

DATASHEET

SISD0600ED120i23_D01

ED-Type phase leg IGBT module



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

$I_C = 2 \times 600\text{ A}$

- 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 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	$T_C = 110\text{ °C}$, $T_{vj} = 175\text{ °C}$		600	A
Peak collector current	I_{CM}	$t_p = 1\text{ ms}$		1200	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		2775	W
DC forward current	I_F			900	A
Peak forward current	I_{FRM}	$t_p = 1\text{ ms}$		1800	A
Surge current	I_{FSM} I^2t	$V_R = 0\text{ V}$, $T_{vj} = 150\text{ °C}$, $t_p = 10\text{ ms}$, half-sinewave		3000 45000	A A^2s
Isolation voltage	V_{isol}	1 min, $f = 50\text{ Hz}$		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

**IGBT⁴**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Collector(-emitter) breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$, $I_C = 10\text{ mA}$, $T_{vj} = 25^\circ\text{C}$	1200			V
Collector-emitter saturation voltage ⁵	V_{CESat}	$I_C = 600\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25^\circ\text{C}$	1.55	1.85	V
			$T_{vj} = 125^\circ\text{C}$	1.75		V
			$T_{vj} = 175^\circ\text{C}$	1.85		V
Collector cut-off current	I_{CES}	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25^\circ\text{C}$		1	mA
			$T_{vj} = 125^\circ\text{C}$	2		mA
			$T_{vj} = 175^\circ\text{C}$	24		mA
Gate leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$	-0.5		0.5	μA
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 30\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^\circ\text{C}$	5	6.3	7.5	V
Gate charge	Q_G	$I_C = 600\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = -15\text{ V} \dots 15\text{ V}$		5		μC
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$, $T_{vj} = 25^\circ\text{C}$		78		nF
Reverse transfer capacitance	C_{res}			0.72		nF
Internal gate resistor	R_{Gint}	Per switch		1.05		Ω
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 600\text{ V}$, $I_C = 600\text{ A}$, $R_G = 0.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 35\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	260		ns
			$T_{vj} = 125^\circ\text{C}$	266		ns
			$T_{vj} = 175^\circ\text{C}$	267		ns
Rise time	t_r		$T_{vj} = 25^\circ\text{C}$	60		ns
			$T_{vj} = 125^\circ\text{C}$	68		ns
			$T_{vj} = 175^\circ\text{C}$	71		ns
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 600\text{ V}$, $I_C = 600\text{ A}$, $R_G = 0.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 35\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	313		ns
			$T_{vj} = 125^\circ\text{C}$	375		ns
			$T_{vj} = 175^\circ\text{C}$	402		ns
Fall time	t_f		$T_{vj} = 25^\circ\text{C}$	230		ns
			$T_{vj} = 125^\circ\text{C}$	334		ns
			$T_{vj} = 175^\circ\text{C}$	387		ns
Turn-on switching energy	E_{on}	$V_{CC} = 600\text{ V}$, $I_C = 600\text{ A}$, $R_G = 0.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 35\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	52		mJ
			$T_{vj} = 125^\circ\text{C}$	80		mJ
			$T_{vj} = 175^\circ\text{C}$	95		mJ
Turn-off switching energy	E_{off}	$V_{CC} = 600\text{ V}$, $I_C = 600\text{ A}$, $R_G = 0.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 35\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	56		mJ
			$T_{vj} = 125^\circ\text{C}$	75		mJ
			$T_{vj} = 175^\circ\text{C}$	84		mJ
Short circuit current	I_{SC}	$t_{PCS} \leq 8\text{ }\mu\text{s}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 175^\circ\text{C}$, $V_{CC} = 800\text{ V}$, $V_{CEM\text{ Chip}} \leq 1200\text{ V}$		2800		A

⁴ Characteristic values according to IEC 60747-9⁵ Collector-emitter saturation voltage is given at chip-level



Diode⁶

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Forward voltage ⁷	V _F	I _F = 600 A	T _{vj} = 25 °C		1.45	1.85	V
			T _{vj} = 125 °C		1.45		V
			T _{vj} = 175 °C		1.35		V
Peak reverse recovery current	I _{RM}	V _R = 600 V, I _F = 600 A, di/dt = 8100 A/μs (175°C), R _G = 0.5 Ω, V _{GE} = ± 15 V, L _s = 35 nH, inductive load	T _{vj} = 25 °C		533		A
			T _{vj} = 125 °C		627		A
			T _{vj} = 175 °C		692		A
Recovery charge	Q _{rr}		T _{vj} = 25 °C		76		μC
			T _{vj} = 125 °C		131		μC
			T _{vj} = 175 °C		165		μC
Reverse recovery time	t _{rr}		T _{vj} = 25 °C		572		ns
			T _{vj} = 125 °C		637		ns
			T _{vj} = 175 °C		747		ns
Reverse recovery energy	E _{rec}		T _{vj} = 25 °C		33		mJ
			T _{vj} = 125 °C		55		mJ
			T _{vj} = 175 °C		68		mJ

NTC Thermistor

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

⁶ Characteristic values according to IEC 60747-2

⁷ Forward voltage is given at chip-level



Package properties⁸

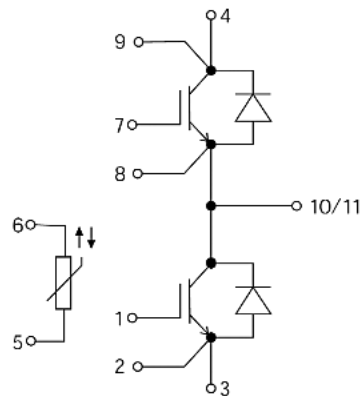
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$	Per switch				0.054	K/W
Diode thermal resistance junction to case	$R_{th(j-c)Diode}$					0.062	K/W
IGBT thermal resistance case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch			0.033		K/W
Diode thermal resistance case to heatsink	$R_{th(c-s)Diode}$	diode per switch			0.036		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	$T_{vj} = 25\ ^\circ\text{C}$		0.7		mΩ
			$T_{vj} = 125\ ^\circ\text{C}$		1		mΩ
			$T_{vj} = 175\ ^\circ\text{C}$		1.1		mΩ
Maximum RMS DC-Terminal current	$I_{Term\ RMS}$		$T_{Terminal} = 90^\circ\text{C}$		590		A
			$T_{Terminal} = 105^\circ\text{C}$		565		A

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

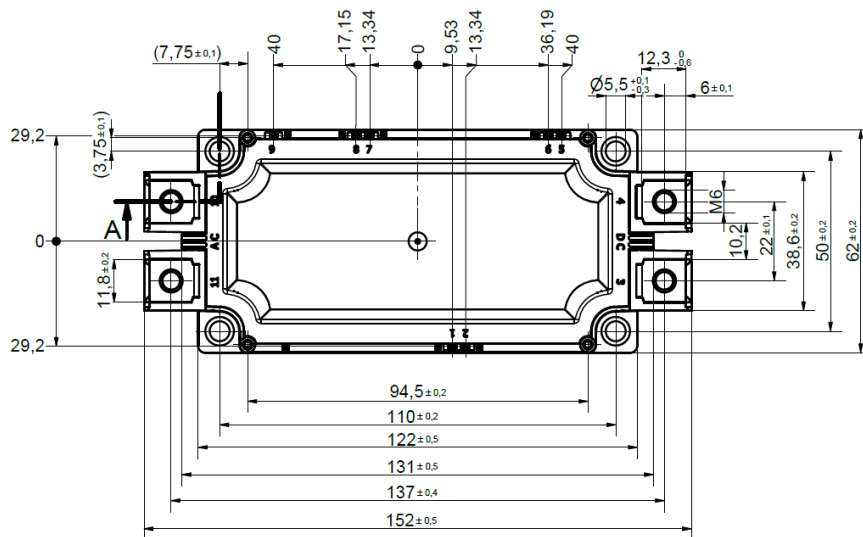
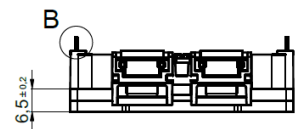
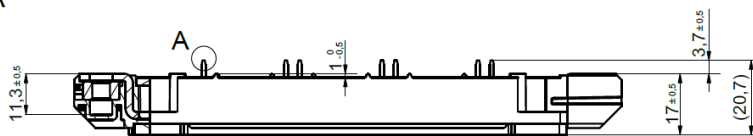
⁸ Package and mechanical properties according to IEC 60747-15

Electrical configuration

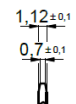


Outline drawing

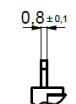
A-A



A (2:1)



B (2:1)



This is an electrostatic sensitive device.

This product has been designed and qualified for Industrial Level.

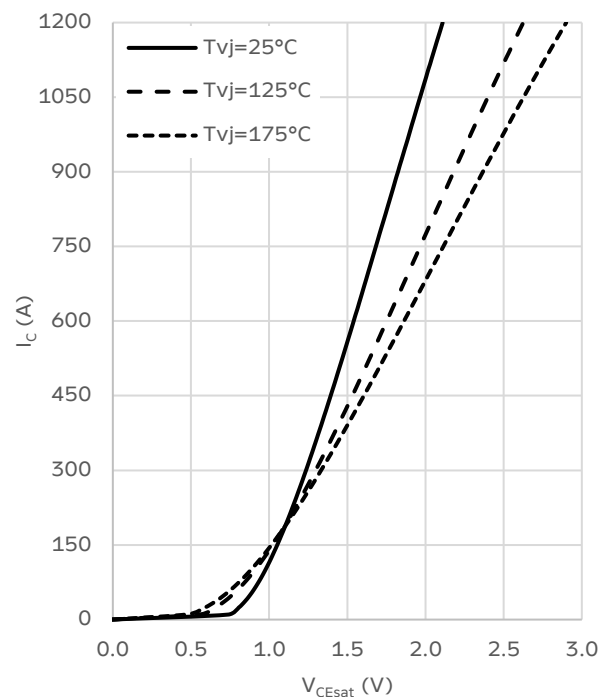


Characteristics

IGBT on-state characteristics (typical)

$$I_C = f(V_{CE})$$

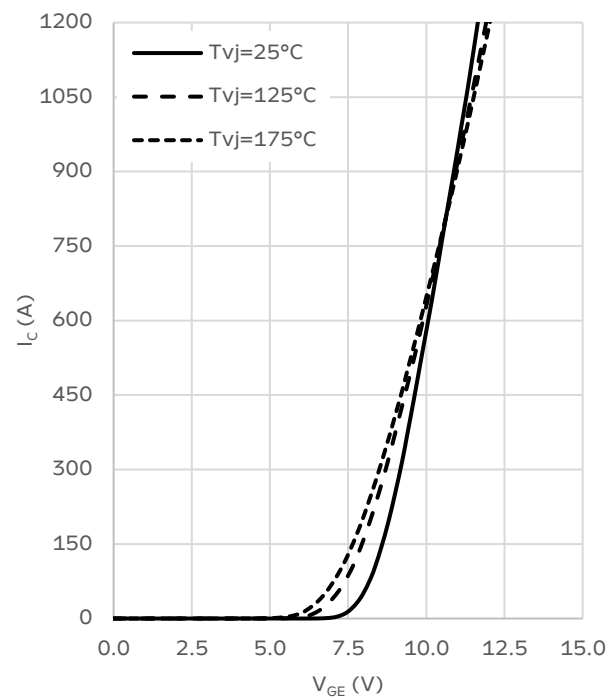
$$V_{GE} = 15 \text{ V}$$



IGBT transfer characteristics (typical)

$$I_C = f(V_{GE})$$

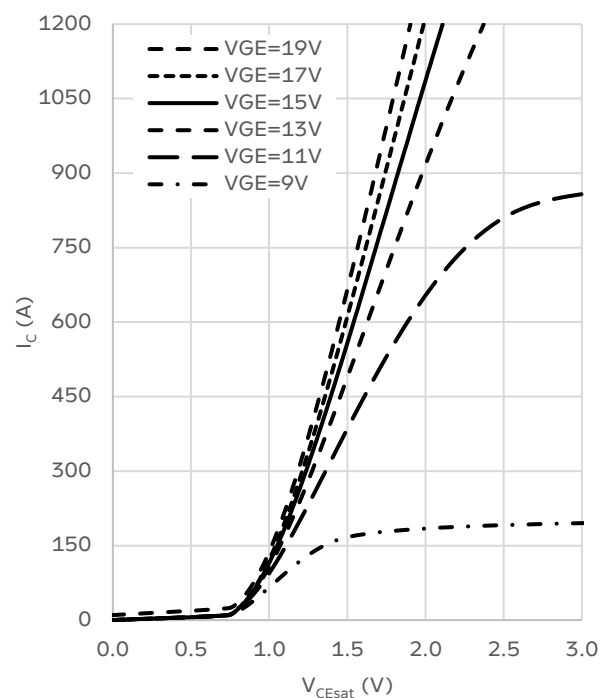
$$V_{CE} = 20 \text{ V}$$



IGBT output characteristics (typical)

$$I_C = f(V_{CE})$$

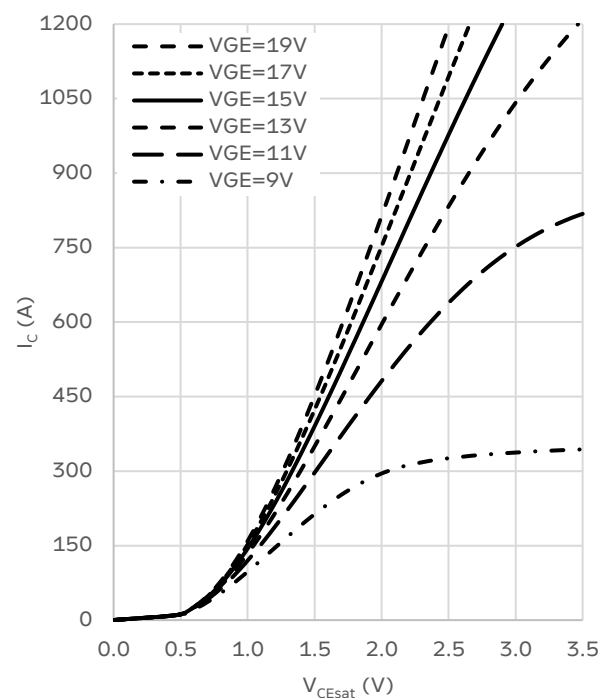
$$T_{vj} = 25^\circ\text{C}$$



IGBT output characteristics (typical)

$$I_C = f(V_{CE})$$

$$T_{vj} = 175^\circ\text{C}$$

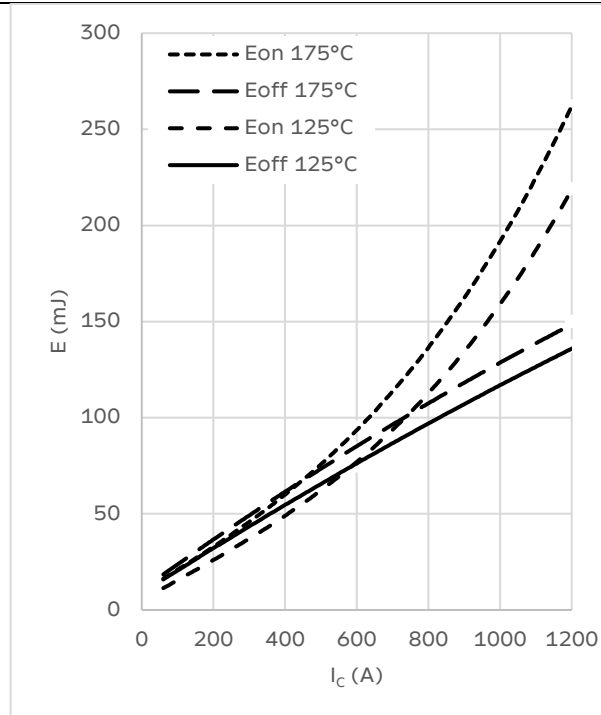




IGBT switching losses (typical)

$E = f(I_{CE})$

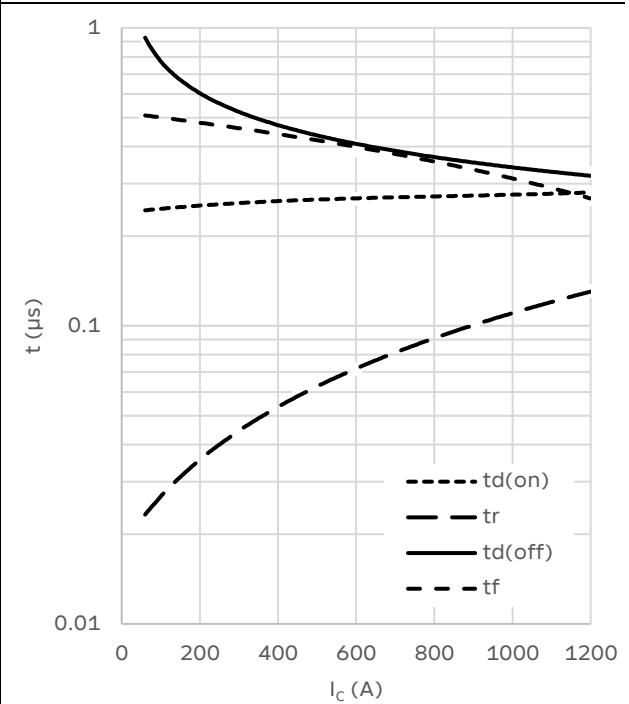
$V_{CE} = 600 \text{ V}$, $R_{Gon} = 0.5 \Omega$, $R_{Goff} = 0.5 \Omega$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching times (typical)

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

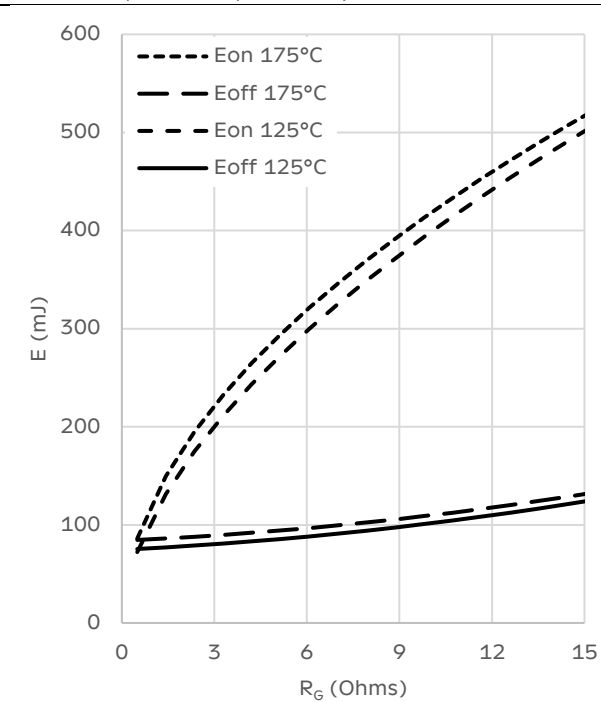
$V_{CE} = 600 \text{ V}$, $R_{Gon} = 0.5 \Omega$, $R_{Goff} = 0.5 \Omega$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching losses (typical)

$E = f(R_G)$

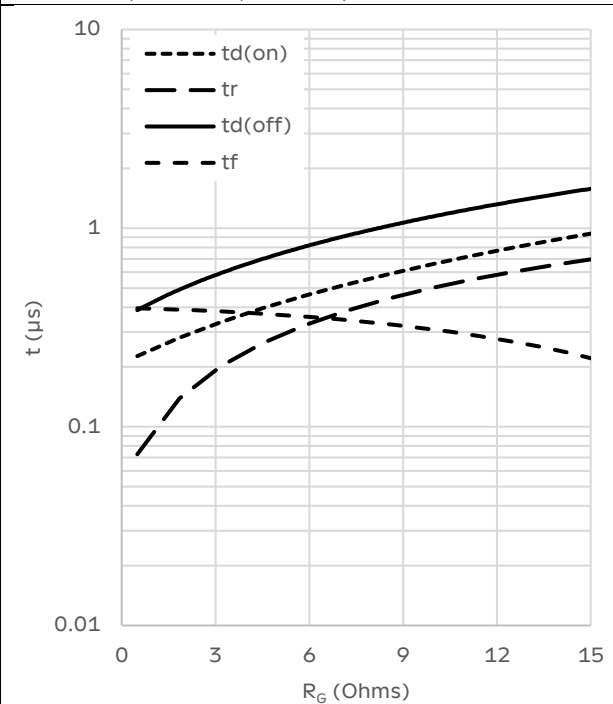
$V_{CE} = 600 \text{ V}$, $I_C = 600 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching times (typical)

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

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

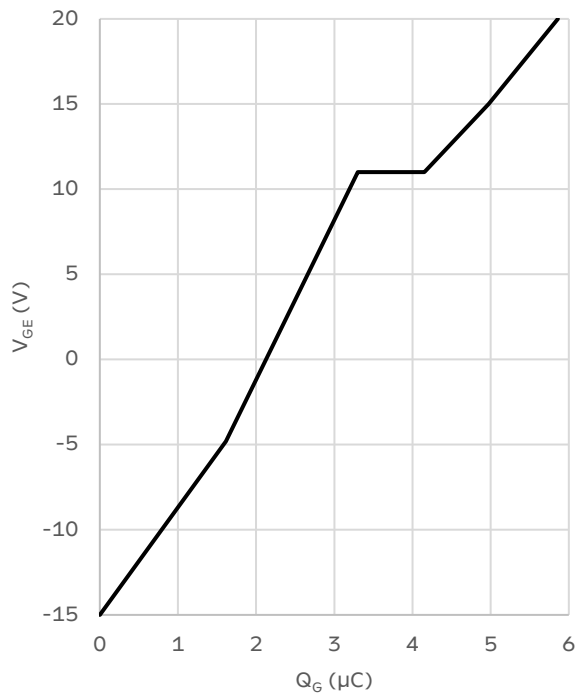




IGBT gate charge (typical)

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

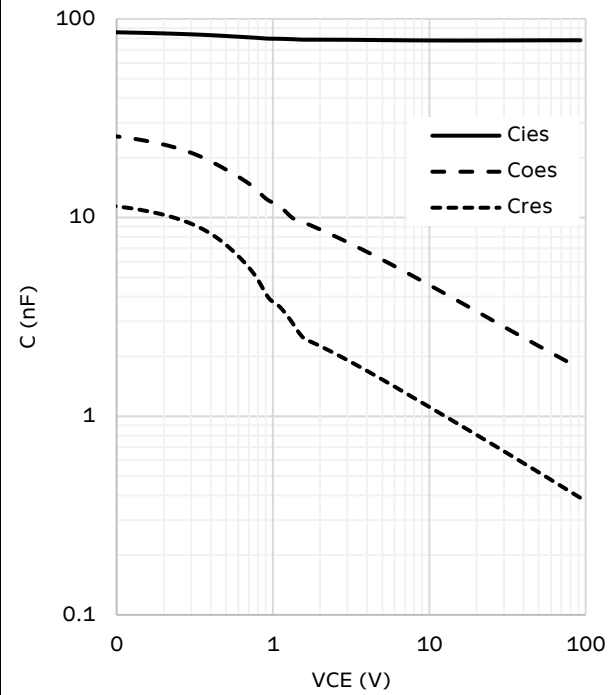
$V_{CE} = 600\text{ V}$, $I_C = 600\text{ A}$



Capacitance characteristics (typical)

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

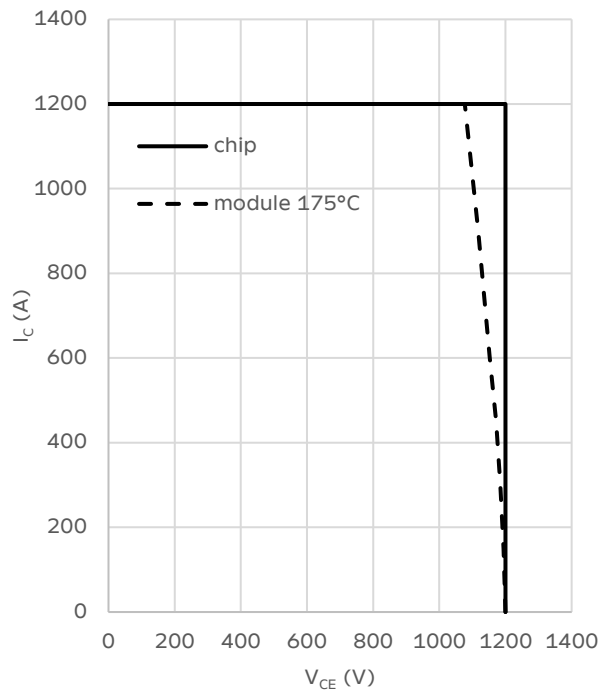
$f = 100\text{ kHz}$, $V_{GE} = 0\text{ V}$



IGBT RBSOA

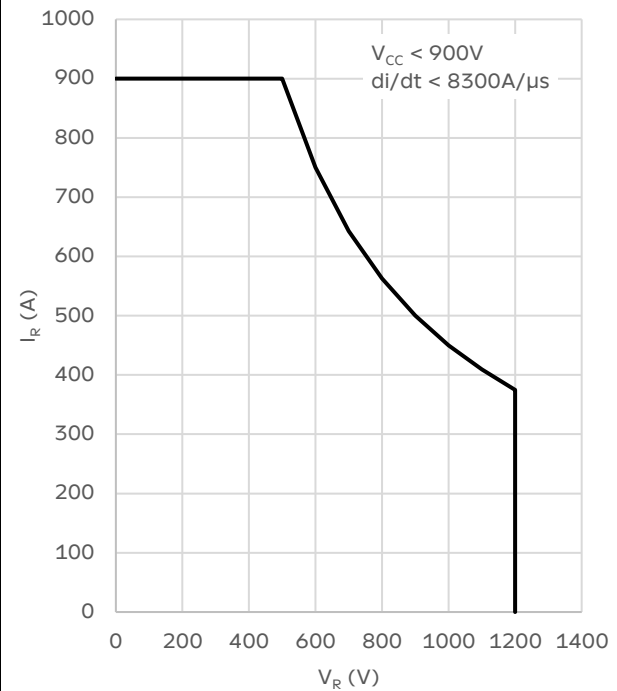
$I_C = f(V_{CEM})$

$R_{Goff} = 0.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$



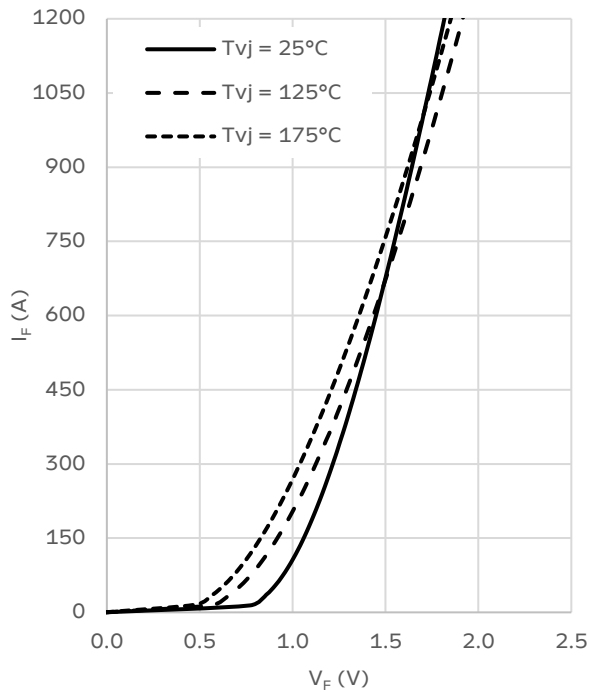
Diode SOA

$T_{vj} \leq 175\text{ °C}$



Diode forward characteristic (typical)

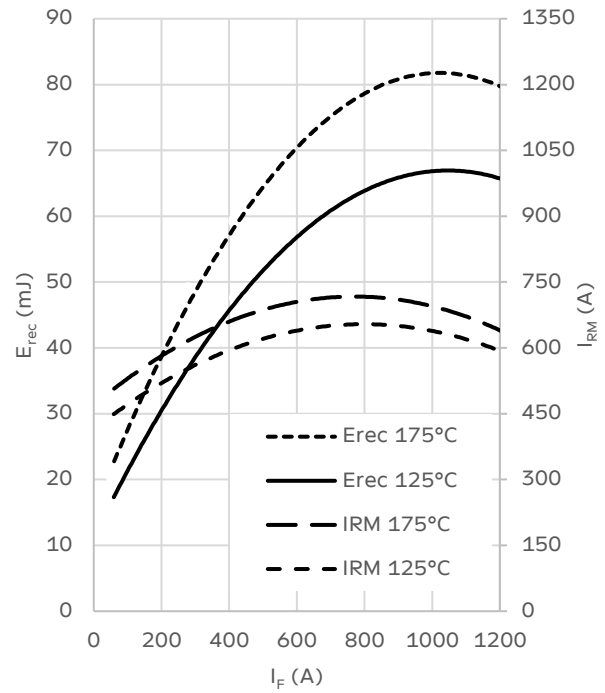
$$I_F = f(V_F)$$



Diode switching characteristics (typical)

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

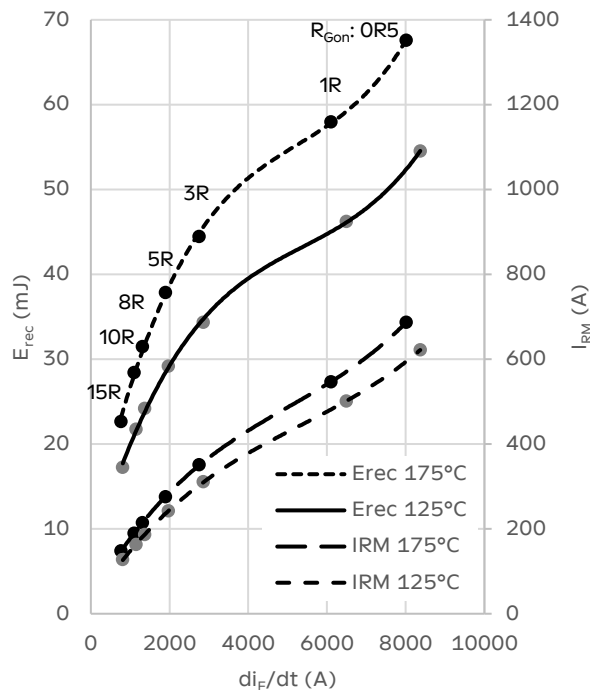
$$V_{DC} = 600 \text{ V}, R_{Gon} = 0.5 \Omega \text{ (IGBT)}, V_{GE} = -15/+15 \text{ V (IGBT)}$$



Diode switching characteristics (typical)

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

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



Thermal impedance (typical)

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

