

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## MCP1700T-XX02E/TT(MS)

Product specification

## 产品描述

MCP1700T-XX02E/TT(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。

MCP1700T-XX02E/TT(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。

MCP1700T-XX02E/TT(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)。MCP1700T-XX02E/TT(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。

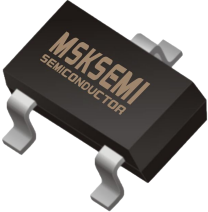
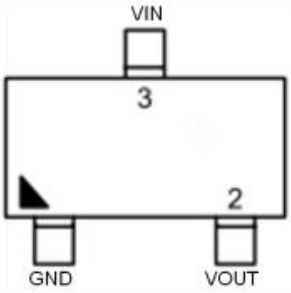
## 产品特性

- 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

MCP1700T-1202E/TT(MS)	MCP1700T-1502E/TT(MS)
<b>AADU</b> ****	<b>AADV</b> ****
MCP1700T-1802E/TT(MS)	MCP1700T-2502E/TT(MS)
<b>AAEB</b> ****	<b>AAEC</b> ****
MCP1700T-2802E/TT(MS)	MCP1700T-3002E/TT(MS)
<b>AAEG</b> ****	<b>AABW</b> ****
MCP1700T-3302E/TT(MS)	
<b>AABM</b> ****	

订单型号	封装形式	包装/数量
MCP1700T-1202E/TT(MS)	SOT-23	盘装/3000pcs
MCP1700T-1502E/TT(MS)	SOT-23	盘装/3000pcs
MCP1700T-1802E/TT(MS)	SOT-23	盘装/3000pcs
MCP1700T-2502E/TT(MS)	SOT-23	盘装/3000pcs
MCP1700T-2802E/TT(MS)	SOT-23	盘装/3000pcs
MCP1700T-3002E/TT(MS)	SOT-23	盘装/3000pcs
MCP1700T-3302E/TT(MS)	SOT-23	盘装/3000pcs

## 典型应用电路

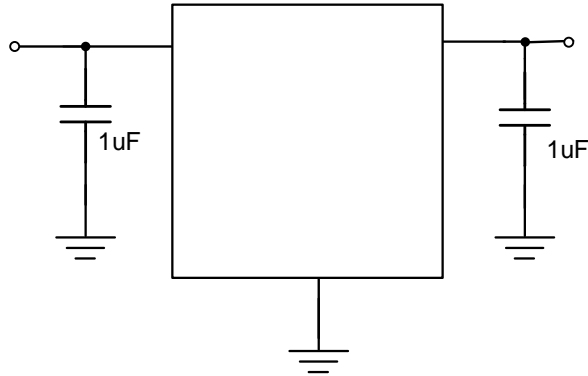


图 1: 固定输出应用电路

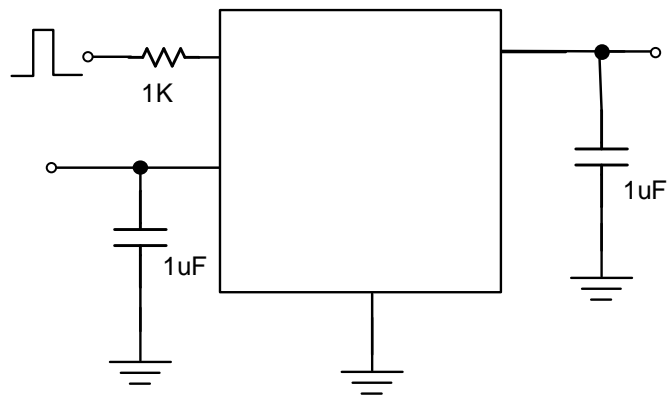


图 2: 带使能脚的固定输出应用电路

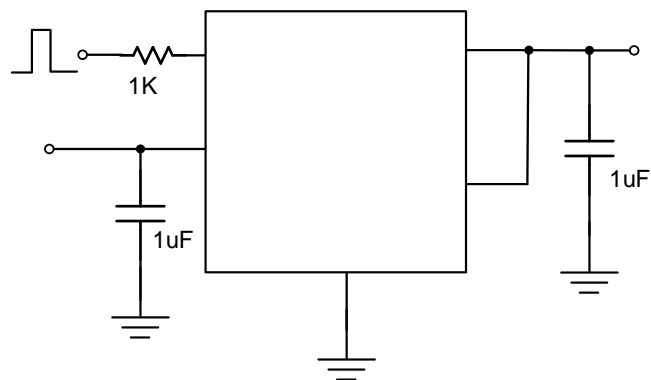


图 3: 固定输出带使能功能和输出电压检测功能之应用电路

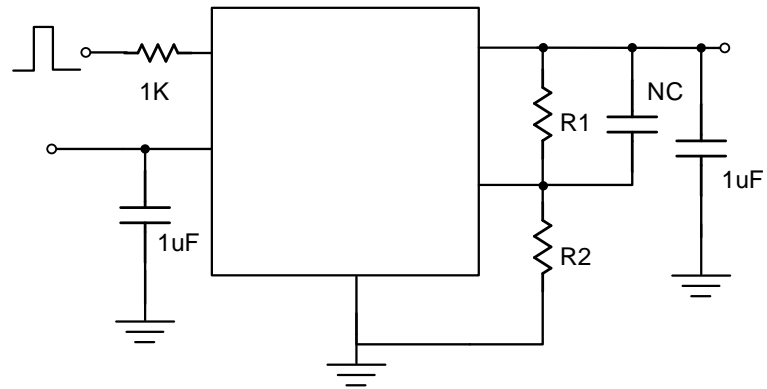
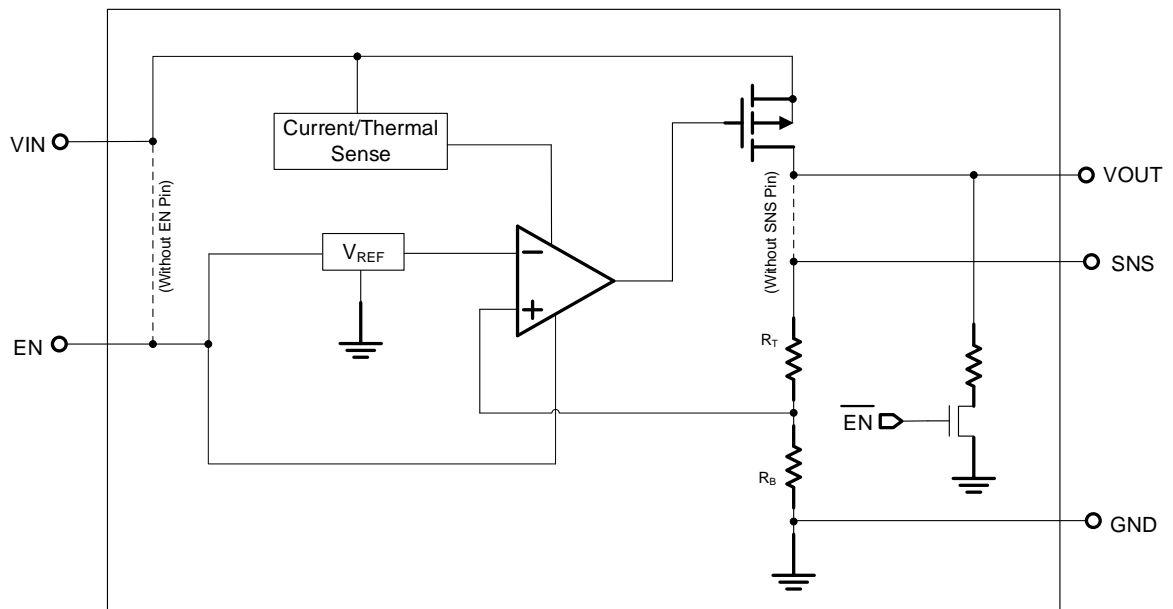


图 4: 带使能脚和输出电压检测可调电压输出应用电路

**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)

 $\theta_{JA}$  ----- 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)

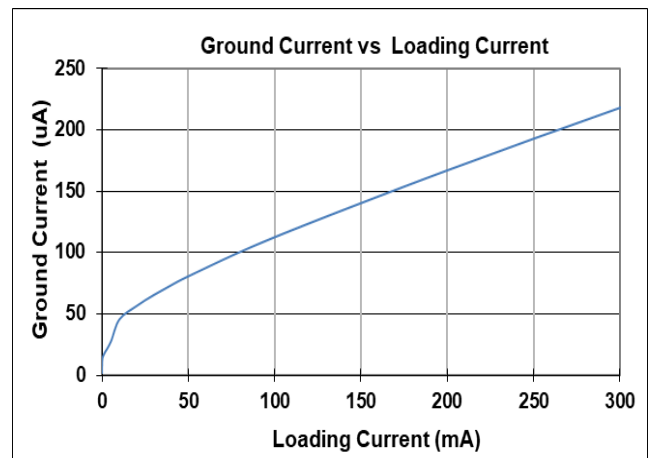
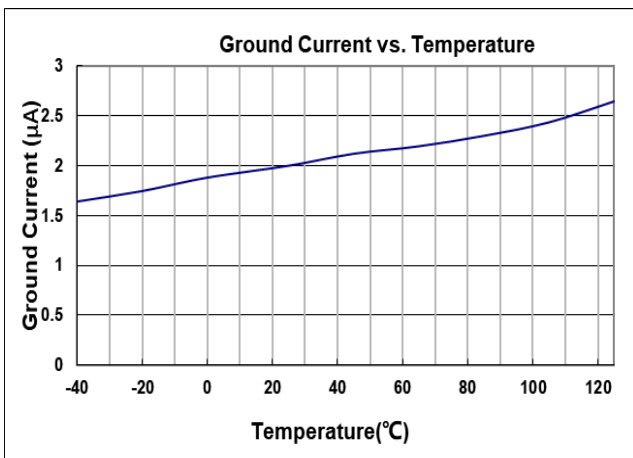
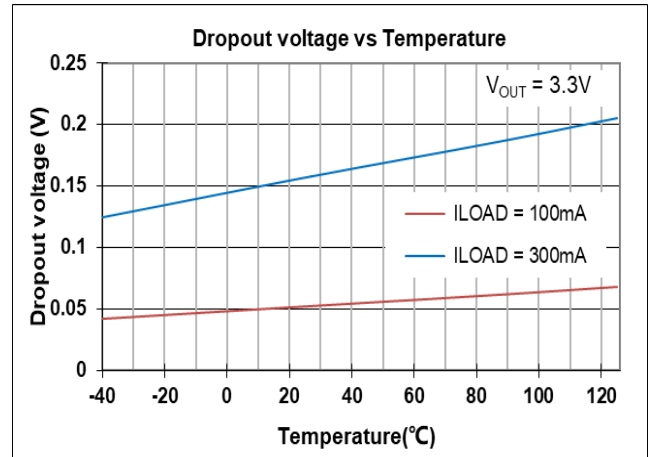
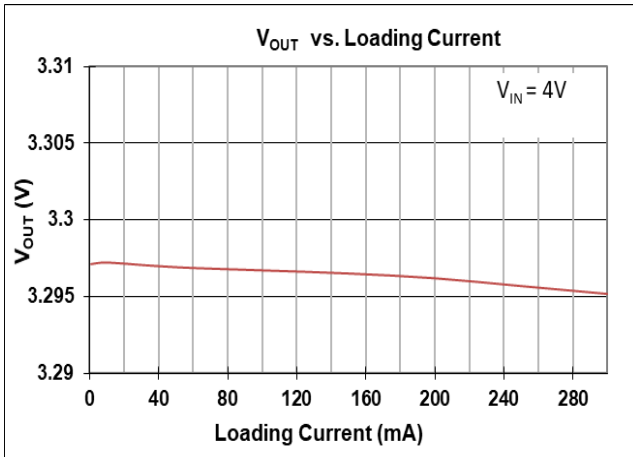
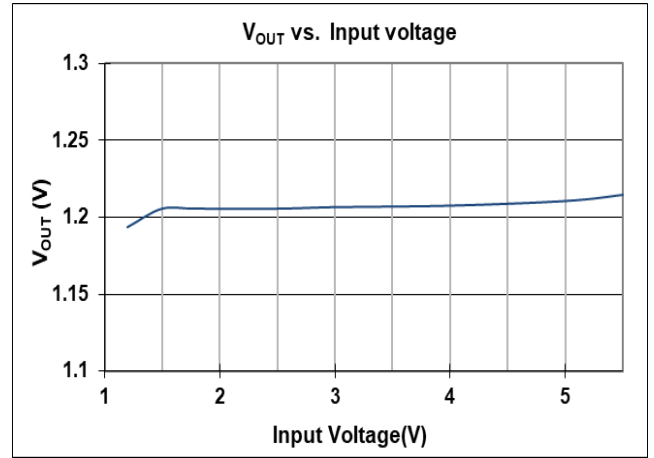
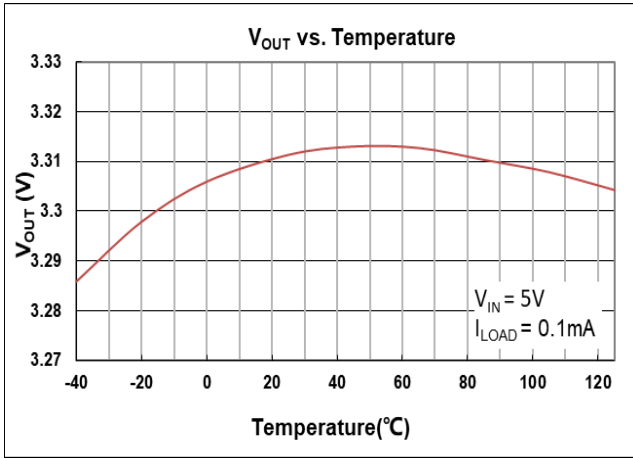
参数	符号	测试条件	最小值	典型值	最大值	单位	
输入电压	$V_{IN}$		1.2	--	5.5	V	
输出电压精度		$I_{LOAD} = 0.1mA$	-2		2	%	
SNS 输入电流	$I_{SNS}$	$SNS = V_{OUT}$		0.5		$\mu A$	
Dropout 电压 ( $I_{LOAD} = 300mA$ ) (Note 3)	$V_{DROP\_3V}$	$V_{OUT} \geq 3V$		0.18		V	
	$V_{DROP\_2.8V}$	$V_{OUT} = 2.8V$		0.23			
	$V_{DROP\_2.5V}$	$V_{OUT} = 2.5V$		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		$\mu A$	
关闭电流	$I_{SD}$	$V_{EN} = 0V$ , $V_{OUT} = 0V$		0.1	0.5	$\mu A$	
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	--	$\mu V_{RMS}$
			$V_{OUT} = 2.8V$	--	120	--	
过温度关断温度	$T_{SD}$	$I_{LOAD} = 10mA$	--	155	--	$^\circ C$	
过温度关断迟滞	$\Delta T_{SD}$		--	15	--	$^\circ C$	
放电电阻	$R_{DC}$	$EN = 0V$ , $V_{OUT} = 0.1V$	--	30	--	$\Omega$	

**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。

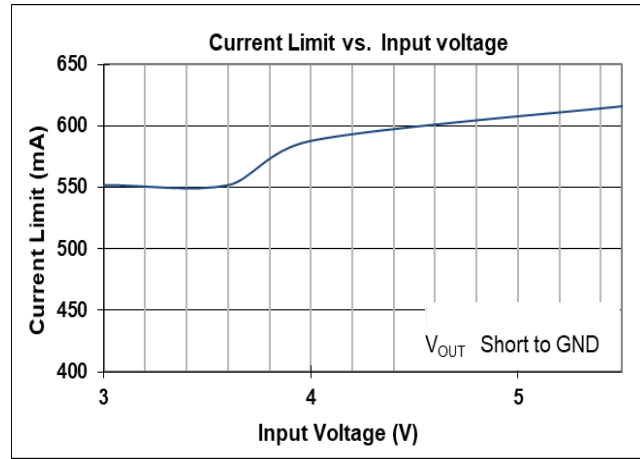
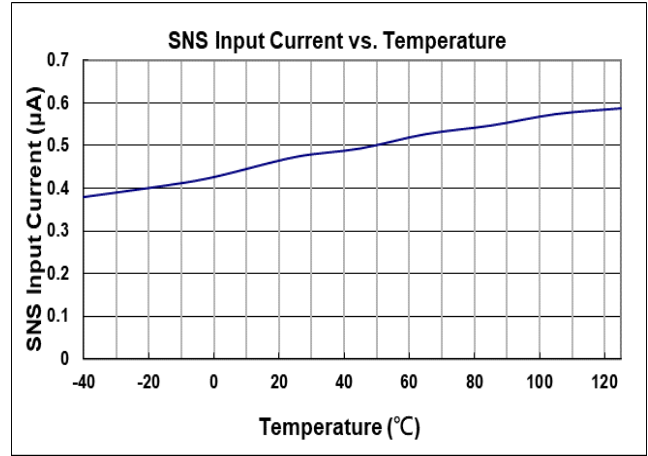
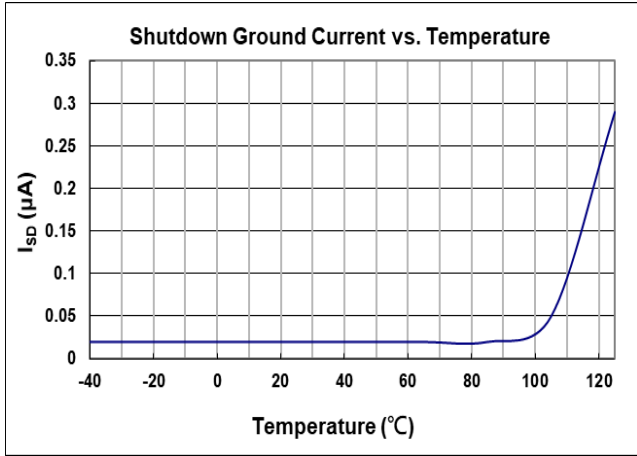
**Note 2.**  $\theta_{JA}$  测量条件： $T_A = 25^\circ C$ ，使用 EVB 板。

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

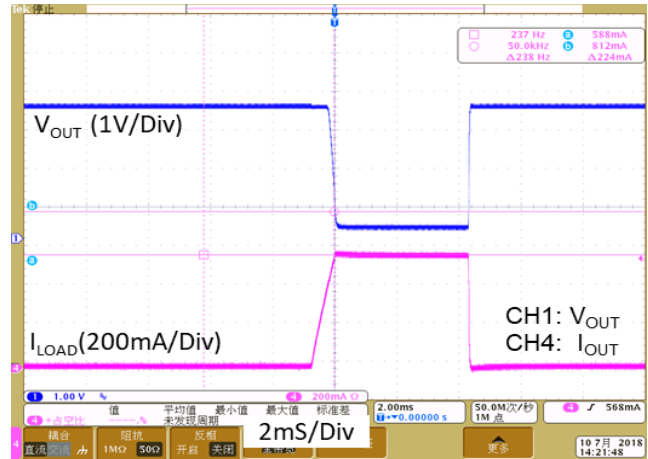
典型电气特性



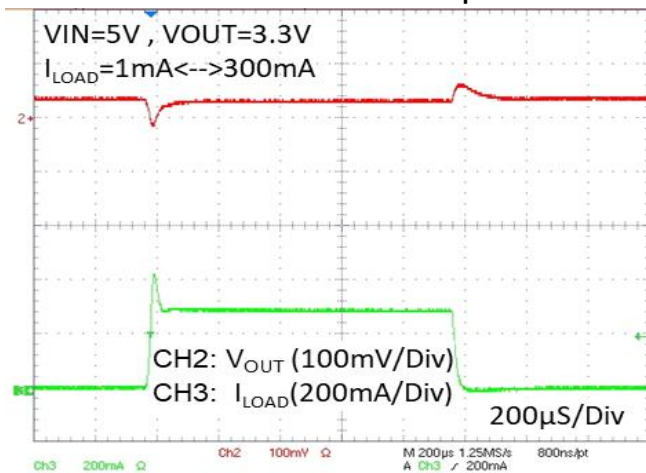




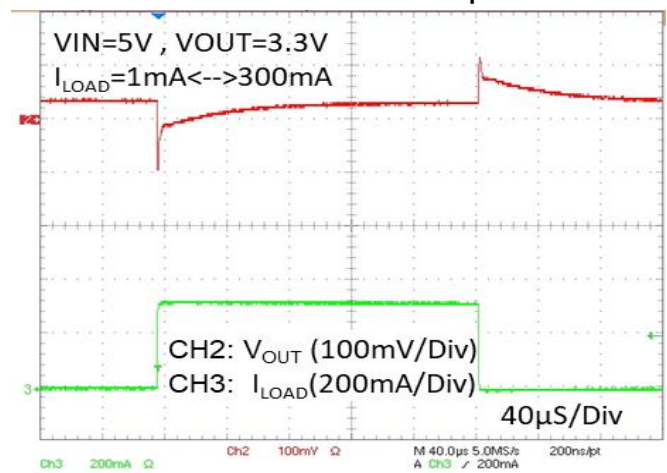
## Current Limit Response



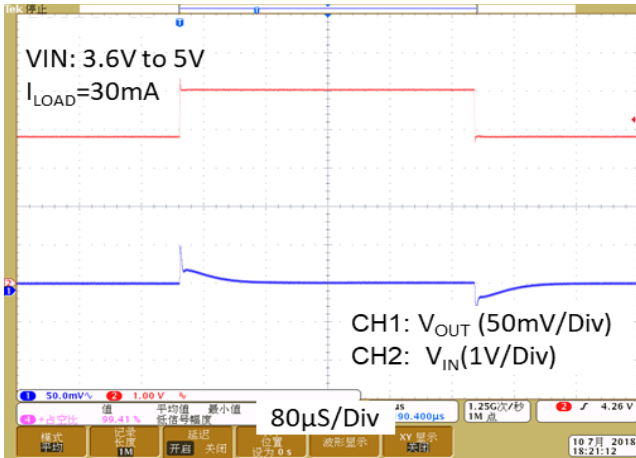
## Load Transient Response I



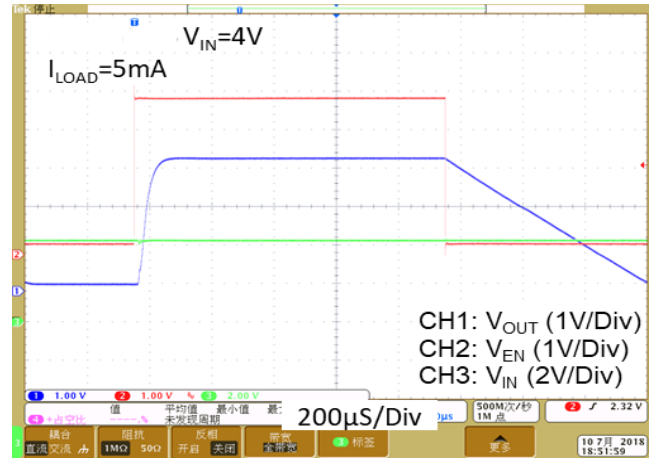
## Load Transient Response II



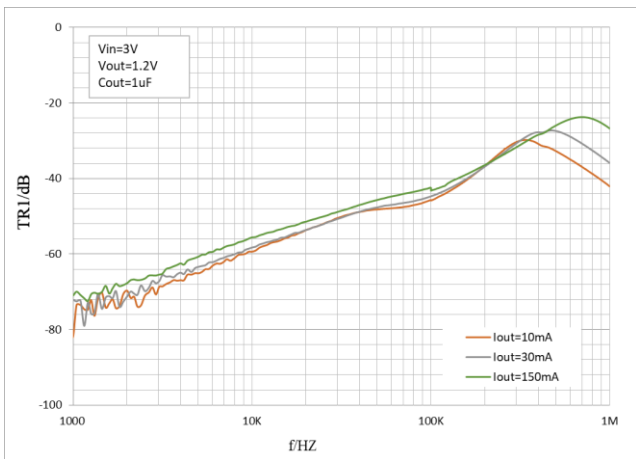
### Line Transient Response



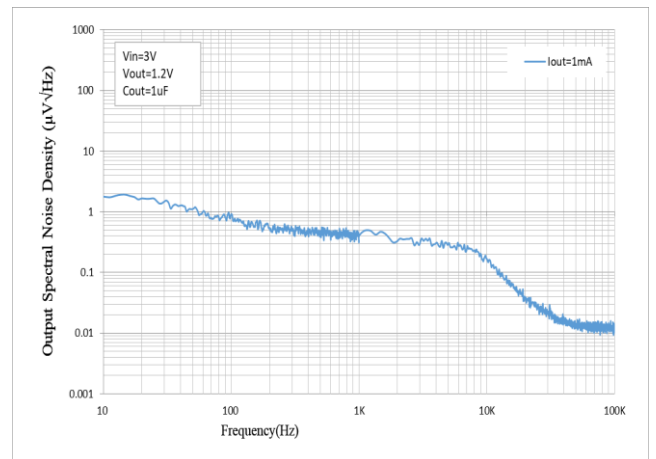
### V<sub>OUT</sub> Turn On/Off by EN



### PSRR vs. Frequency



### Noise Density Spectrum



## 应用指导

### 输入和输出电容

MCP1700T-XX02E/TT(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<sub>OUT</sub> 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

MCP1700T-XX02E/TT(MS) 系列采用 PMOS 传输晶体管来实现低压差。当  $(V_{IN} - V_{OUT})$  小于  $(V_{DROPO})$  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,  $V_{DROPO}$  和输出电流近似成比例, 和其他线性电压转换器一样, TLV702XXDBVR(MS) 系列的 PSRR 和瞬态响应能力会随着  $(V_{IN} - V_{OUT})$  压差接近  $V_{DROPO}$  而下降。

### 电流限制功能

MCP1700T-XX02E/TT(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, MCP1700T-XX02E/TT(MS) 会关闭 P-MOS 关闭输出。当结点温度往回降大约 15°C 时, TLV702XXDBVR(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  $T_A = 25^\circ\text{C}$ , 使用 MSKSEMI PCB,

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

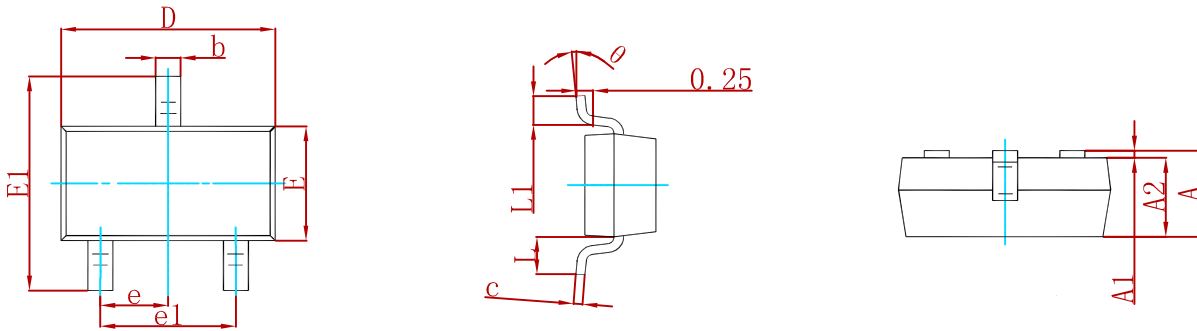
热散功率(PD)等于输出电流和 LDO 上的压降的乘积, 计算公式如下:

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

## Layout 注意事项

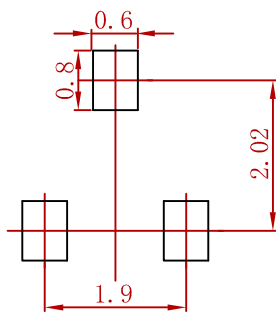
将输入电容、输出电容和 LDO 放置在 PCB 的同一面, 并尽量将电容器靠近 IC 的输入输出脚摆放, 可实现电路最佳性能。输入电容和输出电容的接地连接必须拉回到 MCP1700T-XX02E/TT(MS) 的接地引脚, 并使用短而粗的铺线连接。避免使用长走线、窄走线、或者通过过孔走线, 这些会增加寄生电感和电阻, 导致电路性能变差, 特别是在瞬态工作条件下。

**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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