e2v technologies

MG4004
X-Band Magnetron

The data should be read in conjunction with the Magnetron Preamble.

ABRIDGED DATA

Compact, rugged, lightweight, fixed frequency pulse magnetron with very low levels of unwanted emissions.

Operating frequency	9410 ± 30 MHz
Typical peak output power	4.0 kW
Magnet	integral
Cooling	conduction and natural

GENERAL

Electrical

Cathode	indirectly heated
Heater voltage (see note 1)	6.3 V
Heater current at 6.3 V (see note 2)	0.55 A
Cathode pre-heating time (minimum) (see note 3)	60 s
Input capacitance	8.0 pF max
Temperature coefficient of frequency	see note 4

Mechanical

Overall dimensions	see outline
Net weight	250 g approx
Mounting position	any
Output	no. 16 waveguide
Coupler	IEC UBR100

A minimum clearance of 25 mm must be maintained between the magnetron and any magnetic materials.

A clearance of at least 50 mm is needed to prevent mutual attraction between magnetrons when removed from protective packaging.

Cooling . . . . . conduction and natural

MAXIMUM AND MINIMUM RATINGS
(Absolute values)

These ratings cannot necessarily be used simultaneously, and no individual rating should be exceeded.

	Min	Max	
Heater voltage (see note 1)	5.7	6.9	V
Heater starting current (peak)	–	3.0	A
Anode voltage (peak)	3.4	3.9	kV
Anode current (peak)	2.0	4.0	A
Input power (mean) (see note 5)	–	25	W
Duty cycle	–	0.0025	
Pulse duration	–	2.5	µs
Rate of rise of voltage pulse (see notes 6 and 7)	–	100	kV/µs
VSWR at the output coupler	–	1.5:1	
Anode temperature	−55	120	°C

TYPICAL OPERATION

Operating Conditions

Heater voltage (for operation)	6.3	V
Anode current (peak)	3.0	A
Pulse duration	1.0	µs
Pulse repetition rate	1000	pps
Rate of rise of voltage pulse	40	kV/µs

Typical Performance

Anode voltage (peak)	3.7	kV
Output power (peak)	4.0	kW
Output power (mean)	4.0	W

TEST CONDITIONS AND LIMITS

The magnetron is tested to comply with the following electrical specification.

Test Conditions

Heater voltage (for test)	6.3	V
Anode current (mean)	3.0	mA
Duty cycle	0.001	
Pulse duration (see note 8)	1.0	µs
VSWR at the output coupler	1.15:1	max
Rate of rise of voltage pulse (see note 6):		
using hard tube pulser	100	kV/µs min
alternatively using line type pulser	50	kV/µs min

Limits

	Min	Max	
Anode voltage (peak) (see note 9)	3.5	3.8	kV
Output power (mean)	3.6	–	W
Frequency (see note 10)	9380	9440	MHz
RF bandwidth at $^1/_4$ power (see note 11)	–	2.5	MHz
Frequency pulling (VSWR not less than 1.5:1) (see note 11)	–	30	MHz
Stability (see note 12)	–	0.1	%
Heater current	see note 2		

LIFE TEST

The quality of all production is monitored by the random selection of tubes which are then life-tested under the above Test Conditions. If the tube is to be operated under conditions other than those specified herein, e2v technologies should be consulted to verify that the life of the magnetron will not be impaired.

End of Life Criteria
(Under the above Test Conditions)

Anode voltage (peak)	3.4 to 3.9	kV
Output power (mean)	3.4	W min
RF bandwidth at $^1/_4$ power	3.5	MHz max
Frequency	9350 to 9440	MHz

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NOTES

1. No reduction of heater voltage is required at any value of mean input power. For optimum performance a value within the specified ratings must be maintained.

   The magnetron heater must be protected against arcing by the use of a minimum capacitance of 4000 pF shunted across the heater directly at the input terminals; in some cases a capacitance as high as 2 μF may be necessary depending on the equipment design. For further details see the Magnetron Preamble.
2. Measured with heater voltage of 6.3 V and no anode input power, the heater current limits are 0.5 A minimum, 0.6 A maximum.
3. For ambient temperatures above 0 °C. For ambient temperatures between 0 and −55 °C, cathode pre-heating time is 75 seconds minimum.
4. Design test only. The maximum frequency change with anode temperature change (after warming) is −0.25 MHz/°C.
5. The various parameters are related by the following formula:

   $Pi = i_{apk} \times v_{apk} \times Du$

   where Pi = mean input power in watts

   i_{apk} = peak anode current in amperes

   v_{apk} = peak anode voltage in volts

   and Du = duty cycle.
6. Defined as the steepest tangent to the leading edge of the voltage pulse above 80% amplitude. Any capacitance in the viewing system must not exceed 6.0 pF.
7. The maximum rate of rise of voltage for stable operation depends upon detailed characteristics of the applied pulse and the pulser design. The specified maximum rating applies to typical hard tube pulsers. For minimum starting jitter and optimum operation, the recommended rate of rise of voltage for most line type pulsers is from 30 to 50 kV/μs.
8. Tolerance ± 10%.
9. Measurements taken 'as read' using suitably calibrated equipment.
10. Measured at factory ambient. Anode temperature 40 °C approx.
11. Design test only.
12. Design test only. With the magnetron operating into a VSWR of 1.15:1 over a peak anode current range of 2.0 to 4.0 A. Pulses are defined as missing when the RF energy level is less than 70% of the normal energy level in a 0.5% frequency range. Missing pulses are expressed as a percentage of the number of input pulses applied during a two minute period of observation.

HEALTH AND SAFETY HAZARDS

e2v technologies magnetrons are safe to handle and operate, provided that the relevant precautions stated herein are observed. e2v technologies does not accept responsibility for damage or injury resulting from the use of electronic devices it produces. Equipment manufacturers and users must ensure that adequate precautions are taken. Appropriate warning labels and notices must be provided on equipments incorporating e2v technologies devices and in operating manuals.

High Voltage

Equipment must be designed so that personnel cannot come into contact with high voltage circuits. All high voltage circuits and terminals must be enclosed and fail-safe interlock switches must be fitted to disconnect the primary power supply and discharge all high voltage capacitors and other stored charges before allowing access. Interlock switches must not be bypassed to allow operation with access doors open.

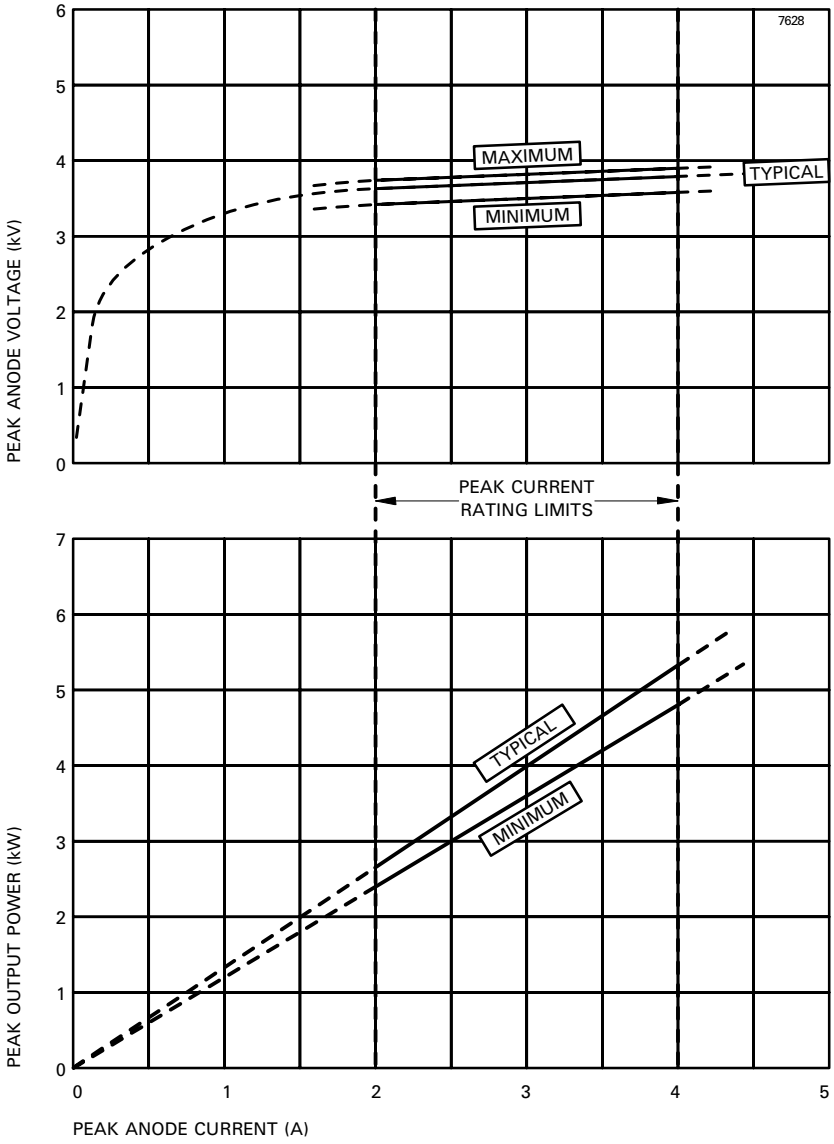
RF Radiation

Personnel must not be exposed to excessive RF radiation. All RF connectors must be correctly fitted before operation so that no leakage of RF energy can occur and the RF output must be coupled efficiently to the load. It is particularly dangerous to look into open waveguide or coaxial feeders while the device is energised. Screening of the cathode sidearm of high power magnetrons may be necessary.

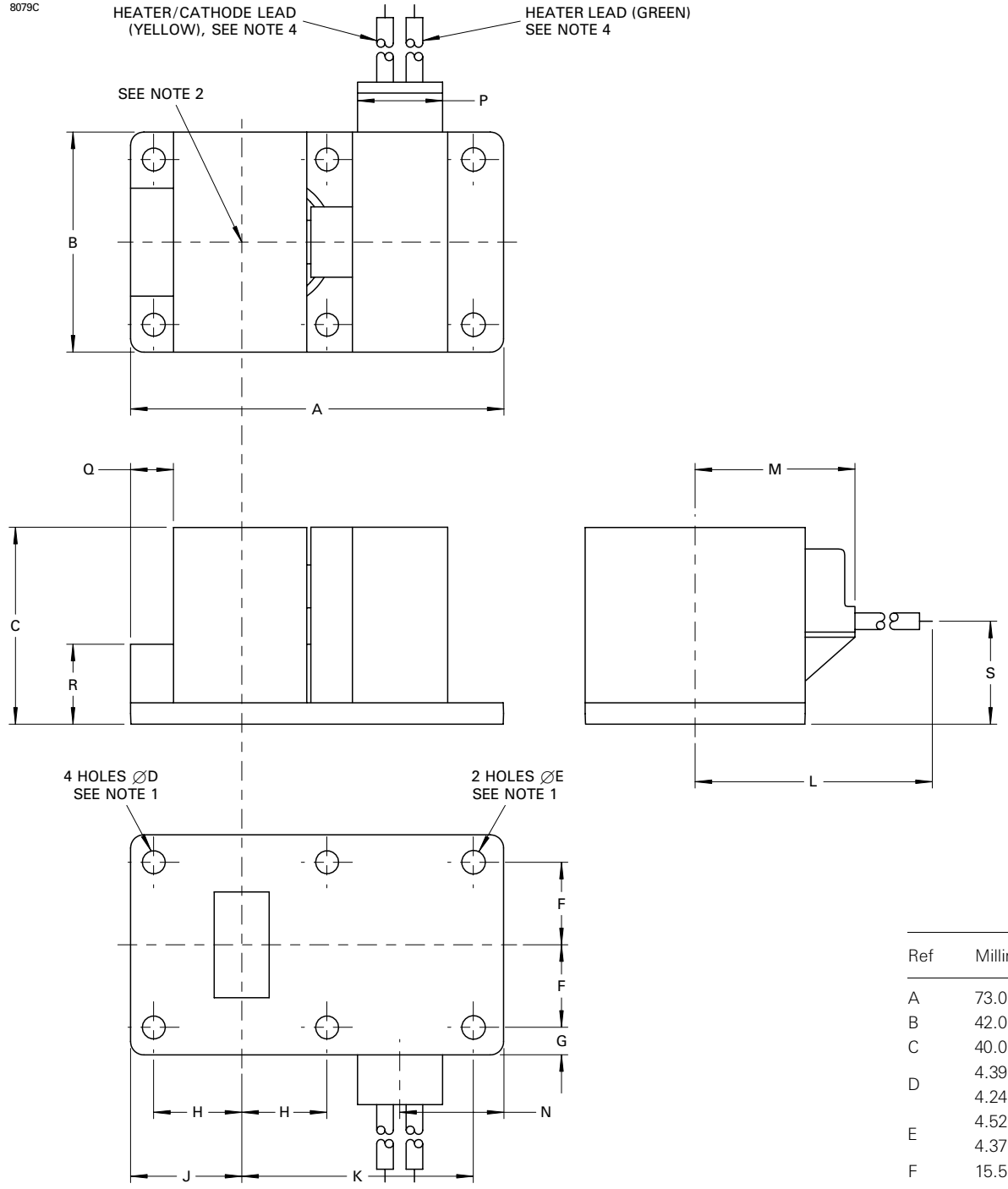
X-Ray Radiation

High voltage magnetrons emit a significant intensity of X-rays not only from the cathode sidearm but also from the output waveguide. These rays can constitute a health hazard unless adequate shielding for X-ray radiation is provided. This is a characteristic of all magnetrons and the X-rays emitted correspond to a voltage much higher than that of the anode.

PERFORMANCE CHART



OUTLINE (Not for inspection purposes)
(All dimensions without limits are nominal)



Ref	Millimetres
A	73.0 max
B	42.0 max
C	40.0 max
D	4.39 max 4.24 min
E	4.52 max 4.37 min
F	15.5
G	5.2
H	16.26
J	20.2 max
K	43.74
L	240.0 min
M	30.0 max
N	19.0
P	16.0
Q	8.0 min
R	15.5 max
S	19.0 ± 1.0

Outline Notes

1. Positional tolerance 0.4 mm diameter.
2. Anode temperature measured at this point.
3. The mating surface of the magnetron baseplate will be flat to within 0.2 mm.
4. Silicone rubber insulated leads, 3.2 mm diameter, contained within dimension P.