LM(2)5085 COT PFET Buck Switching Controller Quick Start

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Note: The components calculated in this worksheet are reasonable starting values for a design using the LM(2)5085 They are not optimized for any particular performance attribute. The most recent version of this excel file can be found in the product folders of the parts at national.com Make sure to input or select values in all of the blue shaded cells even if a value already exists in that cell. Blue shaded cells require input from user.

National Semiconductor

Step 1 - General Requirements

Vin(max) [V]	24
Vin(nom) [V]	24
Vin(min) [V]	12
Target Vout [V]	12
Io(max), Maximum load current [A]	2
Io(min), Minimum load current [A]	0.01
Recommended Controller IC	LM25085

Step 2 - Feedback Resistors

R_{FB2}/R_{FB1} =	8.6
User select R_{FB2}, upper feedback resistor [kOhm]	19
Recommended value for R_{FB1}, lower feedback resistor [kOhm]	2.21
User select R_{FB1}, lower feedback resistor [kOhm]	2.21
Actual Vout [V]	11.997

Step 3 - Frequency Setting

Maximum allowed frequency [kHz]	1000
Desired Switching Frequency [kHz]	300
User select the PFET	SI7465
Td(off) - Td(on), Difference of PFET On/Off delays [nSec]	57
Calculated value for R_T [kOhm]	239.97

Step 4 - Inductor Selection

Minimum recommended value for L1 [µH]	49.8
User Select the value for L1 [µH]	15.0
Peak Inductor Current [A]	2.7

Step 5 - Current Limit Setting

User select the Current Limit Type	1
	NA
User select the value for RSEN, Current sensing resistor [mOhm]	10
Max power dissipation at Io(max) in the selected sense resistor [W]	0.04
Recommended minimum value for R_{ADJ} [kOhm]	1.11
User select the value for R_{ADJ} [kOhm]	2.2
Norminal current limit [A]	8.1
Max power dissipation in the selected sense resistor at max current limit [W]	1.12

Step 6 - Input Capacitor

Maximum Allowable Input Ripple [Vp-p]	0.5
C_{IN}(min), Minimum Required Input Capacitor [µF]	14
User Select the value for C_{IN} [µF]	20
Maximum RMS Ripple Current in C_{IN} [A]	0.00

Step 7 - Output Capacitor & Ripple Configulation

User select the ripple Configuration Type	3
Recommended value for R4 [mOhm]	0
Maximum allowed value for R4 [mOhm]	8
User select the value for R4 [mOhm]	0
Minimum Recommened Output Capacitor C_{OUT} [uF]	55
User Select the value for C_{OUT} [uF]	200
Maximum RMS Current Ripple [A]	0.38

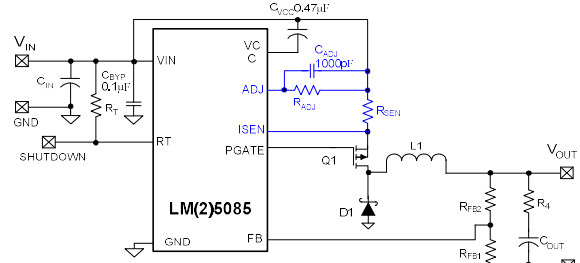|	
	NA
	NA
Recommended value for C1 [pF]	3300
Recommended value for R3 [kOhm]	#VALUE!
User Select the value for R3 [kOhm]	19.1
Recommended value for C2 [uF]	0.1
Resulting Min Output Ripple [mVp-p]	0
Resulting Max Output Ripple [mVp-p]	3

Step 8 - Power Dissipation in controller

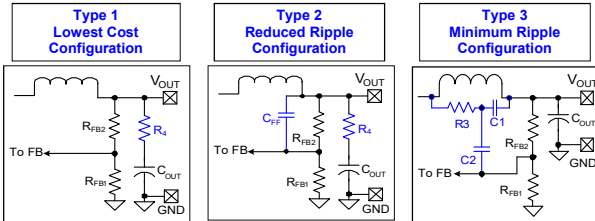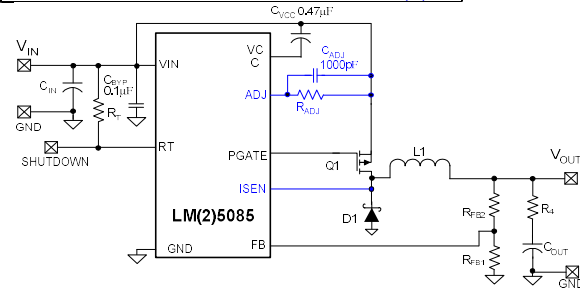|	
Qg, MOSFET total gate charge [nC]	40
Power dissipation in the controller IC [W]	0.32
Temperature Rise using the MSOP-8 package [ºC]	41
Temperature Rise using the MSOP-8EP package [ºC]	15
Temperature Rise using the LLP-8 package [ºC]	17

Step 9 - Power Dissipation in D1

User select the diode, D1	SK36
Forward diode drop at maximum load current [V]	0.57
Maximum power dissipation in D1 [W]	0.9

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<current Sense Type1> Sense the voltage across R_{SEN}

<Current Sense Type2> Sense the voltage across Q1's $R_{DS(ON)}$

Type 1 Lowest Cost Configuration	Type 2 Reduced Ripple Configuration	Type 3 Minimum Ripple Configuration

List of Components and Parameters

Description	Reference	Value	Min Rating
COT Buck PFET Controller	U1	LM25085	
Output Inductor	L1	15.0uH	
PFET	Q1	SI7465	
Diode	D1	SK36	
Lower Feedback Resistor	R_{FB1}	2.21kOhm	1/16 W
Upper Feedback Resistor	R_{FB2}	19.0kOhm	1/8 W
Frequency Setting Resistor	R_T	#########	1/16 W
Current Limit Sense Resistor	Rsen or Rdson	10mOhm	1.12W
Current Limit Setting Resistor	R_{ADJ}	2.2kOhm	1/8 W
Ripple Setting Resistor	R4	mOhm	0.00W
Ripple Injection Resistor	R3	19.1kOhm	0.03W
Input Capacitor	C_{IN}	20.2uF	24V
Output Capacitor	C_{OUT}	200.uF	12V
Vcc Capacitor	C_{VCC}	0.47uF	9V
Bypass Capacitor on Vcc	C_{BYP}	0.1uF	24V
Noise Filter for Current Limit	C_{ADJ}	1000pF	24V
Ripple Sensing Capacitor	C1	3300	24V
Ripple Injection Capacitor	C2	0.1uF	24V