

SiC

Silicon Carbide Diode

2nd Generation thinQ!™

2nd Generation thinQ!™ SiC Schottky Diode
IDV04S60C

Data Sheet

Rev. 2.0, 2010-01-08
Final

Industrial & Multimarket

2nd Generation thinQ!™ SiC Schottky Diode

IDV04S60C

1 Description

The second generation of Infineon SiC Schottky diodes has emerged over the years as the industry standard. The IDVxxS60C family is extending the already broad portfolio with the TO220FullPAK package. In order to greatly reduce the impact of the internal isolation of the FullPAK on the thermal performance, Infineon is applying its new diffusion soldering process for attaching the chip to the leadframe. The result of this is nearly identical thermal characteristics to that of the SiC diodes in the non-isolated TO220 package.



Features

- Revolutionary semiconductor material - Silicon Carbide
- Nearly no reverse / forward recovery charge
- High surge current capability
- Fully isolated package with nearly similar $R_{th,jc}$ as the standard TO220
- Suitable for high temperature operation
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications
- Switching behavior independent of forward current, switching speed and temperature



Benefits

- System efficiency improvement over Si diodes
- System cost / size savings due to reduced cooling requirements
- Good thermal performance without the need for additional isolation layer and washer
- Enabling higher frequency / increased power density solutions
- Higher system reliability due to lower operating temperatures and less fans
- Reduced EMI

Applications

Fully isolated TO220 package for e.g. CCM PFC; Motor Drives; Solar Applications; UPS

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DC}	600	V
Q_C	8	nC
$I_F @ T_C < 100^\circ\text{C}$	4	A

Table 2 Pin Definition

Pin 1	Pin2	Pin 3
C	A	n.a.

Type / Ordering Code	Package	Marking	Related Links
IDV04S60C	PG-TO220 FullPAK	D04S60C	IFX SiC Diodes Webpage

1) J-STD20 and JESD22

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2 Maximum ratings

Table 3 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous forward current	I_F	-	-	4	A	$T_C = < 110^\circ\text{C}$
Surge non-repetitive forward current, sine halfwave	$I_{F, SM}$	-	-	32		$T_C = 25^\circ\text{C}, t_p = 10 \text{ ms}$
		-	-	23		$T_C = 150^\circ\text{C}, t_p = 10 \text{ ms}$
Non-repetitive peak forward current	$I_{F, max}$	-	-	190		$T_C = 25^\circ\text{C}, t_p = 10 \mu\text{s}$
$i^2 t$ value	$\int i^2 dt$	-	-	4	A ² s	$T_C = 25^\circ\text{C}, t_p = 10 \text{ ms}$
		-	-	2		$T_C = 150^\circ\text{C}, t_p = 10 \text{ ms}$
Repetitive peak reverse voltage	V_{RRM}	-	-	600	V	$T_j = 25^\circ\text{C}$
Diode dv/dt ruggedness	dv/dt	-	-	50	V/ns	$V_R = 0 \dots 480 \text{ V}$
Power dissipation	P_{tot}	-	-	26	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	T_j, T_{stg}	- 55	-	175	°C	
Mounting torque		-	-	50	Ncm	M2.5 screws

3 Thermal characteristics

Table 4 Thermal characteristics TO-220 FullPAK

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	5.6	K/W	
Thermal resistance, junction - ambient	R_{thJA}	-	-	62		leaded
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	°C	1.6 mm (0.063 in.) from case for 10 s

4 Electrical characteristics

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
DC blocking voltage	V_{DC}	600	-	-	V	$T_j = 25\text{ °C}$, $I_R = 0.05\text{ mA}$
Diode forward voltage	V_F	-	1.7	1.9		$I_F = 4\text{ A}$, $T_j = 25\text{ °C}$
		-	2	2.4		$I_F = 4\text{ A}$, $T_j = 150\text{ °C}$
Reverse current	I_R	-	0.5	50	μA	$I_R = 600\text{ V}$, $T_j = 25\text{ °C}$
		-	2	500		$I_R = 600\text{ V}$, $T_j = 150\text{ °C}$

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_c	-	8	-	nC	$V_R = 400\text{ V}$, $F \leq F_{\max}$
Switching time ¹⁾	t_c	-	-	<10	ns	$di_F/dt = 200\text{ A}/\mu\text{s}$, $T_j = 150\text{ °C}$
	C	-	130	-	pF	$V_R = 1\text{ V}$, $f = 1\text{ MHz}$
		-	20	-		$V_R = 300\text{ V}$, $f = 1\text{ MHz}$
		-	20	-		$V_R = 600\text{ V}$, $f = 1\text{ MHz}$

1) t_c is the time constant for the capacitive displacement current waveform (independent from T_j , I_{LOAD} and di/dt), different from t_{rr} which is dependent on T_j , I_{LOAD} and di/dt . No reverse recovery time constant t_{rr} due to absence of minority carrier injection.

5 Electrical characteristics diagrams

Table 7

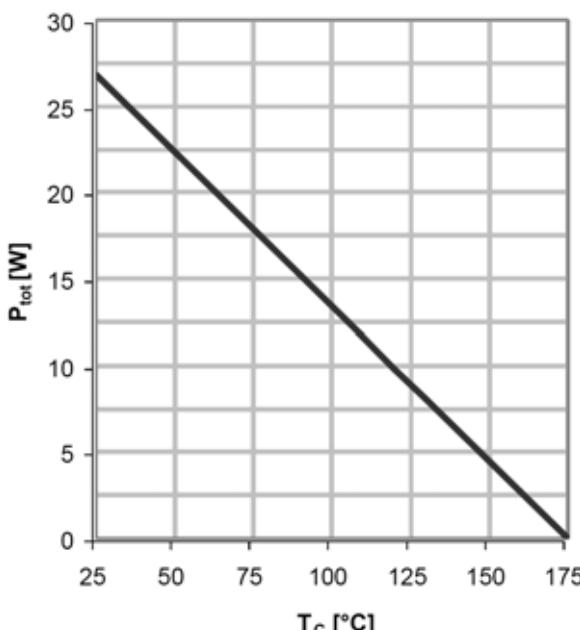
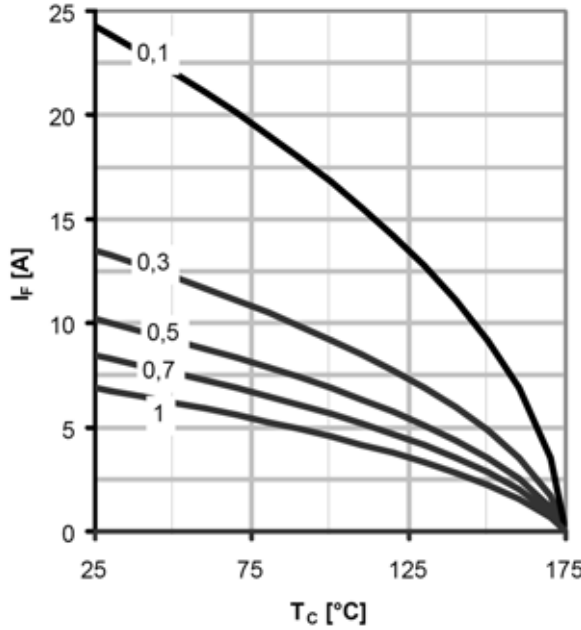
Power dissipation	Diode forward current
	
$P_{\text{tot}} = f(T_c)$	$I_F = f(T_c); T_j \leq 175^\circ\text{C}$

Table 8

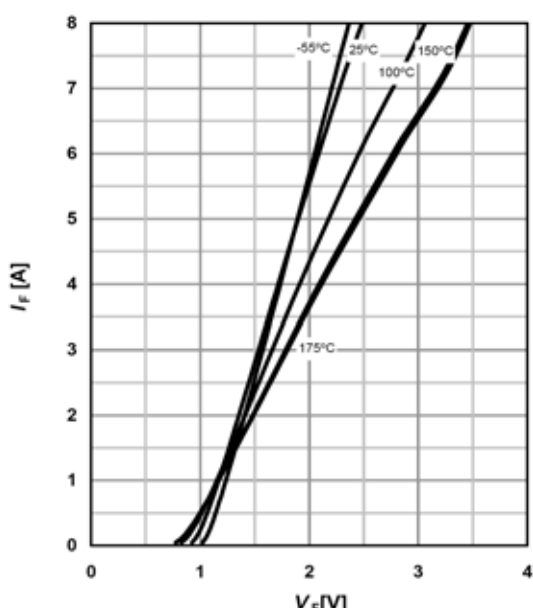
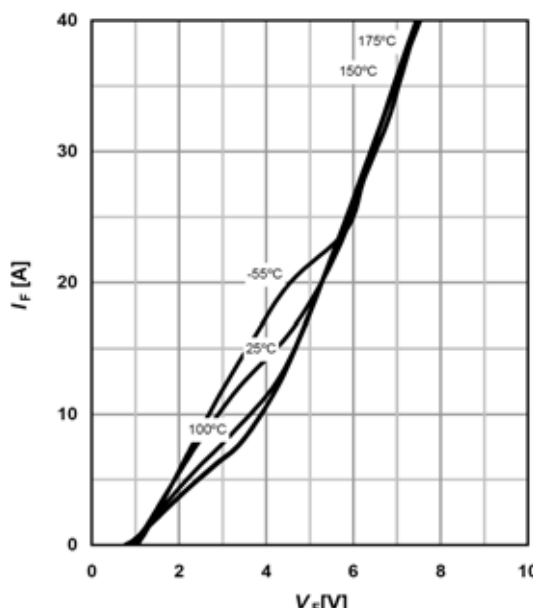
Typ. forward characteristic	Typ. forward characteristic in surge current
	
$I_F = f(V_F); t_p = 400 \mu\text{s}; \text{parameter: } T_j$	$I_F = f(V_F); t_p = 400 \mu\text{s}; \text{parameter: } T_j$

Table 9

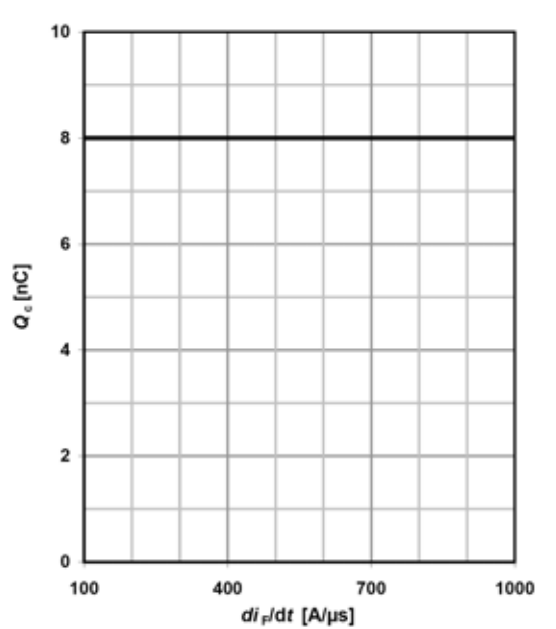
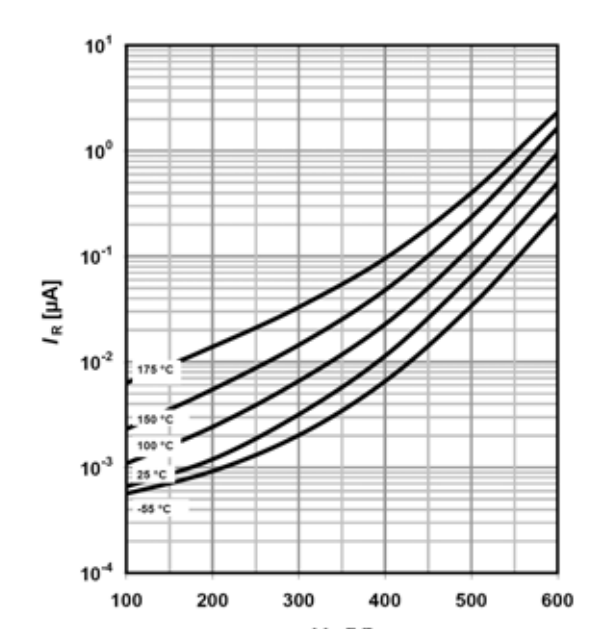
Typ. capacitance charge vs. current slope ¹⁾	Typ. reverse current vs. reverse voltage
	
$Q_D = f(diF/dt)4$; $T_j = 150\text{ °C}$; $I_F \leq I_{F\text{ max}}$	$I_R = f(V_R)$
1) Only capacitive charge occurring, guaranteed by design	

Table 10

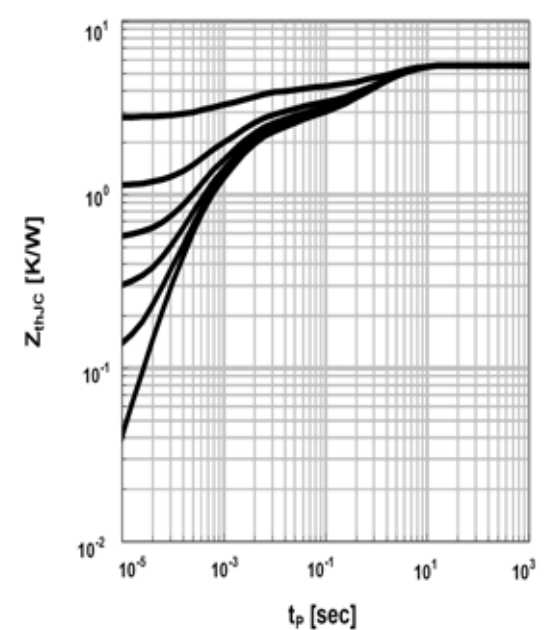
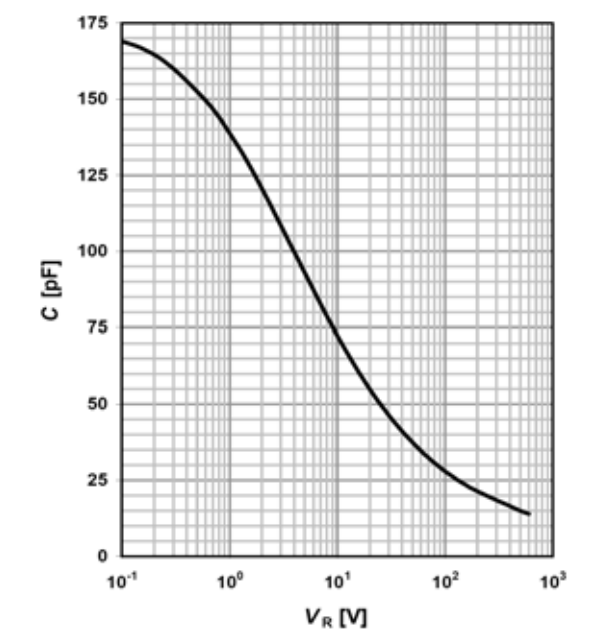
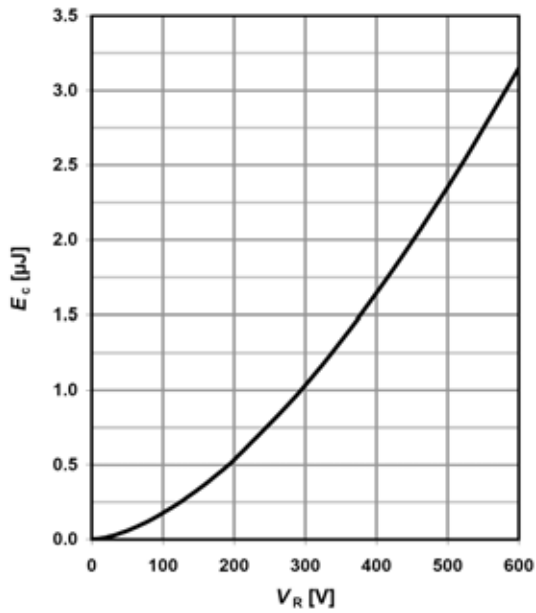
Typ. transient thermal impedance	Typ. capacitance vs. reverse voltage
	
$Z_{thJC} = f(t_p)$; parameter: $D = t_p / T$	$C = f(V_R)$; $T_C = 25\text{ °C}$, $f = 1\text{ MHz}$

Table 11

Typ. C stored energy



$$E_C = f(V_R)$$

6 Package outlines

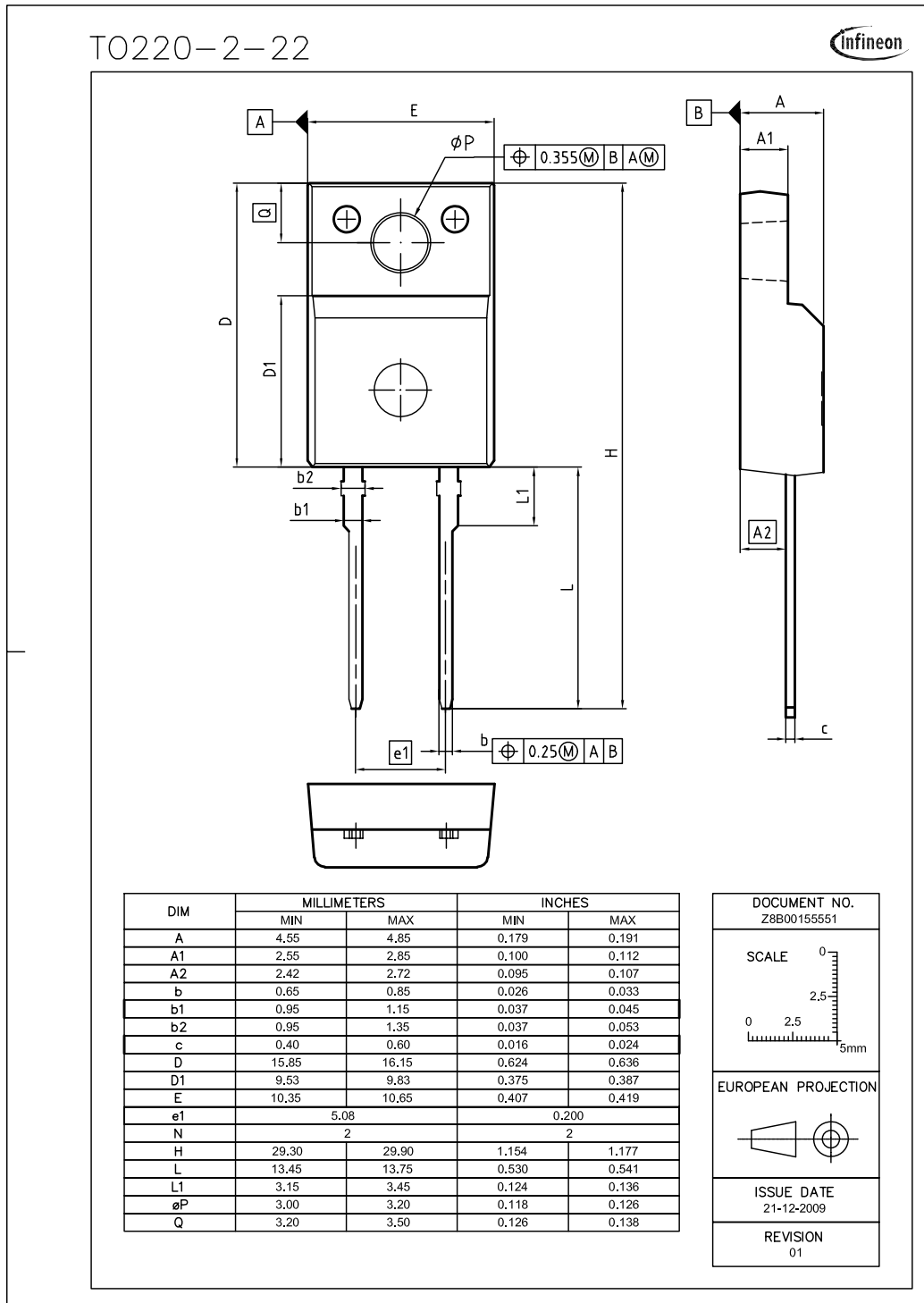


Figure 1 Outlines TO-220 FullPAK, dimensions in mm/inches

7 Revision History

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Revision History: 2010-01-08, Rev. 2.0

Previous Revision:

Revision	Subjects (major changes since last revision)
2.0	Release of final data sheet

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