

SK 150 MLI 07F3 TD1p



SEMITOP® 4 Press-Fit

3-Level NPC Inverter

SK 150 MLI 07F3 TD1p

Features

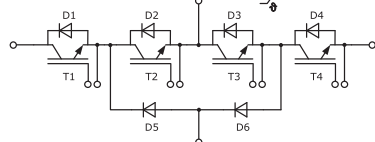
- One screw mounting module
- Solder free mounting with Press-Fit terminals
- Fully compatible with other SEMITOP® Press-Fit types
- Improved thermal performances by aluminium oxide substrate
- 650V Trench IGBT technology
- CAL4F technology FWD
- Rapid switching clamping diode technology
- Integrated NTC temperature sensor
- UL recognized, file no. E 63 532

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
- Diode5: clamping diodes D5 & D6

Footnotes

¹⁾ Please find further technical information on the SEMIKRON website.



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Absolute Maximum Ratings				
Symbol		Conditions	Values	Unit
IGBT1				
V _{CES}	T _j = 25 °C		650	V
I _C	T _j = 175 °C	T _s = 25 °C	151	A
		T _s = 70 °C	120	A
I _{Cnom}			150	A
I _{CRM}	I _{CRM} = 3 x I _{Cnom}		450	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 400 V, V _{GE} ≤ 15 V, T _j = 150 °C, V _{CES} ≤ 650 V		5	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	178	A
		T _s = 70 °C	143	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, T _j = 150 °C, V _{CES} ≤ 650 V		6	μs
T _j			-40 ... 175	°C
Diode1				
V _{RRM}	T _j = 25 °C		650	V
I _F	T _j = 175 °C	T _s = 25 °C	137	A
		T _s = 70 °C	107	A
I _{Fnom}			100	A
I _{FRM}	I _{FRM} = 2 x I _{Fnom}		200	A
I _{FSM}	10 ms, sin 180°, T _j = 25 °C		990	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	137	A
		T _s = 70 °C	107	A
I _{Fnom}			100	A
I _{FRM}	I _{FRM} = 2 x I _{Fnom}		200	A
I _{FSM}	10 ms, sin 180°, T _j = 25 °C		990	A
T _j			-40 ... 175	°C
Diode5				
V _{RRM}	T _j = 25 °C		650	V
I _F	T _j = 175 °C	T _s = 25 °C	134	A
		T _s = 70 °C	105	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		810	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}	T _{terminal} = 100 °C, T _S = 60°C, per pin		40	A
T _{stg}			-40 ... 125	°C
V _{isol}	AC, sinusoidal, t = 1 min		2500	V

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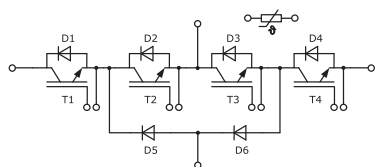
Remarks*

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- IGBT1: outer IGBTs T1 & T4
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT1						
V _{CE(sat)}	I _C = 150 A	T _j = 25 °C		1.85	2.22	V
	V _{GE} = 15 V chiplevel	T _j = 150 °C		2.18	2.55	V
V _{CE0}	chiplevel	T _j = 25 °C		1.10	1.20	V
		T _j = 150 °C		1.00	1.10	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		5.0	6.8	mΩ
	chiplevel	T _j = 150 °C		7.9	9.7	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 2.4 mA		4.2	5.1	5.6	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 650 V, T _j = 25 °C				0.4	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		9.24		nF
C _{oes}		f = 1 MHz		480		nF
C _{res}		f = 1 MHz		0.274		nF
Q _G	V _{GE} = -15V ... +15 V			1500		nC
R _{Gint}	T _j = 25 °C			2.4		Ω
t _{d(on)}	V _{CE} = 300 V	T _j = 150 °C		194		ns
t _r	I _C = 150 A	T _j = 150 °C		80		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		9.07		mJ
	R _{G on} = 1.8 Ω	T _j = 150 °C				
t _{d(off)}	R _{G off} = 1.8 Ω	T _j = 150 °C		374		ns
t _f	di/dt _{on} = 1650 A/μs	T _j = 150 °C		27		ns
	di/dt _{off} = 5083 A/μs					
E _{off}		T _j = 150 °C		1.3		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			0.38		K/W
IGBT2						
V _{CE(sat)}	I _C = 150 A	T _j = 25 °C		1.45	1.77	V
	V _{GE} = 15 V chiplevel	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	T _j = 25 °C		3.7	5.1	mΩ
	chiplevel	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				0.4	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		9.24		nF
C _{oes}		f = 1 MHz		0.6		nF
C _{res}		f = 1 MHz		0.274		nF
Q _G	V _{GE} = -15V ... +15 V			1360		nC
R _{Gint}	T _j = 25 °C			2.0		Ω
t _{d(on)}	V _{CE} = 300 V	T _j = 150 °C		69		ns
t _r	I _C = 150 A	T _j = 150 °C		47		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		3.47		mJ
	R _{G on} = 3 Ω	T _j = 150 °C				
t _{d(off)}	R _{G off} = 3 Ω	T _j = 150 °C		288		ns
t _f	di/dt _{on} = 3460 A/μs	T _j = 150 °C		43		ns
	di/dt _{off} = 2011 A/μs					
E _{off}		T _j = 150 °C		3.98		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			0.35		K/W



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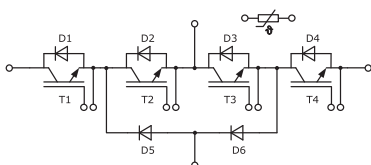
Remarks*

- Recommended $T_{jop} = -40 \dots +150^\circ\text{C}$
- IGBT1: outer IGBTs T1 & T4
- IGBT2: inner IGBTs T2 & T3
- Diode1: outer Diodes D1 & D4
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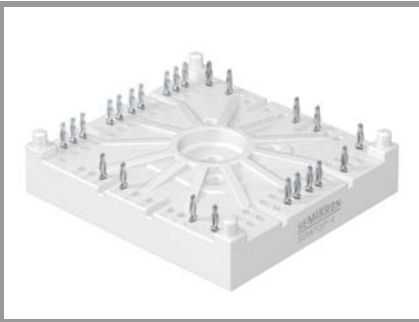
¹⁾ Please find further technical information on the SEMIKRON website.

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Diode1						
V _F = V _{EC}	I _F = 100 A	T _j = 25 °C		1.37	1.73	V
	chiplevel	T _j = 150 °C		1.35	1.72	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		3.3	4.9	mΩ
		T _j = 150 °C		5.0	7.3	mΩ
I _{RRM}	I _F = 150 A	T _j = 150 °C		135		A
Q _{rr}	di/dt _{off} = 3460 A/μs V _R = 300 V	T _j = 150 °C		13.8		μC
E _{rr}	V _{GE} = +15/-15 V	T _j = 150 °C		1.76		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			0.58		K/W
Diode2						
V _F = V _{EC}	I _F = 100 A	T _j = 25 °C		1.37	1.73	V
	chiplevel	T _j = 150 °C		1.35	1.72	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		3.3	4.9	mΩ
		T _j = 150 °C		5.0	7.3	mΩ
I _{RRM}	I _F = 100 A	T _j = 150 °C		-		A
Q _{rr}	V _R = 300 V	T _j = 150 °C		-		μC
E _{rr} 1)	V _{GE} = +15/-15 V	T _j = 150 °C		-		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			0.58		K/W
Diode5						
V _F = V _{EC}	I _F = 150 A	T _j = 25 °C		1.35	1.92	V
	chiplevel	T _j = 150 °C		1.30	1.89	V
V _{F0}	chiplevel	T _j = 25 °C		0.90	1.10	V
		T _j = 150 °C		0.71	0.94	V
r _F	chiplevel	T _j = 25 °C		3.0	5.5	mΩ
		T _j = 150 °C		3.9	6.3	mΩ
I _{RRM}	I _F = 150 A	T _j = 150 °C		55		A
Q _{rr}	di/dt _{off} = 1650 A/μs V _R = 300 V	T _j = 150 °C		9.7		μC
E _{rr}	V _{GE} = +15/-15 V	T _j = 150 °C		1.39		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			0.63		K/W



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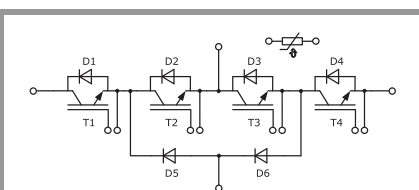
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Module					
L_{sCE1}			-		nH
L_{sCE2}			-		nH
$R_{CC'+EE'}$			-		$T_s = 25^{\circ}\text{C}$ mΩ
					$T_s = 125^{\circ}\text{C}$ mΩ
M_s	to heatsink	2.5		2.75	Nm
M_t			-		Nm
			-		Nm
w			60		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



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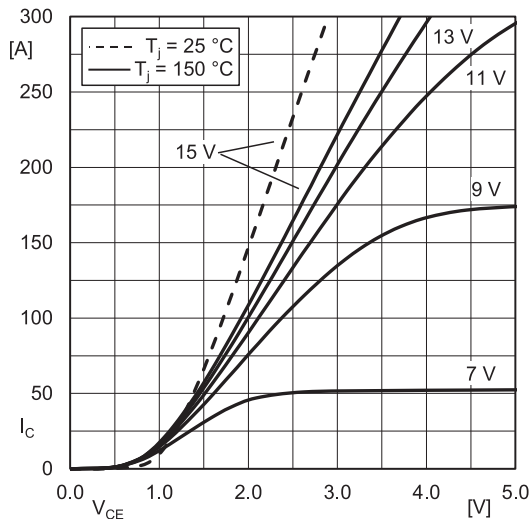


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+EE'}$

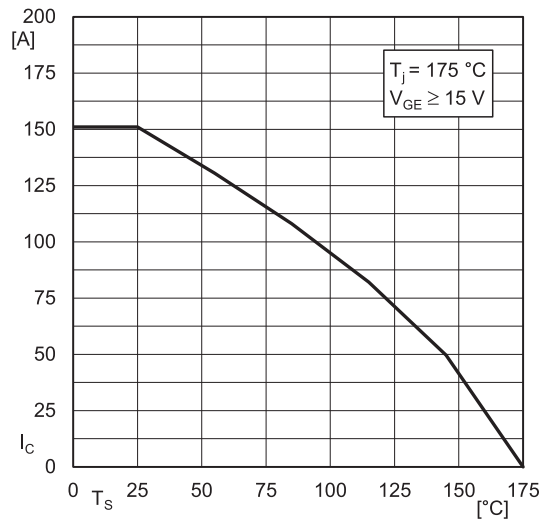


Fig. 2: IGBT1 rated current vs. Temperature $I_C=f(T_s)$

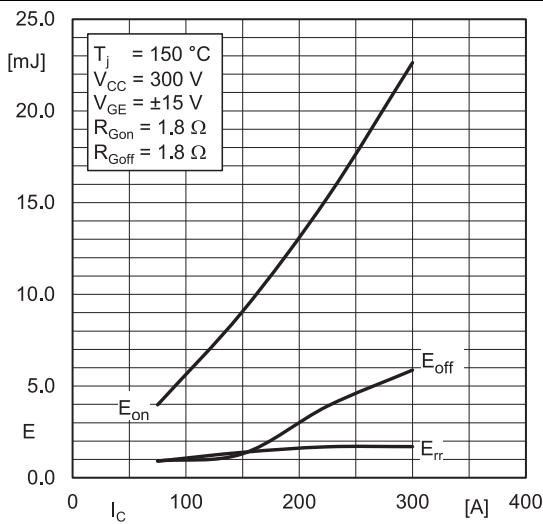


Fig. 3: Typ. IGBT1 & Diode5 turn-on /-off energy = $f(I_C)$

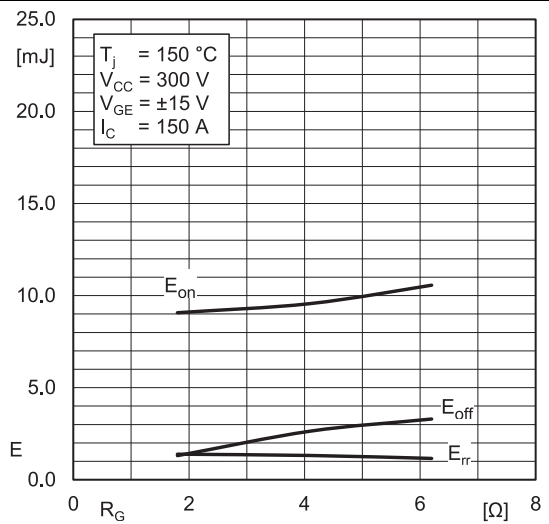


Fig. 4: Typ. IGBT1 & Diode5 turn-on /-off energy = $f(R_G)$

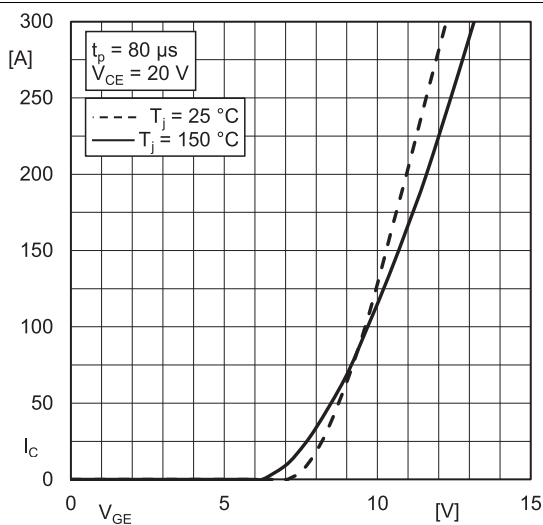


Fig. 5: Typ. IGBT1 transfer characteristic

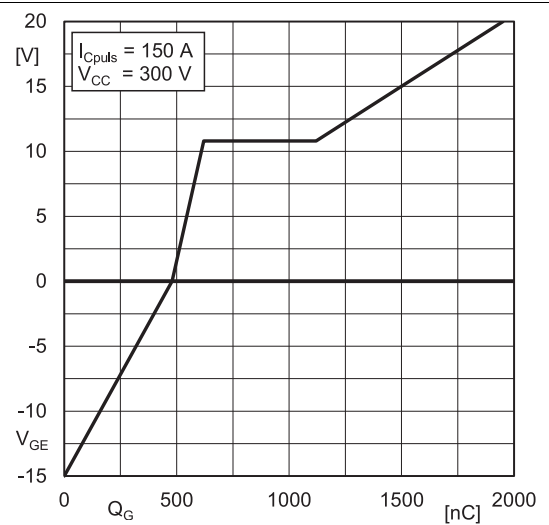


Fig. 6: Typ. IGBT1 gate charge characteristic

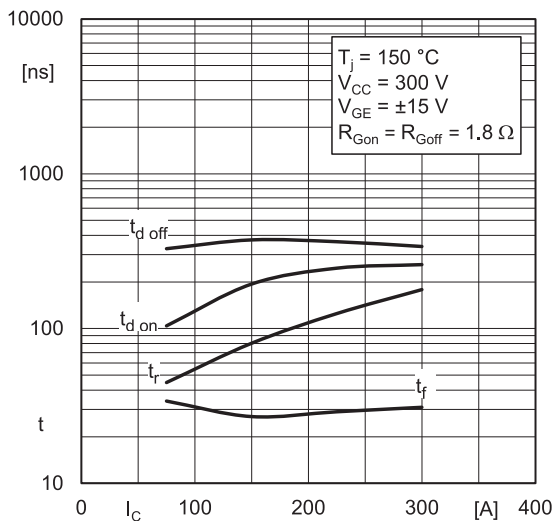


Fig. 7: Typ. IGBT1 switching times vs. I_C

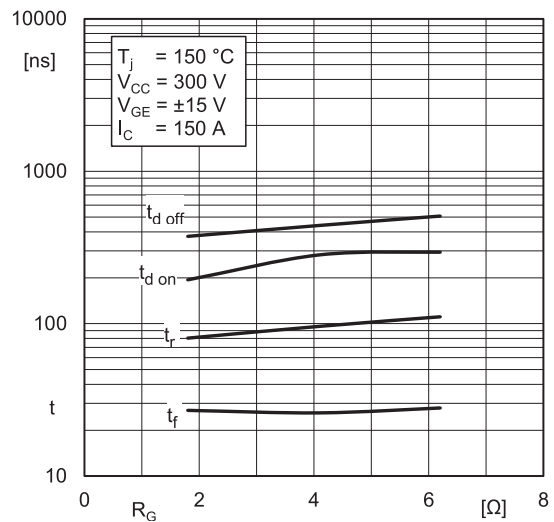


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

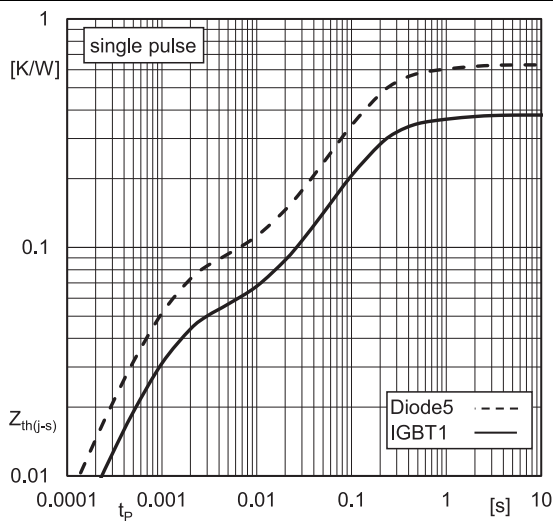


Fig. 9: Transient thermal impedance of IGBT1 & Diode5

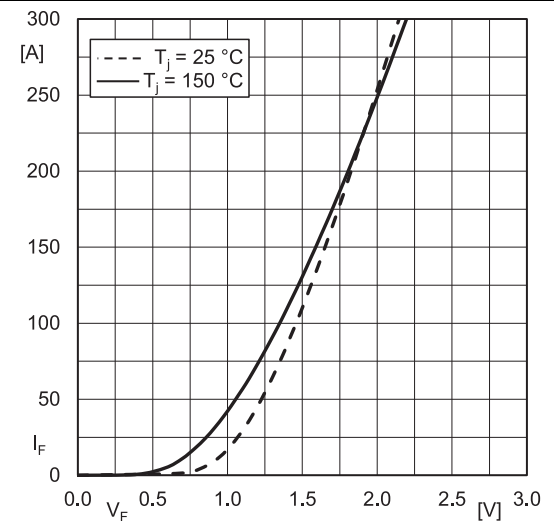


Fig. 10: Typ. Diode5 forward characteristic, incl. $R_{CC'+EE'}$

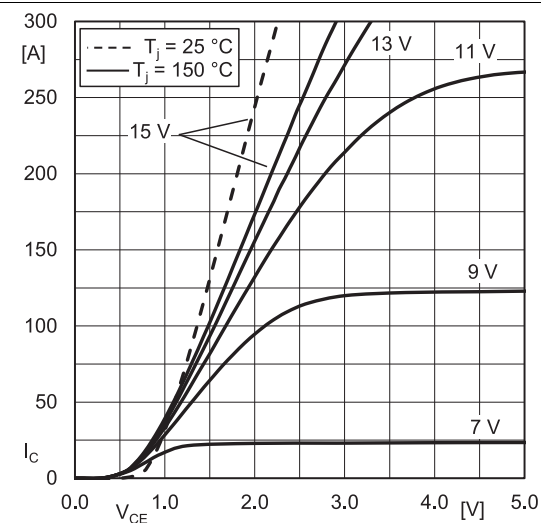


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

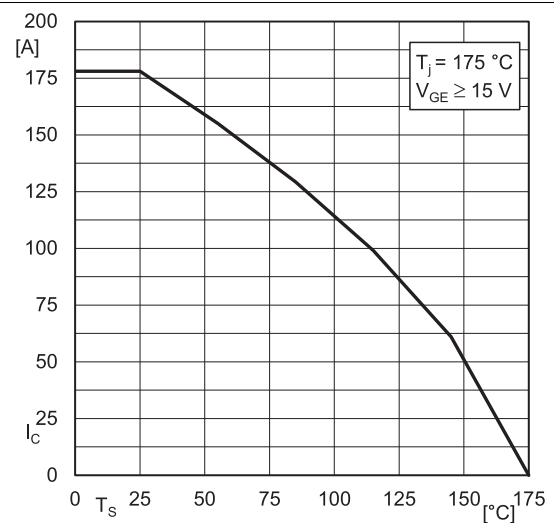


Fig. 14: IGBT2 Rated current vs. Temperature $I_C = f(T_s)$

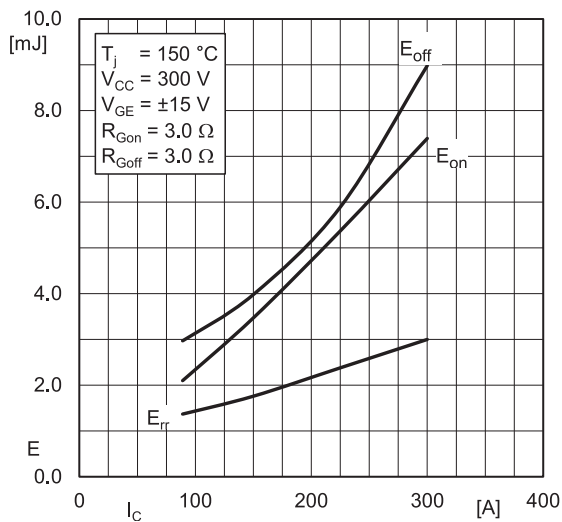


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(I_C)$

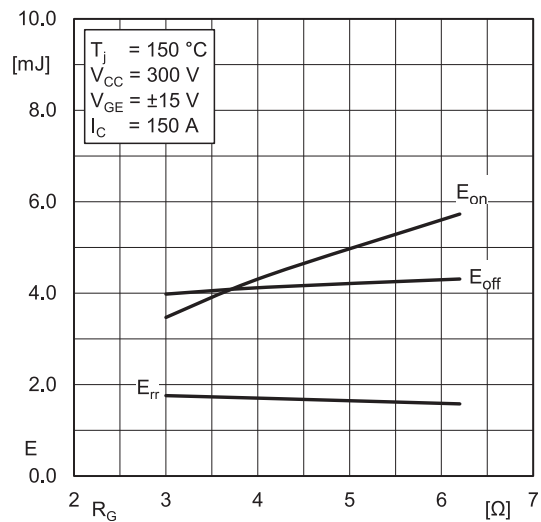


Fig. 16: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(R_G)$

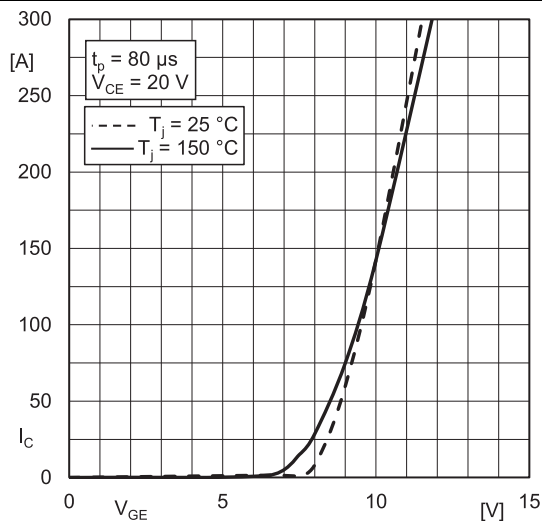


Fig. 17: Typ. IGBT2 transfer characteristic

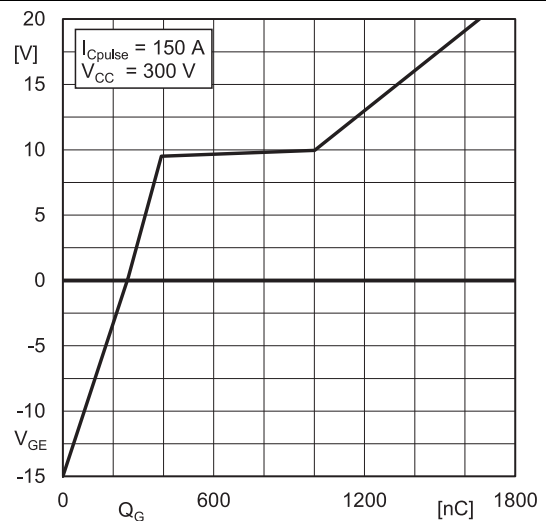


Fig. 18: Typ. IGBT2 gate charge characteristic

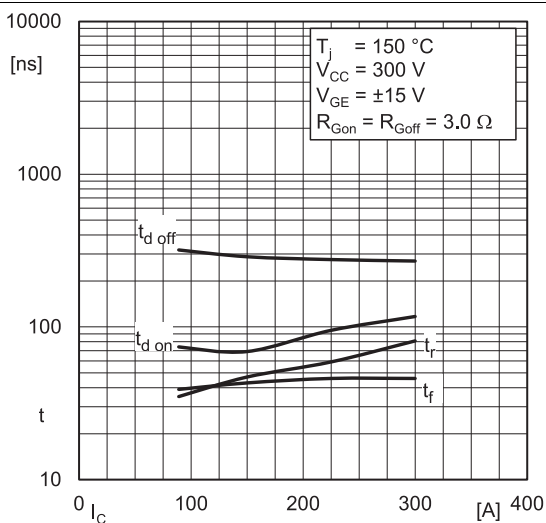


Fig. 19: Typ. IGBT2 switching times vs. I_C

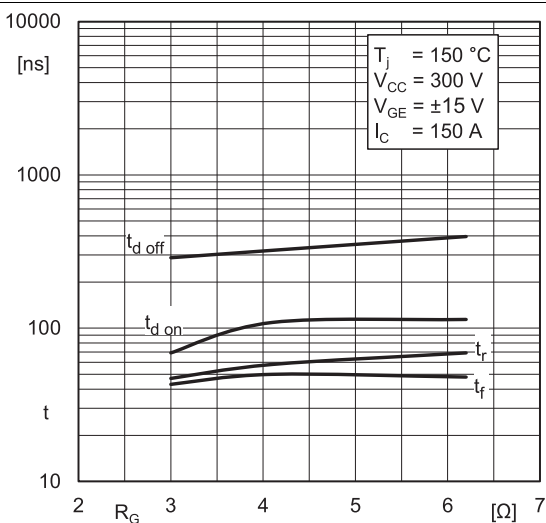


Fig. 20: Typ. IGBT2 switching times vs. gate resistor R_G

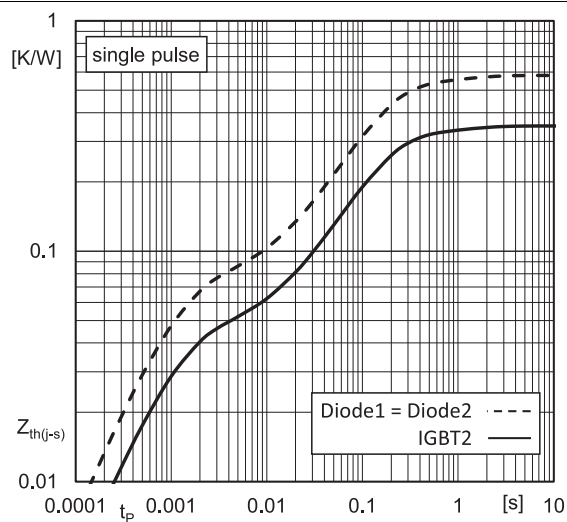


Fig. 21: Transient thermal impedance of IGBT2, Diode1 & Diode2

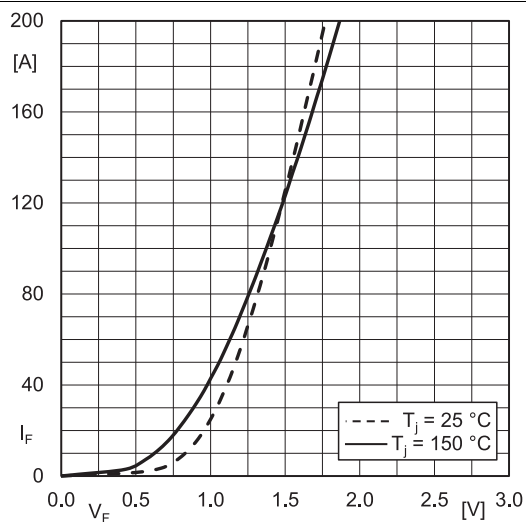
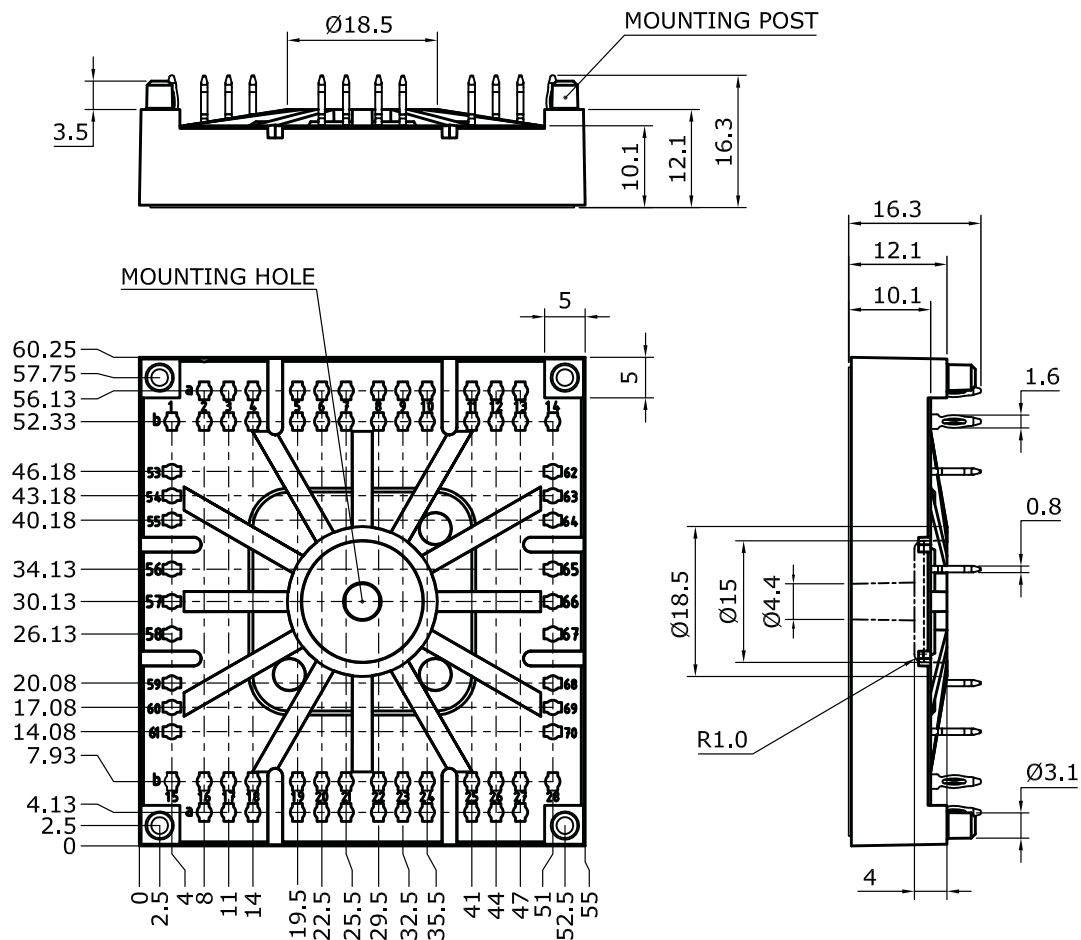


Fig. 22: Typ. Diode1 & Diode2 forward characteristic, incl. $R_{CC'+EE'}$

Dimensions: mm

Tolerance system: ISO 2768-m



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

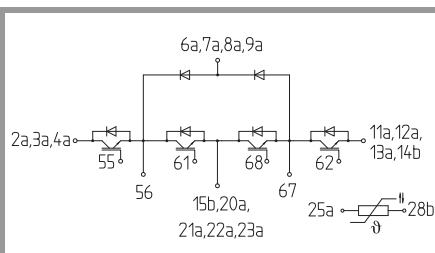
- minimum: 1.575 mm
- typical: 1.6 mm
- maximum: 1.625 mm

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

- 3.6 mm

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SEMIPOT 4 Press-Fit



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

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