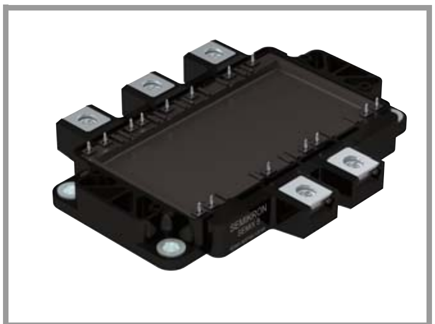


SEMiX® 5

3-Level NPC IGBT-Module

SEMiX305MLI12E4

Features

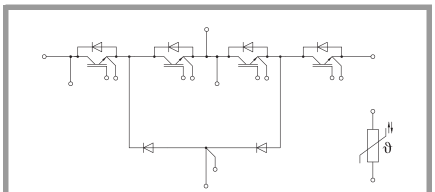
- Solderless assembling solution with PressFIT signal pins and screw power terminals
- IGBT 4 Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Remarks*

- Case temperature limited to T_C=125°C max.
- Product reliability results valid for T_j ≤150°C (recommended Tj,op= -40…+150°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
- For storage and case temperature with TIM see document “TP(HALA P8) SEMiX 5p”

Footnotes

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



MLI

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT1				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	451	A
		T_c = 80 °C	347	A
I_{Cnom}			300	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		900	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		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	451	A
		T_c = 80 °C	347	A
I_{Cnom}			300	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		900	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
Diode1				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_c = 25 °C	344	A
		T_c = 80 °C	257	A
I_{Fnom}			300	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		600	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		1620	A
T_j			-40 ... 175	°C
Diode2				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_c = 25 °C	344	A
		T_c = 80 °C	257	A
I_{Fnom}			300	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		600	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		1620	A
T_j			-40 ... 175	°C
Diode5				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_c = 25 °C	344	A
		T_c = 80 °C	257	A
I_{Fnom}			300	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		600	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		1620	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			340	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC sinus 50Hz, t = 1 min		4000	V

SEMiX® 5

3-Level NPC IGBT-Module

SEMiX305MLI12E4

Features

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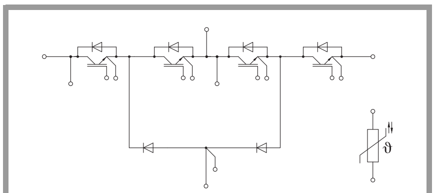
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Remarks*

- Case temperature limited to T_C=125°C max.
- Product reliability results valid for T_j ≤150°C (recommended Tj,op= -40…+150°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
- For storage and case temperature with TIM see document “TP(HALA P8) SEMiX 5p”

Footnotes

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



MLI

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT1						
$V_{CE(sat)}$	I_C = 300 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		3.3	3.8	mΩ
		T_j = 150 °C		5.0	5.3	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 12 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				4	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		18.6		nF
C_{oes}		f = 1 MHz		1.16		nF
C_{res}		f = 1 MHz		1.02		nF
Q_G	V_{GE} = - 8 V...+ 15 V			1700		nC
R_{Gint}	T_j = 25 °C			2.5		Ω
$t_{d(on)}$	V_{CC} = 600 V, I_C = 300 A, V_{GE} = +15/-8 V, $R_{G\ on}$ = 0.5 Ω, $R_{G\ off}$ = 1.5 Ω, di/dt_{on} = 5700 A/µs, di/dt_{off} = 2300 A/µs, du/dt = 3500 V/µs	T_j = 150 °C		71		ns
t_r		T_j = 150 °C		51		ns
E_{on}		T_j = 150 °C		17.4		mJ
$t_{d(off)}$		T_j = 150 °C		488		ns
t_f		T_j = 150 °C		148		ns
E_{off}		T_j = 150 °C		38.7		mJ
$R_{th(j-c)}$	per IGBT				0.1	K/W
$R_{th(c-s)}$	per IGBT (λgrease=0.81 W/(m*K))			0.077		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material			0.037		K/W
IGBT2						
$V_{CE(sat)}$	I_C = 300 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		3.3	3.8	mΩ
		T_j = 150 °C		5.0	5.3	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 12 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				4	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		18.6		nF
C_{oes}		f = 1 MHz		1.16		nF
C_{res}		f = 1 MHz		1.02		nF
Q_G	V_{GE} = - 8 V...+ 15 V			1700		nC
R_{Gint}	T_j = 25 °C			2.5		Ω
$t_{d(on)}$	V_{CC} = 600 V, I_C = 300 A, V_{GE} = +15/-8 V, $R_{G\ on}$ = 0.5 Ω, $R_{G\ off}$ = 1.5 Ω, di/dt_{on} = 4500 A/µs, di/dt_{off} = 2100 A/µs, du/dt = 4000 V/µs	T_j = 150 °C		116		ns
t_r		T_j = 150 °C		58		ns
E_{on}		T_j = 150 °C		17.6		mJ
$t_{d(off)}$		T_j = 150 °C		520		ns
t_f		T_j = 150 °C		158		ns
E_{off}		T_j = 150 °C		40.6		mJ
$R_{th(j-c)}$	per IGBT				0.1	K/W
$R_{th(c-s)}$	per IGBT (λgrease=0.81 W/(m*K))			0.09		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material			0.047		K/W

SEMiX® 5

3-Level NPC IGBT-Module

SEMiX305MLI12E4

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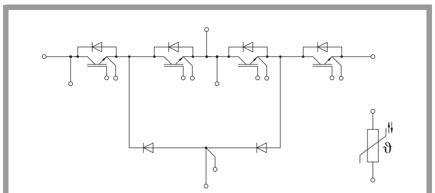
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Remarks*

- Case temperature limited to T_C=125°C max.
- Product reliability results valid for T_j ≤150°C (recommended Tj,op= -40…+150°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
- For storage and case temperature with TIM see document “TP(HALA P8) SEMiX 5p”

Footnotes

[1] Please find further technical information on the SEMIKRON website.



MLI

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Diode1						
$V_F = V_{EC}$	I_F = 300 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.14	2.46	V
		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		2.8	3.2	mΩ
		T_j = 150 °C		3.9	4.3	mΩ
I_{RRM}	I_F = 300 A di/dt_{off} = 4500 A/µs V_{CC} = 600 V V_{GE} = +15/-8 V	T_j = 150 °C		306		A
Q_{rr}		T_j = 150 °C		46		µC
E_{rr}		T_j = 150 °C		22		mJ
$R_{th(j-c)}$	per diode				0.18	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/(m*K))			0.074		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.058		K/W
Diode2						
$V_F = V_{EC}$	I_F = 300 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.14	2.46	V
		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		2.8	3.2	mΩ
		T_j = 150 °C		3.9	4.3	mΩ
I_{RRM}	I_F = 300 A di/dt_{off} = 6000 A/µs V_R = 600 V V_{GE} = +15/-8 V	T_j = 150 °C		306		A
Q_{rr}		T_j = 150 °C		46		µC
E_{rr} [1]		T_j = 150 °C		-		mJ
$R_{th(j-c)}$	per diode				0.18	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/(m*K))			0.098		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.054		K/W
Diode5						
$V_F = V_{EC}$	I_F = 300 A chiplevel	T_j = 25 °C		2.14	2.46	V
		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		2.8	3.2	mΩ
		T_j = 150 °C		3.9	4.3	mΩ
I_{RRM}	I_F = 300 A di/dt_{off} = 5700 A/µs V_R = 600 V V_{GE} = +15/-8 V	T_j = 150 °C		406		A
Q_{rr}		T_j = 150 °C		46		µC
E_{rr}		T_j = 150 °C		24.2		mJ
$R_{th(j-c)}$	per diode				0.18	K/W
$R_{th(c-s)}$	per diode (λgrease=0.81 W/(m*K))			0.109		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.081		K/W

SEMiX® 5

3-Level NPC IGBT-Module

SEMiX305MLI12E4

Features

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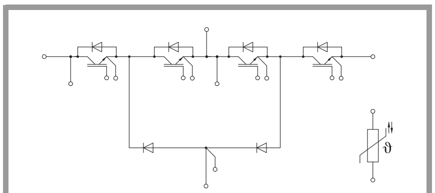
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Remarks*

- Case temperature limited to T_C=125°C max.
- Product reliability results valid for T_j ≤150°C (recommended Tj,op= -40…+150°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
- For storage and case temperature with TIM see document "TP(HALA P8) SEMiX 5p"

Footnotes

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



MLI

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Module						
L_{sCE1}				27		nH
L_{sCE2}				34		nH
$R_{CC'+EE'}$	measured between terminal 5 and 1	T_C = 25 °C		0.8		mΩ
		T_C = 125 °C		1.1		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling			0.009		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module (λ_{grease}=0.81 W/(m*K))			0.014		K/W
$R_{th(c-s)2}$	including thermal coupling, Ts underneath module, pre-applied phase change material			0.008		K/W
M_s	to heat sink (M5)		3		6	Nm
M_t		to terminals (M6)	3		6	Nm
						Nm
w				398		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

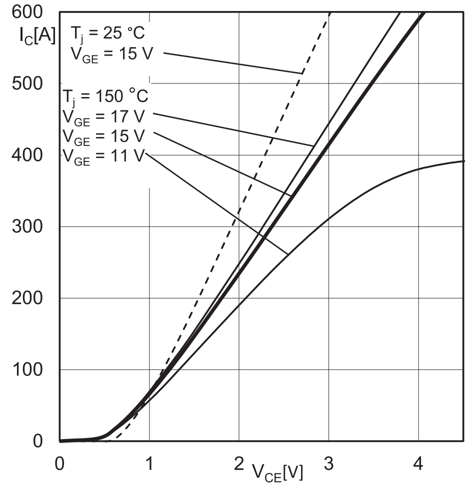


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+ EE'}$

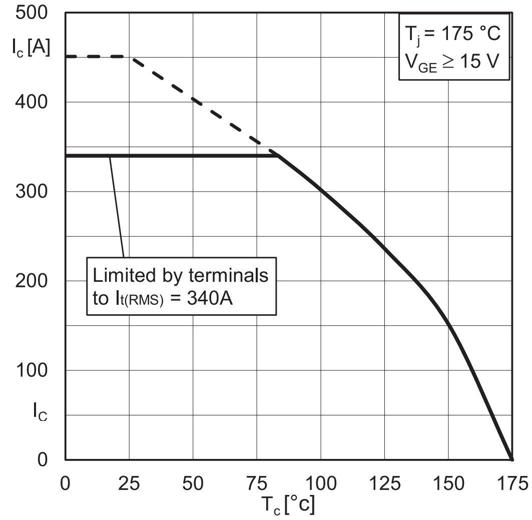


Fig. 2: IGBT1 rated current vs. Temperature I_c=f(T_c)

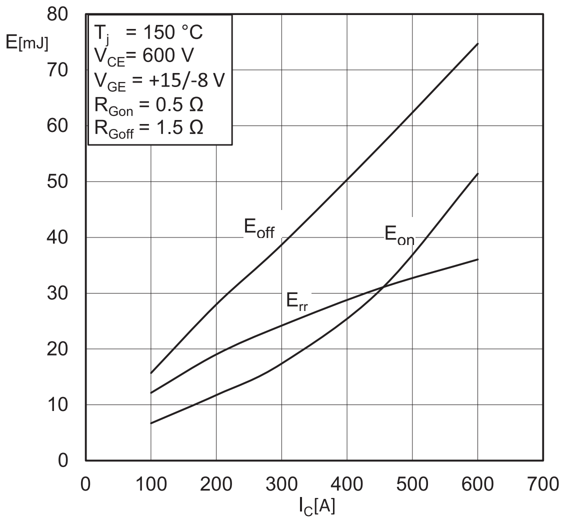


Fig. 3: Typ. IGBT1 & Diode5 turn-on /-off energy = f (I_C)

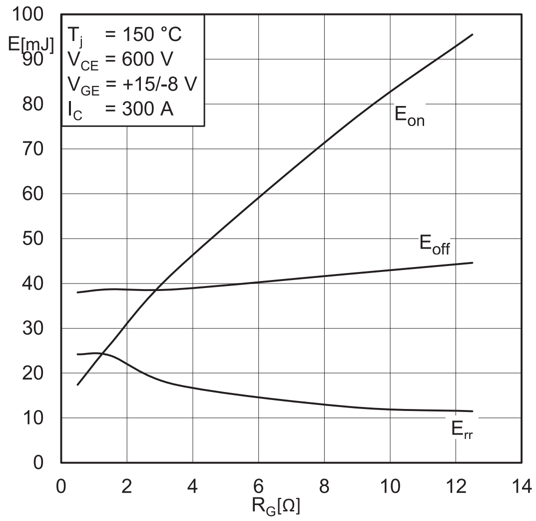


Fig. 4: Typ. IGBT1 & Diode5 turn-on /-off energy = f(R_G)

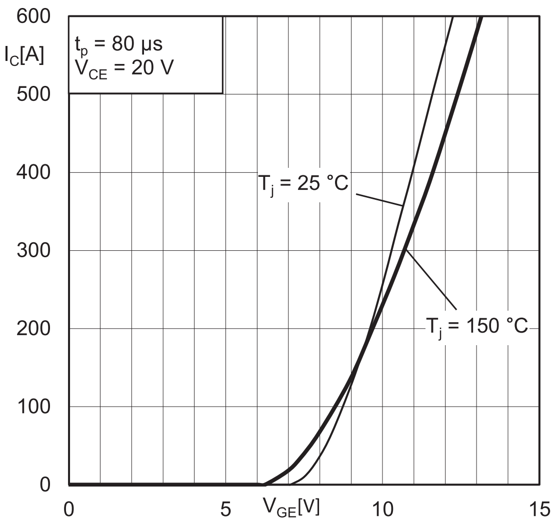


Fig. 5: Typ. IGBT1 transfer characteristic

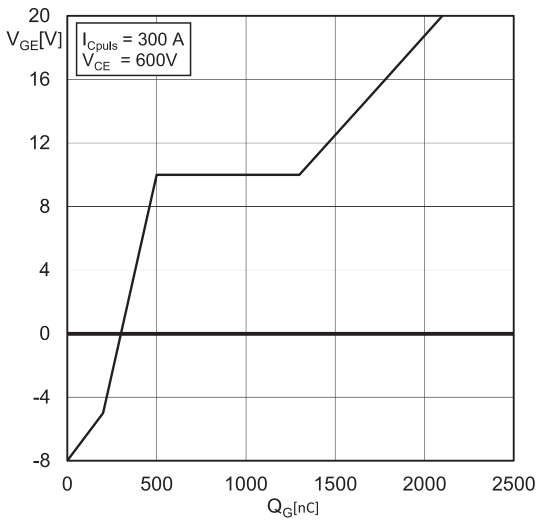


Fig. 6: Typ. IGBT1 gate charge characteristic

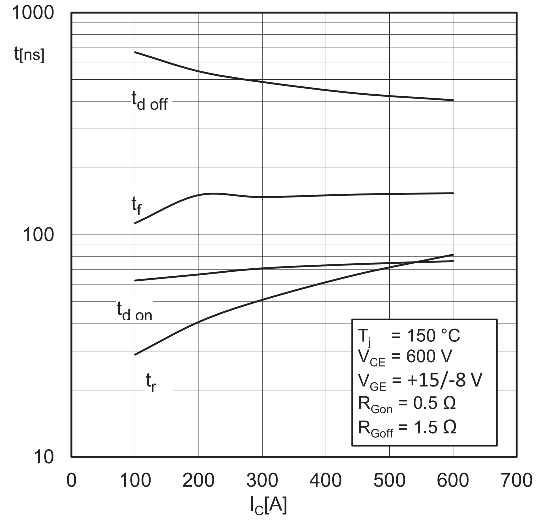


Fig. 7: Typ. IGBT1 switching times vs. I_C

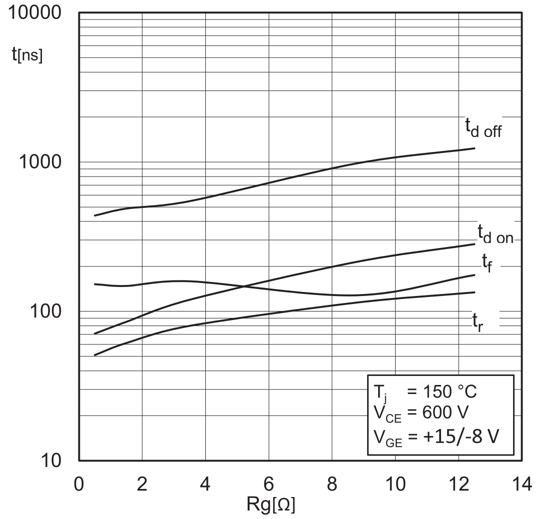


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

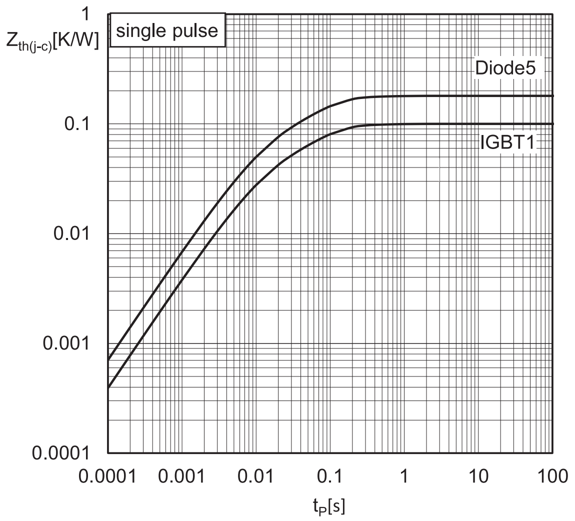


Fig. 9: Transient thermal impedance of IGBT1 & Diode5

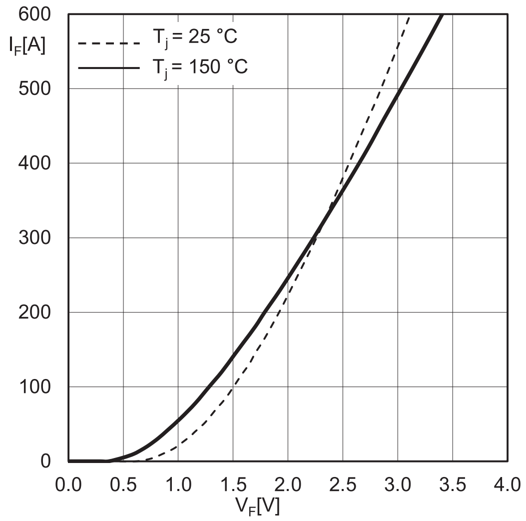


Fig. 10: Typ. Diode5 forward characteristic, incl. $R_{CC'+EE'}$

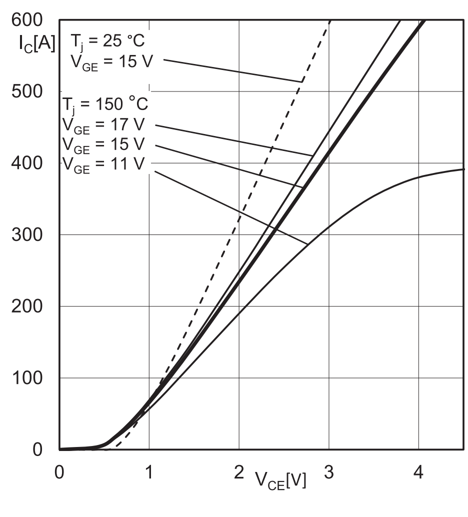


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

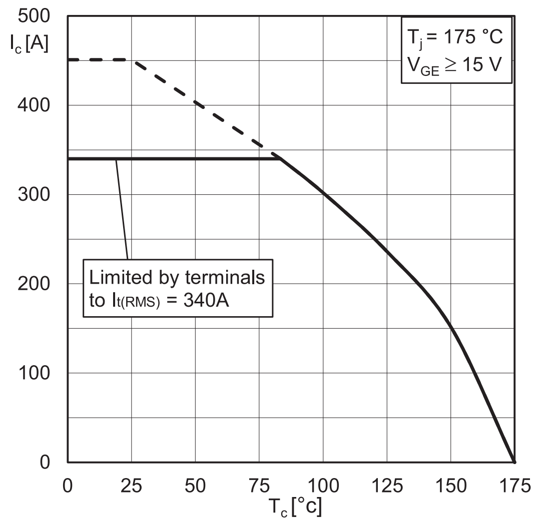


Fig. 14: IGBT2 rated current vs. Temperature $I_c = f(T_c)$

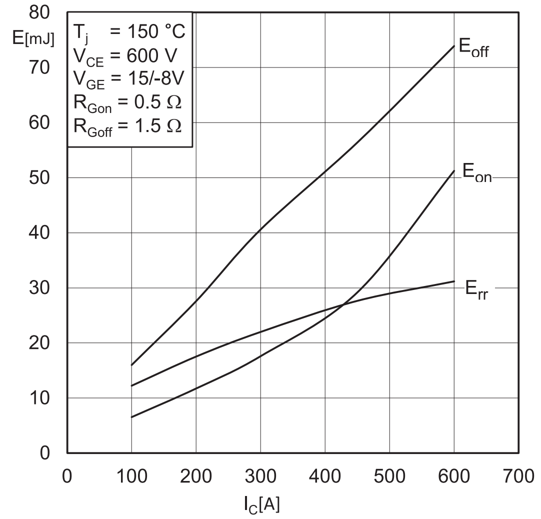


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = f (I_C)

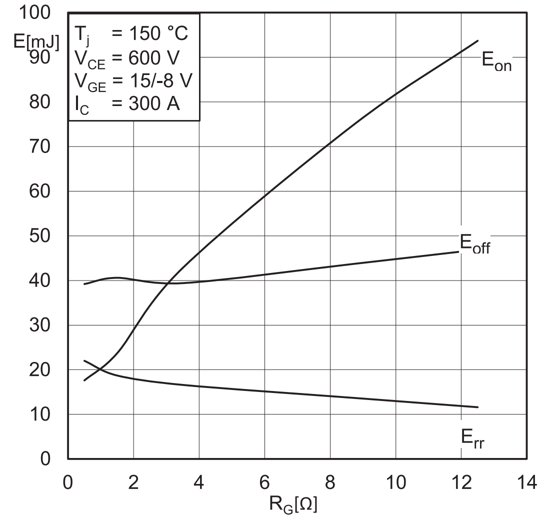


Fig. 16: Typ. IGBT2 & Diode1 turn-on / -off energy = f(R_G)

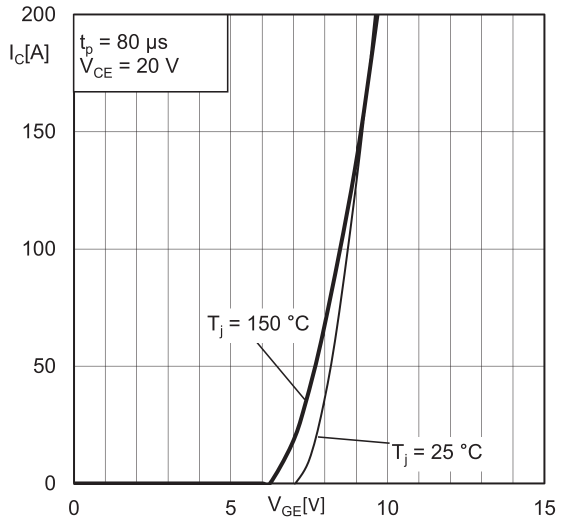


Fig. 17: Typ. IGBT2 transfer characteristic

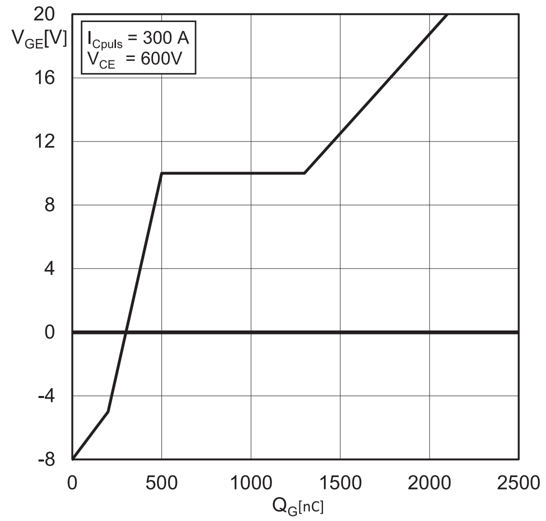


Fig. 18: Typ. IGBT2 gate charge characteristic

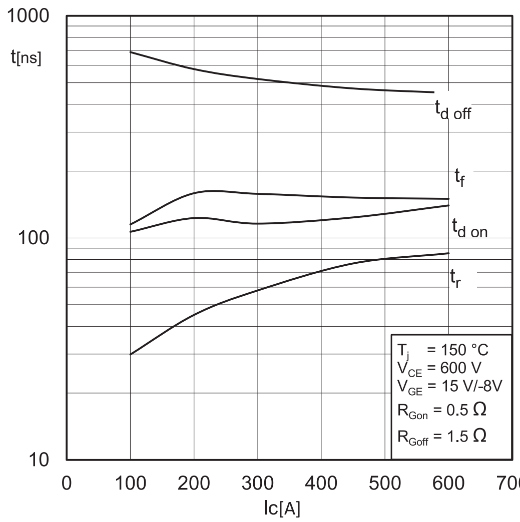


Fig. 19: Typ. IGBT2 switching times vs. I_C

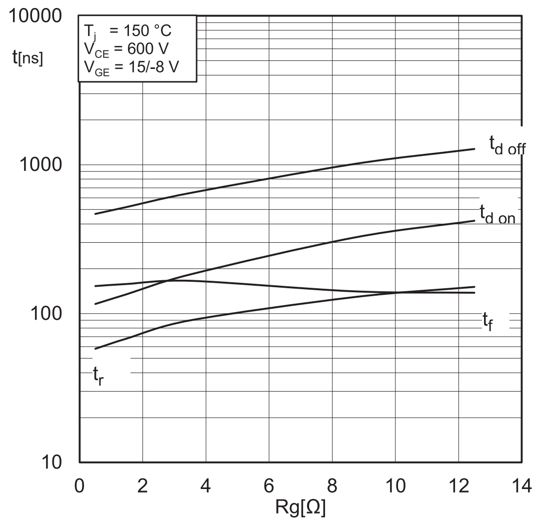


Fig. 20: Typ. IGBT2 switching times vs. gate resistor R_G

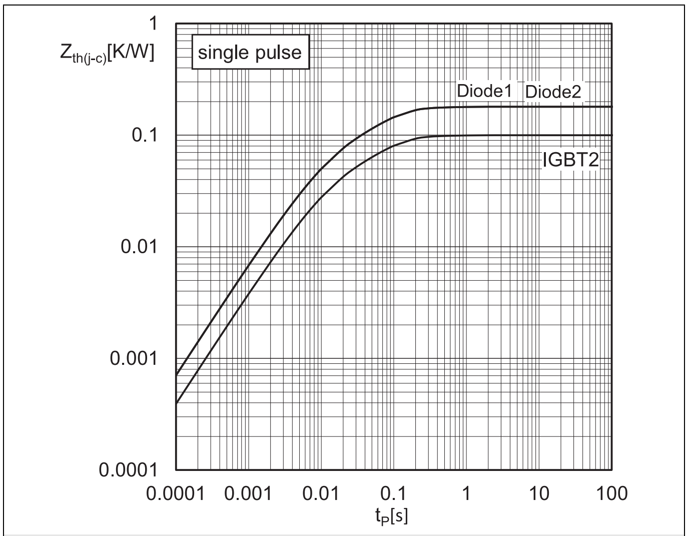


Fig. 21: Transient thermal impedance of IGBT2, Diode1 & Diode2

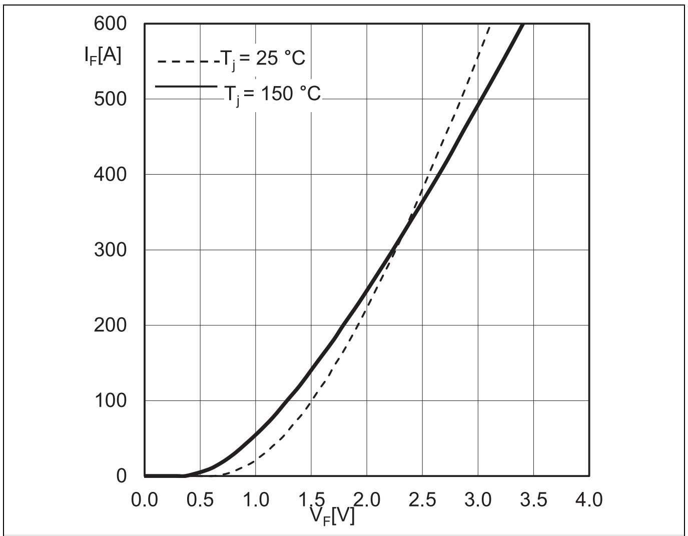
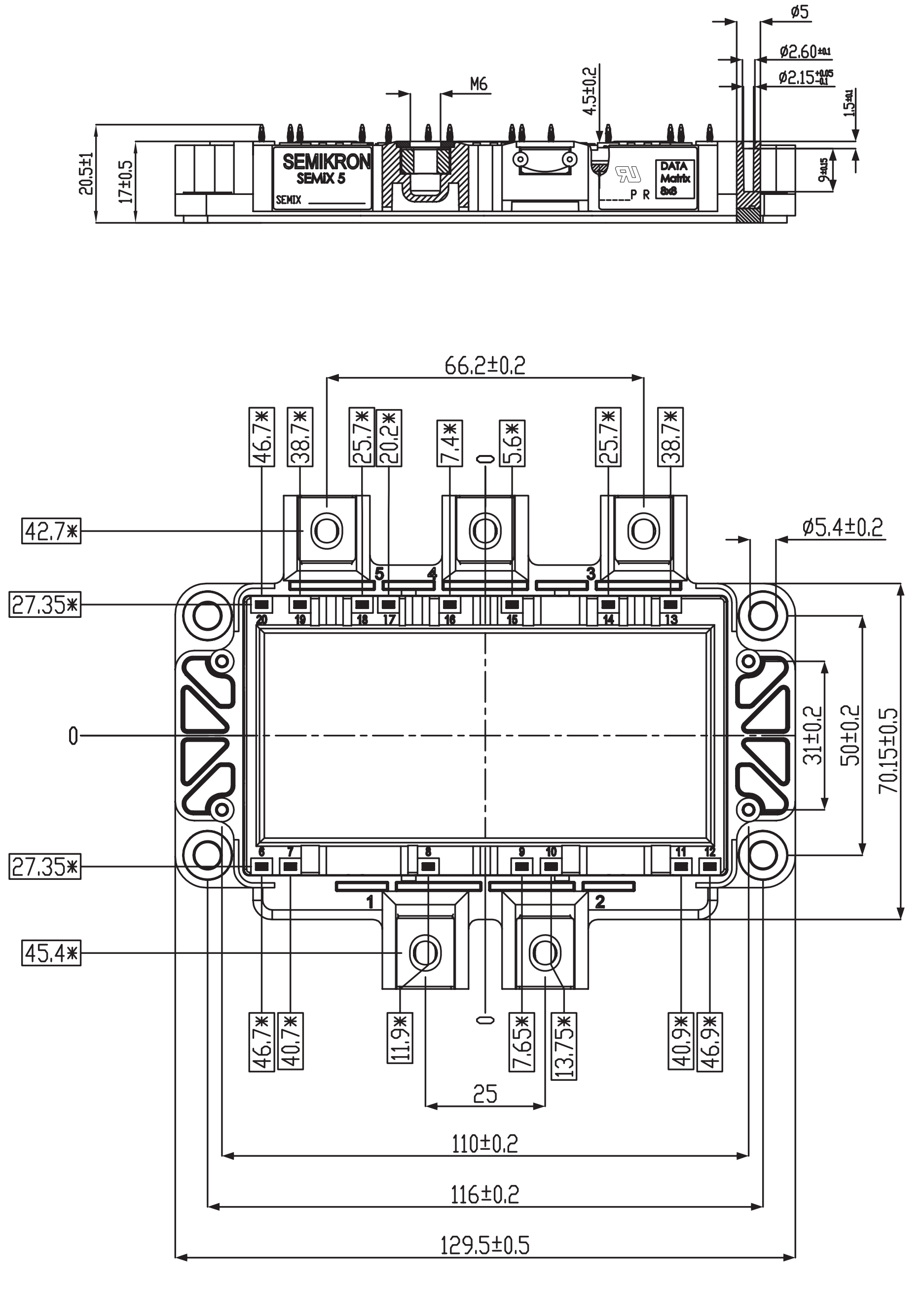


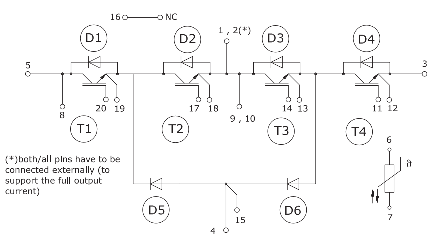
Fig. 22: Typ. Diode1 & Diode2 forward characteristic, incl. $R_{CC'+ EE'}$



* = All dimensions with tolerance of ⌖ | ø 0.4

For technical details please refer
to SEMiX(R)5 Mounting Instruction

SEMiX5p



MLI

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

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