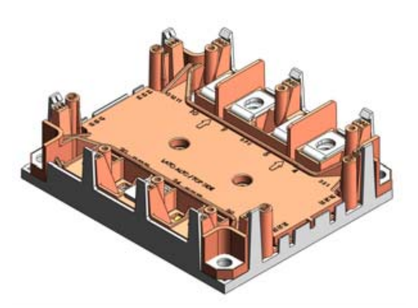
SKiM601TMLI12E4B



SKiM® 4

Trench IGBT Modules

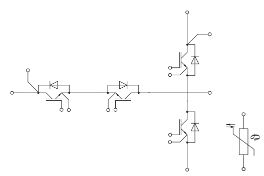
SKiM601TMLI12E4B

Features

- IGBT 4 Trench Gate Technology
- Solder technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Insulated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to 6 x I_C
- Integrated temperature sensor

Remarks*

- Case temperature limited to T_s = 125°C max; T_c = T_s (for baseplateless modules)
- Recommended T_{op} = -40 ...+150°C
- IGBT1: outer IGBTs T1 & T4
- IGBT2: inner IGBTs T2 & T3
- Diode1: outer diodes D1 & D4
- Diode2: inner diodes D2 & D3



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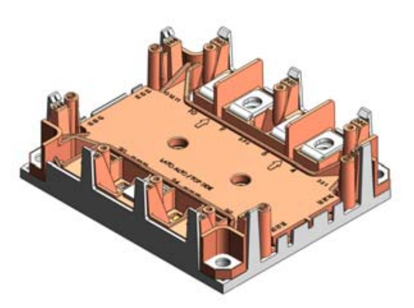
Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT1				
V_{CES}	T_j = 25 °C		1200	V
I_C	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	529	A
	T_j = 175 °C	T_s = 70 °C	425	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	699	A
	T_j = 175 °C	T_s = 70 °C	567	A
I_{Cnom}			600	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		1800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V, $V_{GE} \leq$ 15 V, T_j = 150 °C, $V_{CES} \leq$ 1200 V		10	µs
T_j			-40 ... 175	°C
IGBT2				
V_{CES}	T_j = 25 °C		650	V
I_C	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	433	A
	T_j = 175 °C	T_s = 70 °C	340	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	545	A
	T_j = 175 °C	T_s = 70 °C	433	A
I_{Cnom}			600	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		1800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V, $V_{GE} \leq$ 15 V, T_j = 150 °C, $V_{CES} \leq$ 650 V		10	µs
T_j			-40 ... 175	°C
Diode1				
V_{RRM}	T_j = 25 °C		1200	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	495	A
	T_j = 175 °C	T_s = 70 °C	389	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	606	A
	T_j = 175 °C	T_s = 70 °C	480	A
I_{Fnom}			600	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		1200	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		3240	A
T_j			-40 ... 175	°C
Diode2				
V_{RRM}	T_j = 25 °C		650	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	527	A
	T_j = 175 °C	T_s = 70 °C	406	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	655	A
	T_j = 175 °C	T_s = 70 °C	509	A
I_{Fnom}			600	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		1200	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		3969	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			400	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min		2500	V



SKiM® 4

Trench IGBT Modules

SKiM601TMLI12E4B

Features

- IGBT 4 Trench Gate Technology
- Solder technology
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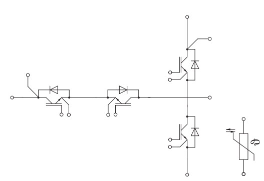

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT1						
$V_{CE(sat)}$	I_C = 600 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		0.80	0.90	V
		T_j = 150 °C		0.70	0.80	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.67	1.92	mΩ
		T_j = 150 °C		2.5	2.7	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				5	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		37.2		nF
C_{oes}		f = 1 MHz		2.32		nF
C_{res}		f = 1 MHz		2.04		nF
Q_G	V_{GE} = - 15 V...+ 15 V			3750		nC
R_{Gint}	T_j = 25 °C			1.3		Ω
$t_{d(on)}$	V_{CE} = 300 V, I_C = 600 A, V_{GE} = +15/-15 V, $R_{G\,on}$ = 2 Ω, $R_{G\,off}$ = 2 Ω, di/dt_{on} = 2584 A/µs, di/dt_{off} = 2673 A/µs	T_j = 150 °C		261		ns
t_r		T_j = 150 °C		231		ns
E_{on}		T_j = 150 °C		11.44		mJ
$t_{d(off)}$		T_j = 150 °C		585		ns
t_f		T_j = 150 °C		182		ns
E_{off}		T_j = 150 °C		44.88		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.125		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.078		K/W
IGBT2						
$V_{CE(sat)}$	I_C = 600 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.55	1.95	V
		T_j = 150 °C		1.75	2.15	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		1.08	1.58	mΩ
		T_j = 150 °C		1.55	2.1	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 12 mA		5.1	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 650 V, T_j = 25 °C				1.4	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		37.005		nF
C_{oes}		f = 1 MHz		2.307		nF
C_{res}		f = 1 MHz		1.098		nF
Q_G	V_{GE} = - 15 V...+ 15 V			5002.2		nC
R_{Gint}	T_j = 25 °C			0.7		Ω
$t_{d(on)}$	V_{CE} = 300 V, I_C = 600 A, V_{GE} = +15/-15 V, $R_{G\,on}$ = 2 Ω, $R_{G\,off}$ = 2 Ω, di/dt_{on} = 2648 A/µs, di/dt_{off} = 3097 A/µs	T_j = 150 °C		121		ns
t_r		T_j = 150 °C		232		ns
E_{on}		T_j = 150 °C		6.05		mJ
$t_{d(off)}$		T_j = 150 °C		599		ns
t_f		T_j = 150 °C		156		ns
E_{off}		T_j = 150 °C		44		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.19		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.133		K/W

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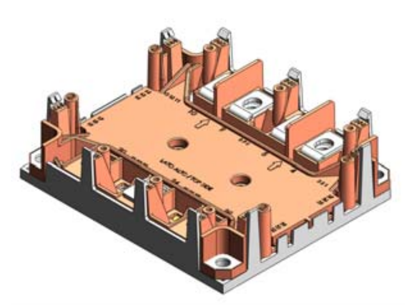

SKiM® 4

Trench IGBT Modules

SKiM601TMLI12E4B

Features

- IGBT 4 Trench Gate Technology
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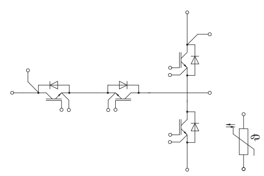

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Diode1						
$V_F = V_{EC}$	I_F = 600 A	T_j = 25 °C		2.14	2.46	V
	chiplevel	T_j = 150 °C		2.07	2.38	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		1.40	1.60	mΩ
		T_j = 150 °C		1.95	2.1	mΩ
I_{RRM}	I_F = 600 A	T_j = 150 °C		251		A
Q_{rr}	V_R = 300 V	T_j = 150 °C		21.9		µC
E_{rr}	V_{GE} = +15/-15 V	T_j = 150 °C		4.37		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.15		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.11		K/W
Diode2						
$V_F = V_{EC}$	I_F = 600 A	T_j = 25 °C		1.39	1.75	V
	chiplevel	T_j = 150 °C		1.38	1.76	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		0.59	0.86	mΩ
		T_j = 150 °C		0.88	1.28	mΩ
I_{RRM}	I_F = 600 A	T_j = 150 °C		247		A
Q_{rr}	V_R = 300 V	T_j = 150 °C		25.2		µC
E_{rr}	V_{GE} = +15/-15 V	T_j = 150 °C		2.64		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.18		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.132		K/W
Module						
L_{sCE1}				29		nH
L_{CE}				40		nH
$R_{CC'+EE'}$	measured betw. terminal 4 and 24	T_s = 25 °C		0.4		mΩ
		T_s = 125 °C		0.6		mΩ
M_s	to heat sink (M5)		2		3	Nm
M_t		to terminals M6	4		5	Nm
						Nm
w				317		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

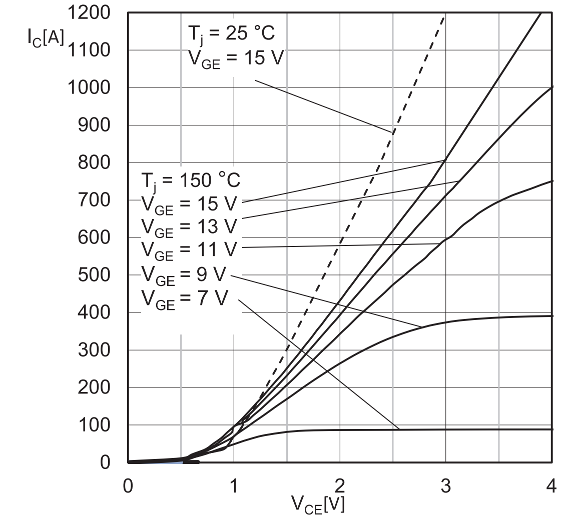

Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+EE'}$

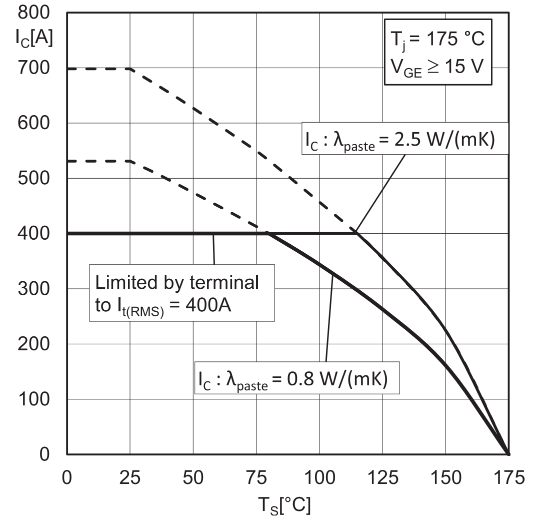

Fig. 2: IGBT1 rated current vs. Temperature I_c=f(T_s)

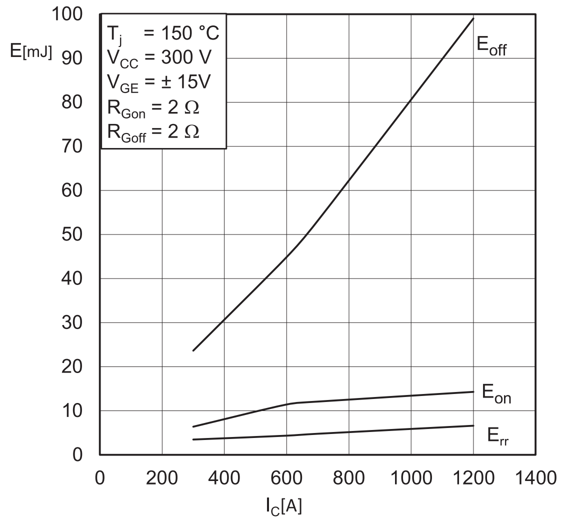

Fig. 3: Typ. IGBT1 & Diode2 turn-on /-off energy = f (I_C)

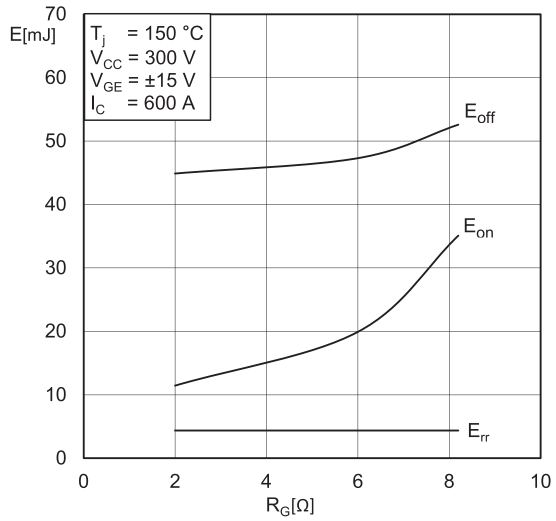

Fig. 4: Typ. IGBT1 & Diode2 turn-on /-off energy = f(R_G)

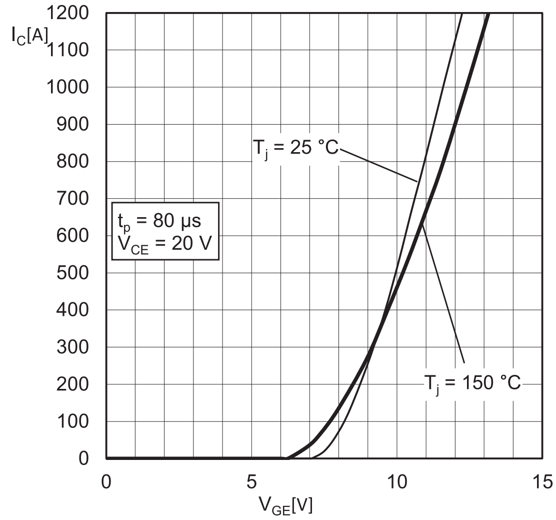

Fig. 5: Typ. IGBT1 transfer characteristic

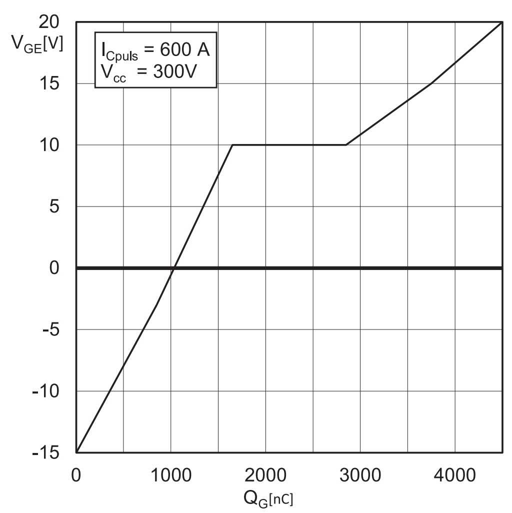

Fig. 6: Typ. IGBT1 gate charge characteristic

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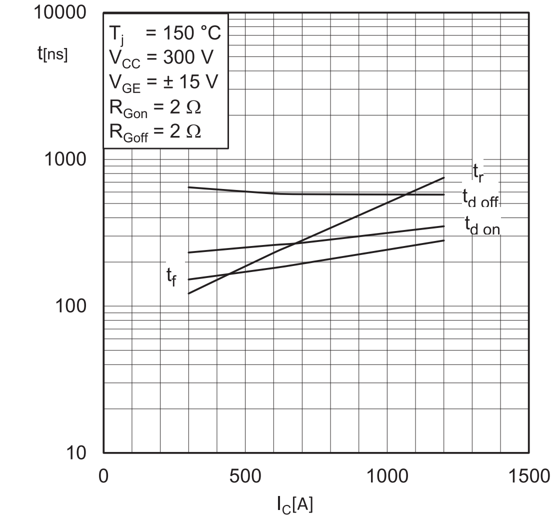

Fig. 7: Typ. IGBT1 switching times vs. I_C

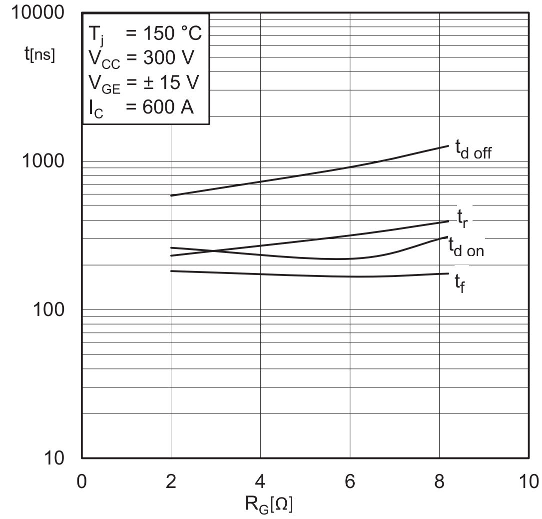

Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

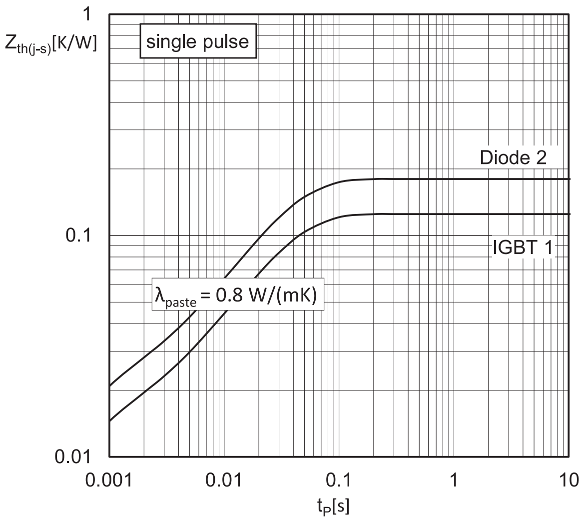

Fig. 9: Transient thermal impedance of IGBT1 & Diode2

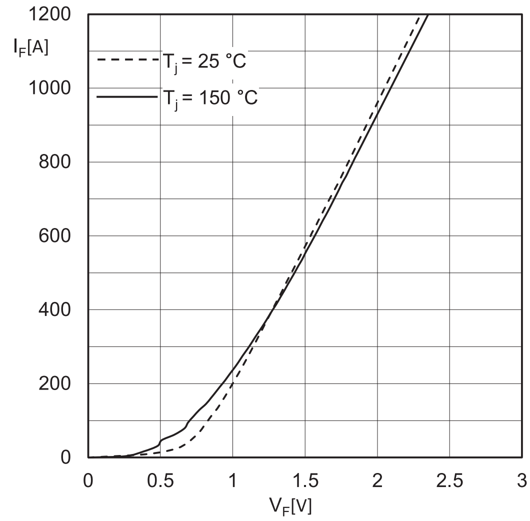

Fig. 10: Typ. Diode2 forward characteristic, incl. $R_{CC'+ EE'}$

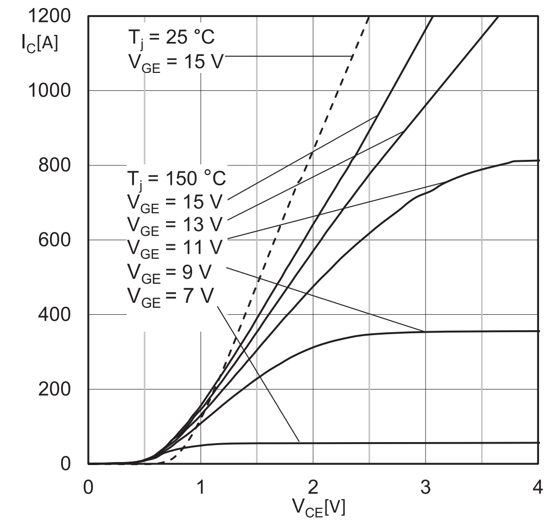

Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+ EE'}$

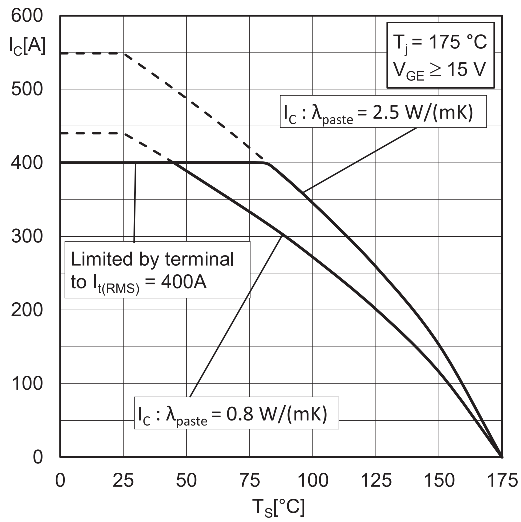

Fig. 14: IGBT2 Rated current vs. Temperature I_c= f (T_s)

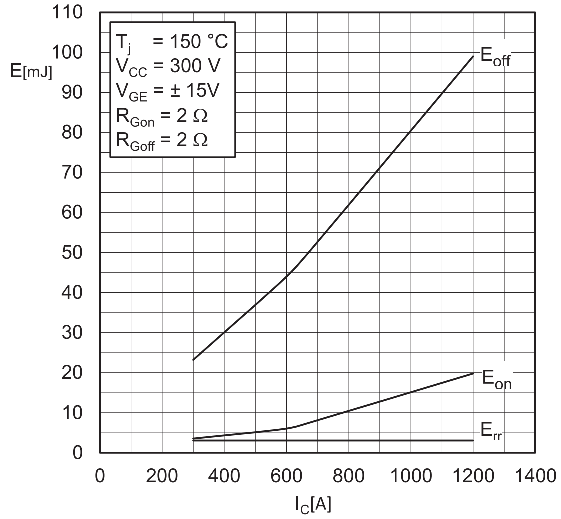

Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = f (I_C)

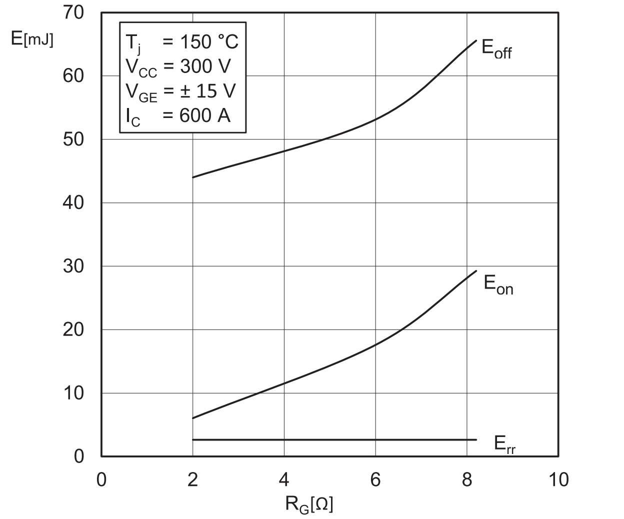

Fig. 16: Typ. IGBT2 & Diode1 turn-on / -off energy = f(R_G)

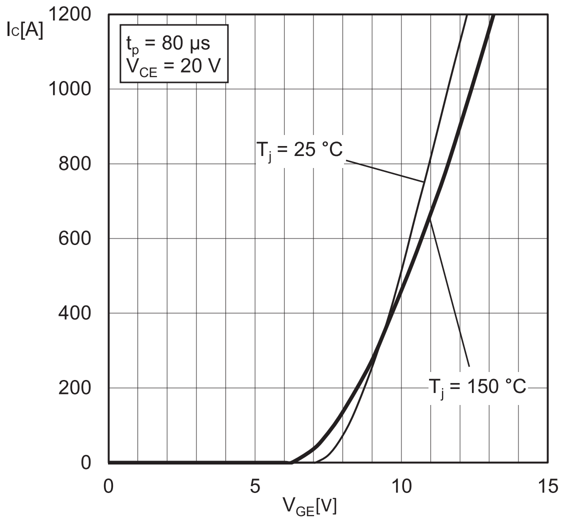

Fig. 17: Typ. IGBT2 transfer characteristic

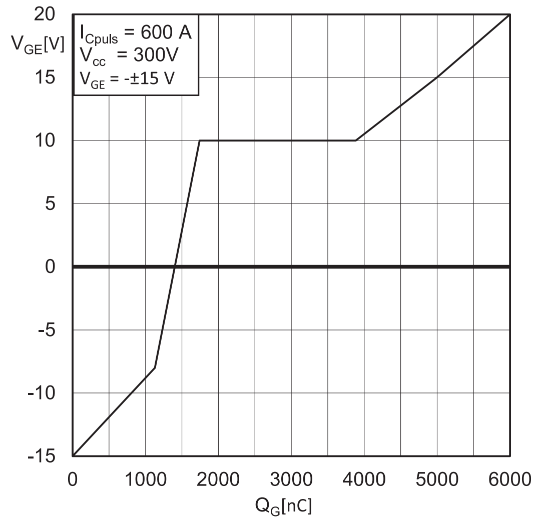

Fig. 18: Typ. IGBT2 gate charge characteristic

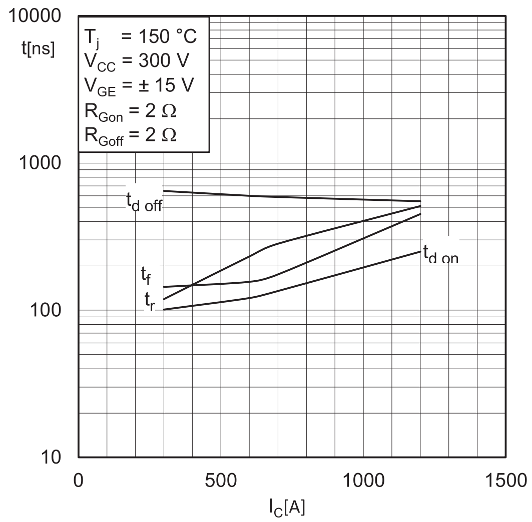

Fig. 19: Typ. IGBT2 switching times vs. I_C

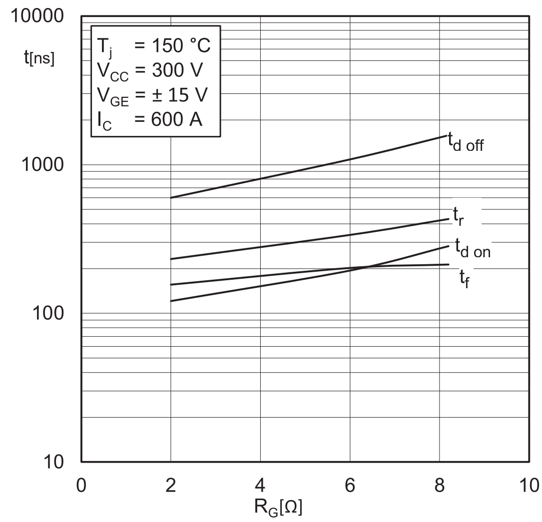

Fig. 20: Typ. IGBT2 switching times vs. gate resistor R_G

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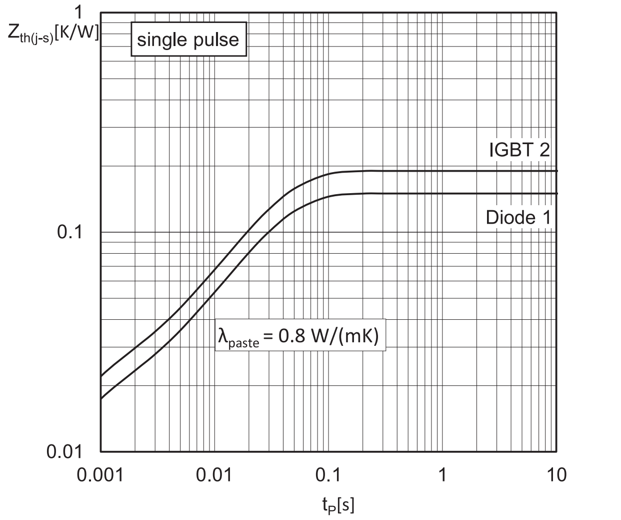


Fig. 21: Transient thermal impedance of IGBT2 & Diode1

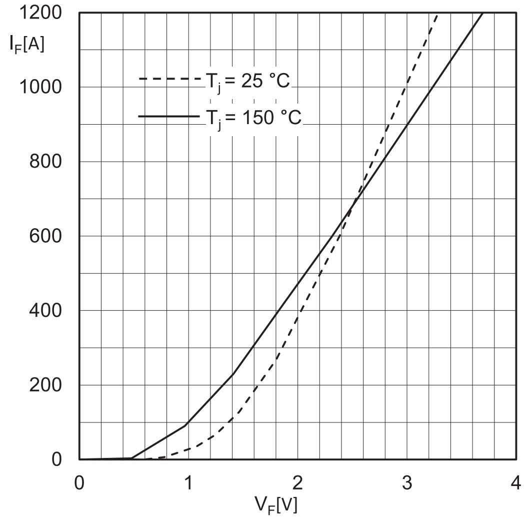
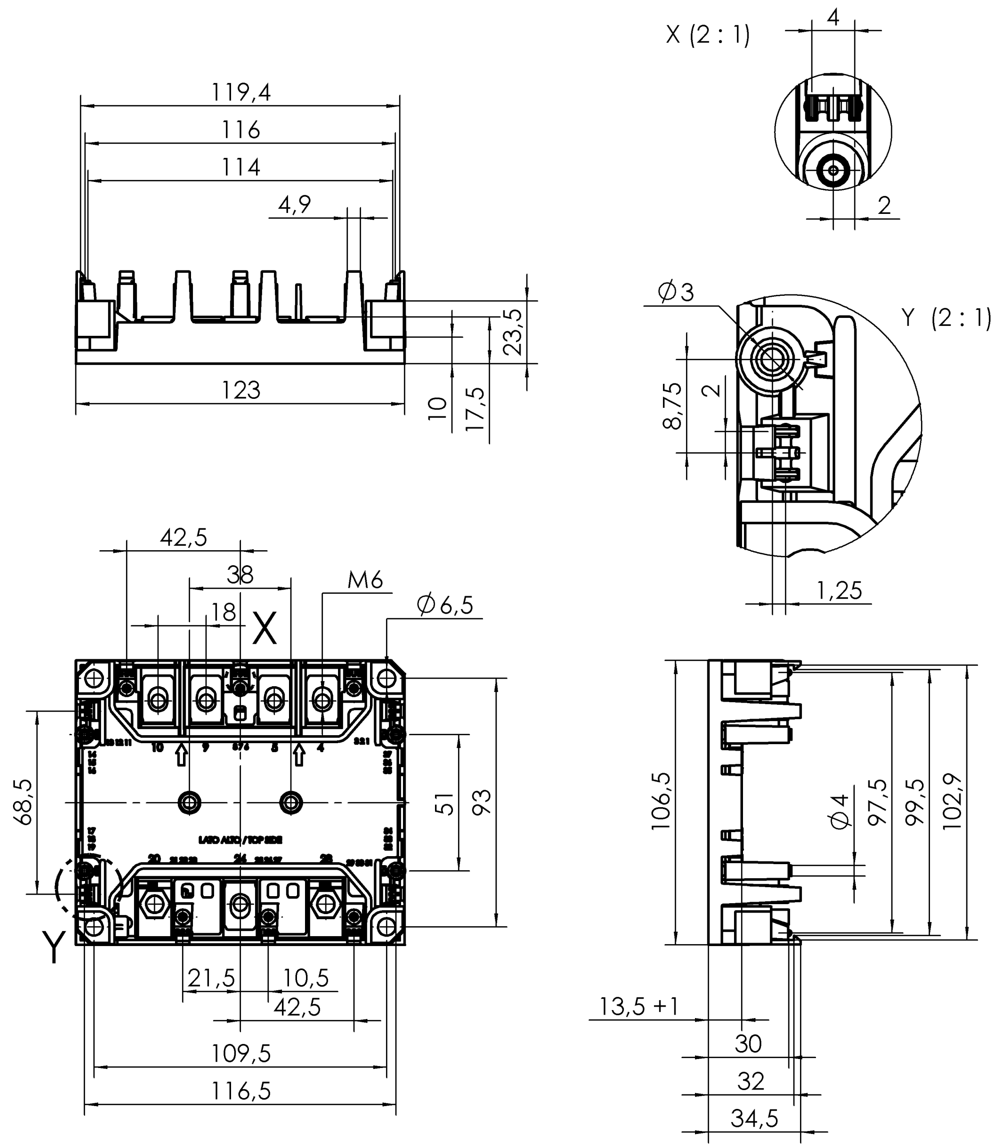
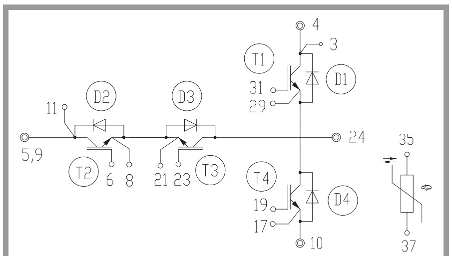


Fig. 22: Typ. Diode1 forward characteristic, incl. $R_{CC'+ EE'}$


X (2 : 1)
4
2
119,4
116
114
4,9
23,5
123
10
17,5
Ø3
Y (2 : 1)
8,75
2
1,25
42,5
38
18
X
M6
Ø6,5
68,5
51
93
Y
21,5
10,5
42,5
109,5
116,5
106,5
Ø4
97,5
99,5
102,9
13,5 +1
30
32
34,5

SKiM 4


4
3
T1
D1
31
29
11
D2
D3
5,9
24
T2
6
8
21
23
T3
35
T4
19
17
D4
10
37

TMLI

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

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