National Semiconductor

WEBENCH® Design Report

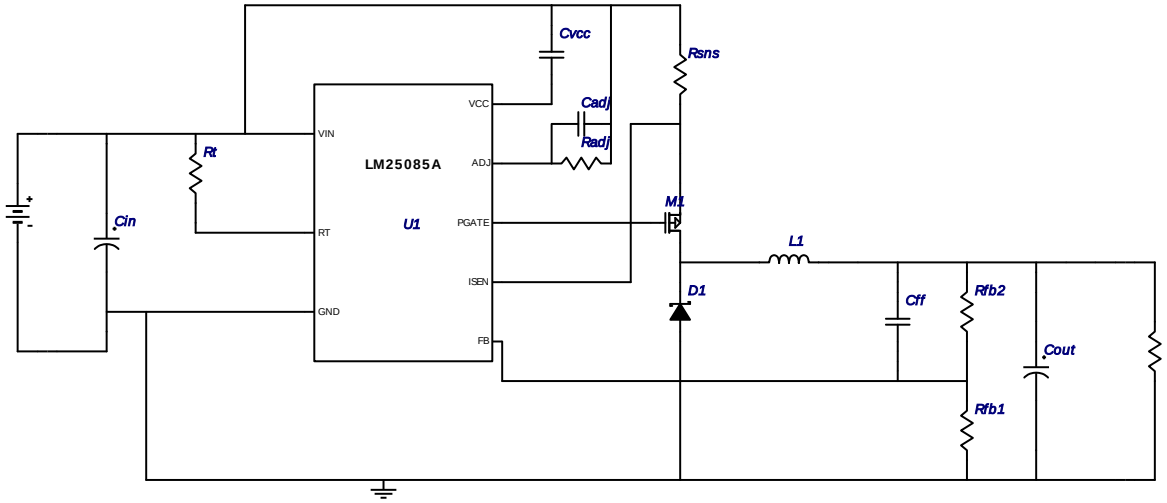
Design : 930095/2 LM25085A

Design 2 - LM25085A

WEBENCH® Design : LM25085A_none_Buck_None

VinMin = 22.0V
VinMax = 28.0V
Vout = 19.0V
Iout = 4.0A

Device = LM25085A
Topology = Buck
Creation date = 2/7/11 9:07:24 AM
Total BOM Cost = $5.31
Total Pd = 2.45 W
Footprint = 627.0 mm2
BOM Count = 15



Electrical BOM

#	Name	Manufacturer	Part Number	Qty	Price	Properties	Footprint
1.	Cadj	Yageo America	CC0805KRX7R9BB102 Series= X7R	1	$0.01	Cap= 1.0 nF ESR= 0.0 Ohm VDC= 50.0 V IRMS= 0.0 A	0805 13mm2
2.	Cff	AVX	12061C102JAT2A Series= X7R	1	$0.05	Cap= 1.0 nF ESR= 427.0 mOhm VDC= 100.0 V IRMS= 0.0 A	1206 19mm2
3.	Cin	TDK	C5750X7R1H106M Series= X7R	2	$0.63	Cap= 10.0 µF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 5.5 A	2220 60mm2
4.	Cout	Kemet	T495X336M035ATE175 Series= T495	1	$0.84	Cap= 33.0 µF ESR= 175.0 mOhm VDC= 35.0 V IRMS= 874.0 mA	7343-43 59mm2
5.	Cvcc	MuRata	GRM155R61A105KE15D Series= X5R	1	$0.01	Cap= 1.0 µF ESR= 0.0 Ohm VDC= 10.0 V IRMS= 0.0 A	0402 8mm2
6.	D1	Diodes Inc.	B240A-13-F	1	$0.09	VF@Io= 500.0 mV VRRM= 40.0 V	SMA 37mm2
7.	L1	Coiltronics	HC9-220-R	1	$1.08	L= 22.0 µH DCR= 25.7 mOhm	HC9 243mm2
8.	M1	Vishay-Siliconix	SI4401BDY	1	$0.89	VdsMax= -40.0 V IdsMax= -8.7 Amps	SOIC-8 55mm2
9.	Radj	Vishay-Dale	CRCW04021K82FKED Series= CRCW..e3	1	$0.01	Res= 1.82 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2

#	Name	Manufacturer	Part Number	Qty	Price	Properties	Footprint
10.	Rfb1	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	1	$0.01	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
11.	Rfb2	Vishay-Dale	CRCW0402200KFKED Series= CRCW..e3	1	$0.01	Res= 200.0 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
12.	Rsns	Stackpole Electronics Inc	CSR 1/2 0.01 1 I Series= ?	1	$0.11	Res= 10.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1206 19mm2
13.	Rt	Vishay-Dale	CRCW0402392KFKED Series= CRCW..e3	1	$0.01	Res= 392.0 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
14.	U1	National Semiconductor	LM25085AMM	1	$0.93	Switcher	eMSOP-0 0mm2

Op Vals

#	Name	Value	Category	Description
1.	Cin IRMS	1.856 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	259.5 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	2.802 A	Current	Average input current
4.	L Ipp	898.936 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	4.449 A	Current	Peak switch current
6.	BOM Count	15.0	General	Total Design BOM count
7.	FootPrint	627.0 mm2	General	Total Foot Print Area of BOM components
8.	Frequency	301.936 kHz	General	Switching frequency
9.	Mode	CCM	General	Conduction Mode
10.	Pout	76.0 W	General	Total output power
11.	Total BOM	$5.31	General	Total BOM Cost
12.	D1 Tj	45.697 degC	Op_Point	D1 junction temperature
13.	Duty Cycle	68.606 %	Op_point	Duty cycle
14.	Efficiency	96.88 %	Op_point	Steady state efficiency
15.	IC Tj	51.243 degC	Op_point	IC junction temperature
16.	ICThetaJA	46.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	4.0 A	Op_point	Iout operating point
18.	M1 Tj	75.362 degC	Op_point	M1 MOSFET junction temperature
19.	VIN_OP	28.0 V	Op_point	Vin operating point
20.	Vout p-p	157.717 mV	Op_point	Peak-to-peak output ripple voltage
21.	Cin Pd	5.169 mW	Power	Input capacitor power dissipation
22.	Cout Pd	11.785 mW	Power	Output capacitor power dissipation
23.	Diode Pd	627.886 mW	Power	Diode power dissipation
24.	IC Pd	461.803 mW	Power	IC power dissipation
25.	L Pd	514.0 mW	Power	Inductor power dissipation
26.	M1 PdCond	254.216 mW	Power	M1 MOSFET conduction losses
27.	M1 PdSw	415.833 mW	Power	M1 MOSFET switching losses
28.	Total Pd	2.448 W	Power	Total Power Dissipation
29.	IC Tolerance	18.0 mV	Unknown	IC Feedback Tolerance
30.	Vout OP	19.0 V	Unknown	Vin operating point

Design Inputs

#	Name	Value	Description
1.	ErrorFeature	I	Error feature
2.	Iout	4.0 A	Maximum Output Current
3.	Iout1	4.0 Amps	Output Current #1
4.	SoftStart	0.0 ms	Soft Start Time (ms)
5.	SyncFeature	I	External Sync feature
6.	VinMax	28.0 V	Maximum input voltage
7.	VinMin	22.0 V	Minimum input voltage
8.	Vout	19.0 V	Output Voltage
9.	Vout1	19.0 Volt	Output Voltage #1
10.	base_pn	LM25085A	National Based Product Number
11.	customfreq	Y	Use Customer Frequency
12.	onOff	I	On/Off feature
13.	optfactor	0.0	Optimization factor to tune up the design
14.	pricefactor	0.0	Price factor to tune up the design cost
15.	ta	30.0 degC	Ambient temperature

Design Assist

1. For a Constant On Time device to be stable, we need to provide a ripple at the feedback comparator. There are various methods to implement the ripple. Depending on the circuit complexity vs. the allowable ripple, we have three options to choose from. The simplest option, 'Low Complexity', would require only a high ESR cap at the output. This means that the BOM count will be small, but the output voltage ripple will be quite large. The 'optimal solution' would require a feed-forward cap in parallel with the upper feedback resistor to AC couple the ripple to the feedback node. This increases the BOM count slightly, but now we have more control over the output voltage ripple. If the output voltage requirement is very tight, then the best option is to go for the 'Low Output Ripple' solution. In this option we can go with very low ESR output caps and have very good control over the output voltage ripple

2. **LM25085A** Product Folder : http://www.national.com/pf/LM/LM25085A.html : contains the data sheet and other resources.