TPS564201 Step-Down Voltage Regulator Test Report

Test Date: 07/18/2016

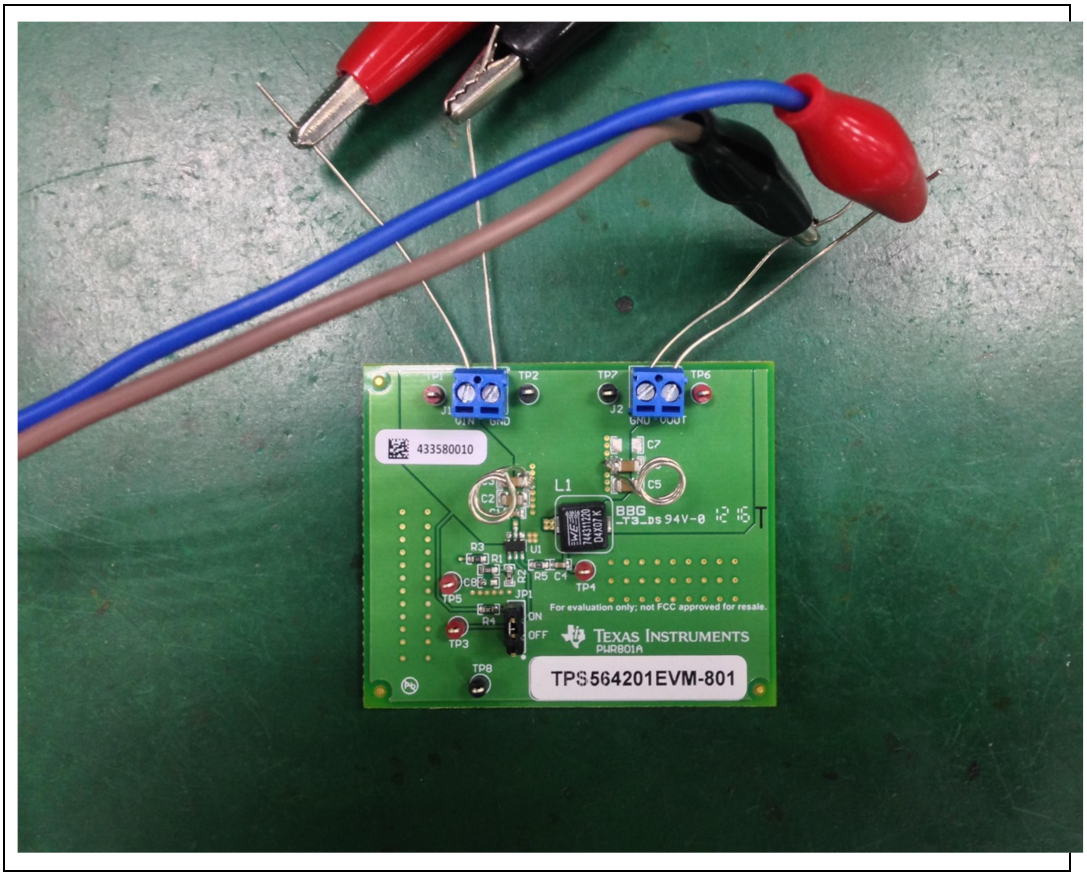
Test Model: TPS564201EVM-801 Evaluation Module

Tested By: Josh

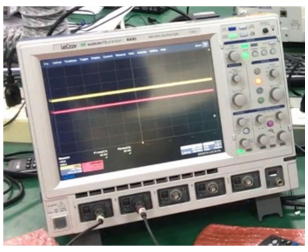
- **測試目的:**

  依據測試數據之結果判定此 PWM Step-Down IC 廠內能否使用

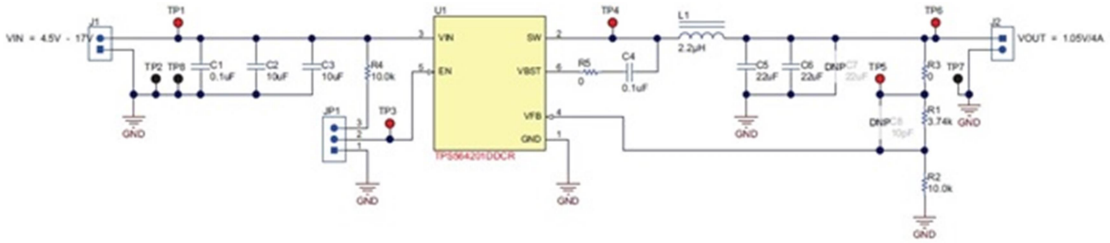
- **測試環境:**



- **測試設備:**

Lecroy 44Xi Scope	三用電表	5210 DC Electronic Load
		

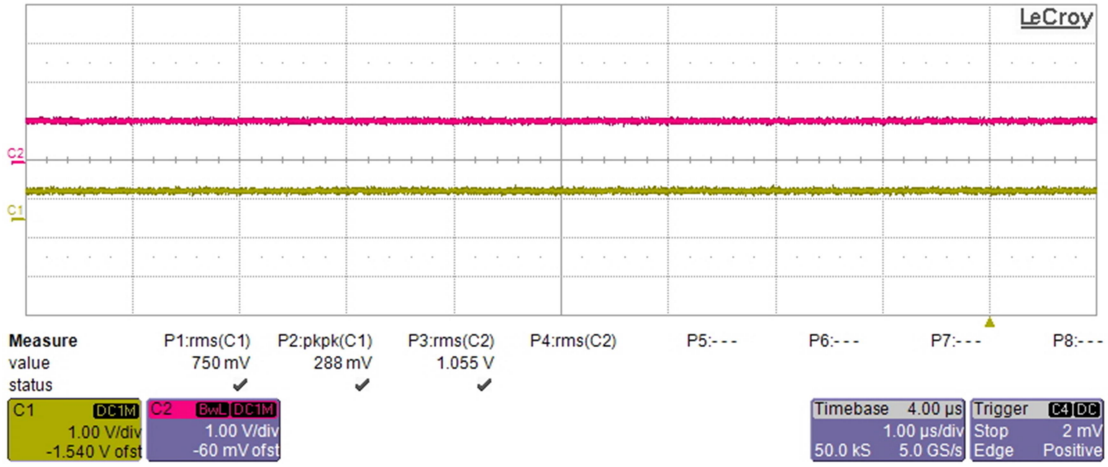
➢ TPS564201EVM-801 Schematic Diagram:



➢ SPEC 與測試數據:

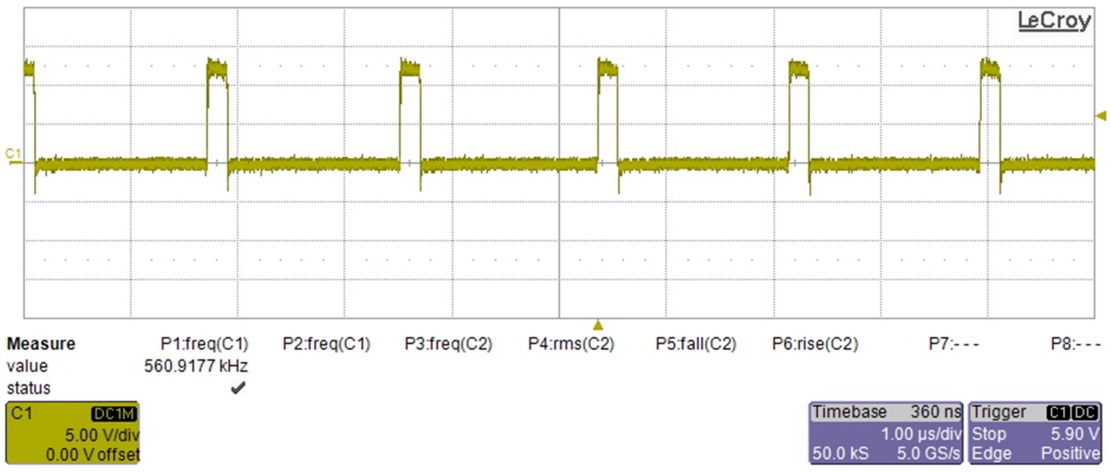
(1) Vfb Voltage:

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{FBTH}	V_{FB} threshold voltage	V_O = 1.05 V,	739	759	779	mV



(2) Switch Frequency:

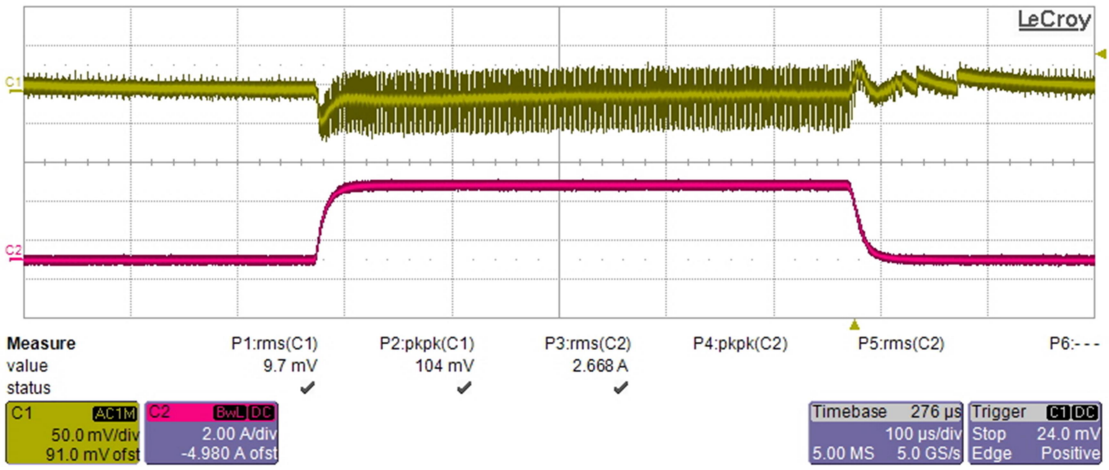
Specifications	Test Conditions	MIN	TYP	MAX	Unit
Operating frequency	V_{IN} = 12 V, I_{OUT} = 4 A		560		kHz



(3) Output Voltage Ripple:

1.05Vout DCC mode : 0-4A (Spec:52.5mVpp)

Full:



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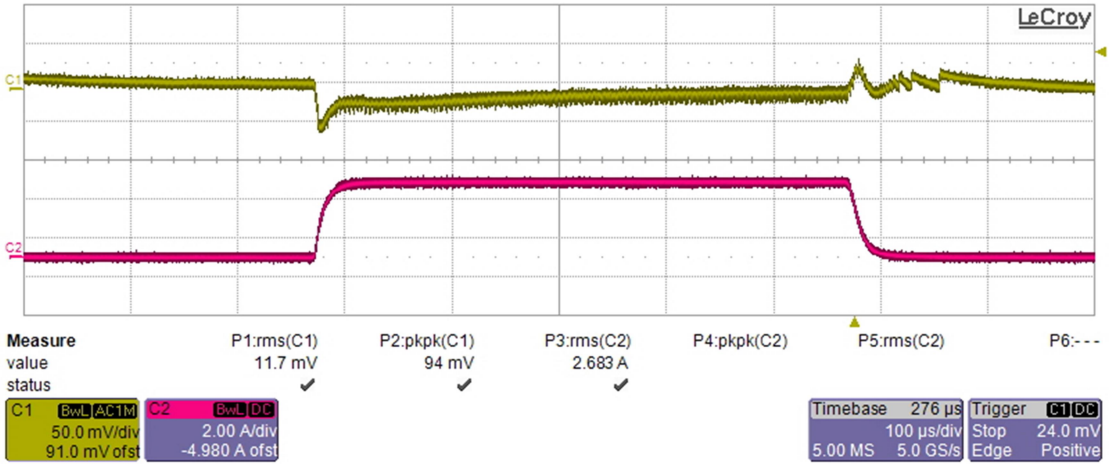
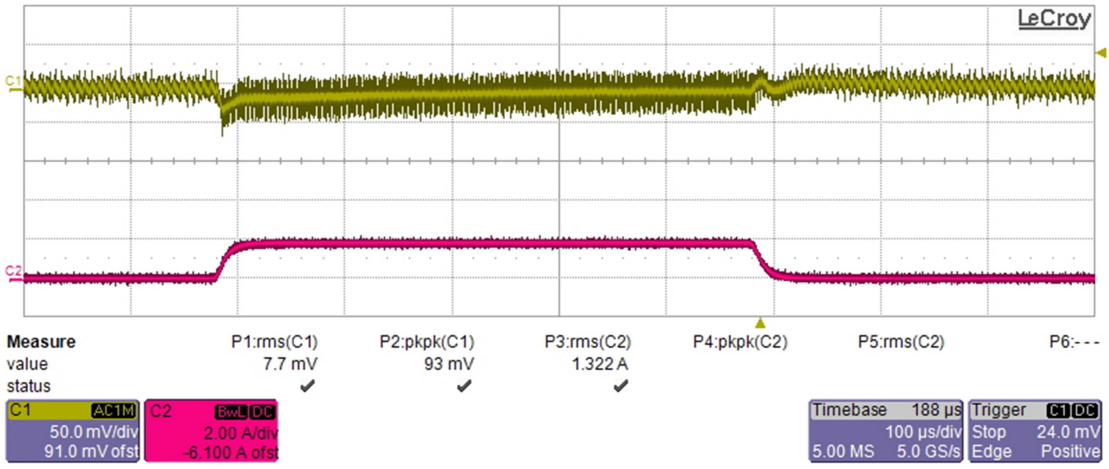


1.05Vout DCC mode : 0.1-2A

Full:



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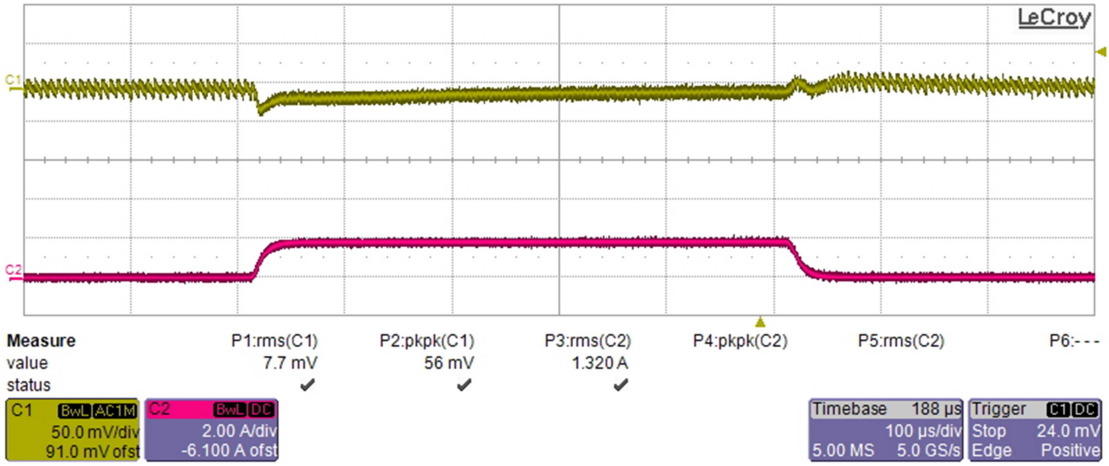
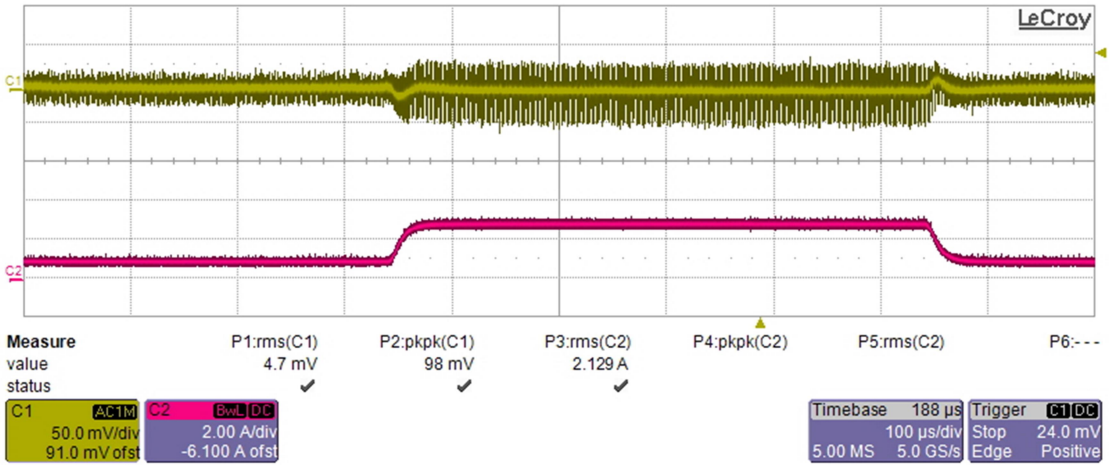


1.05Vout DCC mode : 1-3A

Full:



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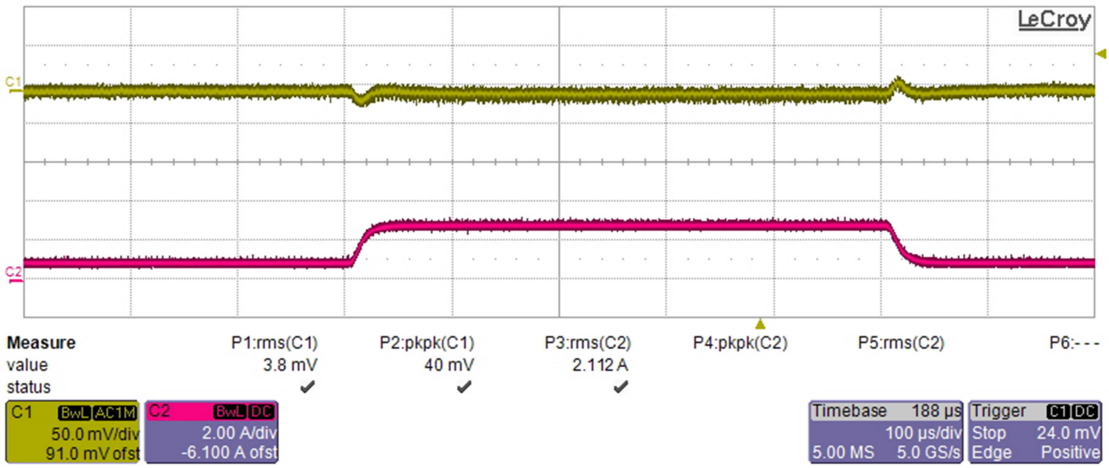
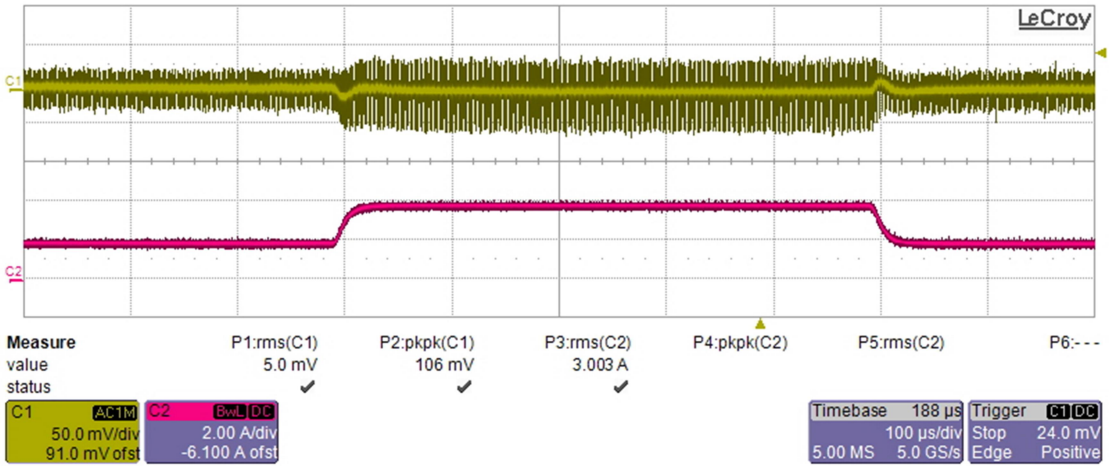


1.05Vout DCC mode : 2-4A

Full:



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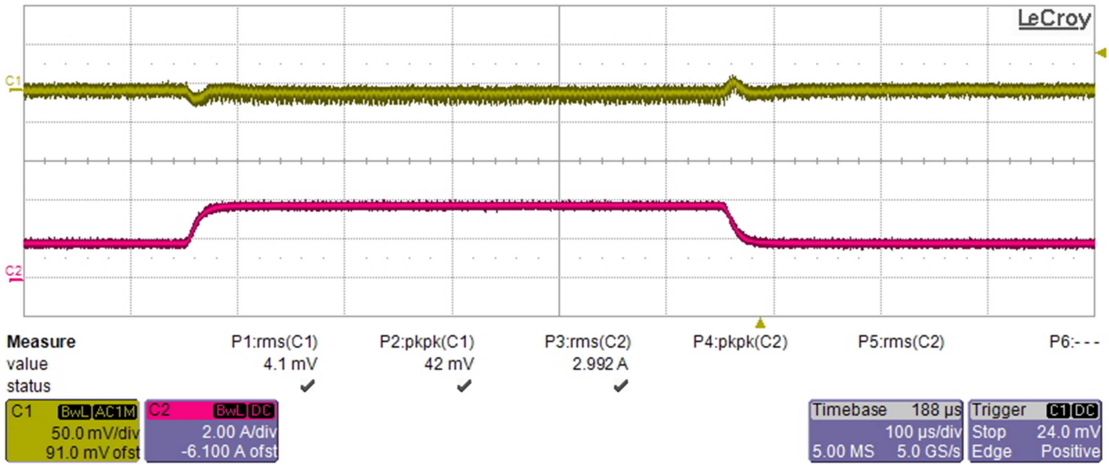
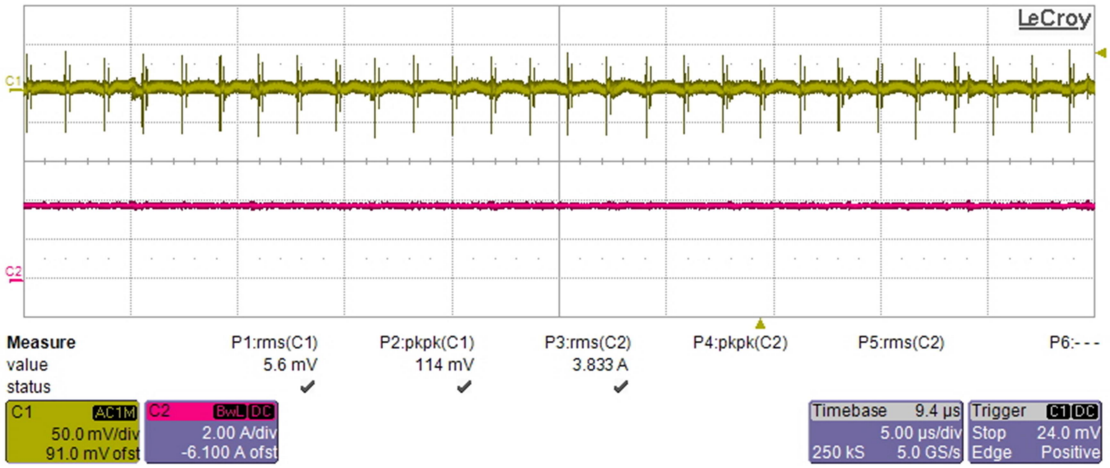


1.05Vout CC mode:

Specifications	Test Conditions	MIN	TYP	MAX	Unit
Output ripple voltage	V_{IN} = 12 V, I_{OUT} = 4 A		20		mV_{PP}

Full:



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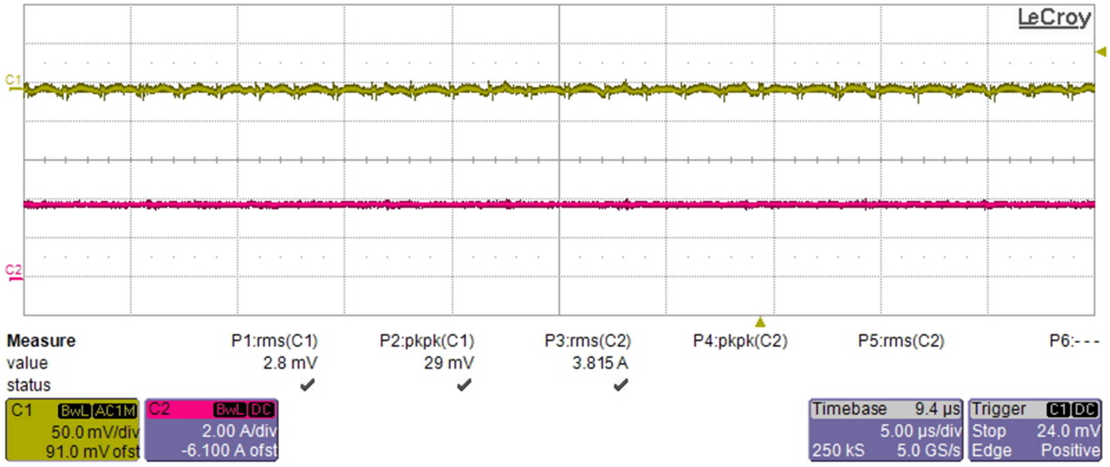
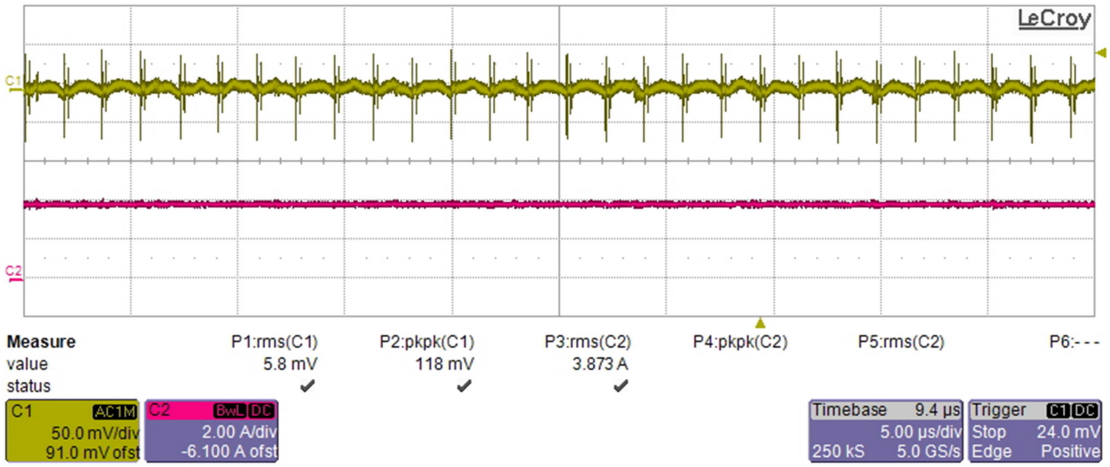


1.05Vout CR mode:

Full:



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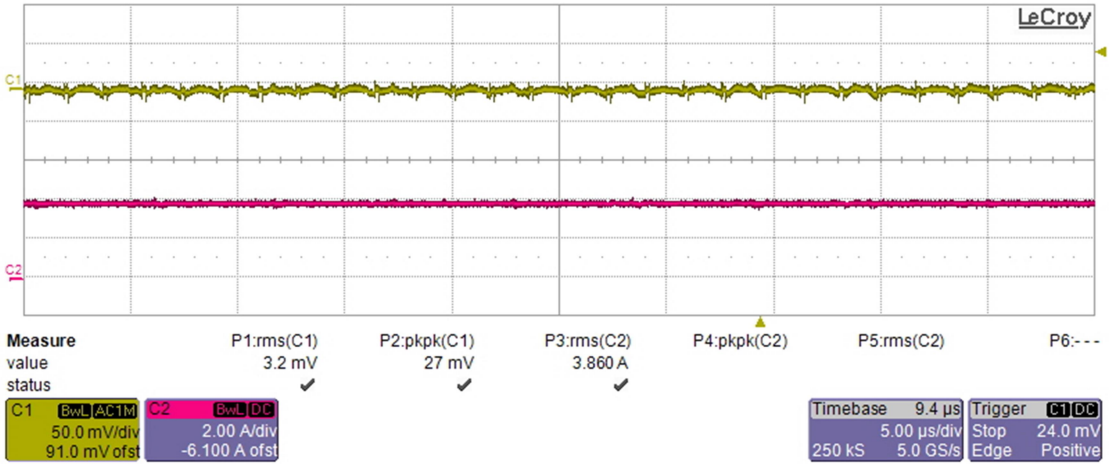


(4) 1.05Vout Overcurrent limit:

Specifications	Test Conditions	MIN	TYP	MAX	Unit
Overcurrent limit	V_{IN} = 12 V, L_{OUT} = 2.2 µH		6		A

實際量測當負載電流超過 6.3A 時 IC 會 shutdown

(5) 1.05Vout Operating Temperature:

		MIN	NOM	MAX	UNIT
T_J	Operating junction temperature	–40		125	°C

室溫情況下 IC 溫度:

no load →34.3 度

4A-load →58.5 度

Short →85.1 度

(6) 1.05Vout Efficiency:

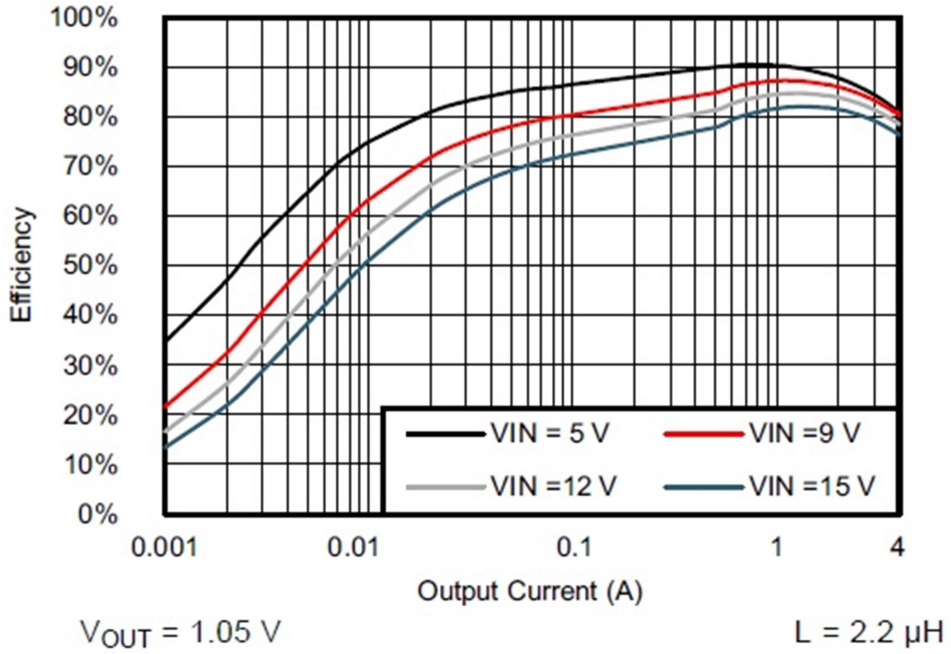


Figure 9. TPS564201 Efficiency vs Output Current

實際量測:

0.1A load → Pi=12V x 0.011A = 0.132W , Pout=1.05V x 0.1A = 0.101W

Efficiency =(Pout/Pi)x100 = (0.101/0.132)x100 = 0.765x100=76.5

1A load → Pi=12V x 0.104A = 1.248W , Pout=1.05V x 1A = 1.05W

Efficiency =(Pout/Pi)x100 = (1.05/1.248)x100 = 0.841x100=84.1

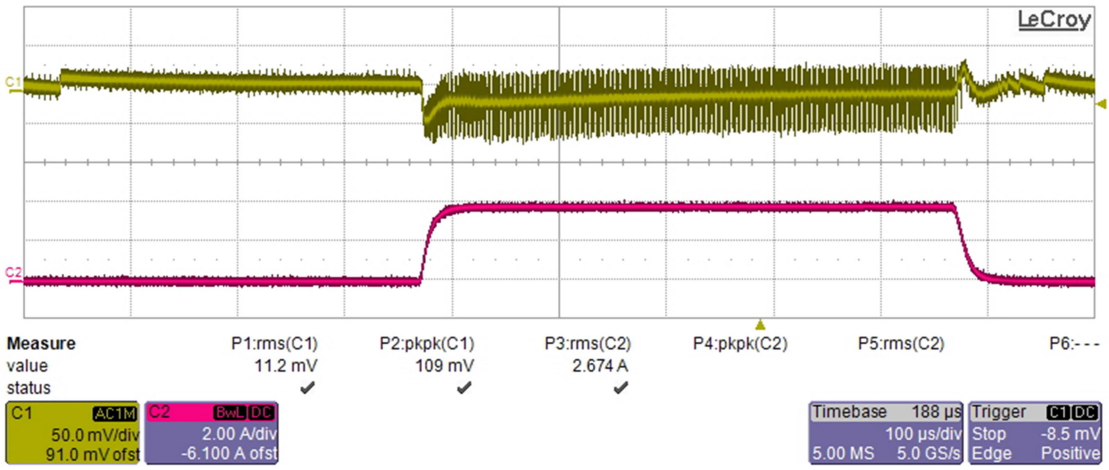
4A load → Pi=12V x 0.444A = 5.328W , Pout=1.05V x 4A = 4.2W

Efficiency =(Pout/Pi)x100 = (4.2/5.328)x100 = 0.788x100=78.8

(7) Output Voltage Ripple:

0.8Vout DCC mode : 0-4A (Spec:40mVpp)

Full:



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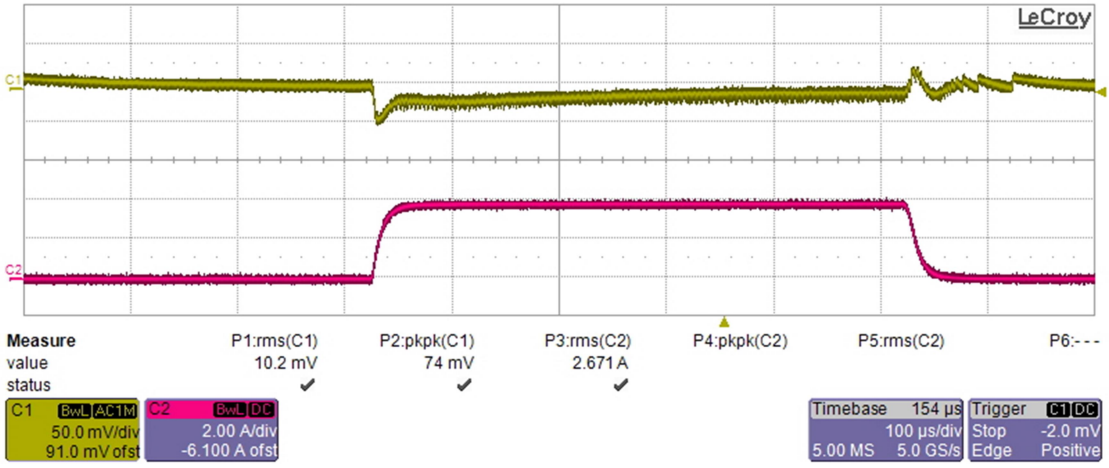
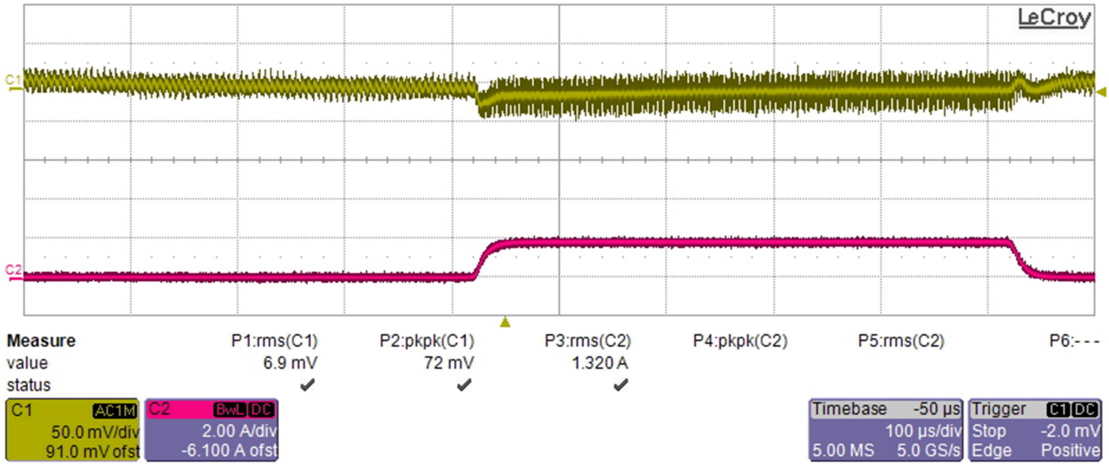


0.8Vout DCC mode : 0.1-2A

Full:



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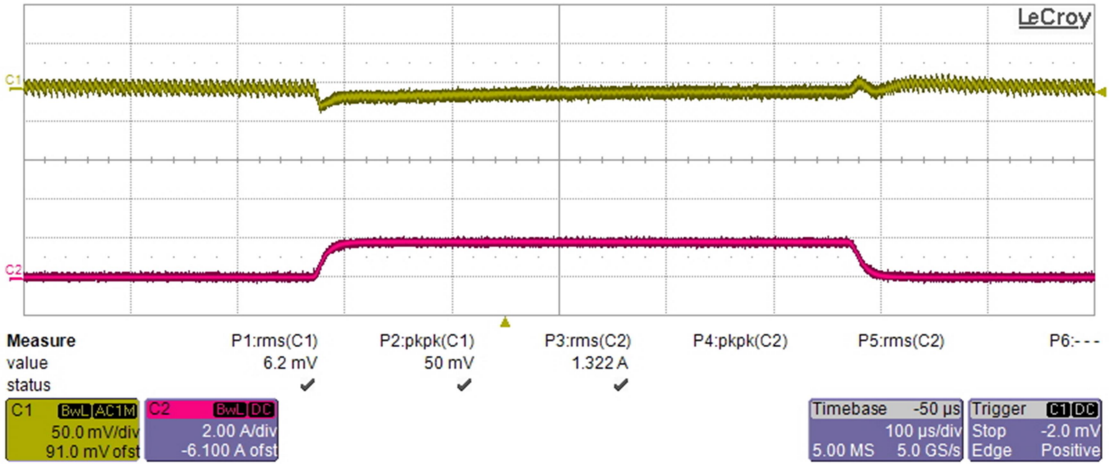
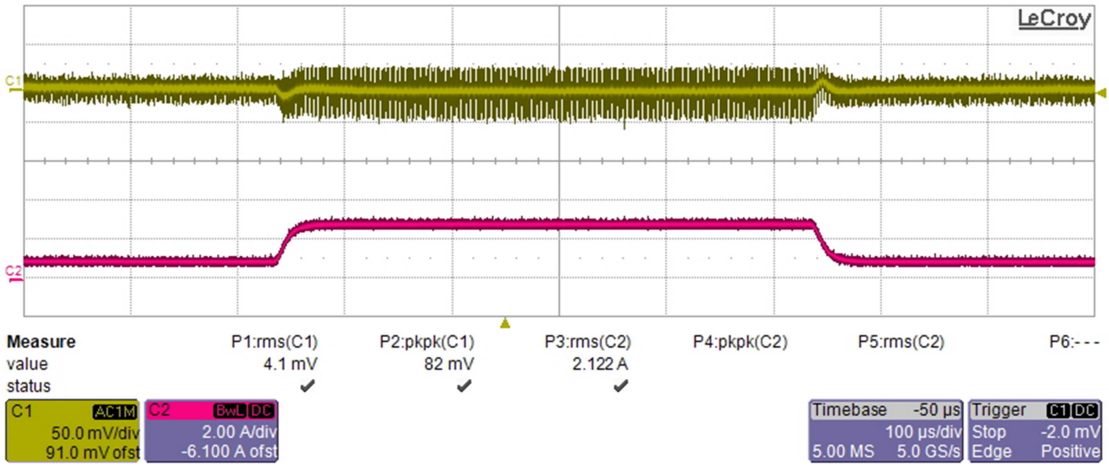


0.8Vout DCC mode : 1-3A

Full:



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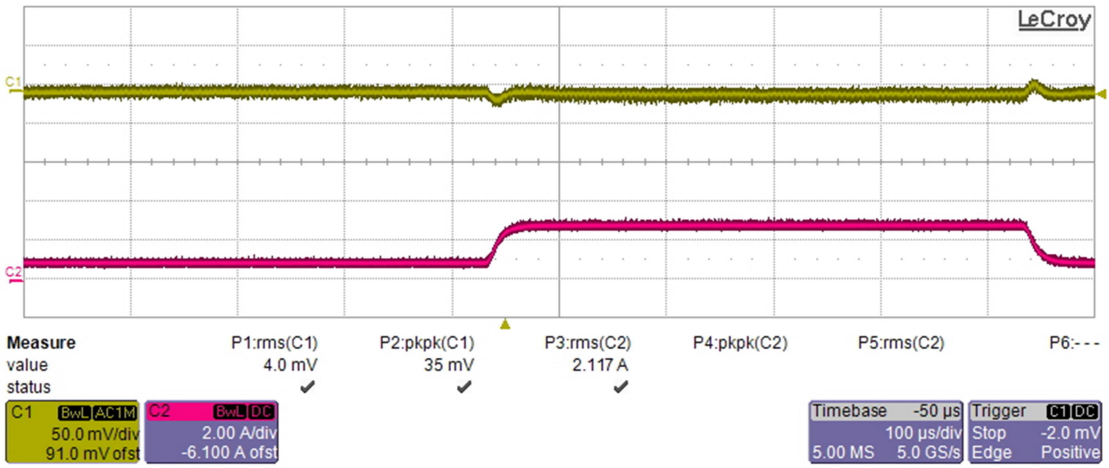
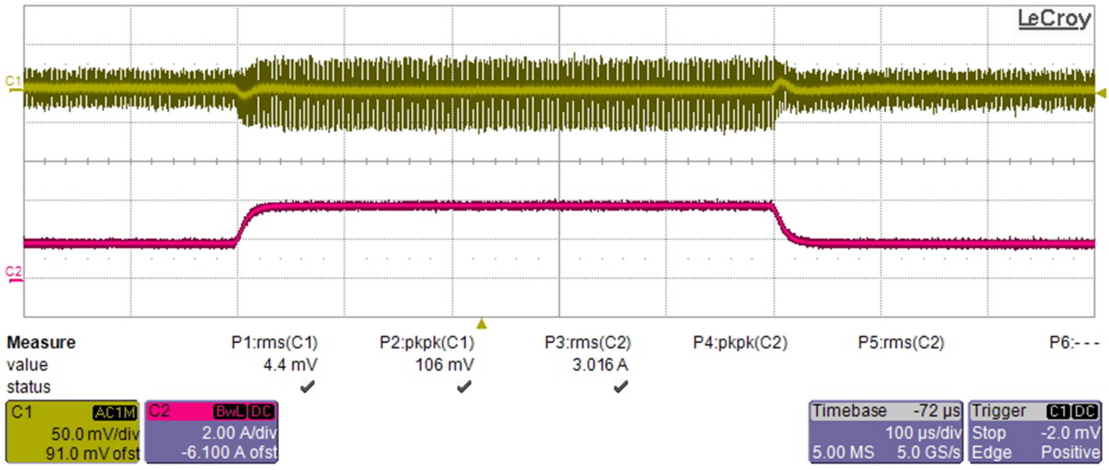


0.8Vout DCC mode : 2-4A

Full:



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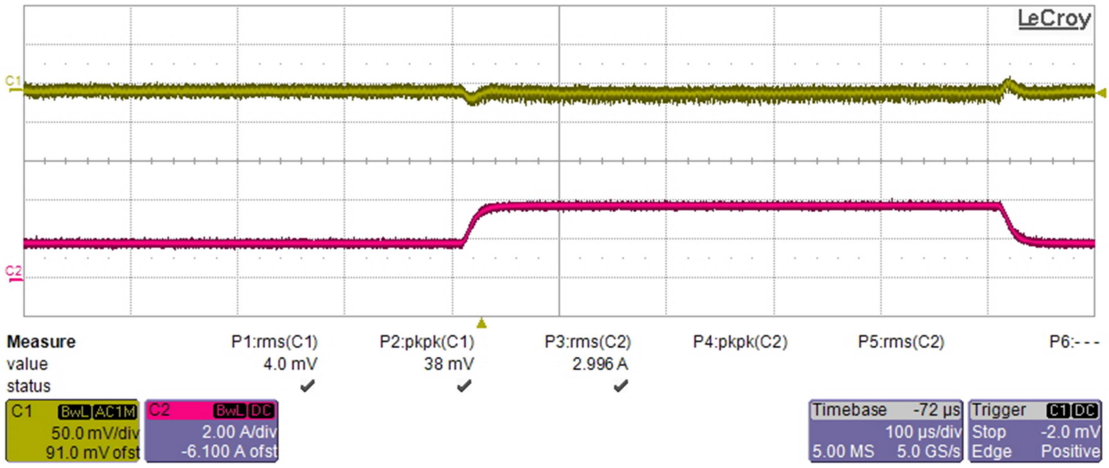
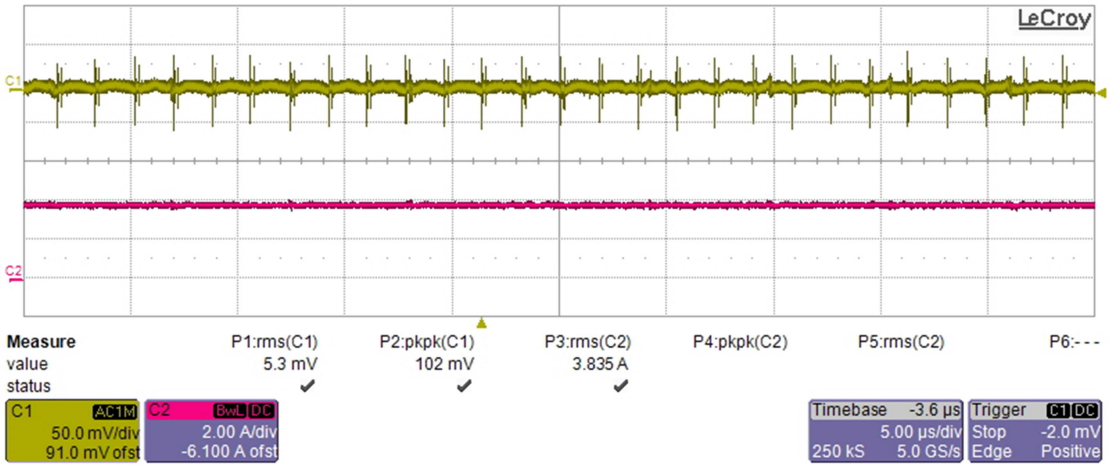


0.8Vout CC mode:

Full:



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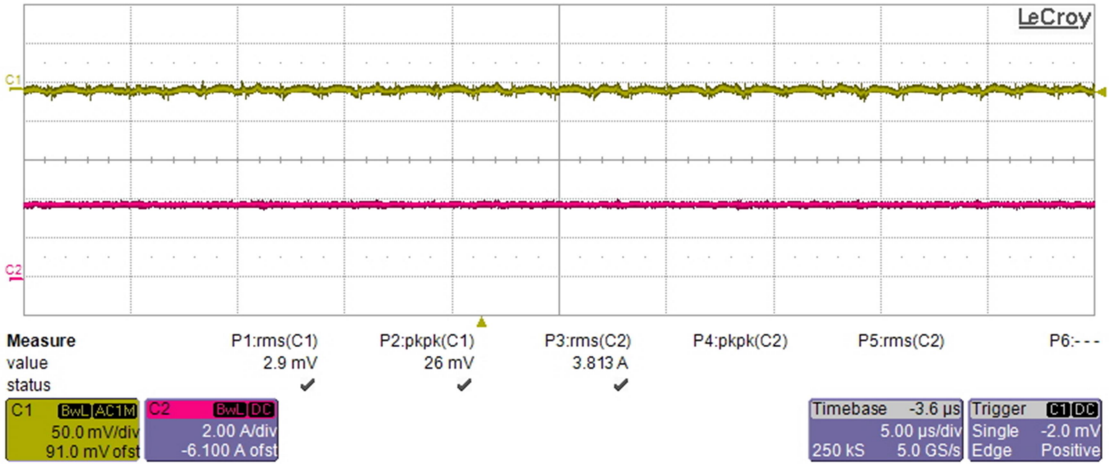
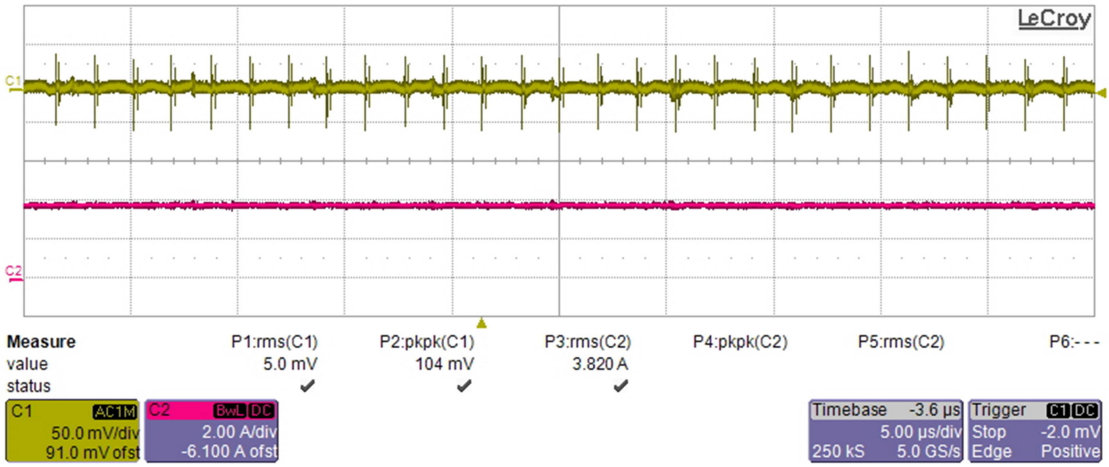


0.8Vout CR mode:

Full:



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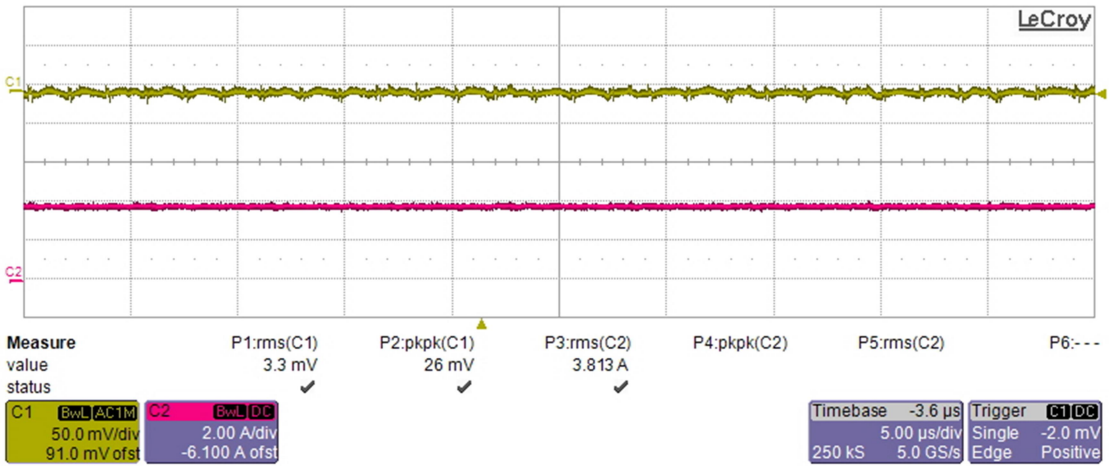


(8) 0.8Vout Overcurrent limit:

Specifications	Test Conditions	MIN	TYP	MAX	Unit
Overcurrent limit	V_{IN} = 12 V, L_{OUT} = 2.2 µH		6		A

實際量測當負載電流超過 6.2A 時 IC 會 shutdown

(9) 0.8Vout Operating Temperature:

		MIN	NOM	MAX	UNIT
T_J	Operating junction temperature	–40		125	°C

室溫情況下 IC 溫度:

no load →31.1 度

4A-load →56.5 度

Short →81.2 度

(10) 0.8Vout Efficiency:

實際量測:

0.1A load → Pi=12V x 0.01A = 0.12W , Pout=0.8V x 0.1A = 0.08W

Efficiency =(Pout/Pi)x100 = (0.08/0.12)x100 = 0.666x100=66.6

1A load → Pi=12V x 0.085A = 1.02W , Pout=0.8V x 1A = 0.8W

Efficiency =(Pout/Pi)x100 = (0.8/1.02)x100 = 0.784x100=78.4

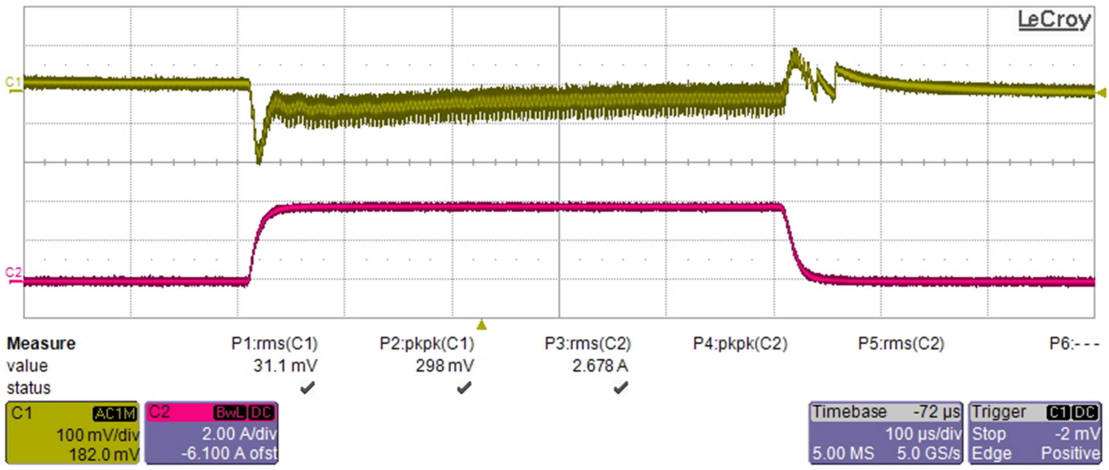
4A load → Pi=12V x 0.372A = 4.464W , Pout=0.8V x 4A = 3.2W

Efficiency =(Pout/Pi)x100 = (3.2/4.464)x100 = 0.716x100=71.6

(11) Output Voltage Ripple:

5Vout DCC mode : 0-4A (Spec:250mVpp)

Full:



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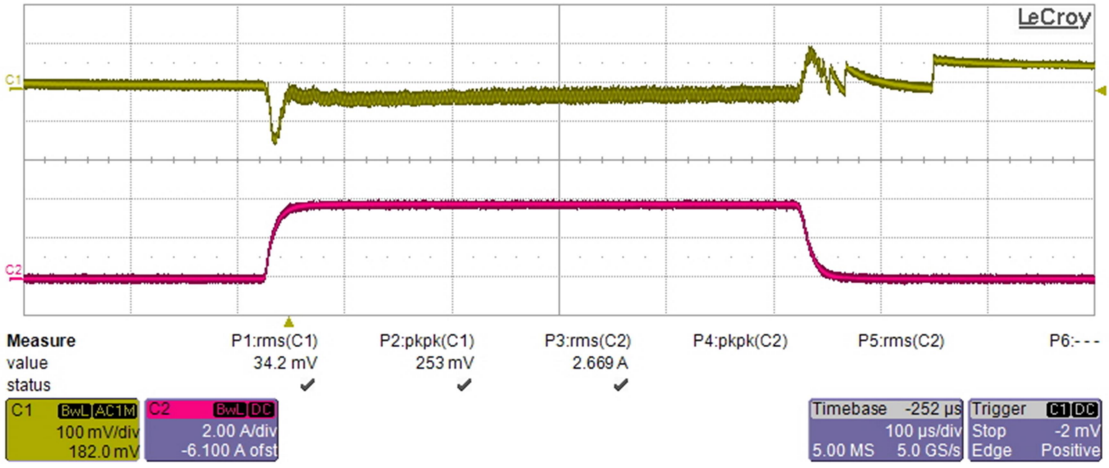

5Vout DCC mode : 0.1-2A

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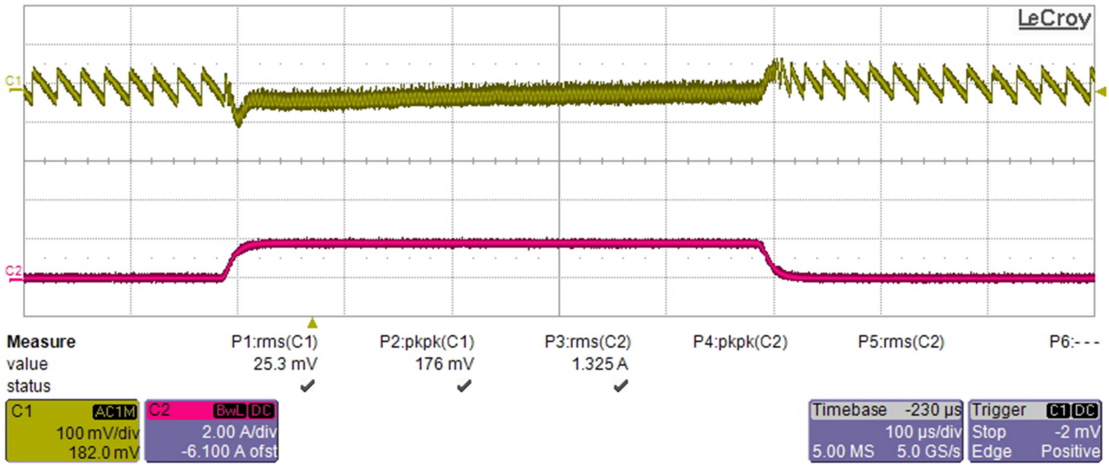

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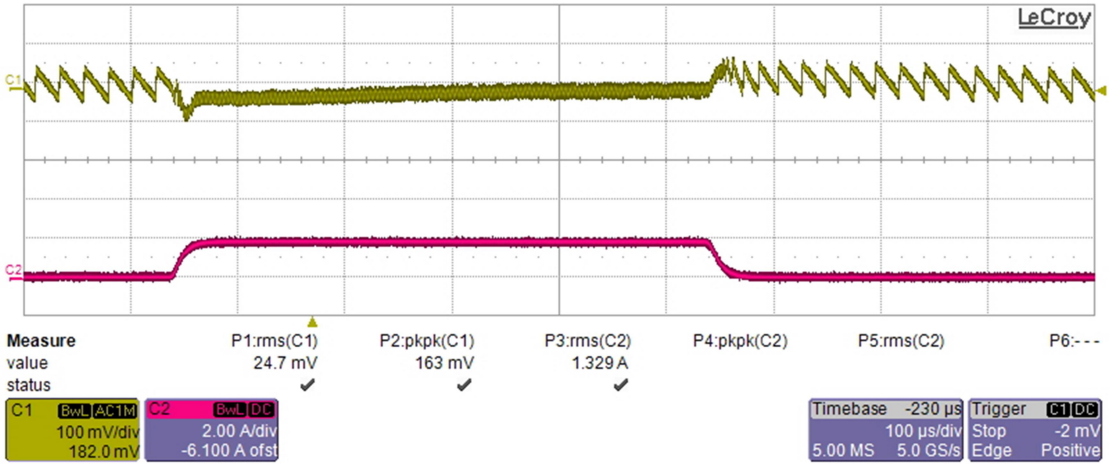
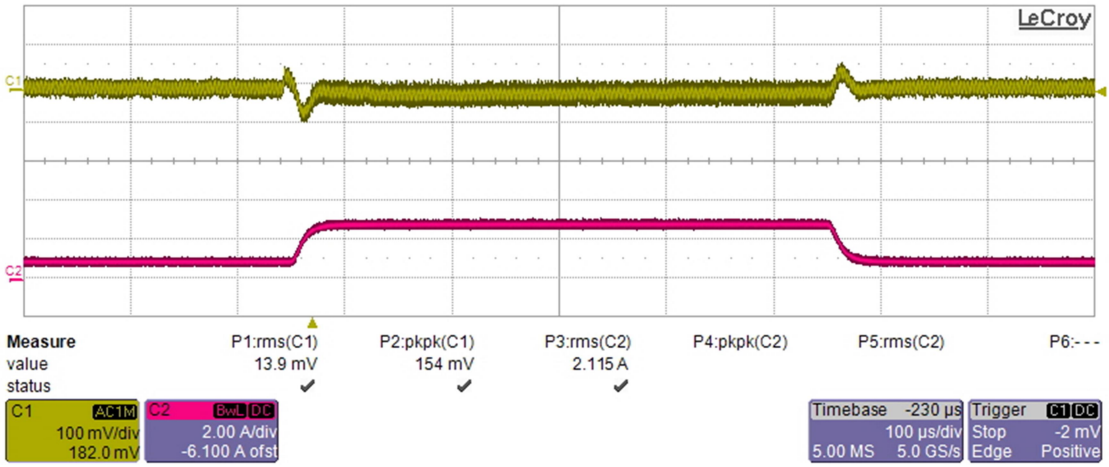


5Vout DCC mode : 1-3A

Full:



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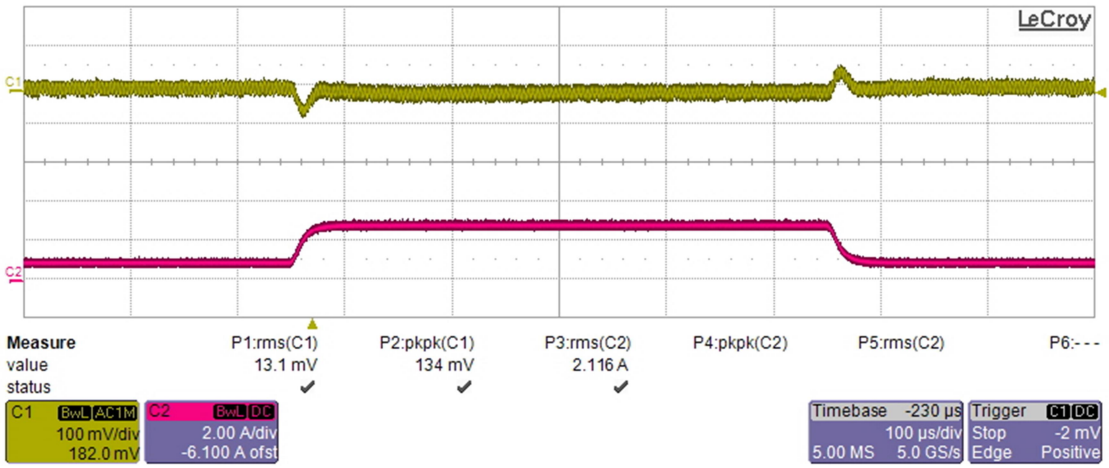

5Vout DCC mode : 2-4A

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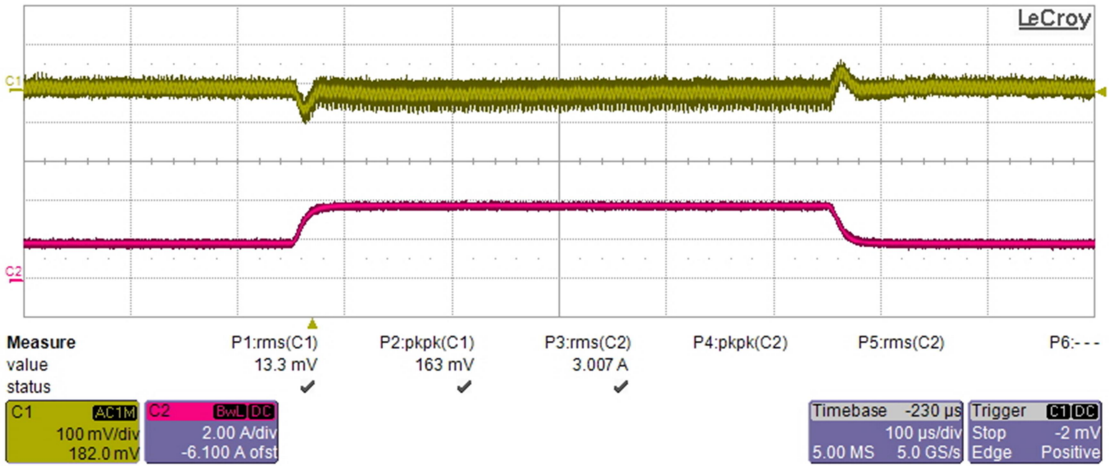

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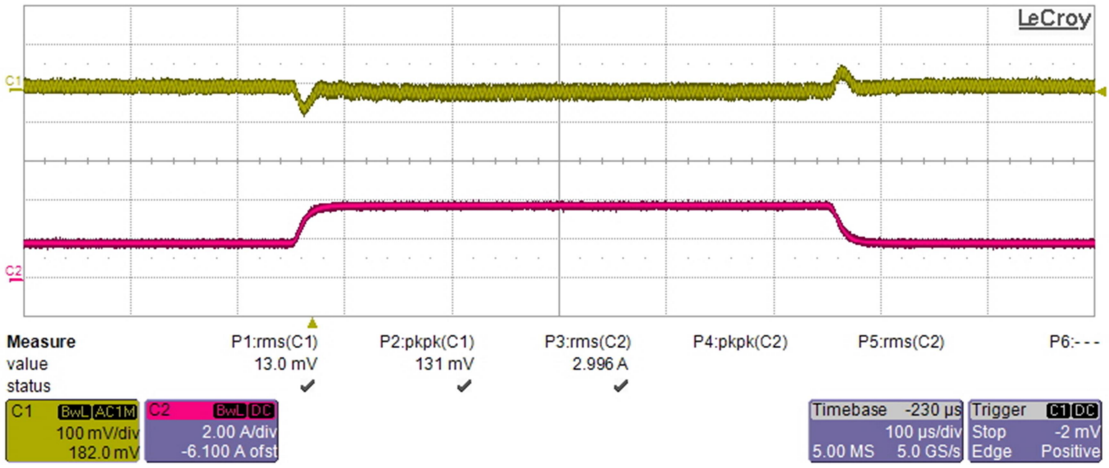
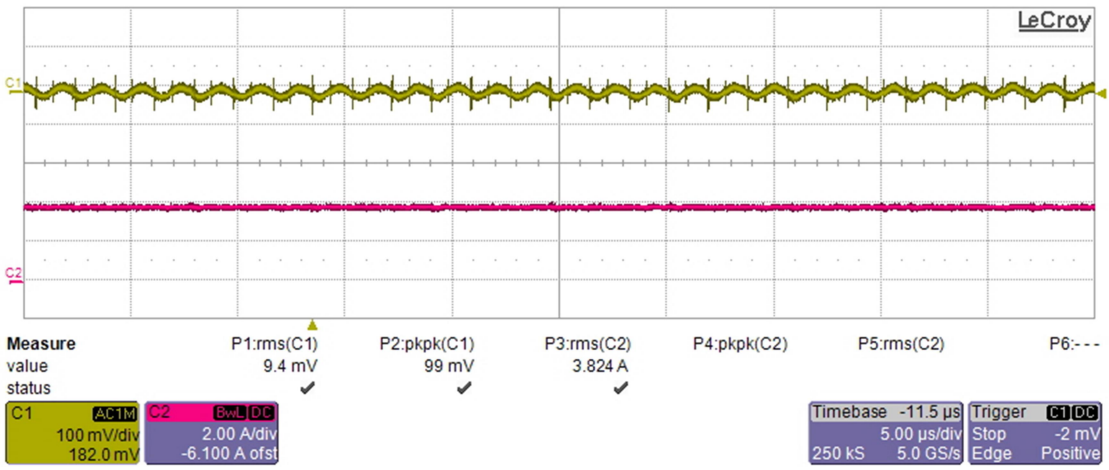


5Vout CC mode:

Full:



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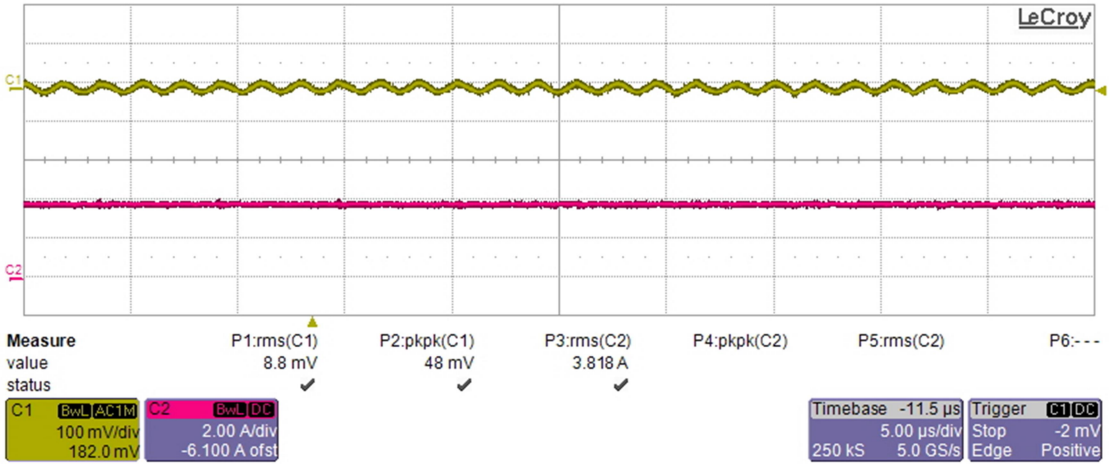
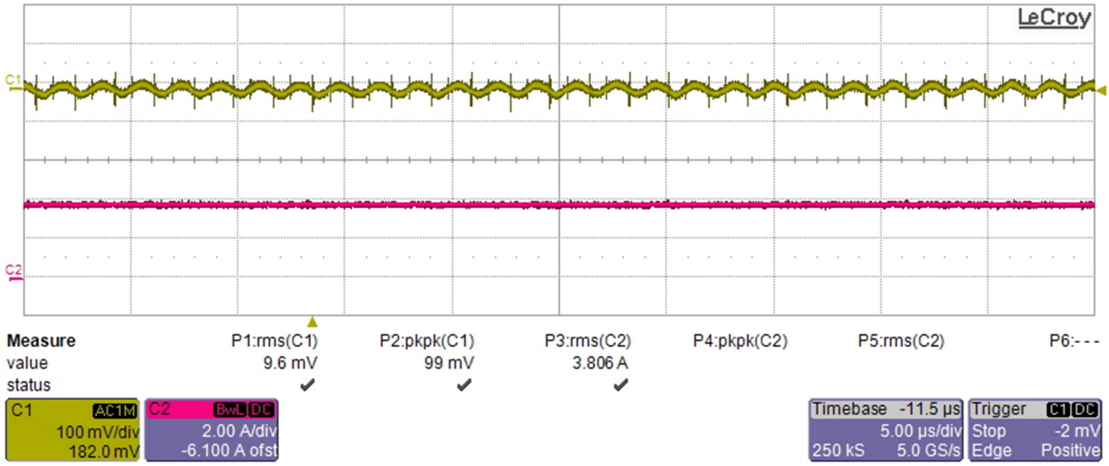


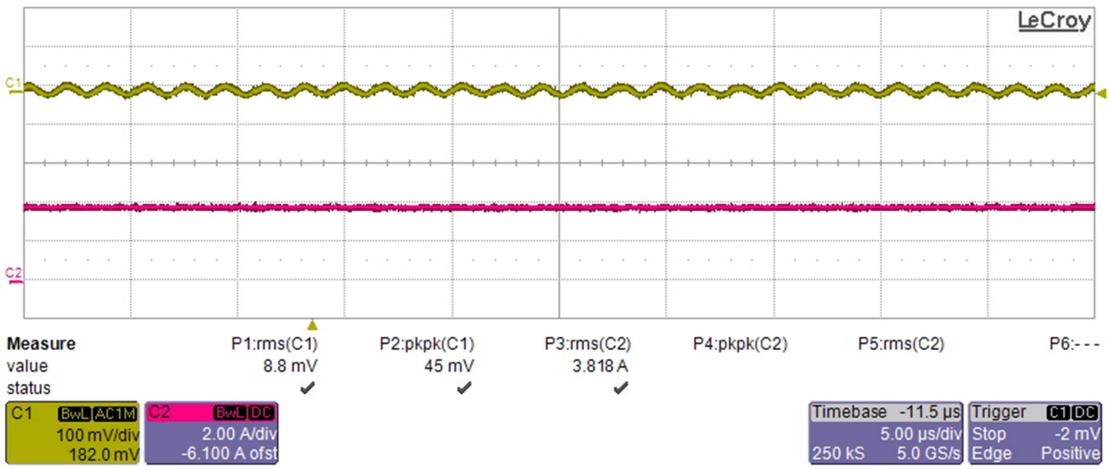
5Vout CR mode:

Full:



Specifications	Test Conditions	MIN	TYP	MAX	Unit
Output ripple voltage	V_{IN} = 12 V, I_{OUT} = 4 A		20		mV_{PP}

20MHz:



(12) 5Vout Overcurrent limit:

Specifications	Test Conditions	MIN	TYP	MAX	Unit
Overcurrent limit	V_{IN} = 12 V, L_{OUT} = 2.2 µH		6		A

實際量測當負載電流超過 5.75A 時 IC 會 shutdown

(13) 5Vout Operating Temperature:

		MIN	NOM	MAX	UNIT
T_J	Operating junction temperature	–40		125	°C

室溫情況下 IC 溫度:

no load →39.6 度

4A-load →67.5 度

Short →97.8 度

(14) 5Vout Efficiency:

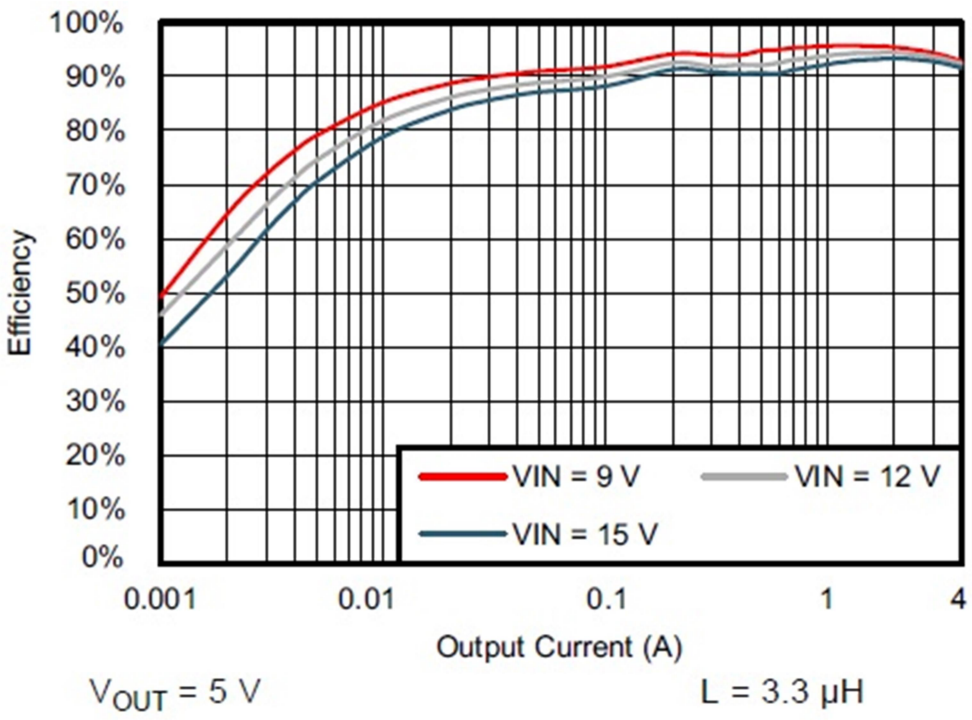


Figure 13. TPS564201 Efficiency vs Output Current

實際量測:

0.1A load → Pi=12V x 0.0462A = 0.554W , Pout=5V x 0.1A = 0.5W

Efficiency =(Pout/Pi)x100 = (0.5/0.554)x100 = 0.902x100=90.2

1A load → Pi=12V x 0.447A = 5.364W , Pout=5V x 1A = 5W

Efficiency =(Pout/Pi)x100 = (5/5.364)x100 = 0.932x100=93.2

4A load → Pi=12V x 1.807A = 21.691W , Pout=5V x 4A = 20W

Efficiency =(Pout/Pi)x100 = (20/21.691)x100 = 0.922x100=92.2

- **測試結論:**

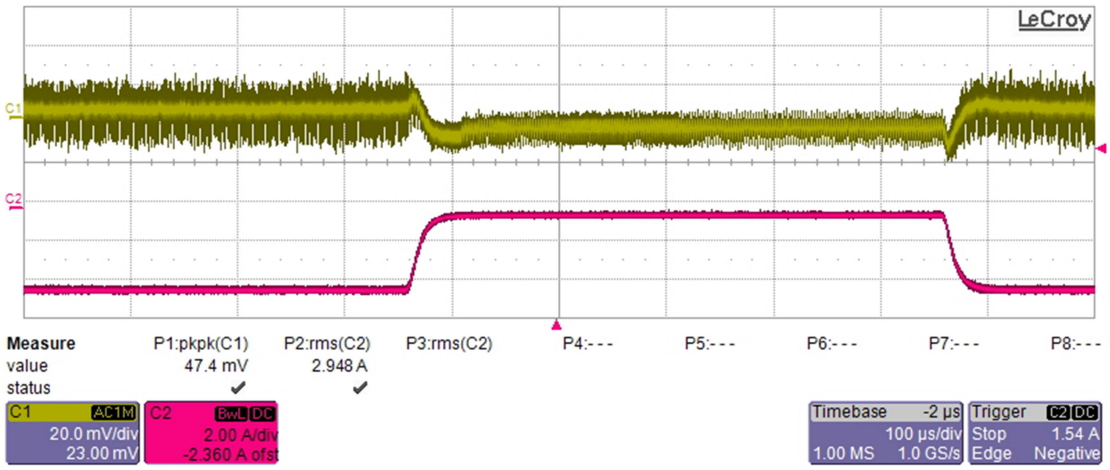
(1) 測試之數據(ripple voltage)不符合規範
(2) TPS564201 Step-Down IC 建議廠內不要使用

TI TPS54428 step-down converter IC

(1) Output Voltage Ripple:

1.05Vout DCC mode : 0-4A (Spec:52.5mVpp)

Full:



20MHz: