致尊敬的顾客

关于产品目录等资料中的旧公司名称

NEC电子公司与株式会社瑞萨科技于2010年4月1日进行业务整合（合并），整合后的新公司暨“瑞萨电子公司”继承两家公司的所有业务。因此，本资料中虽还保留有旧公司名称等标识，但是并不妨碍本资料的有效性，敬请谅解。

瑞萨电子公司网址：http://www.renesas.com

2010年4月1日
瑞萨电子公司

【发行】瑞萨电子公司（http://www.renesas.com）

【业务咨询】http://www.renesas.com/inquiry

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

H8/300L Super Low Power（SLP）系列

外围功能的说明

内容

说明 H8/38024F 单片机的外围功能。

要点

本应用说明叙述在使用 H8/38024F 单片机的外围功能时应该注意的重要事项。
在本应用说明中叙述的外围功能，主要面向单片机的 SCI 和 LCD。

动作确认器件

H8/38024F

目录

1. SCI 接口

H8/38024F 单片机的串行通信接口只有一个 SCI3，运行在异步或者同步模式。支持全双工通信，内置能选择所需的位速率的波特率发生器，能选择内部或者外部时钟作为接收/发送时钟源，能使用 6 种中断。

另外，支持多处理器通信功能，能在多个处理器间传送串行数据。

本应用说明不叙述各种 SCI 寄存器的概要、设定和存取方法，而集中叙述在使用 SCI3 时需要注意和探讨的事项（时序问题等）。

1.1 异步模式

在异步模式下，与每个字符同步传送串行数据。通过 UART 或 ACIA 等标准异步通信 LSI 的接收器 / 发送器进行串行数据的传送。能选择 16 种传送格式。

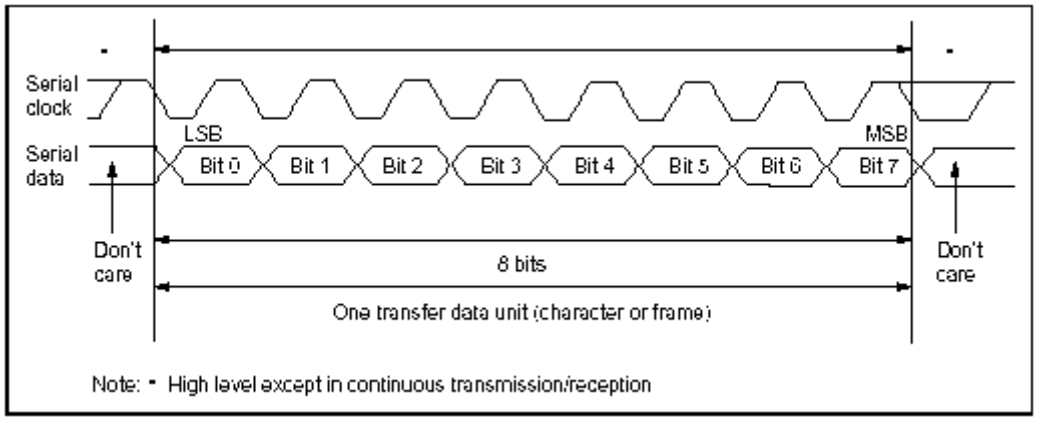
数据长	7、8、5 位
停止位长	1 位或者 2 位
奇偶校验	偶数校验、奇数校验、或者无奇偶校验
多处理器位	1 或者 0
接收错误的检测	奇偶校验、溢出、帧错误
中止的检测	在帧错误时，直接读 RXD_{32} 管脚的电平，检测中止

1.2 同步模式

在同步模式下，与时钟同步传送串行数据，能和具有同步通信功能的其他 LSI 进行串行数据的传送。此模式适用于高速串行通信。

数据长	8 位
接收错误的检测	溢出错误

同步通信在串行时钟的下降沿和下一个下降沿之间输出通信线上的数据，并在串行时钟的上升沿确定数据。请参照下图：



1 个传送数据从 LSB 开始，以 MSB 结束。在输出 MSB 后，通信线保持 MSB 的值。在同步模式的数据接收中，SCI3 在串行时钟的上升沿锁存接收数据。数据传送格式为 8 位固定的数据长，不能附加奇偶校验位和多处理器位。

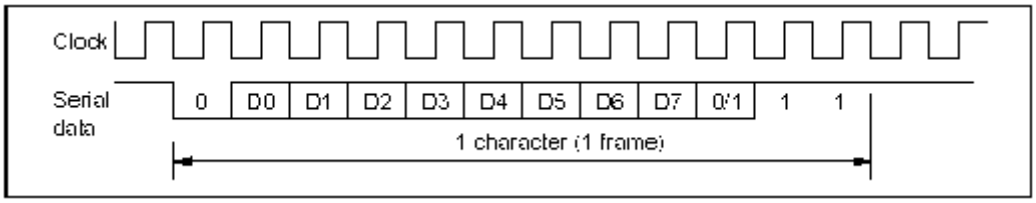
1.3 时钟

1.3.1 异步模式

能选择波特率发生器生成的内部时钟或者输入到 SCK32 管脚的外部时钟作为 SCI3 发送 / 接收时钟。在选择时钟源时，设定硬件手册中记载的寄存器。

将外部时钟输入到 SCK32 管脚时，时钟频率必须设定为位速率的 16 倍。

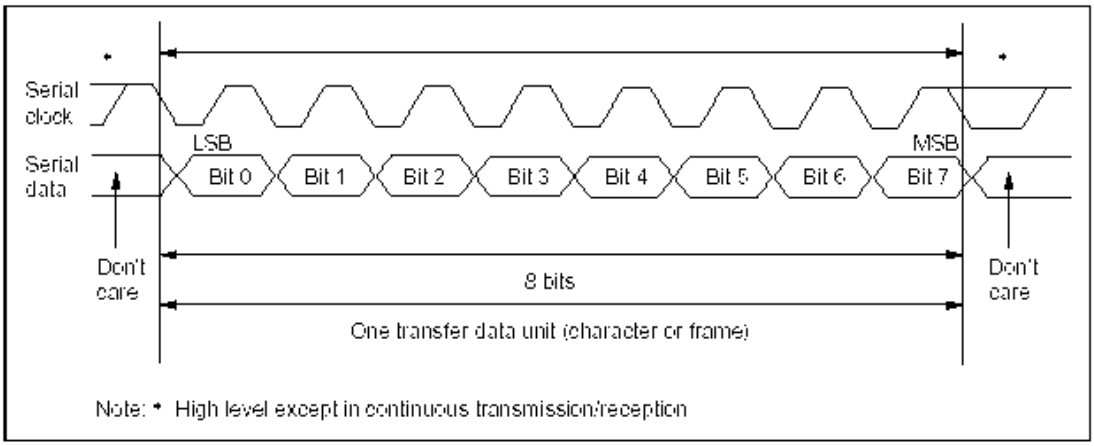
通过内部时钟进行 SCI3 运行时，能从 SCK32 管脚输出时钟。此时，输出时钟频率等于位速率，该相位在发送/接收数据的各位中央时钟上升。请参照以下的异步模式图：



1.3.2 同步模式

能选择波特率发生器生成的内部时钟或者输入到 SCK32 管脚的外部时钟中作为 SCI3 发送/接收时钟。

通过内部时钟进行 SCI3 运行时，能从 SCK32 管脚输出时钟。在发送或者接收 1 个字符中输出 8 个脉冲的串行时钟。当 SCI3 既不发送也不接收时，时钟固定为高电平。请参照下图：

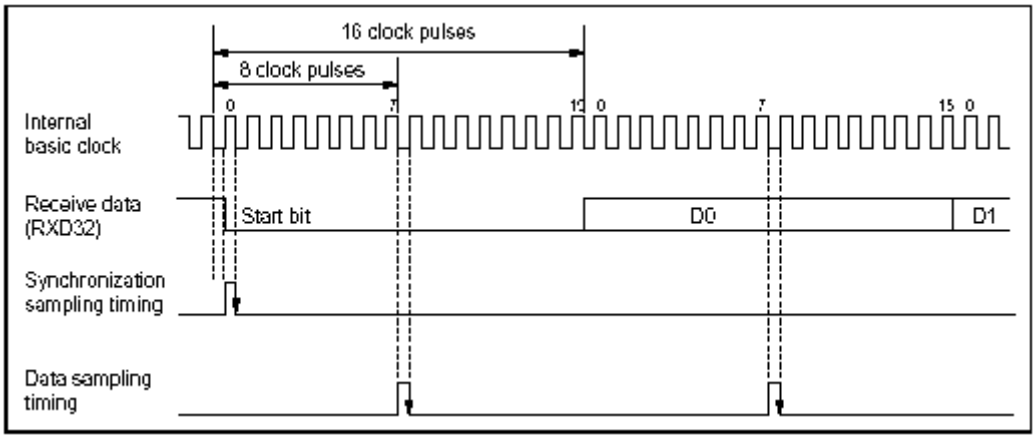


在异步模式使用外部时钟的情况下，必须注意不要在运行中（包含初始化）停止时钟。在同步模式使用外部时钟的情况下，不要在包含初始化的运行中供给时钟。

1.4 中断

SCI3 有发送结束、发送数据空、接收数据满和 3 种接收错误中断（溢出错误、帧错误、奇偶校验错误）共 6 种中断，这些中断被分配了相同的向量地址。关于中断的允许/禁止，请参照单片机的硬件手册。

最后，在此应该说明的要点是异步模式的接收数据的采样时序和接收数据的容限。在异步模式下，SCI3 通过频率为 16 倍传送率的基本时钟运行。在接收数据时，SCI3 以基本时钟为准，采样起始位的下降沿，取得内部同步。在基本时钟的第 8 个上升沿将接收数据取到内部。如下图所示：



2. LCD 接口

在此说明使用 H8/38024F 单片机的 LCD 功能连接 LCD 显示屏时的注意事项，不说明各种寄存器的设定方法。

H8/38024F 单片机内置段型 LCD 控制电路、LCD 驱动器和电源供给电路，能直接驱动 LCD 显示屏。LCD 驱动器/控制器的特点如下所示：

- 显示能力

Duty Cycle	Internal Driver
Static	32 seg
1/2	32 seg
1/3	32 seg
1/4	32 seg

- LCD RAM 容量 [128 位 = 8 位 x 16 字节]
- LCD RAM 的字存取
- 能并联
- 能在待机以外的全部运行模式进行显示
- 能选择 11 种帧频
- 通过内部电源分压电阻供给 LCD 驱动功率
- 能选择 A 或者 B 波形

2.1 帧频

LCD 帧频是底板和段输出变化的速度，能由 LCD 周期/2 * 底板数求出。帧频的范围是 25 到 250Hz，但是最一般的是 50 到 150Hz。如果频率高，消耗功率就增加；如果频率低，LCD 显示屏的图像就不清晰。下表总结了帧频的几种选择方法：

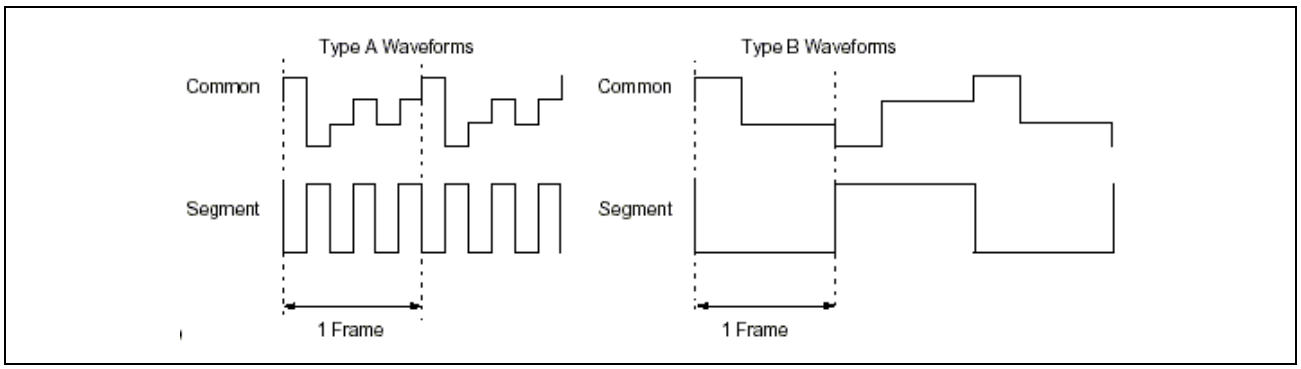
Bit 3	Bit 2	Bit 1	Bit 0		Frame Frequency*2	
CKS3	CKS2	CKS1	CKS0	Operating Clock	ø = 2 MHz	ø = 250 kHz*1
0	*	0	0	øw	128 Hz*3 (initial value)	
0	*	0	1	øw/2	64 Hz*3	
0	*	1	*	øw/4	32 Hz*3	
1	0	0	0	ø/2	—	244 Hz
1	0	0	1	ø/4	977 Hz	122 Hz
1	0	1	0	ø/8	488 Hz	61 Hz
1	0	1	1	ø/16	244 Hz	30.5 Hz
1	1	0	0	ø/32	122 Hz	—
1	1	0	1	ø/64	61 Hz	—
1	1	1	0	ø/128	30.5 Hz	—
1	1	1	1	ø/256	—	—

*: Don't care

Notes: *1 This is the frame frequency in active (medium-speed, øosc/16) mode when ø = 2 MHz.
*2 When 1/3 duty is selected, the frame frequency is 4/3 times the value shown.
*3 This is the frame frequency when øw = 32.768 kHz.

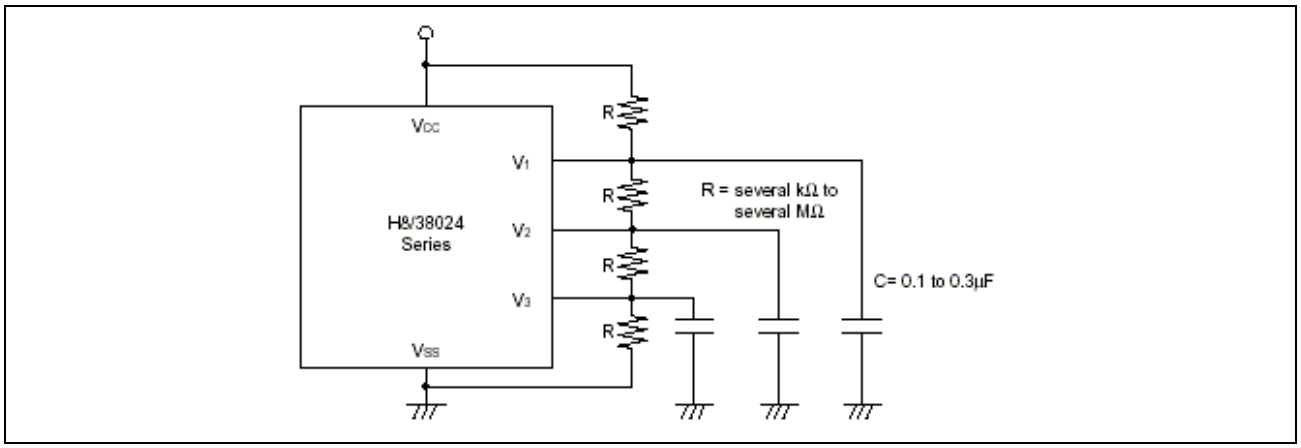
2.2 驱动波形

驱动 LCD 显示屏的波形有 A 型和 B 型 2 种。在给像素加载电压时，LCD 驱动器必须保持各像素的端到端的电压为 $0V_{DC}$。A 型的波形为：在 1 帧内保持 $0V_{DC}$，B 型的波形为：在 2 帧内保持 $0V_{DC}$。各类型的波形如下图所示：



2.3 LCD 驱动电源的升压

在使用大型 LCD 显示屏时，有时内部的电源供给能力不足。如果在使用 VCC 作为电源时电源不足，就必须降低电源阻抗。为了实现这一功能，将 0.1uF~0.3uF 的旁路电容连接到 V1~V3 的管脚，或者在外部附加分压电阻。外部分压电阻的连接如下图所示：



2.4 低功耗模式的 LCD 控制器/驱动器的运行

H8/38024 系列的 LCD 控制器/驱动器也能在低功耗模式下运行。

必须注意：由于在子激活模式、时钟模式和子睡眠模式下系统时钟振荡器停止，所以当还没有选择内部子时钟时，不供给时钟且停止显示。此时，由于电流可能直接供给 LCD 显示屏，所以必须选择子时钟。由于在激活（中速）模式下提供系统时钟，为了使帧频不变，需要更改帧频的设定。关于帧频的选择，请参照本应用说明的 2.1 章。

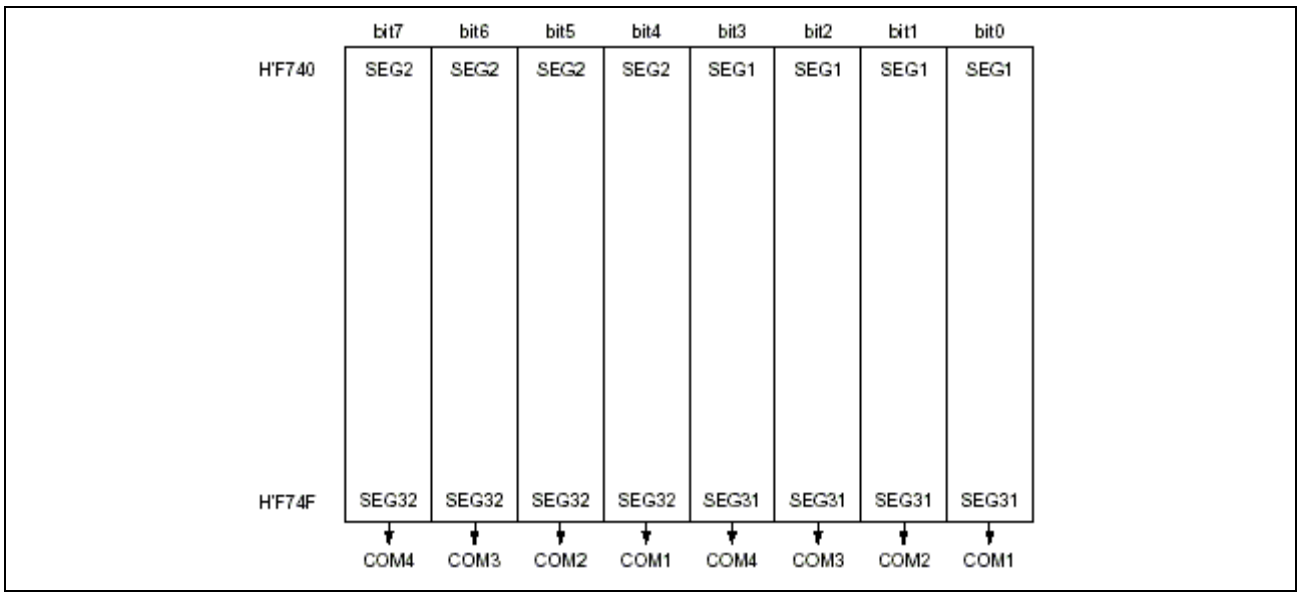
Mode		Reset	Active	Sleep	Watch	Sub-active	Sub-sleep	Standby	Module Standby
Clock	ø	Runs	Runs	Runs	Stops	Stops	Stops	Stops	Stops*4
	øw	Runs	Runs	Runs	Runs	Runs	Runs	Stops*1	Stops*4
Display	ACT = 0	Stops	Stops	Stops	Stops	Stops	Stops	Stops*2	Stops
operation	ACT = 1	Stops	Functions	Functions	Functions*3	Functions*3	Functions*3	Stops*2	Stops

Notes: *1 The subclock oscillator does not stop, but clock supply is halted.
*2 The LCD drive power supply is turned off regardless of the setting of the PSW bit.
*3 Display operation is performed only if øw, øw/2, or øw/4 is selected as the operating clock.
*4 The clock supplied to the LCD stops.

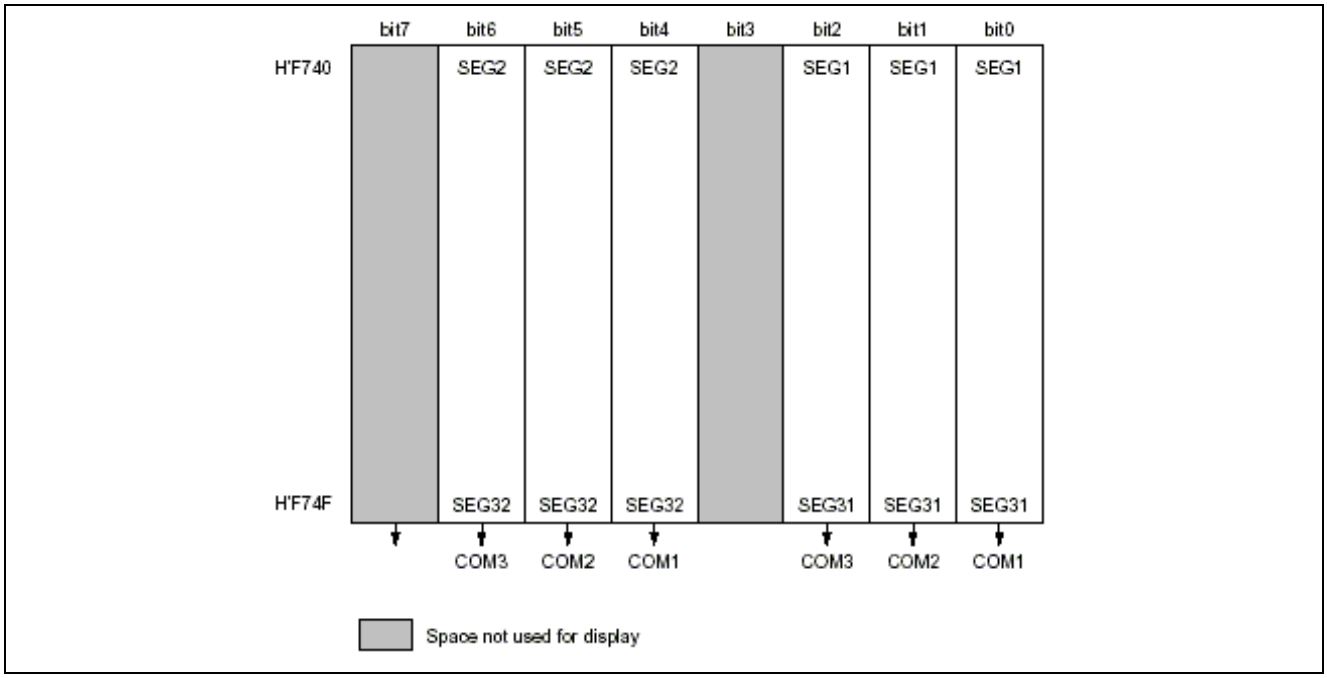
2.5 LCD RAM 和占空比的关系

LCD RAM 和显示段的关系因占空比而不同。在设定了显示所需的寄存器后，使用和通常 RAM 存取的相同指令将数据写到对应占空比的部分。其次，如果将显示为 ON，就自动开始显示。设定 RAM 时，能使用字或者字节存取指令。

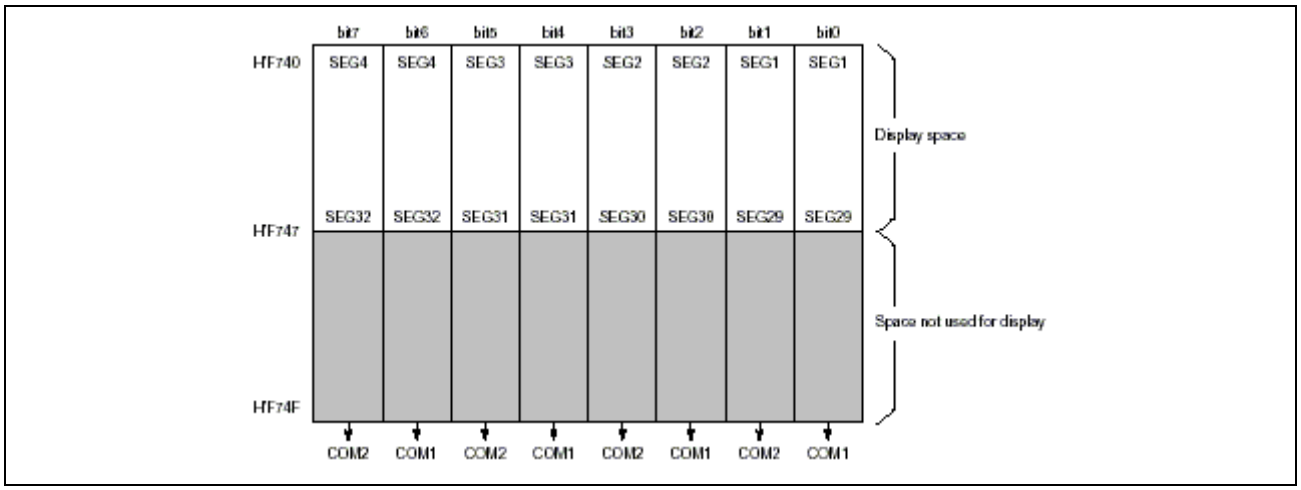
LCD RAM 和支持的各种占空比的关系如下图所示：



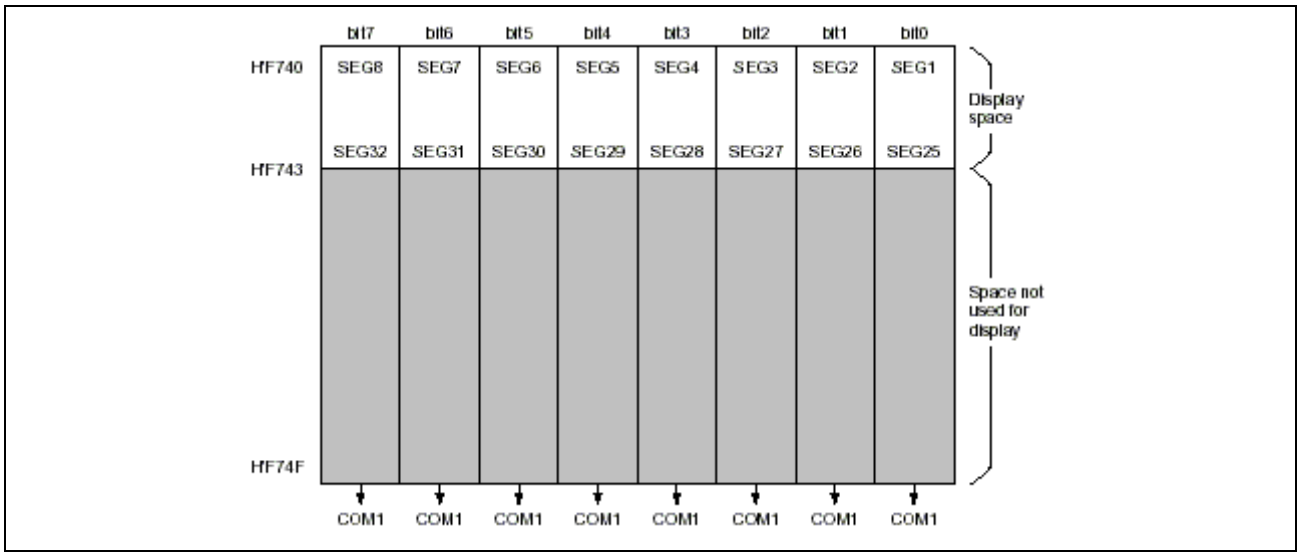
1/4 占空比周期的 LCD RAM 映像



1/3 占空比周期的 LCD RAM 映像



1/2 占空比周期的 LCD RAM 映像



静态模式的 LCD RAM 映像

2.6 电特性

LCD 控制器/驱动器的电特性因掩模版和 F-ZTAT 版而不同。为了正确地运行，系统设计员必须注意此不同点。另外，必须调查 LCD 厂家提供的 LCD 显示屏的电气规格，确认 LCD 控制器/驱动器是否适合 LCD 显示屏。

掩模版和 F-ZTAT 版的值如下所示：

2.6.1 掩模版和 Z-TAT 版

V_{CC} = 1.8 V to 5.5 V, AV_{CC} = 1.8 V to 5.5 V, V_{SS} = AV_{SS} = 0.0 V, T_a = –20°C to +75°C*3 (including subactive mode) unless otherwise specified.

Item	Symbol	Applicable Pins	Test Conditions	Values Min	Typ	Max	Unit	Reference Figure
Segment driver drop voltage	V_{DS}	SEG_1 to SEG_{32}	I_D = 2 µA, V_1 = 2.7 V to 5.5 V	—	—	0.6	V	*1
Common driver drop voltage	V_{DC}	COM_1 to COM_4	I_D = 2 µA, V_1 = 2.7 V to 5.5 V	—	—	0.3	V	*1
LCD power supply split-resistance	R_{LCD}		Between V_1 and V_{SS}	0.5	3.0	9.0	MΩ	
Liquid crystal display voltage	V_{LCD}	V_1		2.2	—	5.5	V	*2

Notes: *1 The voltage drop from power supply pins V_1, V_2, V_3, and VSS to each segment pin or common pin.
*2 When the liquid crystal display voltage is supplied from an external power source, ensure that the following relationship is maintained: $V_{CC} \geq V_1 \geq V_2 \geq V_3 \geq V_{SS}$.
*3 The guaranteed temperature as an electrical characteristic for Die products is 75°C.

2.6.2 F-ZTAT 版

V_{CC} = 2.7 V to 3.6 V, AV_{CC} = 2.7 V to 3.6 V, V_{SS} = AV_{SS} = 0.0 V, T_a = –20°C to +75°C*3 (including subactive mode) unless otherwise specified.

Item	Symbol	Applicable Pins	Test Conditions	Values Min	Typ	Max	Unit	Reference Figure
Segment driver drop voltage	V_{DS}	SEG_1 to SEG_{32}	I_D = 2 µA, V_1 = 2.7 V to 3.6 V	—	—	0.6	V	*1
Common driver drop voltage	V_{DC}	COM_1 to COM_4	I_D = 2 µA, V_1 = 2.7 V to 3.6 V	—	—	0.3	V	*1
LCD power supply split-resistance	R_{LCD}		Between V_1 and V_{SS}	0.5	3.0	9.0	MΩ	
Liquid crystal display voltage	V_{LCD}	V_1		2.2	—	3.6	V	*2

Notes: *1 The voltage drop from power supply pins V_1, V_2, V_3, and VSS to each segment pin or common pin.
*2 When the liquid crystal display voltage is supplied from an external power source, ensure that the following relationship is maintained: $V_{CC} \geq V_1 \geq V_2 \geq V_3 \geq V_{SS}$.
*3 The guaranteed temperature as an electrical characteristic for Die products is 75°C.

3. 参考文献

1. H8/38024 Series, H8/38024F-ZTAT™ Hardware Manual
2. www.embedded.com
3. www.ednmag.com

公司主页和咨询窗口

有关本应用说明的技术方面的咨询请发邮件到下面的邮箱。

瑞萨科技公司主页　　http://www.cn.renesas.com
亚洲地区技术支持中心　　E-Mail：support.asia@renesas.com

修订记录

Rev.	发行日	修订内容	
		页	修订要点
1.00	2006.03.28	—	初版发行

Cautions

Keep safety first in your circuit designs!

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors.
   Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
   Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.

注意

本文只是参考译文，前页所载英文版“Cautions”具有正式效力。

请遵循安全第一进行电路设计

1. 虽然瑞萨科技尽力提高半导体产品的质量和可靠性，但是半导体产品也可能发生故障。半导体的故障可能导致人身伤害、火灾事故以及财产损害。在电路设计时，请充分考虑安全性，采用合适的如冗余设计、利用非易燃材料以及故障或者事故防止等的安全设计方法。

关于利用本资料时的注意事项

1. 本资料是为了让用户根据用途选择合适的瑞萨科技产品的参考资料，不转让属于瑞萨科技或者第三者所有的知识产权和其它权利的许可。
2. 对于因使用本资料所记载的产品数据、图、表、程序、算法以及其它应用电路的例子而引起的损害或者对第三者的权力的侵犯，瑞萨科技不承担责任。
3. 本资料所记载的产品数据、图、表、程序、算法以及其它所有信息均为本资料发行时的信息，由于改进产品或者其它原因，本资料记载的信息可能变动，恕不另行通知。在购买本资料所记载的产品时，请预先向瑞萨科技或者经授权的瑞萨科技产品经销商确认最新信息。
   本资料所记载的信息可能存在技术不准确或者印刷错误。因这些错误而引起的损害、责任问题或者其它损失，瑞萨科技不承担责任。
   同时也请通过各种方式注意瑞萨科技公布的信息，包括瑞萨科技半导体网站。
   （http：//www.renesas.com）
4. 在使用本资料所记载部分或者全部数据、图、表、程序以及算法等信息时，在最终做出有关信息和产品是否适用的判断前，务必对作为整个系统的所有信息进行评价。由于本资料所记载的信息而引起的损害、责任问题或者其它损失，瑞萨科技不承担责任。
5. 瑞萨科技的半导体产品不是为在可能和人命相关的环境下使用的设备或者系统而设计和制造的产品。在研讨将本资料所记载的产品用于运输、交通车辆、医疗、航空宇宙用、原子能控制、海底中继器的设备或者系统等特殊用途时，请与瑞萨科技或者经授权的瑞萨产品经销商联系。
6. 未经瑞萨科技的书面许可，不得翻印或者复制全部或者部分资料的内容。
7. 如果本资料所记载的某产品或者技术内容受日本出口管理限制，必须在得到日本政府的有关部门许可后才能出口，并且不准进口到批准目的地国家以外的国家。
   禁止违反日本和（或者）目的地国家的出口管理法和法规的任何转卖、挪用或者再出口。
8. 如果需要了解本资料所记载的信息或者产品的详细，请与瑞萨科技联系。