

SiC

Silicon Carbide Diode

5th Generation thinQ!™

650V SiC Schottky Diode

IDW40G65C5B

Final Datasheet

Rev. 2.0, 2015-04-13

Power Management & Multimarket

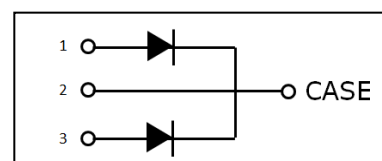
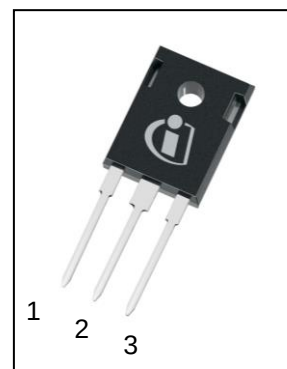
5th Generation thinQ!™ SiC Schottky Diode

IDW40G65C5B

1 Description

ThinQ!™ Generation 5 represents Infineon leading edge technology for the SiC Schottky Barrier diodes. A combination with a new, more compact design and thin-wafer technology results in a new family of products showing improved efficiency over all load conditions, resulting from both the improved thermal characteristics and a lower figure of merit ($Q_c \times V_f$).

The new thinQ!™ Generation 5 has been designed to complement our 650V CoolMOS™ families: this ensures meeting the most stringent application requirements in this voltage range.



Features

- Revolutionary semiconductor material - Silicon Carbide
- Benchmark switching behavior
- No reverse recovery/ No forward recovery
- Temperature independent switching behavior
- High surge current capability
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications
- Breakdown voltage tested at 44 mA^{2) 3)}
- Optimized for high temperature operation

Benefits

- System efficiency improvement over Si diodes
- System cost / size savings due to reduced cooling requirements
- Enabling higher frequency / increased power density solutions
- Higher system reliability due to lower operating temperatures
- Reduced EMI

Applications

- Switch mode power supply
- Power factor correction
- Solar inverter
- Uninterruptible power supply



Table 1 Key Performance Parameters ⁴⁾

Parameter	Value	Unit
V_{DC}	650	V
$Q_C; V_R=400V$	2 x 29	nC
$E_C; V_R=400V$	2 x 6.6	μJ
$I_F @ T_C < 120^\circ C$	2 x 20	A

Table 2 Pin Definition

Pin 1	Pin 2	Pin 3
A	C	A

Type / ordering Code	Package	Marking	Related links
IDW40G65C5B	PG-TO247-3	D4065B5	www.infineon.com/sic

1) J-STD20 and JESD22

2) All devices tested under avalanche conditions for a time periode of 10ms

3) Per Leg

4) Per Device

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2 Maximum ratings

Table 3 Maximum ratings

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Continuous forward current ¹⁾	I_F	–	–	20	A	$T_C < 120^\circ\text{C}$, $D=1$
Surge non-repetitive forward current, sine halfwave ¹⁾	$I_{F,SM}$	–	–	103		$T_C = 25^\circ\text{C}$, $t_p=10\text{ ms}$
		–	–	87		$T_C = 150^\circ\text{C}$, $t_p=10\text{ ms}$
Non-repetitive peak forward current ¹⁾	$I_{F,max}$	–	–	776		$T_C = 25^\circ\text{C}$, $t_p=10\text{ }\mu\text{s}$
i ² t value ¹⁾	$\int i^2 dt$	–	–	53	A ² s	$T_C = 25^\circ\text{C}$, $t_p=10\text{ ms}$
		–	–	38		$T_C = 150^\circ\text{C}$, $t_p=10\text{ ms}$
Repetitive peak reverse voltage	V_{RRM}	–	–	650	V	$T_j = 25^\circ\text{C}$
Diode dv/dt ruggedness	dv/dt	–	–	100	V/ns	$V_R=0..480\text{ V}$
Power dissipation ¹⁾	P_{tot}	–	–	112	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	T_j, T_{stg}	-55	–	175	°C	
Mounting torque		–	–	60	Ncm	M3 screws

3 Thermal characteristics

Table 4 Thermal characteristics TO-247-3

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction-case ¹⁾	R_{thJC}	–	1.0	1.3	K/W	
Thermal resistance, junction-ambient ¹⁾	R_{thJA}	–	–	62		leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	–	–	260	°C	1.6mm (0.063 in.) from case for 10 s

1) Per Leg

2) Per Device

4 Electrical characteristics

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
DC blocking voltage	V_{DC}	650	–	–	V	$T_j=25^{\circ}\text{C}$
Diode forward voltage	V_F	–	1.5	1.7		$I_F=20\text{ A}, T_j=25^{\circ}\text{C}$
		–	1.8	2.1		$I_F=20\text{ A}, T_j=150^{\circ}\text{C}$
Reverse current ¹⁾	I_R	–	1.1	210	μA	$V_R=650\text{ V}, T_j=25^{\circ}\text{C}$
		–	0.3	75		$V_R=600\text{ V}, T_j=25^{\circ}\text{C}$
		–	4.1	1450		$V_R=650\text{ V}, T_j=150^{\circ}\text{C}$

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge ¹⁾	Q_c	–	29	–	nC	$V_R=400\text{ V}, di/dt=200\text{ A}/\mu\text{s}, I_F \leq I_{F,MAX}, T_j=150^{\circ}\text{C}$
Total Capacitance ¹⁾	C	–	590	–	pF	$V_R=1\text{ V}, f=1\text{ MHz}$
		–	76	–		$V_R=300\text{ V}, f=1\text{ MHz}$
		–	74	–		$V_R=600\text{ V}, f=1\text{ MHz}$

1) Per Leg

2) Per Device

5 Electrical characteristics diagrams

Table 7

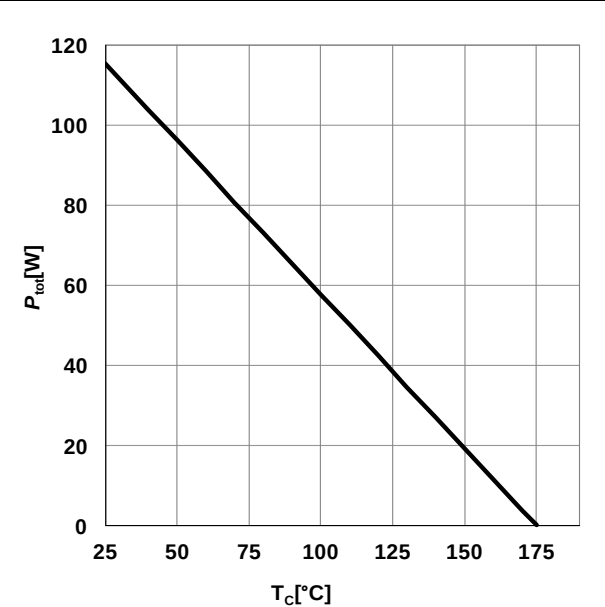
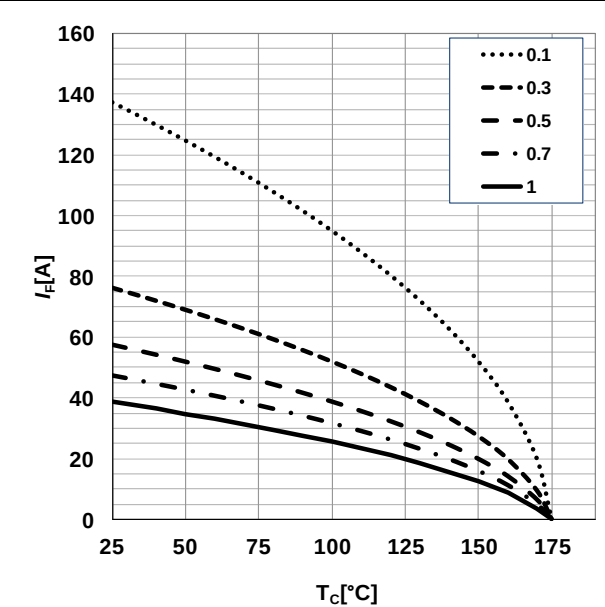
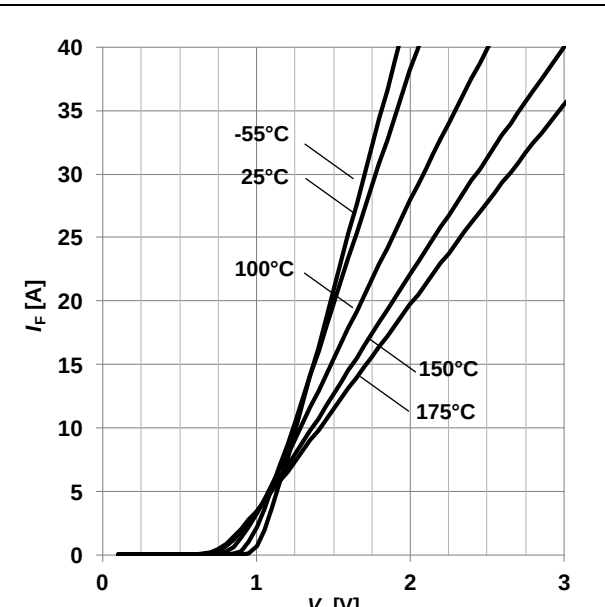
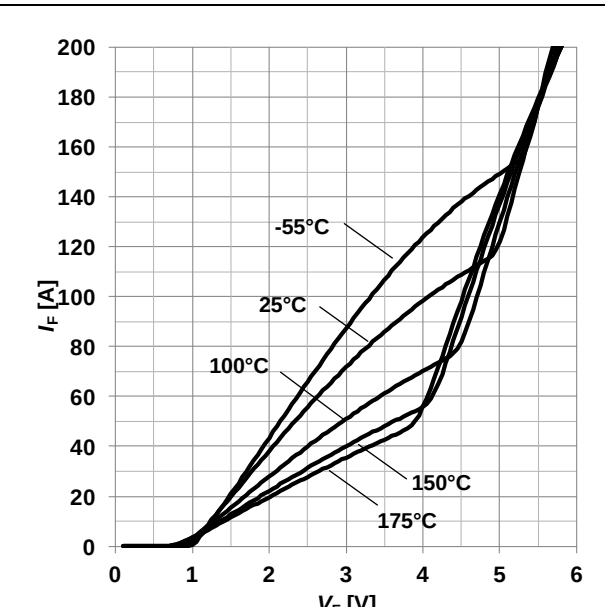
Power dissipation ¹⁾	Maximal diode forward current ¹⁾
	
$P_{tot}=f(T_C); R_{thJC,max}$	$I_F=f(T_C); R_{thJC,max}; T_j \leq 175^\circ\text{C}; \text{parameter } D=\text{duty cycle}$

Table 8

Typical forward characteristics ¹⁾	Typical forward characteristics in surge current ¹⁾
	
$I_F=f(V_F); t_p=200 \mu\text{s}; \text{parameter: } T_j$	$I_F=f(V_F); t_p=200 \mu\text{s}; \text{parameter: } T_j$

1) Per Leg

2) Per Device

Electrical characteristics diagrams

Table 9

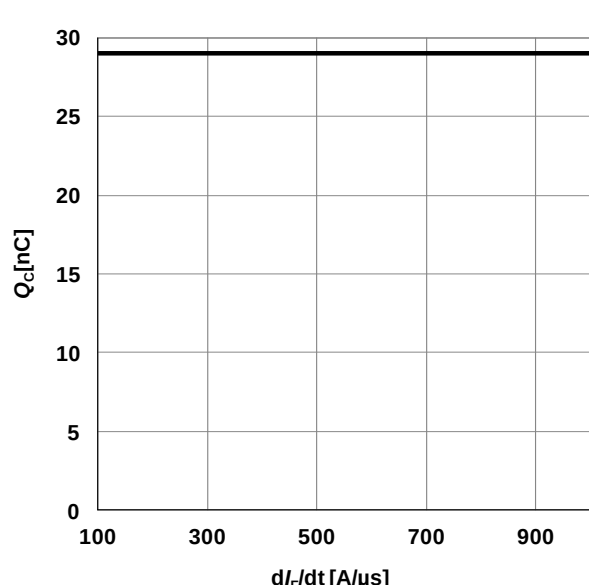
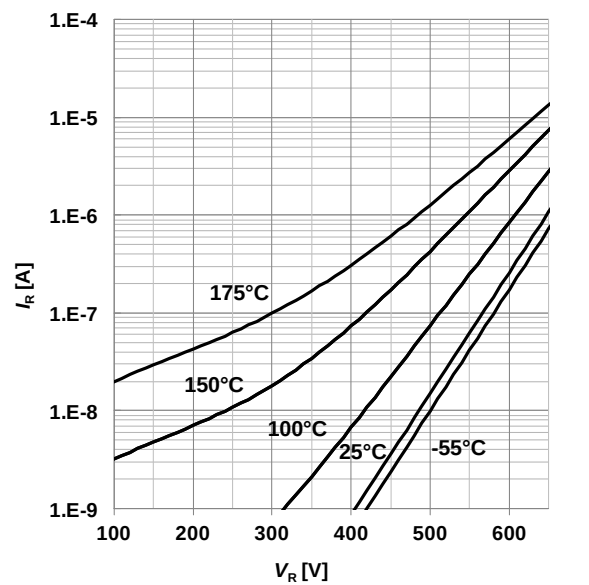
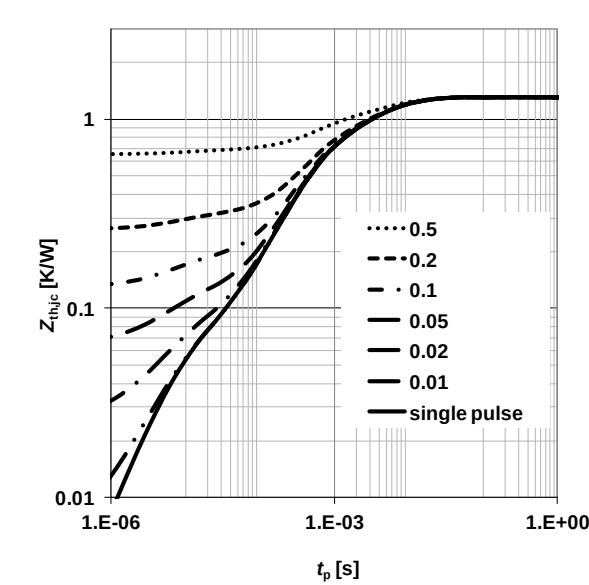
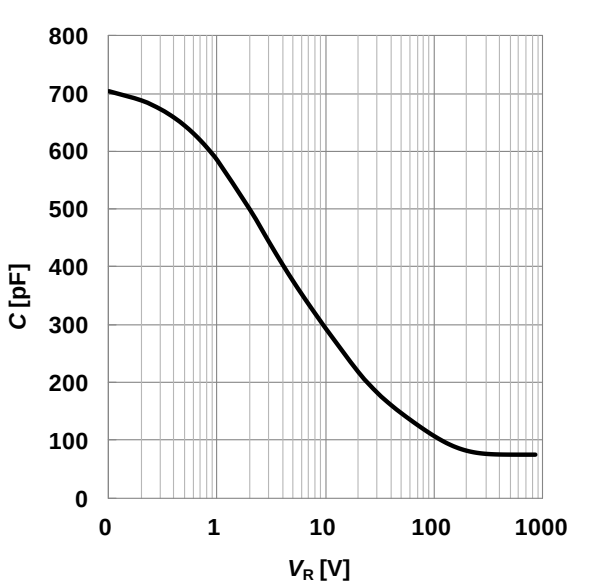
Typ. capacitance charge vs. current slope ¹⁾	Typ. Reverse current vs. reverse voltage ¹⁾
	
$Q_C = f(dI_F/dt); T_j = 150^\circ\text{C}; V_R = 400\text{ V}; I_F \leq I_{F,\text{max}}$	$I_R = f(V_R); \text{parameter: } T_j$

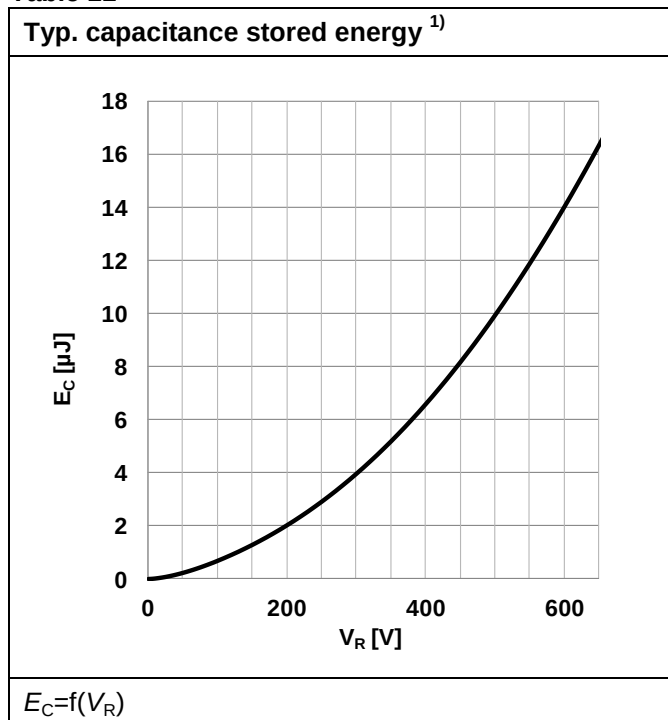
Table 10

Max. transient thermal impedance ¹⁾	Typ. capacitance vs. reverse voltage ¹⁾
	
$Z_{thjc} = f(t_p); \text{parameter: } D = t_p/T$	$C = f(V_R); T_j = 25^\circ\text{C}; f = 1\text{ MHz}$

1) Per Leg

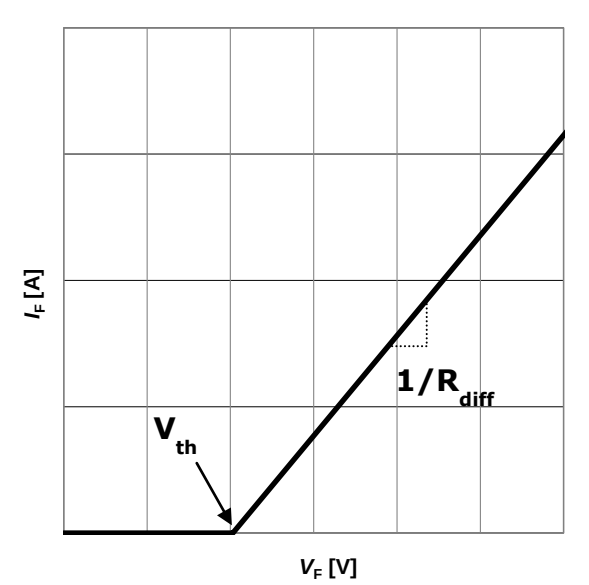
2) Per Device

Table 11



6 Simplified Forward Characteristics Model

Table 12

Equivalent forward current curve ¹⁾	Mathematical Equation
 $V_F = f(I_F)$	$V_F = V_{TH} + R_{DIFF} \cdot I_F$ $V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \text{ [V]}$ $R_{DIFF}(T_j) = 6.4 \cdot 10^{-7} \cdot T_j^2 + 6.4 \cdot 10^{-5} \cdot T_j + 0.023 \text{ [}\Omega\text{]}$
	$T_j \text{ in } ^\circ\text{C}; -55^\circ\text{C} < T_j < 175^\circ\text{C}; I_F < 40 \text{ A}$

1) Per Leg

2) Per Device

7 Package outlines

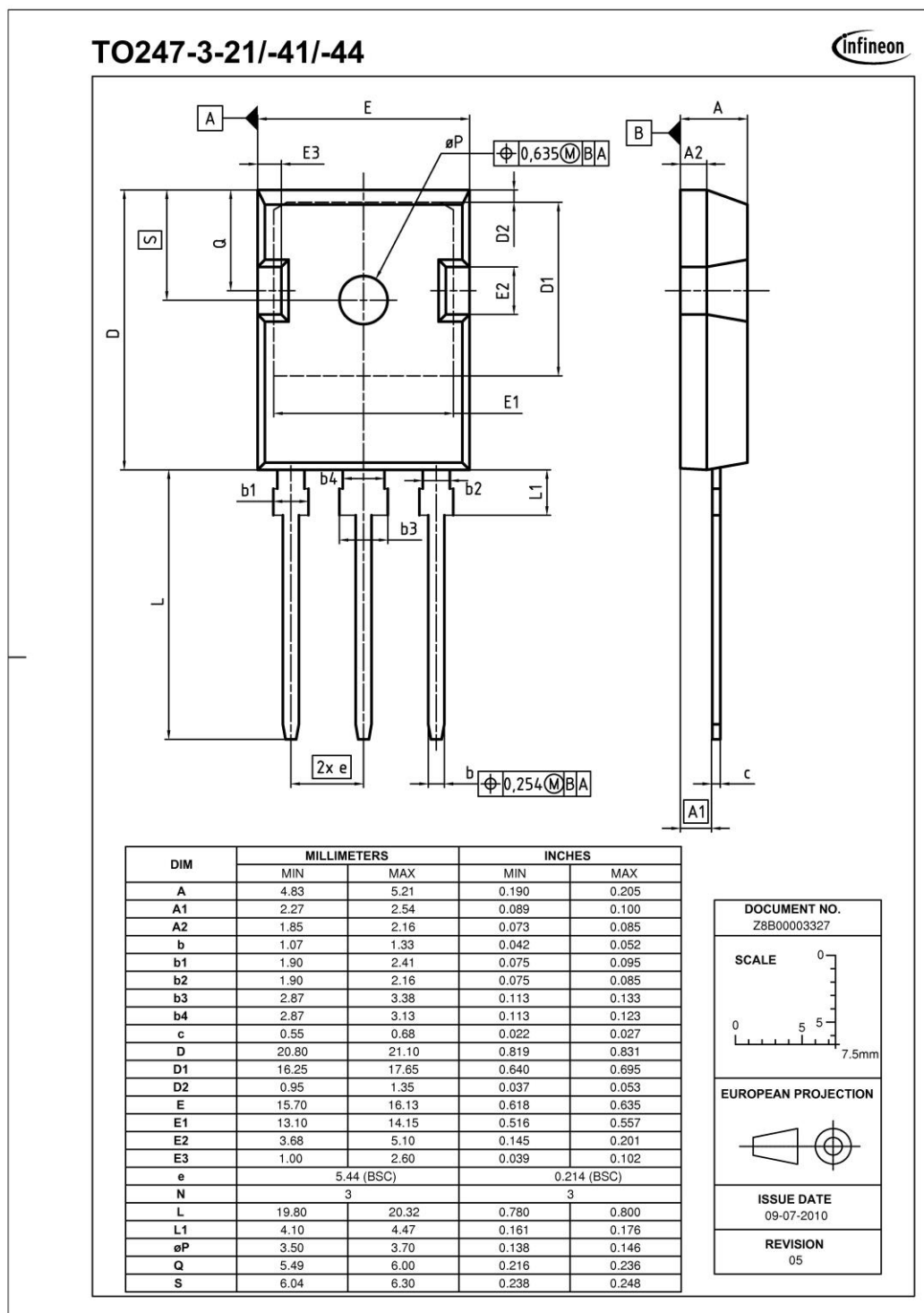


Figure 1 Outlines TO-247, dimensions in mm/inches

- 1) Per Leg
- 2) Per Device

8 Revision History

5th Generation thinQ!™ SiC Schottky Diode

Revision History: 2015-04-13, Rev. 2.0

Previous Revision:

Revision	Subjects (major changes since last version)
2.0	Release of the final datasheet.

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