DATASHEET

SISD0450ST120i20_A01

ST-Type phase leg IGBT module



V_{CE} = 1200 V
I_C = 2 x 450 A

- *i20* ultra-low loss fine pattern Trench IGBT chipset
- 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_{GE} = 0 V, T_{vj} = 25°C		1200	V
DC collector current	I_C	T_C = 120°C, T_{vj} = 175°C		450	A
Peak collector current	I_{CM}	t_p = 1 ms		900	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_C = 25°C, T_{vj} = 175°C, per switch		2500	W
DC forward current	I_F			450	A
Peak forward current	I_{FRM}	t_p = 1 ms		900	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 150°C, t_p = 10 ms, half-sinewave		1830 16750	A A^2s
Isolation voltage	V_{isol}	1 min, f = 50 Hz		4000	V
Junction operating temperature	$T_{vj(op)}$		-40	175[2]	°C
Case temperature	T_C		-40	150	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques [3]	M_S	Base-heatsink, M6 screws	3	6	Nm
	M_{t1}	Main terminals, M6 screws	2.5	5	Nm

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[1] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747
[2] Tvj(op) > 150°C allowed for overload conditions, in maximum for 60s and less than 20% of operation time 60s
[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 = 10 mA, T_{vj} = 25°C		1200			V
Collector-emitter saturation voltage [5]	$V_{CE\ sat}$	I_c = 450 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.6	2	V
			T_{vj} = 125 °C		1.8		V
			T_{vj} = 175 °C		1.95		V
Collector cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
			T_{vj} = 125 °C		0.7		mA
			T_{vj} = 175 °C		15		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 = 22.5mA, V_{CE} = V_{GE}, T_{vj} = 25°C		5	6.2	7.5	V
Gate charge	Q_G	I_C = 450 A, V_{CE} = 600 V, V_{GE} = -15 V .. 15 V			3.5		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100kHz, T_{vj} = 25 °C			29		nF
Output capacitance	C_{oes}				2.6		
Reverse tansfer capacitance	C_{res}				1.4		
Internal gate resistor	R_{Gint}	Per switch			1.8		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 600 V, I_C = 450 A, R_G = 2 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		124		ns
			T_{vj} = 125 °C		271		
			T_{vj} = 175 °C		279		
Rise time	t_r		T_{vj} = 25 °C		66		
			T_{vj} = 125 °C		67		
			T_{vj} = 175 °C		68		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 600 V, I_C = 450 A, R_G = 2.5 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		586		ns
			T_{vj} = 125 °C		666		
			T_{vj} = 175 °C		699		
Fall time	t_f		T_{vj} = 25 °C		237		
			T_{vj} = 125 °C		347		
			T_{vj} = 175 °C		393		
Turn-on switching energy	E_{on}	V_{CC} = 600 V, I_C = 450 A, R_G = 2 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		39		mJ
			T_{vj} = 125 °C		57		
			T_{vj} = 175 °C		67		
Turn-off switching energy	E_{off}	V_{CC} = 600 V, I_C = 450 A, R_G = 2.5 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		52		
			T_{vj} = 125 °C		70		
			T_{vj} = 175 °C		77		
Short circuit current	I_{SC}	t_{pcs} ≤ 10 µs, V_{GE} = 15 V, T_{vj} = 175 °C, V_{CC} = 800 V, $V_{CEM\ Chip}$ ≤ 1200 V			1785		A

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

Diode[6]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Forward voltage[7]	V_F	I_F = 450 A	T_{vj} = 25 °C		1.95	2.5	V
			T_{vj} = 125 °C		2.05		V
			T_{vj} = 175 °C		2.05		V
Peak reverse recovery current	I_{RM}	V_R = 600 V, I_F = 450 A, dI/dt = 6600 A/µs (175 °C), R_G = 2 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		314		A
			T_{vj} = 125 °C		414		A
			T_{vj} = 175 °C		463		A
Recovery charge	Q_r		T_{vj} = 25 °C		47		µC
			T_{vj} = 125 °C		87		µC
			T_{vj} = 175 °C		112		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		619		ns
			T_{vj} = 125 °C		782		ns
			T_{vj} = 175 °C		921		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		21		mJ
			T_{vj} = 125 °C		37		mJ
			T_{vj} = 175 °C		47		mJ

Package properties[8]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
IGBT thermal resistance junction to case IGBT	$R_{th(j-c)IGBT}$	Per switch				0.060	K/W
Diode thermal resistance junction to case	$R_{th(j-c)Diode}$					0.102	K/W
IGBT thermal resistance case to heatsink IGBT	$R_{th(c-s)IGBT}$	IGBT per switch, lambda grease = 1 W/m x K			0.032		K/W
Diode thermal resistance case to heatsink	$R_{th(c-s)Diode}$	diode per switch, lambda grease = 1 W/m x K			0.039		K/W
Comparative tracking index	CTI			>400			
Module stray inductance	$L_{s\,CE}$	Per switch			20		nH
Resistance, terminal chip	$R_{CC'+EE'}$	Per switch	T_{vj} = 25°C		0.7		mΩ
			T_{vj} = 125°C				
			T_{vj} = 175°C				

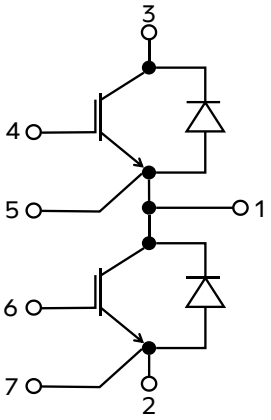
[6] Characteristic values according to IEC 60747-2
[7] Forward voltage is given at chip-level
[8] Package and mechanical properties according to IEC 60747-15

Mechanical properties[9]

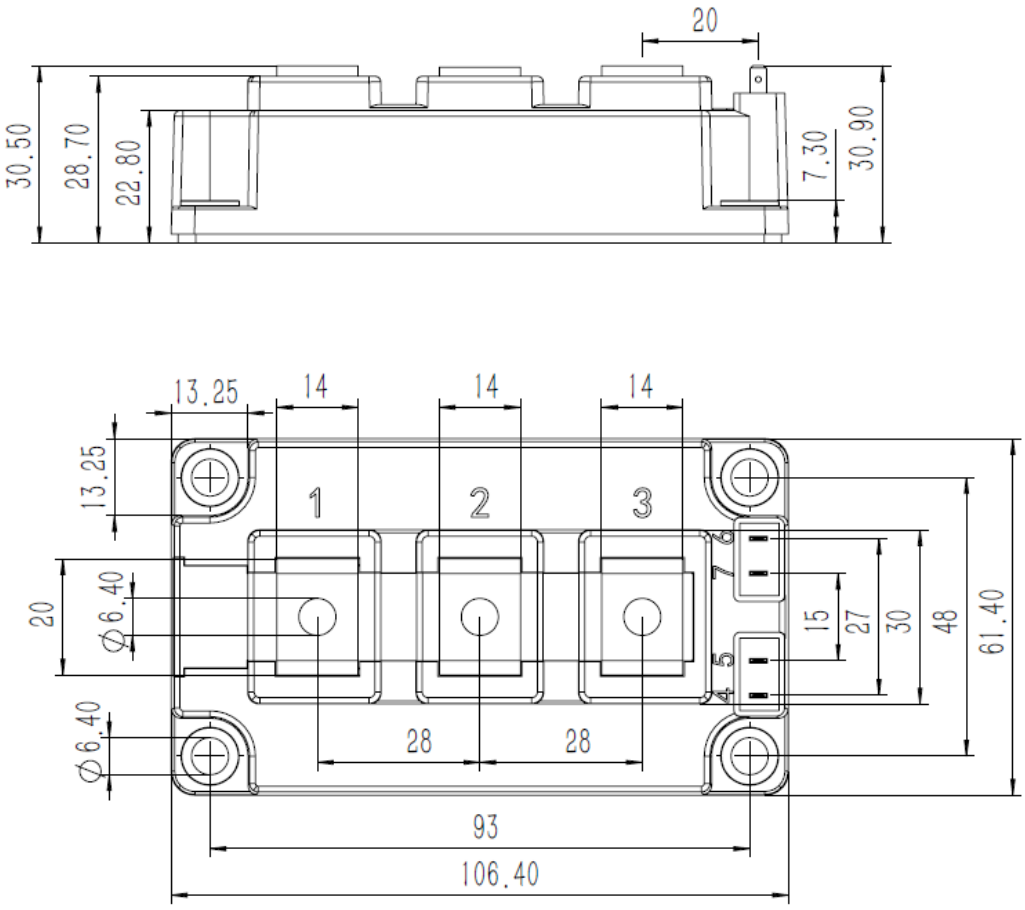
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Dimensions	L x W x H	Typical			106 x 62 x 30.9		mm^3
Clearance distance in air	da	According to IEC 60664-1 and EN 50124-1	Terminal to base:		23		mm
			Terminal to terminal:		11		
Surface creepage distance	ds		Terminal to base:		29		mm
			Terminal to terminal:		23		
Mass	m				310		g

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

Electrical configuration



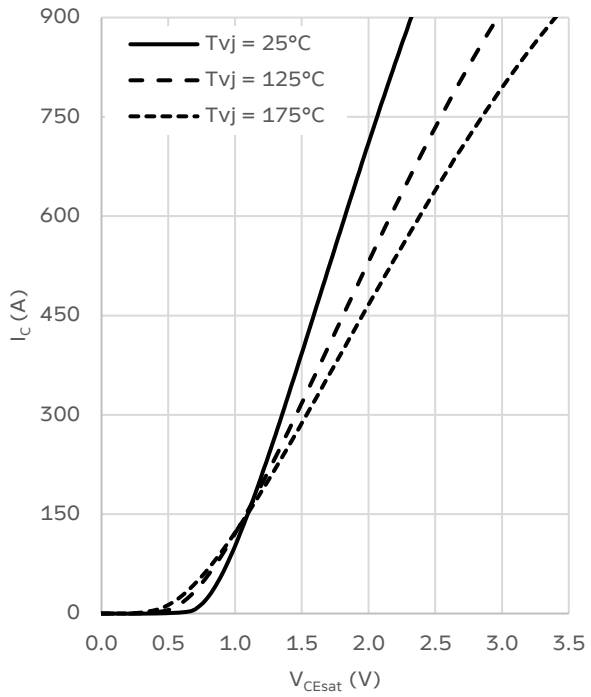
Outline drawing



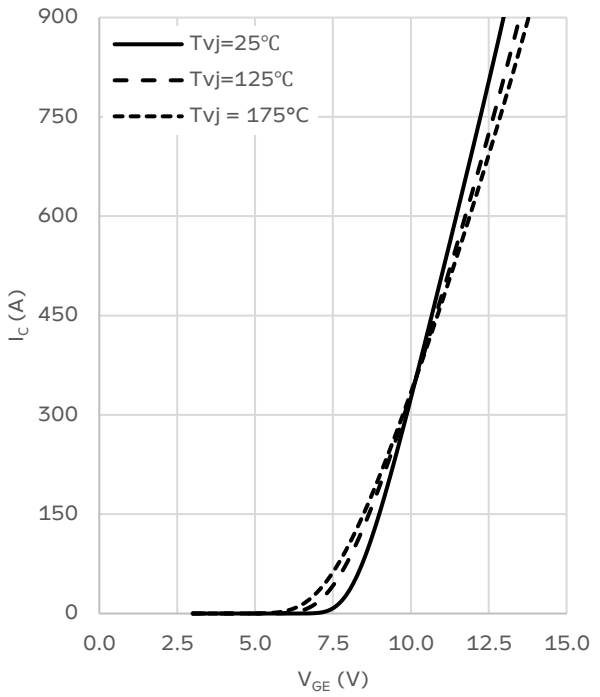
This is an electrocstatic sensitive device, please observe the international standard.
This product has been designed and qualified for Industrial Level.

Characteristics

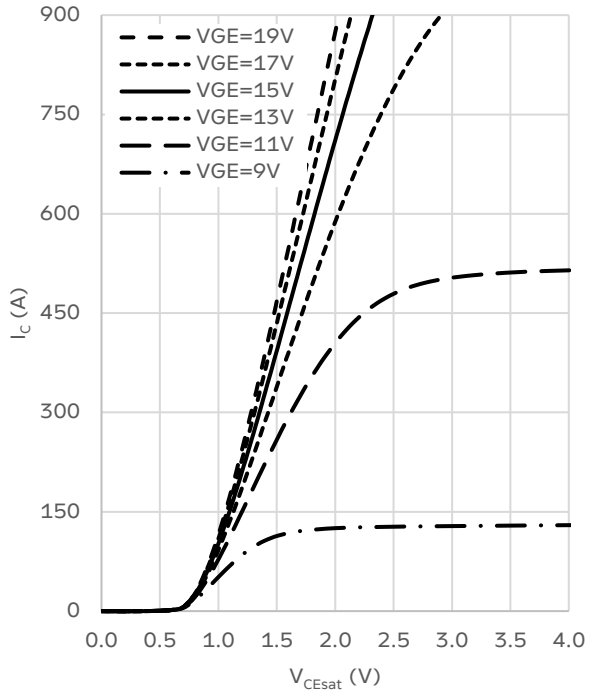
IGBT on-state characteristics (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



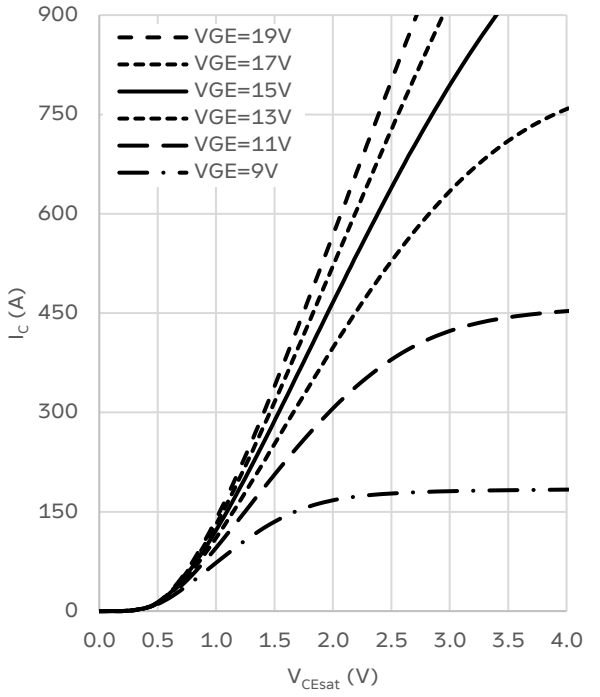
IGBT transfer characteristics (typical)
$I_C = f(V_{GE})$
V_{CE} = 20V



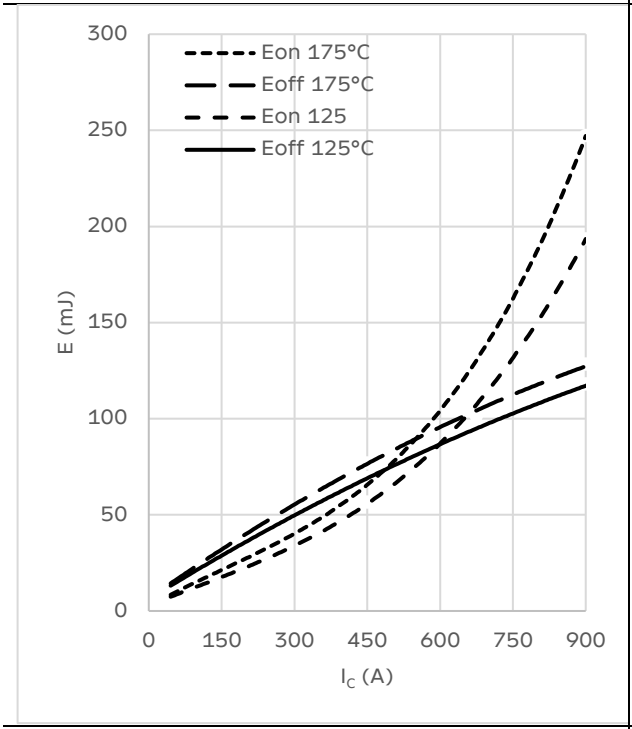
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 25°C



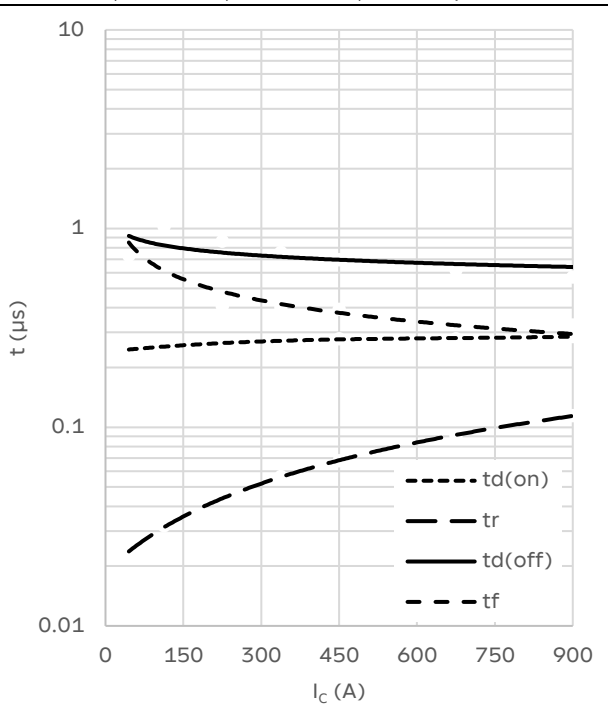
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 175°C



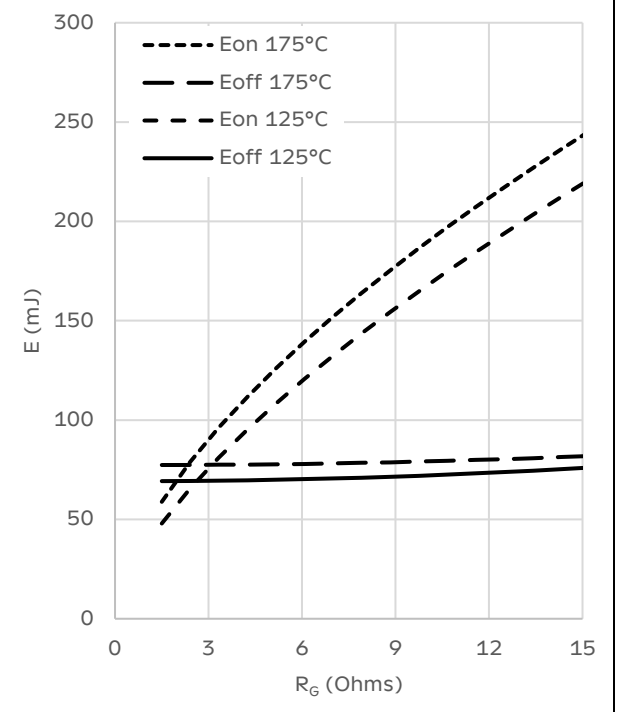
IGBT switching losses (typical)
E = f(I_{CE})
V_{CE} = 600 V, R_{Gon} = 2 Ω, R_{Goff} = 2.5 Ω, V_{GE} = -15/+15 V



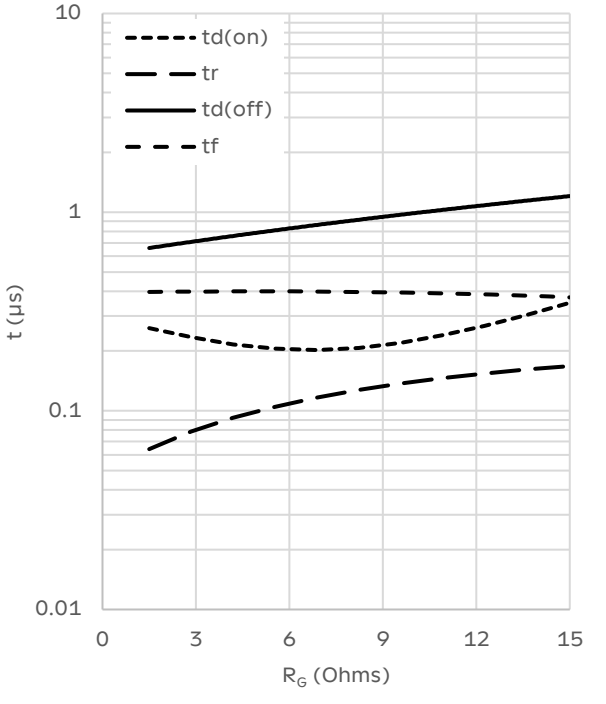
IGBT switching times (typical)
t = f(I_{CE}), T_{vj} = 175°C
V_{CE} = 600 V, R_{Gon} = 2 Ω, R_{Goff} = 2.5 Ω, V_{GE} =-15/+15 V



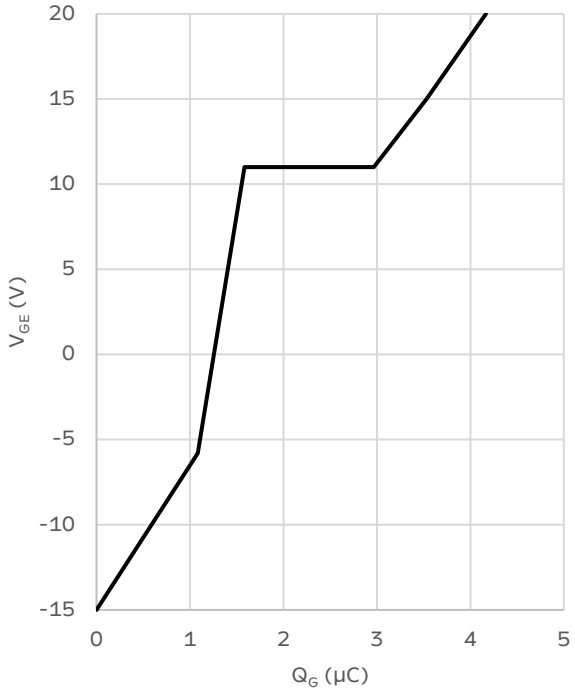
IGBT switching losses (typical)
E = f(R_G)
V_{CE} = 600 V, I_C = 450 A, $V_{G\,E}$ = -15/+15 V



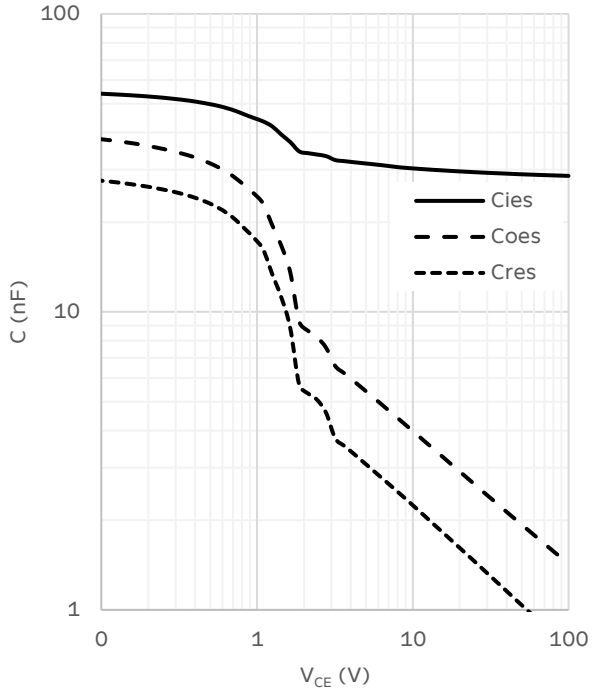
IGBT switching times (typical)
t = f(R_G), T_{vj} = 175°C
V_{CE} = 600 V, I_C = 450 A, V_{GE} = -15/+15 V



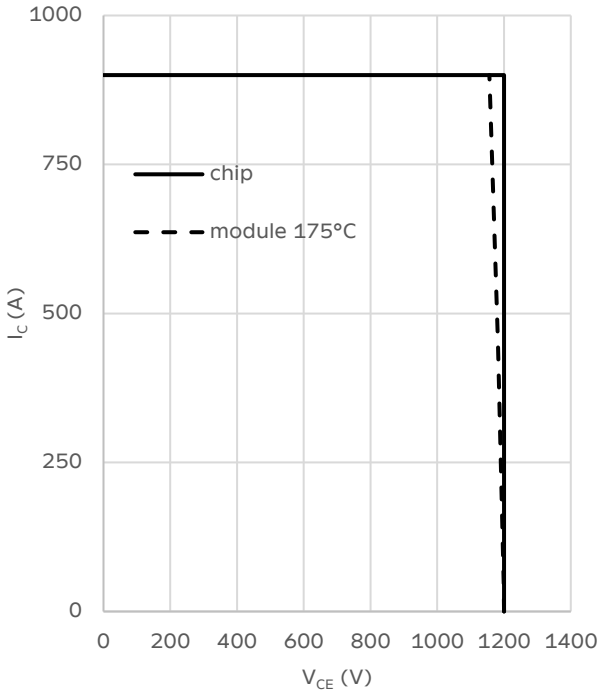
IGBT gate charge (typical)
$V_{GE} = f(Q_G)$, $T_{vj} = 25°C$
$V_{CE} = 600$ V, $I_C = 450$ A



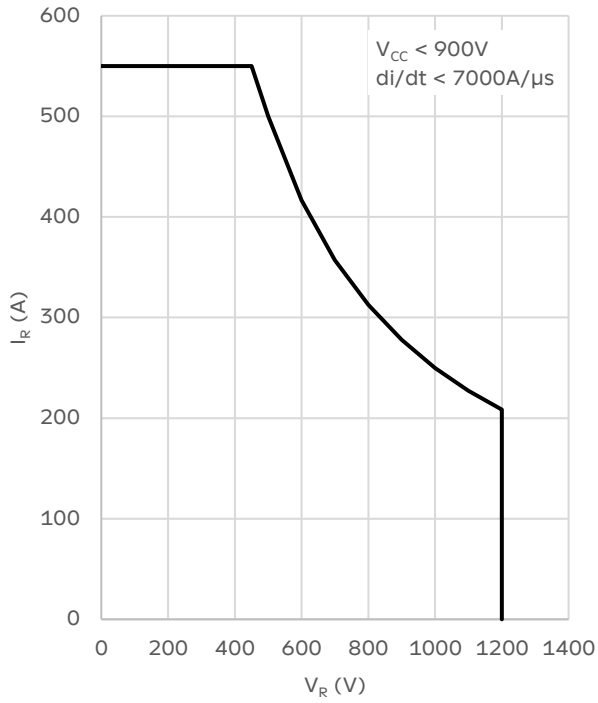
Capacitance characteristics (typical)
$C = f(V_{CE})$, $T_{vj} = 25°C$
$f = 100$ kHz, $V_{GE} = 0$ V



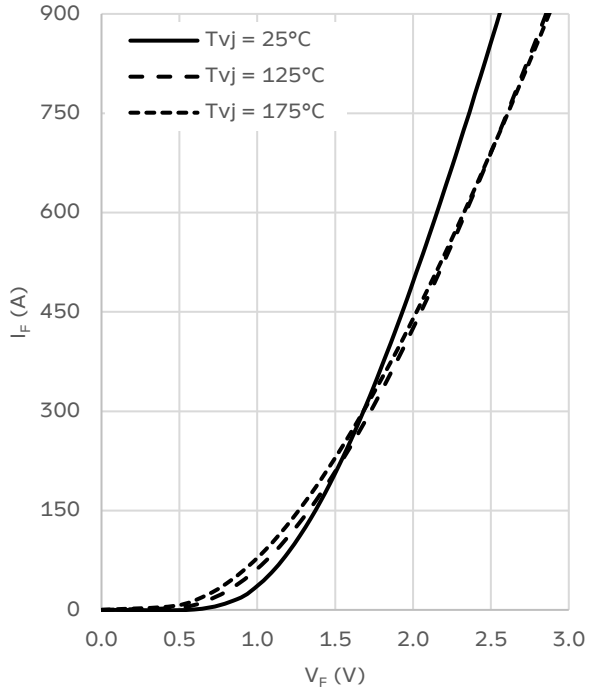
IGBT RBSOA
$I_C = f(V_{CEm})$
$R_{Goff} = 2.5\ \Omega$, $V_{GE} = \pm 15$ V



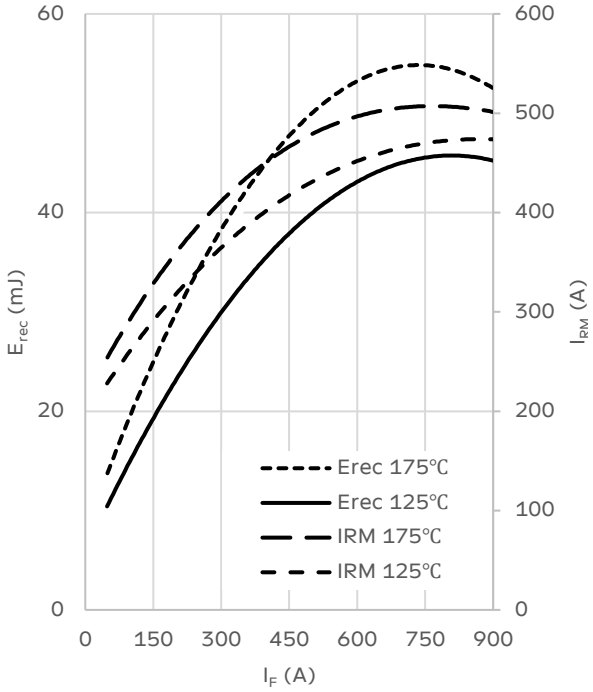
Diode SOA
$T_{vj} \leq 175$ °C



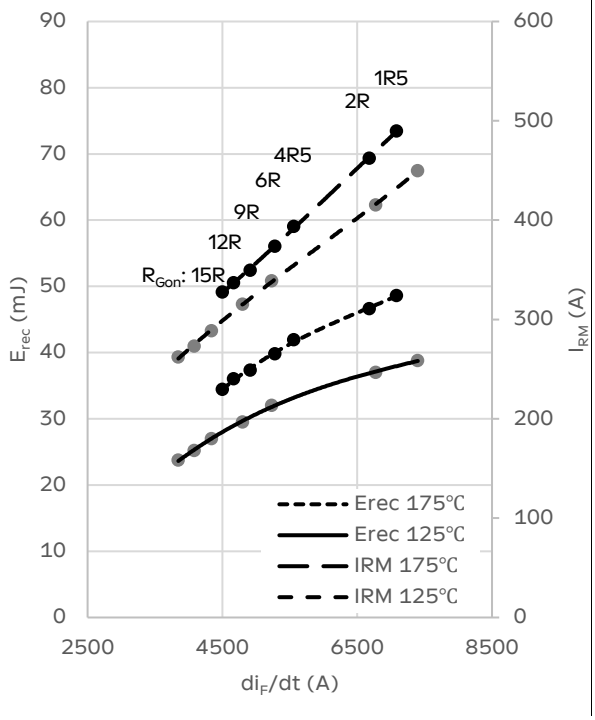
Diode forward characteristic (typical)
$I_F = f(V_F)$



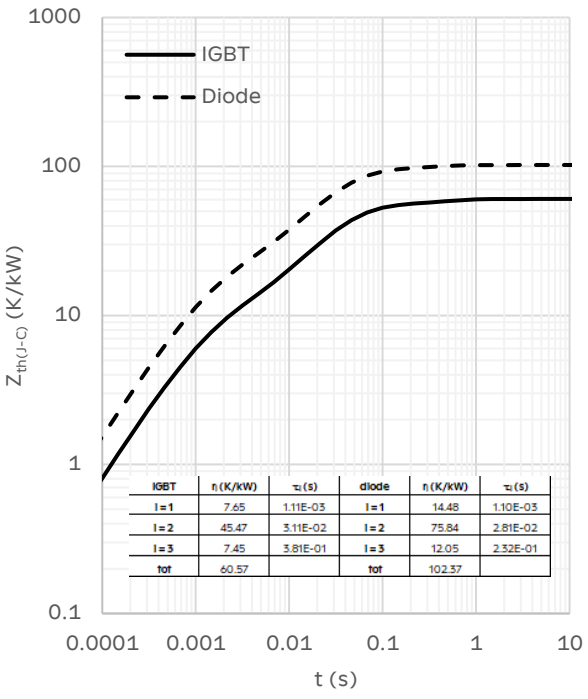
Diode switching characteristics (typical)
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
V_{DC} = 600 V, R_{Gon} = 2 Ω (IGBT), V_{GE} =-15/+15 V (IGBT)



Diode switching characteristics (typical)
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
V_{DC} = 600 V, I_F = 450 A, V_{GE} =-15/+15 V (IGBT)



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



IGBT	r_i (K/kW)	τ_i (s)	diode	r_i (K/kW)	τ_i (s)
i = 1	7.65	1.11E-03	i = 1	14.48	1.10E-03
i = 2	45.47	3.11E-02	i = 2	75.84	2.81E-02
i = 3	7.45	3.81E-01	i = 3	12.05	2.32E-01
tot	60.57		tot	102.37	