

Features :

- * 1,048,576 words by 16 bits organization.
- * Fast $\overline{\text{RAS}}$ access time and cycle time.
- * Dual CAS Input.
- * Low power dissipation.
- * $\overline{\text{Read-Modify-Write}}$, $\overline{\text{RAS-Only Refresh}}$, $\overline{\text{CAS-Before-RAS Refresh}}$, Hidden Refresh and Test Mode Capability.
- * 1024 refresh cycles per 16ms.
- * Available in 400 mil SOJ / TSOPII Packages.
- * Single 3.3V \pm 0.3V Power Supply.
- * All inputs and Outputs are TTL compatible.
- * Extended Data-Out(EDO) Page Mode operation.
- * Self – refresh capability. (S-Version).
- * Extended Temperature Available (-25°C ~ 85°C)

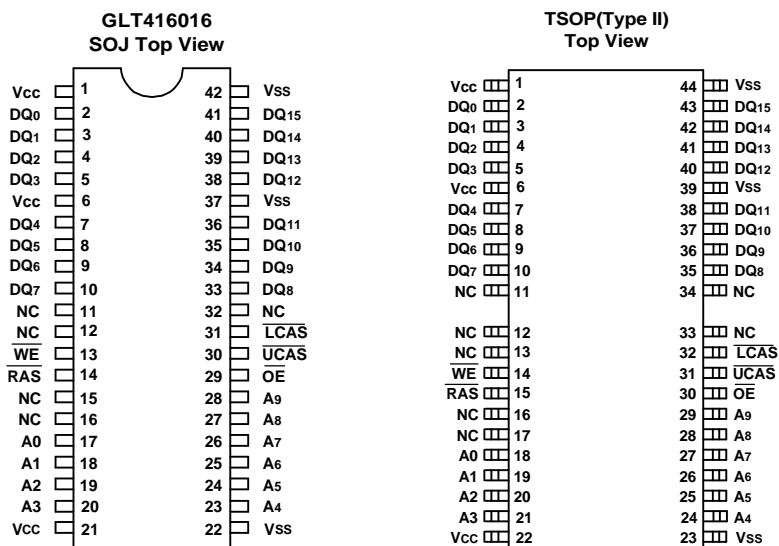
Description :

The GLT4160L16 is a 1,048,576 x 16 bit high-performance CMOS dynamic random access memory. The GLT4160L16 offers Fast Page mode with Extended Data Output, and has both BYTE WRITE and WORD WRITE access cycles via two $\overline{\text{CAS}}$ pins. The GLT4160L16 has symmetric address and accepts 1024-cycle refresh in 16ms interval.

All inputs are TTL compatible. EDO Page Mode operation allows random access up to 1024 x 16 bits within a page, with cycle times as short as 18ns.

The GLT4160L16 is best suited for graphics, and DSP applications requiring high performance memories.

HIGH PERFORMANCE	45	50	60	70
Max. $\overline{\text{RAS}}$ Access Time, (t_{RAC})	45 ns	50 ns	60 ns	70 ns
Max. Column Address Access Time, (t_{CAA})	22 ns	25 ns	30 ns	35 ns
Min. Extended Data Out Page Mode Cycle Time, (t_{PC})	18 ns	20 ns	25 ns	30 ns
Min. Read/Write Cycle Time, (t_{RC})	80 ns	85 ns	104 ns	124 ns
Max. $\overline{\text{CAS}}$ Access Time (t_{CAC})	12 ns	14 ns	15 ns	20 ns

Pin Configuration :

Pin Descriptions:

Name	Function
A ₀ - A ₉	Address Inputs
RAS	Row Address Strobe
UCAS	Column Address Strobe/Upper Byte Control
LCAS	Column Address Strobe/Lower Byte Control
WE	Write Enable
OE	Output Enable
DQ ₀ - DQ ₁₅	Data Inputs / Outputs
V _{CC}	+3.3V Power Supply
V _{SS}	Ground
NC	No Connection

Absolute Maximum Ratings*

Operating Temperature, T_A (ambient)
0°C to +70°C
(extended)..-25°C to +85°C
 Storage Temperature(plastic).....-55°C to +150°C
 Voltage Relative to V_{SS}-1.0V to + 4.6V
 Short Circuit Output Current.....50mA
 Power Dissipation.....1.0W

*Note: Operation above Absolute Maximum Ratings can adversely affect device reliability.

Capacitance*

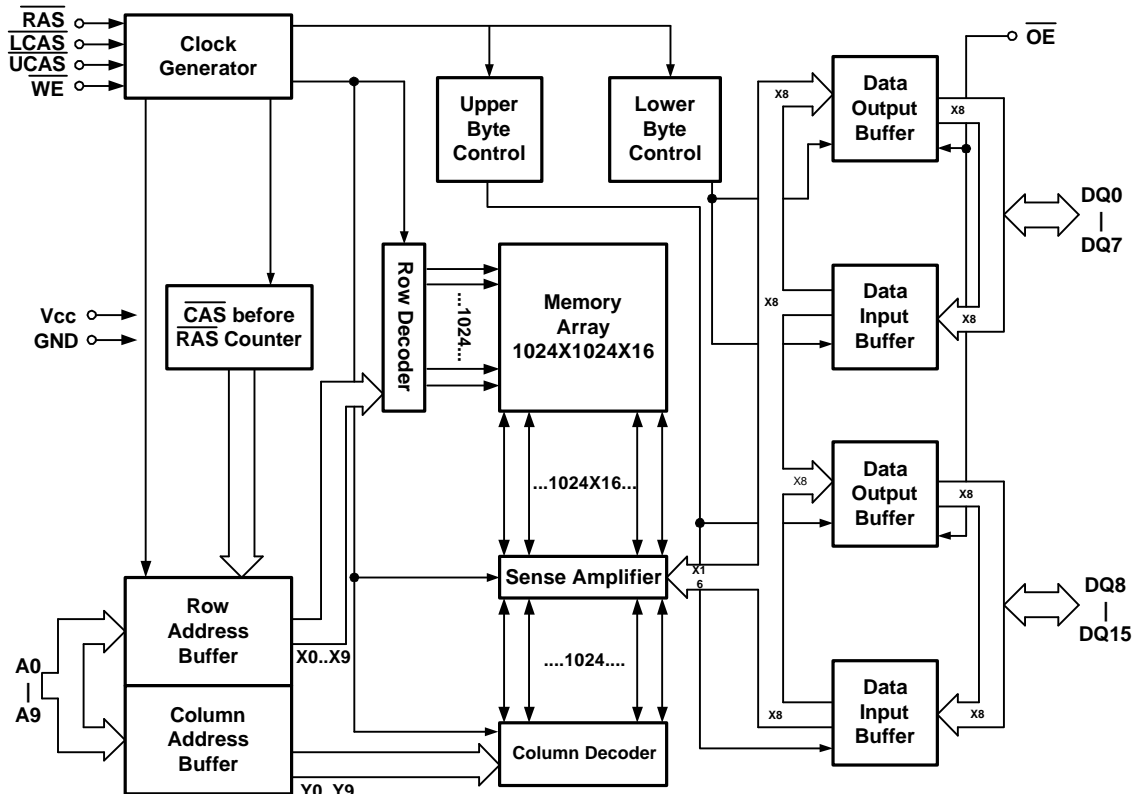
$T_A=25^\circ\text{C}$, $V_{CC}=3.3\text{V}\pm 0.3\text{V}$, $V_{SS}=0\text{V}$

Symbol	Parameter	Max.	Unit
C_{IN1}	Address Input	5	pF
C_{IN2}	$\overline{\text{RAS}}$, $\overline{\text{LCAS}}$, $\overline{\text{UCAS}}$, $\overline{\text{WE}}$, $\overline{\text{OE}}$	7	pF
C_{OUT}	Data Input/Output	7	pF

*Note: Capacitance is sampled and not 100% tested

Electrical Specifications

- $\overline{\text{CAS}}$ means $\overline{\text{UCAS}}$ and $\overline{\text{LCAS}}$.
- All voltages are referenced to GND.
- After power up, wait more than 100 μs and then, execute eight $\overline{\text{CAS}}$ -before-RAS or RAS-only refresh cycles as dummy cycles to initialize internal circuit.

Block Diagram :


DC and Operating Characteristics (1-2)
 $T_A = 0^{\circ}\text{C to } 70^{\circ}\text{C, } -25^{\circ}\text{C to } 85^{\circ}\text{C (extended temperature) } V_{CC}=3.3\text{V}\pm 0.3\text{V, } V_{SS}=0\text{V, unless otherwise specified.}$

Sym.	Parameter	Test Conditions	Access Time	Min.	Typ	Max.	Unit	Notes
I_{LI}	Input Leakage Current (any input pin)	$0\text{V} \leq V_{IN} \leq V_{CC}+0.3\text{V}$ (All other pins not under test=0V)		-5		+5	μA	
I_{LO}	Output Leakage Current (for High-Z State)	$0\text{V} \leq V_{out} \leq V_{CC}$ Output is disabled (Hiz)		-5		+5	μA	
I_{CC1}	Operating Current, Random READ/WRITE	$t_{RC} = t_{RC}(\text{min.})$	$t_{RAC} = 45\text{ns}$ $t_{RAC} = 50\text{ns}$ $t_{RAC} = 60\text{ns}$ $t_{RAC} = 70\text{ns}$			150 150 140 130	mA	1,2
I_{CC2}	Standby Current,(TTL)	$\overline{\text{RAS}}, \overline{\text{UCAS}}, \overline{\text{LCAS}}$ at V_{IH} other inputs $\geq V_{SS}$				1	mA	
I_{CC3}	Refresh Current, RAS-Only	$\overline{\text{RAS}}$ cycling, $\overline{\text{UCAS}}, \overline{\text{LCAS}}$ at V_{IH} $t_{RC} = t_{RC}(\text{min.})$	$t_{RAC} = 45\text{ns}$ $t_{RAC} = 50\text{ns}$ $t_{RAC} = 60\text{ns}$ $t_{RAC} = 70\text{ns}$			150 150 140 130	mA	2
I_{CC4}	Operating Current, EDO Page Mode	$\overline{\text{RAS}}$ at V_{IL} , $\overline{\text{UCAS}}, \overline{\text{LCAS}}$ address cycling: $t_{PC}=t_{PC}(\text{min.})$	$t_{RAC} = 45\text{ns}$ $t_{RAC} = 50\text{ns}$ $t_{RAC} = 60\text{ns}$ $t_{RAC} = 70\text{ns}$			150 150 140 130	mA	1,2
I_{CC5}	Refresh Current, CAS Before RAS	$\overline{\text{RAS}}, \overline{\text{UCAS}}, \overline{\text{LCAS}}$ address cycling: $t_{RC}=t_{RC}(\text{min.})$	$t_{RAC} = 45\text{ns}$ $t_{RAC} = 50\text{ns}$ $t_{RAC} = 60\text{ns}$ $t_{RAC} = 70\text{ns}$			150 150 140 130	mA	1
I_{CC6}	Standby Current, (CMOS)	$\overline{\text{RAS}} \geq V_{CC}-0.2\text{V},$ $\overline{\text{UCAS}} \geq V_{CC}-0.2\text{V},$ $\overline{\text{LCAS}} \geq V_{CC}-0.2\text{V},$ All other inputs V_{SS}				300	μA	1,5
I_{CC7}	Self Refresh Current	$\overline{\text{RAS}} = \overline{\text{UCAS}} = \overline{\text{LCAS}} = V_{IL}$ $\overline{\text{WE}} = \overline{\text{OE}} = A_0 \sim A_9 = V_{CC}-0.2\text{V or } 0.2\text{V}$ $\text{DQ}_0 \sim \text{DQ}_{15} = V_{CC}-0.2\text{V, } 0.2\text{V or Open}$				300	μA	
V_{IL}	Input Low Voltage			-0.3		+0.8	V	3
V_{IH}	Input High Voltage			2.0		$V_{CC}+0.3$	V	3
V_{OL}	Output Low Voltage	$I_{OL} = 2\text{mA}$				0.4	V	
V_{OH}	Output High Voltage	$I_{OH} = -2\text{mA}$		2.4			V	

Notes:

- I_{CC} is dependent on output loading when the device output is selected. Specified $I_{CC}(\text{max.})$ is measured with the output open.
- I_{CC} is dependent upon the number of address transitions specified $I_{CC}(\text{max.})$ is measured with a maximum of one transition per address cycle in random Read/Write and EDO Fast Page Mode.
- Specified $V_{IL}(\text{min.})$ is steady state operation. During transitions $V_{IL}(\text{min.})$ may undershoot to -1.0V for a period not to exceed 15ns. All AC parameters are measured with $V_{IL}(\text{min.}) \geq V_{SS}$ and $V_{IH}(\text{max.}) \leq V_{CC}$.
- Specified $V_{IH}(\text{max.})$ is steady state operation. During transitions $V_{IH}(\text{max.})$ may undershoot to +1.0V for a period not to exceed 15ns. All AC parameters are measured with $V_{IL}(\text{min.}) \geq V_{SS}$ and $V_{IH}(\text{max.}) \leq V_{CC}$.
- S-Version.

G-Link Technology Corporation, Taiwan

 Web : www.glink.com.tw Email : sales@glink.com.tw
 TEL : 886-2-26599658

AC Characteristics
 $T_A = 0^\circ\text{C to } 70^\circ\text{C, } -25^\circ\text{C to } 85^\circ\text{C (extended temperature), } V_{CC} = 3\text{V} \pm 0.3\text{V, } V_{IH} / V_{IL} = 3.0/0\text{ V, } V_{OH}/V_{OL} = 2.0/0.8\text{V}$

 An initial pause of 100 μs and 8 CAS-before-RAS or RAS-only refresh cycles are required after power-up.

Parameter	Symbol	45		50		60		70		Unit	Notes
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
Read or Write Cycle Time	t_{RC}	80		85		104		124		ns	
Read Modify Write Cycle Time	t_{RWC}	103		106		133		170		ns	
RAS Precharge Time	t_{RP}	30		30		40		50		ns	
RAS Pulse Width	t_{RAS}	45	100K	50	100K	60	100k	70	10k	ns	
Access Time from RAS	t_{RAC}		45		50		60		70	ns	1,2,3
Access Time from CAS	t_{CAC}		12		14		15		20	ns	1,5,10
Access Time from Column Address	t_{AA}		22		25		30		35	ns	1,5,6
CAS to Output Low-Z	t_{CLZ}	0		0		0		3		ns	
CAS to Output High-Z	t_{CEZ}	3	8	3	8	3	10	3	20	ns	
RAS Hold Time	t_{RSH}	13		14		13		20		ns	
RAS Hold Time Referenced to OE	t_{ROH}	9		9		10		10		ns	
CAS Hold Time	t_{CSH}	40		45		40		50		ns	
CAS Pulse Width	t_{CAS}	7	10K	8	10k	12	10k	15	10k	ns	
RAS to CAS Delay Time	t_{RCD}	18	33	19	37	18	45	20	50	ns	
RAS to Column Address Delay Time	t_{RAD}	13	23	14	25	13	30	15	35	ns	7
CAS to RAS Precharge Time	t_{CRP}	5		5		5		5		ns	
Row Address Set-Up Time	t_{ASR}	0		0		0		0		ns	
Row Address Hold Time	t_{RAH}	8		9		10		10		ns	
Column Address Set-Up Time	t_{ASC}	0		0		0		0		ns	
Column Address Hold Time	t_{CAH}	6		7		10		15		ns	
Column Address to RAS Lead Time	t_{RAL}	23		25		30		35		ns	
Column Address Hold Time Referenced to RAS	t_{AR}	39		44		55		50		ns	
Read Command Set-Up Time	t_{RCS}	0		0		0		0		ns	
Read Command Hold Time Referenced to CAS	t_{RCH}	0		0		0		0		ns	4
Read Command Hold Time Referenced to RAS	t_{RRH}	0		0		0		0		ns	4
Write Command Set-Up Time	t_{WCS}	0		0		0		0		ns	8,9
Write Command Hold Time	t_{WCH}	6		6		10		15		ns	
Write Command Pulse Width	t_{WP}	6		6		10		15		ns	
Write Command to RAS Lead Time	t_{RWL}	12		13		13		30		ns	
Write Command to CAS Lead Time	t_{CWL}	12		13		13		15		ns	

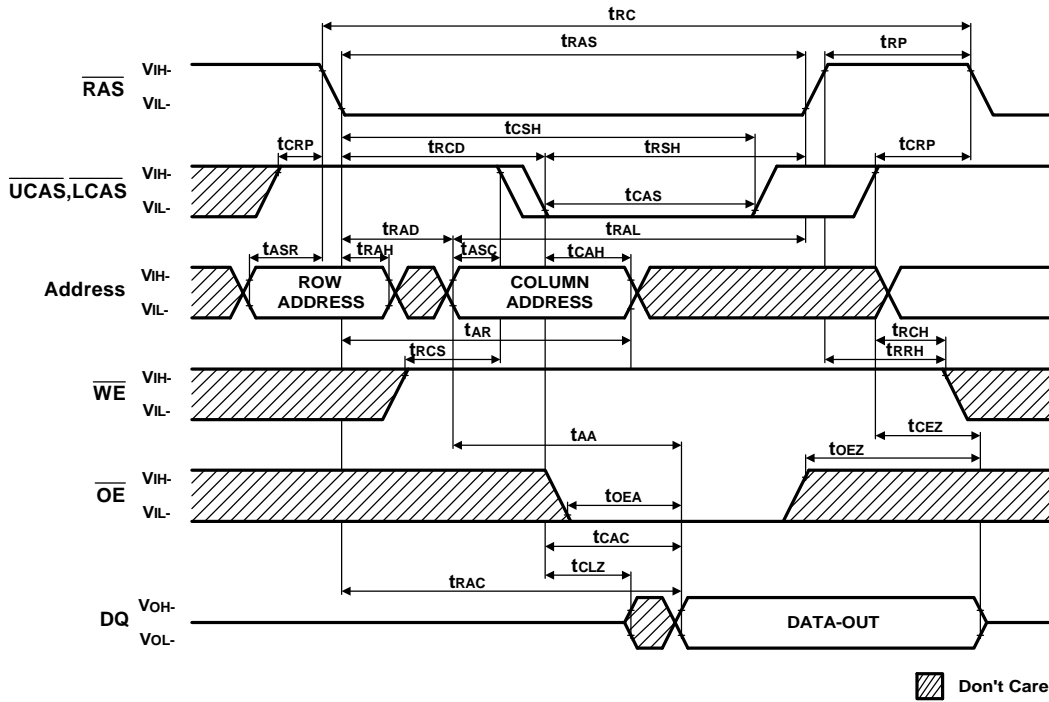
AC Characteristics

Parameter	Symbol	45		50		60		70		Unit	Notes
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
Data Set-Up Time	t_{DS}	0		0		0		0		ns	
Data Hold Time	t_{DH}	8		8		10		15		ns	
Data Hold Time Referenced to \overline{RAS}	t_{DHR}	41		46		55		50		ns	
\overline{RAS} to \overline{WE} Delay Time	t_{RWD}	59		64		79		94		ns	
CAS to \overline{WE} Delay Time	t_{CWD}	24		25		32		44		ns	
Column Address to \overline{WE} Delay Time	t_{AWD}	34		37		47		59		ns	
\overline{RAS} to CAS Precharge Time	t_{RPC}	0		0		0		0		ns	
Access Time from CAS Precharge	t_{CPA}		24		30		32		40	ns	
EDO Page Mode Cycle Time	t_{PC}	18		20		25		30		ns	
EDO Page Mode Read-Modify-Write Cycle Time	t_{PRWC}	52		59		63		71		ns	
\overline{CAS} Precharge Time (EDO Page Mode)	t_{CP}	7		8		15		10		ns	
\overline{RAS} Pulse Width (EDO Page Mode Only)	t_{RASP}	45	100K	50	100K	60	100k	70	100k	ns	
Access Time from \overline{OE}	t_{OEA}		12		14		15		20	ns	
\overline{OE} to Data Delay Time	t_{OED}	8		8		13		20		ns	
\overline{OE} to Output High-Z	t_{OEZ}	3	8	3	8	3	8	3	20	ns	
\overline{OE} Command Hold Time	t_{OEH}	7		7		7		20		ns	
Data Output Hold after \overline{CAS} low	t_{DOH}	5		5		5		5		ns	
\overline{RAS} to Output High-Z	t_{REZ}	3	8	3	8	3	8	3	20	ns	
\overline{WE} to Output High-Z	t_{WEZ}	3	10	3	12	3	12	3	20	ns	
\overline{OE} to CAS Hold Time	t_{OCH}	8		8		5		5		ns	
CAS Hold Time to \overline{OE}	t_{CHO}	8		8		5		5		ns	
\overline{OE} Precharge Time	t_{OEP}	8		8		5		5		ns	
CAS Set-Up Time for \overline{CAS} -before- \overline{RAS} Cycle	t_{CSR}	10		10		10		5		ns	
CAS Hold Time for \overline{CAS} -before- \overline{RAS} Cycle	t_{CHR}	10		10		10		15		ns	
Transition Time	t_T	2	50	2	50	2	50	2	50	ns	
Refresh Period	t_{REF}		16		16		16		16	ms	
\overline{RAS} pulse width (\overline{CAS} -before- \overline{RAS} Self refresh)	t_{RASS}	100		100		100		100		μ s	
\overline{RAS} precharge time (\overline{CAS} -before- \overline{RAS} Self refresh)	t_{RPS}	80		90		110		130		ns	
\overline{CAS} precharge time (\overline{CAS} -before- \overline{RAS} Self refresh)	t_{CHS}	-50		-50		-50		-50		ns	

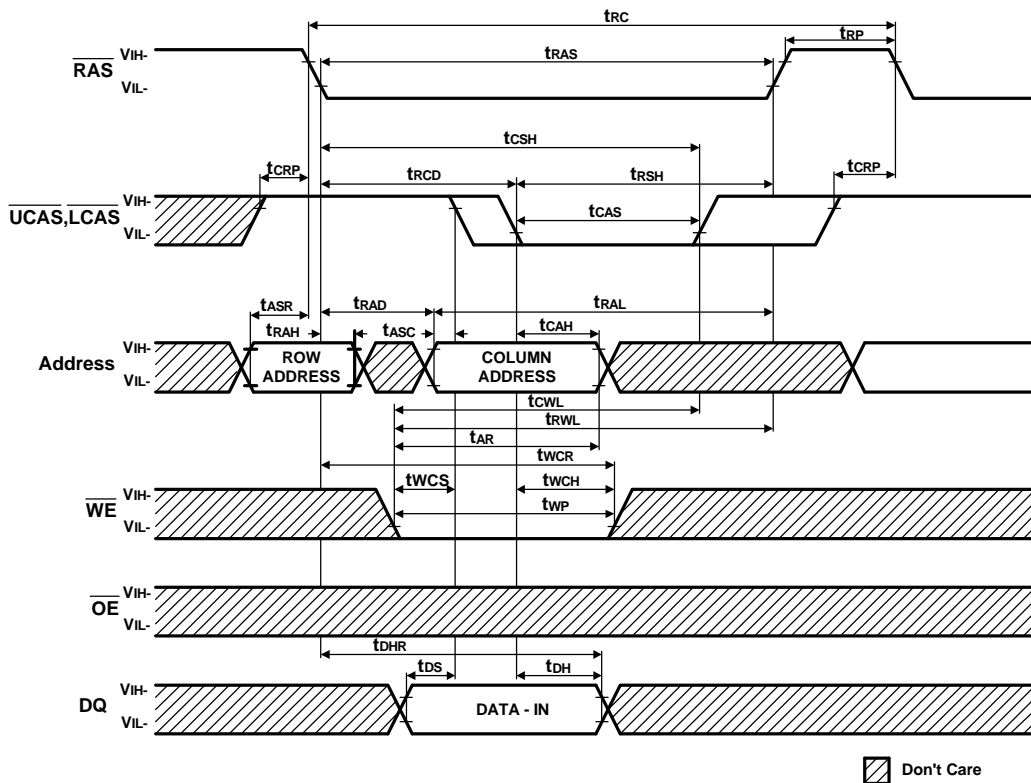
Notes:

1. Measure with a load equivalent to one TTL inputs and 50 pF.
2. Assumes that $t_{\text{RCD}} \leq t_{\text{RCD}}(\text{max.})$. If t_{RCD} is greater than $t_{\text{RCD}}(\text{max.})$, access time will be t_{CAC} dominant.
3. Assumes that $t_{\text{RAD}} \leq t_{\text{RAD}}(\text{max.})$. If t_{RAD} is greater than $t_{\text{RAD}}(\text{max.})$, access time will be controlled by t_{AA} .
4. Either t_{RRH} or t_{RCH} must be satisfied for a Read Cycle.
5. Access time is determined by the longest of t_{CAA} , t_{CAC} and t_{CPA} .
6. Assumes that $t_{\text{RAD}} \geq t_{\text{RAD}}(\text{max.})$.
7. Operation within the $t_{\text{RAD}}(\text{max.})$ limit ensures that $t_{\text{RAC}}(\text{max.})$ can be met. $t_{\text{RAD}}(\text{max.})$ is specified as a reference point only. If t_{RAD} is greater than the specified $t_{\text{RAD}}(\text{max.})$ limit, the access time is controlled by t_{CAA} and t_{CAC} .
8. t_{WCS} , t_{RWD} , t_{AWD} and t_{CWD} are not restrictive operating parameters.
9. $t_{\text{WCS}}(\text{min.})$ must be satisfied in an Early Write Cycle.
10. t_{DS} and t_{DH} are referenced to the latter occurrence of $\overline{\text{CAS}}$ or $\overline{\text{WE}}$.
11. t_{T} is measured between $V_{\text{IH}}(\text{min.})$ and $V_{\text{IL}}(\text{max.})$. AC-measurements assume $t_{\text{T}} = 1.5 \text{ ns}$.

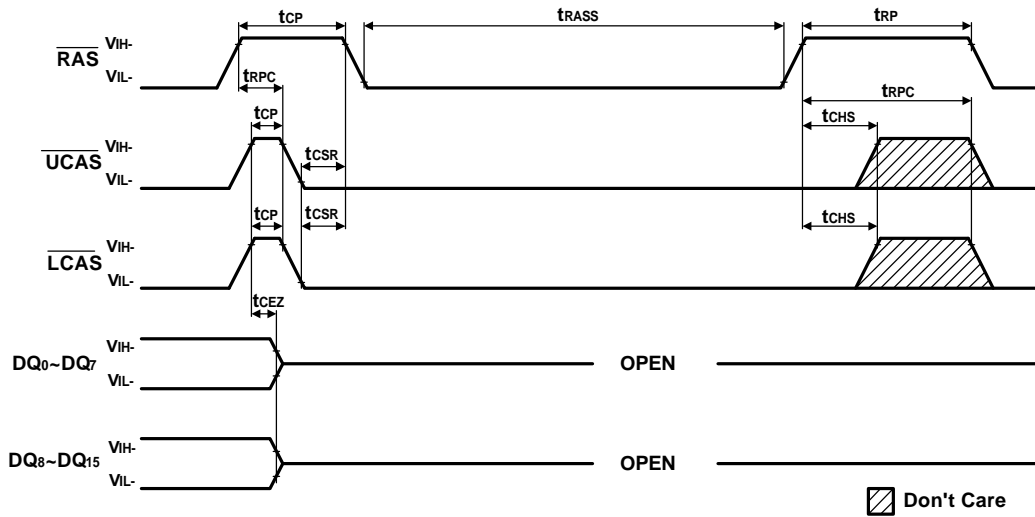
Read CYCLE Note : $D_{IN} = OPEN$



Early Write Cycle NOTE : $D_{OUT} = OPEN$

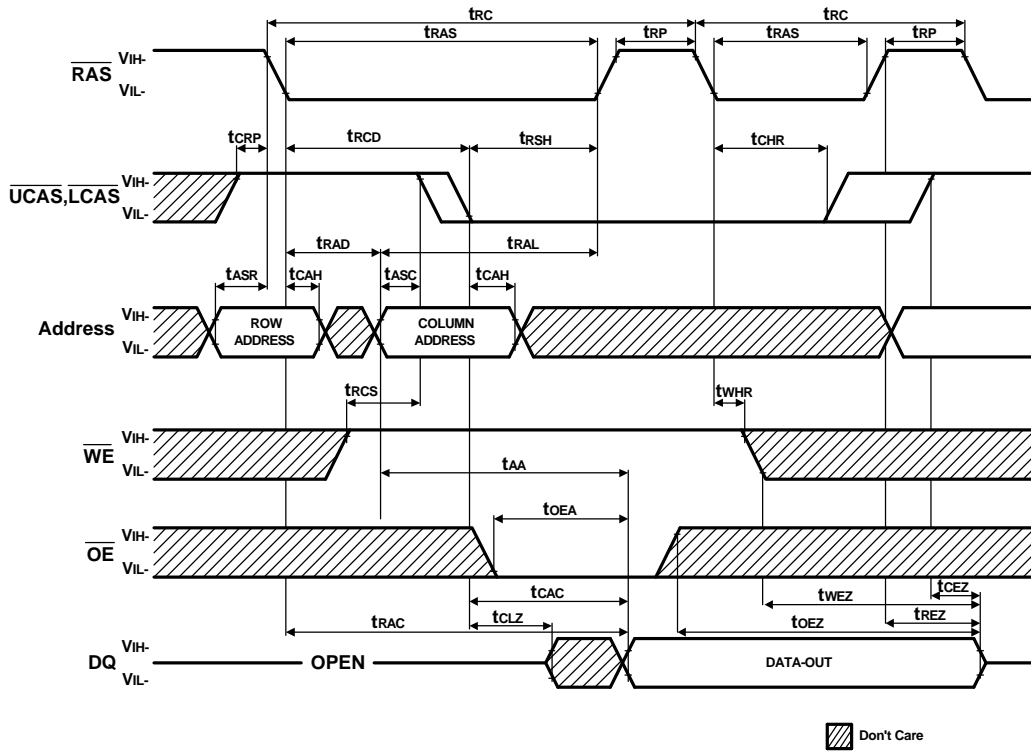


CAS - Before - RAS Self Refresh Cycle

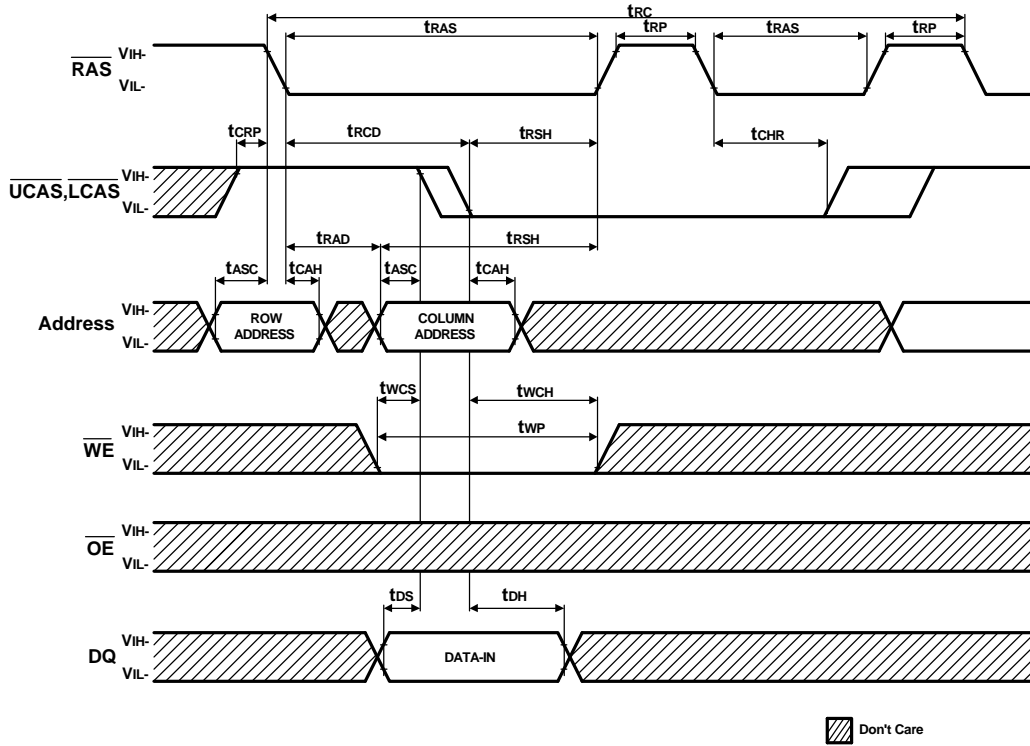


NOTE : \overline{WE} , \overline{OE} , Address = Don't care.

Hidden Refresh Cycle (Read)

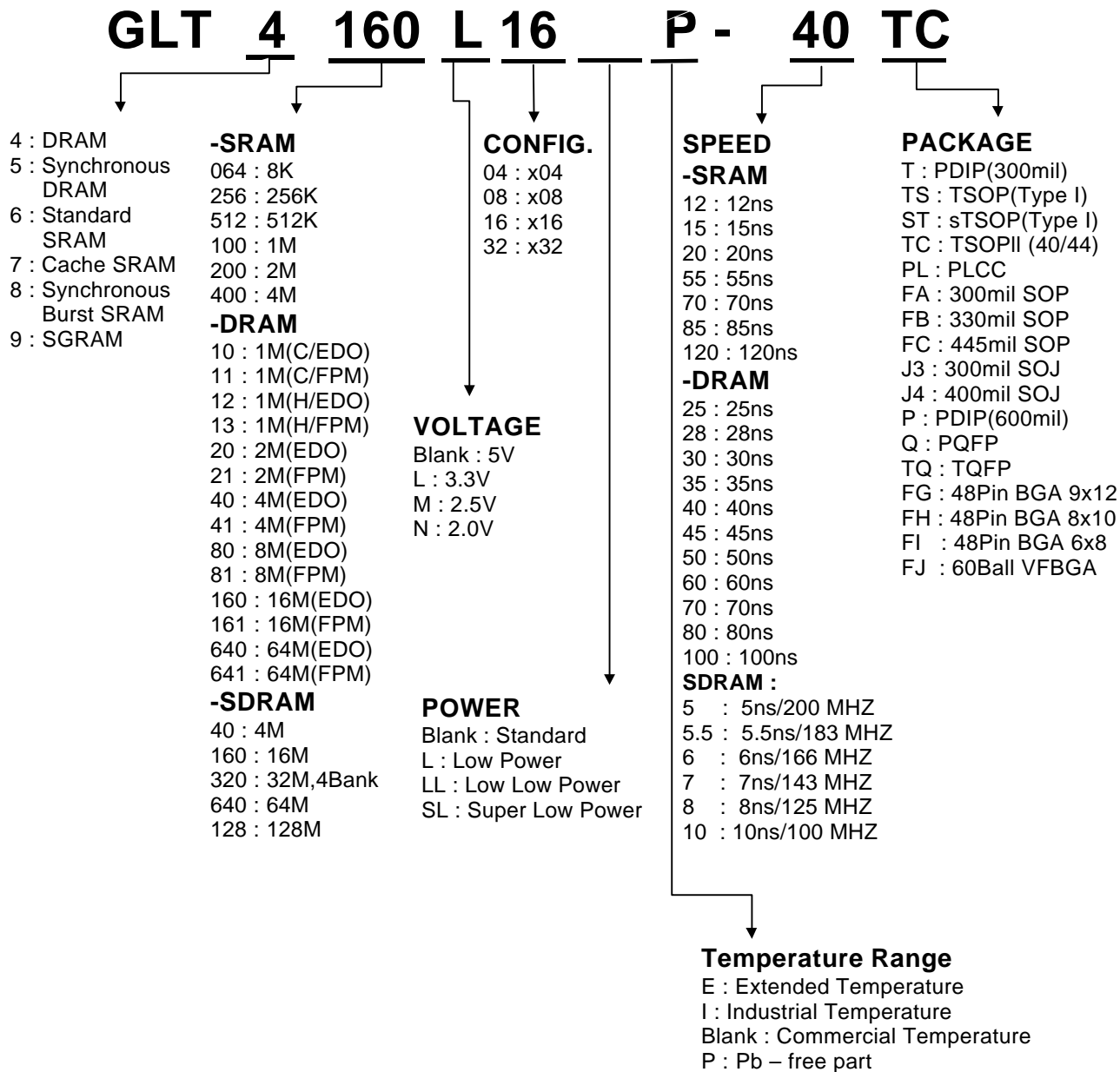


Hidden Refresh Cycle (Write) NOTE : D_{OUT} = OPEN



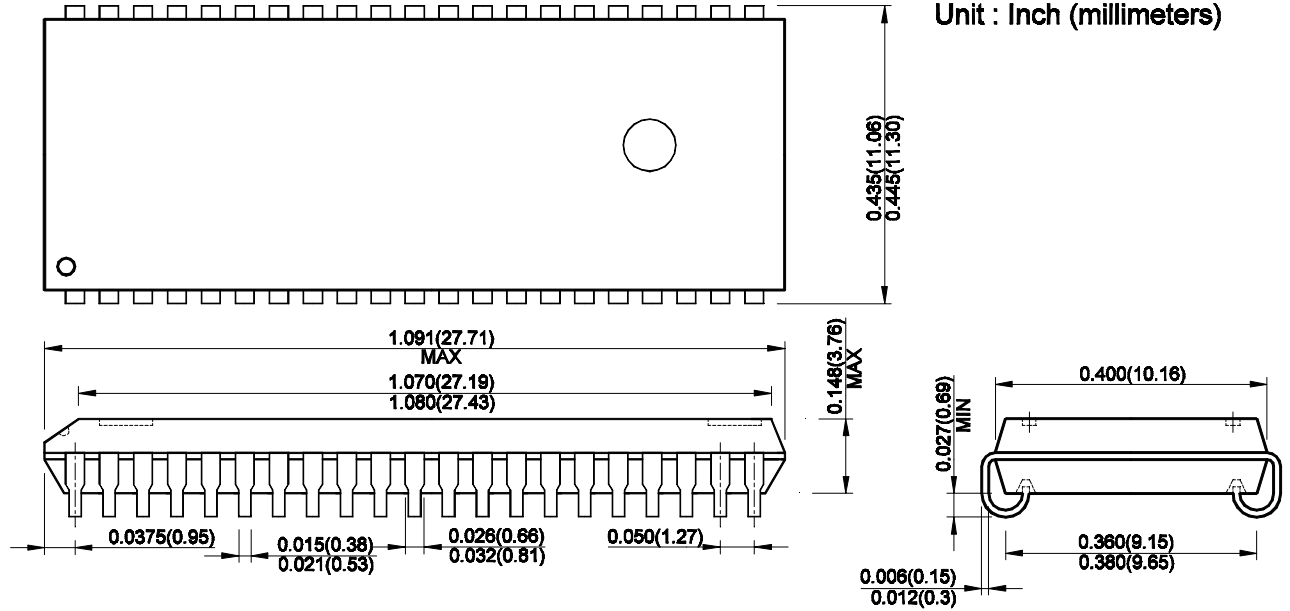
Ordering Information

Part Number	SPEED	POWER	FEATURE	TEMPERATUR	PACKAGE
GLT4160L16-45J4	45ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16-50J4	50ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16-60J4	60ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16-70J4	70ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16S-45J4	45ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16S-50J4	50ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16S-60J4	60ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16S-70J4	70ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16P-45J4	45ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16P-50J4	50ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16P-60J4	60ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16P-70J4	70ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16SP-45J4	45ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SP-50J4	50ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SP-60J4	60ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SP-70J4	70ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16-45TC	45ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16-50TC	50ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16-60TC	60ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16-70TC	70ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16S-45TC	45ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16S-50TC	50ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16S-60TC	60ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16S-70TC	70ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16P-45TC	45ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16P-50TC	50ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16P-60TC	60ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16P-70TC	70ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SP-45TC	45ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SP-50TC	50ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SP-60TC	60ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SP-70TC	70ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16E-45J4	45ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16E-50J4	50ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16E-60J4	60ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16E-70J4	70ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16EP-45J4	45ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16EP-50J4	50ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16EP-60J4	60ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16EP-70J4	70ns	Normal	EDO	Commercial	42L 400mil SOJ
GLT4160L16SE-45J4	45ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SE-50J4	50ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SE-60J4	60ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SE-70J4	70ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SEP-45J4	45ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SEP-50J4	50ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SEP-60J4	60ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16SEP-70J4	70ns	Self Refresh	EDO	Commercial	42L 400mil SOJ
GLT4160L16E-45TC	45ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16E-50TC	50ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16E-60TC	60ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16E-70TC	70ns	Normal	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SE-45TC	45ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SE-50TC	50ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SE-60TC	60ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SE-70TC	70ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SEP-45TC	45ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SEP-50TC	50ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SEP-60TC	60ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII
GLT4160L16SEP-70TC	70ns	Self Refresh	EDO	Commercial	44/50L 400mil TSOPII

Parts Numbers (Top Mark) Definition :


Package Information

40/42L 400MIL SOJ



44/50L TSOPII 400MIL

