7V, 500mA , Ultra Low Noise ,High PSRR, CMOS LDO

Features

- 500mA Guaranteed Output Current
- Wide Operating Input Voltage Range: 1.8V to 7V
- PSRR=70dB @1KHz
- Adjustable output voltage range: 0.6V to 5.5V
- Quiescent Current: 45uA
- Dropout Voltage:110mV@100mA
- ±2% (Typ.) Output Accuracy
- Excellent Line and Load Transient Response
- Integrated Short-circuit Protection
- Over-temperature Protection
- Ultralow-Noise：40μVRMS(10Hz~100kHz)
- Available in Green SOT-23-5 Packages

Applications

- Portable, Battery Powered，Equipment
- Ultra Low Power Microcontrollers
- Notebook Computers
- Audio/Video Equipment
- Weighting Scales
- Home Automation

General Description

The HCR6213 is a low-power(LDO) voltage regulator with enable function that operates from a 1.8V to 7V supply. It has ultralow noise LDOs with high accuracy, high ripple rejection and ultra-fast load transient performance. The HCR6213 has the FB pin and the fold-back maximum output current which depends on the output voltage in miniaturized packaging.

The series are very suitable for the battery-powered equipment such as RF applications and other systems requiring a quiet voltage source.

The HCR6213 is available in Green SOT-23-5 packages. It operates over an ambient temperature range of -40'C to +85'C.

SOT-23-5

Figure 1. Package Type of HCR6213

7V, 500mA , Ultra Low Noise ,High PSRR, CMOS LDO

Pin Configuration

SOT-23-5 Top View

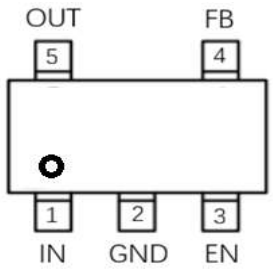


Figure 2. Pin Configuration of HCR6213 (Top View)

Pin Function Table

SOT-23-5	name	Function
1	IN	Regulator Input. Supply voltage can range from 1.8V to 7.0V. Bypass with a 1uF capacitor to GND.
2	GND	Ground
3	EN	Enable Control Input
4	FB	Feedback Input Pin (VFB=0.6V). Connect this pin to the external resistor divider to adjust the output voltage. Place the resistors as close as possible to this pin.
5	OUT	Regulator Output Pin. It is recommended to use an output capacitor with effective capacitance in the range of 0.5μF to 10μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin.

Functional Diagrams

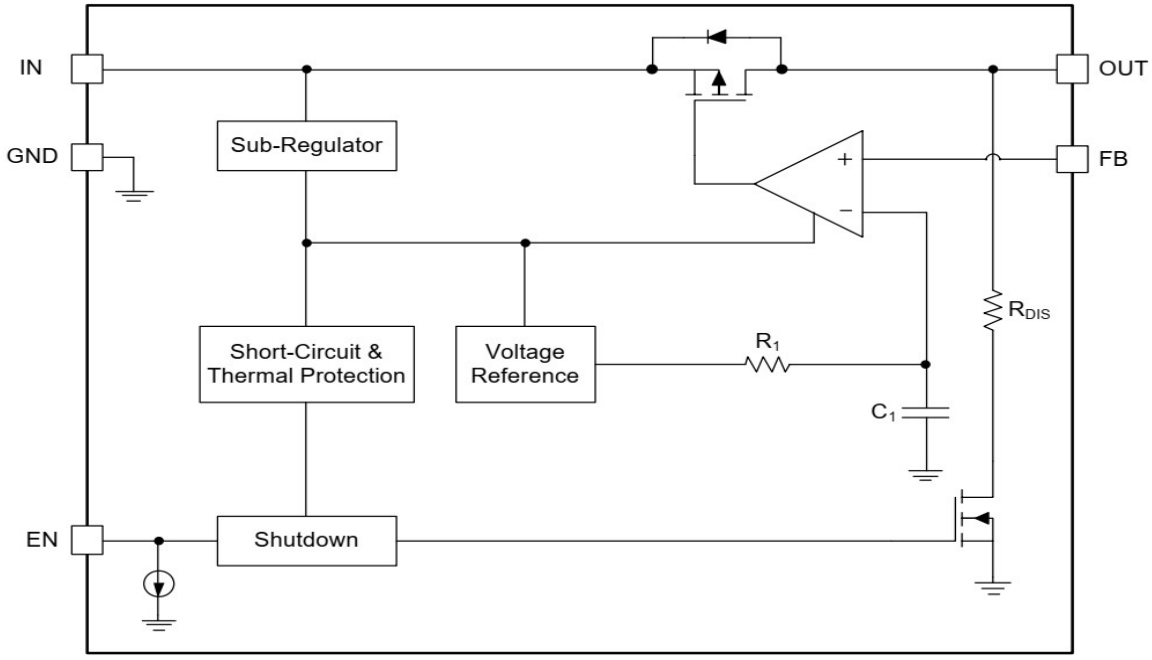
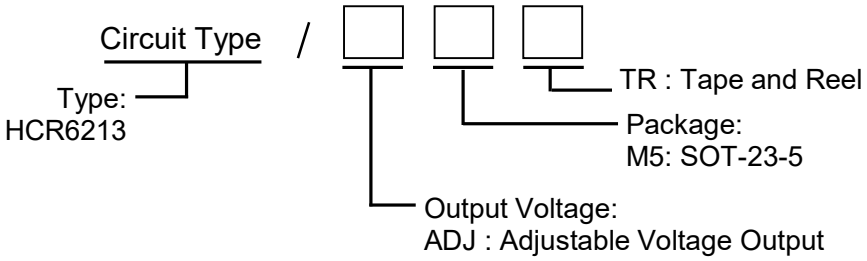


Figure 3. Fixed Output Voltage Functional Diagrams of HCR6213

Ordering Information

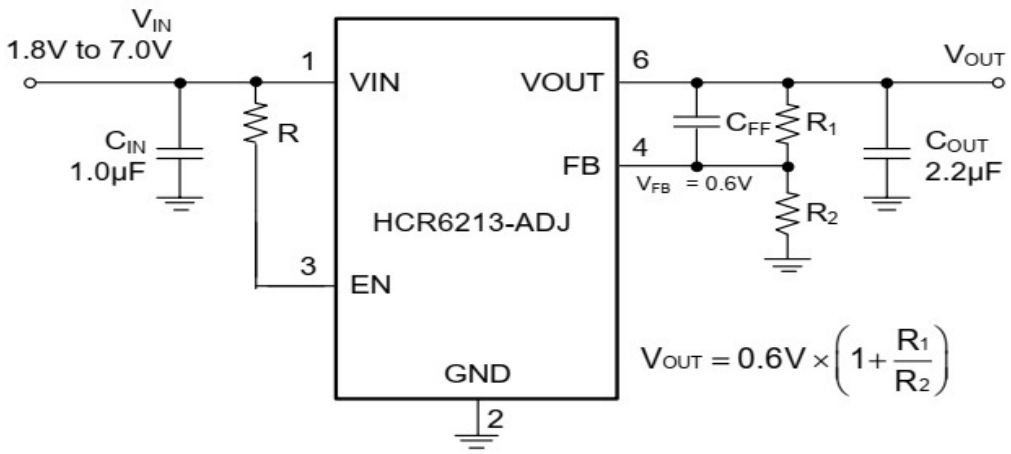


Ordering Code

Part Number	VOUT(V)	Marking [2]	Temperature Range	Package	Package Type
HCR6213/ADJM5TR	ADJ	x 1305 ADJ xxxx	-40'C to +85'C	SOT-23-5	3000pcs/TR

Note [2]. The "x = 3 with 1305" is product Type and the "x" first is represents the last year, 2020 is 0, the second "x" represents the month, in A-L 12 letters; The third and fourth "x" on behalf of the date, 01-31 said;

Typical Application Circuits



Note: the R is 47K as reference.

Figure 4. The adjstable voltage output Circuits of HCR6213

Absolute Maximum Ratings Note 2

Parameter		Symbol	Value	Unit
Supply Voltage, IN to GND		VIN	-0.3 to 8.0	V
Supply Voltage, OUT to GND		VOUT	-0.3 to VIN	V
Supply Voltage, OUT to IN		VDP	-0.3 to (VIN+0.3V)	V
Power Dissipation at TA=25'C	SOT-23-5	PD	0.45	W
Junction-to-ambient Thermal Resistance at TA=+25'C	SOT-23-5	θJA	191.6	'C/W
Junction-to-case(top) thermal Resistance at TA=+25'C	SOT-23-5	θJC	141.4	'C/W
Storage Temperature Range		TSTG	-55 to +150	'C
Operating Temperature Range note 2		TOPG	-40 to +85	'C
Junction Temperature		TJ	+150	'C
Lead Temperature (Soldering, 10s)		TLEAD	260	'C
Human-body model, per ANSI/ESDA/JEDEC JS-001(3)		HBM	±2000	V
Charged-device model, per JEDEC specification JESD22-C101		CDM	±200	V

Note 2: Stresses above those listed under"Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

3. JEDEC document JEP155 states that 500-V HBM allows safe manufcturing with a standard ESD control process.

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Unit
Operating Voltage Range	VIN	1.8	7.0	V
Operating Temperature Range	Ta	-40	+85	'C

7V, 500mA , Ultra Low Noise ,High PSRR, CMOS LDO

Electrical Characteristics

(V_{IN}=V_{OUT}+1.0V, C_{IN}=1uF, C_{OUT}=1uF, at T_A=25'C, unless otherwise noted.)

Parameter	Symbol	Conditions		Min	Type	Max	Unit
Input Voltage	V_{IN}			1.8	-	7.0	V
Output Voltage Accuracy		I_{OUT}=1mA		-2	-	+2	%
Quiescent Current	I_Q	EN=V_{IN}, V_{IN}>V_{OUT}, No load		-	45	90	uA
Shutdown Ground Current	I_{SD}	V_{EN}=V_{SS}		-	0.1	1	uA
Maximum Output Current note2	I_{OUT}	-		500	-	-	mA
Current Limit	I_{LIM}	V_{IN}=5V		600	600	-	mA
Short Load Current	I_{SHORT}	VOUT=VSS		-	20	-	mA
Dropout Voltage	V_{DPV}	I_{OUT}=100mA, V_{OUT}=2.8V		-	110	120	mV
		I_{OUT}=200mA, V_{OUT}=2.8V		-	220	250	
		I_{OUT}=500mA, V_{OUT}=2.8V		-	650	250	
Line Regulation	ΔV_{LNR}	V_{IN}=V_{OUT}+1V to 7.0V, I_{OUT}=10mA		-	0.01	0.2	%/V
Load Regulation	ΔV_{LDR}	V_{IN}=V_{OUT}+1V, I_{OUT}=1mA to 100mA		-	10	-	mV
FB Voltage	V_{FB}	I_{OUT}=1mA		0.588	0.6	0.612	V
Temperature Coefficient	T_C	I_{OUT}=10mA, -40'C<T_A<85'C		-	50	-	ppm
Power Supply Rejection Ratio	PSRR	I_{OUT}=50mA	f=100Hz	-	80	-	dB
			f=1KHz	-	70	-	
			f=10KHz	-	50	-	
SHUTDOWN							
EN Input Threshold	V_{IH}	VEN is High Level		1.5	-	VIN	V
	V_{IL}	VEN is Low Level		-	-	0.3	
Output Noise Voltage	en	10Hz to 100KHz, I_{OUT}=10mA		-	40	-	uV_{RMS}
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}			-	160	-	'C
Thermal Shutdown Hysteresis	ΔT_{SHDN}			-	20	-	'C

note 2. Maximum output current is affected by PCB layout, size of metal trace, the thermal conduction path between metal layers and the environment of the system.

3. Minimum VIN is 1.8V or VOUT + VDO, whichever is greater.

Typical Performance Characteristics (Unless Otherwise Specified.)

(VIN=VOUT+1.0V, CIN=1uF, COUT=1uF, at TA=25'C, unless otherwise noted.)

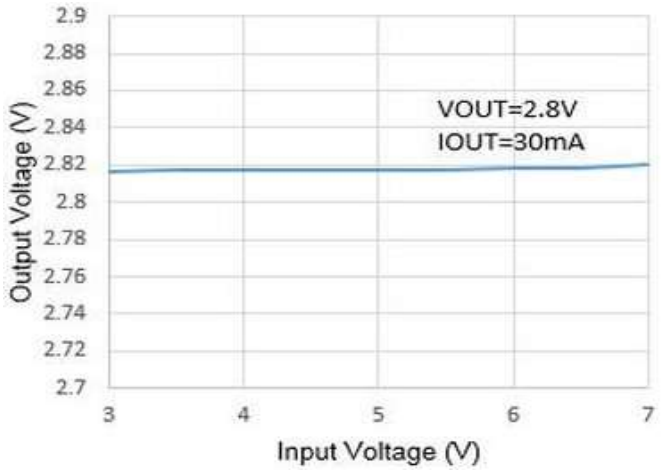


Figure 5. Input Voltage vs Output Voltage

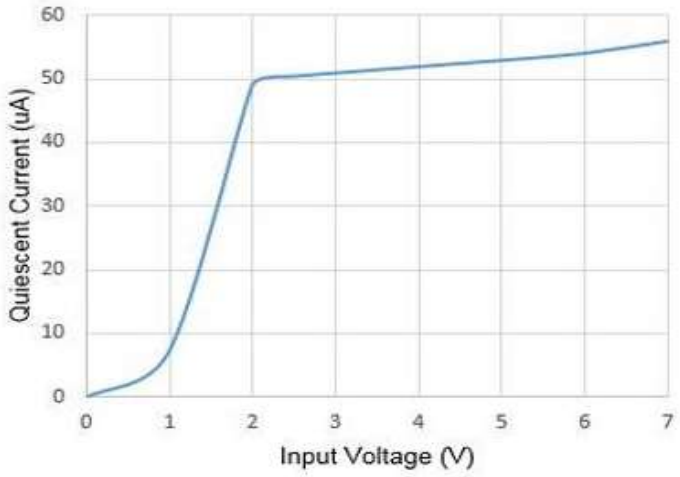


Figure 6. IQ vs VIN(*)

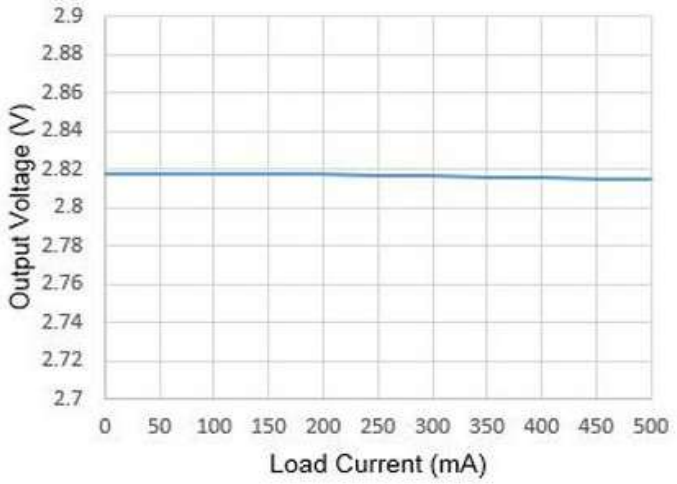


Figure 7. Load Current vs Output Voltage

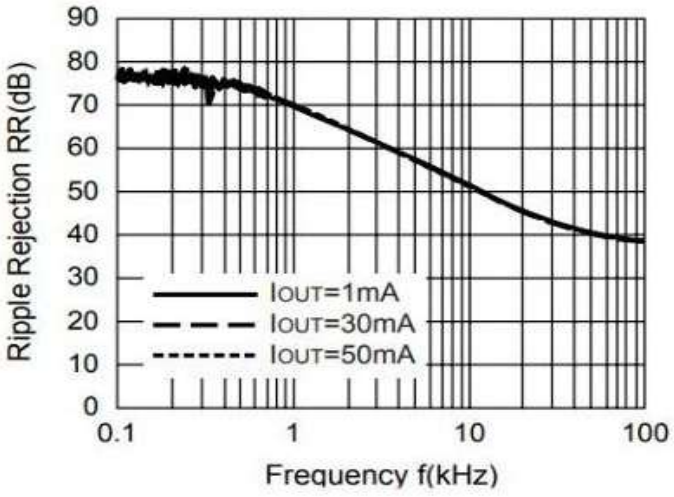


Figure 8. Ripple Rejection PSRR vs. Frequency

Typical Performance Characteristics (Con.)

(VIN=VOUT+1.0V, CIN=1uF, COUT=1uF, at TA=25'C, unless otherwise noted.)

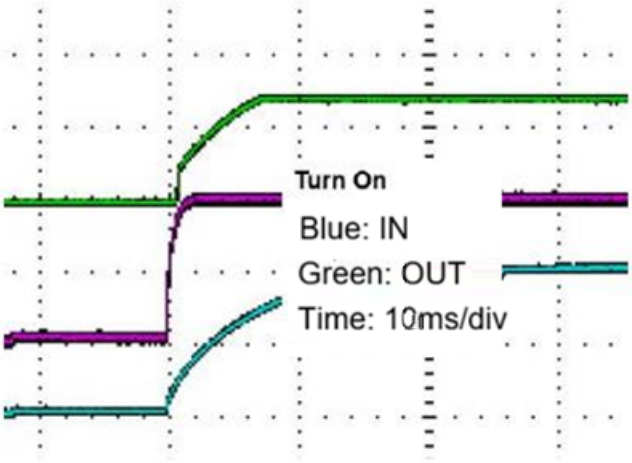


Figure 9. turn on Status

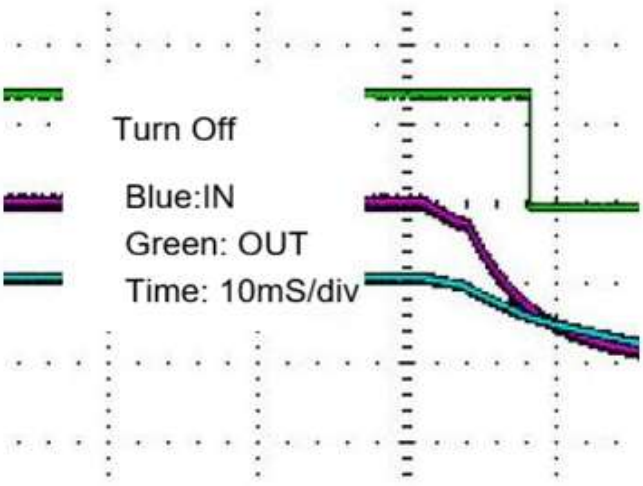


Figure 10. turn off Status

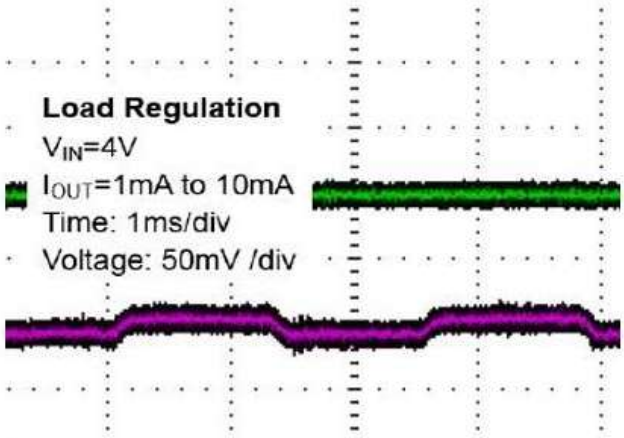


Figure 11. Load Regulation

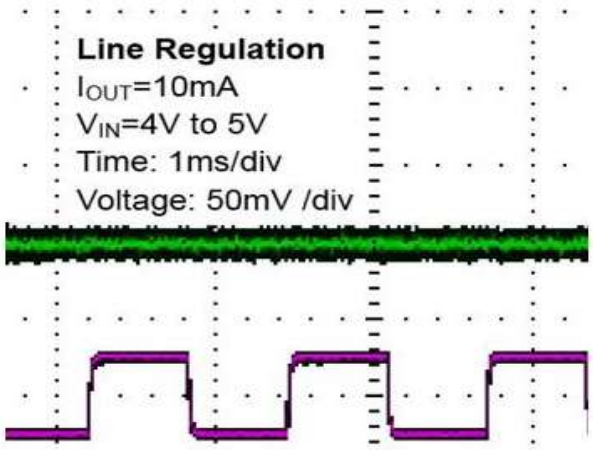


Figure 12. Line Regulation

Application Information

The HCR6213 is a low VIN, low noise and low dropout CMOS LDO and provides 500mA output current. These features make the device a reliable solution to solve many challenging problems in the generation of clean and accurate power supply.The high performance also makes the HCR6213 useful in a variety of applications. The HCR6213 provides the protection functions for output overload and overheating.

The HCR6213 provides an EN pin as an external chip enable control to enable/disable the device. When the regulator is in shutdown state, the shutdown current consumes as low as 0.1μA (TYP).

Input Capacitor Selection (CIN)

The input decoupling capacitor should be placed as close as possible to the IN pin for ensuring the device stability. CIN =1μF or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance.

When VIN is required to provide large current instantane -ously, a large effective input capacitor is required. Multiple input capacitors can limit the input tracking inductance. Adding more input capacitors is available to restrict the ringing and to keep it below the device absolute maximum ratings. For COUT with larger capacitance, it is recommended to choose the larger capacitance CIN.

Output Capacitor Selection (COUT)

One or more output capacitors are required to maintain the stability of the LDO, and the output capacitors should be placed as close as possible to the OUT pin. In addition, in order to obtain the best transient performance, it is recommended to use X7R and X5R ceramic capacitors as output capacitors.Ceramic capacitors have low equivalent series resistance (ESR), excellent temperature and DC bias characteristics. However, it cannot be ignored that the effective capacitance of ceramic capacitors is affected by temperature, DC bias and package size.

For example, Figure 4 shows the capacitance and DC bias and temperature characteristics of 0805, 10V, 10uF±10%, X7R capacitor. Therefore, it is necessary to

Output Capacitor Selection (con.)

evaluate whether the effective capacitance of the output capacitor can meet the stability requirements of the LDO in practical applications. In general, a capacitor in higher voltage rating and a larger package exhibits better stability, and the effective capacitance can be obtained from the manufacturer datasheet.

The HCR6213 requires a minimum effective capacitance of 2.2μF for COUT to ensure stability Additionally, COUT with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

Enable Operation

The EN pin of the HCR6213 is used to enable/disable its device and to deactivate/activate the output automatic discharge function.

When the EN pin voltage is lower than 0.3V, the device is in shutdown state. There is no current flowing from IN to OUT pins. In this state, the automatic discharge transistor is active to discharge the output voltage through a 60Ω (TYP) resistor.

When the EN pin voltage is higher than 1.2V, the device is in active state. The output voltage is regulated to the expected value and the automatic discharge transistor is turned off.

Adjustable Regulator

The HCR6213-ADJ, set the output voltage by using a resistor divider as shown in Figure 4. Capacitance CFF=10nF can be added to improve stability and reduce noise. Choose R2 =30.1kΩ to maintain a 20μA minimum load. Calculate the value for R1 using the following equation:

$$V_{OUT} = 0.6V \times (1 + R1/R2) \quad (1)$$

Resistor select for output voltage setting:

VOUT	R1	R2
1.2V	30.1K	30.1K
2.5V	95.3K	30.1K
3.3V	137K	30.1K
5.0V	221K	30.1K

Application Information(con.)

Output Current Limit Protection

When overload events happen, the output current is internally limited to 600mA (TYP). When the OUT pin is shorted to ground, the output current is internally limited to 20mA (TYP).

Thermal Shutdown

The HCR6213 can detect the temperature of die. When the die temperature exceeds the threshold value of thermal shutdown, the HCR6213 will be in shutdown state and it will remain in this state until the die temperature decreases to +160°C.

Power Dissipation (PD)

Power dissipation(PD) of the HCR6213 can be calculated by the equation PD = (VIN - VOUT) × IOUT.

The maximum allowable power dissipation (PD(MAX)) of

Power Dissipation (PD)

the HCR6213 is affected by many factors, including the difference between junction temperature and ambient temperature (TJ(MAX) - TA), package thermal resistance from the junction to the ambient environment (θJA), the rate of ambient airflow and PCB layout. PD(MAX) can be approximated by the following equation:

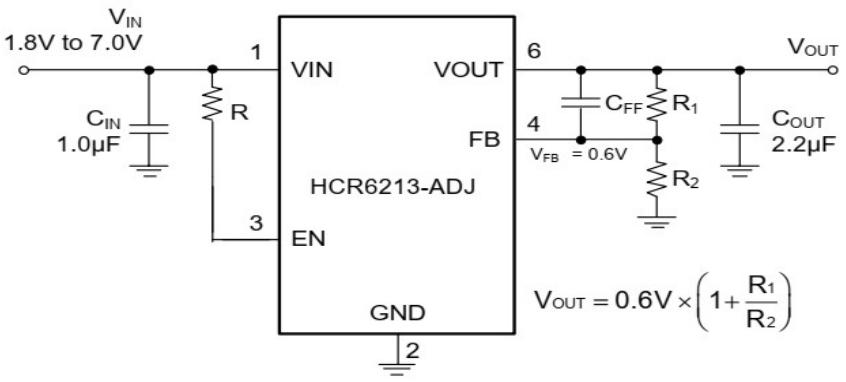
$$P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA} \quad (2)$$

where $T_{J(MAX)}$ is the maximum junction temperature, TA is the ambient temperature, and θJA is the junction-to-ambient thermal resistance.

Layout Guidelines

To get good PSRR, low output noise and high transient response performance, the input and output bypass capacitors must be placed as close as possible to the IN pin and OUT pin separately.

Typical Application Circuits



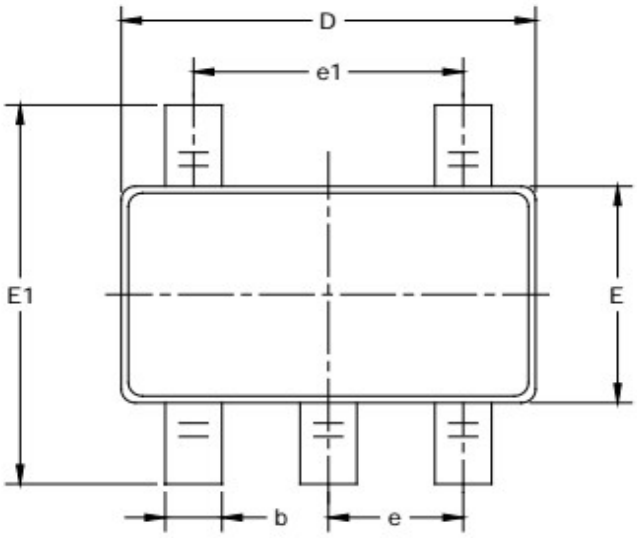
Note: the R is 47K as reference.

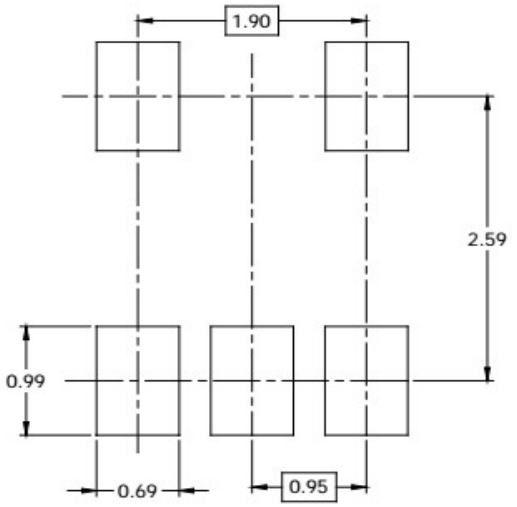
Figure 13. The adjstable voltage output Circuits of HCR6213

Mechanical Dimensions

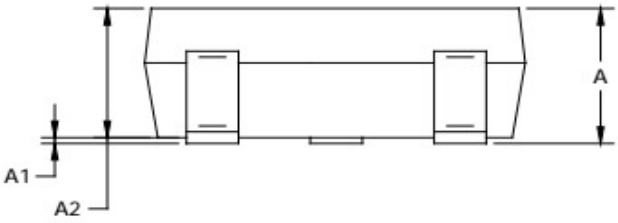
PKG:SOT-23-5 (M5)

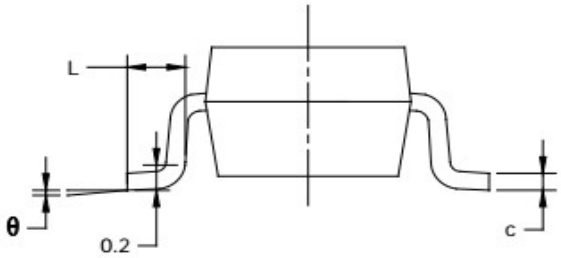
Unit: mm (inch)





RECOMMENDED LAND PATTERN (Unit: mm)

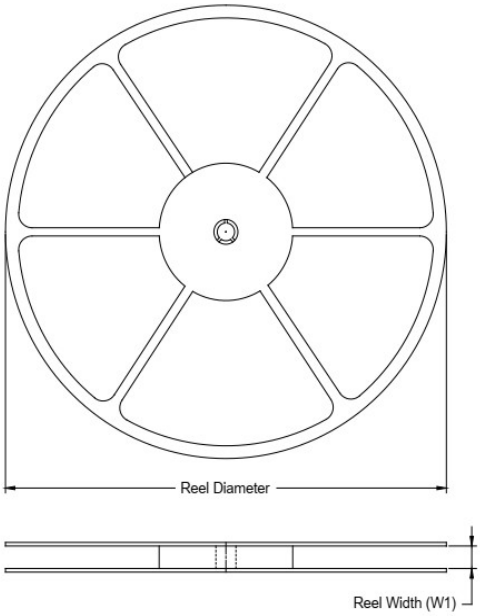




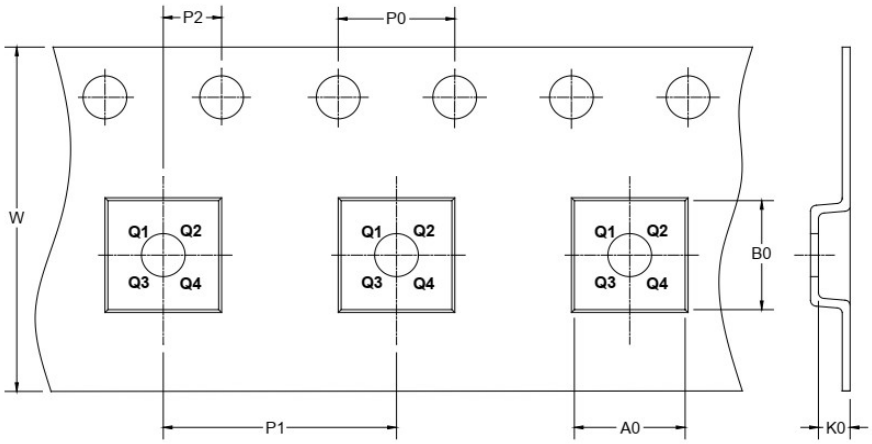
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

Tape and Reel Information

REEL DIMENSIONS



TAPE DIMENSIONS



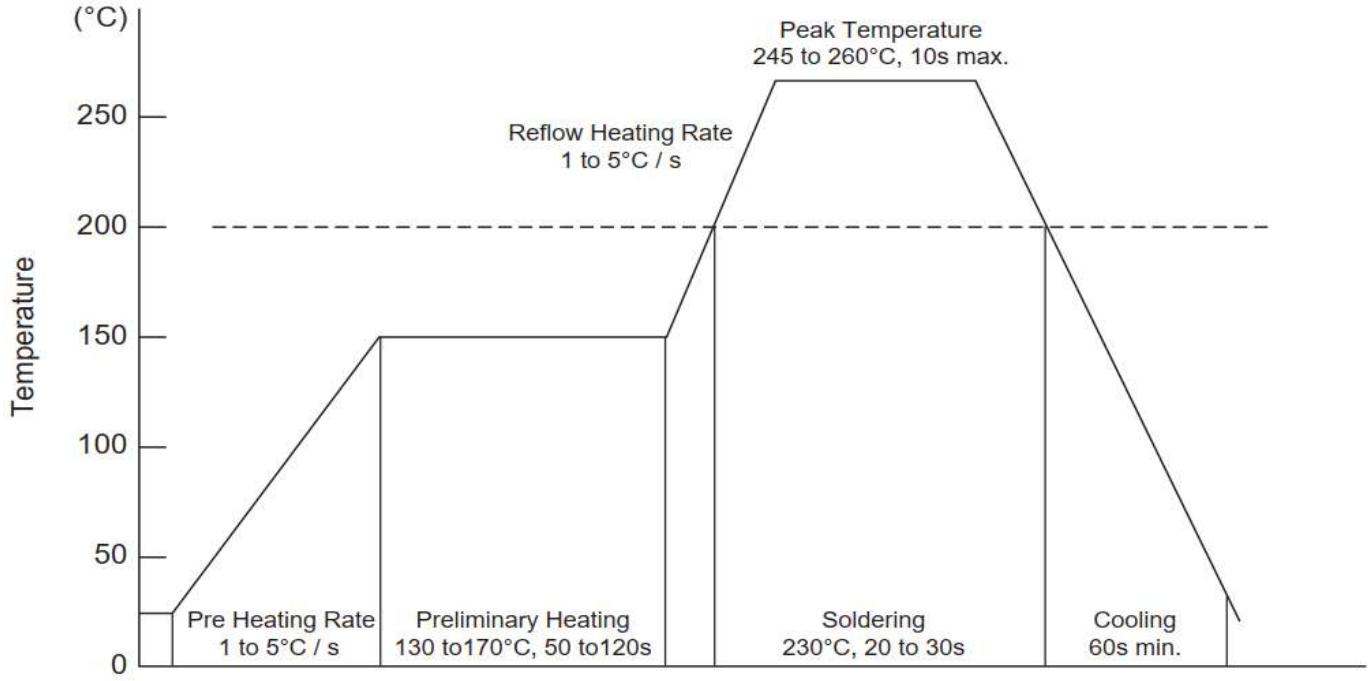
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

Conditins of Soldering and Storage

* Recommended condition of reflow soldering



Recommended peak temperature is over 245'C, if peak temperature is below 245'C, you may adjust the following parameters:

* Time length of peak temperature (longer)
* Time length of soldering (longer)
* Thickness of solder paste (thicker)

* Conditions of hand soldering
  * Temperature : 300'C
  * Time : 3s max
  * Times : one time

* Storage conditions
  * Temperature
    5 to 40'C
  * Humidity
    30 to 80% RH
  * Recommended period
    One year after manufacturing