EasyPACK™ module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and NTC

Features

Typical appearance

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 100 A / I_{CRM} = 200 A
  - Low $V_{CE,sat}$
  - Overload operation up to 175°C
  - TRENCHSTOP™ IGBT7
- Mechanical features
  - Solder contact technology
  - High power density
  - Compact design
  - 2.5 kV AC 1 minute insulation
  - Al_2O_3 substrate with low thermal resistance

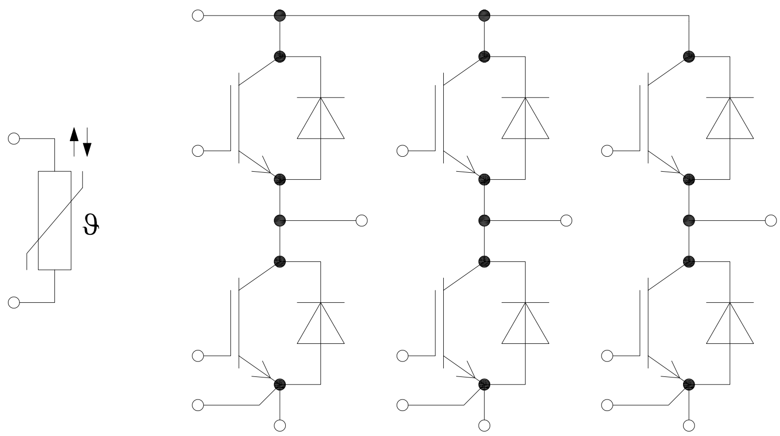
Potential applications

- Air conditioning
- Auxiliary inverters
- Motor drives
- Servo drives
- UPS systems

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 = 1 min	2.5	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	11.5	mm
Creepage distance	d_{Creep}	terminal to terminal	6.3	mm
Clearance	d_{Clear}	terminal to heatsink	10.0	mm
Clearance	d_{Clear}	terminal to terminal	5.0	mm
Comparative tracking index	*CTI*		> 200	
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_H = 25 °C, per switch		4		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting force per clamp	*F*		40		80	N
Weight	*G*			39		g

Note: The current under continuous operation is limited to 30 A rms per connector pin.

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
Implemented collector current	I_{CN}			100	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 65 °C	80	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		200	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	$V_{CE\ sat}$	$I_C = 100$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.50	1.80	V
			$T_{vj} = 125$ °C		1.64		
			$T_{vj} = 175$ °C		1.72		
Gate threshold voltage	V_{GEth}	$I_C = 2.5$ mA, $V_{CE} = V_{GE}$, $T_{vj} = 25$ °C		5.15	5.80	6.45	V
Gate charge	Q_G	$V_{GE} = \pm15$ V, $V_{CC} = 600$ V			1.8		µC
Internal gate resistor	R_{Gint}	$T_{vj} = 25$ °C			1.5		Ω
Input capacitance	C_{ies}	$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			21.7		nF
Reverse transfer capacitance	C_{res}	$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			0.075		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200$ V, $V_{GE} = 0$ V	$T_{vj} = 25$ °C			0.009	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}	$I_C = 100$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Gon} = 1.8$ Ω	$T_{vj} = 25$ °C		0.150		µs
			$T_{vj} = 125$ °C		0.166		
			$T_{vj} = 175$ °C		0.174		
Rise time (inductive load)	t_r	$I_C = 100$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Gon} = 1.8$ Ω	$T_{vj} = 25$ °C		0.041		µs
			$T_{vj} = 125$ °C		0.045		
			$T_{vj} = 175$ °C		0.047		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 100$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Goff} = 1.8$ Ω	$T_{vj} = 25$ °C		0.300		µs
			$T_{vj} = 125$ °C		0.380		
			$T_{vj} = 175$ °C		0.420		
Fall time (inductive load)	t_f	$I_C = 100$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $R_{Goff} = 1.8$ Ω	$T_{vj} = 25$ °C		0.100		µs
			$T_{vj} = 125$ °C		0.180		
			$T_{vj} = 175$ °C		0.250		
Turn-on energy loss per pulse	E_{on}	$I_C = 100$ A, $V_{CC} = 600$ V, $L_\sigma = 35$ nH, $V_{GE} = \pm15$ V, $R_{Gon} = 1.8$ Ω, di/dt = 1700 A/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		6		mJ
			$T_{vj} = 125$ °C		8.4		
			$T_{vj} = 175$ °C		10.1		
Turn-off energy loss per pulse	E_{off}	$I_C = 100$ A, $V_{CC} = 600$ V, $L_\sigma = 35$ nH, $V_{GE} = \pm15$ V, $R_{Goff} = 1.8$ Ω, dv/dt = 2850 V/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		6		mJ
			$T_{vj} = 125$ °C		9.6		
			$T_{vj} = 175$ °C		12		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
SC data	I_{SC}	$V_{GE} \leq 15$ V, V_{CC} = 800 V, $V_{CEmax}=V_{CES}-L_{sCE}$*di/dt	$t_P \leq 8$ µs, T_{vj}=150 °C		370		A
			$t_P \leq 7$ µs, T_{vj}=175 °C		350		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 1 W/(m·K)			0.700		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			100	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		200	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	970	A^2s
			T_{vj} = 175 °C	860	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
Forward voltage	V_F	I_F = 100 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.72	2.10	V
			T_{vj} = 125 °C		1.59		
			T_{vj} = 175 °C		1.52		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 100 A, V_{GE} = -15 V, -di_F/dt = 1700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		60		A
			T_{vj} = 125 °C		79		
			T_{vj} = 175 °C		91		

(table continues...)

Table 6 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 100 A, V_{GE} = -15 V, -di_F/dt = 1700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		7.1		µC
			T_{vj} = 125 °C		12.7		
			T_{vj} = 175 °C		17.3		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 100 A, V_{GE} = -15 V, -di_F/dt = 1700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		2.4		mJ
			T_{vj} = 125 °C		3.9		
			T_{vj} = 175 °C		5.6		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			0.966		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 NTC-Thermistor

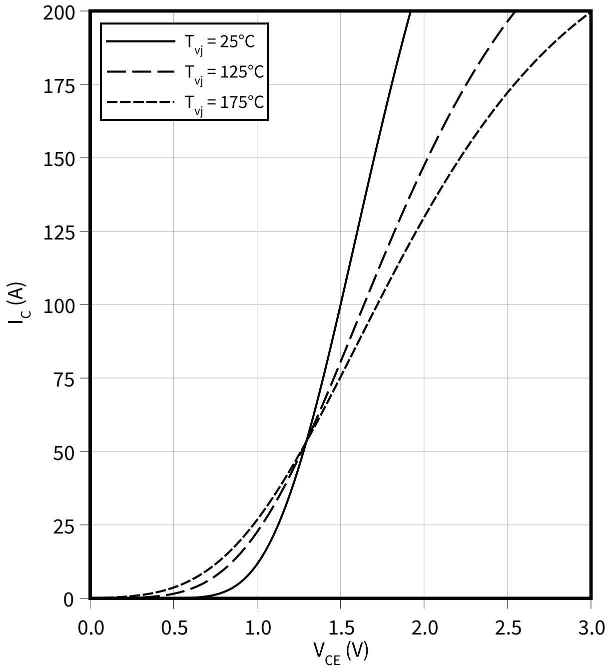
Table 7 **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\ K))]$		3433		K

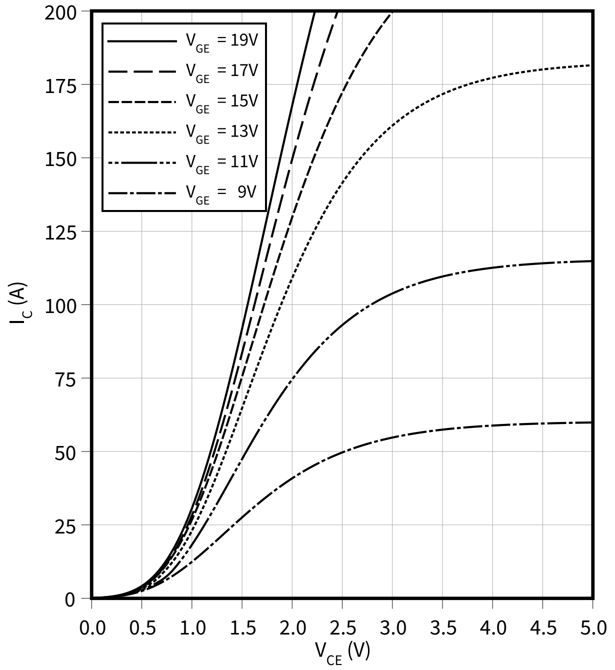
Note: *Specification according to the valid application note.*

5 Characteristics diagrams

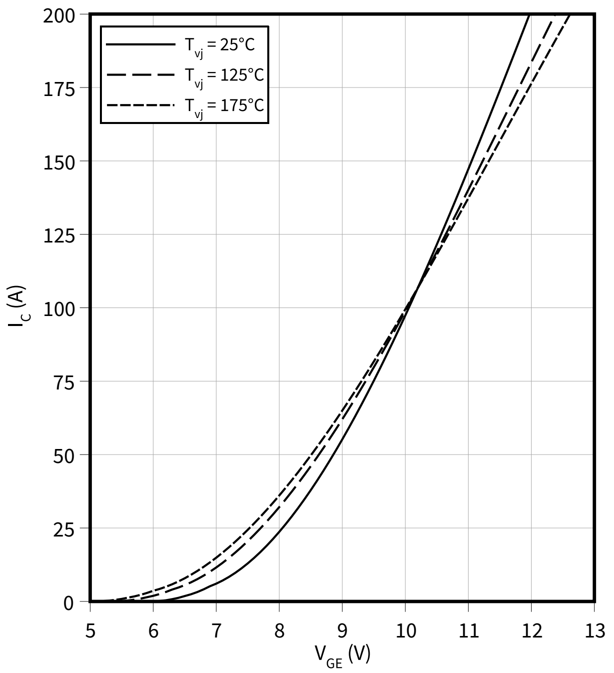
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



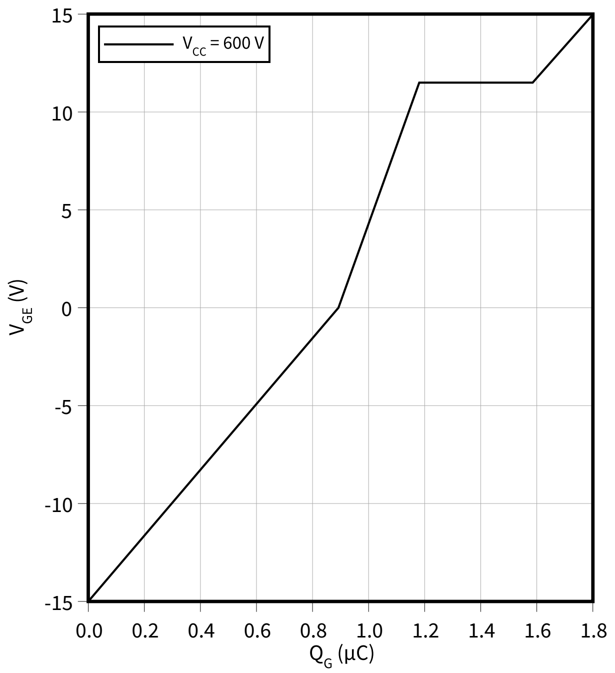
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 175$ °C



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



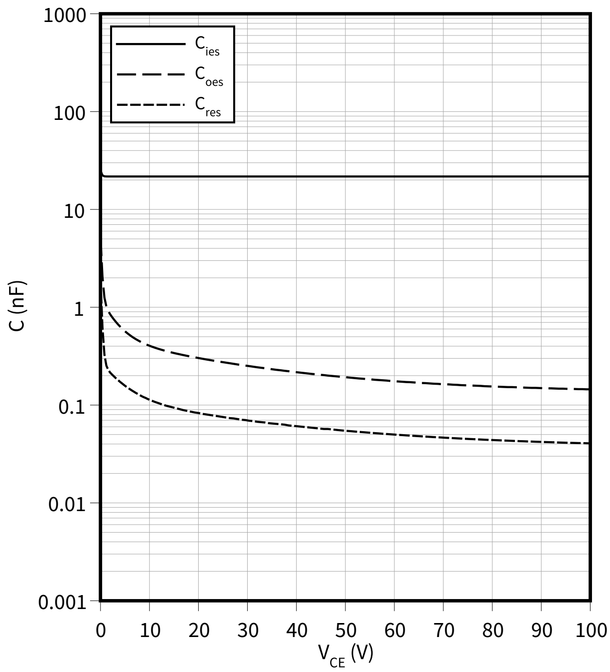
Gate charge characteristic (typical), IGBT, Inverter
$V_{GE} = f(Q_G)$
$I_C = 100$ A, $T_{vj} = 25$ °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

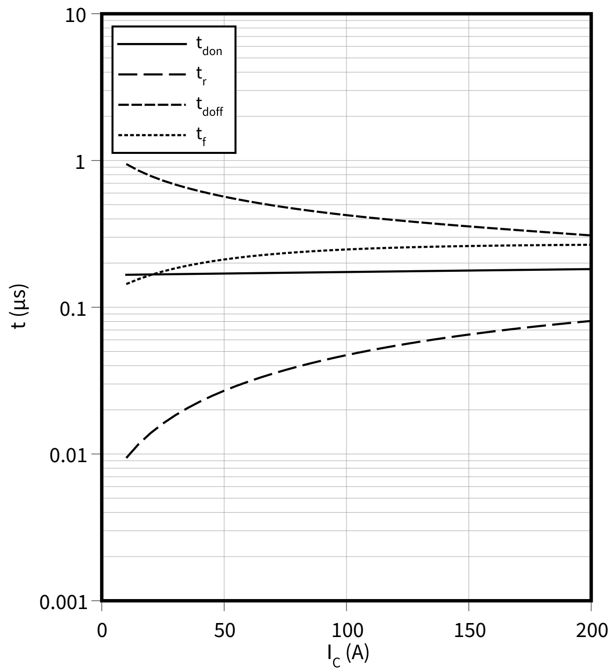
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

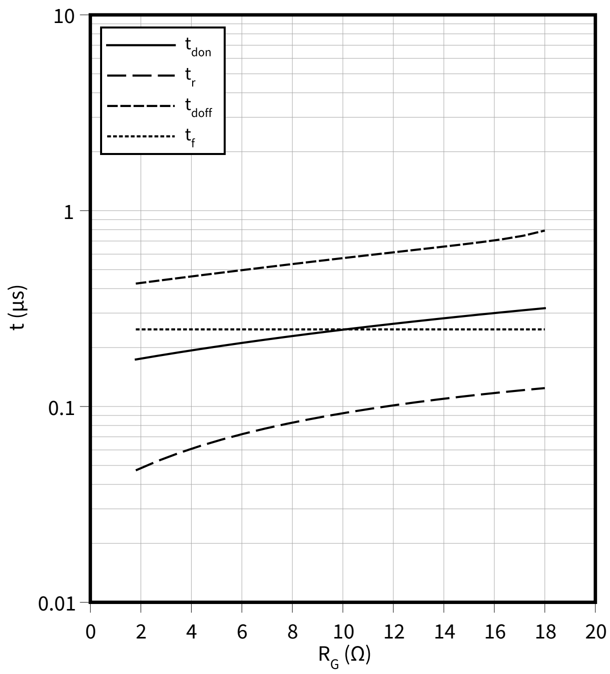
$R_{Goff} = 1.8\ \Omega$, $R_{Gon} = 1.8\ \Omega$, $V_{GE} = \pm15\ V$, $V_{CC} = 600\ V$, $T_{vj} = 175\ °C$



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

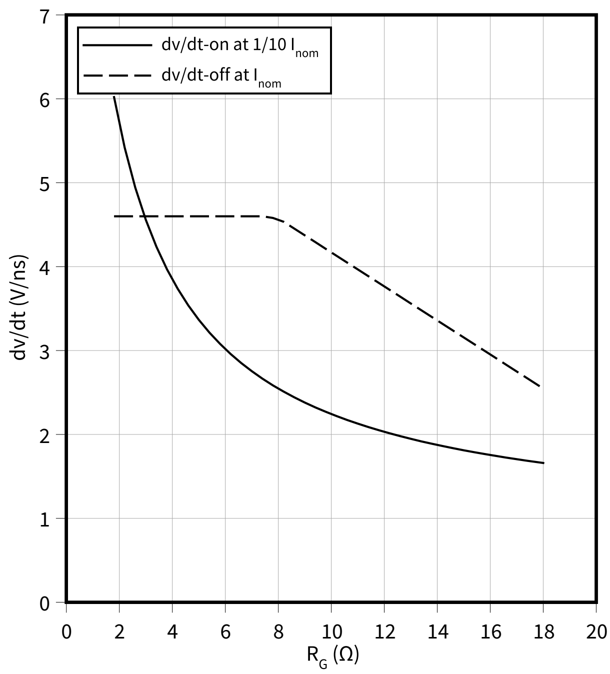
$V_{GE} = \pm15\ V$, $I_C = 100\ A$, $V_{CC} = 600\ V$, $T_{vj} = 175\ °C$



Voltage slope (typical), IGBT, Inverter

$dv/dt = f(R_G)$

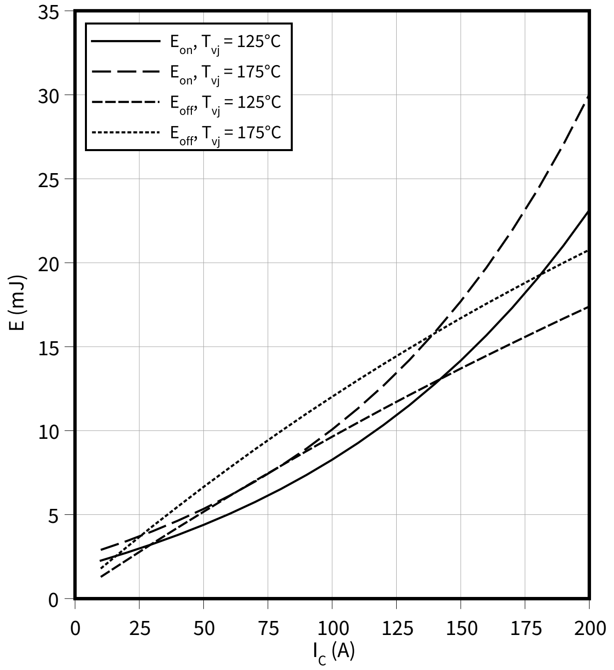
$I_C = 100\ A$, $V_{CC} = 600\ V$, $V_{GE} = \pm15\ V$, $T_{vj} = 25\ °C$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

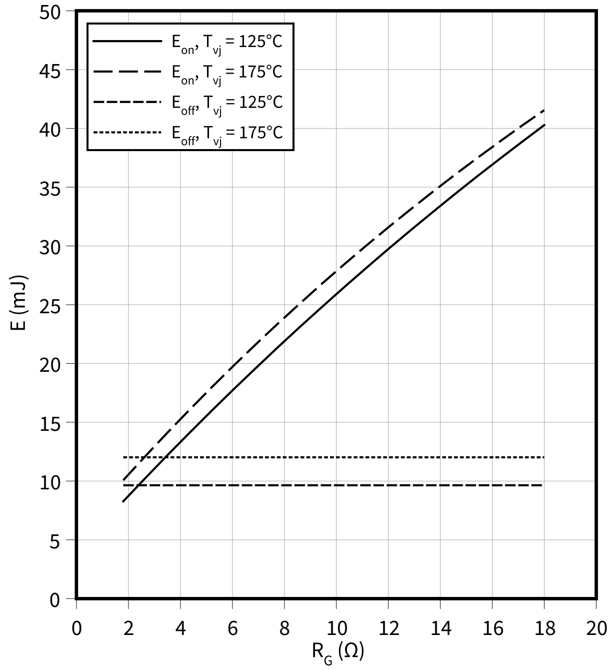
R_{Goff} = 1.8 Ω, R_{Gon} = 1.8 Ω, V_{GE} = ±15 V, V_{CC} = 600 V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

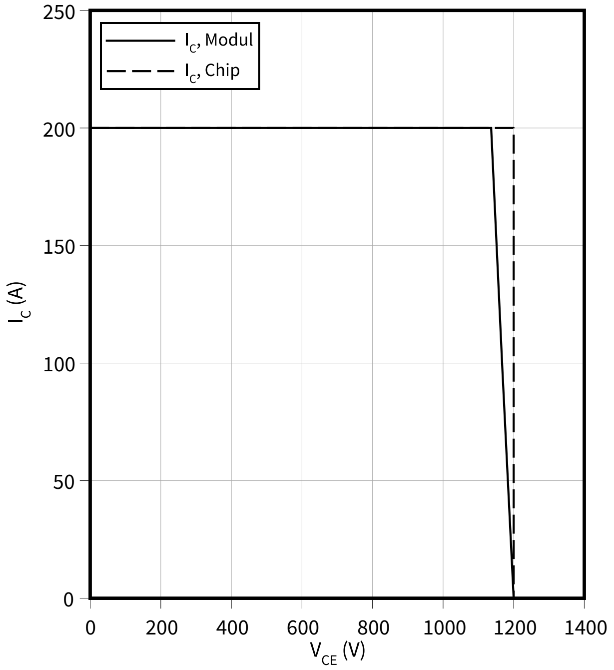
V_{GE} = ±15 V, I_C = 100 A, V_{CC} = 600 V



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

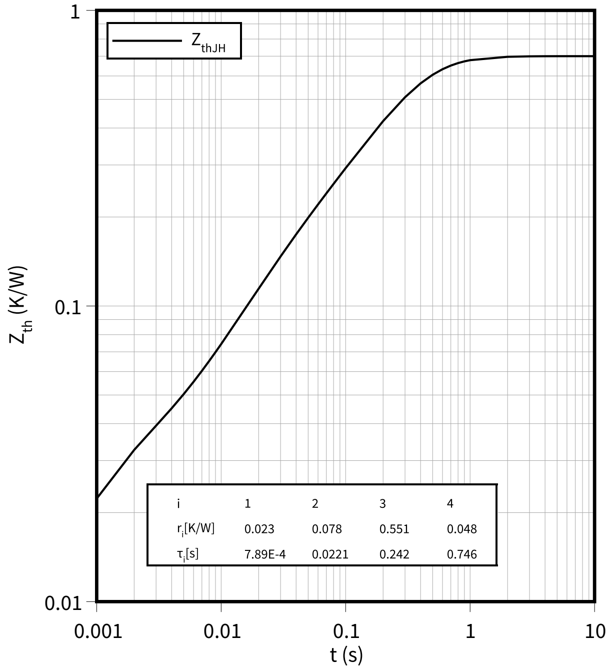
$I_C = f(V_{CE})$

R_{Goff} = 1.8 Ω, V_{GE} = ±15 V, T_{vj} = 175 °C



Transient thermal impedance, IGBT, Inverter

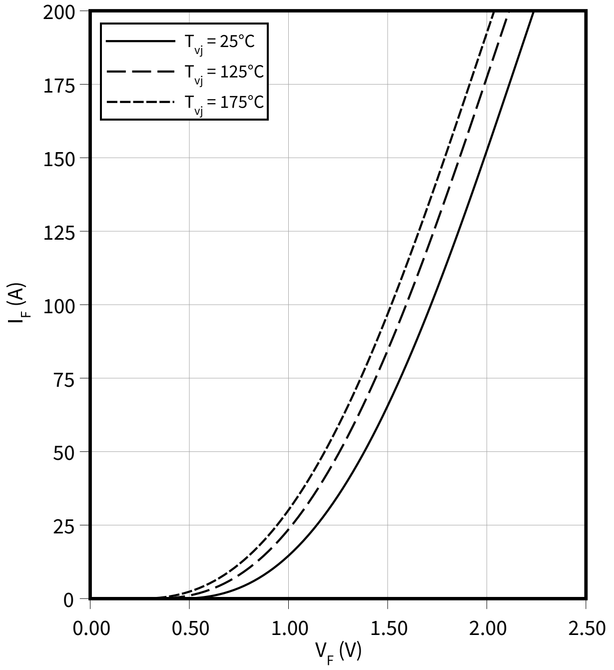
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.023	0.078	0.551	0.048
τ_i[s]	7.89E-4	0.0221	0.242	0.746

Forward characteristic (typical), Diode, Inverter

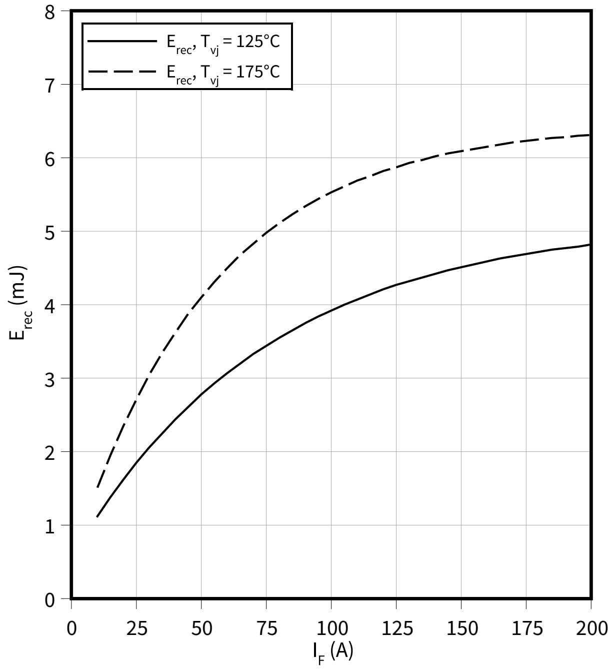
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

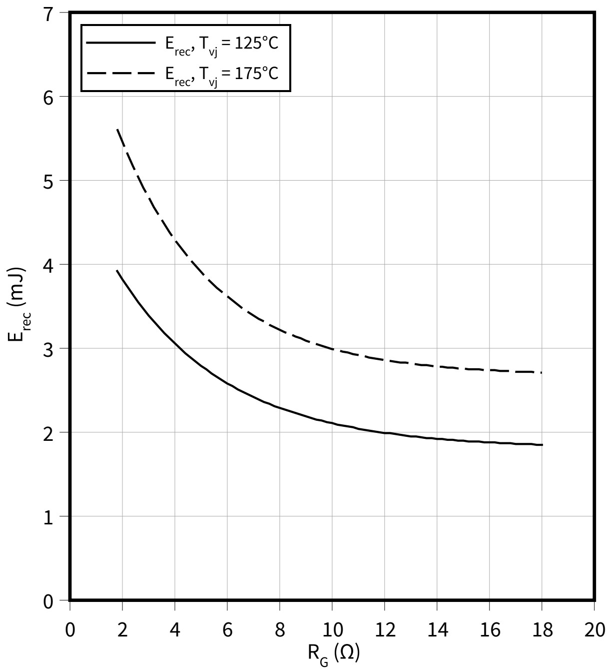
$R_{Gon} = 1.8\ \Omega$, $V_{CC} = 600$ V



Switching losses (typical), Diode, Inverter

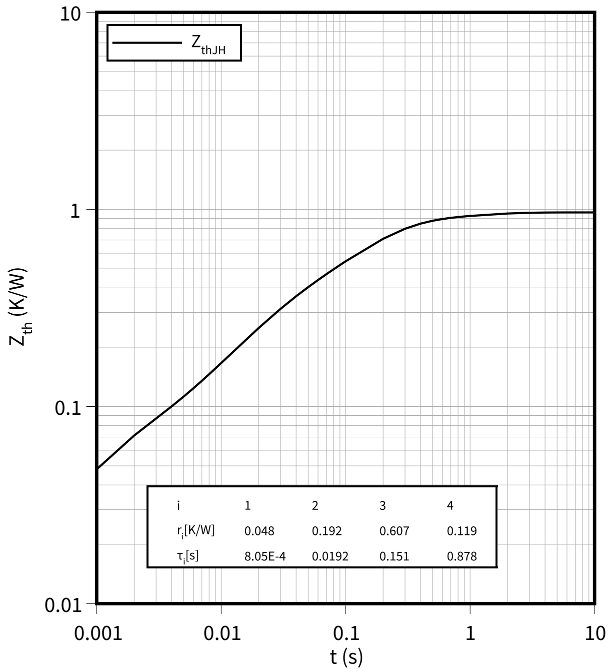
$E_{rec} = f(R_G)$

$I_F = 100$ A, $V_{CC} = 600$ V

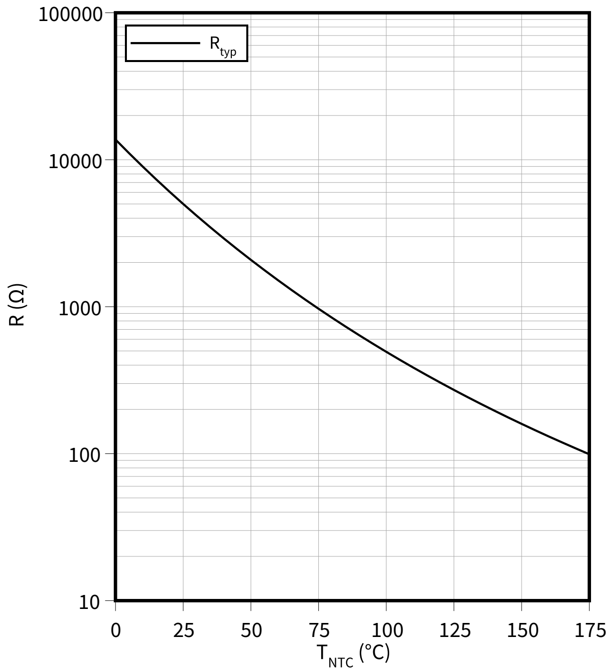


Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor
$R = f(T_{NTC})$



6 Circuit diagram

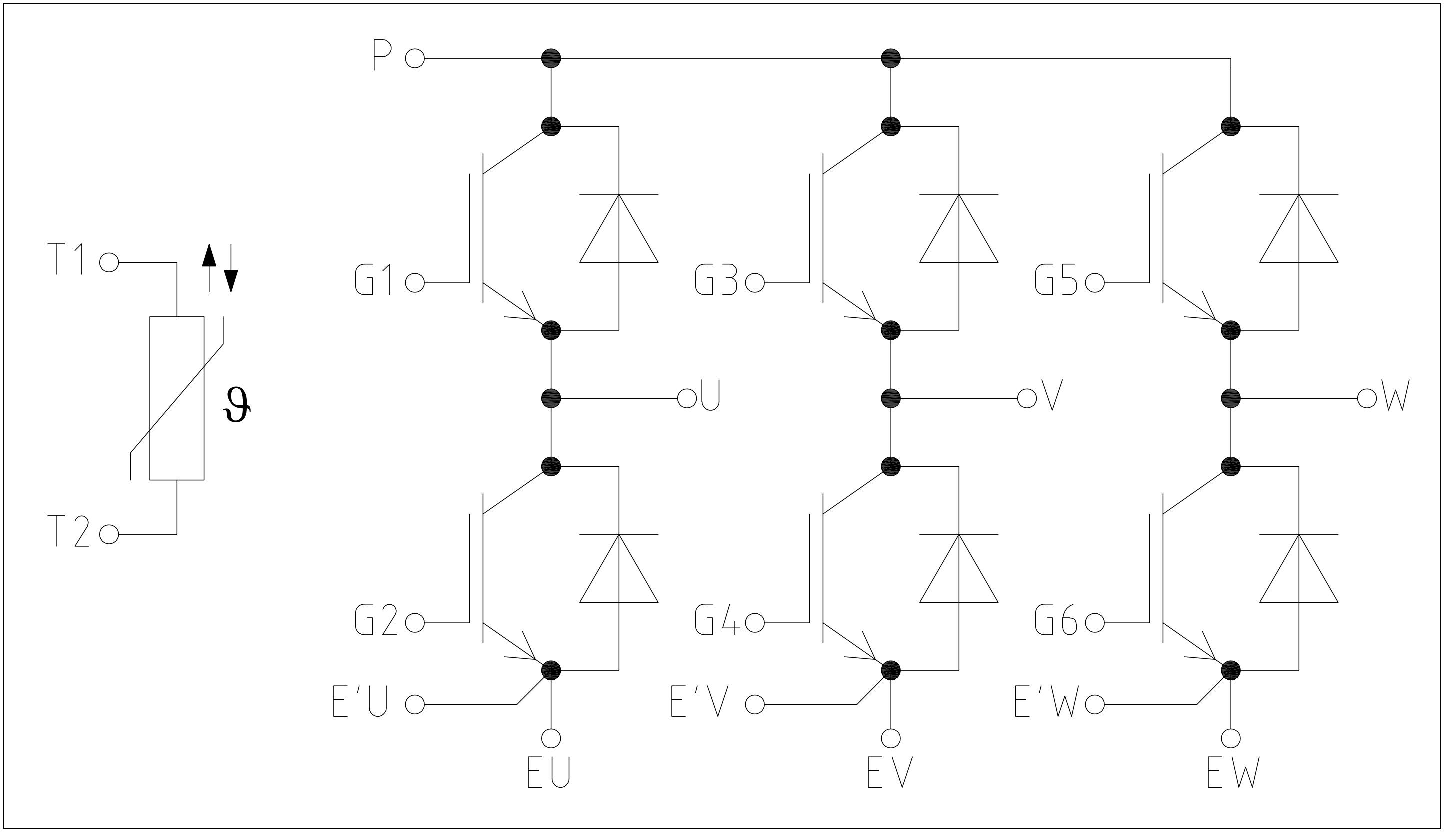


Figure 1

7 Package outlines

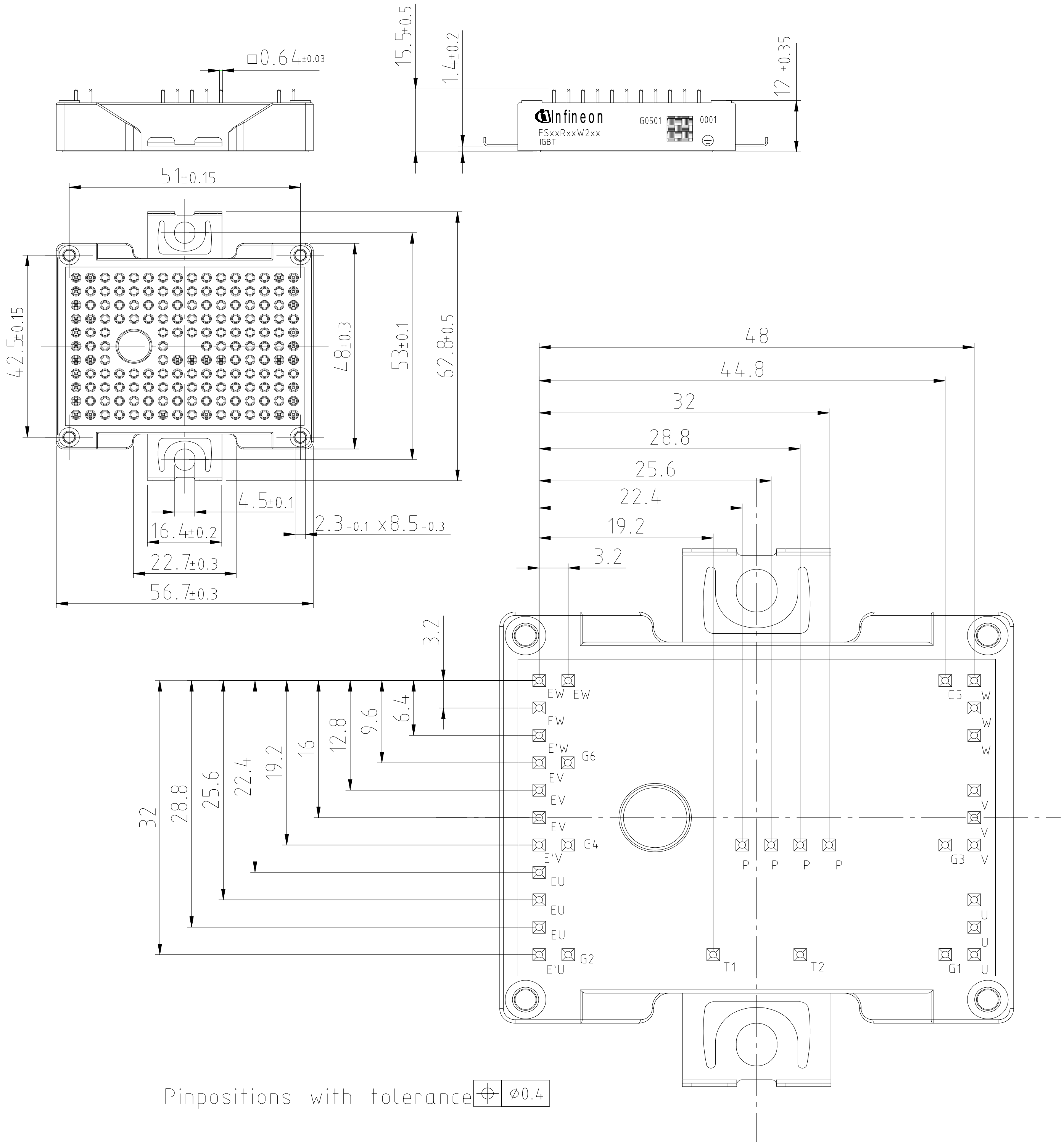


Figure 2

8 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
V2.0	2019-08-12	Preliminary 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
1.00	2023-05-19	Final datasheet

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