SKiM® 93

Trench IGBT Modules

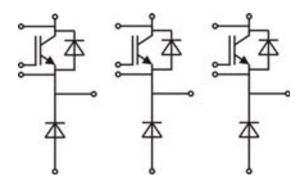
SKiM609GAR12E4

Features

- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts and electrical contacts
- High short circuit capability, self limiting to 6 x I_C
- Integrated temperature sensor

Typical Applications*

- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives



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Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT				
V_{CES}			1200	V
I_C	T_j = 175 °C	T_s = 25 °C	748	A
		T_s = 70 °C	608	A
I_{Cnom}			600	A
I_{CRM}	I_{CRM} = 3xI_{Cnom}		1800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Inverse diode				
I_F	T_j = 175 °C	T_s = 25 °C	139	A
		T_s = 70 °C	110	A
I_{Fnom}			600	A
I_{FRM}	I_{FRM} = 3xI_{Fnom}		1800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		900	A
T_j			-40 ... 175	°C
Freewheeling diode				
I_F	T_j = 175 °C	T_s = 25 °C	1397	A
		T_s = 70 °C	1107	A
I_{Fnom}			1350	A
I_{FRM}	I_{FRM} = 3xI_{Fnom}		4050	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		6480	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C		700	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min		2500	V

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT						
$V_{CE(sat)}$	I_C = 600 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.85	2.10	V
		T_j = 150 °C		2.25	2.45	V
V_{CE0}		T_j = 25 °C		0.8	0.9	V
		T_j = 150 °C		0.7	0.8	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		1.8	2.0	mΩ
		T_j = 150 °C		2.6	2.8	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 24 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V V_{CE} = 1200 V	T_j = 25 °C		0.1	0.3	mA
		T_j = 150 °C				mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		35.20		nF
C_{oes}		f = 1 MHz		2.32		nF
C_{res}		f = 1 MHz		1.88		nF
Q_G	V_{GE} = - 8 V...+ 15 V			3400		nC
R_{Gint}	T_j = 25 °C			1.3		Ω

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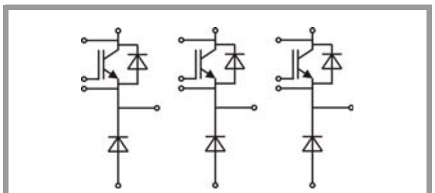

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
$t_{d(on)}$	V_{CC} = 600 V	T_j = 150 °C		150		ns
t_r	I_C = 600 A	T_j = 150 °C		121		ns
E_{on}	V_{GE} = 15 V	T_j = 150 °C		136		mJ
$t_{d(off)}$	$R_{G\,on}$ = 4.1 Ω $R_{G\,off}$ = 4.1 Ω	T_j = 150 °C		808		ns
t_f	di/dt_{on} = 5000 A/µs	T_j = 150 °C		100		ns
E_{off}	di/dt_{off} = 4400 A/µs	T_j = 150 °C		83		mJ
$R_{th(j-s)}$	per IGBT				0.068	K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 150 A	T_j = 25 °C		2.1	2.5	V
	V_{GE} = 0 V chip	T_j = 150 °C		2.1	2.4	V
V_{F0}		T_j = 25 °C	1.1	1.3	1.5	V
		T_j = 150 °C	0.7	0.9	1.1	V
r_F		T_j = 25 °C	4.3	5.6	6.4	mΩ
		T_j = 150 °C	6.7	7.8	8.5	mΩ
I_{RRM}	I_F = 150 A	T_j = 150 °C		153		A
Q_{rr}	di/dt_{off} = 3300 A/µs	T_j = 150 °C		15		µC
E_{rr}	V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		9		mJ
$R_{th(j-s)}$	per diode				0.501	K/W
Freewheeling diode						
$V_F = V_{EC}$	I_F = 600 A	T_j = 25 °C		1.7	1.9	V
	V_{GE} = 0 V chip	T_j = 150 °C		1.4	1.7	V
V_{F0}		T_j = 25 °C	1.1	1.3	1.5	V
		T_j = 150 °C	0.7	0.9	1.1	V
r_F		T_j = 25 °C	0.5	0.6	0.7	mΩ
		T_j = 150 °C	0.7	0.9	0.9	mΩ
I_{RRM}	I_F = 600 A	T_j = 150 °C		510		A
Q_{rr}	di/dt_{off} = 5300 A/µs	T_j = 150 °C		123		µC
E_{rr}	V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		39		mJ
$R_{th(j-s)}$	per diode				0.048	K/W
Module						
L_{CE}				10	15	nH
$R_{CC'+EE'}$	terminal-chip	T_s = 25 °C		0.3		mΩ
		T_s = 125 °C		0.5		mΩ
w				1042		g
Temperatur Sensor						
R_{100}	T_{Sensor} = 100 °C (R_{25} = 5 kΩ)			339		Ω
$B_{100/125}$	$R_{(T)} = R_{100}exp[B_{100/125}(1/T-1/373)]$; T[K];			4096		K

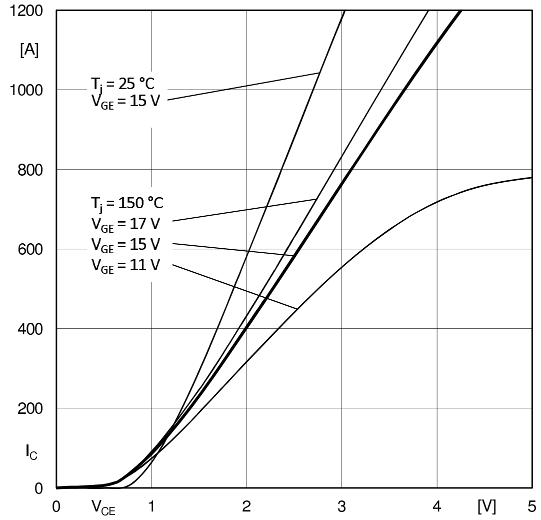


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

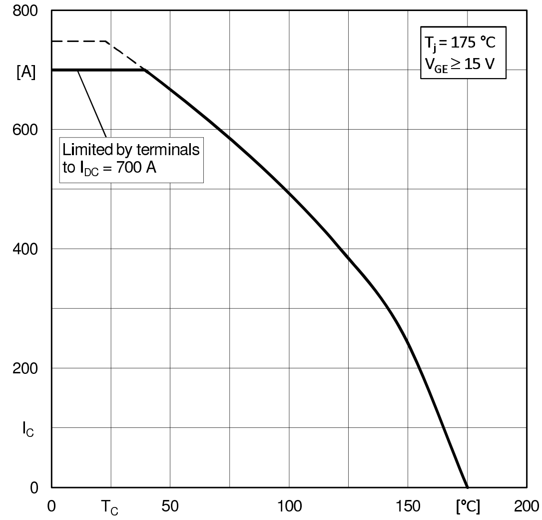


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

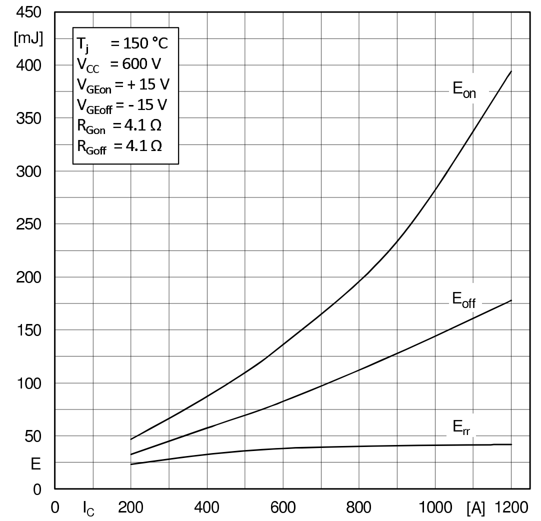


Fig. 3: Typ. turn-on /-off energy = f (I_C)

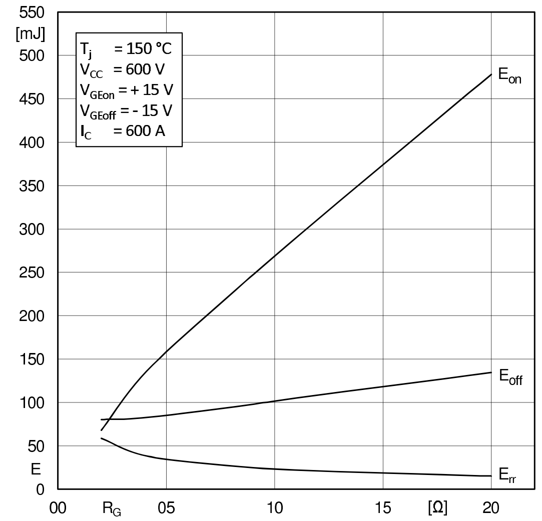


Fig. 4: Typ. turn-on /-off energy = f (R_G)

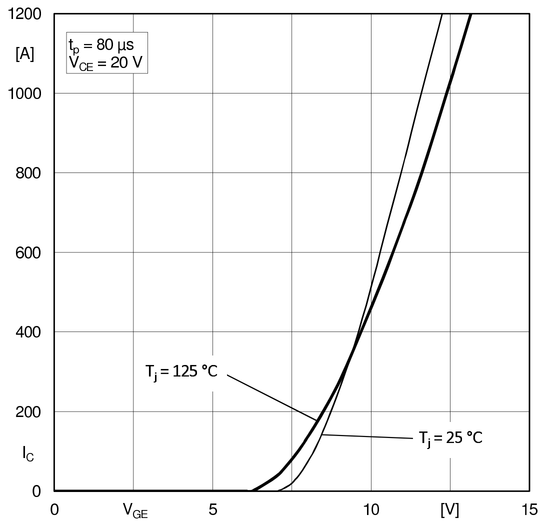


Fig. 5: Typ. transfer characteristic

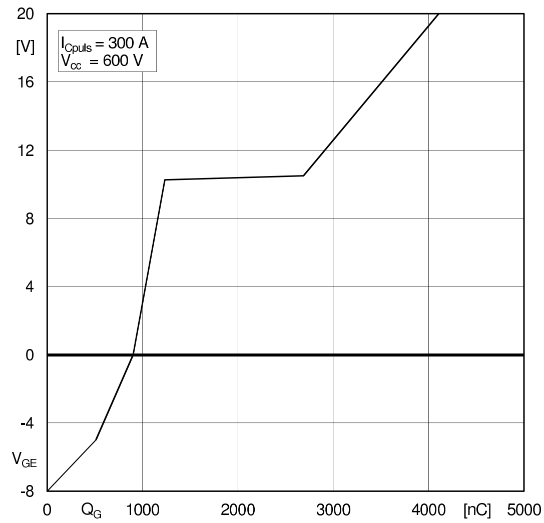


Fig. 6: Typ. gate charge characteristic

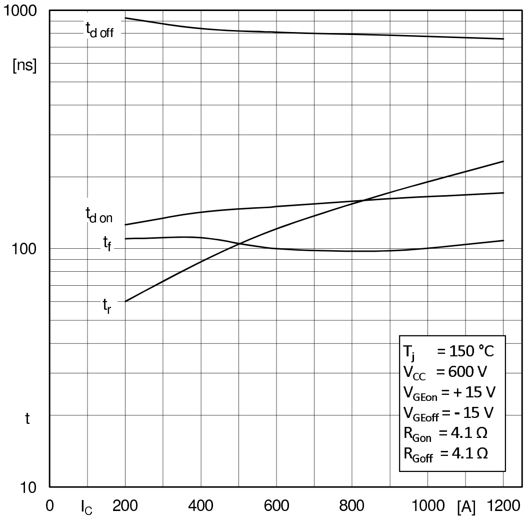


Fig. 7: Typ. switching times vs. I_C

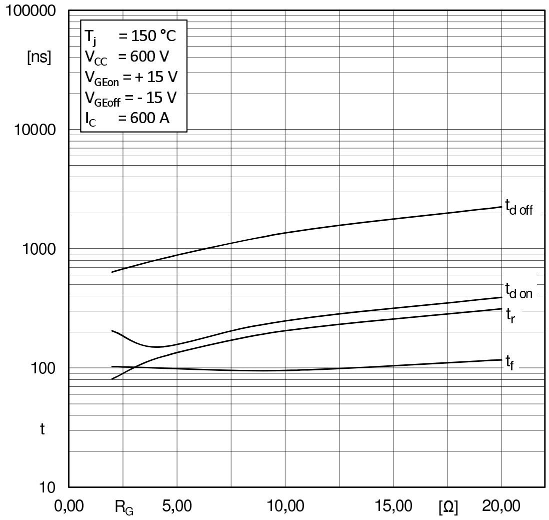


Fig. 8: Typ. switching times vs. gate resistor R_G

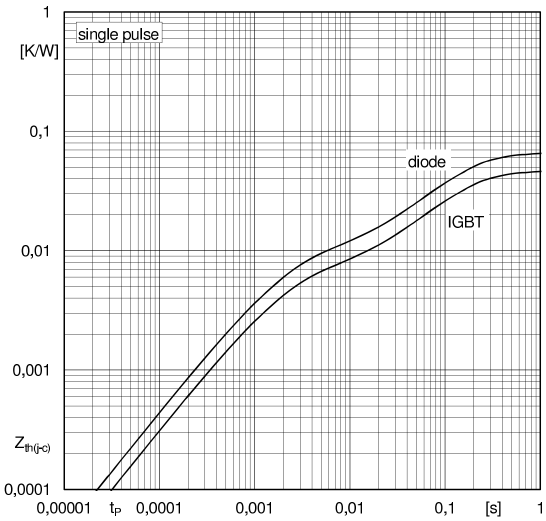


Fig. 9: Typ. transient thermal impedance

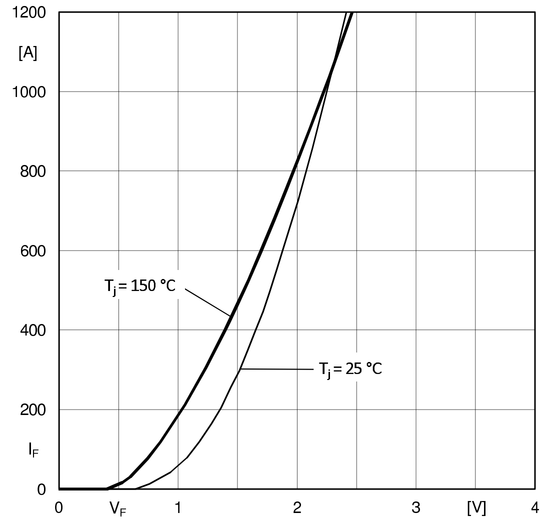


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

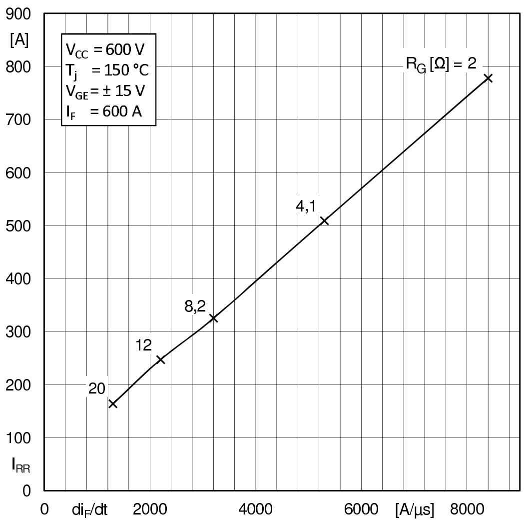


Fig. 11: Typ. CAL diode peak reverse recovery current

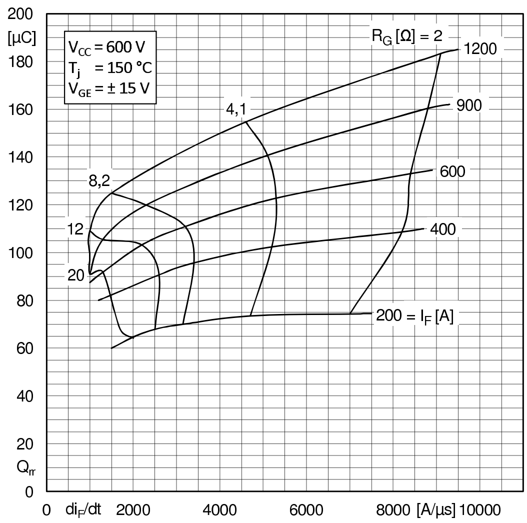
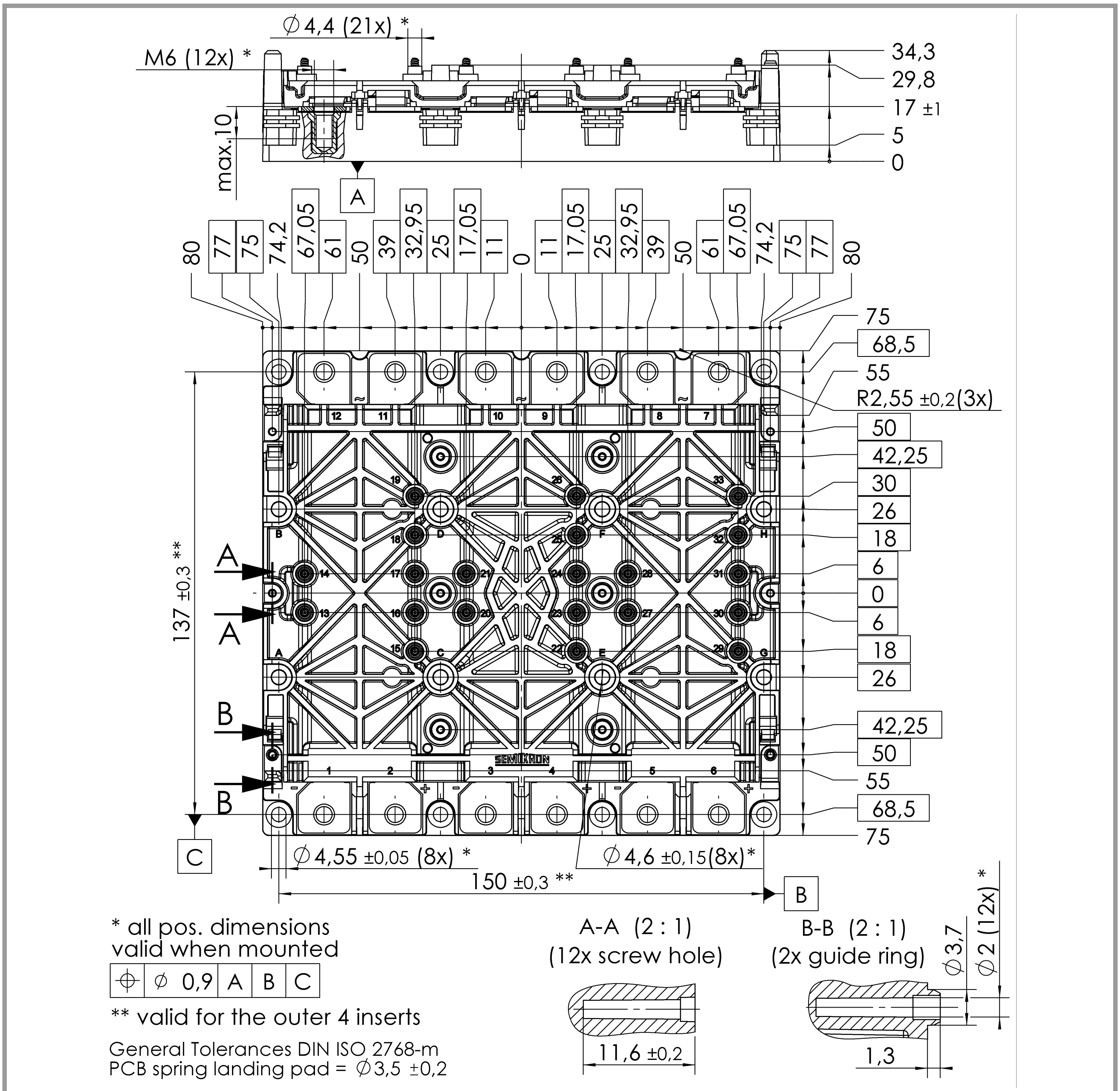


Fig. 12: Typ. CAL diode recovery charge



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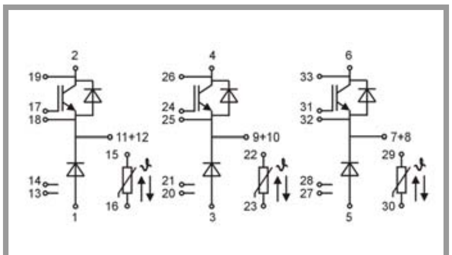

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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX

* 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.