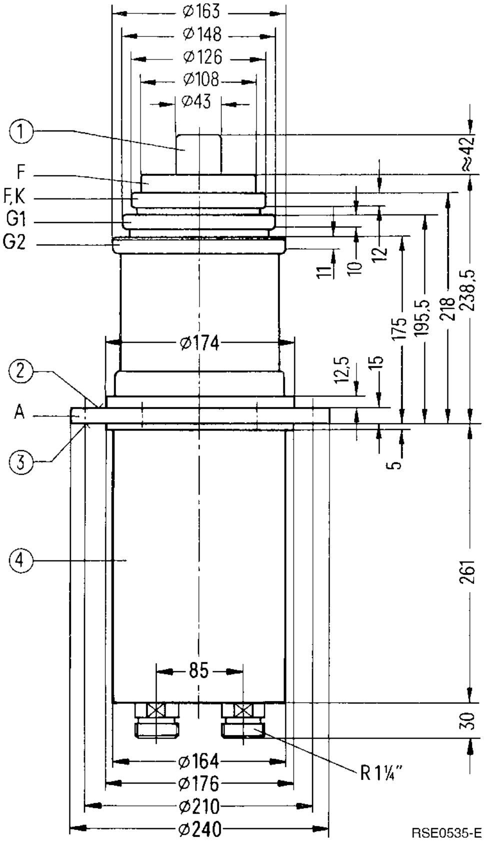
For frequencies up to 150 MHz Ordering code Q53-X2054

Coaxial metal-ceramic tetrode, vapor-condensation-cooled, particularly suitable for 100 kW broadcast transmitters up to 30 MHz, for grid-current free operated modulators in transmitters up to 300 kW, and for use as switching tube in PDM transmitters up to 100 kW, as well as for RF amplifiers up to 150 kW/up to 150 MHz.



Dimensions in mm

① Do not use as terminal
② Taphole M8 for handle RöZub252
③ 6 fixing holes, 13 mm dia. (6 × 60°)
④ Do not use boiler as anode terminal

Approx. weight 24 kg

Heating

Heater voltage	U_F	15	V
Heater current	I_F	≈ 180	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 500$ V	I_{em}	150	A
Amplification factor of screen grid at $U_A = 4$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 5$ A	μ	4,5	
Transconductance at $U_A = 4$ kV, $U_{G2} = 1000$ V, $I_A = 5$ A	s	90	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 170	pF
Cathode/screen grid	c_{kg2}	≈ 16	pF
Cathode/anode	c_{ka}	≈ 0,5	pF [1])
Control grid/screen grid	c_{g1g2}	≈ 300	pF
Control grid/anode	c_{g1a}	≈ 3,0	pF [1])
Screen grid/anode	c_{g2a}	≈ 70	pF

Accessories		**Ordering code**
Cathode connecting strip (2 for each tube)	RöKat363	Q81-X1174
Short-wave header socket	RöKpf254K	Q81-X1801
Medium-wave header socket	RöKpf254M	Q81-X1857
Handle	RöZub252	Q81-X1705
Insulating hose	RöZub254SK	Q81-X2117
LL electrolytic target for $^3/_4$″ hose	RöEl8	Q81-X513

1) Measured by means of a 60 cm diameter screening plate in the screen grid terminal plane.

RF amplifier,
class B operation, grounded control-grid screen-grid circuit

Maximum ratings

Frequency	f	110	MHz
Anode voltage (dc)	U_A	24	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	30	A
Peak cathode current	$I_{K\,M}$	150	A
Anode dissipation	P_A	120	kW [3])
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics

Frequency	f	50	100	MHz
Output power	P_2	180 + 10,6 [2])	100	kW [1])
Anode voltage (dc)	U_A	10	11	kV
Screen grid voltage (dc)	U_{G2}	1200	800	V
Control grid voltage (dc)	U_{G1}	– 400	– 300	V
Peak control grid voltage (ac)	$U_{g1\,m}$	500	350	V
Anode current (dc)	I_A	26,8	13,6	A
Screen grid current (dc)	I_{G2}	0,7	0,3	A
Control grid current (dc)	I_{G1}	0,8	0,25	A
Anode input power	$P_{B\,A}$	268	150	kW
Drive power	P_1	0,4 + 10,6 [2])	4,0	kW [1])
Anode dissipation	P_A	88	54	kW
Screen grid dissipation	P_{G2}	900	240	W
Control grid dissipation	P_{G1}	80	8	W
Efficiency	η	67	64	%
Anode load resistance	R_A	200	500	Ω

1) Circuit losses are not included.
2) Power transition of grounded control-grid screen-grid circuit.
3) 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}	15	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_{K}	20	A
Peak cathode current	$I_{K\,M}$	150	A
Anode dissipation	P_{A}	120	kW [5])
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	105	kW [1])
Anode voltage (dc)	U_{A}	11,2	kV
Screen grid voltage (dc)	U_{G2}	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 250	V
Control grid resistance	R_{G1}	360	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	770	V
Anode current (dc)	I_{A}	10,8	A
Screen grid current (dc)	I_{G2}	1,0	A
Control grid current (dc)	I_{G1}	1,1	A
Anode input power	$P_{B\,A}$	121	kW
Drive power	P_{1}	800	W [1])
Anode dissipation	P_{A}	16	kW [2])
Screen grid dissipation	P_{G2}	800	W
Control grid dissipation	P_{G1}	90	W
Efficiency	η	87	% [3])
Anode load resistance	R_{A}	520	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	550	V
Anode input power during modulation	$P_{B\,A\,mod}$	182	kW
Control grid current (dc)	I_{G1}	1,3	A [4])
Drive power	P_{1}	1000	W [1])[4])
Anode dissipation at modulation	$P_{A\,mod}$	24	kW

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) Without 3-*f* circuit.
4) Maximum values at U_{A} = 0 V.
5) Higher max. ratings may be released upon request.

PDM switching tube
for 100 kW carrier power of final stage

Maximum ratings

Anode input voltage (dc)	U_{BA}	30	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	I_{KM}	150	A
Anode dissipation	P_A	120	kW
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics

Modulation factor of the RF final stage	m	0	100	%
Switching frequency	f	54	54	kHz
Output power	P_2	121	181,5	kW
Anode input voltage (dc)	U_{BA}	23,5	23,5	kV [1])
Screen grid voltage (dc)	U_{G2}	600	600	V
Control grid voltage (dc)	U_{G1}	– 750	– 750	V
Peak control grid voltage (ac)	U_{g1m}	790	790	V
Anode current (dc)	I_A	5,25	7,9	A
Screen grid current (dc)	I_{G2}	2,7	2,0	A
Control grid current (dc)	I_{G1}	0,85	0,85	A
Anode input power	P_{BA}	123,5	185,5	kW
Drive power	P_1	1400	1400	W [2])
Anode dissipation	P_A	2,5	4,0	kW
Screen grid dissipation	P_{G2}	1700	1200	W
Control grid dissipation	P_{G1}	35	35	W
Efficiency	η	98	98	% [2])
Effective load resistance (RF final stage)	R_A	1040	1040	Ω

1) Output voltage of RF rectifier.
2) Losses in other components of the pulse-duration modulator are not included.

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

Maximum ratings

Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	1500	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	20	A
Peak cathode current	I_{KM}	150	A
Anode dissipation	P_A	120	kW [1])
Screen grid dissipation	P_{G2}	3000	W
Control grid dissipation	P_{G1}	1000	W

Operating characteristics at modulator operation for

		300 kW carrier power		
Output power	P_2	0	186	kW
Anode voltage (dc)	U_A	12	12	kV
Screen grid voltage (dc)	U_{G2}	1200	1200	V
Control grid voltage (dc)	U_{G1}	– 390	– 390	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	720	V
Anode current (dc)	I_A	$2 \times 0{,}7$	$2 \times 11{,}6$	A
Screen grid current (dc)	I_{G2}	0	$2 \times 0{,}5$	A
Anode input power	P_{BA}	$2 \times 8{,}4$	$2 \times 139{,}2$	kW
Anode dissipation	P_A	$2 \times 8{,}4$	$2 \times 46{,}2$	kW
Screen grid dissipation	P_{G2}	0	2×600	W
Efficiency	η	—	66,8	%
Effective load resistance (anode to anode)	R_{AA}	—	1100	Ω

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

Tube mounting

Axis vertical, anode up or down.

For connection of the tube use the terminals listed under “Accessories”.

Maximum tube surface temperature

The maximum temperature of the tube surface must not exceed 220 °C. The maximum permissible temperature difference at the tube circumference is 50 °C. The temperature gradient at the tube must not exceed 25 °C/cm. The surface temperature will remain below the maximum values if an air stream of approx. 2 to 3 m^3/min is directed onto the tube terminals.

Vapor condensation cooling

The cooling water diagram gives the minimum water flow rate (distilled or deionized water) for maximum anode dissipation, as well as pressure drop and water outlet temperature at 65 °C water inlet temperature. The diagram applies to a hermetically sealed cooling system with 1,5 bar overpressure at the cooling water outlet with a maximum permissible outlet temperature of 100 °C.

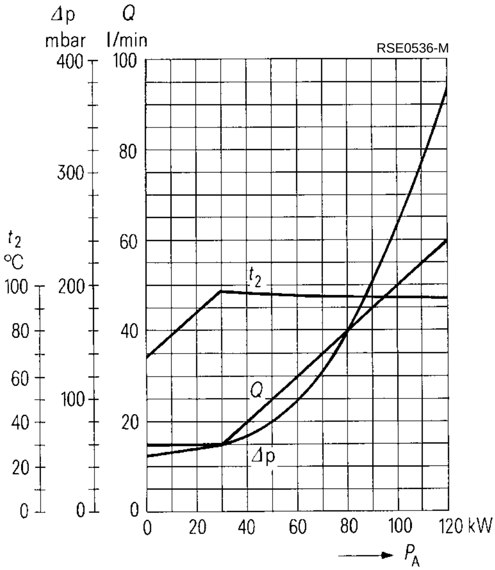
Operation with open cooling cycle (without overpressure) is possible if the maximum outlet temperature remains below 65 °C (sea level, air pressure ≈ 1 bar) with lower inlet temperature and, if required, increased water flow rate.

For more information on vapor condensation cooling refer to “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 0,30 mm diameter should be used to test the anode overcurrent trip circuit.

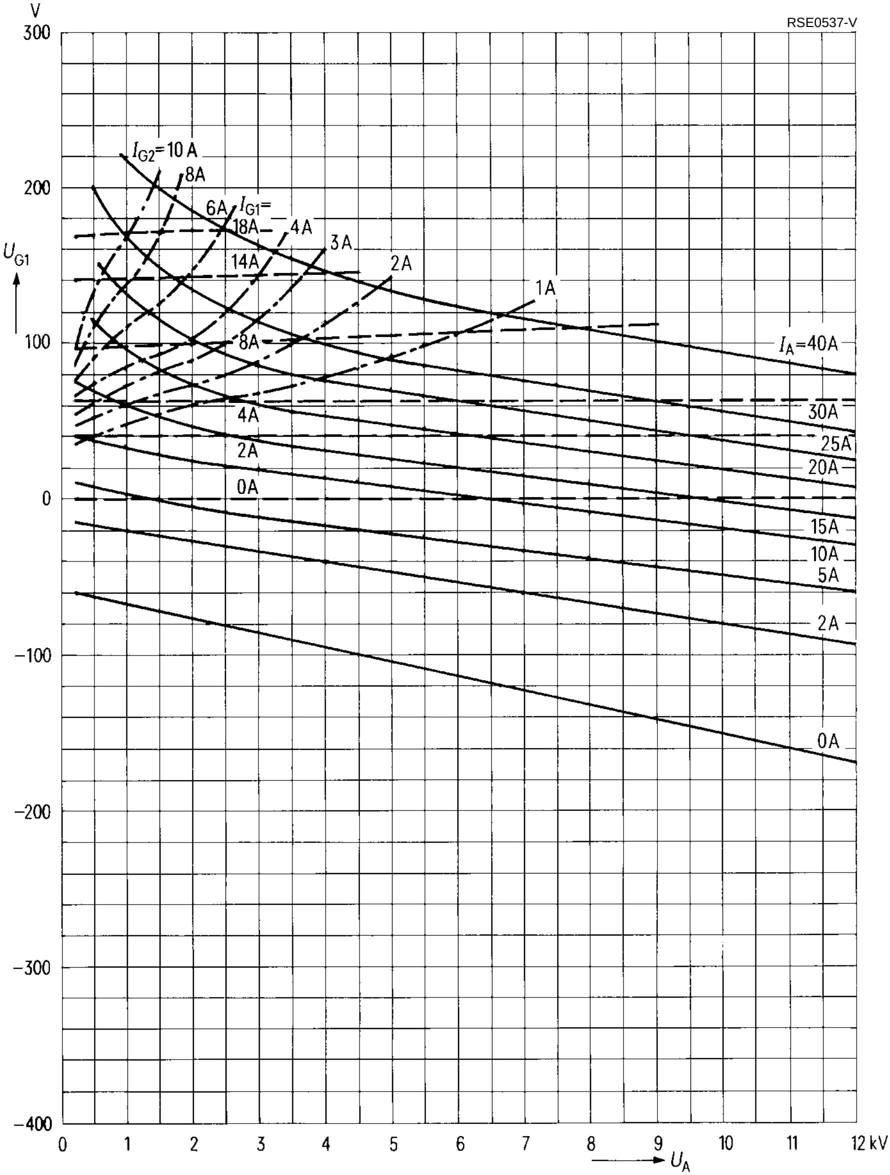
Cooling water diagram



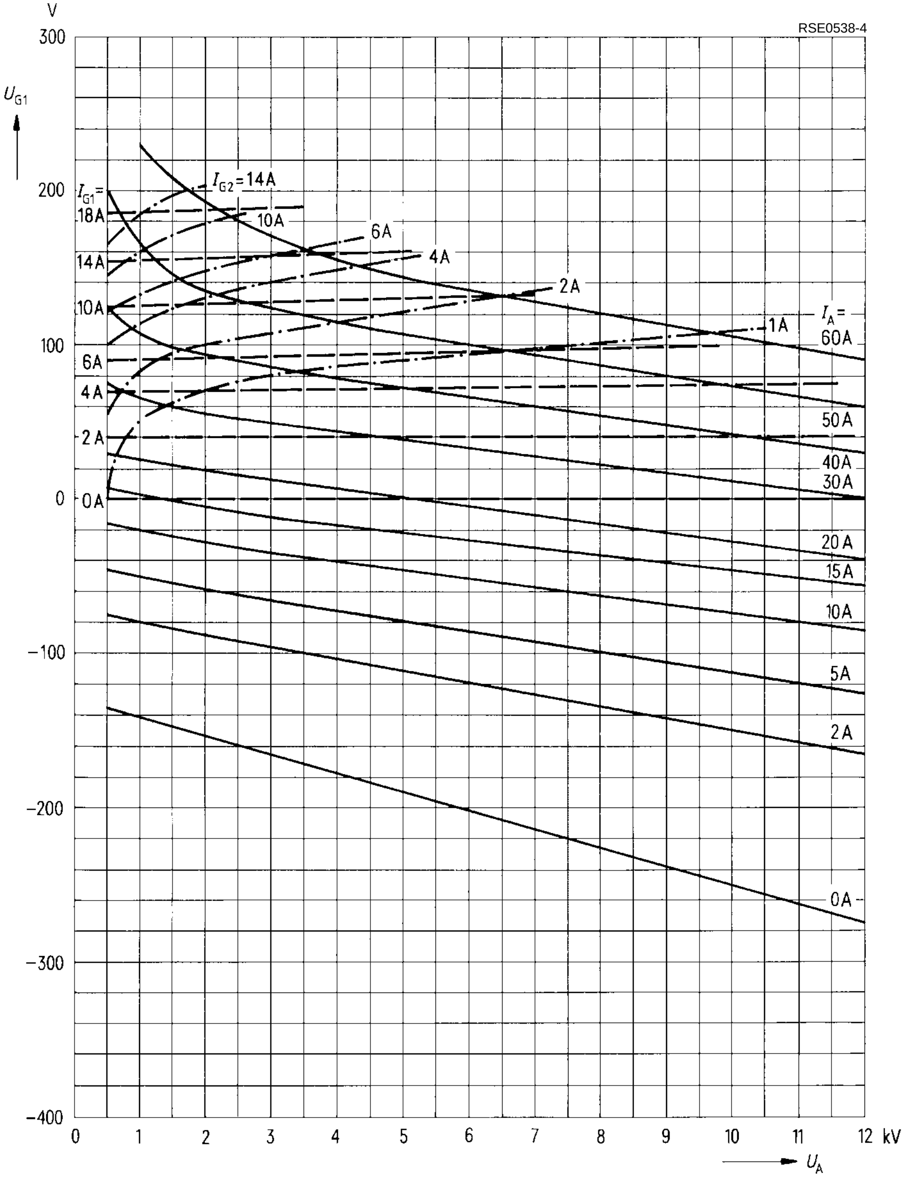
Hermetically sealed cooling system with destilled water.

Overpressure = 1,5 bar
t_1 = 60 °C

$U_{G1} = f\,(U_A)$ Parameter = I_A ————————
U_{G2} = 200 V Parameter = I_{G2} —·—·—·—·—
Parameter = I_{G1} — — — — — — —



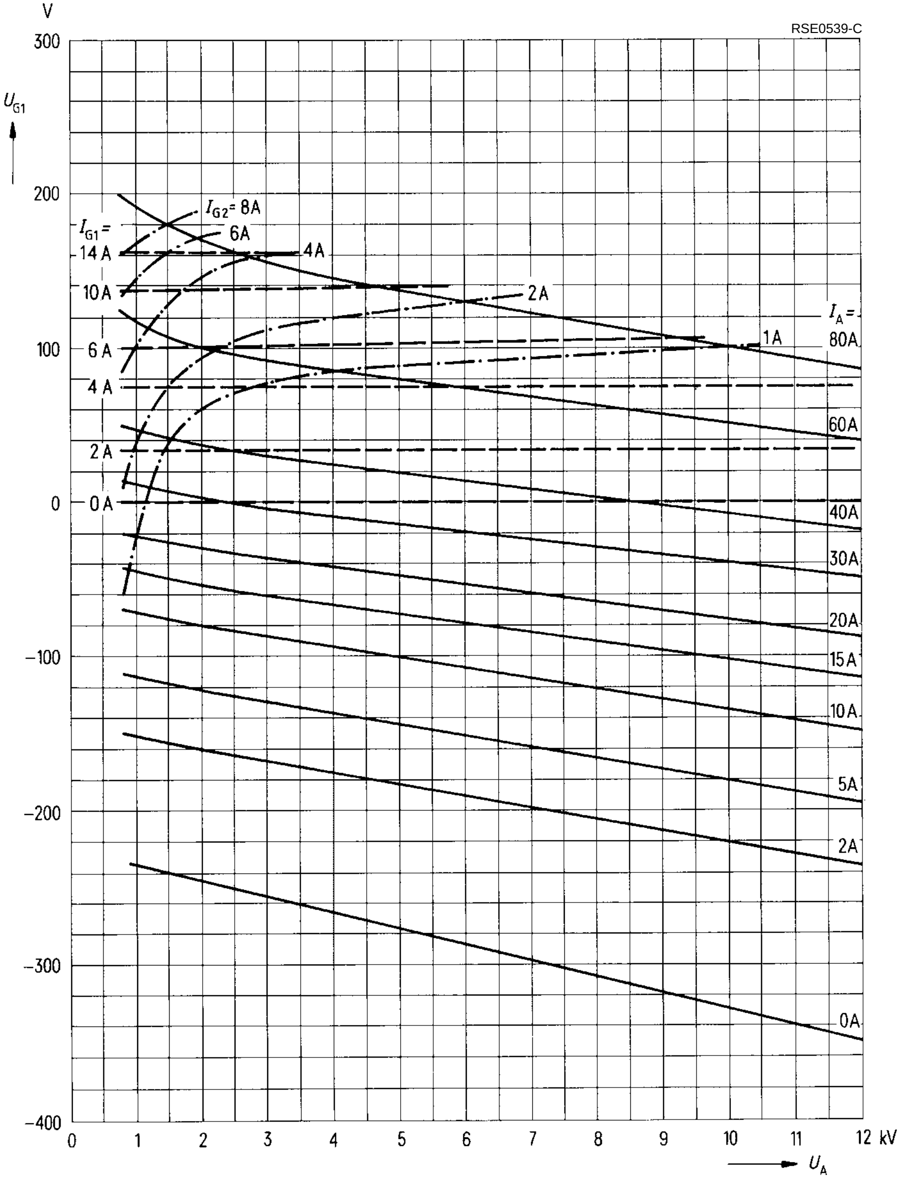
$U_{G1} = f(U_A)$ Parameter = I_A ————
U_{G2} = 500 V Parameter = I_{G2} —·—·—
Parameter = I_{G1} — — — —



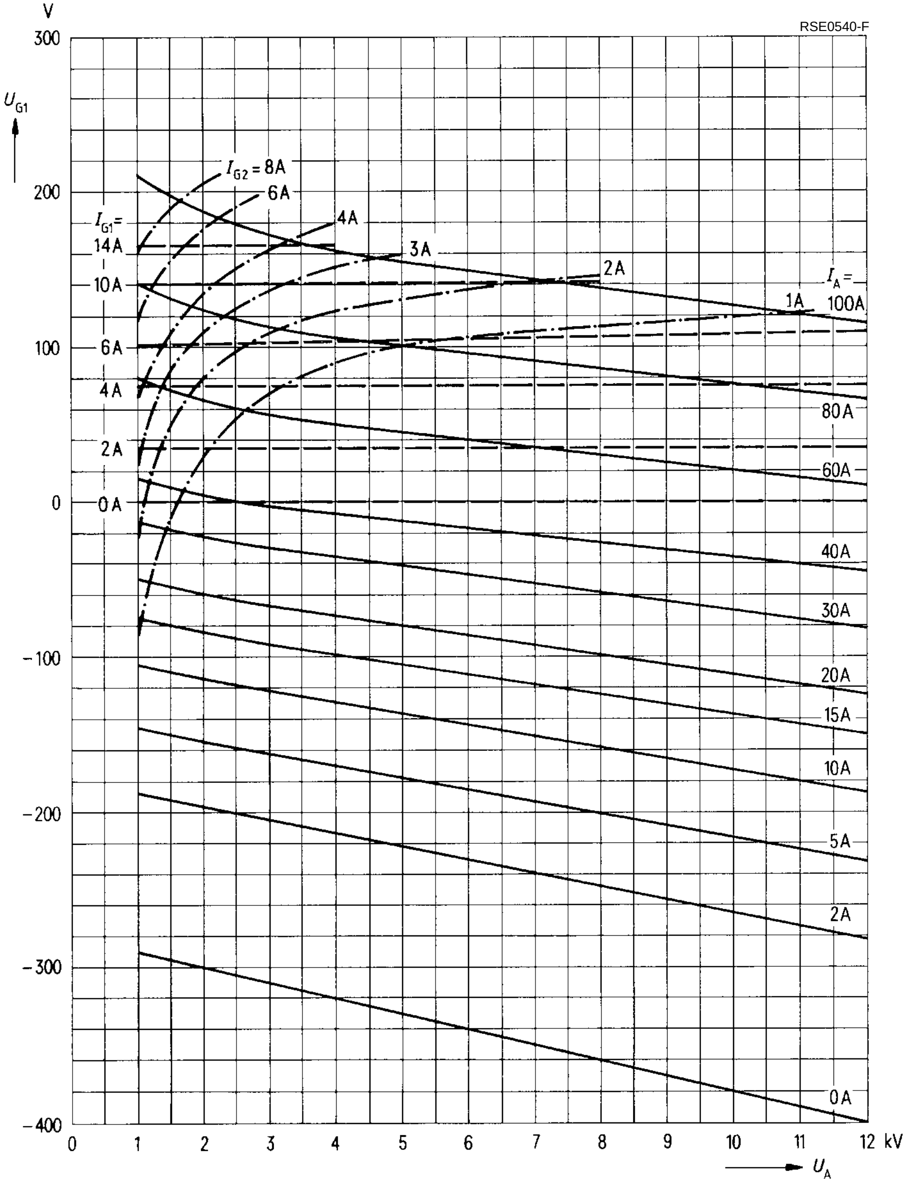
$U_{G1} = f(U_A)$ Parameter = I_A ——————

U_{G2} = 800 V Parameter = I_{G2} —◦—◦—◦—◦—

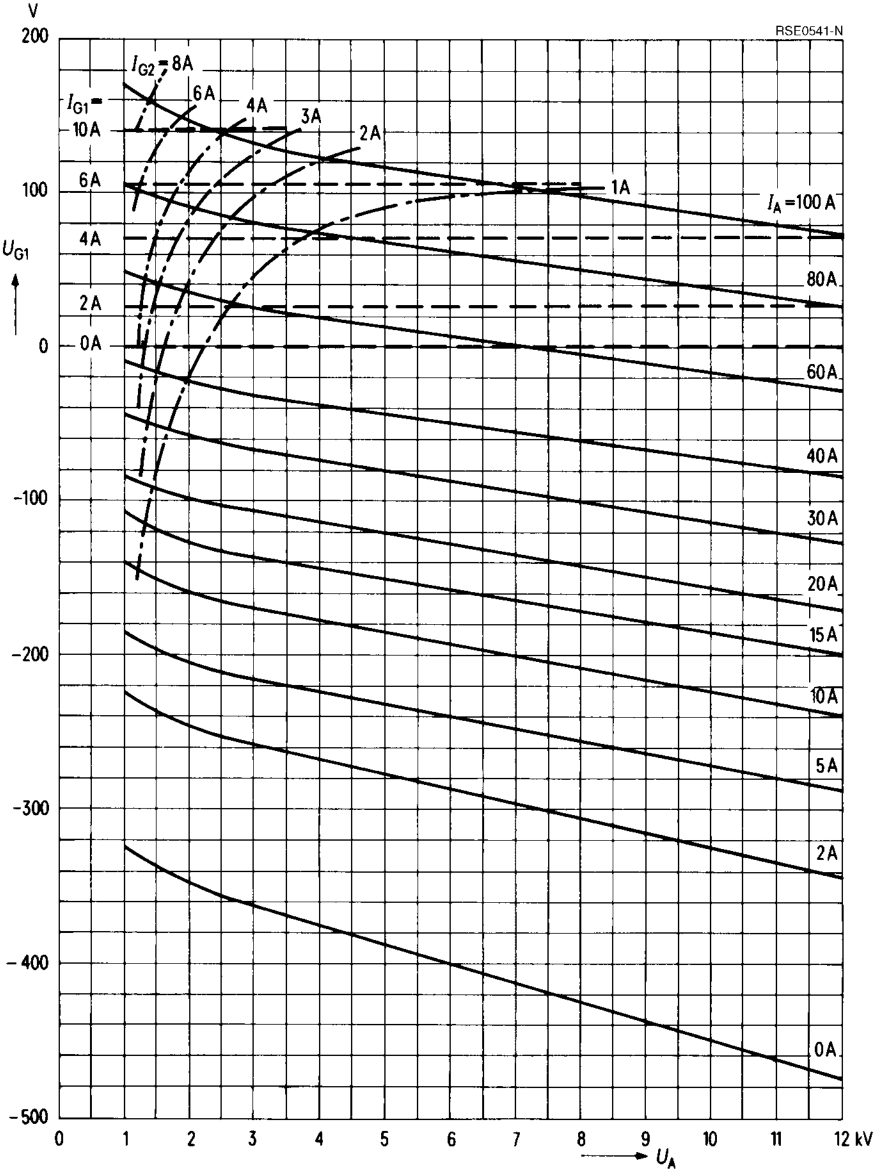
Parameter = I_{G1} — — — — —



$U_{G1} = f(U_A)$ 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} — — —



$U_{G1} = f(U_A)$ Parameter = I_A ————————
U_{G2} = 1400 V Parameter = I_{G2} —◦—◦—◦—
Parameter = I_{G1} — — — — —