5SDF 90Z0401

High Frequency Housingless Welding Diode

Properties

- High forward current capability
- Low forward and reverse recovery losses

Key Parameters

V_{RRM}	=	400	V
I_{FAVm}	=	9 041	A
I_{FSM}	=	48 000	A
V_{TO}	=	0.979	V
r_T	=	0.032	mΩ

Applications

- Welding equipment
- High current application up to 10 kHz

Types

	V_{RRM}
5SDF 90Z0401	**400 V**
Conditions:	*T_j = -40 ÷ 190 °C, half sine waveform, f = 50 Hz*

Mechanical Data

F_m	**Mounting force**	22 ÷ 50 kN
m	**Weight**	0.10 kg
D_S	**Surface creepage distance**	2 mm
D_a	**Air strike distance**	2 mm

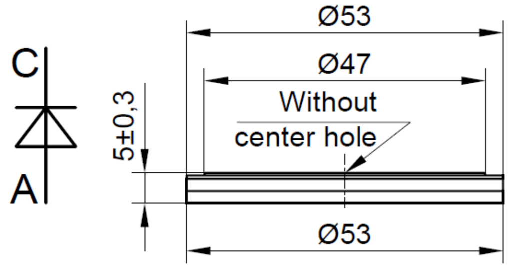

Fig. 1 Case

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Novodvorska 1768/138a, 142 21 Praha 4, Czech Republic
tel.: +420 261 306 250, http://www.abb.com/semiconductors

Maximum Ratings			***Maximum Limits***	***Unit***
V_{RRM}	**Repetitive peak reverse voltage** *T_j = -40 ÷ 190 °C*		**400**	**V**
I_{FAVm}	***Average forward current***	*T_c = 85 °C*	**9 041**	**A**
		T_c = 110 °C	**7 440**	
I_{FRMS}	***RMS forward current***	*T_c = 85 °C*	**14 202**	**A**
		T_c = 110 °C	**11 687**	
I_{RRM}	***Repetitive reverse current*** *$V_R = V_{RRM}$*		**200**	**mA**
I_{FSM}	**Non repetitive peak surge current** *V_R = 0 V, half sine pulse*	*t_p = 8.3 ms*	**51 000**	**A**
		t_p = 10 ms	**48 000**	
I^2t	**Limiting load integral** *V_R = 0 V, half sine pulse*	*t_p = 8.3 ms*	**10 911 000**	**A^2s**
		t_p = 10 ms	**11 520 000**	
T_{jmin} –T_{jmax}	***Operating temperature range***		**- 40 ÷ 190**	**°C**
T_{stgmin} -T_{stgmax}	***Storage temperature range***		**- 40 ÷ 190**	

Unless otherwise specified T_j = 190 °C

Characteristics			***Value***			***Unit***
			min	***typ***	***max***	
V_{T0}	**Threshold voltage**				**0.979**	**V**
r_T	**Forward slope resistance** *I_{F1} = 7 000 A, I_{F2} = 21 000 A*				**0.032**	**mΩ**
V_{FM}	**Maximum forward voltage**	*I_{FM} = 5 000 A*			**1.130**	**V**
		I_{FM} = 8 000 A			**1.240**	
Q_{rr}	**Recovered charge** *I_{FM} = 2 000 A, di/dt = -30 A/µs, V_R = 50 V*				**200**	**µC**

Unless otherwise specified T_j = 190 °C

Thermal Parameters			Value	Unit
R_{thjc}	**Thermal resistance junction to case**	*double side cooling*	**5.6**	**K/kW**
		anode side cooling	**7.4**	
		cathode side cooling	**23.5**	
R_{thch}	**Thermal resistance case to heatsink**	*double side cooling*	**3.6**	**K/kW**
		anode side cooling	**6.7**	
		cathode side cooling	**8.0**	

Transient Thermal Impedance

Analytical function for transient thermal impedance

$$Z_{thjc} = \sum_{i=1}^{4} R_i (1 - \exp(-t / \tau_i))$$

Conditions:

F_m = 22 ÷ 50 kN, Double side cooled

Correction for periodic waveforms

180°	**sine:**	**1.3**	**K/kW**
120°	**sine:**	**1.6**	**K/kW**
60°	**sine:**	**2.7**	**K/kW**
180°	**rectangular:**	**1.1**	**K/kW**
120°	**rectangular:**	**1.8**	**K/kW**
60°	**rectangular:**	**3.0**	**K/kW**

i	1	2	3	4
τ_i (s)	**0.0461**	**0.0241**	**0.0045**	**0.0006**
R_i(K/kW)	**3.8860**	**1.1830**	**0.3610**	**0.1700**

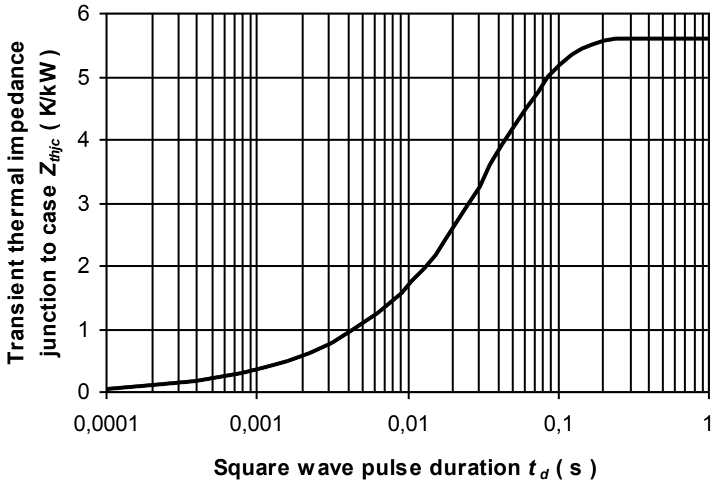

Fig. 2 Dependence transient thermal impedance junction to case on square pulse

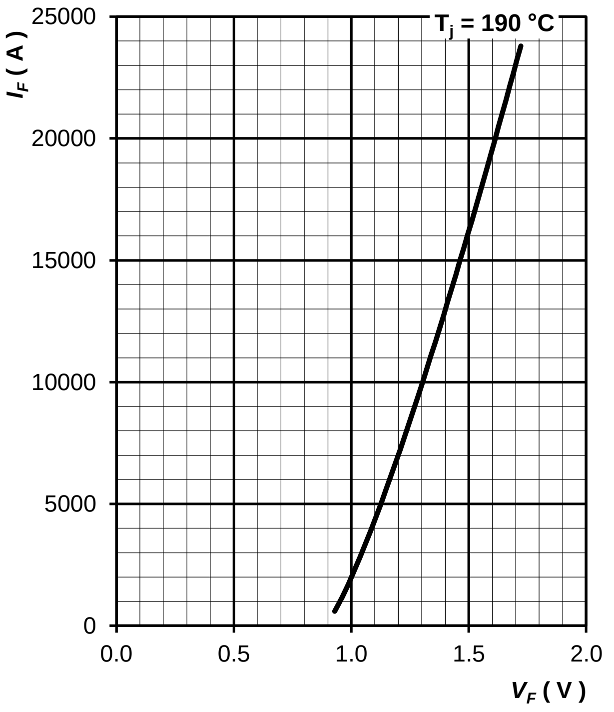

Fig. 3 Maximum forward voltage drop characteristics

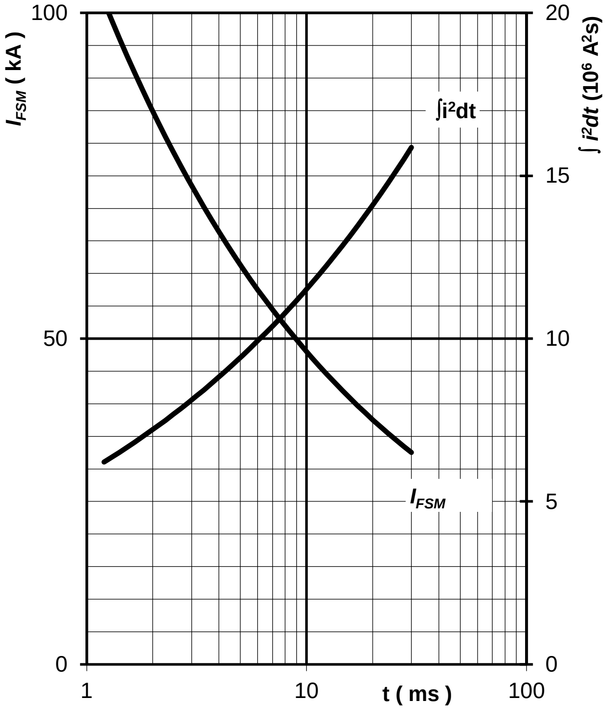

Fig. 4 Surge forward current vs. pulse length, half sine wave, single pulse, $V_R = 0$ V, $T_j = T_{jmax}$

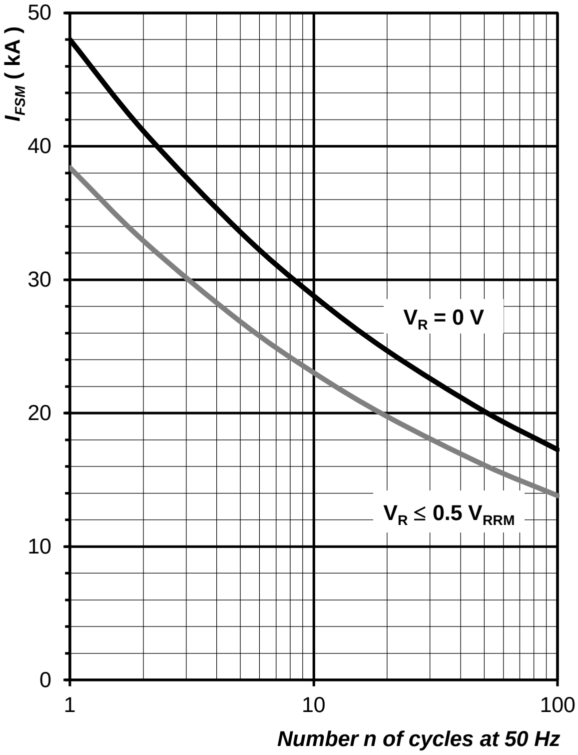

Fig. 5 Surge forward current vs. number of pulses, half sine wave, $T_j = T_{jmax}$

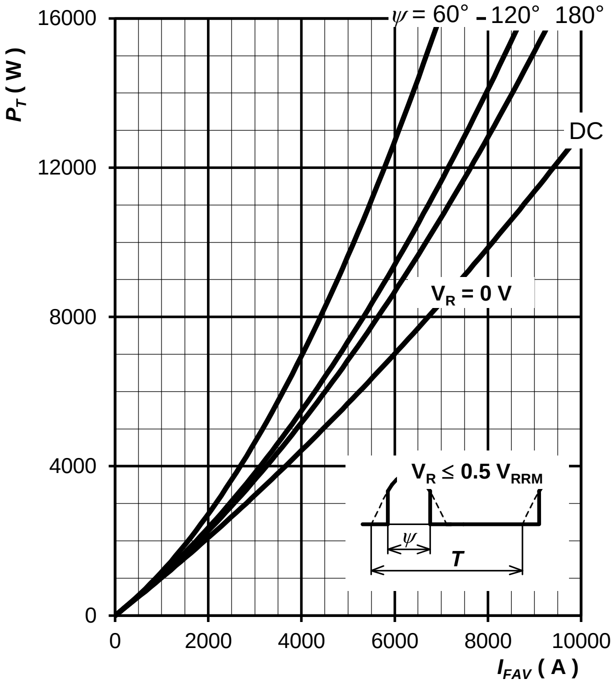

Fig. 6 Forward power loss vs. average forward current, sine waveform, f = 50 Hz, T = 1/f

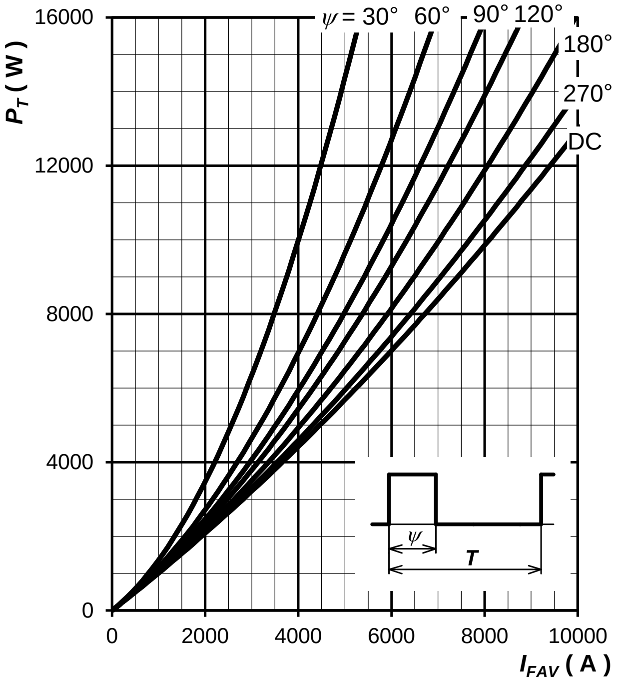

Fig. 7 Forward power loss vs. average forward current, square waveform, f = 50 Hz, T = 1/f

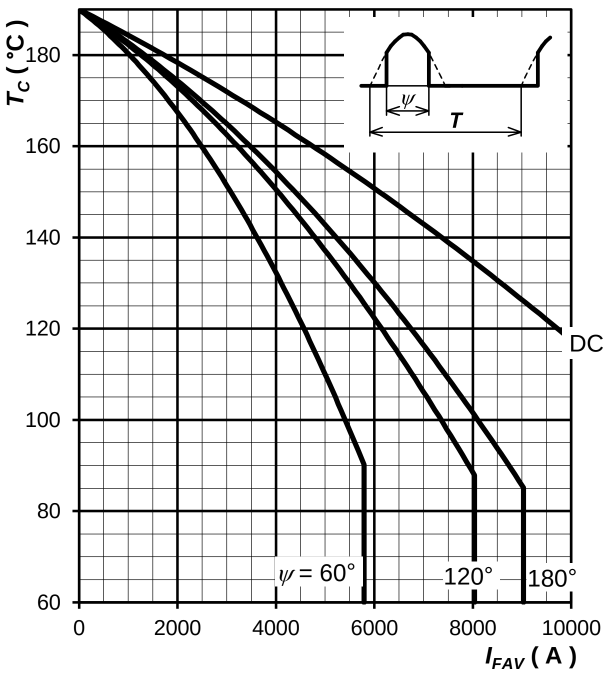

Fig. 8 Max. case temperature vs. aver. forward current, sine waveform, f = 50 Hz, T = 1/f

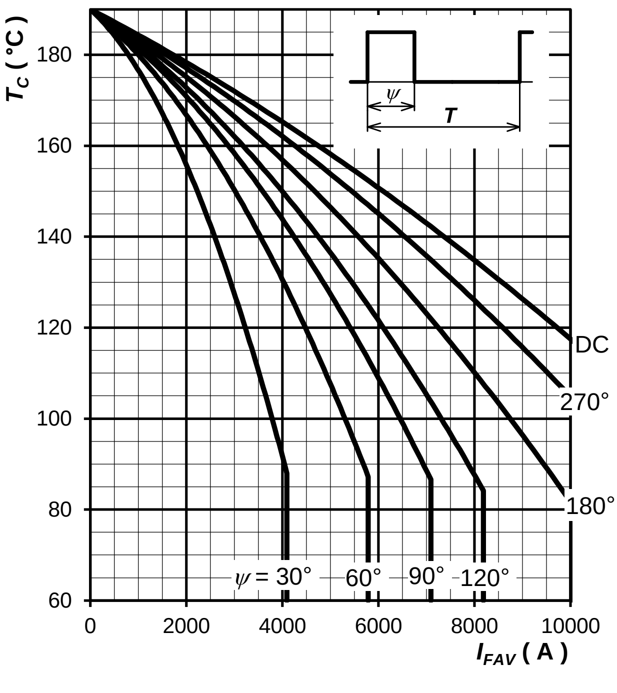

Fig. 9 Max.case temperature vs. aver. forward current, square waveform, f = 50 Hz, T = 1/f

Note 2: Figures number 6 ÷ 9 have been calculated without considering any forward and reverse recovery losses. They are valid for f = 50 or 60 Hz operation.

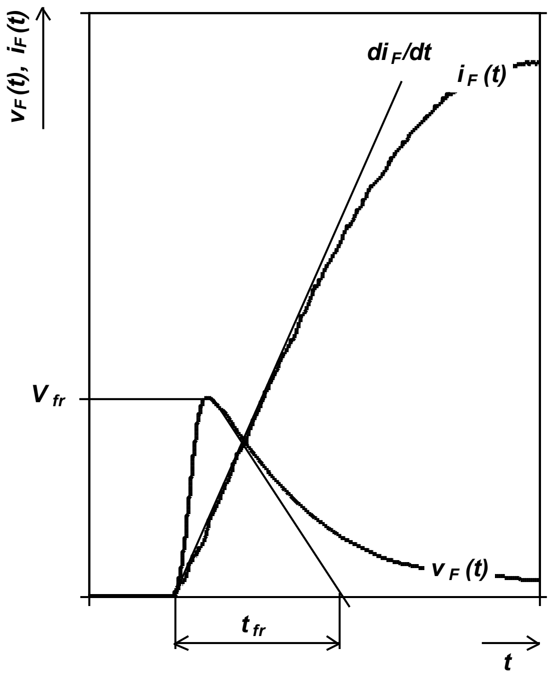

Fig. 10 Typical forward recovery voltage waveform when the diode is turned on with high di_F/dt

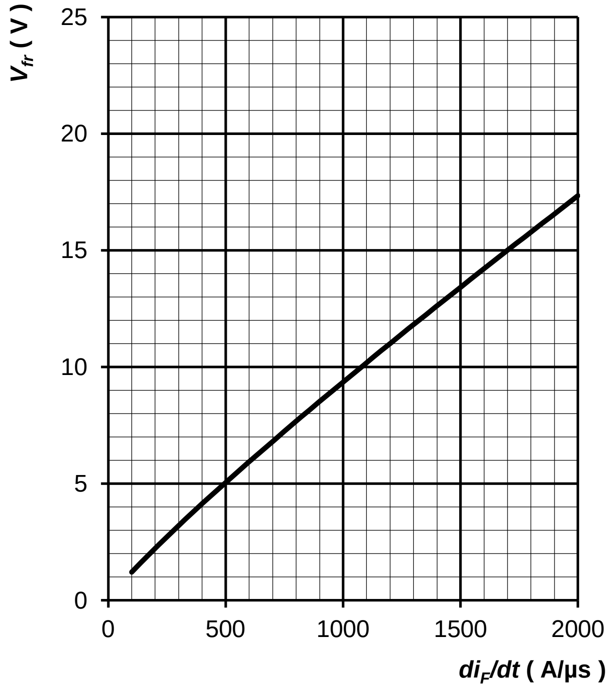

Fig. 11 Max. forward recovery voltage vs. rate of rise forward current, trapezoid pulse, $T_j = T_{jmax}$, $t_{fr} \leq 10$ µs

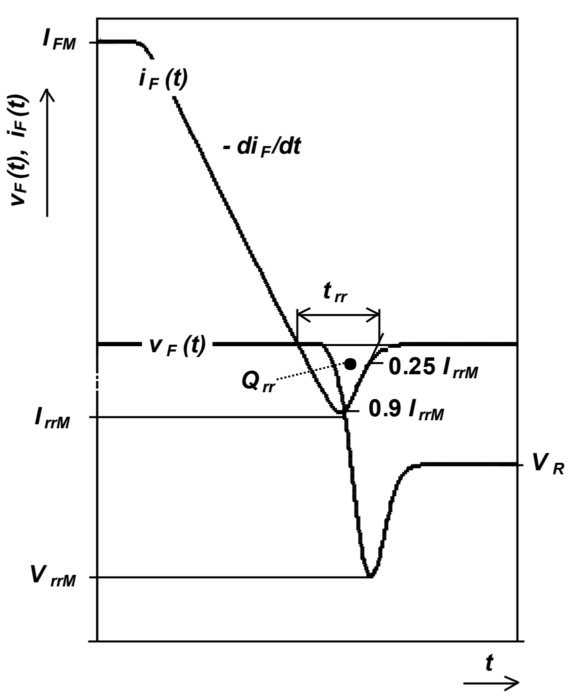

Fig. 12 Definition of reverse recovery parameters

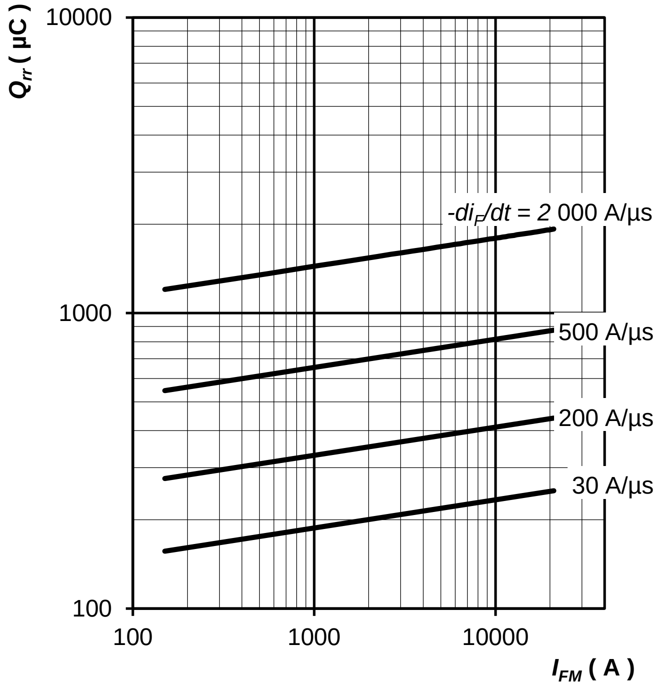

Fig. 13 Max. recovered charge vs. forward current,trapezoid pulse, $T_j = T_{jmax}$

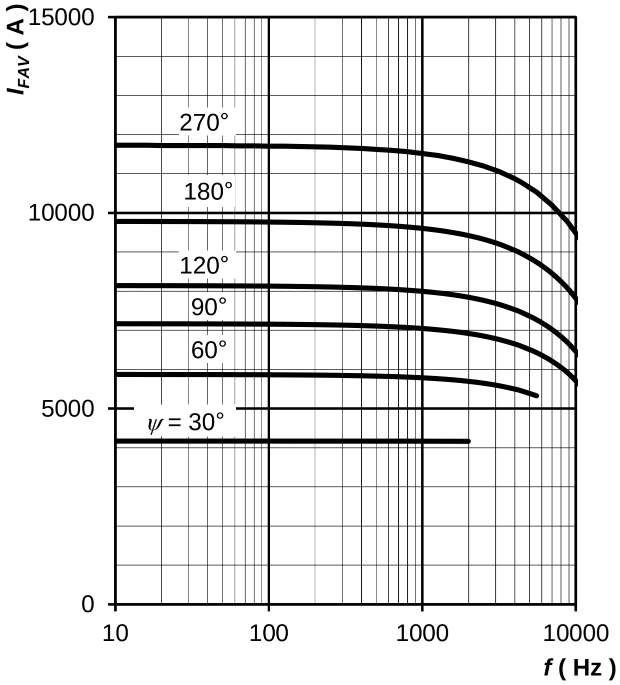

Fig. 14 Average forward current vs. frequency, trapezoid waveform, T_C = 85 °C, di_F/dt = ± 2 000 A/µs, V_R = 50 V

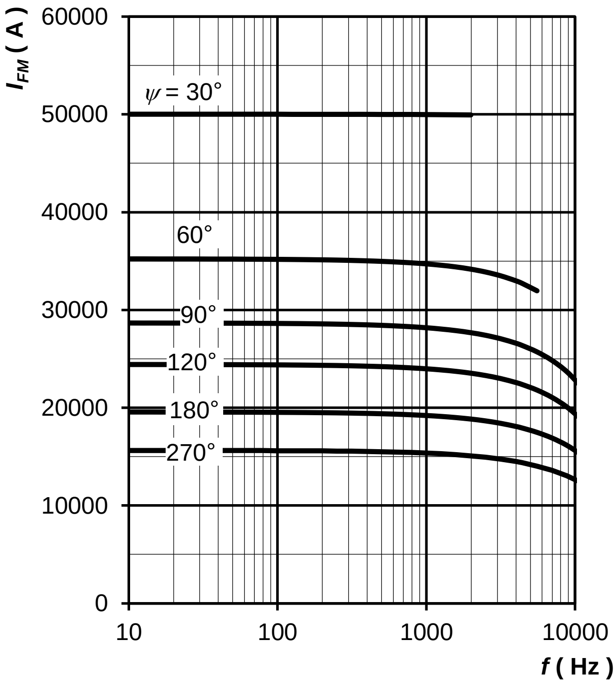

Fig. 15 Maximum forward current vs. frequency, trapezoid waveform, T_C = 85 °C, di_F/dt = ± 2 000 A/µs, V_R = 50 V

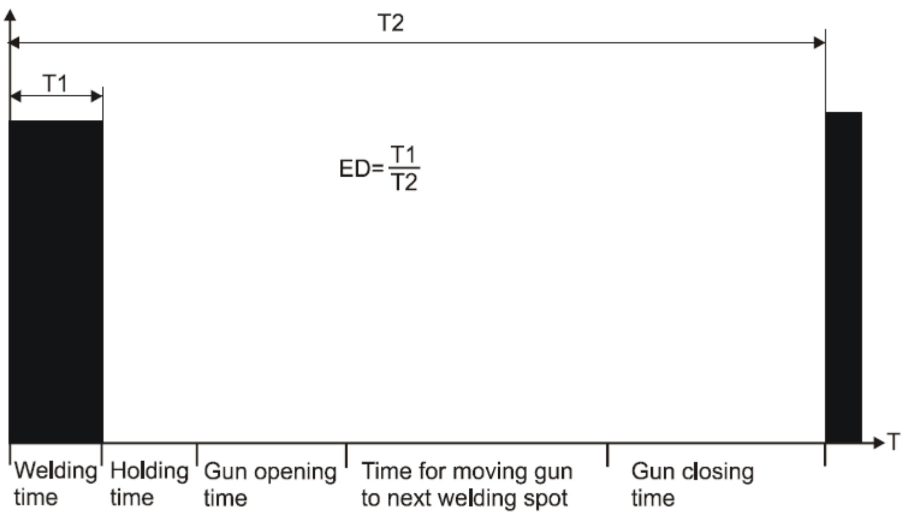

Fig. 16 Definition of ED for typical welding sequence

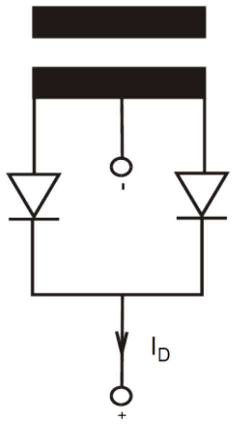

Fig. 17 Definition of I_D for single-phase centre tap

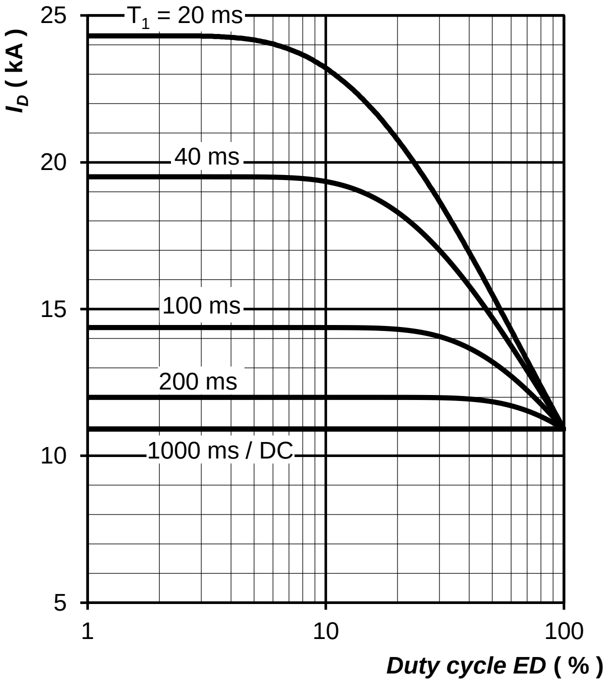

Fig. 18 Current load capacity, cont., DC output welding current with single-phase centre tap vs. duty cycle
f = 10 kHz, square wave, ΔT_j = 80 °C

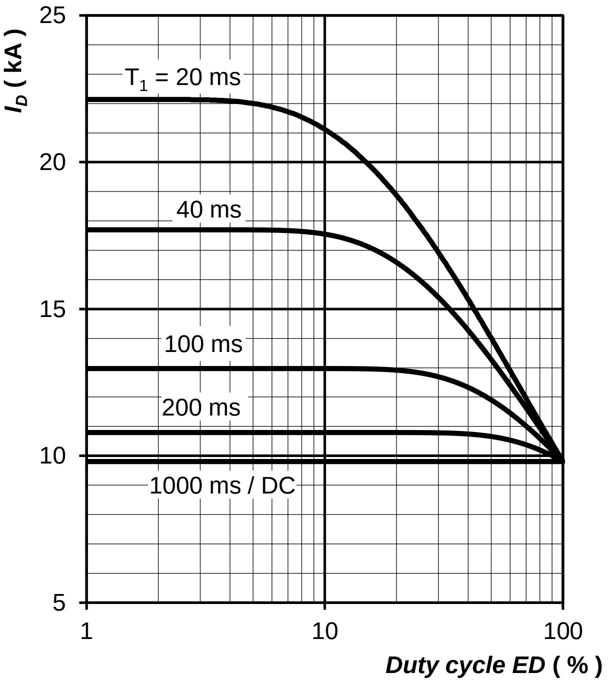

Fig. 19 Current load capacity, cont., DC output welding current with single-phase centre tap vs. duty cycle
f = 10 kHz, square wave, ΔT_j = 70 °C

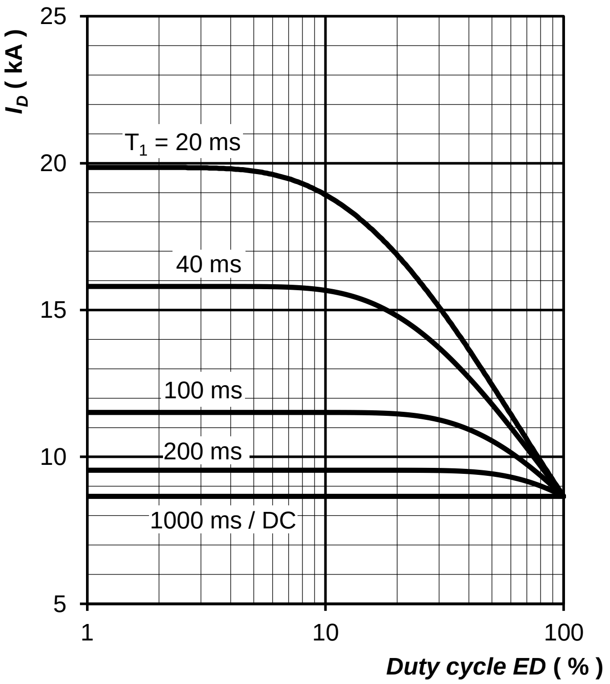

Fig. 20 Current load capacity, cont., DC output welding current with single-phase centre tap vs. duty cycle
f = 10 kHz, square wave, ΔT_j = 60 °C

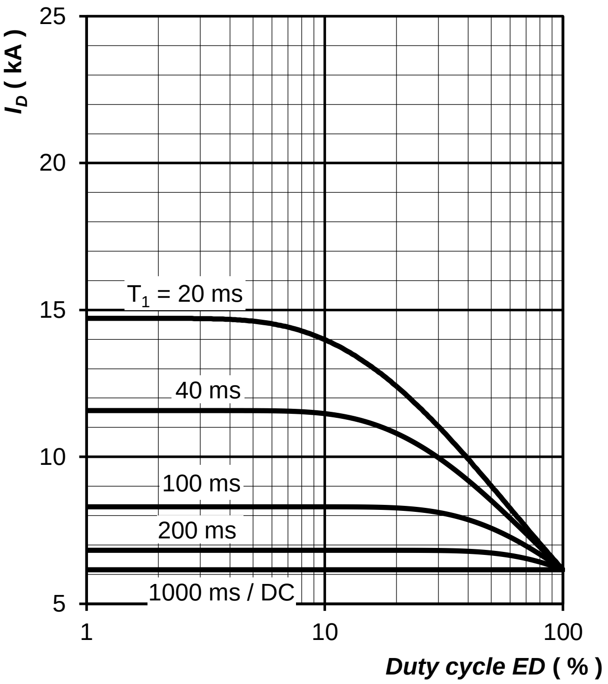

Fig. 21 Current load capacity, cont., DC output welding current with single-phase centre tap vs. duty cycle
f = 10 kHz, square wave, ΔT_j = 40 °C

Notes: