

INTELLIGENT POWER HIGH SIDE SWITCH

Features

- Over temperature shutdown (with auto-restart)
- Short circuit protection (current limit)
- Reverse battery protection (turns On the MOSFET)
- Full diagnostic capability (short circuit to battery)
- Active clamp
- Open load detection in On and Off state
- Ground loss protection
- Logic ground isolated from power ground
- ESD protection
- Lead Free and RoHS compliant

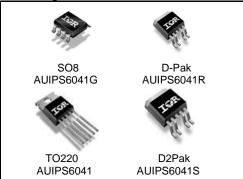
Description

The AUIPS6041(G)(R)(S) is a five terminal Intelligent Power Switch (IPS) for use in a high side configuration. It features short circuit, over-temperature, ESD protection, inductive load capability and diagnostic feedback. The output current is limited to the Ilim value. The current limitation is activated until the thermal protection acts. The over-temperature protection turns off the device if the junction temperature exceeds the Tshutdown value. It will automatically restart after the junction has cooled 7°C below the Tshutdown value. The reverse battery protection turns On the MOSFET. A diagnostic pin provides different voltage levels for each fault condition. The double level shifter circuitry will allow large offsets between the logic and load ground.

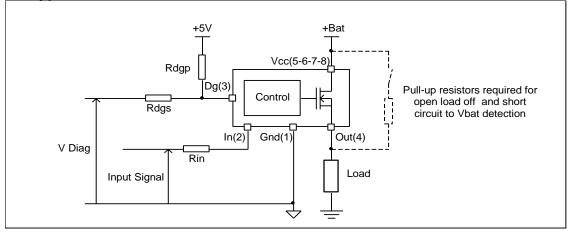
Product Summary

 $\begin{array}{ll} \text{Rds(on)} & 130\text{m}\Omega \text{ max.} \\ \text{Vclamp} & 39\text{V} \\ \text{I Limit} & 7\text{A} \\ \text{Open load} & 3\text{V} \, / \, 0.22\text{A} \end{array}$

Packages



Typical Connection





Qualification Information[†]

Qualifica	tion Level	Automotive (per AEC-Q100 ^{††}) Comments: This family of ICs has passed an Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher			
		Automotive level. D2PAK-5L	MSL1, 260°C		
Maiotura Canaitivitu Laval		TO-220	(per IPC/JEDEC J-STD-020) Not applicable (non-surface mount package style)		
Moisture	Sensitivity Level	DPAK-5L	MSL1, 260°C (per IPC/JEDEC J-STD-020)		
		SOIC-8L MSL2, 260°C (per IPC/JEDEC J-STD			
	Machine Model	Class M2 (- (per AEC-0			
ESD	Human Body Model	Class H1C (- (per AEC-0	,		
ESD	Charged Device Model (SOIC, DPAK,D2PAK)	(per AEC-0	Class C4 (+/-900V) *** (per AEC-Q100-011)		
	Charged Device Model (TO220)	Class C3B (+/-750V) *** (per AEC-Q100-011)			
IC Latch-		Class II, Level A (per AEC-Q100-004)			
RoHS Co	mpliant	Ye	es		

[†] Qualification standards can be found at International Rectifier's web site http://www.irf.com/

^{††} Exceptions to AEC-Q100 requirements are noted in the qualification report.

^{†††} Passing voltage level



Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters

are referenced to Ground lead. Tj= -40°C..150°C, Vcc=6..35V (unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
Vout	Maximum output voltage	Vcc-35	Vcc+0.3	
Voffset	Maximum logic ground to load ground offset	Vcc-35	Vcc+0.3	
Vin	Maximum input voltage	-0.3	5.5	V
Vcc max.	Maximum Vcc voltage	_	36	
Vcc cont.	Maximum continuous Vcc voltage	_	28	
lin max.	Maximum IN current	-3	10	mA
ldg max.	Maximum diagnostic output current	-3	10	ША
Vdg	Maximum diagnostic output voltage	-0.3	5.5	V
Pulse 2a max	Maximum voltage ISO pulse 2a x 500cy (ISO7637)	_	55	V
Pd	Maximum power dissipation (internally limited by thermal protection) Rth=100°C/W AUIPS6041G	_	1.25	W
	Rth=50°C/W AUIPS6041R 1"sqrt. footprint	_	2.5	• •
Tj max.	Max. storage & operating temperature junction temperature	-40	150	°C

Thermal Characteristics

Symbol	Parameter	Тур.	Max.	Units
Rth1	Thermal resistance junction to ambient AUIPS6041G	100	_	
Rth1	Thermal resistance junction to ambient AUIPS6041R D-Pak std. footprint	70	_	
Rth2	Thermal resistance junction to ambient AUIPS6041R D-Pak 1" sqrt. footprint	50	_	
Rth3	Thermal resistance junction to case AUIPS6041(R)(S) D-Pak/D2pak/TO220	6	_	°C/W
Rth1	Thermal resistance junction to ambient AUIPS6041(S) D2Pak/TO220 std. footprint	60	_	
Rth2	Thermal resistance junction to ambient AUIPS6041S D2Pak 1" sqrt. footprint	40	_	

Recommended Operating Conditions

These values are given for a quick design. For operation outside these conditions, please consult the application notes.

Symbol	Parameter	Min.	Max.	Units
VIH	High level input voltage	4	5.5	
VIL	Low level input voltage	0	0.9	
lout	Continuous drain current, Tambient=85°C, Tj=125°C, Vin=5V			
lout	Rth=100°C/W AUIPS6041G	_	1.6	Α
	Rth=50°C/W AUIPS6041R 1" sqrt. footprint	_	2.3	_ ^
Rin	Recommended resistor in series with IN pin	4	10	
Rdgs	Recommended resistor in series with DG pin for reverse battery protection	4	20	kΩ
Rdgp	Recommended pull-up resistor for DG	4	20	K22
Rol	Recommended pull-up resistor for open load detection	5	100	
F max.	Max. switching frequency	_	3.5	kHz



Static Electrical Characteristics

Tj=-40°C..150°C, Vcc=6..28V (unless otherwise specified), typical values are given for Vcc=14V and Tj=25°C

Symbol	Parameter	Min.	Тур.	Max.	Units	Test Conditions
	ON state resistance Tj=25°C	_	110	130		Vin=5V, lout=2.5A
	ON state resistance Tj=150°C	_	190	230		Vin=5V, lout=2.5A
Rds(on)	ON state resistance Tj=25°C, Vcc=6V	_	125	155	$m\Omega$	Vin=5V, lout=1.5A
	ON state resistance during reverse battery Tj=25°C	_	140	180		Vcc-Gnd=-14V
Vcc op.	Operating voltage range	6	_	28		
V clamp 1	Vcc to Out clamp voltage 1	37	39	43	V	lout=20mA
V clamp 2	Vcc to Out clamp voltage 2	_	40	_		lout=2.5A (see Fig. 1)
Icc Off	Supply current when Off and with Vout connected to ground Rconnection $<4\Omega$	_	4	9	μΑ	Vin=0V, Vout=0V, Tj=25°C, Vcc=14V
Icc On	Supply current when On	_	2.2	5	mA	Vin=5V, Vcc=14V
Vih	Input high threshold voltage	_	2.5	3		
Vil	Input low threshold voltage	1.5	2	_	V	
In hyst.	Input hysteresis	0.2	0.5	1		
lin On	Input current when device is On	_	40	100		Vin=5V
ldg	Dg leakage current	_	0.1	10	μA	Vdg=5V
Vdg	Low level DG voltage	_	0.25	0.4	V	ldg=1.6mA

Switching Electrical Characteristics

Vcc=14V, Resistive load=6Ω, Vin=5V, Tj=-40°C..150°C, typical values are given for Tj=25°C

Symbol	Parameter	Min.	Тур.	Max.	Units	Test Conditions
Tdon	Turn-on delay time	_	5	15		
Tr1	Rise time to Vout=Vcc-5V	_	3	10	μs	
Tr2	Rise time to Vout=0.9 x Vcc	_	4	30		
dV/dt (On)	Turn On dV/dt	_	2.5	_	V/µs	
EOn	Turn On energy	_	100	_	μJ	see Fig. 3
Tdoff	Turn-off delay time	_	10	20	110	
Tf	Fall time to Vout=0.1 x Vcc	_	3	10	μs	
dV/dt (Off)	Turn Off dV/dt	_	6.5	_	V/µs	
EOff	Turn Off energy		50	_	μJ	



Protection Characteristics

Tj=-40°C..150°C, Vcc=6..28V (unless otherwise specified), typical values are given for Vcc=14V and Tj=25°C

Symbol	Parameter	Min.	Тур.	Max.	Units	Test Conditions
Ilim	Internal current limit	4	7	10	Α	Vout=0V, Tj=25°C
Tsd+	Over temperature high threshold	150(1)	165	_	°C	See fig. 2
Tsd-	Over temperature low threshold	_	158	_	٥	See lig. 2
Vsc	Short-circuit detection voltage(2)	2	3	4		
UV+		_	5	6.2		
UV -		_	4.5	5.8	V	
VOL Off	Open load detection threshold	2	3	4		
I OL On	Open load detection threshold	0.05	0.17	0.27	Α	Tj=-4025°C
I TOLOII		0.05	0.15	0.22	_ ^	Tj=25150°C

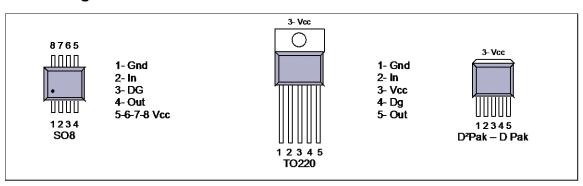
⁽¹⁾ Guaranteed by design

True Table

Operating Conditions	IN	OUT	DG
Normal	Н	Н	Н
Normal	L	L	Н
Open Load	Н	Н	L
Open Load (3)	L	Н	L
Short circuit to Gnd	Н	L	L
Short circuit to Gnd	L	L	Н
Short circuit to Vcc	Н	Н	L (4)
Short circuit to Vcc (5)	L	Н	L
Over-temperature	Н	Ĺ	Ĺ
Over-temperature	L	L	Н

⁽³⁾ With a pull-up resistor connected between the output and Vcc.

Lead Assignments



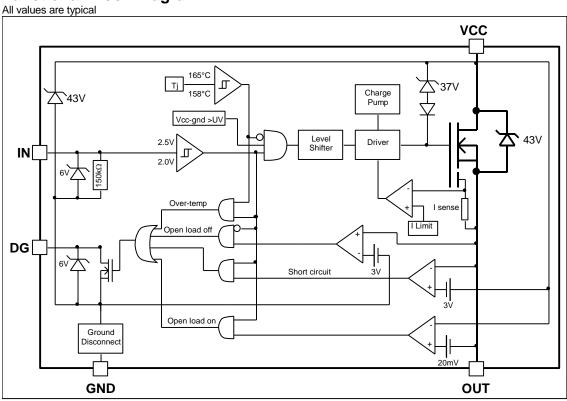
⁽²⁾ Reference to Vcc

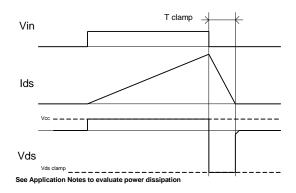
⁽⁴⁾ Vds lower than 10mV.

⁽⁵⁾ Without a pull-up resistor connected between the output and Vcc.



Functional Block Diagram



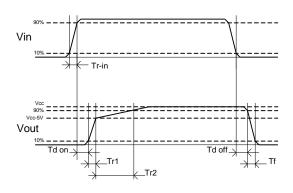


Vin lout limiting Thermal cycling

Ti Tsd+
TsdDG

Figure 1 - Active clamp waveforms

Figure 2 - Protection timing diagram



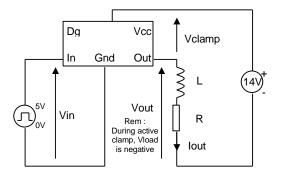


Figure 3 - Switching times definitions

Figure 4 - Active clamp test circuit

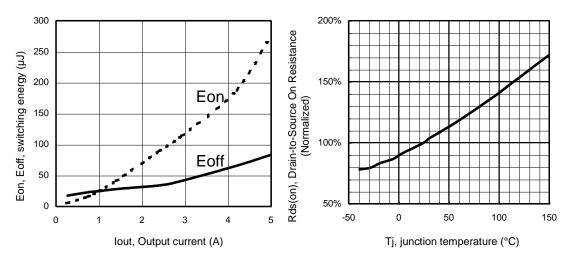


Figure 5 – Switching energy (µJ) Vs Output current (A)

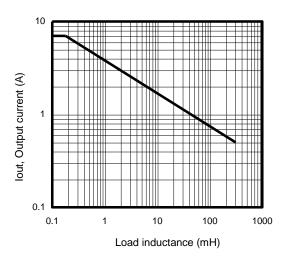


Figure 7 – Max. Output current (A) Vs Load inductance (mH)

Figure 6 - Normalized Rds(on) (%) Vs Tj (°C)

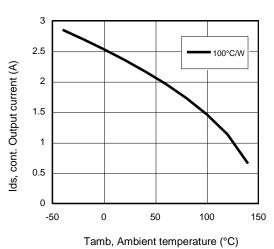
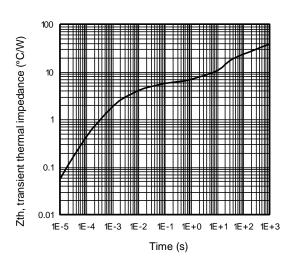


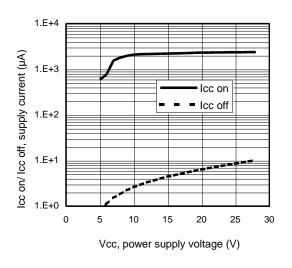
Figure 8 – Max. ouput current (A) Vs Ambient temperature (°C)



8
6
2
2
0
-50
0
50
100
Tj, junction temperature (°C)

Figure 9 – Transient thermal impedance (°C/W)
Vs time (s)

Figure 10 –I limit (A) Vs junction temperature (°C)



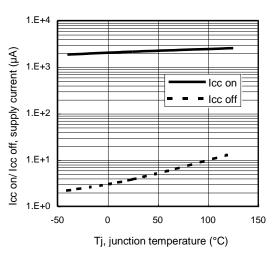


Figure 11 - Icc on/ Icc off (µA) Vs Vcc (V)*

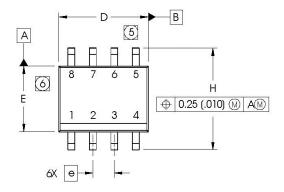
Figure 12 - Icc on/ Icc off (μA) Vs Tj (°C)*

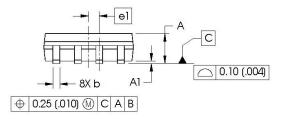
J

^{*}Vout connected to ground with R<4 Ω

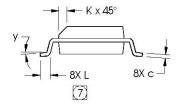
Case Outline - SO8

Dimensions are shown in millimeters (inches)



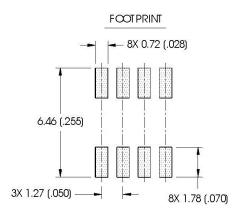


DIM	INCHES		MILLIMETERS		
DIIVI	MIN	MAX	MIN	MAX	
Α	.0532	.0688	1.35	1.75	
A1	.0040	.0098	0.10	0.25	
b	.013	.020	0.33	0.51	
С	.0075	.0098	0.19	0.25	
D	.189	.1968	4.80	5.00	
Е	.1497	.1574	3.80	4.00	
е	.050 B	ASIC	1.27 BASIC		
е1	.025 B	ASIC	0.635 BASIC		
Н	.2284	.2440	5.80	6.20	
Κ	.0099	.0196	0.25	0.50	
L	.016	.050	0.40	1.27	
У	0°	8°	0°	8°	

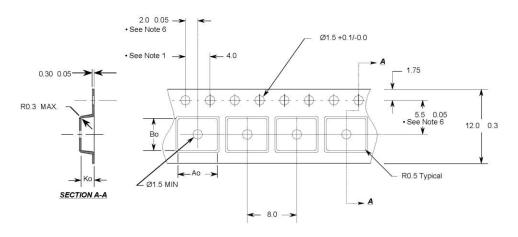


NOTES:

- 1. DIMENSIONING & TOLERANGING PER ASME Y14.5M-1994.
- 2. CONTROLLING DIMENSION: MILLIMETER
- 3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
- 4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- (5) DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 (.006).
- (6) DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.010).
- DIMENSION IS THE LENGTH OF LEAD FOR SOLDERINGTO A SUBSTRATE.



Tape & Reel - SO8



Notes:

- 1. 10 sprocket hole pitch cumulative tolerance 0.2
- 2. Camber not to exceed 1mm in 100mm
- Material: Black Conductive Advantek Polystyrene
 Ao and Bo measured on a plane 0.3mm above the
- 4. Ao and Bo measured on a plane 0.3mm above the bottom of the pocket
- Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
- Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

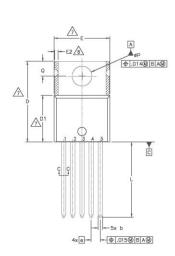
Ao = 6.4 mm

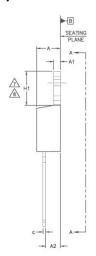
Bo = 5.2 mm

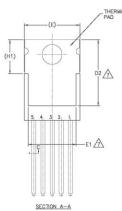
Ko = 2.1 mm

- All Dimensions in Millimeters -

Case Outline - TO220 (5 leads)







S	DIMENSIONS					
SYMBOL	MILLIME	TERS	INC	INCHES		
Ľ	MIN.	MAX.	MIN.	MAX.	OTES	
A	3.56	4.83	.140	.190	1	
A1	0.51	1.40	.020	.055		
A2	2.03	2.92	.080	.115		
ь	0.64	0.89	.025	.035		
b1	0.64	0.84	.025	.033	5	
c	0.36	0.61	.014	.024		
c1	0.36	0.56	.014	.022	5	
D	14.22	16.51	.560	.650	4	
D1	8.38	9.02	.330	.355		
D2	11.68	12.88	.460	.507	7	
E	9.65	10.67	.380	.420	4,7	
E1	6.86	8.89	.270	.350	7	
E2	-	0.76	-	.030	8	
e	1.70	BSC	.067 BSC		7	
H1	5.84	6.86	.230	.270	7,8	
L	12.70	14.73	.500	.580		
φP	3.53	3.73	.139	.147		
Q	2.54	3.05	.100	.120		

PLATING \	b BASE METAL
(c)	e1 5
	SECTION C=C

- NOTES:

 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M 1994.

 DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS).

 LEAD DIMENSION AND FINISH UNCONTROLLED IN 11.

 DIMENSION AND FINISH UNCONTROLLED IN 11.

 DIMENSION D. 11 & E DO NOT INCLIDE MOLD FLASH, MOLD FLASH SHALL NOT EXCEED, 0.05" (0.12") PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERWOST EXTREMES OF THE PLASTIC BOOY.

 DIMENSION IS & c. 1 APPLY TO BASE METAL ONLY.

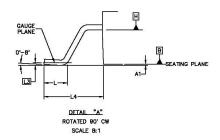
 CONTROLING DIMENSION IN KOMES.

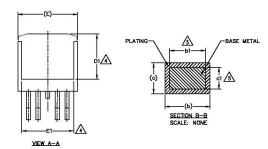
 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,HI.02 & E1.

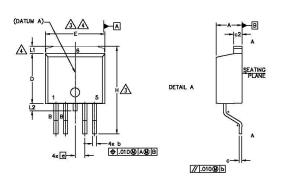
 PLINING FOR 22 H. IN DEFINIS A ZONE MEMERS STAMPHING.

- DIBENSION 22 X H1 DEFINE A ZONE MHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED. OUTLINE CONFORMS TO JEDEC TO –220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.
- 10.- LEADS AND DRAIN ARE PLATED WITH 100% Sn

Case Outline 5 Leads - D2PAK





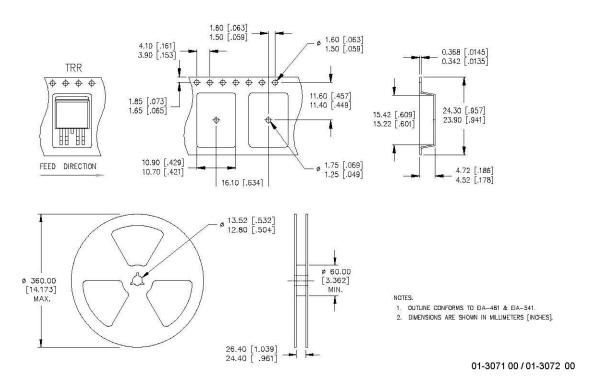


NOTES:

- 1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994
- 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- \$\timession d & e dd not include mold flash. Mold flash shall not exceed 0.127 [.005"] Per side. These dimensions are measured at the outmost extremes of the plastic body at datum h.
- 4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
- 5 DIMENSION 61 AND c1 APPLY TO BASE METAL ONLY.
- 6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- 7. CONTROLLING DIMENSION: INCH.
- 8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263BA.
- 9 LEADS AND DRAIN ARE PLATED : 100% Sn

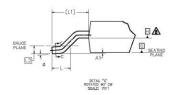
S Y M	DIMENSIONS					
B	МІШИ	IETERS	INC	INCHES		
Ĺ	MIN.	MAX.	MIN.	MAX.	NOTES	
A	4.06	4.83	.160	.190		
A1	=	0.254	=	.010		
ь	0.51	0.99	.020	.039	4	
b1	0.51	0.89	.020	.035		
c	0.38	0.74	.015	.029		
c1	0.38	0.58	.015	.023	4	
c2	1.14	1.65	.045	.065		
D	8.38	9.65	.330	.380	3	
D1	6.86	-	.270	_		
E	9.65	10.67	.380	.420	3	
E1	6.22	-	.245	-		
e	1.70	BSC	.067	BSC		
н	14.61	15.88	.575	.625		
L	1.78	2.79	.070	.110		
L1	-	1.68	=	.066		
L2	1-	1.78	-	.070		
L3	0.25	BSC	.010	BSC		
L4	4.78	5.28	.188	.208		

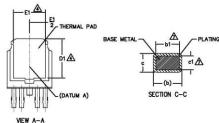
Tape & Reel 5 Leads - D2PAK

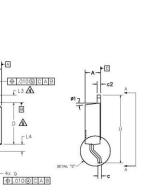




Case Outline 5 Leads - DPAK





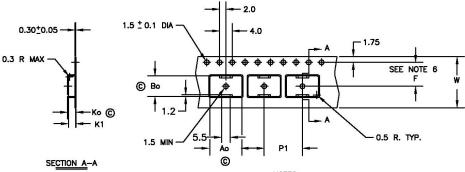


S	DIMENSIONS				
МВО	MILLIMETERS		INC	Ö	
L	MIN.	MAX.	MIN.	MAX.	Ė
Α	2.18	2.39	.086	.094	
A1	_	0.13	-	.005	
ь	0.56	0.79	.022	.031	
b1	.056	0.74	.022	.029	2
b2	0.65	0.89	.026	.035	
b3	4.95	5.46	.195	.215	2
c	0.46	0.61	.018	.024	
c1	0.41	0.56	.016	.022	2
c2	0.46	0.89	.018	.035	
D	5.97	6.22	.235	.245	3
D1	5.21	-	.205	-	
E	6.35	6.73	.250	.265	3
E1	4.32	_	.170	_	
e	1.14	BSC	.045	BSC	
Н	9.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 BSC		.108	REF.	
L2	0.51 BSC		.020	BSC	
L3	0.89	1.27	.035	.050	
L4	_	1.02	_	.040	
L5	1.14	1.52	.045	.060	
ø	0.	10°	0,	10°	
ø1	0.	15*	0.	15°	
ø2	28*	32*	28*	32*	

NOTES

- 1.- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994
- 2.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS].
- A- LEAD DIMENSION UNCONTROLLED IN L5.
- A- DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
- 5.— SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- A- DIMENSION 61 & c1 APPLIED TO BASE METAL ONLY.
- 8.- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- 9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252.
- 10. LEADS AND DRAIN ARE PLATED WITH 100% Sn

Tape & Reel 5 Leads - DPAK



Ao = 10.5 mm Bo = 7.0 mm Ko = 2.8 mm K1 = 2.4 mm F = 7.5 mm P1 = 12.0 mm 16.0 ± .3 mm

NOTES:

- 10 SPROCKET HOLE PUNCH CUMULATIVE TOLERANCE ±.02
 CAMBER NOT TO EXCEED 1mm IN 100mm
 MATERIAL: CONDUCTIVE BLACK POLYSTYRENE
 A6 AND B6 MEASURED ON A PLANE 0.3mm ABOVE THE
 BOTTOM OF THE POCKET
 K6 MEASURED FROM A PLANE ON THE INSIDE BOTTOM OF THE
 POCKET TO THE TOP SURFACE OF THE CARRIER
 POCKET POSITION RELATIVE TO THE SPROCKET HOLE MEASURED AS
 TRUE POSITION OF POCKET, NOT POCKET HOLE

- TRUE POSITION OF POCKET, NOT POCKET HOLE

 7. VENDOR: (OPTIONAL)

 8. MUST ALSO MEET REQUIREMENTS OF EIA STANDARD #EIA-481A,
 TAPING OF SURFACE-MOUNT COMPONENTS FOR AUTOMATIC
 PLACEMENT.

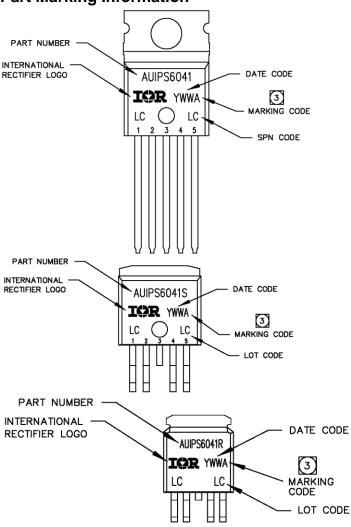
 9. TOLERANCE TO BE MANUFACTURER STANDARD

 10. SURFACE RESISTIVITY OF MOLDED MATL: MUST MEASURE
 LESS THAN OR EQUAL TO 10* OHMS PER SQUARE. MEASURED
 IN ACCORDANCE TO PROCEDURE GIVEN IN ASTM D-257 &
 ASTM D-991 (REF. C-9000 SPEC.)

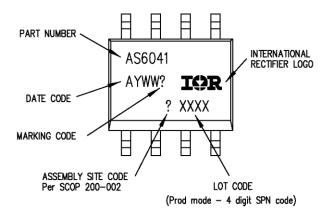
 11. TOTAL LENGTH PER REEL MUST BE 79 METERS
- 12. C CRITICAL DIMENSION



Part Marking Information







Ordering Information

Base Part Number		Standard Pack			
base Fait Number	Package Type	Form	Quantity	Complete Part Number	
AUIPS6041	TO220-5-Leads	Tube	50	AUIPS6041	
		Tube	50	AUIPS6041S	
AUIPS6041S	D2-Pak-5-Leads	Tape and reel left	800	AUIPS6041STRL	
		Tape and reel right	800	AUIPS6041STRR	
	D-Pak-5-Leads	Tube	75	AUIPS6041R	
AUIPS6041R		Tape and reel	2000	AUIPS6041RTR	
AUIPS004TR		Tape and reel left	3000	AUIPS6041RTRL	
		Tape and reel right	3000	AUIPS6041RTRR	
AUIPS6041G	SOIC-8	Tube	95	AUIPS6041G	
AUIF30041G		Tape and reel	2500	AUIPS6041GTR	



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AUIPS6041(G)(R)(S)

Revision History

Revision	Date	Notes/Changes
С	Februrary, 28th 2009	AU number update
D	March, 14th 2011	AU release
F	May 15, 2012	Add the test condition for the ICC (off) parameters
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单击下面可查看定价,库存,交付和生命周期等信息

>>Infineon Technologies(英飞凌)