Final datasheet

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

Features

Typical appearance

- Electrical features
  - V_{DSS} = 650 V
  - I_{DN} = 35 A / I_{DRM} = 70 A
  - Low switching losses
  - Low inductive design
  - Integrated snubber
- Mechanical features
  - PressFIT contact technology
  - Integrated NTC temperature sensor
  - Rugged mounting due to integrated mounting clamps

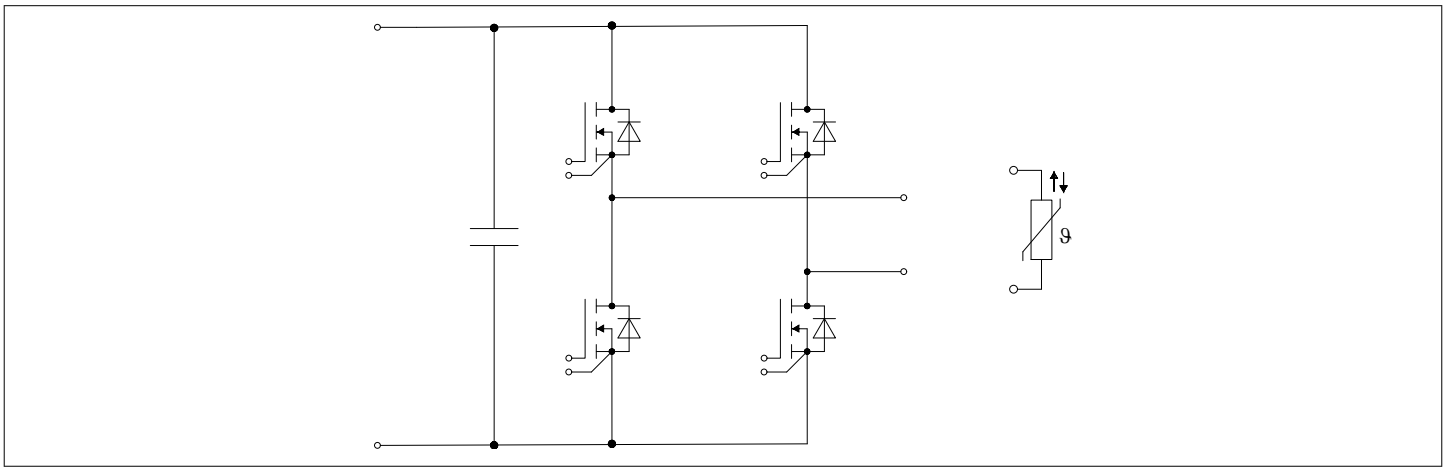
Potential applications

- Automotive auxillary 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
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	4.2	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.	
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		3.3		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	
Implemented drain current	I_{DN}			35	A
Continuous DC drain current	I_{DDC}	T_{vj} = 150 °C, V_{GS} = 10 V	T_H = 65 °C	30	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by T_{vjmax}		70	A
Gate-source voltage, max. transient voltage	V_{GS}	$f_{repetition}$ ≤ 100 kHz, t_{pulse} ≤ 2 ns		±30	V

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Gate-source voltage, max. static voltage	V_{GS}		±20	V
dv/dt ruggedness	dv/dt	V_{DS} = 0...400 V	120	V/ns

Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-resistance	$R_{DS(on)}$	I_D = 35 A	V_{GS} = 10 V, T_{vj} = 25 °C		30	39.4	mΩ
			V_{GS} = 10 V, T_{vj} = 125 °C		53		
			V_{GS} = 10 V, T_{vj} = 150 °C		61		
Gate threshold voltage	$V_{GS(th)}$	I_D = 1.74 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} = 10 V			0.141		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			3.8		Ω
Input capacitance	C_{ISS}	f = 100 kHz, V_{DS} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		6.95		nF
Output capacitance	C_{OSS}	f = 100 kHz, V_{DS} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.092		nF
Reverse transfer capacitance	C_{rss}	f = 100 kHz, V_{DS} = 400 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.021		nF
C_{OSS} stored energy	E_{OSS}	V_{DS} = 400 V, V_{GS} = 10 V, T_{vj} = 25 °C			17.9		µJ
Drain-source leakage current	I_{DSS}	V_{DS} = 650 V, V_{GS} = 0 V	T_{vj} = 25 °C			10	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 = 35 A, R_{Gon} = 12 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		146		ns
			T_{vj} = 125 °C		145		
			T_{vj} = 150 °C		145		
Rise time (inductive load)	t_r	I_D = 35 A, R_{Gon} = 12 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		11.5		ns
			T_{vj} = 125 °C		12.4		
			T_{vj} = 150 °C		12.8		
Turn-off delay time (inductive load)	$t_{d\,off}$	I_D = 35 A, R_{Goff} = 0 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		106		ns
			T_{vj} = 125 °C		114		
			T_{vj} = 150 °C		117		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Fall time (inductive load)	t_f	I_D = 35 A, R_{Goff} = 0 Ω, V_{DD} = 400 V, V_{GS} = 0/10 V	T_{vj} = 25 °C		4.7		ns
			T_{vj} = 125 °C		5.6		
			T_{vj} = 150 °C		5.9		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, λ_{grease} = 1 W/(m·K)			0.992		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

3 Body diode (MOSFET)

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
DC body diode forward current	I_{SD}	T_{vj} = 25 °C, V_{GS} = 0 V	T_H = 65 °C	35	A
dv/dt ruggedness	dv/dt	V_{DS} = 0...400 V, I_{SD} ≤ 35 A	T_{vj} = 25 °C	70	V/ns
di/dt ruggedness	di/dt	V_{DS} = 0...400 V, I_{SD} ≤ 35 A	T_{vj} = 25 °C	1300	A/µs

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_{SD}	I_{SD} = 35 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		

4 Capacitor

Table 7 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated DC voltage	V_{DC}	T = 25 °C		630		V
Capacitance value	C_{nom}	T = 25 °C		66		nF
Temperature range	T_{cap}		-40		125	°C

5 NTC-Thermistor

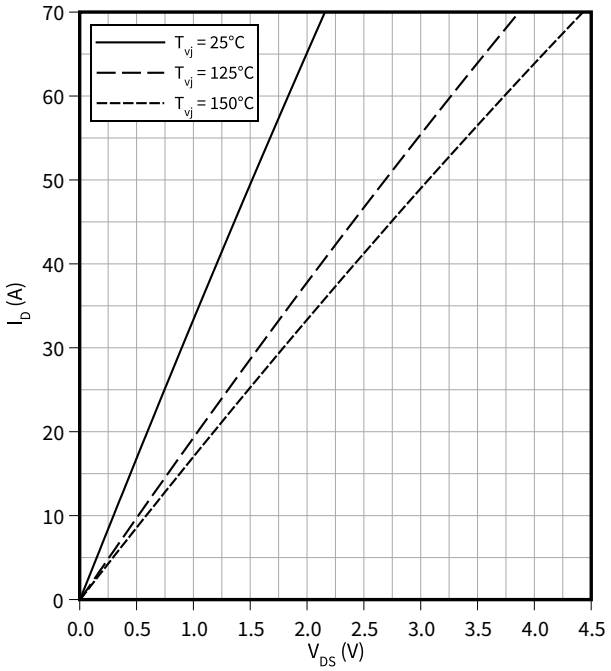
Table 8 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C	9.7	10	10.3	kΩ
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$		3447		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2\text{-}1/(298{,}15\ K))]$		3487		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2\text{-}1/(298{,}15\ K))]$		3510		K

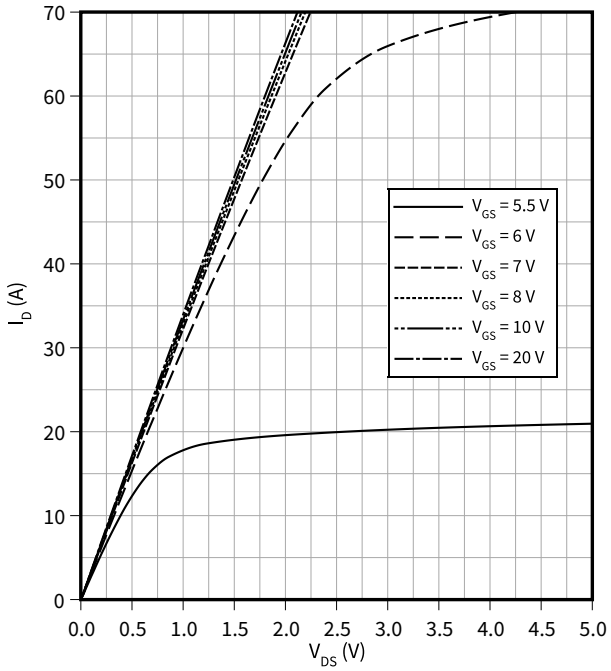
Note: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4

6 Characteristics diagrams

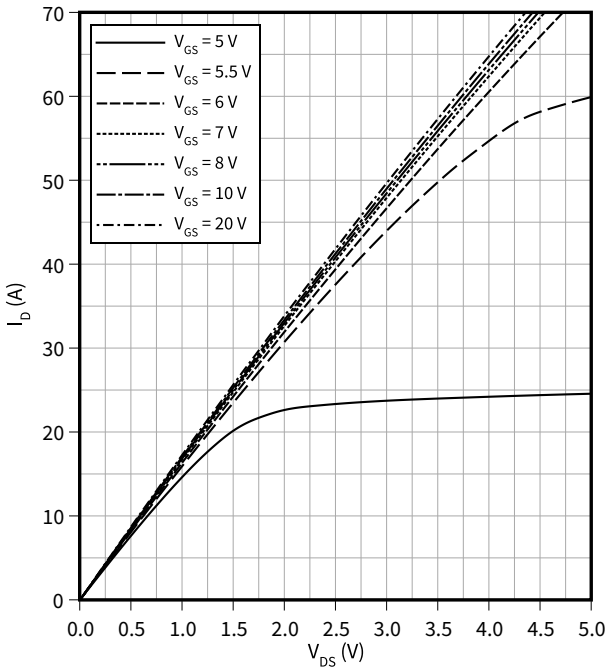
Output characteristic (typical), MOSFET
$I_D = f(V_{DS})$
V_{GS} = 10 V



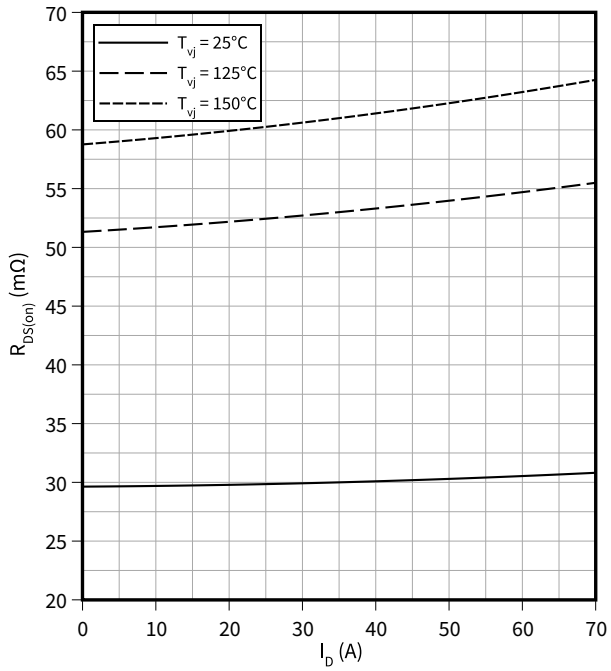
Output characteristic field (typical), MOSFET
$I_D = f(V_{DS})$
T_{vj} = 25 °C



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

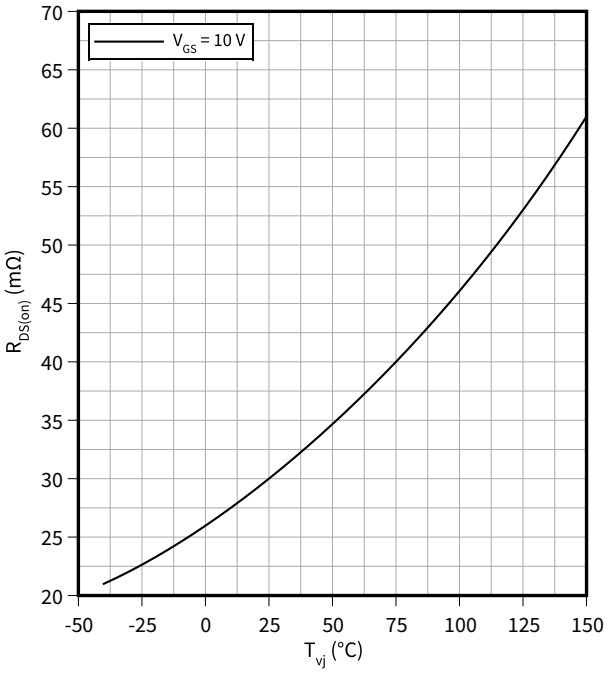


Drain source on-resistance (typical), MOSFET
$R_{DS(on)} = f(I_D)$
V_{GS} = 10 V



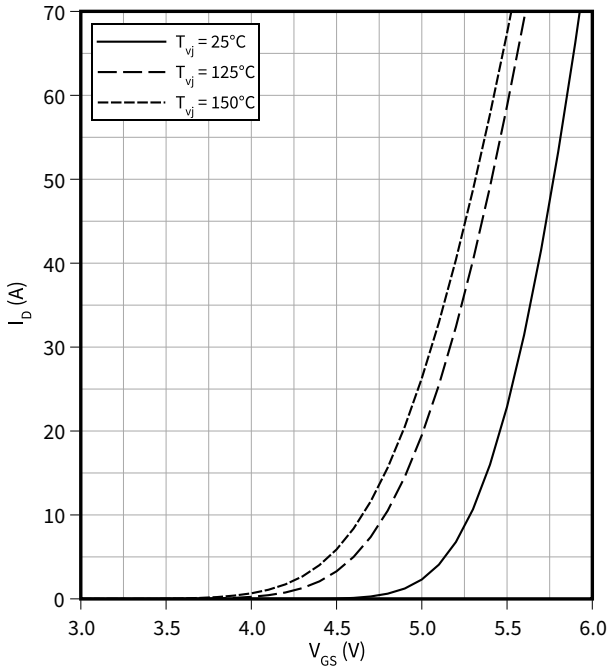
Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(T_{vj})$
$I_D = 35$ A



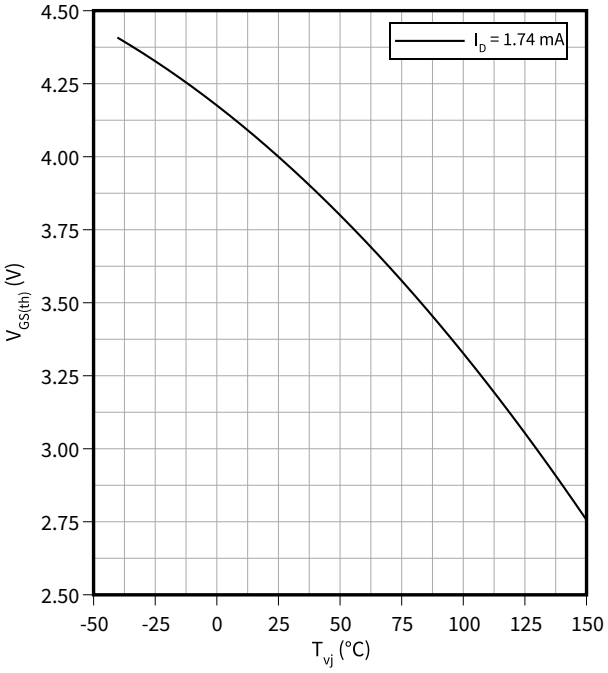
Transfer characteristic (typical), MOSFET

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



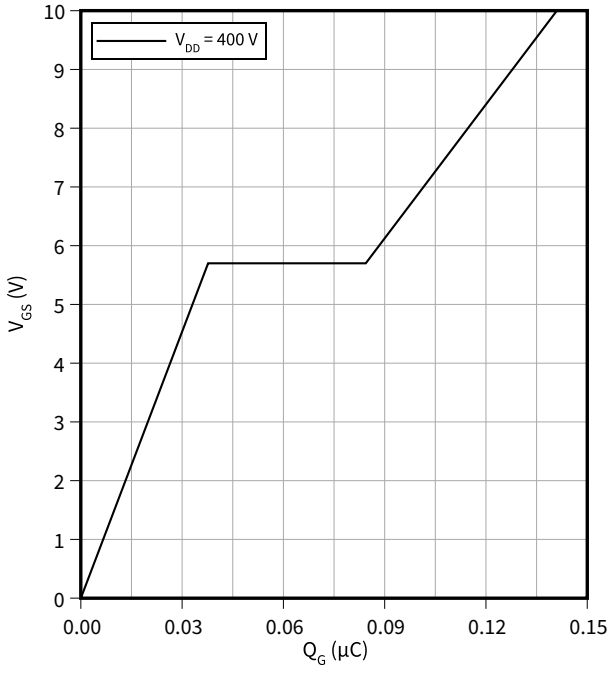
Gate-source threshold voltage (typical), MOSFET

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



Gate charge characteristic (typical), MOSFET

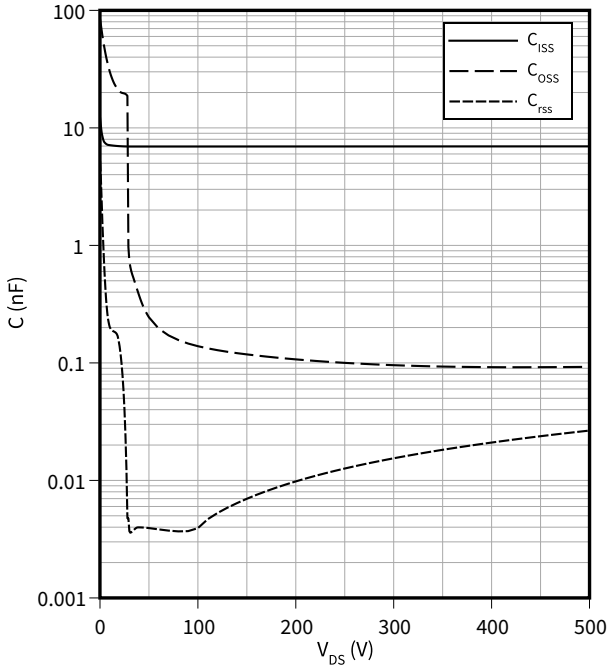
$V_{GS} = f(Q_G)$
$I_D = 35$ A, $T_{vj} = 25$ °C



Capacity characteristic (typical), MOSFET

$C = f(V_{DS})$

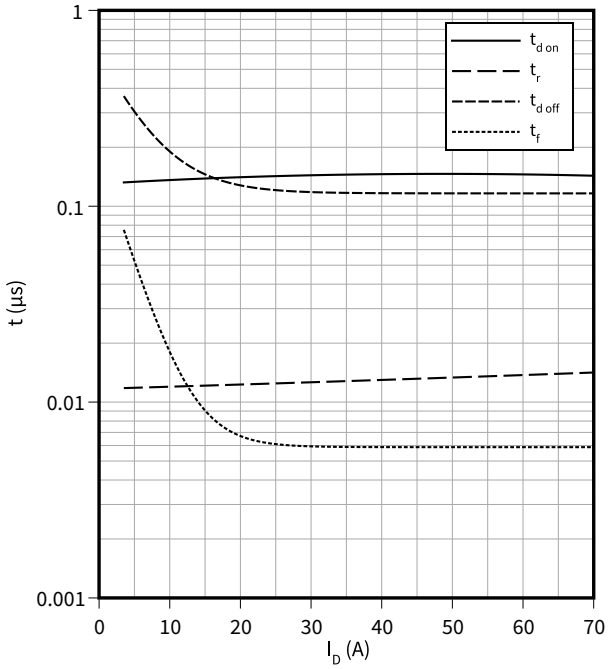
T_{vj} = 25 °C, f = 100 kHz, V_{GS} = 0 V



Switching times (typical), MOSFET

$t = f(I_D)$

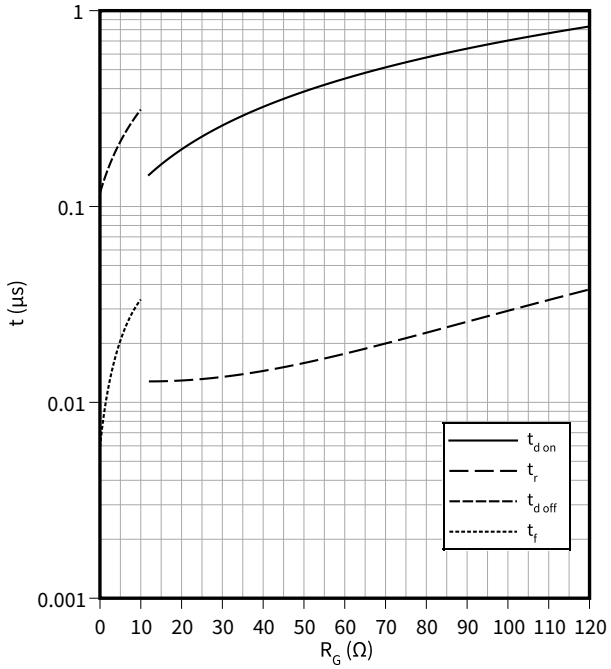
R_{Goff} = 0 Ω, R_{Gon} = 12 Ω, V_{DD} = 400 V, T_{vj} = 150 °C, V_{GS} = 0/10 V



Switching times (typical), MOSFET

$t = f(R_G)$

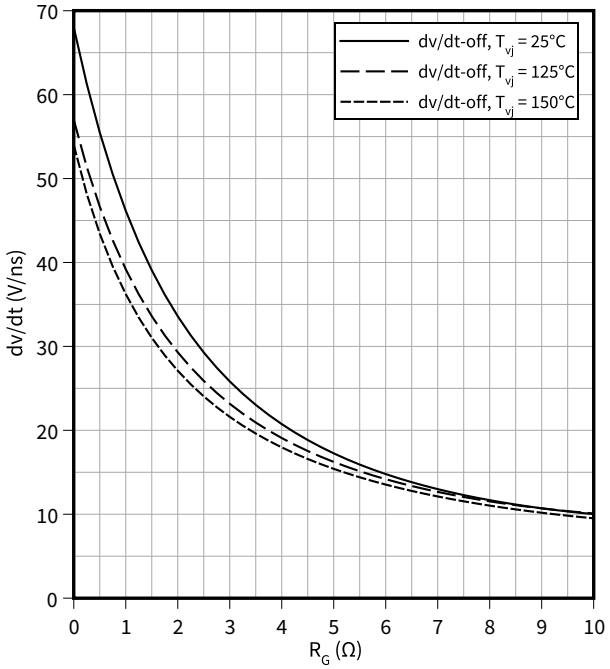
V_{DD} = 400 V, I_D = 35 A, T_{vj} = 150 °C, V_{GS} = 0/10 V



Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$

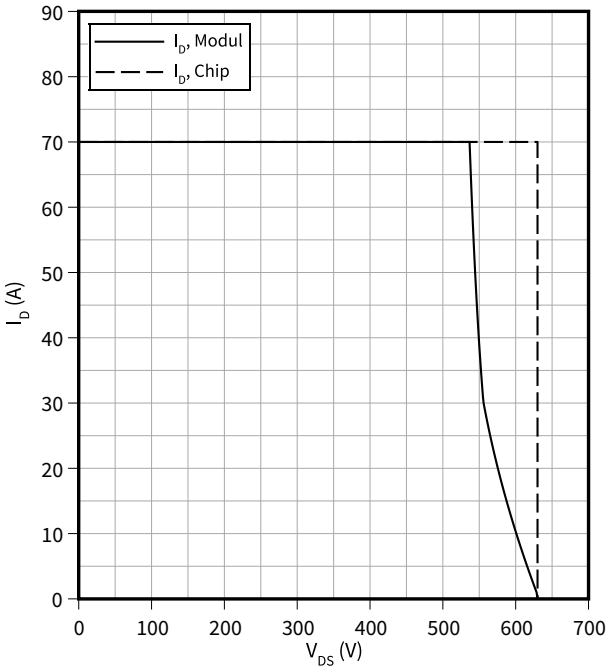
V_{DD} = 400 V, I_D = 35 A, V_{GS} = 0/10 V



Reverse bias safe operating area (RBSOA), MOSFET

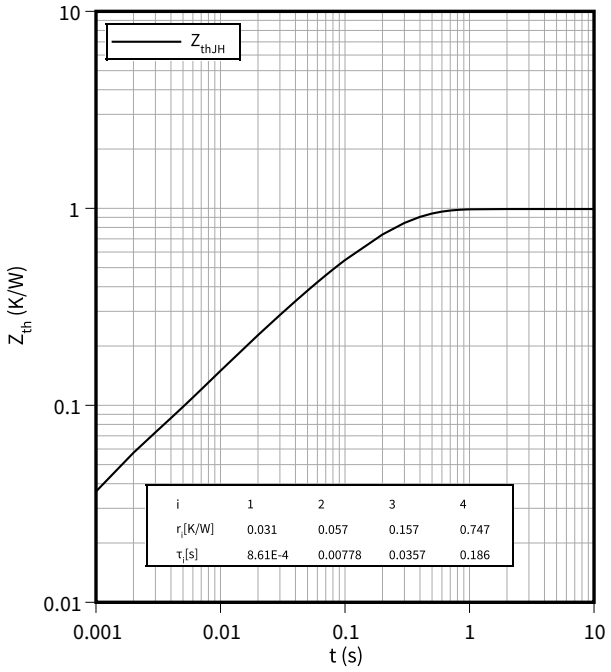
$I_D = f(V_{DS})$

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



Transient thermal impedance, MOSFET

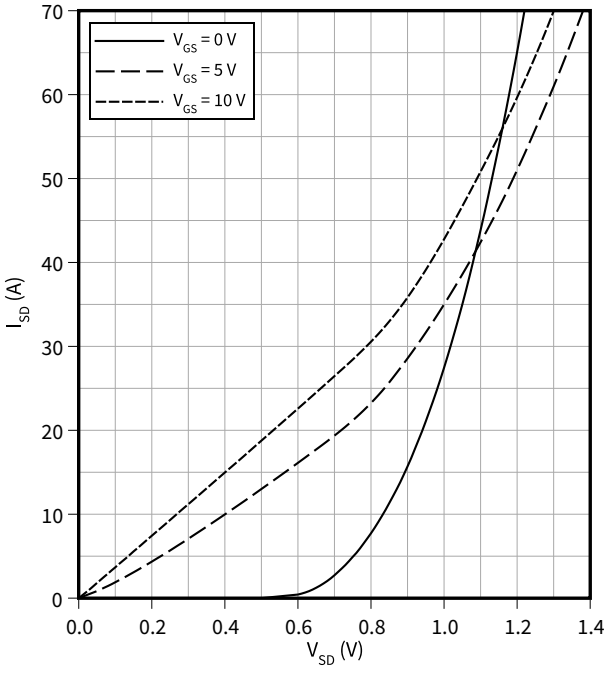
$Z_{th} = f(t)$



Forward characteristic body diode (typical), MOSFET

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

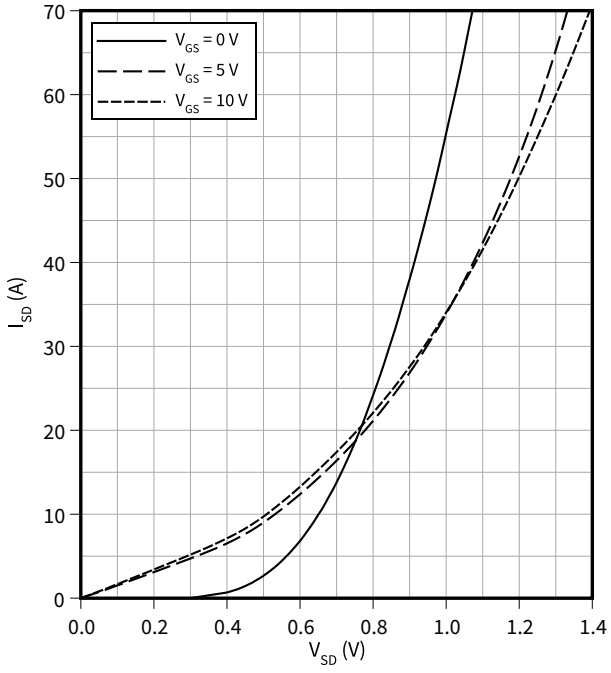
$T_{vj} = 25\ °C$



Forward characteristic body diode (typical), MOSFET

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

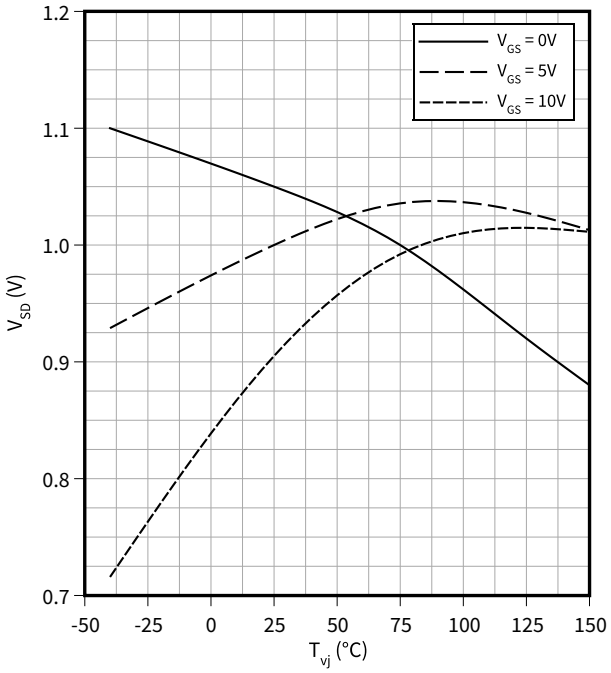
$T_{vj} = 150\ °C$



Forward voltage of body diode (typical), MOSFET

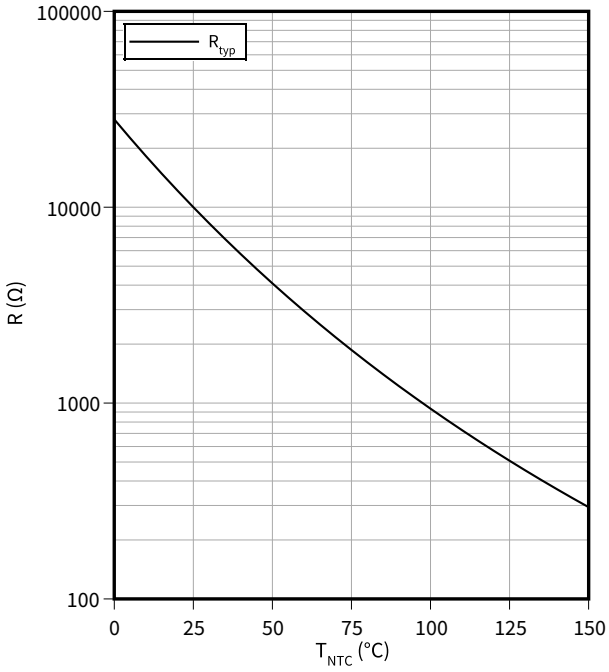
$V_{SD} = f(T_{vj})$

$I_{SD} = 35$ A



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 Circuit diagram

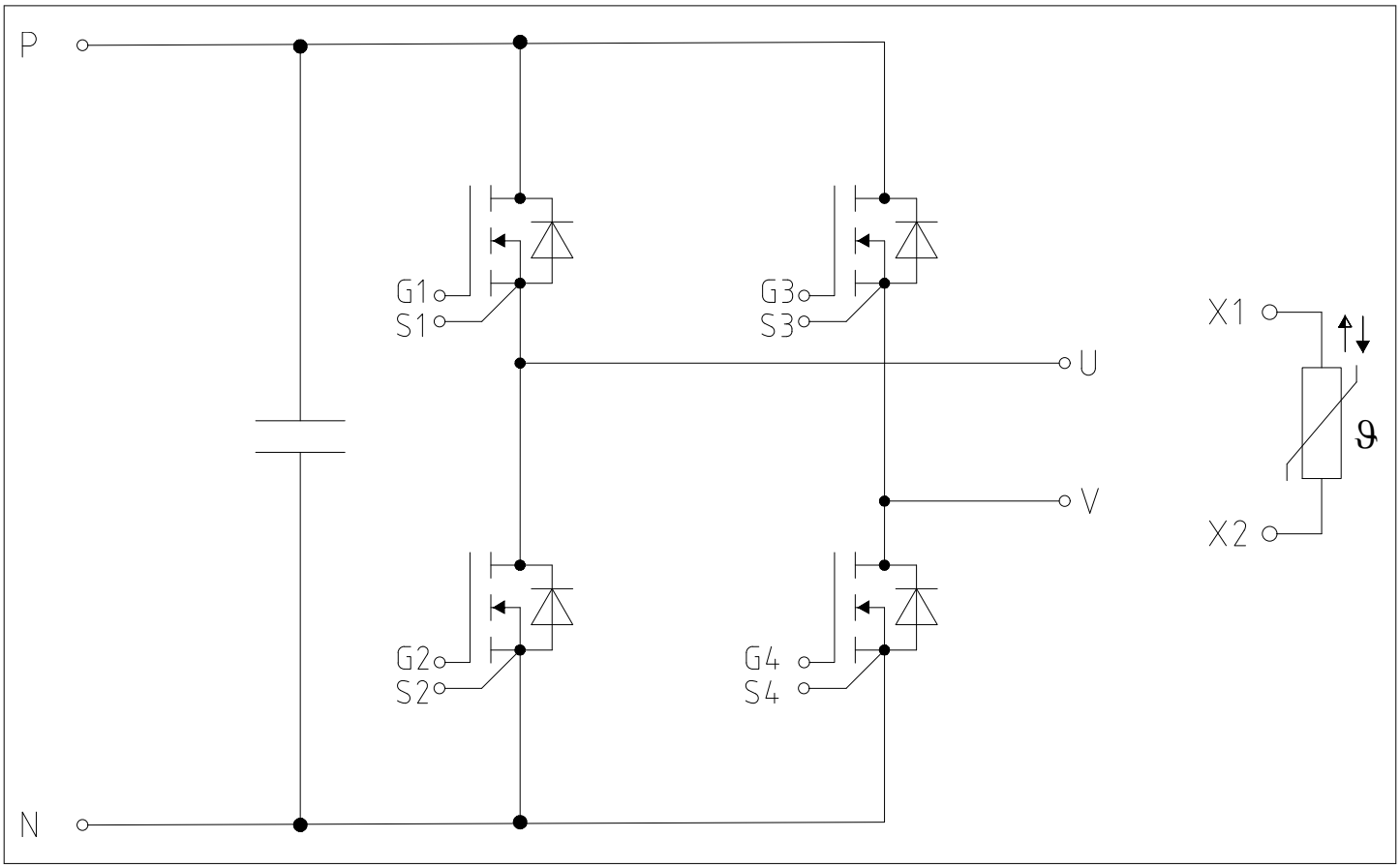


Figure 1

8 Package outlines

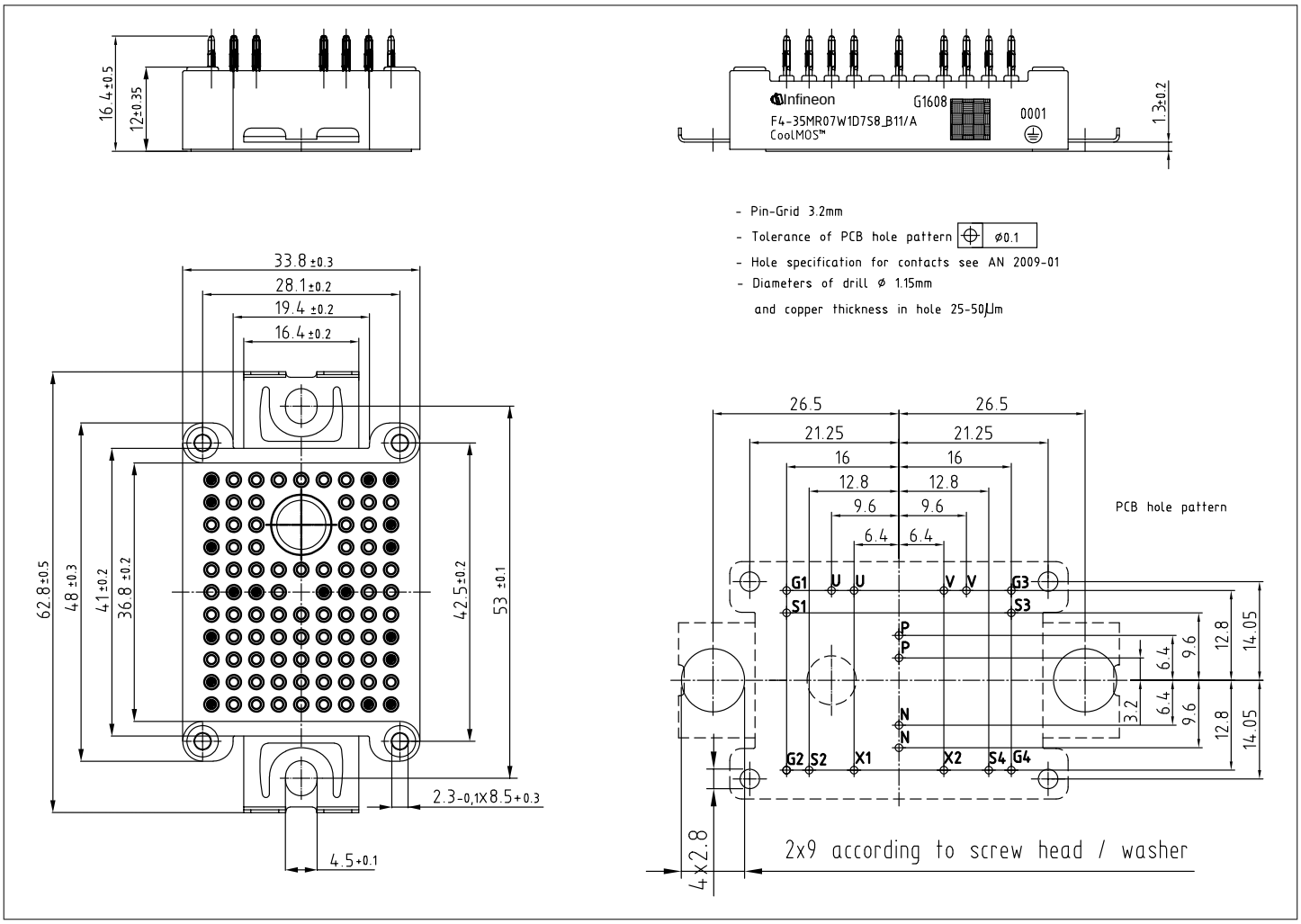


Figure 2

9 Module label code

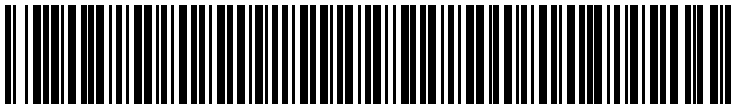
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production 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

Revision history

Document revision	Date of release	Description of changes
0.10	2022-03-17	Initial version
0.20	2022-06-20	Preliminary datasheet
1.00	2022-06-21	Final datasheet
1.10	2023-08-22	10424AERRA

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