



## FD 400 R 12 KF 4

### Höchstzulässige Werte / Maximum rated values Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung	collector-emitter voltage		$V_{CES}$	1200 V
Kollektor-Dauergleichstrom	DC-collector current		$I_C$	400 A
Periodischer Kollektor Spitzenstrom	repetitive peak collector current	$t_p=1$ ms	$I_{CRM}$	800 A
Gesamt-Verlustleistung	total power dissipation	$t_C=25^\circ\text{C}$ , Transistor /transistor	$P_{tot}$	2700 W
Gate-Emitter-Spitzenspannung	gate-emitter peak voltage		$V_{GE}$	$\pm 20$ V
Dauergleichstrom	DC forward current		$I_F$	400 A
Periodischer Spitzenstrom	repetitive peak forw. current	$t_p=1$ ms	$I_{FRM}$	800 A
Isolations-Prüfspannung	insulation test voltage	RMS, f=50 Hz, t= 1 min.	$V_{ISOL}$	2,5 kV

### Charakteristische Werte / Characteristic values: Transistor

				min.	typ.	max.
Kollektor-Emitter Sättigungsspannung	collector-emitter saturation voltage	$i_C=400\text{A}, V_{GE}=15\text{V}, t_{vj}=25^\circ\text{C}$ $i_C=400\text{A}, V_{GE}=15\text{V}, t_{vj}=125^\circ\text{C}$	$V_{CE\text{ sat}}$	-	2,7 3,3	3,2 3,9 V
Gate-Schwellenspannung	gate threshold voltage	$i_C=16\text{mA}, V_{CE}=V_{GE}, t_{vj}=25^\circ\text{C}$	$V_{GE(th)}$	4,5	5,5	6,5 V
Eingangskapazität	input capacity	$f_i=1\text{MHz}, t_{vj}=25^\circ\text{C}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$	$C_{ies}$	-	28	- nF
Kollektor-Emitter Reststrom	collector-emitter cut-off current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, t_{vj}=25^\circ\text{C}$ $V_{CE}=1200\text{V}, V_{GE}=0\text{V}, t_{vj}=125^\circ\text{C}$	$i_{CES}$	-	8 32	- mA
Gate-Emitter Reststrom	gate leakage current	$V_{CE}=0\text{V}, V_{EG}=20\text{V}, t_{vj}=25^\circ\text{C}$	$i_{GES}$	-	-	400 nA
Emitter-Gate Reststrom	gate leakage current	$V_{CE}=0\text{V}, V_{EG}=20\text{V}, t_{vj}=25^\circ\text{C}$	$i_{EGS}$	-	-	400 nA
Einschaltzeit (induktive Last)	turn-on time (inductive load)	$i_C=400\text{A}, V_{CE}=600\text{V}, V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=25^\circ\text{C}$ $i_C=400\text{A}, V_{CE}=600\text{V}, V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=125^\circ\text{C}$	$t_{on}$	-	0,7 0,8	- $\mu\text{s}$
Speicherzeit (induktive Last)	storage time (inductive load)	$i_C=400\text{A}, V_{CE}=600\text{V}, V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=25^\circ\text{C}$ $i_C=400\text{A}, V_{CE}=600\text{V}, V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=125^\circ\text{C}$	$t_s$	-	0,9 1,0	- $\mu\text{s}$
Fallzeit (induktive Last)	fall time (inductive load)	$i_C=400\text{A}, V_{CE}=600\text{V}, V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=25^\circ\text{C}$ $i_C=400\text{A}, V_{CE}=600\text{V}, V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=125^\circ\text{C}$	$t_f$	-	0,10 0,15	- $\mu\text{s}$
Einschaltverlustenergie pro puls	turn-on energie per pulse	$i_C=400\text{A}, V_{CE}=600\text{V}, L_s=70\text{nH}$ $V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=125^\circ\text{C}$	$E_{on}$	-	70	- mWs
Abschaltverlustenergie pro Puls	turn-off energie loss per pulse	$i_C=400\text{A}, V_{CE}=600\text{V}, L_s=70\text{nH}$ $V_L=\pm 15\text{V}, R_G=3,6\text{W}, t_{vj}=125^\circ\text{C}$	$E_{off}$	-	60	- mWs

### Charakteristische Werte / Characteristic values

Inversdiode / Inverse diode						
Durchlaßspannung	forward voltage	$i_F=400\text{A}, V_{GE}=0\text{V}, t_{vj}=25^\circ\text{C}$ $i_F=400\text{A}, V_{GE}=0\text{V}, t_{vj}=125^\circ\text{C}$	$V_F$	-	2,2 2,0	2,7 2,5 V
Rückstromspitze	peak reverse recovery current	$i_F=400\text{A}, V_{RM}=600\text{V}, V_{EG}=10\text{V}$ $-di_F/dt = 2,0 \text{ kA}/\mu\text{s}, t_{vj} = 25^\circ\text{C}$ $-di_F/dt = 2,0 \text{ kA}/\mu\text{s}, t_{vj} = 125^\circ\text{C}$	$I_{RM}$	-	140 240	- A
Sperrverzögerungsladung	recovered charge	$i_F=400\text{A}, V_{RM}=600\text{V}, V_{EG}=10\text{V}$ $-di_F/dt = 3,0 \text{ kA}/\mu\text{s}, t_{vj} = 25^\circ\text{C}$ $-di_F/dt = 3,0 \text{ kA}/\mu\text{s}, t_{vj} = 125^\circ\text{C}$	$Q_r$	-	18 50	- $\mu\text{As}$

### Thermische Eigenschaften / Thermal properties

Innerer Wärmewiderstand	thermal resistance, junction to case	Transistor / transistor, DC Transistor, DC, pro Zweig/per arm Diode, DC, pro Modul/per module Diode, DC, pro Zweig/per arm	$R_{thJC}$		0,023 $^\circ\text{C}/\text{W}$ 0,046 $^\circ\text{C}/\text{W}$ 0,044 $^\circ\text{C}/\text{W}$ 0,088 $^\circ\text{C}/\text{W}$
Übergangs-Wärmewiderstand	thermal resistance, case to heatsink	pro Modul / per Module pro Zweig / per arm	$R_{thCK}$		0,01 $^\circ\text{C}/\text{W}$ 0,02 $^\circ\text{C}/\text{W}$
Höchstzul. Sperrschichttemperatur	max. junction temperature	pro Modul / per Module	$t_{vj\text{ max}}$		150 $^\circ\text{C}$
Betriebstemperatur	operating temperature	Transistor / transistor	$t_{c\text{ op}}$		-40...+150 $^\circ\text{C}$
Lagertemperatur	storage temperature		$t_{stg}$		-40...+125 $^\circ\text{C}$

### Mechanische Eigenschaften / Mechanical properties

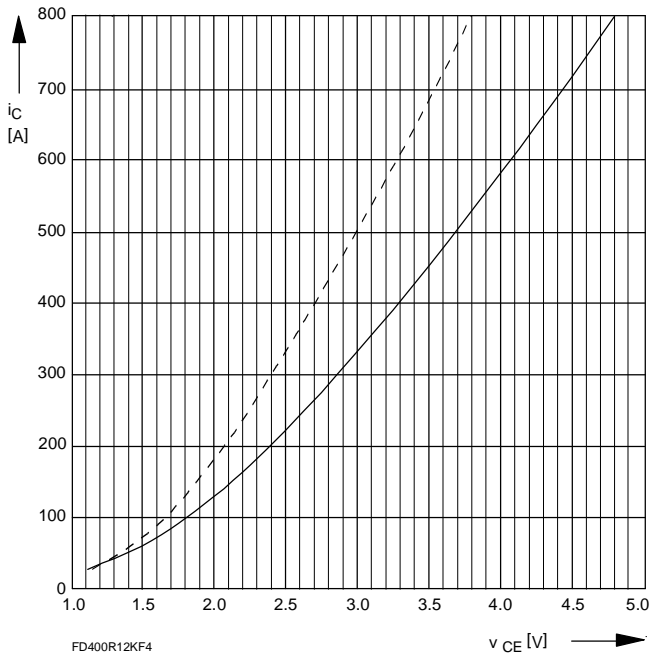
Gehäuse, siehe Anlage	case, see appendix			Seite / page	1
Innere Isolation	internal insulation				$\text{Al}_2\text{O}_3$
Anzugsdrehmoment f. mech. Befestigung	mounting torque	terminals M6 / tolerance +/-15%	M1		5 Nm
Anzugsdrehmoment f. elektr. Anschlüsse	terminal connection torque	terminals M4 / tolerance +/-15%	M2		2 Nm
		terminals M8			8...10 Nm
Gewicht	weight		G		ca. 1500 g

### Bedingung für den Kurzschlußschutz / Conditions for short-circuit protection

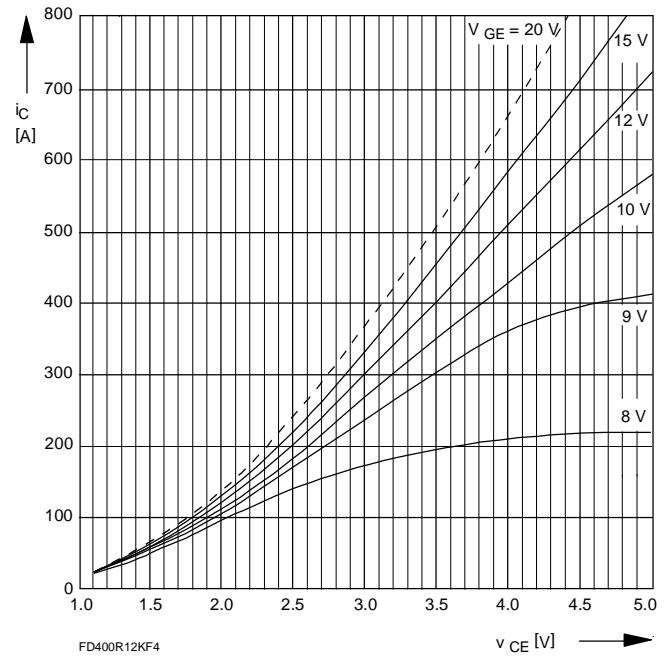
$t_{ig} = 10 \mu\text{s}$	$V_{CC} = 750 \text{ V}$
$V_L = \pm 15 \text{ V}$	$V_{CEM} = 900 \text{ V}$
$R_{GF} = R_{GR} = 3,6 \text{ W}$	$i_{CMK1} \gg 3500 \text{ A}$
$t_{vj} = 125^\circ\text{C}$	$i_{CMK2} \gg 3000 \text{ A}$

Unabhängig davon gilt bei abweichenden Bedingungen / with regard to other conditions  $v_{CEM} = V_{CES} - 20\text{nH} \times |di/dt|$

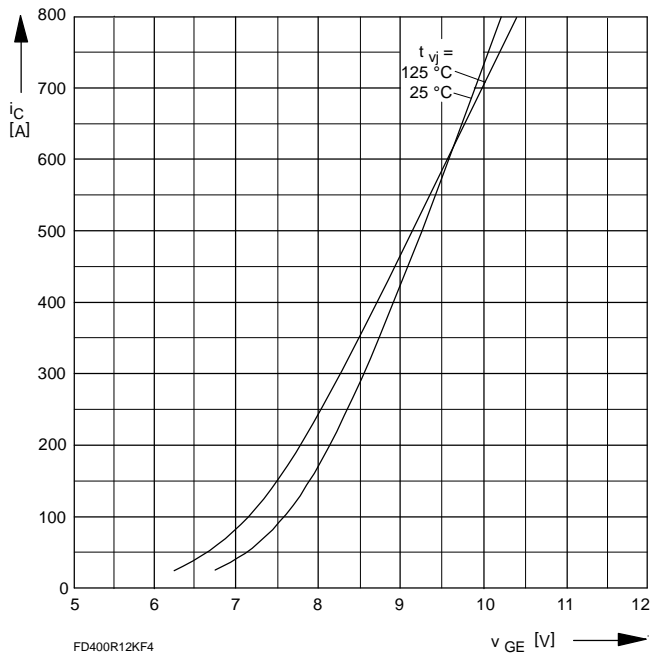
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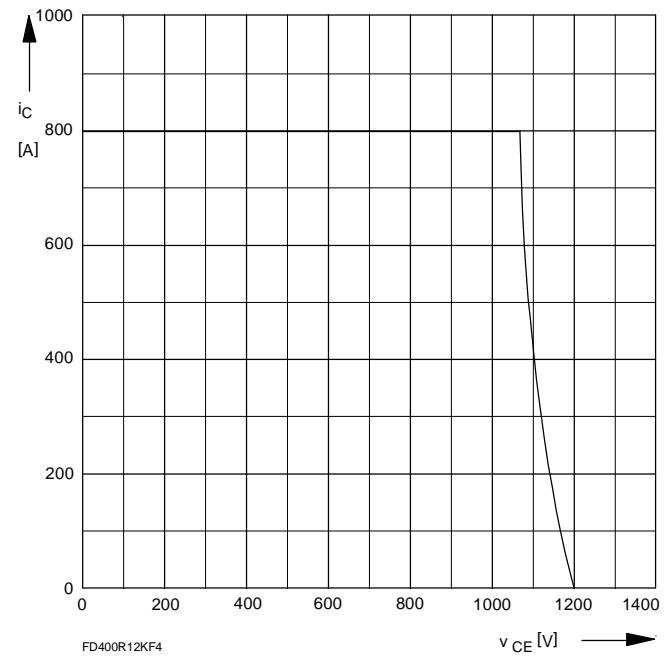
Bild/Fig. 1  
 Kollektor-Emitter-Spannung im Sättigungsbereich (typisch)  
 Collector-emitter-voltage in saturation region (typical)  
 $V_{GE} = 15V$   
 -----  $T_{vj} = 25^\circ C$   
 —  $T_{vj} = 125^\circ C$



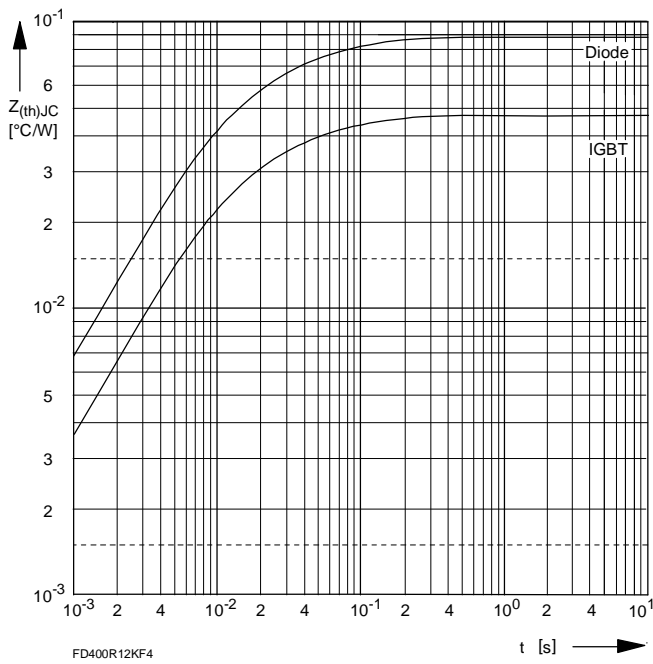
Bild/Fig. 2  
 Kollektor-Emitter-Spannung im Sättigungsbereich (typisch)  
 Collector-emitter-voltage in saturation region (typical)  
 $t_{vj} = 125^\circ C$



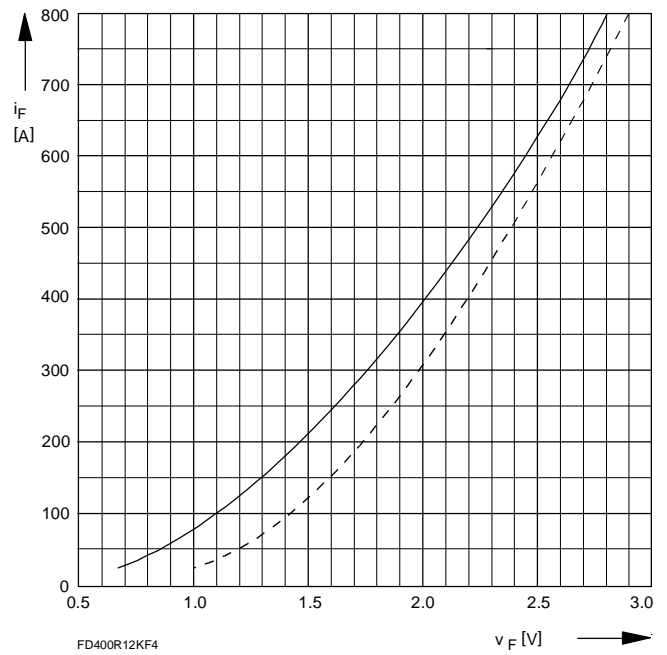
Bild/Fig. 3  
 Übertragungscharakteristik (typisch)  
 Transfer characteristic (typical)  
 $V_{CE} = 20V$



Bild/Fig. 4  
 Rückwärts-Arbeitsbereich  
 Reverse biased safe operating area  
 $t_{vj} = 125^\circ C, v_{LF} = v_{LR} = 15V, R_G = 3.6W$



Bild/Fig. 5  
 Transienter innerer Wärmewiderstand je Zweig (DC)  
 Transient thermal impedance per arm (DC)



Bild/Fig. 6  
 Durchlaßkennlinie der Inversdiode (typisch)  
 Forward characteristic of the inverse diode (typical)  
 .....  $t_{vj} = 25^{\circ}C$   
 —  $t_{vj} = 125^{\circ}C$

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