

## Three-Channel Current Console with I2C Programmable Current DAC

### General Description

The uP1816P is a high precision current console consisting of three sets I2C programmable current DACs. Each current DAC is capable of sinking 128-step and sourcing 128-step output currents that are programmed by the I2C interface. The sinking and sourcing currents of OUT1, OUT2, and OUT3 are programmable for 2x boost respectively.

The uP1816P features soft-jump, easily interfacing with standard DC/DC converter for current console. The uP1816P is available in space-saving SOT23 - 8L and WDFN2x2 - 8L packages.

### Ordering Information

Order Number	Package	Top Marking
uP1816PMA8	SOT23-8L	S83P
uP1816PDN8	WDFN2x2-8L	EK

Note:

- (1) Please check the sample/production availability with uPI representatives.
- (2) uPI products are compatible with the current IPC/JEDEC J-STD-020 requirement. They are halogen-free, RoHS compliant and 100% matte tin (Sn) plating that are suitable for use in SnPb or Pb-free soldering processes.

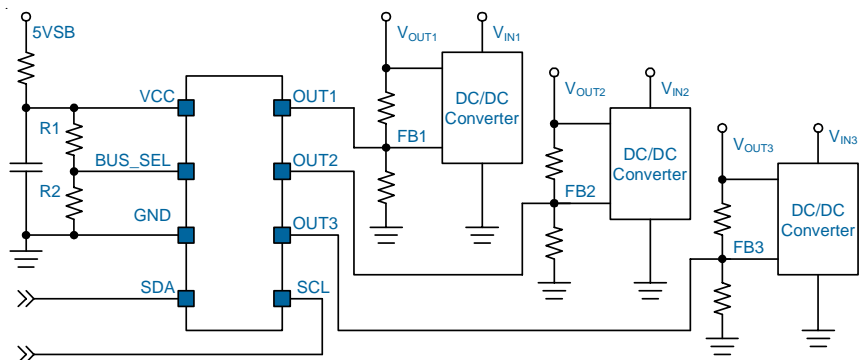
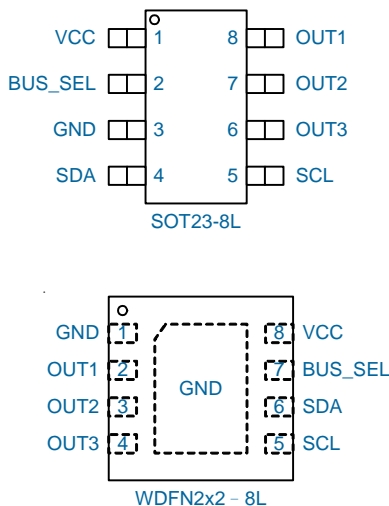
### Features

- Provide 3 Sets of Current DACs
  - 5% Accuracy
  - I2C Programmable 128-Step Sourcing Current
  - I2C Programmable 128-Step Sinking Current
  - Programmable Full Scale Current
- Internal Soft-Jump Function
- Low External Component Count
- Low Cost and Easy to Use
- Small Footprint in SOT23 - 8L and WDFN2x2 - 8L Packages
- RoHS Compliant and 100% Lead (Pb)- Free

### Applications

- Power Supply Adjustment for M/B and VGA
- Power Supply Margining
- Adjustable Current Sink and Source

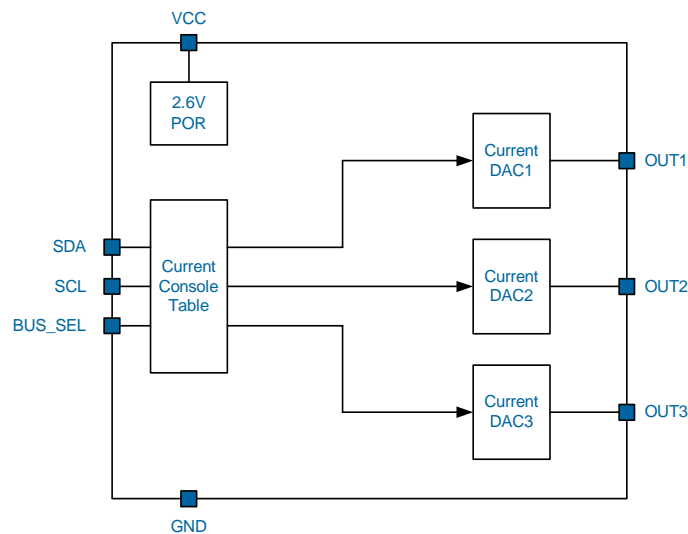
### Pin Configuration & Typical Application Circuit



## Functional Pin Description

Pin No.		Name	Pin Function
PMA8	PDN8		
1	8	VCC	<b>Supply Voltage Input.</b> This pin is power input of uP1816P. This pin is continuously monitored for power-on reset (POR). The POR threshold level is 2.6V. Connect this pin to 5VSB with a ceramic decoupling capacitor directly to GND pin.
2	7	BUS_SEL	<b>Bus Address Selection.</b> Connect a voltage divider to program the bus address of the uP1816P.
3	1	GND	<b>Ground.</b>
4	6	SDA	<b>Serial Data Input.</b> This pin is input or output of serial bus data signal.
5	5	SCL	<b>Serial Clock Input.</b> This pin receives serial bus clock signal.
6	4	OUT3	<b>Current Output 3.</b>
7	3	OUT2	<b>Current Output 2.</b>
8	2	OUT1	<b>Current Output 1.</b>
--	Exposed Pad		<b>Ground.</b> Tie this pin to ground island/plane through the lowest impedance connection available.

## Functional Block Diagram



## Functional Description

The uP1816P is a high precision current console consisting of three sets of I2C programmable current DACs. Each current DAC is capable of sinking 128-step and sourcing 128-step output currents that are programmed by the I2C interface. The sinking and sourcing currents of OUT1, OUT2 and OUT3 are programmable for 2x boost respectively.

The uP1816P features soft-jump, easily interfacing with standard DC/DC converter for current console. The uP1816P is available in space-saving SOT23 - 8L and WDFN2x2 - 8L packages.

### Power On Reset

The uP1816P continuously monitors supply voltage at VCC pin for power on reset circuit POR. The POR threshold at  $V_{CC}$  rising is typically 2.6V. All three current DAC outputs are disabled if the supply voltage is lower than the POR threshold level.

### I2C Address Programming

The uP1816P features user programmable address by a voltage divider from VCC-to-BUS\_SEL-to-GND as shown in the *Typical Application Circuit*. BUS\_SEL pin voltage is compared with internal reference voltage for address programming. There are total 6 addresses available. Table 1 illustrates recommended external voltage divider for address programming.

Table 1. Recommended Address Programming

Address	0x2A	0x28	0x26	0x24	0x22	0x20
R1 (k $\Omega$ )	open	3.9	3	2.2	1.3	10
R2 (k $\Omega$ )	10	1.3	2.2	3	3.9	open
BUS_SEL Voltage (% of VCC)	0	25	42	58	75	100

### I2C Programming Interface

The uP1816P integrates 3-channel current DAC OUT1, OUT2 and OUT3 that are programmed by Reg0x01, Reg0x02 and Reg0x03 respectively. Each output can sink 128-step current (0~1270uA) and source 128 step current (0~1270uA) as shown in Table 2. When bit 0, bit2, or bit 4 of Reg0x05 is set to 1, the corresponding output current has 2x value boost.

When the undefined value for Reg0x01~03 is selected, the output current will keep the last value.

### Soft Jump

The uP1816P features soft jump function that changes output current gradually to its final value. Each step takes about 10us. This makes the output voltage of accompanying DC/DC converter smooth transition to its final value, resulting in minimum inrush current from its supply input and avoiding false trigger of overcurrent protection.

### Bit 7 Transition

The uP1816P current DAC supports bit 7 direct transition (from 0 to 1 or 1 to 0) by using I2C program. In the transition, the output current is changed gradually and crosses zero to the new target by soft jump function. It increases/decreases from initial value to zero, and then keep increasing/decreasing to reach its final value. For example, when Reg0x01 is programmed from 0x8F to 0x0F, the output current transition is executed in an order as Reg0x01 = 0x80 -> 0x00 -> 0x0F.

### 0x04 Watchdog Timer Delay; Default 0x00

#### Bit 7: Enable Watchdog Timer

- 1: Start watchdog counter and reset all registers to default after time-out.
- 0: Stop watchdog counter and reset watchdog timer.

#### Bit 6: Watchdog Timer Status; Read Only

- This bit is set 1 when watchdog time-out happens.
- This bit is clear to 0 once this register is read out.

#### Bits 5~4: Watchdog Timer. Accuracy 50%

- 11: 11000ms
- 10: 5500ms
- 01: 2800ms
- 00: 1400ms

#### Bit 3~2: Step Speed Controller Delay

- 11: 40us
- 10: 30us
- 01: 20us
- 00: 10us

Bit 1~0: Version Identification

### 0x05 Current DAC control and Power Saving

#### Bit 7, 5, 3, 1: Reserved

#### Bit 6: Power Saving

- 1: Power saving function enabled
- 0: Power saving function disabled

#### Bit 4, 2, 0: Output current 2x for OUT3, OUT2, and OUT1

- 1: Output current 2x enabled
- 0: Output current 2x disabled

#### 0x5D Vendor ID1

#### 0x5E Vendor ID2

## Functional Description

Table 2. Current DAC Table with Bit7 = 0

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
0	0000,0000	0	0	0
1	0000,0001	-10	-10	-10
2	0000,0010	-20	-20	-20
3	0000,0011	-30	-30	-30
4	0000,0100	-40	-40	-40
5	0000,0101	-50	-50	-50
6	0000,0110	-60	-60	-60
7	0000,0111	-70	-70	-70
8	0000,1000	-80	-80	-80
9	0000,1001	-90	-90	-90
10	0000,1010	-100	-100	-100
11	0000,1011	-110	-110	-110
12	0000,1100	-120	-120	-120
13	0000,1101	-130	-130	-130
14	0000,1110	-140	-140	-140
15	0000,1111	-150	-150	-150
16	0001,0000	-160	-160	-160
17	0001,0001	-170	-170	-170
18	0001,0010	-180	-180	-180
19	0001,0011	-190	-190	-190
20	0001,0100	-200	-200	-200
21	0001,0101	-210	-210	-210
22	0001,0110	-220	-220	-220
23	0001,0111	-230	-230	-230
24	0001,1000	-240	-240	-240
25	0001,1001	-250	-250	-250
26	0001,1010	-260	-260	-260
27	0001,1011	-270	-270	-270
28	0001,1100	-280	-280	-280
29	0001,1101	-290	-290	-290
30	0001,1110	-300	-300	-300
31	0001,1111	-310	-310	-310

Table 2. Current DAC Table with Bit7 = 0 (cont.)

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
32	0010,0000	-320	-320	-320
33	0010,0001	-330	-330	-330
34	0010,0010	-340	-340	-340
35	0010,0011	-350	-350	-350
36	0010,0100	-360	-360	-360
37	0010,0101	-370	-370	-370
38	0010,0110	-380	-380	-380
39	0010,0111	-390	-390	-390
40	0010,1000	-400	-400	-400
41	0010,1001	-410	-410	-410
42	0010,1010	-420	-420	-420
43	0010,1011	-430	-430	-430
44	0010,1100	-440	-440	-440
45	0010,1101	-450	-450	-450
46	0010,1110	-460	-460	-460
47	0010,1111	-470	-470	-470
48	0011,0000	-480	-480	-480
49	0011,0001	-490	-490	-490
50	0011,0010	-500	-500	-500
51	0011,0011	-510	-510	-510
52	0011,0100	-520	-520	-520
53	0011,0101	-530	-530	-530
54	0011,0110	-540	-540	-540
55	0011,0111	-550	-550	-550
56	0011,1000	-560	-560	-560
57	0011,1001	-570	-570	-570
58	0011,1010	-580	-580	-580
59	0011,1011	-590	-590	-590
60	0011,1100	-600	-600	-600
61	0011,1101	-610	-610	-610
62	0011,1110	-620	-620	-620
63	0011,1111	-630	-630	-630

**Functional Description**

Table 2. Current DAC Table with Bit7 = 0 (cont.)

Table 2. Current DAC Table with Bit7 = 0 (cont.)

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
64	0100,0000	-640	-640	-640
65	0100,0001	-650	-650	-650
66	0100,0010	-660	-660	-660
67	0100,0011	-670	-670	-670
68	0100,0100	-680	-680	-680
69	0100,0101	-690	-690	-690
70	0100,0110	-700	-700	-700
71	0100,0111	-710	-710	-710
72	0100,1000	-720	-720	-720
73	0100,1001	-730	-730	-730
74	0100,1010	-740	-740	-740
75	0100,1011	-750	-750	-750
76	0100,1100	-760	-760	-760
77	0100,1101	-770	-770	-770
78	0100,1110	-780	-780	-780
79	0100,1111	-790	-790	-790
80	0101,0000	-800	-800	-800
81	0101,0001	-810	-810	-810
82	0101,0010	-820	-820	-820
83	0101,0011	-830	-830	-830
84	0101,0100	-840	-840	-840
85	0101,0101	-850	-850	-850
86	0101,0110	-860	-860	-860
87	0101,0111	-870	-870	-870
88	0101,1000	-880	-880	-880
89	0101,1001	-890	-890	-890
90	0101,1010	-900	-900	-900
91	0101,1011	-910	-910	-910
92	0101,1100	-920	-920	-920
93	0101,1101	-930	-930	-930
94	0101,1110	-940	-940	-940
95	0101,1111	-950	-950	-950

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
96	0110,0000	-960	-960	-960
97	0110,0001	-970	-970	-970
98	0110,0010	-980	-980	-980
99	0110,0011	-990	-990	-990
100	0110,0100	-1000	-1000	-1000
101	0110,0101	-1010	-1010	-1010
102	0110,0110	-1020	-1020	-1020
103	0110,0111	-1030	-1030	-1030
104	0110,1000	-1040	-1040	-1040
105	0110,1001	-1050	-1050	-1050
106	0110,1010	-1060	-1060	-1060
107	0110,1011	-1070	-1070	-1070
108	0110,1100	-1080	-1080	-1080
109	0110,1101	-1090	-1090	-1090
110	0110,1110	-1100	-1100	-1100
111	0110,1111	-1110	-1110	-1110
112	0111,0000	-1120	-1120	-1120
113	0111,0001	-1130	-1130	-1130
114	0111,0010	-1140	-1140	-1140
115	0111,0011	-1150	-1150	-1150
116	0111,0100	-1160	-1160	-1160
117	0111,0101	-1170	-1170	-1170
118	0111,0110	-1180	-1180	-1180
119	0111,0111	-1190	-1190	-1190
120	0111,1000	-1200	-1200	-1200
121	0111,1001	-1210	-1210	-1210
122	0111,1010	-1220	-1220	-1220
123	0111,1011	-1230	-1230	-1230
124	0111,1100	-1240	-1240	-1240
125	0111,1101	-1250	-1250	-1250
126	0111,1110	-1260	-1260	-1260
127	0111,1111	-1270	-1270	-1270

## Functional Description

Table 3. Current DAC Table with Bit7 = 1

Table 3. Current DAC Table with Bit7 = 1 (cont.)

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
0	1000,0000	0	0	0
1	1000,0001	10	10	10
2	1000,0010	20	20	20
3	1000,0011	30	30	30
4	1000,0100	40	40	40
5	1000,0101	50	50	50
6	1000,0110	60	60	60
7	1000,0111	70	70	70
8	1000,1000	80	80	80
9	1000,1001	90	90	90
10	1000,1010	100	100	100
11	1000,1011	110	110	110
12	1000,1100	120	120	120
13	1000,1101	130	130	130
14	1000,1110	140	140	140
15	1000,1111	150	150	150
16	1001,0000	160	160	160
17	1001,0001	170	170	170
18	1001,0010	180	180	180
19	1001,0011	190	190	190
20	1001,0100	200	200	200
21	1001,0101	210	210	210
22	1001,0110	220	220	220
23	1001,0111	230	230	230
24	1001,1000	240	240	240
25	1001,1001	250	250	250
26	1001,1010	260	260	260
27	1001,1011	270	270	270
28	1001,1100	280	280	280
29	1001,1101	290	290	290
30	1001,1110	300	300	300
31	1001,1111	310	310	310

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
32	1010,0000	320	320	320
33	1010,0001	330	330	330
34	1010,0010	340	340	340
35	1010,0011	350	350	350
36	1010,0100	360	360	360
37	1010,0101	370	370	370
38	1010,0110	380	380	380
39	1010,0111	390	390	390
40	1010,1000	400	400	400
41	1010,1001	410	410	410
42	1010,1010	420	420	420
43	1010,1011	430	430	430
44	1010,1100	440	440	440
45	1010,1101	450	450	450
46	1010,1110	460	460	460
47	1010,1111	470	470	470
48	1011,0000	480	480	480
49	1011,0001	490	490	490
50	1011,0010	500	500	500
51	1011,0011	510	510	510
52	1011,0100	520	520	520
53	1011,0101	530	530	530
54	1011,0110	540	540	540
55	1011,0111	550	550	550
56	1011,1000	560	560	560
57	1011,1001	570	570	570
58	1011,1010	580	580	580
59	1011,1011	590	590	590
60	1011,1100	600	600	600
61	1011,1101	610	610	610
62	1011,1110	620	620	620
63	1011,1111	630	630	630

**Functional Description**

Table 3. Current DAC Table with Bit7 = 1 (cont.)

Table 3. Current DAC Table with Bit7 = 1 (cont.)

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
64	1100,0000	640	640	640
65	1100,0001	650	650	650
66	1100,0010	660	660	660
67	1100,0011	670	670	670
68	1100,0100	680	680	680
69	1100,0101	690	690	690
70	1100,0110	700	700	700
71	1100,0111	710	710	710
72	1100,1000	720	720	720
73	1100,1001	730	730	730
74	1100,1010	740	740	740
75	1100,1011	750	750	750
76	1100,1100	760	760	760
77	1100,1101	770	770	770
78	1100,1110	780	780	780
79	1100,1111	790	790	790
80	1101,0000	800	800	800
81	1101,0001	810	810	810
82	1101,0010	820	820	820
83	1101,0011	830	830	830
84	1101,0100	840	840	840
85	1101,0101	850	850	850
86	1101,0110	860	860	860
87	1101,0111	870	870	870
88	1101,1000	880	880	880
89	1101,1001	890	890	890
90	1101,1010	900	900	900
91	1101,1011	910	910	910
92	1101,1100	920	920	920
93	1101,1101	930	930	930
94	1101,1110	940	940	940
95	1101,1111	950	950	950

Step	Bits 7~0	OUT1 (uA)	OUT2 (uA)	OUT3 (uA)
96	1110,0000	960	960	960
97	1110,0001	970	970	970
98	1110,0010	980	980	980
99	1110,0011	990	990	990
100	1110,0100	1000	1000	1000
101	1110,0101	1010	1010	1010
102	1110,0110	1020	1020	1020
103	1110,0111	1030	1030	1030
104	1110,1000	1040	1040	1040
105	1110,1001	1050	1050	1050
106	1110,1010	1060	1060	1060
107	1110,1011	1070	1070	1070
108	1110,1100	1080	1080	1080
109	1110,1101	1090	1090	1090
110	1110,1110	1100	1100	1100
111	1110,1111	1110	1110	1110
112	1111,0000	1120	1120	1120
113	1111,0001	1130	1130	1130
114	1111,0010	1140	1140	1140
115	1111,0011	1150	1150	1150
116	1111,0100	1160	1160	1160
117	1111,0101	1170	1170	1170
118	1111,0110	1180	1180	1180
119	1111,0111	1190	1190	1190
120	1111,1000	1200	1200	1200
121	1111,1001	1210	1210	1210
122	1111,1010	1220	1220	1220
123	1111,1011	1230	1230	1230
124	1111,1100	1240	1240	1240
125	1111,1101	1250	1250	1250
126	1111,1110	1260	1260	1260
127	1111,1111	1270	1270	1270

## Absolute Maximum Rating

(Note 1)

Supply Input Voltage $V_{CC}$	-----	-0.3V to +6V
Other Pins	-----	-0.3V to ( $V_{CC} + 0.3V$ )
Storage Temperature Range	-----	-65°C to +150°C
Junction Temperature	-----	150°C
Lead Temperature (Soldering, 10 sec)	-----	260°C
ESD Rating (Note 2)		
HBM (Human Body Mode)	-----	2kV
MM (Machine Mode)	-----	200V

## Thermal Information

Package Thermal Resistance (Note 3)

SOT23 - 8L $\theta_{JA}$	-----	250°C/W
SOT23 - 8L $\theta_{JC}$	-----	140°C/W
WDFN2x2 - 8L $\theta_{JA}$	-----	155°C/W
WDFN2x2 - 8L $\theta_{JC}$	-----	20°C/W
Power Dissipation, $P_D$ @ $T_A = 25^\circ\text{C}$		
SOT23 - 8L	-----	0.4W
WDFN2x2 - 8L	-----	0.625W

## Recommended Operation Conditions

(Note 4)

Operating Junction Temperature Range	-----	-40°C to +125°C
Operating Ambient Temperature Range	-----	-40°C to +85°C
Supply Input Voltage, $V_{CC}$	-----	+3V to +5.5V

- Note 1.** Stresses listed as the above *Absolute Maximum Ratings* may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.
- Note 2.** Devices are ESD sensitive. Handling precaution recommended.
- Note 3.**  $\theta_{JA}$  is measured in the natural convection at  $T_A = 25^\circ\text{C}$  on a low effective thermal conductivity test board of JEDEC 51-3 thermal measurement standard.
- Note 4.** The device is not guaranteed to function outside its operating conditions.



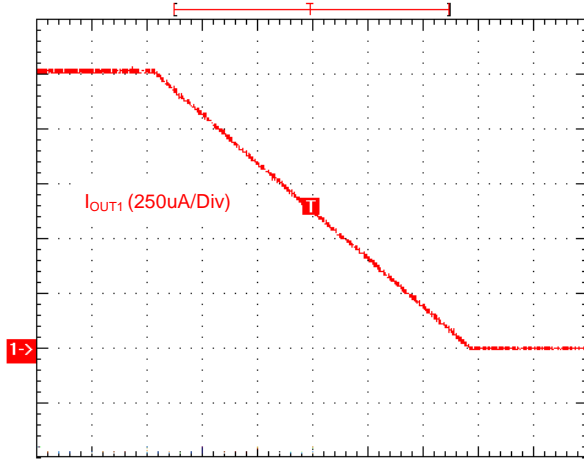
**Electrical Characteristics**

 ( $V_{CC} = 5V$ ,  $T_A = 25^\circ C$ , unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Supply Input Voltage</b>						
POR Threshold	$V_{CC\_RTH}$		--	2.6	--	V
Supply Input Current	$I_{CC}$	$I_{OUT1} = I_{OUT2} = I_{OUT3} = 0\mu A$	0.5	--	1.5	mA
Supply Input Current in Power Saving Mode	$I_{CC\_PSM}$	$I_{OUT1} = I_{OUT2} = I_{OUT3} = 0\mu A$	0.3	--	0.6	mA
Input High Leakage	$I_{IH}$		--	--	1	$\mu A$
Input Low Leakage	$I_{IL}$		-1	--	--	$\mu A$
<b>Current DAC Output</b>						
Output Offset Current	$I_{OUT\_OFST}$	$I_{OUT}$ programmed as $0\mu A$ , $V_{OUT} = 0V \sim 5V$	-1	--	1	$\mu A$
Output Current Accuracy		$I_{OUT}$ programmed as $110\mu A \sim 2540\mu A$ , $V_{OUT} = 0.8V$	-5	--	+5	%
		$I_{OUT}$ programmed as $0\mu A \sim 100\mu A$ , $V_{OUT} = 0.8V$	-5	--	+5	$\mu A$
Output Current Line Regulation		$I_{OUT}$ sinking, $V_{OUT} = 0.5V \sim V_{CC} - 1V$	-1.2	--	+1.2	%/V
		$I_{OUT}$ sourcing, $V_{OUT} = 0.5V \sim V_{CC} - 1V$	-1	--	+1	%/V
Step Speed Accuracy			--	80	--	%
Watchdog Delay Accuracy			--	80	--	%
<b>I2C Interface</b>						
SCL, SDA Input High Level	$V_{IH}$		2.1	--	$V_{PULLUP}$	V
SCL, SDA Input Low Level	$V_{IL}$		--	--	0.6	V
SDA Output Low Voltage	$V_{OL}$	$I_{OL} = I_{PULLUP}$	--	--	0.4	V
Nominal Pullup Voltage	$V_{PULLUP}$		2.7	--	5.5	V
Current Sinking	$I_{PULLUP}$	$V_{OL} = 0.4V$	12	--	--	mA
<b>Address Selection</b>						
Adress 1 Voltage Range		Address = 0x2A	--	--	15	% $V_{CC}$
Adress 2 Voltage Range		Address = 0x28	20	25	30	% $V_{CC}$
Adress 3 Voltage Range		Address = 0x26	37	42	47	% $V_{CC}$
Adress 4 Voltage Range		Address = 0x24	53	58	62	% $V_{CC}$
Adress 5 Voltage Range		Address = 0x22	70	75	80	% $V_{CC}$
Adress 6 Voltage Range		Address = 0x20	85	--	--	% $V_{CC}$

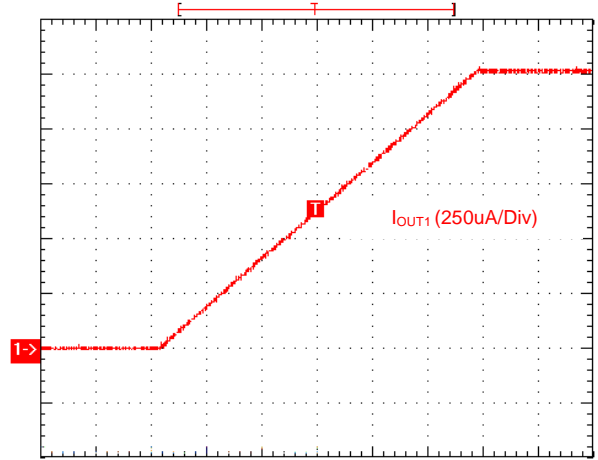
**Typical Operation Characteristics**

**Output Current Transition**



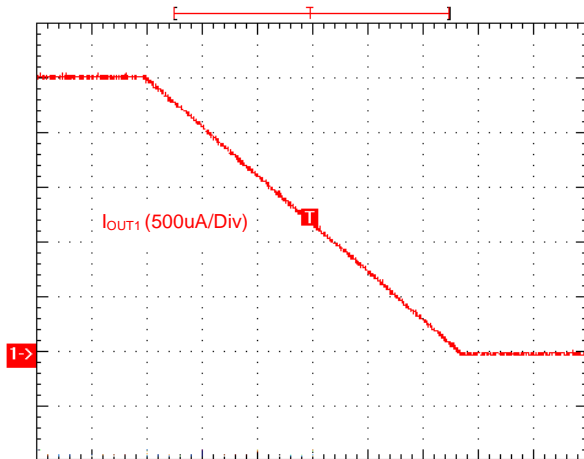
200us/Div  
Reg0x01 = 00 to 7F, Reg0x05 bit 0 = 0  
Output Voltage = 0.8V

**Output Current Transition**



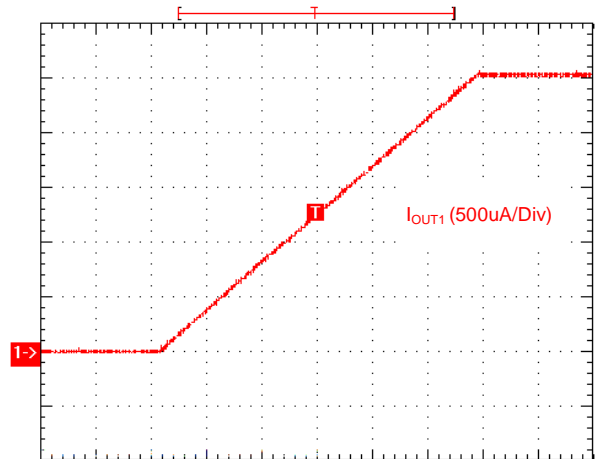
200us/Div  
Reg0x01 = 80 to FF, Reg0x05 bit 0 = 0  
Output Voltage = 0.8V

**Output Current Transition**



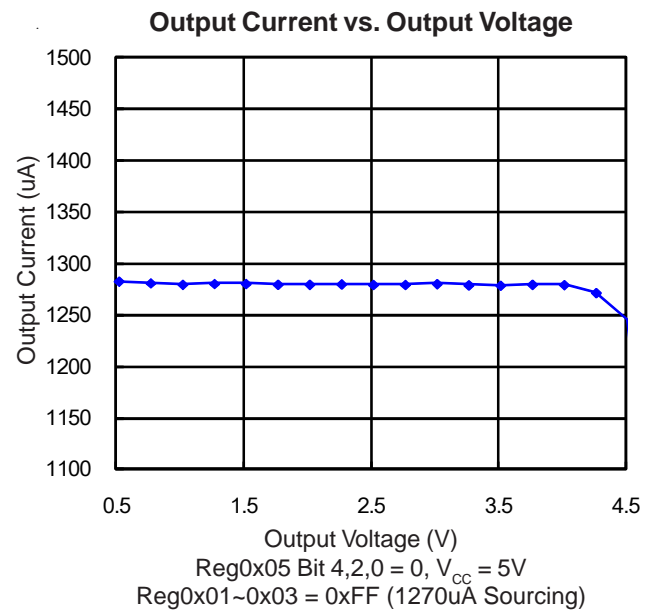
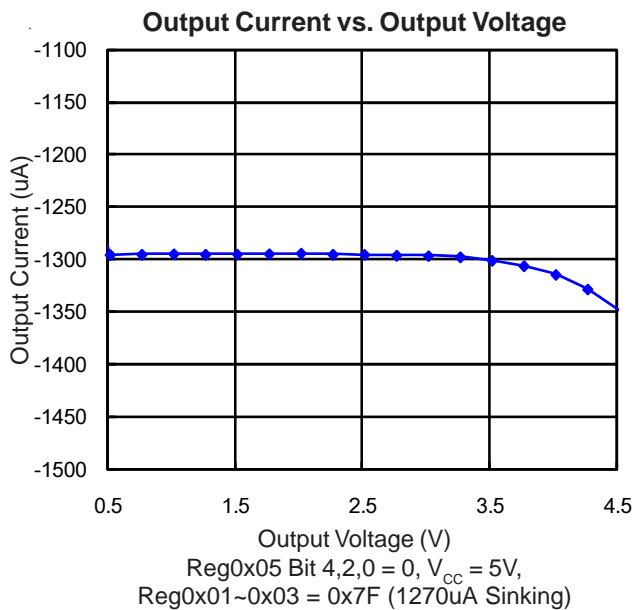
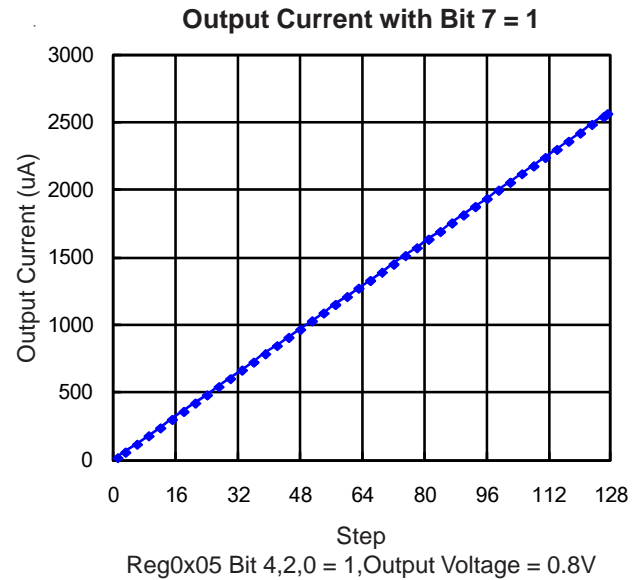
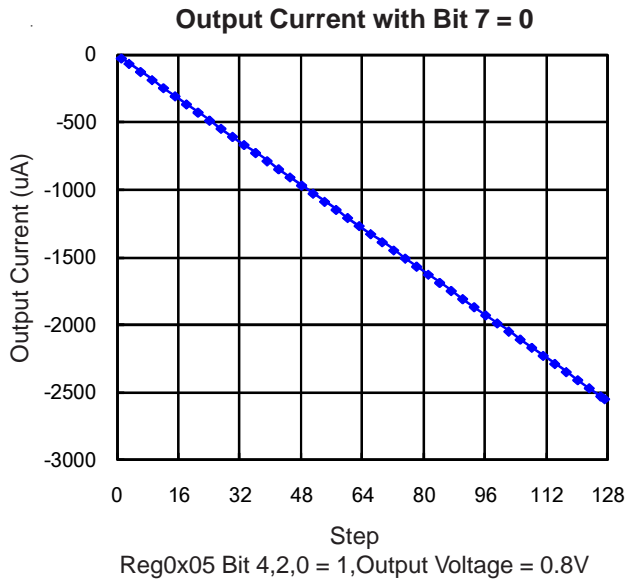
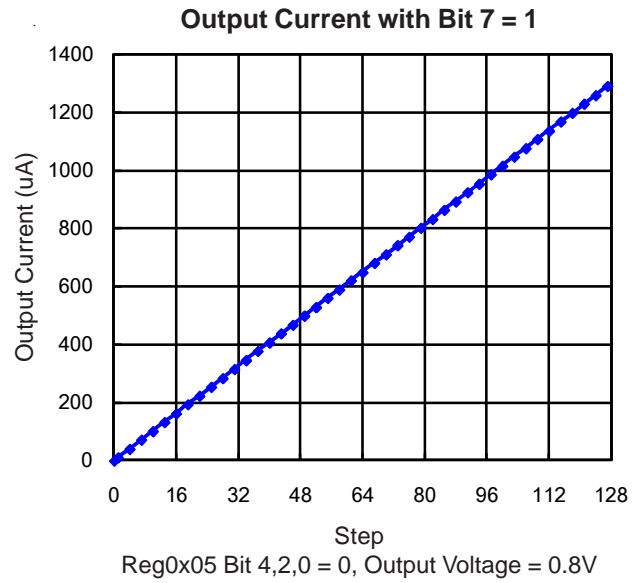
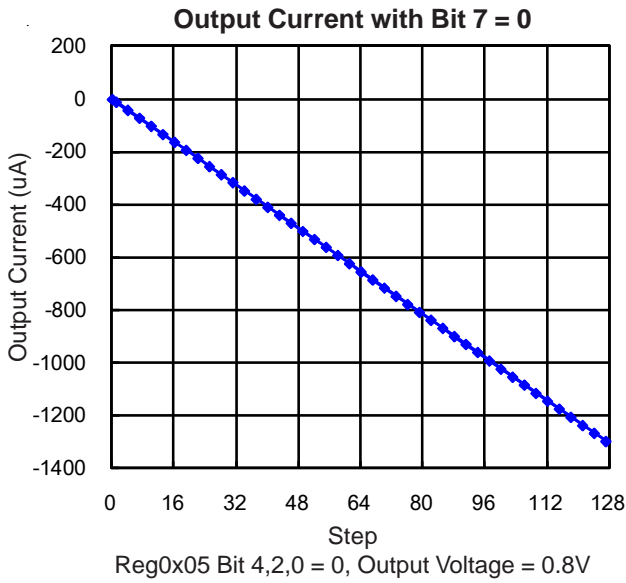
200us/Div  
Reg0x01 = 00 to 7F, Reg0x05 bit 0 = 1  
Output Voltage = 0.8V

**Output Current Transition**



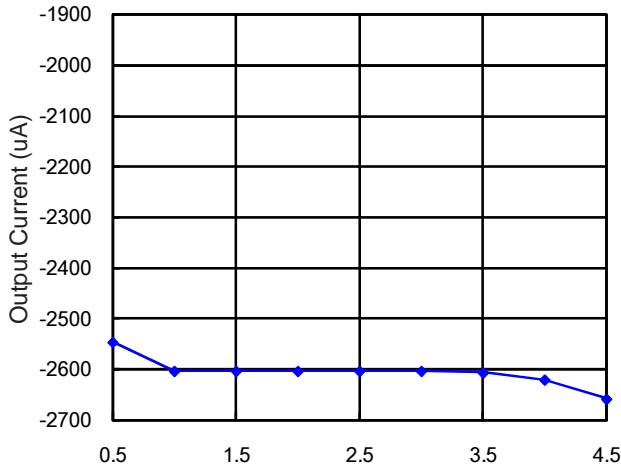
200us/Div  
Reg0x01 = 80 to FF, Reg0x05 bit 0 = 1  
Output Voltage = 0.8V

## Typical Operation Characteristics



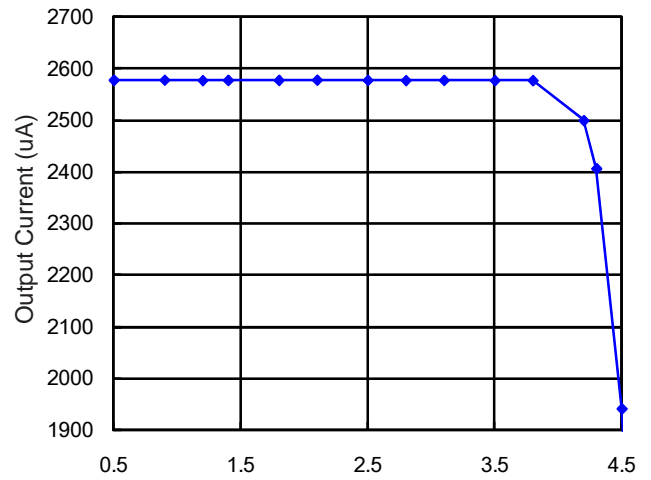
**Typical Operation Characteristics**

**Output Current vs. Output Voltage**



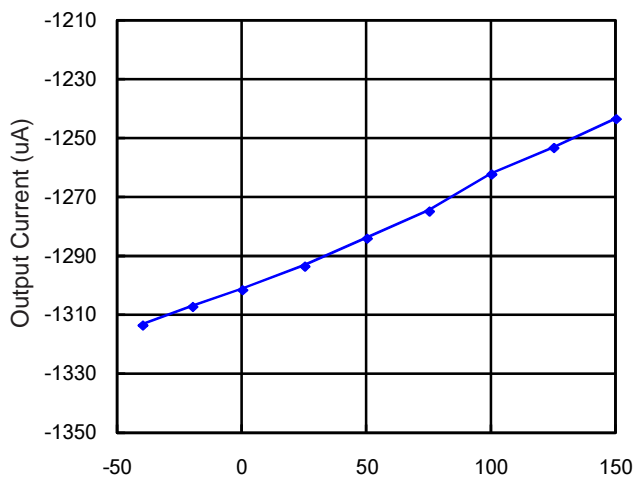
Output Voltage (V)  
Reg0x05 Bit 4,2,0 = 1,  $V_{CC} = 5V$   
Reg0x01~0x03 = 0x7F (2540 uA Sinking)

**Output Current vs. Output Voltage**



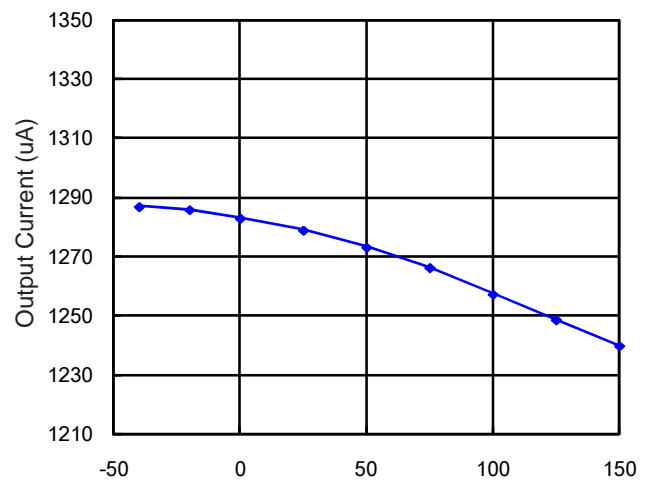
Output Voltage (V)  
Reg0x05 Bit 4,2,0 = 1,  $V_{CC} = 5V$   
Reg0x01~0x03 = 0xFF (2540 uA Sourcing)

**Output Current vs. Junction Temperature**



Junction Temperature (°C)  
Reg0x05 Bit 4,2,0 = 0  
Reg0x01~0x03 = 0x7F (1270 uA Sinking)

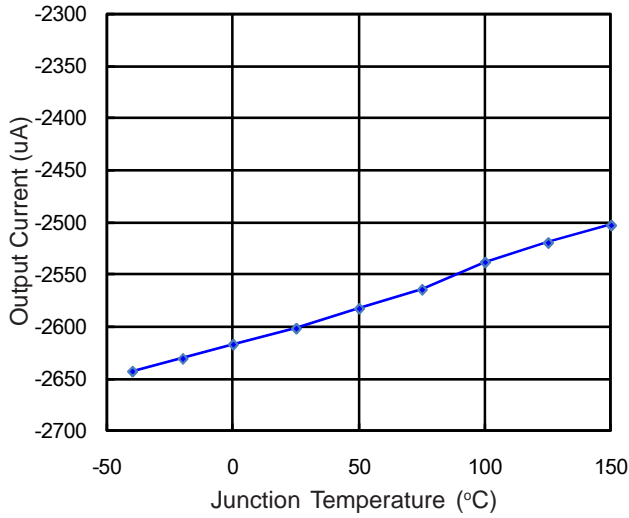
**Output Current vs. Junction Temperature**



Junction Temperature (°C)  
Reg0x05 Bit 4,2,0 = 0  
Reg0x01~0x03 = 0xFF (1270 uA Sourcing)

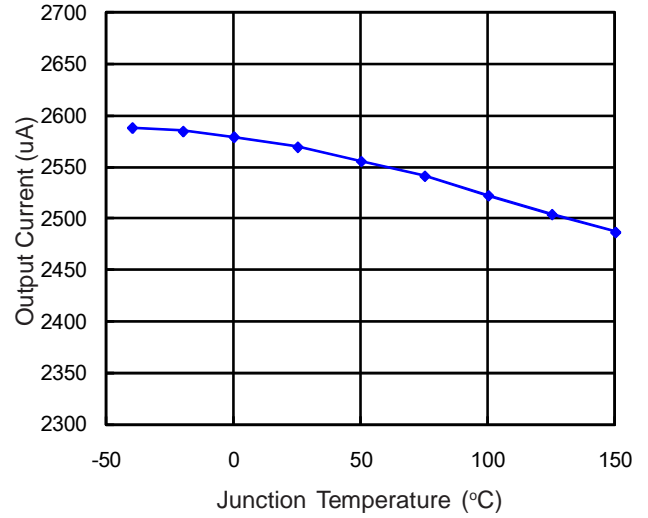
**Typical Operation Characteristics**

**Output Current vs. Junction Temperature**



Reg0x05 Bit 4,2,0 = 1  
Reg0x01~0x03 = 0x7F (2540 uA Sinking)

**Output Current vs. Junction Temperature**



Reg0x05 Bit 4,2,0 = 1  
Reg0x01~0x03 = 0xFF (2540 uA Sourcing)

## Application Information

The uP1816P is a high precision current console consisting of three sets I2C programmable current DACs. Each current DAC is capable of sinking 128-step and sourcing 128-step output current that are programmed by the I2C interface. The sinking and sourcing current of OUT1, OUT2 and OUT3 are programmable for 2x boost respectively.

The uP1816P features soft-jump, easily interfacing with standard DC/DC converter for current console. The uP1816P is available in space-saving SOT23 - 8L and WDFN2x2 - 8L package.

### Output Voltage Programming of DC/DC Converter

Figure 2 shows a typical interface between uP1816P and a general-purposed DC/DC converter. It is convenient to program the output voltage  $V_{OUT}$  by selecting appropriate output current  $I_{OUT}$  of uP1816P.

The output voltage difference when  $I_{OUT}$  is applied is calculated as:

$$\Delta V_{OUT} = V_{OUT} - V_{OUT\_NORM} = -I_{OUT} \times R1$$

For example, if  $I_{OUT} = -630\mu A$  (sinking) is selected and  $R1 = 1k\Omega$ , the output voltage will increase by amount as:

$$\Delta V_{OUT} = 630\mu A \times 1k\Omega = 0.63V$$

It is noted the above calculation is independent of R2. Users can select R2 according to required nominal output voltage.

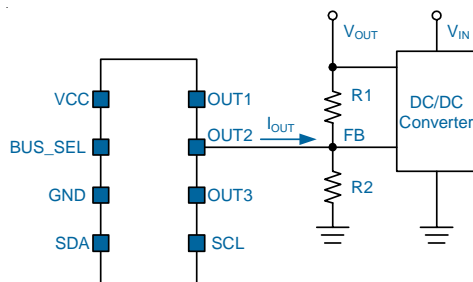


Figure 2. Interfacing the uP1816P and DC/DC Converter

### Extra Current for Charging/Discharging Output Capacitor

Extra current besides normal loading is required to charge/discharge the output capacitors to its new level when the output voltage is making transition due to  $I_{OUT}$  change of uP1816P. For example,  $I_{OUT}$  changes from  $0\mu A$  to  $-630\mu A$  in 63 steps and  $\Delta V_{OUT}$  changes from  $0V$  to  $0.63V$  accordingly. It takes about  $630\mu s$  for  $I_{OUT}$  to change from  $0\mu A$  to  $-630\mu A$ . The extra current to charge the output capacitor  $C_{OUT} = 2000\mu F$  is calculated as:

$$I_{EXTRA} = \frac{C_{OUT} \times \Delta V_{OUT}}{\Delta T} = \frac{2000\mu F \times 0.63V}{630\mu s} = 2A$$

Make sure the DC/DC converter can afford the extra current without false triggering any protection functions.

### Layout Consideration

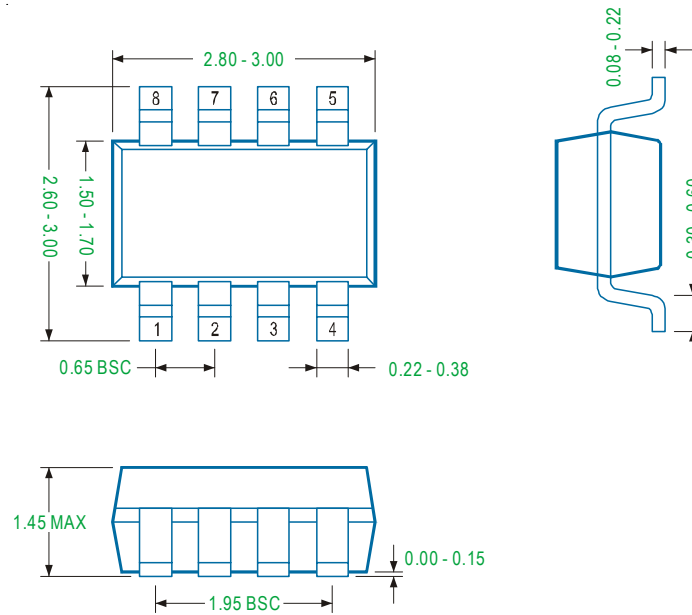
PCB layout is an important part of design for uP1816P. The FB pin of the DC/DC converter is a noise sensitive pin. Great care should be taken when placing the parts and routing the FB trace.

Place the uP1816P physically near the FB pin of the DC/DC converter. Keep the FB traces short and away from noisy nodes to avoid noise pick-up.

### Check Transient Response and Stability

Even though the output impedance of uP1816P is quite high over a wide frequency range, the insertion of uP1816P does affect voltage control loop design of the DC/DC converter. It is highly recommended to check the transient response and stability of the converter when uP1816P is applied.

**SOT23 - 8L**



**Note**

**1. Package Outline Unit Description:**

BSC: Basic. Represents theoretical exact dimension or dimension target

MIN: Minimum dimension specified.

MAX: Maximum dimension specified.

REF: Reference. Represents dimension for reference use only. This value is not a device specification.

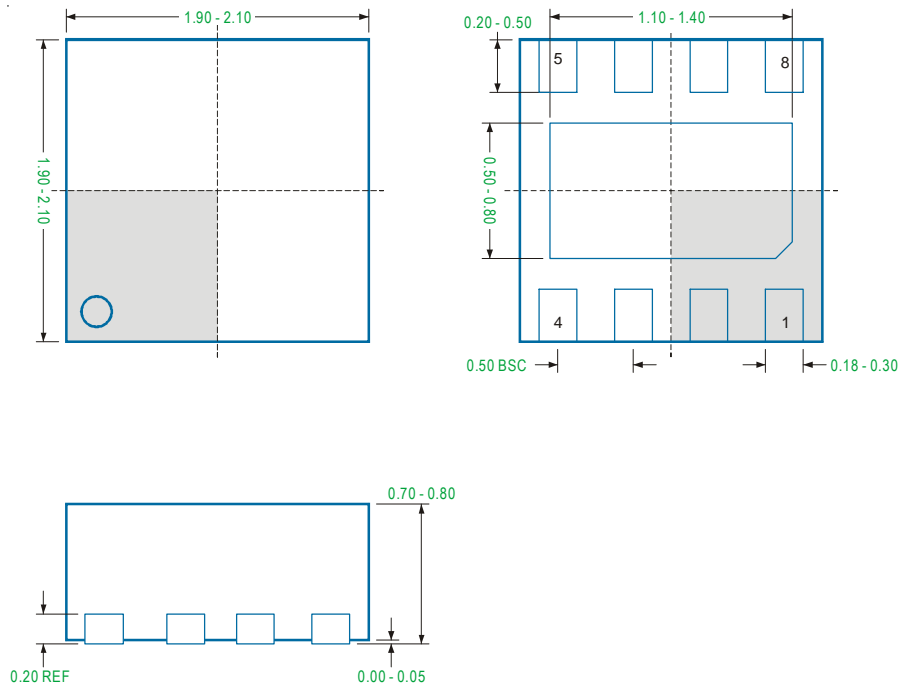
TYP: Typical. Provided as a general value. This value is not a device specification.

**2. Dimensions in Millimeters.**

**3. Drawing not to scale.**

**4. These dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm.**

WDFN2x2 - 8L



Note

1. Package Outline Unit Description:

BSC: Basic. Represents theoretical exact dimension or dimension target

MIN: Minimum dimension specified.

MAX: Maximum dimension specified.

REF: Reference. Represents dimension for reference use only. This value is not a device specification.

TYP: Typical. Provided as a general value. This value is not a device specification.

2. Dimensions in Millimeters.

3. Drawing not to scale.

4. These dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm.



### Important Notice

UPI and its subsidiaries reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

UPI products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment. However, no responsibility is assumed by UPI or its subsidiaries for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of UPI or its subsidiaries.

COPYRIGHT (c) 2013, UPI SEMICONDUCTOR CORP.

#### **UPI Semiconductor Corp.**

Headquarter

9F.,No.5, Taiyuan 1st St. Zhubei City,  
Hsinchu Taiwan, R.O.C.

TEL : 886.3.560.1666 FAX : 886.3.560.1888

Sales Branch Office

12F-5, No. 408, Ruiguang Rd. Neihu District,  
Taipei Taiwan, R.O.C.

TEL : 886.2.8751.2062 FAX : 886.2.8751.5064