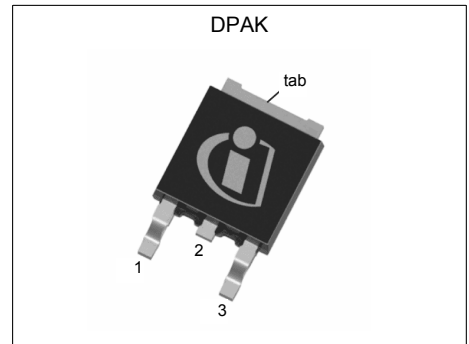


# MOSFET

## 600V CoolMOS™ CM8 Power Transistor

The CoolMOS™ 8th generation platform is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies. The 600V CoolMOS™ CM8 series is the successor to the CoolMOS™ 7. It combines the benefits of a fast switching SJ MOSFET with excellent ease of use, e.g low ringing tendency, implemented fast body diode (CFD) for all products with outstanding robustness against hard commutation and excellent ESD capability. Furthermore, extremely low switching and conduction losses of CM8, make switching applications even more efficient.

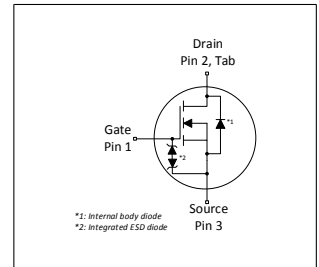


### Features

- Suitable for hard and soft switching topologies thanks to an outstanding commutation ruggedness
- Significant reduction of switching and conduction losses
- Best in class  $R_{DS(on)}$  per package products enabled by ultra low  $R_{DS(on)} \cdot A$

### Benefits

- Ease of use and fast design-in through low ringing tendency and usage across PFC and PWM stages
- Simplified thermal management thanks to our advanced die attach technique
- Increased power density solutions enabled by using products with smaller footprint and higher manufacturing quality due state of the art ESD protection
- Suitable for a wide variety of applications and power ranges



RoHS

### Potential applications

- Power supplies and converters
- PFC stages & LLC resonant converters
- High efficiency switching applications
- e.g. Server, Telecom, EV Charging, UPS

### 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
$R_{DS(on),max}$	600	mΩ
$Q_{g,typ}$	6	nC
$I_{D,pulse}$	14	A
$E_{oss} @ 400V$	0.9	μJ
Body diode $di_F/dt$	1300	A/μs
ESD class (HBM)	2	-

Type / Ordering Code	Package	Marking	Related Links
IPD60R600CM8	PG-TO252-3	60R600C8	see Appendix A

## Table of Contents

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## 1 Maximum ratings

at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

**Table 2 Maximum ratings**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current <sup>1)</sup>	$I_D$	-	-	7 4	A	$T_C=25^\circ\text{C}$ $T_C=100^\circ\text{C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	14	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	8	mJ	$I_D=1.0\text{A}$ ; $V_{DD}=50\text{V}$ ; see table 10
Avalanche energy, repetitive	$E_{AR}$	-	-	0.04	mJ	$I_D=1.0\text{A}$ ; $V_{DD}=50\text{V}$ ; see table 10
Avalanche current, single pulse	$I_{AS}$	-	-	1.0	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	$P_{tot}$	-	-	64	W	$T_C=25^\circ\text{C}$
Storage temperature	$T_{stg}$	-55	-	150	$^\circ\text{C}$	-
Operating junction temperature	$T_j$	-55	-	150	$^\circ\text{C}$	-
Extended operating junction temperature	$T_j$	150	-	175	$^\circ\text{C}$	$\leq 50\text{ h}$ in the application lifetime
Mounting torque	-	-	-	-	Ncm	-
Continuous diode forward current	$I_S$	-	-	7	A	$T_C=25^\circ\text{C}$
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	-	-	14	A	$T_C=25^\circ\text{C}$
Reverse diode dv/dt <sup>3)</sup>	dv/dt	-	-	70	V/ns	$V_{DS}=0\dots400\text{V}$ , $I_{SD}\leq 7\text{A}$ , $T_j=25^\circ\text{C}$ see table 8
Maximum diode commutation speed	di <sub>F</sub> /dt	-	-	1300	A/ $\mu\text{s}$	$V_{DS}=0\dots400\text{V}$ , $I_{SD}\leq 7\text{A}$ , $T_j=25^\circ\text{C}$ see table 8
Insulation withstand voltage	$V_{ISO}$	-	-	n.a.	V	$V_{rms}$ , $T_C=25^\circ\text{C}$ , $t=1\text{min}$

<sup>1)</sup> Limited by  $T_{j,max}$ .

<sup>2)</sup> Pulse width  $t_p$  limited by  $T_{j,max}$

<sup>3)</sup> Identical low side and high side switch with identical  $R_\theta$

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	$R_{thJC}$	-	-	1.94	K/W	-
Thermal resistance, junction - ambient	$R_{thJA}$	-	-	62	K/W	device on PCB, minimal footprint
Thermal resistance, junction - ambient for SMD version	$R_{thJA}$	-	35	45	K/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  $T_j=25^\circ\text{C}$ , 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	$V_{GS}=0V, I_D=1mA$
Gate threshold voltage	$V_{(GS)th}$	3.7	4.2	4.7	V	$V_{DS}=V_{GS}, I_D=0.04mA$
Zero gate voltage drain current	$I_{DSS}$	-	-	1	$\mu A$	$V_{DS}=600V, V_{GS}=0V, T_j=25^\circ C$ $V_{DS}=600V, V_{GS}=0V, T_j=150^\circ C$
Gate-source leakage current	$I_{GSS}$	-	-	2.2	$\mu A$	$V_{GS}=20V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.500 1.104	0.600	$\Omega$	$V_{GS}=10V, I_D=1.7A, T_j=25^\circ C$ $V_{GS}=10V, I_D=1.7A, T_j=150^\circ C$
Gate resistance	$R_G$	-	24	-	$\Omega$	$f=1MHz$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	230	-	pF	$V_{GS}=0V, V_{DS}=400V, f=250kHz$
Output capacitance	$C_{oss}$	-	5	-	pF	$V_{GS}=0V, V_{DS}=400V, f=250kHz$
Effective output capacitance, energy related <sup>1)</sup>	$C_{o(er)}$	-	11	-	pF	$V_{GS}=0V, V_{DS}=0...400V$
Effective output capacitance, time related <sup>2)</sup>	$C_{o(tr)}$	-	96	-	pF	$I_D=constant, V_{GS}=0V, V_{DS}=0...400V$
Turn-on delay time	$t_{d(on)}$	-	9.5	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=0.8A,$ $R_G=11.0\Omega$ ; see table 9
Rise time	$t_r$	-	4.8	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=0.8A,$ $R_G=11.0\Omega$ ; see table 9
Turn-off delay time	$t_{d(off)}$	-	58.5	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=0.8A,$ $R_G=11.0\Omega$ ; see table 9
Fall time	$t_f$	-	20	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=0.8A,$ $R_G=11.0\Omega$ ; see table 9

**Table 6 Gate charge characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{GS}$	-	1	-	nC	$V_{DD}=400V, I_D=0.8A, V_{GS}=0$ to 10V
Gate to drain charge	$Q_{gd}$	-	3	-	nC	$V_{DD}=400V, I_D=0.8A, V_{GS}=0$ to 10V
Gate charge total	$Q_g$	-	6	-	nC	$V_{DD}=400V, I_D=0.8A, V_{GS}=0$ to 10V
Gate plateau voltage	$V_{plateau}$	-	6.3	-	V	$V_{DD}=400V, I_D=0.8A, V_{GS}=0$ to 10V

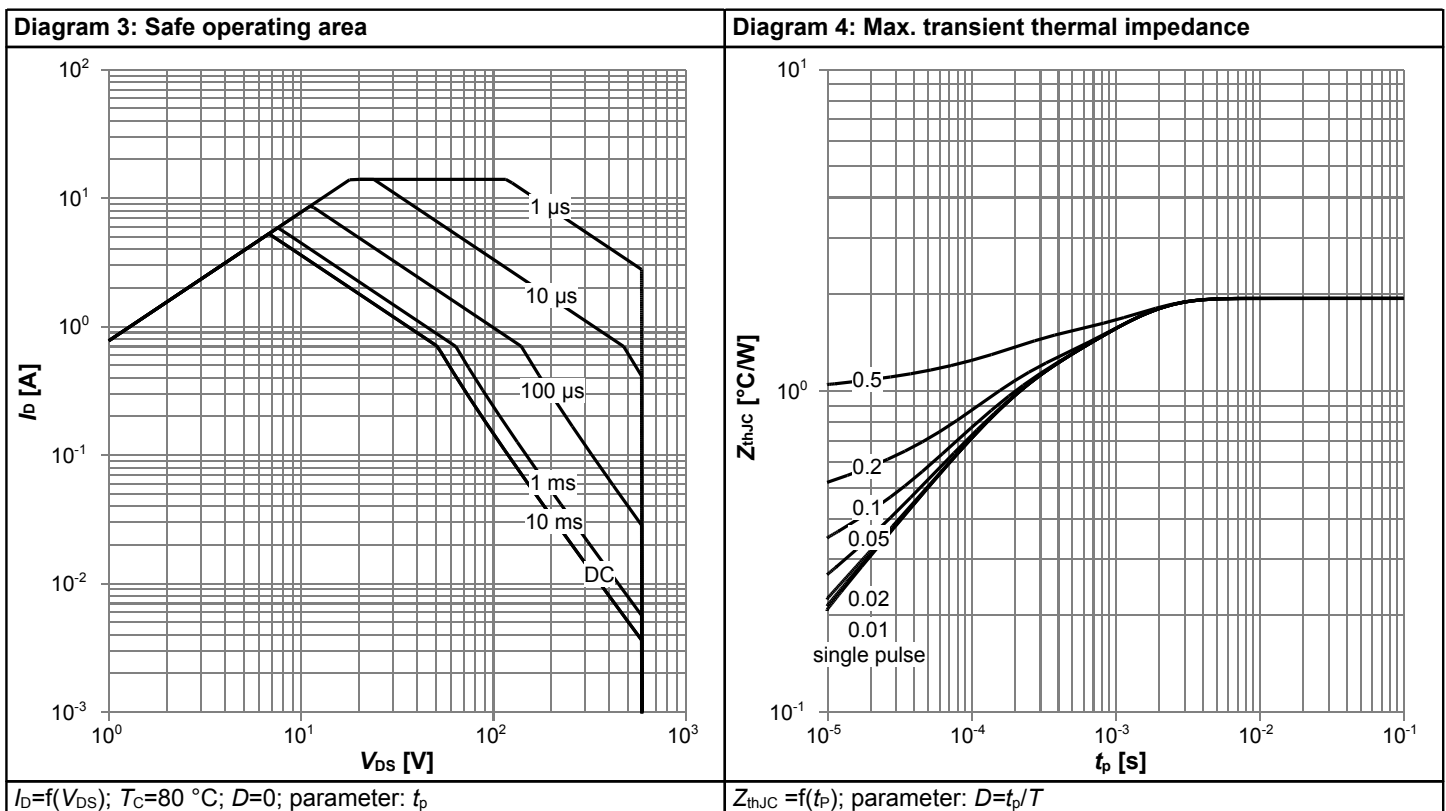
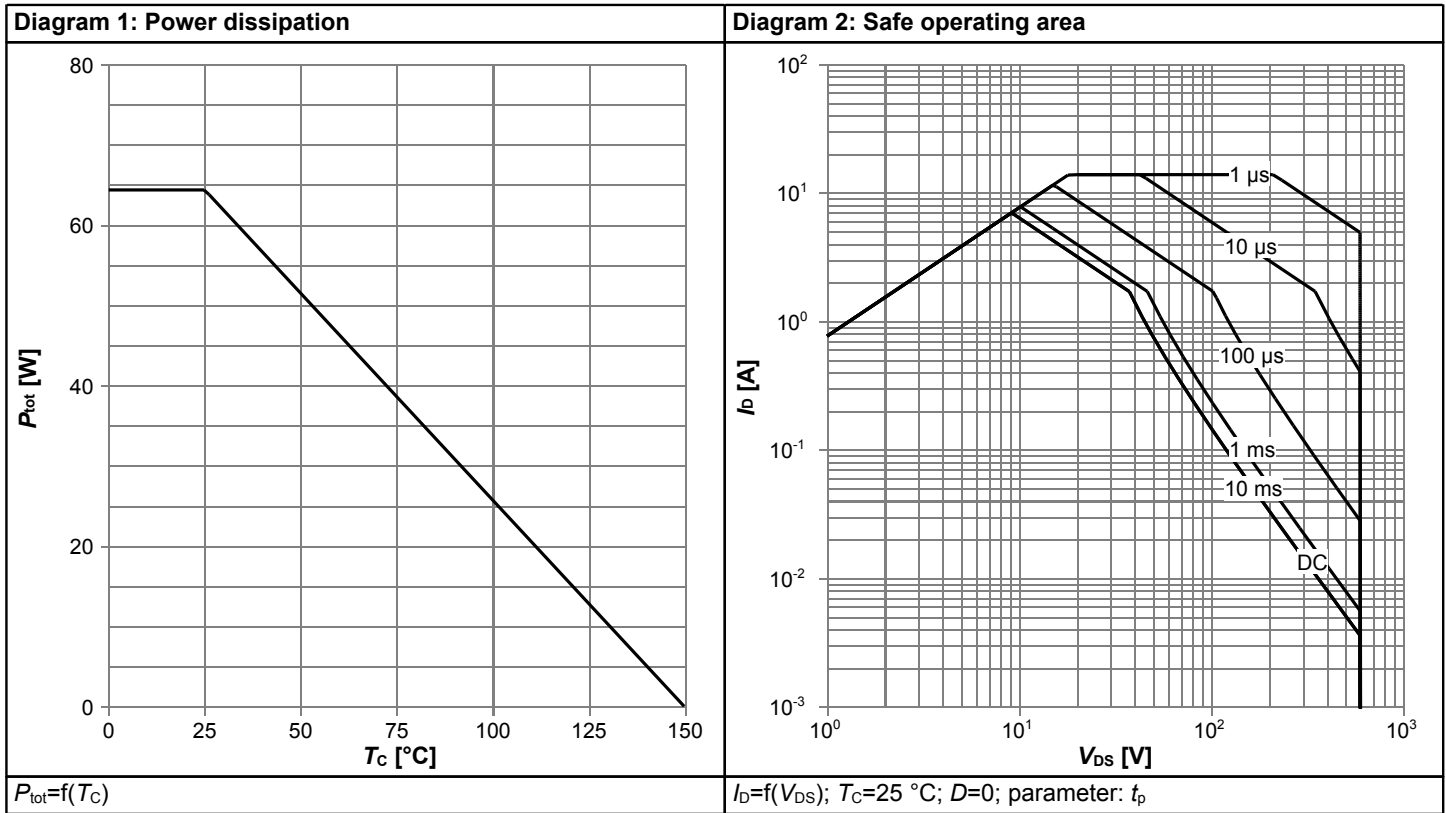
<sup>1)</sup>  $C_{o(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 400V

<sup>2)</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 7 Reverse diode characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	$V_{SD}$	-	0.9	-	V	$V_{GS}=0V, I_F=0.8A, T_j=25^\circ C$
Reverse recovery time	$t_{rr}$	-	37.0	46	ns	$V_R=400V, I_F=0.8A, di_F/dt=100A/\mu s$ ; see table 8
Reverse recovery charge	$Q_{rr}$	-	0.07	0.11	$\mu C$	$V_R=400V, I_F=0.8A, di_F/dt=100A/\mu s$ ; see table 8
Peak reverse recovery current	$I_{rrm}$	-	3.4	-	A	$V_R=400V, I_F=0.8A, di_F/dt=100A/\mu s$ ; see table 8

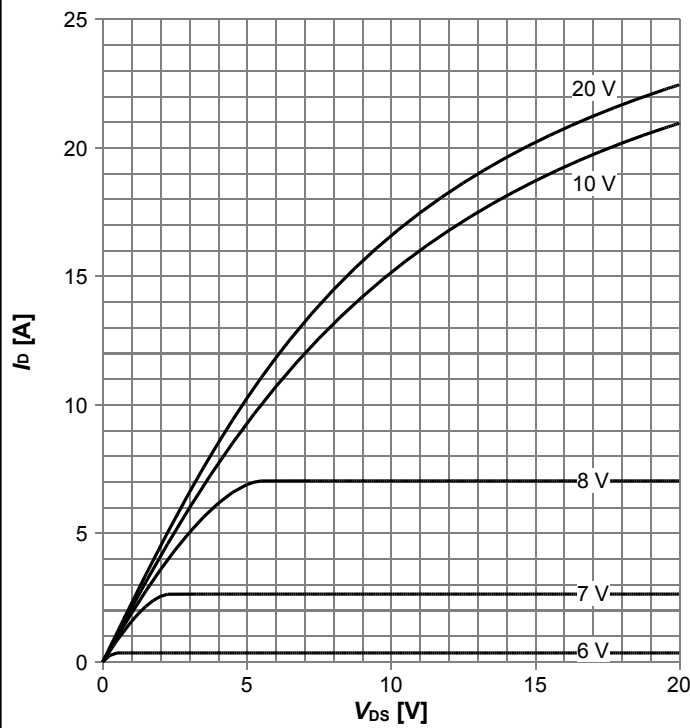
### 4 Electrical characteristics diagrams



# 600V CoolMOS™ CM8 Power Transistor

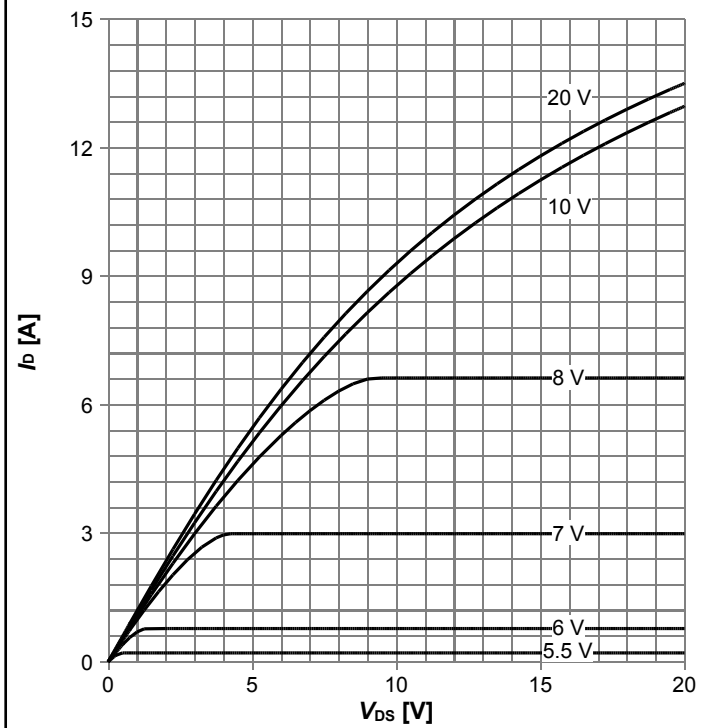
## IPD60R600CM8

Diagram 5: Typ. output characteristics



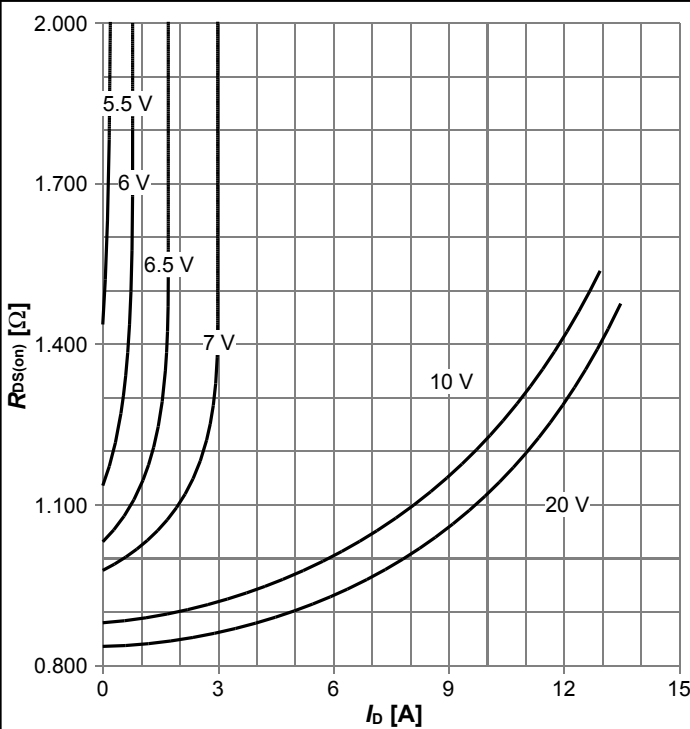
$I_D = f(V_{DS})$ ;  $T_j = 25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. output characteristics



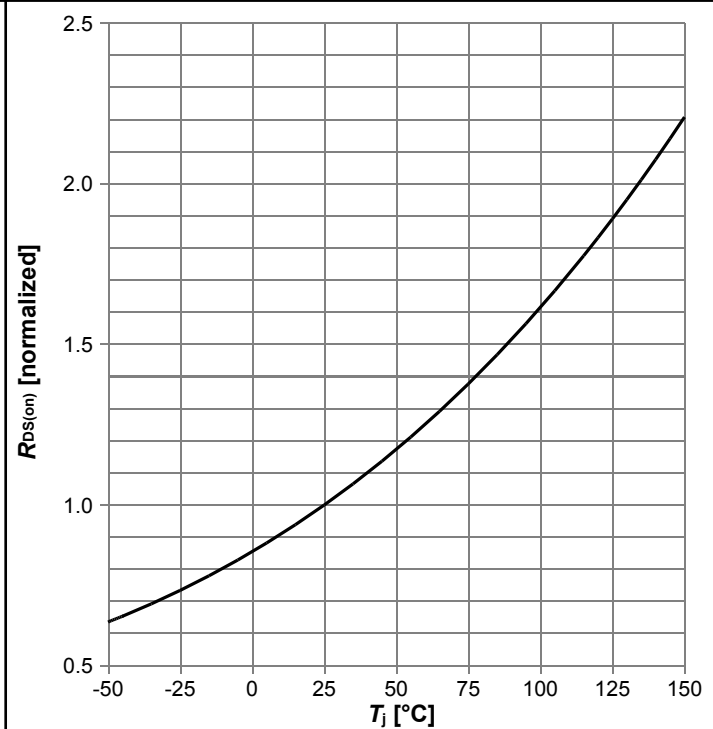
$I_D = f(V_{DS})$ ;  $T_j = 125\text{ °C}$ ; parameter:  $V_{GS}$

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



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

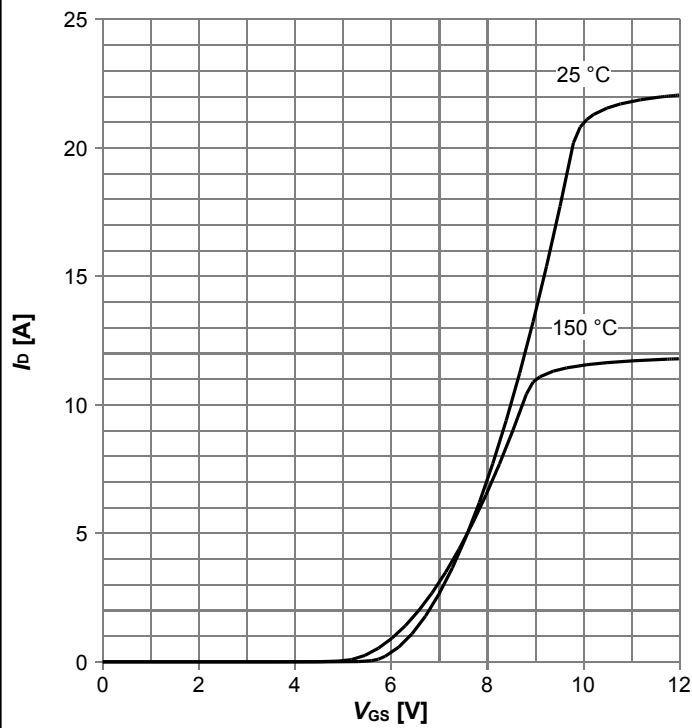
Diagram 8: Drain-source on-state resistance



$R_{DS(on)} = f(T_j)$ ;  $I_D = 1.7\text{ A}$ ;  $V_{GS} = 10\text{ V}$

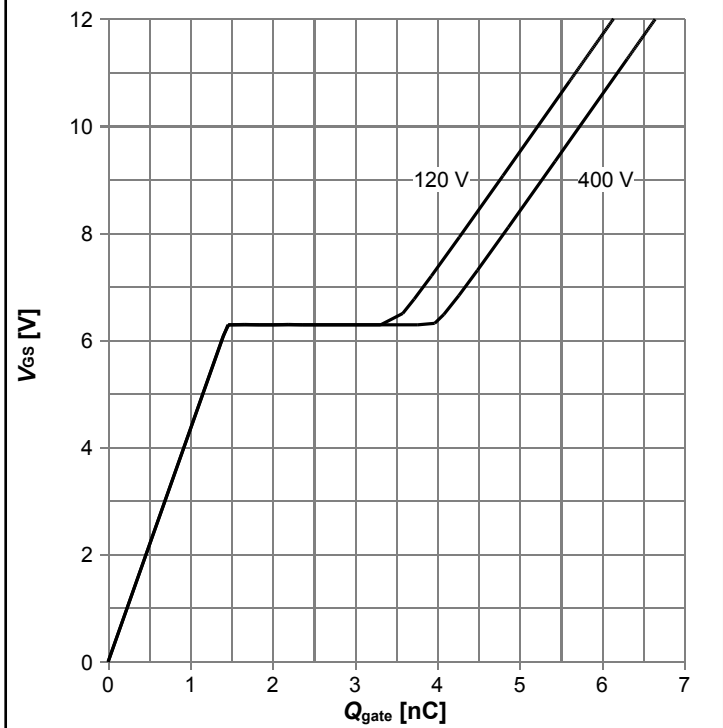


Diagram 9: Typ. transfer characteristics



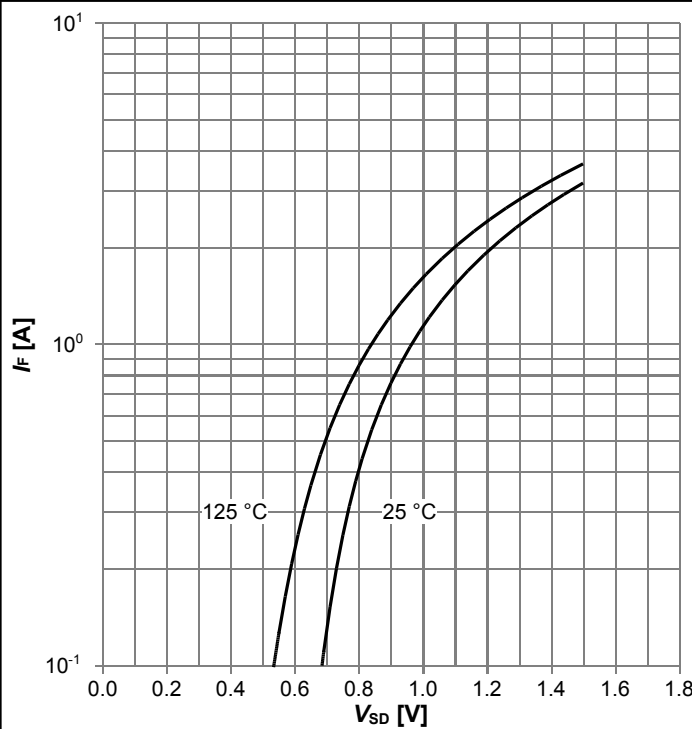
$I_D = f(V_{GS})$ ;  $V_{DS} = 20V$ ; parameter:  $T_j$

Diagram 10: Typ. gate charge



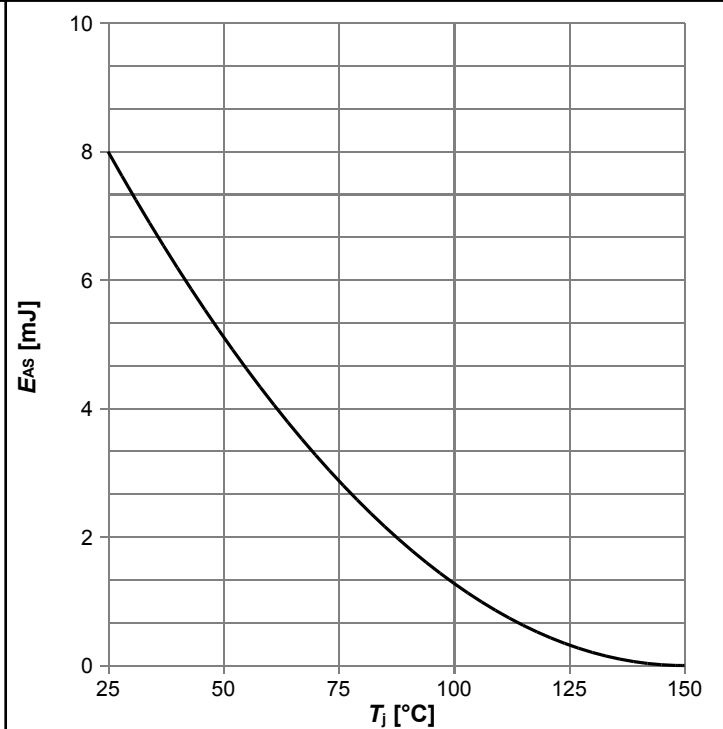
$V_{GS} = f(Q_{gate})$ ;  $I_D = 0.8$  A pulsed; parameter:  $V_{DD}$

Diagram 11: Forward characteristics of reverse diode



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

Diagram 12: Avalanche energy

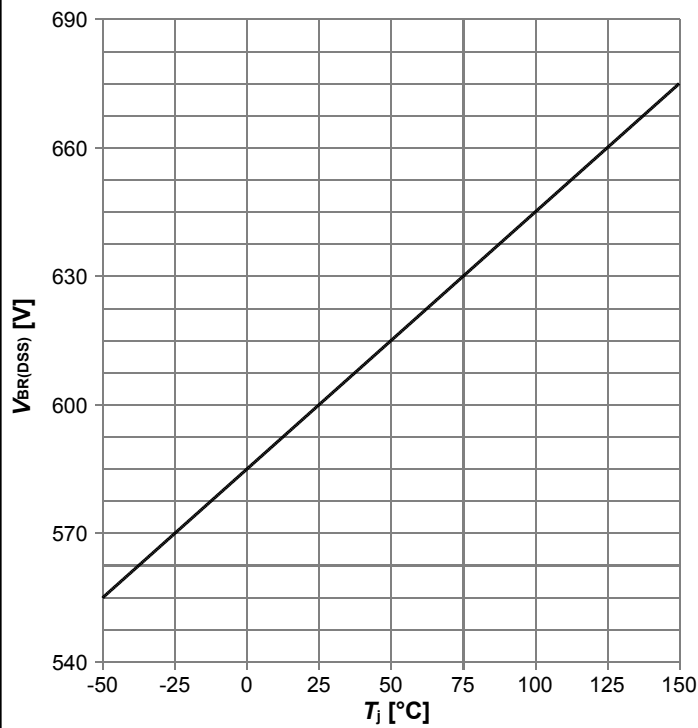


$E_{AS} = f(T_j)$ ;  $I_D = 1.0$  A;  $V_{DD} = 50$  V

# 600V CoolMOS™ CM8 Power Transistor

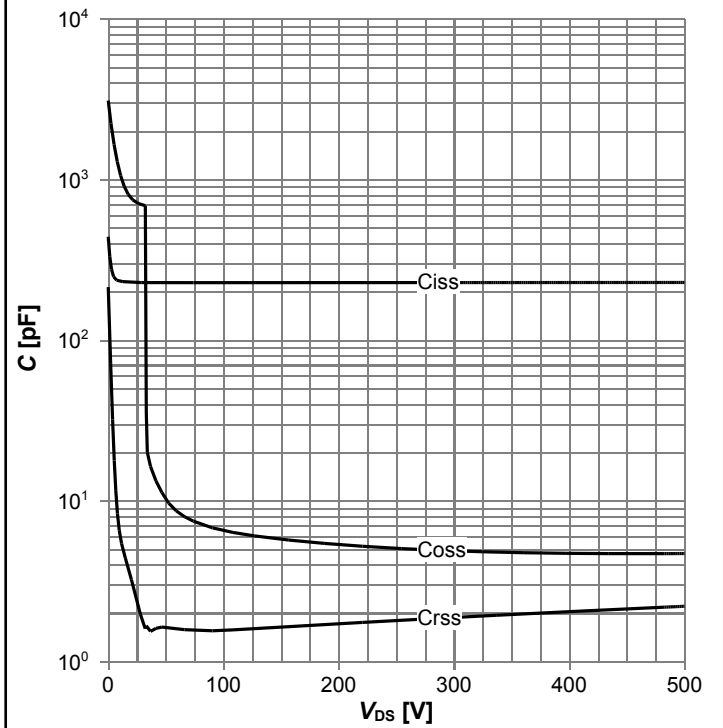
## IPD60R600CM8

Diagram 13: Drain-source breakdown voltage



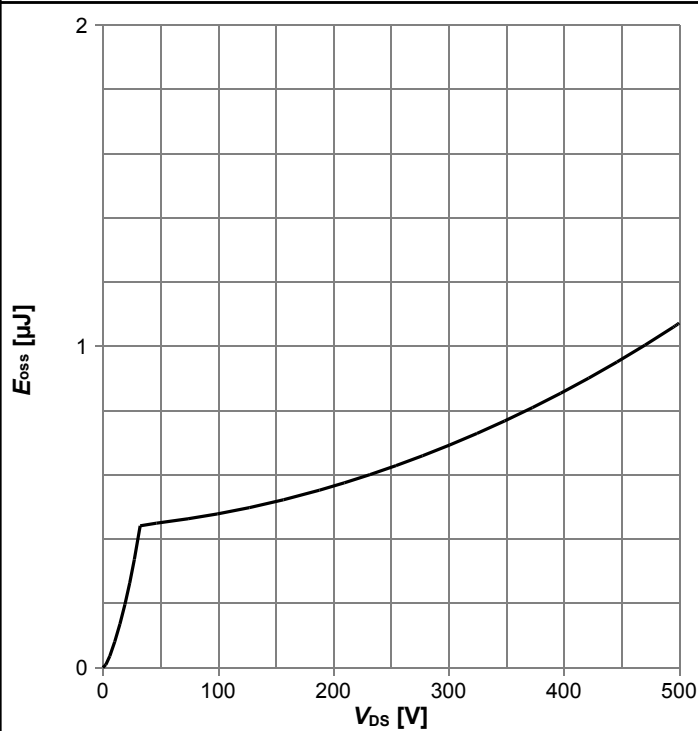
$V_{BR(DSS)}=f(T_j); I_D=1\text{ mA}$

Diagram 14: Typ. capacitances



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

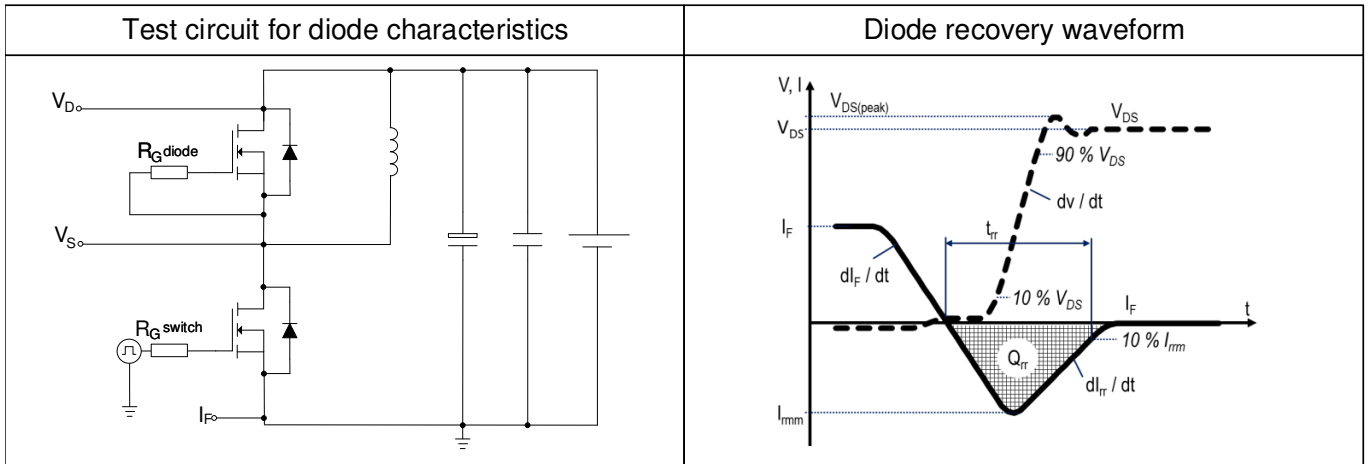
Diagram 15: Typ. Coss stored energy



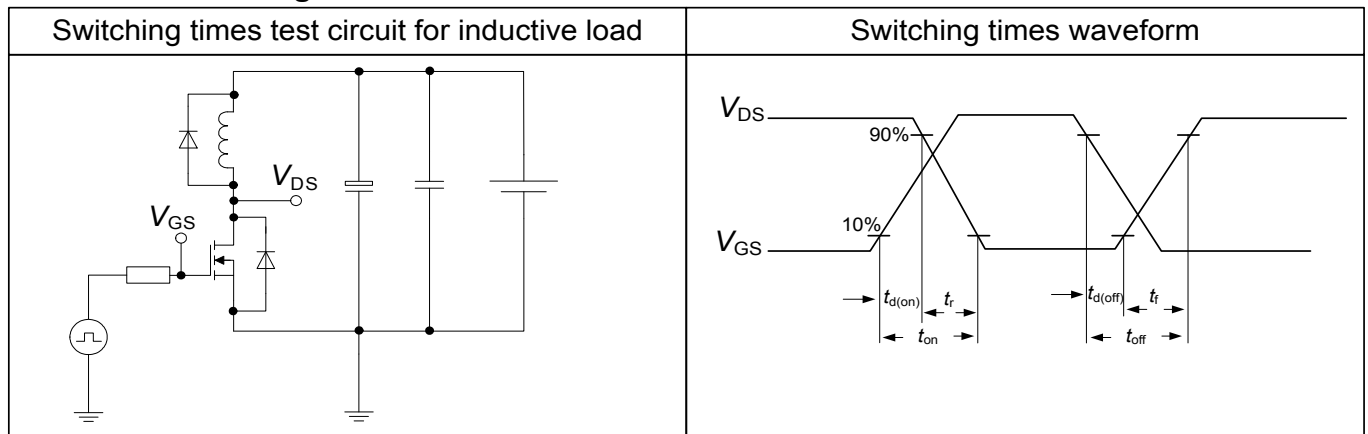
$E_{oss}=f(V_{DS})$

## 5 Test Circuits

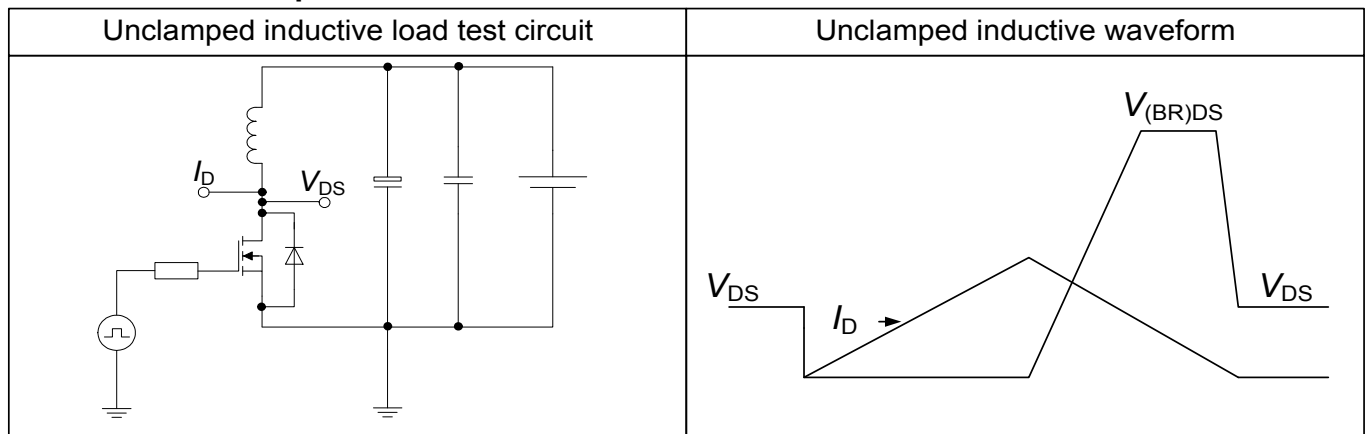
**Table 8 Diode characteristics (C8)**



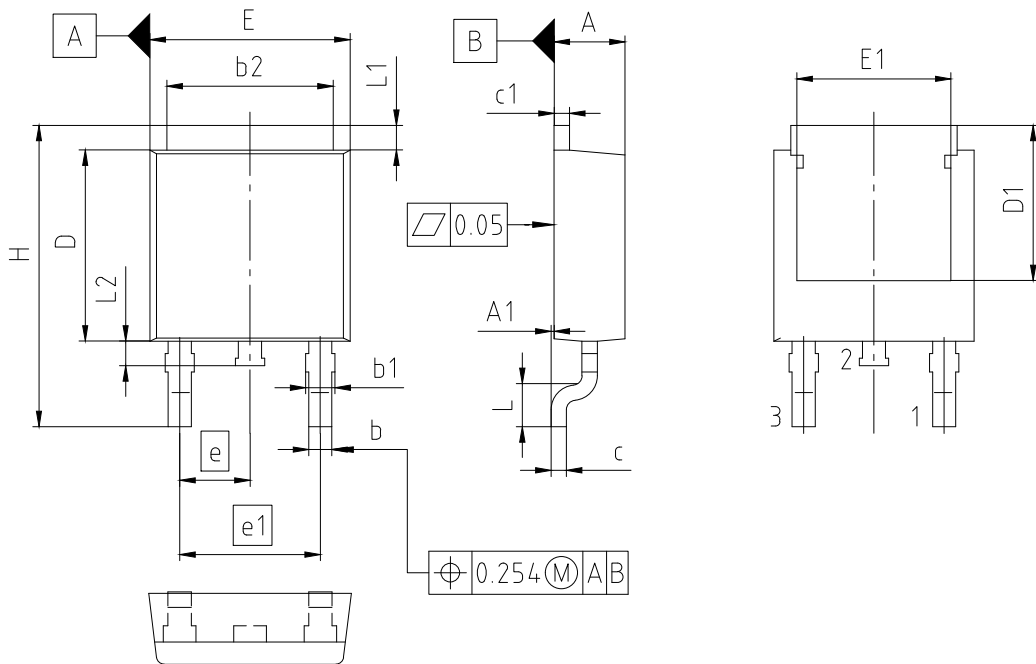
**Table 9 Switching times**



**Table 10 Unclamped inductive load**



## 6 Package Outlines



PACKAGE - GROUP NUMBER: <b>PG-TO252-3-U02</b>		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	2.16	2.41
A1	0.00	0.15
b	0.64	0.89
b1	0.65	1.15
b2	4.95	5.50
c	0.46	0.61
c1	0.40	0.98
D	5.97	6.22
D1	5.02	5.84
E	6.35	6.73
E1	4.32	5.50
e	2.29	
e1	4.57	
N	3	
H	9.40	10.48
L	1.18	1.78
L1	0.89	1.27
L2	0.51	1.02

ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

Figure 1 Outline PG-TO252-3, dimensions in mm

## 7 Appendix A

### Table 11 Related Links

- IFX CoolMOS CM8 Webpage: [www.infineon.com](http://www.infineon.com)
- IFX CoolMOS CM8 application note: [www.infineon.com](http://www.infineon.com)
- IFX CoolMOS CM8 simulation model: [www.infineon.com](http://www.infineon.com)
- IFX Design tools: [www.infineon.com](http://www.infineon.com)

## Revision History

IPD60R600CM8

**Revision: 2024-03-21, Rev. 2.2**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2023-09-26	Release of final version
2.1	2023-10-14	Update of switching times
2.2	2024-03-21	Update of $R_{thJC}$

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### Published by

**Infineon Technologies AG**

**81726 München, Germany**

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