EasyPACK™ 2B module with TRENCHSTOP™ 5 H5 IGBT and PressFIT / NTC

Features


Typical appearance

- Electrical features
  - V_{CES} = 650 V
  - $I_{C\ nom}$ = 35 A / I_{CRM} = 70 A
  - Trench IGBT 5
  - Low switching losses
  - Increased blocking voltage capability up to 650 V
- Mechanical features
  - Rugged mounting due to integrated mounting clamps
  - Al_2O_3 substrate with low thermal resistance
  - Compact design
  - PressFIT contact technology

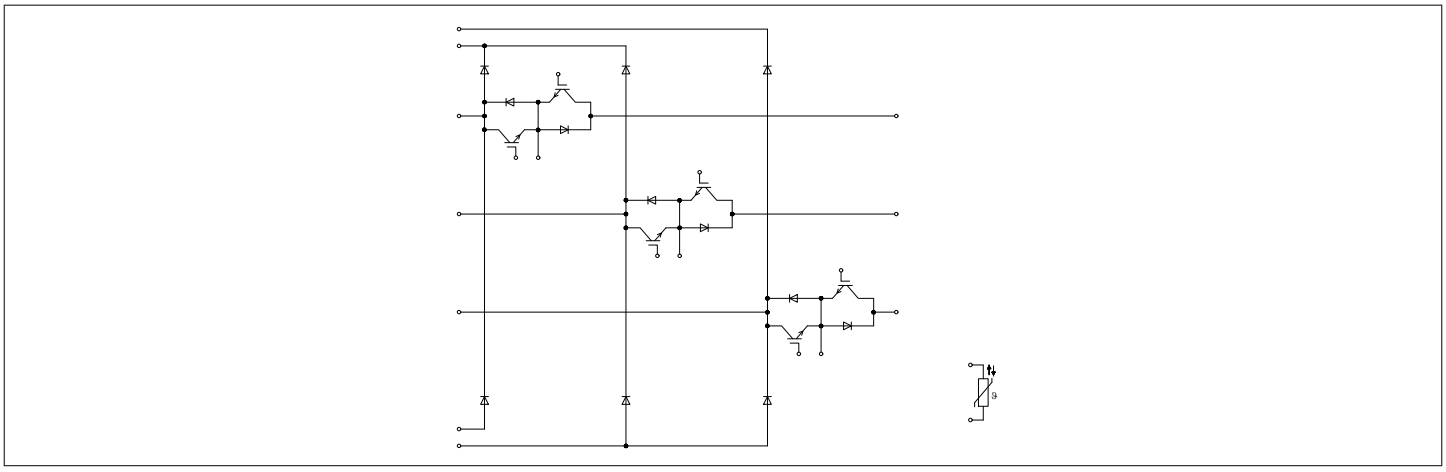
Potential applications

- UPS systems
- DC charger for EV
- Motor drives

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	
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	$R_{AA'+CC'}$	T_H = 25 °C, per switch		2.4		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		3.9		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 25A rms per connector pin

2 IGBT, T1-T6

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	650	V
Implemented collector current	I_{CN}			35	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 65 °C	25	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		70	A
Gate-emitter peak voltage	V_{GES}			±20	V

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Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 20 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.32	1.67	V
			T_{vj} = 125 °C		1.39		
			T_{vj} = 150 °C		1.41		
Gate threshold voltage	V_{GEth}	I_C = 0.35 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		3.85	4.60	5.35	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 300 V			0.152		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			1.94		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.007		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.012	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 = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 6.2 Ω	T_{vj} = 25 °C		0.016		µs
			T_{vj} = 125 °C		0.017		
			T_{vj} = 150 °C		0.017		
Rise time (inductive load)	t_r	I_C = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 6.2 Ω	T_{vj} = 25 °C		0.004		µs
			T_{vj} = 125 °C		0.005		
			T_{vj} = 150 °C		0.006		
Turn-off delay time (inductive load)	t_{doff}	I_C = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.090		µs
			T_{vj} = 125 °C		0.110		
			T_{vj} = 150 °C		0.120		
Fall time (inductive load)	t_f	I_C = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.018		µs
			T_{vj} = 125 °C		0.052		
			T_{vj} = 150 °C		0.073		
Turn-on energy loss per pulse	E_{on}	I_C = 20 A, V_{CC} = 350 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 6.2 Ω, di/dt = 2260 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.39		mJ
			T_{vj} = 125 °C		0.49		
			T_{vj} = 150 °C		0.507		
Turn-off energy loss per pulse	E_{off}	I_C = 20 A, V_{CC} = 350 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω, dv/dt = 7200 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.14		mJ
			T_{vj} = 125 °C		0.31		
			T_{vj} = 150 °C		0.365		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 1 W/(m·K)			2.12		K/W

(table continues...)

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Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

3 Diode, D1-D6

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	650	V
Continuous DC forward current	I_F			30	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		60	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	90	A^2s
			T_{vj} = 150 °C	82	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 30 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.60	2.00	V
			T_{vj} = 125 °C		1.55		
			T_{vj} = 150 °C		1.52		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			2.48		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

4 Diode, D7-D12

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Implemented forward current	I_{FN}			50	A
Continuous DC forward current	I_F			20	A

(table continues...)

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Table 7 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		100	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	220	A^2s
			T_{vj} = 175 °C	200	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 20 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.30	1.50	V
			T_{vj} = 125 °C		1.18		
			T_{vj} = 175 °C		1.10		
Peak reverse recovery current	I_{RM}	V_{CC} = 350 V, I_F = 20 A, V_{GE} = -15 V, -di$_F$/dt = 2260 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		40.9		A
			T_{vj} = 125 °C		53.1		
			T_{vj} = 175 °C		62		
Recovered charge	Q_r	V_{CC} = 350 V, I_F = 20 A, V_{GE} = -15 V, -di$_F$/dt = 2260 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		2.27		µC
			T_{vj} = 125 °C		4.36		
			T_{vj} = 175 °C		5.6		
Reverse recovery energy	E_{rec}	V_{CC} = 350 V, I_F = 20 A, V_{GE} = -15 V, -di$_F$/dt = 2260 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.5		mJ
			T_{vj} = 125 °C		1.08		
			T_{vj} = 175 °C		1.48		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			1.46		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.

5 NTC-Thermistor

Table 9 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

(table continues...)

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Table 9 (continued) Characteristic values

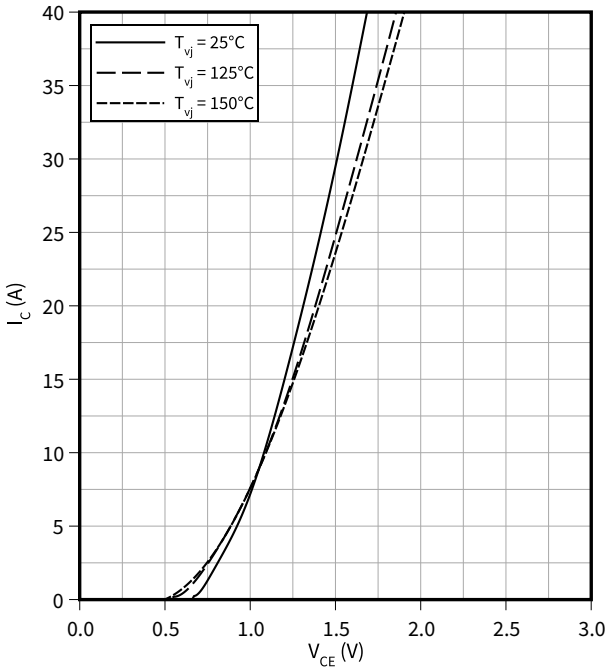
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2\text{-}1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2\text{-}1/(298{,}15\ K))]$		3433		K

Note: Specification according to the valid application note.

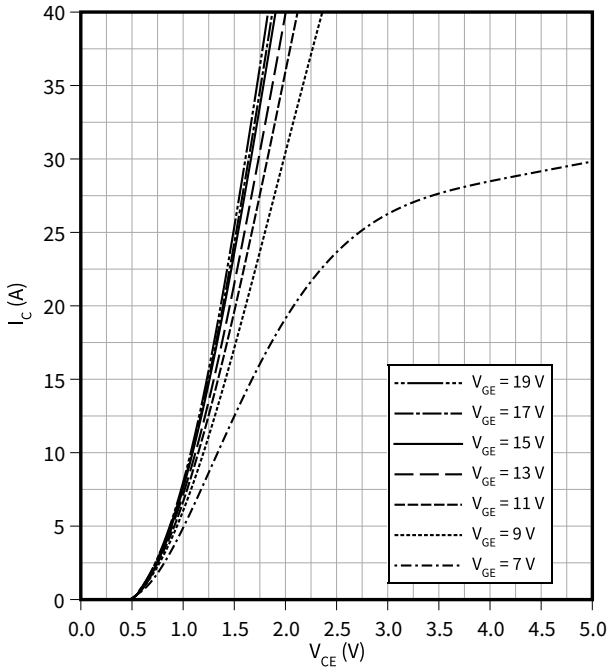
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6 Characteristics diagrams

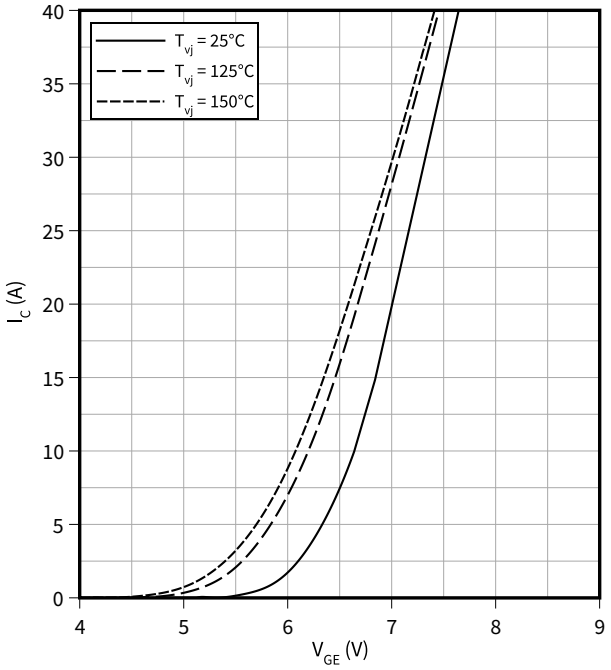
Output characteristic (typical), IGBT, T1-T6
$I_C = f(V_{CE})$
V_{GE} = 15 V



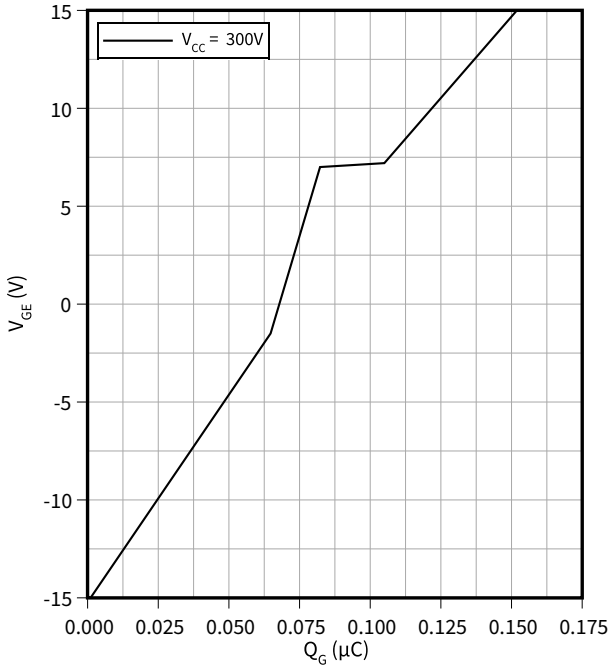
Output characteristic field (typical), IGBT, T1-T6
$I_C = f(V_{CE})$
T_{vj} = 150 °C



Transfer characteristic (typical), IGBT, T1-T6
$I_C = f(V_{GE})$
V_{CE} = 20 V



Gate charge characteristic (typical), IGBT, T1-T6
$V_{GE} = f(Q_G)$
I_C = 35 A, T_{vj} = 25 °C

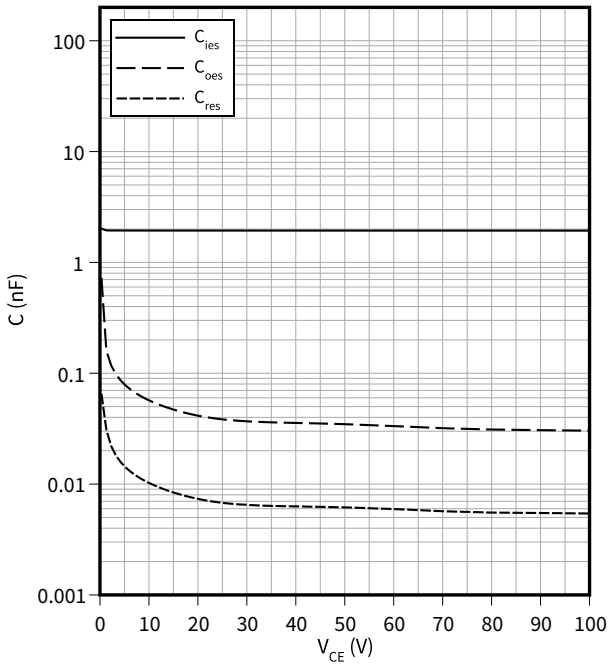


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Capacity characteristic (typical), IGBT, T1-T6

$C = f(V_{CE})$

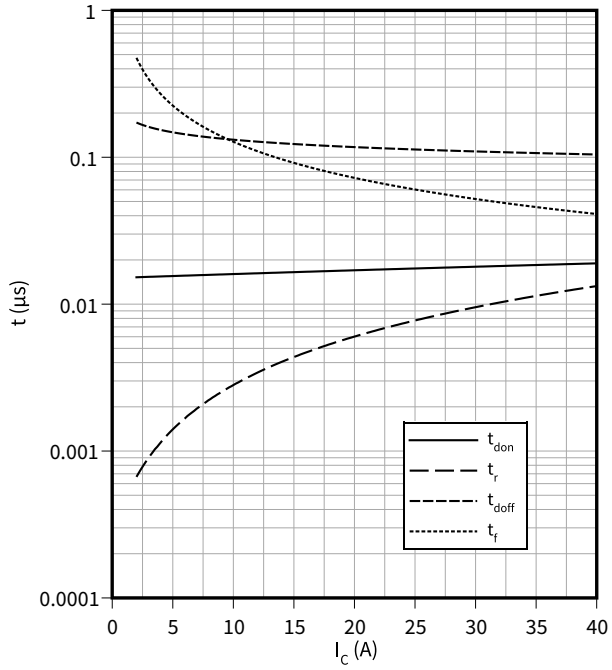
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



Switching times (typical), IGBT, T1-T6

$t = f(I_C)$

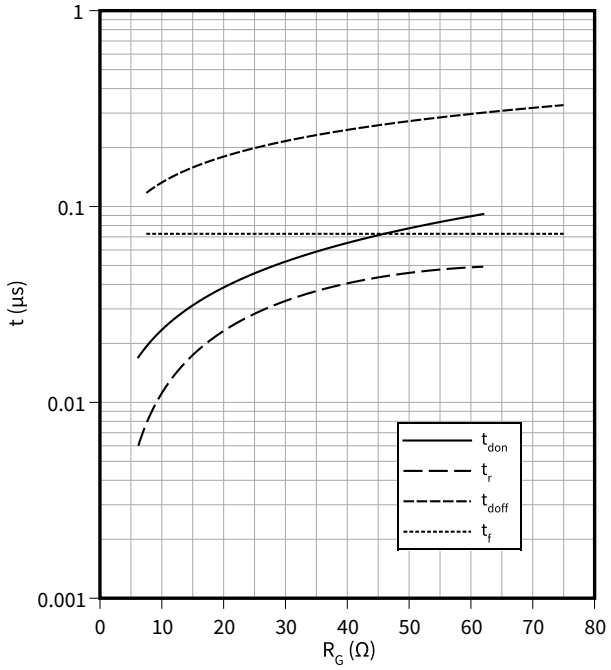
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 6.2\ \Omega$, $V_{CC} = 350\ V$, $V_{GE} = -15\ /\ 15\ V$, $T_{vj} = 150\ °C$



Switching times (typical), IGBT, T1-T6

$t = f(R_G)$

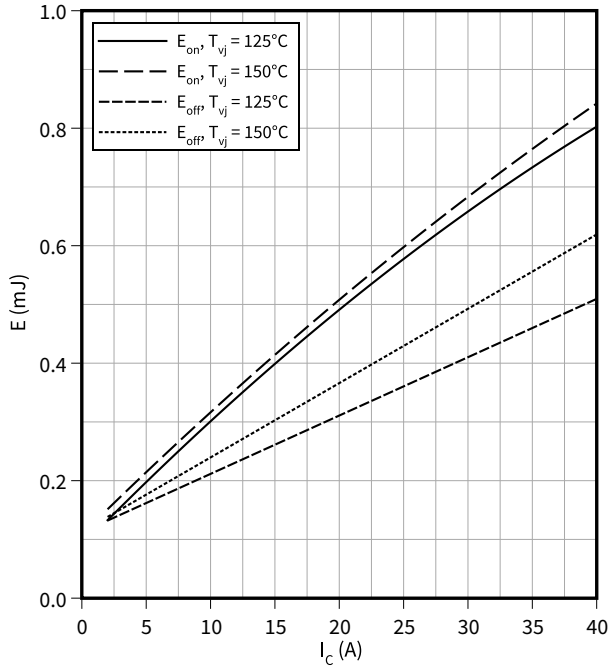
$I_C = 20\ A$, $V_{CC} = 350\ V$, $V_{GE} = -15\ /\ 15\ V$, $T_{vj} = 150\ °C$



Switching losses (typical), IGBT, T1-T6

$E = f(I_C)$

$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 6.2\ \Omega$, $V_{CC} = 350\ V$, $V_{GE} = -15\ /\ 15\ V$

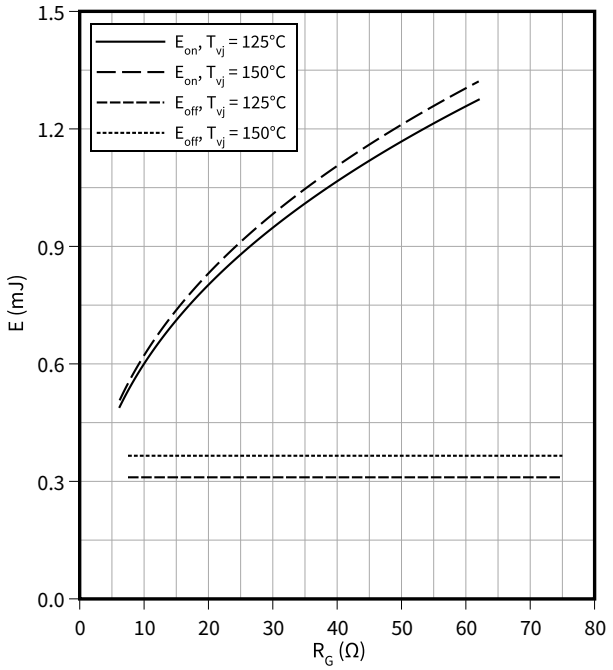


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Switching losses (typical), IGBT, T1-T6

$E = f(R_G)$

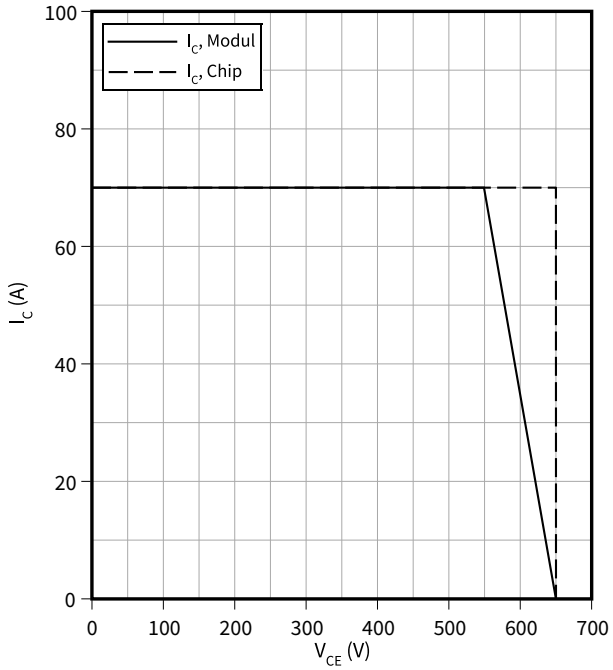
I_C = 20 A, V_{CC} = 350 V, V_{GE} = -15 / 15 V



Reverse bias safe operating area (RBSOA), IGBT, T1-T6

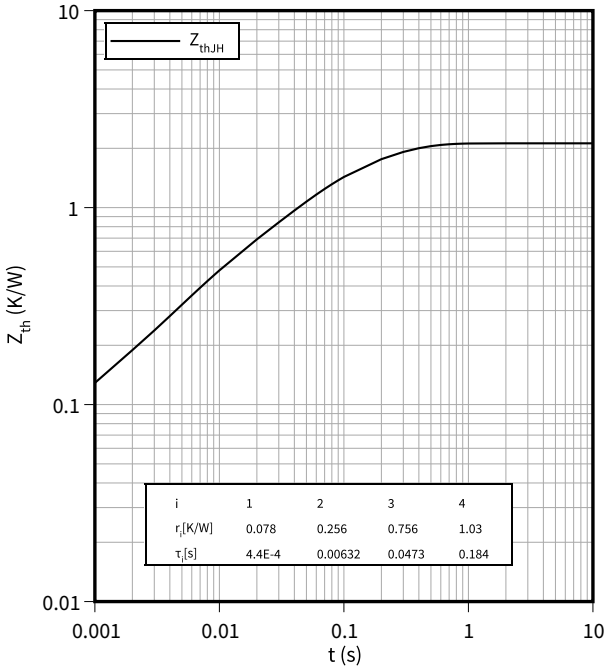
$I_C = f(V_{CE})$

R_{Goff} = 7.5 Ω, V_{GE} = ±15 V, T_{vj} = 150 °C



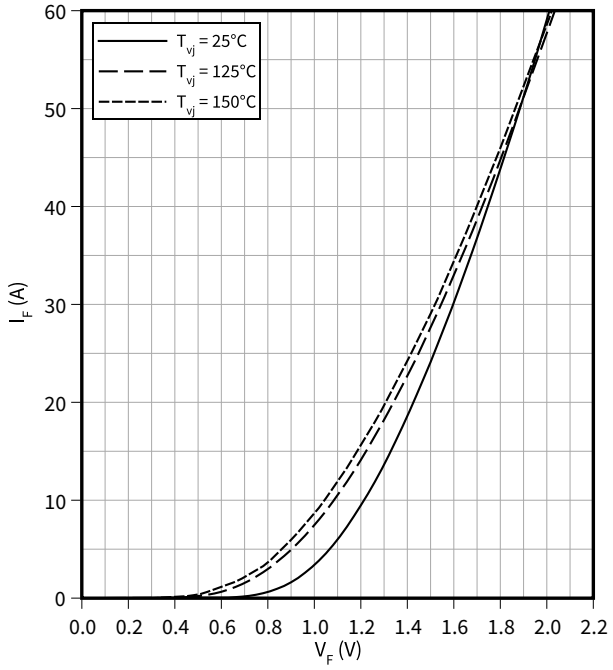
Transient thermal impedance , IGBT, T1-T6

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D1-D6

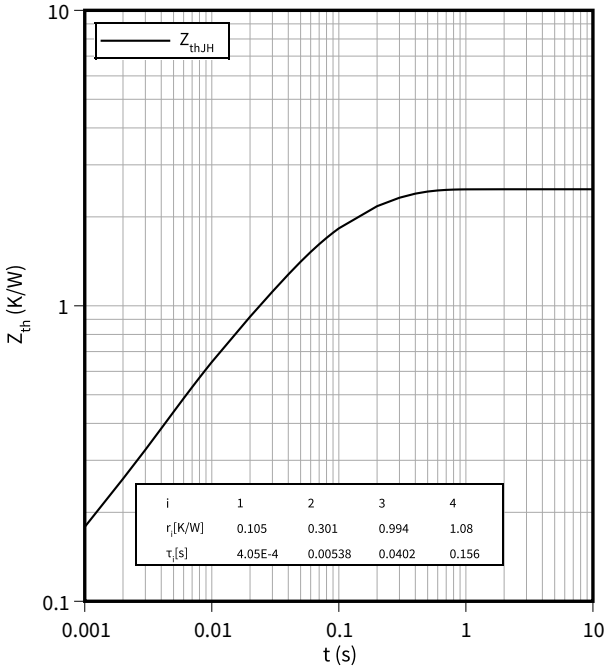
$I_F = f(V_F)$



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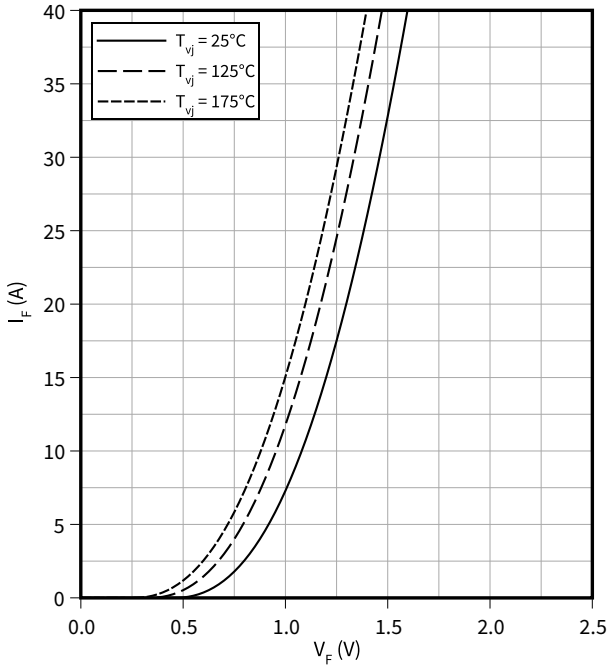
Transient thermal impedance, Diode, D1-D6

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D7-D12

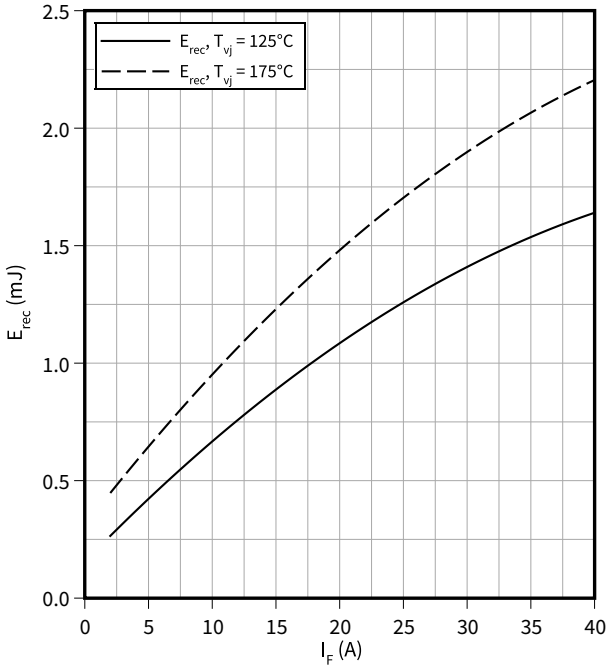
$I_F = f(V_F)$



Switching losses (typical), Diode, D7-D12

$E_{rec} = f(I_F)$

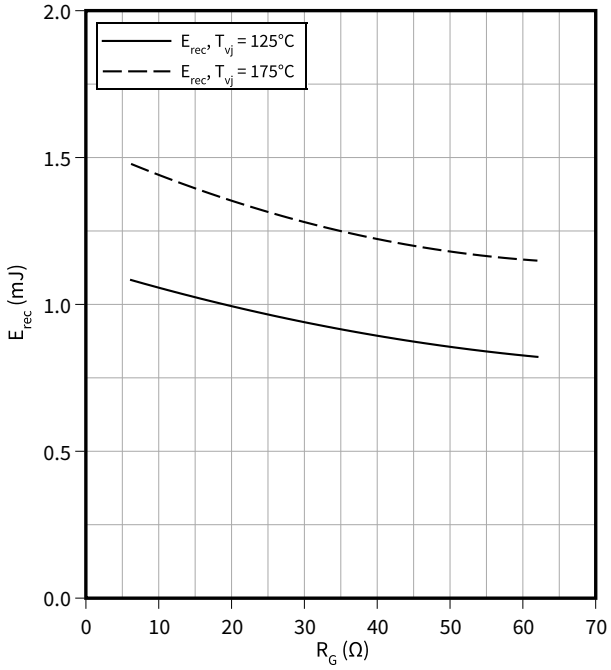
$R_{Gon} = 6.2\ \Omega$, $V_{CC} = 350\ V$



Switching losses (typical), Diode, D7-D12

$E_{rec} = f(R_G)$

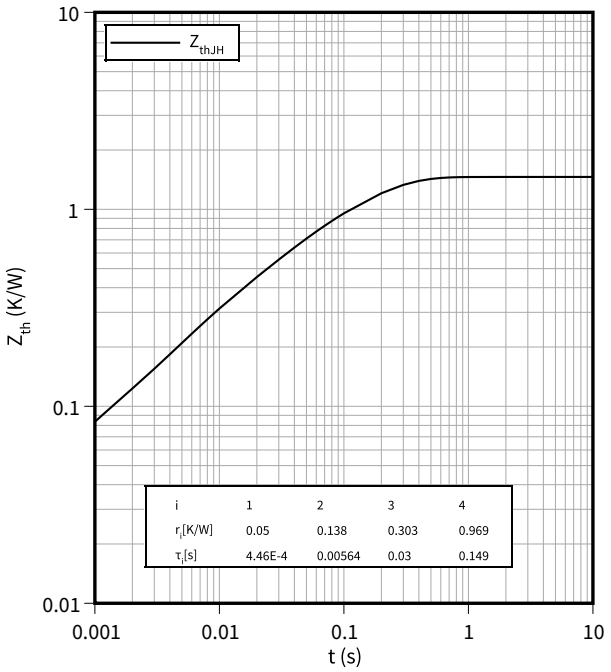
$I_F = 20\ A$, $V_{CC} = 350\ V$



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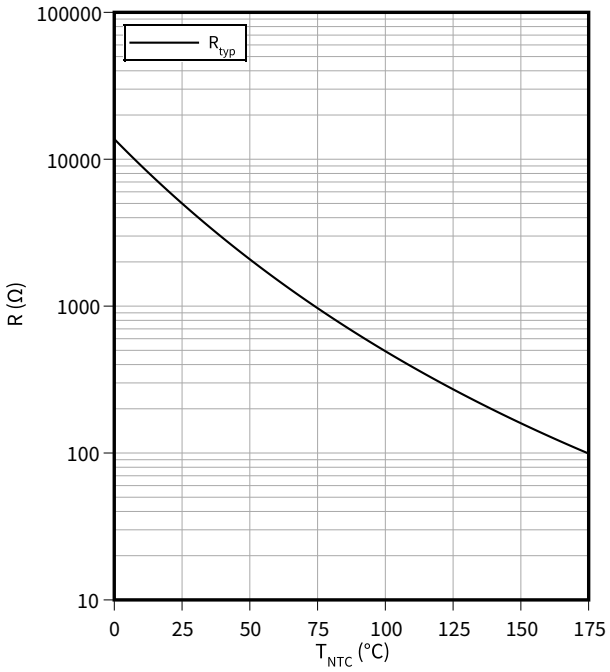
Transient thermal impedance, Diode, D7-D12

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



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7 Circuit diagram

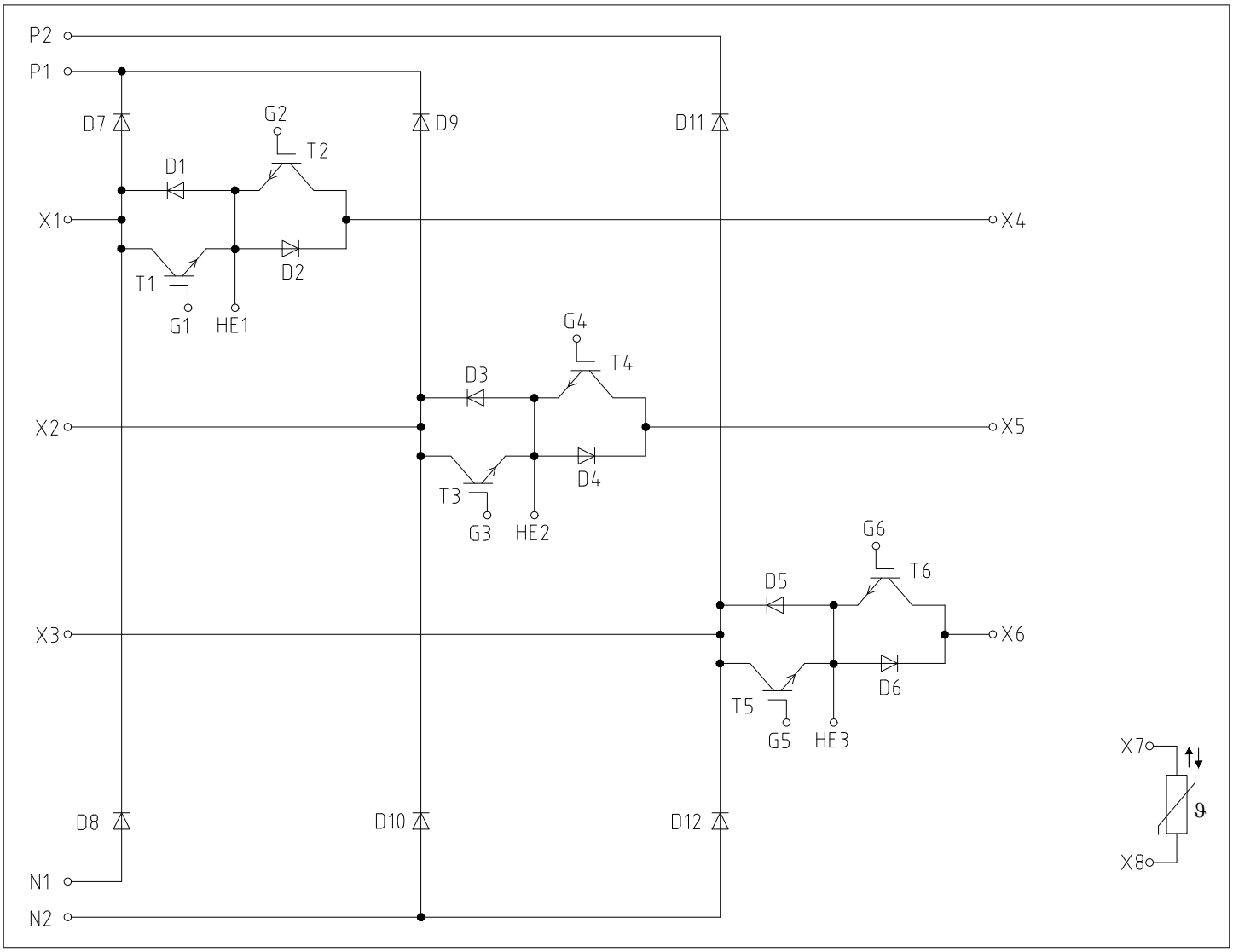


Figure 1

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8 Package outlines

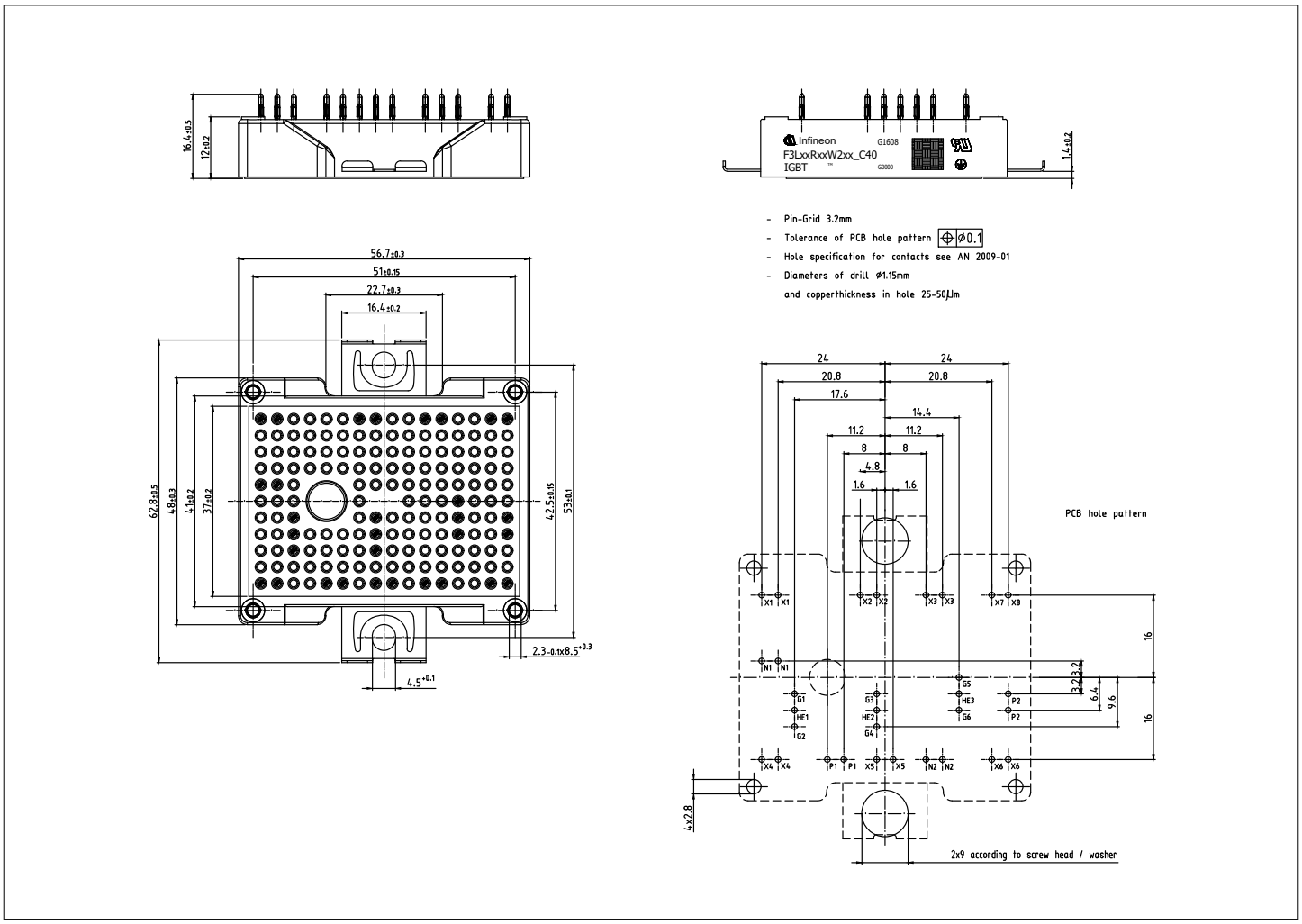


Figure 2

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9 Module label code

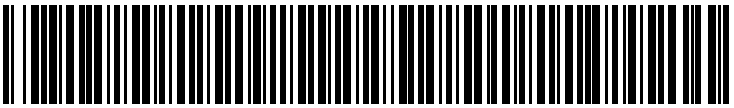
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	 715491428465505499115 30		 715491428465505499115 30

Figure 3

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Revision history

Document revision	Date of release	Description of changes
1.00	2023-04-26	Final datasheet

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