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SEMICONDUCTOR



ESD



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PLED

RT9080

产品手册

静态电流 2 μ A, 输出电流 600mA 低压降线性降压转换器

概述

RT9080系列是一组低压差(LDO) 转换器, 具有1.2V至6V宽电压输入范围、低压差、低功耗和小型化封装的等特性。

RT9080低至 2 μ A 低静态电流特性, 特别适用于电池供电、长时间待机系统设备应用, 能帮助降低系统设备的待机功耗, 有效延长待机时间和电池使用寿命。RT9080有带 EN 使能引脚的版本可选, 将 EN 脚拉低可进入关断模式, 此关断模式下静态电流可降至仅10nA (典型值)。

RT9080 系列支持输出电容采用陶瓷电容器, 在 1.2V 至 6V 的宽输入电压范围内和整个输出负载电流 0mA- 600mA 范围内稳定工作。

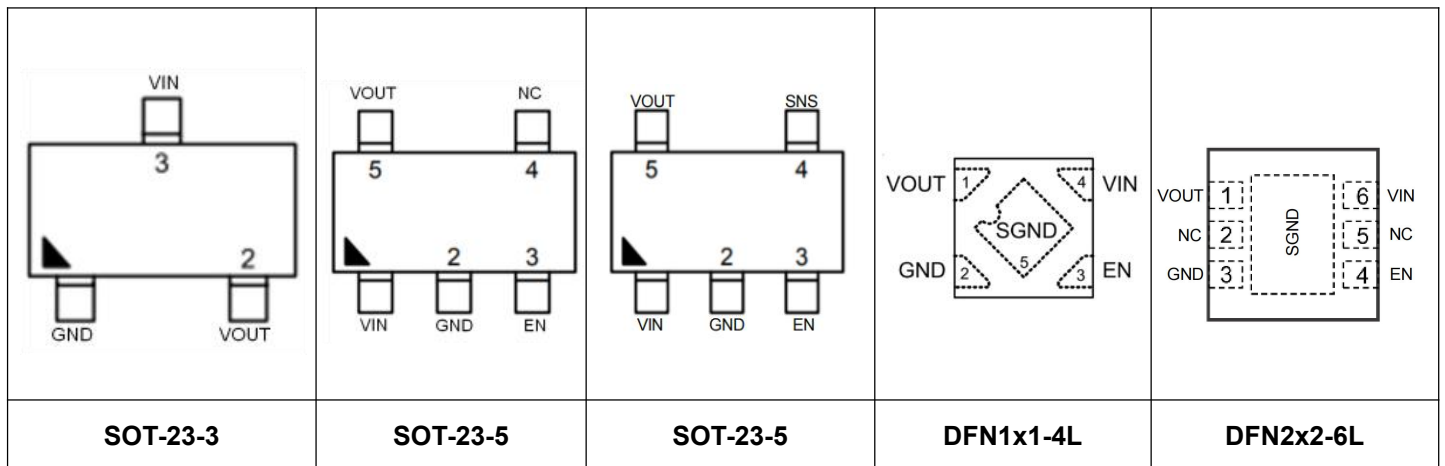
产品特点

- 2 μ A 静态电流 (无负载)
- $\pm 2\%$ 输出电压精度
- 600mA 输出电流能力
- 10nA 关断电流(可选版本)
- 宽范围输入电压: 1.2V 至 6V
- 低压差: 0.32V ($V_o=3.3V/I_o=600mA$ 条件下)
- 支持固定输出电压: 0.8V, 1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V
- 支持陶瓷电容或者钽电容
- 限流保护
- 过温保护
- 提供 SOT-23-3、 SOT-23-5、 DFN1x1-4L 和 DFN2x2-6L 封装

产品用途

- 手持式、电池供电设备
- 低功耗微处理器
- 笔记本电脑、掌上型电脑和 PDA
- 无线通讯设备
- 音频/视频设备
- 车载导航系统

封装脚位图



引脚功能描述
RT9080

脚位号				名称	功能描述
SOT-23-3	SOT-23-5	DFN1x1	DFN2x2		
1	2	2	3	GND	接地
2	5	1	1	VOUT	电源输出端口
3	1	4	6	VIN	电源输入端口
	3	3	4	EN	使能控制
	4		2,5	NC	浮空脚
		Exposed Pad	Exposed Pad	SGND	散热焊盘, 浮空或连接到地

RT9080N (SOT-23-5 有 SNS 脚版本)

脚位号	名称	功能描述
SOT-23-5		
1	VIN	电源输入端口
2	GND	接地
3	EN	使能控制
4	SNS	输出电压检测
5	VOUT	电压输出端口

产品信息

RT9080-AABB-MS

代码	描述	符号	说明
AA	输出电压	08	$V_{OUT} = 0.8V$
	
		25	$V_{OUT} = 2.5V$
	
		33	$V_{OUT} = 3.3V$
		075	$V_{OUT} = 0.75V$
		105	$V_{OUT} = 1.05V$
		285	$V_{OUT} = 2.85V$
BB	封装类型	S3	SOT-23-3
		GJ5	SOT-23-5
		D4	DFN1x1-4L
		D6	DFN2x2-6L

RT9080N-AABB-MS (SOT-23-5 有 SNS 脚版本)

代码	描述	符号	说明
AA	基准电压	08	$V_{OUT} = 0.8V$
BB	封装类型	GJ5	SOT-23-5

Notes : $V_{OUT} = (R1 + R2) / R2 \times 0.8V$, And $R2 < 16K\Omega$.

典型应用电路

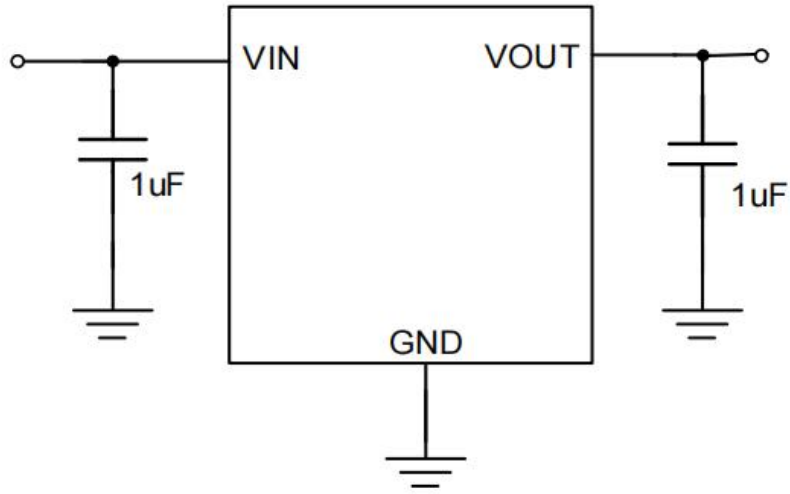


图 1：固定输出应用电路

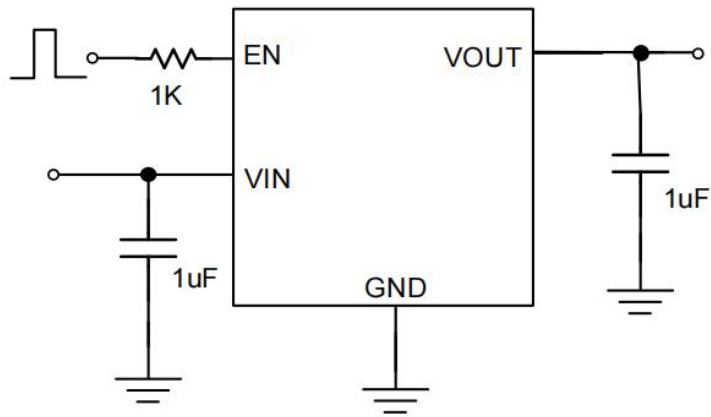


图 2：带使能脚的固定输出应用电路

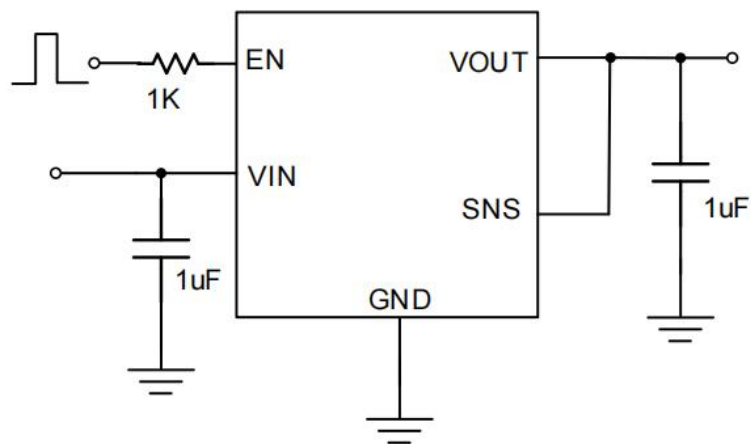


图 3：固定输出带使能功能和输出电压检测功能之应用电路

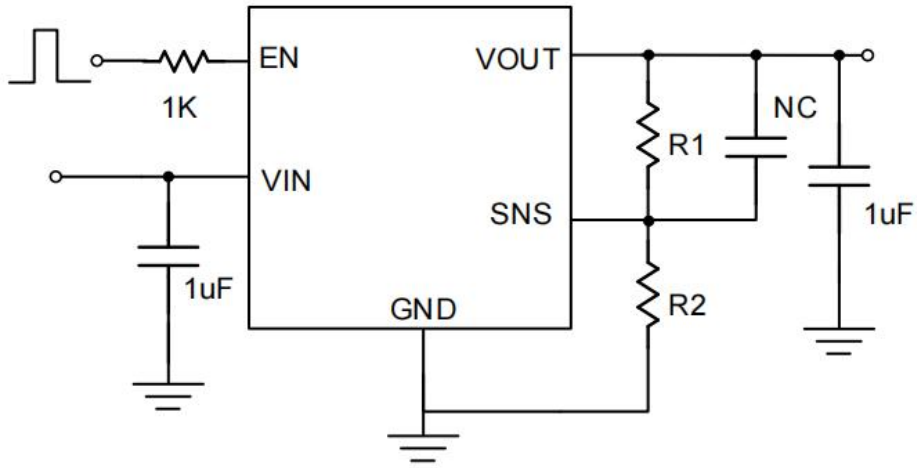
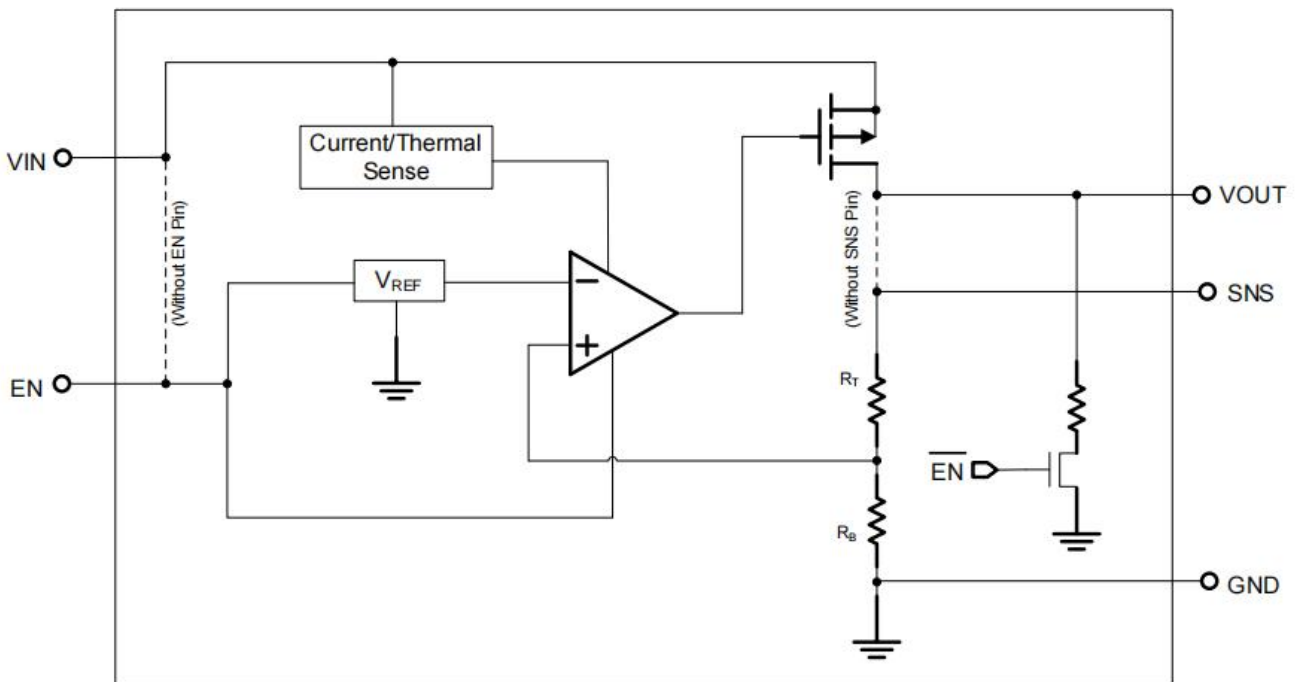


图 4: 带使能脚和输出电压检测可调电压输出应用电路

产品功能框图



最大耐压值 (Note 1)

VIN 至 GND-----0.3V to 7V

VOUT, EN 至 GND-----0.3V to 6V

VOUT 至 VIN-----6V to 0.3V

封装热阻 (Note 2)

SOT-23-5, SOT-23-3, θ_{JA} -----200°C /WDFN1x1-4L, θ_{JA} -----195°C /WDFN2x2-6L, θ_{JA} -----95°C /W

引脚焊锡温度 (Soldering, 10 sec.)-----260°C

结点温度-----150°C

存储温度范围-----60°Cto150°C

ESD 静电

HBM-----2KV

MM-----200V

CDM-----2KV

建议应用条件

输入电压 VIN -----1.2V to 6V

应用结温范围 -----40°Cto 125°C

应用环温范围 -----40°Cto85°C

电气特性 ($V_{IN} = 5V, V_{EN} = 5V, T_A = 25^\circ C$ 除另有说明外)

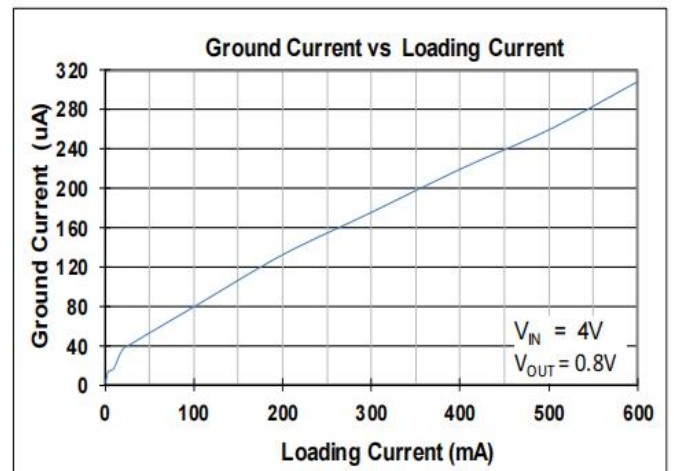
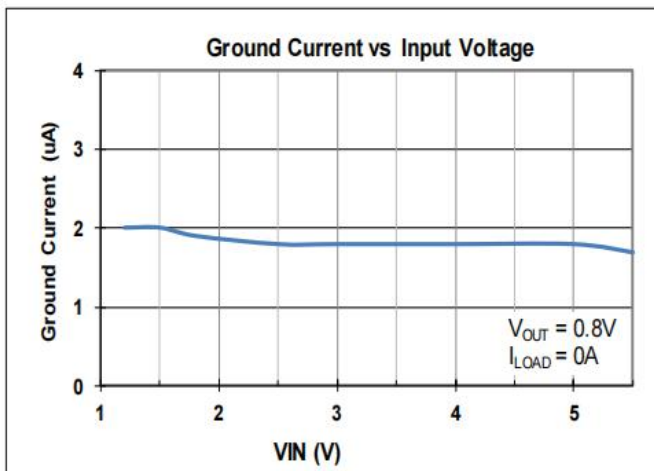
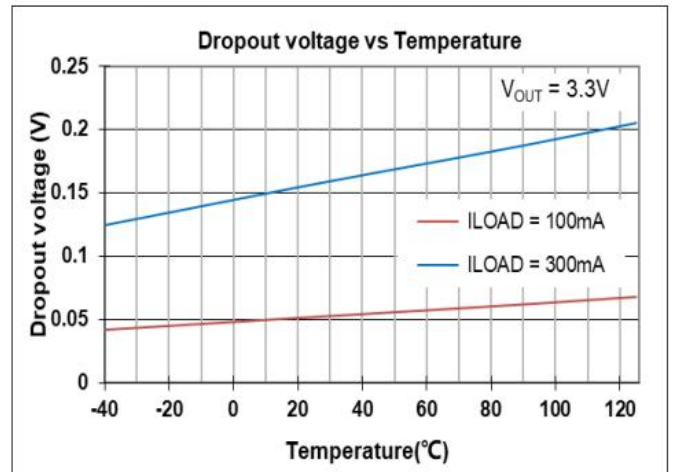
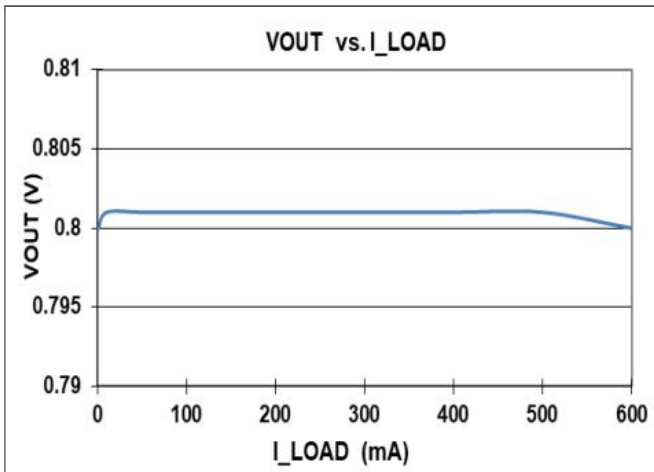
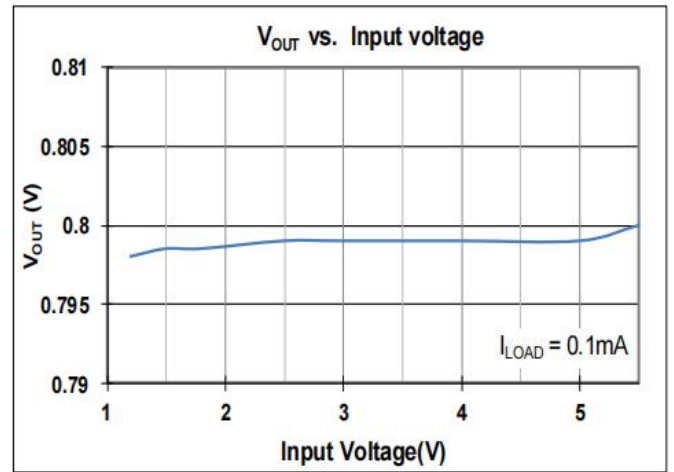
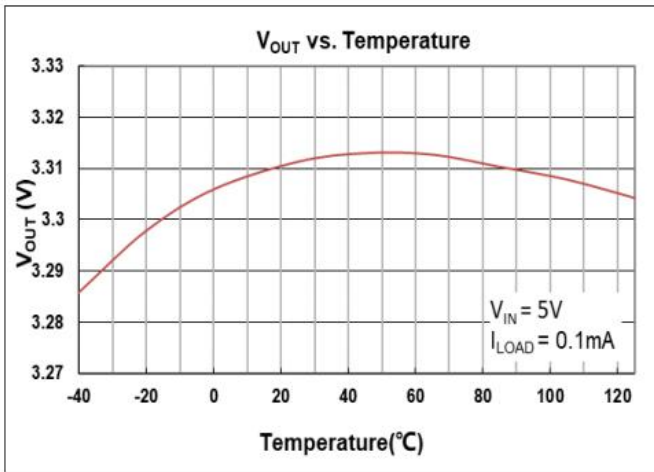
参数	符号	测试条件	最小值	典型值	最大值	单位	
输入电压	V_{IN}		1.2	--	6.0	V	
输出电压精准度		$I_{LOAD} = 0.1mA$	-2		2	%	
SNS 输入电流	I_{SNS}	$SNS = V_{OUT}$		0.7		μA	
Dropout 电压 ($I_{LOAD} = 600mA$) (Note 3)	V_{DROP_3V}	$V_{OUT} \geq 3V$		0.32		V	
	$V_{DROP_2.8V}$	$V_{OUT} = 2.8V$		0.36			
	$V_{DROP_2.5V}$	$V_{OUT} = 2.5V$		0.36			
	$V_{DROP_1.8V}$	$V_{OUT} = 1.8V$		0.57			
	$V_{DROP_1.5V}$	$V_{OUT} = 1.5V$		0.71			
	$V_{DROP_1.2V}$	$V_{OUT} = 1.2V$		0.8			
	$V_{DROP_0.8V}$	$V_{OUT} = 0.8V$		1.1			
静态电流	I_Q	$I_{LOAD} = 0mA$		2		μA	
关闭电流	I_{SD}	$V_{EN} = 0V, V_{OUT} = 0V$		0.01	0.5	μA	
使能电压阈值	V_{IH}	EN Rising	1.7			V	
	V_{IL}	EN Falling			0.6		
EN 输入电流	I_{EN}	$V_{EN} = 5V$		10	100	nA	
输入电压调整率	$\Delta LINE$	$I_{LOAD} = 30mA,$ $1.5V \leq V_{IN} \leq 5.5V$ or $(V_{OUT} + 0.2V) \leq V_{IN} \leq 5.5V$		0.2		%	
负载电压调整率	$\Delta LOAD$	$10mA \leq I_{LOAD} \leq 0.3A$		0.2		%	
输出电流限流值	I_{LIM}	$V_{OUT} = 0V$	601	1100		mA	
电源抑制比 ($I_{LOAD} = 5mA$)	PSRR	$V_{OUT} = 1.2V,$ $V_{IN} = 2V$	$f = 100Hz$	--	80	--	dB
			$f = 1kHz$	--	75	--	
输出电流噪声 ($BW = 10Hz$ to $100kHz,$ $C_{OUT} = 1\mu F$.)		$V_{IN} = 3.5V,$ $I_{LOAD} = 0.1A$	$V_{OUT} = 0.9V$	--	40	--	μV_{RMS}
			$V_{OUT} = 2.8V$	--	70	--	
过温度关断温度	T_{SD}	$I_{LOAD} = 10mA$	--	155	--	$^\circ C$	
过温度关断迟滞	ΔT_{SD}		--	15	--	$^\circ C$	
放电电阻	R_{DC}	$EN = 0V, V_{OUT} = 0.1V$	--	80	--	Ω	

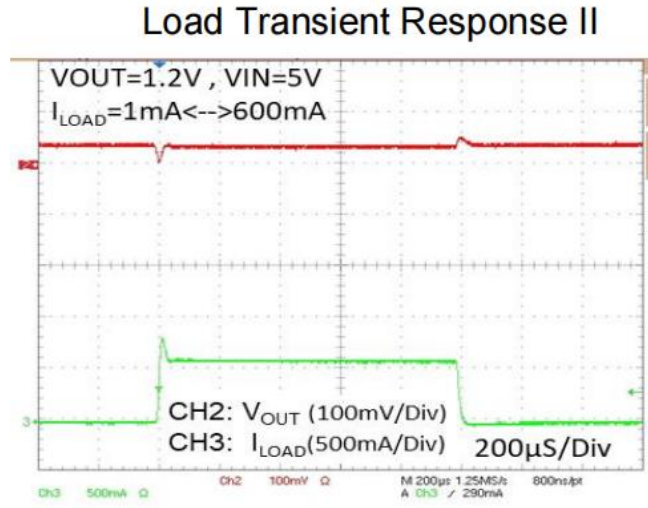
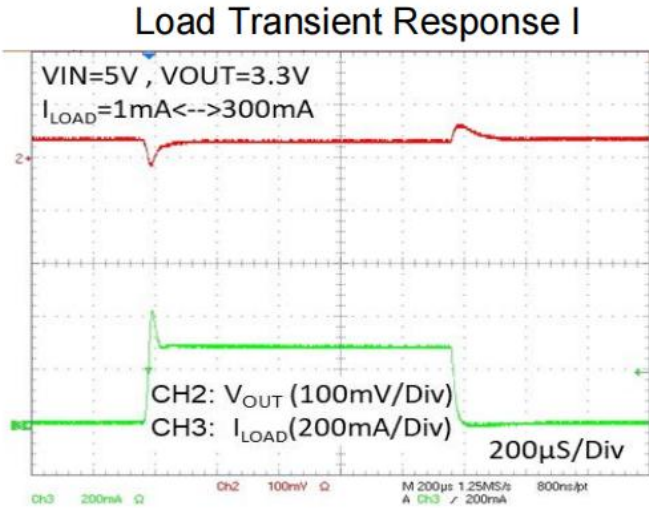
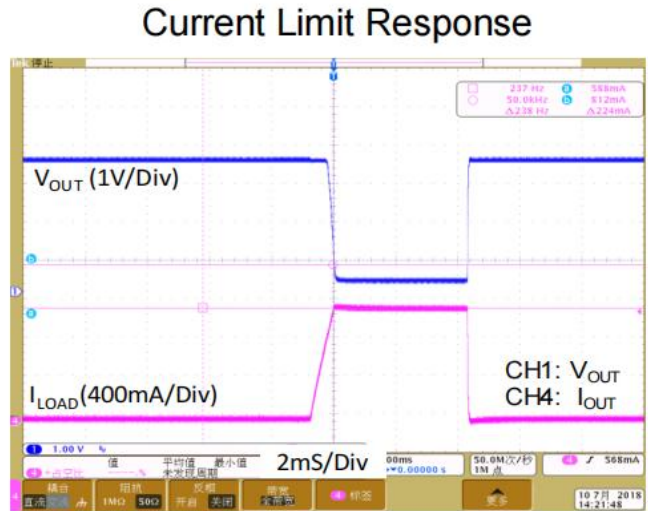
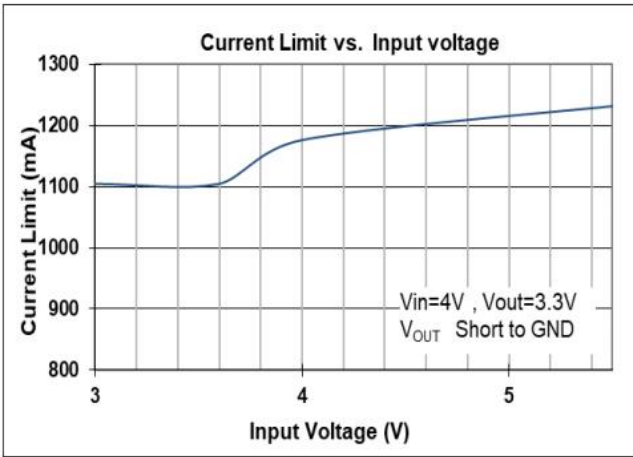
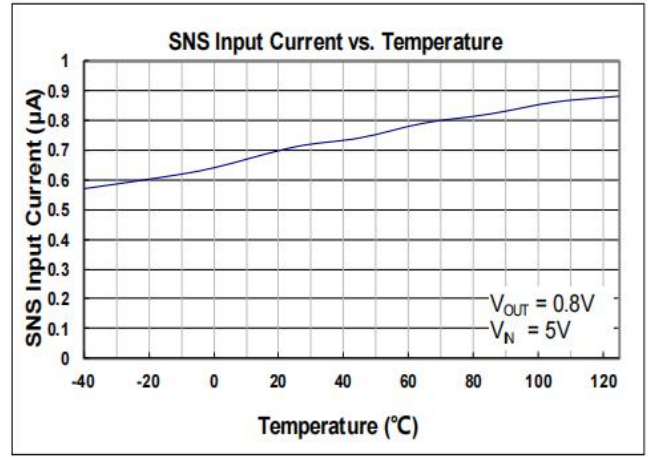
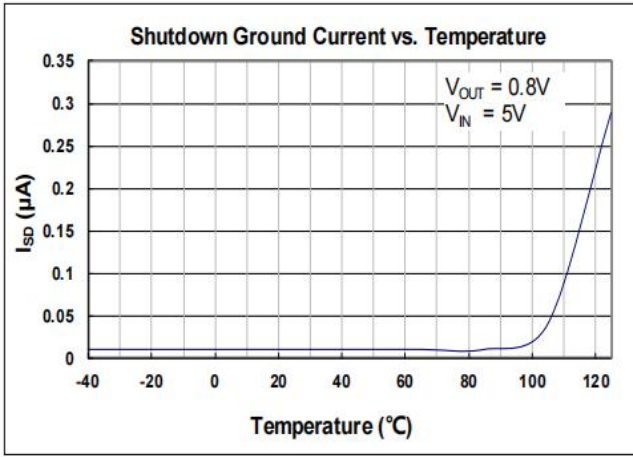
Note 1. 任何超过“最大耐压值”的应用可能会导致芯片遭受永久性损坏。这些是额定最大耐压值，仅表示在这个范围内芯片不会损伤，但不保证所有性能指标都正常，在任何超过“最大耐压值”的场合使用，都可能导致芯片永久性损坏。在接近或等于最大耐压值情况下使用，可能会影响产品可靠性。

Note 2. θ_{JA} 测量条件: $T_A = 25^\circ C$, 使用 EVB 板。

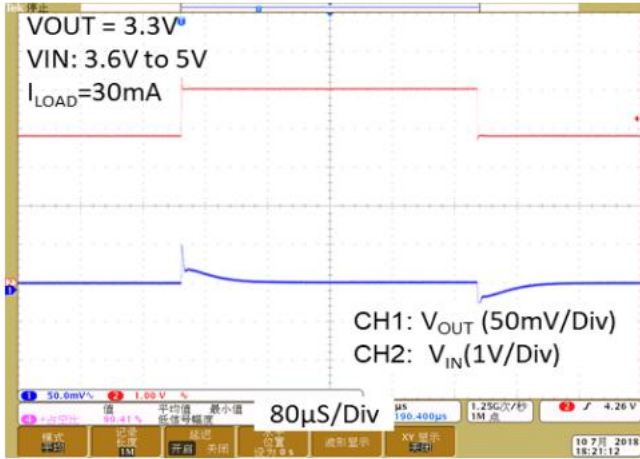
Note 3. $V_{DROP} = V_{IN} - V_{OUT}$ (V_{OUT} 达到 98%标准值)。

典型电气特性

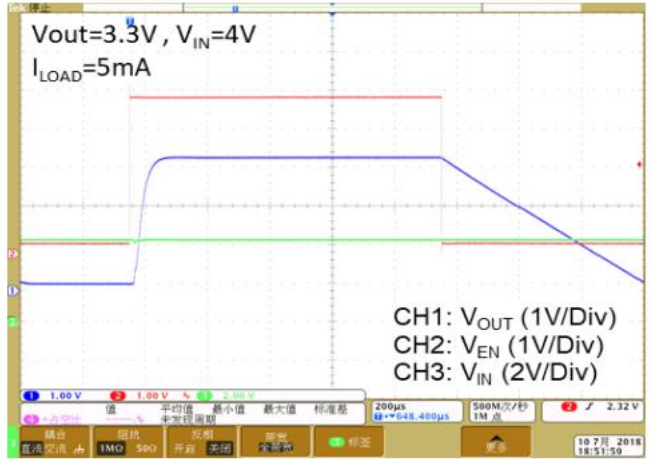




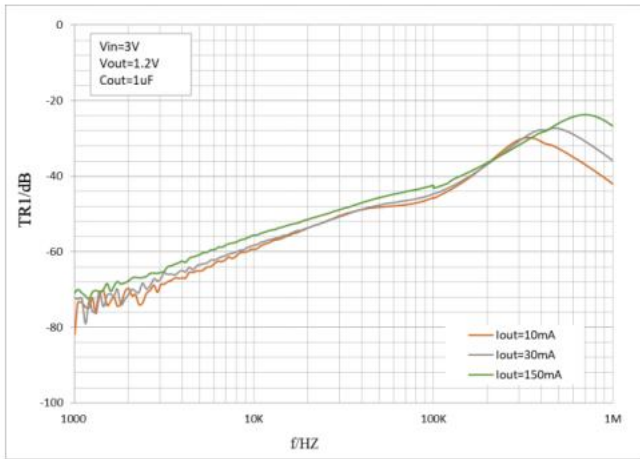
Line Transient Response



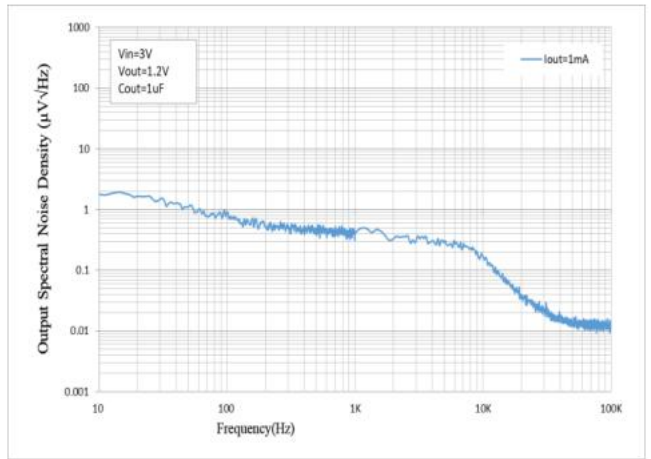
V_{OUT} Turn On/Off by EN



PSRR vs. Frequency



Noise Density Spectrum



应用指导

输入和输出电容

RT9080系列产品应用,需要选择合适的输入电容和输出电容,以确保产品应用获得稳定可靠的性能。使用 1 μ F 或者更大容值的输入电容,并将其靠近 IC 的 VIN 和 GND pin脚摆放。输出电容可选用1m Ω 以上 ESR (等效串联阻抗),有效容值 1 μ F 至 22 μ F 的电容。并将输出电容靠近IC的V_{OUT}和GND脚摆放。增加输出电容的容值和降低 ESR 能够提升电路的PSRR和瞬态响应能力。

电流限制功能

RT9080系列产品内部的电流限制器可持续监控及控制 输出功率晶体管,将输出电流限制至1100mA(典型值)。限流功能确保输出可以短路至地,器件不会损坏。

Dropout 电压

RT9080系列采用 PMOS 传输晶体管来实现低压差。当(V_{IN} - V_{OUT}) 小于(V_{DROP})时, PMOS 晶体管处于线性工作区域,输入至输出阻抗即为PMOS的R_{DS(ON)},在此状态下, PMOS 等效于一颗电阻, V_{DROP}和输出电流近似成比例。和其他线性电压转换器一样, RT9080系列的PSRR和瞬态响应能力会随着(V_{IN} - V_{OUT})压差接近 V_{DROP} 而下降。

可调输出电压应用

RT9080N带SNS Pin版本可同时作为可调输出电压LDO。图4是可调输出电压典型应用电路。从V_{OUT}到SNS的分压电阻网络设定输出电压,输出电压值由R1和R2的值决定。为确保输出电压的输出精度,需要合理选择R1和R2的值,以减少 SNS 脚处输入电流的温度影响。为了满足上述要求,建议流过分压电阻器的电流大于50 μ A。

可调输出电压计算公式如下:

$$V_{OUT} = \frac{R1+R2}{R2} \times V_{SNS} \quad (1)$$

V_{SNS} 取决于选用的产品型号 RT9080N-08, V_{SNS} 值为0.8V。由于可调输出分压电阻最小 50 μ A电流的要求,整个降压电路的静态电流不再是2 μ A。

OTP (过温度保护)

当产品的结点温度超过 155 $^{\circ}$ C (典型值) 时, RT9080会关闭 P-MOS 关闭输出。当结点温度往回降大约 15 $^{\circ}$ C 时, RT9080会重新自动重启工作。

热散功率

持续工作时，IC 的结点温度不应超过其额定值。最大的热散功率取决于 IC 封装的热阻、PCB 布图、周围气流速率以及结点和环境温度的差异。最大热散功率计算如下：

环温 $T_A = 25^\circ\text{C}$, 使用 PCB,

SOT-23-3 / SOT-23-5 封装:

$$PD (\text{Max}) = (125^\circ\text{C} - 25^\circ\text{C}) / (200^\circ\text{C}/\text{W}) = 0.5\text{W}$$

DFN1x1-4L 封装:

$$PD (\text{Max}) = (125^\circ\text{C} - 25^\circ\text{C}) / (195^\circ\text{C}/\text{W}) = 0.51\text{W}$$

DFN2x2-6L 封装:

$$PD (\text{Max}) = (125^\circ\text{C} - 25^\circ\text{C}) / (95^\circ\text{C}/\text{W}) = 1.05\text{W}$$

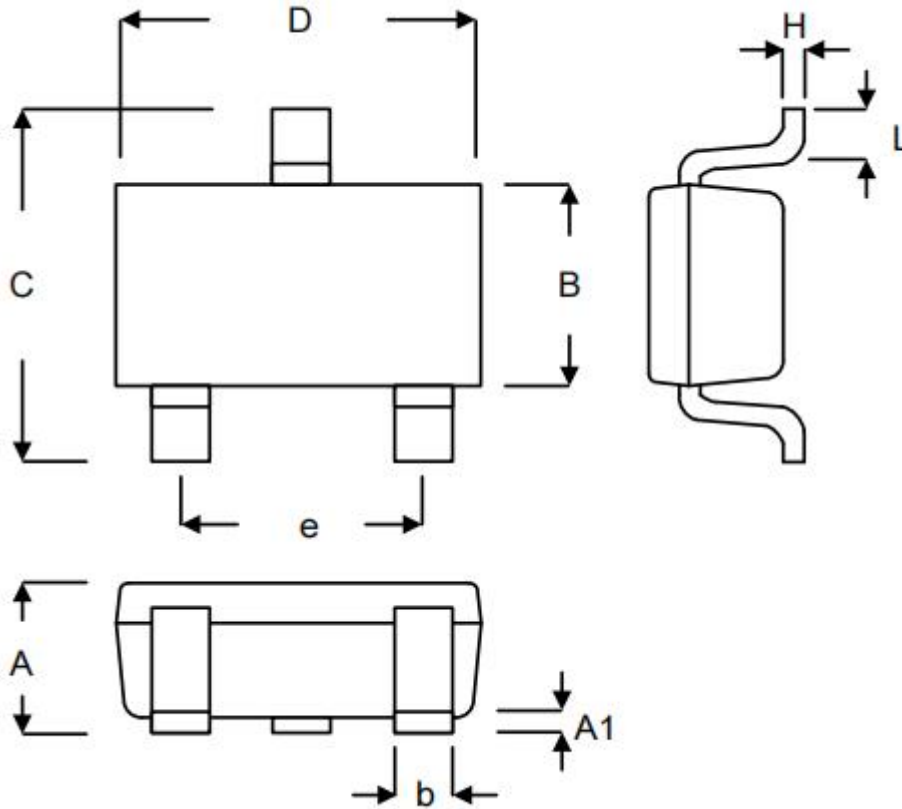
热散功率(PD)等于输出电流和 LDO 上的压降的乘积，计算公式如下：

$$PD = (V_{IN} - V_{OUT}) \times I_{OUT}$$

Layout 注意事项

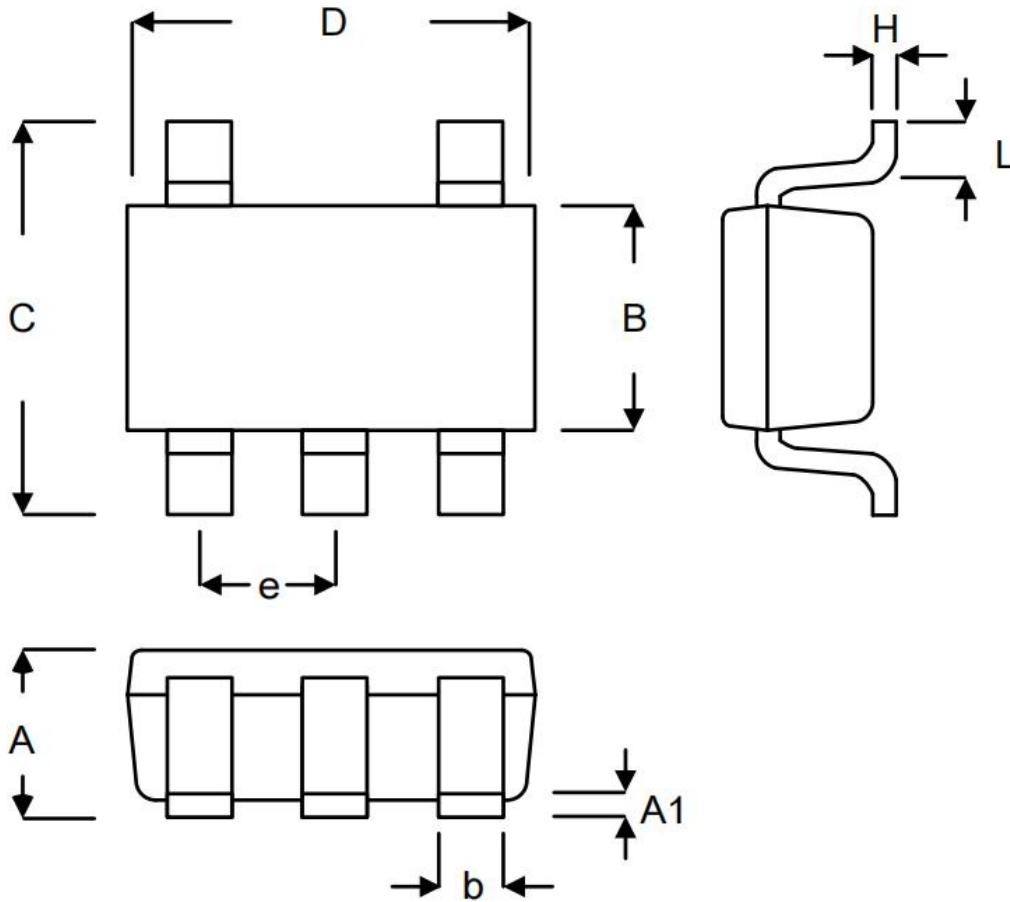
将输入电容、输出电容和 LDO 放置在 PCB 的同一面，并尽量将电容器靠近 IC 的输入输出脚摆放，可实现电路最佳性能。输入电容和输出电容的接地连接必须拉回到 RT9080 的接地引脚，并使用短而粗的铺线连接。避免使用长走线、窄走线、或者通过过孔走线，这些会增加寄生电感和电阻，导致电路性能变差，特别是在瞬态工作条件下。

封装信息



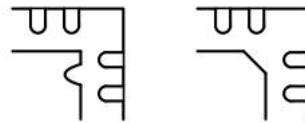
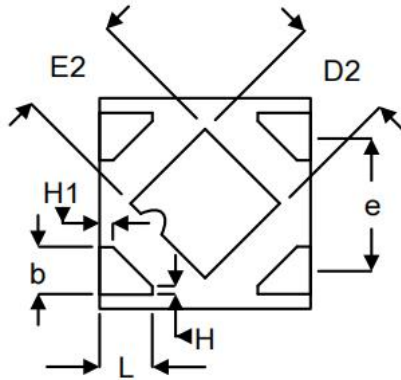
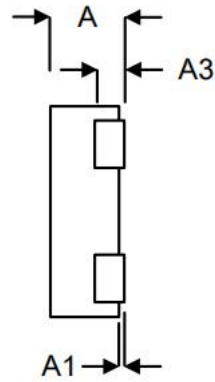
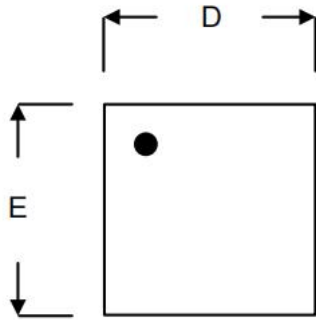
Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-3L



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-5L



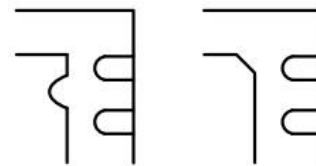
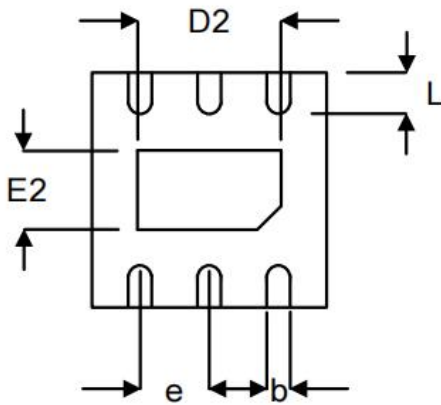
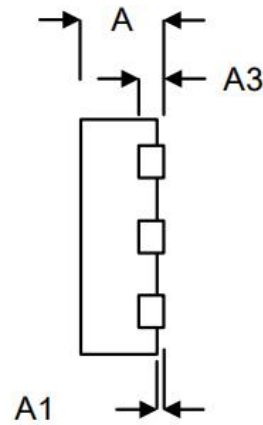
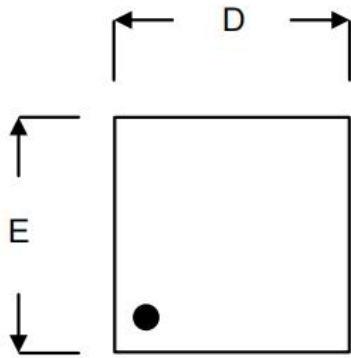
DETAILA

PIN #1 ID and Tie Bar Mark Options

Note : The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.300	0.400	0.012	0.016
A1	0.000	0.050	0.000	0.002
A3	0.117	0.162	0.005	0.006
b	0.175	0.280	0.007	0.011
D	0.900	1.100	0.035	0.043
D2	0.430	0.550	0.017	0.022
E	0.900	1.100	0.035	0.043
E2	0.430	0.550	0.017	0.022
e	0.650		0.026	
L	0.200	0.300	0.008	0.012
H	0.039		0.002	
H1	0.064		0.003	

DFN1x1-4L



DETAILA

PIN #1 ID and Tie Bar Mark Options

Note: The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.175	0.250	0.007	0.010
b	0.200	0.350	0.008	0.014
D	1.950	2.050	0.077	0.081
D2	1.000	1.450	0.039	0.057
E	1.950	2.050	0.077	0.081
E2	0.500	0.850	0.020	0.033
e	0.650		0.026	
L	0.300	0.400	0.012	0.016

DFN2x2-6L

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