SEMiX305MLI12E4V2

SEMiX® 5

3-Level NPC IGBT-Module

SEMiX305MLI12E4V2

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

Typical Applications

- Solar, Power Supply

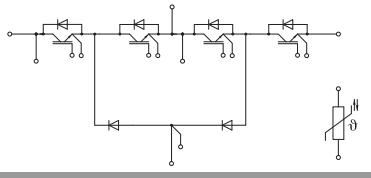
Remarks*

- 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.

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}			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	453	A
		T_c = 80 °C	348	A
I_{Cnom}			300	A
I_{CRM}			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_{FRM}			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_{FRM}			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_{FRM}			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



MLI

SEMiX® 5

3-Level NPC IGBT-Module

SEMiX305MLI12E4V2

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

Typical Applications

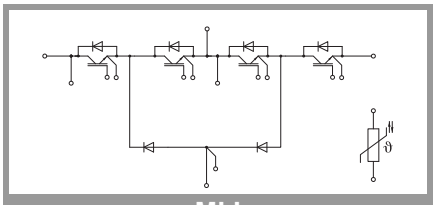
- Solar, Power Supply

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				4.0	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} = -8V...+15V			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 dv/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				4.0	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} = -8V...+15V			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 dv/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

SEMiX305MLI12E4V2

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

Typical Applications

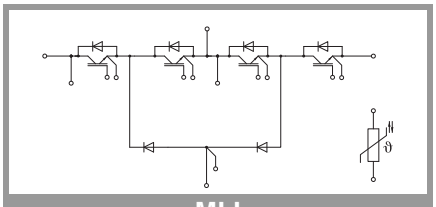
- Solar, Power Supply

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

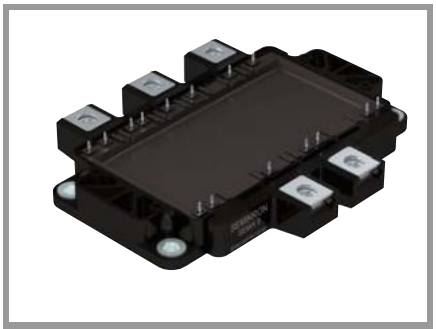
[1] Please find further technical information on the SEMIKRON website.



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

SEMiX305MLI12E4V2

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

Typical Applications

- Solar, Power Supply

Remarks*

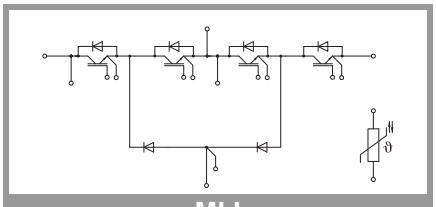
- Case temperature limited to T_C=125°C max.
- Product reliability results valid for T_j ≤150°C (recommended Tj,op= -40…+150°C)
- IGBT1: outer IGBTs T1 & T4
- IGBT2: inner IGBTs T2 & T3
- Diode1: outer diodes D1 & D4
- Diode2: inner diodes D2 & D3
- Diode5: clamping diodes D5 & D6
- For storage and case temperature with TIM see document “TP(HALA P8) SEMiX 5p”

Footnotes

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

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, T_s underneath module (λ_{grease}=0.81 W/(m*K))			0.014		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s 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



MLI

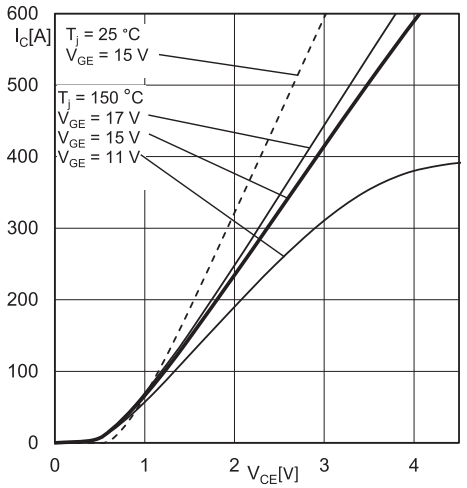


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+EE'}$

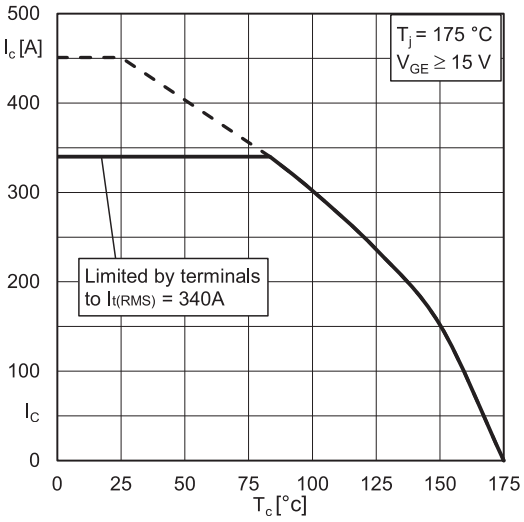


Fig. 2: IGBT1 rated current vs. Temperature $I_c=f(T_c)$

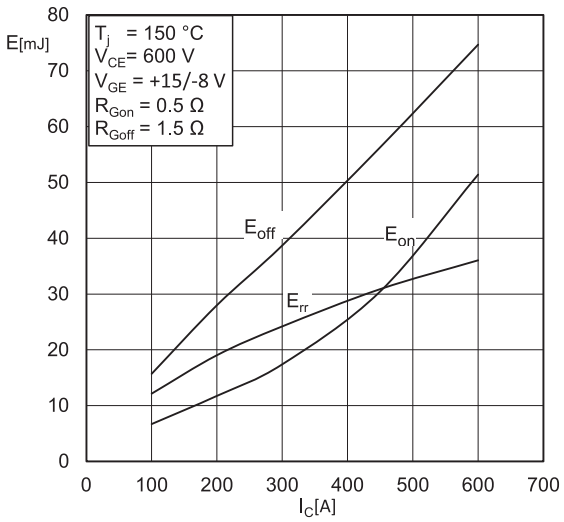


Fig. 3: Typ. IGBT1 & Diode5 turn-on /-off energy = f (I_C)

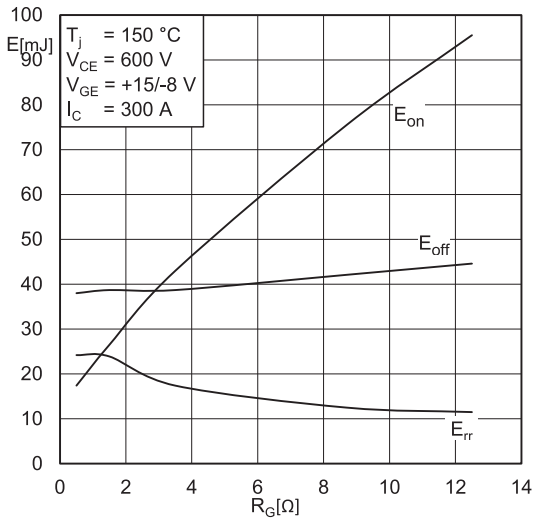


Fig. 4: Typ. IGBT1 & Diode5 turn-on /-off energy = f(R_G)

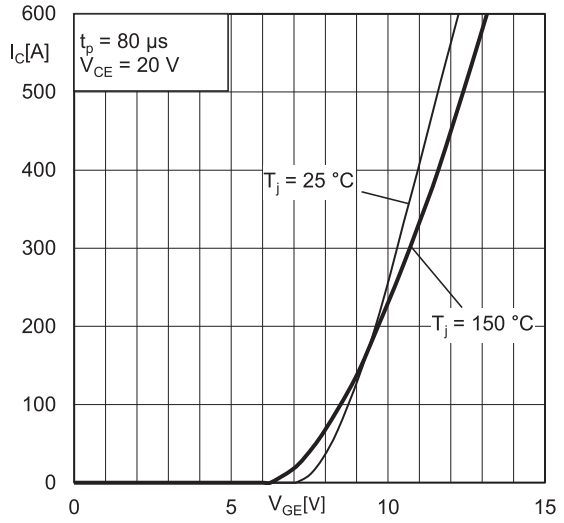


Fig. 5: Typ. IGBT1 transfer characteristic

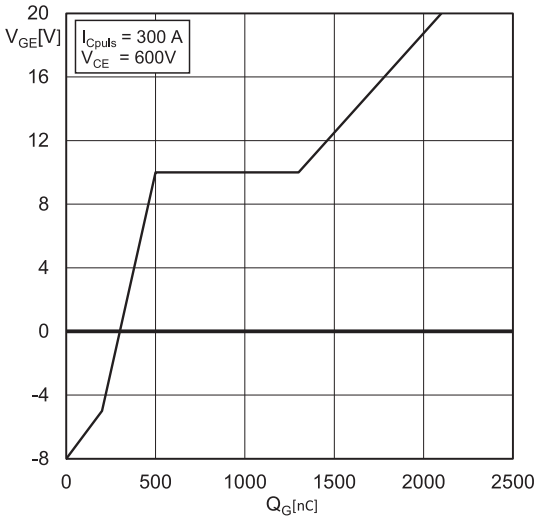


Fig. 6: Typ. IGBT1 gate charge characteristic

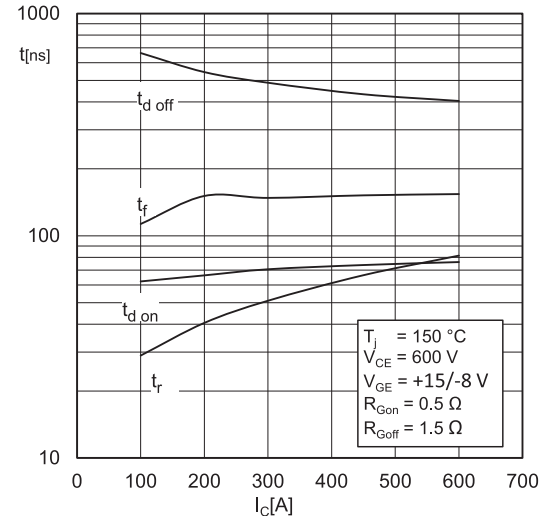


Fig. 7: Typ. IGBT1 switching times vs. I_C

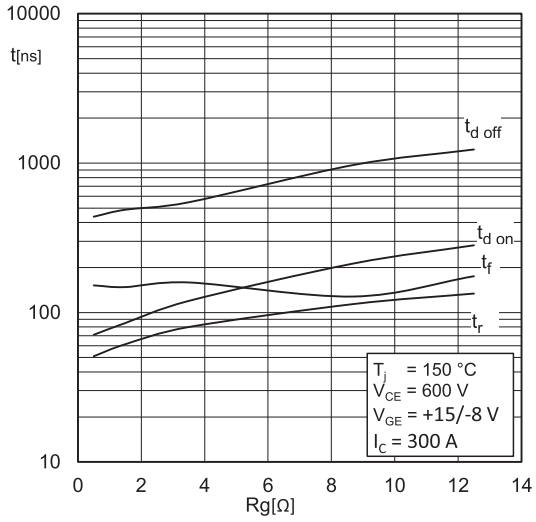


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

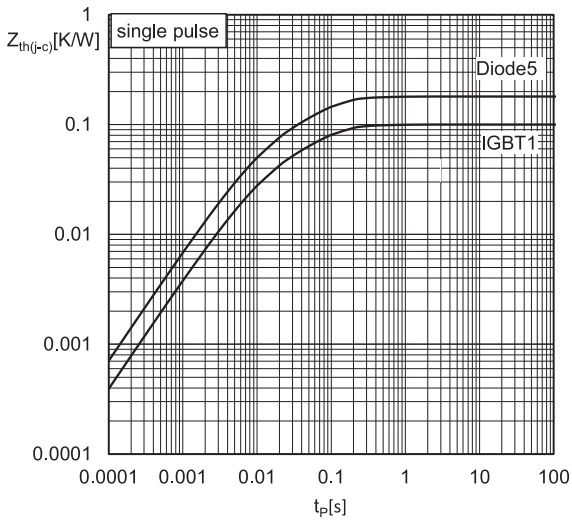


Fig. 9: Transient thermal impedance of IGBT1 & Diode5

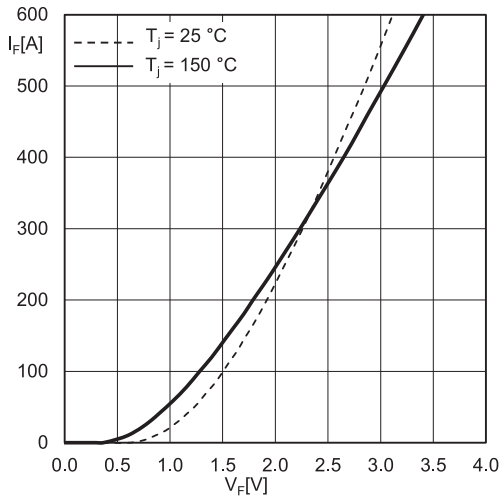


Fig. 10: Typ. Diode5 forward characteristic, incl. $R_{CC'+EE'}$

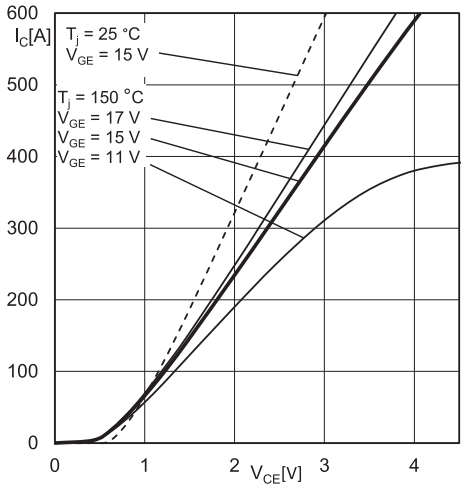


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

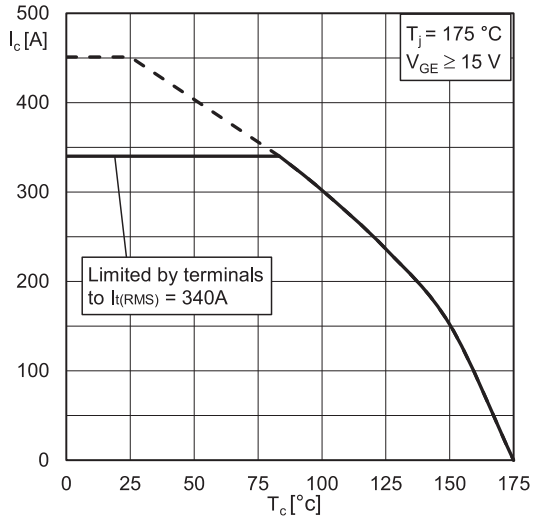


Fig. 14: IGBT2 rated current vs. Temperature $I_c = f(T_c)$

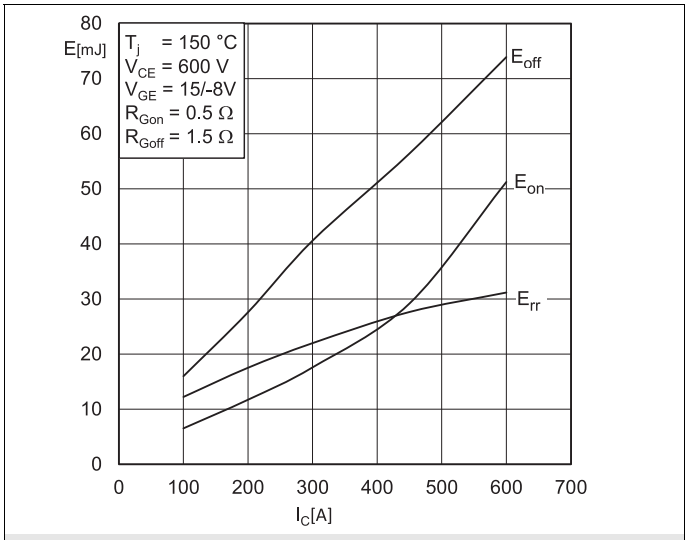


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = f (I_C)

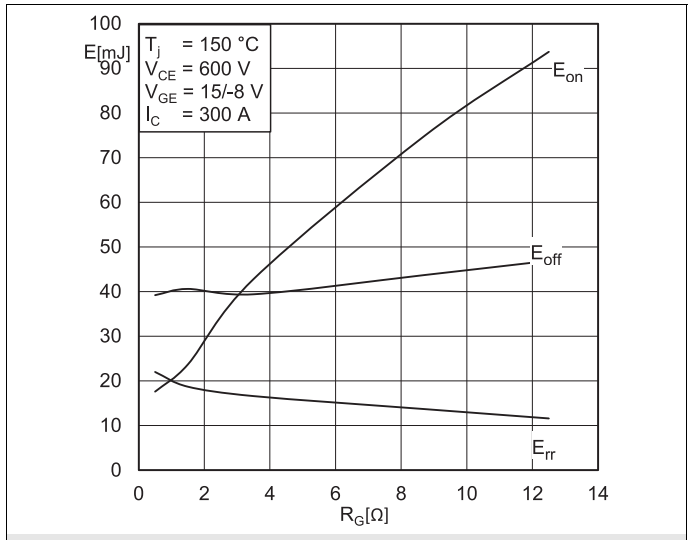


Fig. 16: Typ. IGBT2 & Diode1 turn-on / -off energy = f(R_G)

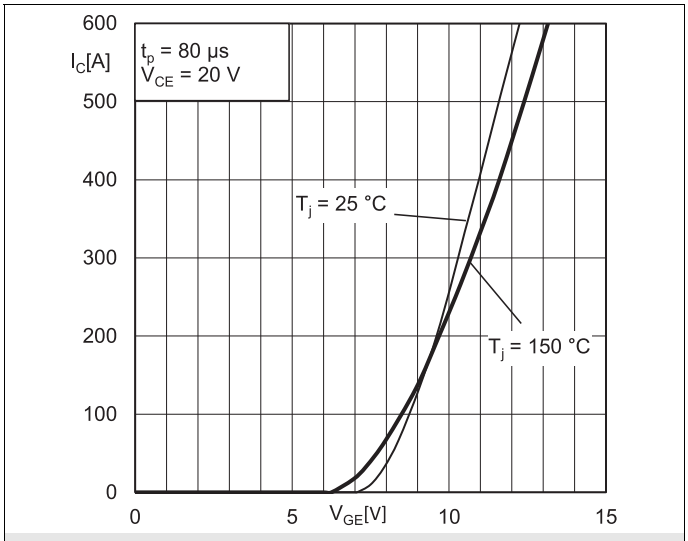


Fig. 17: Typ. IGBT2 transfer characteristic

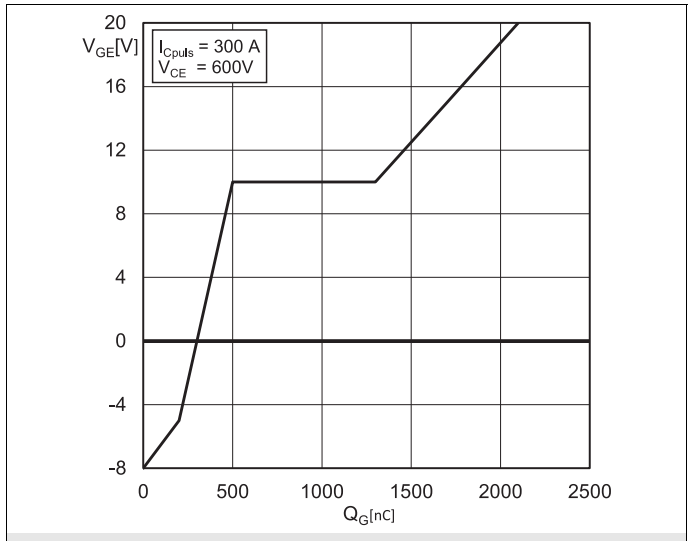


Fig. 18: Typ. IGBT2 gate charge characteristic

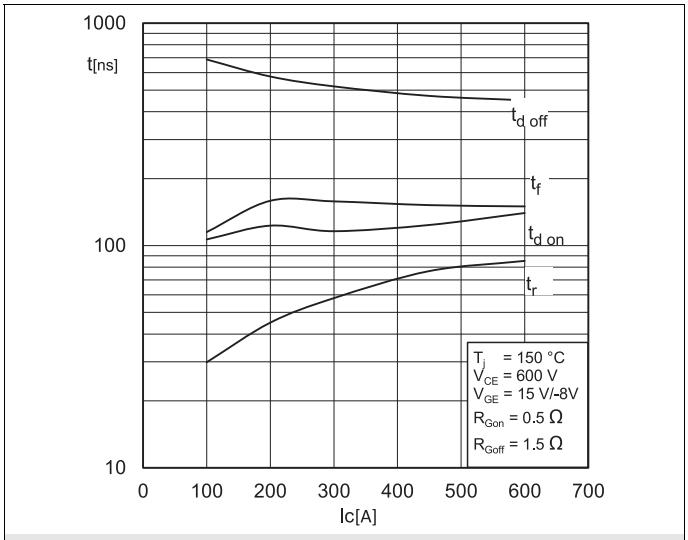


Fig. 19: Typ. IGBT2 switching times vs. I_C

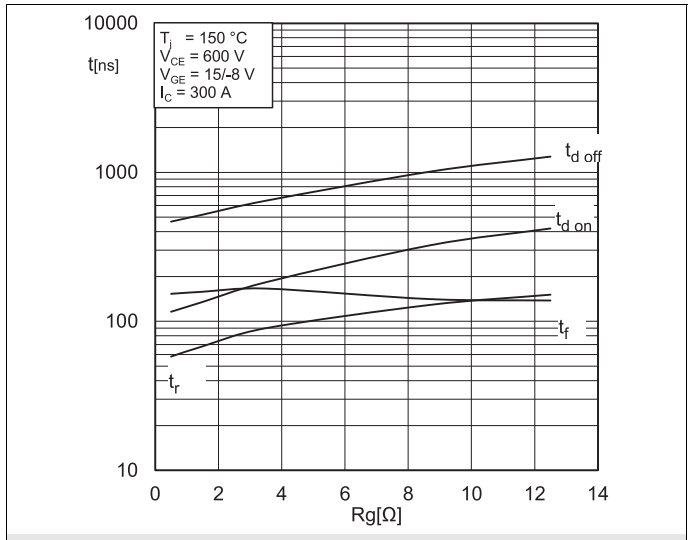


Fig. 20: Typ. IGBT2 switching times vs. gate resistor R_G

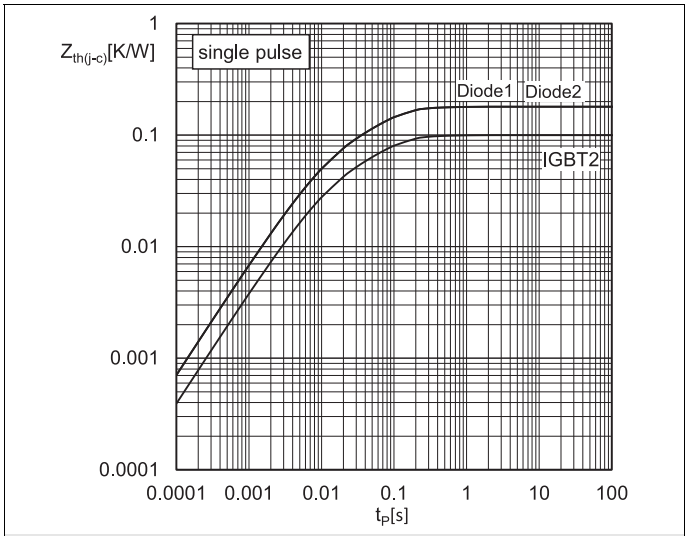


Fig. 21: Transient thermal impedance of IGBT2, Diode1 & Diode2

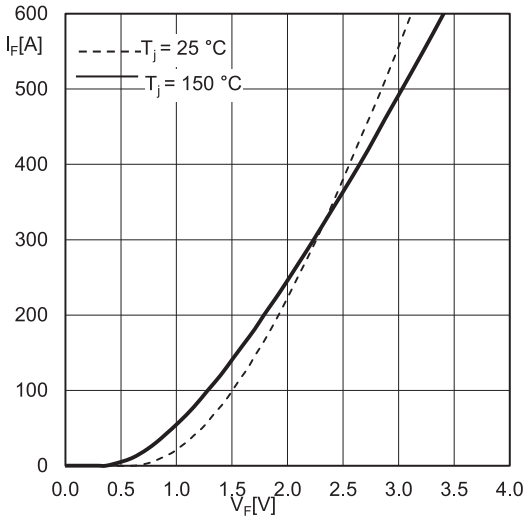
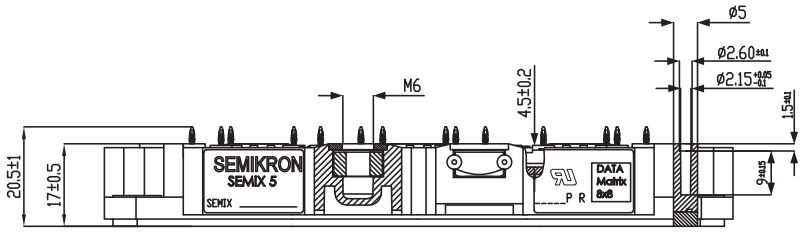
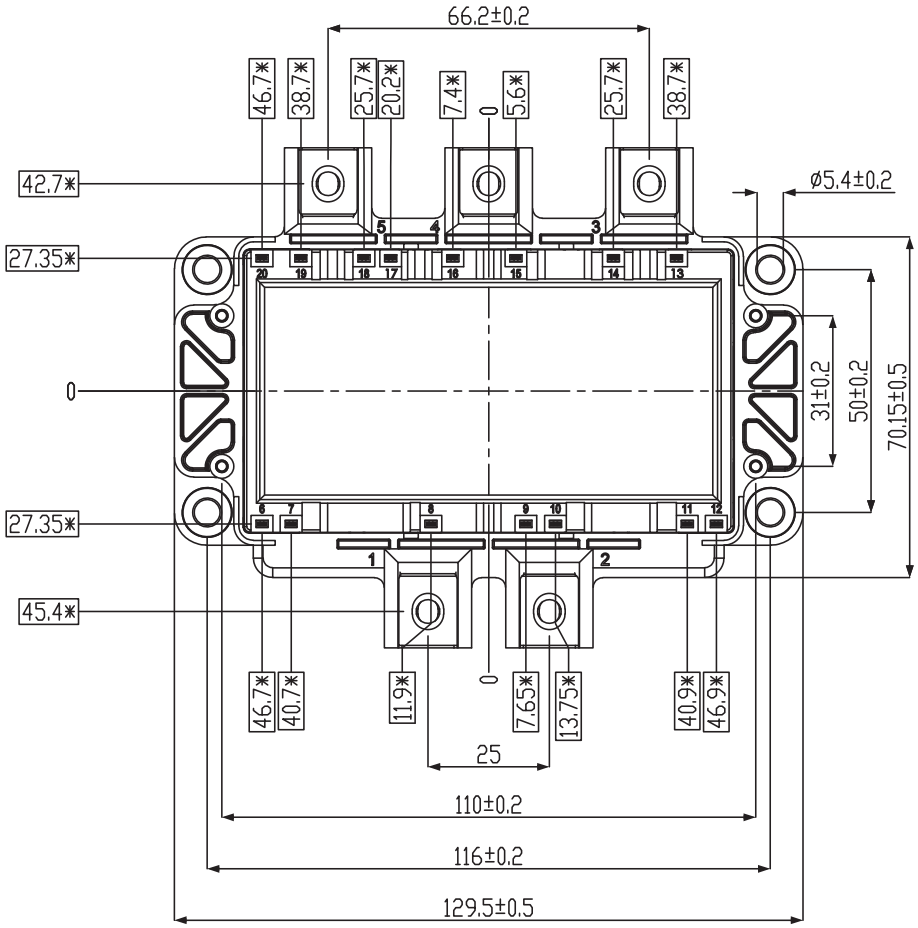


Fig. 22: Typ. Diode1 & Diode2 forward characteristic, incl. $R_{CC'+EE'}$

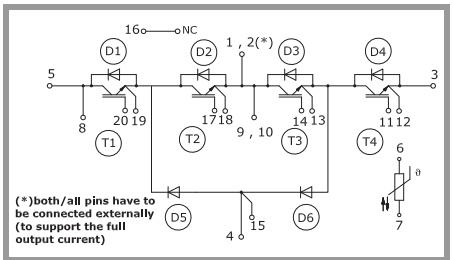




* = Dimensions in mm with tolerance of ⌖ | Ø 0.4

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

SEMiX5p



MLI

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

***IMPORTANT INFORMATION AND WARNINGS**

The specifications of SEMIKRON products may not be considered as guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). The specifications of SEMIKRON products describe only the usual characteristics of products to be expected in typical applications, which may still vary depending on the specific application. Therefore, products must be tested for the respective application in advance. Application adjustments may be necessary. The user of SEMIKRON products is responsible for the safety of their applications embedding SEMIKRON products and must take adequate safety measures to prevent the applications from causing a physical injury, fire or other problem if any of SEMIKRON products become faulty. The user is responsible to make sure that the application design is compliant with all applicable laws, regulations, norms and standards. Except as otherwise explicitly approved by SEMIKRON in a written document signed by authorized representatives of SEMIKRON, SEMIKRON products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury. No representation or warranty is given and no liability is assumed with respect to the accuracy, completeness and/or use of any information herein, including without limitation, warranties of non-infringement of intellectual property rights of any third party. SEMIKRON does not assume any liability arising out of the applications or use of any product; neither does it convey any license under its patent rights, copyrights, trade secrets or other intellectual property rights, nor the rights of others. SEMIKRON makes no representation or warranty of non-infringement or alleged non-infringement of intellectual property rights of any third party which may arise from applications. Due to technical requirements our products may contain dangerous substances. For information on the types in question please contact the nearest SEMIKRON sales office. This document supersedes and replaces all information previously supplied and may be superseded by updates. SEMIKRON reserves the right to make changes.

