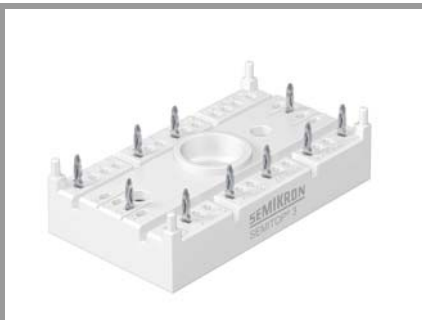


SK80TMLI12F4Tp



SEMITOP® 3 Press-Fit

3-Level TNPC

SK80TMLI12F4Tp

Features*

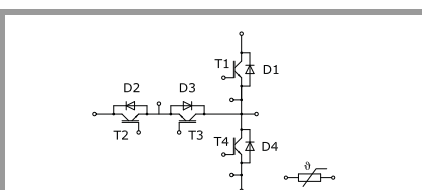
- One screw mounting module
- Low inductive design
- Press-Fit contact technology
- Fully compatible with other SEMITOP® Press-Fit types
- 1200V Trench IGBT4 Fast (F4)
- 650V Trench IGBT3 (E3)
- Robust and soft switching CAL 4F diode technology
- Integrated NTC temperature sensor
- UL recognized, file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

Typical Applications

- UPS
- Solar

Remarks*

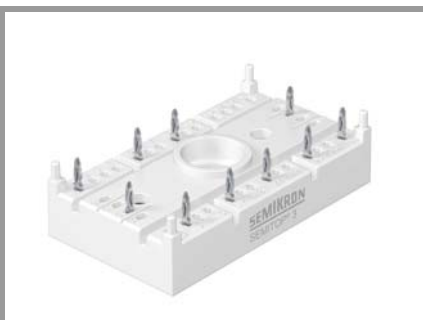
- Recommended $T_{jop} = -40 \dots +150^\circ\text{C}$
- IGBT1: outer IGBTs T1 & T4
- IGBT2: inner IGBTs T2 & T3
- Diode1: outer Diodes D1 & D4
- Diode2: inner Diodes D2 & D3



TMLI-T

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

SK80TMLI12F4Tp



SEMIPRESS® 3 Press-Fit

3-Level TNPC

SK80TMLI12F4Tp

Features*

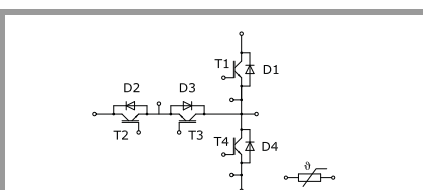
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- Fully compatible with other SEMIPRESS® Press-Fit types
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- Robust and soft switching CAL 4F diode technology
- Integrated NTC temperature sensor
- UL recognized, file no. E 63 532

Typical Applications

- UPS
- Solar

Remarks*

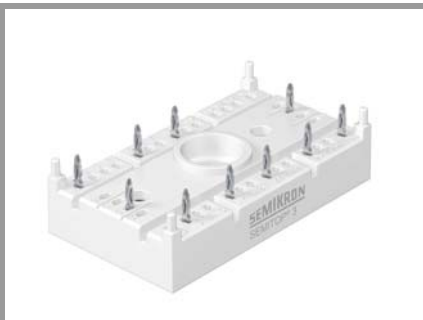
- Recommended $T_{jop} = -40 \dots +150^\circ\text{C}$
- IGBT1: outer IGBTs T1 & T4
- IGBT2: inner IGBTs T2 & T3
- Diode1: outer Diodes D1 & D4
- Diode2: inner Diodes D2 & D3



TMLI-T

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT1						
$V_{CE(sat)}$	$I_C = 80\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.05	2.40	V
		$T_j = 150^\circ\text{C}$		2.59	2.85	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$		0.80	0.90	V
		$T_j = 150^\circ\text{C}$		0.70	0.80	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		16	19	m Ω
		$T_j = 150^\circ\text{C}$		24	26	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 3\text{ mA}$		5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25^\circ\text{C}$				1	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		4.6		nF
C_{oes}		$f = 1\text{ MHz}$		0.37		nF
C_{res}		$f = 1\text{ MHz}$		0.27		nF
Q_G	$V_{GE} = -15\text{ V} \dots +15\text{ V}$			667		nC
R_{Gint}	$T_j = 25^\circ\text{C}$			0		Ω
$t_{d(on)}$	$V_{CE} = 300\text{ V}$	$T_j = 150^\circ\text{C}$		22		ns
t_r	$I_C = 80\text{ A}$	$T_j = 150^\circ\text{C}$		23		ns
E_{on}	$V_{GE} = +15/-15\text{ V}$ $R_{G on} = 0.5\ \Omega$	$T_j = 150^\circ\text{C}$		1.75		mJ
$t_{d(off)}$	$R_{G off} = 0.5\ \Omega$	$T_j = 150^\circ\text{C}$		183		ns
t_f	$di/dt_{on} = 3100\text{ A}/\mu\text{s}$ $di/dt_{off} = 783\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		59		ns
E_{off}	$dv/dt = 3200\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		3		mJ
$R_{th(j-s)}$	per IGBT			0.54		K/W
IGBT2						
$V_{CE(sat)}$	$I_C = 75\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		1.45	1.77	V
		$T_j = 150^\circ\text{C}$		1.83	2.15	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$		0.75	0.90	V
		$T_j = 150^\circ\text{C}$		0.68	0.83	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		9.3	12	m Ω
		$T_j = 150^\circ\text{C}$		15	18	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 1.2\text{ mA}$		5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 650\text{ V}, T_j = 25^\circ\text{C}$				0.2	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		4.62		nF
C_{oes}		$f = 1\text{ MHz}$		0.288		nF
C_{res}		$f = 1\text{ MHz}$		0.137		nF
Q_G	$V_{GE} = -15\text{ V} \dots +15\text{ V}$			718		nC
R_{Gint}	$T_j = 25^\circ\text{C}$			0		Ω
$t_{d(on)}$	$V_{CE} = 300\text{ V}$	$T_j = 150^\circ\text{C}$		14		ns
t_r	$I_C = 80\text{ A}$	$T_j = 150^\circ\text{C}$		15		ns
E_{on}	$V_{GE} = +15/-15\text{ V}$ $R_{G on} = 0.5\ \Omega$	$T_j = 150^\circ\text{C}$		0.56		mJ
$t_{d(off)}$	$R_{G off} = 0.5\ \Omega$	$T_j = 150^\circ\text{C}$		132		ns
t_f	$di/dt_{on} = 5300\text{ A}/\mu\text{s}$ $di/dt_{off} = 1000\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		60		ns
E_{off}	$dv/dt = 4200\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		2.46		mJ
$R_{th(j-s)}$	per IGBT			0.82		K/W

SK80TMLI12F4Tp



SEMITOP® 3 Press-Fit

3-Level TNPC

SK80TMLI12F4Tp

Features*

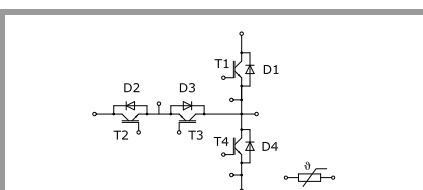
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- Low inductive design
- Press-Fit contact technology
- Fully compatible with other SEMITOP® Press-Fit types
- 1200V Trench IGBT4 Fast (F4)
- 650V Trench IGBT3 (E3)
- Robust and soft switching CAL 4F diode technology
- Integrated NTC temperature sensor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

Typical Applications

- UPS
- Solar

Remarks*

- Recommended $T_{jop} = -40 \dots +150^\circ\text{C}$
- IGBT1: outer IGBTs T1 & T4
- IGBT2: inner IGBTs T2 & T3
- Diode1: outer Diodes D1 & D4
- Diode2: inner Diodes D2 & D3



TMLI-T

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Diode1						
$V_F = V_{EC}$	$I_F = 75 \text{ A}$	$T_j = 25^\circ\text{C}$		2.17	2.49	V
		chipelevel	$T_j = 150^\circ\text{C}$	2.11	2.42	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		12	13	mΩ
		$T_j = 150^\circ\text{C}$		16	18	mΩ
I_{RRM}	$I_F = 80 \text{ A}$	$T_j = 150^\circ\text{C}$		147		A
Q_{rr}	$di/dt_{off} = 5300 \text{ A}/\mu\text{s}$ $V_R = 300 \text{ V}$	$T_j = 150^\circ\text{C}$		7.5		μC
E_{rr}	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$		1.43		mJ
$R_{th(j-s)}$	per Diode			0.79		K/W
Diode2						
$V_F = V_{EC}$	$I_F = 100 \text{ A}$	$T_j = 25^\circ\text{C}$		1.40	1.76	V
		chipelevel	$T_j = 150^\circ\text{C}$	1.38	1.77	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		1.04	1.24	V
		$T_j = 150^\circ\text{C}$		0.85	0.99	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		3.6	5.3	mΩ
		$T_j = 150^\circ\text{C}$		5.3	7.8	mΩ
I_{RRM}	$I_F = 80 \text{ A}$	$T_j = 150^\circ\text{C}$		113		A
Q_{rr}	$di/dt_{off} = 3096 \text{ A}/\mu\text{s}$ $V_R = 300 \text{ V}$	$T_j = 150^\circ\text{C}$		7.3		μC
E_{rr}	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$		1.47		mJ
$R_{th(j-s)}$	per Diode			0.79		K/W
Module						
L_{sCE1}				-		nH
L_{CE}				-		nH
R_{CC+EE}			$T_s = 25^\circ\text{C}$		-	mΩ
			$T_s = 150^\circ\text{C}$		-	mΩ
M_s	to heatsink		2.25		2.5	Nm
w				30		g
Temperature Sensor						
R_{100}	$T_c = 100^\circ\text{C}$ ($R_{25} = 5 \text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R(T) = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$; $T[K]$			$3550 \pm 2\%$		K

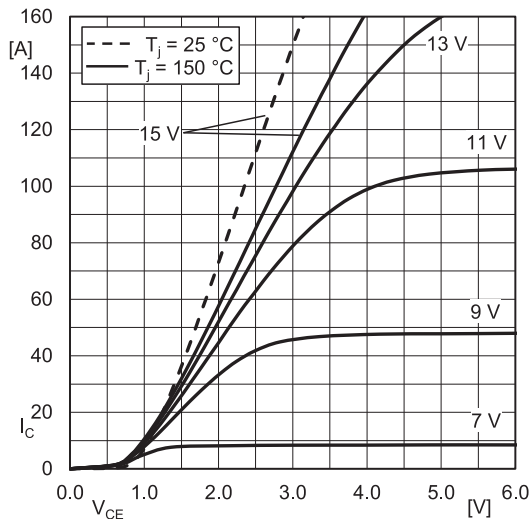


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+EE'}$

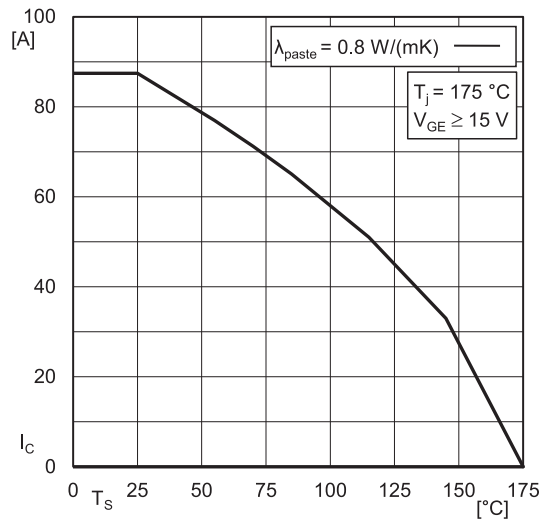


Fig. 2: IGBT1 rated current vs. Temperature $I_c=f(T_s)$

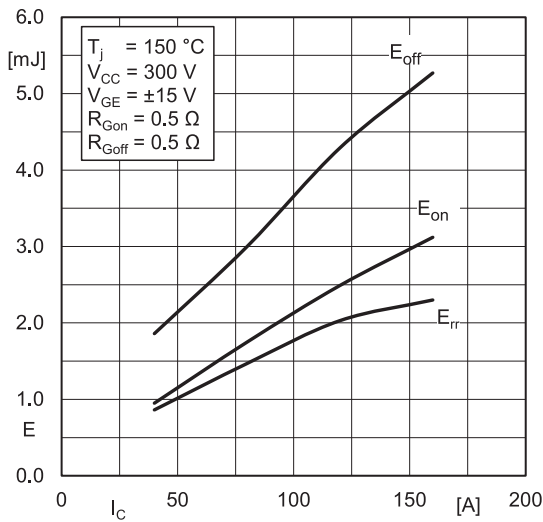


Fig. 3: Typ. IGBT1 & Diode2 turn-on /-off energy = $f(I_c)$

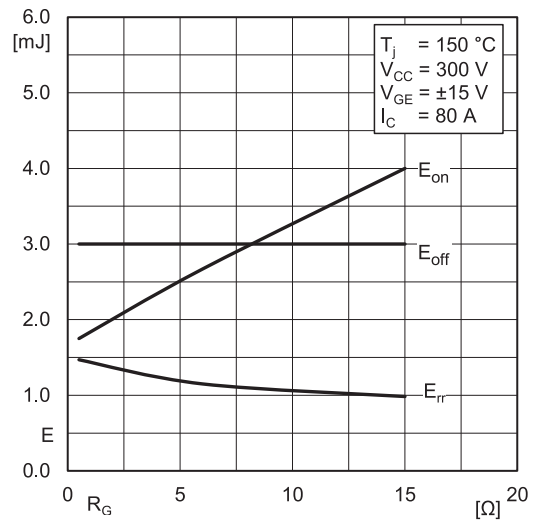


Fig. 4: Typ. IGBT1 & Diode2 turn-on /-off energy = $f(R_G)$

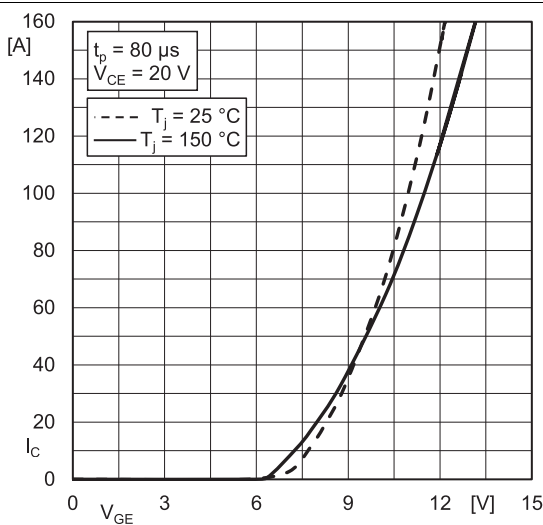


Fig. 5: Typ. IGBT1 transfer characteristic

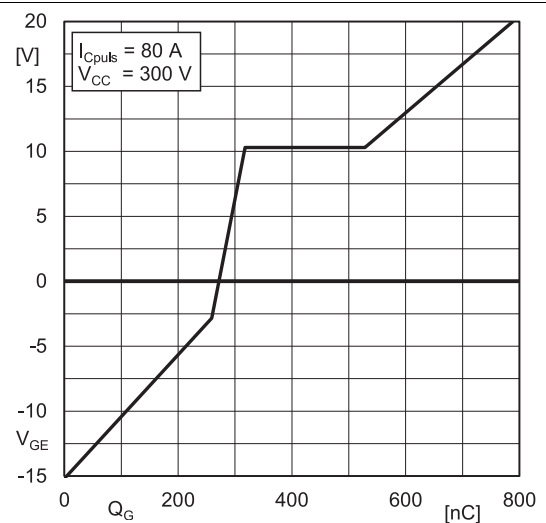


Fig. 6: Typ. IGBT1 gate charge characteristic

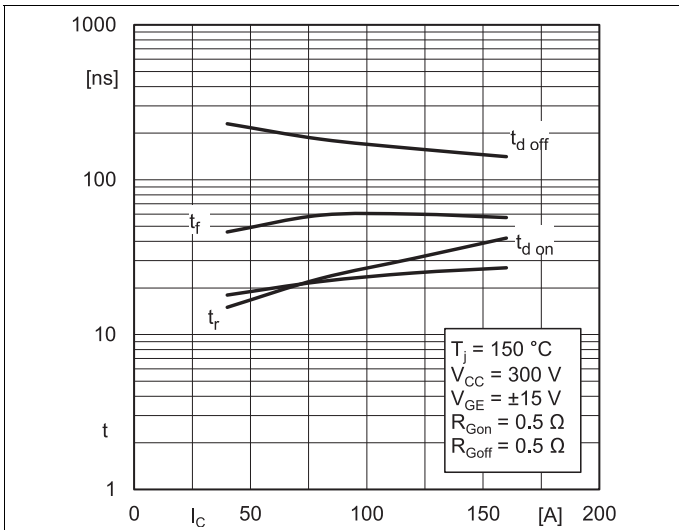


Fig. 7: Typ. IGBT1 switching times vs. I_C

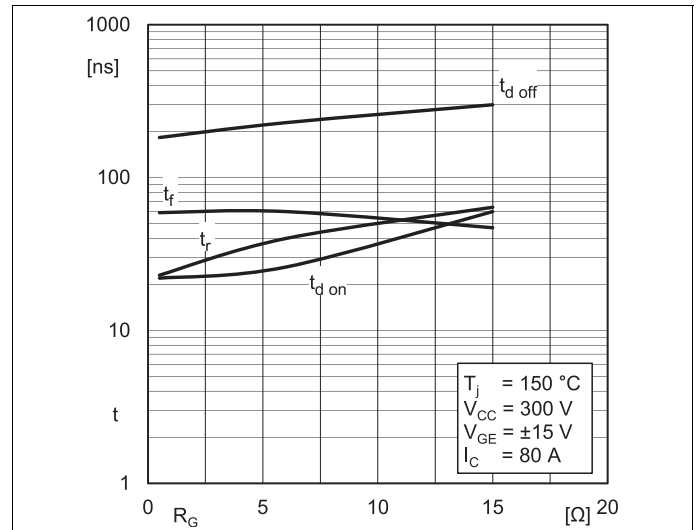


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

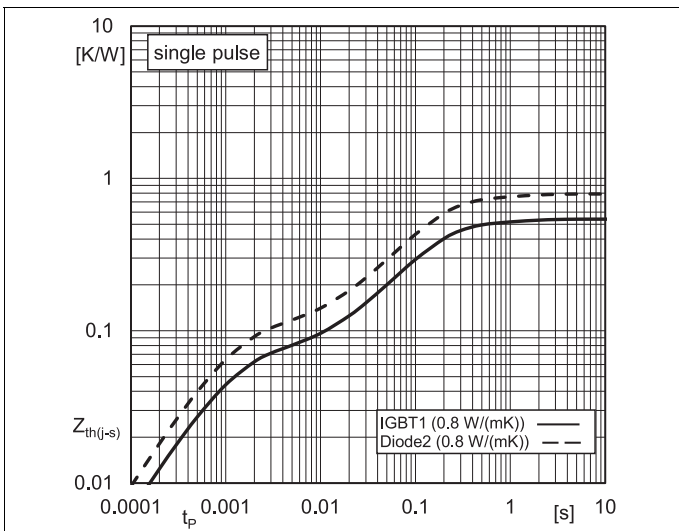


Fig. 9: Transient thermal impedance of IGBT1 & Diode2

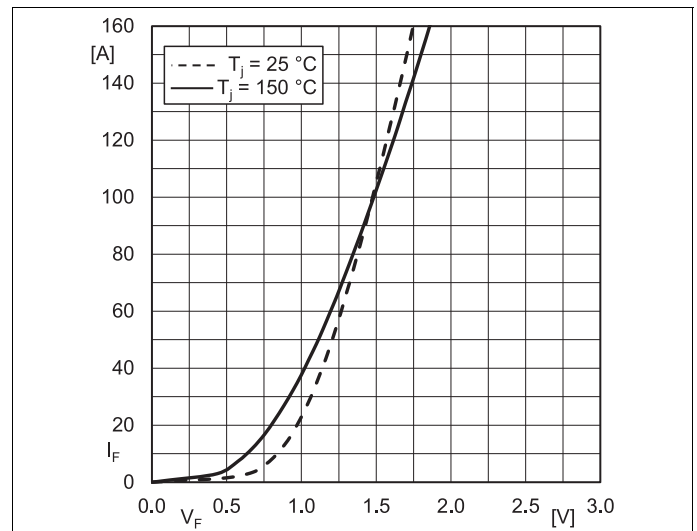


Fig. 10: Typ. Diode2 forward characteristic, incl. $R_{CC+EE'}$

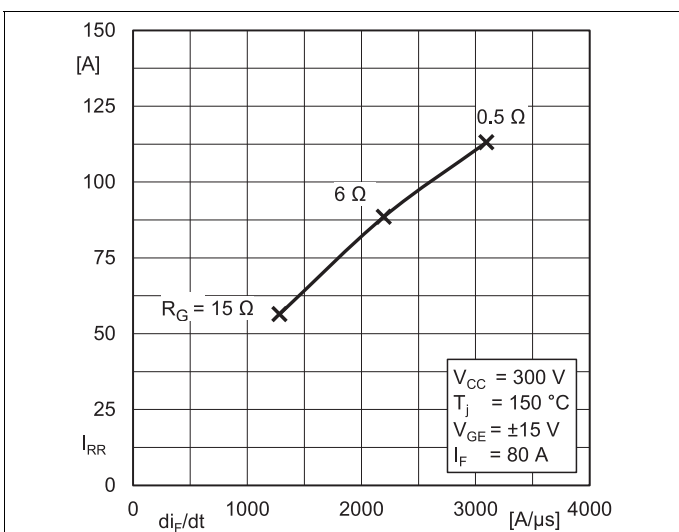


Fig. 11: Typ. Diode2 peak reverse recovery current

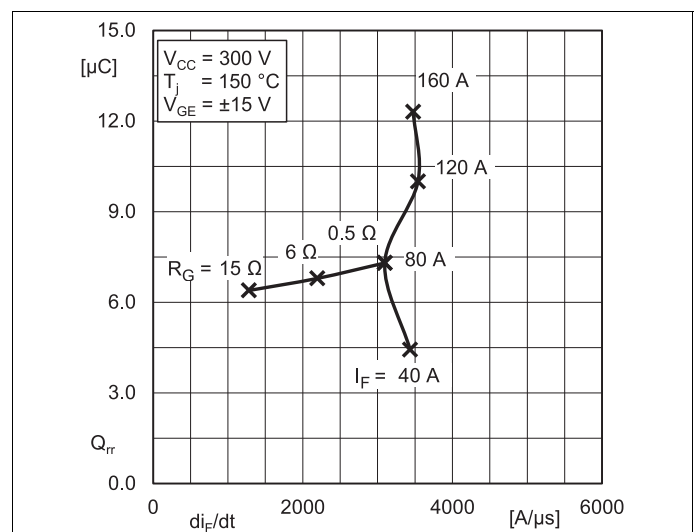


Fig. 12: Typ. Diode2 recovery charge

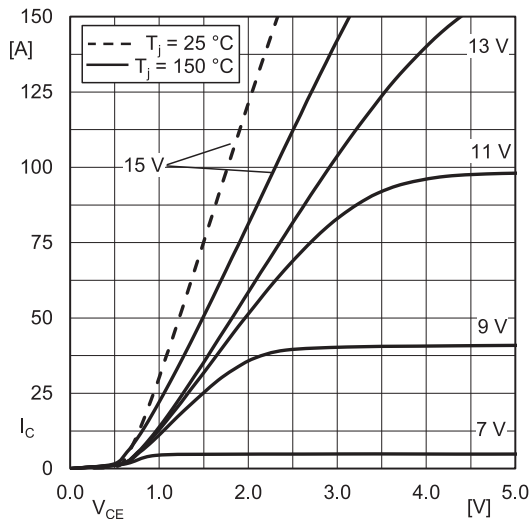


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

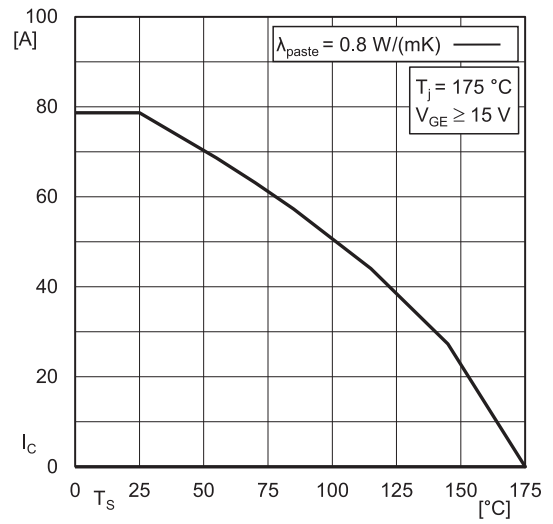


Fig. 14: IGBT2 Rated current vs. Temperature $I_c = f(T_s)$

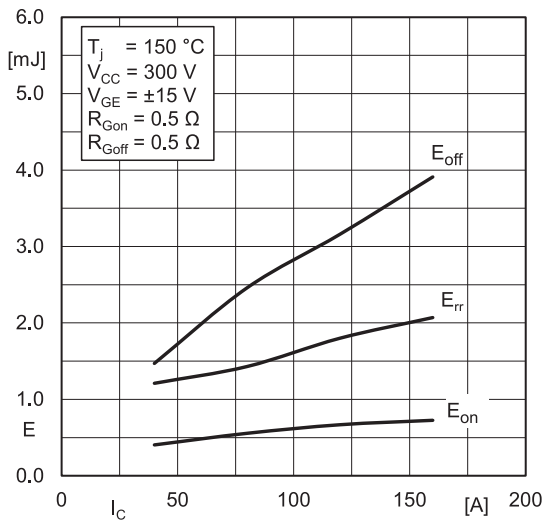


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(I_c)$

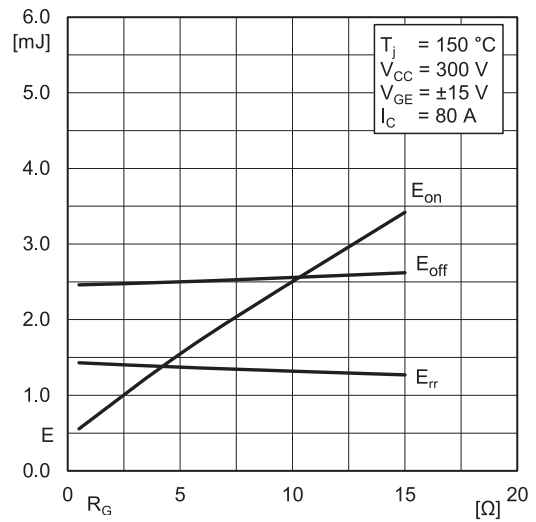


Fig. 16: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(R_G)$

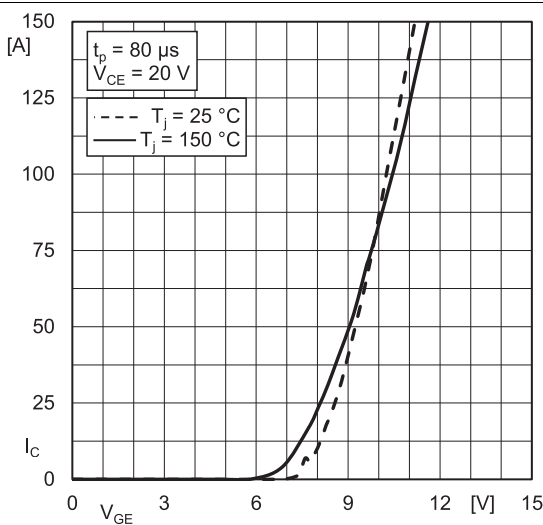


Fig. 17: Typ. IGBT2 transfer characteristic

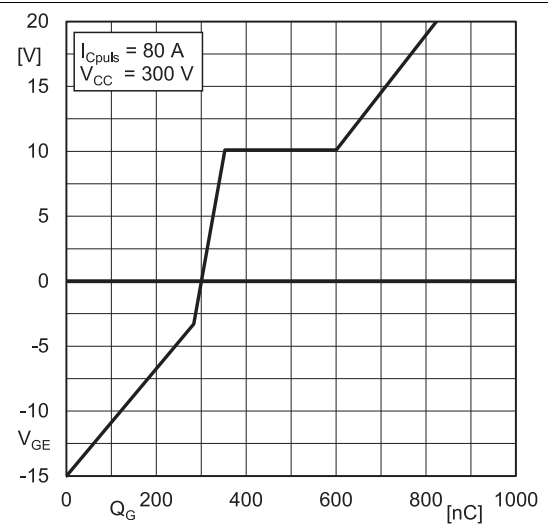


Fig. 18: Typ. IGBT2 gate charge characteristic

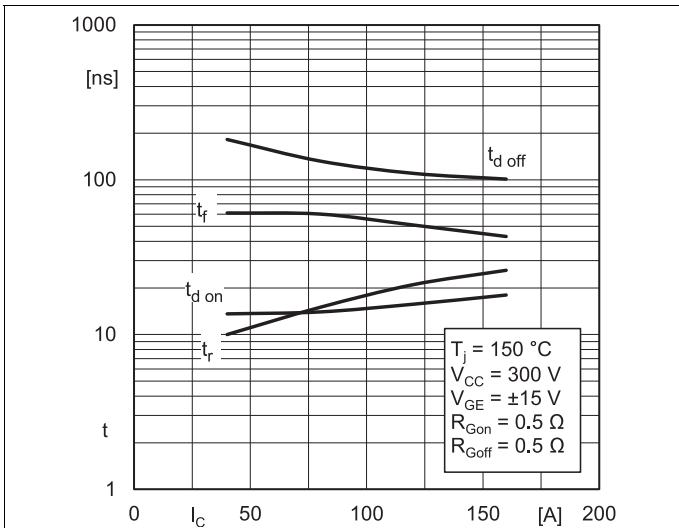


Fig. 19: Typ. IGBT2 switching times vs. I_C

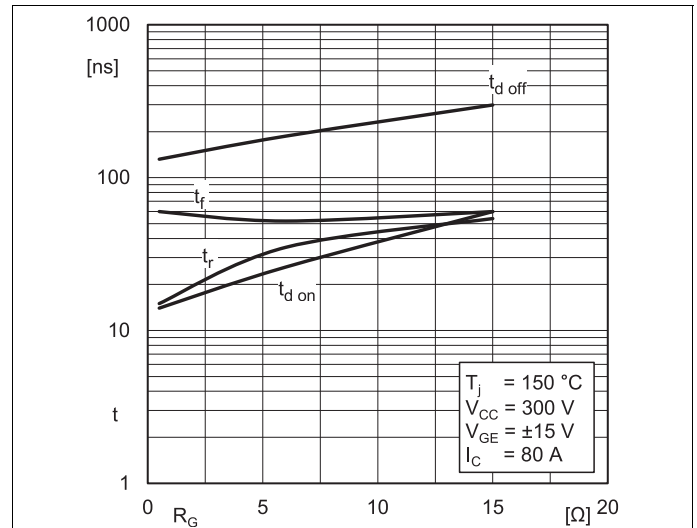


Fig. 20: Typ. IGBT2 switching times vs. gate resistor R_G

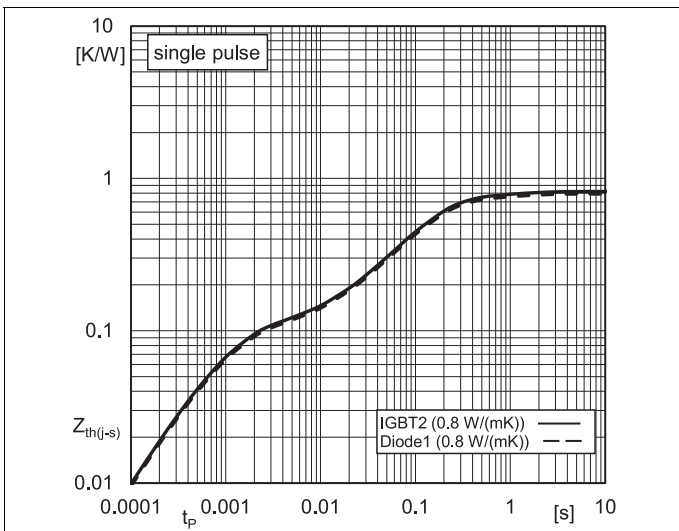


Fig. 21: Transient thermal impedance of IGBT2 & Diode1

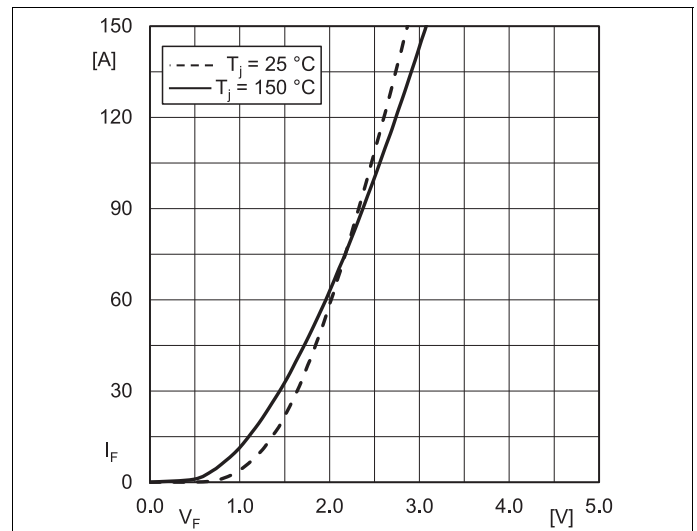


Fig. 22: Typ. Diode1 forward characteristic, incl. $R_{CC+EE'}$

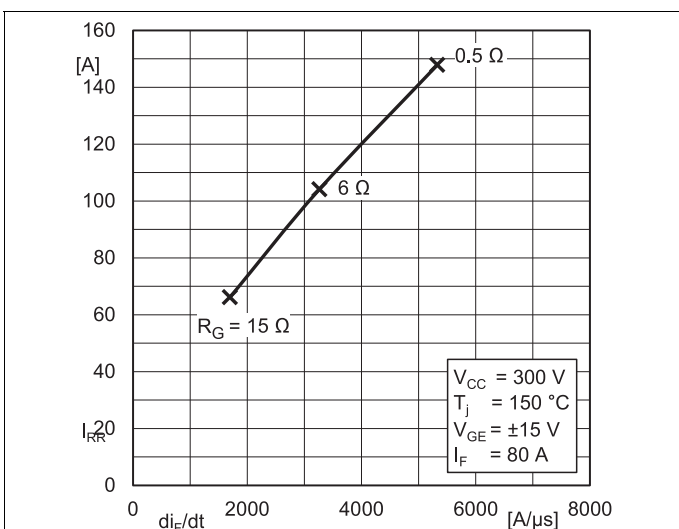


Fig. 23: Typ. Diode1 peak reverse recovery current

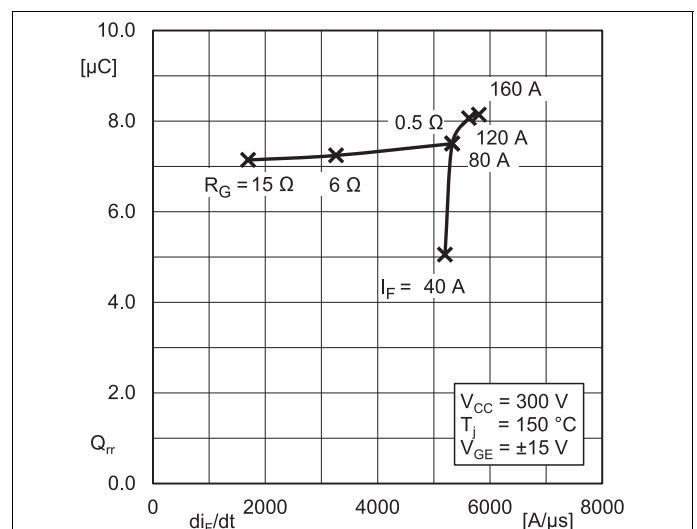
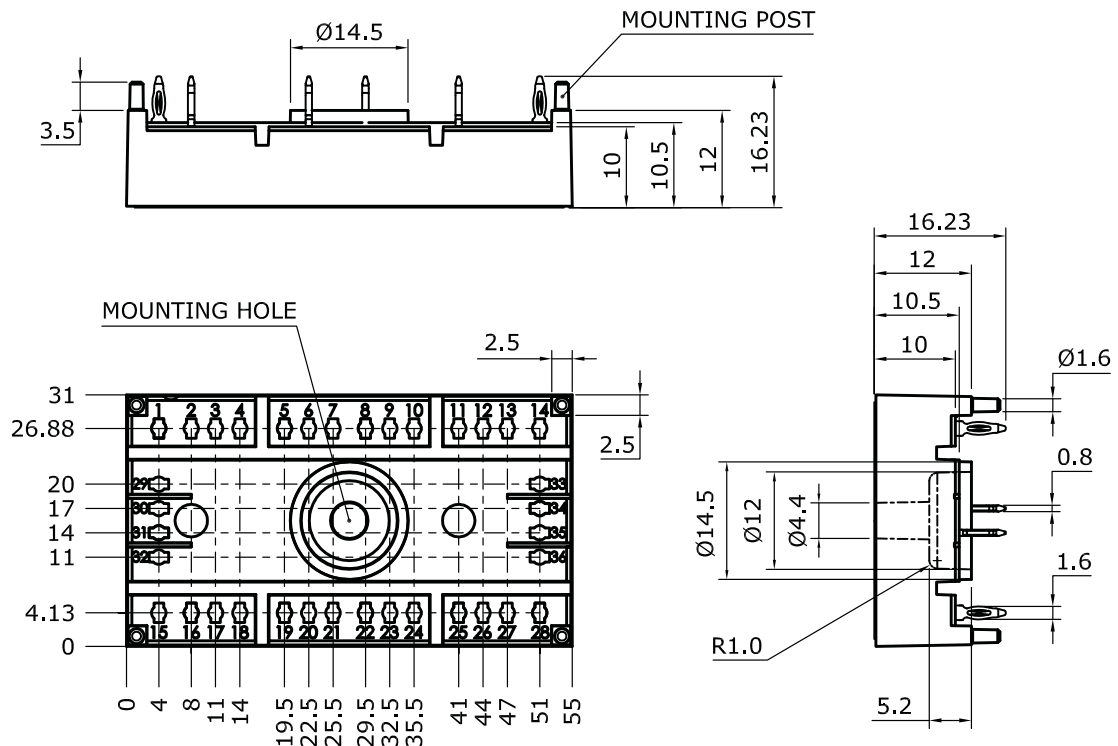


Fig. 24: Typ. Diode1 recovery charge

SK80TMLI12F4Tp

Dimensions: mm

Tolerance system: ISO 2768-m



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

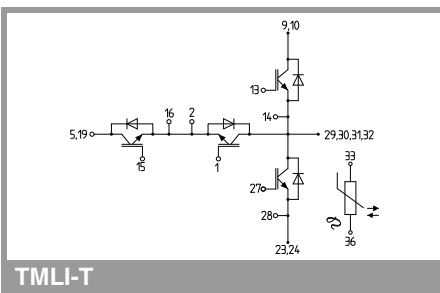
- minimum: 1.575 mm
- typical: 1.6 mm
- maximum: 1.625 mm

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

- 2 mm

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SEMITOP 3 Press-Fit



TMLI-T

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

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