

MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

AP2125N-X.XTRG1(MS)

Product specification

产品描述

AP2125N-X.XTRG1(MS) 系列是一组低压差 (LDO) 转换器, 具有 1.2V 至 5.5V 宽电压输入范围、低压差、低功耗和小型化封装的等特性。

AP2125N-X.XTRG1(MS) 低至 2uA 低静态电流特性, 特别适合用于电池供电、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。

AP2125N-X.XTRG1(MS) 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 100nA (典型值)。AP2125N-X.XTRG1(MS) 系列支持输出电容采用陶瓷电容器, 在 1.2V 至 5.5V 的宽输入电压范围内和整个输出负载电流 0mA-300mA 范围内稳定工作。


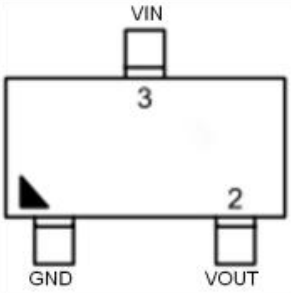
产品特性

- 2uA 静态电流 (无负载)
- $\pm 2\%$ 输出电压精度
- 300mA 输出电流能力
- 100nA 关断电流 (可选版本)
- 宽范围输入电压: 1.2V 至 5.5V
- 低压差: 0.18V ($V_o=3.3V/I_o=300mA$ 条件下)
- 支持固定输出电压: 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

产品应用

- 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






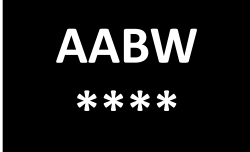

封装脚位图

| SOT-23 | Pin Configurations |
|---|--|
|  |  |

引脚功能描述

| 脚位号 | 名称 | 功能描述 |
|-----|------|--------|
| 1 | GND | 接地 |
| 2 | VOUT | 电压输出端口 |
| 3 | VIN | 电源输入端口 |

产品信息

| | |
|---|---|
| AP2125N-1.2TRG1(MS) | AP2125N-1.5TRG1(MS) |
|  |  |
| AP2125N-1.8TRG1(MS) | AP2125N-2.5TRG1(MS) |
|  |  |
| AP2125N-2.8TRG1(MS) | AP2125N-3.0TRG1(MS) |
|  |  |
| AP2125N-3.3TRG1(MS) | |
|  | |

| 订单型号 | 封装形式 | 包装/数量 |
|---------------------|--------|------------|
| AP2125N-1.2TRG1(MS) | SOT-23 | 盘装/3000pcs |
| AP2125N-1.5TRG1(MS) | SOT-23 | 盘装/3000pcs |
| AP2125N-1.8TRG1(MS) | SOT-23 | 盘装/3000pcs |
| AP2125N-2.5TRG1(MS) | SOT-23 | 盘装/3000pcs |
| AP2125N-2.8TRG1(MS) | SOT-23 | 盘装/3000pcs |
| AP2125N-3.0TRG1(MS) | SOT-23 | 盘装/3000pcs |
| AP2125N-3.3TRG1(MS) | SOT-23 | 盘装/3000pcs |

典型应用电路

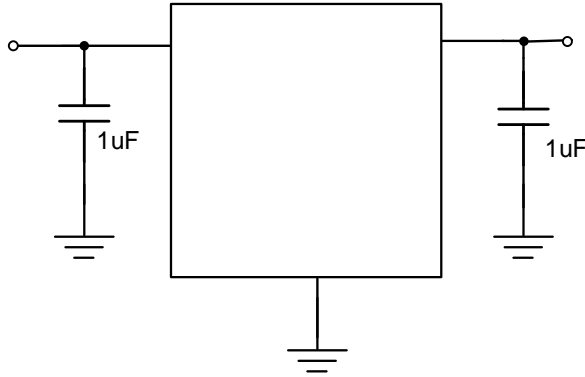


图 1: 固定输出应用电路

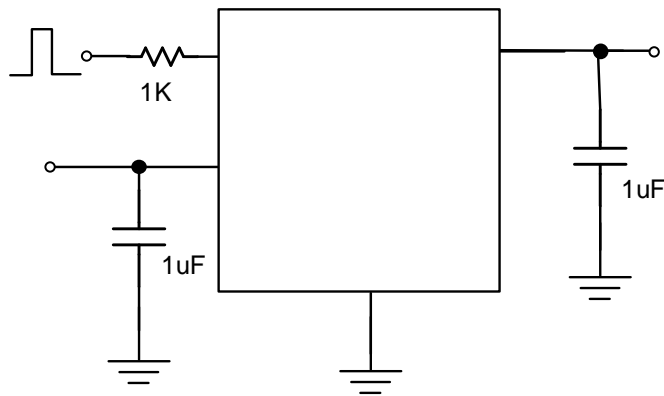


图 2: 带使能脚的固定输出应用电路

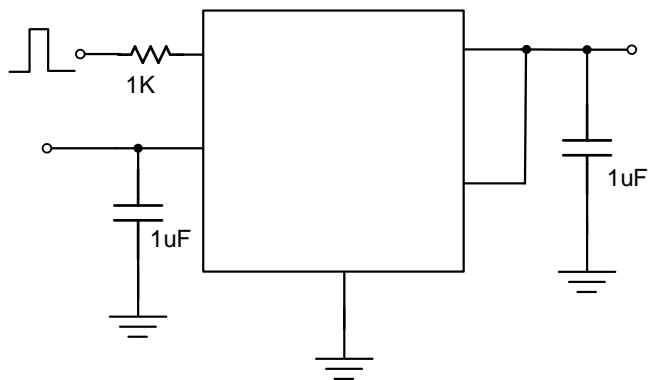


图 3: 固定输出带使能功能和输出电压检测功能之应用电路

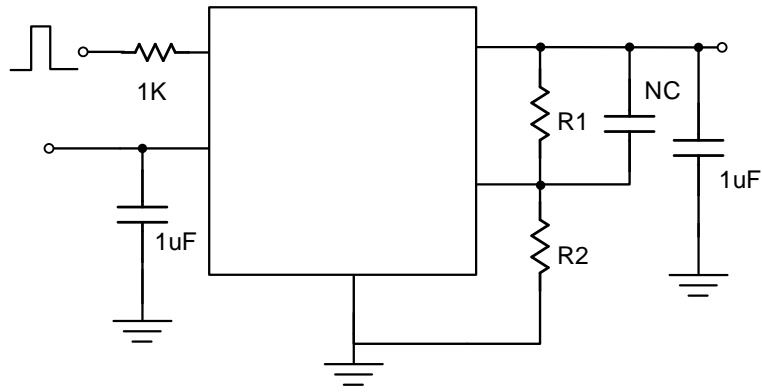
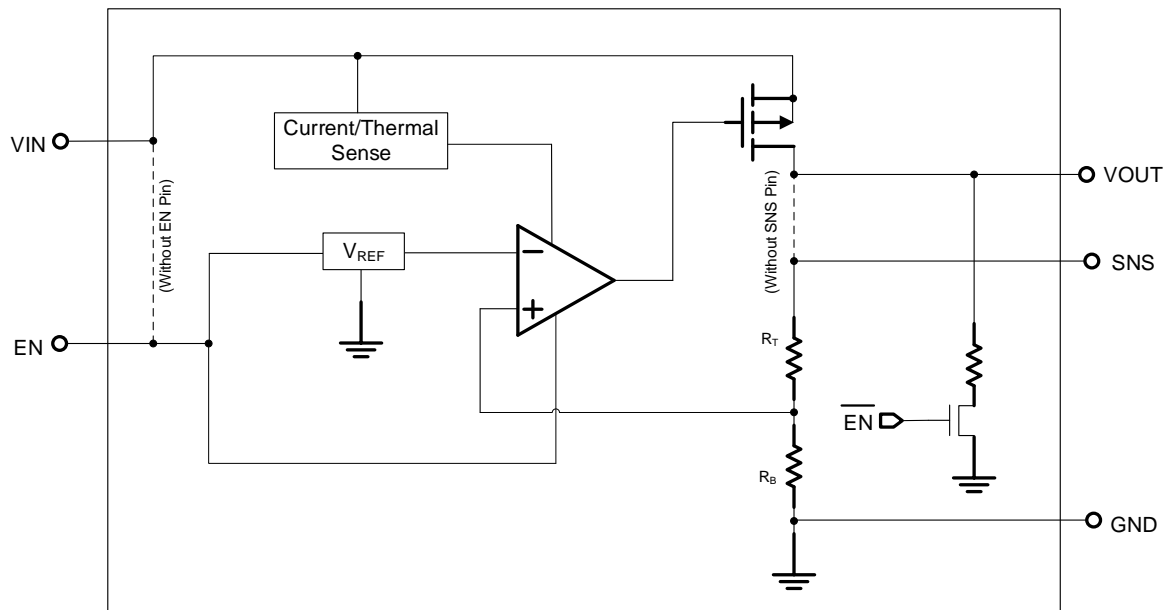


图 4: 带使能脚和输出电压检测可调电压输出应用电路

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) | |
| θ_{JA} | 250 °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 °C to 150 °C |
| ESD 静电 | |
| HBM | 2KV |
| MM | 200V |
| CDM | 2KV |

建议应用条件

| | |
|----------|------------------|
| 输入电压 VIN | 1.2V to 5.5V |
| 应用结温范围 | -40 °C to 125 °C |
| 应用环温范围 | -40 °C to 85 °C |

电气特性

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

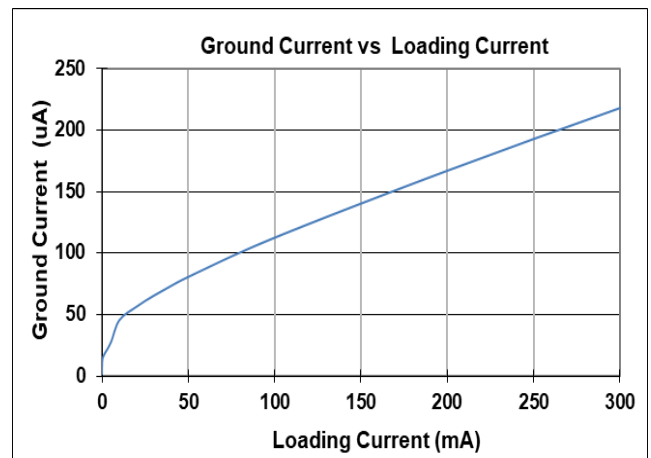
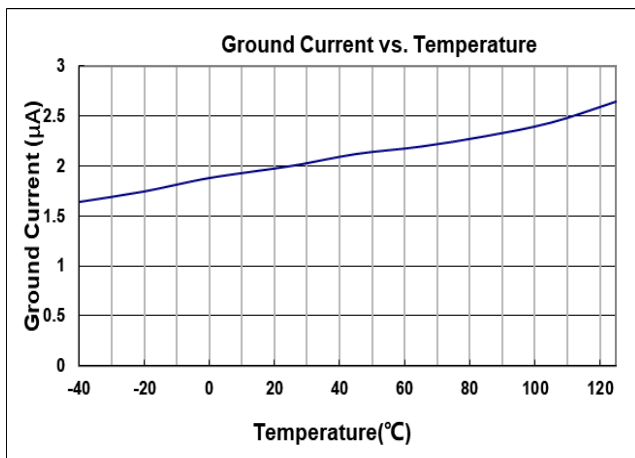
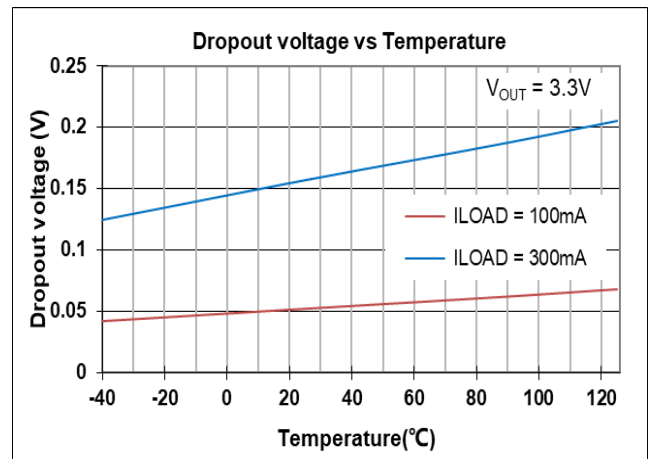
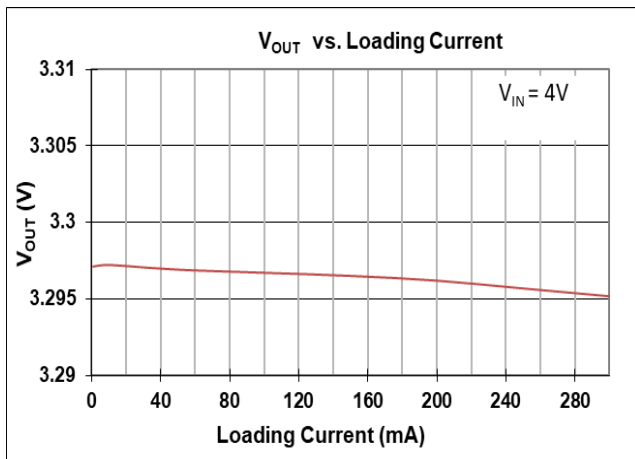
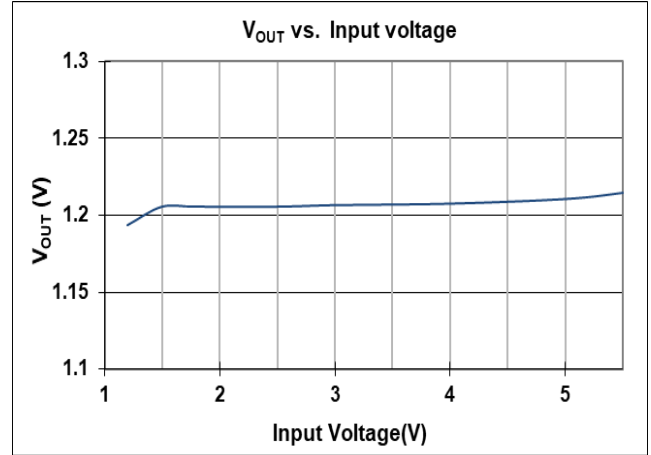
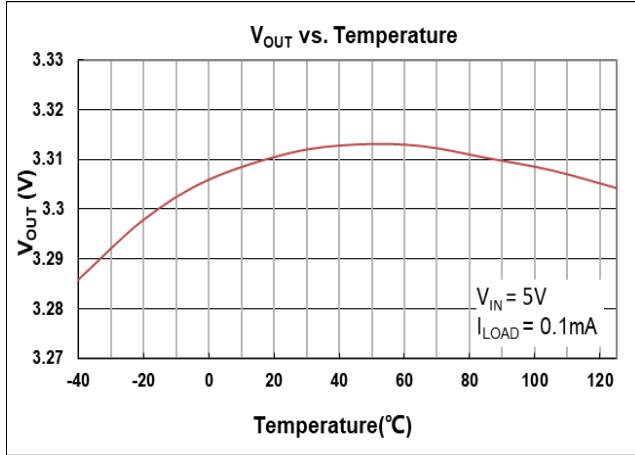
| 参数 | 符号 | 测试条件 | 最小值 | 典型值 | 最大值 | 单位 | |
|---|------------------|--|------------------|------|-----|------------|---------------|
| 输入电压 | V_{IN} | | 1.2 | -- | 5.5 | V | |
| 输出电压精度 | | $I_{LOAD} = 0.1mA$ | -2 | | 2 | % | |
| SNS 输入电流 | I_{SNS} | $SNS = V_{OUT}$ | | 0.5 | | μA | |
| Dropout 电压 ($I_{LOAD} = 300mA$) (Note 3) | V_{DROP_3V} | $V_{OUT} \geq 3V$ | | 0.18 | | V | |
| | $V_{DROP_2.8V}$ | $V_{OUT} = 2.8V$ | | 0.23 | | | |
| | $V_{DROP_2.5V}$ | $V_{OUT} = 2.5V$ | | 0.23 | | | |
| | $V_{DROP_1.8V}$ | $V_{OUT} = 1.8V$ | | 0.28 | | | |
| | $V_{DROP_1.5V}$ | $V_{OUT} = 1.5V$ | | 0.36 | | | |
| | $V_{DROP_1.2V}$ | $V_{OUT} = 1.2V$ | | 0.45 | | | |
| 静态电流 | I_Q | $I_{LOAD} = 0mA$ | | 2 | | μA | |
| 关闭电流 | I_{SD} | $V_{EN} = 0V$, $V_{OUT} = 0V$ | | 0.1 | 0.5 | μA | |
| 使能电压阈值 | V_{IH} | EN Rising | 1.0 | | | V | |
| | V_{IL} | EN Falling | | | 0.4 | | |
| 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} | $V_{OUT} = 0V$ | 301 | 600 | | 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 $100kHz$, $C_{OUT} = 1\mu F$.) | | $V_{IN} = 3.5V$ $I_{LOAD} = 0.1A$ | $V_{OUT} = 1.2V$ | -- | 80 | -- | μV_{RMS} |
| | | | $V_{OUT} = 2.8V$ | -- | 120 | -- | |
| 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} | $EN = 0V$, $V_{OUT} = 0.1V$ | -- | 30 | -- | Ω | |

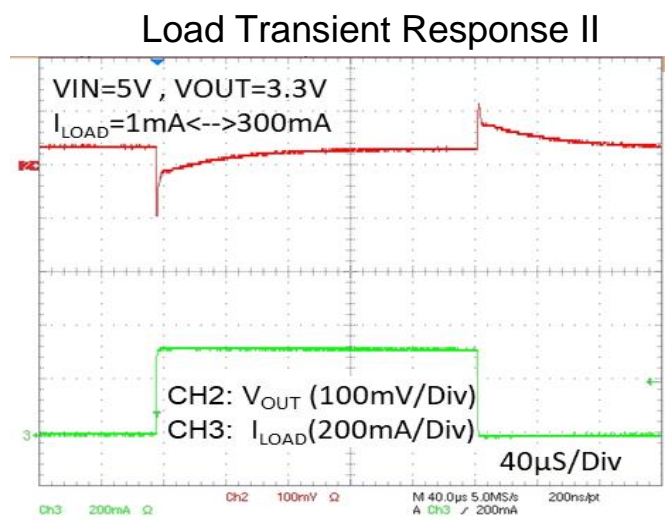
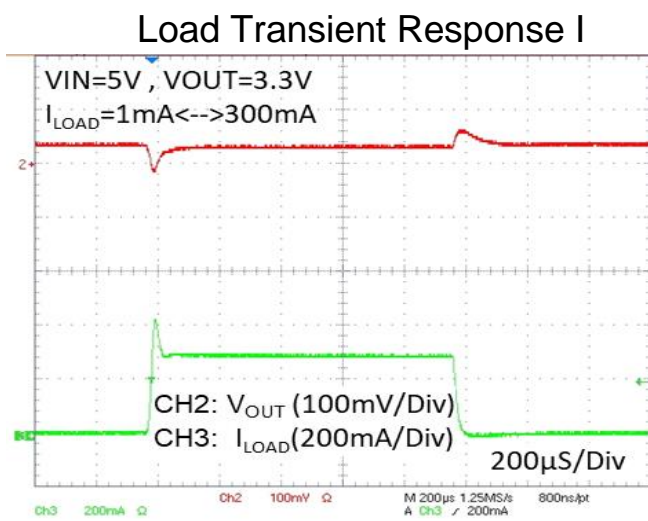
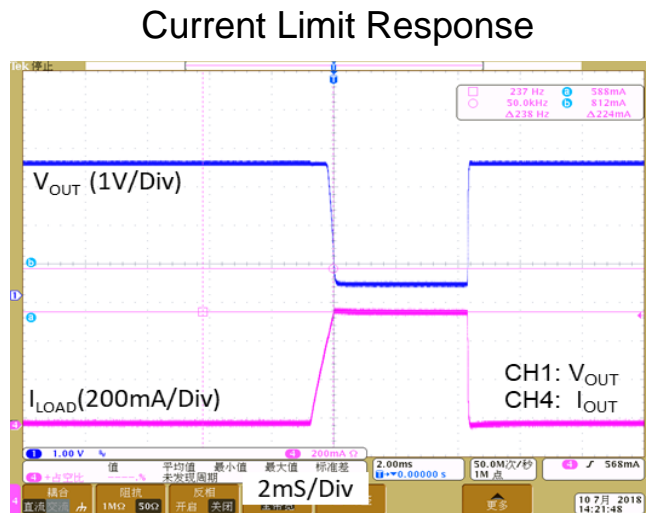
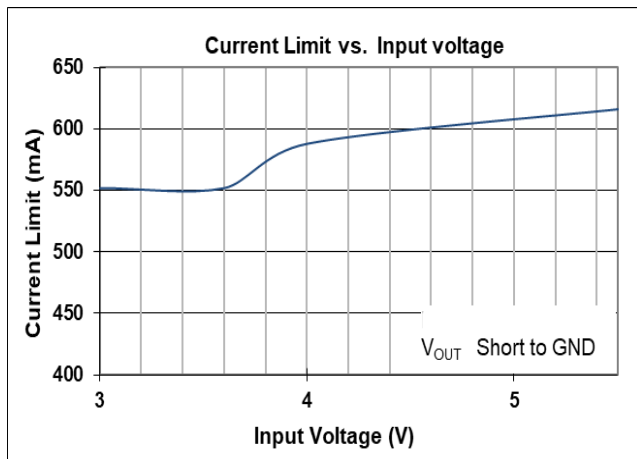
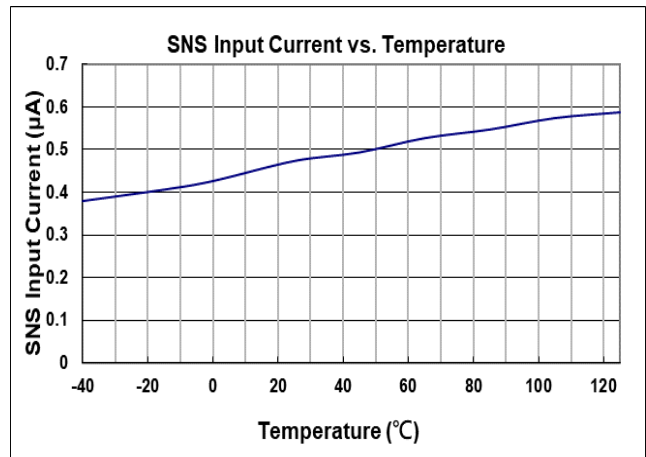
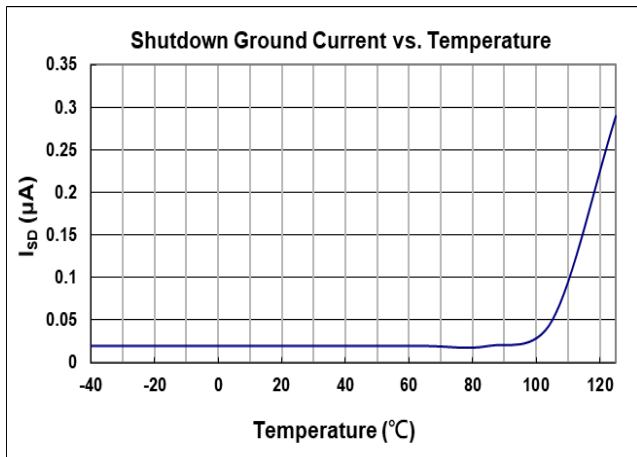
Note 1. 任何超过“最大耐压值”的应用可能会导致芯片遭受永久性损坏。这些是额定最大耐压值，仅表示在这个范围内芯片不会损伤，但不保证所有性能指标都正常，在任何超过“最大耐压值”的场合使用，都可能导致芯片永久性损坏。在接近或等于最大耐压值情况下使用，可能会影响产品可靠性。

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

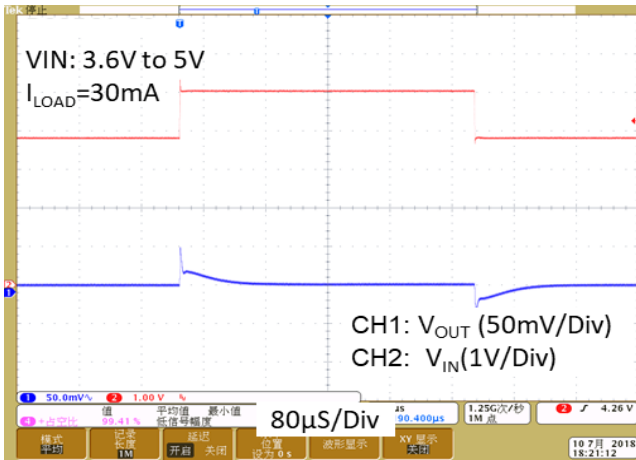
Note 3. $V_{DROP} = V_{IN} - V_{OUT}$ (V_{OUT} 达到 98%标准值)。

典型电气特性

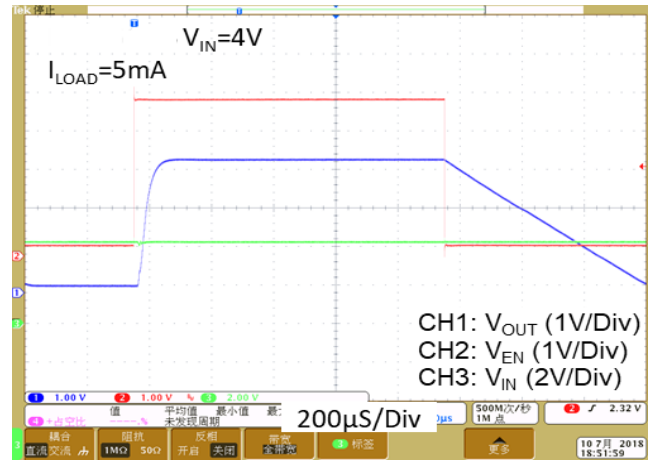




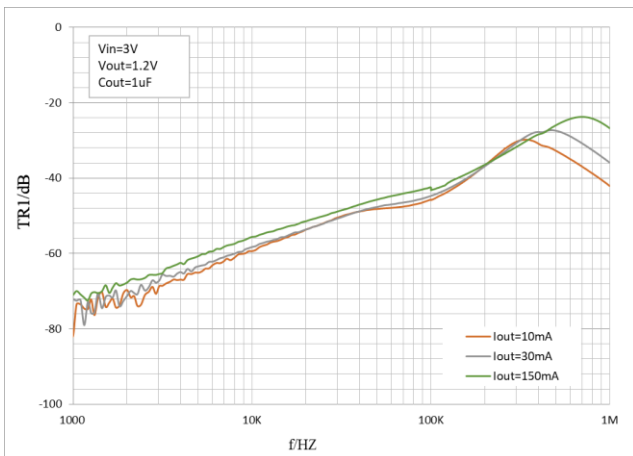
Line Transient Response



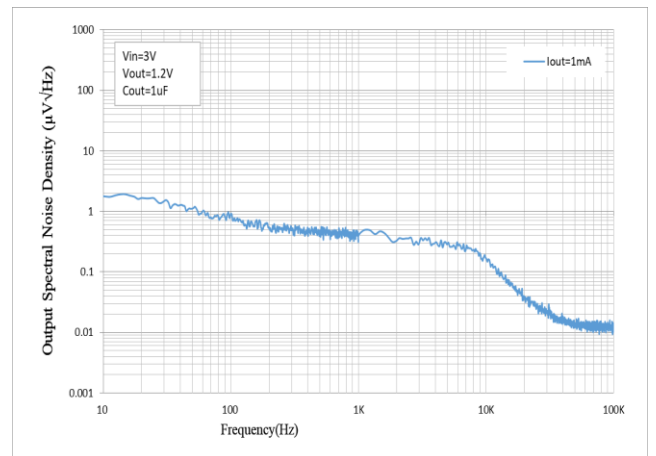
V_{OUT} Turn On/Off by EN



PSRR vs. Frequency



Noise Density Spectrum



应用指导

输入和输出电容

AP2125N-X.XTRG1(MS) 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 1uF 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 1mΩ 以上 ESR (等效串联阻抗), 有效容值 1uF 至 22uF 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。

Dropout 电压

AP2125N-X.XTRG1(MS) 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, AP2125N-X.XTRG1(MS) 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。

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 AP2125N-X.XTRG1(MS) 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。

电流限制功能

AP2125N-X.XTRG1(MS) 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 600mA (典型值)。限流功能确保输出可以短路至地, 器件不会损坏。

OTP (过温度保护)

当产品的结点温度超过 155°C (典型值) 时, AP2125N-X.XTRG1(MS) 会关闭 P-MOS 关闭输出。当结点温度往回降大约 15°C 时, AP2125N-X.XTRG1(MS) 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:

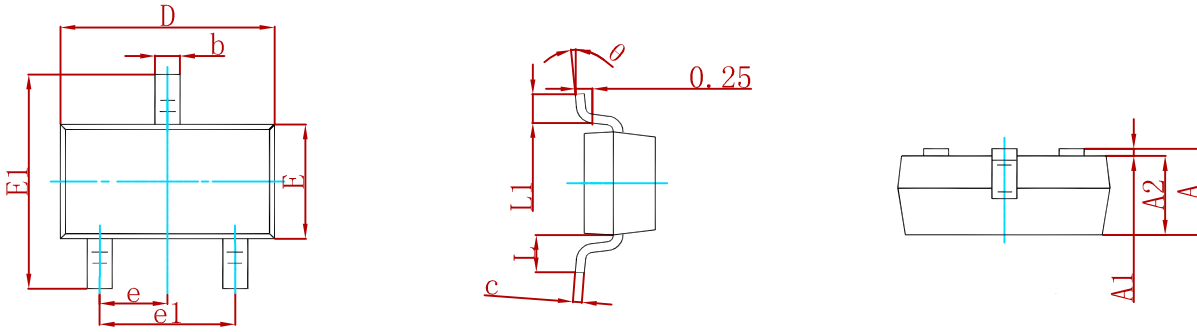
环温 T_A=25°C, 使用 MSKSEMI PCB,

$$PD (Max) = (125°C - 25°C) / (200°C/W) = 0.5W$$

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:

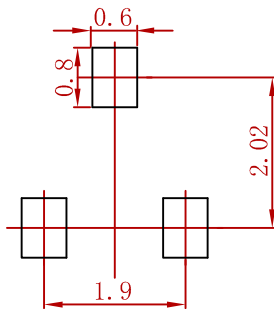
$$PD = (VIN - VOUT) \times IOUT$$

PACKAGE MECHANICAL DATA



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 0.900 | 1.150 | 0.035 | 0.045 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.050 | 0.035 | 0.041 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.800 | 3.000 | 0.110 | 0.118 |
| E | 1.200 | 1.400 | 0.047 | 0.055 |
| E1 | 2.250 | 2.550 | 0.089 | 0.100 |
| e | 0.950 TYP | | 0.037 TYP | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.550 REF | | 0.022 REF | |
| L1 | 0.300 | 0.500 | 0.012 | 0.020 |
| θ | 0° | 8° | 0° | 8° |

Suggested Pad Layout



- Note:
1. Controlling dimension: in millimeters.
 2. General tolerance: $\pm 0.05\text{mm}$.
 3. The pad layout is for reference purposes only.

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