



PT16755 LED Driver test report

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1. Buck-Boost LED Driver Electrical Performance Specification

Parameter	Specifications
Topology	BUCK-BOOST
Input voltage range	8~30V
Output voltage range	9~33V (3~11 LEDs)
Output current	100~1000mA
Efficiency (Input voltage = 14 V, 7 LEDs, I _{out} = 500 mA)	≈88%
Switching frequency	400 kHz
Over-voltage protection	40V

Table1.BUCK-BOOST Configuration Electrical Performance Specifications



2. Buck-Boost LED Driver Schematic

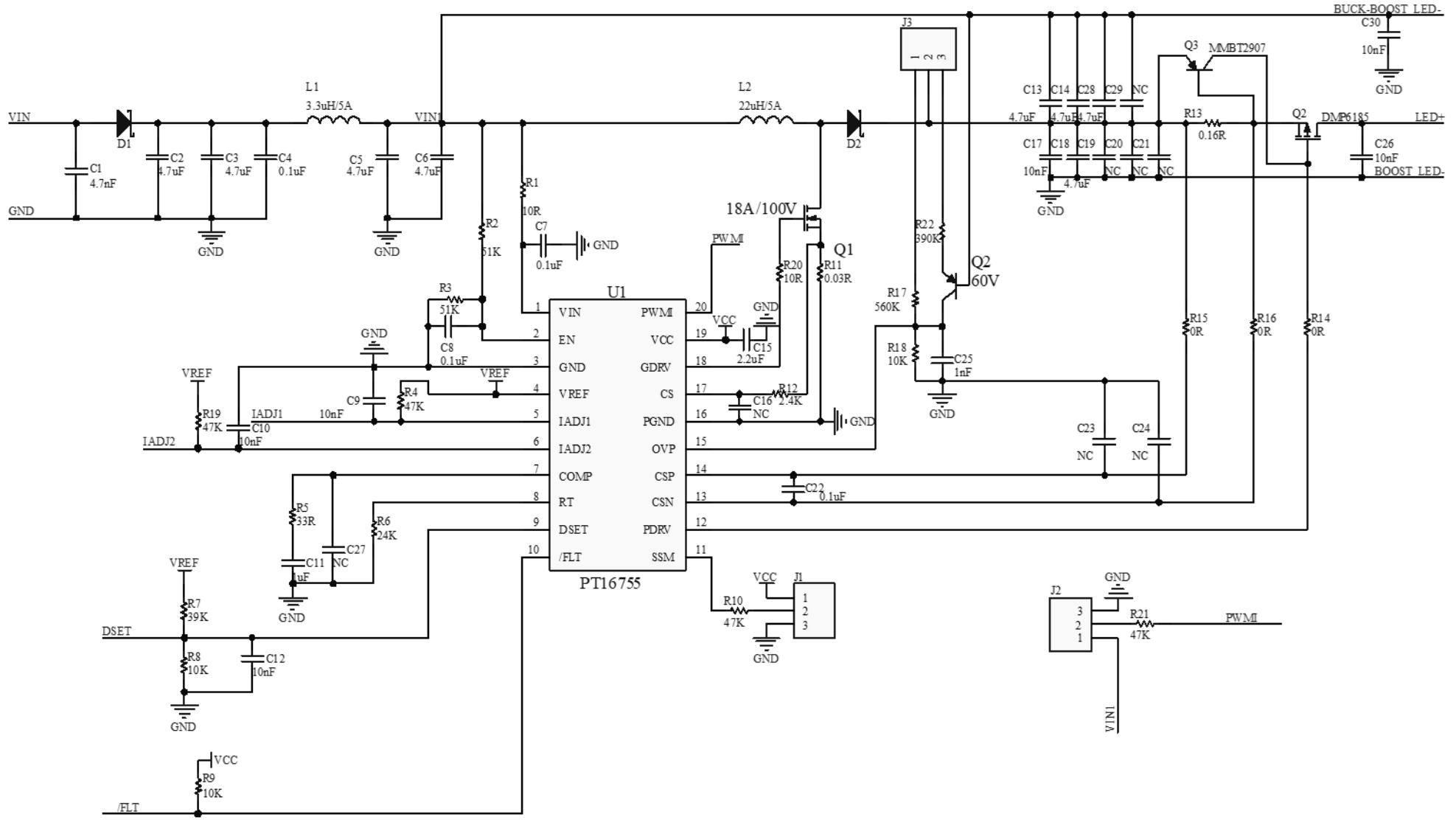


Figure 1. Buck-Boost LED Driver Schematic



3. Buck-Boost LED Driver BOM

Designator	Qty.	Value	Description	Package
C1	1	4.7nF	CAP, CERM, 4.7-nF, 100-V, +/- 10%, X7R	0805
C2, C3, C5, C6, C13, C14, C18, C28	8	4.7uF	CAP, CERM, 4.7-μF, 100-V, +/- 10%, X7R	1210
C4, C7, C8,	3	100nF	CAP, CERM, 100-nF, 100-V, +/- 10%, X7R	0805
C9, C10, C12	3	10nF	CAP, CERM, 10-nF, 25-V, +/- 10%, X7R	1210
C11	1	1uF	CAP, CERM, 1-uF, 25-V, +/- 10%, X7R	0805
C15	1	2.2uF	CAP, CERM, 2.2-μF, 25-V, +/- 10%, X7R	0805
C17,C26,C30	3	10nF	CAP, CERM, 10-nF, 100-V, +/- 10%, X7R	0805
C22	1	100nF	CAP, CERM, 100-nF, 25-V, +/- 10%, X7R	0805
C25	1	1nF	CAP, CERM, 1-nF, 25-V, +/- 10%, X7R	0805
D1, D2	1	PDS5100Q	Diode, Schottky, 100-V, 5-A, AEC-Q101	PowerDI5
L1	1	3.3uH	Inductor, Shielded, Ferrite, 3.3-uH, 6.8-A	7.1mmX6.5mm
L2	1	ETQP5M220YFC	inductor, 22-uH, 5.2-A AEC-Q200	10.7mmX10mm
Q1	1	SQJ476EP	MOSFET, N-CH, 100-V, 23-A, AEC-Q101 (SQJ476EP, AEC-Q101)	PowerPAK SO-8L
Q2	1	DMP6185SEQ-13	MOSFET, P-CH, 60-V, 3-A, AEC-Q101	SOT223
Q3	1	MMBT2907	PNP Transistor, 60-V, AEC-Q101	SOT23
R1, R20	2	10Ω	RES, 10-Ω, 1%, 0.125-W	0805
R2, R3	2	51K	RES, 51-kΩ, 1%, 0.125-W	0805
R4, R10, R19, R21	4	47K	RES, 47-kΩ, 1%, 0.125-W	0805
R5	1	33Ω	RES, 33-Ω, 1%, 0.125-W	0805
R6	1	24K	RES, 24-kΩ, 1%, 0.125-W	0805
R7	1	39K	RES, 39-kΩ, 1%, 0.125-W	0805
R8, R9, R18	3	10K	RES, 10-kΩ, 1%, 0.125-W	0805
R11	1	0.03Ω	RES, 0.03-Ω, 1%, 1-W	2512
R12	1	2.4K	RES, 2.4-kΩ, 1%, 0.125-W	0805
R13	1	0.16Ω	RES, 0.16-Ω, 1%, 0.5-W	1210
R14, R15, R16	3	0Ω	RES, 0-Ω, 1%, 0.125-W	0805
R17	1	560K	RES, 560-kΩ, 1%, 0.125-W	0805
R22	1	390K	RES, 390-kΩ, 1%, 0.125-W	0805
U1	1	PT16755	Multi-Topology Automotive Headlight LED Driver	HTSSOP20

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

4.1 Efficiency (D1 removed)

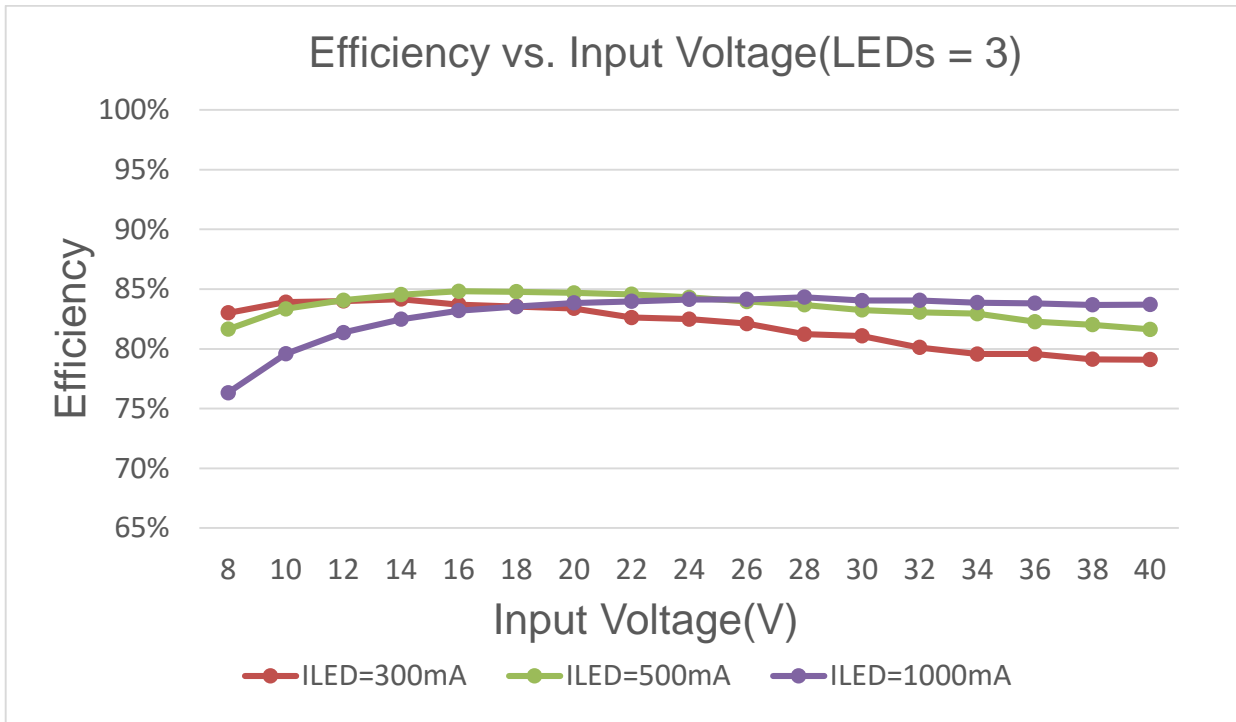


Figure 2. Efficiency vs Input Voltage (Number of Series Connected LEDs = 3)

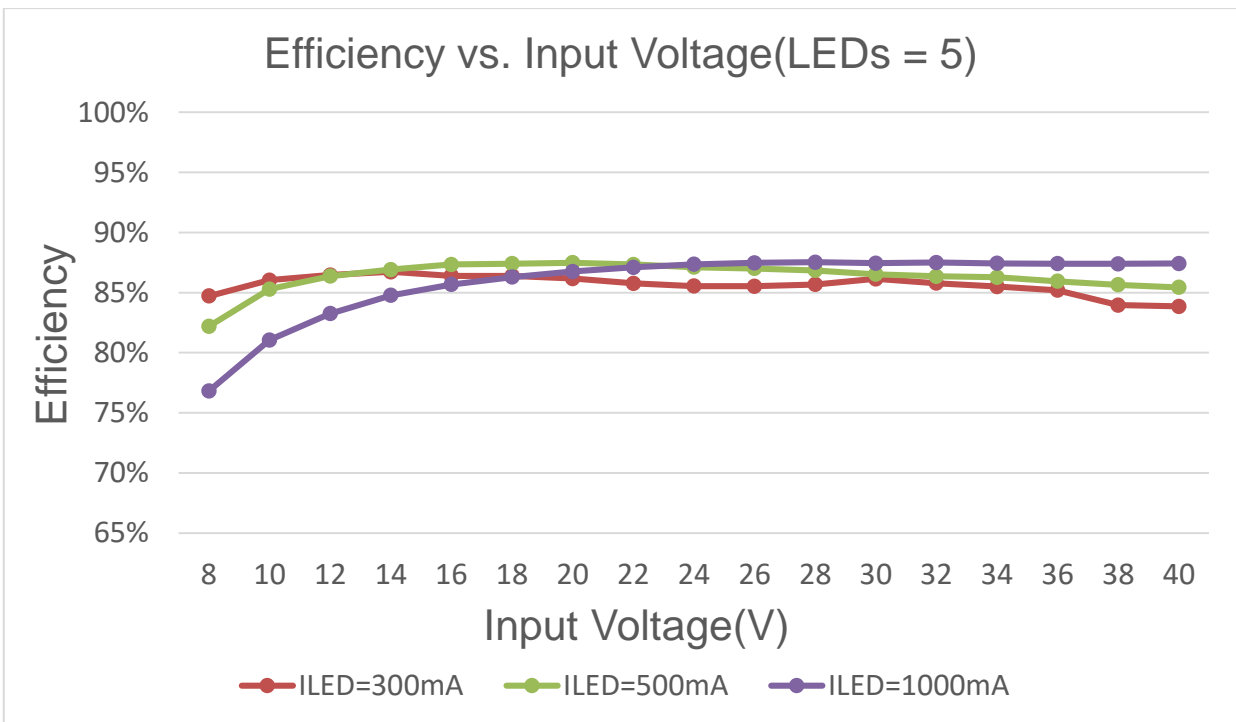


Figure 3. Efficiency vs Input Voltage (Number of Series Connected LEDs = 5)

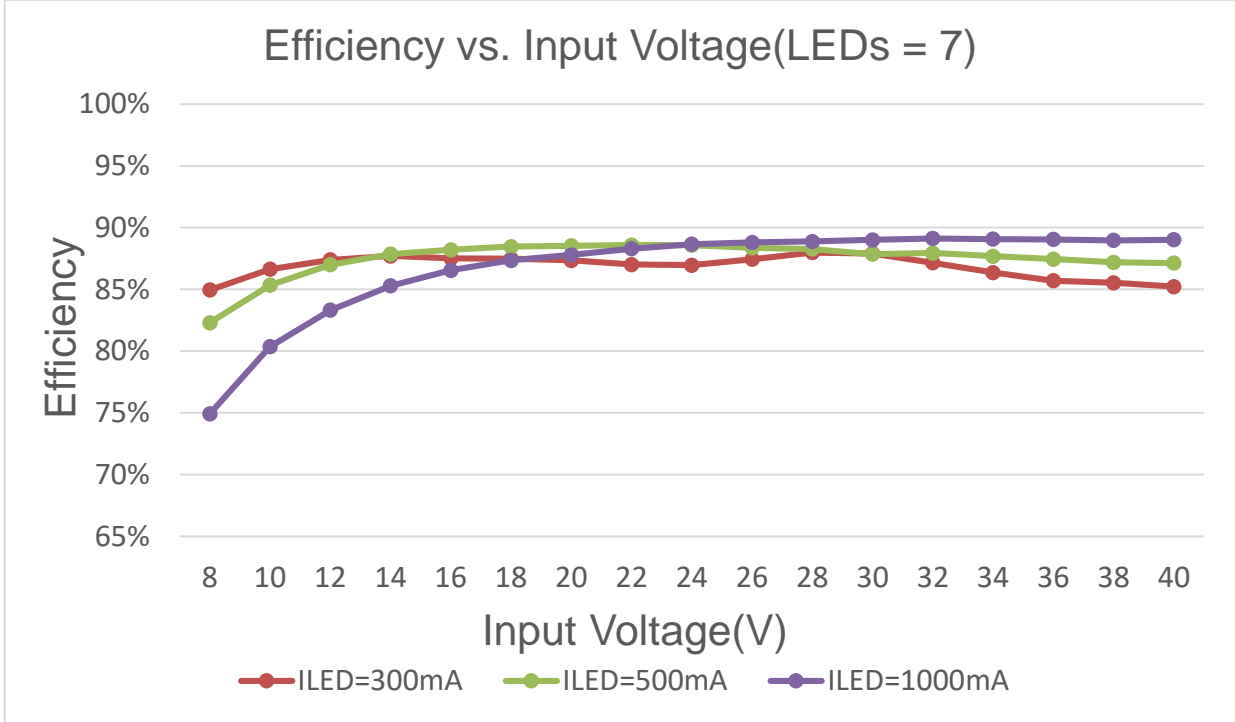


Figure 4. Efficiency vs Input Voltage (Number of Series Connected LEDs = 7)

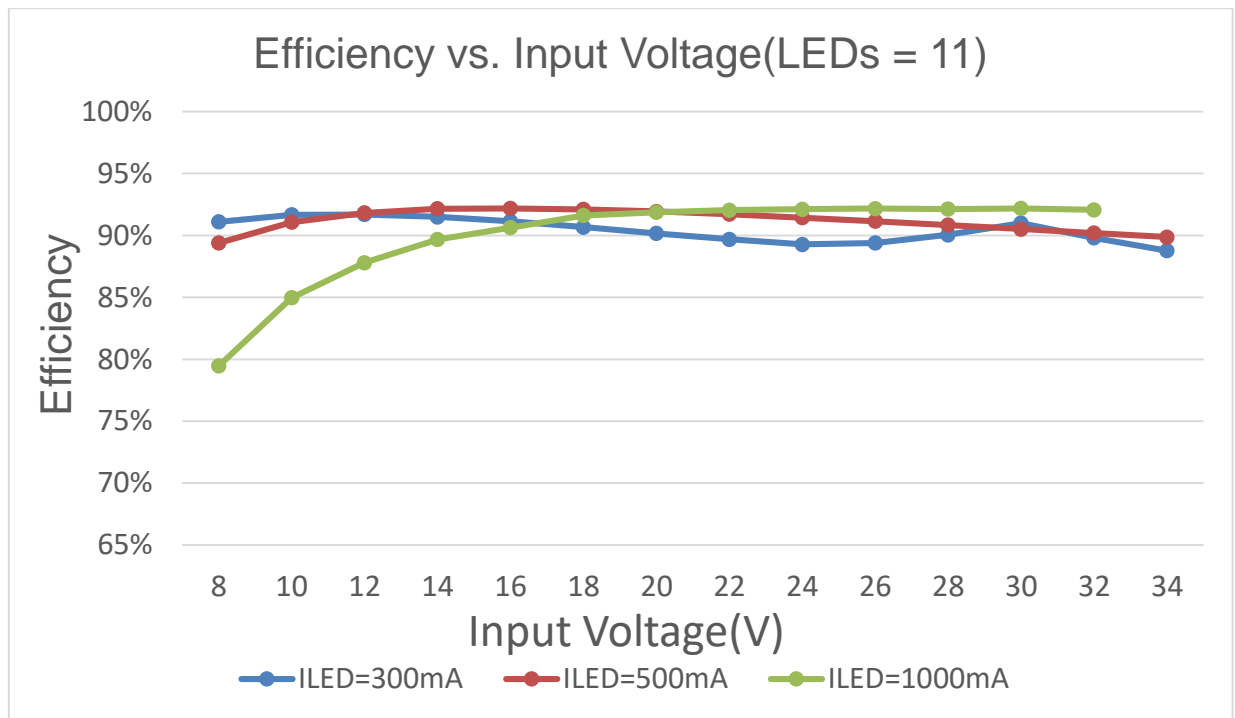


Figure 5. Efficiency vs Input Voltage (Number of Series-Connected LEDs = 11)

4.2 Line Regulation

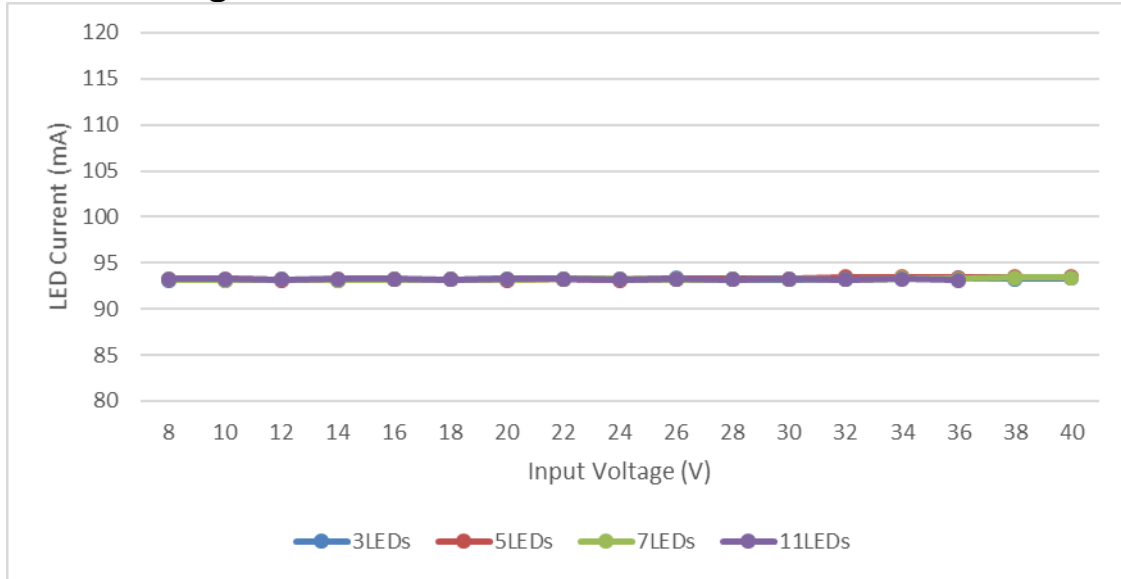


Figure 6. Output LED Current vs Input Voltage (VIADJ = 360 mV)

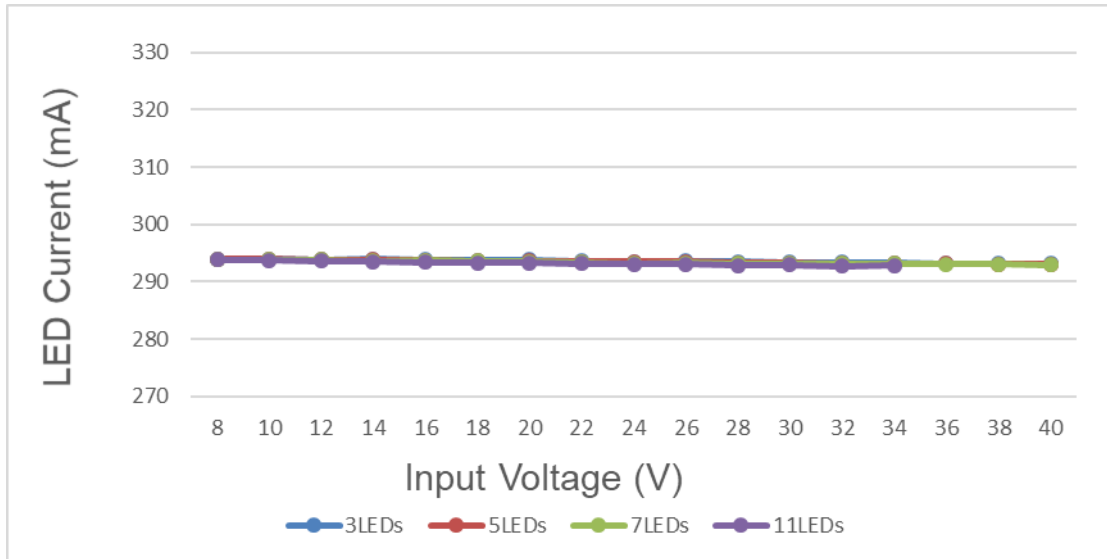


Figure 7. Output LED Current vs Input Voltage (VIADJ = 750 mV)

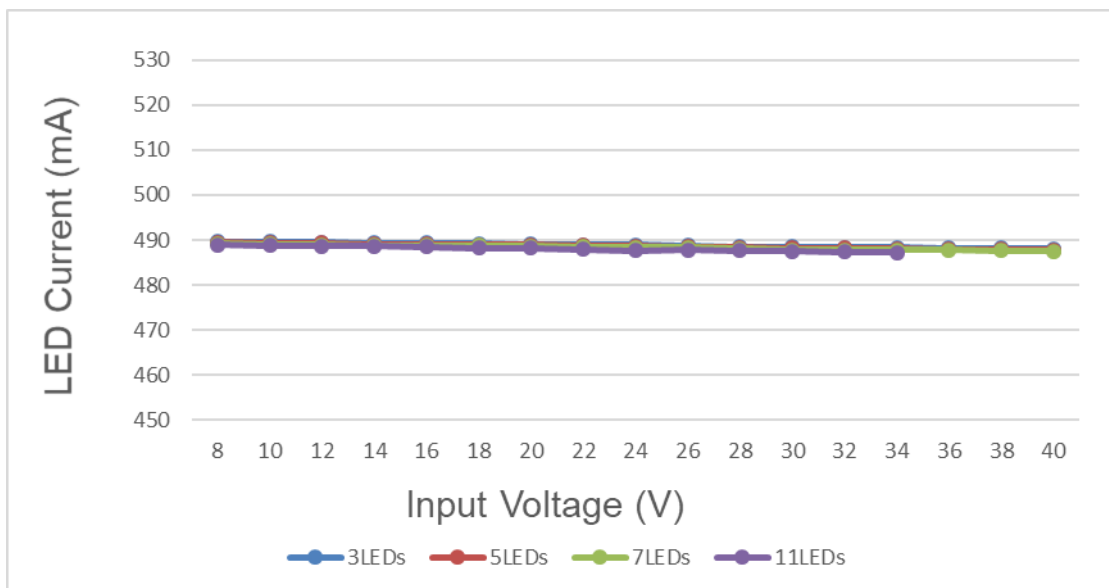


Figure 8. Output LED Current vs Input Voltage (VIADJ = 1140 mV)

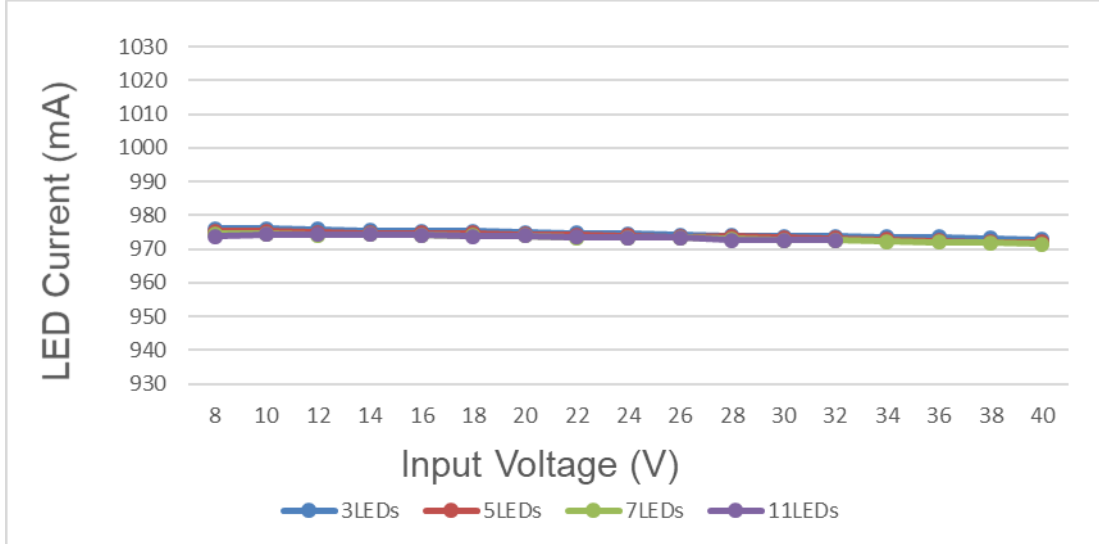


Figure 9. Output LED Current vs Input Voltage (VIADJ = 2120 mV)

4.3 Load Regulation

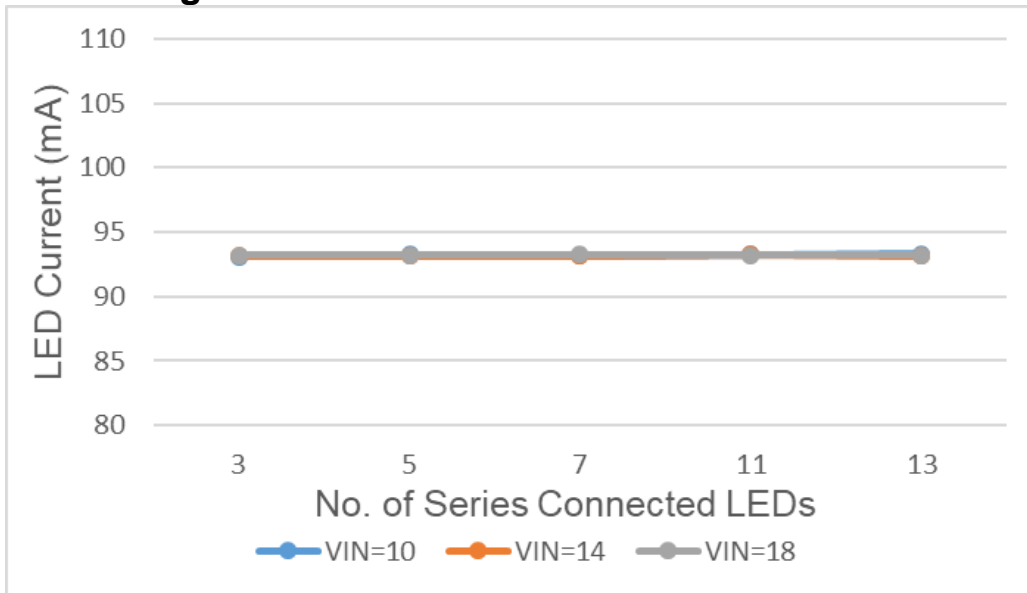


Figure 10. Output LED Current vs LED String Configuration (VIADJ = 360 mV)

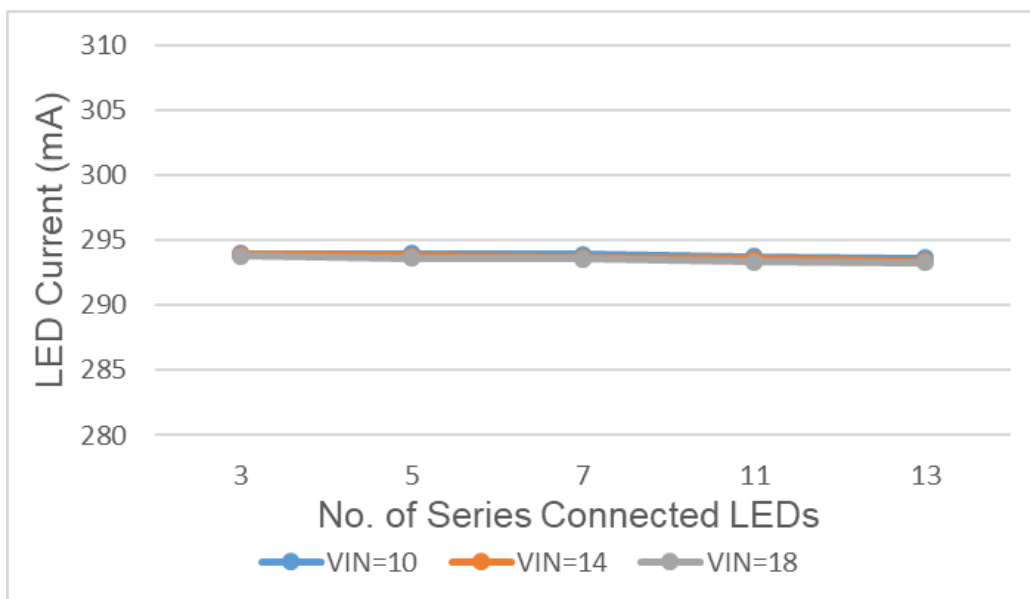


Figure 11. Output LED Current vs LED String Configuration (VIADJ = 750 mV)

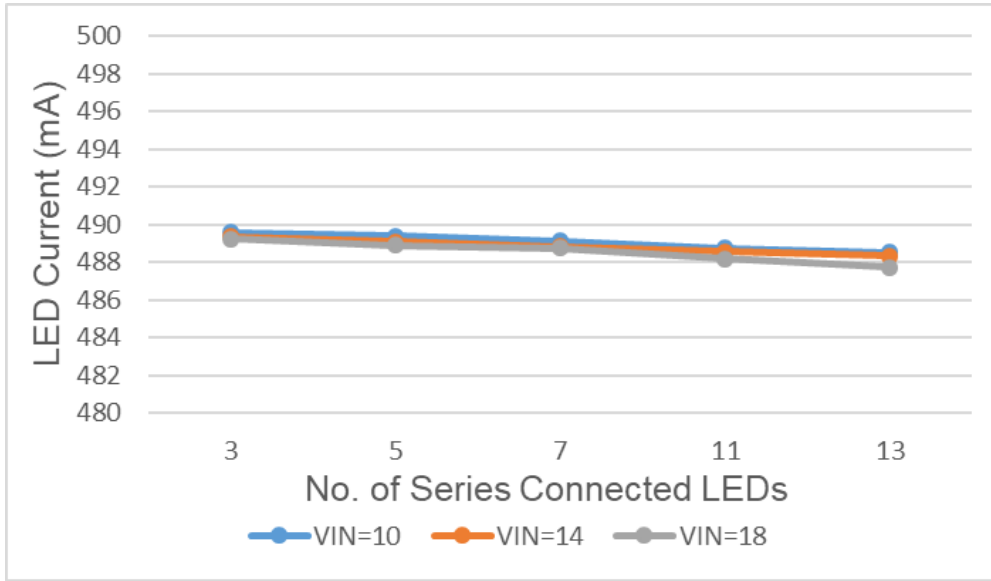


Figure 12. Output LED Current vs LED String Configuration (VIADJ = 1140 mV)

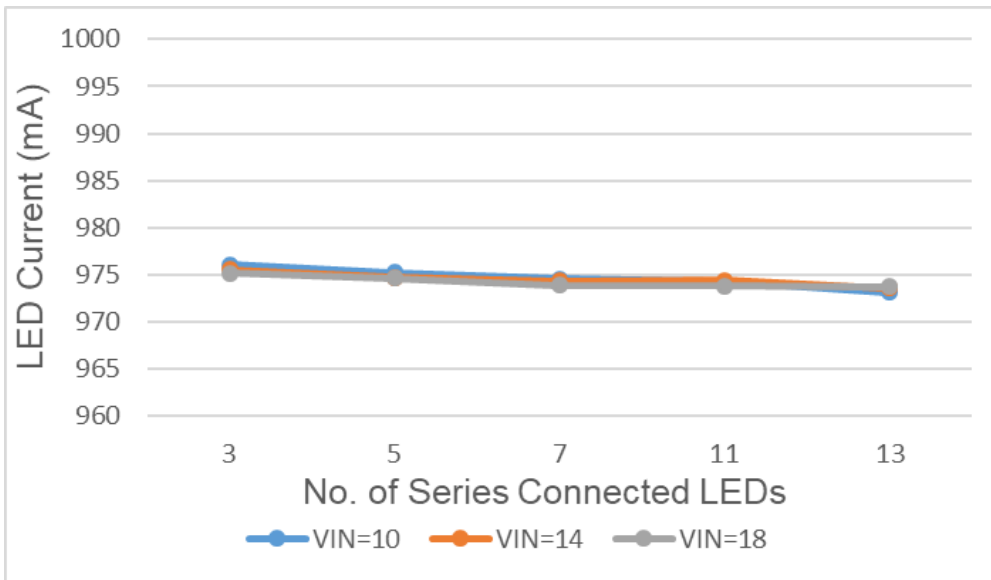


Figure 13. Output LED Current vs LED String Configuration (VIADJ = 2120 mV)

4.4 PWM Dimming

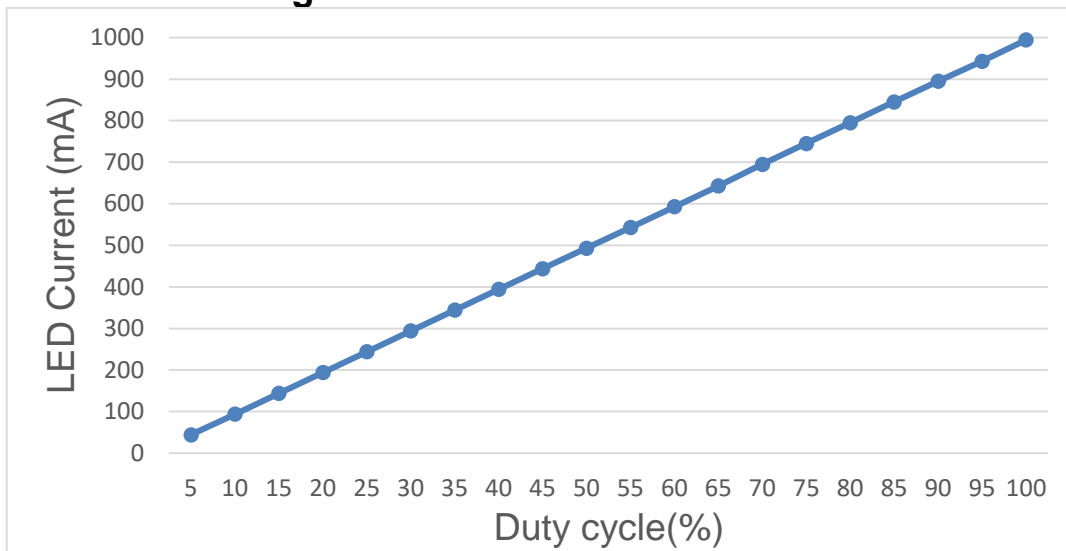


Figure 14. Output LED Current vs PWM Duty cycle (Vin=14V, Number of LED Series=6)

4.5 DSET Voltage to PWM Dimming

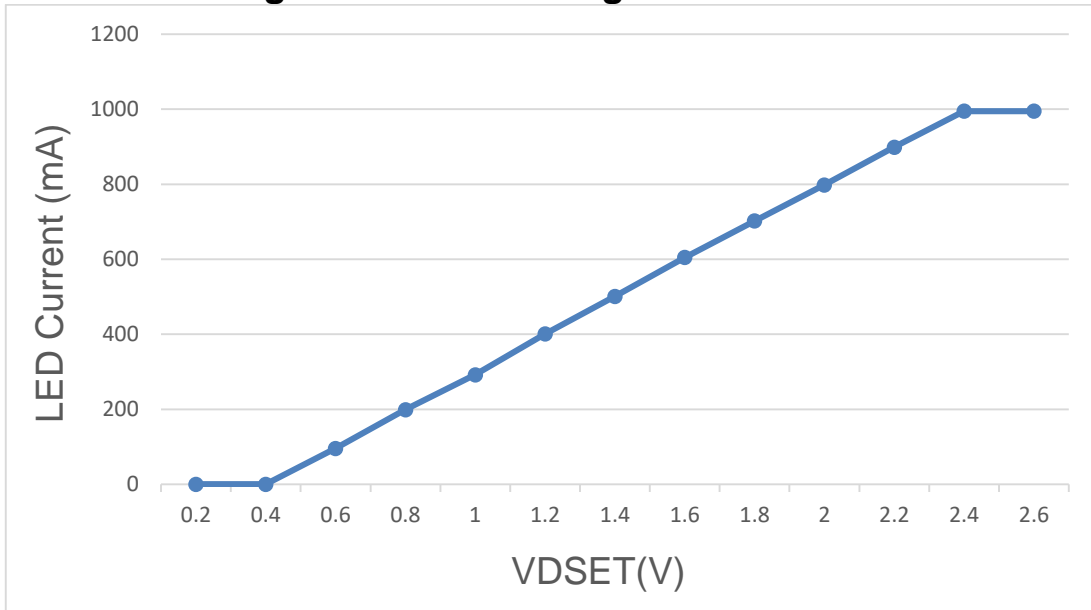


Figure 15. LED Current vs DIM/PWM Voltage (Vin=14V, Number of LED Series=8)

4.6 Analog Dimming

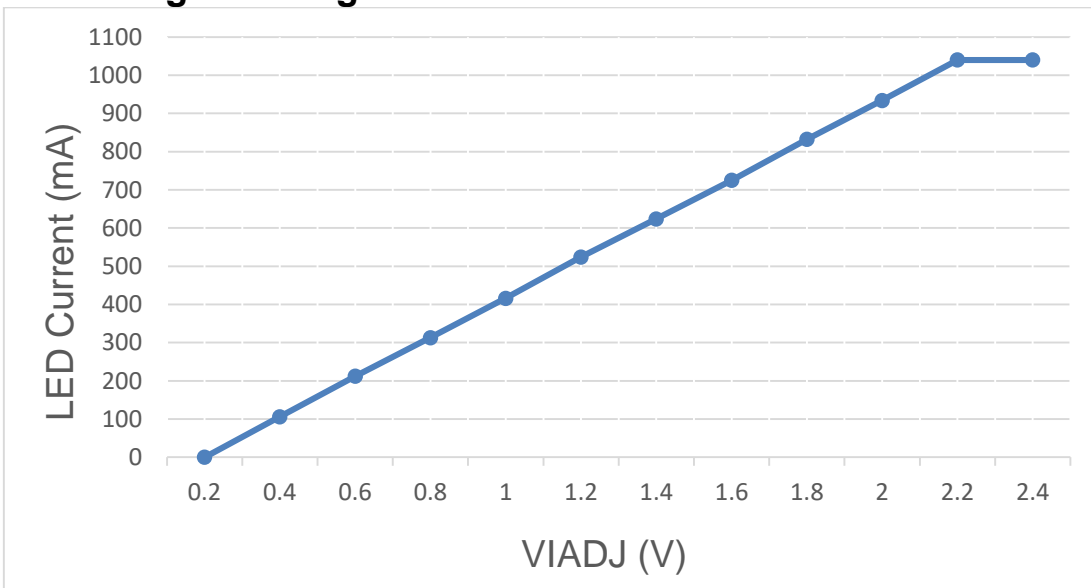
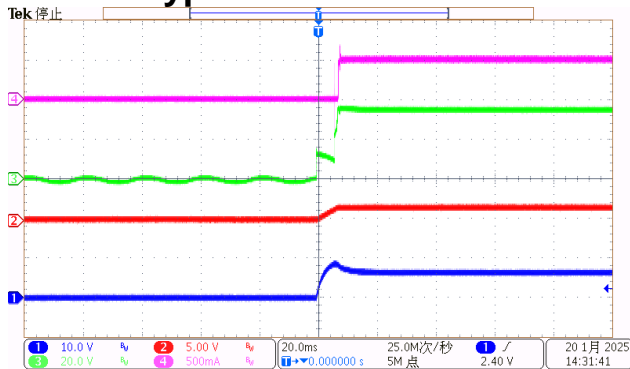
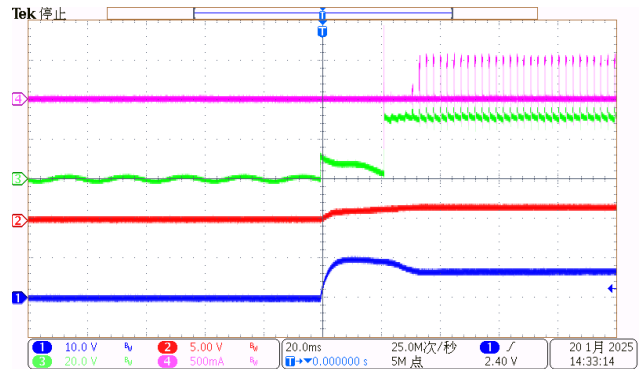


Figure 16. LED Current vs IADJ Voltage (Vin=14V, Number of LED Series=8)

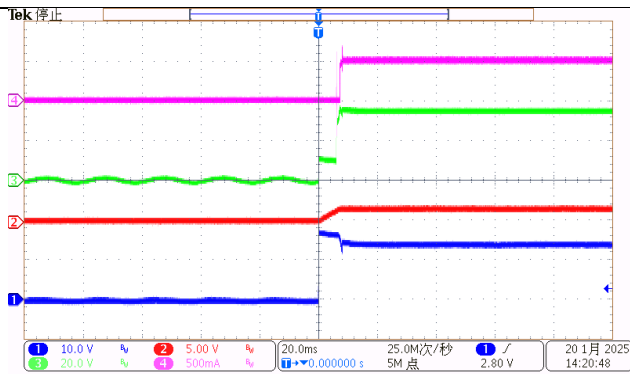
4.7 Typical Waveforms



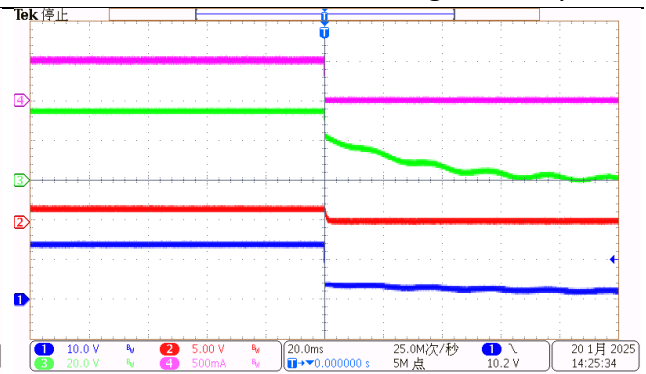
CH1:EN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 17. EN Power ON (DRL Mode)



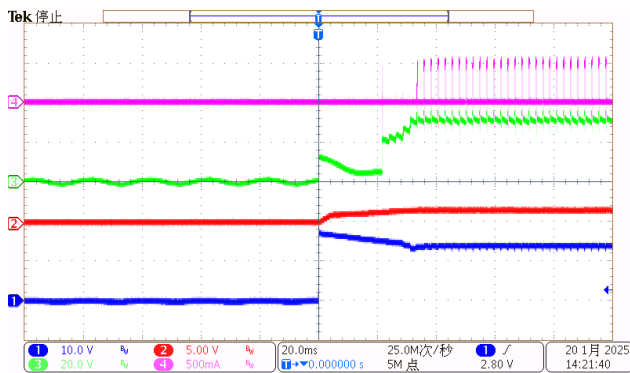
CH1: EN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 18. EN Power ON (PWM Mode)



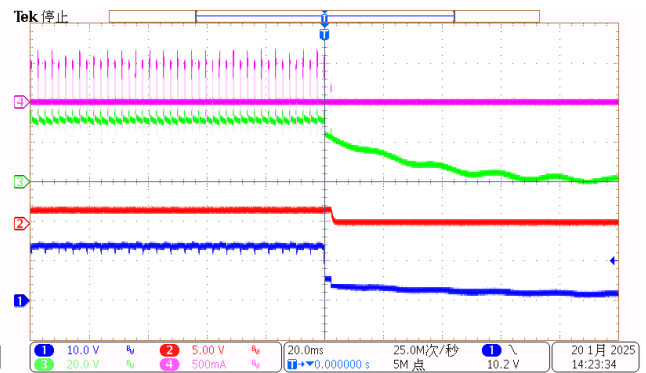
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 19. VIN Power ON (DRL Mode)



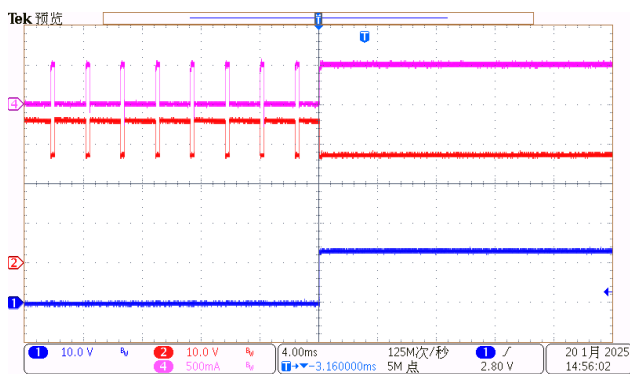
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 20. VIN Power OFF (DRL Mode)



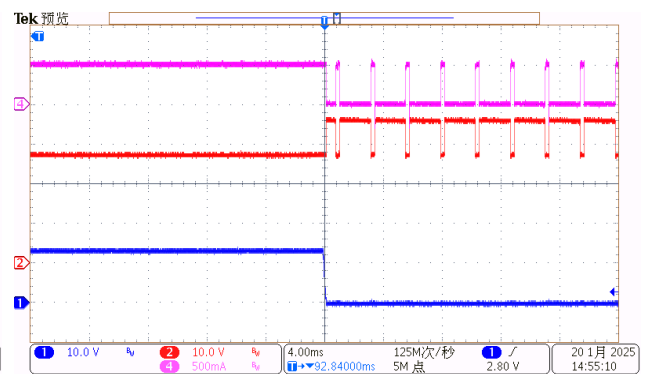
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 10ms/div
Figure 21. VIN Power ON (PWM Mode)



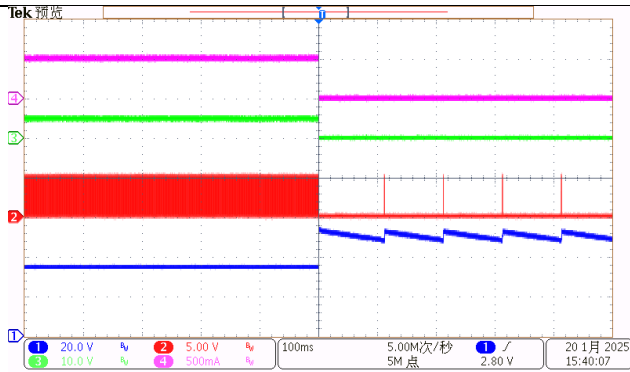
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 10ms/div
Figure 22. VIN Power OFF (PWM Mode)



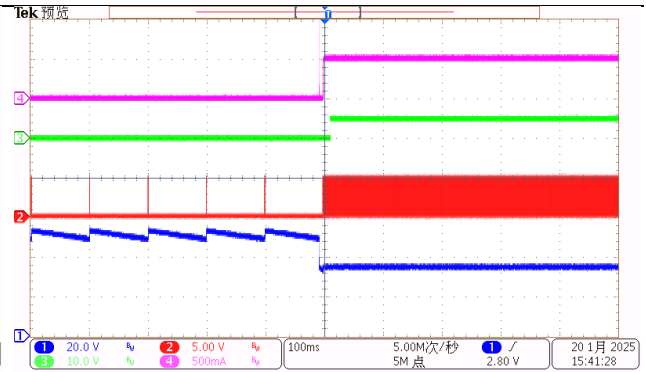
CH1: PWMI; CH2: PDRV; CH4: ILED
Time: 4ms/div
Figure 23. PWM Mode → DRL Mode



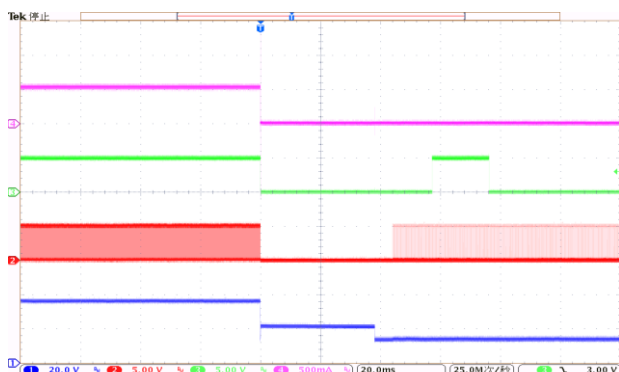
CH1: PWMI; CH2: PDRV; CH4: ILED
Time: 4ms/div
Figure 24. DRL Mode → PWM Mode



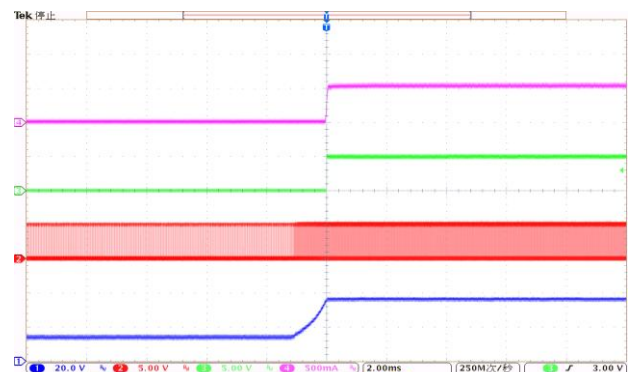
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 100ms/div
Figure 25. LED Open Operation (Normal → Open)
DRL Mode



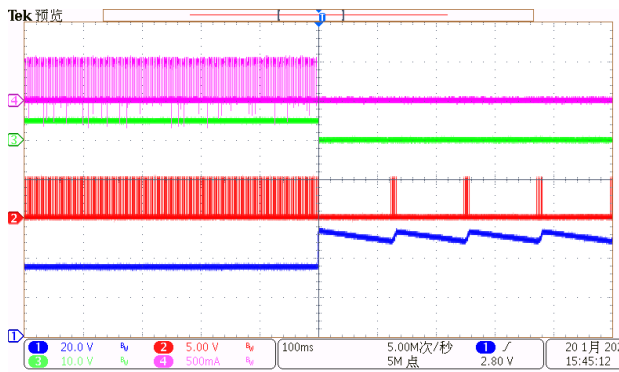
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 100ms/div
Figure 26. LED Open Operation (Open → Normal)
DRL Mode



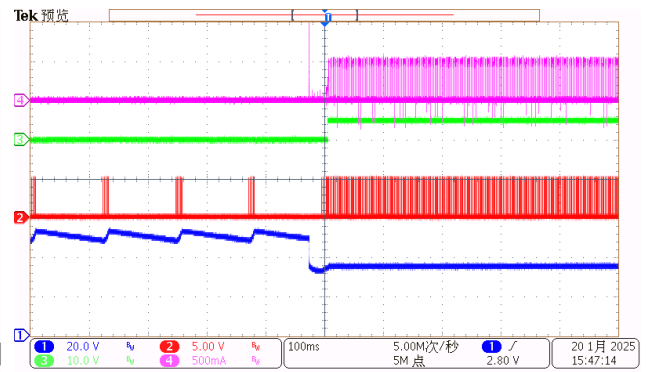
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 20ms/div
Figure 27. SCP Operation (Normal → Short)
DRL Mode



CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 2ms/div
Figure 28. SCP Operation (Short → Normal)
DRL Mode



CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 100ms/div
Figure 29. LED Open Operation (Normal → Open)
PWM Mode

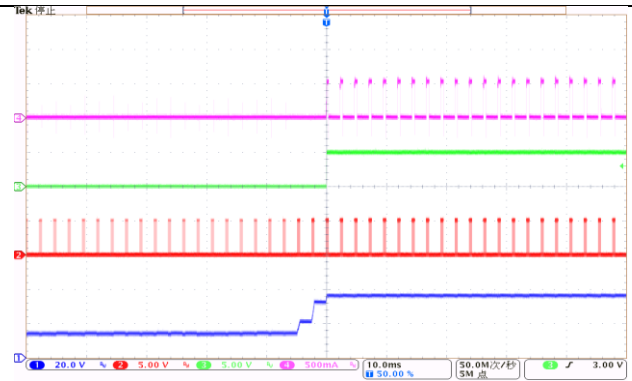


CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 100ms/div
Figure 30. LED Open Operation (Open → Normal)
PWM Mode



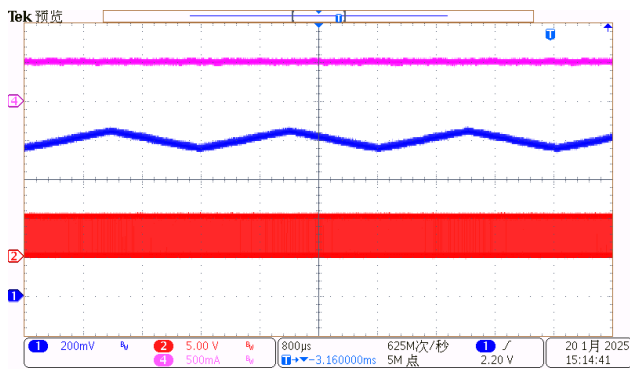
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 20ms/div

Figure 31. SCP Operation (Normal → Short)
PWM Mode



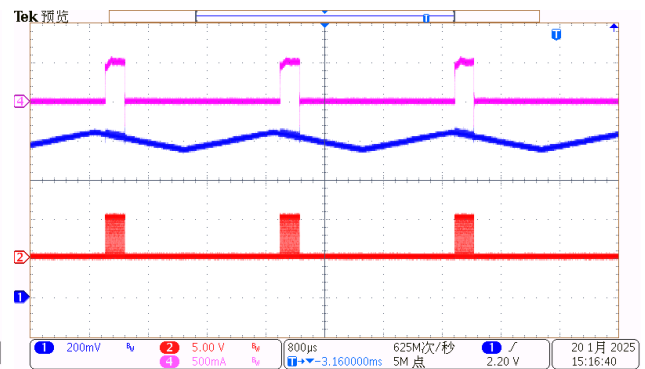
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
Time: 10ms/div

Figure 32. SCP Operation (Short → Normal)
PWM Mode



CH1: RT; CH2: GDRV; CH4: ILED
Time: 0.8ms/div

Figure 33. SSFM Operation (DRL Mode)



CH1: RT; CH2: GDRV; CH4: ILED
Time: 0.8ms/div

Figure 34. SSFM Operation (PWM Mode)



5. Boost LED Driver Electrical Performance Specifications

Parameter	Specifications
Topology	BOOST
Input voltage range	8~18V
Output voltage range	21~52V (8~17 LEDs)
Output current	100~1000mA
Efficiency (Input voltage = 14 V, 8 LEDs, I _{out} = 500 mA)	≈94.7%
Switching frequency	400 kHz
Over-voltage protection	57V

Table 2. BOOST Configuration Electrical Performance Specification

6. Boost LED Driver Schematic

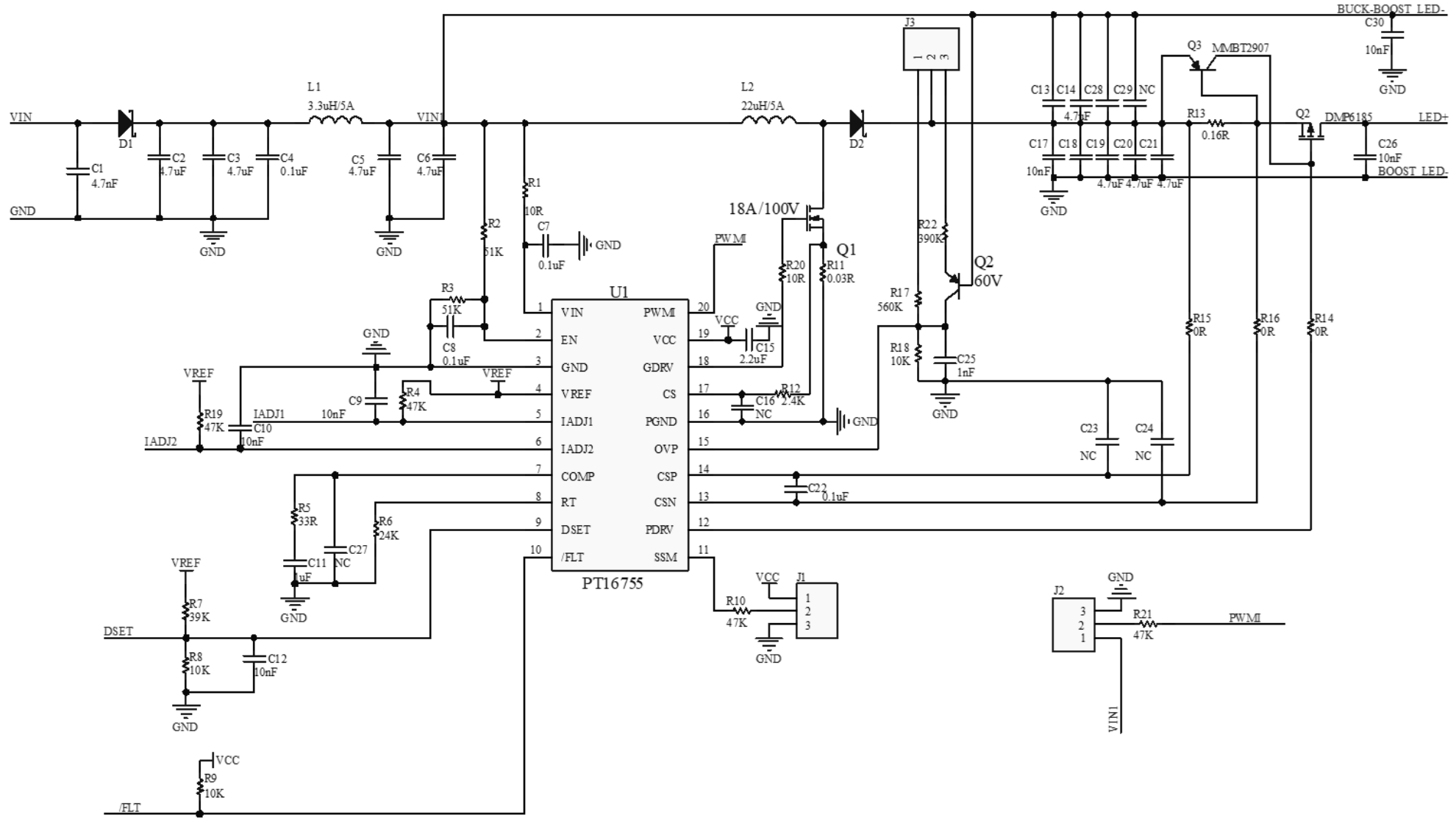


Figure 35. Boost LED Driver Schematic

7. Boost LED Driver BOM

Designator	Qty.	Value	Description	Package
C1	1	4.7nF	CAP, CERM, 4.7-nF, 100-V, +/- 10%, X7R	0805
C2, C3, C5, C6, C14, C19, C20, C21	8	4.7uF	CAP, CERM, 4.7-μF, 100-V, +/- 10%, X7R	1210
C4, C7, C8,	3	100nF	CAP, CERM, 100-nF, 100-V, +/- 10%, X7R	0805
C9, C10, C12	3	10nF	CAP, CERM, 10-nF, 25-V, +/- 10%, X7R	1210
C11	1	1uF	CAP, CERM, 1-uF, 25-V, +/- 10%, X7R	0805
C15	1	2.2uF	CAP, CERM, 2.2-μF, 25-V, +/- 10%, X7R	0805
C17,C26,C30	3	10nF	CAP, CERM, 10-nF, 100-V, +/- 10%, X7R	0805
C22	1	100nF	CAP, CERM, 100-nF, 25-V, +/- 10%, X7R	0805
C25	1	1nF	CAP, CERM, 1-nF, 25-V, +/- 10%, X7R	0805
D1, D2	1	PDS5100Q	Diode, Schottky, 100-V, 5-A, AEC-Q101	PowerDI5
L1	1	3.3uH	Inductor, Shielded, Ferrite, 3.3-uH, 6.8-A	7.1mmX6.5mm
L2	1	ETQP5M220YFC	inductor, 22-uH, 5.2-A AEC-Q200	10.7mmX10mm
Q1	1	SQJ476EP	MOSFET, N-CH,100-V, 23-A, AEC-Q101 (SQJ476EP,AEC-Q101)	PowerPAK SO-8L
Q2	1	DMP6185SEQ-13	MOSFET, P-CH, 60-V, 3-A, AEC-Q101	SOT223
Q3	1	MMBT2907	PNP Transistor, 60-V, AEC-Q101	SOT23
R1, R20	2	10Ω	RES, 10-Ω, 1%, 0.125-W	0805
R2, R3	2	51K	RES, 51-kΩ, 1%, 0.125-W	0805
R4, R10, R19, R21	4	47K	RES, 47-kΩ, 1%, 0.125-W	0805
R5	1	33Ω	RES, 33-Ω, 1%, 0.125-W	0805
R6	1	24K	RES, 24-kΩ, 1%, 0.125-W	0805
R7	1	39K	RES, 39-kΩ, 1%, 0.125-W	0805
R8, R9, R18	3	10K	RES, 10-kΩ, 1%, 0.125-W	0805
R11	1	0.03Ω	RES, 0.03-Ω, 1%, 1-W	2512
R12	1	2.4K	RES, 2.4-kΩ, 1%, 0.125-W	0805
R13	1	0.16Ω	RES, 0.16-Ω, 1%, 0.5-W	1210
R14, R15, R16	3	0Ω	RES, 0-Ω, 1%, 0.125-W	0805
R17	1	560K	RES, 560-kΩ, 1%, 0.125-W	0805
R22	1	390K	RES, 390-kΩ, 1%, 0.125-W	0805
U1	1	PT16755	Multi-Topology Automotive Headlight LED Driver	HTSSOP20

8. BOOST LED Driver Performance Data and Typical Characteristic Curves

8.1 Efficiency (D1 removed)

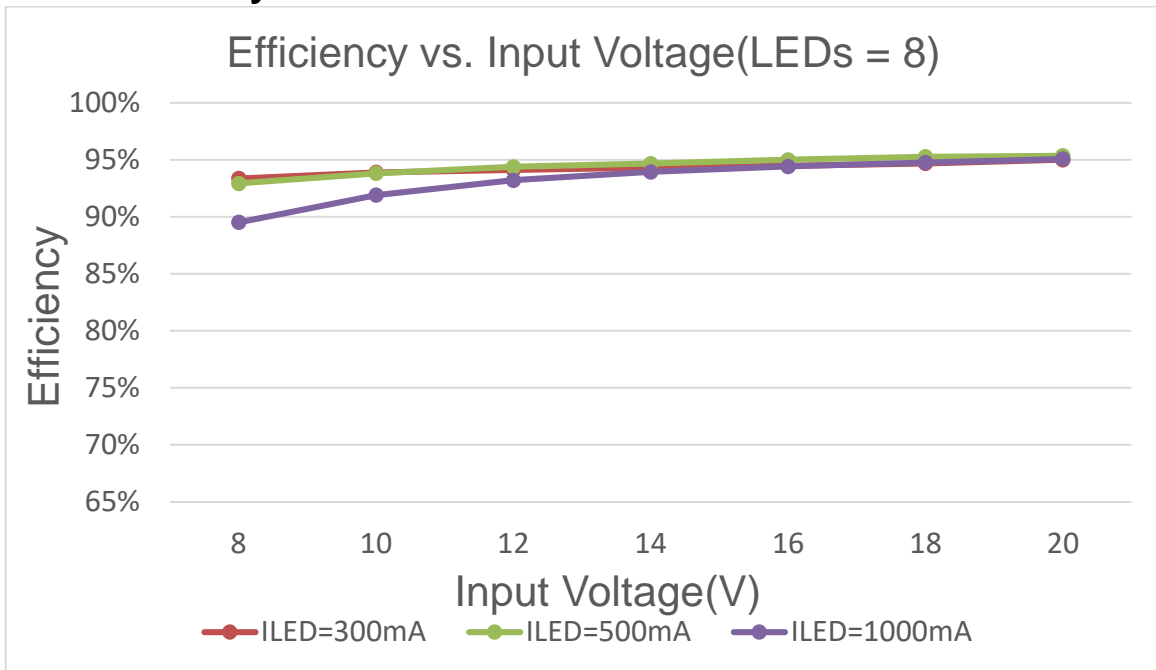


Figure 36. Efficiency vs Input Voltage (Number of Series Connected LEDs = 8)

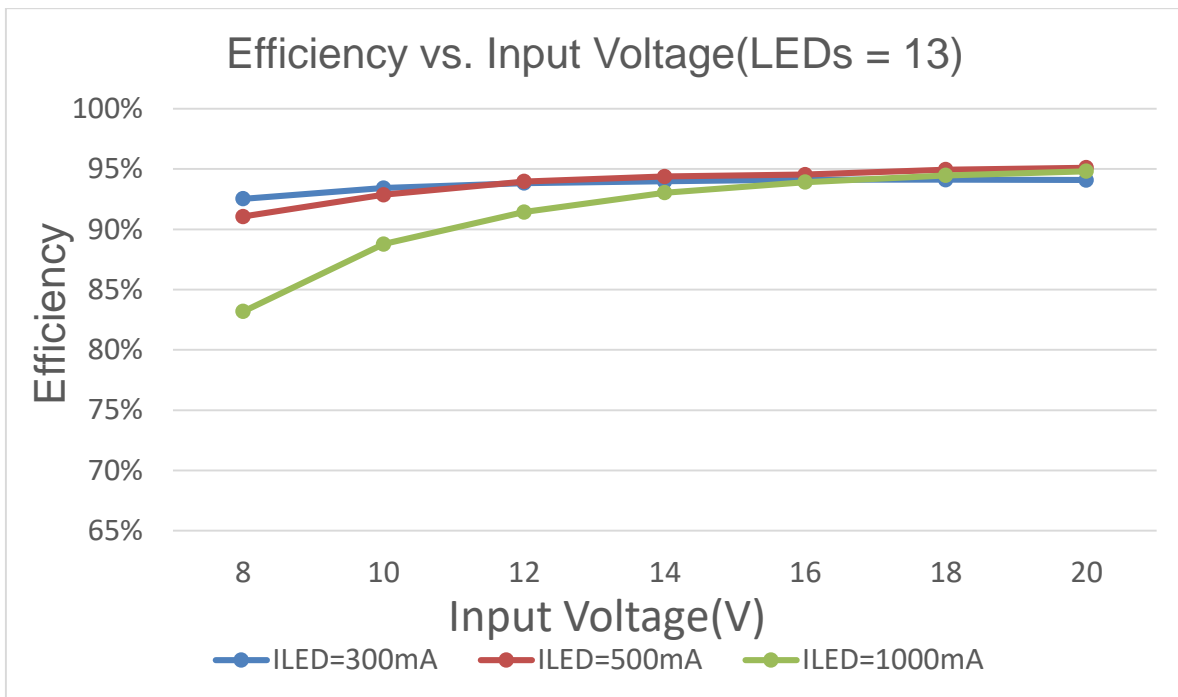


Figure 37. Efficiency vs Input Voltage (Number of Series Connected LEDs = 13)

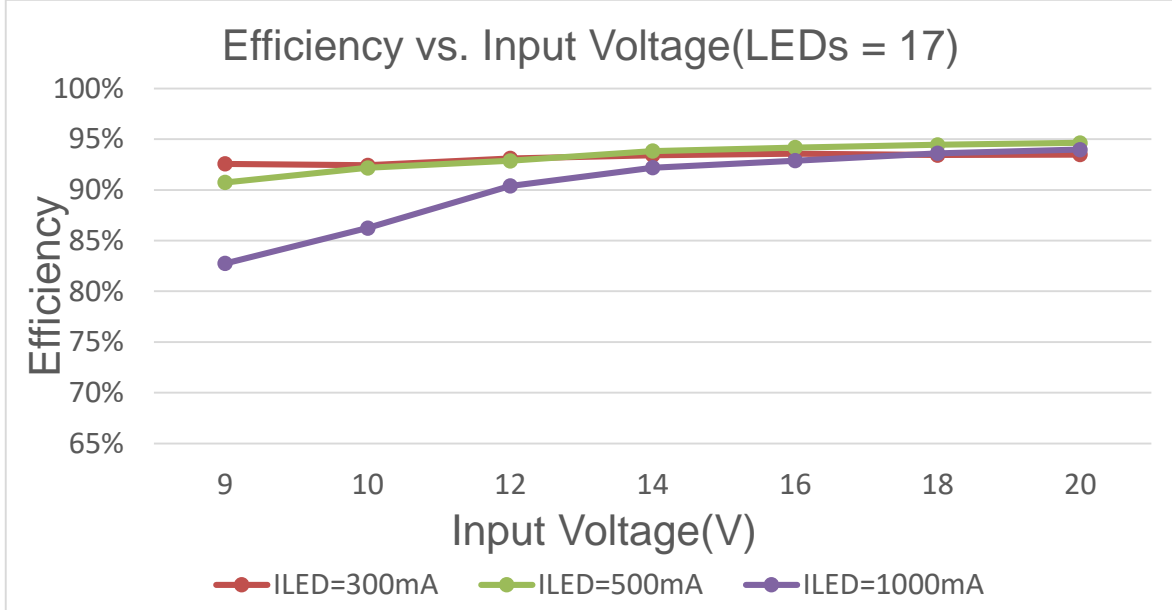


Figure 38. Efficiency vs Input Voltage (Number of Series Connected LEDs = 17)

8.2 Line Regulation

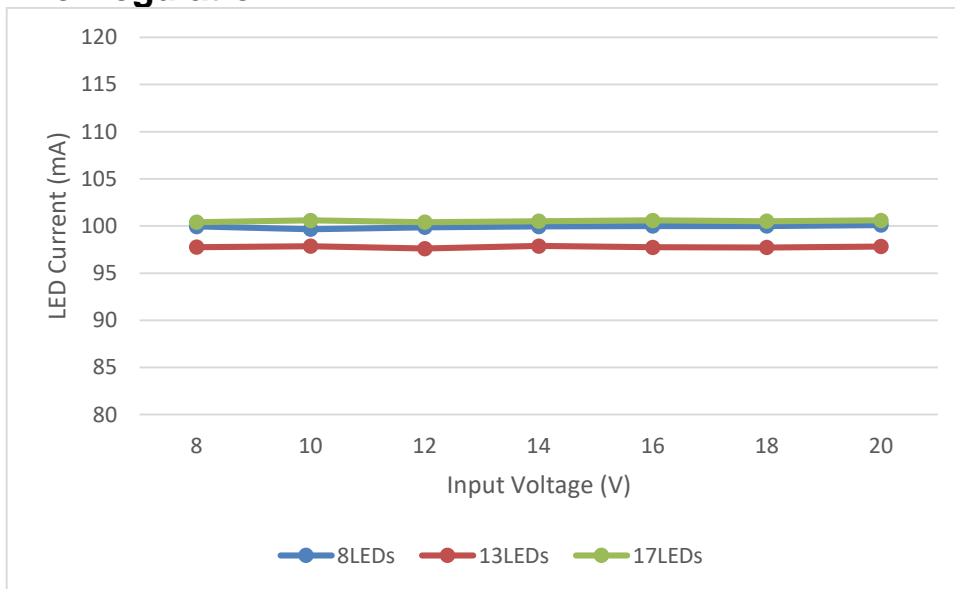


Figure 39. Output LED Current vs Input Voltage (VIADJ = 360 mV)

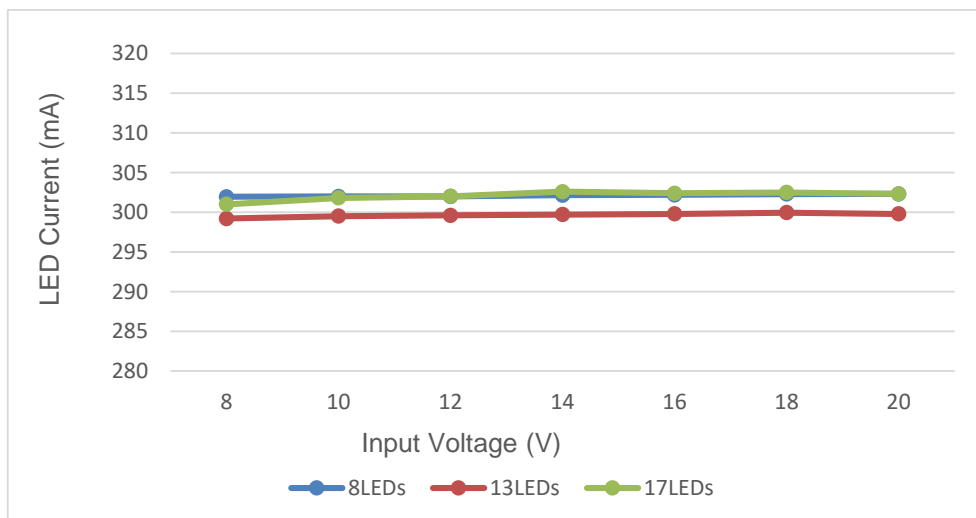


Figure 40. Output LED Current vs Input Voltage (VIADJ = 750 mV)

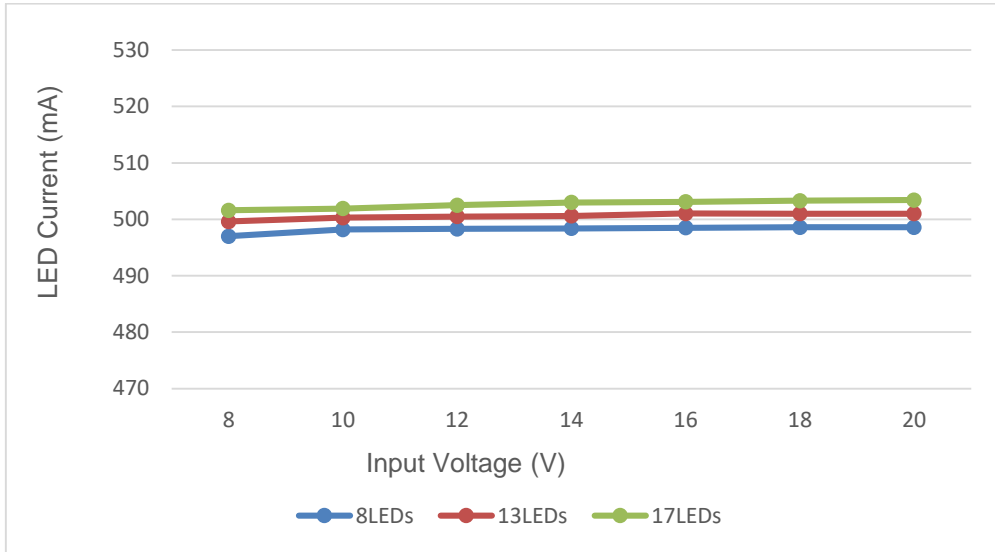


Figure 41. Output LED Current vs Input Voltage (VIADJ =1140 mV)

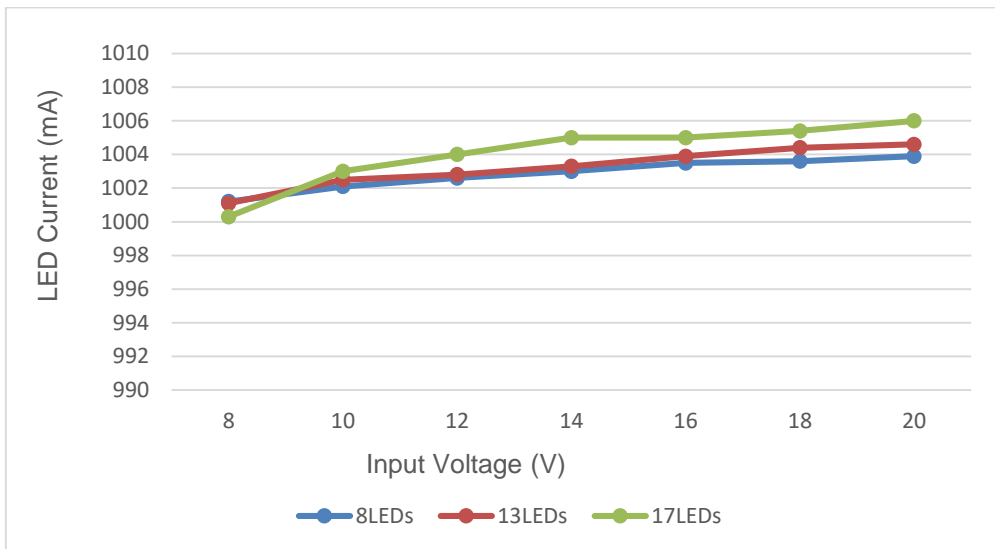


Figure 42. Output LED Current vs Input Voltage (VIADJ =2120 mV)

8.3 Load Regulation

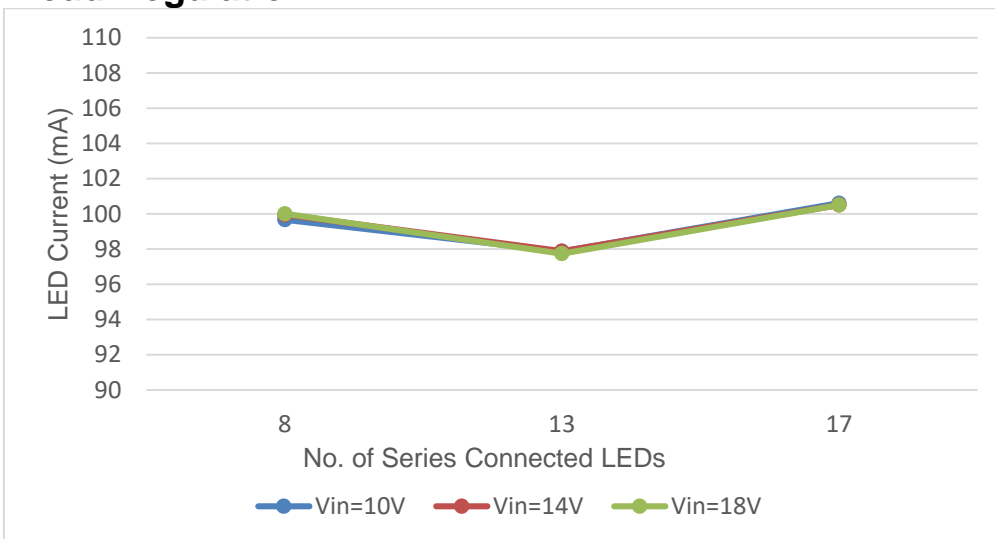


Figure 43. Output LED Current vs LED String Configuration (VIADJ = 360 mV)

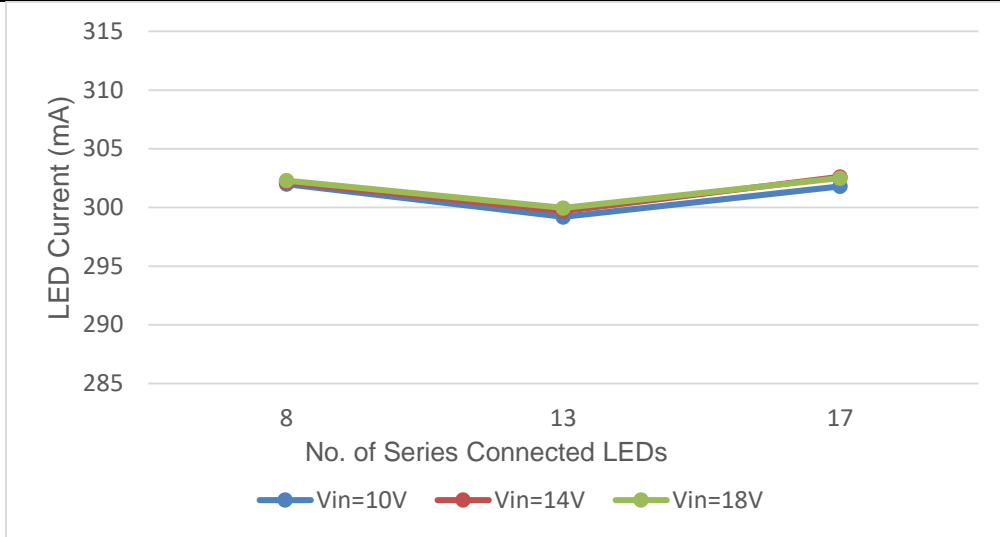


Figure 44. Output LED Current vs LED String Configuration (VIADJ = 750 mV)

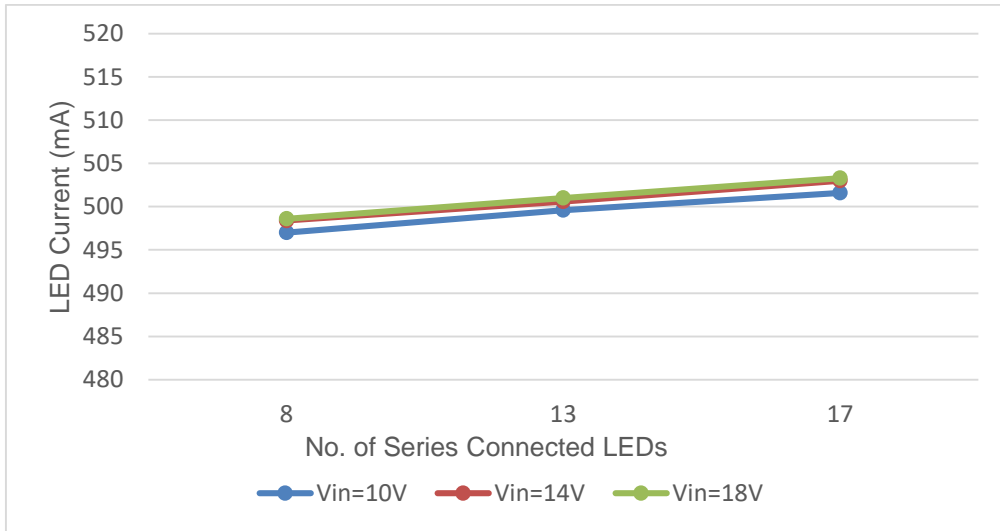


Figure 45. Output LED Current vs LED String Configuration (VIADJ = 1140 mV)

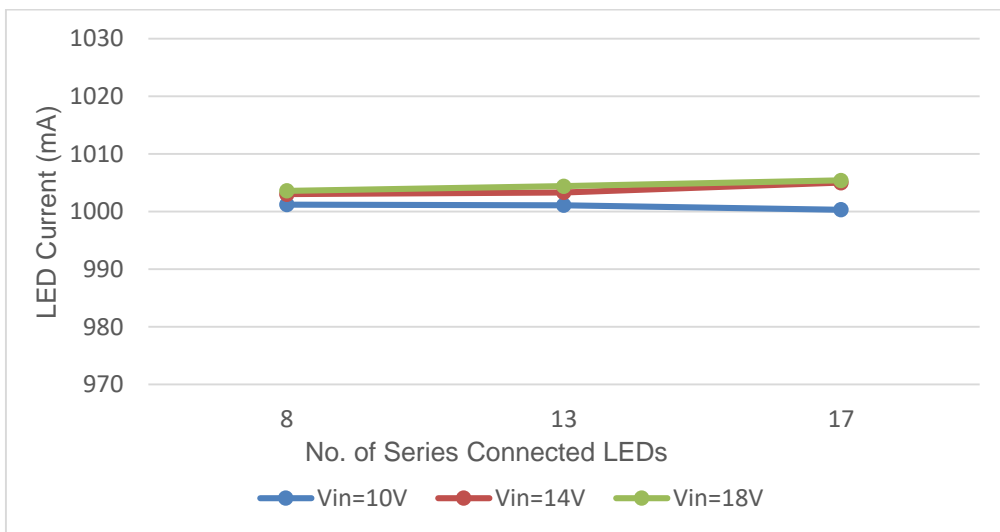


Figure 46. Output LED Current vs LED String Configuration (VIADJ = 2120 mV)

8.4 PWM Dimming

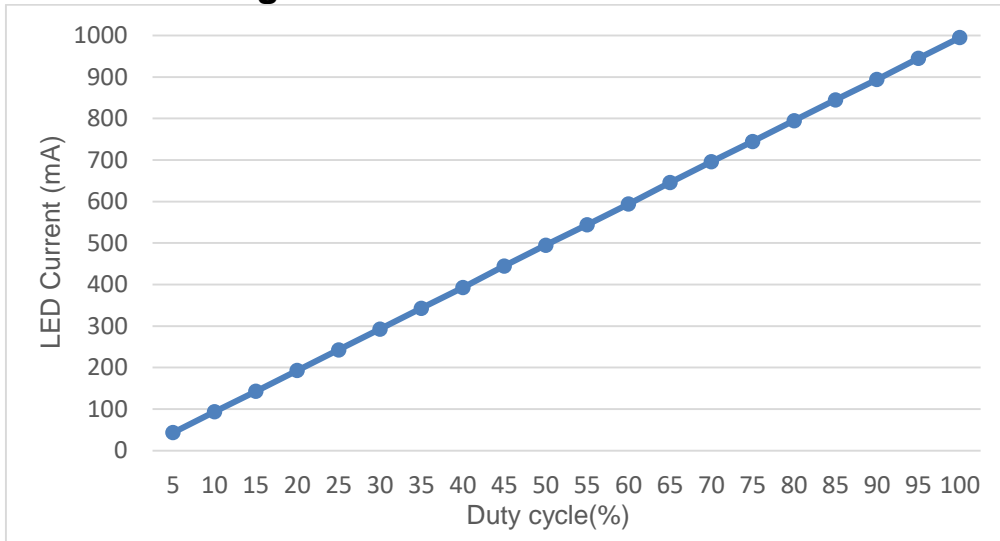


Figure 47. Output LED Current vs PWM Duty cycle (Vin=14V, Number of LED Series=8)

8.5 DSET Voltage to PWM Dimming

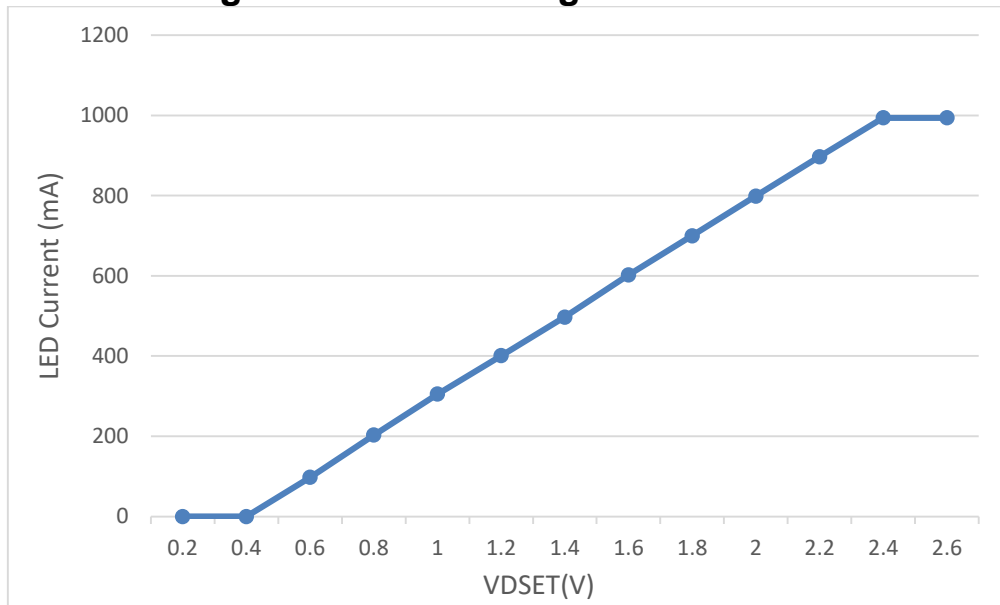


Figure 48. LED Current vs DIM/PWM Voltage (Vin=14V, Number of LED Series=8)

8.6 Analog Dimming

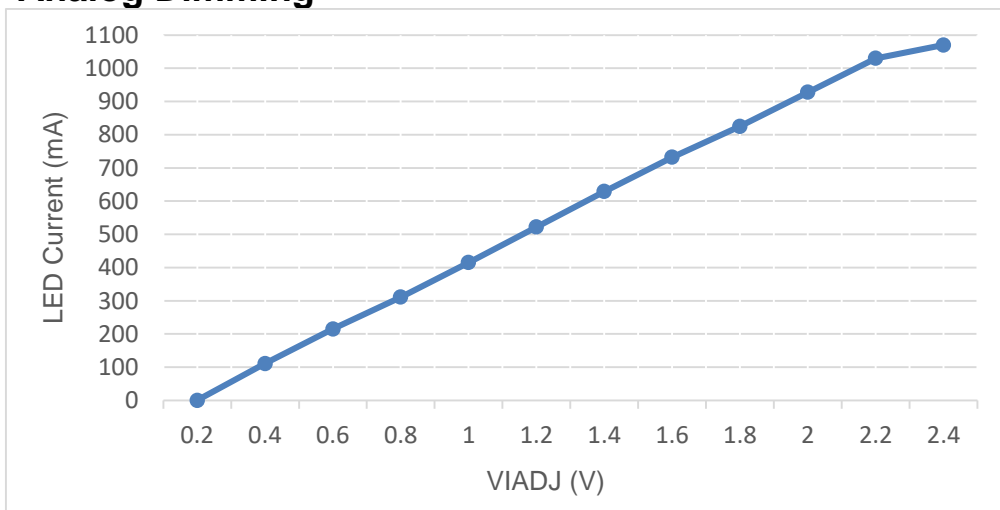
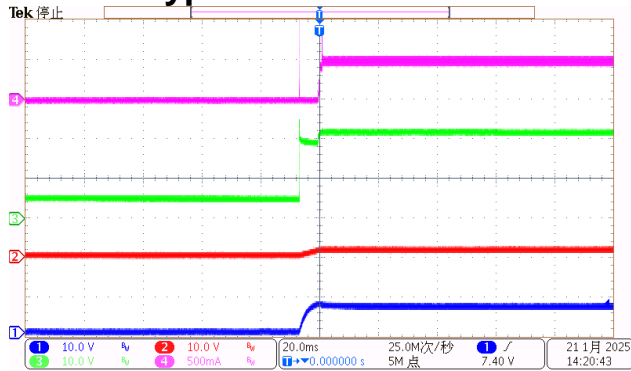
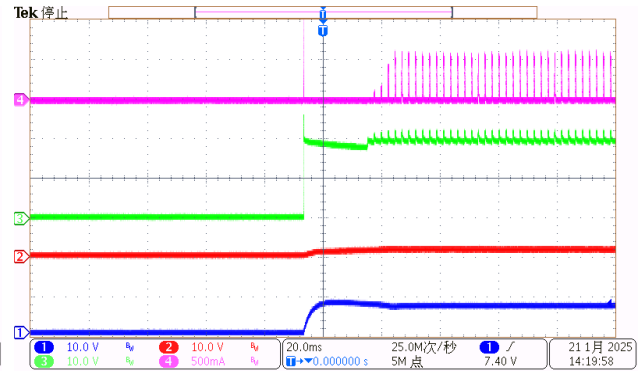


Figure 49. LED Current vs IADJ Voltage (Vin=14V, Number of LED Series=8)

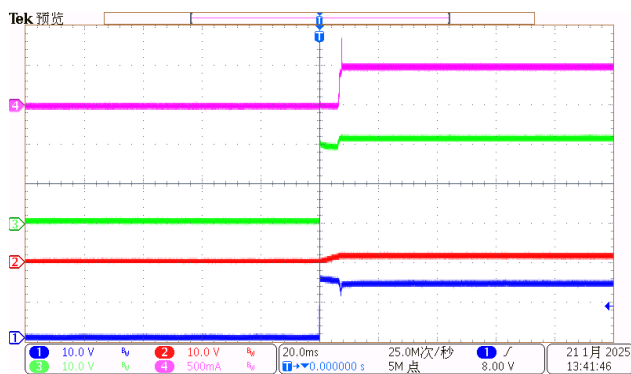
8.7 Typical Waveforms



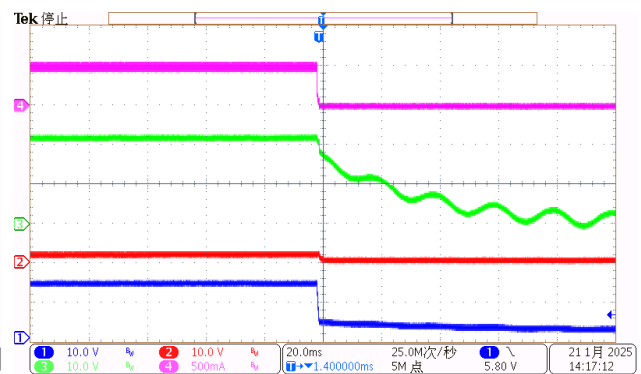
CH1: EN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 50. EN Power ON (DRL Mode)



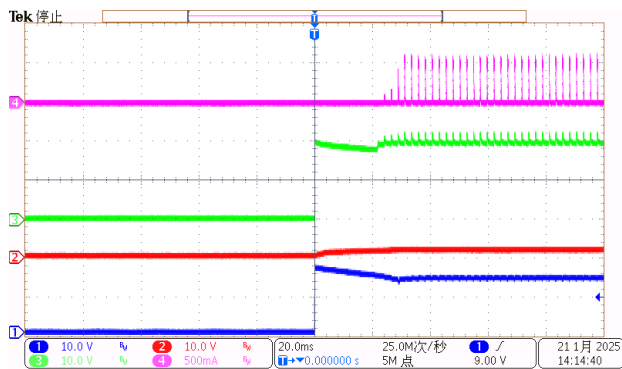
CH1: EN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 51. EN Power ON (PWM Mode)



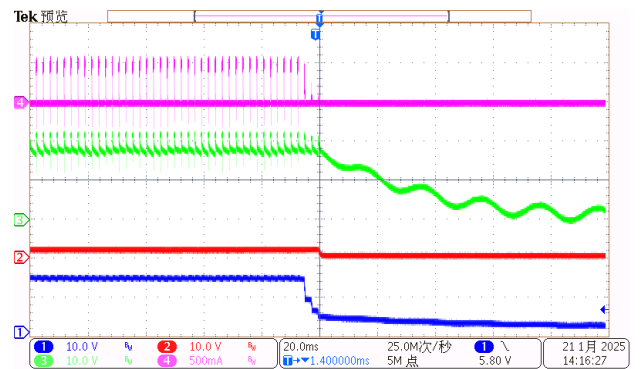
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 52. VIN Power ON (DRL Mode)



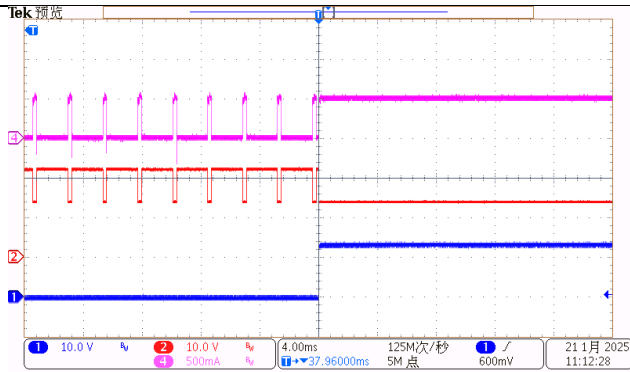
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 53. VIN Power OFF (DRL Mode)



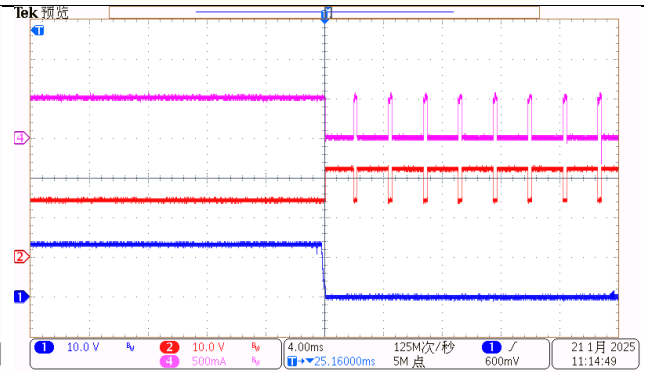
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 54. VIN Power ON (PWM Mode)



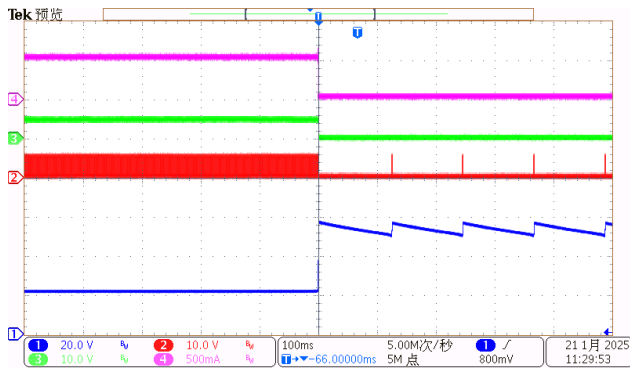
CH1: VIN; CH2: COMP; CH3: VLED+; CH4: ILED
Time: 20ms/div
Figure 55. VIN Power OFF (PWM Mode)



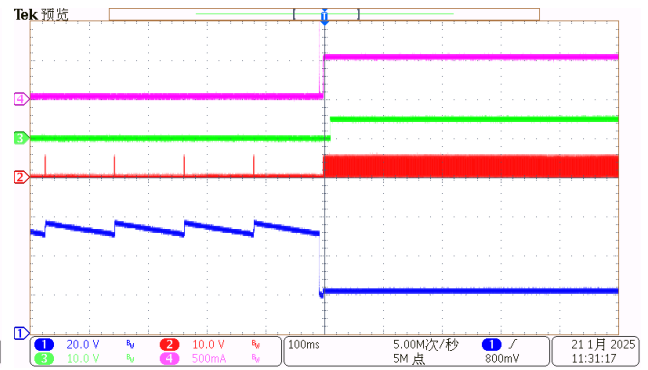
CH1: PWMI; CH2: PDRV; CH4: ILED
 Time: 4ms/div
 Figure 56. PWM Mode → DRL Mode



CH1: PWMI; CH2: PDRV; CH4: ILED
 Time: 4ms/div
 Figure 57. DRL Mode → PWM Mode



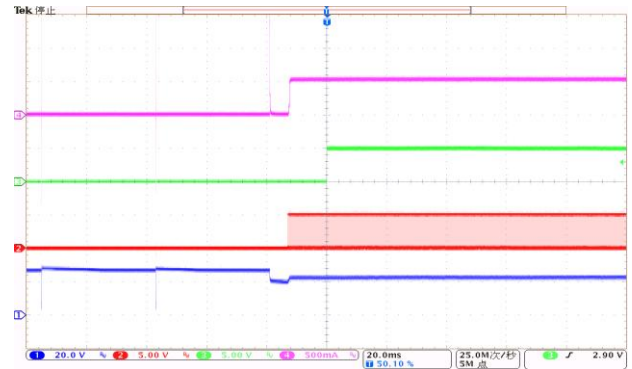
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 100ms/div
 Figure 58. LED Open Operation (Normal → Open)
 DRL Mode



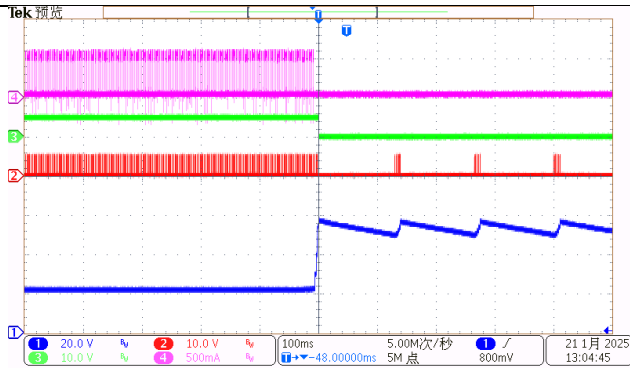
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 100ms/div
 Figure 59. LED Open Operation (Open → Normal)
 DRL Mode



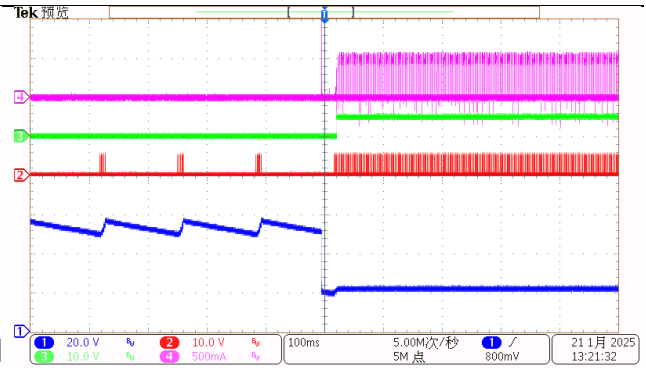
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 200ms/div
 Figure 60. SCP Operation (Normal → Short)
 DRL Mode



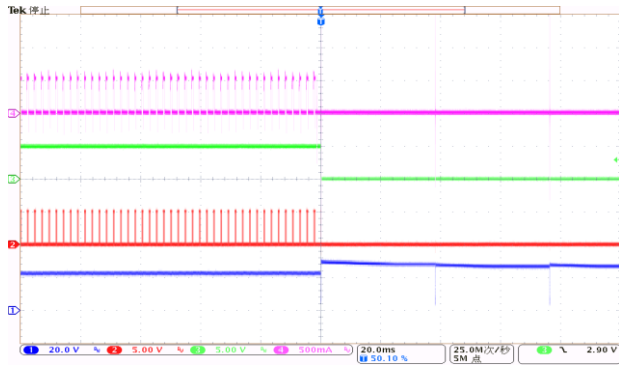
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 200ms/div
 Figure 61. SCP Operation (Short → Normal)
 DRL Mode



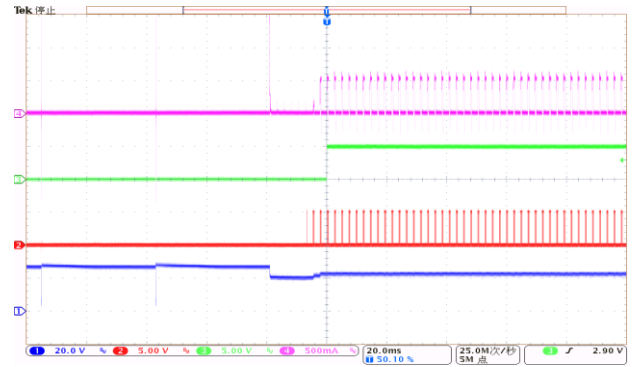
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 100ms/div
 Figure 62. LED Open Operation (Normal → Open)
 PWM Mode



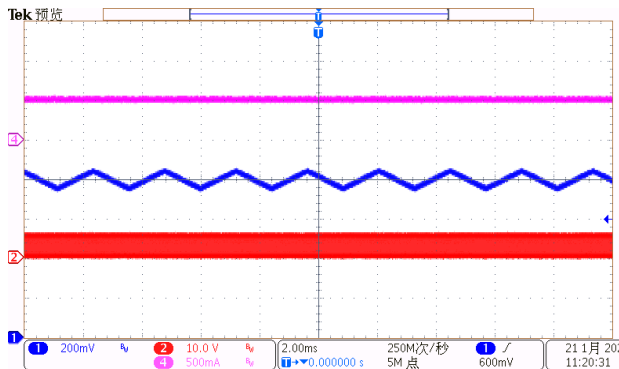
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 100ms/div
 Figure 63. LED Open Operation (Open → Normal)
 PWM Mode



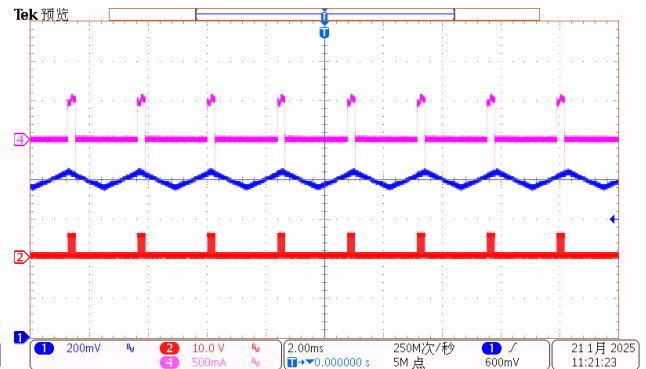
CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 100ms/div
 Figure 64. SCP Operation (Normal → Short)
 PWM Mode



CH1: VCSP; CH2: GDRV; CH3: /FLT; CH4: ILED
 Time: 100ms/div
 Figure 65. SCP Operation (Short → Normal)
 PWM Mode



CH1: RT; CH2: GDRV; CH4: ILED
 Time: 2ms/div
 Figure 66. SSFM Operation (DRL Mode)



CH1: RT; CH2: GDRV; CH4: ILED
 Time: 2ms/div
 Figure 67. SSFM Operation (PWM Mode)