SK 70 MLI 12T4 Tp

SEMITOP® 4 Press-Fit

3-Level NPC Inverter

SK 70 MLI 12T4 Tp

Features*

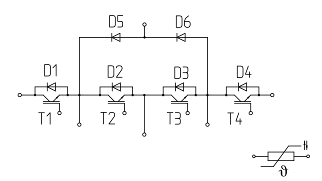
- One screw mounting module
- Solder free mounting with Press-Fit terminals
- Fully compatible with other SEMITOP® Press-Fit types
- Improved thermal performances by aluminium oxide substrate
- 1200V Trench4 IGBT technology
- Robust and soft switching CAL4F diode technology
- Integrated NTC temperature sensor
- UL recognized, file no. E 63 532

Remarks*

- Recommended T_{jop}= -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

Footnotes

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



MLI-T

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT1				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_s = 25 °C	98	A
		T_s = 70 °C	80	A
I_{Cnom}			70	A
I_{CRM}			210	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_s = 25 °C	98	A
		T_s = 70 °C	80	A
I_{Cnom}			70	A
I_{CRM}			210	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_s = 25 °C	78	A
		T_s = 70 °C	63	A
I_{FRM}			140	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		306	A
T_j			-40 ... 175	°C
Diode2				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_s = 25 °C	78	A
		T_s = 70 °C	63	A
I_{FRM}			140	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		306	A
T_j			-40 ... 175	°C
Diode5				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_s = 25 °C	78	A
		T_s = 70 °C	63	A
I_{FRM}			140	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		306	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	$\Delta T_{terminal}$ at PCB joint = 30 K, per pin		35	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC, sinusoidal, t = 1 min		2500	V

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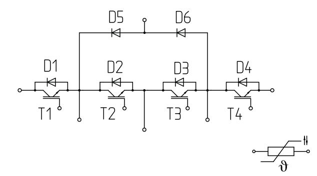

MLI-T

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT1						
$V_{CE(sat)}$	I_C = 70 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.85	2.10	V
		T_j = 150 °C		2.25	2.45	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		15	17	mΩ
		T_j = 150 °C		22	24	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 2.4 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		3.9		nF
C_{oes}		f = 1 MHz		0.31		nF
C_{res}		f = 1 MHz		0.23		nF
Q_G	V_{GE} = -15 V ... +15 V			516		nC
R_{Gint}	T_j = 25 °C			2.4		Ω
$t_{d(on)}$	V_{CE} = 600 V, I_C = 70 A, V_{GE} = +15/-15 V, $R_{G\,on}$ = 1.8 Ω, $R_{G\,off}$ = 1.8 Ω, di/dt_{on} = 1750 A/µs, di/dt_{off} = 1386 A/µs, dv/dt = 3780 V/µs	T_j = 150 °C		14		ns
t_r		T_j = 150 °C		34		ns
E_{on}		T_j = 150 °C		5.5		mJ
$t_{d(off)}$		T_j = 150 °C		248		ns
t_f		T_j = 150 °C		67		ns
E_{off}		T_j = 150 °C		6.5		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.47		K/W
IGBT2						
$V_{CE(sat)}$	I_C = 70 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.85	2.10	V
		T_j = 150 °C		2.25	2.45	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		15	17	mΩ
		T_j = 150 °C		22	24	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 2.4 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		3.9		nF
C_{oes}		f = 1 MHz		0.31		nF
C_{res}		f = 1 MHz		0.23		nF
Q_G	V_{GE} = -15 V ... +15 V			516		nC
R_{Gint}	T_j = 25 °C			2.4		Ω
$t_{d(on)}$	V_{CE} = 600 V, I_C = 70 A, V_{GE} = +15/-15 V, $R_{G\,on}$ = 1.8 Ω, $R_{G\,off}$ = 1.8 Ω, di/dt_{on} = 1883 A/µs, di/dt_{off} = 1386 A/µs, dv/dt = 4508 V/µs	T_j = 150 °C		14		ns
t_r		T_j = 150 °C		36		ns
E_{on}		T_j = 150 °C		6		mJ
$t_{d(off)}$		T_j = 150 °C		248		ns
t_f		T_j = 150 °C		67		ns
E_{off}		T_j = 150 °C		6.8		mJ
$R_{th(j-s)}$	per IGBT			0.47		K/W

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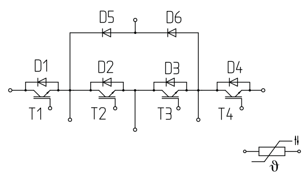

MLI-T

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Diode1						
$V_F = V_{EC}$	I_F = 70 A	T_j = 25 °C		2.30	2.62	V
	chiplevel	T_j = 150 °C		2.29	2.62	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		14	16	mΩ
		T_j = 150 °C		20	22	mΩ
I_{RRM}	I_F = 70 A	T_j = 150 °C		59		A
Q_{rr}	di/dt_{off} = 1883 A/µs V_R = 600 V	T_j = 150 °C		9.95		µC
E_{rr}	V_{GE} = -15 V	T_j = 150 °C		3.3		mJ
$R_{th(j-s)}$	per Diode			0.73		K/W
Diode2						
$V_F = V_{EC}$	I_F = 70 A	T_j = 25 °C		2.30	2.62	V
	chiplevel	T_j = 150 °C		2.29	2.62	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		14	16	mΩ
		T_j = 150 °C		20	22	mΩ
I_{RRM}	I_F = 70 A	T_j = 150 °C		-		A
Q_{rr}	V_R = 600 V	T_j = 150 °C		-		µC
E_{rr} 1)	V_{GE} = -15 V	T_j = 150 °C		-		mJ
$R_{th(j-s)}$	per Diode			0.73		K/W
Diode5						
$V_F = V_{EC}$	I_F = 70 A	T_j = 25 °C		2.30	2.62	V
	chiplevel	T_j = 150 °C		2.29	2.62	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		14	16	mΩ
		T_j = 150 °C		20	22	mΩ
I_{RRM}	I_F = 70 A	T_j = 150 °C		42		A
Q_{rr}	di/dt_{off} = 1750 A/µs V_R = 600 V	T_j = 150 °C		7.12		µC
E_{rr}	V_{GE} = -15 V	T_j = 150 °C		2.3		mJ
$R_{th(j-s)}$	per Diode			0.73		K/W

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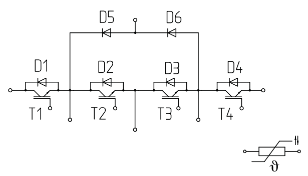


MLI-T

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Module						
L_{sCE1}				17		nH
L_{sCE2}				21		nH
$R_{CC'+EE'}$	per switch	T_s = 25 °C		1.5		mΩ
		T_s = 150 °C		2		mΩ
M_s	to heatsink		2.5		2.75	Nm
M_t				-		Nm
				-		Nm
w				60		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

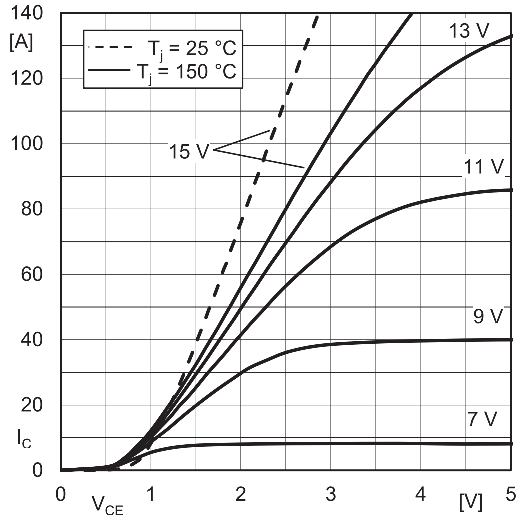


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+ EE'}$

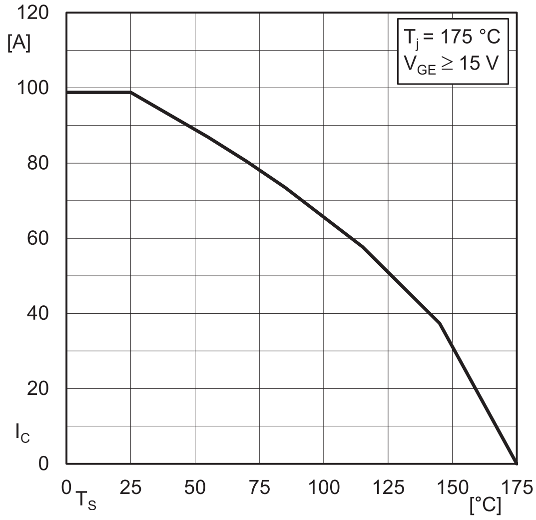


Fig. 2: IGBT1 rated current vs. Temperature $I_c=f(T_s)$

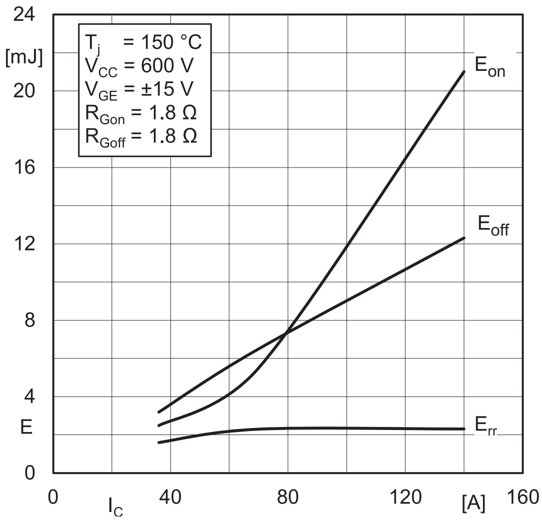


Fig. 3: Typ. IGBT1 & Diode5 turn-on /-off energy = f (I_C)

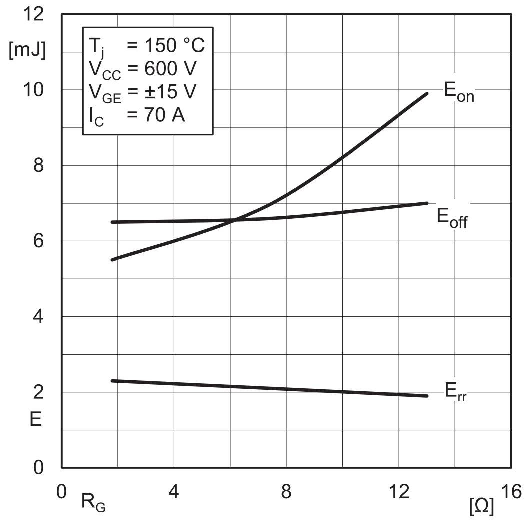


Fig. 4: Typ. IGBT1 & Diode5 turn-on /-off energy = f(R_G)

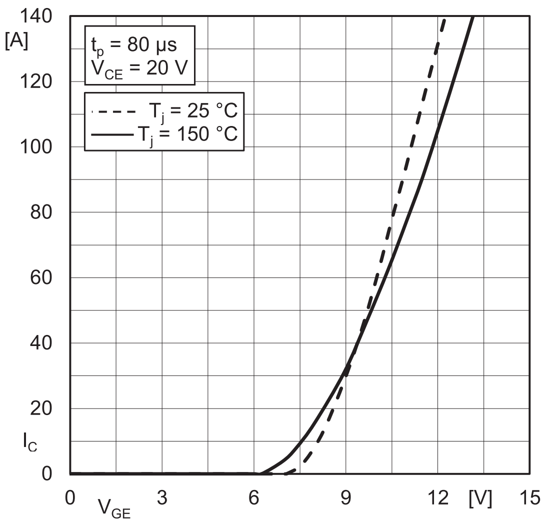


Fig. 5: Typ. IGBT1 transfer characteristic

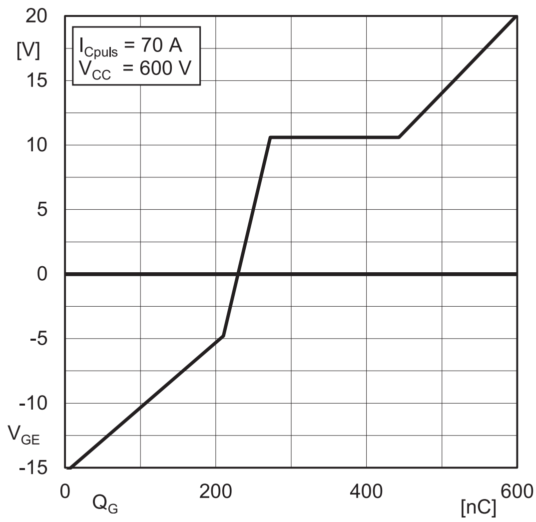


Fig. 6: Typ. IGBT1 gate charge characteristic

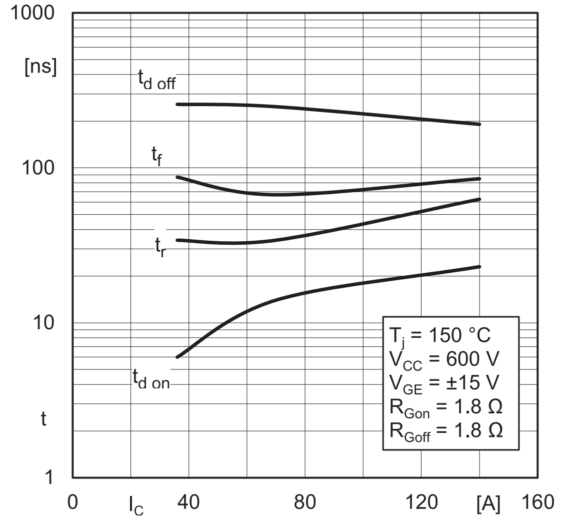


Fig. 7: Typ. IGBT1 switching times vs. I_C

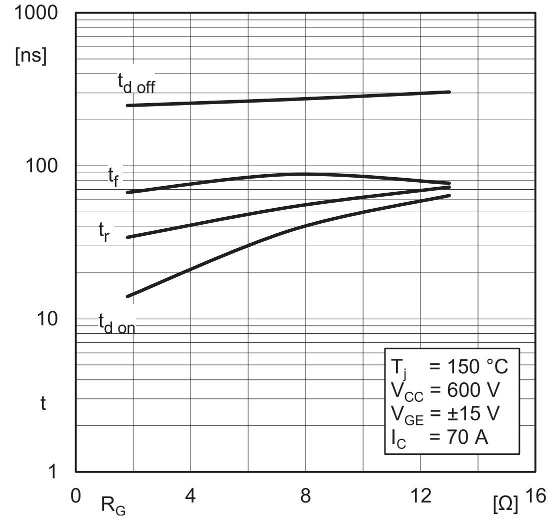


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

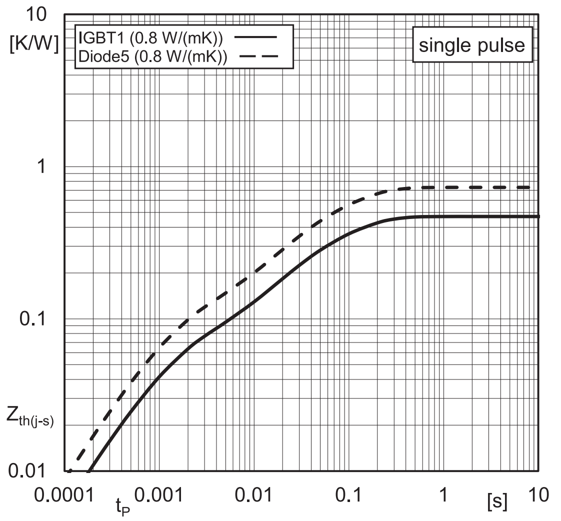


Fig. 9: Transient thermal impedance of IGBT1 & Diode5

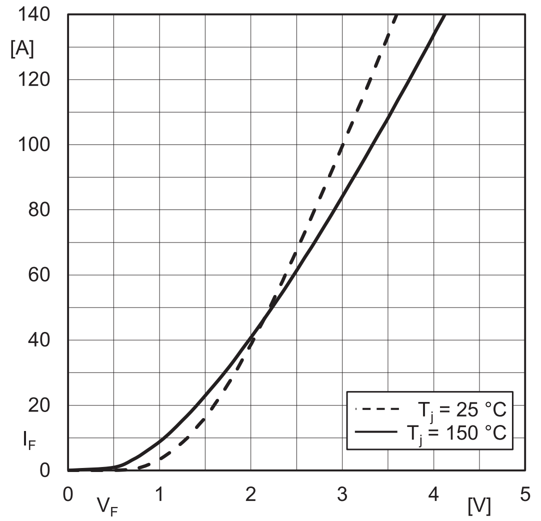


Fig. 10: Typ. Diode5 forward characteristic, incl. $R_{CC'+EE'}$

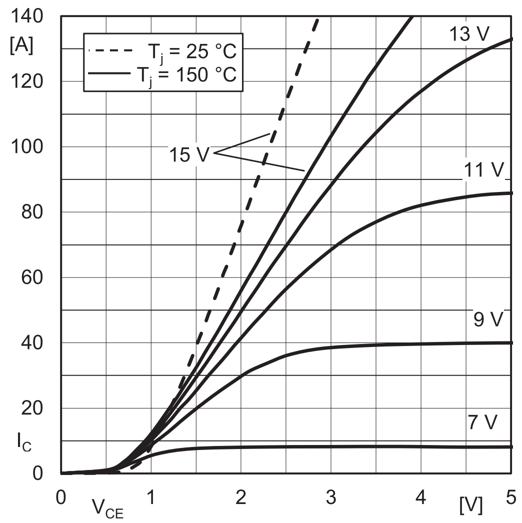


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

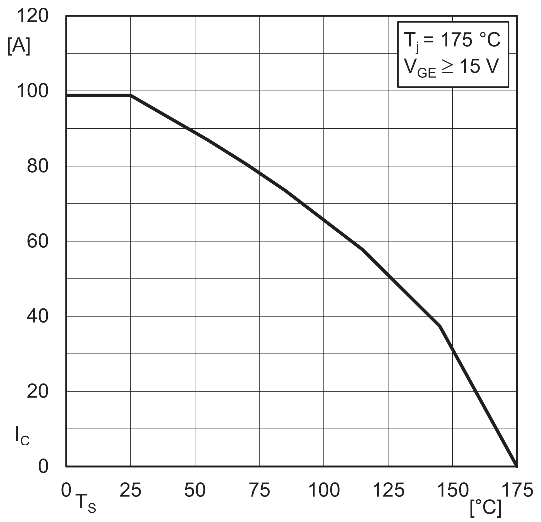


Fig. 14: IGBT2 Rated current vs. Temperature I_c= f (T_s)

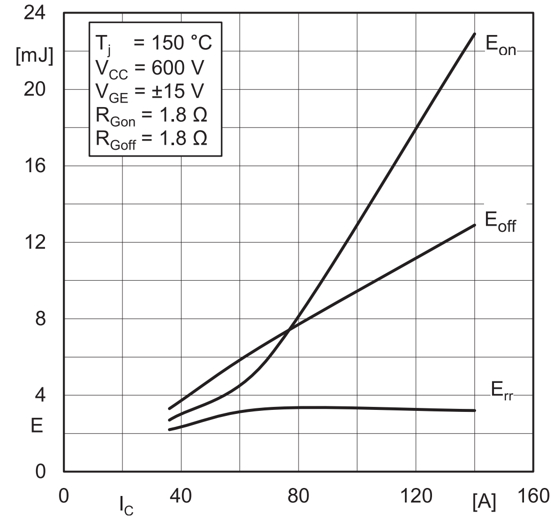


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = f (I_C)

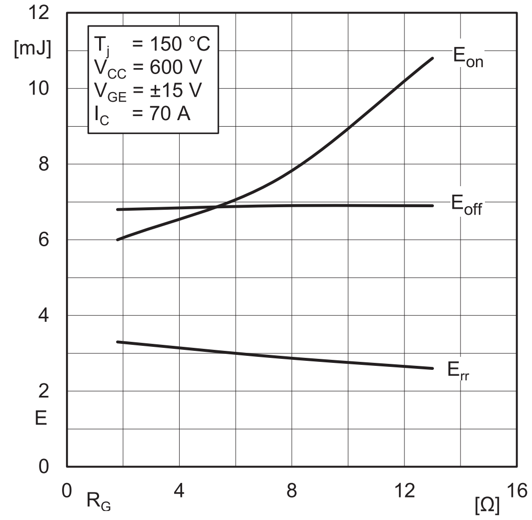


Fig. 16: Typ. IGBT2 & Diode1 turn-on / -off energy = f(R_G)

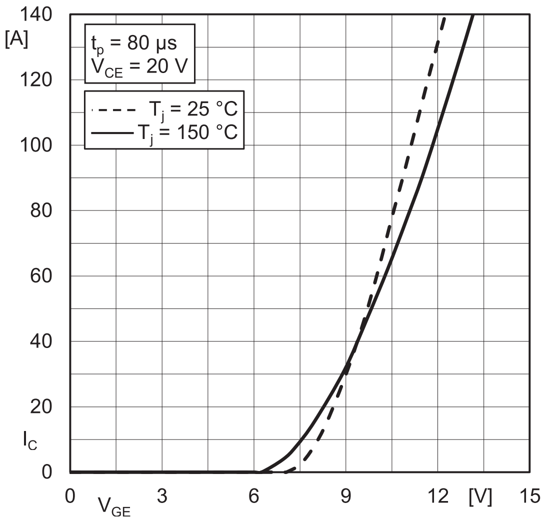


Fig. 17: Typ. IGBT2 transfer characteristic

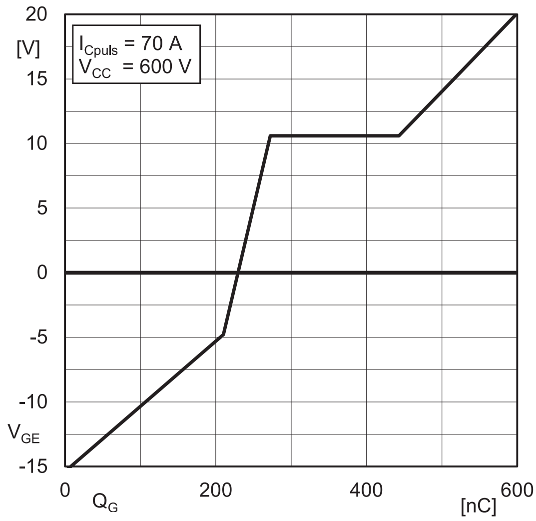


Fig. 18: Typ. IGBT2 gate charge characteristic

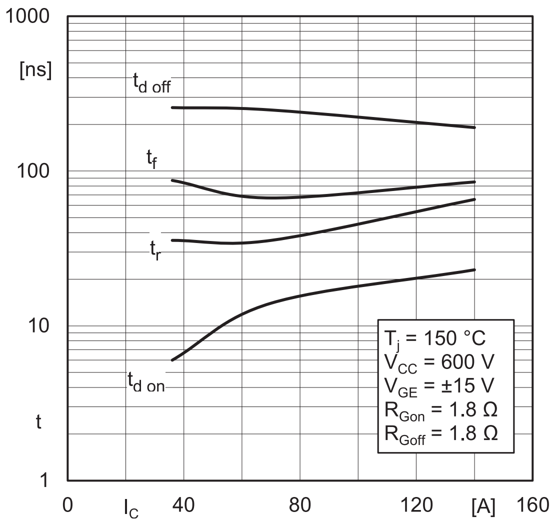


Fig. 19: Typ. IGBT2 switching times vs. I_C

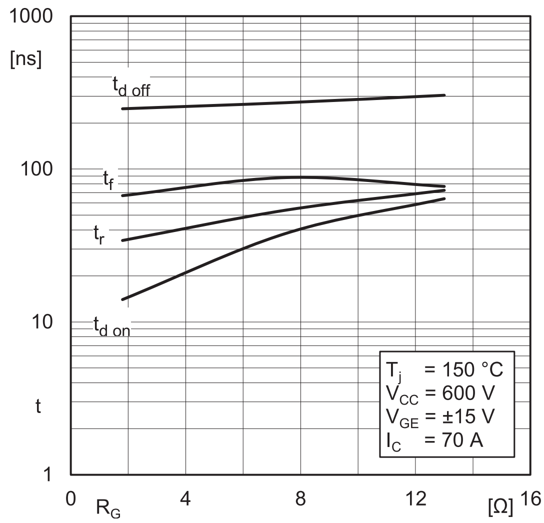


Fig. 20: Typ. IGBT2 switching times vs. gate resistor R_G

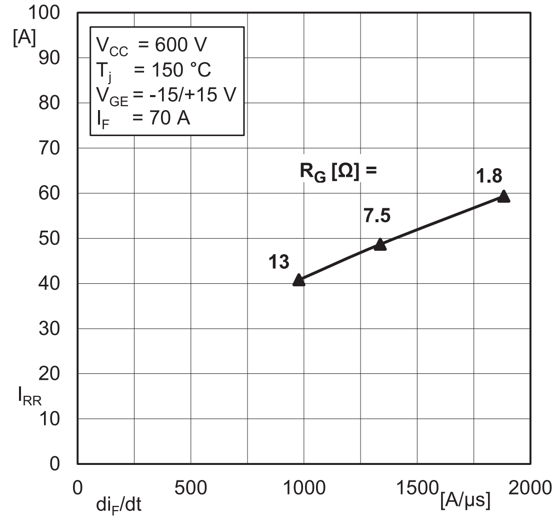


Fig. 21: Typ. CAL Diode 1 peak reverse recovery current

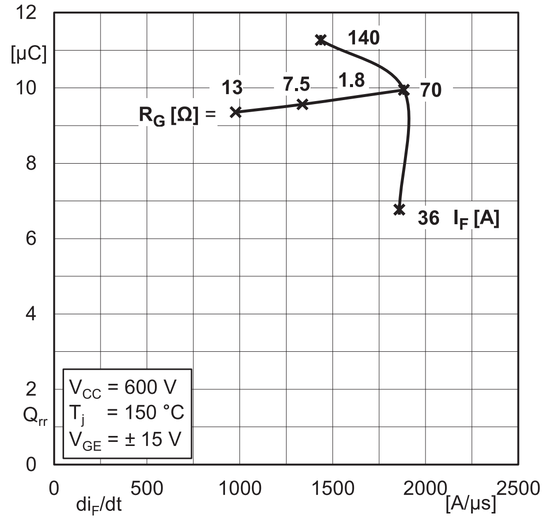


Fig. 22: Typ. CAL Diode 1 reverse recovery charge

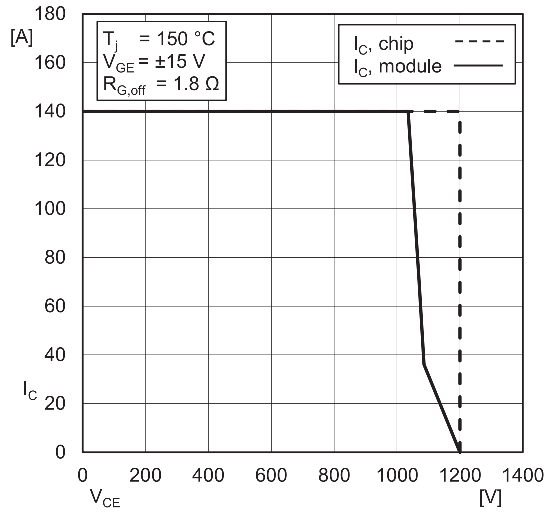
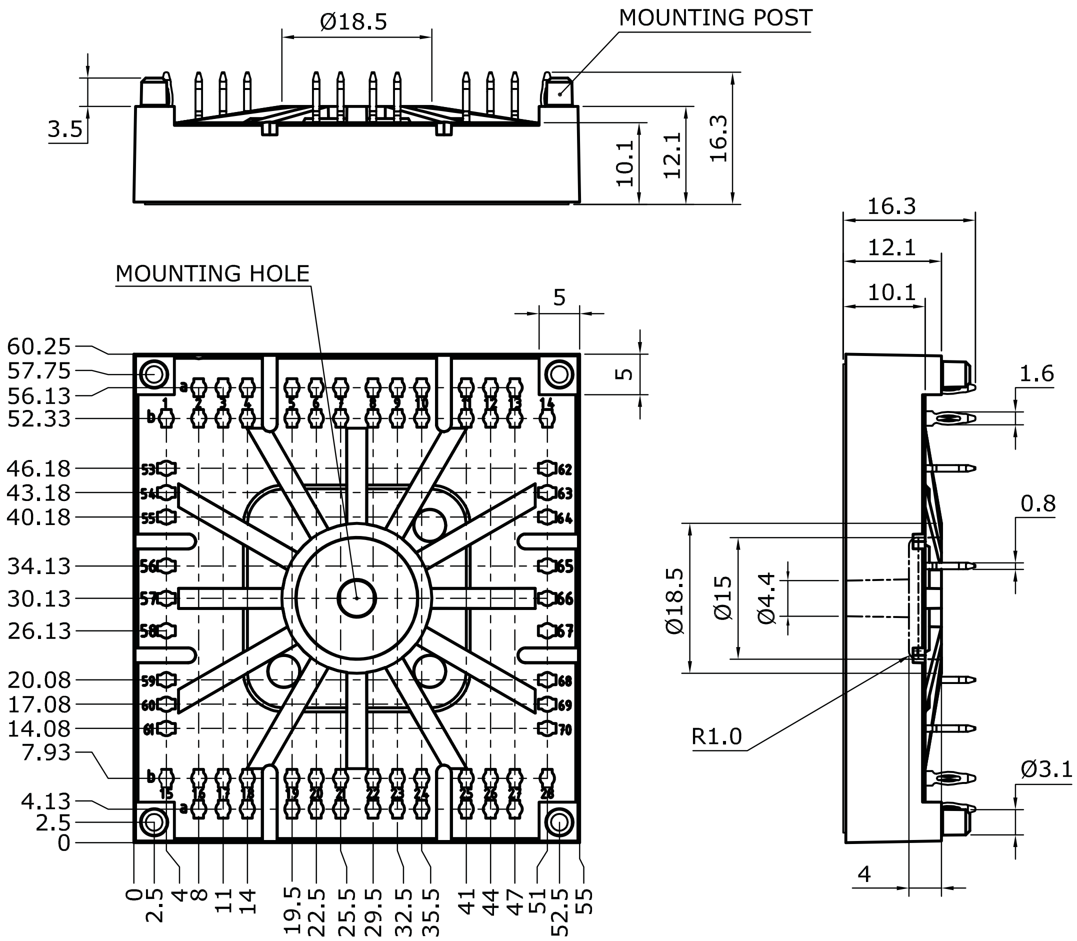


Fig. 24: IGBT Reverse Bias Safe Operating Area (RBSOA)

Dimensions: mm

Tolerance system: ISO 2768-m



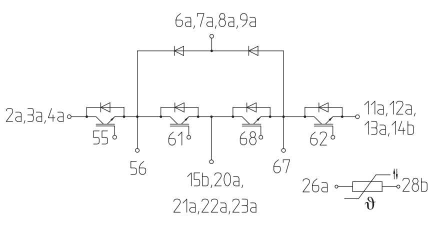
Suggested drilled hole diameter for terminal pins in the circuit board:

- 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

SEMITOP 4 Press-Fit



MLI-T

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

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