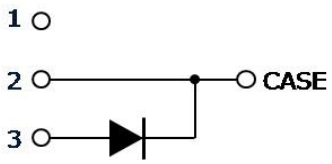
CoolSiC™ Automotive Schottky Diode 650V G5

650V/20A Silicon Carbide Schottky Diode in TO247-3

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
- Junction Temperature range from -40°C to 175°C
- 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



Potential Applications

- Traction inverter
- Booster / DCDC Converter
- On board Charger / PFC

Product Validation

“Qualified for Automotive Applications. Product Validation according to AEC-Q100/101”

Description

The 5th Generation CoolSiC™ Automotive Schottky Diode represents Infineon leading edge technology for Silicon Carbide Schottky Barrier diodes. Thanks to a compact design and a technology based on thin wafers, this family of products shows improved efficiency over all load conditions resulting from both its thermal characteristics and low figure of merit (Qc x Vf). This product family has been designed to complement Infineon’s IGBT and CoolMOS™ portfolio. This ensures meeting the most stringent application requirements in the 650V voltage class.

Product Information	
Ordering Code	AIDW20S65C5
Marking	AD2065C5
Package	PG-TO247-3-41
SP Number	SP001725214

Parameter	Value/Unit
$V_{DC,max}$	650 V
I_F; T_C< 127 °C	20 A
Q_C; V_R= 400 V	29 nC
E_C; V_R= 400 V	6.6 µJ
$T_{j,max}$	175 °C

Pin	Definition
Pin 2, case	Cathode
Pin 3	Anode

Table of Contents

1 Maximum Ratings

Table 1 Maximum ratings[1]

Parameter	Symbol	Value	Unit
Repetitive peak reverse voltage	V_{RRM}	650	V
Continuous forward current for $R_{thJC,max}$ T_C = 127 °C, D=1	I_F	20	A
Surge non-repetitive forward current, sine halfwave T_C= 25°C, t_p=10ms T_C= 150°C, t_p=10ms	$I_{F,SM}$	 103 87	A
Non-repetitive peak forward current T_C= 25°C, t_p=10µs	$I_{F,max}$	776	A
i^2t value T_C= 25°C, t_p=10ms T_C= 150°C, t_p=10ms	$\int i^2\,dt$	53 38	A^2s
Diode dv/dt ruggedness V_R=0...480V	dv/dt	100	V/ns
Power dissipation T_C = 25°C	P_{tot}	112	W
Operating temperature	T_j	-40…175	°C
Storage temperature	T_{stg}	-55…150	°C
ESD Human body model, R= 1.5 kΩ, C = 100 pF Charged device model		 8 2	kV
Soldering temperature, wavesoldering only allowed at leads, 1.6mm (0.063 in.) from case for 10 s	T_{sold}	260	°C
Mounting Torque (M3 and M4 screws)		70	Ncm

2 Thermal Characteristics

Table 2 Thermal Characteristics[1]

Parameter	Symbol	Values			Unit	Note/Test condition
		Min.	Typ.	Max.		
Thermal resistance, junction–case[2]	R_{thJC}	-	1.0	1.4	K/W	
Thermal resistance, junction-ambient[2]	R_{thJA}	-	-	62	K/W	

3 Electrical Characteristics

Table 3 Static Characteristics

Parameter	Symbol	Values			Unit	Note/Test condition
		Min.	Typ.	Max.		
DC blocking voltage	V_{DC}	650	-	-	V	T_j = 25°C, I_R = 0.12 mA
Diode forward voltage[3]	V_F	-	1.5	1.7		T_j = 25°C, I_F = 20 A
		-	1.8	2.1		T_j = 150°C, I_F = 20 A
Reverse current	I_R	-	3	120	µA	V_R = 650 V, T_j = 25 °C
		-	24	-		V_R = 650 V, T_j = 150 °C

Table 4 Dynamic Characteristics at Tj=25°C unless noted otherwise

Parameter	Symbol	Values			Unit	Note/Test condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_C	-	29	-	nC	V_R = 400 V, di/dt = 200 A/µs, $I_F \leq I_{F,MAX}$, T_j = 150 °C
Total capacitance	C	-	584	-	pF	V_R = 1 V, f = 1 MHz
		-	76	-		V_R = 300 V, f = 1 MHz
		-	75	-		V_R = 600 V, f = 1 MHz

Footnotes:

[1] The parameter is not subject to production test- verified by design/characterization.

[2] Rth,JC defined as per JESD-51-14. Rth,JA defined as per JESD-51-2.

[3] Only the value at 25°C is subject to production test. The value at 150°C is only verified by design/characterization.

4 Electrical Characteristics Diagrams

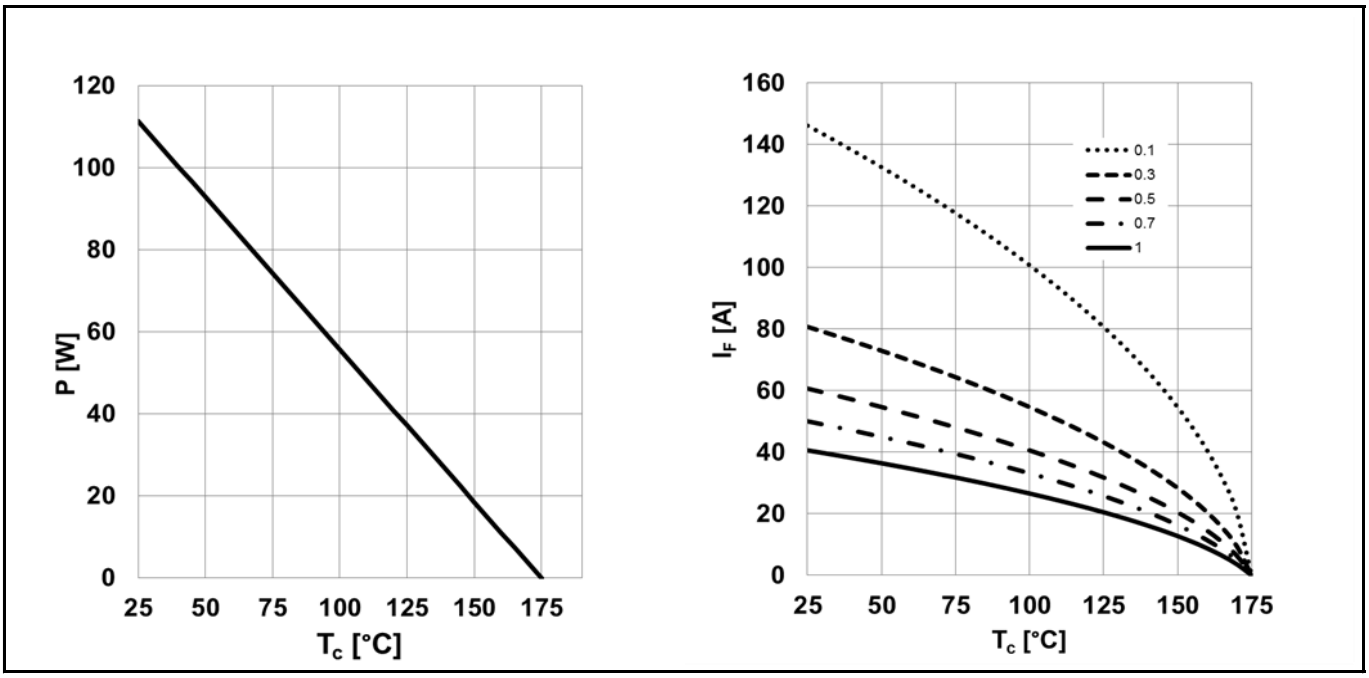


Figure 1 (LEFT) Power dissipation; $P_{tot}= f(T_C)$; $R_{thJC,max}$
(RIGHT) Diode forward current; $I_F= f(T_C)$; $T_j \leq 175$ °C; $R_{thJC,max}$; parameter: D=duty cycle

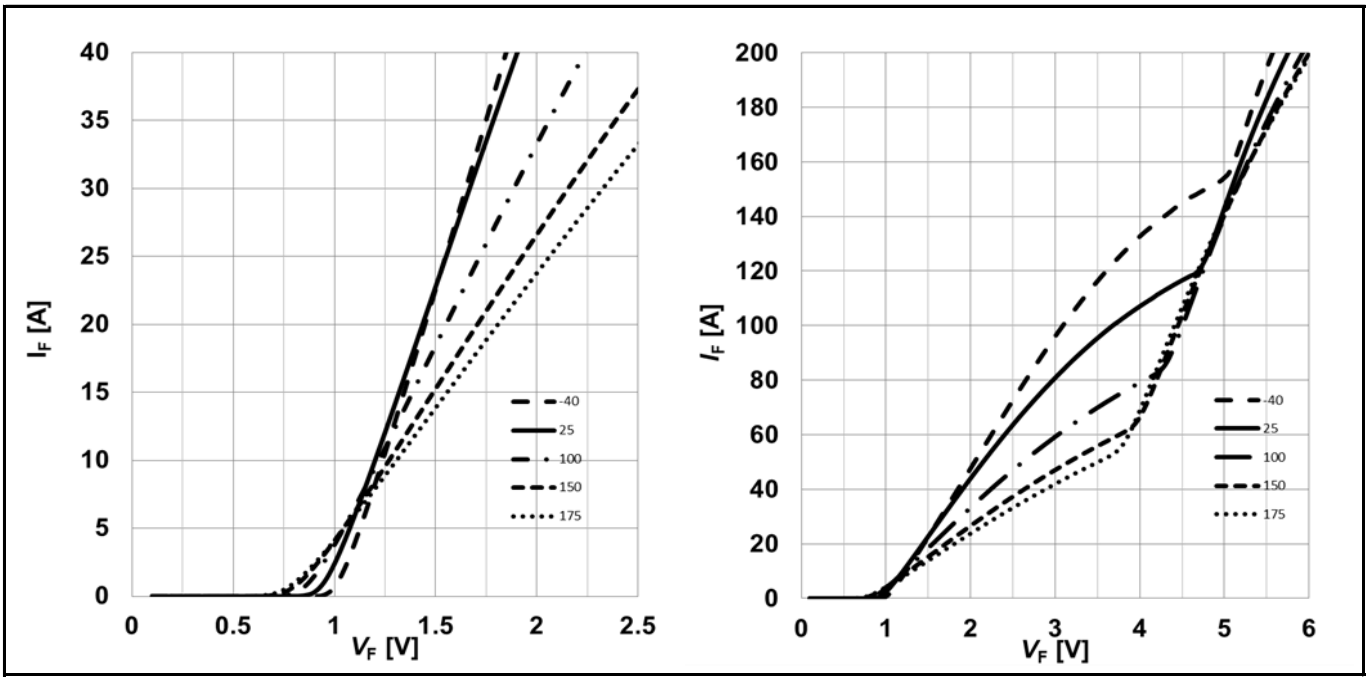


Figure 2 (LEFT) Typical forward characteristic; $I_F= f(V_F)$; t_P=200 µs; parameter:T_j
(RIGHT) Typical forward characteristics in surge current; $I_F= f(V_F)$; t_P=200 µs; parameter:T_j

Electrical Characteristics Diagrams

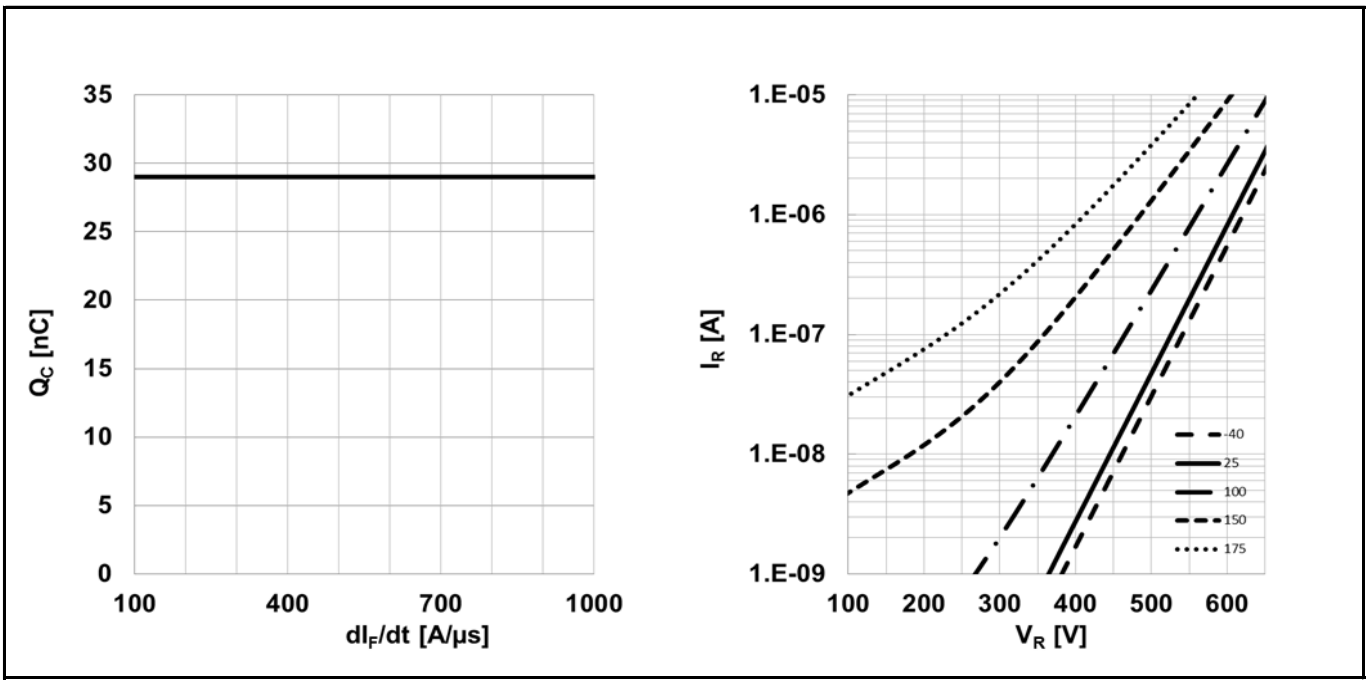
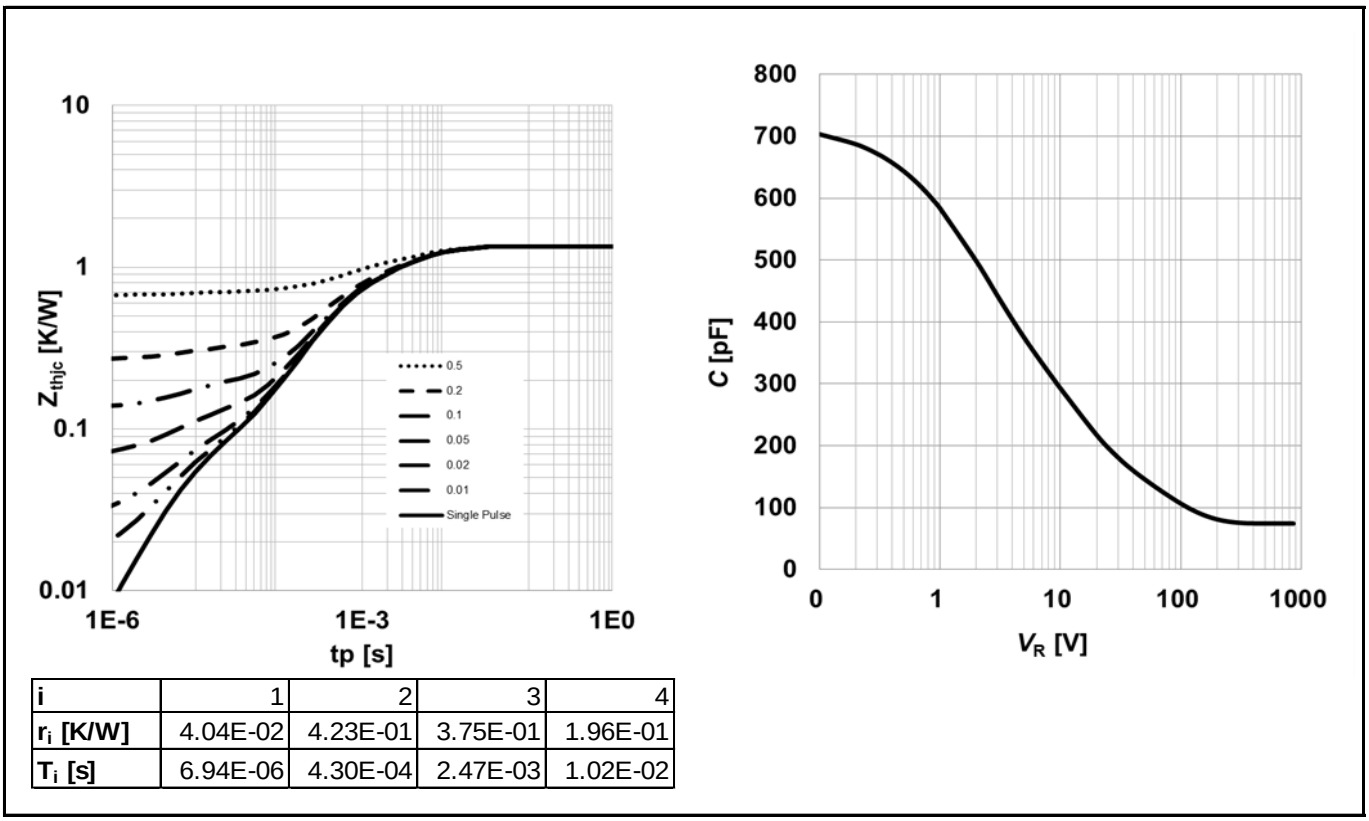


Figure 3 (LEFT) Typical capacitive charge versus current slope (only capacitive charge, guaranteed by design); $Q_C = f(di_F/dt)$; T_j=150°C; V_R=400V; $I_F \leq I_{F,max}$
(RIGHT) Typical reverse current versus reverse voltage; $I_R = f(V_R)$;parameter: T_j



i	1	2	3	4
r_i [K/W]	4.04E-02	4.23E-01	3.75E-01	1.96E-01
T_i [s]	6.94E-06	4.30E-04	2.47E-03	1.02E-02

Figure 4 (LEFT) Max. Transient thermal impedance; $Z_{thJC} = f(t_P)$; parameter:$D=t_P/T$
(RIGHT) Typ. Capacitance vs. Reverse voltage; $C = f(V_R)$; T_j=25°C; f=1 MHz

Electrical Characteristics Diagrams

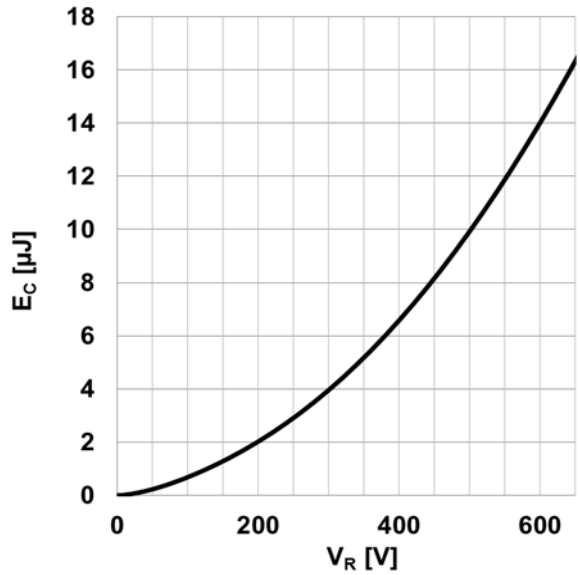
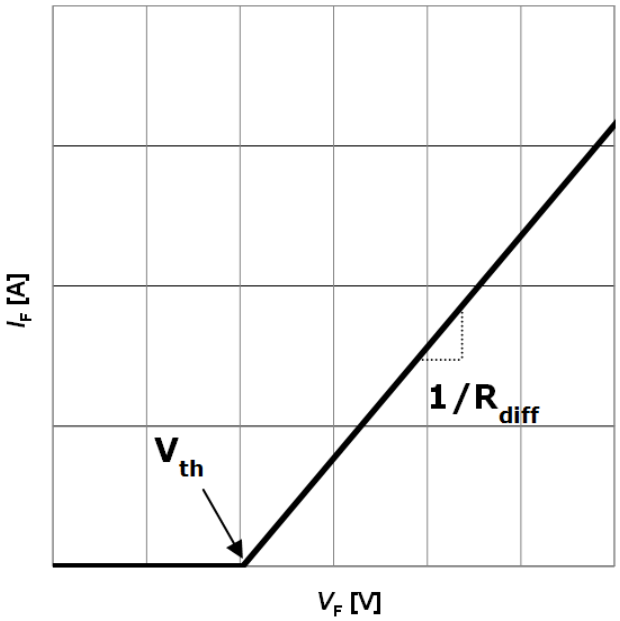


Figure 5 Typical capacitance stored energy; $E_C = f(V_R)$



$$V_F = V_{th} + R_{diff} \cdot I_F$$

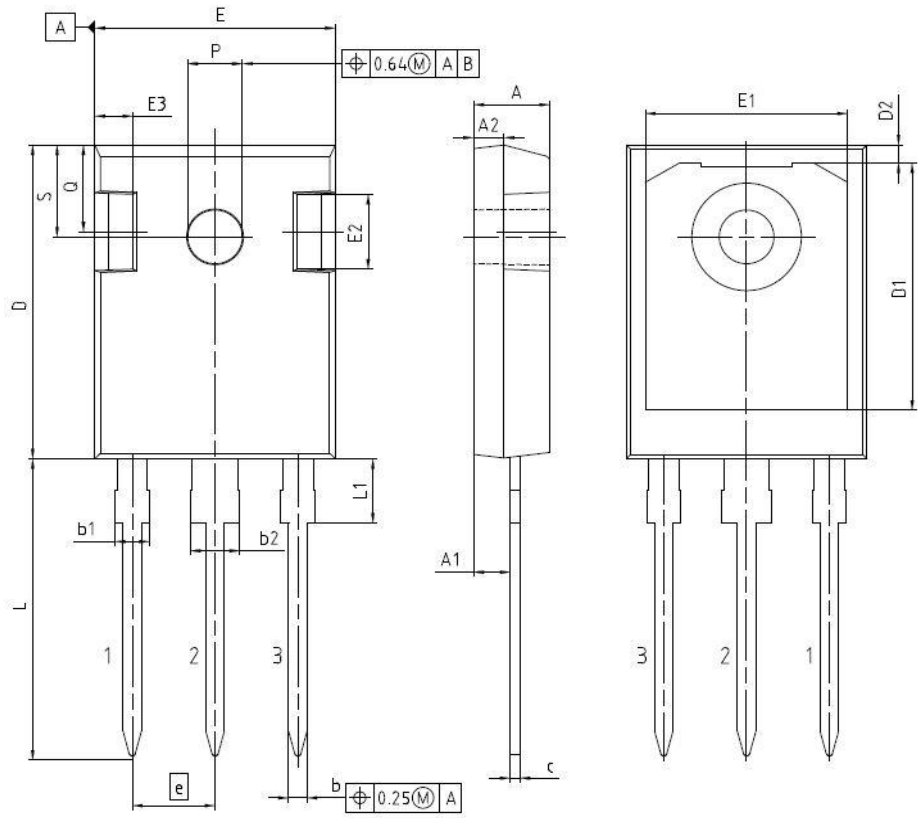
$$V_{th} = A \cdot T_j + B \text{ [V]}$$

$$R_{diff} = C \cdot T_j^2 + D \cdot T_j + E \text{ [}\Omega\text{]}$$

A =	-9.2E-04	[V/°C]
B =	1.0E+00	[V]
C =	6.4E-07	[Ω/(°C)^2]
D =	3.7E-05	[Ω/°C]
E =	2.0E-02	[Ω]

Figure 6 Simplified forward characteristics model $V_F = f(I_F)$;
$-40°C < T_j < 175°C$; $I_F <$ 40 A

5 Package Outlines



DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.70	5.30
A1	2.20	2.60
A2	1.50	2.50
b	1.00	1.40
b1	1.60	2.41
b2	2.57	3.43
c	0.38	0.89
D	20.70	21.50
D1	13.08	17.65
D2	0.51	1.35
E	15.50	16.30
E1	12.38	14.15
E2	3.40	5.10
E3	1.00	2.60
e	5.44	
L	19.80	20.40
L1	3.85	4.50
P	3.50	3.70
Q	5.35	6.25
S	6.04	6.30

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0 1 2 3 4 5mm

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Figure 6 Package outline of PG-TO247-3-41 leaded (Dimensions in mm)

Revision History

Document Version	Date of Release	Description of changes
V3.0	26.11.2018	1st release of Data Sheet

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