

40V 250mA Ultralow-Quiescent-Current LDO

General Description

The MGR2402 ultra-low quiescent current regulator features low dropout voltage and low current in the standby mode. With less than 1.5µA quiescent current at no load, the MGR2402 is ideally suited for standby micro-control-unit systems, especially for always-on applications like E-meters, fire alarms, smoke detectors and other battery operated systems. The MGR2402 retains all of the features that are common to low dropout regulators including a low dropout PMOS pass device, short circuit protection, and thermal shutdown.

The MGR2402 has a 40-V maximum operating voltage limit, a -40°C to 125°C operating temperature range, and ±2% output voltage tolerance. The MGR2402 is available in a SOT233, SOT235, SOT893, ESOP8 surface mount packages.

Ordering Information

Part Number	Voltage	Package	
MGR2402-33	V _{OUT} = 3.3V	SOT233	MGR2402-33GV
		SOT235	MGR2402-33GB
		SOT893	MGR2402-33GX
		ESOP8	MGR2402-33S8
MGR2402-50	V _{OUT} = 5.0V	SOT233	MGR2402-50GV
		SOT235	MGR2402-50GB
		SOT893	MGR2402-50GX
		ESOP8	MGR2402-50S8

Features

- VIN Range up to 40V
- Output Voltage Tolerances of ±2%
- Output Current of 250 mA
- Ultra Low Quiescent Current (IQ = 1.5 µA)

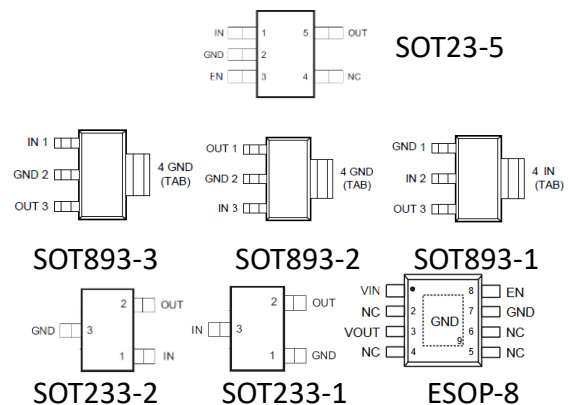
- Dropout Voltage Typically 1200 mV at I_{OUT} = 250 mA
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limit
- Ceramic Capacitor Stable

Applications

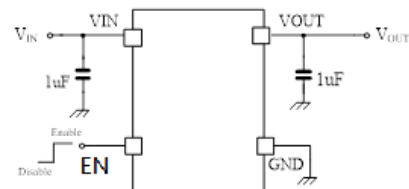
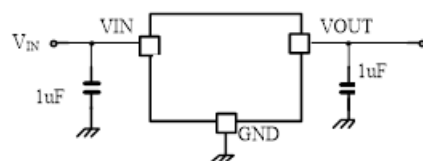


- E-meters, Water Meters and Gas Meters
- Fire Alarm, Smoke Detector
- Appliances and White Goods

Pin Configuration

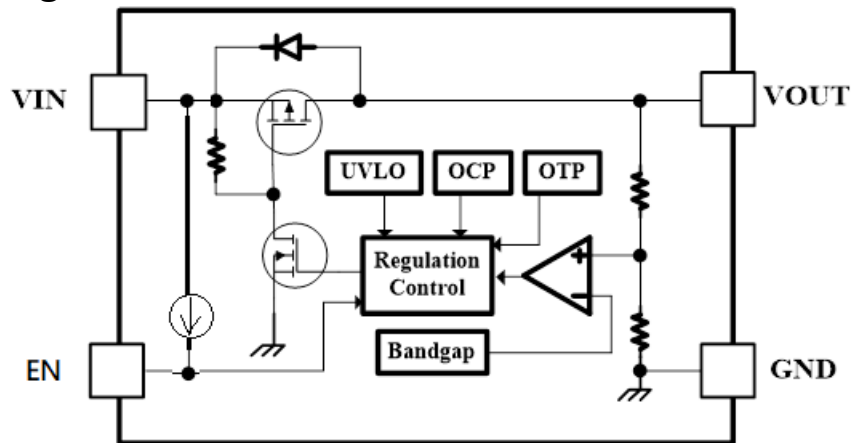


Typical Application Circuit



Pin Assignment

Pin Name	Pin No. SOT235	Pin No. SOT893	Pin No. SOT893	Pin No. SOT233	Pin No. SOT233	Pin Function
VOUT	5	3	3	2	2	Output Voltage Pin
GND	2	2,4	1	3	1	Ground
VIN	1	1	2,4	1	3	Input Voltage pin.
EN	3	--	--	--	--	Enable

Function Block Diagram


Absolute Maximum Ratings (Note1)

- V_{IN} ----- -0.3V to +45V
- V_{EN} ----- -0.3V to V_{IN}
- V_{OUT} ----- -0.3V to +6V
- Junction Temperature----- 125°C
- Lead Temperature (Soldering, 10 sec.)----- 300°C
- Storage Temperature ----- -65°C to 150°C

Recommended Operating Conditions

- Input Voltage, V_{IN} ----- +2.7V to +40V
- Junction Temperature ----- -40°C to 125°C

Electrical Characteristics
 $V_{IN}=12V$, $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=1\mu F$, $T_J=25^\circ C$, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage	V_{OUT}		-2%		2%	V
Line Regulation	ΔV_{LINE}	$V_{IN}=V_{OUT} + 1V$ to 40V,		2	12	mV
Load Regulation	ΔV_{LOAD}	$I_{OUT}= 1mA$ to 100mA		20	30	mV
		$I_{OUT}= 1mA$ to 250mA		50	80	
Dropout Voltage	V_{DROP}	$I_{OUT}=100mA$		400		mV
		$I_{OUT}=250mA$		1200		mV
Quiescent Current	I_Q	$T_J= 25^\circ C$		1.5	4.0	uA
Current Limit	I_{CL}		270	340		mA
Enable high level	V_{ENHI}		0.9			V
Enable low level	V_{ENLO}				0.4	V
Enable pin pull high current	I_{EN}			0.1		uA
Thermal Shutdown	T_{SD}			140		°C
Thermal Shutdown Hysteresis	T_{HY}			20		°C

Typical Characteristics

$V_{IN}=12V$, $I_{OUT}=1mA$, $V_{OUT}=3.3V$, $C_{IN}=C_{OUT}=1\mu F$, $T_J=25^\circ C$, unless otherwise specified

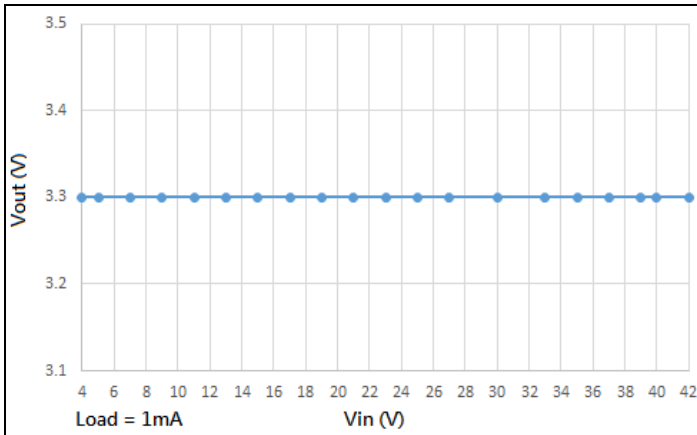


Fig 1 Vout vs Vin

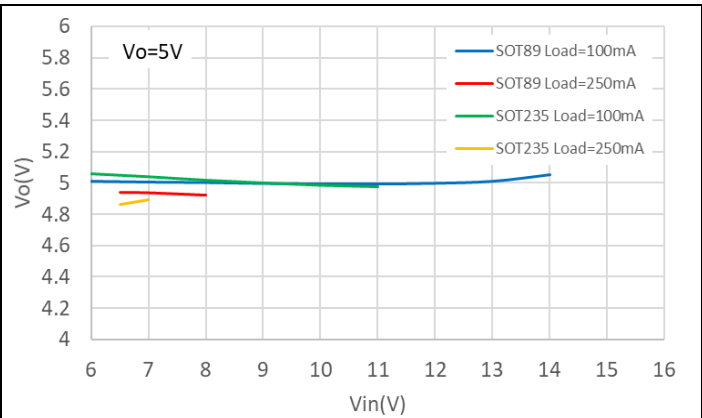


Fig 2 Vout vs Vin

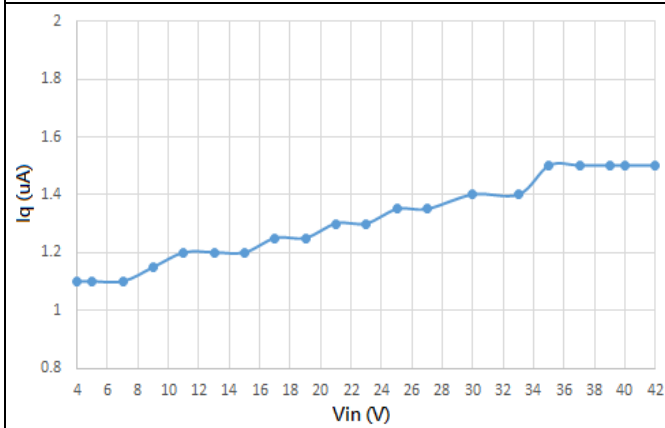


Fig 3 Iq vs Vin

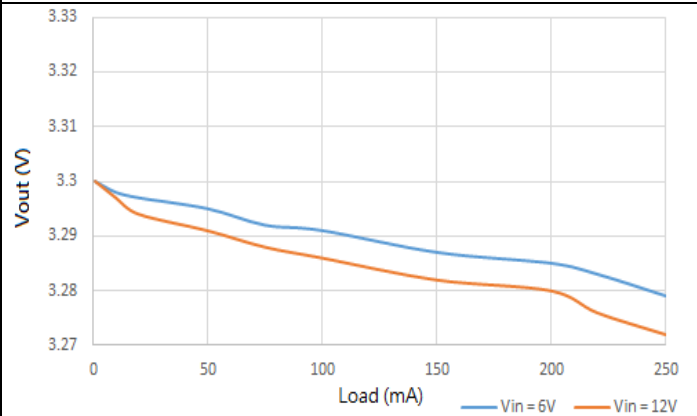


Fig 4 Vout vs Load

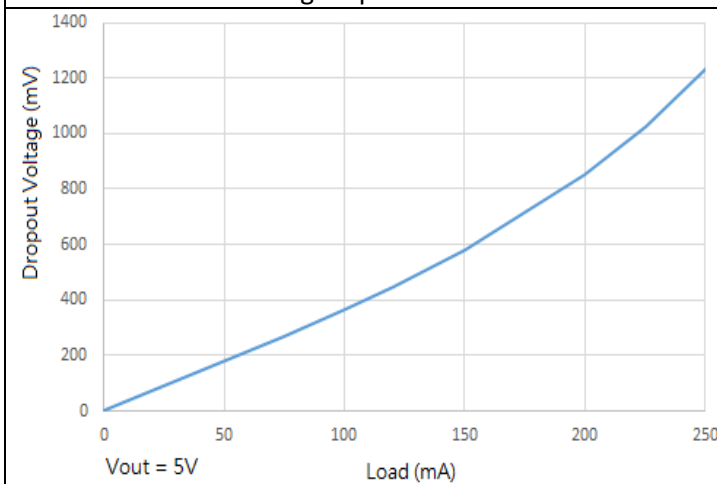


Fig 5 Dropout vs Load

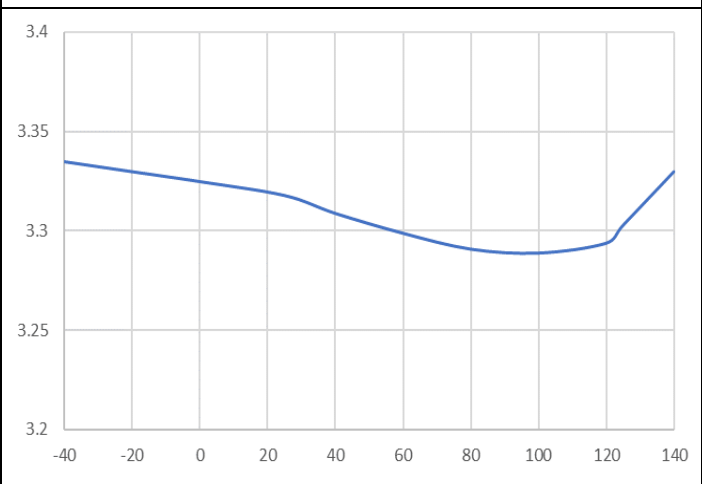


Fig 6 Vout (3.3V) vs Temperature

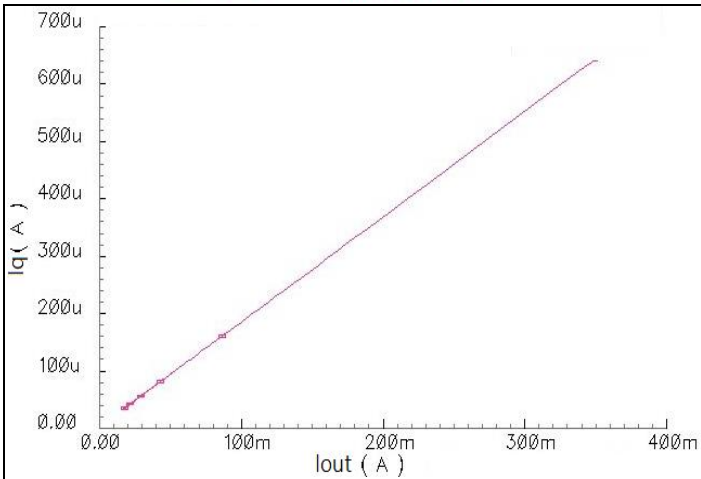


Fig 7 I_q vs Load

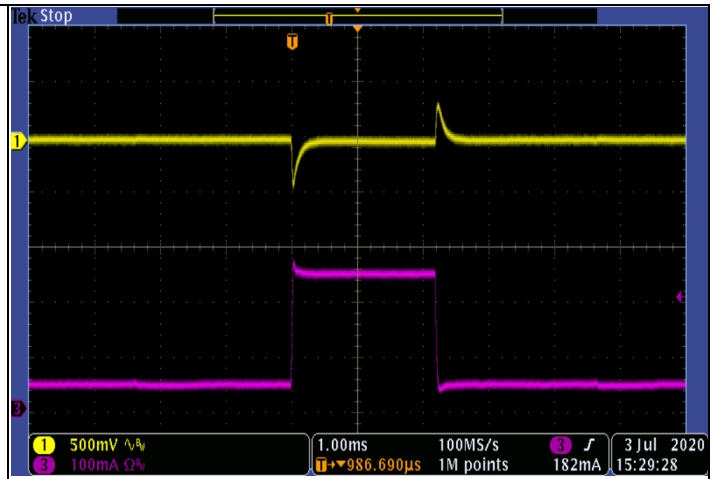


Fig 8 V_{out} Load Transient (50 to 250mA)

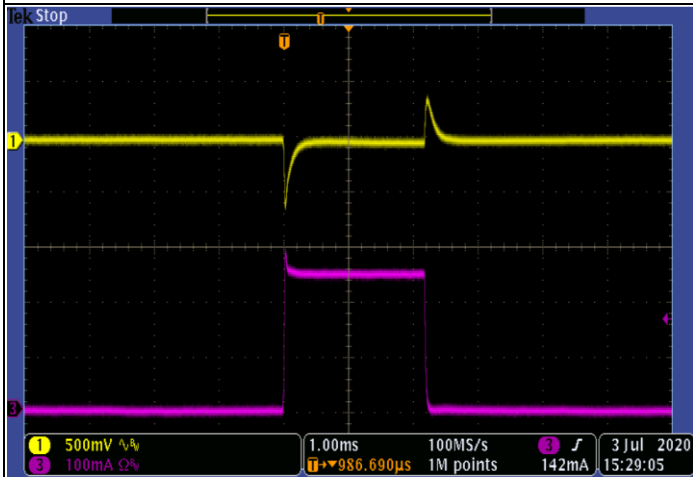


Fig 9 V_{out} Load Transient (1 to 250mA)

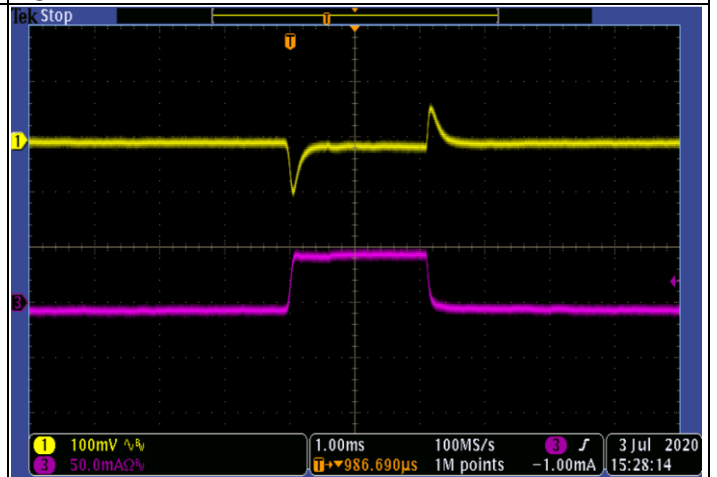


Fig 10 V_{out} Load Transient (0 to 50mA)

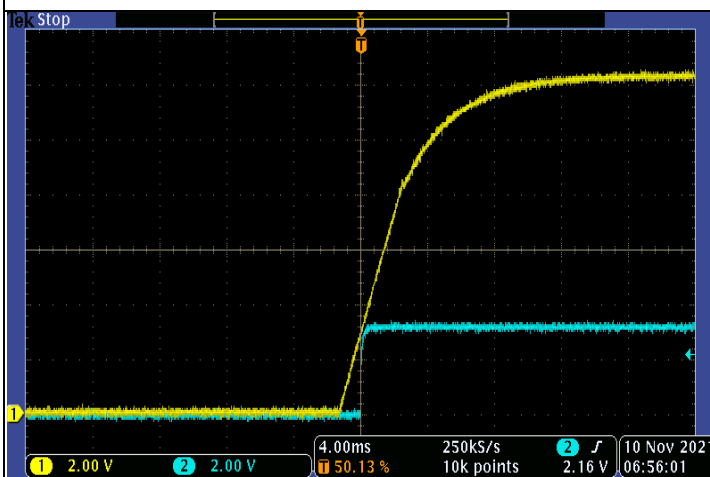


Fig 10 V_{in} Start up

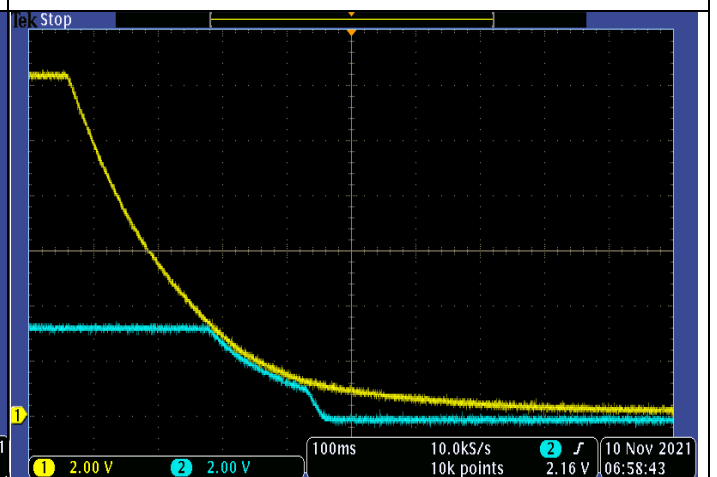


Fig 11 V_{in} power off

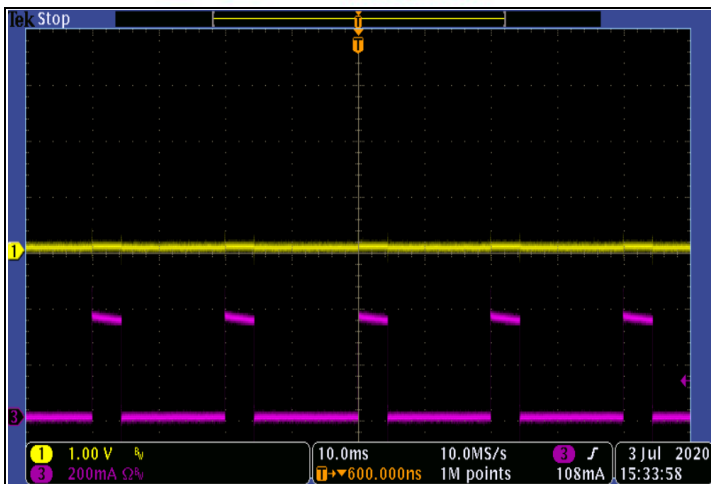
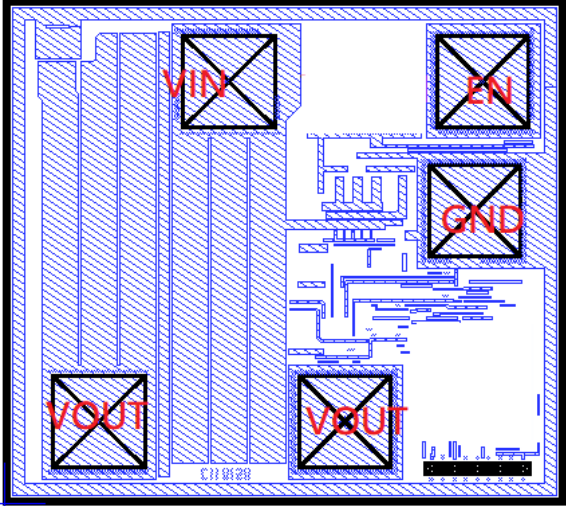


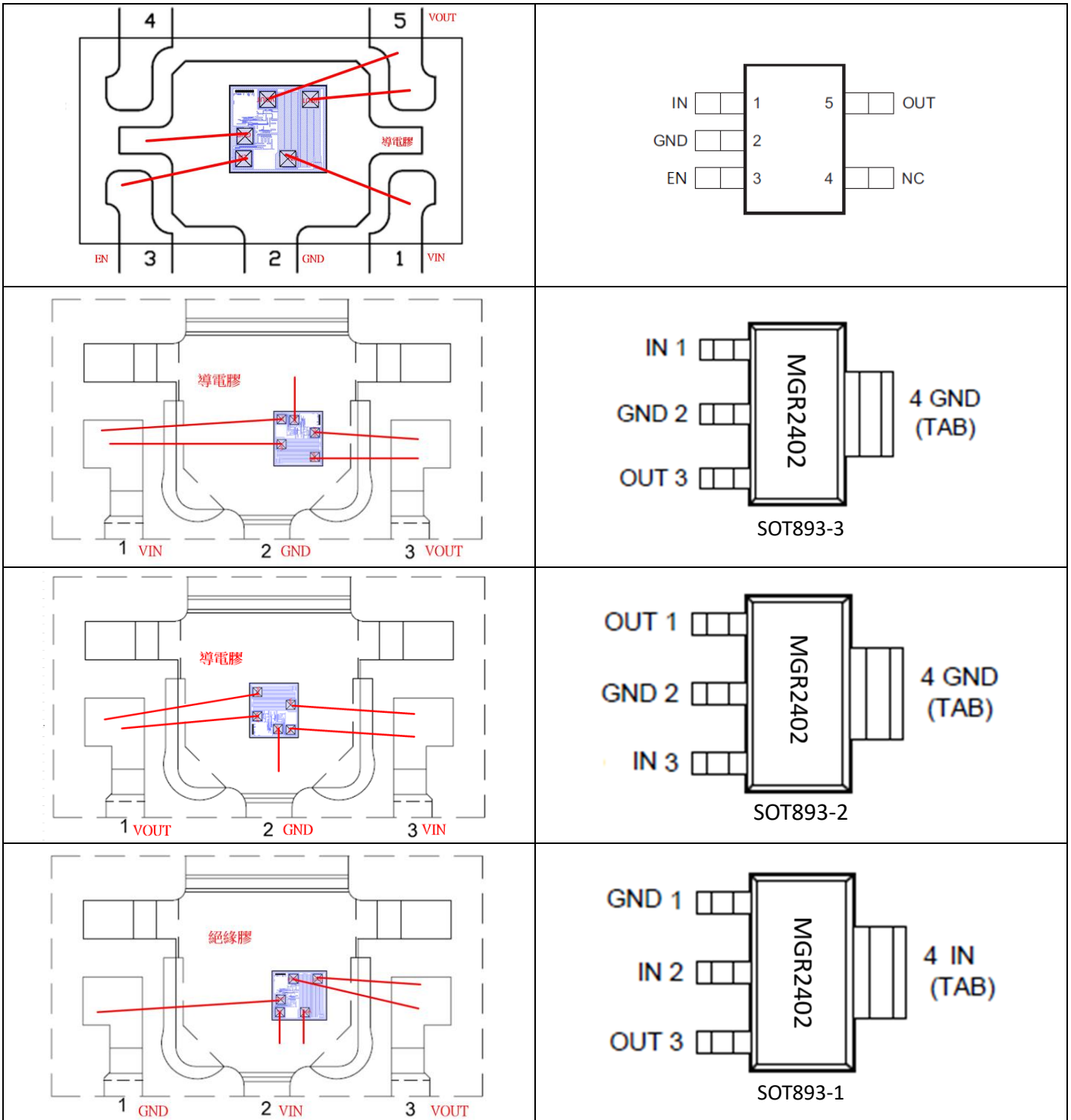
Fig 12 Vout Short to GND

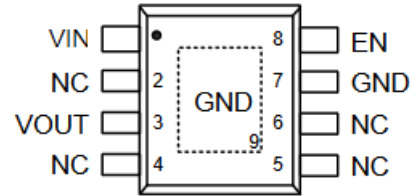
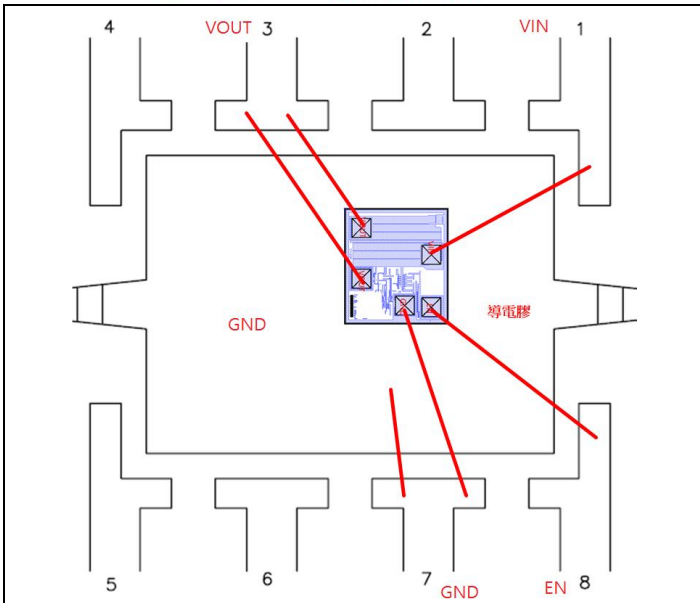
PAD Location and Coordinates

PHYSICAL CHARACTERISTICS		UNIT	CHIP DRAWING
Wafer Size	200	mm	
Die Size (with S/L)	0.550 * 0.500	mm ²	
Scribe line width	60	um	
TOP Metal thickness	3	μm	
Metal layers	3	layers	
Top Metallization	Al-Cu		
Wafer Thickness	736	μm	
CUP (circuit under PAD) or not	YES		
Bonding wire dimension	0.8 / 1.0	mil	

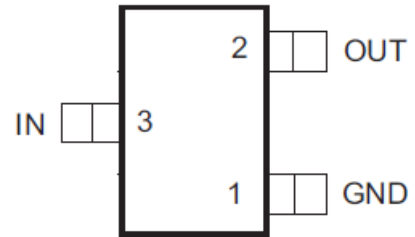
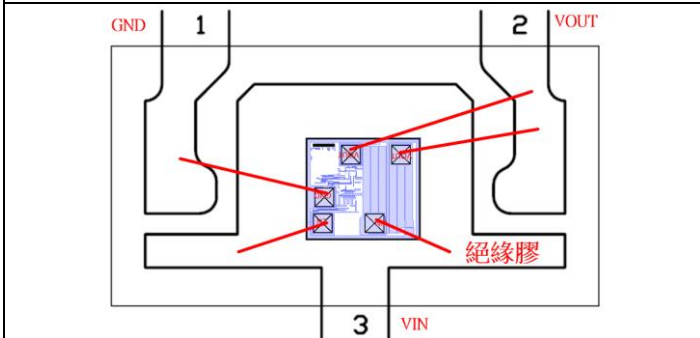
PAD NAME	PAD SIZE (μm ²)	Coordinate
VOUT	80*80	(82,71)
VOUT	80*80	(298,71)
EN	80*80	(419,369)
GND	80*80	(411,256)
VIN	80*80	(196,369)

Bonding Diagram Example

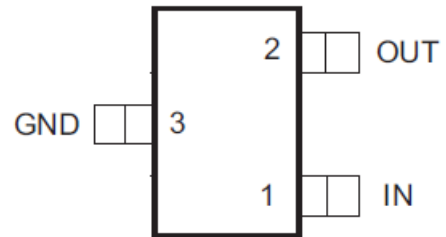
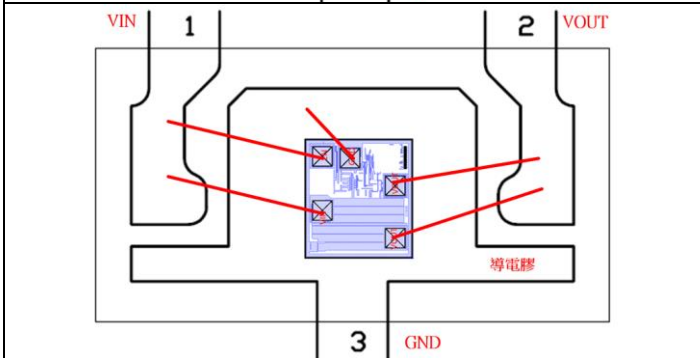




ESOP-8



SOT233-1



SOT233-2