RModule

Description

Rambus™ Modules (RModule™) are used in conjunction with Rambus Sockets (RSocket™) and RTransceivers™ to provide memory expansion capabilities of up to 320 Rambus DRAMs (RDRAM™) on a Rambus Channel with a 500 MHz data transfer rate.

RModule Features

- Adheres to Rambus Channel electrical and mechanical specifications
- 500 MB/sec peak transfer rate
- Compact modules use high density vertical surface mount RDRAMs
- Up to 32 RDRAMs per RModule
- Three voltage keying options
- Board design uses standard manufacturing design rules
- Passive latching to RSocket helps ensure module retention
- Custom RModules are easily designed and manufactured for applications where standard off the shelf configurations are not appropriate

Rambus System Overview

A typical Rambus memory system has three main elements: the Rambus Channel, the Rambus DRAMs, and a Rambus Interface on a controller. In addition to this, expandable systems employ RModules and RSockets for memory upgrade purposes. A typical system containing these components is shown in the figure below.

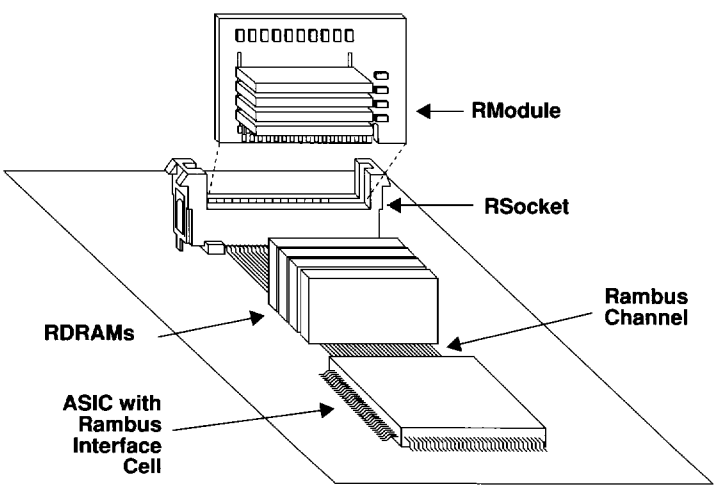
The physical length of any one Rambus Channel is currently limited to approximately 10 cm. This length is determined by a 2 nanosecond propagation delay constraint for signals traveling from end to end on the Channel. Because of this, a Rambus Channel can accommodate up to 32 RDRAMs, ten RSockets, or some combination of the two. Since each RModule can hold up to 32 RDRAMs, a fully configured system can have up to 320 RDRAMs while a minimum system can have as few as one.

RModule Overview

There are four types of RModules referred to as the Primary, Secondary, Terminator, and Null RModules. The Primary RModule contains up to 32 RDRAMs and is used at the end of a Channel to extend and terminate it.

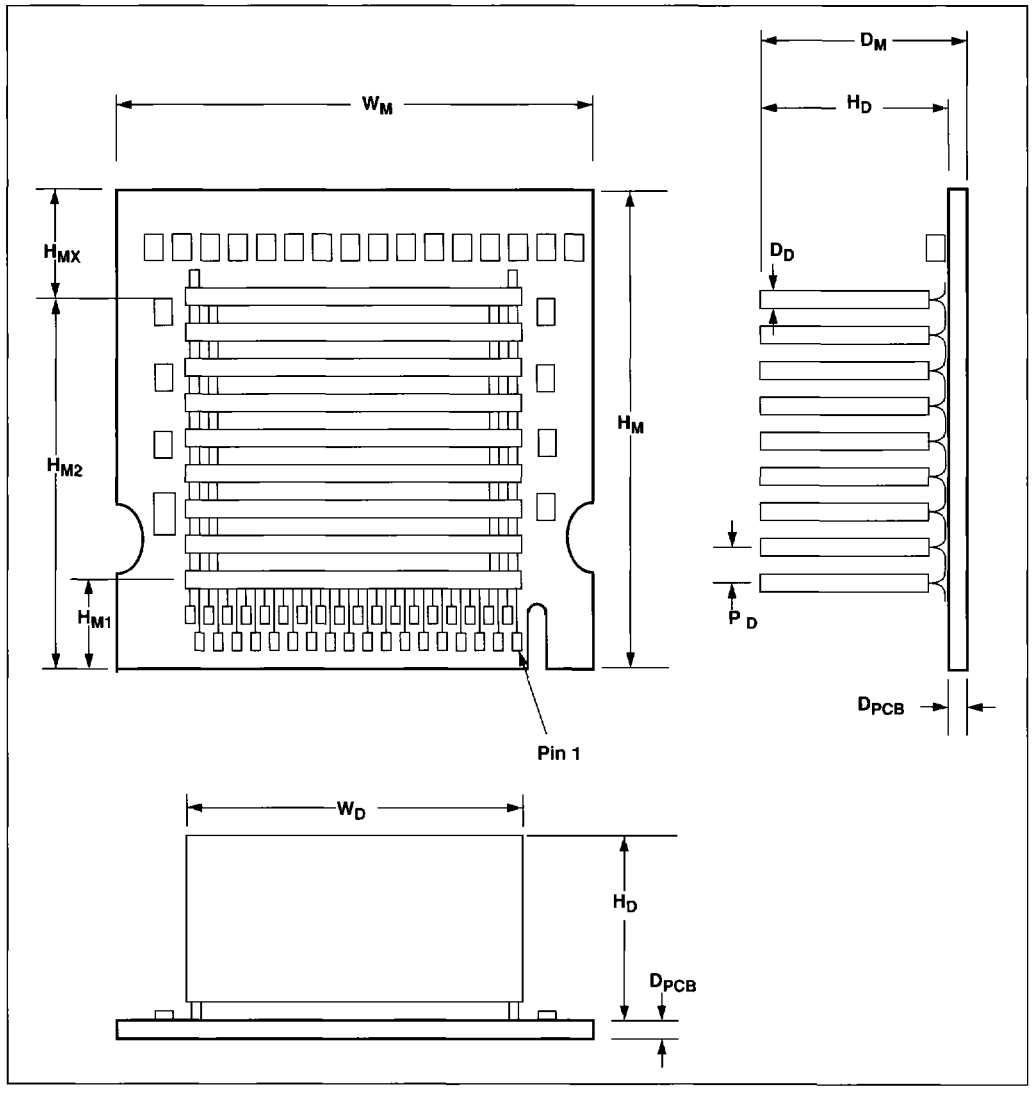
The Secondary RModule adds a Rambus Transceiver (RTransceiver™) device which is used to create a Secondary Channel on the RModule. By acting as a repeater between the Primary and Secondary Channels, the RTransceiver allows RDRAMs on the RModule to be electrically isolated from the Primary Channel. By reducing Channel loading in this manner, very large memory systems can be built.

The remaining two RModules are the Terminator and Null RModule. Both of these are used to maintain Channel continuity across unused RSockets. The Terminator RModule is used when a Primary RModule is not installed. Similarly, the Null RModule is used when a Secondary RModule is not installed.



A Rambus System Example

RModule Outline for N RDRAMs

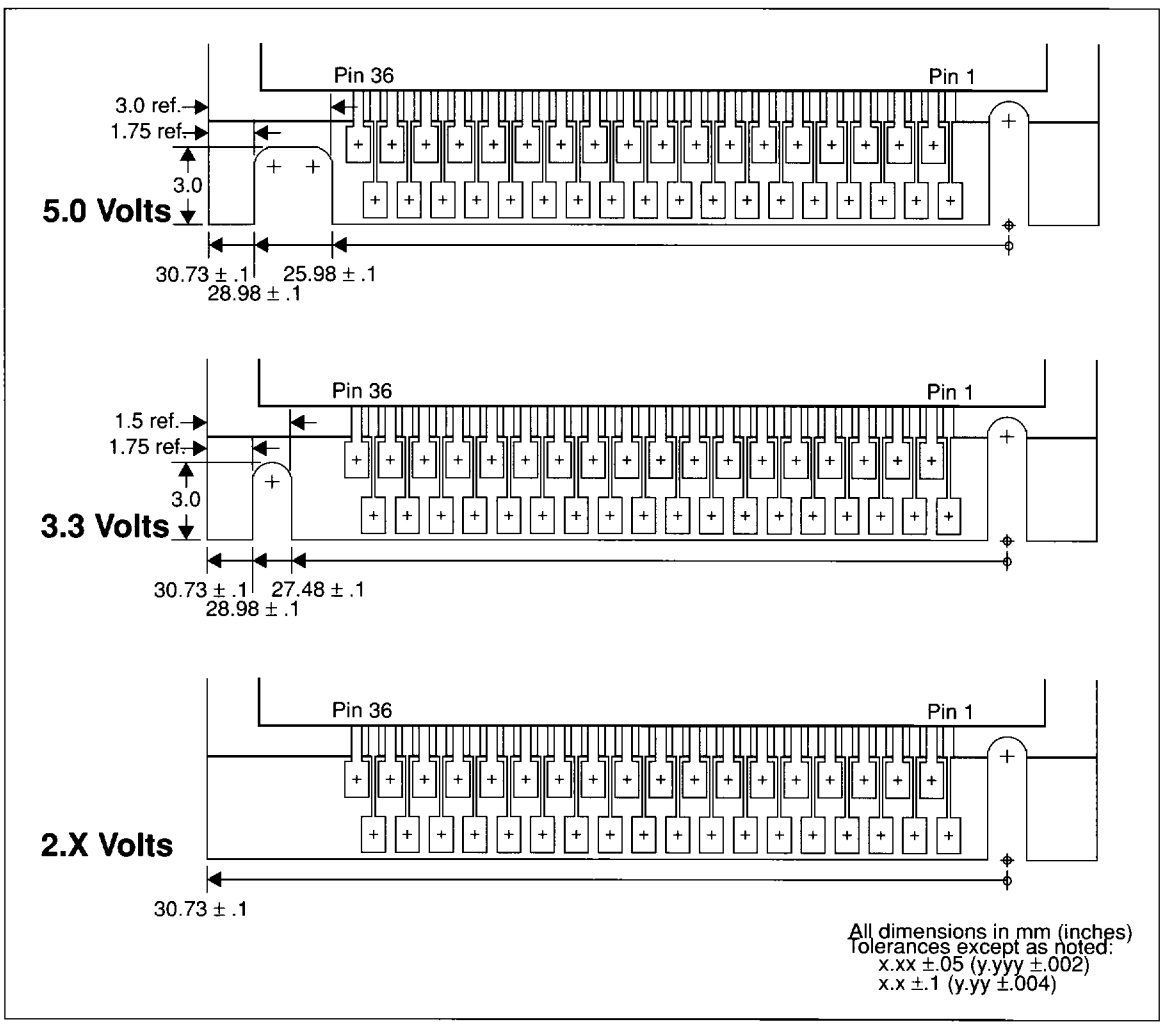


RModule Dimensions for N RDRAMs

Parameters	Description	Min	Nom	Max	Units
H_{MX}	Distance from RModule board top edge to middle of last device		8.0 (0.315)		mm (inches)
H_{M2}	Height from middle of last device to bottom edge of RModule board.		2.54N + 3.96		mm
H_M	Total RModule height		2.54N+11.96		mm
H_{M1}	Height from bottom edge or RModule board to middle of first device	5.2 (0.205)			mm (inches)
W_M	RModule PC board width	34.1 (1.342)	34.2 (1.346)	34.3 (1.35)	mm (inches)

Parameters	Description	Min	Nom	Max	Units
P_D	Device pitch on RModule	2.00 (0.08)	2.54 (0.1)	3.04 (0.12)	mm (inches)
D_D	Device thickness (depth)		1.25 (0.049)		mm (inches)
H_D	Device height from RModule PCB			11.8 (0.465)	mm (inches)
D_M	Fully assembled RModule depth		12.3 (0.483)		mm (inches)
D_{PCB}	RModule PC board depth	1.17 (0.046)	1.27 (0.05)	1.37 (0.054)	mm (inches)
W_D	Device width		25 (0.984)		mm (inches)

RModule Voltage Keying



Primary and Secondary RModule Pinout

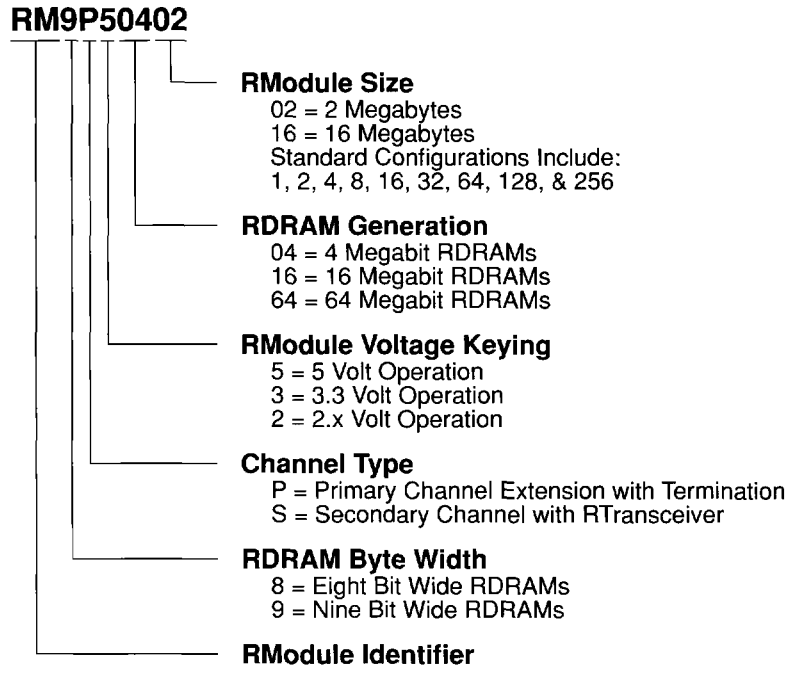
RModule Pin	Primary RModule	Secondary RModule
1	ClkToEnd	CCtlPgm
2	Vdd	Vdd
3	Vdd	Vdd
4	Gnd	Gnd
5	BusData8	BusData8
6	Gnd	Gnd
7	BusData7	BusData7
8	V_{TERM}	V_{TERM}
9	BusEnable	BusEnable
10	Vdd	Vdd
11	BusData6	BusData6
12	Gnd	Gnd
13	BusData5	BusData5
14	Vdd	Vdd
15	RxClk	RxClk
16	Gnd	Gnd
17	TxClk	TxClk
18	Vdd	Vdd

RModule Pin	Primary RModule	Secondary RModule
19	BusData4	BusData4
20	Gnd	Gnd
21	BusCtrl	BusCtrl
22	SIn	SIn
23	Vref	Vref
24	SOut	SOut
25	BusData3	BusData3
26	Gnd	Gnd
27	BusData2	BusData2
28	V_{TERM}	V_{TERM}
29	BusData1	BusData1
30	Gnd	Gnd
31	BusData0	BusData0
32	Gnd	Gnd
33	NC	NC
34	Vdd	Vdd
35	Vdd	Vdd
36	Vdd	Vdd

RModule Electrical Parameters

Parameter	Description	Min	Nom	Max	Units
$V_{DD(M)}$	Operating voltage of RDRAMs on RModule	2.x	3.3	5	V
$I_{SS(M)}$	Maximum RModule ground current			4	A
$Z_{0(M)}$	Unloaded transmission line characteristic impedance	49.5	55	60.5	Ω
$Z_{LD(M)}$	Loaded transmission line characteristic impedance	18	20	22	W
$Z_{0C(M)}$	Unloaded transmission line characteristic impedance		20		Ω
$R_{T(M)}$	Termination resistance (R_1 to R_{12} in schematics)		20		Ω
V_{TERM}	Termination voltage	2.2	2.45	2.7	V
C_{B1}	RModule bypass capacitors (SMT 1206)		0.1		µF
C_B	RModule bypass capacitors (SMT 0805)		10		nF
C_1	RxClk terminating capacitor		0.01		µF
C_2	Termination capacitance at V_{TERM} line		0.01		µF
C_3	Termination capacitance at V_{TERM} line		100		pF
C_4	Termination capacitance at V_{TERM} line		100		pF
$C_{T(NULL)}$	Null RModule termination capacitance	2.2	2.5	2.8	pF
$\varepsilon_{r,FR-4}$	Relative dielectric permittivity for FR-4	3.6	4.0	4.4	

RModule Numbering Conventions



RModule Numbering Examples

Part Number	Description
RM9P50402	2 Megabyte RModule Using 512K x 9 (4 Megabit) RDRAMs. 5 Volt Operation as a Primary Channel Extension with Termination.
RM8S31608	8 Megabyte RModule Using 2M x 8 (16 Megabit) RDRAMs. 3.3 Volt Operation as a Secondary Channel with RTransceiver.
RM9P31616	16 Megabyte RModule Using 2M x 9 (16 Megabit) RDRAMs. 3.3 Volt Operation as a Primary Channel Extension with Termination.
RMT20	20Ω Terminator RModule
RMN0	Null RModule