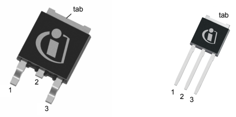
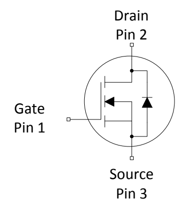
MOSFET

500V CoolMOS™ CE Power Transistor

CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies. CoolMOS™ CE is a price-performance optimized platform enabling to target cost sensitive applications in Consumer and Lighting markets by still meeting highest efficiency standards. The new series provides all benefits of a fast switching Superjunction MOSFET while not sacrificing ease of use and offering the best cost down performance ratio available on the market.

DPAK IPAK





Features

- Extremely low losses due to very low FOM Rdson*Qg and Eoss
- Very high commutation ruggedness
- Easy to use/drive
- Pb-free plating, Halogen free mold compound
- Qualified for standard grade applications

Applications

PFC stages, hard switching PWM stages and resonant switching stages for e.g. PC Silverbox, Adapter, LCD & PDP TV and indoor lighting.

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} @ $T_{j,max}$	550	V
$R_{DS(on),max}$	2	Ω
I_D	3.6	A
$Q_{g.typ}$	6	nC
$I_{D,pulse}$	6.1	A
E_{oss}@400V	0.62	µJ

Type / Ordering Code	Package	Marking	Related Links
IPD50R2K0CE	PG-TO 252	50S2K0CE	see Appendix A
IPU50R2K0CE	PG-TO 251		

Table of Contents

1 Maximum ratings

at T_j = 25°C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1)]	I_D	- -	- -	3.6 2.3	A	T_C = 25°C T_C = 100°C
Pulsed drain current[2)]	$I_{D,pulse}$	-	-	6.1	A	T_C=25°C
Avalanche energy, single pulse	E_{AS}	-	-	34	mJ	I_D =0.8A; V_{DD} = 50V
Avalanche energy, repetitive	E_{AR}	-	-	0.05	mJ	I_D =0.8A; V_{DD} = 50V
Avalanche current, repetitive	I_{AR}	-	-	0.8	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	50	V/ns	V_{DS} =0...400V
Gate source voltage	V_{GS}	-20 -30	- -	20 30	V	static; AC (f>1 Hz)
Power dissipation (non FullPAK) TO-252, TO-251	P_{tot}	-	-	33	W	T_C=25°C
Operating and storage temperature	T_j, T_{stg}	-55	-	150	°C	-
Continuous diode forward current	I_S	-	-	2.5	A	T_C=25°C
Diode pulse current[2)]	$I_{S,pulse}$	-	-	6.1	A	T_C = 25°C
Reverse diode dv/dt[3)]	dv/dt	-	-	15	V/ns	V_{DS} =0...400V, I_{SD}<=I_S, T_j=25°C, t_{cond}<2µs
Maximum diode commutation speed[3)]	di_f/dt	-	-	500	A/µs	V_{DS} =0...400V, I_{SD}<=I_S, T_j=25°C, t_{cond}<2µs

2 Thermal characteristics

Table 3 Thermal characteristics DPAK, IPAK

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	3.75	°C/W	-
Thermal resistance, junction - ambient[4)]	R_{thJA}	- -	- 35	62 -	°C/W	SMD version, device on PCB, minimal footprint SMD version, device on PCB, 6cm^2 cooling area[4)]
Soldering temperature, wave- & reflowsoldering allowed	T_{sold}	-	-	260	°C	reflow MSL 1

[1)] Limited by $T_{j\,max}$. Maximum duty cycle D=0.5
[2)] Pulse width t_p limited by $T_{j,max}$
[3)] V_{DClink}=400V; $V_{DS,peak}$<$V_{(BR)DSS}$; identical low side and high side switch with identical R_G
[4)] Device on 40mm*40mm*1.5mm one layer epoxy PCB FR4 with 6cm^2 copper area (thickness 70µm) for drain connection. PCB is vertical without air stream cooling.

3 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	500	-	-	V	V_{GS}=0V, I_D=1mA
Gate threshold voltage	$V_{(GS)th}$	2.50	3	3.50	V	V_{DS}=V_{GS}, I_D=0.05mA
Zero gate voltage drain current	I_{DSS}	- -	- 10	1 -	µA	V_{DS}=500V, V_{GS}=0V, T_j=25°C V_{DS}=500V, V_{GS}=0V, T_j=150°C
Gate-source leakage curent	I_{GSS}	-	-	100	nA	V_{GS}=20V, V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	1.80 4.68	2.00 -	Ω	V_{GS}=13V, I_D=0.6A, T_j=25°C V_{GS}=13V, I_D=0.6A, T_j=150°C
Gate resistance	R_G	-	7	-	Ω	f=1 MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	124	-	pF	V_{GS}=0V, V_{DS}=100V, f=1MHz
Output capacitance	C_{oss}	-	9	-	pF	V_{GS}=0V, V_{DS}=100V, f=1MHz
Effective output capacitance, energy related[1]	$C_{o(er)}$	-	8	-	pF	V_{GS}=0V, V_{DS}=0...400V
Effective output capacitance, time related[2]	$C_{o(tr)}$	-	26	-	pF	I_D=constant, V_{GS}=0V, V_{DS}=0...400V
Turn-on delay time	$t_{d(on)}$	-	6	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=0.8A, R_G=5.3Ω
Rise time	t_r	-	5	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=0.8A, R_G=5.3Ω
Turn-off delay time	$t_{d(off)}$	-	21	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=0.8A, R_G=5.3Ω
Fall time	t_f	-	38	-	ns	V_{DD}=400V, V_{GS}=13 V, I_D=0.8A, R_G=5.3Ω

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	0.7	-	nC	V_{DD}=400V, I_D=0.8A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	3.5	-	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	$V_{plateau}$	-	5.4	-	V	V_{DD}=400V, I_D=0.8A, V_{GS}=0 to 10V

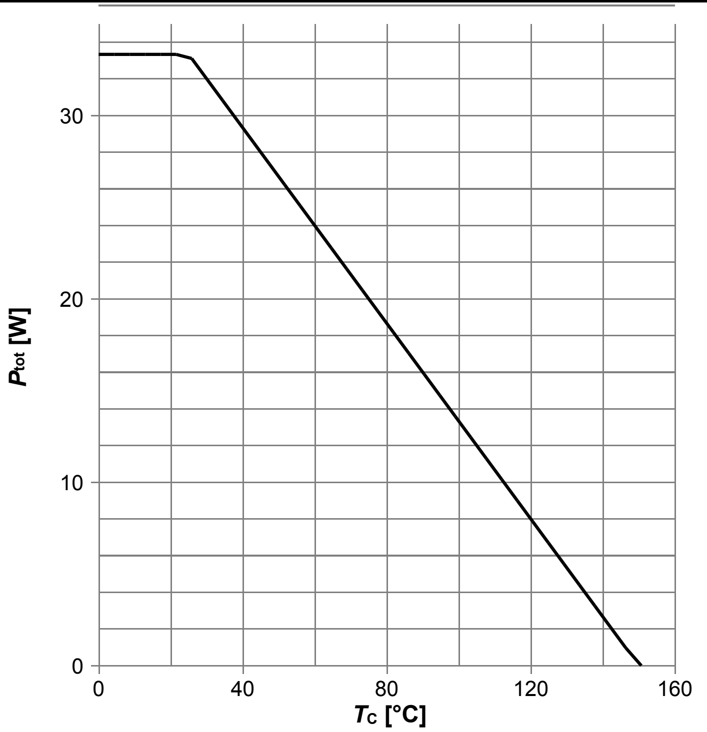
[1] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$
[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$

Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.83	-	V	V_{GS}=0V, I_F=0.8A, T_f=25°C
Reverse recovery time	t_{rr}	-	110	-	ns	V_R=400V, I_F=0.8A, di_F/dt=100A/µs
Reverse recovery charge	Q_{rr}	-	0.35	-	µC	V_R=400V, I_F=0.8A, di_F/dt=100A/µs
Peak reverse recovery current	I_{rrm}	-	5.2	-	A	V_R=400V, I_F=0.8A, di_F/dt=100A/µs

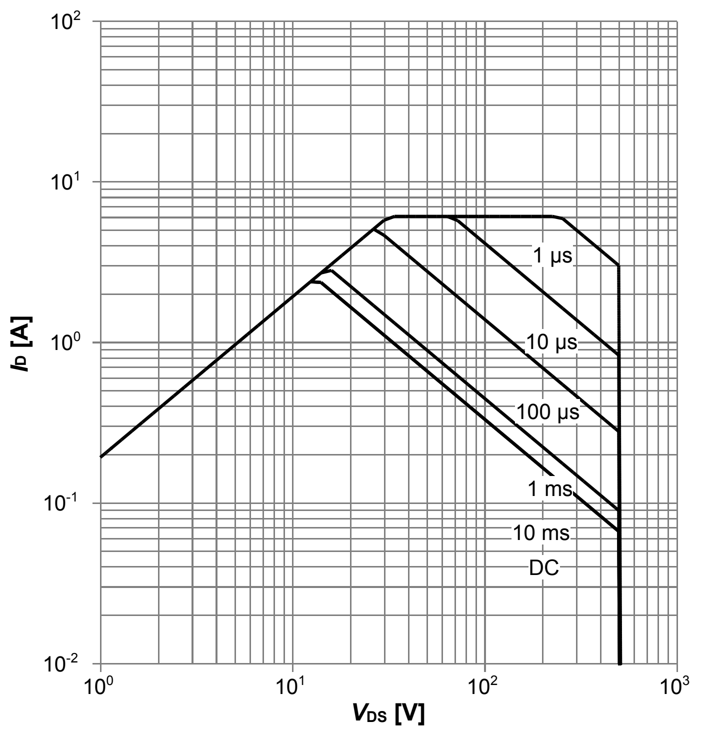
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



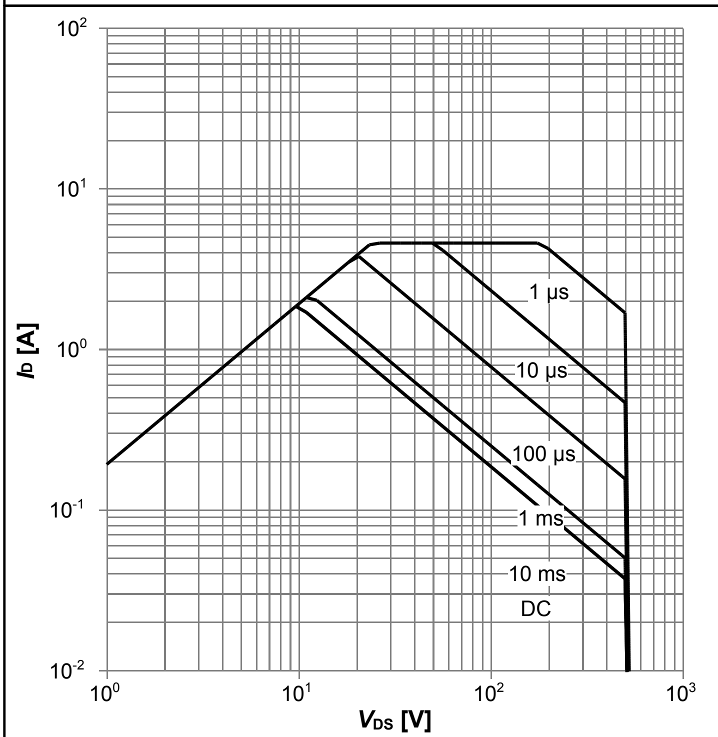
P_{tot}=f(T_C)

Diagram 2: Safe operating area



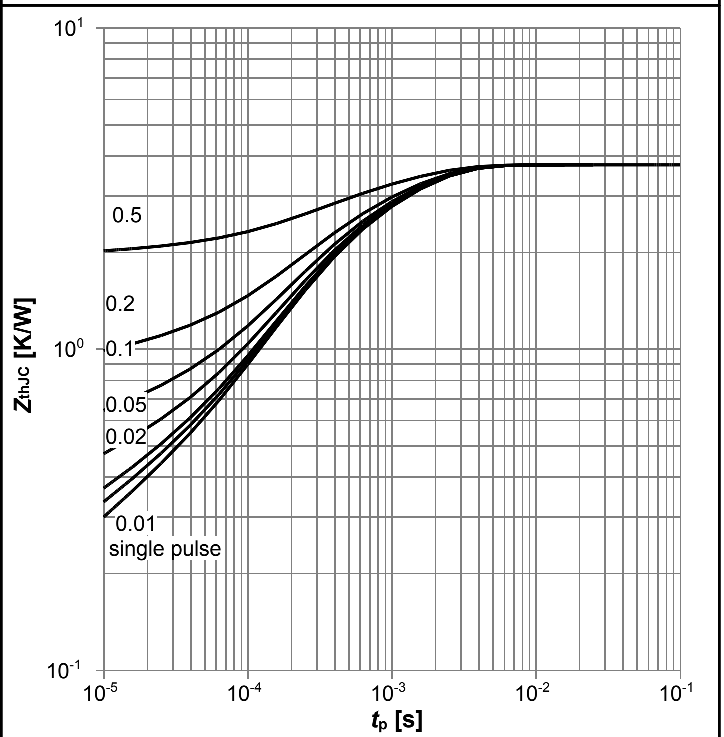
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

Diagram 3: Safe operating area



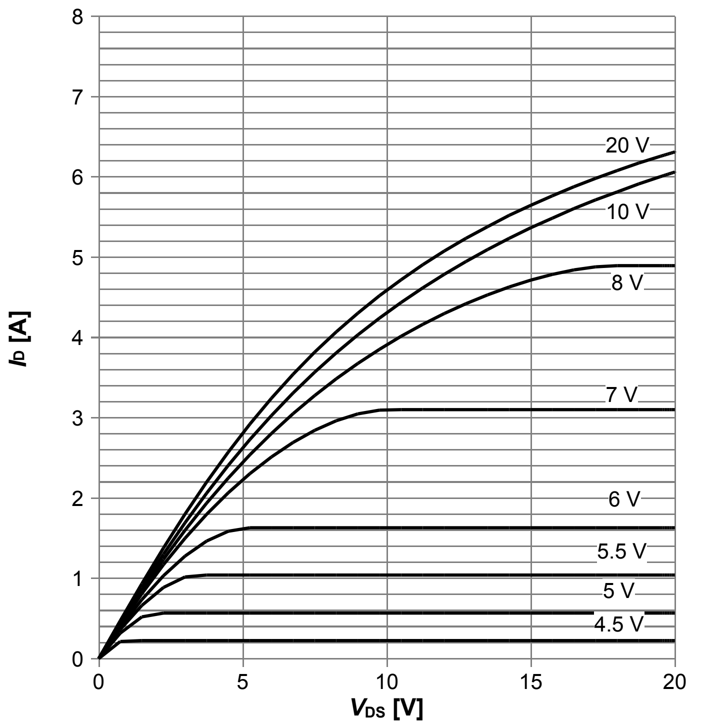
I_D=f(V_{DS}); T_C=80 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



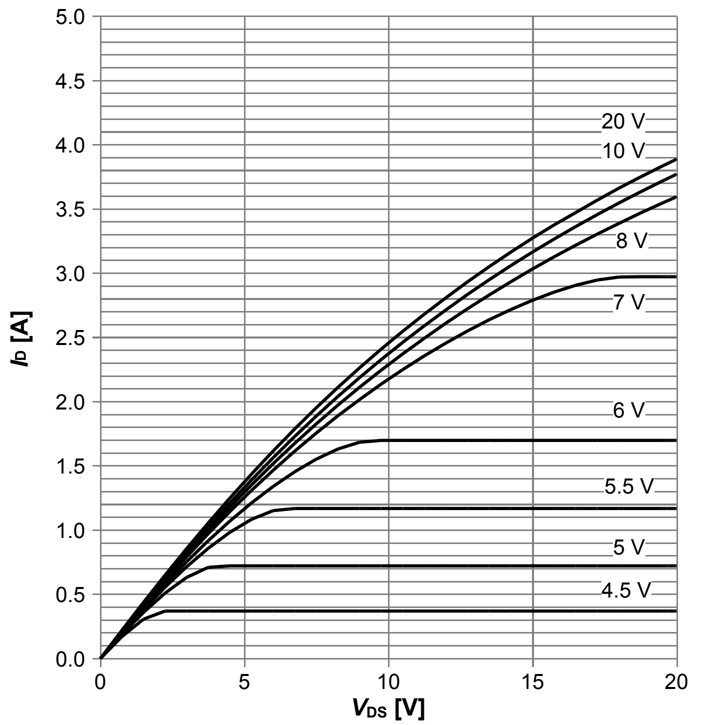
Z_{thJC} =f(t_P); parameter: D=t_p/T

Diagram 5: Typ. output characteristics Tj=25°C



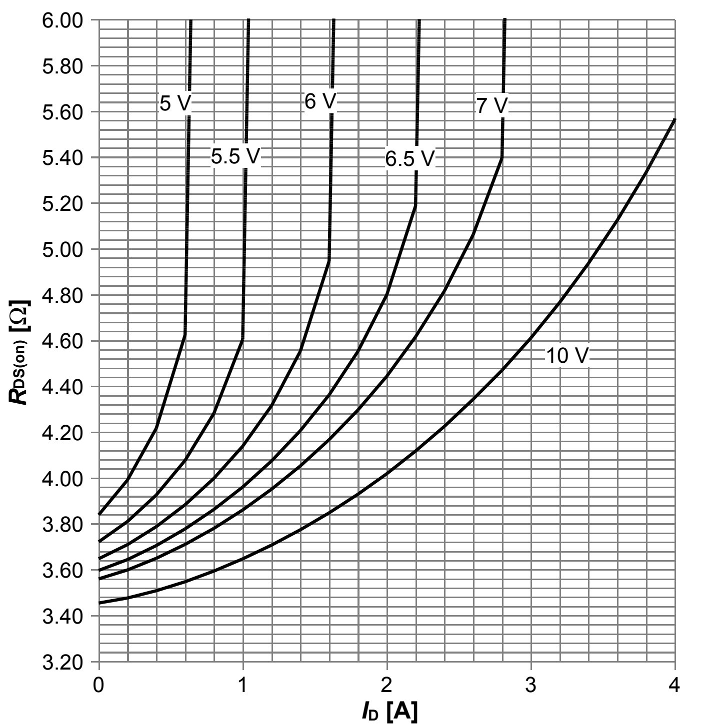
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. output characteristics Tj=125°C



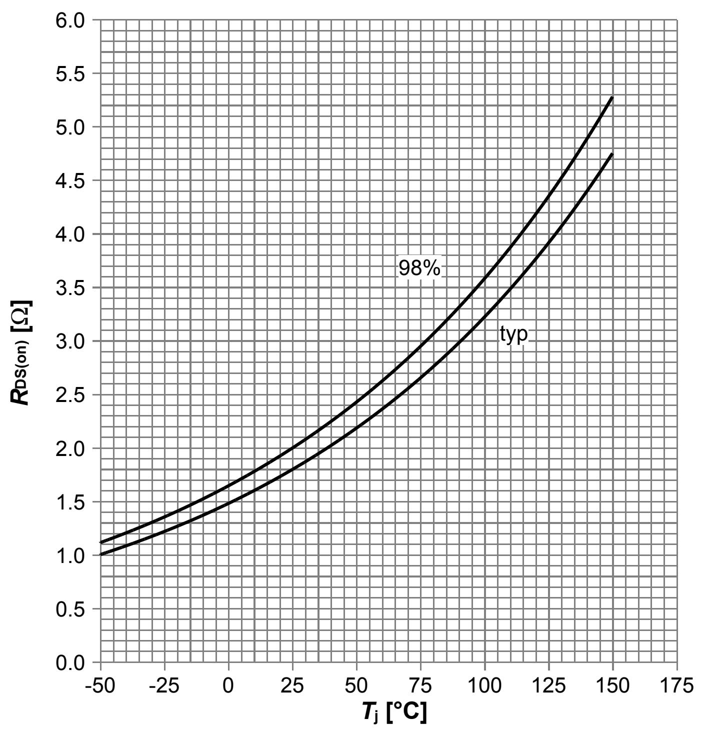
I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

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



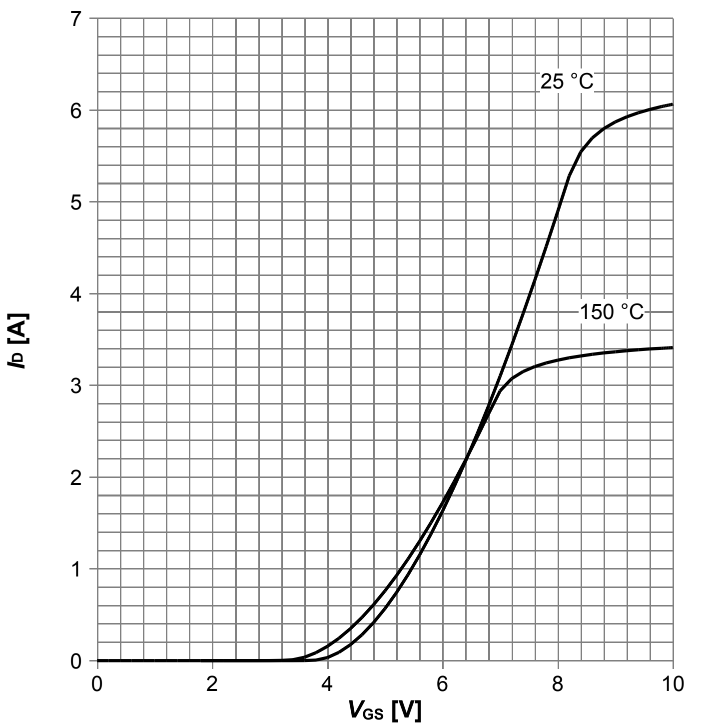
$R_{DS(on)}$=f(I_D); T_j=125 °C; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



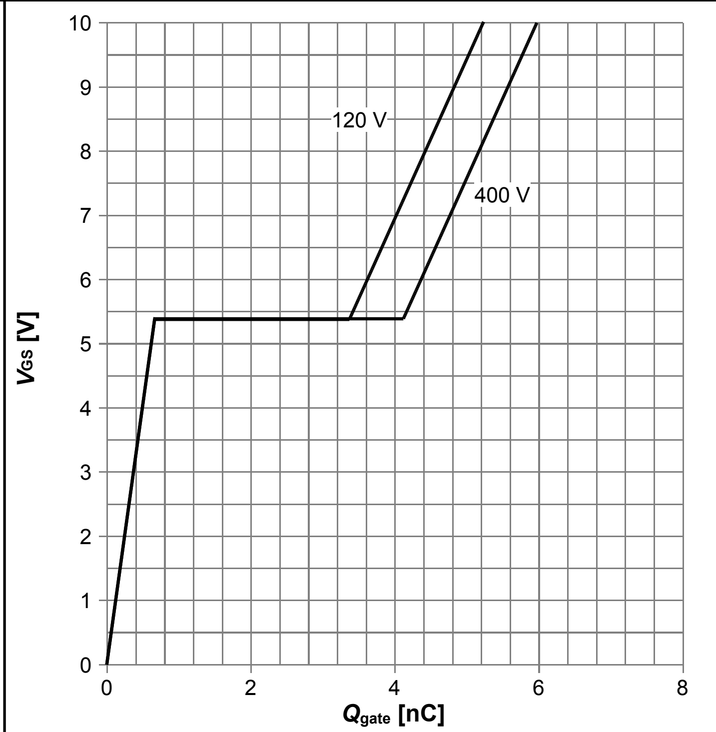
$R_{DS(on)}$=f(T_j); I_D=0.6 A; V_{GS}=13 V

Diagram 9: Typ. transfer characteristics



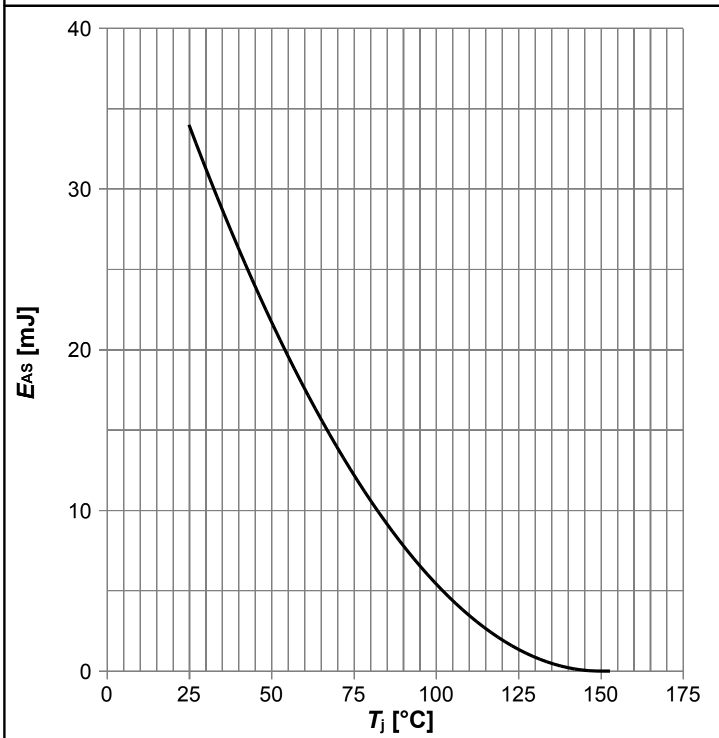
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 10: Typ. gate charge



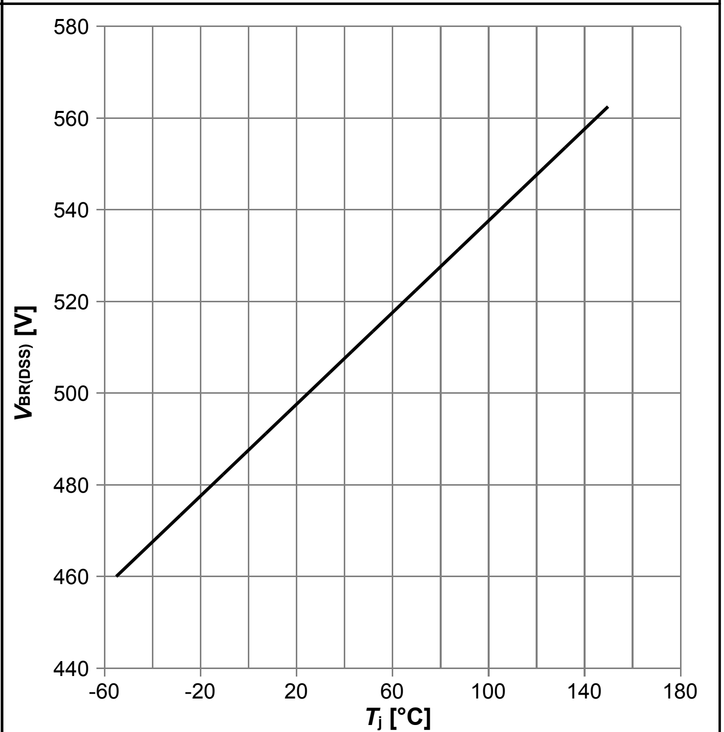
V_{GS}=f(Q_{gate}); I_D=0.8 A pulsed; parameter: V_{DD}

Diagram 11: Avalanche energy



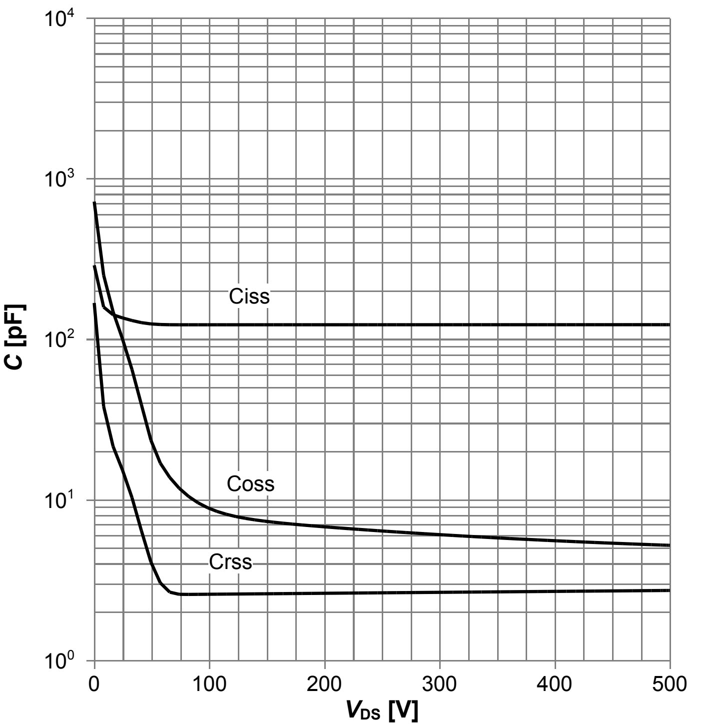
E_{AS}=f(T_j); I_D=0.8 A; V_{DD}=50 V

Diagram 12: Drain-source breakdown voltage



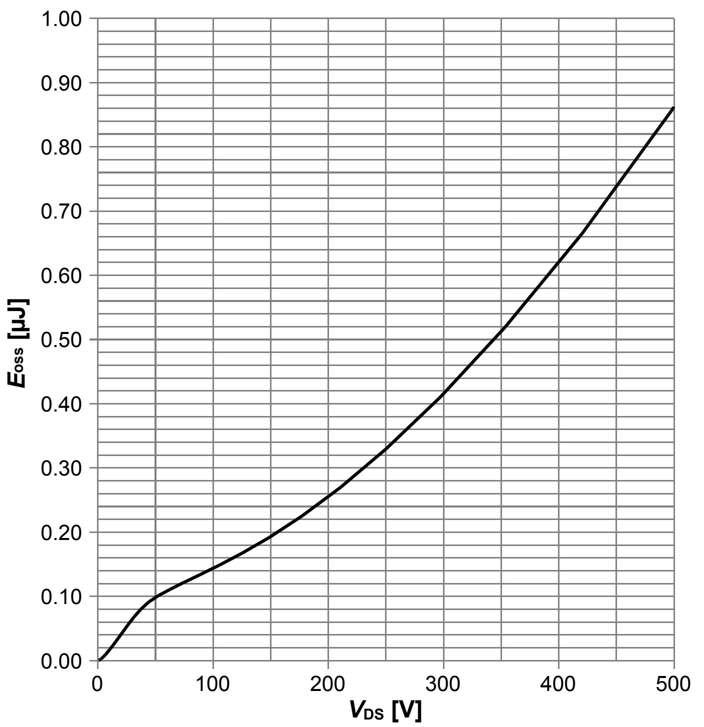
$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Diagram 13: Typ. capacitances



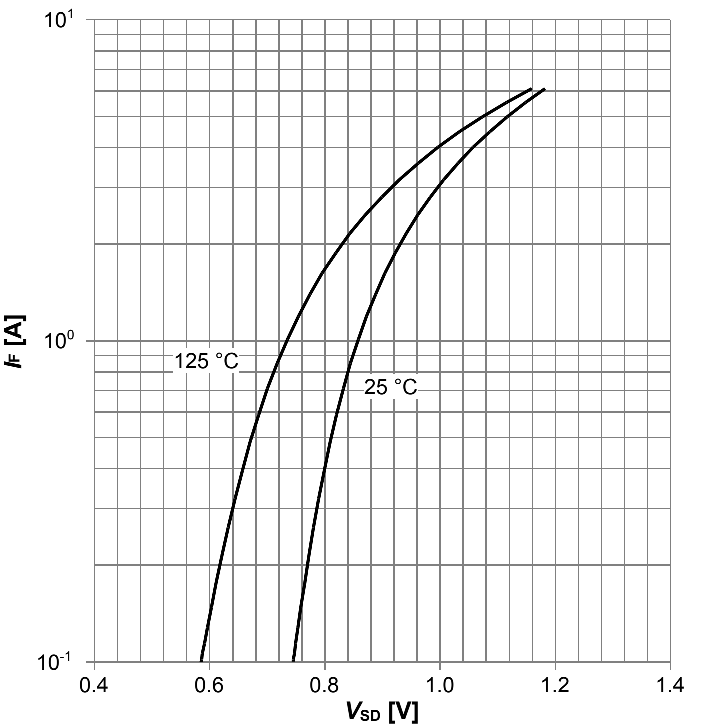
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz

Diagram 14: Typ. Coss stored energy



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

Diagram 15: Forward characteristics of reverse diode



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

5 Test Circuits

Table 8 Diode characteristics

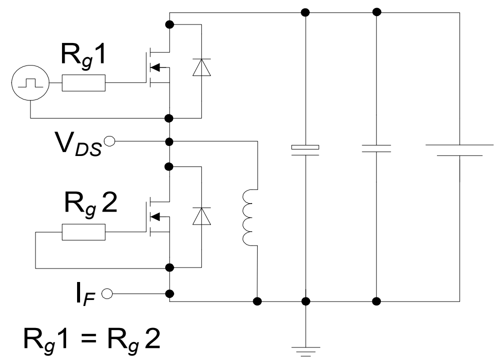
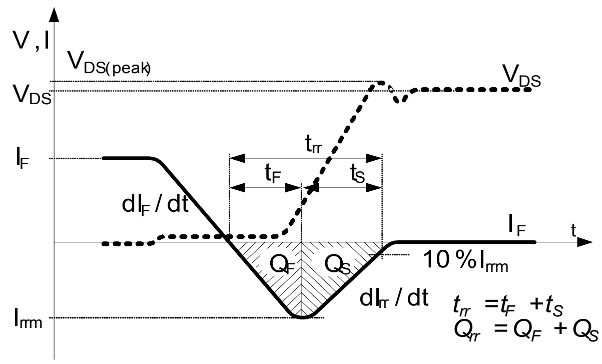
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

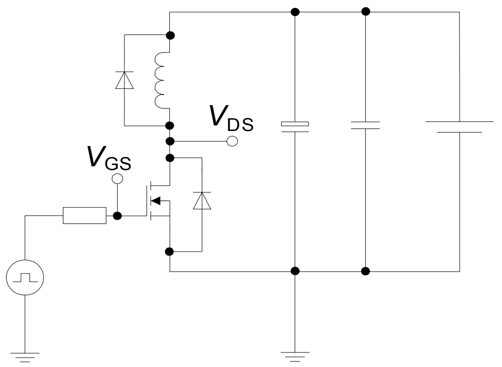
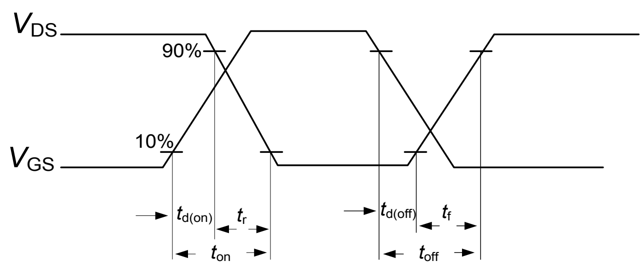
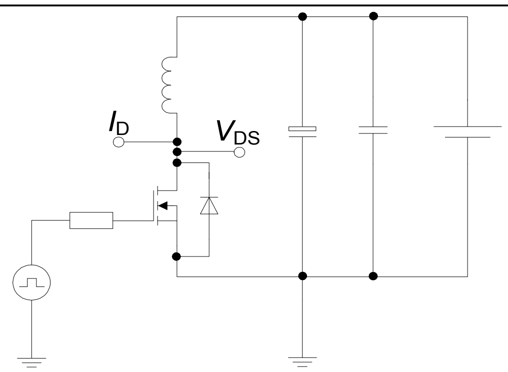
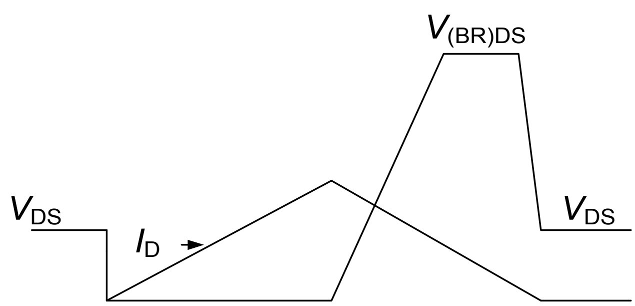
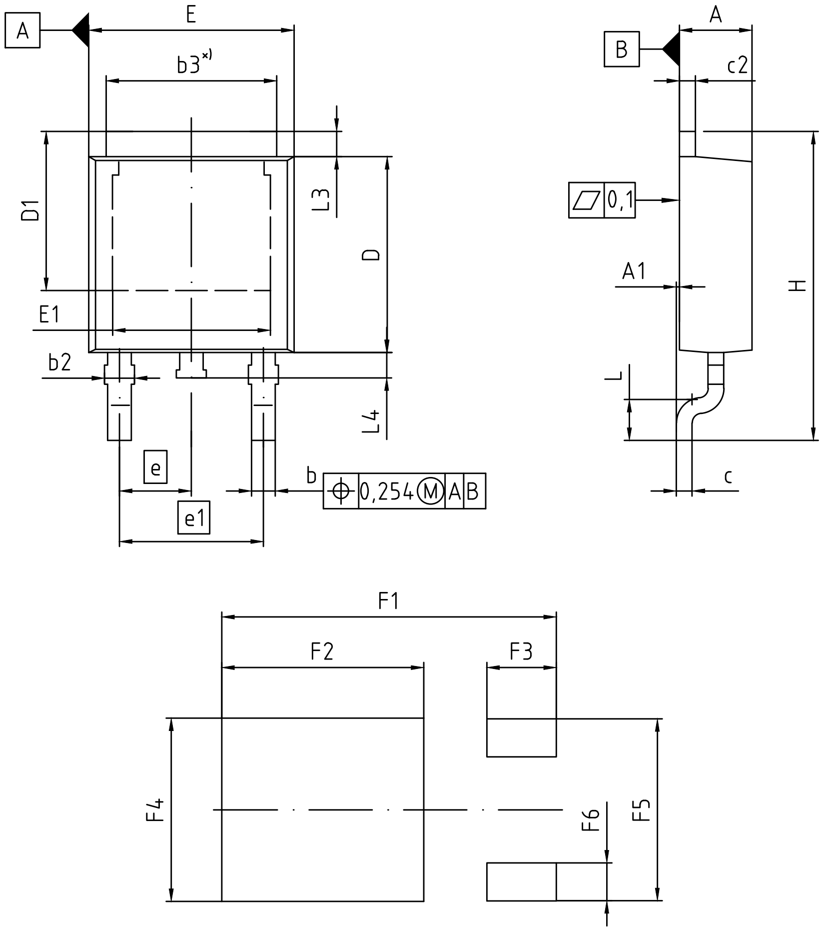
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

6 Package Outlines



*) mold flash not included

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.60	0.185	0.220
e	2.29 (BSC)		0.090 (BSC)	
e1	4.57 (BSC)		0.180 (BSC)	
N	3		3	
H	9.40	10.48	0.370	0.413
L	1.18	1.70	0.046	0.067
L3	0.90	1.25	0.035	0.049
L4	0.51	1.00	0.020	0.039
F1	10.60		0.417	
F2	6.40		0.252	
F3	2.20		0.087	
F4	5.80		0.228	
F5	5.76		0.227	
F6	1.20		0.047	

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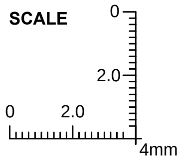
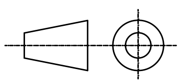


EUROPEAN PROJECTION



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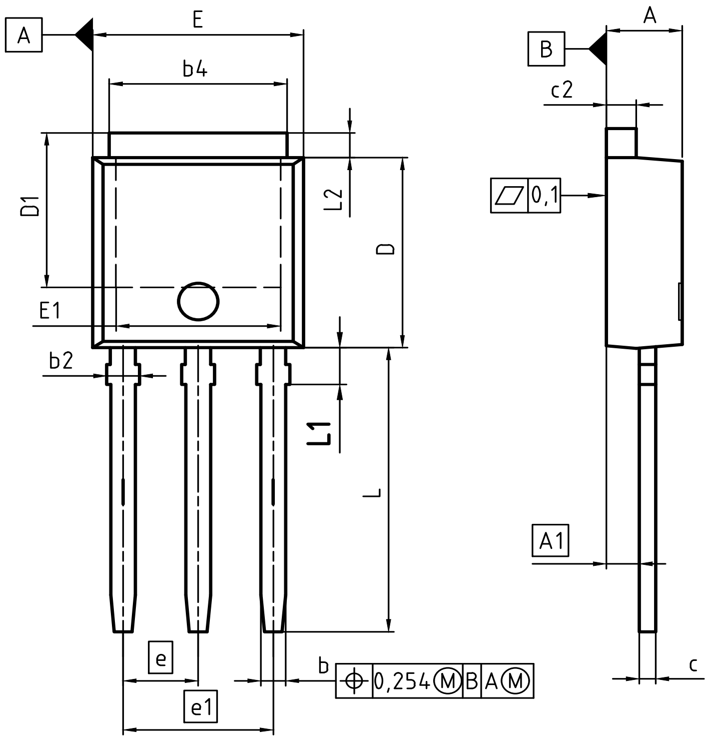
05

Figure 1 Outline PG-TO 252, dimensions in mm/inches

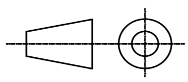


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.90	1.14	0.035	0.045
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b4	4.95	5.50	0.195	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.04	5.77	0.198	0.227
E	6.35	6.73	0.250	0.265
E1	4.70	5.21	0.185	0.205
e	2.29		0.090	
e1	4.57		0.180	
N	3		3	
L	8.89	9.65	0.350	0.380
L1	0.85	2.29	0.033	0.090
L2	0.89	1.37	0.035	0.054

DOCUMENT NO.
Z8B00003330

SCALE 0 2.0 4mm

EUROPEAN PROJECTION



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04

Figure 2 Outline PG-TO 251, dimensions in mm/inches

7 Appendix A

Table 11 Related Links

- **IFX CoolMOS Webpage:** www.infineon.com
- **IFX Design tools:** www.infineon.com

Revision History

IPD50R2K0CE, IPU50R2K0CE

Revision: 2016-06-13, Rev. 2.3

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2012-12-05	Release of final version
2.1	2013-07-16	update to Halogen free mold compound
2.2	2015-11-17	Updated to qualified for standard grade & updated package drawing
2.3	2016-06-13	Updated ID ratings, Zth, SOA and Pd curves

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