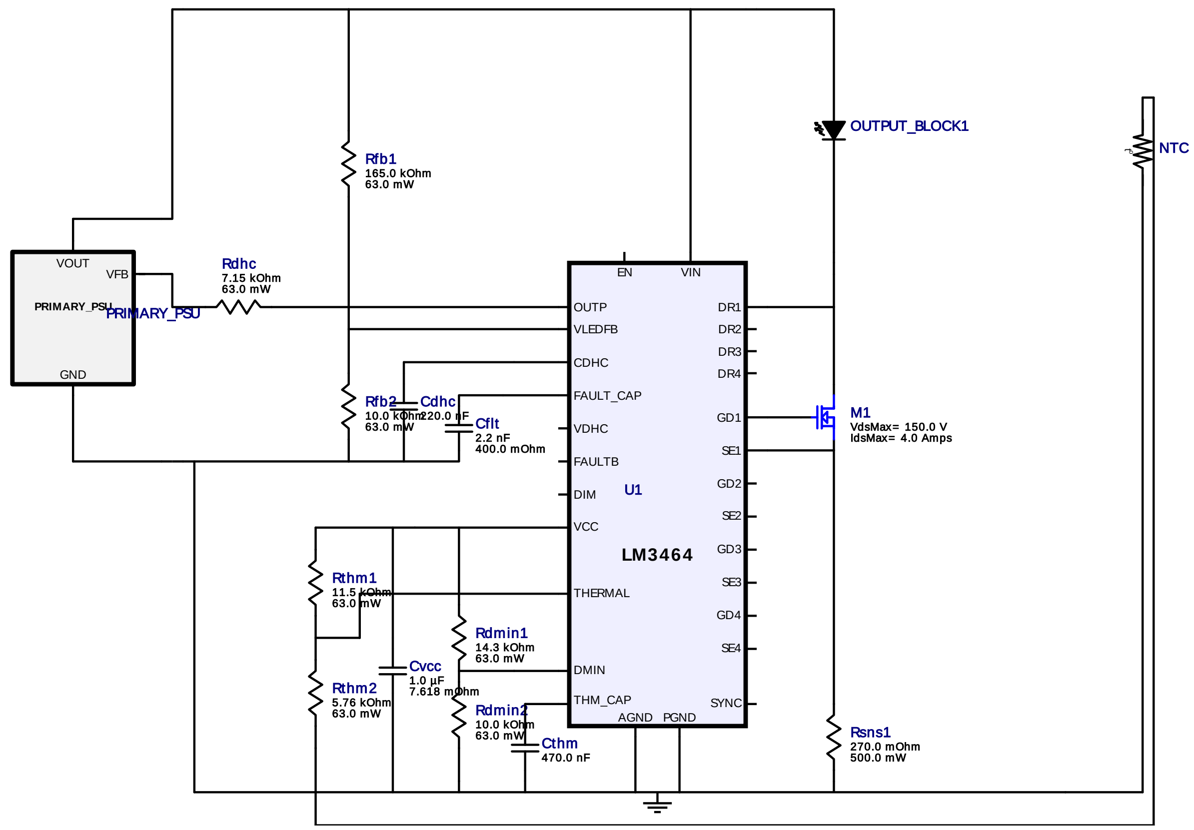
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 200.0V
VinMax = 230.0V
Vout = 37.2V
Iout = 0.72A

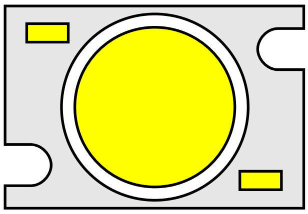
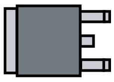
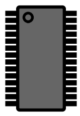
Device = LM3464MH/NOPB
Topology = Buck
Created = 8/11/16 2:43:05 PM
BOM Cost = $0.00
BOM Count = 16
Total Pd = 0.68W

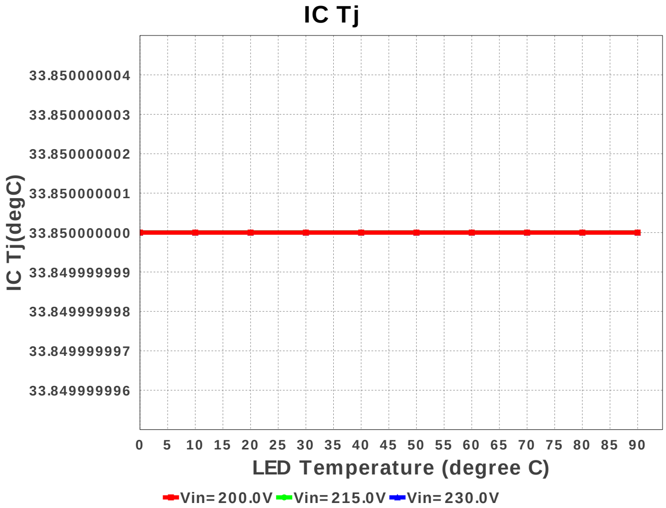
Design : 921712/283 LM3464MH/NOPB
LM3464MH/NOPB 200.0V-230.0V to 38.10V @ 0.72A

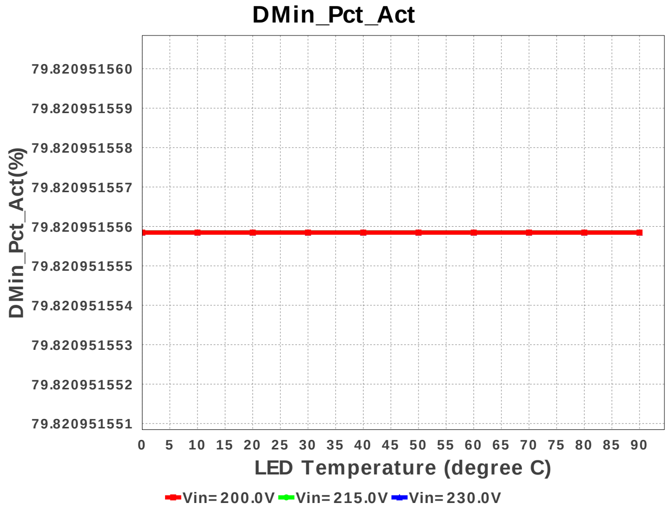


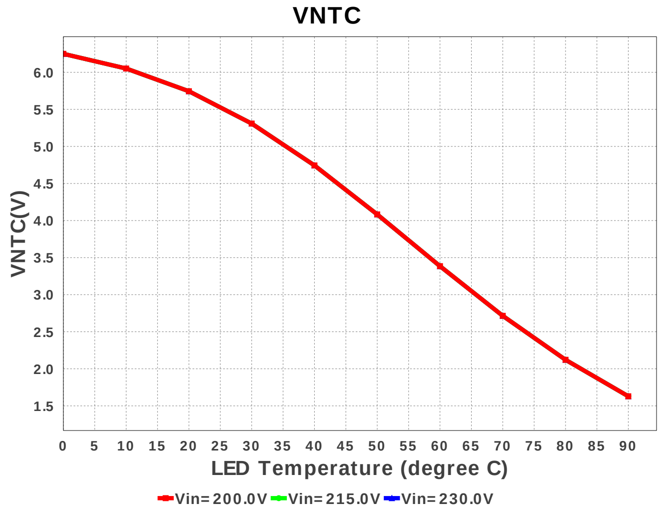
Electrical BOM

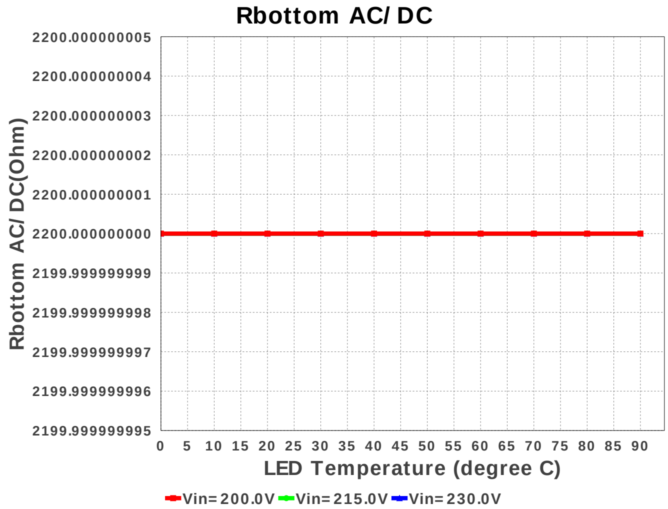
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cdhc	MuRata	GRM155R71C224KA12D Series= X7R	Cap= 220.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cflt	Kemet	C0805C222K5RACTU Series= X7R	Cap= 2.2 nF ESR= 400.0 mOhm VDC= 50.0 V IRMS= 251.0 mA	1	$0.01	0805 7 mm²
3.	Cthm	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
4.	Cvcc	TDK	C1005X5R0J105M Series= X5R	Cap= 1.0 uF ESR= 7.618 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²

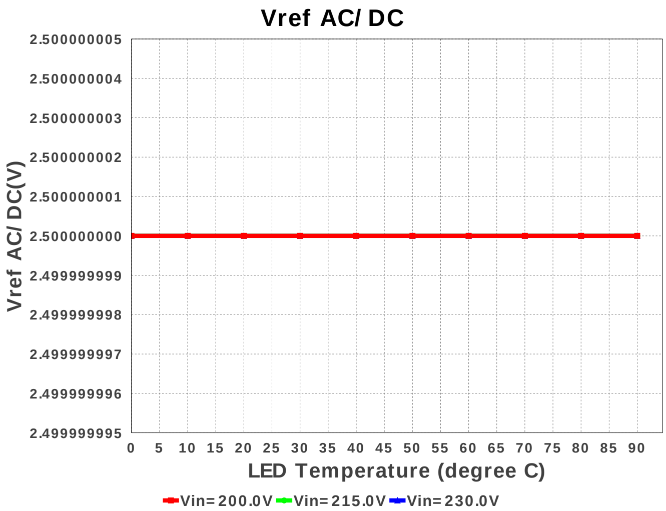
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
5.	D_LED1	Citizen Electronics	CL-L330-C26N-C	LED	1	NA	 CIT_LED_6 645 mm^2
6.	M1	Fairchild Semiconductor	FDD2572	VdsMax= 150.0 V IdsMax= 4.0 Amps	1	$0.70	 DPAK 102 mm^2
7.	NTC	Panasonic	ERT-J0EV104H Series= ERT-J	Thermistor	1	$0.08	0402 3 mm^2
8.	Rdhc	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
9.	Rdmin1	Vishay-Dale	CRCW040214K3FKED Series= CRCW..e3	Res= 14.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
10.	Rdmin2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
11.	Rfb1	Vishay-Dale	CRCW0402165KFKED Series= CRCW..e3	Res= 165.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
12.	Rfb2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
13.	Rsns1	Rohm	MCR25JZHFLR270 Series= MCR25	Res= 270.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.03	1210 15 mm^2
14.	Rthm1	Vishay-Dale	CRCW040211K5FKED Series= CRCW..e3	Res= 11.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
15.	Rthm2	Vishay-Dale	CRCW04025K76FKED Series= CRCW..e3	Res= 5.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
16.	U1	Texas Instruments	LM3464MH/NOPB	Switcher	1	$2.40	 MXA28A 98 mm^2

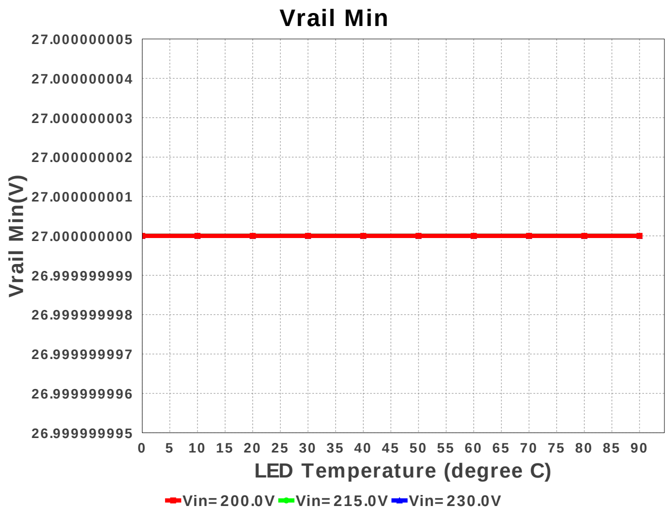

IC Tj
IC Tj(degC)
33.850000004
33.850000003
33.850000002
33.850000001
33.850000000
33.849999999
33.849999998
33.849999997
33.849999996
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

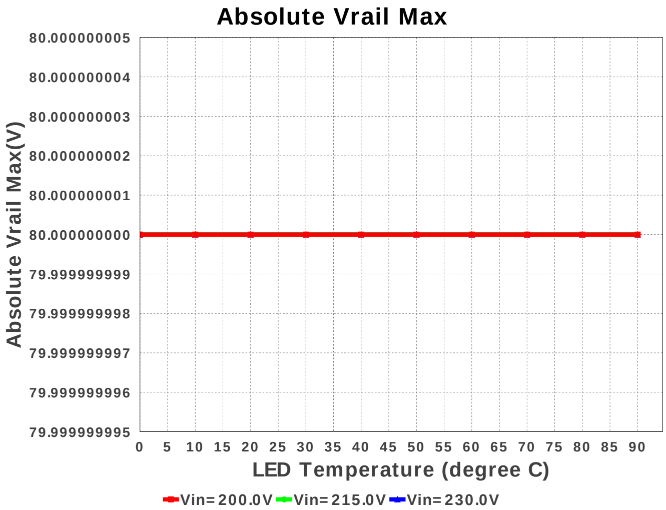

DMin_Pct_Act
DMin_Pct_Act(%)
79.820951560
79.820951559
79.820951558
79.820951557
79.820951556
79.820951555
79.820951554
79.820951553
79.820951552
79.820951551
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

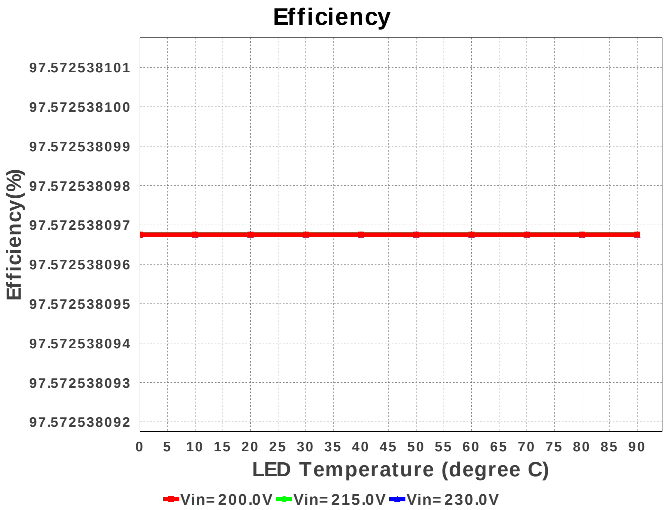

VNTC
VNTC(V)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

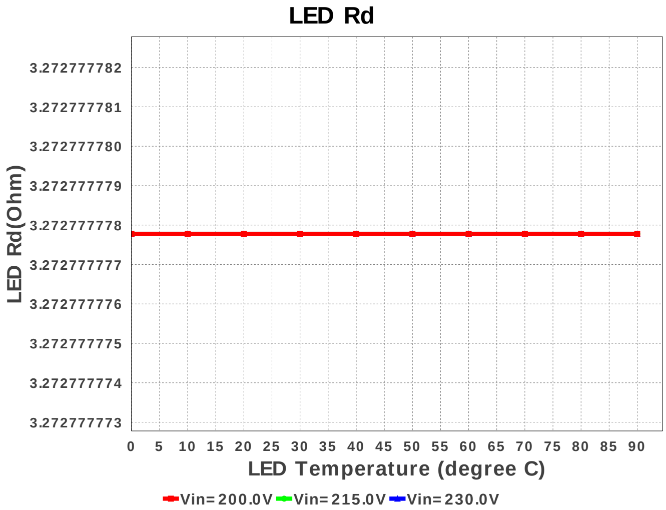

Rbottom AC/DC
Rbottom AC/DC(Ohm)
2200.000000005
2200.000000004
2200.000000003
2200.000000002
2200.000000001
2200.000000000
2199.999999999
2199.999999998
2199.999999997
2199.999999996
2199.999999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

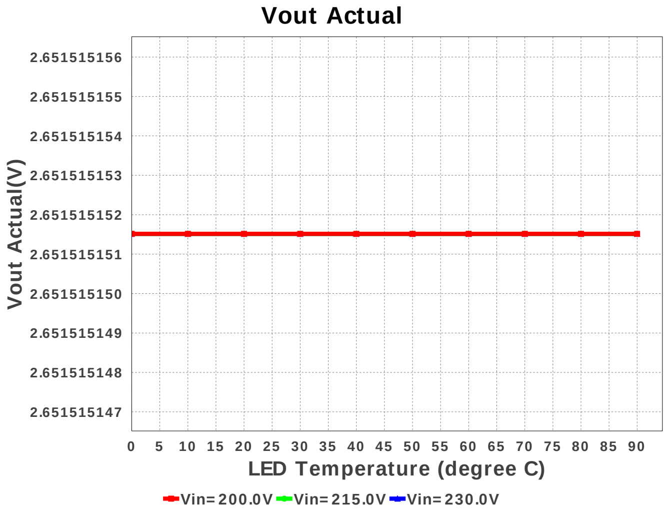

Vref AC/DC
Vref AC/DC(V)
2.500000005
2.500000004
2.500000003
2.500000002
2.500000001
2.500000000
2.499999999
2.499999998
2.499999997
2.499999996
2.499999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

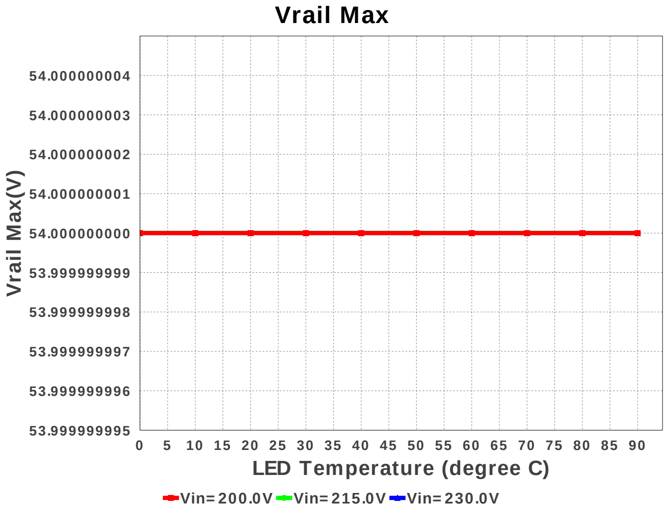

Vrail Min
Vrail Min(V)
27.000000005
27.000000004
27.000000003
27.000000002
27.000000001
27.000000000
26.999999999
26.999999998
26.999999997
26.999999996
26.999999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

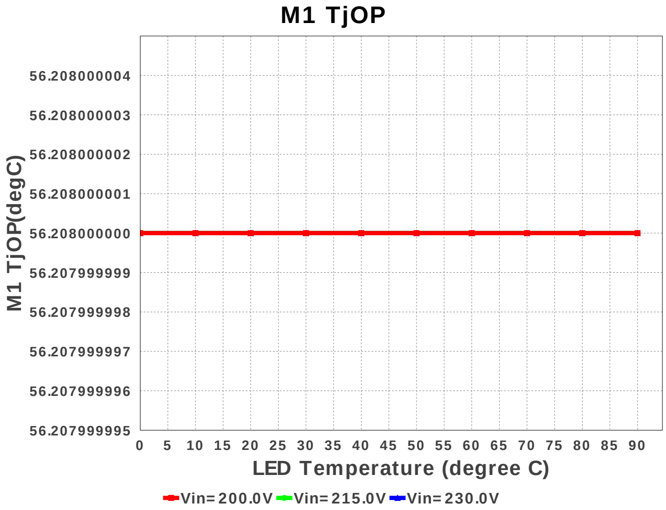

Absolute Vrail Max
Absolute Vrail Max(V)
80.000000005
80.000000004
80.000000003
80.000000002
80.000000001
80.000000000
79.999999999
79.999999998
79.999999997
79.999999996
79.999999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V


Efficiency
Efficiency(%)
97.572538101
97.572538100
97.572538099
97.572538098
97.572538097
97.572538096
97.572538095
97.572538094
97.572538093
97.572538092
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

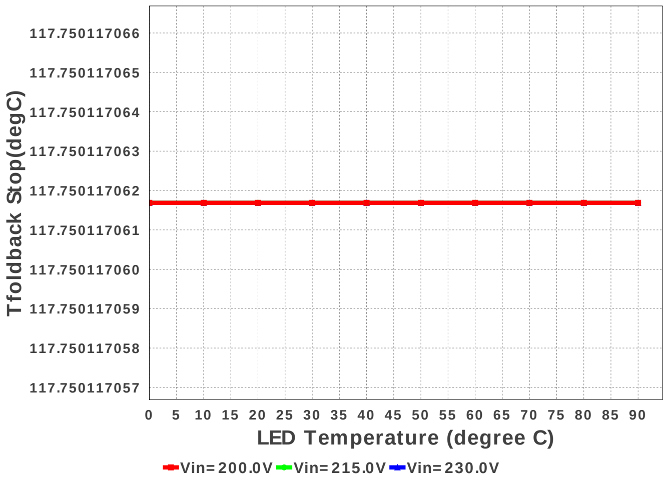

LED Rd
LED Rd(Ohm)
3.272777782
3.272777781
3.272777780
3.272777779
3.272777778
3.272777777
3.272777776
3.272777775
3.272777774
3.272777773
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V


Vout Actual
Vout Actual(V)
2.651515156
2.651515155
2.651515154
2.651515153
2.651515152
2.651515151
2.651515150
2.651515149
2.651515148
2.651515147
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

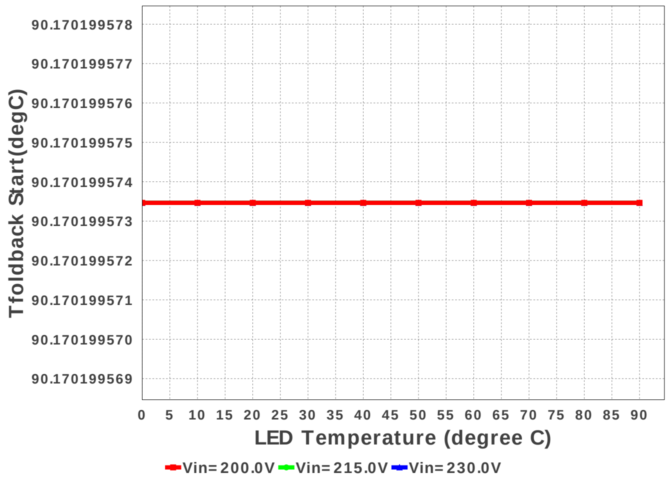

Vrail Max
Vrail Max(V)
54.000000004
54.000000003
54.000000002
54.000000001
54.000000000
53.999999999
53.999999998
53.999999997
53.999999996
53.999999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V


M1 TjOP
M1 TjOP(degC)
56.208000004
56.208000003
56.208000002
56.208000001
56.208000000
56.207999999
56.207999998
56.207999997
56.207999996
56.207999995
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
LED Temperature (degree C)
Vin=200.0V Vin=215.0V Vin=230.0V

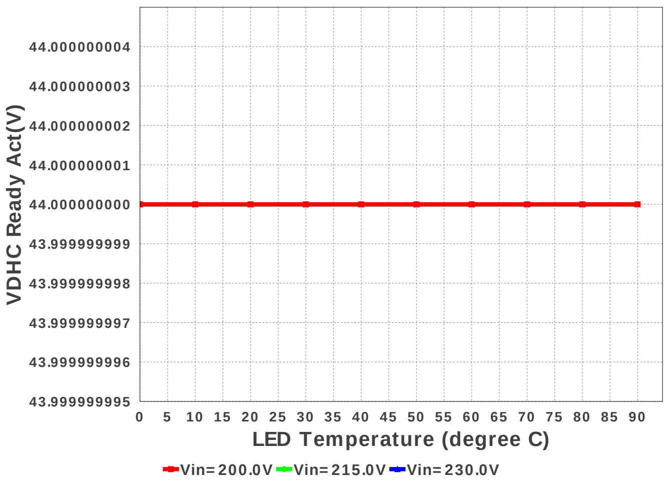
Tfoldback Stop



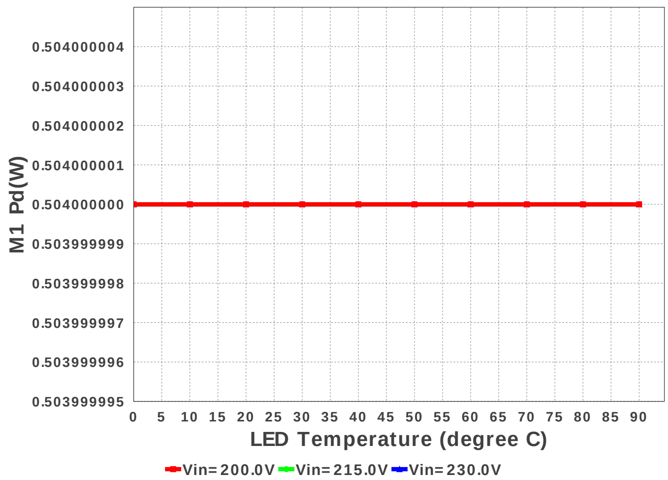
Tfoldback Start



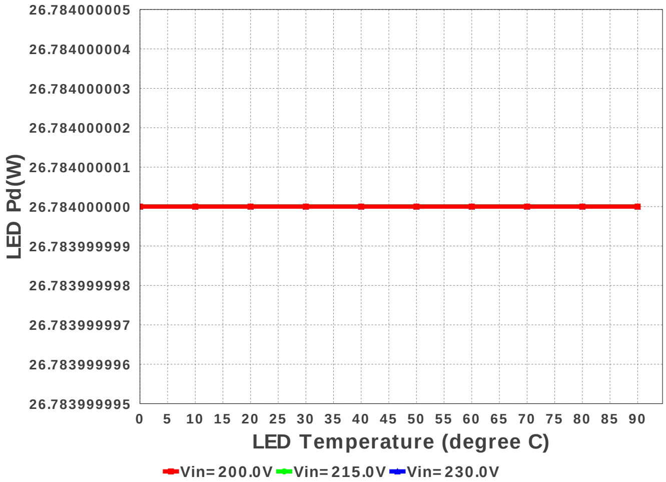
VDHC Ready Act



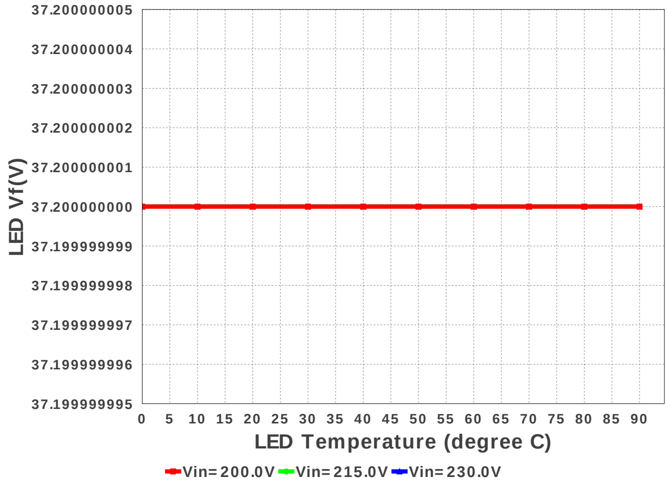
M1 Pd



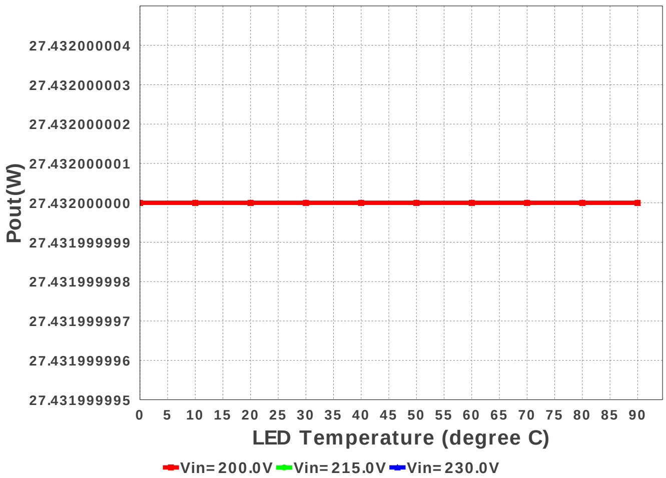
LED Pd



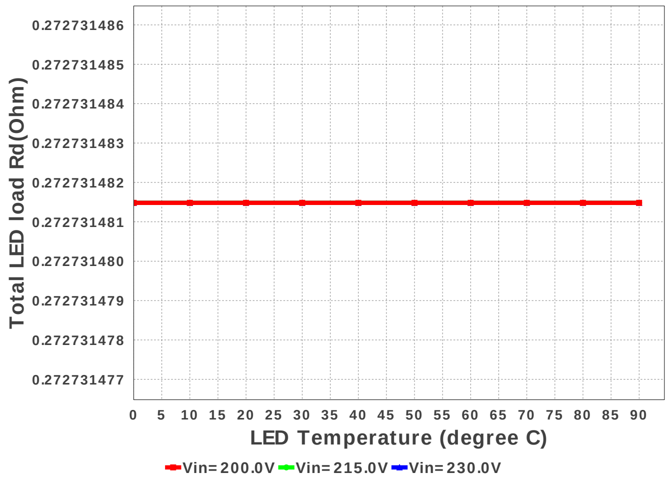
LED Vf



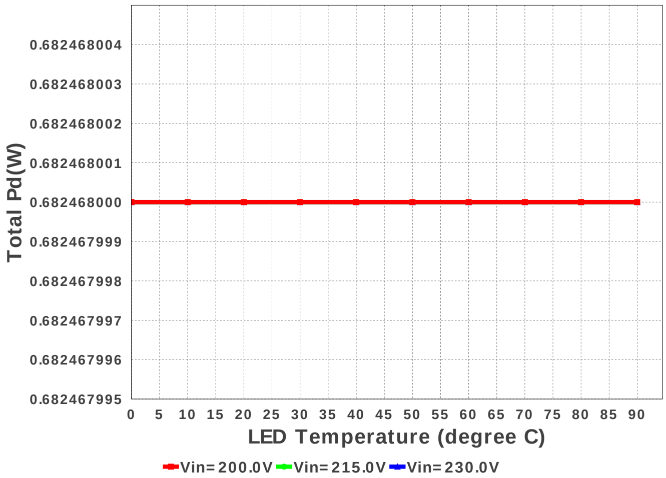
Pout



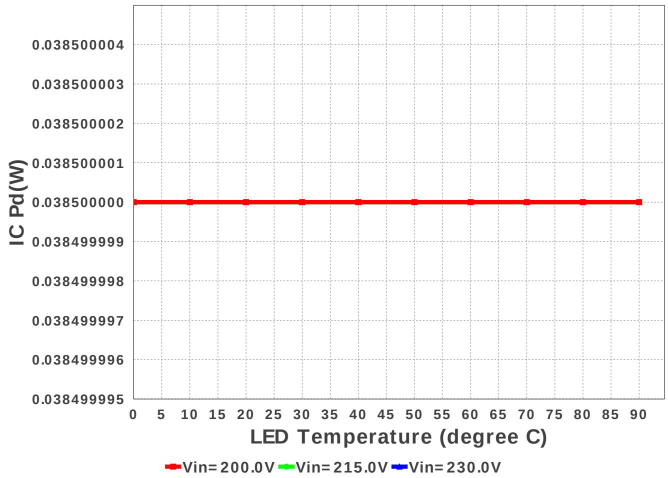
Total LED load Rd



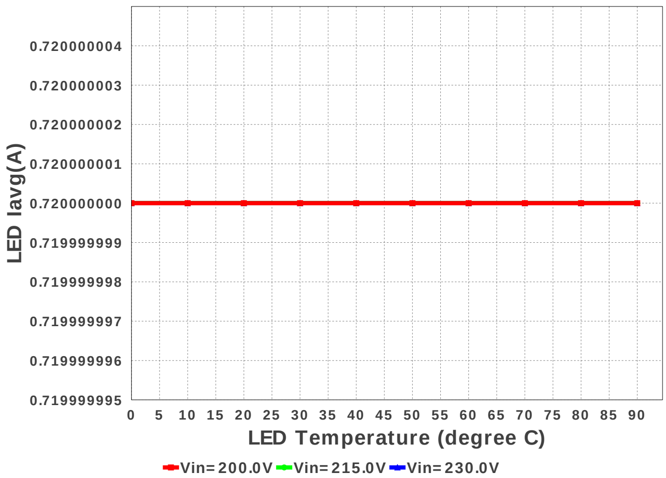
Total Pd



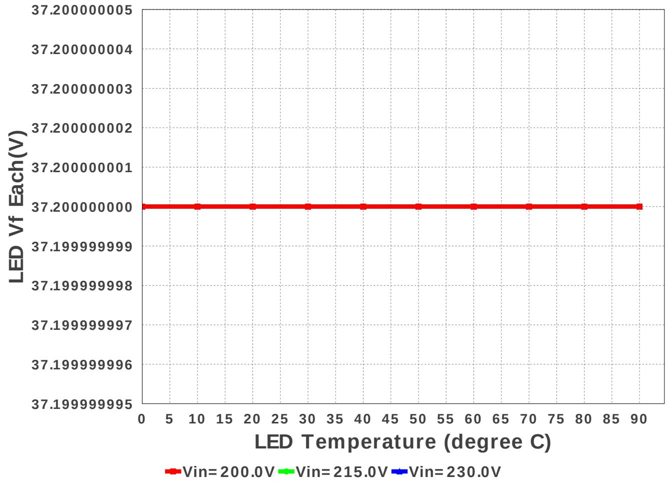
IC Pd



LED Iavg



LED Vf Each



Operating Values

#	Name	Value	Category	Description
1.	LED Iavg	720.0 mA	Current	LED Average Current
2.	BOM Count	16	General	Total Design BOM count
3.	FootPrint	900.0 mm^2	General	Total Foot Print Area of BOM components
4.	Frequency	0.0 Hz	General	Switching frequency
5.	Pout	27.432 W	General	Total output power
6.	Total BOM	$0.0	General	Total BOM Cost
7.	Tfoldback Stop	117.75 degC	Op_Point	Stop Temperature for Thermal Foldback
8.	Vout Actual	2.652 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
9.	Efficiency	97.573 %	Op_point	Steady state efficiency
10.	IC Tj	33.85 degC	Op_point	IC junction temperature
11.	IOUT_OP	720.0 mA	Op_point	Iout operating point

#	Name	Value	Category	Description
12.	LED Rd	3.273 Ohm	Op_point	LED DynamicResistance
13.	LED Vf	37.2 V	Op_point	Total LED Forward Calculated Voltage
14.	M1 TjOP	56.208 degC	Op_point	MOSFET junction temperature
15.	VIN_OP	230.0 V	Op_point	Maximum AC voltage input to power supply
16.	IC Pd	38.5 mW	Power	IC power dissipation
17.	LED Pd	26.784 W	Power	LED Power Dissipation
18.	M1 Pd	504.0 mW	Power	Average power dissipation in the switching FET over the AC line period
19.	Total Pd	682.468 mW	Power	Total Power Dissipation
20.	Absolute Vrail Max	80.0 V		Absolute Vrail Maximum
21.	DMin_Pct_Act	79.821 %		Minimum Duty Cycle Limit when LEDs are Hot
22.	Single LED Vf	37.2 V		Calculated Forward Voltage of Each LED
23.	Rbottom AC/DC	2.2 kOhm		Bottom Resistor in Feedback Loop of Power Supply Unit
24.	Tfoldback Start	90.17 degC		Start Temperature for Thermal Foldback
25.	Total LED load Rd	272.731 mOhm		Total LED Load DynamicResistance
26.	VDHC Ready Act	44.0 V		Ready Voltage for DHC Startup
27.	VNTC	6.249 V		Voltage across NTC resistor
28.	Vout Tolerance	115.44 m%		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
29.	Vrail Max	54.0 V		Maximum Rail voltage that can be pushed up by the LM3464
30.	Vrail Min	27.0 V		Minimum Rail voltage of Power Supply Unit
31.	Vref AC/DC	2.5 V		Reference Voltage for Circuit in Power Supply Unit

Design Inputs

#	Name	Value	Description
1.	Iout	720.0 m	Maximum Output Current
2.	VinMax	230.0	Maximum input voltage
3.	VinMin	200.0	Minimum input voltage
4.	Vout	37.2	Output Voltage
5.	line_fsw	60.0	Light Output in Lumen
6.	application	LED_DRIVER	LED Application
7.	base_pn	LM3464	Base Product Number
8.	LED_Architect	N	LED Architect Project
9.	ledparallel	1.0	Number of LED in parallel
10.	ledpartnumber	CL-L330-C26N-C	LED Part number
11.	ledseries	1.0	Number of LED in series
12.	line_fsw	60.0	AC Line Frequency
13.	source	AC	Input Source Type
14.	Ta	30.0	Ambient temperature

Design Assistance

1. Thermal foldback is necessary in many applications due to the extreme temperatures created in LED environments. In general, two functions are necessary a temperature break-point after which the nominal operating current needs to be reduced, and a slope corresponding to the amount of LED current decrease per temperature increase.

2. The user can set the 'Start' and 'Stop' temperatures for the thermal foldback by changing the default settings on the 'Thermal Foldback start and end temperatures' in the 'Advanced Options' menu on the left side bar. These values are then updated on the 'Op-Vals' section. The 'Op-Vals' section has a slider to simulate the increase or decrease in temperature. The operating value 'Thermal Resistance' changes based on the change in temperature. This is the resistance of the thermistor at the selected temperature and it's value is then updated in the simulation directly

3. **LM3464** Product Folder : http://www.ti.com/product/LM3464 : contains the data sheet and other resources.