

AUIRG4PC40S-E

Insulated Gate Bipolar Transistor

Features

- Standard: Optimized for minimum saturation voltage and low operating frequencies (< 1kHz)
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AD package
- Lead-Free
- Automotive Qualified*

Benefits

- Generation 4 IGBT's offer highest efficiency available
- IGBT's optimized for specified application conditions
- Designed to be a "drop-in" replacement for equivalent industry-standard Generation 3 IR IGBT's



$$V_{CES} = 600V$$

 $V_{CE(ON)}$ typ. = 1.32V

@ V_{GE} = 15V, IC = 31A



G	С	E
Gate	Collector	Emitter

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRG4PC40S-E	TO-247AD	Tube	25	AUIRG4PC40S-E

Absolute Maximum Ratings

	Parameter	Max.	Units
V _{CES}	Collector-to-Emitter Voltage	600	V
I _C @ T _C = 25°C	Continuous Collector Current	60	
I _C @ T _C = 100°C	Continuous Collector Current	31	۸
I _{CM}	Pulse Collector Current ①	120	A
I _{LM}	Clamped Inductive Load Current ②	120	
V _{GE}	Continuous Gate-to-Emitter Voltage	±20	V
E _{ARV}	Reverse Voltage Avalanche Energy 3	15	
P _D @ T _C = 25°C	Maximum Power Dissipation	160	۱۸/
P _D @ T _C = 100°C	Maximum Power Dissipation	65	VV
TJ	Operating Junction and	-55 to +150	
T _{STG}	Storage Temperature Range		0
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	C
	Mounting Torque, 6-32 or M3 Screw	10 lbf·in (1.1 N·m)	

Thermal Resistance

	Parameter	Тур.	Max.	Units
$R_{ ext{ heta}JC}$	Thermal Resistance Junction-to-Case		0.77	
$R_{ ext{ heta}CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	0.24		°C/W
$R_{ ext{ heta}JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)		40	
Wt	Weight	6 (0.21)		g (oz)

*Qualification standard can be found at www.infineon.com/



		-	-			
	Parameter	Min.	Тур.	Max.	Units	Conditions
V _{(BR)CES}	Collector-to-Emitter Breakdown Voltage	600				V _{GE} = 0V, I _C = 250μA
V _{(BR)ECS}	Emitter-to-Collector Breakdown Voltage ④	18	-		V	V _{GE} = 0V, I _C = 1.0A
$\Delta V_{(BR)CES} / \Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.75	—	V/°C	$V_{GE} = 0V, I_C = 1mA$
		—	1.32	1.5		<u>I_C = 31A, V_{GE} = 15V,</u> T _J = 25°C
V _{CE(on)}	Collector-to-Emitter Saturation Voltage		1.68	—	V	I_{C} = 60A, V_{GE} = 15V, See Fig. 2,5
		—	1.32			I _C = 31A, V _{GE} = 15V, T _J = 150°C
V _{GE(th)}	Gate Threshold Voltage	3.0	—	6.0	V	V _{CE} = V _{GE} , I _C = 250μΑ
$\Delta V_{GE(th)} / \Delta T_J$	Threshold Voltage Temperature Coeff.	—	-9.3		mV/°C	V _{CE} = V _{GE} , I _C = 250μΑ
gfe	Forward Transconductance [®]	12	21	—	S	V _{CE} = 100V, I _C = 31A
				250		$V_{GE} = 0V, V_{CE} = 600V$
I _{CES}	Collector-to-Emitter Leakage Current		_	2.0	μA	$V_{GE} = 0V, V_{CE} = 10V, T_{J} = 25^{\circ}C$
			—	1000		$V_{GE} = 0V, V_{CE} = 600V, T_{J} = 150^{\circ}C$
I _{GES}	Gate-to-Emitter Leakage Current			±100	nA	$V_{GE} = \pm 20V$

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Тур.	Max	Units	Conditions	
Q _g	Total Gate Charge (turn-on)		100	150		I _C = 31A	
Q _{ge}	Gate-to-Emitter Charge (turn-on)		14	21	nC	V _{GE} = 15V See Fig.8	
Q_{gc}	Gate-to-Collector Charge (turn-on)		34	51		V _{CC} = 400V	
t _{d(on)}	Turn-On delay time		22	_			
t _r	Rise time		18	_	na	I_{C} = 31A, V_{CC} = 480V, V_{GE} =15V	
t _{d(off)}	Turn-Off delay time		650	980	115	R _G = 10Ω, T _J = 25°C	
t _f	Fall time		380	570		Francy losses include "tail"	
Eon	Turn-On Switching Loss		0.45	_		Energy losses include tail	
E _{off}	Turn-Off Switching Loss		6.5	_	mJ	See Fig. 10, 11, 13, 14	
E _{ts}	Total Switching Loss		6.95	9.9			
t _{d(on)}	Turn-On delay time		23	_		I _C = 31A, V _{CC} = 480V, V _{GE} =15V	
t _r	Rise time	—	21		ne	R _G = 10Ω, T _J = 150°C	
t _{d(off)}	Turn-Off delay time	—	1000	_	115	Energy losses include "tail"	
t _f	Fall time		940	_			
E _{ts}	Total Switching Loss		12	_	mJ	See Fig. 13, 14	
L _E	Internal Emitter Inductance		13	_	nH	Measured 5mm from package	
C _{ies}	Input Capacitance		2200	_		V _{GE} = 0V	
C _{oes}	Output Capacitance		140	_	pF	V _{CC} = 30V See Fig. 7	
C _{res}	Reverse Transfer Capacitance		26	—		f = 1.0Mhz	

Notes:

- \odot Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature. (See fig. 13b)
- $@~V_{CC}$ = 80%(V_{CES}), V_{GE} = 20V, L = 10µH, R_G = 10Ω, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- \bigcirc Pulse width 5.0µs, single shot.



Fig. 1 - Typical Load Current vs. Frequency (For square wave, $I=I_{PK}$)



Fig. 2 - Typical Output Characteristics



Fig. 3 - Typical Transfer Characteristics





Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



-

Resistance

Junction Temperature





Driver same type as D.U.T.; Vc = 80% of Vce(max)
 Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated Id.

Fig. 13a - Clamped Inductive Load Test Circuit



Fig. 13b - Pulsed Collector Current Test Circuit



Fig. 14a - Switching Loss Test Circuit



Fig. 14b - Switching Loss Waveforms

TO-247AD Package Outline Dimensions are shown in millimeters (inches)



A €1 ⊕.010 ⊕ B A ⊕

VIEW A-A

VIEW B

NOTES:

- 1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
- DIMENSIONS ARE SHOWN IN INCHES.
- CONTOUR OF SLOT OPTIONAL.
- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127)
 - PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
- LEAD FINISH UNCONTROLLED IN L1.
- /}. #P TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ' TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
- OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AD. 8.

SYMBOL INCHES MILLIMETERS MIN. MAX. MIN. MAX. NOTES A .190 .203 4.83 5.13 A1 .087 .102 2.21 2.599 A2 .072 .084 1.83 2.13 LEAD ASSIGN b .041 .051 1.04 1.30 LEAD ASSIGN b1 .041 .050 1.04 1.28 LEAD ASSIGN b2 .065 .094 1.65 2.39 1 GA b3 .065 .092 1.65 2.34 b4 .102 .135 2.59 3.43 b5 .102 .133 2.59 3.43 b5 .102 .133 2.59 3.38 c .017 .035 0.44 0.84 b1 .515 - 13.08 5 3 EM c1 <th>MENTS TE AIN JRCE AIN</th>	MENTS TE AIN JRCE AIN
MIN. MAX. MIN. MAX. NOTES A .190 .203 4.83 5.13 Image: constraint of the system of t	MENTS TE AIN JRCE AIN
A .190 .203 4.83 5.13 A1 .087 .102 2.21 2.59 A2 .072 .084 1.83 2.13 b .041 .051 1.04 1.30 b1 .041 .050 1.04 1.28 HEXFEI b2 .065 .094 1.65 2.39 1 GA b3 .065 .092 1.65 2.34 2 DR b4 .102 .135 2.59 3.43 4 DR b5 .102 .133 2.59 3.38 - c1 .017 .034 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO E .604 .625 15.35 15.87 4	MENTS TE AIN JRCE AIN
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	MENTS TE AIN URCE AIN
A2 .072 .084 1.83 2.13 LEAD ASSIGN b .041 .051 1.04 1.30 HEXFET b1 .041 .050 1.04 1.28 HEXFET b2 .065 .094 1.65 2.39 1 GA b3 .065 .092 1.65 2.34 2 DR b4 .102 .135 2.59 3.43 4 DR b5 .102 .133 2.59 3.88 IGBTs. CoP c1 .017 .035 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 co D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 co E .604 .625 15.35 15.87 4 HODES	MENTS TE AIN URCE AIN
b .041 .051 1.04 1.30 HEXFEI b1 .041 .050 1.04 1.28 HEXFEI b2 .065 .094 1.65 2.39 1 GA b3 .065 .092 1.65 2.34 2 DR b4 .102 .135 2.59 3.43 4 DR b5 .102 .133 2.59 3.38 IGBTs. COP c1 .017 .035 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO E .604 .625 15.35 15.87 4 E1	TE AIN URCE AIN
b1 .041 .050 1.04 1.28 HEXFET b2 .065 .094 1.65 2.39 1 GA b3 .065 .092 1.65 2.34 2 DR b4 .102 .135 2.59 3.43 4 DR b5 .102 .133 2.59 3.38 - c .017 .035 0.44 0.88 - c1 .017 .034 0.44 0.84 - - D .776 .795 19.71 20.20 4 2 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO D2 .020 .053 0.51 1.35 4 CO E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	TE AIN URCE AIN
b2 .065 .094 1.65 2.39 1 GA b3 .065 .092 1.65 2.34 2 DR b4 .102 .135 2.59 3.43 4 DR b5 .102 .133 2.59 3.38 4 DR c .017 .035 0.44 0.88 ICBTs, COP c1 .017 .034 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO 2 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO E .604 .625 15.35 15.87 4 DIODES	te Ain Urce Ain
b3 .065 .092 1.65 2.34 2 DR b4 .102 .135 2.59 3.43 4 DR b5 .102 .133 2.59 3.38 4 DR c .017 .035 0.44 0.88 IGBTs, CoP c1 .017 .034 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 co D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 co D2 .020 .053 0.51 1.35 4 co E .604 .625 15.35 15.87 4 DIODES E1 .530 - 13.46 - DIODES DIODES	ain Urce Ain
b4 .102 .135 2.59 3.43 3 SU b5 .102 .133 2.59 3.38 4 DR c .017 .035 0.44 0.88 IGBTs. CoP c1 .017 .034 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	AIN
b5 .102 .133 2.59 3.38 IGBTs, CoP c .017 .035 0.44 0.88 IGBTs, CoP c1 .017 .034 0.44 0.84 1 GAI D .776 .795 19.71 20.20 4 2 CO D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 CO E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	
c .017 .035 0.44 0.88 IGBTs, CoP c1 .017 .034 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 co D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 co E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	
c1 .017 .034 0.44 0.84 1 GA D .776 .795 19.71 20.20 4 2 co D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 co E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	ACK
D .776 .795 19.71 20.20 4 1 GA D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 co E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	 TC
D1 .515 - 13.08 - 5 3 EM D2 .020 .053 0.51 1.35 4 co E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	LLECTOR
D2 .020 .053 0.51 1.35 4 co E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	ITTER
E .604 .625 15.35 15.87 4 E1 .530 - 13.46 - DIODES	LECTOR
E1 .530 - 13.46 - DIODES	
E2 .178 .216 4.52 5.49 1 AN	DE/OPEN
e .215 BSC 5.46 BSC 3 AN	ODE
øk .010 0.25	
L .791 .823 20.10 20.90	
L1 .146 .169 3.71 4.29	
ØP .140 .144 3.56 3.66	
øP1 – .291 – 7.39	
Q .209 .224 5.31 5.69	
S .217 BSC 5.51 BSC	

TO-247AD Part Marking Information

SECTION C-C. D-D. E-E



TO-247AD package is not recommended for Surface Mount Application.

8 Downloaded from Arrow.com.

Qualification Information[†]

Qualification Level		Automotive					
		(per AEC-Q101) ^{††}					
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.					
Moisture Sensitivity Level		TO-247AD	O-247AD N/A				
			Class H1C (+/- 2000V)				
ESD Charged Device Model	AEC-Q101-001						
		Class C5 (+/- 2000V)					
	Charged Device Model	AEC-Q101-005					
RoHS C	Compliant Yes		Yes				

† Qualification standards can be found at International Rectifier's web site: <u>www.infineon.com</u>

the function of the second sec

Revision History

Date	Comments		
08/12/2020	 Updated datasheet with corporate template. 		
00/12/2020	 Update the Dimensions table and package outline drawing on page 8 		

Published by Infineon Technologies AG 81726 München, Germany © Infineon Technologies AG 2015 All Rights Reserved.

IMPORTANT NOTICE

The information given in this document shall in <u>no event</u> be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (<u>www.infineon.com</u>).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may <u>not</u> be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.