P863

RUGGEDISED VIDICON

Service Type CV6243

INTRODUCTION

The P863 is a short, rugged 1-inch vidicon of separate mesh construction with magnetic deflection and focusing, designed for special applications involving severe shock and vibration. This very sensitive vidicon features a separate mesh electrode and a very uniform target layer, resulting in good signal uniformity over a wide range of signal electrode voltages. It has a low power (0.6 watt) heater and differs from the P831 mainly in the mesh connection, which is brought out to a ring contact near the faceplate instead of to the 8-pin base (see outline drawing).

When operated with high voltages on grid 3 and the mesh, higher and more uniform resolution and improved signal uniformity are obtained over a wide range of signal electrode voltage than may be obtained using standard vidicons. Limiting resolutions in the region of 1000 TV lines may be obtained in the centre of the picture when the tube is operated under these conditions, optimum resolution being achieved when the grid 3 voltage is 0.6 to 0.7 of the mesh voltage.

The high sensitivity and low lag properties of the P863 photoconductive surface allow it to be used under lighting conditions encountered in special industrial and military applications. The uniformity of the layer enables uniform dark current and improved uniformity of sensitivity over the scanned area to be obtained provided that suitable associated deflecting and focusing components are used.

GENERAL DATA

Electrical

Cathode	indirectly heated, oxide coated	
Heater voltage	6.3	V
Heater current	95	mA
Inter-electrode capacitance, signal electrode to all other electrodes (average value) (see note 1)	5.0	pF
Spectral response	see spectral sensitivity curve	
Focusing method	magnetic	
Deflection method	magnetic	
Magnetic fields:		
focusing field, at centre of focusing device (see note 2)	37 to 56	gauss
alignment field, adjustable	0 to 4	gauss

Mechanical

Overall length	5.180 inches (131.6mm) max
Overall diameter	1.135 inches (28.9mm) max
Useful size of rectangular image; diagonal, centrally situated	0.63 inches (15.9mm) max
Orientation	The horizontal scan should be parallel to the plane passing through the tube axis and the blank key-pin position. The masking is for orientation only and does not define the proper scanned area.
Net weight	2 ounces (60g) approx
Mounting position (see note 3)	any
Base	small button ditetrar 8-pin (JEDEC no. E8-11)
Mating socket	Type R41-79502 by United Carr Fasteners Ltd. (or equivalent)

Storage

Recommended store temperature	15 to 35	°C

Tubes should be stored in darkness.

WARNING

When operating a tube the following precautions should be observed:

1. Ensure that the temperature of the tube is within its recommended range.
2. Avoid over exposure of stationary pictures, e.g. test patterns, or after-image may result.
3. A surge limiting device must be incorporated if necessary to ensure that the heater current does not exceed 150mA when switching on or at any other time.
4. Ensure that the envelope between the signal electrode and mesh contacts is clean.

MAXIMUM AND MINIMUM RATINGS (Absolute values)

No individual rating to be exceeded.

	Min	Max	
Heater voltage	5.7	6.9	V
Signal electrode voltage	—	100	V
Grid 4 (mesh) voltage (see note 4)	—	1000	V
Grid 3 (beam focus) voltage (see note 4)	—	1000	V
Grid 2 (accelerator) voltage	—	750	V

Continued on page 3

MAXIMUM AND MINIMUM RATINGS (Absolute values) — continued

	Min	Max	
Grid 1 voltage:			
negative bias value	—	300	V
positive bias value	—	0	V
Blanking voltage, peak to peak (see note 5):			
when applied to grid 1 (negative pulses)	40	—	V
when applied to cathode (positive pulses)	20	—	V
Peak heater to cathode voltage:			
heater negative with respect to cathode	—	125	V
heater positive with respect to cathode	—	10	V
Dark current	—	0.25	μA
Peak signal electrode current (see note 6)	—	0.55	μA
Faceplate temperature	—	71	°C
Peak illumination of faceplate	—	1000	ft-candles
	—	10 760	lux

TYPICAL OPERATION

Operating Conditions (for scanned area of 0.5 x 0.375 inch)

The following values and notes are for general guidance and may vary from tube to tube.

	Low Voltage Operation	High Voltage Operation	
Grid 4 (mesh) voltage (see note 4)	500	750	V
Grid 3 (beam focus) voltage (approx) (see notes 4 and 7)	300	450	V
Grid 2 (accelerator) voltage	300	300	V
Grid 1 voltage for picture cut-off (with no blanking voltage on grid 1)	−45 to −100	−45 to −100	V
Blanking voltage, peak to peak:			
when applied to grid 1 (negative pulses)	75	75	V
when applied to cathode (positive pulses)	20	20	V
Field strength at centre of focusing coil (see notes 2, 7 and 8)	41 ± 4	52 ± 4	gauss
Alignment field, adjustable (see notes 9 and 10)	0 to 4	0 to 4	gauss
Faceplate temperature (see note 11)	30 to 35	30 to 35	°C

Typical Performance	**Low Voltage**	**High Voltage**	
Limiting resolution at centre of picture (approx)	900	1000	TV lines
Amplitude response to a 400 TV line square wave test pattern at centre of picture (approx)	60	70	%
Lag (see note 12)	20		% max
'Gamma' of transfer characteristic for signal output between 0.02 and 0.2μA	0.5 to 0.6		
Visual equivalent signal to noise ratio (see note 13)	300:1		approx

	Condition				
	1*	**2†**	**3‡**	**4⊕**	
Faceplate illumination (highlights) (see note 18)	0.1	0.5	1.0	5.0	ft-candles
Signal output current (peak) (see note 19):					
typical	0.14	0.27	0.20	0.25	μA
minimum	—	—	0.15	—	μA
Approximate range of signal electrode voltage (see note 20)	35–70	30–60	20–40	10–40	V
Dark current (see note 21)	0.2	0.1	0.02	<0.02	μA

* See note 14 † See note 15 ‡ See note 16 ⊕ See note 17

SPECIAL PERFORMANCE

Tubes of this type have been successfully submitted to a type approval programme including the following environmental tests.

1. Thermal shock
2. Rapid depressurisation
3. Tropical exposure
4. Long term storage at elevated temperature (70°C)
5. Mechanical shock
6. Combined temperature, pressure and vibration
7. Random noise vibration

It may be possible, from the results of these tests to predict the probable performance of the tube under various environmental conditions.

If it is proposed to use the tubes under conditions of severe vibration etc., the manufacturer may be able to advise as to the performance to be expected.

SEQUENCE OF CAMERA ADJUSTMENTS

(For Typical Operating Conditions as shown on page 3)

(a) Set the grid 1 voltage for the maximum negative bias for picture cut-off and apply the other voltages given under Typical Operating Conditions.

(b) Check that the deflection circuits are functioning properly and adjust the scanning amplitude controls so that a maximum area of the photoconductive layer will be scanned.

(c) Set the signal electrode voltage to give the signal current specified for the particular condition of operation. The table on page 4 gives an indication of the ranges of signal electrode voltage required for four conditions of operation. For other conditions of operation, reference should be made to the light transfer characteristic and the graph showing the range of signal electrode voltage to produce a given dark current and therefore a given sensitivity. It is preferable, if possible, to adjust the dark current to the specified value for the particular condition of operation; P863 tubes will have substantially identical performances when operated with identical values of dark current.

The magnitude of non-uniformities of dark current, as well as lag, tend to increase with signal electrode voltage; therefore operation at low values of signal electrode voltage helps to minimise these effects.

(d) Decrease grid 1 voltage from its maximum negative value until a signal is produced.

(e) Adjust grid 3 (beam focus) or grid 3 and grid 4 (mesh) voltages, the lens stop and the optical focus alternately to obtain the best focused picture with the peak signal output current specified under Typical Performance.

(f) Adjust the lens aperture and signal electrode voltage to produce the desired output signal. Lag decreases with increase in illumination on the faceplate.

(g) Adjust the alignment field so that the centre of the picture does not move as grid 3 (beam focus) and grid 4 (mesh) voltages are rocked slightly. Adjust grid 1 (beam current) voltage to provide sufficient beam to just discharge the highlights. It is permissible to set the alignment fields slightly off the minimum movement position to maintain signal uniformity.

(h) Adjust the deflection amplitude and position to scan an area 0.500 inch x 0.375 inch. This is facilitated by the use of a perspex mask inscribed with circles 0.500 inch and 0.375 inch diameter, placed in contact and

concentric with the faceplate of the tube. Light is allowed to fall on the photoconductive layer and an image of the rings is obtained on the monitor. No lens is necessary. The scan amplitude and centring controls are adjusted until the diameter of the larger circle is equal to the width of the raster and that of the smaller equal to the height.

(j) Centre the raster in the useful area of the photoconductive layer and check the alignment (step g).

(k) If the picture is faint, even with adequate video gain, open the lens iris more and, if necessary, increase the signal electrode voltage.

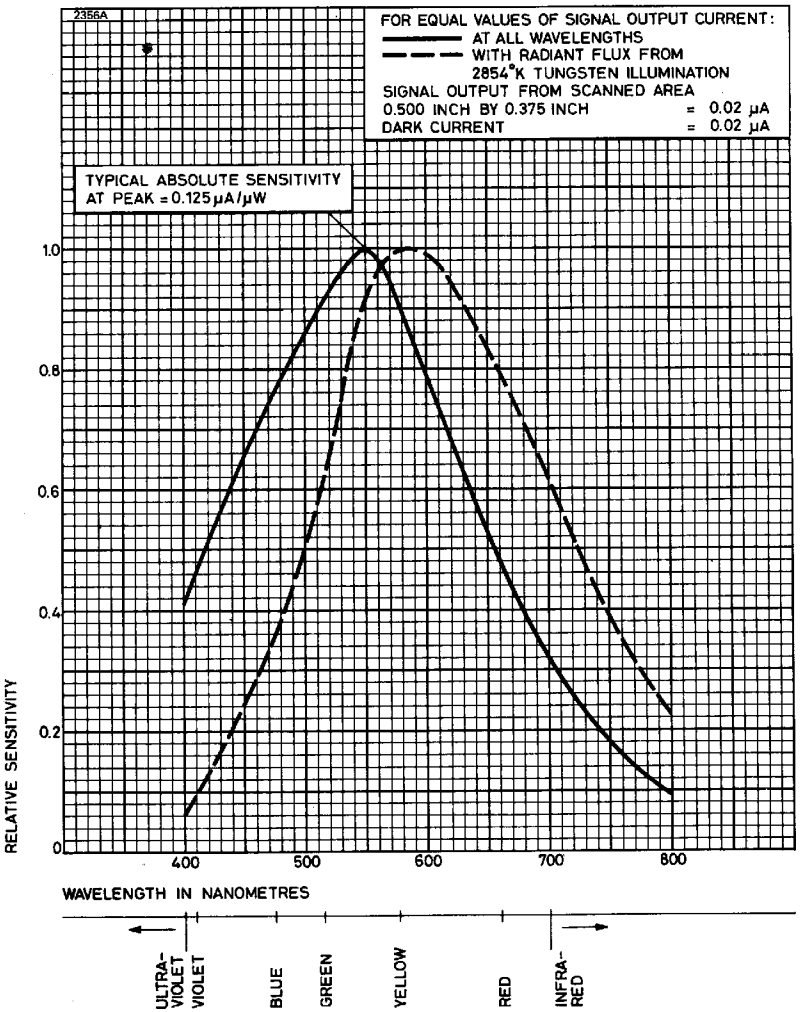
(l) Repeat steps (e) to (g) until optimum picture reproduction is obtained.

NOTES

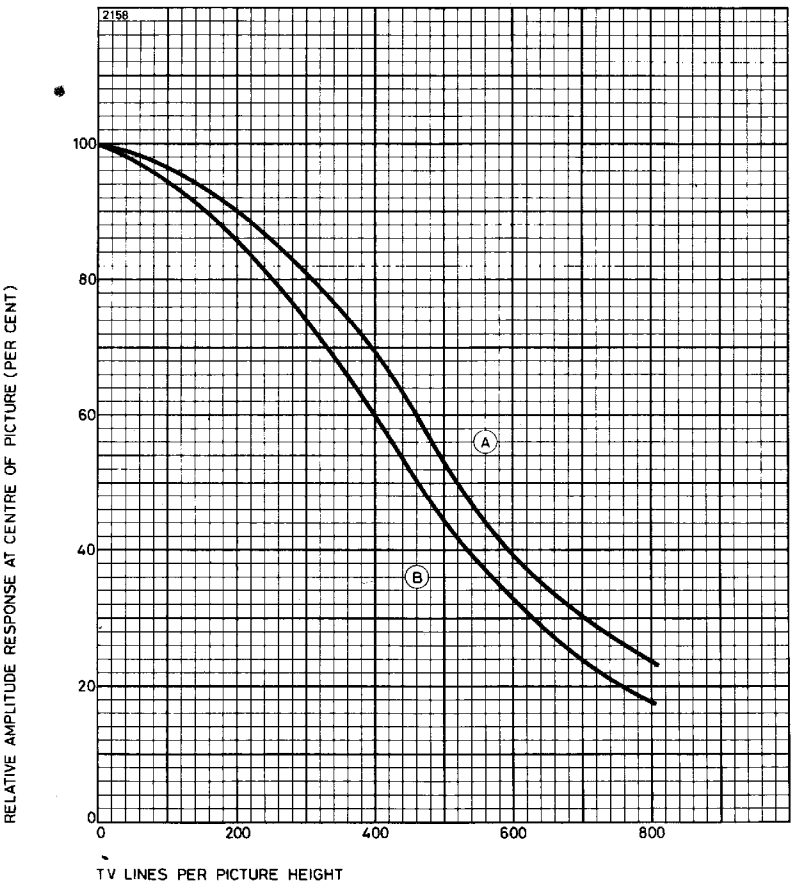
1. This capacitance, which in effect forms the output impedance of the tube, is increased when the tube is mounted in a deflecting yoke and focusing coil assembly. The resistive component of the output impedance is of the order of 100 megohms.
2. The direction of the focusing current should be such that a north pole is attracted to the image end of the focusing coil.
3. When subjected to vibration the tube should not be displaced with respect to the focus, deflection and alignment fields.
4. Grid 3 and grid 4 voltages are adjusted for the best focus. The resolution, uniformity of focus and picture quality decrease with decreasing grid 3 and grid 4 voltage. In general grid 3 should be operated above 250 volts and be approximately 0.6 of grid 4 voltage.
5. The blanking voltage required when applied to the cathode is less than that required when applied to grid 1 as the former reduces the potential difference between the cathode and the scanned side of the target.
6. The video amplifier must be designed to handle signal currents of this magnitude, to avoid picture distortion due to overloading of the amplifier.
7. It may be preferred to adjust beam focus by varying the focus coil current to obtain the field strengths indicated in the Typical Operating Conditions. If the focus coil field strength is fixed, beam focus may be obtained within a $\pm 10\%$ range (approximately) of the grid 3 and grid 4 voltages. The ratio of 0.6 between grid 3 and grid 4 should be maintained as these voltages are varied.
8. Use a deflection yoke, focusing coil and alignment coil which have been approved for operation under specified conditions of shock and vibration.

9. Adjust the current through the alignment coils until the centre of the test pattern does not move as grid 3 and grid 4 voltages or the focus coil current are varied in and out of focus.
10. The alignment coil should be located so that its centre is 3.69 inches from the faceplate of the tube. Its axis should be coincident with the axis of the tube, the deflecting yoke and the focusing coil.
11. Unless the temperature of the faceplate is maintained at a constant value within this range, the dark current and performance will drift from the optimum performance established on initial setting up.
12. Percentage of initial value of signal output current remaining 3 field periods after light is cut off (i.e. 50ms in American standard systems and 60ms in European systems) with a faceplate illumination of 2ft-candles and a total signal current of 0.3μA.
13. Measured with a high gain, low noise, cascode type pre-amplifier having a bandwidth of 5.1MHz and a peak signal output current of 0.35μA. The visual equivalent signal to noise ratio is taken as the ratio of the highlight signal output current to the r.m.s. noise current, multiplied by a factor of 3 (ref. Otto H. Schade, 'Electro-optical Characteristics of Television Systems; Introduction and Part 1 — Characteristics of Vision and Visual Systems', RCA Review, March 1948).
14. Maximum sensitivity operation.
15. Intermediate sensitivity operation.
16. Average sensitivity operation.
17. High light level operation.
18. For example, a scene brightness of approximately 430 ft-lamberts with lens aperture f/4 and a transmission of 75% produces 5 foot candles illumination on the faceplate.
19. The signal output current is the highlight signal electrode current during one frame after the dark current component has been subtracted. Signal currents higher than 0.25μA may be used depending on requirements.
20. The signal electrode voltage for each tube is adjusted to that value which gives the desired operating signal current; the indicated range of signal electrode voltage for each operational condition is given to illustrate the variation normally encountered.
21. The deflecting circuits must provide extremely linear scanning for good black level reproduction under these conditions. Dark current is proportional to the scanning velocity. Any change in scanning velocity produces a black level error in direct proportion to the change in velocity of scanning.

TYPICAL SPECTRAL SENSITIVITY CHARACTERISTIC



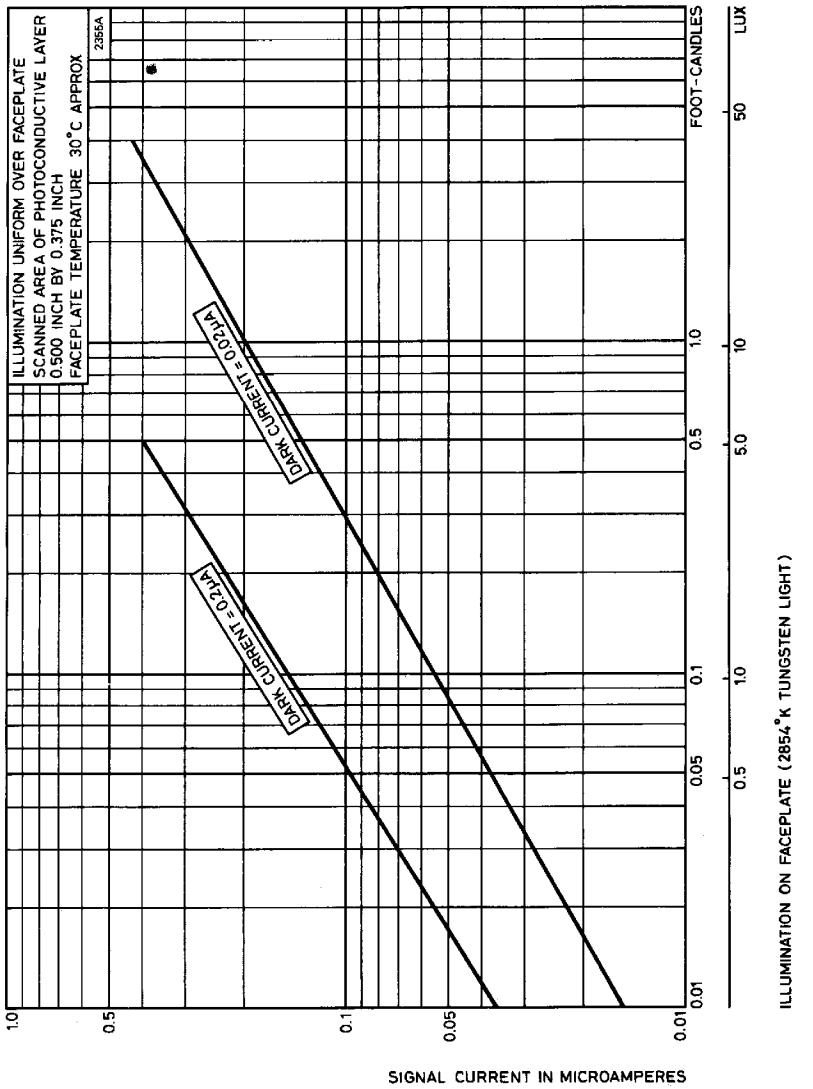
TYPICAL RESOLUTION



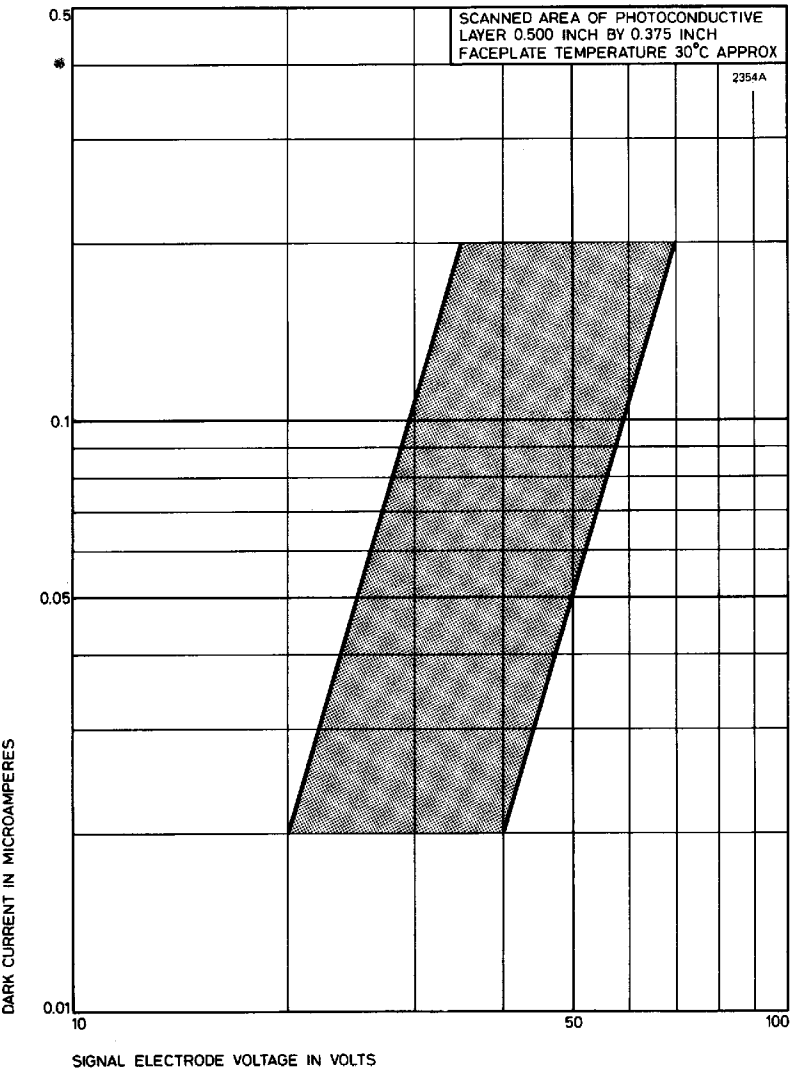
	Curve A	Curve B	
Grid 4 voltage	750	500	V
Grid 3 voltage	450	300	V
Focus field	52	41	gauss
Highlight signal output current	0.35	0.35	μA
Dark current	0.02	0.02	μA
Test pattern	square wave resolution wedge transparency		

Measured on a camera incorporating Cleveland Electronics deflection yoke VY-111-3, focusing coil VF-115-12 and alignment coil VA-118, the channel having a flat response and adequate bandwidth.

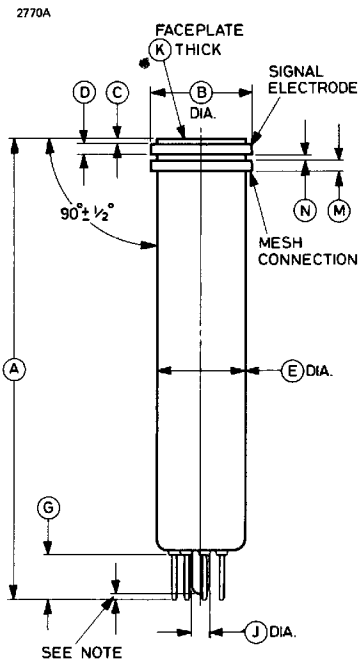
TYPICAL LIGHT TRANSFER CHARACTERISTICS

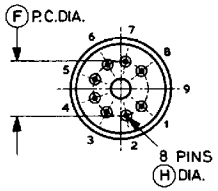


TYPICAL RANGE OF DARK CURRENT



OUTLINE (All dimensions without limits are nominal)





Pin	Element
1	Heater
2	Grid 1
3	No connection
4	Internal connection. Do not use
5	Grid 2
6	Grid 3 (beam focus)
7	Cathode
8	Heater
9	Key pin position, blank

Note The seal-off will not project beyond the pins.

Ref	Inches	Millimetres
A	5.120 ± 0.060	130.0 ± 1.5
B	1.125 ± 0.010	28.58 ± 0.25
C	0.050 max	1.27 max
D	0.125 ± 0.002	3.175 ± 0.051
E	$1.020^{+0.030}_{-0.035}$	$25.91^{+0.76}_{-0.89}$
F	0.600	15.24
G	0.503 max	12.78 max
H	$0.050^{+0.002}_{-0.004}$	$1.270^{+0.051}_{-0.102}$
J	0.265 max	6.73 max
K	0.093 ± 0.005	2.36 ± 0.13
M	0.125 ± 0.002	3.175 ± 0.051
N	0.050	1.27

Millimetre dimensions have been derived from inches.

* P863, page 12