T45-23-13

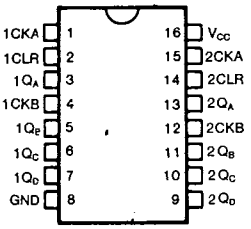
KS54AHCT 390
KS74AHCT 390

Dual 4-Bit Decade Counters

FEATURES

- Individual clock for A and B flip-flops provide dual ÷2 and ÷5 counters
- Direct clear for each 4-bit counter
- Significant improvement in system density through reduced counter package count.
- Function, pin-out, speed and drive compatibility with 54/74ALS logic family
- Low power consumption characteristic of CMOS
- High-Drive-Current outputs: (I_{OL} = 8 mA @ V_{OL} = 0.5V)
- Inputs and outputs interface directly with TTL, NMOS and CMOS devices
- Wide operating voltage range: 4.5V to 5.5V
- Characterized for operation over industrial and military temperature ranges:
  KS74HCTLS: −40°C to +85°C
  KS54HCTLS: −55°C to +125°C
- Package options include plastic "small outline" packages, standard plastic and ceramic 300-mil DIPs

PIN CONFIGURATION



DESCRIPTION

These devices incorporate dual divide-by-two and divide-five counters, which can be used to implement cycle lengths equal to any whole and/or cumulative multiple of 2 and/or 5 up to divide-by-100. When conneoted as a bi-quinary counter, the separate divide-by-two circuit can be used to provide symmetry (a square ware) at the final outpur stage. The '390 incorporates dual divide-by-two and divide-by-five counters, which can be used to implement cycle lengths equal to any whole and/or cumulative multiples of 2 and/or 5 up to divide-by-100. When connected as a bi-quinary counter, the separate divide-by-tow circuit can be used to provide symmetry (a square wave) at the final outpur stage. The '390 has parallel outputs from each counter stage so that any submultiple of the input count frequency is available for system-timing signals.

These devices provide speeds and drive capability equivalent to their ALSTTL counterparts and yet maintain CMOS power levels. The input and output voltage levels allow direct interface with TTL, NMOS and CMOS devices without any external components.

All inputs and outputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

FUNCTION TABLES

BCD COUNT SEQUENCE
(EACH COUNTER)
(See Note A)

COUNT	OUTPUT			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

BIQUINARY (5-2)
(EACH COUNTER)
(See Note B)

COUNT	OUTPUT			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	H	L	L	L
6	H	L	L	H
7	H	L	H	L
8	H	L	H	H
9	H	H	L	L

NOTES A. Output Q_A is connected to input $\overline{CKB}$ for BCD count.
B. Output Q_D is connected to input $\overline{CKA}$ for biquinary count.

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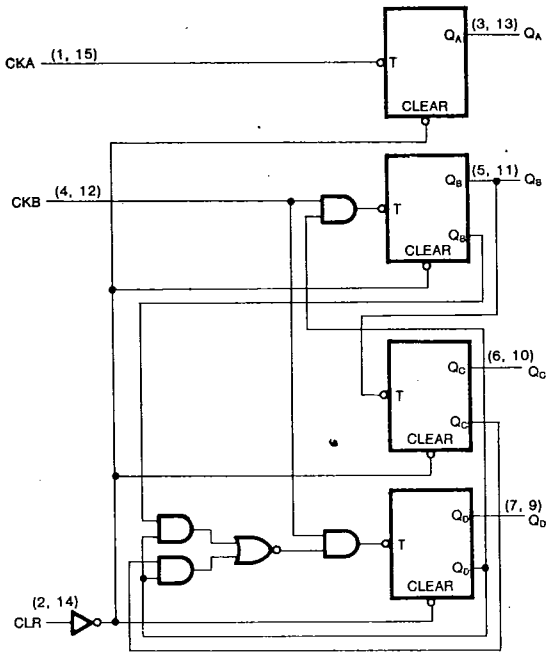
LOGIC DIAGRAM



Absolute Maximum Ratings*

Supply Voltage Range V_{CC}, ... −0.5V to +7V
DC Input Diode Current, I_{IK}
(V_I < −0.5V or V_I > V_{CC} +0.5V) . . . . . ±20 mA
DC Output Diode Current, I_{OK}
(V_O < −0.5V or V_O > V_{CC} +0.5V) . . . . ±20 mA
Continuous Output Current Per Pin, I_O
(−0.5V < V_O < V_{CC} +0.5V) . . . . . ±35 mA
Continuous Current Through
V_{CC} or GND pins . . . . . ±125 mA
Storage Temperature Range, T_{stg} . . . −65°C to +150°C
Power Dissipation Per Package, P_d† . . . . . 500 mW

* Absolute Maximum Ratings are those values beyond which permanent damage to the device may occur. These are stress ratings only and functional operation of the device at or beyond them is not implied. Long exposure to these conditions may affect device reliability.

† Power Dissipation temperature derating:
Plastic Package (N): −12mW/°C from 65°C to 85°C
Ceramic Package (J): −12mW/°C from 100°C to 125°C

Recommended Operating Conditions

Supply Voltage, V_{CC} . . . . . 4.5V to 5.5V
DC Input & Output Voltages*, V_{IN}, V_{OUT} . . 0V to V_{CC}
Operating Temperature
Range KS74AHCT: −40°C to +85°C
KS54AHCT: −55°C to +125°C
Input Rise & Fall Times, t_r, t_f . . . . . Max 500 ns

* Unused inputs must always be tied to an appropriate logic voltage level (either V_{CC} or GND)

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DC ELECTRICAL CHARACTERISTICS (V_{CC}=5V±10% Unless Otherwise Specified)

Characteristic	Symbol	Test Conditions	T_a=25°C	KS74AHCT T_a=−40°C to +85°C	KS54AHCT T_a=−55°C to +125°C	Unit
			Typ	Guaranteed Limits		
Minimum High-Level Input Voltage	V_{IH}			2.0	2.0	2.0	V
Maximum Low-Level Input Voltage	V_{IL}			0.8	0.8	0.8	V
Minimum High-Level Output Voltage	V_{OH}	V_{IN}=V_{IH} or V_{IL} I_O=−20μA I_O=−4mA	V_{CC} 4.2	V_{CC} −0.1 3.98	V_{CC} −0.1 3.84	V_{CC} −0.1 3.7	V
Maximum Low-Level Output Voltage	V_{OL}	V_{IN}=V_{IH} or V_{IL} I_O=20μA I_O=4mA I_O=8mA	0	0.1 0.26 0.39	0.1 0.33 0.5	0.1 0.4	V
Maximum Input Current	I_{IN}	V_{IN}=V_{CC} or GND		±0.1	±1.0	±1.0	μA
Maximum Quiescent Supply Current	I_{CC}	V_{IN}=V_{CC} or GND I_{OUT}=0μA		8.0	80.0	160.0	μA
Additional Worst Case Supply Current	ΔI_{CC}	per input pin V_I=2.4V other inputs: at V_{CC} or GND I_{OUT}=0μA		2.7	2.9	3.0	mA

AC ELECTRICAL CHARACTERISTICS (Input t_r, t_f≤2 ns), AHCT390

Characteristic		Symbol	Conditions†	T_a=25°C V_{CC}=5.0V	KS74AHCT T_a=−40°C to +85°C V_{CC}=5.0V±10%		KS54AHCT T_a=−55°C to +125°C V_{CC}=5.0V± 10%		Unit
				Typ	Min	Max	Min	Max	
Propagation Delay, CKA to Q_A or CKB to Q_B		f_{max}	C_L=50pF	50	30		25		MHz
Propagation Delay, CKA to Q_A		t_{PLH}		9		15		18	ns
		t_{PHL}		9		15		18	ns
Propagation Delay, CKA to Q_C		t_{PLH}		24		40		48	ns
		t_{PHL}		24		40		48	ns
Propagation Delay, CKB to Q_B		t_{PLH}		10		17		21	ns
		t_{PHL}		10		17		21	ns
Propagation Delay, CKB to Q_C		t_{PLH}		16		27		33	ns
		t_{PHL}		16		27		33	ns
Propagation Delay, CKB to Q_D		t_{PLH}		10		17		21	ns
		t_{PHL}		10		17		21	ns
Propagation Delay, CLR to Any Q		t_{PHL}		14		24		29	ns
Pulse Width	CKA or CKB High or Low	t_w		7	12		15		ns
	CLR High			7	12		15		
Minimum Setup Time, CLR inactive before CKA or CKB		t_{SU}		5	8		10		ns
Input Capacitance		C_{IN}		5					pF
Power Dissipation Capocitance		C_{PD}							pF

* C_{PD} determines the no-load dynamic power dissipation: P_D=C_{PD} V_{CC}^2 f + I_{CC} V_{CC}.

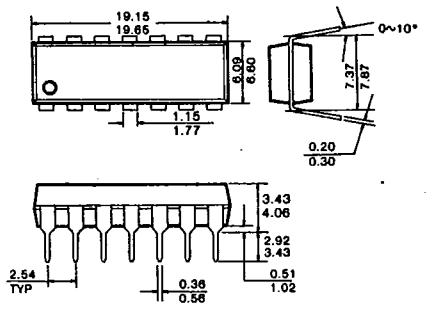
† For AC switching test circuits and timing waveforms see section 2.

PACKAGE DIMENSIONS

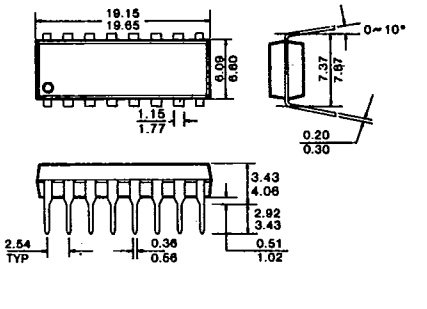
T-90-20

1. PLASTIC PACKAGES

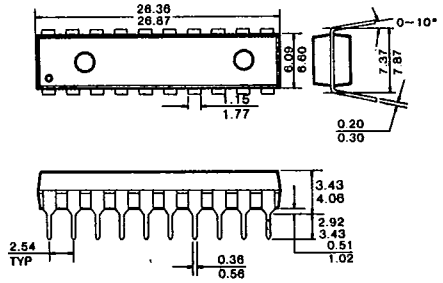
14-Pin Plastic DIP **Units: mm**



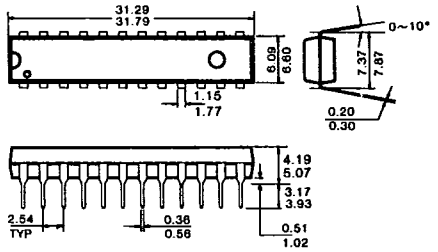
16-Pin Plastic DIP **Units: mm**



20-Pin Plastic DIP **Units: mm**



24-Pin Plastic DIP **Units: mm**



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PACKAGE DIMENSIONS

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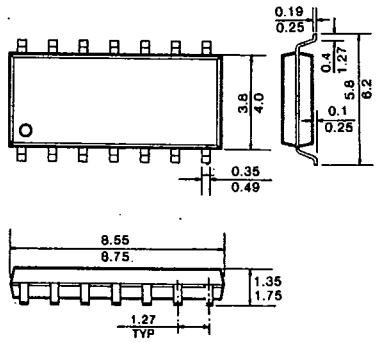
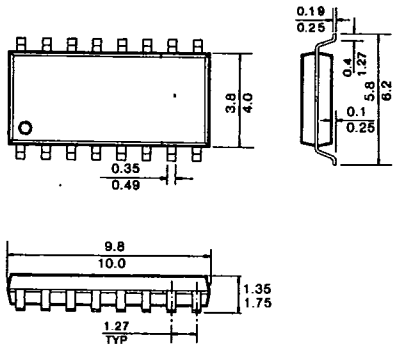
14-Pin SOP

Unit: mm



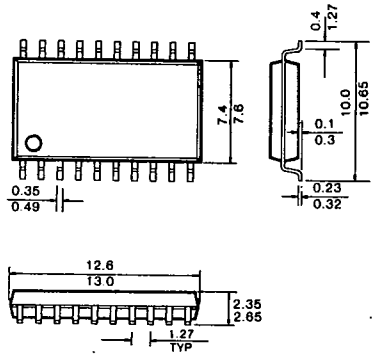
16-Pin SOP

Unit: mm



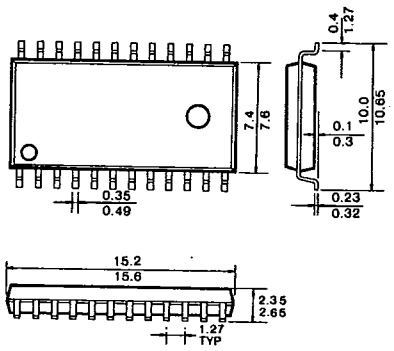
20-Pin SOP

Unit: mm



24-Pin SOP

Unit: mm



PACKAGE DIMENSIONS

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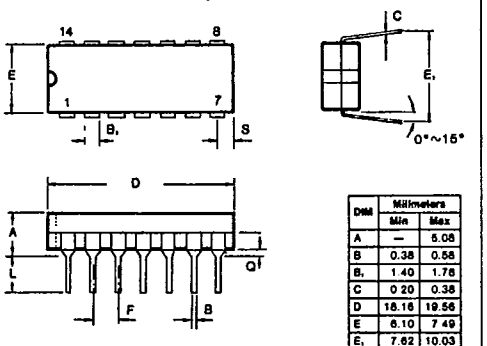
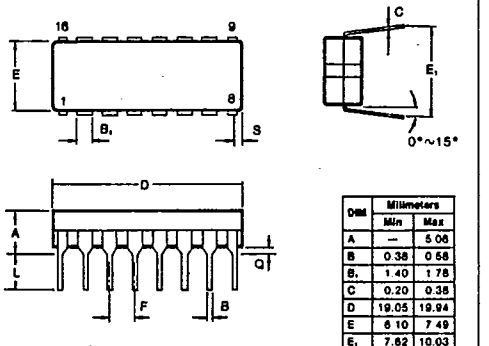
2. CERAMIC PACKAGES

14-Pin Ceramic DIP Units: mm



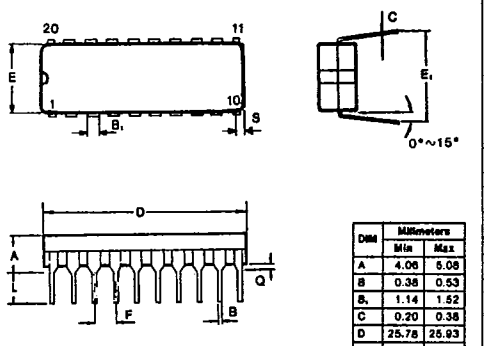
DIM	Millimeters	
	Min	Max
A	—	5.08
B	0.38	0.58
B1	1.40	1.78
C	0.20	0.38
D	18.16	19.56
E	6.10	7.49
E1	7.62	10.03
F	2.54	
L	3.16	4.19
Q	0.51	1.02
S	1.91	2.29

16-Pin Ceramic DIP Units: mm



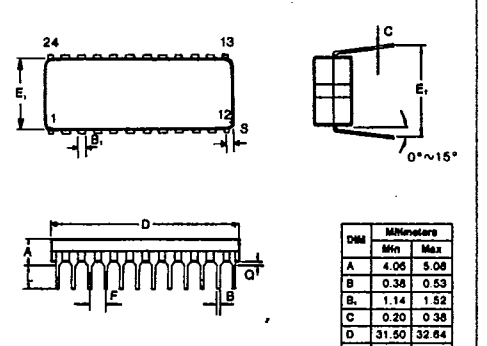
DIM	Millimeters	
	Min	Max
A	—	5.08
B	0.38	0.58
B1	1.40	1.78
C	0.20	0.38
D	19.05	19.94
E	6.10	7.49
E1	7.62	10.03
F	2.54	
L	3.16	4.19
Q	0.51	1.02
S	0.51	1.14

20-Pin Ceramic DIP Units: mm



DIM	Millimeters	
	Min	Max
A	4.06	5.08
B	0.38	0.53
B1	1.14	1.52
C	0.20	0.38
D	25.78	25.93
E	6.10	6.60
E1	7.77	7.98
F	2.54	
L	3.73	4.01
Q	0.38	0.89
S	0.51	1.14

24-Pin Ceramic DIP Units: mm



DIM	Millimeters	
	Min	Max
A	4.06	5.08
B	0.38	0.53
B1	1.14	1.52
C	0.20	0.38
D	31.50	32.64
E	7.24	7.75
E1	7.77	7.98
F	2.54	
L	3.73	4.01
Q	0.508	1.778
S	1.65	1.93

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