TPS92692-Q1 BOOST LED DRIVER COMI

Sym.	Parameter	Min	Typ	Max
Input Specifications				
V_{IN}	Nominal input voltage range	**10**	**14**	**15**
Output Specifications				
$V_{F,LED}$	LED forward voltage	**2.8**	**3.2**	**3.6**
r_{LED}	Dynamic resistance		**0.3**	
N_S	Number of LEDs in series	**7**	**7**	**7**
V_O	Output voltage range	19.6	22.4	25.2
$P_{O(MAX)}$	Maximum output power			**58**
$I_{LED(CALC)}$	LED current range	-	-	2959.2
RR	LED current ripple ratio		**3**	
r_D	LED string resistance	2.1	2.1	2.1
Dimming Specifications				
	Program LED current using analog dimming	**YES**		
	Analog dimming range	**1000**		
I_{LED}	LED current set point / range	1000	-	2959.2
	Enable series FET dimming	**YES**		
f_{PWM}	PWM dimming frequency		**200**	
Converter Specifications				
$\Delta V_{IN(PP)}$	Input voltage ripple		**20**	
$V_{O(OV)}$	Overvoltage protection threshold		**37**	
$V_{OV(HYS)}$	Overvoltage protection hysteresis		**3**	
$P_{O,BDRY}$	CCM-DCM boundary condition	**20**		
t_{SS}	Soft-start period		**8**	

f_{SW}	Switching frequency		**390**	
BOOST Design Calculations				
D	Duty cycle	0.235	0.375	0.603
	SETTING SWITCHING FREQUENCY			
R_T	Rcommended timing resistor		20.0	
	INDUCTOR SELECTION			
L	Calculated inductor value	3.87	4.71	5.84
L	Enter standard inductor value		**5.2**	
$I_{L(PK)}$	Peak inductor current	3.91	4.20	5.86
R_L	DC winding resistance		**70.5**	
$P_{L(COND)}$	Total conduction power loss			2.42
	OUTPUT CAPACITOR SELECTION			
$C_{OUT(CALC)}$	Calculated output capacitor value		24.55	
C_{OUT}	Enter selected output capacitor value		**30**	
	INPUT CAPACITOR SELECTION			
$C_{IN(CALC)}$	Calculated input capacitor value		47.66	
C_{IN}	Enter selected input capacitor value		**50**	
	MAIN N-CHANNEL MOSFET SELECTION			
$V_{Q1DS(MAX)}$	Main N-channel MOSFET breakdown voltage		40	
$I_{Q1(RMS)}$	Main N-channel MOSFET RMS current		7.13	
$R_{DS(ON)}$	MOSFET on-resistance		**15.0**	
$P_{Q(COND)}$	MOSFET conduction power loss		0.76	
Q_g	MOSFET gate charge (Qgd+Qgs/2))		**6.50**	
C_{OSS}	MOSFET output capacitance		**115.0**	
$P_{SW,CAP}$	MOSFET switching loss (Capacitive losses)		0.036	
P_{SW}	MOSFET switching loss		0.78	
$P_{SW(TOT)}$	Estimated switching power loss		0.81	
	RECTIFYIND DIODE SELECTION			
$V_{D(BR)}$	Rectifying diode forward voltage drop		40	
I_D	Rectifying diode average current		2.96	
V_{DF}	Diode forward voltage drop		**450**	
P_D	Diode power loss		1.33	
	PROGRAMMING LED CURRENT			
V_{IADJ}	Analog adjust voltage setting	0.760345	-	2.25
R_{ADJ2}	IADJ resistor divider setting		**68.1**	

R_{ADJ1}	IADJ resistor divider setting	12.1		56.2
R_{CS}	Recommended current sense resistor		0.054	
	SETTING SWITCH CURRENT LIMIT & SLOPE COMPENSATION			
R_{IS}	Switch current sense resistor		0.040	
R_{IS}	Switch current sense resistor		**0.040**	
P_{RIS}	Switch current sense resistor power loss		1.4	
	SLOPE COMPENSATION			
R_{SL}	Switch current sense resistor		34.80	
	COMPENSATION PARAMETERS			
G_0	DC gain		21.7	
w_Z	Pole frequency		20.3	
w_P	Zero frequency		568.6	
	Compensation network		**PI (TYPE 2)**	
C_{COMP}	Compensation capacitor		0.012	
R_{COMP}	Compensation resistor		4020	
C_{HF}	High frequency bypass capacitor		120	
	SETTING STARTUP DURATION			
C_{SS}	Soft-start capacitor		0.082	
	SETTING OVERVOLTAGE PROTECTION			
R_{OV2}	Over-voltage protection resistor divider setting		150	
R_{OV1}	Over-voltage protection resistor divider setting		5.11	
$V_{O(UV)}$	Under voltage detection threshold	2.480	3.035	3.494
	SPREAD SPECTRUM FREQUENCY MODULATION			
f_{MOD}	Modulation Frequency		**600**	
C_{DM}	Dither modulation capacitor		0.027	
	PWM DIMMING			
			Analog-to-PWM	
R_{RAMP}	Internal PWM comparator threshold		-	
C_{RAMP}	RAMP frequency capacitor		0.012	

D_{PWM}	Analog PWM dimming setting		**8**	
R_{DIM2}	DIM resistor divider setting		**33**	
R_{DIM1}	DIM resistor divider setting		10	
	SERIES FET PWM DIMMING CONSIDERATIONS			
Q_2	Dimming MOSFET selection		P-CHANNEL	
V_{DSQ2}	Diimming MOSFET breakdown voltage		-40	
I_{DQ2}	Dimming MOSFET current capability		2959.18	
	BYPASS CAPACITOR CONSIDERATIONS			
C_{VCC}	Recommended VCC bypass capacitor		2.2	
C_{IMON}	Recommended IMON bypass capacitor		10	
C_{OV}	Recommended OVP bypass capacitor		1000	

PONENT CALCULATOR

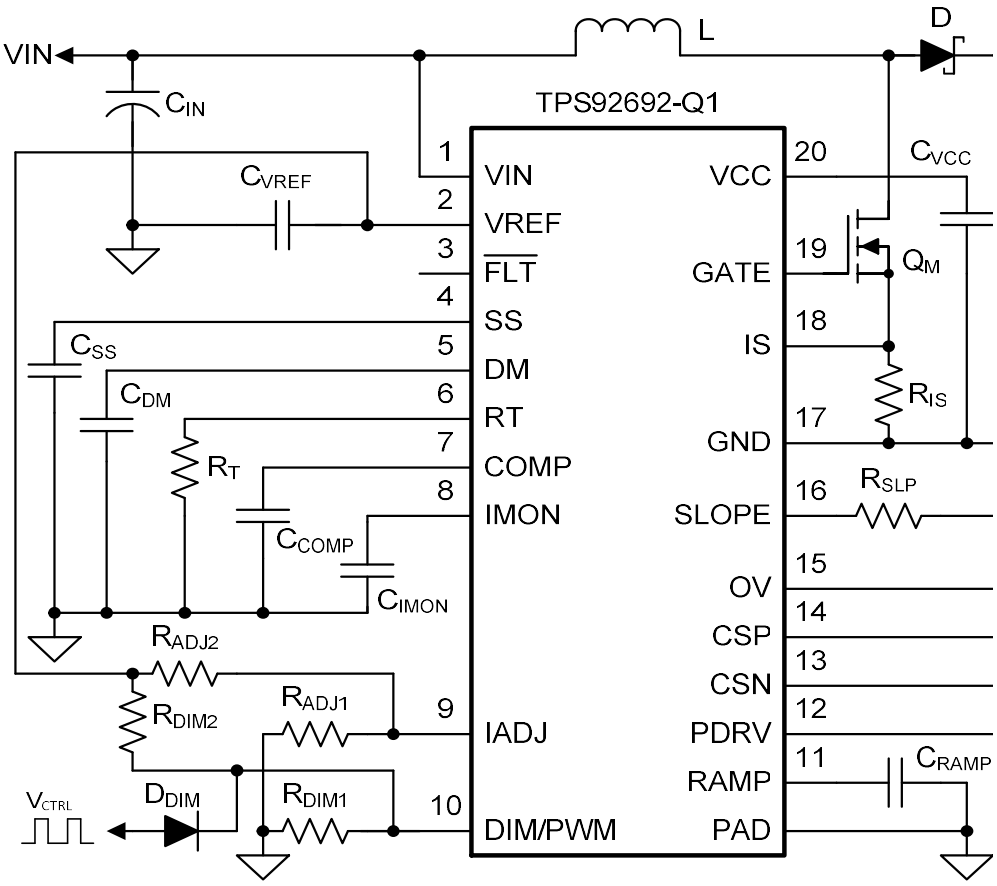
Units	NOTE
V	Enter nominal battery or power supply output voltage range
V	Enter typical forward voltage range specified by LED manufacturer
Ω	Enter ypical LED dynamic resistance based on device I-V characteristics.
	–To support multiple LED string configurations, enter min, typ and max quantity –For fixed string of LEDs, enter the same quantity in all columns (e.g. 10 10 10)
V	Boost output voltage range (LED+ to GND)
W	Enter maximum power required to achieve specified lumen output in application
mA	Calculated LED current based on maximum power and LED voltage range
%	Enter LED current ripple specifications as percentage of maximum value
Ω	LED string dynamic resistance
	Select YES to program LED current Select NO for fixed LED string current
mA	Set minimum LED string current or enter the minimum value calculated in 'Line 14'
mA	LED current set point / range calculated based on user inputs
Hz	Enter PWM dimming frequency
mV	The parameter is used to determine input capacitance
V	OVP threshold should be greater than maximum output voltage and less than 65V
V	Recommended hysteresis is 10% of the overvoltage protection threshold
W	Enter minimum power level at which CCM operation is desired (typically set betwee the maximum power listed in 'Line 13').
ms	

kHz	Frequency should be set between 80 kHz and 1 MHz
	Calculated CCM operatioin duty cycle range (Max duty cycle < 0.9)
kΩ	
µH	Calculated inductor value
µH	Enter preferred inductor value (greater than or equal to typical calculated value)
A	Inductor saturation current should be greater than peak current
mΩ	Enter DC winding resistance of the inductor based on the device datasheet
W	Total conduction power loss through coupled inductor
µF	Calculated output capacitor value
µF	Enter preferred output capacitor value (must be greater than calculated value)
µF	Calculated input capacitor value
µF	Enter preferred input capacitor value (must be greater than calculated value)
V	
A	
mΩ	Enter MOSFET Rds on-resistance based on the device datasheet
W	
nC	Enter MOSEFT total gate charge based on the device datasheet
pF	Enter MOSFET output capacitance based on the device datasheet
W	
W	
W	
V	
A	
mV	Enter diode forward voltage drop based on the device datasheet
W	
V	
kΩ	Minimum of 49.9kΩ is recommended, when connecting the pin to VREF node

kΩ	
Ω	
Ω	
Ω	Enter preferred inductor value (less than or equal to the calculated value)
W	
kΩ	
dB krad/s rad/s	Simplified low frequency model: 1. Neglecting the affect of slope compensation 2. Ignoring higher order dynamics
	→ Integral (type 1) network recommended for multiple LED string configuration → Proportional integral (type 2) network recommeded for fixed LED string output
µF	
Ω	
pF	
µF	
kΩ	
kΩ	
V	Undervoltage fault detection threshold based on R_{OV1} and R_{OV2}
Hz	Enter the modulationf frequency. Modulation frequency between 500Hz and 1KHz is for reducing noise signature in average scan. Modulation frequency between 9kHz a recommended for reducing noise signature in quasi-peak EMI scan.
µF	Connect capacitor across DM pin to GND to enable SSFM. Connect directly to GND SSFM.
	Select Analog-to-PWM to enable dimming based on internal PWM generator. Selec control dimming based on externally generated PWM signal.
kΩ	
µF	

%	Set PWM duty cycle. Valid for Analog-to-PWM function only
kΩ	Minimum of 10 kΩ is recommended, when connecting the pin to VREF node
kΩ	
V	
mA	
µF	
pF	
pF	

Boost LED Driver



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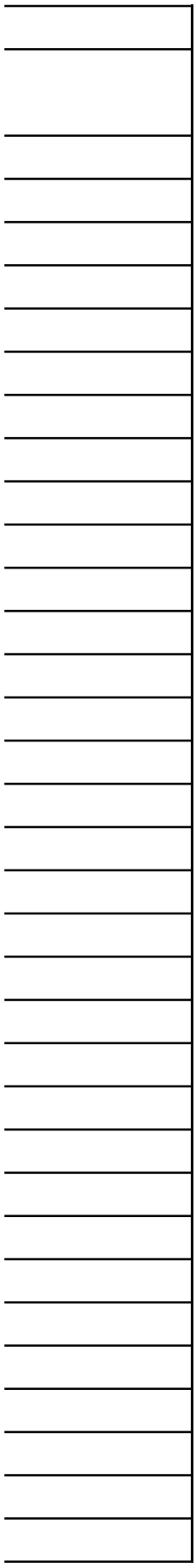
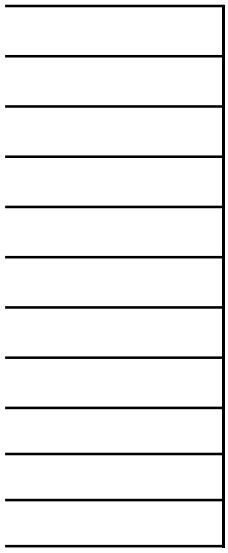
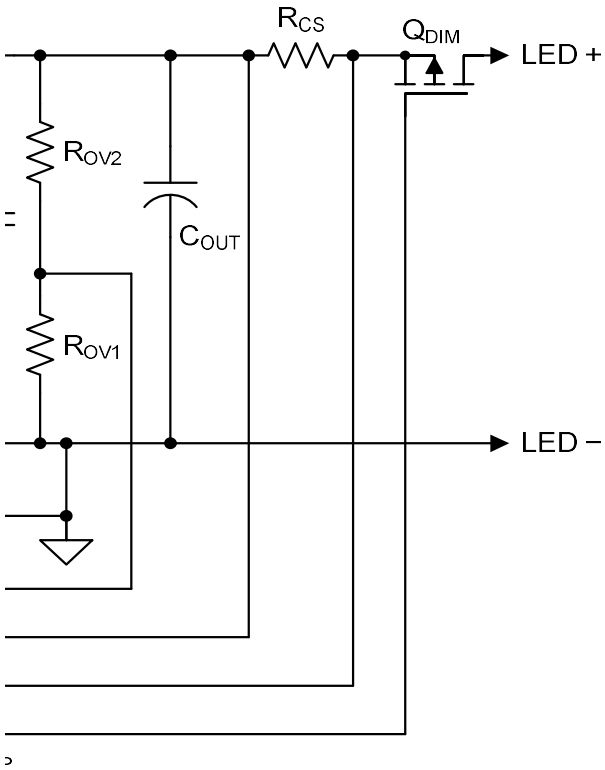


s recommended
and 12kHz is

) to disable

t Direct PWM to




RCS
QDIM
LED +
ROV2
COUT
ROV1
LED –