



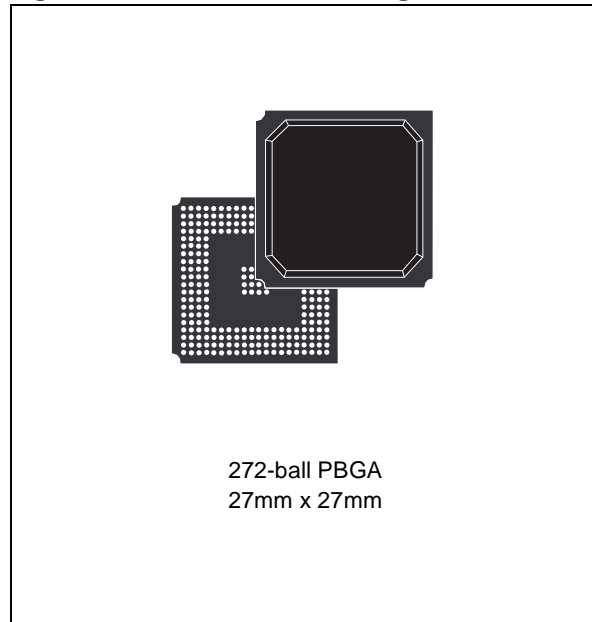
## 32K x 68-bit Entry NETWORK SEARCH ENGINE

DATA BRIEFING

### FEATURES SUMMARY

- 32K DATA ENTRIES IN 68-BIT MODE
- TABLE MAY BE PARTITIONED INTO UP TO FOUR (4) QUADRANTS  
(Data entry width in each octant is configurable as 34, 68, 136, or 272 bits.)
- UP TO 83 MILLION SUSTAINED SEARCHES PER SECOND IN 68-BIT and 136-BIT CONFIGURATIONS
- UP TO 41.5 MILLION SEARCHES PER SECOND IN 34-BIT and 272-BIT CONFIGURATIONS
- SEARCHES ANY SUB-FIELD IN A SINGLE CYCLE
- OFFERS BIT-BY-BIT and GLOBAL MASKING
- SYNCHRONOUS, PIPELINED OPERATION
- UP TO 31 SEARCH ENGINES CASCADABLE WITHOUT PERFORMANCE DEGRADATION
- WHEN CASCADED, THE DATABASE ENTRIES CAN SCALE FROM 248K TO 1984K DEPENDING ON THE WIDTH OF THE ENTRY
- GLUELESS INTERFACE TO INDUSTRY-STANDARD SRAMS
- SIMPLE HARDWARE INSTRUCTION INTERFACE
- IEEE 1149.1 TEST ACCESS PORT
- OPERATING SUPPLY VOLTAGES INCLUDE:  
 $V_{DD}$  (Operating Supply Voltage) = 1.8V  
 $V_{DDQ}$  (Operating Supply Voltage for I/O) = 2.5 or 3.3V
- 272 PBGA, 27mm x 27mm

Figure 1. 272-ball PBGA Package



# M7020R

## DESCRIPTION

### Overview

ST Microelectronics, Inc.'s M7020R Search Engine incorporates patent-pending Associative Processing Technology™ (APT) and is designed to be a high-performance, pipelined, synchronous, 32K-entry network database search engine. The M7020R database entry size can be 68 bits, 136 bits, or 272 bits. In the 68-bit entry mode, the size of the database is 32K entries. In the 136-bit mode, the size of the database is 16K entries, and in the 272-bit mode, the size of the database is 8K entries. The M7020R is configurable to support multiple databases with different entry sizes. The 34-bit entry table can be implemented using the Global Mask Registers (GMRs) building-database size of 64K entries with a single device.

### Performance

The Search Engine can sustain 83 million transactions per second when the database is programmed or configured as 68 or 136 bits. When the database is programmed to have an entry size

of 34 or 272 bits, the Search Engine will perform at 41.5 million transactions per second. STM's M7020R can be used to accelerate network protocols such as Longest-prefix Match (CIDR), ARP, MPLS, and other Layer 2, 3, and 4 protocols.

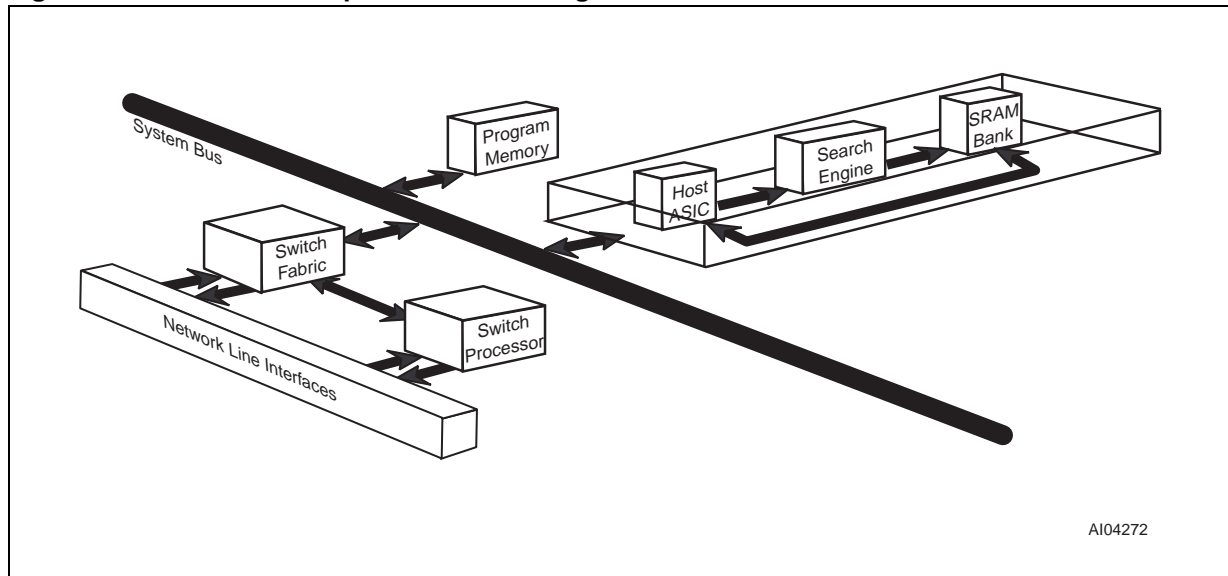
### Applications

This high-speed, high-capacity Search Engine can be deployed in a variety of networking and communications applications. The performance and features of the M7020R make it attractive in applications such as Enterprise LAN switches and routers and broadband switching and/or routing equipment supporting multiple data rates at OC-48 and beyond. The Search Engine is designed to be scalable in order to support network database sizes to 1984K entries specifically for environments that require large network policy databases. Figure 4, page 5 shows the block diagram for the M7020R device.

**Table 1. Product Range**

Part Number	Operating Supply Voltage	Operating I/O Voltage	Speed	Temperature Range
M7020R-083ZA1	1.8V	2.5 or 3.3V	83MHz	Commercial
M7020R-066ZA1	1.8V	2.5 or 3.3V	66MHz	Commercial
M7020R-050ZA1	1.8V	2.5 or 3.3V	50MHz	Commercial

**Figure 2. Switch/Router Implementation Using the M7020R**



AI04272

Table 2. Signal Names

Symbol	Type <sup>(1)</sup>	Description
<b>Clocks and Reset</b>		
CLK2X	I	Master Clock
PHS_L	I	Phase
TEST	I	Test Input
RST_L	I	Reset
<b>Command and DQ Bus</b>		
CMD[8:0]	I	Command Bus
CMDV	I	Command Valid
DQ[67:0]	I/O	Address/Data Bus
ACK <sup>(4)</sup>	T	READ Acknowledge
EOT <sup>(4)</sup>	T	End of Transfer
SSF	T	SEARCH Successful Flag
SSV	T	SEARCH Successful Flag Valid
<b>SRAM Interface</b>		
SADR[21:0]	T	SRAM Address
CE_L	T	SRAM Chip Enable
WE_L	T	SRAM Write Enable
OE_L	T	SRAM Output Enable
ALE_L	T	Address Latch Enable

<b>Cascade Interface</b>		
LHI[6:0]	I	Local Hit In
LHO[1:0]	O	Local Hit Out
BHI[2:0]	I	Block Hit In
BHO[2:0]	O	Block Hit Out
FULI[6:0]	I	Full In
FULO[1:0]	O	Full Out
FULL	O	Full Flag
<b>Device Identification</b>		
ID[4:0]	I	Device Identification
<b>Supplies</b>		
V <sub>DD</sub>	n/a	Chip Core Supply (1.8V)
V <sub>DDQ</sub>	n/a	Chip I/O Supply (2.5 or 3.3V)
<b>Test Access Port</b>		
TDI	I	Test Access Port's Test Data In
TCK	I	Test Access Port's Test Clock
TDO	T	Test Access Port's Test Data Out
TMS	I	Test Access Port's Test Mode Select
TRST_L	I	Test Access Port's Reset

- Note: 1. Signal types are: I = Input only; I/O = Input or Output; O = Output; and T = Tristate  
2. "CLK" is an internal clock signal. Any reference to "CLK Cycles" means one cycle of CLK.  
3. ACK and EOT Signals require a weak, external pull-down resistor of 47 K $\Omega$  or 100 K $\Omega$ .

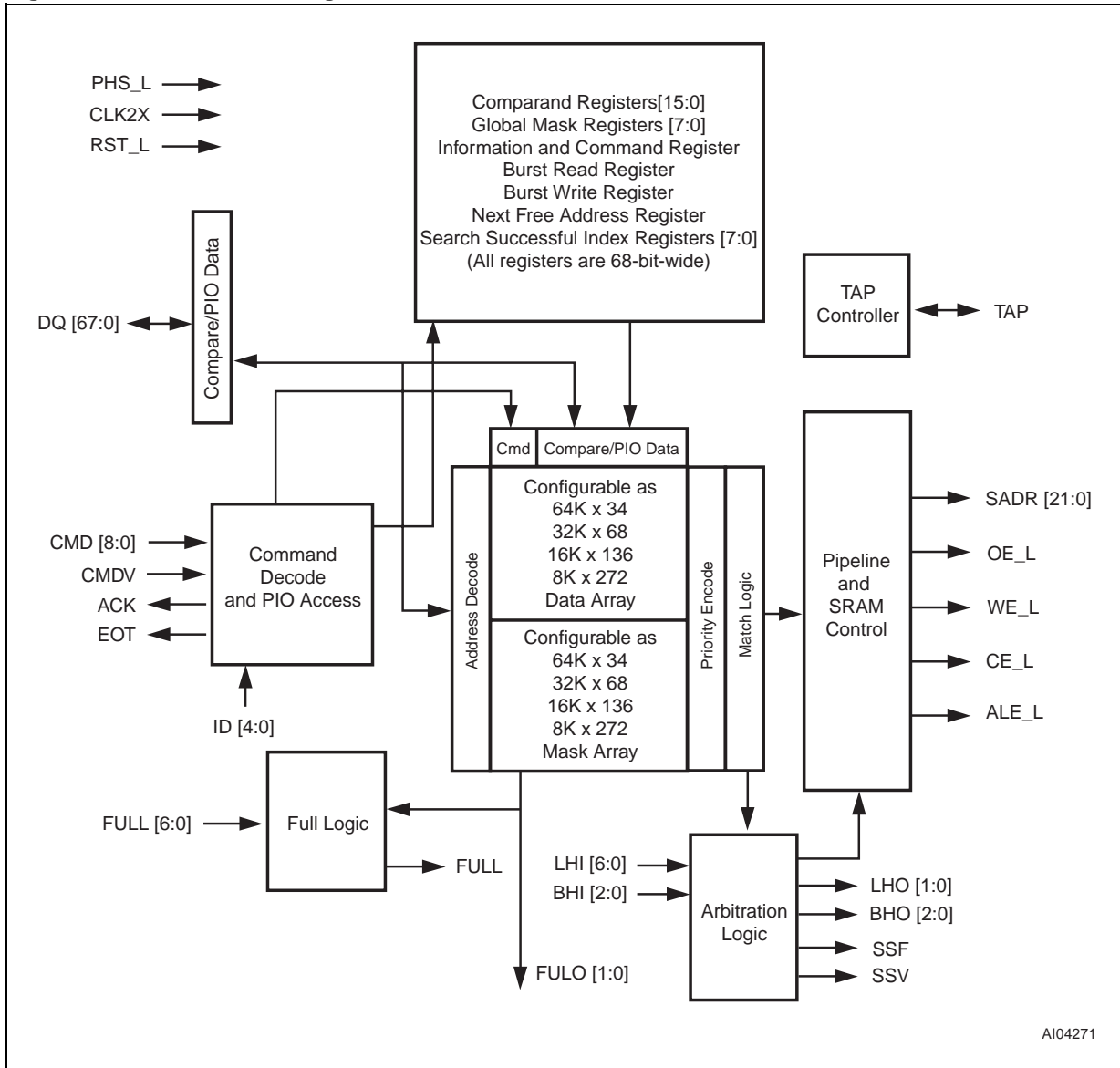
Figure 3. Connections

NC	GND	EOT	NC	NC	V <sub>DD</sub>	FULI5	FULI4	FULI1	BHO0	V <sub>DD</sub>	BHI0	LHI6	NC	V <sub>DD</sub>	ID2	ID0	TDO	NC	NC	
NC	NC	ACK	FULL	NC	FULO1	NC	FULI6	FULI2	BHO1	BHI2	V <sub>DDQ</sub>	LHI5	LHI3	LHI2	ID3	TMS	TDI	V <sub>DD</sub>	NC	
DQ64	NC	NC	V <sub>DDQ</sub>	V <sub>DD</sub>	V <sub>DDQ</sub>	NC	NC	V <sub>DDQ</sub>	BHO2	V <sub>DD</sub>	LHO1	LHI4	V <sub>DDQ</sub>	LHI0	ID1	TCK	NC	NC	DQ65	
DQ62	NC	V <sub>DD</sub>	GND	RSTL	NC	FULO0	GND	FULI3	FULI0	BHI1	LHO0	GND	LHI1	ID4	<sup>T</sup> RST_L	GND	DQ63	DQ61	DQ57	
DQ60	V <sub>DDQ</sub>	NC	DQ66	TOP												DQ67	DQ59	NC	DQ53	
V <sub>DD</sub>	NC	DQ56	DQ58													V <sub>DDQ</sub>	DQ55	DQ49	V <sub>DD</sub>	
DQ50	V <sub>DDQ</sub>	DQ52	DQ54													DQ47	V <sub>DDQ</sub>	DQ51	V <sub>DDQ</sub>	
NC	DQ46	DQ48	GND													GND	NC	DQ45	DQ43	
DQ40	DQ42	V <sub>DDQ</sub>	DQ44													DQ41	DQ39	V <sub>DD</sub>	DQ37	
V <sub>DD</sub>	NC	DQ36	DQ38	LEFT	GND				GND				RIGHT				V <sub>DDQ</sub>	DQ35	DQ33	DQ31
V <sub>DDQ</sub>	DQ34	DQ32	DQ30													V <sub>DDQ</sub>	NC	DQ29	V <sub>DD</sub>	
NC	DQ28	V <sub>DDQ</sub>	DQ26													NC	DQ23	DQ25	DQ27	
DQ24	V <sub>DD</sub>	DQ20	GND													GND	DQ19	V <sub>DDQ</sub>	DQ21	
DQ22	DQ16	DQ14	V <sub>DDQ</sub>													V <sub>DDQ</sub>	NC	DQ15	DQ17	
V <sub>DD</sub>	DQ18	V <sub>DDQ</sub>	DQ6													DQ9	DQ11	DQ13	V <sub>DD</sub>	
NC	DQ12	DQ8	DQ0													DQ1	DQ5	DQ7	NC	
BOTTOM																				
DQ10	NC	V <sub>DDQ</sub>	GND	NC	CMD4	CMD2	GND	WE_L	CLK2X	V <sub>DD</sub>	SADR <sub>15</sub>	GND	V <sub>DDQ</sub>	SADR <sub>5</sub>	V <sub>DDQ</sub>	GND	NC	NC	V <sub>DDQ</sub>	
DQ2	DQ4	V <sub>DD</sub>	SSF	CMD6	CMD3	CMD0	AE_L	OE_L	SADR <sub>21</sub>	SADR <sub>18</sub>	SADR <sub>16</sub>	SADR <sub>12</sub>	SADR <sub>9</sub>	SADR <sub>7</sub>	SADR <sub>6</sub>	NC	SADR <sub>0</sub>	V <sub>DD</sub>	DQ3	
NC	NC	NC	SSV	CMD5	CMD1	CMDV	V <sub>DDQ</sub>	PHS_L	V <sub>DDQ</sub>	SADR <sub>19</sub>	V <sub>DDQ</sub>	NC	SADR <sub>10</sub>	SADR <sub>11</sub>	NC	SADR <sub>4</sub>	SADR <sub>3</sub>	NC	NC	
NC	NC	CMD8	CMD7	V <sub>DDQ</sub>	V <sub>DD</sub>	NC	CE_L	NC	V <sub>DD</sub>	SADR <sub>20</sub>	SADR <sub>17</sub>	SADR <sub>14</sub>	SADR <sub>13</sub>	V <sub>DD</sub>	SADR <sub>8</sub>	V <sub>DDQ</sub>	SADR <sub>2</sub>	SADR <sub>1</sub>	NC	

A104270



Figure 4. M7020R Block Diagram



**PART NUMBERING**

**Table 3. Ordering Information Scheme**

Example:	M70	20	R	-083	ZA	1	T
<b>Device Type</b>	M70 Search Engine						
<b>Density</b>	20 = 2Mb (32K x 68-bit Table Entries)						
<b>Operating Supply Voltage</b>	R = $V_{DD} = 1.8V$						
<b>Speed</b>	-083 = 83 Million Searches per Second -066 = 66 Million Searches per Second -050 = 50 Million Searches per Second						
<b>Package</b>	PBGA = 272-ball count, 27mm x 27mm <sup>(1)</sup> , 1.27mm ball pitch						
<b>Temperature Range</b>	1 = 0 to 70°C						
<b>Shipping Option</b>	Tape & Reel Packing = T						

Note: 1. Where "Z" is the symbol for BGA packages and "A" denotes 1.27mm ball pitch

For a list of available options (e.g., Speed, Package) or for further information on any aspect of this device, please contact the ST Sales Office nearest to you.