

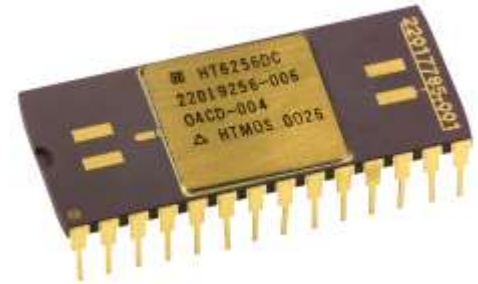
High Temperature 32Kx8 Static RAM HT6256

Honeywell

The 32K x 8 High Temperature Static RAM is a high performance 32,768 word x 8-bit static random access memory with industry-standard functionality. It is fabricated with Honeywell's HTMOS™ technology, and is designed for use in systems operating in severe high temperature environments. The RAM requires only a single 5V ± 10% power supply and has CMOS compatible I/O.

Power consumption is typically less than 30 mW/MHz in operation, and less than 10mW when de-selected. The RAM read operation is fully asynchronous, with a maximum guaranteed access time of 50ns at 5V.

The RAM provides guaranteed performance over the full -55 to +225°C temperature range. Typically, parts will operate up to +300°C for a year, with derated performance. All parts are burned in at 250°C.



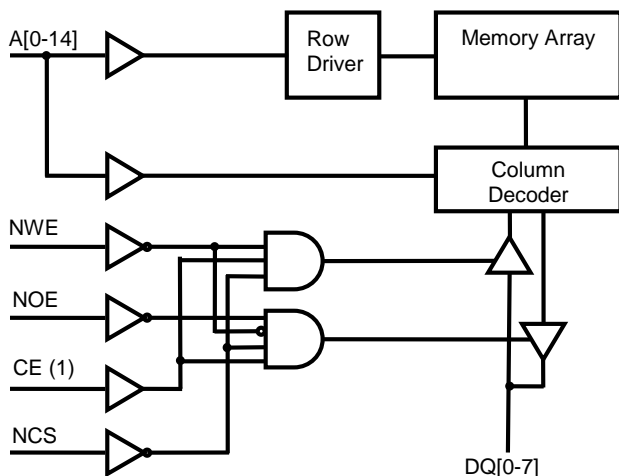
APPLICATIONS

- Down-Hole Oil Well
- Turbine Engine Control
- Avionics
- Industrial Process Control
- Nuclear Reactor
- Electric Power Conversion
- Heavy Duty Internal Combustion Engine

FEATURES

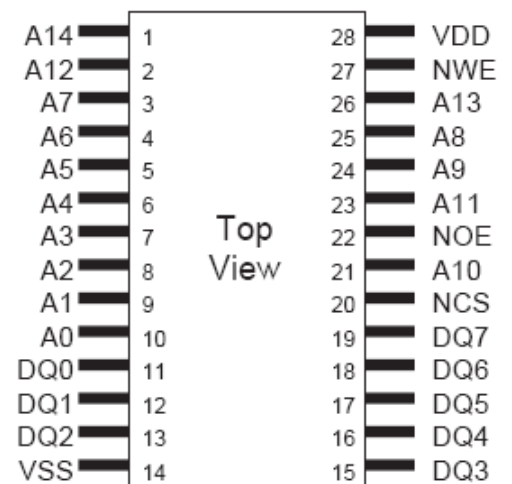
- Specified Over -55 to +225°C
- Fabricated with HTMOS™ IV Silicon on Insulator (SOI)
- Read/Write Cycle Time as Low as 50ns Over the Full Operating Temperature Range
- Asynchronous Operation
- Single 5V ± 10% Power Supply
- Hermetic 28-Lead Ceramic DIP, or Die
- CMOS Input/Output Buffers

SIMPLIFIED FUNCTIONAL BLOCK DIAGRAM



(1) CE input is not available in 28 lead DIP package, and CE is not supported for the HT6256 in die form. For deliverable die user must connect CE to VDD.

28 LEAD PACKAGE PINOUT



HT6256

SIGNAL DEFINITIONS

Pin Name	Timing Symbol	Definition
A[0-14]	A	Address input pins. Selects a particular 8-bit word within the memory array.
DQ[0-7]	D Q	Bi-directional data I/O pins. Data inputs (D) during a write operation. Data outputs (Q) during a read operation.
NCS	S	Negative chip select. Low allows normal read or write operation. High puts the SRAM into a deselected condition and holds the data output drivers in a high impedance (High-Z) state. If not used, it must be connected to VSS.
NWE	W	Negative write enable. Low activates a write operation and holds the data output drivers in a high impedance (High-Z) state. High allows normal read operation.
NOE	G	Negative output enable. High holds the data output drivers in a high impedance (High-Z) state. Low the data output driver state is defined by NCS, CE and NWE. If not used, it must be connected to VSS.
CE	n/a	Chip Enable. This control input is wire-bonded to VDD in the 28 lead package. Use of the CE signal as an enable input is not supported for the HT6256 in die form. For deliverable die, the user must connect CE to VDD.
VDD		Power input. Supplies power to the SRAM.
VSS		Ground

TRUTH TABLE

NCS	NWE	NOE	Mode	DQ Mode
H	X	X	Deselected	High-Z
L	H	L	Read	Data Out
L	H	H	Read Standby	High-Z
L	L	X	Write	Data In

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS (1)

Symbol	Parameter	Ratings		Unit
		Min	Max	
VDD	Positive Supply Voltage Referenced to VSS	-0.5	7.0	V
VIO	Voltage on Any Input or Output Pin Referenced to VSS	-0.5	VDD + 0.5	V
IOUT	Average Output Current		25	mA
TSTORE	Storage Temperature	-65	250	°C
TSOLDER (2)	Soldering Temperature		270	°C
PD (3)	Package Power Dissipation		2.5	W
PJC	Package Thermal Resistance (Junction to Case)	28-Lead DIP	10.0	°C/W
		Die	0.5	°C/W
VHBM	Electrostatic Discharge Protection Voltage (Human Body Model)	2000		V
TJ	Junction Temperature		300	°C

(1) Stresses in excess of those listed above may result in immediate permanent damage to the device. These are stress ratings only and operation at these levels is not implied. Frequent or extended exposure to absolute maximum conditions may affect device reliability.

(2) Maximum soldering temperature can be maintained for no more than 5 seconds.

(3) IDDSB power + IDDOP power + Output driver power due to external loading must not exceed this specification.

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RECOMMENDED OPERATING CONDITIONS (1)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
VDD	Positive Supply Voltage Referenced to VSS	4.5	5.0	5.5	V
TC	Case Temperature	-55	25	225	°C
VIO	Voltage on Any Input or Output Pin Referenced to VSS	-0.3		VDD + 0.3	V

(1) Specifications listed in datasheet apply when operated under the Recommended Operating Conditions unless otherwise specified.

POWER PIN ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Typ(3)	Max	Unit	
IDDSB	Static Supply Current	VIH = VDD, VIL = VSS, DQ = High-Z	0.2	2.0	mA	
IDDOPW (1)(2)	Dynamic Supply Current Selected, Write	VIH = VDD, VIL = VSS, DQ = High-Z	1MHz	3.4	4	mA
IDDOPR (1)(2)	Dynamic Supply Current Selected, Read	VIH = VDD, VIL = VSS, DQ = High-Z	1MHz	2.8	4	mA
IDDOPD (1)(2)	Dynamic Supply Current Deselected	VIH = VDD, VIL = VSS, DQ = High-Z	20MHz	0.2	2.0	mA
IDR	Data Retention Supply Current	VDD = 2.5V		500	uA	

(1) All inputs switching. DC average current.

(2) All dynamic operating mode current measurements (IDDOPx) exclude standby mode current (IDDSB). The total power is the sum of the power from the standby current (IDDSB), dynamic current (IDDOPx) and output driver current driving the output load

(3) Typical operating conditions: VDD=5.0V, TA=25°C

SIGNAL PIN ELECTRICAL CHARACTERISTICS (1)(2)

Symbol	Parameter	Conditions	Min	Max	Unit
IIN	Input Leakage Current	VSS ≤ VIN ≤ VDD	-5	5	uA
IOZ	Output Leakage Current	DQ = High-Z	-10	10	uA
VIL	Low-Level Input Voltage	CMOS		0.3 x VDD	V
VIH	High-Level Input Voltage	CMOS	0.7 x VDD		V
VOL	Low-Level Output Voltage	CMOS IOL = 6mA		0.4	V
VOH	High-Level Output Voltage	CMOS IOH = -3mA	4.2		V

(1) Voltages referenced to VSS.

PIN CAPACITANCE (1)

Symbol	Parameter	Max	Unit
CIN	Input Capacitance	7	pF
CDQ	Data I/O Capacitance	9	pF

(1) Maximum capacitance is verified as part of initial qualification only.

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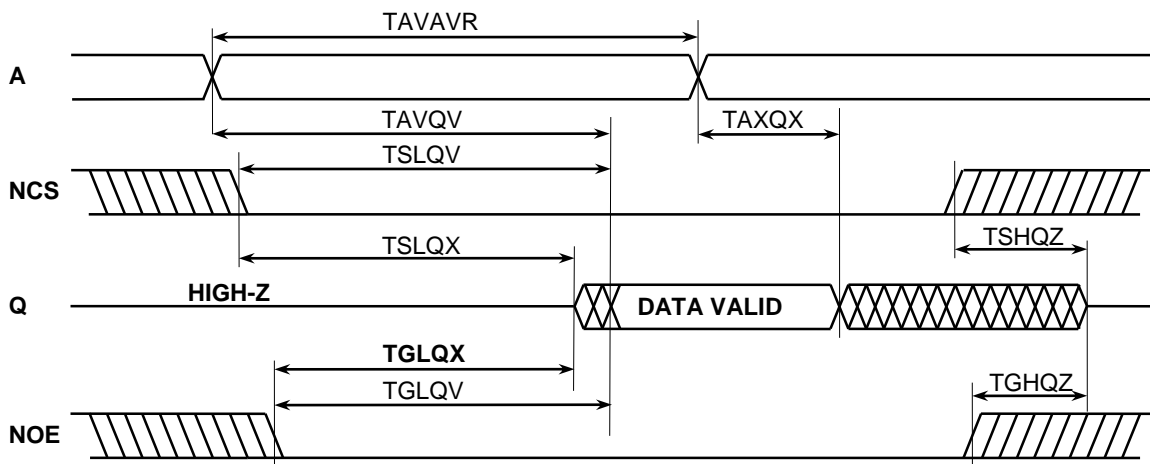
READ CYCLE TIMING CHARACTERISTICS (1)(2)

Symbol	Parameter	Limits		Unit
		Min	Max	
TAVAVR	Read Cycle Time	50		ns
TAVQV	Address Valid to Output Valid Access Time		50	ns
TAXQX	Address Change to Output Invalid Time	3		ns
TSLQV	Chip Select to Output Valid Access Time		50	ns
TSLQX	Chip Select to Output Low-Z Time	5		ns
TSHQZ	Chip Select to Output High-Z Time		20	ns
TGLQV	Output Enable to Output Valid Access Time		20	ns
TGLQX	Output Enable to Output Low-Z Time	0		ns
TGHQZ	Output Enable to Output High-Z Time		15	ns

(1) The timing specifications are referenced to the Timing Input / Output References diagrams and the Timing Reference Load Circuit diagrams.

(2) NWE = High

READ CYCLE TIMING WAVEFORMS

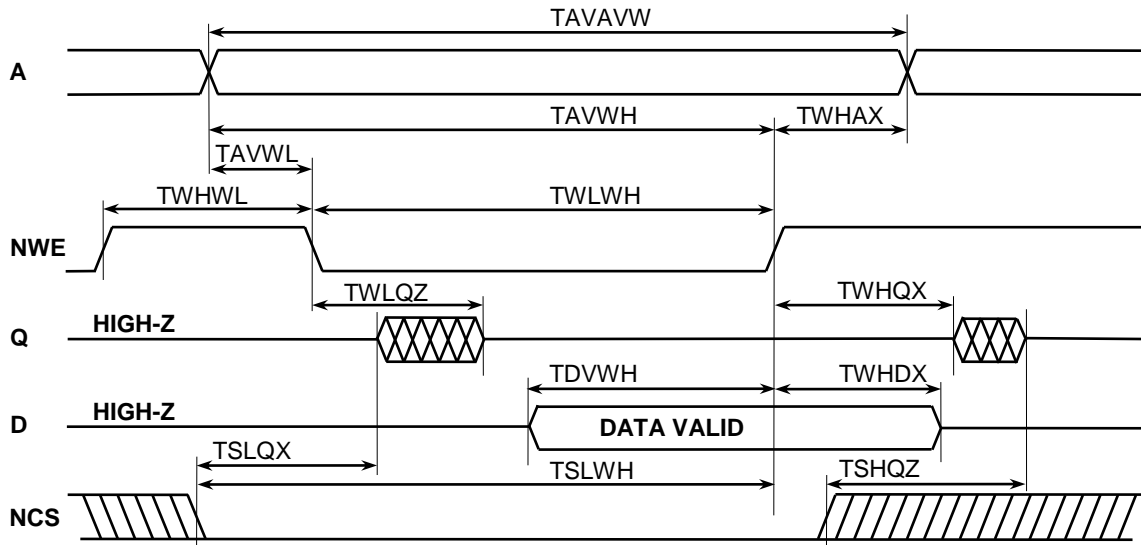


WRITE CYCLE TIMING CHARACTERISTICS (1)(2)(3)

Symbol	Parameter	Limits		Unit
		Min	Max	
TAVAVW	Write Cycle Time	50		ns
TWLWH	Start of Write to End of Write Pulse Width	45		ns
TSLWH	Chip Select to End of Write Time	45		ns
TDVWH	Data Input Valid to End of Write Time	35		ns
TAVWH	Address Valid to End of Write Time	45		ns
TWHDX	Data Input Hold after End of Write Time	0		ns
TAVWL	Address Valid Setup to Start of Write Time	0		ns
TWHAX	Address Valid Hold after End of Write Time	0		ns
TWLQZ	Start of Write to Output High-Z Time		15	ns
TWHQX	End of Write to Output Low-Z Time	5		ns
TWHWL (4)	End of Write to Start of Write Pulse Width	5		ns

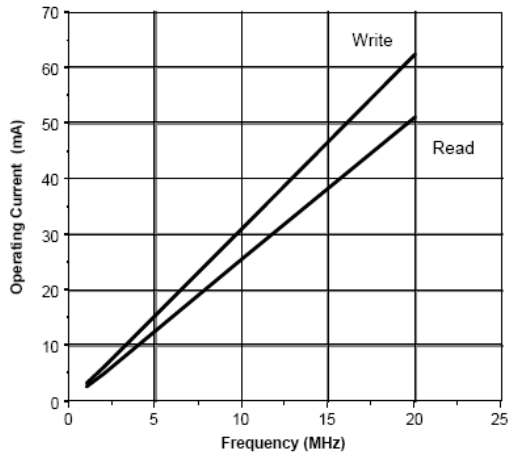
- (1) The timing specifications are referenced to the Timing Input / Output References diagrams and the Timing Reference Load Circuit diagrams. IBIS models should be used to evaluate timing under application load and conditions.
- (2) For an NWE controlled write, NCS must be Low and CE must be High when NWE is Low.
- (3) Can use NOE = High to hold Q in a High-Z state when NWE = High, NCS = Low and CE = High.
- (4) Guaranteed but not tested.

WRITE CYCLE TIMING WAVEFORMS

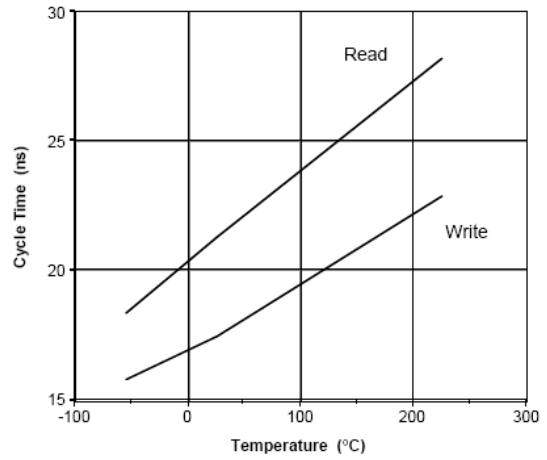


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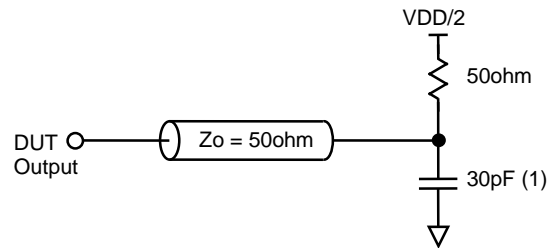
Typical Operating Current vs. Frequency @ 225°C



Typical Cycle Times vs. Temperature



TIMING REFERENCE LOAD CIRCUIT (CMOS)



Notes

- (1) Set to 5pF for T*QZ (Low-Z to High-Z) timing parameters.

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FUNCTIONAL DESCRIPTION

SRAM Operation

SRAM operation is asynchronous. Operating modes are defined in the Truth Table. Read operations can be controlled by Address (A) or Chip Select (NCS). Write operations can be controlled by Write Enable (NWE) or Chip Select (NCS).

Read Operation

A read operation occurs when Chip Select (NCS) is low and Write Enable (NWE) is high. The output drivers are controlled independently by the Output Enable (NOE) signal.

To control a read cycle with NCS where TSLQV is the access time, all addresses must be valid TAVQV minus TSLQV prior to the enabling NCS transition. Address transitions can occur later; however, the valid Data Output (Q) access time will then be defined by TAVQV instead of TSLQV. NCS can disable the read at any time; however, Data Output drivers will enter a High-Z state TSHQZ later.

To control a read cycle with Address where TAVQV is the access time, NCS must transition to active TSLQV minus TAVQV prior to the last Address transition. The NCS active transition can occur later; however, the valid Data Output (Q) access time will then be defined by TSLQV instead of TAVQV. To perform consecutive read cycles, NCS is held continuously low/high, and the toggling of any Address will start a new read cycle. Any amount of toggling or skew between Address transitions is permissible; however, Data Output will not become valid until TAVQV following the last occurring Address transition. The minimum Address activated read cycle time is TAVAVR which is the time between the last Address transition of the previous cycle and the first Address transition of the next cycle. The valid Data Output from a previous cycle will remain valid until TAXQX following the first Address transition of the next cycle.

Write Operation

A write operation occurs when Write Enable (NWE) and Chip Select (NCS) are low. The write mode can be controlled via two different control signals: NWE or NCS can start the write mode and end the write mode, but the write operation itself is defined by the overlap of NWE low, and NCS low. Both modes of control are similar, except the NCS mode deselects the SRAM when NCS is high between writes.

To write Data (D) into the SRAM, NWE and NCS must be held low for at least TWLWH and TSLSH respectively. Any amount of skew between these signal transitions can be tolerated, and any one of these control signals can start or end the write operation as long as there is sufficient overlap in these signals to ensure a valid write time (e.g., TSLWH and TWLSH).

Address inputs must be valid at least TAVWL/TAVSL before the start of write and TAVWH/TAVSH before the end of write and must remain valid during the write operation. Hold times for address inputs with respect to the end of write must be a minimum of TWHAX/TSHAX.

A Data Input (D) valid to the end of write time of TDVWH/TDVSH must be provided during the write operation. Hold times for Data Input with respect to the end of write must be at least TWHDX/TSHDX. To avoid Data Input driver contention with the SRAM output driver, the Data Input (D) must not be applied until TWLQZ/TGHQZ/TSHQZ after the output drive (Q) is put into a High-Z condition by NWE/NOE/NCS.

Consecutive write cycles are performed by toggling at least one of the start of write control signals for TWHWL/TSHSL. If only one of these signals is used, the other two must be in their write enable states. The minimum write cycle time is TAVAVW/TAVAVS.

Signal Integrity

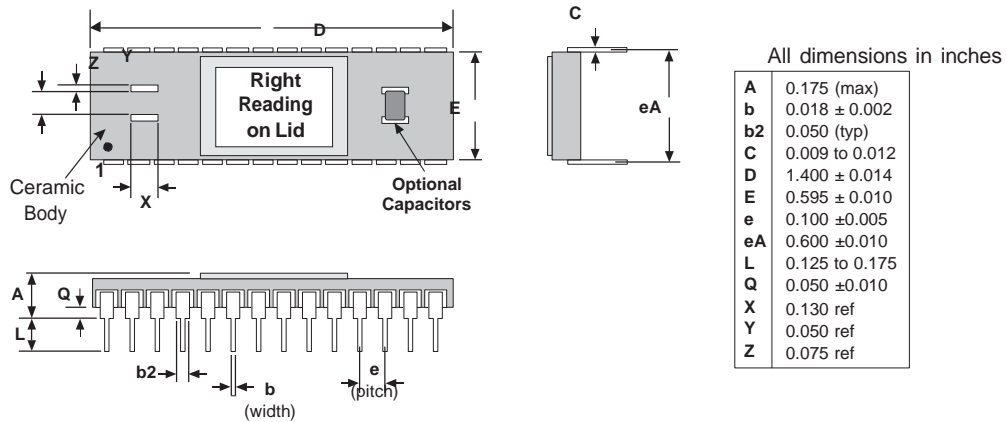
As a general design practice, one should have good signal integrity which means input signals that are free of noise, glitches and ringing with rising and falling edges of $\leq 10\text{ns}$. More specifically, an input is considered to have good signal integrity when the input voltage monotonically traverses the region between VIL and VIH in $\leq 10\text{ns}$. This is especially important in a selected and enabled state. When the device is selected and enabled, the last transitioning input for the desired operation must have good signal integrity to maintain valid operation. The transitioning inputs that bring the device into and out of a selected and enabled state must also have good signal integrity to maintain valid operation. When the device is deselected and/or disabled, inputs can have poor signal integrity and even float as long as the inputs that are defining the deselected and/or disabled state stay within valid VIL and VIH voltage levels. However, floating inputs for an extended period of time is not recommended.

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PACKAGING

The standard package is a hermetic 28-lead DIP constructed of multilayer ceramic (Al_2O_3) and features internal power and ground planes. Ceramic chip capacitors can be mounted on the package by the user to maximize supply noise decoupling and increase board packing density. These capacitors connect to the internal package power and ground planes. This design minimized resistance and inductance of the bond wire and package. For other packaging options or external control of Chip Enable (CE), call Honeywell.

28-LEAD DIP PACKAGE

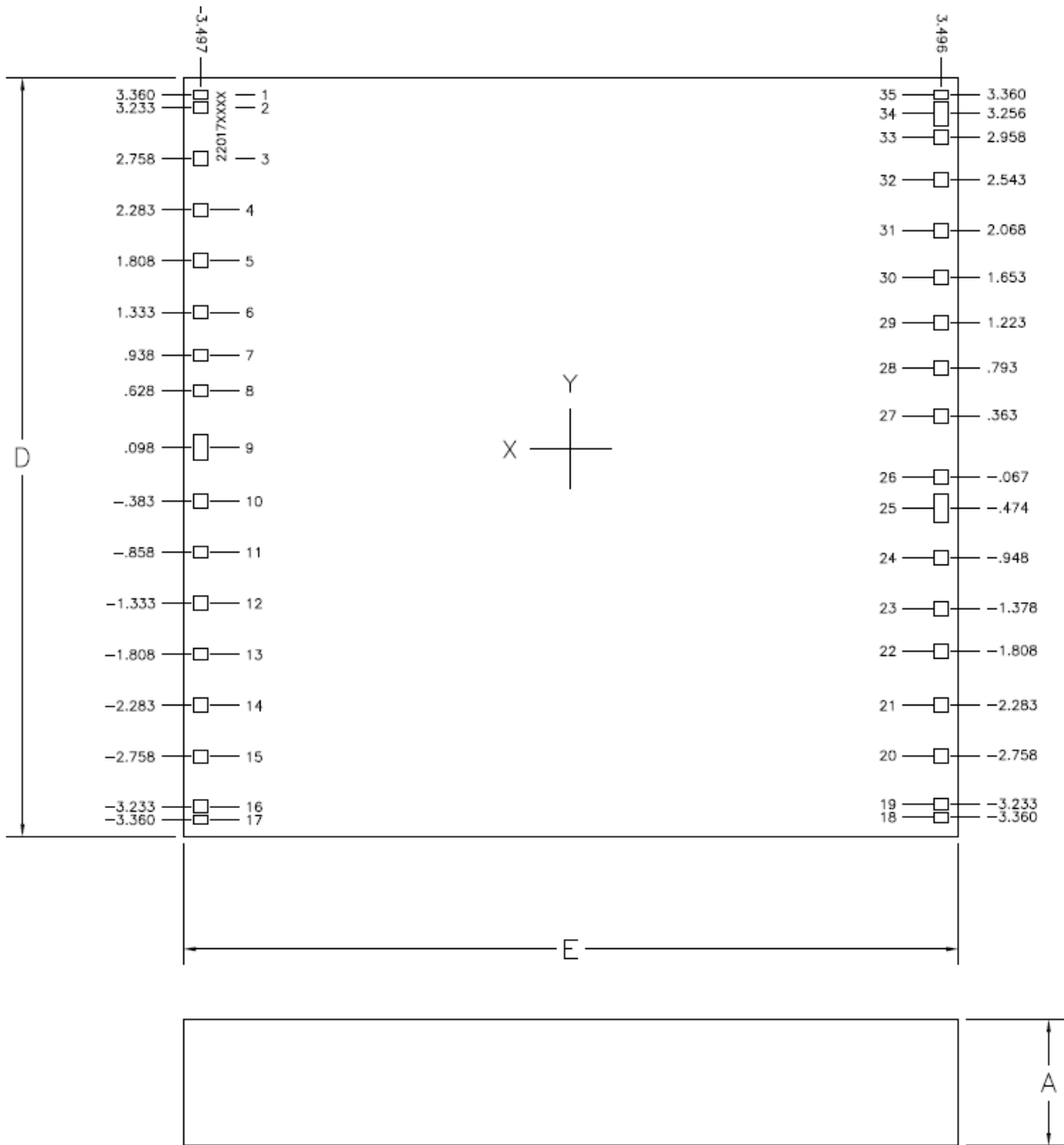


PACKAGE LEVEL SCREENING

The HT6256 package screening includes assembly screening (die-bond and wire-bond adhesion testing, pre-cap visual inspection, and hermetic seal leak checking). Post-assembly electrical screening includes initial electrical test, dynamic burn-in at 250°C, and final electrical testing at -55°C, 25°C, and 225°C.

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DIE DETAIL



Die Dimension (millimeters)

	Min.	Nom.	Max.
A	0.655	0.675	0.695
D	---	6.955	---
E	---	7.295	---

Notes:

- (1) Backside metalization is gold.
- (2) Metalization on the pads is aluminum.
- (3) The backside of the die is connected to VSS.

DIE PAD DIMENSIONS AND TERMINAL CONNECTIONS

Die Pad Number	Terminal Connection	Pad Dimensions (millimeters)	
		X	Y
1	VSS	0.139	0.080
2	NOE	0.129	0.100
3	A11	0.129	0.119
4	A9	0.129	0.119
5	A8	0.129	0.119
6	A13	0.129	0.119
7	VSS	0.129	0.119
8	NWE	0.129	0.119
9	VDD	0.129	0.233
10	A14	0.129	0.119
11	A12	0.129	0.119
12	A7	0.129	0.119
13	A6	0.129	0.119
14	A5	0.129	0.119
15	A4	0.129	0.119
16	A3	0.129	0.100
17	VSS	0.129	0.080
18	VSS	0.129	0.080
19	A2	0.129	0.100
20	A1	0.129	0.119
21	A0	0.129	0.119
22	D0	0.129	0.119
23	D1	0.129	0.119
24	D2	0.129	0.119
25	VSS	0.129	0.233
26	D3	0.129	0.119
27	D4	0.129	0.119
28	D5	0.129	0.119
29	D6	0.129	0.119
30	D7	0.129	0.119
31	NCS	0.129	0.119
32	A10	0.129	0.119
33	CE	0.129	0.100
34	VDD	0.129	0.216
35	VSS	0.139	0.080

ASSEMBLY INFORMATION FOR DIE

Die Bonding

Honeywell recommends using a Eutectic Gold/Silicon perform or high temperature conductive adhesive for die bonding to a ceramic package.

Wire Bonding

Aluminum bond wires must be used to achieve high temperature reliability. Wirebond the power and ground pads before the other signal pads.

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DIE LEVEL SCREENING

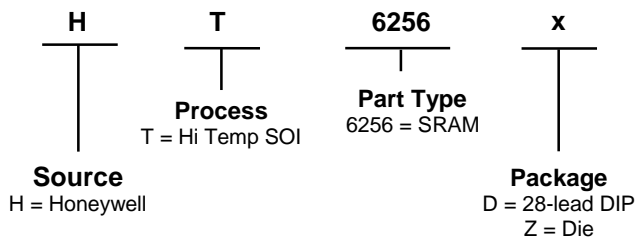
The HT6256 die are specified to operate over the entire temperature range. To meet this objective, three levels of screening are in place.

1. Wafer Level – Each die is 100% electrical tested at room temperature.
2. Sample Package Test – A sample of die from each wafer are assembled into packages and screened over the temperature range of -55C to +225C to verify performance.
3. The sample packaged parts also receive 44 hours of burn-in at 250C.

RELIABILITY

Honeywell understands the stringent reliability requirements for extreme environment systems and has extensive experience in reliability testing on programs of this nature. Reliability attributes of the HTMOS™ process were characterized by testing test structures from which specific failure mechanisms were evaluated. These specific mechanisms included, but were not limited to, hot carriers, electromigration, and time dependent dielectric breakdown. This data was then used to make changes to the design models and process to ensure reliable -55 to +225°C specified products.

ORDER INFORMATION



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