

# Quad 3-State Noninverting Buffers

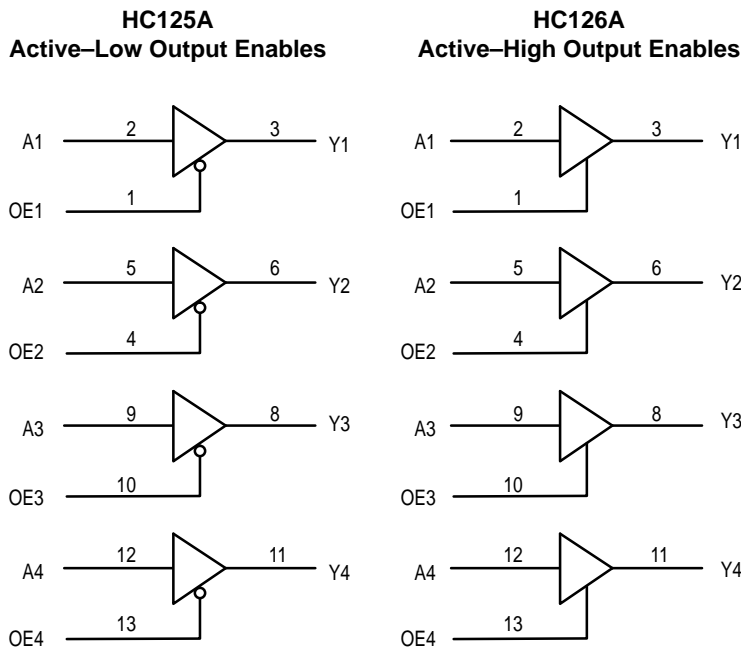
## High-Performance Silicon-Gate CMOS

The MC74HC125A and MC74HC126A are identical in pinout to the LS125 and LS126. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

The HC125A and HC126A noninverting buffers are designed to be used with 3-state memory address drivers, clock drivers, and other bus-oriented systems. The devices have four separate output enables that are active-low (HC125A) or active-high (HC126A).

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 72 FETs or 18 Equivalent Gates

### LOGIC DIAGRAM

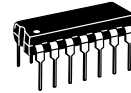


PIN 14 = VCC  
PIN 7 = GND

### FUNCTION TABLE

HC125A			HC126A		
Inputs		Output	Inputs		Output
A	OE	Y	A	OE	Y
H	L	H	H	H	H
L	L	L	L	H	L
X	H	Z	X	L	Z

# MC74HC125A MC74HC126A



**N SUFFIX**  
14-LEAD PLASTIC DIP PACKAGE  
CASE 646-06



**D SUFFIX**  
14-LEAD PLASTIC SOIC PACKAGE  
CASE 751A-03

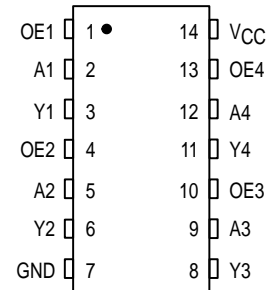


**DT SUFFIX**  
14-LEAD PLASTIC TSSOP PACKAGE  
CASE 948G-01

### ORDERING INFORMATION

MC74HCXXXAN Plastic  
MC74HCXXXAD SOIC  
MC74HCXXXADT TSSOP

### PIN ASSIGNMENT



# MC74HC125A MC74HC126A

## MAXIMUM RATINGS\*

Symbol	Parameter	Value	Unit	
$V_{CC}$	DC Supply Voltage (Referenced to GND)	- 0.5 to + 7.0	V	
$V_{in}$	DC Input Voltage (Referenced to GND)	- 0.5 to $V_{CC} + 0.5$	V	
$V_{out}$	DC Output Voltage (Referenced to GND)	- 0.5 to $V_{CC} + 0.5$	V	
$I_{in}$	DC Input Current, per Pin	$\pm 20$	mA	
$I_{out}$	DC Output Current, per Pin	$\pm 35$	mA	
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	$\pm 75$	mA	
$P_D$	Power Dissipation in Still Air	Plastic DIP† SOIC Package† TSSOP Package†	750 500 450	mW
$T_{stg}$	Storage Temperature	- 65 to + 150	°C	
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP, SOIC or TSSOP Package)	260	°C	

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

\* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.  
 † Derating — Plastic DIP: - 10 mW/°C from 65° to 125°C  
 SOIC Package: - 7 mW/°C from 65° to 125°C  
 TSSOP Package: - 6.1 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit	
$V_{CC}$	DC Supply Voltage (Referenced to GND)	2.0	6.0	V	
$V_{in}, V_{out}$	DC Input Voltage, Output Voltage (Referenced to GND)	0	$V_{CC}$	V	
$T_A$	Operating Temperature, All Package Types	- 55	+ 125	°C	
$t_r, t_f$	Input Rise and Fall Time (Figure 1)	$V_{CC} = 2.0 \text{ V}$ $V_{CC} = 4.5 \text{ V}$ $V_{CC} = 6.0 \text{ V}$	0 0 0	1000 500 400	ns

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	$V_{CC}$ V	Guaranteed Limit			Unit	
				- 55 to 25°C	$\leq 85^\circ\text{C}$	$\leq 125^\circ\text{C}$		
$V_{IH}$	Minimum High-Level Input Voltage	$V_{out} = V_{CC} - 0.1 \text{ V}$ $ I_{out}  \leq 20 \mu\text{A}$	2.0	1.5	1.5	1.5	V	
			3.0	2.1	2.1	2.1		
			4.5	3.15	3.15	3.15		
			6.0	4.2	4.2	4.2		
$V_{IL}$	Maximum Low-Level Input Voltage	$V_{out} = 0.1 \text{ V}$ $ I_{out}  \leq 20 \mu\text{A}$	2.0	0.5	0.5	0.5	V	
			3.0	0.9	0.9	0.9		
			4.5	1.35	1.35	1.35		
			6.0	1.8	1.8	1.8		
$V_{OH}$	Minimum High-Level Output Voltage	$V_{in} = V_{IH}$ $ I_{out}  \leq 20 \mu\text{A}$	2.0	1.9	1.9	1.9	V	
			4.5	4.4	4.4	4.4		
			6.0	5.9	5.9	5.9		
			$V_{in} = V_{IH}$ $ I_{out}  \leq 3.6 \text{ mA}$	3.0	2.48	2.34		2.2
			$ I_{out}  \leq 6.0 \text{ mA}$	4.5	3.98	3.84		3.7
			$ I_{out}  \leq 7.8 \text{ mA}$	6.0	5.48	5.34		5.2
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{in} = V_{IL}$ $ I_{out}  \leq 20 \mu\text{A}$	2.0	0.1	0.1	0.1	V	
			4.5	0.1	0.1	0.1		
			6.0	0.1	0.1	0.1		
			$V_{in} = V_{IL}$ $ I_{out}  \leq 3.6 \text{ mA}$	3.0	0.26	0.33		0.4
			$ I_{out}  \leq 6.0 \text{ mA}$	4.5	0.26	0.33		0.4
			$ I_{out}  \leq 7.8 \text{ mA}$	6.0	0.26	0.33		0.4

**DC ELECTRICAL CHARACTERISTICS** (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit
				- 55 to 25°C	≤ 85°C	≤ 125°C	
I <sub>in</sub>	Maximum Input Leakage Current	V <sub>in</sub> = V <sub>CC</sub> or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I <sub>OZ</sub>	Maximum Three-State Leakage Current	Output in High-Impedance State V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>out</sub> = V <sub>CC</sub> or GND	6.0	± 0.5	± 5.0	± 10	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per Package)	V <sub>in</sub> = V <sub>CC</sub> or GND I <sub>out</sub> = 0 μA	6.0	4.0	40	160	μA

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

**AC ELECTRICAL CHARACTERISTICS** (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

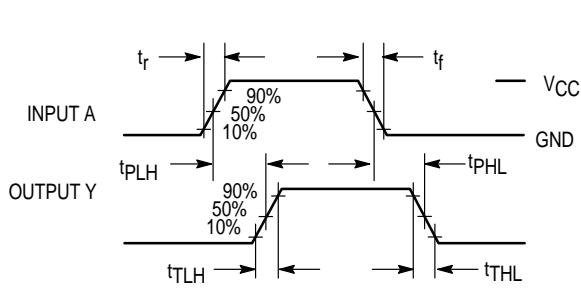
Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			- 55 to 25°C	≤ 85°C	≤ 125°C	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input A to Output Y (Figures 1 and 3)	2.0 3.0 4.5 6.0	90 36 18 15	115 45 23 20	135 60 27 23	ns
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Propagation Delay, Output Enable to Y (Figures 2 and 4)	2.0 3.0 4.5 6.0	120 45 24 20	150 60 30 26	180 80 36 31	ns
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Propagation Delay, Output Enable to Y (Figures 2 and 4)	2.0 3.0 4.5 6.0	90 36 18 15	115 45 23 20	135 60 27 23	ns
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 1 and 3)	2.0 3.0 4.5 6.0	60 22 12 10	75 28 15 13	90 34 18 15	ns
C <sub>in</sub>	Maximum Input Capacitance	—	10	10	10	pF
C <sub>out</sub>	Maximum Three-State Output Capacitance (Output in High-Impedance State)	—	15	15	15	pF

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

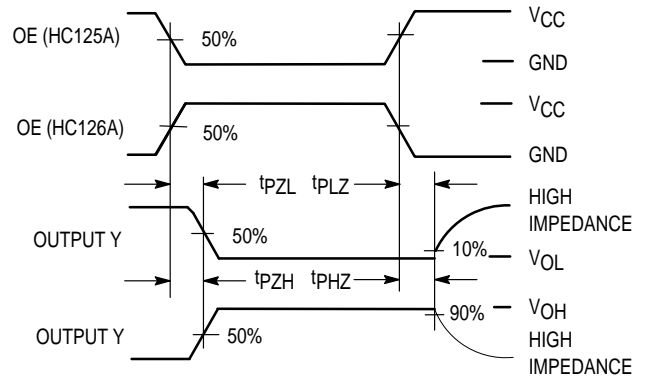
CPD	Power Dissipation Capacitance (Per Buffer)*	Typical @ 25°C, V <sub>CC</sub> = 5.0 V		pF
		30		

\* Used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup>f + I<sub>CC</sub> V<sub>CC</sub>. For load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

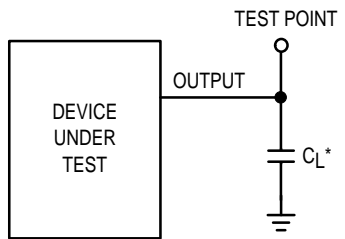
**SWITCHING WAVEFORMS**



**Figure 1.**

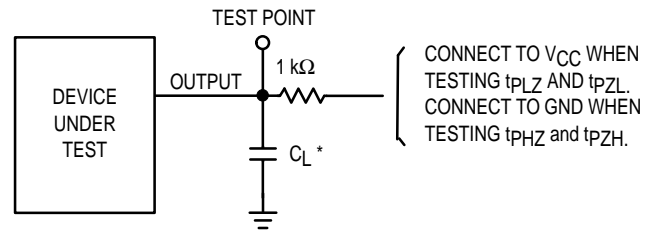


**Figure 2.**



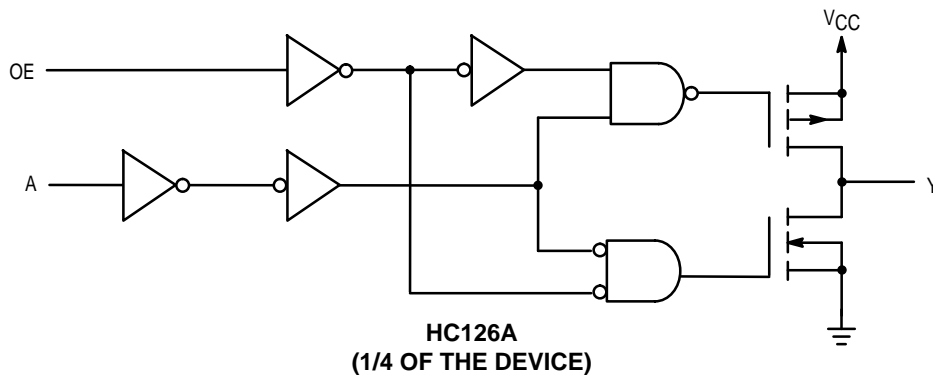
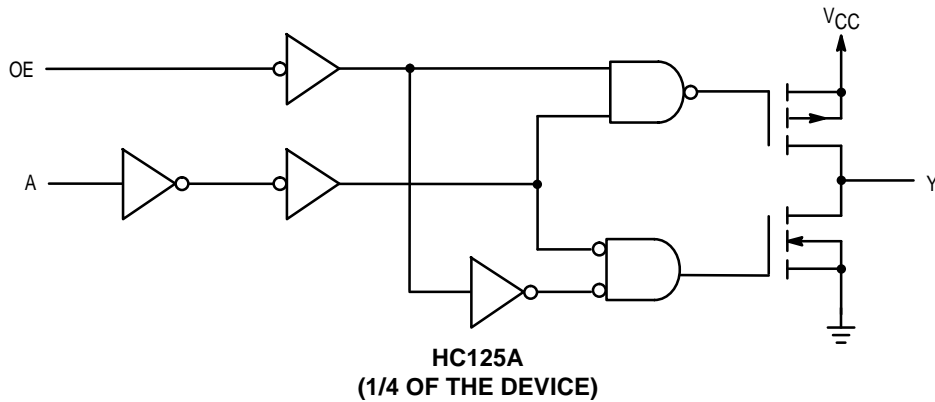
\* Includes all probe and jig capacitance

**Figure 3. Test Circuit**



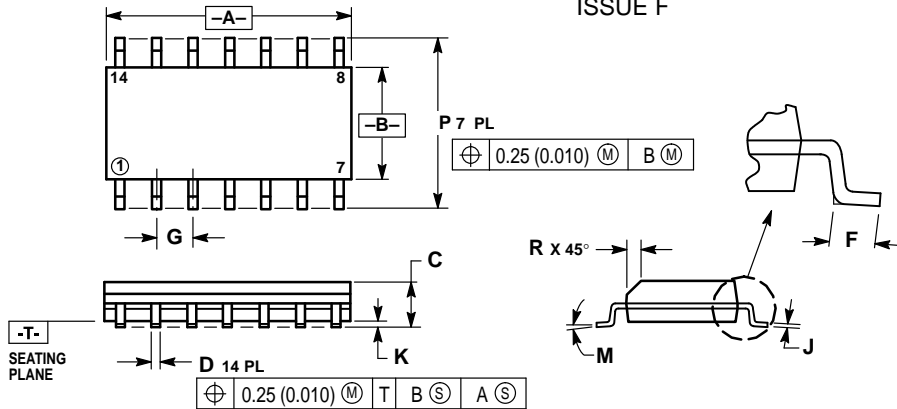
\* Includes all probe and jig capacitance

**Figure 4. Test Circuit**



OUTLINE DIMENSIONS

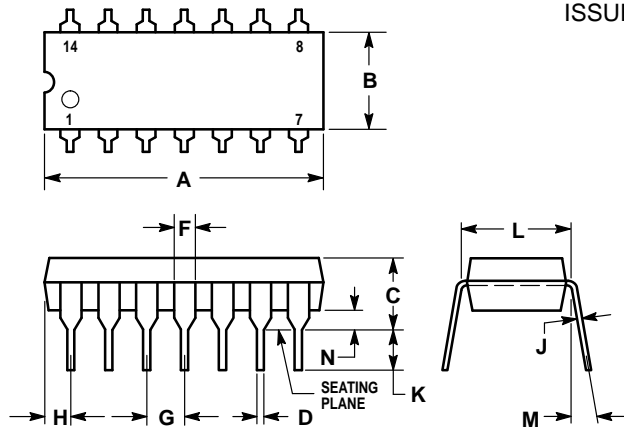
**D SUFFIX**  
 PLASTIC SOIC PACKAGE  
 CASE 751A-03  
 ISSUE F



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

**N SUFFIX**  
 PLASTIC DIP PACKAGE  
 CASE 646-06  
 ISSUE L

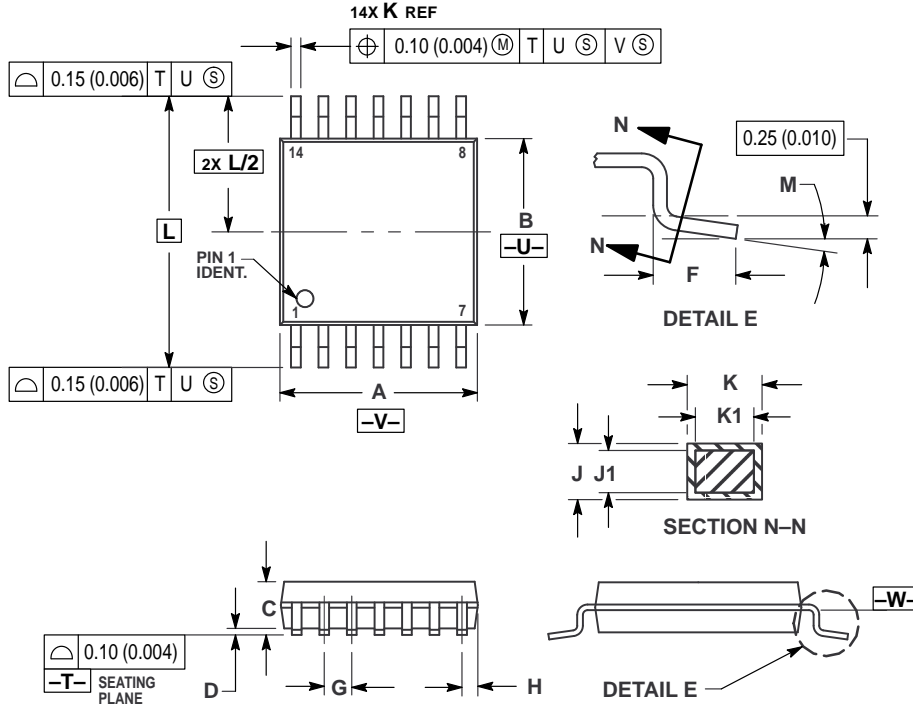


- NOTES:
1. LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
  4. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	19.56
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.300 BSC		7.62 BSC	
M	0°	10°	0°	10°
N	0.015	0.039	0.39	1.01

OUTLINE DIMENSIONS

DT SUFFIX  
 PLASTIC TSSOP PACKAGE  
 CASE 948G-01  
 ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
  5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
  6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	—	1.20	—	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

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