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

Features

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 800 A / I_{CRM} = 1600 A
  - TRENCHSTOP™ IGBT7
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - Standard housing
  - 4 kV AC 1 min insulation
  - High creepage and clearance distances
  - High power density
  - Isolated base plate
  - Package with CTI > 400

Potential applications

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

Product validation

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

Description

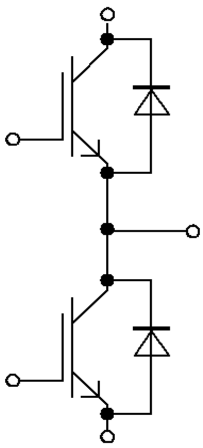


Table of contents

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, Inverter

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	800	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 $T_{vj\,op}$	1600	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 = 800 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 = 16 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			12.8		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.43		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			122		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.6		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 = 800 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.500		µs
			T_{vj} = 125 °C		0.517		
			T_{vj} = 150 °C		0.522		
			T_{vj} = 175 °C		0.527		
Rise time (inductive load)	t_r	I_C = 800 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.065		µs
			T_{vj} = 125 °C		0.073		
			T_{vj} = 150 °C		0.075		
			T_{vj} = 175 °C		0.077		
Turn-off delay time (inductive load)	t_{doff}	I_C = 800 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω	T_{vj} = 25 °C		0.544		µs
			T_{vj} = 125 °C		0.628		
			T_{vj} = 150 °C		0.652		
			T_{vj} = 175 °C		0.675		

(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 = 800 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω	T_{vj} = 25 °C		0.122		µs
			T_{vj} = 125 °C		0.260		
			T_{vj} = 150 °C		0.310		
			T_{vj} = 175 °C		0.360		
Turn-on energy loss per pulse	E_{on}	I_C = 800 A, V_{CC} = 600 V, $L_σ$ = 25 nH, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω, di/dt = 8700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		27.2		mJ
			T_{vj} = 125 °C		42.7		
			T_{vj} = 150 °C		48.7		
			T_{vj} = 175 °C		54.6		
Turn-off energy loss per pulse	E_{off}	I_C = 800 A, V_{CC} = 600 V, $L_σ$ = 25 nH, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω, dv/dt = 3400 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		69.7		mJ
			T_{vj} = 125 °C		108		
			T_{vj} = 150 °C		120		
			T_{vj} = 175 °C		132		
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		3000		A
			t_P ≤ 6 µs, T_{vj}=175 °C		2700		
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.0483	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT			0.0251		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

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

3 Diode, Inverter

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			800	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1600	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	53000	A^2s
			T_{vj} = 175 °C	41000	

Table 6 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 800 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 = 800 A, V_{GE} = -15 V, -di_F/dt = 8700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		540		A
			T_{vj} = 125 °C		720		
			T_{vj} = 150 °C		765		
			T_{vj} = 175 °C		810		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 800 A, V_{GE} = -15 V, -di_F/dt = 8700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		62		µC
			T_{vj} = 125 °C		117		
			T_{vj} = 150 °C		137		
			T_{vj} = 175 °C		156		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 800 A, V_{GE} = -15 V, -di_F/dt = 8700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		27.9		mJ
			T_{vj} = 125 °C		54.5		
			T_{vj} = 150 °C		63.3		
			T_{vj} = 175 °C		72.1		
Thermal resistance, junction to case	R_{thJC}	per diode				0.0892	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode			0.0333		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

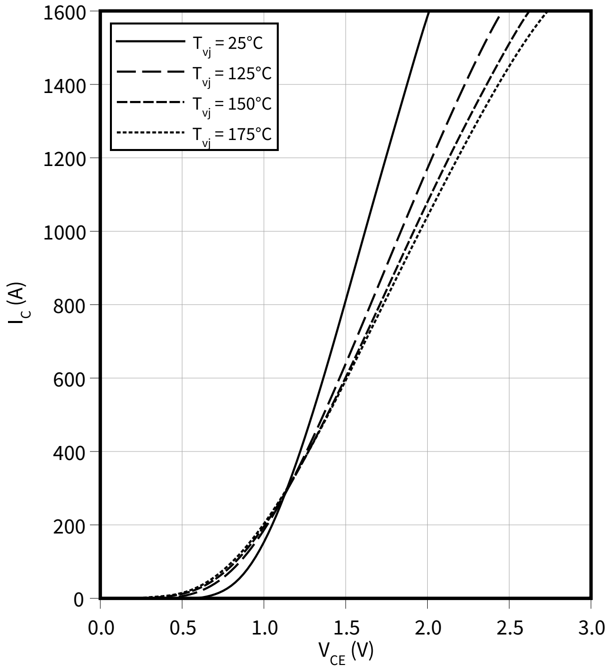
Note: *$T_{vj\,op}$ > 150°C is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.*

4 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

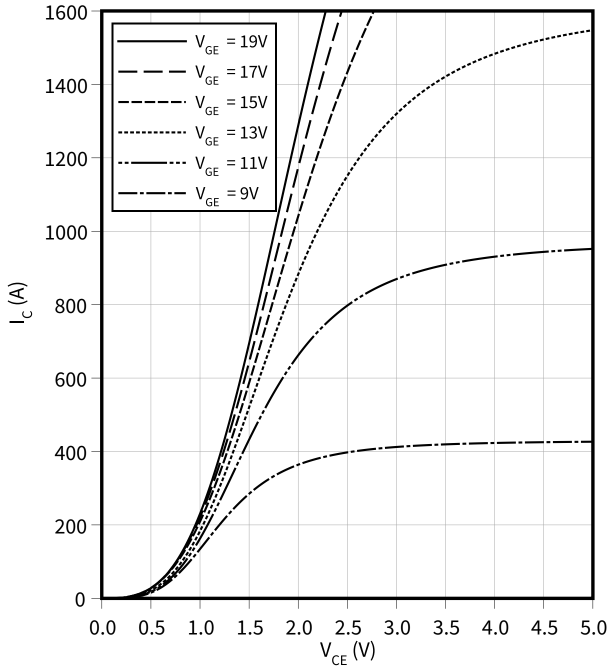
$V_{GE} = 15$ V



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

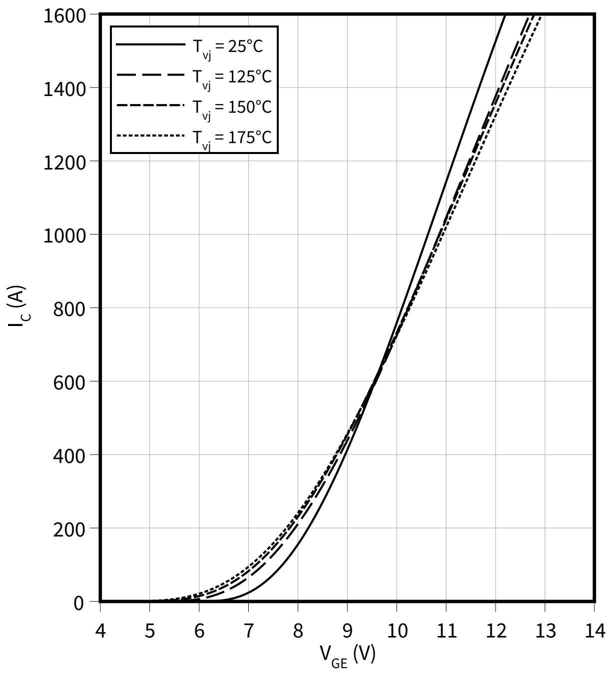
$T_{vj} = 175$ °C



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

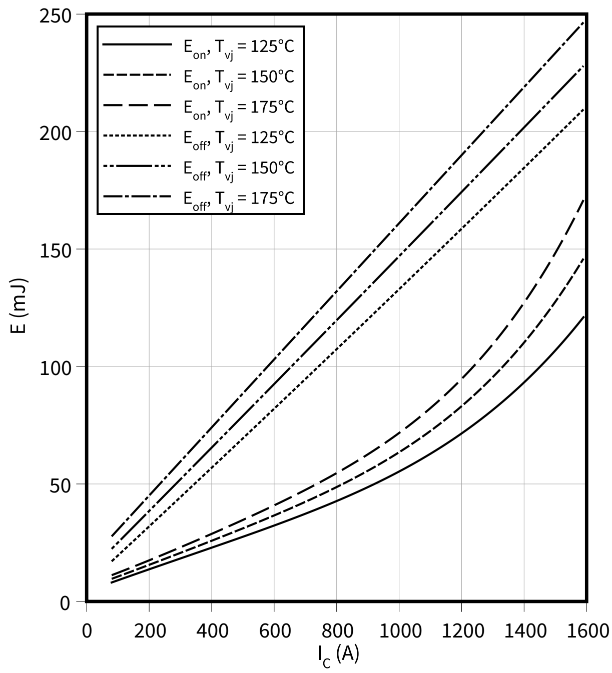
$V_{CE} = 20$ V



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

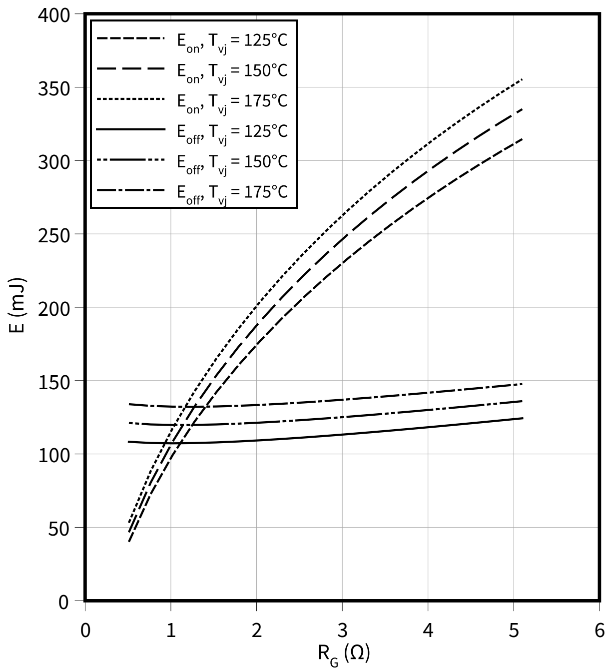
$R_{Goff} = 0.51\ \Omega$, $R_{Gon} = 0.51\ \Omega$, $V_{CC} = 600$ V, $V_{GE} = \pm 15$ V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

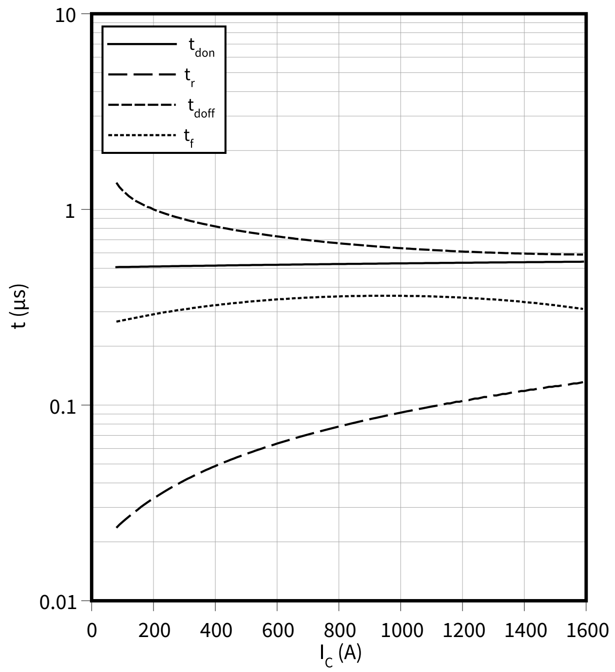
I_C = 800 A, V_{CC} = 600 V, V_{GE} = ± 15 V



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

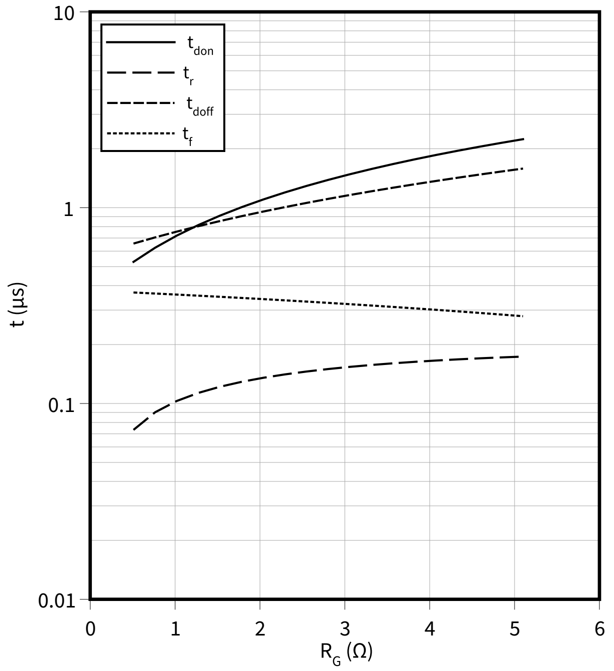
R_{Goff} = 0.51 Ω, R_{Gon} = 0.51 Ω, V_{CC} = 600 V, V_{GE} = ± 15 V, T_{vj} = 175 °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

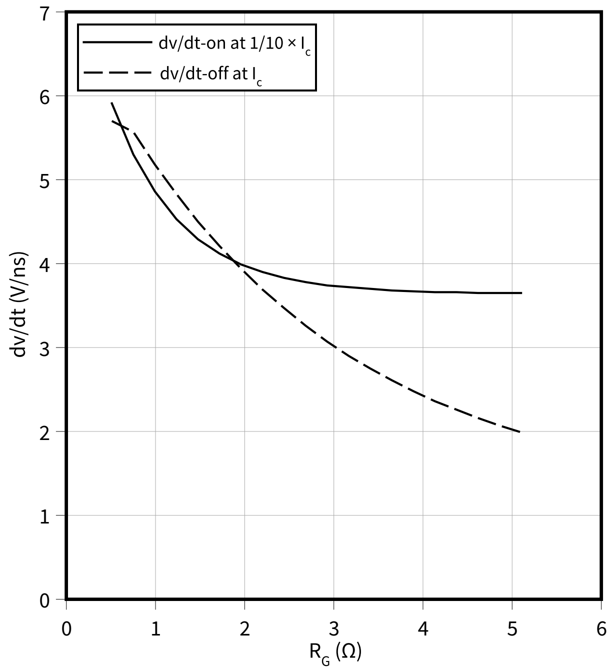
I_C = 800 A, V_{CC} = 600 V, V_{GE} = ± 15 V, T_{vj} = 175 °C



Voltage slope (typical), IGBT, Inverter

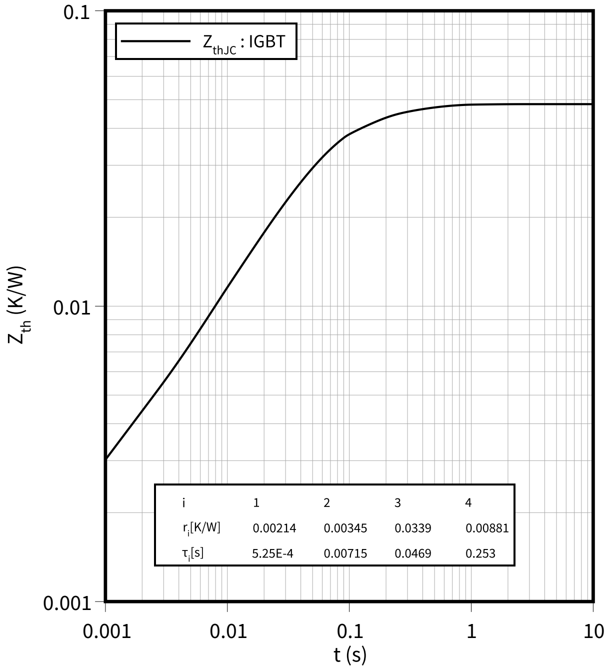
$dv/dt = f(R_G)$

I_C = 800 A, V_{CC} = 600 V, V_{GE} = ±15 V, T_{vj} = 25 °C



Transient thermal impedance , IGBT, Inverter

$Z_{th} = f(t)$

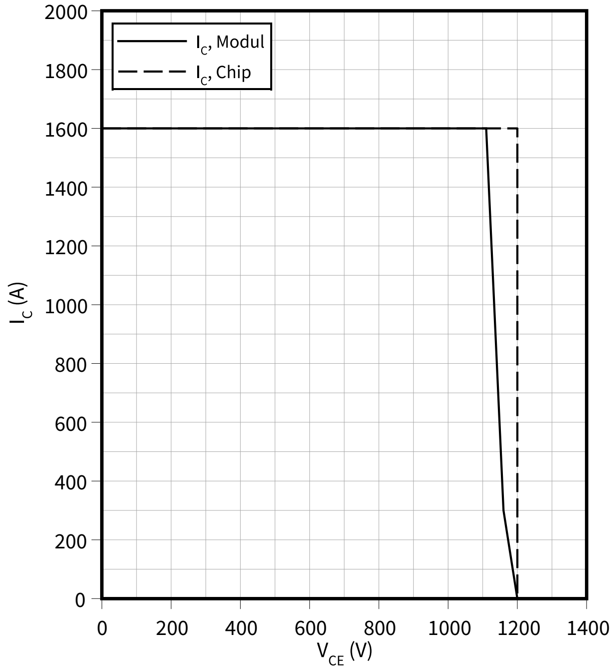


i	1	2	3	4
r_i[K/W]	0.00214	0.00345	0.0339	0.00881
τ_i[s]	5.25E-4	0.00715	0.0469	0.253

Reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$

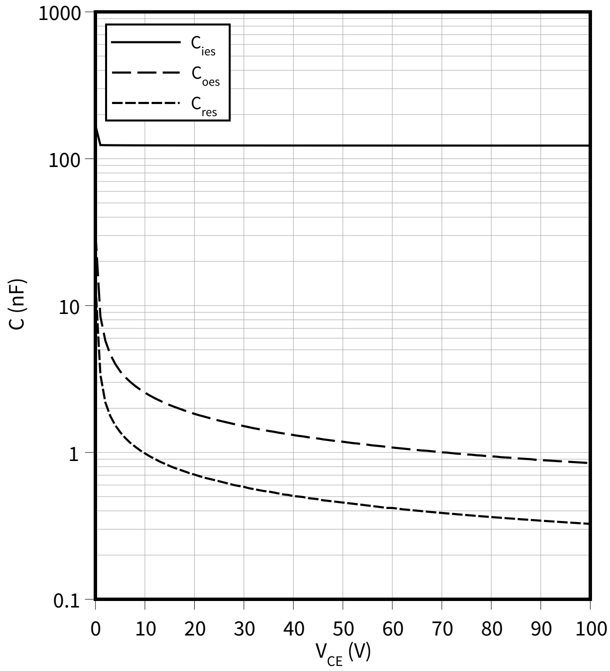
$R_{Goff} = 0.51\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

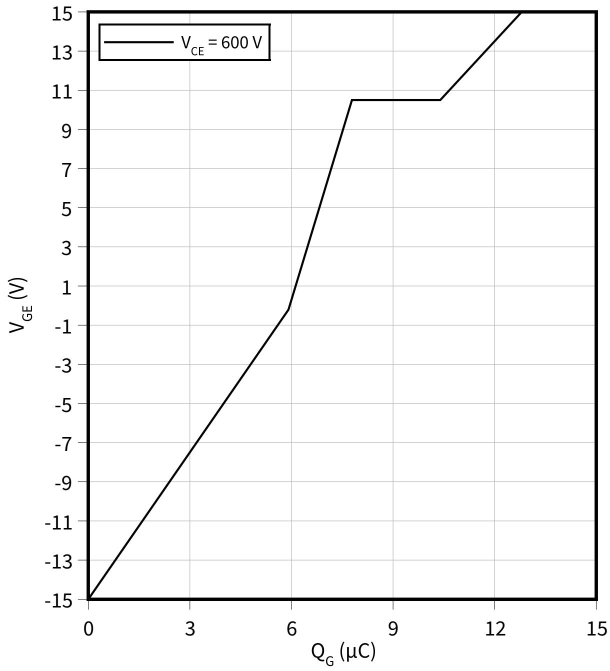
f = 100 kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Gate charge characteristic (typical), IGBT, Inverter

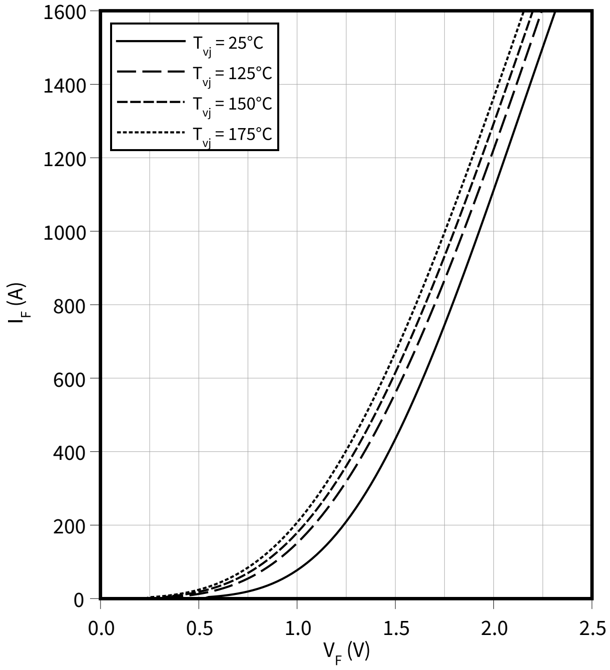
$V_{GE} = f(Q_G)$

$I_C = 800$ A, $T_{vj} = 25$ °C



Forward characteristic (typical), Diode, Inverter

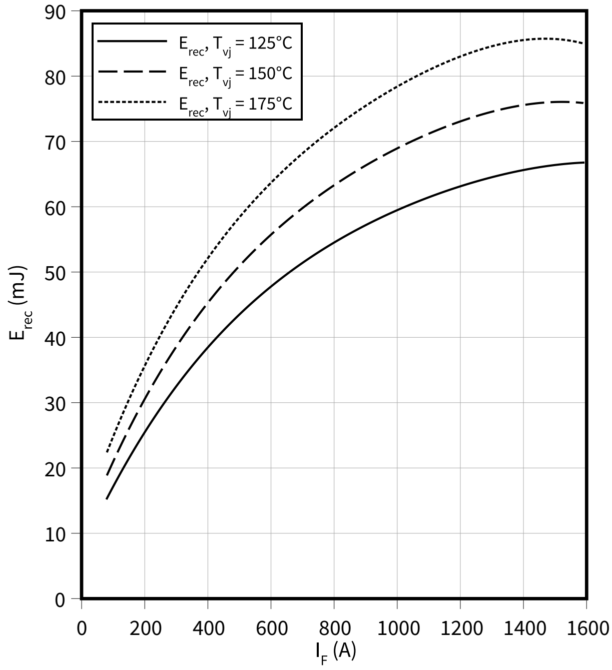
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

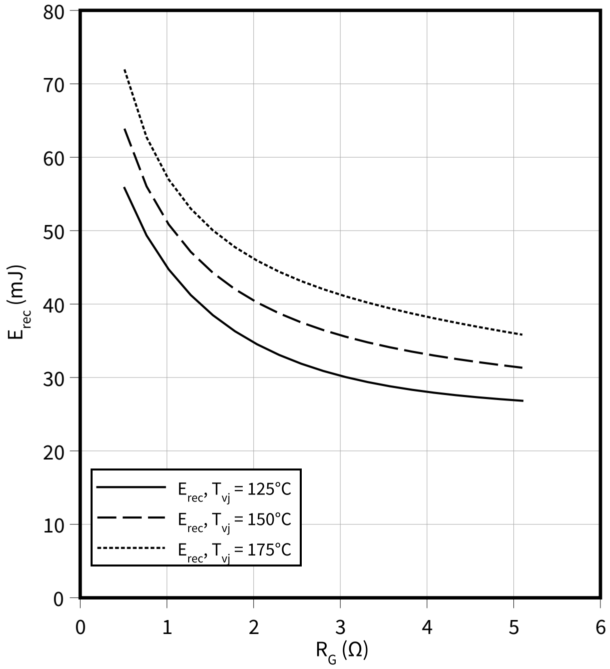
R_{Gon} = 0.51 Ω, V_{CE} = 600 V



Switching losses (typical), Diode, Inverter

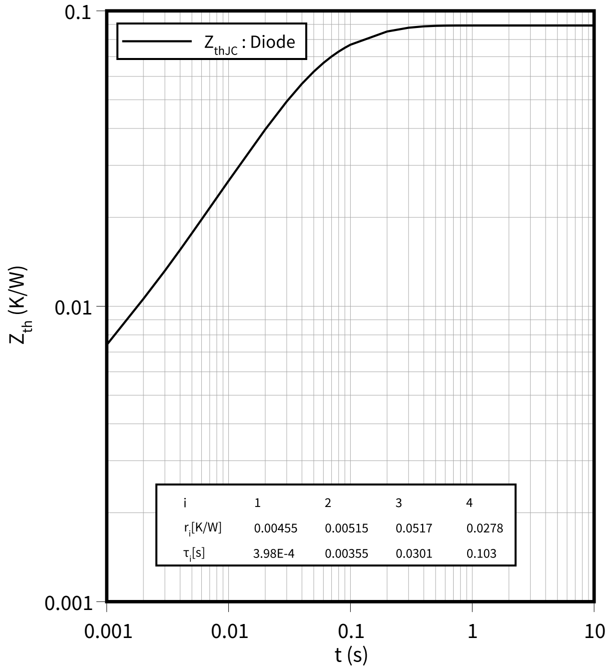
$E_{rec} = f(R_G)$

V_{CE} = 600 V, I_F = 800 A



Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.00455	0.00515	0.0517	0.0278
τ_i[s]	3.98E-4	0.00355	0.0301	0.103

5 Circuit diagram

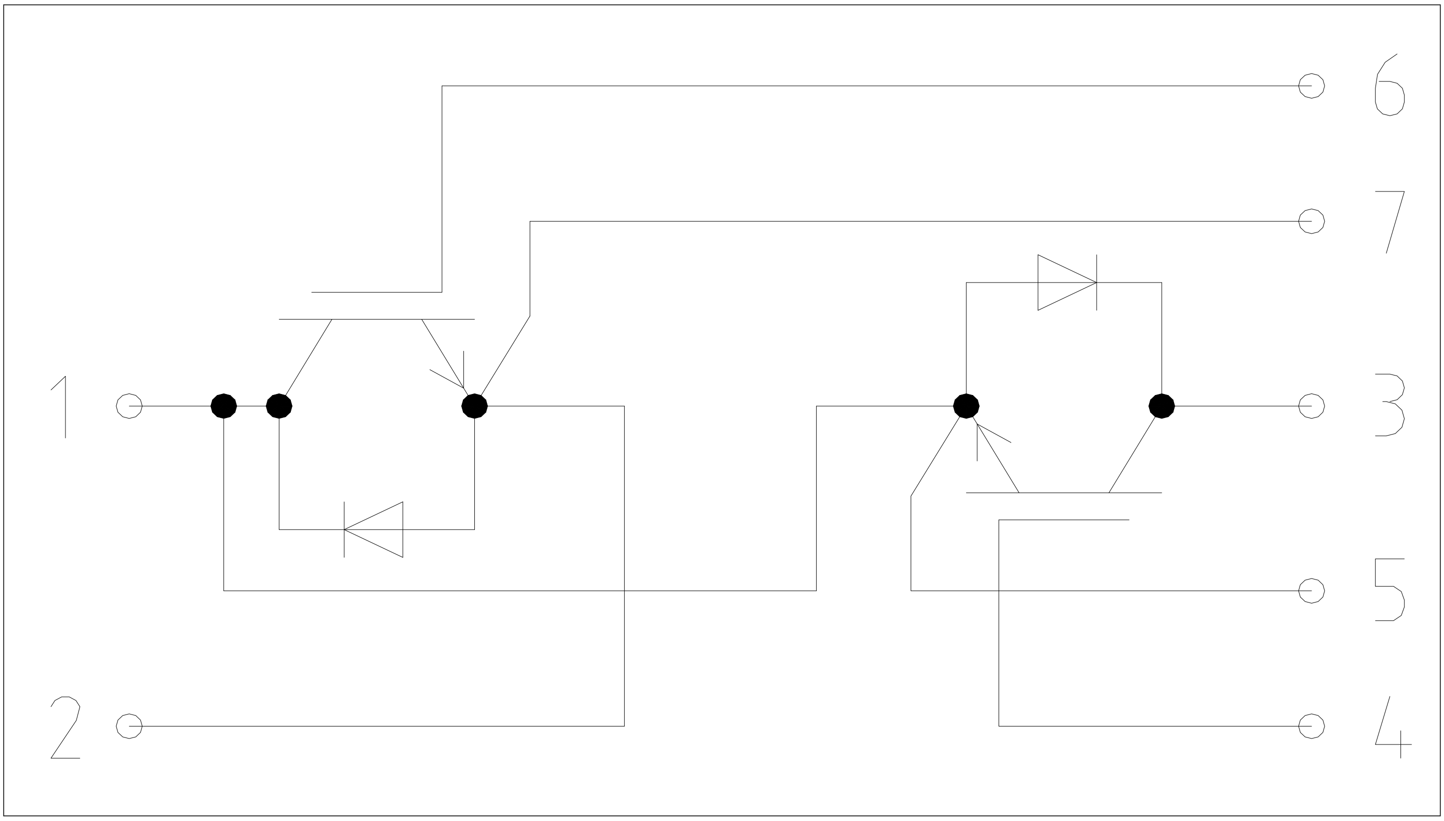


Figure 1

6 Package outlines

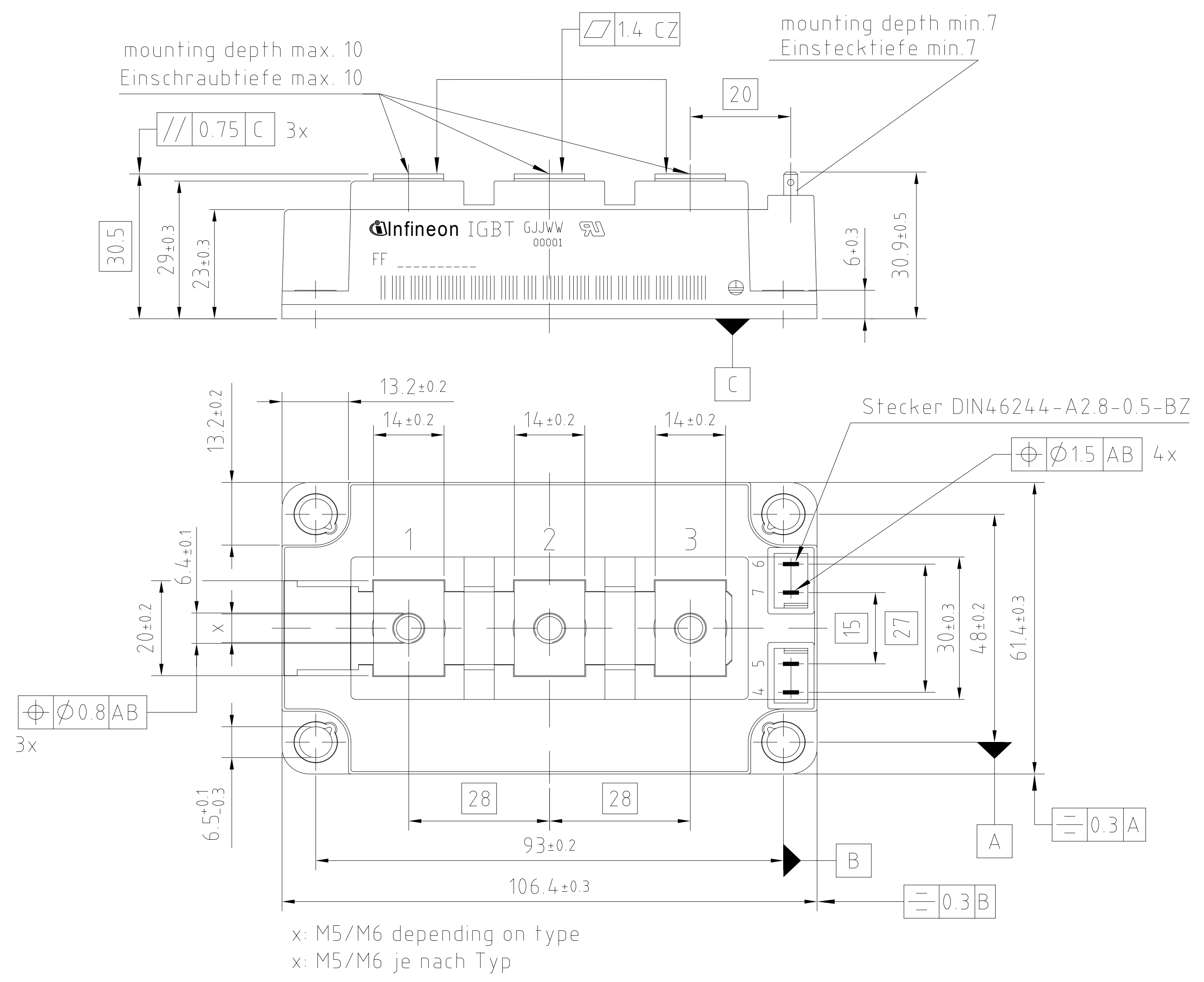


Figure 2

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*	*Digit*	*Example*
	Module serial number	1 – 5	71549
	Module material number	6 - 11	142846
	Production order number	12 - 19	55054991
	Date code (production year)	20 – 21	15
	Date code (production week)	22 – 23	30
Example	71549142846550549911530	71549142846550549911530	

Figure 3

Revision history

Document revision	Date of release	Description of changes
V1.0	2020-06-19	Target datasheet
V1.1	2020-08-21	Target datasheet
n/a	2020-09-01	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
0.10	2021-09-02	Target datasheet
0.30	2021-11-15	Target datasheet
0.40	2021-12-17	Preliminary datasheet
1.00	2022-05-11	Final datasheet

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