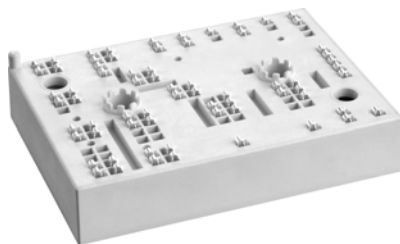


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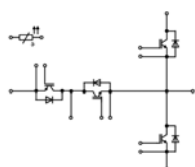
SKiP 39TMLI12T4V2

Features

- Robust and soft freewheeling diodes in CAL technology
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- 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
- $I_{L(RMS)} = 160\text{A}$ max. for power terminals



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT 1				
V _{CES}	T _j = 25 °C		1200	V
I _C	T _j = 150 °C	T _s = 25 °C	212	A
		T _s = 70 °C	162	A
I _C	T _j = 175 °C	T _s = 25 °C	235	A
		T _s = 70 °C	191	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 V _{CES} ≤ 1200 V	T _j = 150 °C	10	μs
T _j			-40 ... 175	°C

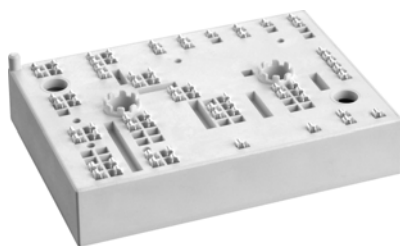
Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT 2				
V _{CES}	T _j = 25 °C		650	V
I _C	T _j = 150 °C	T _s = 25 °C	185	A
		T _s = 70 °C	138	A
I _C	T _j = 175 °C	T _s = 25 °C	207	A
		T _s = 70 °C	165	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 V _{CES} ≤ 650 V	T _j = 150 °C	6	μs
T _j			-40 ... 175	°C

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Diode 1				
V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 150 °C	T _s = 25 °C	172	A
		T _s = 70 °C	128	A
I _F	T _j = 175 °C	T _s = 25 °C	194	A
		T _s = 70 °C	154	A
I _{Fnom}			200	A
I _{FRM}	I _{FRM} = 3 x I _{Fnom}		600	A
I _{FSM}	10 ms, sin 180°, T _j = 150 °C		990	A
T _j			-40 ... 175	°C

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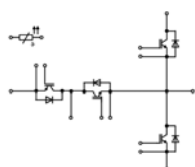
SKiP 39TMLI12T4V2

Features

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Remarks

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- Diode 1: outer diodes D1&D4
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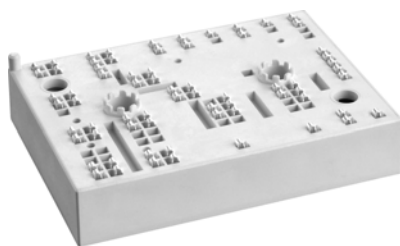
Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Diode 2				
V _{RRM}	T _j = 25 °C		650	V
I _F	T _j = 150 °C	T _s = 25 °C	196	A
		T _s = 70 °C	143	A
I _F	T _j = 175 °C	T _s = 25 °C	223	A
		T _s = 70 °C	174	A
I _{Fnom}			200	A
I _{FRM}	I _{FRM} = 2 x I _{Fnom}		400	A
I _{FSM}	10 ms	T _j = 25 °C	1476	A
	sin 180°	T _j = 150 °C	1224	A
T _i			-40 ... 175	°C

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
Module			
$I_{L(RMS)}$	$T_{terminal} = 80^\circ\text{C}$, 20 A per spring	160	A
T_{stg}		-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min	2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT 1						
V _{CE(sat)}	I _C = 200 A	T _j = 25 °C		1.80	2.05	V
	V _{GE} = 15 V chipelevel	T _j = 150 °C		2.20	2.40	V
V _{CE0}	chipelevel	T _j = 25 °C		0.8	0.9	V
		T _j = 150 °C		0.7	0.8	V
r _{CE}	V _{GE} = 15 V chipelevel	T _j = 25 °C		5	5.8	mΩ
		T _j = 150 °C		7.5	8	mΩ
V _{GE(th)}	V _{GE} = V _{CE} V, I _C = 12 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V	T _j = 25 °C		0.1	0.3	mA
	V _{CE} = 1200 V					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	- 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	T _j = 150 °C		80		ns
E _{on}	R _{G on} = 1.5 Ω	T _j = 150 °C		7.5		mJ
t _{d(off)}	R _{G off} = 1.5 Ω	T _j = 150 °C		377		ns
	di/dt _{on} = 2300 A/μs			109		ns
t _f	di/dt _{off} = 1630 A/μs	T _j = 150 °C		109		ns
E _{off}	V _{GE neg} = -15 V	T _j = 150 °C		12.8		mJ
	V _{GE pos} = 15 V					
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/K*m			0.23		K/W

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Module					
M_s	to heat sink	2		2.5	Nm
w	weight		82		g

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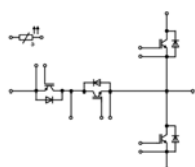
SKiiP 39TMLI12T4V2

Features

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- UL recognised: File no. E63532

Remarks

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- Diode 1: outer diodes D1&D4
- Diode 2: inner diodes D2&D3
- $I_{L(RMS)} = 160\text{A}$ max. for power terminals



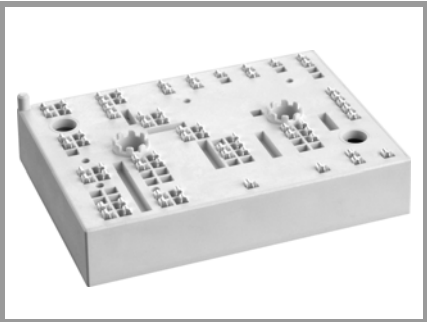
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT 2						
V _{CE(sat)}	I _C = 200 A	T _j = 25 °C		1.45	1.85	V
	V _{GE} = 15 V chipllevel	T _j = 150 °C		1.70	2.10	V
V _{CE0}	chipllevel	T _j = 25 °C		0.9	1	V
		T _j = 150 °C		0.82	0.9	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		2.8	4.3	mΩ
	chipllevel	T _j = 150 °C		4	6	mΩ
V _{GE(th)}	V _{GE} = V _{CE} V, I _C = 3.2 mA		5	5.8	6.5	V
I _{CES}	V _{GE} = 0 V	T _j = 25 °C		0.1	0.3	mA
	V _{CE} = 650 V	T _j = 150 °C				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	- 8 V...+ 15 V			1600		nC
R _{Gint}	T _j = 25 °C			1		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}	R _{G on} = 2 Ω	T _j = 150 °C		2		mJ
	R _{G off} = 2 Ω	T _j = 150 °C				
t _{d(off)}	di/dt _{on} = 3300 A/μs	T _j = 150 °C		295		ns
t _f	di/dt _{off} = 2200 A/μs	T _j = 150 °C		86		ns
E _{off}	V _{GE neg} = -15 V	T _j = 150 °C		9.3		mJ
	V _{GE pos} = 15 V					
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/K*m			0.33		K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Diode 1						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		2.2	2.5	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.2	2.5	V
V _{F0}	chiplevel	T _j = 25 °C		1.3	1.5	V
		T _j = 150 °C		0.9	1.1	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 _{GE} = -15 V V _R = 300 V	T _j = 150 °C		9.7		mJ
R _{th(l-s)}	per Diode, λ _{paste} =0.8 W/K*m			0.34		K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Diode 2						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		1.4	1.8	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		1.4	1.8	V
V _{F0}	chiplevel	T _j = 25 °C		1	1.2	V
		T _j = 150 °C		0.9	1	V
r _F	chiplevel	T _j = 25 °C		1.8	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 _{GE} = -15 V V _R = 300 V	T _j = 150 °C		5.5		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/K*m			0.38		K/W

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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
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				

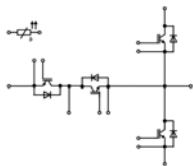
SKiiP 39TMLI12T4V2

Features

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- UL recognised: File no. E63532

Remarks

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- IGBT 1: outer IGBTs T1&T4
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- Diode 1: outer diodes D1&D4
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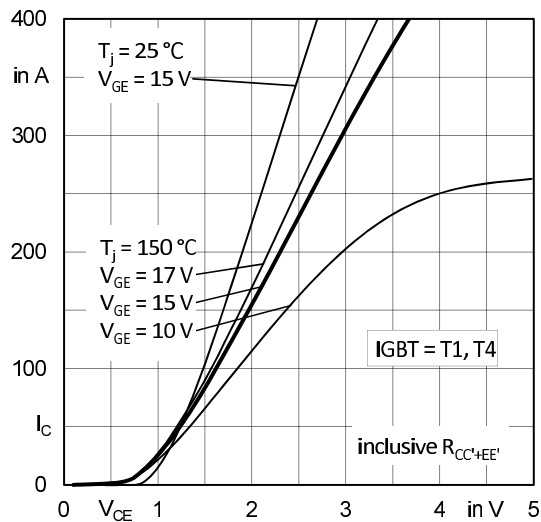


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

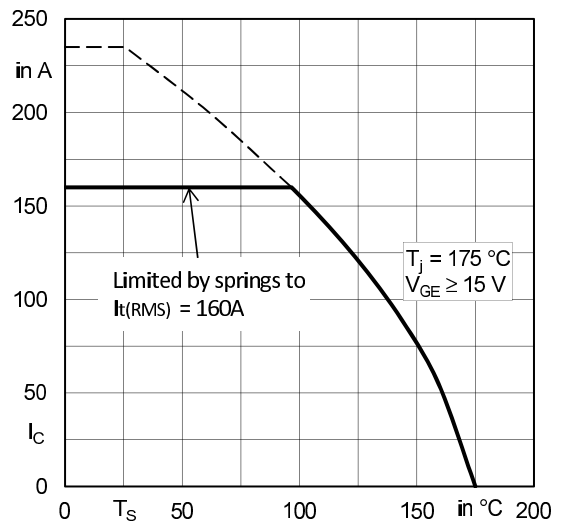


Fig. 2: Rated current vs. temperature $I_C = f(T_s)$

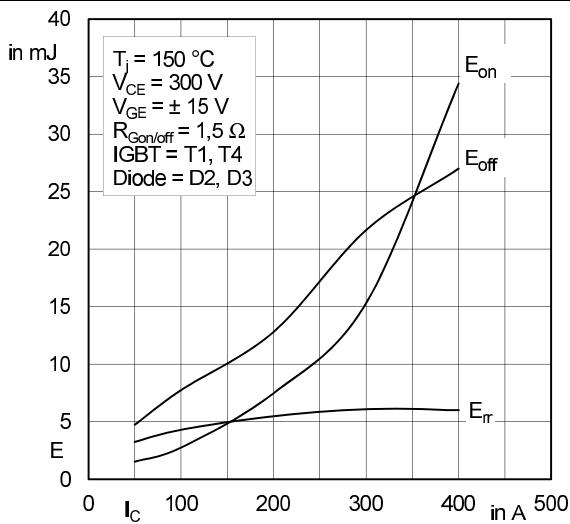


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

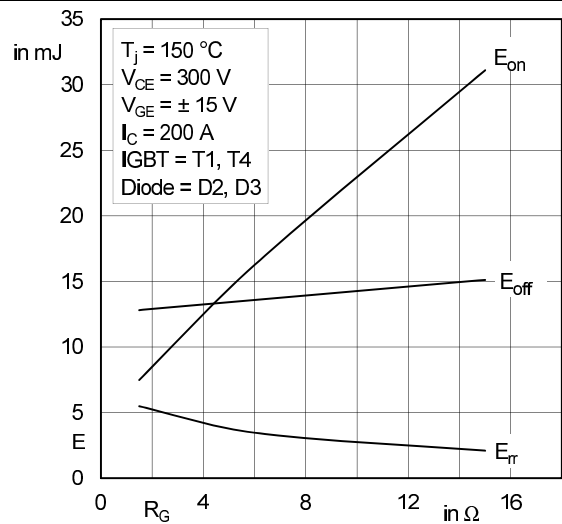


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

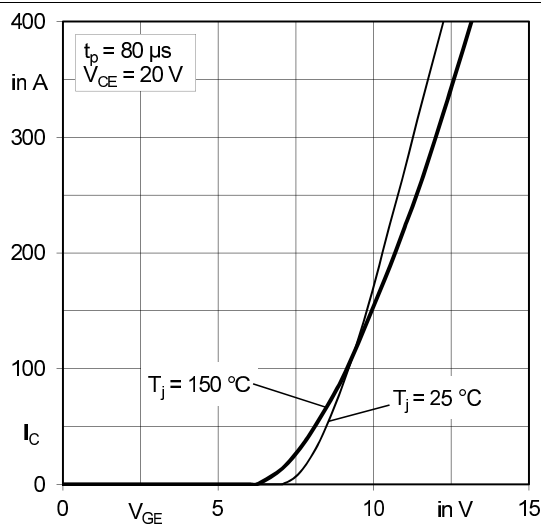


Fig. 5: Typ. transfer characteristic

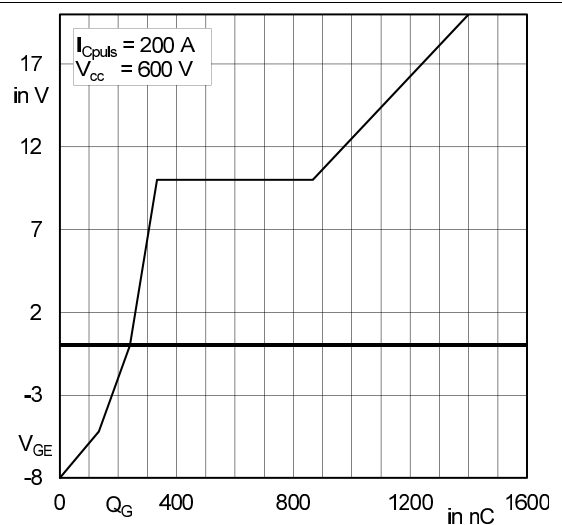


Fig. 6: Typ. gate charge characteristic

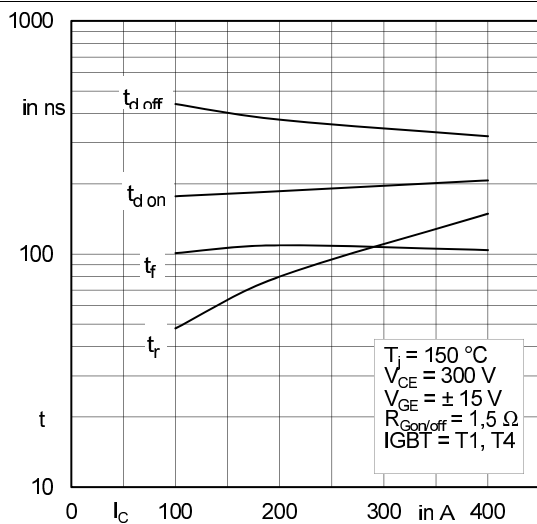


Fig. 7: Typ. switching times vs. I_C

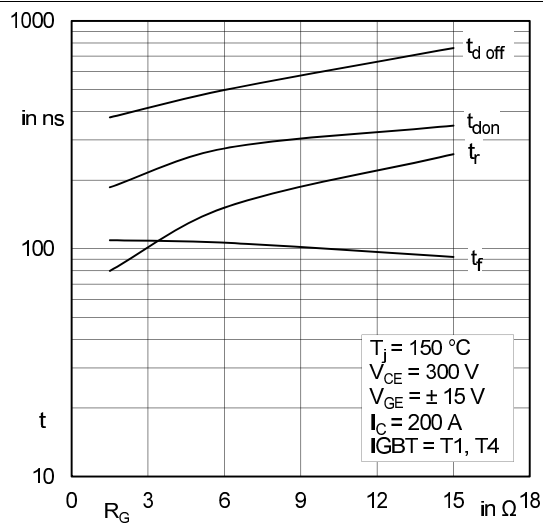


Fig. 8: Typ. switching times vs. gate resistor R_G

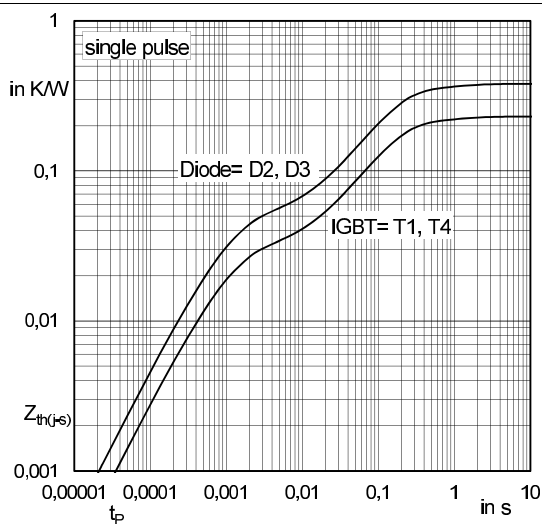


Fig. 9: Transient thermal impedance of IGBT and Diode

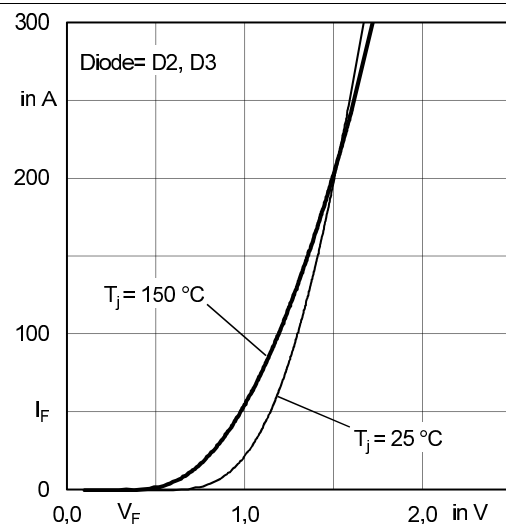


Fig. 10: CAL diode forward characteristic

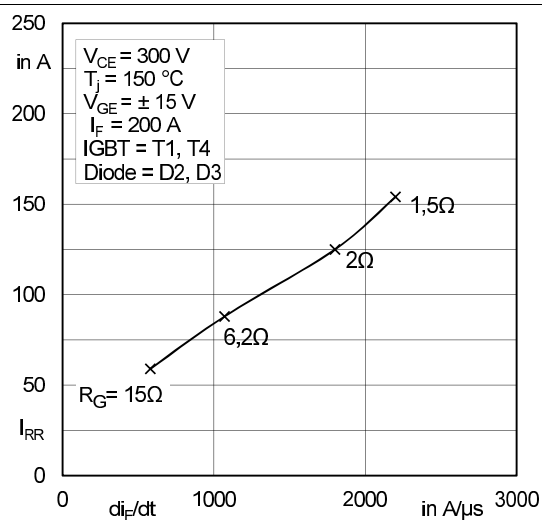


Fig. 11: Typ. CAL diode peak reverse recovery current

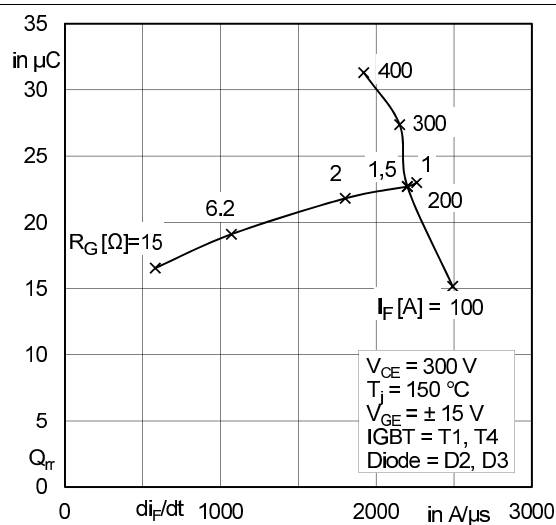


Fig. 12: Typ. CAL diode recovery charge

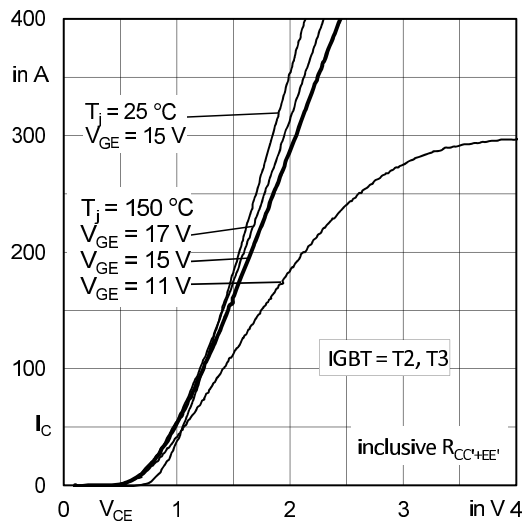


Fig. 13: Typ. output characteristic, inclusive $R_{CC'+EE'}$

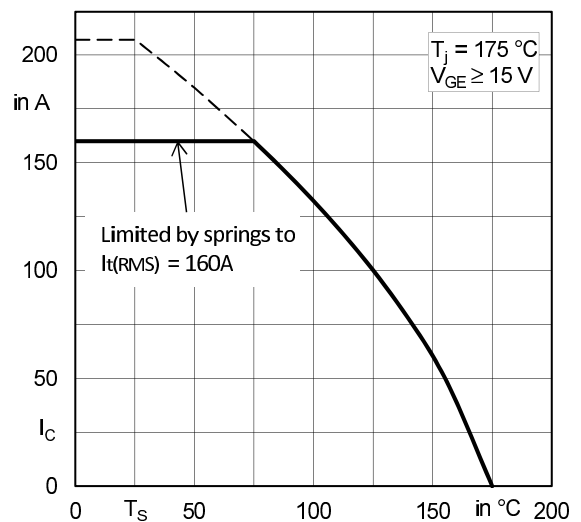


Fig. 14: Rated current vs. temperature $I_C = f(T_S)$

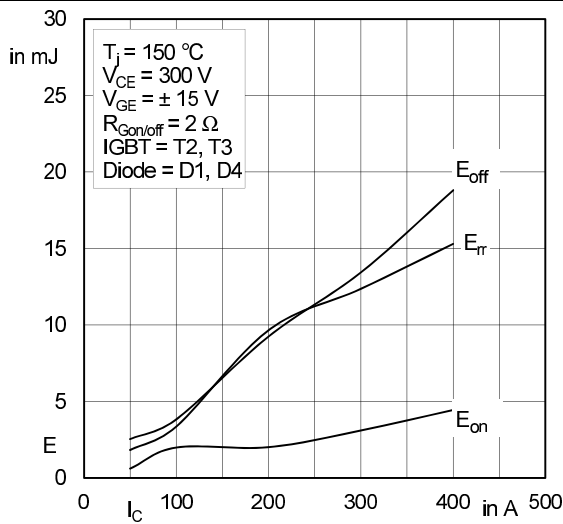


Fig. 15: Typ. turn-on /-off energy = $f(I_C)$

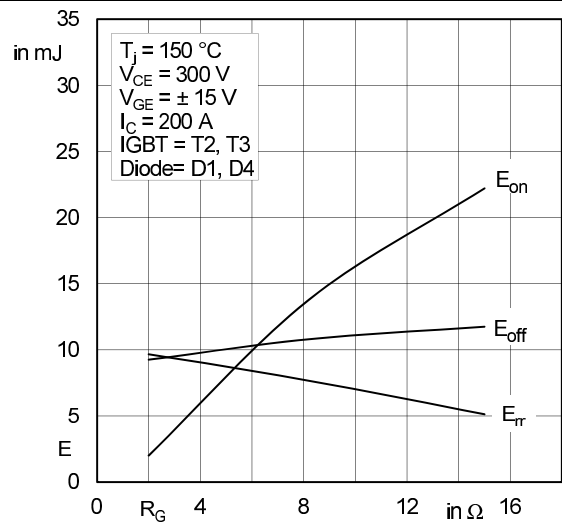


Fig. 16: Typ. turn-on /-off energy = $f(R_G)$

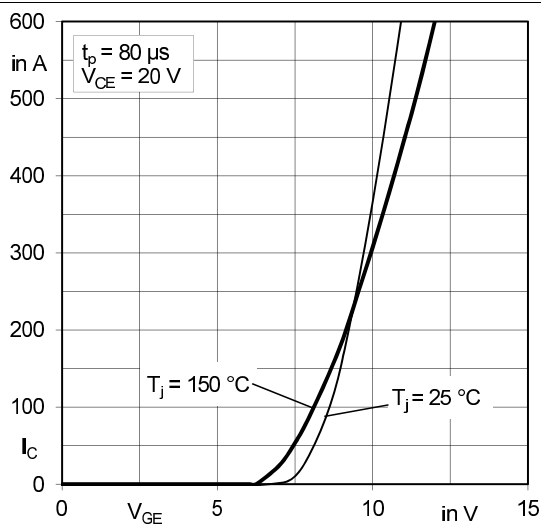


Fig. 17: Typ. transfer characteristic

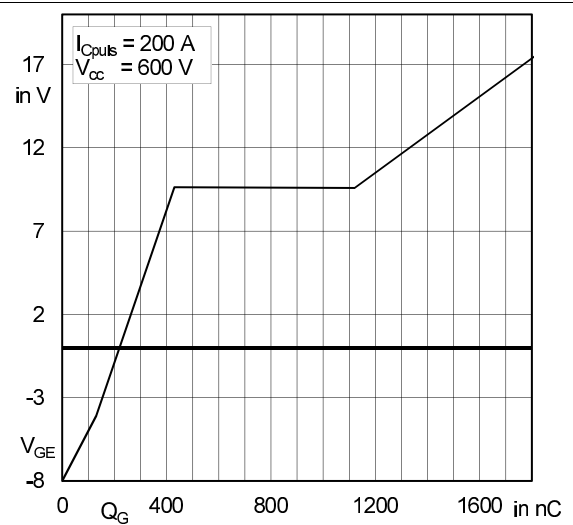
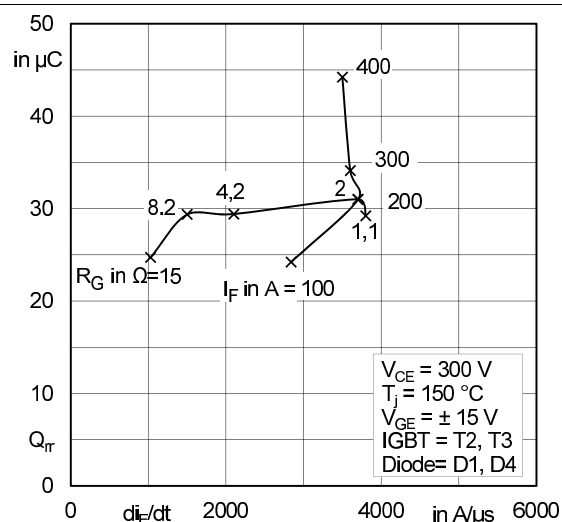
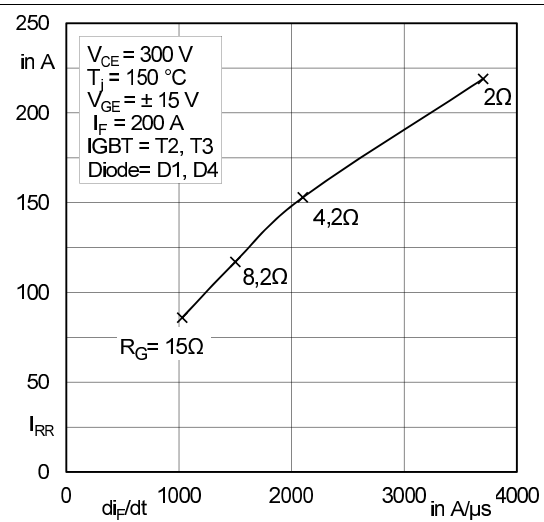
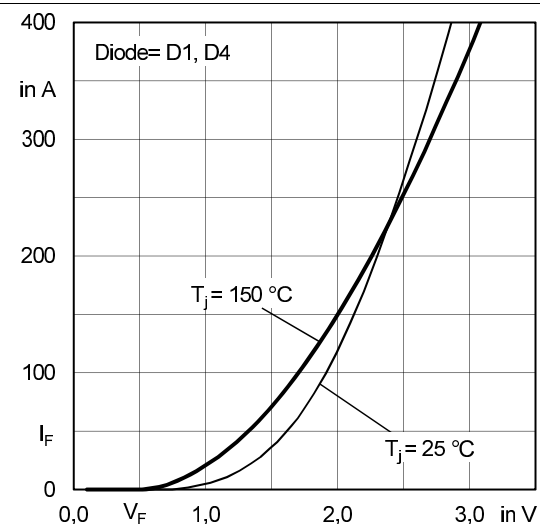
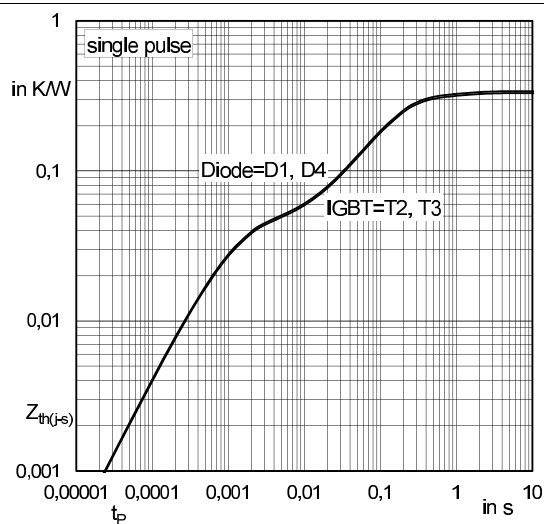
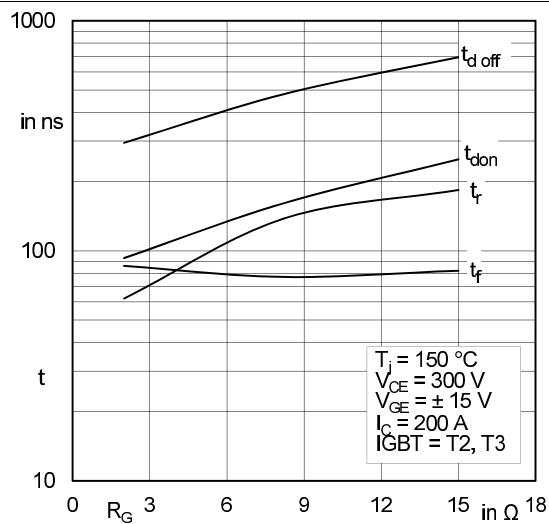
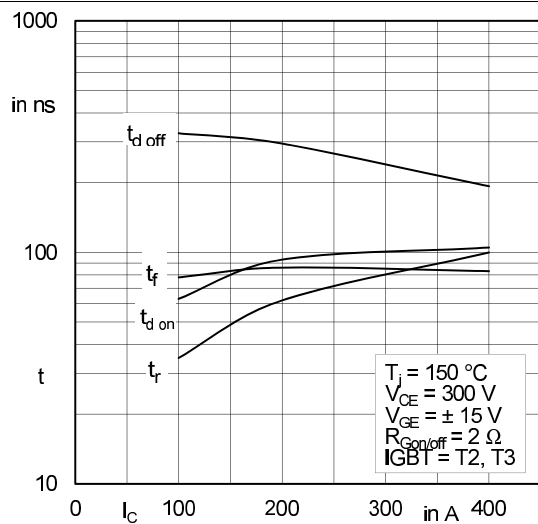


Fig. 18: Typ. gate charge characteristic





* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.