General Description

The OCP1410 is a 1A LDO equipped with NMOS pass transistor and a separate bias supply voltage (V_{BIAS}).

The device provides very stable, accurate output voltage with low noise suitable for space constrained, noise sensitive applications, In order to optimize performance for battery operated portable applications, the OCP1410 features low IQ consumption.

The OCP1410 is available in 1.17mm x 0.77mm WLCSP-6B package, and it is RoHS compliant and 100% lead Pb free. Operating temperature range of the OCP1410 is from -40°C to 85°C.

Features

- Ultra-Low Dropout: Typ. 60mV at 1A
- ±1% Accuracy over Temperature, ±0.5% VOUT @25℃
- Adjustable and Fixed voltage version available
- Output voltage range: 0.4V to 2.4V (Fixed)
  0.5V to 3.0V (Adjustable)
- Input voltage range: V_{OUT} to 5.5V
- Bias voltage range: 3.0V to 5.5V
- Very low Bias input current of Typ. 38μA
- Very low Bias input current in Disable mode: Typ. 0.5μA
- Logic Level Enable Input for ON/OFF Control
- Output Active Discharge Available
- Stable with a 10μF Ceramic Capacitor
- Available in WLCSP6 − 1.17 mm x 0.77 mm, 0.4 mm pitch Package
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Smart-phones
- Tablets
- Cameras
- Battery powered equipment
- DVRS
- STP
- Camcorders

Pin Configuration

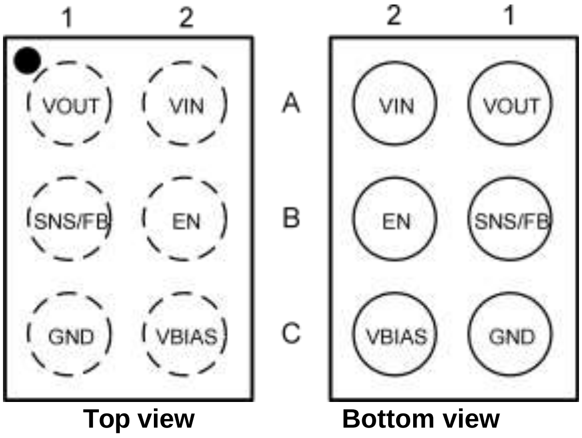


Figure 1, Pin Assignments of OCP1410

Pin Name	Pin No.	Pin Function
	WLCSP6B	
VOUT	A1	Regulated output voltage pin
VIN	A2	Input voltage pin
VBIAS	C2	Bias voltage for internal control circuits. This pin is monitored by internal Under-Voltage Lockout Circuit.
EN	B2	Enable pin. Driving this pin high enables the regulator. Driving this pin low puts the regulator into shutdown mode.
SNS（FIX）	B1	Output voltage Sensing Input pin. Connect to output on the PCB to output the voltage corresponding to the part version.
FB（ADJ）	B1	Adjustable regulator feedback input. Connect to output voltage resistor divider central node.
GND	C1	Ground pin.

Typical Application Circuit

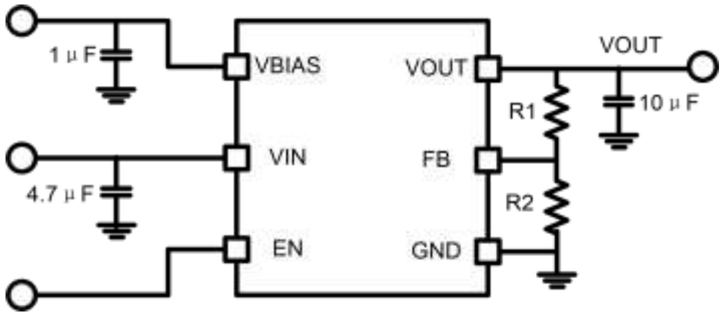


Figure 2(A), Typical Application Schematics at Adjustable mode

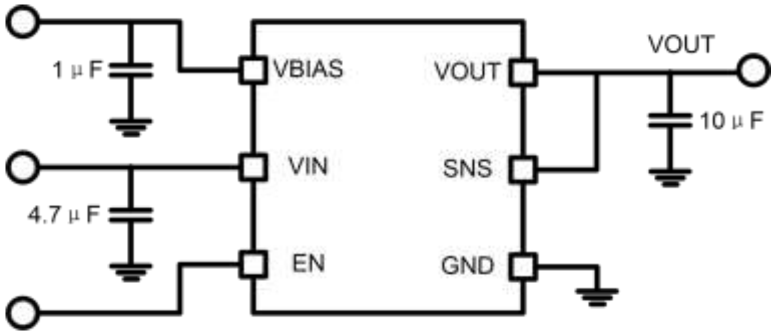


Figure 2(B), Typical Application Schematics at Fixed mode

■ Block Diagram

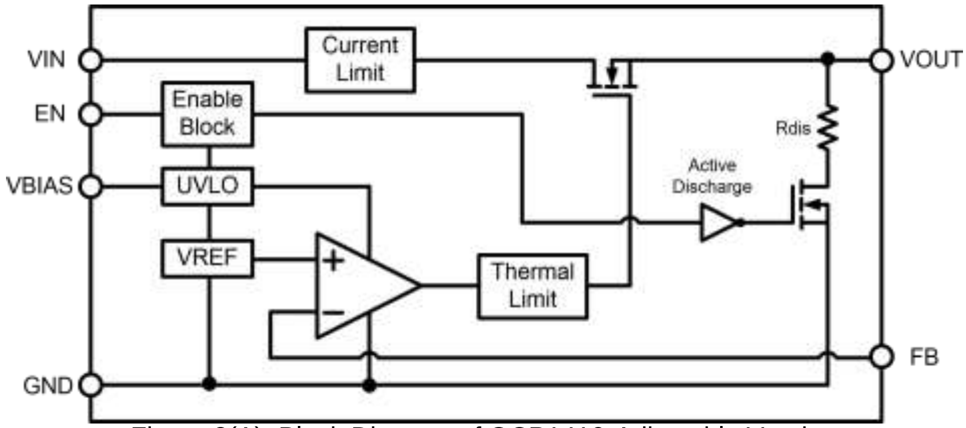


Figure 3(A), Block Diagram of OCP1410-Adjustable Version

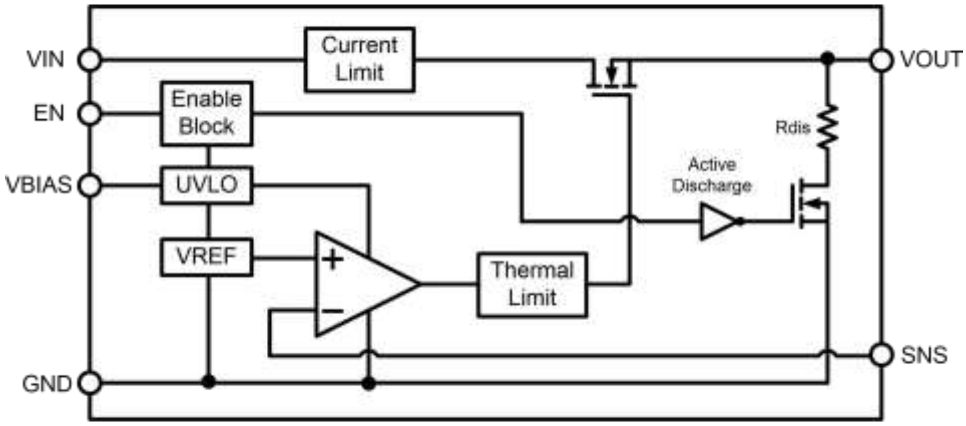


Figure 3(B), Block Diagram of OCP1410-Fixed Version

■ Absolute Maximum Ratings[1] (T_A=25°C unless otherwise noted)

Parameter	Symbol	Rating	Unit
Voltage at V_{IN}	V_{IN}	-0.3 to 6	V
Voltage at V_{BIAS}	V_{BIAS}	-0.3 to 6	V
Voltage at V_{OUT}	V_{OUT}	-0.3 to (VIN+0.3)≤6	V
Voltage at EN, FB/SNS	V_{EN}, V_{FB}/V_{SNS}	-0.3 to 6	V
Operating Junction Temperature Range	T_J	-40 to 150	℃
Storage Temperature Range	Ts	-40 to 150	℃
ESD Capability, HBM	ESD-HBM	2000	V
ESD Capability, CDM	ESD-CDM	500	V
Thermal Characteristics, WLCSP6 1.18 mm x 0.78 mm Thermal Resistance, Junction−to−Air	$R_{θJA}$	69	℃/W

■ Recommended Operating Conditions (T_A=25°C unless otherwise noted)

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	VIN	Operating	（VOUT+ V_{DO}）~5.5	V
Supply Voltage	VBIAS	Operating	3.0~5.5	V
Operating Temperature Range	T_A	Operating	-40 ~ +85	℃

■ Electrical Characteristics

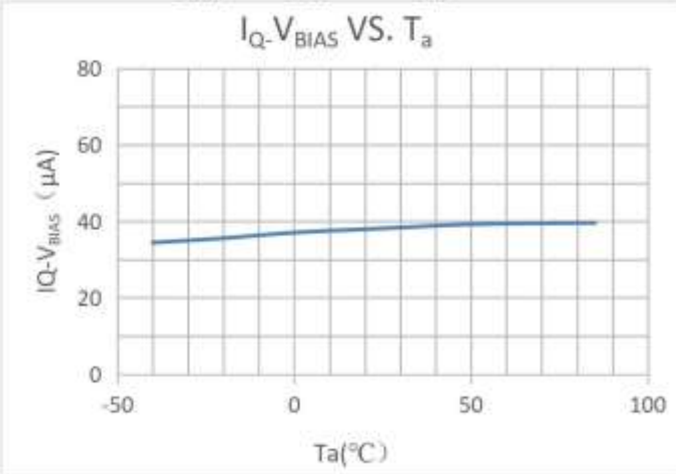
(Unless otherwise noted, typical values are at Ta=25°C,V_{BIAS}=3.0V or （V_{OUT}+1.6V）,whichever is greater ,V_{IN}=$V_{OUT(NOM)}$ +0.3V,I_{OUT}=1mA,V_{EN}=1V,C_{IN}=4.7μF,C_{OUT}=10μF,C_{BIAS}=1μF)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Power supply		V_{OUT}+V_{DO}	-	5.5	V
V_{BIAS}	Power supply		(V_{OUT}+1.6)≥3.0	-	5.5	V
I_Q	V_{BIAS} Input Current	V_{BIAS}=3.0V, I_{OUT}=0mA	-	38	50	μA
I_{SD}	V_{BIAS} Input Current	V_{EN} ≤ 0.4V	-	0.5	1	μA
	V_{IN} Input Current	V_{EN} ≤ 0.4V	-	0.5	1	μA
UVLO	Under voltage Lockout	V_{BIAS} Rising	-	1.7	-	V
		Hysteresis	-	0.2	-	V
V_{REF}	Reference voltage (Adj version)		-	0.5	-	V
V_{OUT}	Output Voltage Accuracy		-	±0.5		%
	Output Voltage Accuracy	−40°C ≤TJ ≤85°C, $V_{OUT(NOM)}$ + 0.3 V≤V_{IN} ≤$V_{OUT(NOM)}$ + 1.0 V, 3.0 V or ($V_{OUT(NOM)}$ + 1.6 V), whichever is greater < V_{BIAS}< 5.5 V, 1mA < I_{OUT}< 1 A (Note 5)	-1.0	-	1.0	%
LR	V_{IN} Line Regulation	V_{OUT}+0.3V≤V_{IN}≤5.0V	-	0.01	-	%/V
LR	V_{BIAS} Line Regulation	3.0V or (V_{OUT}+1.6V), whichever is greater<V_{BIAS}<5.5V	-	0.01	-	%/V
LDR	Load Regulation	I_{OUT}=1.0mA to 1.0A	-	2.0	-	mV
V_{DO}	V_{IN} Dropout Voltage	I_{OUT} = 1.0A (Notes 1,2)	-	60	90	mV
	V_{BIAS} Dropout Voltage	I_{OUT} = 1.0A, V_{IN} = V_{BIAS} (Notes 1,3,4)	-	1.05	1.5	V
I_{CL}	Output Current Limit	V_{OUT} = 90%$V_{OUT(NOM)}$	1.7	2.3	3.0	A
$I_{FB/SNS}$	FB/SNS Pin Operating Current		-	0.1	0.5	μA
V_{ENH}	EN Pin Threshold Voltage	V_{EN} Logic Voltage H	0.9	-	-	V
V_{ENL}		V_{EN} Logic Voltage L	-	-	0.4	V
T_{ON}	Turn-on Time	From assertion of V_{EN} to V_{OUT} = 98% $V_{OUT(NOM)}$. $V_{OUT(NOM)}$ = 1 V, C_{OUT} = 10μF	-	240	-	μs
PSRR	Power Supply Rejection Ratio (Adj Version)	V_{IN} to V_{OUT}, f = 1kHz, I_{OUT} = 10mA, V_{IN} ≥ V_{OUT} +0.5V, $V_{OUT(NOM)}$ = 1V, C_{OUT} = 10μF	-	75	-	dB
		V_{BIAS} to V_{OUT}, f = 1kHz, I_{OUT} = 10mA, V_{IN} ≥ V_{OUT} +0.5V, $V_{OUT(NOM)}$ = 1V, C_{OUT} = 10μF	-	85	-	dB
	Power Supply Rejection Ratio (Fixed Version)	V_{IN} to V_{OUT}, f = 1kHz, I_{OUT} = 10mA, V_{IN} ≥ V_{OUT} +0.5V, $V_{OUT(NOM)}$ = 1.8V, COUT = 10μF	-	72	-	dB
		V_{BIAS} to V_{OUT}, f = 1kHz, I_{OUT} = 10 mA, V_{IN} ≥ V_{OUT} +0.5V, $V_{OUT(NOM)}$ = 1.8V, V_{BIAS} = 4.0V, C_{OUT} = 10μF	-	75	-	dB
V_N	Output Noise Voltage (Fix Version)	V_{IN} = V_{OUT} +0.5V, f = 10Hz to 100kHz, $V_{OUT(NOM)}$ = 1.0V, C_{OUT} = 10μF, I_{OUT}=0A		48		$μV_{RMS}$
		V_{IN} = V_{OUT} +0.5V, f = 10Hz to 100kHz, $V_{OUT(NOM)}$ = 1.0V, C_{OUT} = 10μF, I_{OUT}=0.6A		130		$μV_{RMS}$
		V_{IN} = V_{OUT} +0.5V, f = 10Hz to 100kHz, $V_{OUT(NOM)}$ = 1.8V, C_{OUT} = 10μF, I_{OUT}=1A		130		$μV_{RMS}$
OTP	Thermal Shutdown Threshold	Temperature increasing		160		°C
		Temperature decreasing		140		
R_{DIS}	Output Discharge Pull−Down	V_{EN} ≤ 0.4 V, V_{OUT} = 0.5 V,		80		Ω

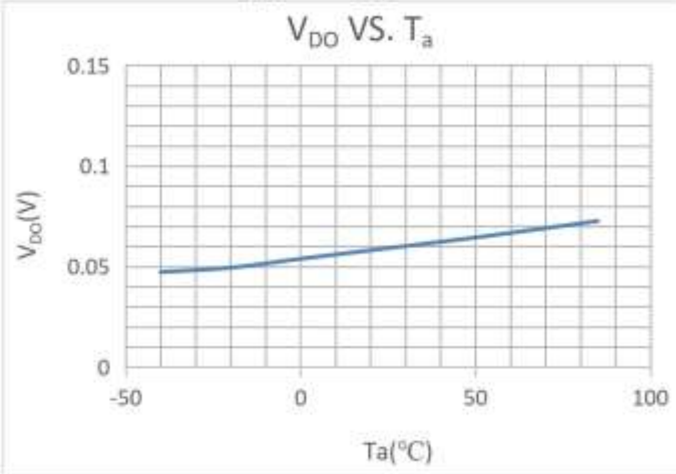
1. Dropout voltage is characterized when V_{OUT} falls 3% below $V_{OUT(NOM)}$.
2. For adjustable devices, V_{IN} dropout voltage tested at $V_{OUT(NOM)}$ = 2 x V_{REF}.
3. For adjustable devices, V_{BIAS} dropout voltage tested at $V_{OUT(NOM)}$=3 x V_{REF} due to a minimum VBias operating voltage of 3.0V.
4. For Fixed Voltages below1.8V, V_{BIAS} dropout voltage does not apply due to a minimum Bias operating voltage of 3.0V.
5. This parameter is guaranteed by design and characterization, not production tested.

■ Electrical Characteristics

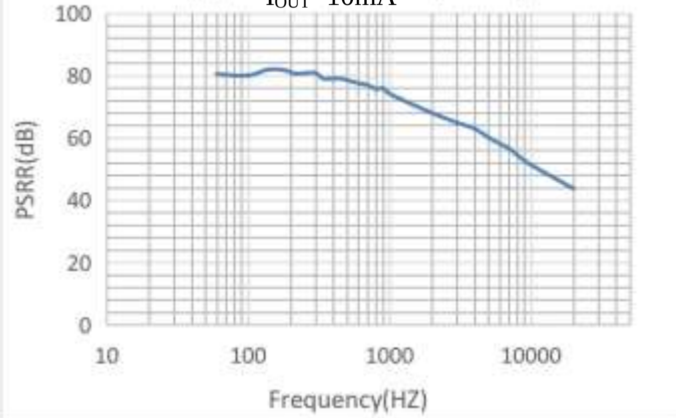
I_Q-V_{BIAS} VS. T_a
V_{BIAS}=3V I_{OUT}=0mA V_{EN}=1V



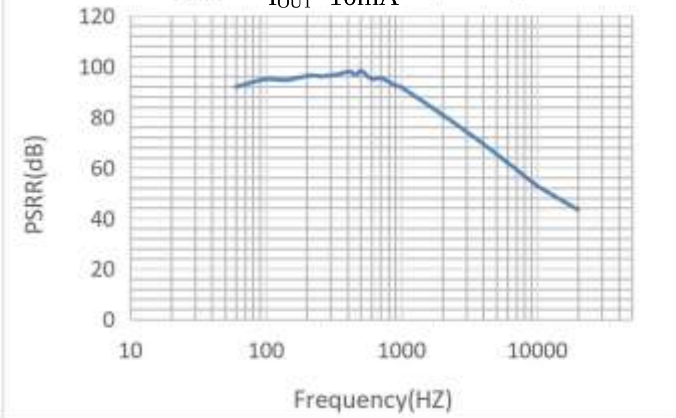
V_{DO} VS. T_a
V_{BIAS}=3V I_{OUT}=1A



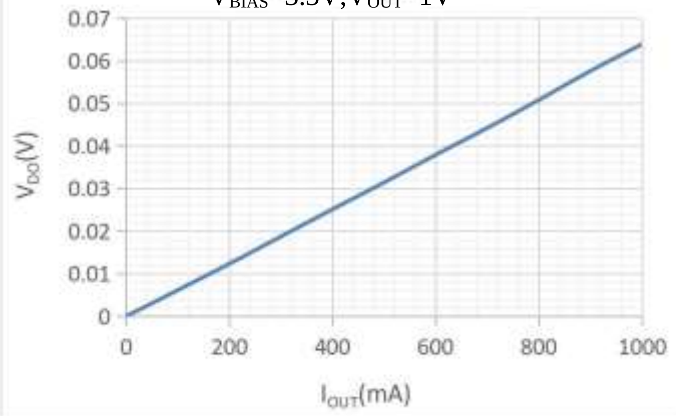
V_{IN} PSRR VS. Frequency
V_{BIAS}=3V,V_{IN}=1.3V+0.2V_{PP},V_{OUT}=1V,C_{OUT}=10μF, I_{OUT}=10mA



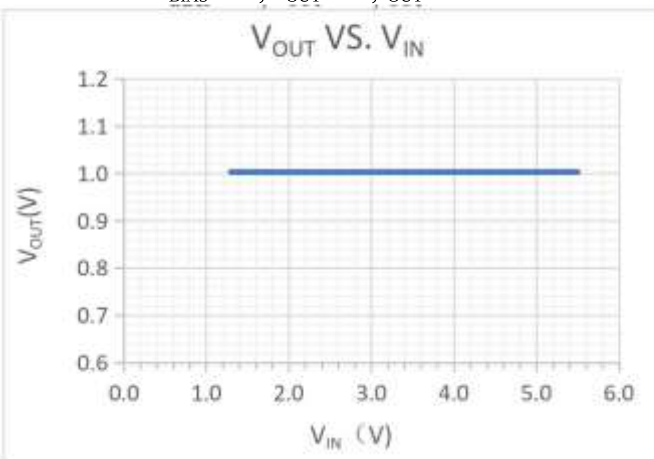
V_{BIAS} PSRR VS. Frequency
V_{BIAS}=3V+0.2V_{PP},V_{IN}=1.3V,V_{OUT}=1V,C_{OUT}=10μF, I_{OUT}=10mA



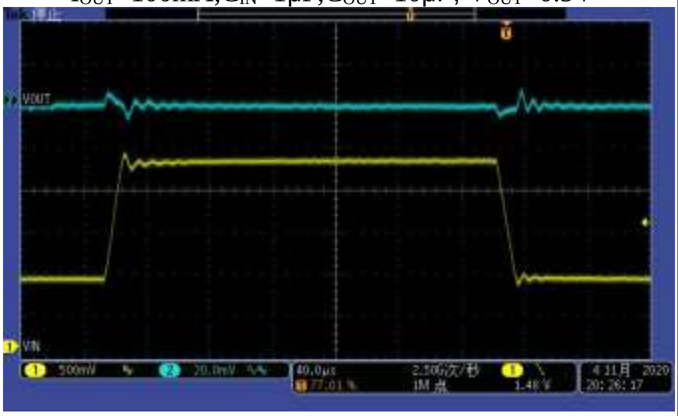
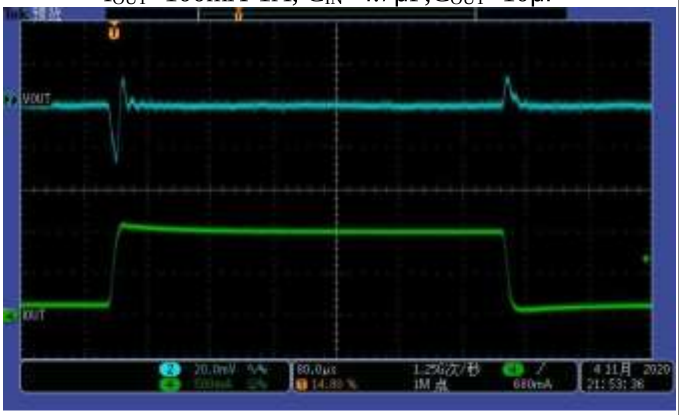
V_{DO} VS. I_{OUT}
V_{BIAS}=3.3V,V_{OUT}=1V



V_{OUT} VS. V_{IN}
V_{BIAS}=3V,V_{OUT}=1V,I_{OUT}=10mA



■ Electrical Characteristics (continue)

Enable Transient Response V_{BIAS}=3V,V_{IN}=1.3V, I_{OUT}=1A,C_{IN}=4.7μF, C_{OUT}=10μF, V_{OUT}=1V 	Enable Transient Response V_{BIAS}=3V,V_{IN}=1.3V, I_{OUT}=1A,C_{IN}=4.7μF, C_{OUT}=10μF, V_{OUT}=1V 
V_{IN} Line Transient Response V_{BIAS}=3V,V_{IN}=0.8-2.2V, I_{OUT}=100mA,C_{IN}=1μF,C_{OUT}=10μF, V_{OUT}=0.5V 	Load Transient Response V_{BIAS}=3V,V_{IN}=0.8V,V_{OUT}=0.5V, I_{OUT}=100mA-1A, C_{IN}=4.7μF,C_{OUT}=10μF 

Application Information

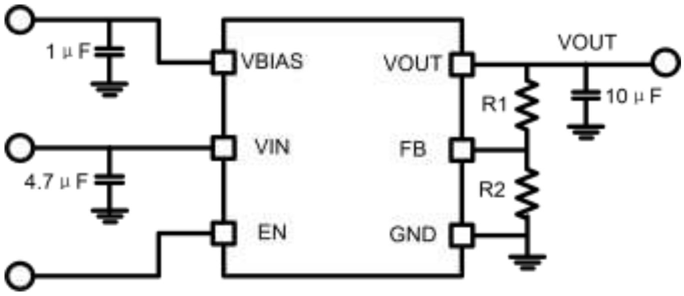


Figure 4
Typical application schematics
$V_{OUT}=V_{REF}*(1+R1/R2)$

Dropout Voltage

Because of two powers supply inputs V_{IN} and VBIAS and one V_{OUT} regulator output, there are two Dropout voltages specified. The first, the V_{IN} Dropout voltage is the voltage difference ($V_{IN} – V_{OUT}$) when V_{OUT} starts to decrease by percent specified in the Electrical Characteristics table. V_{BIAS} is high enough; specific value is published in the Electrical Characteristics table. The second, V_{BIAS} dropout voltage is the voltage difference ($V_{BIAS} – V_{OUT}$) when V_{IN} and V_{BIAS} pins are joined together and V_{OUT} starts to decrease.

Output Voltage Adjust

The required output voltage of Adjustable devices can be adjusted from V_{REF} to 3.0 V using two external resistors. Typical application schematics are shown in Figure 4.

It is recommended to keep the total serial resistance of resistors (R1 + R2) no greater than 100 kΩ.

Input and Output Capacitors

The device is designed to be stable for ceramic output capacitors with Effective capacitance in the range from 10μF to 22μF. The device is also stable with multiple capacitors in parallel, having the total effective capacitance in the specified range. In applications where no low input supplies impedance available (PCB inductance in V_{IN} and/or V_{BIAS} inputs as example), the recommended C_{IN} = 1μF and C_{BIAS} = 0.1μF or greater. Ceramic capacitors are recommended. For the best performance all the capacitors should be connected to the OCP1410 respective pins directly in the device PCB copper layer, not through vias having not negligible impedance. When using small ceramic capacitor, their capacitance is not constant but varies with applied DC biasing voltage, temperature and tolerance. The effective capacitance can be much lower than their nominal capacitance value, most importantly in negative temperatures and higher LDO output voltages. That is why the recommended Output capacitor capacitance value is specified as Effective value in the specific application conditions.

Enable Operation

The enable pin will turn the regulator on or off. The threshold limits are covered in the electrical characteristics table in this data sheet. If the enable function is not to be used then the pin should be connected to V_{IN} or V_{BIAS}.

Thermal Protection

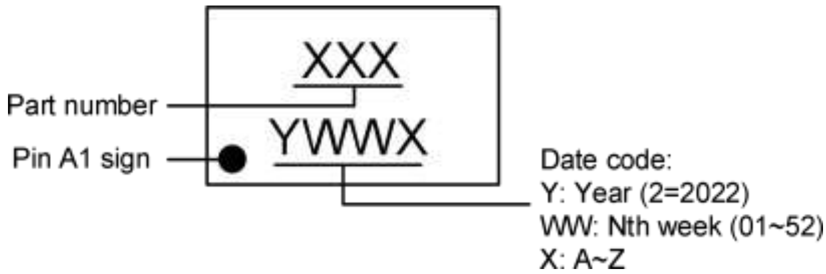
Internal thermal shutdown (TSD) circuitry is provided to protect the integrated circuit in the event that the maximum junction temperature is exceeded. When TSD activated, the regulator output turns off. When cooling down under the low temperature threshold, device output is activated again. This TSD feature is provided to prevent failures from accidental overheating. Activation of the thermal protection circuit indicates excessive power dissipation or inadequate heat sinking. For reliable operation, junction temperature should be limited to +85°C maximum.

Ordering Information

Part Number	Package Type	Package Qty	V_{REF}	Marking ID	$V_{OUT(NOM)}$
OCP1410W100PAD	WLCSP-6B	7-in reel 3000pcs/reel	-	LAK	1.00V
OCP1410W105PAD			-	LAC	1.05V
OCP1410W110PAD			-	LAJ	1.10V
OCP1410W120PAD			-	LAL	1.20V
OCP1410W180PAD			-	LAZ	1.80V
OCP1410W000PAD			0.5V	LAY	ADJ

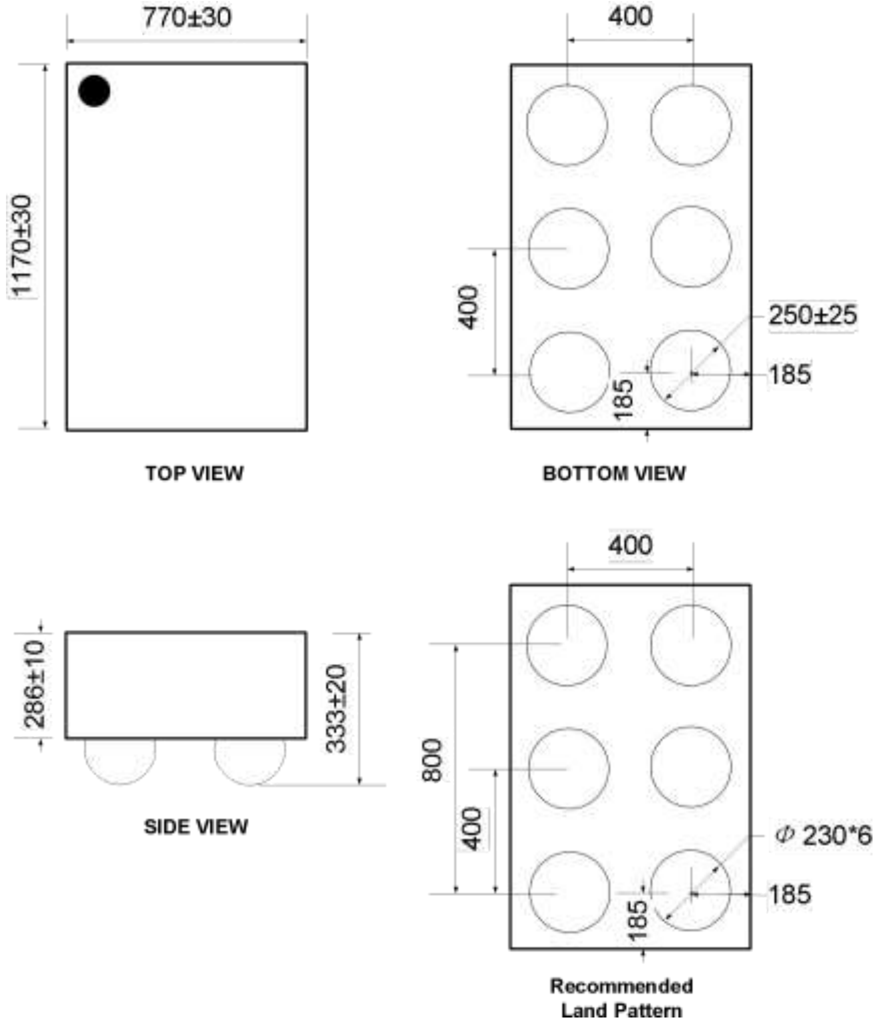
Marking Information

WLCSP-6B



Package Information

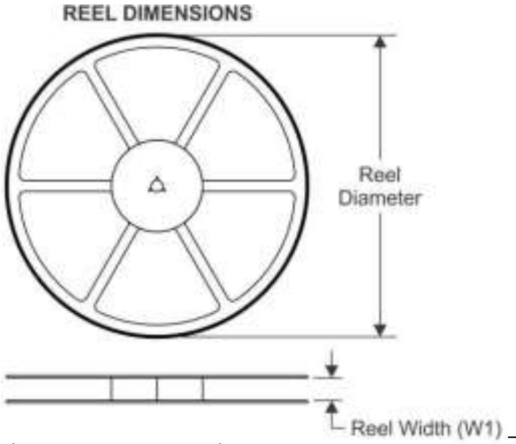
WLCSP-6B

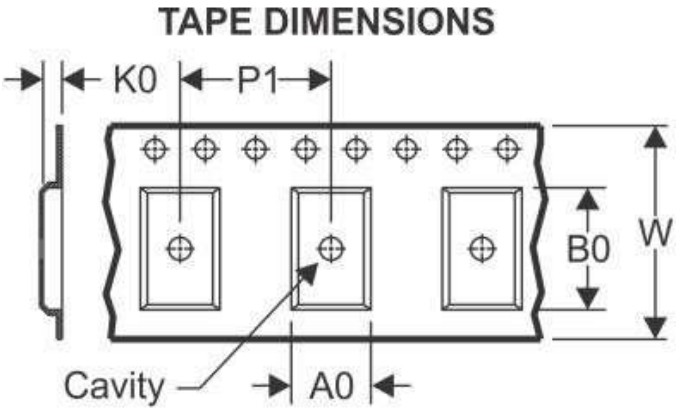


NOTE: All dimensions are in microns(μm)

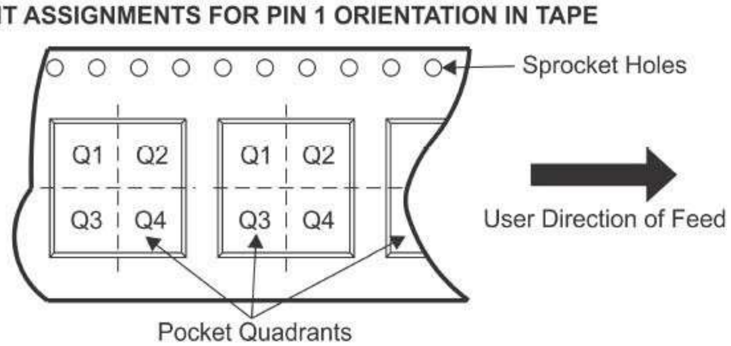
■ Packing Information

WLCSP-6B





A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers



Package tape	PIN A1 Quadrant	MSL	SPQ	Reel Diameter (mm)	Reel Width W1(mm)
6-Ball WLCSP WLCSP-6B	Q1	Level-1-260C	3000PCS	180	8.4
A0 (mm)	**B0 (mm)**	**K0 (mm)**	**P1 (mm)**	**W (mm)**	
0.9	1.3	0.42	4.0	8.0	

Note: Carrier Tape Dimension, Reel Size and Packing Minimum

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