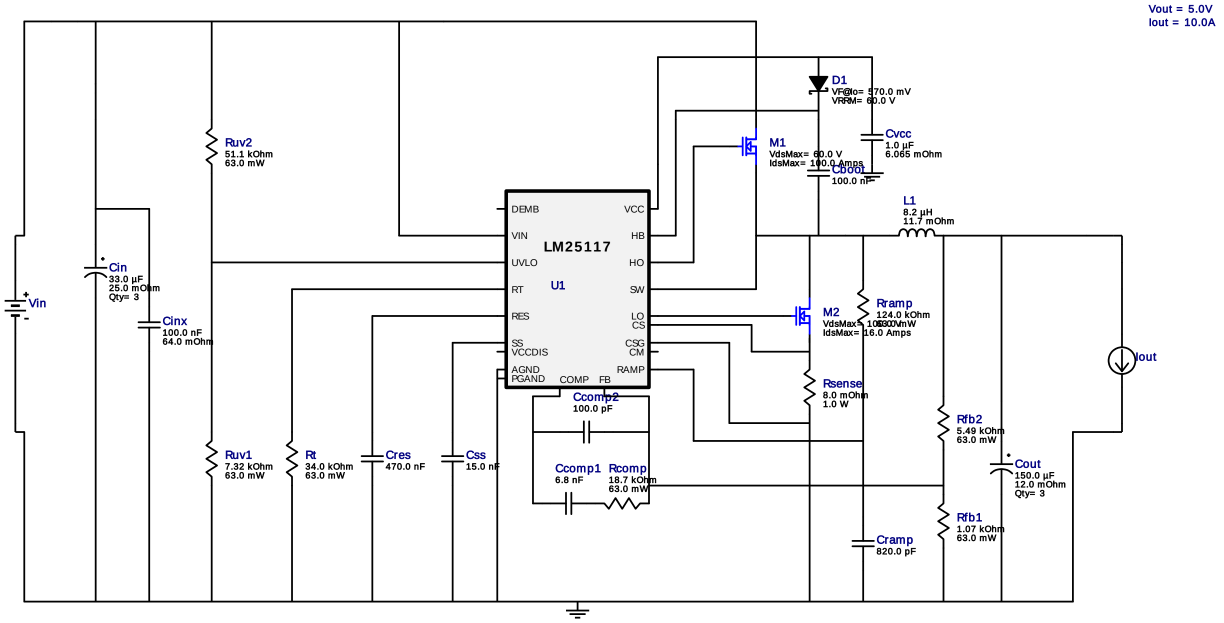
VinMin = 12.0V
VinMax = 40.0V
Vout = 5.0V
Iout = 10.0A

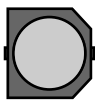
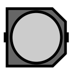
Device = LM25117PMHX/NOPB
Topology = Buck
Created = 7/2/16 5:43:38 PM
BOM Cost = $10.10
BOM Count = 27
Total Pd = 4.96W

WEBENCH ® Design Report

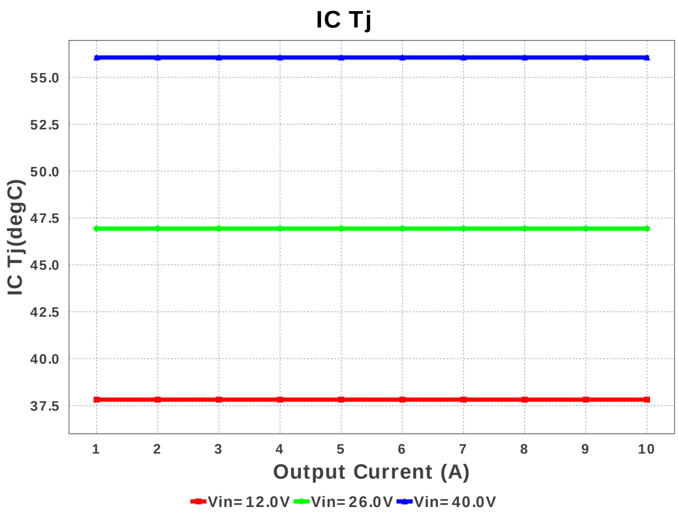
Design : 4058737/188 LM25117PMHX/NOPB
LM25117PMHX/NOPB 12.0V-40.0V to 4.90V @ 10.0A

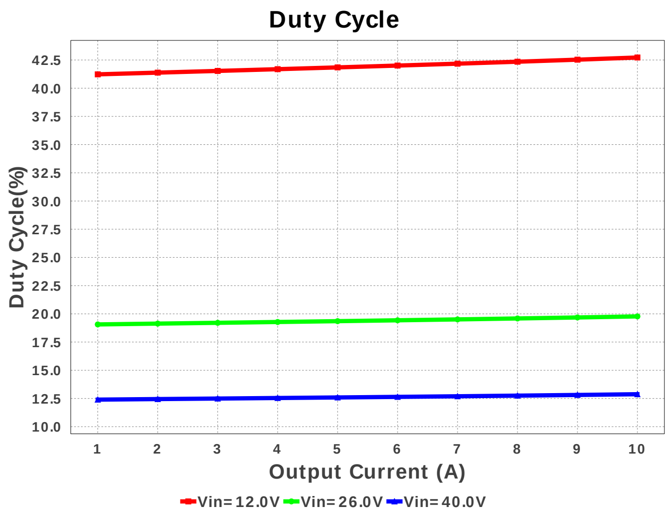


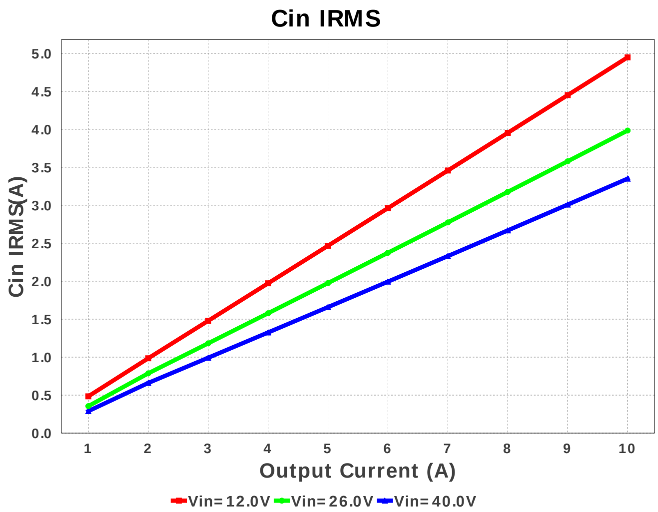
Electrical BOM

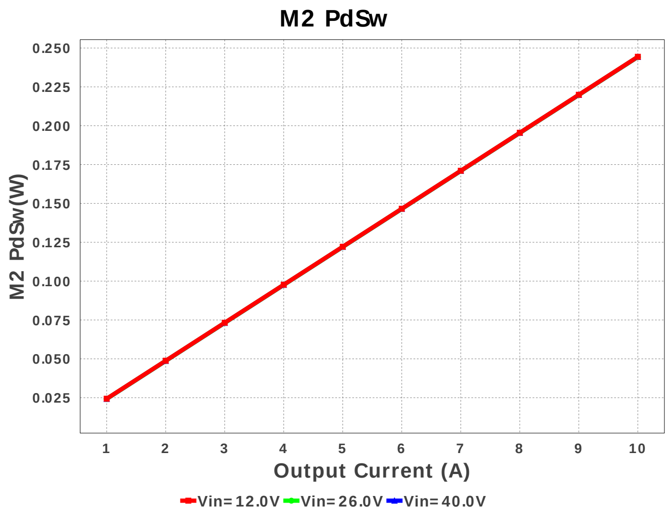
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp1	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805JRNPO9BN101 Series= C0G/NP0	Cap= 100.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	Panasonic	63SXV33M Series= ?	Cap= 33.0 uF ESR= 25.0 mOhm VDC= 63.0 V IRMS= 2.95 A	3	$1.25	 CAPSMT_62_E12 106 mm²
5.	Cinx	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
6.	Cout	Panasonic	6SVPE150M Series= SVPE	Cap= 150.0 uF ESR= 12.0 mOhm VDC= 6.3 V IRMS= 3.52 A	3	$0.29	 CAPSMT_62_E61 53 mm²
7.	Cramp	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
8.	Cres	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²

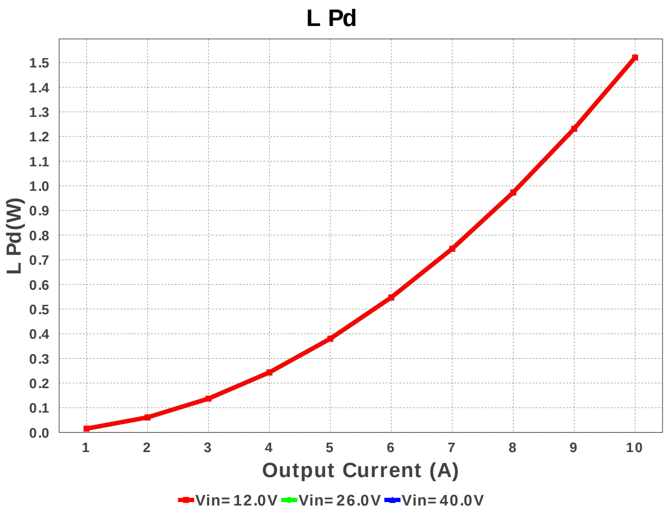
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Css	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
10.	Cvcc	MuRata	GRM188R61A105KA61D Series= X5R	Cap= 1.0 uF ESR= 6.065 mOhm VDC= 10.0 V IRMS= 1.30675 A	1	$0.01	0603 5 mm^2
11.	D1	NXP Semiconductor	PMEG6010CEH,115	VF@Io= 570.0 mV VRRM= 60.0 V	1	$0.04	SOD-123F 12 mm^2
12.	L1	Coilcraft	XAL1010-822MEB	L= 8.2 µH DCR= 11.7 mOhm	1	$1.71	XAL1010 160 mm^2
13.	M1	Texas Instruments	CSD18563Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	$0.68	TRANS_NexFET_Q5A 55 mm^2
14.	M2	Texas Instruments	CSD19531Q5A	VdsMax= 100.0 V IdsMax= 16.0 Amps	1	$1.01	TRANS_NexFET_Q5A 55 mm^2
15.	Rcomp	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
16.	Rfb1	Vishay-Dale	CRCW04021K07FKED Series= CRCW..e3	Res= 1.07 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
17.	Rfb2	Vishay-Dale	CRCW04025K49FKED Series= CRCW..e3	Res= 5.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
18.	Rramp	Vishay-Dale	CRCW0402124KFKED Series= CRCW..e3	Res= 124.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
19.	Rsense	Susumu Co Ltd	PRL1632-R008-F-T1 Series= PRL1632	Res= 8.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	0612 11 mm^2
20.	Rt	Vishay-Dale	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
21.	Ruv1	Vishay-Dale	CRCW04027K32FKED Series= CRCW..e3	Res= 7.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
22.	Ruv2	Vishay-Dale	CRCW040251K1FKED Series= CRCW..e3	Res= 51.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
23.	U1	Texas Instruments	LM25117PMHX/NOPB	Switcher	1	$1.70	PWP0020A 71 mm^2

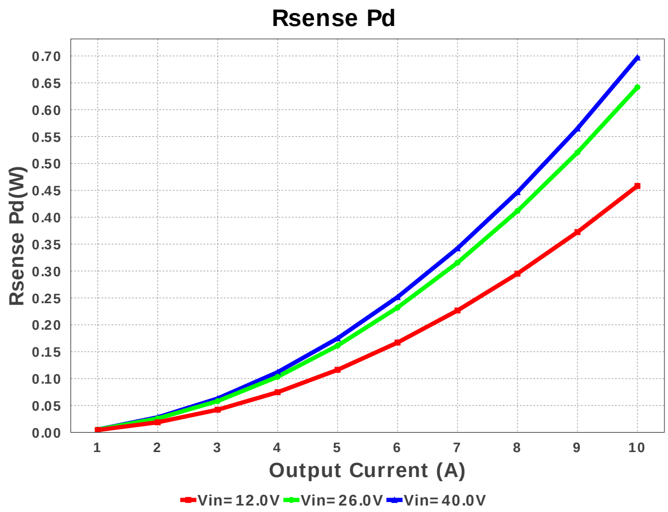

IC Tj
IC Tj(degC)
55.0
52.5
50.0
47.5
45.0
42.5
40.0
37.5
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

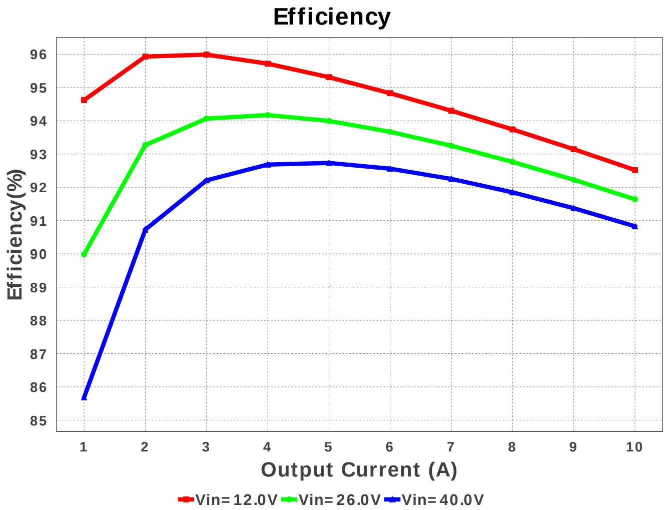

Duty Cycle
Duty Cycle(%)
42.5
40.0
37.5
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

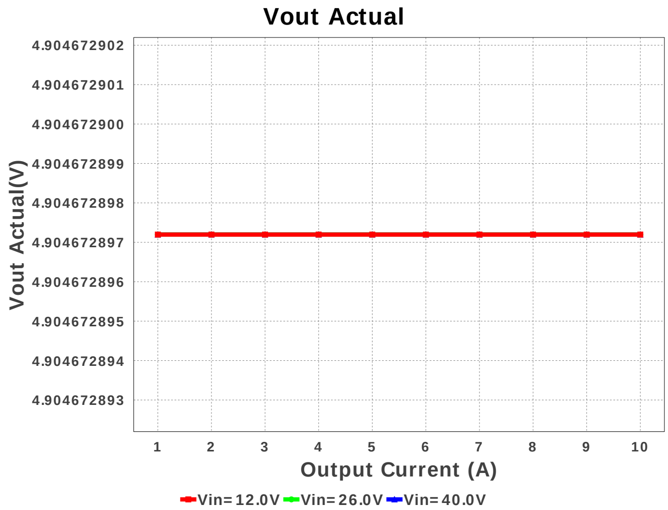

Cin IRMS
Cin IRMS(A)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

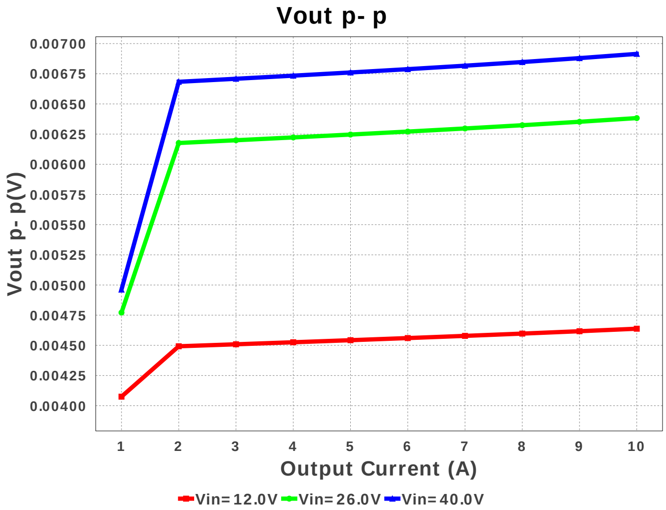

M2 PdSw
M2 PdSw(W)
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

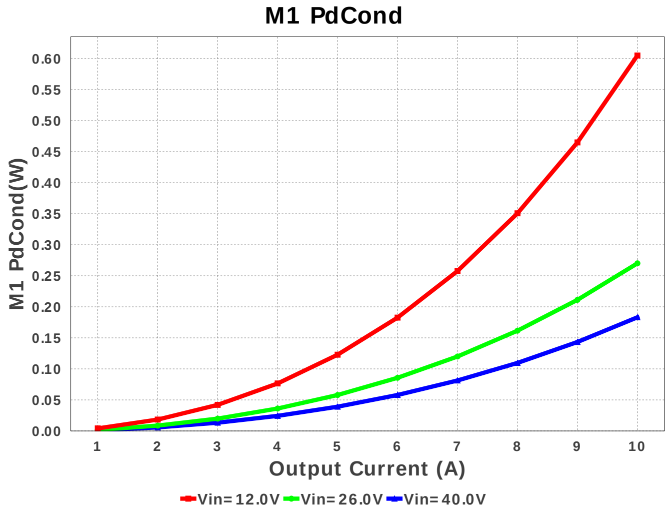

L Pd
L Pd(W)
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

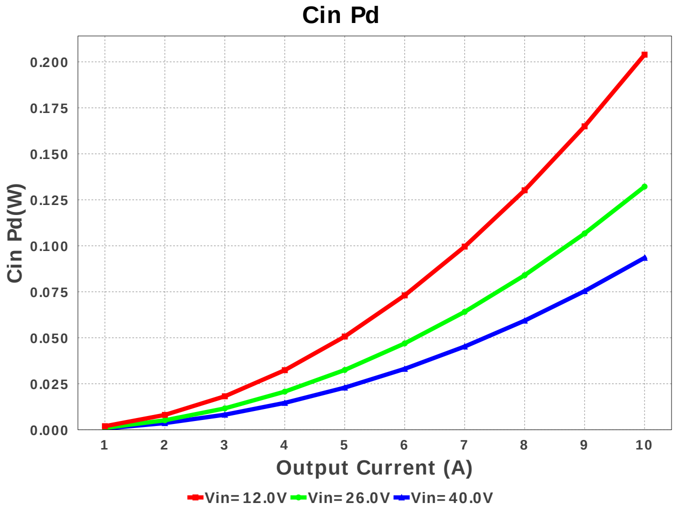

Rsense Pd
Rsense Pd(W)
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

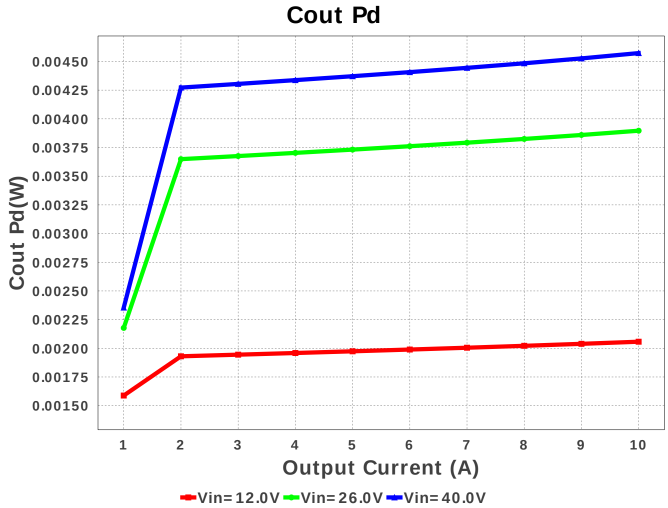

Efficiency
Efficiency(%)
96
95
94
93
92
91
90
89
88
87
86
85
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

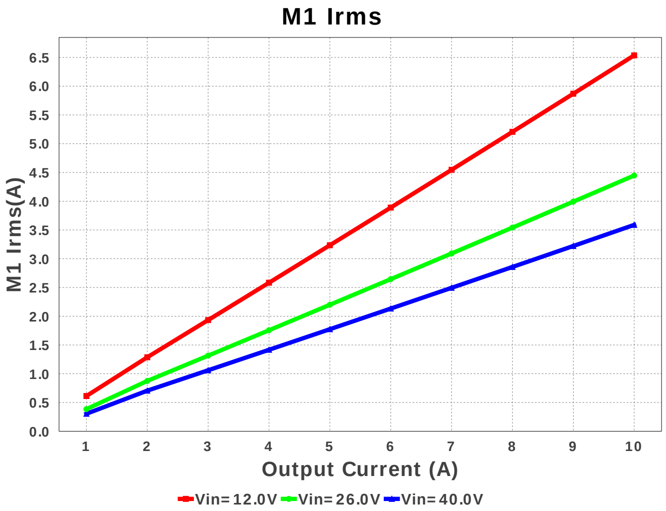

Vout Actual
Vout Actual(V)
4.904672902
4.904672901
4.904672900
4.904672899
4.904672898
4.904672897
4.904672896
4.904672895
4.904672894
4.904672893
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

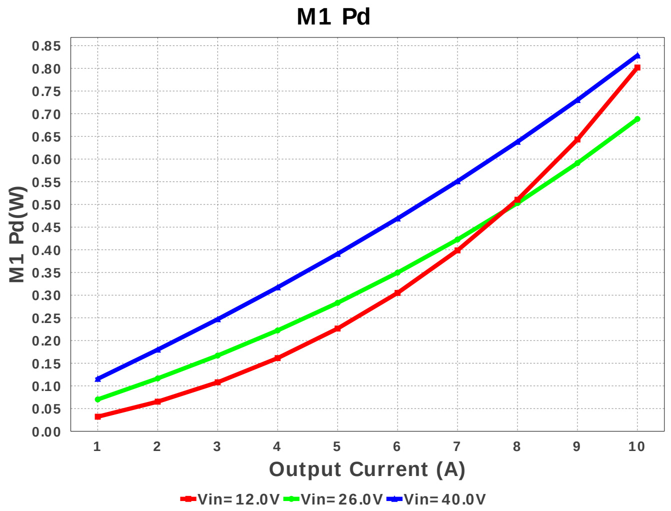

Vout p-p
Vout p-p(V)
0.00700
0.00675
0.00650
0.00625
0.00600
0.00575
0.00550
0.00525
0.00500
0.00475
0.00450
0.00425
0.00400
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

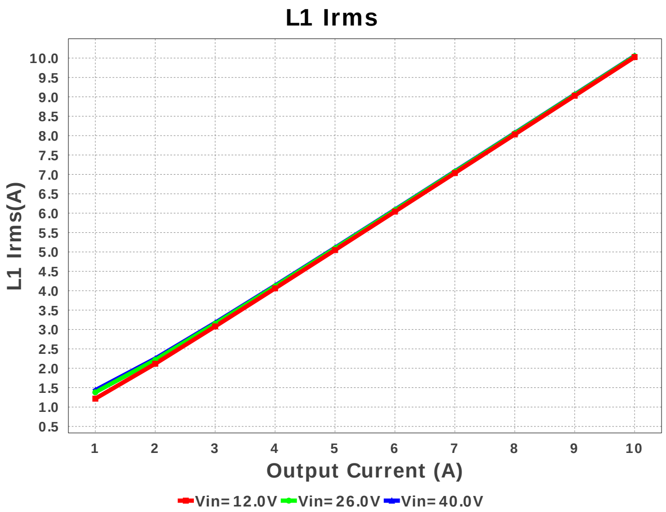

M1 PdCond
M1 PdCond(W)
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

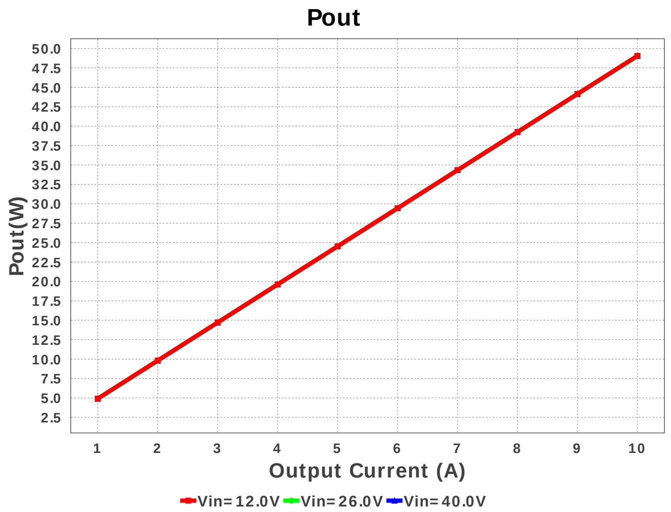

Cin Pd
Cin Pd(W)
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

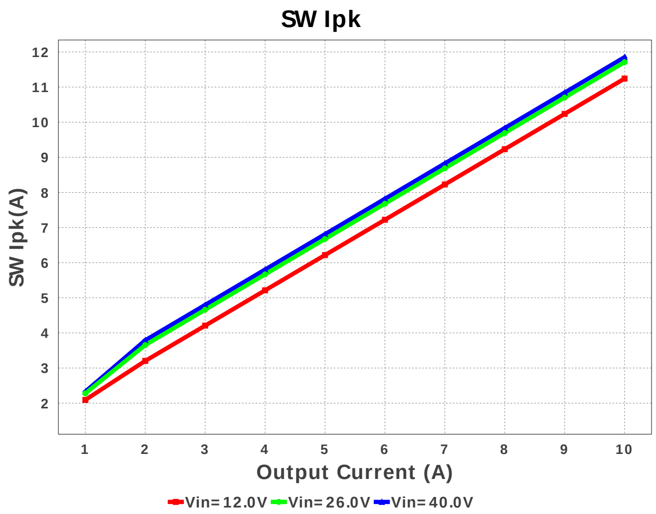

Cout Pd
Cout Pd(W)
0.00450
0.00425
0.00400
0.00375
0.00350
0.00325
0.00300
0.00275
0.00250
0.00225
0.00200
0.00175
0.00150
1 2 3 4 5 6 7 8 9 10
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

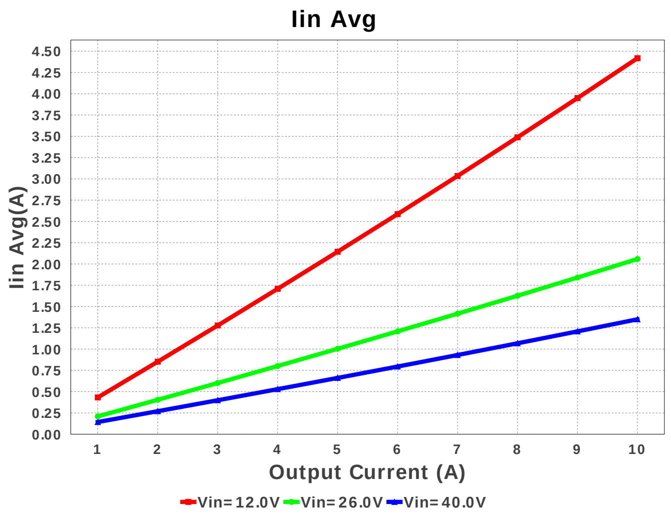

M1 Irms
M1 Irms(A)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

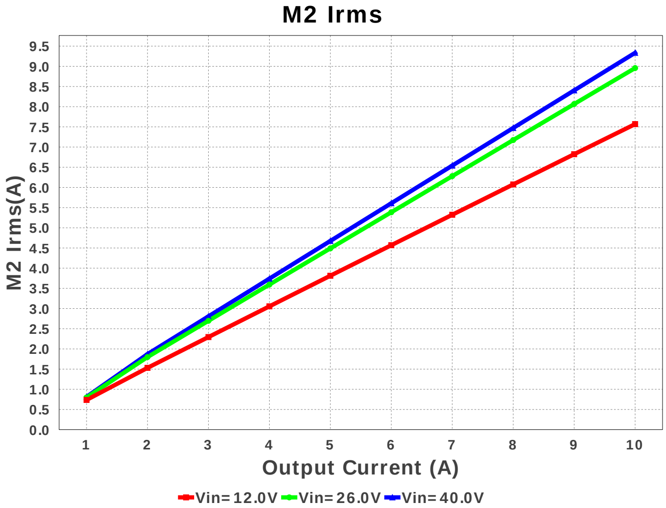

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

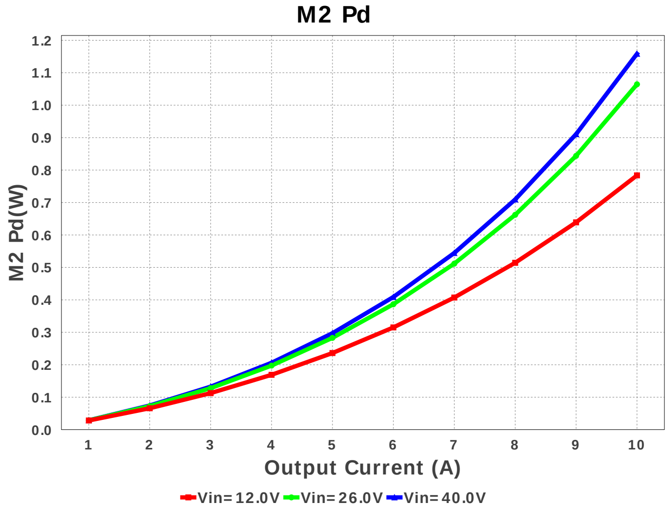

L1 Irms
L1 Irms(A)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

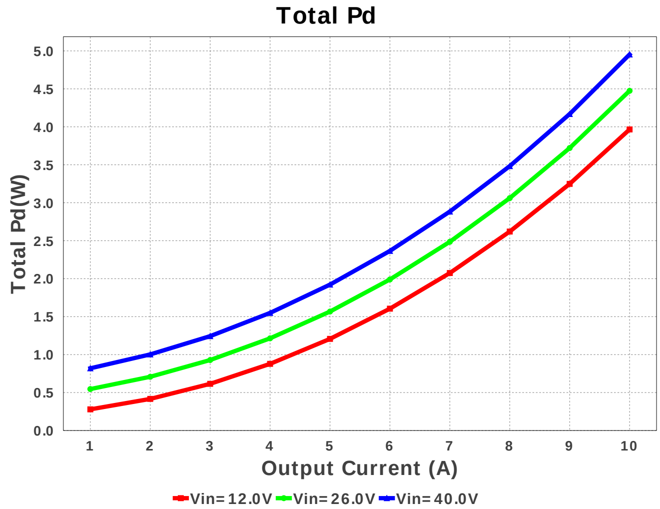

Pout
Pout(W)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

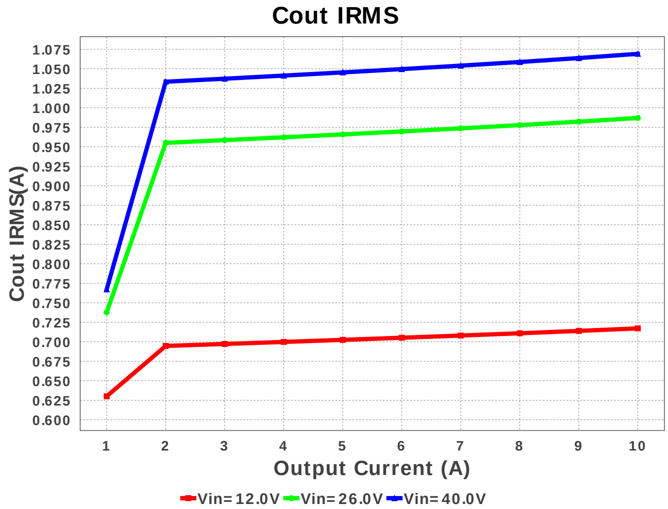

SW Ipk
SW Ipk(A)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

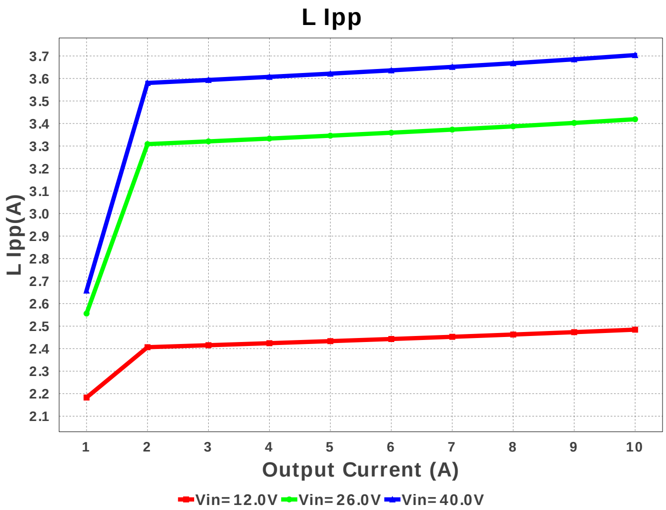

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

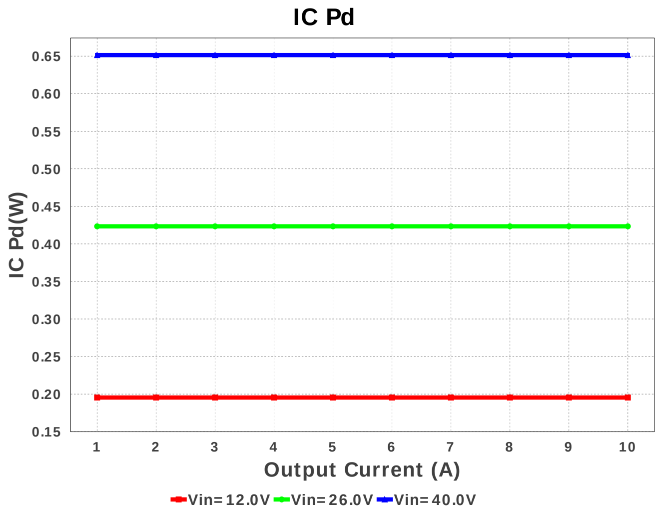

M2 Irms
M2 Irms(A)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

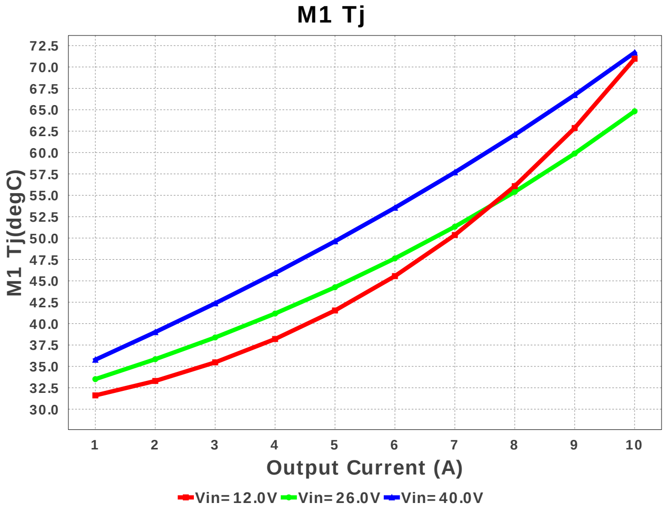

M2 Pd
M2 Pd(W)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

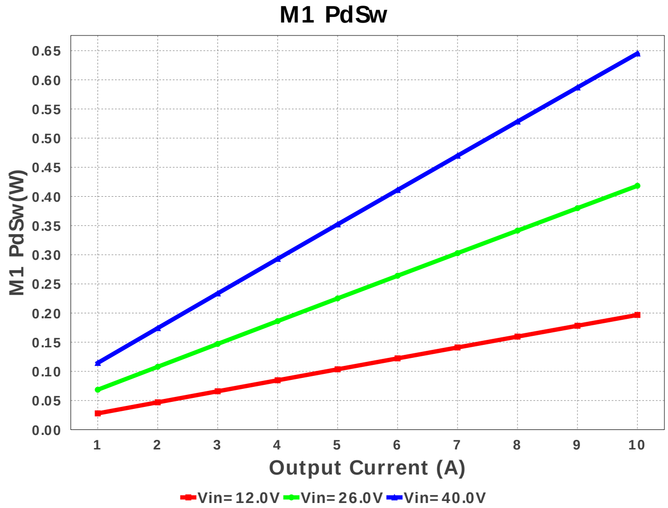

Total Pd
Total Pd(W)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

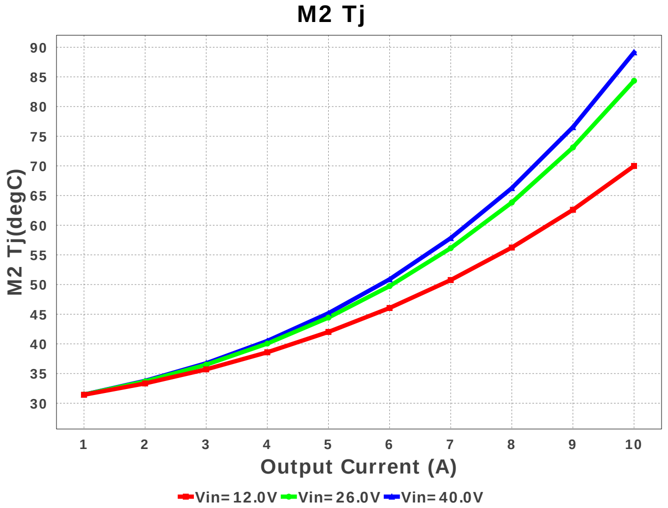

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

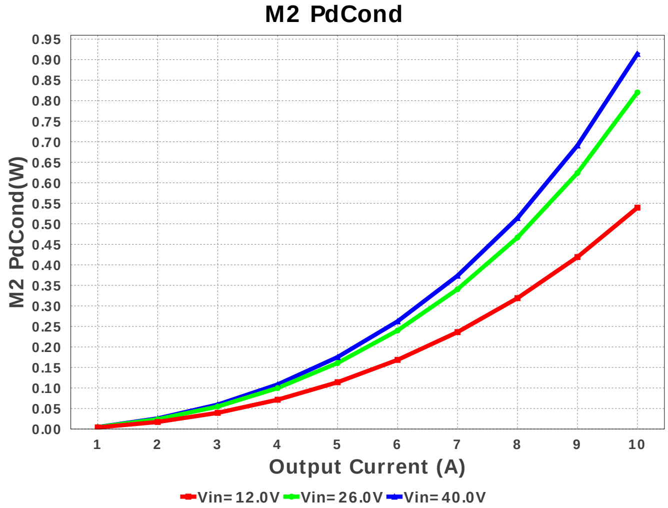

L Ipp
L Ipp(A)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V

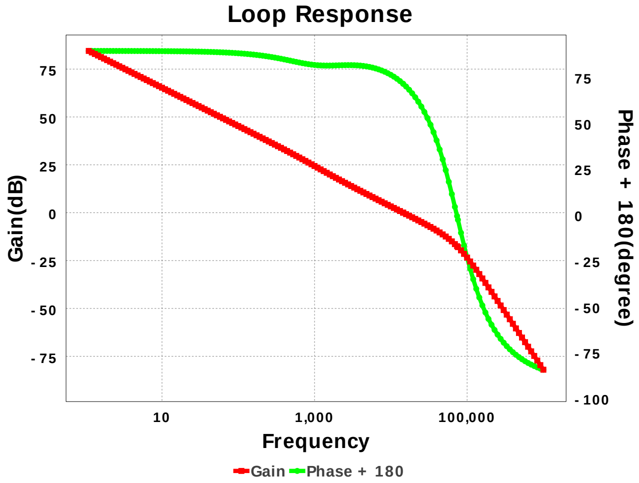

IC Pd
IC Pd(W)
Output Current (A)
Vin=12.0V Vin=26.0V Vin=40.0V











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	3.349 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.069 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	1.35 A	Current	Average input current
4.	L Ipp	3.704 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	10.056 A	Current	Inductor ripple current
6.	M1 Irms	3.588 A	Current	MOSFET RMS ripple current
7.	M2 Irms	9.334 A	Current	MOSFET RMS ripple current
8.	SW Ipk	11.852 A	Current	Peak switch current
9.	BOM Count	27	General	Total Design BOM count
10.	FootPrint	908.0 mm^2	General	Total Foot Print Area of BOM components
11.	Frequency	148.792 kHz	General	Switching frequency

#	Name	Value	Category	Description
12.	IC Tolerance	12.0 mV	General	IC Feedback Tolerance
13.	Pout	49.047 W	General	Total output power
14.	Total BOM	$10.1	General	Total BOM Cost
15.	Low Freq Gain	84.487 dB	Op_Point	Gain at 10Hz
16.	Vout Actual	4.905 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
17.	Vout OP	4.905 V	Op_Point	Operational Output Voltage
18.	Cross Freq	14.567 kHz	Op_point	Bode plot crossover frequency
19.	Duty Cycle	12.877 %	Op_point	Duty cycle
20.	Efficiency	90.824 %	Op_point	Steady state efficiency
21.	Gain Marg	-17.502 dB	Op_point	Bode Plot Gain Margin
22.	IC Tj	56.114 degC	Op_point	IC junction temperature
23.	IOUT_OP	10.0 A	Op_point	Iout operating point
24.	M1 Tj	71.683 degC	Op_point	M1 MOSFET junction temperature
25.	M2 Tj	89.14 degC	Op_point	M2 MOSFET junction temperature
26.	Phase Marg	72.018 deg	Op_point	Bode Plot Phase Margin
27.	VIN_OP	40.0 V	Op_point	Vin operating point
28.	Vout p-p	6.915 mV	Op_point	Peak-to-peak output ripple voltage
29.	Cin Pd	93.488 mW	Power	Input capacitor power dissipation
30.	Cout Pd	4.573 mW	Power	Output capacitor power dissipation
31.	IC Pd	652.857 mW	Power	IC power dissipation
32.	L Pd	1.521 W	Power	Inductor power dissipation
33.	M1 Pd	828.369 mW	Power	M1 MOSFET total power dissipation
34.	M1 PdCond	183.123 mW	Power	M1 MOSFET conduction losses
35.	M1 PdSw	645.246 mW	Power	M1 MOSFET switching losses
36.	M2 Pd	1.158 W	Power	M2 MOSFET total power dissipation
37.	M2 PdCond	914.053 mW	Power	M2 MOSFET conduction losses
38.	M2 PdSw	244.261 mW	Power	M2 MOSFET switching losses
39.	Rsense Pd	696.987 mW	Power	Rsense Power Dissipation
40.	Total Pd	4.955 W	Power	Total Power Dissipation
41.	Vout Tolerance	3.216 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	10.0	Maximum Output Current
2.	VinMax	40.0	Maximum input voltage
3.	VinMin	12.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM25117	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. Outline The LM25117 is a synchronous buck controller intended for step-down regulator applications from a high voltage or widely varying input supply. The control method is based upon current mode control utilizing an emulated current ramp. Current mode control provides inherent line feed-forward, cycle-by-cycle current limiting and ease of loop compensation. The use of an emulated control ramp reduces noise sensitivity of the pulse-width modulation circuit, allowing reliable control of very small duty cycles necessary in high input voltage applications. External Vcc An output voltage derived bias supply can be applied to the VCC pin to reduce the controller power dissipation at higher input voltage. This can also relax constraints on the driver supply current if your external source can supply more than the LM25117 internal regulator. Please see Datasheet for more information. Diode Emulation A fully synchronous buck regulator implemented with a freewheel MOSFET rather than a diode has the capability to sink current from the output in certain conditions such as light load, over-voltage or pre-bias startup. The LM25117 provides a diode emulation feature that can be enabled to prevent reverse (drain to source) current flow in the low side free-wheel MOSFET.

2. LM25117 Product Folder : http://www.ti.com/product/LM25117 : contains the data sheet and other resources.