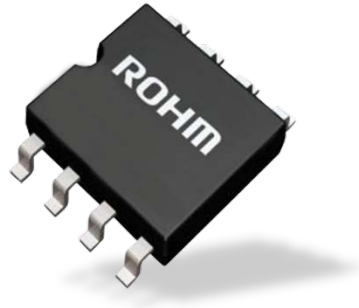
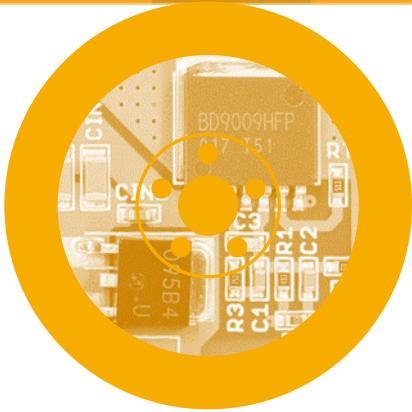


# 汽车稳压器选择指南

Rev. 1.21





## 电源IC所需的技术

**低暗电流**

➤ P5,6,15

**低电压工作**

➤ P7,12

**小型、大电流**

➤ P9,10,21

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### 开关稳压器产品阵容

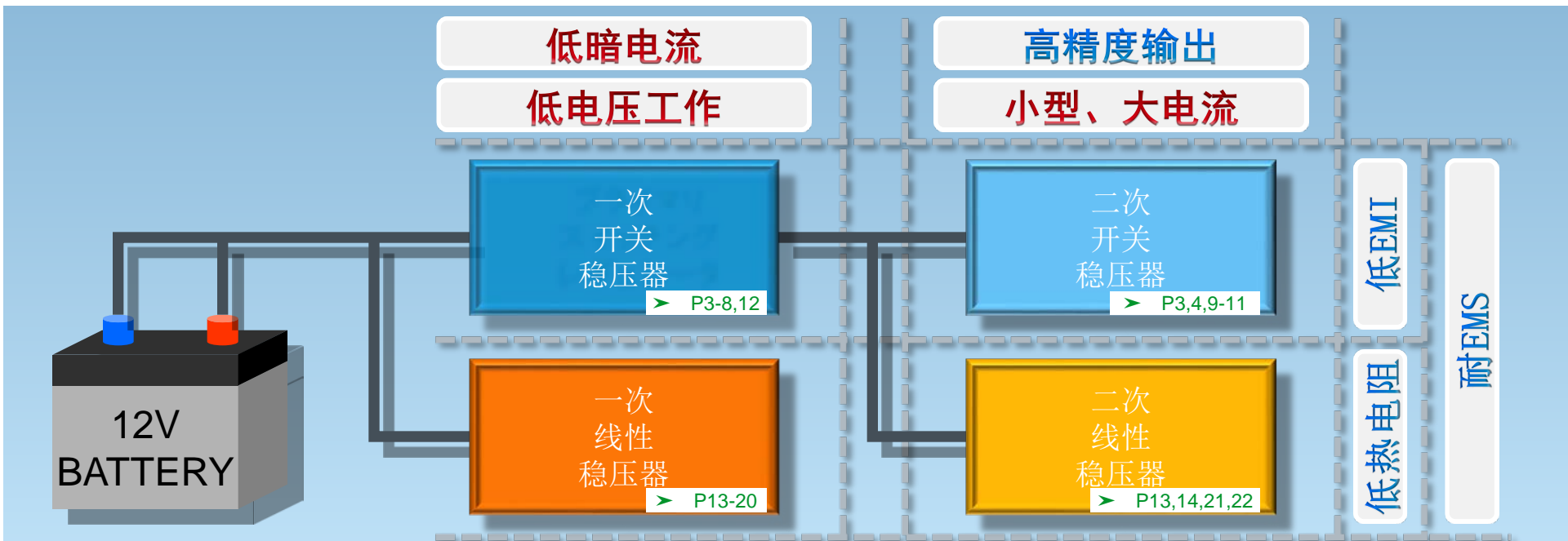
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### 应用

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	开关稳压器 (DC/DC)	线性稳压器 (LDO)
特点	不仅是降压，升压及升压降压也可以 (根据产品的不同会有所差异) 外部元件多 ⇒ 总成本增加 转换效率高 ⇒ 发热量少	电路构成简单 外部元件少 ⇒ 控制总成本 (与DC/DC比较) 转换效率差 ⇒ 发热量多
电压的产生方法	PWM (宽) / PFM (频率) ⇒ 噪音多	电阻的分压 ⇒ 噪音少
用途	有助于节能 (高效率) 从小功率到大功率	有助于对应噪音、成本 面向小功率

能更突出电源IC特点的技术

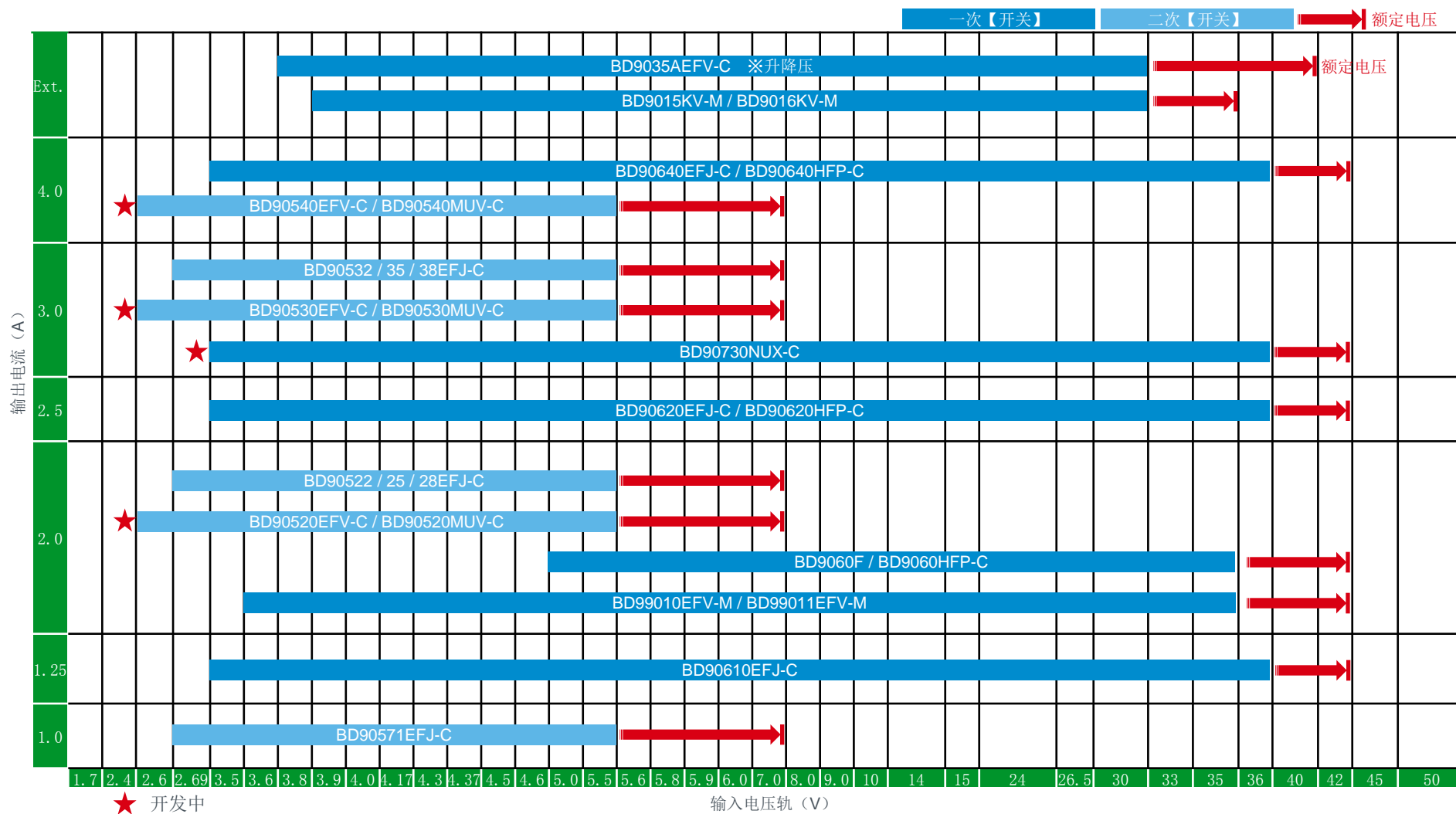
**有效的噪音抑制技术**

何谓“噪音特性和耐性” > P25-27

**有效的散热技术**

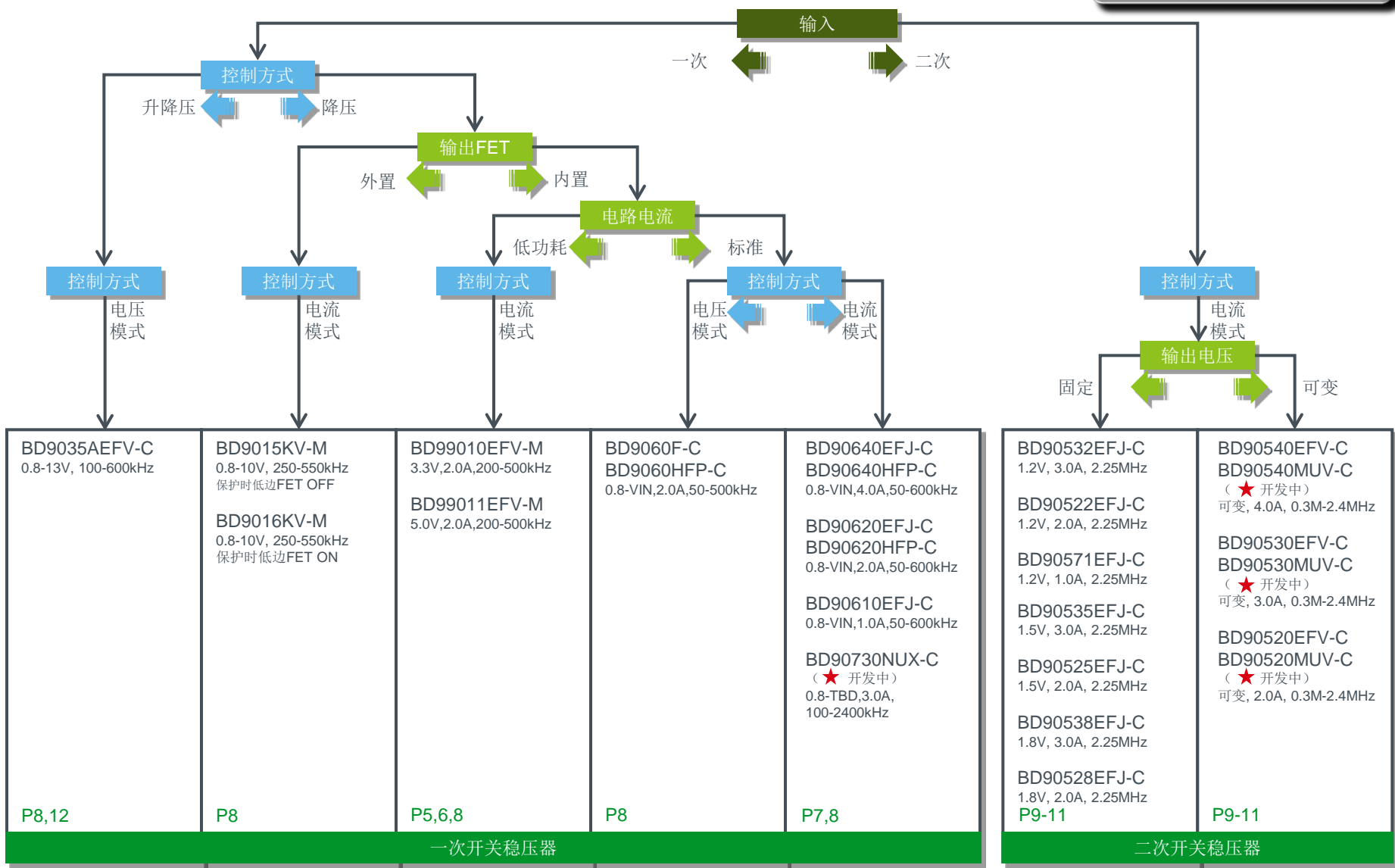
何谓“热电阻和热性能” > P23,24

# 车载用降压开关稳压器产品阵容



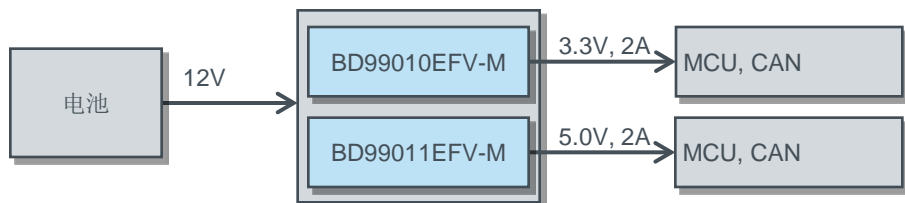
# 车载降压开关稳压器系列图

符合AEC-Q100



### “低暗电流”解决方案

BD99010EFV-M 和BD99011EFV-M是低暗电流降压DCDC转换器，分别内置了 3.3V 和5V输出的POWER MOSFET。重负载时不仅能一边维持被调节的输出电压一边实现高效率，还能通过SLLMTM (Simple Light Load Mode)即使在轻负载时也能实现低消费电流和高效率。此IC支持符合汽车标准的42V绝对最大额定值。此外，为了在冷启动时保持输出状态，最小工作电压为3.6V。通过电流模式控制可实现快速瞬态响应和轻松的相位补偿。BD99010EFV-M 和 BD99011EFV-M通过 HTSSOP-B24封装和一些外接元件可进行紧凑型的PCB设计。



### 产品概要: BD9901xEFV-M

实现低暗电流! 此产品是以往产品的1/100

- 低消耗电流 : 22μA (Typ.)

实现高效率!

- 采用同步整流, 无需外接肖特基二极管
- 采用罗姆独有的轻负载模式SLLM™ (Simple Light Load Mode)

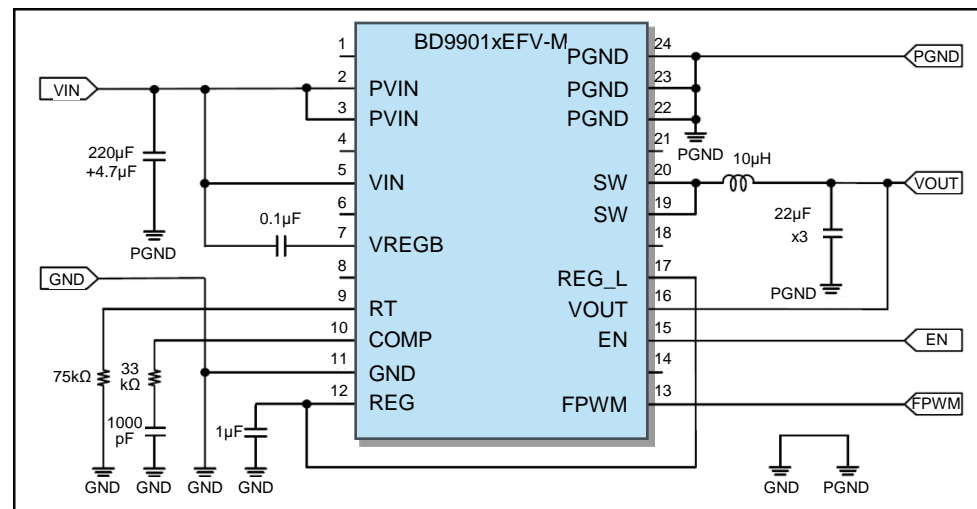
支持冷启动! 可3.6V开始工作

- 输入电压范围 : 3.6V~35V (额定42V)  
(但是刚启动时电压为3.9V 以上)
- 输出电压 : 3.3V ± 2% (BD99010EFV-M)  
5.0V ± 2% (BD99011EFV-M)
- 开关输出电流 : 2A (Max.)
- 开关频率 : 200k~500kHz
- 内置开关FET : Pch 170mΩ (Typ.)、Nch 130mΩ (Typ.)
- 内置防止电源开启时浪涌电流的软启动
- 具有支持从CMOS逻辑输入到电池电压输入的使能引脚
- 强制PWM模式功能
- 电流模式控制
- 多种保护功能

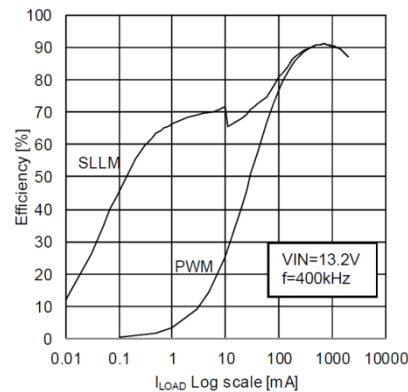
过电流保护、短路保护、VOUT过电压保护、  
低输入故障预防保护、过热保护



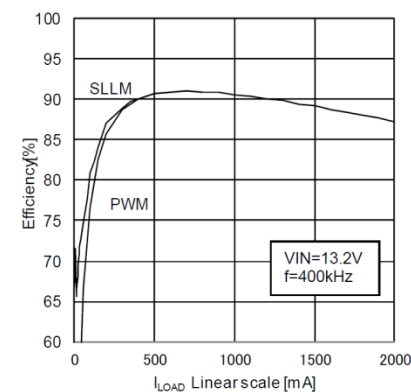
HTSSOP-B24



BD9901xEFV应用电路



BD99011EFV-M 效率vs 负载电流  
VIN=13.2V, VOUT=5.0V (Log scale)



BD99011EFV-M 效率vs 负载电流  
VIN=13.2V, VOUT=5.0V (Linear scale)

## SLLM™ (Simple Light Load Mode) 控制

轻负载时自动切换至SLLM。

SLLM会比较输出电压和内部参考电压后进行PWM控制。

当输出电压比内部参考电压低时，为提高输出电压，需要输出几个开关脉冲，再次使输出电压高于参考水平，使SW输出OFF，因此开关脉冲的间隔被拉长。

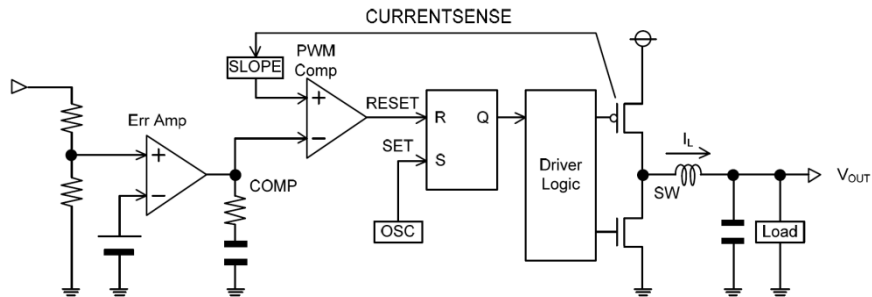
输出负载不同，开关脉冲的间隔周期也不同，

在输出电压比参考电压低，直到开关再开，

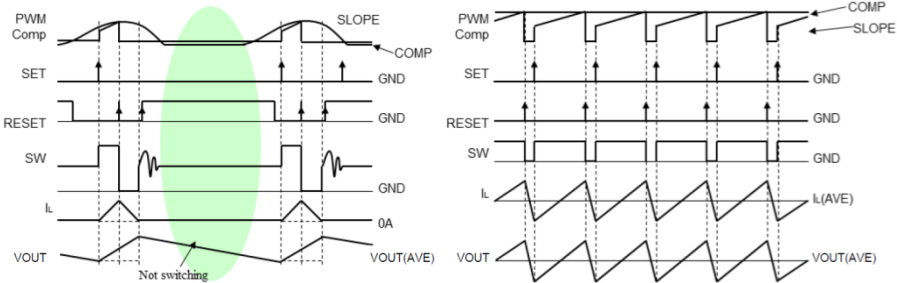
控制电路部以低消耗电流处于待机状态。

当开关脉冲间隔周期变短时，IC避开SLLM，再次转为正常的连续模式。

另外，拉长开关脉冲间隔的负载电流水平根据输入电压、电感值等而变化。

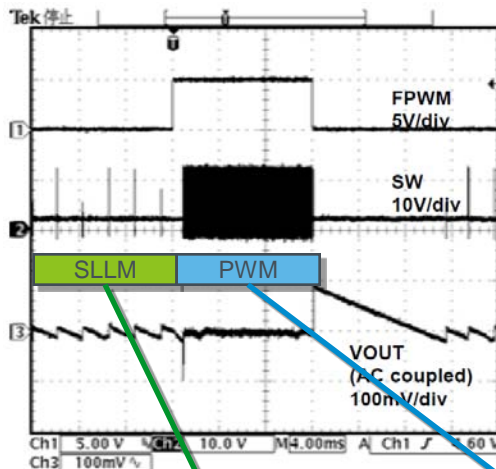


电流模式PWM控制框图

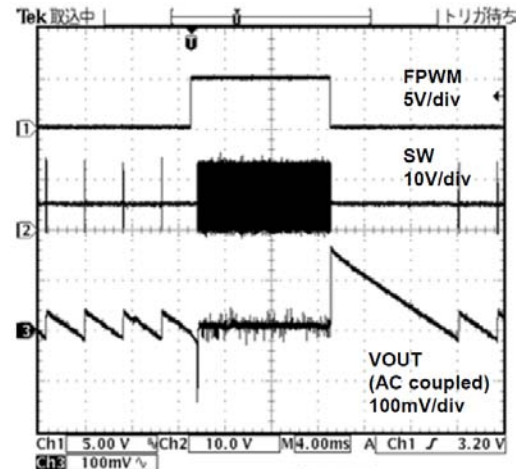


SLLM开关时序图

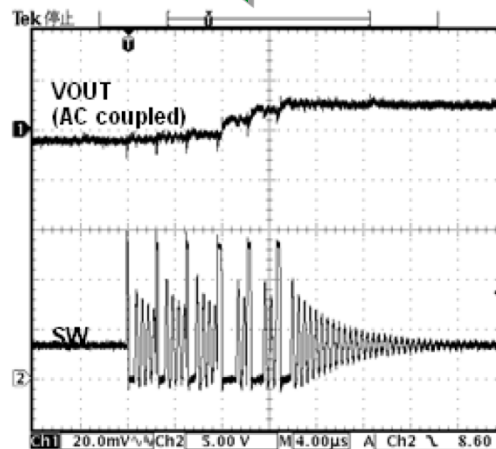
PWM开关时序图



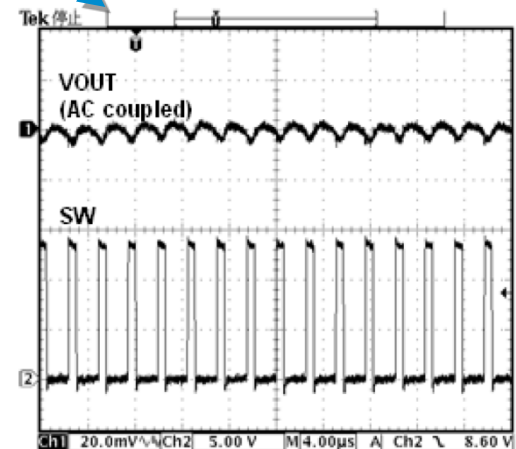
BD99010EFV-M 状态转移 (SLLM⇒PWM)



BD99011EFV-M 状态转移 (SLLM⇒PWM)



SLLM控制时的SW和VOUT波形  
(轻负载时)

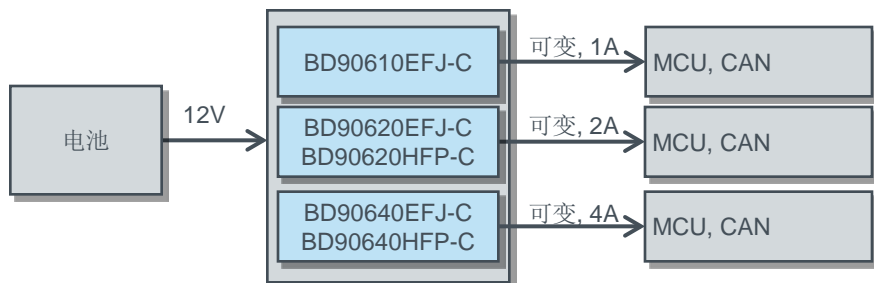


PWM控制时的SW和VOUT波形  
(重负载时)

SLLM控制的轻负载与正常的PWM控制不同，因此输出纹波电压有所增加。另外，SLLM控制时对大负载的瞬态响应变慢。

### “低电压工作”解决方案

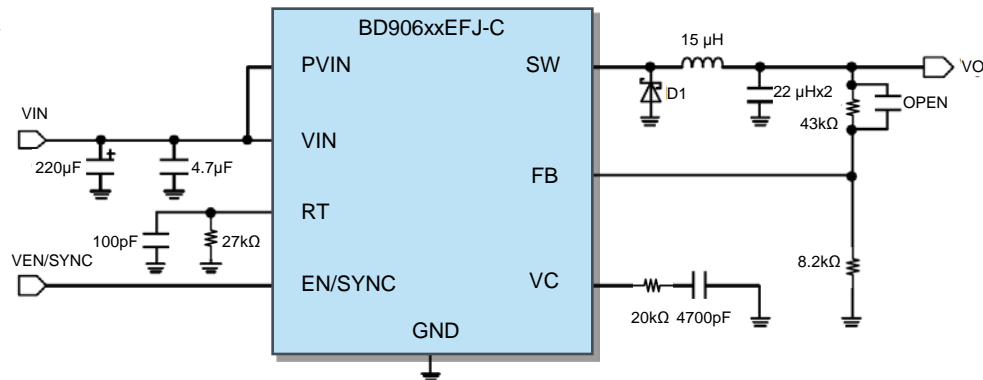
BD906xxEFJ-C是可通过外置电阻自由设定工作频率的内置耐高压POWER MOSFET的开关稳压器。以广泛的输入电压范围 (3.5V ~ 36V)、广泛的工作温度范围 (-40°C ~ +125°C) 著称, 可与外部同步输入引脚输入的外部时钟同步工作。在怠速停止车辆等中, 需要在比以往的启动电压更苛刻的电池电压降状态下正常工作, 因此该系列产品作为降压型开关稳压器, 也采用了占空比可达100%的Pch型。



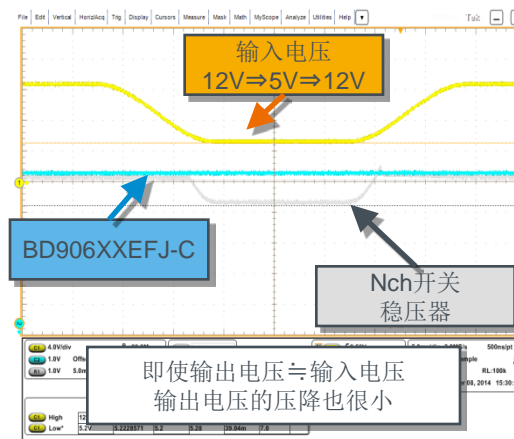
### 产品概要: BD906xxEFJ-C/HFP-C

广泛的输入电压范围!

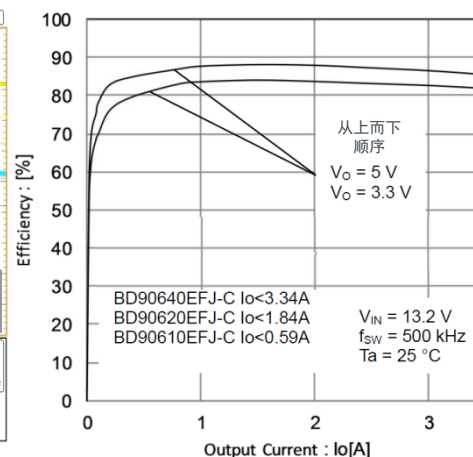
- 输入电压范围 : 3.5V~36V (额定42V)  
(但刚启动时电压为3.9V 以上)
- 内置PchFET, 实现100%duty
- 关断时电路电流 : 0μA (Typ.)
- 参考电压 : 0.8V ± 2% (Ta: -40°C ~ +125°C)  
0.8V ± 1% (Ta: 25°C)
- 开关输出电流 : 1.25A Max. (BD90610EFJ-C)  
2.5A Max. (BD90620EFJ-C/HFP-C)  
4A Max. (BD90640EFJ-C/HFP-C)
- 开关频率 : 50k~600kHz
- 内置开关FET : Pch 160mΩ (Typ.)
- 内置防止电源开启时浪涌电流的软启动功能(根据振荡频率变化)
- 支持从CMOS逻辑输入到电池电压输入的使能引脚
- 电流模式控制
- 多种保护功能  
过电流保护、短路保护、防止低输入误动作保护、过热保护



BD906xxEFJ-C应用电路



BD906xxEFJ-C输入电压变动时  
输出电压波形



BD906xxEFJ-C 效率 vs 负载电流  
VIN=13.2V


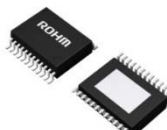



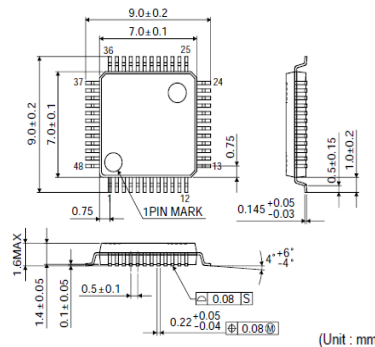
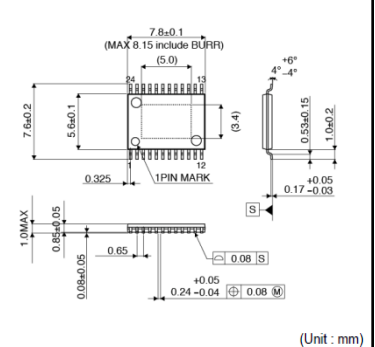
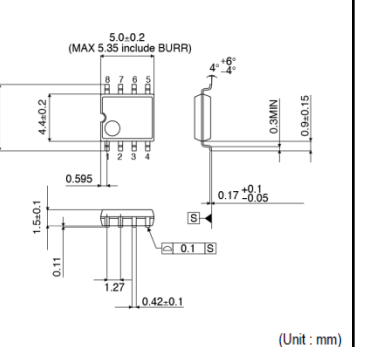
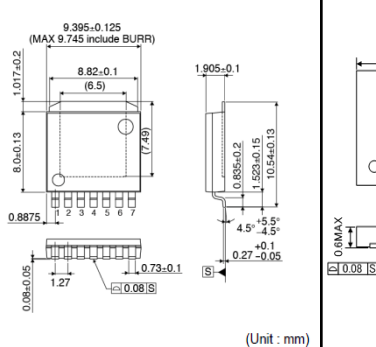
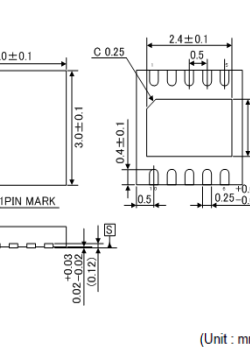


# 一次开关稳压器选型指南

产品名	输出数	输出FET		额定电压 (V)	输出电流 (A) Max.	输入电压范围 (V)		输出电压 (V) Typ.	基准 (输出) 电压精度 (%)	开关频率		控制方式	工作时 电路电流 (mA) Typ.	功能							工作温度 (°C)	封装	
		上侧 (Typ.)	下侧 (Typ.)			Min.	Max.			设定范围 (kHz)	精度 (%)			电源良好	外部同步	可变软启动	同步整流	轻负载效率	过电流保护	温度保护			过电压保护
BD9015KV-M	2	Ext. Nch	Ext. Nch	35	-	3.9	30	可变(0.8-10)	±1.5	250 ~ 550	±10	电流	4	✓	✓	✓	✓	-	反馈	反馈	✓	-40 ~ 105	VQFP48C
BD9016KV-M	2	Ext. Nch	Ext. Nch	35	-	3.9	30	可变(0.8-10)	±1.5	250 ~ 550	±10	电流	4	✓	✓	✓	✓	-	反馈	反馈	✓	-40 ~ 105	VQFP48C
BD99010EFV-M	1	Pch(170mΩ)	Nch(130mΩ)	42	2.0	3.6	35	3.3	(±2.0)	200 ~ 500	±20	电流	0.02	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 105	HTSSOP-B24
BD99011EFV-M	1	Pch(170mΩ)	Nch(130mΩ)	42	2.0	3.6	35	5.0	(±2.0)	200 ~ 500	±20	电流	0.02	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 105	HTSSOP-B24
BD9060F-C	1	Pch(300mΩ)	-	42	2.0	5.0	35	可变(0.8-VIN)	±2.0	50 ~ 550	±5	电压	4.5	-	✓	-	-	-	反馈	反馈	-	-40 ~ 125	SOP8
BD9060HFP-C	1	Pch(300mΩ)	-	42	2.0	5.0	35	可变(0.8-VIN)	±2.0	50 ~ 550	±5	电压	4.5	-	✓	-	-	-	反馈	反馈	-	-40 ~ 125	HRP7
BD90640HFP-C	1	Pch(160mΩ)	-	42	4.0	3.5	36	可变(0.8-VIN)	±2.0	50 ~ 600	±10	电流	2.2	-	✓	✓	-	-	反馈	反馈	-	-40 ~ 125	HRP7
BD90640EFJ-C	1	Pch(160mΩ)	-	42	4.0	3.5	36	可变(0.8-VIN)	±2.0	50 ~ 600	±10	电流	2.2	-	✓	✓	-	-	反馈	反馈	-	-40 ~ 125	HTSOP-J8
BD90620HFP-C	1	Pch(160mΩ)	-	42	2.5	3.5	36	可变(0.8-VIN)	±2.0	50 ~ 600	±10	电流	2.2	-	✓	✓	-	-	反馈	反馈	-	-40 ~ 125	HRP7
BD90620EFJ-C	1	Pch(160mΩ)	-	42	2.5	3.5	36	可变(0.8-VIN)	±2.0	50 ~ 600	±10	电流	2.2	-	✓	✓	-	-	反馈	反馈	-	-40 ~ 125	HTSOP-J8
BD90610EFJ-C	1	Pch(160mΩ)	-	42	1.25	3.5	36	可变(0.8-VIN)	±2.0	50 ~ 600	±10	电流	2.2	-	✓	✓	-	-	反馈	反馈	-	-40 ~ 125	HTSOP-J8
★BD90730NUX-C	1	Nch(180mΩ)	-	42	3.0	3.5	36	可变(0.8-TBD)	±2.0	100 ~ 2400	±10	电流	1.9	✓	✓	✓	-	-	闭锁	反馈	✓	-40 ~ 125	VSON10

★ 开发中

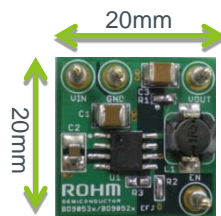
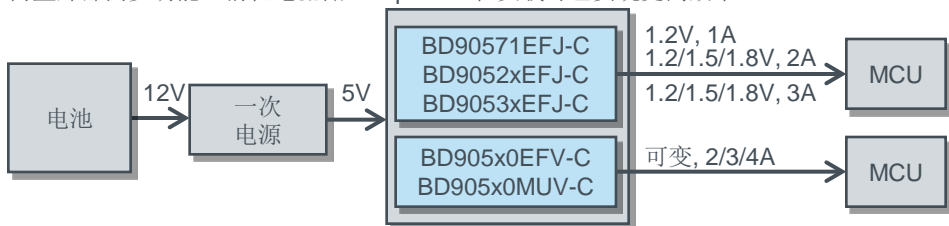
※ 反馈: 自动反馈型, 闭锁: 闭锁(Latch-up)型

VQFP48C	HTSSOP-B24	SOP8	HRP7	VSON10
				
				

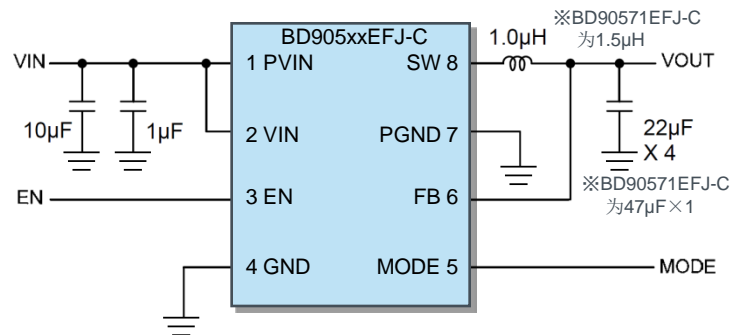
### “节省空间与高效率”解决方案

BD905xxEFJ-C 系列是2.25MHz 固定频率的同步整流式降压型DC/DC 转换器。内置供应固定输出电压1.2V/1.5V/1.8V的反馈电阻和相位补偿常量，用较少的外部元件即可组成应用。

BD905x0系列是频率可变 (0.3~2.4MHz) 的同步整流降压型DC/DC转换器。内置外部同步功能，消耗电流低 (65μA)，轻负载时也实现更高效率。



BD90571EFJ-C安装PCB板



BD905xxEFJ-C应用电路

### 产品概要: BD905xxFEJ-C / BD905x0EFV-C/MUV-C

减少外部元件的数量，使配套产品设计更容易！安装面积更小！

● 内置输出反馈电阻和相位补偿功能(输出固定型)

实现高效率！

● 采用同步整流方式

● 低消耗电流：65μA (可变量)

● 轻负载模式、PWM固定模式可选

噪音对策更容易！

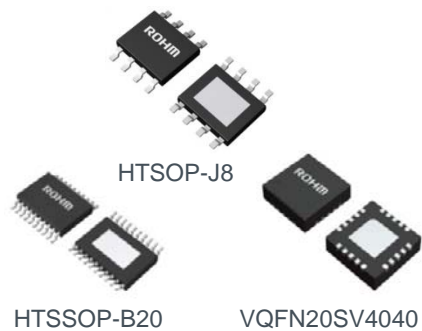
● 开关频率：2.25MHz ± 20% (固定型)  
0.3~2.4MHz ± 15% (可变量)  
内置外部同步功能 (可变量)

● 输入电压范围：2.6V (可变量) / 2.69V (固定型) ~ 5.5V (额定7V)

● 开关FET内置：Pch 85mΩ (Typ.)、Nch 70mΩ (Typ.) (固定型)  
Pch 90mΩ (Typ.)、Nch 60mΩ (Typ.) (可变量)

● 电流模式控制

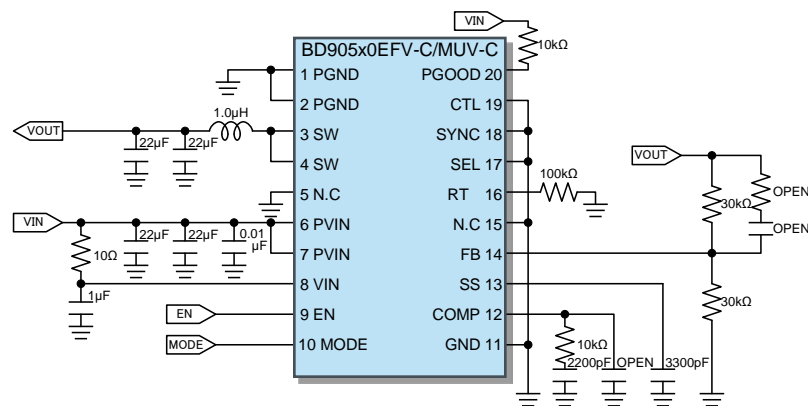
● 多种保护功能：过电流保护、短路保护、防止低输入误动作保护、VOUT过电压保护



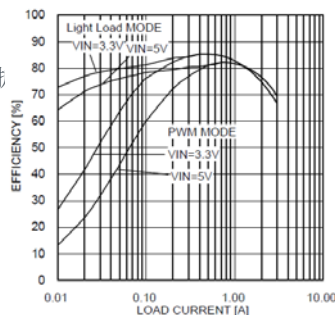
输出电流	输出(参考)电压			
	可变(0.8V ± 1.5%)	1.2V ± 2%	1.5V ± 2%	1.8V ± 2%
1A	—	BD90571EFJ-C	—	—
2A	★ BD90520EFV-C	BD90522EFJ-C	BD90525EFJ-C	BD90528EFJ-C
3A	★ BD90530EFV-C	BD90532EFJ-C	BD90535EFJ-C	BD90538EFJ-C
4A	★ BD90540EFV-C	—	—	—

★ 开发中 BD905xxFEJ-C/BD905x0EFV-C/MUV-C产品阵容

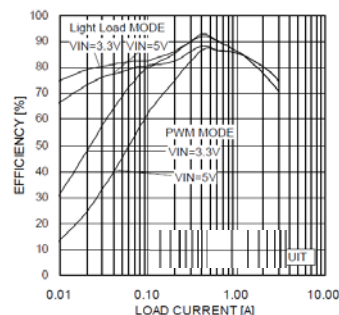
汽车稳压器选择指南



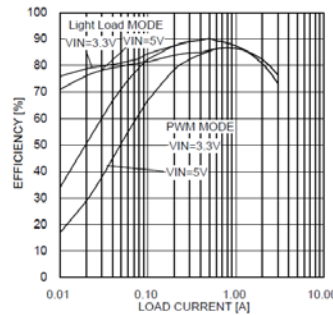
BD905x0EFV-C应用电路



BD90532EFJ-C 效率vs负载电流



BD90535EFJ-C 效率vs负载电流



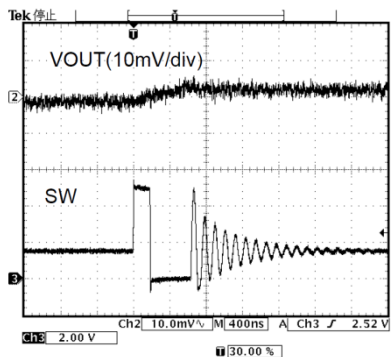
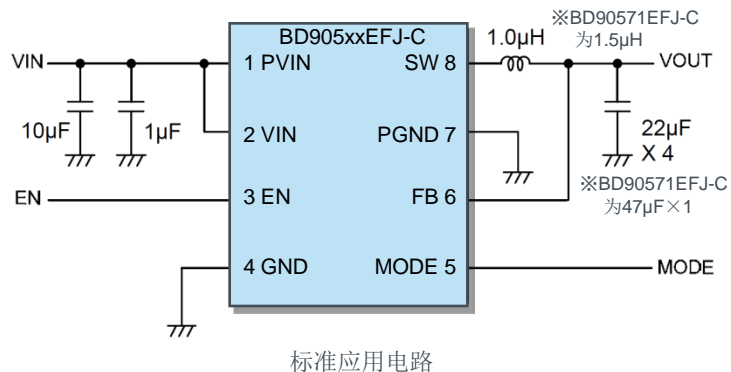
BD90538EFJ-C 效率vs负载电流

## 轻负载模式和PWM 固定模式

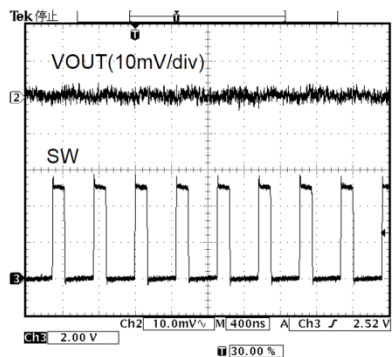
当MODE引脚为0.7V 以下时，以轻负载模式(LIGHT LOAD MODE)运行。

在轻负载模式下，当输出负载电流较小时，开关动作自动变为间歇性动作。间歇性动作可将开关损耗抑制在较小状态，因此，与PWM固定模式相比，轻负载时的效率更佳。转为间歇动作的负载电流水平根据输入电压、电感值等的变化而变化。

另外，当MODE引脚为2.1V 以上时，以PWM 固定模式运行。在PWM 固定模式下，与轻负载模式相比，轻负载时的效率下降，但在整个负载范围内，以固定的频率进行开关动作，因此，噪音对策较容易。



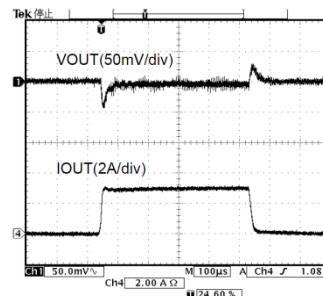
轻负载模式时的开关动作



PWM模式时的开关动作

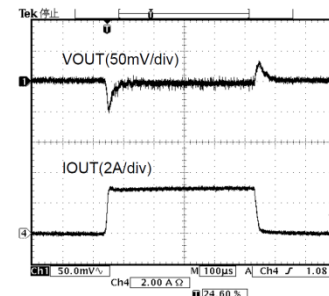
## 各模式下的负载变动波形

轻负载模式



轻负载 模式时负载变动  
BD90535EFJ-C, MODE=0V  
IOUT=0→3.0→0A

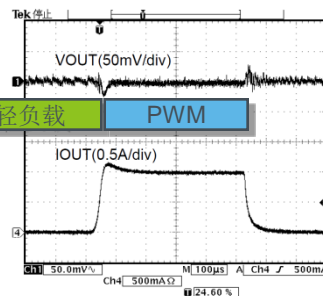
PWM模式



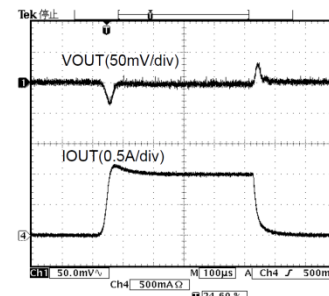
PWM 模式时负载变动  
BD90535EFJ-C, MODE=3.3V  
IOUT=0→3.0→0A

BD90535EFJ-C

轻负载 PWM



轻负载 模式时负载变动  
BD90571EFJ-C, MODE=0V  
IOUT=0→1.0→0A



PWM 模式时负载变动  
BD90571EFJ-C, MODE=3.3V  
IOUT=0→1.0→0A

BD90571EFJ-C




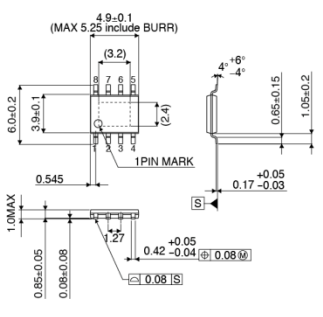
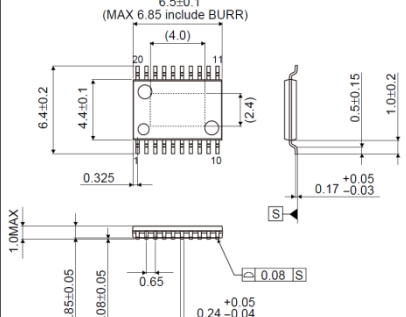
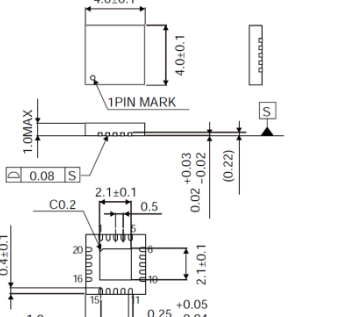
SLLM控制的轻负载与正常的PWM 控制不同，因此输出波纹电压有所增加。另外，SLLM控制时，对大负载的瞬态响应变慢。

# 二次开关稳压器选型指南

型号	输出数	输出FET		额定电压 (V)	输出电流 (A) Max.	输入电压范围 (V)		输出电压 (V) Typ.	基准 (输出) 电压精度 (%)	开关频率		控制方式	工作时 电路电流 (mA) Typ.	功能							工作温度 (°C)	封装	
		上侧 (Typ.)	下侧 (Typ.)			Min.	Max.			设定范围 (MHz)	精度 (%)			电源良好	外部同步	可变软启动	同步整流	轻负载效率	过电流保护	温度保护			过电压保护
★ BD90540EFV-C	1	Pch(90mΩ)	Nch(60mΩ)	7	4.0	2.6	5.5	可变(0.6-5.0)	±1.5	0.3~2.4	±15	电流	0.065	✓	✓	✓	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSSOP-B20
★ BD90540MUV-C	1	Pch(90mΩ)	Nch(60mΩ)	7	4.0	2.6	5.5	可变(0.6-5.0)	±1.5	0.3~2.4	±15	电流	0.065	✓	✓	✓	✓	✓	反馈	反馈	✓	-40 ~ 125	VQFN20SV4040
★ BD90530EFV-C	1	Pch(90mΩ)	Nch(60mΩ)	7	3.0	2.6	5.5	可变(0.6-5.0)	±1.5	0.3~2.4	±15	电流	0.065	✓	✓	✓	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSSOP-B20
★ BD90530MUV-C	1	Pch(90mΩ)	Nch(60mΩ)	7	3.0	2.6	5.5	可变(0.6-5.0)	±1.5	0.3~2.4	±15	电流	0.065	✓	✓	✓	✓	✓	反馈	反馈	✓	-40 ~ 125	VQFN20SV4040
BD90532EFJ-C	1	Pch(85mΩ)	Nch(70mΩ)	7	3.0	2.69	5.5	1.2	(±2.0)	2.25	±20	电流	0.65	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSOP-J8
BD90535EFJ-C	1	Pch(85mΩ)	Nch(70mΩ)	7	3.0	2.69	5.5	1.5	(±2.0)	2.25	±20	电流	0.65	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSOP-J8
BD90538EFJ-C	1	Pch(85mΩ)	Nch(70mΩ)	7	3.0	2.69	5.5	1.8	(±2.0)	2.25	±20	电流	0.65	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSOP-J8
★ BD90520EFV-C	1	Pch(90mΩ)	Nch(60mΩ)	7	2.0	2.6	5.5	可变(0.6-5.0)	±1.5	0.3~2.4	±15	电流	0.065	✓	✓	✓	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSSOP-B20
★ BD90520MUV-C	1	Pch(90mΩ)	Nch(60mΩ)	7	2.0	2.6	5.5	可变(0.6-5.0)	±1.5	0.3~2.4	±15	电流	0.065	✓	✓	✓	✓	✓	反馈	反馈	✓	-40 ~ 125	VQFN20SV4040
BD90522EFJ-C	1	Pch(85mΩ)	Nch(70mΩ)	7	2.0	2.69	5.5	1.2	(±2.0)	2.25	±20	电流	0.65	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSOP-J8
BD90525EFJ-C	1	Pch(85mΩ)	Nch(70mΩ)	7	2.0	2.69	5.5	1.5	(±2.0)	2.25	±20	电流	0.65	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSOP-J8
BD90528EFJ-C	1	Pch(85mΩ)	Nch(70mΩ)	7	2.0	2.69	5.5	1.8	(±2.0)	2.25	±20	电流	0.65	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSOP-J8
BD90571EFJ-C	1	Pch(85mΩ)	Nch(70mΩ)	7	1.0	2.69	5.5	1.2	(±2.0)	2.25	±20	电流	0.65	-	-	-	✓	✓	反馈	反馈	✓	-40 ~ 125	HTSOP-J8

★ 开发中

※ 反馈：自动反馈型

HTSOP-J8	HTSSOP-B20	VQFN20SV4040		
				
				
(Unit: mm)	(Unit: mm)	(Unit: mm)		

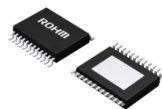
### “可低电压驱动的升降压自动控制”解决方案

BD9035AEFV-C是在广泛的输入电压范围 (VIN=3.8~30V) 下使用的耐高压的升降压型开关控制器, 仅1个电感器即可实现升降压输出。  
 另外, 采用升降压自动控制方式, 与以往的REGSPIC方式开关稳压器相比, 电源效率更高。  
 开关频率在整个工作温度范围 (Ta=-40°C~+125°C) 内实现高达±7%的精度。

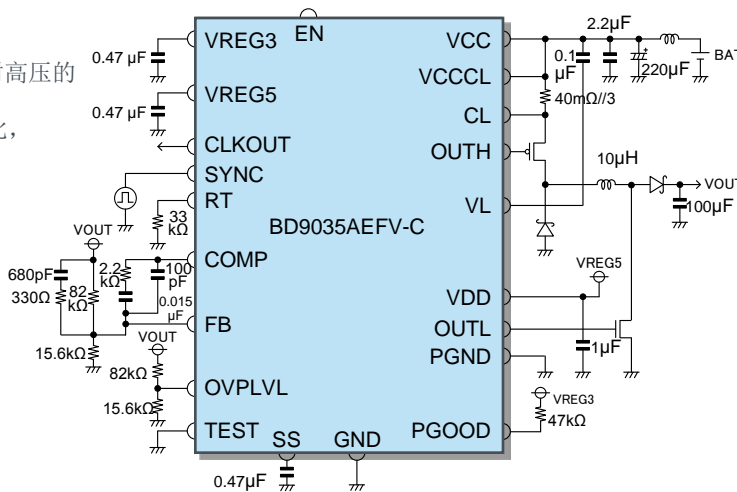
### 产品概要: BD9035AEFV-C

仅1个电感器即可实现升降压输出。  
 而且, 通过升压/升降压/降压的自动控制切换, 实现更高效率!

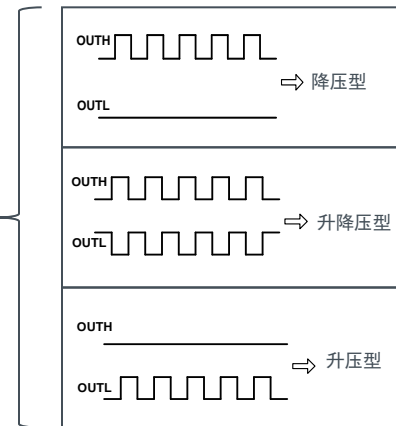
- 升降压三种模式自动切换控制方式
- 振荡频率的精度更高, 加上内置PLL的外部同步功能, 使噪音对策更容易!
- 开关频率精度: ±7% (-40°C~+125°C)
- PLL使外部同步频率范围更宽: 100~600kHz
- 输入电压范围: 3.8V~30V (额定40V)
- 振荡频率范围: 100k~600kHz
- 1个检测电阻, 两段式过电流保护电路
- 配备输出低电压/过电压保护和电源良好(Power Good)引脚



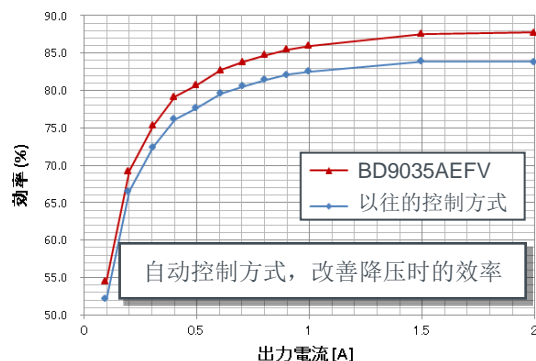
HTSSOP-B24



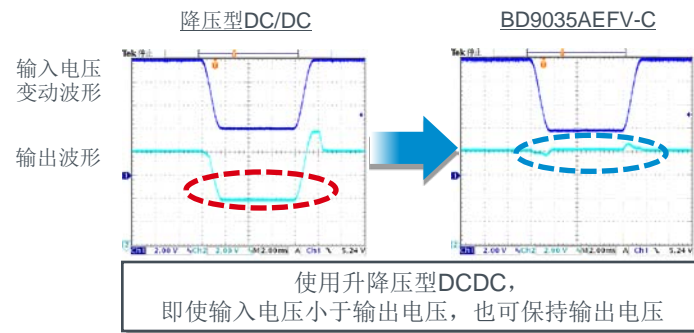
BD9035AEFV-C应用电路



各模式下的外置MOS栅极波形



BD9035AEFV-C 效率 vs 负载电流  
VIN=12V, VOUT=6V, f=350kHz

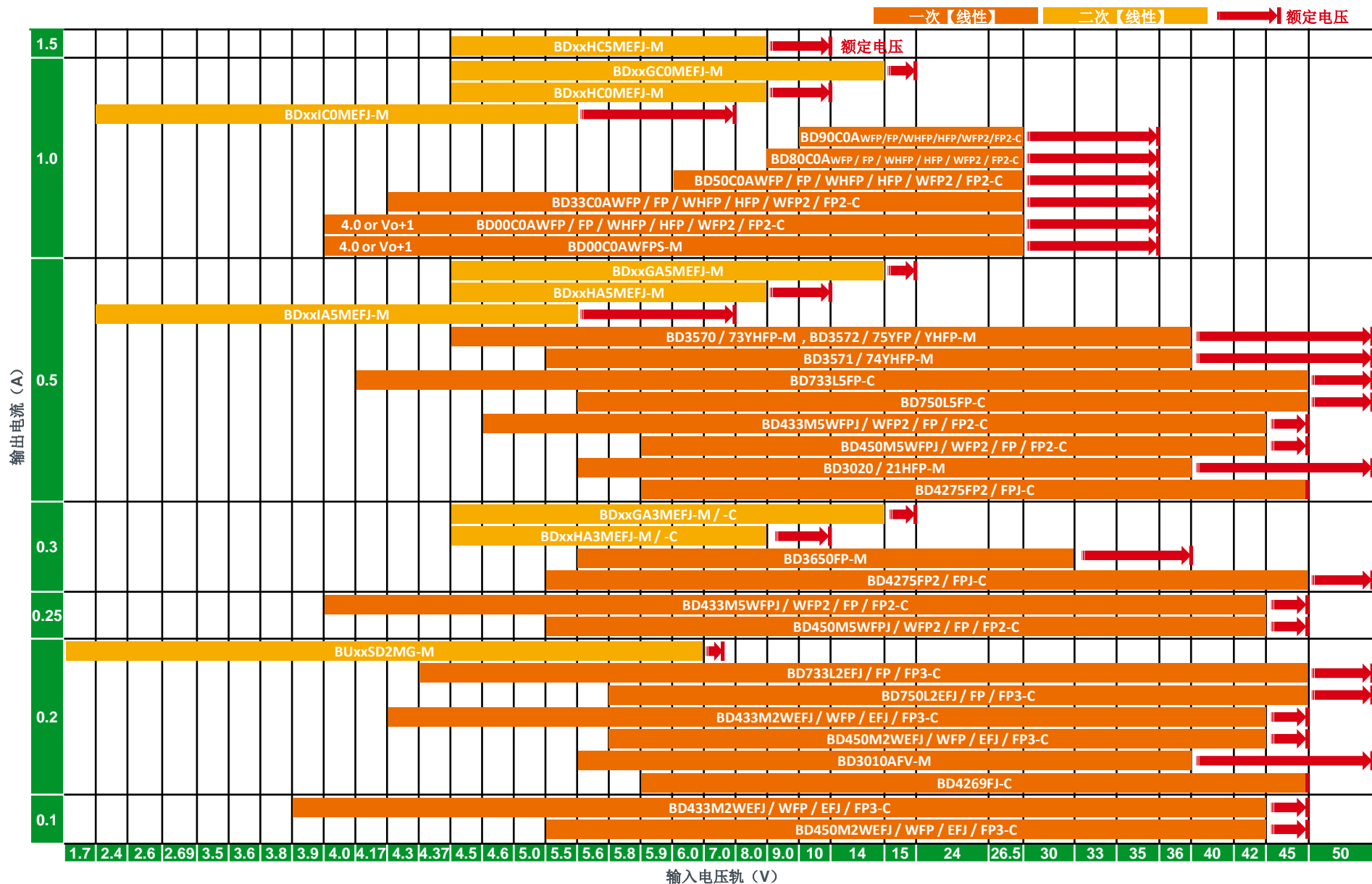


BD9035AEFV-C 输入电压 vs 输出电压  
VIN=10V, VOUT=8V, f=350kHz

产品名	输出数	输出控制方式		输入耐压 (V)	输出电流 (A) Max.	输入电压范围 (V)		输出电压 (V) Typ.	基准 (输出) 电压精度 (%)	开关频率		控制方式	工作时 电路电流 (mA) Typ.	功能							工作温度 (°C)	封装	
		Pch 控制器	Nch 控制器			Min.	Max.			设定范围 (kHz)	精度 (%)			电源良好	外部同步	可变软启动	同步整流	轻负载效率	过流保护	温度保护			过电压保护
BD9035AEFV-C	1	推挽	推挽	40	-	3.8	30	可变	±1.5	100 ~ 600	±7	电压	7	✓	✓	✓	-	-	反馈	反馈	✓	-40 ~ 125	HTSSOP-B24

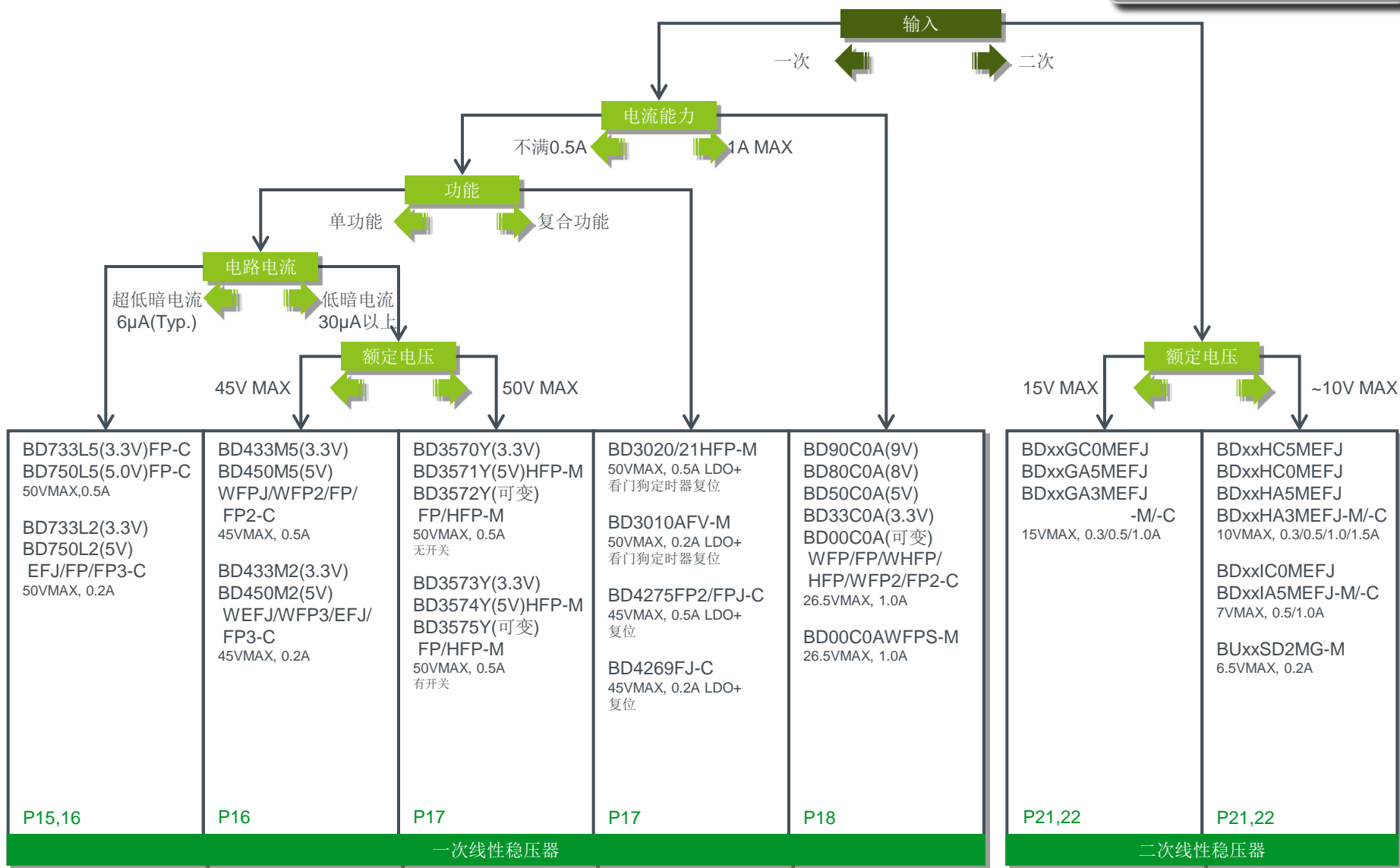
※ 反馈: 自动反馈型

# 车载用降压线性稳压器产品阵容



# 车载降压线性稳压器系列图

符合AEC-Q100

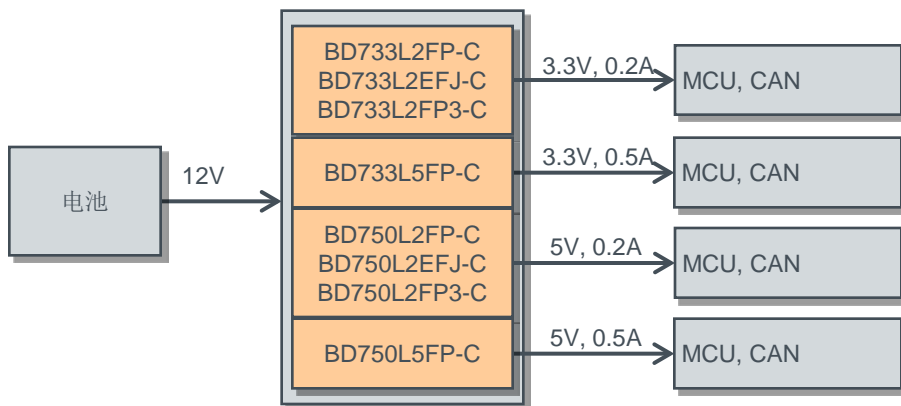


### “低暗电流”解决方案

BD7xxLxxxx-C系列是耐压50V、输出电压精度±2%、输出电流200/500mA、消耗电流6μA (Typ.) 的低暗电流稳压器，最适合直接连接电池系统实现更低耗电量。

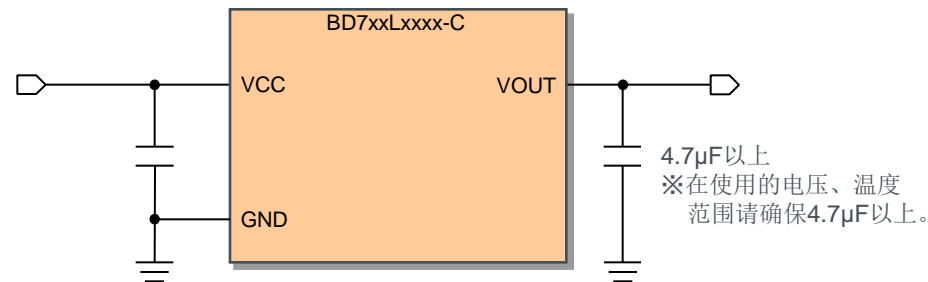
输出的相位补偿电容可使用陶瓷电容。

另外，本IC内置防止输出短路等导致IC损坏的过电流保护电路、防止过载状态等导致的IC热破坏的过热保护电路。

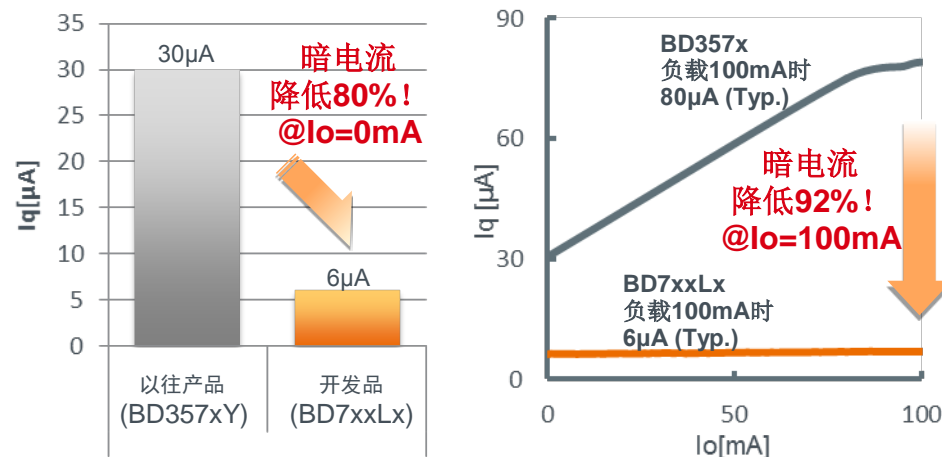


### 产品概要: BD7xxLxxxx-C

- 超低暗电流 : 6μA (Typ.)
- 输出晶体管 : Pch DMOS低饱和型 (3Ω(Typ.))
- VCC最大施加电压 : 50V
- 输出电流 : 200mA (Max.) / 500mA (Max.)
- 输出电压 : 3.3V ± 2% / 5.0V ± 2%
- 输出相位补偿可使用低ESR陶瓷电容
- 内置输出电流限制电路，可防止因输出短路等导致的IC损坏
- 内置过热保护电路，以防止过载状态等导致的IC热破坏



BD7xxLxxxx-C应用电路



BD7xxLxxxx-C低暗电流比较



TO252-3  
BD733L2FP-C  
BD733L5FP-C  
BD750L2FP-C  
BD750L5FP-C



HTSOPJ-8  
BD733L2EFJ-C  
BD750L2EFJ-C



SOT223-4  
BD733L2FP3-C  
BD750L2FP3-C  
※开发中



# 一次线性稳压器选型指南





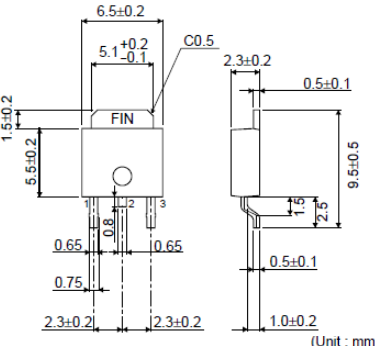
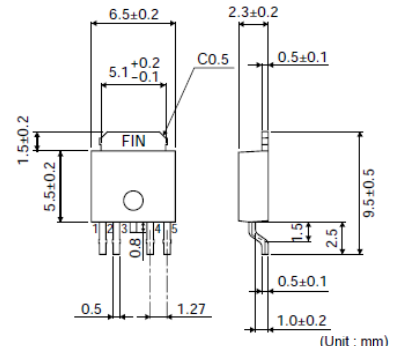
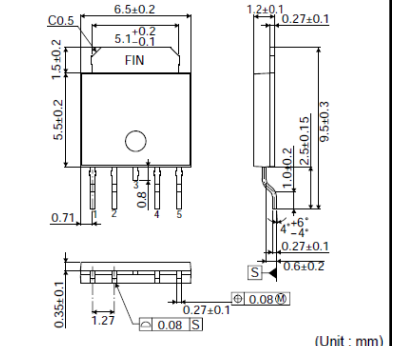
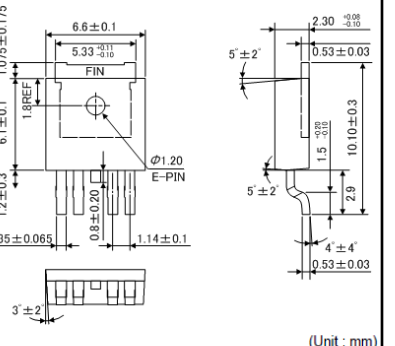



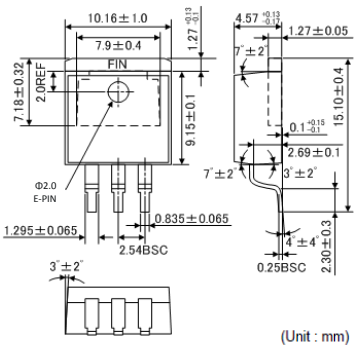
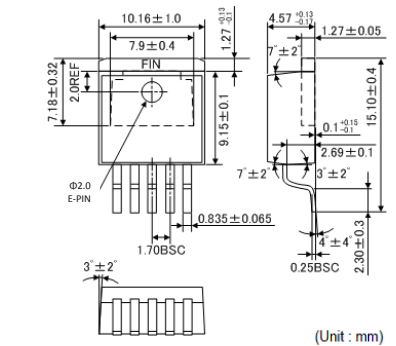
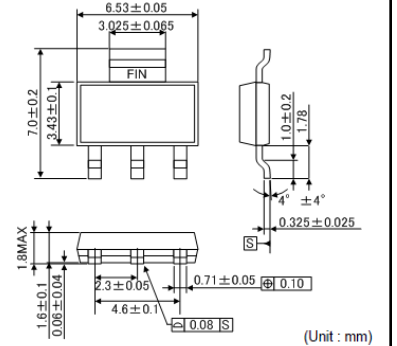
型号	额定电压 (V)	输入电压范围 (V)		输出电压 (V) Typ.	输出电流 (A) Max.	输出电压精度 (%)	最小输入电压差 (V) Typ.	电路电流 (μA) Typ.	关断开关	其他	功能					工作温度 (C)	封装
		Min.	Max.								检测可变复位	4.5V检测复位	检测精度(%)	WDT	WDT(可切换)		
BD733L2FP-C	50	4.37	45	3.3	0.20	±2	0.60@0.20A	6	-	-	-	-	-	-	-40~+125@Ta	TO252-3	
BD733L2EFJ-C									-	-	-	-	-	HTSOP-J8			
BD733L2FP3-C(开发中)									-	-	-	-	-	SOT223-4			
BD733L5FP-C									-	-	-	-	-	TO252-3			
BD750L2FP-C		5.8	5.0	0.20	0.40@0.20A	-	-	-	-	-	-	TO252-3					
BD750L2EFJ-C						-	-	-	-	-	HTSOP-J8						
BD750L2FP3-C(开发中)						-	-	-	-	-	SOT223-4						
BD750L5FP-C						5.6	0.50	0.25@0.20A	-	-	-	-	-	TO252-3			
BD433M2EFJ-C	45	4.3 @0.20A / 3.9 @0.10A	42	3.3	0.20	±2	0.20@0.10A	40	-	-	-	-	-	-40~+150@Tj	HTSOP-J8		
BD433M2FP3-C									-	-	-	-	-		SOT223-4		
BD433M2WEFJ-C									有	-	-	-	-		HTSOP-J8		
BD433M2WFP3-C									有	-	-	-	-		SOT223-4		
BD433M5FP-C		4.6 @0.50A / 4.0 @0.25A	0.50	0.25@0.30A	38	-	-	-	-	-	-	TO252-3					
BD433M5FP2-C						-	-	-	-	-	TO263-3						
BD433M5WFP2-C						有	-	-	-	-	TO263-5						
BD433M5WFPJ-C						有	-	-	-	-	TO252-J5						
BD450M2EFJ-C		5.8 @0.20A / 5.5 @0.10A	0.20	0.16@0.10A	40	-	-	-	-	-	-	HTSOP-J8					
BD450M2FP3-C						-	-	-	-	-	SOT223-4						
BD450M2WEFJ-C						有	-	-	-	-	HTSOP-J8						
BD450M2WFP3-C						有	-	-	-	-	SOT223-4						
BD450M5FP-C		5.9 @0.50A / 5.5 @0.25A	0.50	0.20@0.30A	38	-	-	-	-	-	-	TO252-3					
BD450M5FP2-C						-	-	-	-	-	TO263-3						
BD450M5WFP2-C						有	-	-	-	-	TO263-5						
BD450M5WFPJ-C						有	-	-	-	-	TO252-J5						





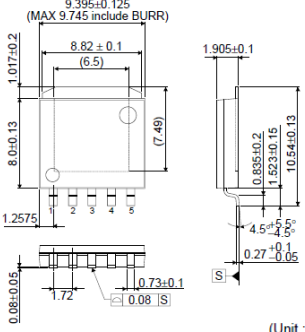
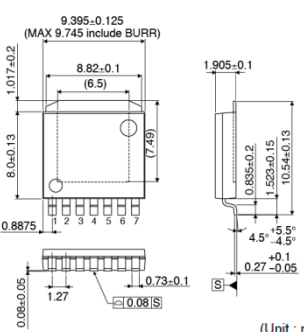
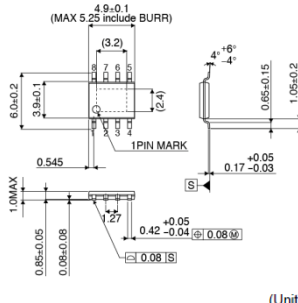
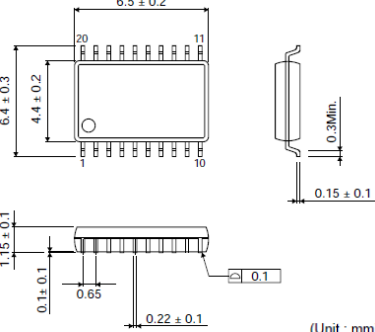
# 一次线性稳压器选型指南

型号	额定电压 (V)	输入电压范围 (V)		输出电压 (V) Typ.	输出电流 (A) Max.	输出电压精度 (%)	最小输入电压差 (V) Typ.	电路电流 ( $\mu$ A) Typ.	关断开关	其他	功能					工作温度 (C)	封装
		Min.	Max.								检测可变复位	4.5V检测复位	检测精度(%)	WDT	WDT(可切换)		
BD3572YFP-M	50	4.5	36	可变(2.8-12.0)	0.50	$\pm 2$	0.25@0.20A	30	-	-	-	-	-	-	-40~+125@Ta	TO252-5	
BD3575YFP-M		4.5		可变(2.8-12.0)			0.25@0.20A		有	-	-	-	-				
BD3570YHFP-M		4.5		3.3			-		-	-	-	-					
BD3571YHFP-M		5.5		5.0			-		-	-	-	-					
BD3572YHFP-M		4.5		可变(2.8-12.0)			0.25@0.20A		-	-	-	-					
BD3573YHFP-M		4.5		3.3			-		-	-	-	-					
BD3574YHFP-M		5.5		5.0			0.25@0.20A		有	-	-	-					
BD3575YHFP-M		4.5		可变(2.8-12.0)			-		-	-	-	-					
BD3650FP-M	36	5.6	30	5.0	0.30	$\pm 2$	0.20@0.20A	500	-	-	-	-	-	-	-40~+125@Ta	TO252-3	
BD3020HFP-M	50	5.6	36	5.0	0.50	$\pm 2$	0.30@0.20A	80	-	-	✓	-	$\pm 2$	✓	-	-40~+125@Ta	HRP7
BD3021HFP-M											-	✓	$\pm 2$	-	✓		HRP7
BD3010AFV-M	50	6.0	36	5.0	0.20	$\pm 2$	0.25@0.15A	80	-	-	✓	-	$\pm 2$	-	✓	-40~+125@Ta	SSOP-B20
BD4275FP2-C	45	5.5@0.3A / 5.9@0.5A	45	5.0	0.50	$\pm 2$	0.25@0.30A	65	-	-	-	✓	-2.6 / +2.8	-	-	-40~+125@Ta -40~+150@Tj	TO263-5
BD4275FPJ-C											-	-	-	-	-		TO252-J5
BD4269FJ-C	45	5.5	45	5.0	0.20	$\pm 2$	0.25@0.10A	70	-	-	✓	-	$\pm 2.6$	-	-	-40~+125@Ta -40~+150@Tj	SOP-J8

型号	额定电压 (V)	输入电压范围 (V)		输出电压 (V) Typ.	输出电流 (A) Max.	输出电压精度 (%)	最小输入电压差 (V) Typ.	电路电流 (μA) Typ.	关断开关	其他	功能					工作温度 (°C)	封装															
		Min.	Max.								检测可复位	4.5V检测复位	检测精度(%)	WDT	WDT(可切换)																	
BD00C0AWFPS-M	35	4.0 or Vo+1.0	26.5	可变(3.0-15.0)	1.00	±3	0.30 @0.50A Vo ≥ 5.0	500	有	-	-	-	-	-	-40~+105@Ta	TO252S-5																
BD33C0AFP-C	35	26.5	26.5	可变(3.0-15.0)	1.00	±3	0.30 @0.50A Vo ≥ 5.0	500	-	-	-	-	-	-	-40~+125@Ta	TO252-3																
BD33C0AFP2-C									4.3	3.3	-	-	-	-		-	-	TO263-3														
BD33C0AHFP-C									-	-	-	-	-	-		-	-	HRP5														
BD50C0AFP-C									6.0	5.0	5.0	5.0	±3	0.30 @0.50A Vo ≥ 5.0		500	-	-	-	-	-	-	TO252-3									
BD50C0AFP2-C																	-	-	-	-	-	-	-	-	TO263-3							
BD50C0AHFP-C																	-	-	-	-	-	-	-	-	HRP5							
BD80C0AFP-C																	9.0	8.0	8.0	8.0	±3	0.30 @0.50A Vo ≥ 5.0	500	-	-	-	-	-	-	TO252-3		
BD80C0AFP2-C																								-	-	-	-	-	-	-	-	TO263-3
BD80C0AHFP-C																								-	-	-	-	-	-	-	-	HRP5
BD90C0AFP-C									10.0	9.0	9.0	9.0	±3	0.30 @0.50A Vo ≥ 5.0		500								-	-	-	-	-	-	TO252-3		
BD90C0AFP2-C							-										-	-	-	-	-	-	-	TO263-3								
BD90C0AHFP-C							-										-	-	-	-	-	-	-	HRP5								
BD00C0AWFP-C							4.0 or Vo+1.0										26.5	26.5	可变(1.0-15.0)	1.00	±3	0.30@0.50A Vo ≥ 5.0	500	-	-	-	-	-	-	TO252-5		
BD00C0AWFP2-C									-	-	-	-	-	-		-								-	TO263-5							
BD00C0AWHFP-C									-	-	-	-	-	-		-								-	HRP5							
BD33C0AWFP-C									4.3	3.3	3.3	3.3	±3	0.30@0.50A Vo ≥ 5.0		500								-	-	-	-	-	-	TO252-5		
BD33C0AWFP2-C																								-	-	-	-	-	-	-	-	TO263-5
BD33C0AWHFP-C																								-	-	-	-	-	-	-	-	HRP5
BD50C0AWFP-C									6.0	5.0	5.0	5.0	±3	0.30@0.50A Vo ≥ 5.0		500								-	-	-	-	-	-	TO252-5		
BD50C0AWFP2-C																								-	-	-	-	-	-	-	-	TO263-5
BD50C0AWHFP-C	-	-	-	-	-	-		-							-									HRP5								
BD80C0AWFP-C	9.0	8.0	8.0	8.0	±3	0.30@0.50A Vo ≥ 5.0		500							-									-	-	-	-	-	TO252-5			
BD80C0AWFP2-C							-		-	-	-	-	-	-	-	TO263-5																
BD80C0AWHFP-C							-		-	-	-	-	-	-	-	HRP5																
BD90C0AWFP-C							10.0		9.0	9.0	9.0	±3	0.30@0.50A Vo ≥ 5.0	500	-	-	-	-	-	-	TO252-5											
BD90C0AWFP2-C	-	-	-	-	-	-		-							-	TO263-5																
BD90C0AWHFP-C	-	-	-	-	-	-		-							-	HRP5																

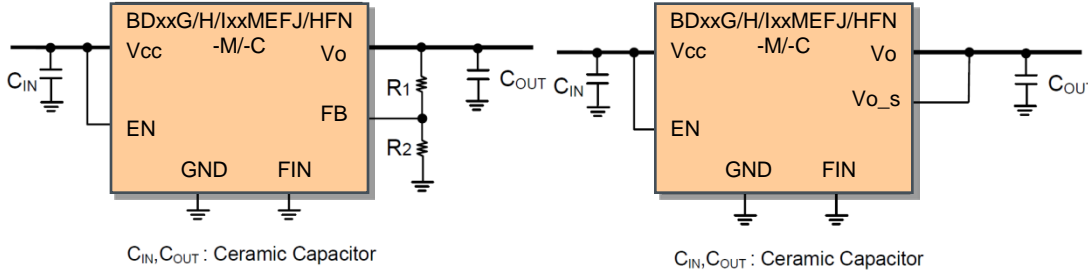
# 一次线性稳压器选择指南

T0252-3	T0252-5	T0252S-5	T0252-J5
			
 <p>(Unit: mm)</p>	 <p>(Unit: mm)</p>	 <p>(Unit: mm)</p>	 <p>(Unit: mm)</p>
T0263-3	T0263-5	SOT223-4	
			
 <p>(Unit: mm)</p>	 <p>(Unit: mm)</p>	 <p>(Unit: mm)</p>	

HRP5	HRP7	HTSOP-J8	SSOP-B20	
				
 <p>(Unit : mm)</p>	 <p>(Unit : mm)</p>	 <p>(Unit : mm)</p>	 <p>(Unit : mm)</p>	

### 【BDxxG/H/lxxMEFJ/HFN-M/-C】

绝对最大额定值 G: 15V H: 10V I: 7V



C<sub>IN</sub>, C<sub>OUT</sub>: Ceramic Capacitor

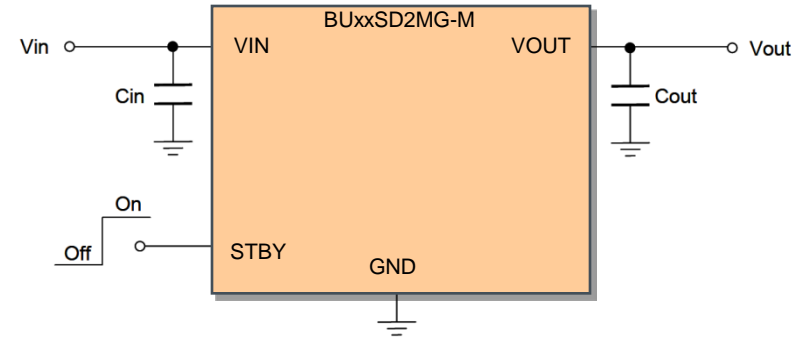
可变输出型  
应用电路

C<sub>IN</sub>, C<sub>OUT</sub>: Ceramic Capacitor

固定输出型  
应用电路

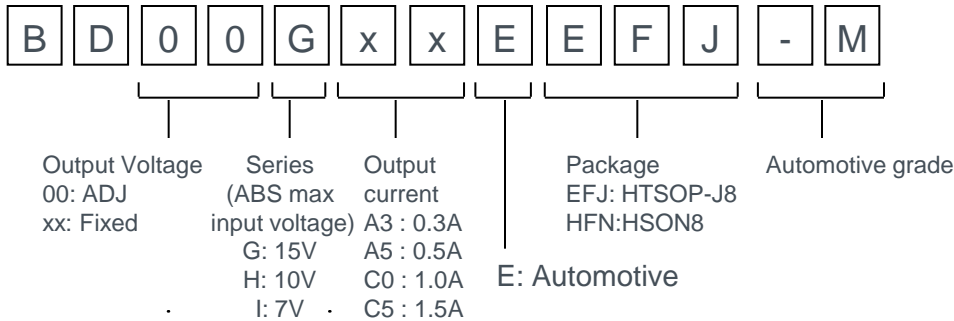
### 【BUxxSD2MG-M】

绝对最大额定值 6.5V



应用电路

#### 产品概要: BDxxG/H/lxxMEFJ/HFN-M/-C



- 关断时电路电流 : 0μA (Typ.)
- 输出电压精度 : -M=±3% (Ta: -40°C ~ +105°C)  
-C=±2% (Ta: -40°C ~ +125°C)
- 具备待机功能
- 输出相位补偿可使用低ESR陶瓷电容 (1.0μF Min.)
- 内置输出电流限制电路, 可防止输出短路等导致的IC损坏
- 内置过热保护电路, 以防止过载状态等导致的IC热破坏

#### 产品概要: BUxxSD2MG-M

- 输入电压范围 : 1.7V~6.0V (额定6.5V)
- 低暗电流 : 35μA (Typ.)
- 输出电流 : 200mA (Max.)
- 输出电压精度 : ±2% (Ta: -40°C ~ +105°C)
- 低输出噪音 : 30μVrms (10-100kHz)
- 高PSRR (Ripple Rejection) : 70dB typ.@1kHz
- 具备待机功能
- 输出相位补偿可使用低ESR陶瓷电容 (0.47μF Min.)
- 内置输出过电流保护电路, 可防止输出短路等导致的IC损坏
- 内置过热保护电路, 以防止过载状态等导致的IC热破坏



HTSOPJ-8



HSON8

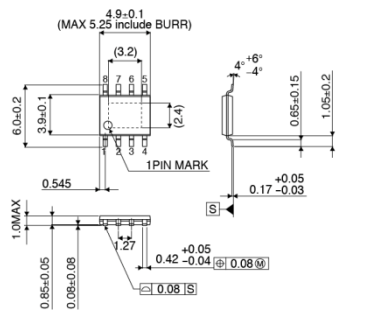


SSOP5

# 二次线性稳压器选择指南

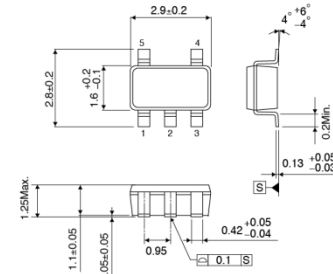
产品名	额定电压 (V)	输入电压范围(V)		输出电压(V) Typ.	输出电流 (A) Max.	输出电压精度 (%)	最小输入电压差 (V) Typ.	电路电流 (μA) Typ.	关断开关	其他	功能					工作温度 (C)	封装			
		Min.	Max.								检测可复位	4-5V检测复位	检测精度(%)	WDT	WDT(可切换)					
BDxxGC0MEFJ-M	15	4.5	14	可变(1.5-13.0) / 1.5 / 1.8 / 2.5	1.00	±3	0.60@1.00A	600	有	-	-	-	-	-	-	-	-	HTSOP-J8		
BDxxGA5MEFJ-M	15	4.5	14	/ 3.0 / 3.3 / 5.0 / 6.0 / 7.0 / 8.0 / 9.0/10.0/12.0	0.50	±3	0.60@0.50A	600	有	-	-	-	-	-	-	-	-	-40~+105@Ta	HTSOP-J8	
BDxxGA3MEFJ-M	15	4.5	14		0.30	±3	0.60@0.30A	600	有	-	-	-	-	-	-	-	-	HTSOP-J8		
BDxxGA3MEFJ-C	15	4.5	14	可变 / 3.3 / 5.0	0.30	±2	0.60@0.30A	600	有	-	-	-	-	-	-	-	-	-40~+125@Ta	HTSOP-J8	
BDxxHC5MEFJ-M	10	4.5	8.0	可变(1.5-7.0) / 1.5 / 1.8 / 2.5 / 3.0 / 3.3 / 5.0 / 6.0 / 7.0	1.50	±3	0.60@1.50A	600	有	-	-	-	-	-	-	-	-	-	HTSOP-J8	
BDxxHC0MEFJ-M	10	4.5	8.0		1.00	±3	0.60@1.00A	600	有	-	-	-	-	-	-	-	-	-	-40~+105@Ta	HTSOP-J8
BDxxHA5MEFJ-M	10	4.5	8.0		0.50	±3	0.60@0.50A	600	有	-	-	-	-	-	-	-	-	-	HTSOP-J8	
BDxxHA3MEFJ-M	10	4.5	8.0		0.30	±3	0.60@0.30A	600	有	-	-	-	-	-	-	-	-	-	HTSOP-J8	
BDxxHA3MEFJ-C	10	4.5	8.0		0.30	±2	0.60@0.30A	600	有	-	-	-	-	-	-	-	-	-	-40~+125@Ta	HTSOP-J8
BDxxIC0MEFJ-M	7	2.4	5.5	可变(0.8-4.5) / 1.0 / 1.2 / 1.5 / 1.8 / 2.5 / 3.0 / 3.3	1.00	±3	0.40@1.00A	250	有	-	-	-	-	-	-	-	-	-	-40~+105@Ta	HTSOP-J8
BDxxIA5MEFJ-M	7	2.4	5.5		0.50	±3	0.40@0.50A	250	有	-	-	-	-	-	-	-	-	-	HTSOP-J8	
BUxxSD2MG-M	6.5	1.7	6.0	1.2 / 1.5 / 1.8 / 2.5 / 2.8 / 3.0 / 3.3	0.20	±2	0.28 / 0.18 / 0.15 / 0.10 / 0.085 @0.10A	33	有	-	-	-	-	-	-	-	-	-	-40~+105@Ta	SSOP5

HTSOP-J8



(Unit : mm)

SSOP5



(Unit : mm)

何谓  
热性能何谓  
噪音

## 何谓“热电阻和热性能”

本定义符合JEDEC 标准 JESD51。

符号	定义	用途	计算公式
$\theta_{JA}$	将封装搭载于PCB时的结点温度 $T_j$ 和周围环境温度 $T_a$ 间的热电阻。	形状不同的封装间的散热性能比较。	$\theta_{JA} = (T_j - T_a) / P$
$\Psi_{JT}$	表示针对元器件整体的功耗 $P$ 的结点温度 $T_j$ 和封装顶部中央温度 $T_T$ 间的温度差的热性能参数。	结点温度的推算。	$\Psi_{JT} = (T_j - T_T) / P$
$\theta_{JC-TOP}$	结点温度 $T_j$ 和封装顶部温度 $T_{C-TOP}$ 间的热电阻。散热路径仅为封装顶部，其他为隔热状态。	用于采用双电阻模式的仿真。	$\theta_{JC-TOP} = (T_j - T_{C-TOP}) / P$
$\theta_{JC-BOT}$	结点温度 $T_j$ 和封装底部温度 $T_{C-BOT}$ 间的热电阻。散热路径仅为封装底部，其他为隔热状态。	当封装底部露出散热用金属时，大部分热量仅流入封装底部，因此用于结点温度推算。	$\theta_{JC-BOT} = (T_j - T_{C-BOT}) / P$

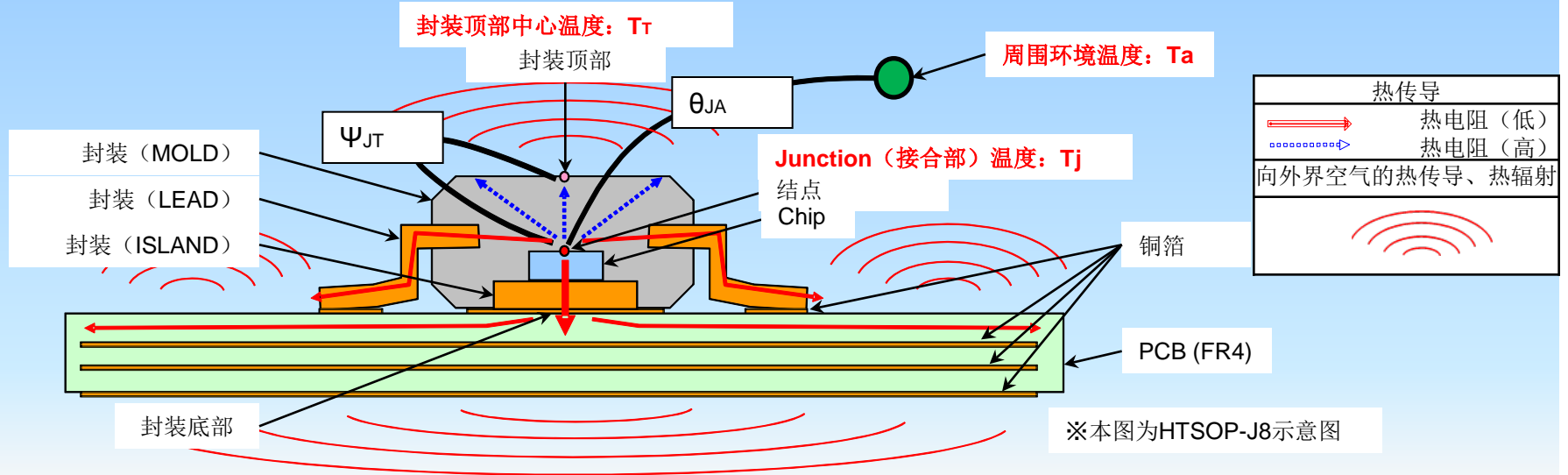
(注1)  $\theta_{JA}$  /  $\Psi_{JT}$ 为JEDEC板安装时的数据。(注2) 以往作为 $\theta_{JC}$ 提供的数据在本定义中为 $\Psi_{JT}$ 。



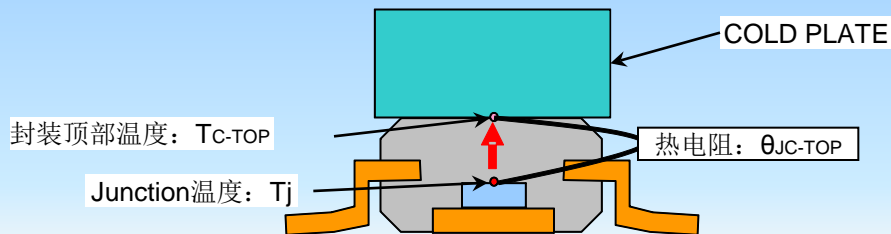
# 何谓“热电阻和热性能”

参考JEDEC (JESD51)

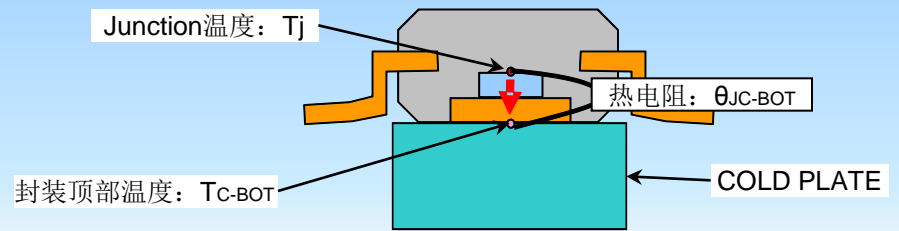
- $\theta_{JA}$  : 从结点到周围环境的热电阻(多个散热路径进行散热)
- $\psi_{JT}$  : 从结点到封装顶部中心的热性能参数(封装顶部之外也有热传导、散热)



- $\theta_{JC-TOP}$  : 从结点到封装顶部的热电阻 (散热仅为封装顶部。其他为隔热。)



- $\theta_{JC-BOT}$  : 从结点到封装底部的热电阻 (散热仅为封装底部。其他为隔热。)



何谓  
热性能

何谓  
噪音

## 何谓“噪音特性和耐性”

### EMC (Electromagnetic Compatibility)

不妨碍其他设备，受其他设备影响时能够保持本来的性能是非常重要的。  
从两种性能兼备的必要性角度，称之为“电磁兼容性”。  
如下所示，分为EMI和EMS两种。

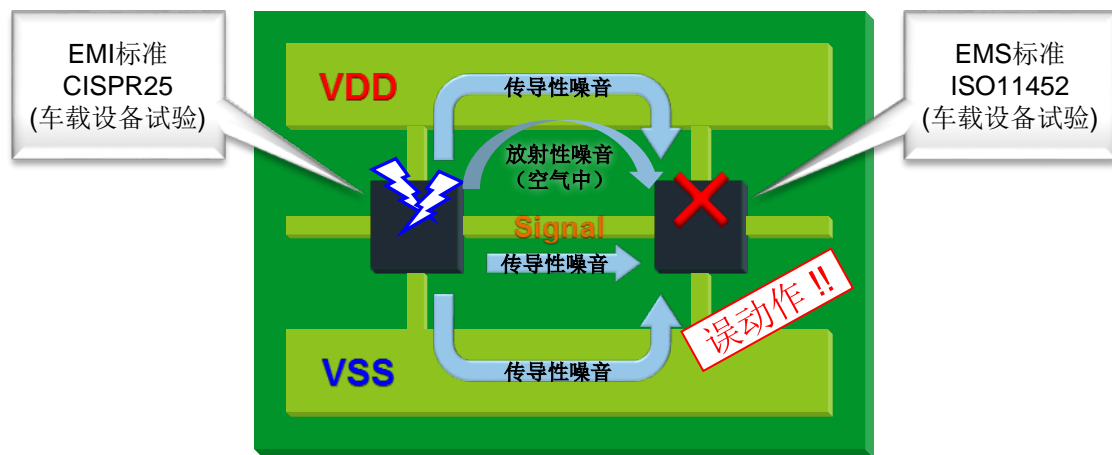
### EMI (Electromagnetic Interference; Emission)

使对象IC工作，产生噪音，有时会引起周边IC和系统误动作或不工作。  
为避免此类现象发生，需要精细的电路设计。

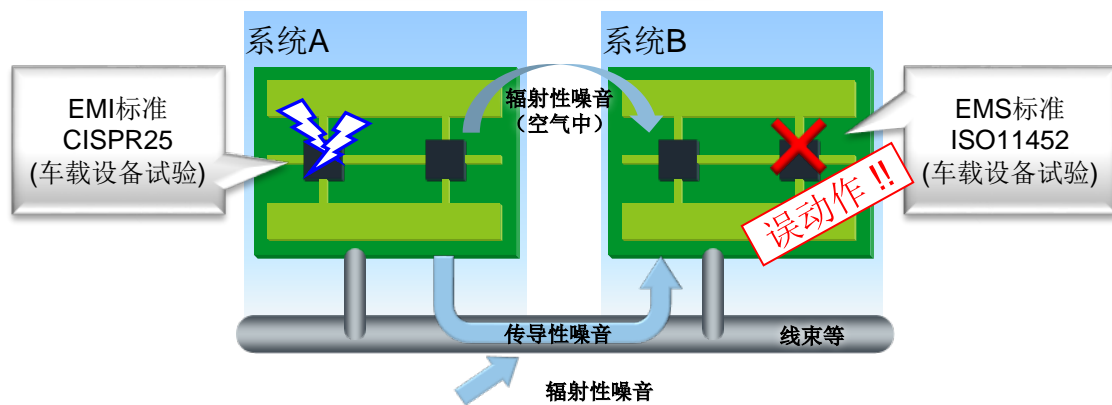
### EMS (Electromagnetic Susceptibility; Immunity)

使外围IC和系统工作，产生噪音，有时会引起对象IC误动作或不工作。  
为避免此类现象发生，需要坚固（牢固）的电路设计。

### 同一PCB板上的EMC故障



### PCB板外部的EMC故障



何谓  
热性能

何谓  
噪音

# PCB设计时的确认要点

## DC/DC的PCB布局不当时可能发生的问题点

EMC性能、PI (Power Integrity: 电源品质)下降

输出电压精度等基本性能恶化

不稳定运行 (振荡、SW波形断裂等)

## PCB设计时的检查点

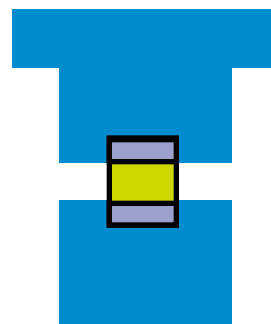
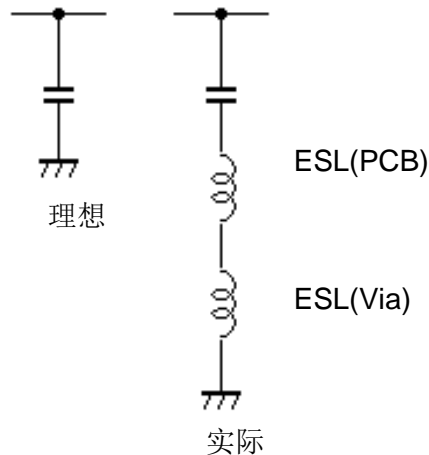
1. 电源系统线路请尽量宽而短。
2. 输入的去耦 (陶瓷) 电容请尽量配置于距离IC电源-GND引脚近的位置。  
(如果是斩波型则IC电源-SBD的GND侧) ⇒ 使AC电流路径最短。
3. 决定振荡频率的RT电阻请尽量配置于距离GND引脚 (基准GND) 近的位置。
4. 输出电压可变型的反馈电阻请尽量配置于距离反馈 (Feedback) 引脚近的位置, 从反馈电阻到反馈引脚之间的布线请尽量短。
5. 反馈电阻请配置于距离电感器、开关线等噪音源尽量远的位置。如果是两面贴装型, 则电源系统部件配置于IC同面、其他配置于背面也是有效的对策。  
此时, 请注意反馈线不要从电感器的下面通过。
6. 将电源系统GND (SBD、输入输出电容GND) 和基准GND (RT、GND) 分开, 可使开关噪音的影响变小。请在GND平面共享。
7. 请尽可能不要使用热风焊盘。  
⇒ 高频特性恶化。

## 关于热风焊盘的注意点

作为噪音对策使用的电容需要注意布局。



按上述布局热风焊盘, 则由于新增PCB的ESL成分, 因此, 共振频率向低频侧转移, 有时无法得到期望的噪音消除效果。



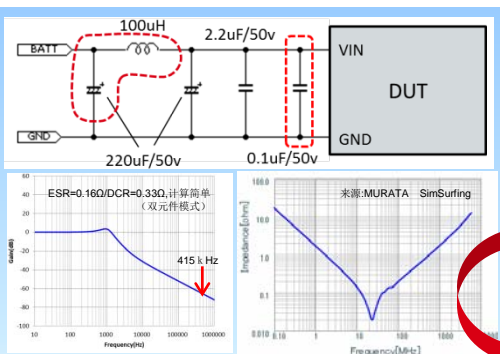
何谓  
热性能

何谓  
噪音

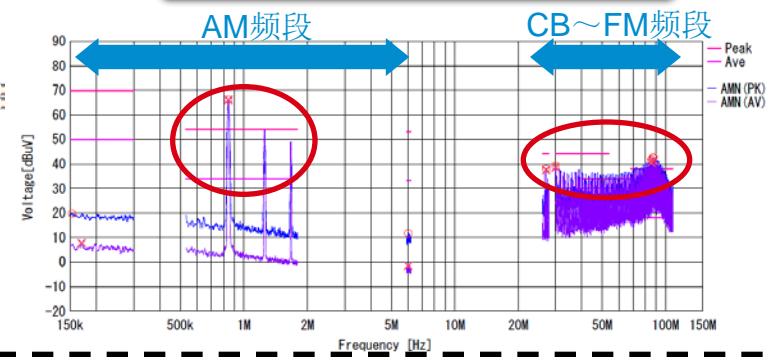
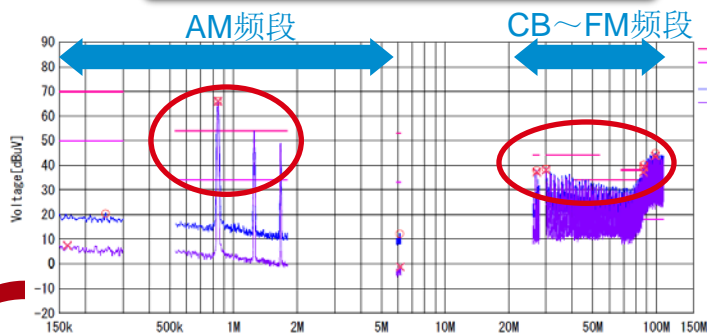
# 通过输入滤波器对应传导噪音示例

传导噪音 (BATTERY侧)

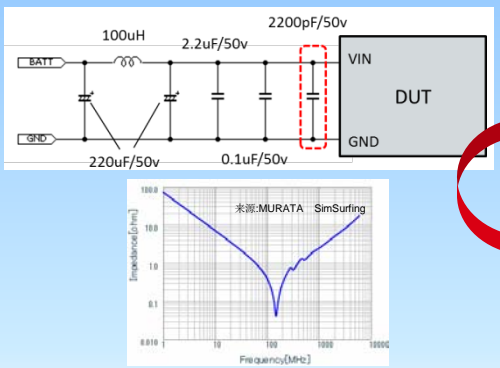
传导噪音 (GND侧)



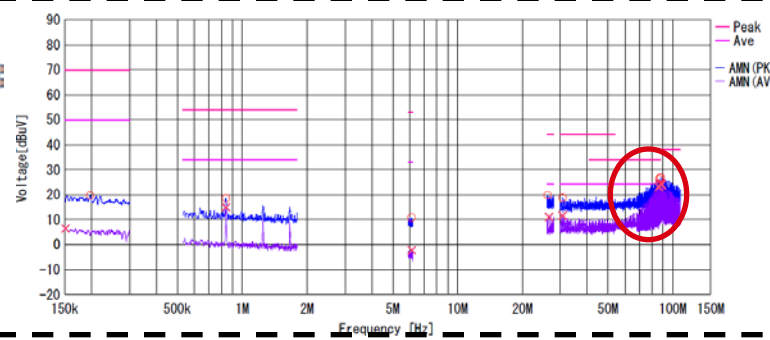
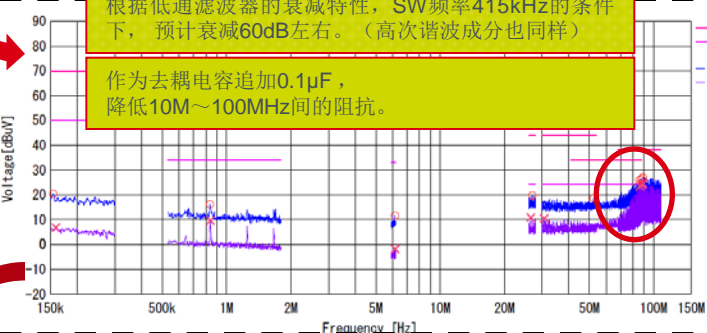
从低滤波器的DUT侧看到的衰减特性  
旁路电容 0.1μF /50v的阻抗



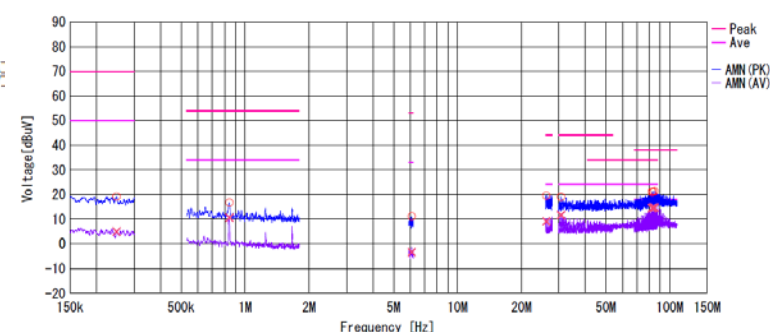
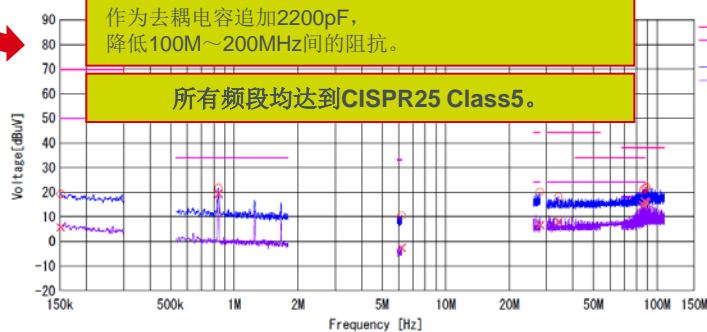
根据低通滤波器的衰减特性, SW频率415kHz的条件下, 预计衰减60dB左右。(高次谐波成分也同样)  
作为去耦电容追加0.1μF, 降低10M~100MHz间的阻抗。



旁路电容 2200pF /50v的阻抗



作为去耦电容追加2200pF, 降低100M~200MHz间的阻抗。  
所有频段均达到CISPR25 Class5。

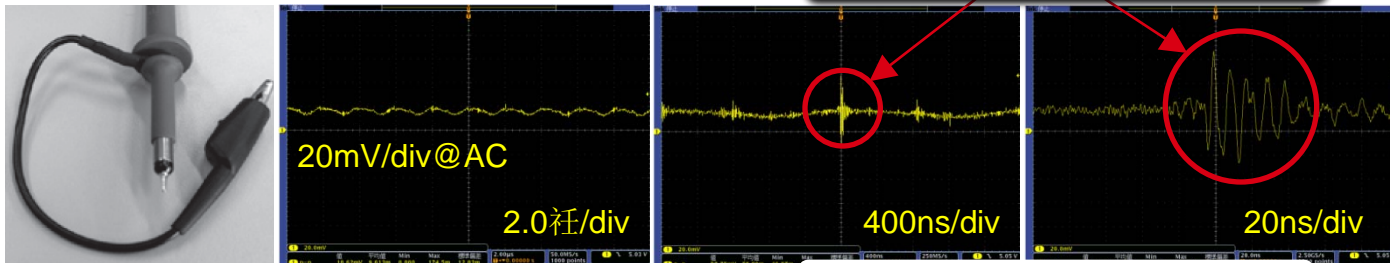


何谓  
热性能

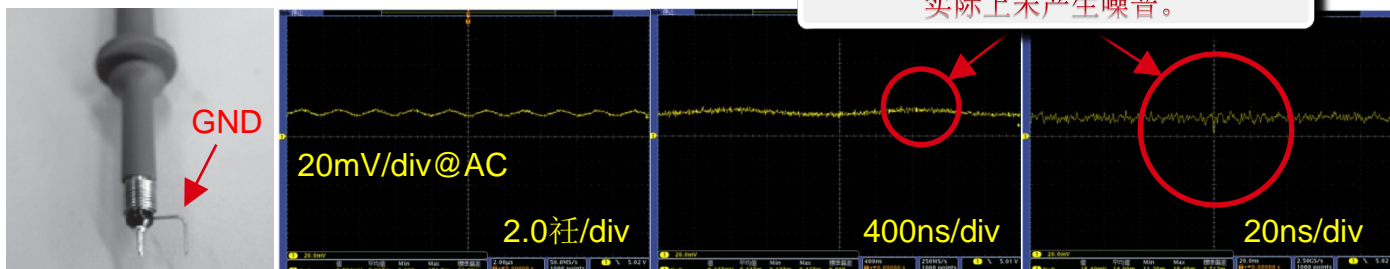
何谓  
噪音

## 附加：波形数据采集技巧

看起来像是产生了噪音...



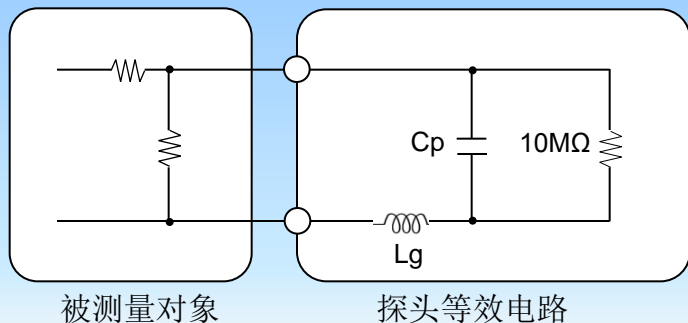
实际上未产生噪音。



$$\text{共振频率} = \frac{1}{2 \cdot \pi \cdot \sqrt{L_g \cdot C_p}}$$

L<sub>g</sub>: 探头的接地引线电感

C<sub>p</sub>: 探头的输入容量



上面的波形是使用附属于探头的GND引线采集到的波形。

下面的波形是在给GND缠绕镀锡线、缩短距离后的状态下测量输出波纹电压的结果。

2.0µs/div条件下未见较大差距，但放大比较后发现产生了尖峰。

此类尖峰是GND引线的电感和探头的输入容量的共振引起的。

要想防止此类共振，以接近理想的形式探测，需要将等效电路上的C<sub>p</sub>和L<sub>g</sub>变小。

通常无源探头的输入容量为10pF左右，有极限，因此，减小GND引线的电感L<sub>g</sub>（每1mm为数nH）可改善测量精度。

希望进一步提高精度时，可使用有源探头（FET探头）等。

产品名	页	产品名	页	产品名	页	产品名	页	产品名	页
●BD00COAWFP-C	13, 14, 18	○BD25GCOMFJ-M	13, 14, 21, 22	●BD3572HFP-M	13, 14, 17	○BD60GA5MEFJ-M	13, 14, 21, 22	◇BD90538EFJ-C	3, 4, 9, 10, 11
●BD00COAWFP2-C	13, 14, 18	○BD25HA3MEFJ-C	13, 14, 21, 22	●BD3573HFP-M	13, 14, 17	○BD60GCOMFJ-M	13, 14, 21, 22	◇BD90540EFV-C	3, 4, 9, 10, 11
●BD00COAWFPS-M	13, 14, 18	○BD25HA3MEFJ-M	13, 14, 21, 22	●BD3574HFP-M	13, 14, 17	○BD60HA3MEFJ-C	13, 14, 21, 22	◇BD90540MUV-C	3, 4, 9, 10, 11
●BD00COAWHFP-C	13, 14, 18	○BD25HA5MEFJ-M	13, 14, 21, 22	●BD3575FPP-M	13, 14, 17	○BD60HA3MEFJ-M	13, 14, 21, 22	◇BD90571EFJ-C	3, 4, 9, 10, 11
○BD00GA3MEFJ-C	13, 14, 21, 22	○BD25HCOMFJ-M	13, 14, 21, 22	●BD3575HFP-M	13, 14, 17	○BD60HA5MEFJ-M	13, 14, 21, 22	◆BD9060F-C	3, 4, 8
○BD00GA3MEFJ-M	13, 14, 21, 22	○BD25HC5MEFJ-M	13, 14, 21, 22	●BD3650FPP-M	13, 14, 17	○BD60HCOMFJ-M	13, 14, 21, 22	◆BD9060HFP-C	3, 4, 8
○BD00GA5MEFJ-M	13, 14, 21, 22	○BD25IA5MEFJ-M	13, 14, 21, 22	●BD4269FJ-C	13, 14, 17	○BD60HC5MEFJ-M	13, 14, 21, 22	◆BD90610EFJ-C	3, 4, 7, 8
○BD00GCOMFJ-M	13, 14, 21, 22	○BD25ICOMFJ-M	13, 14, 21, 22	●BD4275FPP2-C	13, 14, 17	○BD70GA3MEFJ-M	13, 14, 21, 22	◆BD90620EFJ-C	3, 4, 7, 8
○BD00HA3MEFJ-C	13, 14, 21, 22	●BD3010AFV-M	13, 14, 17	●BD4275FPPJ-C	13, 14, 17	○BD70GA5MEFJ-M	13, 14, 21, 22	◆BD90640EFJ-C	3, 4, 7, 8
○BD00HA3MEFJ-M	13, 14, 21, 22	●BD3020HFP-M	13, 14, 17	●BD433M2FP-C	13, 14, 16	○BD70GCOMFJ-M	13, 14, 21, 22	◆BD90640HFP-C	3, 4, 7, 8
○BD00HA5MEFJ-M	13, 14, 21, 22	●BD3021HFP-M	13, 14, 17	●BD433M2FP2-C	13, 14, 16	○BD70HA3MEFJ-C	13, 14, 21, 22	◆BD90730NUNIX-C	3, 4, 8
○BD00HCOMFJ-M	13, 14, 21, 22	○BD30GA3MEFJ-M	13, 14, 21, 22	●BD433M2WFP2-C	13, 14, 16	○BD70HA3MEFJ-M	13, 14, 21, 22	●BD90COAFP-C	13, 14, 18
○BD00HC5MEFJ-M	13, 14, 21, 22	○BD30GA5MEFJ-M	13, 14, 21, 22	●BD433M2WFPJ-C	13, 14, 16	○BD70HA5MEFJ-M	13, 14, 21, 22	●BD90COAFP2-C	13, 14, 18
○BD00IA5MEFJ-M	13, 14, 21, 22	○BD30GCOMFJ-M	13, 14, 21, 22	●BD433M5EFJ-C	13, 14, 16	○BD70HCOMFJ-M	13, 14, 21, 22	●BD90COAHFP-C	13, 14, 18
○BD00ICOMFJ-M	13, 14, 21, 22	○BD30HA3MEFJ-C	13, 14, 21, 22	●BD433M5FP3-C	13, 14, 16	○BD70HC5MEFJ-M	13, 14, 21, 22	●BD90COAWFP-C	13, 14, 18
○BD10IA5MEFJ-M	13, 14, 21, 22	○BD30HA3MEFJ-M	13, 14, 21, 22	●BD433M5WEFJ-C	13, 14, 16	●BD733L2FP-C	13, 14, 15, 16	●BD90COAWFP2-C	13, 14, 18
○BD10ICOMFJ-M	13, 14, 21, 22	○BD30HA5MEFJ-M	13, 14, 21, 22	●BD433M5WFP3-C	13, 14, 16	●BD733L2EFJ-C	13, 14, 15, 16	●BD90COAWHFP-C	13, 14, 18
○BD12IA5MEFJ-M	13, 14, 21, 22	○BD30HCOMFJ-M	13, 14, 21, 22	●BD450M2FP-C	13, 14, 16	●BD733L2FP3-C	13, 14, 15, 16	◆BD99010EFV-M	3, 4, 5, 6, 8
○BD12ICOMFJ-M	13, 14, 21, 22	○BD30HC5MEFJ-M	13, 14, 21, 22	●BD450M2FP2-C	13, 14, 16	●BD733L5FP-C	13, 14, 15, 16	◆BD99011EFV-M	3, 4, 5, 6, 8
○BD15GA3MEFJ-M	13, 14, 21, 22	○BD30IA5MEFJ-M	13, 14, 21, 22	●BD450M2WFP2-C	13, 14, 16	●BD750L2FP-C	13, 14, 15, 16	○BU12SD2MG-M	13, 14, 21, 22
○BD15GA5MEFJ-M	13, 14, 21, 22	○BD30ICOMFJ-M	13, 14, 21, 22	●BD450M2WFPJ-C	13, 14, 16	●BD750L2EFJ-C	13, 14, 15, 16	○BU15SD2MG-M	13, 14, 21, 22
○BD15GCOMFJ-M	13, 14, 21, 22	●BD33COAFP-C	13, 14, 18	●BD450M5EFJ-C	13, 14, 16	●BD750L2FP3-C	13, 14, 15, 16	○BU18SD2MG-M	13, 14, 21, 22
○BD15HA3MEFJ-C	13, 14, 21, 22	●BD33COAFP2-C	13, 14, 18	●BD450M5FP3-C	13, 14, 16	●BD750L5FP-C	13, 14, 15, 16	○BU25SD2MG-M	13, 14, 21, 22
○BD15HA3MEFJ-M	13, 14, 21, 22	●BD33COAHFP-C	13, 14, 18	●BD450M5WEFJ-C	13, 14, 16	●BD80COAFP-C	13, 14, 18	○BU28SD2MG-M	13, 14, 21, 22
○BD15HA5MEFJ-M	13, 14, 21, 22	●BD33COAWFP-C	13, 14, 18	●BD450M5WFP3-C	13, 14, 16	●BD80COAFP2-C	13, 14, 18	○BU30SD2MG-M	13, 14, 21, 22
○BD15HCOMFJ-M	13, 14, 21, 22	●BD33COAWFP2-C	13, 14, 18	●BD50COAFP-C	13, 14, 18	●BD80COAHFP-C	13, 14, 18	○BU33SD2MG-M	13, 14, 21, 22
○BD15HC5MEFJ-M	13, 14, 21, 22	●BD33COAWHFP-C	13, 14, 18	●BD50COAFP2-C	13, 14, 18	●BD80COAWFP-C	13, 14, 18		
○BD15IA5MEFJ-M	13, 14, 21, 22	○BD33GA3MEFJ-C	13, 14, 21, 22	●BD50COAHFP-C	13, 14, 18	●BD80COAWFP2-C	13, 14, 18		
○BD15ICOMFJ-M	13, 14, 21, 22	○BD33GA3MEFJ-M	13, 14, 21, 22	●BD50COAWFP-C	13, 14, 18	●BD80COAWHFP-C	13, 14, 18		
○BD18GA3MEFJ-M	13, 14, 21, 22	○BD33GA5MEFJ-M	13, 14, 21, 22	●BD50COAWFP2-C	13, 14, 18	◆BD9015KV-M	3, 4, 8		
○BD18GA5MEFJ-M	13, 14, 21, 22	○BD33GCOMFJ-M	13, 14, 21, 22	●BD50COAWHFP-C	13, 14, 18	◆BD9016KV-M	3, 4, 8		
○BD18GCOMFJ-M	13, 14, 21, 22	○BD33HA3MEFJ-C	13, 14, 21, 22	○BD50GA3MEFJ-C	13, 14, 21, 22	◆BD9035AEFV-C	3, 4, 12		
○BD18HA3MEFJ-C	13, 14, 21, 22	○BD33HA3MEFJ-M	13, 14, 21, 22	○BD50GA3MEFJ-M	13, 14, 21, 22	◇BD90520EFV-C	3, 4, 9, 10, 11		
○BD18HA3MEFJ-M	13, 14, 21, 22	○BD33HA5MEFJ-M	13, 14, 21, 22	○BD50GA5MEFJ-M	13, 14, 21, 22	◇BD90522EFJ-C	3, 4, 9, 10, 11		
○BD18HA5MEFJ-M	13, 14, 21, 22	○BD33HCOMFJ-M	13, 14, 21, 22	○BD50GCOMFJ-M	13, 14, 21, 22	◇BD90525EFJ-C	3, 4, 9, 10, 11		
○BD18HCOMFJ-M	13, 14, 21, 22	○BD33HC5MEFJ-M	13, 14, 21, 22	○BD50HA3MEFJ-C	13, 14, 21, 22	◇BD90528EFJ-C	3, 4, 9, 10, 11		
○BD18HC5MEFJ-M	13, 14, 21, 22	○BD33IA5MEFJ-M	13, 14, 21, 22	○BD50HA3MEFJ-M	13, 14, 21, 22	◇BD90528EFJ-C	3, 4, 9, 10, 11		
○BD18IA5MEFJ-M	13, 14, 21, 22	○BD33ICOMFJ-M	13, 14, 21, 22	○BD50HA5MEFJ-M	13, 14, 21, 22	◇BD90530EFV-C	3, 4, 9, 10, 11		
○BD18ICOMFJ-M	13, 14, 21, 22	●BD3570HFP-M	13, 14, 17	○BD50HC5MEFJ-M	13, 14, 21, 22	◇BD90530MUV-C	3, 4, 9, 10, 11		
○BD25GA3MEFJ-M	13, 14, 21, 22	●BD3571HFP-M	13, 14, 17	○BD50HCOMFJ-M	13, 14, 21, 22	◇BD90532EFJ-C	3, 4, 9, 10, 11		
○BD25GA5MEFJ-M	13, 14, 21, 22	●BD3572FP-M	13, 14, 17	○BD60GA3MEFJ-M	13, 14, 21, 22	◇BD90535EFJ-C	3, 4, 9, 10, 11		

◆一次开关, ◇二次开关, ●一次线性, ○二次线性

# Notice

## Precaution on using ROHM Products

1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment <sup>(Note 1)</sup>, aircraft/spacecraft, nuclear power controllers, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSIII		CLASS II b	
CLASSIV	CLASSIII	CLASS III	CLASS III

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
  - [a] Installation of protection circuits or other protective devices to improve system safety
  - [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure
3. Our Products are not designed under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc. prior to use, must be necessary:
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  - [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
  - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
  - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
  - [f] Sealing or coating our Products with resin or other coating materials
  - [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
  - [h] Use of the Products in places subject to dew condensation
4. The Products are not subject to radiation-proof design.
5. Please verify and confirm characteristics of the final or mounted products in using the Products.
6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
8. Confirm that operation temperature is within the specified range described in the product specification.
9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

## Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

## Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

## Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of ionizer, friction prevention and temperature / humidity control).

## Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
  - [a] the Products are exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [b] the temperature or humidity exceeds those recommended by ROHM
  - [c] the Products are exposed to direct sunshine or condensation
  - [d] the Products are exposed to high Electrostatic
2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

## Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

## Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

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