



# 5SDF 0102C0400

## High Frequency Welding Diode

### Properties

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

### Applications

- Welding equipment
- High current application up to 10 kHz

### Key Parameters

|            |   |        |            |
|------------|---|--------|------------|
| $V_{RRM}$  | = | 400    | V          |
| $I_{FAVm}$ | = | 10 159 | A          |
| $I_{FSM}$  | = | 70 000 | A          |
| $V_{TO}$   | = | 0.977  | V          |
| $r_T$      | = | 0.022  | m $\Omega$ |

### Types

|                       |   |
|-----------------------|---|
|                       | $V_{RRM}$   |
| <b>5SDF 0102C0400</b> | <b>400 V</b>  |
| Conditions:           | $T_j = -40 \div 190 \text{ }^\circ\text{C}$ ,<br>half sine waveform,<br>$f = 50 \text{ Hz}$ |

### Mechanical Data

|       |                           |            |
|-------|---------------------------|------------|
| $F_m$ | Mounting force            | 35 ÷ 40 kN |
| $m$   | Weight                    | 0.22 kg    |
| $D_s$ | Surface creepage distance | 4 mm       |
| $D_a$ | Air strike distance       | 4 mm       |

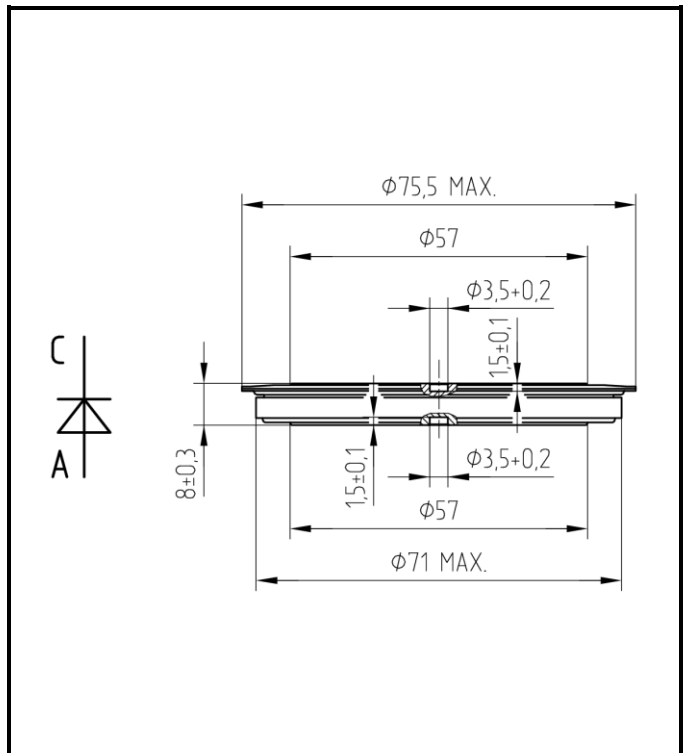


Fig. 1 Case



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| <b>Maximum Ratings</b>    |   |                                    | <b>Maximum Limits</b>             | <b>Unit</b>                        |
|---------------------------|---|------------------------------------|-----------------------------------|------------------------------------|
| $V_{RRM}$                 | <b>Repetitive peak reverse voltage</b><br>$T_j = -40 \div 190 \text{ }^\circ\text{C}$ |                                    | <b>400</b>                        | <b>V</b>                           |
| $I_{FAVm}$                | <b>Average forward current</b>  | $T_c = 85 \text{ }^\circ\text{C}$  | <b>10 159</b>                     | <b>A</b>                           |
|                           |   | $T_c = 110 \text{ }^\circ\text{C}$ | <b>8 286</b>                      |                                    |
| $I_{FRMS}$                | <b>RMS forward current</b>  | $T_c = 85 \text{ }^\circ\text{C}$  | <b>15 958</b>                     | <b>A</b>                           |
|                           |   | $T_c = 110 \text{ }^\circ\text{C}$ | <b>13 016</b>                     |                                    |
| $I_{RRM}$                 | <b>Repetitive reverse current</b><br>$V_R = V_{RRM}$                                  |                                    | <b>200</b>                        | <b>mA</b>                          |
| $I_{FSM}$                 | <b>Non repetitive peak surge current</b><br>$V_R = 0 \text{ V, half sine pulse}$      | $t_p = 8.3 \text{ ms}$             | <b>75 000</b>                     | <b>A</b>                           |
|                           |   | $t_p = 10 \text{ ms}$              | <b>70 000</b>                     |                                    |
| $I^2t$                    | <b>Limiting load integral</b><br>$V_R = 0 \text{ V, half sine pulse}$                 | $t_p = 8.3 \text{ ms}$             | <b>23 205 000</b>                 | <b>A<sup>2</sup>s</b>              |
|                           |   | $t_p = 10 \text{ ms}$              | <b>24 500 000</b>                 |                                    |
| $T_{jmin} - T_{jmax}$     | <b>Operating temperature range</b>  |                                    | <b>- 40 <math>\div</math> 190</b> | <b><math>^\circ\text{C}</math></b> |
| $T_{stgmin} - T_{stgmax}$ | <b>Storage temperature range</b>  |                                    | <b>- 40 <math>\div</math> 190</b> |                                    |

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

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

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

| Thermal Parameters |                                     |                     | Value | Unit |
|--------------------|-------------------------------------|---------------------|-------|------|
| $R_{thjc}$         | Thermal resistance junction to case | double side cooling | 6     | K/kW |
|                    |                                     | single side cooling | 12    |      |
| $R_{thch}$         | Thermal resistance case to heatsink | double side cooling | 3     | K/kW |
|                    |                                     | single side cooling | 6     |      |

**Transient Thermal Impedance**

Analytical function for transient thermal impedance

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

Conditions:  
 $F_m = 35 \div 40$  kN, Double side cooled

Correction for periodic waveforms

|                   |          |
|-------------------|----------|
| 180° sine:        | 0.8 K/kW |
| 180° rectangular: | 0.7 K/kW |
| 120° rectangular: | 1.2 K/kW |
| 60° rectangular:  | 2.1 K/kW |

| $i$          | 1      | 2      | 3      | 4      |
|--------------|--------|--------|--------|--------|
| $\tau_i$ (s) | 0.0950 | 0.0480 | 0.0035 | 0.0010 |
| $R_i$ (K/kW) | 3.2000 | 1.5000 | 0.6300 | 0.6700 |

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

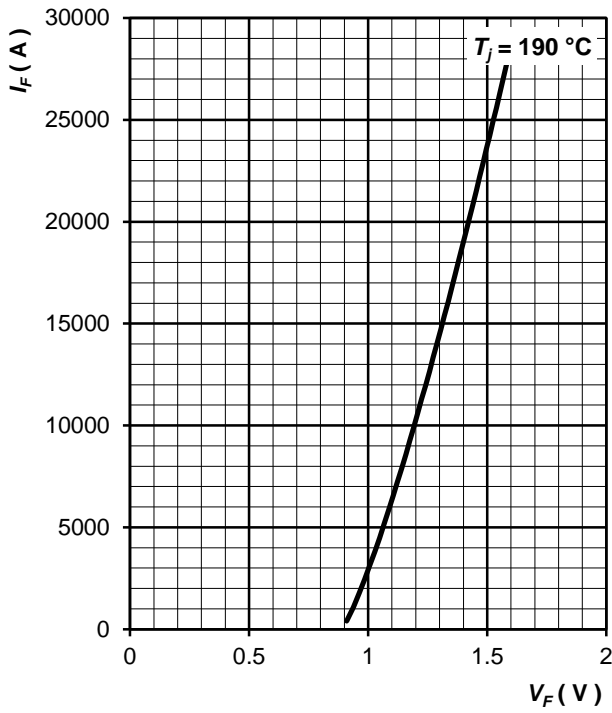


Fig. 3 Maximum forward voltage drop characteristics

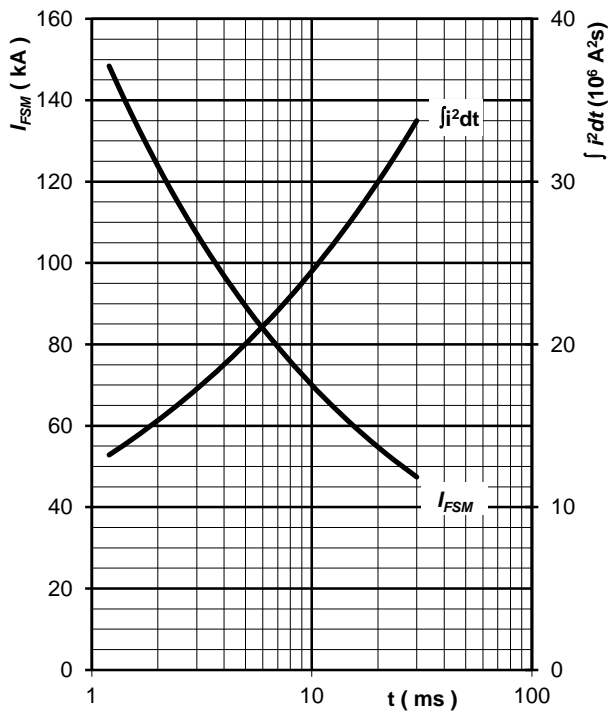


Fig. 4 Surge forward current vs. pulse length, half sine wave, single pulse,  $V_R = 0 \text{ V}$ ,  $T_j = T_{jmax}$

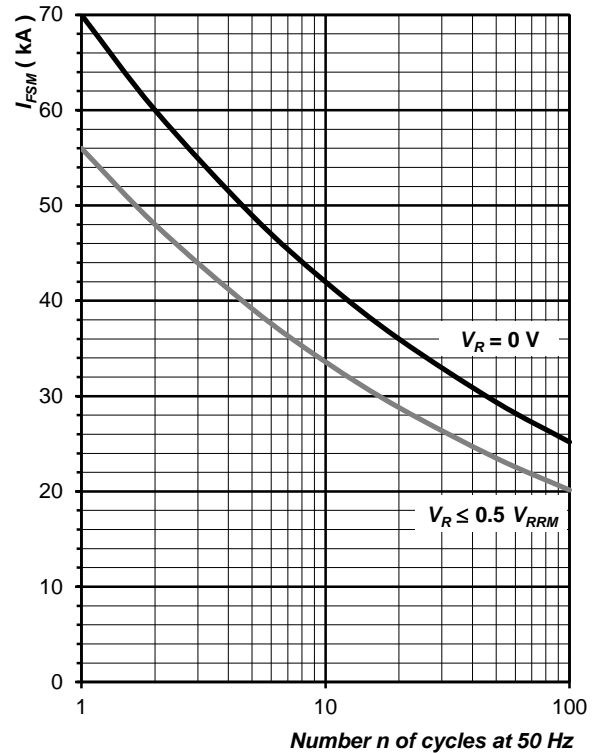


Fig. 5 Surge forward current vs. number of pulses, half sine wave,  $T_j = T_{jmax}$

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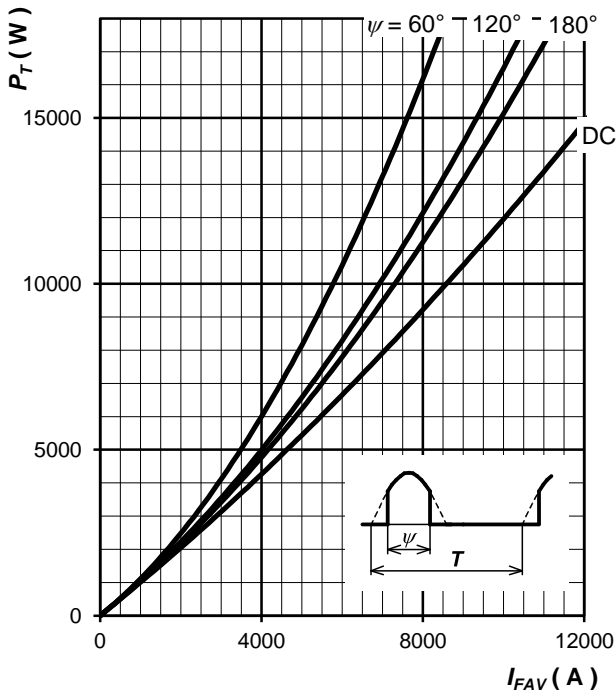


Fig. 6 Forward power loss vs. average forward current, sine waveform,  $f = 50 \text{ Hz}$ ,  $T = 1/f$

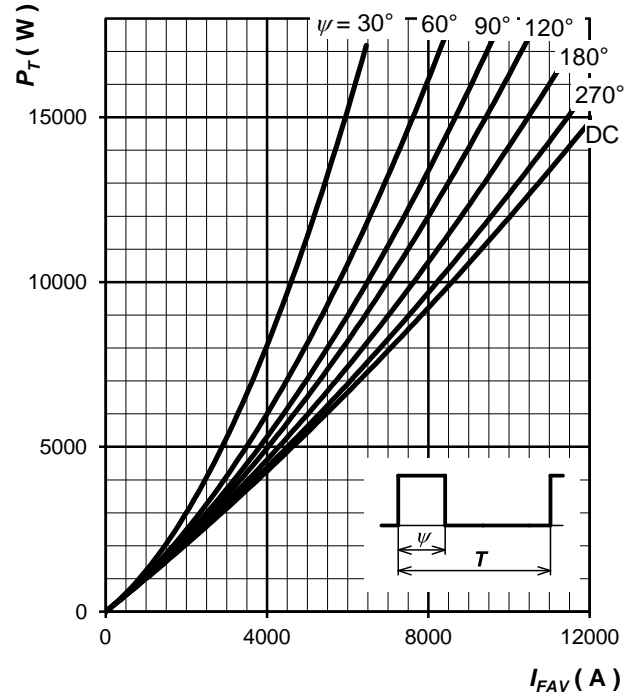


Fig. 7 Forward power loss vs. average forward current, square waveform,  $f = 50 \text{ Hz}$ ,  $T = 1/f$

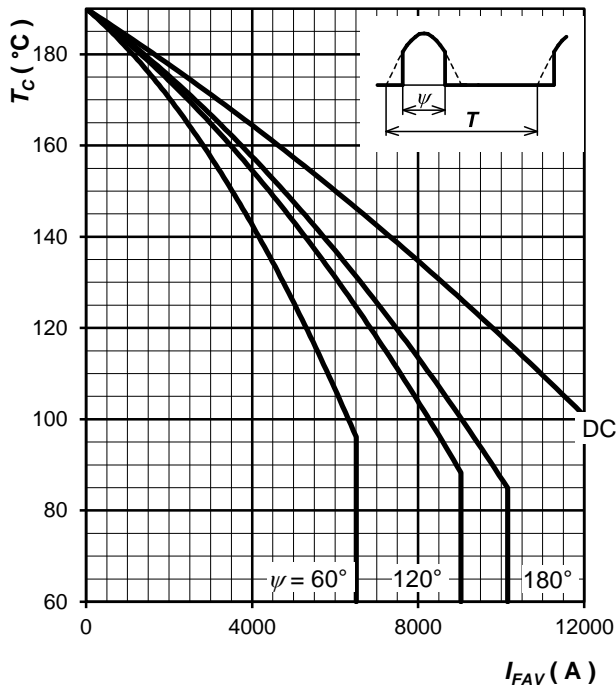


Fig. 8 Max. case temperature vs. aver. forward current, sine waveform,  $f = 50 \text{ Hz}$ ,  $T = 1/f$

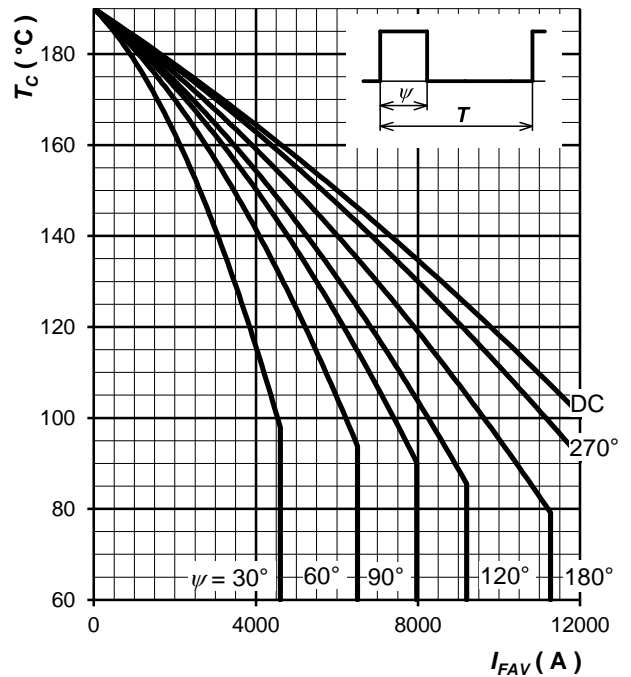


Fig. 9 Max. case temperature vs. aver. forward current, square waveform,  $f = 50 \text{ Hz}$ ,  $T = 1/f$

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

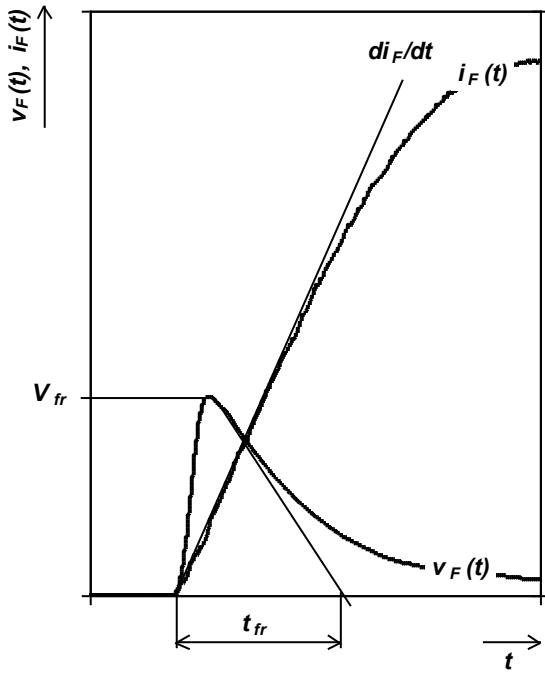


Fig. 10 Typical forward recovery voltage waveform when the diode is turned on with high  $di_F/dt$

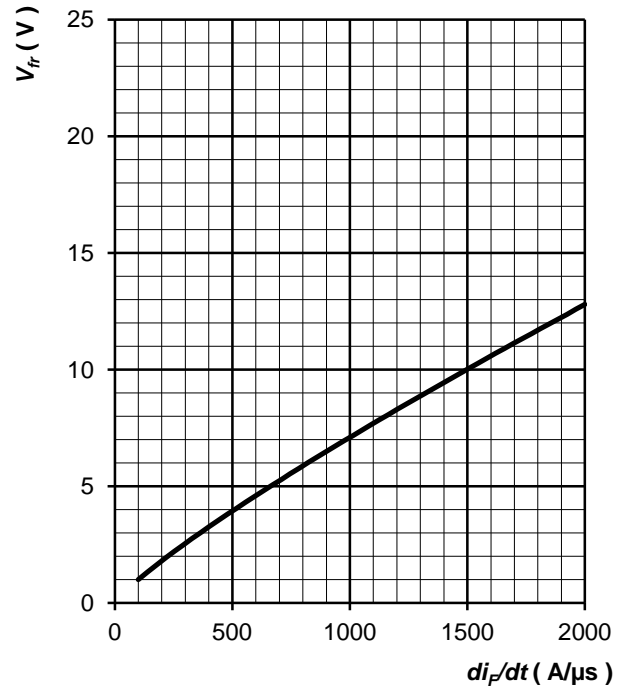


Fig. 11 Max. forward recovery voltage vs. rate of rise forward current, trapezoid pulse,  $T_j = T_{jmax}$ ,  $t_{fr} \leq 10 \mu s$

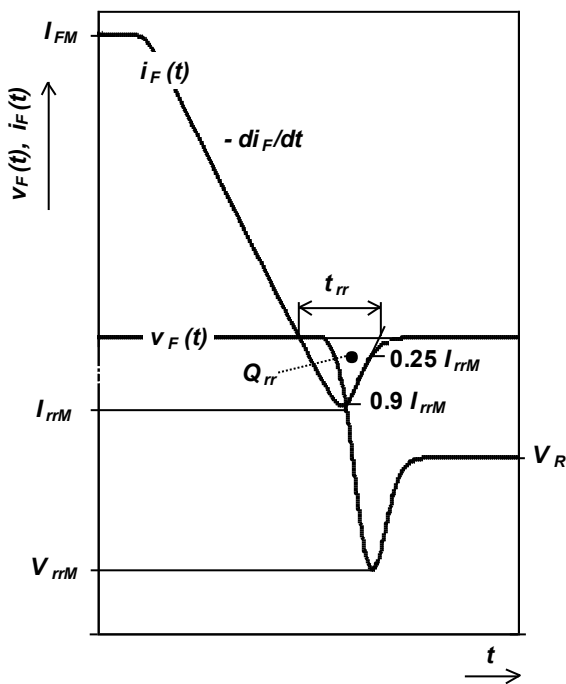


Fig. 12 Definition of reverse recovery parameters

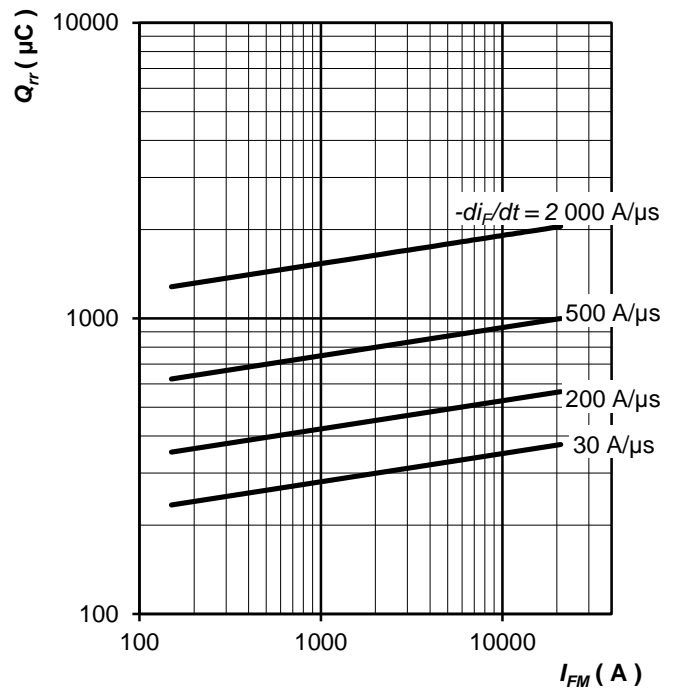


Fig. 13 Max. recovered charge vs. forward current, trapezoid pulse,  $T_j = T_{jmax}$

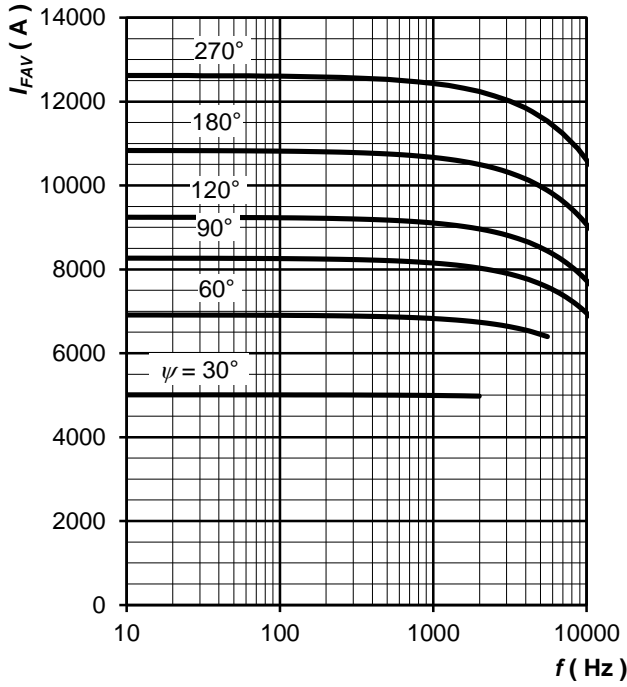


Fig. 14 Average forward current vs. frequency, trapezoid waveform,  $T_C = 85\text{ }^\circ\text{C}$ ,  $di_F/dt = \pm 2\ 000\ \text{A}/\mu\text{s}$ ,  $V_R = 50\ \text{V}$

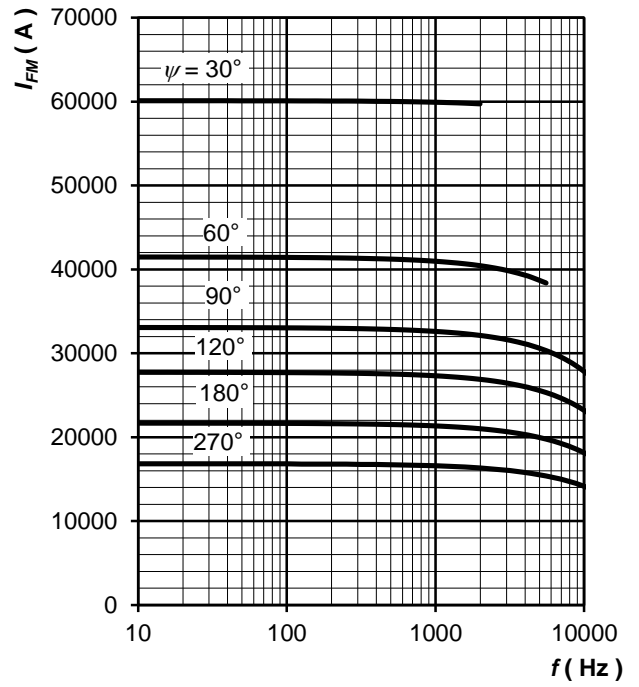


Fig. 15 Maximum forward current vs. frequency, trapezoid waveform,  $T_C = 85\text{ }^\circ\text{C}$ ,  $di_F/dt = \pm 2\ 000\ \text{A}/\mu\text{s}$ ,  $V_R = 50\ \text{V}$

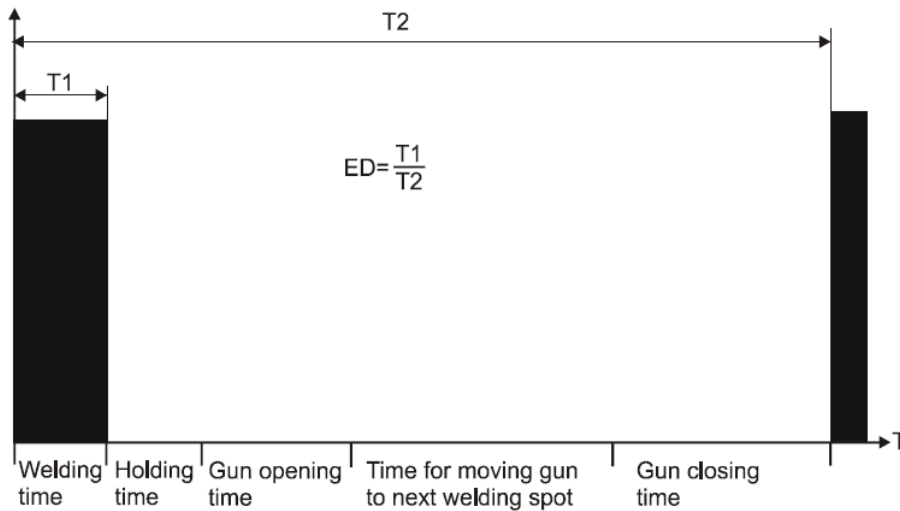


Fig. 16 Definition of ED for typical welding sequence

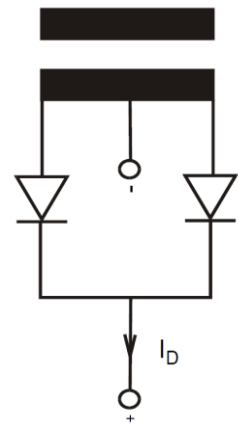


Fig. 17 Definition of  $I_D$  for single-phase centre tap

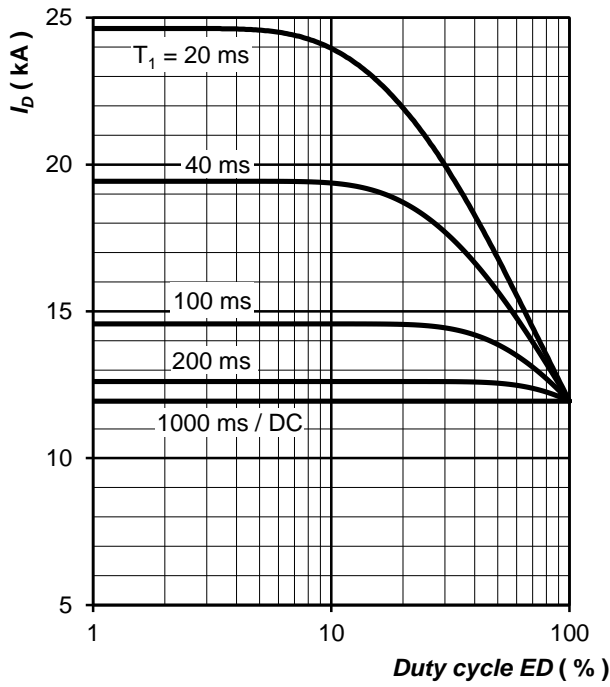


Fig. 18 Current load capacity, cont.,  
DC output welding current with single-phase  
centre tap vs. duty cycle  
 $f = 10 \text{ kHz}$ , square wave,  $\Delta T_j = 80 \text{ }^\circ\text{C}$

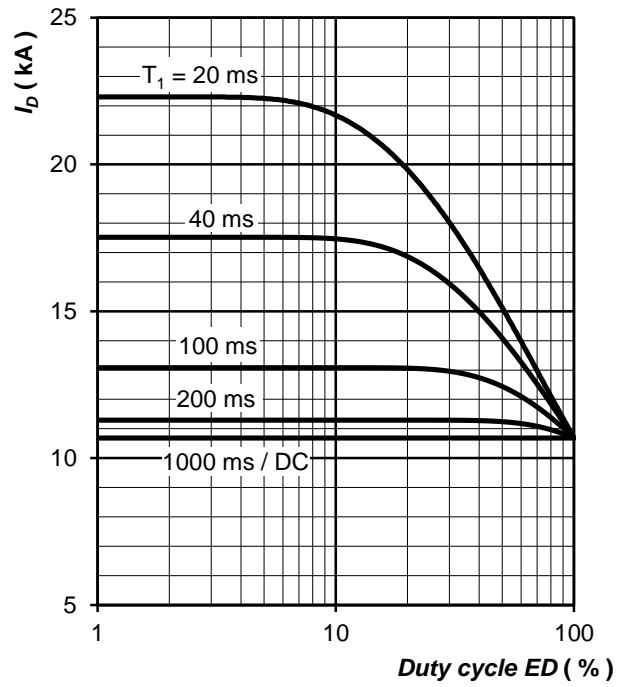


Fig. 19 Current load capacity, cont.,  
DC output welding current with single-phase  
centre tap vs. duty cycle  
 $f = 10 \text{ kHz}$ , square wave,  $\Delta T_j = 70 \text{ }^\circ\text{C}$

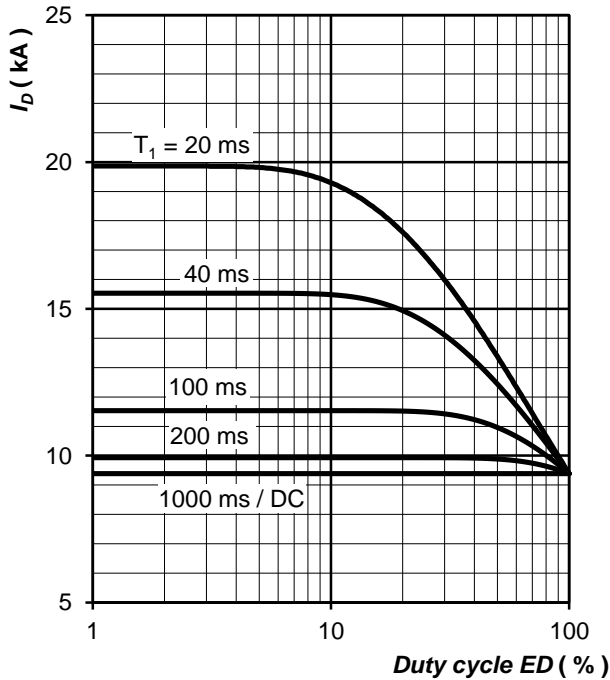


Fig. 20 Current load capacity, cont.,  
DC output welding current with single-phase  
centre tap vs. duty cycle  
 $f = 10 \text{ kHz}$ , square wave,  $\Delta T_j = 60 \text{ }^\circ\text{C}$

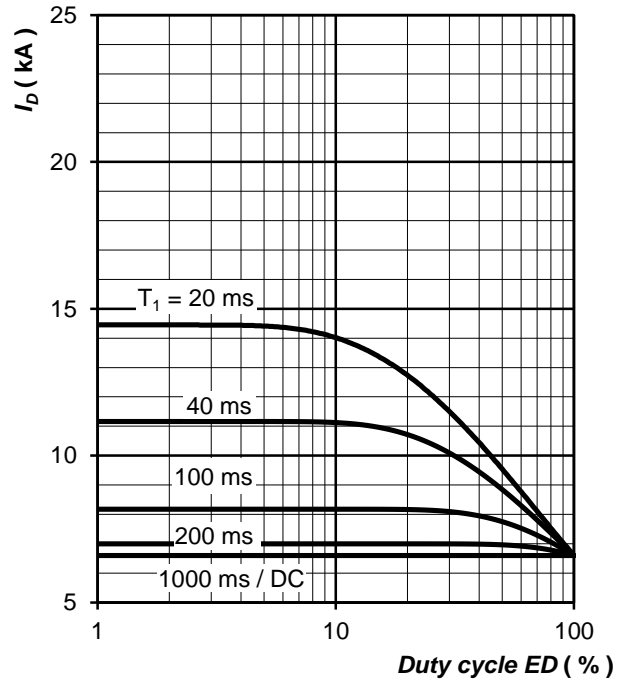


Fig. 21 Current load capacity, cont.,  
DC output welding current with single-phase  
centre tap vs. duty cycle  
 $f = 10 \text{ kHz}$ , square wave,  $\Delta T_j = 40 \text{ }^\circ\text{C}$

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Notes:

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