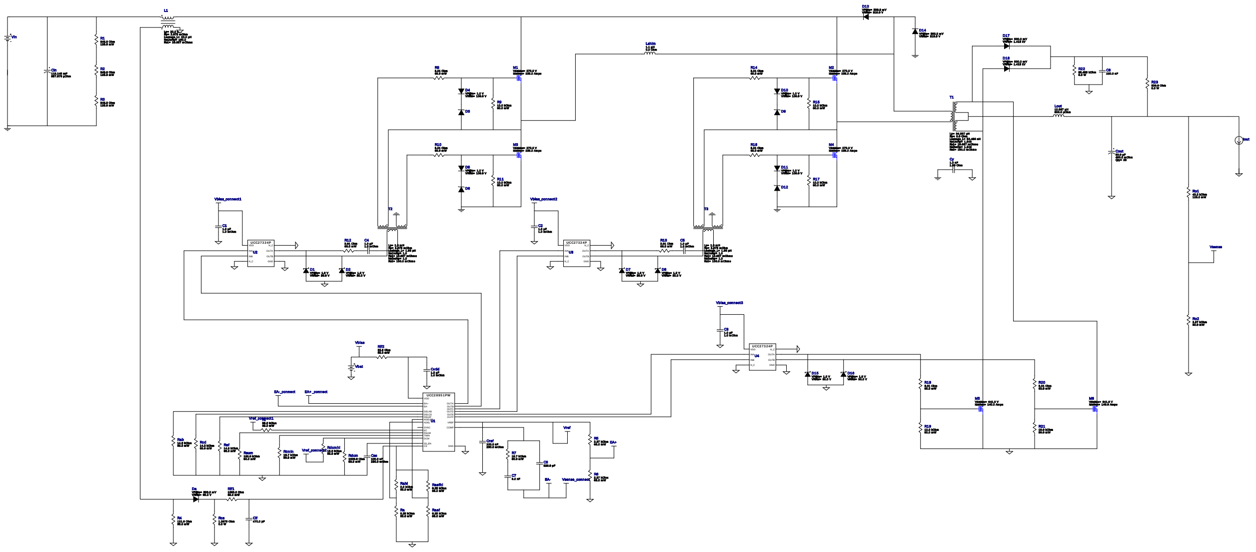
VinMin = 55.0V
VinMax = 220.0V
Vout = 48.0V
Iout = 90.0A

Device = UCC28951PWR
Topology = Phase Shifted Full Bridge
Created = 2024-01-23 02:54:17.028
BOM Cost = NA
BOM Count = 115
Total Pd =

WEBENCH ® Design Report

Design : 3 UCC28951PWR
UCC28951PWR 55V-220V to 48V @ 90A



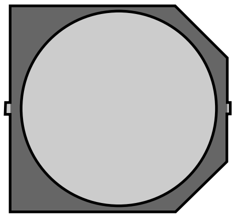
Design Alerts

UCC28951 Design

With the current design condition, suitable FETs M1, M2, M3, M4, M5 and M6 could not be found in the current database. Hence, this design is created using ideal FETs. Please note that the resulting FET parameters are ideal, so the efficiency/loss values have been disabled.

Electrical BOM

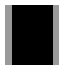
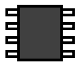
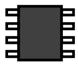
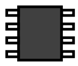
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C1	Taiyo Yuden	TMK212BJ105KG-T Series= X5R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
C2	Taiyo Yuden	TMK212BJ105KG-T Series= X5R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
C3	Taiyo Yuden	TMK212BJ105KG-T Series= X5R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
C4	Taiyo Yuden	TMK212BJ105KG-T Series= X5R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
C5	Taiyo Yuden	TMK212BJ105KG-T Series= X5R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
C6	CUSTOM	CUSTOM Series= ?	Cap= 220.0 nF VDC= 1.41785 kV IRMS= 0.0 A	1	NA	CUSTOM 0 mm^2

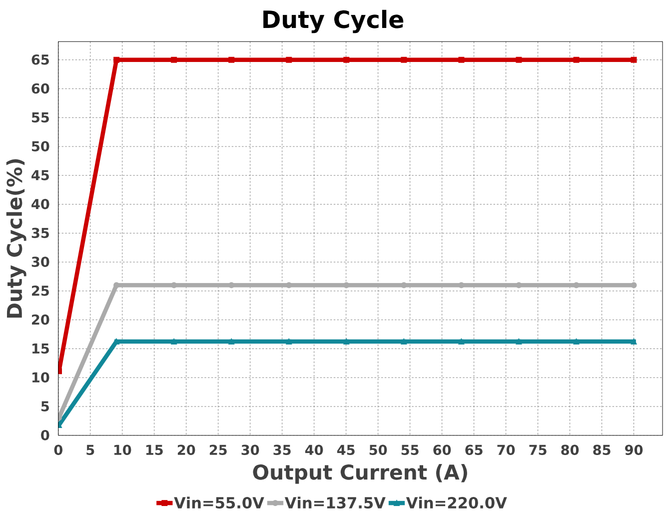
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C7	TDK	C2012C0G1H822K060AA Series= C0G/NP0	Cap= 8.2 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.05	0805 7 mm^2
C8	Samsung Electro-Mechanics	CL05C821JB5NNNC Series= C0G/NP0	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
Cin	CUSTOM	CUSTOM Series= ?	Cap= 118.145 mF ESR= 857.08 uOhm VDC= 233.2 V IRMS= 75.302 A	1	NA	CUSTOM 0 mm^2
Clf	Samsung Electro-Mechanics	CL21C471JBANNNC Series= C0G/NP0	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Cout	Panasonic	EEV-EB2E330SM Series= ?	Cap= 33.0 uF ESR= 400.0 mOhm VDC= 250.0 V IRMS= 560.0 mA	26	$2.82	 EB_K16 483 mm^2
Cref	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Css	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Cvdd	Taiyo Yuden	TMK212BJ105KG-T Series= X5R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm^2
Cy	TDK	B81123C1102M Series= B81123	Cap= 1.0 nF ESR= 1.59 Ohm VDC= 3.0 kV IRMS= 0.0 A	1	$0.26	 B81123_1800x500x1050 140 mm^2
D1	SMC Diode Solutions	BAT54WSTR	VF@Io= 1.0 V VRRM= 30.0 V	1	$0.02	SOD-323 9 mm^2
D10	ON Semiconductor	MMSD4148T1G	VF@Io= 1.0 V VRRM= 100.0 V	1	$0.03	SOD-123 13 mm^2
D11	ON Semiconductor	MMSD4148T1G	VF@Io= 1.0 V VRRM= 100.0 V	1	$0.03	SOD-123 13 mm^2
D12	Diodes Inc.	MMSZ5242B-7-F	Zener	1	$0.04	SOD-123 13 mm^2
D13	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 319.0 V	1	NA	CUSTOM 0 mm^2
D14	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 319.0 V	1	NA	CUSTOM 0 mm^2
D15	SMC Diode Solutions	BAT54WSTR	VF@Io= 1.0 V VRRM= 30.0 V	1	$0.02	SOD-323 9 mm^2
D16	SMC Diode Solutions	BAT54WSTR	VF@Io= 1.0 V VRRM= 30.0 V	1	$0.02	SOD-323 9 mm^2

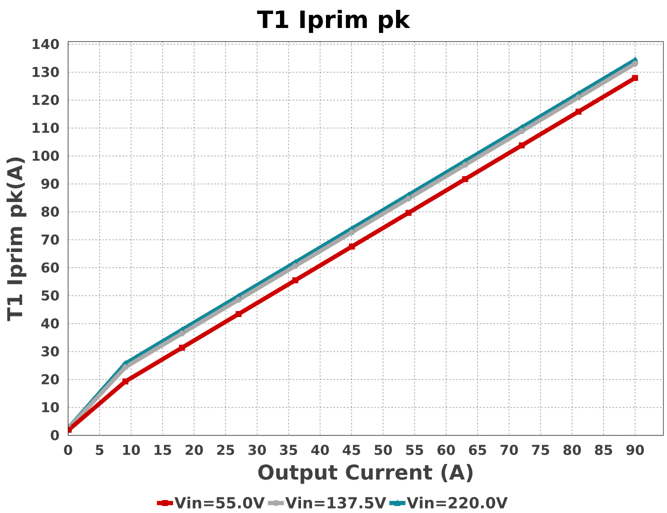
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
D17	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 1.418 kV	1	NA	CUSTOM 0 mm^2
D18	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 1.418 kV	1	NA	CUSTOM 0 mm^2
D2	SMC Diode Solutions	BAT54WSTR	VF@Io= 1.0 V VRRM= 30.0 V	1	$0.02	SOD-323 9 mm^2
D3	Diodes Inc.	MMSZ5242B-7-F	Zener	1	$0.04	SOD-123 13 mm^2
D4	ON Semiconductor	MMSD4148T1G	VF@Io= 1.0 V VRRM= 100.0 V	1	$0.03	SOD-123 13 mm^2
D5	ON Semiconductor	MMSD4148T1G	VF@Io= 1.0 V VRRM= 100.0 V	1	$0.03	SOD-123 13 mm^2
D6	Diodes Inc.	MMSZ5242B-7-F	Zener	1	$0.04	SOD-123 13 mm^2
D7	SMC Diode Solutions	BAT54WSTR	VF@Io= 1.0 V VRRM= 30.0 V	1	$0.02	SOD-323 9 mm^2
D8	SMC Diode Solutions	BAT54WSTR	VF@Io= 1.0 V VRRM= 30.0 V	1	$0.02	SOD-323 9 mm^2
D9	Diodes Inc.	MMSZ5242B-7-F	Zener	1	$0.04	SOD-123 13 mm^2
Da	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 95.0 V	1	NA	CUSTOM 0 mm^2
L1	CUSTOM	CUSTOM	Lp= 20.0 mH Rp= 2.875 mOhm Leakage_L= 20.0 µH Ns1toNp= 100.0 Rs1= 10.667 mOhms	1	NA	CUSTOM 0 mm^2
Lout	CUSTOM	CUSTOM	L= 12.087 µH 500.0 µOhm	1	NA	CUSTOM 0 mm^2
Lshim	CUSTOM	CUSTOM	L= 1.1 µH 0.0 Ohm	1	NA	CUSTOM 0 mm^2
M1	NA	IdealFET1	VdsMax= 270.0 V IdsMax= 183.0 Amps	1	NA	NA 0 mm^2
M2	NA	IdealFET2	VdsMax= 270.0 V IdsMax= 183.0 Amps	1	NA	NA 0 mm^2
M3	NA	IdealFET3	VdsMax= 270.0 V IdsMax= 183.0 Amps	1	NA	NA 0 mm^2
M4	NA	IdealFET4	VdsMax= 270.0 V IdsMax= 183.0 Amps	1	NA	NA 0 mm^2
M5	NA	IdealFET5	VdsMax= 641.0 V IdsMax= 140.0 Amps	1	NA	NA 0 mm^2
M6	NA	IdealFET6	VdsMax= 641.0 V IdsMax= 140.0 Amps	1	NA	NA 0 mm^2
R1	Vishay-Dale	CRCW0805845RFKEA Series= CRCW..e3	Res= 845.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
R10	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R11	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
R12	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

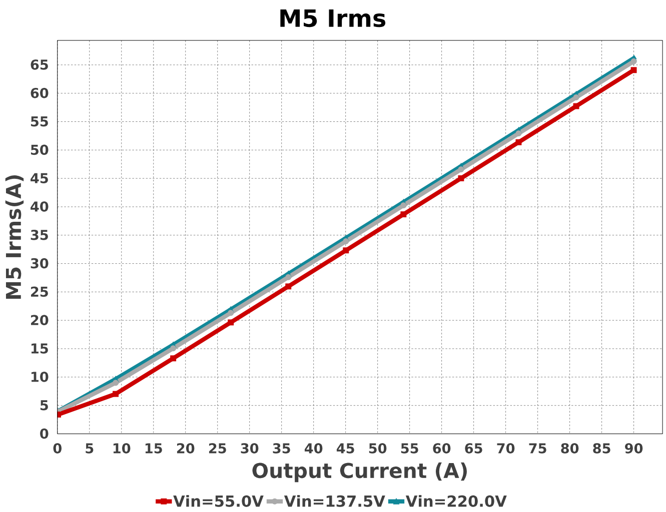
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
R13	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R14	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R15	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
R16	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R17	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
R18	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R19	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
R2	Vishay-Dale	CRCW0805845RFKEA Series= CRCW..e3	Res= 845.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
R20	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R21	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
R22	CUSTOM	CUSTOM Series= ?	Res= 89.455 kOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
R23	CUSTOM	CUSTOM Series= ?	Res= 800.0 Ohm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
R3	Vishay-Dale	CRCW0805845RFKEA Series= CRCW..e3	Res= 845.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
R4	Vishay-Dale	CRCW0402121RFKED Series= CRCW..e3	Res= 121.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R5	Vishay-Dale	CRCW04022K37FKED Series= CRCW..e3	Res= 2.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R6	Vishay-Dale	CRCW04022K37FKED Series= CRCW..e3	Res= 2.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R7	Yageo	RC0201FR-0718K7L Series= ?	Res= 18.7 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
R8	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R9	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
Ra	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rab	Vishay-Dale	CRCW040214K3FKED Series= CRCW..e3	Res= 14.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

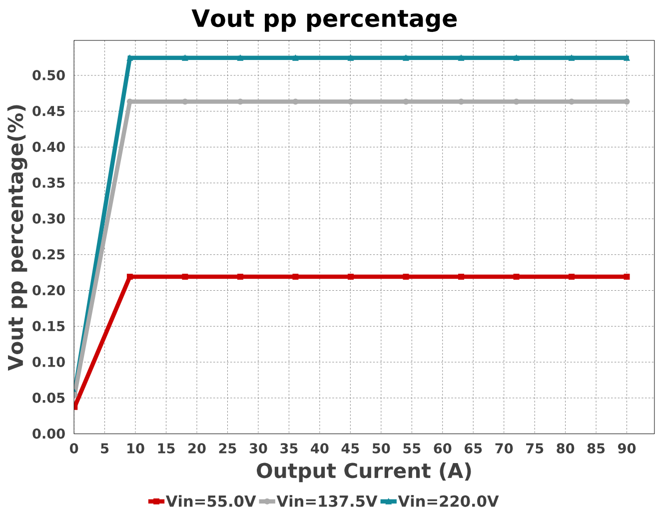
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Raef	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Raefhi	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rahi	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rcd	Vishay-Dale	CRCW040214K3FKED Series= CRCW..e3	Res= 14.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rcs	CUSTOM	CUSTOM Series= ?	Res= 1.2079 Ohm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
Rdcm	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rdcmhi	Vishay-Dale	CRCW040213K3FKED Series= CRCW..e3	Res= 13.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Ref	Vishay-Dale	CRCW040214K3FKED Series= CRCW..e3	Res= 14.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rlf1	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rlf2	Vishay-Dale	CRCW040222R6FKED Series= CRCW..e3	Res= 22.6 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Ro1	Vishay-Dale	CRCW080543K2FKEA Series= CRCW..e3	Res= 43.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Ro2	Vishay-Dale	CRCW04022K37FKED Series= CRCW..e3	Res= 2.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rsum	Yageo	RC0201FR-07133KL Series= ?	Res= 133.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
Rt	Vishay-Dale	CRCW040259K0FKED Series= CRCW..e3	Res= 59.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rtmin	Yageo	RC0201FR-0718K7L Series= ?	Res= 18.7 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
T1	CUSTOM	CUSTOM	Lp= 34.997 µH Rp= 0.0 Ohm Leakage_L= 52.496 nH Ns1toNp= 1.343 Rs1= 10.667 mOhms Ns2toNp= 1.343 Rs2= 100.0 mOhms	1	NA	CUSTOM 0 mm^2
T2	CUSTOM	CUSTOM	Lp= 1.3 mH Rp= 2.875 mOhm Leakage_L= 1.95 µH Ns1toNp= 1.0 Rs1= 10.667 mOhms Ns2toNp= 1.0 Rs2= 100.0 mOhms	1	NA	CUSTOM 0 mm^2

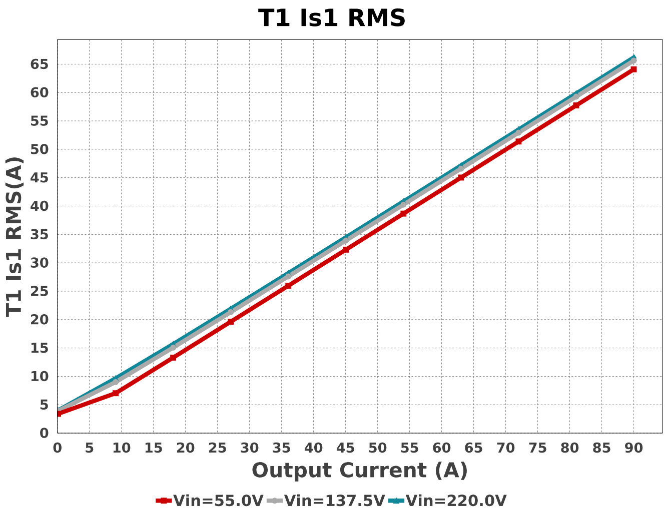
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
T3	CUSTOM	CUSTOM	Lp= 1.3 mH Rp= 2.875 mOhm Leakage_L= 1.95 µH Ns1toNp= 1.0 Rs1= 10.667 mOhms Ns2toNp= 1.0 Rs2= 100.0 mOhms	1	NA	CUSTOM 0 mm^2
U1	Texas Instruments	UCC28951PWR	Switcher	1	$2.31	 0 mm^2
U2	Texas Instruments	UCC27324P	Switcher	0	$0.55	 D0008A_N 57 mm^2
U3	Texas Instruments	UCC27324P	Switcher	0	$0.55	 D0008A_N 57 mm^2
U4	Texas Instruments	UCC27324P	Switcher	0	$0.55	 D0008A_N 57 mm^2

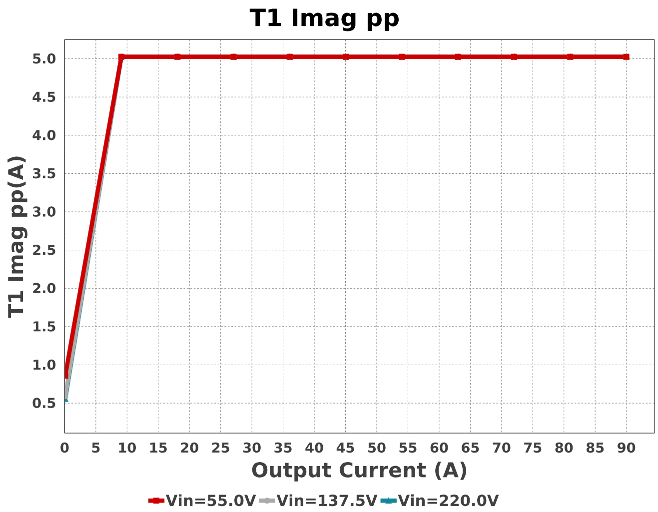


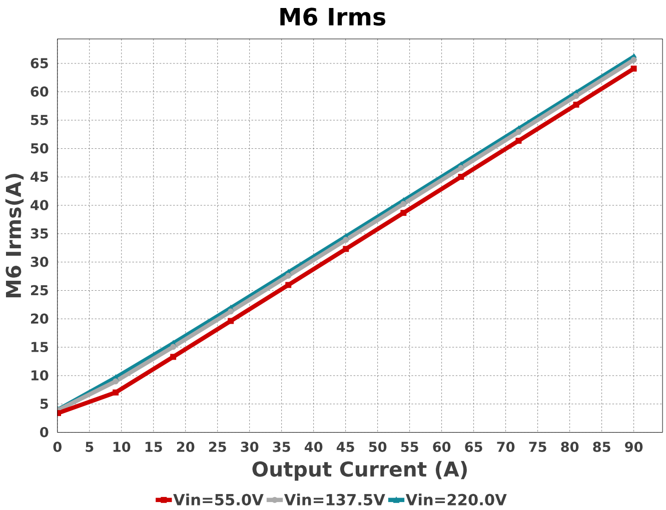


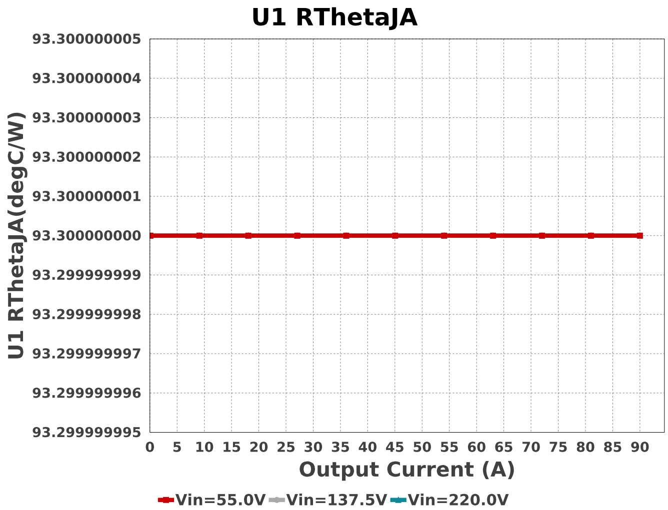

M5 Irms
M5 Irms(A)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

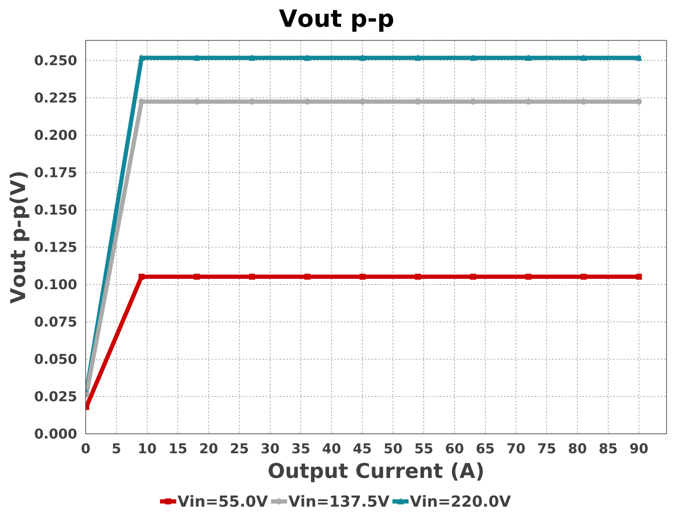

Vout pp percentage
Vout pp percentage(%)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

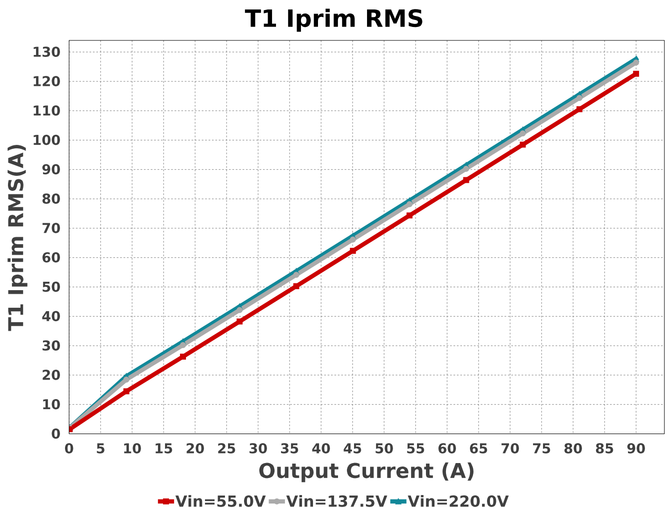

T1 Is1 RMS
T1 Is1 RMS(A)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

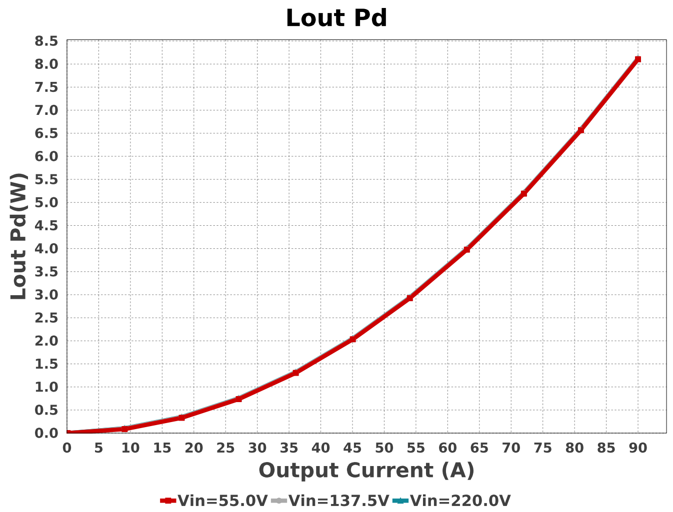

T1 Imag pp
T1 Imag pp(A)
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

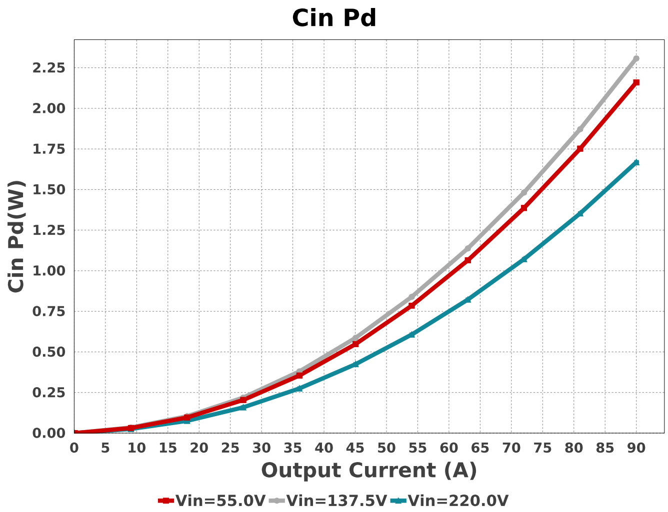

M6 Irms
M6 Irms(A)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

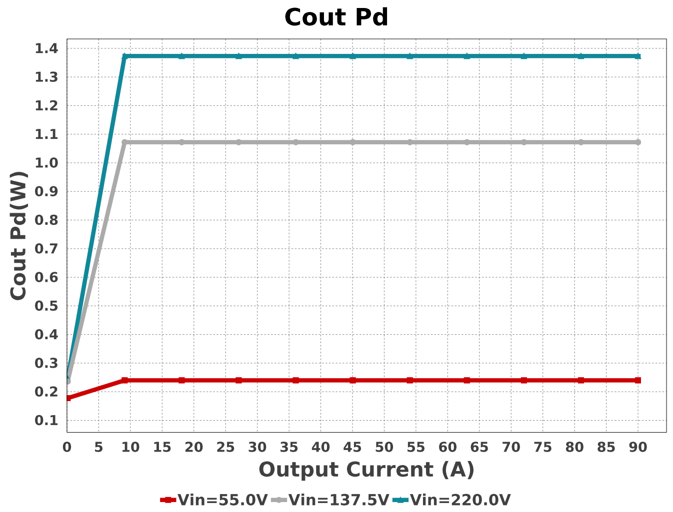

U1 RThetaJA
U1 RThetaJA(degC/W)
93.300000005
93.300000004
93.300000003
93.300000002
93.300000001
93.300000000
93.299999999
93.299999998
93.299999997
93.299999996
93.299999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

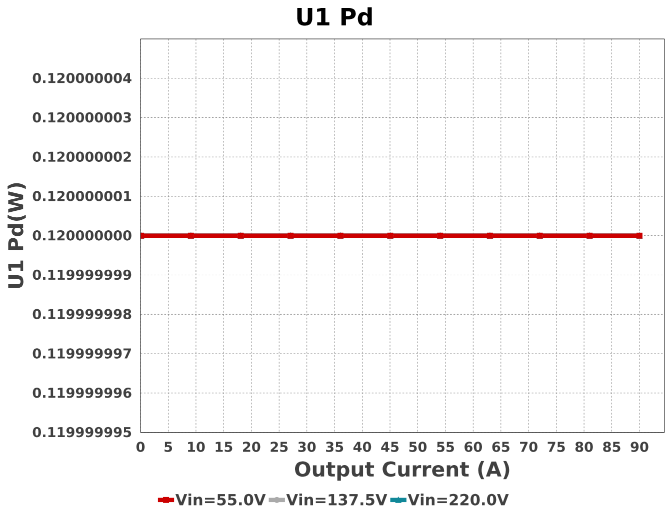

Vout p-p
Vout p-p(V)
0.000 0.025 0.050 0.075 0.100 0.125 0.150 0.175 0.200 0.225 0.250
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

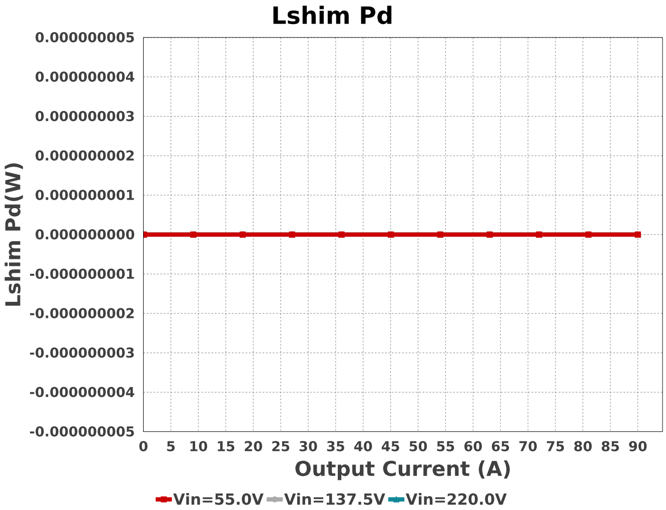

T1 Iprim RMS
T1 Iprim RMS(A)
0 10 20 30 40 50 60 70 80 90 100 110 120 130
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

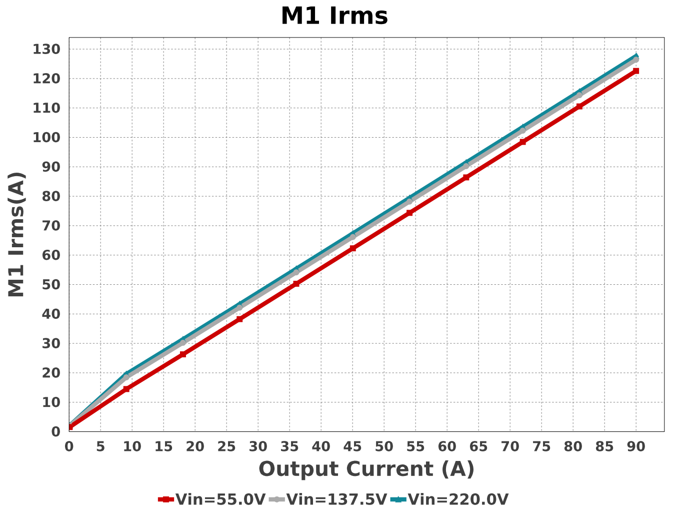

Lout Pd
Lout Pd(W)
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

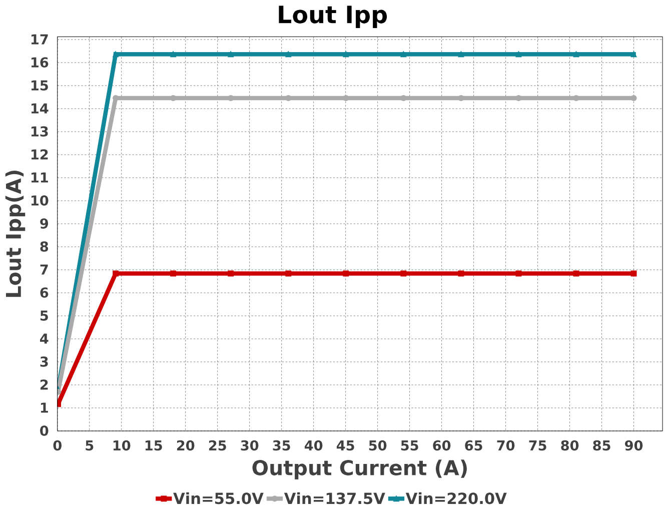

Cin Pd
Cin Pd(W)
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

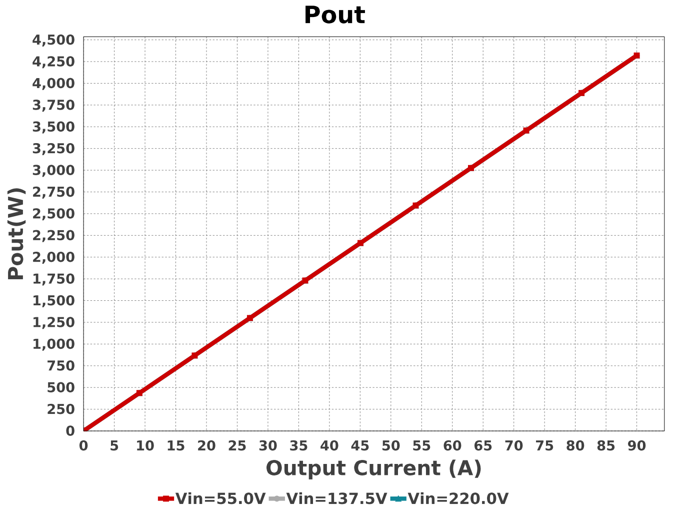

Cout Pd
Cout Pd(W)
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

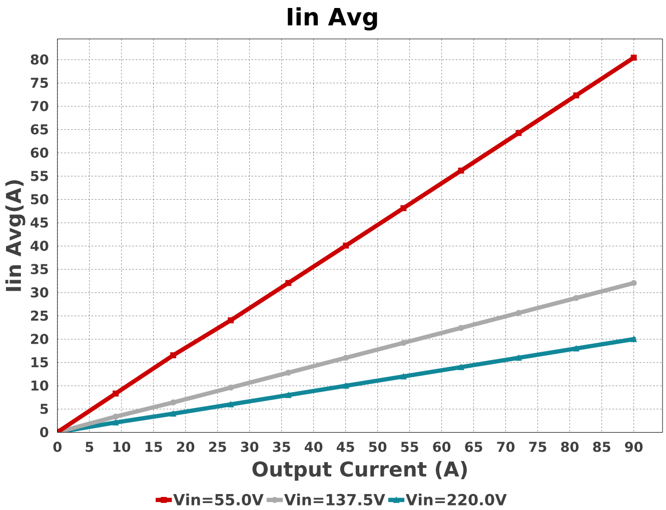

U1 Pd
U1 Pd(W)
0.119999995 0.119999996 0.119999997 0.119999998 0.119999999 0.120000000 0.120000001 0.120000002 0.120000003 0.120000004
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

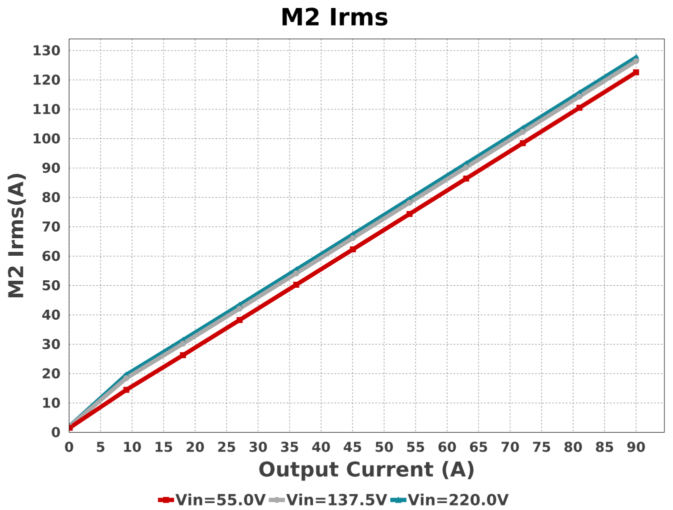

Lshim Pd
Lshim Pd(W)
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

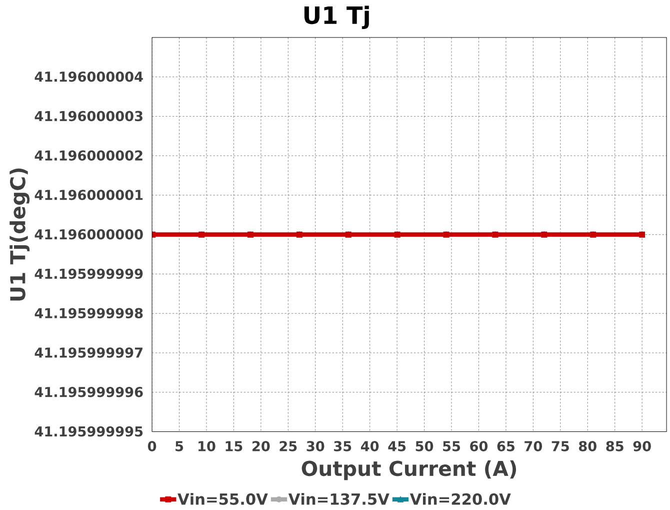

M1 Irms
M1 Irms(A)
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

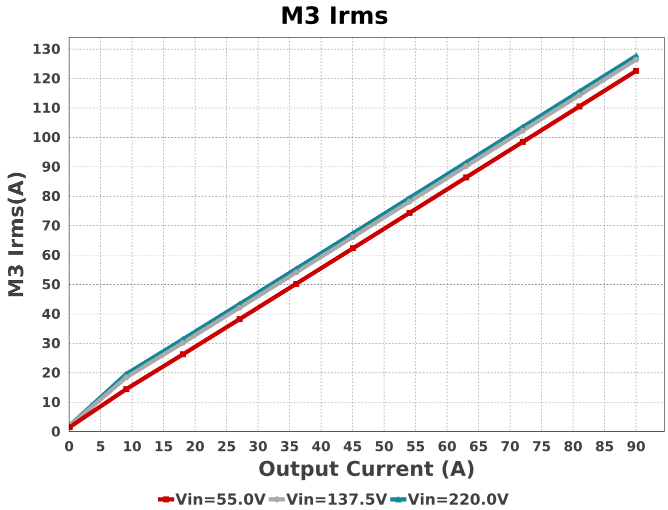

Lout Ipp
Lout Ipp(A)
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

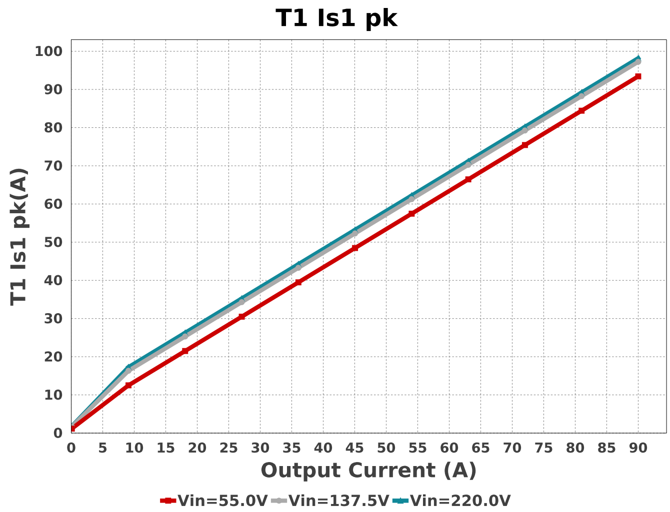

Pout
Pout(W)
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

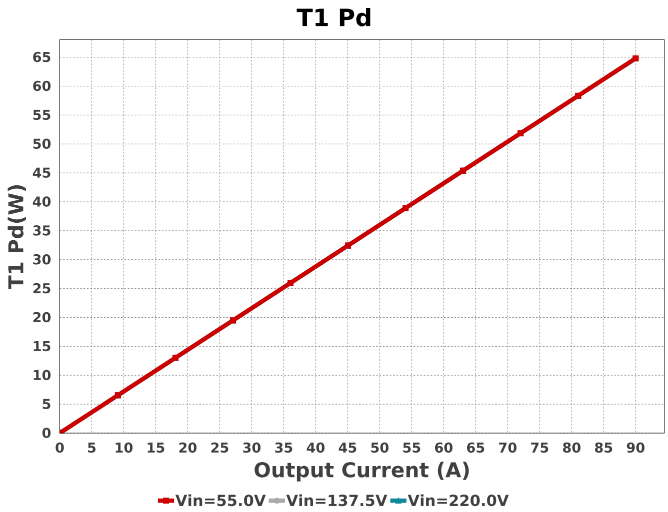

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

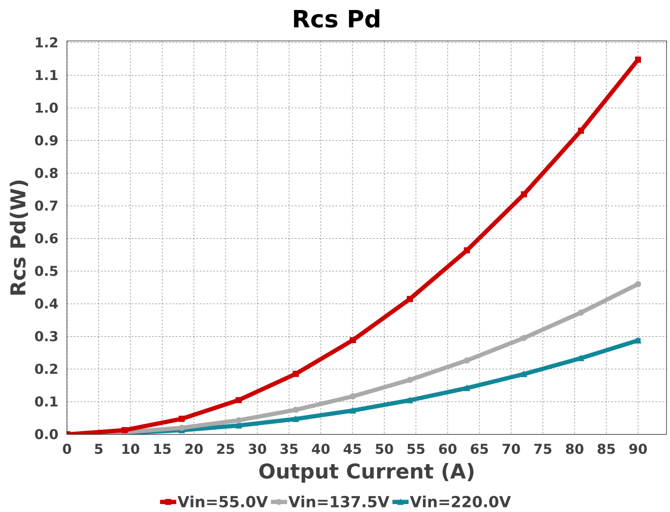

M2 Irms
M2 Irms(A)
Output Current (A)
Vin=55.0V
Vin=137.5V
Vin=220.0V

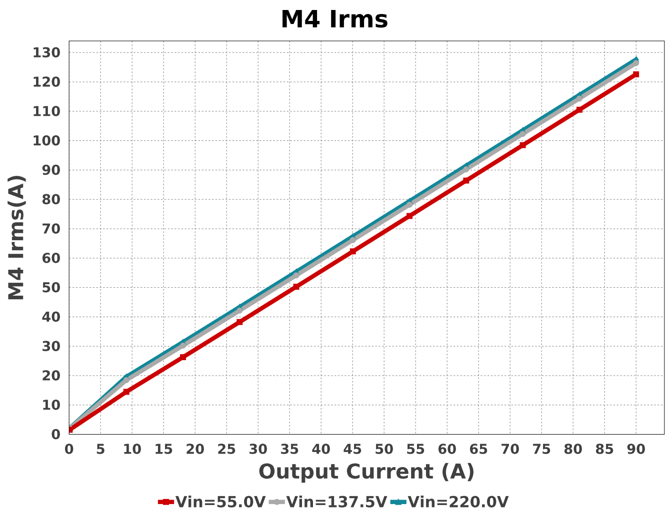

U1 Tj
U1 Tj(degC)
41.196000004
41.196000003
41.196000002
41.196000001
41.196000000
41.195999999
41.195999998
41.195999997
41.195999996
41.195999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

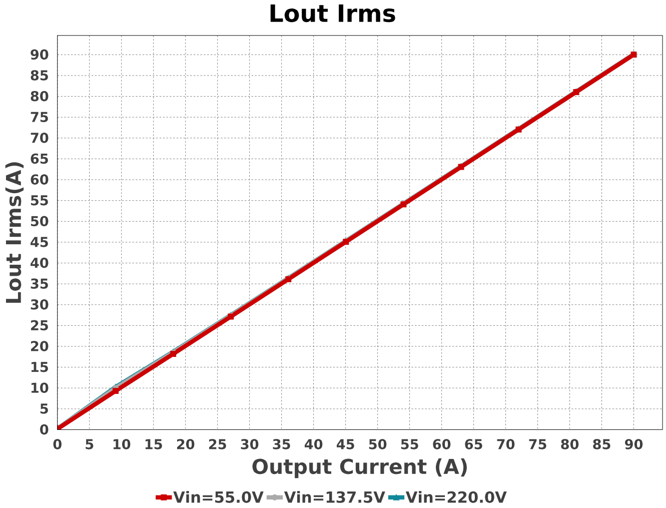

M3 Irms
M3 Irms(A)
130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V

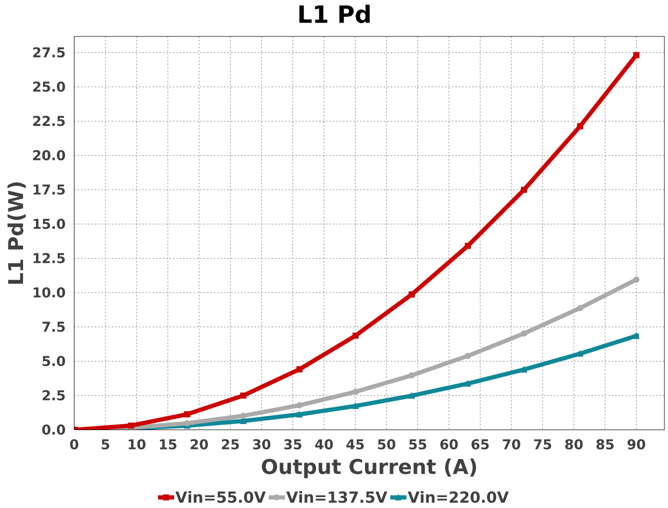

T1 Is1 pk
T1 Is1 pk(A)
100 90 80 70 60 50 40 30 20 10 0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V


T1 Pd
T1 Pd(W)
65 60 55 50 45 40 35 30 25 20 15 10 5 0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V


Rcs Pd
Rcs Pd(W)
1.2 1.1 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V


M4 Irms
M4 Irms(A)
130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
Output Current (A)
Vin=55.0V Vin=137.5V Vin=220.0V





Operating Values

#	Name	Value	Category	Description
1.	Cin Pd	2.16 W	Capacitor	Input capacitor power dissipation
2.	Cout Pd	239.82 mW	Capacitor	Output capacitor power dissipation
3.	Lout Irms	90.022 A	Current	Lout ripple current
4.	Iin Avg	80.443 A	IC	Average input current
5.	U1 RThetaJA	93.3 degC/W	IC	U1 IC junction-to-ambient thermal resistance
6.	L1 Pd	27.315 W	Inductor	Power Dissipation in the Inductor
7.	Lout Ipp	6.839 A	Inductor	Peak-to-peak output inductor ripple current
8.	Lshim Pd	0.0 W	Inductor	Power Dissipation in Shim Inductor
9.	M1 Irms	122.591 A	Mosfet	M1 MOSFET Irms
10.	M2 Irms	122.591 A	Mosfet	M2 MOSFET Irms
11.	M3 Irms	122.591 A	Mosfet	M3 MOSFET Irms
12.	M4 Irms	122.591 A	Mosfet	M4 MOSFET Irms
13.	M5 Irms	64.082 A	Mosfet	M5 MOSFET Irms
14.	M6 Irms	64.082 A	Mosfet	M6 MOSFET Irms
15.	Cin Pd	2.16 W	Power	Input capacitor power dissipation
16.	Cout Pd	239.82 mW	Power	Output capacitor power dissipation
17.	L1 Pd	27.315 W	Power	Power Dissipation in the Inductor
18.	Lout Pd	8.104 W	Power	Lout power dissipation
19.	Lshim Pd	0.0 W	Power	Power Dissipation in Shim Inductor
20.	Rcs Pd	1.148 W	Power	Power Dissipation in Current Sense Resistors
21.	T1 Pd	64.8 W	Power	Estimated Losses in Transformer
22.	U1 Pd	120.0 mW	Power	U1 Power Dissipation
23.	Rcs Pd	1.148 W	Resistor	Power Dissipation in Current Sense Resistors
24.	BOM Count	115	System Information	Total Design BOM count
25.	Duty Cycle	65.0 %	System Information	Duty cycle
26.	FootPrint	14.352 k mm^2	System Information	Total Foot Print Area of BOM components
27.	Frequency	101.626 kHz	System Information	Switching frequency
28.	Iout	90.0 A	System Information	Iout operating point
29.	Mode	FET Conduction Mode	System Information	Conduction Mode
30.	Pout	4.32 kW	System Information	Total output power
31.	Total BOM	NA	System Information	Total BOM Cost
32.	U1 Tj	41.196 degC	System Information	U1 junction temperature
33.	Vin	55.0 V	System Information	Vin operating point
34.	Vout	48.0 V	System Information	Operational Output Voltage
35.	Vout p-p	105.208 mV	System Information	Peak-to-peak output ripple voltage
36.	Vout pp percentage	219.184 m%	System Information	Output Voltage ripple percentage
37.	T1 Imag pp	5.026 A	Transformer	Transformer peak to peak magnetising current
38.	T1 Iprim RMS	122.591 A	Transformer	Transformer Primary RMS Current
39.	T1 Iprim pk	127.943 A	Transformer	Transformer Primary Peak Current

#	Name	Value	Category	Description
40.	T1 Is1 RMS	64.082 A	Transformer	Transformer Secondary1 RMS Current
41.	T1 Is1 pk	93.419 A	Transformer	Transformer Secondary1 Peak Current
42.	T1 Pd	64.8 W	Transformer	Estimated Losses in Transformer

Design Inputs

Name	Value	Description
Iout	90.0	Maximum Output Current
VinMax	220.0	Maximum input voltage
VinMin	55.0	Minimum input voltage
Vout	48.0	Output Voltage
base_pn	UCC28951	Base Product Number
source	DC	Input Source Type
Ta	30.0	Ambient temperature

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

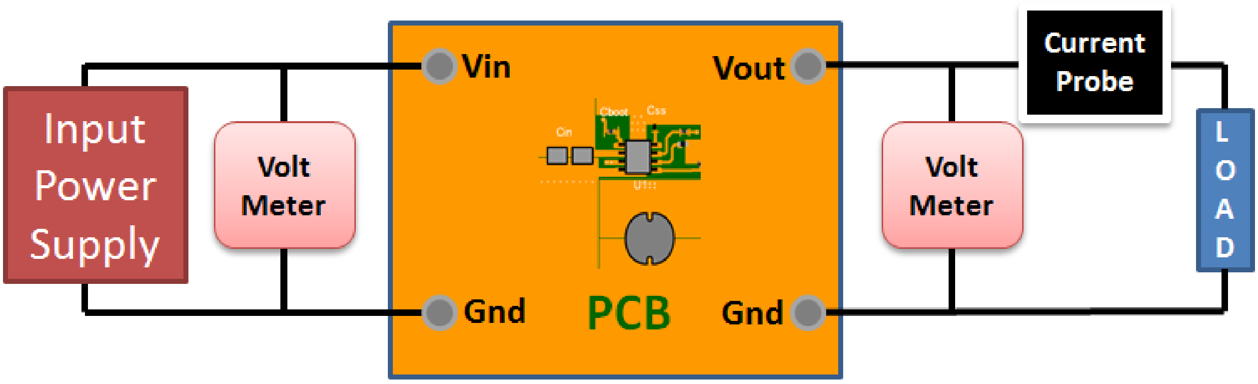
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 55.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

1. Master key : E555852C8D374582B07D349F2390E0BA[v1]

2. **UCC28951** Product Folder : http://www.ti.com/product/UCC28951 : contains the data sheet and other resources.

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