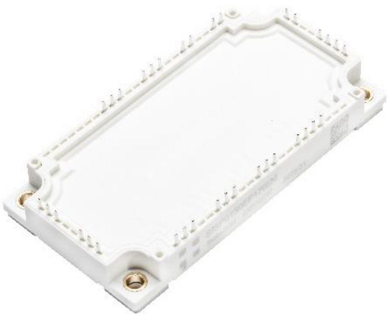
DATASHEET

SISP0100EP170i20

EP-Type H-bridge IGBT module with input rectifier



V_{CE} = 1700 V
I_C = 4 x 100 A

- *i20* ultra-low loss fine pattern Trench IGBT chipset *i20*IGBT
- PIM with H-bridge and input rectifier
- Baseplate isolation with efficient Al_2O_3 ceramic Al_2O_3
- Cu baseplate for low thermal resistance
- Industry standard package

Maximum ratings[1]

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNIT
Collector-emitter voltage	V_{CES} / V_{RRM}	V_{GE} = 0 V, T_{vj} = 25 °C		1700	V
DC collector current	I_C	T_C = 125 °C, T_{vj} = 175 °C		100	A
Peak collector current	I_{CM}	t_p = 1 ms		200	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_C = 25 °C, T_{vj} = 175 °C, per IGBT		750	W
DC forward current	I_F			100	A
Peak forward current	I_{FRM}	t_p = 1 ms		200	A
Surge current FWD	I_{FSM} I^2t	V_R = 0 V, T_{vj} = 150 °C, t_p = 10 ms, half-sinewave		450 1000	A A^2s
Surge current Rectifier	I_{FSM} I^2t	V_R = 0 V, T_{vj} = 150 °C, t_p = 10 ms, half-sinewave		1050 5500	A A^2s
Isolation voltage	V_{isol}	1 min, f = 50 Hz		3400	V
Junction operating temperature	$T_{vj(op)}$		-40	175[2]	°C
Case temperature	T_C		-40	125	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques [3]	M_S	Base-heatsink, M5 screws	3	6	Nm

[1] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747;
[2] $T_{vj(op)}$ > 150°C allowed for overload conditions, less than 20% of operation time
[3] For details, please refer to the mounting instructions.

IGBT[4]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Collector(-emitter) breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0 V, I_C = 1 mA, T_{vj} = 25°C		1700			V
Collector-emitter saturation voltage [5]	V_{CEsat}	I_C = 100 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.65	2.0	V
			T_{vj} = 125 °C		1.85		V
			T_{vj} = 175 °C		2.05		V
Collector cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
			T_{vj} = 125 °C		0.3		mA
			T_{vj} = 175 °C		4.5		mA
Gate leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V		-0.5		0.5	µA
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 5 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		5	6.15	7.5	V
Gate charge	Q_G	I_C = 100 A, V_{CE} = 900 V, V_{GE} = -15 V .. 15 V			0.73		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25 °C			8		nF
Output capacitance	C_{oes}				0.32		nF
Reverse tansfer capacitance	C_{res}				0.23		nF
Internal gate resistor	R_{Gint}	Per switch, f = 1 MHz, V_{GE} = 0V, CE short			5		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 900 V, I_C = 100 A, V_{GE} = ± 15 V, R_G = 11 Ω(A1 switch), R_G = 6.5 Ω(A2 switch), L_s = 90 nH, inductive load	T_{vj} = 25 °C		168		ns
			T_{vj} = 125 °C		177		ns
			T_{vj} = 175 °C		178		ns
Rise time	t_r		T_{vj} = 25 °C		27		ns
			T_{vj} = 125 °C		30		ns
			T_{vj} = 175 °C		33		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 900 V, I_C = 100 A, R_G = 4.5 Ω, V_{GE} = ± 15 V, L_s = 90 nH, inductive load	T_{vj} = 25 °C		377		ns
			T_{vj} = 125 °C		475		ns
			T_{vj} = 175 °C		510		ns
Fall time	t_f		T_{vj} = 25 °C		415		ns
			T_{vj} = 125 °C		562		ns
			T_{vj} = 175 °C		650		ns
Turn-on switching energy	E_{on}	V_{CC} = 900 V, I_C = 100 A, R_G = 11 Ω(A1 switch), R_G = 6.5 Ω(A2 switch), L_s = 90 nH, inductive load	T_{vj} = 25 °C		32		mJ
			T_{vj} = 125 °C		39		mJ
			T_{vj} = 175 °C		44		mJ
Turn-off switching energy	E_{off}	V_{CC} = 900 V, I_C = 100 A, R_G = 4.5 Ω, V_{GE} = ± 15 V, L_s = 90 nH, inductive load	T_{vj} = 25 °C		18		mJ
			T_{vj} = 125 °C		25		mJ
			T_{vj} = 175 °C		28		mJ
Short circuit current	I_{SC}	t_{pcs} ≤ 10 µs, V_{GE} = 15 V, T_{vj} = 175 °C, V_{CC} = 1200V, $V_{CEM\ Chip}$ ≤ 1700 V			496		A

[4] Characteristic values according to IEC 60747-9
[5] Collector-emitter saturation voltage is given at chip-level

Diode FWD[6]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Forward voltage[7]	V_F	I_F = 100 A	T_{vj} = 25 °C		1.7	2.15	V
			T_{vj} = 125 °C		1.85		V
			T_{vj} = 175 °C		1.95		V
Peak reverse recovery current	I_{RM}	V_R = 900 V, I_F = 100 A, R_G = 11 Ω(A1 switch), R_G = 6.5 Ω(A2 switch), L_s = 90 nH, inductive load	T_{vj} = 25 °C		117		A
			T_{vj} = 125 °C		119		A
			T_{vj} = 175 °C		119		A
Recovery charge	Q_{rr}		T_{vj} = 25 °C		26		μC
			T_{vj} = 125 °C		40		μC
			T_{vj} = 175 °C		49		μC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		712		ns
			T_{vj} = 125 °C		1156		ns
			T_{vj} = 175 °C		1453		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		14		mJ
			T_{vj} = 125 °C		23		mJ
			T_{vj} = 175 °C		29		mJ

Diode Rectifier[8]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25°C, I_R = 1mA		1700			V
Maximum RMS forward current	I_{FRMSM}	T_C=95°C				125	A
Forward voltage[9]	V_F	I_F=125 A	T_{vj} = 25 °C		1.08		V
			T_{vj} = 125 °C		1.02		V
			T_{vj} = 150 °C		1.0		V
Forward threshold voltage	$V_{(F0)}$	T_{vj}=150°C, I_F=50 – 125 A			0.7		V
Forward slope resistance	r_F	T_{vj}=150°C, I_F=50 – 125 A			2		mΩ
Junction operating temperature	$T_{vj(op)}$			-40		150	°C

[6] Characteristic values according to IEC 60747-2
[7] Forward voltage is given at chip-level
[8] Characteristic values according to IEC 60747-2
[9] Forward voltage is given at chip-level

NTC Thermistor

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Rated resistance	R_{25}	T_C = 25 °C		5		kΩ
R100	R_{100}	T_C = 100 °C	468		518	Ω
B-value B	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T2 - 1/(298.15K))]$		3375		K
B-value B	$B_{25/100}$	$R_2 = R_{25} \exp [B_{25/100}(1/T2 - 1/(298.15K))]$		3433		K

Package properties [10]

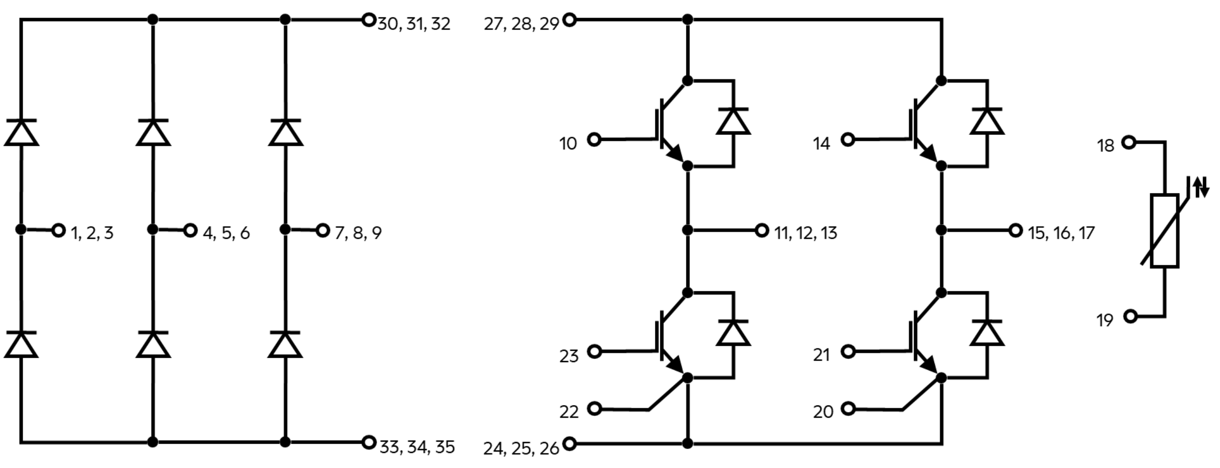
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$	Per switch				0.20	K/W
FWD thermal resistance junction to case	$R_{th(j-c)Diode}$					0.32	K/W
Rectifier thermal resistance junction to case	$R_{th(j-c)rectifier\ Diode}$					0.28	K/W
IGBT thermal resistance case to heatsink	$R_{th(c-h)IGBT}$				0.089		K/W
FWD thermal resistance case to heatsink	$R_{th(c-h)Diode}$				0.099		K/W
Rectifier thermal resistance case to heatsink	$R_{th(c-h)rectifier\ Diode}$				0.159		K/W
Comparative tracking index	CTI			400			
Module stray inductance	$L_{s\ CE}$	Per switch			35		nH
Resistance, terminal chip	$R_{CC'+EE'}$	Per switch	T_{vj} = 25 °C		2		mΩ
			T_{vj} = 125 °C		2.8		mΩ
			T_{vj} = 175 °C		3.1		mΩ

[10] Package and mechanical properties according to IEC 60747-15

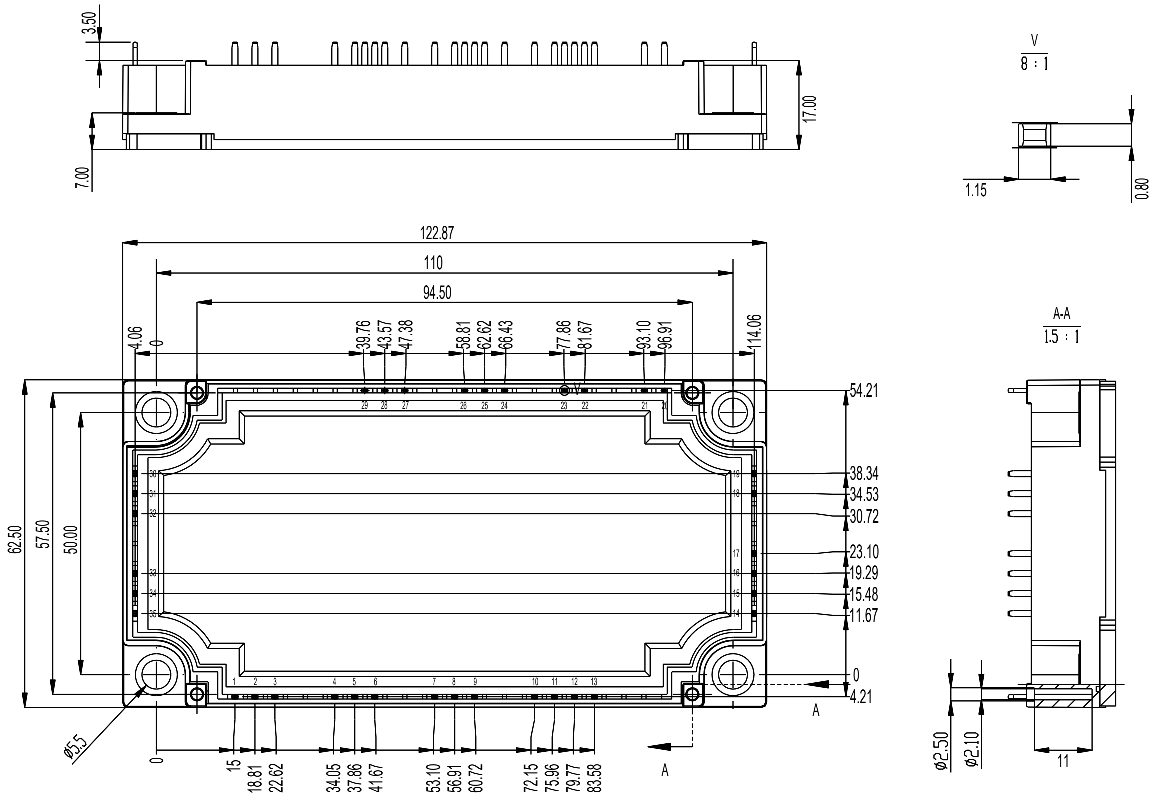
Mechanical properties

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Dimensions	L x W x H	Typical		122 x 62.5 x 17			mm^3
Clearance distance in air	d_a	According to IEC 60664-1 and EN 50124-1	Terminal to base:	10			mm
			Terminal to terminal:	10			mm
Surface creepage distance	d_s	According to IEC 60664-1 and EN 50124-1	Terminal to base:	7.5			mm
			Terminal to terminal:	10			mm
Mass	m				300		g

Electrical configuration



Outline drawing

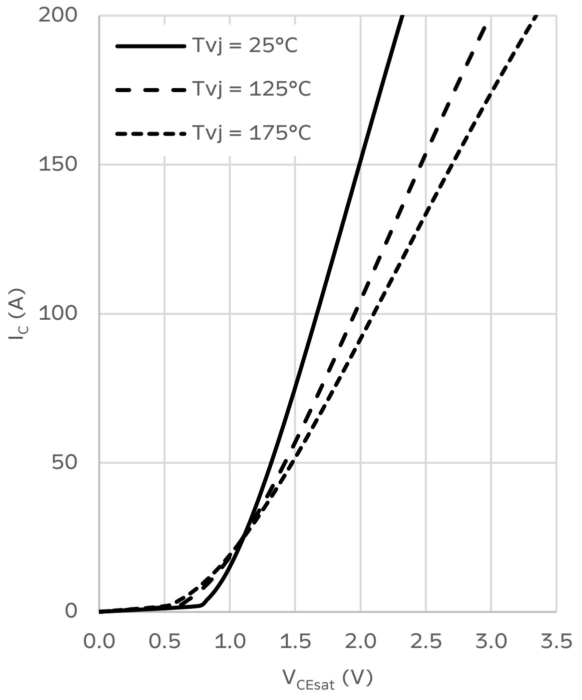


This is an electrostatic sensitive device. .

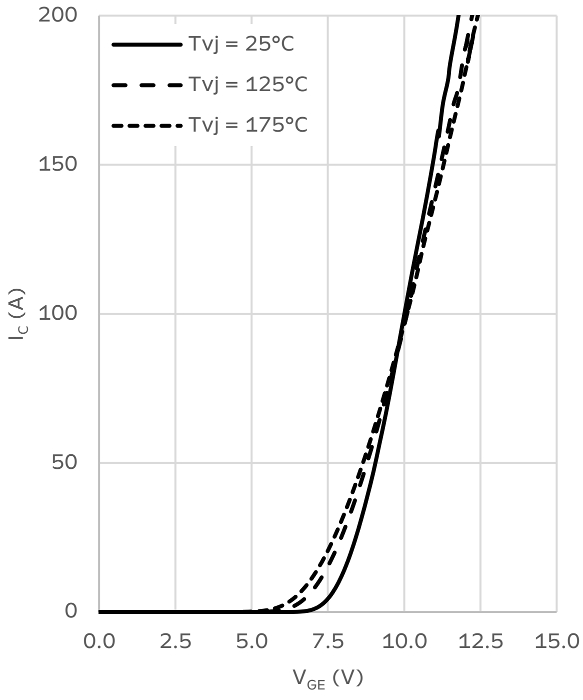
This product has been designed and qualified for Industrial Level. .

Characteristics

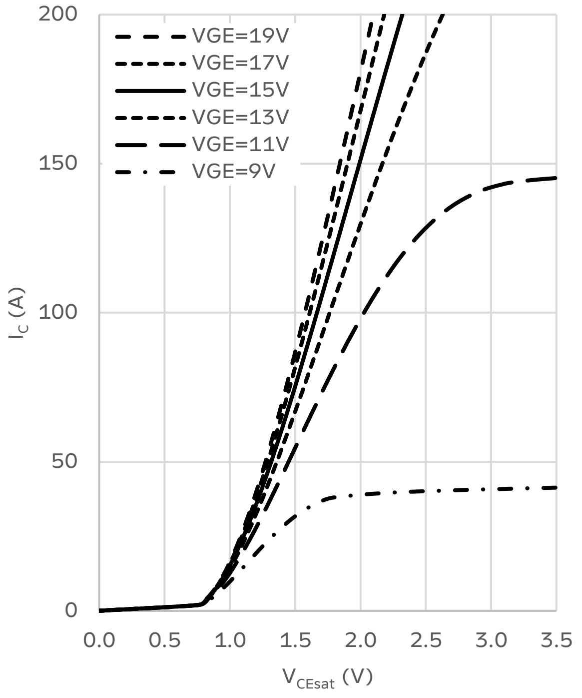
IGBT on-state characteristics (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



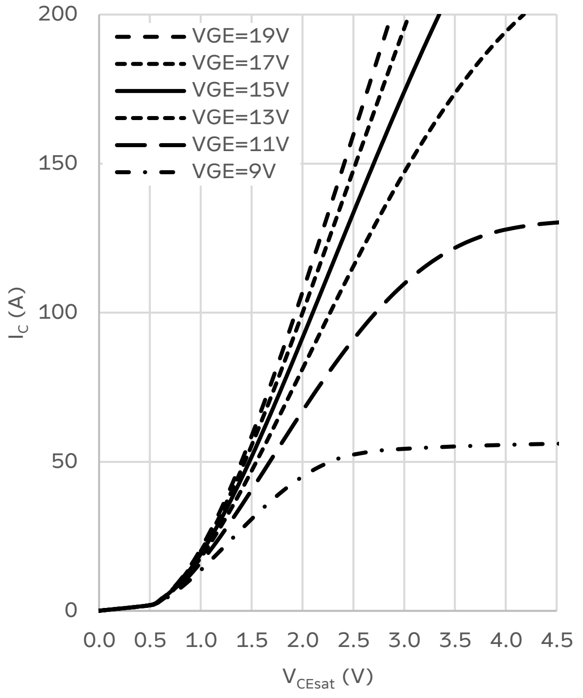
IGBT transfer characteristics (typical)
IGBT
$I_C = f(V_{GE})$
V_{CE} = 20V



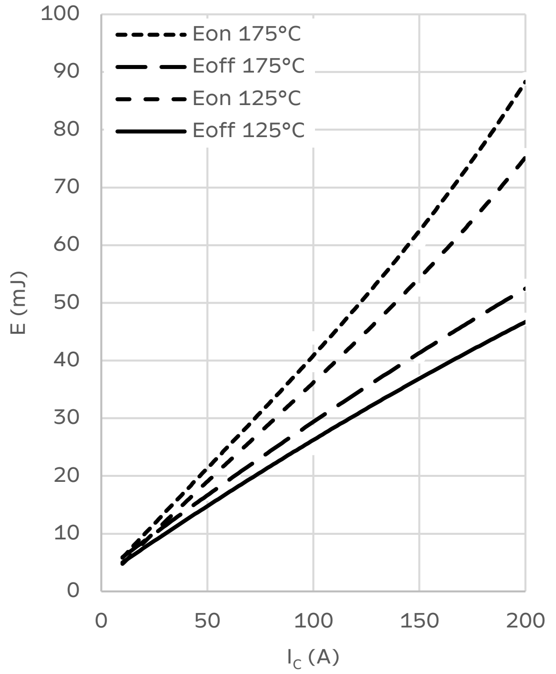
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 25 °C



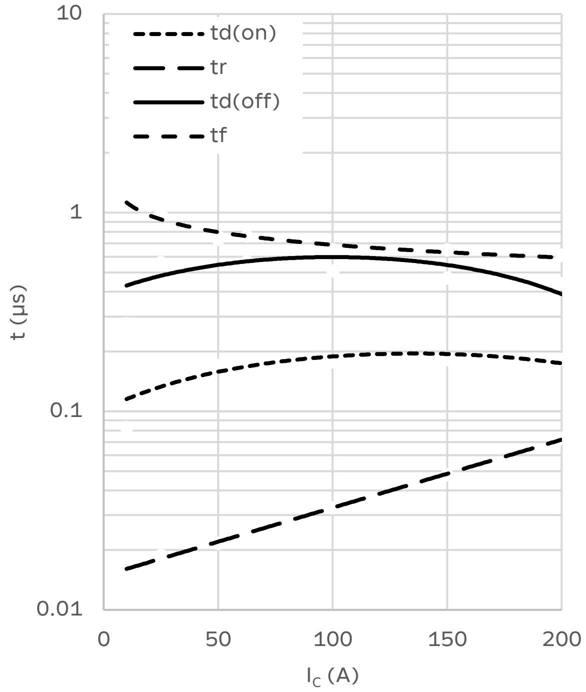
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 175 °C



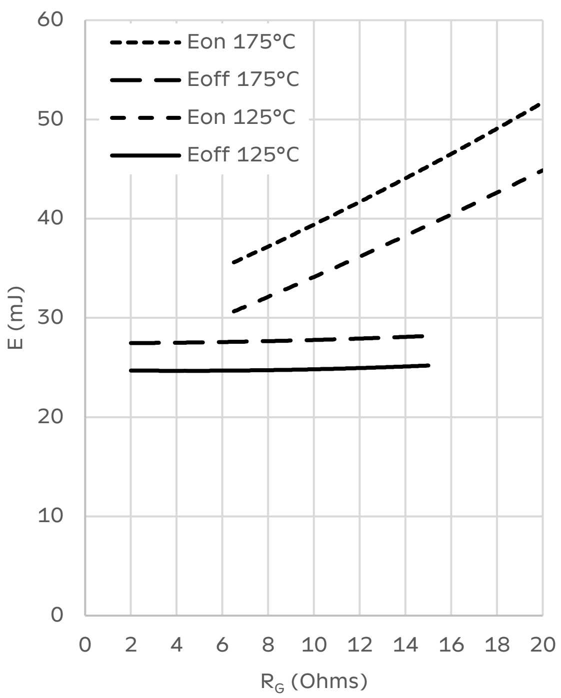
IGBT switching losses (typical)
E = f(I_{CE})
V_{CE} = 900 V, R_{Gon} = 11 / 6.5 Ω, R_{Goff} = 4.5 Ω, V_{GE} = -15/+15 V



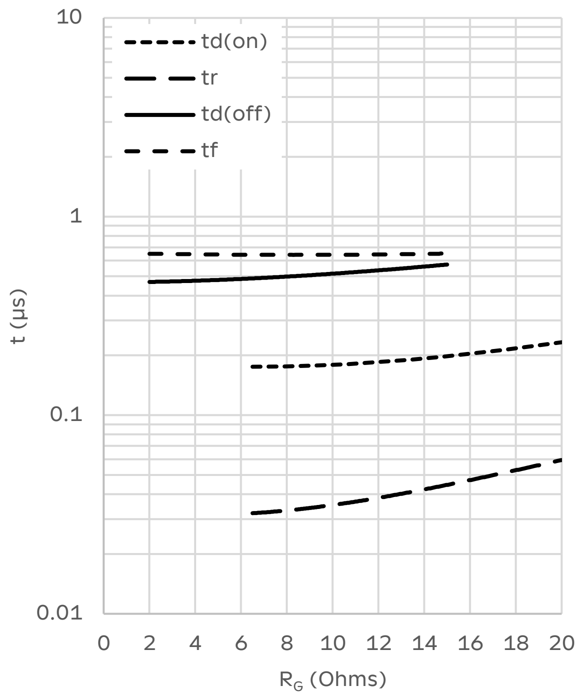
IGBT switching times (typical)
t = f(I_{CE}), T_{vj} = 175 °C
V_{CE} = 900 V, R_{Gon} = 11 / 6.5 Ω, R_{Goff} = 4.5 Ω, V_{GE} = -15/+15 V



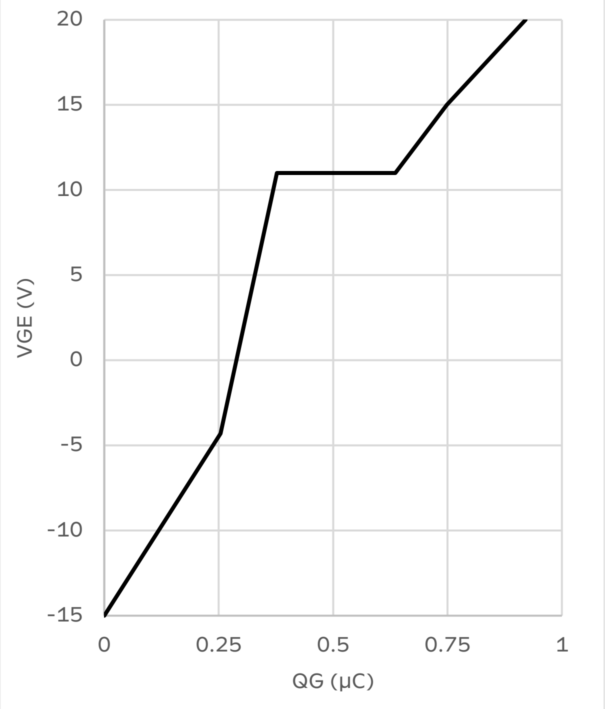
IGBT switching losses (typical)
E = f(R_G)
V_{CE} = 900 V, I_C = 100 A, V_{GE} = -15/+15 V



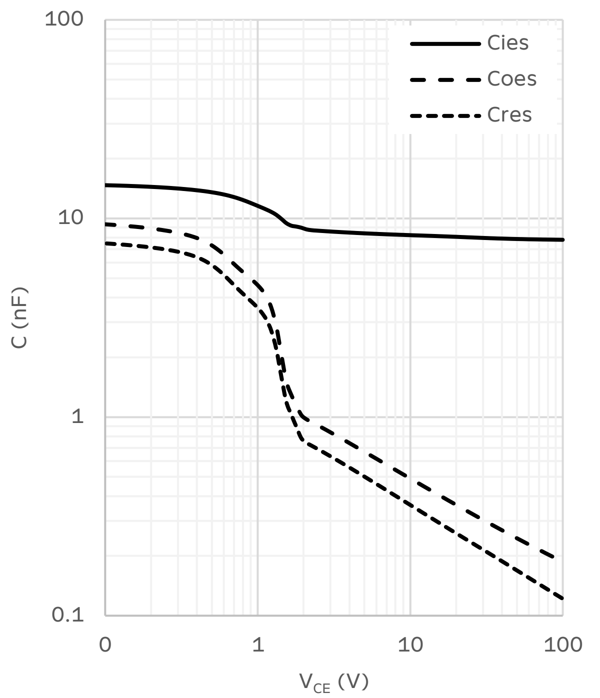
IGBT switching times (typical)
t = f(R_G), T_{vj} = 175 °C
V_{CE} = 900 V, I_C = 100 A, V_{GE} = -15/+15 V



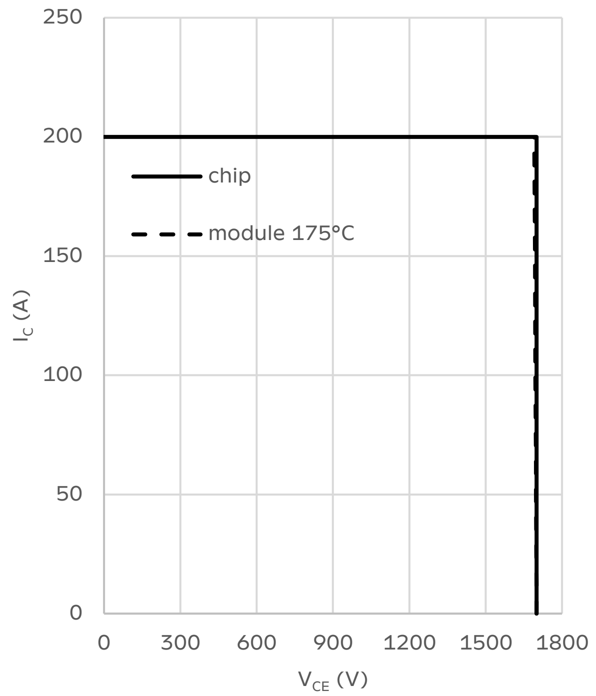
IGBT gate charge (typical)
$V_{GE} = f(Q_G)$, $T_{vj} = 25$ °C
$V_{CE} = 900$ V, $I_C = 100$ A



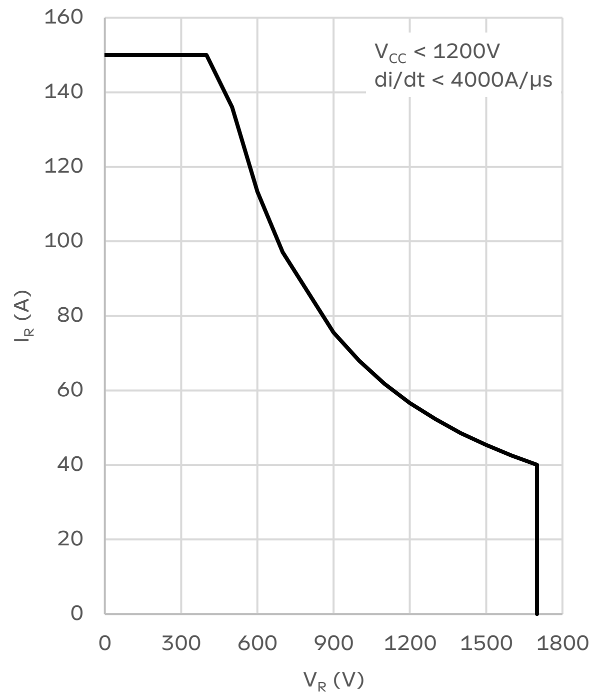
Capacitance characteristics (typical)
$C = f(V_{CE})$, $T_{vj} = 25$ °C
$f = 100$ kHz, $V_{GE} = 0$ V



IGBT RBSOA
$I_C = f(V_{CEm})$
$R_{Goff} = 4.5\ \Omega$, $V_{GE} = \pm 15$ V

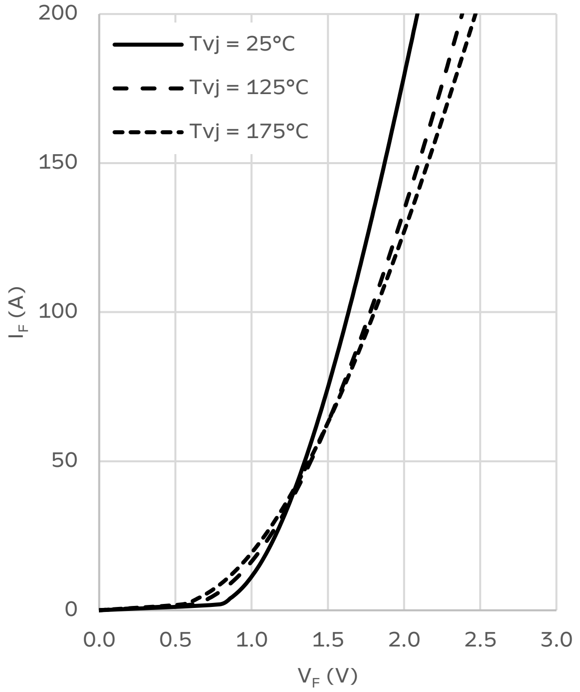


Diode SOA
$T_{vj} \leq 175$ °C



Diode forward characteristic (typical)

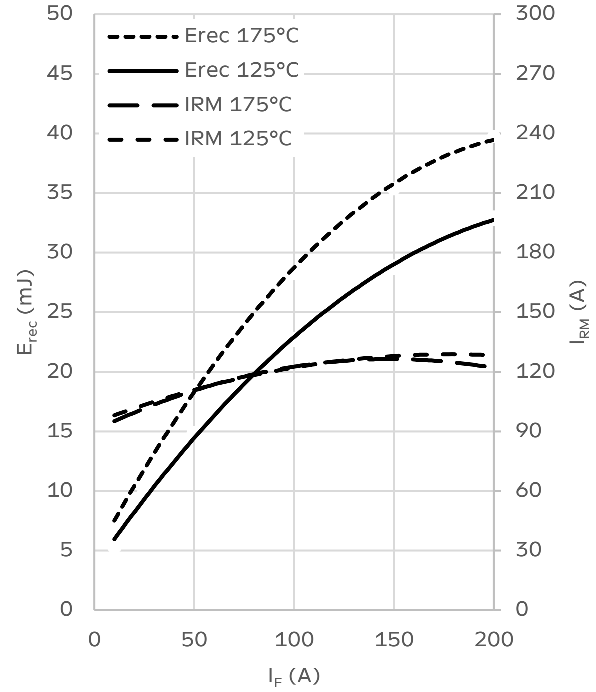
$I_F = f(V_F)$



Diode switching characteristics (typical)

$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$

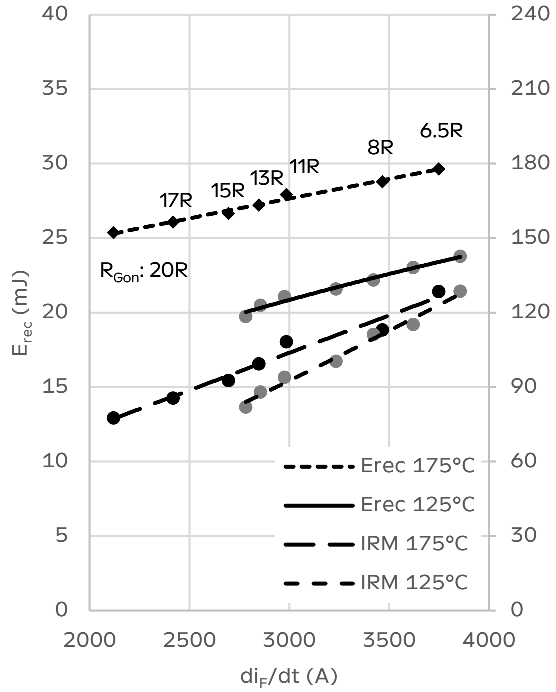
$V_{DC} = 900$ V, $R_{Gon} = 11$ / 6.5 Ω (IGBT), $V_{GE} = -15/+15$ V (IGBT)



Diode switching characteristics (typical)

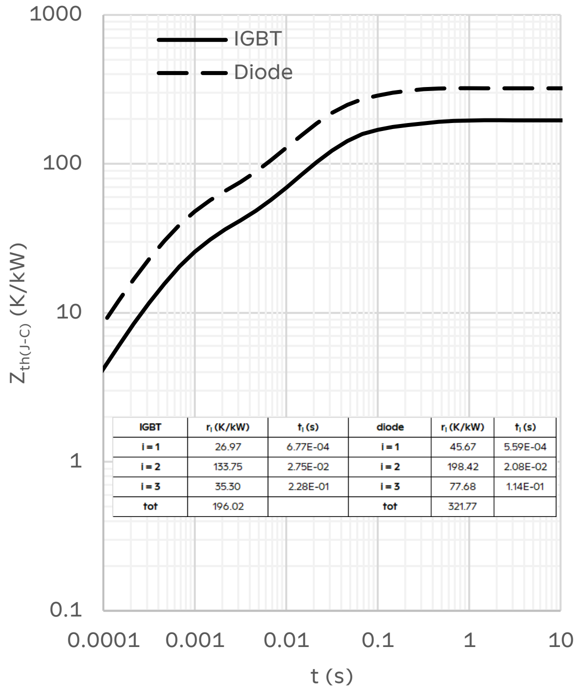
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$

$V_{DC} = 900$ V, $I_F = 100$ A, $V_{GE} = -15/+15$ V (IGBT)



Thermal impedance Inverter

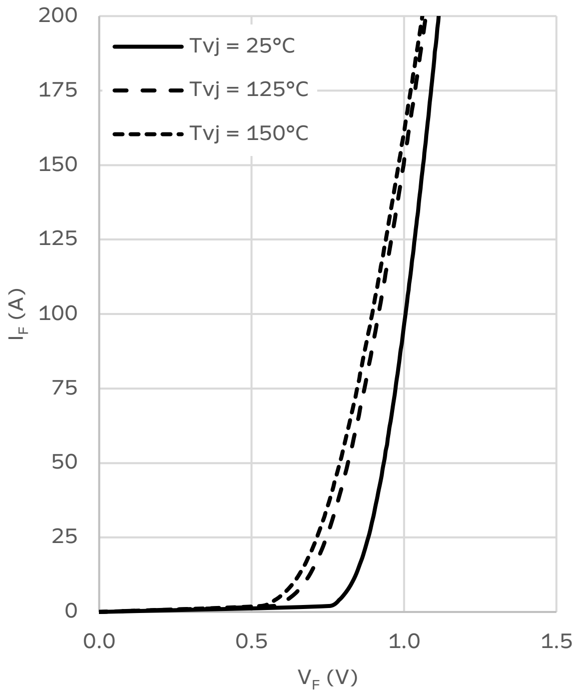
$Z_{th(j-c)} = f(t)$



IGBT	r_i (K/kW)	t_i (s)	diode	r_i (K/kW)	t_i (s)
i = 1	26.97	6.77E-04	i = 1	45.67	5.59E-04
i = 2	133.75	2.75E-02	i = 2	198.42	2.08E-02
i = 3	35.30	2.28E-01	i = 3	77.68	1.14E-01
tot	196.02		tot	321.77	

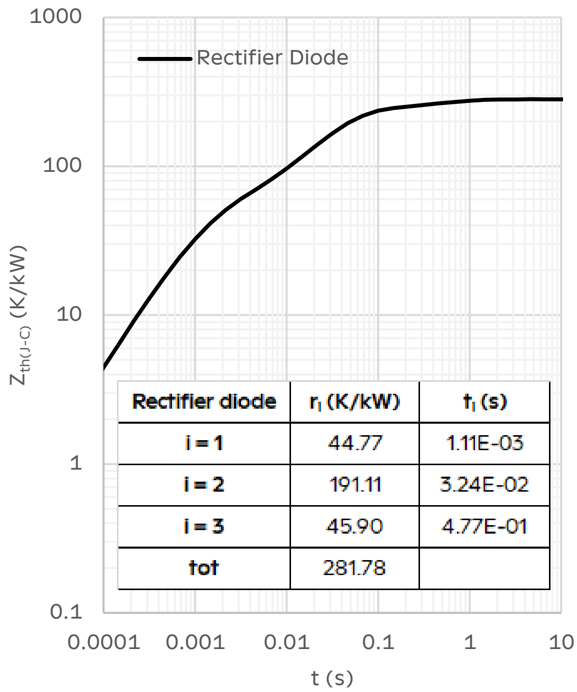
Rectifier Diode forward characteristic (typical)

$I_F = f(V_F)$



Thermal impedance Rectifier

$Z_{th(j-c)} = f(t)$



Rectifier diode	r_i (K/kW)	t_i (s)
i = 1	44.77	1.11E-03
i = 2	191.11	3.24E-02
i = 3	45.90	4.77E-01
tot	281.78	