

SKiiP 11NAB12T4V1



MiniSKiiP® 1

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Features

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

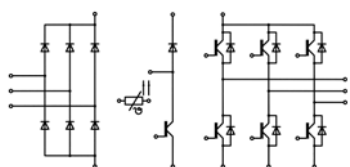
Typical Applications*

- Inverter up to 8 kVA
- Typical motor power 4 kW

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

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$		1200	V
I_C	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	18	A
		$T_j = 175^\circ\text{C}$	15	A
I_C	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	19	A
		$T_j = 175^\circ\text{C}$	16	A
I_{Cnom}			8	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$		24	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 800 \text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
	$V_{GE} \leq 15 \text{ V}$			
	$V_{CES} \leq 1200 \text{ V}$			
T_j			-40 ... 175	$^\circ\text{C}$
Chopper - IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$		1200	V
I_C	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	18	A
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	$V_{GE} \leq 15 \text{ V}$			
	$V_{CES} \leq 1200 \text{ V}$			
T_j			-40 ... 175	$^\circ\text{C}$
Inverse - Diode				
V_{RRM}	$T_j = 25^\circ\text{C}$		1200	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	15	A
		$T_j = 175^\circ\text{C}$	12	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	17	A
		$T_j = 175^\circ\text{C}$	13	A
I_{Fnom}			8	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		24	A
I_{FSM}	$t_p = 10 \text{ ms, sin } 180^\circ, T_j = 150^\circ\text{C}$		36	A
T_j			-40 ... 175	$^\circ\text{C}$
Freewheeling - Diode				
V_{RRM}	$T_j = 25^\circ\text{C}$		1200	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	15	A
		$T_j = 175^\circ\text{C}$	12	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	17	A
		$T_j = 175^\circ\text{C}$	13	A
I_{Fnom}			8	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		24	A
I_{FSM}	$t_p = 10 \text{ ms, sin } 180^\circ, T_j = 150^\circ\text{C}$		36	A
T_j			-40 ... 175	$^\circ\text{C}$



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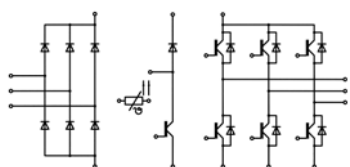
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Remarks

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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	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	39	A
		$T_j = 150^\circ\text{C}$	29	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	42	A
		$T_j = 150^\circ\text{C}$	32	A
I_{Fnom}			8	A
I_{FSM}	10 ms sin 180°	$T_j = 25^\circ\text{C}$	220	A
		$T_j = 150^\circ\text{C}$	200	A
I^2t	10 ms sin 180°	$T_j = 25^\circ\text{C}$	242	A ² s
		$T_j = 150^\circ\text{C}$	200	A ² s
T_j			-40 ... 150	°C
Module				
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$,		12	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, 1 min		2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
$V_{CE(sat)}$	$I_C = 8 \text{ A}$ $V_{GE} = 15 \text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.85	2.10		V
		$T_j = 150^\circ\text{C}$	2.25	2.45		V
V_{CE0}	chiplevel	$T_j = 25^\circ\text{C}$	0.80	0.90		V
		$T_j = 150^\circ\text{C}$	0.70	0.80		V
r_{CE}	$V_{GE} = 15 \text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	131	150		mΩ
		$T_j = 150^\circ\text{C}$	194	206		mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE} \text{ V}, I_C = 1 \text{ mA}$		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
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$		0.49		nF
C_{oes}		$f = 1 \text{ MHz}$		0.05		nF
C_{res}		$f = 1 \text{ MHz}$		0.03		nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$			45		nC
R_{Gint}	$T_j = 25^\circ\text{C}$			0		Ω
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$ $I_C = 8 \text{ A}$	$T_j = 150^\circ\text{C}$		31		ns
t_r		$T_j = 150^\circ\text{C}$		31		ns
E_{on}	$R_{G on} = 47 \Omega$ $R_{G off} = 47 \Omega$	$T_j = 150^\circ\text{C}$		0.87		mJ
$t_{d(off)}$		$T_j = 150^\circ\text{C}$		290		ns
t_f				70		ns
E_{off}	$V_{GE} = +15/-15 \text{ V}$			0.74		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W/(mK)}$			1.84		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W/(mK)}$			1.58		K/W



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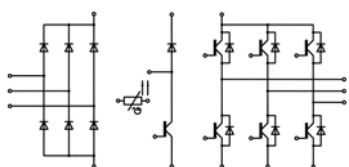
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Remarks

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- Please refer to MiniSKiiP "Technical Explanations" and "Mounting Instructions" for further information

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
$V_{CE(sat)}$	$I_C = 8\text{ A}$ $V_{GE} = 15\text{ V}$ 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	$T_j = 25^\circ\text{C}$		131	150	m Ω
		$T_j = 150^\circ\text{C}$		194	206	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}\text{ V}, I_C = 1\text{ mA}$		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
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$			45		nC
R_{Gint}	$T_j = 25^\circ\text{C}$			0		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 8\text{ A}$	$T_j = 150^\circ\text{C}$		31		ns
t_r	$R_{G\ on} = 47\ \Omega$	$T_j = 150^\circ\text{C}$		31		ns
E_{on}	$R_{G\ off} = 47\ \Omega$	$T_j = 150^\circ\text{C}$		0.87		mJ
$t_{d(off)}$		$T_j = 150^\circ\text{C}$		290		ns
t_f		$T_j = 150^\circ\text{C}$		70		ns
E_{off}	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$		0.74		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			1.84		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			1.58		K/W
Inverse - Diode						
$V_F = V_{EC}$	$I_F = 8\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.33	2.65	V
		$T_j = 150^\circ\text{C}$		2.35	2.68	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		129	144	m Ω
		$T_j = 150^\circ\text{C}$		181	198	m Ω
I_{RRM}	$I_F = 8\text{ A}$	$T_j = 150^\circ\text{C}$		8.3		A
Q_{rr}	$di/dt_{off} = 380\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		1.35		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		0.57		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			2.53		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			2.2		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	$I_F = 8\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.33	2.65	V
		$T_j = 150^\circ\text{C}$		2.35	2.68	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		129	144	m Ω
		$T_j = 150^\circ\text{C}$		181	198	m Ω
I_{RRM}	$I_F = 8\text{ A}$	$T_j = 150^\circ\text{C}$		8.3		A
Q_{rr}	$di/dt_{off} = 380\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		1.35		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		0.57		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			2.53		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			2.2		K/W



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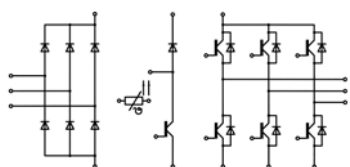
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
$V_F = V_{EC}$	$I_F = 8 \text{ A}$ $V_{GE} = 0 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		1.00	1.21	V
		$T_j = 125^\circ\text{C}$		0.90	1.10	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		0.88	0.98	V
		$T_j = 125^\circ\text{C}$		0.73	0.83	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		15	29	m Ω
		$T_j = 125^\circ\text{C}$		21	34	m Ω
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8 \text{ W/(mK)}$			1.5		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5 \text{ W/(mK)}$			1.29		K/W
Module						
M_s	to heat sink		2		2.5	Nm
w				30		g
L_{CE}				-		nH
Temperature Sensor						
R_{100}	$T_r = 100^\circ\text{C}$			1670 \pm 3%		Ω
$R(T)$	$R(T)=1000\Omega[1+A(T-25^\circ\text{C})+B(T-25^\circ\text{C})^2]$], $A = 7.635 \cdot 10^{-3} \text{ }^\circ\text{C}^{-1}$, $B = 1.731 \cdot 10^{-5} \text{ }^\circ\text{C}^{-2}$					



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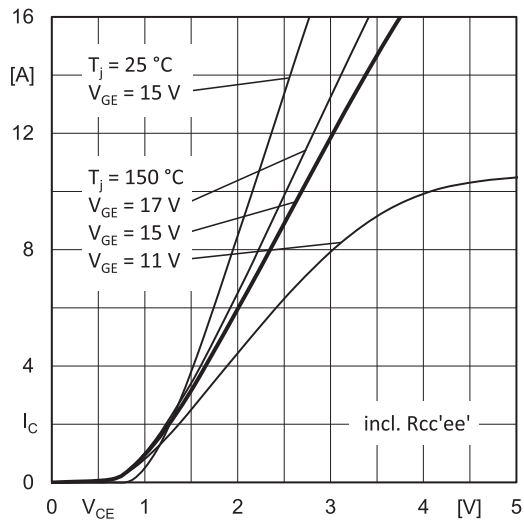


Fig. 1: Typ. output characteristic

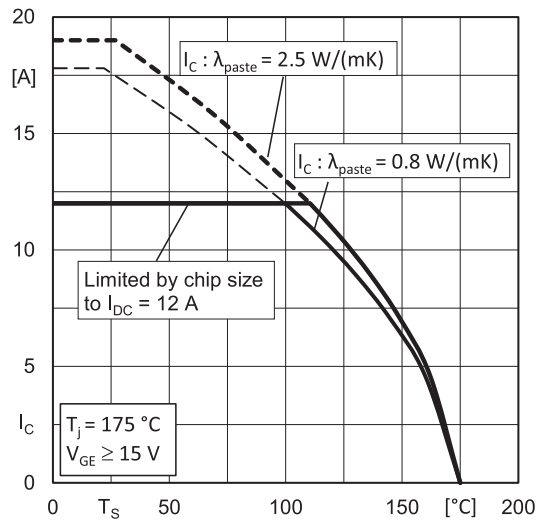


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

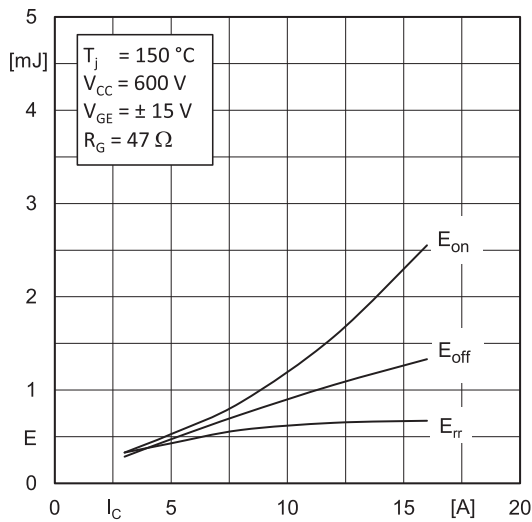


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

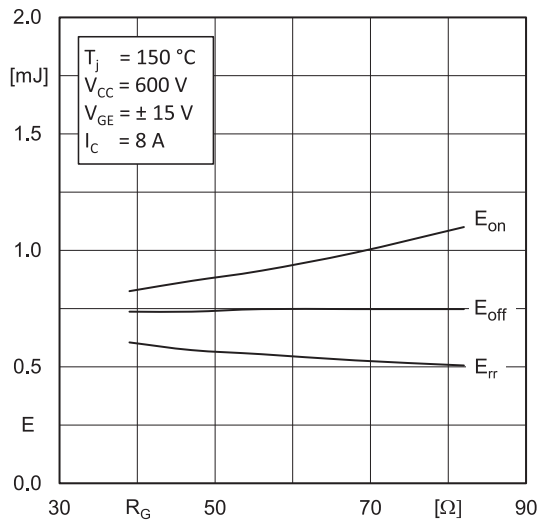


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

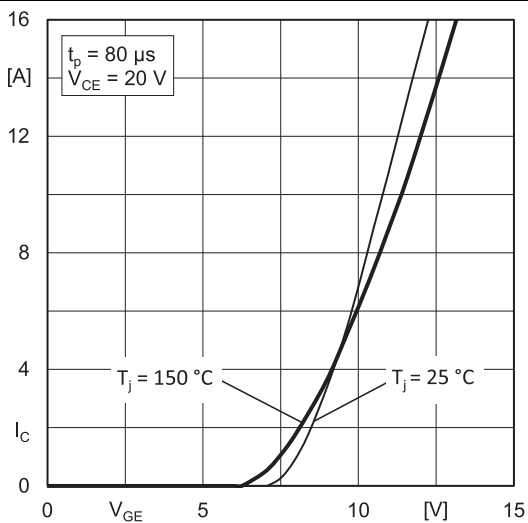


Fig. 5: Typ. transfer characteristic

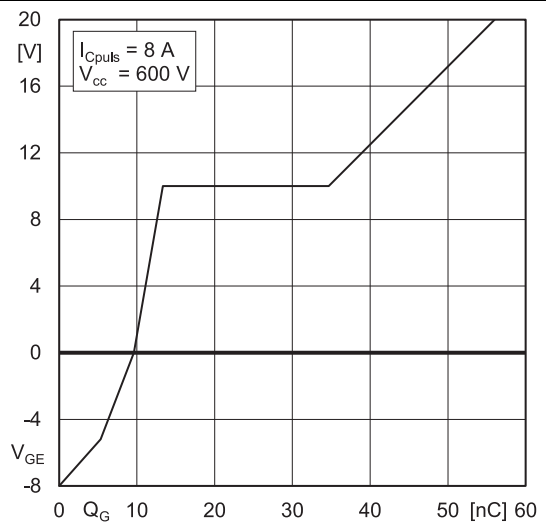


Fig. 6: Typ. gate charge characteristic

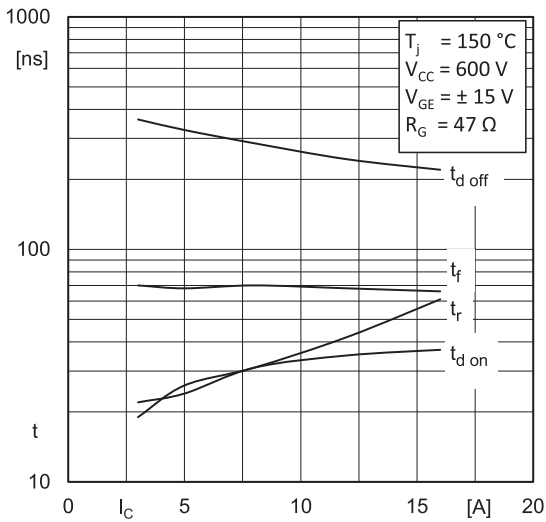


Fig. 7: Typ. switching times vs. I_C

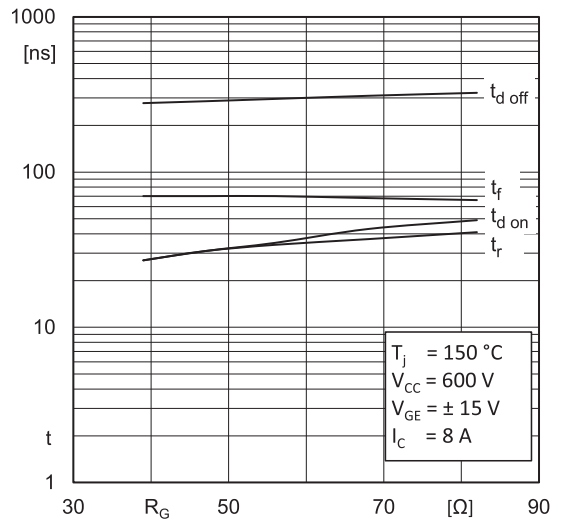


Fig. 8: Typ. switching times vs. gate resistor R_G

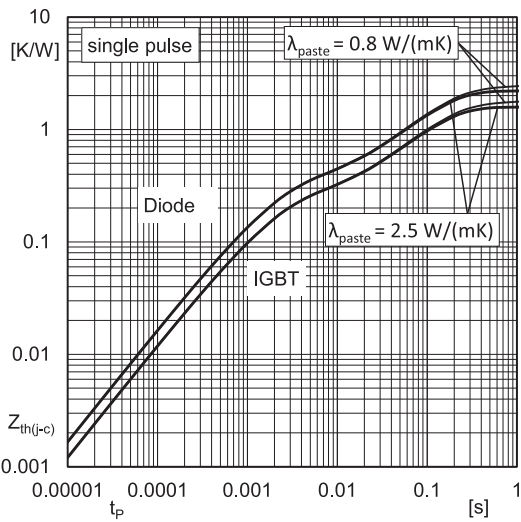


Fig. 9: Transient thermal impedance of IGBT and Diode

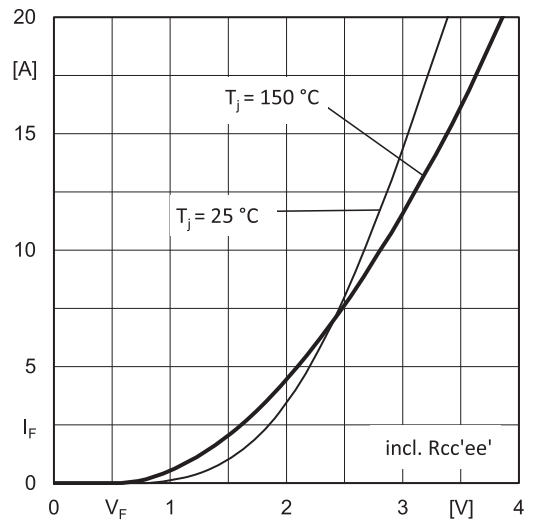


Fig. 10: CAL diode forward characteristic

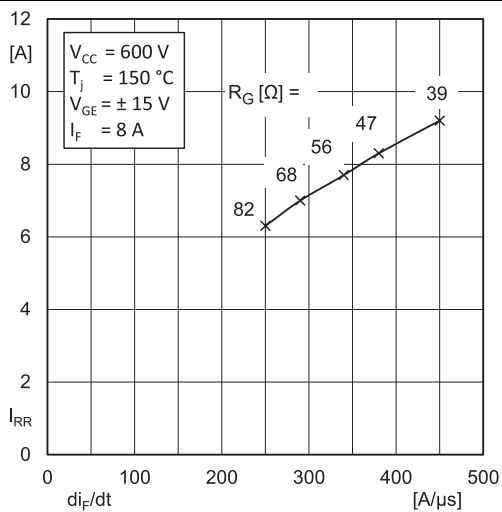


Fig. 11: Typ. CAL diode peak reverse recovery current

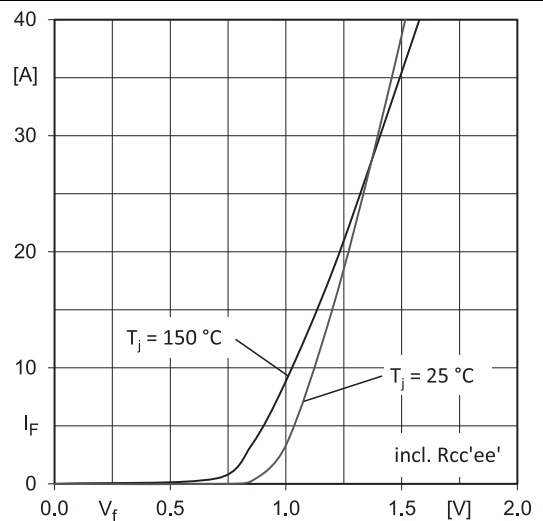


Fig. 12: Typ. input bridge forward characteristic

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

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