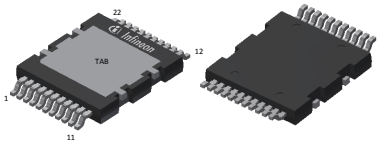
SiC MOSFET

Q-DPAK

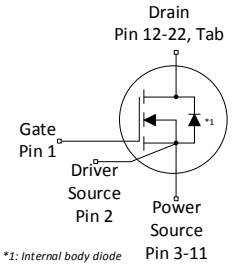
CoolSiC™ MOSFET 750 V G2



Built on Infineon's robust 2nd generation Silicon Carbide trench technology, the 750 V CoolSiC™ MOSFET delivers unparalleled performance, superior reliability, and great ease of use. It enables cost effective, highly efficient, and simplified designs to fulfill the ever-growing system and market needs.

Features

- Highly robust 750V technology, 100% avalanche tested
- Best-in-class $R_{DS(on)}$ x Q_{fr}
- Excellent $R_{DS(on)}$ x Q_{oss} and $R_{DS(on)}$ x Q_G
- Unique combination of low C_{rss}/C_{iss} and high $V_{GS(th)}$
- Infineon proprietary die attach technology
- Cutting edge TSC package with material group I
- Driver source pin available
- Best-in-class $R_{DS(on)}$ in SMD device



Benefits

- Enhanced robustness and reliability for bus voltages beyond 500 V
- Superior efficiency in hard switching
- Robustness against parasitic turn on for unipolar gate driving
- Best-in-class thermal dissipation

Potential applications

- Solid state relays and circuit breakers
- EV charging infrastructure (Only in AC line frequency rectification)
- Telecom and Server SMPS (Only in AC line frequency rectification)

Product validation

Qualified for industrial applications according to the relevant tests of JEDEC JESD47, JESD22 and J-STD-020.

Please note: Dual chip product, not recommended for high frequency (kHz) switching applications. The source and driver source pins are not exchangeable. Their exchange might lead to malfunction. When paralleling MOSFETs the placement of the gate resistor is generally recommended to be in series to the Driver Source instead of the Gate.

Table 1 Key performance parameters

Parameter	Value	Unit
V_{DSS} over full $T_{j,range}$	750	V
$R_{DS(on),typ}$	3.5	mΩ
$R_{DS(on),max}$	5	mΩ
$Q_{G,typ}$	342	nC
$I_{D,pulse}$	1699	A
$Q_{oss,typ}$ @ 500 V	723	nC
$E_{oss,typ}$ @ 500 V	123.9	µJ

Part number	Package	Marking	Related links
IMDQ75R004M2H	PG-HDSOP-22	75R004M2	see Appendix A

Table of contents

1 Maximum ratings

at T_j = 25°C, unless otherwise specified.

Note: for optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.
“Linear mode” operation is not recommended. For assessment of potential “linear mode” operation, please contact Infineon sales office.

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source voltage	V_{DSS}	-	-	750	V	static, T_j = -55°C to 175°C
Continuous DC drain current [1]	I_{DDC}	-	-	357	A	T_c = 25°C
				283		T_c = 100°C
Peak drain current [2]	I_{DM}	-	-	1699	A	T_c = 25°C, V_{GS} = 18 V
Avalanche energy, single pulse	E_{AS}	-	-	1071	mJ	I_D = 39.6 A, V_{DD} = 50 V; see table 11
Avalanche energy, repetitive	E_{AR}			5.35		
Avalanche current, single pulse	I_{AS}	-	-	500	A	L = 1 µH, V_{DD} = 50 V
MOSFET *dv/dt* ruggedness	*dv/dt*	-	-	200	V/ns	V_{DS}= 0…500 V
Gate source voltage (static) [3]	V_{GS}	-7	-	23	V	-
Gate source voltage (transient)	V_{GS}	-11	-	25	V	t_p ≤ 500 ns, duty cycle ≤ 1%
Power dissipation	P_{tot}	-	-	1499	W	T_c = 25°C
Storage temperature	T_{stg}	-55	-	150	°C	-
Operating junction temperature	T_j			175		
Extended operating junction temperature [4]	T_j	-	-	200	°C	≤ 100 h in the application lifetime
Mounting torque	-	-	-	n.a	Ncm	-
Continuous reverse drain current [1]	I_{SDC}	-	-	357	A	V_{GS} = 18 V, T_c = 25°C
				289		V_{GS} = 0 V, T_c = 25°C
Peak reverse drain current [2]	I_{SM}	-	-	1699	A	T_c = 25°C, t_p ≤ 250 ns
				494		T_c = 25°C
Insulation withstand voltage	V_{ISO}	-	-	n.a.	V	V_{rms}, T_c = 25°C, t = 1 min

1) Limited by $T_{j,max}$.
2) Pulse width t_{pulse} limited by $T_{j,max}$.
3) The maximum gate-source voltage in the application design should be in accordance to IPC-9592B.
4) Up to 7500 temperature cycles, where maximum delta T is limited to 100K.

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{th(j-c)}$	-	0.07	0.1	°C/W	Not subject to production test. Parameter verified by design/characterization according to JESD51-14.
Soldering temperature, reflow soldering allowed	T_{sold}	-	-	260	°C	reflow MSL1

3 Operating range

Table 4 Operating range

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Recommended turn-on voltage	$V_{GS(on)}$	-	18	-	V	-
Recommended turn-off voltage	$V_{GS(off)}$		0			

4 Electrical characteristics

at T_j = 25°C, unless otherwise specified

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage [5]	$V_{(BR)DSS}$	840	-	-	V	V_{GS} = 0 V, I_D = 5.77 mA
Gate threshold voltage [6]	$V_{GS(th)}$	3.5	4.5	5.6	V	V_{DS} = V_{GS}, I_D = 57.7 mA, T_j = 25°C
		-	3.3	-		V_{DS} = V_{GS}, I_D = 57.7 mA, T_j = 175°C
Zero gate voltage drain current	I_{DSS}	-	2	150	µA	V_{DS} = 750 V, V_{GS} = 0 V, T_j = 25°C
			20	-		V_{DS} = 750 V, V_{GS} = 0 V, T_j = 175°C
Gate-source leakage current	I_{GSS}	-	-	200	nA	V_{GS} = 23V, V_{DS} = 0 V, T_j = 25°C
				-200		V_{GS} = -7V, V_{DS} = 0 V, T_j = 25°C
Forward transconductance	g_{fs}	-	152	-	S	I_D = 262.4 A, V_{DS} = 20 V
Drain-source on-state resistance	$R_{DS(on)}$	-	4.6	-	mΩ	V_{GS} = 15 V, I_D = 170 A, T_j = 25°C
			3.5	5		V_{GS} = 18 V, I_D = 170 A, T_j = 25°C
			3.2	-		V_{GS} = 20 V, I_D = 170 A, T_j = 25°C
Drain-source on-state resistance [7]	$R_{DS(on)}$	-	5.7	8	mΩ	V_{GS} = 18 V, I_D = 170 A, T_j = 150°C
Drain-source on-state resistance	$R_{DS(on)}$	-	6.5	-	mΩ	V_{GS} = 18 V, I_D = 170 A, T_j =175°C
Internal gate resistance	$R_{G,int}$	-	0.8	-	Ω	f = 1 MHz

[5] Provided as measure of robustness under abnormal operating conditions and not recommended for normal operation.

[6] Tested after pre-conditioning pulse at V_{GS} = +20 V. “Linear mode” operation is not recommended. For assessment of potential “linear mode” operation, please contact Infineon sales office.

[7] Specified by design, not subject to production test.

Table 6 Dynamic characteristics

External parasitic elements (PCB layout) influence switching behavior significantly.
Stray inductances and coupling capacitances must be minimized.
For layout recommendations please use provided application notes or contact Infineon sales office.

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	11844	-	pF	V_{GS} = 0 V, V_{DS} = 500 V, f = 250 kHz
Reverse transfer capacitance	C_{rss}		62	-		
Output capacitance [8]	C_{oss}		773	1005		
Output charge [8]	Q_{oss}	-	723	940	nC	calculation based on C_{oss}
Effective output capacitance, energy related [9]	$C_{o(er)}$	-	991	-	pF	V_{GS} = 0 V, V_{DS} = 0…500 V
Effective output capacitance, time related [10]	$C_{o(tr)}$	-	1447	-	pF	I_D = constant, V_{GS} = 0 V, V_{DS} = 0…500 V

Table 6 Dynamic characteristics

External parasitic elements (PCB layout) influence switching behavior significantly.
Stray inductances and coupling capacitances must be minimized.
For layout recommendations please use provided application notes or contact Infineon sales office.

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Turn-on delay time	$t_{d(on)}$	-	24	-	ns	V_{DD} = 500 V, V_{GS} = 0/18 V, I_D = 262.4 A, $R_{G,ext}$ = 1.8 Ω, L_{stray} = 15 nH; see table 10
Rise time	t_r		24		ns	
Turn-off delay time	$t_{d(off)}$		56		ns	
Fall time	t_f		13		ns	
Turn-ON switching losses [11]	E_{on}		416		µJ	
Turn-OFF switching losses [11]	E_{off}		2044		µJ	
Total switching losses [11]	E_{tot}		2461		µJ	

[8] Maximum specification is defined by calculated six sigma upper confidence bound.

[9] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 500 V.

[10] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 500 V.

[11] MOSFET used in half-bridge configuration without external diode. Parameter verified by characterization according to IEC 60747-8.

Table 7 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Plateau gate to source charge	$Q_{GS(pl)}$	-	86	-	nC	V_{DD} = 500 V, I_D = 262.4 A, V_{GS} = 0 to 18 V
Gate to drain charge	Q_{GD}		74			
Total gate charge	Q_G		342			

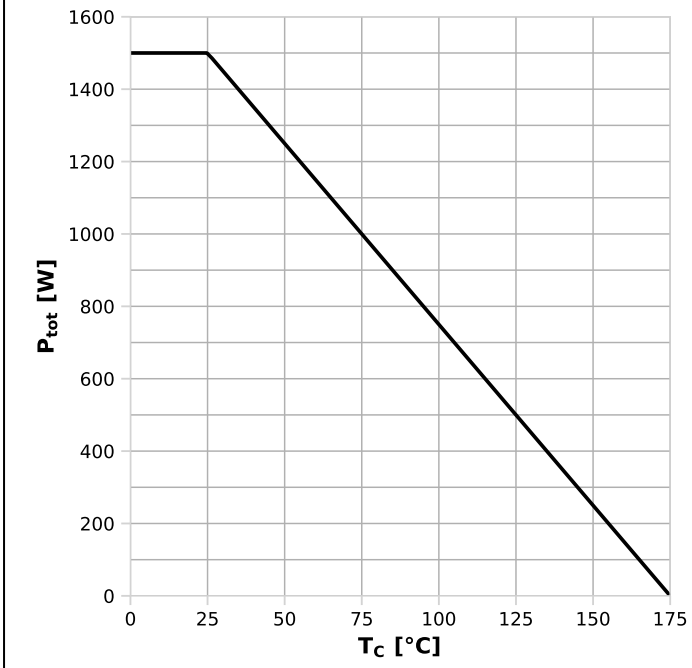
Table 8 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source reverse voltage	V_{SD}	-	3.7	5	V	V_{GS} = 0 V, I_S = 170 A, T_j = 25°C
			3.4	-		V_{GS} = 0 V, I_S = 170 A, T_j = 175°C
MOSFET forward recovery time	t_{fr}	-	31	-	ns	V_{DD} = 500 V, I_S = 262.4 A, di_S/dt = 4000 A/µs; see table 9
MOSFET forward recovery charge [12]	Q_{fr}		1087		nC	
MOSFET peak forward recovery current	I_{frm}		71		A	

[12] Q_{fr} includes Q_{oss}.

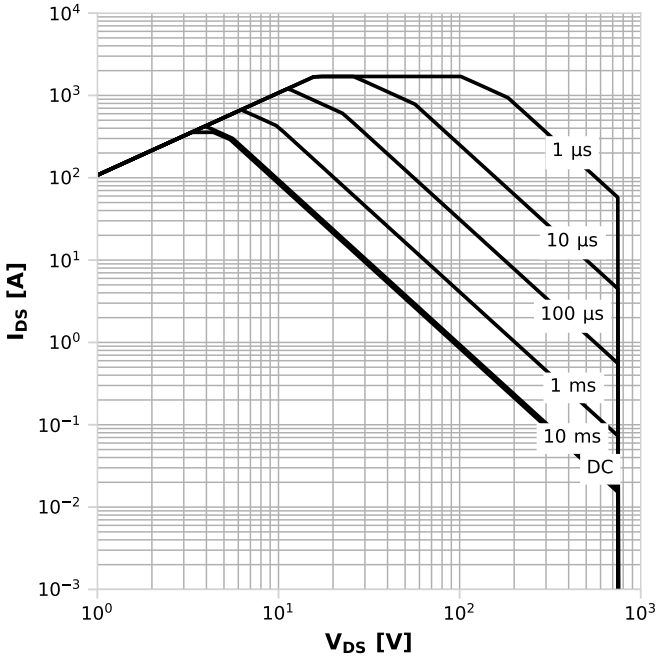
5 Electrical characteristics diagrams

Diagram 1: Power dissipation



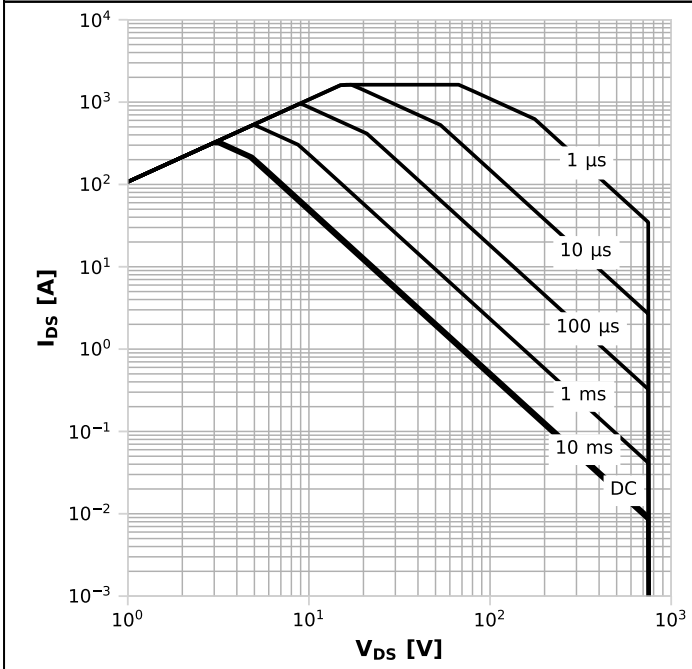
$P_{tot}=f(T_C)$

Diagram 2: Safe operating area



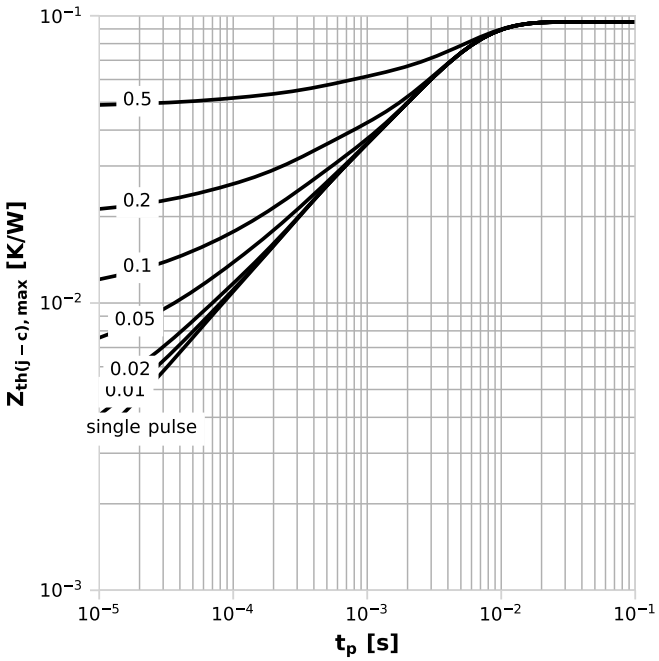
$I_{DS}=f(V_{DS})$; $T_C=25°C$; D=0; parameter: t_p

Diagram 3: Safe operating area



$I_{DS}=f(V_{DS})$; $T_C=80°C$; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



$Z_{th(j-c),max}=f(t_P)$; parameter: $D=t_p/T$

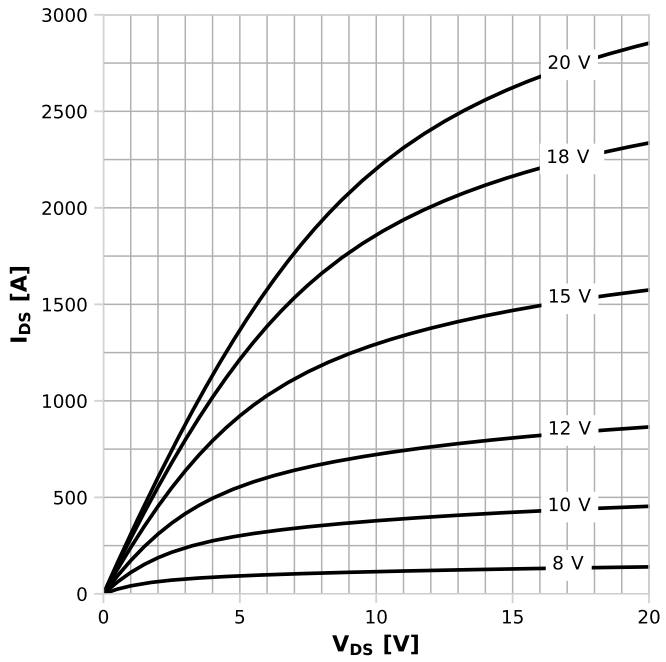
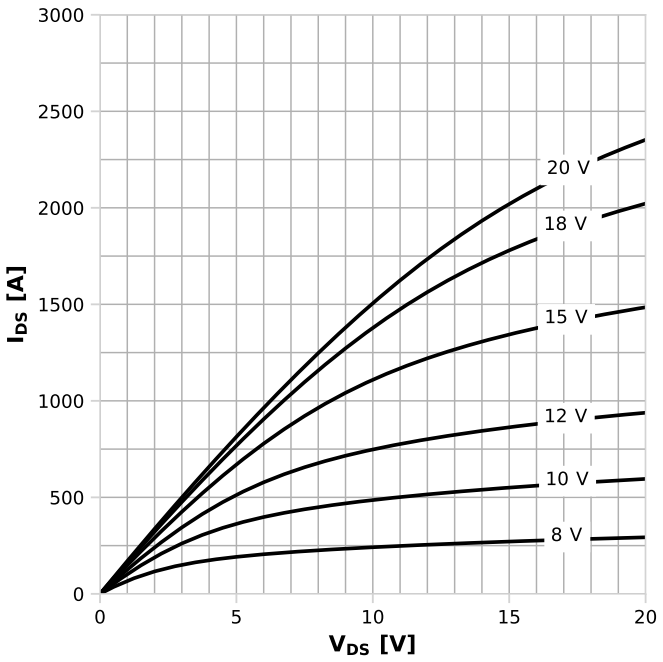
Diagram 5: Typ. output characteristics	Diagram 6: Typ. output characteristics
	
$I_{DS}=f(V_{DS})$; $T_j=25°C$; parameter: V_{GS}	$I_{DS}=f(V_{DS})$; $T_j=175°C$; parameter: V_{GS}

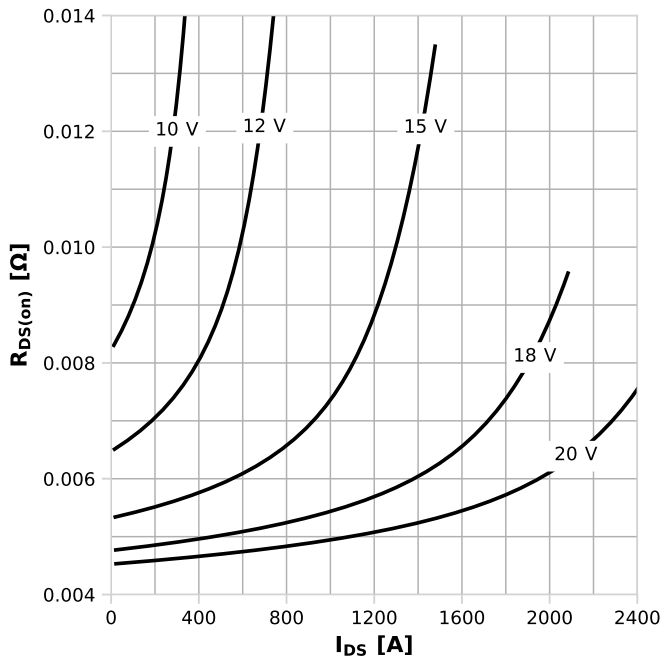
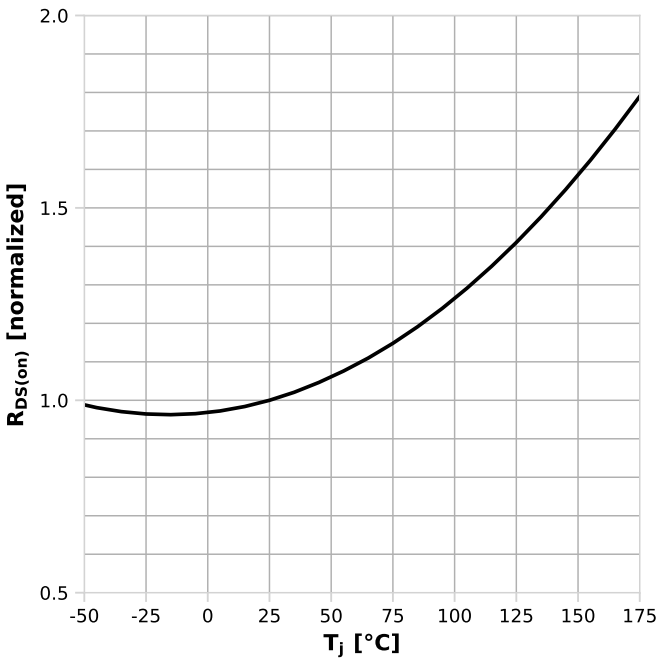
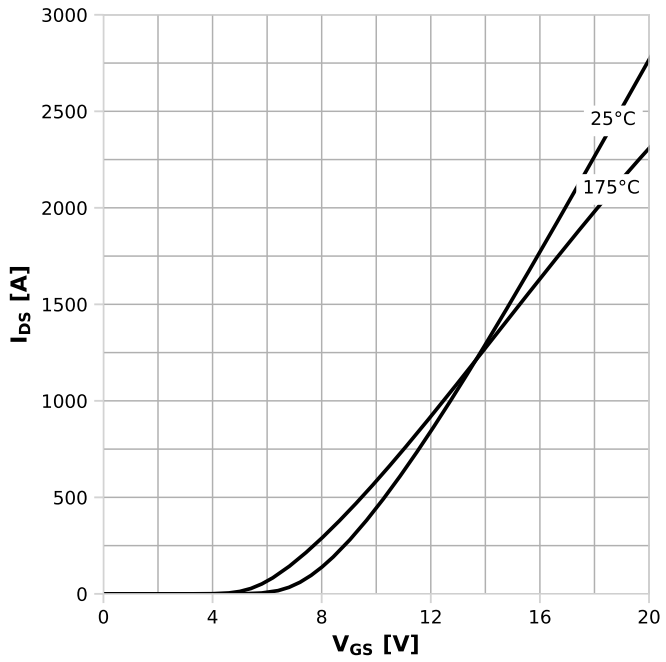
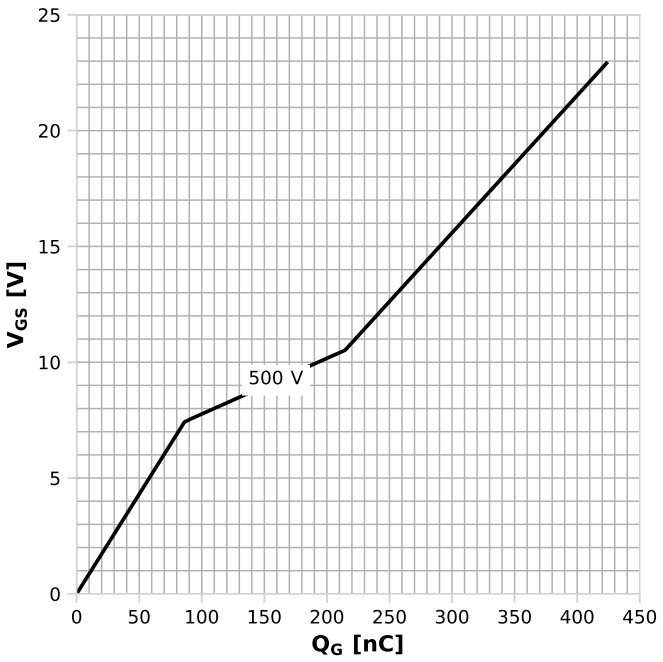
Diagram 7: Typ. drain-source on-state resistance	Diagram 8: Drain-source on-state resistance
	
$R_{DS(on)}=f(I_{DS})$; $T_j=125°C$; parameter: V_{GS}	$R_{DS(on)}=f(T_j)$; $I_D=170.0$ A; $V_{GS}=18$ V

Diagram 9: Typ. transfer characteristics



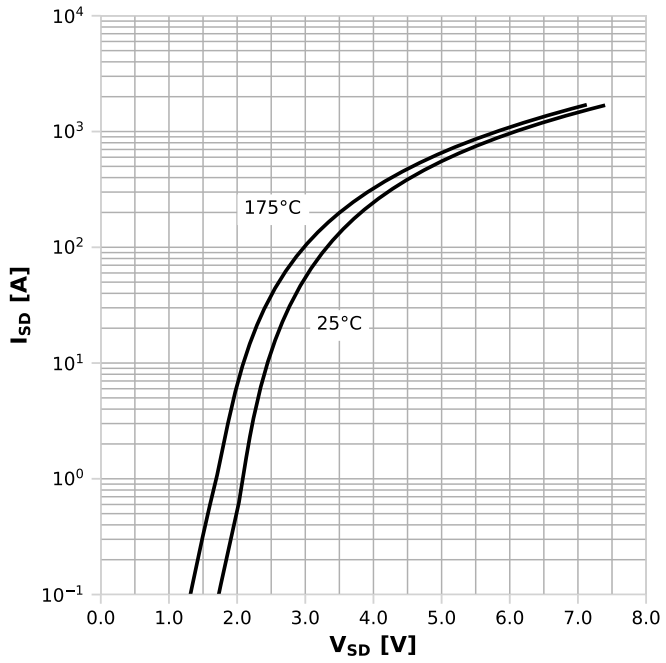
$I_{DS}=f(V_{GS})$; $V_{DS}=20$ V; parameter: T_j

Diagram 10: Typ. gate charge



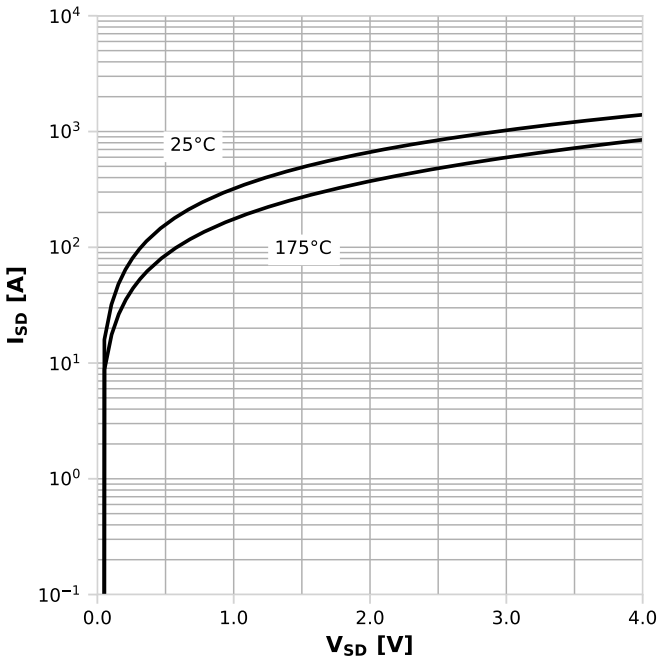
$V_{GS}=f(Q_G)$; $I_D=262.4$ A pulsed; parameter: V_{DD}

Diagram 11: Typ. reverse drain current characteristics



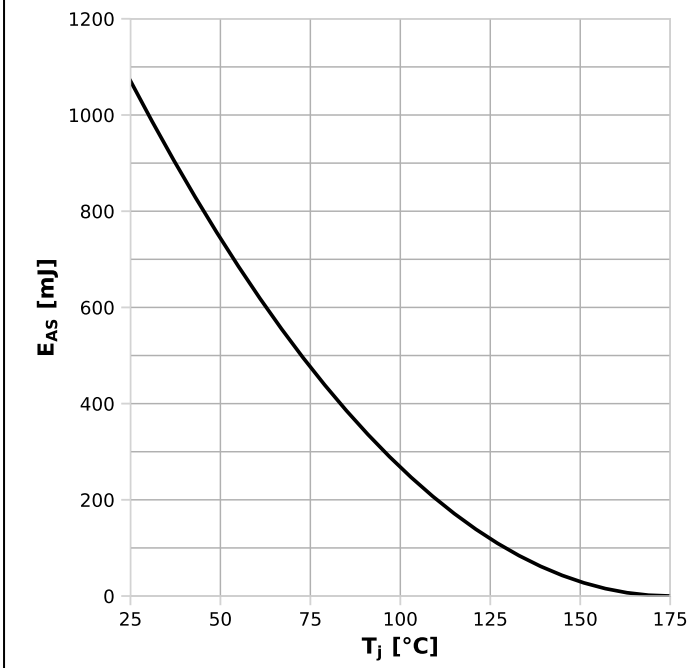
$I_{SD}=f(V_{SD})$; $V_{GS}=0$ V; parameter: T_j

Diagram 12: Typ. reverse drain current characteristics



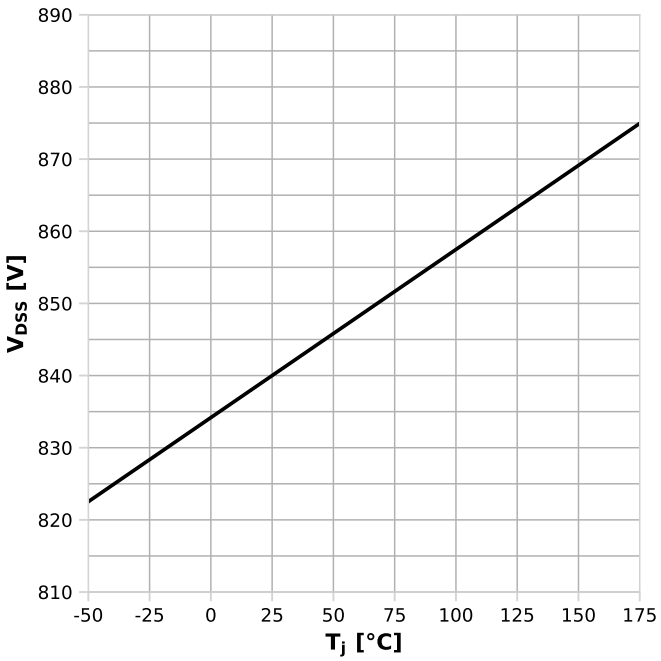
$I_{SD}=f(V_{SD})$; $V_{GS}=18$ V; parameter: T_j

Diagram 13: Avalanche energy



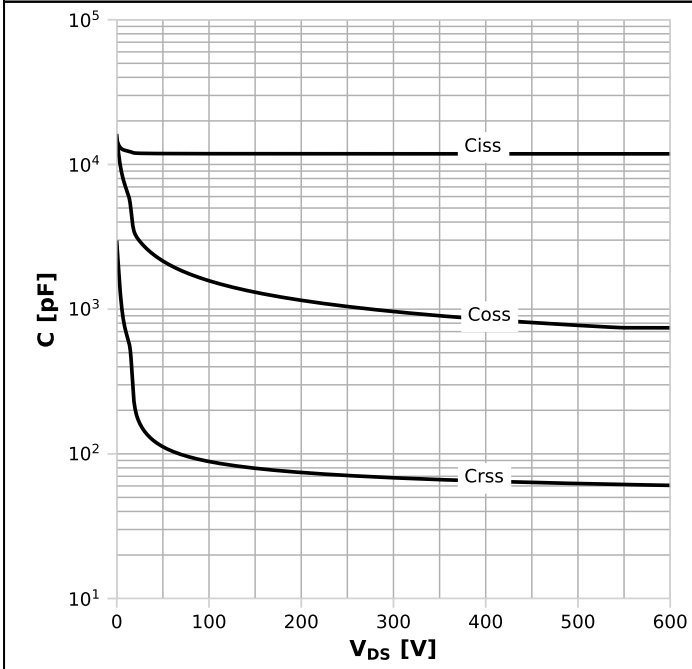
$E_{AS}=f(T_j)$; I_D=39.6 A; V_{DD}=50 V

Diagram 14: Drain-source breakdown voltage



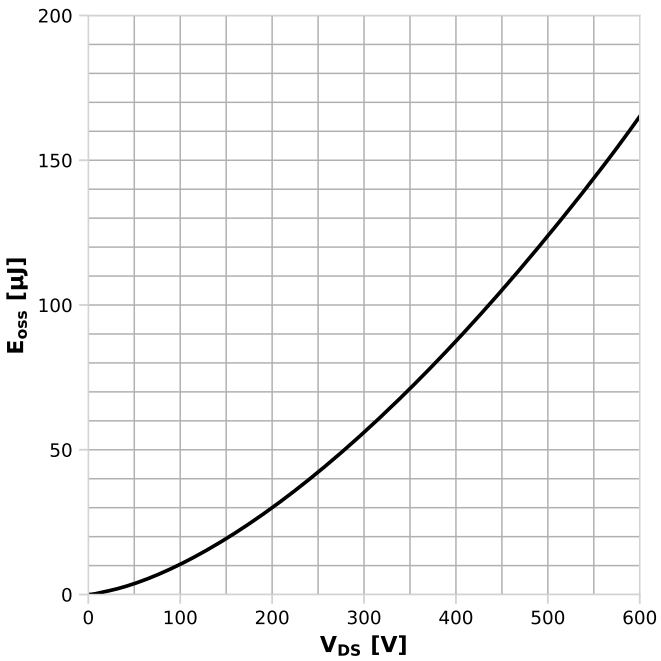
$V_{DSS}=f(T_j)$; I_D=5.77 mA

Diagram 15: Typ. capacitances

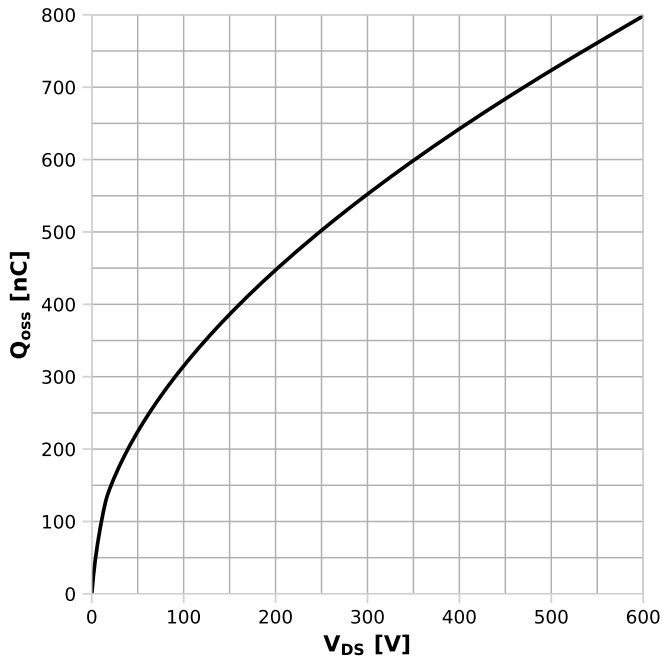
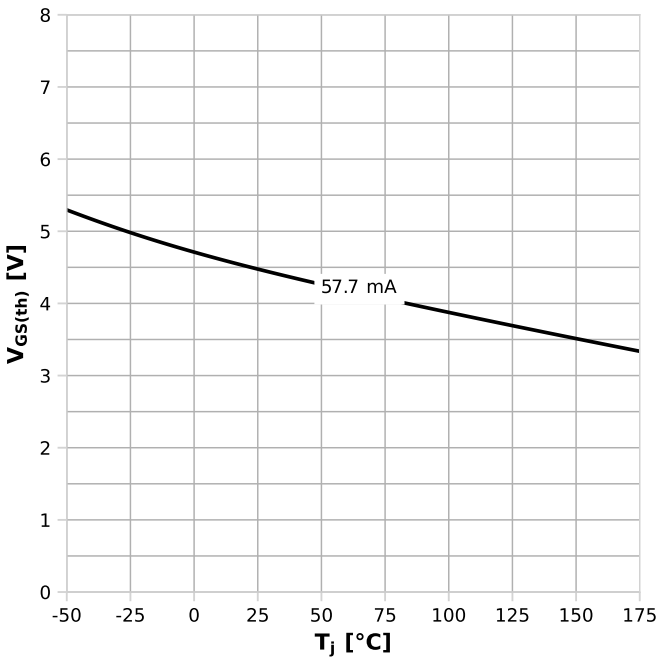


$C=f(V_{DS})$; V_{GS}=0 V; f=250 kHz

Diagram 16: Typ. Coss stored energy



$E_{oss}=f(V_{DS})$

Diagram 17: Typ. Qoss output charge	Diagram 18: Typ. gate threshold voltage
	
$Q_{oss}=f(V_{DS})$	$V_{GS(th)}=f(T_j)$, $V_{GS}=V_{DS}$; parameter: I_D

6 Test circuits

Table 9 Body diode characteristics

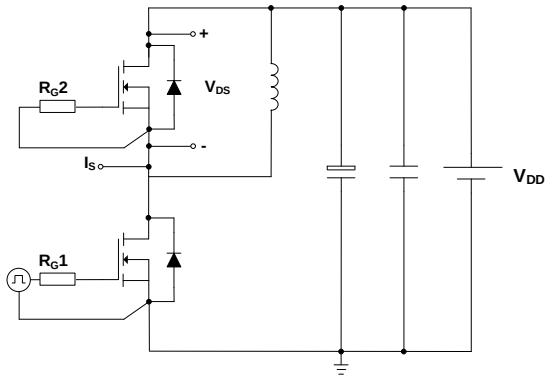
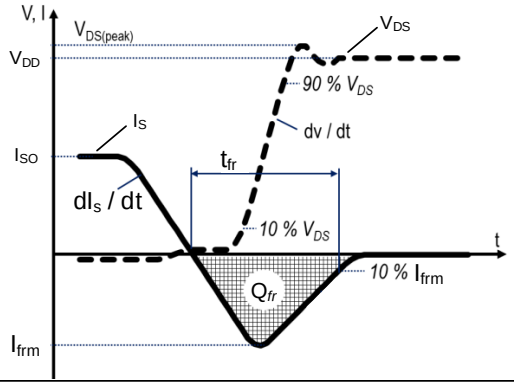
Test circuit for body diode characteristics	Body diode recovery waveform
	

Table 10 Switching times

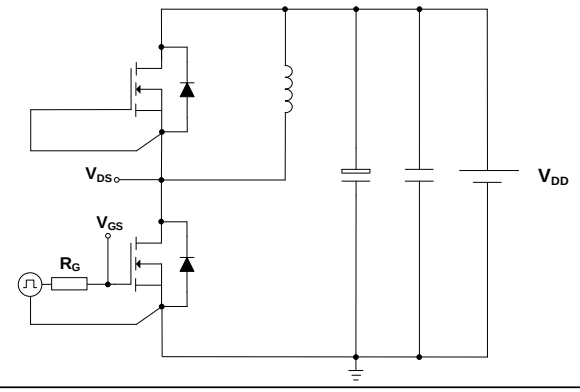
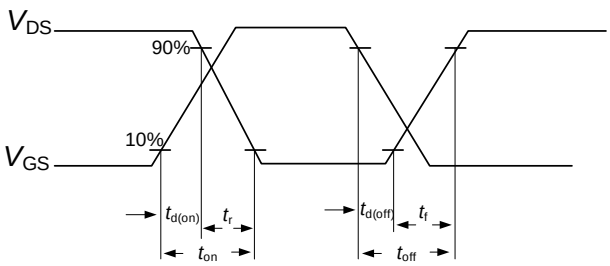
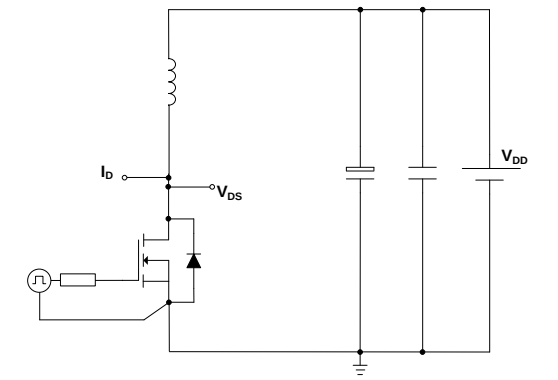
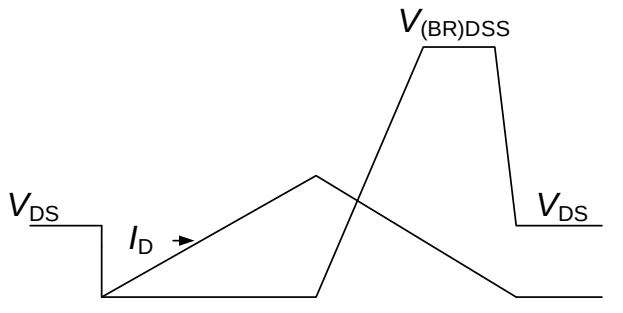
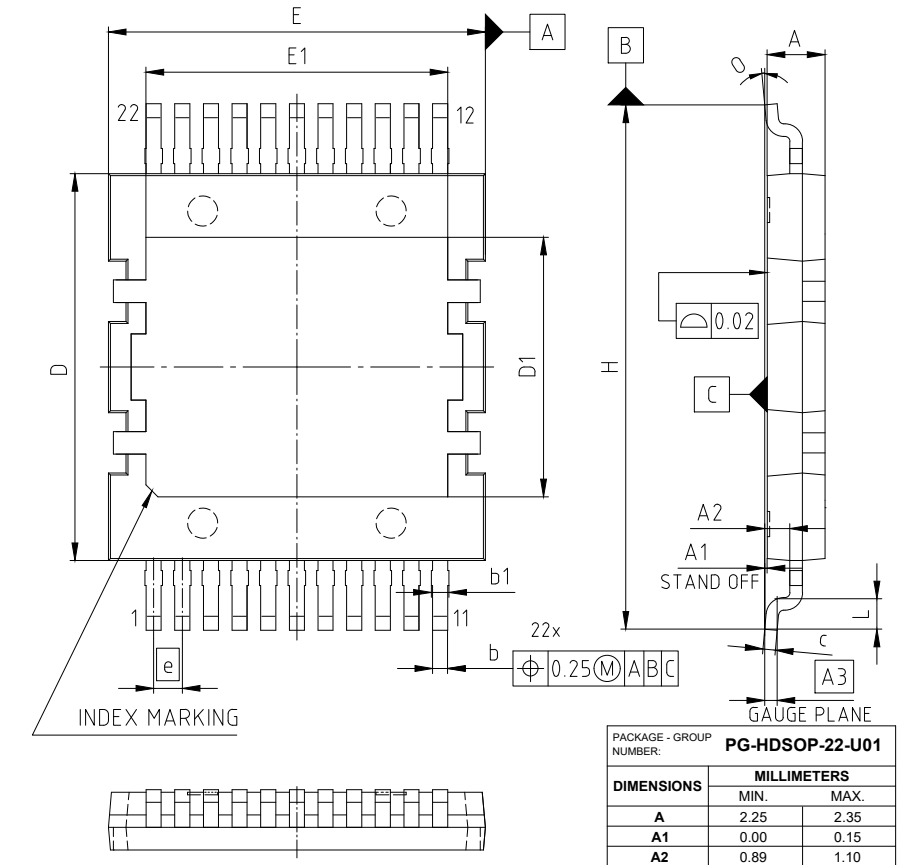
Switching times test circuit for inductive load	Switching times waveform
	

Table 11 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7 Package outlines



PACKAGE - GROUP NUMBER:	PG-HDSOP-22-U01	
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	2.25	2.35
A1	0.00	0.15
A2	0.89	1.10
A3	0.5	
b	0.50	0.70
b1	0.50	0.90
c	0.46	0.58
D	15.30	15.50
D1	10.23	10.43
E	14.90	15.10
E1	11.91	12.11
e	1.14	
N	22	
H	20.86	21.06
L	1.20	1.40
O	0°	8°

NOTES:

1. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
2. ALL METAL SUFACES ARE TIN PLATED, EXCEPT AREA OF CUT.

Figure 1 Outline PG-HDSOP-22, dimensions in mm

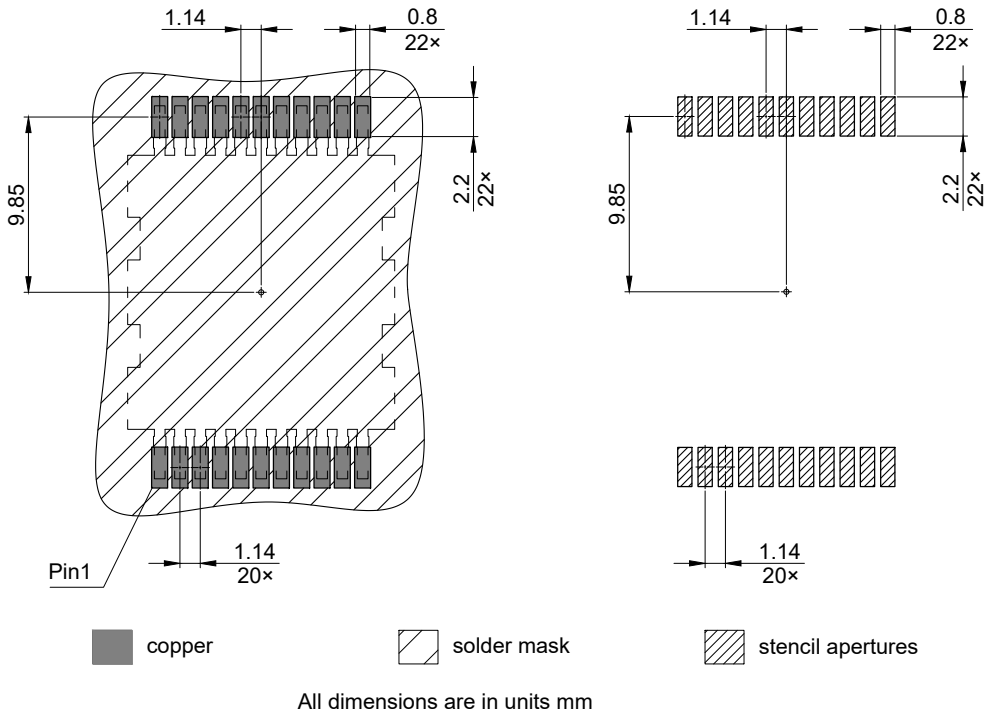


Figure 2 Footprint drawing PG-HDSOP-22, dimensions in mm

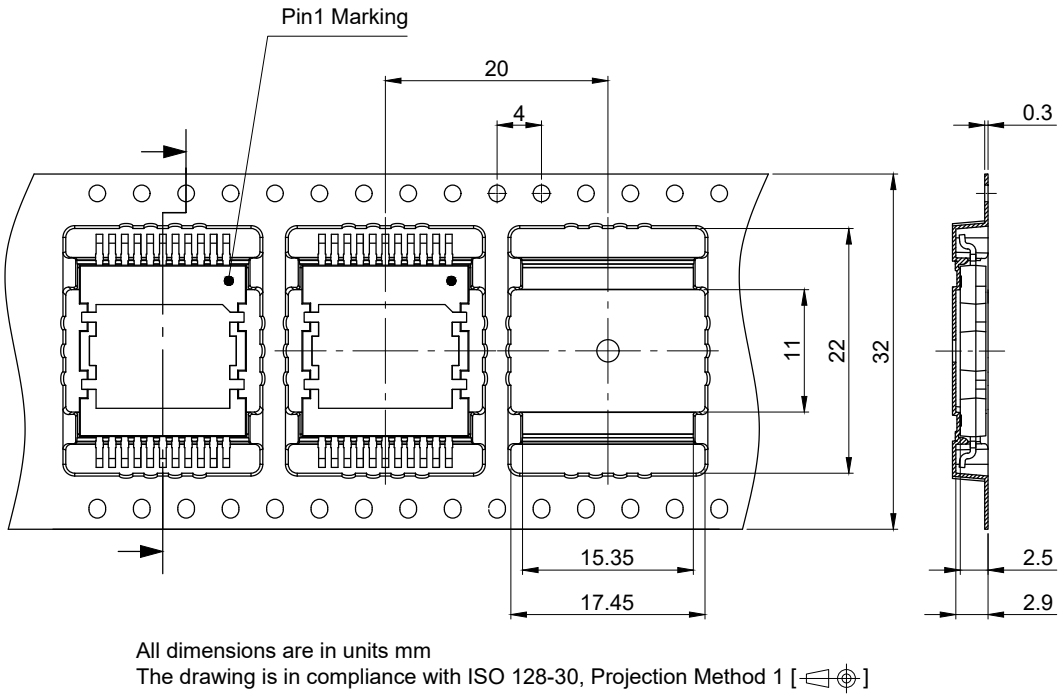


Figure 3 Packaging variant PG-HDSOP-22, dimensions in mm

8 Appendix A

Table 12 Related links

- IFX CoolSiC CoolSiC™ MOSFET 750 V G2 Webpage
- IFX CoolSiC CoolSiC™ MOSFET 750 V G2 Application Note
- IFX CoolSiC CoolSiC™ MOSFET 750 V G2 Simulation Model
- IFX Design tools

Revision history

IMDQ75R004M2H

Revision 2025-06-05, Rev. 2.1

Previous revisions

Revision	Date	Subjects (major changes since last revision)
2.0	2025-03-07	Release of final version
2.1	2025-06-05	Inclusion of drain-source static and breakdown voltage and typical Rthjc; Clarification on footnote 1 and front page with list of benefits and potential applications.

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Infineon Technologies AG
81726 München, Germany

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