SEMiX® 3p shunt

Trench IGBT Modules

SEMiX603GB17E4I30p

Features*

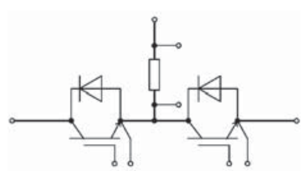
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- Current sensing shunt resistor
- UL recognized, file no. E63532

Typical Applications

- AC inverter drives
- UPS
- Renewable energy systems

Remarks

- Product reliability results are valid for T_j=150°C
- V_{isol} between temperature sensor and power section is only 2500V
- For storage and case temperature with TIM see document "TP(*) SEMiX 3p"



GB + shunt

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	T_j = 175 °C	T_c = 25 °C	912	A
		T_c = 80 °C	699	A
I_{Cnom}			600	A
I_{CRM}			1800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 1000 V V_{GE} ≤ 15 V V_{CES} ≤ 1700 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Inverse diode				
V_{RRM}	T_j = 25 °C		1700	V
I_F	T_j = 175 °C	T_c = 25 °C	557	A
		T_c = 80 °C	412	A
I_{FRM}			900	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		2565	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			600	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC sinus 50Hz, t = 1 min		4000	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		1.95	2.30	V
		T_j = 150 °C		2.48	2.80	V
V_{CE0}	chiplevel	T_j = 25 °C		1.02	1.20	V
		T_j = 150 °C		0.92	1.03	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.55	1.83	mΩ
		T_j = 150 °C		2.6	3.0	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 24 mA		5.2	5.8	6.2	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1700 V, T_j = 25 °C				5	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		46.5		nF
C_{oes}		f = 1 MHz		1.98		nF
C_{res}		f = 1 MHz		1.65		nF
Q_G	V_{GE} = - 8 V...+ 15 V			4800		nC
R_{Gint}	T_j = 25 °C			1.1		Ω
$t_{d(on)}$	V_{CC} = 900 V I_C = 600 A V_{GE} = +15/-15 V $R_{G\,on}$ = 1.2 Ω $R_{G\,off}$ = 1.2 Ω di/dt_{on} = 9800 A/µs di/dt_{off} = 2800 A/µs dv/dt = 3450 V/µs L_s = 25 nH	T_j = 150 °C		303		ns
t_r		T_j = 150 °C		67		ns
E_{on}		T_j = 150 °C		79		mJ
$t_{d(off)}$		T_j = 150 °C		718		ns
t_f		T_j = 150 °C		171		ns
E_{off}		T_j = 150 °C		211		mJ
$R_{th(j-c)}$	per IGBT				0.042	K/W
$R_{th(c-s)}$	per IGBT, P12 (reference)			0.033		K/W
$R_{th(c-s)}$	per IGBT, HP-PCM			0.015		K/W

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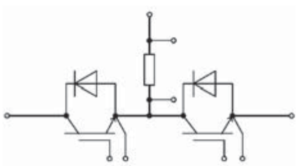


GB + shunt

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse diode						
$V_F = V_{EC}$	I_F = 450 A V_{GE} = 0 V chiplevel	T_j = 25 °C		1.98	2.37	V
		T_j = 150 °C		2.12	2.52	V
V_{F0}	chiplevel	T_j = 25 °C		1.32	1.56	V
		T_j = 150 °C		1.08	1.22	V
r_F	chiplevel	T_j = 25 °C		1.46	1.80	mΩ
		T_j = 150 °C		2.3	2.9	mΩ
I_{RRM}	I_F = 450 A di/dt_{off} = 9930 A/µs V_{GE} = -15 V V_{CC} = 900 V	T_j = 150 °C		664		A
Q_{rr}		T_j = 150 °C		139		µC
E_{rr}		T_j = 150 °C		102		mJ
$R_{th(j-c)}$	per diode				0.10	K/W
$R_{th(c-s)}$	per diode, P12 (reference)			0.043		K/W
$R_{th(c-s)}$	per diode, HP-PCM			0.019		K/W
Module						
L_{CE}				20		nH
$R_{CC'+EE'}$	measured per switch, shunt excluded	T_C = 25 °C		0.95		mΩ
		T_C = 125 °C		1.25		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling			0.009		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, P12 (reference)			0.016		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, HP-PCM			0.007		K/W
M_s	to heat sink (M5)		3		6	Nm
M_t		to terminals (M6)	3		6	Nm
						Nm
w					350	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

Characteristics					
Symbol	**Conditions**	**min.**	**typ.**	**max.**	**Unit**
Shunt					
R_{Shunt}	Tolerance = ±1 %, T_c = 20°C		0.30		mΩ
α				50	ppm/K
T_{Shunt}				170	°C
$R_{th(r-c)}$				2.3	K/W
P_{Shunt}	T_c = 80 °C			39	W

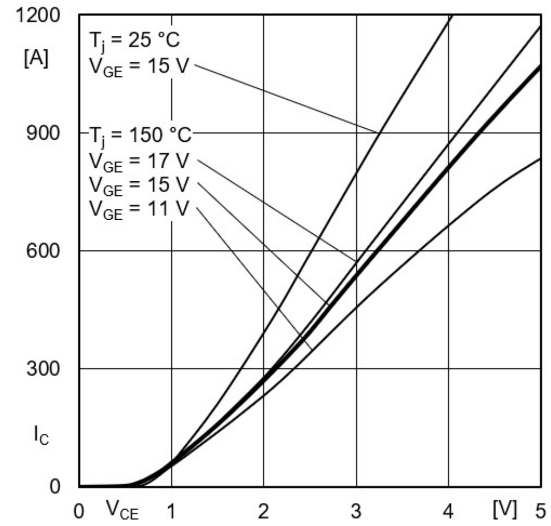


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

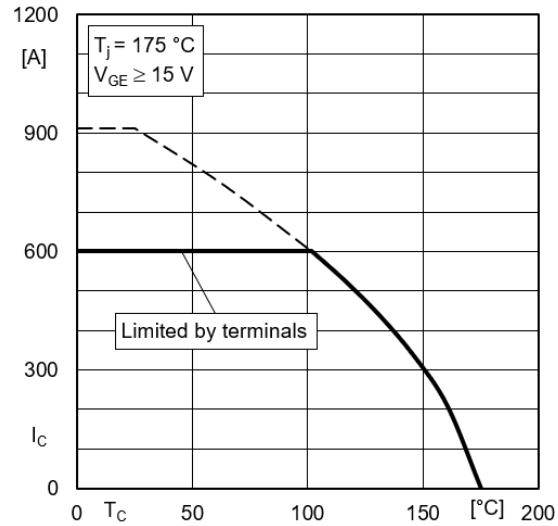


Fig. 2: Rated current vs. temperature $I_c = f(T_c)$

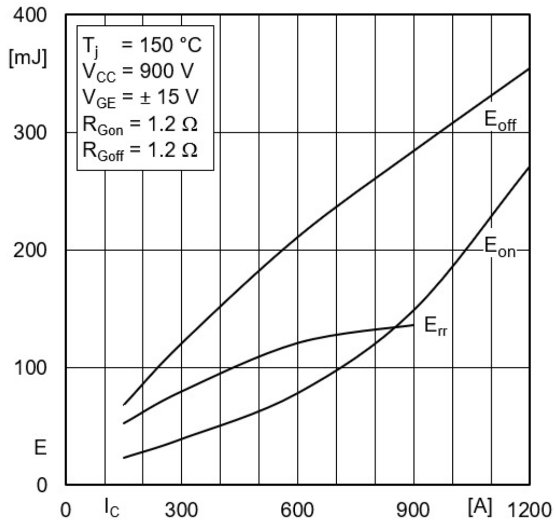


Fig. 3: Typ. turn-on /-off energy = f (I_C)

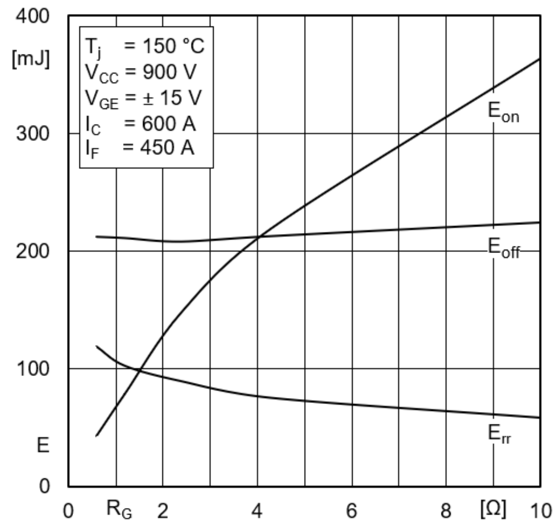


Fig. 4: Typ. turn-on /-off energy = f (R_G)

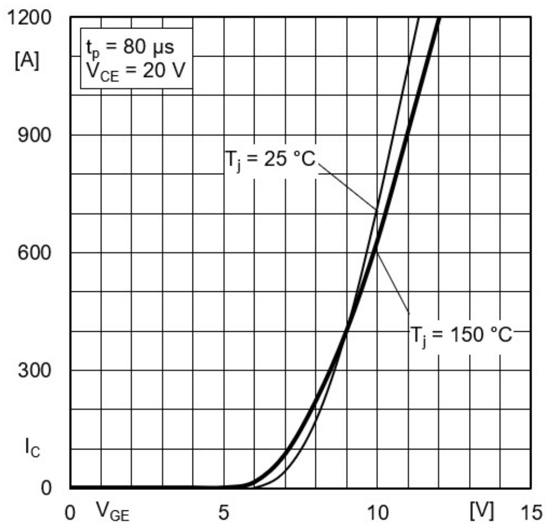


Fig. 5: Typ. transfer characteristic

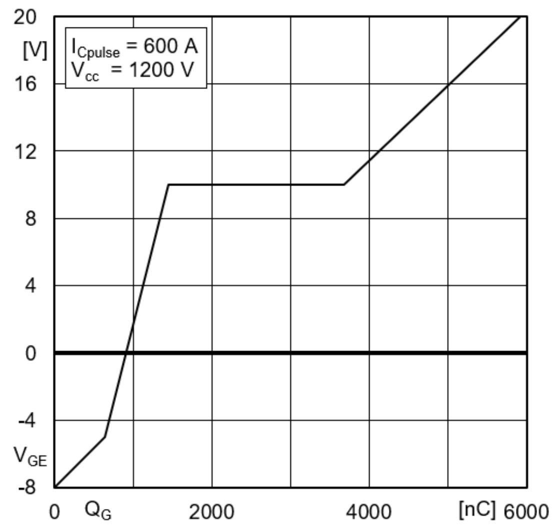


Fig. 6: Typ. gate charge characteristic

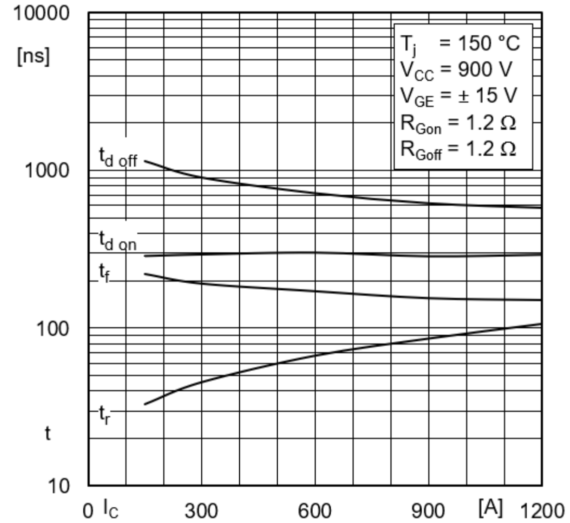


Fig. 7: Typ. switching times vs. I_C

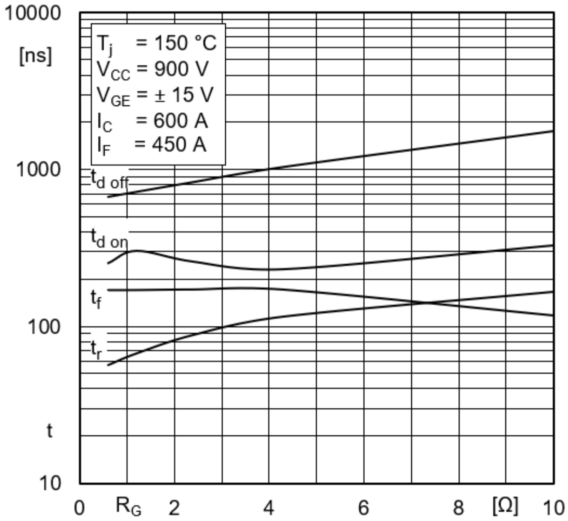


Fig. 8: Typ. switching times vs. gate resistor R_G

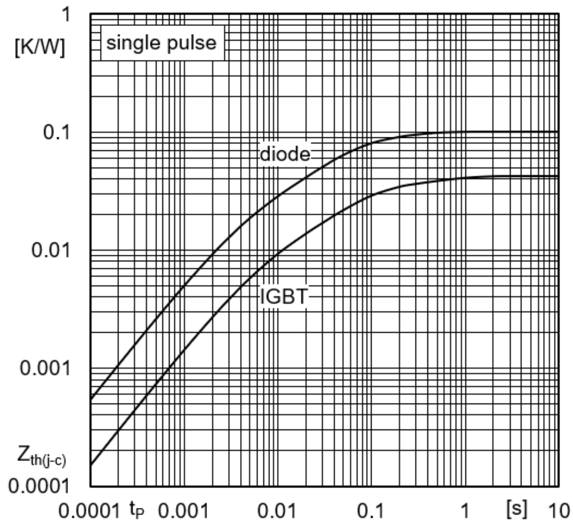


Fig. 9: Transient thermal impedance

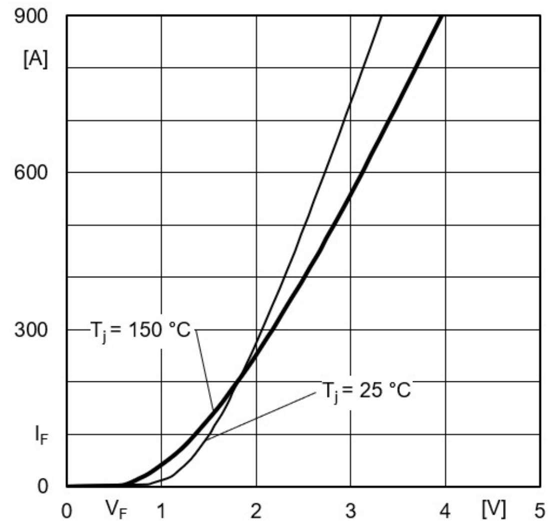


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

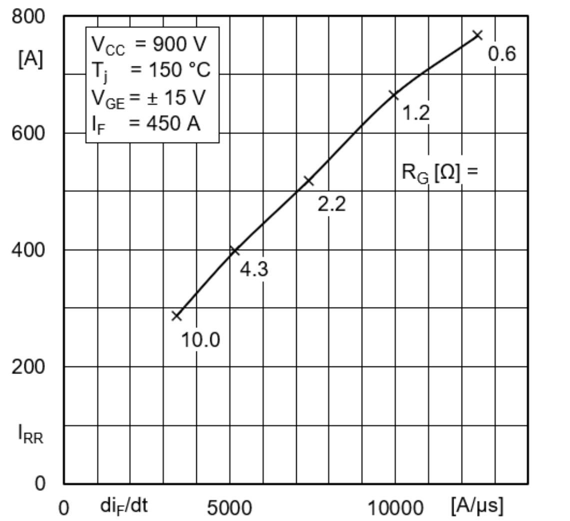


Fig. 11: Typ. CAL diode peak reverse recovery current

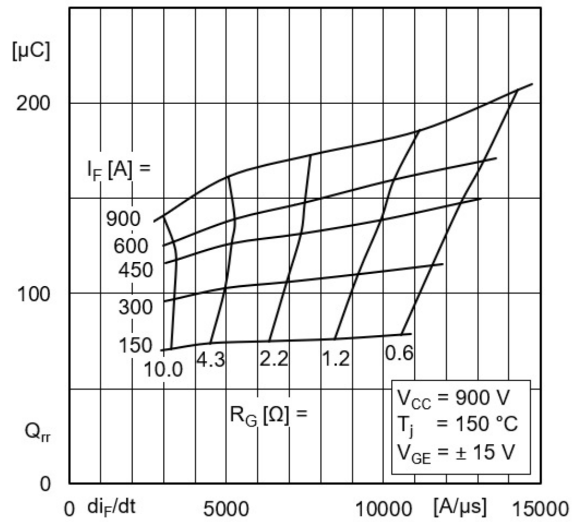
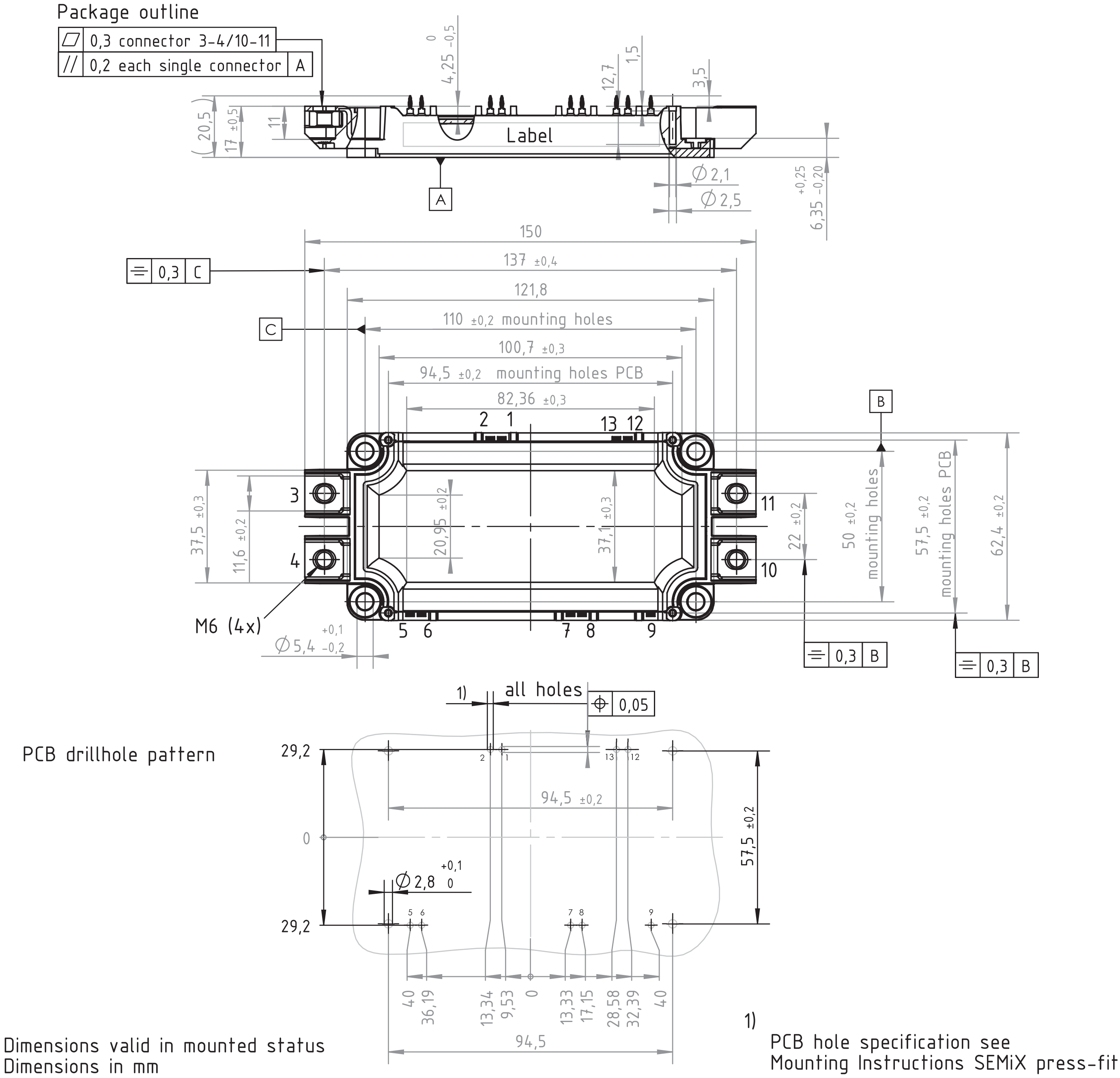


Fig. 12: Typ. CAL diode recovery charge



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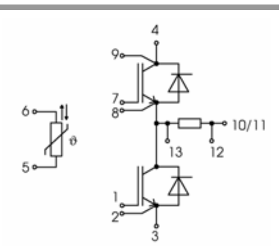

pinout

This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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