译文

TB6615PG

本资料是为了参考的目的由原始文档翻译而来。

使用本资料时，请务必确认原始文档关联的最新信息，并遵守其相关指示。

原本: “TB6615PG” 2012-11-01

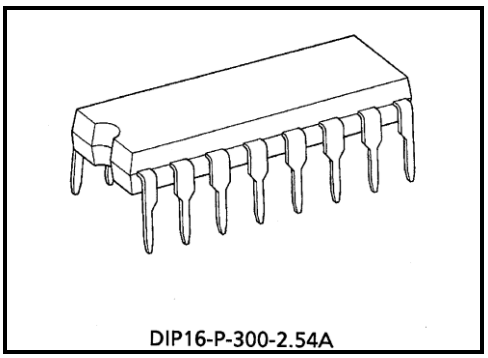
翻译日: 2016-02-22

东芝两极线性集成电路 单晶硅

TB6615PG

步进马达控制器/驱动器

TB6615PG 为带有 MOS 输出晶体管的步进马达控制器/驱动器。
TB6615PG 可以单极模式驱动 2 相步进马达，并可利用时钟信号在正向和反向之间选择旋转方向。也支持一些励磁模式(1 相，2 相和 1-2 相)。

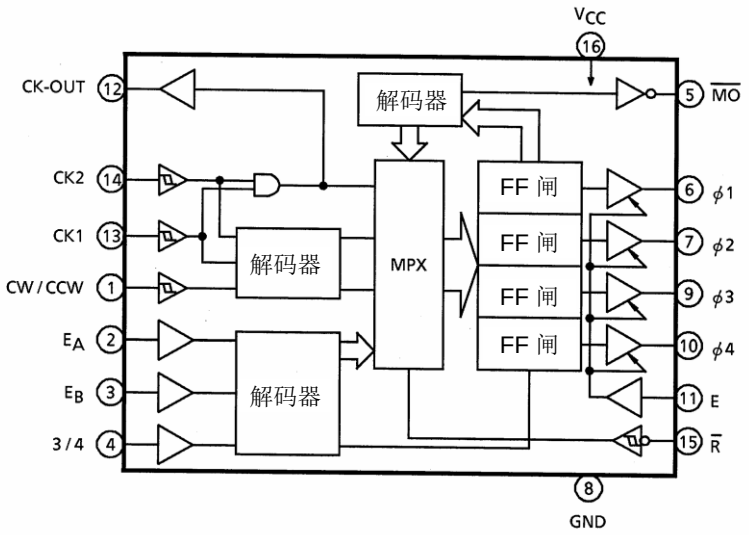


重量: 1.11 g (典型值)

特征

- 单片步进马达控制器/驱动器
- 所有输入均为 TTL 电平。
- CK1，CK2，CW/CCW 和 RESET 引脚为施密特触发输入。
- 旋转方向控制(顺时针(CW)/逆时针(CCW)): 单时钟和双时钟模式
- 输出启用和初始状态检测能力
- 高输出耐电压: $V_{CE\ (SUS)}$ ϕ= 28 V(最小值)
- 高输出电流: I_{OUT} ϕ= 400 mA(最大值)
- 封装: DIP-16
- 过电压保护电路由每次输出提供。(该电路在输出电压达到 30 V 时(典型值)或更高时激活。)

方块图



引脚描述

引脚编号	符号	引脚名称	功能描述	
1	CW/CCW	顺时针/逆时针	旋转方向选择输入(见真值表 A。)	
2	E_A	励磁 A	励磁模式选择输入	见真值表 B。
3	E_B	励磁 B		
4	3/4	3 相/4 相	3-相/4-相选择输入	
5	$\overline{MO}$	监控器输出	初始状态检测输出；此引脚在初始状态时设置为低。	
6	$\phi 1$	$\phi 1$ 输出	$\phi 1$ 输出	
7	$\phi 2$	$\phi 2$ 输出	$\phi 2$ 输出	
8	GND	GND	接地	
9	$\phi 3$	$\phi 3$ 输出	$\phi 3$ 输出	
10	$\phi 4$	$\phi 4$ 输出	$\phi 4$ 输出	
11	E	输出启用	当该引脚为高时，启用输出$\phi 1$ - $\phi 4$。	
12	CK−OUT	时钟−输出	时钟输出	
13	CK1	时钟 I_n-1	时钟输入 1	见真值表 A。
14	CK2	时钟 I_n−2	时钟输入 2	
15	$\overline{R}$	复位	复位输入；当该引脚为低状态时，复位输出 (注 1)	
16	V_{CC}	V_{CC}	V_{CC}	

真值表 A

CK1	CK2	CW/CCW	功能
↑	H	L	CW
↓	L	L	抑制(注 2)
H	↑	L	CCW
L	↓	L	抑制(注 2)
↑	H	H	CCW
↓	L	H	抑制(注 2)
H	↑	H	CW
L	↓	H	抑制(注 2)

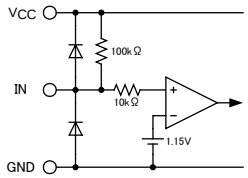
真值表 B

E_A	E_B	3/4 (注 3)	功能	
L	L	L	4-相输出	1-相励磁
H	L	L		2-相励磁
L	H	L		1−2-相励磁
H	H	L	测试模式启用所有输出	
L	L	H	3–相输出	1-相励磁
H	L	H		2-相励磁
L	H	H		1-2-相励磁
H	H	H	测试模式: 启用所有输出。	

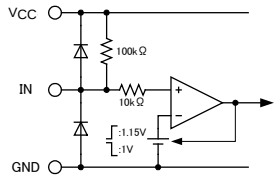
注 1: 将复位引脚设置为低会造成输出状态进入初始状态，$\overline{MO}$ 输出变为低。
将复位引脚设置为高状态时，输出状态会在时钟信号下一个前沿时进入初始状态后的状态。
注 2: 禁止使用抑制模式。
注 3: 在切换 3/4，E_A 和/或 E_B 引脚前，施以复位脉冲将 TB6615PG 设置成复位模式。
注 4: 双相步进马达应以四相输出模式驱动。

等效电路

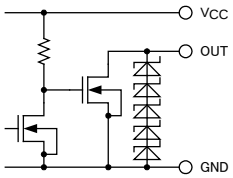
E_A, E_B, 3/4, E



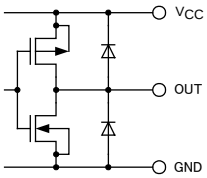
CK1, CK2, CW/CCW, $\overline{R}$



Φ1 ~ Φ4



$\overline{MO}$, CK−OUT



绝对最大额定值(Ta = 25°C)

特性	符号	额定值	单位
电源电压	V_{CC}	-0.3 ~ 6.0	V
输出耐电压(ϕn)	$V_{CE\ (SUS)\phi}$	-0.3 ~ 28	V
输出电流(ϕn)	$I_{OUT\phi}$	400	mA
输出电流 ($\overline{MO}$ CK−OUT)	I_{OUT} $\overline{MO}$ CK−OUT	10	mA
输入电压	V_{IN}	−0.3 ~ V_{CC} + 0.3	V
输入电流	I_{IN}	±1	mA
功耗	P_D	1.8	W
工作温度	T_{opr}	-30 ~ 85	°C
贮存温度	T_{stg}	−55 ~ 150	°C

工作范围(Ta = 25°C)

特性		符号	测试条件	最小	典型值	最大	单位
电源电压		V_{CC}	—	2.7	5.0	5.5	V
输出耐电压		$V_{CE\ (SUS)\phi}$	—	0	—	26	V
输出电流ϕn	低	$I_{OUT\phi}$	—	—	—	200	mA
输出电流，	高	I_{OH}	—	—	—	-0.4	mA
$\overline{MO}$, CK−OUT	低	I_{OL}	—	—	—	8	
输入电压		V_{IN}	—	0	—	V_{CC}	V
时钟频率		f_{CLOCK}	—	0	—	100	kHz

电气特性(Ta = 25°C)

特性			符号	测试电路	测试条件	最小	典型值	最大	单位
输入电压	高		V_{IH}	—	—	2.0	—	—	V
	低		V_{IL}	—	—	—	—	0.8	
输入电流	高		I_{IH}	—	VCC = 5.5 V, VIH = 5.5 V	—	—	2	μA
	低		I_{IL}	—	VCC = 5.5 V, VIL = 0.4 V	—	—	-0.15	mA
滞后电压			ΔV_T	—	VCC = 5.0 V	—	150	—	mV
电流消耗			I_{CC}	—	VCC = 5.5 V	—	—	27	mA
输出漏电流ϕn			$I_{OH\phi}$	—	VCC = 5.5 V, VOUT = 26 V	—	—	1	μA
输出电压	高	$\overline{MO}$ CK−OUT	V_{OH}	—	VCC = 2.7 V, IOH = -0.4 mA	V_{CC} × 0.8	—	—	V
	低	$\overline{MO}$ CK-OUT	V_{OL}	—	VCC = 2.7 V, IOL = 8 mA	—	—	V_{CC} × 0.2	
		ϕn	$V_{OUT\phi}$	—	VCC = 2.7 V, IOUT = 400 mA t = 100 ms	—	—	0.8	
					VCC = 2.7 V, IOUT = 200 mA t = 100 ms	—	—	0.5	

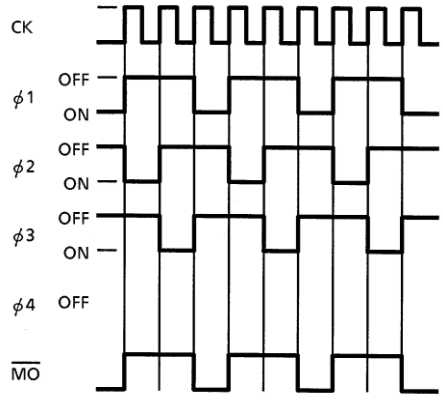
切换特性(Ta = 25°C)

特性			符号	检测用电路	测试条件	最小	典型值	最大	单位
传输延迟	高	CK-ϕn	t_{pLH}	—	仅设计目标	—	200	—	ns
		CK-CK-OUT				—	100	—	
		CK-$\overline{MO}$				—	150	—	
		E-ϕn				—	200	—	
		$\overline{R}$-ϕn				—	200	—	
	低	CK-ϕn	t_{pHL}	—	仅设计目标	—	200	—	
		CK-CK-OUT				—	110	—	
		CK-$\overline{MO}$				—	150	—	
		E-ϕn				—	200	—	
		$\overline{R}$-ϕn				—	200	—	
		$\overline{R}$-$\overline{MO}$				—	110	—	
最大工作频率			fmax	—	仅设计目标	—	250	—	kHz
设置时间(CK，CW/CCW)			tset-up	—	仅设计目标	—	10	—	ns
保留时间(CK，CW/CCW)			thold			—	10	—	
最小时钟脉冲宽度			$t_{w\,(CK)}$	—	仅设计目标	—	100	—	
最小复位脉冲宽度			$t_{w\,(\overline{R})}$	—	仅设计目标	—	100	—	
最大时钟上升时间			t_r (CK)	—	仅设计目标	—	2	—	μs

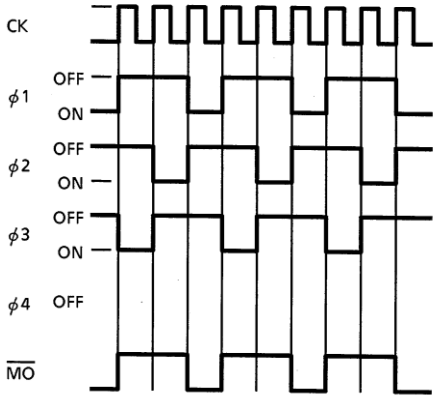
时序图

三相输出模式

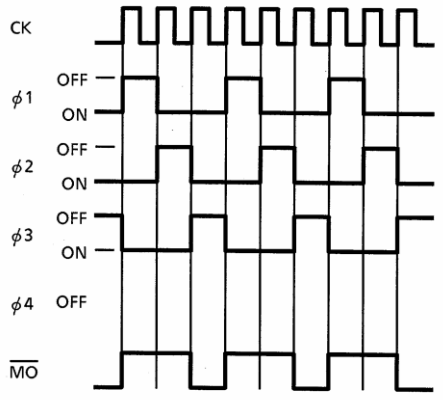
1-相励磁(CW)



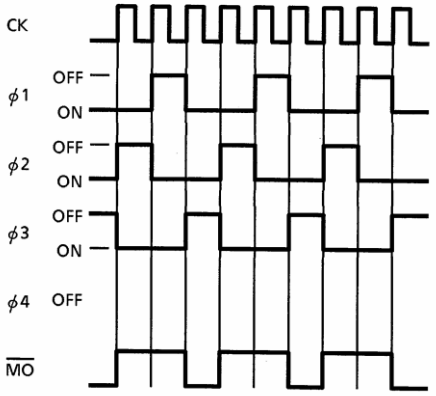
1-相励磁(CCW)



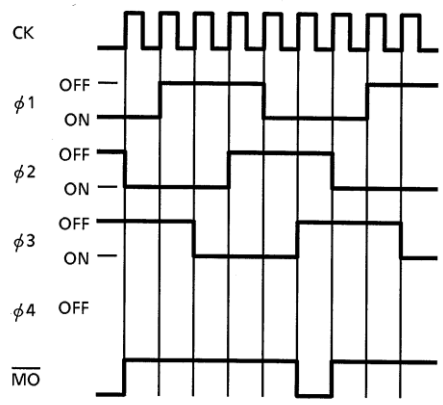
2-相励磁(CW)



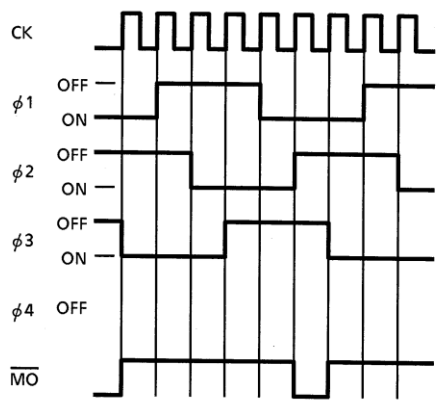
2-相励磁(CCW)



1-2-相励磁(CW)

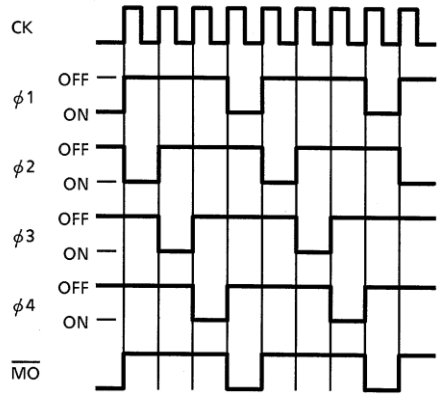


1-2-相励磁(CCW)

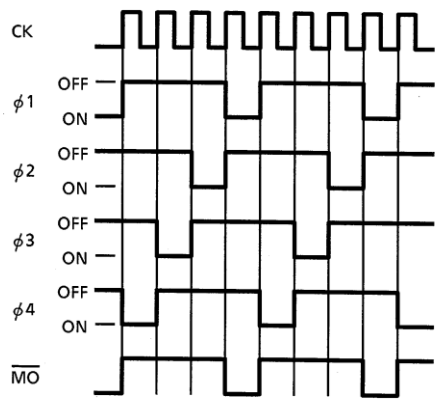


四相输出模式

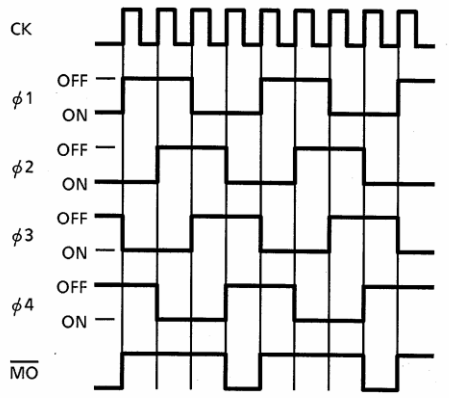
1-相励磁(CW)



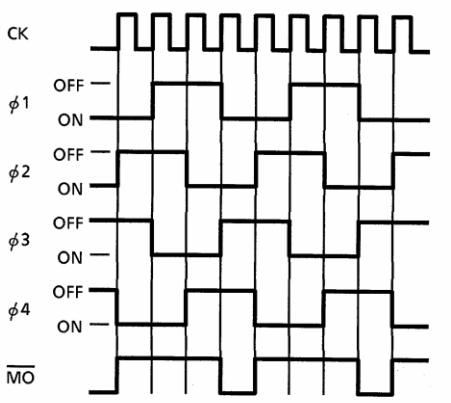
1-相励磁(CCW)



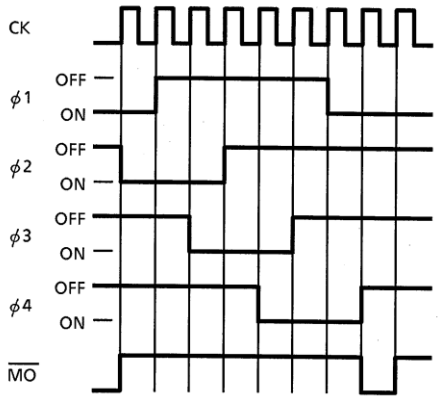
2-相励磁(CW)



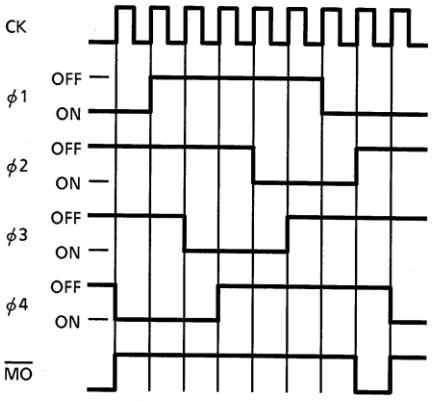
2-相励磁(CCW)

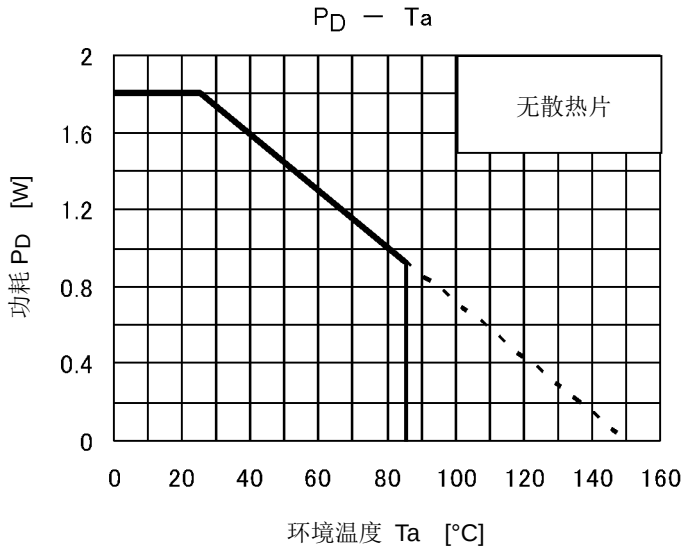


1-2-相励磁(CW)



1-2-相励磁(CCW)



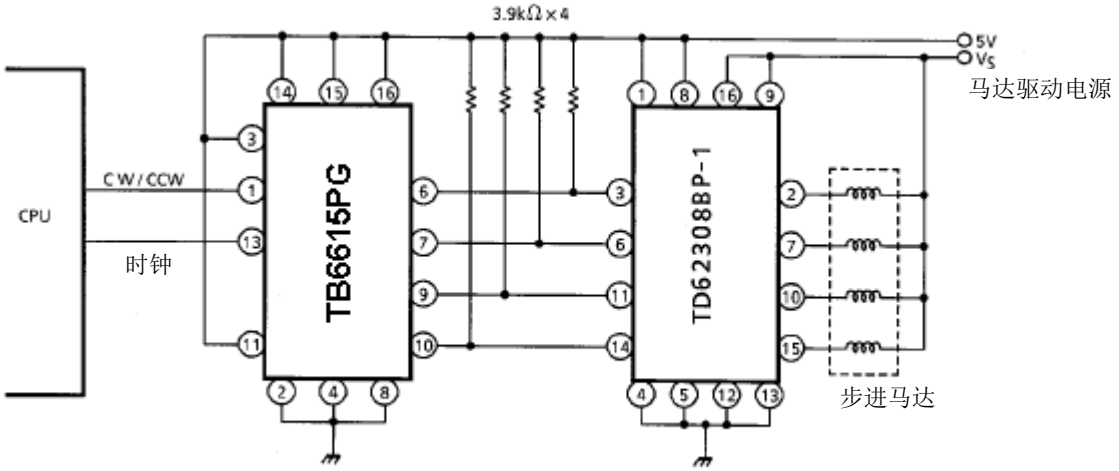


使用注意事项

- 输出电路，电源或接地发生短路会破坏 IC。因此，在设计输出电路，VCC 和接地线路时，应充分考虑到这种情况。
- 应确保装置插入正确。装置插入方向错误会破坏 IC。
- 如装置损坏，则大电流会作为二次效应继续流经马达驱动端。因此，东芝建议应为驱动器端的电源线路连接保险丝。

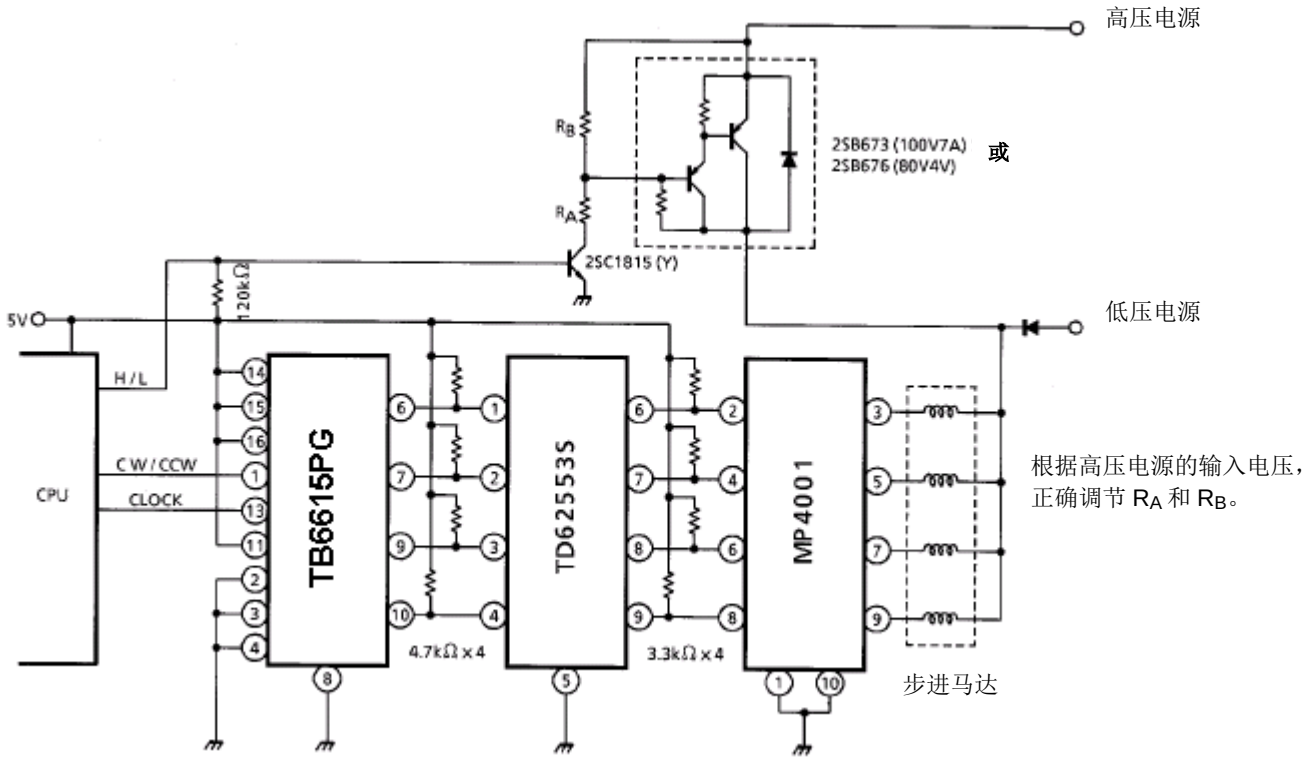
应用电路示例 1

TB6615PG+TD62308BP-1



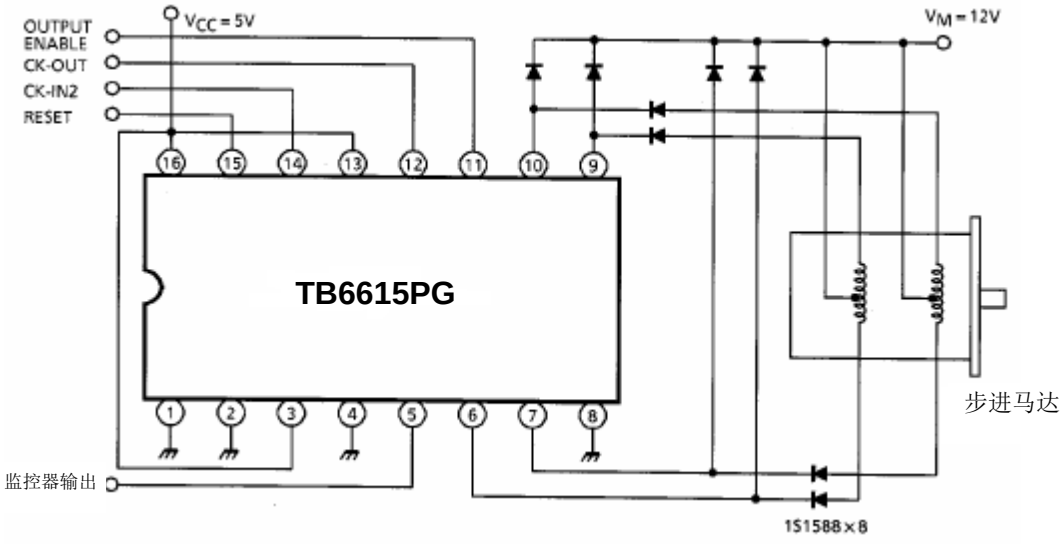
应用电路示例 2

TB6615G+TD62553S+MP4001
此电路以两个电源工作。



应用电路示例 3

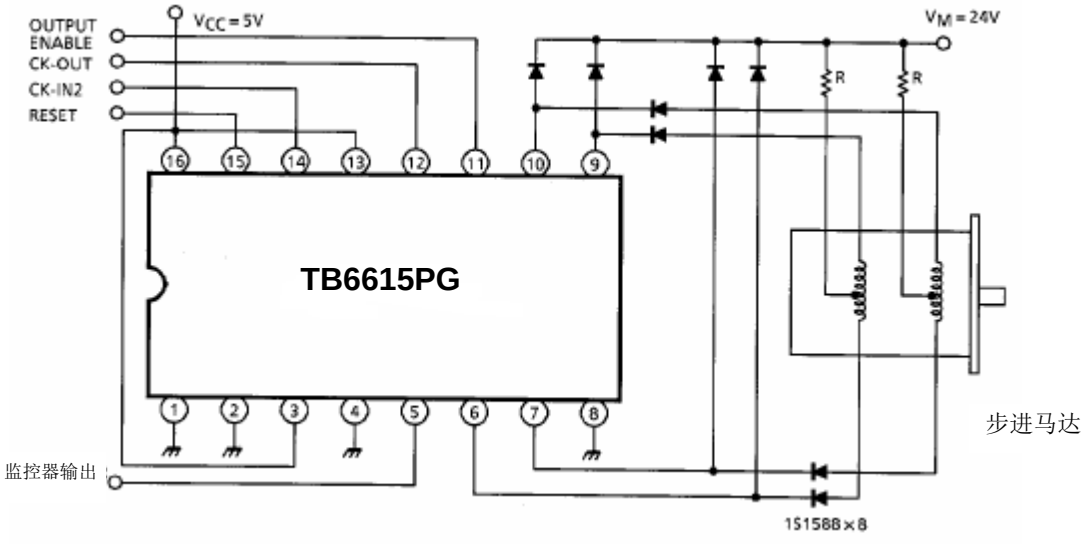
2-相马达的 1-2-相励磁系统，I



・当马达的感应脉冲较大时，吸收二极管应跨越线圈放置，以抑制感应脉冲。(这也适用于应用电路示例 4。)

应用电路示例 4

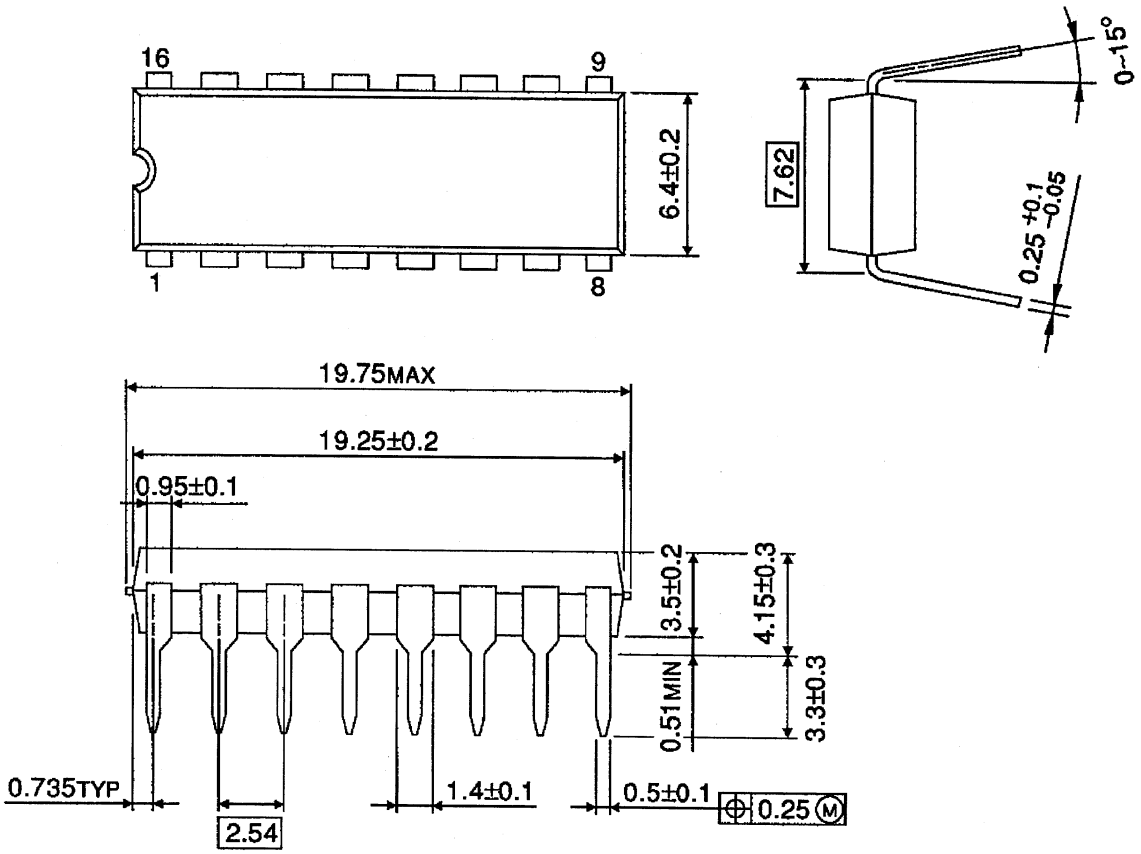
2-相马达的 1-2-相励磁系统，II



注: 输出电路，电源或接地发生短路会破坏 IC。在设计输出电路，V_{CC}(V_M，V_S 和 V_{EE})和接地线路时，应充分考虑到这种情况的可能性。

封装尺寸

DIP16-P-300-2.54A 单位: mm



重量:1.11g (典型值)

内容注释

1. 方块图

出于解释目的，可能忽略或简化部分功能块，电路或常数。

2. 等效电路

出于解释目的，可能简化等效电路图或忽略其中的一部分。

3. 时序图

出于解释目的，可能简化时序图。

4. 应用电路

本文件所示应用电路仅供参考。在大规范生产设计阶段，必须进行全面评估。
东芝不因提供这些应用电路示例而授予任何工业产权许可。

5. 测试电路

测试电路中的部件仅用于获取及确认装置特性。不保证这些部件和电路能防止在应用设备中发生故障或失效。

IC 使用注意事项

IC 处理注意事项

[1] 半导体装置绝对最大额定值为一组在任何时候都不得超过的额定值。不得超出任何额定值。
超出这些额定值可导致装置击穿，损坏或劣化，并会因发生爆炸或燃烧而造成伤害。

[2] 应使用适当的电源保险丝，保证在过电流及 IC 故障的情况下不会有大电流持续流过。当在超过绝对最大额定值的条件下使用，接线路径不对，或者在接线或负载处产生异常脉冲噪声而造成大电流持续通过时，IC 会被完全击穿，并导致烟雾或起火。为尽量减小击穿时大电流流过的影响，必须进行正确设置，例如保险丝容量，熔断时间及插入电路的位置。

[3] 若您的设计包括马达线圈等有感负荷，则应在设计中包含防护电路，防止上电时涌流产生的电流或者断电时反电动势产生的负电流造成装置故障或击穿。进而造成伤害，烟雾或起火。应使用带 IC 的具有内置保护功能的稳定电源。若电源不稳定，保护功能可能不工作而造成 IC 击穿，进而造成伤害，烟雾或起火。

[4] 不要以错误方位或错误的方式插入设备。
确认电源的正负端子连接正确。
另外，电流或功耗有可能超出绝对最大额定值，而超出这些额定值则可导致装置击穿，损坏或劣化，并可因发生爆炸或燃烧而造成伤害。
此外，不得使用其电源电流插接方位或方式错误的任何设备，即使一次也不行。

IC 处理记住要点

(1) 过流保护电路

过流保护电路(简称限流电路)不一定能在所有情况下对 IC 进行保护。若过流保护电路在过流下工作，应立即消除过流状态。

例如：超过绝对最大额定值可导致过电流保护电路不能正确工作，或导致在操作前发生 IC 击穿现象，视使用方法和使用条件而定。

此外，视使用方法及使用条件而定，若在工作后过电流继续长时间流过，IC 会发热而造成击穿。

(2) 散热设计

在使用大电流 IC 时例如，功率放大器，调节器或驱动器，请设计适当的散热装置，保证在任何时间和情况下不会超过规定的接点温度(Tj)。这些 IC 甚至在正常使用时会发热。对于 IC 散热不足的设计，会造成 IC 特性变差或击穿。此外，在设计装置时，请考虑 IC 散热对外围部件的影响。

(3) 反电动势

当马达突然反转，停止或放慢时，由于反电动势的影响，电流会回流到马达电源。若电源的电流吸收能力小，装置的电机电源和输出引脚就会存在超过绝对最大额定值的风险。为了避免出现这种问题，在系统设计中应考虑反电动势的影响。

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