

SKM400GM12T4



SEMITRANS® 3

Fast IGBT4 Modules

SKM400GM12T4

Features

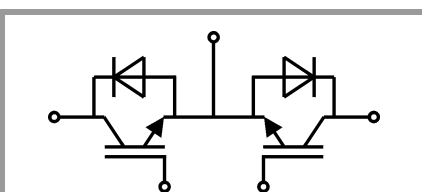
- IGBT4 = 4. generation fast trench IGBT (Infineon)
- CAL4 = Soft switching 4. generation CAL-diode
- Isolated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 20kHz
- UL recognized, file no. E63532

Typical Applications*

- Matrix Inverter
- Bidirectional switch

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$



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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	616
		$T_c = 80^\circ\text{C}$	474
I_{Cnom}		400	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1200	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150^\circ\text{C}$	10
T_j		-40 ... 175	$^\circ\text{C}$
Inverse diode			
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	440
		$T_c = 80^\circ\text{C}$	329
I_{Fnom}		400	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	1200	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	1980	A
T_j		-40 ... 175	$^\circ\text{C}$
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$	500	A
T_{stg}		-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 400\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel		$T_j = 25^\circ\text{C}$	1.80	2.05
			$T_j = 150^\circ\text{C}$	2.20	2.40
V_{CE0}	chiplevel		$T_j = 25^\circ\text{C}$	0.8	0.9
			$T_j = 150^\circ\text{C}$	0.7	0.8
r_{CE}	$V_{GE} = 15\text{ V}$ chiplevel		$T_j = 25^\circ\text{C}$	2.50	2.88
			$T_j = 150^\circ\text{C}$	3.75	4.00
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 15.2\text{ mA}$	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}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$		$f = 1\text{ MHz}$	24.6	nF
C_{oes}			$f = 1\text{ MHz}$	1.62	nF
C_{res}			$f = 1\text{ MHz}$	1.38	nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$			2260	nC
R_{Gint}	$T_j = 25^\circ\text{C}$			1.9	Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$		$T_j = 150^\circ\text{C}$	220	ns
t_r	$I_C = 400\text{ A}$		$T_j = 150^\circ\text{C}$	47	ns
E_{on}	$V_{GE} = \pm 15\text{ V}$		$T_j = 150^\circ\text{C}$	33	mJ
$t_{d(off)}$	$R_{G on} = 1\text{ }\Omega$		$T_j = 150^\circ\text{C}$	505	ns
t_f	$R_{G off} = 1\text{ }\Omega$		$T_j = 150^\circ\text{C}$	78	ns
E_{off}	$di/dt_{on} = 9700\text{ A}/\mu\text{s}$ $di/dt_{off} = 4300\text{ A}/\mu\text{s}$		$T_j = 150^\circ\text{C}$	42	mJ
$R_{th(j-c)}$	per IGBT			0.072	K/W



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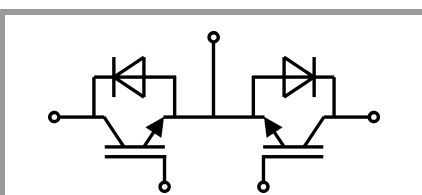
Typical Applications*

- Matrix Inverter
- Bidirectional switch

Remarks

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 400\text{ A}$	$T_j = 25\text{ }^{\circ}\text{C}$		2.20	2.52	V
	$V_{GE} = 0\text{ V}$ chiplevel	$T_j = 150\text{ }^{\circ}\text{C}$		2.15	2.47	V
V_{F0}	chiplevel	$T_j = 25\text{ }^{\circ}\text{C}$		1.3	1.5	V
		$T_j = 150\text{ }^{\circ}\text{C}$		0.9	1.1	V
r_F	chiplevel	$T_j = 25\text{ }^{\circ}\text{C}$		2.3	2.5	mΩ
		$T_j = 150\text{ }^{\circ}\text{C}$		3.1	3.4	mΩ
I_{RRM}	$I_F = 400\text{ A}$	$T_j = 150\text{ }^{\circ}\text{C}$		450		A
Q_{rr}	$di/dt_{off} = 8800\text{ A}/\mu\text{s}$	$T_j = 150\text{ }^{\circ}\text{C}$		68		μC
E_{rr}	$V_{GE} = \pm 15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150\text{ }^{\circ}\text{C}$		30.5		mJ
$R_{th(j-c)}$	per diode				0.14	K/W
Module						
L_{CE}				15	20	nH
$R_{CC'+EE'}$	terminal-chip	$T_C = 25\text{ }^{\circ}\text{C}$		0.25		mΩ
		$T_C = 125\text{ }^{\circ}\text{C}$		0.5		mΩ
$R_{th(c-s)}$	per module			0.02	0.038	K/W
M_s	to heat sink M6		3		5	Nm
M_t		to terminals M6	2.5		5	Nm
						Nm
w					325	g



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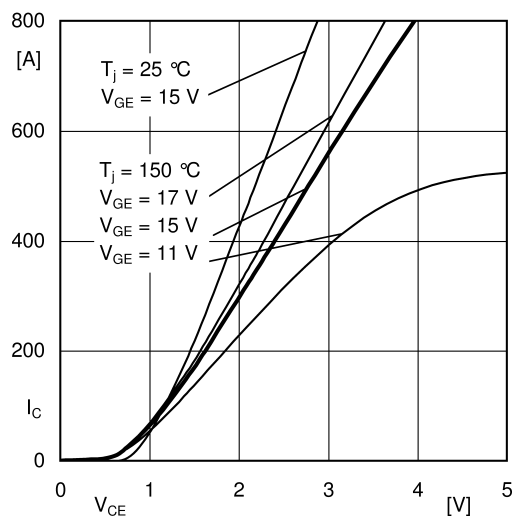


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

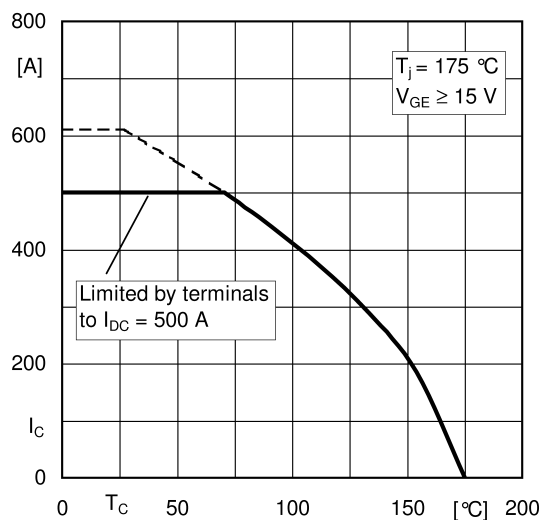


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

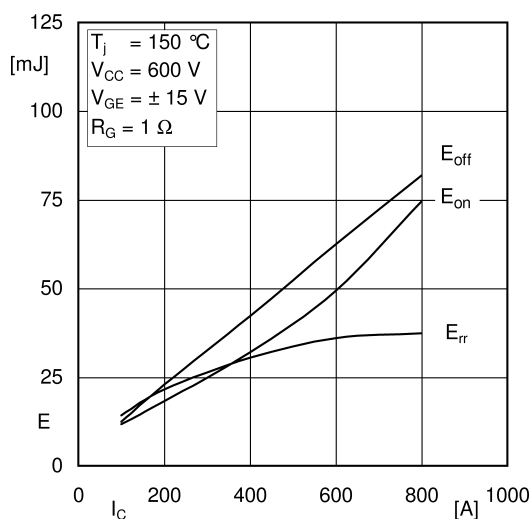


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

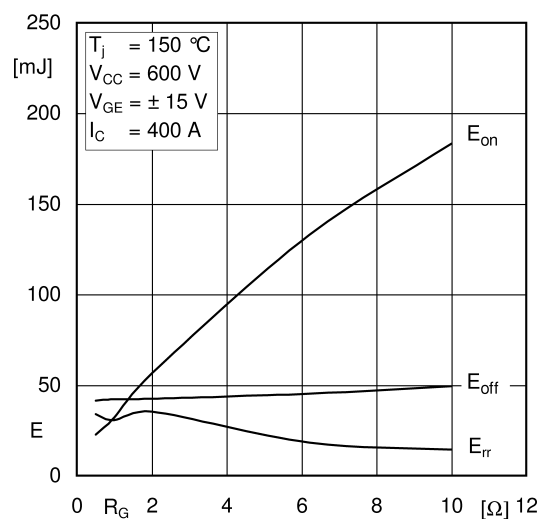


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

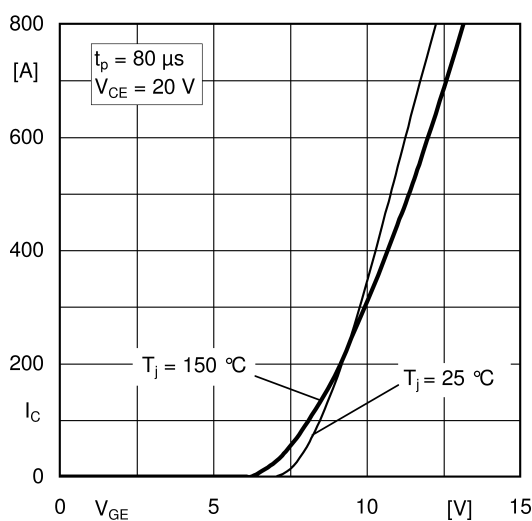


Fig. 5: Typ. transfer characteristic

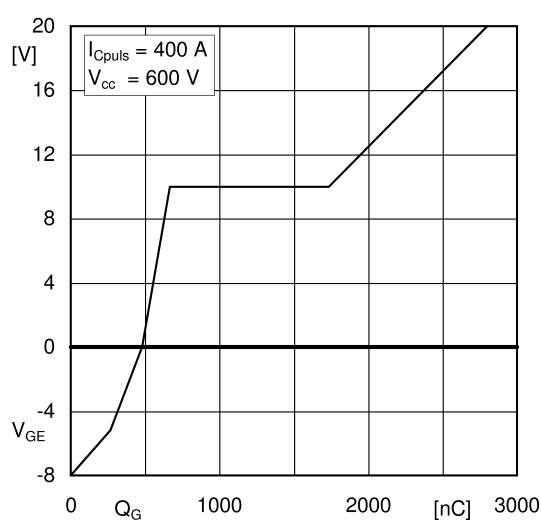


Fig. 6: Typ. gate charge characteristic

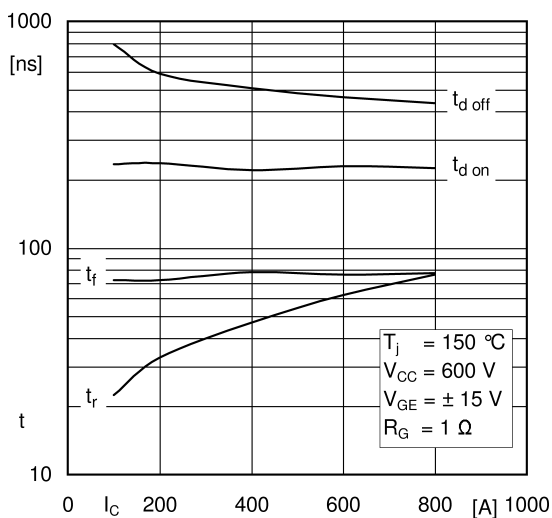


Fig. 7: Typ. switching times vs. I_C

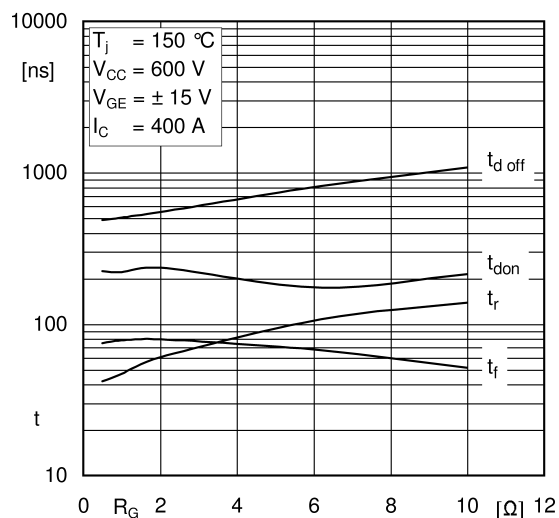


Fig. 8: Typ. switching times vs. gate resistor R_G

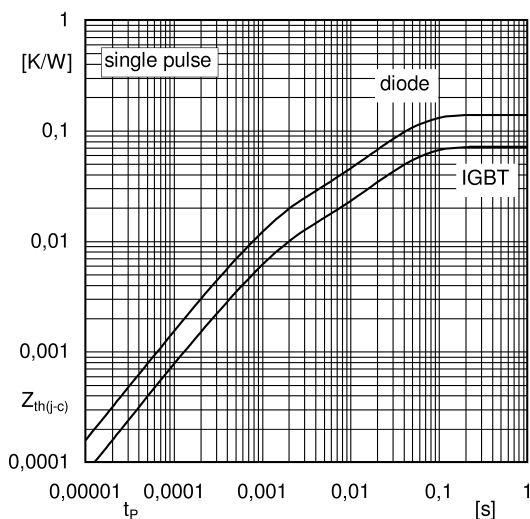


Fig. 9: Transient thermal impedance

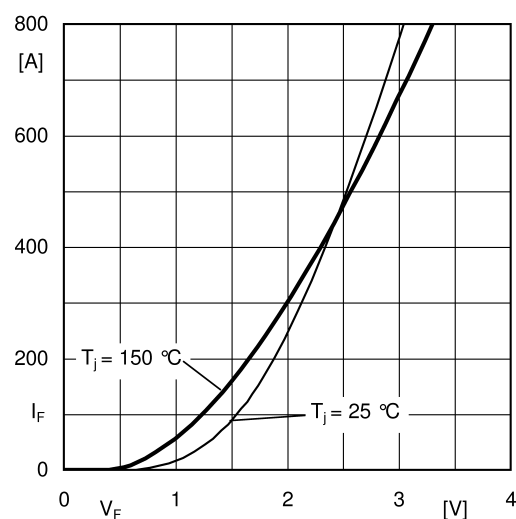


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'}+EE'$

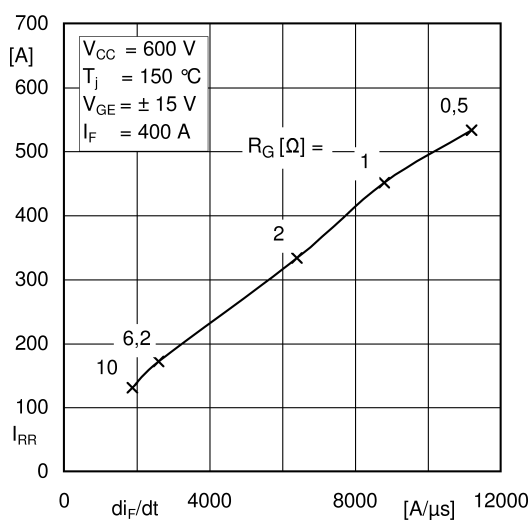


Fig. 11: CAL diode peak reverse recovery current

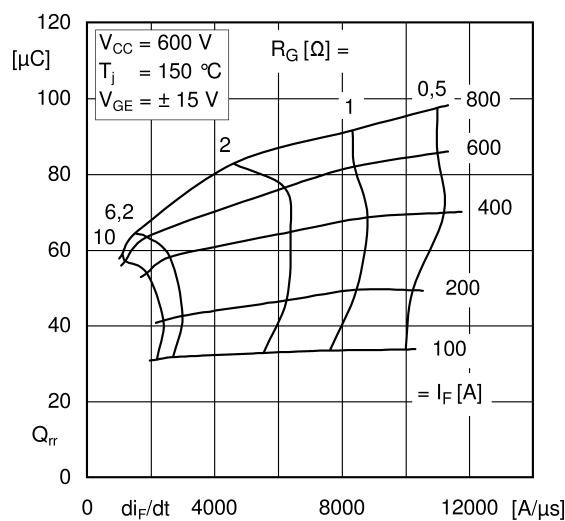
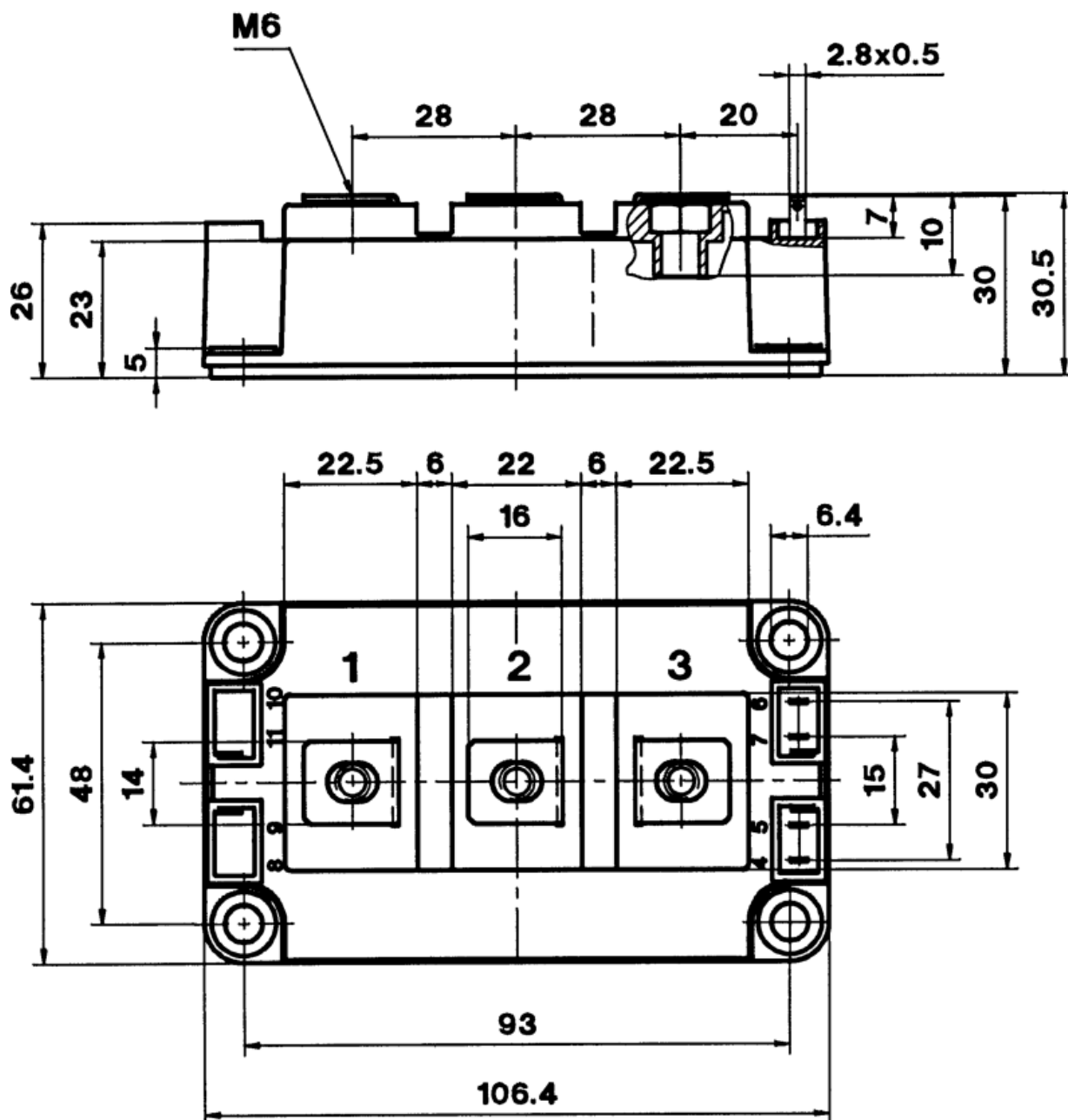
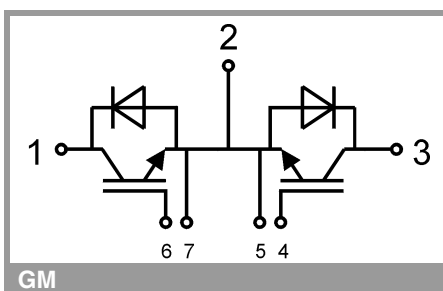


Fig. 12: Typ. CAL diode peak reverse recovery charge



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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.