

PT16752 LED Driver test report

Contents

1.	Buck-Boost LED Driver Electrical Performance Specification	2
2.	Buck-Boost LED Driver Schematic.....	3
3.	Buck-Boost LED Driver BOM	4
4.	Buck-Boost LED Driver Performance Data and Typical Characteristic Curves.....	5
4.1	Efficiency	5
4.2	Line Regulation	7
4.3	Load Regulation	9
4.4	PWM Dimming.....	11
4.5	Analog to PWM Dimming.....	11
4.6	Analog Dimming.....	12
4.7	Temperature Characteristics	12
4.8	Typical Waveforms	13
5.	Boost LED Driver Electrical Performance Specifications.....	16
6.	Boost LED Driver Schematic.....	17
7.	Boost LED Driver BOM	18
8.	BOOST LED Driver Performance Data and Typical Characteristic Curves	19
8.1	Efficiency	19
8.2	Line Regulation	20
8.3	Load Regulation	22
8.4	Typical Waveforms	24

1. Buck-Boost LED Driver Electrical Performance Specification

Parameter	Specifications
Topology	BUCK-BOOST
Input voltage range	7~18V
Output voltage range	9~39V (3~13 LEDs)
Output current	100~1000mA
Efficiency (Input voltage = 14 V, 7 LEDs, Iout = 500 mA)	≈90%
Switching frequency	400 kHz
Over-voltage protection	55V

Table1.BUCK-BOOST Configuration Electrical Performance Specifications

2. Buck-Boost LED Driver Schematic

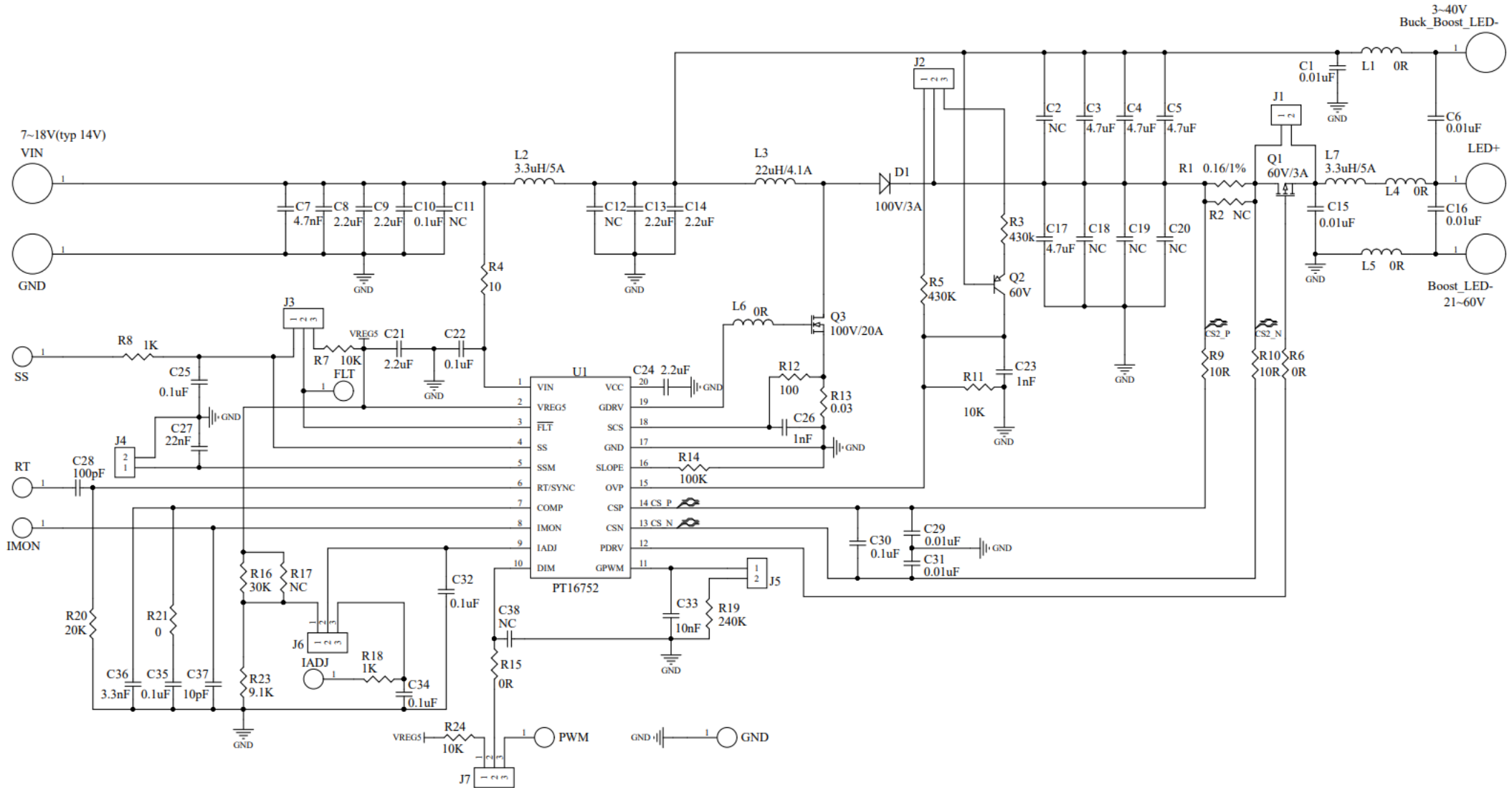


Figure 1. Buck-Boost LED Driver Schematic

3. Buck-Boost LED Driver BOM

Designator	Qty.	Value	Description	Package
C1, C6, C15, C16, C29, C31	6	10nF	CAP, CERM, 10nF, 100 V, +/- 10%, X7R	0805
C3, C4, C5, C17	4	4.7uF	CAP, CERM, 4.7uF, 100 V, +/- 10%, X7R	1210
C7	1	4.7nF	CAP, CERM, 4.7nF, 100 V, +/- 10%, X7R	0805
C8, C9, C13, C14	4	2.2uF	CAP, CERM, 2.2uF, 100 V, +/- 10%, X7R	1210
C10	1	0.1uF	CAP, CERM, 0.1uF, 100V, +/- 10%, X7R	0805
C21, C24	2	2.2uF	CAP, CERM, 2.2uF, 25 V, +/- 10%, X7R	0805
C22, C25, C30, C32, C34, C35	6	0.1uF	CAP, CERM, 0.1uF, 25V, +/- 10%, X7R	0805
C23, C26	2	1nF	CAP, CERM, 1nF, 50 V, +/- 10%, X7R	0805
C27	1	22nF	CAP, CERM, 22nF, 50 V, +/- 10%, X7R	0805
C28	1	100pF	CAP, CERM, 100pF, 25V, +/- 10%, X7R	0805
C33	1	10nF	CAP, CERM, 10nF, 50 V, +/- 10%, X7R	0805
C36	1	3.3nF	CAP, CERM, 3.3nF, 50 V, +/- 10%, X7R	0805
C37	1	10pF	CAP, CERM, 10pF, 50 V, +/- 10%, X7R	0805
D1	1	PDS3100Q	Diode, Schottky, 100 V, 3 A, AEC-Q101	PowerDI5
L2, L7	2	SRN6045TA-3R3Y	Inductor, Shielded, Ferrite, 3.3uH, 5 A	6mmX4.2mm
L3	1	IHLP-4040DZ	inductor, 22uH, 4.1 A AEC-Q200	10mmX10mm
L1, L4, L5, L6	4	0Ω	RES, 0 OHM, 1%, 0.25 W	1206
Q1	1	DMP6185SEQ-13	MOSFET, P-CH, 60V, 3 A, AEC-Q101	SOT223
Q2	1	MMBT2907	PNP Transistor, 60V, AEC-Q101	SOT23
Q3	1	STL45N10F7AG	MOSFET, N-CH, 100V, 18 A, AEC-Q101 (STL8N10LF3, AEC-Q101)	PowerFLAT™5x6
R1	1	0.16Ω	RES, 0.16 OHM, 1%, 0.5 W	1210
R3, R5	2	430k	RES, 430k, 1%, 0.125 W	0805
R4	1	10Ω	RES, 10 OHM, 1%, 0.25 W	1206
R6, R15, R21	3	0Ω	RES, 0Ω, 1%, 0.125 W	0805
R7, R11, R24	3	10k	RES, 10k, 1%, 0.125 W	0805
R8, R18	2	1k	RES, 1k, 1%, 0.125 W	0805
R9, R10	2	10Ω	RES, 10Ω, 1%, 0.125 W	0805
R12	1	100Ω	RES, 100 OHM, 1%, 0.125 W	0805
R13	1	0.03Ω	RES, 0.03 OHM, 1%, 1W	2512
R14	1	100k	RES, 100k, 1%, 0.125 W	0805
R16	1	30k	RES, 30k, 1%, 0.125 W	0805

R19	1	240k	RES, 240k, 1%, 0.125 W	0805
R20	1	20k	RES, 20k, 1%, 0.125 W	0805
R23	1	9.1k	RES, 9.1k, 1%, 0.125 W	0805
U1	1	PT16752	Multi-Topology Automotive Headlight LED Driver	HTSSOP20

4. Buck-Boost LED Driver Performance Data and Typical Characteristic Curves

4.1 Efficiency

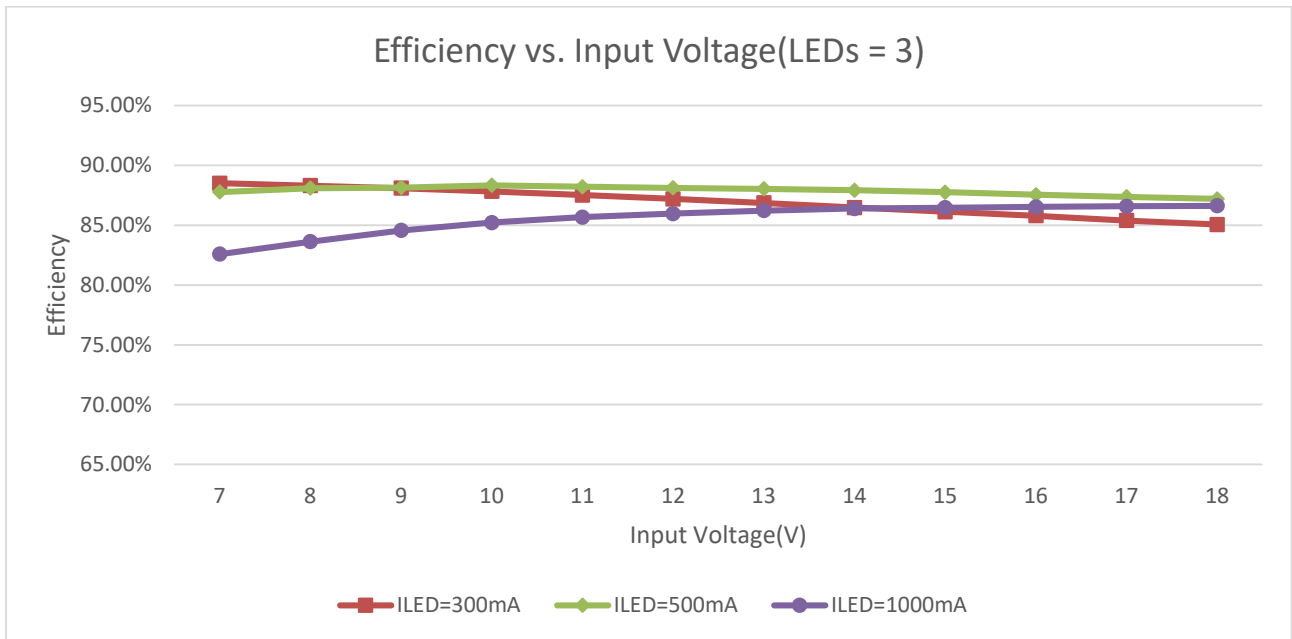


Figure 2. Efficiency vs Input Voltage (Number of Series Connected LEDs = 3)

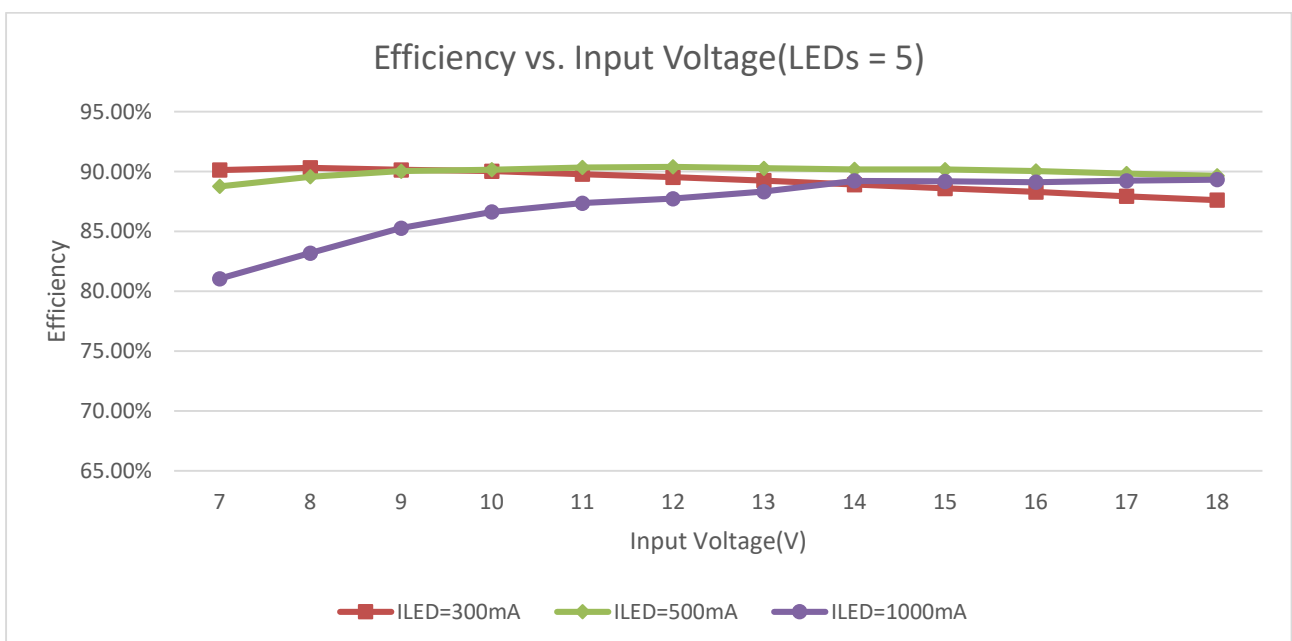


Figure 3. Efficiency vs Input Voltage (Number of Series Connected LEDs = 5)

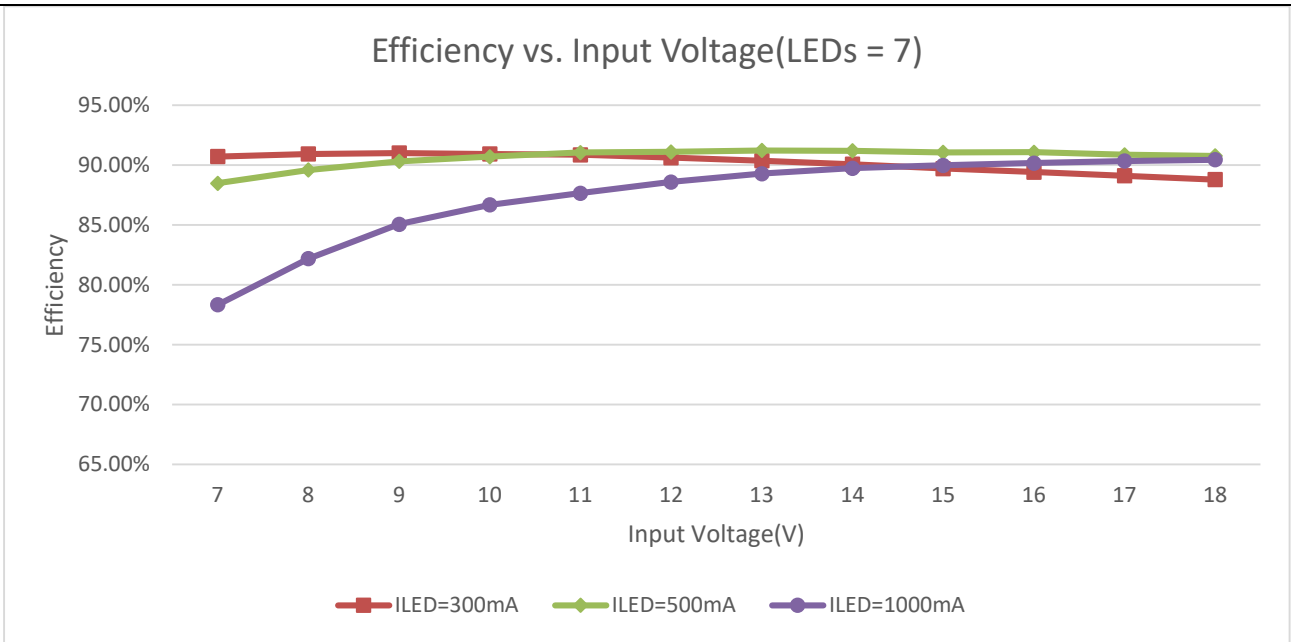


Figure 4. Efficiency vs Input Voltage (Number of Series Connected LEDs = 7)

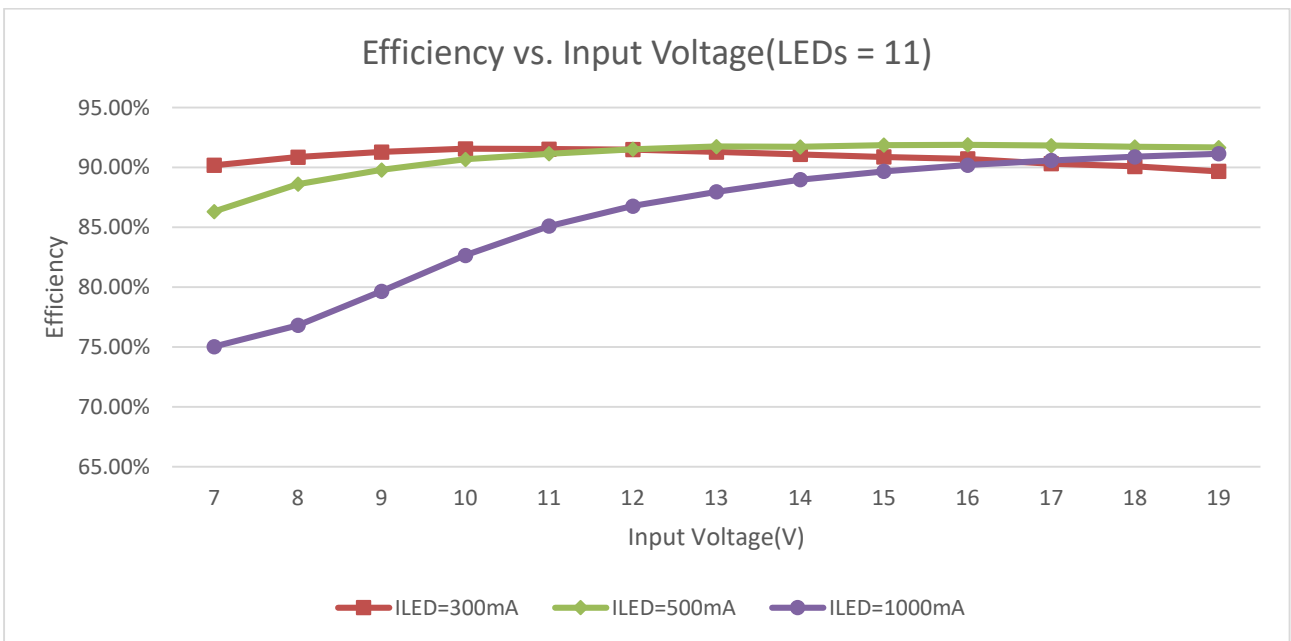


Figure 5. Efficiency vs Input Voltage (Number of Series-Connected LEDs = 11)

4.2 Line Regulation

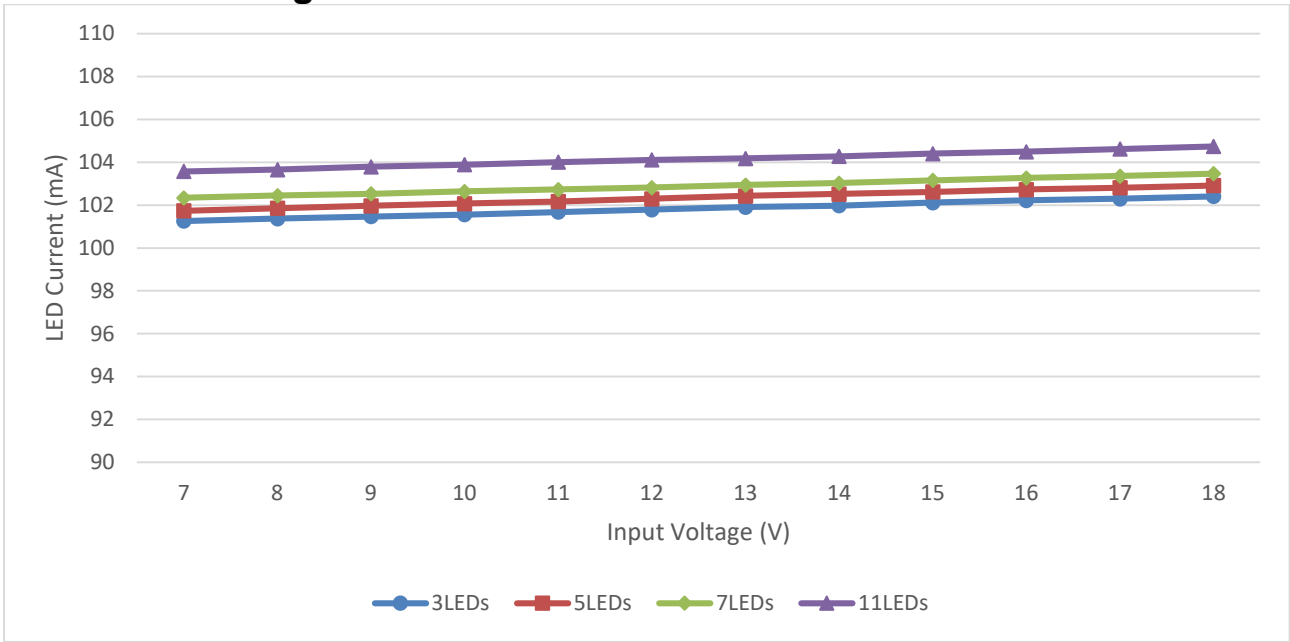


Figure 6. Output LED Current vs Input Voltage (VIADJ = 210 mV)

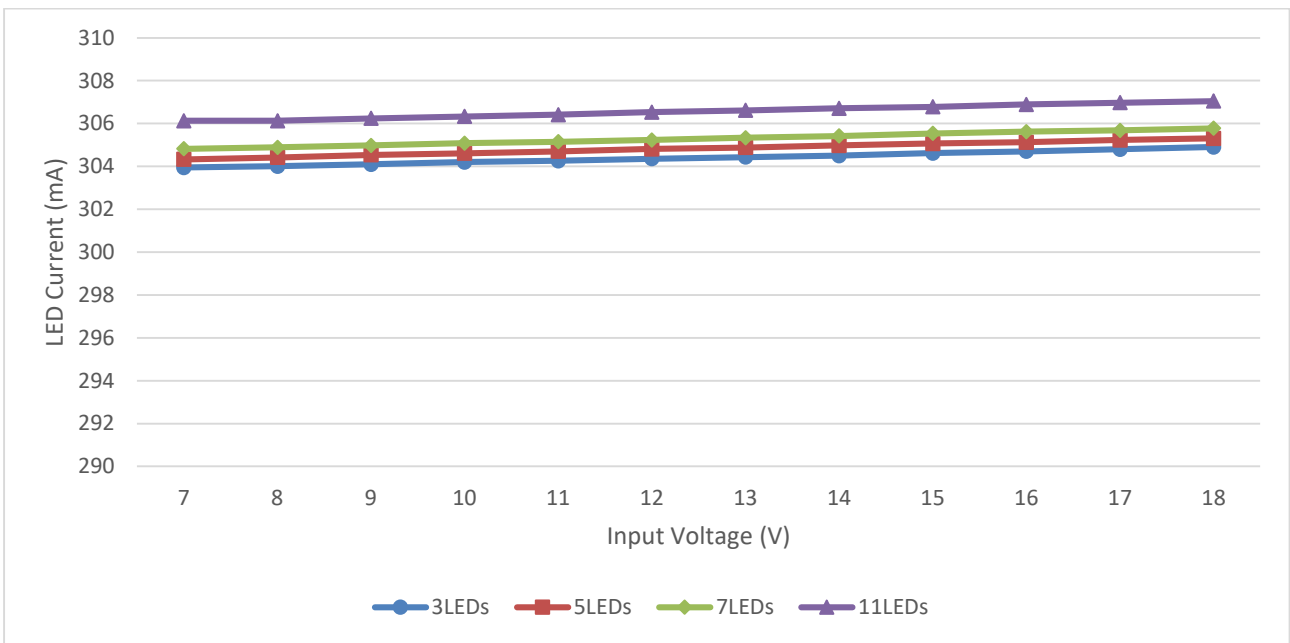


Figure 7. Output LED Current vs Input Voltage (VIADJ = 670 mV)

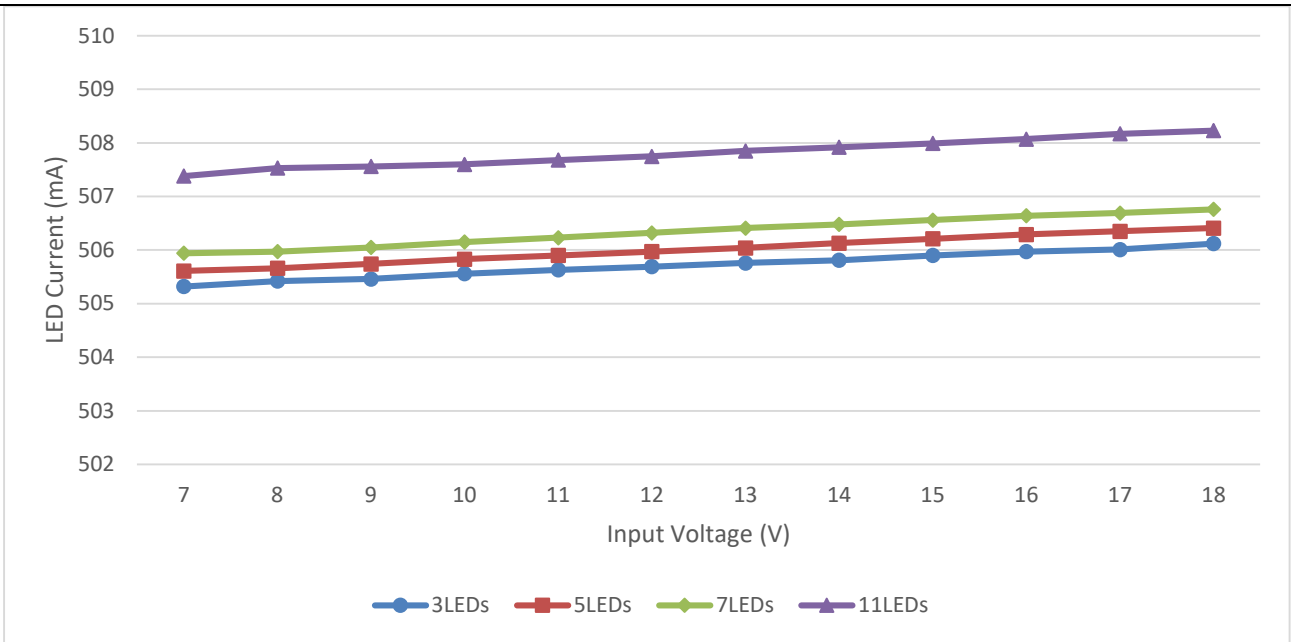


Figure 8. Output LED Current vs Input Voltage (VIADJ =1128 mV)

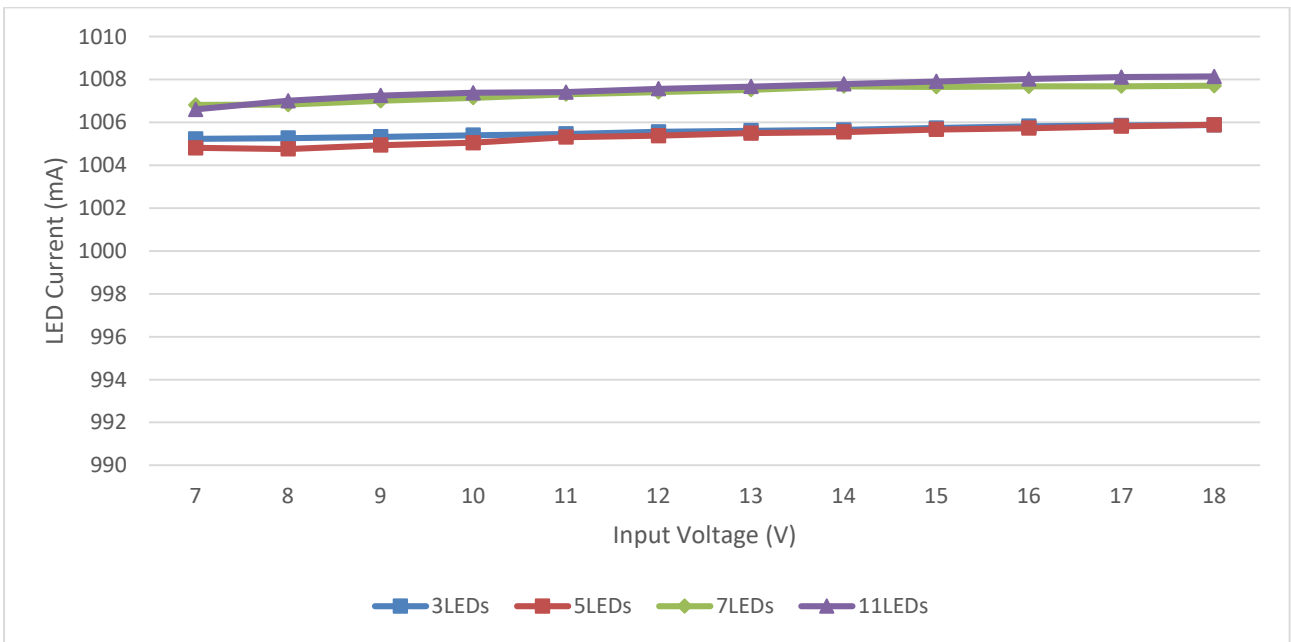


Figure 9. Output LED Current vs Input Voltage (VIADJ =2268 mV)

4.3 Load Regulation

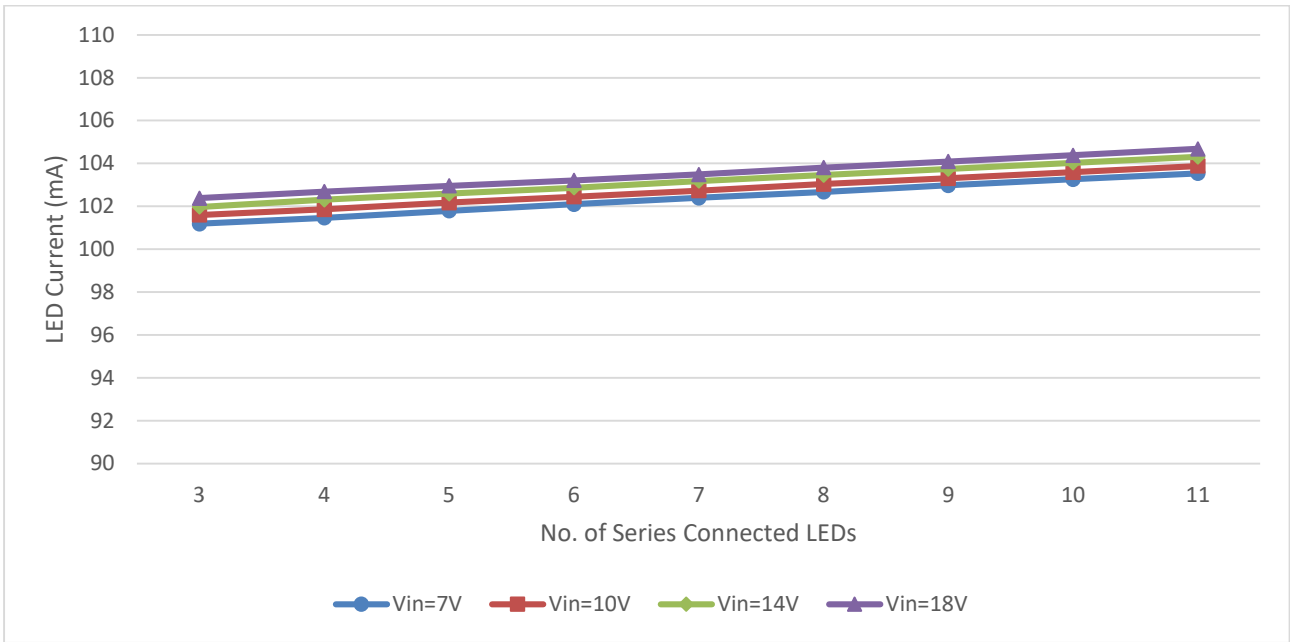


Figure 10. Output LED Current vs LED String Configuration (VIADJ = 210 mV)

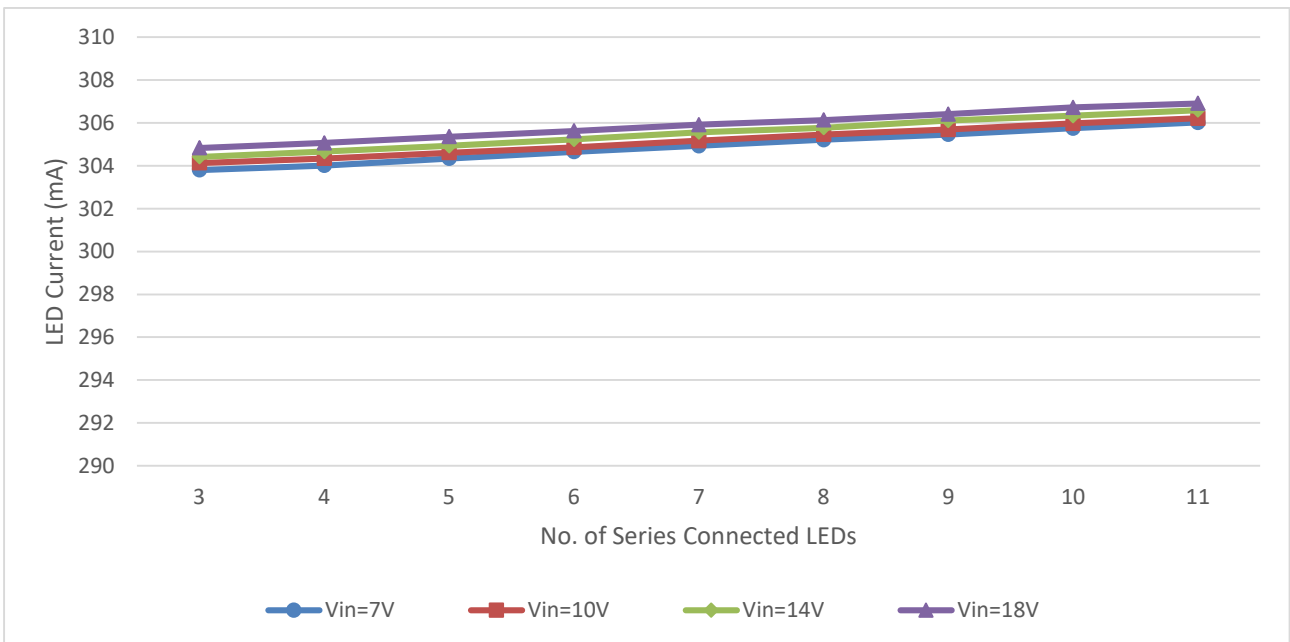


Figure 11. Output LED Current vs LED String Configuration (VIADJ = 670 mV)

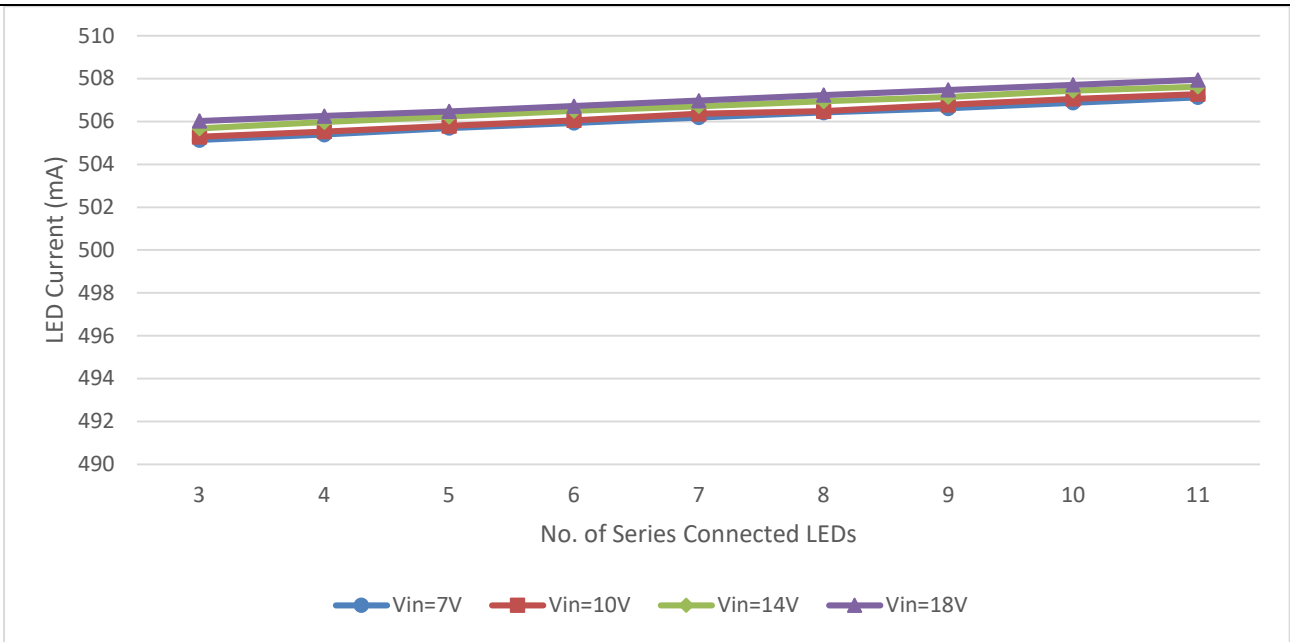


Figure 12. Output LED Current vs LED String Configuration (VIADJ = 1128 mV)

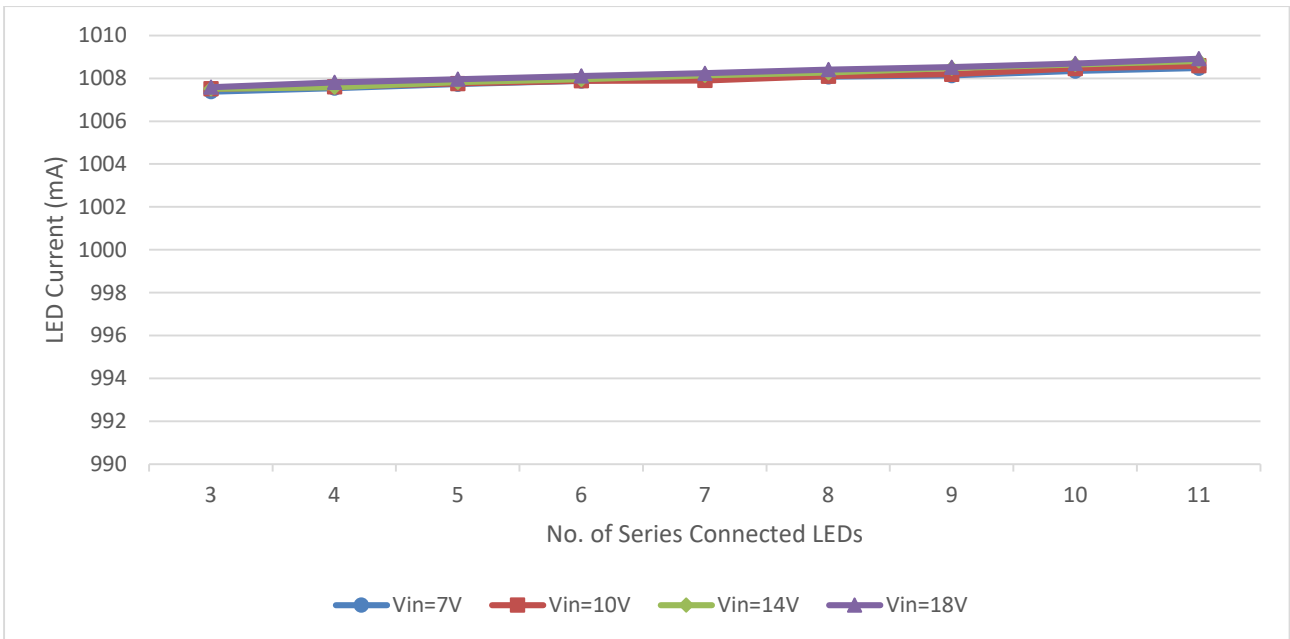


Figure 13. Output LED Current vs LED String Configuration (VIADJ = 2268 mV)

4.4 PWM Dimming

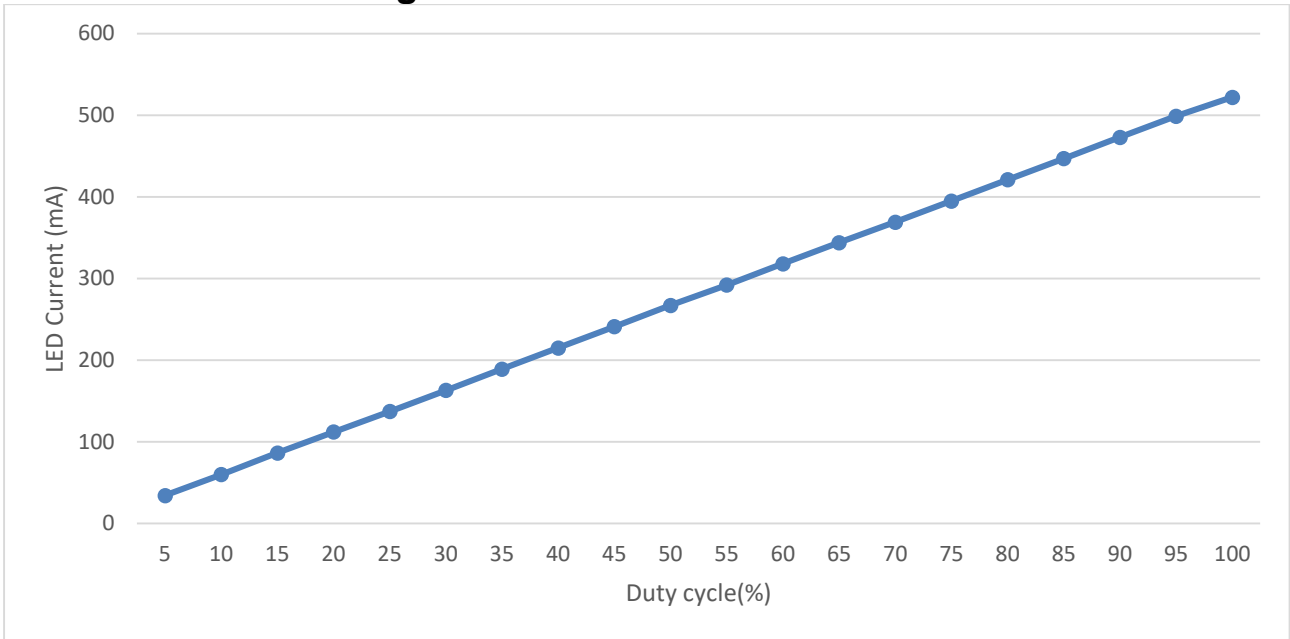


Figure 14. Output LED Current vs PWM Duty cycle (Vin=14V, Number of LED Series=6)

4.5 Analog to PWM Dimming

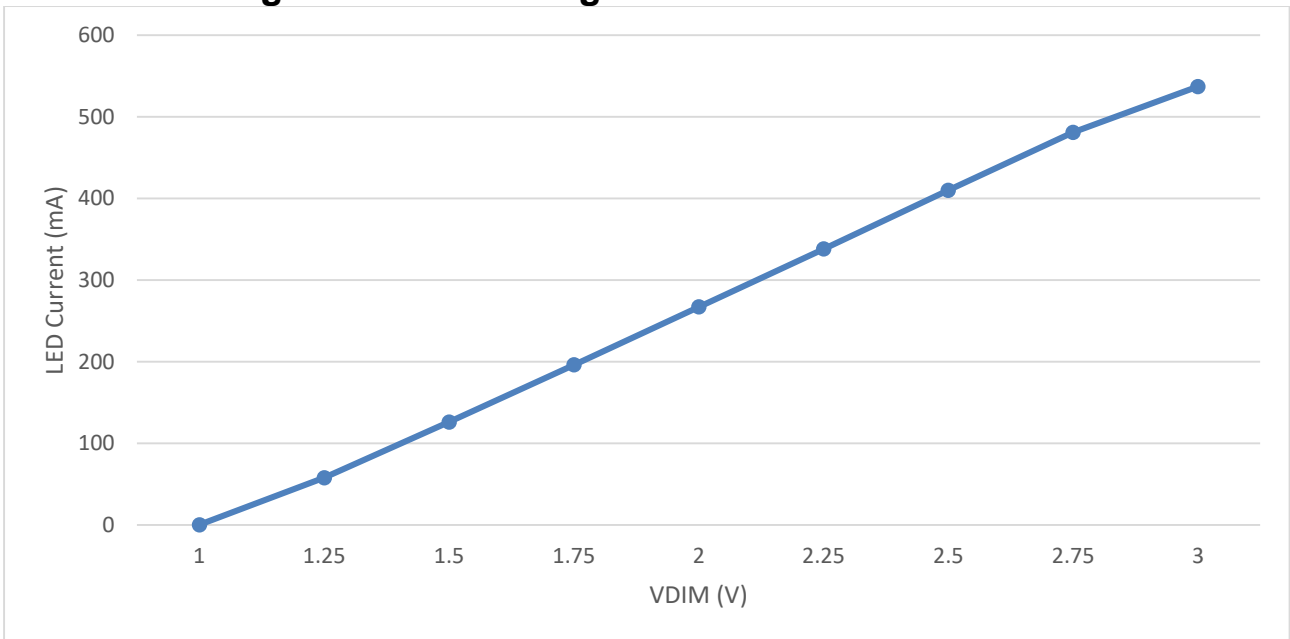


Figure 15. LED Current vs DIM/PWM Voltage (Vin=14V, Number of LED Series=6)

4.6 Analog Dimming

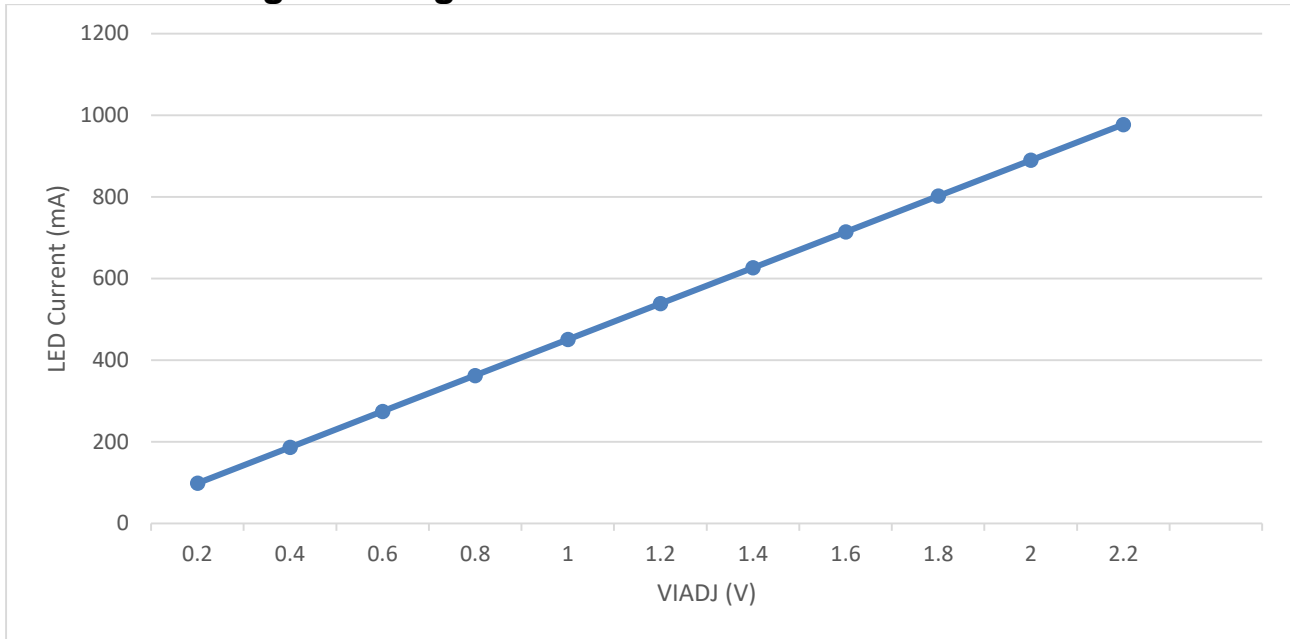


Figure 16. LED Current vs IADJ Voltage (Vin=14V, Number of LED Series=6)

4.7 Temperature Characteristics

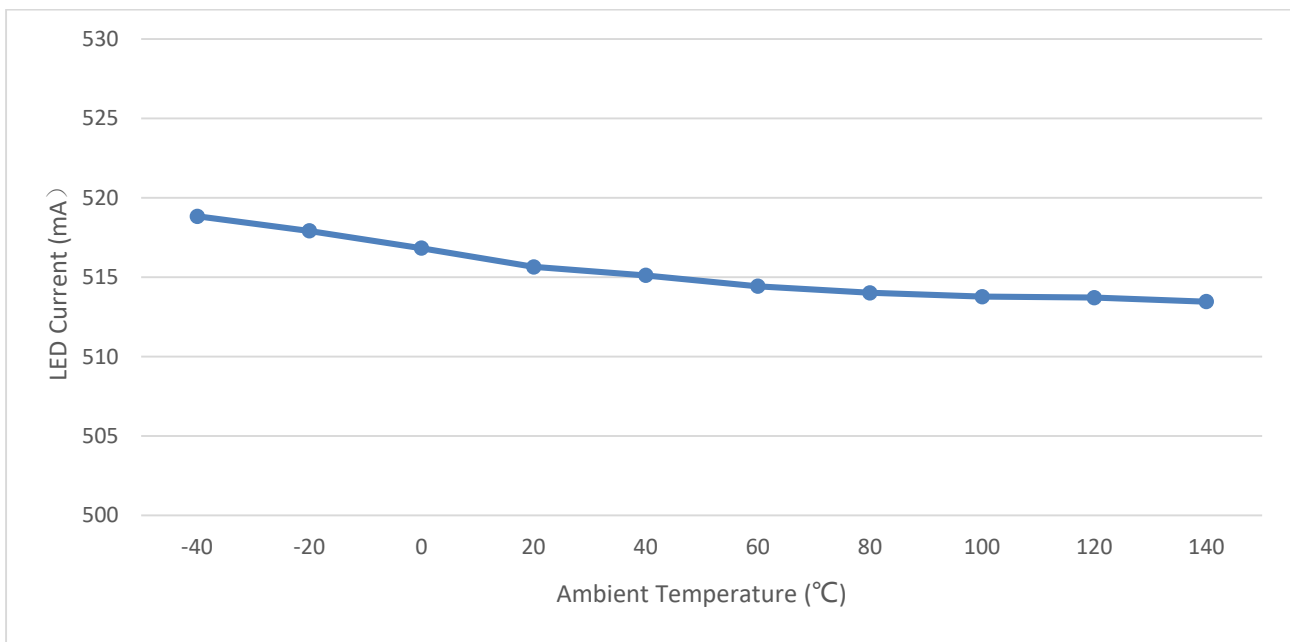
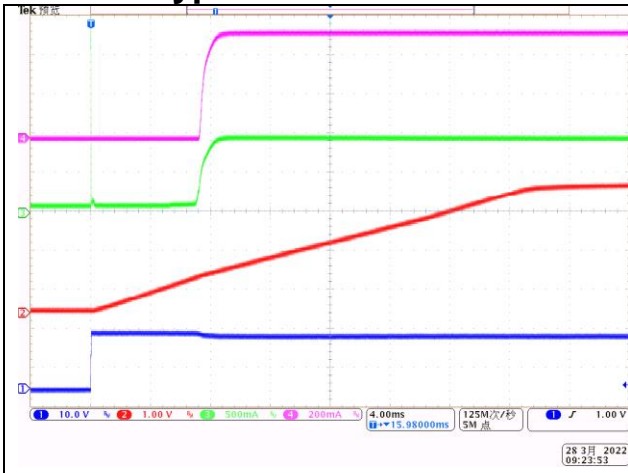


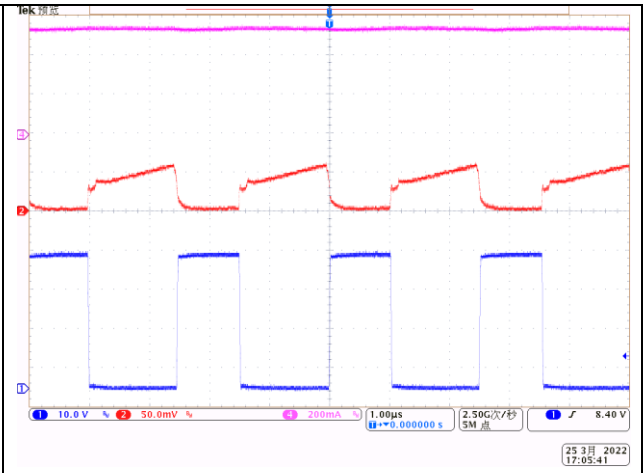
Figure 17. LED Current vs Ambient Temperature (VIN = 14 V, Number of LEDs in Series = 6)

4.8 Typical Waveforms



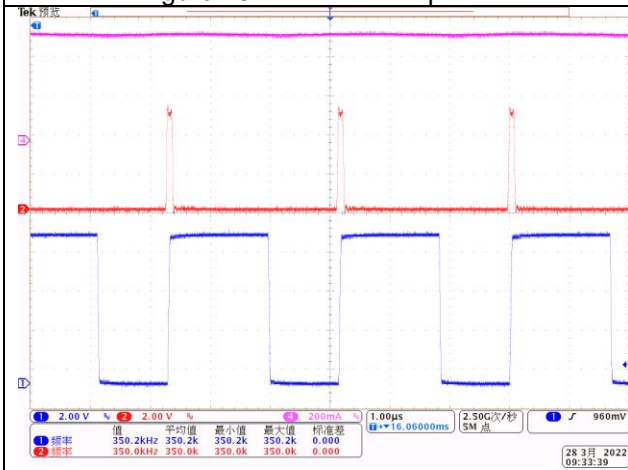
CH1: Vin
CH2: SS Voltage,
CH3: Iin
CH4: Iout
Time: 4ms/div

Figure 18. Soft-Start Sequence



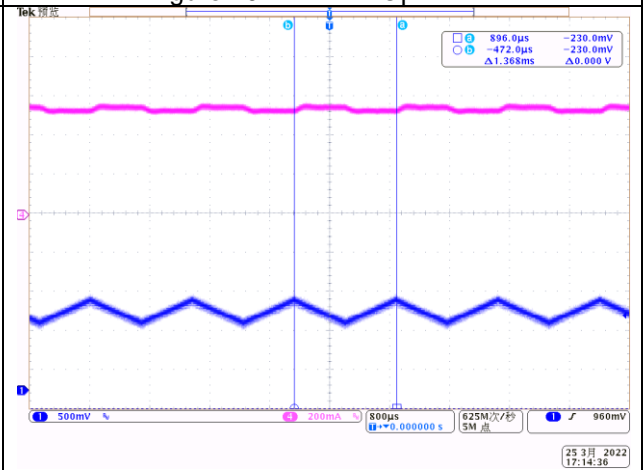
CH1: Drain voltage,
CH2: SCS voltage,
CH4: Iout
Time: 1µs/div

Figure 19. Nominal Operation



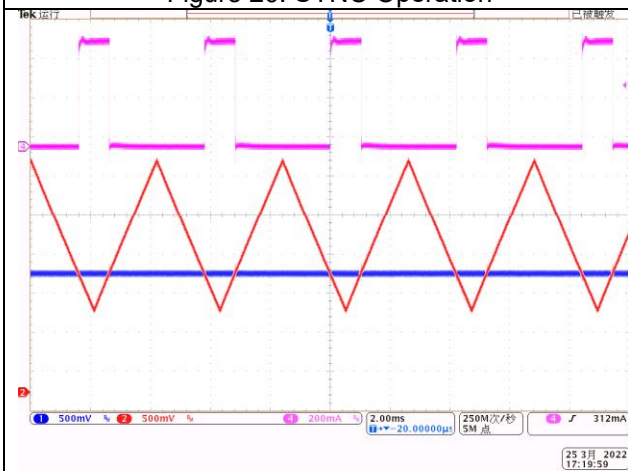
CH1: GATE voltage,
CH2: SYNC input,
CH4: Iout
Time: 1µs/div

Figure 20. SYNC Operation



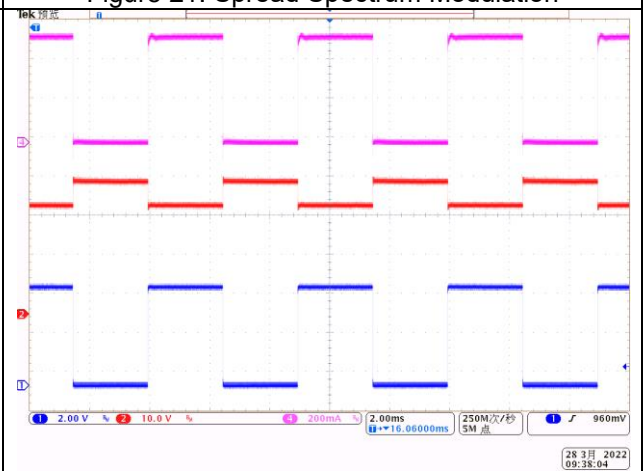
CH1: SSM voltage;
CH4: Iout;
Time: 800µs/div

Figure 21. Spread Spectrum Modulation



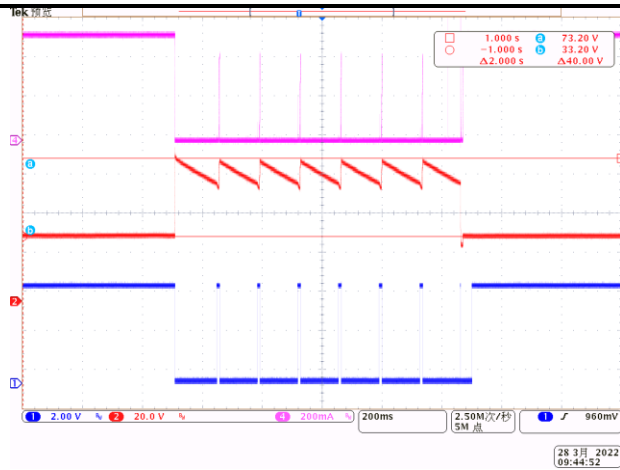
CH1: DIM voltage,
CH2: GPWM pin voltage,
CH4: Iout
Time: 2ms/div

Figure 22. Analog-to-PWM Dimming Transient

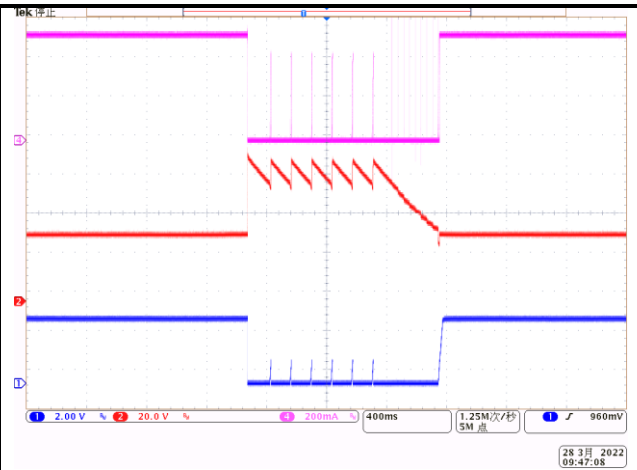


CH1: External PWM input signal;
CH2: PDRV voltage;
CH4: Iout;
Time: 2ms/div

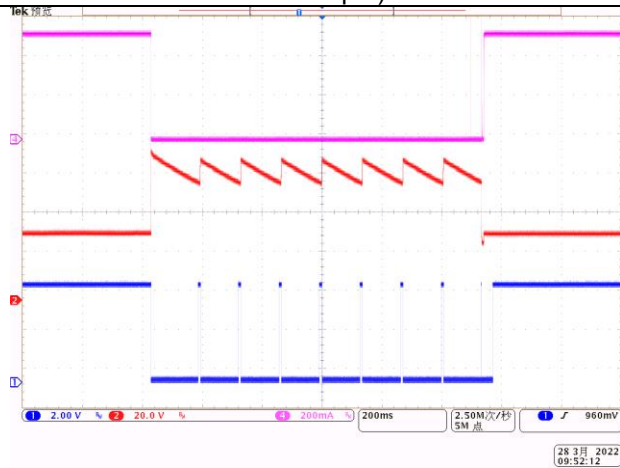
Figure 23. Direct PWM Dimming Transient



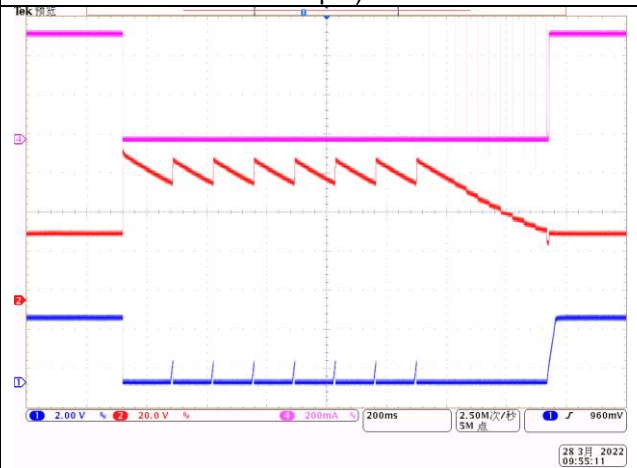
CH1: /FLT Output,
CH2: CSP Voltage,
CH4: Iout
Time: 200ms/div
Figure 24. LED Over Voltage Fault(/FLT connect to VREG5 pin)



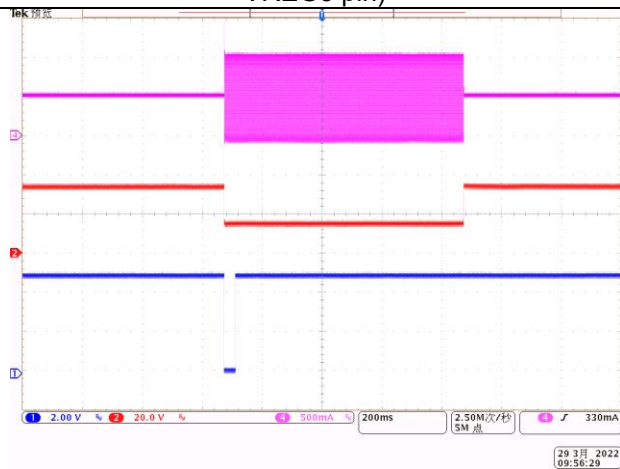
CH1: /FLT Output,
CH2: CSP Voltage,
CH4: Iout
Time: 400ms/div
Figure 25. LED Over Voltage Fault(/FLT connect to SS pin)



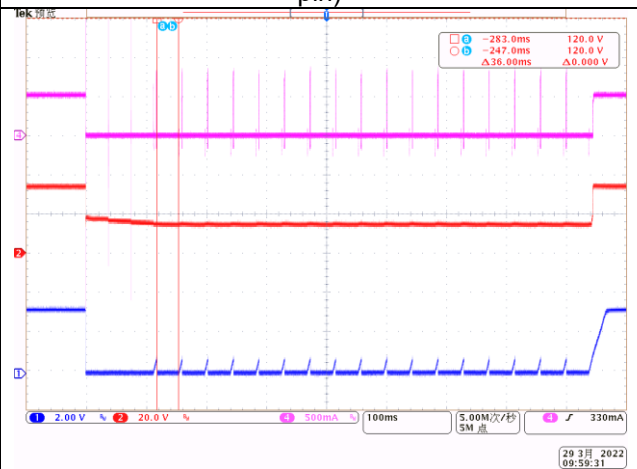
CH1: /FLT Output
CH2: CSP Voltage
CH4: Iout
Time: 200ms/div
Figure 26. LED OPEN Fault(/FLT Connected to VREG5 pin)



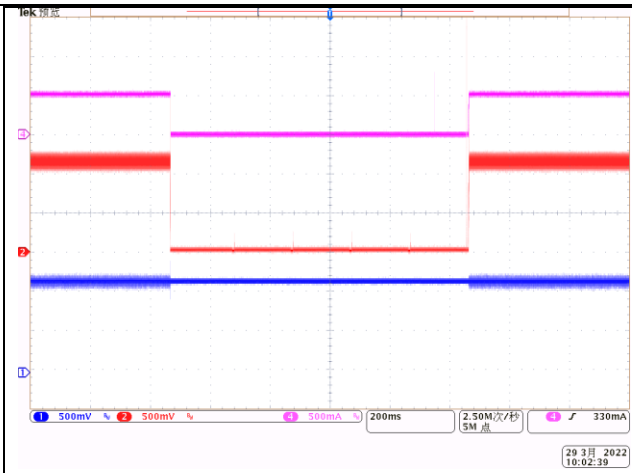
CH1: /FLT Output
CH2: CSP Voltage
CH4: Iout
Time: 200ms/div
Figure 27. LED OPEN Fault(/FLT Connected to SS pin)



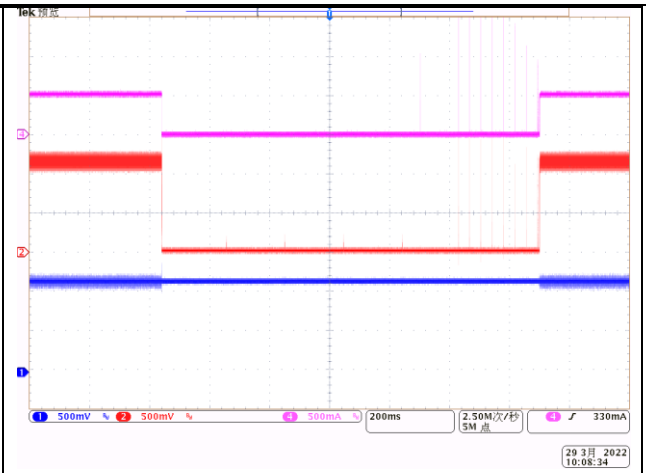
CH1: /FLT Output
CH2: CSP Voltage
CH4: Iout
Time: 200ms/div
Figure 28. LED Shorted Fault (/FLT Connected to VREG5 pin)



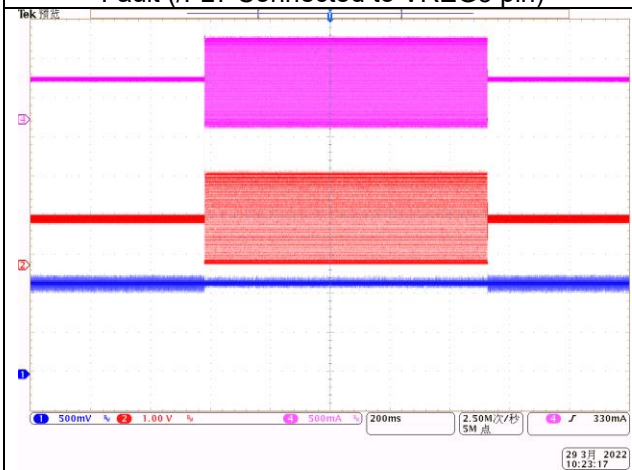
CH1: /FLT Output
CH2: CSP Voltage
CH4: Iout
Time: 100ms/div
Figure 29. LED Shorted Fault (/FLT Connected to SS pin)



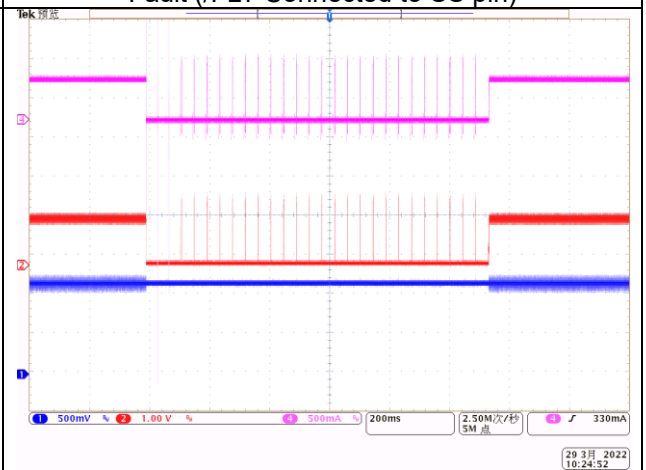
CH1: IADJ Voltage,
CH2: IMON Voltage,
CH4: Iout Time: 200ms/div
Figure 30. IMON Response to LED Open-Circuit
Fault (/FLT Connected to VREG5 pin)



CH1: IADJ Voltage,
CH2: IMON Voltage,
CH4: Iout Time: 200ms/div
Figure 31. IMON Response to LED Open-Circuit
Fault (/FLT Connected to SS pin)



CH1: IADJ Voltage,
CH2: IMON Voltage,
CH4: Iout Time: 200ms/div
Figure 32. IMON Response to LED Short-Circuit
Fault (/FLT Connected to VREG5 pin)



CH1: IADJ Voltage,
CH2: IMON Voltage,
CH4: Iout Time: 200ms/div
Figure 33. IMON Response to LED Short-Circuit
Fault (/FLT Connected to SS pin)

5. Boost LED Driver Electrical Performance Specifications

Parameter	Specifications
Topology	BOOST
Input voltage range	7~18V
Output voltage range	21~52V (8~17 LEDs)
Output current	100~1000mA
Efficiency (Input voltage = 14 V, 8 LEDs, I _{out} = 500 mA)	≈94%
Switching frequency	400 kHz
Over-voltage protection	55V

Table 2. BOOST Configuration Electrical Performance Specification

6. Boost LED Driver Schematic

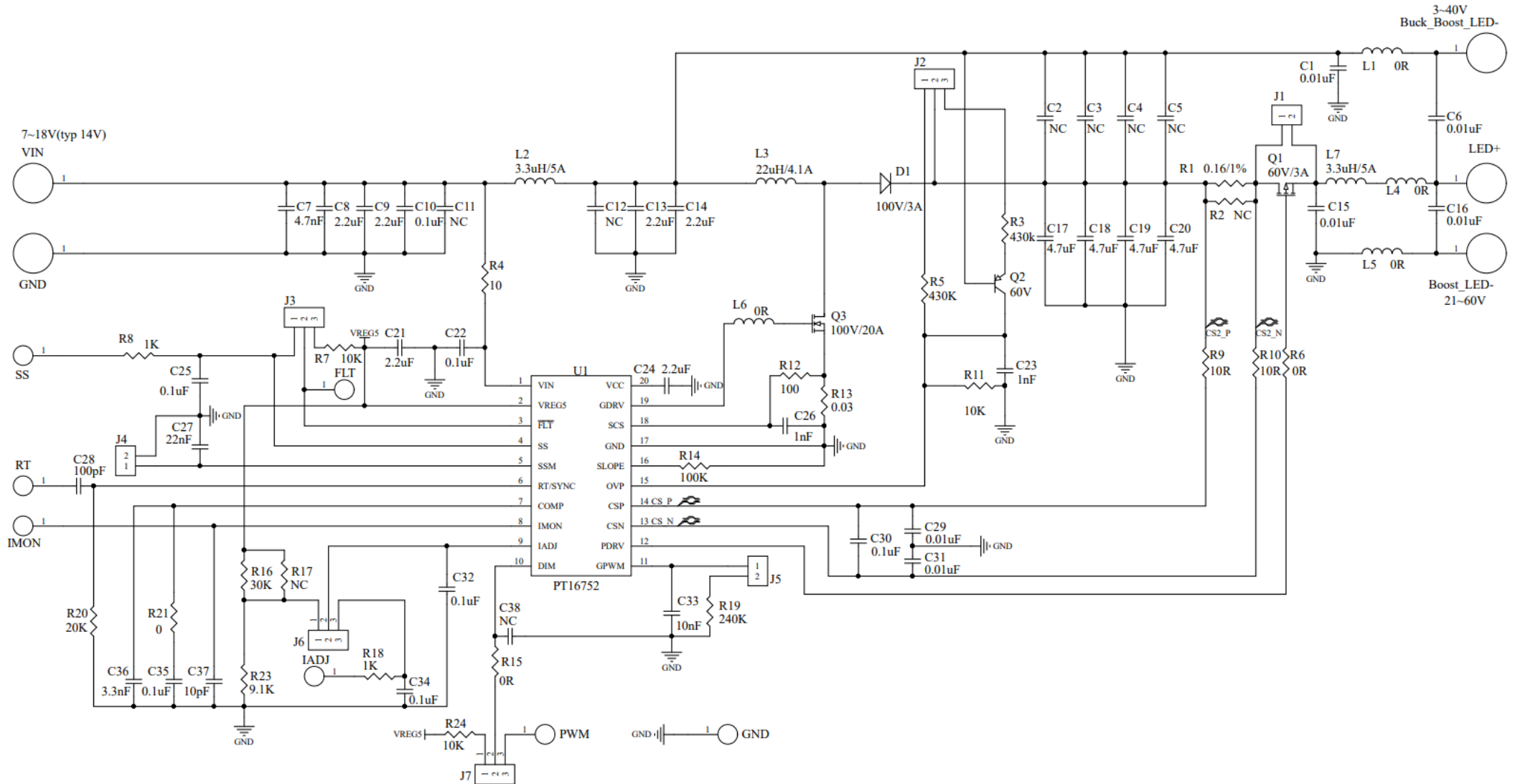


Figure 34. Boost LED Driver Schematic

7. Boost LED Driver BOM

Designator	Qty.	Value	Description	Package
C1, C6, C15, C16, C29, C31	6	10nF	CAP, CERM, 10nF, 100 V, +/- 10%, X7R	0805
C17, C18, C19, C20	4	4.7uF	CAP, CERM, 4.7uF, 100 V, +/- 10%, X7R	1210
C7	1	4.7nF	CAP, CERM, 4.7nF, 100 V, +/- 10%, X7R	0805
C8, C9, C13, C14	4	2.2uF	CAP, CERM, 2.2uF, 100 V, +/- 10%, X7R	1210
C10	1	0.1uF	CAP, CERM, 0.1uF, 100V, +/- 10%, X7R	0805
C21, C24	2	2.2uF	CAP, CERM, 2.2uF, 25 V, +/- 10%, X7R	0805
C22, C25, C30, C32, C34, C35	6	0.1uF	CAP, CERM, 0.1uF, 25V, +/- 10%, X7R	0805
C23, C26	2	1nF	CAP, CERM, 1nF, 50 V, +/- 10%, X7R	0805
C27	1	22nF	CAP, CERM, 22nF, 50 V, +/- 10%, X7R	0805
C28	1	100pF	CAP, CERM, 100pF, 25V, +/- 10%, X7R	0805
C33	1	10nF	CAP, CERM, 10nF, 50 V, +/- 10%, X7R	0805
C36	1	3.3nF	CAP, CERM, 3.3nF, 50 V, +/- 10%, X7R	0805
C37	1	10pF	CAP, CERM, 10pF, 50 V, +/- 10%, X7R	0805
D1	1	PDS3100Q	Diode, Schottky, 100 V, 3 A, AEC-Q101	PowerDI5
L2, L7	2	SRN6045TA-3R3Y	Inductor, Shielded, Ferrite, 3.3uH, 5 A	6mmX4.2mm
L3	1	IHLP-4040DZ	inductor, 22uH, 4.1 A (MSD1278T-223MLB AEC-Q200)	10mmX10mm
L1, L4, L5, L6	4	0Ω	RES, 0 OHM, 1%, 0.25 W	1206
Q1	1	DMP6185SEQ-13	MOSFET, P-CH, 60V, 3 A, AEC-Q101	SOT223
Q2	1	MMBT2907	PNP Transistor, 60V, AEC-Q101	SOT23
Q3	1	STL45N10F7AG	MOSFET, N-CH, 100V, 18 A, AEC-Q101 (STL8N10LF3, AEC-Q101)	PowerFLAT™5x6
R1	1	0.16Ω	RES, 0.16 OHM, 1%, 0.5 W	1210
R3, R5	2	430k	RES, 430k, 1%, 0.125 W	0805
R4	1	10Ω	RES, 10 OHM, 1%, 0.25 W	1206
R6, R15, R21	3	0Ω	RES, 0Ω, 1%, 0.125 W	0805
R7, R11, R24	3	10k	RES, 10k, 1%, 0.125 W	0805
R8, R18	2	1k	RES, 1k, 1%, 0.125 W	0805
R9, R10	2	10Ω	RES, 10Ω, 1%, 0.125 W	0805
R12	1	100Ω	RES, 100 OHM, 1%, 0.125 W	0805
R13	1	0.03Ω	RES, 0.03 OHM, 1%, 1W	2512
R14	1	100k	RES, 100k, 1%, 0.125 W	0805

R16	1	30k	RES, 30k, 1%, 0.125 W	0805
R19	1	240k	RES, 240k, 1%, 0.125 W	0805
R20	1	20k	RES, 20k, 1%, 0.125 W	0805
R23	1	9.1k	RES, 9.1k, 1%, 0.125 W	0805
U1	1	PT16752	Multi-Topology Automotive Headlight LED Driver	HTSSOP20

8. BOOST LED Driver Performance Data and Typical Characteristic Curves

8.1 Efficiency

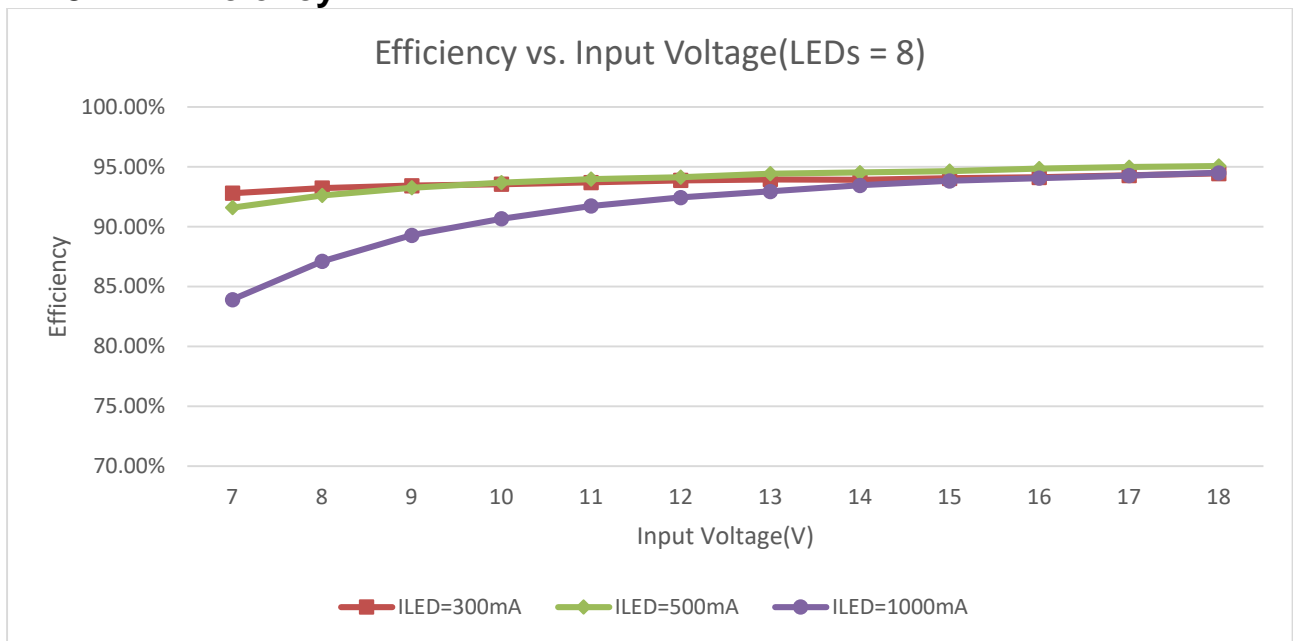


Figure 35. Efficiency vs Input Voltage (Number of Series Connected LEDs = 8)

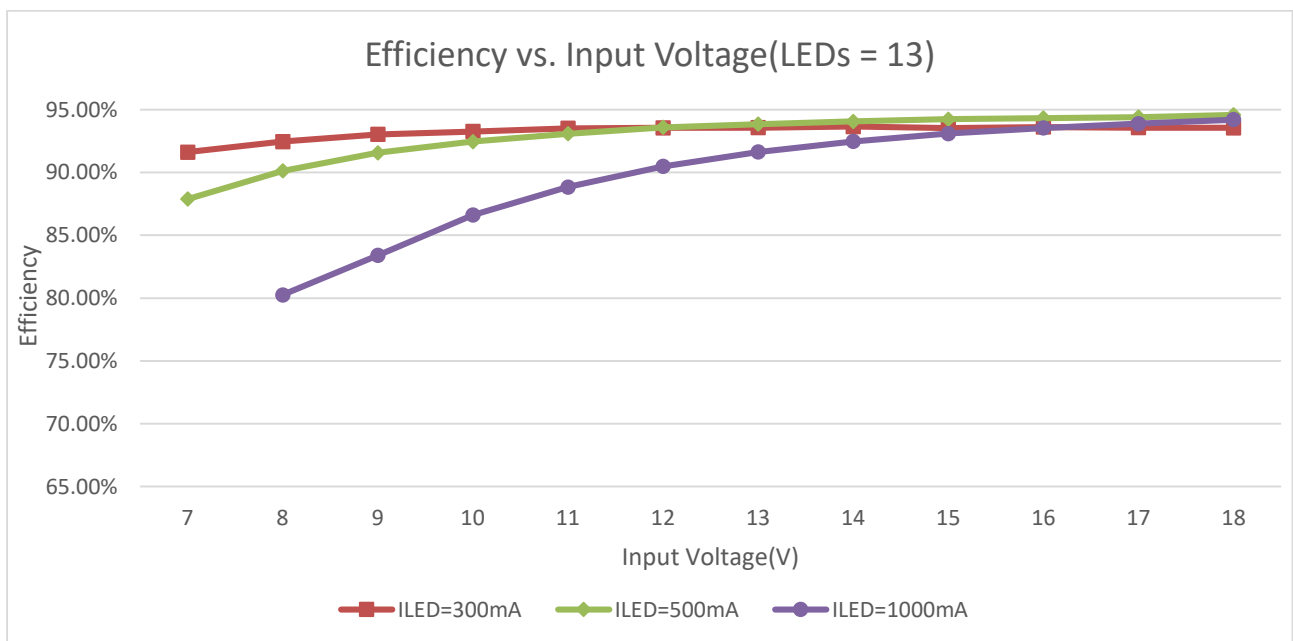


Figure 36. Efficiency vs Input Voltage (Number of Series Connected LEDs = 13)

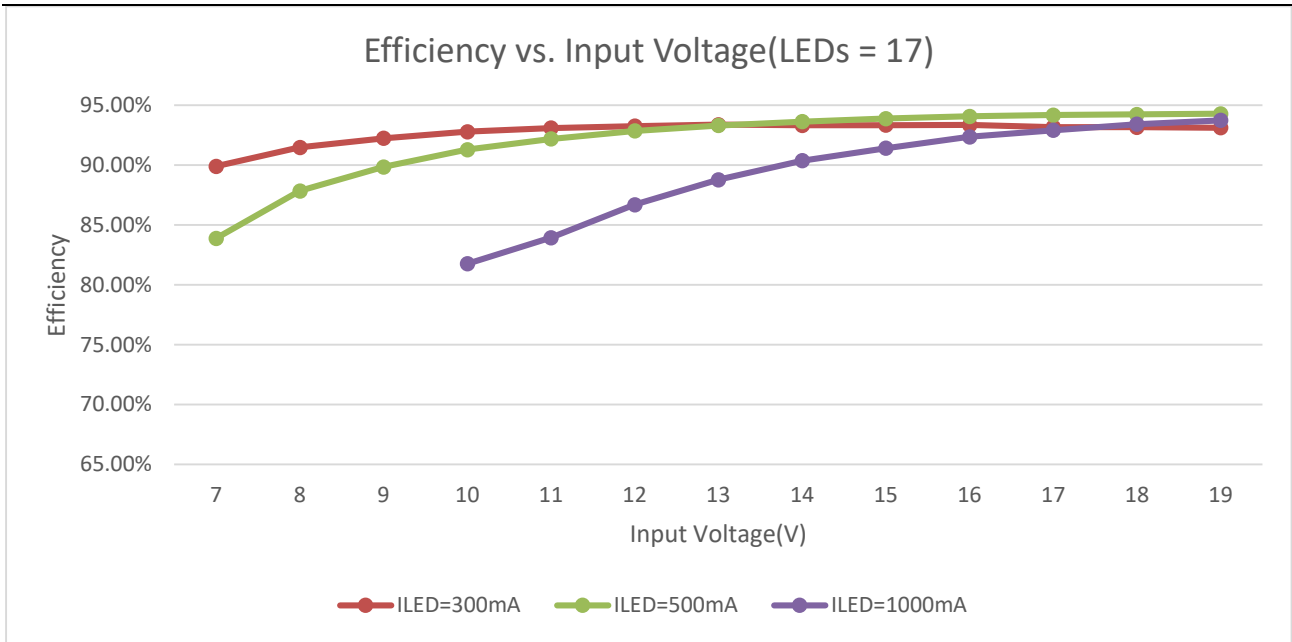


Figure 37. Efficiency vs Input Voltage (Number of Series Connected LEDs = 17)

8.2 Line Regulation

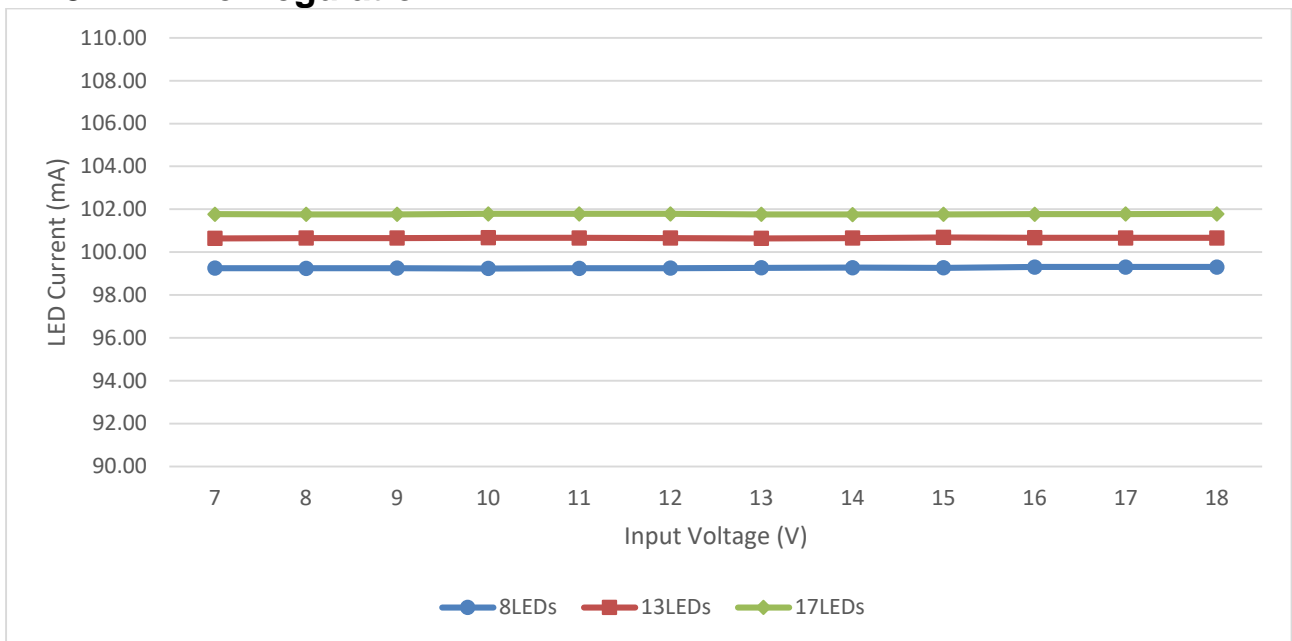


Figure 38. Output LED Current vs Input Voltage (VIADJ = 210 mV)

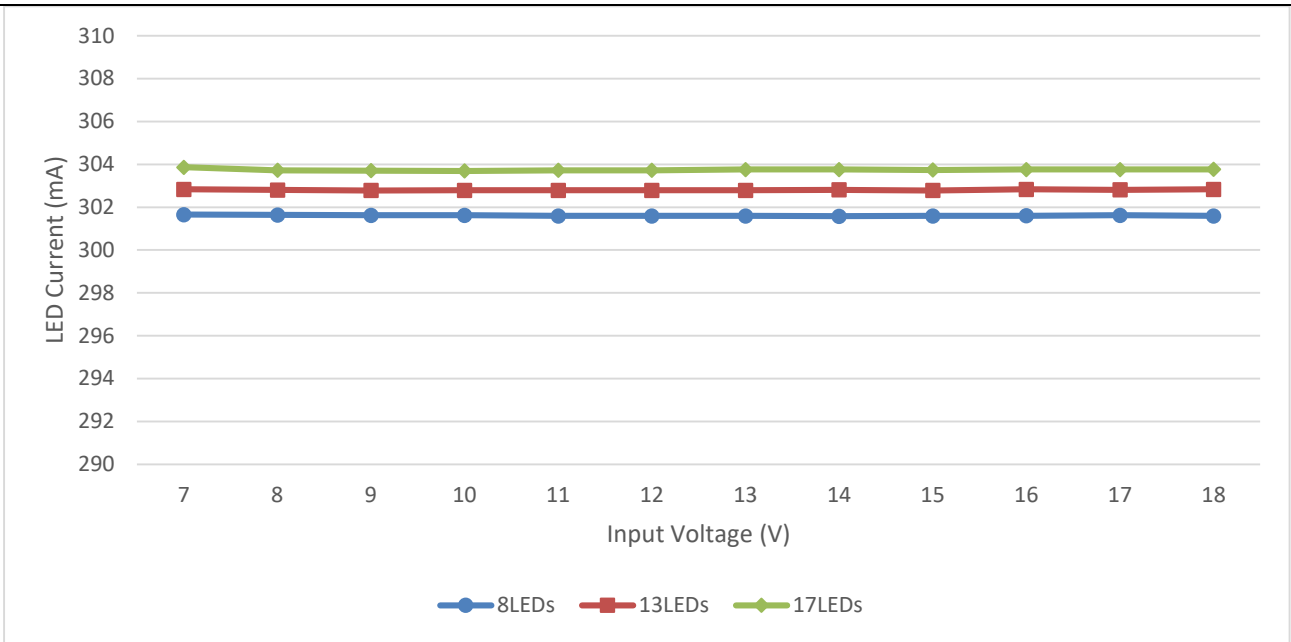


Figure 39. Output LED Current vs Input Voltage (VIADJ =670 mV)

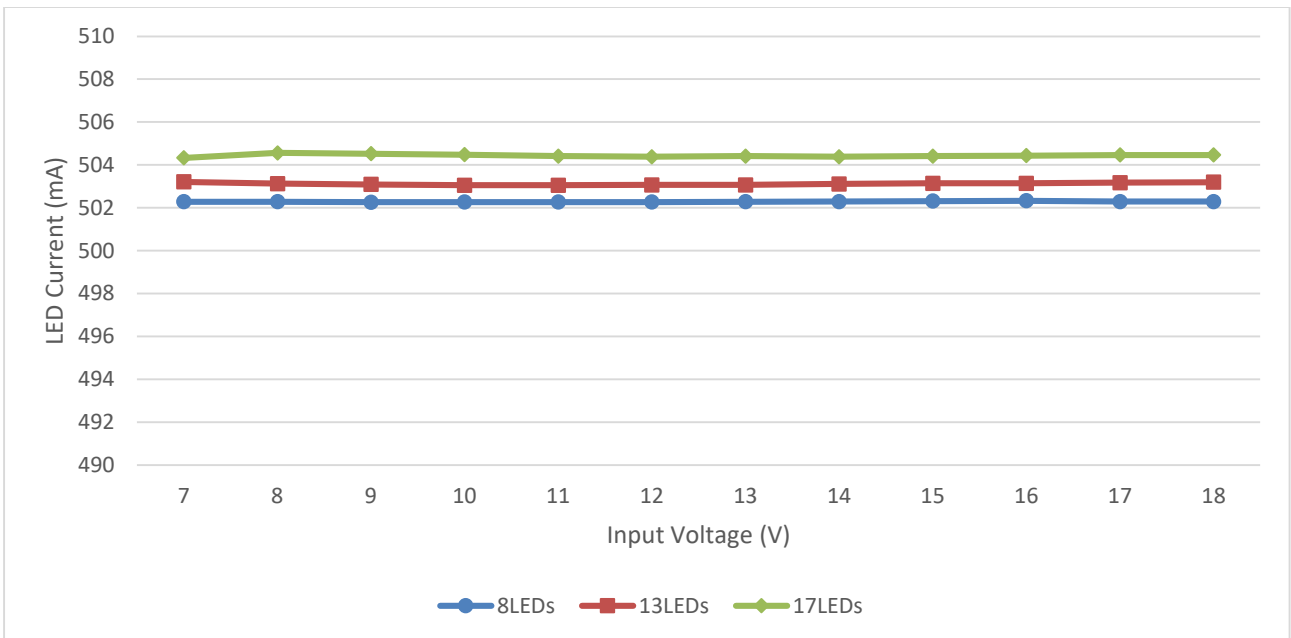


Figure 40. Output LED Current vs Input Voltage (VIADJ =1128 mV)

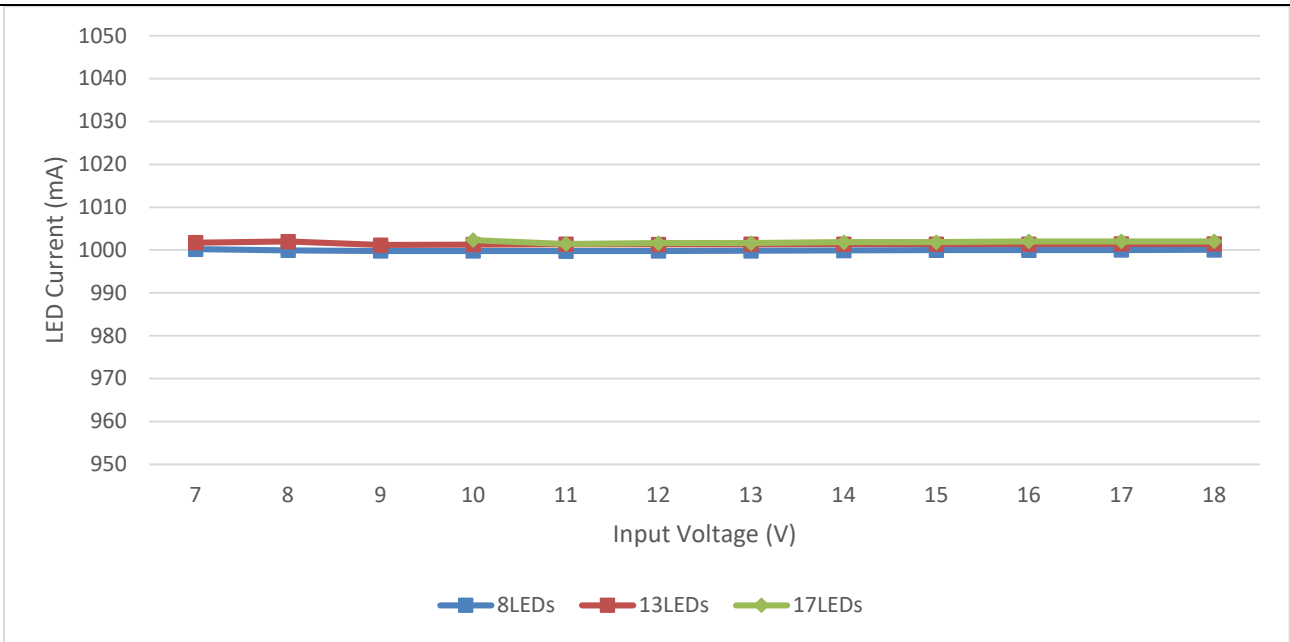


Figure 41. Output LED Current vs Input Voltage (VIADJ = 2268 mV)

8.3 Load Regulation

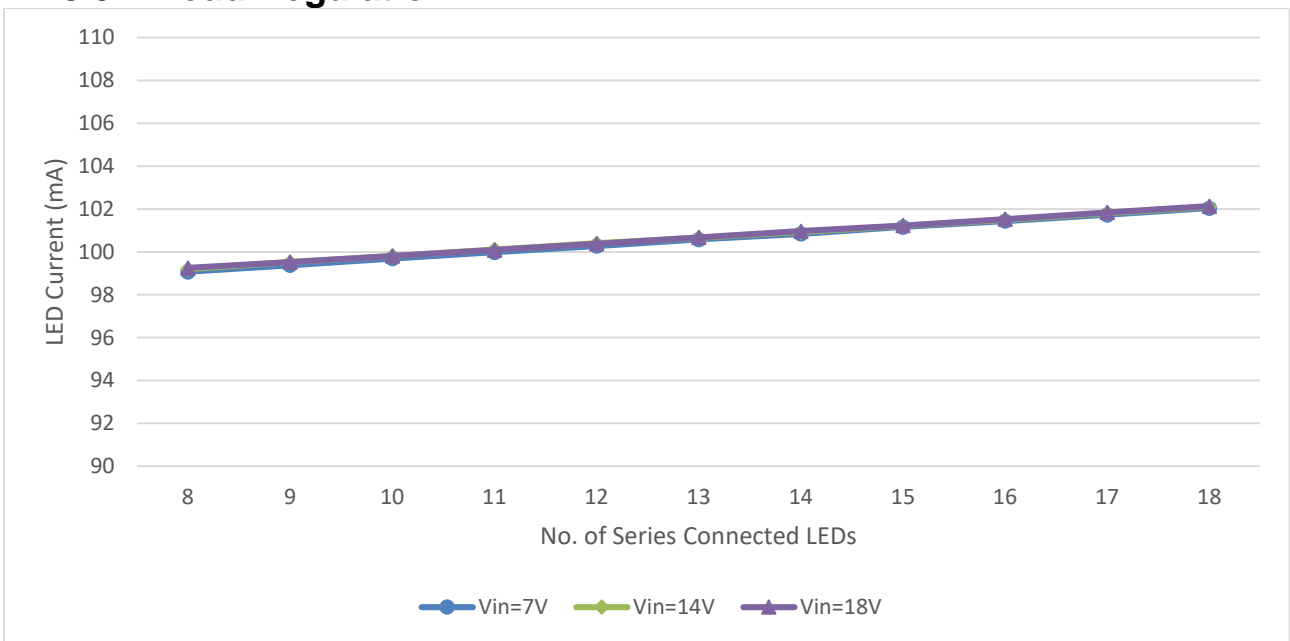


Figure 42. Output LED Current vs LED String Configuration (VIADJ = 210 mV)

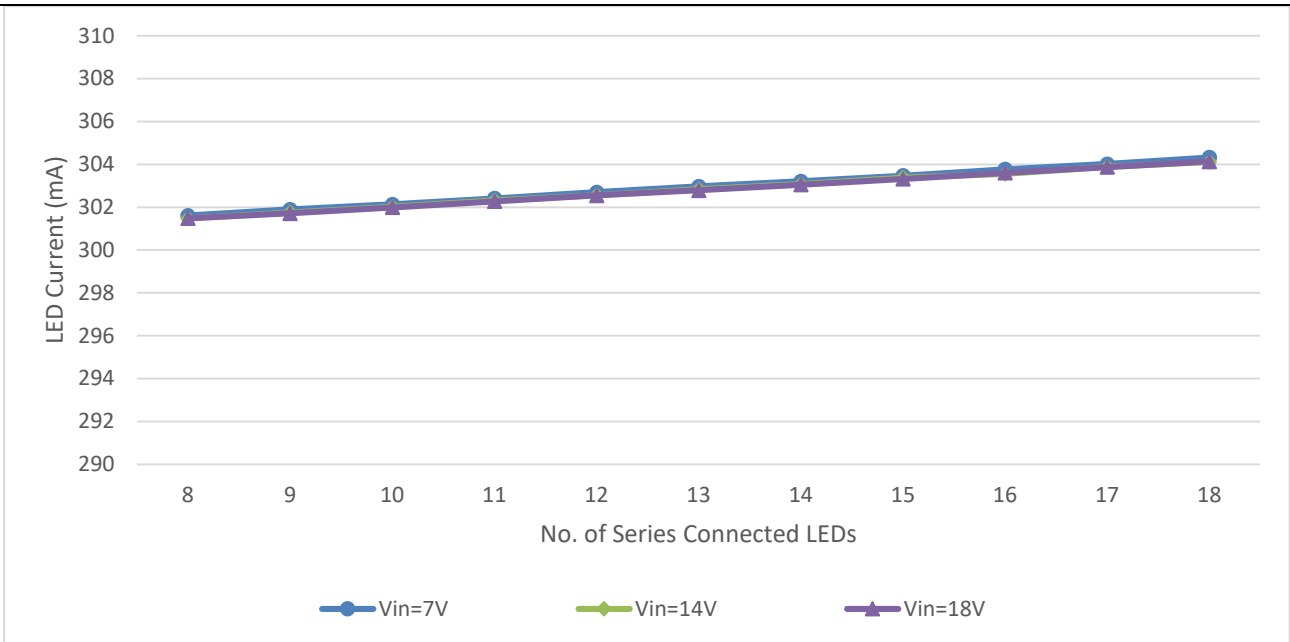


Figure 43. Output LED Current vs LED String Configuration (VIADJ = 670 mV)

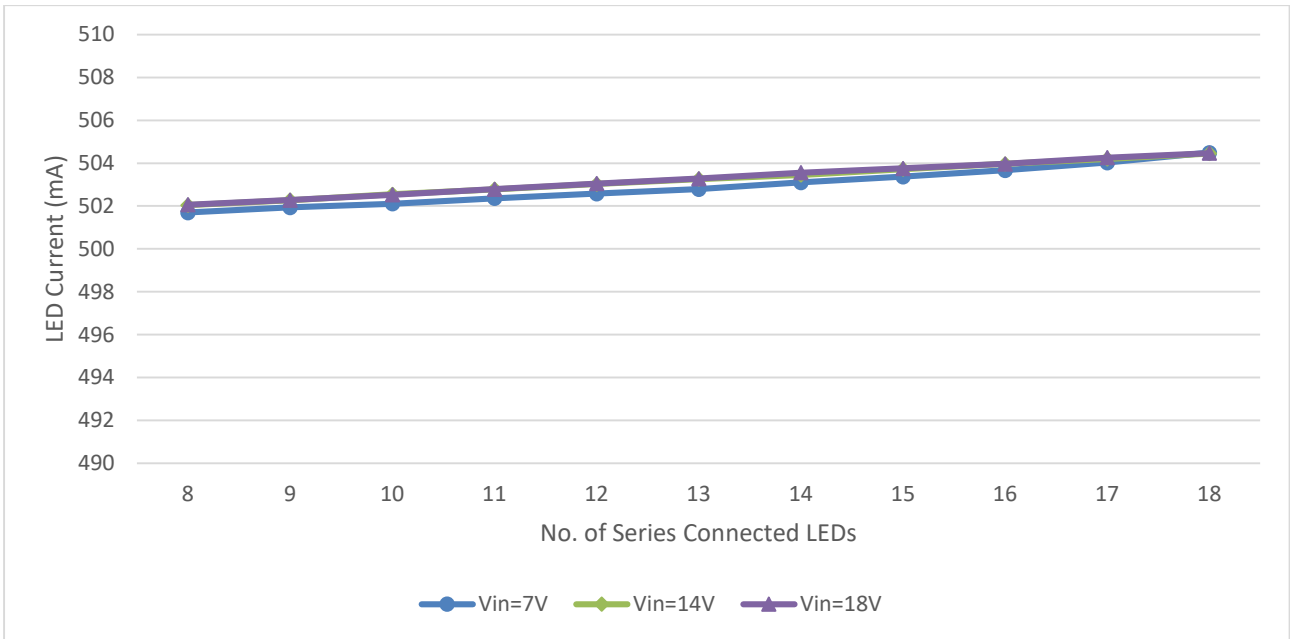


Figure 44. Output LED Current vs LED String Configuration (VIADJ = 1128 mV)

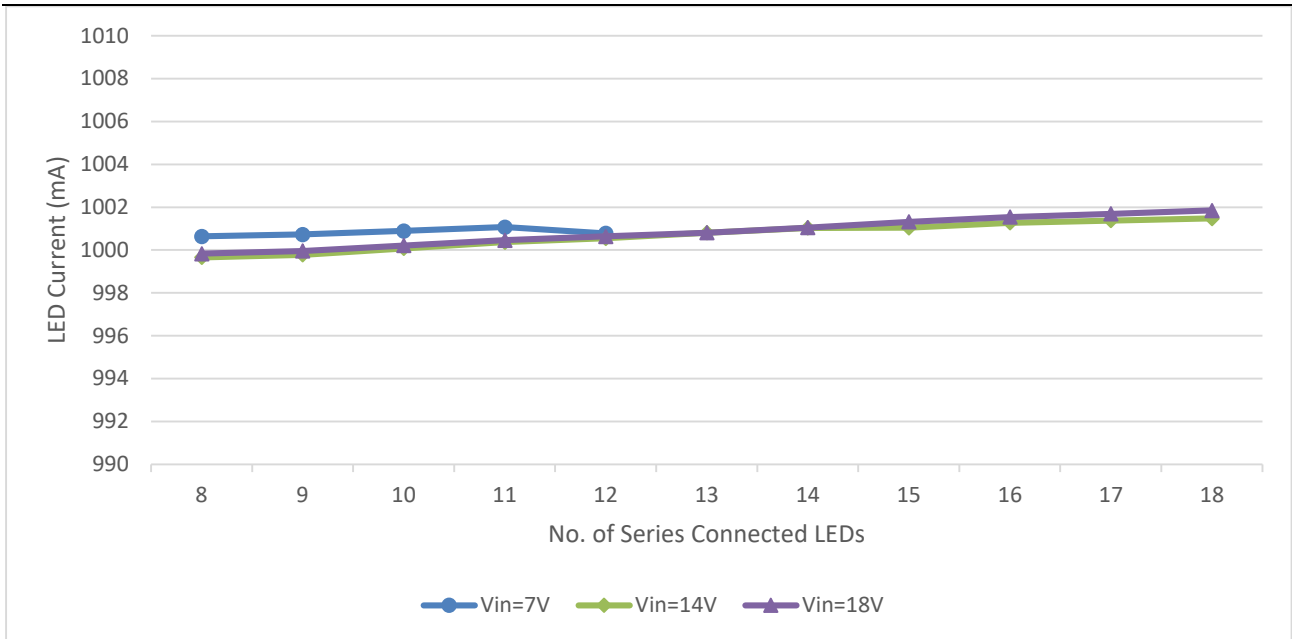
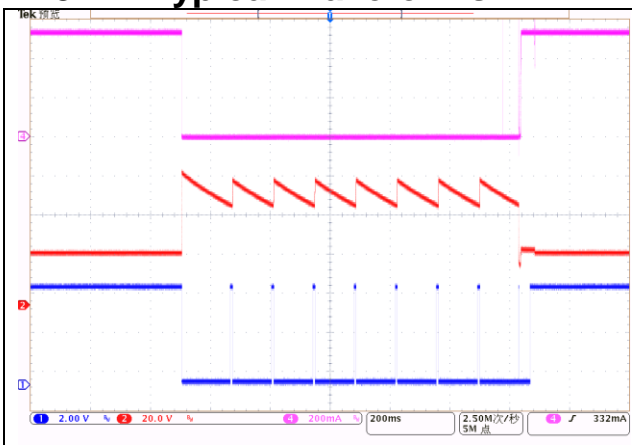
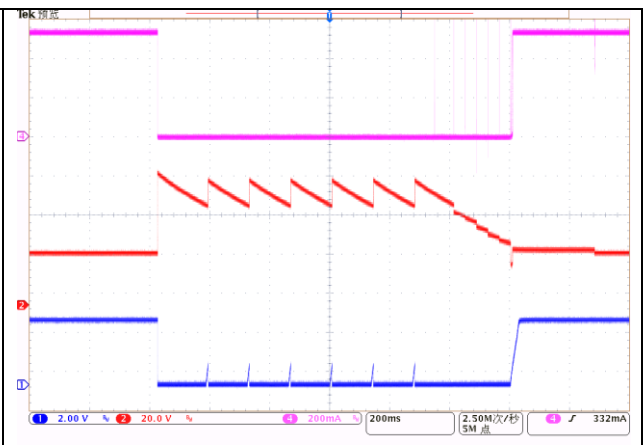


Figure 45. Output LED Current vs LED String Configuration (VIADJ = 2268 mV)

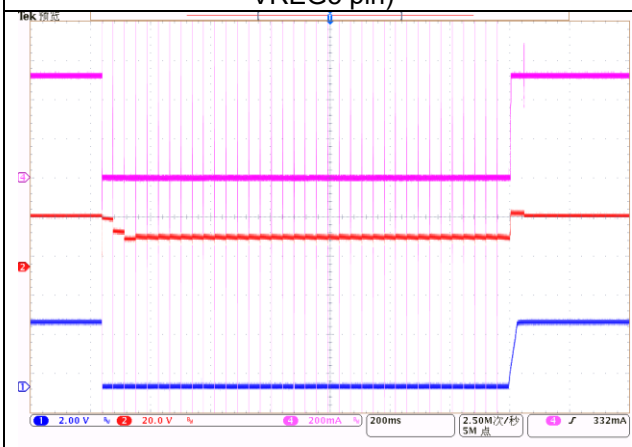
8.4 Typical Waveforms



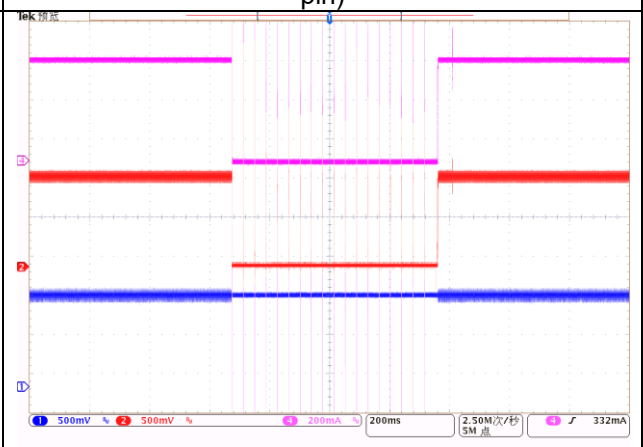
CH1: /FLT Output CH2: CSP Voltage
CH4: Iout
Time: 200ms/div
Figure 46. LED OPEN Fault(/FLT Connected to VREG5 pin)



CH1: /FLT Output CH2: CSP Voltage
CH4: Iout
Time: 200ms/div
Figure 47. LED OPEN Fault(/FLT Connected to SS pin)



CH1: /FLT Output CH2: CSP Voltage
CH4: Iout
Time: 200ms/div
Figure 48. LED Shorted Fault (/FLT Connected to SS pin)



CH1: IADJ Voltage, CH2: IMON Voltage,
CH4: Iout
Time: 200ms/div
Figure 49. IMON Response to LED Short-Circuit Fault (/FLT Connected to SS pin)