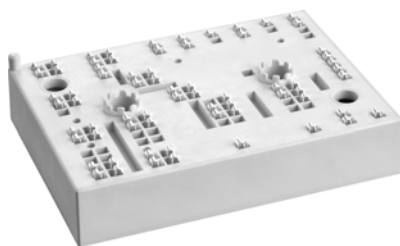


SKiP 39TMLI12T4V2



MiniSKiP® 3

IGBT module

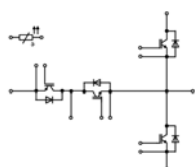
SKiP 39TMLI12T4V2

Features*

- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

Remarks*

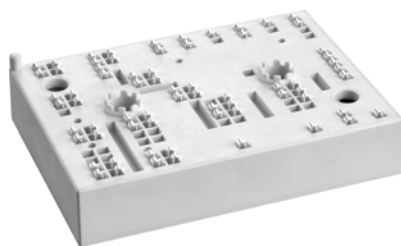
- Case temperature limited to $T_C = 125^\circ\text{C}$ max.; $T_C = T_S$ (valid for baseplateless modules)
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$ (recommended $T_{op} = -40 \dots +150^\circ\text{C}$)
- IGBT 1: outer IGBTs T1&T4
- IGBT 2: inner IGBTs T2&T3
- Diode 1: outer diodes D1&D4
- Diode 2: inner diodes D2&D3
- $I_{t(RMS)} = 160\text{A}$ max. for power terminals



TMLI

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT1				
V _{CES}	T _j = 25 °C		1200	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	235	A
	T _j = 175 °C	T _s = 70 °C	191	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	290	A
	T _j = 175 °C	T _s = 70 °C	236	A
I _{Cnom}			200	A
I _{CRM}	I _{CRM} = 3 x I _{Cnom}		600	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V, V _{GE} ≤ 15 V, T _j = 150 °C, V _{CES} ≤ 1200 V		6	μs
T _j			-40 ... 175	°C
IGBT2				
V _{CES}	T _j = 25 °C		650	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	207	A
	T _j = 175 °C	T _s = 70 °C	165	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	240	A
	T _j = 175 °C	T _s = 70 °C	192	A
I _{Cnom}			200	A
I _{CRM}	I _{CRM} = 3 x I _{Cnom}		600	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		1200	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	194	A
	T _j = 175 °C	T _s = 70 °C	154	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	224	A
	T _j = 175 °C	T _s = 70 °C	179	A
I _{Fnom}			200	A
I _{FRM}	I _{FRM} = 3 x I _{Fnom}		600	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	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	223	A
	T _j = 175 °C	T _s = 70 °C	174	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	255	A
	T _j = 175 °C	T _s = 70 °C	200	A
I _{Fnom}			200	A
I _{FRM}	I _{FRM} = 2 x I _{Fnom}		400	A
I _{FSM}	10 ms, sin 180°, T _j = 25 °C		1476	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			160	A
T _{stg}			-40 ... 125	°C
V _{isol}	AC sinus 50 Hz, t = 1 min		2500	V

SKiIP 39TMLI12T4V2



MiniSKiIP® 3

IGBT module

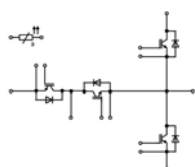
SKiIP 39TMLI12T4V2

Features*

- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

Remarks*

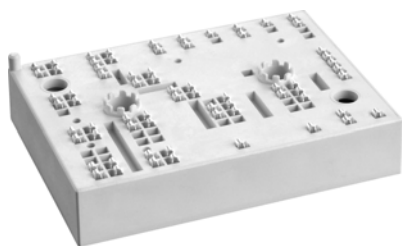
- Case temperature limited to $T_C = 125^\circ\text{C}$ max.; $T_C = T_S$ (valid for baseplateless modules)
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$ (recommended $T_{op} = -40 \dots +150^\circ\text{C}$)
- IGBT 1: outer IGBTs T1&T4
- IGBT 2: inner IGBTs T2&T3
- Diode 1: outer diodes D1&D4
- Diode 2: inner diodes D2&D3
- $I_{T(RMS)} = 160\text{A}$ max. for power terminals



TMLI

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT1						
V _{CE(sat)}	I _C = 200 A	T _j = 25 °C		1.80	2.05	V
	V _{GE} = 15 V chiplevel	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		5.0	5.8	mΩ
		T _j = 150 °C		7.5	8.0	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				0.3	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		12.30		nF
C _{oes}		f = 1 MHz		0.81		nF
C _{res}		f = 1 MHz		0.69		nF
Q _G	V _{GE} = - 8 V...+ 15 V			1130		nC
R _{Gint}	T _j = 25 °C			3.8		Ω
t _{d(on)}	V _{CE} = 300 V	T _j = 150 °C		186		ns
t _r	I _C = 200 A			80		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		7.5		mJ
t _{d(off)}	R _{G on} = 1.5 Ω	T _j = 150 °C		377		ns
t _f	R _{G off} = 1.5 Ω	T _j = 150 °C		109		ns
E _{off}	di/dt _{on} = 2300 A/μs di/dt _{off} = 1630 A/μs	T _j = 150 °C		12.8		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			0.23		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			0.16		K/W
IGBT2						
V _{CE(sat)}	I _C = 200 A	T _j = 25 °C		1.45	1.85	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 chiplevel	T _j = 25 °C		2.8	4.3	mΩ
		T _j = 150 °C		4.4	6.0	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 3.2 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 650 V, T _j = 25 °C				0.3	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		12.32		nF
C _{oes}		f = 1 MHz		0.77		nF
C _{res}		f = 1 MHz		0.37		nF
Q _G	V _{GE} = - 8 V...+ 15 V			1600		nC
R _{Gint}	T _j = 25 °C			1.0		Ω
t _{d(on)}	V _{CE} = 300 V	T _j = 150 °C		93		ns
t _r	I _C = 200 A	T _j = 150 °C		62		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		2		mJ
t _{d(off)}	R _{G on} = 2 Ω	T _j = 150 °C		295		ns
t _f	R _{G off} = 2 Ω	T _j = 150 °C		86		ns
E _{off}	di/dt _{on} = 3300 A/μs di/dt _{off} = 2200 A/μs	T _j = 150 °C		9.3		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			0.33		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			0.26		K/W

SKiiP 39TMLI12T4V2



MiniSKiiP® 3

IGBT module

SKiiP 39TMLI12T4V2

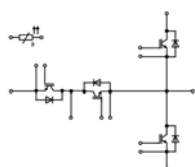
Features*

- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

Remarks*

- Case temperature limited to $T_C = 125^\circ\text{C}$ max.; $T_C = T_S$ (valid for baseplateless modules)
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$ (recommended $T_{op} = -40 \dots +150^\circ\text{C}$)
- IGBT 1: outer IGBTs T1&T4
- IGBT 2: inner IGBTs T2&T3
- Diode 1: outer diodes D1&D4
- Diode 2: inner diodes D2&D3
- $I_{t(RMS)} = 160\text{A}$ max. for power terminals

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Diode1						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		2.20	2.52	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.15	2.47	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		4.5	5.1	mΩ
		T _j = 150 °C		6.3	6.9	mΩ
I _{RRM}	I _F = 200 A	T _j = 150 °C		219		A
Q _{rr}	di/dt _{off} = 3700 A/μs	T _j = 150 °C		31		μC
E _{rr}	V _R = 300 V V _{GE} = +15/-15 V	T _j = 150 °C		9.7		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			0.34		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			0.27		K/W
Diode2						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		1.40	1.76	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		1.38	1.77	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		1.78	2.6	mΩ
		T _j = 150 °C		2.7	3.9	mΩ
I _{RRM}	I _F = 200 A	T _j = 150 °C		154		A
Q _{rr}	di/dt _{off} = 2200 A/μs	T _j = 150 °C		22.7		μC
E _{rr}	V _R = 300 V V _{GE} = +15/-15 V	T _j = 150 °C		5.5		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			0.38		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			0.31		K/W
Module						
L _{sCE1}				-		nH
L _{CE}				-		nH
R _{CC'+EE'}		T _s = 25 °C		-		mΩ
		T _s = 125 °C		-		mΩ
M _s	to heat sink		2		2.5	Nm
M _t				-		Nm
						Nm
w				82		g
Temperature Sensor						
R ₁₀₀	T _r =100°C (R ₂₅ =1000Ω)			1670 ± 3%		Ω
R(T)	R(T)=1000Ω[1+A(T-25°C)+B(T-25°C) ²] , A = 7.635*10 ⁻³ °C ⁻¹ , B = 1.731*10 ⁻⁵ °C ⁻²					



TMLI

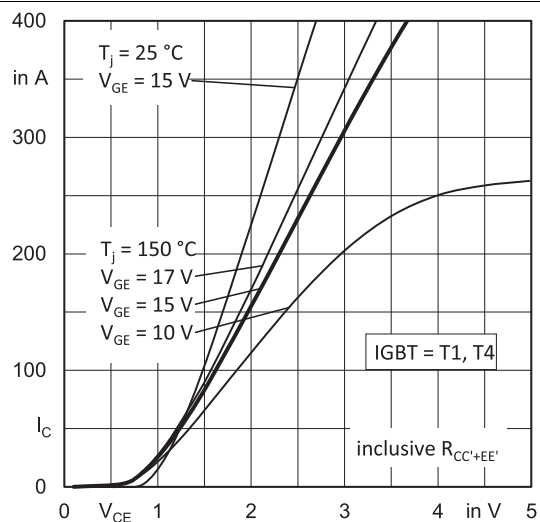


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

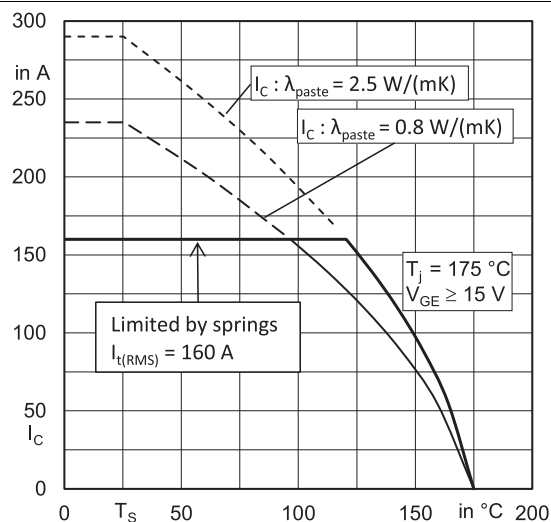


Fig. 2: IGBT1 rated current vs. Temperature $I_C=f(T_s)$

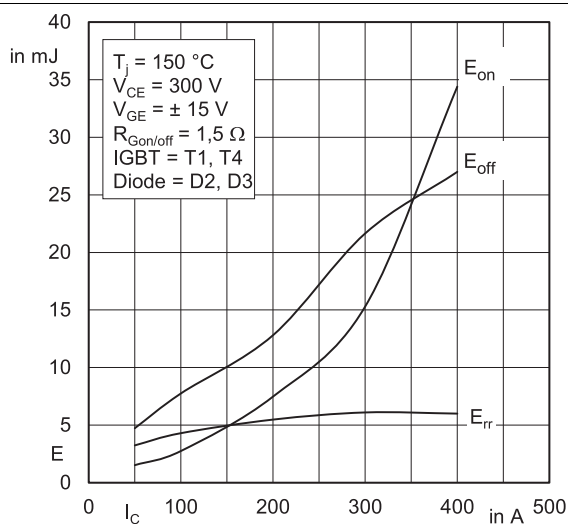


Fig. 3: Typ. IGBT1 & Diode2 turn-on /-off energy = $f(I_C)$

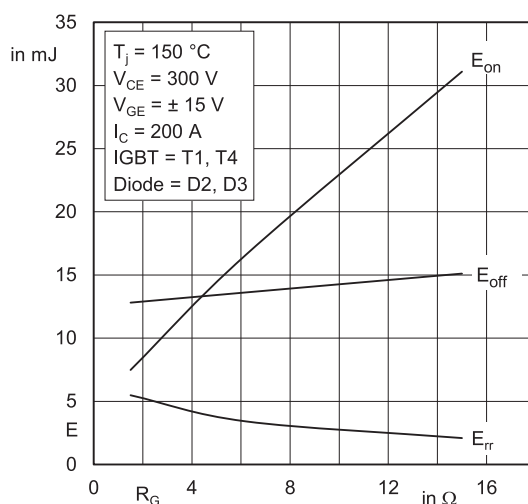


Fig. 4: Typ. IGBT1 & Diode2 turn-on /-off energy = $f(R_G)$

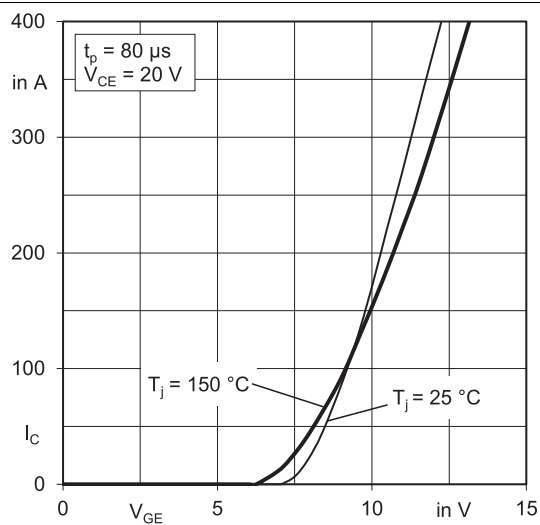


Fig. 5: Typ. IGBT1 transfer characteristic

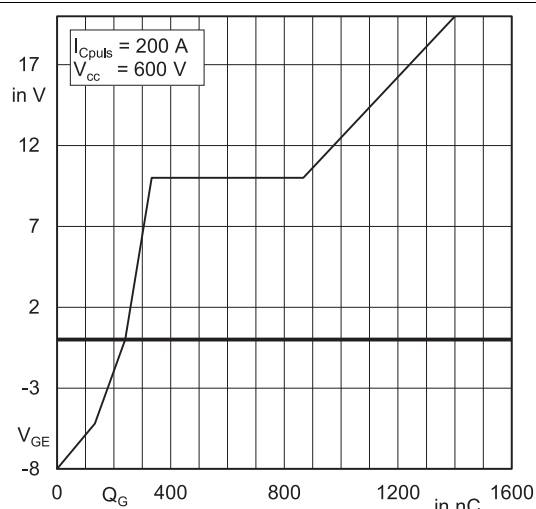


Fig. 6: Typ. IGBT1 gate charge characteristic

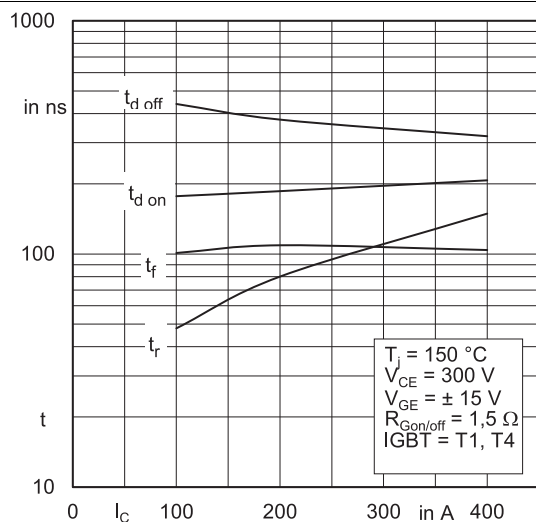


Fig. 7: Typ. IGBT1 switching times vs. I_C

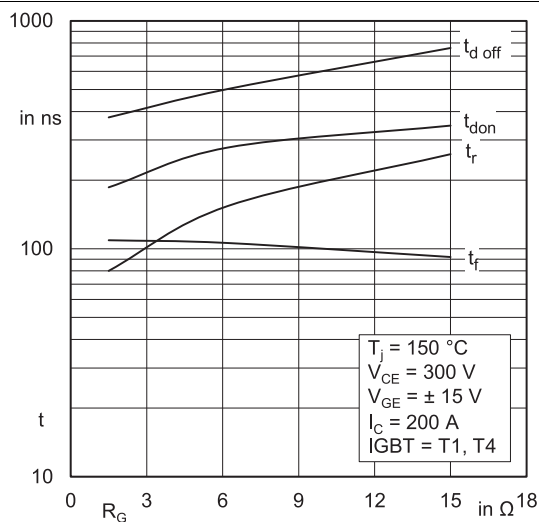


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

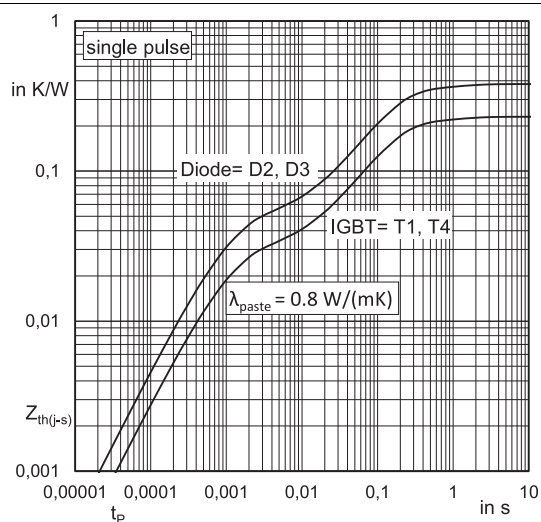


Fig. 9: Transient thermal impedance of IGBT1 & Diode2

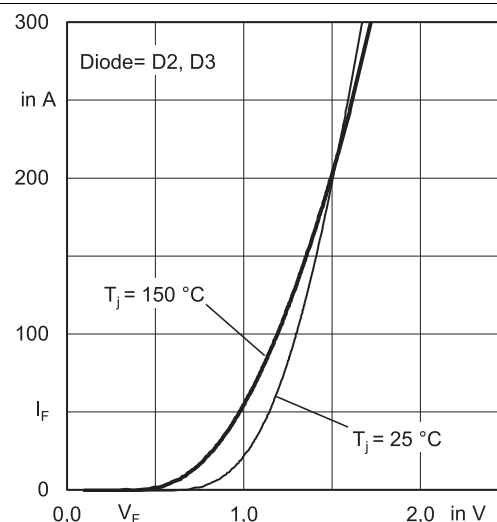


Fig. 10: Diode2 forward characteristic

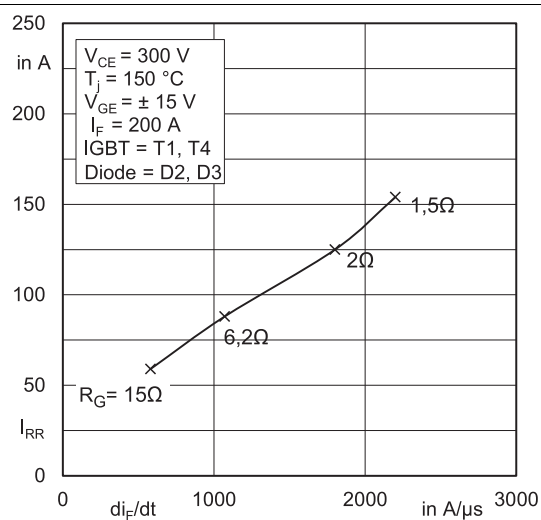


Fig. 11: Typ. Diode2 peak reverse recovery current

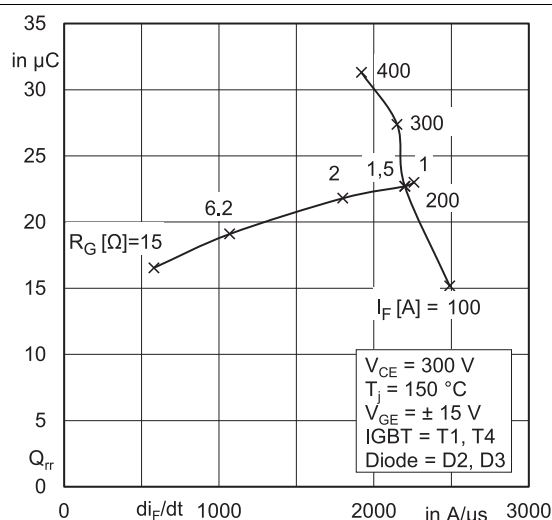


Fig. 12: Typ. Diode2 recovery charge

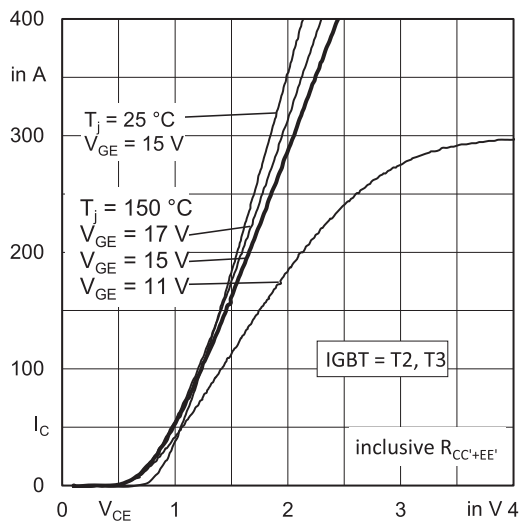


Fig. 13: Typ. IGBT2 output characteristic, incl. $R_{CC'+EE'}$

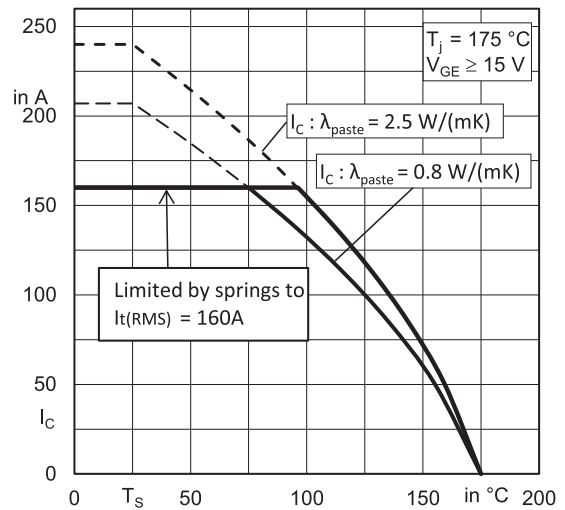


Fig. 14: Rated current vs. temperature $I_C = f(T_s)$

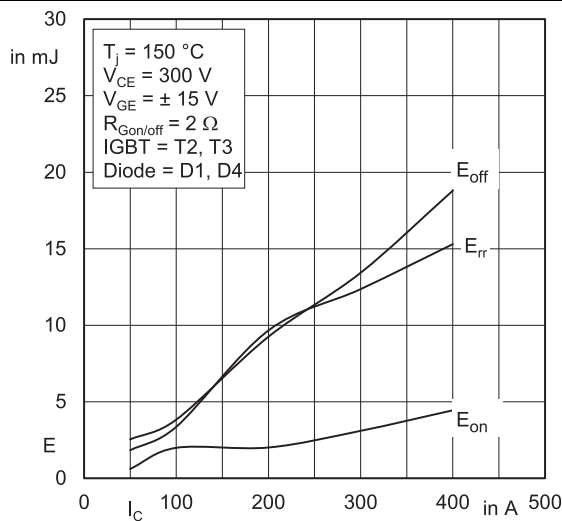


Fig. 15: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(I_C)$

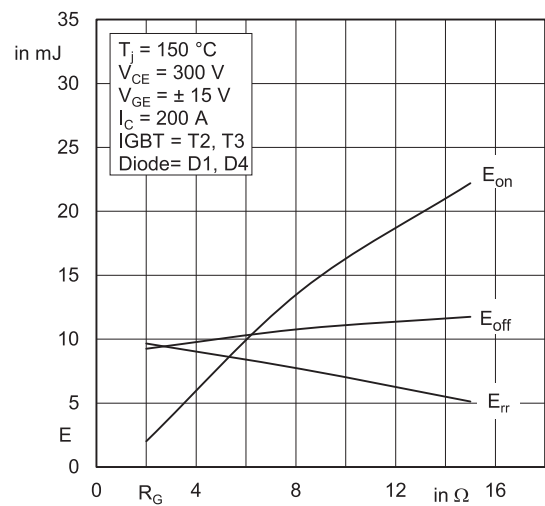


Fig. 16: Typ. IGBT2 & Diode1 turn-on /-off energy = $f(R_G)$

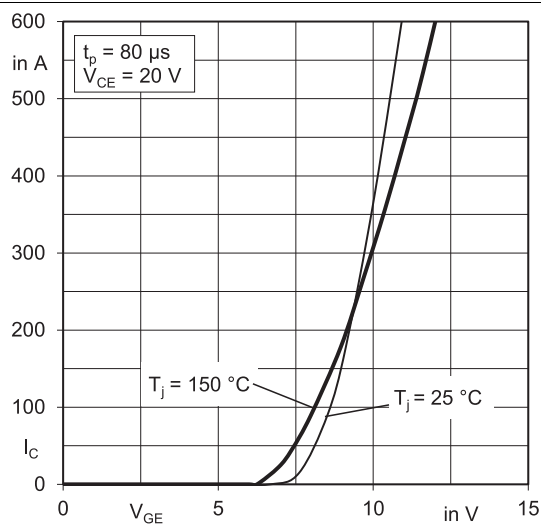


Fig. 17: Typ. IGBT2 transfer characteristic

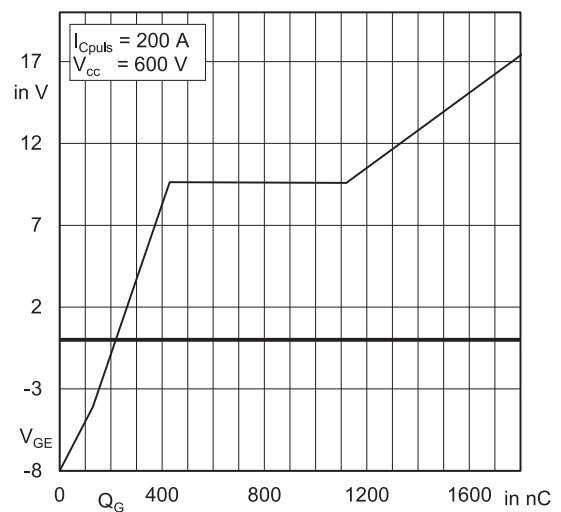
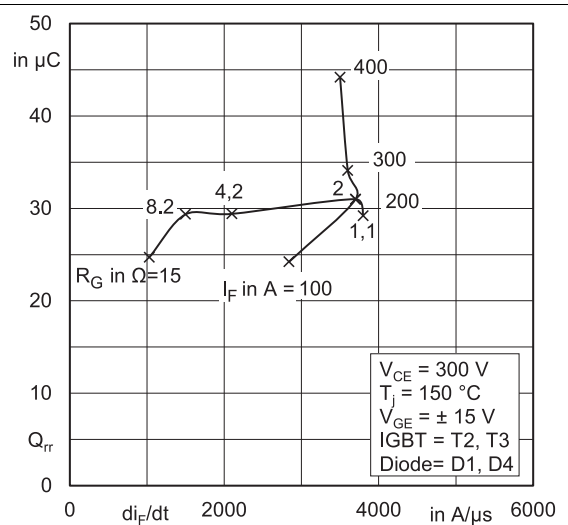
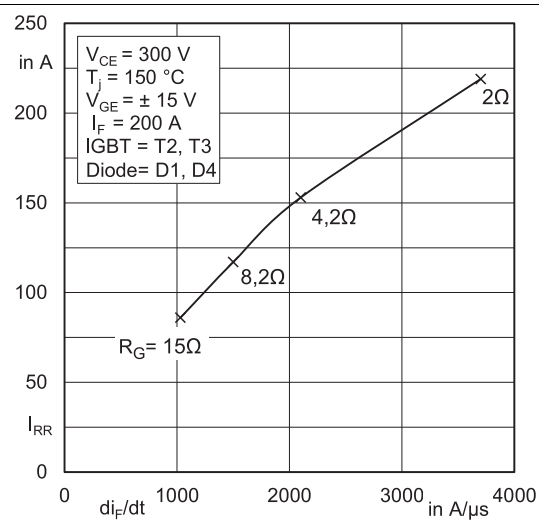
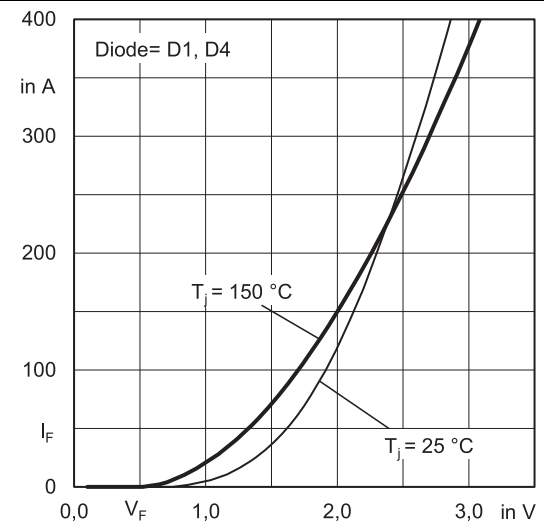
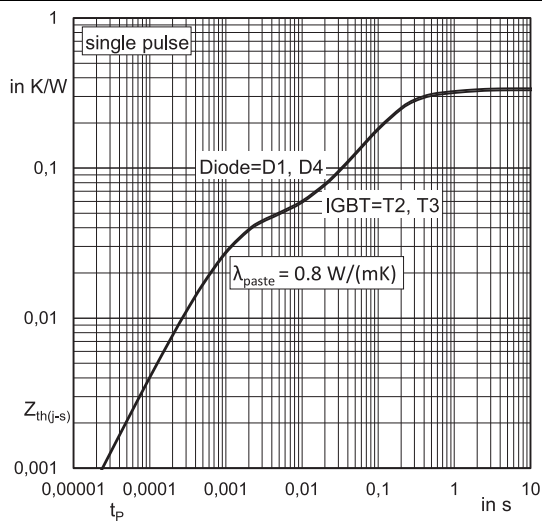
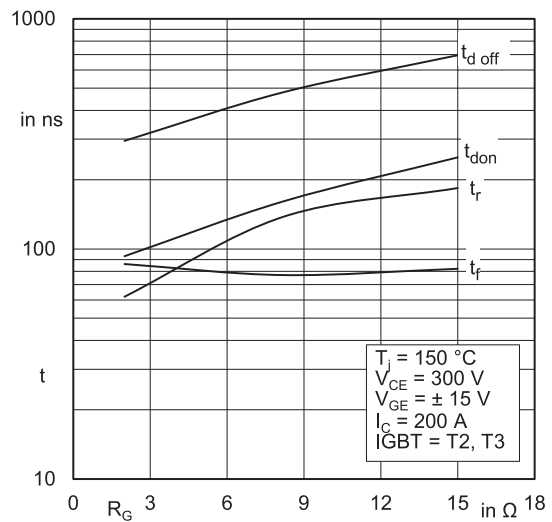
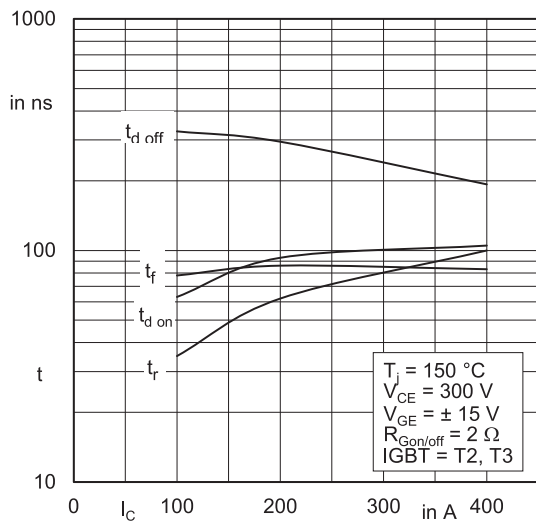
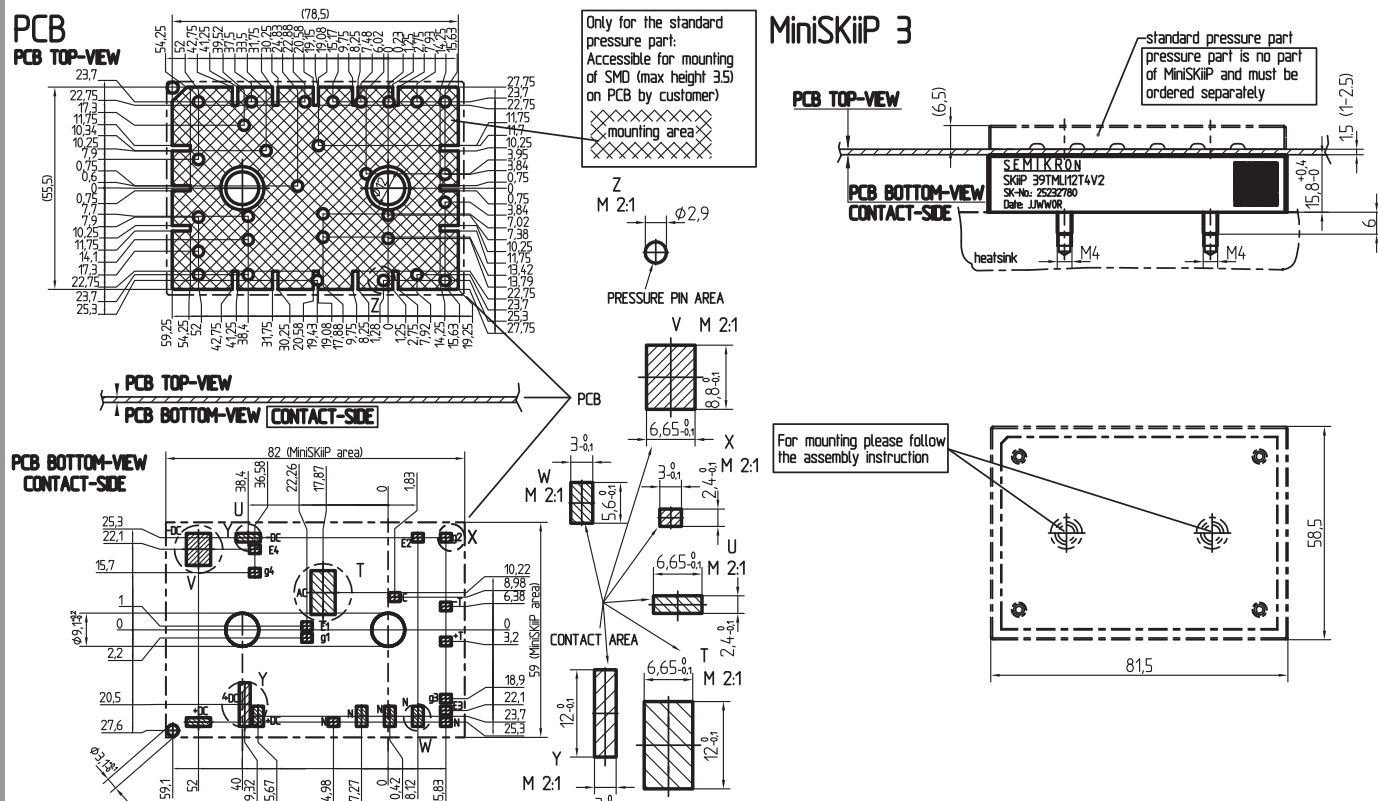
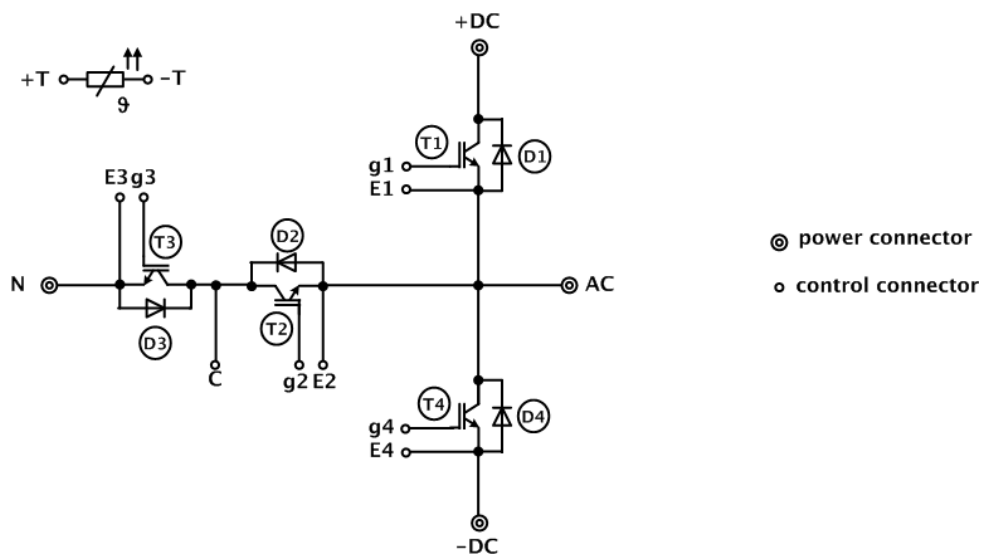


Fig. 18: Typ. IGBT2 gate charge characteristic





pinout, dimensions



pinout

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

***IMPORTANT INFORMATION AND WARNINGS**

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