SK80TMLI12F4Tp

SEMITOP® 3 Press-Fit

3-Level TNPC

SK80TMLI12F4Tp

Features*

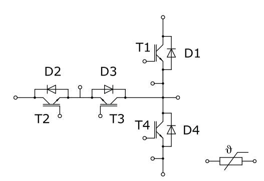
- One screw mounting module
- Low inductive design
- Press-Fit contact technology
- Fully compatible with other SEMITOP® Press-Fit types
- 1200V Trench IGBT4 Fast (F4)
- 650V Trench IGBT3 (E3)
- Robust and soft switching CAL 4F diode technology
- Integrated NTC temperature sensor
- UL recognized, file no. E 63 532

Typical Applications

- UPS
- Solar

Remarks*

- Recommended T_{jop}= -40 ... +150°C
- IGBT1: outer IGBTs T1 & T4
- IGBT2: inner IGBTs T2 & T3
- Diode1: outer Diodes D1 & D4
- Diode2: inner Diodes D2 & D3



TMLI-T

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT1				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_s = 25 °C	88	A
		T_s = 70 °C	72	A
I_{Cnom}			80	A
I_{CRM}			240	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V, V_{GE} ≤ 15 V, T_j = 150 °C, V_{CES} ≤ 1200 V		10	µs
T_j			-40 ... 175	°C
IGBT2				
V_{CES}	T_j = 25 °C		650	V
I_C	T_j = 175 °C	T_s = 25 °C	79	A
		T_s = 70 °C	63	A
I_{Cnom}			75	A
I_{CRM}			225	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V, V_{GE} ≤ 15 V, T_j = 150 °C, V_{CES} ≤ 650 V		6	µs
T_j			-40 ... 175	°C
Diode1				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_s = 25 °C	81	A
		T_s = 70 °C	64	A
I_{FRM}			150	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		430	A
T_j			-40 ... 175	°C
Diode2				
V_{RRM}	T_j = 25 °C		650	V
I_F	T_j = 175 °C	T_s = 25 °C	108	A
		T_s = 70 °C	84	A
I_{FRM}			200	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		820	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	$\Delta T_{terminal}$ at PCB joint = 30 K, per pin		35	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC, sinusoidal, t = 1 min		2500	V

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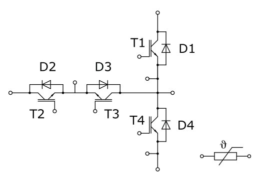
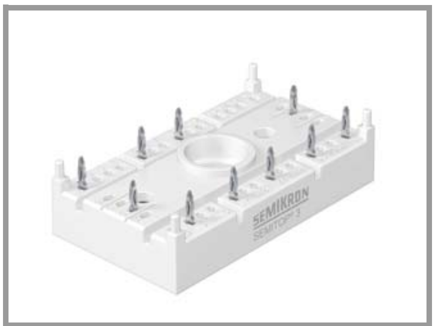


TMLI-T

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT1						
$V_{CE(sat)}$	I_C = 80 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		2.05	2.40	V
		T_j = 150 °C		2.59	2.85	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		16	19	mΩ
		T_j = 150 °C		24	26	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 3 mA		5.2	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		4.6		nF
C_{oes}		f = 1 MHz		0.37		nF
C_{res}		f = 1 MHz		0.27		nF
Q_G	V_{GE} = - 15 V...+ 15 V			667		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CE} = 300 V, I_C = 80 A, V_{GE} = +15/-15 V, $R_{G\,on}$ = 0.5 Ω, $R_{G\,off}$ = 0.5 Ω, di/dt_{on} = 3100 A/µs, di/dt_{off} = 783 A/µs, dv/dt = 3200 V/µs	T_j = 150 °C		22		ns
t_r		T_j = 150 °C		23		ns
E_{on}		T_j = 150 °C		1.75		mJ
$t_{d(off)}$		T_j = 150 °C		183		ns
t_f		T_j = 150 °C		59		ns
E_{off}		T_j = 150 °C		3		mJ
$R_{th(j-s)}$	per IGBT			0.54		K/W
IGBT2						
$V_{CE(sat)}$	I_C = 75 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.45	1.77	V
		T_j = 150 °C		1.83	2.15	V
V_{CE0}	chiplevel	T_j = 25 °C		0.75	0.90	V
		T_j = 150 °C		0.68	0.83	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		9.3	12	mΩ
		T_j = 150 °C		15	18	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 1.2 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 650 V, T_j = 25 °C				0.2	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		4.62		nF
C_{oes}		f = 1 MHz		0.288		nF
C_{res}		f = 1 MHz		0.137		nF
Q_G	V_{GE} = - 15 V...+ 15 V			718		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CE} = 300 V, I_C = 80 A, V_{GE} = +15/-15 V, $R_{G\,on}$ = 0.5 Ω, $R_{G\,off}$ = 0.5 Ω, di/dt_{on} = 5300 A/µs, di/dt_{off} = 1000 A/µs, dv/dt = 4200 V/µs	T_j = 150 °C		14		ns
t_r		T_j = 150 °C		15		ns
E_{on}		T_j = 150 °C		0.56		mJ
$t_{d(off)}$		T_j = 150 °C		132		ns
t_f		T_j = 150 °C		60		ns
E_{off}		T_j = 150 °C		2.46		mJ
$R_{th(j-s)}$	per IGBT			0.82		K/W



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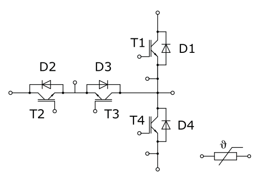


TMLI-T

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Diode1						
$V_F = V_{EC}$	I_F = 75 A	T_j = 25 °C		2.17	2.49	V
	chiplevel	T_j = 150 °C		2.11	2.42	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		12	13	mΩ
		T_j = 150 °C		16	18	mΩ
I_{RRM}	I_F = 80 A	T_j = 150 °C		147		A
Q_{rr}	di/dt_{off} = 5300 A/µs	T_j = 150 °C		7.5		µC
E_{rr}	V_R = 300 V V_{GE} = +15/-15 V	T_j = 150 °C		1.43		mJ
$R_{th(j-s)}$	per Diode			0.79		K/W
Diode2						
$V_F = V_{EC}$	I_F = 100 A	T_j = 25 °C		1.40	1.76	V
	chiplevel	T_j = 150 °C		1.38	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		3.6	5.3	mΩ
		T_j = 150 °C		5.3	7.8	mΩ
I_{RRM}	I_F = 80 A	T_j = 150 °C		113		A
Q_{rr}	di/dt_{off} = 3096 A/µs	T_j = 150 °C		7.3		µC
E_{rr}	V_R = 300 V V_{GE} = +15/-15 V	T_j = 150 °C		1.47		mJ
$R_{th(j-s)}$	per Diode			0.79		K/W
Module						
L_{sCE1}				-		nH
L_{CE}				-		nH
$R_{CC'+EE'}$		T_s = 25 °C		-		mΩ
		T_s = 150 °C		-		mΩ
M_s	to heatsink		2.25		2.5	Nm
w				30		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

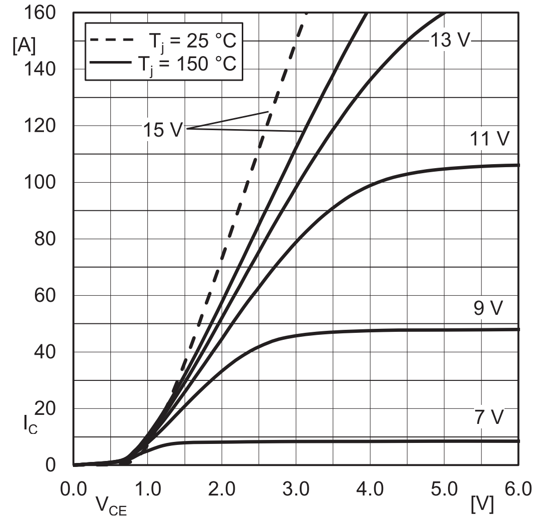


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+EE'}$

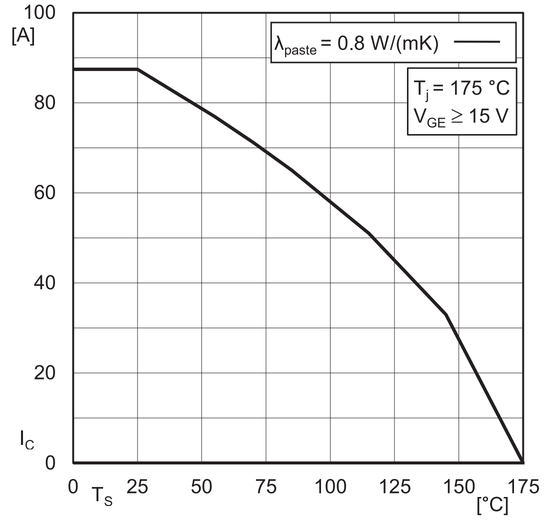


Fig. 2: IGBT1 rated current vs. Temperature I_c=f(T_s)

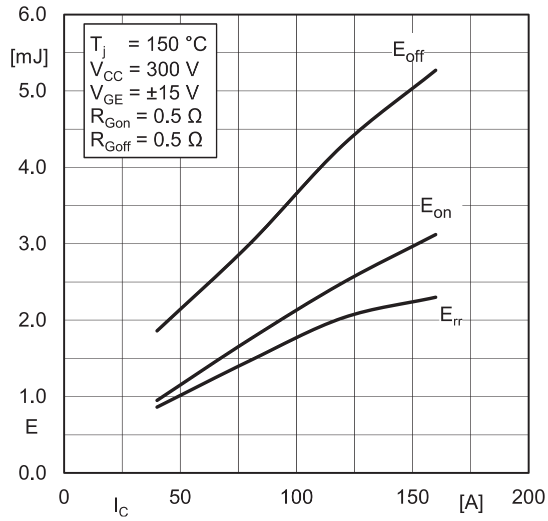


Fig. 3: Typ. IGBT1 & Diode2 turn-on /-off energy = f (I_C)

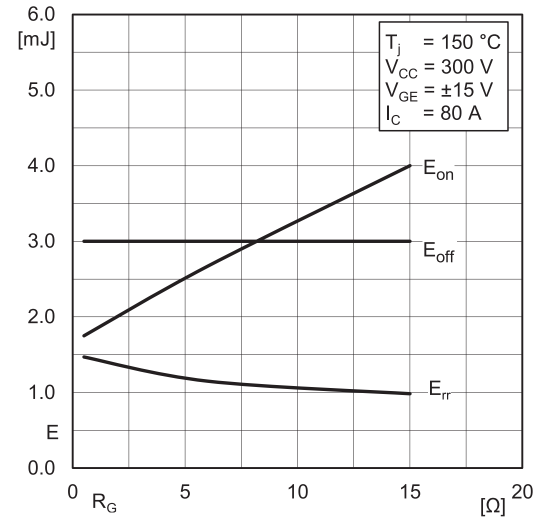


Fig. 4: Typ. IGBT1 & Diode2 turn-on /-off energy = f(R_G)

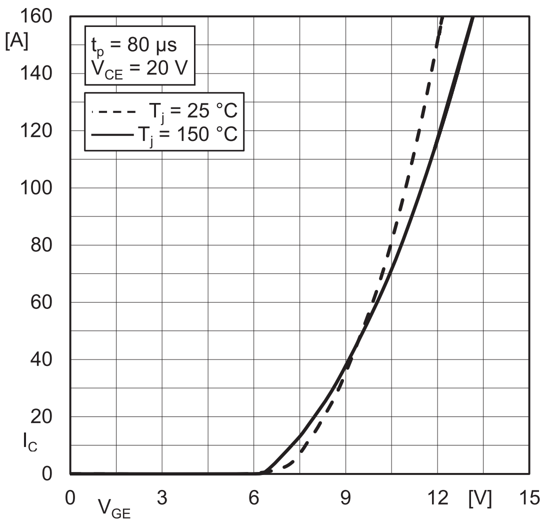


Fig. 5: Typ. IGBT1 transfer characteristic

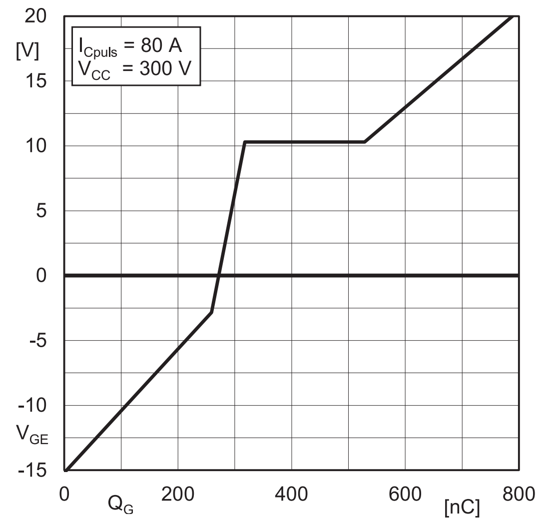


Fig. 6: Typ. IGBT1 gate charge characteristic

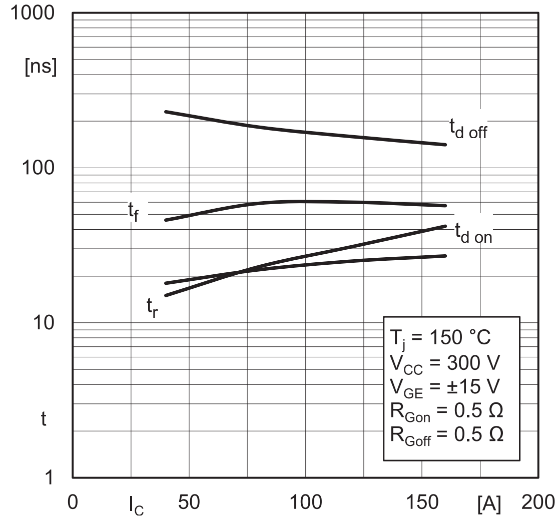


Fig. 7: Typ. IGBT1 switching times vs. I_C

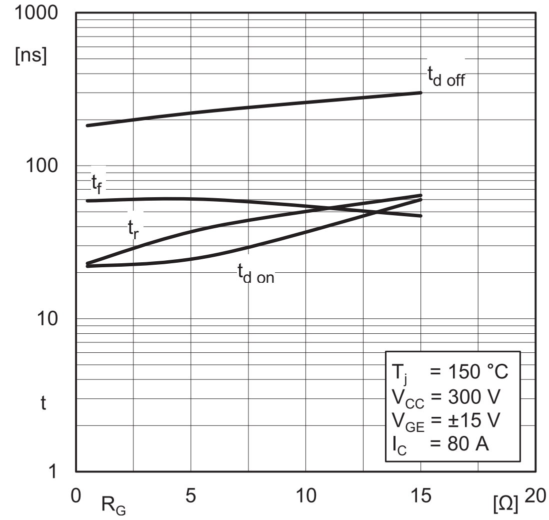


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

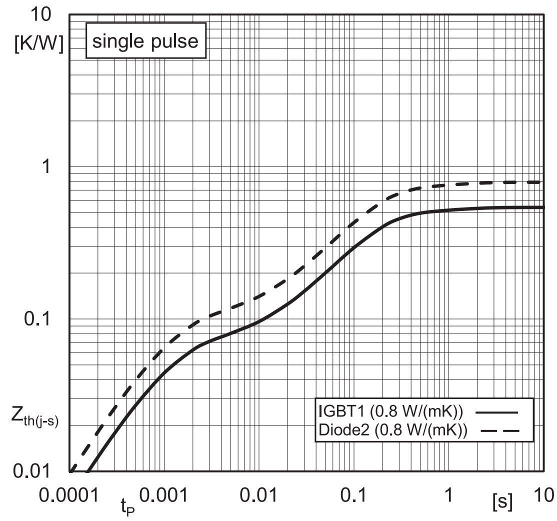


Fig. 9: Transient thermal impedance of IGBT1 & Diode2

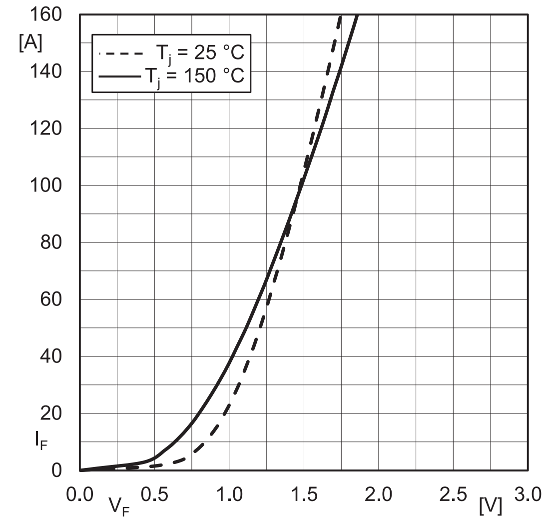


Fig. 10: Typ. Diode2 forward characteristic, incl. $R_{CC'+EE'}$

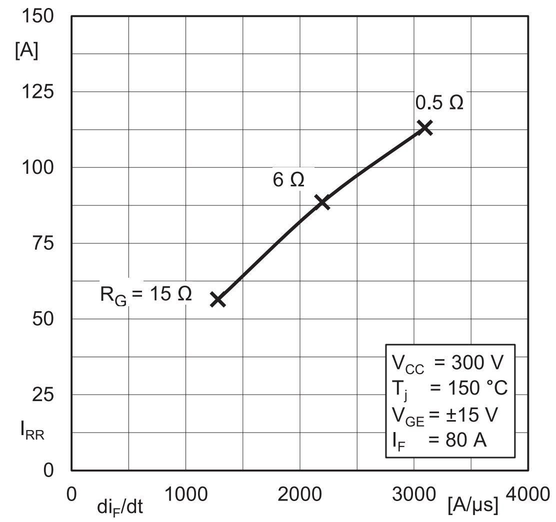


Fig. 11: Typ. Diode2 peak reverse recovery current

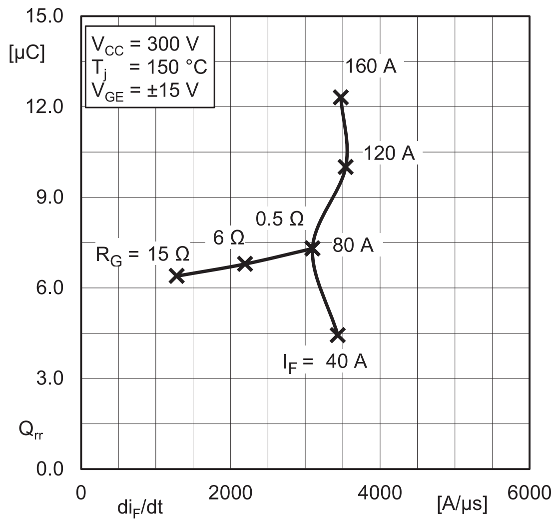


Fig. 12: Typ. Diode2 recovery charge

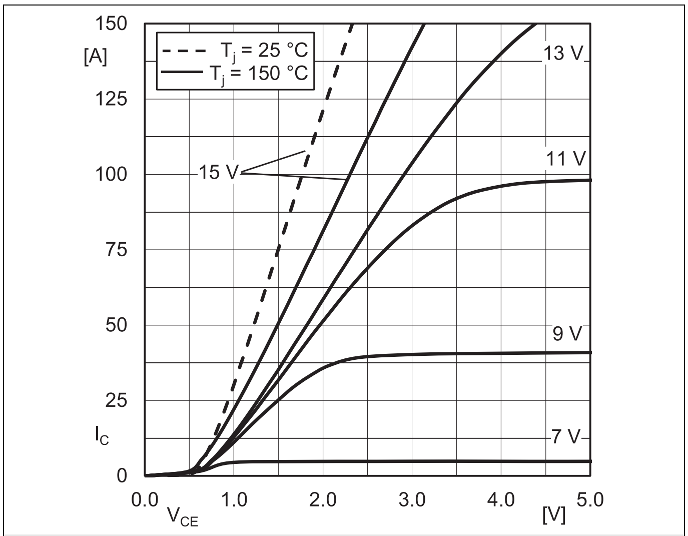


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

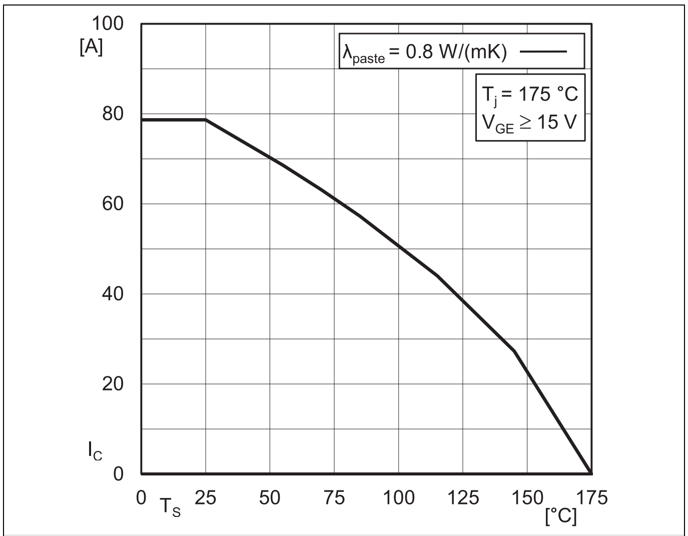


Fig. 14: IGBT2 Rated current vs. Temperature I_c= f (T_s)

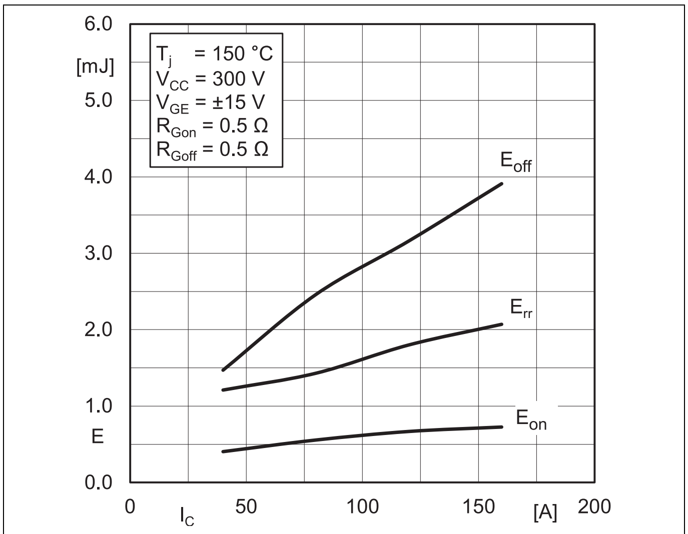


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = f (I_C)

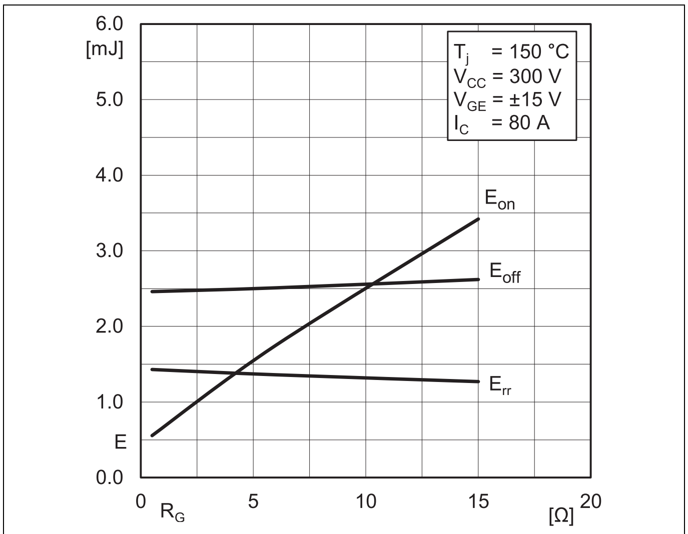


Fig. 16: Typ. IGBT2 & Diode1 turn-on / -off energy = f(R_G)

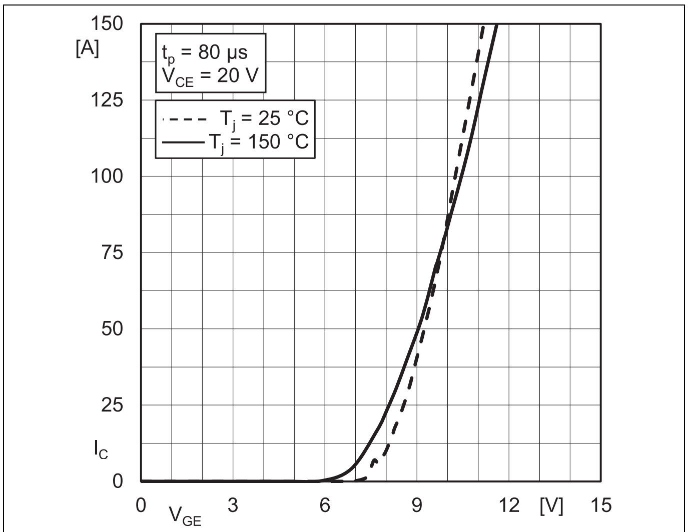


Fig. 17: Typ. IGBT2 transfer characteristic

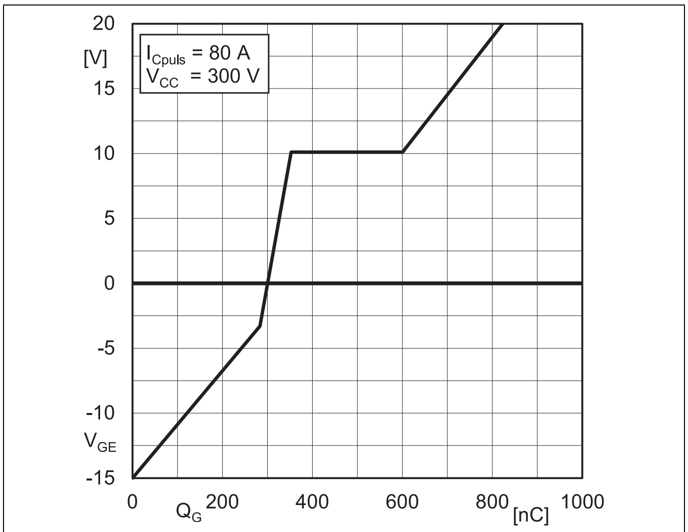


Fig. 18: Typ. IGBT2 gate charge characteristic

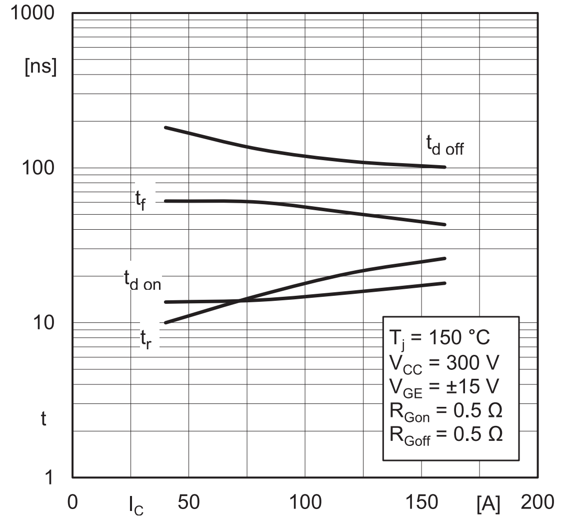


Fig. 19: Typ. IGBT2 switching times vs. I_C

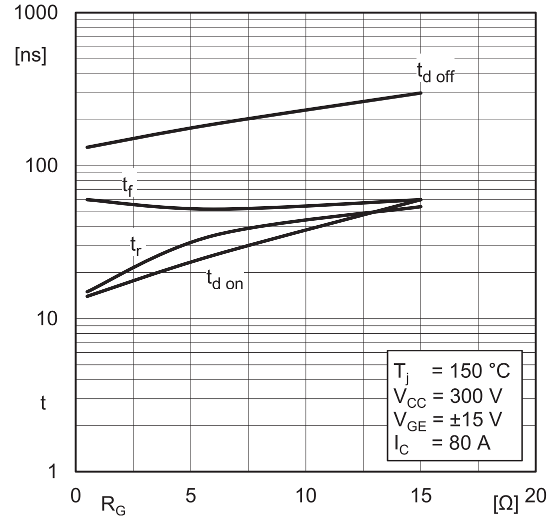


Fig. 20: Typ. IGBT2 switching times vs. gate resistor R_G

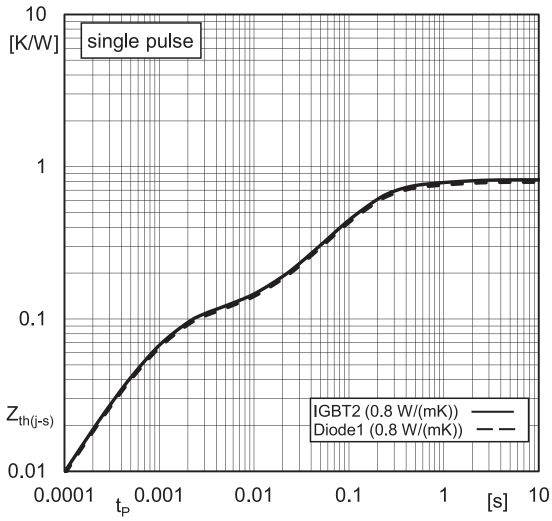


Fig. 21: Transient thermal impedance of IGBT2 & Diode1

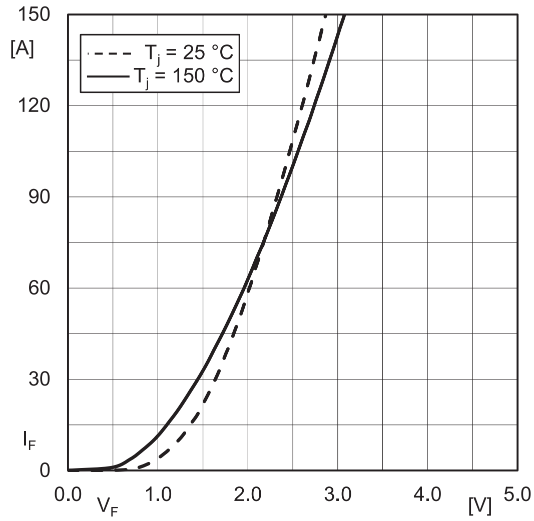


Fig. 22: Typ. Diode1 forward characteristic, incl. $R_{CC'+EE'}$

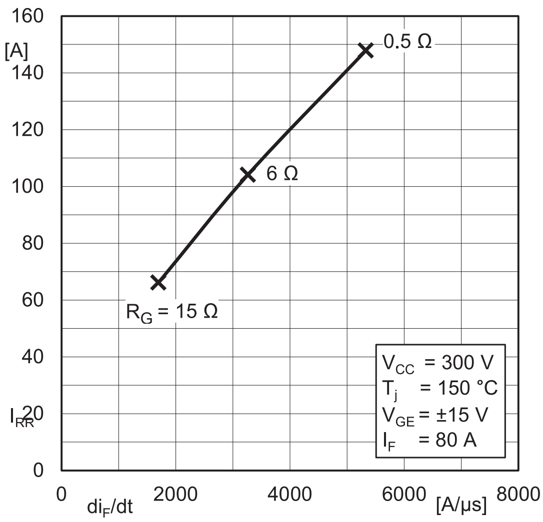


Fig. 23: Typ. Diode1 peak reverse recovery current

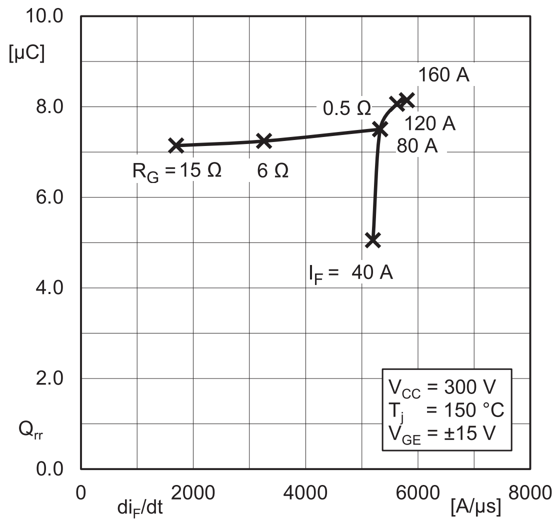
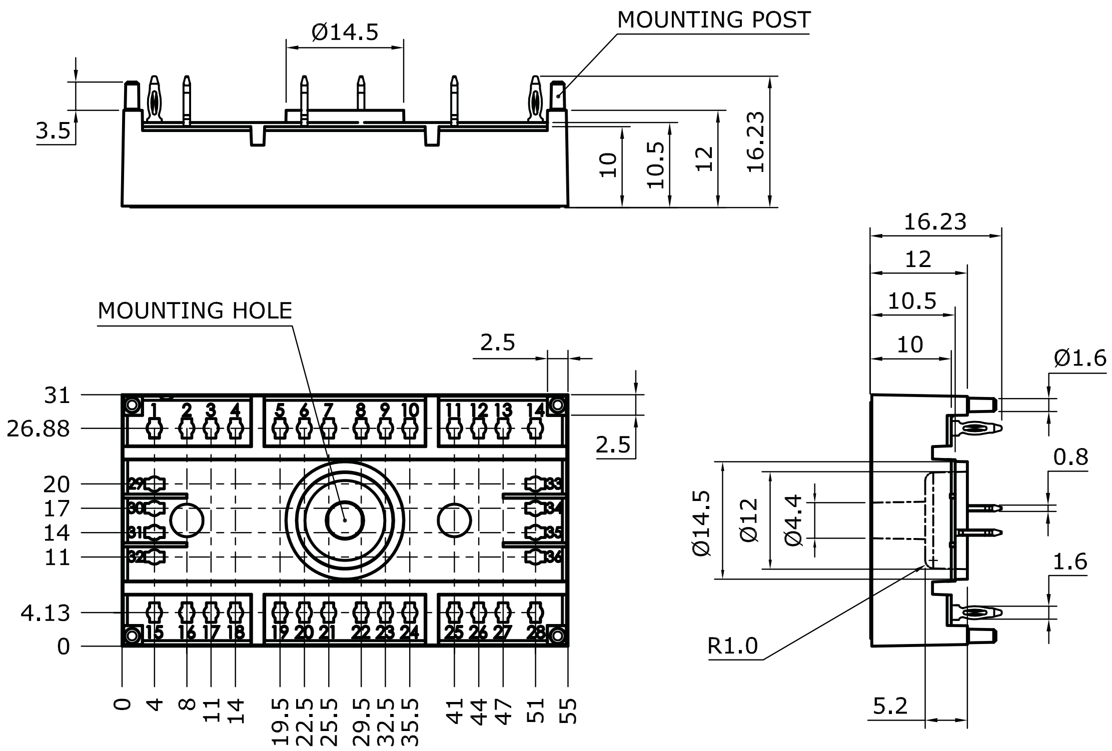


Fig. 24: Typ. Diode1 recovery charge

Dimensions: mm
Tolerance system: ISO 2768-m



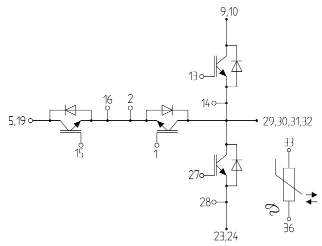
Suggested drilled hole diameter for terminal pins in the circuit board:

• minimum: 1.575 mm
• typical: 1.6 mm
• maximum: 1.625 mm

Suggested hole diameter for the mounting post in the circuit board:

• 2 mm

SEMITOP 3 Press-Fit



TMLI-T

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

***IMPORTANT INFORMATION AND WARNINGS**

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