



SEMiX® 33c

Trench IGBT Modules

SEMiX453GD12E4c

Features

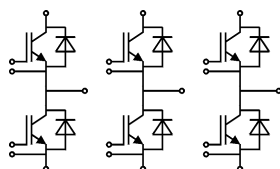
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to $T_C=125^{\circ}\text{C}$ max.
- Product reliability results are valid for $T_J=150^{\circ}\text{C}$



GD

Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}	$T_J = 25^{\circ}\text{C}$	1200	V
I_C	$T_J = 175^{\circ}\text{C}$	$T_C = 25^{\circ}\text{C}$	683
		$T_C = 80^{\circ}\text{C}$	526
I_{Cnom}		450	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1350	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 20\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_J = 150^{\circ}\text{C}$	10
T_J		-40 ... 175	$^{\circ}\text{C}$

Inverse diode

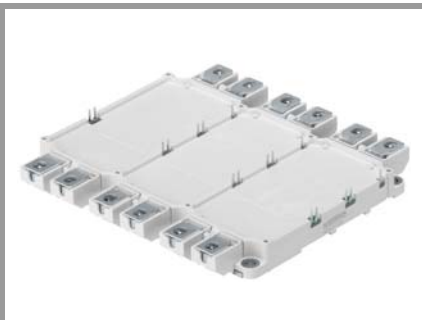
I_F	$T_J = 175^{\circ}\text{C}$	$T_C = 25^{\circ}\text{C}$	544	A
		$T_C = 80^{\circ}\text{C}$	407	A
I_{Fnom}			450	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		1350	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^{\circ}, T_J = 25^{\circ}\text{C}$		2430	A
T_J			-40 ... 175	$^{\circ}\text{C}$

Module

$I_{t(RMS)}$	$T_{terminal} = 80^{\circ}\text{C}$	600	A
T_{stg}		-40 ... 125	$^{\circ}\text{C}$
V_{isol}	AC sinus 50Hz, $t = 1\text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel		$T_J = 25^{\circ}\text{C}$	1.8	2.05
			$T_J = 150^{\circ}\text{C}$	2.2	2.4
V_{CE0}	chipelevel		$T_J = 25^{\circ}\text{C}$	0.8	0.9
			$T_J = 150^{\circ}\text{C}$	0.7	0.8
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel		$T_J = 25^{\circ}\text{C}$	2.2	2.6
			$T_J = 150^{\circ}\text{C}$	3.3	3.6
$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C = 18\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$		$T_J = 25^{\circ}\text{C}$		5
			$T_J = 150^{\circ}\text{C}$		
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$		$f = 1\text{ MHz}$	27.9	nF
C_{oes}			$f = 1\text{ MHz}$	1.74	nF
C_{res}			$f = 1\text{ MHz}$	1.53	nF
Q_G	$V_{GE} = -8\text{ V}...+15\text{ V}$		2550		nC
R_{Gint}	$T_J = 25^{\circ}\text{C}$		1.67		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$		$T_J = 150^{\circ}\text{C}$	253	ns
t_r	$I_C = 450\text{ A}$		$T_J = 150^{\circ}\text{C}$	85	ns
E_{on}	$V_{GE} = \pm 15\text{ V}$		$T_J = 150^{\circ}\text{C}$	52	mJ
$t_{d(off)}$	$R_{G on} = 2\text{ }\Omega$		$T_J = 150^{\circ}\text{C}$	629	ns
t_f	$R_{G off} = 2\text{ }\Omega$		$T_J = 150^{\circ}\text{C}$	130	ns
E_{off}	$di/dt_{on} = 4400\text{ A}/\mu\text{s}$ $di/dt_{off} = 3900\text{ A}/\mu\text{s}$		$T_J = 150^{\circ}\text{C}$	67.8	mJ
$R_{th(j-c)}$	per IGBT			0.065	K/W



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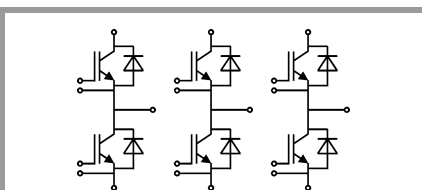
Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
- Product reliability results are valid for $T_J=150^\circ\text{C}$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 450 A	T _j = 25 °C		2.1	2.46	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.1	2.4	V
V _{F0}	chiplevel	T _j = 25 °C	1.1	1.3	1.5	V
		T _j = 150 °C	0.7	0.9	1.1	V
r _F	chiplevel	T _j = 25 °C	1.4	1.9	2.1	mΩ
		T _j = 150 °C	2.2	2.6	2.8	mΩ
I _{RRM}	I _F = 450 A	T _j = 150 °C		350		A
Q _{rr}	di/dt _{off} = 5200 A/μs	T _j = 150 °C		67		μC
E _{rr}	V _{GE} = -15 V	T _j = 150 °C		28		mJ
	V _{CC} = 600 V					
R _{th(j-c)}	per diode				0.11	K/W
Module						
L _{CE}				20		nH
R _{CC'+EE'}	res., terminal-chip	T _C = 25 °C		0.7		mΩ
		T _C = 125 °C		1		mΩ
R _{th(c-s)}	per module			0.014		K/W
M _s	to heat sink (M5)		3		5	Nm
M _t		to terminals (M6)	2.5		5	Nm
						Nm
w					900	g
Temperature Sensor						
R ₁₀₀	T _c =100°C (R ₂₅ =5 kΩ)			493 ± 5%		Ω
B _{100/125}	R(T)=R ₁₀₀ exp[B _{100/125} (1/T-1/T ₁₀₀)]; T[K];			3550 ±2%		K



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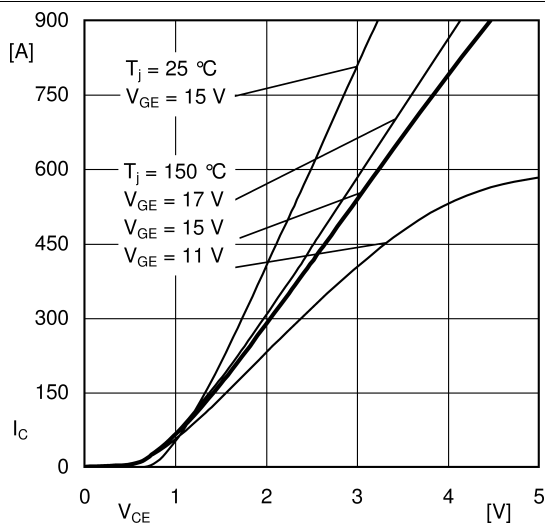


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

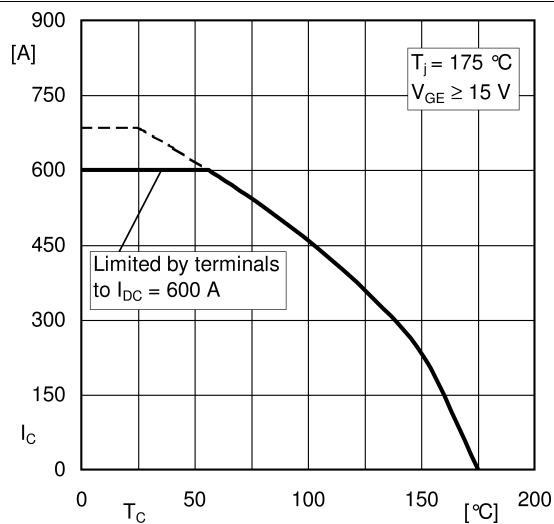


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

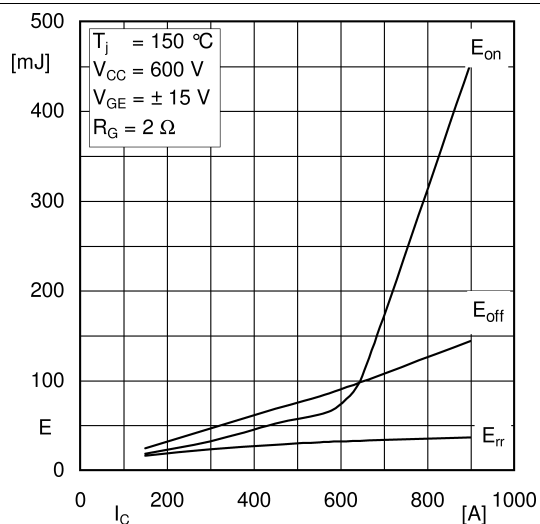


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

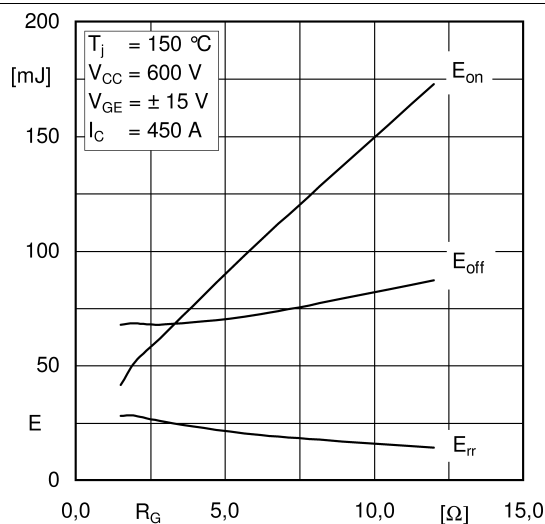


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

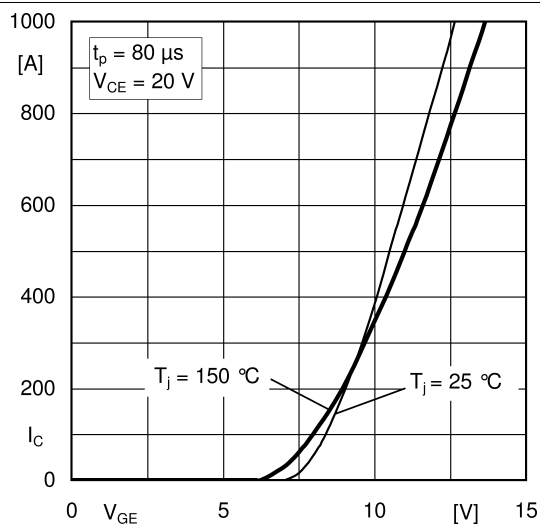


Fig. 5: Typ. transfer characteristic

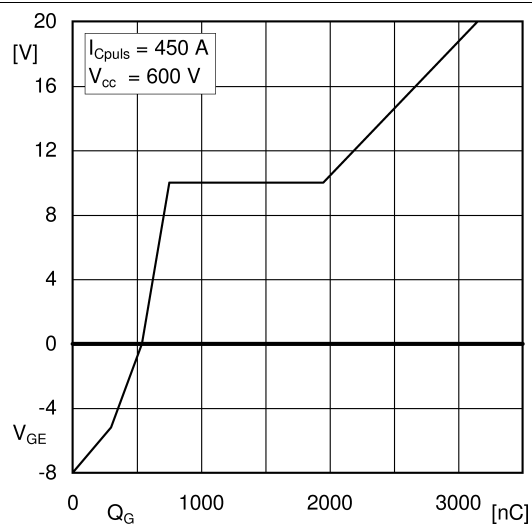


Fig. 6: Typ. gate charge characteristic

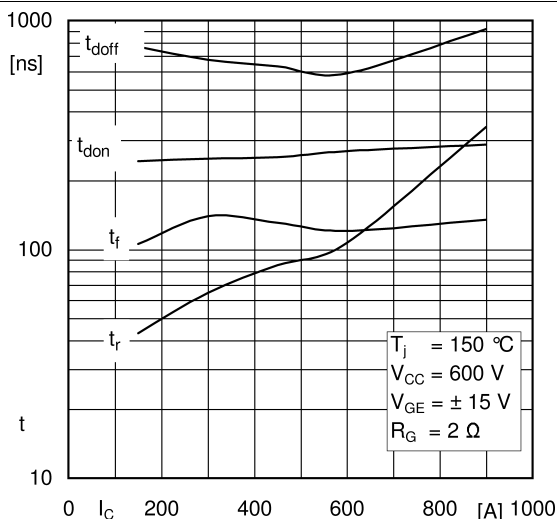


Fig. 7: Typ. switching times vs. I_C

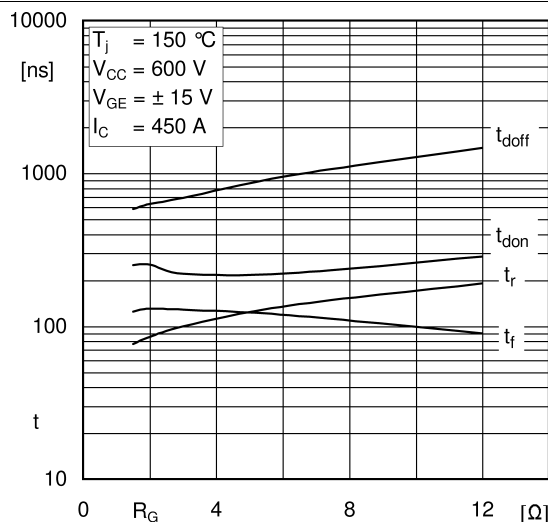


Fig. 8: Typ. switching times vs. gate resistor R_G

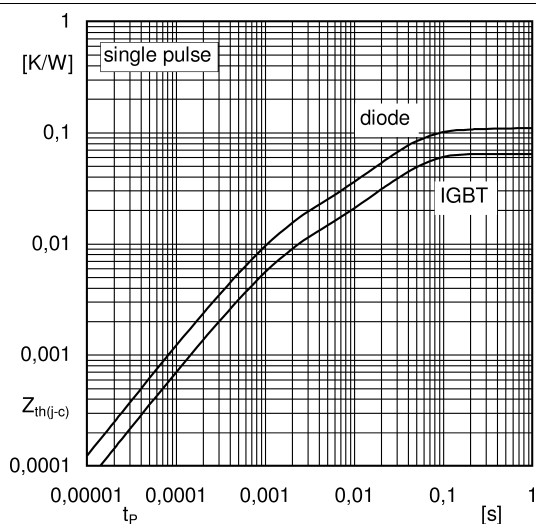


Fig. 9: Typ. transient thermal impedance

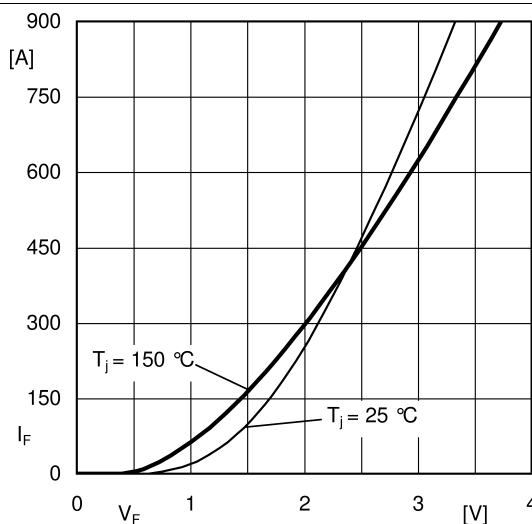


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

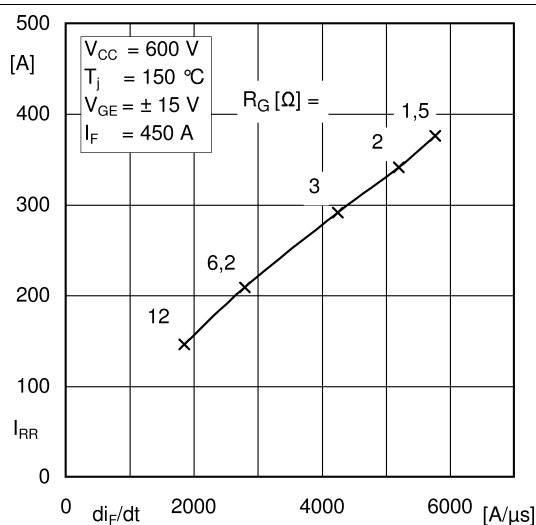


Fig. 11: Typ. CAL diode peak reverse recovery current

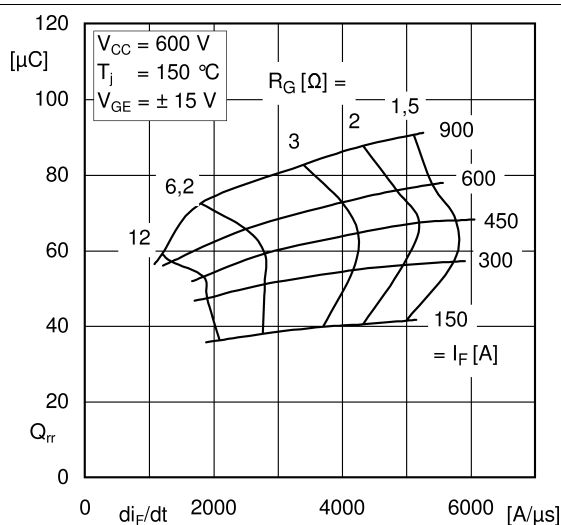
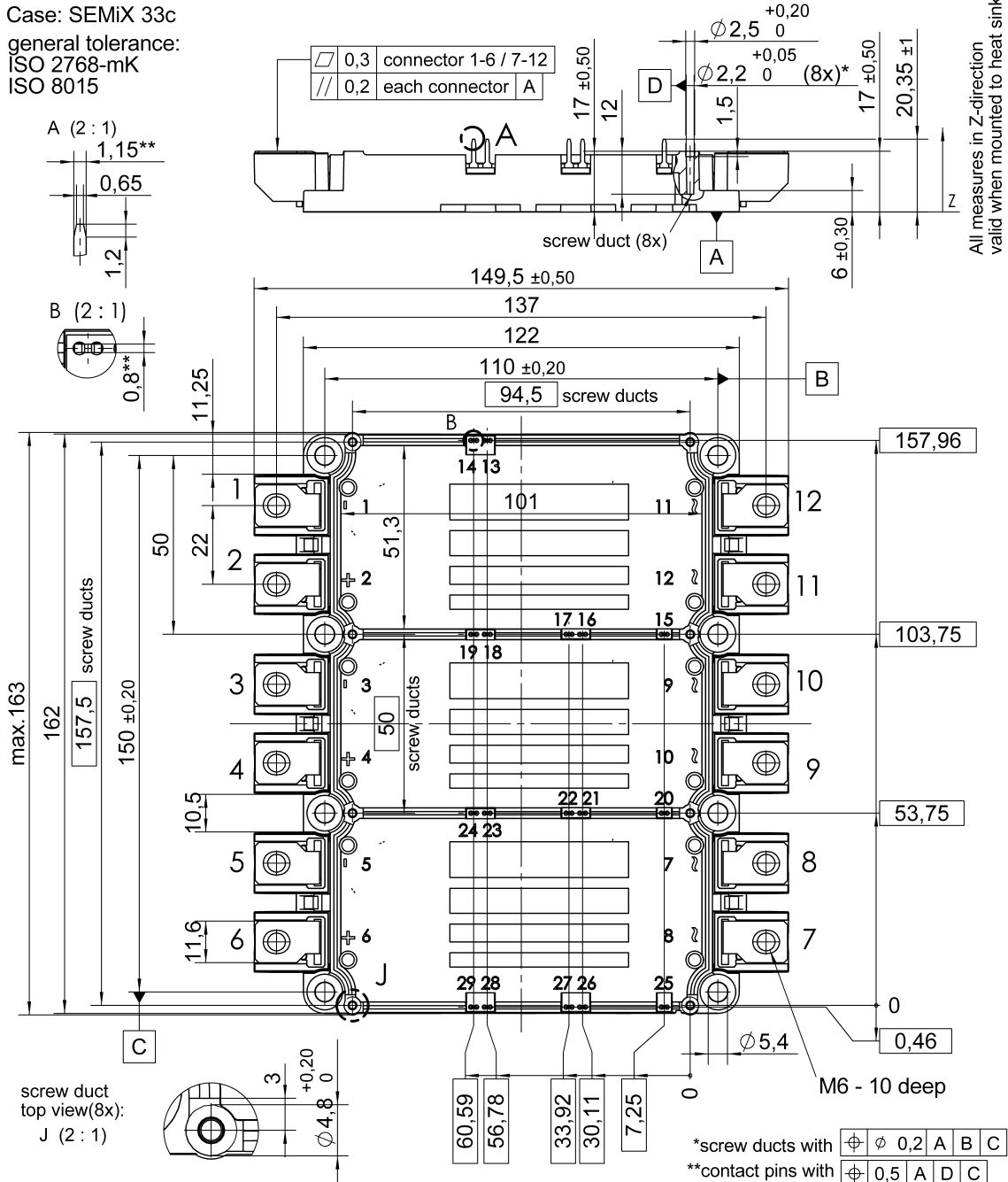
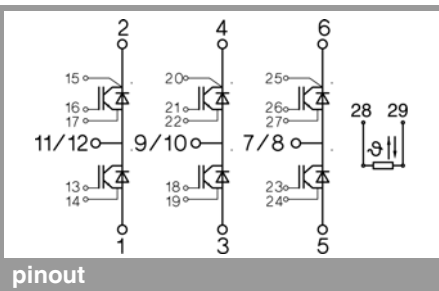


Fig. 12: Typ. CAL diode recovery charge

SEMiX453GD12E4c

Case: SEMiX 33c
general tolerance:
ISO 2768-mK
ISO 8015

**SEMiX 33c**

This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.