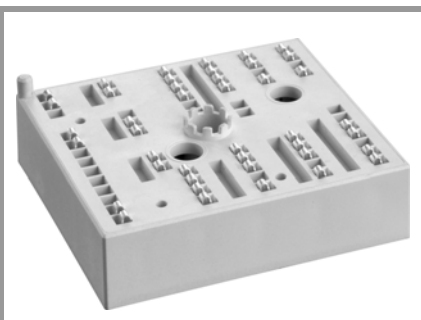


SKiIP 23NAB12T4V1



MiniSKiIP® 2

SKiIP 23NAB12T4V1

Features

- Trench 4 IGBT's
- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised file no. E63532

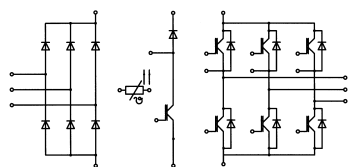
Typical Applications*

- Inverter up to 14 kVA
- Typical motor power 7,5 kW

Remarks

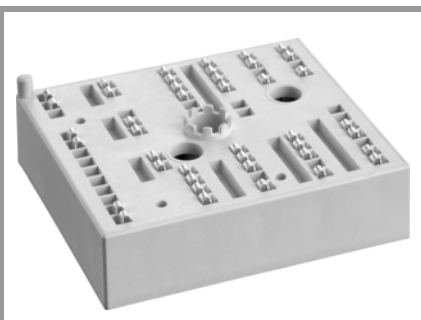
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- product rel. results valid for $T_j \leq 150$ (recomm. Top = $-40 \dots +150^\circ\text{C}$)

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
Inverter - IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V
I_C	$T_j = 150^\circ\text{C}$	$T_s = 25^\circ\text{C}$	33
		$T_s = 70^\circ\text{C}$	26
I_C	$T_j = 175^\circ\text{C}$	$T_s = 25^\circ\text{C}$	37
		$T_s = 70^\circ\text{C}$	30
I_{Cnom}		25	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	75	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150^\circ\text{C}$	10
T_j		-40 ... 175	$^\circ\text{C}$
Chopper - IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V
I_C	$T_j = 150^\circ\text{C}$	$T_s = 25^\circ\text{C}$	33
		$T_s = 70^\circ\text{C}$	26
I_C	$T_j = 175^\circ\text{C}$	$T_s = 25^\circ\text{C}$	37
		$T_s = 70^\circ\text{C}$	30
I_{Cnom}		25	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	75	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150^\circ\text{C}$	10
T_j		-40 ... 175	$^\circ\text{C}$
Inverse - Diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1200	V
I_F	$T_j = 150^\circ\text{C}$	$T_s = 25^\circ\text{C}$	29
		$T_s = 70^\circ\text{C}$	22
I_F	$T_j = 175^\circ\text{C}$	$T_s = 25^\circ\text{C}$	32
		$T_s = 70^\circ\text{C}$	26
I_{Fnom}		25	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	75	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 150^\circ\text{C}$	100	A
T_j		-40 ... 175	$^\circ\text{C}$
Freewheeling - Diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1200	V
I_F	$T_j = 150^\circ\text{C}$	$T_s = 25^\circ\text{C}$	29
		$T_s = 70^\circ\text{C}$	22
I_F	$T_j = 175^\circ\text{C}$	$T_s = 25^\circ\text{C}$	32
		$T_s = 70^\circ\text{C}$	26
I_{Fnom}		25	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	75	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 150^\circ\text{C}$	100	A
T_j		-40 ... 175	$^\circ\text{C}$



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Features

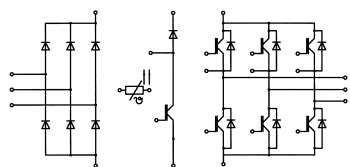
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- V_{CEsat} , V_F = chip level value
- Case temp. limited to $T_C = 125^\circ\text{C}$ max. (for baseplateless modules $T_C = T_S$)
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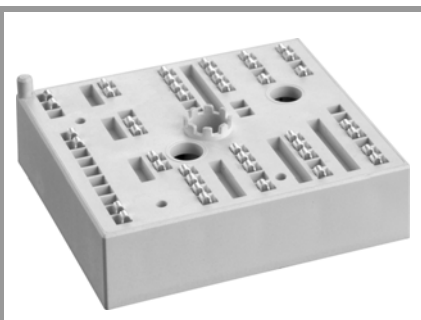


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Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
Rectifier - Diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1600	V
I_F	$T_s = 25^\circ\text{C}, T_j = 150^\circ\text{C}$	52	A
I_{Fnom}		13	A
I_{FSM}	10 ms	$T_j = 25^\circ\text{C}$	370
	sin 180°	$T_j = 150^\circ\text{C}$	270
I^2t	10 ms	$T_j = 25^\circ\text{C}$	685
	sin 180°	$T_j = 150^\circ\text{C}$	365
T_j		-40 ... 150	$^\circ\text{C}$
Module			
$I_t(\text{RMS})$	$T_{\text{terminal}} = 80^\circ\text{C}, 20\text{A per spring}$	40	A
T_{stg}		-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50Hz, 1 min	2500	V

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Inverter - IGBT					
$V_{CE(\text{sat})}$	$I_C = 25\text{ A}$ $V_{GE} = 15\text{ V}$ 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}		$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	42	48	m Ω
		$T_j = 150^\circ\text{C}$	62	66	m Ω
$V_{GE(\text{th})}$	$V_{GE} = V_{CE}\text{ V}, I_C = 1\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3	mA
					mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	1.43		nF
C_{oes}		$f = 1\text{ MHz}$	0.12		nF
C_{res}		$f = 1\text{ MHz}$	0.09		nF
Q_G	- 8 V...+ 15 V		142		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0.00		Ω
$t_{d(\text{on})}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	28		ns
t_r	$I_C = 25\text{ A}$	$T_j = 150^\circ\text{C}$	40		ns
E_{on}	$R_{G\text{ on}} = 24\ \Omega$	$T_j = 150^\circ\text{C}$	2.65		mJ
$t_{d(\text{off})}$	$R_{G\text{ off}} = 24\ \Omega$	$T_j = 150^\circ\text{C}$	295		ns
t_f		$T_j = 150^\circ\text{C}$	68		ns
E_{off}	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	2.3		mJ
$R_{\text{th}(j-s)}$	per IGBT		1.2		K/W
Chopper - IGBT					
$V_{CE(\text{sat})}$	$I_C = 25\text{ A}$ $V_{GE} = 15\text{ V}$ 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}		$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	42	48	m Ω
		$T_j = 150^\circ\text{C}$	62	66	m Ω
$V_{GE(\text{th})}$	$V_{GE} = V_{CE}\text{ V}, I_C = 1\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3	mA
		$T_j = 150^\circ\text{C}$			mA
Q_G	- 8 V...+ 15 V		142		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0.00		Ω

SKiIP 23NAB12T4V1



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SKiIP 23NAB12T4V1

Features

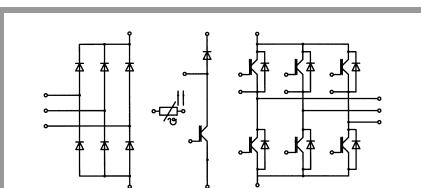
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Remarks

- V_{CEsat} , $V_{F=}$ chip level value
- Case temp. limited to $T_C = 125^\circ\text{C}$ max. (for baseplateless modules $T_C = T_S$)
- product rel. results valid for $T_j \leq 150$ (recomm. Top = $-40 \dots +150^\circ\text{C}$)



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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Chopper - IGBT					
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	28		ns
t_r	$I_C = 25\text{ A}$	$T_j = 150^\circ\text{C}$	40		ns
E_{on}	$R_{G\ on} = 24\ \Omega$	$T_j = 150^\circ\text{C}$	2.65		mJ
	$R_{G\ off} = 24\ \Omega$	$T_j = 150^\circ\text{C}$	295		ns
$t_{d(off)}$		$T_j = 150^\circ\text{C}$	68		ns
t_f		$T_j = 150^\circ\text{C}$	68		ns
E_{off}	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	2.3		mJ
$R_{th(j-s)}$	per IGBT		1.2		K/W
Inverse - Diode					
$V_F = V_{EC}$	$I_F = 25\text{ A}$	$T_j = 25^\circ\text{C}$	2.40	2.7	V
	$V_{GE} = 0\text{ V}$ chiplevel	$T_j = 150^\circ\text{C}$	2.5	2.8	V
V_{F0}		$T_j = 25^\circ\text{C}$	1.3	1.5	V
		$T_j = 150^\circ\text{C}$	0.9	1.1	V
r_F		$T_j = 25^\circ\text{C}$	44	50	m Ω
		$T_j = 150^\circ\text{C}$	62	68	m Ω
I_{RRM}	$I_F = 25\text{ A}$	$T_j = 150^\circ\text{C}$	24		A
Q_{rr}	$di/dt_{off} = 850\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	3.7		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	1.6		mJ
$R_{th(j-s)}$	per Diode		1.52		K/W
Freewheeling - Diode					
$V_F = V_{EC}$	$I_F = 25\text{ A}$	$T_j = 25^\circ\text{C}$	2.4	2.7	V
	$V_{GE} = 0\text{ V}$ chiplevel	$T_j = 150^\circ\text{C}$	2.5	2.8	V
V_{F0}		$T_j = 25^\circ\text{C}$	1.3	1.5	V
		$T_j = 150^\circ\text{C}$	0.9	1.1	V
r_F		$T_j = 25^\circ\text{C}$	44	50	m Ω
		$T_j = 150^\circ\text{C}$	62	68	m Ω
I_{RRM}	$I_F = 25\text{ A}$	$T_j = 150^\circ\text{C}$	24		A
Q_{rr}	$di/dt_{off} = 850\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	3.7		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	1.6		mJ
$R_{th(j-s)}$	per Diode		1.52		K/W
Rectifier - Diode					
$V_F = V_{EC}$	$I_F = 13\text{ A}$	$T_j = 25^\circ\text{C}$	1	1.21	V
	$V_{GE} = 0\text{ V}$ chiplevel	$T_j = 125^\circ\text{C}$		1.1	V
V_{F0}		$T_j = 25^\circ\text{C}$		1.0	V
		$T_j = 125^\circ\text{C}$		0.8	V
r_F		$T_j = 25^\circ\text{C}$	9.2	18	m Ω
		$T_j = 125^\circ\text{C}$		21	m Ω
$R_{th(j-s)}$	per Diode		1.25		K/W
Module					
M_s	to heat sink		2	2.5	Nm
w			65		g
Temperatur Sensor					
R_{100}	$T_r = 100^\circ\text{C}$, tolerance = 3 %		1670 \pm 3%		Ω
$R(T)$	$R(T) = 1000\ \Omega [1 + A(T - 25^\circ\text{C}) + B(T - 25^\circ\text{C})^2]$ $A = 7.635 \cdot 10^{-3}\ \text{C}^{-1}$, $B = 1.731 \cdot 10^{-5}\ \text{C}^{-2}$				

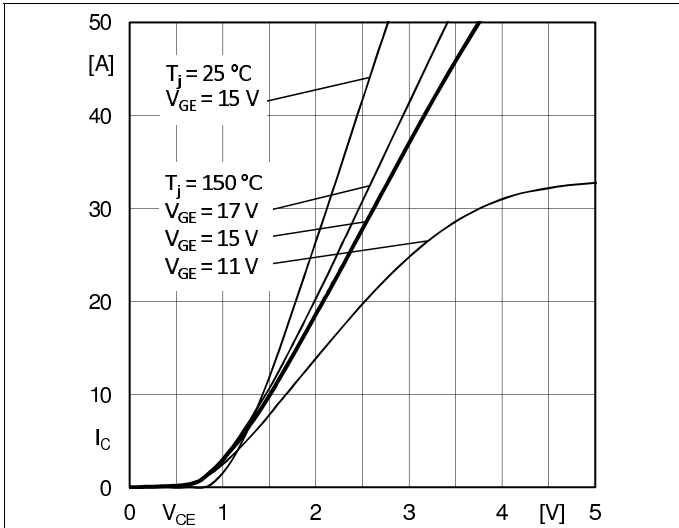


Fig. 1: Typ. output characteristic

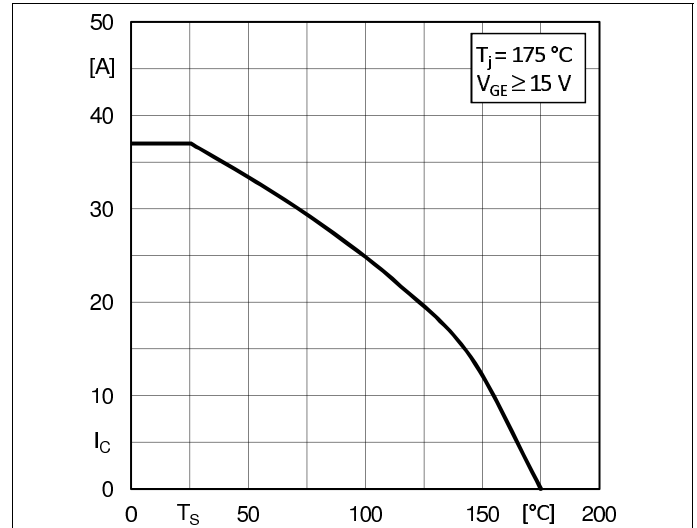


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_s)$

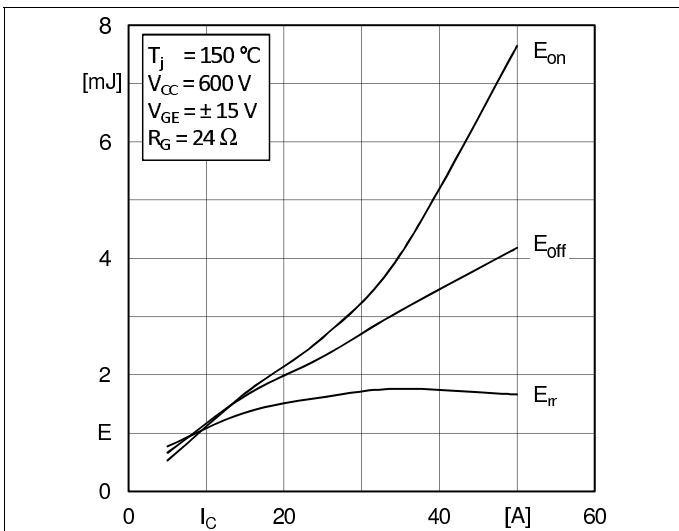


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

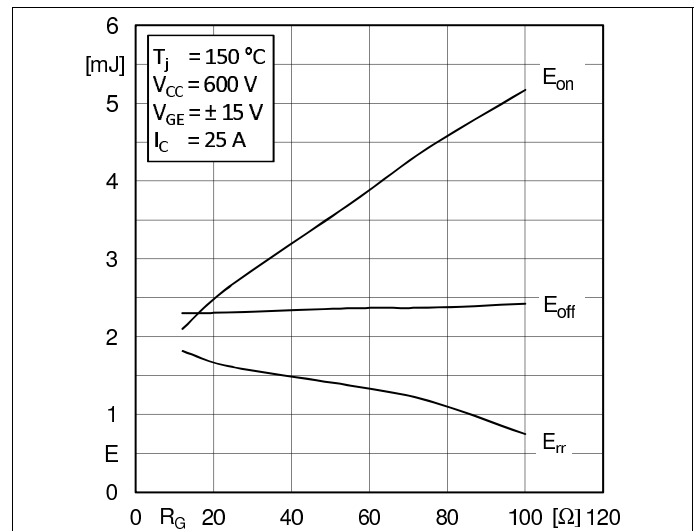


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

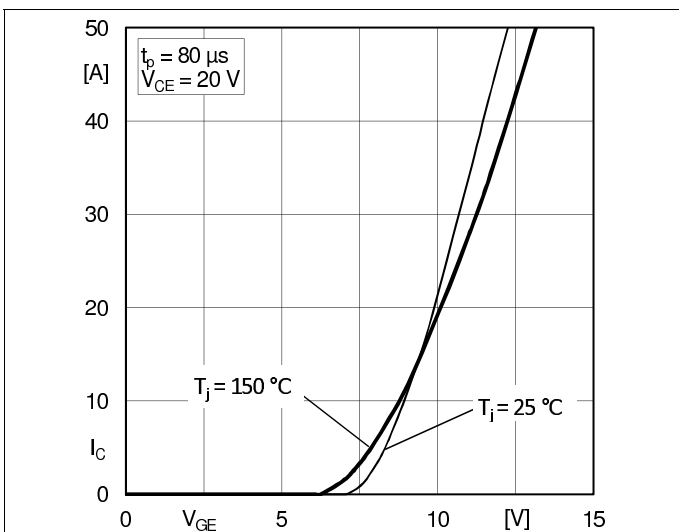


Fig. 5: Typ. transfer characteristic

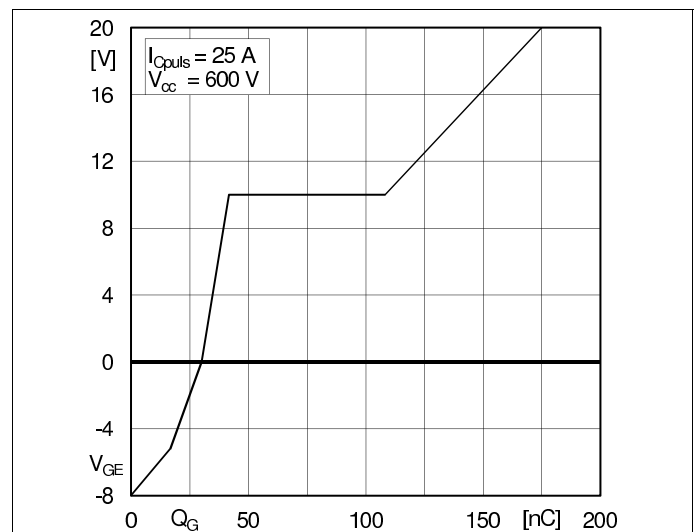


Fig. 6: Typ. gate charge characteristic

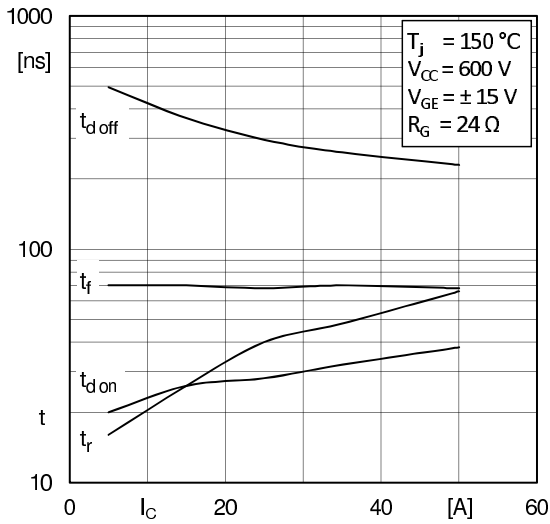


Fig. 7: Typ. switching times vs. I_C

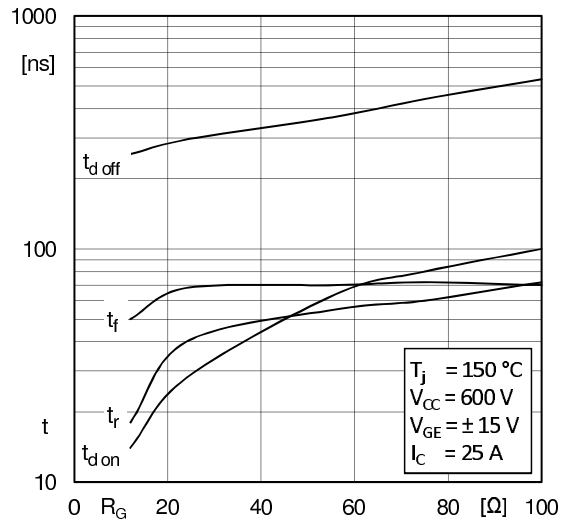


Fig. 8: Typ. switching times vs. gate resistor R_G

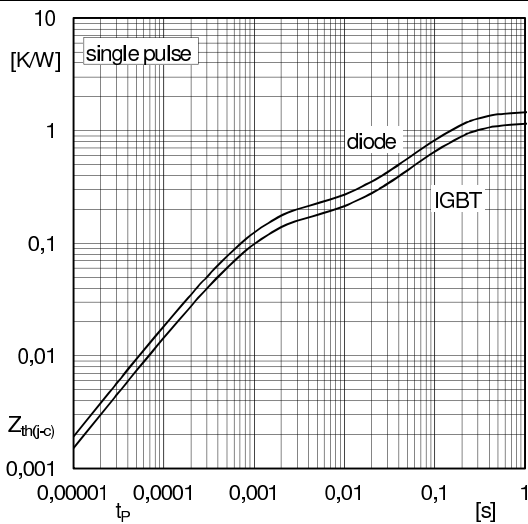


Fig. 9: Transient thermal impedance of IGBT and Diode

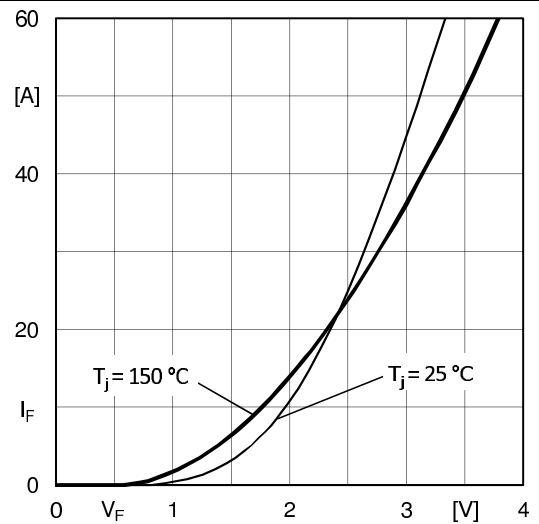


Fig. 10: CAL diode forward characteristic

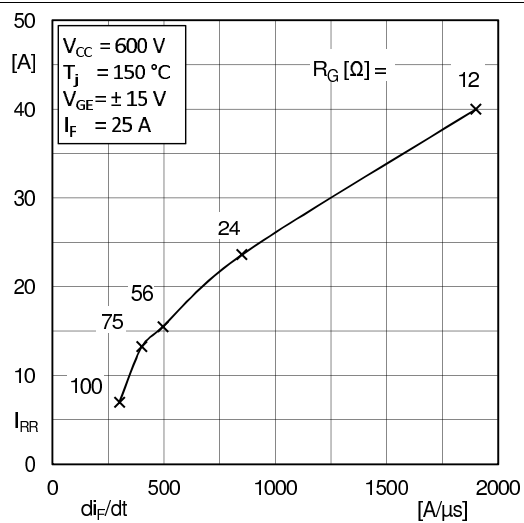


Fig. 11: Typ. CAL diode peak reverse recovery current

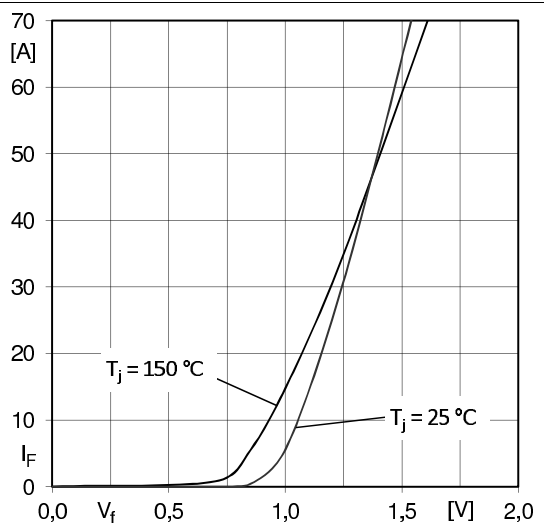


Fig. 12: Typ. input bridge forward characteristic

