



DESCRIPTION

PT2N501B is a 2A/500V advanced IPM based on Fast-Recovery MOSFET technology as a compact inverter solution for small power motor drive applications, such as fans and pumps. PT2N501B contains two MOSFETs, a half-bridge gate drive HVIC in a compact package fully isolated and optimized for thermal performance without a heat sink. PT2N501B offers a combination of low RDS(on) Trench MOSFET and the industry benchmark half-bridge high voltage, rugged driver in a small PQFN package. At only 8x9mm and featuring integrated bootstrap functionality, the compact footprint of this surface mount package makes it suitable for applications that are space-constrained.

描述

PT2N501B 是 2A/500V 基于快恢复 MOSFET 技术，为小功率电机驱动应用（如风扇和水泵）提供紧凑型逆变解决方案。PT2N501B 由 2 个 MOSFET，1 个 HVIC 组成紧凑高绝缘并具有优化的热性能，且不需要额外散热片。PT2N501B 通过优化开关速度和减小寄生电感实现低电磁干扰（EMI）特性集成在小型 8x9mm PQFN 封装内。这种表面安装封装的紧凑的占位面积使其适合空间有限的应用。

FEATURES

- Integrated gate drivers
- Suitable for sinusoidal or trapezoidal modulation
- Low RDS(on) Trench MOSFET
- Under-voltage lockout for both channels
- Matched propagation delay for all channels
- Optimized dV/dt for loss and EMI trade offs
- 3.3V input logic compatible
- Active high HIN and LIN
- Isolation 1500VRMS m

APPLICATIONS

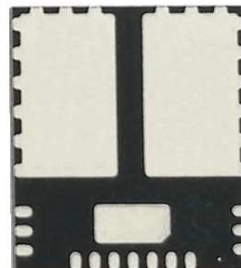
- Small power AC motor

主要特点

- 内置半桥驱动芯片
- 适用于正弦波或梯形波调制应用
- 低导通电阻的沟槽栅 MOSFET
- 双通道欠压保护
- 所有通道延迟时间匹配
- 优化的 dV/dt 和 EMI 特性
- 输入正逻辑
- 绝缘电压 1500VRMS min
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应用

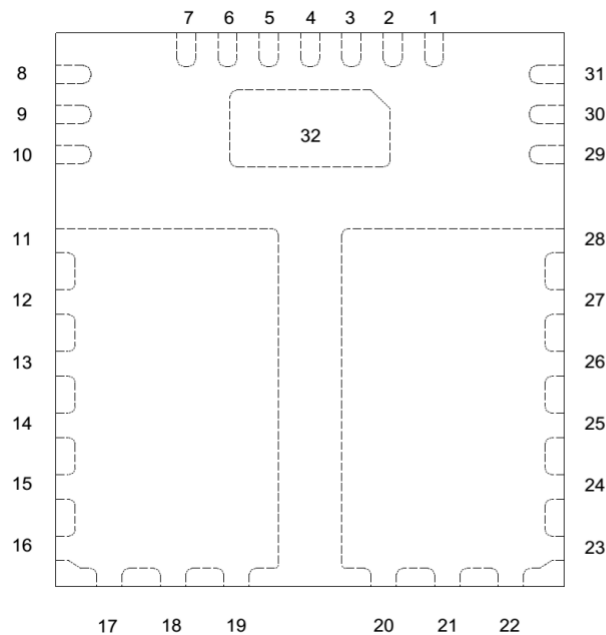
- 小功率电机





引脚描述/PIN DESCRIPTIONS

引脚号 /Pin Number	引脚名 /Pin Name	引脚描述 /Pin Description
1, 4, 7, 32	COM	IC 公共电源接地 IC Common Supply Ground
2	VCC	低端 MOSFET 驱动的偏压 Bias Voltage for IC and Low Side MOSFET Driving
3	HIN	高端的信号输入 Signal Input for High-Side
5	LIN	低端的信号输入 Signal Input for Low-Side
6	N.C	无连接 N.C
8, 9, 10	VSS	直流输入负端 Negative DC-Link Input
11-19	VO	相输出 Phase Output
20-28	VDD	直流输入正端 Positive DC-Link Input
29, 30	VO2	高端 MOSFET 驱动的偏压接地输出 Output for & Bias Voltage Ground for High Side MOSFET Driving
31	VB	相高端 MOSFET 驱动的偏压 Bias Voltage for High Side MOSFET Driving



Top view

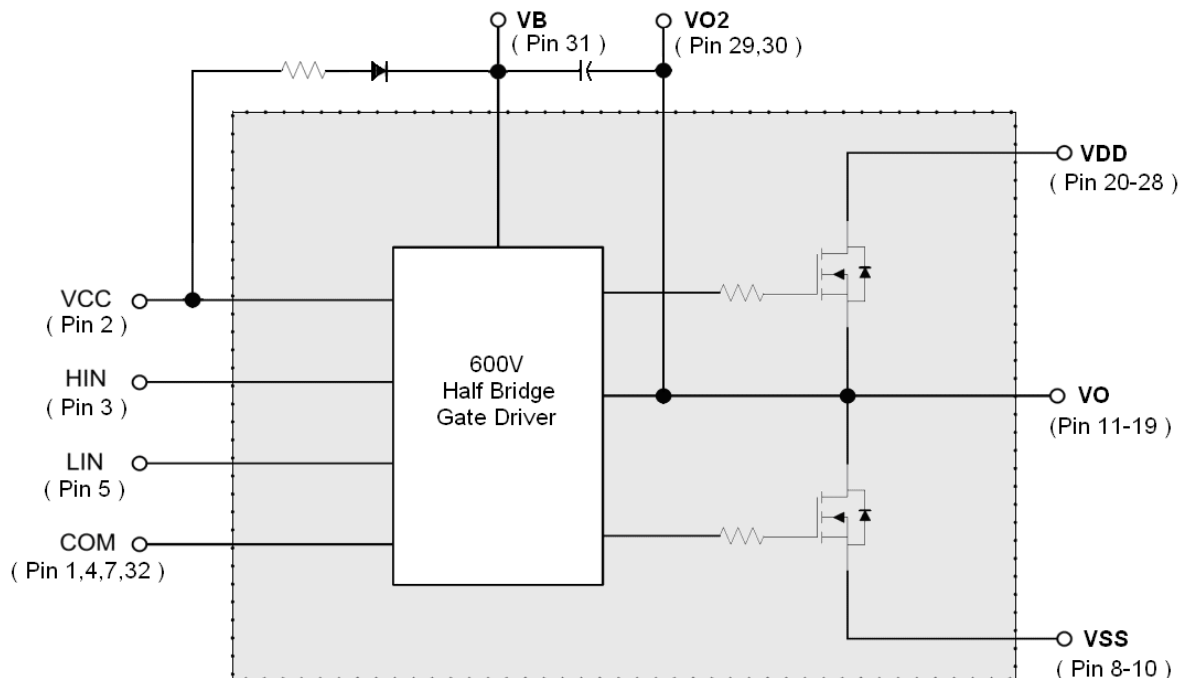
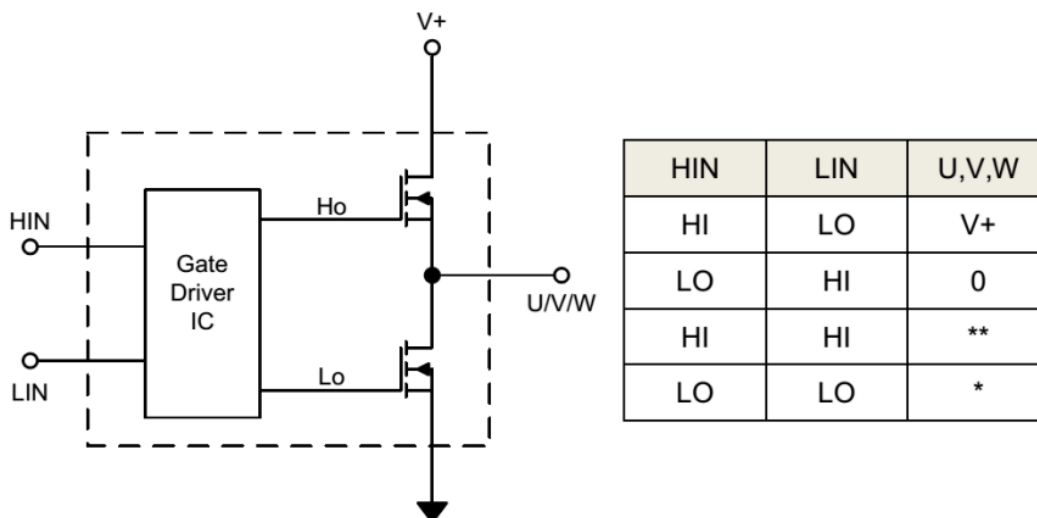


图 1. 引脚布局 and 内部框图
Figure 1. Pin Configuration and Internal Block Diagram

輸入輸出邏輯表 / INPUT OUTPUT LOGIC TABLE



Note : * V+ if motor current is flowing into VS, 0 if current is flowing out of VS into the motor winding
 ** Anti shoot-through protection active (LO, HO are switched off)



推荐工作条件 / RECOMMENDED OPERATING CONDITION

符号 /Symbol	参数 /Parameter	工作条件 /Conditions	最小值 /Min	典型值 /Typ	最大值 /Max	单位 /Unit
V_{PN}	电源电压 Supply Voltage	施加在 VDD 和 VSS 之间 Applied Between VDD and VSS	-	300	400	V
V_{CC}	控制电源电压 Control Supply Voltage	施加在 VCC 和 COM 之间 Applied Between VCC and COM	12	15	16.5	V
V_{BS}	高端偏压 High-Side Bias Voltage	施加在 VB 和 VO2 之间 Applied Between V_B and V_S	12	15	16.5	V
$V_{IN(ON)}$	输入导通阈值电压 Input ON Threshold Voltage	施加在 HIN, LIN 和 COM 之间 Applied Between HIN, LIN and COM	3.0	-	V_{CC}	V
$V_{IN(OFF)}$	输入关断阈值电压 Input OFF Threshold Voltage		0	-	0.6	V
t_{dead}	防止桥臂直通的死区时间 Blanking Time for Preventing Arm-Short	$V_{CC} = 13.5 \sim 16.5 \text{ V}$, $T_J \leq 150^\circ\text{C}$	1	-	-	us
f_{PWM}	PWM 开关频率 PWM Switching Frequency	$T_J \leq 150^\circ\text{C}$	-	15	20	kHz

电气特性/ELECTRICAL CHARACTERISTICS

逆变器部分(单个 MOSFET, 除非另有说明)

/Inverter Part (Each MOSFET Unless Otherwise Specified)

($T_J = 25^\circ\text{C}$, $V_{CC} = 15 \text{ V}$, 除非另有说明) / ($T_J = 25^\circ\text{C}$, $V_{CC} = 15 \text{ V}$ Unless Otherwise Specified)

符号 /Symbol	参数 /Parameter	工作条件 /Conditions	最小值 /Min	典型值 /Typ	最大值 /Max	单位 /Unit
BV_{DSS}	漏极-源极击穿电压 Drain-Source Break down Voltage	$V_{IN} = 0 \text{ V}$, $I_D = 1 \text{ mA}$ (Note 1)	500	-	-	V
I_{DSS}	零栅极电压漏极电流 Zero Gate Voltage Drain Current	$V_{IN} = 0 \text{ V}$, $V_{DS} = 500 \text{ V}$	-	10	-	uA
$R_{DS(on)}$	漏极-源极静态导通电阻 Static Drain-Source On-Resistance	$V_{CC} = 15 \text{ V}$, $V_{IN} = 5 \text{ V}$, $I_D = 1.2 \text{ A}$	-	3	3.5	Ω
V_{SD}	漏极-源极二极管正向导通电压 Drain-Source Diode Forward Voltage	$V_{CC} = 15 \text{ V}$, $V_{IN} = 0 \text{ V}$, $I_D = -1.2 \text{ A}$	-	0.8	1.2	V
t_{ON}	开关时间 Switching Times	$V_{PN} = 300 \text{ V}$, $V_{CC} = 15 \text{ V}$, $I_D = 1.2 \text{ A}$ $V_{IN} = 0 \text{ V} \leftrightarrow 5 \text{ V}$, 电感负载 / Inductive Load $L = 3 \text{ mH}$, 高端和低端 MOSFET 开关(注 2) / High- and Low-Side MOSFET Switching(Note 2)	-	400	-	ns
t_{OFF}			-	450	-	ns
t_{rr}			-	40	-	ns
E_{ON}			-	12	-	uJ
E_{OFF}			-	9	-	uJ
D_T	内置死区时间 Built-in Dead Time	$V_{CC} = 13.5 \sim 16.5 \text{ V}$, $T_J \leq 150^\circ\text{C}$	-	300	-	nS
$T_{FIL,IN}$	输入滤波时间 Input Filter Time(HIN,LIN)	$V_{CC} = 13.5 \sim 16.5 \text{ V}$, $T_J \leq 150^\circ\text{C}$	-	300	-	nS
RBSOA	反向偏压安全工作区 Reverse-Bias Safe Operating Area	$V_{PN} = 400 \text{ V}$, $V_{CC} = 15 \text{ V}$, $I_D = I_{DP}$, $V_{DS} = BV_{DSS}$, $T_J = 150^\circ\text{C}$, 高端和低端 MOSFET 开关(注 3) / High- and Low-Side MOSFET Switching (Note 3)	整个区域 Full Square			



控制部分(单个HVIC，除非另有说明)

/Control Part(Each HVIC Unless Otherwise Specified)

符号 /Symbol	参数 /Parameter	工作条件 /Conditions		最小值 /Min	典型值 /Typ	最大值 /Max	单位 /Unit
I _{QCC}	V _{CC} 静态电流 Quiescent V _{CC} Current	V _{CC} =15 V, V _{IN} =0V	施加在 V _{CC} 和 COM 之间 Applied Between V _{CC} and COM	-	180	250	uA
I _{QBS}	V _{BS} 静态电流 Quiescent V _{BS} Current	V _{CC} =15 V, V _{IN} =0V	施加在 V _B ,V _{O2} Applied Between V _B , V _{O2}	-	50	85	uA
UV _{CCD}	低端欠压保护 Low-Side Under voltage Protection	V _{CC} 欠压保护检测电平 V _{CC} Under voltage Protection Detection Level		7.7	8.6	9.5	V
UV _{CCR}		V _{CC} 欠压保护复位电平 V _{CC} Under voltage Protection Reset Level		7.2	8.1	9.0	V
UV _{BSD}	高端欠压保护 High-Side Under voltage Protection	V _{BS} 欠压保护检测电平 V _{BS} Under voltage Protection Detection Level		6.6	7.8	9.0	V
UV _{BSR}		V _{BS} 欠压保护复位电平 V _{BS} Under voltage Protection Reset Level		6.0	7.2	8.4	V
V _{IH}	导通阈值电压 ON Threshold Voltage	逻辑高电平 Logic High Level	施加在 V _{IN} 和 COM 之间 Applied between IN and COM	-	-	2.5	V
V _{IL}	关断阈值电压 OFF Threshold Voltage	逻辑低电平 Logic Low Level		0.8	-	-	V
IN+	输入偏置电流 V _{IN} =5V Input Bias Current V _{IN} =5V	施加在 V _{IN} 和 COM 之间 Applied between IN and COM		-	50	70	uA
IN-	输入偏置电流 V _{IN} =0V Input Bias Current V _{IN} =0V			-	0	1	uA

注/Note:

- BV_{DSS} 是 IPM 产品中单个 MOSFET 的漏极和源极端子之间的绝对最大额定电压。考虑到寄生电感， V_{PN} 应远低于该值，因此 V_{PN} 在任何情况下不得超过 BV_{DSS} 。
 BV_{DSS} is the Absolute Maximum Voltage Rating Between Drain and Source Terminal of Each MOSFET Inside IPM. V_{PN} Should be Sufficiently Less Than This Value Considering the Effect of the Stray Inductance so that V_{DS} Should Not Exceed BV_{DSS} in Any Case.
- t_{ON} 和 t_{OFF} 包括内部驱动 IC 的传输延迟。所列出的数值是在实验室条件下测得，在实际应用中因为印刷电路板和布线的差异，数值也会有所不同。
 t_{ON} and t_{OFF} Include the Propagation Delay Time of the Internal Drive IC. Listed Values are Measured at the Laboratory Test Condition, and They Can be Different According to the Field Applications Due to the Effect of Different Printed Circuit Boards and Wirings.
- 每个 MOSFET 在开关工作时的峰值电流和电压也应在安全工作区 (SOA) 的范围内。
The peak current and voltage of each MOSFET during the switching operation should be included in the safe operating area (SOA).

参考波型 / REFERENCE FIGURES

开关时间 / Switching Time

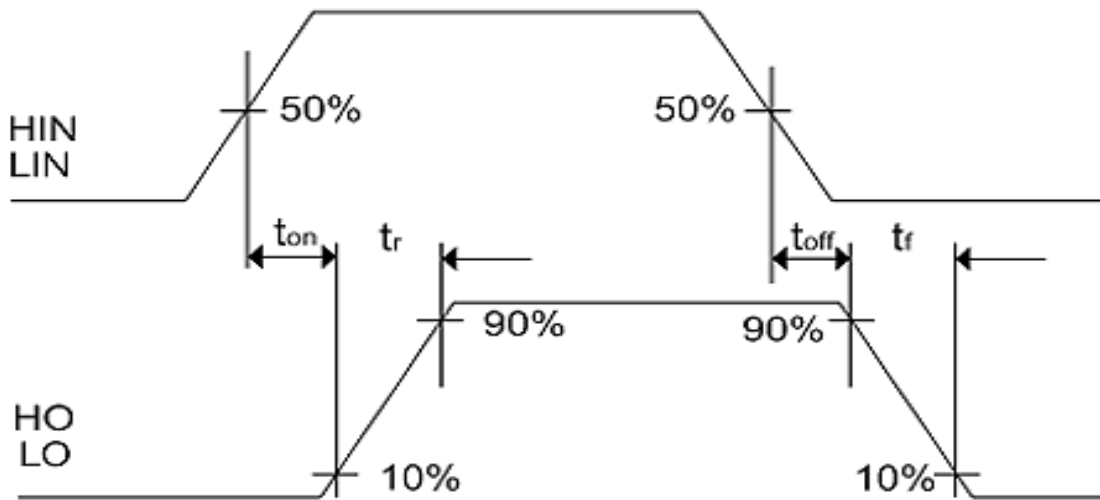


图 2. 开关时间定义
Figure 2. Switching Time Definitions

欠压保护 / Under Voltage Protection

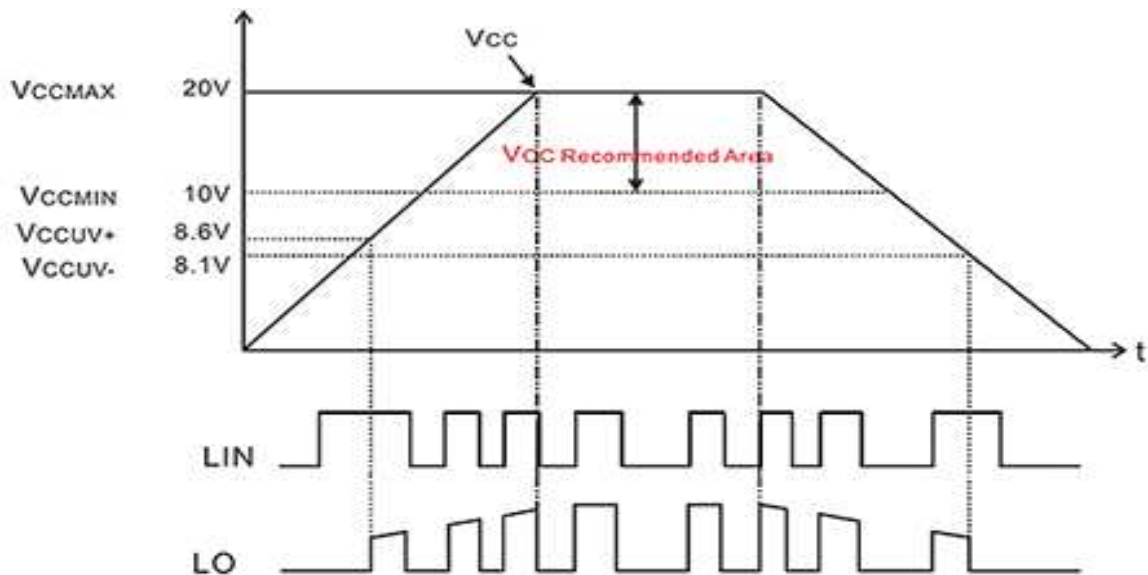


图 3. 欠压保护 (低端)
Figure 3. Under Voltage Protection (Low-side)

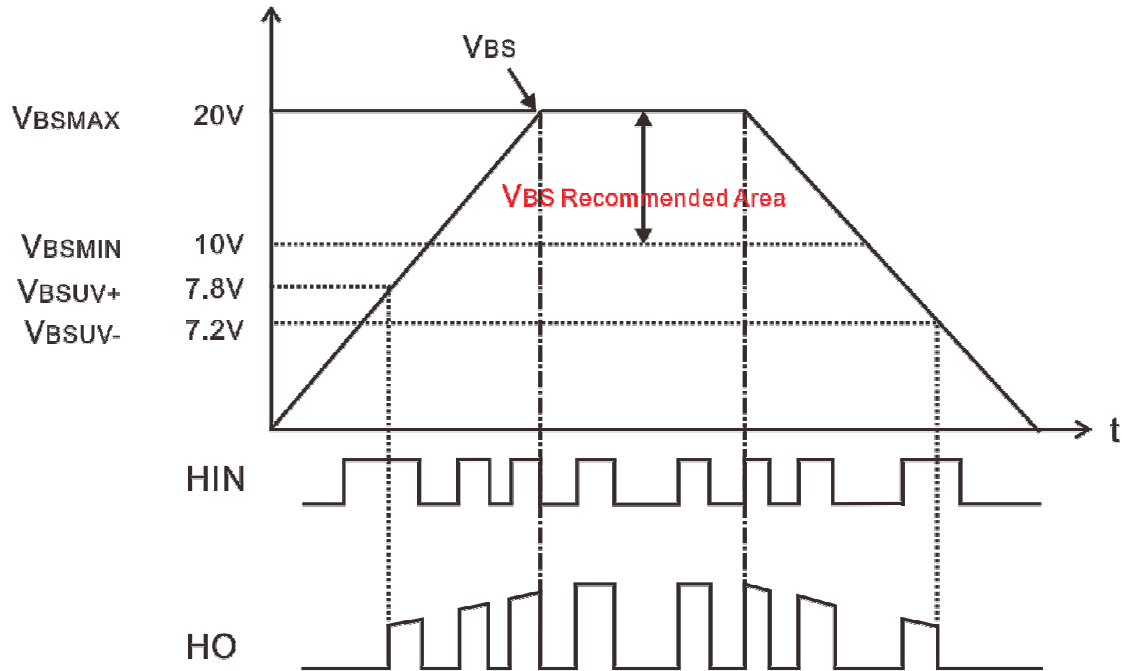
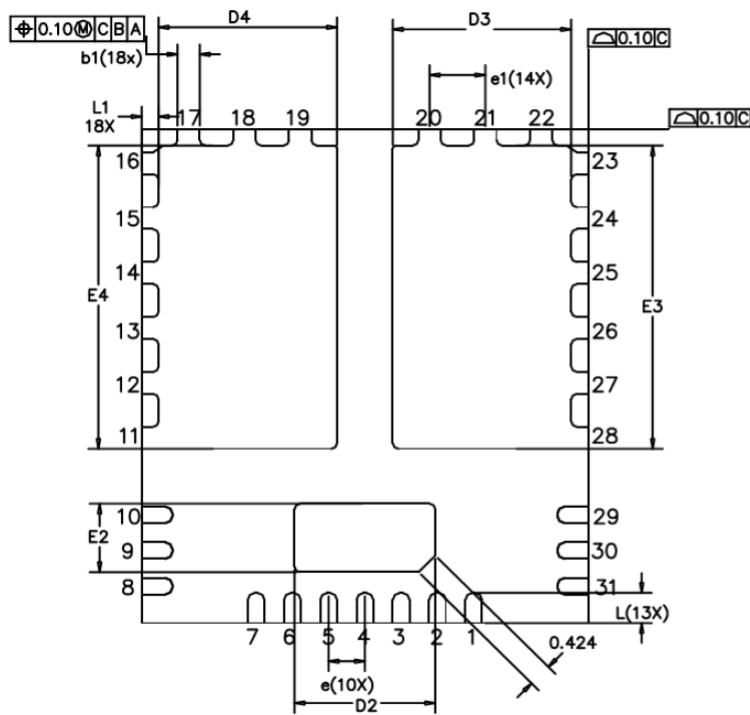


图 4. 欠压保护（高端）

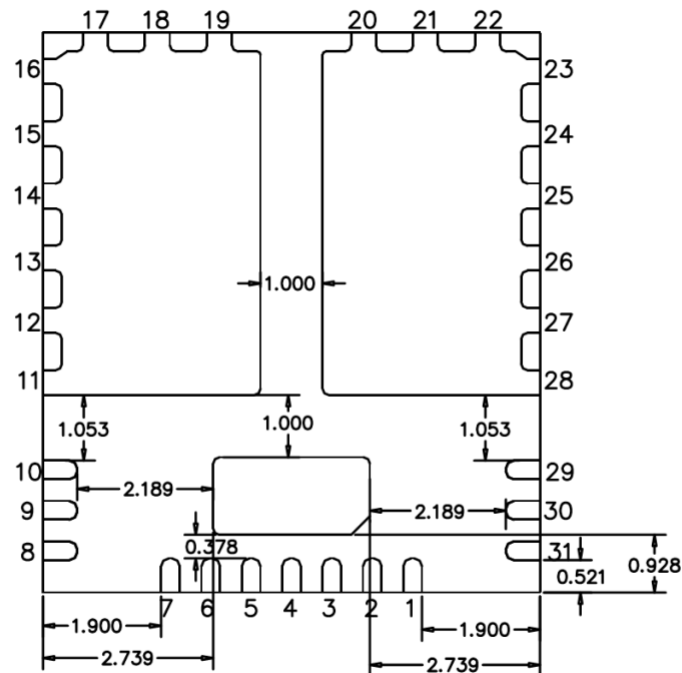
Figure 4.Undervoltage Protection (High-side)

轮廓封装（底部） / PACKAGE OUTLINE (BOTTOM VIEW)



SYMBOL	DIMENSIONS IN MILLIMETER		
	MIN.	NOM.	MAX.
A	0.800	0.900	1.000
A1	0.000		0.050
A3	0.203 REF.		
b	0.250	0.300	0.350
b1	0.350	0.400	0.450
D	7.900	8.000	8.100
E	8.900	9.000	9.100
D2	2.472	2.522	2.572
E2	1.197	1.247	1.297
D3	3.147	3.197	3.247
E3	5.472	5.522	5.572
D4	3.147	3.197	3.247
E4	5.472	5.522	5.572
e	0.650 BSC		
e1	1.000 BSC		
e2	1.403 BSC		
e3	2.318 BSC		
L	0.500	0.550	0.600
L1	0.253	0.303	0.353

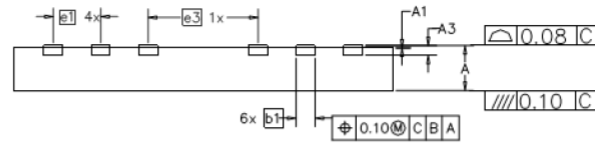
Dimensions in mm



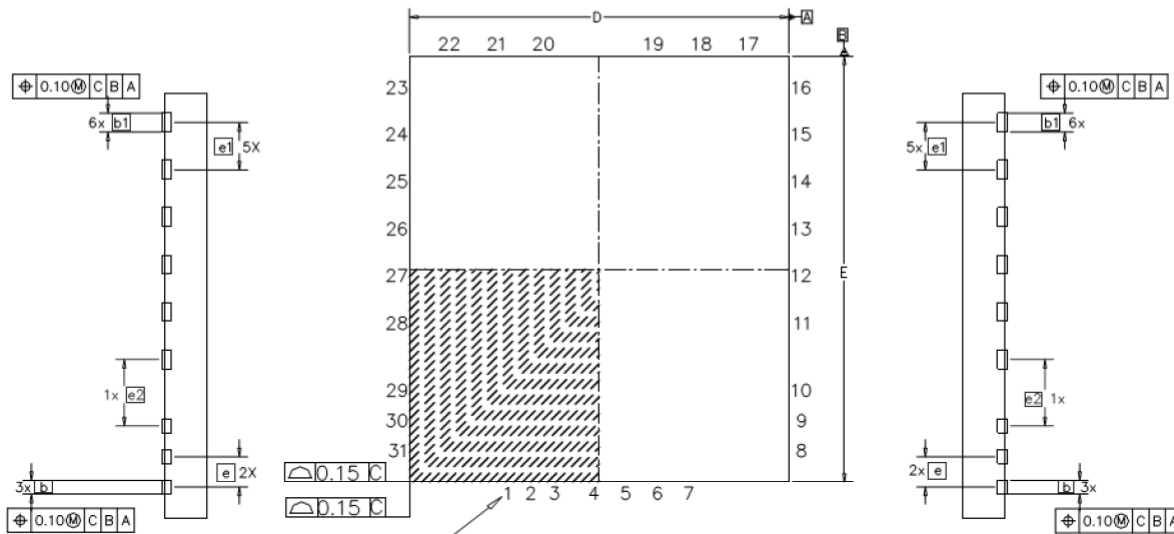
Dimensions in mm

轮廓封装（顶部和侧面）/ PACKAGE OUTLINE (TOP & SIDE VIEW)

BACK SIDE VIEW

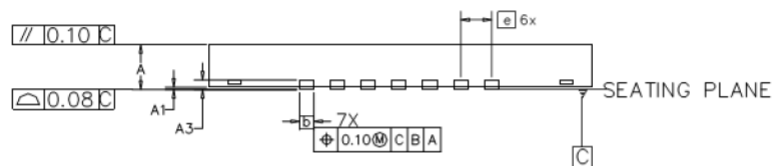


TOP VIEW



LEFT SIDE VIEW

RIGHT SIDE VIEW



FRONT SIDE VIEW

SYMBOL	DIMENSIONS IN MILLIMETER					
	MIN.	NOM.	MAX.			
A	0.800	0.900	1.000	E2	1.197	1.247 1.297
A1	0.000		0.050	D3	3.147	3.197 3.247
A3	0.203 REF.			E3	5.472	5.522 5.572
b	0.250	0.300	0.350	D4	3.147	3.197 3.247
b1	0.350	0.400	0.450	E4	5.472	5.522 5.572
D	7.900	8.000	8.100	e	0.650 BSC	
E	8.900	9.000	9.100	e1	1.000 BSC	
D2	2.472	2.522	2.572	e2	1.403 BSC	
				e3	2.318 BSC	
				L	0.500	0.550 0.600
				L1	0.253	0.303 0.353

Dimensions in mm



IMPORTANT NOTICE

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