



5SDF 0131Z0401

High Frequency Housingless Welding Diode

Properties

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

Applications

- Welding equipment
- High current application up to 10 kHz

Key Parameters

V_{RRM}	=	400	V
I_{FAVm}	=	13 058	A
I_{FSM}	=	70 000	A
V_{TO}	=	0.977	V
r_T	=	0.022	mΩ

Types

	V_{RRM}
5SDF 0131Z0401	400 V
Conditions: $T_j = -40 \div 190$ °C, half sine waveform, $f = 50$ Hz	

Mechanical Data

F_m	Mounting force	35 ÷ 70 kN
m	Weight	0.14 kg
D_s	Surface creepage distance	2 mm
D_a	Air strike distance	2 mm

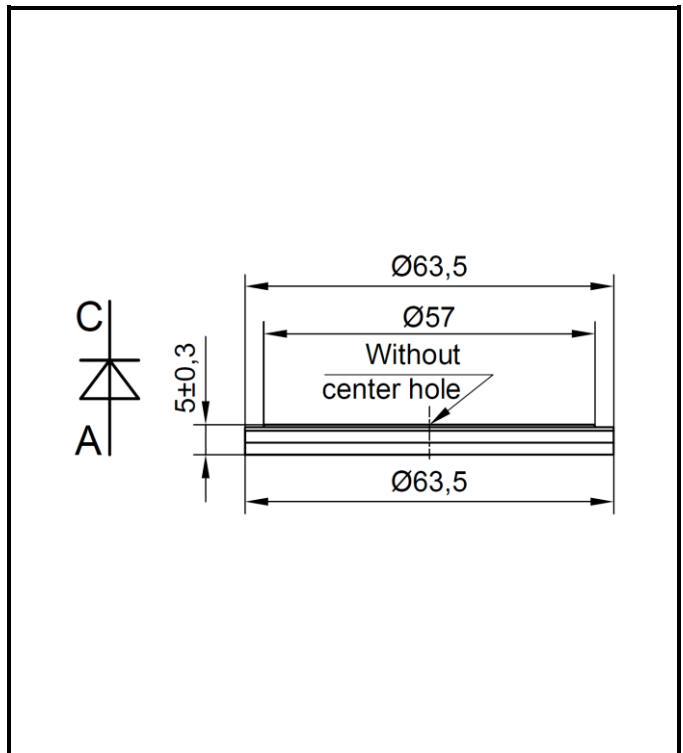


Fig. 1 Case



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Maximum Ratings			Maximum Limits	Unit
V_{RRM}	Repetitive peak reverse voltage $T_j = -40 \div 190 \text{ }^\circ\text{C}$		400	V
I_{FAVM}	Average forward current	$T_c = 85 \text{ }^\circ\text{C}$	13 058	A
		$T_c = 110 \text{ }^\circ\text{C}$	10 743	
I_{FRMS}	RMS forward current	$T_c = 85 \text{ }^\circ\text{C}$	20 512	A
		$T_c = 110 \text{ }^\circ\text{C}$	16 875	
I_{RRM}	Repetitive reverse current $V_R = V_{RRM}$		200	mA
I_{FSM}	Non repetitive peak surge current $V_R = 0 \text{ V, half sine pulse}$	$t_p = 8.3 \text{ ms}$	75 000	A
		$t_p = 10 \text{ ms}$	70 000	
Pt	Limiting load integral $V_R = 0 \text{ V, half sine pulse}$	$t_p = 8.3 \text{ ms}$	23 205 000	A²s
		$t_p = 10 \text{ ms}$	24 500 000	
$T_{jmin} - T_{jmax}$	Operating temperature range		- 40 \div 190	$^\circ\text{C}$
$T_{stgmin} - T_{stgmax}$	Storage temperature range		- 40 \div 190	

Unless otherwise specified $T_j = 190 \text{ }^\circ\text{C}$

Characteristics			Value			Unit
			<i>min</i>	<i>typ</i>	<i>max</i>	
V_{T0}	Threshold voltage				0.977	V
r_T	Forward slope resistance $I_{F1} = 10\,000 \text{ A, } I_{F2} = 30\,000 \text{ A}$				0.022	mΩ
V_{FM}	Maximum forward voltage	$I_{FM} = 8\,000 \text{ A}$			1.140	V
		$I_{FM} = 10\,000 \text{ A}$			1.190	
Q_{rr}	Recovered charge $I_{FM} = 2\,000 \text{ A, } di/dt = -30 \text{ A}/\mu\text{s, } V_R = 50 \text{ V}$				300	μC

Unless otherwise specified $T_j = 190 \text{ }^\circ\text{C}$

Thermal Parameters			Value	Unit
R_{thjc}	Thermal resistance junction to case	double side cooling	3.9	K/kW
		anode side cooling	5.2	
		cathode side cooling	15.1	
R_{thch}	Thermal resistance case to heatsink	double side cooling	2.6	K/kW
		anode side cooling	4.7	
		cathode side cooling	5.8	

Transient Thermal Impedance

Analytical function for transient thermal impedance

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

Conditions:
 $F_m = 35^{+5}_{-0}$ kN, Double side cooled

Correction for periodic waveforms

180° sine:	0.9 K/kW
120° sine:	1.2 K/kW
60° sine:	2.2 K/kW
180° rectangular:	0.8 K/kW
120° rectangular:	1.2 K/kW
60° rectangular:	2.2 K/kW

i	1	2	3	4
τ_i (s)	0.0454	0.0255	0.0041	0.0006
R_i (K/kW)	2.6480	0.8700	0.2200	0.1500

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

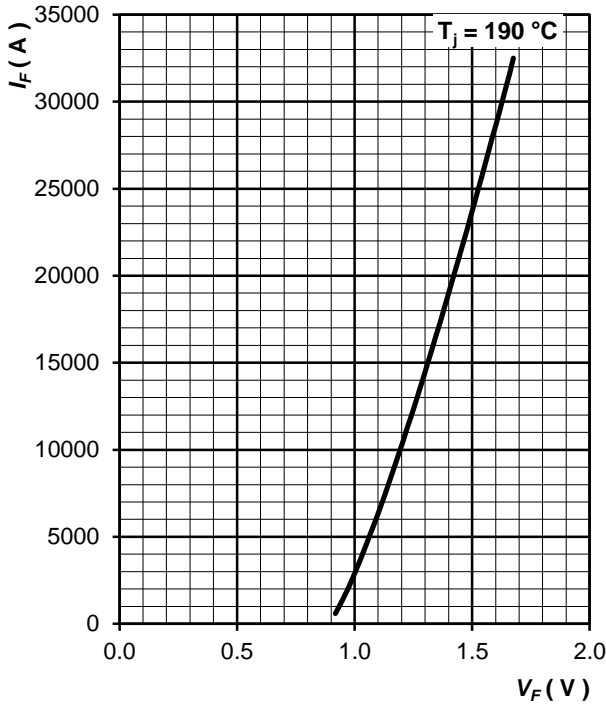


Fig. 3 Maximum forward voltage drop characteristics

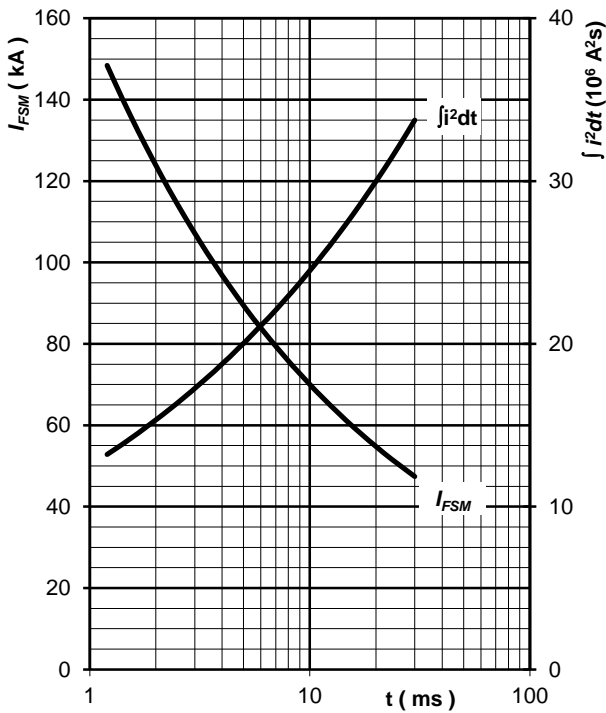


Fig. 4 Surge forward current vs. pulse length, half sine wave, single pulse, $V_R = 0 \text{ V}$, $T_j = T_{jmax}$

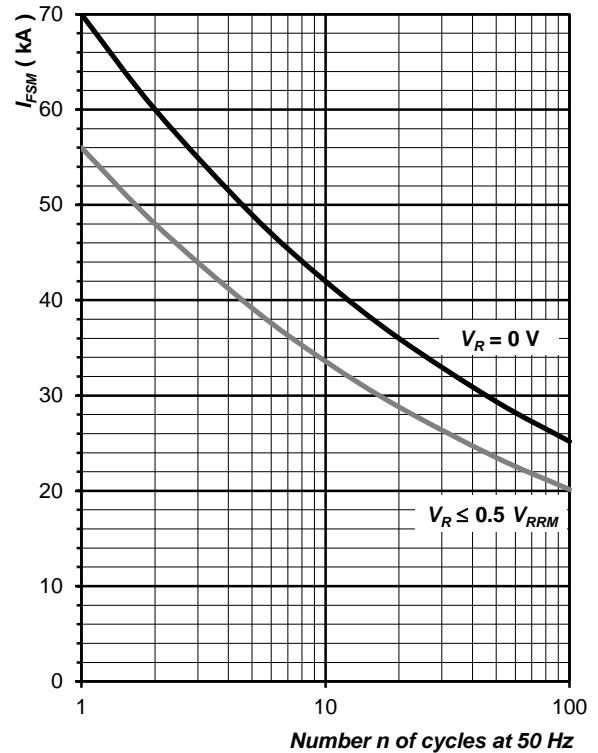


Fig. 5 Surge forward current vs. number of pulses, half sine wave, $T_j = T_{jmax}$

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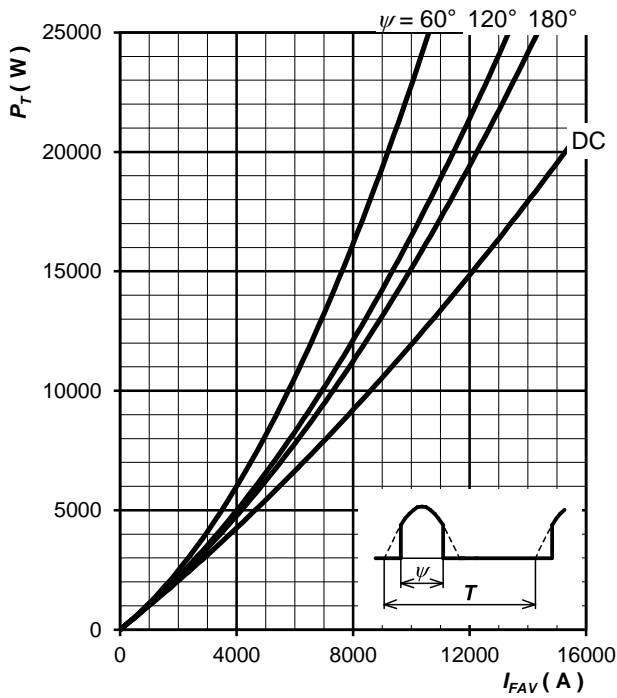


Fig. 6 Forward power loss vs. average forward current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

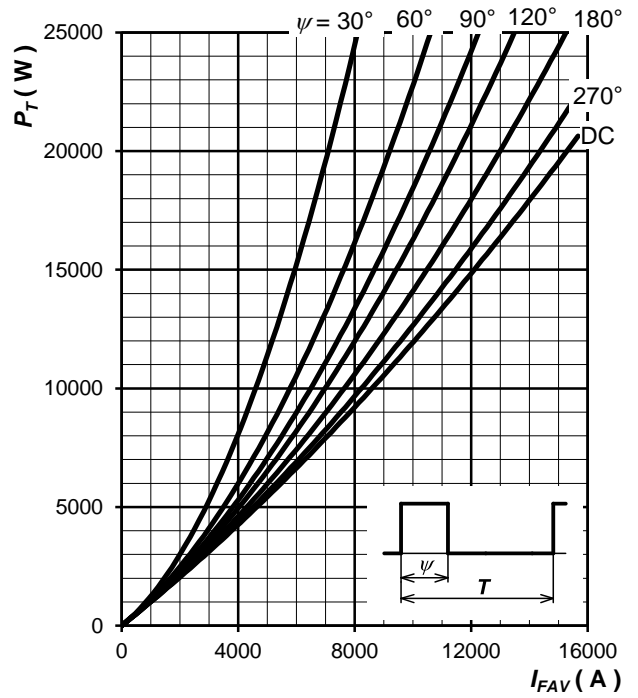


Fig. 7 Forward power loss vs. average forward current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

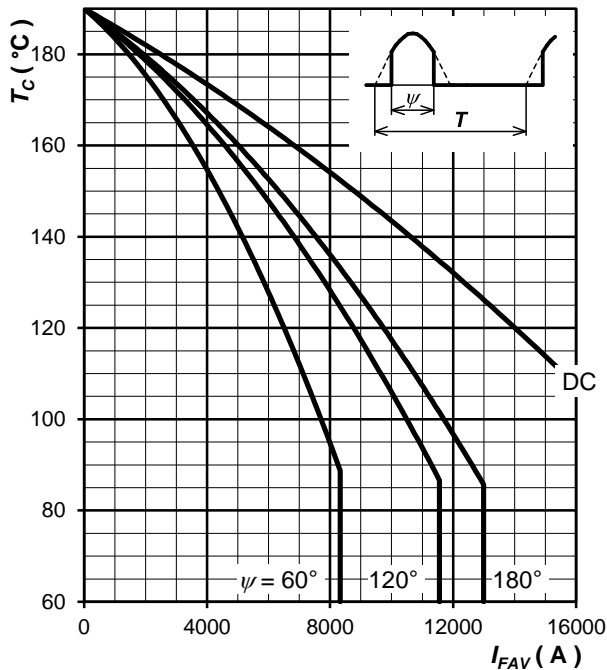


Fig. 8 Max. case temperature vs. aver. forward current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

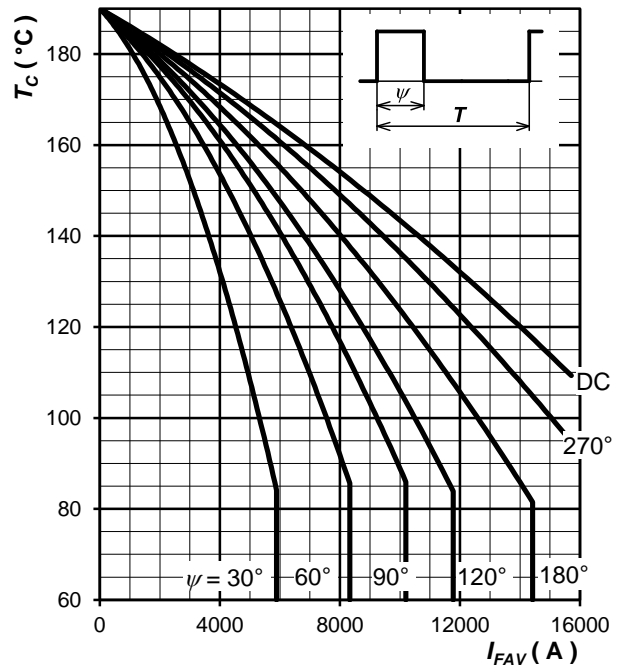


Fig. 9 Max. case temperature vs. aver. forward current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

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.

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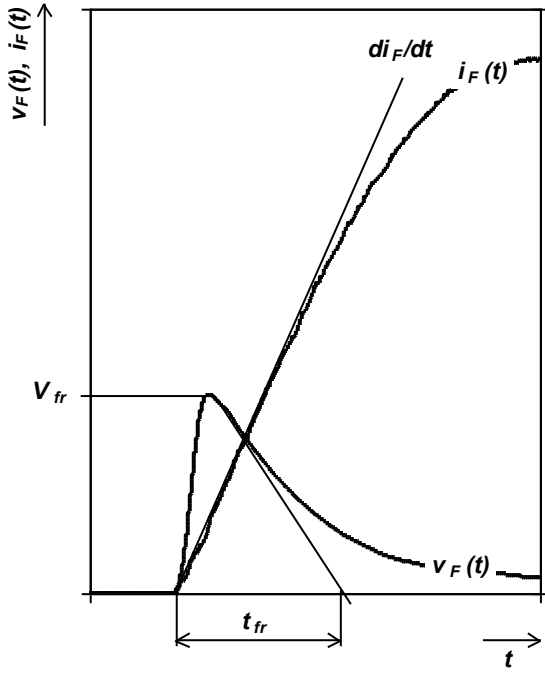


Fig. 10 Typical forward recovery voltage waveform when the diode is turned on with high di_F/dt

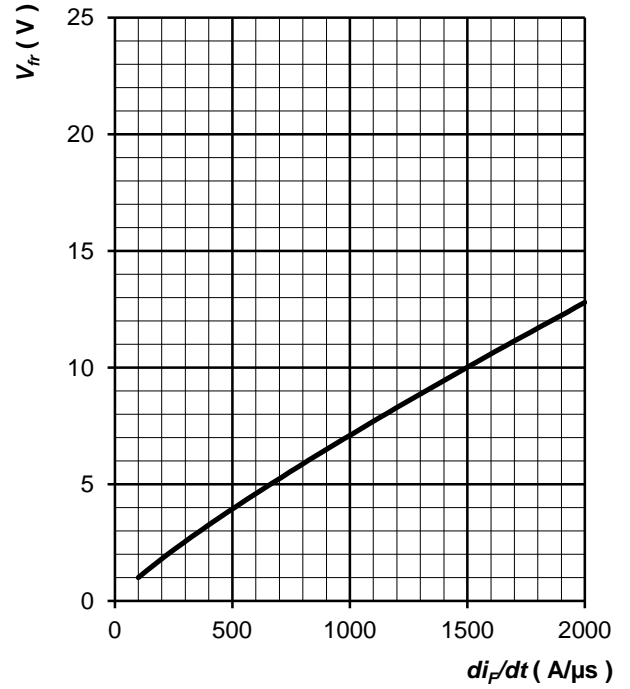


Fig. 11 Max. forward recovery voltage vs. rate of rise forward current, trapezoid pulse, $T_j = T_{jmax}$, $t_{fr} \leq 10 \mu s$

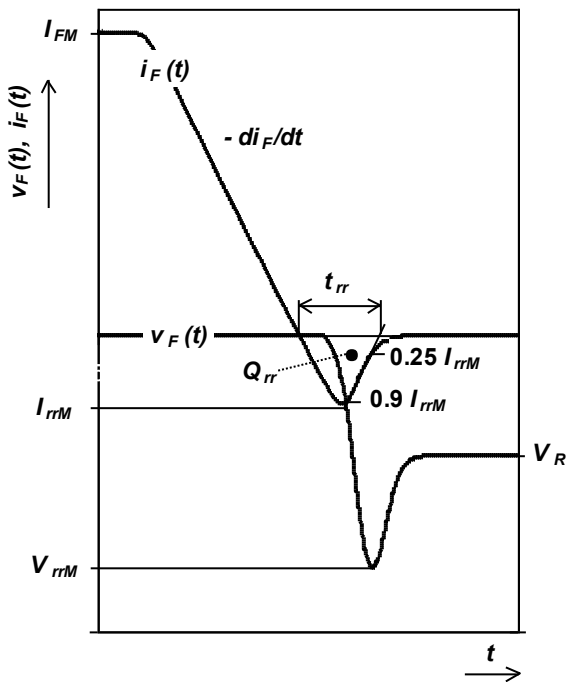


Fig. 12 Definition of reverse recovery parameters

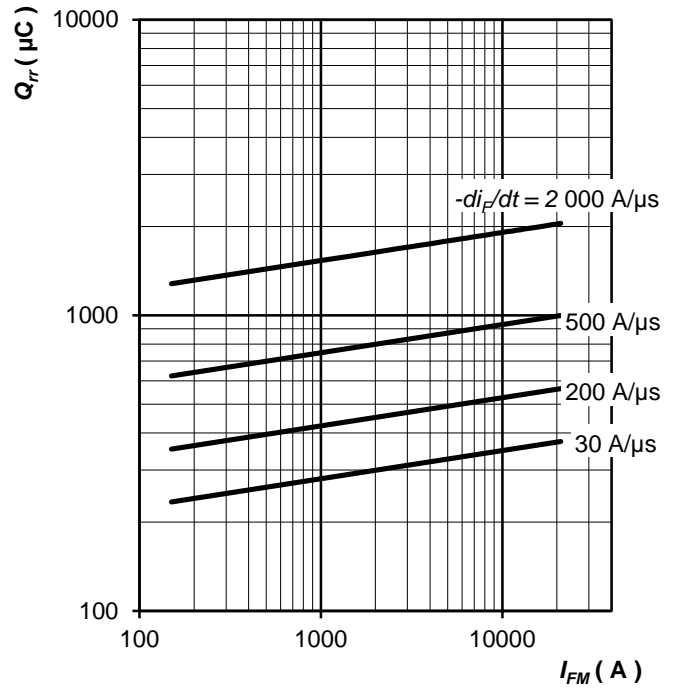


Fig. 13 Max. recovered charge vs. forward current, trapezoid pulse, $T_j = T_{jmax}$

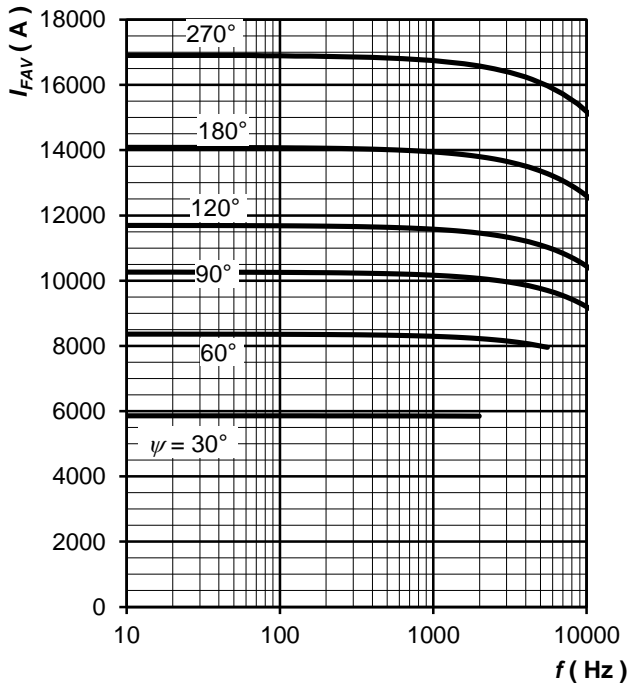


Fig. 14 Average forward current vs. frequency, trapezoid waveform, $T_C = 85^\circ\text{C}$, $di_F/dt = \pm 2\,000\text{ A}/\mu\text{s}$, $V_R = 50\text{ V}$

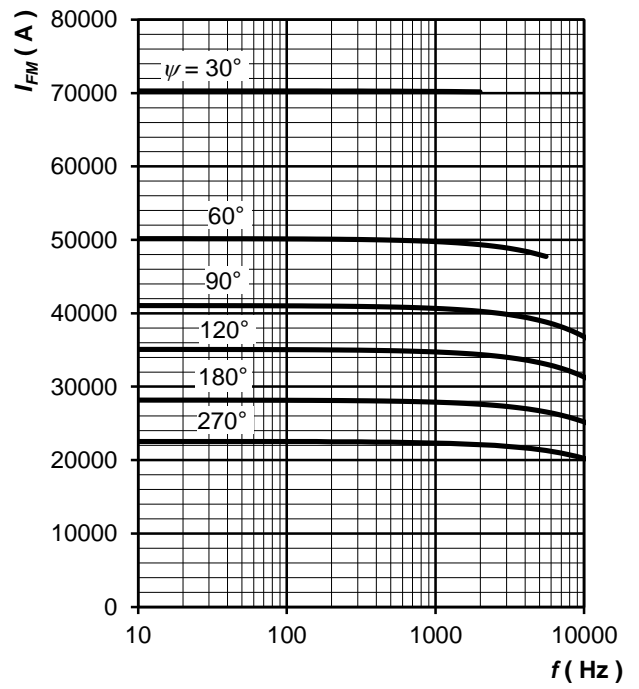


Fig. 15 Maximum forward current vs. frequency, trapezoid waveform, $T_C = 85^\circ\text{C}$, $di_F/dt = \pm 2\,000\text{ A}/\mu\text{s}$, $V_R = 50\text{ V}$

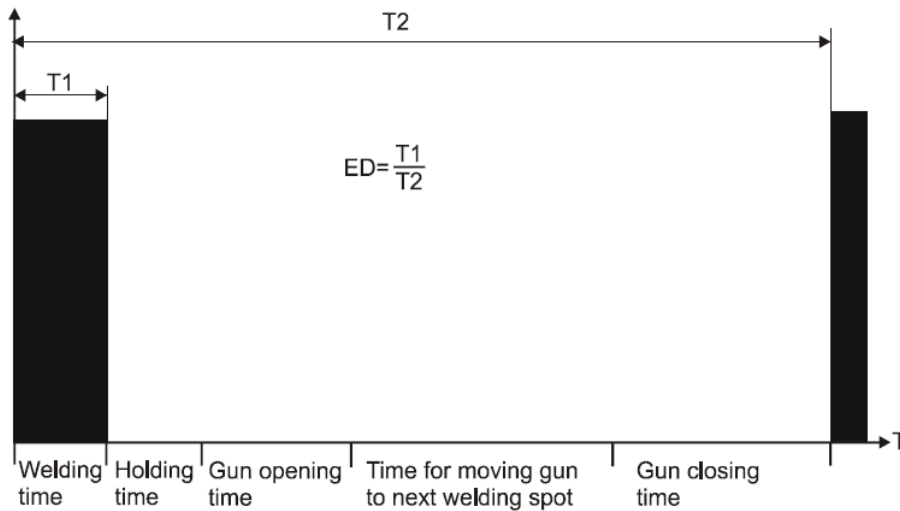


Fig. 16 Definition of ED for typical welding sequence

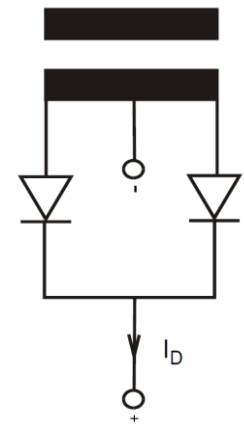


Fig. 17 Definition of I_D for single-phase centre tap

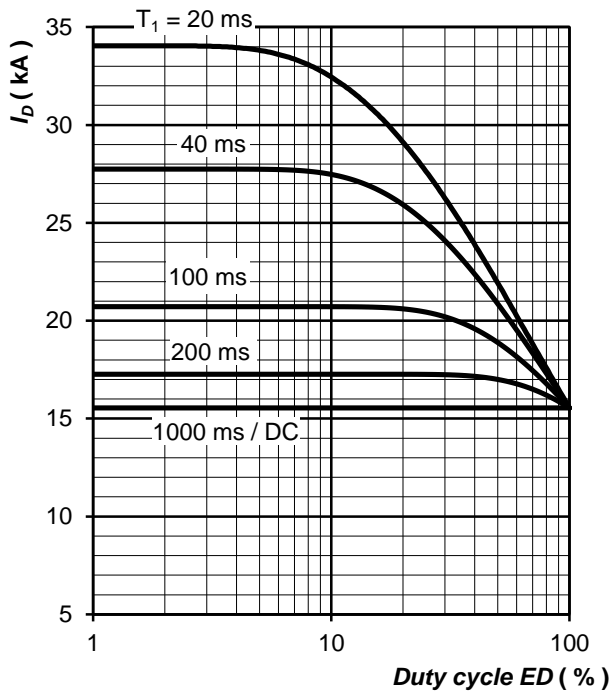


Fig. 18 Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
 $f = 10 \text{ kHz}$, square wave, $\Delta T_j = 80 \text{ }^\circ\text{C}$

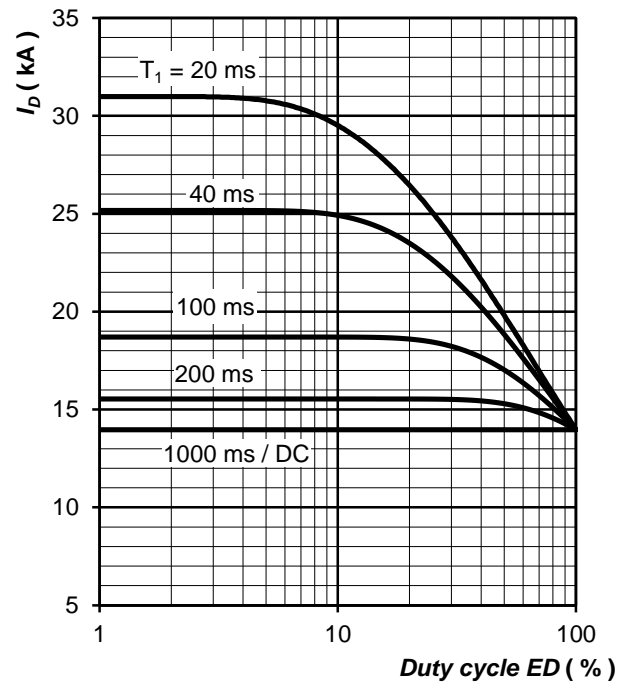


Fig. 19 Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
 $f = 10 \text{ kHz}$, square wave, $\Delta T_j = 70 \text{ }^\circ\text{C}$

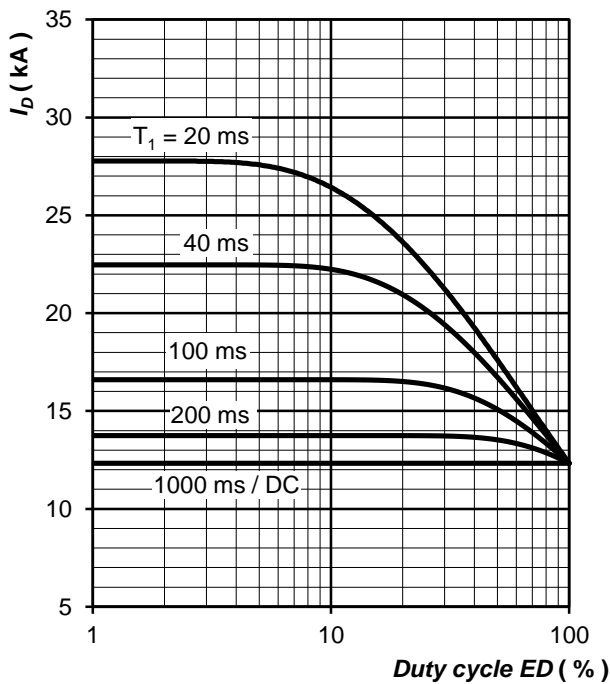


Fig. 20 Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
 $f = 10 \text{ kHz}$, square wave, $\Delta T_j = 60 \text{ }^\circ\text{C}$

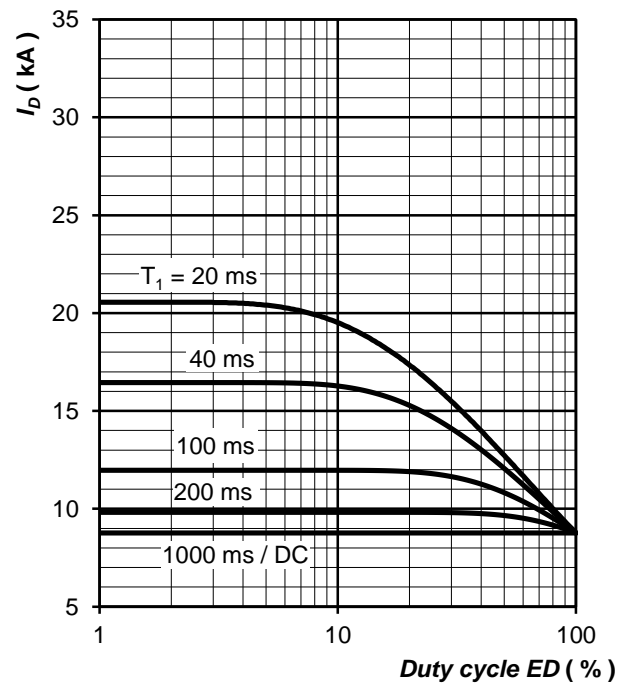


Fig. 21 Current load capacity, cont.,
DC output welding current with single-phase
centre tap vs. duty cycle
 $f = 10 \text{ kHz}$, square wave, $\Delta T_j = 40 \text{ }^\circ\text{C}$

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