chanhvinh.com

FF6MR12W2M1H_B70

EasyDUAL module

Preliminary datasheet

EasyDUAL module with CoolSiC™ Trench MOSFET and PressFIT / NTC

Features


Typical appearance

- Electrical features
  - V_{DSS} = 1200 V
  - I_{DN} = 150 A / I_{DRM} = 300 A
  - Low switching losses
  - Low inductive design
  - High current density
- Mechanical features
  - Rugged mounting due to integrated mounting clamps
  - PressFIT contact technology
  - Integrated NTC temperature sensor
  - AlN substrate with low thermal resistance

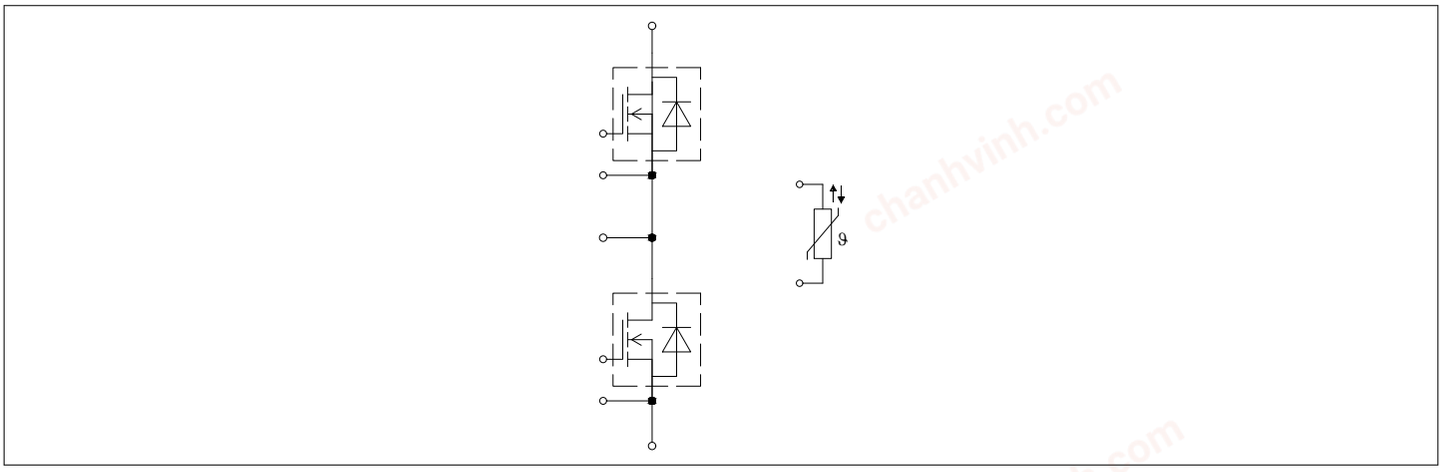
Potential applications

- Solar applications
- High-frequency switching application
- DC/DC converter
- UPS systems

Product validation

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

Description



chanhvinh.com

Table of contents

	Description	1
	Features	1
	Potential applications	1
	Product validation	1
	Table of contents	2
1	**Package**	3
2	**MOSFET**	3
3	**Body diode (MOSFET)**	5
4	**NTC-Thermistor**	6
5	**Characteristics diagrams**	7
6	**Circuit diagram**	12
7	**Package outlines**	13
8	**Module label code**	14
	Revision history	15
	Disclaimer	16

chanhvinh.com

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
Internal isolation		basic insulation (class 1, IEC 61140)	AlN	
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}			8		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		1.4		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 25 A rms per connector pin.

2 MOSFET

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}		T_{vj} = 25 °C	1200	V
Continuous DC drain current	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_H = 90 °C	150	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		300	A
Gate-source voltage, max. transient voltage	V_{GS}	*D* < 0.01		-10/23	V
Gate-source voltage, max. static voltage	V_{GS}			-7/20	V

Table 4 Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
On-state gate voltage	$V_{GS(on)}$		15...18	V
Off-state gate voltage	$V_{GS(off)}$		-5...0	V

chanhvinh.com

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-resistance	$R_{DS(on)}$	I_D = 150 A	V_{GS} = 18 V, T_{vj} = 25 °C		5.4		mΩ
			V_{GS} = 18 V, T_{vj} = 125 °C		8.7		
			V_{GS} = 18 V, T_{vj} = 150 °C		10		
			V_{GS} = 15 V, T_{vj} = 25 °C		6.5		
Gate threshold voltage	$V_{GS(th)}$	I_D = 60 mA, V_{DS} = V_{GS}, T_{vj} = 25 °C, (tested after 1ms pulse at V_{GS} = +20 V)		3.45	4.3	5.15	V
Total gate charge	Q_G	V_{DD} = 800 V, V_{GS} = -3/18 V			0.446		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1.4		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		13.2		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.63		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.042		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			258		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = -3 V	T_{vj} = 25 °C		0.09	530	µA
Gate-source leakage current	I_{GSS}	V_{DS} = 0 V, T_{vj} = 25 °C	V_{GS} = 20 V			400	nA
Turn-on delay time (inductive load)	$t_{d\,on}$	I_D = 150 A, R_{Gon} = 2.4 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		38		ns
			T_{vj} = 125 °C		37		
			T_{vj} = 150 °C		37		
Rise time (inductive load)	t_r	I_D = 150 A, R_{Gon} = 2.4 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		39		ns
			T_{vj} = 125 °C		38		
			T_{vj} = 150 °C		38		
Turn-off delay time (inductive load)	$t_{d\,off}$	I_D = 150 A, R_{Goff} = 1.3 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		69		ns
			T_{vj} = 125 °C		74		
			T_{vj} = 150 °C		75		
Fall time (inductive load)	t_f	I_D = 150 A, R_{Goff} = 1.3 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		15		ns
			T_{vj} = 125 °C		15		
			T_{vj} = 150 °C		15		

(table continues...)

chanhvinh.com

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-on energy loss per pulse	E_{on}	I_D = 150 A, V_{DD} = 600 V, L_σ = 7 nH, V_{GS} = -3/18 V, R_{Gon} = 2.4 Ω, di/dt = 8.1 kA/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1.69		mJ
			T_{vj} = 125 °C		2.14		
			T_{vj} = 150 °C		2.32		
Turn-off energy loss per pulse	E_{off}	I_D = 150 A, V_{DD} = 600 V, L_σ = 7 nH, V_{GS} = -3/18 V, R_{Goff} = 1.3 Ω, dv/dt = 32 kV/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.98		mJ
			T_{vj} = 125 °C		0.99		
			T_{vj} = 150 °C		1		
SC data	I_{SC}	V_{GS} = -5/15 V, V_{DD} = 800 V, V_{DSmax} = V_{DSS}-L_{sDS}*di/dt, R_G = 10 Ω	t_P = 2 µs, T_{vj} = 25 °C		1260		A
			t_P = 2 µs, T_{vj} = 150 °C		1230		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET			0.252		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

Note: The selection of positive and negative gate-source voltages impacts losses and the long-term behavior of the MOSFET and body diode. The design guidelines described in Application Notes AN 2018-09 and AN 2021-13 must be considered to ensure sound operation of the device over the planned lifetime.

3 Body diode (MOSFET)

Table 6 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
DC body diode forward current	I_{SD}	T_{vj} = 175 °C, V_{GS} = -3 V	T_H = 90 °C	85	A

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 150 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.2	5.35	V
			T_{vj} = 125 °C		3.9		
			T_{vj} = 150 °C		3.85		

chanhvinh.com

4 NTC-Thermistor

Table 8 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	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$		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: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.

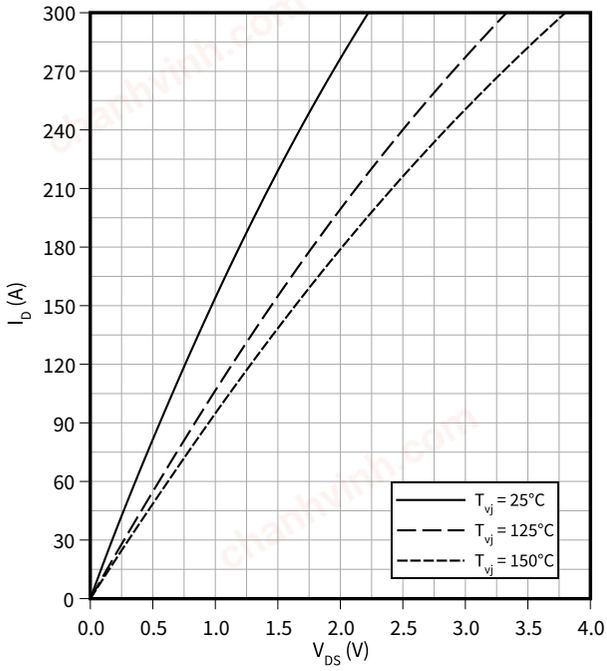
chanhvinh.com

5 Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

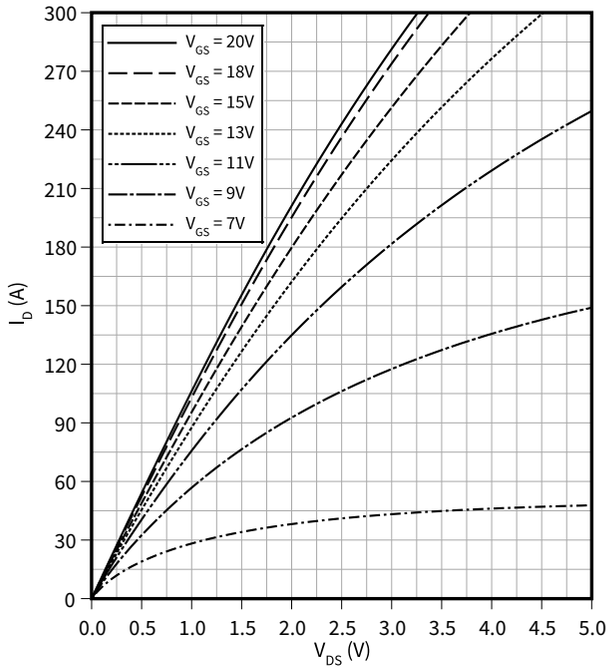
V_{GS} = 15 V



Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$

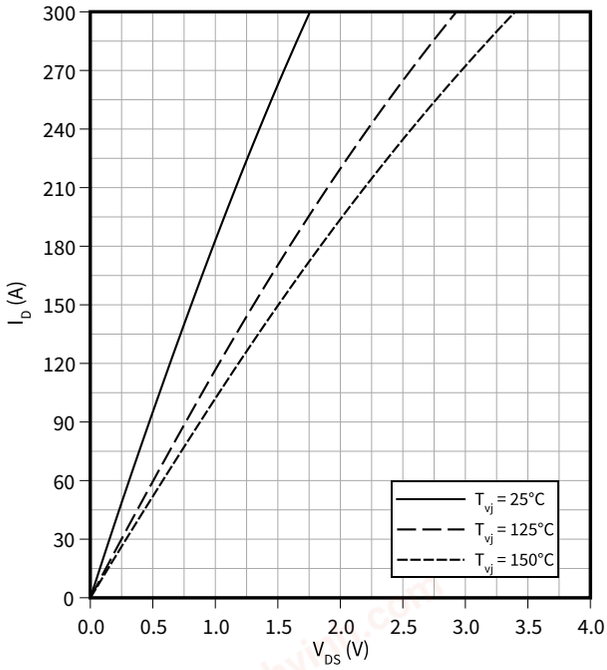
T_{vj} = 150 °C



Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

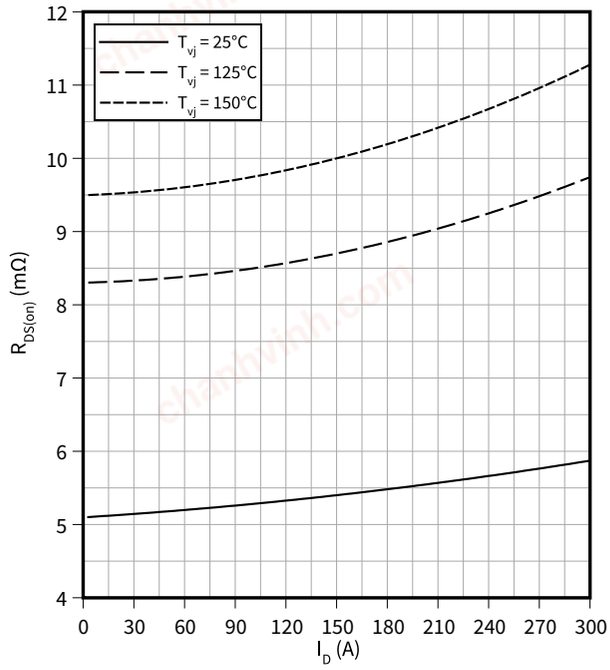
V_{GS} = 18 V



Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(I_D)$

V_{GS} = 18 V

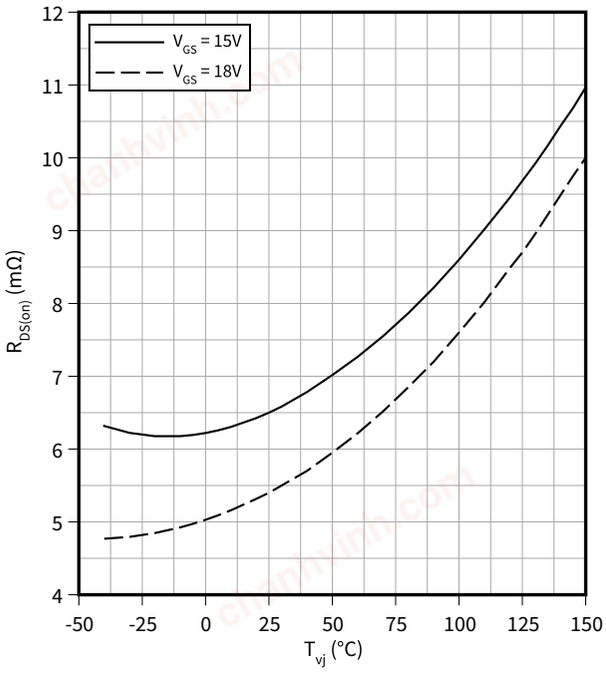


chanhvinh.com

5 Characteristics diagrams

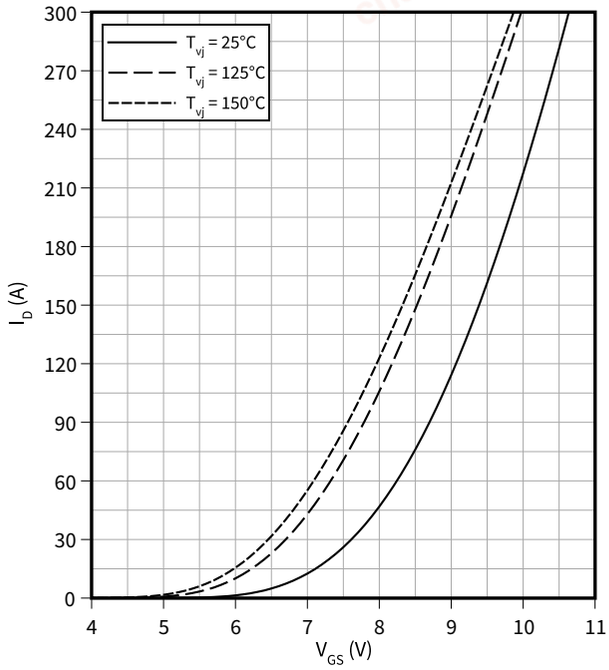
Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(T_{vj})$
$I_D = 150$ A



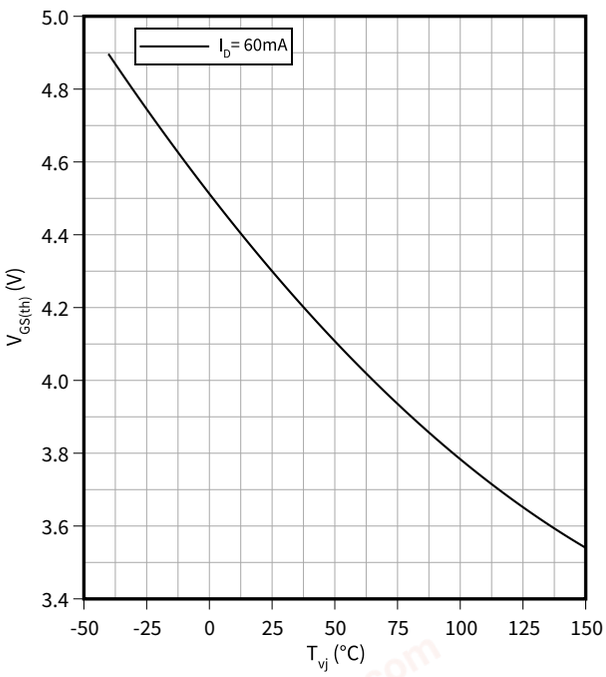
Transfer characteristic (typical), MOSFET

$I_D = f(V_{GS})$
$V_{DS} = 20$ V



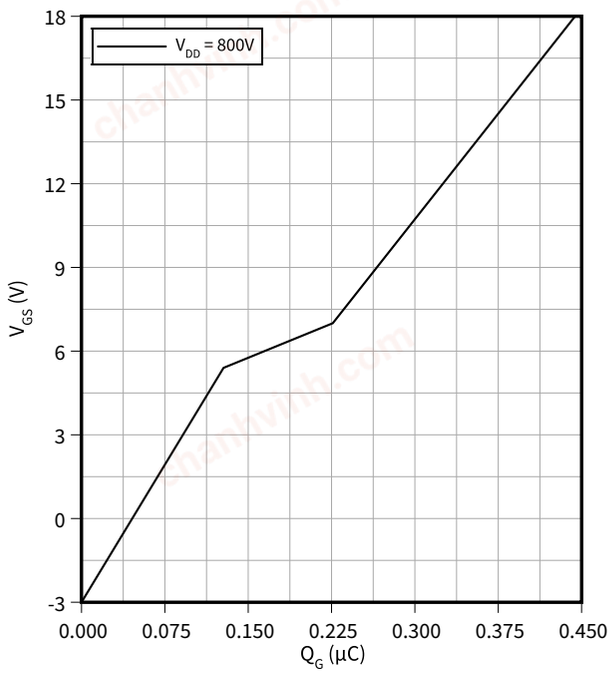
Gate-source threshold voltage (typical), MOSFET

$V_{GS(th)} = f(T_{vj})$
$V_{GS} = V_{DS}$



Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$
$I_D = 150$ A, $T_{vj} = 25$ °C



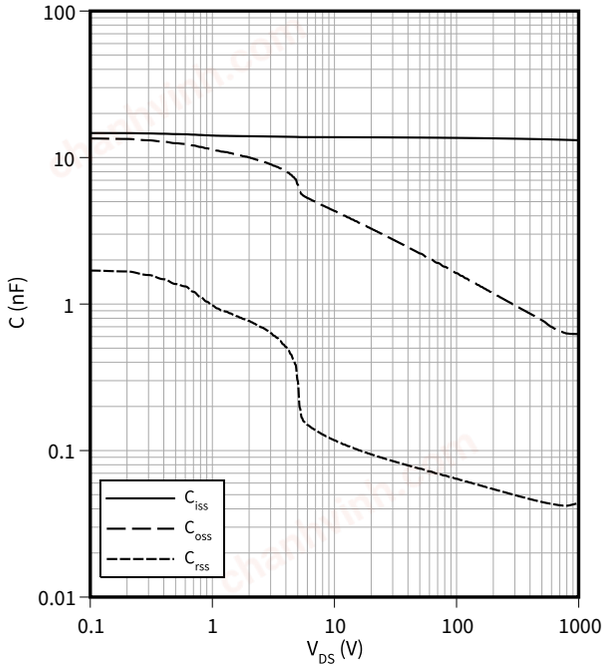
chanhvinh.com

5 Characteristics diagrams

Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

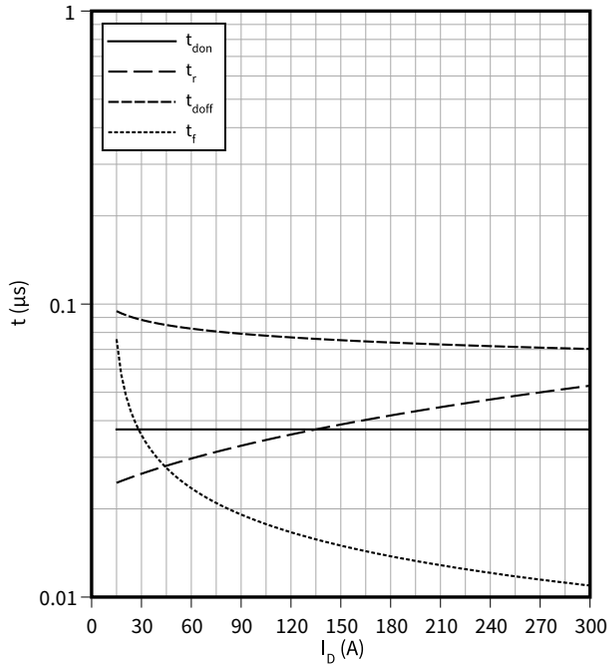
$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{GS} = 0$ V



Switching times (typical), MOSFET

$t = f(I_D)$

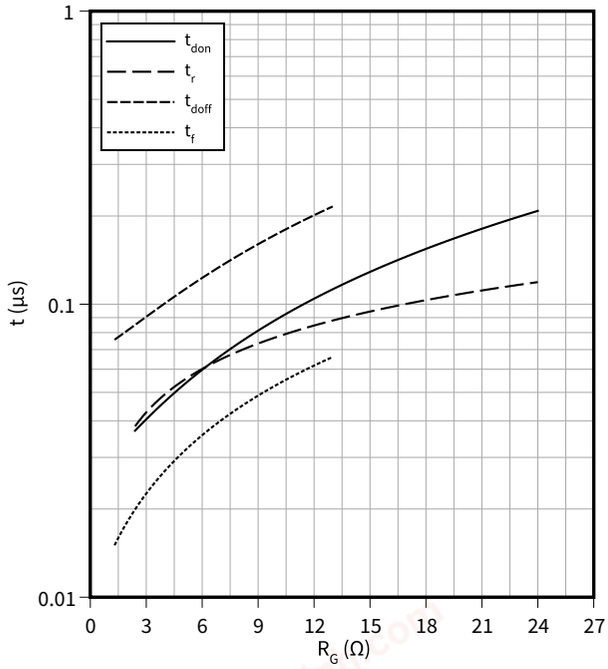
$R_{Goff} = 1.3\ \Omega$, $R_{Gon} = 2.4\ \Omega$, $V_{DD} = 600$ V, $T_{vj} = 150$ °C, $V_{GS} = -3/18$ V



Switching times (typical), MOSFET

$t = f(R_G)$

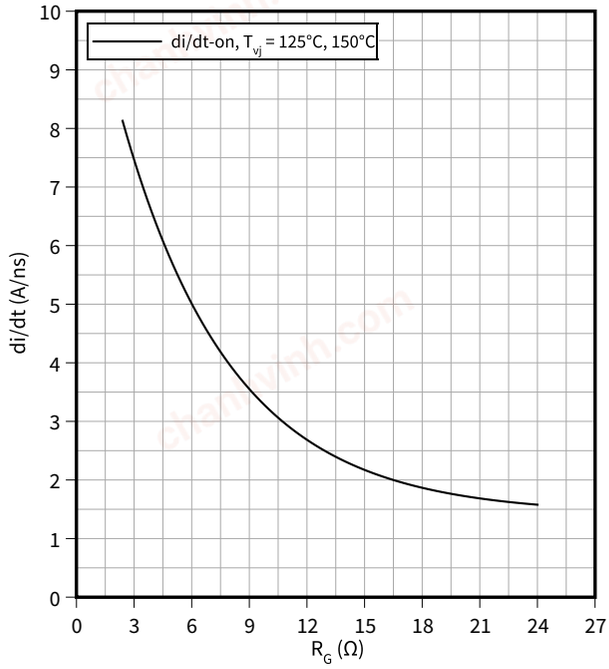
$V_{DD} = 600$ V, $I_D = 150$ A, $V_{GS} = -3/18$ V



Current slope (typical), MOSFET

$di/dt = f(R_G)$

$V_{DD} = 600$ V, $I_D = 150$ A, $V_{GS} = -3/18$ V

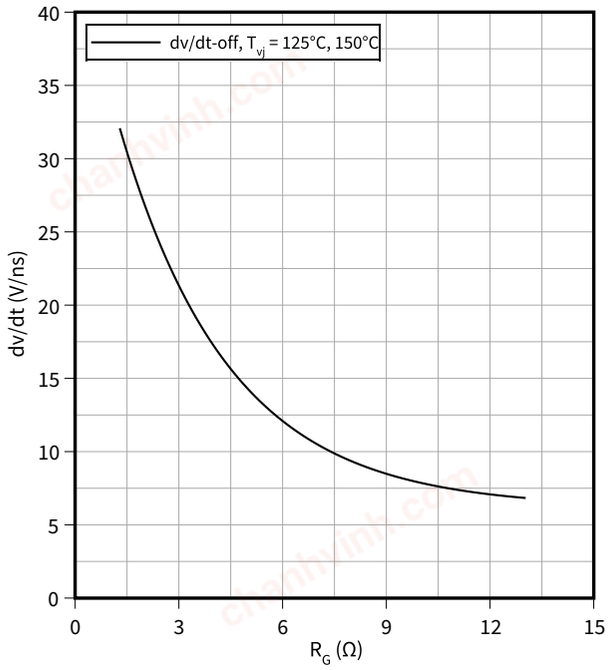


chanhvinh.com

Voltage slope (typical), MOSFET

dv/dt = f(R_G)

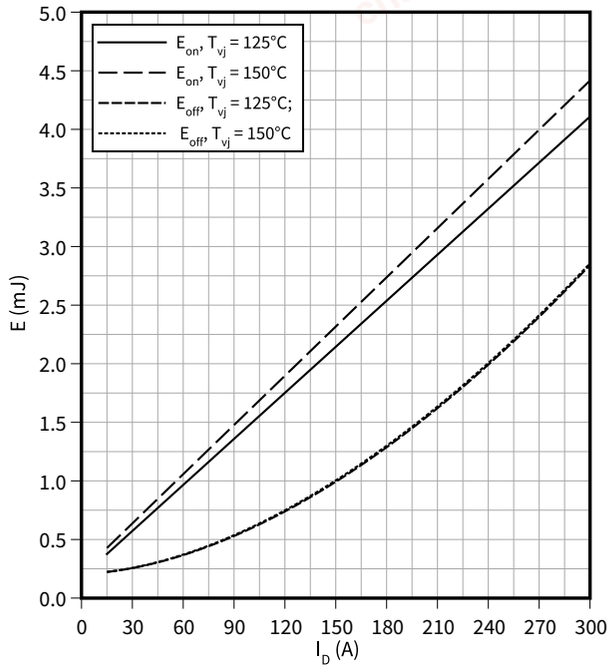
V_{DD} = 600 V, I_D = 150 A, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

E = f(I_D)

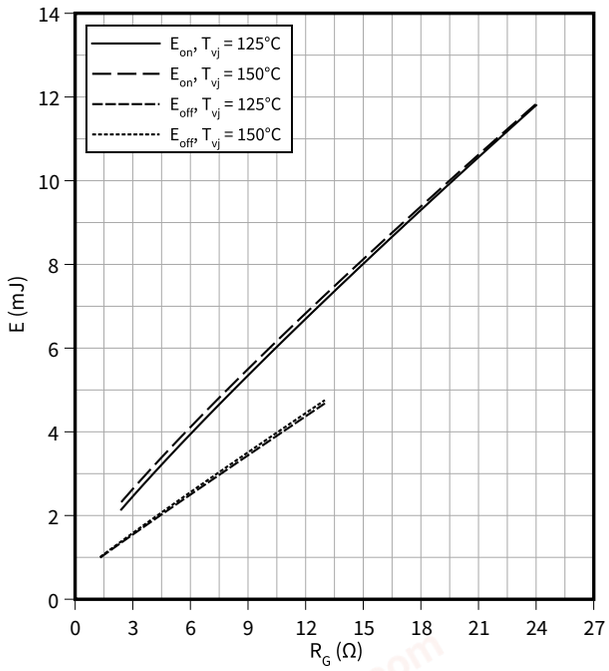
R_{Goff} = 1.3 Ω, R_{Gon} = 2.4 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V



Switching losses (typical), MOSFET

E = f(R_G)

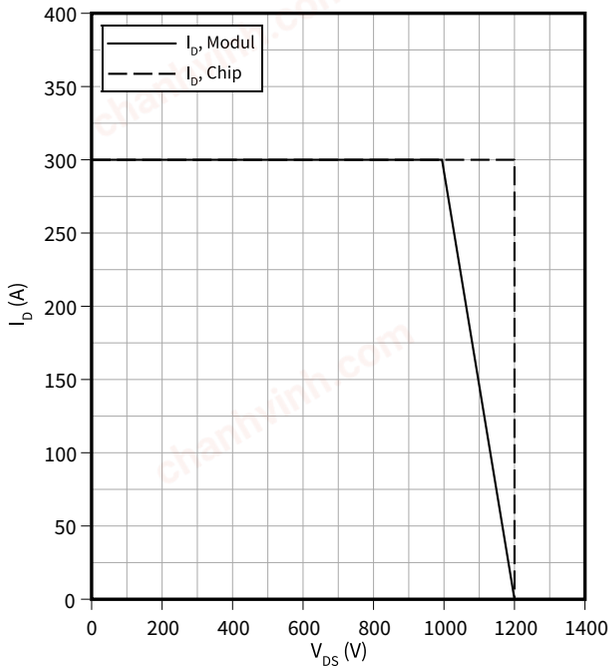
V_{DD} = 600 V, I_D = 150 A, V_{GS} = -3/18 V



Reverse bias safe operating area (RBSOA), MOSFET

I_D = f(V_{DS})

R_{Goff} = 1.3 Ω, T_{vj} = 150 °C, V_{GS} = -3/18 V

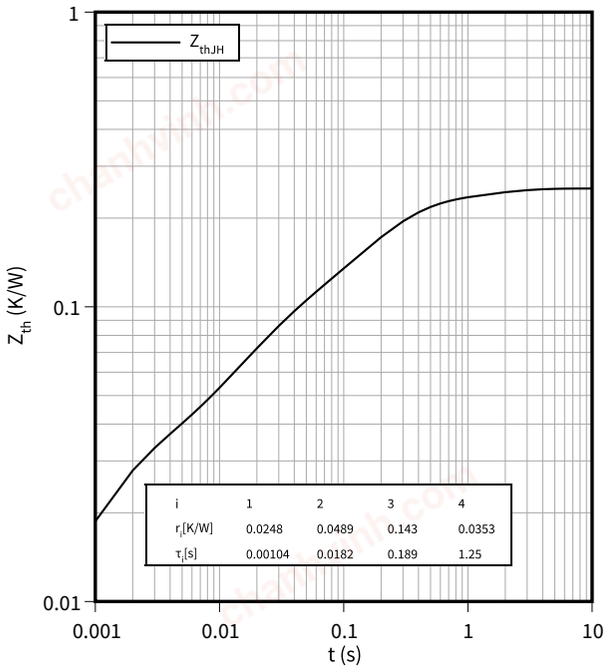


chanhvinh.com

5 Characteristics diagrams

Transient thermal impedance, MOSFET

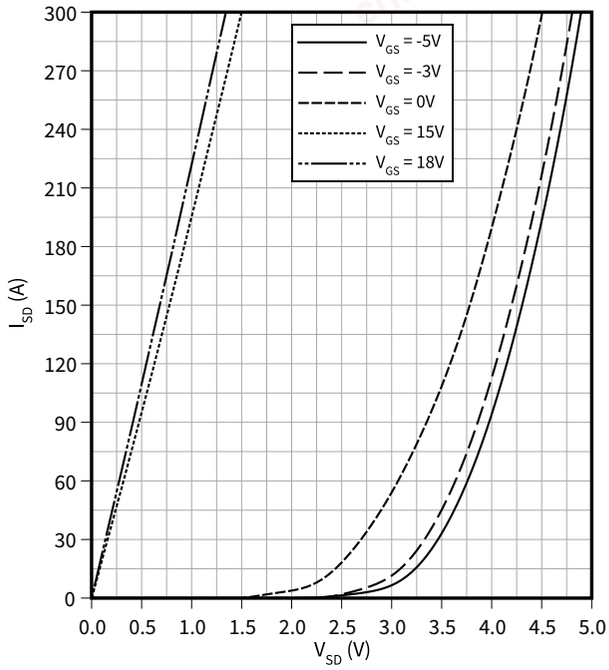
$Z_{th} = f(t)$



Forward characteristic body diode (typical), MOSFET

$I_{SD} = f(V_{SD})$

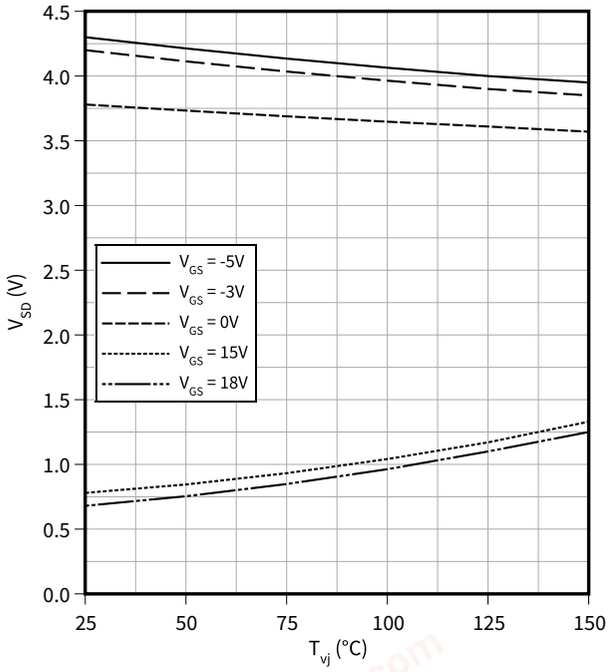
$T_{vj} = 25\ °C$



Forward voltage of body diode (typical), MOSFET

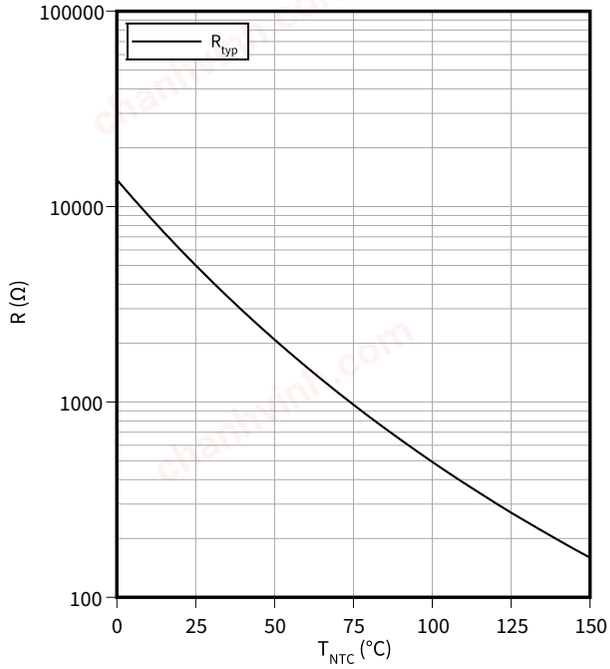
$V_{SD} = f(T_{vj})$

$I_{SD} = 150\ A$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



chanhvinh.com

6 Circuit diagram

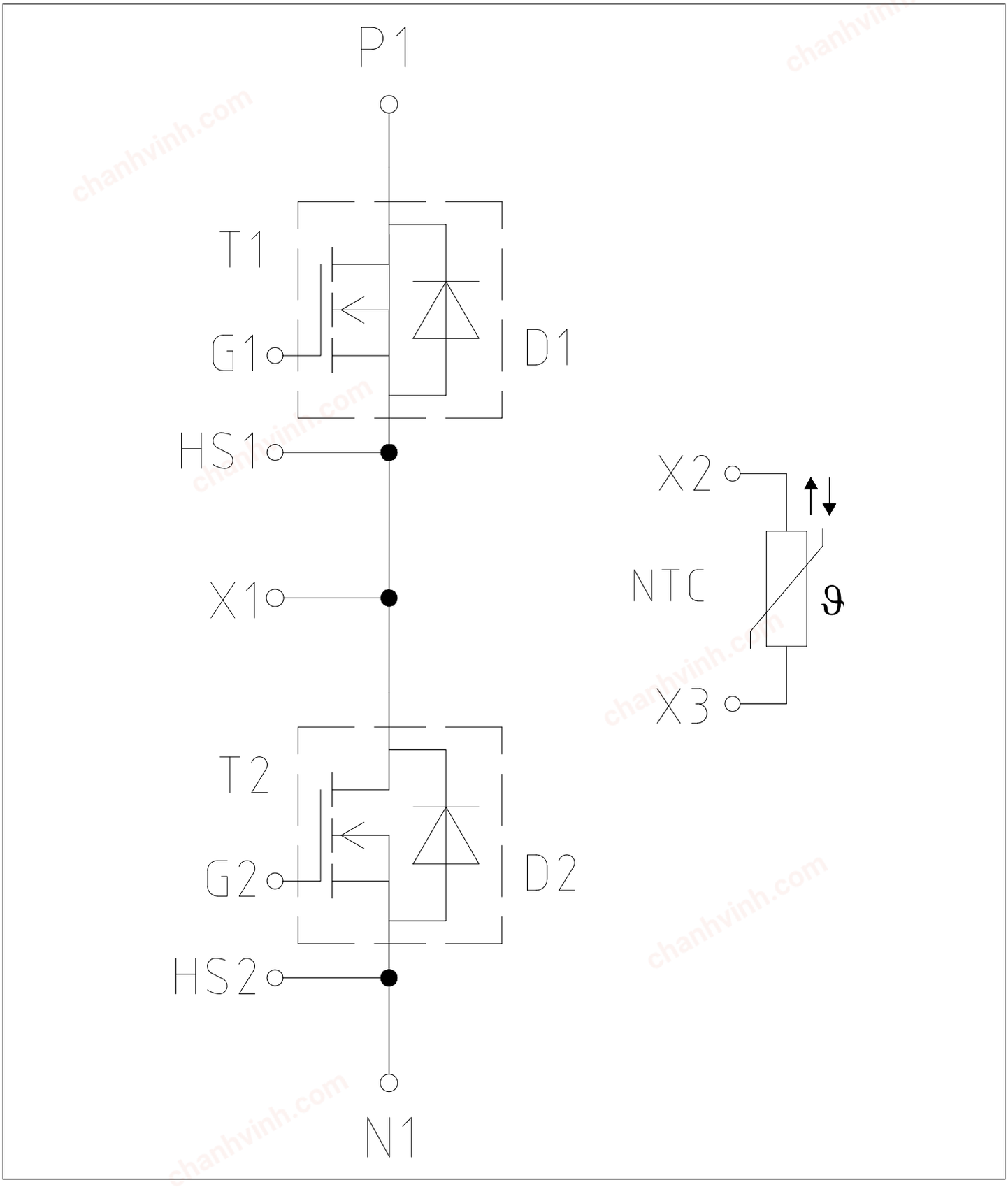


Figure 1

chanhvinh.com

7 Package outlines

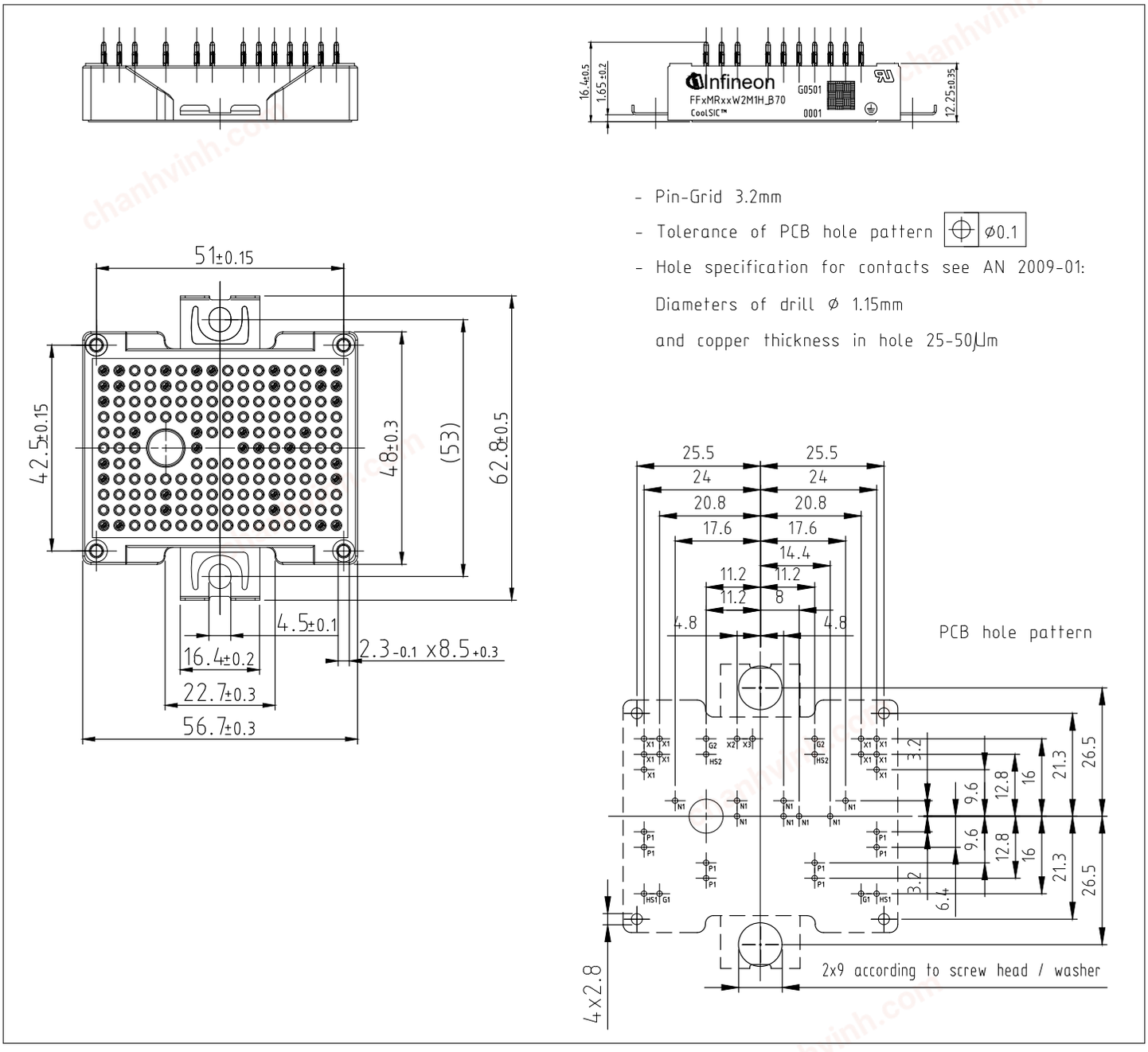


Figure 2

chanhvinh.com

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* 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

chanhvinh.com

Revision history

Document version	Date of release	Description of changes
0.20	2023-05-12	Preliminary datasheet

chanhvinh.com

chanhvinh.com

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2023-05-12

Published by

Infineon Technologies AG

81726 Munich, Germany

© 2023 Infineon Technologies AG

All Rights Reserved.

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-ABE422-002

Important notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”).

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer’s compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer’s products and any use of the product of Infineon Technologies in customer’s applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer’s technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies’ products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.