5SDD 92Z0401

Housingless Welding Diode

Properties

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

Applications

- Welding equipment
- High current application up to 2000 Hz

Key Parameters

V_{RRM}	=	400	V
I_{FAVm}	=	9 244	A
I_{FSM}	=	60 000	A
V_{TO}	=	0.780	V
r_T	=	0.031	mΩ

Types

	V_{RRM}
5SDD 92Z0401	**400 V**
Conditions:	$T_j = -40 \div 180\ °C$, 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
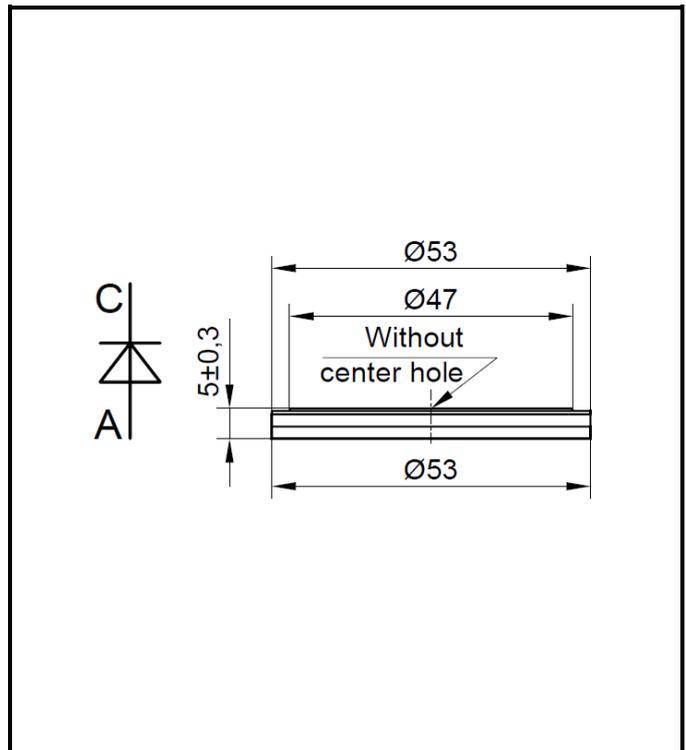
Fig. 1 Case

Maximum Ratings			Maximum Limits	Unit
V_{RRM}	**Repetitive peak reverse voltage** $T_j = -40 \div 180 \text{ °C}$		**400**	**V**
I_{FAVm}	**Average forward current**	$T_c = 85 \text{ °C}$	**9 244**	**A**
		$T_c = 110 \text{ °C}$	**7 489**	
I_{FRMS}	**RMS forward current**	$T_c = 85 \text{ °C}$	**14 520**	**A**
		$T_c = 110 \text{ °C}$	**11 763**	
I_{RRM}	**Repetitive reverse current** $V_R = V_{RRM}$		**50**	**mA**
I_{FSM}	**Non repetitive peak surge current** $V_R = 0 \text{ V, half sine pulse}$	$t_p = 8.3 \text{ ms}$	**64 000**	**A**
		$t_p = 10 \text{ ms}$	**60 000**	
I^2t	**Limiting load integral** $V_R = 0 \text{ V, half sine pulse}$	$t_p = 8.3 \text{ ms}$	**17 049 000**	**A^{2}s**
		$t_p = 10 \text{ ms}$	**18 000 000**	
$T_{jmin} - T_{jmax}$	**Operating temperature range**		**- 40 ÷ 180**	**°C**
$T_{stgmin} - T_{stgmax}$	**Storage temperature range**		**- 40 ÷ 180**	

Unless otherwise specified $T_j = 180 \text{ °C}$

Characteristics			Value			Unit
			min	typ	max	
V_{T0}	**Threshold voltage**				**0.780**	**V**
r_T	**Forward slope resistance** $I_{F1} = 7\,000 \text{ A}, I_{F2} = 21\,000 \text{ A}$				**0.031**	**mΩ**
V_{FM}	**Maximum forward voltage**	$I_{FM} = 5\,000 \text{ A}$			**0.920**	**V**
		$I_{FM} = 8\,000 \text{ A}$			**1.030**	
Q_{rr}	**Recovered charge** $I_{FM} = 1\,000 \text{ A}, di/dt = -30 \text{ A/}\mu s, V_R = 50 \text{ V}$			**400**		**µC**

Unless otherwise specified $T_j = 180 \text{ °C}$

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

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

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

Conditions:

F_m = 22 ± 2 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
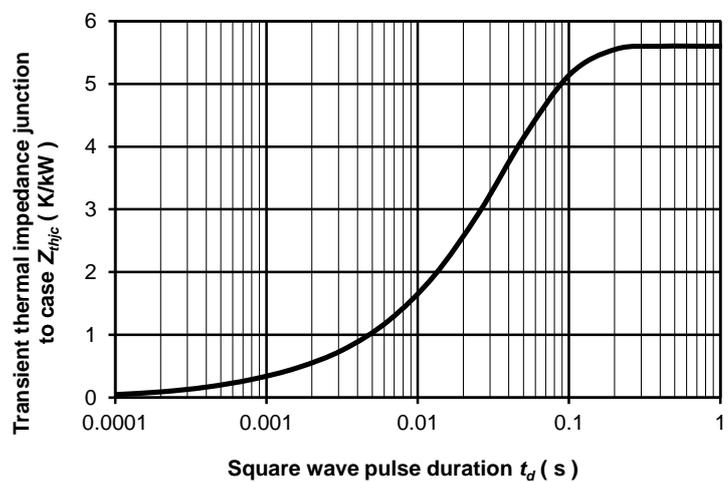
Fig. 2   Dependence transient thermal impedance junction to case on square pulse
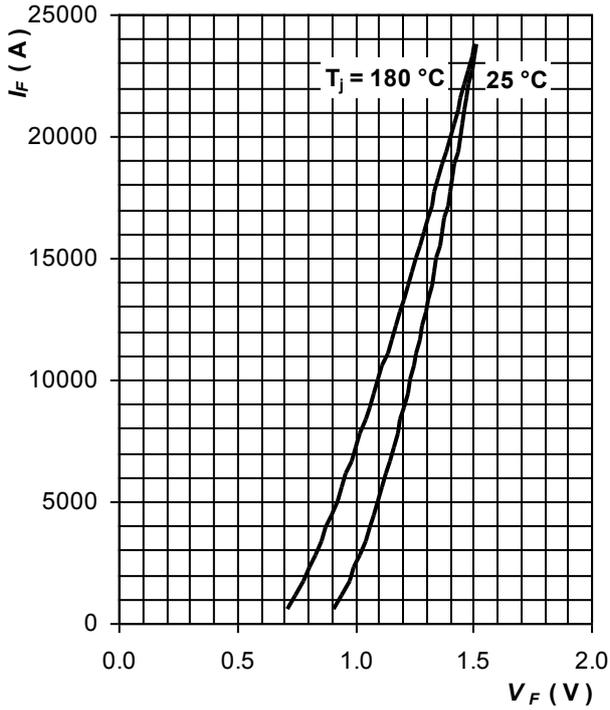
Fig. 3 Maximum forward voltage drop
characteristics
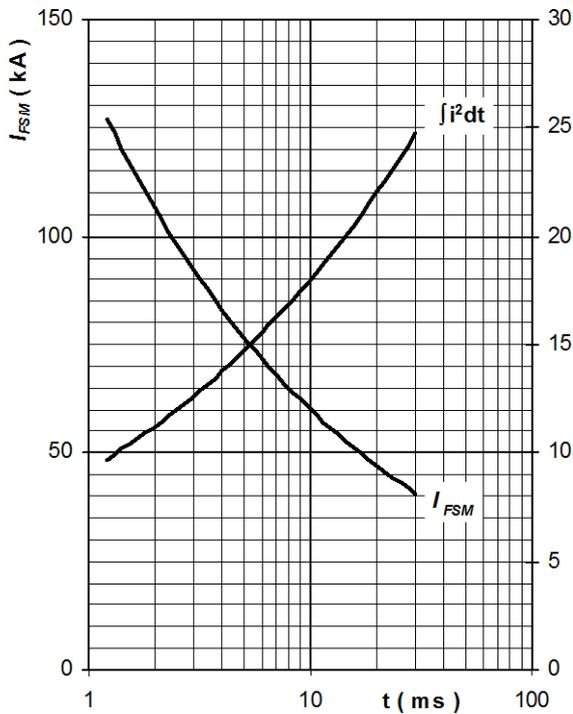
Fig. 4 Surge forward current vs. pulse length,
half sine wave, single pulse,
$V_R = 0$ V, $T_j = T_{jmax}$
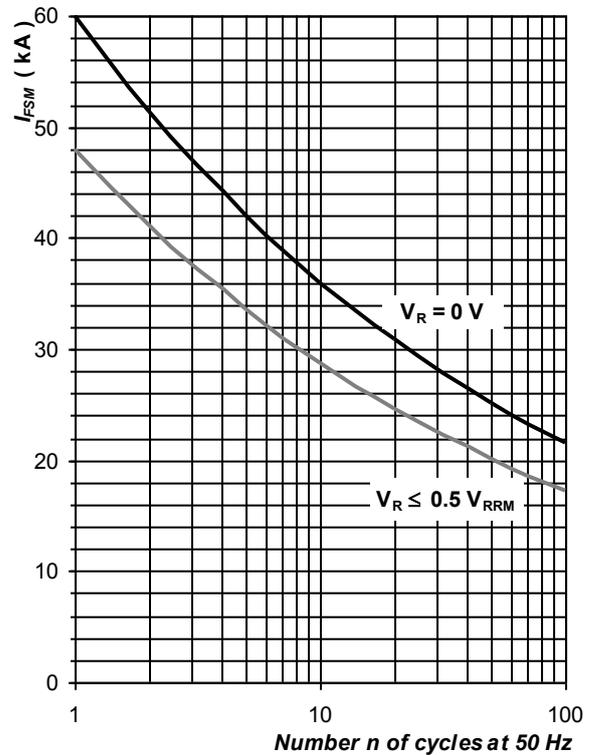
Fig. 5 Surge forward current vs. number
of pulses, half sine wave, $T_j = T_{jmax}$
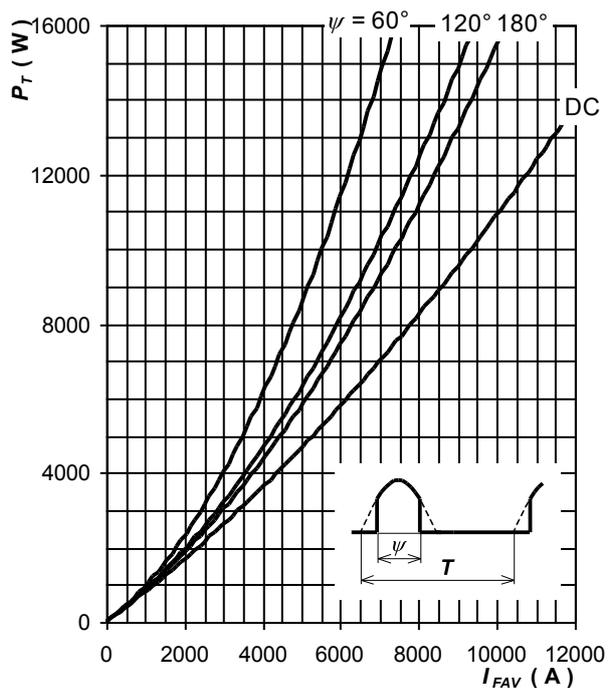
Fig. 6 Forward power loss vs. average forward
current, sine waveform, f = 50 Hz, T = 1/f
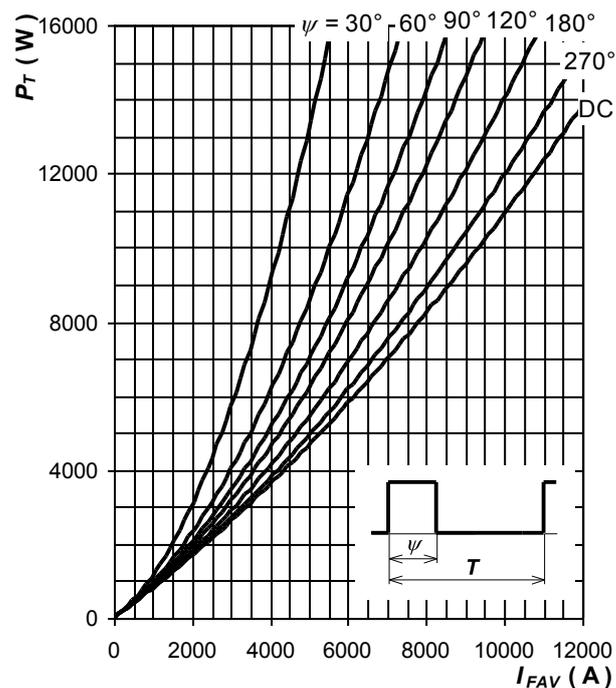
Fig. 7 Forward power loss vs. average forward
current, square waveform, f = 50 Hz, T = 1/f
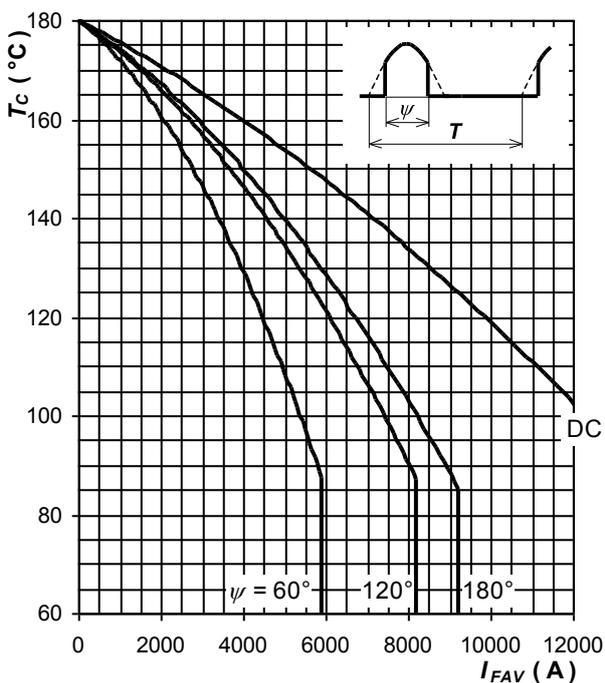
Fig. 8 Max. case temperature vs. aver. forward
current, sine waveform, f = 50 Hz, T = 1/f
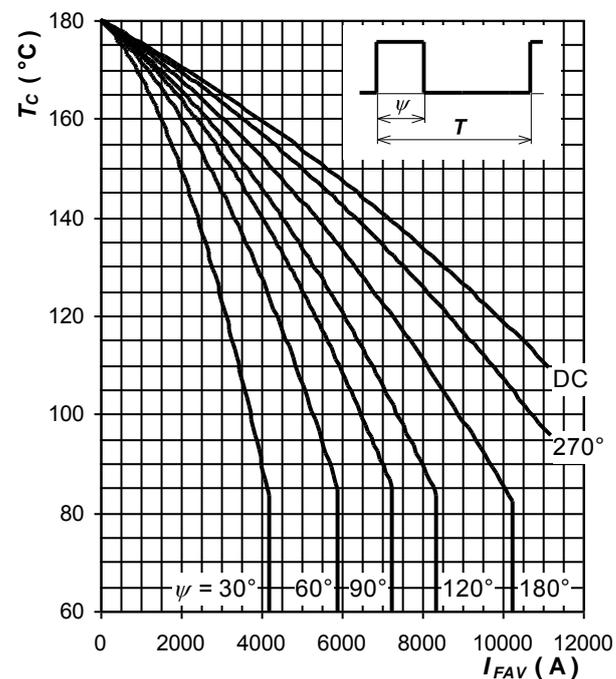
Fig. 9 Max.case temperature vs. aver. forward
current, square waveform, f = 50 Hz, T = 1/f

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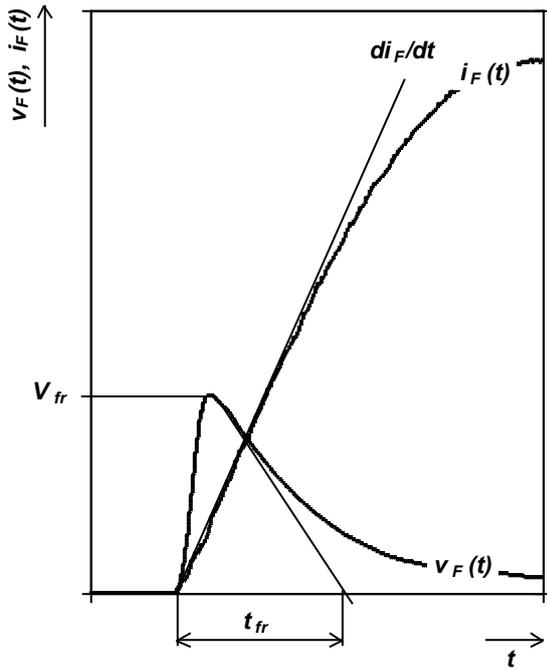
Fig. 10 Typical forward recovery voltage waveform
when the diode is turned on with high di_F/dt
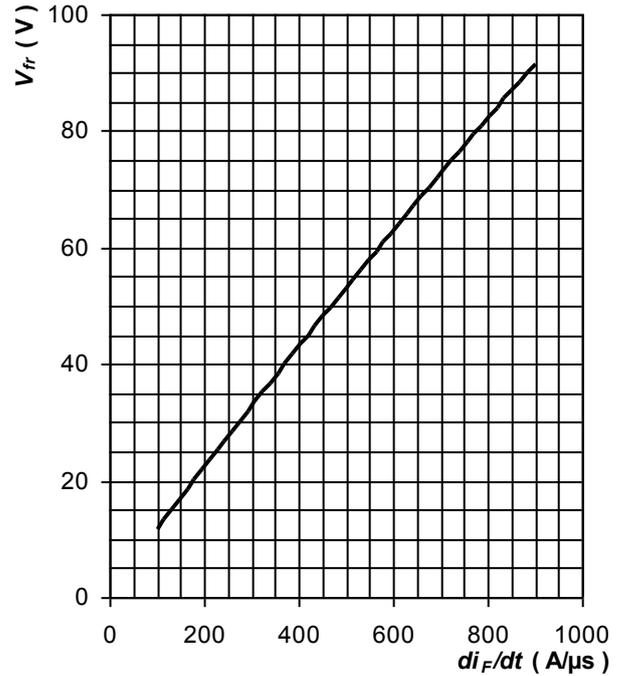
Fig. 11 Max. forward recovery voltage vs.
rate of rise forward current,
trapezoid pulse, $T_j = T_{jmax}$, $t_{fr} \leq 10\ \mu s$
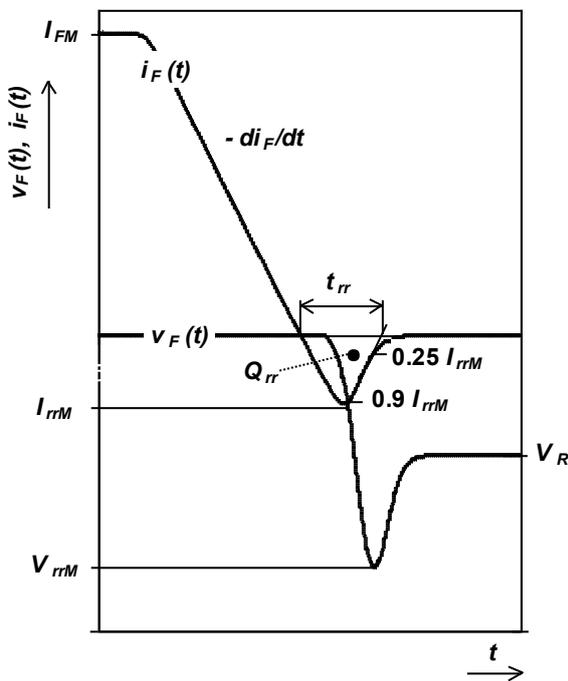
Fig. 12 Definition of reverse recovery parameters
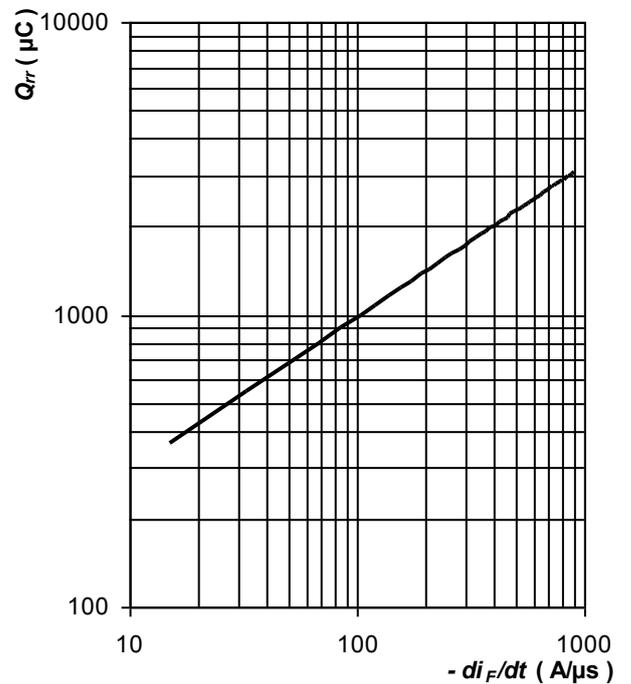
Fig. 13 Max. recovered charge vs. rate of fall
forward current, trapezoid pulse,
$I_{FM} = 2\ 000\ A$, $V_R = 100\ V$, $T_j = T_{jmax}$

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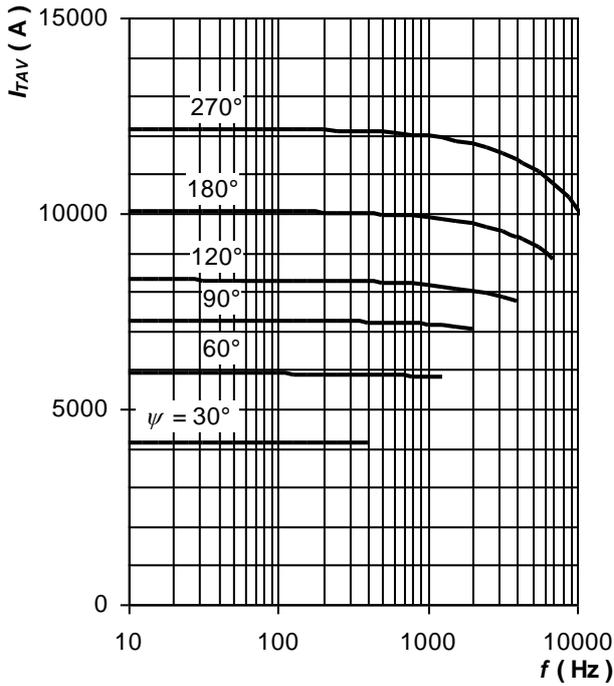
Fig. 14 Average forward current vs. frequency,
trapezoid waveform, $T_C = 85$ °C,
$di_F/dt = \pm 500$ A/µs, $V_R = 50$ V
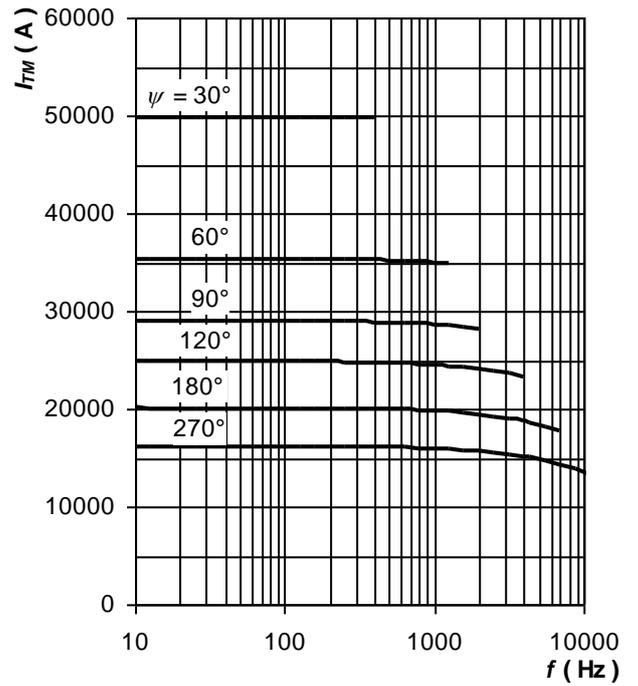
Fig. 15 Maximum forward current vs. frequency,
trapezoid waveform, $T_C = 85$ °C,
$di_F/dt = \pm 500$ A/µs, $V_R = 50$ V
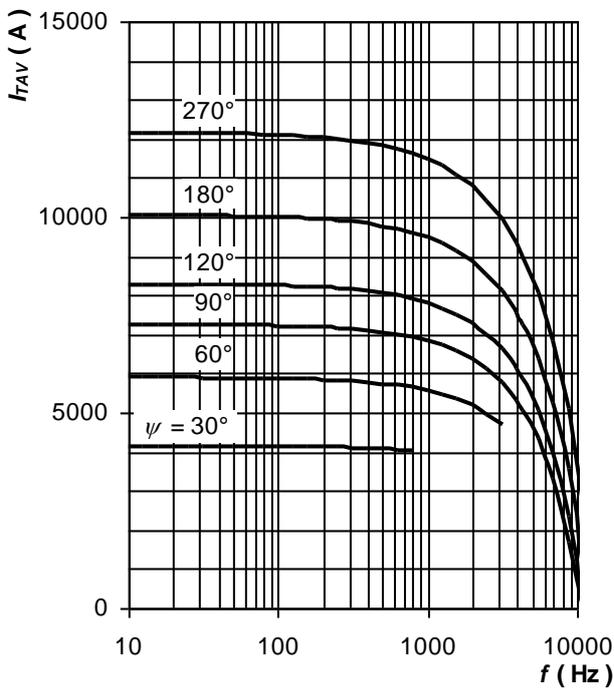
Fig. 16 Average forward current vs. frequency,
trapezoid waveform, $T_C = 85$ °C,
$di_F/dt = \pm 1\ 000$ A/µs, $V_R = 50$ V
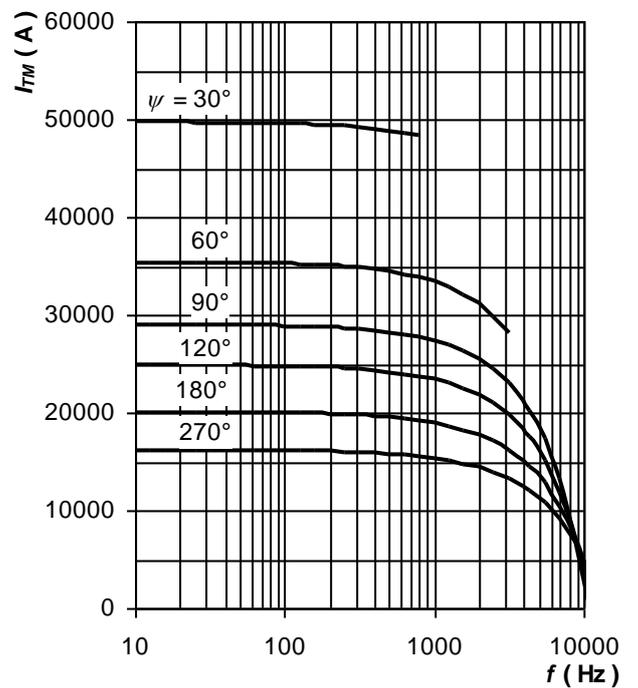
Fig. 17 Maximum forward current vs. frequency,
trapezoid waveform, $T_C = 85$ °C,
$di_F/dt = \pm 1\ 000$ A/µs, $V_R = 50$ V

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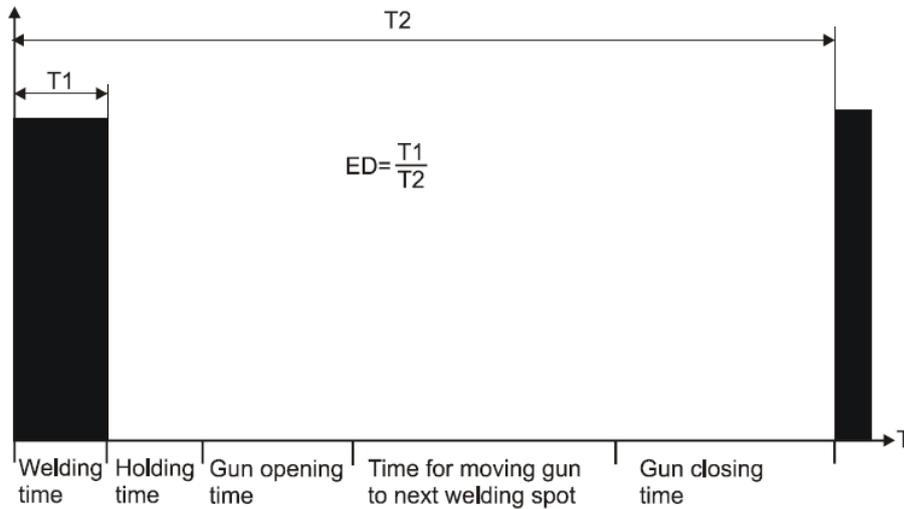
Fig. 18   Definition of ED for typical welding sequence
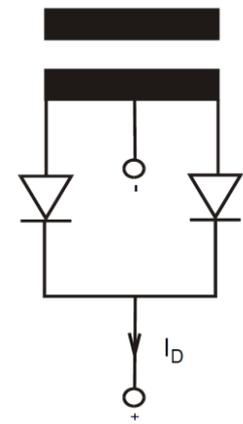
Fig. 19   Definition of I_D for single-phase centre tap

$$ED = \frac{T1}{T2}$$
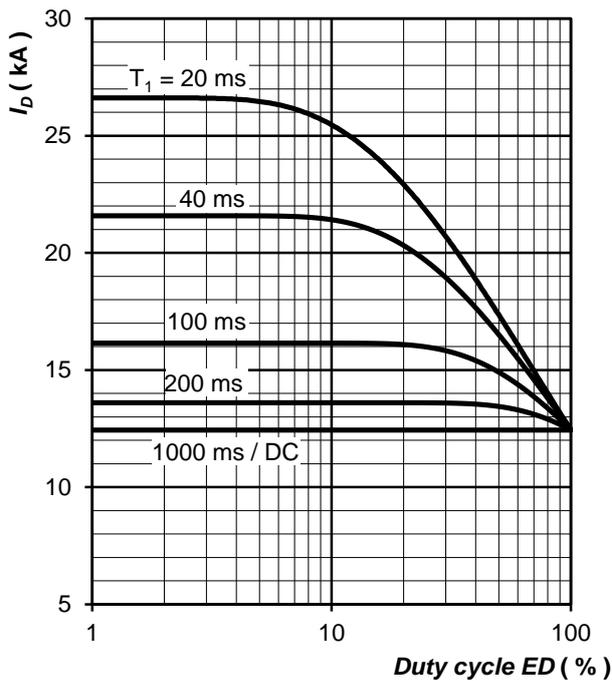

Fig. 20   Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
$f = 1000$ Hz, square wave, $\Delta T_j = 80\ °C$
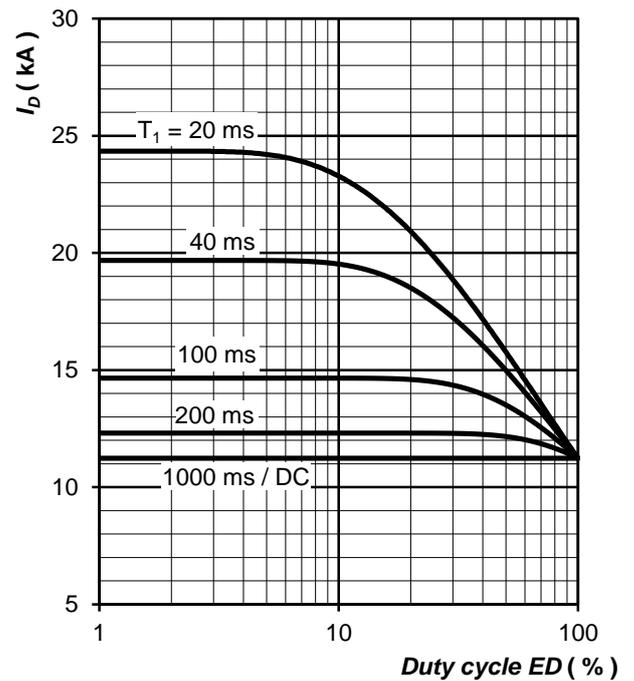
Fig. 21   Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
$f = 1000$ Hz, square wave, $\Delta T_j = 70\ °C$
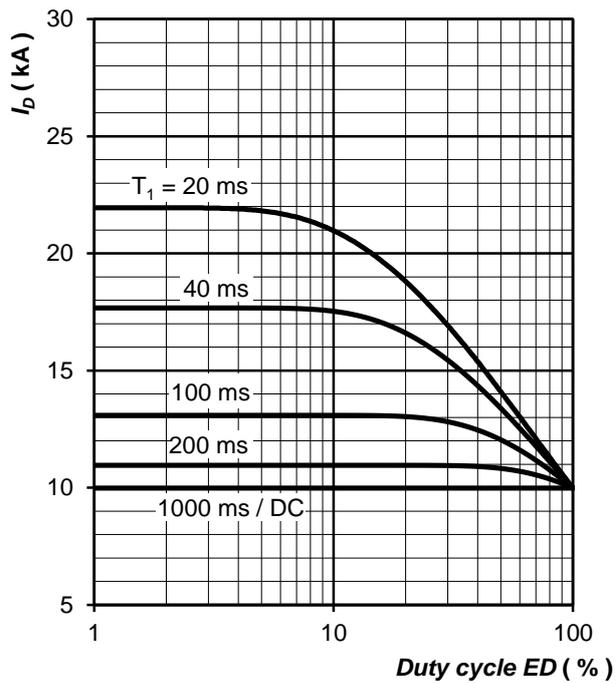
Fig. 22   Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
f = 1000 Hz, square wave, ΔT_j = 60 °C

Fig. 23   Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
f = 1000 Hz, square wave, ΔT_j = 40 °C

Notes: