MiniSKiiP® 2

3-Level NPC IGBT-Module

SKiiP 28MLI07E3V1

Features

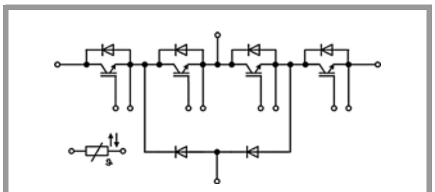
- 650V Trench IGBTs
- Robust and soft diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532
- NTC T-Sensor

Typical Applications*

- Uninterruptible power supplies (UPS)
- Solar inverters

Remarks

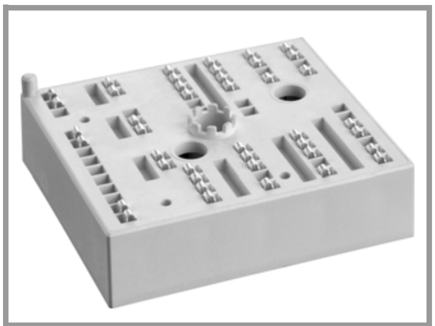
- Case temperature limited to T_C=125°C max.; T_C=T_S (valid for baseplate-less modules)
- Product reliability results are valid for T_{jop}=150°C



MLI

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V_{CES}			650	V
I_C	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	135	A
		T_s = 70 °C	107	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	163	A
		T_s = 70 °C	130	A
I_{Cnom}			150	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		450	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V V_{GE} ≤ 15 V V_{CES} ≤ 650 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Inverse diode				
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	126	A
		T_s = 70 °C	97	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	151	A
		T_s = 70 °C	118	A
I_{Fnom}			150	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		300	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		1200	A
T_j			-40 ... 175	°C
Clamping diode				
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	126	A
		T_s = 70 °C	97	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	151	A
		T_s = 70 °C	118	A
I_{Fnom}			150	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		300	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		1200	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80°C, 20A per spring		120	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 = 150 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.45	1.90	V
		T_j = 150 °C		1.70	2.10	V
V_{CE0}	chiplevel	T_j = 25 °C		0.90	1.00	V
		T_j = 150 °C		0.82	0.90	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		3.7	6.0	mΩ
		T_j = 150 °C		5.9	8.0	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 2.4 mA		5.1	5.8	6.4	V
I_{CES}	V_{GE} = 0 V V_{CE} = 650 V	T_j = 25 °C		0.1	0.3	mA
				-		mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		9.24		nF
C_{oes}		f = 1 MHz		0.58		nF
C_{res}		f = 1 MHz		0.27		nF



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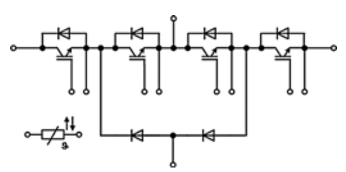


MLI

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT						
Q_G	V_{GE} = - 8 V...+ 15 V			1200		nC
R_{Gint}	T_j = 25 °C			2.0		Ω
T1 / T4						
$t_{d(on)}$	V_{CE} = 300 V	T_j = 150 °C		108		ns
t_r	I_C = 150 A	T_j = 150 °C		73		ns
E_{on}	V_{GE} = +15/-15 V	T_j = 150 °C		5.5		mJ
$t_{d(off)}$	$R_{G\,on}$ = 3 Ω	T_j = 150 °C		268		ns
t_f	$R_{G\,off}$ = 1.6 Ω di/dt_{on} = 2100 A/µs	T_j = 150 °C		76		ns
E_{off}	di/dt_{off} = 1700 A/µs	T_j = 150 °C		5.6		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.55		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.41		K/W
T2 / T3						
$t_{d(on)}$	V_{CE} = 300 V	T_j = 150 °C		106		ns
t_r	I_C = 150 A	T_j = 150 °C		64		ns
E_{on}	V_{GE} = +15/-15 V	T_j = 150 °C		2		mJ
$t_{d(off)}$	$R_{G\,on}$ = 3 Ω	T_j = 150 °C		268		ns
t_f	$R_{G\,off}$ = 1.6 Ω di/dt_{on} = 2520 A/µs	T_j = 150 °C		77		ns
E_{off}	di/dt_{off} = 1750 A/µs	T_j = 150 °C		5.2		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.55		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.41		K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 150 A	T_j = 25 °C		1.40	1.76	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		1.39	1.77	V
V_{F0}	chiplevel	T_j = 25 °C		1.04	1.24	V
		T_j = 150 °C		0.85	0.99	V
r_F	chiplevel	T_j = 25 °C		2.4	3.5	mΩ
		T_j = 150 °C		3.6	5.2	mΩ
I_{RRM}	I_F = 150 A	T_j = 150 °C		121		A
Q_{rr}	di/dt_{off} = 2450 A/µs	T_j = 150 °C		20		µC
E_{rr}	V_{GE} = -15 V	T_j = 150 °C		5.5		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.75		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.58		K/W
Clamping diode						
$V_F = V_{EC}$	I_F = 150 A	T_j = 25 °C		1.40	1.76	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		1.39	1.77	V
V_{F0}	chiplevel	T_j = 25 °C		1.04	1.24	V
		T_j = 150 °C		0.85	0.99	V
r_F	chiplevel	T_j = 25 °C		2.4	3.5	mΩ
		T_j = 150 °C		3.6	5.2	mΩ
I_{RRM}	I_F = 150 A	T_j = 150 °C		116		A
Q_{rr}	di/dt_{off} = 2210 A/µs	T_j = 150 °C		13.2		µC
E_{rr}	V_{GE} = -15 V	T_j = 150 °C		2.6		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.75		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.58		K/W
Module						
M_s	to heat sink		2		2.5	Nm
w	weight			55		g
Temperature Sensor						
R_{25}	NTC, T_r = 25 °C [1)]			5.0 ± 5%		kΩ

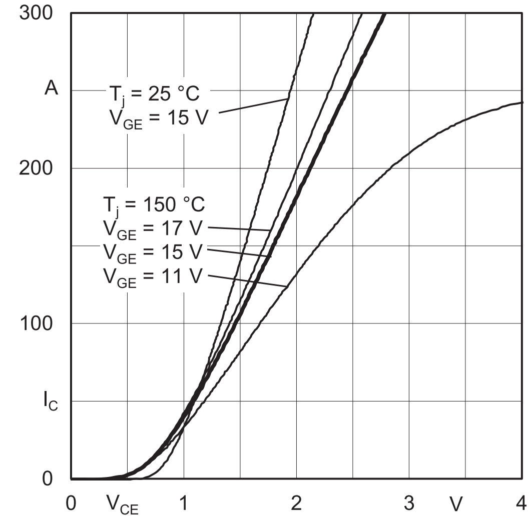


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

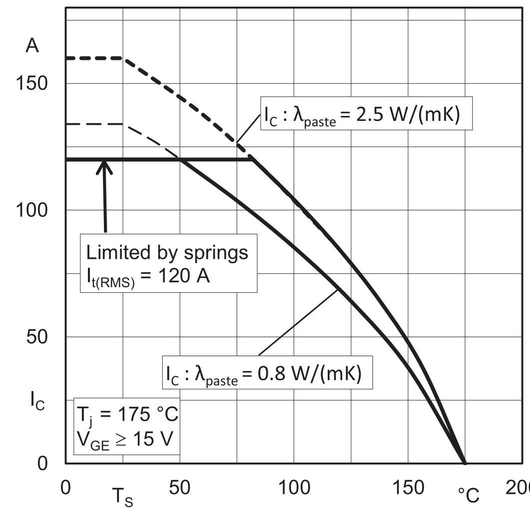


Fig. 2: Rated current vs. temperature $I_C = f(T_S)$

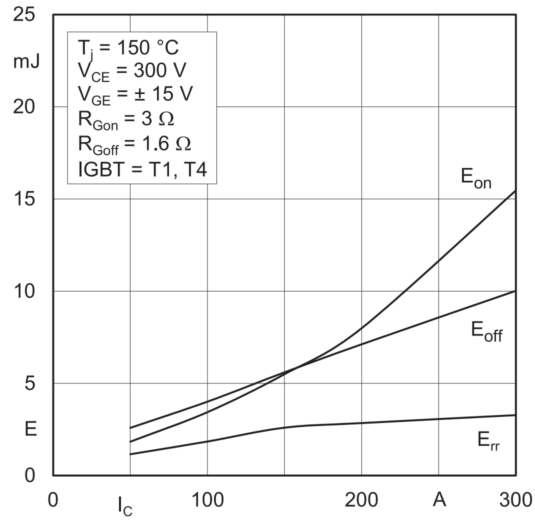


Fig. 3: Typ. turn-on /-off energy = f (I_C)

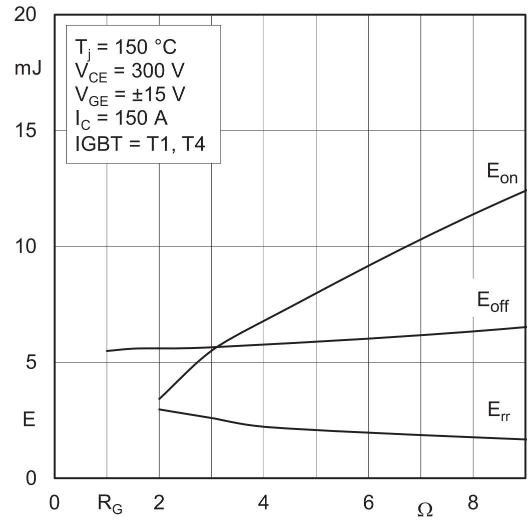


Fig. 4: Typ. turn-on /-off energy = f (R_G)

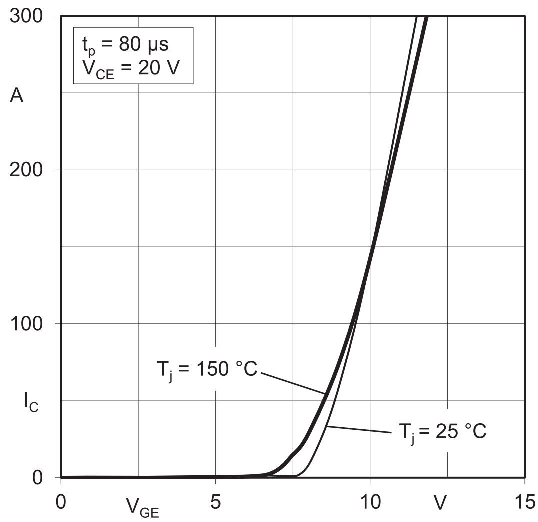


Fig. 5: Typ. transfer characteristic

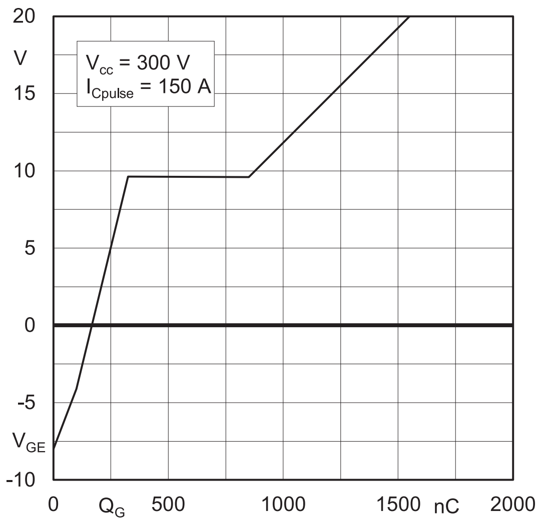


Fig. 6: Typ. gate charge characteristic

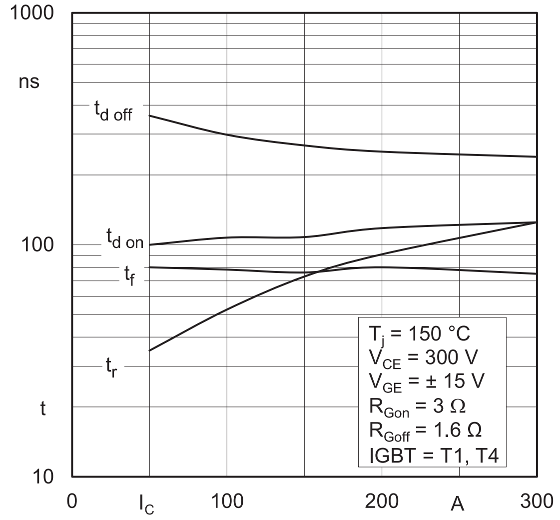


Fig. 7: Typ. switching times vs. I_C

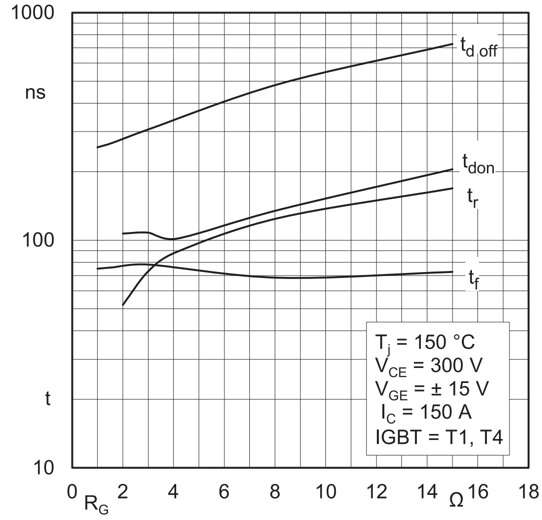


Fig. 8: Typ. switching times vs. gate resistor R_G

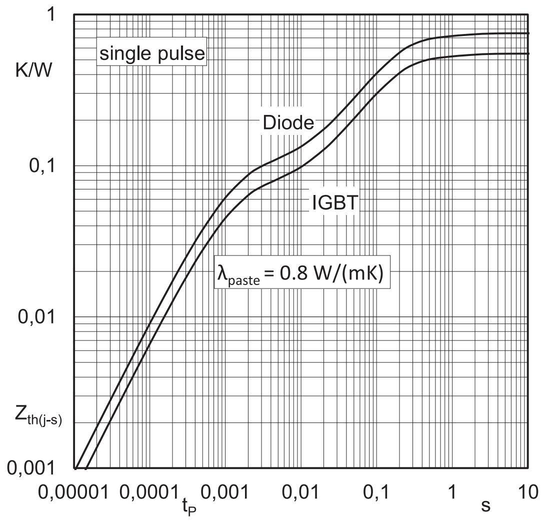


Fig. 9: Transient thermal impedance of IGBT and Diode

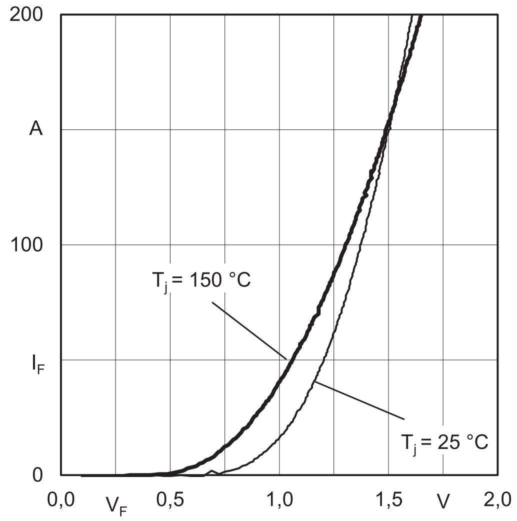


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

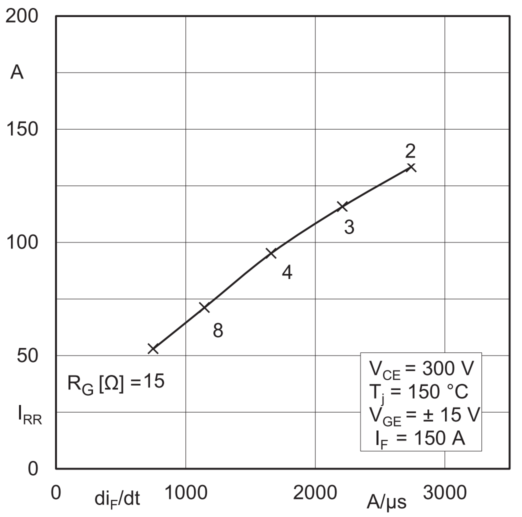


Fig. 11: Typ. CAL diode peak reverse recovery current

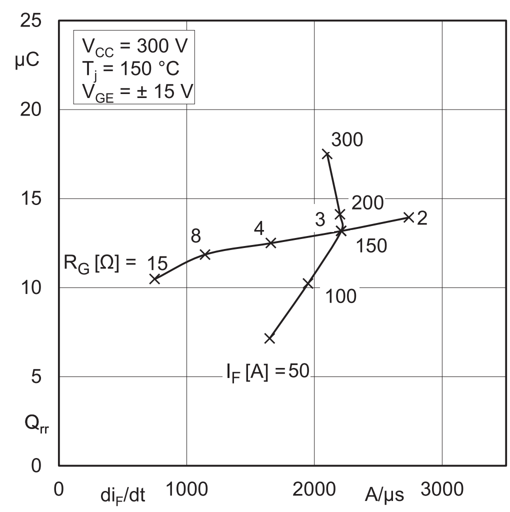
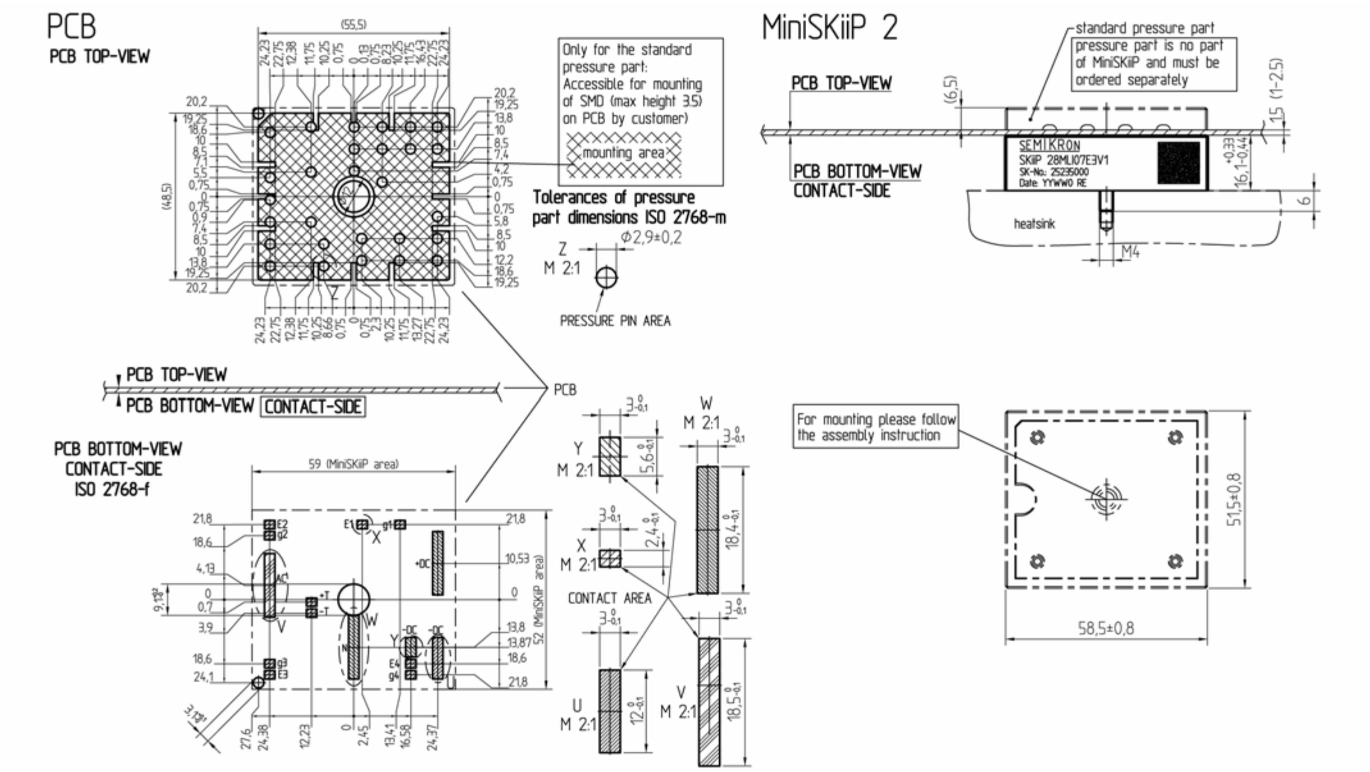
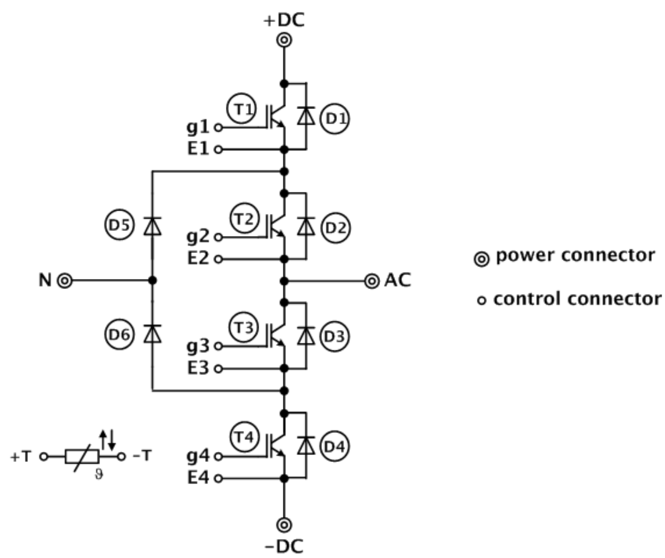


Fig. 12: Typ. CAL diode recovery charge



pinout, dimensions



pinout

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

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