DATASHEET

SISD0450ED120i23_D01

ED-Type phase leg IGBT module

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

i23 ultra-low loss micro pattern Trench IGBT chip-set
- Baseplate isolation with reinforced Al_2O_3 ceramic Al_2O_3
- Cu baseplate for low thermal resistance
- Improved Package with reduced internal
- impedance and terminal heating
Enhanced diode performance for regenerative power flow

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 = 110 °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		2300	W
DC forward current	I_F			600	A
Peak forward current	I_{FRM}	t_p = 1 ms		1200	A
Surge current	I_{FSM} I^2t	V_R = 0 V, T_{vj} = 150 °C, t_p = 10 ms, half-sinewave		2000 20000	A A^2s
Isolation voltage	V_{isol}	1 min, f = 50 Hz		3400	V
Junction operating temperature	$T_{vj(op)}$		-40	175	°C
Case temperature	T_C		-40	125[2]	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques [3]	M_S	Base-heatsink, M5 screws	3	6	Nm
	M_{t1}	Main terminals, M6 screws	3	6	Nm

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[1] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747
[2] For UL1557 compliance T_{Cmax} must be limited to 125°C
[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_{CEsat}	I_c = 450 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.55	1.85	V
			T_{vj} = 125 °C		1.75		V
			T_{vj} = 175 °C		1.85		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		1.5		mA
			T_{vj} = 175 °C		13		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 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		5	6.3	7.5	V
Gate charge	Q_G	I_C = 450 A, V_{CE} = 600 V, V_{GE} = -15 V .. 15 V			3.75		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25 °C			58		nF
Reverse tansfer capacitance	C_{res}				0.54		nF
Internal gate resistor	R_{Gint}	Per switch			1.1		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 600 V, I_C = 450 A, R_G = 1 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		148		ns
			T_{vj} = 125 °C		170		ns
			T_{vj} = 175 °C		180		ns
Rise time	t_r		T_{vj} = 25 °C		60		ns
			T_{vj} = 125 °C		70		ns
			T_{vj} = 175 °C		75		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 600 V, I_C = 450 A, R_G = 1 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		297		ns
			T_{vj} = 125 °C		364		ns
			T_{vj} = 175 °C		393		ns
Fall time	t_f		T_{vj} = 25 °C		265		ns
			T_{vj} = 125 °C		379		ns
			T_{vj} = 175 °C		435		ns
Turn-on switching energy	E_{on}	V_{CC} = 600 V, I_C = 450 A, R_G = 1 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		46		mJ
			T_{vj} = 125 °C		70		mJ
			T_{vj} = 175 °C		84		mJ
Turn-off switching energy	E_{off}	V_{CC} = 600 V, I_C = 450 A, R_G = 1 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		44		mJ
			T_{vj} = 125 °C		60		mJ
			T_{vj} = 175 °C		67		mJ
Short circuit current	I_{SC}	t_{pcs} ≤ 8 µs, V_{GE} = 15 V, T_{vj} = 175 °C, V_{CC} = 800 V, $V_{CEM\,Chip}$ ≤ 1200 V			2100		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		1.5	1.9	V
			T_{vj} = 125 °C		1.5		V
			T_{vj} = 175 °C		1.45		V
Peak reverse recovery current	I_{RM}	V_R = 600 V, I_F = 450 A, dI/dt = 6000 A/µs (175°C), R_G = 1 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		370		A
			T_{vj} = 125 °C		423		A
			T_{vj} = 175 °C		454		A
Recovery charge	Q_{rr}		T_{vj} = 25 °C		59		µC
			T_{vj} = 125 °C		100		µC
			T_{vj} = 175 °C		126		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		680		ns
			T_{vj} = 125 °C		736		ns
			T_{vj} = 175 °C		865		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		25		mJ
			T_{vj} = 125 °C		39		mJ
			T_{vj} = 175 °C		48		mJ

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

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

Package properties [8]

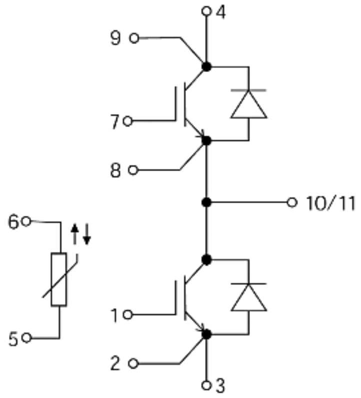
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$	Per switch				0.064	K/W
Diode thermal resistance junction to case	$R_{th(j-c)Diode}$					0.084	K/W
IGBT thermal resistance case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch			0.035		K/W
Diode thermal resistance case to heatsink	$R_{th(c-s)Diode}$	diode per switch			0.038		K/W
Comparative tracking index	CTI			200			
Module stray inductance	$L_{s\ CE}$	Per switch			16		nH
Resistance, terminal chip	$R_{CC'+EE'}$	Per switch	T_{vj} = 25 °C		0.75		mΩ
			T_{vj} = 125 °C		1.05		mΩ
			T_{vj} = 175 °C		1.15		mΩ
Maximum RMS DC-Terminal current	$I_{Term\ RMS}$		$T_{Terminal}$ = 90°C		580		A
			$T_{Terminal}$ = 105°C		565		A

Mechanical properties

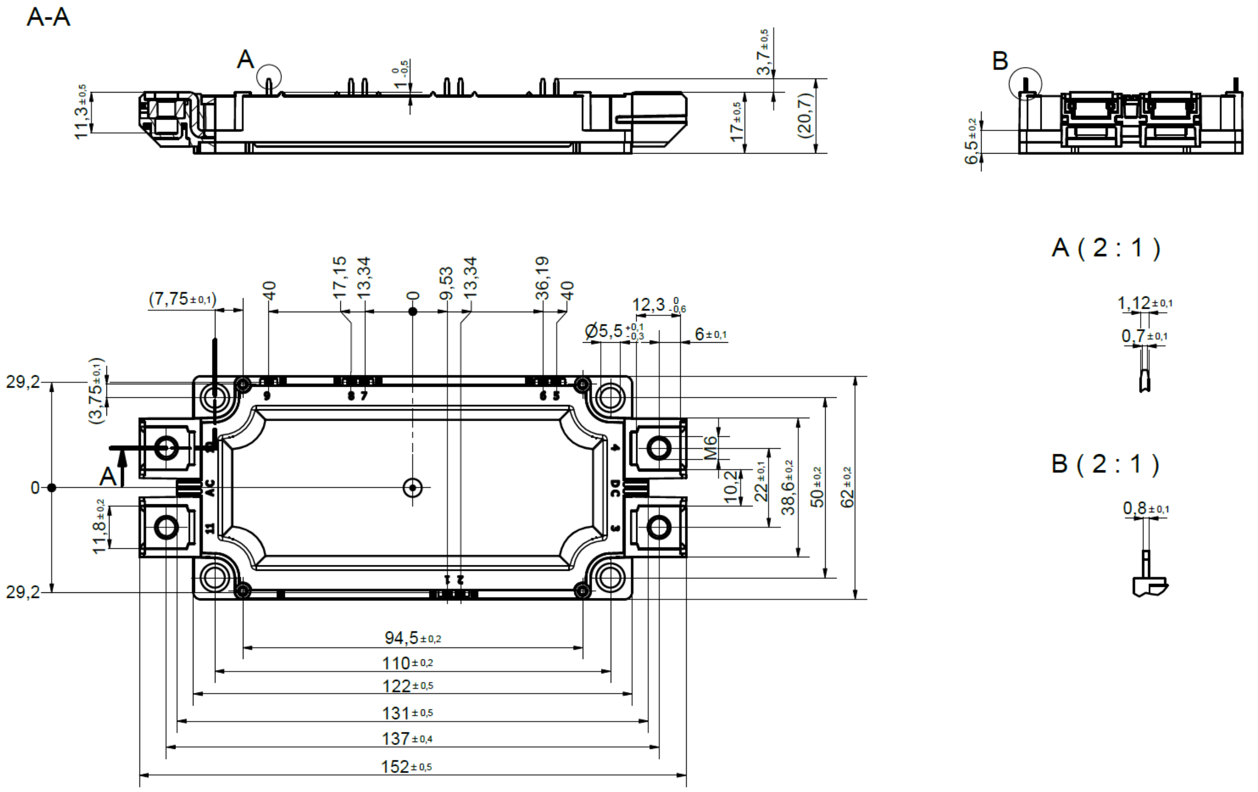
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Dimensions	L x W x H	Typical			152 x 62 x 17		mm³
Clearance distance in air	d_a	According to IEC 60664-1 and EN 50124-1	Terminal to base:	12.5			mm
			Terminal to terminal:	10			mm
Surface creepage distance	d_s	According to IEC 60664-1 and EN 50124-1	Terminal to base:	15			mm
			Terminal to terminal:	13			mm
Mass	m				350		g

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

Electrical configuration



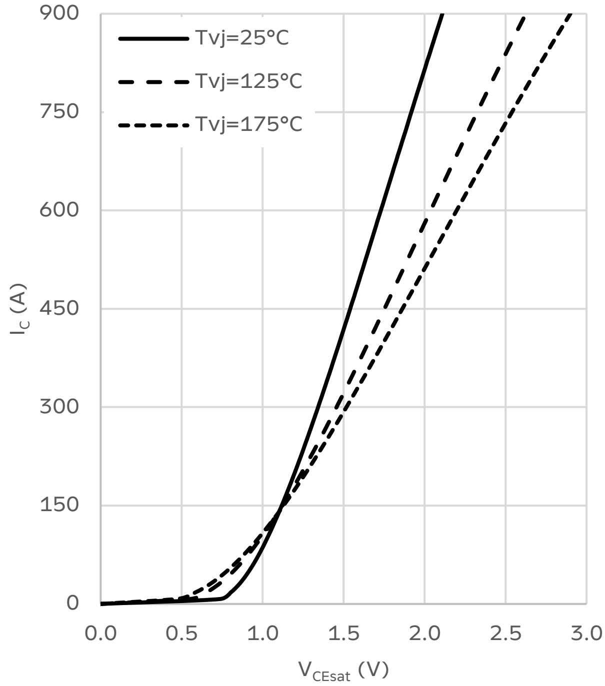
Outline drawing



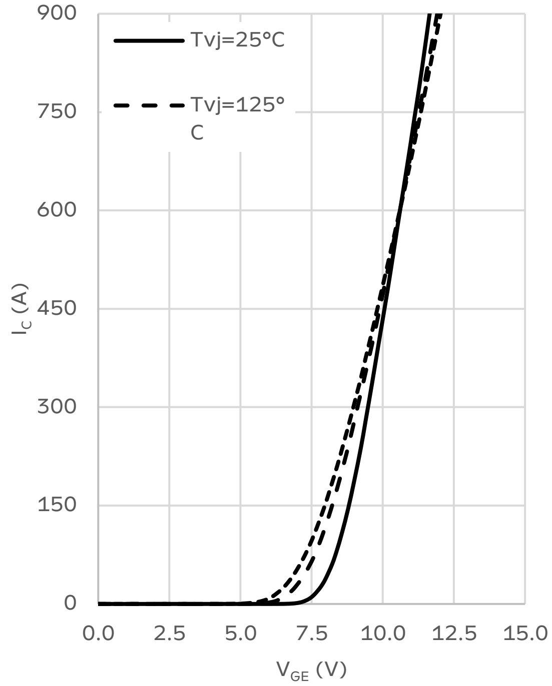
This is an electrostatic sensitive device.
This product has been designed and qualified for Industrial Level.

Characteristics

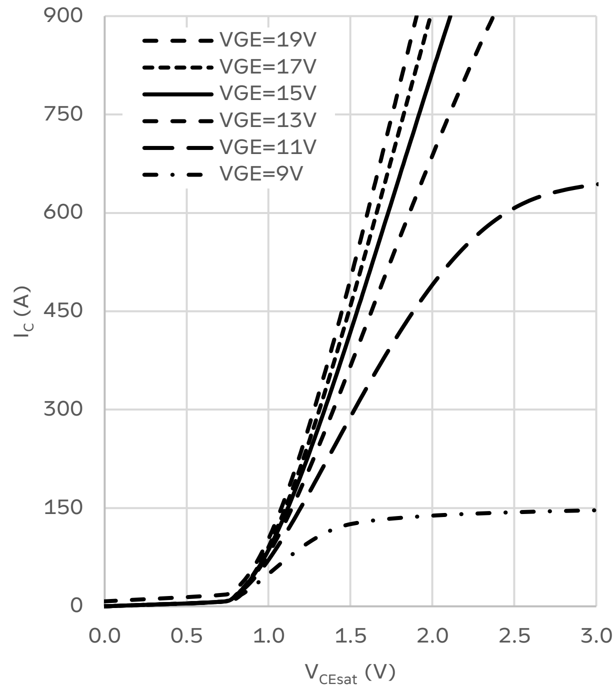
IGBT on-state characteristics (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



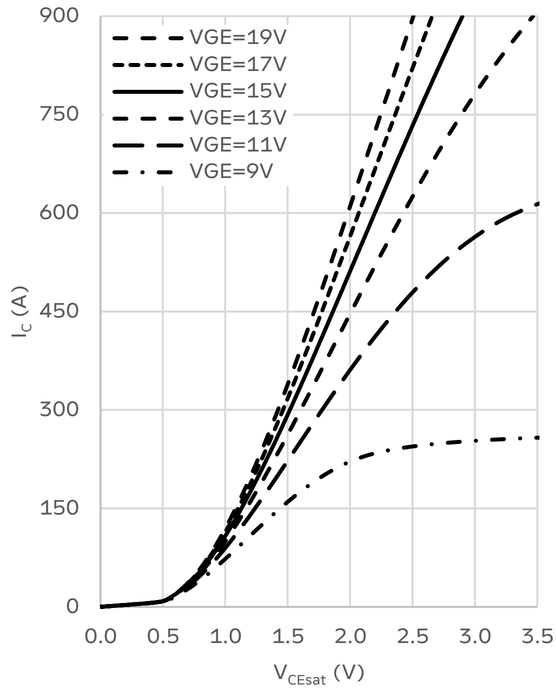
IGBT transfer characteristics (typical)
$I_C = f(V_{GE})$
V_{CE} = 20V



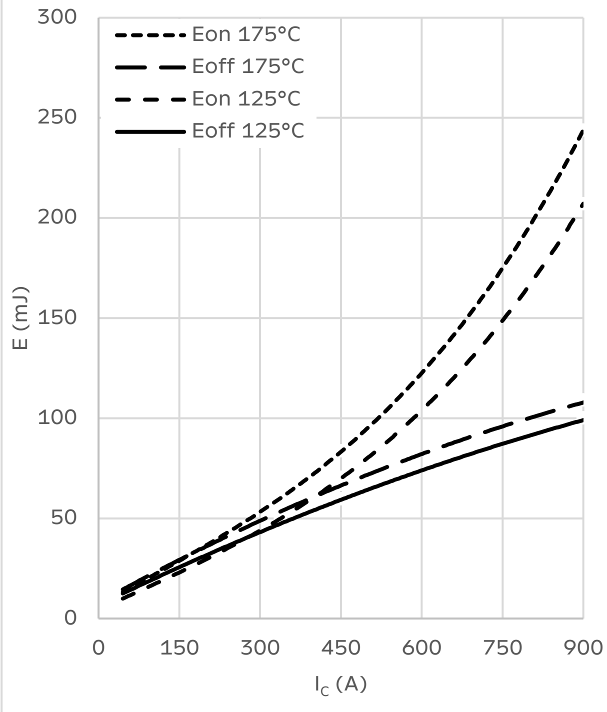
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 25 °C



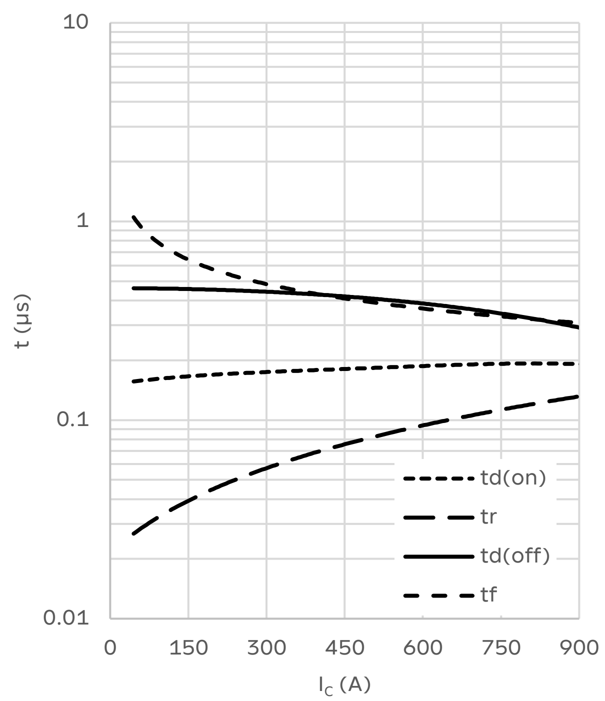
IGBT output characteristics (typical)
$I_C = f(V_{CE})$
T_{vj} = 175 °C



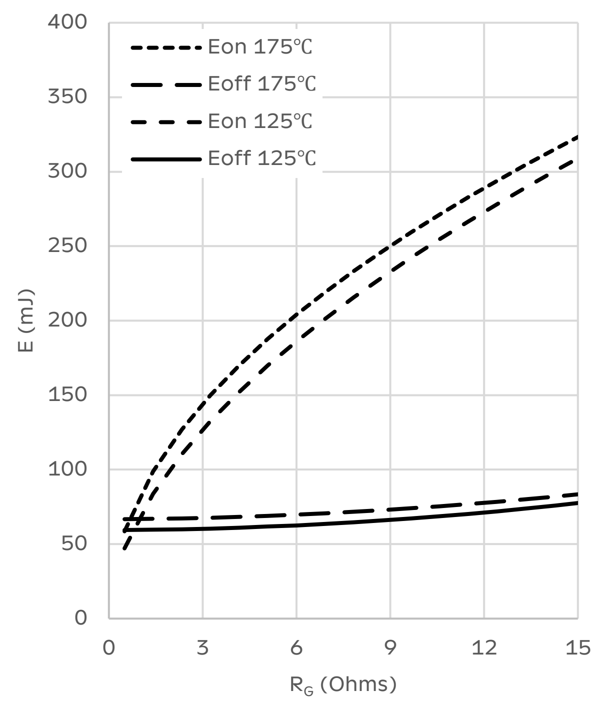
IGBT switching losses (typical)
E = f(I_{CE})
V_{CE} = 600 V, R_{Gon} = 1 Ω, R_{Goff} = 1 Ω, V_{GE} = -15/+15 V



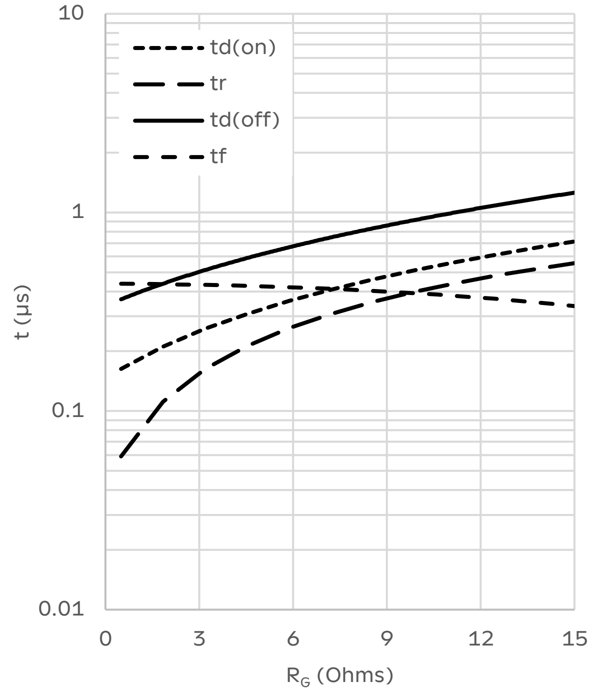
IGBT switching times (typical)
t = f(I_{CE}), T_{vj} = 175 °C
V_{CE} = 600 V, R_{Gon} = 1 Ω, R_{Goff} = 3 Ω, V_{GE} =-15/+15 V



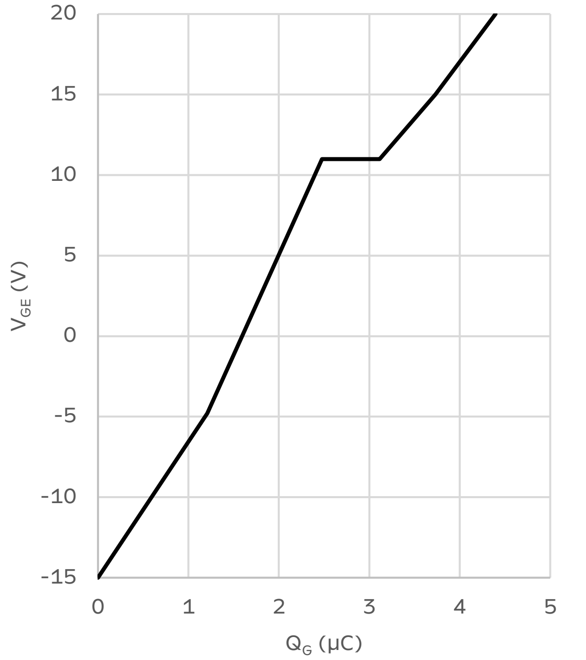
IGBT switching losses (typical)
E = f(R_G)
V_{CE} = 600 V, I_C = 450 A, V_{GE} = -15/+15 V



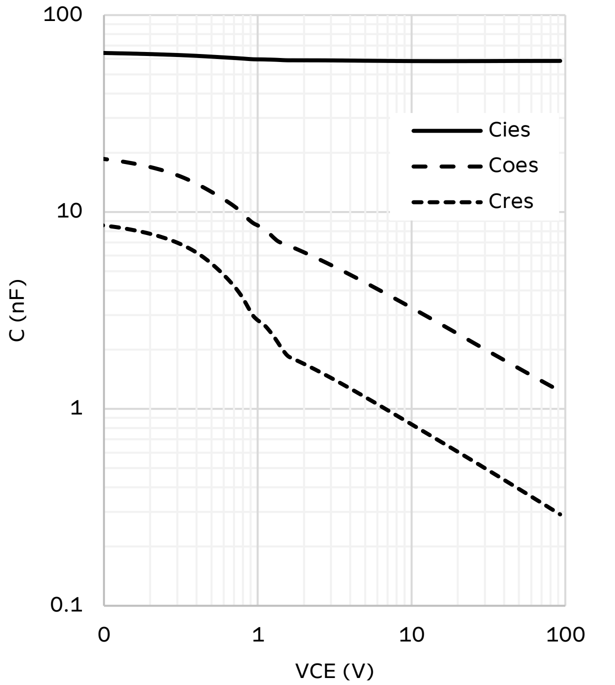
IGBT switching times (typical)
t = f(R_G), T_{vj} = 175 °C
V_{CE} = 600 V, I_C = 450 A, V_{GE} = -15/+15 V



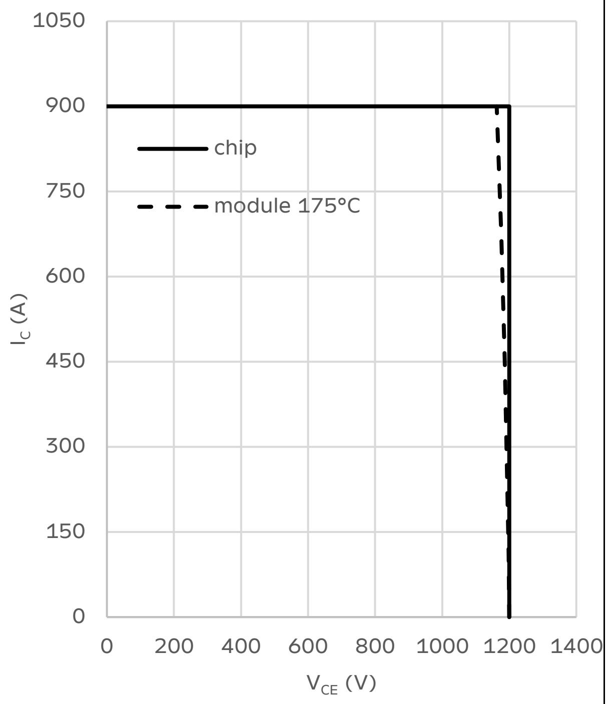
IGBT gate charge (typical)
$V_{GE} = f(Q_G)$, $T_{vj} = 25$ °C
$V_{CE} = 600$ V, $I_C = 450$ A



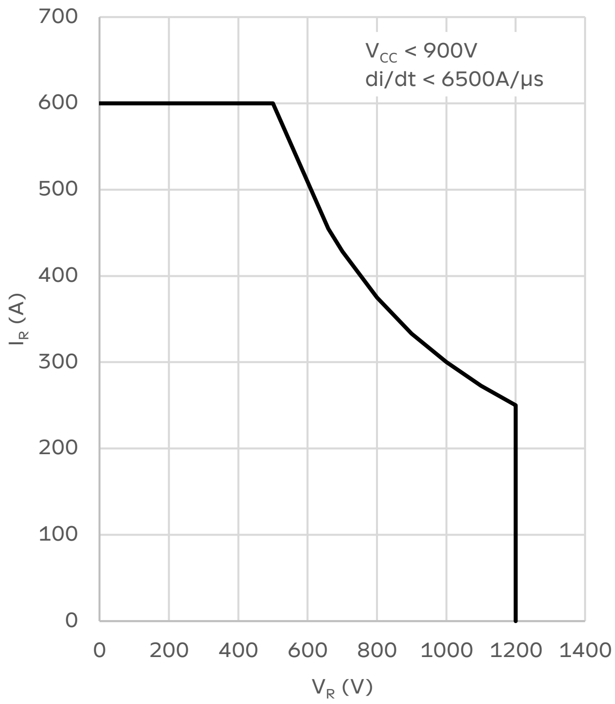
Capacitance characteristics (typical)
$C = f(V_{CE})$, $T_{vj} = 25$ °C
$f = 100$ kHz, $V_{GE} = 0$ V



IGBT RBSOA
$I_C = f(V_{CEm})$
$R_{Goff} = 1\ \Omega$, $V_{GE} = \pm 15$ V

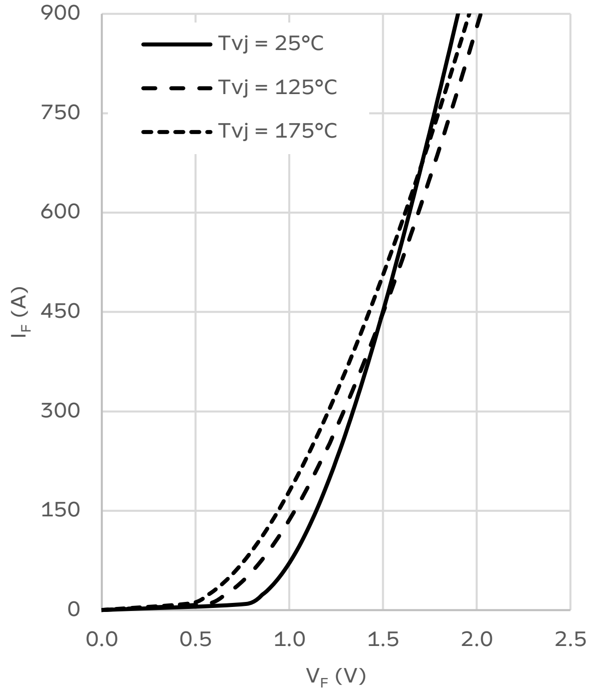


Diode SOA
$T_{vj} \leq 175$ °C



Diode forward characteristic (typical)

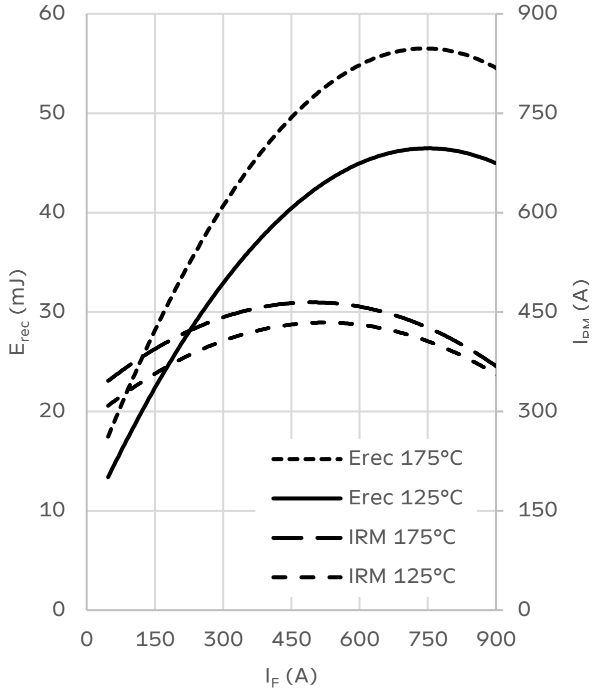
$I_F = f(V_F)$



Diode switching characteristics (typical)

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

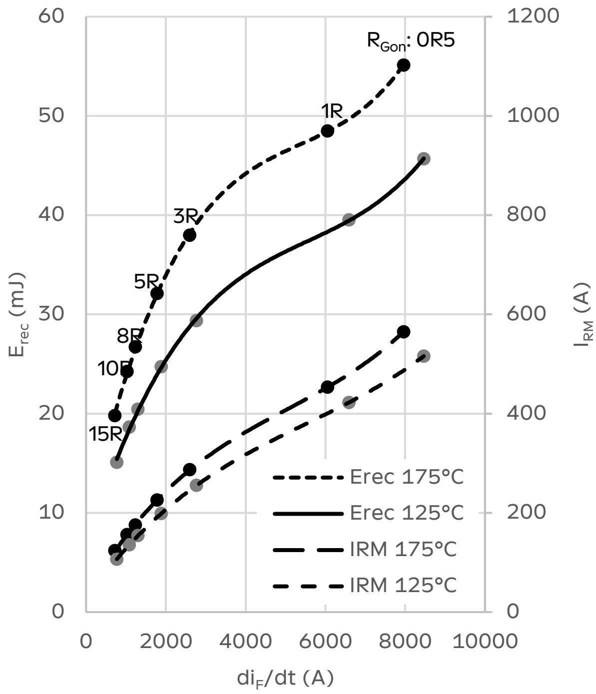
$V_{DC} = 600$ V, $R_{Gon} = 1\ \Omega$ (IGBT), $V_{GE} = -15/+15$ V (IGBT)



Diode switching characteristics (typical)

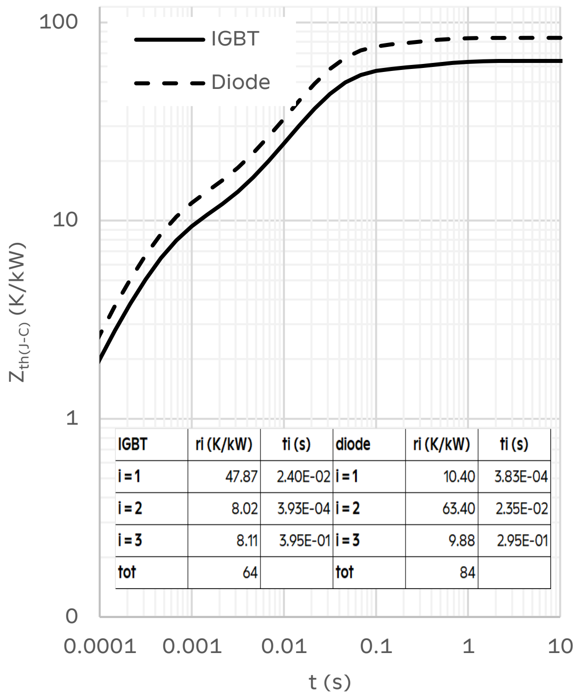
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$

$V_{DC} = 600$ V, $I_F = 450$ A, $V_{GE} = -15/+15$ V (IGBT)



Thermal impedance (typical)

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



IGBT	ri (K/kW)	ti (s)	diode	ri (K/kW)	ti (s)
i = 1	47.87	2.40E-02	i = 1	10.40	3.83E-04
i = 2	8.02	3.93E-04	i = 2	63.40	2.35E-02
i = 3	8.11	3.95E-01	i = 3	9.88	2.95E-01
tot	64		tot	84	