Final datasheet

EasyPACK™ 1B module with CoolMOS™ CFD7A Automotive MOSFET and PressFIT / NTC

Features



Typical appearance

- Electrical features
  - V_{DSS} = 650 V
  - I_{DN} = 12 A / I_{DRM} = 24 A
  - Low switching losses
  - Low inductive design
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - PressFIT contact technology
  - Integrated NTC temperature sensor
  - Rugged mounting due to integrated mounting clamps

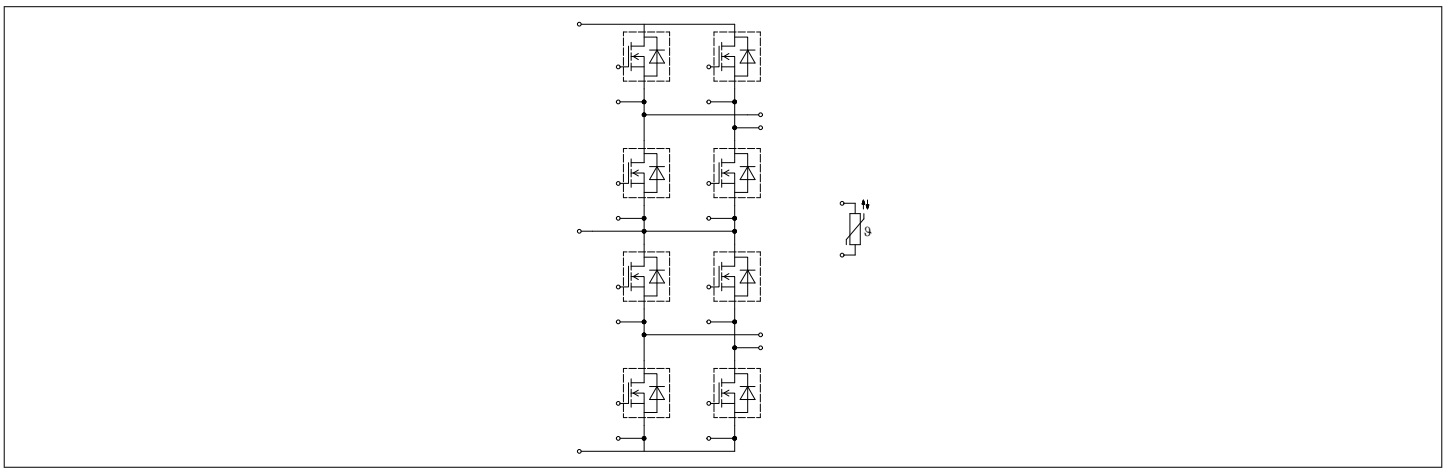
Potential applications

- Automotive applications
- DC charger for EV
- High-frequency switching application

Product validation

- Qualified according to AQG 324, release no.: 02.1/2019

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
Isolation test voltage NTC	$V_{ISOL(NTC)}$	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}			19		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		5.1		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting force per clamp	*F*		20		50	N
Weight	*G*			24		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	650	V
			T_{vj} = -40 °C	605	
Continuous DC drain current	I_{DDC}	T_{vj} = 150 °C, V_{GS} = 10 V	T_H = 85 °C	12	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		24	A
Gate-source voltage, max. transient voltage	V_{GS}	$f_{repetition}$ = 100 kHz, t_{pulse} = 2 ns		±30	V
Gate-source voltage, max. static voltage	V_{GS}			±20	V
dv/dt ruggedness	*dv/dt*	V_{DS} = 0...400 V		120	V/ns

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Table 4 Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
On-state gate voltage	$V_{GS(on)}$		10	V
Off-state gate voltage	$V_{GS(off)}$		0	V

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-resistance	$R_{DS(on)}$	I_D = 12 A	V_{GS} = 10 V, T_{vj} = 25 °C		90	119	mΩ
			V_{GS} = 10 V, T_{vj} = 125 °C		159		
			V_{GS} = 10 V, T_{vj} = 150 °C		183		
Gate threshold voltage	$V_{GS(th)}$	I_D = 0.58 mA, V_{DS} = V_{GS}, T_{vj} = 25 °C		3.55	4	4.45	V
Total gate charge	Q_G	V_{DD} = 400 V, V_{GS} = 0/10 V, T_{vj} = 25 °C			0.048		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			5.8		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		2.31		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.033		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.007		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 400 V, V_{GS} = 0 V, T_{vj} = 25 °C			6.4		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 650 V, V_{GS} = 0 V	T_{vj} = 25 °C			4.8	µA
Gate-source leakage current	I_{GSS}	V_{DS} = 0 V, T_{vj} = 25 °C	V_{GS} = 20 V			100	nA
Turn-on delay time (inductive load)	$t_{d\,on}$	I_D = 12 A, R_{Gon} = 24 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		159		ns
			T_{vj} = 125 °C		156		
			T_{vj} = 150 °C		154		
Rise time (inductive load)	t_r	I_D = 12 A, R_{Gon} = 24 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		26		ns
			T_{vj} = 125 °C		34		
			T_{vj} = 150 °C		39		
Turn-off delay time (inductive load)	$t_{d\,off}$	I_D = 12 A, R_{Goff} = 0.75 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		76		ns
			T_{vj} = 125 °C		93		
			T_{vj} = 150 °C		94		

(table continues...)

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Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Fall time (inductive load)	t_f	I_D = 12 A, R_{Goff} = 0.75 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		10		ns
			T_{vj} = 125 °C		12		
			T_{vj} = 150 °C		13		
Turn-on energy loss per pulse	E_{on}	I_D = 12 A, V_{DD} = 400 V, L_σ = 10 nH, V_{GS} = 0/10 V, R_{Gon} = 24 Ω, di/dt = 0.725 kA/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.81		mJ
			T_{vj} = 125 °C		1.37		
			T_{vj} = 150 °C		1.56		
Turn-off energy loss per pulse	E_{off}	I_D = 12 A, V_{DD} = 400 V, L_σ = 10 nH, V_{GS} = 0/10 V, R_{Goff} = 0.75 Ω, dv/dt = 24.5 kV/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.02		mJ
			T_{vj} = 125 °C		0.028		
			T_{vj} = 150 °C		0.032		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, λ_{grease} = 1 W/(m·K)			1.8		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

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} = 150 °C, V_{GS} = 0 V	T_H = 125 °C	12	A
Pulsed body diode current	$I_{SD\,pulse}$			24	A
dv/dt ruggedness	dv/dt	V_{DS} = 0...400 V, I_{SD} ≤ 12 A	T_{vj} = 25 °C	70	V/ns
di/dt ruggedness	di/dt	V_{DS} = 0...400 V, I_{SD} ≤ 12 A	T_{vj} = 25 °C	1300	A/µs

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 12 A, V_{GS} = 0 V	T_{vj} = 25 °C		1.05	1.35	V
			T_{vj} = 125 °C		0.92		
			T_{vj} = 150 °C		0.88		
Peak reverse recovery current	I_{rrm}	I_{SD} = 12 A, di_S/dt = 0.725 kA/µs, V_{DD} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		31.5		A
			T_{vj} = 125 °C		56		
			T_{vj} = 150 °C		61		

(table continues...)

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Table 7 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Recovered charge	Q_{rr}	I_{SD} = 12 A, di_S/dt = 0.725 kA/µs, V_{DD} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		1.68		µC
			T_{vj} = 125 °C		3.45		
			T_{vj} = 150 °C		4.07		
Reverse recovery energy	E_{rec}	I_{SD} = 12 A, V_{DD} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.23		mJ
			T_{vj} = 125 °C		0.45		
			T_{vj} = 150 °C		0.51		

4 NTC-Thermistor

Table 8 Characteristic values

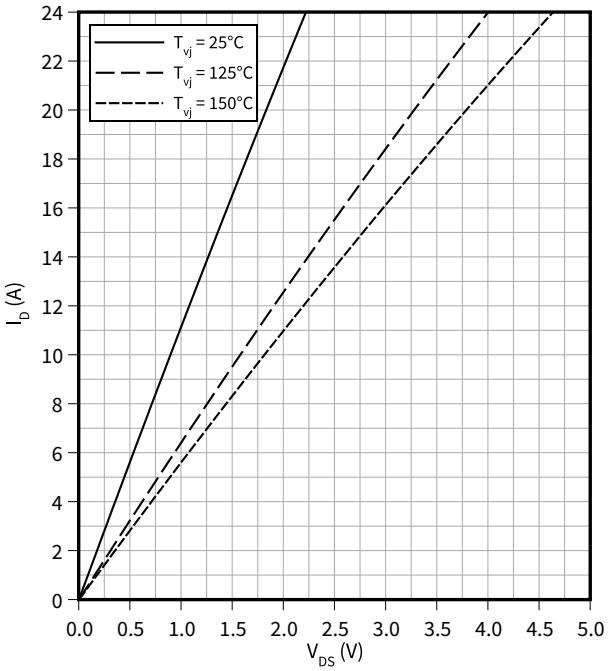
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 25 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298{,}15\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

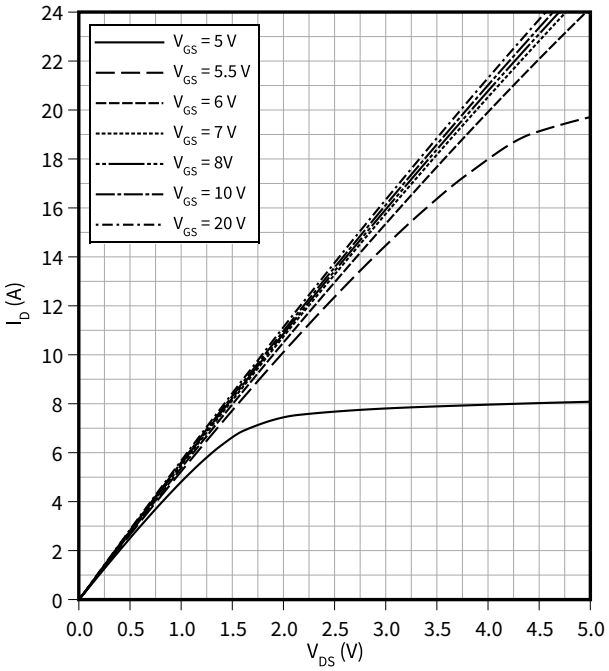
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5 Characteristics diagrams

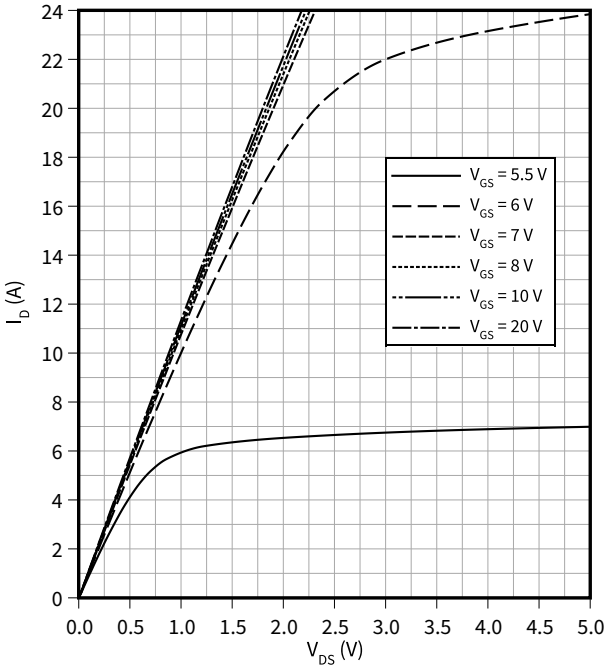
Output characteristic (typical), MOSFET
$I_D = f(V_{DS})$
$V_{GS} = 10$ V



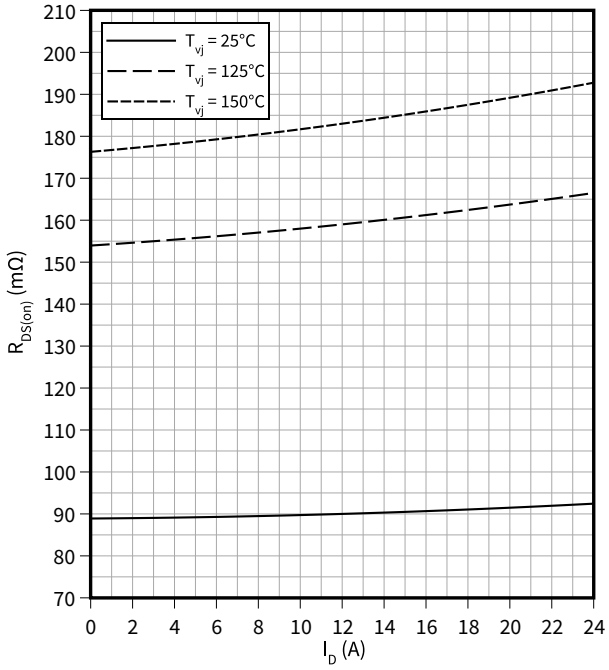
Output characteristic field (typical), MOSFET
$I_D = f(V_{DS})$
$T_{vj} = 150$ °C



Output characteristic field (typical), MOSFET
$I_D = f(V_{DS})$
$T_{vj} = 25$ °C



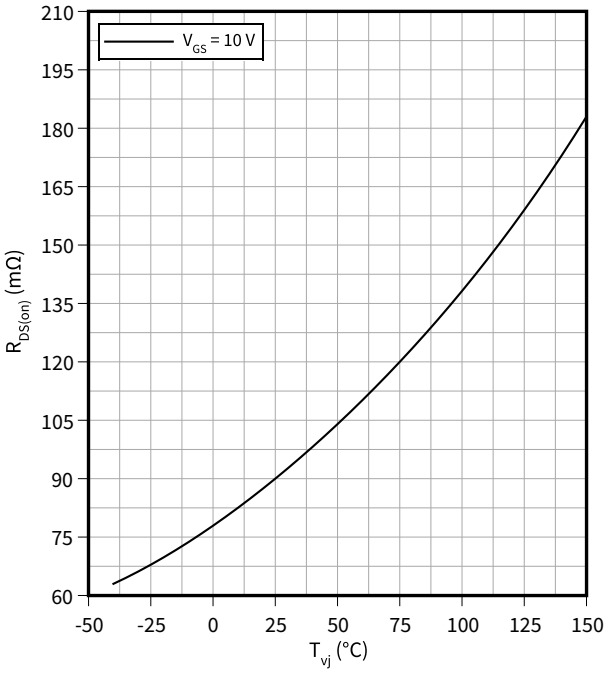
Drain source on-resistance (typical), MOSFET
$R_{DS(on)} = f(I_D)$
$V_{GS} = 10$ V



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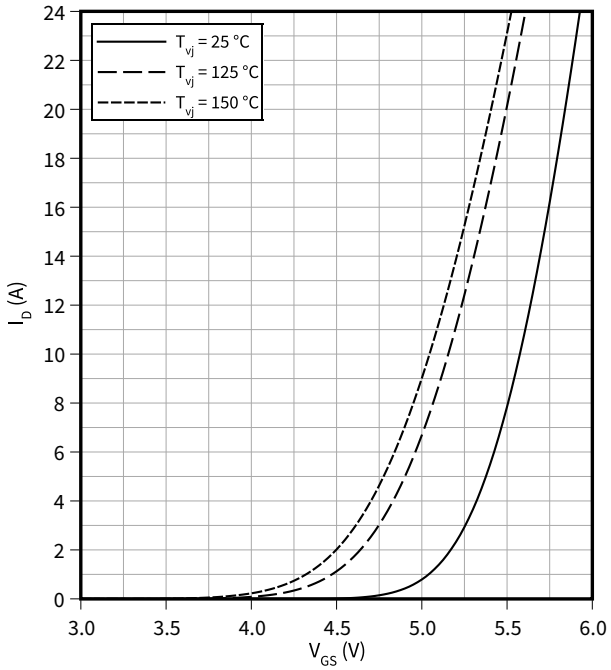
Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(T_{vj})$
$I_D = 12$ A



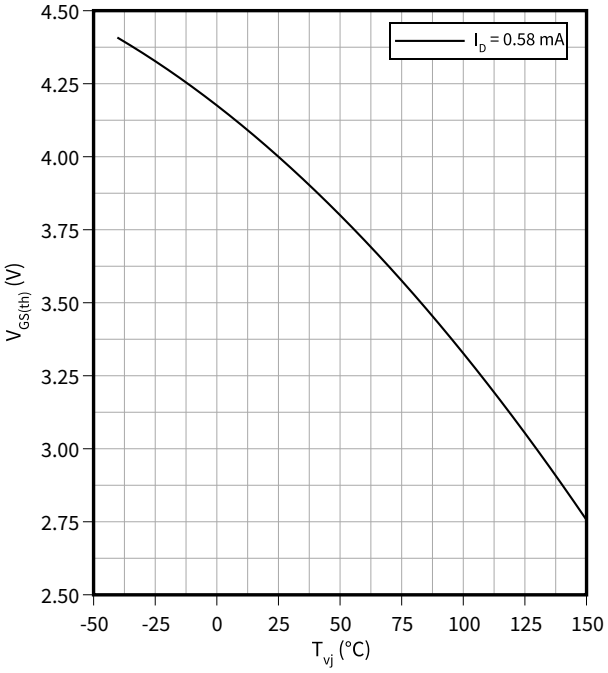
Transfer characteristic (typical), MOSFET

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



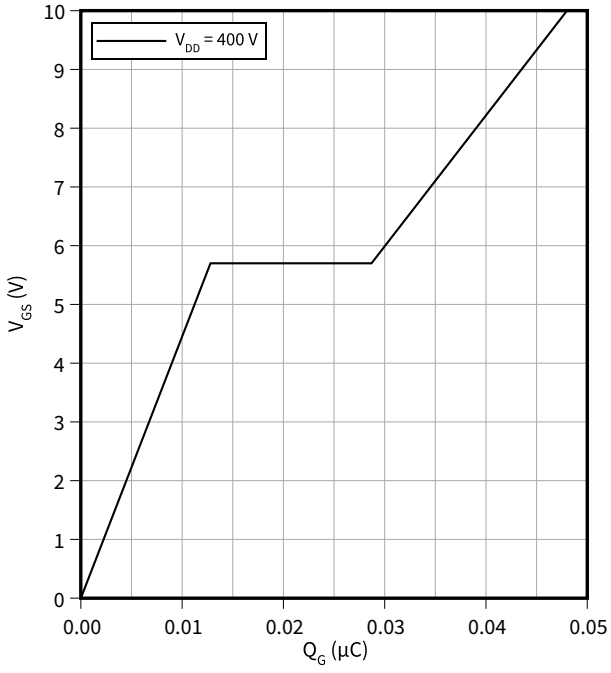
Gate-source threshold voltage (typical), MOSFET

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



Gate charge characteristic (typical), MOSFET

$V_{GS} = f(Q_G)$
$I_D = 12$ A, $T_{vj} = 25$ °C

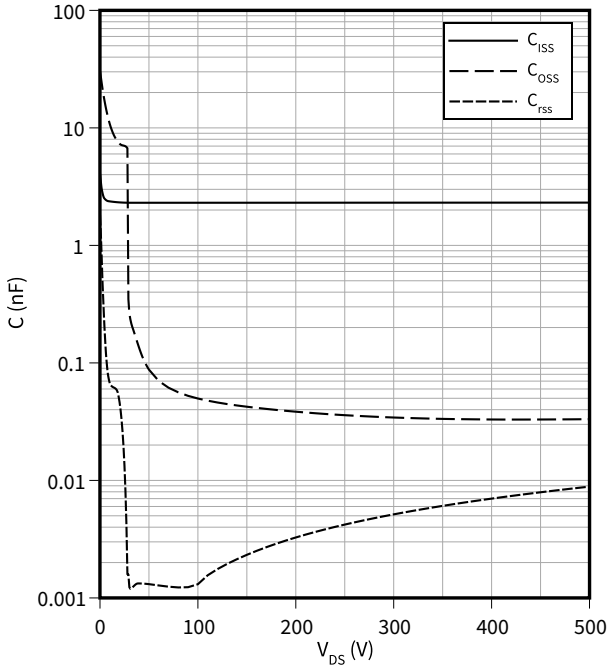


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Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

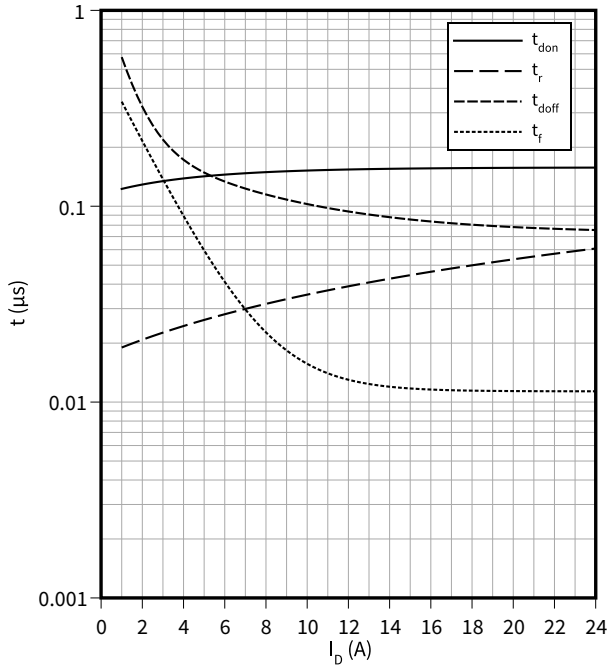
$f = 100\ kHz$, $T_{vj} = 25\ °C$, $V_{GS} = 0\ V$



Switching times (typical), MOSFET

$t = f(I_D)$

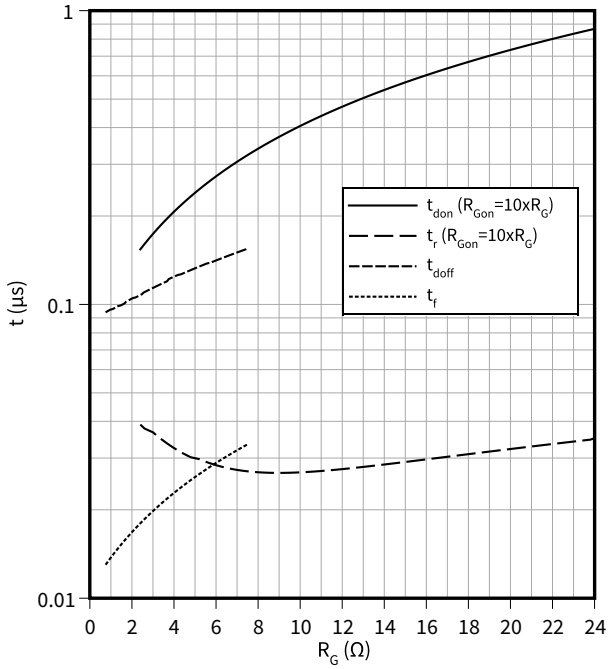
$R_{Goff} = 0{,}75\ \Omega$, $R_{Gon} = 24\ \Omega$, $V_{DD} = 400\ V$, $T_{vj} = 150\ °C$, $V_{GS} = 0/10\ V$



Switching times (typical), MOSFET

$t = f(R_G)$

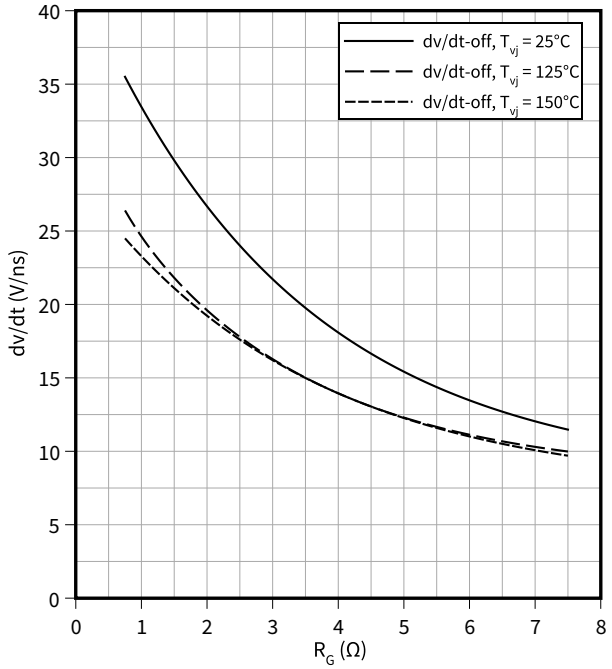
$V_{DD} = 400\ V$, $I_D = 12\ A$, $T_{vj} = 150\ °C$, $V_{GS} = 0/10\ V$



Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$

$V_{DD} = 400\ V$, $I_D = 12\ A$, $V_{GS} = 0/10\ V$

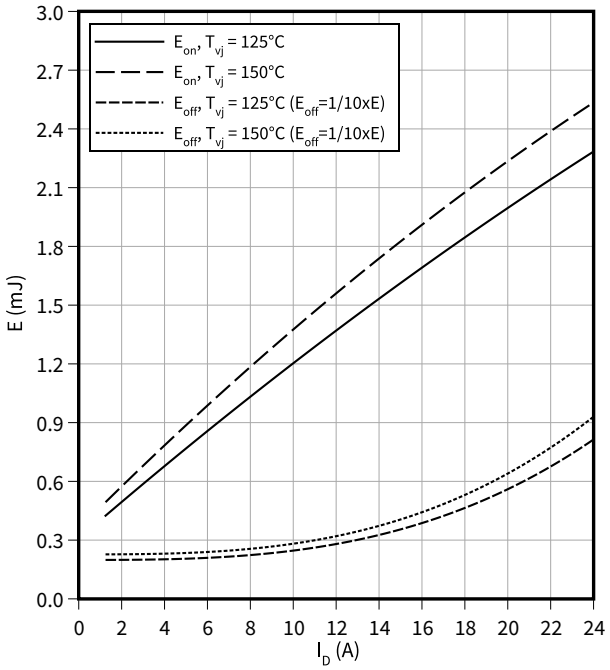


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Switching losses (typical), MOSFET

$E = f(I_D)$

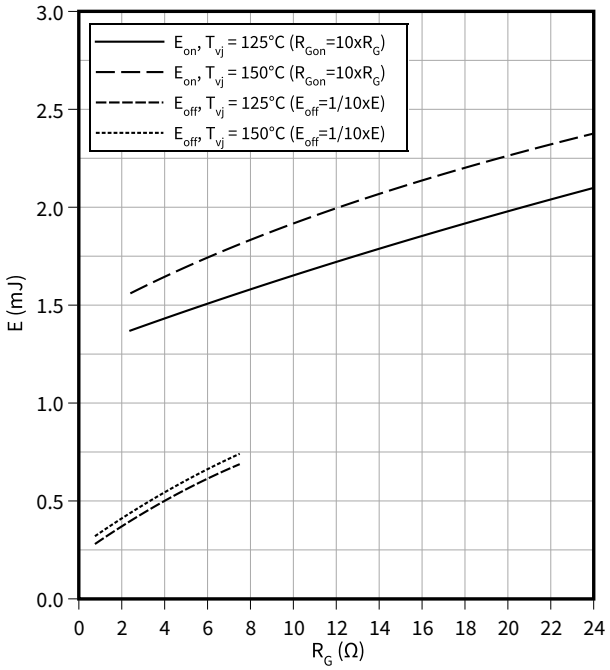
R_{Goff} = 0.75 Ω, R_{Gon} = 24 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V



Switching losses (typical), MOSFET

$E = f(R_G)$

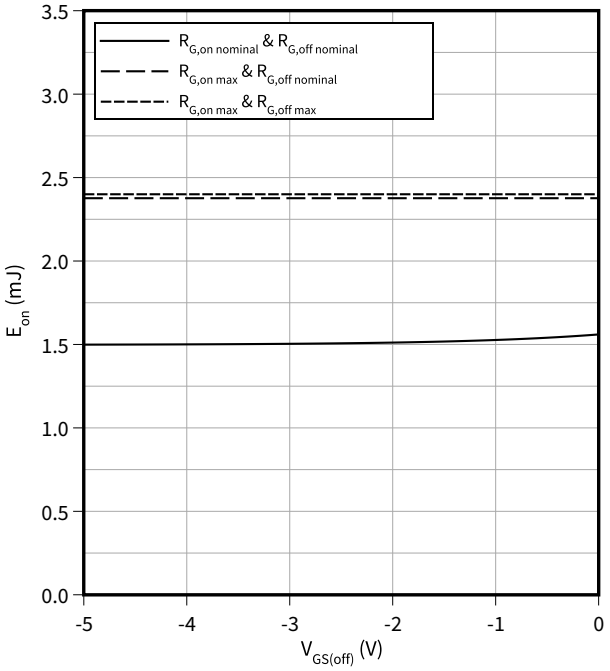
V_{DD} = 400 V, I_D = 12 A, V_{GS} = 0/10 V



Switching losses (typical), MOSFET

$E_{on} = f(V_{GS(off)})$

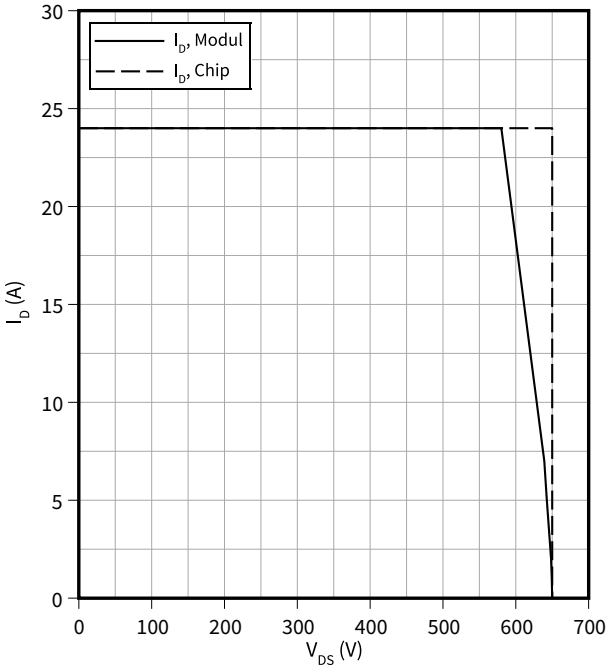
V_{DD} = 400 V, $V_{GS(on)}$ = 10 V, I_D = 12 A, T_{vj} = 150 °C



Reverse bias safe operating area (RBSOA), MOSFET

$I_D = f(V_{DS})$

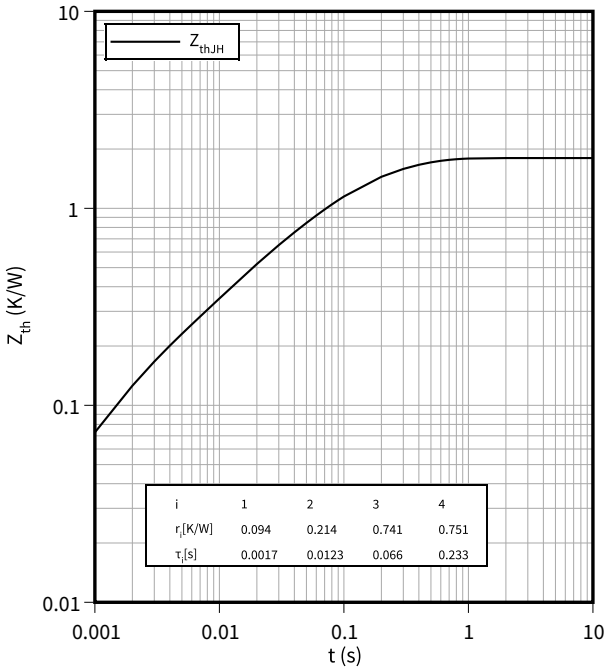
R_{Goff} = 0.75 Ω, T_{vj} = 150 °C, V_{GS} = 0/10 V



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Transient thermal impedance, MOSFET

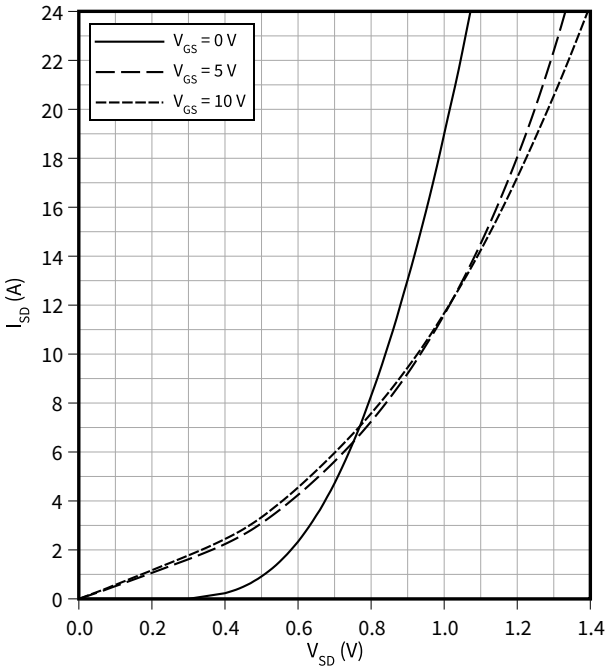
$Z_{th} = f(t)$



Forward characteristic body diode (typical), MOSFET

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

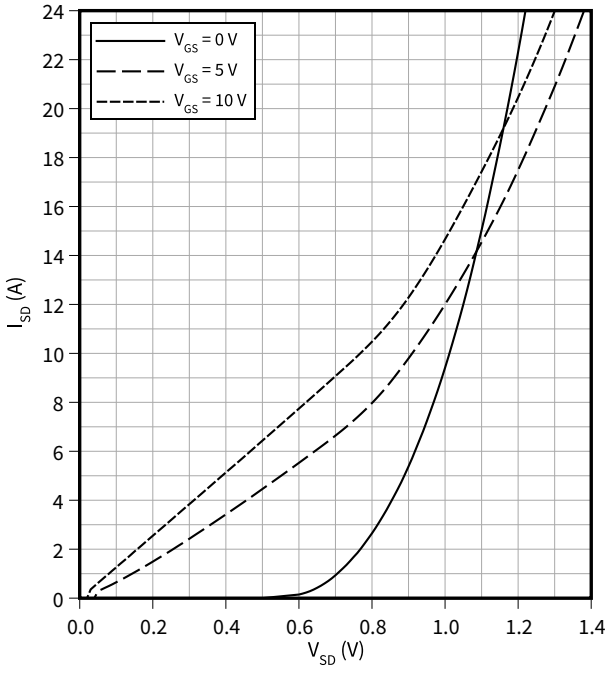
$T_{vj} = 150\ °C$



Forward characteristic body diode (typical), MOSFET

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

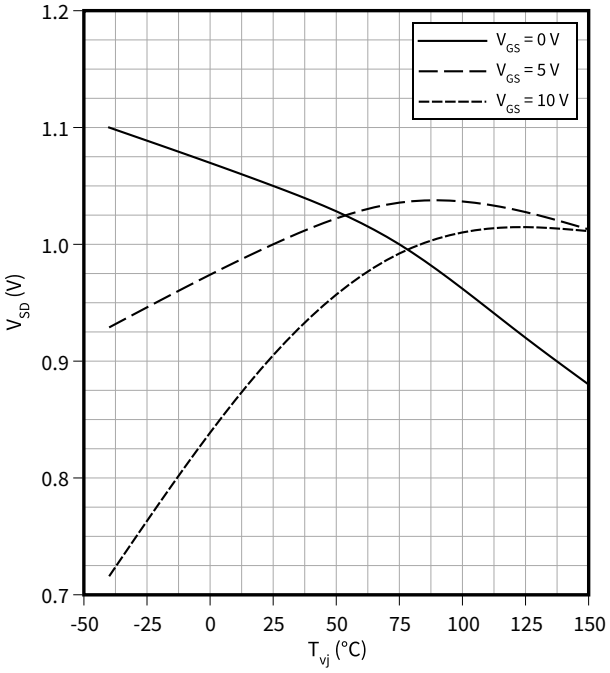
$T_{vj} = 25\ °C$



Forward voltage of body diode (typical), MOSFET

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

$I_{SD} = 12\ A$

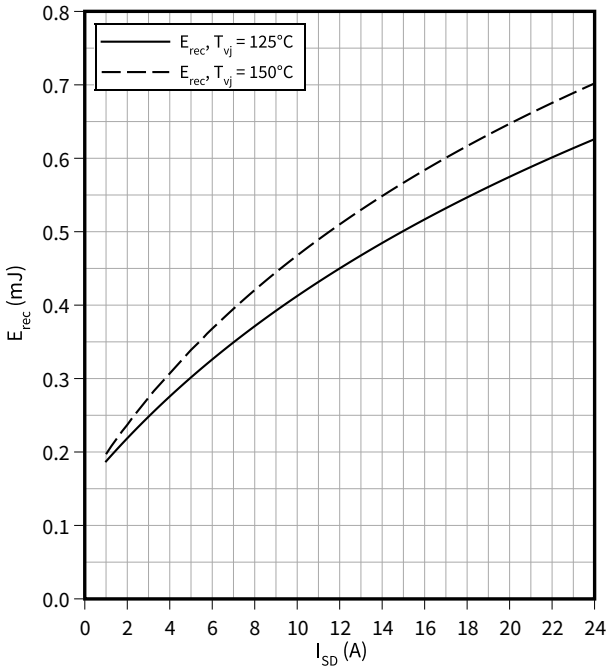


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Switching losses body diode (typical), MOSFET

$E_{rec} = f(I_{SD})$

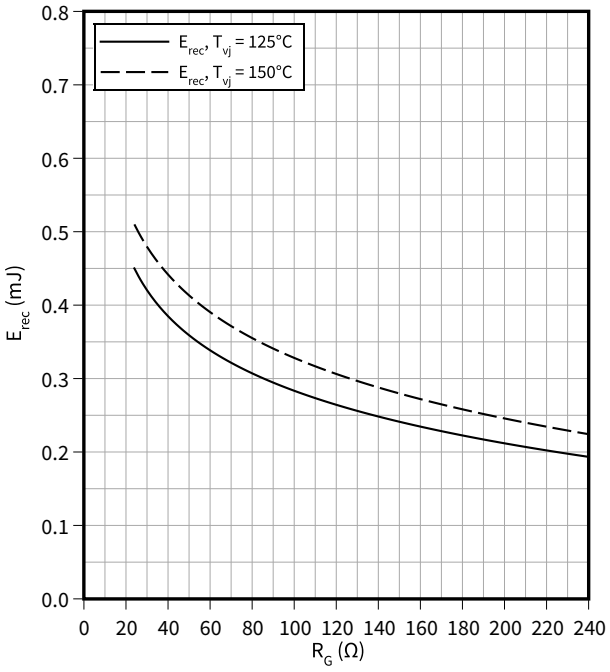
$R_{Gon} = 24\ \Omega$, $V_{DD} = 400$ V



Switching losses body diode (typical), MOSFET

$E_{rec} = f(R_G)$

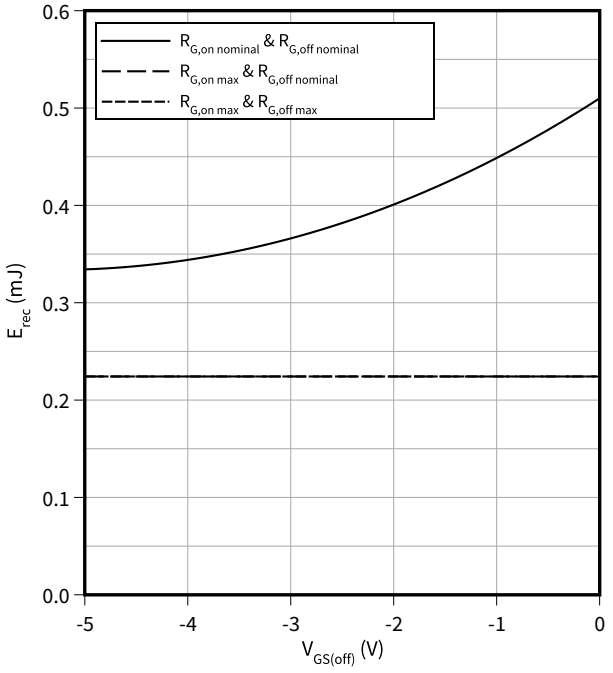
$V_{DD} = 400$ V, $I_{SD} = 12$ A



Switching losses body diode (typical), MOSFET

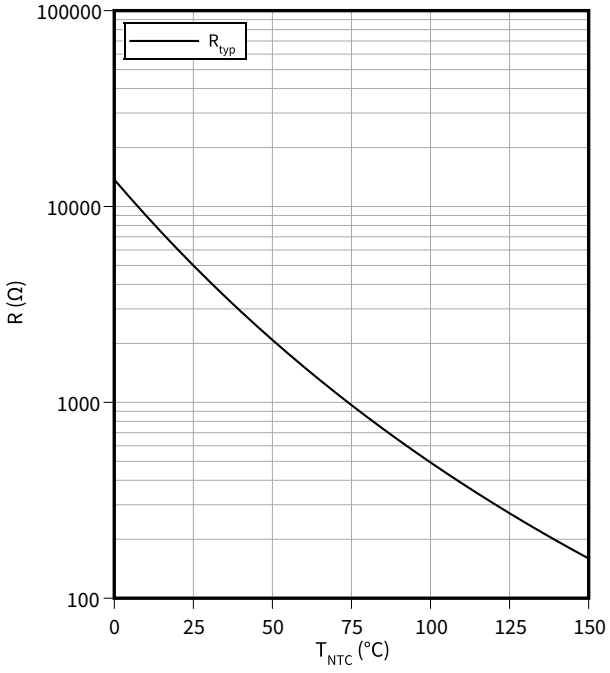
$E_{rec} = f(V_{GS(off)})$

$V_{GS(on)} = 10$ V, $I_{SD} = 12$ A, $V_{DD} = 400$ V, $T_{vj} = 150$ °C



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



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6 Circuit diagram

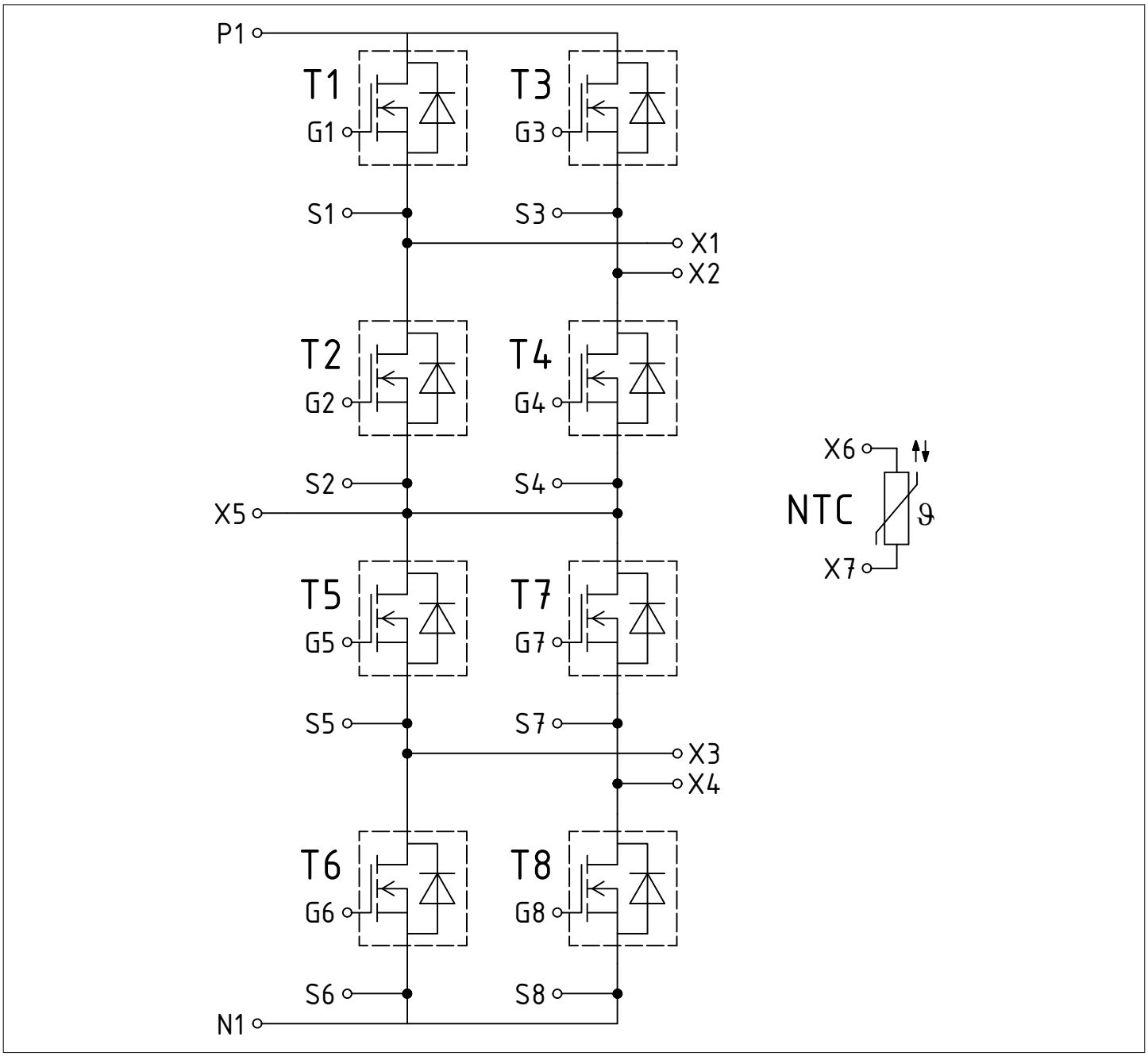


Figure 1

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7 Package outlines

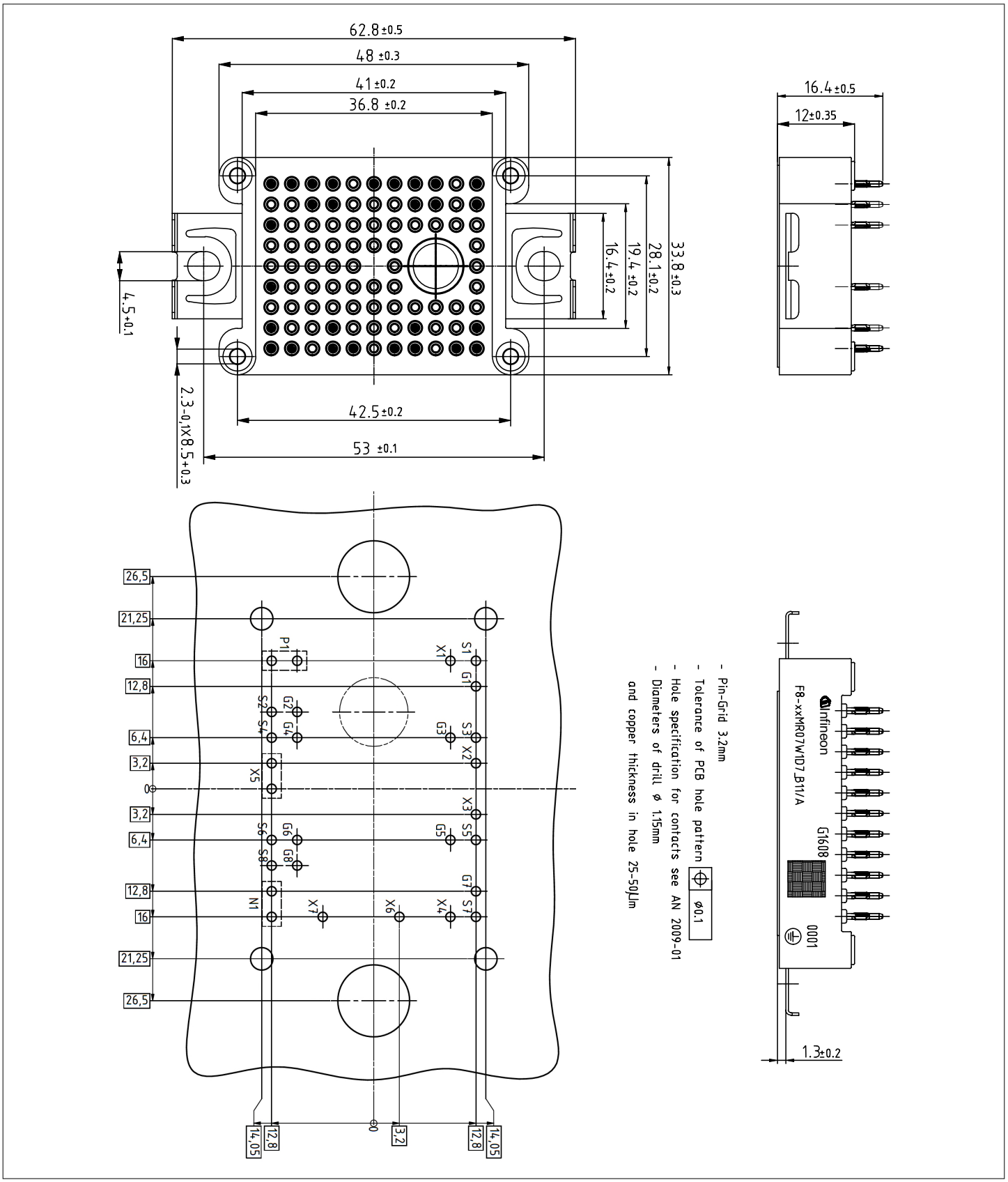


Figure 2

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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	71549142846550549911530		71549142846550549911530

Figure 3

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Revision history

Document revision	Date of release	Description of changes
0.10	2022-09-21	Initial version
1.00	2024-07-30	Final datasheet

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Edition 2024-07-30

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference
IFX-ABE911-002

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