

## MOSFET

### 800V CoolMOS™ P7 Power Transistor

The latest 800V CoolMOS™ P7 series sets a new benchmark in 800V super junction technologies and combines best-in-class performance with state of the art ease-of-use, resulting from Infineon's over 18 years pioneering super junction technology innovation.

#### Features

- Best-in-class FOM  $R_{DS(on)} * E_{oss}$ ; reduced  $Q_g$ ,  $C_{iss}$ , and  $C_{oss}$
- Best-in-class DPAK  $R_{DS(on)}$
- Best-in-class  $V_{(GS)th}$  of 3V and smallest  $V_{(GS)th}$  variation of  $\pm 0.5V$
- Integrated Zener Diode ESD protection
- Best-in-class CoolMOS™ quality and reliability; qualified for industrial grade applications according to JEDEC (J-STD20 and JESD22)
- Fully optimized portfolio

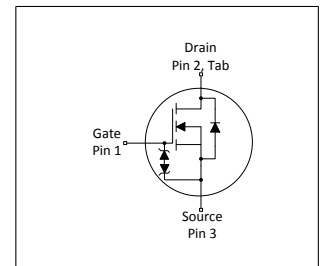
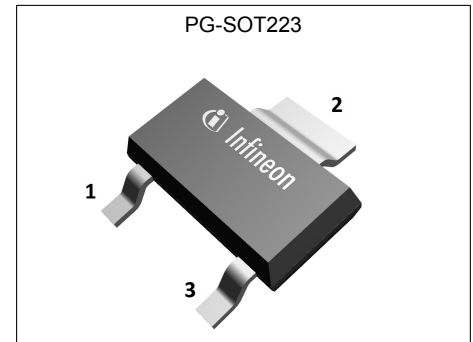
#### Benefits

- Best-in-class performance
- Enabling higher power density designs, BOM savings and lower assembly costs
- Easy to drive and to parallel
- Better production yield by reducing ESD related failures
- Less production issues and reduced field returns
- Easy to select right parts for fine tuning of designs

#### Potential applications

Recommended for hard and soft switching flyback topologies for LED Lighting, low power Chargers and Adapters, Audio, AUX power and Industrial power. Also suitable for PFC stage in Consumer applications and Solar.

*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
$V_{DS} @ T_j=25^\circ C$	800	V
$R_{DS(on),max}$	1.4	$\Omega$
$Q_{g,typ}$	10	nC
$I_D$	4	A
$E_{oss} @ 500V$	0.9	$\mu J$
$V_{GS(th),typ}$	3	V
ESD class (HBM)	2	-

Type / Ordering Code	Package	Marking	Related Links
IPN80R1K4P7	PG-SOT223	80R1K4	see Appendix A

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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>	$I_D$	-	-	4 2.7	A	$T_C=25^\circ\text{C}$ $T_C=100^\circ\text{C}$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	8.9	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	8	mJ	$I_D=0.6\text{A}$ ; $V_{DD}=50\text{V}$
Avalanche energy, repetitive	$E_{AR}$	-	-	0.07	mJ	$I_D=0.6\text{A}$ ; $V_{DD}=50\text{V}$
Avalanche current, repetitive	$I_{AR}$	-	-	0.6	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	100	V/ns	$V_{DS}=0$ to 400V
Gate source voltage	$V_{GS}$	-20 -30	-	20 30	V	static; AC ( $f>1$ Hz)
Power dissipation	$P_{tot}$	-	-	7	W	$T_C=25^\circ\text{C}$
Operating and storage temperature	$T_j, T_{stg}$	-55	-	150	$^\circ\text{C}$	-
Continuous diode forward current	$I_S$	-	-	1.4	A	$T_C=25^\circ\text{C}$
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	-	-	8.9	A	$T_C=25^\circ\text{C}$
Reverse diode dv/dt <sup>3)</sup>	dv/dt	-	-	1	V/ns	$V_{DS}=0$ to 400V, $I_{SD}\leq 0.7\text{A}$ , $T_j=25^\circ\text{C}$
Maximum diode commutation speed <sup>3)</sup>	di/dt	-	-	50	A/ $\mu\text{s}$	$V_{DS}=0$ to 400V, $I_{SD}\leq 0.7\text{A}$ , $T_j=25^\circ\text{C}$

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - solder point	$R_{thJS}$	-	-	18.7	$^\circ\text{C/W}$	-
Thermal resistance, junction - ambient	$R_{thJA}$	-	-	160	$^\circ\text{C/W}$	Device on PCB, minimal footprint
Thermal resistance, junction - ambient soldered on copper area	$R_{thJA}$	-	-	75	$^\circ\text{C/W}$	Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm <sup>2</sup> (one layer 70 $\mu\text{m}$ thickness) copper area for drain connection and cooling. PCB is vertical without air stream cooling.
Soldering temperature, wave- & reflow soldering allowed	$T_{sold}$	-	-	260	$^\circ\text{C}$	reflow MSL1

<sup>1)</sup> DPAK equivalent. Limited by  $T_{j,max}$ . Maximum duty cycle  $D=0.5$

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

<sup>3)</sup>  $V_{DClink}=400\text{V}$ ;  $V_{DS,peak}<V_{(BR)DSS}$ ; identical low side and high side switch with identical  $R_G$ ;  $t_{cond}<2\mu\text{s}$

### 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	$V_{(BR)DSS}$	800	-	-	V	$V_{GS}=0V, I_D=1mA$
Gate threshold voltage	$V_{GS(th)}$	2.5	3	3.5	V	$V_{DS}=V_{GS}, I_D=0.07mA$
Zero gate voltage drain current	$I_{DSS}$	-	-	1	$\mu A$	$V_{DS}=800V, V_{GS}=0V, T_j=25^\circ C$ $V_{DS}=800V, V_{GS}=0V, T_j=150^\circ C$
Gate-source leakage current incl. zener diode	$I_{GSS}$	-	-	1	$\mu A$	$V_{GS}=20V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.2	1.4	$\Omega$	$V_{GS}=10V, I_D=1.4A, T_j=25^\circ C$ $V_{GS}=10V, I_D=1.4A, T_j=150^\circ C$
Gate resistance	$R_G$	-	1.5	-	$\Omega$	$f=250kHz, \text{open drain}$

**Table 5 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	250	-	pF	$V_{GS}=0V, V_{DS}=500V, f=250kHz$
Output capacitance	$C_{oss}$	-	6.5	-	pF	$V_{GS}=0V, V_{DS}=500V, f=250kHz$
Effective output capacitance, energy related <sup>1)</sup>	$C_{o(er)}$	-	8	-	pF	$V_{GS}=0V, V_{DS}=0 \text{ to } 500V$
Effective output capacitance, time related <sup>2)</sup>	$C_{o(tr)}$	-	97	-	pF	$I_D=\text{constant}, V_{GS}=0V, V_{DS}=0 \text{ to } 500V$
Turn-on delay time	$t_{d(on)}$	-	10	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$
Rise time	$t_r$	-	8	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$
Turn-off delay time	$t_{d(off)}$	-	40	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$
Fall time	$t_f$	-	20	-	ns	$V_{DD}=400V, V_{GS}=13V, I_D=1.4A, R_G=22\Omega$

**Table 6 Gate charge characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	1	-	nC	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$
Gate to drain charge	$Q_{gd}$	-	5	-	nC	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$
Gate charge total	$Q_g$	-	10	-	nC	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$
Gate plateau voltage	$V_{plateau}$	-	4.5	-	V	$V_{DD}=640V, I_D=1.4A, V_{GS}=0 \text{ to } 10V$

<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 500V

<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 500V

**Table 7 Reverse diode characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	$V_{SD}$	-	0.9	-	V	$V_{GS}=0V, I_F=1.4A, T_i=25^\circ C$
Reverse recovery time	$t_{rr}$	-	800	-	ns	$V_R=400V, I_F=0.7A, di_F/dt=50A/\mu s$
Reverse recovery charge	$Q_{rr}$	-	5	-	$\mu C$	$V_R=400V, I_F=0.7A, di_F/dt=50A/\mu s$
Peak reverse recovery current	$I_{rrm}$	-	9	-	A	$V_R=400V, I_F=0.7A, di_F/dt=50A/\mu s$

**4 Electrical characteristics diagrams**

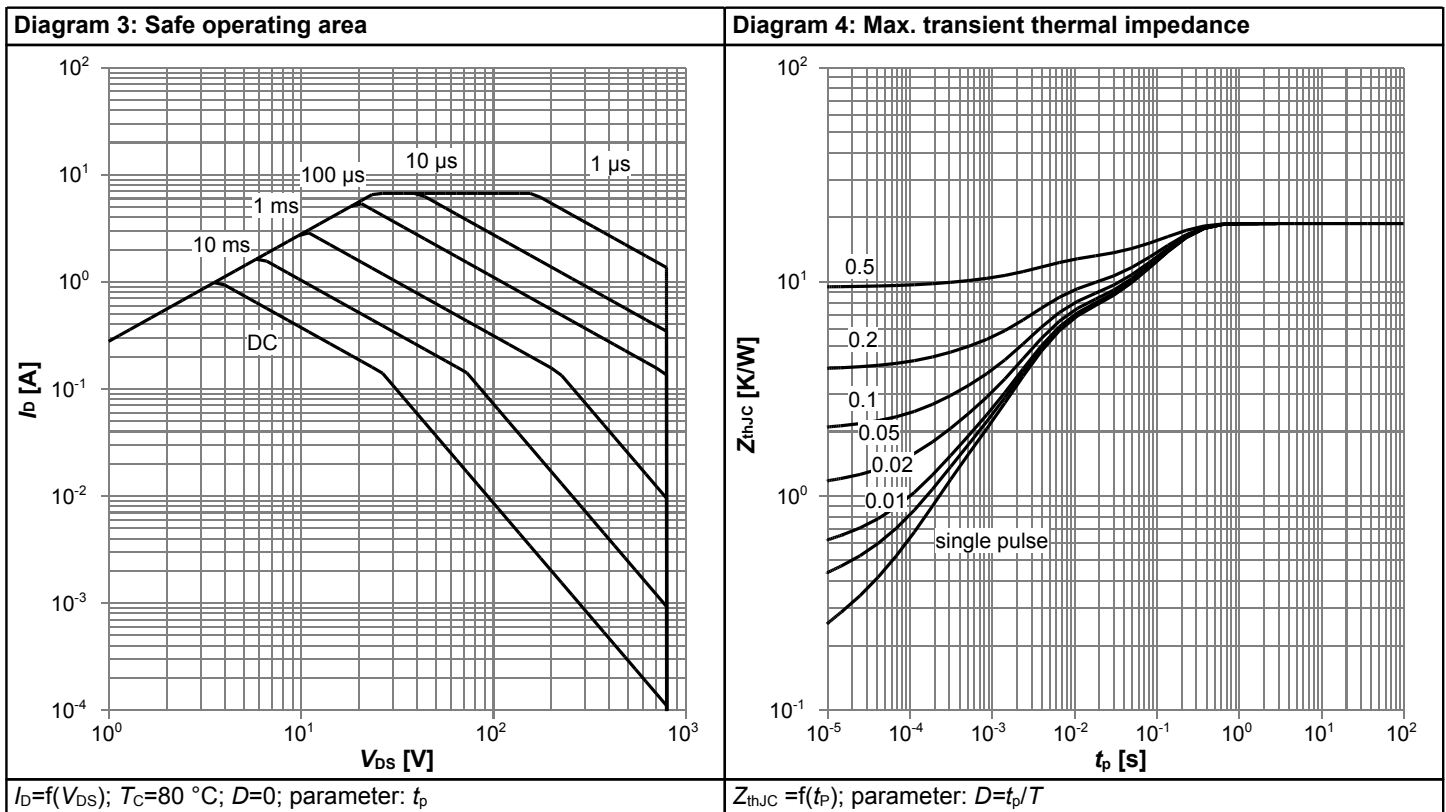
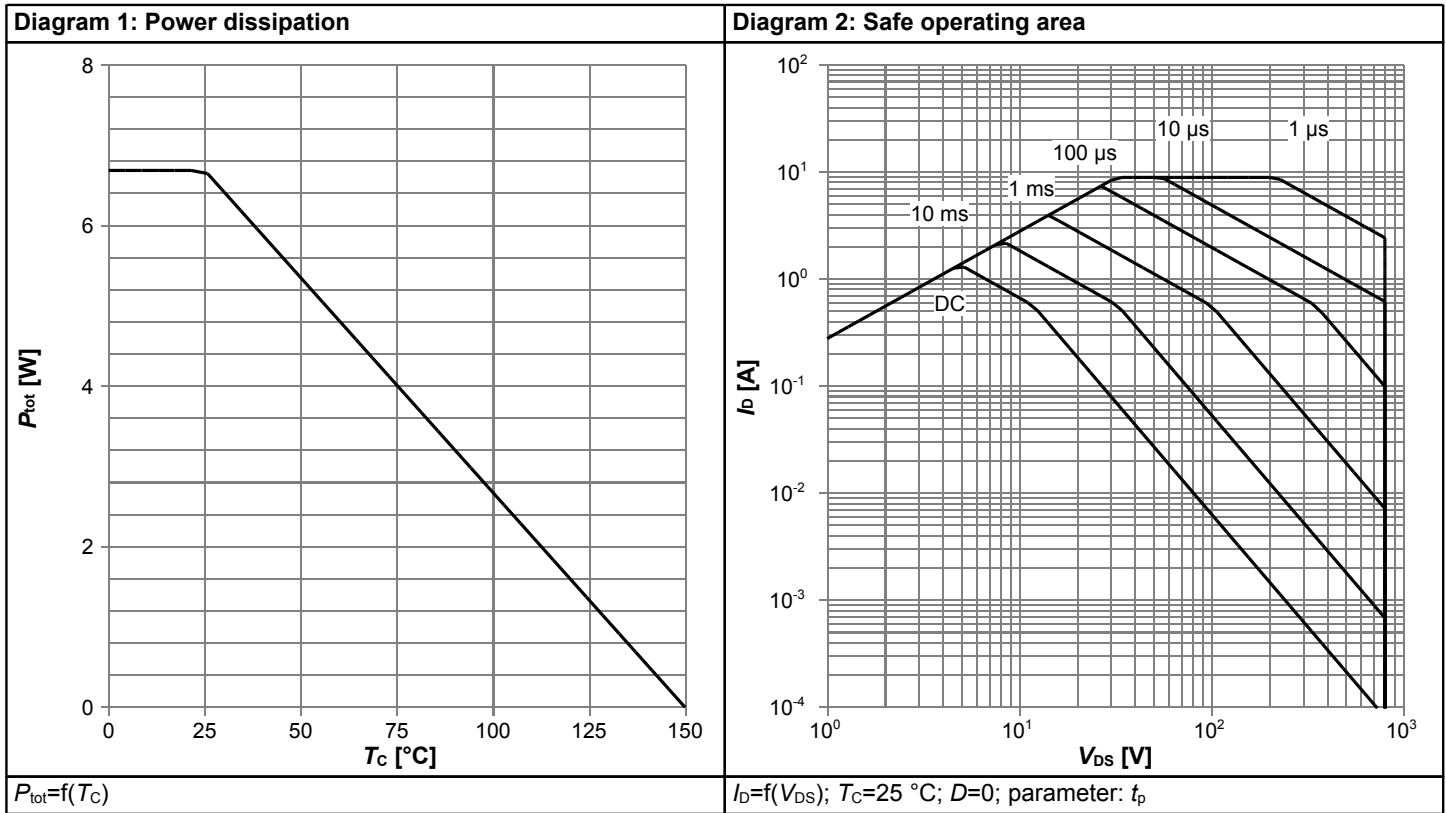
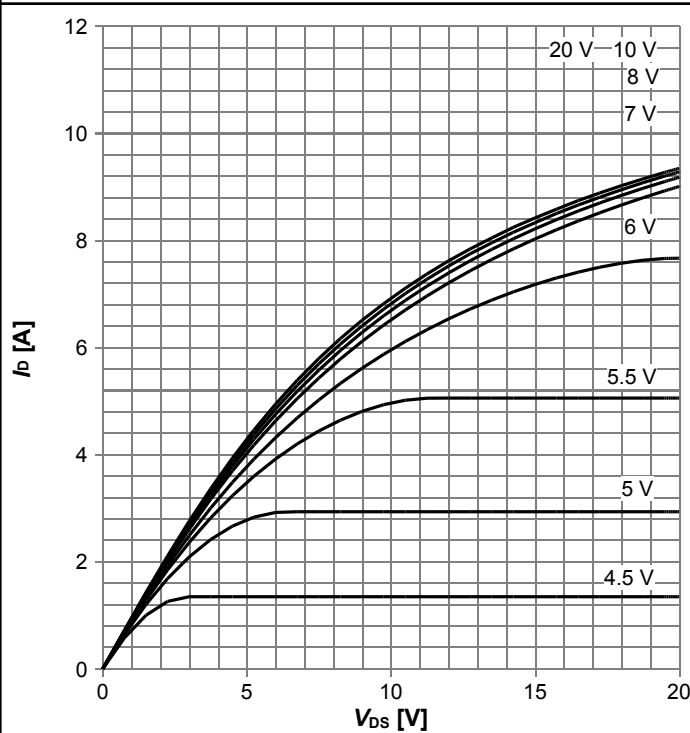
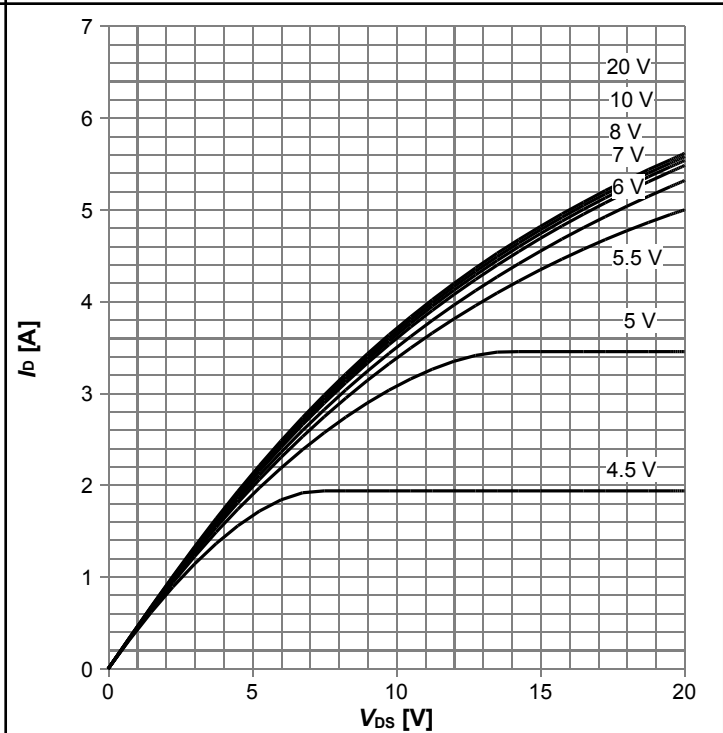


Diagram 5: Typ. output characteristics



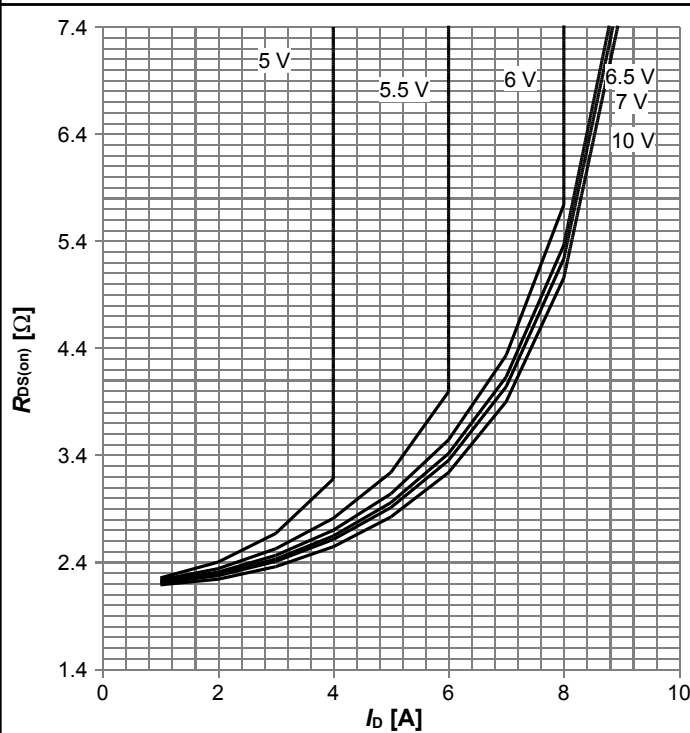
$I_D=f(V_{DS})$ ;  $T_j=25\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. output characteristics



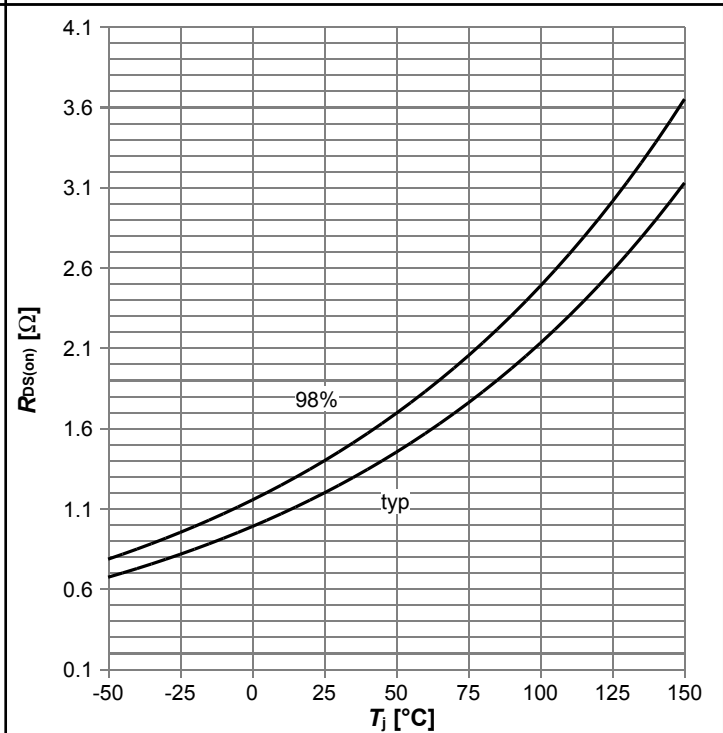
$I_D=f(V_{DS})$ ;  $T_j=125\text{ °C}$ ; parameter:  $V_{GS}$

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



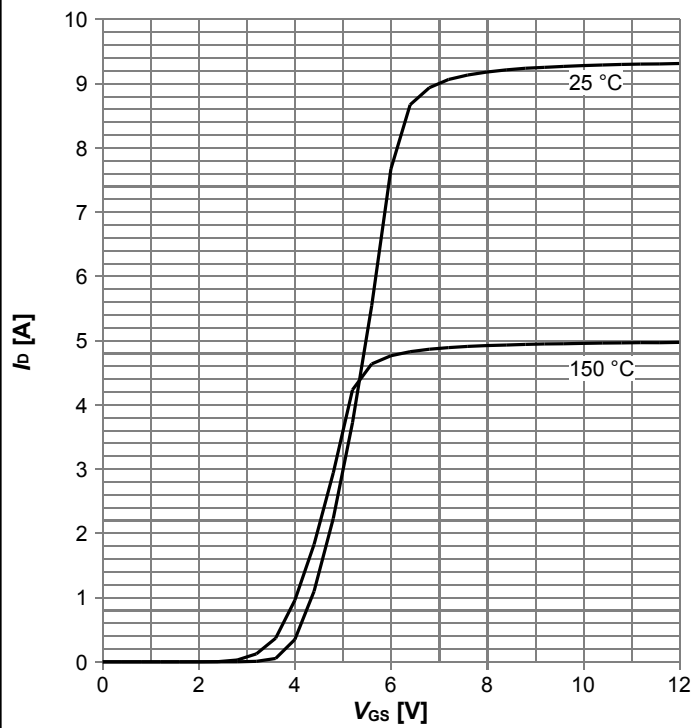
$R_{DS(on)}=f(I_D)$ ;  $T_j=125\text{ °C}$ ; parameter:  $V_{GS}$

Diagram 8: Drain-source on-state resistance



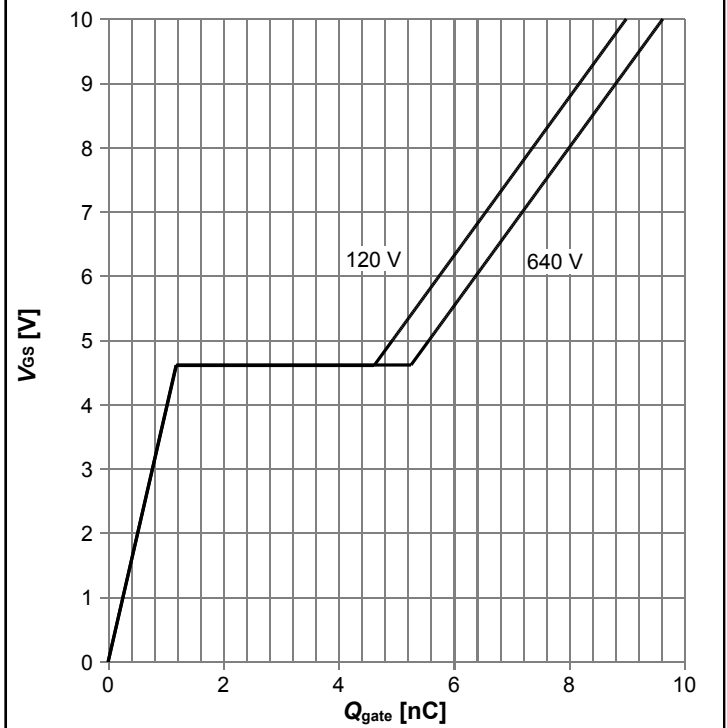
$R_{DS(on)}=f(T_j)$ ;  $I_D=1.4\text{ A}$ ;  $V_{GS}=10\text{ V}$

Diagram 9: Typ. transfer characteristics



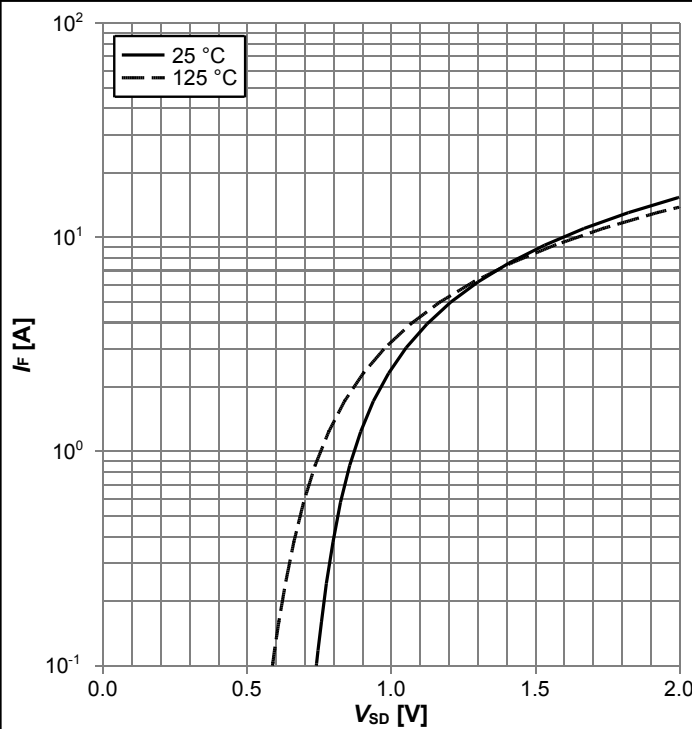
$I_D = f(V_{GS})$ ;  $V_{DS} = 20V$ ; parameter:  $T_j$

Diagram 10: Typ. gate charge



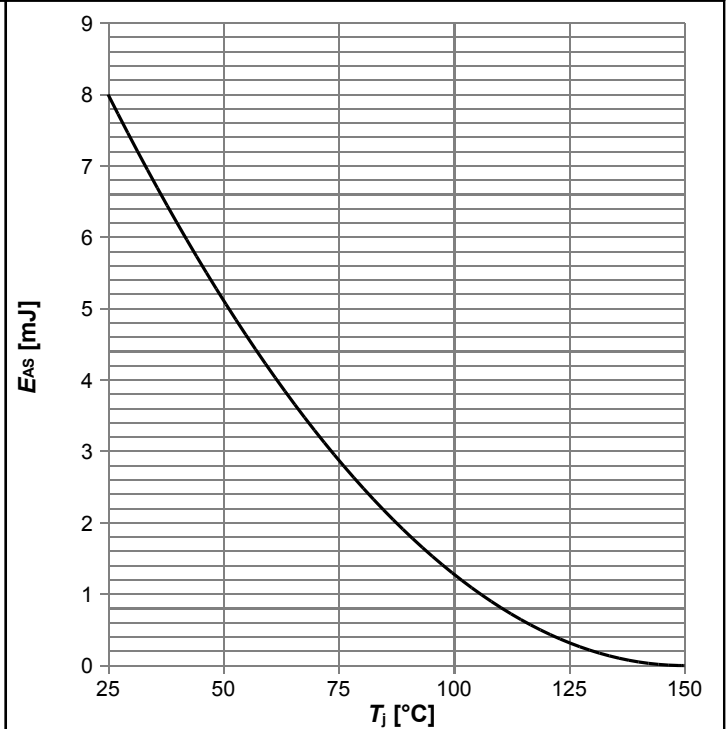
$V_{GS} = f(Q_{gate})$ ;  $I_D = 1.4 A$  pulsed; parameter:  $V_{DD}$

Diagram 11: Forward characteristics of reverse diode



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

Diagram 12: Avalanche energy



$E_{AS} = f(T_j)$ ;  $I_D = 0.6 A$ ;  $V_{DD} = 50 V$

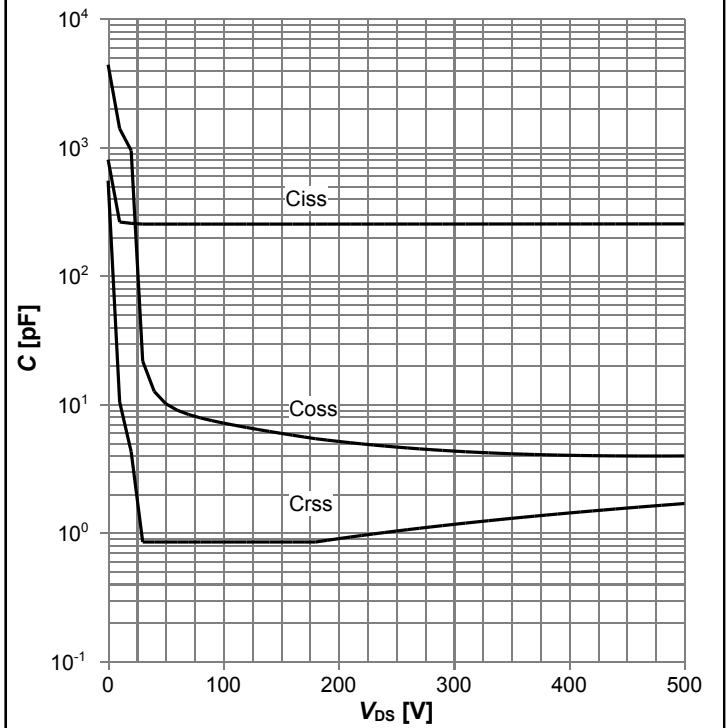


Diagram 13: Drain-source breakdown voltage



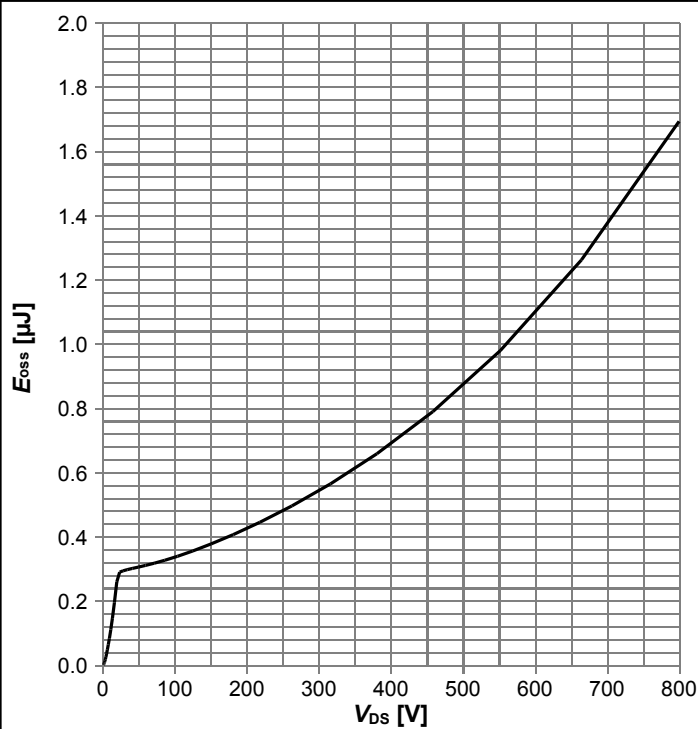
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

Diagram 14: Typ. capacitances



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

Diagram 15: Typ. Coss stored energy



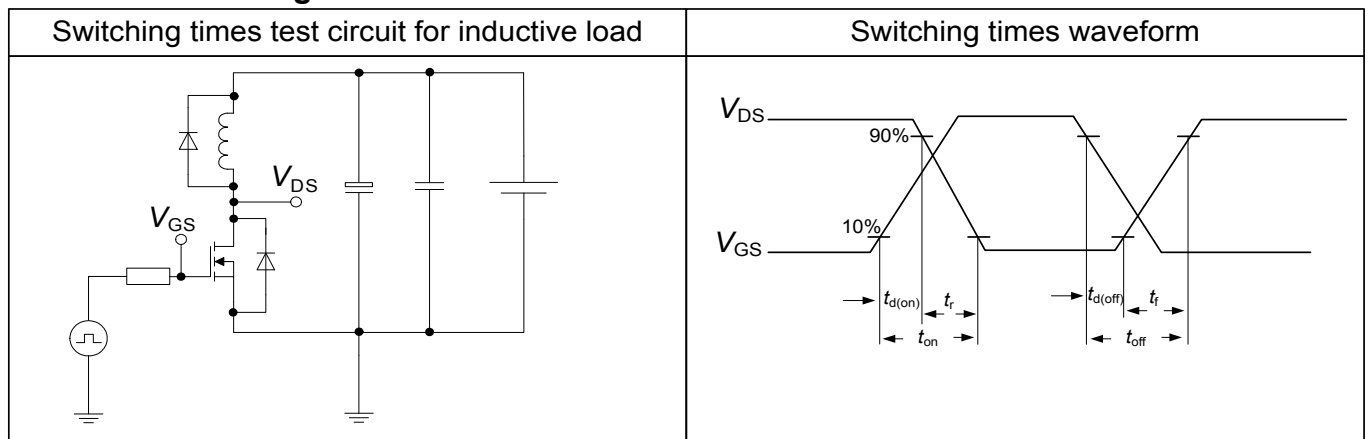
$E_{oss}=f(V_{DS})$

## 5 Test Circuits

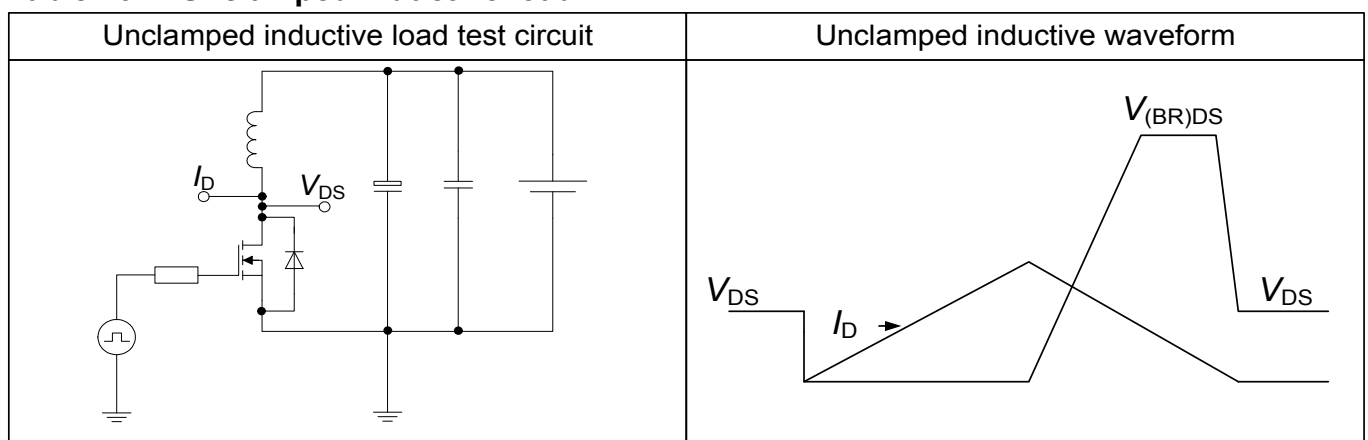
**Table 8 Diode characteristics**



**Table 9 Switching times**



**Table 10 Unclamped inductive load**



## 6 Package Outlines



DIM	MILLIMETERS	
	MIN	MAX
A	1.52	1.80
A1	-	0.10
A2	1.50	1.70
b	0.60	0.80
b2	2.95	3.10
c	0.24	0.32
D	6.30	6.70
E	6.70	7.30
E1	3.30	3.70
e	2.3 BASIC	
e1	4.6 BASIC	
L	0.75	1.10
N	3	
O	0°	10°

NOTES:  
1. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-261

<b>DOCUMENT NO.</b> Z8B00180553
<b>SCALE</b> 0 2.5 5mm
<b>EUROPEAN PROJECTION</b> 
<b>ISSUE DATE</b> 24-02-2016
<b>REVISION</b> 01

Figure 1 Outline PG-SOT223, dimensions in mm - Industrial Grade

## 7 Appendix A

### Table 11 Related Links

- IFX CoolMOS Webpage: [www.infineon.com](http://www.infineon.com)
- IFX Design tools: [www.infineon.com](http://www.infineon.com)

# 800V CoolMOS™ P7 Power Transistor

## IPN80R1K4P7

### Revision History

IPN80R1K4P7

**Revision: 2017-06-23, Rev. 2.0**

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2017-06-23	Release of final version

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