

DATASHEET

SISD0450ED120i20_A01

ED-Type phase leg IGBT module



$V_{CE} = 1200\text{ V}$

$I_C = 2 \times 450\text{ A}$

- *i20* ultra-low loss fine pattern Trench IGBT chipset
- Baseplate isolation with reinforced Al_2O_3 ceramic
- Cu baseplate for low thermal resistance
- Improved Package with reduced internal Impedance and terminal heating

Maximum ratings¹

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNIT
Collector-emitter voltage	V_{CES}	$V_{GE} = 0\text{ V}$, $T_{vj} = 25\text{ °C}$		1200	V
DC collector current	I_C	$T_C = 110\text{ °C}$, $T_{vj} = 175\text{ °C}$		450	A
Peak collector current	I_{CM}	$t_p = 1\text{ ms}$		900	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	$T_C = 25\text{ °C}$, $T_{vj} = 175\text{ °C}$, per switch		2630	W
DC forward current	I_F			450	A
Peak forward current	I_{FRM}	$t_p = 1\text{ ms}$		900	A
Surge current	I_{FSM} I^2t	$V_R = 0\text{ V}$, $T_{vj} = 150\text{ °C}$, $t_p = 10\text{ ms}$, half-sinewave		1830 16750	A A ² s
Isolation voltage	V_{isol}	1 min, $f = 50\text{ Hz}$		3400	V
Junction operating temperature	$T_{vj(op)}$		-40	175 ²	°C
Case temperature	T_C		-40	125 ³	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques ⁴	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 $T_{vj(op)} > 150\text{ °C}$ allowed for overload conditions, in maximum for 60s and less than 20% of operation time;

³ For UL1557 compliance T_{Cmax} must be limited to 125°C;

⁴ For details, please refer to the mounting instructions.

IGBT⁵

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 ⁶	V _{CEsat}	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 = 22.5 mA, 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 = 100 kHz, T _{vj} = 25 °C			29		nF
Output capacitance	C _{Oes}				2.6		nF
Reverse transfer capacitance	C _{res}				1.4		nF
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 = 1 Ω, V _{GE} = ± 15 V, L _S = 30 nH, inductive load	T _{vj} = 25 °C		110		ns
			T _{vj} = 125 °C		140		ns
			T _{vj} = 175 °C		155		ns
Rise time	t _r		T _{vj} = 25 °C		55		ns
			T _{vj} = 125 °C		65		ns
			T _{vj} = 175 °C		70		ns
Turn-off delay time	t _{d(off)}	V _{CC} = 600 V, I _C = 450 A, R _G = 2 Ω, V _{GE} = ± 15 V, L _S = 30 nH, inductive load	T _{vj} = 25 °C		520		ns
			T _{vj} = 125 °C		620		ns
			T _{vj} = 175 °C		670		ns
Fall time	t _f		T _{vj} = 25 °C		190		ns
			T _{vj} = 125 °C		300		ns
			T _{vj} = 175 °C		360		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 = 30 nH, inductive load	T _{vj} = 25 °C		30		mJ
			T _{vj} = 125 °C		54		mJ
			T _{vj} = 175 °C		71		mJ
Turn-off switching energy	E _{off}	V _{CC} = 600 V, I _C = 450 A, R _G = 2 Ω, V _{GE} = ± 15 V, L _S = 30 nH, inductive load	T _{vj} = 25 °C		48		mJ
			T _{vj} = 125 °C		65		mJ
			T _{vj} = 175 °C		73		mJ
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			1350		A

⁵ Characteristic values according to IEC 60747-9

⁶ Collector-emitter saturation voltage is given at chip-level



Diode⁷

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Forward voltage ⁸	V_F	$I_F = 450\text{ A}$	$T_{vj} = 25\text{ °C}$	1.95	2.5	V
			$T_{vj} = 125\text{ °C}$	2.05		V
			$T_{vj} = 175\text{ °C}$	2.05		V
Peak reverse recovery current	I_{RM}	$V_R = 600\text{ V}$, $I_F = 450\text{ A}$, $di/dt = 3980\text{ A}/\mu\text{s}$ (175°C), $R_G = 1\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 30\text{ nH}$, inductive load	$T_{vj} = 25\text{ °C}$	295		A
			$T_{vj} = 125\text{ °C}$	350		A
			$T_{vj} = 175\text{ °C}$	375		A
Recovery charge	Q_{rr}		$T_{vj} = 25\text{ °C}$	24		μC
			$T_{vj} = 125\text{ °C}$	60		μC
			$T_{vj} = 175\text{ °C}$	85		μC
Reverse recovery time	t_{rr}		$T_{vj} = 25\text{ °C}$	160		ns
			$T_{vj} = 125\text{ °C}$	665		ns
			$T_{vj} = 175\text{ °C}$	885		ns
Reverse recovery energy	E_{rec}		$T_{vj} = 25\text{ °C}$	15		mJ
			$T_{vj} = 125\text{ °C}$	24		mJ
			$T_{vj} = 175\text{ °C}$	32		mJ

Package properties⁹

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
IGBT thermal resistance junction to case IGBT	$R_{th(j-c)IGBT}$	Per switch			0.057	K/W
Diode thermal resistance junction to case	$R_{th(j-c)Diode}$				0.098	K/W
IGBT thermal resistance case to heatsink IGBT	$R_{th(c-s)IGBT}$	IGBT per switch		0.032		K/W
Diode thermal resistance case to heatsink	$R_{th(c-s)Diode}$	diode per switch		0.039		K/W
Comparative tracking index	CTI		200			
Module stray inductance	$L_{s\text{ CE}}$	Per switch		16		nH
Resistance, terminal chip	$R_{CC'+EE'}$	Per switch	$T_{vj} = 25\text{ °C}$	0.75		m Ω
			$T_{vj} = 125\text{ °C}$	1.05		m Ω
			$T_{vj} = 175\text{ °C}$	1.15		m Ω

⁷ Characteristic values according to IEC 60747-2

⁸ Forward voltage is given at chip-level

⁹ Package and mechanical properties according to IEC 60747-15



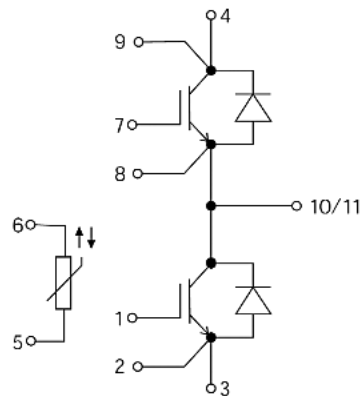
Mechanical properties

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Dimensions	L x W x H	Typical		152 x 62 x 17			mm ³
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

NTC Thermistor

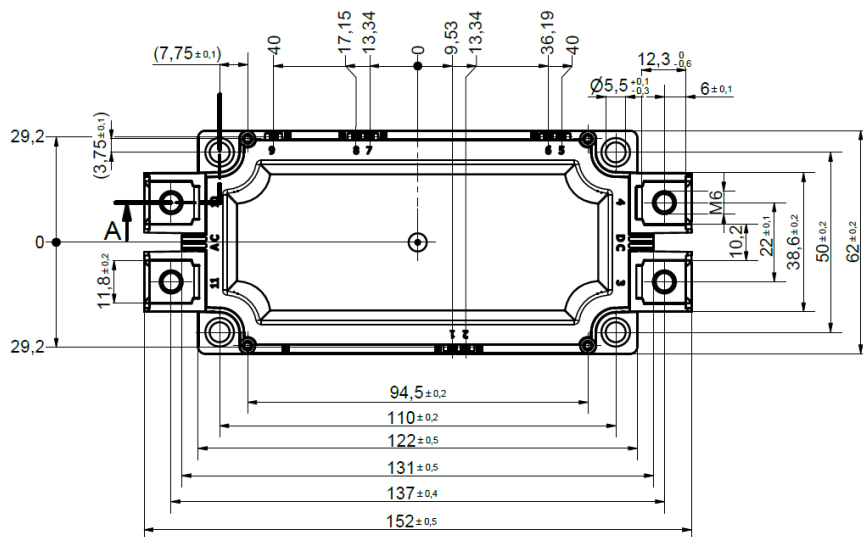
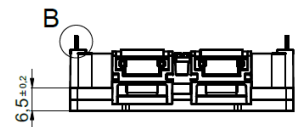
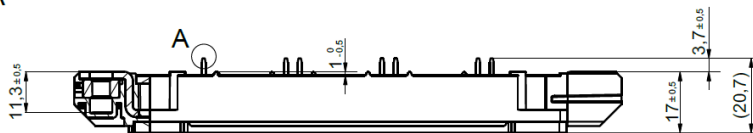
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Rated resistance	R ₂₅	T _c = 25 °C		5		kΩ
R100	R ₁₀₀	T _c = 100 °C	468		518	Ω
B-value B	B _{25/50}	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15K))]$		3375		K
B-value B	B _{25/100}	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15K))]$		3433		K

Electrical configuration

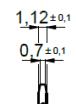


Outline drawing

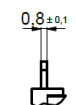
A-A



A (2:1)



B (2:1)

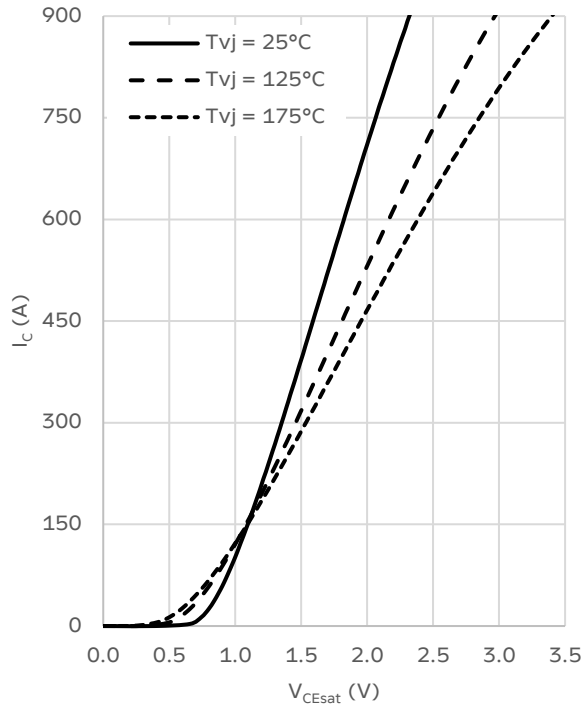


This is an electrostatic sensitive device.
This product has been designed and qualified for Industrial Level.

Characteristics

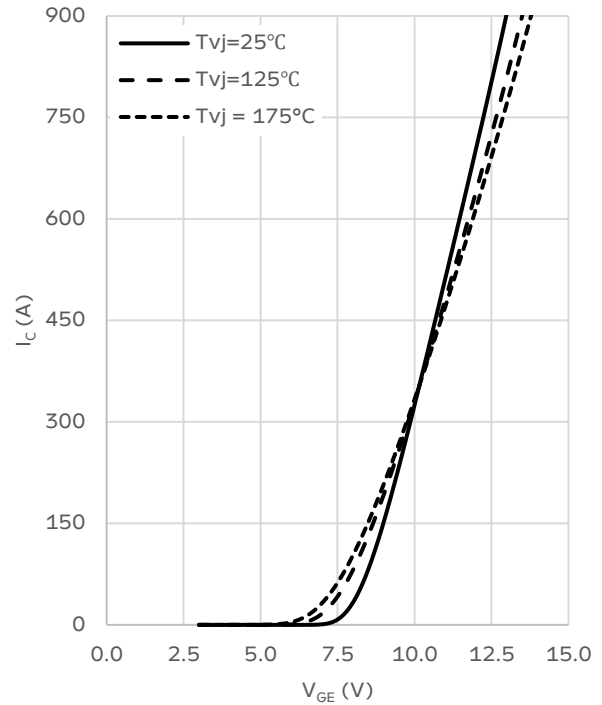
IGBT on-state characteristics (typical)

$I_C = f(V_{CE})$
 $V_{GE} = 15 \text{ V}$



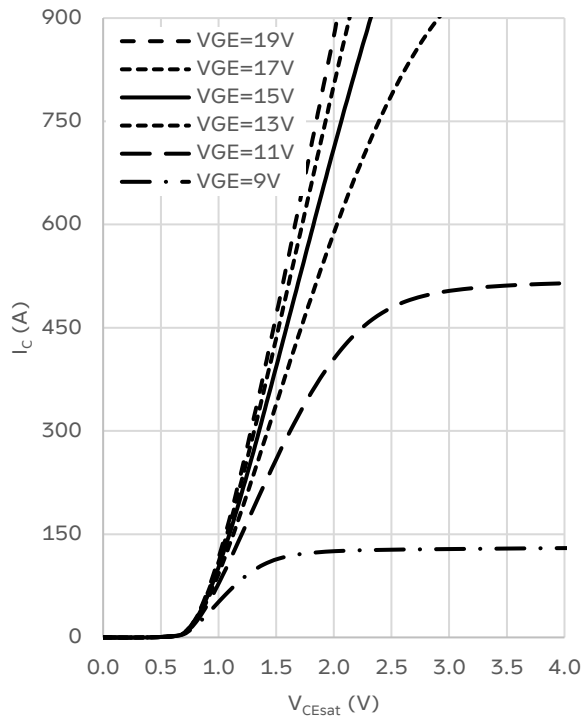
IGBT transfer characteristics (typical)

$I_C = f(V_{GE})$
 $V_{CE} = 20 \text{ V}$



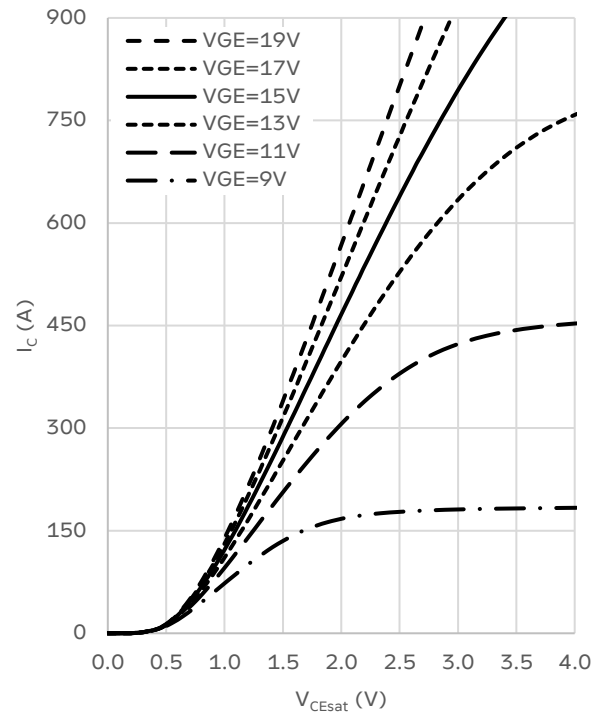
IGBT output characteristics (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 25^\circ\text{C}$



IGBT output characteristics (typical)

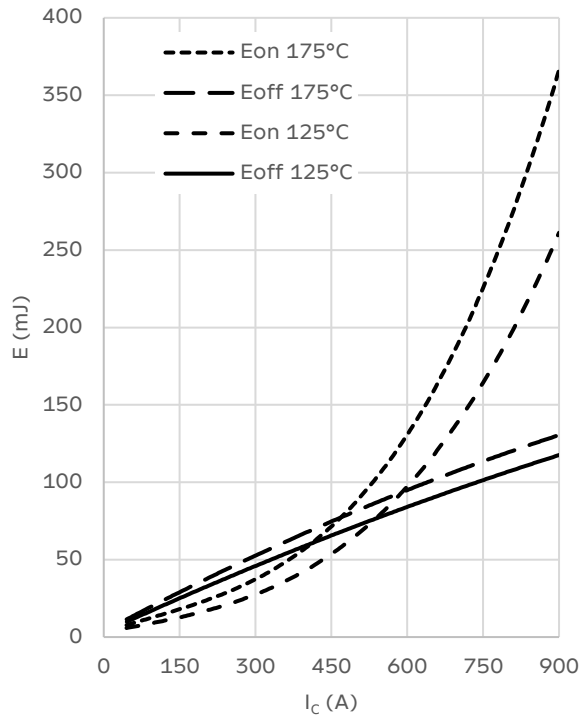
$I_C = f(V_{CE})$
 $T_{vj} = 175^\circ\text{C}$



IGBT switching losses (typical)

$E = f(I_{CE})$

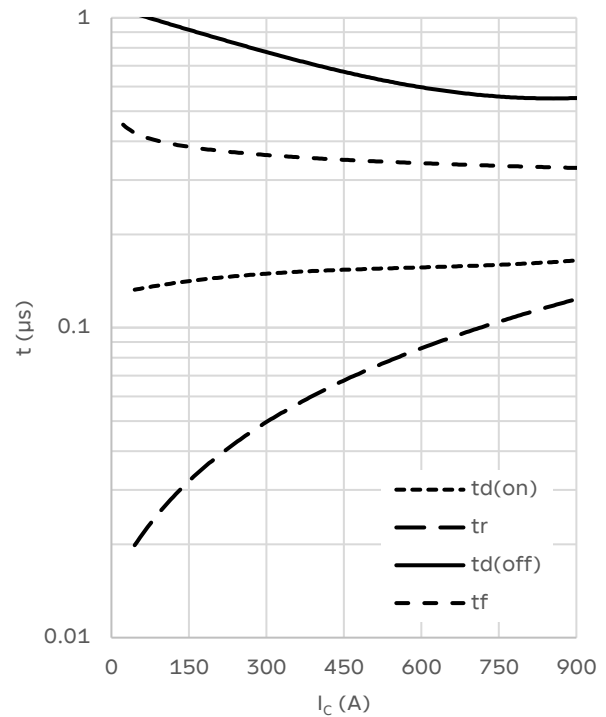
$V_{CE} = 600 \text{ V}$, $R_{Gon} = 1 \Omega$, $R_{Goff} = 2 \Omega$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching times (typical)

$t = f(I_{CE})$, $T_{vj} = 175 \text{ °C}$

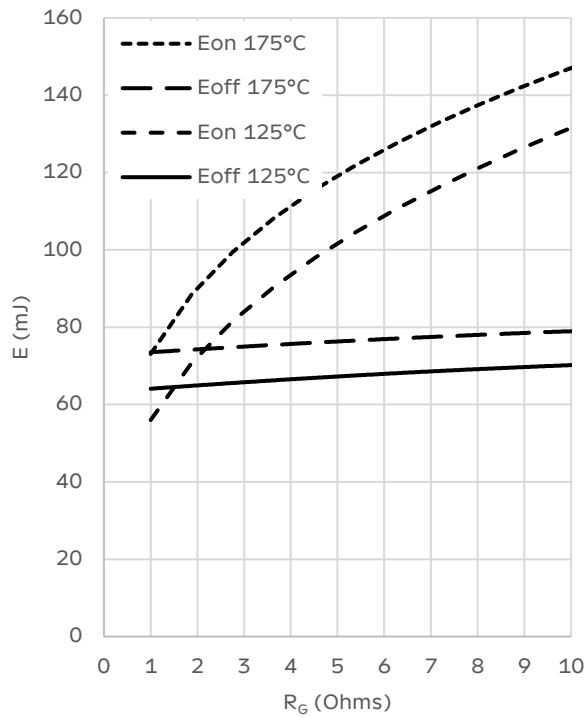
$V_{CE} = 600 \text{ V}$, $R_{Gon} = 1 \Omega$, $R_{Goff} = 2 \Omega$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching losses (typical)

$E = f(R_G)$

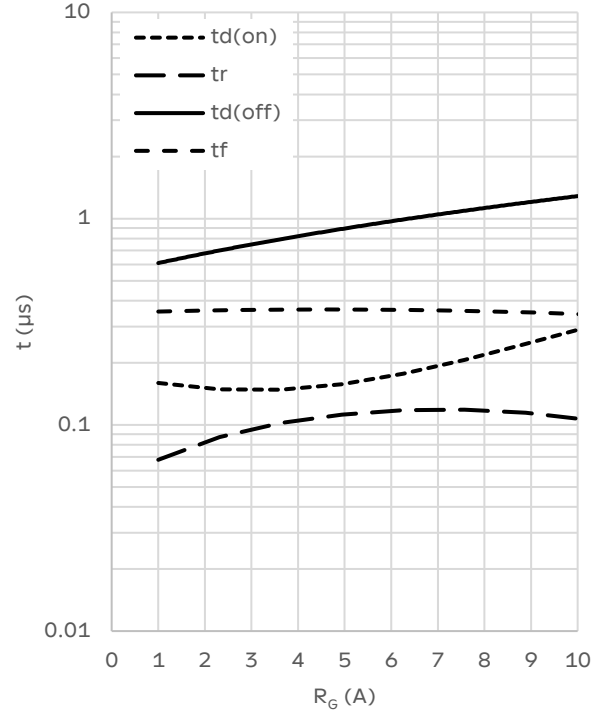
$V_{CE} = 600 \text{ V}$, $I_C = 450 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching times (typical)

$t = f(R_G)$, $T_{vj} = 175 \text{ °C}$

$V_{CE} = 600 \text{ V}$, $I_C = 450 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$

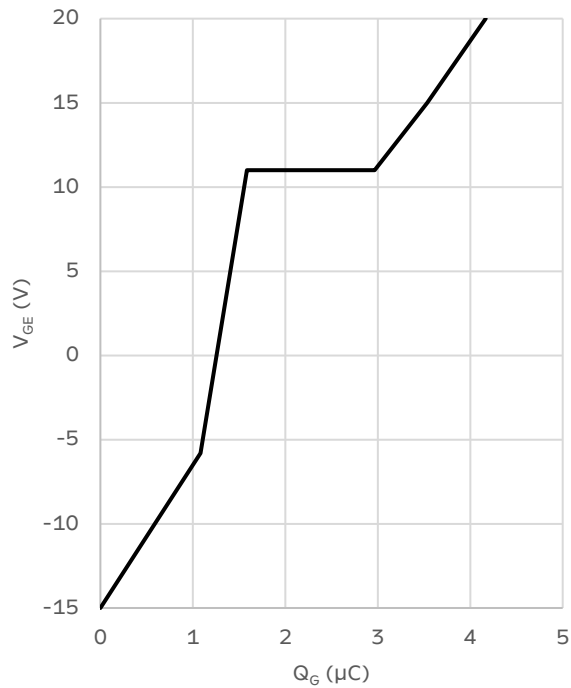




IGBT gate charge (typical)

$V_{GE} = f(Q_G)$, $T_{vj} = 25\text{ °C}$

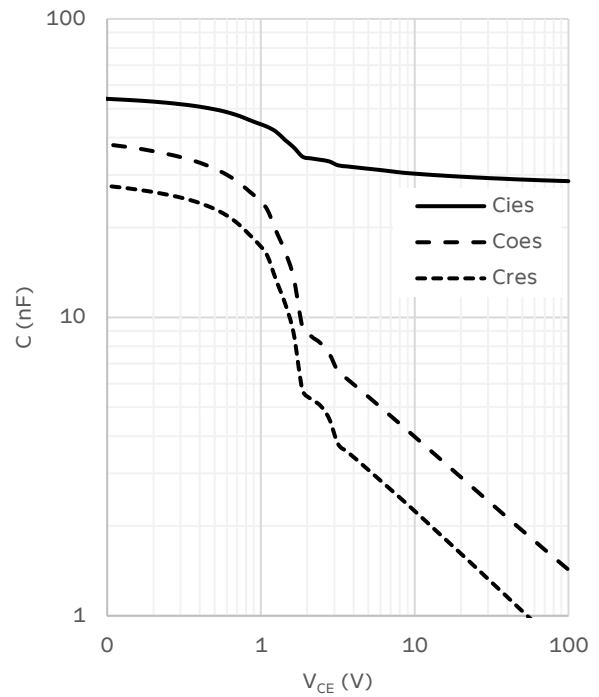
$V_{CE} = 600\text{ V}$, $I_C = 450\text{ A}$



Capacitance characteristics (typical)

$C = f(V_{CE})$, $T_{vj} = 25\text{ °C}$

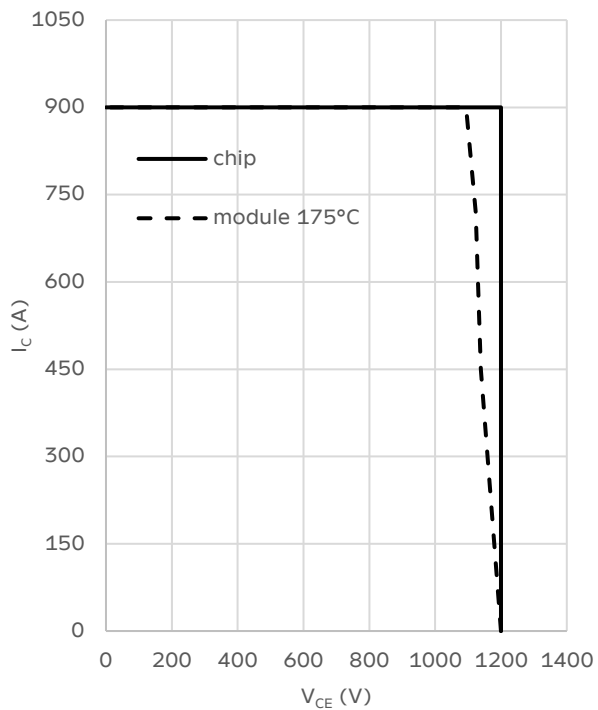
$f = 100\text{ kHz}$, $V_{GE} = 0\text{ V}$



IGBT RBSOA

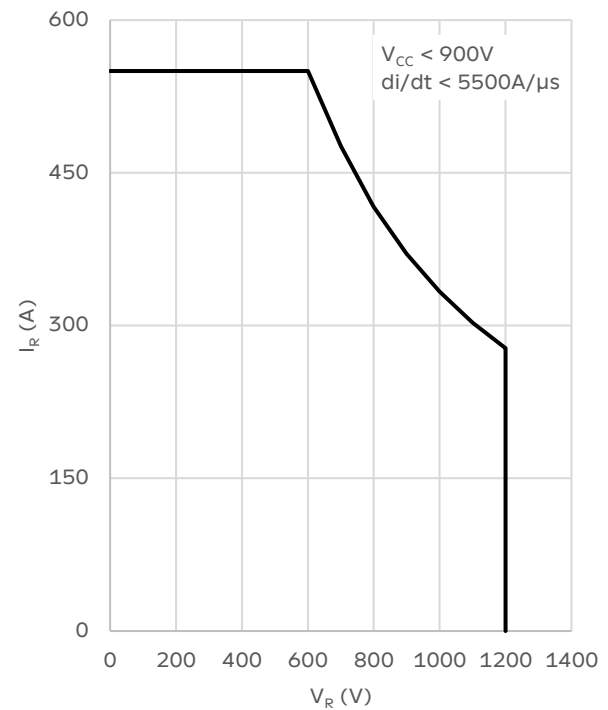
$I_C = f(V_{CEm})$

$R_{Goff} = 2\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$



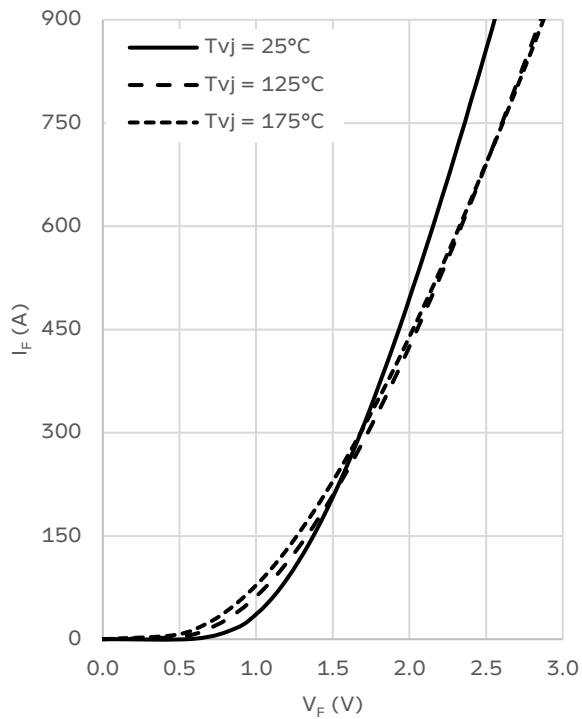
Diode SOA

$T_{vj} \leq 175\text{ °C}$



Diode forward characteristic (typical)

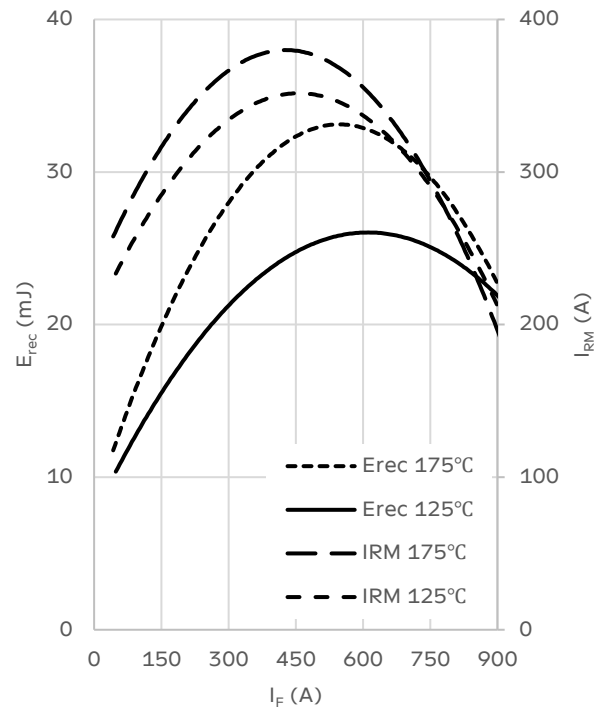
$$I_F = f(V_F)$$



Diode switching characteristics (typical)

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

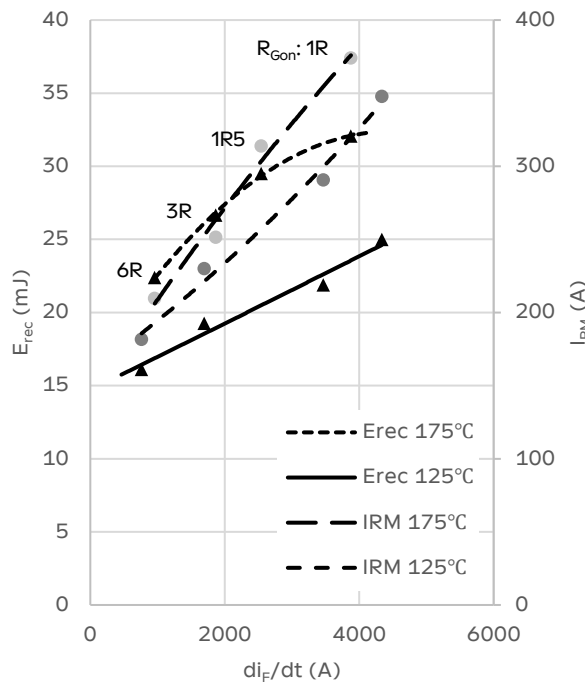
$$V_{DC} = 600 \text{ V}, R_{Gon} = 1 \Omega (\text{IGBT}), V_{GE} = -15/+15 \text{ V (IGBT)}$$



Diode switching characteristics (typical)

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

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



Thermal impedance

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

