GD3162_SDS

具有动态栅极驱动调节功能的先进的IGBT/SiC栅极驱动器

第2版 — 2024年1月12日 **产品简介**

1 简介

GD3162是一款先进的电隔离单通道栅极驱动器，可驱动针对xEV牵引逆变器的最新SiC和IGBT模块。该器件通过提高栅极驱动功能，节省了空间并提升了性能。

GD3162提供集成的电隔离功能，可以通过SPI接口进行编程，具有先进的可编程保护功能，如过温、退饱和以及电流感测保护。GD3162集成了增强功能，可直接驱动大多数SiC MOSFET和IGBT/SiC模块栅极，并能够调节栅极驱动能力，以提高功率器件的开关性能并降低电压应力。

栅极强度的控制可以通过SPI命令或GS使能引脚来实现。GS_ENH逻辑控制开启时的驱动强度，GS_ENL控制关闭时的驱动强度。为了进一步提高性能，这些功能设计为彼此独立运行。通过输入引脚上的三电平功能或SPI命令，提供了三个独立的上拉驱动强度和三个下拉驱动强度。

GD3162可自主管理故障，并通过INTB引脚报告功率器件和栅极驱动的状态。VCE/VDS监测以及VGE监测可选择在INTA/RTRPT引脚上输出。

GD3162具有自检和控制保护功能，适用于功能安全级别较高的系统（ASIL C/D）的设计，满足汽车应用的严苛要求，完全符合AEC-Q100 1级标准。

2 特性和优势

本节总结了GD3162的主要特性、安全特性和监管认证。

2.1 主要特性

- 集成电信号隔离（高达8kV）
- 可提高驱动强度：通过选择栅极驱动强度，可提供高达10A/20A/30A的拉电流/灌电流
- SPI或三态GS_ENH和GS_ENL低压域引脚可以动态控制栅极驱动强度。支持高达20 KHz的栅极强度调节
- 双栅极上拉引脚和双栅极下拉引脚可增强驱动能力、同步调整栅极驱动强度、降低弱驱动时的热负载，并对每个驱动状态操作进行独立验证。
- SPI可编程ISEN/COMP设置点，允许栅极驱动器根据高压域输入自动控制栅极驱动强度。
- 温度感测引脚可兼容NTC和PTC热敏电阻，可实现基于温度的栅极驱动强度本地控制，支持通过AOUT引脚或SPI进行功率器件温度监测。
- 可编程ADC延迟——从PWM上升沿或下降沿开始，最大采样延迟为8µs。
- 主动总线放电功能（仅限MGD3162AM551EK和MGD3162AM581EK）— 提供MCU控制或安全逻辑控制的栅极驱动，对母线电容进行主动放电。
- 用于RDSon和结温估算的VDS测量功能
- 提供SPI接口，可用于安全监测、配置和诊断报告
- 通过低压域INTA/RTRPT引脚监控VCE功率器件
- 支持高PWM开关频率：PWM频率高达100kHz，由于散热限制
- 低压和高压域的故障安全状态管理，进入用户可选择的安全状态
- 对可配置的退饱和与电流感测进行了优化，可保护SiC和IGBT的反应时间少于1µs
- INTA/RTRPT和INTB中断引脚，适用于电流和电压故障报告以及还可以配置为VCE或VGE状态的实时报告。
- 先进两级关断（2LTO）与软关断栅极电流相结合，可降低与快速关断相关的电流和电压应力。
- CMTI > 100V/ns

2.2 安全特性

- 认证符合ISO 26262，支持ASIL D级功能安全
- 使用8位CRC对SPI和配置数据进行错误检查
- 通过可配置的INTB和/或INTA/RTRPT引脚以及SPI接口自主管理严重故障并报告状态
- VCE/VGE逐周期实时监测和报告，以反馈功率器件的状态
- 所有模拟和数字电路的自检（BIST）
- 透过隔离屏障持续监测通信
- 死区时间强制执行
- 低压电路5V偏置供电的过压和欠压监控
- 高压电路VCC供电的过压和欠压监控
- 低压侧和高压侧都有专用的故障安全状态管理引脚

2.3 安全和监管认证

- 按照DIN V VDE V 0884-10标准加强了隔离
- 根据UL 1577标准，可承受5000V rms（1分钟）隔离电压
- 符合AEC-Q100 1级汽车标准

3 订购信息

表1. 可订购的部件型号

部件型号[1]	VDD (V)	外部电气间隙和爬电距离(mm)	材料(隔离) 组	温度(T_J) (°C)	封装
MGD3162AM550EK（无直流母线放电模式）	5.0	>7.72[2]	II[3]	-40至150	32引脚宽体SOIC，0.65mm间距
MGD3162AM551EK（带直流母线放电模式）	5.0	>7.72[2]	II[3]	-40至150	32引脚宽体SOIC，0.65mm间距
MGD3162AM580EK（无直流母线放电模式）	5.0	>8.00[2]	I[3]	-40至150	32引脚宽体SOIC，0.65mm间距
MGD3162AM581EK（带直流母线放电模式）	5.0	>8.00[2]	I[3]	-40至150	32引脚宽体SOIC，0.65mm间距

[1] 若要订购卷带包装的器件，请在器件编号后添加后缀R2。如需订购托盘包装的器件，请在器件编号后添加后缀T。

[2] 根据IEC 60950-1表2K和2N

[3] 根据IEC 60664-1标准

4 框图

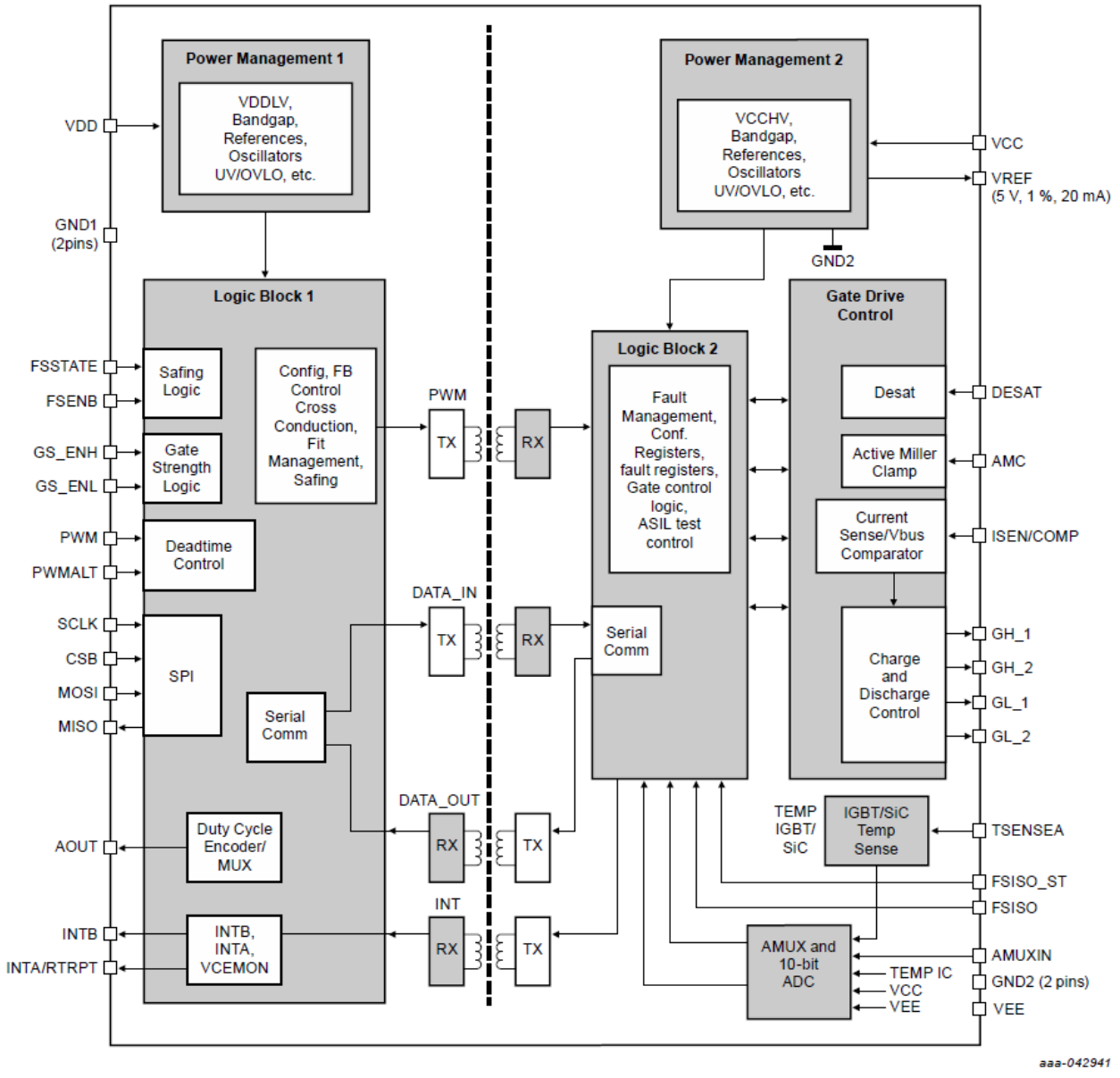

图1. 内部结构框图

5 极限值

表2. 最大额定值

所有电压都以 GND1（低压域）或 GND2（高压域）为参考。除非另有说明，T_j = -40至150 °C。指定引脚的输入电流为正，输出电流为负。

符号	说明（额定值）	最小值	最大值	单位
电源和电流参考值				
V_{VDD}	低压域逻辑供电电压，5.0 V [1]	-0.3	6.0	V
V_{VCC}	高压域正供电电压 [2]	-0.3	25	V
V_{VEE}	高压域负电源电压 [2]	-12	0.3	V
$V_{VCC-VEE}$	高压域正/负供电电压	-0.3	35	V
V_{VREF}	VREF电压 [2]	-0.3	6.0	V
I_{VREF}	VREF输出电流	—	−20	mA
逻辑引脚				
V_{IN}	逻辑输入引脚电压（FSSTATE、FSENB、PWM、PWMALT、GS_ENH、GS_ENL、SCLK、CSB和MOSI） [1]	-0.3	18	V
V_{OUT}	逻辑输出引脚电压（MISO、INTB、INTA/RTRPT、AOUT） [1]	-0.3	V_{VDD} + 0.3	V
V_{FSISO}	逻辑输入引脚电压（FSISO） [2]	-0.3	12	V
V_{FSISO_ST}	逻辑输入引脚电压（FSISO_ST） [2]	-0.3	12	V
栅极驱动输出级				
$V_{GH\_1,2}$	GH_1,2电压 [2]	V_{VEE} - 0.3	V_{VCC} + 0.3	V
$V_{GL\_1,2}$	GL_1,2电压 [2]	V_{VEE} - 0.3	V_{VCC} + 0.3	V
V_{AMC}	AMC电压 [2]	V_{VEE} - 0.3	V_{VCC} + 0.3	V
温度感测引脚				
$V_{TSENSEA}$	TSENSEA电压 [2]	-0.3	6.0	V
中断引脚				
$I_{INTA/RTRPT}$	开漏直流输出电流 [3]	—	−20	mA
I_{INTB}	开漏直流输出电流 [3]	—	−20	mA
ISENSE感测引脚				
$V_{ISEN/COMP}$	ISEN/COMP电压 [2]	-2.0	V_{VCC} + 0.3 V	V
AMUXIN引脚				
V_{AMUXIN}	AMUXIN电压 [2] [4]	-0.3	6.0	V
ESD额定值				
V_{ESDHBM}	ESD电压（HBM） [5] 所有引脚	 -2.0	 2.0	kV
V_{ESDCDM}	ESD电压（CDM） [6] 角引脚 其他引脚	 -750 -500	 750 500	V
$V_{ESDModule}$	ESD电压（模块级） [7] GND1、GND2引脚	 -8.0	 8.0	kV
抗扰度				
dV_{ISO}/dt	共模瞬变抗扰度 [8]	—	100	V/ns

[1] Ref = GND1

[2] Ref = GND2

[3] V_{INTB}, $V_{INTA/RTRPT}$ < 1.0 V

[4] ADC在AMUXIN引脚注入了高达500μA的电流时仍能正常工作并保持其性能。

[5] 器件级人体模型（HBM）

ANSI/ESDA/JEDEC JS-001: 2010模型HBM（人体模型）

静电放电（ESD）灵敏度测试人体模型（HBM）

测试点：引脚至GND1和引脚至GND2

[6] 器件带电模型（CDM）

ANSI/ESD S5.3.1-2009

ESD协会静电放电灵敏度测试标准 - 器件带电模型（CDM）– 元器件级

[7] 模块级ESD测试

ISO 10605:2008/Cor. 1:2010(E)

道路车辆——静电放电电器干扰测试方法

[8] 脉宽 = 10 ns

6 修订历史

表3. 修订历史

文档ID	发布日期	数据手册状态	变更通知	替换版本
GD3162_SDS v.2.0	2024年1月12日	产品	—	v.1.1
更改	• 更新了文件标题 • 状态由“目标”改为“产品” • 第2.1节：将第八项从“（仅PGD3162 AM551EK和PGD3162AM581EK）”改为“（仅MGD3162AM551EK和MGD3162AM581EK）” • 更新了表1；部件编号从“PGD3162AM550EK”、“PGD3162AM551EK”、“PGD3162AM580EK”和“PGD3162AM581EK”改为“MGD3162AM550EK”、“MGD3162AM551EK”、“MGD3162AM580 EK”和“MGD3162AM581EK” • 修订历史已更新，符合恩智浦的文档内容层级结构。		
GD3162_SDS v.1.1	2023年5月10日	目标	—	v.1.0
更改	• 修正了封面上的状态。 • 第2.1节：增加了一项“用于RDSon和结温估算的VDS测量功能”。 • 第3节：在第一个脚注中增加了“如需订购托盘包装的零部件，请在零件编号后添加后缀T”。 • 第5节 – 将标题“绝对最大额定值”更新为“极限值”。 – 表2：删除了“栅极驱动输出状态”小标题下的最后四行。			
GD3162_SDS v.1.0	2022年11月29日	目标	—	—
更改	—			

Legal information

Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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