

## MOSFET

### 600V CoolMOS™ SJ Power Device

The C7 GOLD series (G7) for the first time brings together the benefits of the C7 GOLD CoolMOS™ technology, 4 pin Kelvin Source capability and the improved thermal properties of the TOLL package to enable a possible SMD solution for high current topologies such as PFC up to 3kW

### Features

- C7 Gold gives best in class FOM  $R_{DS(on)} * E_{oss}$  and  $R_{DS(on)} * Q_g$ .
- Suitable for hard and soft switching (PFC and high performance LLC)
- C7 Gold technology enables best in class  $R_{DS(on)}$  in smallest footprint.
- TOLL package has inbuilt 4<sup>th</sup> pin Kelvin Source configuration and low parasitic source inductance (~1nH).
- TOLL package is MSL1 compliant, total Pb-free and has easy visual inspection grooved leads.
- TOLL SMD package combined with lead free die attach process enables improved thermal performance  $R_{th}$ .

### Benefits

- C7 Gold FOM  $R_{DS(on)} * Q_g$  is 15% better than previous C7 600V enabling faster switching leading to higher efficiency.
- Increased economies of scale by use in PFC and PWM topologies in the application
- C7 Gold can reach 28mΩ in in TOLL 115mm<sup>2</sup> footprint, whereas previous BIC C7 600V was 40mΩ in 150mm<sup>2</sup> D<sup>2</sup>PAK footprint.
- Reducing parasitic source inductance by Kelvin Source improves efficiency by faster switching and ease of use due to less ringing.
- TOLL package is easy to use and has the highest quality standards.
- Improved thermals enable SMD TOLL package to be used in higher current designs than has been previously possible.

### Potential applications

PFC stages and PWM stages (TTF, LLC) for high power/performance SMPS e.g. Computing, Server, Telecom, UPS and Solar.

### Product validation

Fully qualified according to JEDEC for Industrial Applications

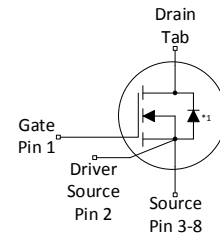
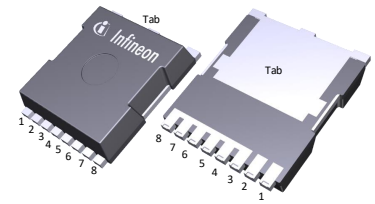
*Please note: For MOSFET paralleling the use of ferrite beads on the gate or separate totem poles is generally recommended.*

**Table 1** Key performance parameters

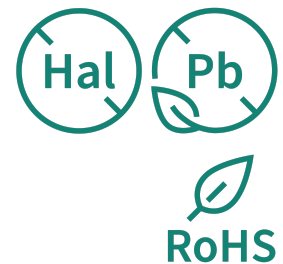
Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	125	mΩ
$Q_{g,typ}$	27	nC
$I_{D,pulse}$	54	A
$I_{D,continuous} @ T_j < 150^{\circ}C$	27	A
$E_{oss}@400V$	3.27	μJ
Body diode di/dt	720	A/μs

Part number	Package	Marking	Related links
IPT60R125G7	PG-HSOF-8	60R125G7	see Appendix A

TOLL



\*1: Internal body diode





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## 1 Maximum ratings

at  $T_{\hat{I}} = 25^{\circ}\text{C}$ , unless otherwise specified

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Continuous drain current <sup>1)</sup>	$I_D$	-	-	20	A	$T_C=25^{\circ}\text{C}$
				12		$T_C=100^{\circ}\text{C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	54	A	$T_C=25^{\circ}\text{C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	64	mJ	$I_D=3.8\text{A}; V_{DD}=50\text{V};$ see table 10
Avalanche energy, repetitive	$E_{AR}$	-	-	0.32		
Avalanche current, single pulse	$I_{AS}$	-	-	3.8	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	120	V/ns	$V_{DS}=0\dots400\text{V}$
Gate source voltage (static)	$V_{GS}$	-20	-	20	V	static;
Gate source voltage (dynamic)	$V_{GS}$	-30	-	30	V	AC ( $f>1\text{ Hz}$ )
Power dissipation	$P_{tot}$	-	-	120	W	$T_C=25^{\circ}\text{C}$
Storage temperature	$T_{stg}$	-55	-	150	$^{\circ}\text{C}$	-
Operating junction temperature	$T_j$	-55	-	150	$^{\circ}\text{C}$	
Mounting torque	-	-	-	n.a.	Ncm	
Continuous diode forward current	$I_S$	-	-	20	A	$T_C=25^{\circ}\text{C}$
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	-	-	54		
Reverse diode dv/dt <sup>3)</sup>	dv/dt	-	-	25	V/ns	$V_{DS}=0\dots400\text{V}, I_{SD}\leq 5.9\text{A}, T_j=25^{\circ}\text{C}$ see table 8
Maximum diode commutation speed	$di_t/dt$	-	-	720	A/ $\mu\text{s}$	
Insulation withstand voltage	$V_{ISO}$	-	-	n.a.	V	$V_{rms}, T_C=25^{\circ}\text{C}, t=1\text{min}$

1) Limited by  $T_{j,max}$ .

2) Pulse width  $t_p$  limited by  $T_{j,max}$ .

3) Identical low side and high side switch.

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	1.04	°C/W	-
Thermal resistance, junction - ambient	$R_{thJA}$	-	-	62	°C/W	device on PCB, minimal footprint
Thermal resistance, junction - ambient for SMD version	$R_{thJA}$	-	35	45	°C/W	Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm <sup>2</sup> (one layer, 70µm thickness) copper area for drain connection and cooling. PCB is vertical without air stream cooling.
Soldering temperature, wave- & reflow soldering allowed	$T_{sold}$	-	-	260	°C	reflow MSL1

### 3 Electrical characteristics

at  $T_{\hat{I}}=25^{\circ}\text{C}$ , unless otherwise specified

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	600	-	-	V	$V_{GS}=0\text{V}$ , $I_D=1\text{mA}$
Gate threshold voltage	$V_{(GS)th}$	3	3.5	4	V	$V_{DS}=V_{GS}$ , $I_D=0.32\text{mA}$
Zero gate voltage drain current	$I_{DSS}$	-	-	1	$\mu\text{A}$	$V_{DS}=600$ , $V_{GS}=0\text{V}$ , $T_j=25^{\circ}\text{C}$
			10	-		$V_{DS}=600$ , $V_{GS}=0\text{V}$ , $T_j=150^{\circ}\text{C}$
Gate-source leakage current	$I_{GSS}$	-	-	100	nA	$V_{GS}=20\text{V}$ , $V_{DS}=0\text{V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.108	0.125	$\Omega$	$V_{GS}=10\text{V}$ , $I_D=6.4\text{A}$ , $T_j=25^{\circ}\text{C}$
			0.269	-		$V_{GS}=10\text{V}$ , $I_D=6.4\text{A}$ , $T_j=150^{\circ}\text{C}$
Gate resistance	$R_G$	-	0.8	-	$\Omega$	$f=1\text{MHz}$ , open drain

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	1080	-	pF	$V_{GS}=0\text{V}$ , $V_{DS}=400\text{V}$ , $f=250\text{kHz}$
Output capacitance	$C_{oss}$	-	22	-		
Effective output capacitance, energy related <sup>4)</sup>	$C_{o(er)}$	-	41	-	pF	$V_{GS}=0\text{V}$ , $V_{DS}=0\dots400\text{V}$
Effective output capacitance, time related <sup>5)</sup>	$C_{o(tr)}$	-	420	-	pF	$I_D=\text{constant}$ , $V_{GS}=0\text{V}$ , $V_{DS}=0\dots400\text{V}$
Turn-on delay time	$t_{d(on)}$	-	18	-	ns	$V_{DD}=400\text{V}$ , $V_{GS}=13\text{V}$ , $I_D=6.4\text{A}$ , $R_G=10\Omega$ ; see table 9
Rise time	$t_r$		5			
Turn-off delay time	$t_{d(off)}$		60			
Fall time	$t_f$		5			

<sup>4)</sup>  $C_{o(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 400V

<sup>5)</sup>  $C_{o(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 400V

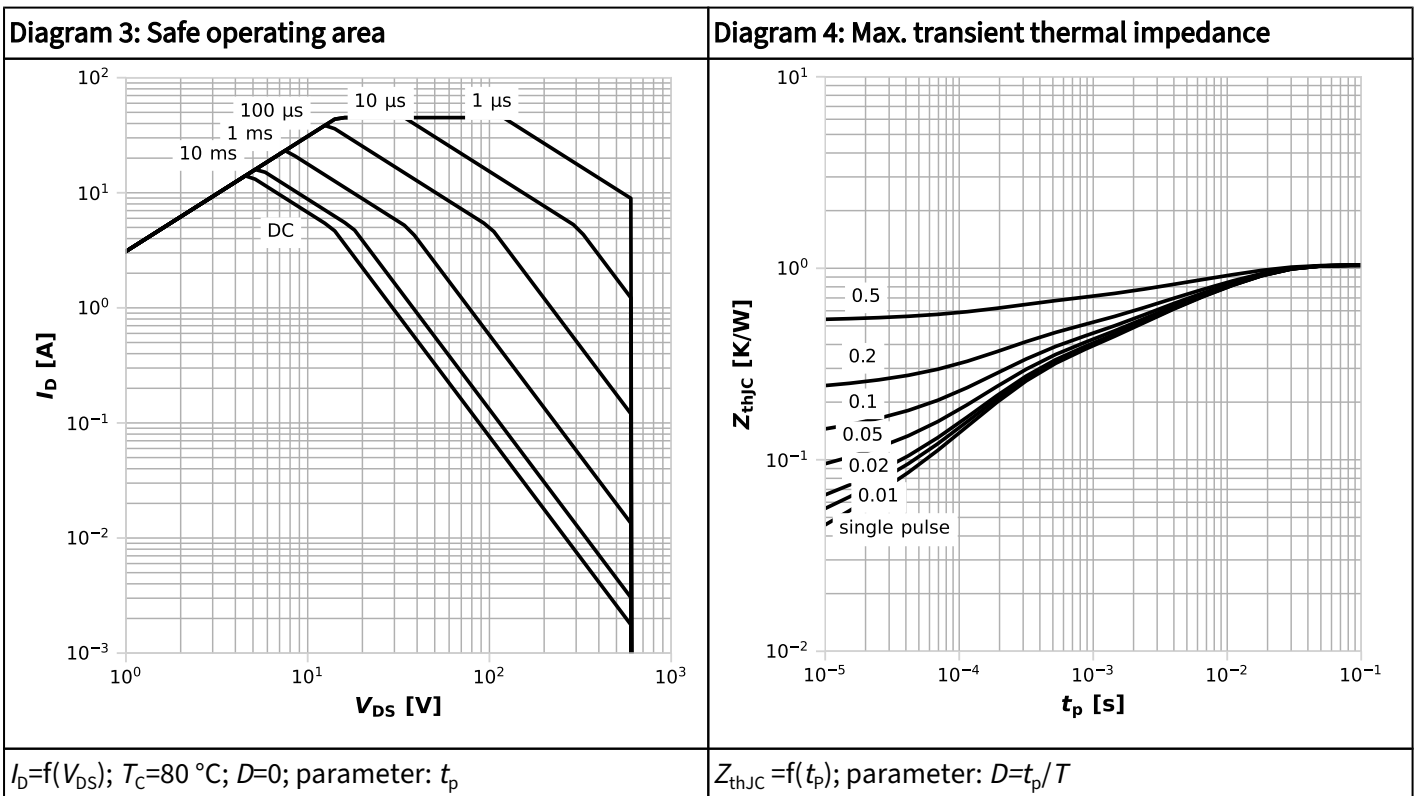
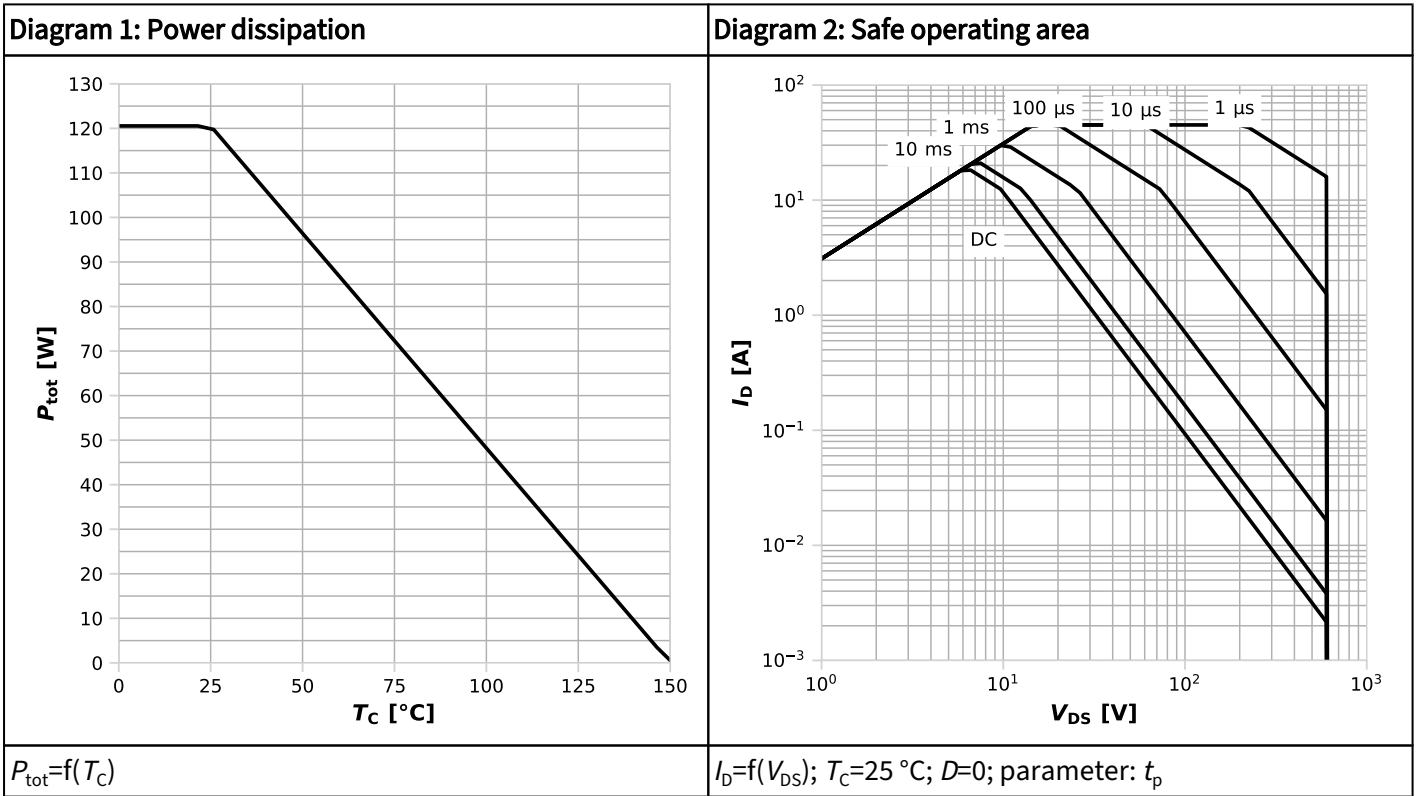
**Table 6 Gate charge characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	5	-	nC	$V_{DD}=400V, I_D=6.4A, V_{GS}=0$ to 10V
Gate to drain charge	$Q_{gd}$	-	10	-	nC	
Gate charge total	$Q_g$	-	27	-	nC	
Gate plateau voltage	$V_{plateau}$	-	5.0	-	V	

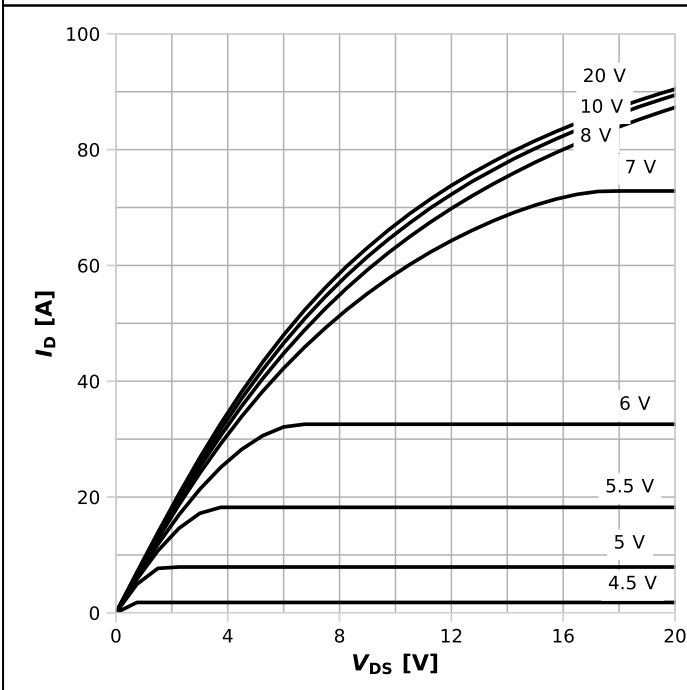
**Table 7 Reverse diode characteristics**

Parameter	Symbol	Values			Unit	Note / Test condition
		Min.	Typ.	Max.		
Diode forward voltage	$V_{SD}$	-	0.8	-	V	$V_{GS}=0V, I_F=6.4A, T_j=25^\circ C$
Reverse recovery time	$t_{rr}$	-	280	-	ns	$V_R=400V, I_F=6.4A, di_F/dt=100A/\mu s$ ; see table 8
Reverse recovery charge	$Q_{rr}$	-	2.8	-	$\mu C$	
Peak reverse recovery current	$I_{rrm}$	-	20	-	A	

## 4 Electrical characteristics diagrams

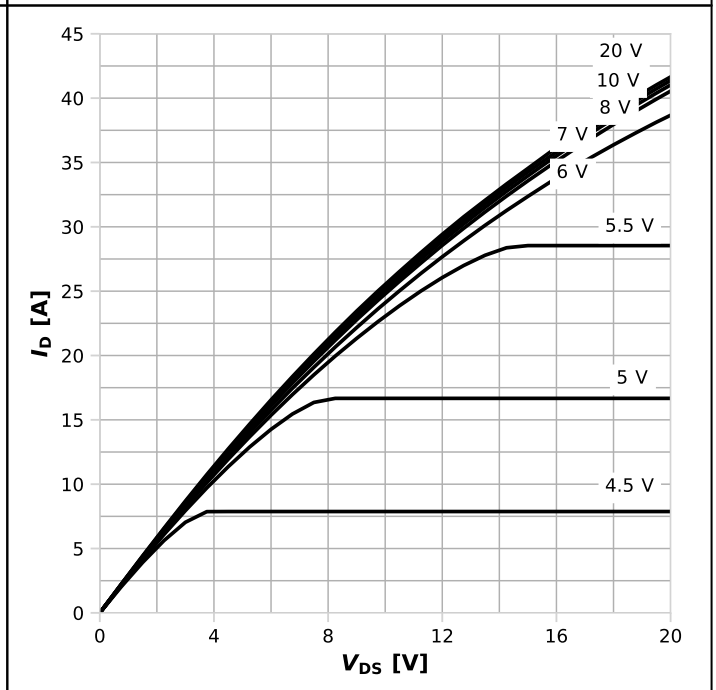


**Diagram 5: Typ. output characteristics**



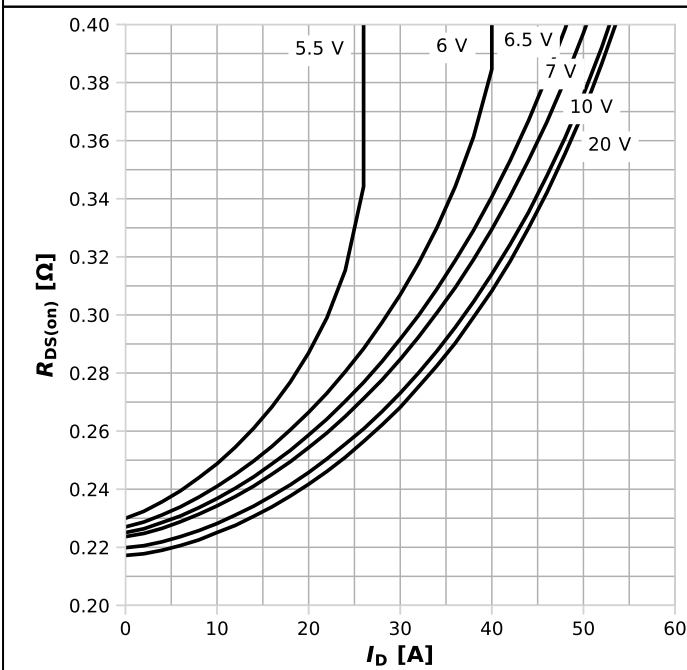
$I_D = f(V_{DS}); T_j = 25\text{ °C};$  parameter:  $V_{GS}$

**Diagram 6: Typ. output characteristics**



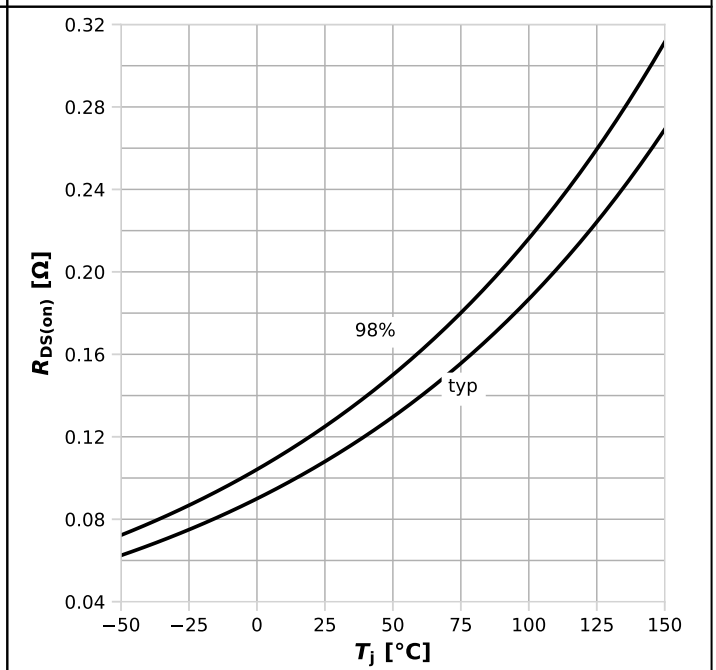
$I_D = f(V_{DS}); T_j = 125\text{ °C};$  parameter:  $V_{GS}$

**Diagram 7: Typ. drain-source on-state resistance**



$R_{DS(on)} = f(I_D); T_j = 125\text{ °C};$  parameter:  $V_{GS}$

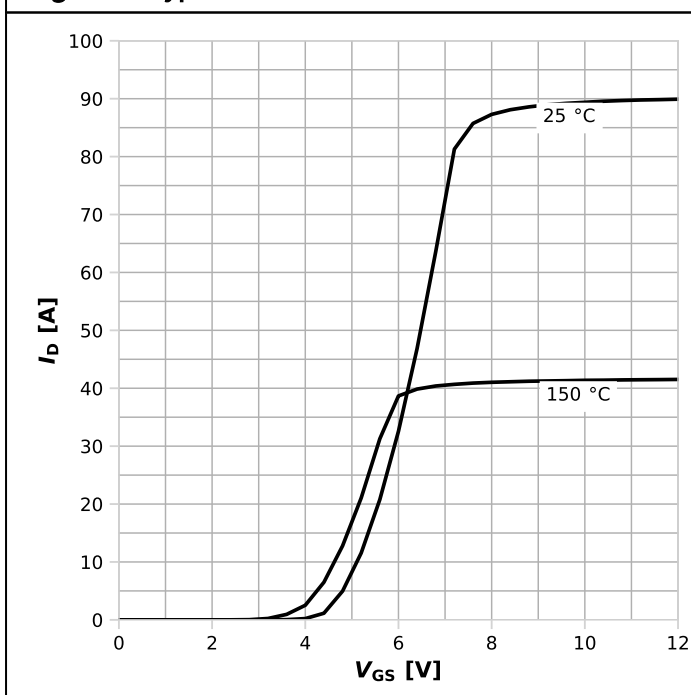
**Diagram 8: Drain-source on-state resistance**



$R_{DS(on)} = f(T_j); I_D = 6.4\text{ A}; V_{GS} = 10\text{ V}$

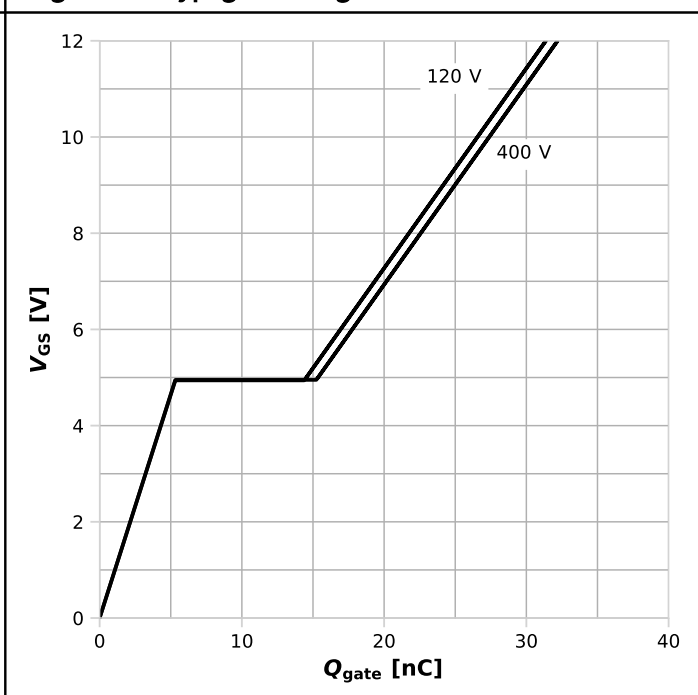


**Diagram 9: Typ. transfer characteristics**



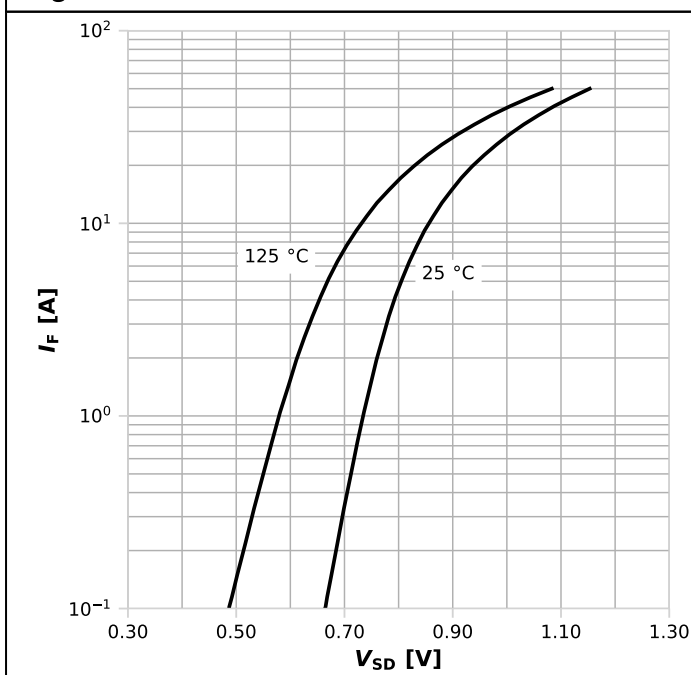
$I_D=f(V_{GS}); V_{DS}=20V$ ; parameter:  $T_j$

**Diagram 10: Typ. gate charge**



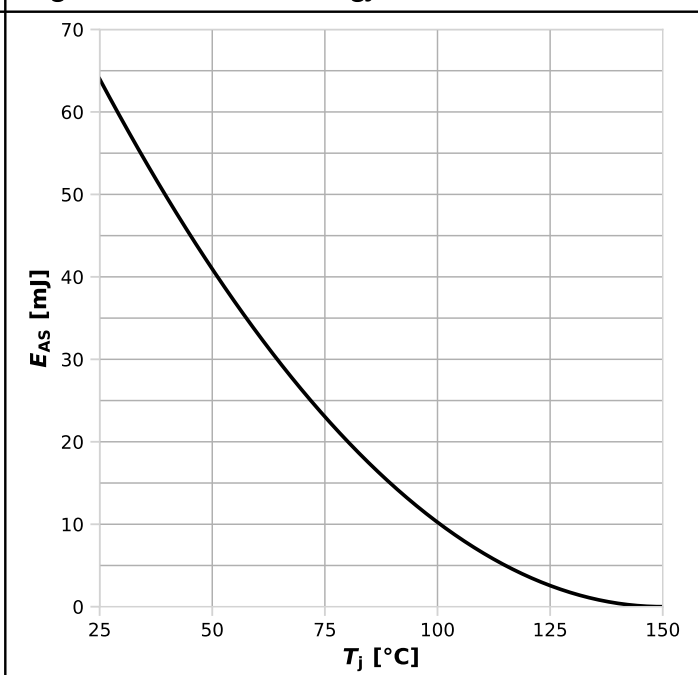
$V_{GS}=f(Q_{gate}); I_D=6.4$  A pulsed; parameter:  $V_{DD}$

**Diagram 11: Forward characteristics of reverse diode**



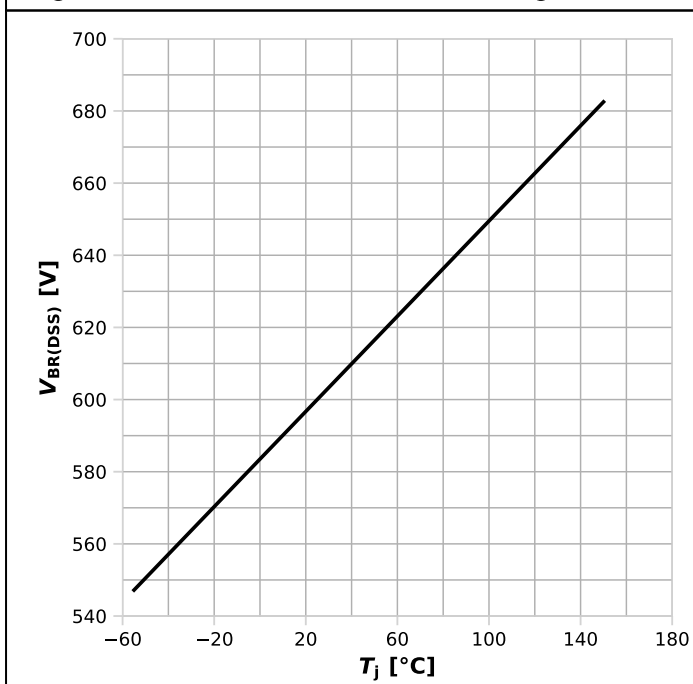
$I_F=f(V_{SD})$ ; parameter:  $T_j$

**Diagram 12: Avalanche energy**



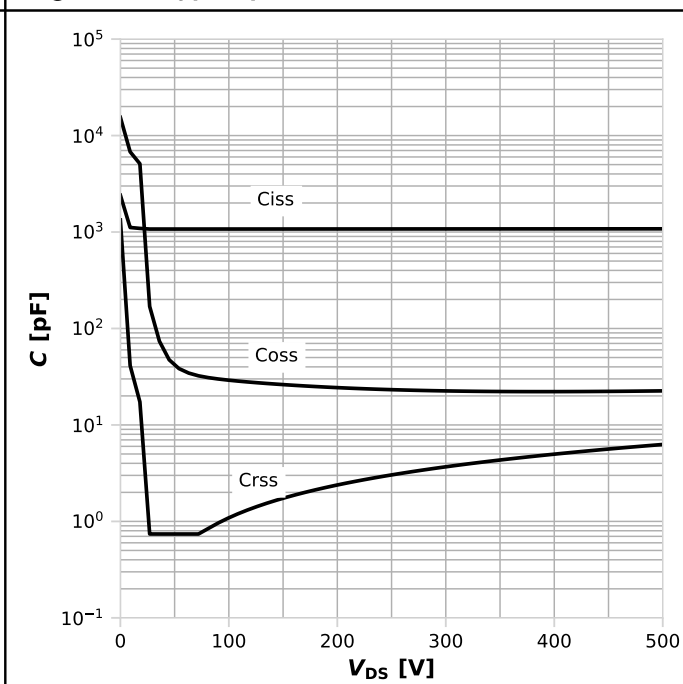
$E_{AS}=f(T_j); I_D=3.8$  A;  $V_{DD}=50$  V

**Diagram 13: Drain-source breakdown voltage**



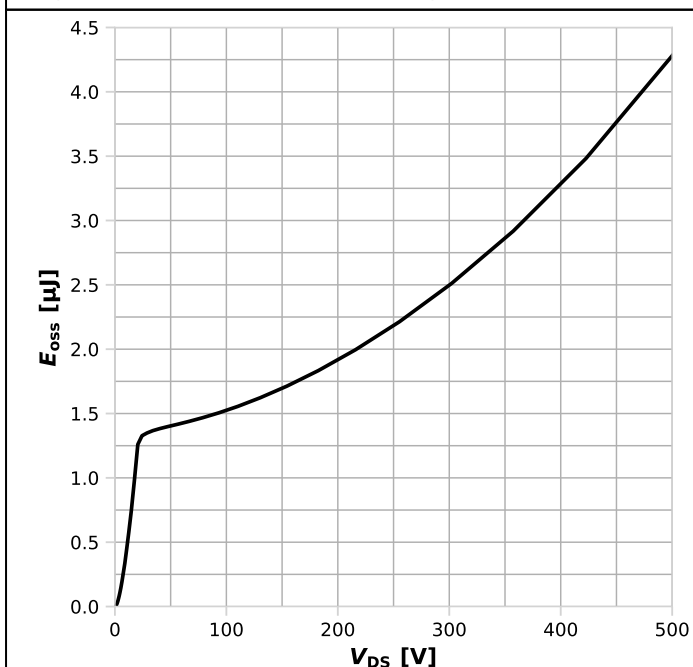
$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$

**Diagram 14: Typ. capacitances**



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

**Diagram 15: Typ. Coss stored energy**



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

## 5 Test circuits

**Table 8 Diode characteristics**

Test circuit for diode characteristics	Diode recovery waveform

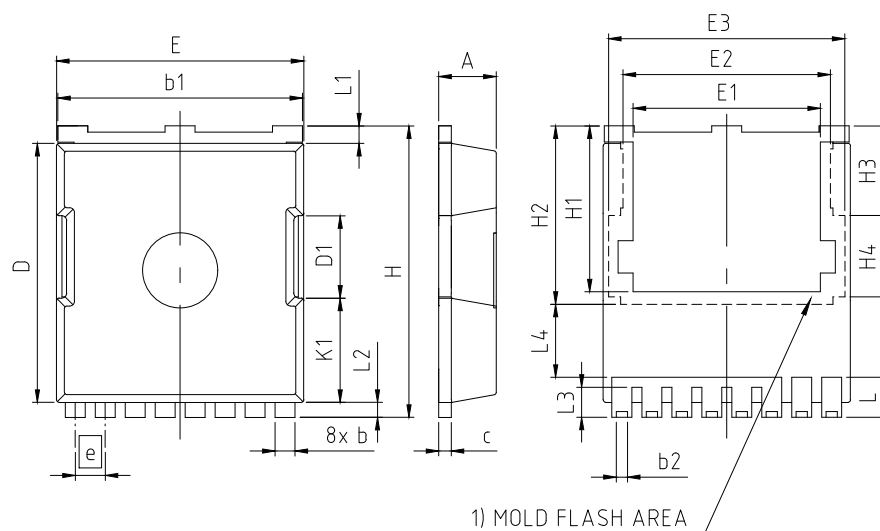
**Table 9 Switching times (ss)**

Switching times test circuit for inductive load	Switching times waveform

**Table 10 Unclamped inductive load (ss)**

Unclamped inductive load test circuit	Unclamped inductive waveform

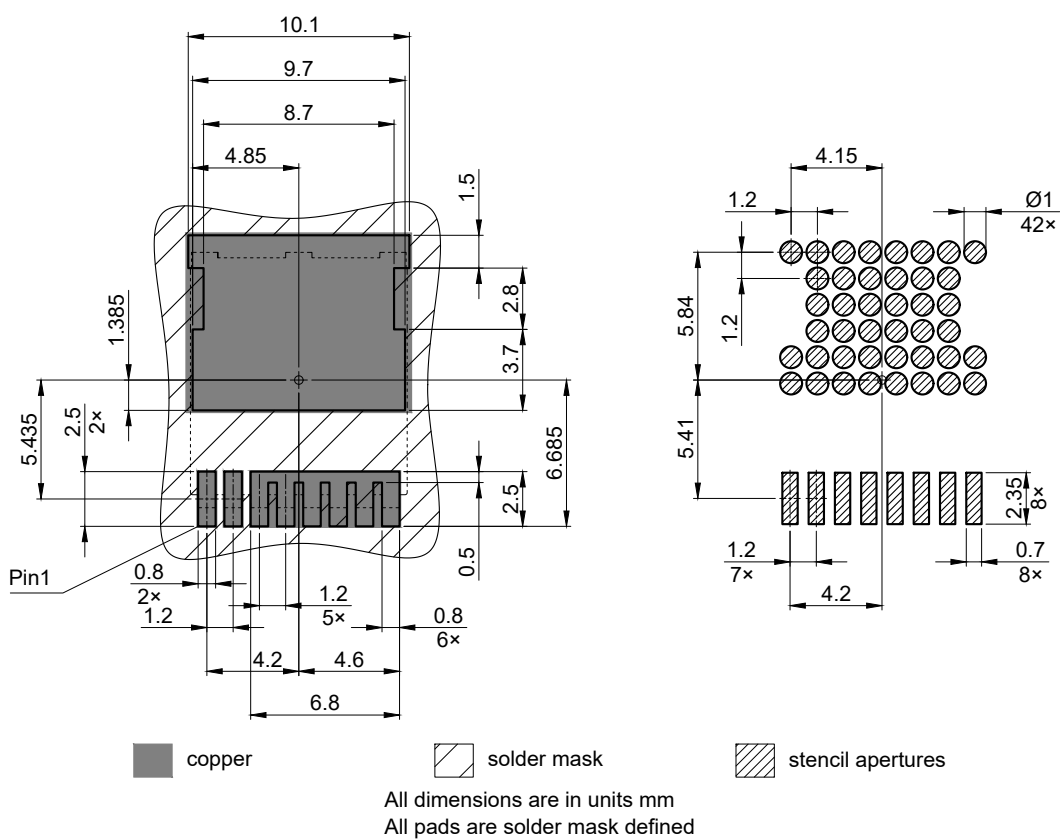
## 6 Package outlines



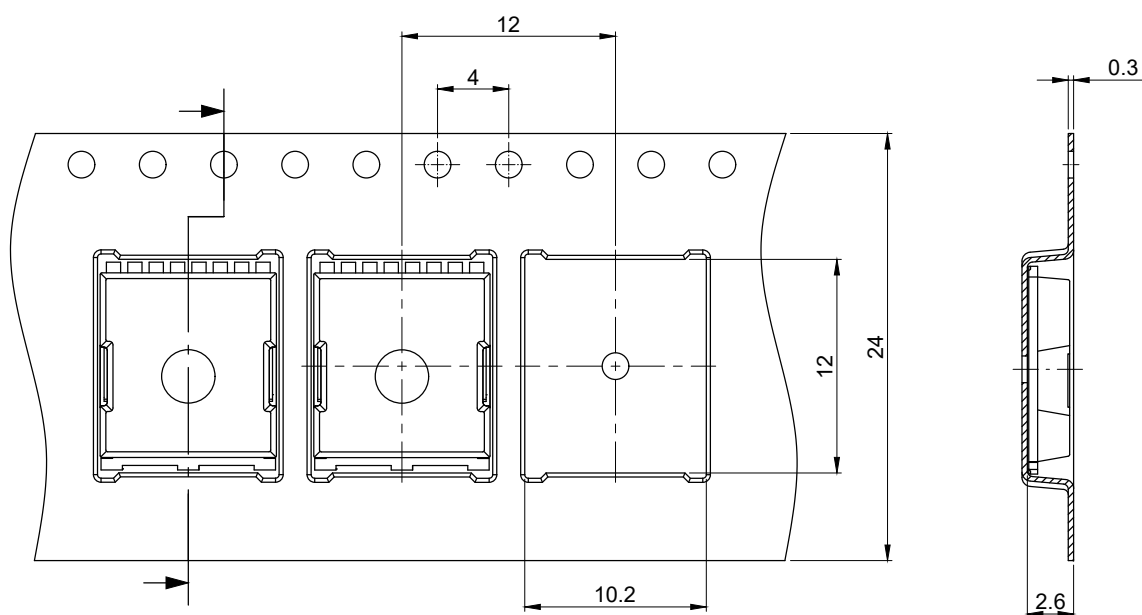
PACKAGE - GROUP NUMBER: <b>PG-HSOF-8-U02</b>		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
<b>A</b>	2.20	2.40
<b>b</b>	0.70	0.90
<b>b1</b>	9.70	9.90
<b>b2</b>	0.42	0.50
<b>c</b>	0.40	0.60
<b>D</b>	10.28	10.58
<b>D1</b>	3.30	
<b>E</b>	9.70	10.10
<b>E1</b>	7.50	
<b>E2</b>	8.50	
<b>E3</b>	9.46	
<b>e</b>	1.20 (BSC)	
<b>H</b>	11.48	11.88
<b>H1</b>	6.55	6.95
<b>H2</b>	7.15	
<b>H3</b>	3.59	
<b>H4</b>	3.26	
<b>N</b>	8	
<b>K1</b>	4.18	
<b>L</b>	1.40	1.80
<b>L1</b>	0.50	0.90
<b>L2</b>	0.50	0.70
<b>L3</b>	1.00	1.30
<b>L4</b>	2.62	2.81

1) PARTIALLY COVERED WITH MOLD FLASH

**Figure 1 Outline PG-HSOF-8, dimensions in mm**



**Figure 2 Footprint drawing PG-HSOF-8, dimensions in mm**



All dimensions are in units mm  
The drawing is in compliance with ISO 128-30, Projection Method 1 [  ]

**Figure 3** Packaging variant PG-HSOF-8, dimensions in mm

## 7 Appendix A

**Table 11**    **Related links**

- [IFX CoolMOS™ G7 Webpage](#)
- [IFX CoolMOS™ G7 application note](#)
- [IFX CoolMOS™ G7 simulation model](#)
- [IFX Design tools](#)

## Revision history

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IPT60R125G7

### Revision 2025-02-03, Rev. 2.2

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Previous revisions

Revision	Date	Subjects (major changes since last revision)
2.0	2016-12-15	Release of final version
2.1	2020-10-28	Content update diagram 2,3,4,7,8 and format update
2.2	2025-02-03	Implementation of standardized Infineon Umbrella-Templates for package drawings. H1 Extension from 6.75 to 6.95 MAX



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