

MiniSKiiP® 2

Converter-Inverter-Brake (CIB)

SKiiP 22NAB12T4V2

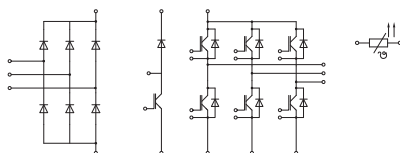
Features*

- Trench 4 IGBTs
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

Remarks

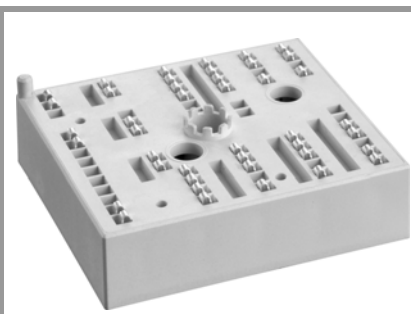
- Max. case temperature limited to $T_C=125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$ (recommended $T_{j,op} = -40 \dots +150^\circ\text{C}$)
- Please refer to MiniSKiiP "Technical Explanations" and "Mounting Instructions" for further information
- No functional isolation between temperature sensor and "-DC/V" and "-DC/W"

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Inverter - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	27	A
	T _j = 175 °C	T _s = 70 °C	22	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	30	A
	T _j = 175 °C	T _s = 70 °C	24	A
I _{Cnom}			15	A
I _{CRM}			45	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
Chopper - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	27	A
	T _j = 175 °C	T _s = 70 °C	22	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	30	A
	T _j = 175 °C	T _s = 70 °C	24	A
I _{Cnom}			15	A
I _{CRM}			45	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
Inverse - Diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	22	A
	T _j = 175 °C	T _s = 70 °C	18	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	24	A
	T _j = 175 °C	T _s = 70 °C	20	A
I _{FRM}			30	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		65	A
T _j			-40 ... 175	°C
Freewheeling - Diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	22	A
	T _j = 175 °C	T _s = 70 °C	18	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	24	A
	T _j = 175 °C	T _s = 70 °C	20	A
I _{FRM}			30	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		65	A
T _j			-40 ... 175	°C



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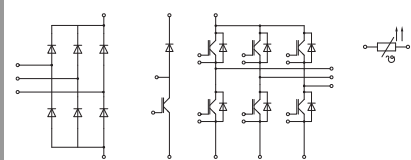
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- No functional isolation between temperature sensor and "-DC/V" and "-DC/W"

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Rectifier - Diode				
V _{RRM}	T _j = 25 °C		1600	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	37	A
	T _j = 150 °C	T _s = 70 °C	28	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	40	A
	T _j = 150 °C	T _s = 70 °C	31	A
I _{FSM}	t _p = 10 ms	T _j = 25 °C	220	A
	sin 180°	T _j = 150 °C	200	A
i ² t	t _p = 10 ms	T _j = 25 °C	242	A ² s
	sin 180°	T _j = 150 °C	200	A ² s
T _j			-40 ... 150	°C
Module				
I _{t(RMS)}	T _{terminal} = 80 °C, 20 A per spring		18	A
T _{stg}	module without TIM		-40 ... 125	°C
V _{isol}	AC sinus 50 Hz, 1 min		2500	V

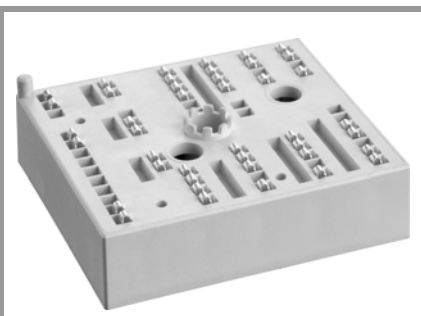
Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverter - IGBT					
$V_{CE(sat)}$	$I_C = 15 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.85	2.10	V
		$T_j = 150^\circ\text{C}$	2.25	2.45	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	0.80	0.90	V
		$T_j = 150^\circ\text{C}$	0.70	0.80	V
r_{CE}	$V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	70	80	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	103	110	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 0.5 \text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0 \text{ V}$, $V_{CE} = 1200 \text{ V}$, $T_j = 25^\circ\text{C}$			1	mA
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	0.90		nF
C_{oes}		$f = 1 \text{ MHz}$	0.08		nF
C_{res}		$f = 1 \text{ MHz}$	0.06		nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		85		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0		Ω
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$	5		ns
t_r	$I_C = 15 \text{ A}$ $R_{G on} = 16 \Omega$	$T_j = 150^\circ\text{C}$	37		ns
		$T_j = 150^\circ\text{C}$	1.5		mJ
E_{on}	$R_{G off} = 16 \Omega$	$T_j = 150^\circ\text{C}$			
$t_{d(off)}$	$di/dt_{on} = 370 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	286		ns
t_f	$di/dt_{off} = 167 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	86		ns
E_{off}	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$	1.54		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W/(mK)}$		1.4		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W/(mK)}$		1.2		K/W



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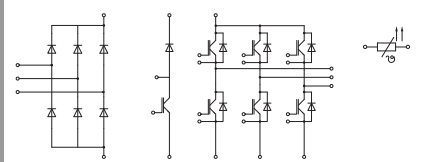
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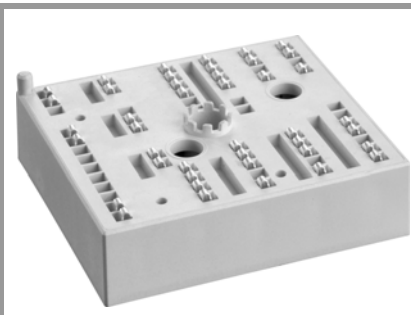
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- Please refer to MiniSKiiP "Technical Explanations" and "Mounting Instructions" for further information
- No functional isolation between temperature sensor and "-DC/V" and "-DC/W"



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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
V _{CE(sat)}	I _C = 15 A	T _J = 25 °C		1.85	2.10	V
	V _{GE} = 15 V chipelevel	T _J = 150 °C		2.25	2.45	V
V _{CE0}	chipelevel	T _J = 25 °C		0.80	0.90	V
		T _J = 150 °C		0.70	0.80	V
r _{CE}	V _{GE} = 15 V chipelevel	T _J = 25 °C		70	80	mΩ
		T _J = 150 °C		103	110	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.5 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		0.90		nF
C _{oes}		f = 1 MHz		0.08		nF
C _{res}		f = 1 MHz		0.06		nF
Q _G	V _{GE} = - 8 V...+ 15 V			85		nC
R _{Gint}	T _J = 25 °C			0		Ω
t _{d(on)}	V _{CC} = 600 V	T _J = 150 °C		5		ns
t _r	I _C = 15 A	T _J = 150 °C		37		ns
E _{on}	R _{G on} = 16 Ω	T _J = 150 °C		1.5		mJ
t _{d(off)}	di/dt _{on} = 370 A/μs	T _J = 150 °C		286		ns
t _f	di/dt _{off} = 167 A/μs	T _J = 150 °C		86		ns
E _{off}	V _{GE} = +15/-15 V	T _J = 150 °C		1.5		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			1.4		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			1.2		K/W
Inverse - Diode						
V _F = V _{EC}	I _F = 15 A	T _J = 25 °C		2.38	2.71	V
	V _{GE} = 0 V chipelevel	T _J = 150 °C		2.44	2.77	V
V _{F0}	chipelevel	T _J = 25 °C		1.30	1.50	V
		T _J = 150 °C		0.90	1.10	V
r _F	chipelevel	T _J = 25 °C		72	81	mΩ
		T _J = 150 °C		103	111	mΩ
I _{RRM}	I _F = 15 A	T _J = 150 °C		11.6		A
Q _{rr}	di/dt _{off} = 370 A/μs	T _J = 150 °C		2.4		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _J = 150 °C		0.95		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			2		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.7		K/W
Freewheeling - Diode						
V _F = V _{EC}	I _F = 15 A	T _J = 25 °C		2.38	2.71	V
	V _{GE} = 0 V chipelevel	T _J = 150 °C		2.44	2.77	V
V _{F0}	chipelevel	T _J = 25 °C		1.30	1.50	V
		T _J = 150 °C		0.90	1.10	V
r _F	chipelevel	T _J = 25 °C		72	81	mΩ
		T _J = 150 °C		103	111	mΩ
I _{RRM}	I _F = 15 A	T _J = 150 °C		11.6		A
Q _{rr}	di/dt _{off} = 370 A/μs	T _J = 150 °C		2.4		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _J = 150 °C		0.95		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			2		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.7		K/W

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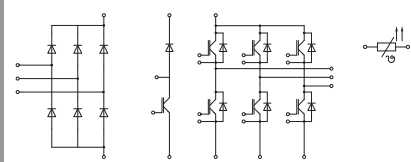
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- Please refer to MiniSKiiP "Technical Explanations" and "Mounting Instructions" for further information
- No functional isolation between temperature sensor and "-DC/V" and "-DC/W"

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
V _F = V _{EC}	I _F = 8 A	T _j = 25 °C		1.00	1.21	V
	chipelevel	T _j = 125 °C		0.90	1.10	V
V _{F0}	chipelevel	T _j = 25 °C		0.88	0.98	V
		T _j = 125 °C		0.73	0.83	V
r _F	chipelevel	T _j = 25 °C		15	29	mΩ
		T _j = 125 °C		21	34	mΩ
I _R	T _j = 145 °C, V _{RRM}				1.1	mA
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.63		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.4		K/W
Module						
M _s	to heat sink		2		2.5	Nm
w				55		g
L _{CE}				-		nH
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					



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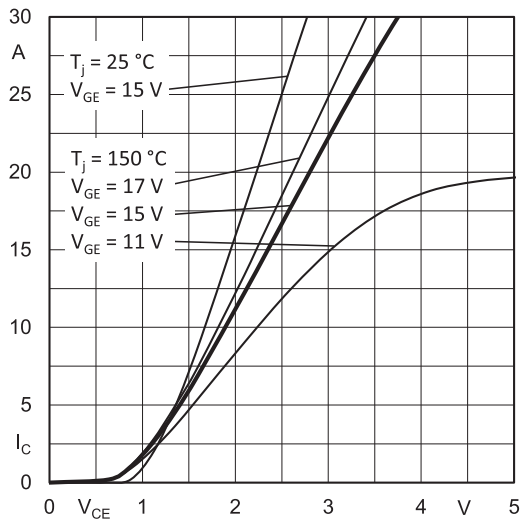


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_{E'}$

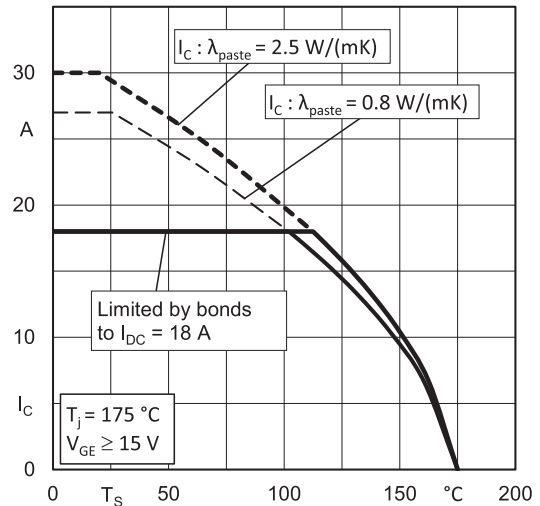


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

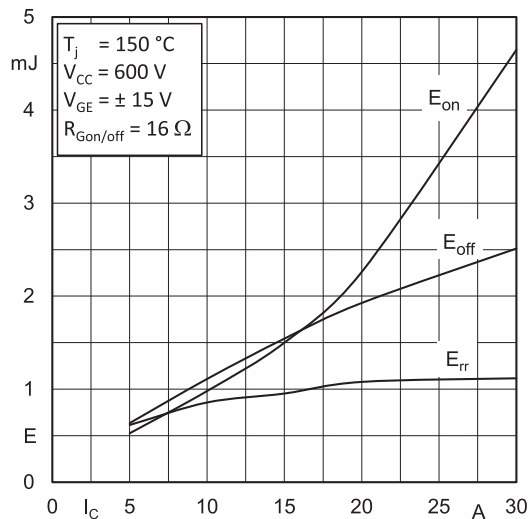


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

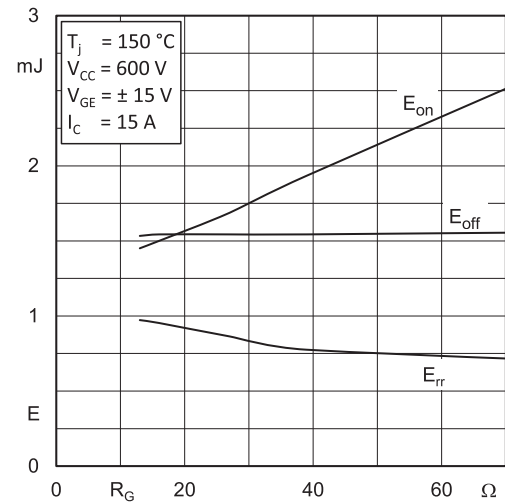


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

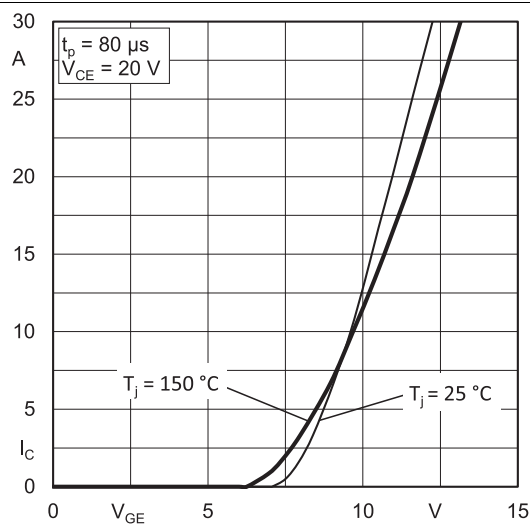


Fig. 5: Typ. transfer characteristic

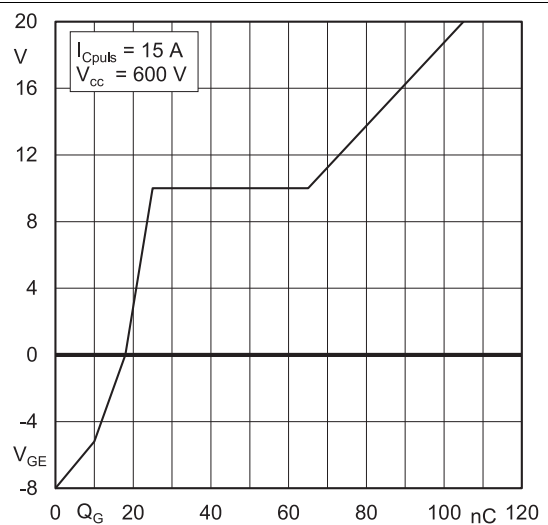
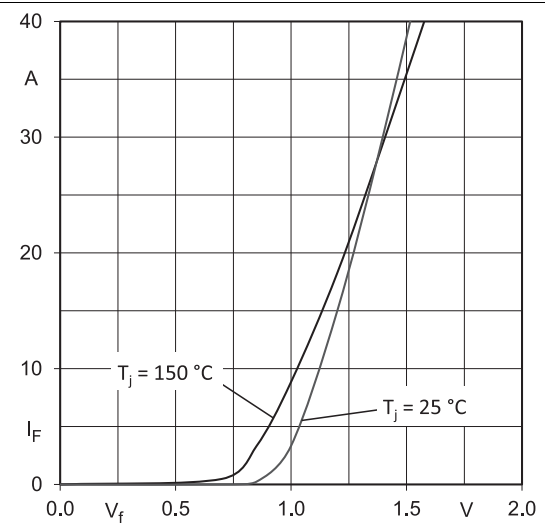
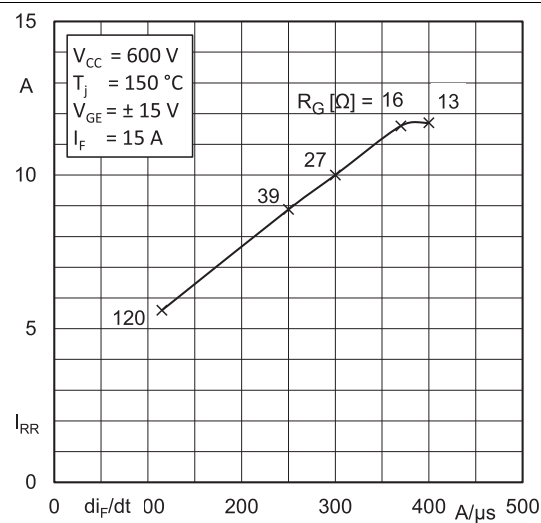
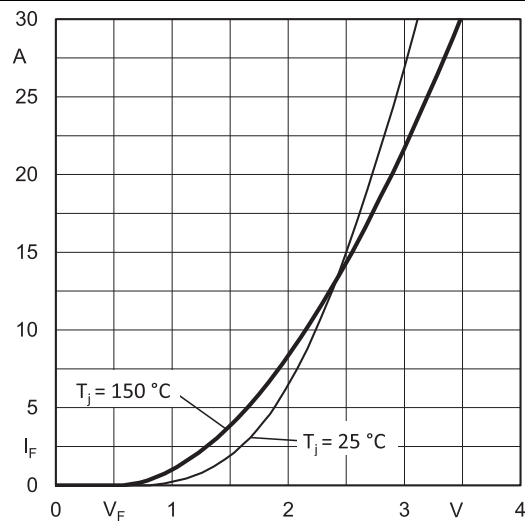
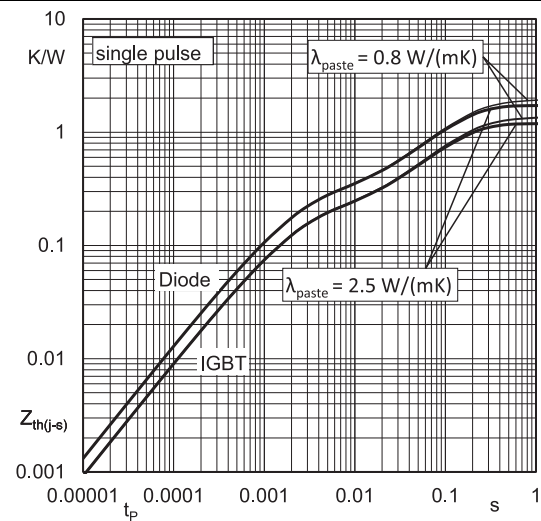
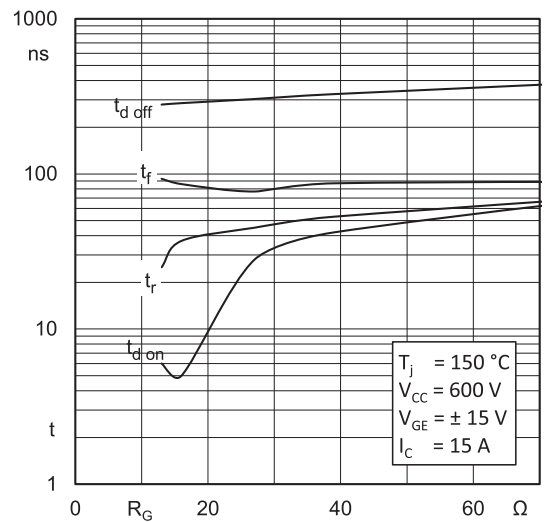
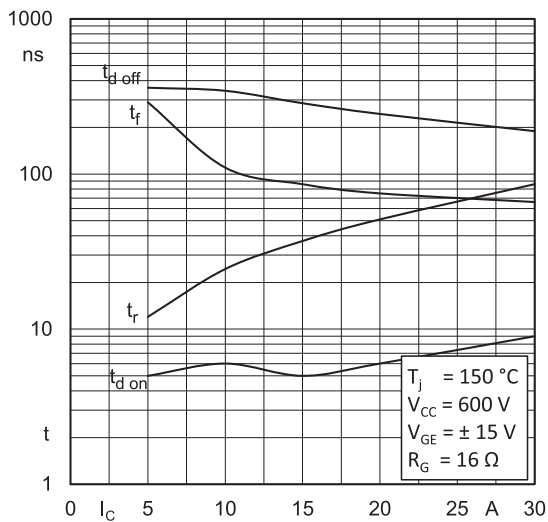
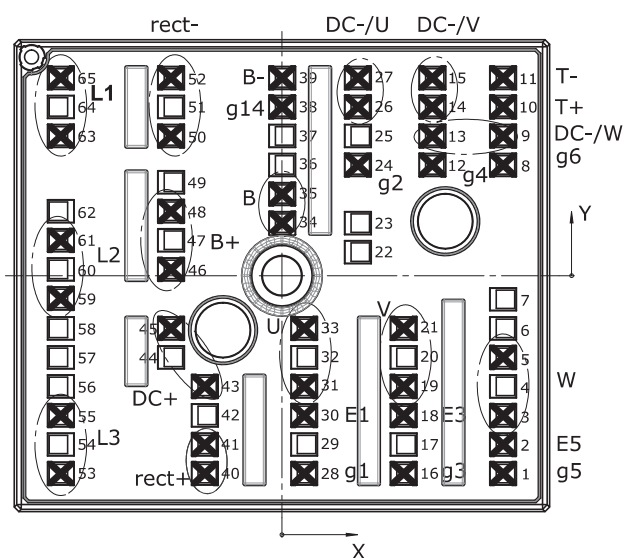


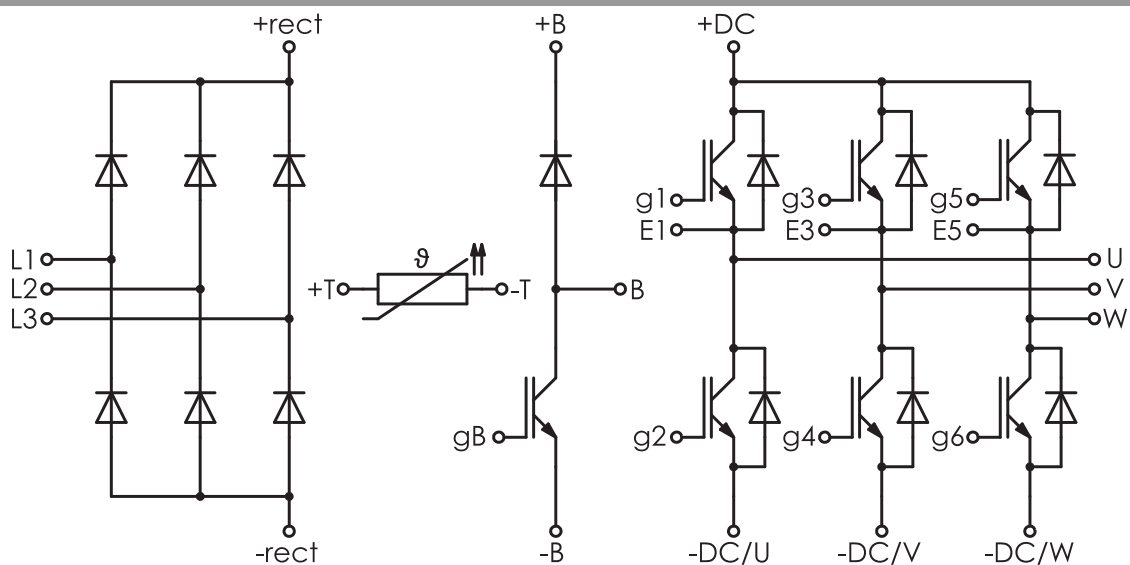
Fig. 6: Typ. gate charge characteristic



all values in mm



Pinout and Dimensions



Pinout

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

***IMPORTANT INFORMATION AND WARNINGS**

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