MQ7868

5.5~30V input, 2~5.5V/5~15V, 10W/30W output, Buck DC-DC Converter

Features

- Wide Operating Voltage:
  - A: 5.5 ~ 30V
  - B: 7 ~ 30V
  - C: 12 ~ 30V
- Output Voltage:
  - A: 2 ~ 5.5V
  - B: 5 ~ 10V
  - C: 10 ~15V
- Output power up to
  - A: 10W
  - B: 25W
  - C: 25W
- Output Current Up to 4A
- Low output voltage ripple
- Remote Control – Negative Logic
- Minimal space on PCB:
  - 12.7mm x 16.5mm x 7.0mm
  - 12.7mm x 16.9mm x 8.5mm (-R)
- No derating to +TBD℃, natural convection
- UL/IEC/EN60950 compliant
- RoHS Compliant

APPLICATIONS

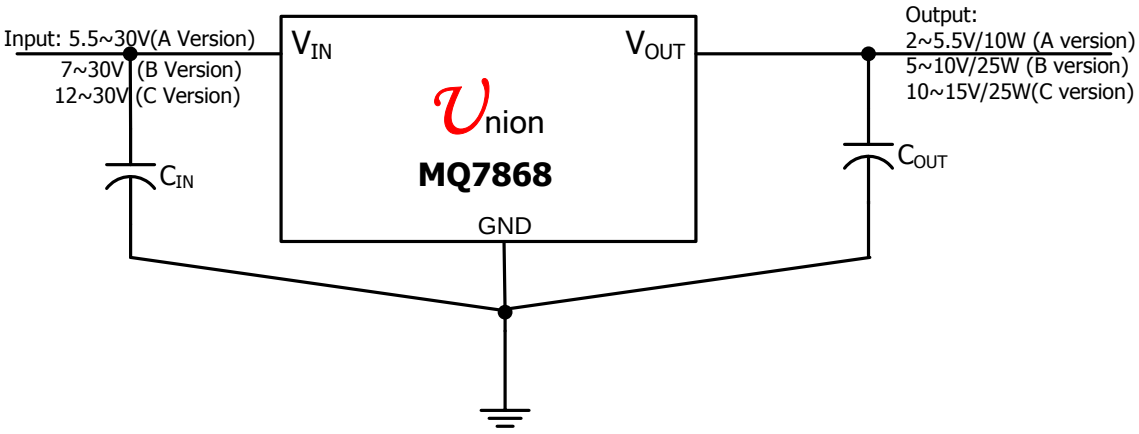
- Industry Control
- Audio Video Devices
- Data Acquisition Equipment
- Automotive Device

Description

The MQ7868A/B Series Power Modules are non-isolated dc-dc converters that operate over a wide input voltage range of 5.5Vdc or 7Vdc to 30Vdc and provide a regulated dc output. Such a module is suitable to application with 3.3V, 5V, 12V, 24V, and 32Vetc bias supply. The modules have a maximum output current rating of 4A at typical full-load efficiency over 92%.

MQ7868 series can load 4A in a very small size. This improves PCB layout and system integration capability.

********** *Typical Application Circuit* **********



Performance Specifications(at T_A=+25℃)

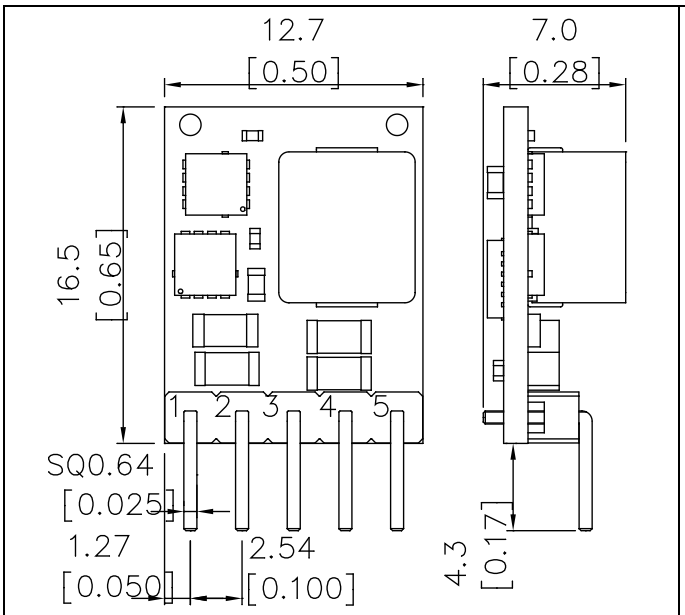
Model	Input V_{IN} Range (V)	Output				Efficiency (%)
		I_{OUT}(A)	Range(V)	Regulation		
				Line (%)	Load (%)	
MQ7868AT	5.5~30	4	2~5.5	1	2	92
MQ7868BT	7~30	4	5~10	1	2	92*
MQ7868CT	12~30	2.1	10~15	1	2	92

Note: * -- 12V input, 5V@4A Load

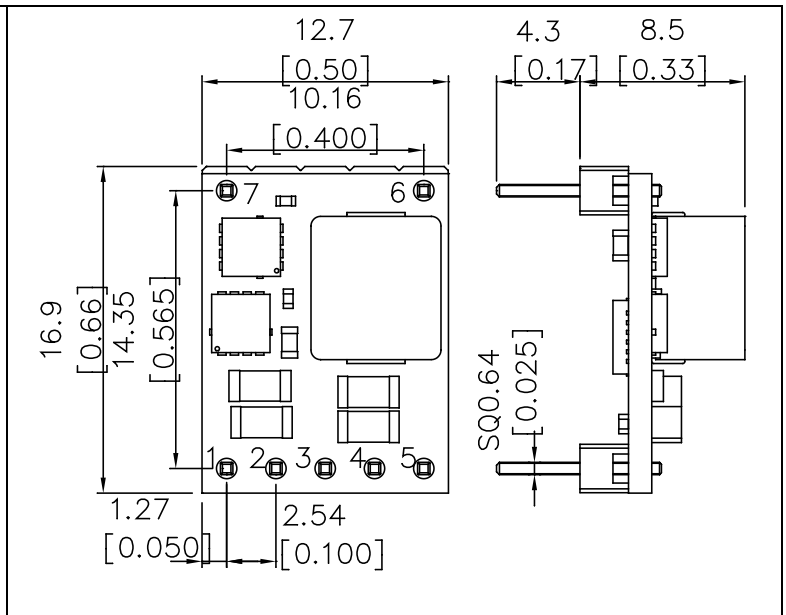
Mechanical Specifications

MQ7868 Dimensions are in millimeters (inches)
Tolerances: x.x mm±0.5mm; x.xx mm±0.25mm

PIN	1	2	3	4	5	6、7
DESCRIPTION	EN, Enable, Logical "High" to turn-off, logic "Low" to turn-on	Vin, input	GND, Ground	Vout, Output	Trim, connect one external resistor to GND pin to adjust output voltage	N.C, No connection



Through Hole



"-R" Right Angle option

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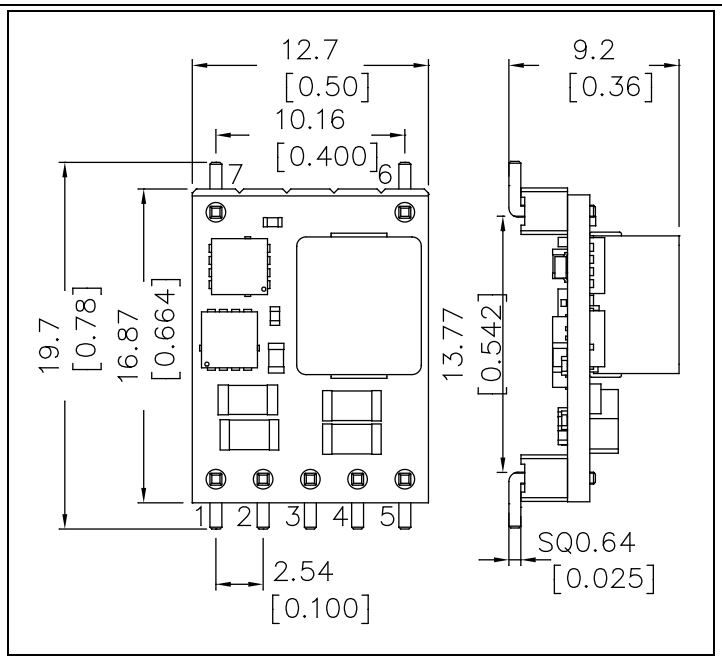

SMT

Ordering Information

MQ7868AT-R

- **Schmid- Multitech Power module P/N**
- **Output:**
  - **A: 2~5.5V**
  - **B: 5~10V**
  - **C: 10~15V**
- **R: Right Angle option**
- **T: Through Hole**
- **S: SMD**

Absolute Maximum Ratings

Note: These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance Specifications Table is not implied.

AAParameter	Symbol	Min	Max	Unit
Input Voltage	V_{IN}	4.5	40	V
Storage Temperature	T_{STG}	-40	125	℃

MQ7868A Electrical Specifications: *(T_A=+25℃)*

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Input Voltage Range		V_{IN}	5.5		30	V
Output Current	Vo set =2V	Io			4	A
Output Voltage Set point	100% load	ΔVo	-2		+2	%
Temperature Regulation	T_A= $T_{A.MIN}$ To $T_{A.MAX}$	-		0.2		$\%V_{O.SET}$
OutputTrimRange						V
Line Regulation				1		%
Load Regulation				2		%
Output Ripple and Noise Voltage	See Typical Characteristic					
Transient Response						

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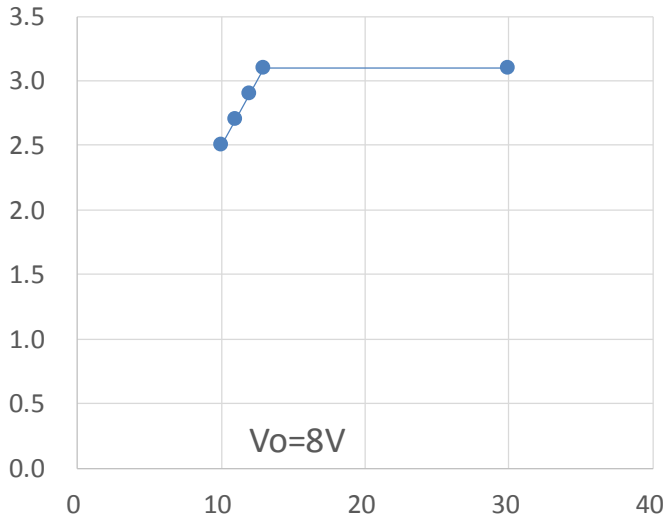
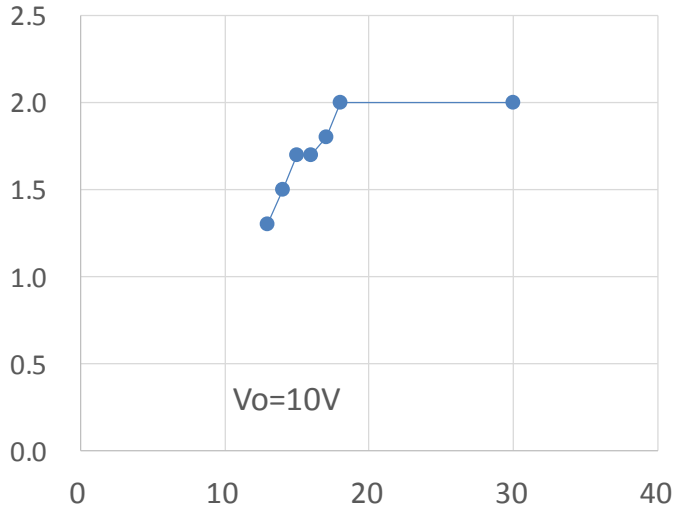
MQ7868B Electrical Specifications: (T_A=+25℃)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Input Voltage Range		V_{IN}	7		30	V
Output Current note	Vo. set =5V	Io			4	A
Output Voltage Set point	100% load	ΔVo	-2		+2	%
Temperature Regulation	T_A= $T_{A.MIN}$ To $T_{A.MAX}$	-		0.2		%$V_{O.SET}$
OutputTrimRange						V
Line Regulation				1		%
Load Regulation				2		%
Output Ripple and Noise Voltage	See Typical Characteristic					
Transient Response						

※Note: Vo=5V, The Over Vin range lomax =4A. output current derating is allowed when input voltage is too low. Find details in figures below.





MQ7868C Electrical Specifications: (T_A=+25℃)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Input Voltage Range		V_{IN}	12		30	V
Output Current	Vo. set =10V	Io			2.1	A
Output Voltage Set point	100% load	ΔVo	-2		+2	%
Temperature Regulation	T_A= $T_{A.MIN}$ To $T_{A.MAX}$	-		0.2		%$V_{O.SET}$
Output Trim Range						V
Line Regulation				1		%
Load Regulation				2		%
Output Ripple and Noise Voltage	See Typical Characteristic					
Transient Response						

Test Configurations

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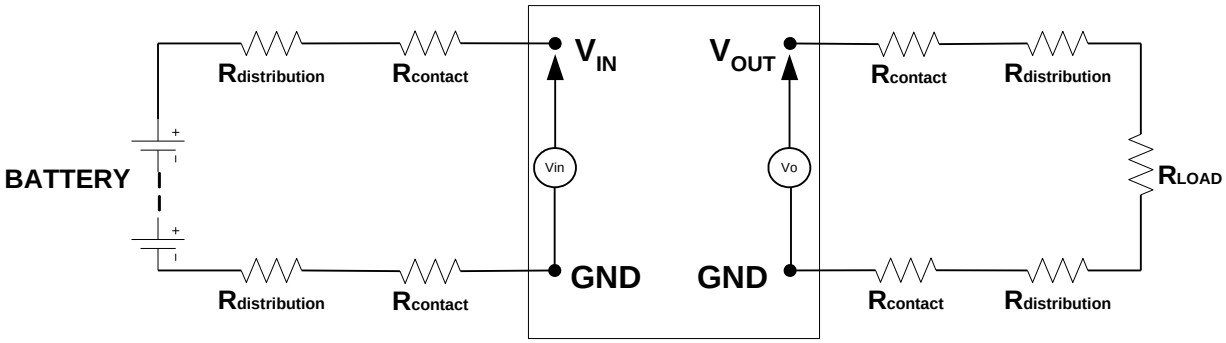

Test setup for efficiency

Note:

All voltage measurements must be taken at the module's terminals, as shown above. If sockets are needed, Kelvin connections are required at the module terminals to avoid measurement errors due to socket contact resistance.

ON/OFF Control

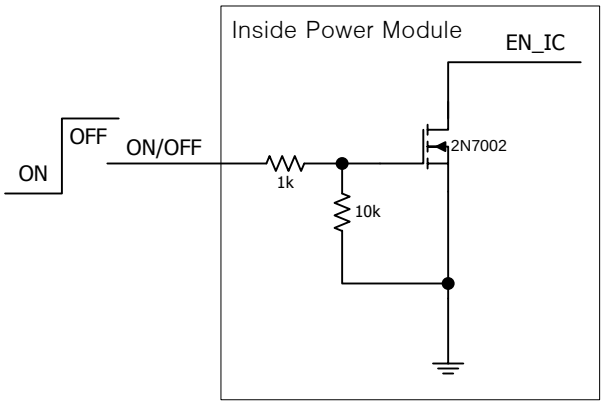

Fig 1, inside Remote ON/OFF circuit

The MQ7868 power modules feature an On/Off pin for remote On/Off operation with negative logic. If not using the remote On/Off pin, just leave the pin open (module will be ON). The On/Off pin signal (Von/Off) is referenced to ground. To switch module ON and OFF using remote On/Off, refer to the inside circuit of Figure1.

Output Voltage Trimming

MQ7868's output voltage can be trimmed in certain ranges. See Figure2 for the programming method. See performance Specifications for allowable trim ranges in detail. Also customized products are offered.

Trim with external resistor (Fig 2), the equation as below:

For MQ7868:

$$R_{TRIM} = \frac{8000}{V_O - Vpre}$$

Resistor values are in Ω;

V_O is desired output voltage;

V pre is the default output, 2V for "A" version, 5V for "B" version, and 10V for "C" version.

If trim the output of MQ7868xA to 4.5V, then

$$R_{TRIM} = \frac{8000}{4.5-2} = 3200$$

So, R_{TRIM} =3.16kΩ, the actual output voltage will be 4.53V.

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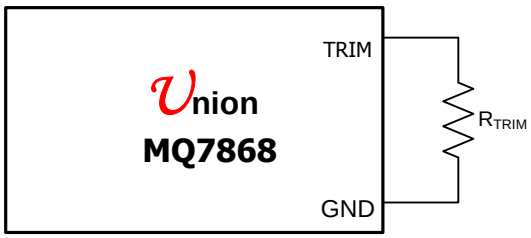

Fig2. Circuit configuration for programming output voltage using external resistor

For most common voltages, the required Trim resistors as Table 2.

Table 2, the required trim resistors R_{TRIM} for most common voltages

V_{OUT}	R_{TRIM}		
	A version	B version	C version
2	OPEN	n/a	n/a
2.5	16k	n/a	n/a
3.3	6.19k	n/a	n/a
5	2.67k	OPEN	n/a
6	n/a	8k	n/a
8	n/a	2.67k	n/a
9	n/a	2k	n/a
10	n/a	1.6k	OPEN
12	n/a	n/a	4k
15	n/a	n/a	1.6k

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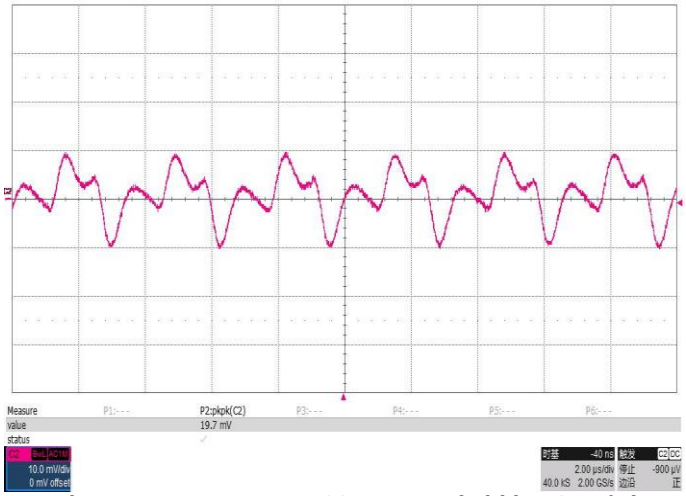
Typical Characteristics–MQ7868AT output adjusted to 2V

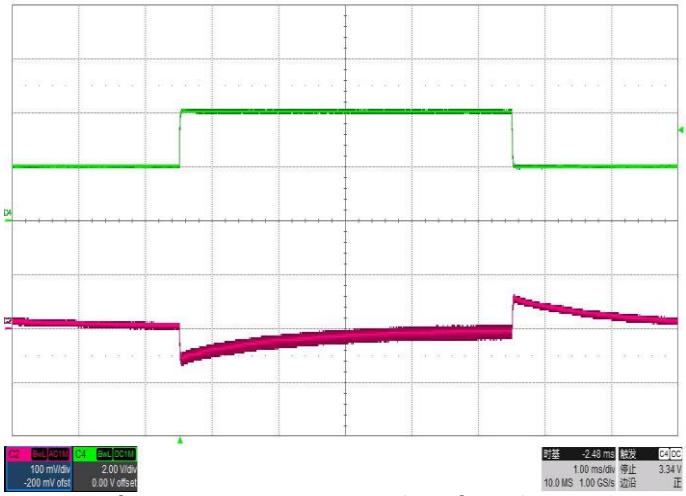
General conditions:

Input filter: 470uF/50V Electrolytic CAP

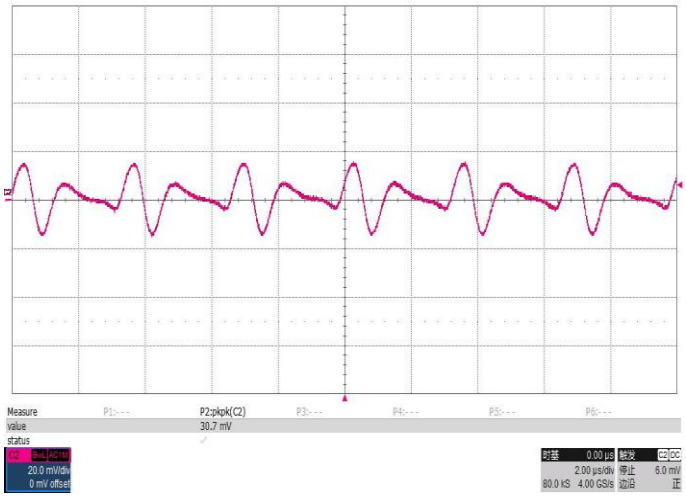
Output filter: 270uF/25V Solid Electrolytic CAP



Noise V_{IN}=5.5V, I_O=4A, 5~20MHz Bandwidth, 10mV/Div

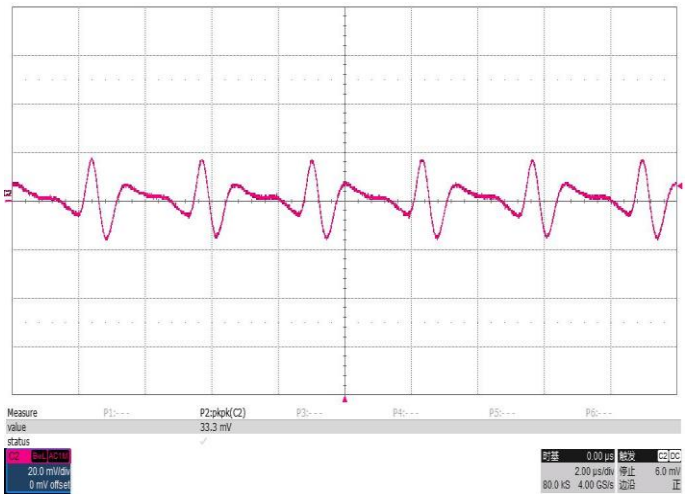


Transient Response V_{IN}=5.5V, Step from 2A~4A~2A

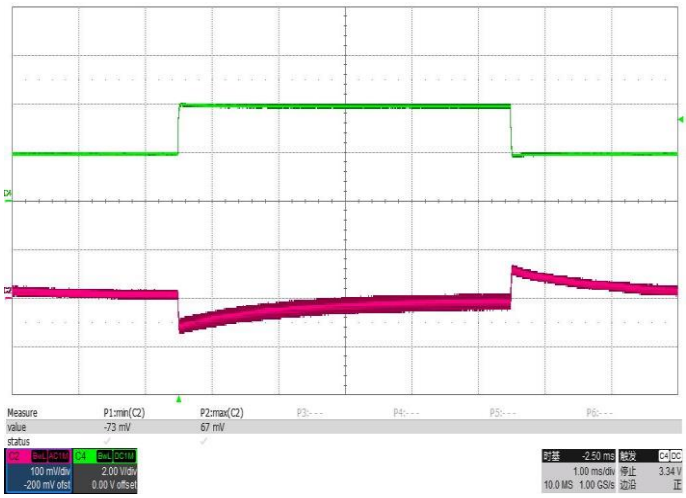


Noise V_{IN}=12V, I_O=4A, 5~20MHz Bandwidth, 20mV/Div

Transient Response V_{IN}=12V, Step from 2A~4A~2A



Noise V_{IN}=24V, I_O=4A, 5~20MHz Bandwidth, 20mV/Div



Transient Response V_{IN}=24V, Step from 2A~4A~2A

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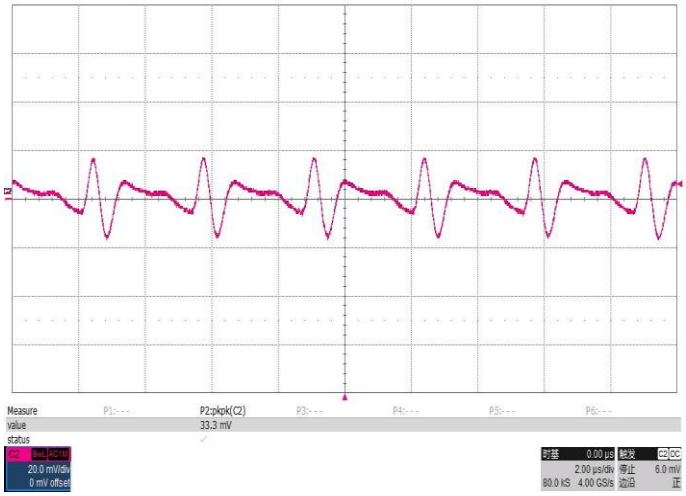
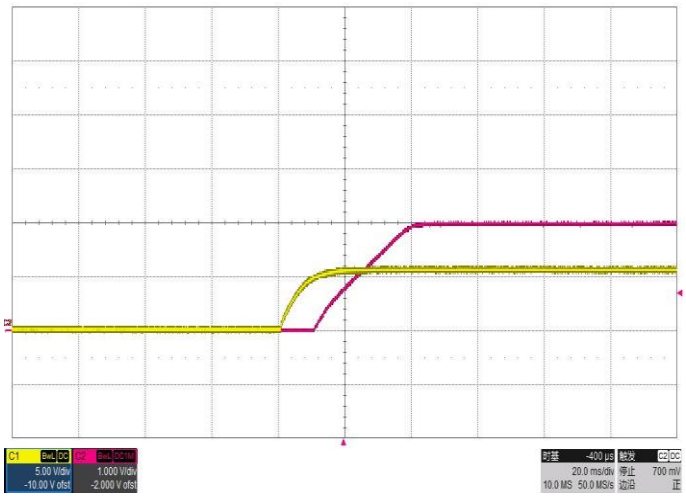
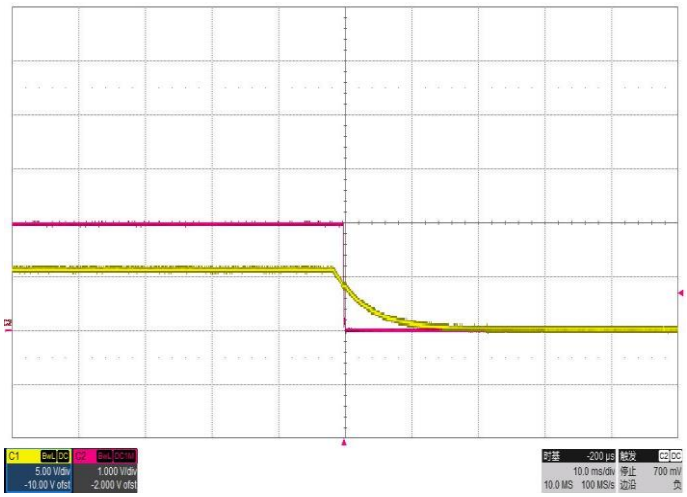


Noise V_{IN}=30V, I_O=4A, 5~20MHz Bandwidth, 20mV/Div

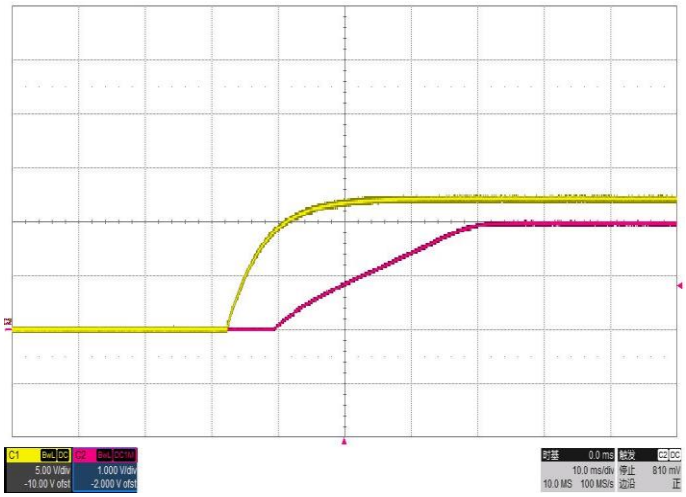
Transient Response V_{IN}=30V, Step from 2A~4A~2A



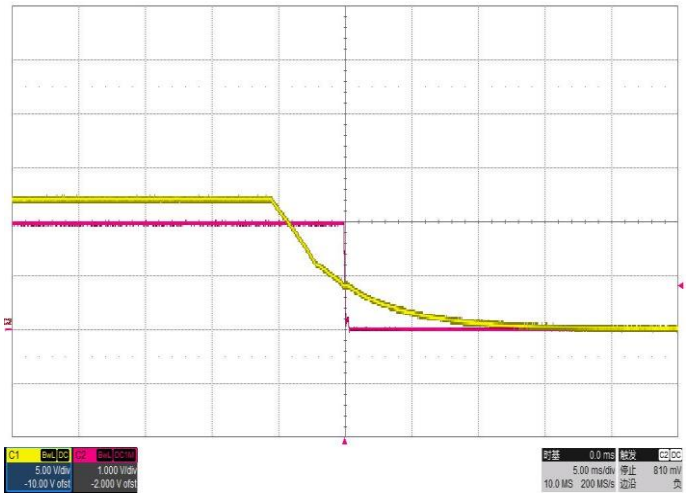
Start-up V_{IN}=5.5V, I_O=4A



Power Down, V_{IN}=5.5V, I_O=4A



Start-up V_{IN}=12V, I_O=4A



Power Down, V_{IN}=12V, I_O=4A

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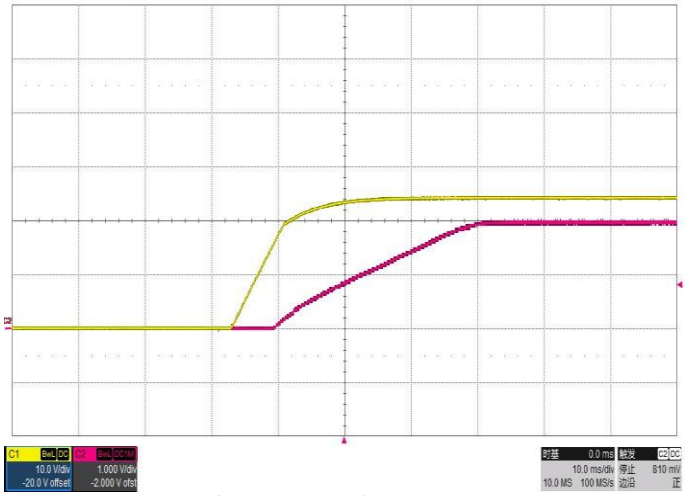
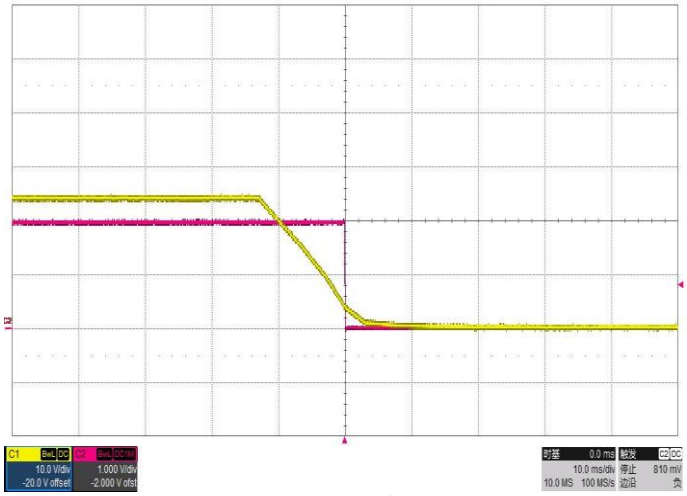
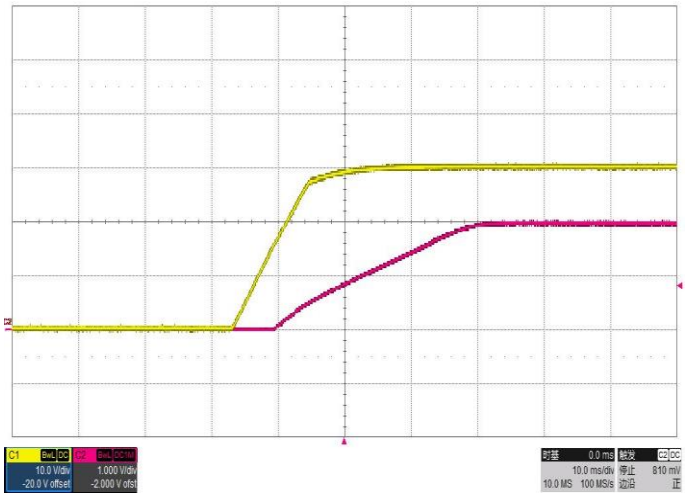


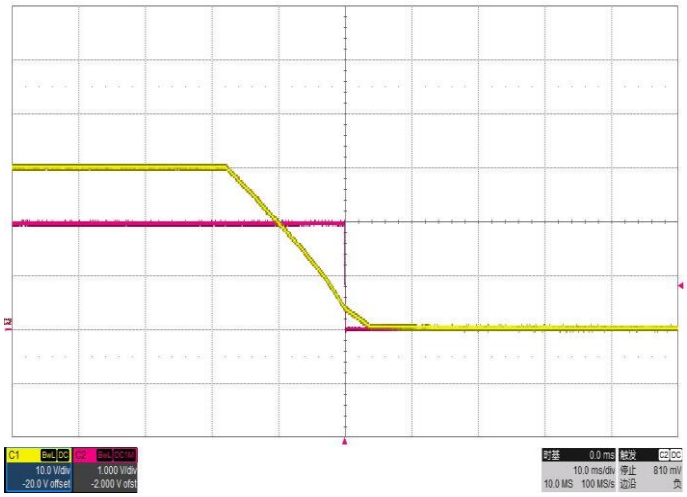
Start-up V_{IN}=24V, I_O=4A



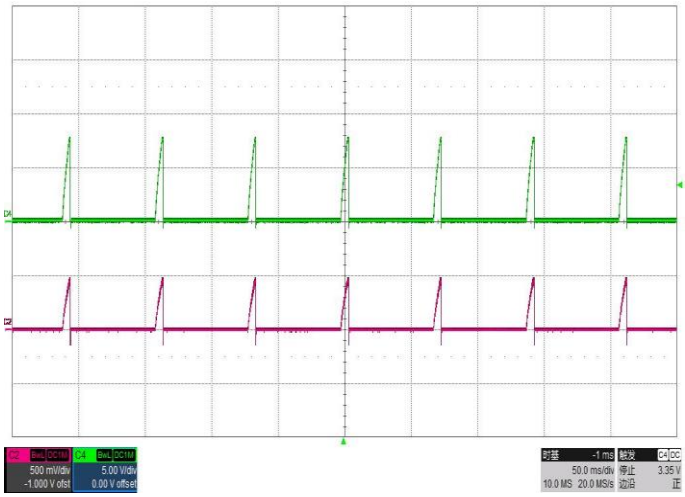
Power Down, V_{IN}=24V, I_O=4A



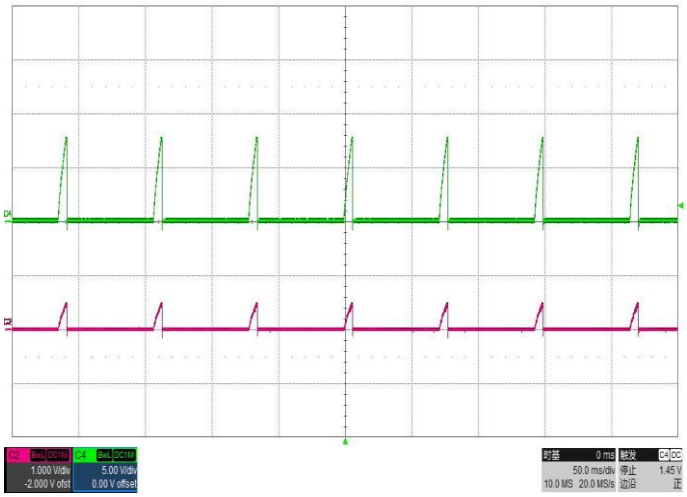
Start-up V_{IN}=30V, I_O=4A



Power Down, V_{IN}=30V, I_O=4A



Short-Circuit Output V_{IN}=5.5V



Short-Circuit Output V_{IN}=12V

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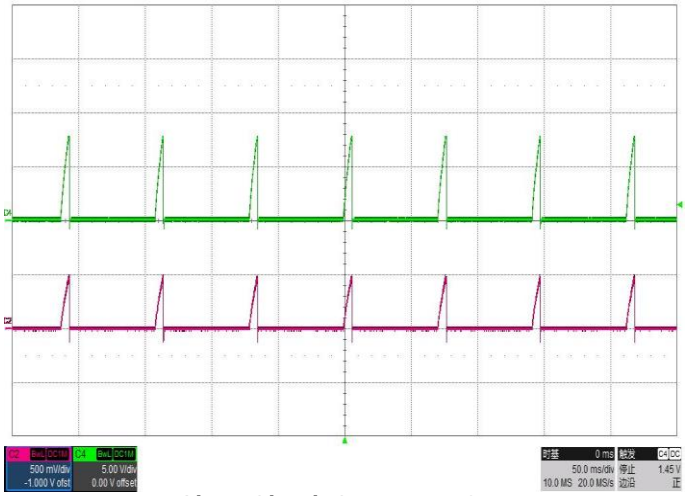
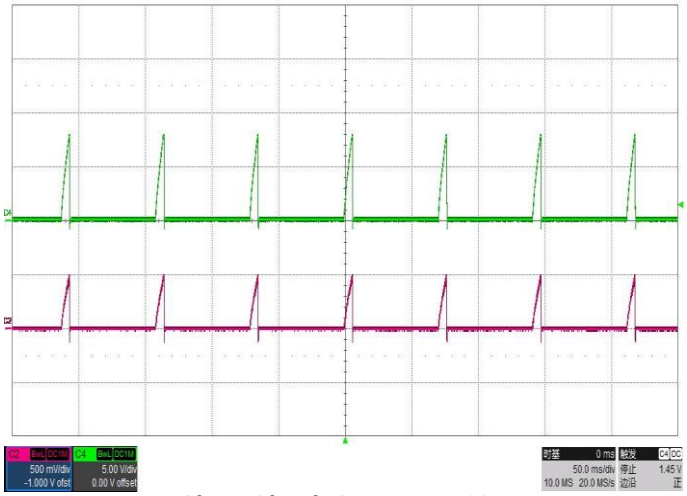
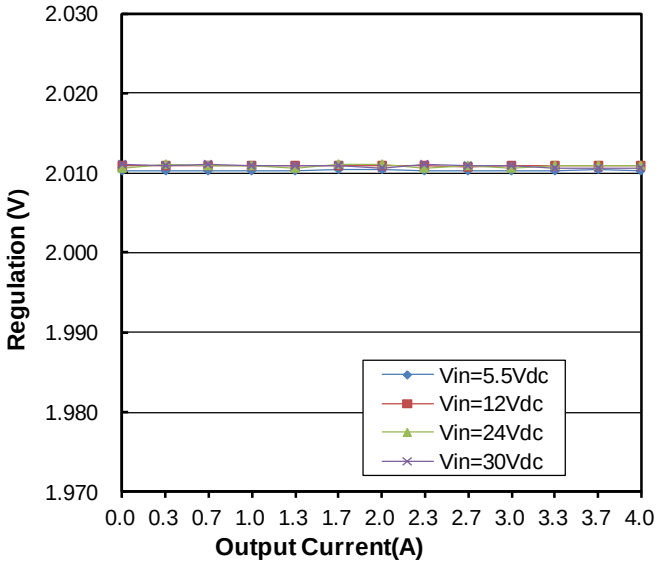


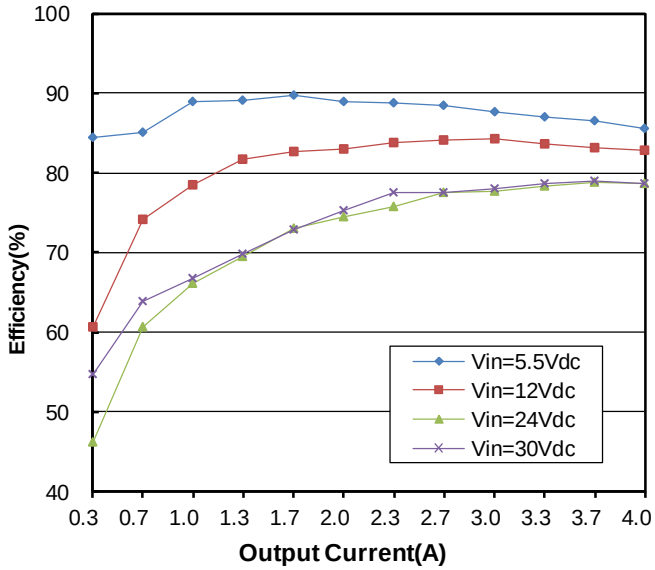
Short-Circuit Output V_{IN}=24V



Short-Circuit Output V_{IN}=30V

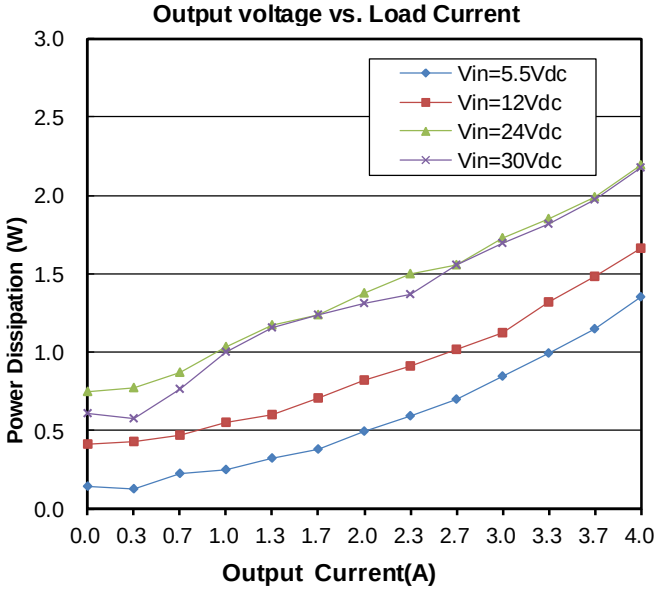


Regulation



Efficiency

Output voltage vs. Load Current



Power Dissipation

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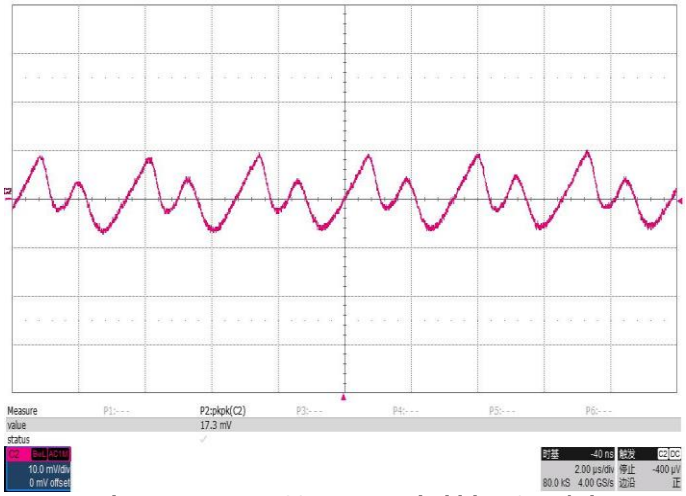
Typical Characteristics–MQ7868AT output adjusted to 5V

General conditions:

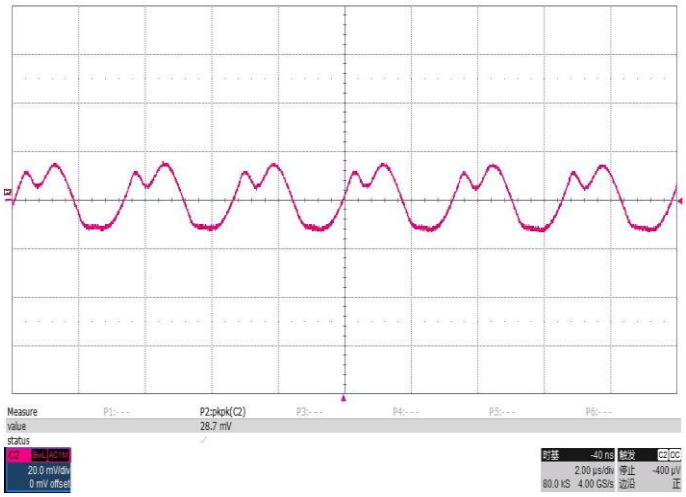
Input filter: 470uF/50V Electrolytic CAP

Output filter: 270uF/25V Solid Electrolytic CAP



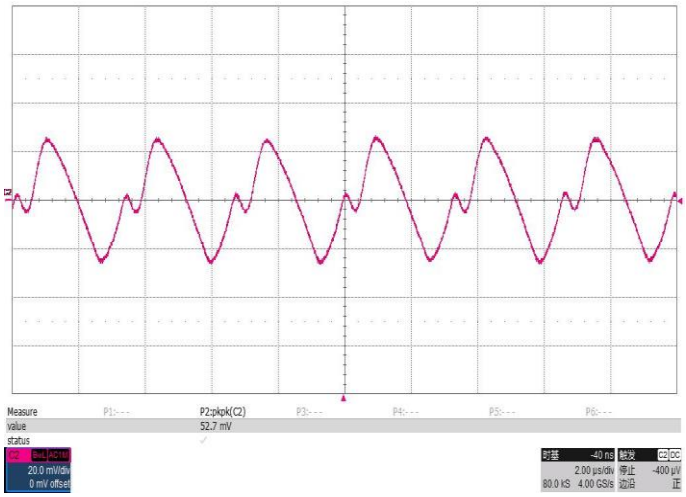
Noise V_{IN}=7.5V 5~20MHz Bandwidth, 10mV/Div

Transient Response V_{IN}=7.5V, Step from fl~hl~fl



Noise V_{IN}=12V 5~20MHz Bandwidth, 20mV/Div

Transient Response V_{IN}=12V, Step from fl~hl~fl



Noise V_{IN}=24V 5~20MHz Bandwidth, 20mV/Div

Transient Response V_{IN}=24V, Step from fl~hl~fl

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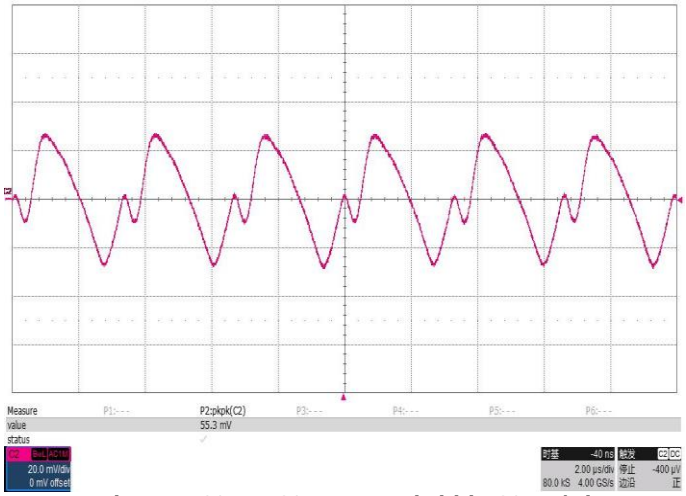
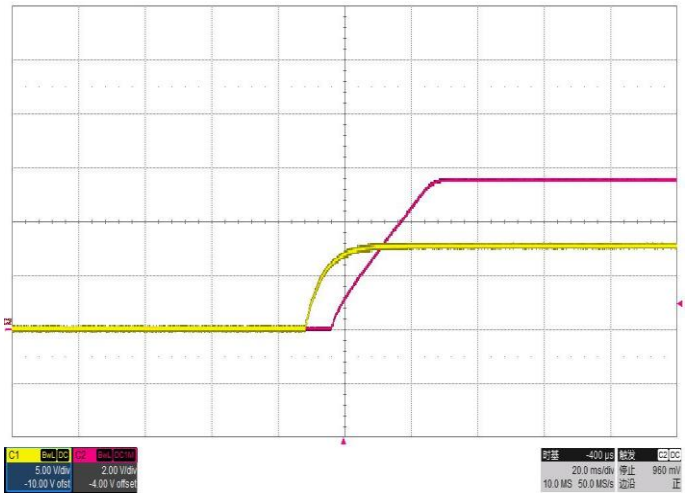
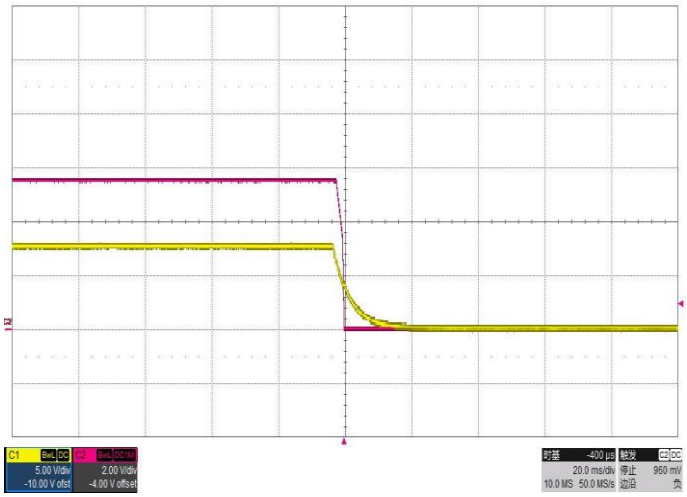


Noise V_{IN}=30V 5~20MHz Bandwidth, 20mV/Div

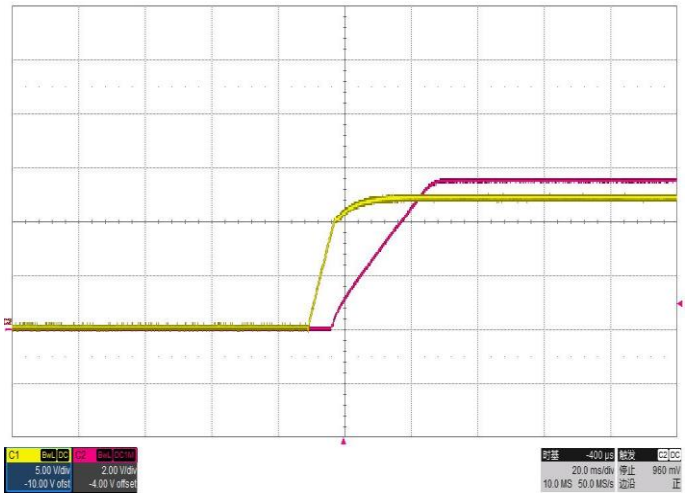
Transient Response V_{IN}=30V, Step from fl~hl~fl



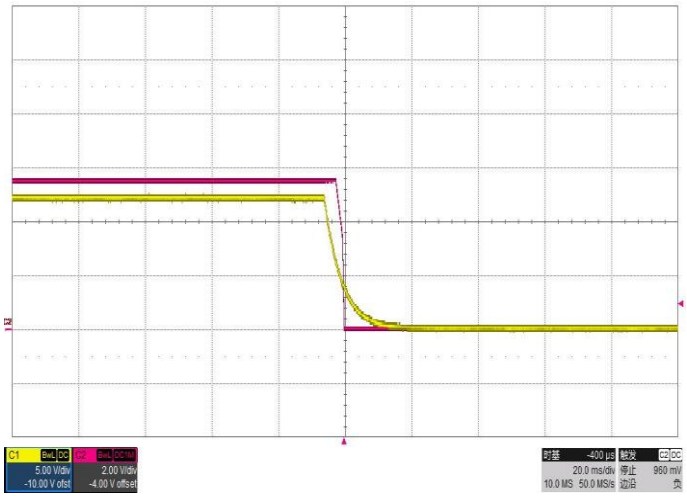
Start-up V_{IN}=7.5V



Power Down, V_{IN}=7.5V



Start-up V_{IN}=12V



Power Down, V_{IN}=12V

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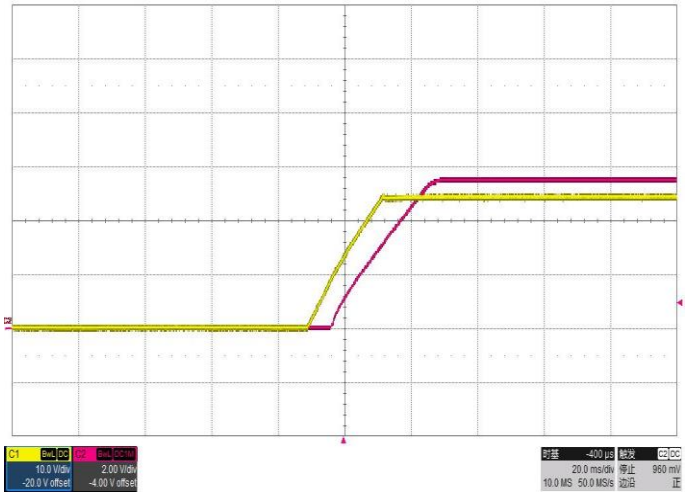
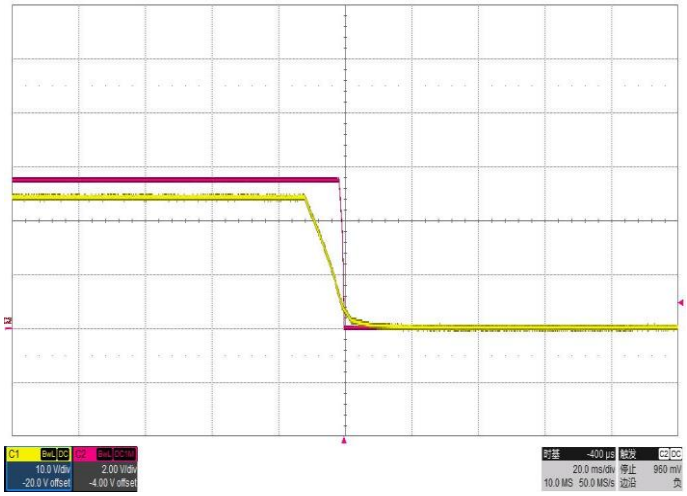
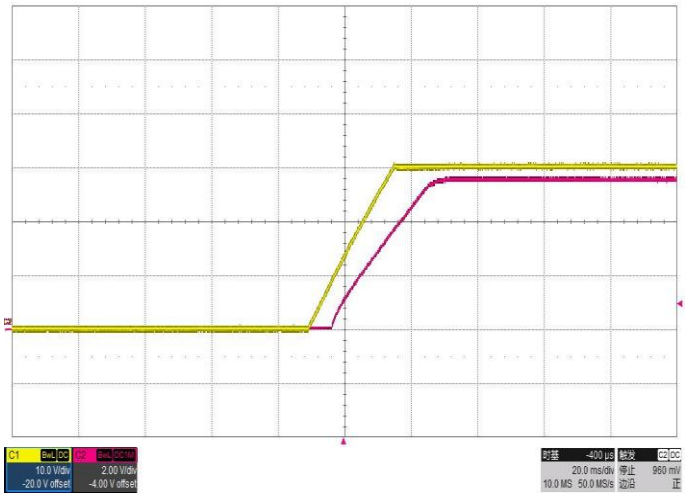


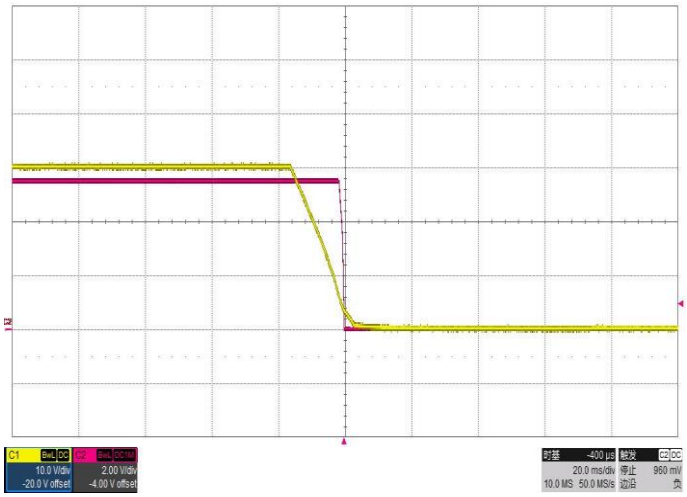
Start-up V_{IN}=24V



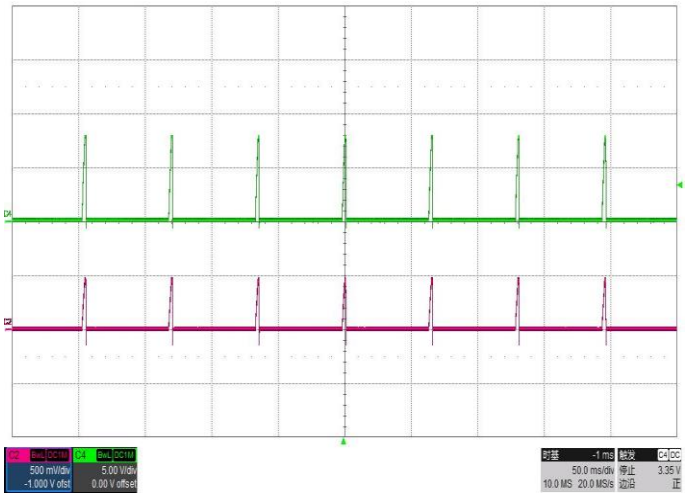
Power Down, V_{IN}=24V



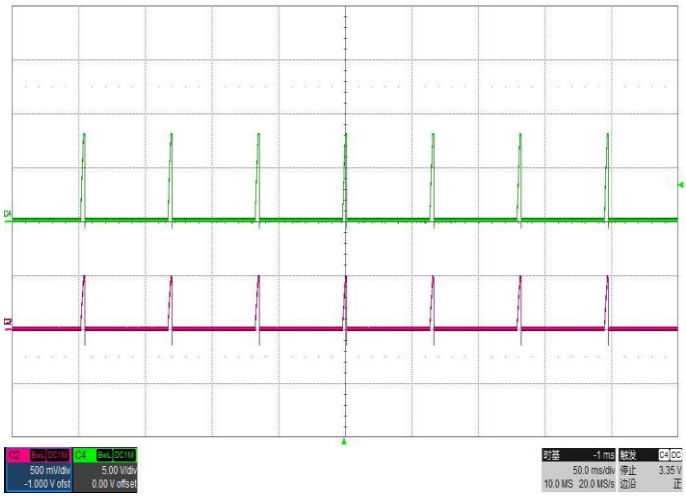
Start-up V_{IN}=30V



Power Down, V_{IN}=30V



Short-Circuit Output V_{IN}=7.5V



Short-Circuit Output V_{IN}=12V

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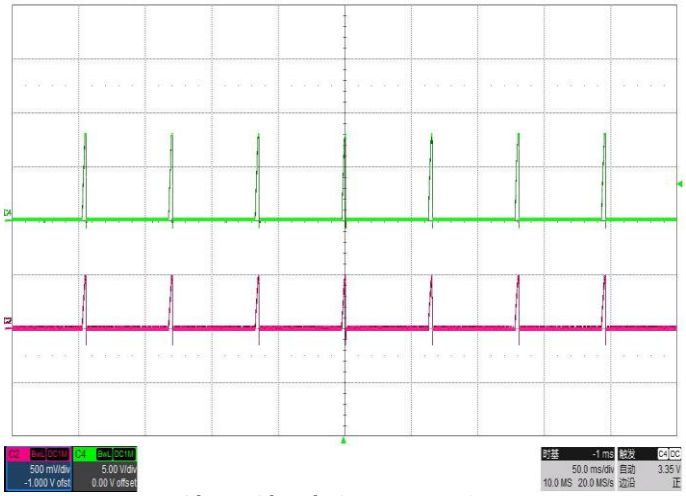
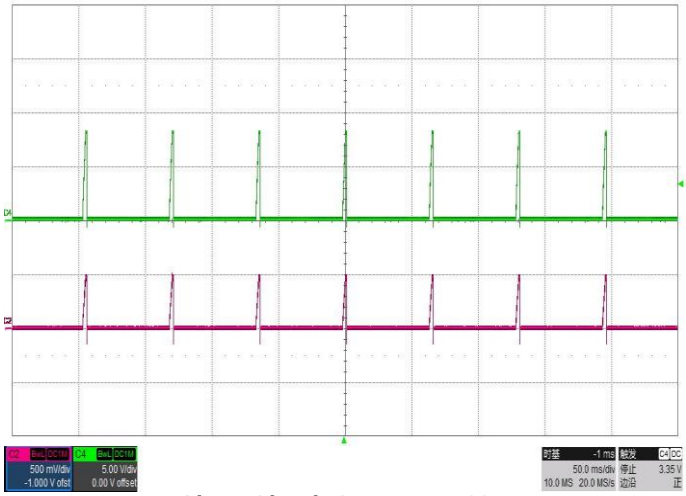
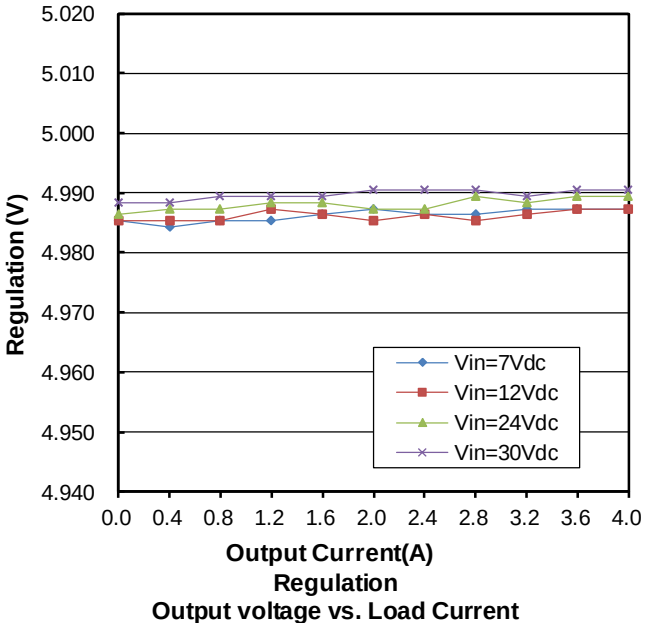


Short-Circuit Output V_{IN}=24V

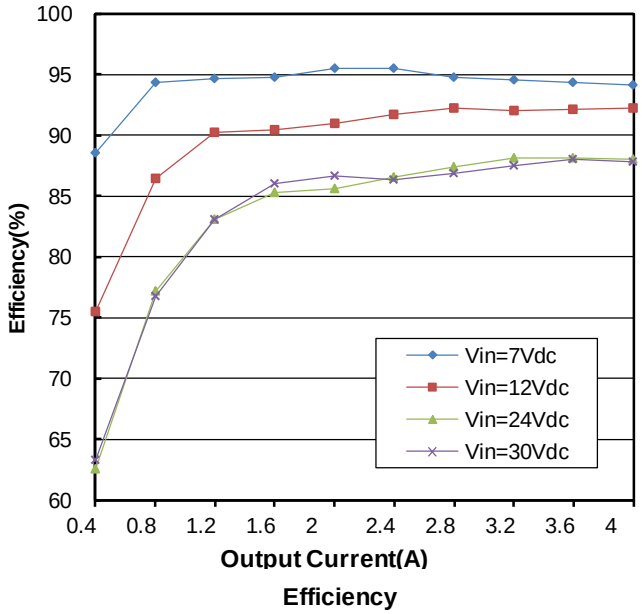


Short-Circuit Output V_{IN}=30V

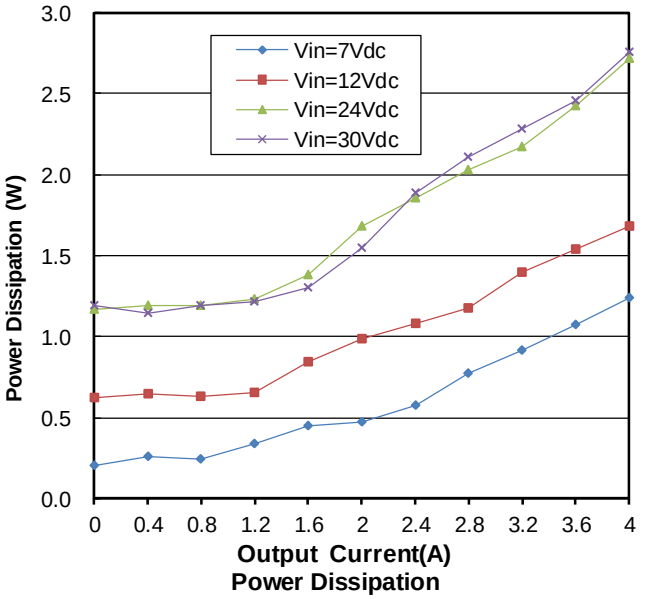


Regulation

Output voltage vs. Load Current



Efficiency



Power Dissipation

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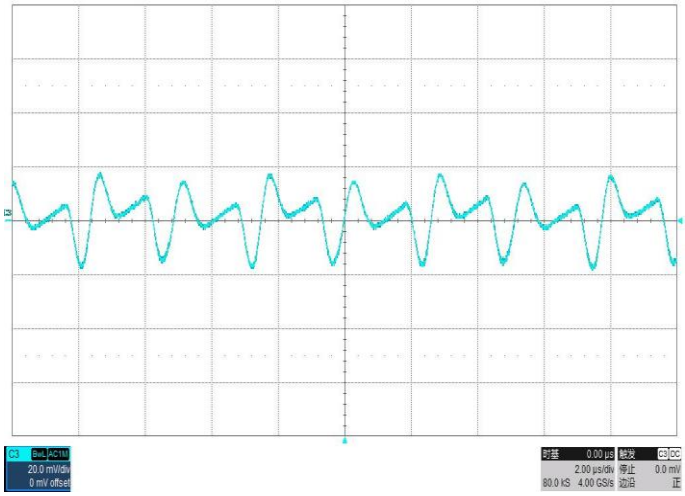
Typical Characteristics–MQ7868BT output adjusted to 5V

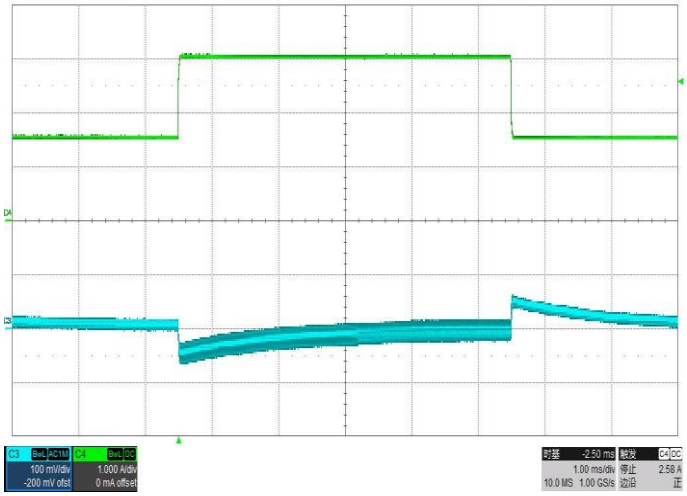
General conditions:

Input filter: 470uF/50V Electrolytic CAP

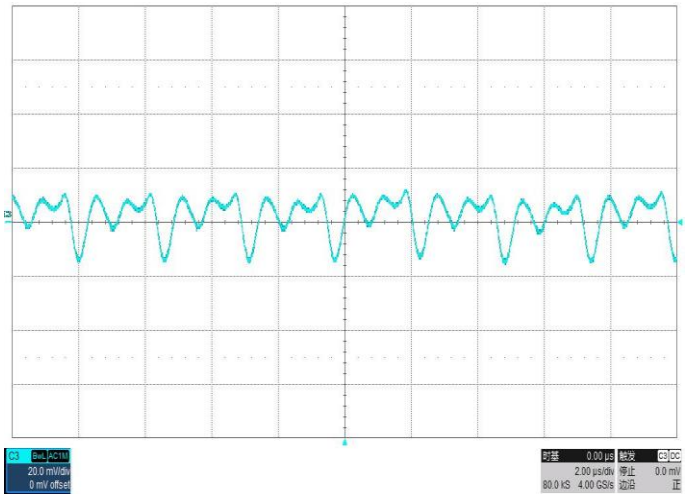
Output filter: 270uF/10V Solid Electrolytic CAP



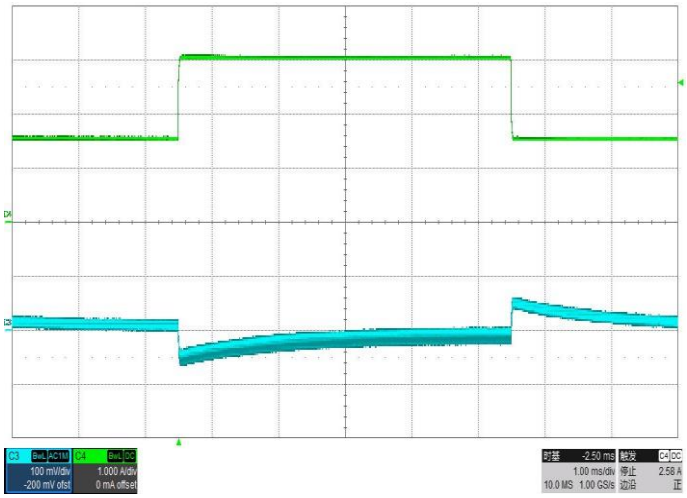
Noise V_{IN}=7V, I_O=4A, 5~20MHz Bandwidth, 20mV/Div



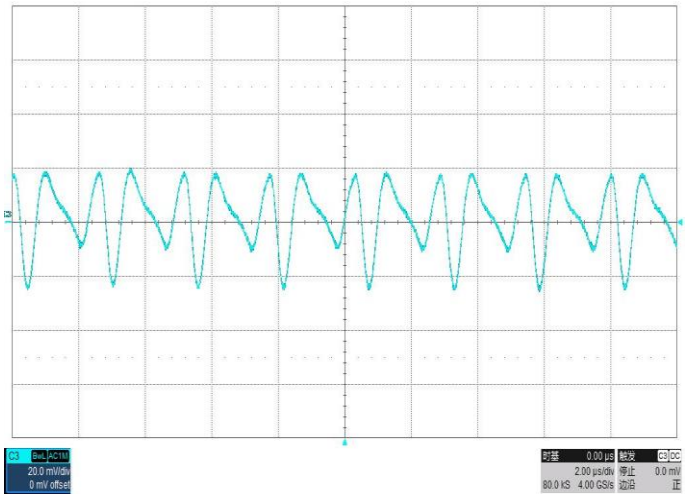
Transient Response V_{IN}=7V, Step from 2A~4A~2A



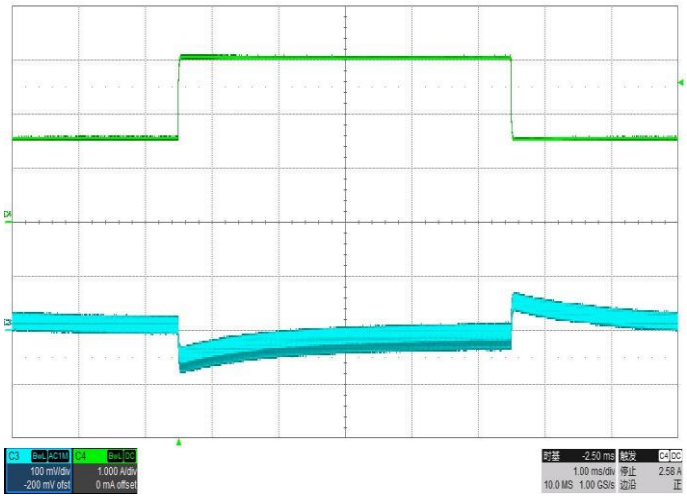
Noise V_{IN}=12V, I_O=4A, 5~20MHz Bandwidth, 20mV/Div



Transient Response V_{IN}=12V, Step from 2A~4A~2A



Noise V_{IN}=24V, I_O=4A, 5~20MHz Bandwidth, 20mV/Div



Transient Response V_{IN}=24V, Step from 2A~4A~2A

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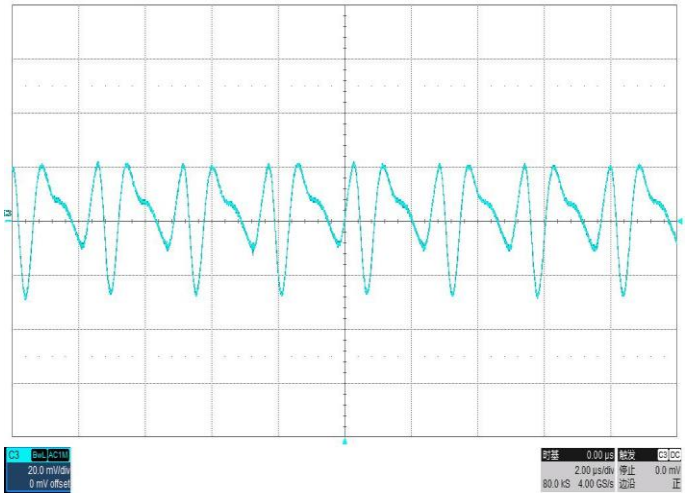
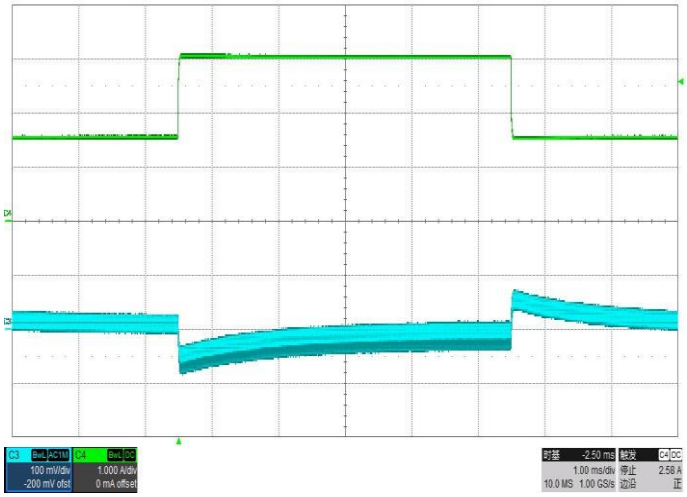
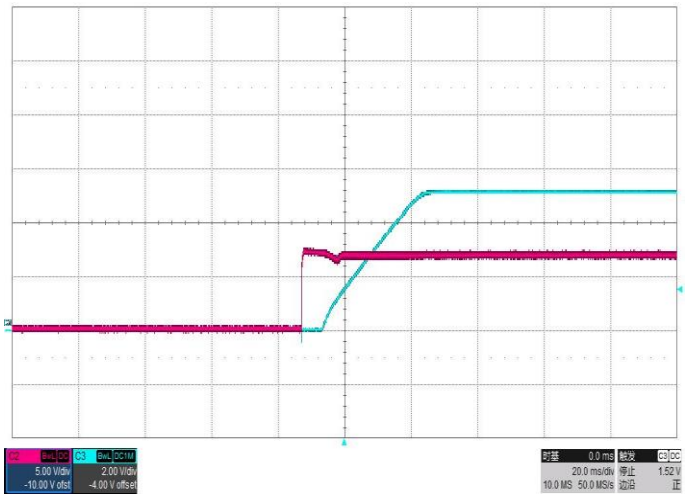


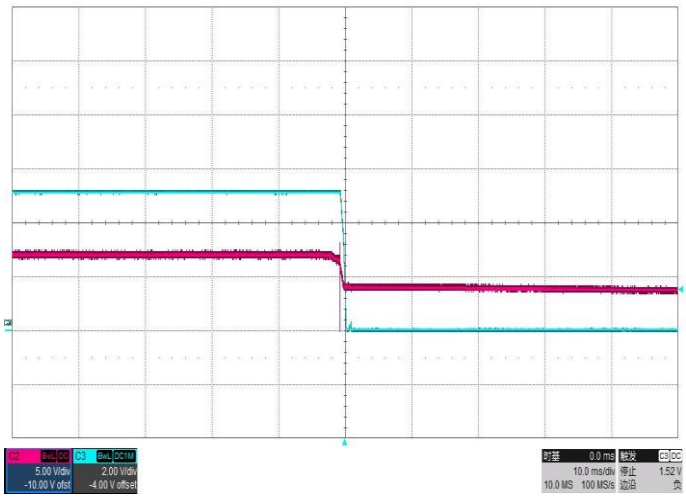
Noise V_{IN}=30V, I_O=4A, 5~20MHz Bandwidth, 20mV/Div



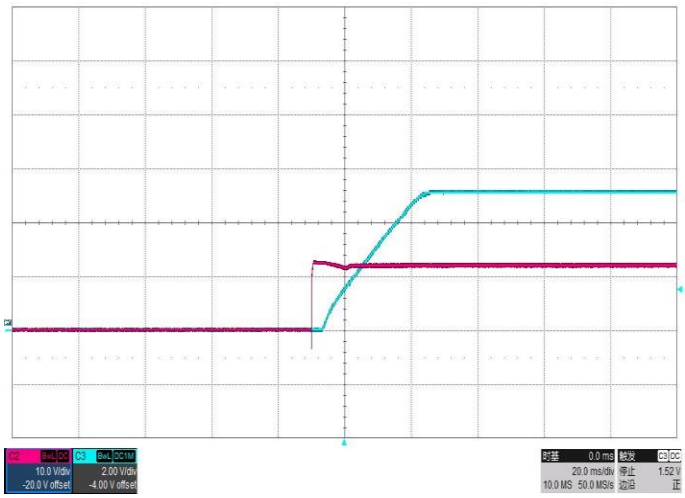
Transient Response V_{IN}=30V, Step from 2A~4A~2A



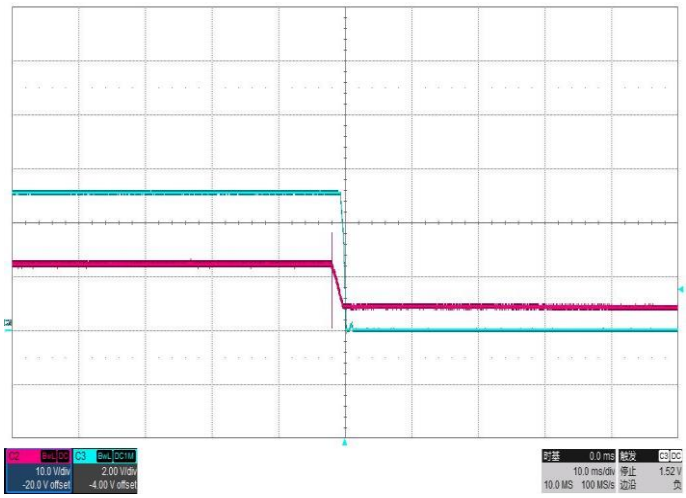
Start-up V_{IN}=7V, I_O=4A



Power Down, V_{IN}=7V, I_O=4A



Start-up V_{IN}=12V, I_O=4A



Power Down, V_{IN}=12V, I_O=4A

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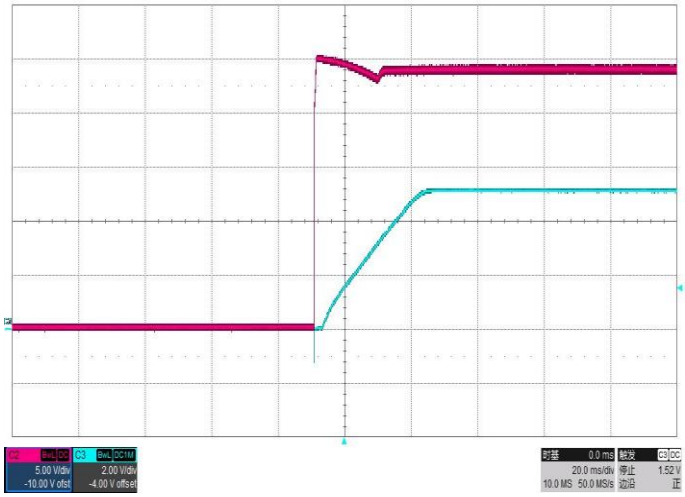
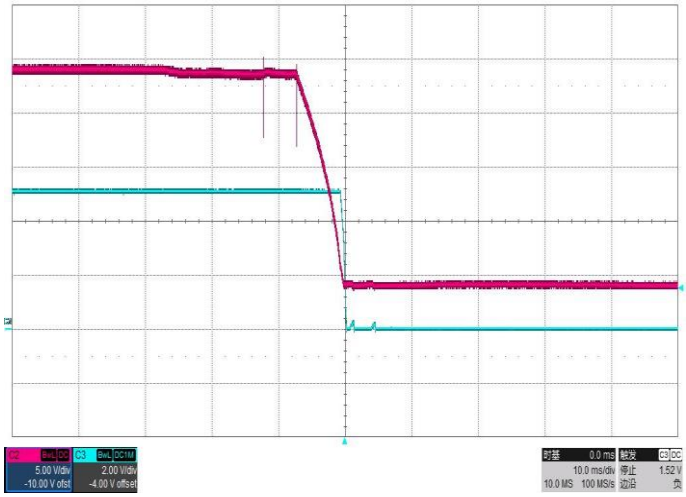
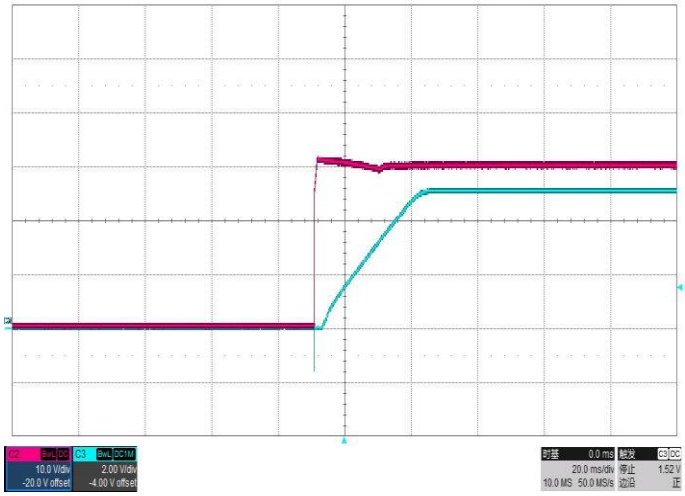


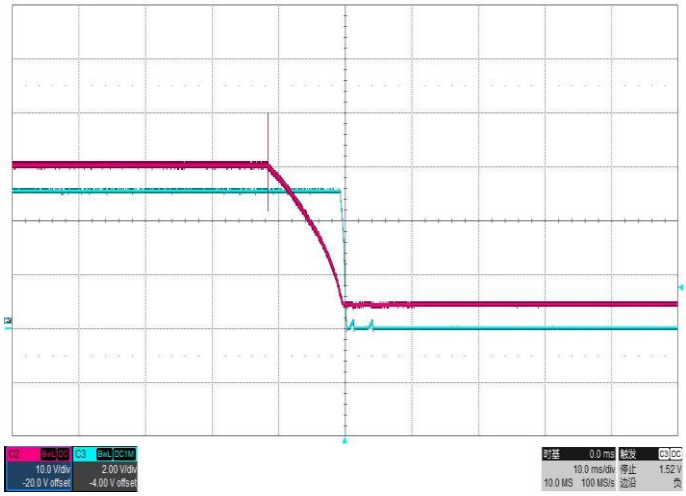
Start-up V_{IN}=24V, I_O=4A



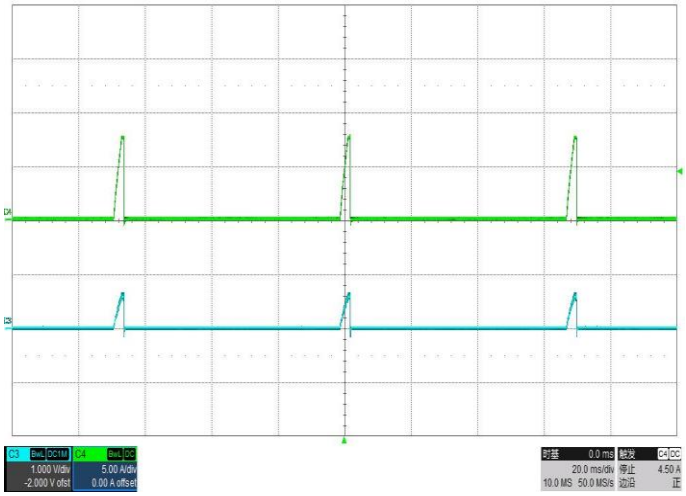
Power Down, V_{IN}=24V, I_O=4A



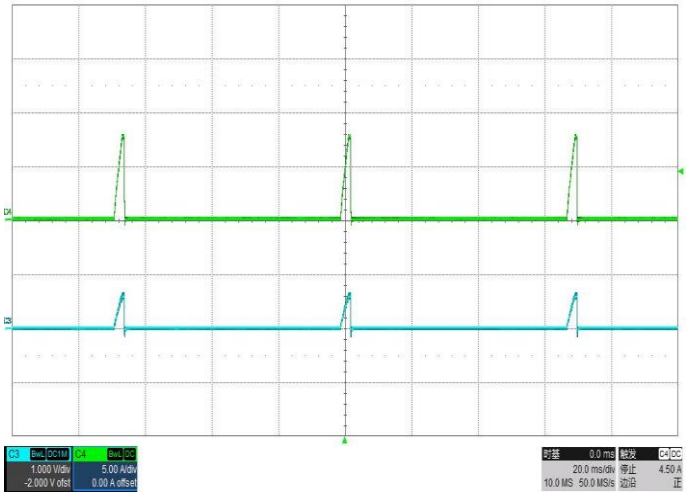
Start-up V_{IN}=30V, I_O=4A



Power Down, V_{IN}=30V, I_O=4A



Short-Circuit Output V_{IN}=7V



Short-Circuit Output V_{IN}=12V

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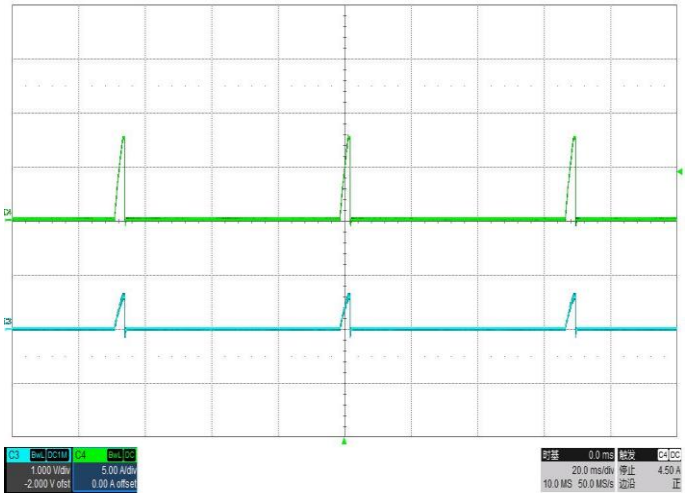
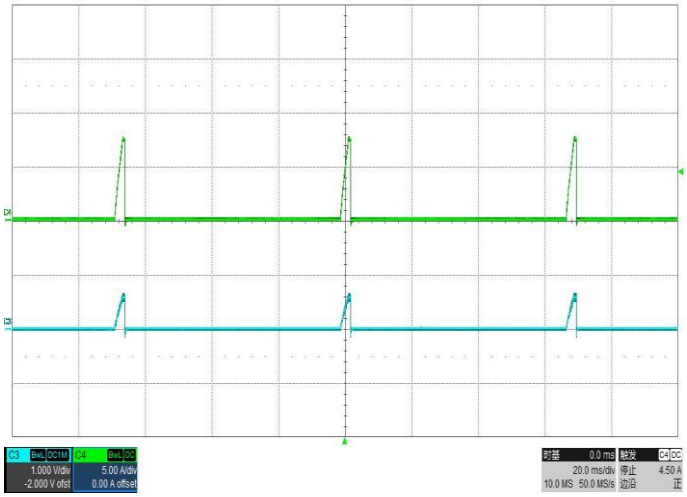
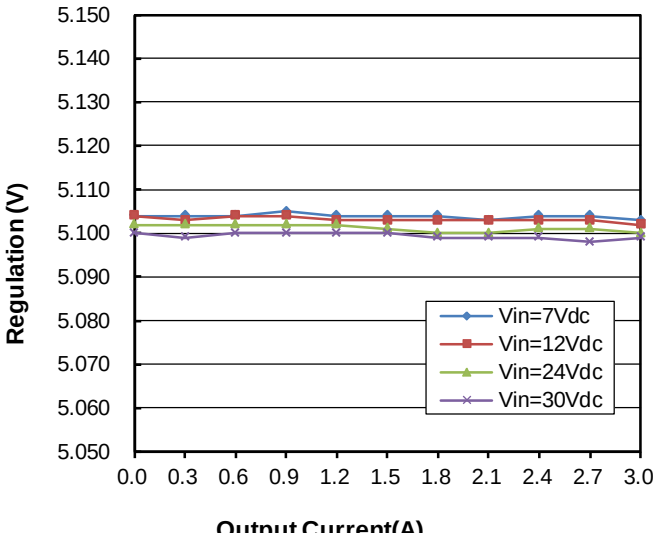


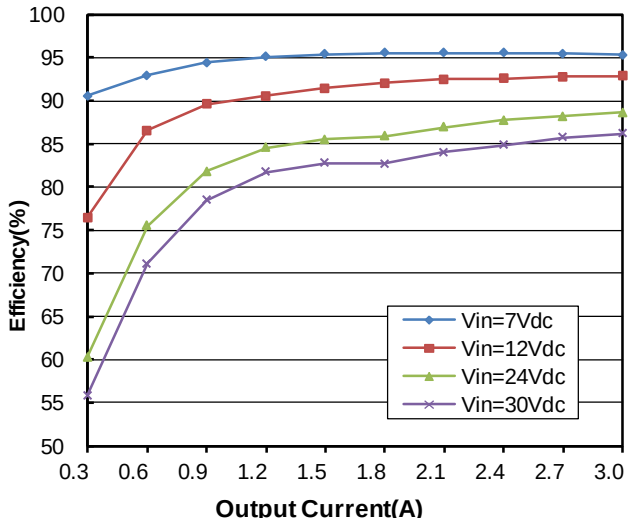
Short-Circuit Output V_{IN}=24V



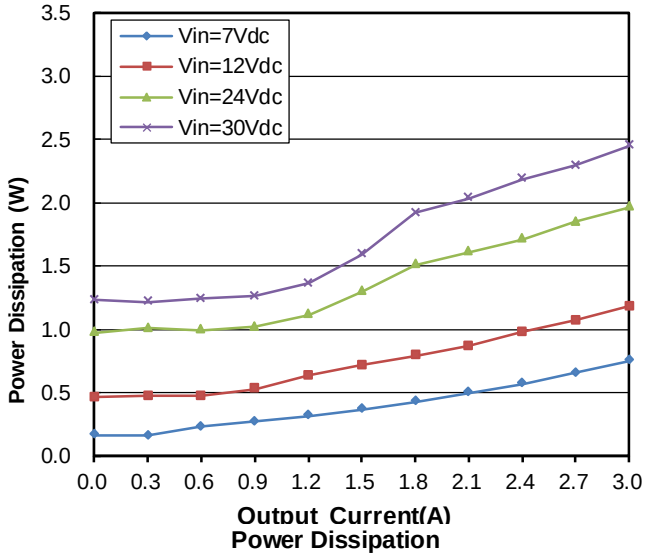
Short-Circuit Output V_{IN}=30V



Regulation
Output voltage vs. Load Current



Efficiency



Power Dissipation

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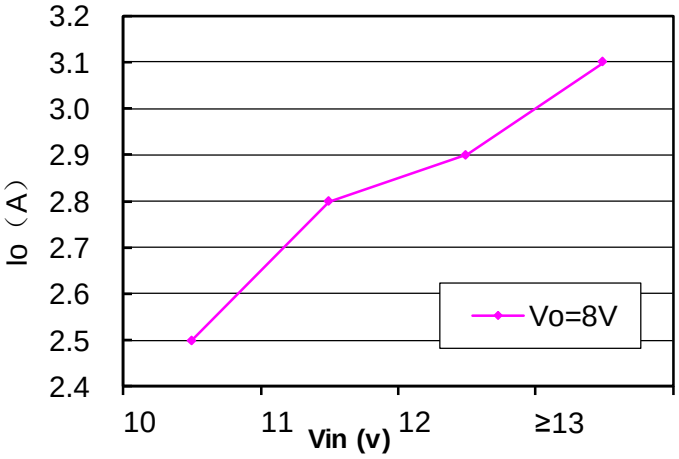
Typical Characteristics–MQ7868BT output adjusted to 8V

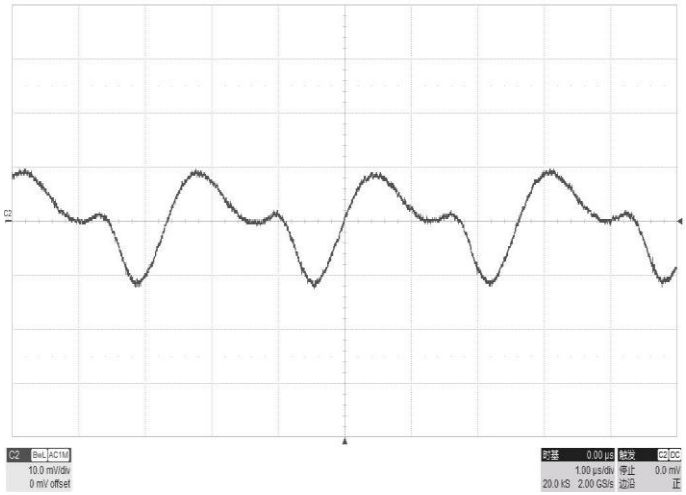
General conditions:

Input filter: 470uF/50V Electrolytic CAP

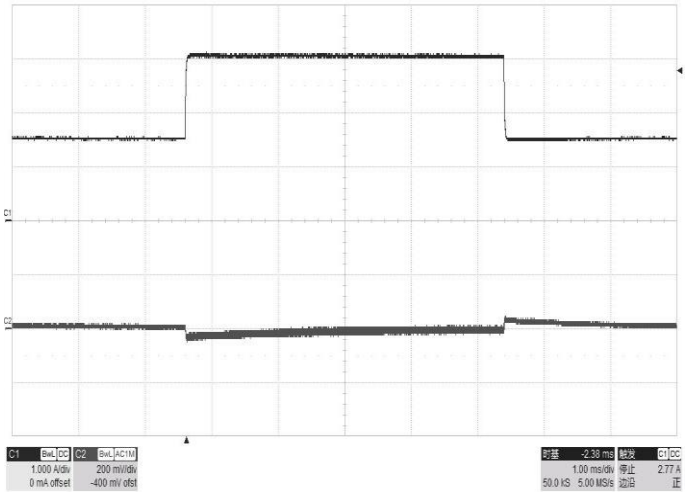
Output filter: 270uF/16V Solid Electrolytic CAP



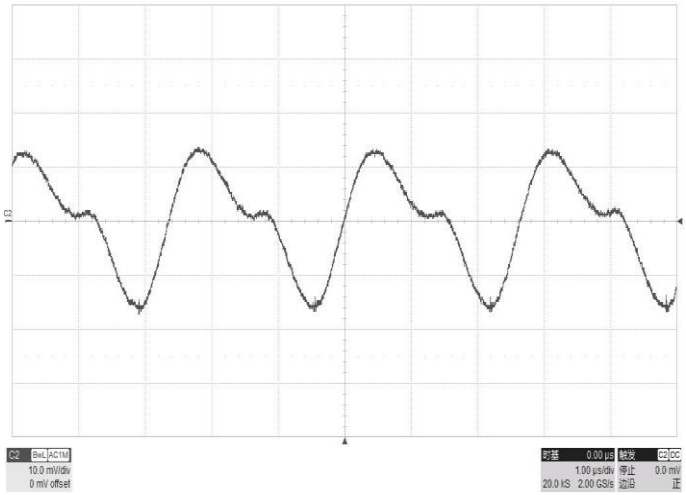
※Note:**输入与输出最大带载对应关系 Vo=8V**



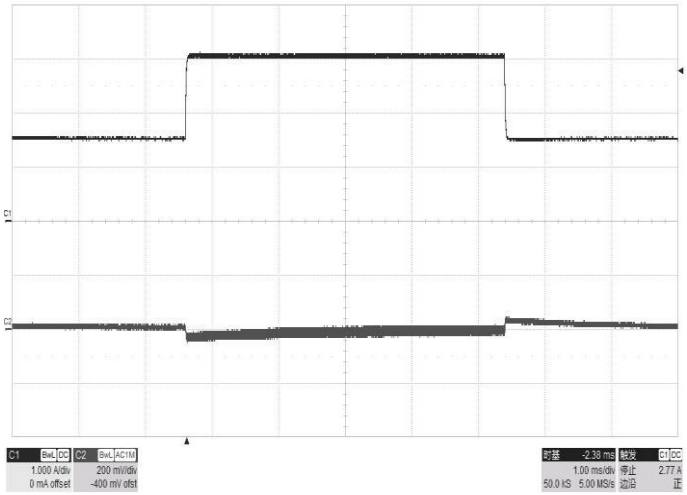
Noise V_{IN}=10V, I_O=3.1A, 5~20MHz Bandwidth, 10mV/Div



Transient Response V_{IN}=10V, Step from 1.55A~3.1A~1.55A
C2: Output Voltage(200mV/Div), C1: Load Current(1A/Div)



Noise V_{IN}=12V, I_O=3.1A, 5~20MHz Bandwidth, 10mV/Div



Transient Response V_{IN}=12V, Step from 1.55A~3.1A~1.55A
C2: Output Voltage(200mV/Div), C1: Load Current(1A/Div)

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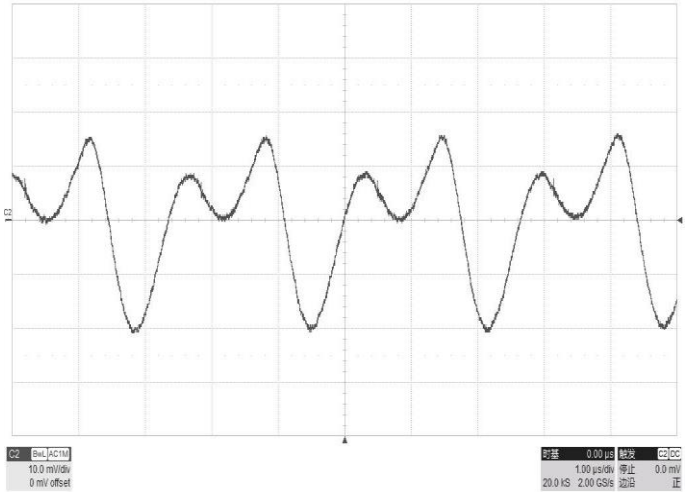
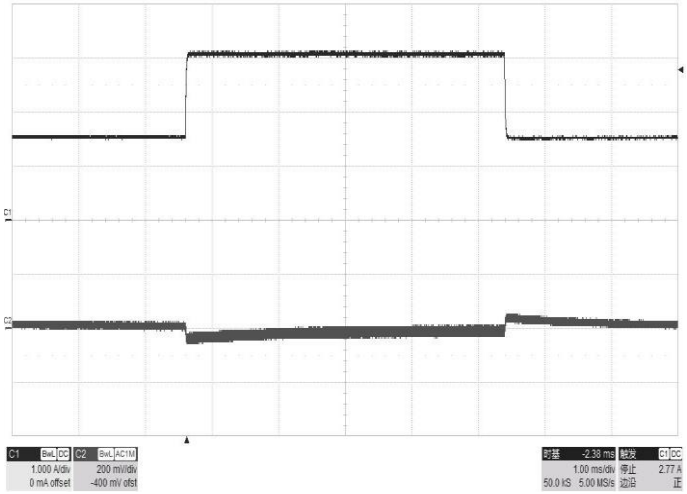
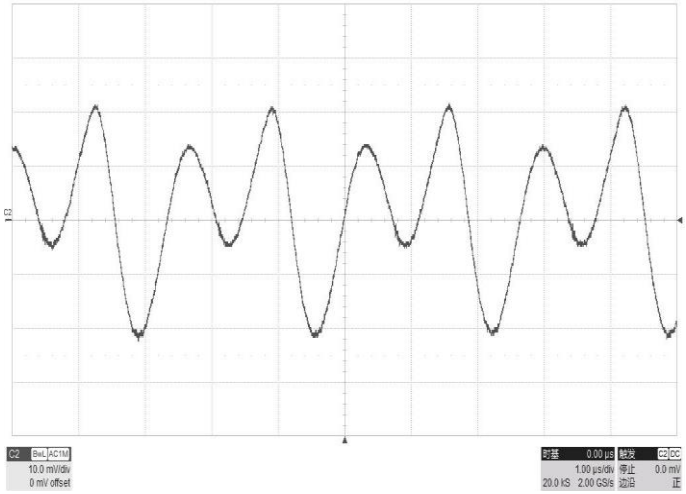


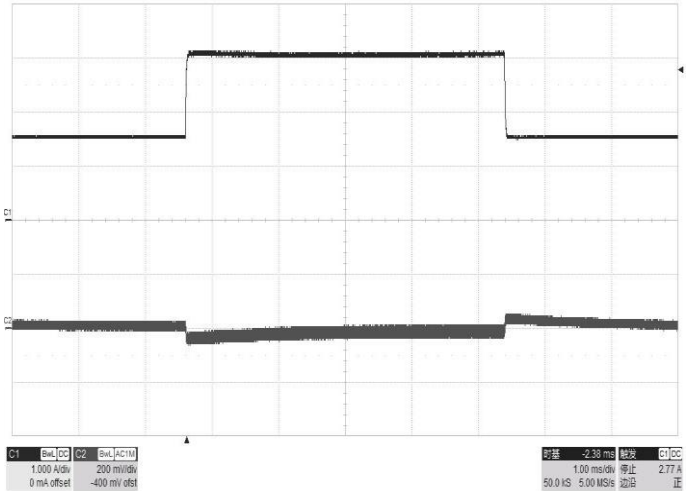
Noise V_{IN}=24V, I_O=3.1A, 5~20MHz Bandwidth, 10mV/Div



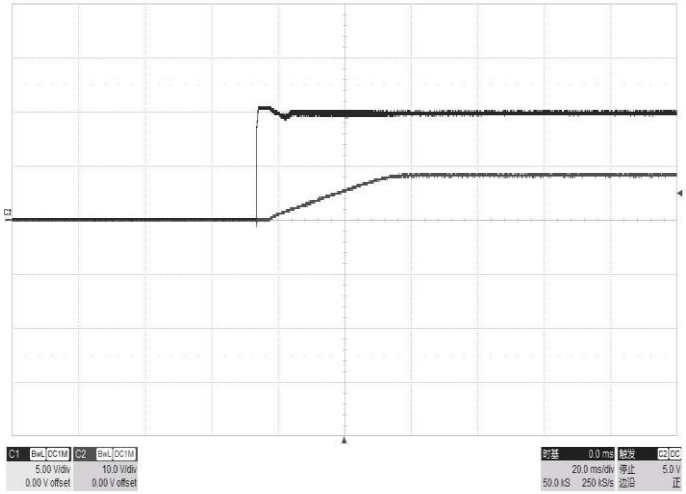
Transient Response V_{IN}=24V, Step from 1.55A~3.1A~1.55A
C2: Output Voltage(200mV/Div),C1: Load Current(1A/Div)



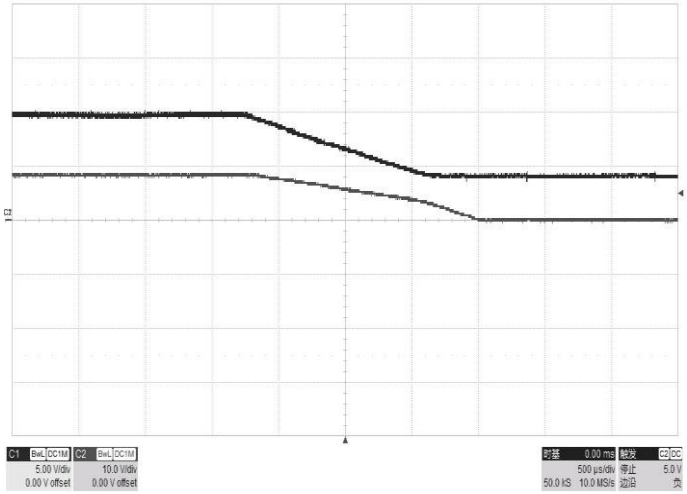
Noise V_{IN}=30V, I_O=3.1A, 5~20MHz Bandwidth, 10mV/Div



Transient Response V_{IN}=30V, Step from 1.55A~3.1A~1.55A
C2: Output Voltage(200mV/Div),C1: Load Current(1A/Div)



Start-up V_{IN}=10V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



Power Down, V_{IN}=10V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)

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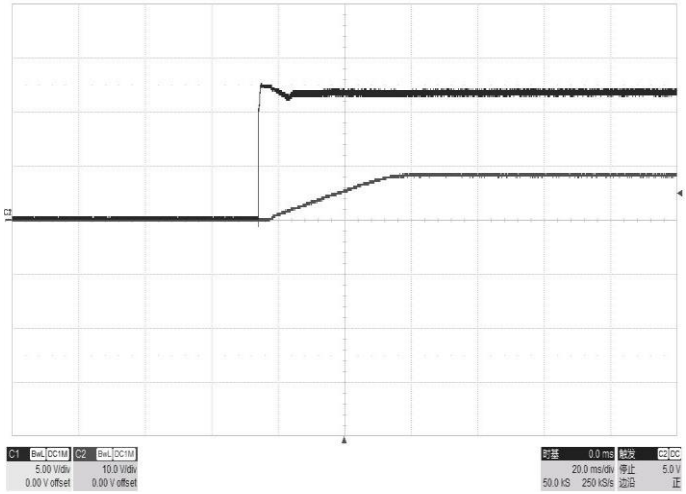
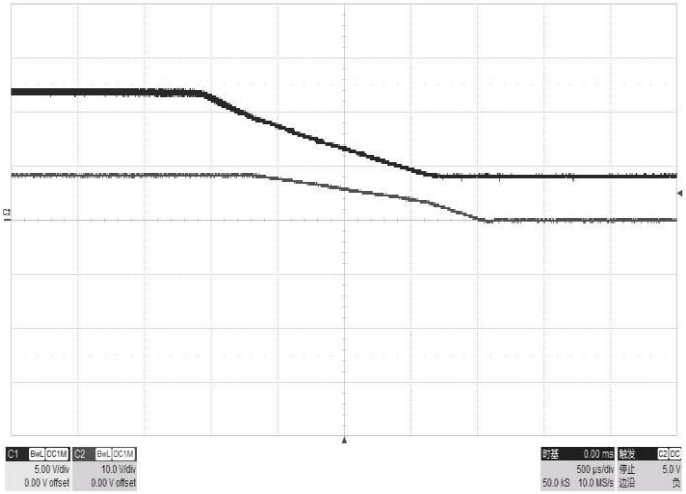
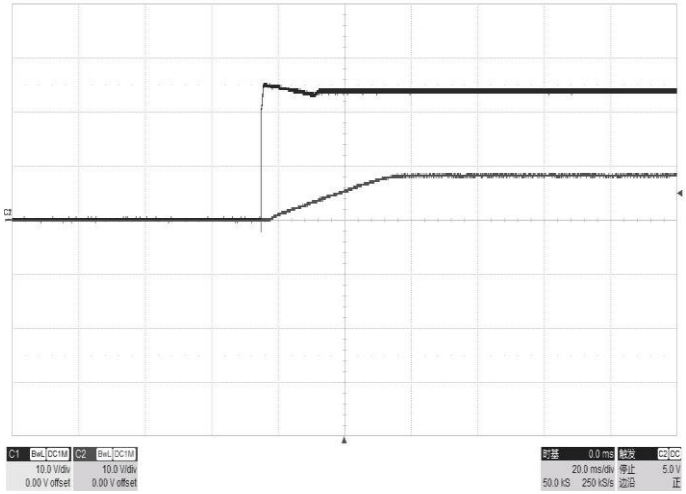


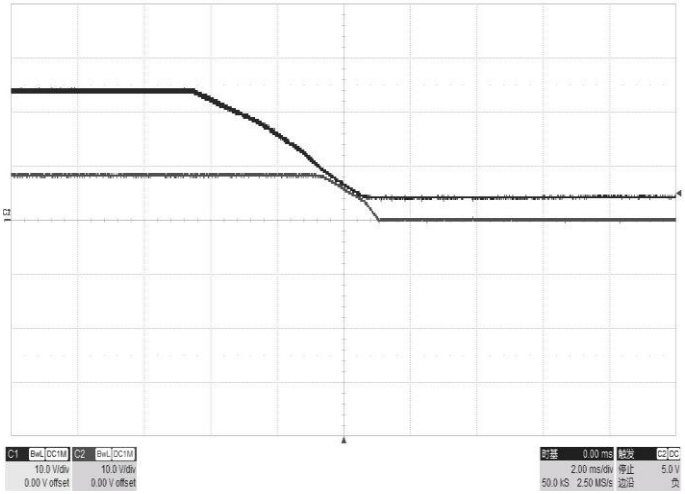
Start-up V_{IN}=12V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



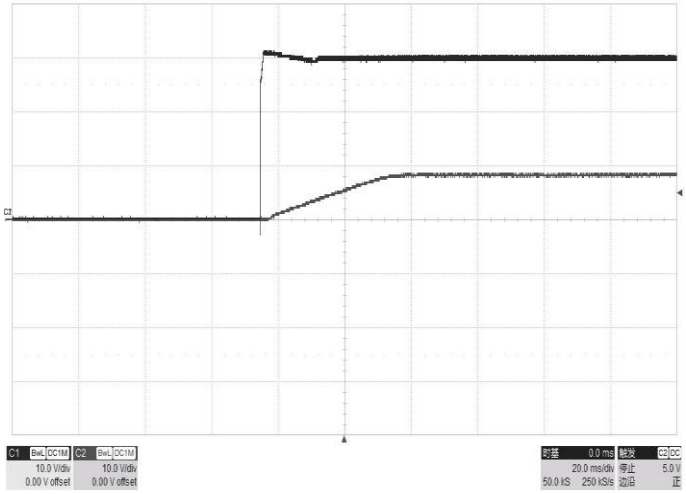
Power Down, V_{IN}=12V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



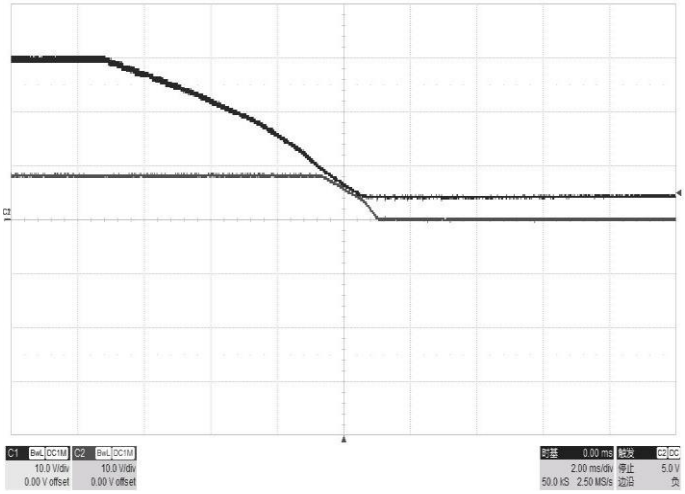
Start-up V_{IN}=24V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



Power Down, V_{IN}=24V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



Start-up V_{IN}=30V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



Power Down, V_{IN}=30V, I_O=3.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)

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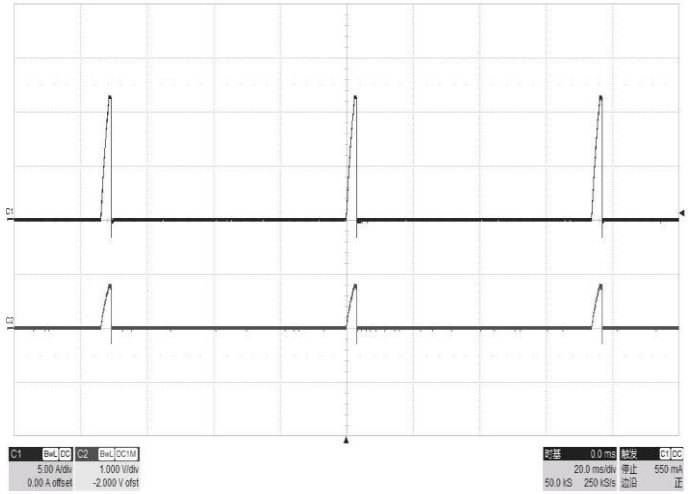
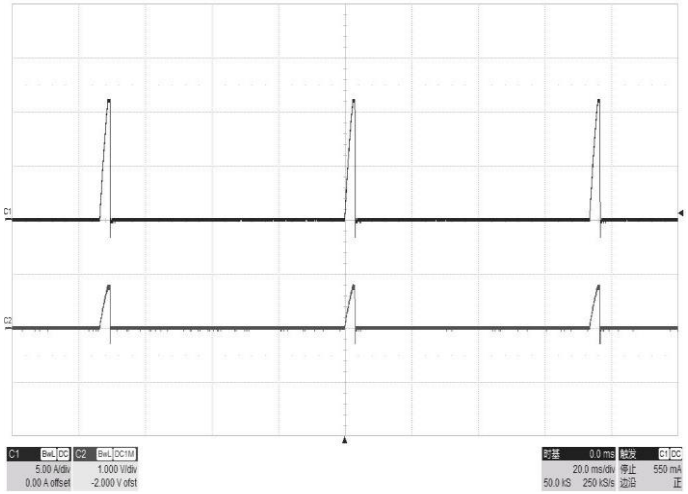
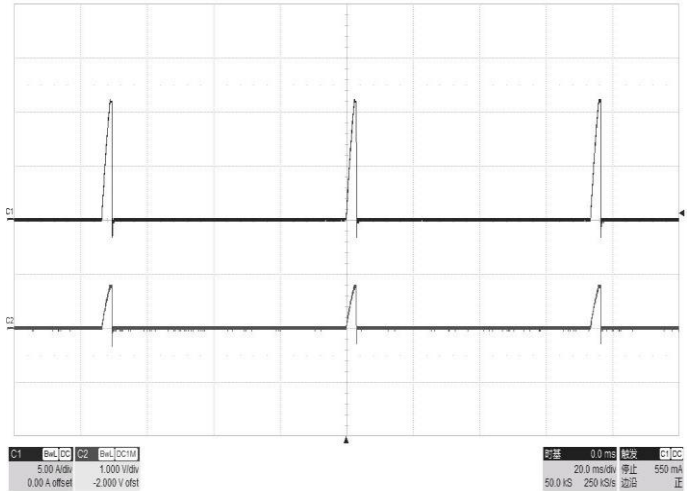


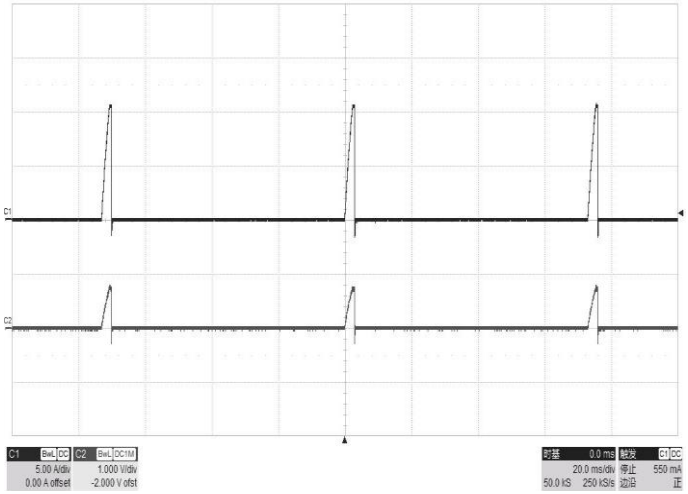
Short-Circuit Output V_{IN}=10V
C2: Output Voltage(1V/Div), C1: Load Current(5A/Div)



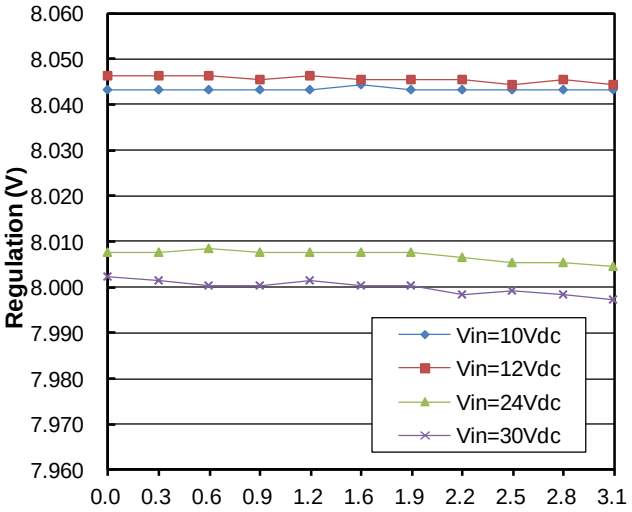
Short-Circuit Output V_{IN}=12V
C2: Output Voltage(1V/Div), C1: Load Current(5A/Div)



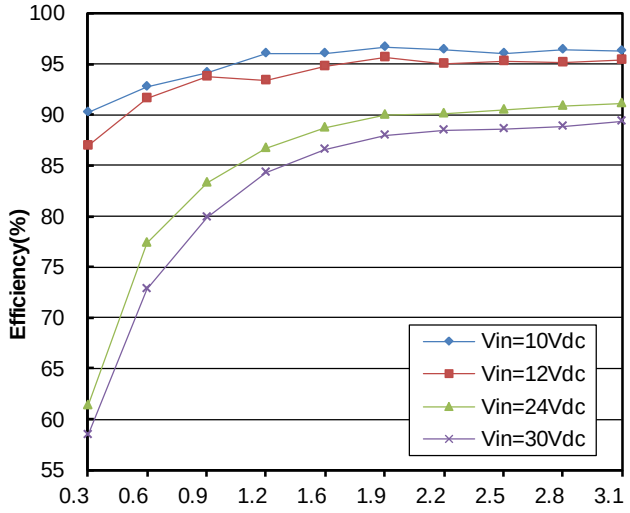
Short-Circuit Output V_{IN}=24V
C2: Output Voltage(1V/Div), C1: Load Current(5A/Div)



Short-Circuit Output V_{IN}=30V
C2: Output Voltage(1V/Div), C1: Load Current(5A/Div)



Regulation
Output voltage vs. Load Current



Efficiency

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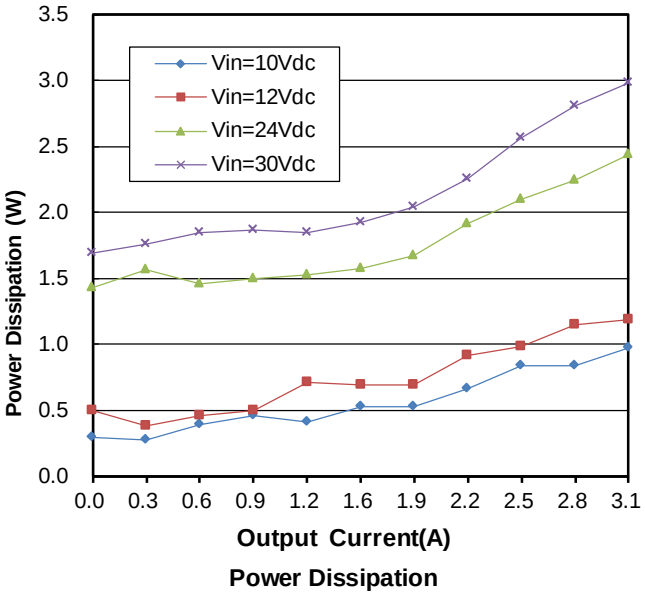

Power Dissipation

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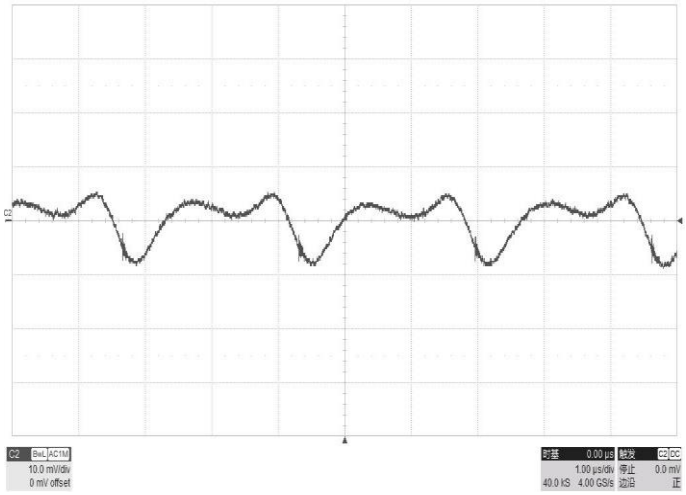
Typical Characteristics–MQ7868CT output adjusted to 12V

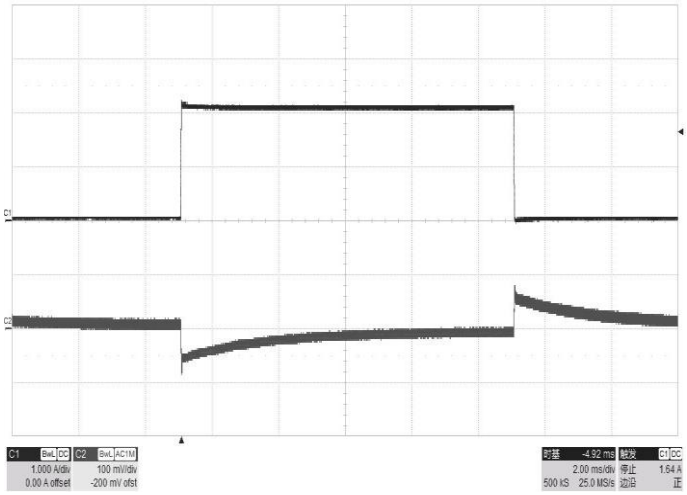
General conditions:

Input filter: 470uF/50V Electrolytic CAP

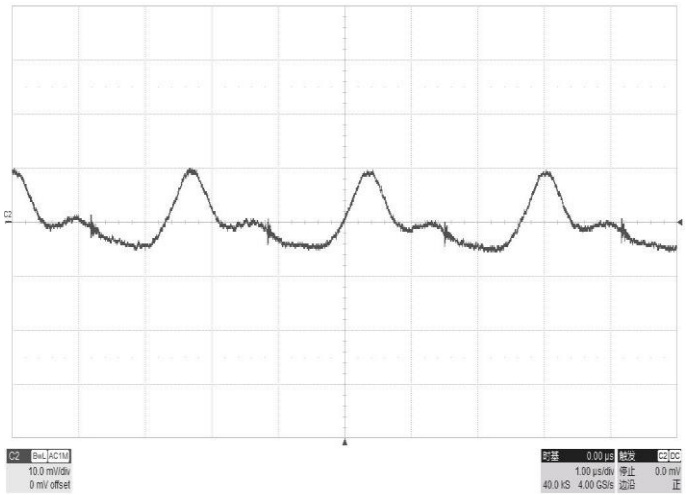
Output filter: 270uF/25V Solid Electrolytic CAP



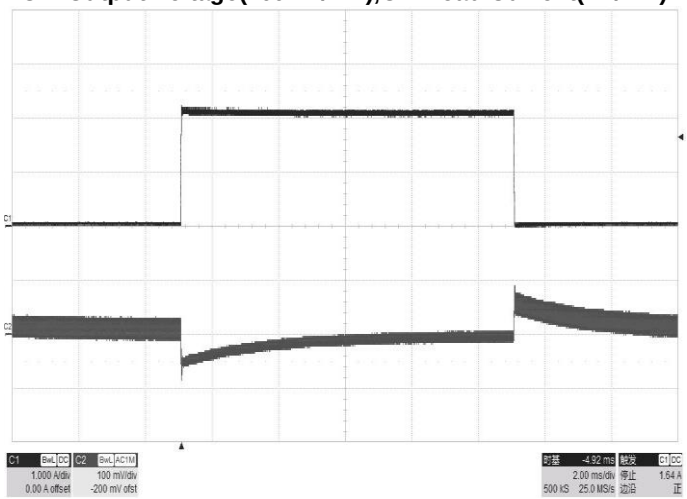
Noise V_{IN}=15V, I_O=2.1A, 5~20MHz Bandwidth,10mV/Div



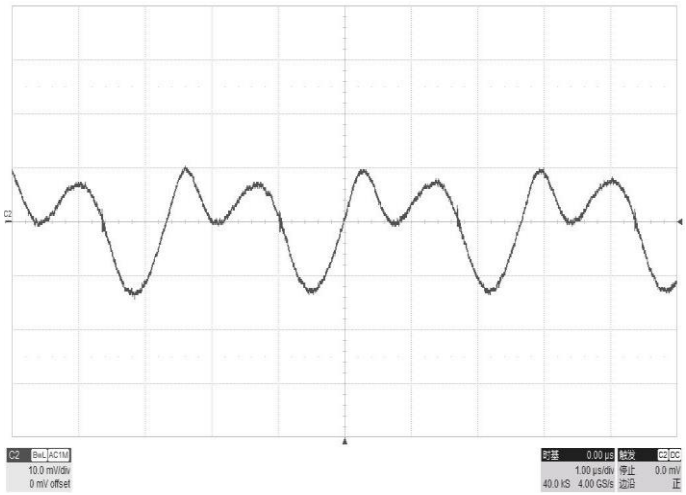
Transient Response V_{IN}=15V, Step from 1A~2A~1A
C2: Output Voltage(100mv/Div),C1: Load Current(1A/Div)



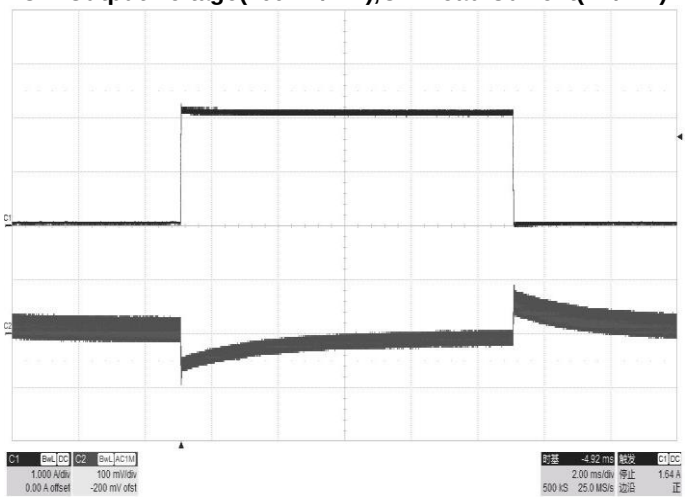
Noise V_{IN}=24V, I_O=2.1A, 5~20MHz Bandwidth, 10mV/Div



Transient Response V_{IN}=24V, Step from 1A~2A~1A
C2: Output Voltage(100mv/Div),C1: Load Current(1A/Div)



Noise V_{IN}=30V, I_O=2.1A, 5~20MHz Bandwidth, 10mV/Div



Transient Response V_{IN}=30V, Step from 1A~2A~1A
C2: Output Voltage(100mv/Div), C1: Load Current(1A/Div)

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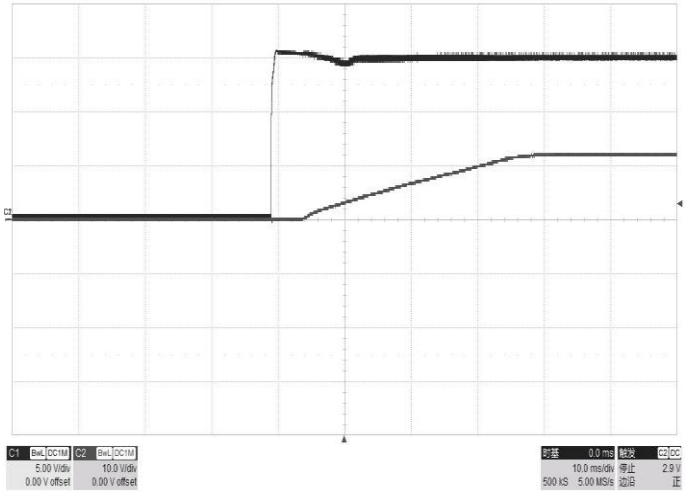
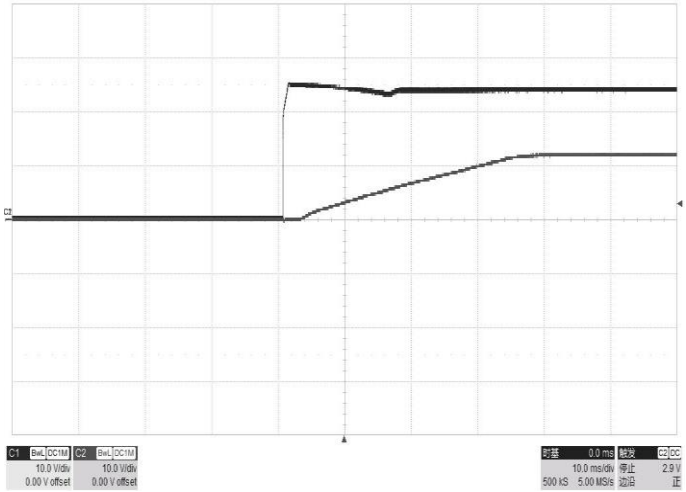
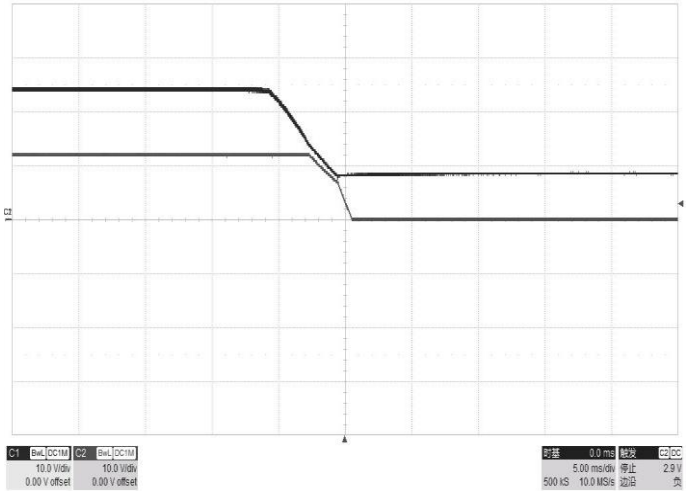


Start-up V_{IN}=15V, I_O=2.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)

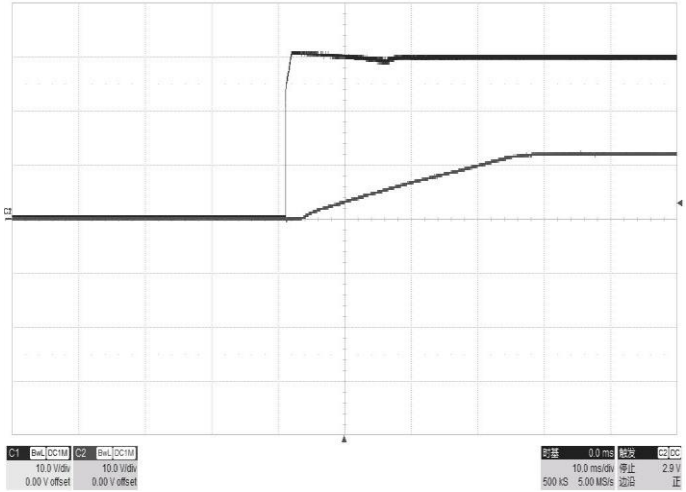
Power Down, V_{IN}=15V, I_O=2.1A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)



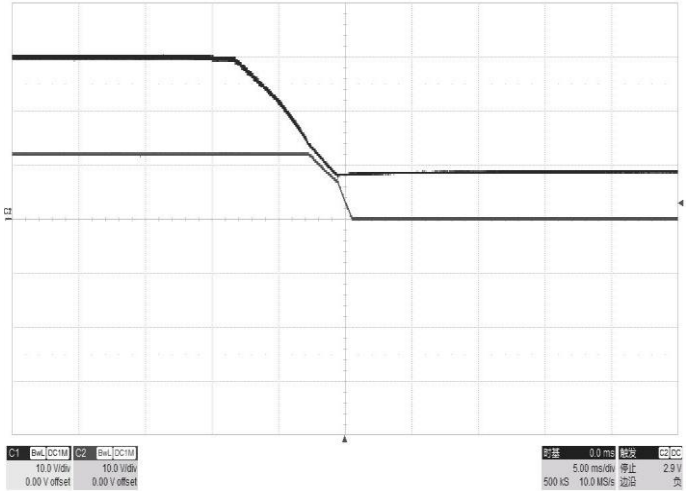
Start-up V_{IN}=24V, I_O=2.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



Power Down, V_{IN}=24V, I_O=2.1A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)



Start-up V_{IN}=30V, I_O=2.1A
C1: Input Voltage (5V/Div), C2: Output Voltage(10V/Div)



Power Down, V_{IN}=30V, I_O=2.1A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)

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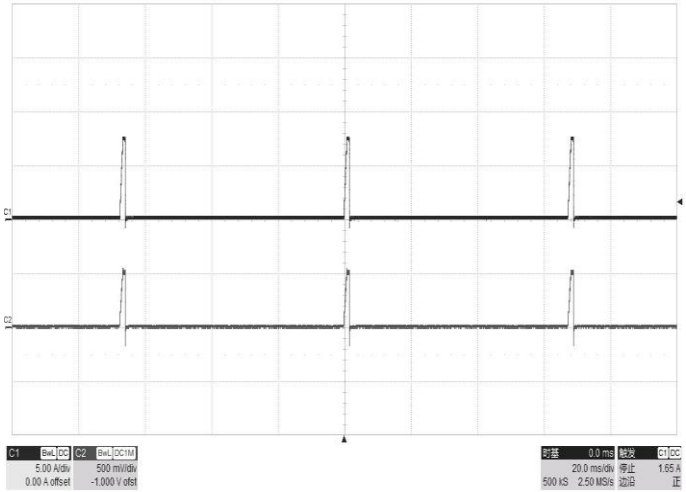
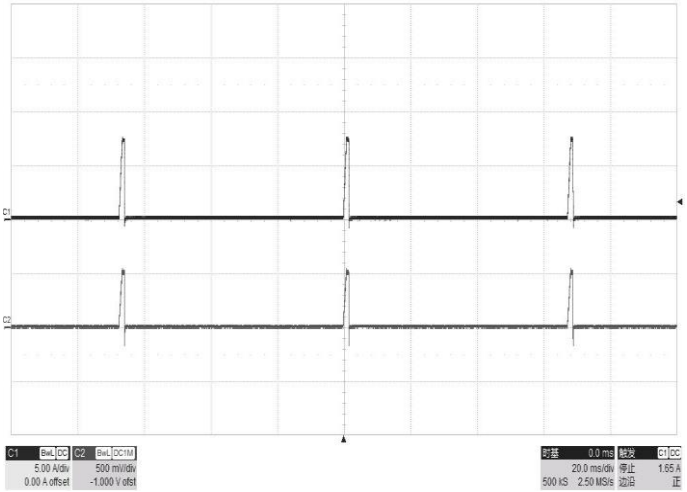
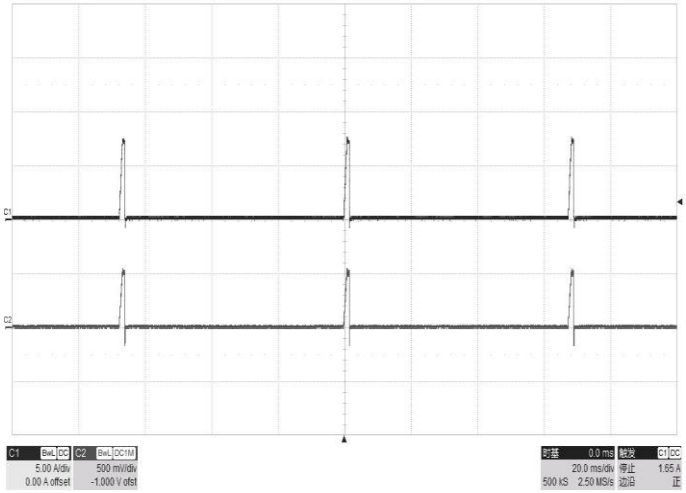


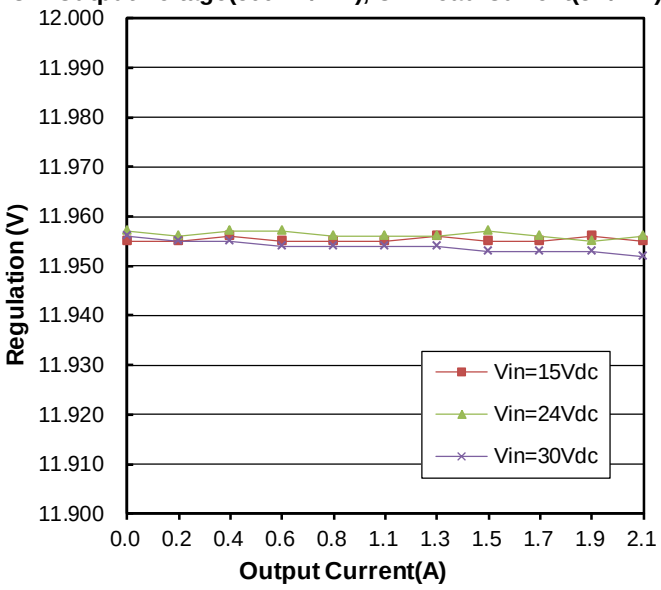
Short-Circuit Output V_{IN}=15V
C2: Output Voltage(500mv/Div), C1: Load Current(5A/Div)



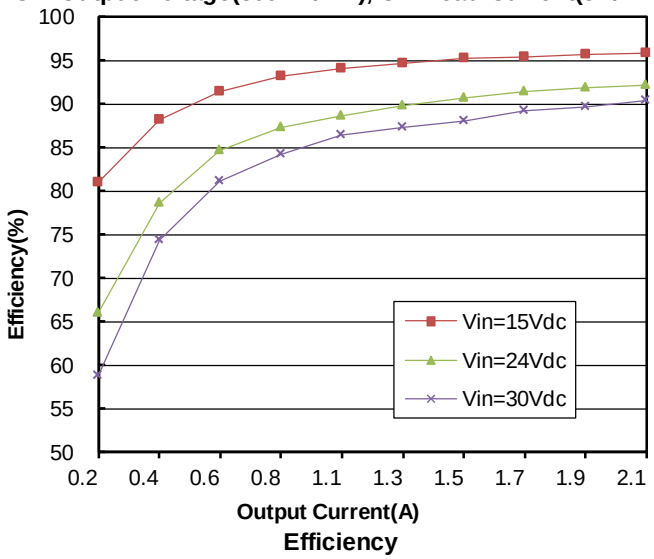
Short-Circuit Output V_{IN}=24V
C2: Output Voltage(500mv/Div), C1: Load Current(5A/Div)



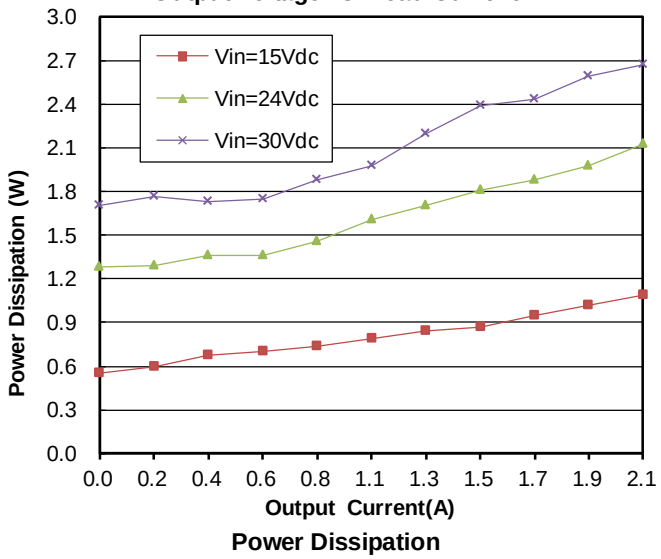
Short-Circuit Output V_{IN}=30V
C2: Output Voltage(500mv/Div), C1: Load Current(5A/Div)



Regulation
Output voltage vs. Load Current



Efficiency



Power Dissipation

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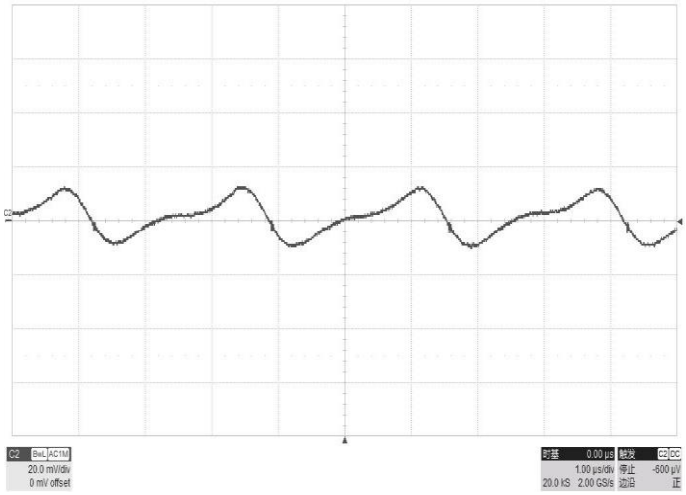
Typical Characteristics–MQ7868CT output adjusted to 15V

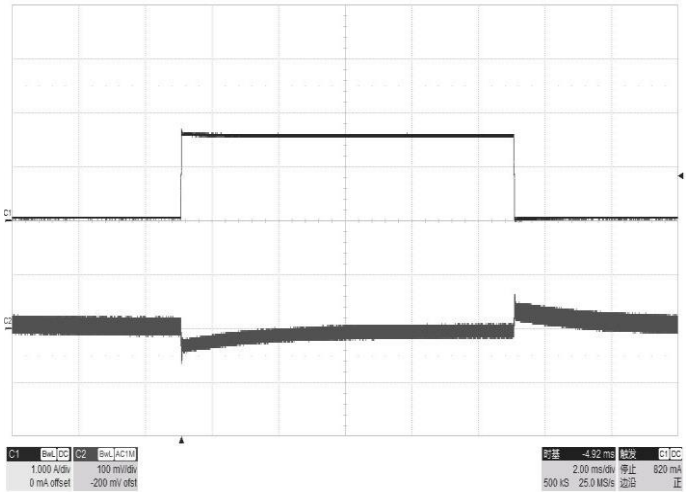
General conditions:

Input filter: 470uF/50V Electrolytic CAP

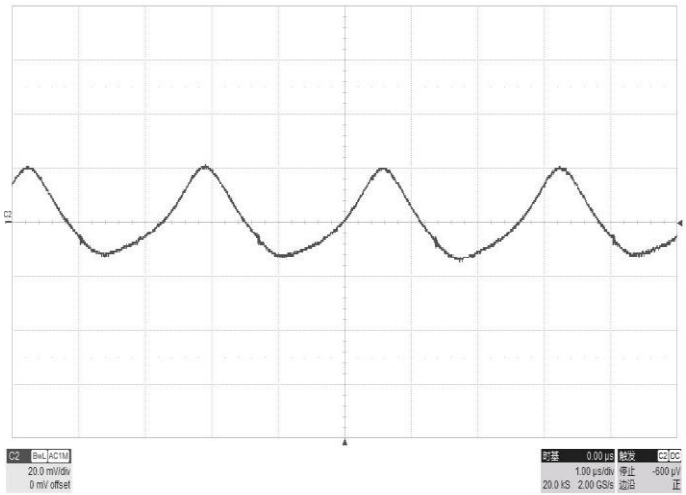
Output filter: 270uF/25V Solid Electrolytic CAP



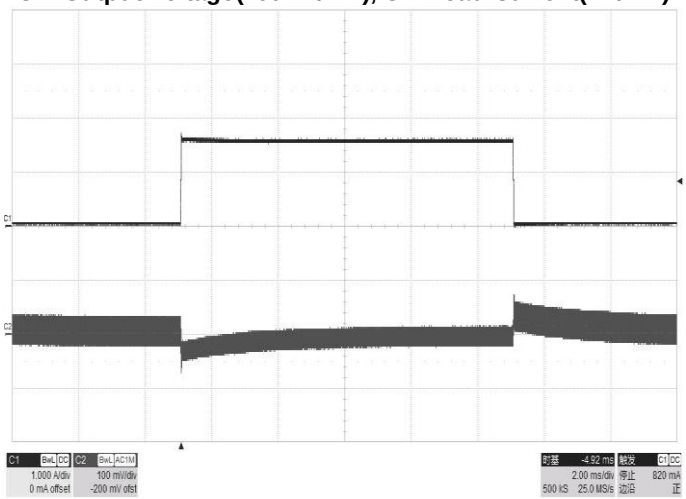
Noise V_{IN}=19V, I_O=1.67A, 5~20MHz Bandwidth, 20mV/Div



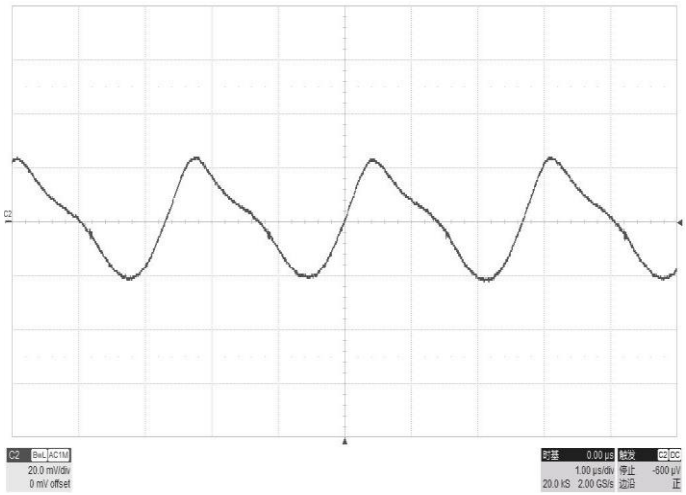
Transient Response V_{IN}=19V, Step from 0.83A~1.67A~0.83A
C2: Output Voltage(100mv/Div), C1: Load Current(1A/Div)



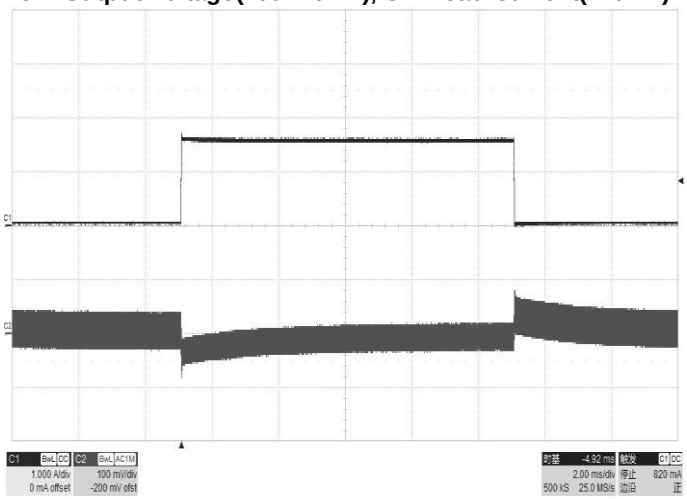
Noise V_{IN}=24V, I_O=1.67A, 5~20MHz Bandwidth, 20mV/Div



Transient Response V_{IN}=24V, Step from 0.83A~1.67A~0.83A
C2: Output Voltage(100mv/Div), C1: Load Current(1A/Div)



Noise V_{IN}=30V, I_O=1.67A, 5~20MHz Bandwidth, 20mV/Div



Transient Response V_{IN}=30V, Step from 0.83A~1.67A~0.83A
C2: Output Voltage(100mv/Div), C1: Load Current(1A/Div)

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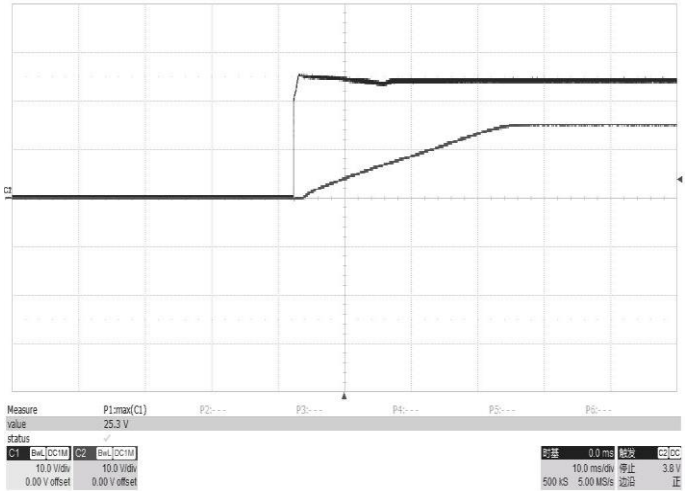
Start-up V_{IN}=19V, I_O=1.67A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)

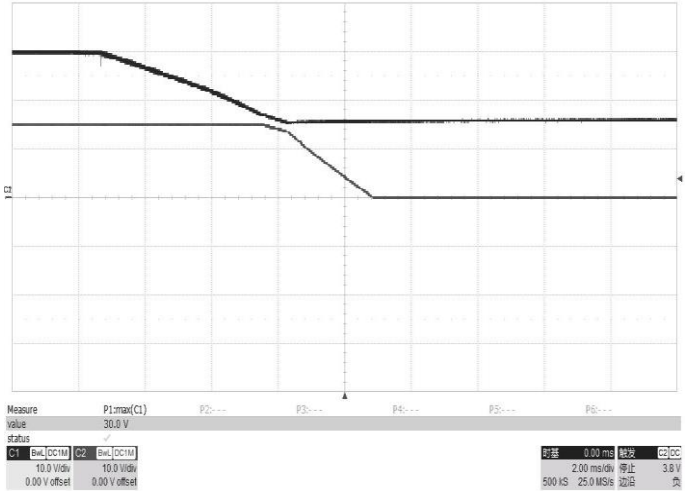
Power Down, V_{IN}=19V, I_O=1.67A
C1: Input Voltage (10V/Div), C2: Output Voltage(5V/Div)



Start-up V_{IN}=24V, I_O=1.67A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)

Power Down, V_{IN}=24V, I_O=1.67A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)

Start-up V_{IN}=30V, I_O=1.67A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)



Power Down, V_{IN}=30V, I_O=1.67A
C1: Input Voltage (10V/Div), C2: Output Voltage(10V/Div)

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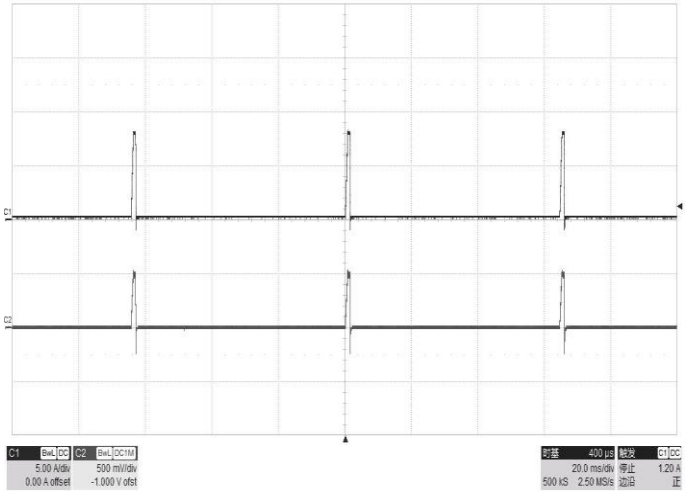
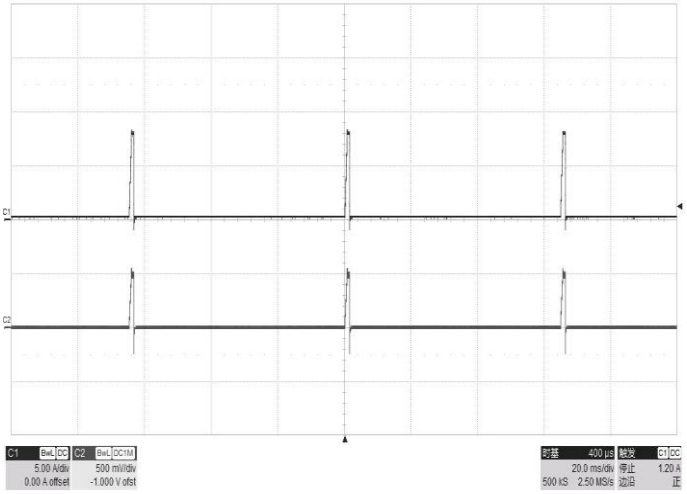
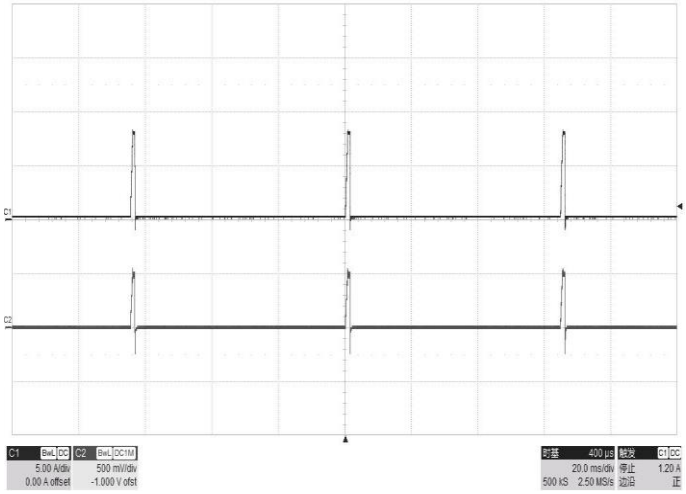


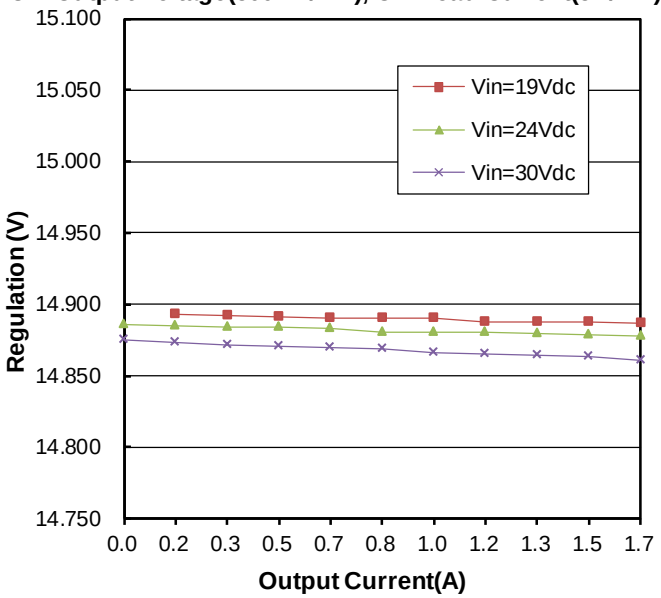
Short-Circuit Output V_{IN}=19V
C2: Output Voltage(500mv/Div), C1: Load Current(5A/Div)



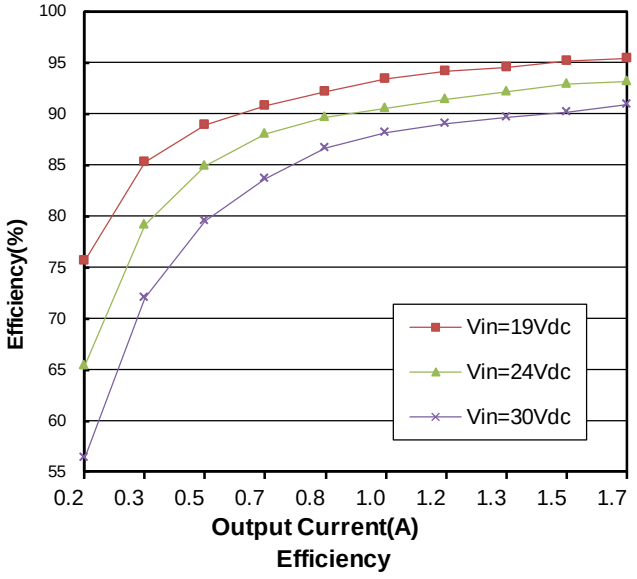
Short-Circuit Output V_{IN}=24V
C2: Output Voltage(500mv/Div), C1: Load Current(5A/Div)



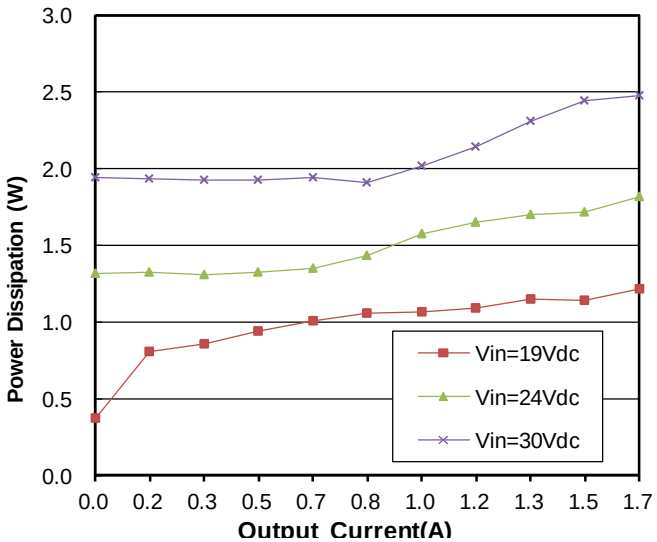
Short-Circuit Output V_{IN}=30V
C2: Output Voltage(500mv/Div), C1: Load Current(5A/Div)



Regulation
Output voltage vs. Load Current



Efficiency



Power Dissipation

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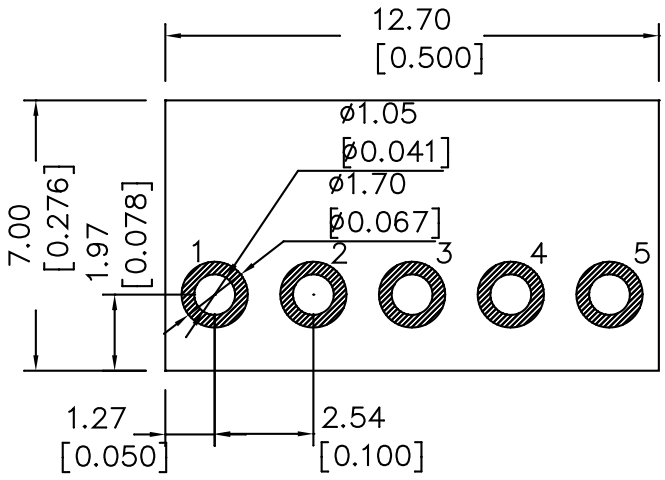
Recommended Hole Pattern

Unit: Dimensions are in millimeters (inches)

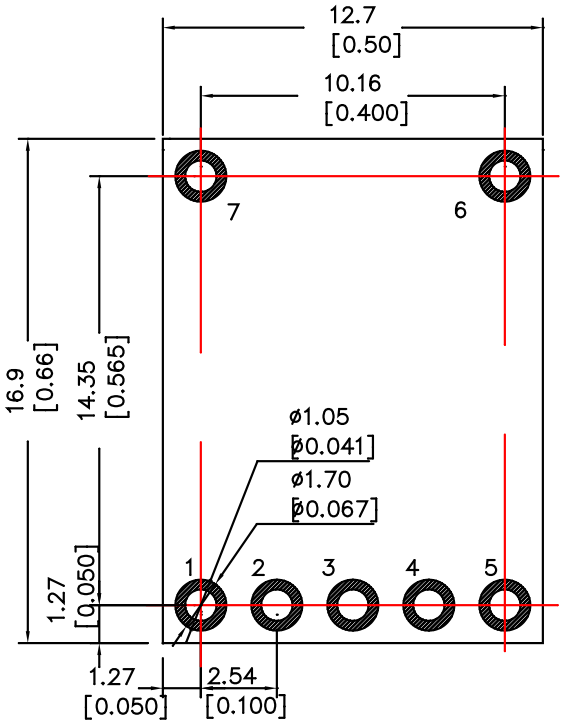
Tolerances: x.x mm±0.5mm (x.xx in ±0.02 in);
x.xx mm±0.25mm (x.xxx in ±0.01 in)



Recommended Hole Pattern for "R" suffix

Unit: Dimensions are in millimeters (inches)

Tolerances: x.x mm±0.5mm (x.xx in ±0.02 in);
x.xx mm±0.25mm (x.xxx in ±0.01 in)



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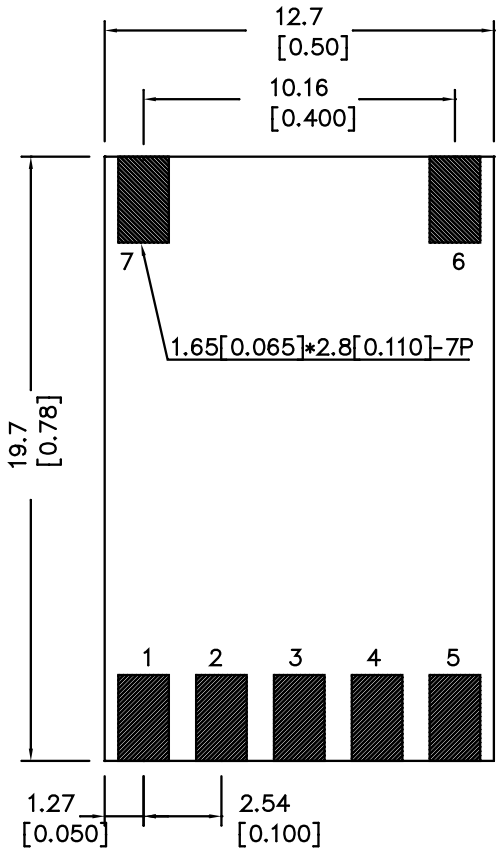
Mechanical Specifications & Recommended Hole Pattern for "S" suffix

Unit: Dimensions are in millimeters (inches)

Tolerances: x.x mm±0.5mm (x.xx in ±0.02 in);
x.xx mm±0.25mm (x.xxx in ±0.01 in)



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