

# SEMiX604GB176HDs



SEMiX® 4s

## Trench IGBT Modules

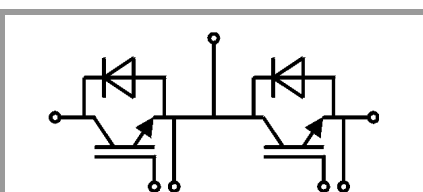
### SEMiX604GB176HDs

#### Features

- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- UL recognised file no. E63532

#### Typical Applications\*

- AC inverter drives
- UPS
- Electronic welders



GB

Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$		1700	V	
$I_C$	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	567	A
		$T_c = 80\text{ °C}$	402	A
$I_{Cnom}$		400	A	
$I_{CRM}$	$I_{CRM} = 2 \times I_{Cnom}$	800	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 1000\text{ V}$	$T_j = 125\text{ °C}$	10	$\mu\text{s}$
	$V_{GE} \leq 20\text{ V}$			
	$V_{CES} \leq 1700\text{ V}$			
$T_j$		-55 ... 150	$^{\circ}\text{C}$	
<b>Inverse diode</b>				
$I_F$	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	740	A
		$T_c = 80\text{ °C}$	496	A
$I_{Fnom}$		400	A	
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	800	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ °C}$	2700	A	
$T_j$		-40 ... 150	$^{\circ}\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$	$T_{terminal} = 80\text{ °C}$	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
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 400\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25\text{ °C}$	2	2.45	V
		$T_j = 125\text{ °C}$	2.5	2.9	V
$V_{CE0}$		$T_j = 25\text{ °C}$	1	1.2	V
		$T_j = 125\text{ °C}$	0.9	1.1	V
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25\text{ °C}$	2.5	3.1	$\text{m}\Omega$
		$T_j = 125\text{ °C}$	3.9	4.5	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 16\text{ mA}$	5.2	5.8	6.4	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 1700\text{ V}$	$T_j = 25\text{ °C}$	0.12	4	$\text{mA}$
		$T_j = 125\text{ °C}$			$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$		35.3		nF
$C_{oes}$	$V_{GE} = 0\text{ V}$		1.46		nF
$C_{res}$			1.17		nF
$Q_G$	$V_{GE} = -8\text{ V...} + 15\text{ V}$		3732		nC
$R_{Gint}$	$T_j = 25\text{ °C}$		1.88		$\Omega$
$t_{d(on)}$	$V_{CC} = 1200\text{ V}$ $I_C = 400\text{ A}$	$T_j = 125\text{ °C}$	360		ns
$t_r$	$V_{GE} = \pm 15\text{ V}$	$T_j = 125\text{ °C}$	65		ns
$E_{on}$	$R_{Gon} = 3\text{ }\Omega$	$T_j = 125\text{ °C}$	215		mJ
$t_{d(off)}$	$R_{Goff} = 3\text{ }\Omega$	$T_j = 125\text{ °C}$	900		ns
$t_f$		$T_j = 125\text{ °C}$	165		ns
$E_{off}$		$T_j = 125\text{ °C}$	165		mJ
$R_{th(j-c)}$	per IGBT			0.058	K/W

# SEMiX604GB176HDs



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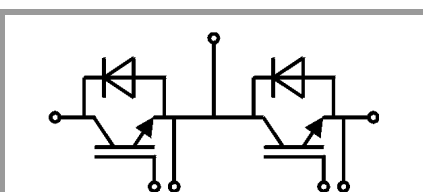
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#### Typical Applications\*

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- UPS
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 400\text{ A}$	$T_j = 25\text{ °C}$		1.5	1.70	V
	$V_{GE} = 0\text{ V}$	$T_j = 125\text{ °C}$		1.4	1.6	V
	chip					
$V_{F0}$		$T_j = 25\text{ °C}$	0.9	1.1	1.3	V
		$T_j = 125\text{ °C}$	0.7	0.9	1.1	V
$r_F$		$T_j = 25\text{ °C}$	1.0	1.0	1.0	mΩ
		$T_j = 125\text{ °C}$	1.3	1.3	1.3	mΩ
$I_{RRM}$	$I_F = 400\text{ A}$	$T_j = 125\text{ °C}$		560		A
$Q_{rr}$	$di/dt_{off} = 6600\text{ A}/\mu\text{s}$	$T_j = 125\text{ °C}$		131		μC
$E_{rr}$	$V_{GE} = -15\text{ V}$	$T_j = 125\text{ °C}$		95		mJ
	$V_{CC} = 1200\text{ V}$					
$R_{th(j-c)}$	per diode				0.081	K/W
<b>Module</b>						
$L_{CE}$				22		nH
$R_{CC'+EE'}$	res., terminal-chip	$T_C = 25\text{ °C}$		0.7		mΩ
		$T_C = 125\text{ °C}$		1		mΩ
$R_{th(c-s)}$	per module			0.03		K/W
$M_s$	to heat sink (M5)		3		5	Nm
$M_t$		to terminals (M6)	2.5		5	Nm
						Nm
$w$					400	g
<b>Temperatur Sensor</b>						
$R_{100}$	$T_c = 100\text{ °C}$ ( $R_{25} = 5\text{ k}\Omega$ )			$493 \pm 5\%$		Ω
$B_{100/125}$	$R(T) = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$ ; $T[K]$ ;			$3550 \pm 2\%$		K



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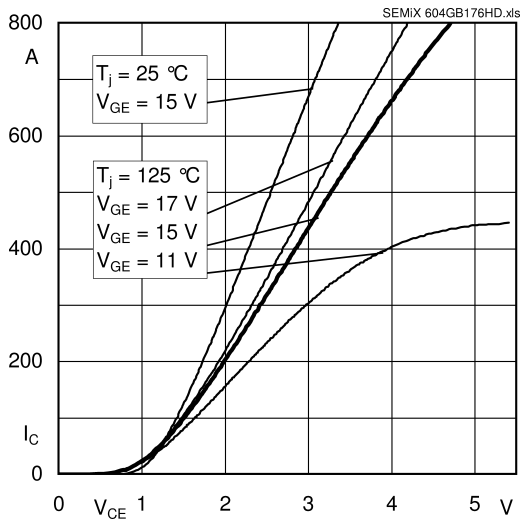


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

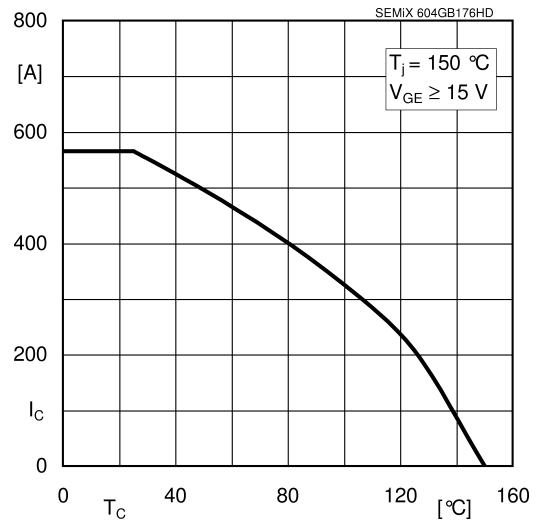


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

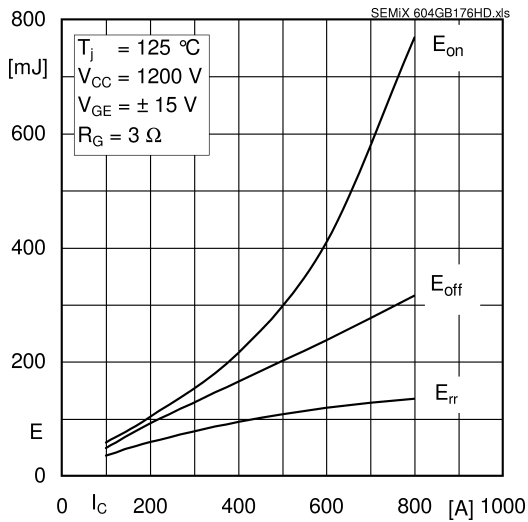


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

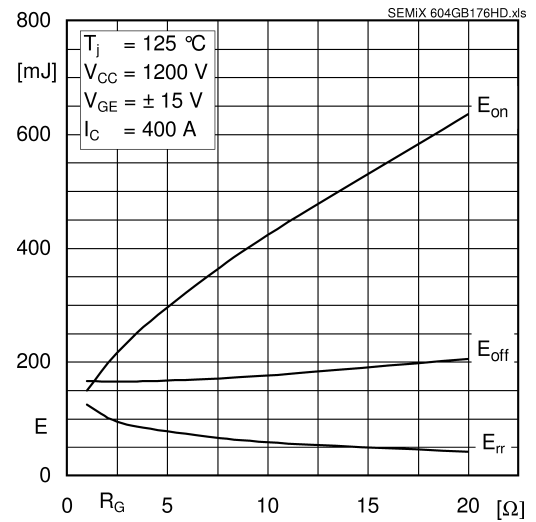


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

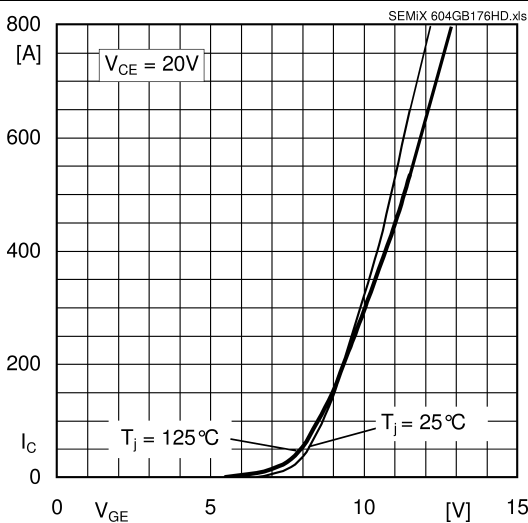


Fig. 5: Typ. transfer characteristic

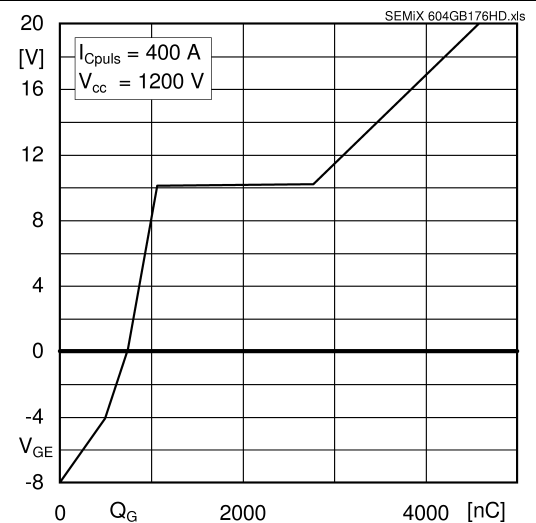


Fig. 6: Typ. gate charge characteristic

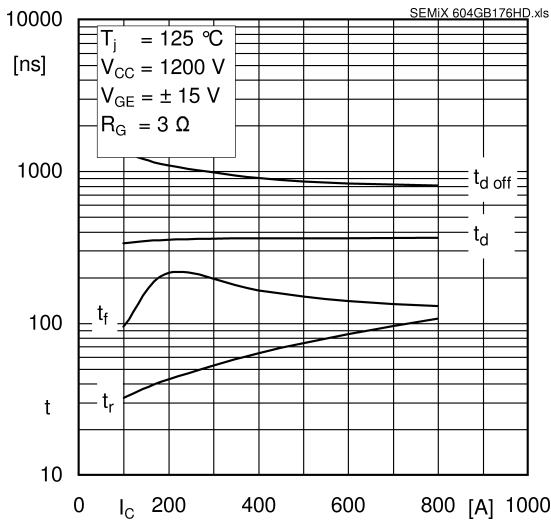


Fig. 7: Typ. switching times vs.  $I_C$

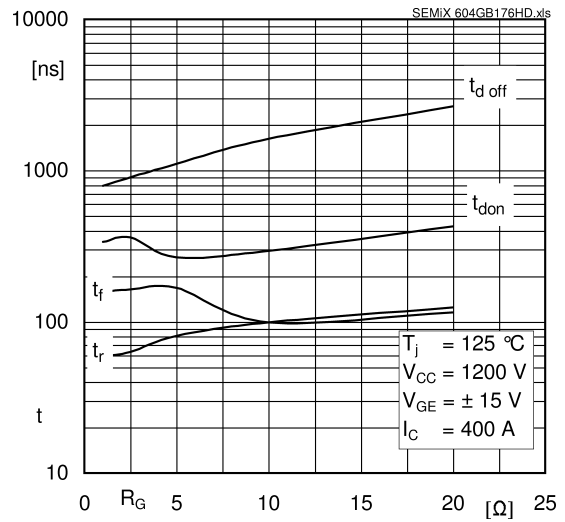


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

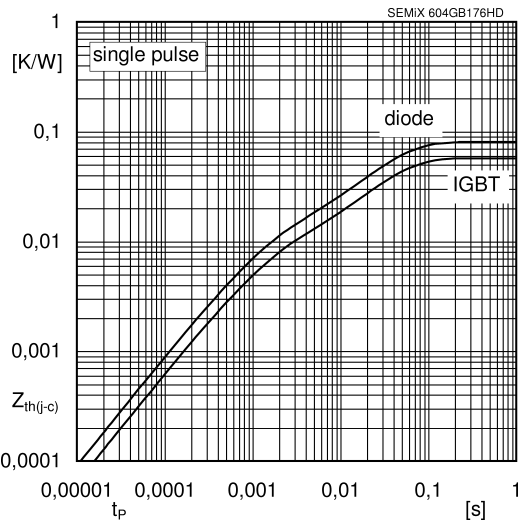


Fig. 9: Typ. transient thermal impedance

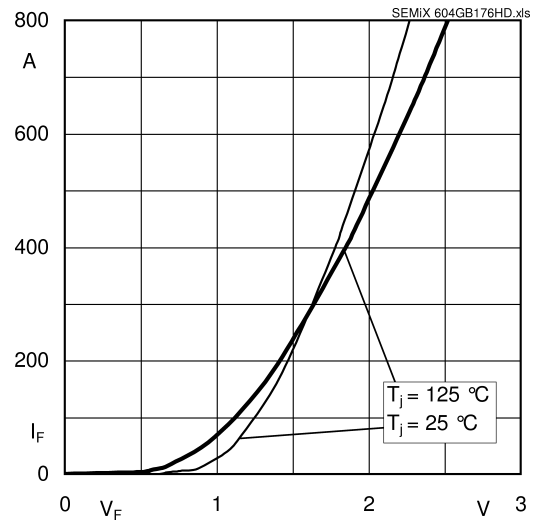


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

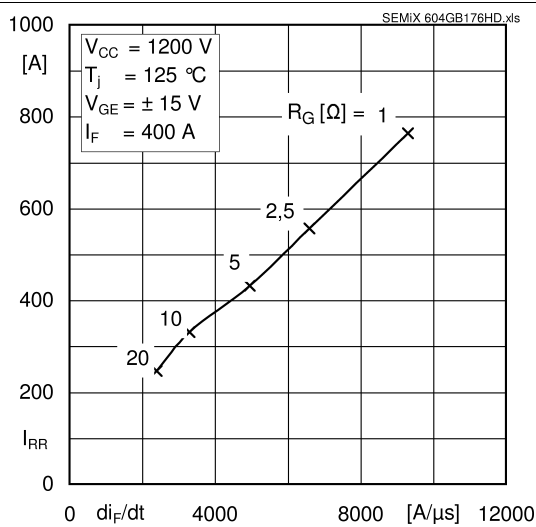


Fig. 11: Typ. CAL diode peak reverse recovery current

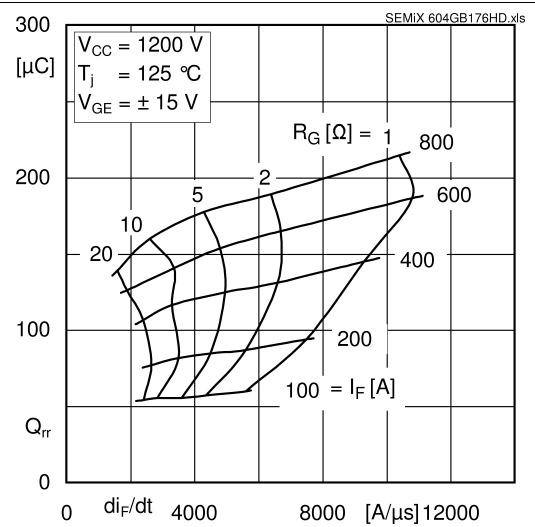
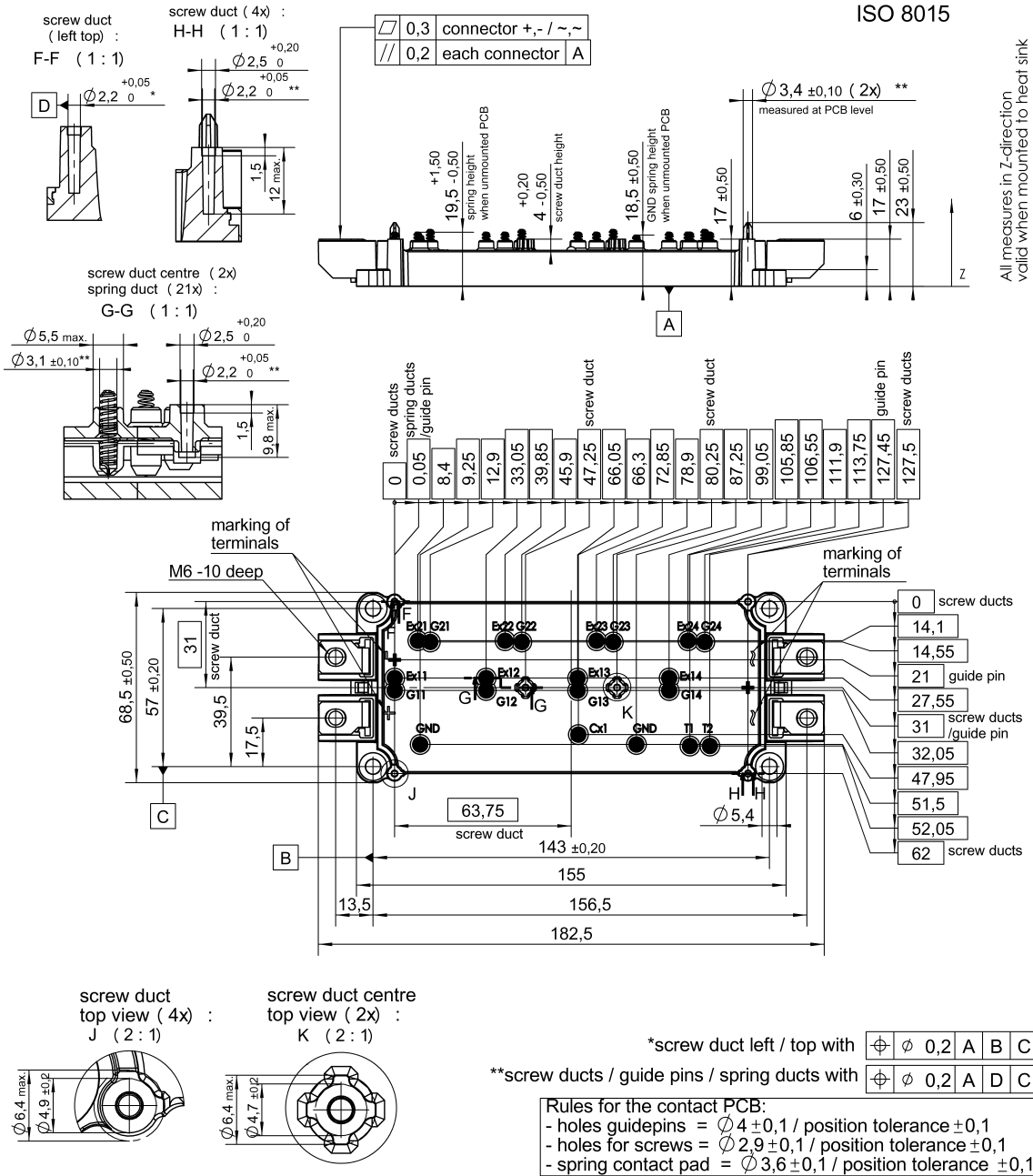


Fig. 12: Typ. CAL diode recovery charge

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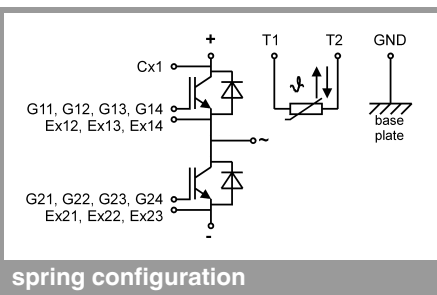
Case: SEMiX 4s

general tolerance:  
ISO 2768-mK  
ISO 8015



All measures in Z-direction valid when mounted to heat sink

SEMiX 4s



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.