



SEMITOP®E1

3-Level NPC

SK75MLI07S5TD1E1

Features*

- Optimized design for superior thermal performance
- Low inductive design
- Press-Fit contact technology
- 650V Trench5 IGBT (S5/L5)
- Rapid switching diode technology
- Integrated NTC temperature sensor
- UL recognized file no. E 63 532

Typical Applications

- UPS
- Solar

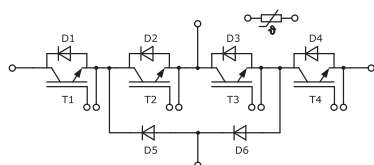
Remarks*

- Recommended $T_{j,op} = -40 \dots +150 \text{ °C}$
- 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.

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT1				
V _{CES}	T _j = 25 °C		650	V
I _C	λ _{paste} =0.8 W/(mK) T _j = 175 °C	T _s = 25 °C	70	A
		T _s = 70 °C	55	A
I _C	λ _{paste} =2.5 W/(mK) T _j = 175 °C	T _s = 25 °C	85	A
		T _s = 70 °C	67	A
I _{Cnom}			75	A
I _{CRM}			150	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 360 V, V _{GE} ≤ 15 V, T _j = 150 °C, V _{CES} ≤ 650 V		not capable	μs
T _j			-40 ... 175	°C
IGBT2				
V _{CES}	T _j = 25 °C		650	V
I _C	λ _{paste} =0.8 W/(mK) T _j = 175 °C	T _s = 25 °C	102	A
		T _s = 70 °C	80	A
I _C	λ _{paste} =2.5 W/(mK) T _j = 175 °C	T _s = 25 °C	128	A
		T _s = 70 °C	101	A
I _{Cnom}			75	A
I _{CRM}			150	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 360 V, V _{GE} ≤ 15 V, T _j = 150 °C, V _{CES} ≤ 650 V		not capable	μs
T _j			-40 ... 175	°C
Diode1				
V _{RRM}	T _j = 25 °C		650	V
I _F	λ _{paste} =0.8 W/(mK) T _j = 175 °C	T _s = 25 °C	53	A
		T _s = 70 °C	42	A
I _F	λ _{paste} =2.5 W/(mK) T _j = 175 °C	T _s = 25 °C	60	A
		T _s = 70 °C	48	A
I _{FRM}			100	A
I _{FSM}	10 ms, sin 180°, T _j = 25 °C		300	A
T _j			-40 ... 175	°C
Diode2				
V _{RRM}	T _j = 25 °C		650	V
I _F	λ _{paste} =0.8 W/(mK) T _j = 175 °C	T _s = 25 °C	59	A
		T _s = 70 °C	46	A
I _F	λ _{paste} =2.5 W/(mK) T _j = 175 °C	T _s = 25 °C	68	A
		T _s = 70 °C	53	A
I _{FRM}			100	A
I _{FSM}	10 ms, sin 180°, T _j = 25 °C		350	A
T _j			-40 ... 175	°C



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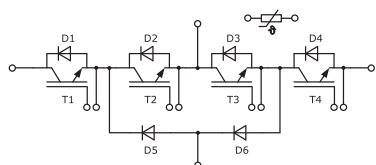
Symbol	Conditions		Values	Unit
Diode5				
V _{RRM}	T _j = 25 °C		650	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	67	A
	T _j = 175 °C	T _s = 70 °C	53	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	81	A
	T _j = 175 °C	T _s = 70 °C	64	A
I _{FRM}			150	A
I _{FSM}	10 ms, sin 180°, T _j = 25 °C		450	A
T _j			-40 ... 175	°C

Module

$I_{t(RMS)}$	$\Delta T_{terminal}$ at PCB joint = 30 K, per pin	30	A
T_{stg}	module without TIM	-40 ... 125	$^{\circ}\text{C}$
V_{isol}	AC, sinusoidal, $t = 1 \text{ min}$	2500	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT1					
$V_{CE(sat)}$	$I_C = 75 \text{ A}$	$T_j = 25 \text{ }^{\circ}\text{C}$	1.42	1.75	V
	$V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 150 \text{ }^{\circ}\text{C}$	1.61	2.06	V
V_{CE0}	chipelevel	$T_j = 25 \text{ }^{\circ}\text{C}$	0.95	1.05	V
		$T_j = 150 \text{ }^{\circ}\text{C}$	0.85	1.00	V
r_{CE}	$V_{GE} = 15 \text{ V}$	$T_j = 25 \text{ }^{\circ}\text{C}$	6.3	9.3	m Ω
	chipelevel	$T_j = 150 \text{ }^{\circ}\text{C}$	10	14	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 0.75 \text{ mA}$	3.2	4	4.8	V
I_{CES}	$V_{GE} = 0 \text{ V}$, $V_{CE} = 650 \text{ V}$, $T_j = 25 \text{ }^{\circ}\text{C}$			0.3	mA
C_{ies}	$V_{CE} = 25 \text{ V}$	$f = 1 \text{ MHz}$	4.5		nF
C_{oes}	$V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	0.13		nF
C_{res}		$f = 1 \text{ MHz}$	0.017		nF
Q_G	$V_{GE} = -15 \text{ V} \dots +15 \text{ V}$		360		nC
R_{Gint}	$T_j = 25 \text{ }^{\circ}\text{C}$		0		Ω
$t_{d(on)}$	$V_{CE} = 300 \text{ V}$	$T_j = 150 \text{ }^{\circ}\text{C}$	43		ns
t_r	$I_C = 75 \text{ A}$	$T_j = 150 \text{ }^{\circ}\text{C}$	34		ns
E_{on}	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150 \text{ }^{\circ}\text{C}$	1.15		mJ
$t_{d(off)}$	$R_{G on} = 15 \text{ }^{\circ}\Omega$	$T_j = 150 \text{ }^{\circ}\text{C}$	163		ns
t_f	$R_{G off} = 15 \text{ }^{\circ}\Omega$	$T_j = 150 \text{ }^{\circ}\text{C}$	33		ns
E_{off}	$di/dt_{on} = 1950 \text{ A}/\mu\text{s}$	$T_j = 150 \text{ }^{\circ}\text{C}$	1.46		mJ
	$di/dt_{off} = 1440 \text{ A}/\mu\text{s}$ $dv/dt = 7220 \text{ V}/\mu\text{s}$	$T_j = 150 \text{ }^{\circ}\text{C}$			
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W/(mK)}$		1.06		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W/(mK)}$		0.78		K/W



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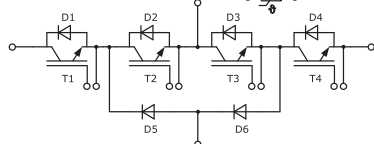
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT2						
V _{CE(sat)}	I _C = 75 A	T _J = 25 °C		1.10	1.45	V
	V _{GE} = 15 V chiplevel	T _J = 150 °C		1.12	1.38	V
V _{CE0}	chiplevel	T _J = 25 °C		0.78	0.98	V
		T _J = 150 °C		0.65	0.85	V
r _{CE}	V _{GE} = 15 V	T _J = 25 °C		4.3	6.3	mΩ
	chiplevel	T _J = 150 °C		6.3	7.1	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 1 mA		4.2	5	5.8	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 650 V, T _J = 25 °C				0.45	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		12.1		nF
C _{oes}		f = 1 MHz		0.15		nF
C _{res}		f = 1 MHz		0.042		nF
Q _G	V _{GE} = -15V ... +15V			1000		nC
R _{Gint}	T _J = 25 °C			0		Ω
t _{d(on)}	V _{CC} = 300 V	T _J = 150 °C		21		ns
t _r	I _C = 75 A	T _J = 150 °C		16		ns
E _{on}	V _{GE} = +15/-15 V R _{G on} = 1 Ω	T _J = 150 °C		0.08		mJ
t _{d(off)}	R _{G off} = 1 Ω	T _J = 150 °C		223		ns
t _f	di/dt _{on} = 4400 A/μs di/dt _{off} = 470 A/μs	T _J = 150 °C		118		ns
E _{off}	dv/dt = 2630 V/μs	T _J = 150 °C		4.43		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			0.94		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			0.67		K/W
Diode1						
V _F = V _{EC}	I _F = 50 A	T _J = 25 °C		1.35	1.92	V
	chiplevel	T _J = 150 °C		1.29	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		9.0	16	mΩ
		T _J = 150 °C		12	19	mΩ
I _{RRM}	I _F = 75 A	T _J = 150 °C		73		A
Q _{rr}	di/dt _{off} = 5100 A/μs V _R = 300 V	T _J = 150 °C		4.3		μC
E _{rr}	V _{GE} = +15/-15 V	T _J = 150 °C		1.25		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.43		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.19		K/W
Diode2						
V _F = V _{EC}	I _F = 50 A	T _J = 25 °C		1.55	1.82	V
	chiplevel	T _J = 150 °C		1.45	1.75	V
V _{F0}	chiplevel	T _J = 25 °C		1.10	1.32	V
		T _J = 150 °C		0.95	1.14	V
r _F	chiplevel	T _J = 25 °C		9.0	10	mΩ
		T _J = 150 °C		10	12	mΩ
I _{RRM}	I _F = 50 A	T _J = 150 °C		-		A
Q _{rr}		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)			1.36		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.11		K/W



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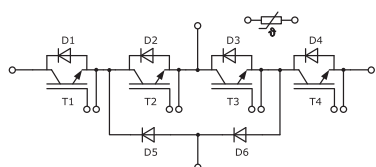
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Diode5						
V _F = V _{EC}	I _F = 75 A	T _j = 25 °C		1.35	1.92	V
	chiplevel	T _j = 150 °C		1.30	1.89	V
V _{F0}	chiplevel	T _j = 25 °C		0.90	1.10	V
		T _j = 150 °C		0.71	0.94	V
r _F	chiplevel	T _j = 25 °C		6.0	11	mΩ
		T _j = 150 °C		7.9	13	mΩ
I _{RRM}	I _F = 75 A	T _j = 150 °C		67		A
Q _{rr}	di/dt _{off} = 2150 A/μs V _R = 300 V	T _j = 150 °C		4.36		μC
E _{rr}	V _{GE} = +15/-15 V	T _j = 150 °C		0.98		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.25		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			0.95		K/W
Module						
L _{sCE1}				14		nH
L _{sCE2}				18		nH
R _{CC'+EE'}		T _s = 25 °C		-		mΩ
		T _s = 150 °C		-		mΩ
M _s	to heatsink		1.6		2.3	Nm
M _t				-		Nm
				-		Nm
w				25		g
Temperature Sensor						
R ₂₅	T _r =25°C			22 ± 1%		kΩ
B _{25/100}	R(T)=R ₂₅ exp[B _{25/100} (1/T-1/T ₂₅); T[K]			4000 ±1%		K



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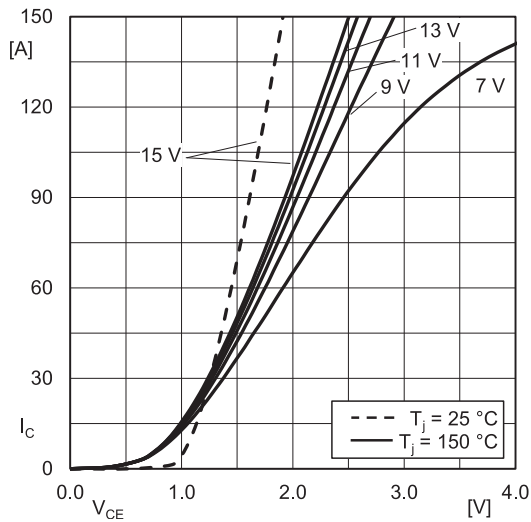


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+EE'}$

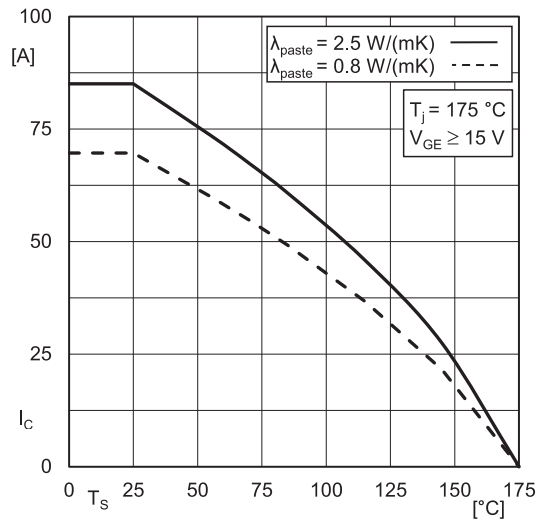


Fig. 2: IGBT1 rated current vs. Temperature $I_C=f(T_s)$

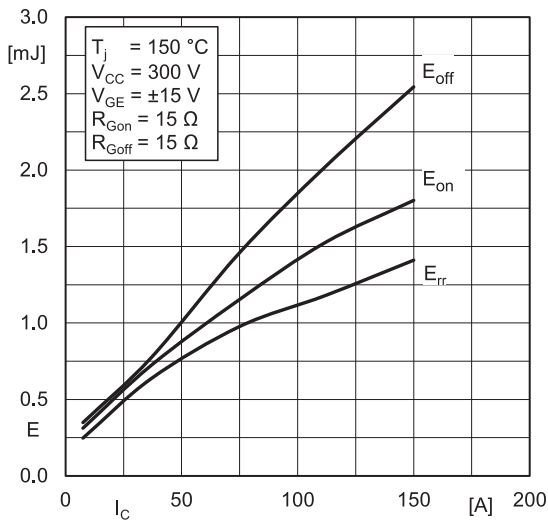


Fig. 3: Typ. IGBT1 & Diode5 turn-on /-off energy = $f(I_C)$

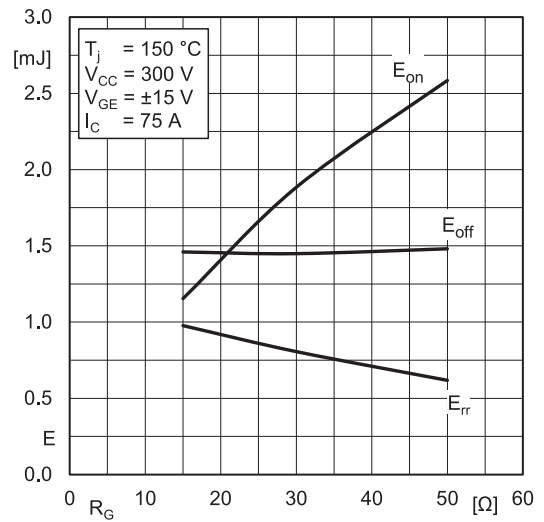


Fig. 4: Typ. IGBT1 & Diode5 turn-on /-off energy = $f(R_G)$

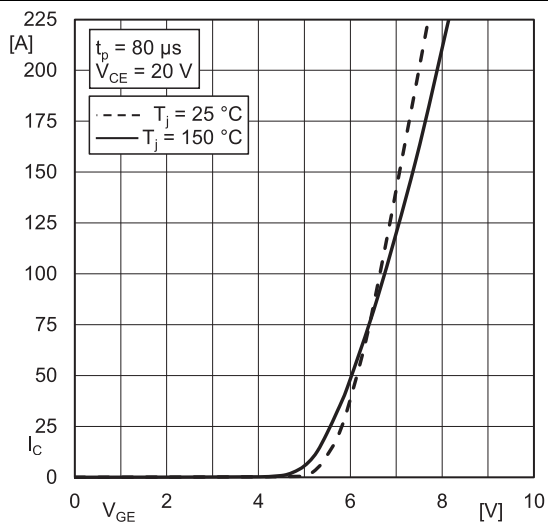


Fig. 5: Typ. IGBT1 transfer characteristic

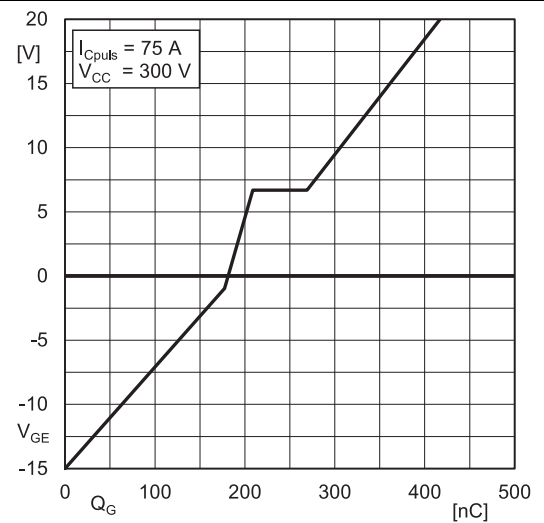


Fig. 6: Typ. IGBT1 gate charge characteristic

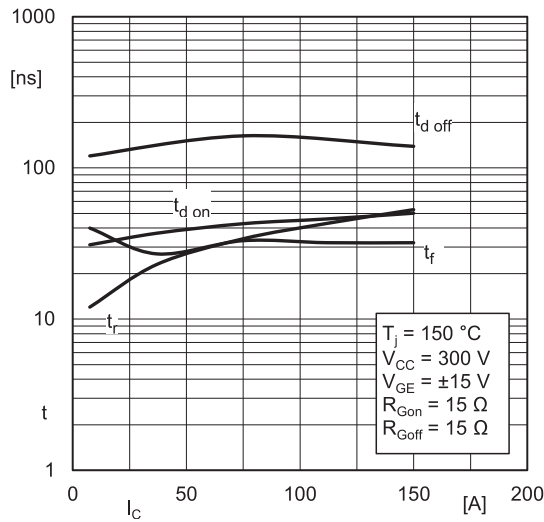


Fig. 7: Typ. IGBT1 switching times vs. I_C

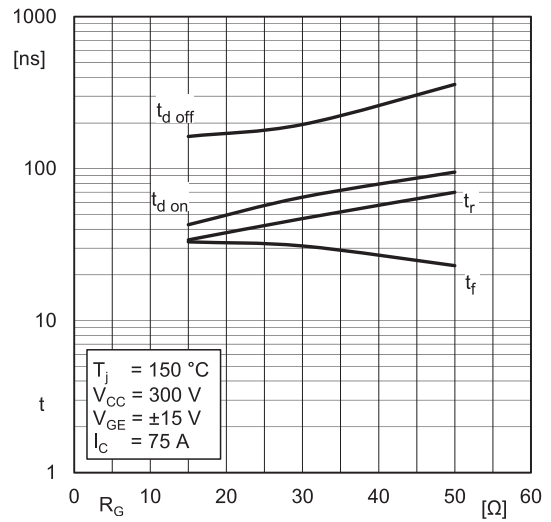


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

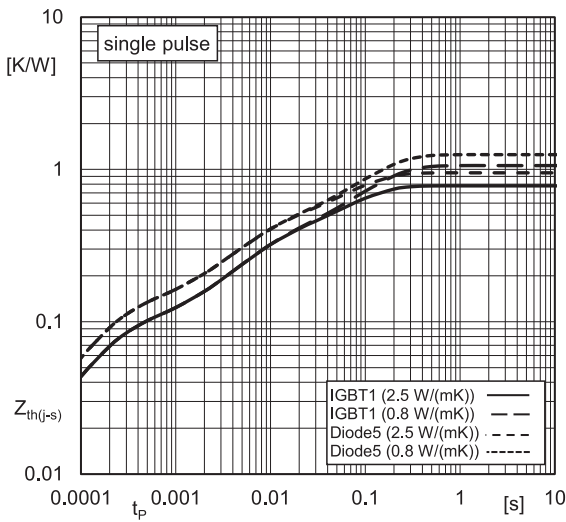


Fig. 9: Typ. transient thermal impedance

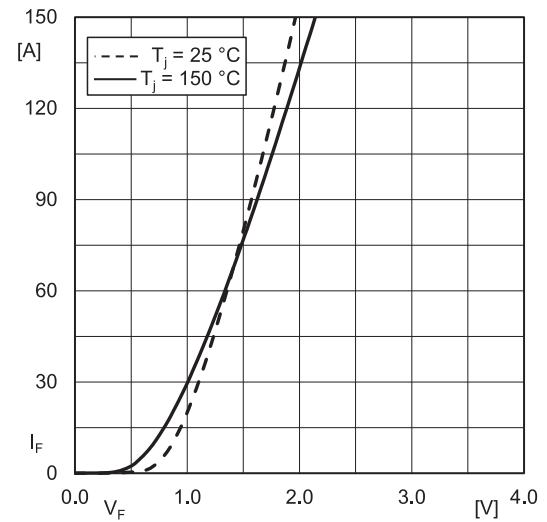


Fig. 10: Typ. Diode5 forward characteristic, incl. $R_{CC'+EE'}$

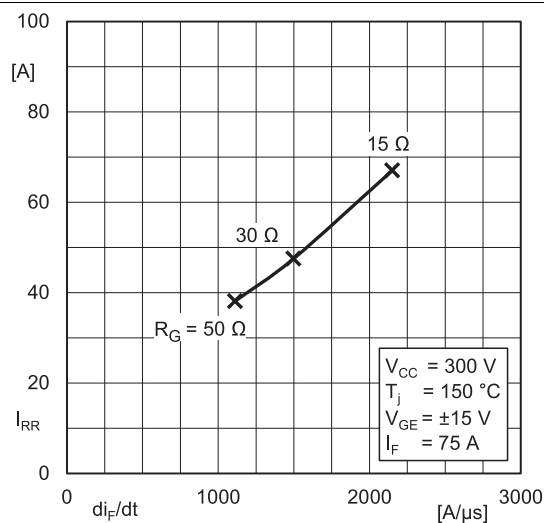


Fig. 11: Typ. Diode5 peak reverse recovery current

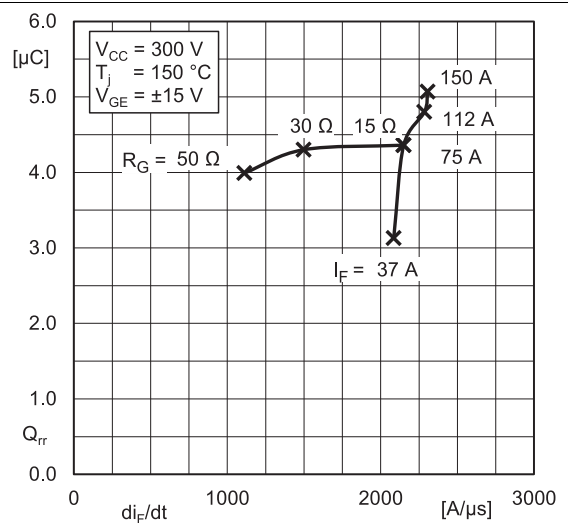


Fig. 12: Typ. Diode5 recovery charge

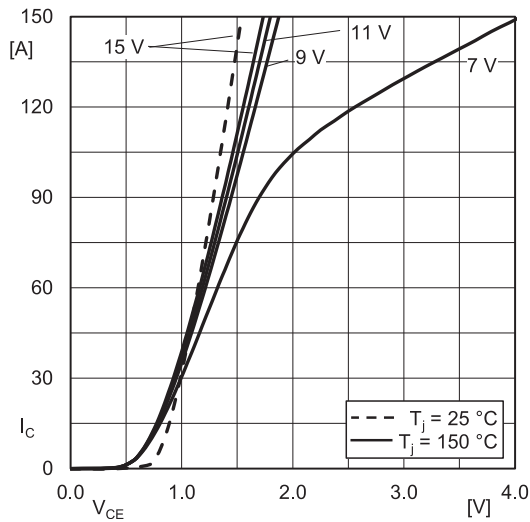


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

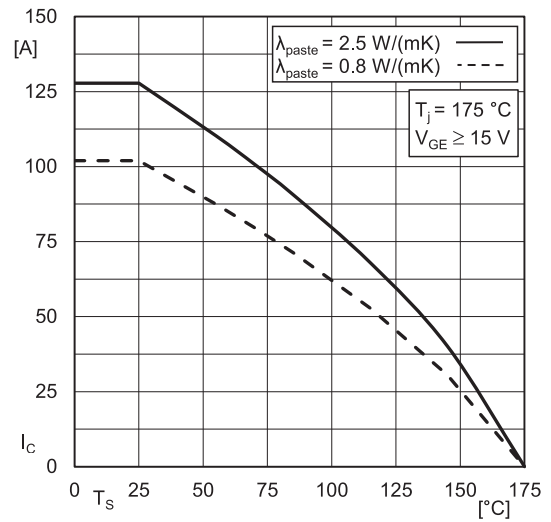


Fig. 14: IGBT2 Rated current vs. Temperature $I_C = f(T_s)$

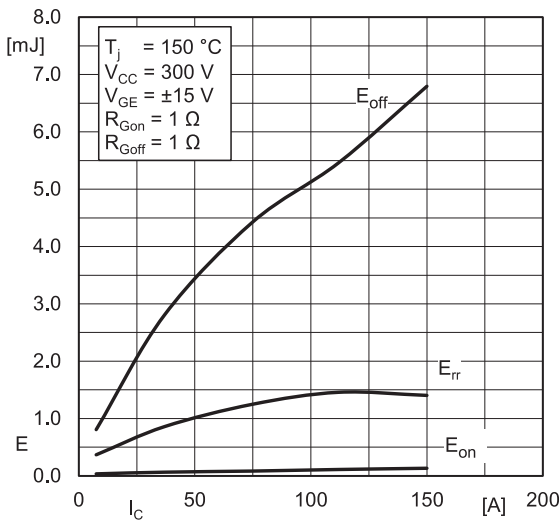


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(I_C)$

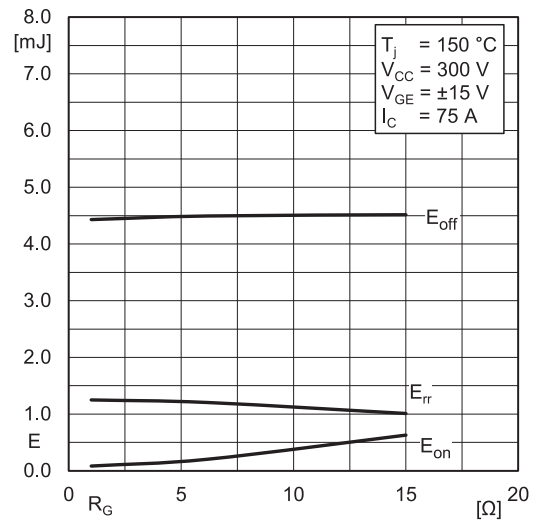


Fig. 16: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(R_G)$

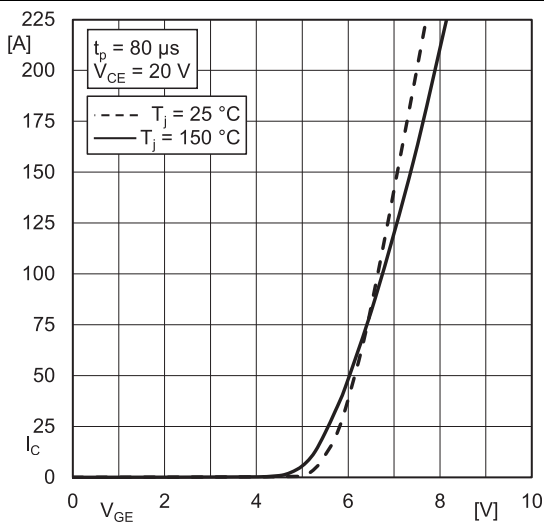


Fig. 17: Typ. IGBT2 transfer characteristic

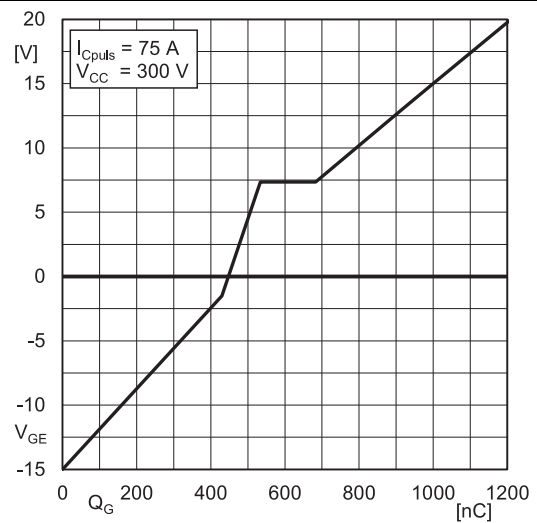
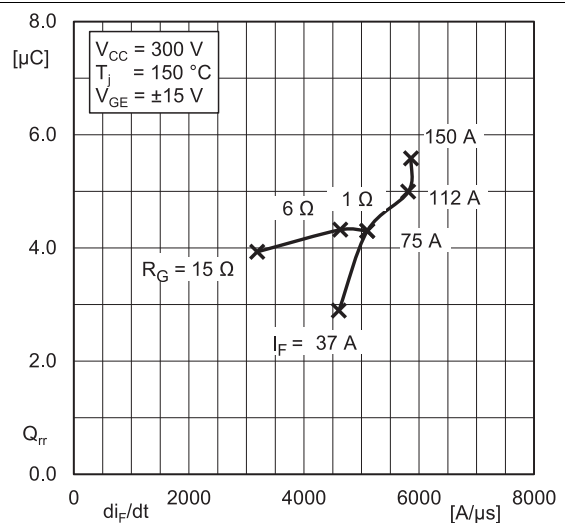
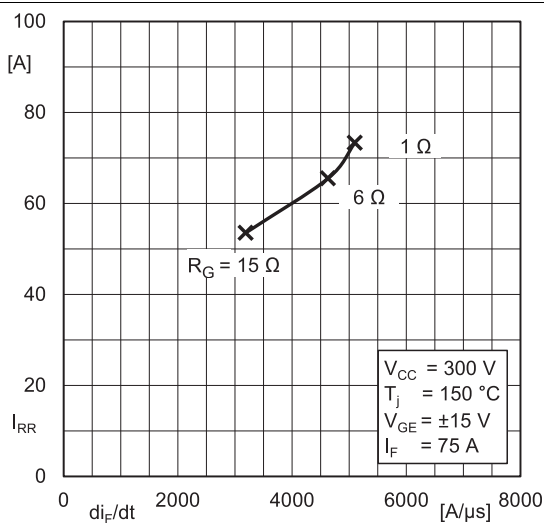
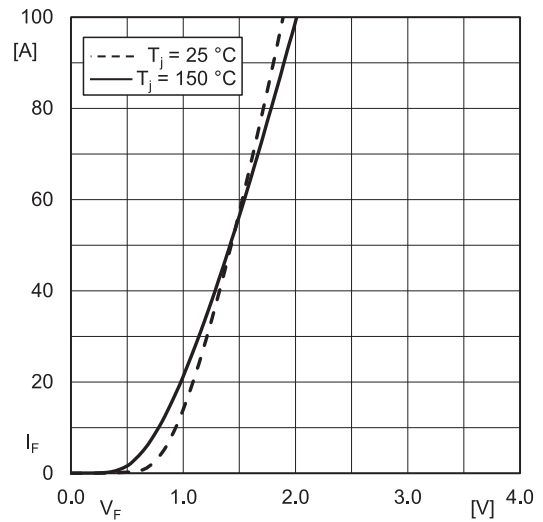
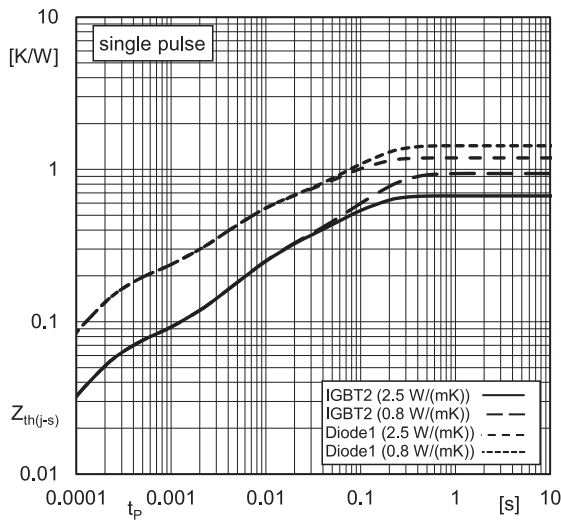
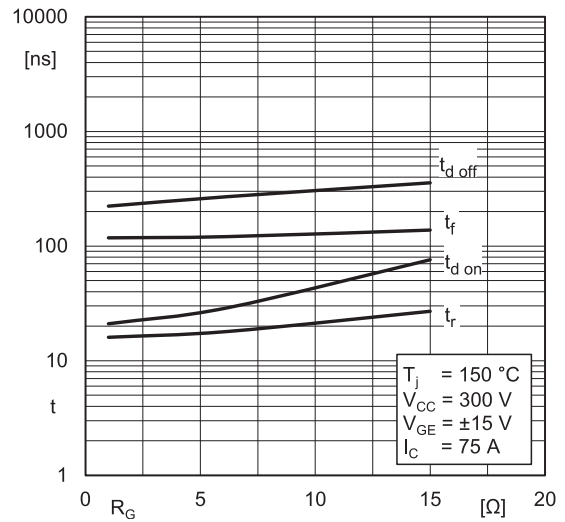
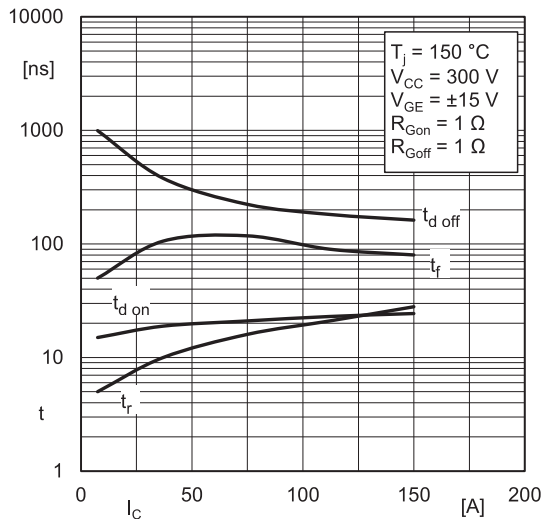
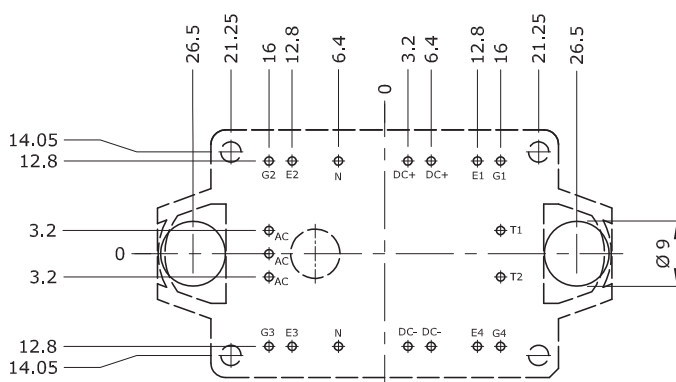
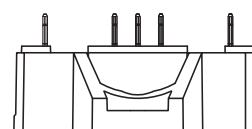
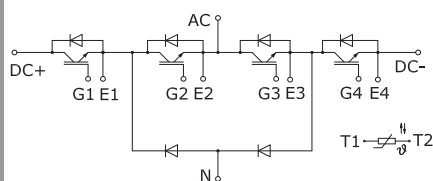


Fig. 18: Typ. IGBT2 gate charge characteristic





- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern $\boxed{\Phi \pm 0.1}$
- Diameters of drill $\varnothing$ 1.15mm
- Copper thickness in hole 25 - 50 μ m
- Hole specification for contacts:
refer to SEMITOP E1/E2 Mounting Instruction



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

***IMPORTANT INFORMATION AND WARNINGS**

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