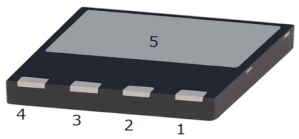
MOSFET

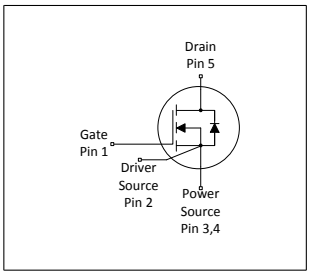
650V CoolMOS™ CFD2 Power Transistor

ThinPAK 8x8



CoolMOS™ is a revolutionary technology for high voltage power MOSFETs, designed according to the superjunction (SJ) principle and pioneered by Infineon Technologies. 650V CoolMOS™ CFD2 series combines the experience of the leading SJ MOSFET supplier with high class innovation. The resulting devices provide all benefits of a fast switching SJ MOSFET while offering an extremely fast and robust body diode. This combination of extremely low switching, commutation and conduction losses together with highest robustness make especially resonant switching applications more reliable, more efficient, lighter and cooler.

ThinPAK
ThinPAK is a a new leadless SMD package for HV MOSFETs. The new package has a very small footprint of only 64mm² (vs. 150mm² for the D²PAK) and a very low profile with only 1mm height (vs. 4.4mm for the D²PAK). The significantly smaller package size, combined with benchmark low parasitic inductances, provides designers with a new and effective way to decrease system solution size in power-density driven designs.



Features

- Reduced board space consumption
- Increased power density
- Short commutation loop
- Smooth switching waveform
- Ultra-fast body diode
- Very high commutation ruggedness
- Extremely low losses due to very low FOM Rdson*Qg and Eoss
- Easy to use/drive
- Qualified for industrial grade applications according to JEDEC (J-STD20 and JESD22)
- Pb-free plating, Halogen free mold compound

Potential applications

650V CoolMOS™ CFD2 is especially suitable for resonant switching stages for e.g. PC Silverbox, LCD TV, Lighting, Server and Telecom.

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{ds} @ T_{jmax}	700	V
$R_{DS(on),max}$	0.21	Ω
$Q_{g,typ}$	68	nC
$I_{D,pulse}$	53	A
E_{oss} @ 400V	5.7	µJ
Body diode di_F/dt	900	A/µs
Q_{rr}	0.5	µC
t_r	120	ns
I_{rrm}	7.6	A

Type / Ordering Code	Package	Marking	Related Links
IPL65R210CFD	PG-VSON-4	65F6210	see Appendix A

Downloaded From Oneyac.com

Table of Contents

Downloaded From Oneyac.com

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	- -	- -	16.6 10.5	A	T_C = 25°C T_C = 100°C
Pulsed drain current[2]	$I_{D,pulse}$	-	-	53	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	484	mJ	I_D =3.3 A; V_{DD} = 50 V
Avalanche energy, repetitive	E_{AR}	-	-	0.70	mJ	I_D =3.3 A; V_{DD} = 50 V
Avalanche current, repetitive	I_{AR}	-	-	3.3	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	50	V/ns	V_{DS} =0...400 V
Gate source voltage	V_{GS}	-20 -30	- -	20 30	V	static; AC (f>1 Hz)
Power dissipation	P_{tot}	-	-	151	W	T_C=25 °C
Operating and storage temperature	T_j, T_{stg}	-40	-	150	°C	-
Continuous diode forward current	I_S	-	-	16.6	A	T_C=25 °C
Diode pulse current[2]	$I_{S,pulse}$	-	-	53	A	T_C = 25°C
Reverse diode dv/dt[3]	dv/dt	-	-	50	V/ns	V_{DS} =0...400 V, I_{SD}<= I_D, T_j=25 °C see table 8
Maximum diode commutation speed	di_F/dt	-	-	900	A/µs	V_{DS} =0...400 V, I_{SD}<= I_D, T_j=25 °C see table 8

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.83	°C/W	-
Thermal resistance, junction - ambient[4] [4]	R_{thJA}	- -	- -	62 45	°C/W	SMD version, device on PCB, minimal footprint SMD version, device on PCB, 6cm² cooling area
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	°C	reflow MSL2a

[1] Limited by $T_{j\,max}$
[2] Pulse width t_p limited by $T_{j,max}$
[3] Identical low side and high side switch with identical R_G
[4] Device on 40mm*40mm*1.5mm one layer epoxy PCB FR4 with 6cm² copper area (thickness 70µm) for drain connection. PCB is vertical without air steam cooling.

Downloaded From Oneyac.com

3 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	650	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{(GS)th}$	3.5	4	4.5	V	V_{DS}=V_{GS}, I_D=0.7 mA
Zero gate voltage drain current	I_{DSS}	- -	- 200	1 -	µA	V_{DS}=650 V, V_{GS}=0 V, T_j=25 °C V_{DS}=650 V, V_{GS}=0 V, T_j=150 °C
Gate-source leakage curent	I_{GSS}	-	-	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	0.189 0.491	0.210 -	Ω	V_{GS}=10 V, I_D=7.3A, T_j=25 °C V_{GS}=10 V, I_D=7.3 A, T_j=150 °C
Gate resistance	R_G	-	1	-	Ω	f=1 MHz, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	1850	-	pF	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz
Output capacitance	C_{oss}	-	86	-	pF	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz
Effective output capacitance, energy related[1)]	$C_{o(er)}$	-	70	-	pF	V_{GS}=0 V, V_{DS}=0...400V
Effective output capacitance, time related[2)]	$C_{o(tr)}$	-	336	-	pF	I_D=constant, V_{GS}=0 V, V_{DS}=0...400V
Turn-on delay time	$t_{d(on)}$	-	12	-	ns	V_{DD}=400 V, V_{GS}=13 V, I_D=11 A, R_G=3.4Ω; see table 9
Rise time	t_r	-	8.4	-	ns	V_{DD}=400 V, V_{GS}=13 V, I_D=11 A, R_G=3.4Ω; see table 9
Turn-off delay time	$t_{d(off)}$	-	53.2	-	ns	V_{DD}=400 V, V_{GS}=13 V, I_D=11 A, R_G=3.4Ω; see table 9
Fall time	t_f	-	6.4	-	ns	V_{DD}=400 V, V_{GS}=13 V, I_D=11 A, R_G=3.4Ω; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	12	-	nC	V_{DD}=480 V, I_D=11 A, V_{GS}=0 to 10 V
Gate to drain charge	Q_{gd}	-	37	-	nC	V_{DD}=480 V, I_D=11 A, V_{GS}=0 to 10 V
Gate charge total	Q_g	-	68	-	nC	V_{DD}=480 V, I_D=11 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	6.4	-	V	V_{DD}=480 V, I_D=11 A, V_{GS}=0 to 10 V

[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 400V
[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 400V

Downloaded From Oneyac.com

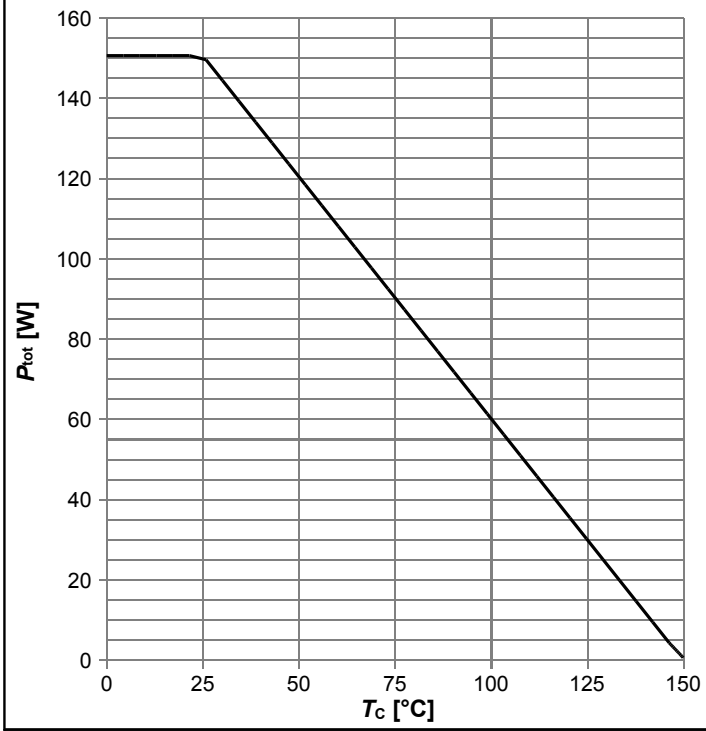
Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.9	-	V	V_{GS}=0 V, I_F=11 A, T_j=25 °C
Reverse recovery time	t_{rr}	-	120	-	ns	V_R=400 V, I_F=11A di_F/dt=100 A/µs see table 8
Reverse recovery charge	Q_{rr}	-	0.5	-	µC	V_R=400 V, I_F=11A di_F/dt=100 A/µs see table 8
Peak reverse recovery current	I_{rrm}	-	7.6	-	A	V_R=400 V, I_F=11A di_F/dt=100 A/µs see table 8

Downloaded From Oneyac.com

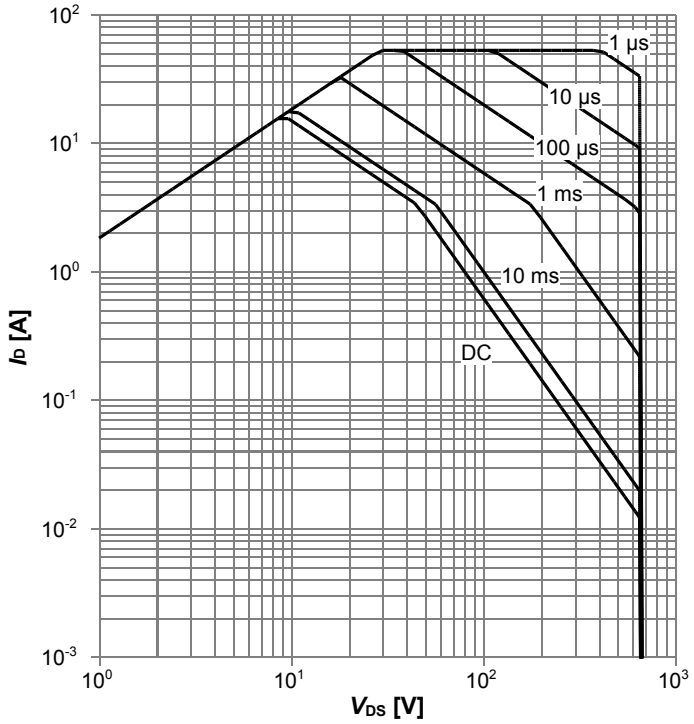
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



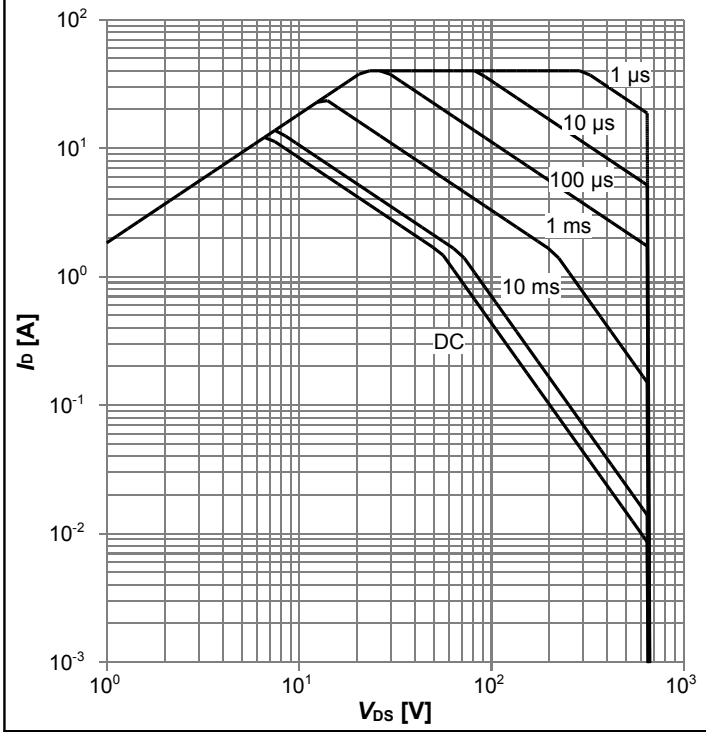
$P_{tot}=f(T_C)$

Diagram 2: Safe operating area



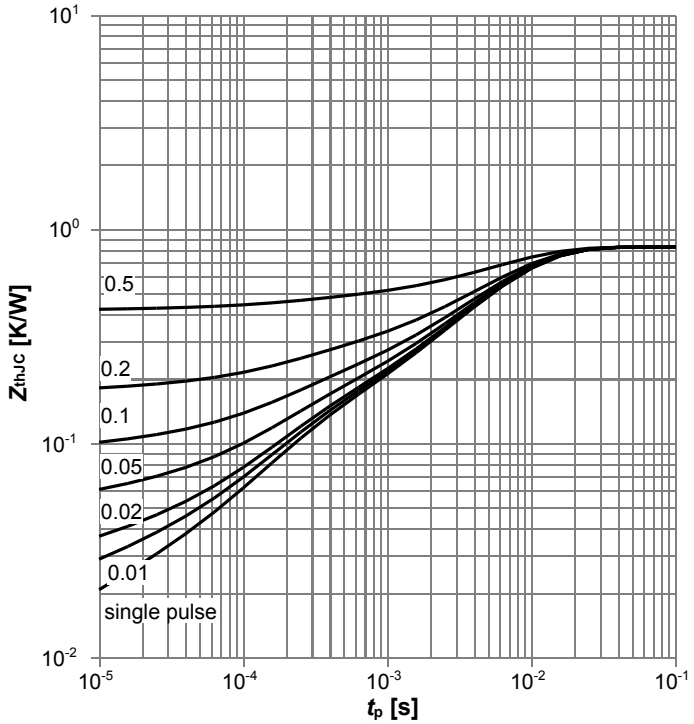
$I_D=f(V_{DS})$; T_C=25 °C; D=0; parameter: t_p

Diagram 3: Safe operating area



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

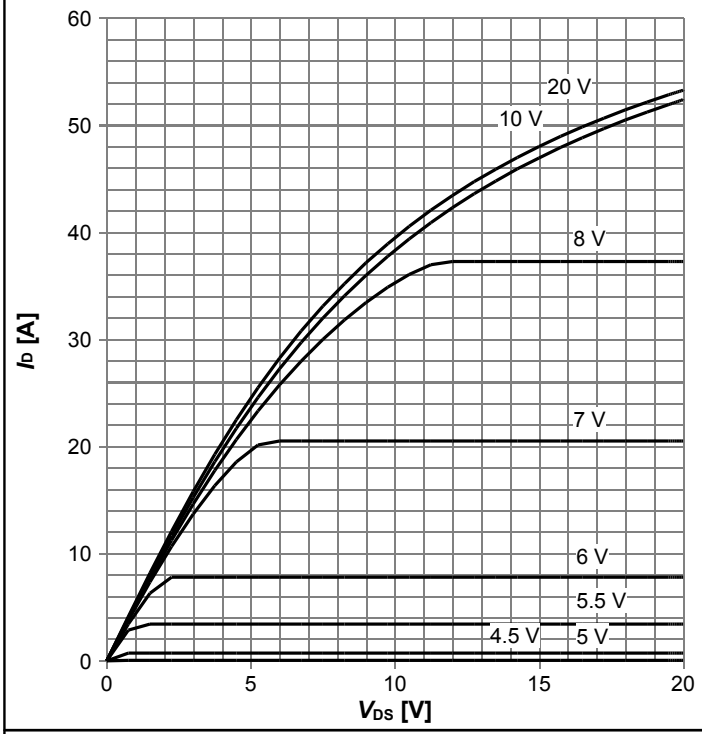
Diagram 4: Max. transient thermal impedance



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

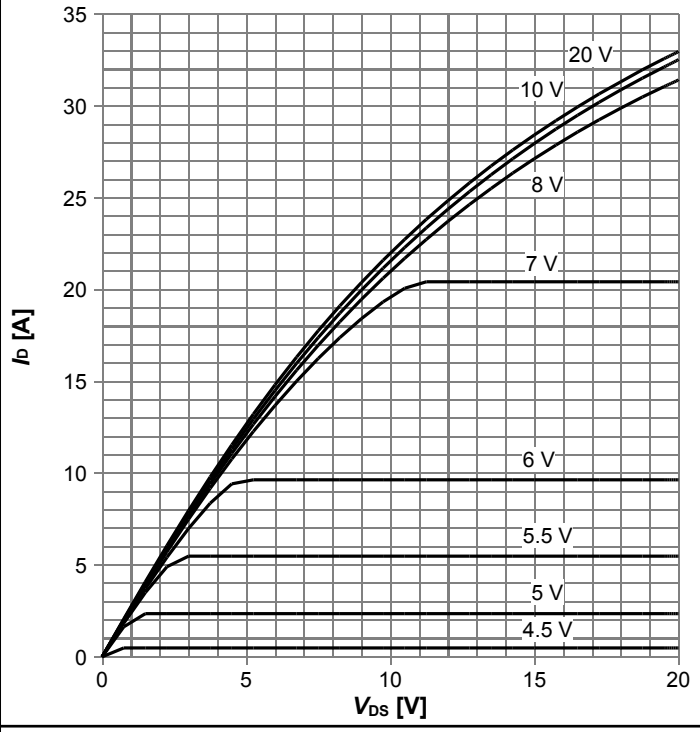
Downloaded From Oneyac.com

Diagram 5: Typ. output characteristics



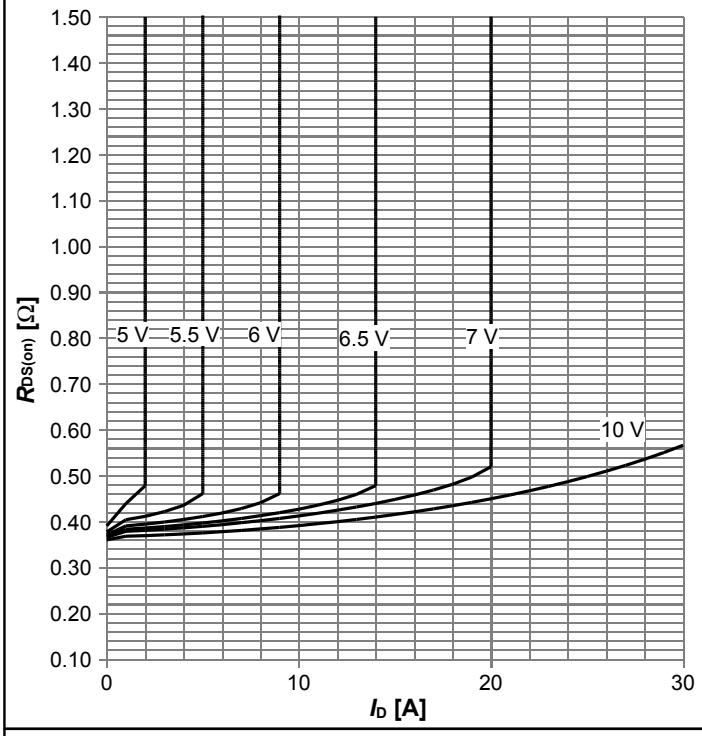
$I_D=f(V_{DS})$; $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. output characteristics



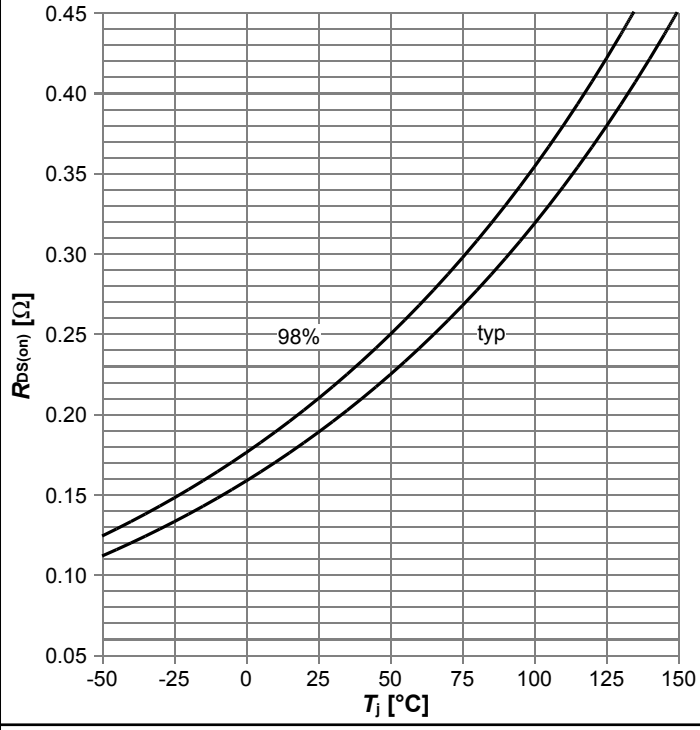
$I_D=f(V_{DS})$; $T_j=125$ °C; parameter: V_{GS}

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



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

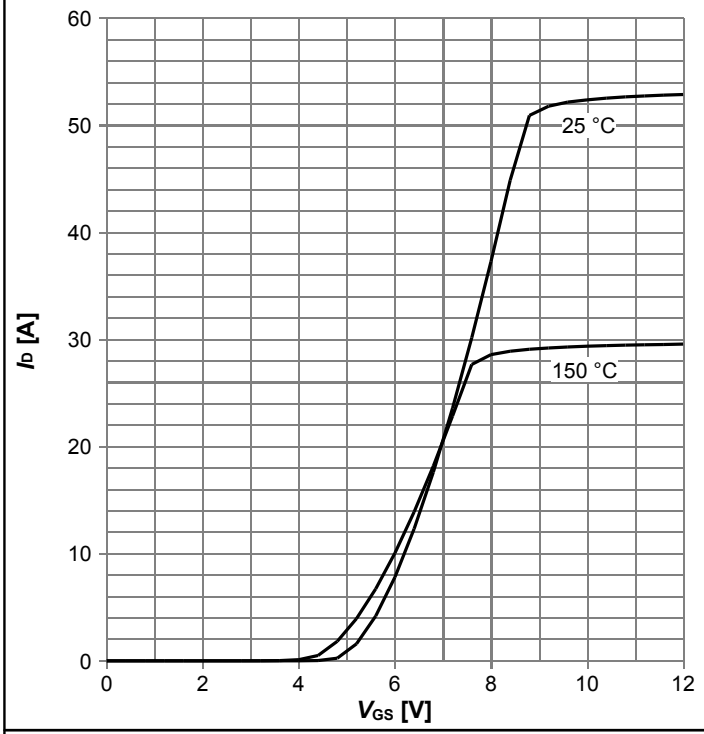
Diagram 8: Drain-source on-state resistance



$R_{DS(on)}=f(T_j)$; $I_D=7.3$ A; $V_{GS}=10$ V

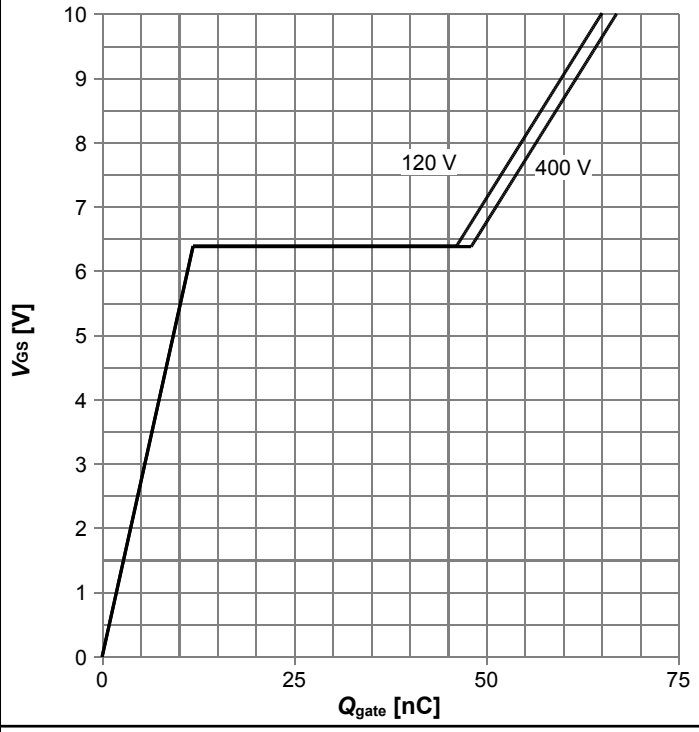
Downloaded From Oneyac.com

Diagram 9: Typ. transfer characteristics



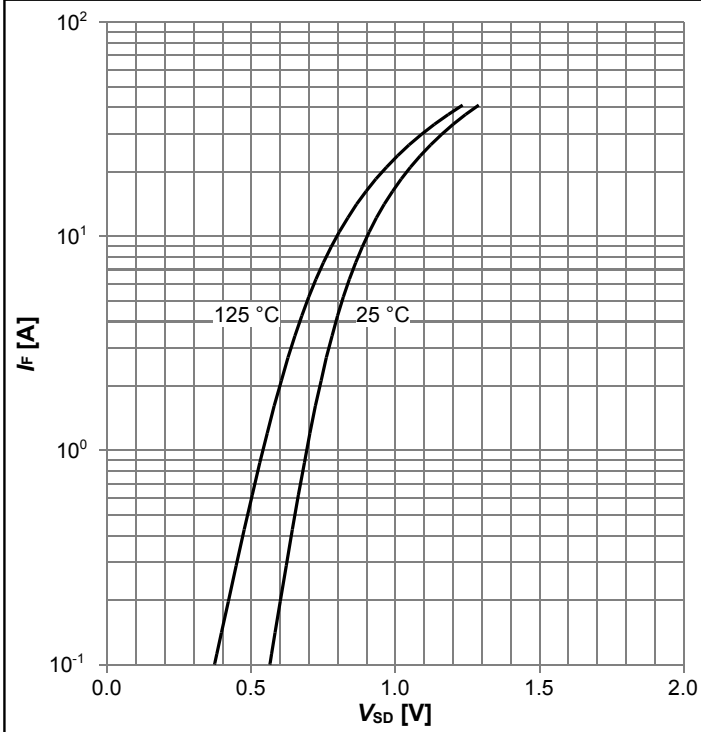
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 10: Typ. gate charge



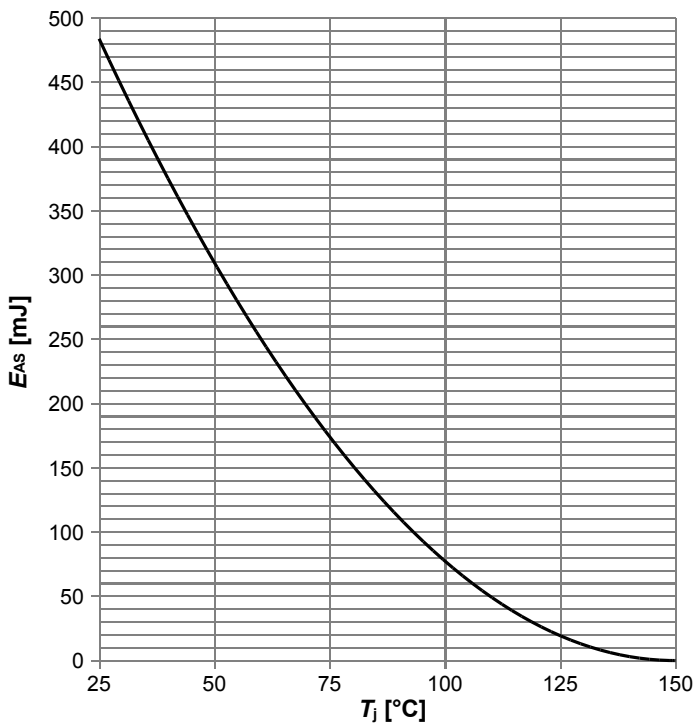
V_{GS}=f(Q_{gate}); I_D=11 A pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



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

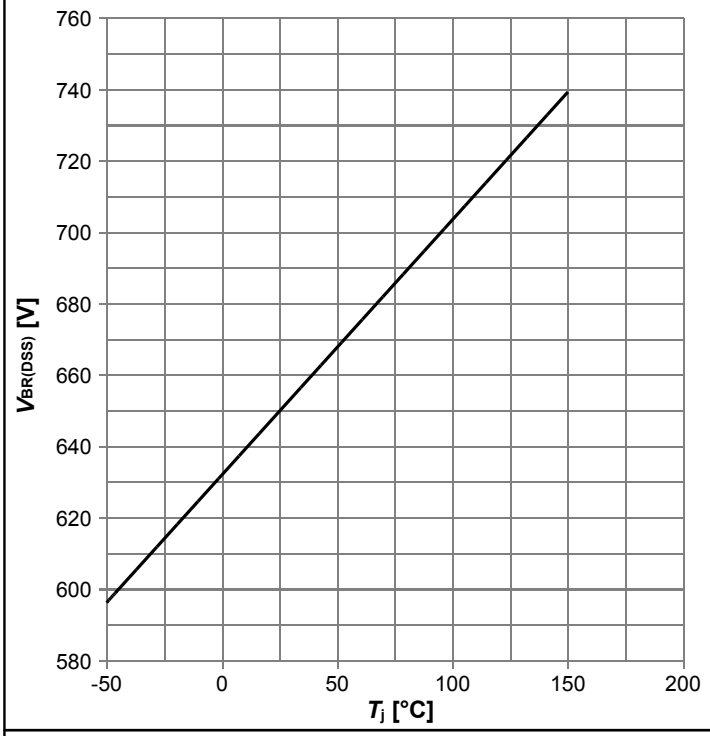
Diagram 12: Avalanche energy



E_{AS}=f(T_j); I_D=3.3 A; V_{DD}=50 V

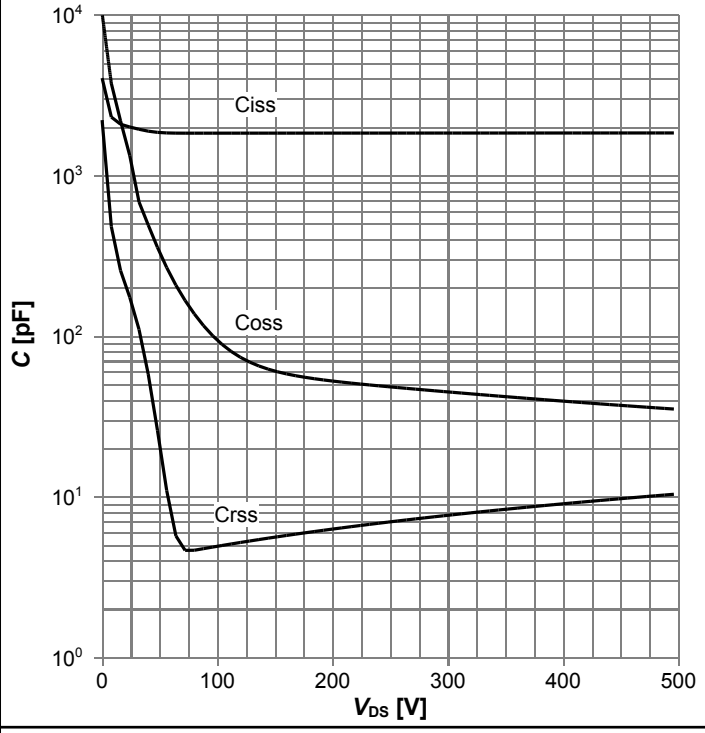
Downloaded From Oneyac.com

Diagram 13: Drain-source breakdown voltage



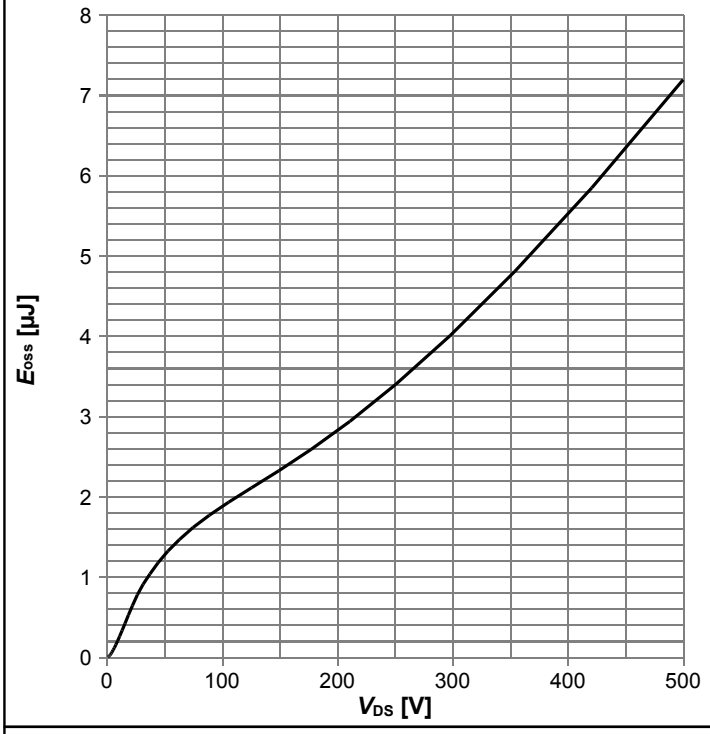
$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Diagram 14: Typ. capacitances



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

Diagram 15: Typ. Coss stored energy



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

Downloaded From Oneyac.com

5 Test Circuits

Table 8 Diode characteristics

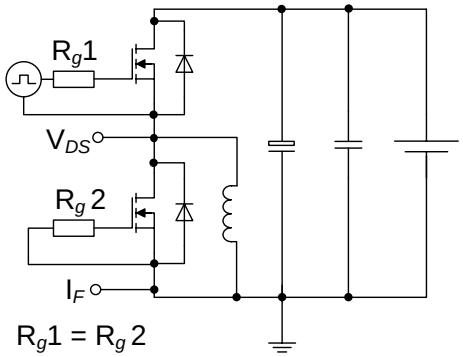
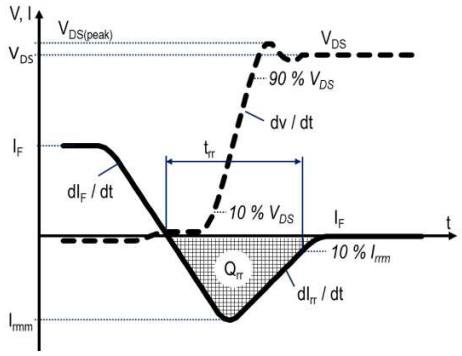
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 switching times (ss)

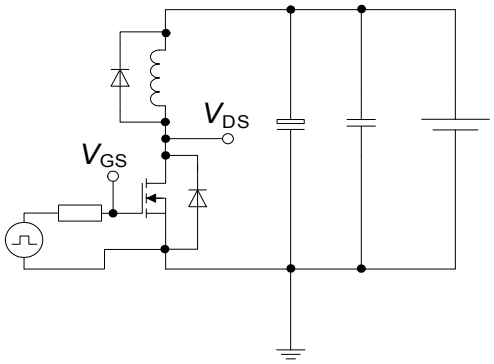
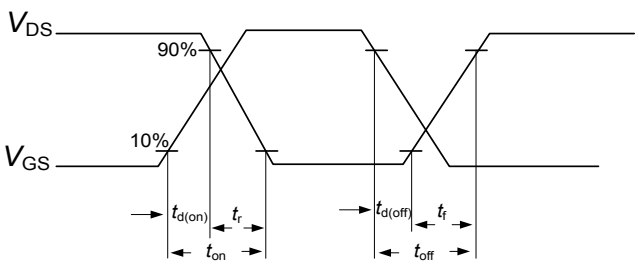
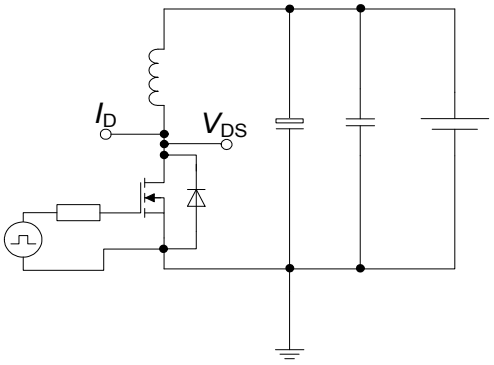
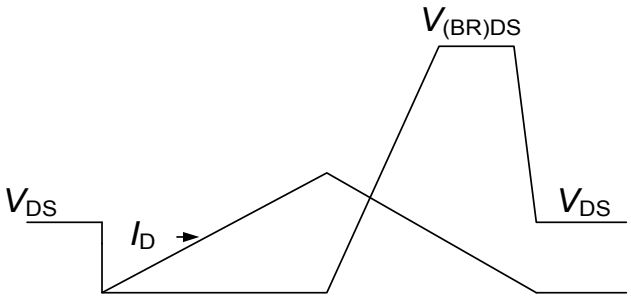
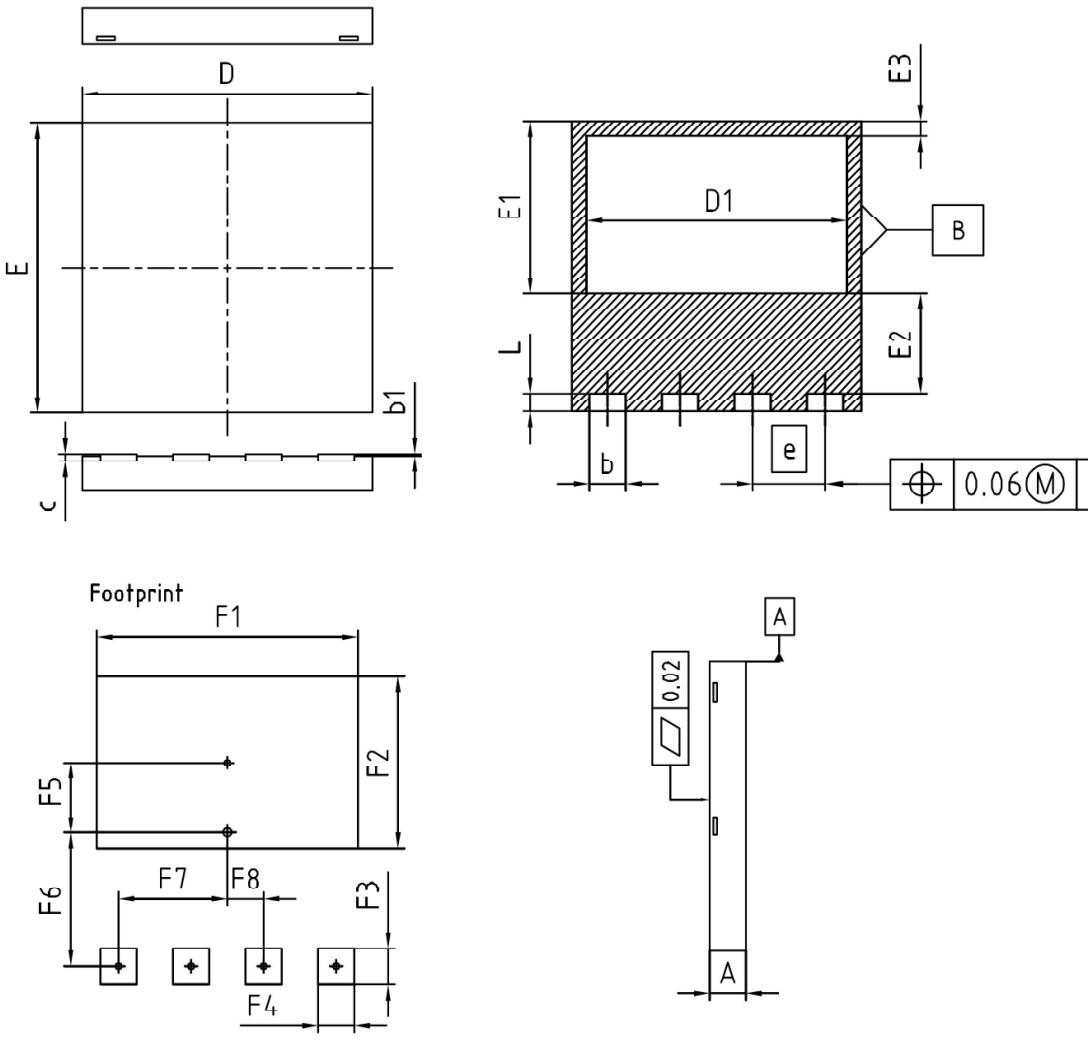
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load (ss)

Unclamped inductive load test circuit	Unclamped inductive waveform
	

Downloaded From Oneyac.com

6 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
b	0.90	1.10	0.035	0.043
b1	0.00	0.05	0.000	0.002
c	0.10	0.30	0.004	0.012
D	7.90	8.10	0.311	0.319
D1	7.10	7.30	0.280	0.287
E	7.90	8.10	0.311	0.319
E1	4.65	4.85	0.183	0.191
E2	2.65	2.85	0.104	0.112
E3	0.30	0.50	0.012	0.020
e	2.00 (BSC)		0.079 (BSC)	
L	0.40	0.60	0.016	0.024
N	4		4	
F1	7.20		0.283	
F2	4.75		0.187	
F3	1.00		0.039	
F4	1.00		0.039	
F5	1.43		0.056	
F6	4.20		0.165	
F7	3.00		0.118	
F8	1.00		0.039	

DOCUMENT NO.
Z8B00156707

SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
05-04-2010

REVISION
01

Figure 1 Outline PG-VSON-4, dimensions in mm/inches

Downloaded From Oneyac.com

7 Appendix A

Table 11 Related Links

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

Downloaded From Oneyac.com

Revision History

IPL65R210CFD

Revision: 2017-09-07, Rev. 2.1

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2014-03-19	Release of final version
2.1	2017-09-07	Updated MSL; style updated

Trademarks of Infineon Technologies AG

AURIX™, C166™, CanPAK™, CIPOS™, CoolGaN™, CoolMOS™, CoolSET™, CoolSiC™, CORECONTROL™, CROSSAVE™, DAVE™, DI-POL™, DrBlade™, EasyPIM™, EconoBRIDGE™, EconoDUAL™, EconoPACK™, EconoPIM™, EiceDRIVER™, eupec™, FCOS™, HITFET™, HybridPACK™, Infineon™, ISOFACE™, IsoPACK™, i-Wafer™, MIPAQ™, ModSTACK™, my-d™, NovalithIC™, OmniTune™, OPTIGA™, OptiMOS™, ORIGA™, POWERCODE™, PRIMARION™, PrimePACK™, PrimeSTACK™, PROFET™, PRO-SIL™, RASIC™, REAL3™, ReverSave™, SatRIC™, SIEGET™, SIPMOS™, SmartLEWIS™, SOLID FLASH™, SPOC™, TEMPFET™, thinQ!™, TRENCHSTOP™, TriCore™.

Trademarks updated August 2015

Other Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

We Listen to Your Comments
Any information within this document that you feel is wrong, unclear or missing at all? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to:
erratum@infineon.com

Published by
Infineon Technologies AG
81726 München, Germany
© 2017 Infineon Technologies AG
All Rights Reserved.

Legal Disclaimer
The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”) .

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.
In addition, any information given in this document is subject to customer’s compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer’s products and any use of the product of Infineon Technologies in customer’s applications.
The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer’s technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Information
For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (**www.infineon.com**).

Warnings
Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.
The Infineon Technologies component described in this Data Sheet may be used in life-support devices or systems and/or automotive, aviation and aerospace applications or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support, automotive, aviation and aerospace device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

Downloaded From Oneyac.com

单击下面可查看定价，库存，交付和生命周期等信息

>>Infineon(英飞凌)

Downloaded From Oneyac.com