62 mm C-Series module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode

Features



- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 600 A / I_{CRM} = 1200 A
  - TRENCHSTOP™ IGBT7
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - 4 kV AC 1 min insulation
  - High creepage and clearance distances
  - High power density
  - Isolated base plate
  - Package with CTI > 400
  - Standard housing

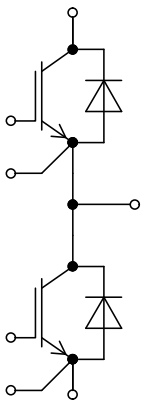
Potential applications

- Servo drives
- Solar applications
- UPS systems
- Motor drives
- High-power converters
- Commercial agriculture vehicles
- Three-level applications

Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

Description



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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, *t* = 60 s	4.0	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	29.0	mm
Creepage distance	d_{Creep}	terminal to terminal	23.0	mm
Clearance	d_{Clear}	terminal to heatsink	23.0	mm
Clearance	d_{Clear}	terminal to terminal	11.0	mm
Comparative tracking index	*CTI*		> 400	
Relative thermal index (electrical)	*RTI*	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray inductance module	L_{sCE}				20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C = 25 °C, per switch			0.5		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for module mounting	*M*	- Mounting according to valid application note	M5, Screw	3		6	Nm
Terminal connection torque	*M*	- Mounting according to valid application note	M6, Screw	2.5		5	Nm
Weight	*G*				340		g

2 IGBT, T1 / T2

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 90 °C	600	A
Maximum RMS module DC-terminal current	I_{tRMS}		$T_{Terminal}$ = 115 °C, T_C = 90 °C	650	A
			$T_{Terminal}$ = 115 °C, T_C = 115 °C	600	

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$	1200	A
Gate-emitter peak voltage	V_{GES}		±20	V

Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 600 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.50	1.75	V
			T_{vj} = 125 °C		1.65		
			T_{vj} = 150 °C		1.70		
			T_{vj} = 175 °C		1.75		
Gate threshold voltage	V_{GEth}	I_C = 12 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.15	5.80	6.45	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 600 V			9.66		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.6		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			92.3		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.462		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.1	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.435		µs
			T_{vj} = 125 °C		0.447		
			T_{vj} = 150 °C		0.451		
			T_{vj} = 175 °C		0.454		
Rise time (inductive load)	t_r	I_C = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.051		µs
			T_{vj} = 125 °C		0.058		
			T_{vj} = 150 °C		0.060		
			T_{vj} = 175 °C		0.062		
Turn-off delay time (inductive load)	t_{doff}	I_C = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω	T_{vj} = 25 °C		0.490		µs
			T_{vj} = 125 °C		0.558		
			T_{vj} = 150 °C		0.578		
			T_{vj} = 175 °C		0.597		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Fall time (inductive load)	t_f	I_C = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω	T_{vj} = 25 °C		0.119		µs
			T_{vj} = 125 °C		0.249		
			T_{vj} = 150 °C		0.295		
			T_{vj} = 175 °C		0.340		
Turn-on energy loss per pulse	E_{on}	I_C = 600 A, V_{CC} = 600 V, L_σ = 25 nH, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω, di/dt = 7700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		17		mJ
			T_{vj} = 125 °C		25.1		
			T_{vj} = 150 °C		28.6		
			T_{vj} = 175 °C		32		
Turn-off energy loss per pulse	E_{off}	I_C = 600 A, V_{CC} = 600 V, L_σ = 25 nH, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω, dv/dt = 3150 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		53.2		mJ
			T_{vj} = 125 °C		80.5		
			T_{vj} = 150 °C		89.7		
			T_{vj} = 175 °C		98.9		
SC data	I_{SC}	V_{GE} ≤ 15 V, V_{CC} = 800 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 8 µs, T_{vj}=150 °C		2250		A
			t_P ≤ 6 µs, T_{vj}=175 °C		2000		
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.0668	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, λ_{grease} = 1 W/(m·K)			0.0336		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

Note: $T_{vj\,op}$ > 150 °C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

3 Diode, D1 / D2

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Continuous DC forward current	I_F			600	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1200	A

(table continues...)

Table 5 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	29900	A^2s
			T_{vj} = 175 °C	23200	

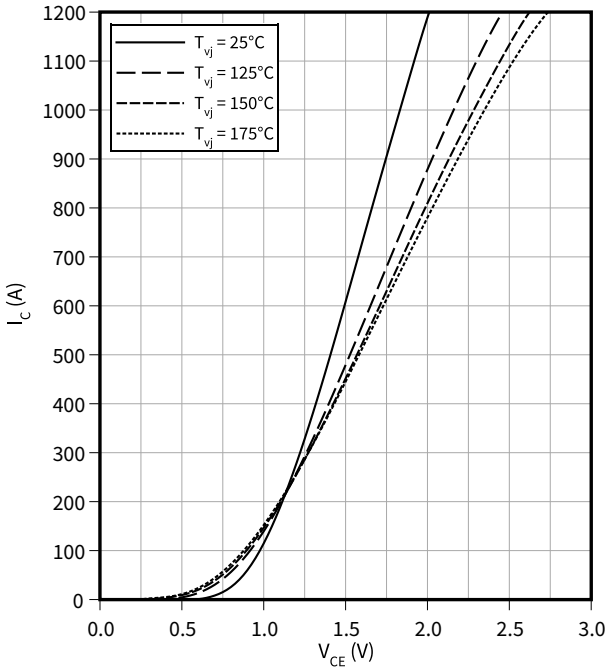
Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 600 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.80	2.10	V
			T_{vj} = 125 °C		1.70		
			T_{vj} = 150 °C		1.65		
			T_{vj} = 175 °C		1.60		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 600 A, V_{GE} = -15 V, -di$_F$/dt = 7700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		448		A
			T_{vj} = 125 °C		583		
			T_{vj} = 150 °C		616		
			T_{vj} = 175 °C		648		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 600 A, V_{GE} = -15 V, -di$_F$/dt = 7700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		49.4		µC
			T_{vj} = 125 °C		85.7		
			T_{vj} = 150 °C		100		
			T_{vj} = 175 °C		115		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 600 A, V_{GE} = -15 V, -di$_F$/dt = 7700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		27.9		mJ
			T_{vj} = 125 °C		45.6		
			T_{vj} = 150 °C		51.8		
			T_{vj} = 175 °C		58		
Thermal resistance, junction to case	R_{thJC}	per diode				0.110	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, λ_{grease} = 1 W/(m·K)			0.0466		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

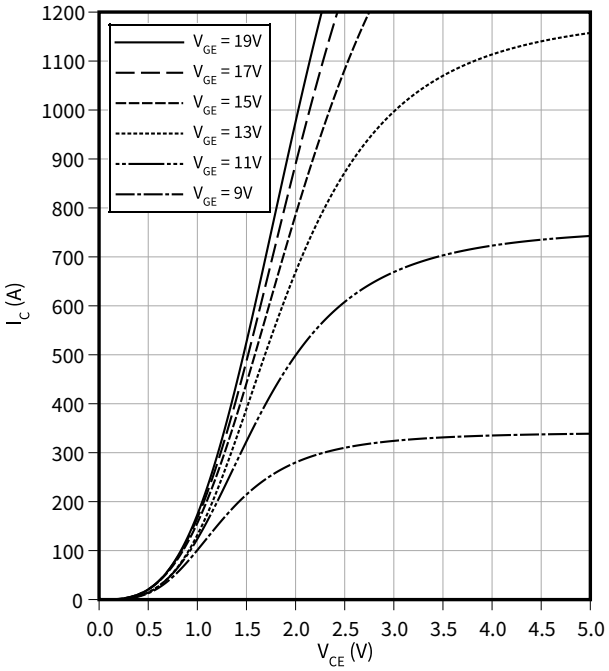
Note: $T_{vj\,op}$ > 150 °C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

4 Characteristics diagrams

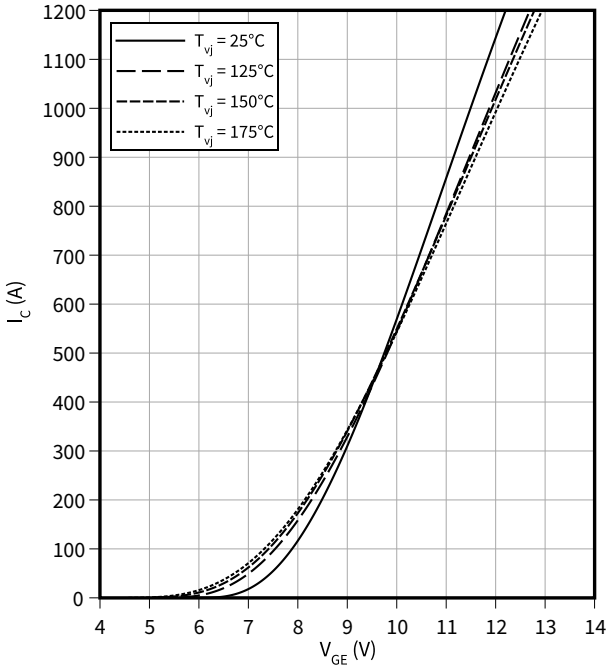
Output characteristic (typical), IGBT, T1 / T2
$I_C = f(V_{CE})$
V_{GE} = 15 V



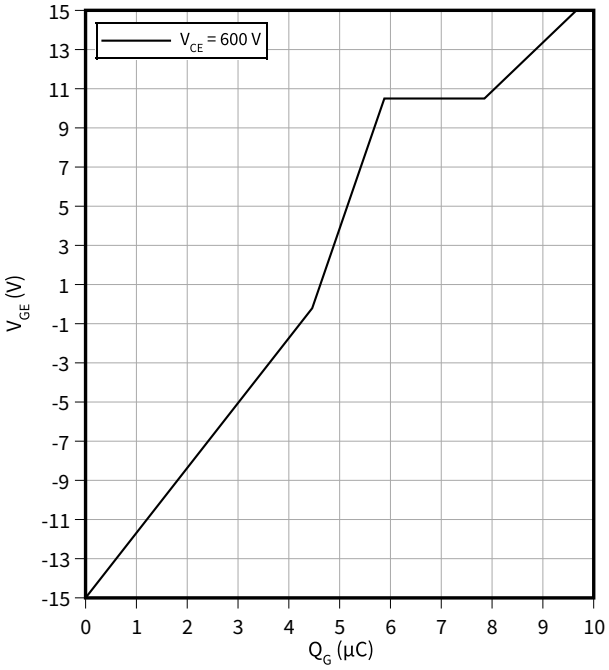
Output characteristic field (typical), IGBT, T1 / T2
$I_C = f(V_{CE})$
T_{vj} = 175 °C



Transfer characteristic (typical), IGBT, T1 / T2
$I_C = f(V_{GE})$
V_{CE} = 20 V



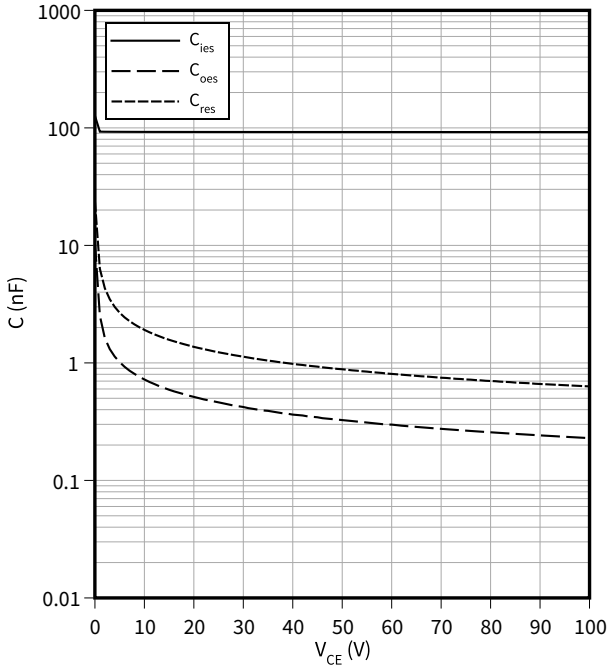
Gate charge characteristic (typical), IGBT, T1 / T2
$V_{GE} = f(Q_G)$
I_C = 600 A, T_{vj} = 25 °C



Capacity characteristic (typical), IGBT, T1 / T2

$C = f(V_{CE})$

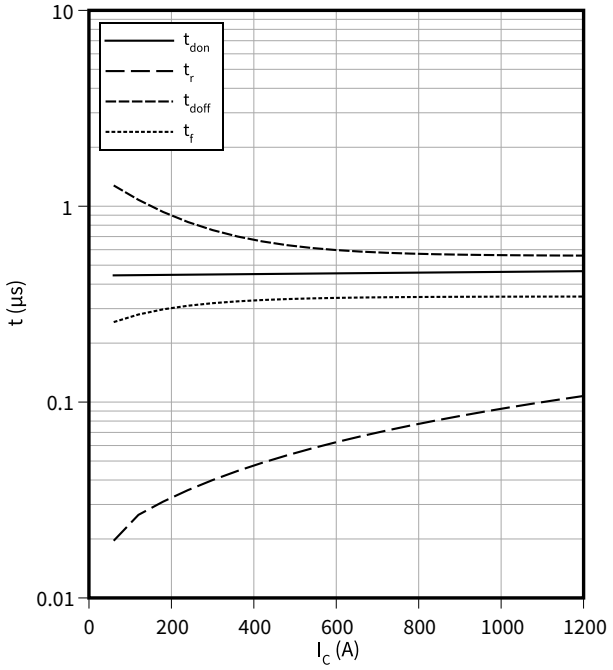
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, T1 / T2

$t = f(I_C)$

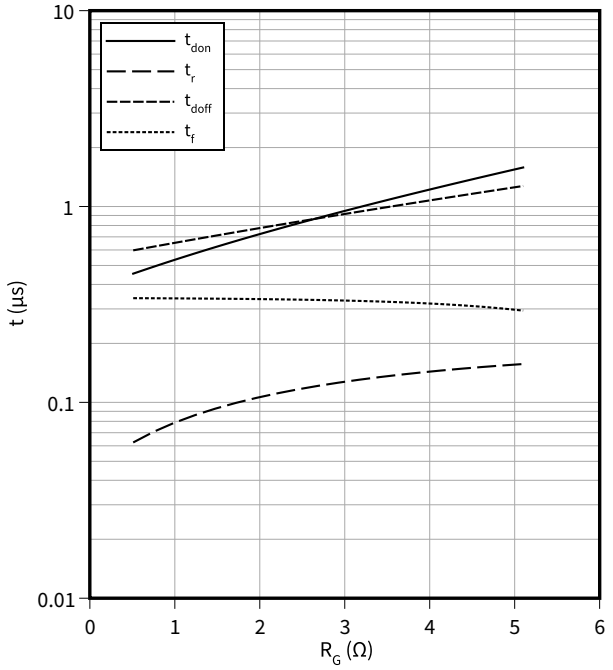
$R_{Goff} = 0.51\ \Omega$, $R_{Gon} = 0.51\ \Omega$, $V_{CC} = 600$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Switching times (typical), IGBT, T1 / T2

$t = f(R_G)$

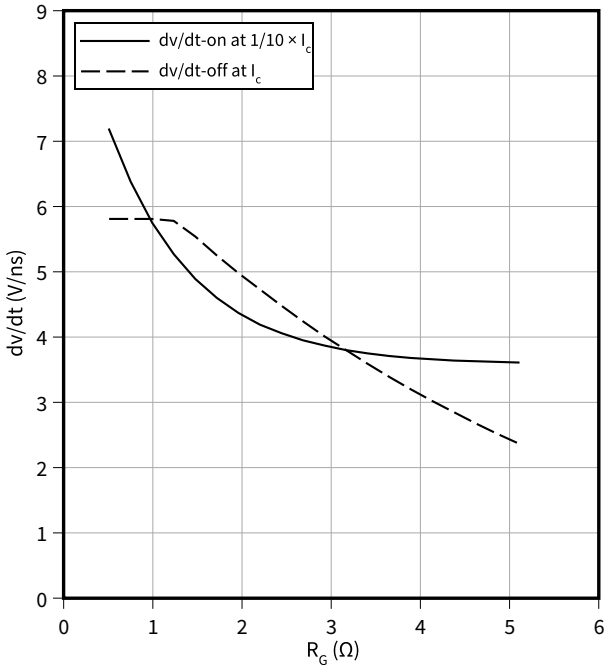
$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Voltage slope (typical), IGBT, T1 / T2

$dv/dt = f(R_G)$

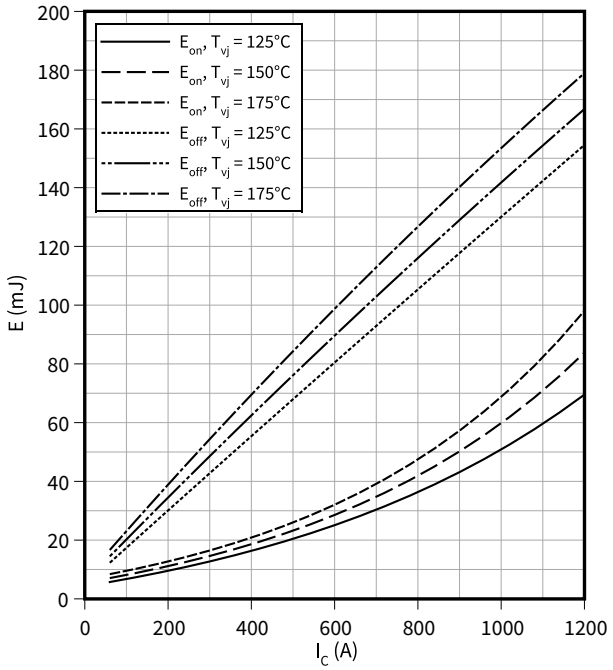
$I_C = 600$ A, $V_{CC} = 600$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 25$ °C



Switching losses (typical), IGBT, T1 / T2

$E = f(I_C)$

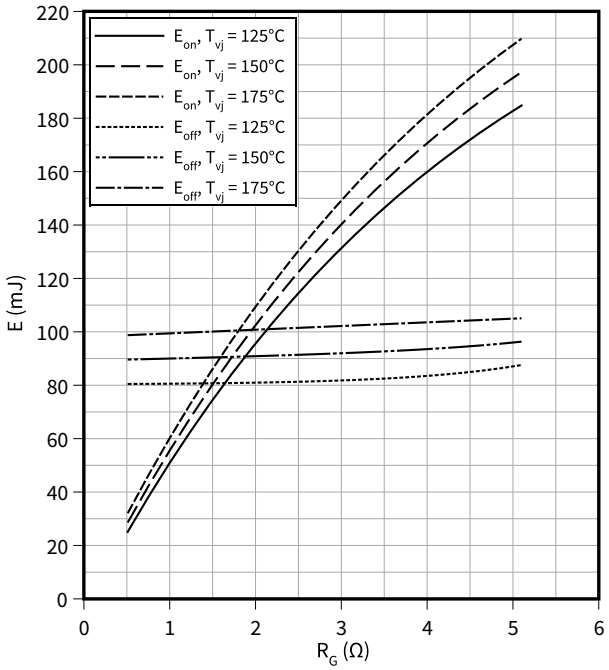
$R_{Goff} = 0.51\ \Omega$, $R_{Gon} = 0.51\ \Omega$, $V_{CC} = 600\ V$, $V_{GE} = \pm 15\ V$



Switching losses (typical), IGBT, T1 / T2

$E = f(R_G)$

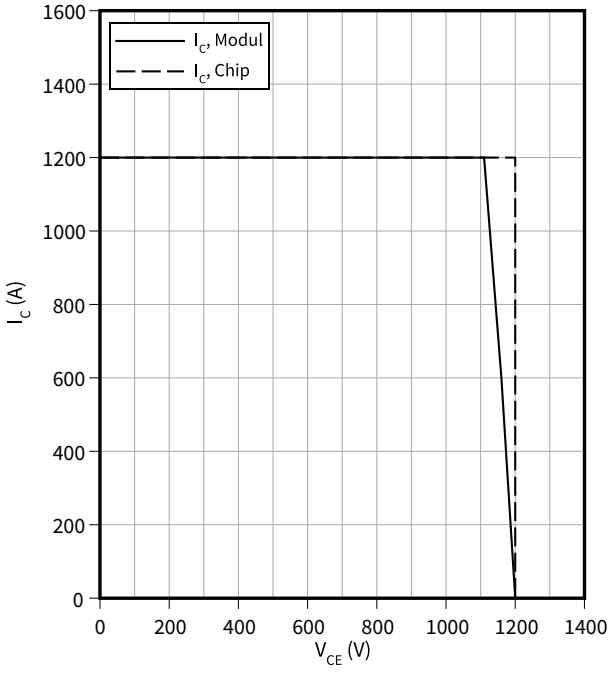
$I_C = 600\ A$, $V_{CC} = 600\ V$, $V_{GE} = \pm 15\ V$



Reverse bias safe operating area (RBSOA), IGBT, T1 / T2

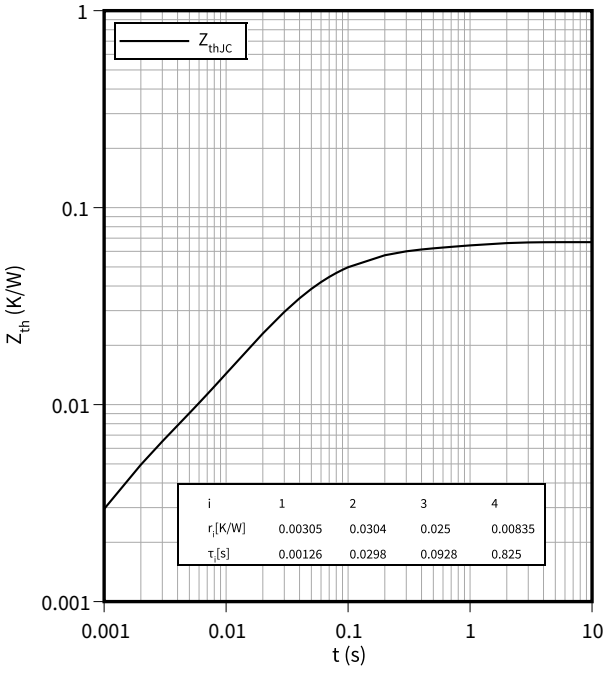
$I_C = f(V_{CE})$

$R_{Goff} = 0.51\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ °C$



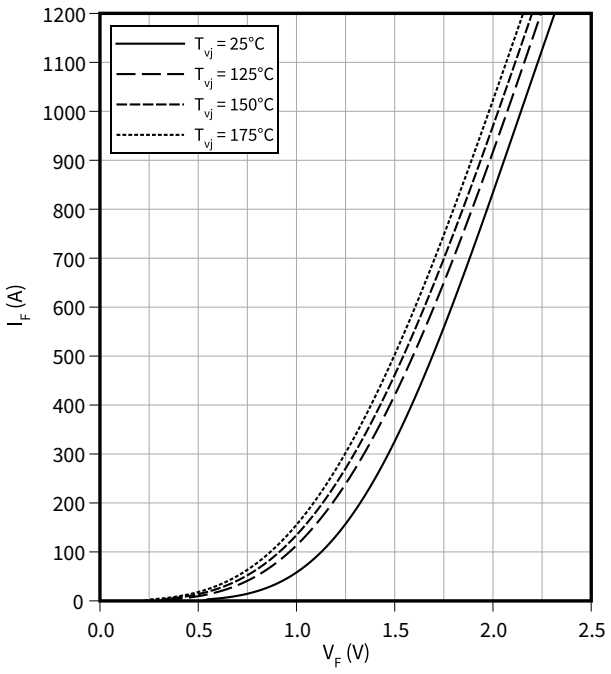
Transient thermal impedance, IGBT, T1 / T2

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D1 / D2

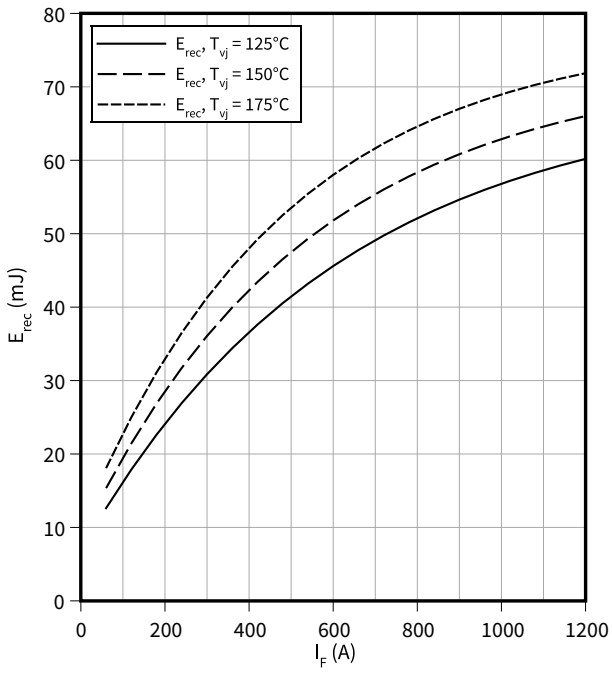
$I_F = f(V_F)$



Switching losses (typical), Diode, D1 / D2

$E_{rec} = f(I_F)$

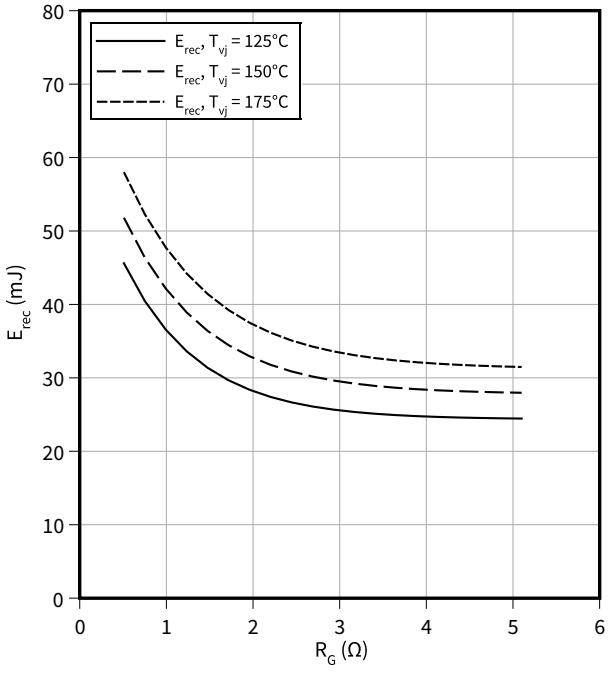
$R_{Gon} = 0.51\ \Omega$, $V_{CC} = 600\ V$



Switching losses (typical), Diode, D1 / D2

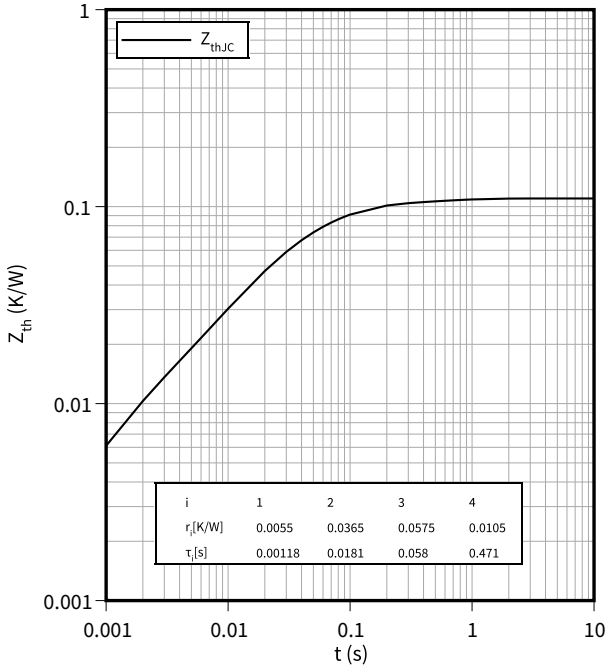
$E_{rec} = f(R_G)$

$I_F = 600\ A$, $V_{CC} = 600\ V$



Transient thermal impedance, Diode, D1 / D2

$Z_{th} = f(t)$



5 Circuit diagram

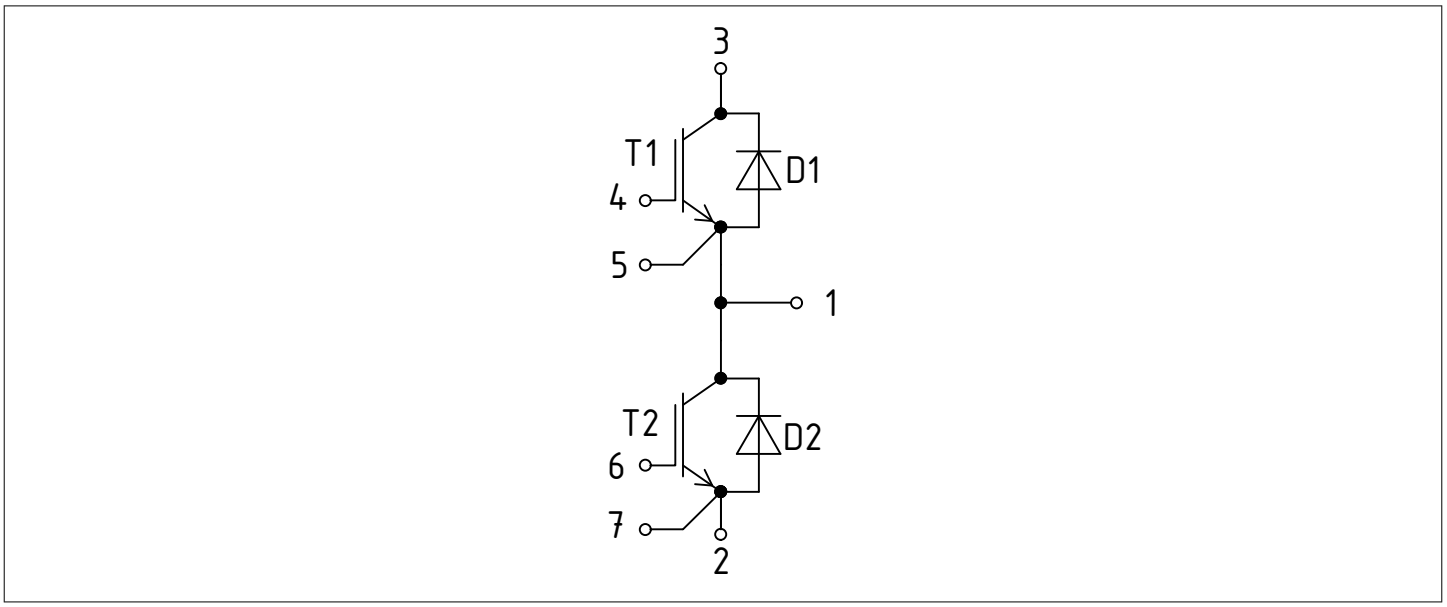


Figure 1

6 Package outlines

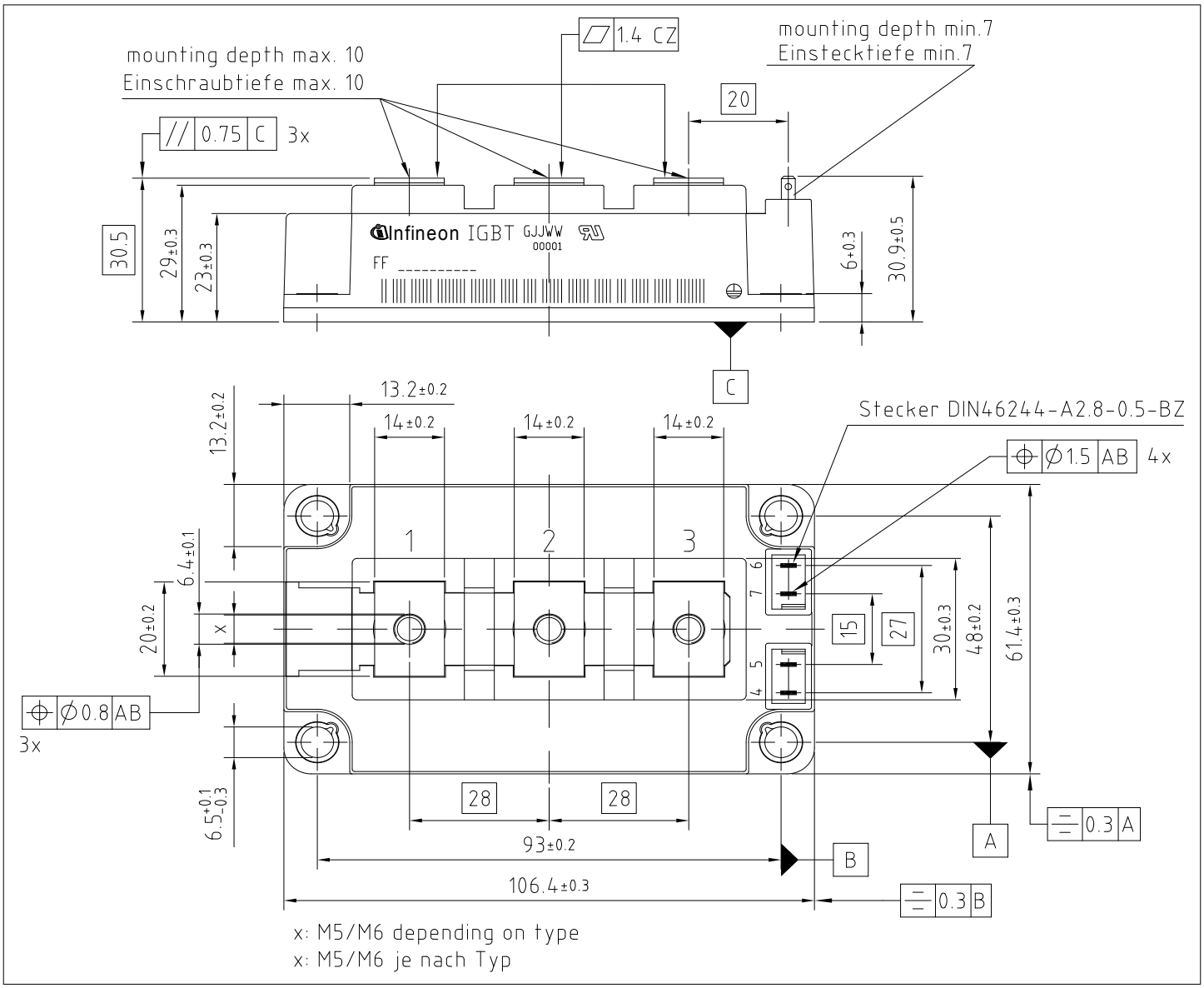


Figure 2

7 Module label code

Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	71549142846550549911530		71549142846550549911530

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2021-12-07	Initial version
0.20	2022-09-06	Preliminary datasheet
1.00	2023-05-31	Final datasheet

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