

# Silicon Carbide Schottky Diode

## IDW40G120C5B

5<sup>th</sup> Generation thinQ!<sup>TM</sup> 1200 V SiC Schottky Diode

### Final Datasheet

Rev. 2.0 2014-06-10

## thinQ!™ SiC Schottky Diode

### Features:

- Revolutionary semiconductor material - Silicon Carbide
- No reverse recovery current / No forward recovery
- Temperature independent switching behavior
- Low forward voltage even at high operating temperature
- Tight forward voltage distribution
- Excellent thermal performance
- Extended surge current capability
- Specified dv/dt ruggedness
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant

### Benefits

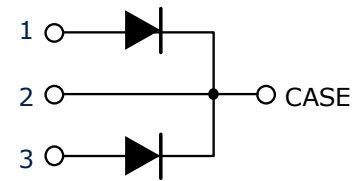
- System efficiency improvement over Si diodes
- Enabling higher frequency / increased power density solutions
- System size/cost savings due to reduced heatsink requirements and smaller magnetics
- Reduced EMI
- Highest efficiency across the entire load range
- Robust diode operation during surge events
- High reliability
- RelatedLinks: [www.infineon.com/sic](http://www.infineon.com/sic)

### Applications

- Solar inverters
- Uninterruptable power supplies
- Motor drives
- Power Factor Correction

### Package pin definitions

- Pin 1 – anode 1
- Pin 2 and backside – cathode
- Pin 3 – anode 2



### Key Performance and Package Parameters (leg/device)

Type	V <sub>DC</sub>	I <sub>F</sub>	Q <sub>C</sub>	T <sub>j,max</sub>	Marking	Package
IDW40G120C5B	1200V	20 / 40 A	101 / 202nC	175°C	D4012B5	PG-TO247-3

1) J-STD20 and JESD22

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**Maximum ratings**

Parameter	Symbol	Value (leg/device)	Unit
Repetitive peak reverse voltage	$V_{RRM}$	1200	V
Continuous forward current for $R_{th(j-c,max)}$ $T_C = 148^\circ\text{C}$ , $D=1$ $T_C = 135^\circ\text{C}$ , $D=1$ $T_C = 25^\circ\text{C}$ , $D=1$	$I_F$	20 / 40 25 / 51 55 / 110	A
Surge non-repetitive forward current, sine halfwave $T_C=25^\circ\text{C}$ , $t_p=10\text{ms}$ $T_C=150^\circ\text{C}$ , $t_p=10\text{ms}$	$I_{F,SM}$	145 / 290 140 / 280	A
Non-repetitive peak forward current $T_C = 25^\circ\text{C}$ , $t_p=10 \mu\text{s}$	$I_{F,max}$	1575 / 3150	A
$i^2t$ value $T_C = 25^\circ\text{C}$ , $t_p=10 \text{ms}$ $T_C = 150^\circ\text{C}$ , $t_p=10 \text{ms}$	$\int i^2 dt$	105 / 420 98 / 392	A <sup>2</sup> s
Diode $dv/dt$ ruggedness $V_R=0\dots960 \text{V}$	$dv/dt$	80	V/ns
Power dissipation for $R_{th(j-c,max)}$ $T_C = 25^\circ\text{C}$	$P_{tot}$	201 / 402	W
Operating and storage temperature	$T_j; T_{stg}$	-55...175	$^\circ\text{C}$
Soldering temperature, wavesoldering only allowed at leads 1.6mm (0.063 in.) from case for 10 s	$T_{sold}$	260	$^\circ\text{C}$
Mounting torque M3 and M4 screws	$M$	0.7	Nm

**Thermal Resistances**

Parameter	Symbol	Conditions	Value (leg/device)			Unit
			min.	typ.	max.	
<b>Characteristic</b>						
Diode thermal resistance, junction – case	$R_{th(j-c)}$		-	0.6/0.3	0.8/0.4	K/W
Thermal resistance, junction – ambient	$R_{th(j-a)}$	leaded	-	-	62	K/W

**Electrical Characteristics**
**Static Characteristic, at T<sub>j</sub>=25°C, unless otherwise specified**

Parameter	Symbol	Conditions	Value (leg/device)			Unit
			min.	typ.	max.	
DC blocking voltage	V <sub>DC</sub>	T <sub>j</sub> = 25°C	1200	-	-	V
Diode forward voltage	V <sub>F</sub>	I <sub>F</sub> = 20/40 A, T <sub>j</sub> =25°C	-	1.4	1.65	V
		I <sub>F</sub> = 20/40 A, T <sub>j</sub> =150°C	-	1.7	2.30	
Reverse current	I <sub>R</sub>	V <sub>R</sub> =1200 V, T <sub>j</sub> =25°C		12 / 23	166 / 332	μA
		V <sub>R</sub> =1200 V, T <sub>j</sub> =150°C		59 / 118	850 / 1700	

**Dynamic Characteristics, at T<sub>j</sub>=25°C, unless otherwise specified**

Parameter	Symbol	Conditions	Value (leg/device)			Unit
			min.	typ.	max.	
Total capacitive charge	Q <sub>C</sub>	V <sub>R</sub> = 800 V, T <sub>j</sub> =150°C & 25°C	-	101 / 202	-	nC
		$Q_C = \int_0^{V_R} C(V) dV$				
Total Capacitance	C	V <sub>R</sub> =1 V, f=1 MHz	-	1296/2592	-	pF
		V <sub>R</sub> =400 V, f=1 MHz	-	92 / 183	-	
		V <sub>R</sub> =800 V, f=1 MHz	-	73 / 146	-	

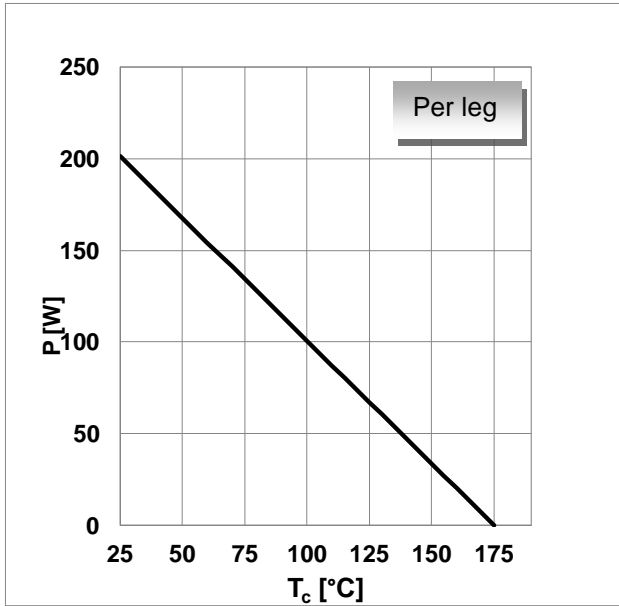


Figure 1. Power dissipation per leg as function of case temperature,  $P_{tot}=f(T_C)$ ,  $R_{th(j-c),max}$

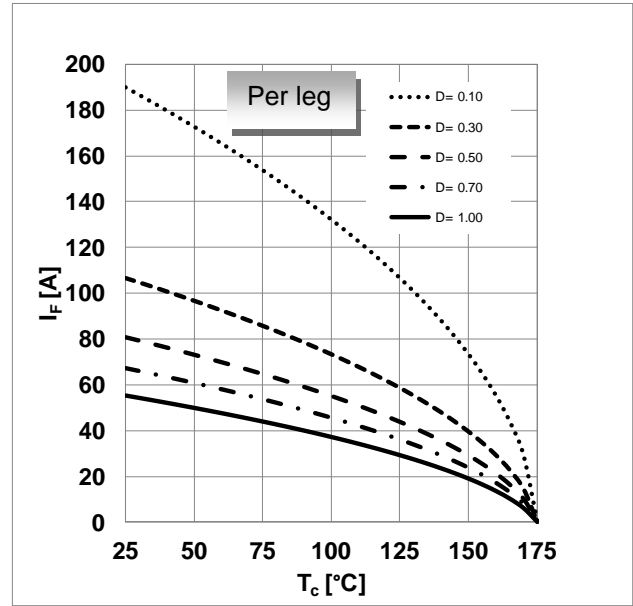


Figure 2. Diode forward current per leg as function of temperature, parameter:  $T_j \leq 175^\circ\text{C}$ ,  $R_{th(j-c),max}$ ,  $D$ =duty cycle,  $V_{th}$ ,  $R_{diff}$  @  $T_j=175^\circ\text{C}$

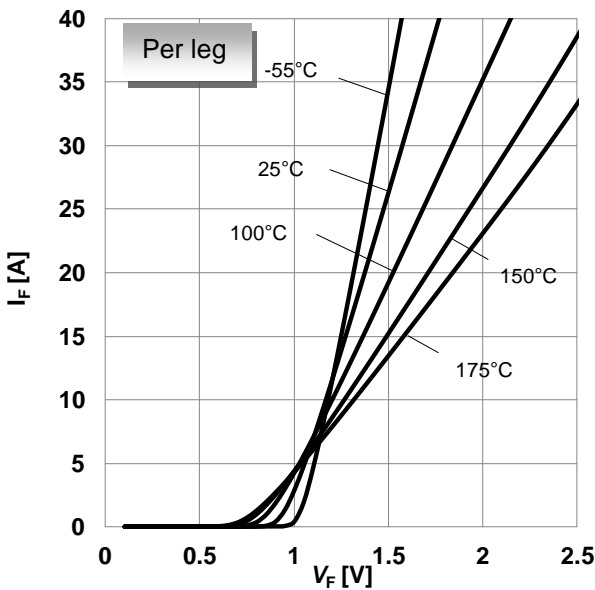


Figure 3. Typical forward characteristics per leg,  $I_F=f(V_F)$ ,  $t_p=10 \mu\text{s}$ , parameter:  $T_j$

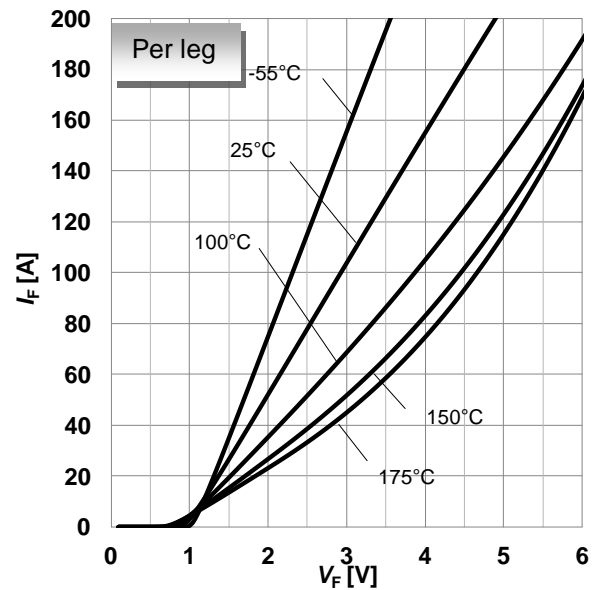


Figure 4. Typical forward characteristics in surge current per leg,  $I_F=f(V_F)$ ,  $t_p=10 \mu\text{s}$ , parameter:  $T_j$

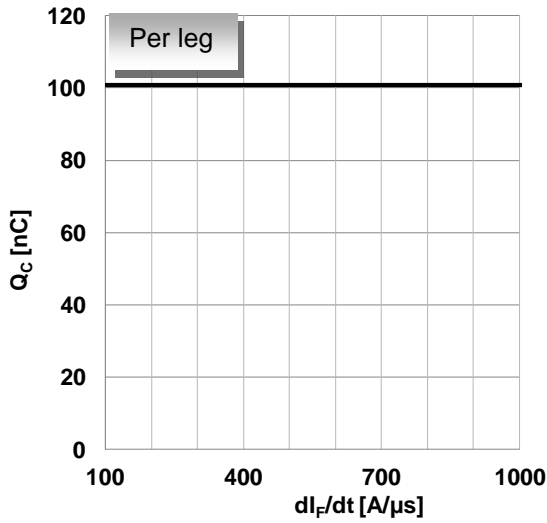


Figure 5. Typical capacitive charge per leg as function of current slope<sup>1</sup>,  $Q_C=f(di_F/dt)$ ,  $T_j=150^\circ\text{C}$   
 1) guaranteed by design.

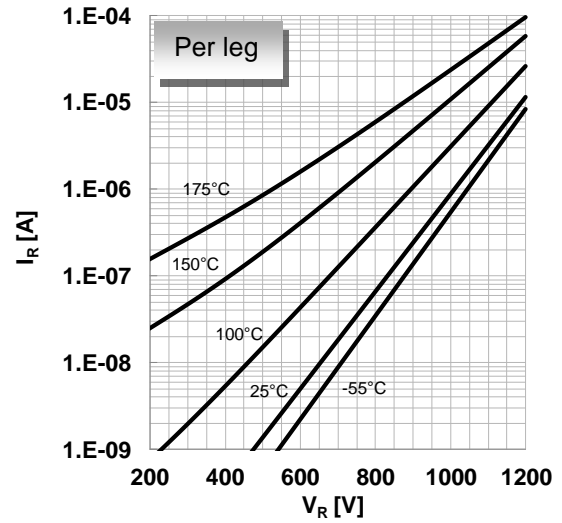


Figure 6. Typical reverse characteristics per leg,  $I_R=f(V_R)$ , parameter:  $T_j$

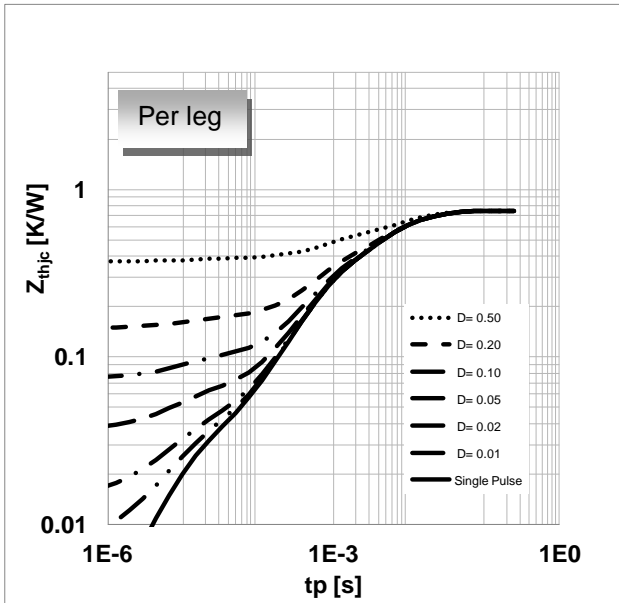


Figure 7. Max. transient thermal impedance per leg,  $Z_{th,jc}=f(t_p)$ , parameter:  $D=t_p/T$

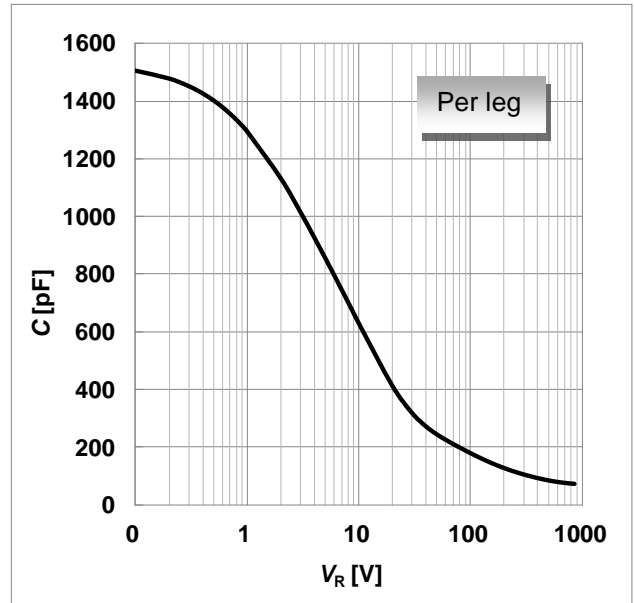


Figure 8. Typical capacitance per leg as function of reverse voltage,  $C=f(V_R)$ ;  $T_j=25^\circ\text{C}$ ;  $f=1\text{ MHz}$

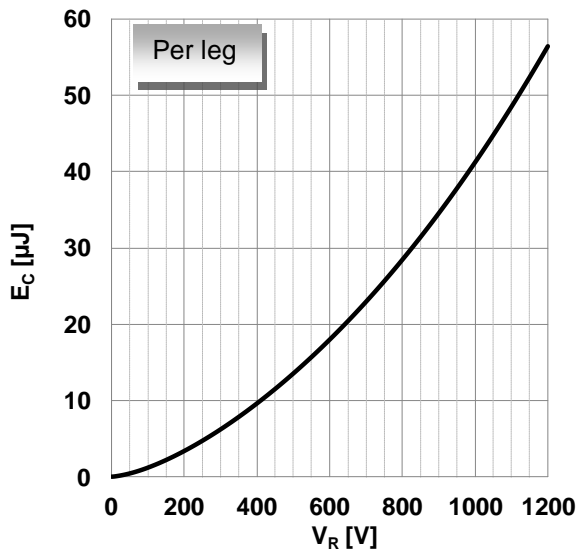
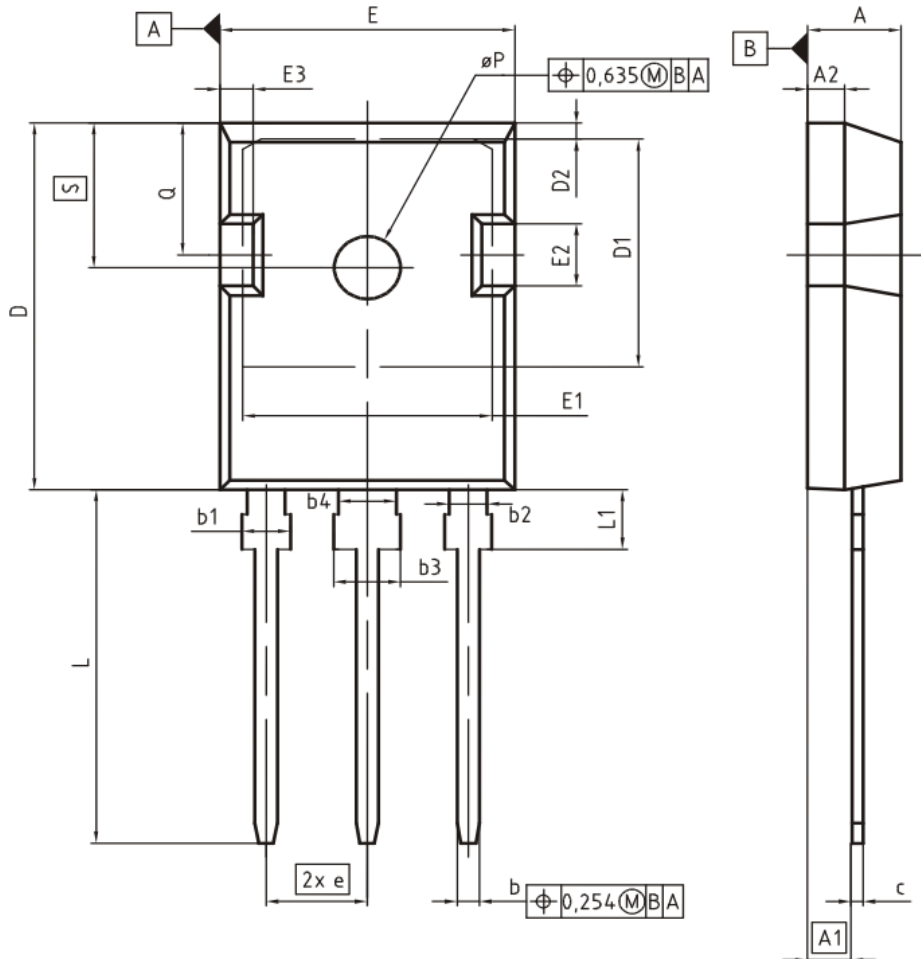


Figure 9. Typical capacitively stored energy as function of reverse voltage, per leg,  $E_C=f(V_R)$



PG-TO247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
$\varnothing P$	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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## Revision History

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### Revision: 2014-06-10, Rev. 2.0

Previous Revision:

Revision	Date	Subjects (major changes since last version)
2.0	-	Final data sheet

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