

# LTC7851

## High Output Current 4-Phase Step-Down Converter

### DESCRIPTION

Demonstration circuit DC2380A features the [LTC<sup>®</sup>7851](#), a high performance 4-phase voltage mode controller, in the following high output current step-down converters:

DC2380A-A: 1.8V/30A, 1.5V/30A, 1.2V/30A and 1.0V/30A

DC2380A-B: 1.8V/60A Dual Phase and 1.2V/60A Dual Phase

DC2380A-C: 1.2V/120A 4-Phase

The above converters provide a maximum per phase current of 30A while operating at a frequency of 400kHz over an input voltage range of 7V to 14V. The power stage of each phase consists of a 5mm × 5mm DrMOS and 0.25μH/0.325mΩ inductors. The PWM outputs of the LTC7851 drive each DrMOS and DCR sensing is employed to sense the inductor current. The LTC7851's integrated current share circuit provides highly accurate current sharing in the DC2380A-B and DC2380A-C converters.

These demo boards use a high density, two sided layout which places the power stage on the top and the control circuit on the bottom. The LTC7851 and DrMOS are biased by an onboard LT3970 buck converter.

Additional features of this demo board include:

- Remote Sensing
- CLKIN and CLKOUT Pins
- PGOOD, RUN and TRACK/SS Pins
- Dynamic Load Circuit

The LTC7851 data sheet provide a complete description of the IC operation and application information. The data sheet must be read in conjunction with the quick start guide.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2380A>**

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### PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

**Table 1. DC2380A-A – No Air Flow Rating**

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		7V
Maximum Input Voltage		14V
Output Voltage V <sub>OUT1</sub>	I <sub>OUT1</sub> = 0A to 30A, V <sub>IN</sub> = 7V to 14V	1.8V ± 2%
Output Voltage V <sub>OUT2</sub>	I <sub>OUT2</sub> = 0A to 30A, V <sub>IN</sub> = 7V to 14V	1.5V ± 2%
Output Voltage V <sub>OUT3</sub>	I <sub>OUT3</sub> = 0A to 30A, V <sub>IN</sub> = 7V to 14V	1.2V ± 2%
Output Voltage V <sub>OUT4</sub>	I <sub>OUT4</sub> = 0A to 30A, V <sub>IN</sub> = 7V to 14V	1.0V ± 2%
I <sub>OUT(MAX)</sub> for V <sub>OUT1</sub> -V <sub>OUT4</sub>	V <sub>IN</sub> = 7V to 14V	30A
Nominal Switching Frequency		400kHz
Efficiency (see Figure 4)	V <sub>OUT1</sub> = 1.8V, I <sub>OUT1</sub> = 30A, V <sub>IN</sub> = 12V	93.5% Typical
	V <sub>OUT2</sub> = 1.5V, I <sub>OUT2</sub> = 30A, V <sub>IN</sub> = 12V	92.7% Typical
	V <sub>OUT3</sub> = 1.2V, I <sub>OUT3</sub> = 30A, V <sub>IN</sub> = 12V	91.7% Typical
	V <sub>OUT4</sub> = 1.0V, I <sub>OUT4</sub> = 30A, V <sub>IN</sub> = 12V	90.5% Typical

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## PERFORMANCE SUMMARY Specifications are at $T_A = 25^\circ\text{C}$

**Table 2. DC2380A-B – No Air Flow Rating**

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		7V
Maximum Input Voltage		14V
Output Voltage $V_{OUT1}$ (Phases 1 and 2 Paralleled)	$I_{OUT1} = 0\text{A to } 60\text{A}, V_{IN} = 7\text{V to } 14\text{V}$	$1.8\text{V} \pm 2\%$
Output Voltage $V_{OUT3}$ (Phases 3 and 4 Paralleled)	$I_{OUT3} = 0\text{A to } 60\text{A}, V_{IN} = 7\text{V to } 14\text{V}$	$1.2\text{V} \pm 2\%$
$I_{OUT(\text{MAX})}$ for $V_{OUT1}$ and $V_{OUT3}$	$V_{IN} = 7\text{V to } 14\text{V}$	60A
Nominal Switching Frequency		400kHz
Efficiency (see Figure 5)	$V_{OUT1} = 1.8\text{V}, I_{OUT1} = 60\text{A}, V_{IN} = 12\text{V}$	93.9%
	$V_{OUT3} = 1.2\text{V}, I_{OUT3} = 60\text{A}, V_{IN} = 12\text{V}$	92.1%

**Table 3. DC2380A-C – No Air Flow Rating**

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		7V
Maximum Input Voltage		14V
Output Voltage $V_{OUT1}$ (Phases 1-4 Paralleled)	$I_{OUT1} = 0\text{A to } 120\text{A}, V_{IN} = 7\text{V to } 14\text{V}$	$1.2\text{V} \pm 2\%$
$I_{OUT(\text{MAX})}$ for $V_{OUT1}$	$V_{IN} = 7\text{V to } 14\text{V}$	120A
Nominal Switching Frequency		400kHz
Efficiency (see Figure 6)	$V_{OUT1} = 1.2\text{V}, I_{OUT1} = 120\text{A}, V_{IN} = 12\text{V}$	91.7%

## QUICK START PROCEDURE

The evaluation setup for DC2380 is straight forward. First, refer to the respective setup drawings listed below:

- A converter: Figure 1
- B converter: Figure 2
- C converter: Figure 3

Next, follow the procedure below:

- 1) With power off, connect the input supply, load and meters as shown in the setup drawings. Preset the load to 0A and  $V_{IN}$  supply to be 0V.
- 2) Place the RUN jumper(s) in the ON position.
- 3) Place the 5V BIAS jumper in the ON position.
- 4) Set the input voltage to 12V.
- 5) Check the output voltage. The output voltage should be within the regulation limits shown in the Performance Summary table.
- 6) Next, apply full load and re-measure  $V_{OUT}$ . Check the output voltage again to make sure it is within the regulation limits.
- 7) Adjust the input voltage and load current to the desired levels within their limits and observe the regulation, output ripple, load step response, efficiency and other parameters.

### Air Flow Requirements

The DC2380A-A/-B/-C can operate with full load on all outputs with no air flow at room temperature. But for ambient temperatures of 35°C or higher, apply 200LFM or more.

### Dynamic Load Circuit (Optional)

Demonstration circuit 2380A provides two simple dynamic load circuits consisting of a MOSFET and sense resistor. Circuit A is for  $V_{OUT1}$  and  $V_{OUT2}$  and circuit B is for  $V_{OUT3}$  and  $V_{OUT4}$ . To apply a load step, follow the steps below.

- 1) Connect the output under test to the correct dynamic load circuit:
  - a) For  $V_{OUT1}$ , stuff copper jumper at R89 and remove jumper from R90.
  - b) For  $V_{OUT2}$ , stuff copper jumper at R90 and remove jumper from R89.
  - c) For  $V_{OUT3}$ , stuff copper jumper at R101 and remove jumper at R102.
  - d) For  $V_{OUT4}$ , stuff copper jumper at R102 and remove jumper at R101.
- 2) Apply signal from the pulse generator.
  - a) Connect the output of the pulse generator between PULSE GEN A and GND for  $V_{OUT1}$  or  $V_{OUT2}$ .
  - b) Connect the output of the pulse generator between PULSE GEN B and GND for  $V_{OUT3}$  or  $V_{OUT4}$ .
- 3) Preset the amplitude of a pulse generator to 0.0V and the duty cycle to 5% or less.
- 4) Monitor the load step current. Depending on which output is being tested, connect a scope probe between  $I_{STEPA+}$  and  $I_{STEPA-}$  or between  $I_{STEPB+}$  and  $I_{STEPB-}$ .
- 5) With the converter running, slowly increase the amplitude of the pulse generator output to provide the desired load step pulse height. The scaling for the load step signals is 2mV / Amp.

**Note 1:** To monitor the output voltage ripple, use the BNC connectors labeled  $V_{OUT1}$ ,  $V_{OUT2}$ ,  $V_{OUT3}$  and  $V_{OUT4}$ .

**Note 2:** Do not connect load between the  $V_{OS+}$  and  $V_{OS-}$  turrets. This could damage the converter. Only apply load across the  $V_{OUT+}$  and  $V_{OUT-}$  stud connectors on the edge of the board.

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## QUICK START PROCEDURE

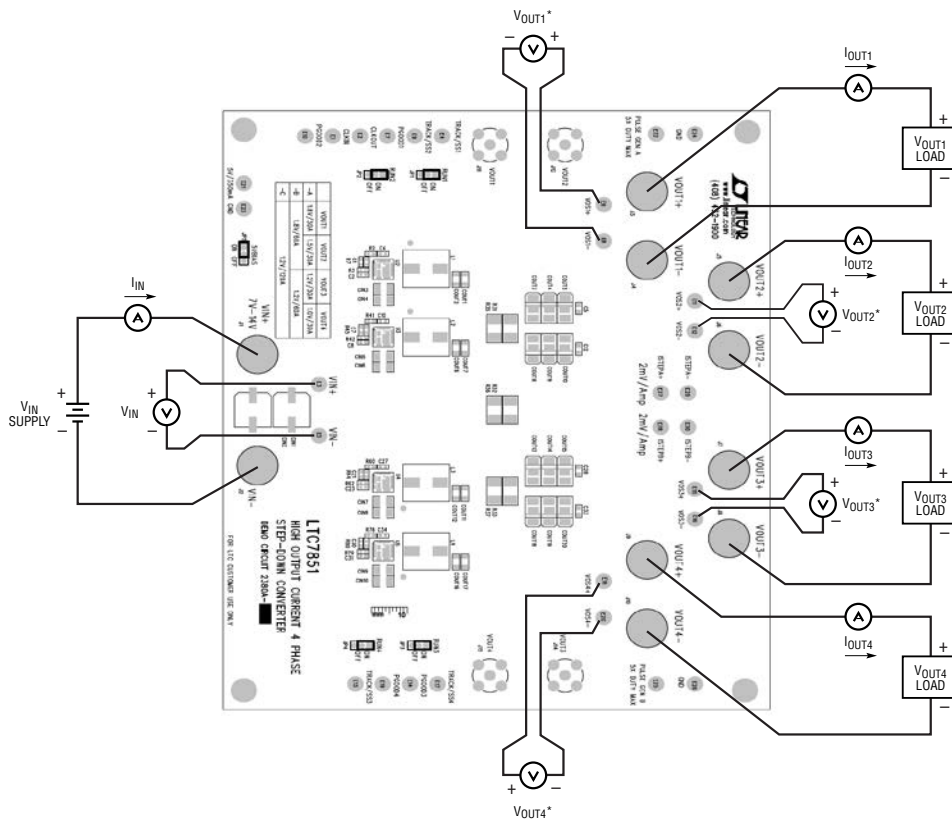


Figure 1. Proper Measurement Equipment Setup for the Four Outputs Converter (-A)

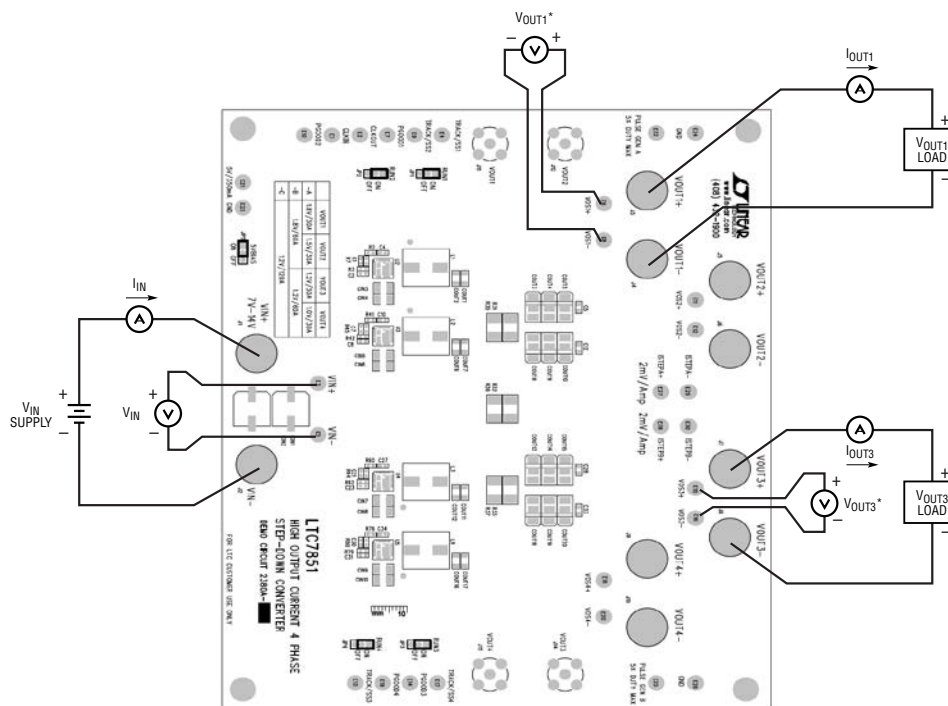


Figure 2. Proper Measurement Equipment Setup for the Two Dual Phase Outputs Converter (-B)

## QUICK START PROCEDURE

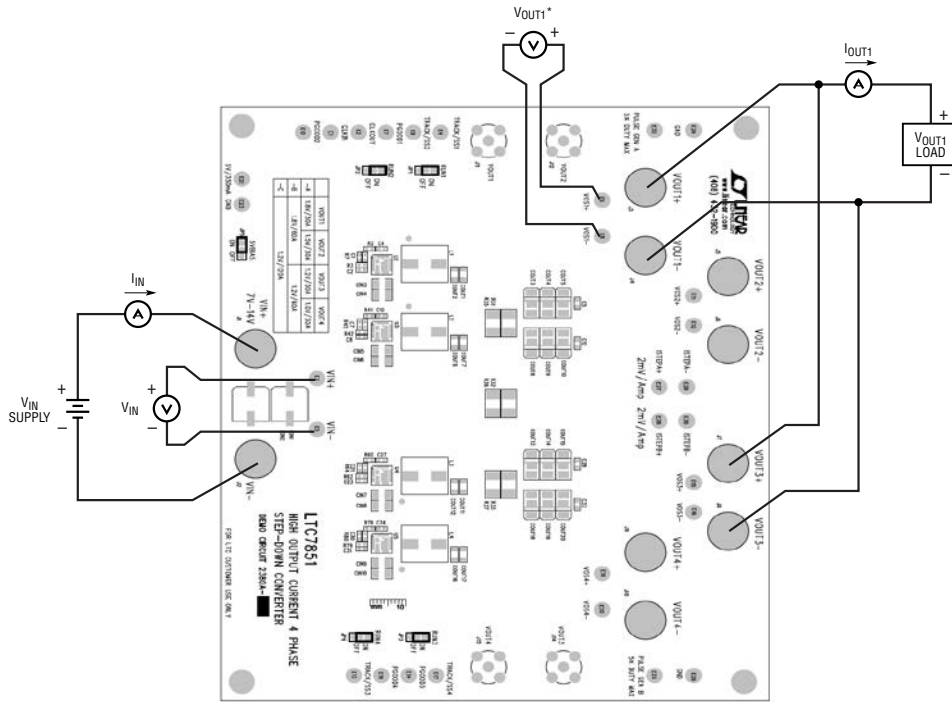
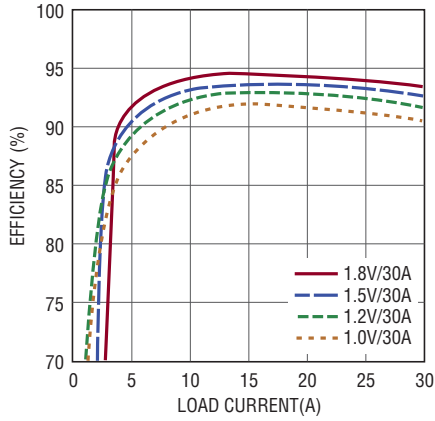


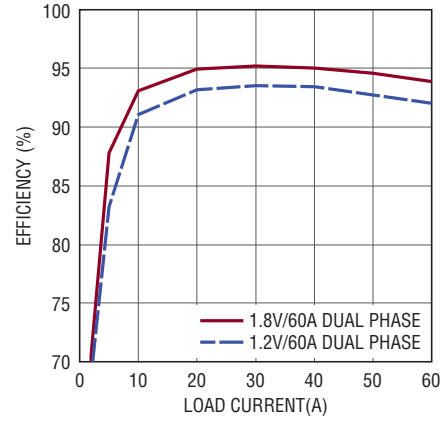
Figure 3. Proper Measurement Equipment Setup for the Single Output 4-Phase Converter (-C)

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## QUICK START PROCEDURE



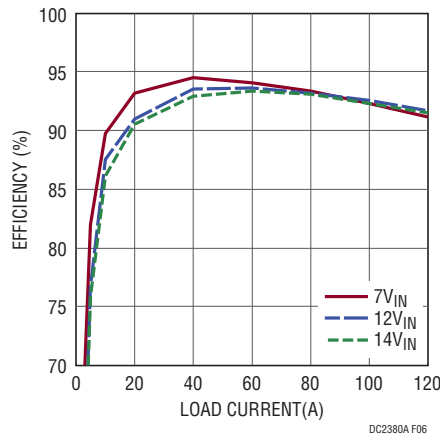
CONDITIONS:  
 $V_{IN} = 12V$   
 $f_{SW} = 400kHz$   
 EACH RAIL IS SINGLE PHASE  
 $L = WURTH 744301025 (0.25\mu H, 0.325m\Omega)$ , EACH PHASE  
 $DrMOS = FDMF5820DC$ , EACH PHASE  
 EXTERNAL 5V BIAS APPLIED (EFF. INCLUDES BIAS POWER)  
 ONE RAIL ENABLED AT A TIME



CONDITIONS:  
 $V_{IN} = 12V$   
 $f_{SW} = 400kHz$   
 $L = WURTH 744301025 (0.25\mu H, 0.325m\Omega)$ , EACH PHASE  
 $DrMOS = FDMF5820DC$ , EACH PHASE  
 EXTERNAL 5V BIAS APPLIED (EFF. INCLUDES BIAS POWER)  
 ONE RAIL ENABLED AT A TIME

Figure 4. Efficiency Curves for the -A Converter at  $12V_{IN}$

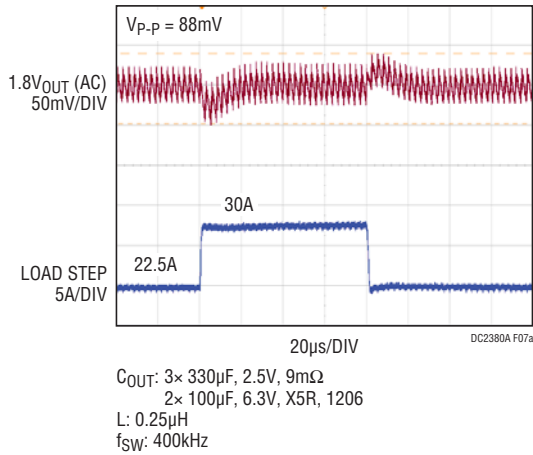
Figure 5. Efficiency Curves for the -B Converter at  $12V_{IN}$



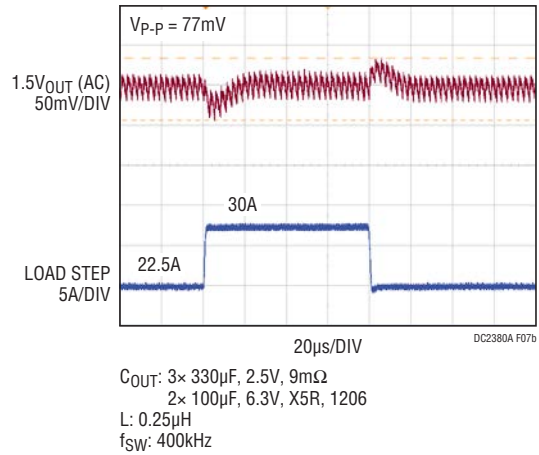
CONDITIONS:  
 $V_{IN} = 12V$   
 $f_{SW} = 400kHz$   
 $L = WURTH 744301025 (0.25\mu H, 0.325m\Omega)$ , EACH PHASE  
 $DrMOS = FDMF5820DC$ , EACH PHASE  
 EXTERNAL 5V BIAS APPLIED (EFF. INCLUDES BIAS POWER)  
 ONE RAIL ENABLED AT A TIME

Figure 6. Efficiency Curves for the -C Converter Over the Input Voltage Range

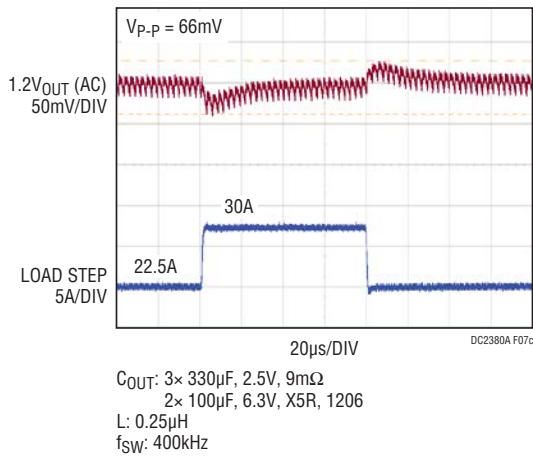
## QUICK START PROCEDURE



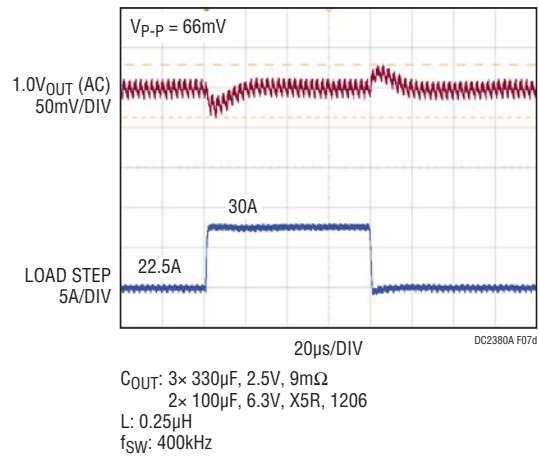
(a)



(b)



(c)

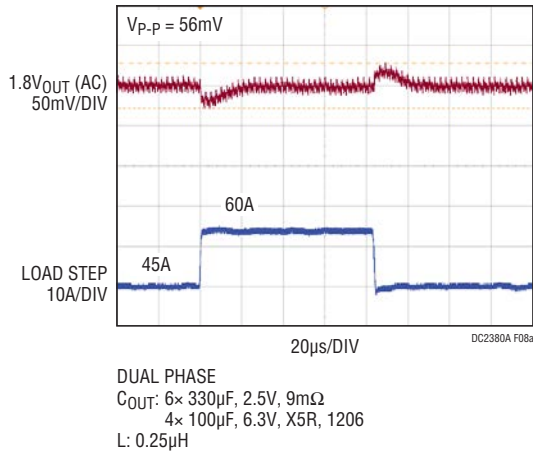


(d)

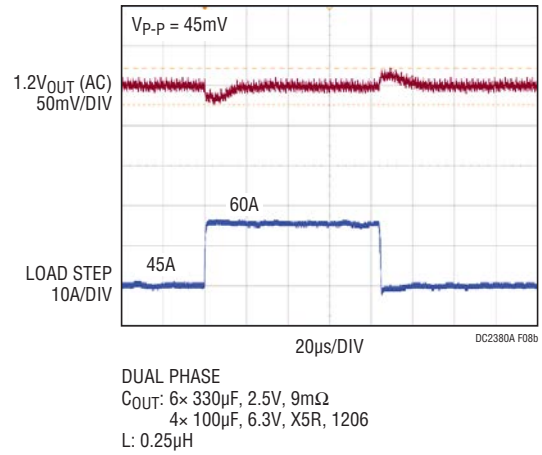
Figure 7. 75% to 100% Load Step Response of the -A Converter

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## QUICK START PROCEDURE



(a)



(b)

Figure 8. 75% to 100% Load Step Response of the -B Converter

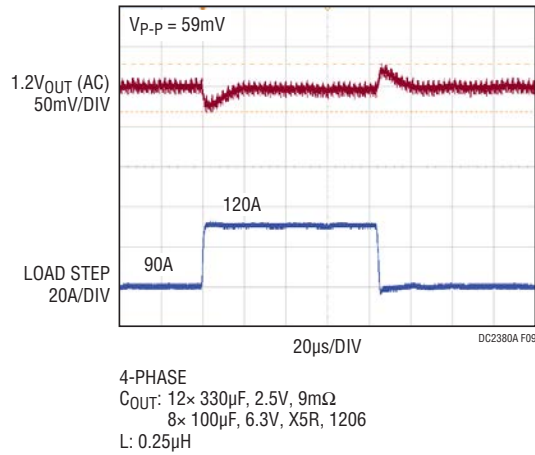


Figure 9. 75% to 100% Load Step Response of the -C Converter



# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>DC2380A-A</b>				
<b>Required Circuit Components</b>				
1	8	C1,C4,C7,C10,C21,C27,C30,C34	CAP, 2.2μF, X7R, 16V, 10%, 0603	MURATA, GRM188R61C225KE15D
2	2	C1-1, C1-2	CAP, 2200pF, X7R, 50V, 10%, 0603	AVX, 06035C222KAT2A
3	1	C18	CAP, 1μF, X5R, 16V, 10%, 0603	AVX, 0603YD105KAT2A
4	8	C2,C8,C13,C14,C22,C23,C24,C31	CAP, 0.22μF, X7R, 16V, 10%, 0603	AVX, 0603YC224KAT2A
5	4	C2-1, C2-2,C2-3,C2-4	CAP, 100pF, NPO, 25V, 10%, 0603	AVX,06033A101KAT2A
6	6	C3-1,C3-2,C3-3,C3-4, C1-3,C1-4	CAP, 3300pF, X7R, 50V, 10%, 0603	AVX, 06035C332KAT2A
7	4	C5,C12,C28,C33	CAP, 10μF, X5R, 35V, 20%, 0805	TDK., C2012X5R1V106M085AC
8	2	CIN1,CIN2	CAP, 180μF, 30mΩ, 3.02A, 16V	SANYO 16SVP180MX
9	8	CIN3-CIN10	CAP, 22μF, X5R, 25V, 10%, 1210	MURATA GRM32ER71E226K
10	8	COU1, COU2, COU6, COU7, COU11, COU12, COU16, COU17	CAP, 100μF, X5R, 6.3V, 20%, 1206	MURATA GRM31CR60J107M
11	12	COU3-COU5, COU8-COU10, COU13-COU15, COU18-COU20	CAP, 330μF, 2.5V, 7343	PANASONIC, EEF5X0E331ER
12	4	L1, L2, L3, L4	IND, 0.25μH, DCR = 0.325mΩ	WURTH ELEKTRONIK 744301025
13	5	R1, R40, R54, R59, R75	RES, 1Ω, 1/10W, 1%, 0603	VISHAY, CRCW06031R00FKED
14	1	R15	RES, 18.2k, 1/10W, 1%, 0603	VISHAY, CRCW060318K2FKEA
15	13	R2, R3, R34, R41, R42, R47, R56, R60, R62, R73, R76, R79, R88	RES, 0, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
16	1	R2-1	RES, 5.62k, 1/10W, 1%, 0603	VISHAY, CRCW06035K62FKEA
17	1	R2-2	RES, 4.75k, 1/10W, 1%, 0603	VISHAY, CRCW06034K75FKEA
18	1	R2-3	RES, 3.48k, 1/10W, 1%, 0603	VISHAY, CRCW06033K48FKEA
19	1	R2-4	RES, 3.32k, 1/10W, 1%, 0603	VISHAY, CRCW06033K32FKEA
20	4	R28, R52, R70, R86	RES, 24.9k, 1/10W, 1%, 0603	VISHAY, CRCW060324K9FKEA
21	5	R29, R39, R53, R71, R77	RES, 10Ω, 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKED
22	4	R30, R50, R68, R83	RES, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
23	4	R3-1, R3-2, R3-3, R3-4	RES, 332Ω, 1/10W, 1%, 0603	VISHAY, CRCW0603332RFKEA
24	4	R38, R55, R72, R87	RES, 3.57k, 1/10W, 1%, 0603	VISHAY, CRCW06033K57FKEA
25	3	R43, R63, R78	RES, 18.2k, 1/10W, 1%, 0603	VISHAY, CRCW060318K2FKEA
26	1	R44	RES, 30.9k, 1/10W, 1%, 0603	VISHAY, CRCW060330K9FKEA
27	1	R51	RES, 43.2k, 1/10W, 1%, 0603	VISHAY, CRCW060343K2FKEA
28	3	R58, R85, R74	RES, 10Ω, 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKED
29	3	R69, R57, R61	RES, 43.2k, 1/10W, 1%, 0603	VISHAY, CRCW060343K2FKEA
30	21	RB-1, RB-2, RB-3, RT-3, RT-4, R1-2, R1-3, R1-4, R81, R84, R1-1, R7, R11, R20, R45, R46, R49, R64, R65, R67, R80	RES, 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
31	1	RT-1	RES, 20k, 1/10W, 1%, 0603	VISHAY, CRCW060320K0FKEA
32	2	RT-2, RB-4	RES, 15k, 1/10W, 1%, 0603	VISHAY, CRCW060315K0FKEA
33	1	U1	IC, LTC7851EUHH#PBF, QFN, 5mm × 9mm	LINEAR TECH., LTC7851EUHH#PBF
34	4	U2, U3, U4, U5	IC, HIGH FREQUENCY DR MOS	FAIRCHILD, FDMF5820DC

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Additional Demo Board Circuit Components</b>				
1	0	C25, C26, C29, C32, C3, C6, C9, C15, C16, C17, C19, C11, C20	CAP, OPTIONAL, 0603	
2	0	COU21-COUT23, COU27-COUT29, COU33-COUT35, COU39-COUT41	CAP, OPTIONAL, 7343	
3	0	R31, R32, R33, R35, R36, R37	RES, OPTIONAL, 2512	
4	0	R4-R6, R8-R10, R12-R14, R16-R19, R21-R24, R25-R27, R48, R66, R82, R90, R96, R99, R100, R102, R105, R106-R108	RES, OPTIONAL, 0603	
<b>Hardware: For Demo Board Only</b>				
1	30	E1-E30	TEST POINT, TURRET, .094" MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
2	4	J11, J12, J14, J15	CONN., BNC PC MOUNT	CONNEX, 112404
3	10	J1-J10	STUD, TESTPIN	PEM KFH-032-10
4	10	J1-J10	RING, LUG #10	KEYSTONE, 8205, #10
5	10	J1-J10	WASHER, TIN PLATED BRASS	ANY #10, #10EXT BZ TN
6	20	J1-J10 X 2	NUT, BRASS 10-32	ANY #10-32
7	5	JP1-JP5	CONN, HEADER, 1x3, 2mm	WURTH ELEKTRONIK, 62000311121
8	5	JP1-JP5	SHUNT, 2mm	WURTH ELEKTRONIK, 60800213421
9	4	MT1, MT2, MT3, MT4	STANDOFF, NYLON, SNAP-ON, 0.500"	WURTH ELEKTRONIK, 702936000
<b>DC2380A-B</b>				
<b>Required Circuit Components</b>				
1	8	C1, C4, C7, C10, C21, C27, C30, C34	CAP, 2.2μF, X7R, 16V, 10%, 0603	MURATA, GRM188R61C225KE15D
2	1	C1-1	CAP, 1500pF, X7R, 50V, 10%, 0603	AVX, 06035C152KAT2A
3	1	C1-3	CAP, 2200pF, X7R, 50V, 10%, 0603	AVX, 06035C222KAT2A
4	1	C18	CAP, 1μF, X5R, 16V, 10%, 0603	AVX, 0603YD105KAT2A
5	8	C2, C8, C13, C14, C22, C23, C24, C31	CAP, 0.22μF, X7R, 16V, 10%, 0603	AVX, 0603YC224KAT2A
6	4	C2-1, C2-3, C11, C20	CAP, 100pF, NP0, 25V, 10%, 0603	AVX, 06033A101KAT2A
7	2	C3-1, C3-3	CAP, 3300pF, X7R, 50V, 10%, 0603	AVX, 06035C332KAT2A
8	4	C5, C12, C28, C33	CAP, 10μF, X5R, 35V, 20%, 0805	TDK., C2012X5R1V106M085AC
9	2	CIN1, CIN2	CAP, 180μF, 30mΩ, 3.02A, 16V	SANYO 16SVP180MX
10	8	CIN3-CIN10	CAP, 22μF, X5R, 25V, 10%, 1210	MURATA GRM32ER71E226K
11	8	COU1, COU2, COU6, COU7, COU11, COU12, COU16, COU17	CAP, 100μF, X5R, 6.3V, 20%, 1206	MURATA GRM31CR60J107M
12	12	COU3-COU5, COU8-COU10, COU13-COU15, COU18-COU20	CAP, 330μF, 2.5V, 7343	PANASONIC, EEF5X0E331ER
13	4	L1, L2, L3, L4	IND, 0.25μH, DCR = 0.325mΩ	WURTH ELEKTRONIK, 744301025
14	5	R1, R40, R54, R59, R75	RES, 1 OHM, 1/10W, 1%, 0603	VISHAY, CRCW06031R00FKED
15	1	R15	RES, 18.2k, 1/10W, 1%, 0603	VISHAY, CRCW060318K2FKEA
16	27	R2, R3, R4, R6, R10, R12, R14, R16, R18, R21, R22, R24, R25, R27, R34, R41, R42, R47, R56, R60, R62, R73, R76, R79, R88, R106, R108	RES, 0, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
17	1	R2-1	RES, 6.98K, 1/10W, 1%, 0603	VISHAY, CRCW06036K98FKEA
18	1	R2-3	RES, 4.99K, 1/10W, 1%, 0603	VISHAY, CRCW06034K99FKEA
19	4	R28, R52, R70, R86	RES, 24.9K, 1/10W, 1%, 0603	VISHAY, CRCW060324K9FKEA

dc2380af

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
20	5	R29, R39, R53, R71, R77	RES, 10 OHM, 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKED
21	4	R30, R50, R68, R83	RES, 100K, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
22	2	R3-1, R3-3	RES, 332Ω, 1/10W, 1%, 0603	VISHAY, CRCW0603332RFKEA
23	4	R31, R33, R35, R37	RES, JUMPER, 0mΩ, 1W, 2512	TEPRO, RN5326
24	4	R38, R55, R72, R87	RES, 3.57K, 1/10W, 1%, 0603	VISHAY, CRCW06033K57FKEA
25	1	R44	RES, 30.9K, 1/10W, 1%, 0603	VISHAY, CRCW060330K9FKEA
26	2	R51, R61	RES, 43.2K, 1/10W, 1%, 0603	VISHAY, CRCW060343K2FKEA
27	1	R63	RES, 18.2K, 1/10W, 1%, 0603	VISHAY, CRCW060318K2FKEA
28	1	R74	RES, 10Ω, 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKED
29	18	RB-1, R1-1, RT-3, RB-3, R1-3, R81, R84, R7, R11, R20, R45, R46, R49, R64, R65, R67, R80, R65	RES, 10K, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
30	1	RT-1	RES, 20K, 1/10W, 1%, 0603	VISHAY, CRCW060320K0FKEA
31	1	U1	IC, LTC7851EUHH#PBF, QFN, 5mm × 9mm	LINEAR TECH., LTC7851EUHH#PBF
32	4	U2, U3, U4, U5	IC, HIGH FREQUENCY DR MOS	FAIRCHILD, FDMF5820DC

### Additional Demo Board Circuit Components

1	0	C1-2, C2-2, C3-2, C2-4, C1-4, C3-4, C3, C6, C9, C15, C16, C17, C19, C25, C26, C29, C32	CAP, OPTIONAL 0603	
2	0	COU21-COU23, COU27-COU29, COU33-COU35, COU39-COU41	CAP, OPTIONAL 7343	
3	0	RT-2, RB-2, R1-2, R2-2, R3-2, RT-4, RB-4, R1-4, R2-4, R3-4, R5, R8, R9, R13, R17, R19, R23, R26, R43, R46, R48, R57, R58, R66, R69, R78, R81, R82, R85, R90, R96, R99, R100, R102, R105, R107	RES, OPTIONAL 0603	
4	0	E11, E12, E18, E20	HARDWARE, OPTIONAL	
5	0	JP2, JP4	HARDWARE, OPTIONAL	

### Hardware: For Demo Board Only

1	26	E1-E10, E13-E17, E19, E21-E30	TEST POINT, TURRET, .094" MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
2	4	J11, J12, J14, J15	CONN., BNC PC MOUNT	CONNEX, 112404
3	10	J1-J10	STUD, TESTPIN	PEM KFH-032-10
4	10	J1-J10	RING, LUG #10	KEYSTONE, 8205, #10
5	10	J1-J10	WASHER, TIN PLATED BRASS	ANY #10, #10EXT BZ TN
6	20	J1-J10 X 2	NUT, BRASS 10-32	ANY #10-32
7	3	JP1, JP3, JP5	CONN, HEADER, 1×3, 2mm	WURTH ELEKTRONIK 62000311121
8	3	JP1, JP3, JP5	SHUNT, 2mm	WURTH ELEKTRONIK 60800213421
9	4	MT1, MT2, MT3, MT4	STANDOFF, NYLON, SNAP-ON, 0.500"	WURTH ELEKTRONIK 702936000

### DC2380A-C

### Required Circuit Components

1	8	C1, C4, C7, C10, C21, C27, C30, C34	CAP, 2.2μF, X7R, 16V, 10%, 0603	MURATA, GRM188R61C225KE15D
2	1	C11	CAP, 100pF, NPO, 25V, 10%, 0603	AVX, 06033A101KAT2A
3	1	C18	CAP, 1μF, X5R, 16V, 10%, 0603	AVX, 0603YD105KAT2A
4	8	C2, C8, C13, C14, C22, C23, C24, C31	CAP, 0.22μF, X7R, 16V, 10%, 0603	AVX, 0603YC224KAT2A
5	1	C2-1	CAP, 220pF, NPO, 25V, 10%, 0603	AVX, 06033A221KAT2A

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
6	1	C1-1	CAP, 2200pF, X7R, 50V, 10%, 0603	AVX, 06035C222KAT2A
7	1	C3-1	CAP, 3300pF, X7R, 50V, 10%, 0603	AVX, 06035C332KAT2A
8	4	C5, C12, C28, C33	CAP, 10µF, X5R, 35V, 20%, 0805	TDK., C2012X5R1V106M085AC
9	2	CIN1, CIN2	CAP, 180µF, 30mΩ, 3.02A, 16V	SANYO 16SVP180MX
10	8	CIN3-CIN10	CAP, 22µF, X5R, 25V, 10%, 1210	MURATA GRM32ER71E226K
11	8	COUT1, COUT2, COUT6, COUT7, COUT11, COUT12, COUT16, COUT17	CAP, 100µF, X5R, 6.3V, 20%, 1206	MURATA GRM31CR60J107M
12	12	COUT3-COUT5, COUT8-COUT10, COUT13- COUT15, COUT18-COUT20	CAP, 330µF, 2.5V, 7343	PANASONIC, EEFX0E331ER
13	4	L1, L2, L3, L4	IND, 0.25µH, DCR = 0.325mΩ	WURTH ELEKTRONIK 744301025
14	5	R1, R40, R54, R59, R75	RES, 1Ω, 1/10W, 1%, 0603	VISHAY, CRCW06031R00FKED
15	1	R15	RES, 18.2k, 1/10W, 1%, 0603	VISHAY, CRCW060318K2FKEA
16	34	R2, R3, R4-R6, R10, R12-R14, R16-R19, R21, R22-R27, R34, R41, R42, R47, R56, R60, R62, R73, R76, R79, R88, R106-R108	RES, 0Ω, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
17	1	R2-1	RES., 4.12k, 1/10W, 1%, 0603	VISHAY, CRCW06034K12FKEA
18	4	R28, R52, R70, R86	RES, 24.9k, 1/10W, 1%, 0603	VISHAY, CRCW060324K9FKEA
19	5	R29, R39, R53, R71, R77	RES, 10Ω, 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKED
20	4	R30, R50, R68, R83	RES, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
21	1	R3-1	RES, 332Ω, 1/10W, 1%, 0603	VISHAY, CRCW0603332RFKEA
22	6	R31, R32, R33, R35, R36, R37	RES, JUMPER, 0mΩ, 1W, 2512	TEPRO, RN5326
23	4	R38, R55, R72, R87	RES, 3.57k, 1/10W, 1%, 0603	VISHAY, CRCW06033K57FKEA
24	1	R44	RES, 30.9k, 1/10W, 1%, 0603	VISHAY, CRCW060330K9FKEA
25	1	R51	RES, 43.2k, 1/10W, 1%, 0603	VISHAY, CRCW060343K2FKEA
26	15	RT-1, RB-1, R1-1, R81, R84, R7, R11, R20, R45, R46, R49, R64, R65, R67, R80	RES, 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
27	1	U1	IC, LTC7851EUHH#PBF, QFN, 5mm × 9mm	LINEAR TECH., LTC7851EUHH#PBF
28	4	U2, U3, U4, U5	IC, HIGH FREQUENCY DRMOS	FAIRCHILD, FDMF5820DC

### Additional Demo Board Circuit Components

1	0	C1-2, C2-2, C3-2, C1-3, C2-3, C3-3, C1-4, C2-4, C3-4, C20, C3, C6, C9, C15, C16, C17, C19, C25, C26, C29, C32	CAP, OPTIONAL 0603	
2	0	RT-2, RB-2, R1-2, R2-2, R3-2, RT-3, RB-3, R1-3, R2-3, R3-3, RT-4, RB-4, R1-4, R2-4, R3-4, R8, R9, R43, R46, R48, R57, R58, R61, R63, R65, R66, R74, R78, R85, R82, R69, R90, R96, R99, R100, R102, R105	RES, OPTIONAL 0603	
3	0	COUT21-COUT23, COUT27-COUT29, COUT33- COUT35, COUT39-COUT41	CAP, OPTIONAL 7343	
4	0	E11, E12, E15, E16, E18, E20	HARDWARE, OPTIONAL	
5	0	JP2-JP4	HARDWARE, OPTIONAL	

### Hardware: For Demo Board Only

1	24	E1-E10, E13, E14, E17, E19, E21-E30	TEST POINT, TURRET, .094" MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
2	4	J11, J12, J14, J15	CONN., BNC PC MOUNT	CONNEX, 112404
3	10	J1-J10	STUD, TESTPIN	PEM KFH-032-10

# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
4	10	J1-J10	RING, LUG #10	KEYSTONE, 8205, #10
5	10	J1-J10	WASHER, TIN PLATED BRASS	ANY #10, #10EXT BZ TN
6	20	J1-J10 X 2	NUT, BRASS 10-32	ANY #10-32
7	2	JP1, JP5	CONN, HEADER, 1×3, 2mm	WURTH ELEKTRONIK 62000311121
8	2	JP1, JP5	SHUNT, 2mm	WURTH ELEKTRONIK 60800213421
9	4	MT1, MT2, MT3, MT4	STANDOFF, NYLON, SNAP-ON, 0.500"	WURTH ELEKTRONIK 702936000

### DC2380A-A / DC2380A-B / DC2380A-C

#### Dynamic Load Circuits

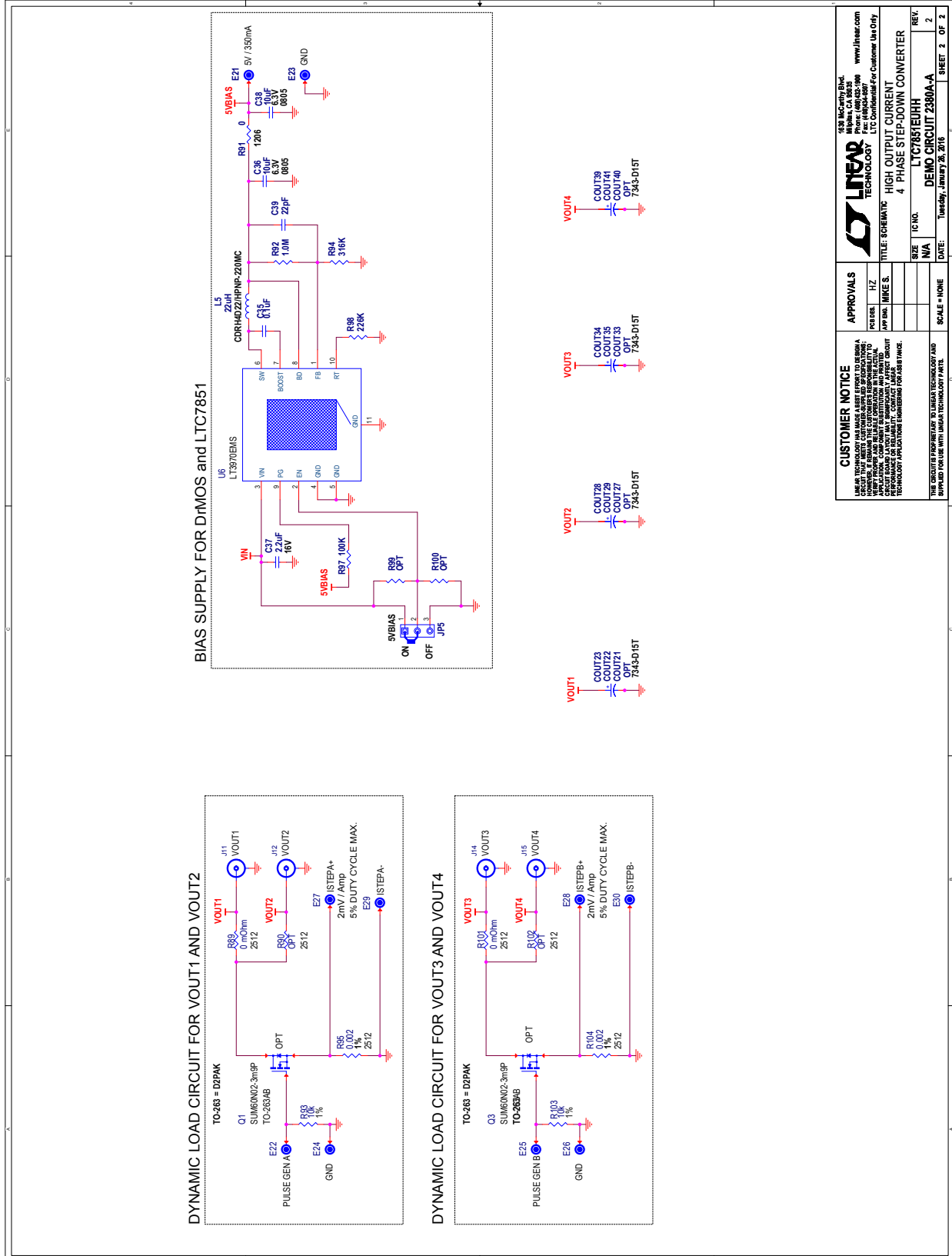
1	2	Q1, Q3	MOSFET N-CHANNEL 20V (D-S)	VISHAY SUM60N02-3M9P-E3
2	2	R95, R104	RES, SENSE, 0.002Ω, 1W, 2512	VISHAY, WSL25122L000FEA
3	2	R93, R103	RES., 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
4	2	R89, R101	RES, JUMPER, 0mΩ, 1W, 2512	TEPRO, RN5326

#### Bias Supply

1	1	L5	INDUCTOR, 22μH	SUMIDA, CDRH4D22HPNP-220MC
2	2	C36, C38	CAP, 10μF, X5R, 35V, 20%, 0805	TDK, C2012X5R1V106M085AC
3	1	C37	CAP, 2.2μF, X7R, 16V, 10%, 0603	MURATA, GRM188R61C225KE15D
4	1	C35	CAP, 0.1μF, X7R, 16V, 10%, 0603	AVX, 0603YC104KAT2A
5	1	C39	CAP, 22pF, COG, 50V, 10%, 0603	AVX, 06035A220KAT2A
6	1	R91	RES, 0Ω, 1/10W, 1206	VISHAY, CRCW12060000Z0EA
7	1	R92	RES, 1MΩ, 5%, 0603	VISHAY, CRCW06031M00JNED
8	1	R94	RES, 316k, 1/10W, 1%, 0603	VISHAY, CRCW0603316KFKEA
9	1	R98	RES, 226k, 1/10W, 1%, 0603	VISHAY, CRCW0603226KFKEA
10	1	R97	RES, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
11	1	U6	IC, LT3970EMS#PBF MSOP	LINEAR TECH., LT3970EMS#PBF



## SCHEMATIC DIAGRAM



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**TITLE** = SCHEMATIC HIGH OUTPUT CURRENT 4 PHASE STEP-DOWN CONVERTER

**REV.**

REV.	2
REV.	1

**DC2380A-A**

**DEMO CIRCUIT 2380A-A**

**LTC7851EUIH**

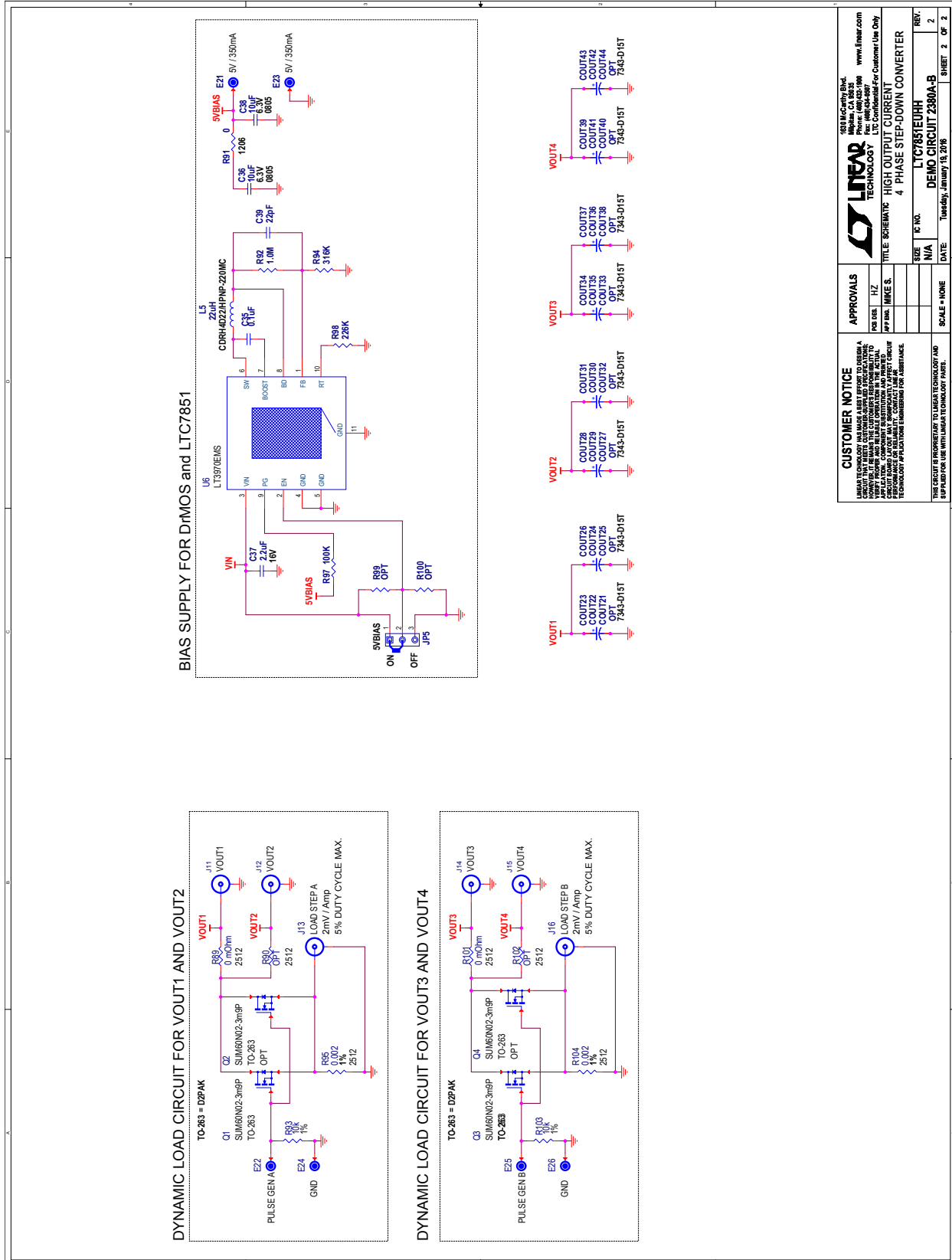
**SHEET 2 OF 2**

Figure 11. DC2380A-A Demo Circuit Schematic





## SCHEMATIC DIAGRAM



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Figure 13. DC2380A-B Demo Circuit Schematic





# DEMO MANUAL DC2380A-A/ DC2380A-B/DC2380A-C

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