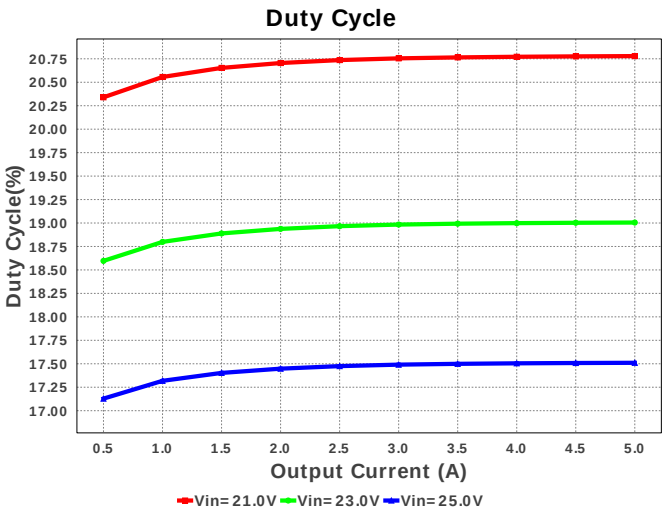


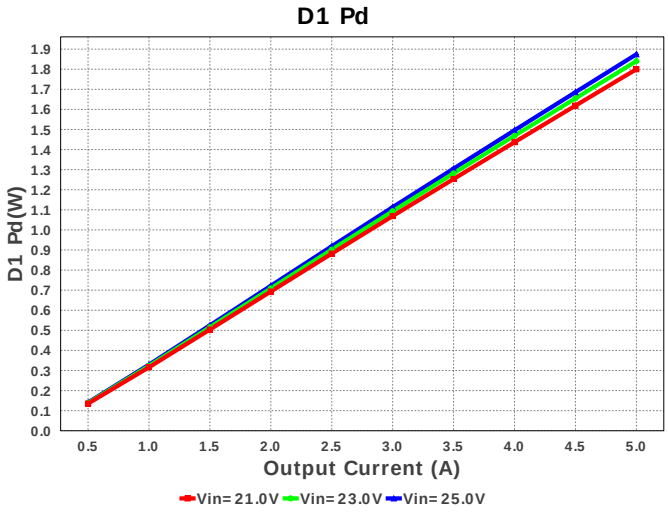
Electrical BOM

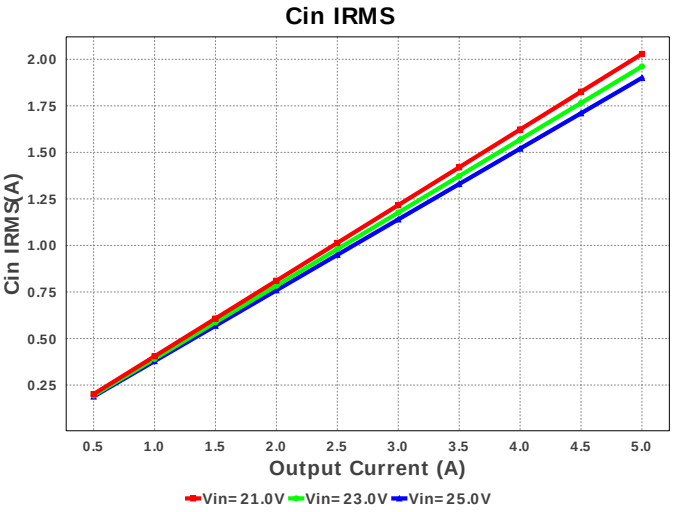
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM188R71E123KA01D Series= X7R	Cap= 12.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.02	0603 5 mm²
2.	Ccomp	MuRata	GRM1885C1H162JA01D Series= C0G/NP0	Cap= 1.6 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
3.	Cdthr	MuRata	GRM188R71C473KA01D Series= X7R	Cap= 47.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
4.	Chf	Kemet	C0603C220K3GACTU Series= C0G/NP0	Cap= 22.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
5.	Cin	TDK	C1608X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 35.0 V IRMS= 2.2162 A	2	$0.05	0603 5 mm²
6.	Cout	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.885 mOhm VDC= 6.3 V IRMS= 4.4118 A	2	$0.14	1206_190 11 mm²
7.	Cout1	MuRata	GRM155R60J225ME15D Series= X5R	Cap= 2.2 uF ESR= 5.0 mOhm VDC= 6.3 V IRMS= 3.67 A	1	$0.02	0402 3 mm²
8.	Cramp	AVX	06033A220JAT2A Series= C0G/NP0	Cap= 220.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	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

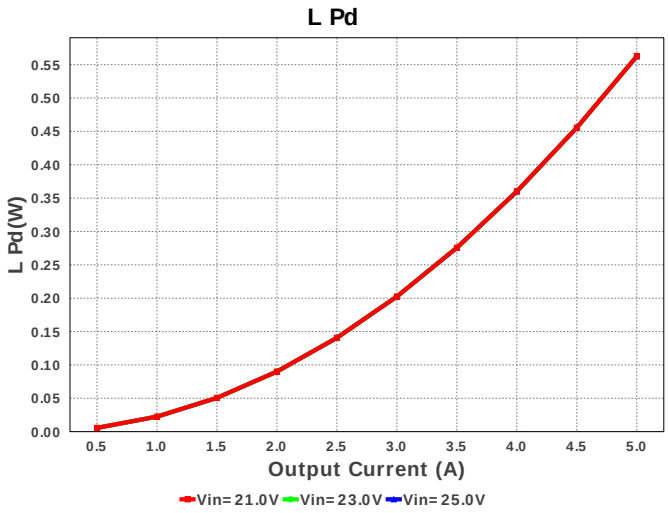
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cvcc	Kemet	C0603C224Z4VACTU Series= Y5V	Cap= 220.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	 0603 5 mm²
11.	D1	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.33	 DDPAK 210 mm²
12.	L1	Bourns	SRR1208-6R5ML	L= 6.5 µH DCR= 18.0 mOhm	1	$0.37	 SRR1208 216 mm²
13.	M1	Texas Instruments	CSD18504Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.37	 TRANS_NexFET_Q5A 55 mm²
14.	Rcomp	Yageo America	RC0603FR-0739KL Series= ?	Res= 39.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
15.	Rfbb	Vishay-Dale	CRCW04021K69FKED Series= CRCW..e3	Res= 1.69 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
16.	Rfbt	Vishay-Dale	CRCW04023K92FKED Series= CRCW..e3	Res= 3.92 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
17.	Rramp	Vishay-Dale	CRCW06031M00FKEA Series= CRCW..e3	Res= 1000.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
18.	Rsns	Stackpole Electronics Inc	CSR1206FK15L0 Series= ?	Res= 15.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	 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-6ENF3831V Series= ERJ-6E	Res= 3.83 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	LM25088QMHX-1/NOPB	Switcher	1	$1.45	 MXA16A 59 mm²

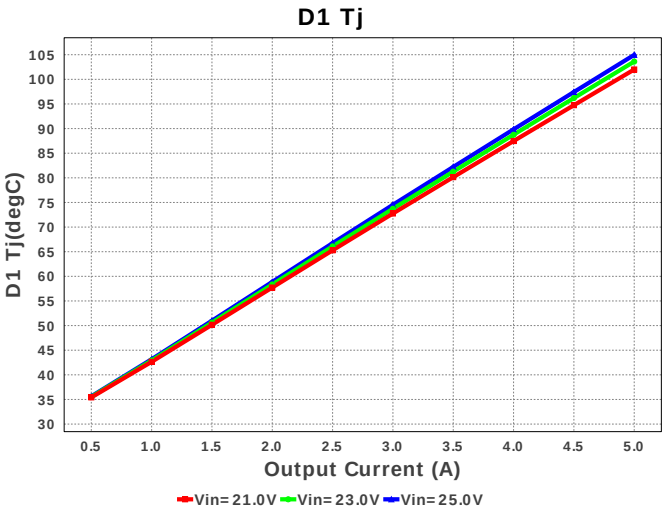




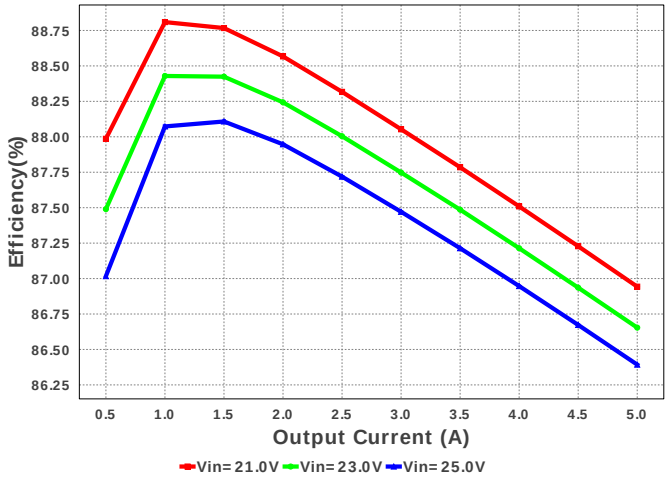




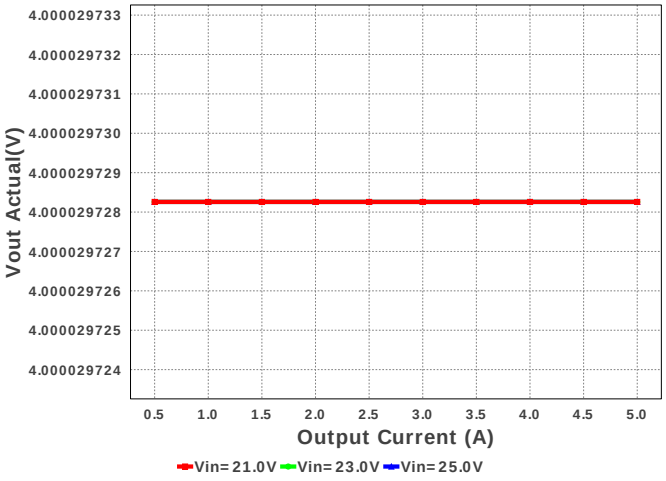




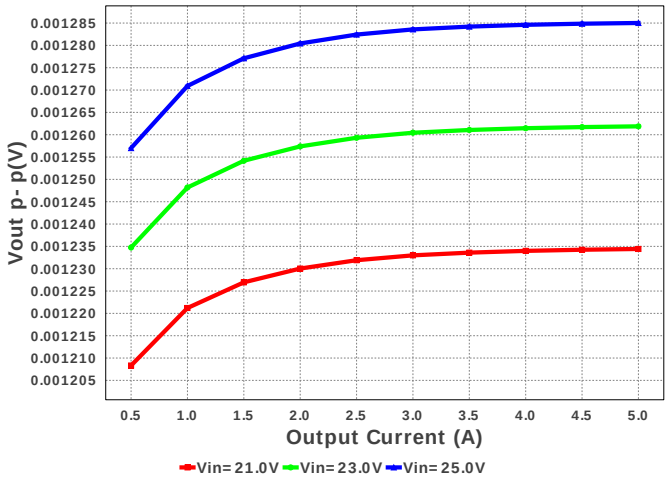
Efficiency



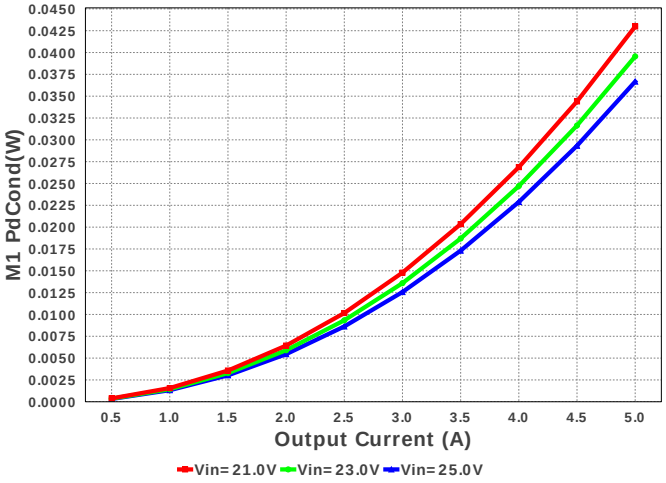
Vout Actual



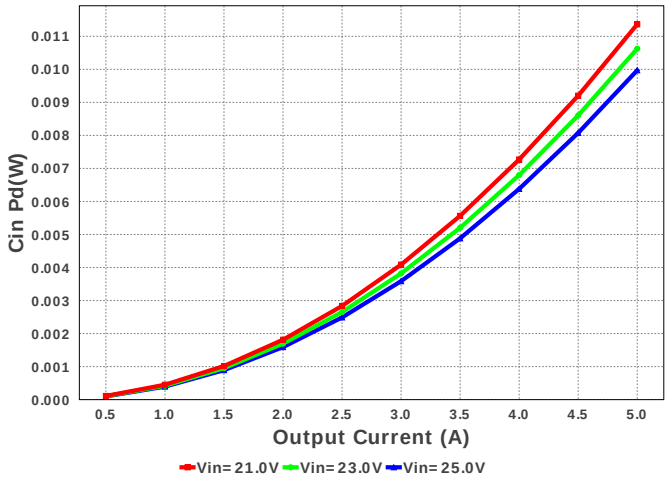
Vout p- p



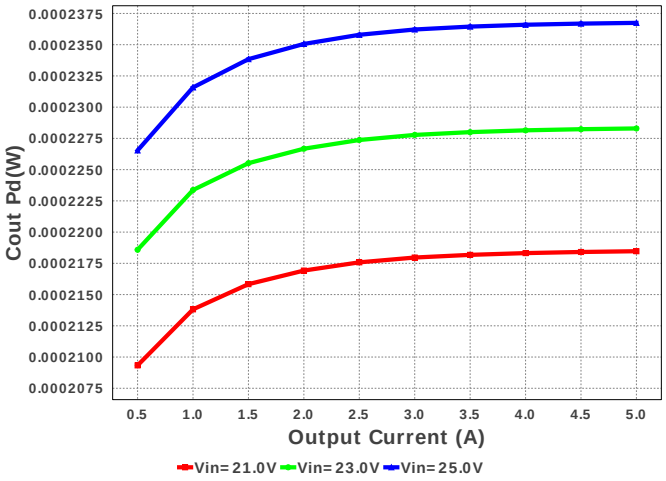
M1 PdCond

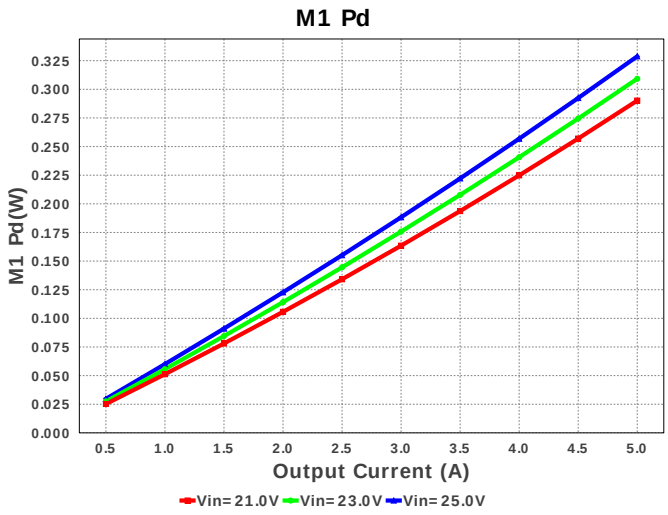


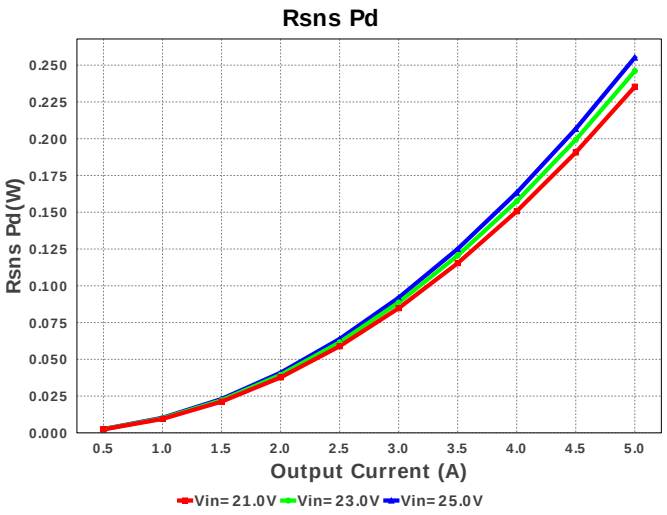
Cin Pd

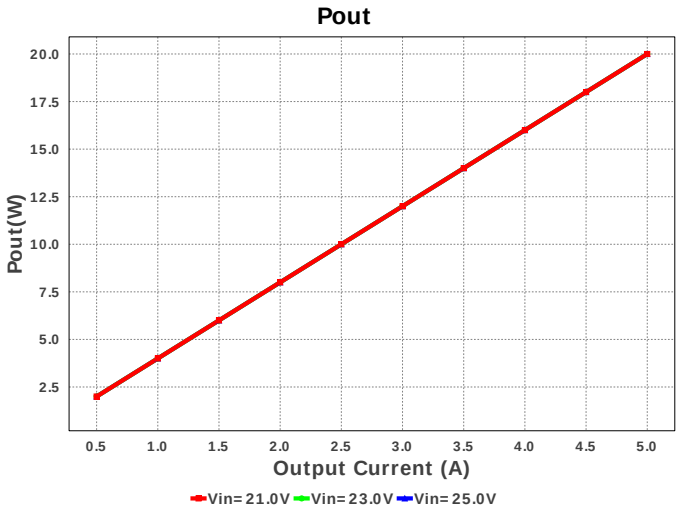


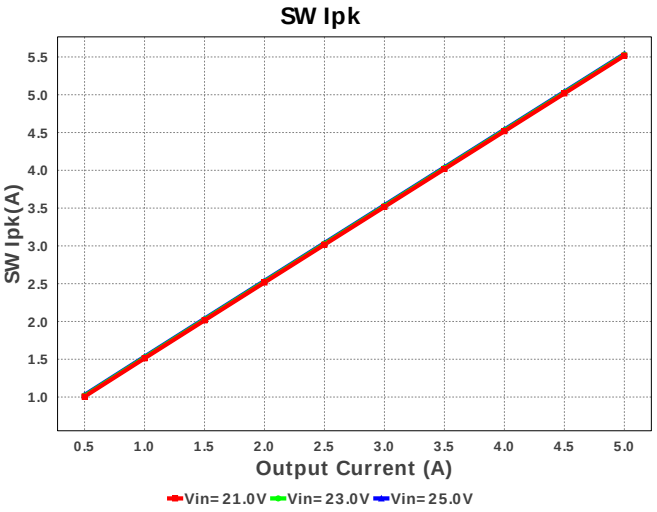
Cout Pd

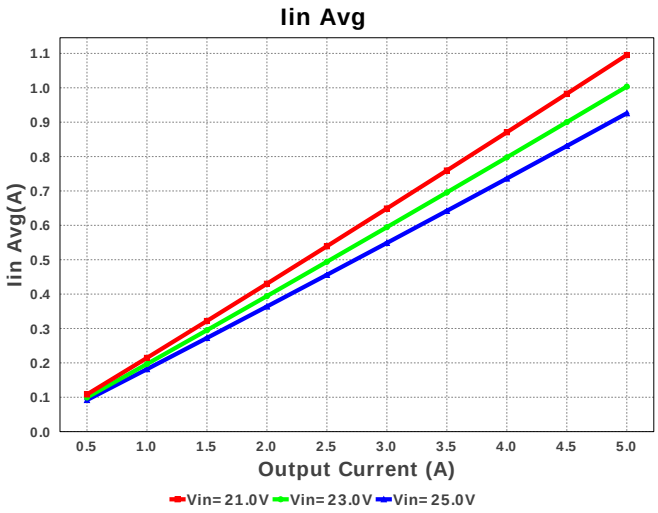


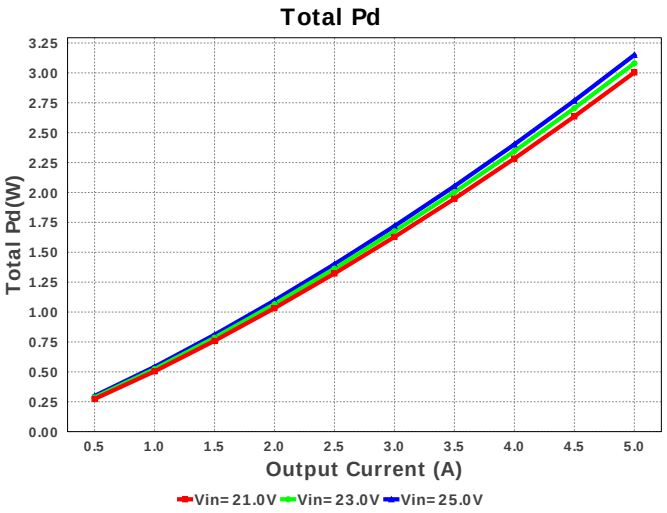


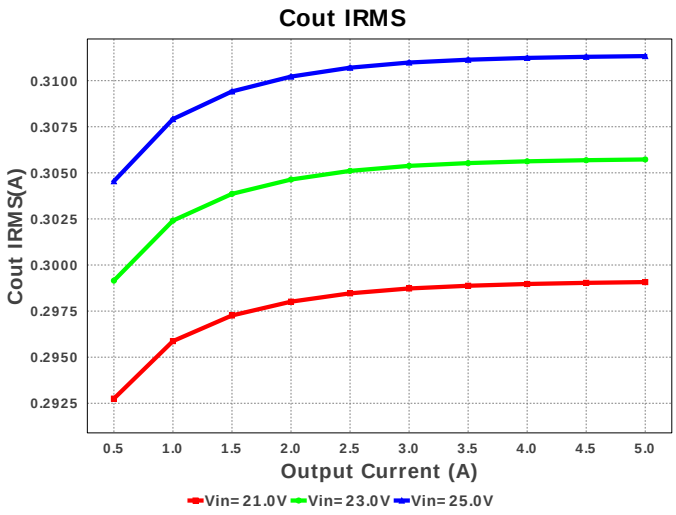


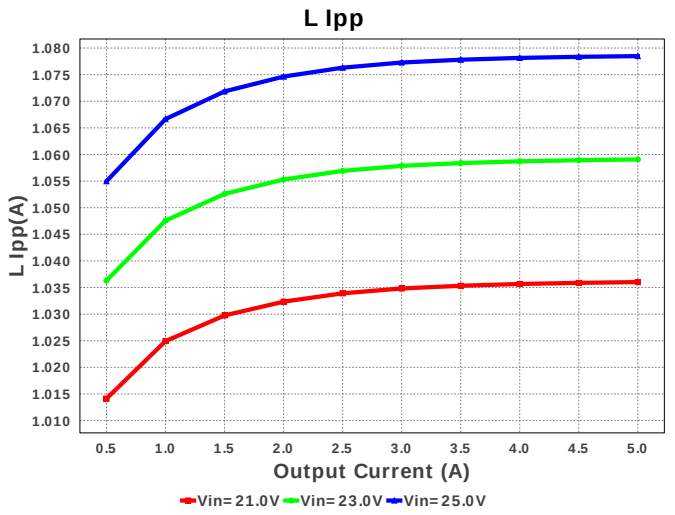


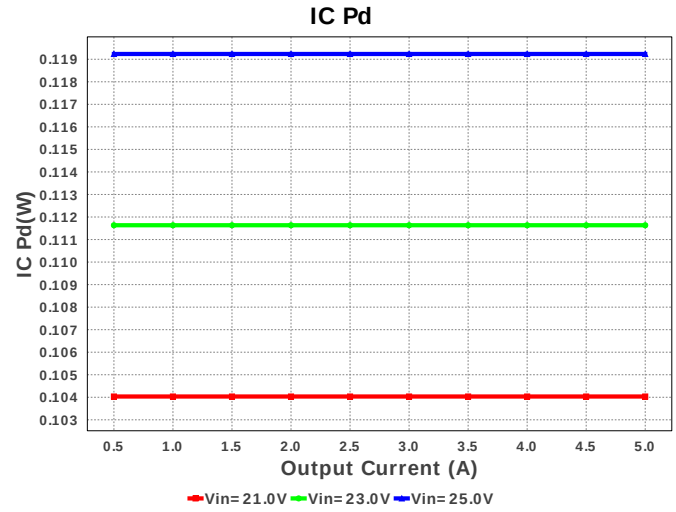


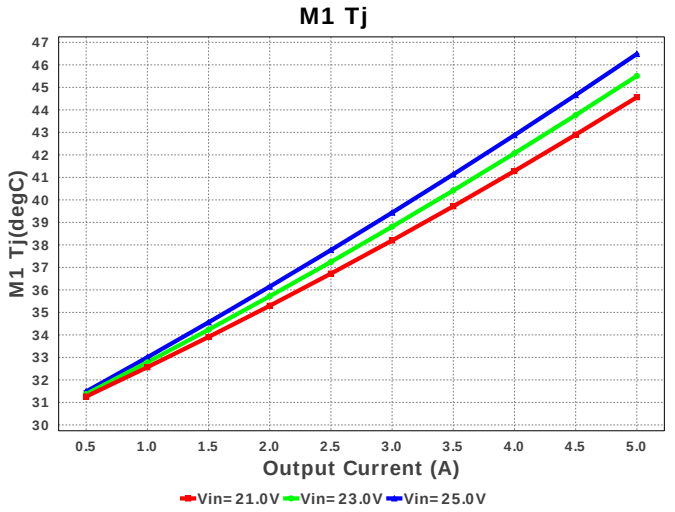


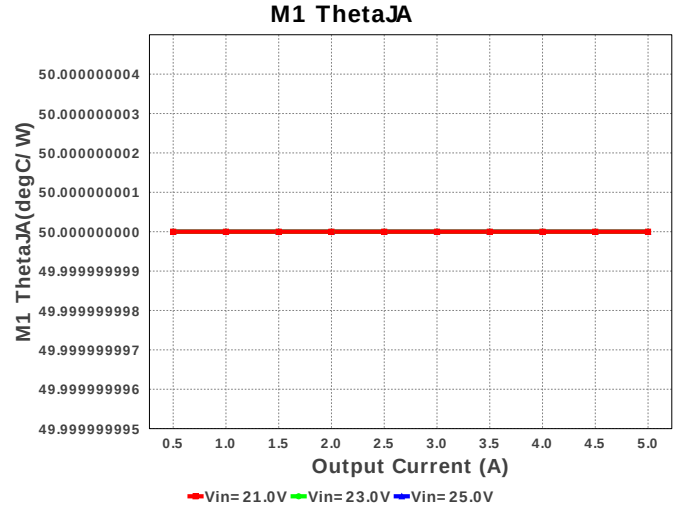


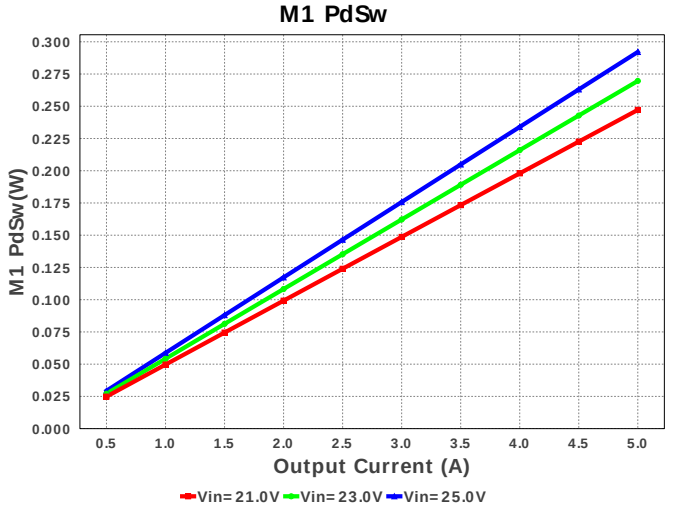


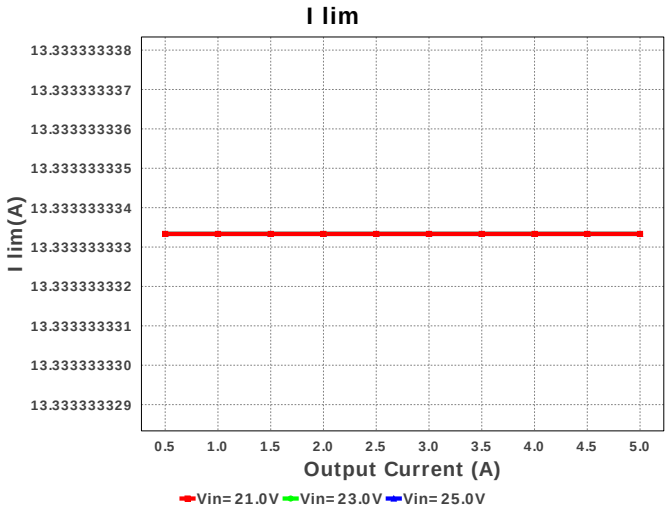












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.9 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	311.065 mA	Current	Output capacitor RMS ripple current
3.	I lim	13.333 A	Current	Current limit threshold
4.	Iin Avg	926.0 mA	Current	Average input current
5.	L Ipp	1.078 A	Current	Peak-to-peak inductor ripple current
6.	SW Ipk	5.539 A	Current	Peak switch current
7.	BOM Count	24	General	Total Design BOM count
8.	FootPrint	651.0 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	20.0 W	General	Total output power
13.	Total BOM	$4.18	General	Total BOM Cost
14.	D1 Tj	104.968 degC	Op_Point	D1 junction temperature
15.	Vout Actual	4.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Duty Cycle	17.51 %	Op_point	Duty cycle
17.	Efficiency	86.393 %	Op_point	Steady state efficiency
18.	IC Tj	34.769 degC	Op_point	IC junction temperature
19.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	5.0 A	Op_point	Iout operating point
21.	M1 Tj	46.484 degC	Op_point	M1 MOSFET junction temperature
22.	VIN_OP	25.0 V	Op_point	Vin operating point
23.	Vout p-p	1.284 mV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	9.97 mW	Power	Input capacitor power dissipation
25.	Cout Pd	236.34 µW	Power	Output capacitor power dissipation
26.	D1 Pd	1.874 W	Power	Diode1 power dissipation
27.	IC Pd	119.234 mW	Power	IC power dissipation
28.	L Pd	562.5 mW	Power	Inductor power dissipation
29.	M1 Pd	328.772 mW	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	36.672 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	292.1 mW	Power	M1 MOSFET switching losses
32.	Rsns Pd	255.17 mW	Power	Current Limit Sense Resistor Power Dissipation
33.	Total Pd	3.15 W	Power	Total Power Dissipation
34.	Vout Tolerance	2.926 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	VinMax	25.0	Maximum input voltage
3.	VinMin	21.0	Minimum input voltage
4.	Vout	4.0	Output Voltage
5.	base_pn	LM25088-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LM25088-Q1** Product Folder : http://www.ti.com/product/LM25088%2DQ1 : contains the data sheet and other resources.