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2010年4月1日
瑞萨电子公司

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7546/7547 群

定时器 A 的操作（输出比较功能实现 PWM 输出）

1. 要点

本篇资料介绍如何使用定时器 A 的比较输出功能产生 PWM 波形。

2. 说明

该应用说明适用于以下条件：

- 采用的 MCU：M37546 群
  M37547 群
- 振荡频率：8MHz

3. 内容

3.1 PWM 输出波形说明

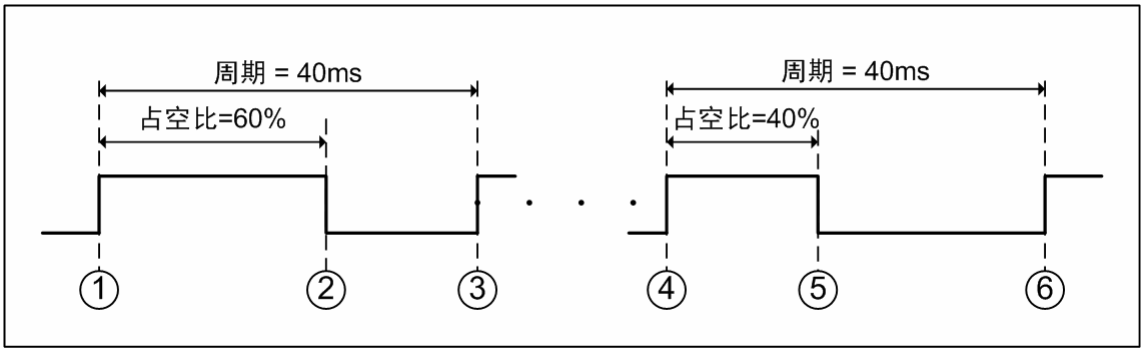


图 1 PWM 输出波形示意图

- 说明

1. 初始化定时器 A 和输出比较功能，设定 PWM 输出的周期和占空比。
2. 当定时器的计数值与比较锁存器中的值一致时，比较输出触发产生；比较输出波形反转。
3. 在定时器下一次下溢时，比较缓冲器中的新设定值写入比较锁存器，当比较输出触发再次产生后，输出波形反转。
4. 重复输出 10 个周期的 PWM 波形后调整占空比参数。
5. 当比较锁存器中新设定值与定时器计数值一致时，比较输出触发产生；比较输出波形反转。
6. 重复输出 10 个周期，调整了占空比的 PWM 波形。

3.2 PWM 输出波形产生时序图

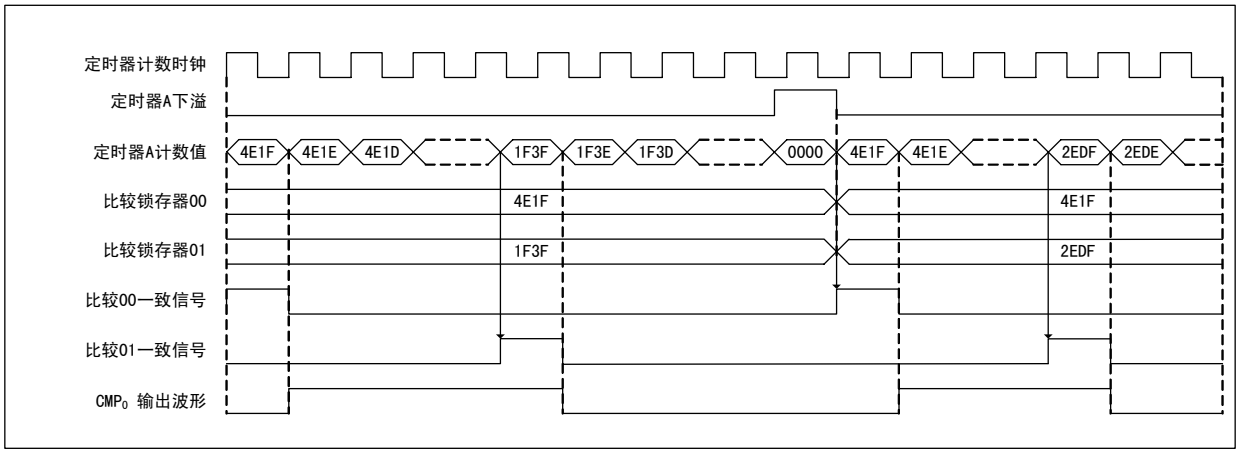


图 2 输出比较功能产生 PWM 波形的时序图

3.3 PWM 参数计算公式

以下公式用于计算 PWM 波形的周期和占空比参数：

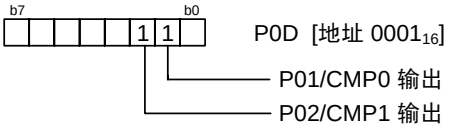
PWM 周期 = (TA + 1) / f(定时器计数时钟);
输出“H”脉冲占空比= [(CMPi0 – CMPi1) / (TA+1)] X 100%;　(i = 0, 1, 2, 3)

注：定时器 A 包括低位（TAL）和高位（TAH）；
CMPi0 和 CMPi1 为输出比较通道 i 的比较锁存器；
输出比较通道 i 选择正极性输出。

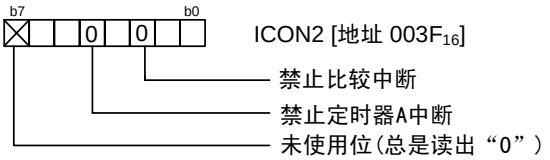
3.4 寄存器设置

本说明使用输出比较通道 0 生成 PWM 波形，特殊寄存器设置方法如下，当使用输出比较通道 1 到 3 时，设置方法相同。

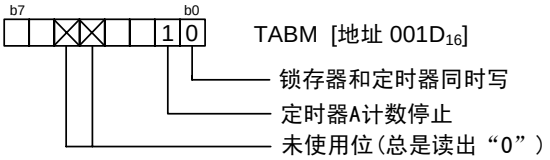
(1) 设置端口P0方向寄存器



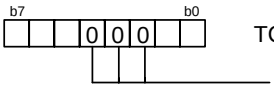
(2) 设置中断控制寄存器2



(3) 设置定时器A、B模式寄存器

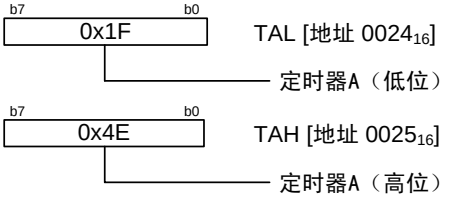


(4) 设置定时器计数源设定寄存器



b4	b3	b2	
0	0	0 :	f(xin)/16
0	0	1 :	f(xin)/2
0	1	0 :	f(xin/32
0	1	1 :	f(xin)/64
1	0	0 :	f(xin)/128
1	0	1 :	f(xin)/256
1	1	0 :	内部振荡器输出
1	1	1 :	禁止选择

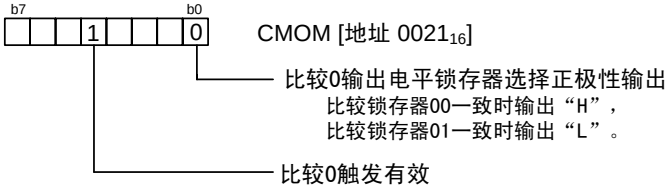
(5) 设置定时器A



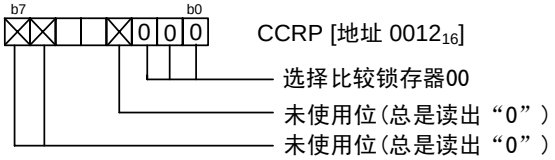
注意： 必须按照定时器A的低位（TAL），定时器A的高位（TAH）的顺序给两个寄存器写

(6) 设置捕捉/比较定时器源选择寄存器

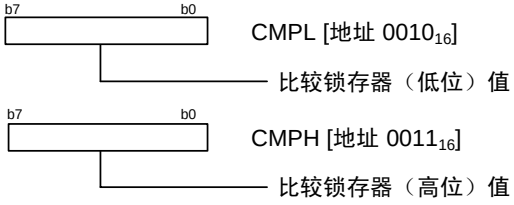
(7) 设置比较输出模式选择寄存器



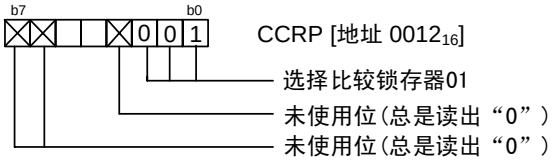
(8) 设置捕捉/比较寄存器R/W指针



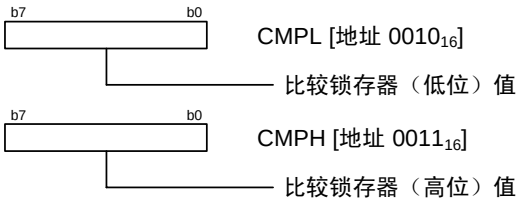
(9) 设置比较锁存器00



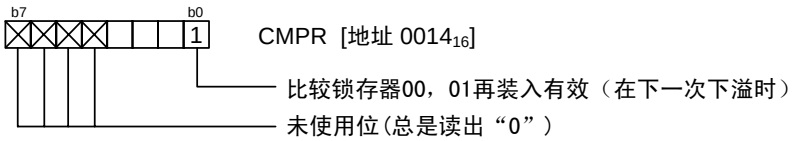
(10) 设置捕捉/比较寄存器R/W指针



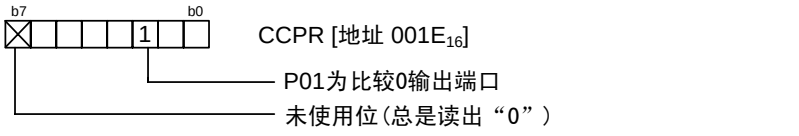
(11) 设置比较锁存器01



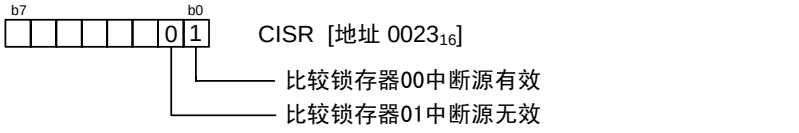
(12) 设置比较设置再装入寄存器



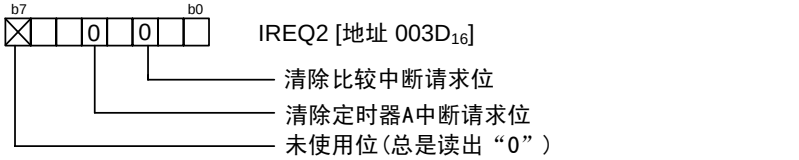
(13) 设置捕捉/比较端口寄存器



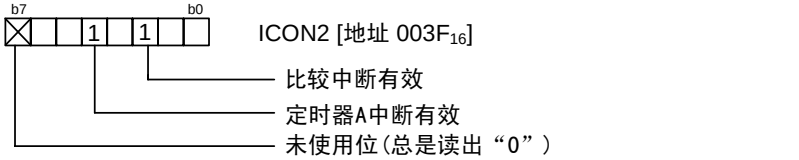
(14) 设置比较中断源设定寄存器



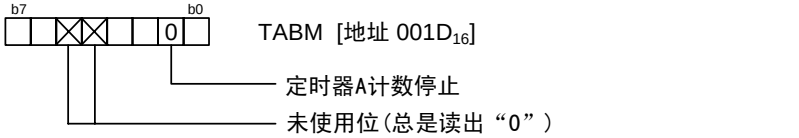
(15) 设置中断请求寄存器2



(16) 设置中断控制寄存器2



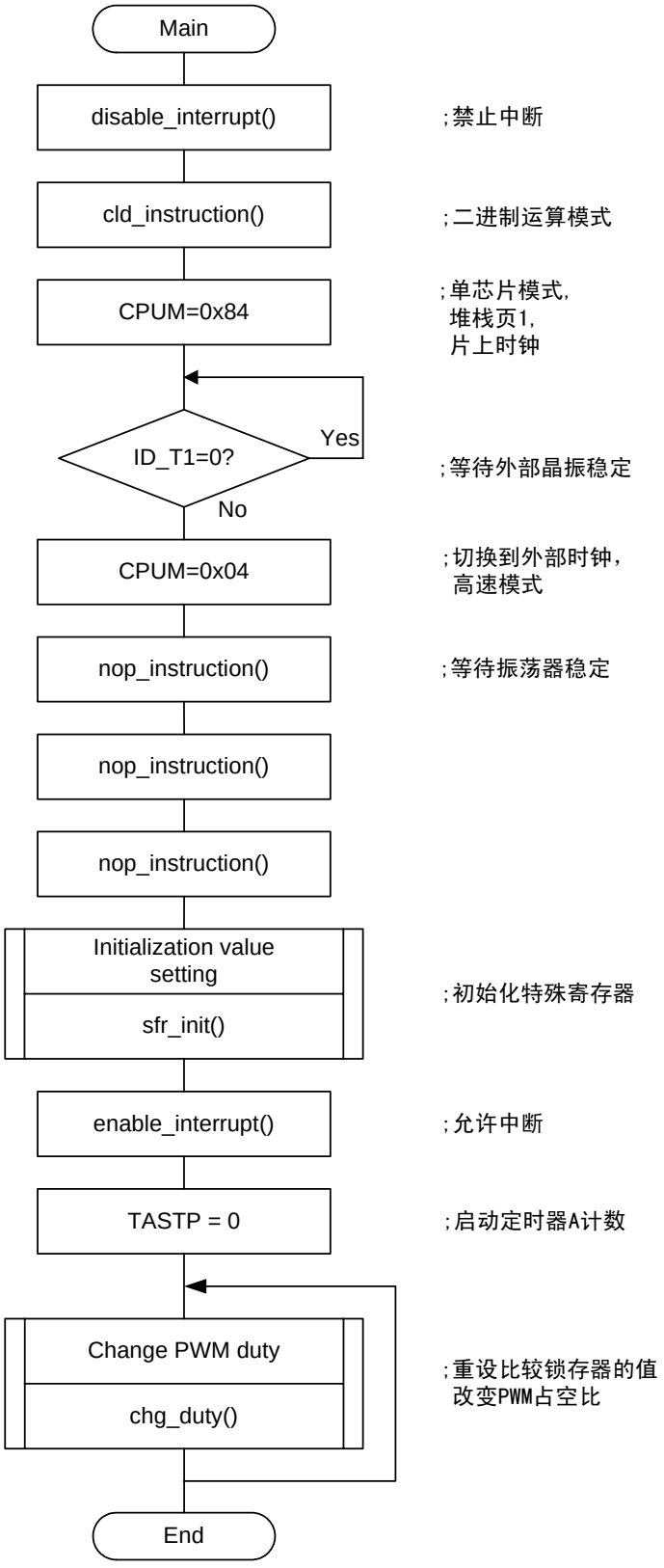
(17) 设置定时器A、B模式寄存器



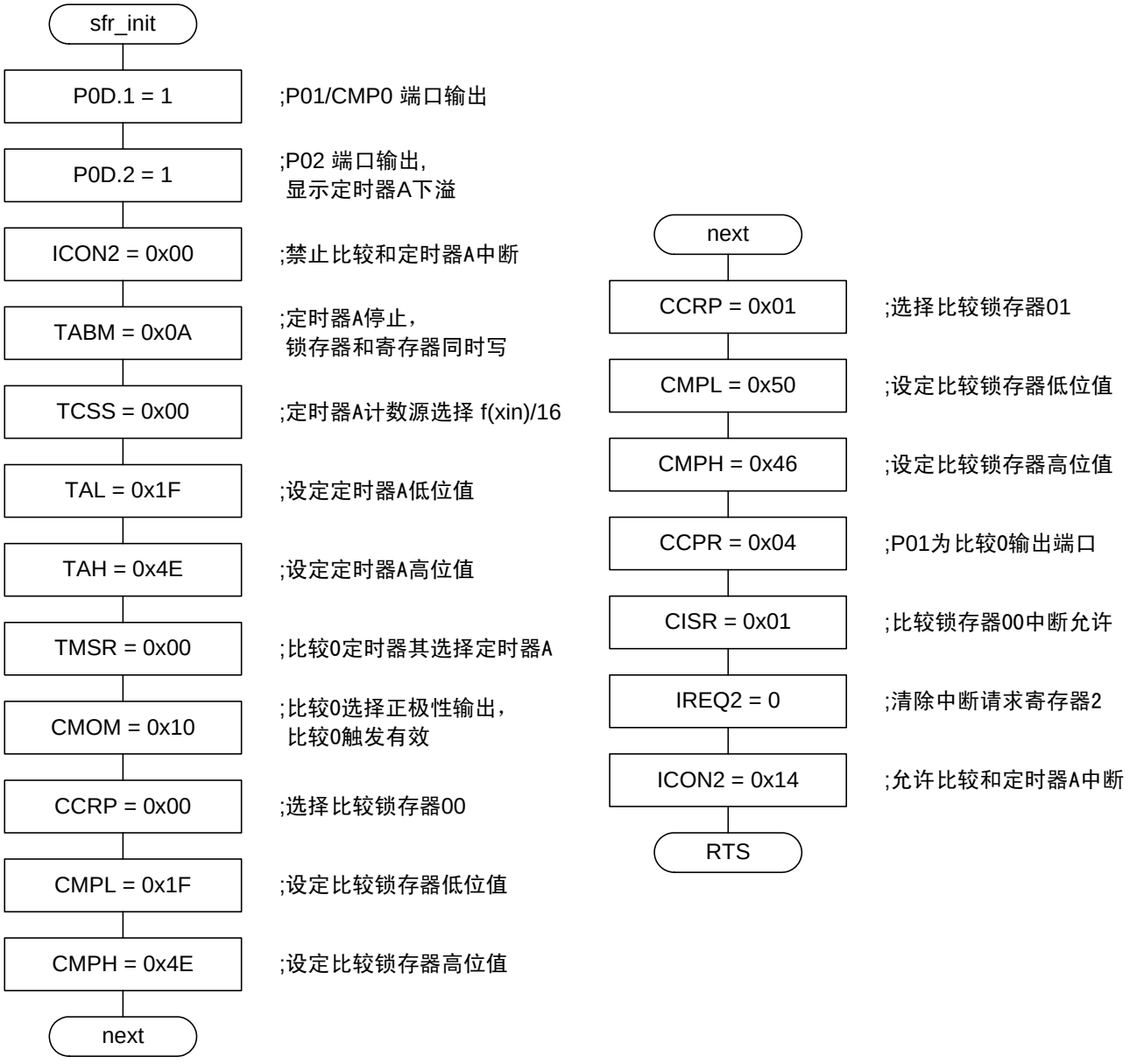
注：在定时器 A 计数期间要改变输出比较通道 0 输出波形时，重复上述步骤(8)～(12)。 必须将比较锁存器 00，01 重装入位设置为“1”（下一次下溢时重装入有效），这样在定时器下一次下溢时，比较缓冲器中的新设定值才写入比较锁存器。

4. 程序流程图

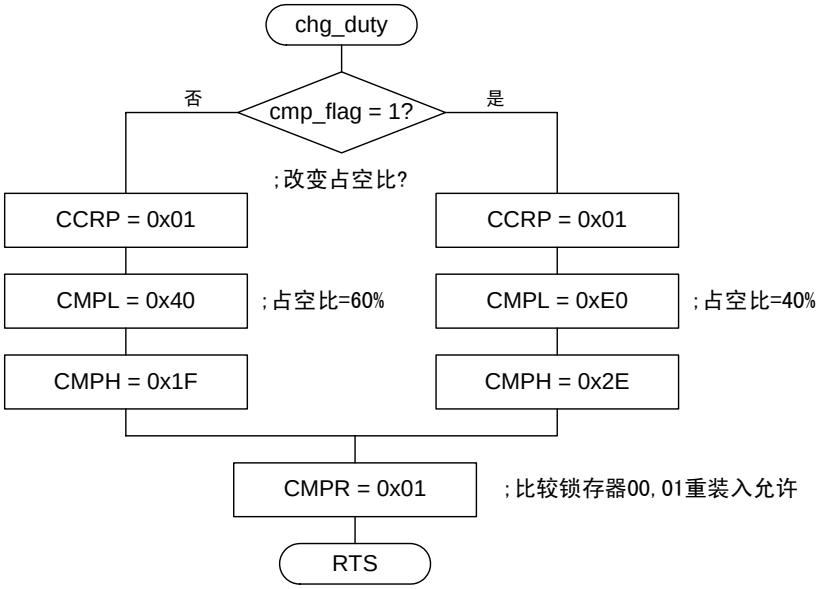
4.1 主程序流程图



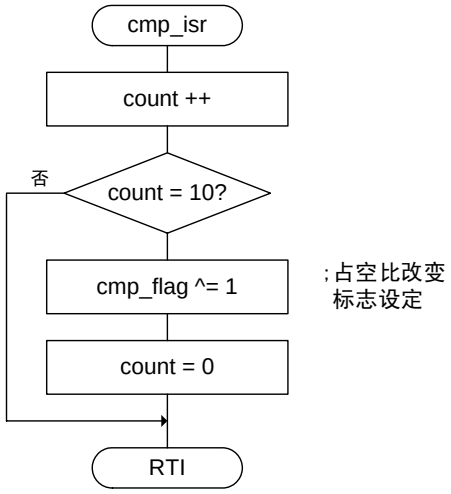
4.2 输出比较初始化子程序（cmp_init）



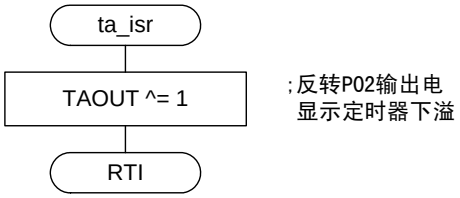
4.3 PWM 输出占空比参数设定子程序（chg_duty）



4.4 比较中断服务子程序（cmp_isr）



4.5 定时器 A 中断服务子程序（ta_isr）



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Rev.	发行日	修订内容	
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1.01	2006.10.26	—	初版发行
1.02	2008.03.17	2 3 9 10	修改 3.1 说明内容第 2、3 项；修改 3.3 公式（定时器时钟→定时器计数时钟；脉冲时间→脉冲占空比）和注释内容 修改 3.4 寄存器设置内容（比较→输出比较通道） 修改参考例程内容 更新咨询邮箱地址

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   1）生命维持装置。
   2）植埋于人体使用的装置。
   3）用于治疗（切除患部、给药等）的装置。
   4）其他直接影响到人的生命的装置。
9. 在使用本资料所记载的产品时，对于最大额定值、工作电源电压的范围、放热特性、安装条件及其他条件请在本公司规定的保证范围内使用。如果超出了本公司规定的保证范围使用时，对于由此而造成的故障和出现的事故，本公司将不承担任何责任。
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11. 如果把本资料所记载的产品从其载体设备上卸下，有可能造成婴儿误吞的危险。顾客在将本公司产品安装到顾客的设备上时，请顾客自行负责将本公司产品设置为不容易剥落的安全设计。如果从顾客的设备上剥落而造成事故时，本公司将不承担任何责任。
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