

PROTECTED HIGH SIDE SWITCH

Features

- Over temperature shutdown (with auto-restart)
- Short circuit protection (current limit)
- Active clamp
- Open load detection
- Logic ground isolated from power ground
- ESD protection
- Ground loss protection
- Status feedback

Product Summary

$R_{ds(on)}$	110m Ω max.
V_{clamp}	70V
I Limit	5A
Open load	3V

Description

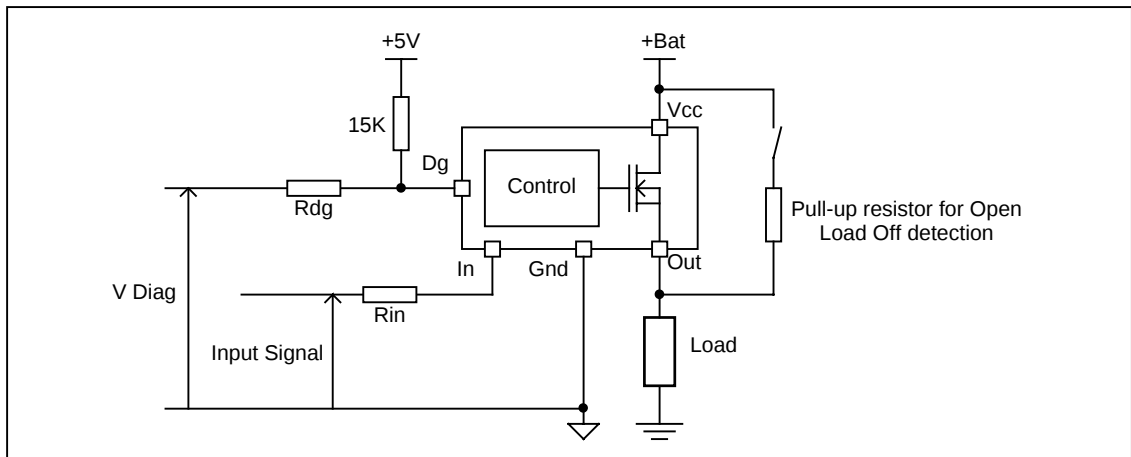
The IPS7071GPbF is a fully protected five terminal high side switch with built in short circuit, over-temperature, ESD protection, inductive load capability and diagnostic feedback. The output current is limited at I_{lim} value. Current limitation is activated until the thermal protection acts. The over-temperature protection turns off the device if the junction temperature exceeds $T_{shutdown}$. It will automatically restart after the junction has cooled 7°C below $T_{shutdown}$. A diagnostic pin is provided for status feedback of short circuit, over-temperature and open load detection. The double level shifter circuitry allows large offsets between the logic ground and the load.

Package



SO8
IPS7071GPbF

Typical Connection



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. (Tambient=25°C unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
Vout	Maximum output voltage	Vcc-65	Vcc+0.3	V
Voffset	Maximum logic ground to load ground offset	Vcc-65	Vcc+0.3	
Vin	Maximum input voltage	-0.3	5.5	
Vcc max.	Maximum Vcc voltage	—	65	
Vcc cont.	Maximum continuous Vcc voltage	—	35	
Iin max.	Maximum IN current	-1	10	mA
I _{dg} max.	Maximum diagnostic output current	-1	10	
V _{dg}	Maximum diagnostic output voltage	-0.3	5.5	V
P _d	Maximum power dissipation (internally limited by thermal protection) R _{th} =100°C/W	—	1.25	W
I _{sd} cont.	Maximum continuous diode current (R _{th} =100°C/W)	—	1.8	A
ESD1	Electrostatic discharge voltage (Human body) 100pF, 1500Ω	—	4	kV
ESD2	Electrostatic discharge voltage (Machine Model) C=200pF, R=0Ω, L=10μH	—	0.5	
T _j max.	Max. storage & operating temperature junction temperature	-40	+150	°C

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
R _{th1}	Thermal resistance junction to ambient IPS7071G	100	—	°C/W

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
V _{IH}	High level input voltage	4	5.5	
V _{IL}	Low level input voltage	-0.3	0.9	
I _{out}	Continuous drain current, T _{amb} =85°C, T _j =125°C, V _{in} =5V, R _{th} =100°C/W	—	1.5	A
R _{in}	Recommended resistor in series with IN pin	4	10	kΩ
R _{dgs}	Recommended resistor in series with DG pin	10	20	
R _{ol}	Recommended pull-up resistor for open load detection	5	100	

Static Electrical Characteristics

 $T_J=25^{\circ}\text{C}$, $V_{CC}=14\text{V}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Rds(on)	ON state resistance $T_J=25^{\circ}\text{C}$	—	80	110	m Ω	$V_{in}=5\text{V}$, $I_{out}=2.5\text{A}$
	ON state resistance $T_J=150^{\circ}\text{C}$ (1)	—	130	175		$V_{in}=5\text{V}$, $I_{out}=2.5\text{A}$
	ON state resistance $T_J=25^{\circ}\text{C}$, $V_{CC}=6.5\text{V}$	—	90	120		$V_{in}=5\text{V}$, $I_{out}=2.5\text{A}$
Vcc op.	Operating voltage range	6	—	35	V	
V clamp 1	Vcc to Out clamp voltage 1	65	70	—		$I_{out}=10\text{mA}$ (see Fig. 1)
V clamp 2	Vcc to Out clamp voltage 2 (1)	—	70	75		$I_{out}=1\text{A}$ (see Fig. 1)
Vf	Body diode forward voltage	—	1	1.35		$I_{out}=2.5\text{A}$
Icc Off	Supply current when Off	—	2.5	10	μA	$V_{in}=0\text{V}$, $V_{out}=0\text{V}$
Icc On	Supply current when On	—	2.5	3.5	mA	$V_{in}=5\text{V}$
Iout@0V	Output leakage current	—	1.1	10	μA	$V_{out}=0\text{V}$
Iout@6V	Output leakage current	—	20	—		$V_{out}=6\text{V}$
I _{dg} leakage	Diagnostic output leakage current	—	—	10		$V_{dg}=5.5\text{V}$
V _{dgl}	Low level diagnostic output voltage	—	0.2	0.3	V	$I_{dg}=1.6\text{mA}$
V _{ih}	Input high threshold voltage	—	2.5	3.5		
V _{il}	Input low threshold voltage	1	2	—		
I _{n hys}	Input hysteresis	0.15	0.4	1		
UV high	Under voltage high threshold voltage	—	5	5.9		
UV low	Under voltage low threshold voltage	3.4	4.5	—		
UV hys	Undervoltage hysteresis	0.1	0.8	1.5		
I _{in} On	Input current when device is On	—	40	80	μA	$V_{in}=5\text{V}$

(1) Guaranteed by design

Switching Electrical Characteristics

 $V_{CC}=14\text{V}$, Resistive load= 14Ω , $V_{in}=5\text{V}$, $T_J=25^{\circ}\text{C}$

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Tdon	Turn-on delay time	—	11	35	μs	See Fig. 3
Tr1	Rise time to $V_{out}=V_{CC}-5\text{V}$	—	7	40		
Tr2	Rise time to $V_{out}=0.9 \times V_{CC}$	—	15	50		
dV/dt (On)	Turn On dV/dt	—	1.3	4	$\text{V}/\mu\text{s}$	
EOn	Turn On energy	—	75	—	μJ	
Tdoff	Turn-off delay time	—	23	45	μs	
Tf	Fall time to $V_{out}=0.1 \times V_{CC}$	—	6	25	μs	
dV/dt (Off)	Turn Off dV/dt	—	2	6	$\text{V}/\mu\text{s}$	
EOff	Turn Off energy	—	25	—	μJ	See Fig. 4 and Fig. 12
Tdiag	Vout to Vdiag propagation delay	—	15	—	μs	

Protection Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Ilim	Internal current limit (2)	2	5	9	A	Vout=0V
Tsd+	Over temperature high threshold	150(2)	165	—	°C	See Fig. 2
Tsd-	Over temperature low threshold	—	158	—		
Vsc	Short-circuit detection voltage(3)	2	3	4	V	
Vopen load	Open load detection threshold	2	3	4		

(2) Guaranteed by design

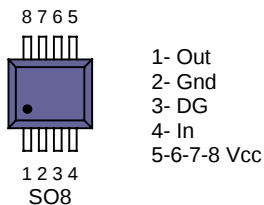
(3) Reference to Vcc

Truth Table

Operating Conditions	IN	OUT	DG pin
Normal	H	H	H
Normal	L	L	L
Open Load	H	H	H
Open Load ⁽³⁾	L	H	H
Short circuit to Gnd	H	L (limiting)	L
Short circuit to Gnd	L	L	L
Over-temperature	H	L (cycling)	L
Over-temperature	L	L	L

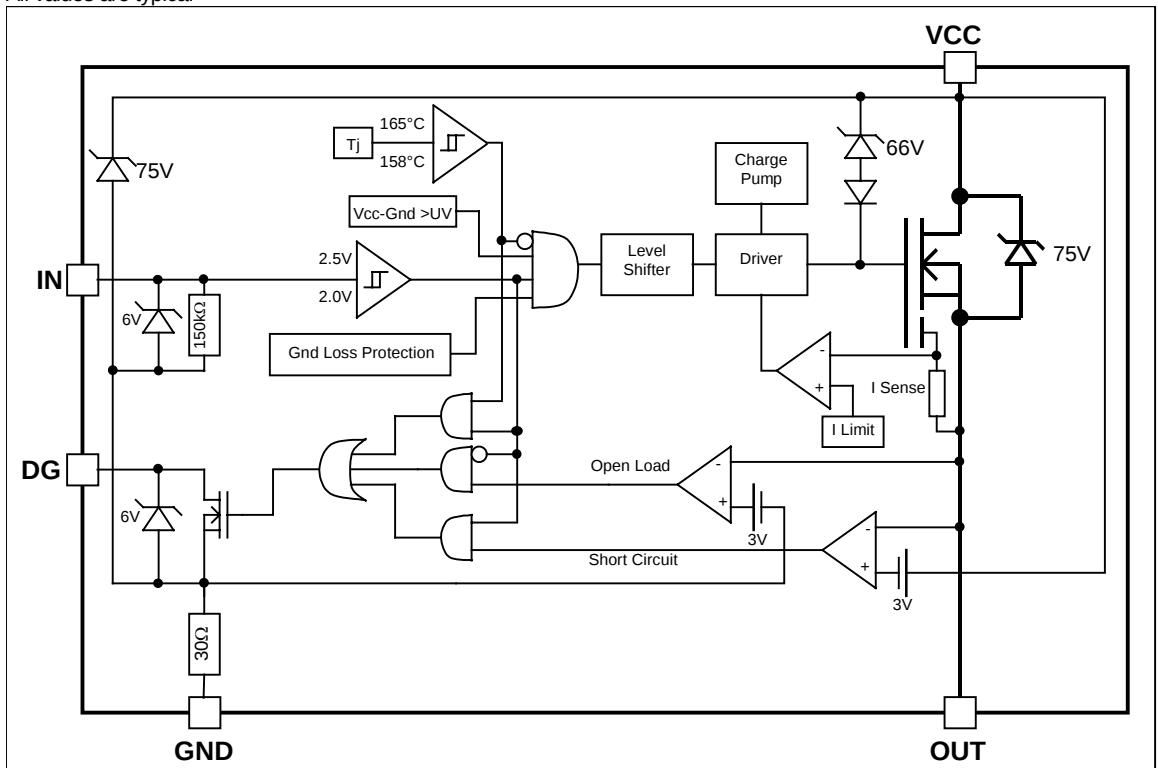
⁽³⁾ With a pull-up resistor connected between the output and Vcc.

Lead Assignments



Functional Block Diagram

All values are typical



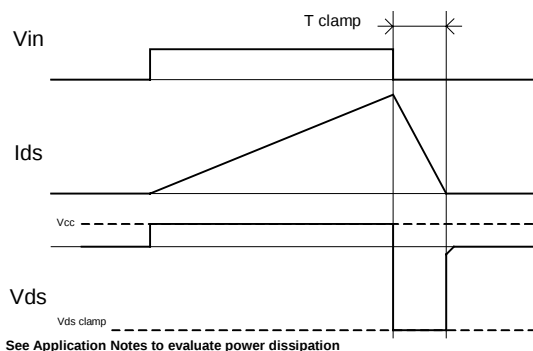


Figure 1 – Active clamp waveforms

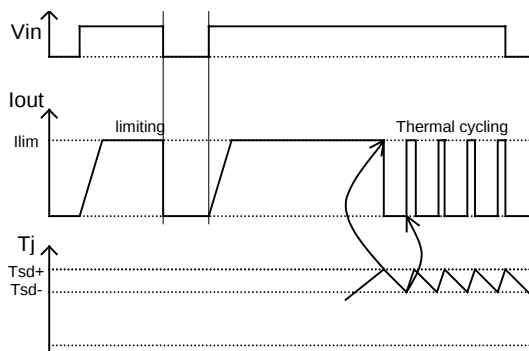


Figure 2 – Protection timing diagram

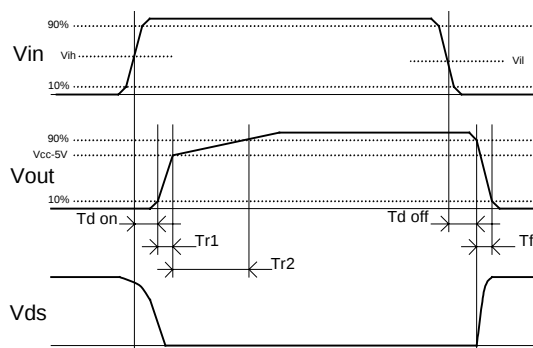


Figure 3 – Switching times definition

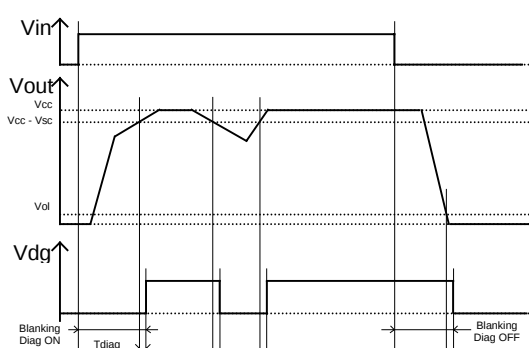


Figure 4 – Diagnostic delay definition

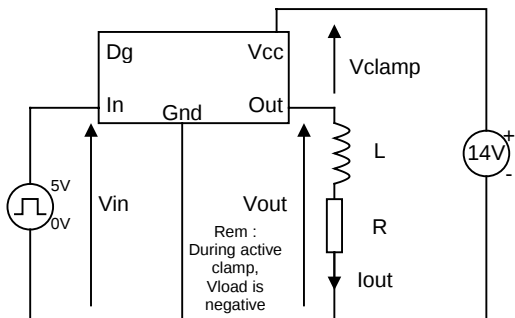


Figure 5 – Active clamp test circuit

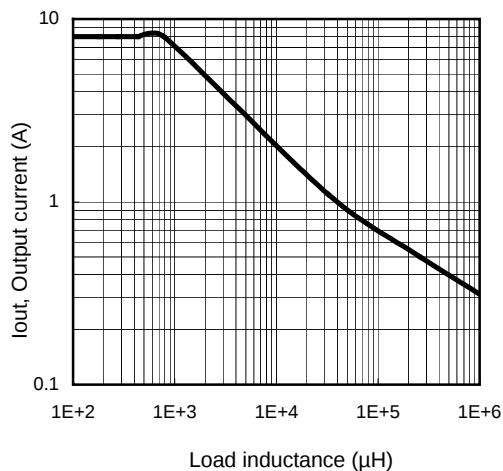


Figure 6 – Max. Output current (A) Vs Load inductance (μH)

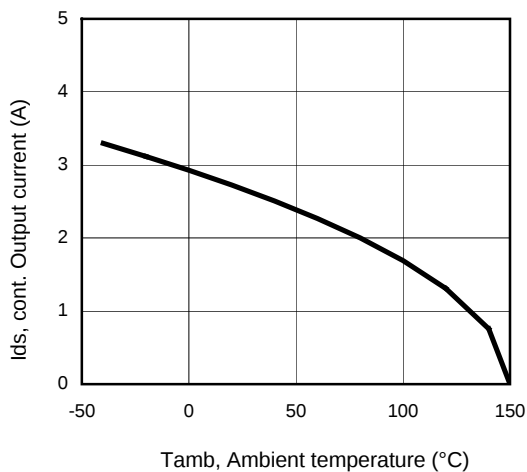


Figure 7 – Max. output current (A) Vs Ambient temperature (°C)

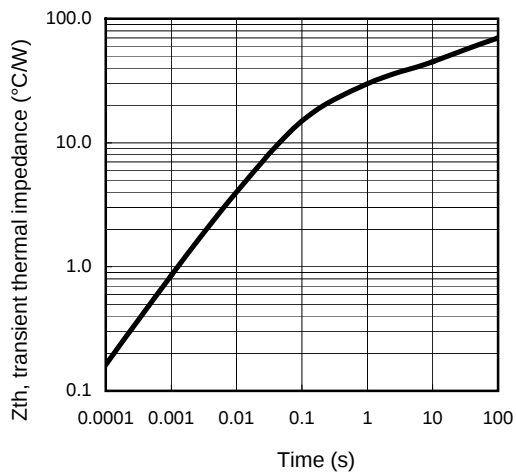
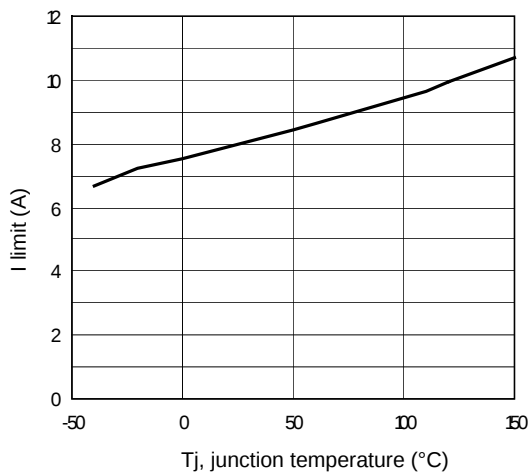
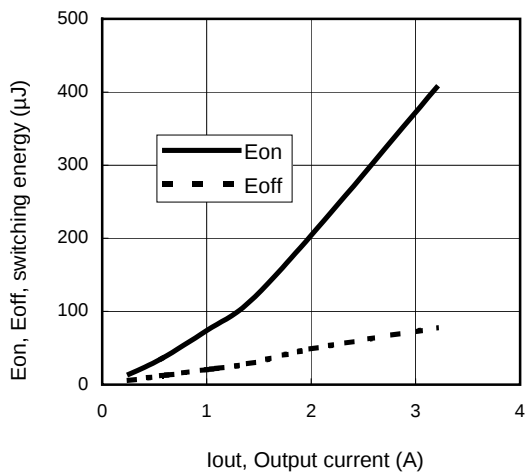


Figure 8 – Transient thermal impedance (°C/W) Vs time (s)



**Figure 9 – I limit (A)
Vs junction temperature (°C)**



**Figure 10 – Switching energy (μJ)
Vs Output current (A)**

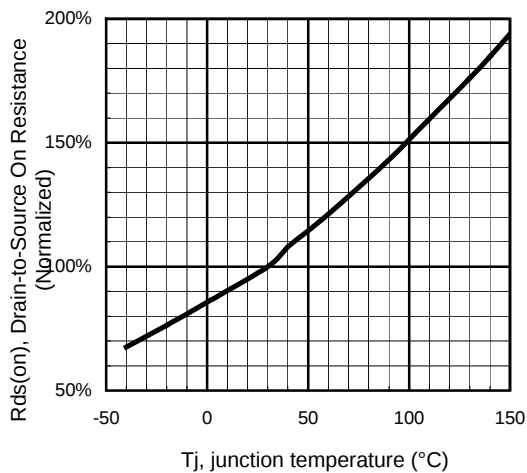
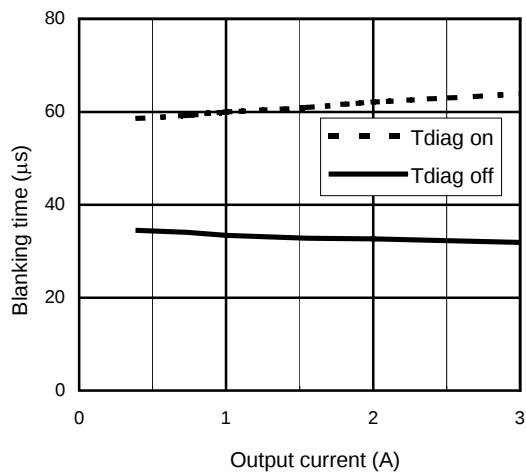


Figure 11 - Normalized Rds(on) (%) Vs Tj (°C)



**Figure 12 – Diagnosis Blanking time (μs)
Vs Output current (A)**

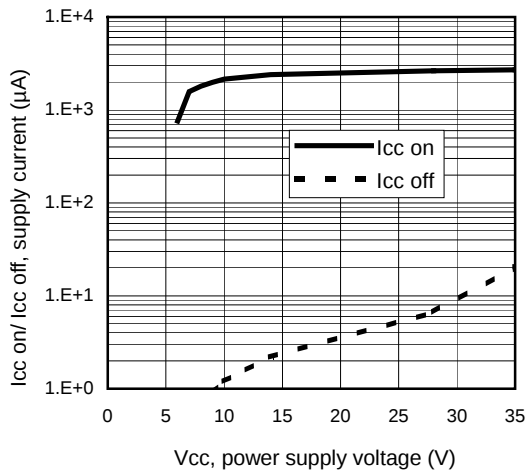


Figure 13 – Icc on/ Icc off (μA) Vs Vcc (V)

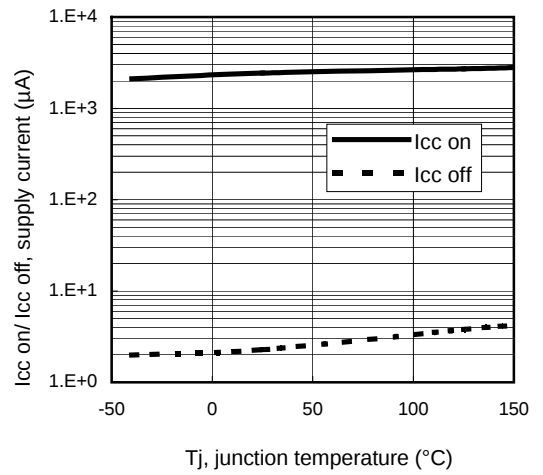
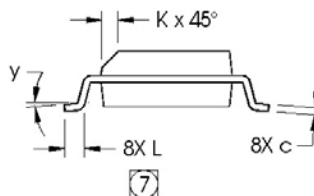
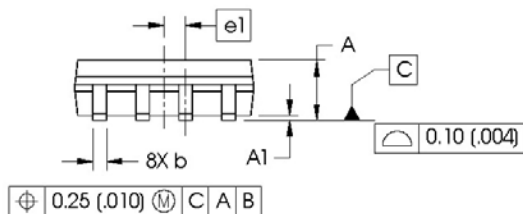
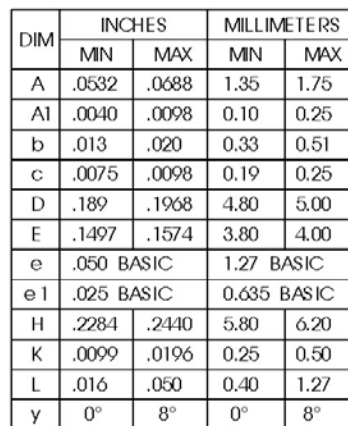


Figure 14 – Icc on/ Icc off (μA) Vs Tj (°C)

Dimensions are shown in millimeters (inches)



FOOTPRINT

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The drawing shows a mechanical component with a side view and a cross-section labeled SECTION A-A.

Side View Dimensions:

- Total width: 8.0
- Distance from left edge to center of first hole: 2.0 ± 0.05 (See Note 6)
- Distance between centers of adjacent holes: 4.0
- Hole diameter: Ø1.5 +0.1/-0.0
- Overall height: 12.0 ± 0.3
- Distance from top surface to center of holes: 5.5 ± 0.05 (See Note 6)
- Bottom flange thickness: 0.3
- Radius at bottom corners: R0.5 Typical
- Section line A-A passes through the center of the holes.

Cross-Section A-A Details:

- Top flange thickness: 1.75
- Inner bore diameter: Ø1.5 MIN
- Outer bore diameter: Bo
- Distance from outer bore centerline to inner bore centerline: Ao
- Distance from outer bore centerline to right edge: Ko
- Top fillet radius: R0.3 MAX.
- Bottom fillet radius: R0.5 Typical

- All Dimensions in Millimeters -

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Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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