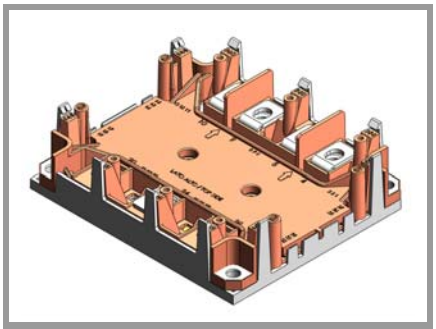
SKiM301TMLI12E4B



SKiM® 4

Trench IGBT Modules

SKiM301TMLI12E4B

Features

- IGBT 4 Trench Gate Technology
- Solder technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
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Typical Applications*

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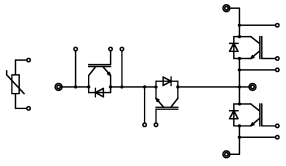
Remarks

- Case temperature limited to T_s = 125°C max; $T_c = T_s$ (for baseplateless modules)
- Recommended T_{op} = -40 … +150°C

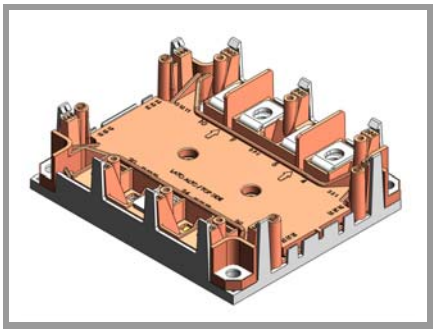


TMLI

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT 1				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 150 °C	T_s = 25 °C	279	A
		T_s = 70 °C	213	A
I_C	T_j = 175 °C	T_s = 25 °C	311	A
		T_s = 70 °C	252	A
I_{Cnom}			300	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		900	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 1200 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT 2				
V_{CES}	T_j = 25 °C		650	V
I_C	T_j = 150 °C	T_s = 25 °C	221	A
		T_s = 70 °C	164	A
I_C	T_j = 175 °C	T_s = 25 °C	248	A
		T_s = 70 °C	197	A
I_{Cnom}			300	A
I_{CRM}	I_{CRM} = 2 x I_{Cnom}		600	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 650 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C

Absolute Maximum Ratings			
Symbol	**Conditions**	**Values**	**Unit**
Module			
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C,	400	A
T_{stg}		-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min	2500	V



SKiM® 4

Trench IGBT Modules

SKiM301TMLI12E4B

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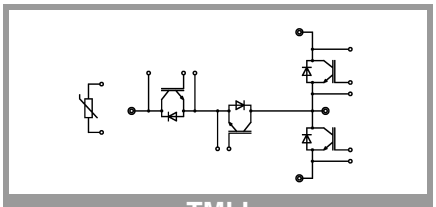
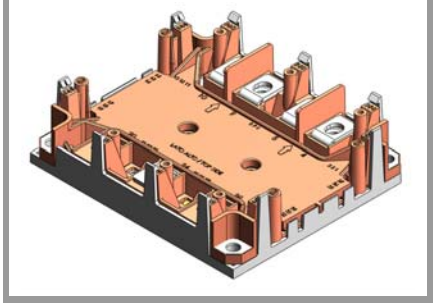


TMLI

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
Diode 1				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_s = 25 °C	249	A
		T_s = 70 °C	196	A
I_F	T_j = 175 °C	T_s = 25 °C	249	A
		T_s = 70 °C	196	A
I_{Fnom}			300	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		900	A
I_{FSM}	10 ms, sin 180°, T_j = 150 °C		1485	A
T_j			-40 ... 175	°C

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
Diode 2				
V_{RRM}	T_j = 25 °C		650	V
I_F	T_j = 175 °C	T_s = 25 °C	266	A
		T_s = 70 °C	205	A
I_F	T_j = 175 °C	T_s = 25 °C	266	A
		T_s = 70 °C	205	A
I_{Fnom}			300	A
I_{FRM}	$I_{FRM} = 2xI_{Fnom}$		600	A
I_{FSM}	10 ms sin 180°	T_j = 25 °C	2160	A
		T_j = 150 °C	1980	A
T_j			-40 ... 175	°C



SKiM® 4

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SKiM301TMLI12E4B

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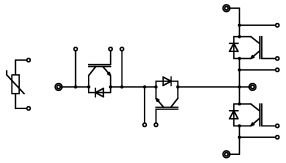


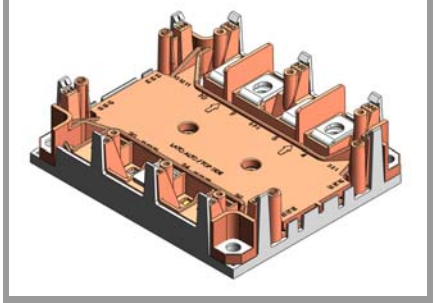
TMLI

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT 1						
$V_{CE(sat)}$	I_C = 300 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.80	2.05	V
		T_j = 150 °C		2.20	2.40	V
V_{CE0}	chiplevel	T_j = 25 °C		0.8	0.9	V
		T_j = 150 °C		0.7	0.8	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		3.3	3.8	mΩ
		T_j = 150 °C		5.0	5.3	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}$ V, I_C = 11.4 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V V_{CE} = 1200 V	T_j = 25 °C				mA
						mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		18.45		nF
C_{oes}		f = 1 MHz		1.215		nF
C_{res}		f = 1 MHz		1.035		nF
Q_G	- 8 V...+ 15 V			1695		nC
R_{Gint}	T_j = 25 °C			2.50		Ω
$t_{d(on)}$	V_{CE} = 300 V I_C = 300 A $R_{G\,on}$ = 2.7 Ω $R_{G\,off}$ = 2.7 Ω di/dt_{on} = 5626 A/µs di/dt_{off} = 2636 A/µs $V_{GE\,neg}$ = -15 V $V_{GE\,pos}$ = 15 V	T_j = 150 °C		217.9		ns
t_r		T_j = 150 °C		69.43		ns
E_{on}		T_j = 150 °C		6.62		mJ
$t_{d(off)}$		T_j = 150 °C		355.5		ns
t_f		T_j = 150 °C		91.3		ns
E_{off}		T_j = 150 °C		19.37		mJ
$R_{th(j-s)}$	per IGBT			0.19		K/W

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT 2						
$V_{CE(sat)}$	I_C = 300 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.55	1.95	V
		T_j = 150 °C		1.75	2.2	V
V_{CE0}	chiplevel	T_j = 25 °C		0.9	1	V
		T_j = 150 °C		0.82	0.9	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		2.2	3.2	mΩ
		T_j = 150 °C		3.1	4.3	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}$ V, I_C = 8 mA		5.1	5.8	6.4	V
I_{CES}	V_{GE} = 0 V V_{CE} = 650 V	T_j = 25 °C				mA
		T_j = 150 °C				mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		18.48		nF
C_{oes}		f = 1 MHz				nF
C_{res}		f = 1 MHz		0.548		nF
Q_G	- 8 V...+ 15 V					nC
R_{Gint}	T_j = 25 °C			1.00		Ω
$t_{d(on)}$	V_{CE} = 300 V I_C = 300 A $R_{G\,on}$ = 2.7 Ω $R_{G\,off}$ = 2.7 Ω di/dt_{on} = 5566 A/µs di/dt_{off} = 1353 A/µs $V_{GE\,neg}$ = -15 V $V_{GE\,pos}$ = 15 V	T_j = 150 °C		149.14		ns
t_r		T_j = 150 °C		79.71		ns
E_{on}		T_j = 150 °C		2.78		mJ
$t_{d(off)}$		T_j = 150 °C		420		ns
t_f		T_j = 150 °C		180		ns
E_{off}		T_j = 150 °C		17.48		mJ
$R_{th(j-s)}$	per IGBT			0.3		K/W



SKiM® 4

Trench IGBT Modules

SKiM301TMLI12E4B

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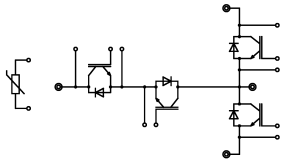


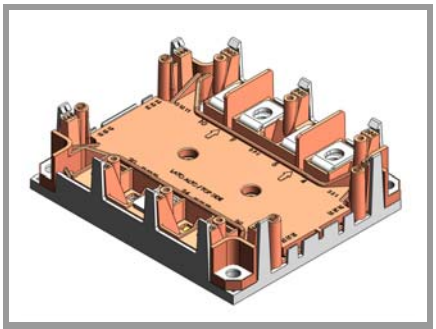
TMLI

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Diode 1						
$V_F = V_{EC}$	I_F = 300 A V_{GE} = 15 V chiplevel	T_j = 25 °C		2.20	2.52	V
		T_j = 150 °C		2.15	2.47	V
V_{F0}	chiplevel	T_j = 25 °C	1.1	1.3	1.5	V
		T_j = 150 °C	0.7	0.9	1.1	V
r_F	chiplevel	T_j = 25 °C	2.7	3.0	3.4	mΩ
		T_j = 150 °C	3.5	4.2	4.6	mΩ
I_{RRM}	I_F = 300 A			132.43		A
Q_{rr}				21.47		µC
E_{rr}	V_R = 300 V			1.79		mJ
$R_{th(j-s)}$	per DIODE			0.29		K/W

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Diode 2						
$V_F = V_{EC}$	I_F = 300 A	T_j = 25 °C		1.4	1.80	V
	chiplevel	T_j = 150 °C		1.39	1.77	V
V_{F0}	chiplevel	T_j = 25 °C	0.95	1.04	1.236	V
		T_j = 150 °C		0.85	0.99	V
r_F	chiplevel	T_j = 25 °C	0.8	1.2	1.8	mΩ
		T_j = 150 °C		1.8	2.6	mΩ
I_{RRM}	I_F = 300 A			126.64		A
Q_{rr}				23.84		µC
E_{rr}	V_R = 300 V			1.7		mJ
$R_{th(j-s)}$	per DIODE			0.35		K/W



SKiM® 4

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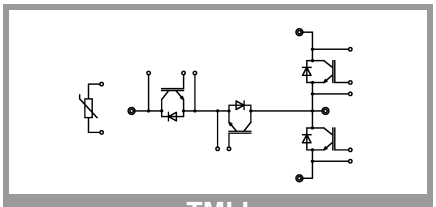


TMLI

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Module						
L_{CE}				18		nH
$R_{CC'+EE'}$	terminal-chip	T_s = 25 °C		1.35		mΩ
		T_s = 125 °C		1.75		mΩ
$R_{th(c-s)}$	per module					K/W
M_s	to heat sink (M5)		2		3	Nm
M_t		to terminals M6	4		5	Nm
						Nm
w				317		g

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Temperature Sensor					
R_{100}	T_r = 100 °C, tolerance = 3 %		493 ± 5%		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; T[K];		3550 ±2%		K

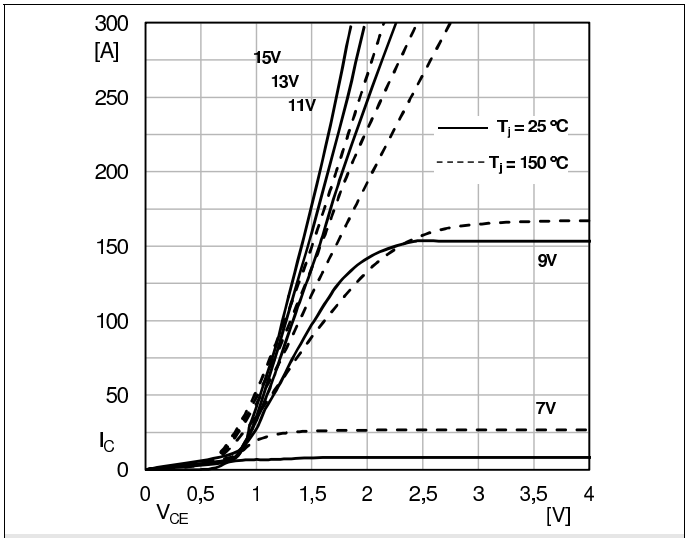


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

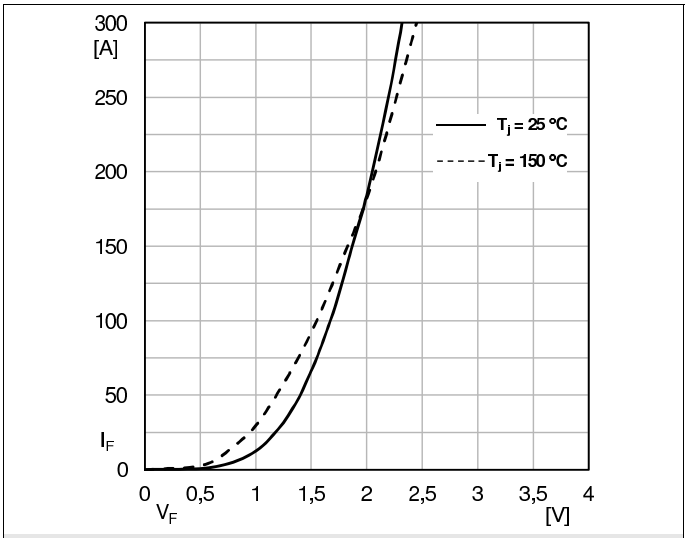


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

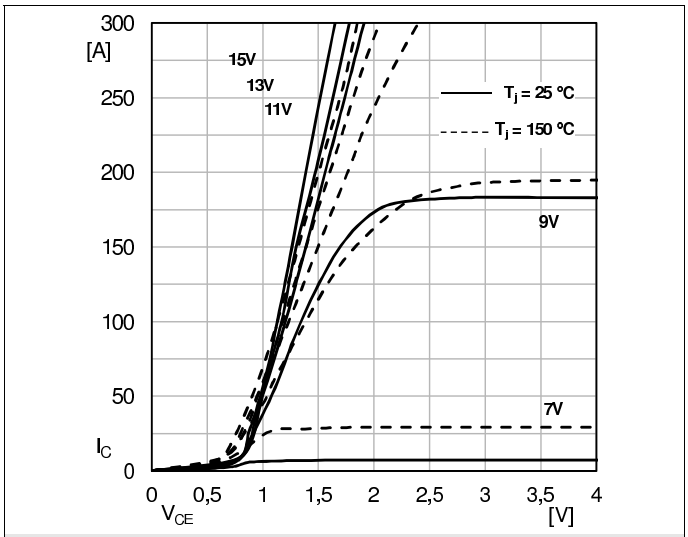


Fig. 3: Typ. turn-on /-off energy = f (I_C)

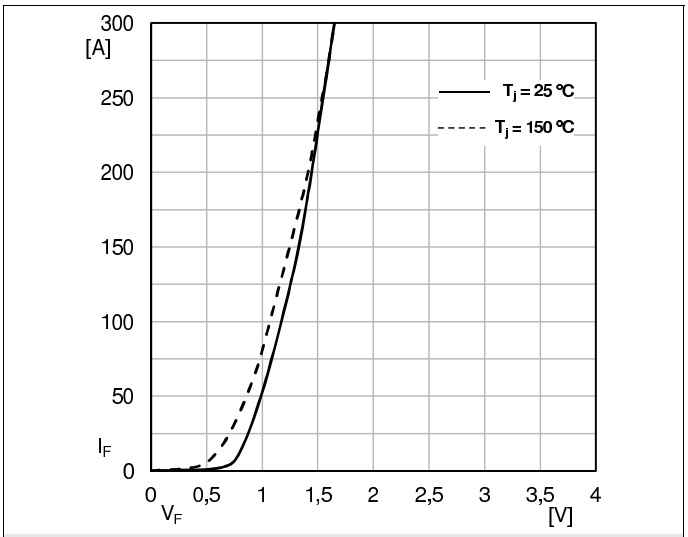


Fig. 4: Typ. turn-on /-off energy = f (R_G)

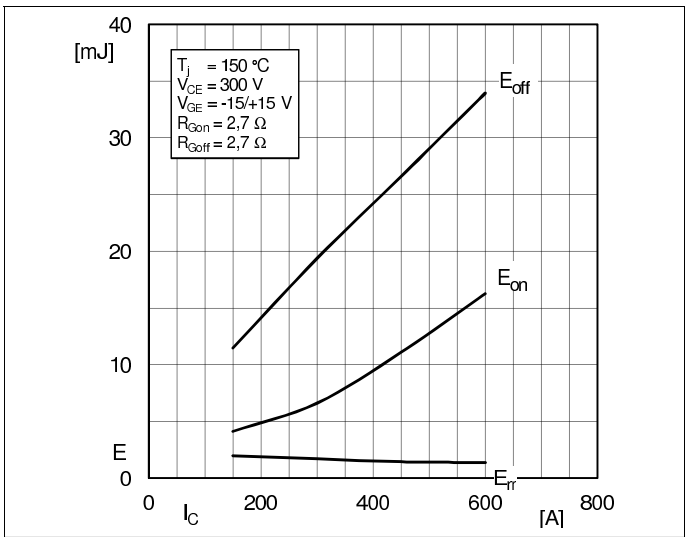


Fig. 5: Typ. transfer characteristic

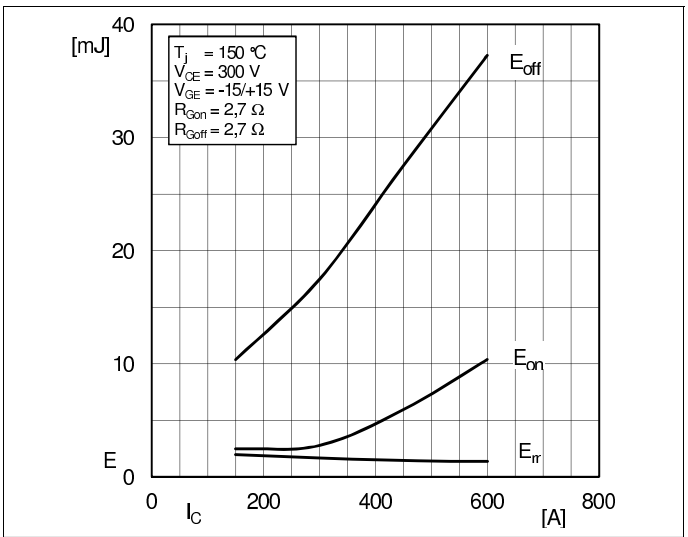


Fig. 6: Typ. gate charge characteristic

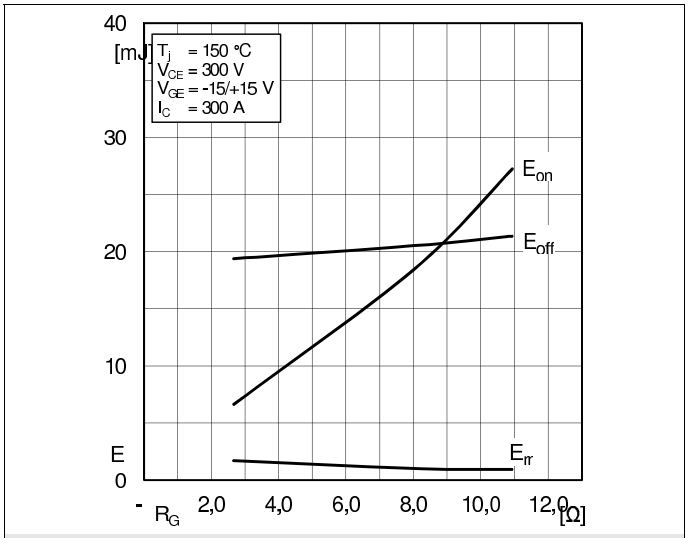


Fig. 7: Typ. switching times vs. I_C

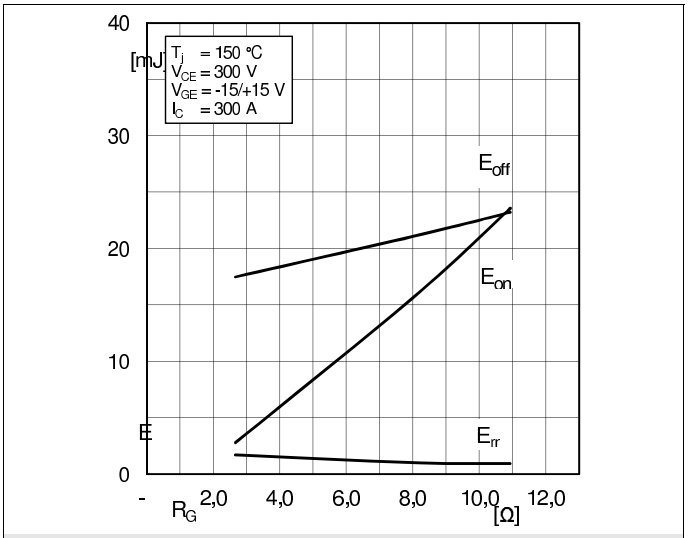


Fig. 8: Typ. switching times vs. gate resistor R_G

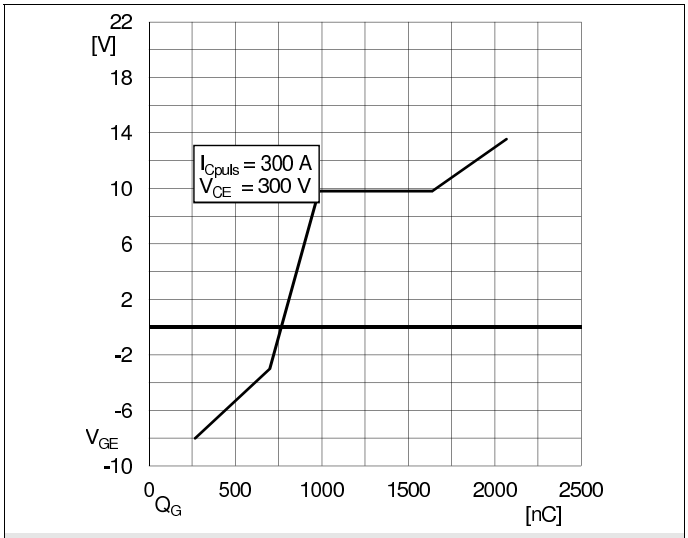


Fig. 9: Typ. transient thermal impedance

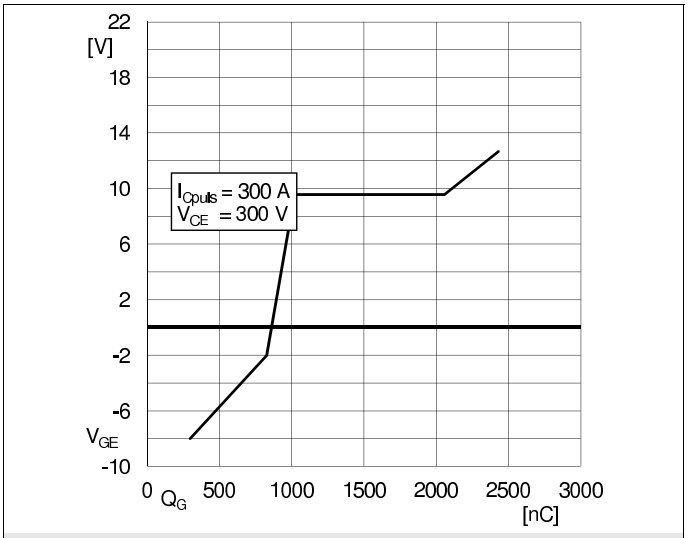


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

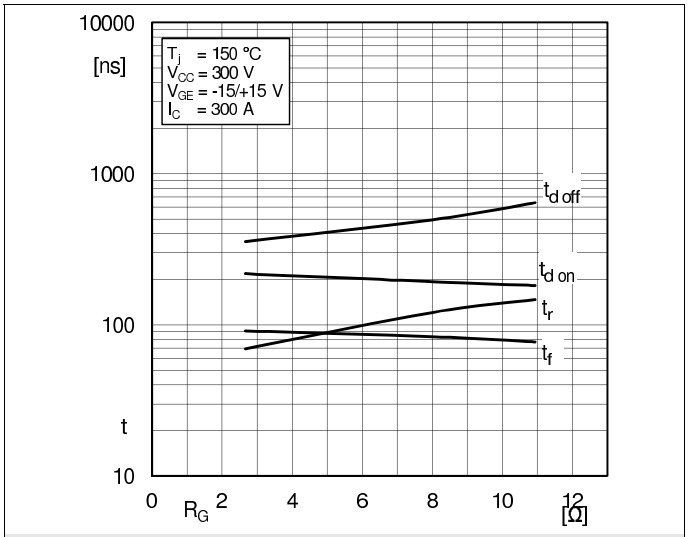


Fig. 11: Typ. diodes transient thermal impedance

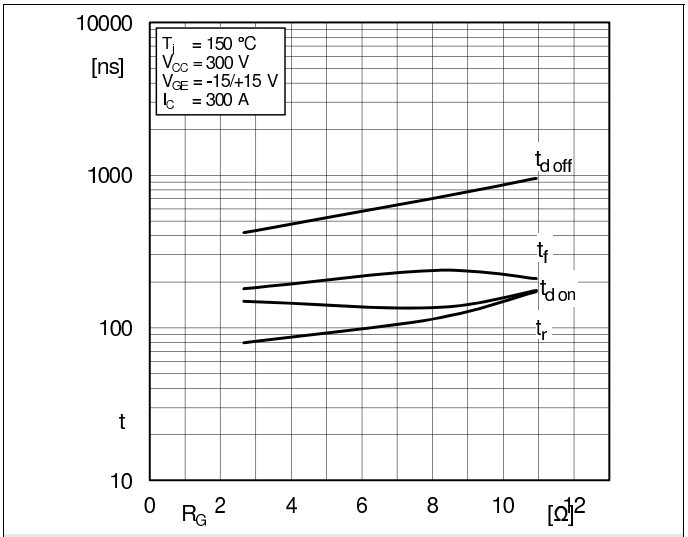
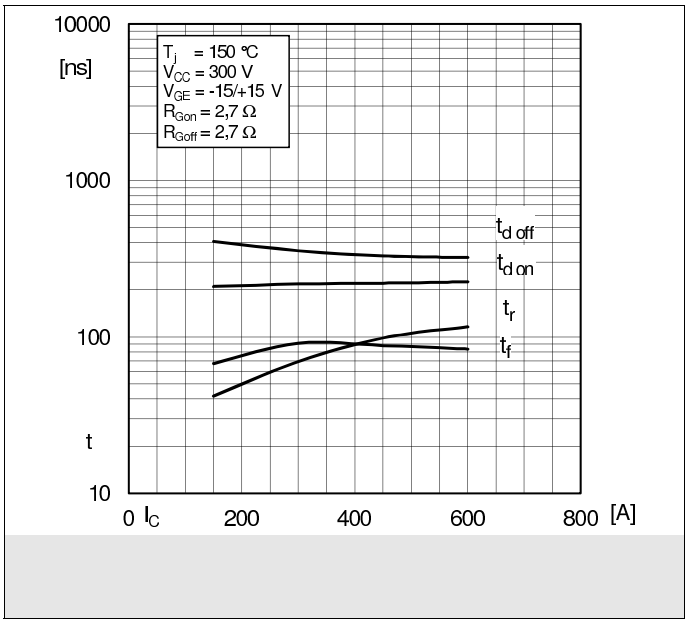
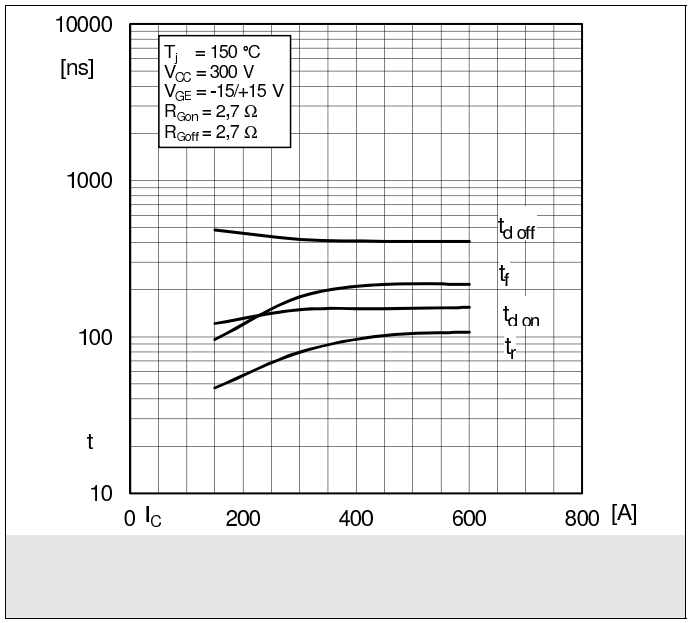
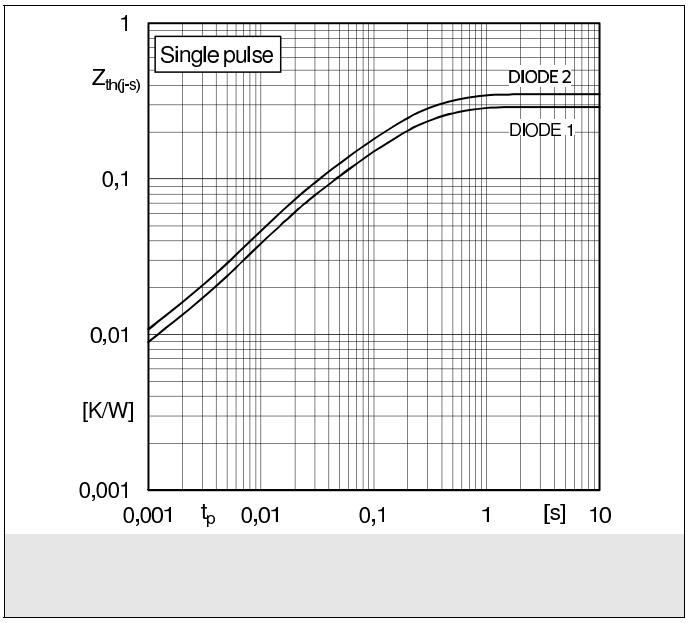
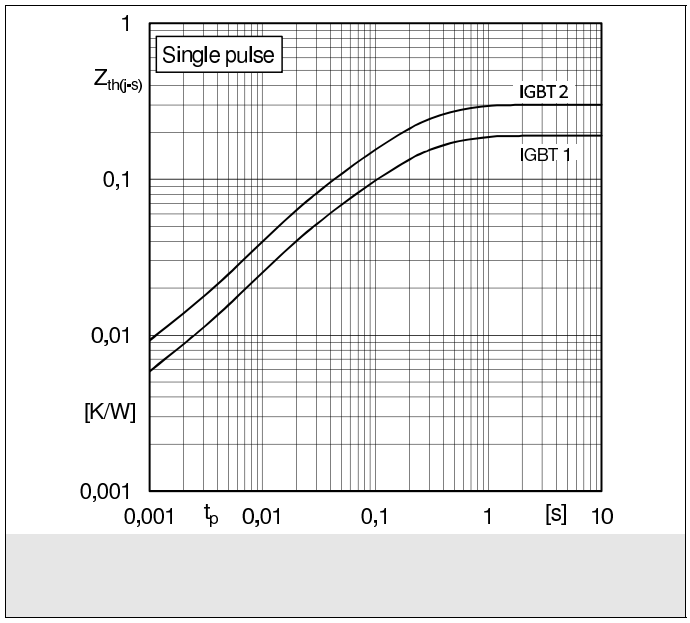


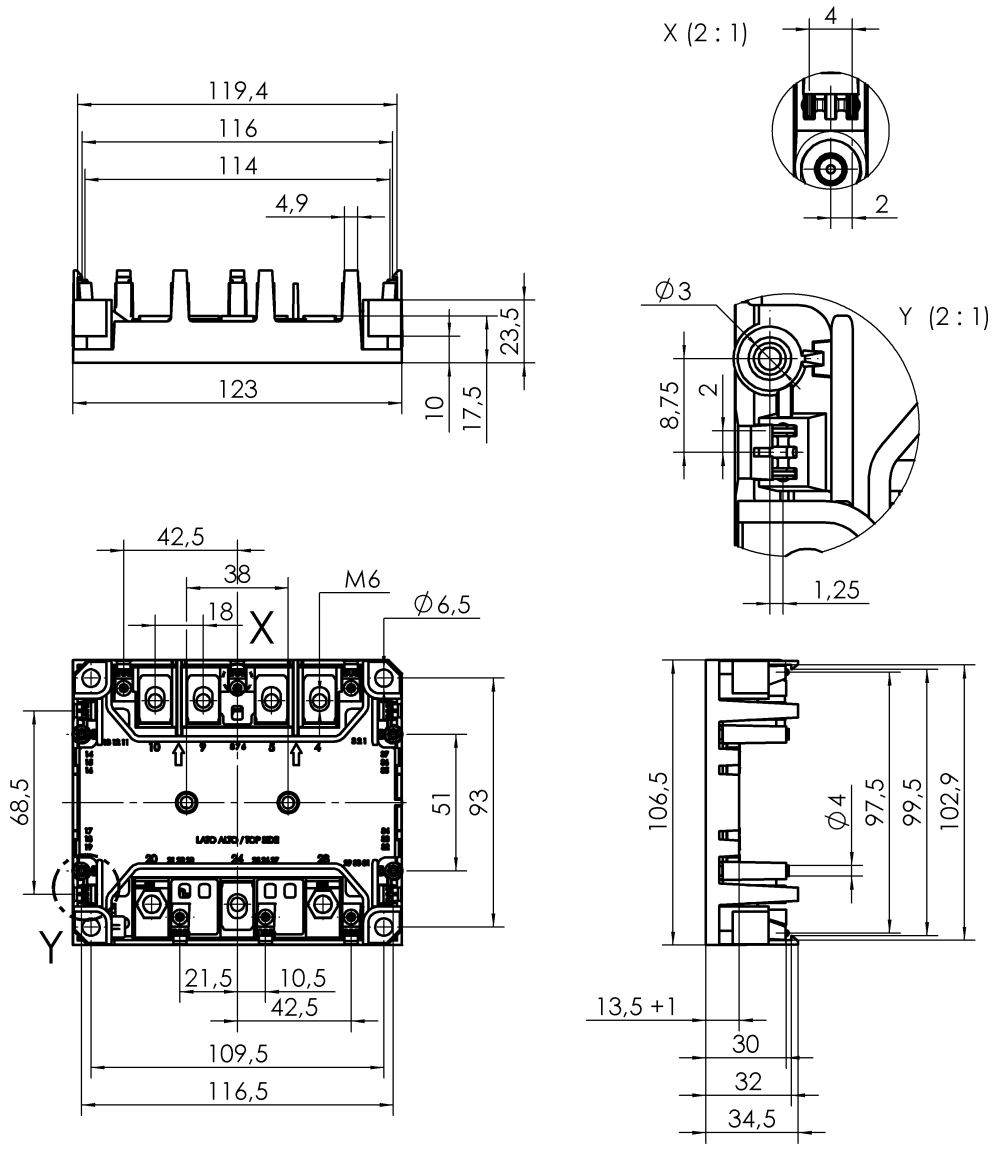
Fig. 12: Typ. IGBTs transient thermal impedance

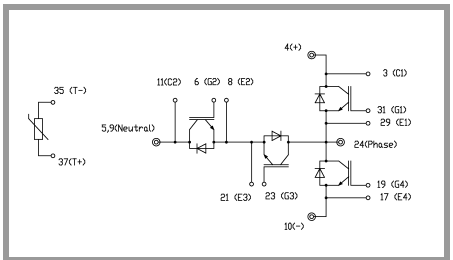

10000
[ns]
1000
100
t
10
T_j = 150 °C
V_{CC} = 300 V
V_{GE} = -15/+15 V
R_{Gon} = 2,7 Ω
R_{Goff} = 2,7 Ω
$t_{d\,off}$
$t_{d\,on}$
t_r
t_f
0 I_C 200 400 600 800 [A]


10000
[ns]
1000
100
t
10
T_j = 150 °C
V_{CC} = 300 V
V_{GE} = -15/+15 V
R_{Gon} = 2,7 Ω
R_{Goff} = 2,7 Ω
$t_{d\,off}$
t_f
$t_{d\,on}$
t_r
0 I_C 200 400 600 800 [A]


1
$Z_{th(j-s)}$
0,1
0,01
[K/W]
0,001
Single pulse
DIODE 2
DIODE 1
0,001 t_p 0,01 0,1 1 [s] 10


1
$Z_{th(j-s)}$
0,1
0,01
[K/W]
0,001
Single pulse
IGBT 2
IGBT 1
0,001 t_p 0,01 0,1 1 [s] 10





TMLI

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.