

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

CFDA Automotive

650V CoolMOS™ CFDA Power Transistor
IPW65R048CFDA

Data Sheet

Rev. 2.0
Final

Automotive

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™ CFDA 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 according to AEC Q101
- Green package (RoHS compliant), Pb-free plating, halogen free for mold compound

Applications

650V CoolMOS™ CFDA is designed for switching applications.

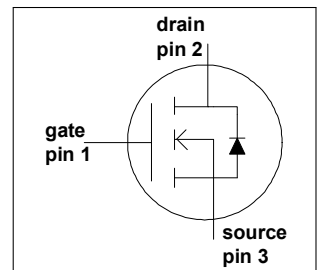
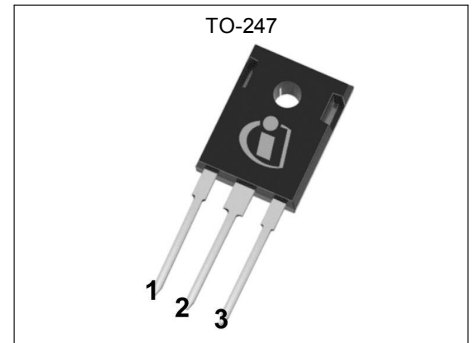


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on),max}$	0.048	Ω
Q_g,typ	270	nC
$I_D,pulse$	228	A
$E_{oss} @ 400V$	20.5	μJ
Body diode di/dt	900	A/ μs
Q_{rr}	1.8	μC
t_{rr}	240	ns
I_{rrm}	12	A

Type / Ordering Code	Package	Marking	Related Links
IPW65R048CFDA	PG-TO 247	65F6048A	-

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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			63.3	A	$T_C = 25^\circ\text{C}$
				40		$T_C = 100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$			228	A	$T_C = 25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}			1943	mJ	$I_D = 12.7\text{A}$, $V_{DD} = 50\text{V}$ (see table 18)
Avalanche energy, repetitive	E_{AR}			2.94	mJ	$I_D = 12.7\text{A}$, $V_{DD} = 50\text{V}$
Avalanche current, repetitive	I_{AR}			12.7	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	P_{tot}			500	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	T_j, T_{stg}	-40		150	$^\circ\text{C}$	
Mounting torque (non FullPAK) TO-247				60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S			63.3	A	$T_C = 25^\circ\text{C}$
Diode pulse current	$I_{S,pulse}$			228	A	$T_C = 25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt			50	V/ns	$V_{DS} = 0 \dots 400\text{V}$, $I_{SD} \leq I_D$, $T_j = 25^\circ\text{C}$ (see table 16)
Maximum diode commutation speed	di/dt			900	A/ μs	

¹⁾ Limited by $T_{j\text{ max}}$.

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

³⁾ Identical low side and high side switch with identical R_G

3 Thermal characteristics

Table 3 Thermal characteristics TO-247

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}			0.25	K/W	
Thermal resistance, junction - ambient	R_{thJA}			62	K/W	leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}			260	°C	1.6 mm (0.063 in.) from case for 10s

4 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 ¹⁾	$V_{(BR)DSS}$	650			V	$V_{GS} = 0V$, $I_D = 1mA$
Gate threshold voltage	$V_{GS(th)}$	3.5	4	4.5	V	$V_{DS} = V_{GS}$, $I_D = 2.9mA$
Zero gate voltage drain current	I_{DSS}			3	μA	$V_{DS} = 650V$, $V_{GS} = 0V$, $T_j = 25^\circ\text{C}$
			900			$V_{DS} = 650V$, $V_{GS} = 0V$, $T_j = 150^\circ\text{C}$
Gate-source leakage current	I_{GSS}			100	nA	$V_{GS} = 20V$, $V_{DS} = 0V$
Drain-source on-state resistance	$R_{DS(on)}$		0.043	0.048	Ω	$V_{GS} = 10V$, $I_D = 29.4A$, $T_j = 25^\circ\text{C}$
			0.112			$V_{GS} = 10V$, $I_D = 29.4A$, $T_j = 150^\circ\text{C}$
Gate resistance	R_G		0.6		Ω	$f = 1MHz$, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}		7440		pF	$V_{GS} = 0V$, $V_{DS} = 100V$, $f = 1MHz$
Output capacitance	C_{oss}		350		pF	
Effective output capacitance, energy related ²⁾	$C_{o(er)}$		250		pF	$V_{GS} = 0V$, $V_{DS} = 0 \dots 400V$
Effective output capacitance, time related ³⁾	$C_{o(tr)}$		1260		pF	$I_D = \text{constant}$, $V_{GS} = 0V$, $V_{DS} = 0 \dots 400V$
Turn-on delay time	$t_{d(on)}$		22		ns	$V_{DD} = 400V$, $V_{GS} = 13V$, $I_D = 44.2A$, $R_G = 1.8\Omega$ (see table 17)
Rise time	t_r		10		ns	
Turn-off delay time	$t_{d(off)}$		85		ns	
Fall time	t_f		4		ns	

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}		48		nC	$V_{DD} = 480V$, $I_D = 44.2A$, $V_{GS} = 0 \text{ to } 10V$
Gate to drain charge	Q_{gd}		147		nC	
Gate charge total	Q_g		270		nC	
Gate plateau voltage	$V_{plateau}$		6.4		V	

¹⁾ For applications with applied blocking voltage > 65% of the specified blocking voltage, we recommend to evaluate the impact of the cosmic radiation effect in early design phase. For assessment please contact local Infineon sales office.

²⁾ $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V

³⁾ $C_{o(tr)}$ 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	$V_{GS} = 0V, I_F = 44.2A, T_j = 25^\circ C$
Reverse recovery time	t_{rr}		240		ns	$V_R = 400V, I_F = 44.2A,$ $di_F/dt = 100A/\mu s$ (see table 16)
Reverse recovery charge	Q_{rr}		1.8		μC	
Peak reverse recovery current	I_{rrm}		12		A	

5 Electrical characteristics diagrams

Table 8

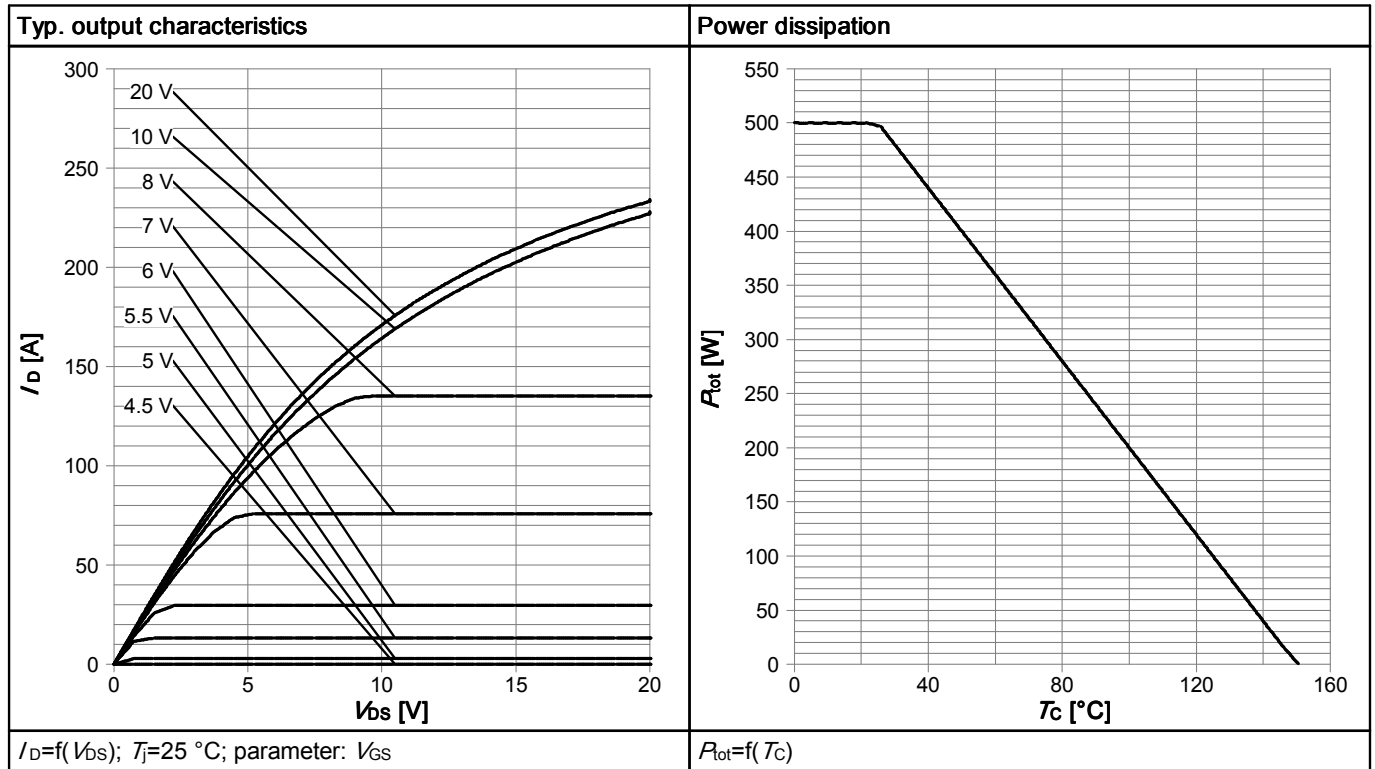


Table 9

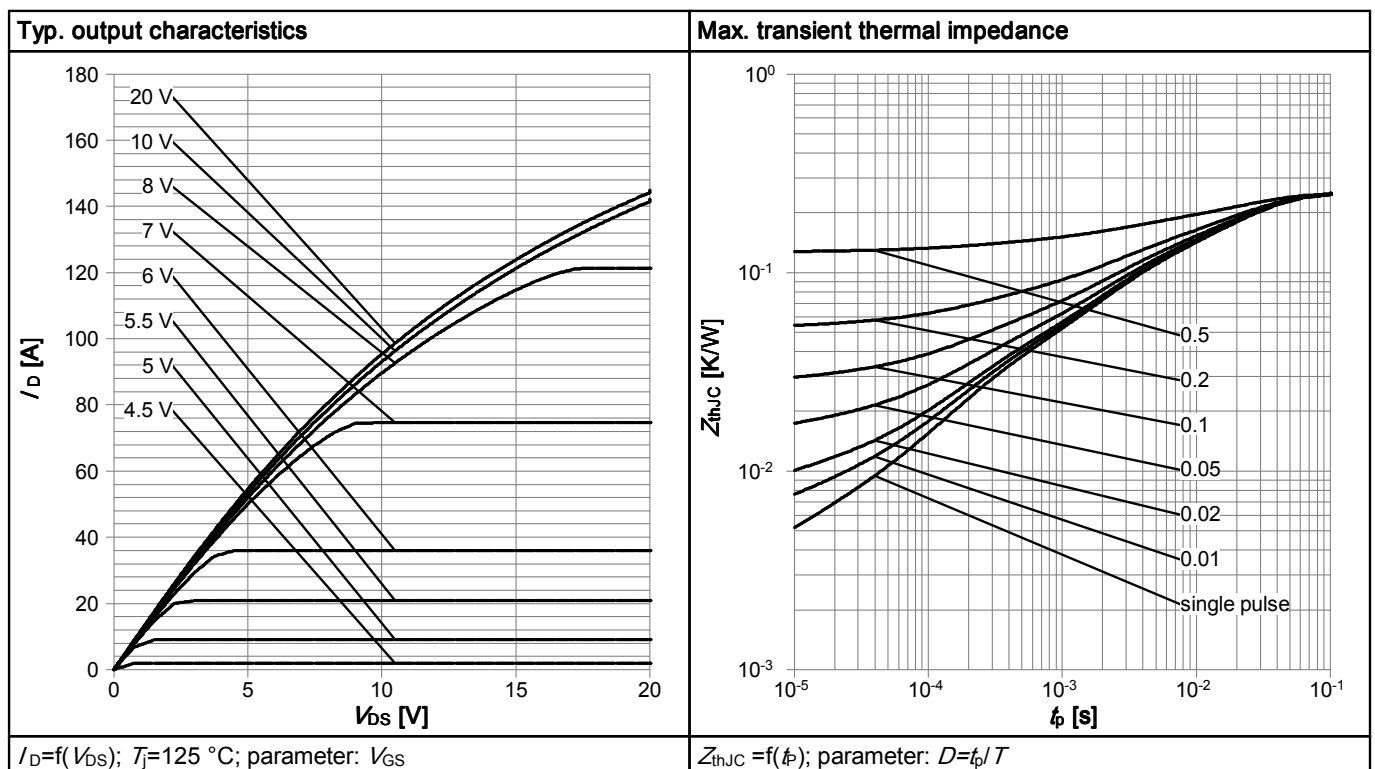


Table 10

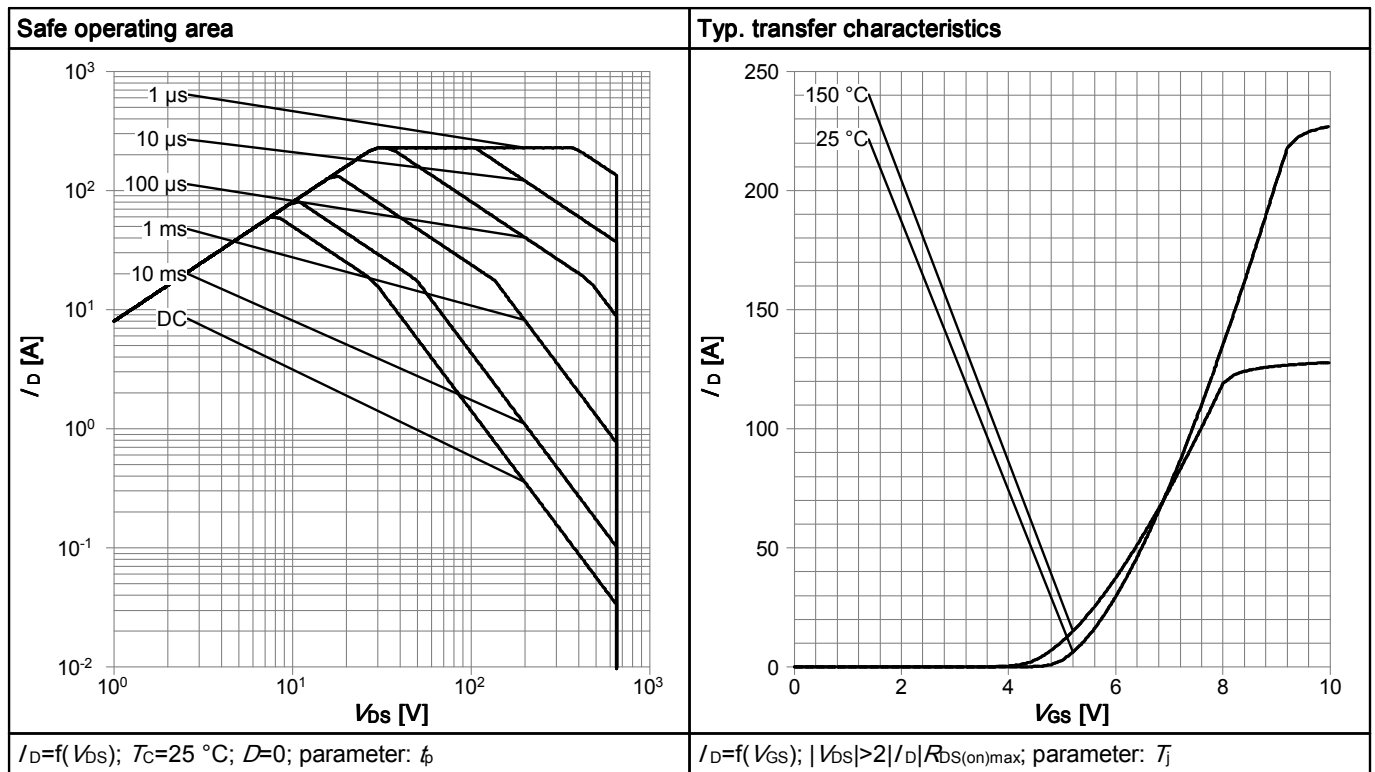


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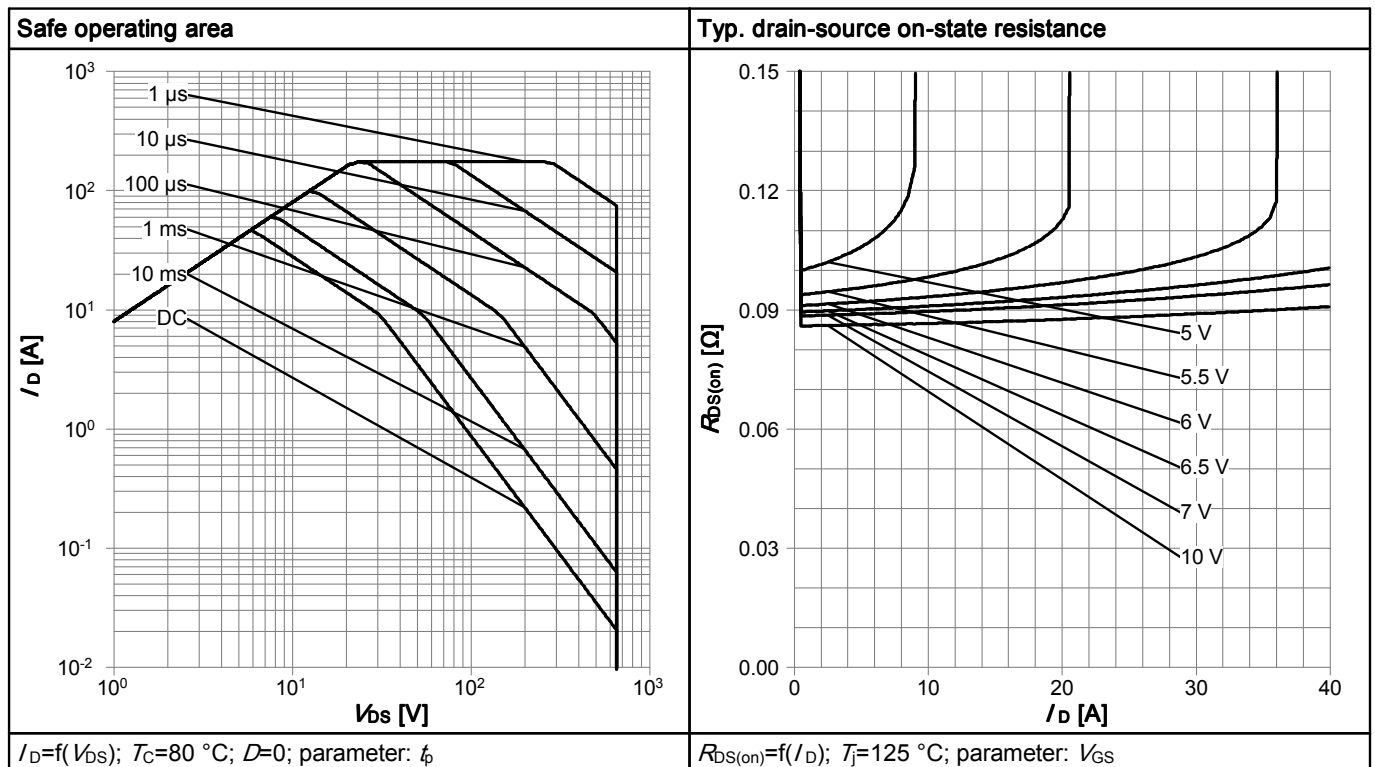


Table 12

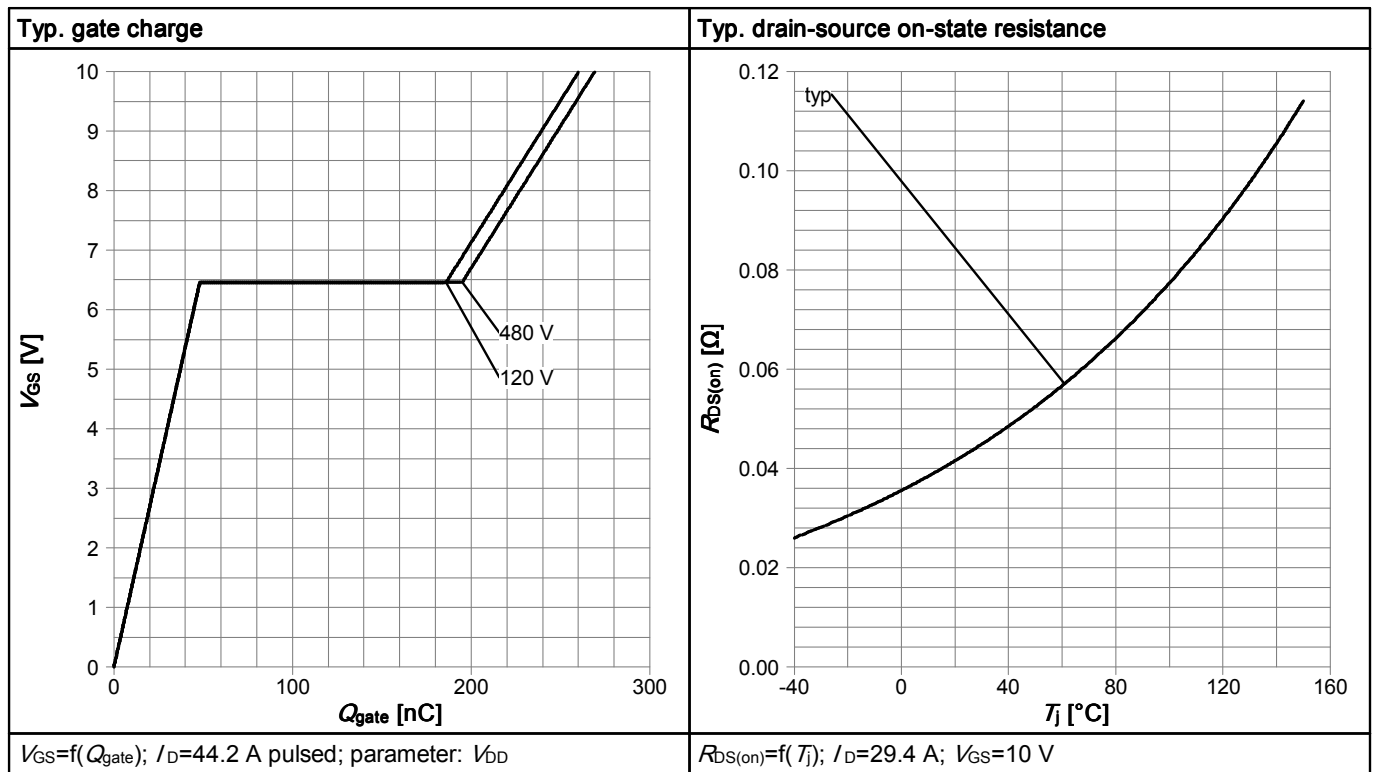


Table 13

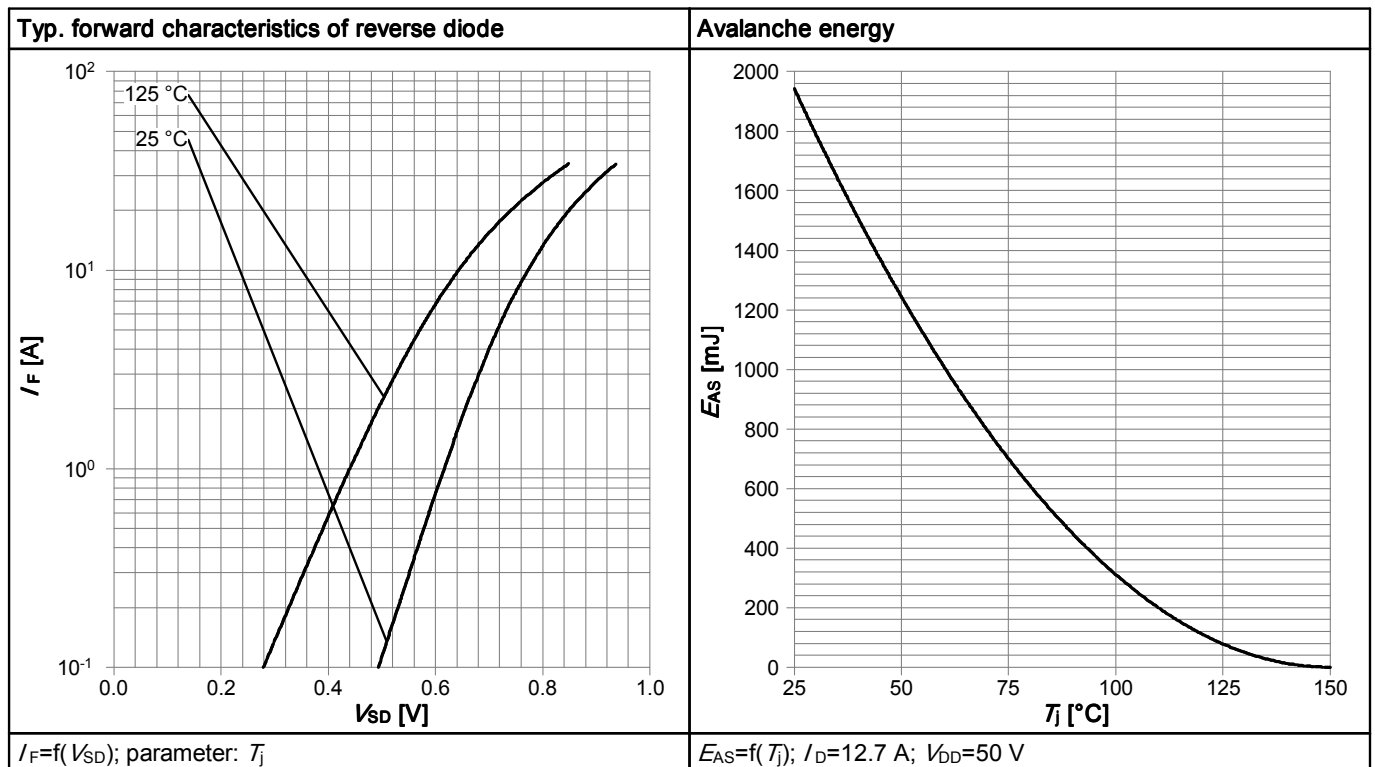


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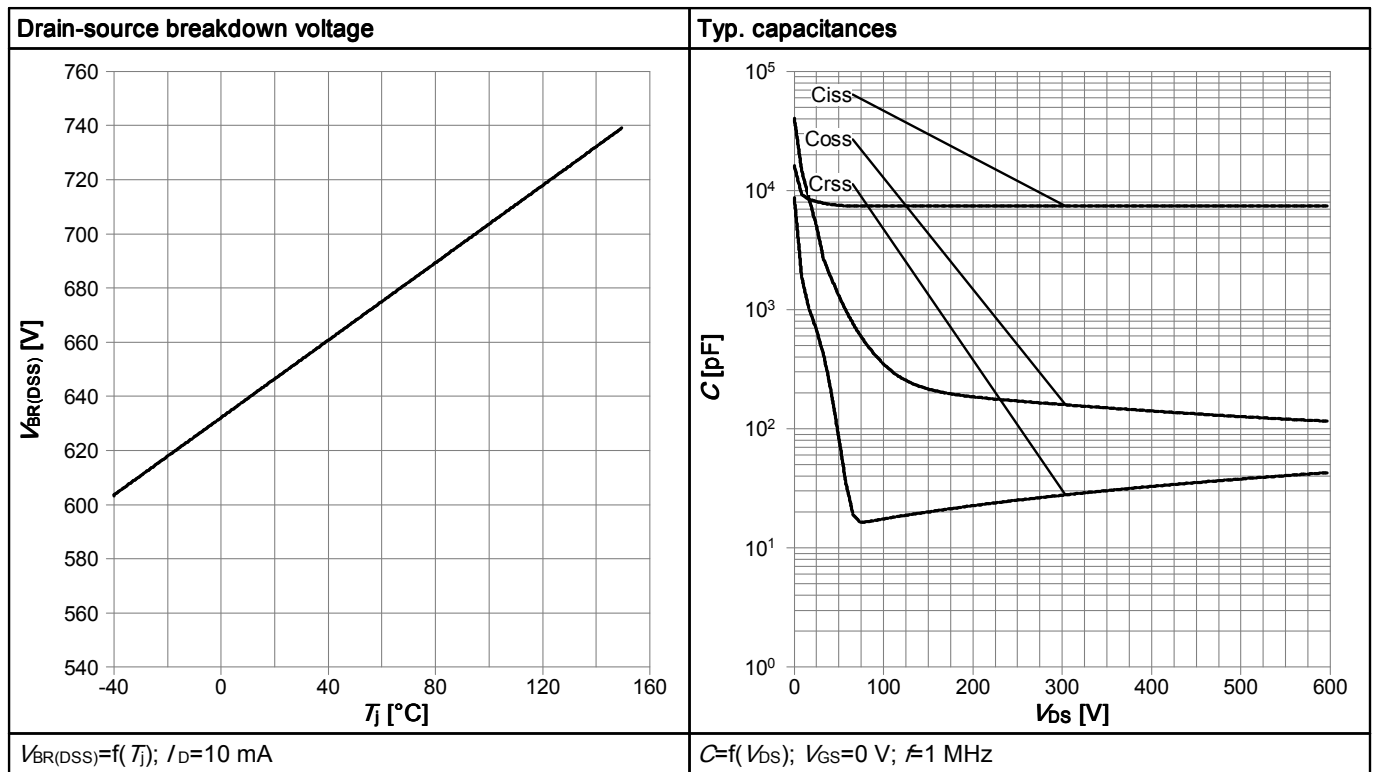
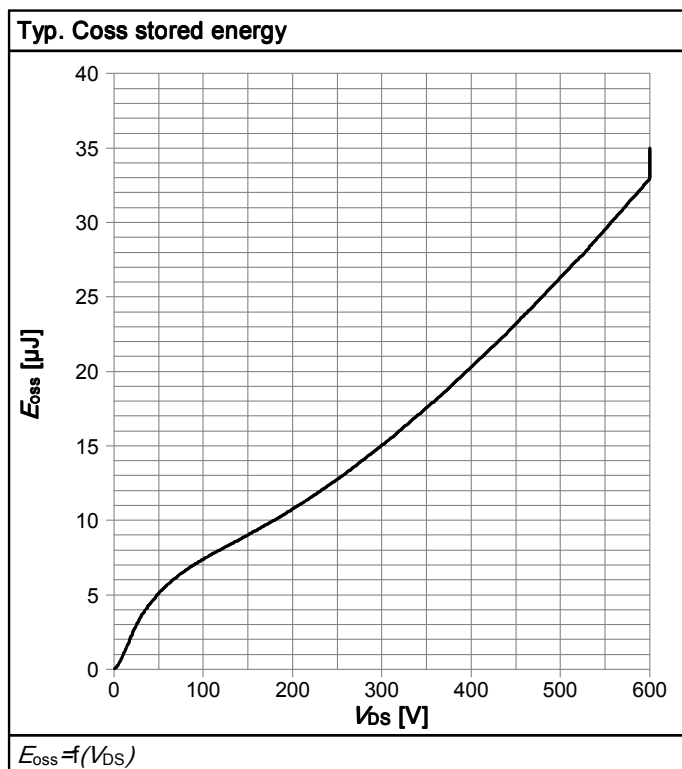


Table 15



6 Test Circuits

Table 16 Diode characteristics

Test circuit for diode characteristics	Diode recovery waveform
	

Table 17 Switching times

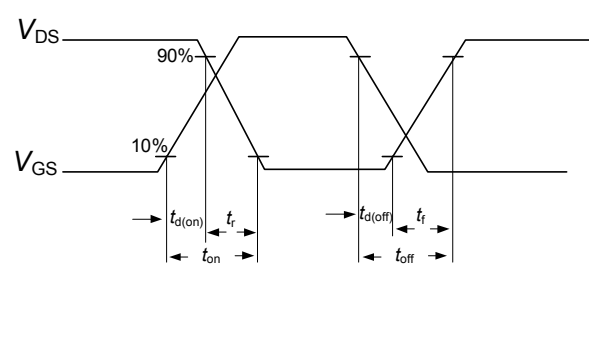
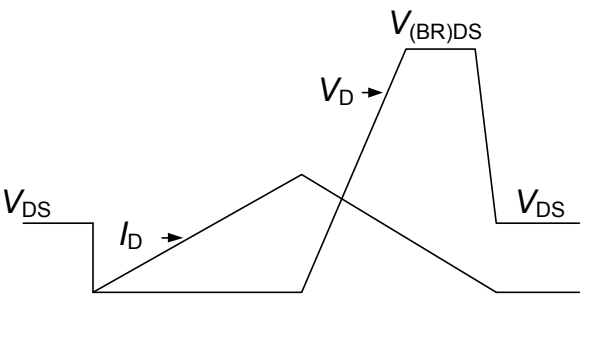
Switching times test circuit for inductive load	Switching times waveform
	

Table 18 Unclamped inductive

Unclamped inductive load test circuit	Unclamped inductive waveform
	

7 Package Outlines

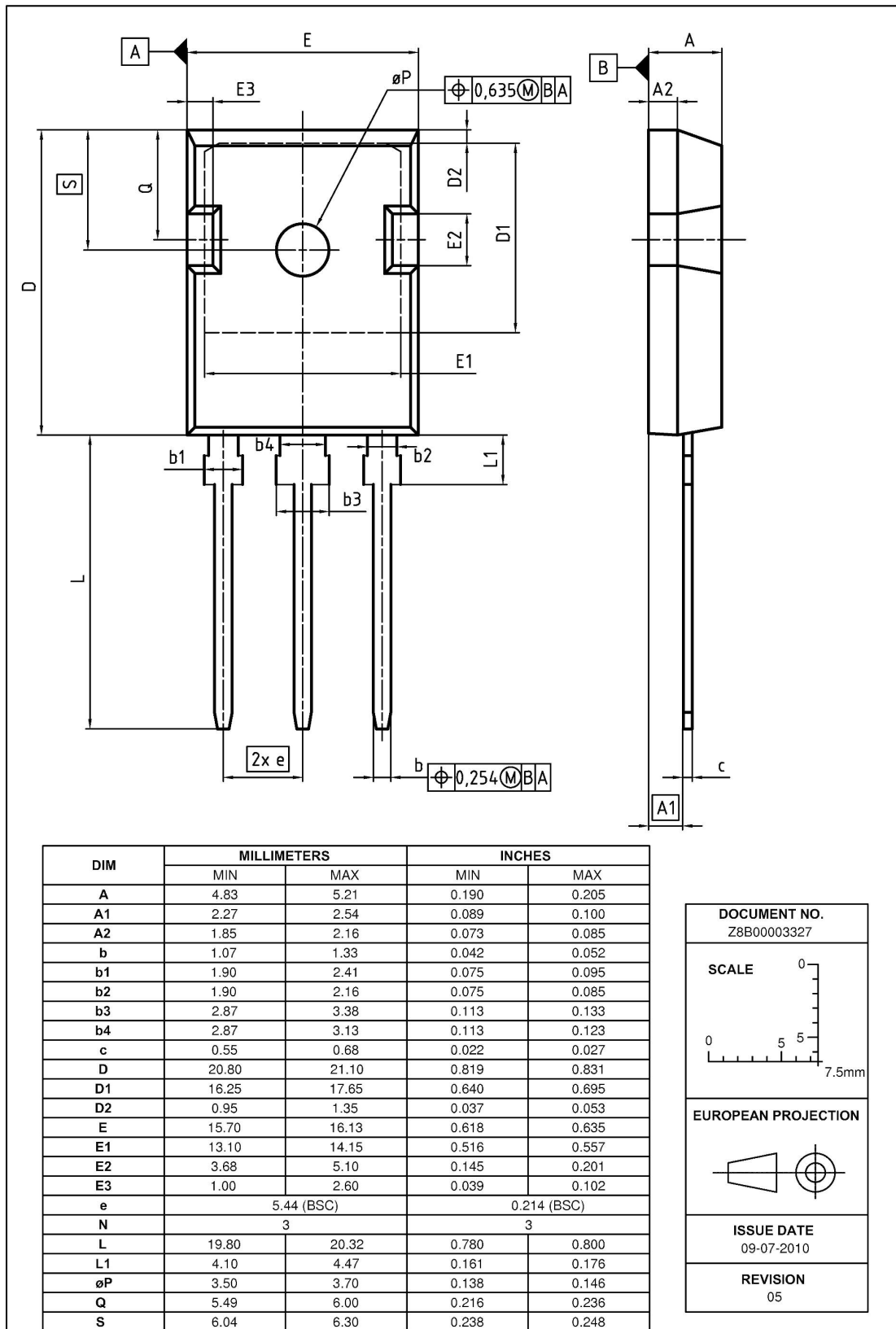


Figure 1 Outline PG-TO 247, dimensions in mm/inches

Revision History

IPW65R048CFDA

Revision: 2012-03-28, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2012-03-28	Final datasheet

Disclaimer ATV

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