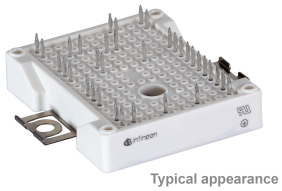
Final datasheet

EasyPACK™ 2B module and PressFIT / pre-applied thermal interface material / NTC

Features


Typical appearance

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 40 A / I_{CRM} = 80 A
  - Ultra fast IGBT chips
  - Overload operation up to 175°C
  - Low switching losses
  - Low $V_{CE,sat}$
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - 3 kV AC 1 minute insulation
  - Al_2O_3 substrate with low thermal resistance
  - Compact design
  - PressFIT contact technology
  - Rugged mounting due to integrated mounting clamps
  - Pre-applied thermal interface material

Potential applications

- Three-level applications
- Solar applications

Product validation

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

Description

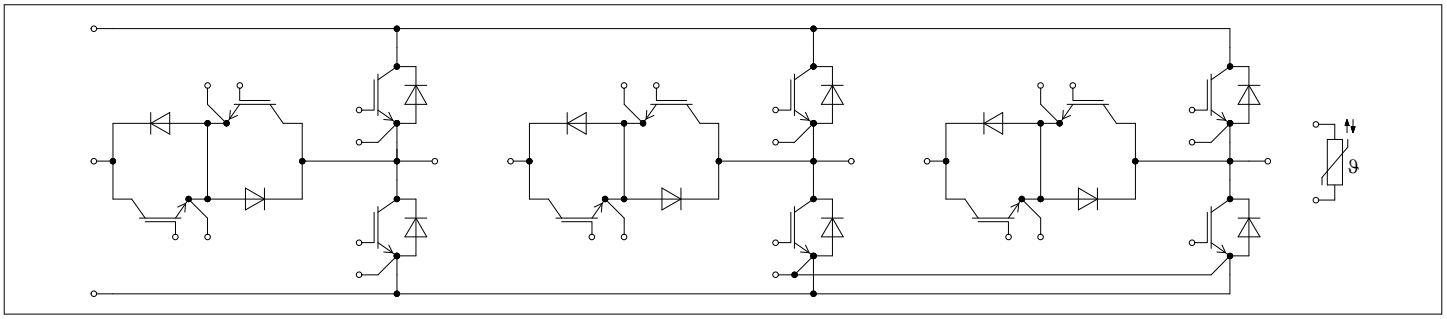


Table of contents

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, *t* = 1 min	3.0	kV
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, f = 50 Hz, *t* = 1 min	3.0	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Comparative tracking index	*CTI*		> 225	
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}			30		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		7		mΩ
Storage temperature	T_{stg}		-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}				125	°C
Mounting force per clamp	*F*		40		80	N
Weight	*G*			39		g

***Note**: Storage and shipment of modules with TIM => see AN2012-07*

The current under continuous operation is limited to 25 A rms per connector pin.

2 IGBT, T1-T2 / T5-T6 / T9-T10

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}			40	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 $T_{vj\,op}$		80	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 = 40 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.70	2.25	V
			T_{vj} = 125 °C		1.90		
			T_{vj} = 175 °C		2.00		
Gate threshold voltage	V_{GEth}	I_C = 8.16 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		4.85	5.5	6.15	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 600 V			0.59		µC
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			4.54		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.086		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			3.5	µA
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 = 40 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.021		µs
			T_{vj} = 125 °C		0.025		
			T_{vj} = 175 °C		0.026		
Rise time (inductive load)	t_r	I_C = 40 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.017		µs
			T_{vj} = 125 °C		0.020		
			T_{vj} = 175 °C		0.022		
Turn-off delay time (inductive load)	t_{doff}	I_C = 40 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 0.62 Ω	T_{vj} = 25 °C		0.110		µs
			T_{vj} = 125 °C		0.140		
			T_{vj} = 175 °C		0.160		
Fall time (inductive load)	t_f	I_C = 40 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 0.62 Ω	T_{vj} = 25 °C		0.080		µs
			T_{vj} = 125 °C		0.150		
			T_{vj} = 175 °C		0.180		
Turn-on energy loss per pulse	E_{on}	I_C = 40 A, V_{CC} = 350 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω, di/dt = 1130 A/ns (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.36		mJ
			T_{vj} = 125 °C		0.51		
			T_{vj} = 175 °C		0.58		
Turn-off energy loss per pulse	E_{off}	I_C = 40 A, V_{CC} = 350 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Goff} = 0.62 Ω, dv/dt = 5300 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.81		mJ
			T_{vj} = 125 °C		1.22		
			T_{vj} = 175 °C		1.45		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				1.68	K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

***Note**: Tvj op > 150 °C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.*

3 Diode, D1-D2 / D5-D6 / D9-D10

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
Implemented forward current	I_{FN}			40	A
Continuous DC forward current	I_F			25	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		80	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	61	A^2s
			T_{vj} = 175 °C	35	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 40 A, V_{GE} = 0 V	T_{vj} = 25 °C		2.50	3.05	V
			T_{vj} = 125 °C		2.18		
			T_{vj} = 175 °C		1.98		
Peak reverse recovery current	I_{RM}	V_{CC} = 350 V, I_F = 40 A, V_{GE} = -15 V, -di$_F$/dt = 2.1 kA/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		36.4		A
			T_{vj} = 125 °C		52.2		
			T_{vj} = 175 °C		58.6		
Recovered charge	Q_r	V_{CC} = 350 V, I_F = 40 A, V_{GE} = -15 V, -di$_F$/dt = 2.1 kA/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.68		µC
			T_{vj} = 125 °C		1.61		
			T_{vj} = 175 °C		2.22		
Reverse recovery energy	E_{rec}	V_{CC} = 350 V, I_F = 40 A, V_{GE} = -15 V, -di$_F$/dt = 2.1 kA/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.214		mJ
			T_{vj} = 125 °C		0.503		
			T_{vj} = 175 °C		0.647		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				2.07	K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

***Note**: Tvj op > 150 °C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.*

4 IGBT, T3-T4 / T7-T8 / T11-T12

Table 7 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	20	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		70	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 35 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.42	1.90	V
			T_{vj} = 125 °C		1.53		
			T_{vj} = 175 °C		1.62		
Gate threshold voltage	V_{GEth}	I_C = 6.5 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		3.25	4	4.75	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 400 V			0.143		µC
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			25.2		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.078		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	T_{vj} = 25 °C			24	µA
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 = 35 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 1.5 Ω	T_{vj} = 25 °C		0.010		µs
			T_{vj} = 125 °C		0.011		
			T_{vj} = 175 °C		0.012		
Rise time (inductive load)	t_r	I_C = 35 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 1.5 Ω	T_{vj} = 25 °C		0.013		µs
			T_{vj} = 125 °C		0.015		
			T_{vj} = 150 °C		0.015		
Turn-off delay time (inductive load)	t_{doff}	I_C = 35 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 1.5 Ω	T_{vj} = 25 °C		0.075		µs
			T_{vj} = 125 °C		0.092		
			T_{vj} = 175 °C		0.099		

(table continues...)

Table 8 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Fall time (inductive load)	t_f	I_C = 35 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 1.5 Ω	T_{vj} = 25 °C		0.036		µs
			T_{vj} = 125 °C		0.051		
			T_{vj} = 175 °C		0.071		
Turn-on energy loss per pulse	E_{on}	I_C = 35 A, V_{CC} = 350 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Gon} = 1.5 Ω, di/dt = 1790 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.13		mJ
			T_{vj} = 125 °C		0.2		
			T_{vj} = 175 °C		0.26		
Turn-off energy loss per pulse	E_{off}	I_C = 35 A, V_{CC} = 350 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Goff} = 1.5 Ω, dv/dt = 7570 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.432		mJ
			T_{vj} = 125 °C		0.625		
			T_{vj} = 175 °C		0.737		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				2.59	K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

5 Diode, D3-D4 / D7-D8 / D11-D12

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	650	V
Implemented forward current	I_{FN}			50	A
Continuous DC forward current	I_F			25	A
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	87	A^2s
			T_{vj} = 175 °C	69.7	

Table 10 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 50 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.65	2.15	V
			T_{vj} = 125 °C		1.55		
			T_{vj} = 175 °C		1.45		

(table continues...)

Table 10 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current	I_{RM}	V_{CC} = 350 V, I_F = 50 A, -di$_F$/dt = 1430 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		25.4		A
			T_{vj} = 125 °C		33.3		
			T_{vj} = 175 °C		37.8		
Recovered charge	Q_r	V_{CC} = 350 V, I_F = 50 A, -di$_F$/dt = 1430 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.9		µC
			T_{vj} = 125 °C		1.71		
			T_{vj} = 175 °C		2.22		
Reverse recovery energy	E_{rec}	V_{CC} = 350 V, I_F = 50 A, -di$_F$/dt = 1430 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.223		mJ
			T_{vj} = 125 °C		0.428		
			T_{vj} = 175 °C		0.555		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				1.83	K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

6 NTC-Thermistor

Table 11 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

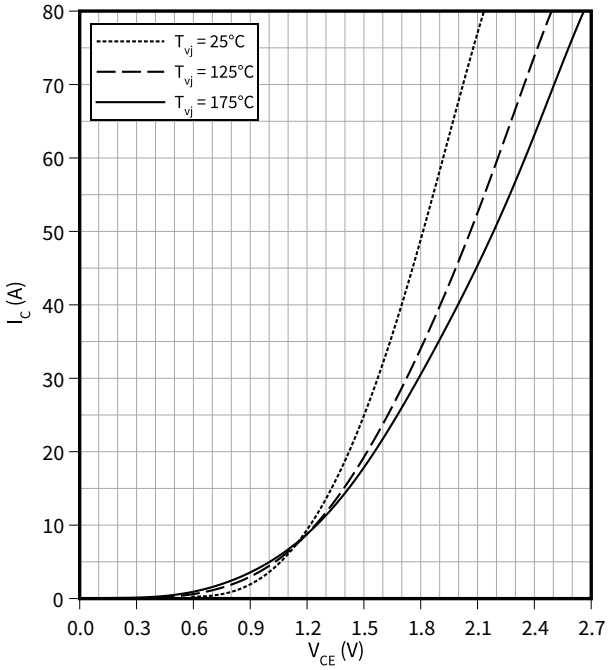
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4*

7 Characteristics diagrams

Output characteristic (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$I_C = f(V_{CE})$

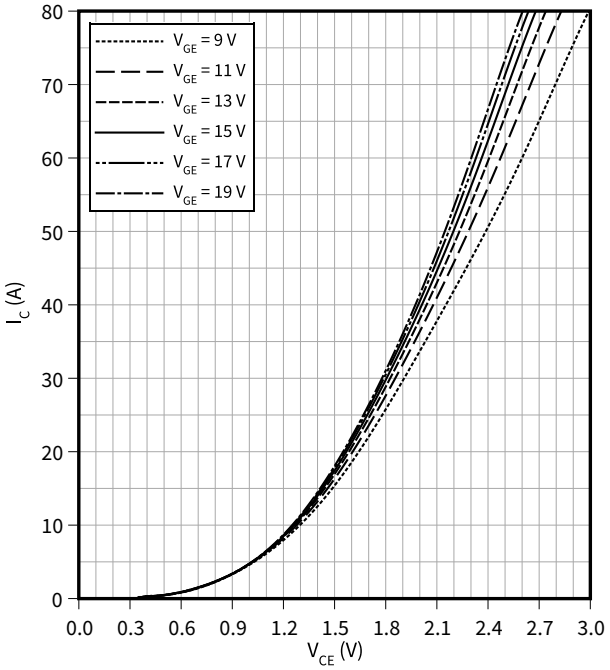
V_{GE} = 15 V



Output characteristic field (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$I_C = f(V_{CE})$

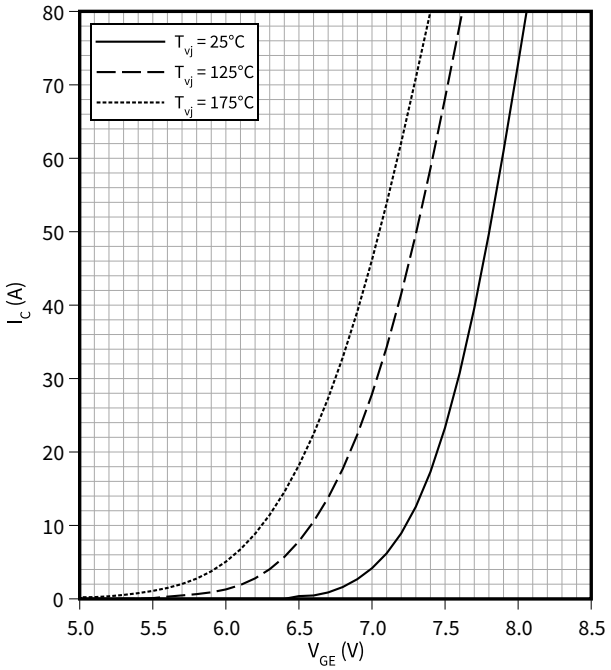
T_{vj} = 175 °C



Transfer characteristic (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$I_C = f(V_{GE})$

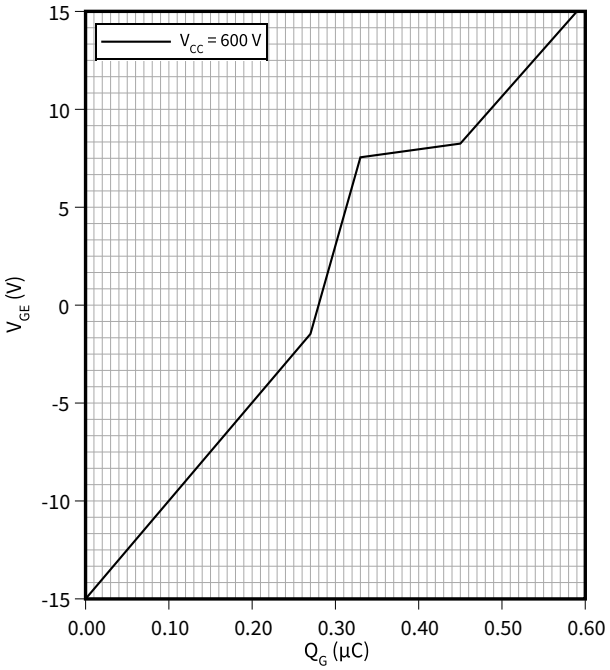
V_{CE} = 20 V



Gate charge characteristic (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$V_{GE} = f(Q_G)$

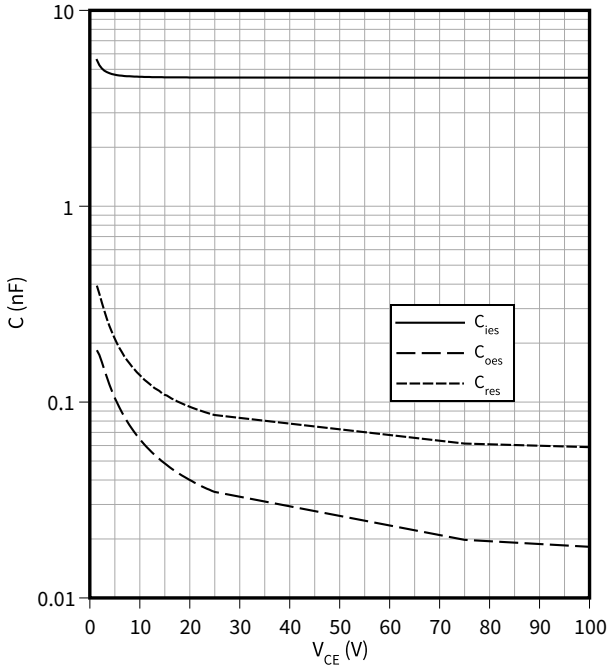
I_C = 40 A, T_{vj} = 25 °C



Capacity characteristic (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$C = f(V_{CE})$

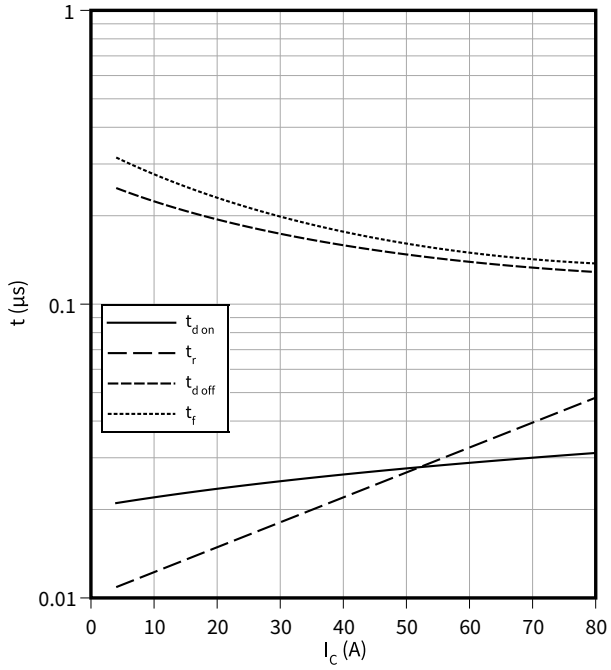
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



Switching times (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$t = f(I_C)$

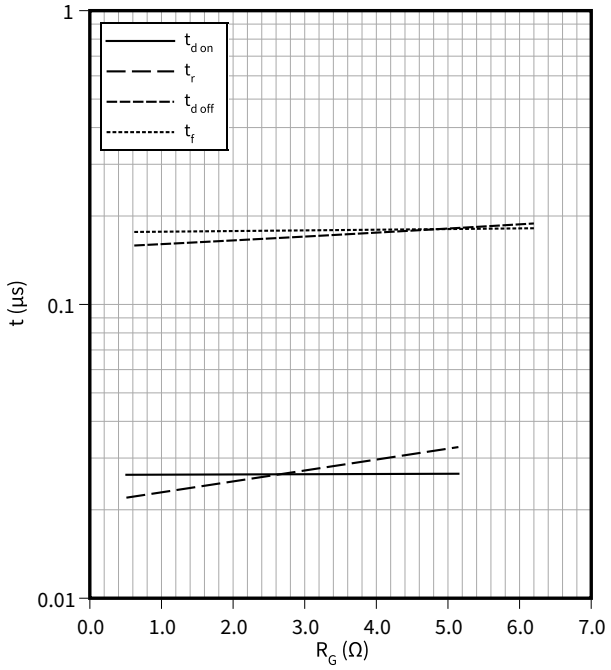
$V_{CC} = 350\ V$, $R_{Goff} = 0.62\ \Omega$, $R_{Gon} = 0.51\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ °C$



Switching times (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$t = f(R_G)$

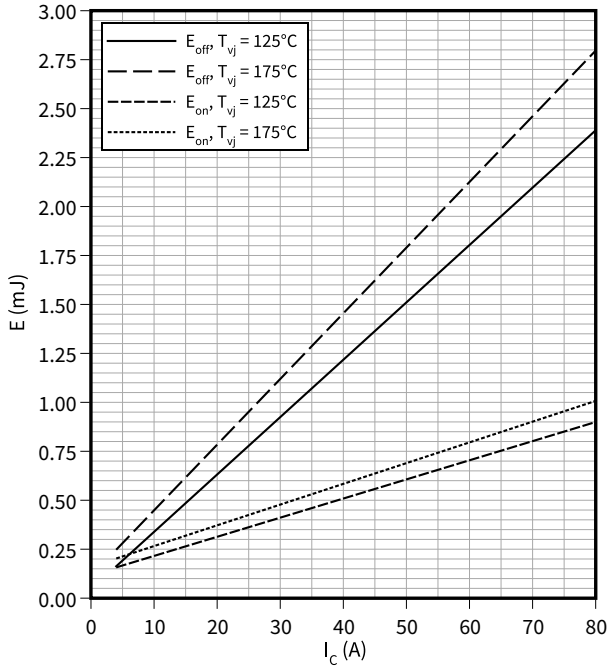
$V_{GE} = \pm 15\ V$, $I_C = 40\ A$, $V_{CC} = 350\ V$, $T_{vj} = 175\ °C$



Switching losses (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$E = f(I_C)$

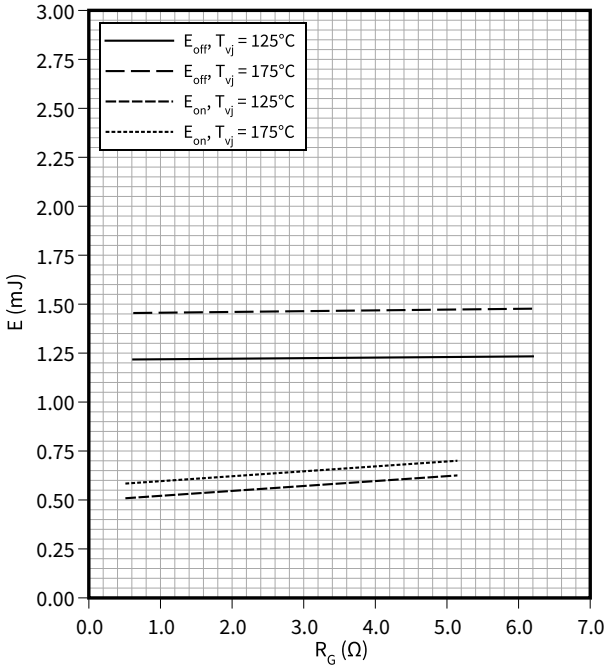
$R_{Goff} = 0.62\ \Omega$, $R_{Gon} = 0.51\ \Omega$, $V_{CC} = 350\ V$, $V_{GE} = \pm\ 15\ V$



Switching losses (typical), IGBT, T1-T2 / T5-T6 / T9-T10

$E = f(R_G)$

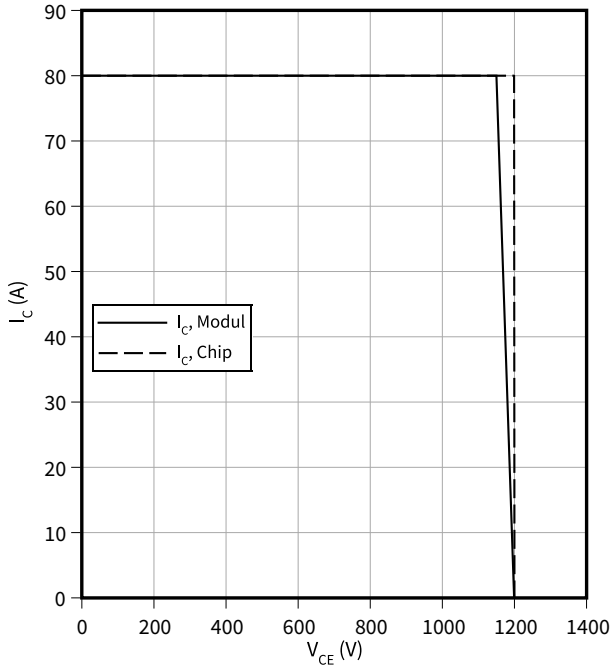
$I_C = 40$ A, $V_{CC} = 350$ V, $V_{GE} = \pm 15$ V



Reverse bias safe operating area (RBSOA), IGBT, T1-T2 / T5-T6 / T9-T10

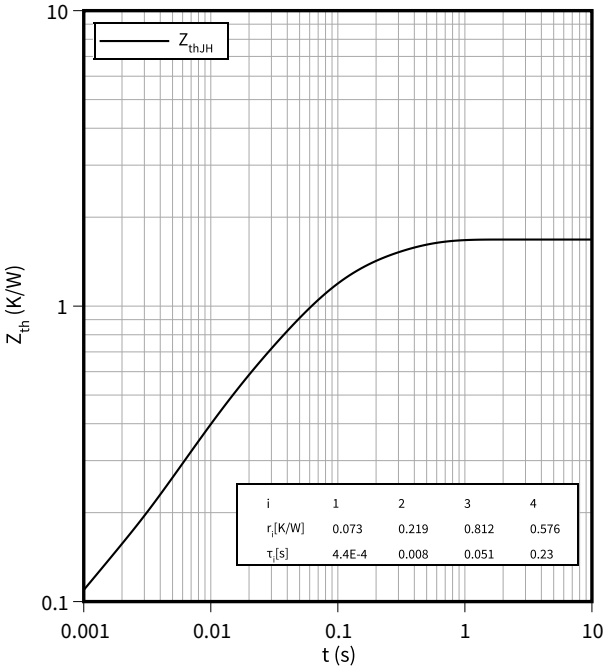
$I_C = f(V_{CE})$

$R_{Goff} = 0.62\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



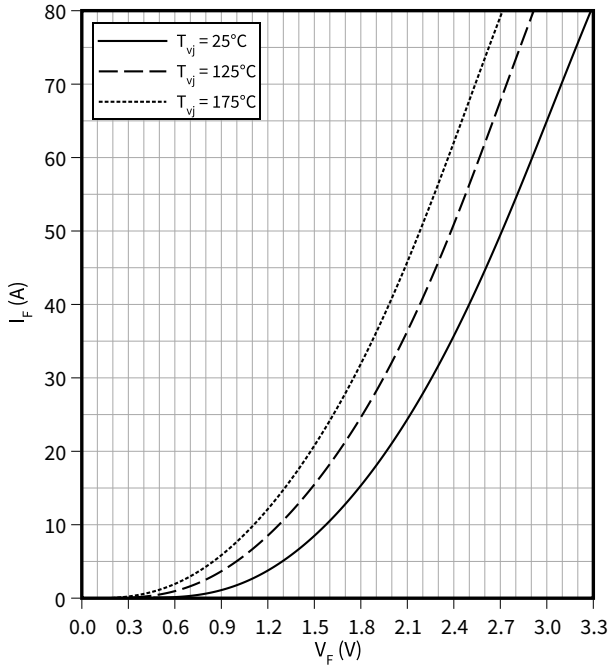
Transient thermal impedance, IGBT, T1-T2 / T5-T6 / T9-T10

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D1-D2 / D5-D6 / D9-D10

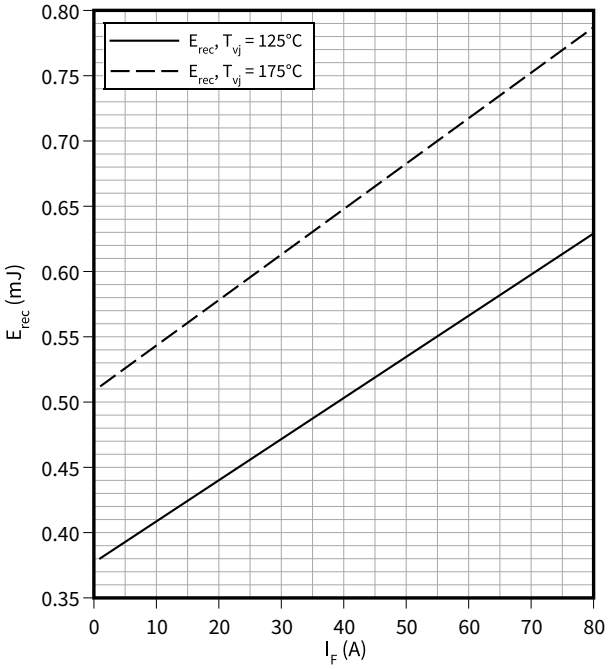
$I_F = f(V_F)$



Switching losses (typical), Diode, D1-D2 / D5-D6 / D9-D10

$E_{rec} = f(I_F)$

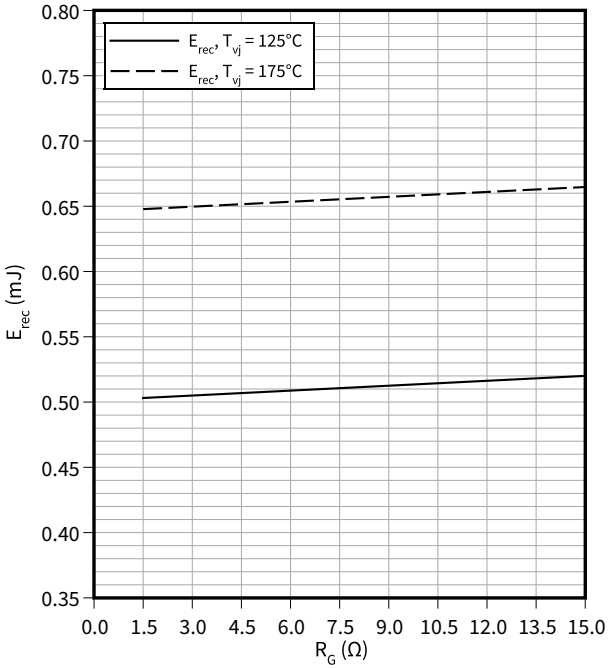
$V_{CE} = 350\ V$, $R_G = 1.5\ \Omega$



Switching losses (typical), Diode, D1-D2 / D5-D6 / D9-D10

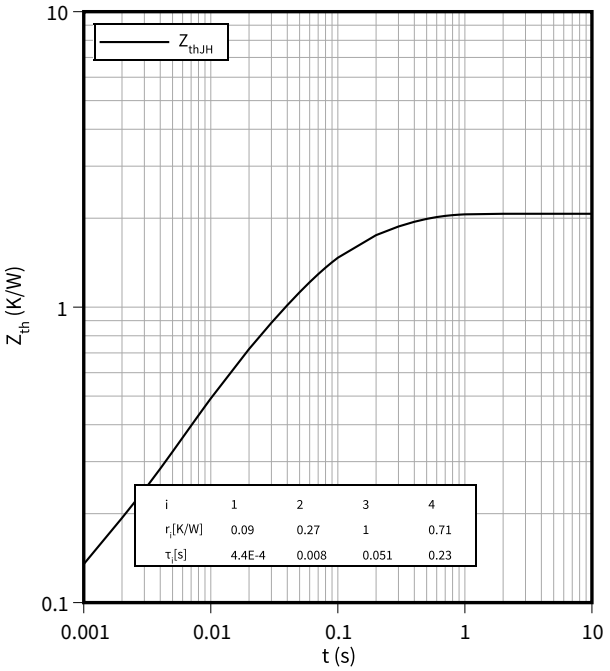
$E_{rec} = f(R_G)$

$V_{CE} = 350\ V$, $I_F = 40\ A$



Transient thermal impedance, Diode, D1-D2 / D5-D6 / D9-D10

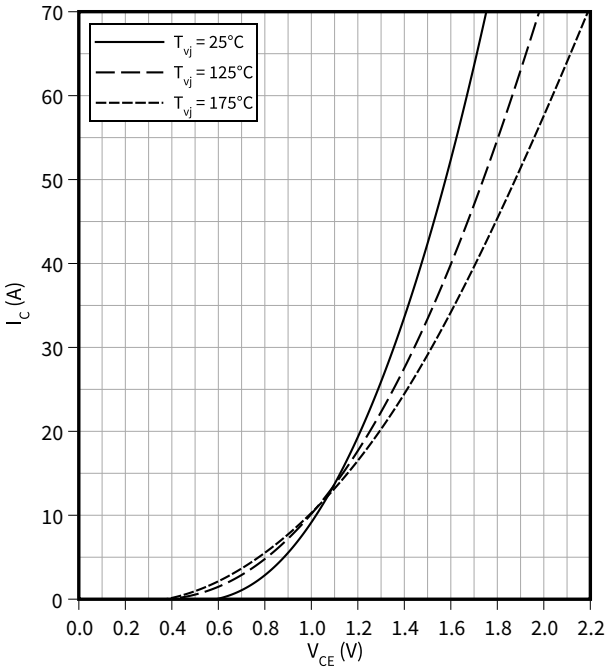
$Z_{th} = f(t)$



Output characteristic (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$I_C = f(V_{CE})$

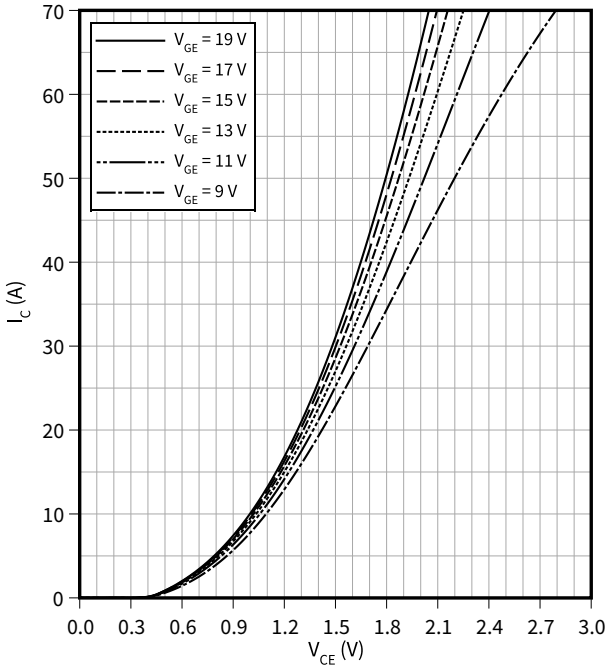
$V_{GE} = 15\ V$



Output characteristic field (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$I_C = f(V_{CE})$

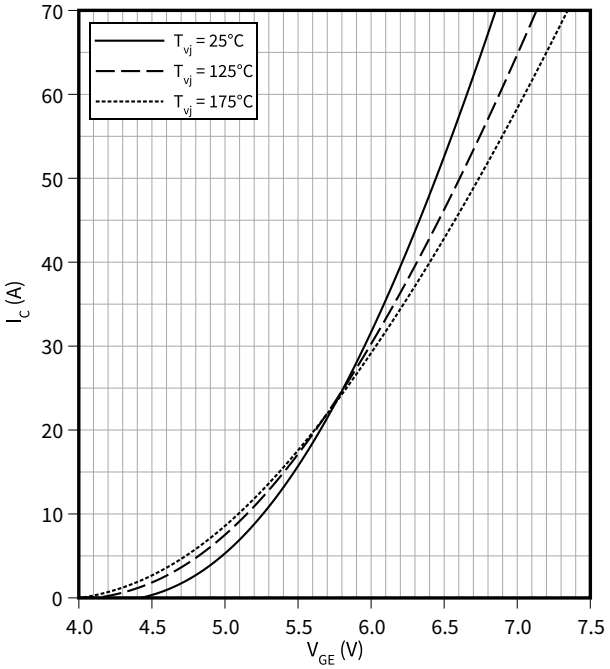
$T_{vj} = 175\ °C$



Transfer characteristic (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$I_C = f(V_{GE})$

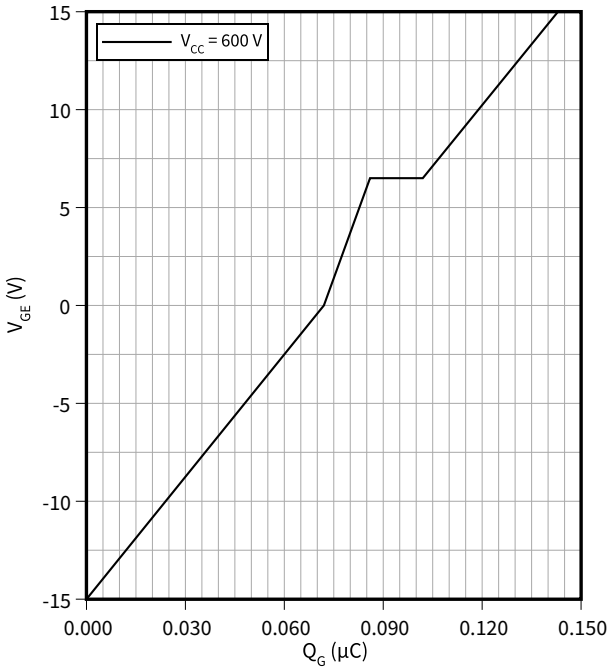
$V_{CE} = 20\ V$



Gate charge characteristic (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$V_{GE} = f(Q_G)$

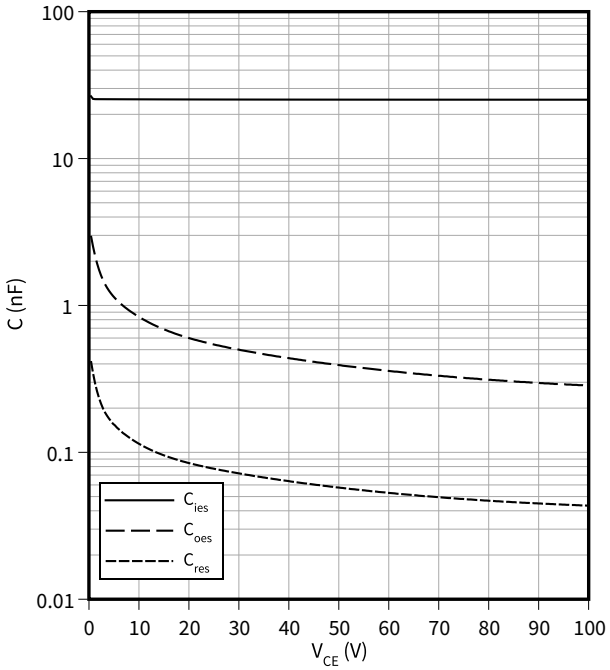
$I_C = 35\ A,\ T_{vj} = 25\ °C$



Capacity characteristic (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$C = f(V_{CE})$

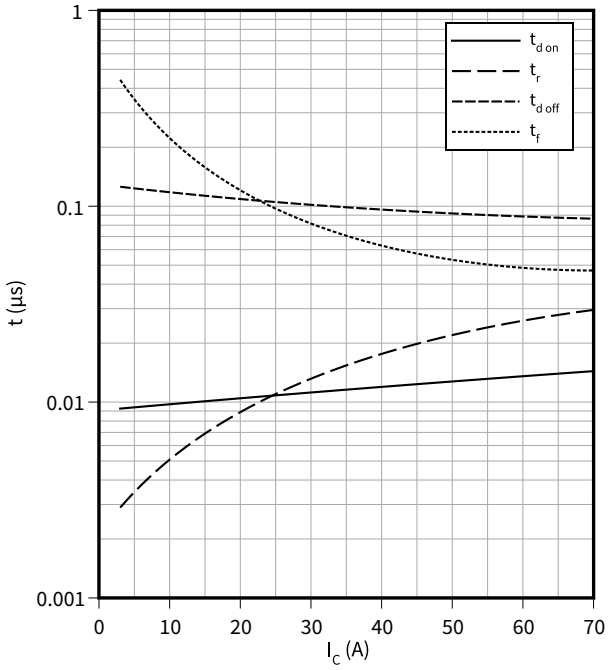
$f = 100\ kHz,\ V_{GE} = 0\ V,\ T_{vj} = 25\ °C$



Switching times (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$t = f(I_C)$

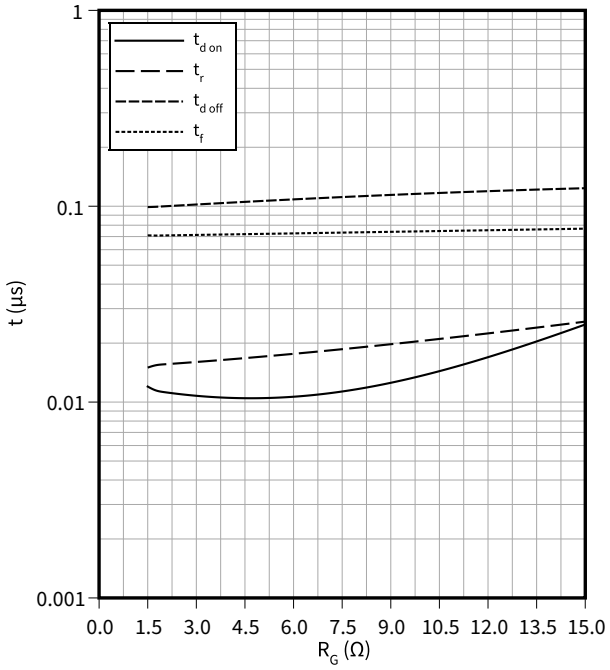
R_{Goff} = 1.5 Ω, R_{Gon} = 1.5 Ω, V_{GE} = ±15 V, V_{CC} = 350 V



Switching times (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$t = f(R_G)$

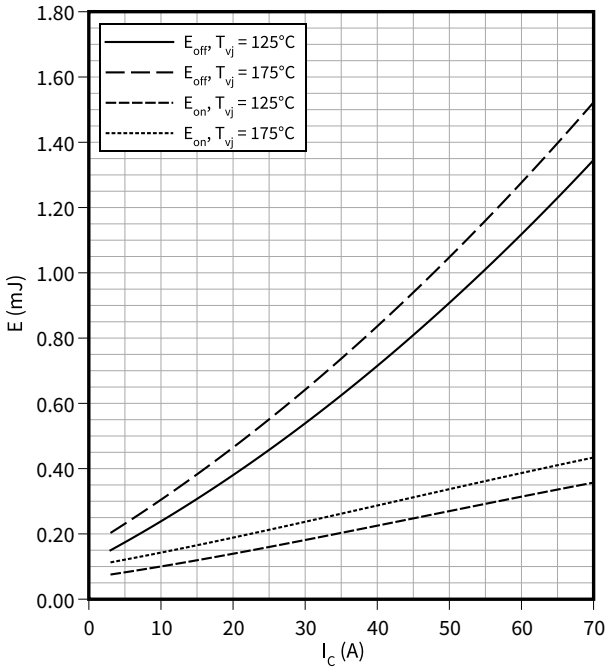
V_{GE} = ±15 V, I_C = 35 A, V_{CC} = 350 V



Switching losses (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$E = f(I_C)$

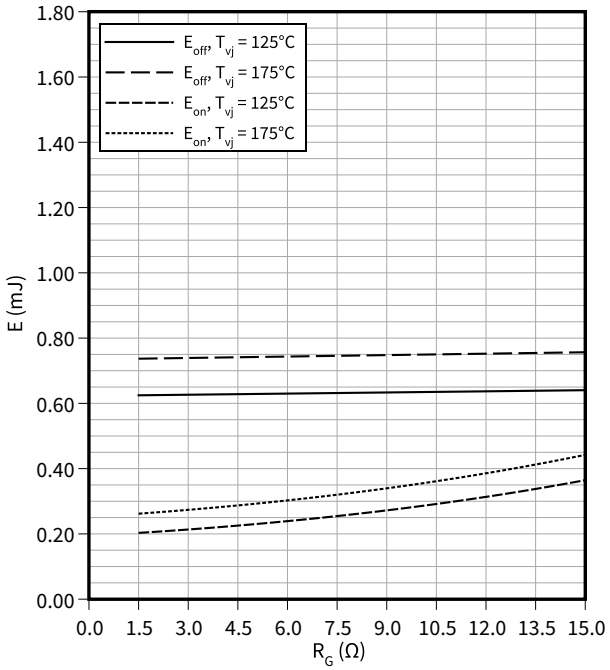
R_{Goff} = 1.5 Ω, R_{Gon} = 1.5 Ω, V_{CC} = 350 V, V_{GE} = ± 15 V



Switching losses (typical), IGBT, T3-T4 / T7-T8 / T11-T12

$E = f(R_G)$

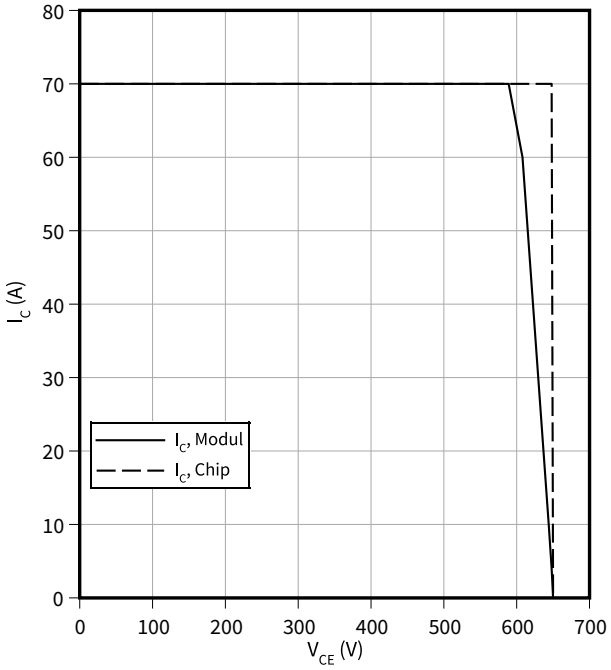
I_C = 35 A, V_{CC} = 350 V, V_{GE} = ± 15 V



Reverse bias safe operating area (RBSOA), IGBT, T3-T4 / T7-T8 / T11-T12

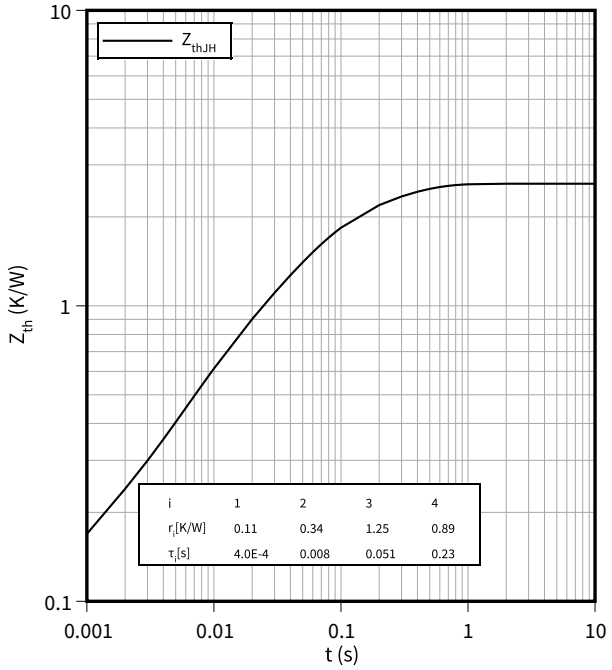
$I_C = f(V_{CE})$

$R_{Goff} = 1.5\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



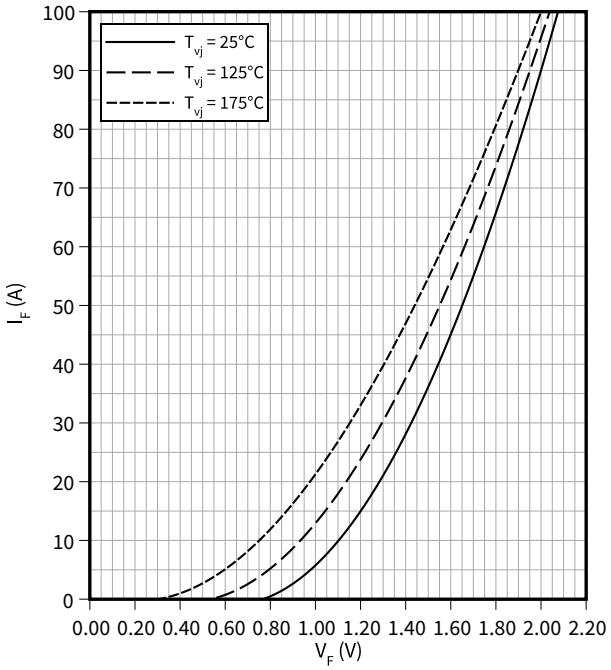
Transient thermal impedance, IGBT, T3-T4 / T7-T8 / T11-T12

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D3-D4 / D7-D8 / D11-D12

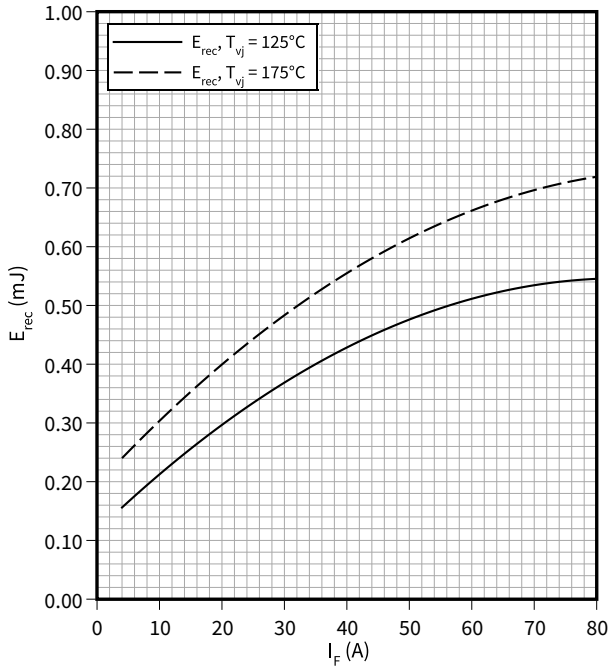
$I_F = f(V_F)$



Switching losses (typical), Diode, D3-D4 / D7-D8 / D11-D12

$E_{rec} = f(I_F)$

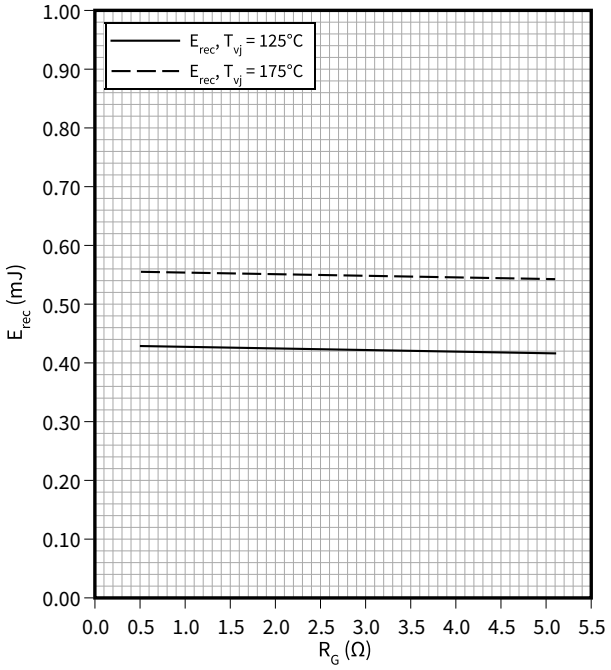
$V_{CE} = 350$ V, $R_G = 0.51\ \Omega$



Switching losses (typical), Diode, D3-D4 / D7-D8 / D11-D12

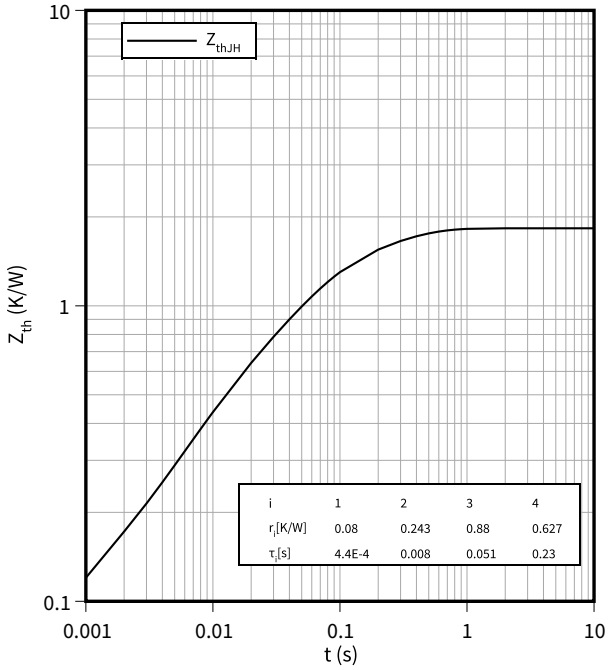
$E_{rec} = f(R_G)$

$V_{CE} = 350\ V$, $I_F = 50\ A$



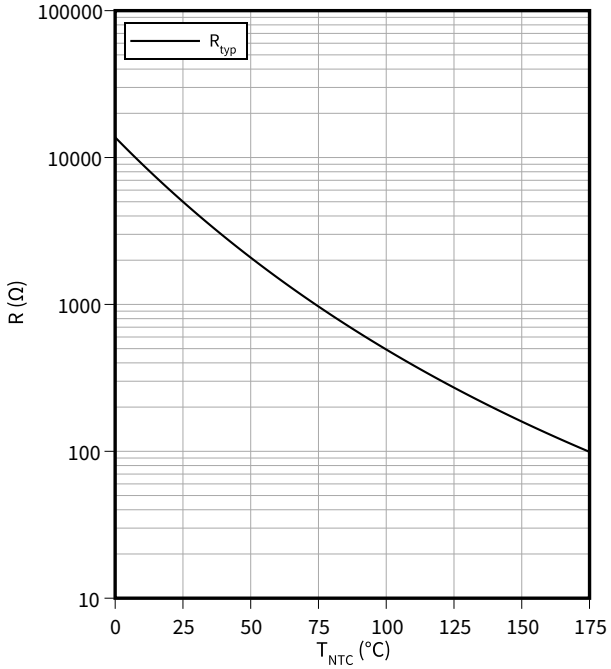
Transient thermal impedance, Diode, D3-D4 / D7-D8 / D11-D12

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



8 Circuit diagram

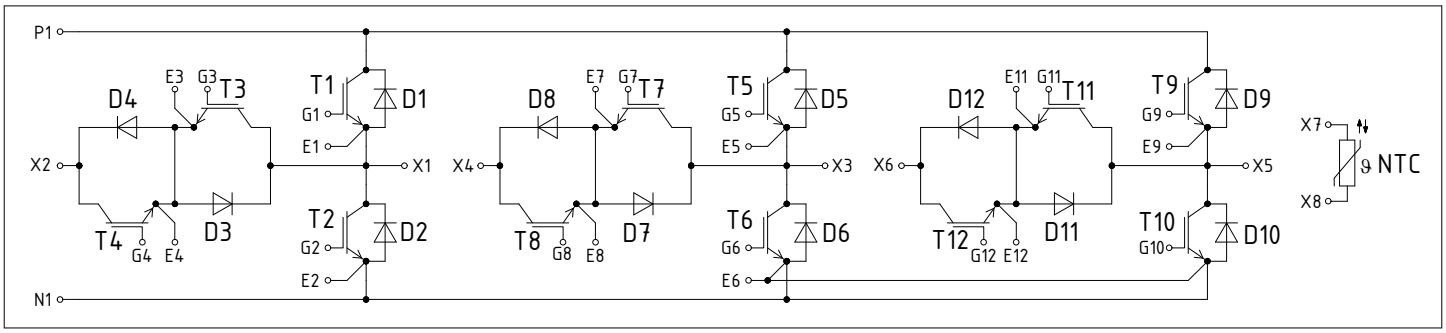


Figure 1

9 Package outlines

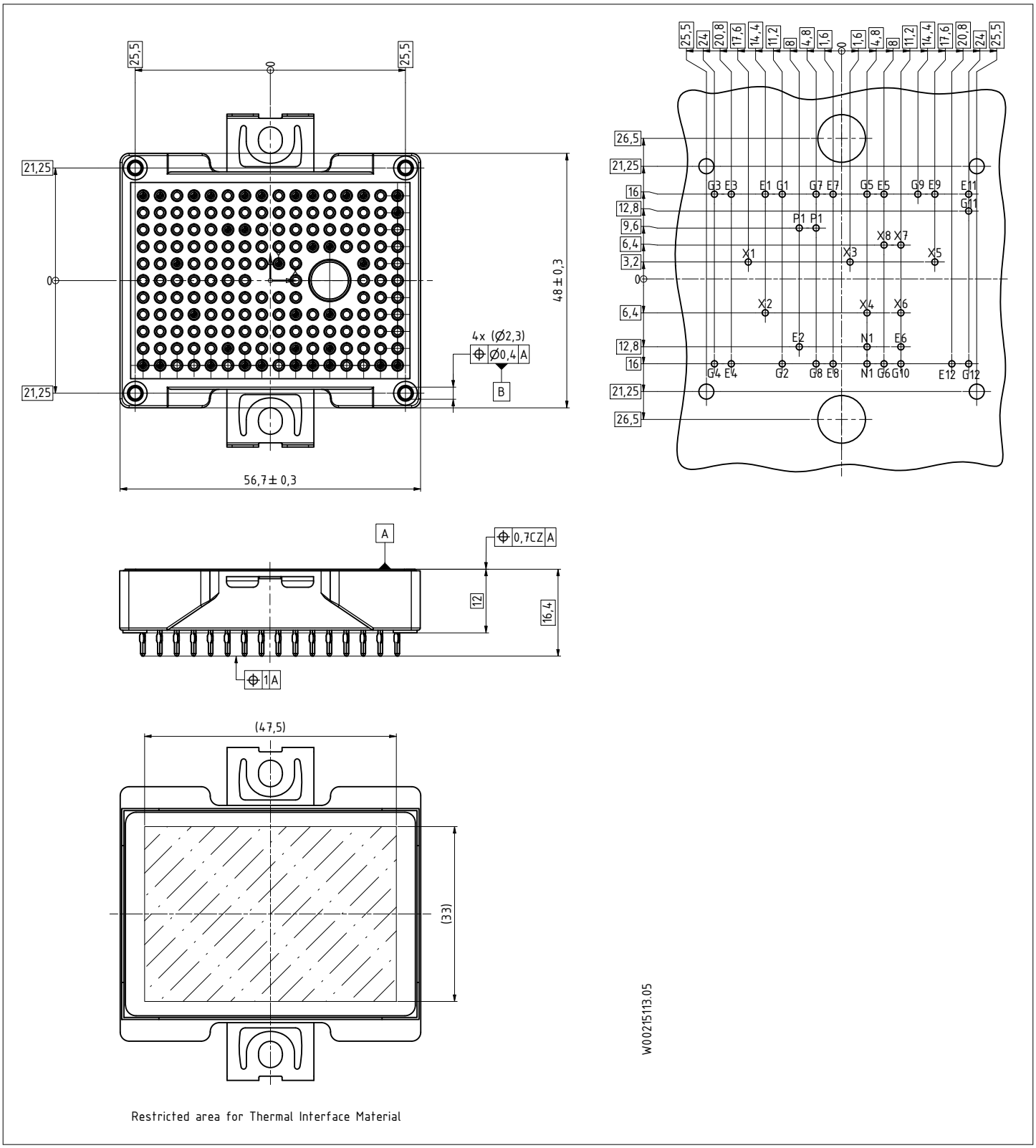


Figure 2

10 Module label code

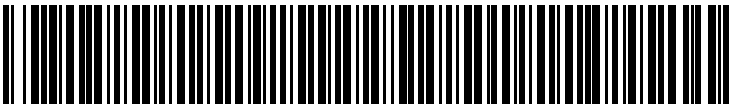
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	 7154914284655054991530	 7154914284655054991530	

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2023-01-26	Initial version
1.00	2023-12-12	Final datasheet

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