

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator**Features**

- 600mA Guaranteed Output Current
- Wide Operating Input Voltage Range: 1.7V to 7V
- High PSRR=75dB @1KHz
- Adjustable output voltage range: 0.8V to 5.0V
- Quiescent Current: 50uA
- Low Dropout Voltage: 110mV@100mA
- $\pm 2\%$ (Typ.) Output Accuracy
- Excellent Line and Load Transient Response
- Fold-back Short-circuit Protection
- Built-in Current Limiter and Thermal Shutdown
- With Output Automatic Discharge
- Available in Green SOT-23-5 Packages

Applications

- RF: VCOs, Receivers, ADC
- Cellular and Cordless Telephones
- Wireless LAN Devices
- Handheld Organizers
- IP Cameras and Audio
- Tablet, MID

General Description

The HCR2135 series are a group of positive voltage regulators manufactured by CMOS technologies with high ripple rejection, ultra low noise, low power consumption and low dropout voltage, which can prolong battery life in portable electronics.

The HCR2135 series work with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications.

The HCR2135 series consume less than 0.1 μ A in shut-down mode and have fast turn-on time less than 50 μ s. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

The HCR2135 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 HCR2135

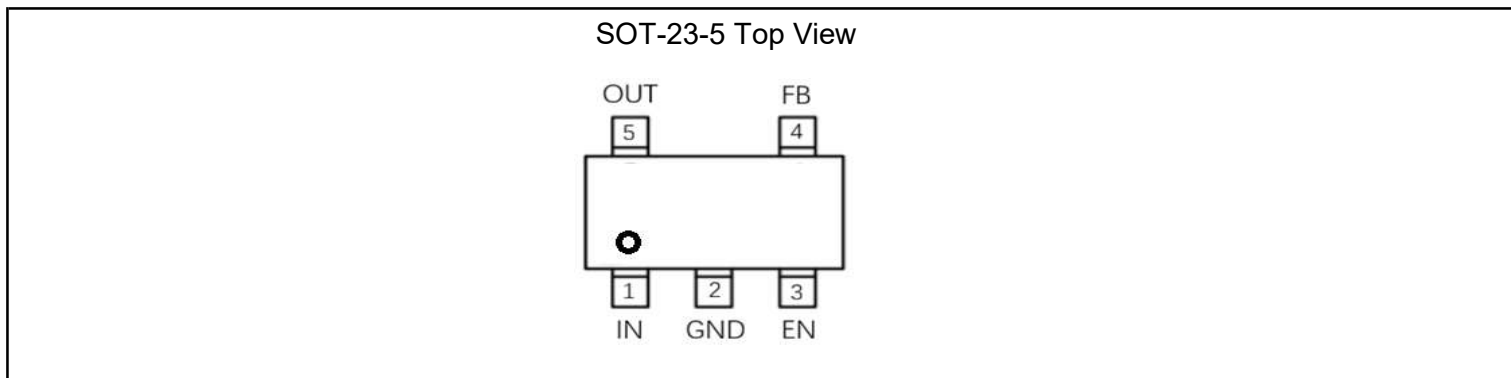
7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator
Pin Configuration


Figure 2. Pin Configuration of HCR2135 (Top View)

Pin Function Table

SOT-23-5	name	Function
1	IN	Regulator Input. Supply voltage can range from 1.7V to 7.0V. Bypass with a 1uF capacitor to GND.
2	GND	Ground
3	EN	Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator. This pin must be pulled high by an external resistor connected to IN pin if EN pin is not used.
4	FB	Feedback pin. Feedback voltage is set to be 0.8V. FB pin for adjustable output option
5	OUT	Regulator Output Pin. It is recommended to use an output capacitor with effective capacitance in the range of 1μF to 10μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin.

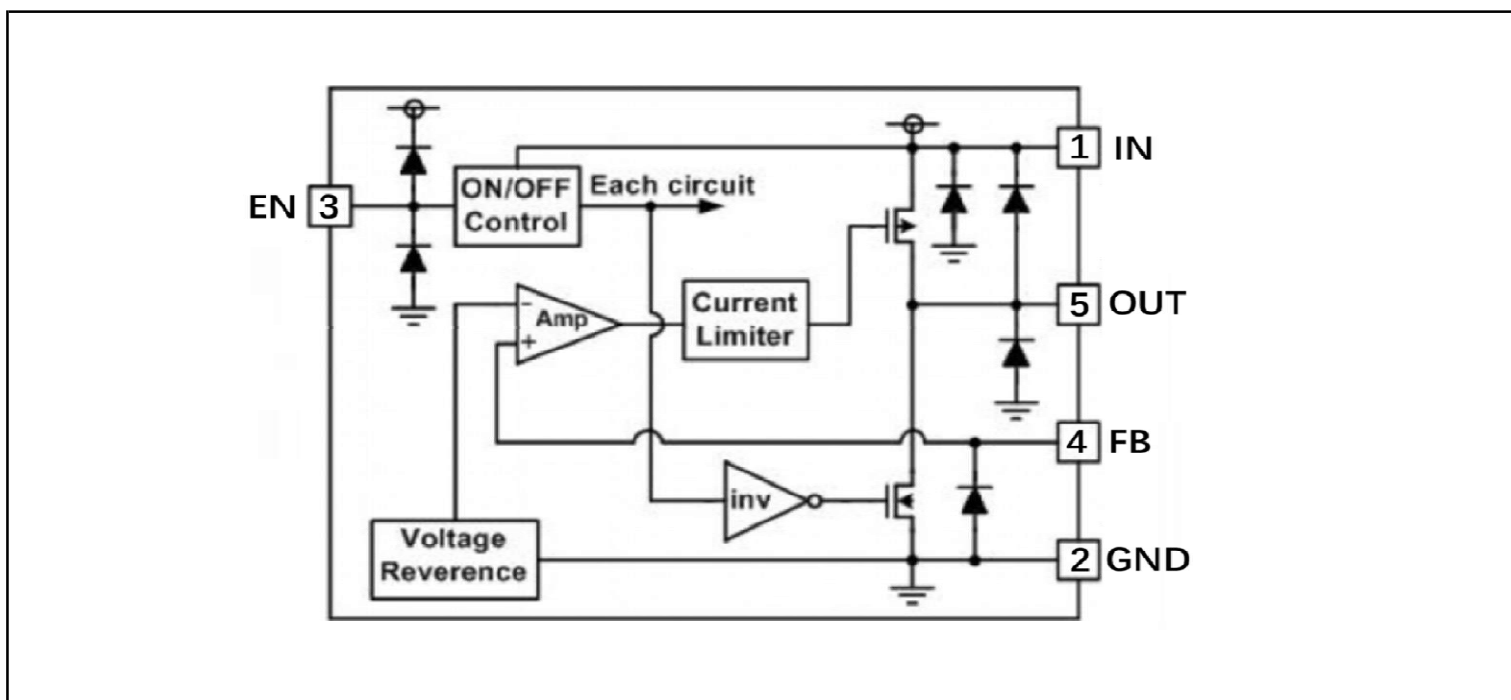
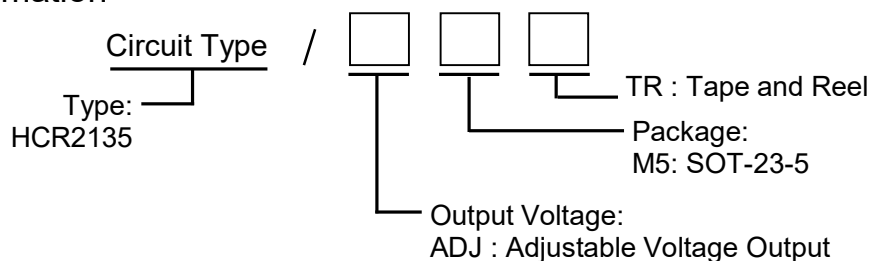
Functional Diagrams


Figure 3. Adjustable Output Voltage Functional Diagrams of HCR2135

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator

Ordering Information



Ordering Code

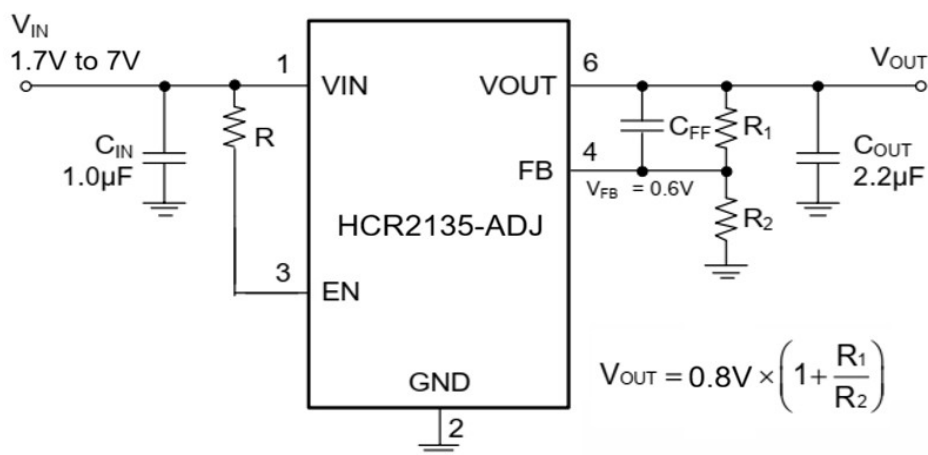
Part Number	V _{OUT} (V)	Marking ^[2]	Temperature Range	Package	Package Type
HCR2135/ADJM5TR	ADJ Volts	H1305 ADJ xxxx	-40'C to +85'C	SOT-23-5	3000pcs/TR

Note [2]. The "H=3 and 1305" is product Type, and the 'ADJ' is adjustable version, 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 adjustable voltage output Circuits of HCR2135

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator**Absolute Maximum Ratings** ^{Note 2}

Parameter		Symbol	Value	Unit
Supply Voltage, IN to GND		V _{IN}	-0.3 to 7.5	V
EN Voltage Range		V _{EN}	-0.3 to 7.5	V
Supply Voltage, OUT to GND		V _{OUT}	-0.3 to V _{IN} +0.3	V
Output Current		I _{MAX}	600	mA
Power Dissipation at TA=25°C	SOT-23-5	P _D	0.45	W
Junction-to-ambient Thermal Resistance at TA=+25°C	SOT-23-5	θ _{JA}	170	°C/W
Junction-to-case(top) thermal Resistance at TA=+25°C	SOT-23-5	θ _{JC}	75	°C/W
Storage Temperature Range		T _{STG}	-55 to +150	°C
Operating Temperature Range ^{note 2}		T _{OPG}	-40 to +85	°C
Junction Temperature		T _J	+150	°C
Lead Temperature (Soldering, 10s)		T _{LEAD}	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 manufacturing with a standard ESD control process.

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Unit
Operating Voltage Range	V _{IN}	1.7	7.0	V
V _{OUT} Voltage	V _{OUT}	0.8	5.0	V
Output Current	I _{OUT}	-	600	mA
Junction Operating Temperature Range	T _J	-40	+125	°C

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator
Electrical Characteristics

($V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, at $T_A=25^{\circ}C$, unless otherwise noted.)

Parameter	Symbol	Conditions		Min	Type	Max	Unit
Input Voltage	VIN	'-		1.7	-	7.0	V
Output Voltage Accuracy		IOUT=1mA		-2	-	+2	%
Quiescent Current	IQ	EN=VIN, VIN>VOUT, No load		30	50	80	uA
Shutdown Ground Current	ISD	VEN=VSS		-	0.1	2	uA
FB Voltage	VFB	IOUT=1mA		0.784	0.800	0.816	V
Maximum Output Current ^{note2}	IOUT	-		-	600	-	mA
Current Limit	ILIM	VIN=5V		700	900	-	mA
Short Load Current	ISHORT	VOUT=VSS		-	90	-	mA
Dropout Voltage	VDROP	IOUT=500mA, VOUT=3.3V		420	460	500	mV
Line Regulation	ΔVLNR	VIN=VOUT+1V to 7.0V, IOUT=100mA		-	0.04	0.2	%/V
Load Regulation	ΔVLDR	VIN=VOUT+1V, IOUT=1mA to 600mA		-	1	1.5	%/A
Temperature Coefficient	TC	IOUT=10mA, -40'C<TA<85'C		-	50	-	ppm
Power Supply Rejection Ratio	PSRR	IOUT=50mA	f=100Hz	-	80	-	dB
			f=1KHz	-	75	-	
			f=10KHz	-	50	-	
SHUTDOWN							
EN Input Threshold	VIH	VEN is High Level		1.1	-	-	V
	VIL	VEN is Low Level		-	-	0.5	
Output Noise Voltage	en	10Hz to 100KHz, IOUT=10mA		-	45	-	uVRMS
THERMAL PROTECTION							
Thermal Shutdown Temperature	TSHDN			-	170	-	'C
Thermal Shutdown Hysteresis	ΔTSHDN			-	30	-	'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 V_{IN} is 1.7V or $V_{OUT} + V_{DO}$, whichever is greater.

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator

Typical Performance Characteristics (Unless Otherwise Specified.)

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

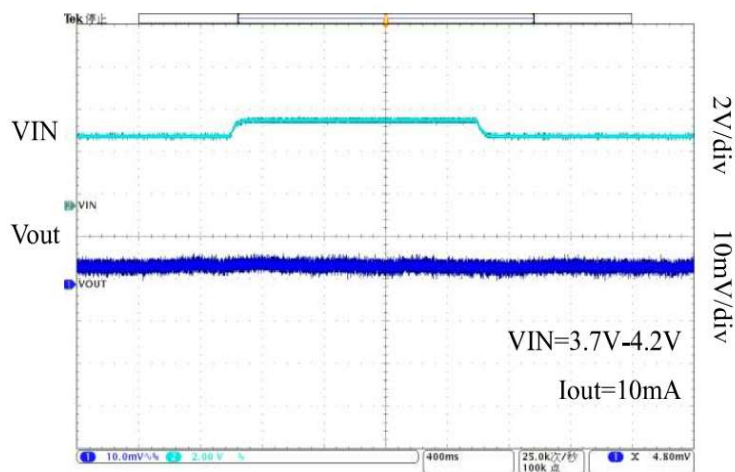


Figure 5. Vout=3.3V Line Transient Response

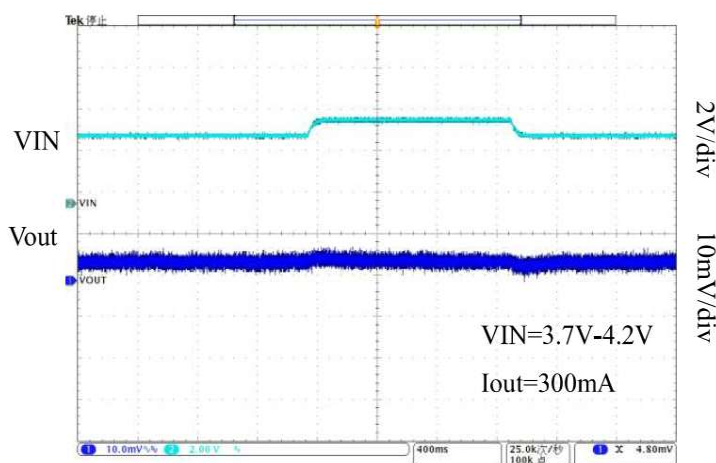


Figure 6. Vout=3.3V Line Transient Response

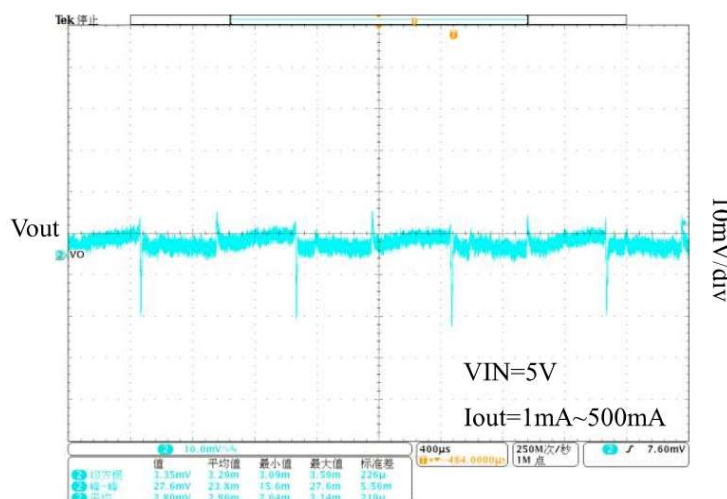


Figure 7. Load Ctransient Response Vout=3.3V

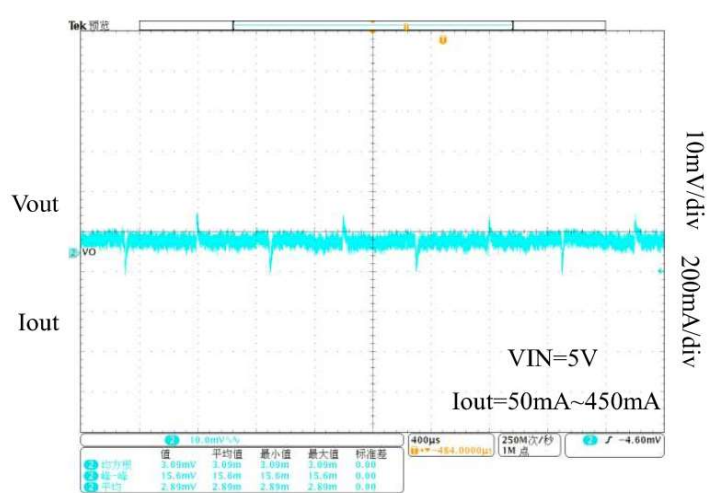


Figure 8. Load Ctransient Response Vout=3.3V

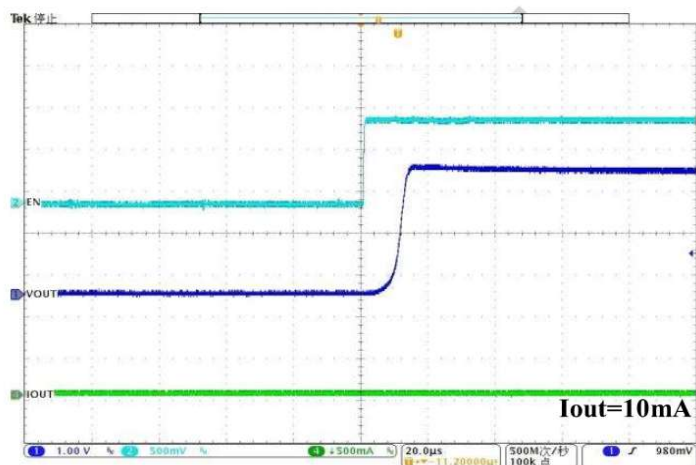


Figure 9. En Start up with Load

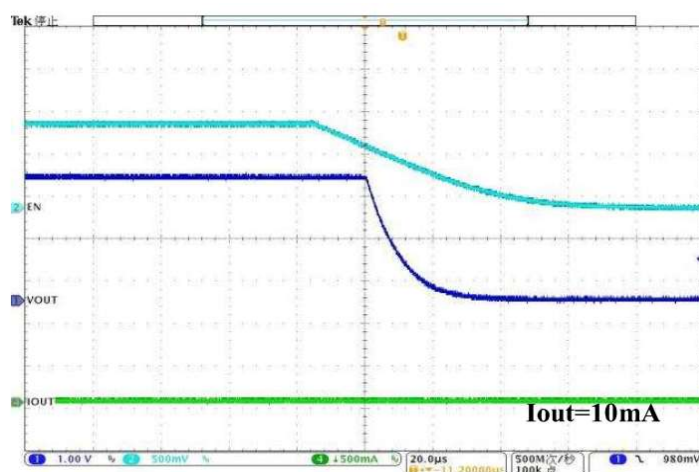


Figure 10. En Start down with Load

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator

Typical Performance Characteristics (Unless Otherwise Specified.)(Con.)

($V_{IN}=V_{OUT}+1.0V$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, at $T_A=25^\circ C$, unless otherwise noted.)

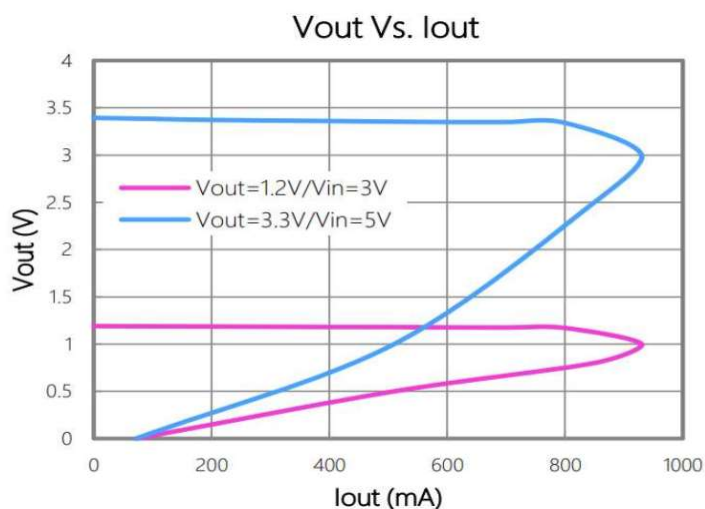


Figure 11. Output Voltage vs. I_{out}

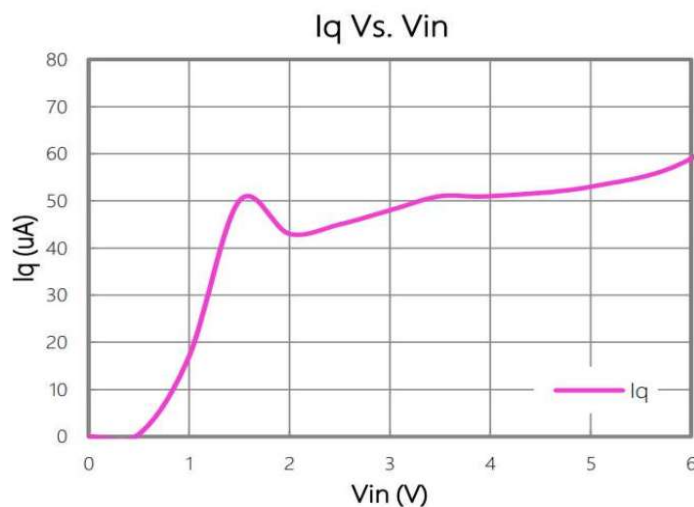


Figure 12. V_{in} Voltage vs I_q

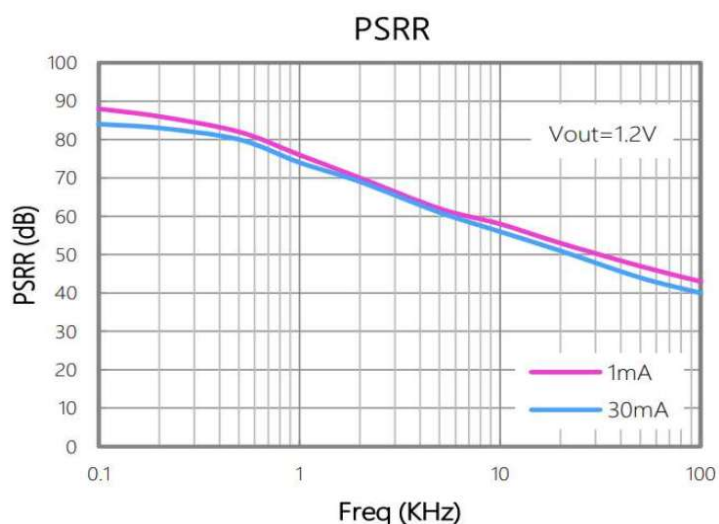


Figure 13. Power Supply Rejection Ratio vs. Frequency

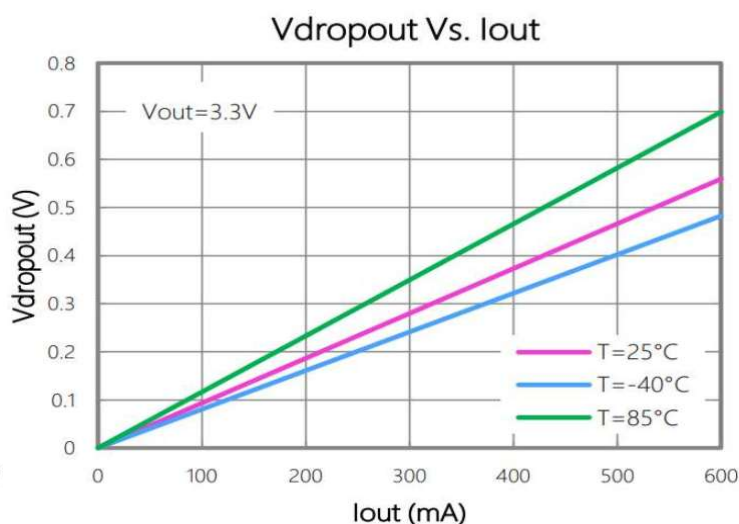


Figure 14. Dropout vs Output Current

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator**Functions Description**

The HCR2135 series are a group of positive voltage regulators manufactured by CMOS technologies with high ripple rejection, ultra-low noise, low power consumption and low dropout voltage, which can prolong battery life in portable electronics.

The HCR2135 series work with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications.

The HCR2135 series consume less than 0.1μA in shutdown mode and have fast turn-on time less than 50μS. The series are very suitable for the battery-powered equipment, such as RF applications and other systems requiring a quiet voltage source..

Output Current Limit and Short-Circuit Protection

When overload events happen, the output current is internally limited to 900mA (TYP). When the OUT pin is shorted to ground, the short-circuit protection will limit the output current to 90mA (TYP).

Thermal Shutdown

The internal thermal-shutdown circuitry forces the device to stop switching if the junction temperature exceeds 160 ° C typically. Once the junction temperature falls below the falling threshold, the device returns to normal operation automatically.

Application Information

The HCR2135 is a low VIN, ultra-low noise and low dropout 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 HCR2135 useful in a variety of applications.

The HCR2135 provides the protection functions for output overload, output short-circuit condition and overheating.

The HCR2135 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 capacitors selection

The input decoupling capacitor should be placed as close as possible to the IN pin to ensure the device stability. 1μF or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance. When VIN is required to provide large current instantaneously, 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.

Output capacitors selection

The output capacitor should be placed as close as possible to the OUT pin. 1μF or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance. The minimum effective capacitance of COUT that HCR2135 can remain stable is 1μF. For ceramic capacitor, temperature, DC bias and package size will change the effective capacitance, so enough margin of COUT must be considered in design.

Additionally, COUT with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

The IC's internal circuitry can be shutdown via the signal from the EN pin with the HCR2135-ADJ series. Driving EN over 1.1 V turns on the regulator. Driving EN below 0.5 V puts the regulator into shutdown mode.

Setting The Output Voltage

Figure 1 shows the typical application circuit with HCR2135. The external resistor sets the output voltage according to the following equation:

$$V_{OUT} = 0.8V \times \left(1 + \frac{R1}{R2}\right)$$

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator

Application Information(con.)

Setting The Output Voltage(con.)

Table 1. Resistor select for output voltage setting

VOUT	R1	R2	Cff
1.2V	50K	100K	Opt.
1.5V	88.7K	100K	Opt.
1.8V	125K	100K	Opt.
2.5V	215K	100K	Opt.
2.8V	250K	100K	Opt.
3.0V	274K	100K	Opt.
3.3V	316K	100K	Opt.

Power Dissipation (PD)

Power dissipation(PD) of the HCR2135 can be calculated by the equation $PD = (V_{IN} - V_{OUT}) \times I_{OUT}$.

The maximum allowable power dissipation (PD(MAX)) of the HCR2135 is affected by many factors, including the difference between junction temperature and ambient temperature ($T_J(MAX) - T_A$), package thermal resistance from the junction to the ambient environment (θ_{JA}), 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, T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance.

PCB Layout

PCB layout is a critical portion of good power supply design.

The following guidelines will help users design a PCB with the best power conversion efficiency, thermal performance.

1.1). The input bypass capacitor C5 and C11 must be placed as close as possible to the VIN pin and ground. Grounding for both the input and output capacitors should consist of localized top side planes that connect to the GND pin and PAD. It is a good practice to place a ceramic ceramic cap near the VIN pin to reduce the high frequency injection current.

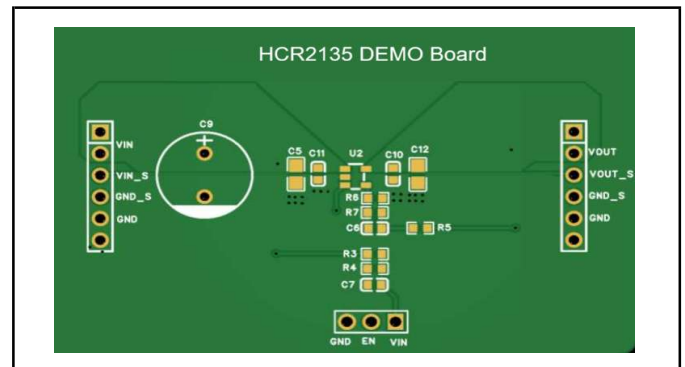
PCB Layout (con.)

1.2). The output capacitor, COUT should be placed close to the junction of Vout Pin.

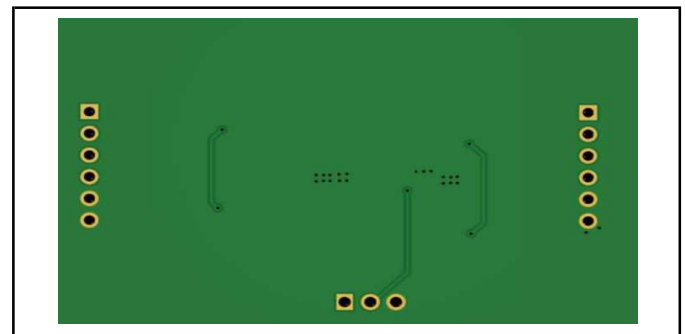
1.3). The ground connection for C5, C11 and C10, C12 should be as small as possible and connect to system ground plane at only one spot (preferably at the COUT ground point) to minimize injecting noise into system ground plane.

1.4). Large GND Copper Pour near IC is recommended to minimize the heat of IC.

Layout Example:



Top Layout Board



Bottom Layout Board

Typical Application Circuits

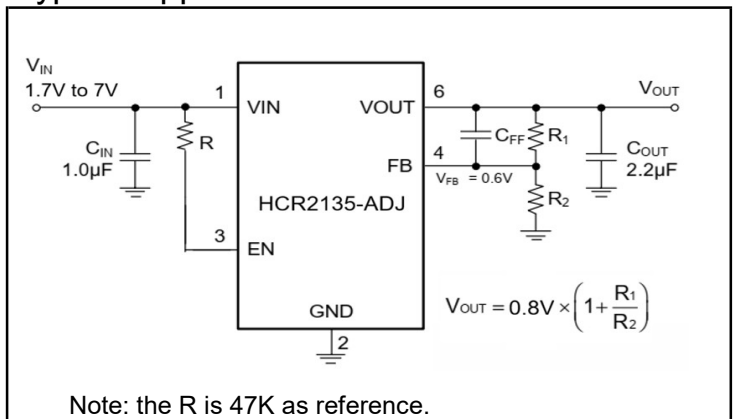
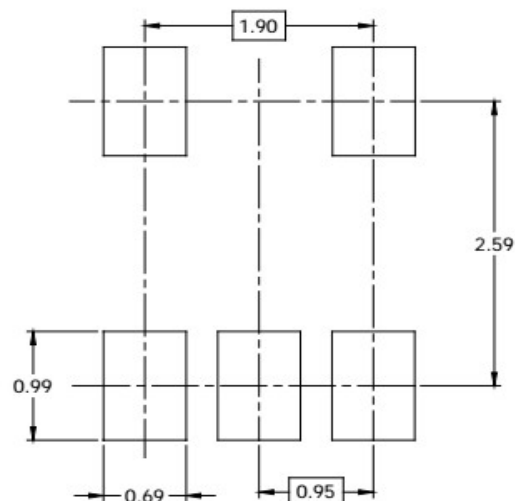
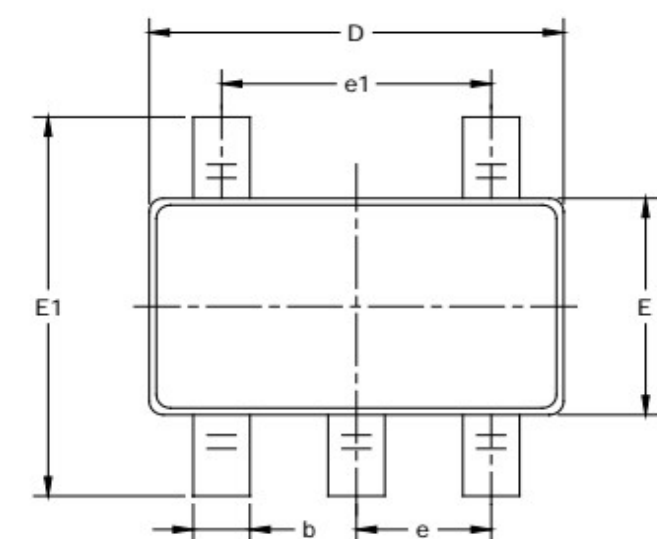
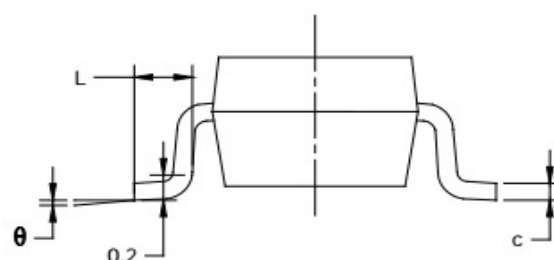
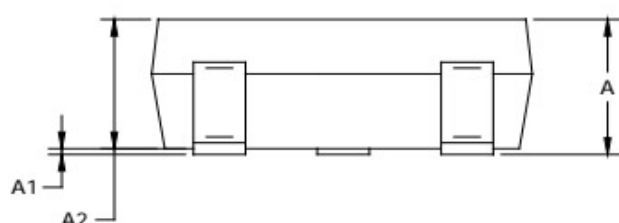


Figure 15. Typical Application Circuits

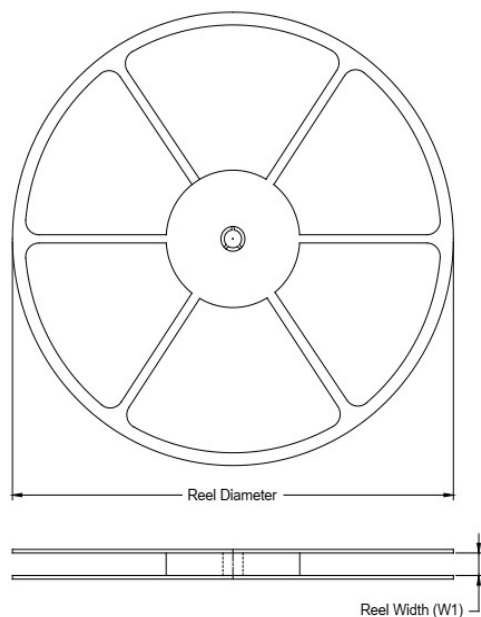
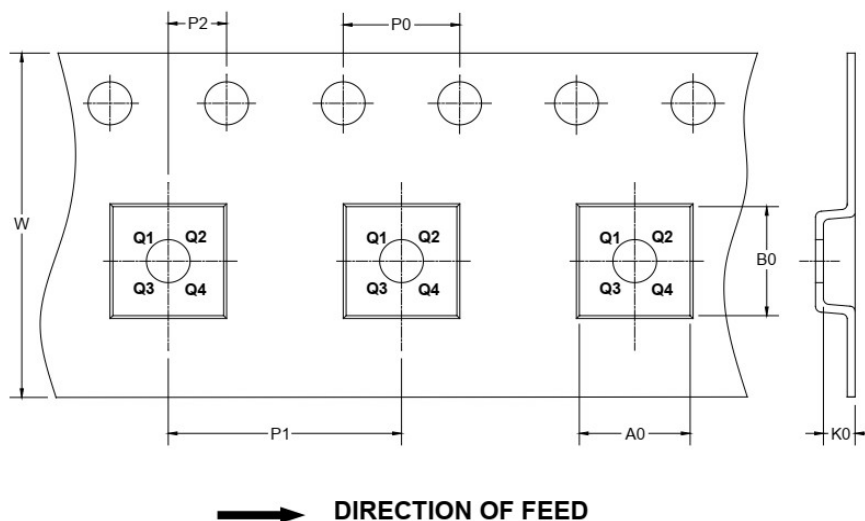
7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator
Mechanical Dimensions

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°

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator
Tape and Reel Information
REEL DIMENSIONS

TAPE DIMENSIONS


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

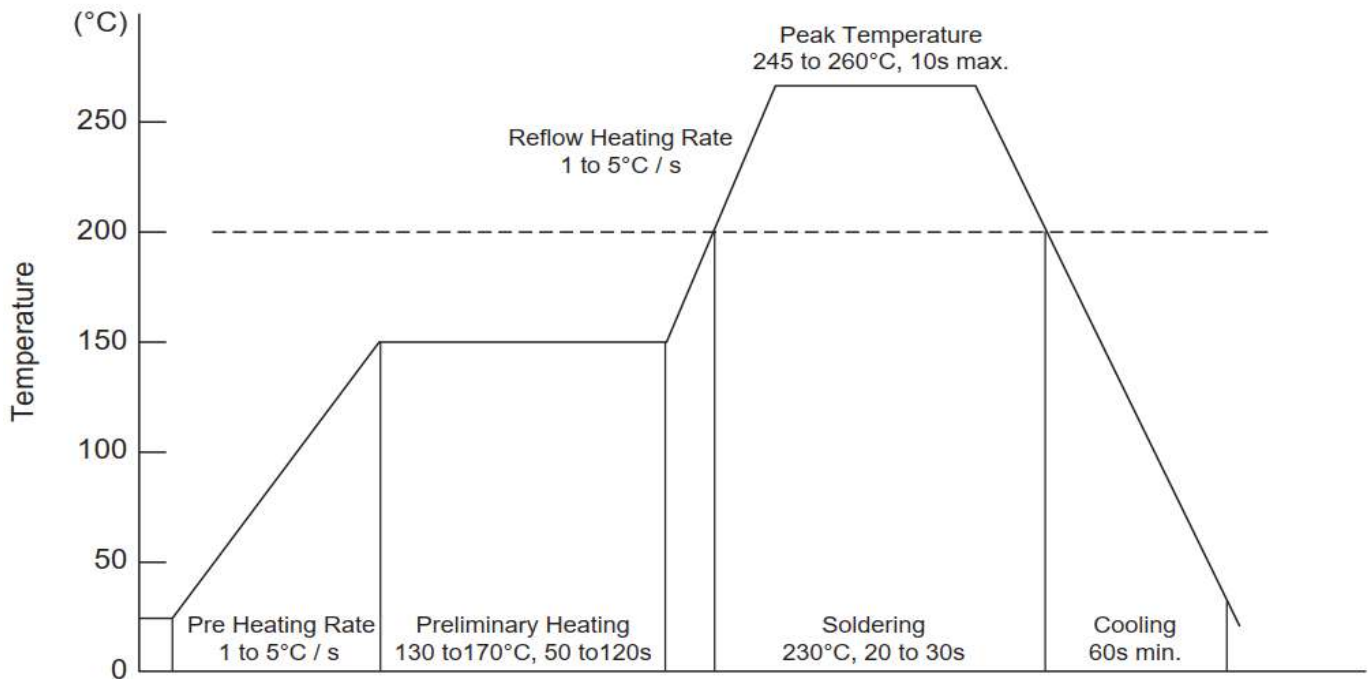
KEY PARAMETER LIST OF TAPE AND REEL

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

7V, 600mA Ultra Low Noise Fast RF and High PSRR Linear Regulator

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