

6th Generation CoolSiC™

650V SiC Schottky Diode

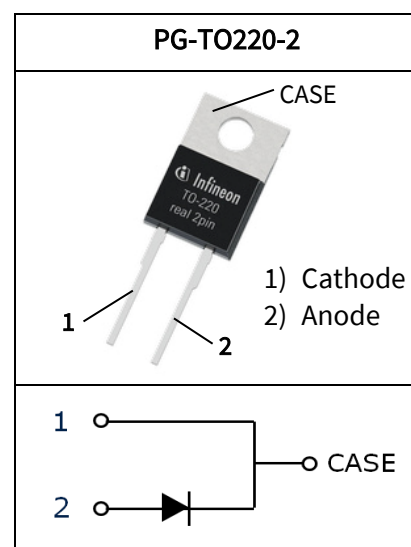
The CoolSiC™ Generation 6 is the leading edge technology from Infineon for the SiC Schottky Barrier diodes. The Infineon proprietary diffusion soldering process is combined with a more compact design, thin-wafer technology and a novel Schottky metal system. The result is a family of products with improved efficiency over all load conditions, resulting from a lower figure of merit ($Q_c \times V_F$). CoolSiC™ Generation 6 has been designed to complement our 600V and 650V CoolMOS™ 7 families, meeting the most stringent application requirements in this voltage range.

Table 1 Key performance parameters

Parameter	Value	Unit
V_{RRM}	650	V
Q_C ($V_R = 400$ V)	26.8	nC
E_C ($V_R = 400$ V)	5.3	μJ
I_F ($T_C \leq 135$ °C, $D = 1$)	20	A
V_F ($I_F = 20$ A, $T_j = 25$ °C)	1.25	V

Table 2 Package information

Type / ordering Code	Package	Marking
IDH20G65C6	PG-TO220-2	D2065C6



Features

- Best in class forward voltage (1.25 V)
- Best in class figure of merit ($Q_c \times V_F$)
- High dv/dt ruggedness (150 V/ns)

Benefits

- System efficiency improvement
- System cost and size savings due to the reduced cooling requirements
- Enabling higher frequency and increased power density

Potential Applications

- Power factor correction in SMPS
- Solar inverter
- Uninterruptible power supply

Product Validation

- Qualified for industrial applications according to the relevant tests of JEDEC (J-STD20 and JESD22)



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1 Maximum ratings

Table 3 Maximum ratings

Parameter	Symbol	Values			Unit	Note/Test condition
		Min.	Typ.	Max.		
Continuous forward current	I_F	–	–	20	A	$T_C \leq 135\text{ °C}, D = 1$
		–	–	22		$T_C \leq 125\text{ °C}, D = 1$
		–	–	41		$T_C \leq 25\text{ °C}, D = 1$
Surge-repetitive forward current, sine halfwave ¹	$I_{F, RM}$	–	–	87		$T_C = 25\text{ °C}, t_p = 10\text{ ms}$
Surge non-repetitive forward current, sine halfwave	$I_{F, SM}$	–	–	99		$T_C = 25\text{ °C}, t_p = 10\text{ ms}$
		–	–	79		$T_C = 150\text{ °C}, t_p = 10\text{ ms}$
Non-repetitive peak forward current	$I_{F, max}$	–	–	780		$T_C = 25\text{ °C}, t_p = 10\text{ }\mu\text{s}$
i^2t value	$\int i^2 dt$	–	–	49	A ² s	$T_C = 25\text{ °C}, t_p = 10\text{ ms}$
		–	–	31		$T_C = 150\text{ °C}, t_p = 10\text{ ms}$
Repetitive peak reverse voltage	V_{RRM}	–	–	650	V	$T_C = 25\text{ °C}$
Diode dv/dt ruggedness	dv/dt	–	–	150	V/ns	$V_R = 0..480\text{ V}$
Power dissipation	P_{tot}	–	–	108	W	$T_C = 25\text{ °C}, R_{thJC, max}$
Operating and storage temperature	T_j	-55	–	175	°C	–
	T_{stg}					
Mounting torque	–	–	–	70	Ncm	M3 screw

2 Thermal characteristics

Table 4 Thermal characteristics (PG-TO-220-2)

Parameter	Symbol	Values			Unit	Note/Test condition
		Min.	Typ.	Max.		
Thermal resistance, junction-case	R_{thJC}	–	0.8	1.3	K/W	–
Thermal resistance, junction-ambient	R_{thJA}	–	–	62		lead
Soldering temperature, wavesoldering only allowed at leads	T_{sld}	–	–	260	°C	1.6 mm (0.063 in.) from case for 10 s

¹ The surge-repetitive forward current test was performed with 1000 pulses (half-wave rectified sine with the 10 ms period).

3 Electrical characteristics

3.1 Static characteristics

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note/Test condition
		Min.	Typ.	Max.		
DC blocking voltage	V_{DC}	650	–	–	V	$T_j = 25\text{ °C}$
Diode forward voltage	V_F	–	1.25	1.35		$I_F = 20\text{ A}, T_j = 25\text{ °C}$
		–	1.5	–		$I_F = 20\text{ A}, T_j = 150\text{ °C}$
Reverse current	I_R	–	2.0	67	μA	$V_R = 420\text{ V}, T_j = 25\text{ °C}$
		–	66	–		$V_R = 420\text{ V}, T_j = 125\text{ °C}$
		–	153	–		$V_R = 420\text{ V}, T_j = 150\text{ °C}$

3.2 AC characteristics

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_c	–	26.8	–	nC	$V_R = 400\text{ V}, T_j = 150\text{ °C},$ $di/dt = 200\text{ A}/\mu\text{s}, I_F \leq I_{F,MAX}$
Total capacitance	C	–	970	–	pF	$V_R = 1\text{ V}, f = 1\text{ MHz},$ $T_j = 25\text{ °C}$
		–	57	–		$V_R = 300\text{ V}, f = 1\text{ MHz},$ $T_j = 25\text{ °C}$
		–	55	–		$V_R = 600\text{ V}, f = 1\text{ MHz},$ $T_j = 25\text{ °C}$

4 Diagrams

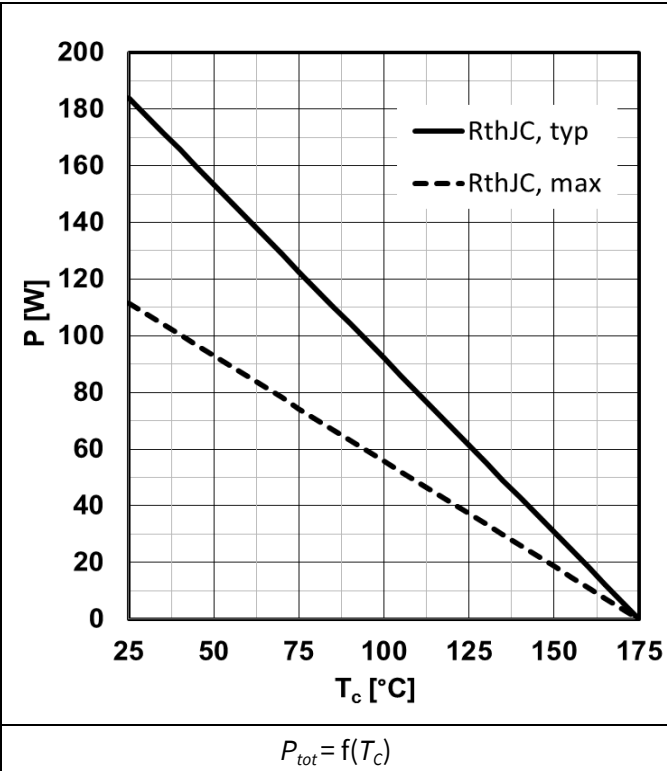


Figure 1 Power dissipation

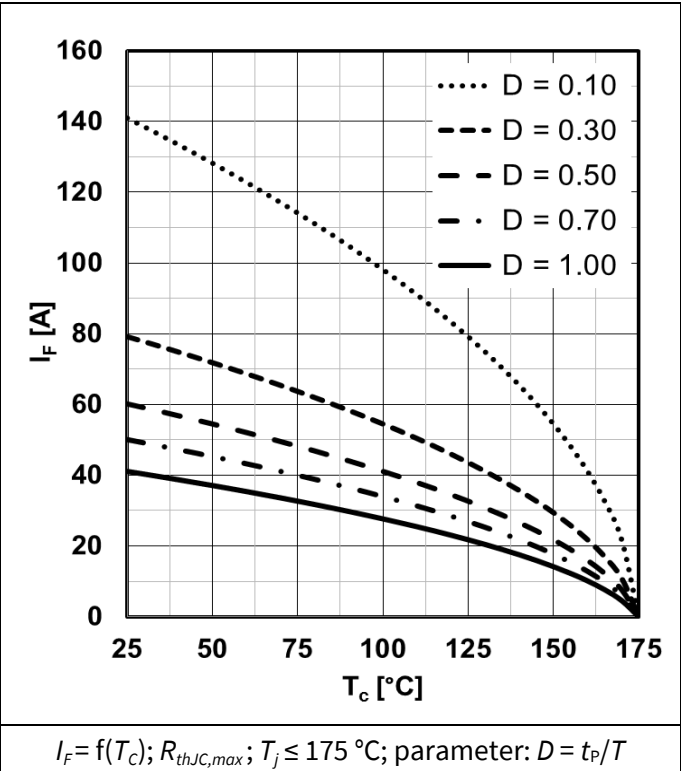


Figure 2 Max. forward current

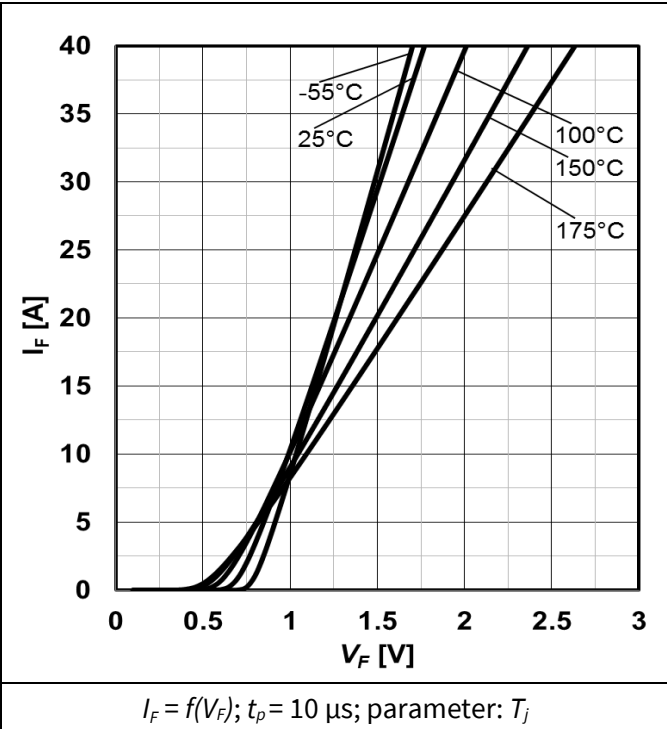


Figure 3 Typ. forward characteristics

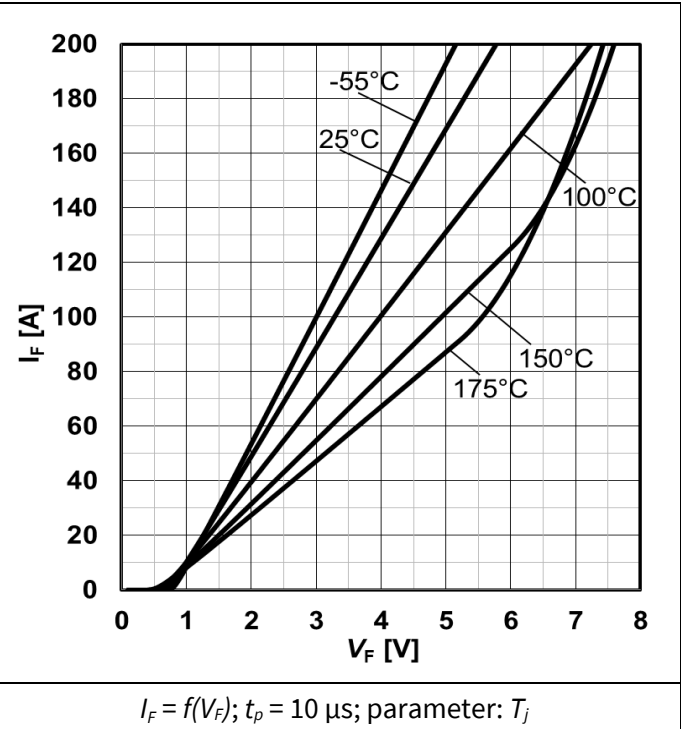
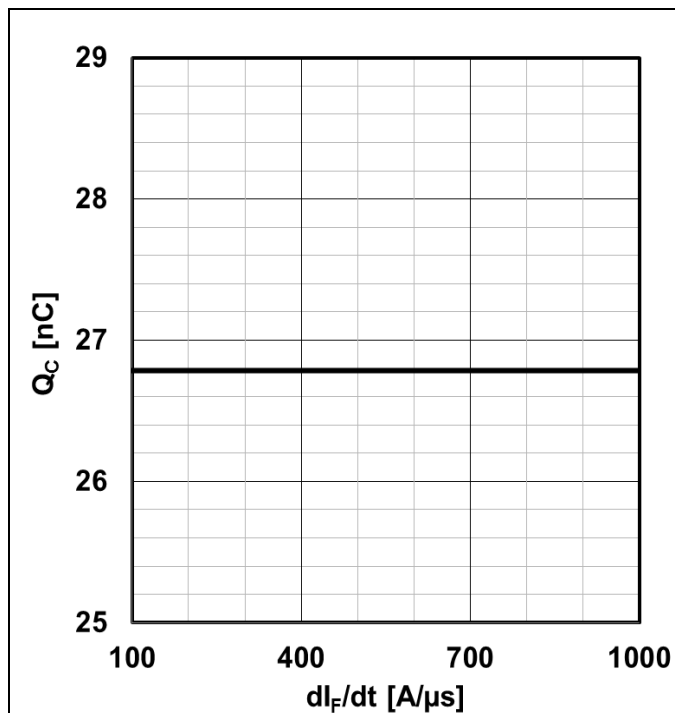
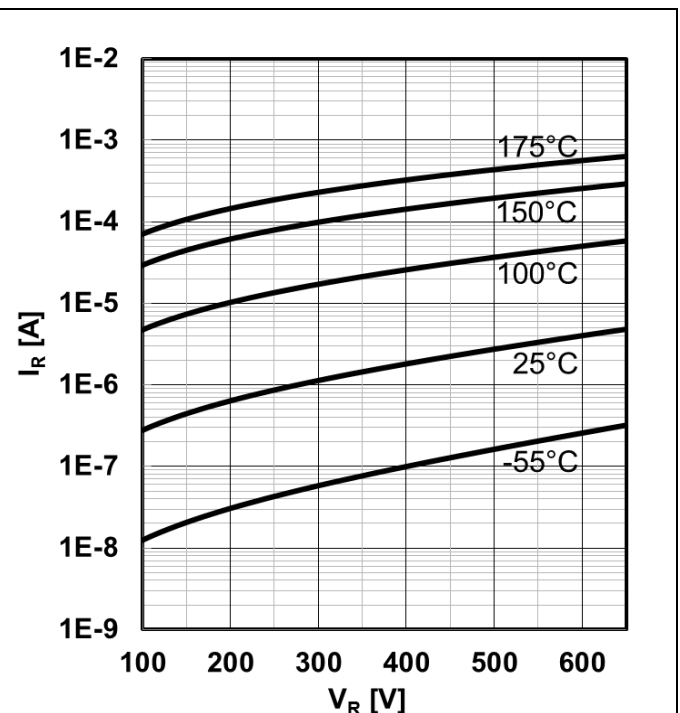


Figure 4 Typ. forward characteristics
in surge current



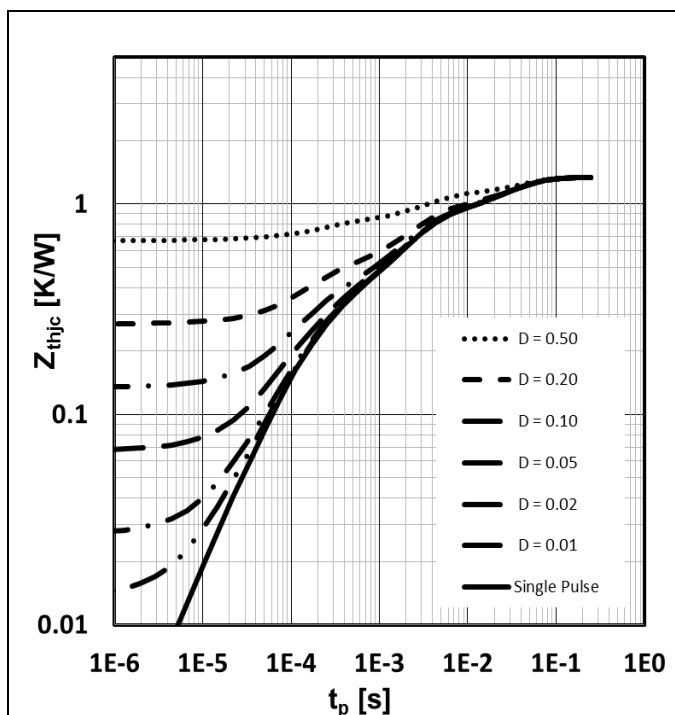
$$Q_C = f(di_F/dt); T_j = 150^\circ\text{C}; V_R = 400\text{ V}; I_F \leq I_{F,max}$$

Figure 5 Typ. cap. charge vs. current slope



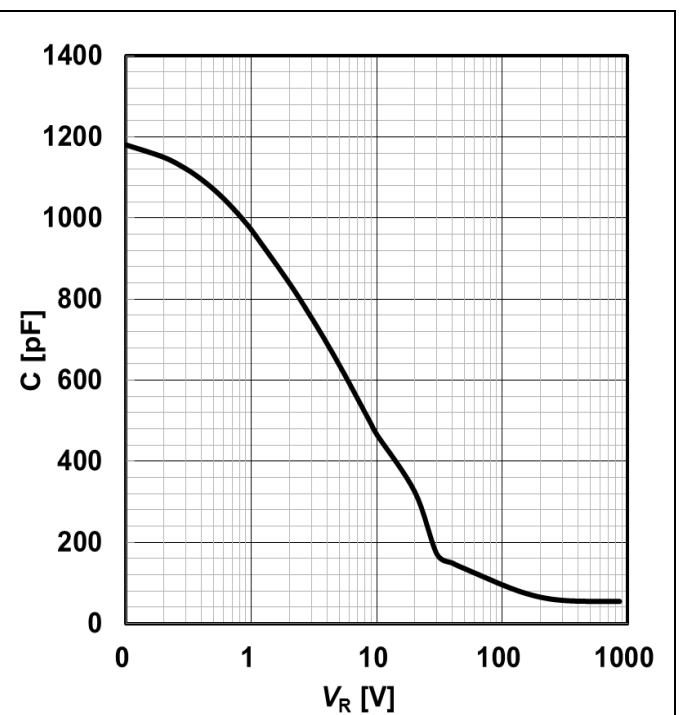
$$I_R = f(V_R); \text{parameter: } T_j$$

Figure 6 Typ. reverse current vs. reverse voltage



$$Z_{th,jc} = f(t_p); \text{parameter: } D = t_p/T$$

Figure 7 Max. transient thermal impedance



$$C = f(V_R); T_j = 25^\circ\text{C}; f = 1\text{ MHz}$$

Figure 8 Typ. capacitance vs. reverse voltage

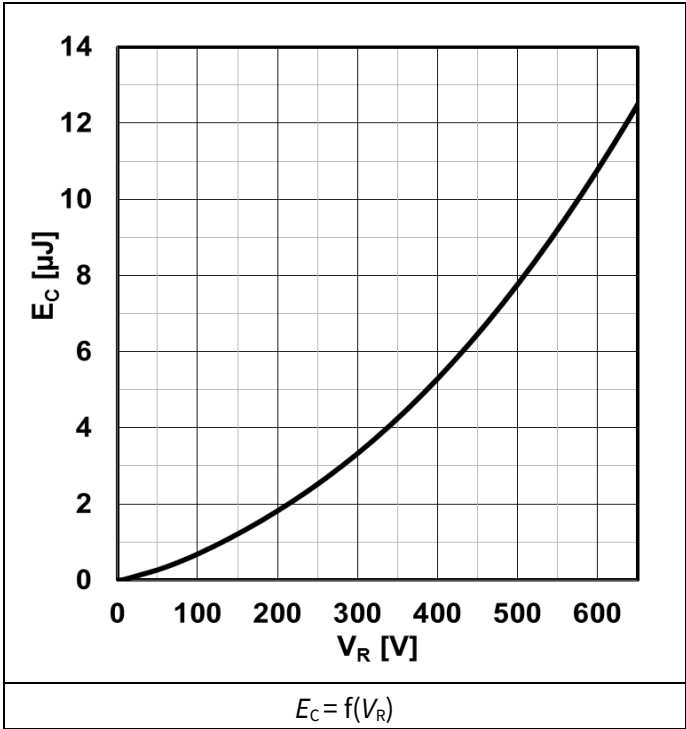


Figure 9 Typ. capacitance stored energy

5 Simplified forward characteristic

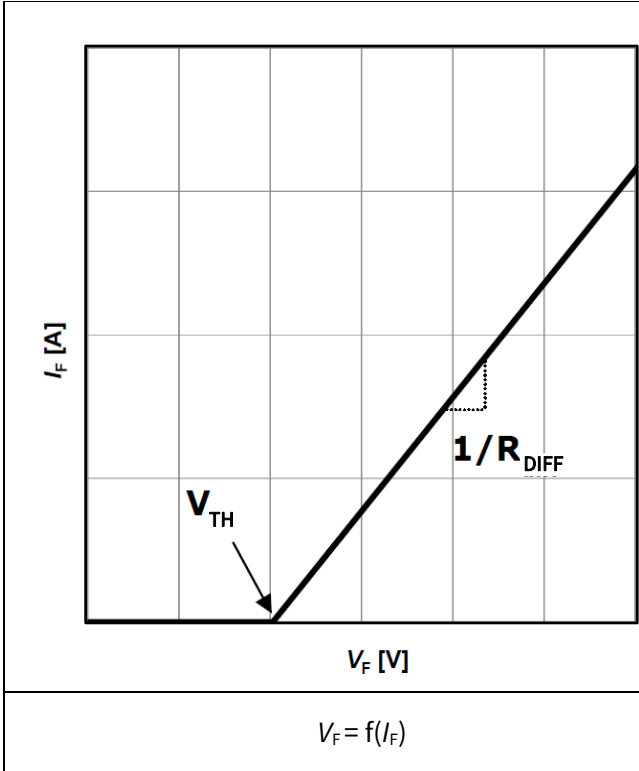


Figure 10 Equivalent forward current curve

$$V_F = V_{TH} + R_{DIFF} \times I_F$$

Threshold voltage (V_{TH}):

$$V_{TH}(T_j) = -0.001 \times T_j + 0.766 \text{ [V]}$$

Differential resistance (R_{DIFF}):

$$R_{DIFF}(T_j) = A \times T_j^2 + B \times T_j + C \text{ } [\Omega]$$

$$A = 6.19 \times 10^{-7}$$

$$B = 4.50 \times 10^{-5}$$

$$C = 2.38 \times 10^{-2}$$

$$T_j \text{ } [^{\circ}\text{C}]; -55 \text{ } ^{\circ}\text{C} \leq T_j \leq 175 \text{ } ^{\circ}\text{C}; I_F \leq 20 \text{ A}$$

Figure 11 Mathematical Equation

6 Package outlines

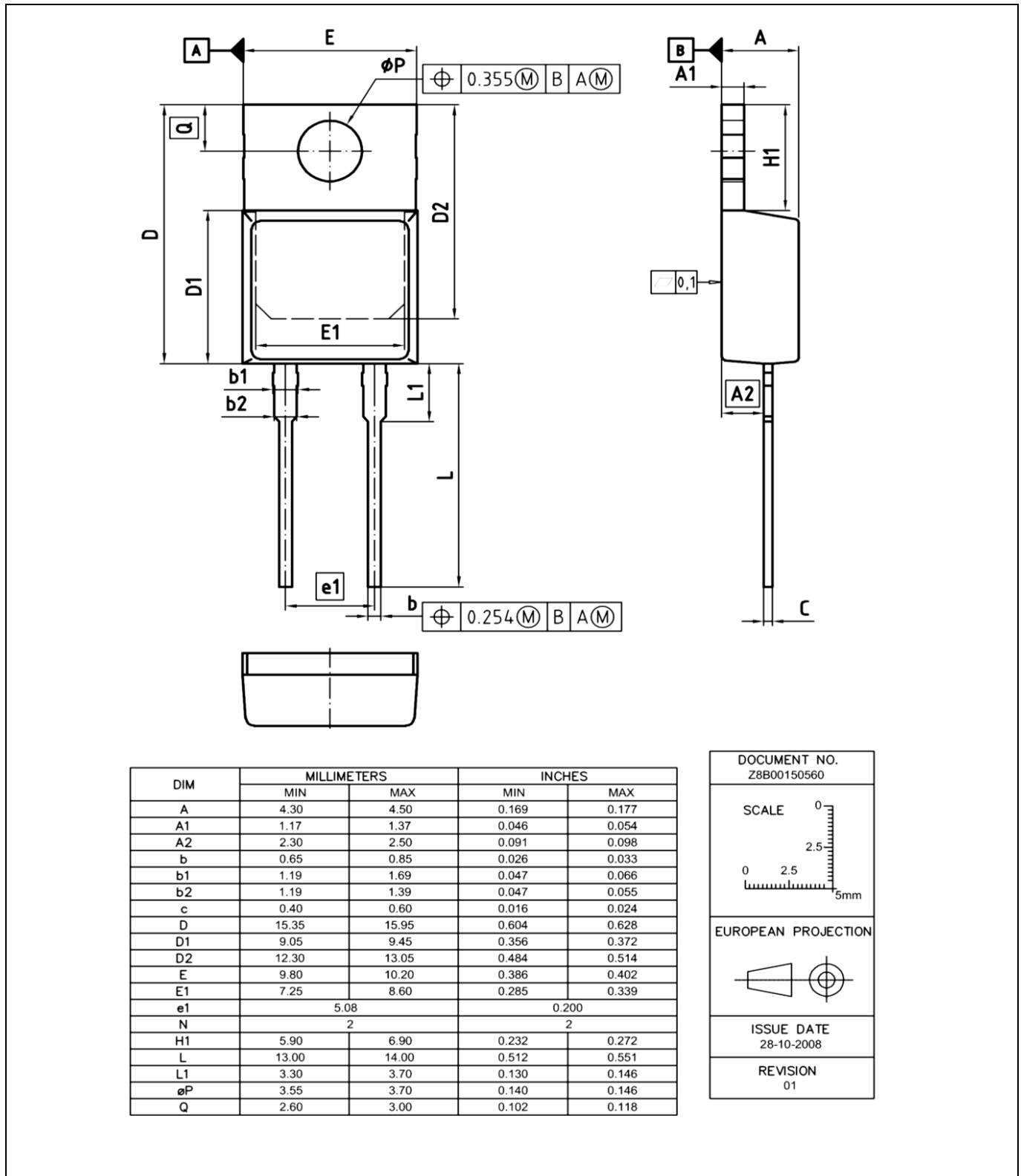


Figure 12 Outlines of the package PG-TO220-2, dimensions in mm/inches

Revision History

Major changes since the last revision

Revision	Date	Subject (major changes since last revision)
2.0	2017-05-23	Release of final version

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Document reference

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