

## 4-Bit ECL/TTL Load Reducing DRAM Driver

The MC10H/100H660 is a 4-bit ECL input, translating DRAM address driver, ideally suited for driving TTL compatible DRAM inputs from an ECL system. It is designed for use in high capacity, highly interleaved DRAM memory boards, that directly interface to a high speed, pipelined ECL bus interface, where new operations may be initiated to the board at up to a 50 MHz rate.

The latch provides the capability for the memory controller to propagate new addresses to different banks without having to wait for the address timing constraints to be satisfied from a previous memory operation. The dual output fanout reduces input loading from the controller by a factor of two, thus significantly improving board etch propagation delays from the controller, without the need for additional ECL buffering.

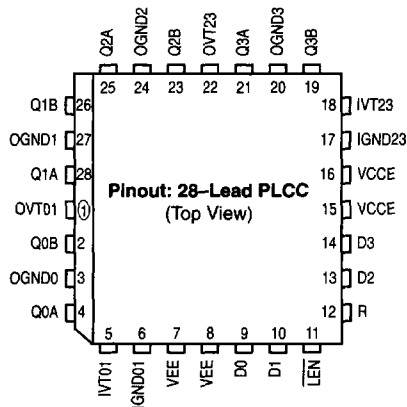
The H660 features special TTL outputs which do not have an IOS limiting resistor, therefore allowing rapid charging of the load capacitance. Output voltage levels are designed specifically for driving DRAM inputs. The output stages feature separate power and ground pins to isolate output switching noise from internal circuitry, and also to improve simultaneous switching performance.

The 10H version is compatible with MECL 10H ECL logic levels. The 100H version is compatible with 100K levels.

- High Capacitive Drive Outputs to Drive DRAM Address Inputs
- Extra TTL and ECL Power/Ground Pins to Minimize Switching Noise
- Dual Supply
- 10.7 ns Max. D to Q into 300 pF

### PIN NAMES

PIN	FUNCTION
OGND[0:3]	Output Ground (0V)
OVT01, OVT23	Output VCCT (+5.0 V)
IGND01, IGND23	Internal TTL Ground (0V)
IVT01, IVT23	Internal TTL VCCT (+5.0 V)
VEE	ECL Neg. Supply (-5.2/ -4.5 V)
VCCE	ECL Ground (0V)
D[0:3]	Data Inputs (ECL)
Q[0:3]A, Q[0:3]B	Data Outputs (TTL levels)
LEN	Latch Enable (ECL)
R	Reset (ECL)

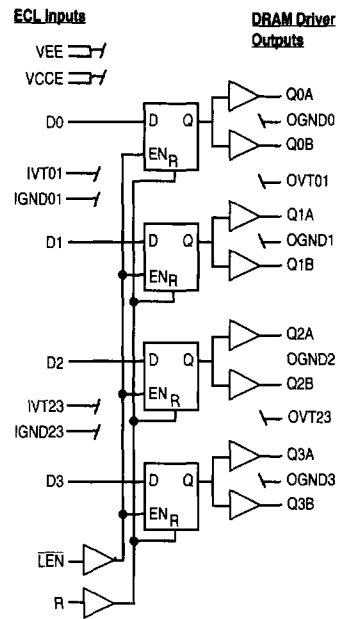


**MC10H660**  
**MC100H660**



**FN SUFFIX**  
PLASTIC PACKAGE  
CASE 776-02

### LOGIC SYMBOL



### TRUTH TABLE

D	LEN	R	Q
L	H	L	L
H	H	L	H
X	L	L	Q <sub>0</sub>
X	X	H	L

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MC10H660 MC100H660

**DC CHARACTERISTICS:**  $V_{CC} = 5.0\text{ V} \pm 10\%$ ;  $V_{EE} = -5.2\text{ V} \pm 5\%$  (10H version);  $V_{EE} = -4.2\text{ V}$  to  $-5.5\text{ V}$  (100H version)

Symbol	Characteristic	0°C		25°C		85°C		Unit	Condition
		min	max	min	max	min	max		
$I_{EE}$	Power Supply Current	ECL		41.8	44.0	46.2		mA	
$I_{CCH}$		TTL		77.0	77.1	79.2			
$I_{CCL}$				94.6	95.7	96.8		mA	

**TTL CHARACTERISTICS:**  $V_{CC} = 5.0\text{ V} \pm 10\%$ ;  $V_{EE} = -5.2\text{ V} \pm 5\%$  (10H version);  $V_{EE} = -4.2\text{ V}$  to  $-5.5\text{ V}$  (100H version)

Symbol	Characteristic	0°C		25°C		85°C		Unit	Condition
		min	max	min	max	min	max		
$V_{OH}$	Output HIGH Voltage	2.6		2.6		2.6		V	$I_{OH} = -24\text{ mA}$
$V_{OL}$	Output LOW Voltage	0.50		0.50		0.50			V
$I_{OS}$	Output Short Circuit Current*	-		-		-		V	

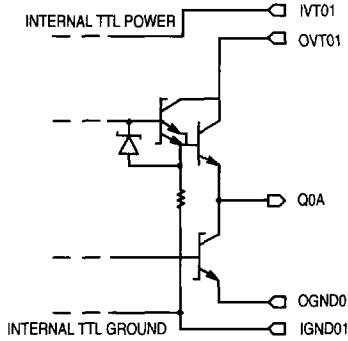
- The outputs must not be shorted to ground, as this will result in permanent damage to the device. The high drive outputs of this device do not include a limiting IOS resistor. Minimum recommended load capacitance is 100 pF. Precise output performance and waveforms will depend on the exact nature of the actual load. The lumped load is of course an approximation to a real memory system load.

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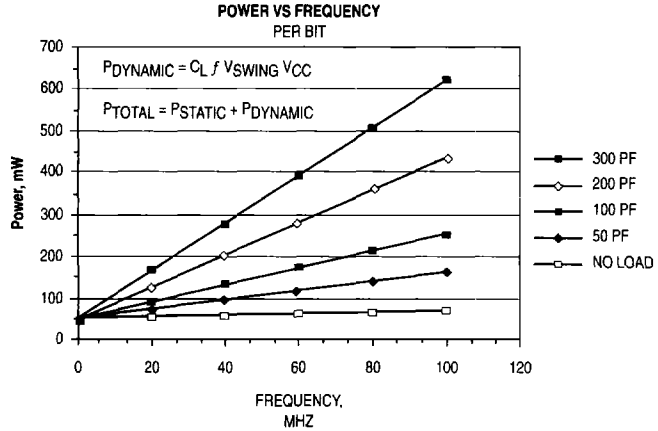
**AC Characteristics:**  $V_{CC} = 5.0\text{ V} \pm 10\%$ ;  $V_{EE} = -5.2\text{ V} \pm 5\%$  (10H version)  $V_{EE} = -4.2\text{ V}$  to  $-5.5\text{ V}$  (100H version)

Symbol	Characteristic	0°C		25°C		85°C		Unit	Condition	
		min	max	min	max	min	max			
$t_s$	Set-up Time, D to $\overline{LEN}$	0.5		0.5		0.5		ns		
$t_h$	Hold Time, D to $\overline{LEN}$	1.5		1.5		1.5				
$t_{w(H)}$	LEN Pulse Width, HIGH	2.0		2.0		2.0				
$t_R$ $t_F$	Output Rise/Fall Time 0.8 V – 2.0 V	0.5	2.0	0.5	2.0	0.5	2.0	ns	$C_L = 200\text{ pF}$	
$t_{PLH}$ $t_{PHL}$	Propagation Delay to Output	D	3.0	6.0	3.0	6.0	3.0			6.0
			4.0	8.0	4.0	8.0	4.0	8.0		
			4.5	9.5	4.5	9.5	4.5	9.5		
$t_{PHL}$	50% point of ECL input to 1.5 V point of TTL output	$\overline{LEN}$	4.3	6.9	4.3	6.9	4.3	6.9	ns	$C_L = 100\text{ pF}$ $C_L = 200\text{ pF}$ $C_L = 300\text{ pF}$
			4.9	8.9	4.9	8.9	4.9	8.9		
			5.4	10.4	5.4	10.4	5.4	10.4		
$t_{PHL}$	Propagation Delay to Output	R	4.1	9.1	4.1	9.1	4.1	9.1	ns	$C_L = 100\text{ pF}$ $C_L = 200\text{ pF}$ $C_L = 300\text{ pF}$
			4.5	8.5	4.5	8.5	4.5	8.5		
			5.0	10.0	5.0	10.0	5.0	10.0		
$t_{PLH}$	Propagation Delay to Output	D	3.9	5.9	3.9	5.9	4.0	6.1	ns	$C_L = 100\text{ pF}$ $C_L = 200\text{ pF}$ $C_L = 300\text{ pF}$
			4.8	7.2	4.8	7.2	5.0	7.4		
			5.8	8.8	5.8	8.8	5.9	8.9		
$t_{PHL}$	50% point of ECL input to 2.4 V point of TTL output	$\overline{LEN}$	4.7	7.1	4.7	7.1	4.8	7.2	ns	$C_L = 100\text{ pF}$ $C_L = 200\text{ pF}$ $C_L = 300\text{ pF}$
			5.5	8.3	5.5	8.3	5.6	8.4		
			6.3	9.5	6.3	9.5	6.4	9.6		
$t_{PHL}$	Propagation Delay to Output	D	4.5	6.7	4.5	6.7	4.4	6.6	ns	$C_L = 100\text{ pF}$ $C_L = 200\text{ pF}$ $C_L = 300\text{ pF}$
			6.0	9.0	6.0	9.0	6.0	9.0		
			7.0	10.6	7.0	10.6	6.9	10.3		
		$\overline{LEN}$	4.0	6.0	4.0	6.0	4.0	6.0	ns	$C_L = 100\text{ pF}$ $C_L = 200\text{ pF}$ $C_L = 300\text{ pF}$
			4.9	7.3	4.9	7.3	4.9	7.3		
			6.0	9.0	6.0	9.0	5.9	8.9		
R	4.3	6.5	4.3	6.5	4.3	6.5	ns	$C_L = 100\text{ pF}$ $C_L = 200\text{ pF}$ $C_L = 300\text{ pF}$		
	6.1	9.1	6.1	9.1	6.1	9.1				
	7.2	10.8	7.2	10.8	7.2	10.8				

**OUTPUT STRUCTURE**  
 – Output Q0A Structure Shown



**POWER VS FREQUENCY**  
 – typical



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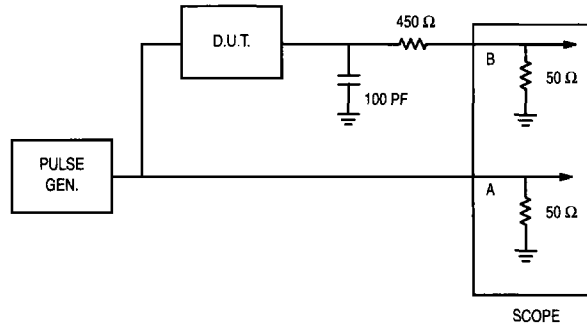
**10H ECL DC Characteristics:**  $V_{CC} = 5.0\text{ V} \pm 10\%$ ;  $V_{EE} = -5.2\text{ V} \pm 5\%$

Symbol	Characteristic	0°C		25°C		85°C		Unit	Condition
		min	max	min	max	min	max		
$I_{IH}$	Input HIGH Current		225		145		145	$\mu\text{A}$	
$I_{IL}$	Input LOW Current	1.5		1.0		1.0		$\mu\text{A}$	
$V_{IH}$	Input HIGH Voltage	-1170	-840	-1130	-810	-1060	-720	mV	
$V_{IL}$	Input LOW Voltage	-1950	-1480	-1950	-1480	-1950	-1445	mV	

**100H ECL DC Characteristics:**  $V_{CC} = 5.0\text{ V} \pm 10\%$ ;  $V_{EE} = -4.2\text{ V to } -5.5\text{ V}$

Symbol	Characteristic	0°C		25°C		85°C		Unit	Condition
		min	max	min	max	min	max		
$I_{IH}$	Input HIGH Current		225		145		145	$\mu\text{A}$	
$I_{IL}$	Input LOW Current	1.5		1.0		1.0		$\mu\text{A}$	
$V_{IH}$	Input HIGH Voltage	-1165	-880	-1165	-880	-1165	-880	mV	
$V_{IL}$	Input LOW Voltage	-1810	-1475	-1810	-1475	-1810	-1475	mV	

## AC TEST SET-UP

 $C_L = 100 \text{ pF}$ **The MC10H/100 H660 ECL-TTL DRAM Address Driver**

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The MC 10H/100H660 was designed for use in high capacity, highly interleaved DRAM memory boards, that directly interface to a high speed, pipelined ECL bus interface, where new operations may be initiated to the board at a 50 MHz rate (e.g. bipolar RISC systems).

The following briefly discusses the major design features of the part over existing semiconductor devices traditionally used in interfacing DRAMs in high performance system environments.

**1. ECL Translator**

High performance memory systems of the past that were interfaced to ECL buses had to rely on separate ECL translators and DRAM drivers to interface to large DRAM arrays, which is acceptable if the module is not highly interleaved and the bus cycle time is comparable to the DRAM access time. This becomes inadequate as the cycle time of the interface becomes significantly faster than the address timing requirements of the RAM, and as the degree of internal board interleaving increases. These higher performance demands require that the internal address and control signals propagated to the DRAM drivers be implemented in ECL, thus requiring the integration of the driver and translator functions.

Integration of the translator/driver function also reduces access latency, as well as keeping DRAM timing parameters from being violated, due to the excessive delays encountered with separate parts.

**2. MOS Drive Capacity**

Outputs are specifically designed for driving large numbers of DRAMs ( $\approx 300 \text{ pF}$ ), which reduce the number of parts and power requirements needed per board. Output voltage levels are designed specifically for driving DRAM inputs. No ECL

translator parts on the market today provide the designer with this drive capability as well as the flexibility to vary the number of DRAMs that are driven by the part.

**3. Transparent Latch**

The latch is added to provide the capability for a memory controller to propagate new addresses to different banks without having to wait for the address timing constraints to be satisfied from a previous memory operation. For system implementations where this is acceptable, the user has the capability to keep the latch open, thus having the part act as an address translator/buffer, with minimal performance impact due to the additional propagation delay incurred from the internal latch. The latch is controlled within an already existing DRAM timing signal.

**4. 1:2 Output Fanout**

This function is useful in that it reduces input loading from the controller by a factor of two, thus significantly improving board etch propagation delays from the controller to the large number of translators, without the addition of ECL glue logic parts to reduce the loading. In large memory boards, so many translators are needed that this type of organization is not a handicap.

**5. Low Skew, Low Propagation Delay**

Low skew of the part as well as fast propagation delay enable faster overall DRAM operation to be attained than is possible with existing parts.

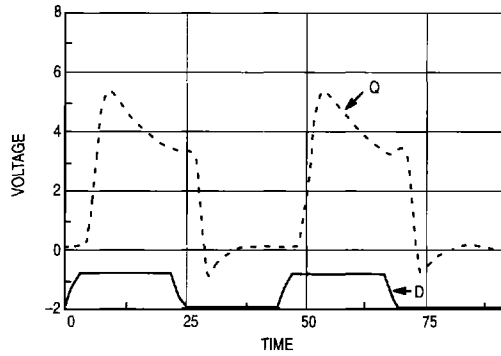
**6. Power and Package Pin Layout**

The H660 is specifically designed with additional power and ground pins to greatly improve simultaneous switching performance over existing driver parts.

**OUTPUT WAVEFORMS**

simulated

*Example 1.* An output load consisting of just  $CL = 50 \text{ pF}$  results in overshoot at the output Q:



*Example 2.* In a memory system application, use of an external source resistor is suggested. Simulations run with  $RS = 8\Omega$  and  $CL = 300\text{pF}$  leads to clean waveforms both at the output, Q, and at point Qp:

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