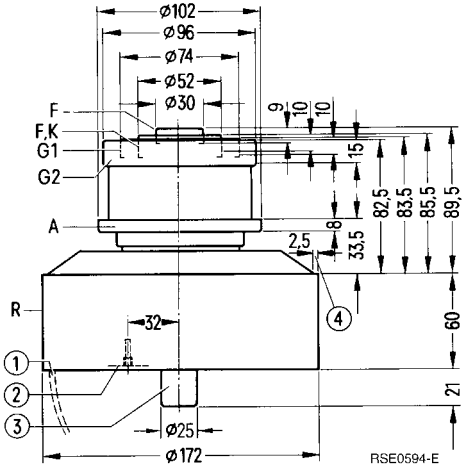
Coaxial metal-ceramic tetrode for frequencies up to 110 MHz, forced-air-cooled or water-cooled; particularly suitable for single-sideband communications transmitters up to 10 kW with grid-current free modulation.

Forced-air-cooled version

RS 2012 CL

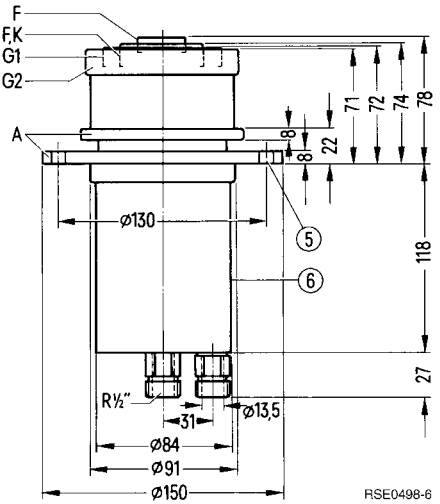
Ordering code Q51-X2012



Water-cooled version
with integrated cooling jacket

RS 2012 CJ

Ordering code Q52-X2012



① Handle, swingable
② Taphole for tube fuse RöSich7
③ Do not use as terminal
④ Free for anode support
⑤ 6 fixing holes Ø 9 (6 × 60°)
⑥ Do not use cooling jacket as terminal for anode voltage

Dimensions in mm

Approx. weight 6,7 kg

Approx. 5,5 kg

The radiator and the terminals are of concentric design with the following diameters:

Radiator	Ø 173,5	Control grid terminal	Ø 75,0
Anode terminal	Ø 103,0	Heater/cathode terminal	Ø 52,6
Screen grid terminal	Ø 97,0	Heater terminal	Ø 30,6

Heating

Heater voltage	U_F	10	V
Heater current	I_F	≈ 83	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 300$ V	I_{em}	35	A
Amplification factor of screen grid at $U_A = 2$ kV, $U_{G2} = 600$ to 1000 V, $I_A = 3$ A	μ_{g2g1}	8,4	
Transconductance at $U_A = 2$ kV, $U_{G2} = 800$ V, $I_A = 2{,}5$ to 3,5 A	s	70	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 76	pF
Cathode/screen grid	c_{kg2}	≈ 5,50	pF
Cathode/anode	c_{ka}	≈ 0,07	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 122	pF
Control grid/anode	c_{g1a}	≈ 0,75	pF [1])
Screen grid/anode	c_{g2a}	≈ 22	pF

1) Measured by means of a 30 cm diameter screening plate in the screen-grid terminal plane.

Accessories

RS 2012 CL		**Ordering code**
Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
Header socket without blocking	RöKpf212	Q81-X1812
SW header socket with screen grid blocking against cathode	RöKpf212K	Q81-X1814
Socket wrench for tube fuse	RöZub09	Q81-X2109
Tube fuse	RöSich7	Q81-X1407
Pull switch for tube fuse	RöKt11	Q81-X1311
Joining piece for air duct	RöAnst212	Q81-X712
Spring-finger contacts:		
Internal cathode terminal		C65055-A815-C901
External cathode terminal		C65055-A815-C902
Control grid terminal		C65055-A815-C903
Screen grid terminal		C65055-A815-C904

RS 2012 CJ		
Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
Spring-finger contacts:		
Internal cathode terminal		C65055-A815-C901
External cathode terminal		C65055-A815-C902
Control grid terminal		C65055-A815-C903
Screen grid terminal		C65055-A815-C904

RF amplifier,
class B operation

Maximum ratings

Frequency		f	110	MHz
Anode voltage (dc)		U_A	7,5	kV
Screen grid voltage (dc)		U_{G2}	1000	V
Control grid voltage (dc)		U_{G1}	– 250	V
Cathode current (dc)		I_K	4,0	A
Peak cathode current		$I_{K\,M}$	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW [5]
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics		I	II	II	
Frequency	f	≤ 110	50	≤ 110	MHz
Output power	P_2	11	15+0,26 [3]	10,8+0,23 [3]	kW [1]
Anode voltage (dc)	U_A	6,0	9,0	7,0	kV
Screen grid voltage (dc)	U_{G2}	800	800	800	V
Control grid voltage (dc)	U_{G1}	– 120	– 125	– 120	V [4]
Peak control grid voltage (ac)	$U_{g1\,m}$	140	140	130	V
Anode current (dc)	I_A	2,9	2,5	2,3	A
Screen grid current (dc)	I_{G2}	130	120	120	mA
Control grid current (dc)	I_{G1}	70	40	10	mA
Anode input power	$P_{B\,A}$	17,5	22,7	16	kW
Drive power	P_1	9,0 [2]	6 + 260 [3]	1 + 230 [3]	W [1]
Anode dissipation	P_A	6,5	7,7	5,2	kW
Screen grid dissipation	P_{G2}	104	96	110	W
Control grid dissipation	P_{G1}	1,0	1,0	0,1	W
Efficiency	η	63	66	68	%

I Grounded cathode circuit
II Grounded control-grid screen grid circuit

1) Circuit losses are not included.
2) Necessary output power of driver stage approx. 175 W at 60 Ω damping of input circuit and neutralization.
3) Power transition of grounded control-grid screen-grid circuit.
4) For zero signal dc anode current approx. 0,2 A.
5) Higher max. ratings may be released upon request.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency		f	30	MHz
Anode voltage (dc)		U_A	6,0	kV
Screen grid voltage (dc)		U_{G2}	750	V
Control grid voltage (dc)		U_{G1}	– 250	V
Cathode current (dc)		I_K	4,0	A
Peak cathode current		$I_{K\,M}$	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW [6]
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	12	6,0	kW [1]
Anode voltage (dc)	U_A	6,0	5,0	kV
Screen grid voltage (dc)	U_{G2}	700	500	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 90	– 70	V
Control grid resistance	R_{G1}	500	470	Ω
Control grid voltage (dc)	U_{G1}	– 220	– 150	V
Peak control grid voltage (ac)	$U_{g1\,m}$	280	190	V
Anode current (dc)	I_A	2,4	1,45	A
Screen grid current (dc)	I_{G2}	200	120	mA
Control grid current (dc)	I_{G1}	260	170	mA
Anode input power	$P_{B\,A}$	14,4	7,3	kW
Drive power	P_1	64	30	W [1]
Anode dissipation	P_A	2,4	1,3	kW [2]
Screen grid dissipation	P_{G2}	140	60	W
Control grid dissipation	P_{G1}	7,0	5,0	W
Efficiency	η	83	82	%
Anode load resistance	R_A	1,2	1,7	kΩ
Modulation factor	m	100	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	600	350	V [3]
Modulation power	P_{mod}	7,2	3,7	kW
Control grid current (dc)	I_{G1}	400	240	mA [4]
Drive power	P_1	100	40	W [1] [4]
Anode dissipation at modulation	$P_{A\,mod}$	3,6	2,0	kW [5]
Screen grid dissipation at modulation	$P_{G2\,mod}$	170	75	W [5]

1) Circuit losses are not included.
2) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
3) Modulation of screen grid via separate transformer winding.
4) Maximum values at U_A = 0 V.
5) Average values at m = 100 %.
6) Higher max. ratings may be released upon request.

AF amplifier and modulator,
class B operation, 2 tubes in push-pull circuit, $I_{G1} = 0$

Maximum ratings

Anode voltage (dc)		U_A	7,0	kV
Screen grid voltage (dc)		U_{G2}	1100	V
Control grid voltage (dc)		U_{G1}	– 200	V
Cathode current (dc)		I_K	4,0	A
Peak cathode current		$I_{K\,M}$	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW [1])
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics at modulator operation for

		20 kW carrier power		10 kW carrier power		
Output power	P_2	0	16	0	8	kW
Anode voltage (dc)	U_A	6	6	5	5	kV
Screen grid voltage (dc)	U_{G2}	1000	1000	800	800	V
Control grid voltage (dc)	U_{G1}	– 130	– 130	– 110	– 110	V
Peak control grid voltage (ac) between 2 tubes	$U_{gg\,m}$	0	220	0	180	V
Anode current (dc)	I_A	$2 \times 0{,}5$	$2 \times 2{,}4$	$2 \times 0{,}3$	$2 \times 1{,}5$	A
Screen grid current (dc)	I_{G2}	0	2×90	0	2×30	mA
Anode input power	$P_{B\,A}$	2×3	$2 \times 14{,}4$	$2 \times 1{,}5$	$2 \times 7{,}5$	kW
Anode dissipation	P_A	2×3	$2 \times 6{,}4$	$2 \times 1{,}5$	$2 \times 3{,}5$	kW
Screen grid dissipation	P_{G2}	0	2×90	0	2×24	W
Efficiency	η	–	55	–	54	%
Effective load resistance (anode to anode)	R_{AA}	–	2000	–	3000	Ω

1) Higher max. ratings may be released upon request.

RF linear amplifier,
single-sideband modulation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency		f	30	MHz
Anode voltage (dc)		U_A	9,0	kV
Screen grid voltage (dc)		U_{G2}	1000	V
Control grid voltage (dc)		U_{G1}	– 250	V
Cathode current (dc)		I_K	6,0	A
Peak cathode current		$I_{K\,M}$	35	A
Anode dissipation	(RS 2012 CL)	P_A	12	kW
Anode dissipation	(RS 2012 CJ)	P_A	18	kW [4]
Screen grid dissipation		P_{G2}	200	W
Control grid dissipation		P_{G1}	70	W

Operating characteristics		I	II [1]	III [1]	
Frequency	f	≤ 30	≤ 30	≤ 30	MHz
Output power	P_2	0	11	5,5	kW [2]
Anode voltage (dc)	U_A	8,0	8,0	8,0	kV
Screen grid voltage (dc)	U_{G2}	900	900	900	V
Control grid voltage (dc)	U_{G1}	– 115	– 115	– 115	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	100	100	V
Anode current (dc)	I_A	1,0	2,2	1,6	A
Screen grid current (dc)	I_{G2}	0	90	30	mA
Anode input power	$P_{B\,A}$	8,0	17,6	12,8	kW
Anode dissipation	P_A	8,0	6,6	7,3	kW
Screen grid dissipation	P_{G2}	0	81	27	W
Efficiency	η	–	62,5	43	%
Third order intermodulation product	d_3	–	–	≥ 38	dB [3]
Fifth order intermodulation product	d_5	–	–	≥ 50	dB [3]

I No modulation
II 1-tone modulation
III 2-tone modulation

1) Carrier suppressed.
2) Circuit losses are not included.
3) Level of non-linear cross talk resulting from third and fifth order intermodulation products as measured by the 2-tone method at f = 30 MHz and 60 Ω input resistance (see also the diagram 'cross-talk values versus output power', page 181).
4) Higher max. ratings may be released upon request.

Tube mounting

Axis vertical, anode up or down.

The tube has to be connected by means of the header sockets RöKpf212 and RöKpf212K, in which the terminal anodes for cathode, control grid, and screen grid contacts are combined to a unit and provided with spring-finger contacts.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 220 °C at any point and the temperature of the internal cathode terminal must not exceed 250 °C. In the forced-air-cooled version these requirements can be met without additional cooling, if an appropriate air duct and sufficient space between the individual contact springs is provided so that enough cooling air can pass through.

For the water-cooled version of the tube with integrated cooling jacket, a cooling air flow rate of approx. 0,3 m^3/min at a static pressure of approx. 1 mbar is required on the terminal side.

Forced-air cooling (RS 2012 CL)

The minimum air flow rate required for the maximum anode dissipation is given in the cooling air diagram, valid for 25 °C inlet temperature at a normal air pressure of 1 bar (sea level). The cooling air is supplied from the electrode terminal side. For further information on forced-air-cooling refer to “Explanations on Technical Data”.

Water cooling (RS 2012 CJ)

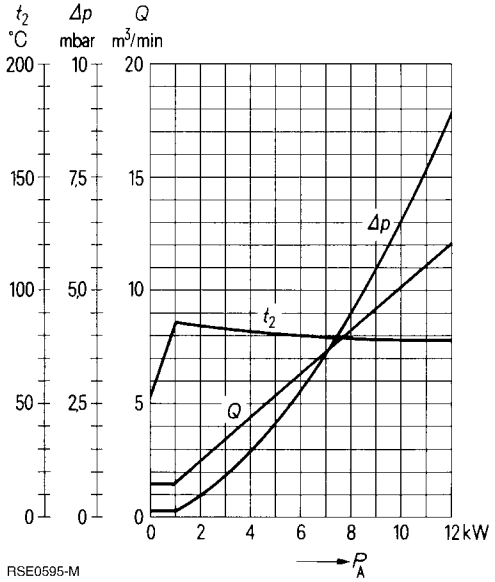
The cooling water diagrams are valid for water inlet temperatures of 35 °C and 50 °C. For other water inlet temperatures within this range the required water flow rate can be calculated by linear interpolation. The pressure of the cooling water must not exceed 6 bar. Please observe the instructions on water cooling given under “Explanations on Technical Data”.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,20 mm diameter should be used to test the anode overcurrent trip circuit.

The tube fuse RöSich7 is recommended for protecting the forced-air-cooled version RS 2012 CL against thermal anode overload. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (see accessories).

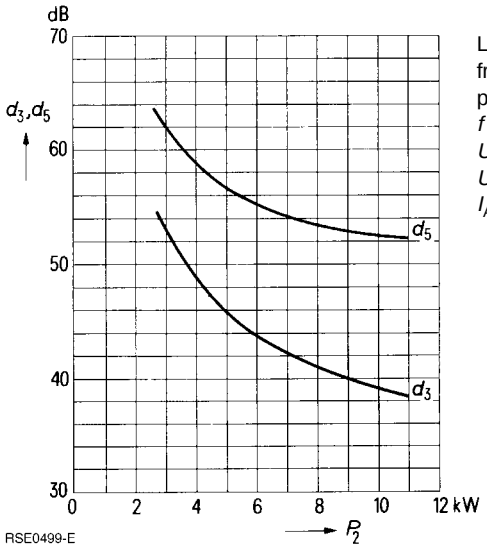
Cooling air diagram (RS 2012 CL)



The cooling air is supplied from the electrode terminal side.

Air pressure = 1 bar
t_1 = 25 °C

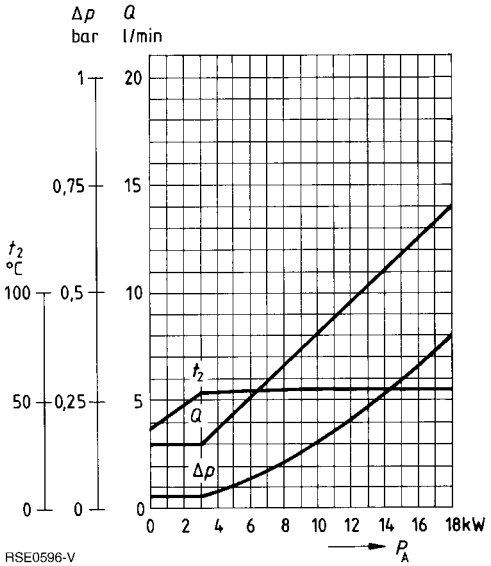
Intermodulation products



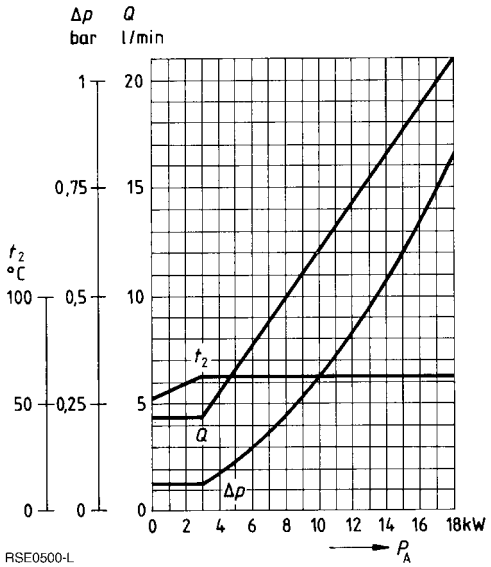
Level of non-linear cross talk resulting from third and fifth order intermodulation products as measured by the 2-tone method at
f = 30 MHz,
U_A = 8 kV,
U_{G2} = 900 V,
$I_{A\,0}$ = 1 A.

Maximum output at 2-tone modulation (PEP)

Cooling water diagrams (RS 2012 CJ)



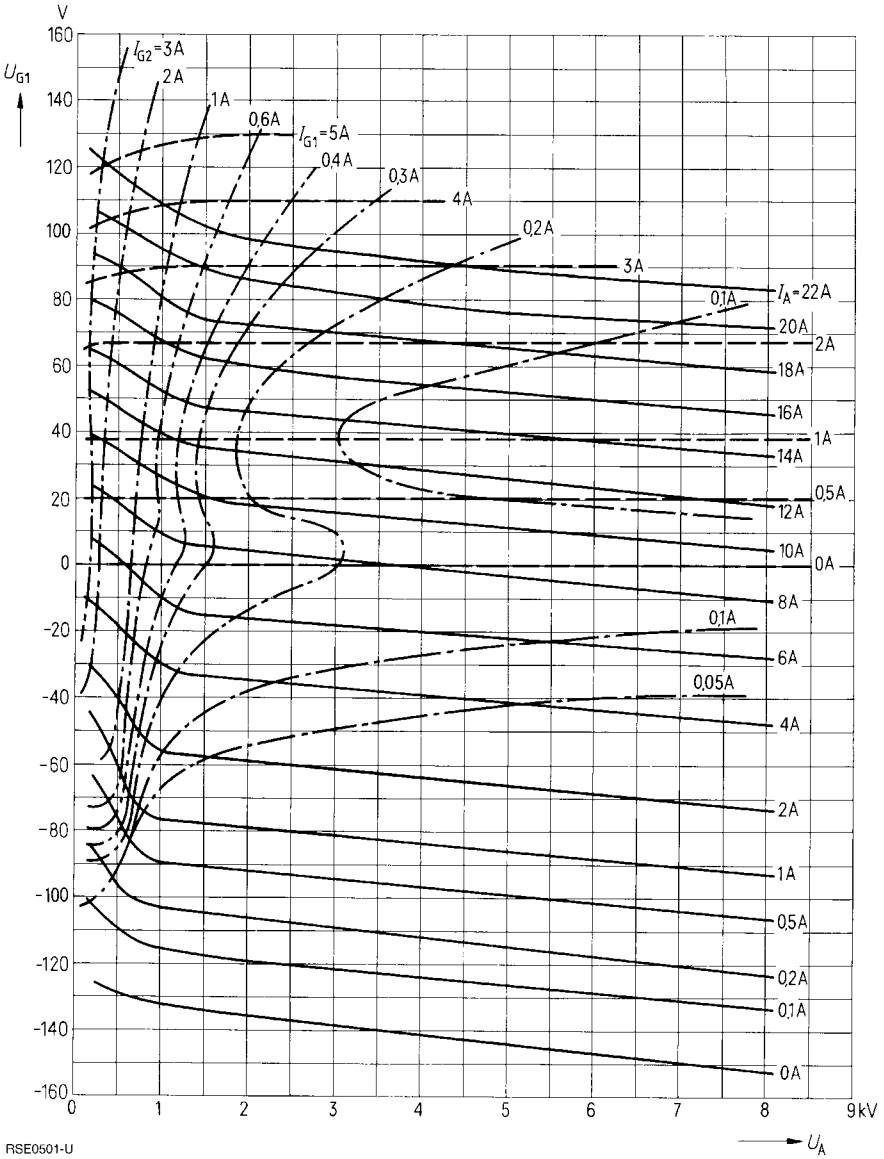
t_1 = 35 °C



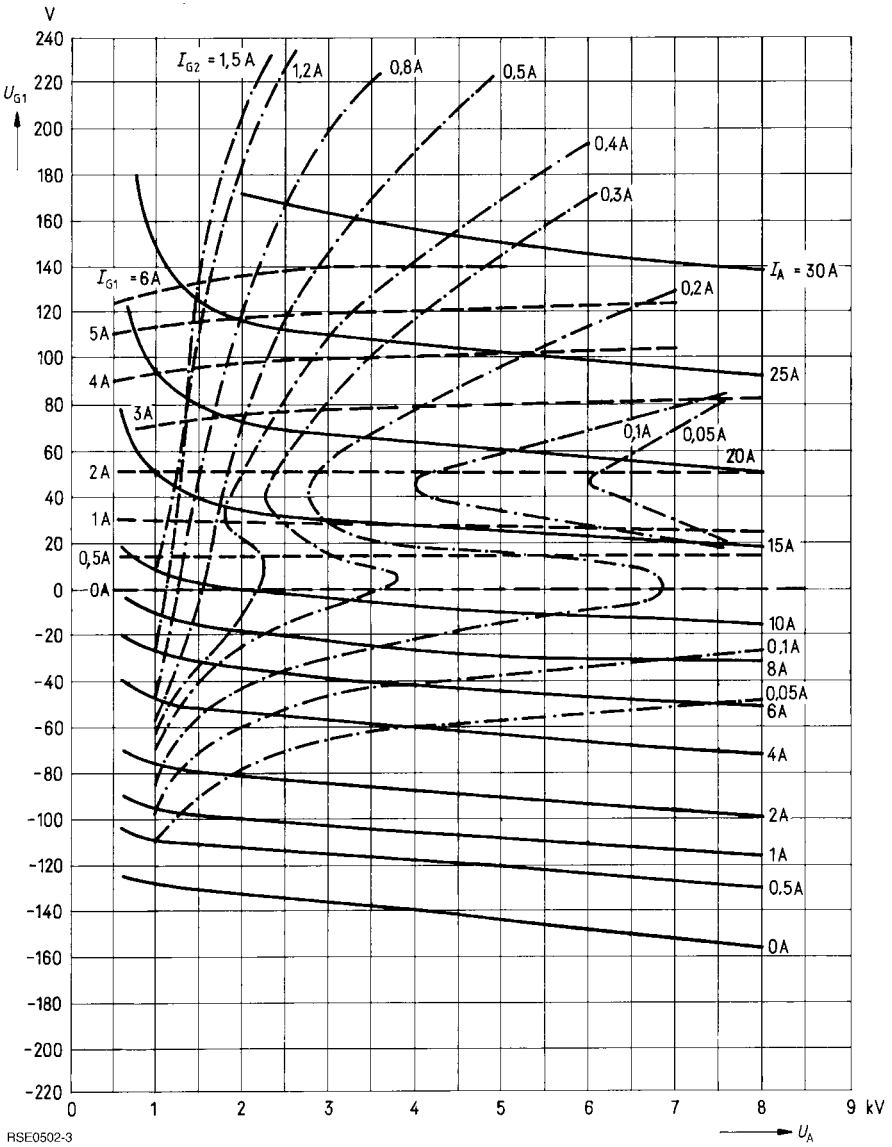
t_1 = 50 °C

$U_{G1} = f(U_A)$
U_{G2} = 800 V

Parameter = I_A ——————
Parameter = I_{G2} —∘—∘—∘—∘—∘—
Parameter = I_{G1} — — — — — — —



$U_{G1} = f(U_A)$ Parameter = I_A ——————
U_{G2} = 1000 V Parameter = I_{G2} —·—·—·—·—·—
Parameter = I_{G1} — — — — — — —



$U_{G1} = f(U_A)$ Parameter = I_A ——————
U_{G2} = 1200 V Parameter = I_{G2} —·—·—·—·—·—
Parameter = I_{G1} — — — — — — —