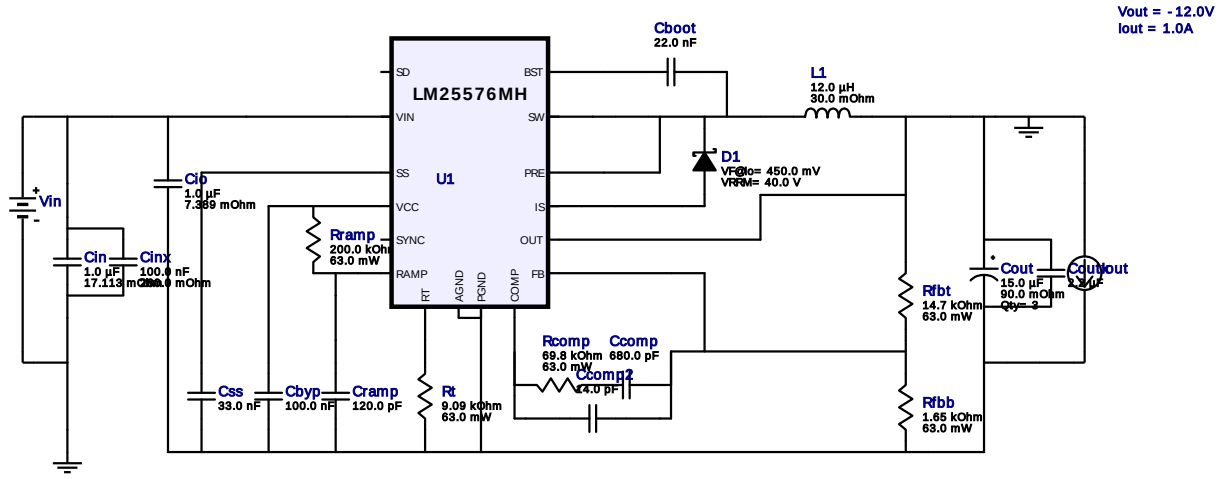
WEBENCH® Design Report

VinMin = 10.0V
VinMax = 14.0V
Vout = -12.0V
Iout = 1.0A

Device = LM25576MHX/NOPB
Topology = Inverting_Buck_Boost
Created = 1/27/16 1:02:54 AM
BOM Cost = $4.68
BOM Count = 21
Total Pd = 1.55W

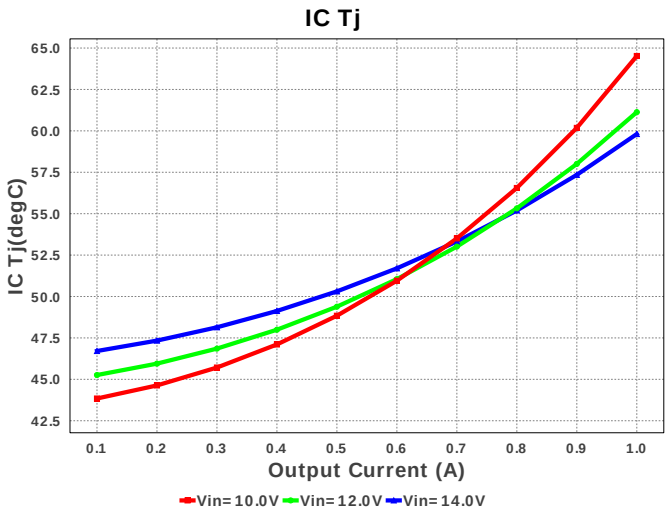
Design : 4079392/13 LM25576MHX/NOPB
LM25576MHX/NOPB 10.0V-14.0V to -12.00V @ 1.0A

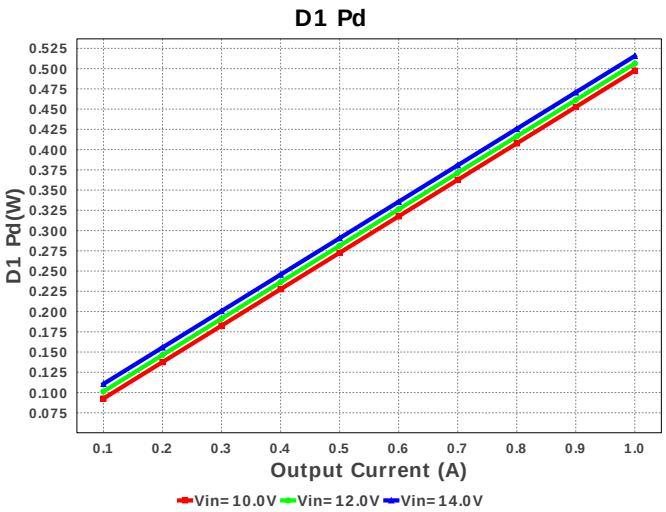


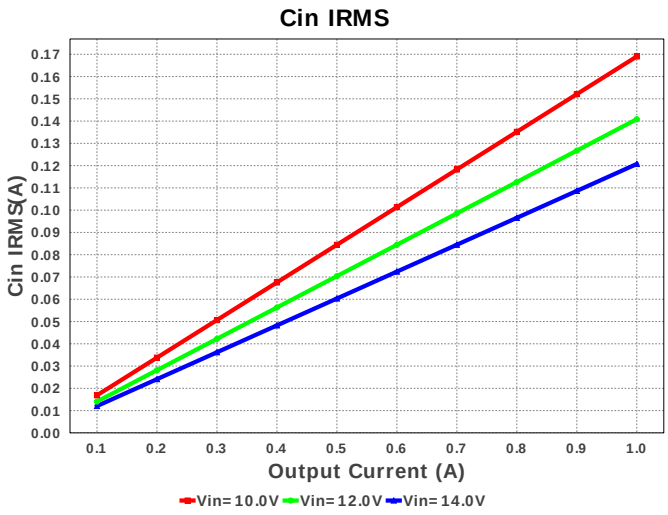
Electrical BOM

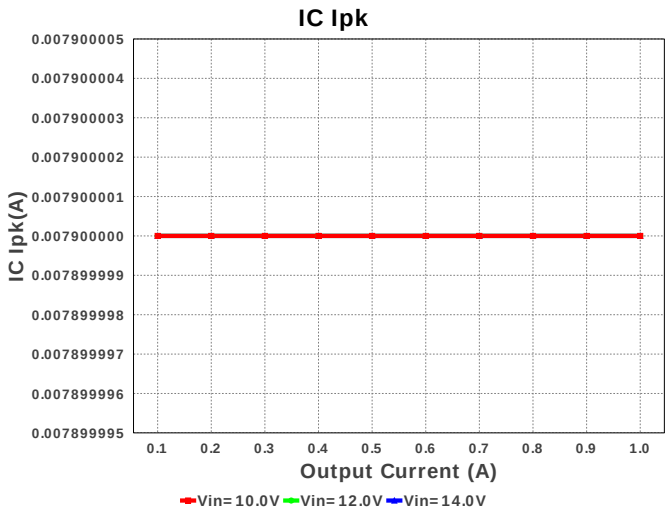
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R71E223KA61D Series= X7R	Cap= 22.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cbyp	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
3.	Ccomp	Yageo America	CC0805KRX7R9BB681 Series= X7R	Cap= 680.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccomp2	Samsung Electro-Mechanics	CL21C140JBANNNC Series= C0G/NP0	Cap= 14.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cin	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	$0.01	0603 5 mm²
6.	Cinx	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 mm²
7.	Cio	MuRata	GRM31MR71H105KA88L Series= X7R	Cap= 1.0 uF ESR= 7.389 mOhm VDC= 50.0 V IRMS= 979.22 mA	1	$0.05	1206 11 mm²
8.	Cout	Panasonic	16TQC15M Series= TQC	Cap= 15.0 uF ESR= 90.0 mOhm VDC= 16.0 V IRMS= 1.0 A	3	$0.66	3528-21 17 mm²
9.	Coutx	Taiyo Yuden	TMK212BJ225KG-T Series= X5R	Cap= 2.2 uF VDC= 20.0 V IRMS= 0.0 A	1	$0.04	0805 7 mm²
10.	Cramp	Samsung Electro-Mechanics	CL21C121JB61PNC Series= C0G/NP0	Cap= 120.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²

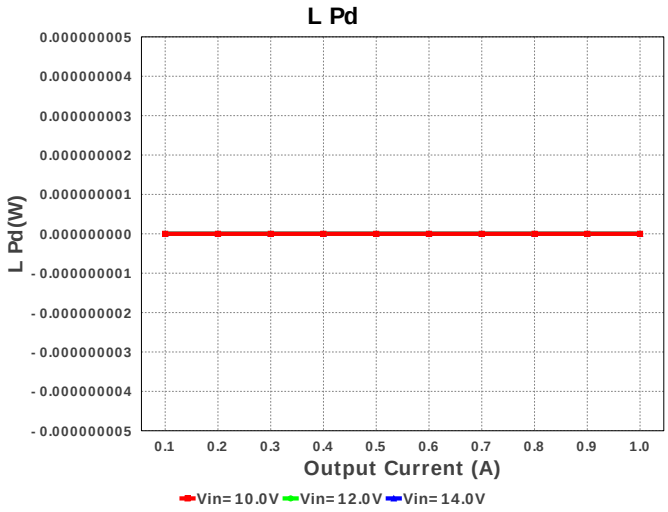
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Css	MuRata	GRM033R60J333KE01D Series= X5R	Cap= 33.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
12.	D1	Diodes Inc.	B340LA-13-F	VF@Io= 450.0 mV VRRM= 40.0 V	1	$0.13	SMA 37 mm²
13.	L1	Bourns	SDR1307-120ML	L= 12.0 µH DCR= 30.0 mOhm	1	$0.35	SDR1307 227 mm²
14.	Rcomp	Vishay-Dale	CRCW040269K8FKED Series= CRCW..e3	Res= 69.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
15.	Rfbb	Vishay-Dale	CRCW04021K65FKED Series= CRCW..e3	Res= 1.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
16.	Rfbt	Vishay-Dale	CRCW040214K7FKED Series= CRCW..e3	Res= 14.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
17.	Rramp	Vishay-Dale	CRCW0402200KFKED Series= CRCW..e3	Res= 200.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
18.	Rt	Vishay-Dale	CRCW04029K09FKED Series= CRCW..e3	Res= 9.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
19.	U1	Texas Instruments	LM25576MHX/NOPB	Switcher	1	$2.00	MXA20A 71 mm²

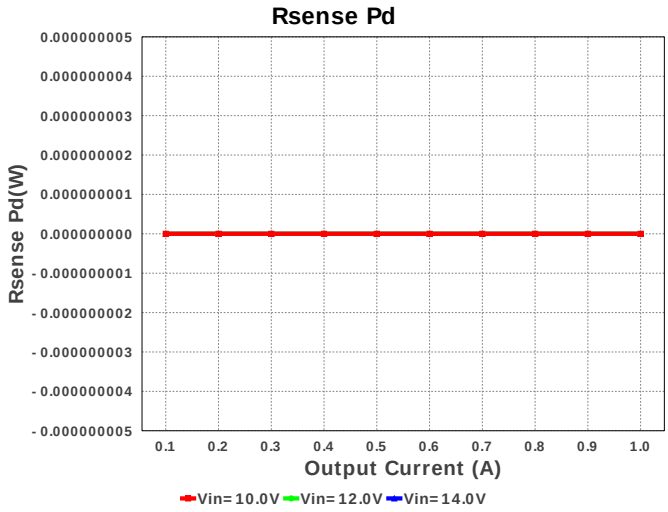


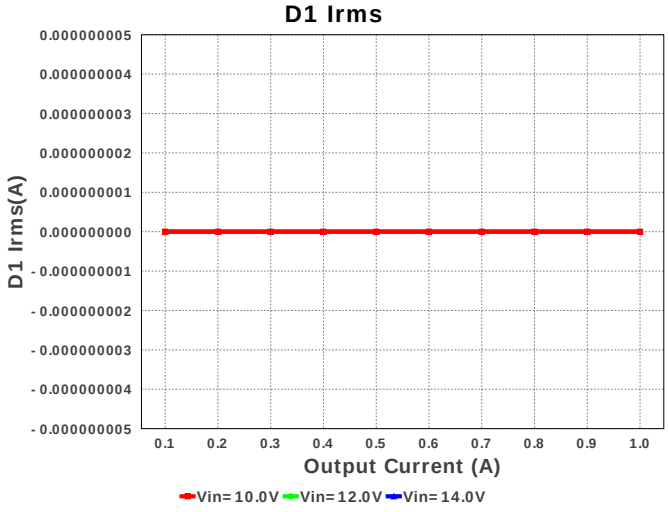


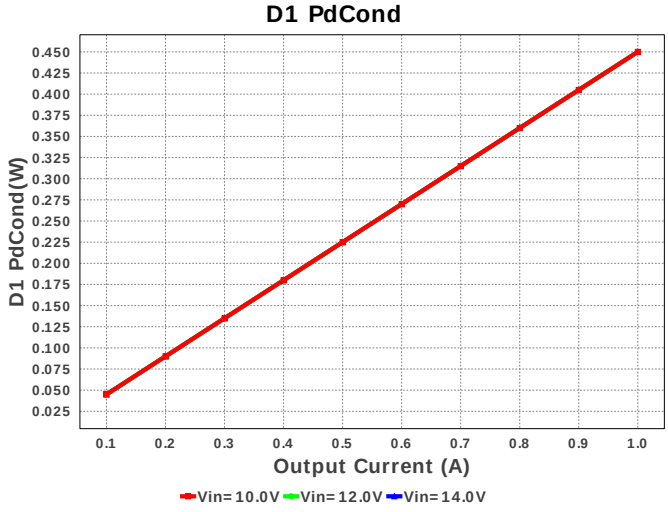




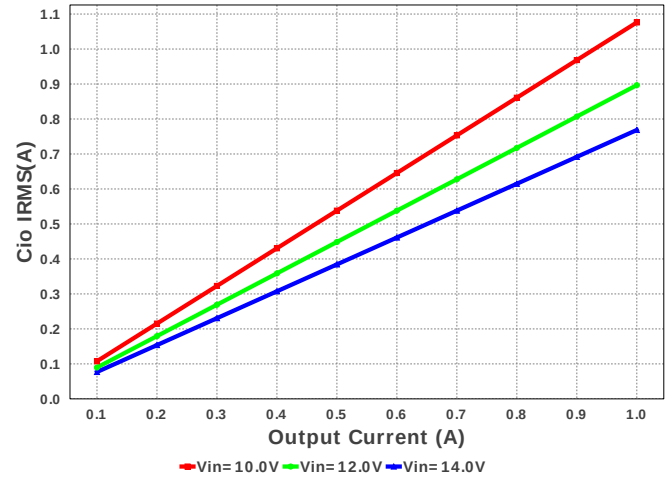




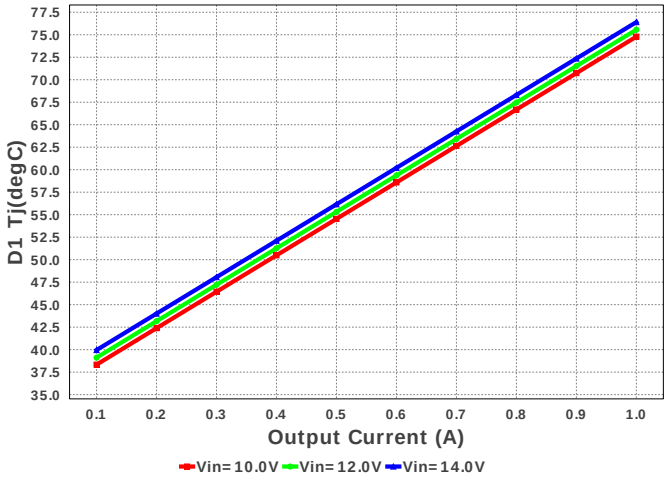




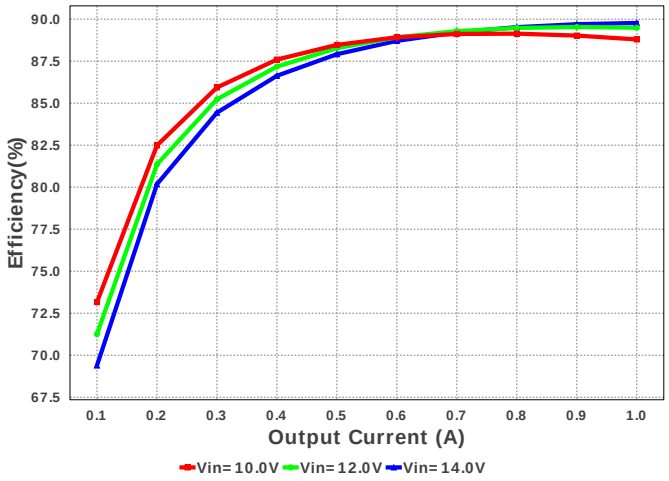
Cio IRMS



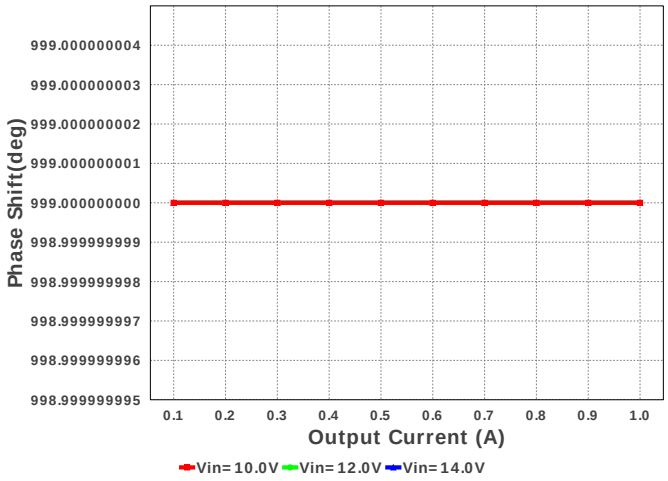
D1 Tj



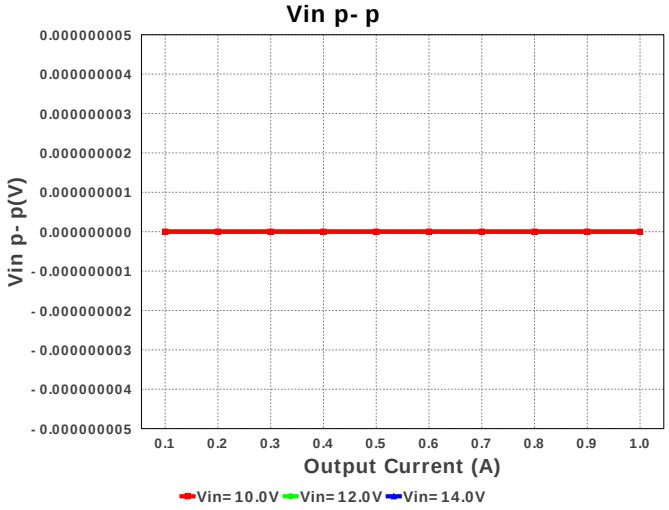
Efficiency



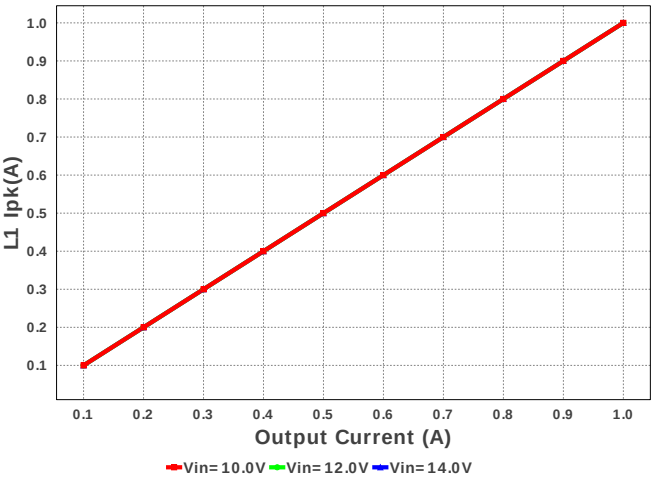
Phase Shift

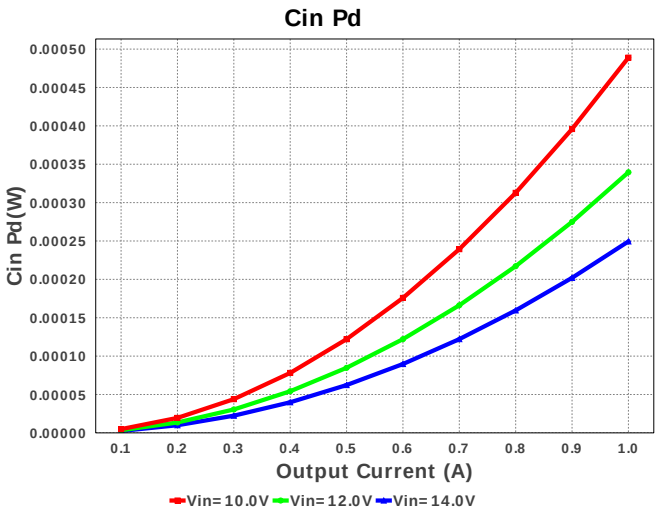


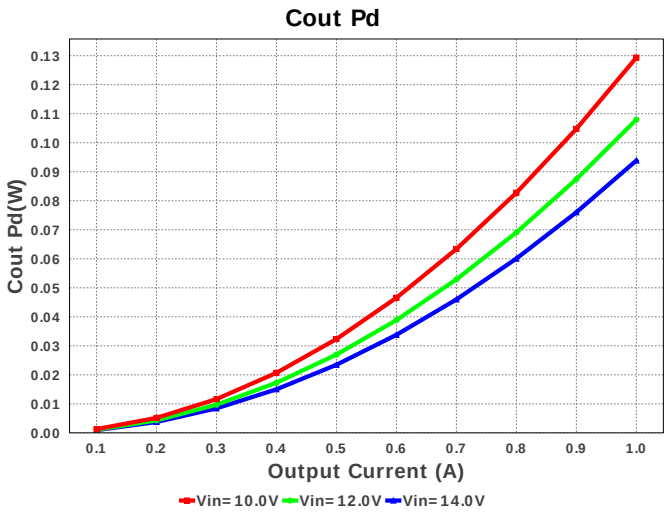
Vin p- p

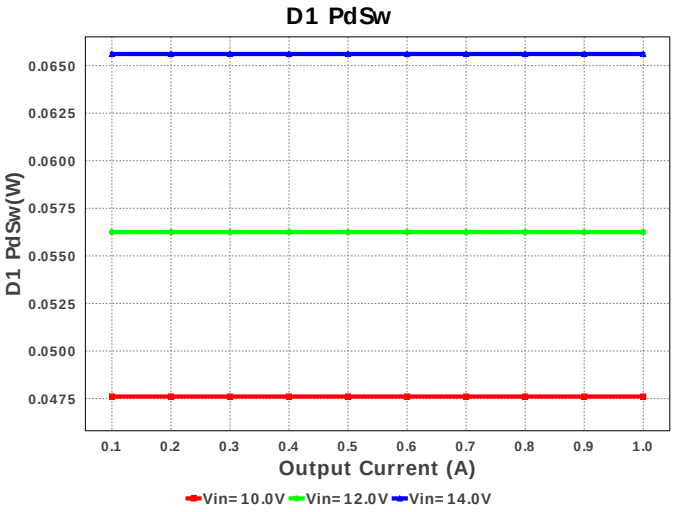


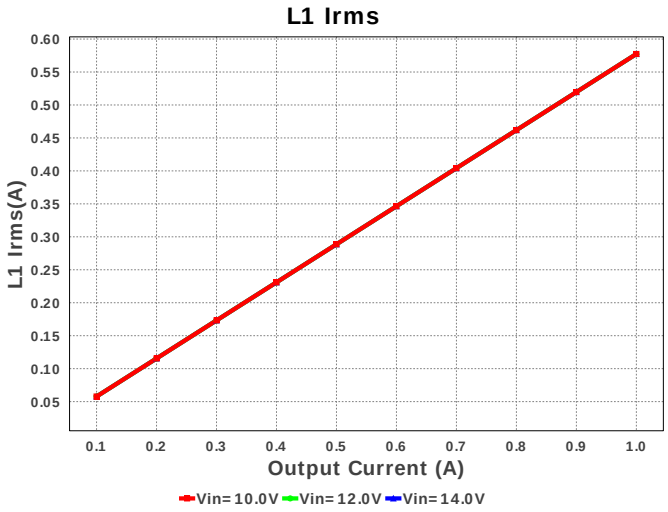
L1 Ipk

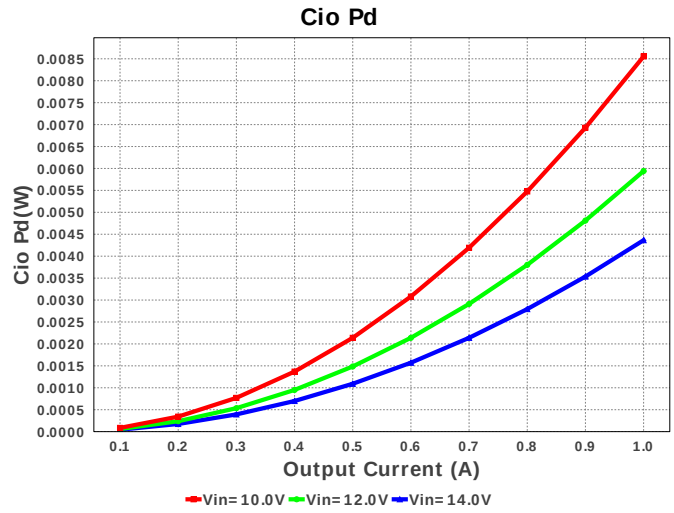


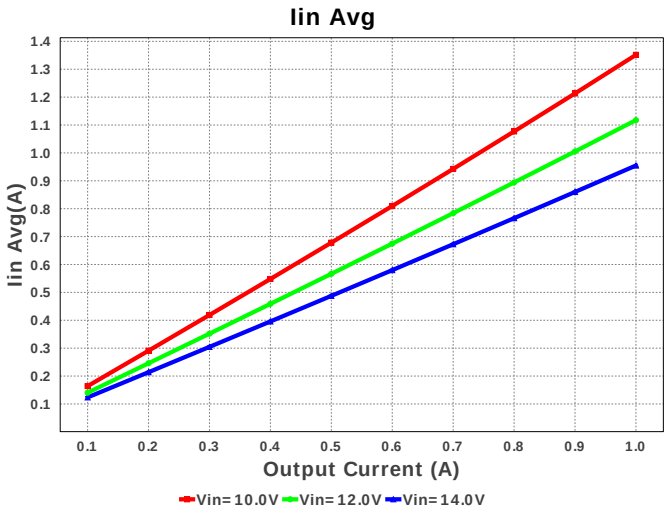


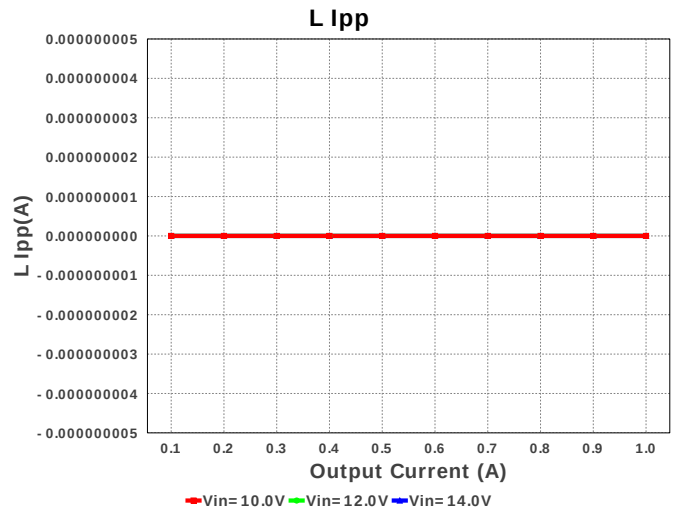


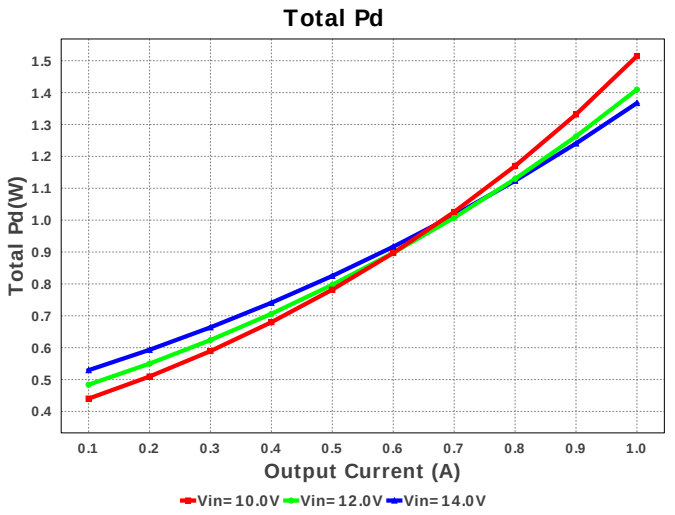


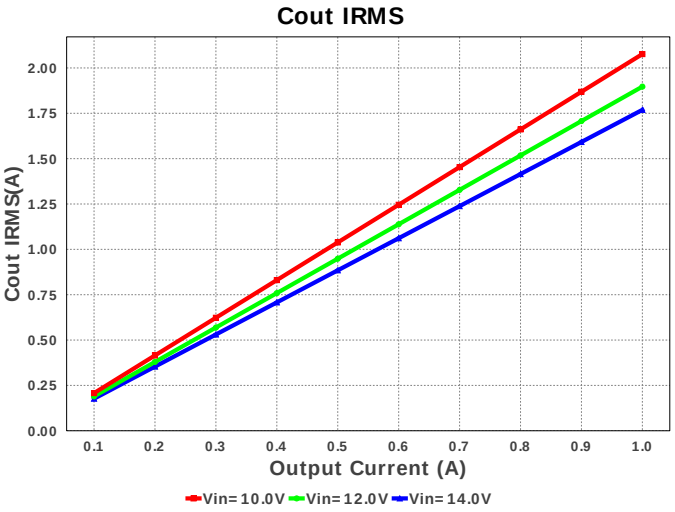


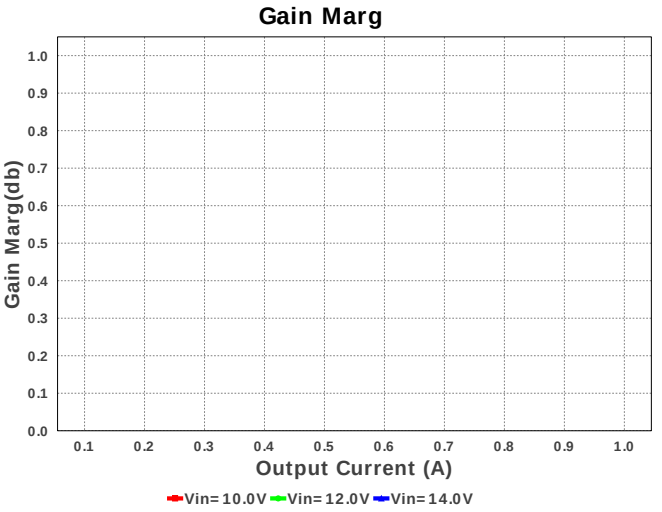


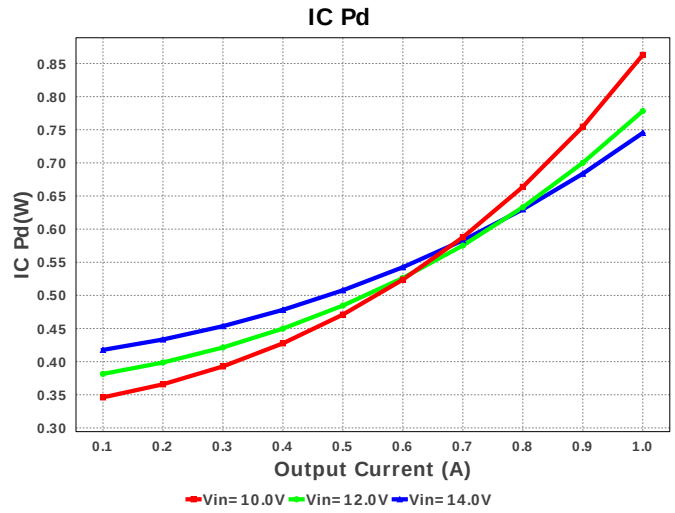


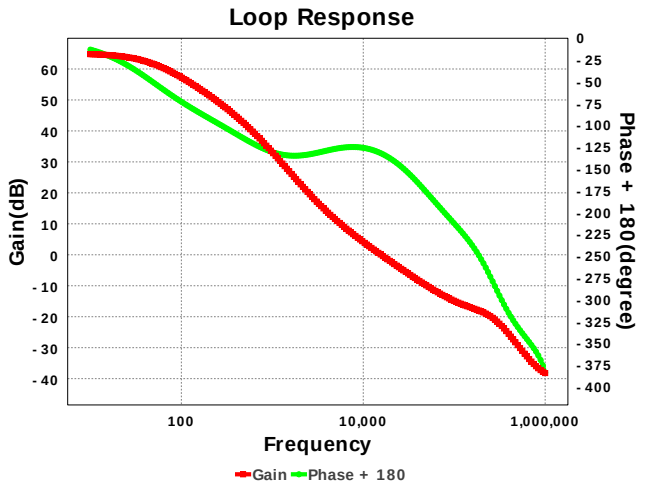












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	524.755 mA	Current	Input capacitor RMS ripple current
2.	Cio IRMS	570.296 mA	Current	Input to output capacitor RMS ripple current
3.	Cout IRMS	1.217 A	Current	Output capacitor RMS ripple current
4.	D1 Irms	1.192 A	Current	D1 Irms
5.	IC Ipk	5.875 mA	Current	Peak switch current in IC
6.	Iin Avg	1.355 A	Current	Average input current
7.	L Ipp	817.445 mA	Current	Peak-to-peak output inductor ripple current
8.	L1 Ipk	2.734 A	Current	Inductor peak current
9.	L1 Irms	1.579 A	Current	Inductor ripple current
10.	BOM Count	21	General	Total Design BOM count
11.	FootPrint	459.0 mm^2	General	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
12.	Frequency	550.0 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	Total BOM	$4.68	General	Total BOM Cost
15.	D1 Tj	72.857 degC	Op_Point	D1 junction temperature
16.	Vin p-p	298.756 mV	Op_Point	Peak-to-peak input voltage
17.	Cross Freq	15.522 kHz	Op_point	Bode plot crossover frequency
18.	Duty Cycle	57.0 %	Op_point	Duty cycle
19.	Efficiency	88.586 %	Op_point	Steady state efficiency
20.	Gain Marg	10.806 db	Op_point	Bode Plot Gain Margin
21.	IC Tj	58.028 degC	Op_point	IC junction temperature
22.	IOUT_OP	1.0 A	Op_point	Iout operating point
23.	Phase Marg	48.164 deg	Op_point	Bode Plot Phase Margin
24.	Phase Shift	45.2 deg	Op_point	Bode Plot Phase Shift
25.	VIN_OP	10.0 V	Op_point	Vin operating point
26.	Vout p-p	112.694 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	4.712 mW	Power	Input capacitor power dissipation
28.	Cio Pd	2.403 mW	Power	Input to output capacitor power dissipation
29.	Cout Pd	44.461 mW	Power	Output capacitor power dissipation
30.	D1 Pd	476.186 mW	Power	Diode power dissipation
31.	D1 PdCond	450.0 mW	Power	Diode conduction losses
32.	D1 PdSw	26.185 mW	Power	Diode switching losses
33.	IC Pd	700.698 mW	Power	IC power dissipation
34.	L Pd	175.515 mW	Power	Inductor power dissipation
35.	Rsense Pd	99.958 mW	Power	LED Current Rsns Power Dissipation
36.	Total Pd	1.546 W	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	-12.0	Output Voltage
5.	base_pn	LM25576	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LM25576** Product Folder : http://www.ti.com/product/LM25576 : contains the data sheet and other resources.