1.5A CMOS LDO Linear Voltage Regulator

◆ DESCRIPTION

The MT5215 series is a low-dropout linear regulator that operates in the input voltage range from +2.4V to +7.0V and delivers 1.5A output current.

The MT5215 is available fixed output voltage type is preset at an internally trimmed voltage 1.8V, 2.5V, or 3.3V. Other options 1.2V, 1.5V, 2.8V and 3.0V are available by special order only.

The MT5215 consists of a 0.95V bandgap reference, an error amplifier, and a P-channel pass transistor. Other features include short-circuit protection and thermal shutdown protection. The MT5215 series devices are available in SOT-223 and TO-252 packages.

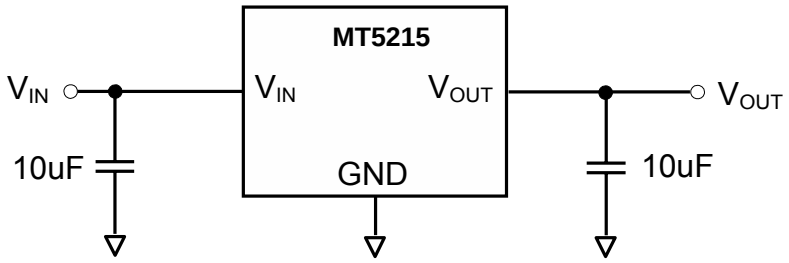
◆ FEATURES

- Operating Voltage Range：+2.4V to +7.0V
- Output Voltages：+1.0V to +5.0V (0.1V Step)
- Maximum Output Current：1.5A
- Dropout Voltage：800mV @ 1.5A(Typ.)
- 35 uS Fast Response when Power-on
- Low Current Consumption：60μA (Typ.)
- ±2% Output Voltage Accuracy (special ±1%highly accurate), V_{OUT}≧1.8V
- Low ESR Capacitor Compatible
- High Ripple Rejection：55 dB (Typ.)
- Output Current Limit Protection :2.0A (Typ.)
- Short Circuit Protection：1.0A (Typ.)
- Thermal Overload Shutdown Protection
- SOT-223 and TO-252 Packages
- RoHS Compliant and 100% Lead (Pb)-Free and Green (Halogen Free with Commercial Standard)

◆ APPLICATIONS

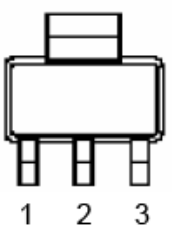
- Active SCSI Terminators
- High Efficiency Linear Regulators
- Monitor Microprocessors
- Low Voltage Micro-Controllers
- Post Regulator for Switching Power

◆ SIMPLIFIED APPLICATION CIRCUIT



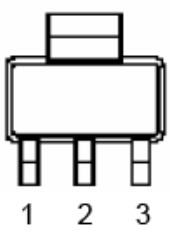
◆ PIN DESCRIPTION

SOT-223 (Top View)



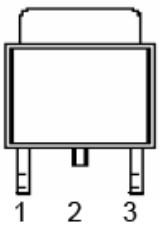
MT5215A-X.XA 1:GND, 2:OUT, 3:IN

SOT -223 (Top View)



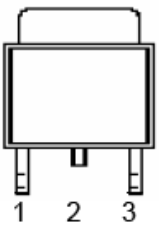
MT5215B-X.XA 1:IN, 2:GND, 3:OUT

TO-252 (Top View)



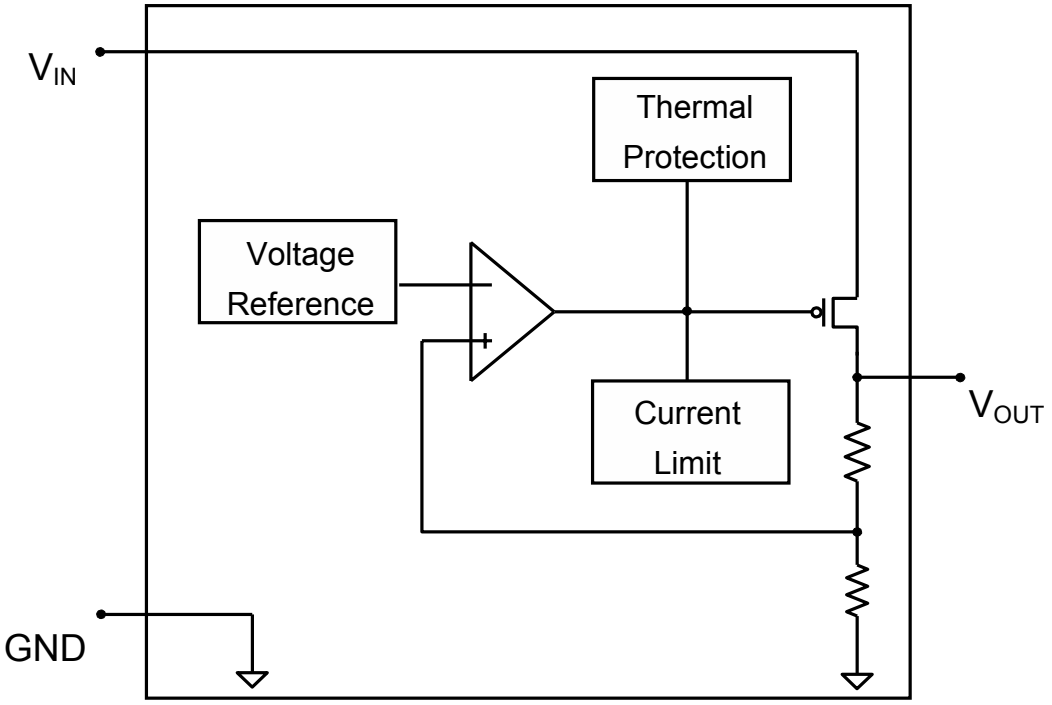
MT5215A-X.XB 1:GND, 2:OUT, 3:IN

TO-252 (Top View)



MT5215B-X.XB 1:IN, 2:GND, 3:OUT

◆ Function Block Diagram



◆ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Maximum	Unit
Input voltage	V_{IN}	9	V
Output Current Limit, $I_{(LIMIT)}$	I_{OUT}	2.0	A
Junction Temperature	T_J	150	°C
Power Dissipation SOT-223 TO-252	P_D	 900 1200	mW
Thermal Resistance (Junction to Ambient) SOT-223 TO-252	θ_{JA}	 155 90	°C/W
Thermal Resistance (Junction to Case) SOT-223 TO-252	θ_{JC}	 20 10	°C/W
Operating Ambient Temperature Range	T_{OPR}	-40 to 85	°C
Storage temperature range	T_{STG}	-55 to 150	°C
Lead temperature (soldering) 10sec	T_{LEAD}	260	°C

Note：

* The power dissipation values are based on the condition that junction temperature T_J and ambient temperature T_A difference is 100°C.

* Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and function operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum -rated conditions for extended periods may affect device reliability.

◆ ORDERING INFORMATION

Device	Package		Vout Volts
MT5215A-X.X A	A	SOT-223	X.X: 1.2 / 1.5 / 1.8 / 2.5 / 2.8 / 3.0 / 3.3
MT5215B-X.X A	A	SOT-223	X.X: 1.2 / 1.5 / 1.8 / 2.5 / 2.8 / 3.0 / 3.3
MT5215A-X.X B	B	TO-252	X.X: 1.2 / 1.5 / 1.8 / 2.5 / 2.8 / 3.0 / 3.3
MT5215B-X.X B	B	TO-252	X.X: 1.2 / 1.5 / 1.8 / 2.5 / 2.8 / 3.0 / 3.3

◆ ELECTRICAL CHARACTERISTICS

Operating Conditions: V_{IN} = 5V, T_A =25 °C, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}		2.4	-	7.0	V
Output Voltage	V_O	V_{IN} = V_{OUT}+1.0V, I_{OUT}=1mA, $V_{OUT} \geqq 1.8V$	-2	V_{OUT}	2	%
		V_{IN} = V_{OUT} +1.0V, I_{OUT} =1mA, $V_{OUT} < 1.8V$, $V_{IN} > 2.4V$	-35	V_{OUT}	35	mV
Line Regulation	V_{SR}	(V_{OUT}+1.0V) ≤ V_{IN} ≤ 7V, I_{OUT} = 1mA	-	0.2	0.3	%/V
Load Regulation	V_{LR}	V_{IN}=V_{OUT}+1.0V, 1mA ≤ I_{OUT} ≤ 100mA	-	0.01	0.02	%/mA
Dropout Voltage	V_D	I_{OUT} = 100mA, $V_{OUT} > 2.4V$	-	30	45	mV
		I_{OUT} = 500mA, $V_{OUT} > 2.4V$	-	230	350	
		I_{OUT} = 900mA, $V_{OUT} > 2.4V$	-	500	750	
		I_{OUT} = 1500mA, $V_{OUT} > 2.4V$	-	900	1350	
Output Current	I_{MAX}		1.5	-	-	A
Current Limit	I_{CL}		-	1.8	-	A
Quiescent Current	I_Q	I_{LOAD}=0mA to 1A, V_{IN} = V_{OUT}+1.0V	-	60	100	μA
Short Circuit Current	I_{SC}		-	1.0	-	A
Ripple Rejection Ratio	PSRR	f =1KHz, I_{OUT} =30mA, C_{OUT} = 10μF	-	55	-	dB
Output Noise	e_N	f =1KHz, I_{OUT} =100mA, C_{OUT} = 10μF	-	40	-	$\mu V_{(rms)}$
Thermal Shutdown Temperature	T_{SD}		-	155	-	°C
Thermal Shutdown Hysteresis	T_{HYC}		-	20	-	°C

NOTES:

A. Measured using a double sided board with 1” x 2” square inches of copper area connected to the GND pins for “heat spreading”.

◆ APPLICATION INFORMATION

The MT5215 is a low-dropout linear regulator. The device provides preset 1.8V, 2.5V and 3.3V output voltages for output current up to 1.5A. As illustrated in function block diagram, it consists of a 0.95V bandgap reference, an error amplifier, a P-channel pass transistor and an internal feedback voltage divider.

The bandgap reference voltage is connected to the error amplifier, which compares this reference with the feedback voltage and amplifies the voltage difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled lower, which allows more current to pass to the output pin and increases the output voltage. If the feedback voltage is too high, the pass transistor gate is pulled up to decrease the output voltage.

The output voltage is feed back through an internal resistive divider connected to OUT pin. Additional blocks include an output current limiter, thermal sensor, and shutdown logic.

Internal P-channel Pass Transistor

The MT5215 features a P-channel MOSFET pass transistor. Unlike similar designs using PNP pass transistors, P-channel MOSFETs require no base drive, which reduces quiescent current. PNP-based regulators also waste considerable current in dropout when the pass transistor saturates, and use high base-drive currents under large loads. The MT5215 does not suffer from these problems and consumes only 60μA (Typ.) of current consumption under heavy loads as well as in dropout conditions.

Output Voltage Selection

For voltage type of MT5215, the output voltage is preset at an internally trimmed voltage. The first two digits of part number suffix identify the output voltage (see Ordering Information). For example, the MT5215-3.3V has a preset 3.3V output voltage.

Current Limit

The MT5215 also includes a fold back current limiter. It monitors and controls the pass transistor's gate voltage, estimates the output current, and limits the output current within 2.0A (Typ.).

Thermal Overload Protection

Thermal overload protection limits total power dissipation in the MT5215. When the junction temperature exceeds T_J = +155°C, a thermal sensor turns off the pass transistor, allowing the IC to cool down. The thermal sensor turns the pass transistor on again after the junction temperature cools down by 20°C, resulting in a pulsed output during continuous thermal overload conditions.

Thermal overload protection is designed to protect the MT5215 in the event of fault conditions. For continuous operation, the absolute maximum operating junction temperature rating of T_J = +125°C should not be exceeded.

Operating Region and Power Dissipation

Maximum power dissipation of the MT5215 depends on the thermal resistance of the case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The power dissipation across the devices is $P = I_{OUT} \times (V_{IN}-V_{OUT})$. The resulting maximum power dissipation is:

$$P_{MAX} = \frac{T_J - T_A}{\theta_{JC}+\theta_{CA}} = \frac{T_J - T_A}{\theta_{JC}}$$

Where $(T_J - T_A)$ is the temperature difference between the MT5215 die junction and the surrounding air, θ_{JC} is the thermal resistance of the package chosen, and θ_{CA} is the thermal resistance through the printed circuit board, copper traces and other materials to the surrounding air. For better heat-sinking, the copper area should be equally shared between the IN, OUT, and GND pins.

Dropout Voltage

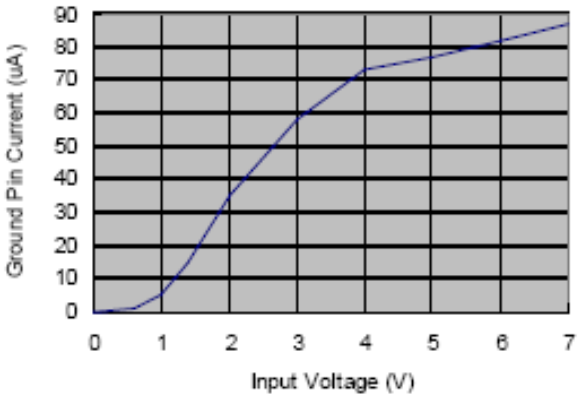
A regulator's minimum input-output voltage differential, or dropout voltage, determines the lowest usable supply voltage. In battery-powered systems, this will determine the useful end-of-life battery voltage. The MT5215 use a P-channel MOSFET pass transistor, its dropout voltage is a function of drain-to-source on-resistance $R_{DS(ON)}$ multiplied by the load current.

$$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS(ON)} \times I_{OUT}$$

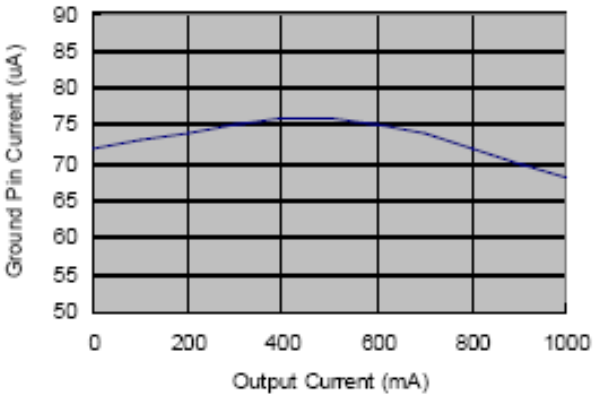
◆ Typical Performance Characteristics

V_{IN} = V_{OUT}+1V, T_A =25oC, C_{IN}=10uF, C_{OUT}=10uF, unless otherwise noted.

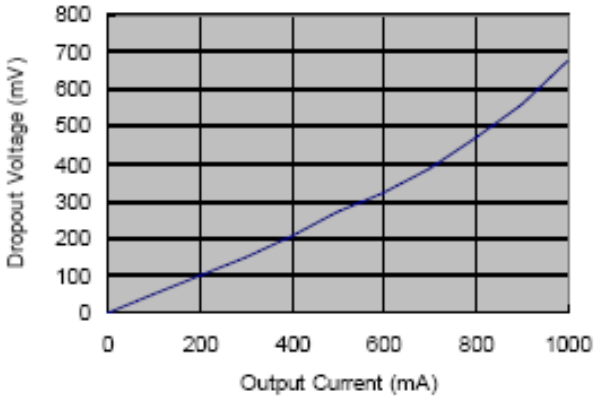
Ground Pin Current v.s. Input Voltage



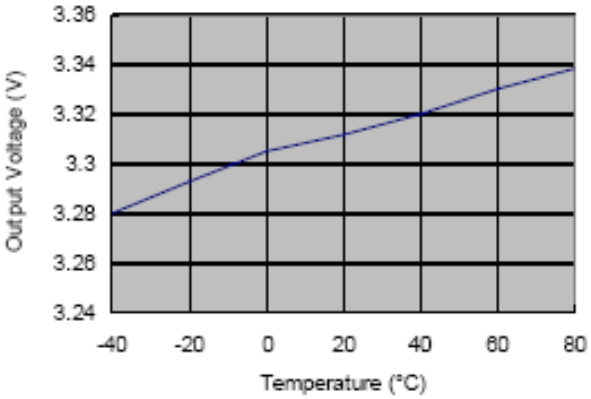
Ground Pin Current v.s. Output Current



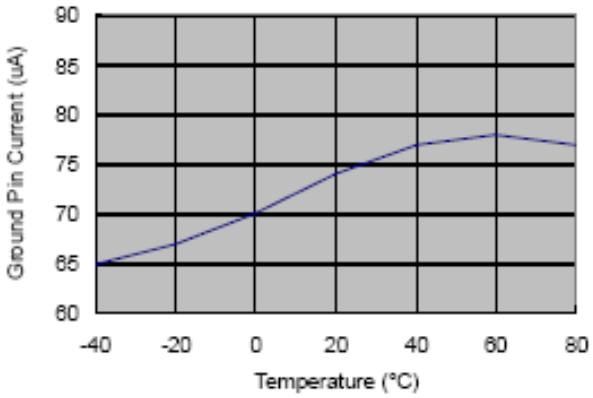
Dropout Voltage v.s. Output Current



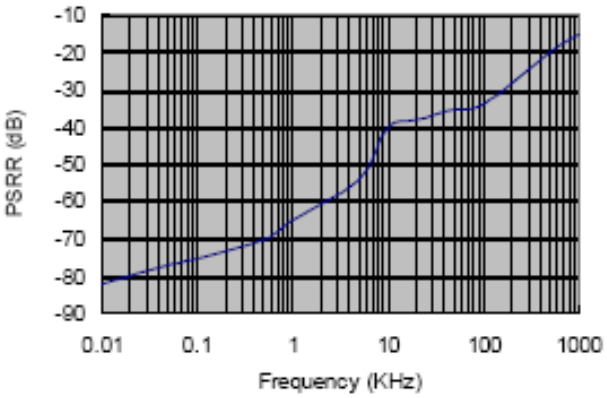
Output Voltage v.s. Temperature



Ground Pin Current v.s. Temperature

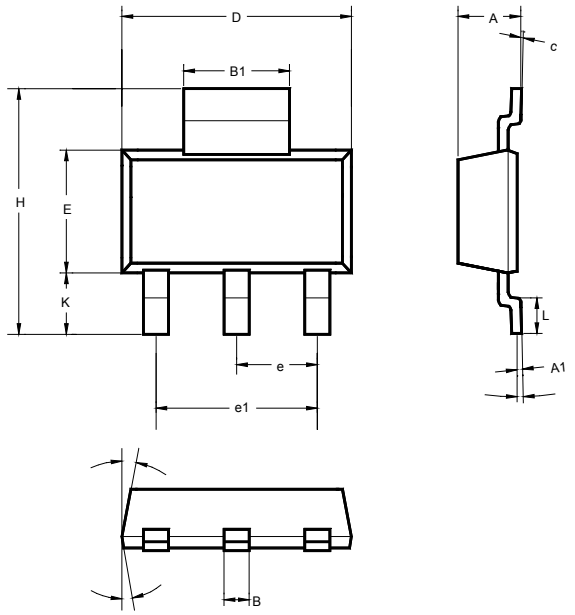


Power Supply Rejection Ratio



◆ PHYSICAL DIMENSIONS

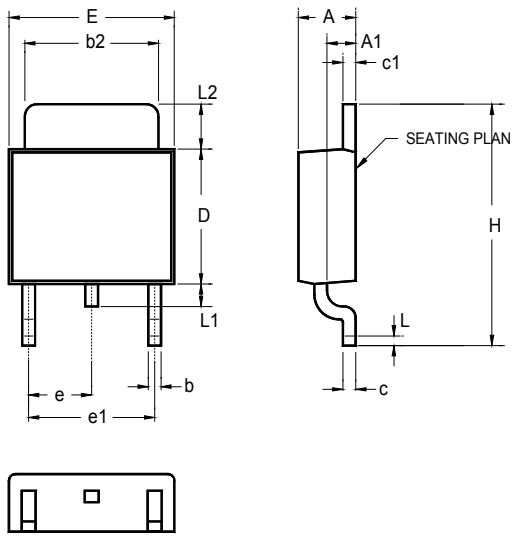
3-Pin Surface Mount SOT-223(A)



	MILLIMETERS		
	MIN	TYP	MAX
A	1.50	1.65	1.80
A1	0.02	0.05	0.08
B	0.60	0.70	0.80
B1	2.90	-	3.15
c	0.28	0.30	0.32
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	2.3 BSC		
e1	4.6 BSC		
H	6.70	7.00	7.30
L	0.91	1.00	1.10
K	1.50	1.75	2.00
α	0°	5°	10°
β		3°	

◆ PHYSICAL DIMENSIONS

3-Pin Surface Mount TO-252 (B)



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.086	-	0.094	2.18	-	2.39
A1	0.040	-	0.050	1.02	-	1.27
b	-	0.024	-	-	0.61	-
b2	0.205	-	0.215	5.21	-	5.46
c	0.018	-	0.023	0.46	-	0.58
c1	0.018	-	0.023	0.46	-	0.58
D	0.210	-	0.220	5.33	-	5.59
E	0.250	-	0.265	6.35	-	6.73
e	0.090 BSC			2.29 BSC		
e1	0.180 BSC			4.58 BSC		
H	0.370	-	0.410	9.40	-	10.41
L	0.020	-	-	0.51	-	-
L1	0.025	-	0.040	0.64	-	1.02
L2	0.060	-	0.080	1.52	-	2.03