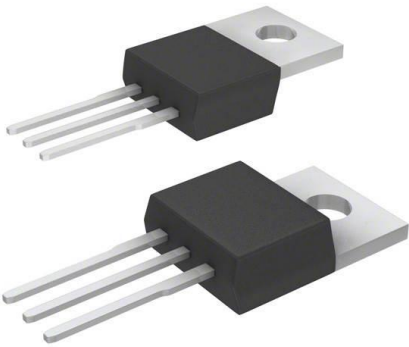


IPP65R110CFDXKSA1 Datasheet

www.digi-electronics.com



<https://www.DiGi-Electronics.com>

DiGi Electronics Part Number	IPP65R110CFDXKSA1-DG
Manufacturer	Infineon Technologies
Manufacturer Product Number	IPP65R110CFDXKSA1
Description	MOSFET N-CH 700V 31.2A TO220-3
Detailed Description	N-Channel 700 V 31.2A (Tc) 277.8W (Tc) Through Hole PG-TO220-3



Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

DiGi is a global authorized distributor of electronic components.

Purchase and inquiry

Manufacturer Product Number:

IPP65R110CFDXKSA1

Series:

CoolMOS™

FET Type:

N-Channel

Drain to Source Voltage (Vdss):

700 V

Drive Voltage (Max Rds On, Min Rds On):

10V

Vgs(th) (Max) @ Id:

4.5V @ 1.3mA

Vgs (Max):

±20V

FET Feature:

-

Operating Temperature:

-55°C ~ 150°C (Tj)

Supplier Device Package:

PG-TO220-3

Base Product Number:

IPP65R110

Manufacturer:

Infineon Technologies

Product Status:

Obsolete

Technology:

MOSFET (Metal Oxide)

Current - Continuous Drain (Id) @ 25°C:

31.2A (Tc)

Rds On (Max) @ Id, Vgs:

110mOhm @ 12.7A, 10V

Gate Charge (Qg) (Max) @ Vgs:

118 nC @ 10 V

Input Capacitance (Ciss) (Max) @ Vds:

3240 pF @ 100 V

Power Dissipation (Max):

277.8W (Tc)

Mounting Type:

Through Hole

Package / Case:

TO-220-3

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99



MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CoolMOS™ CFD2 650V

650V CoolMOS™ CFD2 Power Transistor
IPx65R110CFD

Data Sheet

Rev. 2.6
Final

Industrial & Multimarket

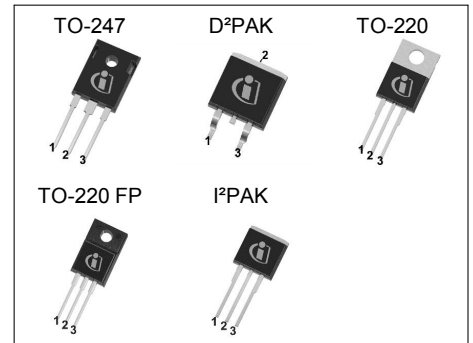


650V CoolMOS™ CFD2 Power Transistor

IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
IPA65R110CFD, IPI65R110CFD

1 Description

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



Features

- Ultra-fast body diode
- Very high commutation ruggedness
- Extremely low losses due to very low FOM $R_{ds(on)} \cdot Q_g$ and E_{oss}
- Easy to use/drive
- Qualified for industrial grade applications according to JEDEC (J-STD20 and JESD22)
- Pb-free plating, Halogen free mold compound

Applications

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

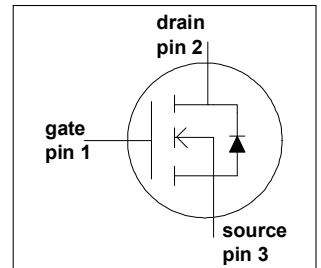


Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j \max}$	700	V
$R_{DS(on),max}$	0.11	Ω
Q_g,typ	118	nC
$I_D,pulse$	99.6	A
$E_{oss} @ 400V$	9.2	μJ
Body diode di/dt	900	A/ μs
Q_{rr}	0.8	μC
t_{rr}	150	ns
I_{rrm}	8.3	A

Type / Ordering Code	Package	Marking	Related Links
IPW65R110CFD	PG-TO 247	65F6110	see Appendix A
IPB65R110CFD	PG-TO 263		
IPP65R110CFD	PG-TO 220		
IPA65R110CFD	PG-TO 220 FullPAK		
IPI65R110CFD	PG-TO 262		



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

Table of Contents

Description	2
Table of Contents	3
Maximum ratings	4
Thermal characteristics	5
Electrical characteristics	6
Electrical characteristics diagrams	8
Test Circuits	13
Package Outlines	14
Appendix A	19
Revision History	20
Disclaimer	20



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

2 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 ¹⁾	I_D			31.2	A	$T_C = 25^\circ\text{C}$
				19.7		$T_C = 100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$			99.6	A	$T_C = 25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}			845	mJ	$t_b = 6.2\text{A}$, $V_{DD} = 50\text{V}$
Avalanche energy, repetitive	E_{AR}			1.30	mJ	$t_b = 6.2\text{A}$, $V_{DD} = 50\text{V}$
Avalanche current, repetitive	I_{AR}			6.2	A	
MOSFET dv/dt ruggedness	dv/dt			50	V/ns	$V_{DS} = 0 \dots 400\text{V}$
Gate source voltage	V_{GS}	-20		20	V	static
		-30		30		AC ($f > 1\text{ Hz}$)
Power dissipation (non FullPAK) TO-247, TO-220, I ² PAK	P_{tot}			277.8	W	$T_C = 25^\circ\text{C}$
Power dissipation (FullPAK) TO-220 FP	P_{tot}			34.7	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	T_j, T_{stg}	-55		150	$^\circ\text{C}$	
Mounting torque (non FullPAK) TO-247, TO-220, I ² PAK				60	Ncm	M3 and M3.5 screws
Mounting torque (FullPAK) TO-220 FP				50	Ncm	M2.5 screws
Continuous diode forward current	I_S			31.2	A	$T_C = 25^\circ\text{C}$
Diode pulse current	$I_{S,pulse}$			99.6	A	$T_C = 25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt			50	V/ns	$V_{DS} = 0 \dots 400\text{V}$, $t_{SD} \leq t_b$, $T_j = 25^\circ\text{C}$
Maximum diode commutation speed	di_f/dt			900	A/ μs	

¹⁾ Limited by $T_{j,max}$. Maximum

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

³⁾ $V_{peak} < V_{(BR)DSS}$, $T_j < T_{j,max}$, identical low side and high side switch with same R_g



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

3 Thermal characteristics

Table 3 Thermal characteristics TO-247, TO-220, I²PAK

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			0.45	°C/W	
Thermal resistance, junction - ambient	R_{thJA}			62	°C/W	leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}			260	°C	1.6 mm (0.063 in.) from case for 10s

Table 4 Thermal characteristics TO-220 FP

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			3.6	°C/W	
Thermal resistance, junction - ambient	R_{thJA}			80	°C/W	leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}			260	°C	1.6 mm (0.063 in.) from case for 10s

Table 5 Thermal characteristics D²PAK

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			0.45	°C/W	
Thermal resistance, junction - ambient ¹⁾	R_{thJA}			62	°C/W	SMD version, device on PCB, minimal footprint
			35			SMD version, device on PCB, 6cm ² cooling area
Soldering temperature, wave- & reflowsoldering allowed	T_{sold}			260	°C	reflow MSL

¹⁾ 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 stream cooling.



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

4 Electrical characteristics

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

Table 6 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	650			V	$V_{GS} = 0V, I_D = 1mA$
Gate threshold voltage	$V_{GS(th)}$	3.5	4	4.5	V	$V_{DS} = V_{GS}, I_D = 1.3mA$
Zero gate voltage drain current	I_{DSS}			1.5	μA	$V_{DS} = 650V, V_{GS} = 0V, T_j = 25^\circ C$
			400			$V_{DS} = 650V, V_{GS} = 0V, T_j = 150^\circ C$
Gate-source leakage current	I_{GSS}			100	nA	$V_{GS} = 20V, V_{DS} = 0V$
Drain-source on-state resistance	$R_{DS(on)}$		0.099	0.11	Ω	$V_{GS} = 10V, I_D = 12.7A, T_j = 25^\circ C$
			0.257			$V_{GS} = 10V, I_D = 12.7A, T_j = 150^\circ C$
Gate resistance	R_G		1.3		Ω	$f = 1MHz, \text{open drain}$

Table 7 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}		3240		pF	$V_{GS} = 0V, V_{DS} = 100V, f = 1MHz$
Output capacitance	C_{oss}		160		pF	
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$		118		pF	$V_{GS} = 0V, V_{DS} = 0 \dots 400V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$		582		pF	$I_D = \text{constant}, V_{GS} = 0V, V_{DS} = 0 \dots 400V$
Turn-on delay time	$t_{d(on)}$		16		ns	$V_{DD} = 400V, V_{GS} = 13V, I_D = 19.1A, R_G = 1.8\Omega$
Rise time	t_r		11		ns	
Turn-off delay time	$t_{d(off)}$		68		ns	
Fall time	t_f		6		ns	

Table 8 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		21		nC	$V_{DD} = 480V, I_D = 19.1A, V_{GS} = 0 \text{ to } 10V$
Gate to drain charge	Q_{gd}		64		nC	
Gate charge total	Q_g		118		nC	
Gate plateau voltage	$V_{plateau}$		6.4		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



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

Table 9 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}		0.9		V	$V_{GS} = 0V, f = 19.1A, T_j = 25^\circ C$
Reverse recovery time	t_{rr}		150		ns	$V_R = 400V, f = 19.1A,$ $dI/dt = 100A/\mu s$
Reverse recovery charge	Q_{rr}		0.8		μC	
Peak reverse recovery current	I_{rrm}		8.3		A	



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

5 Electrical characteristics diagrams

Table 10

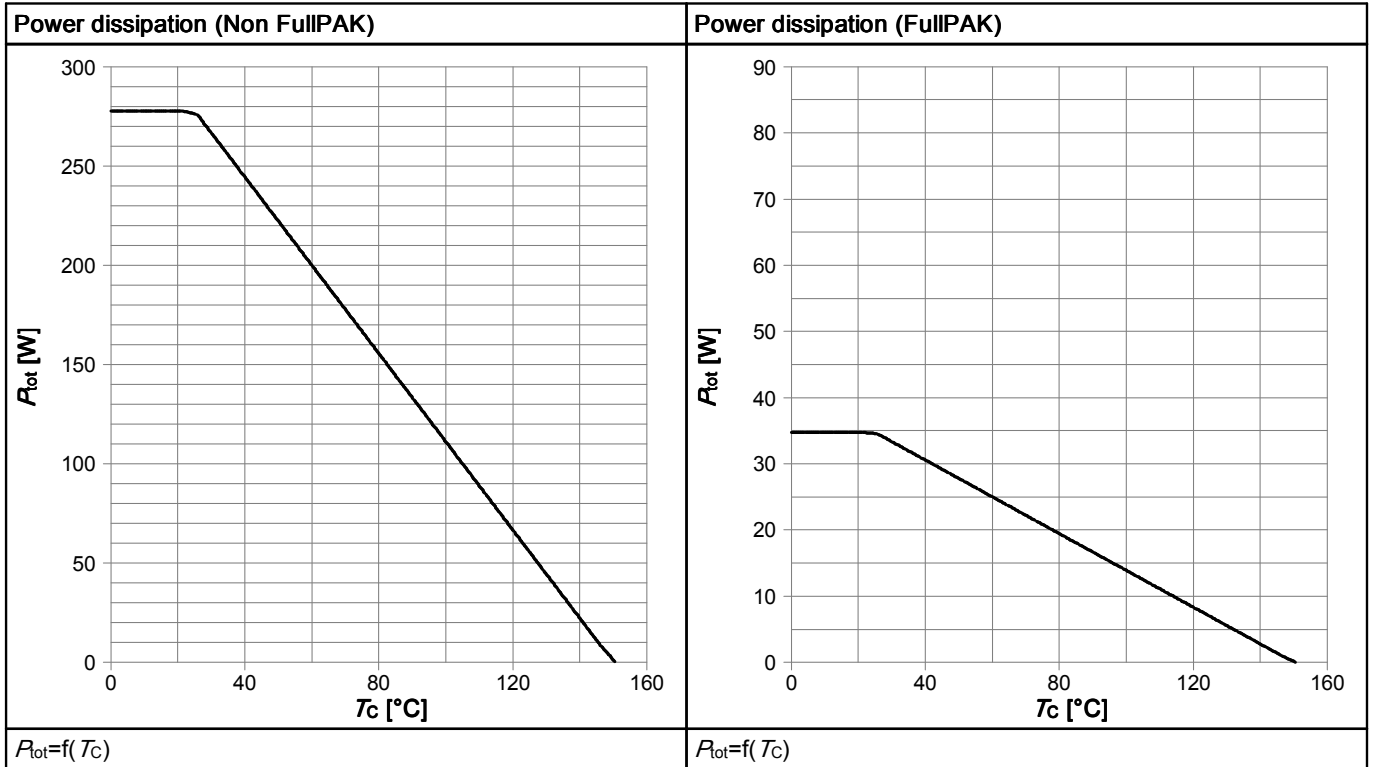
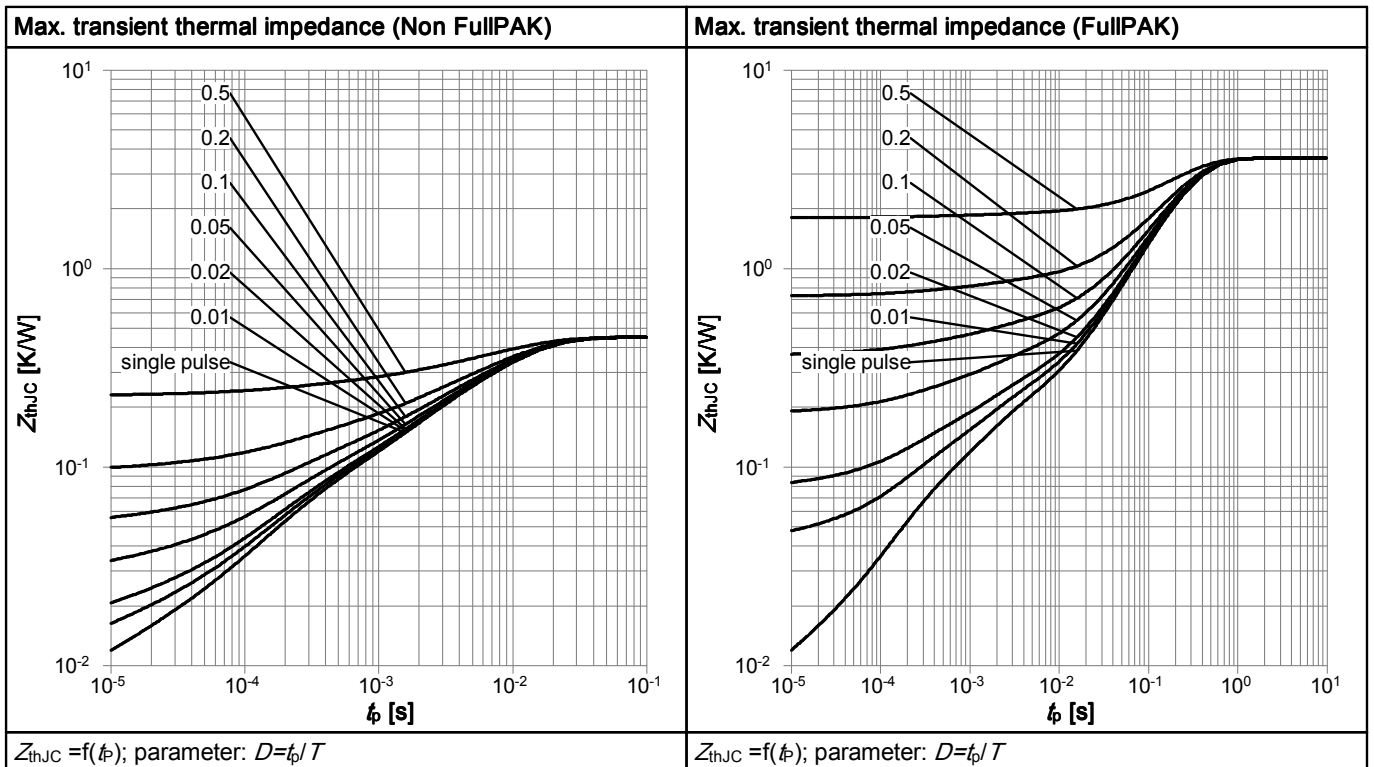


Table 11





650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

Table 12

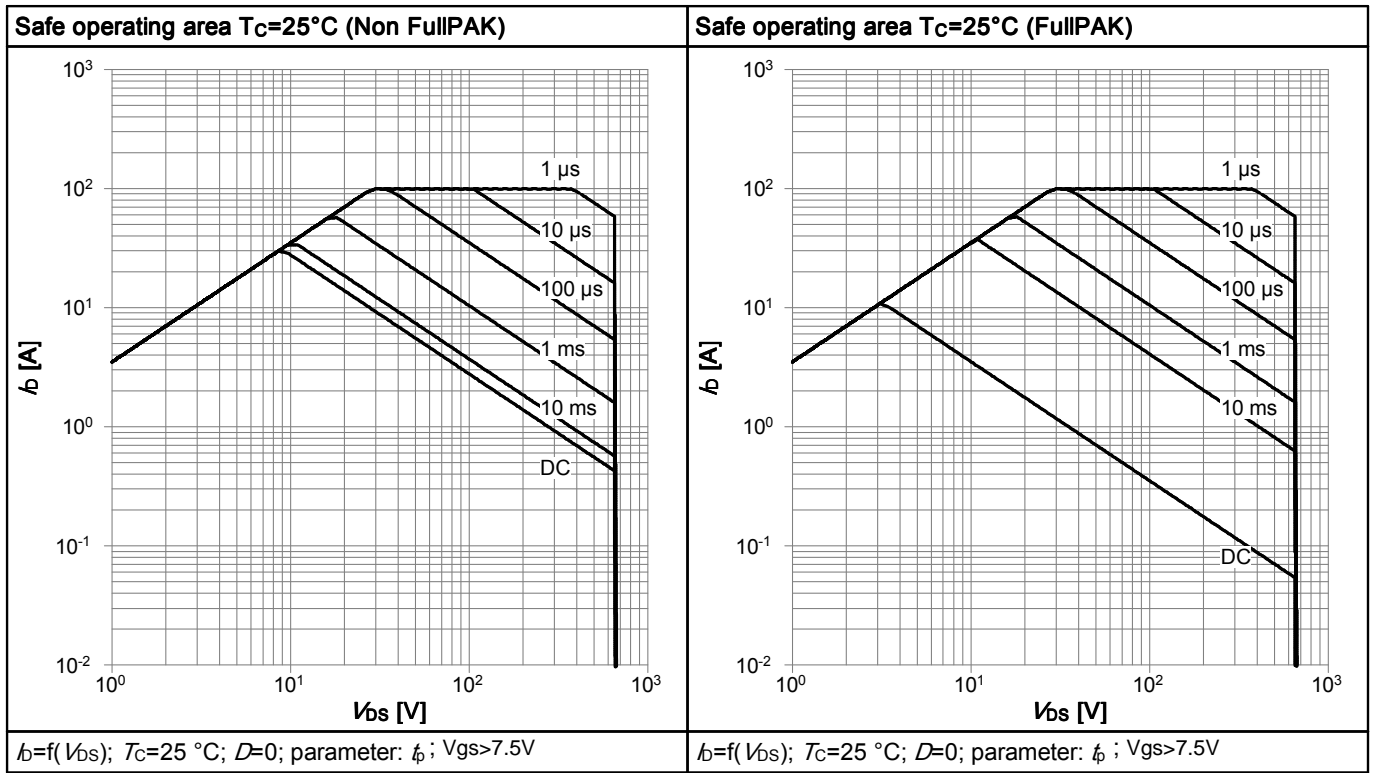
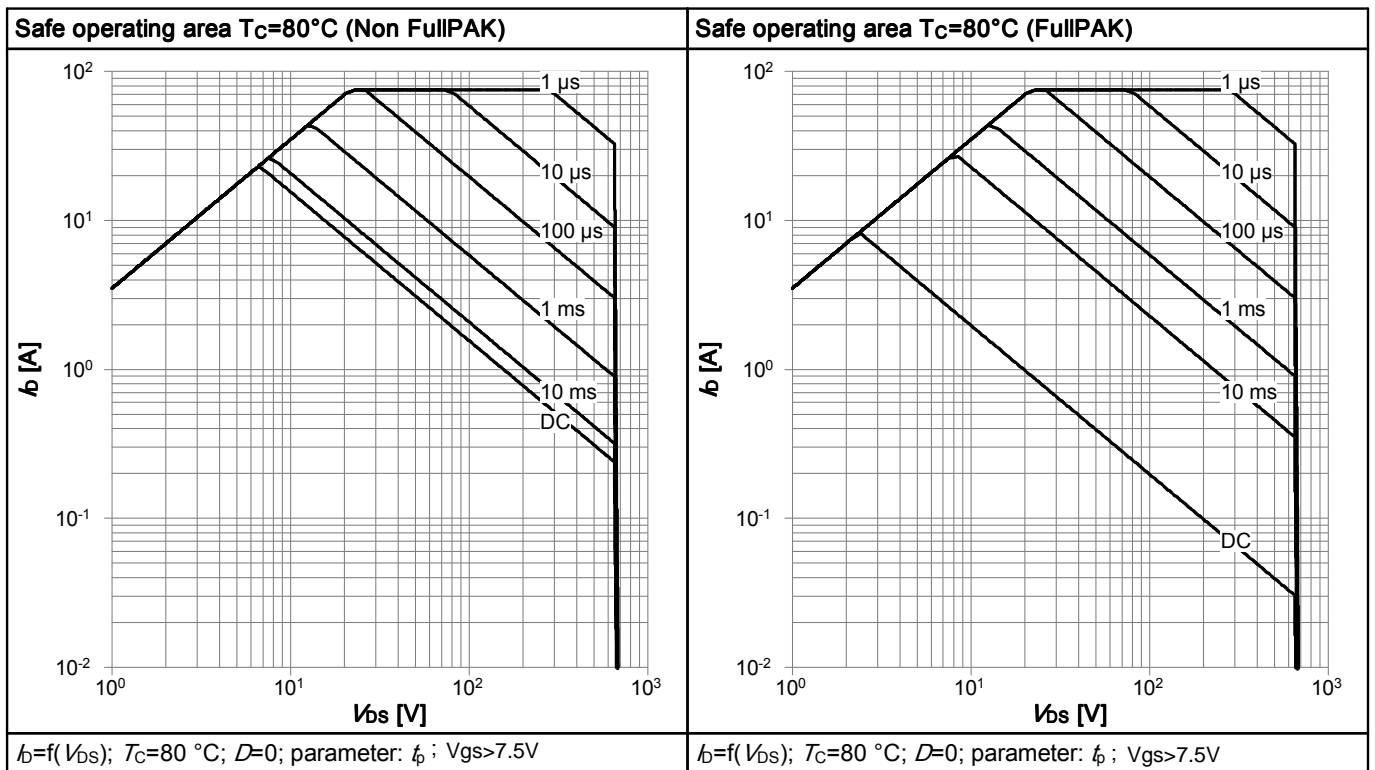


Table 13





650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

Table 14

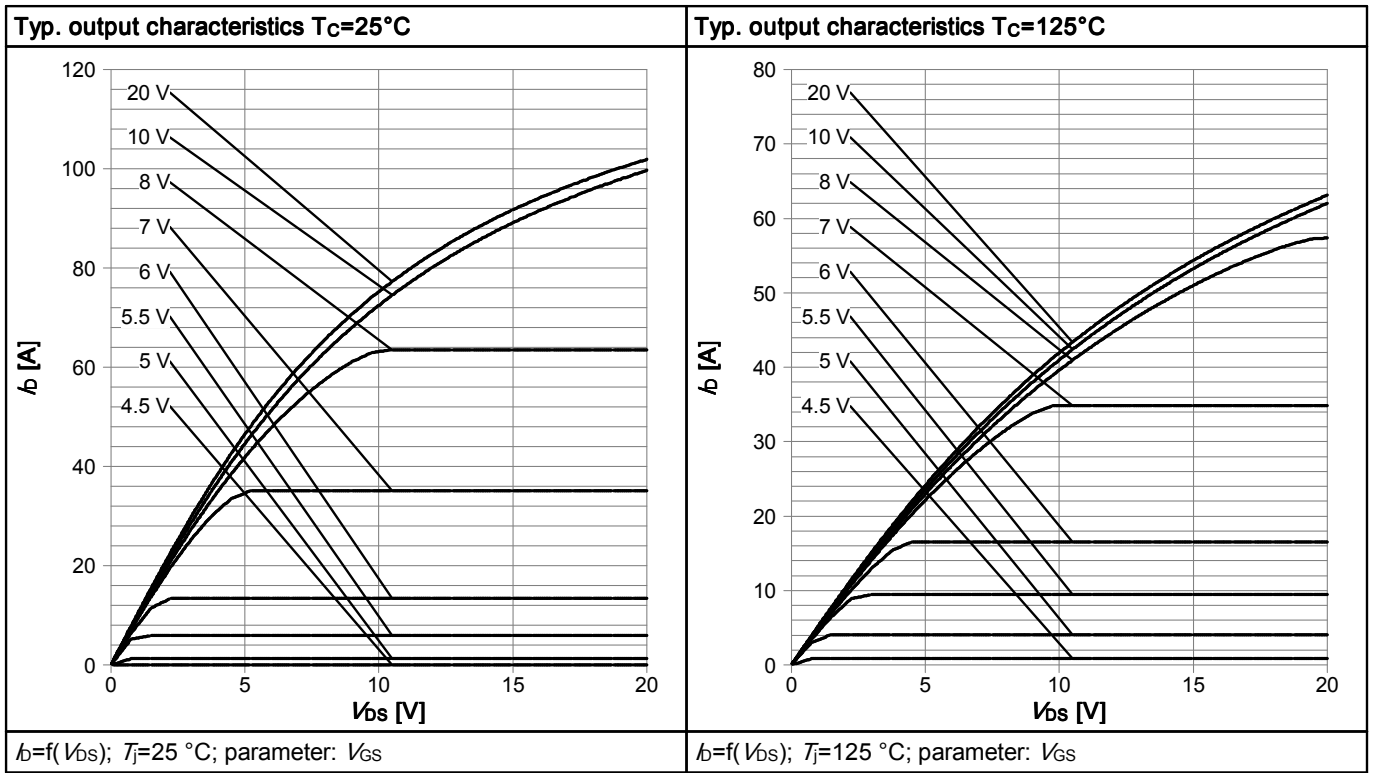
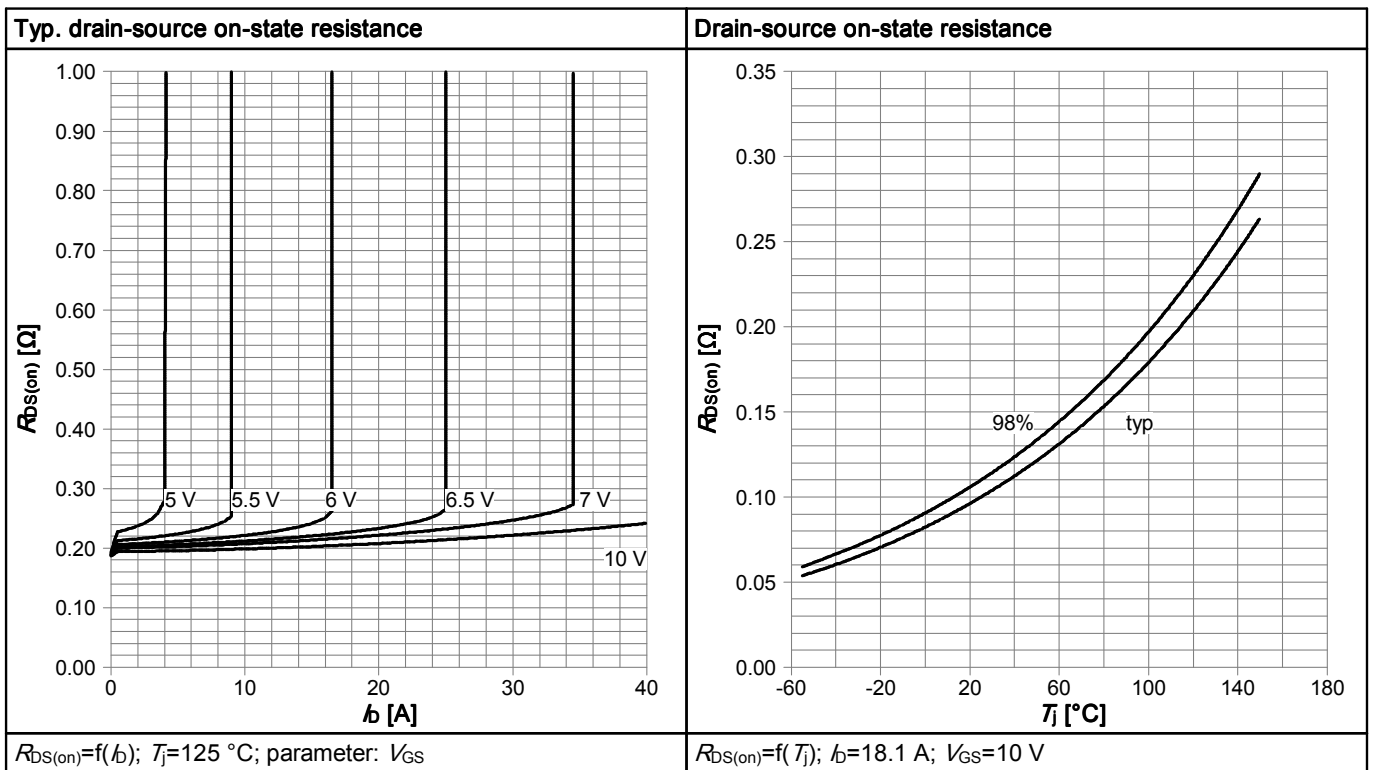


Table 15





650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

Table 16

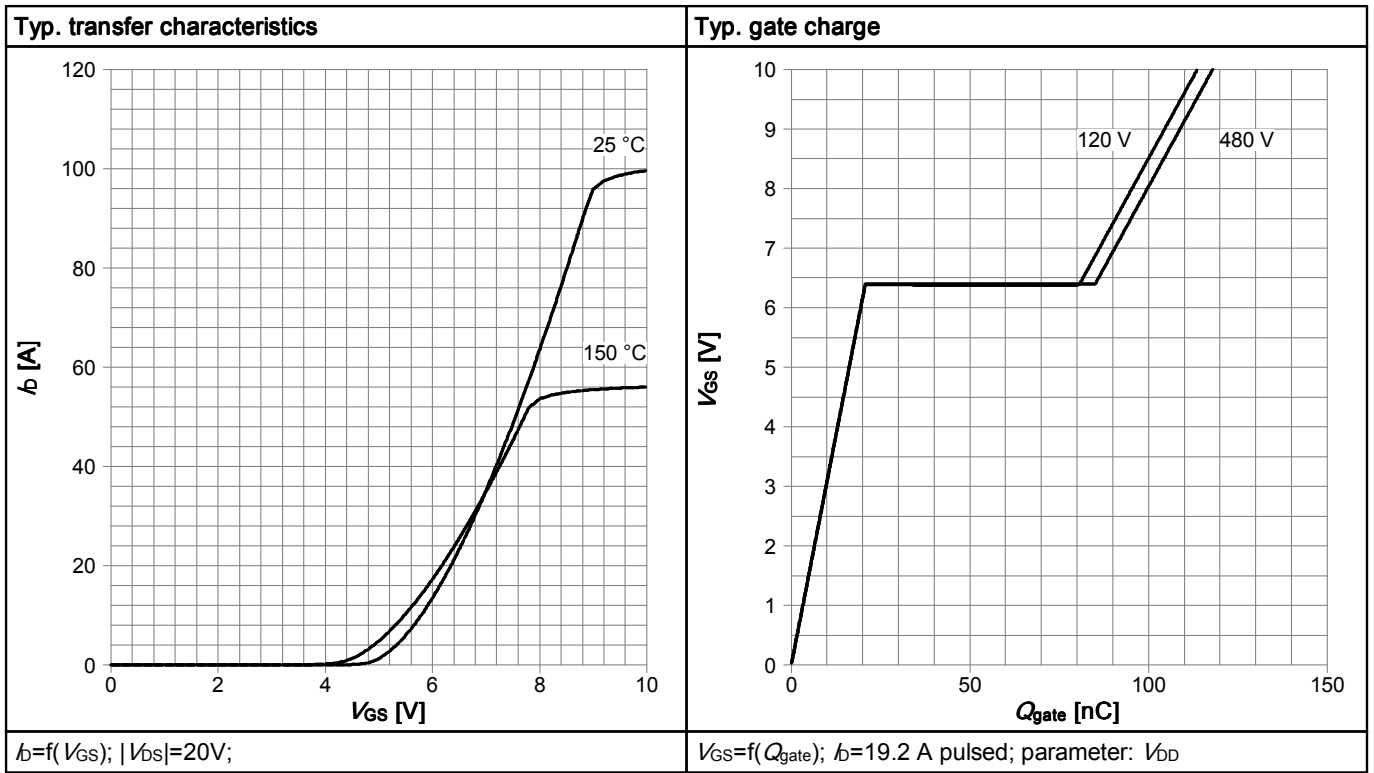
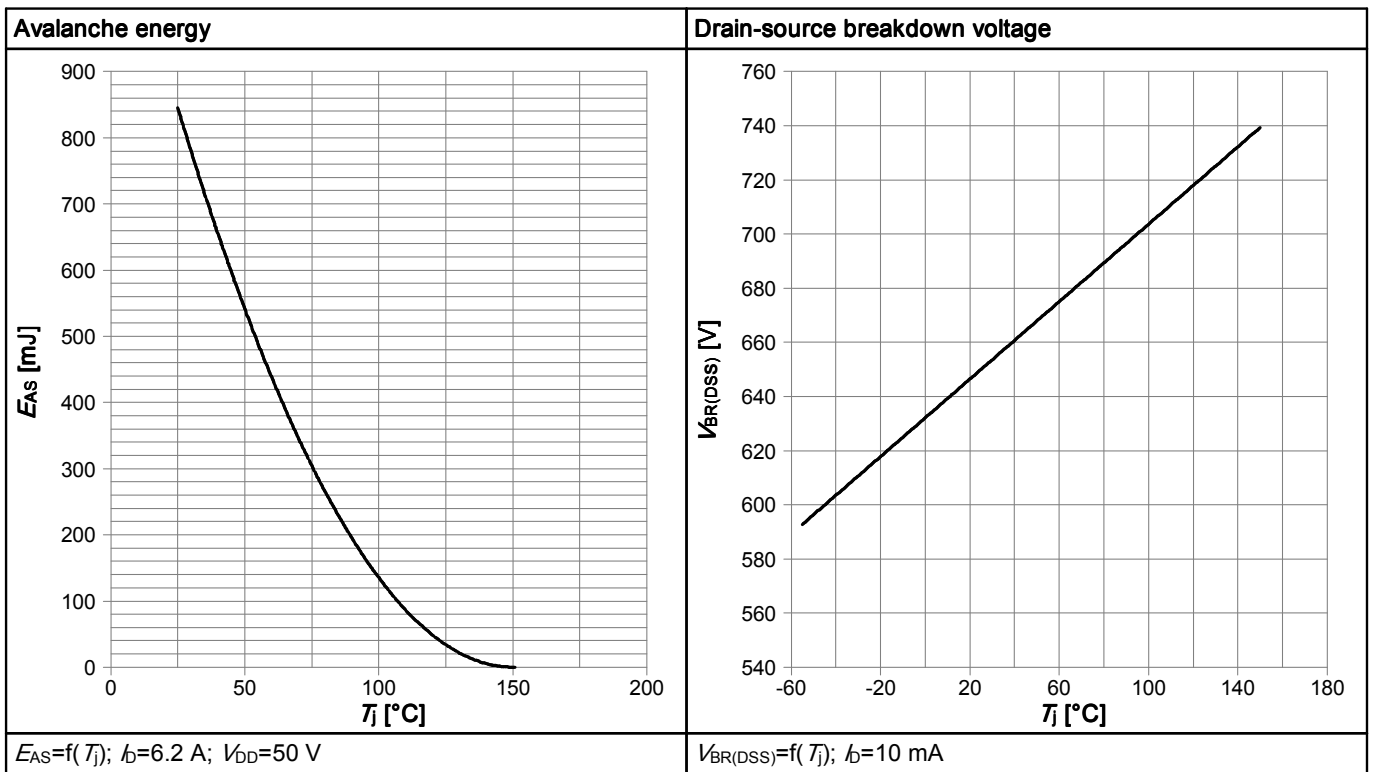


Table 17





650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

Table 18

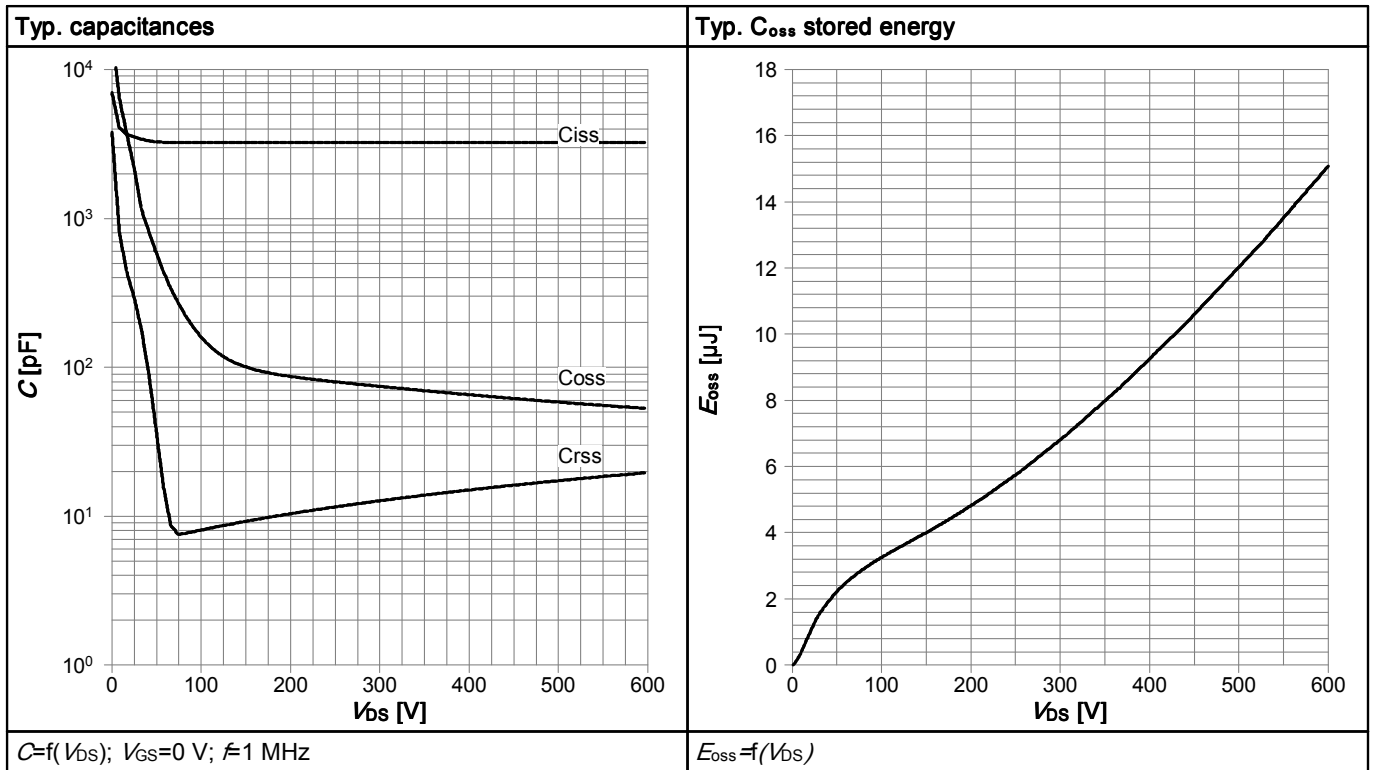
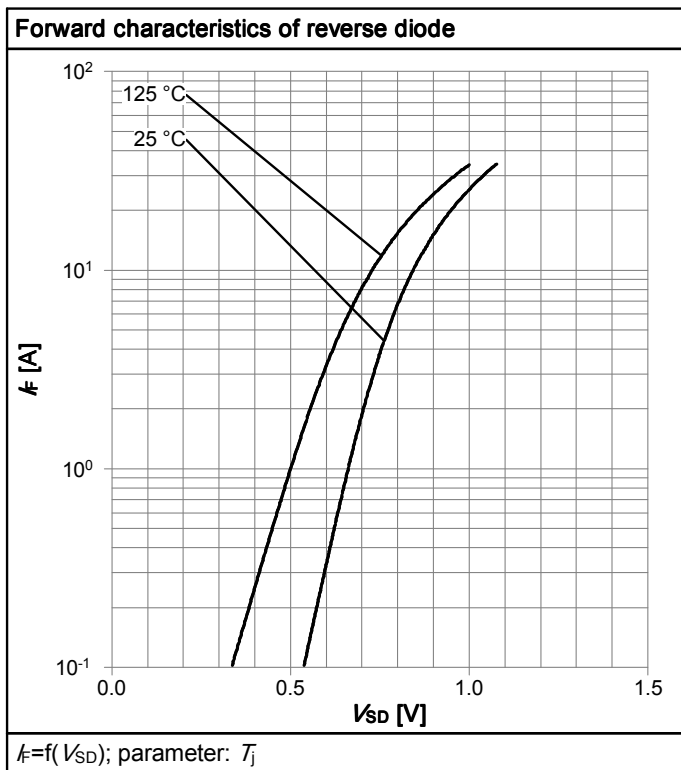


Table 19





650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

6 Test Circuits

Table 20 Diode_characteristics

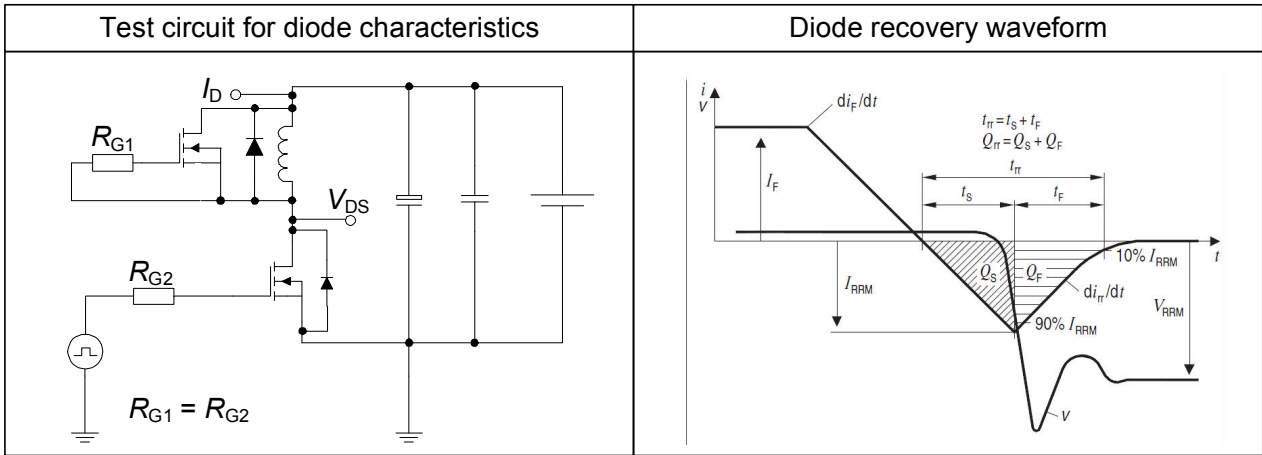


Table 21 Switching_times

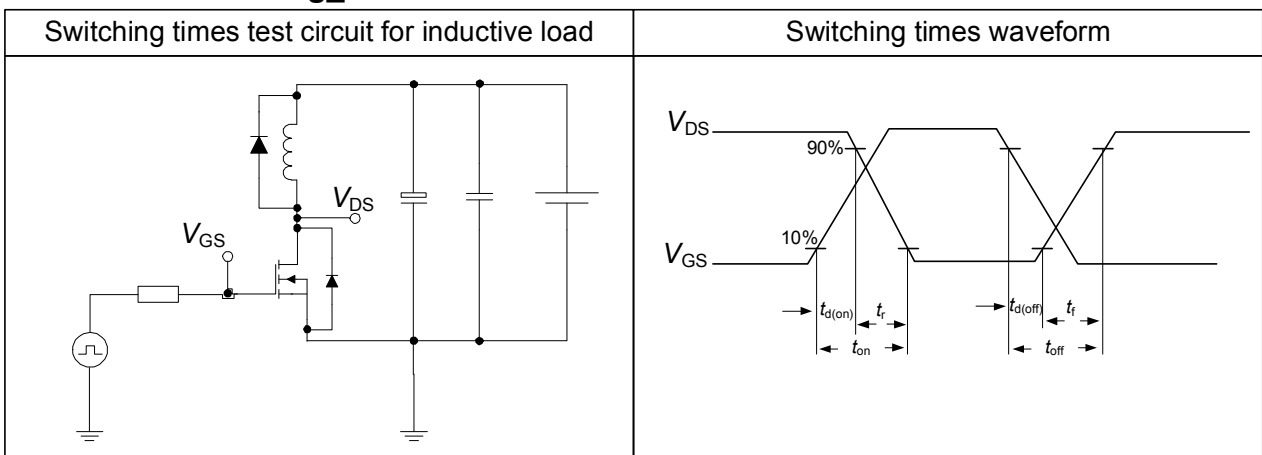
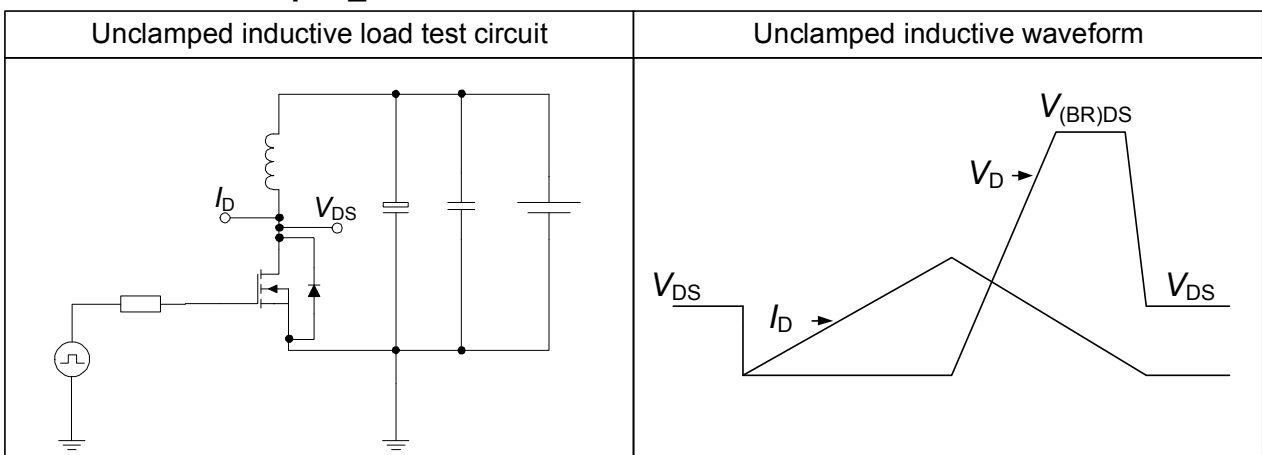


Table 22 Unclamped_inductive





650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

7 Package Outlines

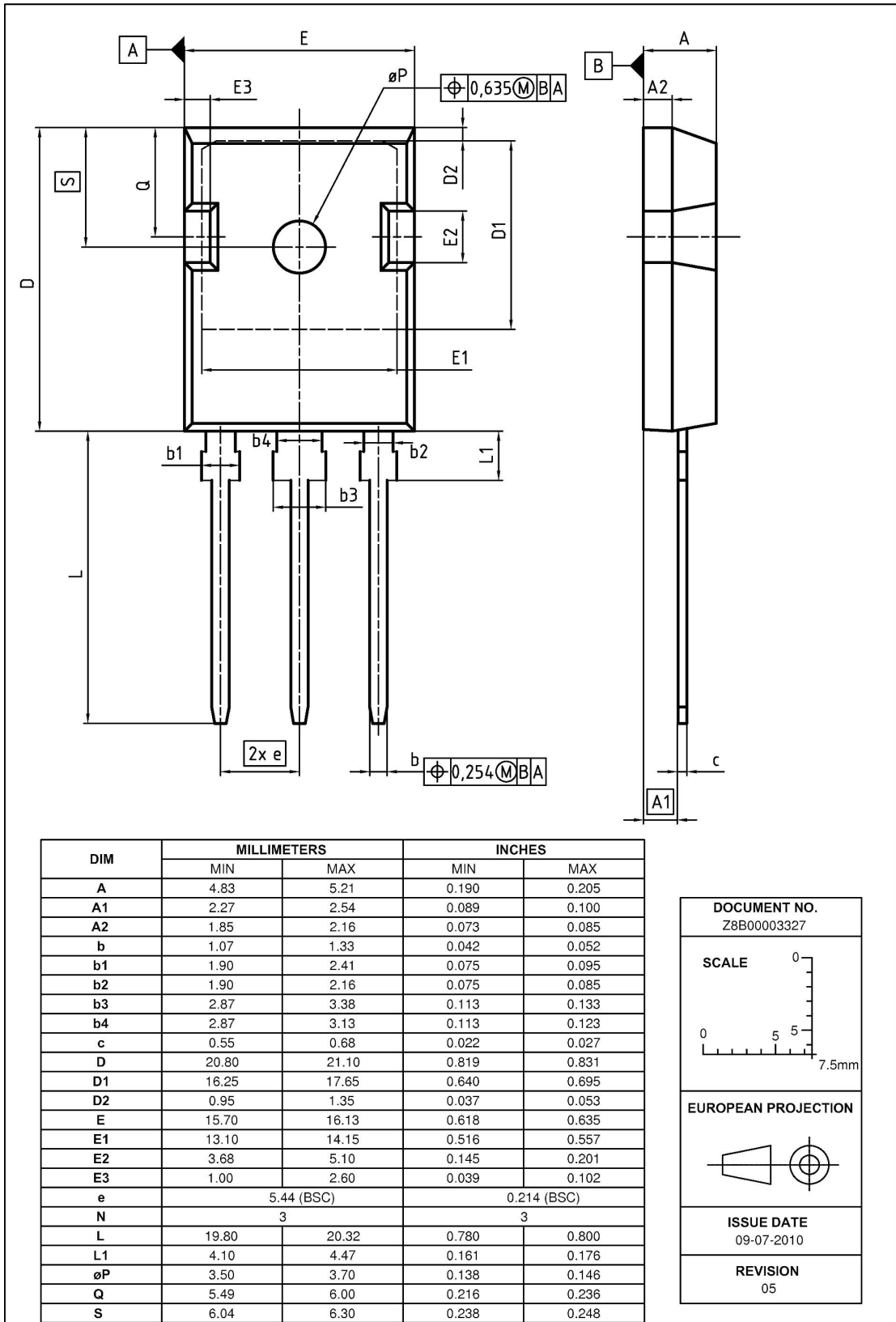


Figure 1 Outline PG-TO 247, dimensions in mm/inches



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

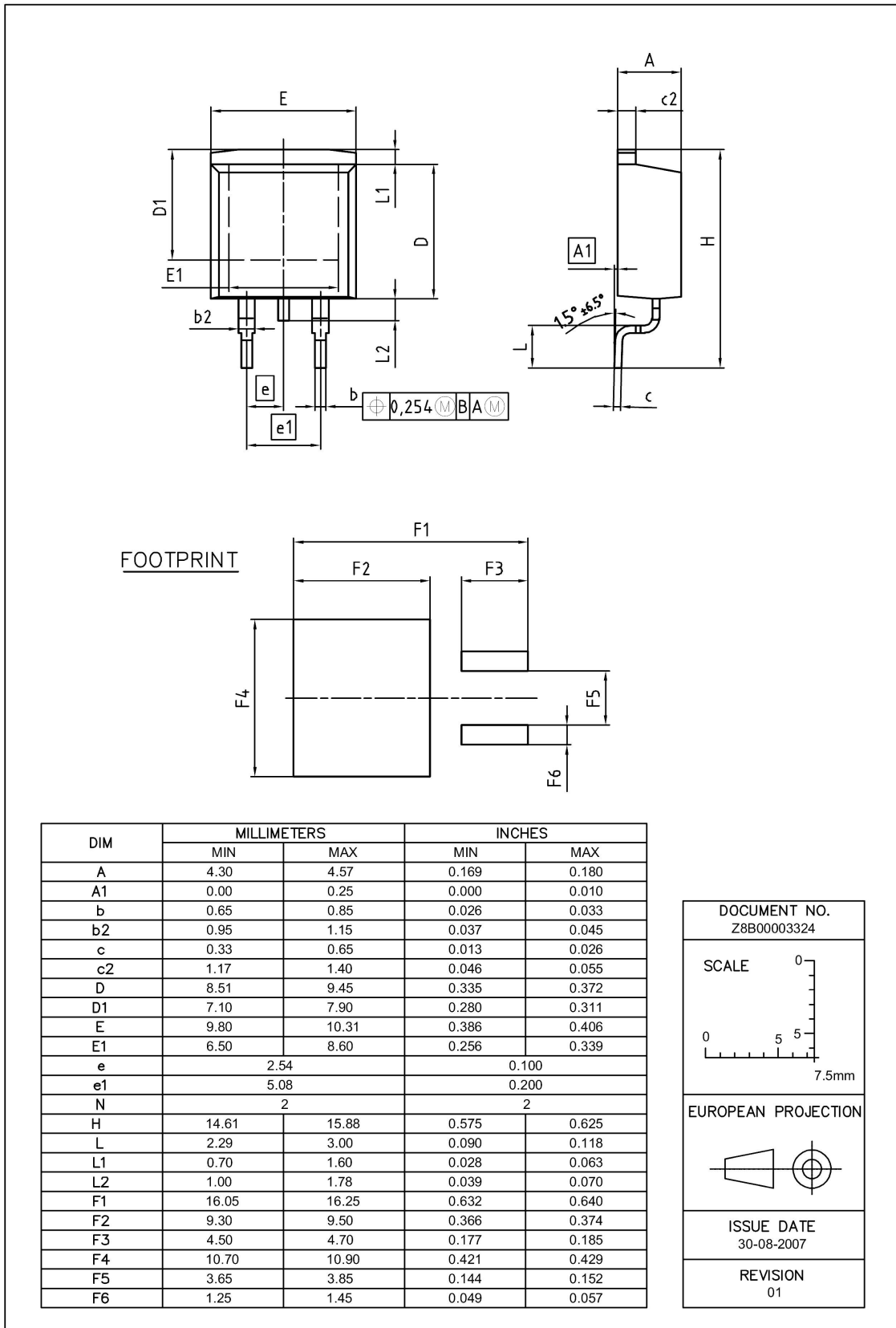


Figure 2 Outline PG-TO 263, dimensions in mm/inches



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

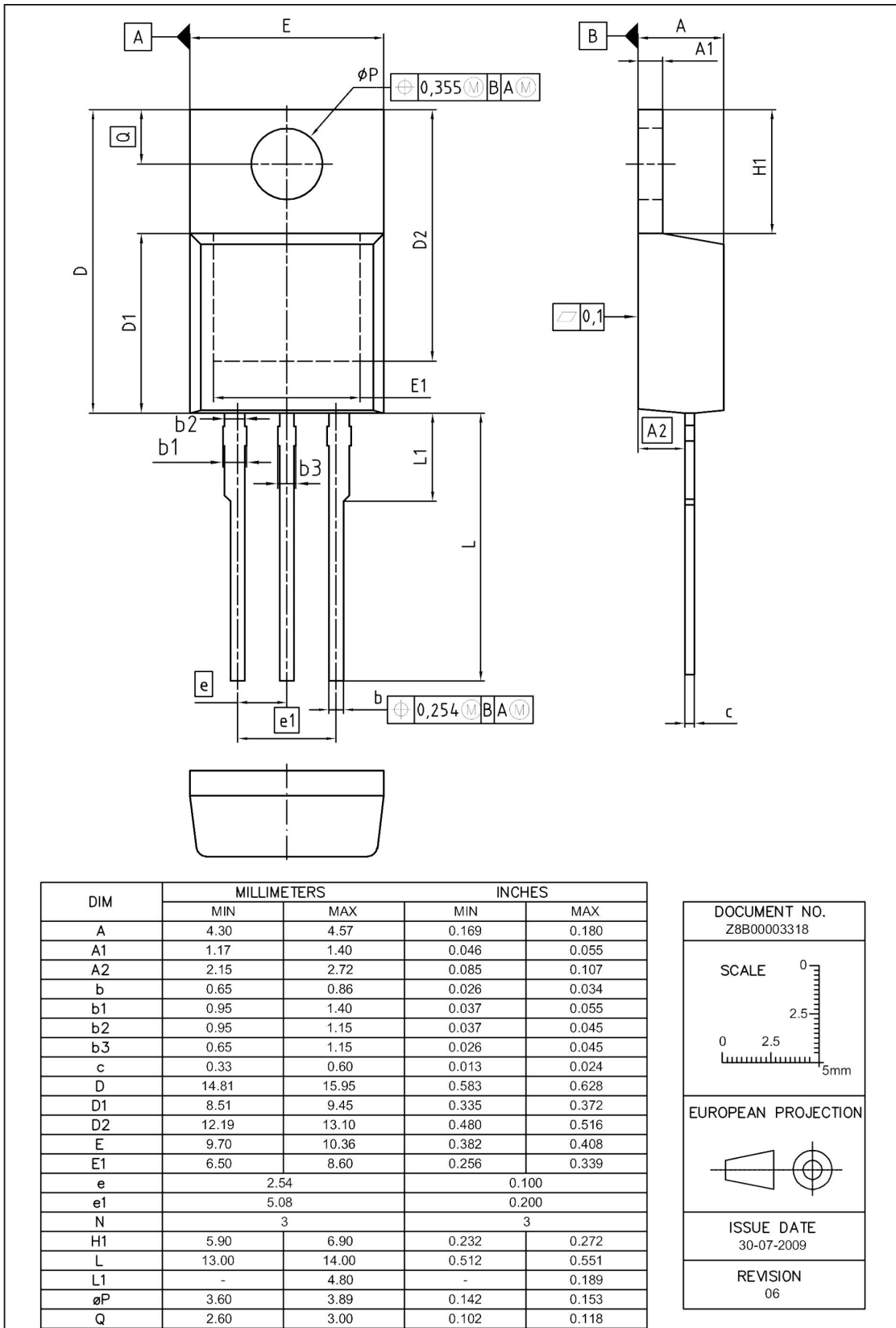


Figure 3 Outline PG-TO 220, dimensions in mm/inches



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

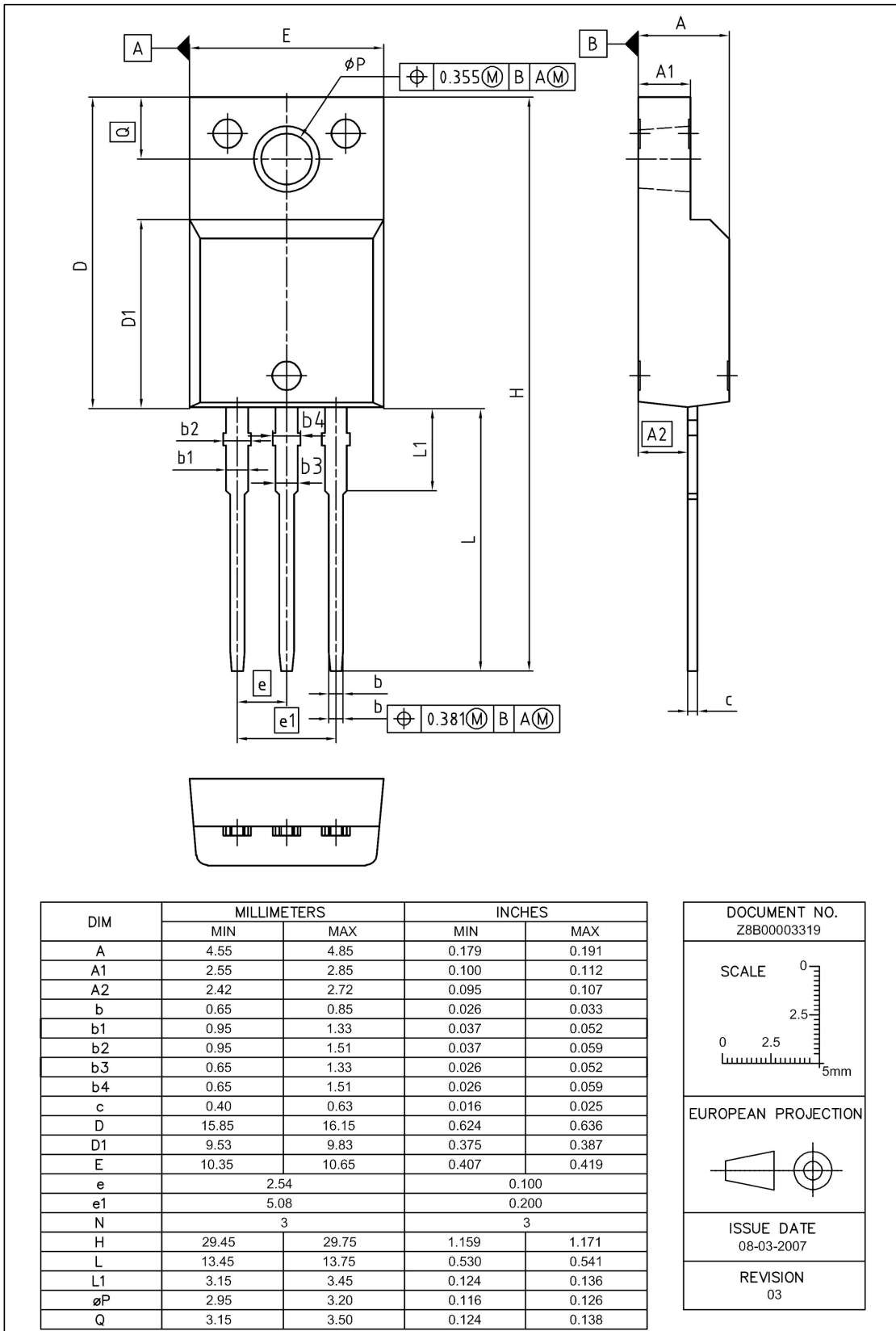


Figure 4 Outline PG-TO 220 FullPAK, dimensions in mm/inches



650V CoolMOS™ CFD2 Power Transistor
 IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
 IPA65R110CFD, IPI65R110CFD

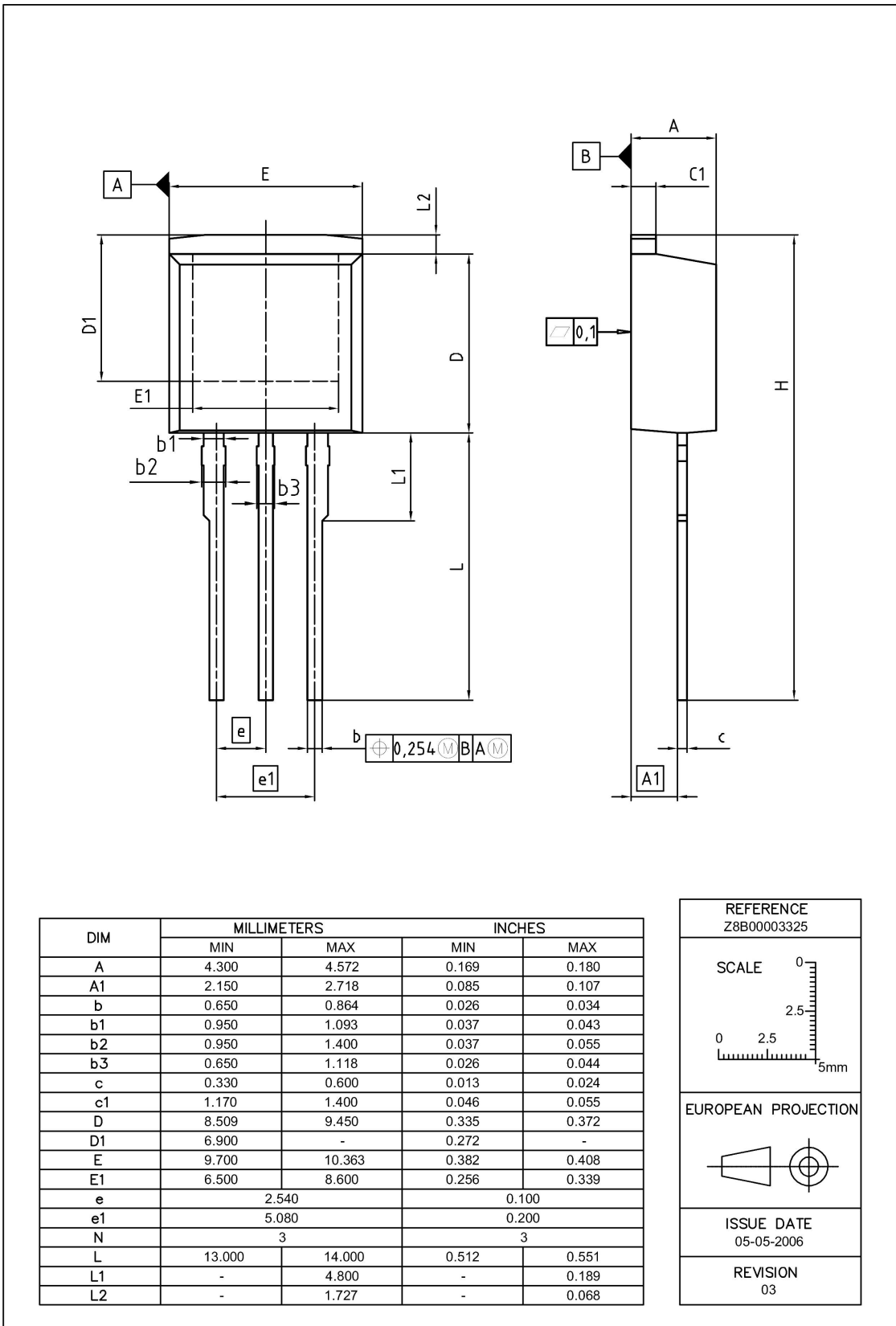


Figure 5 Outline PG-TO 262, dimensions in mm/inches



650V CoolMOS™ CFD2 Power Transistor
IPW65R110CFD, IPB65R110CFD, IPP65R110CFD
IPA65R110CFD, IPI65R110CFD

8 Appendix A

Table 23 Related Links

- **IFX Design Tools:**
<http://www.infineon.com/cms/en/product/promopages/designtools/index.html>
- **IFX CoolMOS Webpage:**
<http://www.infineon.com/cms/en/product/channel.html?channel=ff80808112ab681d0112ab6a628704d8>



650V CoolMOS™ CFD2 Power Transistor

IPW65R110CFD, IPB65R110CFD, IPP65R110CFD IPA65R110CFD, IPI65R110CFD

Revision History

IPW65R110CFD, IPB65R110CFD, IPP65R110CFD, IPA65R110CFD, IPI65R110CFD

Revision: 2011-09-26, Rev. 2.6

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2011-06-07	Release the final datasheet
2.2	2011-06-22	-
2.3	2011-08-30	update to CFD2 standard
2.4	2011-09-14	update pin naming
2.5	2011-09-16	release of new pin naming
2.6	2011-09-26	update the Igss test condition

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

Edition 2011-08-01

Published by

Infineon Technologies AG

81726 München, Germany

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