DESCRIPTION

The Hyundai HY57V1294020 is a 134,217,728bit CMOS Synchronous DRAM, ideally suited for the main memory applications which require large memory density and high bandwidth. HY57V1294020 is organized as 4banks of 8,388,608x4.

HY57V1294020 is offering fully synchronous operation referenced to a positive edge of the clock. All inputs and outputs are synchronized with the rising edge of the clock input. The data paths are internally pipelined to achieve very high bandwidth. All input and output voltage levels are compatible with LVTTL.

Programmable options include the length of pipeline (Read latency of 1,2, or 3), the number of consecutive read or write cycles initiated by a single control command (Burst length of 1,2,4,8, or full page), and the burst count sequence(sequential or interleave). A burst of read or write cycles in progress can be terminated by a burst terminate command or can be interrupted and replaced by a new burst read or write command on any cycle. (This pipelined design is not restricted by a `2N` rule.)

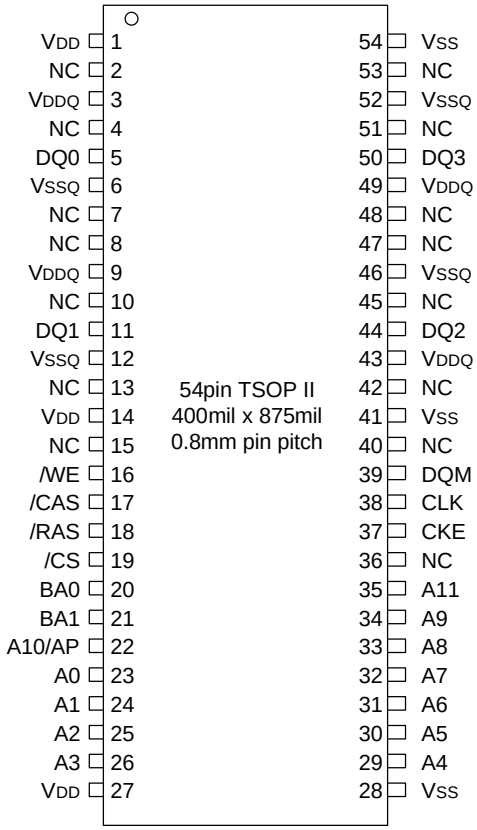
FEATURES

- Single 3.3±0.3V power supply
- All device pins are compatible with LVTTL interface
- JEDEC standard 400mil 54pin TSOP-II with 0.8mm of pin pitch
- All inputs and outputs referenced to positive edge of system clock
- Data mask function by DQM
- Internal four banks operation
- Auto refresh and self refresh
- 4096 refresh cycles / 64ms
- Programmable Burst Length and Burst Type
  - 1, 2, 4, 8 and Full Page for Sequential Burst
  - 1, 2, 4 and 8 for Interleave Burst
- Programmable $\overline{\text{CAS}}$ Latency ; 2, 3 Clocks

ORDERING INFORMATION

Part No.	Clock Frequency	Power	Organization	Interface	Package
HY57V1294020TC-75	133MHz	Normal	4Banks x 8Mbits x4	LVTTL	400mil 54pin TSOP II
HY57V1294020TC-8	125MHz				
HY57V1294020TC-10P	100MHz				
HY57V1294020TC-10S	100MHz				
HY57V1294020TC-10	100MHz				
HY57V1294020LTC-75	133MHz	Low Power			
HY57V1294020LTC-8	125MHz				
HY57V1294020LTC-10P	100MHz				
HY57V1294020LTC-10S	100MHz				
HY57V1294020LTC-10	100MHz				

PIN CONFIGURATION

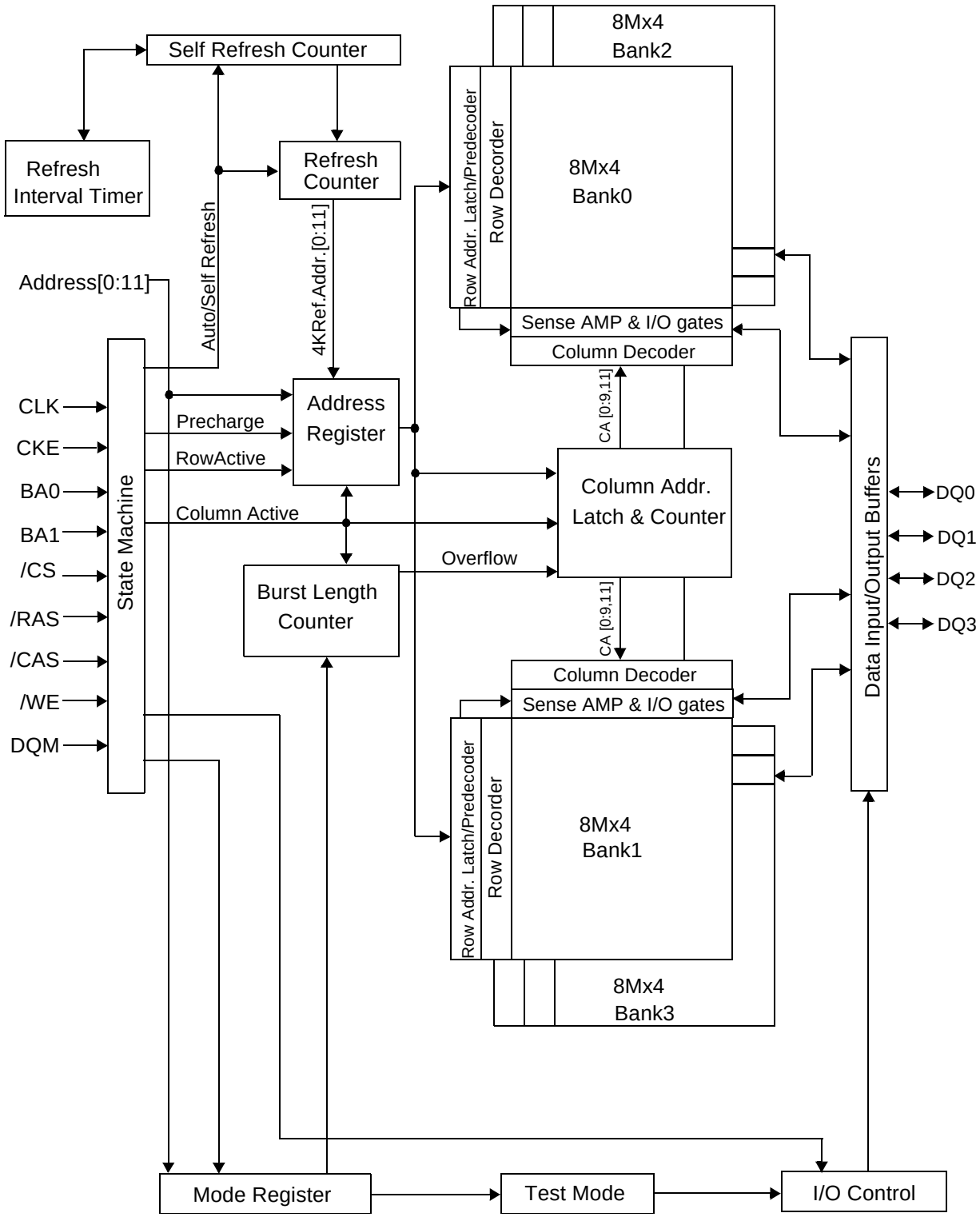


PIN DESCRIPTION

PIN	PIN NAME	DESCRIPTION
CLK	Clock	The system clock input. All other inputs are registerd to the SDRAM on the rising edge of CLK.
CKE	Clock Enable	Controls internal clock signal and when deactivated, the SDRAM will be one of the states among power down, suspend or self refresh.
$\overline{CS}$	Chip Select	Command input enable or mask except CLK, CKE and DQM
BA0, BA1	Bank Address	Select either one of banks during both $\overline{RAS}$ and $\overline{CAS}$ activity.
A0 ~ A11	Address	Row Address : RA0 ~ RA11, Column Address : CA0 ~ CA9,CA11 Auto-precharge flag : A10
$\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$	Row Address Strobe, Column Address Strobe, Write Enable	$\overline{RAS}$, $\overline{CAS}$ and $\overline{WE}$ define the operation. Refer function truth table for details
DQM	Data Input/Output Mask	DQM control output buffer in read mode and masks input data in write mode
DQ0 ~ DQ3	Data Input/Output	Multiplexed data input / output pin
VDD/VSS	Power Supply/Ground	Power supply for internal circuit and input buffer
VDDQ/VSSQ	Data Output Power/Ground	Power supply for DQ
NC	No Connection	No connection

FUNCTIONAL BLOCK DIAGRAM

8Mbit x 4banks x 4 I/O Synchronous DRAM



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit
Ambient Temperature	T_A	0 ~ 70	°C
Storage Temperature	T_{STG}	-55 ~ 125	°C
Voltage on Any Pin relative to V_{SS}	V_{IN}, V_{OUT}	-1.0 ~ 4.6	V
Voltage on V_{DD} relative to V_{SS}	V_{DD}, V_{DDQ}	-1.0 ~ 4.6	V
Short Circuit Output Current	I_{OS}	50	mA
Power Dissipation	P_D	1	W
Soldering Temperature · Time	T_{SOLDER}	260 · 10	°C · Sec

Note : Operation at above absolute maximum rating can adversely affect device reliability.

DC OPERATING CONDITION (T_A=0 to 70°C)

Parameter	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	V_{DD}, V_{DDQ}	3.0	3.3	3.6	V	1
Input High voltage	V_{IH}	2.0	3.0	V_{DDQ} + 0.3	V	1,2
Input Low voltage	V_{IL}	-0.3	0	0.8	V	1,3

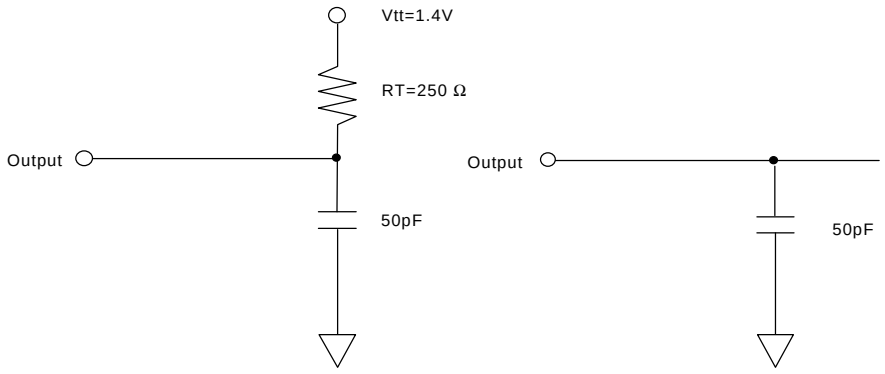
Note :
1.All voltages are referenced to V_{SS} = 0V
2.V_{IH}(max) is acceptable 5.6V AC pulse width with <=3ns of duration.
3.V_{IL}(min) is acceptable -2.0V AC pulse width with <=3ns of duration.

AC OPERATING TEST CONDITION (T_A=0 to 70°C, V_{DD}=3.3±0.3V, V_{SS}=0V)

Parameter	Symbol	Value	Unit	Note
AC Input High / Low Level Voltage	V_{IH} / V_{IL}	2.4/0.4	V	
Input Timing Measurement Reference Level Voltage	Vtrip	1.4	V	
Input Rise / Fall Time	tR / tF	1	ns	
Output Timing Measurement Reference Level Voltage	Voutref	1.4	V	
Output Load Capacitance for Access Time Measurement	C_L	50	pF	1

Note :
1.Output load to measure access times is equivalent to two TTL gates and one capacitor (50pF). For details, refer to AC/DC output load circuit

OUTPUT LOAD CIRCUIT



DC Output Load Circuit AC Output Load Circuit

CAPACITANCE (TA=25°C, f=1MHz)

Parameter	Pin	Symbol	-75/8/10S/10P/10		Unit
			Min.	Max.	
Input Capacitance	CLK	CI1	2.5	4	pF
	$\overline{A0}$ ~ $\overline{A11}$, $\overline{BA0}$, $\overline{BA1}$, CKE, $\overline{CS}$, $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$, DQM	CI2	2.5	5	pF
Data Input / Output Capacitance	DQ0 ~ DQ3	CI/O	4	6.5	pF

DC CHARACTERISTICS I (TA=0 to 70°C, VDD=3.3±0.3V)

Parameter	Symbol	Min.	Max	Unit	Note
Input Leakage Current	ILI	-1	1	uA	1
Output Leakage Current	ILO	-1	1	uA	2
Output High Voltage	VOH	2.4	-	V	IOH = -4mA
Output Low Voltage	VOL	-	0.4	V	IOL =+4mA

Note :
1.VIN = 0 to 3.6V, All other pins are not under test = 0V
2.DOUT is disabled, VOUT=0 to 3.6V

DC CHARACTERISTICS II (TA=0 to 70°C, VDD=3.3±0.3V, VSS=0V)

Parameter	Symbol	Test Condition		Speed					Unit	Note
				-75	-8	-10P	-10S	-10		
Operating Current	IDD1	Burst length=1, One bank active tRAS ≥ tRAS(min),tRP ≥ tRP(min), IOL=0mA		130	120	120	120	105	mA	1
Precharge Standby Current in Power Down Mode	IDD2P	CKE ≤ VIL(max), tCK = min		2					mA	
	IDD2PS	CKE ≤ VIL(max), tCK = ∞		1.5						
Precharge Standby Current in Non Power Down Mode	IDD2N	CKE ≥ VIH(min), $\overline{CS}$ ≥ VIH(min), tCK = min Input signals are changed one time during 2clks. All other pins ≥ VDD-0.2V or ≤ 0.2V		20					mA	
	IDD2NS	CKE ≥ VIH(min), tCK = ∞ Input signals are stable.		10						
Active Standby Current in Power Down Mode	IDD3P	CKE ≤ VIL(max), tCK = min		7					mA	
	IDD3PS	CKE ≤ VIL(max), tCK = ∞		7						
Active Standby Current in Non Power Down Mode	IDD3N	CKE ≥ VIH(min), $\overline{CS}$ ≥ VIH(min), tCK = min Input signals are changed one time during 2clks. All other pins ≥ VDD-0.2V or ≤ 0.2V		40					mA	
	IDD3NS	CKE ≥ VIH(min), tCK = ∞ Input signals are stable		40						
Burst Mode Operating Current	IDD4	tCK ≥ tCK(min), Continuous burst, IOL=0mA All banks active	CL=3	130	120	90	90	90	mA	1
			CL=2	80	80	90	80	80		
Auto Refresh Current	IDD5	tRRC ≥ tRRC(min), All banks active		300	290	290	290	280	mA	2
Self Refresh Current	IDD6	CKE ≤ 0.2V		2					mA	3
				800					uA	4

Note :

1.IDD1 and IDD4 depend on output loading and cycle rates. Specified values are measured with the output open.
2.Min. of tRRC (Refresh $\overline{RAS}$ cycle time) is applied to HY57V1294020TC-75/8/10P/10S which are listed on AC characteristic II.
3.HY57V1294020TC-75/8/10P/10S/10
4.HY57V1294020LTC-75/8/10P/10S/10

AC CHARACTERISTICS I

(AC operating conditions unless otherwise noted)

Parameter		Symbol	-75		-8		-10P		-10S		-10		Unit	Note
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
System Clock Cycle Time	$\overline{CAS}$ Latency = 3	tCK3	7.5	1000	8	1000	10	1000	10	1000	10	1000	ns	
	$\overline{CAS}$ Latency = 2	tCK2	12		12		10		12		12		ns	
Clock High Pulse Width		tCHW	2.5	-	3	-	3	-	3	-	3	-	ns	1
Clock Low Pulse Width		tCLW	2.5	-	3	-	3	-	3	-	3	-	ns	1
Access Time from Clock	$\overline{CAS}$ Latency = 3	tAC3	-	5.4	-	6	-	6	-	6	-	8	ns	2
	$\overline{CAS}$ Latency = 2	tAC2	-	6	-	6	-	6	-	6	-	8	ns	
Data-Out Hold Time		tOH	2.7	-	3	-	3	-	3	-	3	-	ns	
Data-Input Setup Time		tDS	1.5	-	2	-	2	-	2	-	2.5	-	ns	1
Data-Input Hold Time		tDH	0.8	-	1	-	1	-	1	-	1.5	-	ns	1
Address Setup Time		tAS	1.5	-	2	-	2	-	2	-	2.5	-	ns	1
Address Hold Time		tAH	0.8	-	1	-	1	-	1	-	1.5	-	ns	1
CKE Setup Time		tCKS	1.5	-	2	-	2	-	2	-	2.5	-	ns	1
CKE Hold Time		tCKH	0.8	-	1	-	1	-	1	-	1.5	-	ns	1
Command Setup Time		tCS	1.5	-	2	-	2	-	2	-	2.5	-	ns	1
Command Hold Time		tCH	0.8	-	1	-	1	-	1	-	1.5	-	ns	1
CLK to Data Output in Low-Z Time		tOLZ	1	-	1	-	1	-	1	-	1	-	ns	
CLK to Data Output in High-Z Time	$\overline{CAS}$ Latency = 3	tOHZ3	2.7	5.4	3	6	3	6	3	6	3	7	ns	
	$\overline{CAS}$ Latency = 2	tOHZ2	3	6	3	6	3	6	3	6	3	7	ns	

Note :

1.Assume tR / tF (input rise and fall time) is 1ns.

2.Access times to be measured with input signals of 1v/ns edge rate, from 0.8v to 2.0v

AC CHARACTERISTICS II

Parameter		Symbol	-75		-8		-10P		-10S		-10		Unit	Note
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
$\overline{RAS}$ Cycle Time	Operation	tRC	65	-	68	-	70	-	70	-	80	-	ns	
	Auto Refresh	tRRC	65	-	68	-	70	-	70	-	80	-	ns	
$\overline{RAS}$ to $\overline{CAS}$ Delay		tRCD	20	-	20	-	20	-	20	-	24	-	ns	
$\overline{RAS}$ Active Time		tRAS	45	100K	48	100K	50	100K	50	100K	50	100K	ns	
$\overline{RAS}$ Precharge Time		tRP	20	-	20	-	20	-	20	-	24	-	ns	
$\overline{RAS}$ to $\overline{RAS}$ Bank Active Delay		tRRD	15	-	16	-	20	-	20	-	20	-	ns	
$\overline{CAS}$ to $\overline{CAS}$ Delay		tCCD	1	-	1	-	1	-	1	-	1	-	CLK	
Write Command to Data-In Delay		tWTL	0	-	0	-	0	-	0	-	0	-	CLK	
Data-In to Precharge Command		tDPL	2	-	1	-	1	-	1	-	1	-	CLK	
Data-In to Active Command		tDAL	5	-	4	-	3	-	3	-	4	-	CLK	2
DQM to Data-Out Hi-Z		tDQZ	2	-	2	-	2	-	2	-	2	-	CLK	
DQM to Data-In Mask		tDQM	0	-	0	-	0	-	0	-	0	-	CLK	
MRS to New Command		tMRD	2	-	2	-	2	-	2	-	2	-	CLK	
Precharge to Data Output Hi-Z	$\overline{CAS}$ Latency = 3	tPROZ3	3	-	3	-	3	-	3	-	3	-	CLK	
	$\overline{CAS}$ Latency = 2	tPROZ2	2	-	2	-	2	-	2	-	2	-	CLK	
Power Down Exit Time		tPDE	1	-	1	-	1	-	1	-	1	-	CLK	
Self Refresh Exit Time		tSRE	1	-	1	-	1	-	1	-	1	-	CLK	1
Refresh Time		tREF	-	64	-	64	-	64	-	64	-	64	ms	

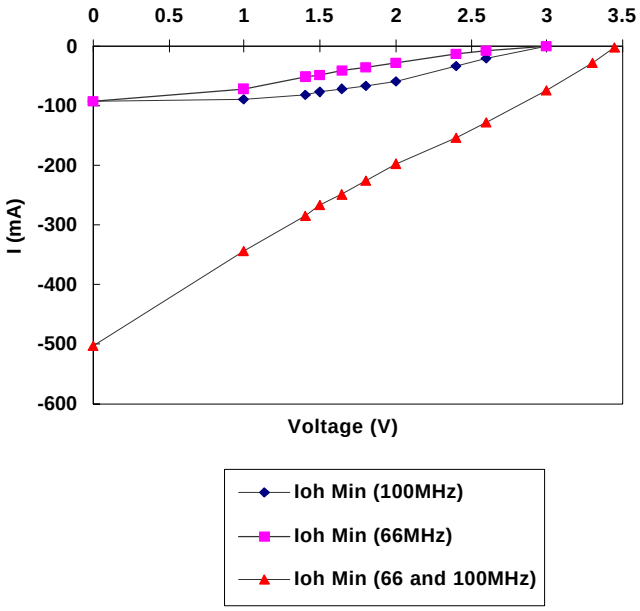
Note :
1. A new command can be given tRRC after self refresh exit.
2. tDAL is 4clks for -10P/10S/10@BL=1, 5clks for -8@BL=1.

IBIS SPECIFICATION

IOH Characteristics (Pull-up)

Voltage	100MHz Min	100MHz Max	66MHz Min
(V)	I (mA)	I (mA)	I (mA)
3.45		-2.4	
3.3		-27.3	
3.0	0.0	-74.1	-0.7
2.6	-21.1	-129.2	-7.5
2.4	-34.1	-153.3	-13.3
2.0	-58.7	-197.0	-27.5
1.8	-67.3	-226.2	-35.5
1.65	-73.0	-248.0	-41.1
1.5	-77.9	-269.7	-47.9
1.4	-80.8	-284.3	-52.4
1.0	-88.6	-344.5	-72.5
0.0	-93.0	-502.4	-93.0

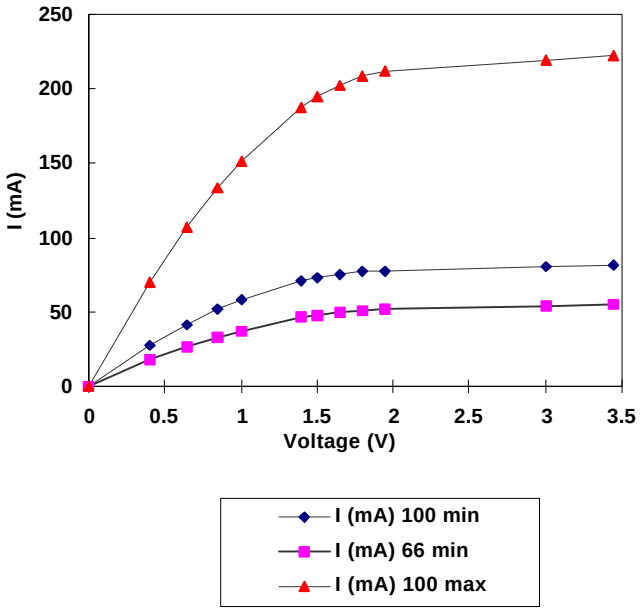
66MHz and 100MHz Pull-up



IOL Characteristics (Pull-down)

Voltage	100MHz Min	100MHz Max	66MHz Min
(V)	I (mA)	I (mA)	I (mA)
0.0	0.0	0.0	0.0
0.4	27.5	70.2	17.7
0.65	41.8	107.5	26.9
0.85	51.6	133.8	33.3
1.0	58.0	151.2	37.6
1.4	70.7	187.7	46.6
1.5	72.9	194.4	48.0
1.65	75.4	202.5	49.5
1.8	77.0	208.6	50.7
1.95	77.6	212.0	51.5
3.0	80.3	219.6	54.2
3.45	81.4	222.6	54.9

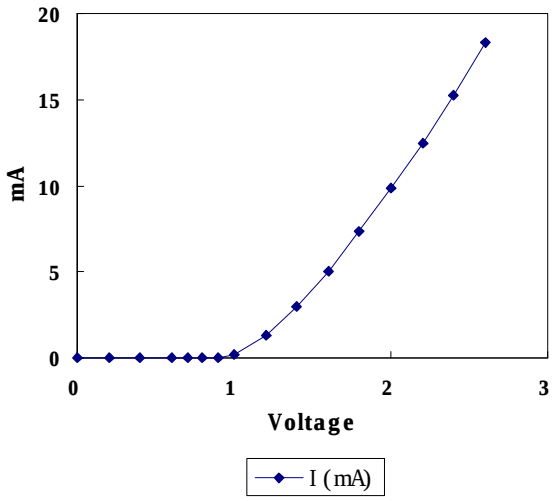
66MHz and 100MHz Pull-down



VDD Clamp @ CLK, CKE, $\overline{CS}$, DQM & DQ

VDD (V)	I(mA)
0.0	0.0
0.2	0.0
0.4	0.0
0.6	0.0
0.7	0.0
0.8	0.0
0.9	0.0
1.0	0.23
1.2	1.34
1.4	3.02
1.6	5.06
1.8	7.35
2.0	9.83
2.2	12.48
2.4	15.30
2.6	18.31

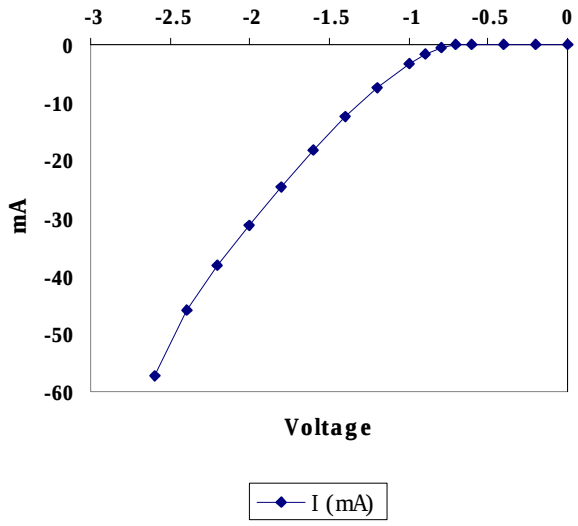
Minimum VDD clamp current (Referenced to VDD)



VSS Clamp @ CLK, CKE, $\overline{CS}$, DQM & DQ

VSS (V)	I (mA)
-2.6	-57.23
-2.4	-45.77
-2.2	-38.26
-2.0	-31.22
-1.8	-24.58
-1.6	-18.37
-1.4	-12.56
-1.2	-7.57
-1.0	-3.37
-0.9	-1.75
-0.8	-0.58
-0.7	-0.05
-0.6	0.0
-0.4	0.0
-0.2	0.0
0.0	0.0

Minimum VSS clamp current



DEVICE OPERATING OPTION TABLE

HY57V1294020TC-75

	$\overline{\text{CAS}}$ Latency	tRCD	tRAS	tRC	tRP	tAC	tOH
133MHz	3CLKs	3CLKs	6CLKs	9CLKs	3CLKs	5.4ns	2.7ns
125MHz	3CLKs	3CLKs	6CLKs	9CLKs	3CLKs	6ns	3ns
100MHz	3CLKs	2CLKs	5CLKs	7CLKs	2CLKs	6ns	3ns

HY57V1294020TC-8

	$\overline{\text{CAS}}$ Latency	tRCD	tRAS	tRC	tRP	tAC	tOH
125MHz	3CLKs	3CLKs	6CLKs	9CLKs	3CLKs	6ns	3ns
100MHz	3CLKs	2CLKs	5CLKs	7CLKs	2CLKs	6ns	3ns
83MHz	3CLKs	2CLKs	4CLKs	6CLKs	2CLKs	6ns	3ns

HY57V1294020TC-10P

	$\overline{\text{CAS}}$ Latency	tRCD	tRAS	tRC	tRP	tAC	tOH
100MHz	2CLKs	2CLKs	5CLKs	7CLKs	2CLKs	6ns	3ns
83MHz	2CLKs	2CLKs	5CLKs	7CLKs	2CLKs	6ns	3ns
66MHz	2CLKs	2CLKs	4CLKs	6CLKs	2CLKs	6ns	3ns

HY57V1294020TC-10S

	$\overline{\text{CAS}}$ Latency	tRCD	tRAS	tRC	tRP	tAC	tOH
100MHz	3CLKs	2CLKs	5CLKs	7CLKs	2CLKs	6ns	3ns
83MHz	2CLKs	2CLKs	5CLKs	7CLKs	2CLKs	6ns	3ns
66MHz	2CLKs	2CLKs	4CLKs	6CLKs	2CLKs	6ns	3ns

HY57V1294020TC-10

	$\overline{\text{CAS}}$ Latency	tRCD	tRAS	tRC	tRP	tAC	tOH
100MHz	3CLKs	3CLKs	5CLKs	8CLKs	3CLKs	8ns	3ns
83MHz	2CLKs	2CLKs	5CLKs	8CLKs	3CLKs	8ns	3ns
66MHz	2CLKs	2CLKs	4CLKs	6CLKs	2CLKs	8ns	3ns

COMMAND TRUTH TABLE

Command		CKEn-1	CKEn	$\overline{CS}$	$\overline{RAS}$	$\overline{CAS}$	$\overline{WE}$	DQM	ADDR	A10/AP	BA	Note
Mode Register Set		H	X	L	L	L	L	X	OP code			1
No Operation		H	X	H	X	X	X	X	X			
				L	H	H	H					
Bank Active		H	X	L	L	H	H	X	RA		V	
Read		H	X	L	H	L	H	X	CA	L	V	
Read with Autoprecharge										H		
Write		H	X	L	H	L	L	X	CA	L	V	
Write with Autoprecharge										H		
Precharge All Banks		H	X	L	L	H	L	X	X	H	X	
Precharge selected Bank										L	V	
Burst Stop		H	X	L	H	H	L	X	X			
DQM		H	X					V	X			
Auto Refresh		H	H	L	L	L	H	X	X			
Self Refresh	Entry	H	L	L	L	L	H	X	X			
	Exit	L	H	H	X	X	X	X				
				L	H	H	H					
Precharge power down	Entry	H	L	H	X	X	X	X	X			
				L	H	H	H					
	Exit	L	H	H	X	X	X	X				
				L	H	H	H					
Clock Suspend	Entry	H	L	H	X	X	X	X	X			
				L	V	V	V					
	Exit	L	H	X				X				

Note :
1. OP Code : Operand Code
2. V = Valid, X = Dont care, H = Logic High, L= Logic Low, RA = Row Address, CA = Column Address.

PACKAGE INFORMATION

400mil 54pin Thin Small Outline Package

Unit : mm(inch)