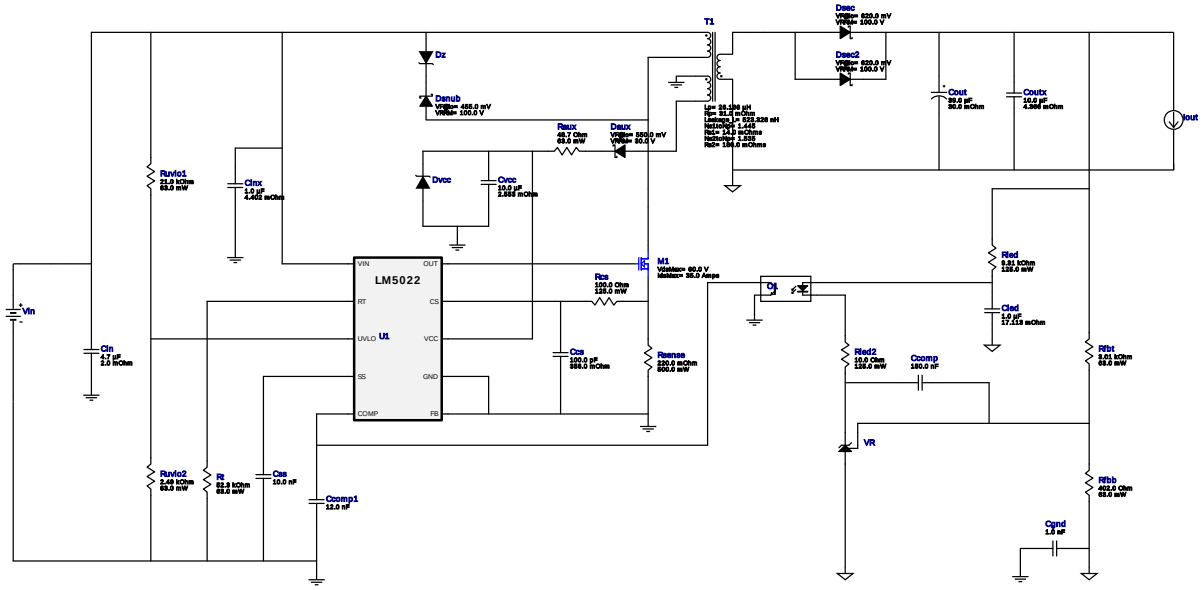
WEBENCH® Design Report

VinMin = 12.0V
VinMax = 18.0V
Vout = 10.5V
Iout = 0.55A

Device = LM5022MM/NOPB
Topology = Flyback
Created = 2017-05-31 08:40:37.773
BOM Cost = $0.00
BOM Count = 32
Total Pd = 0.8W

Design : 916945/918 LM5022MM/NOPB
LM5022MM/NOPB 12.0V-18.0V to 10.50V @ 0.55A

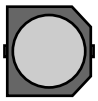
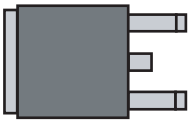


My Comments

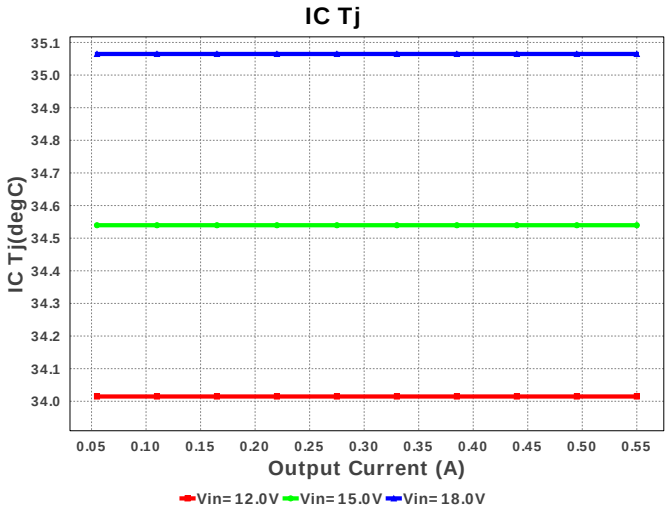
12-18Vin, 10.5Vout isolated 550mA

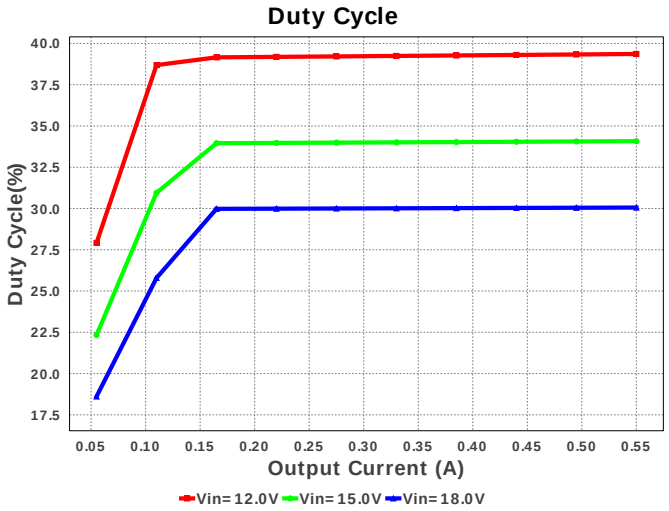
Electrical BOM

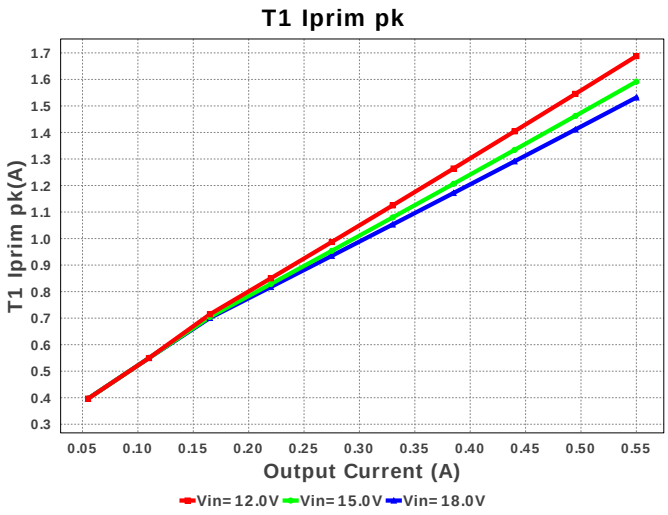
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	MuRata	GRM155R60J154KE01D Series= X5R	Cap= 150.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.02	0402 3 mm²
2.	Ccomp1	MuRata	GRM033C80J123KE01D Series= X6S	Cap= 12.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
3.	Ccs	AVX	08055A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 356.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cgnd	MuRata	GRM21AR72E102KW01D Series= X7R	Cap= 1.0 nF VDC= 250.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
5.	Cin	MuRata	GRM32ER71H475KA88L Series= X7R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 50.0 V IRMS= 5.35 A	1	$0.20	1210 15 mm²

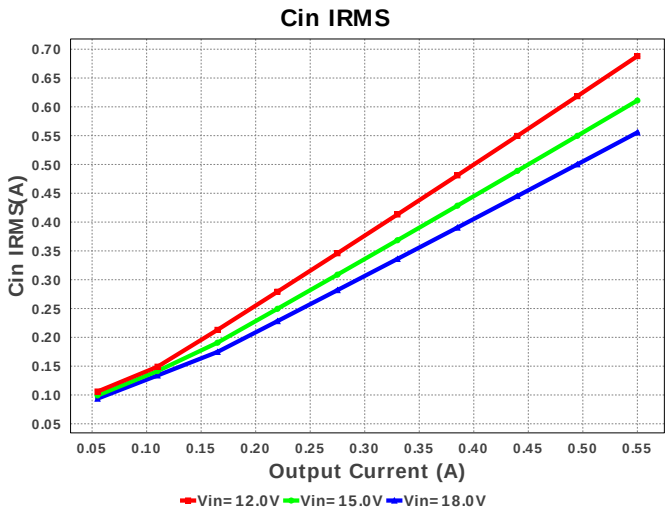
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	Cinx	MuRata	GRM21BR71H105KA12L Series= X7R	Cap= 1.0 uF ESR= 4.402 mOhm VDC= 50.0 V IRMS= 1.677 A	1	$0.07	 0805 7 mm²
7.	Cled	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	$0.01	 0603 5 mm²
8.	Cout	Panasonic	35SVPF39M Series= ?	Cap= 39.0 uF ESR= 30.0 mOhm VDC= 35.0 V IRMS= 2.8 A	1	$0.53	 CAPSMT_62_E7 106 mm²
9.	Coutx	MuRata	GRM31CR71E106KA12L Series= X7R	Cap= 10.0 uF ESR= 4.366 mOhm VDC= 25.0 V IRMS= 2.8022 A	1	$0.06	 1206_190 11 mm²
10.	Css	MuRata	GRM155R71E103KA01D Series= X7R	Cap= 10.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
11.	Cvcc	TDK	C3216X6S1E106K Series= X6S	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.12	 1206 11 mm²
12.	Daux	Panasonic	DB2S31600L	VF@Io= 550.0 mV VRRM= 30.0 V	1	$0.04	 SOD-523 5 mm²
13.	Dsec	Vishay-Semiconductor	SS2PH10-M3	VF@Io= 620.0 mV VRRM= 100.0 V	1	$0.14	 DO-220AA 14 mm²
14.	Dsec2	Vishay-Semiconductor	SS2PH10-M3	VF@Io= 620.0 mV VRRM= 100.0 V	1	$0.14	 DO-220AA 14 mm²
15.	Dsnub	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.39	 DDPAK 210 mm²
16.	Dvcc	Diodes Inc.	DFLZ12-7	Zener	1	$0.15	 PowerDI123 13 mm²
17.	Dz	ON Semiconductor	MMBZ5244BLT1G	Zener	1	$0.03	 SOT-23 14 mm²
18.	M1	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	$0.34	 DNH0008A 18 mm²
19.	O1	California Eastern Laboratories	PS2501L-1-A	Optocoupler	1	$0.23	 PS2501L 77 mm²
20.	Raux	Vishay-Dale	CRCW040248R7FKED Series= CRCW..e3	Res= 48.7 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Rcs	Vishay-Dale	CRCW0805100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²
22.	Rfbb	Vishay-Dale	CRCW0402402RFKED Series= CRCW..e3	Res= 402.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
23.	Rfbt	Vishay-Dale	CRCW04023K01FKED Series= CRCW..e3	Res= 3.01 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	Rled	Panasonic	ERJ-6ENF9311V Series= ERJ-6E	Res= 9.31 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	 0805 7 mm²

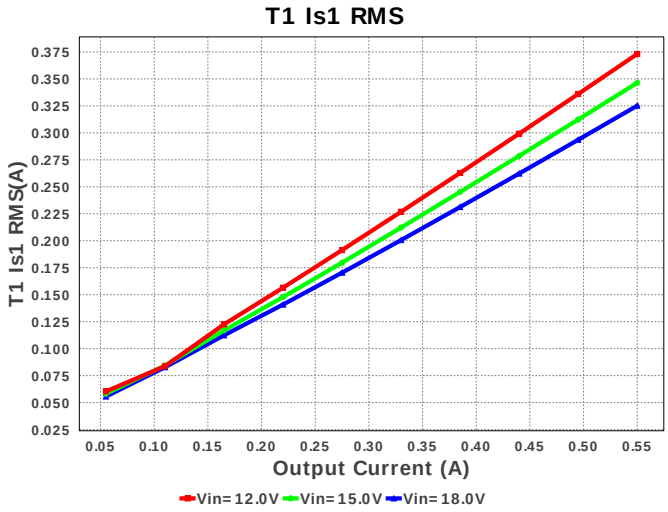
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
25.	Rled2	Vishay-Dale	CRCW080510R0FKEA Series= CRCW..e3	Res= 10.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
26.	Rsense	Rohm	MCR25JZHFLR220 Series= MCR25	Res= 220.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.04	1210 15 mm²
27.	Rt	Vishay-Dale	CRCW040252K3FKED Series= CRCW..e3	Res= 52.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
28.	Ruvlo1	Vishay-Dale	CRCW040221K0FKED Series= CRCW..e3	Res= 21.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
29.	Ruvlo2	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
30.	T1	CUSTOM	CUSTOM	Lp= 26.166 µH Rp= 31.0 mOhm Leakage_L= 523.328 nH Ns1toNp= 1.445 Rs1= 14.0 mOhms Ns2toNp= 1.535 Rs2= 180.0 mOhms	1	NA	CUSTOM 0 mm²
31.	U1	Texas Instruments	LM5022MM/NOPB	Switcher	1	$0.90	MUB10A 24 mm²
32.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	$0.16	R-PDSO-G3 16 mm²

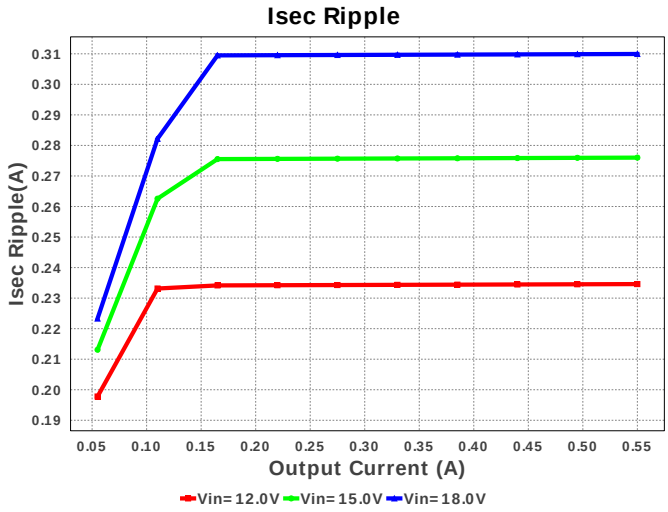


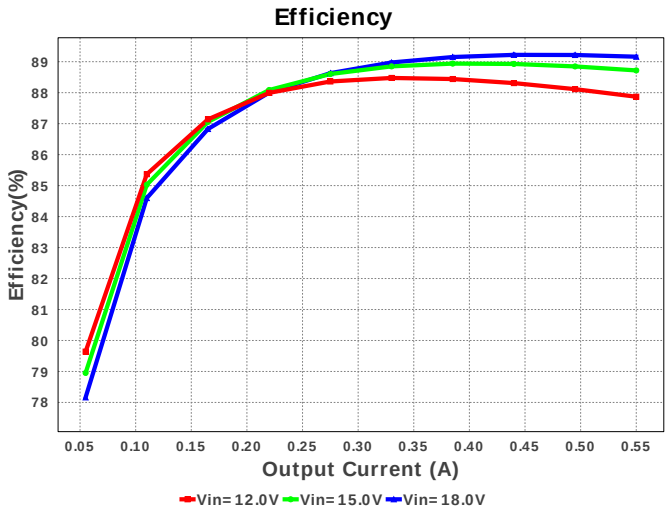


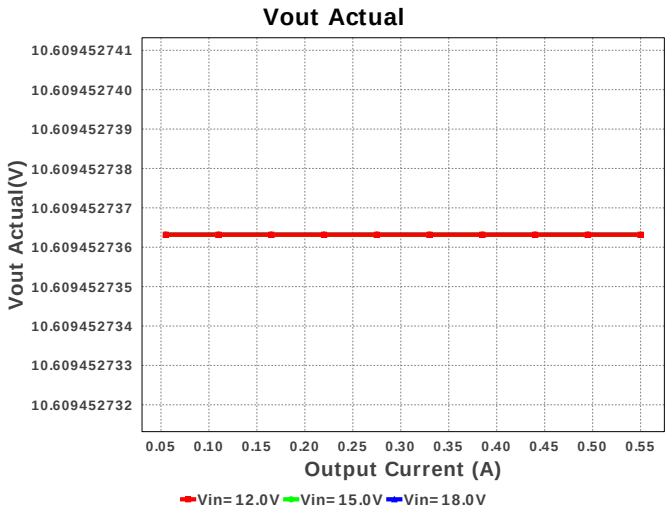


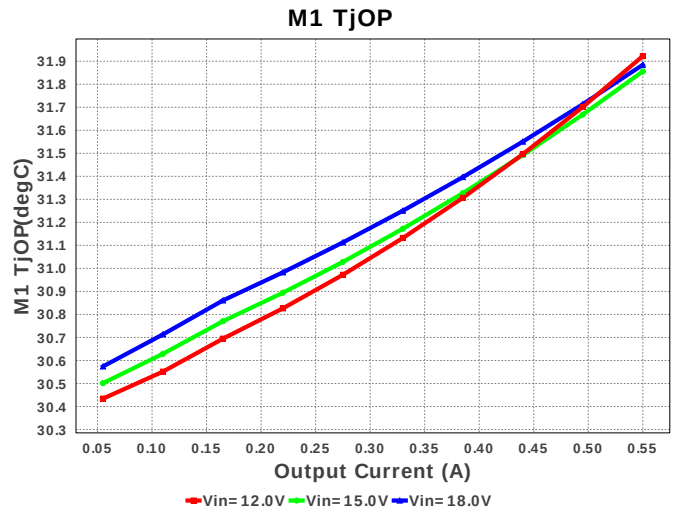


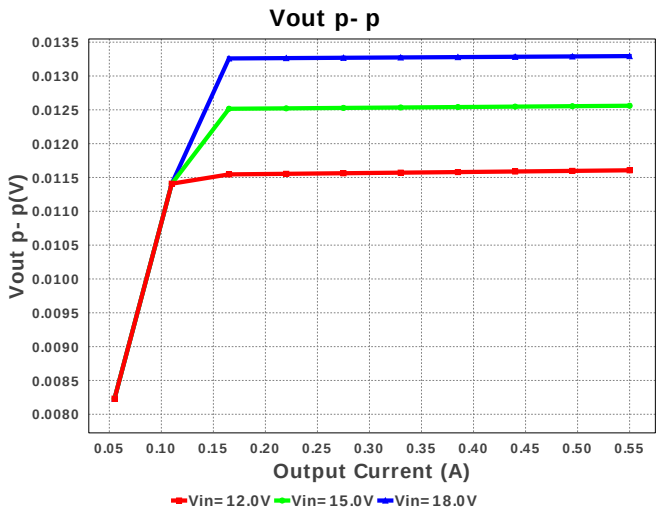


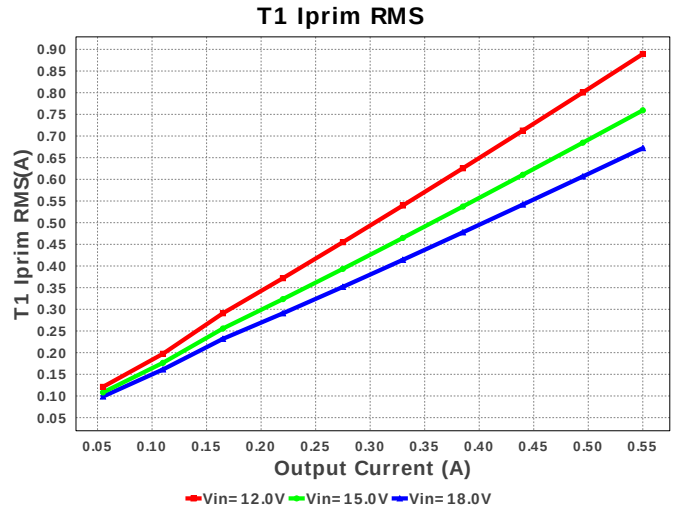


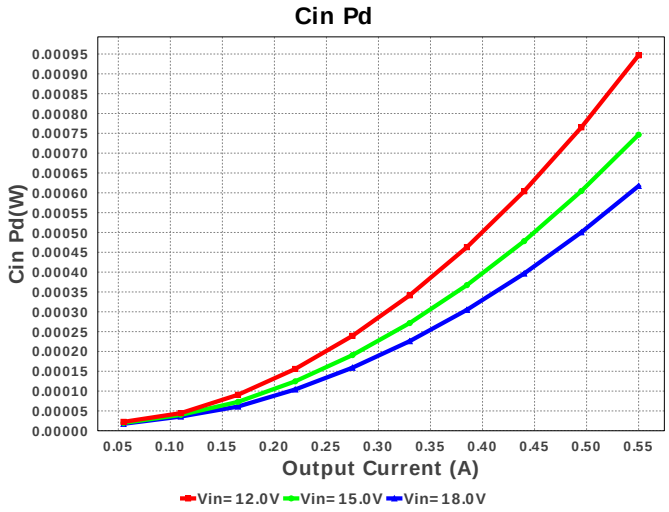


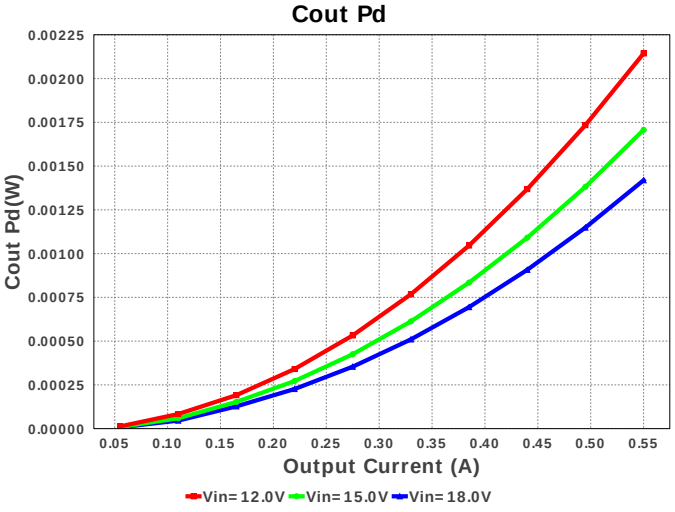


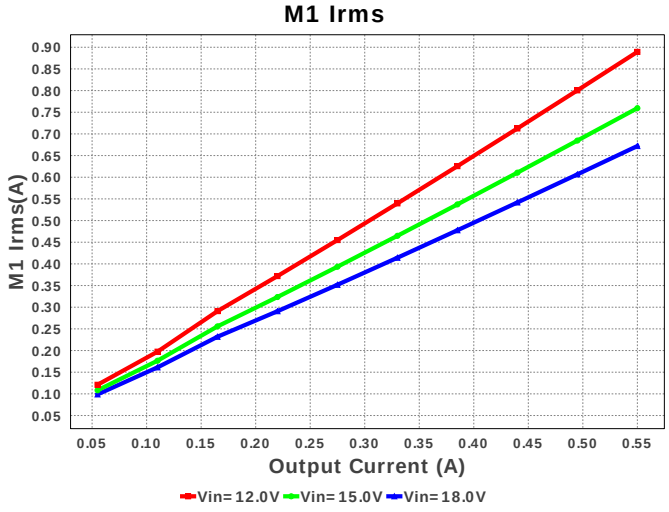


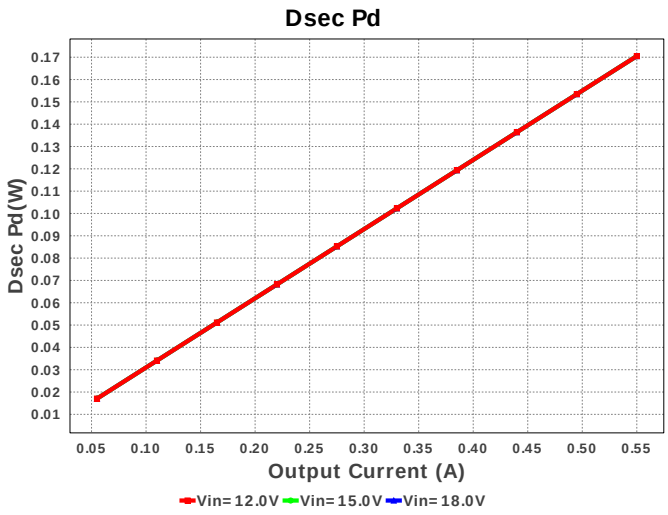


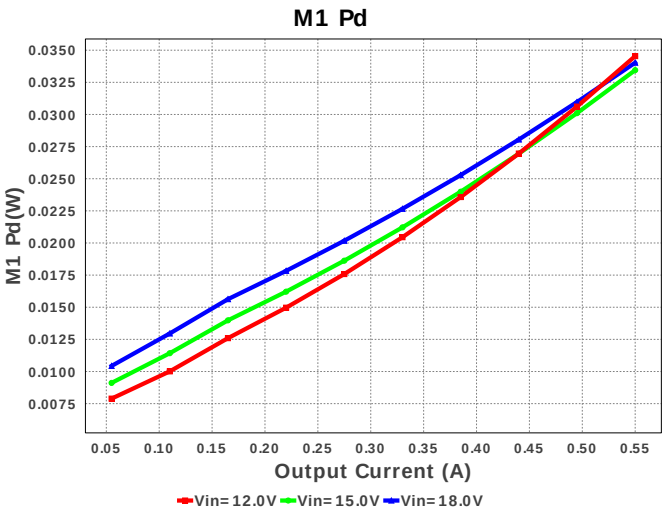


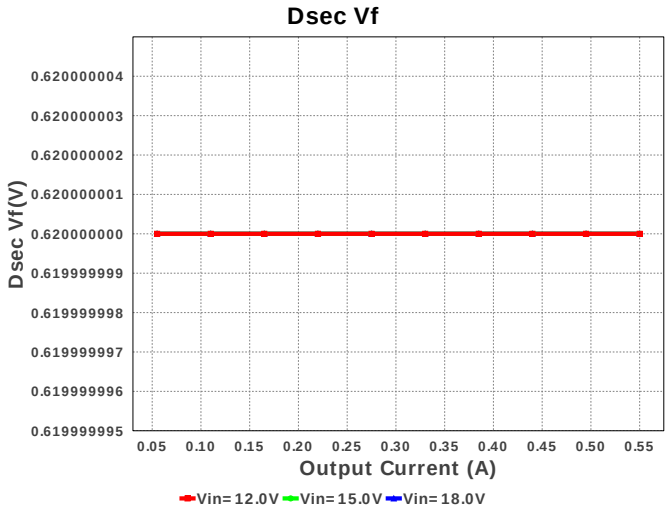


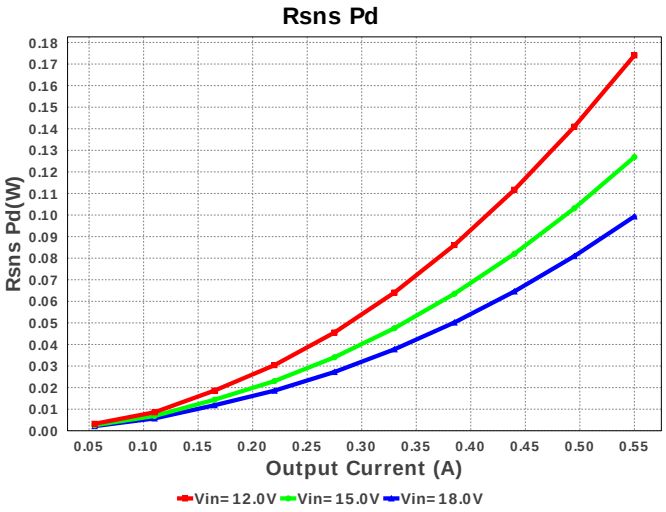


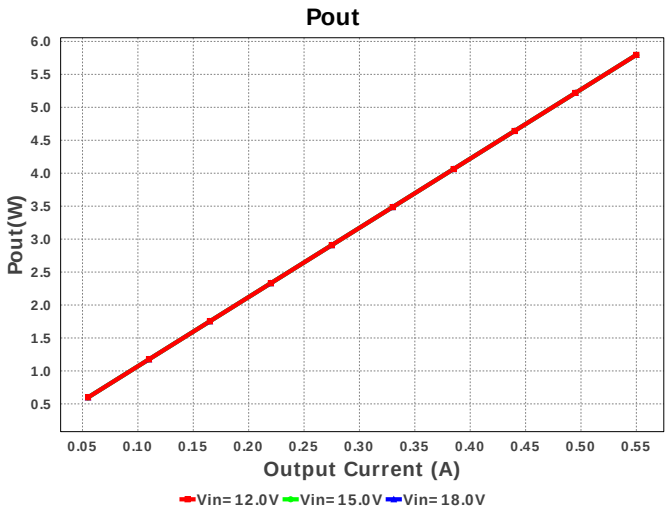


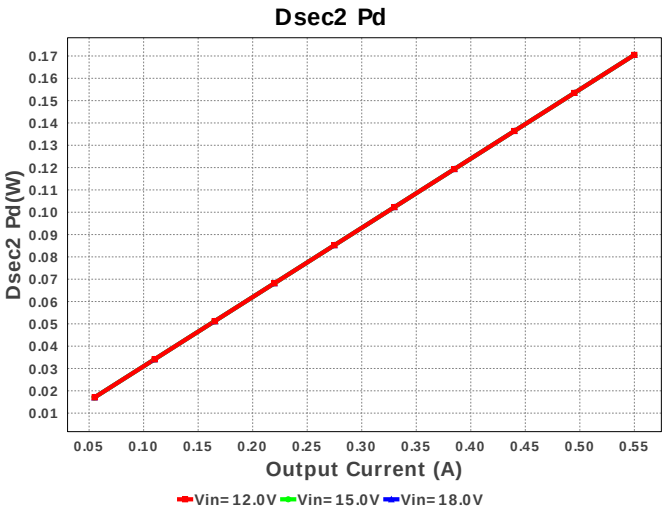


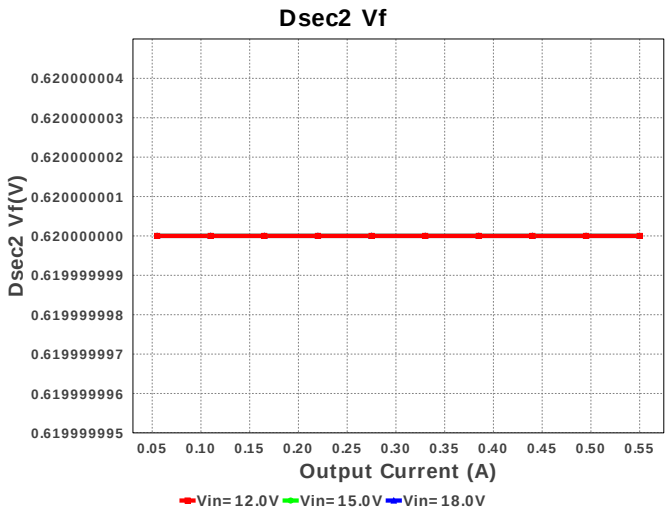


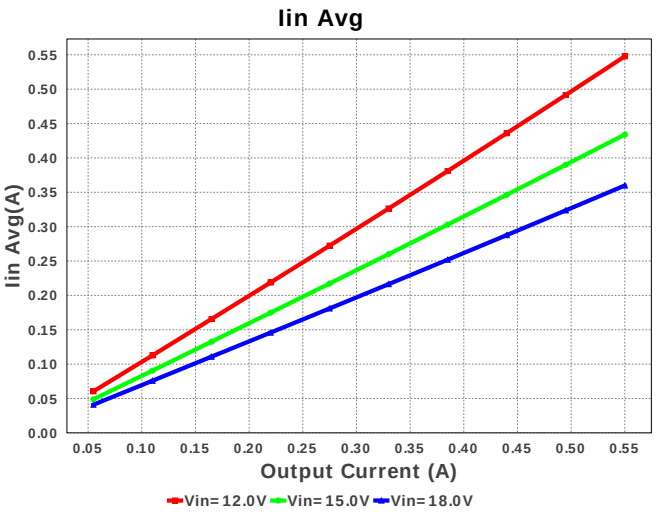


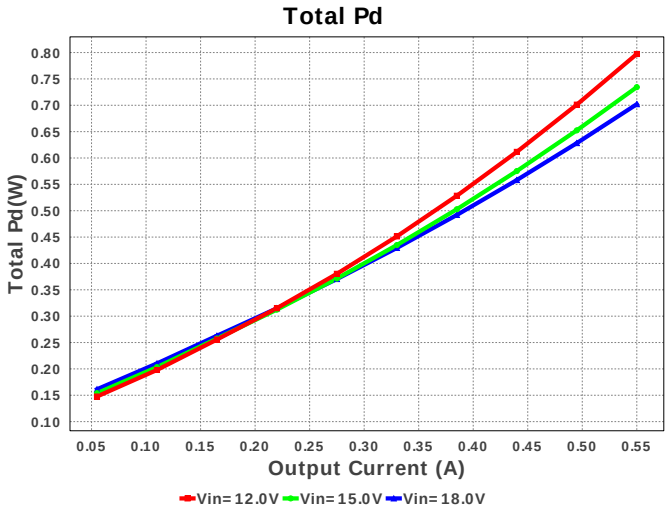


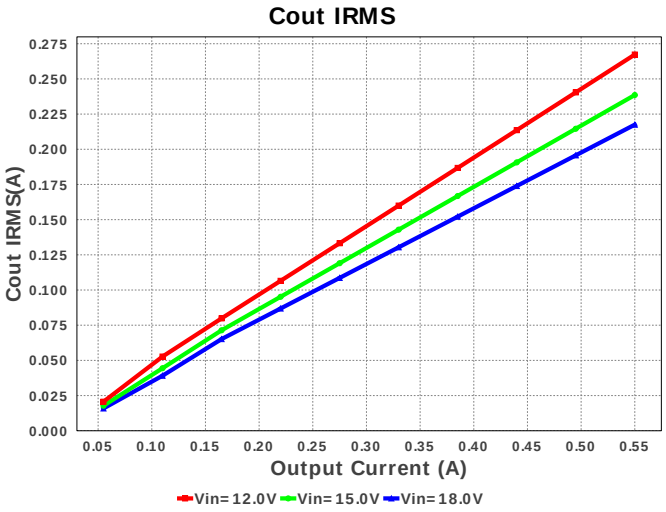


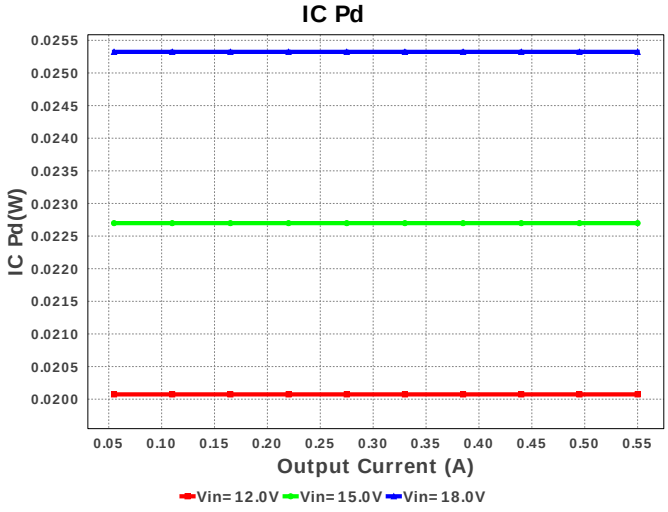


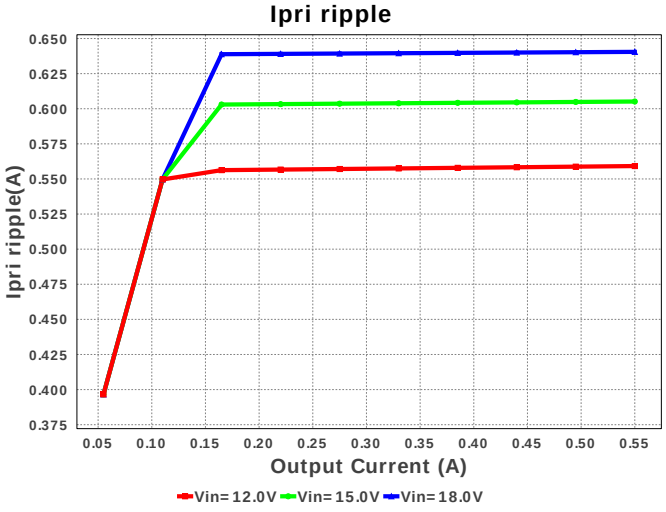


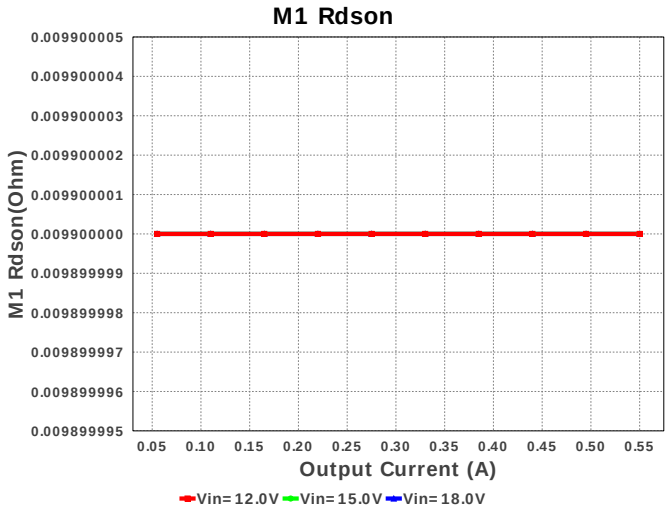


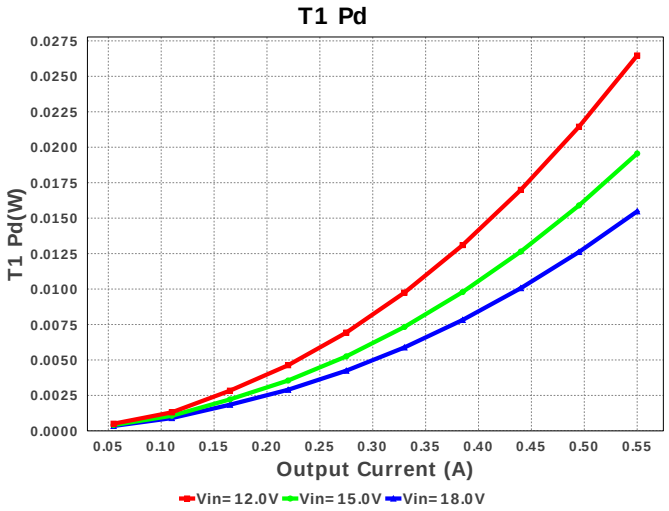












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	688.039 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	267.306 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	547.69 mA	Current	Average input current
4.	Ipri ripple	559.179 mA	Current	Ripple Current in the Primary Winding
5.	Isec Ripple	234.595 mA	Current	Ripple Current in the Secondary Winding
6.	M1 Irms	889.352 mA	Current	Q Iavg
7.	T1 Iprim RMS	889.352 mA	Current	Transformer Primary RMS Current
8.	T1 Iprim pk	1.688 A	Current	Transformer Primary Peak Current
9.	T1 Is1 RMS	373.114 mA	Current	Transformer Secondary1 RMS Current
10.	BOM Count	32	General	Total Design BOM count
11.	Dsec Vf	620.0 mV	General	Effective Forward Voltage Drop at the Operating Current
12.	Dsec2 Vf	620.0 mV	General	Effective Forward Voltage Drop at the Operating Current
13.	FootPrint	639.0 mm^2	General	Total Foot Print Area of BOM components
14.	Frequency	322.82 kHz	General	Switching frequency
15.	M1 Rdson	9.9 mOhm	General	Drain-Source On-resistance
16.	Mode	CCM	General	Conduction Mode
17.	Pout	5.796 W	General	Total output power
18.	Total BOM	$0.0	General	Total BOM Cost
19.	Vout Actual	10.609 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	10.5 V	Op_Point	Operational Output Voltage
21.	Duty Cycle	39.362 %	Op_point	Duty cycle
22.	Efficiency	87.869 %	Op_point	Steady state efficiency
23.	IC Tj	34.015 degC	Op_point	IC junction temperature
24.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
25.	IOUT_OP	550.0 mA	Op_point	Iout operating point
26.	M1 TjOP	31.922 degC	Op_point	M1 MOSFET junction temperature
27.	VIN_OP	12.0 V	Op_point	Vin operating point
28.	Vout p-p	11.606 mV	Op_point	Peak-to-peak output ripple voltage
29.	Cin Pd	946.795 µW	Power	Input capacitor power dissipation
30.	Cout Pd	2.144 mW	Power	Output capacitor power dissipation
31.	Dsec Pd	170.5 mW	Power	Secondary Diode Power Dissipation
32.	Dsec2 Pd	170.5 mW	Power	Secondary Diode Power Dissipation
33.	IC Pd	20.073 mW	Power	IC power dissipation
34.	M1 Pd	34.541 mW	Power	MOSFET power dissipation
35.	Rsns Pd	174.008 mW	Power	Current Limit Sense Resistor Power Dissipation
36.	T1 Pd	26.469 mW	Power	Estimated Losses in Transformer
37.	Total Pd	797.283 mW	Power	Total Power Dissipation
38.	Vout Tolerance	3.818 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	550.0 m	Maximum Output Current
2.	VinMax	18.0	Maximum input voltage
3.	VinMin	12.0	Minimum input voltage
4.	Vout	10.5	Output Voltage
5.	base_pn	LM5022	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. Isolated feedback, DC-DC Flyback controller with wide Vin range
2. **LM5022** Product Folder : http://www.ti.com/product/LM5022 : contains the data sheet and other resources.