SGM25665
5.5V, 10A, 4mΩ On-Resistance Load Switch

GENERAL DESCRIPTION

The SGM25665 is a small single-channel load switch with 4mΩ (TYP) on-resistance. The device can operate over a wide input voltage range of 0.1V to 5.5V. It can support a 10A maximum continuous load current and is controlled by the ON pin, which features direct compatibility with low voltage control signals. The configurable rise time can be used to avoid inrush current.

The device has thermal shutdown function. When the junction temperature exceeds +170 ℃, the inner N-MOSFET will be turned off through the thermal shutdown circuitry, and will remain off until the die temperature drops below +150 ℃. The SGM25665 offers the fixed quick output discharge function in disabled status.

The SGM25665 is available in a Green UTQFN-1.5×2-10L package.

FEATURES

- **Single Channel Load Switch**
- **VIN Voltage Range: 0.1V to 5.5V**
- **VBIAS Voltage Range: 1.5V to 5.5V**
- **Maximum Continuous Current: 10A**
- **On-Resistance: 4mΩ (TYP)**
- **Tri-State Pin with Configurable Slew Rate**
- **Low Power Consumption:**
  - **On-State (I_Q): 12μA (TYP)**
  - **Off-State (I_{SD}): 2μA (TYP)**
- **Thermal Shutdown**
- **Available in a Green UTQFN-1.5×2-10L Package**

APPLICATIONS

Solid State Drive
PC and Notebooks
Industrial PC
Optical Module

SIMPLIFIED SCHEMATIC

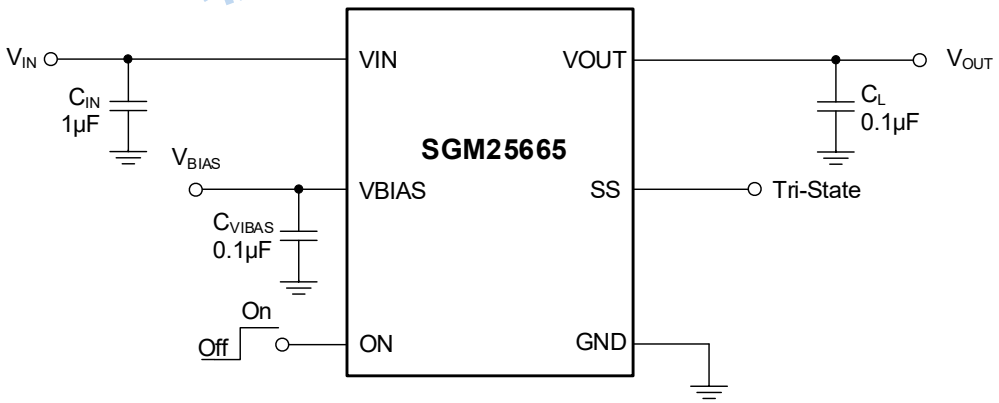


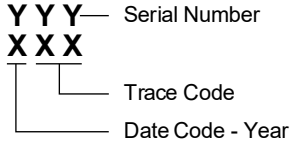
Figure 1. Simplified Schematic

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM25665	UTQFN-1.5×2-10L	-40℃ to +125℃	SGM25665XUWX10G/TR	2NR XXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXX = Date Code, Trace Code.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Input Voltage, V_{IN} ..... -0.3V to 6V
Bias Voltage, V_{BIAS} ..... -0.3V to 6V
Control Pin Voltage, V_{ON}, V_{SS} ..... -0.3V to 6V
Maximum Current, I_{MAX} 10A
Package Thermal Resistance
UTQFN-1.5×2-10L, θ_{JA} ..... 74.6℃/W
UTQFN-1.5×2-10L, θ_{JB} ..... 5.2℃/W
UTQFN-1.5×2-10L, θ_{JC} ..... 62.7℃/W
Package Thermal Characterization Parameter
UTQFN-1.5×2-10L, ψ_{JT} ..... 0.8℃/W
UTQFN-1.5×2-10L, ψ_{JB} ..... 5.1℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±4000V
CDM ..... ±1000V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.

2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Input Voltage, V_{IN} ..... 0.1V to 5.5V
Bias Voltage, V_{BIAS} ..... 1.5V to 5.5V
ON Pin High Voltage Range, V_{IH} ..... 0.7V to 5.5V
ON Pin Low Voltage Range, V_{IL} ..... 0V to 0.35V
Control Pin Voltage, V_{SS} ..... 0V to 5.5V
Operating Junction Temperature Range ..... -40℃ to +125℃
Input Capacitor, C_{IN} 1μF
Output Capacitor, C_L 0.1μF
VBIAS Capacitor, C_{VBIAS} 0.1μF

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

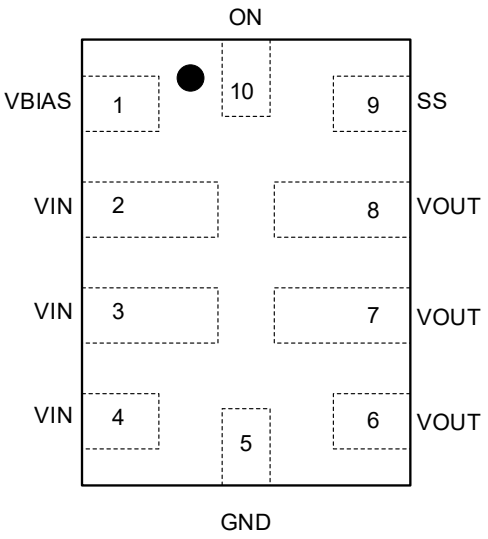
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION

SGM25665 (TOP VIEW)



UTQFN-1.5×2-10L

PIN DESCRIPTION

PIN	NAME	TYPE	FUNCTION
1	VBIAS	I	Power Supply Pin for Internal Circuitry. V_{BIAS} voltage range is 1.5V to 5.5V.
2, 3, 4	VIN	I	Switch Input Pin.
5	GND	G	Device Ground.
6, 7, 8	VOUT	O	Switch Output Pin.
9	SS	I	Slew Rate Control Pin. Can be pulled up, left floating, or connected to ground.
10	ON	I	Enable Pin.

NOTE: I = input, O = output, G = ground.

ELECTRICAL CHARACTERISTICS

(T_J = -40℃ to +125℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_{BIAS} = 5V, V_{IN} = 3.3V, unless otherwise noted.						
Power Consumption						
VBIAS Shutdown Current	I_{SD_VBIAS}	V_{ON} = 0V		2	6	μA
VBIAS Quiescent Current	I_{Q_VBIAS}	V_{ON} > V_{IH}		12	20	μA
VIN Shutdown Current	I_{SD_VIN}	V_{ON} = 0V		0.1	24	μA
ON Pin Leakage Current	I_{ON}	V_{ON} = V_{BIAS}		0.1		μA
Performance						
On-Resistance	R_{DSON}	V_{IN} = 0.1V to 5V		4	7	mΩ
ON Pin Deglitch Time	$t_{ON\_DEGLITCH}$		6.6	11.5	20.7	μs
QOD Resistance	R_{QOD}	V_{BIAS} = V_{IN}, V_{ON} = 0V, I_{QOD} = 1mA sinking		34	50	Ω
Protection						
Thermal Shutdown	T_{SD}			170		℃
Thermal Shutdown Hysteresis	T_{HYS}			20		℃
ON Terminal Input Threshold	V_{IH}	Rising	0.7			V
	V_{IL}	Falling			0.35	
V_{BIAS} = 3.3V, unless otherwise noted.						
Power Consumption						
VBIAS Shutdown Current	I_{SD_VBIAS}	V_{ON} = 0V		2	6	μA
VBIAS Quiescent Current	I_{Q_VBIAS}	V_{ON} > V_{IH}		11	20	μA
VIN Shutdown Current	I_{SD_VIN}	V_{ON} = 0V		0.1	15	μA
ON Pin Leakage Current	I_{ON}	V_{ON} = V_{BIAS}		0.1		μA
Performance						
On-Resistance	R_{DSON}	V_{IN} = 0.1V to 3.3V		4	7	mΩ
ON Pin Deglitch Time	$t_{ON\_DEGLITCH}$		6.8	12	22	μs
QOD Resistance	R_{QOD}	V_{BIAS} = V_{IN}, V_{ON} = 0V, I_{QOD} = 1mA sinking		36	53	Ω
Protection						
Thermal Shutdown	T_{SD}			170		℃
Thermal Shutdown Hysteresis	T_{HYS}			20		℃
ON Terminal Input Threshold	V_{IH}	Rising	0.7			V
	V_{IL}	Falling			0.35	

ELECTRICAL CHARACTERISTICS (continued)

(T_J = -40℃ to +125℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_{BIAS} = 1.5V, unless otherwise noted.						
Power Consumption						
VBIAS Shutdown Current	I_{SD_VBIAS}	V_{ON} = 0V		2	6	μA
VBIAS Quiescent Current	I_{Q_VBIAS}	V_{ON} > V_{IH}		10	20	μA
VIN Shutdown Current	I_{SD_VIN}	V_{ON} = 0V		0.1	10	μA
ON Pin Leakage Current	I_{ON}	V_{ON} = V_{BIAS}		0.1		μA
Performance						
On-Resistance	R_{DSON}	V_{IN} = 0.1V to 1.5V		4	7	mΩ
ON Pin Deglitch Time	$t_{ON\_DEGLITCH}$		8	14.8	27.6	μs
QOD Resistance	R_{QOD}	V_{BIAS} = V_{IN}, V_{ON} = 0V, I_{QOD} = 1mA sinking		48	70	Ω
Protection						
Thermal Shutdown	T_{SD}			170		℃
Thermal Shutdown Hysteresis	T_{HYS}			20		℃
ON Terminal Input Threshold	V_{IH}	Rising	0.7			V
	V_{IL}	Falling			0.35	

SWITCHING CHARACTERISTICS

(V_{BIAS} = 1.5V to 5V, C_{IN} = 47μF, typical values are at T_J = +25℃, C_L = 0.1μF, and a current load of 1mA, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN} = 5V						
Turn-On Time	t_{ON}	SS = open		320		μs
		SS = V_{BIAS}		1931		
		SS = GND		3802		
Rise Time	t_{RISE}	SS = open		226		μs
		SS = V_{BIAS}		1712		
		SS = GND		3452		
Delay Time	t_D	SS = open		94		μs
		SS = V_{BIAS}		218		
		SS = GND		350		
Fall Time	t_{FALL}	SS = open		9		μs
Turn-Off Time	t_{OFF}	SS = open		16		μs
V_{IN} = 3.3V						
Turn-On Time	t_{ON}	SS = open		241		μs
		SS = V_{BIAS}		1293		
		SS = GND		2498		
Rise Time	t_{RISE}	SS = open		152		μs
		SS = V_{BIAS}		1143		
		SS = GND		2278		
Delay Time	t_D	SS = open		89		μs
		SS = V_{BIAS}		150		
		SS = GND		220		
Fall Time	t_{FALL}	SS = open		8		μs
Turn-Off Time	t_{OFF}	SS = open		16		μs
V_{IN} = 1.8V						
Turn-On Time	t_{ON}	SS = open		183		μs
		SS = V_{BIAS}		740		
		SS = GND		1393		
Rise Time	t_{RISE}	SS = open		96		μs
		SS = V_{BIAS}		629		
		SS = GND		1260		
Delay Time	t_D	SS = open		87		μs
		SS = V_{BIAS}		111		
		SS = GND		133		
Fall Time	t_{FALL}	SS = open		8		μs
Turn-Off Time	t_{OFF}	SS = open		16		μs

SWITCHING CHARACTERISTICS (continued)

(V_{BIAS} = 1.5V to 5V, C_{IN} = 47μF, typical values are at T_J = +25℃, C_L = 0.1μF, and a current load of 1mA, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN} = 0.6V						
Turn-On Time	t_{ON}	SS = open		132		μs
		SS = V_{BIAS}		299		
		SS = GND		510		
Rise Time	t_{RISE}	SS = open		47		μs
		SS = V_{BIAS}		204		
		SS = GND		397		
Delay Time	t_D	SS = open		85		μs
		SS = V_{BIAS}		95		
		SS = GND		113		
Fall Time	t_{FALL}	SS = open		8		μs
Turn-Off Time	t_{OFF}	SS = open		16		μs
V_{IN} = 0.285V						
Turn-On Time	t_{ON}	SS = open		116		μs
		SS = V_{BIAS}		194		
		SS = GND		295		
Rise Time	t_{RISE}	SS = open		33		μs
		SS = V_{BIAS}		103		
		SS = GND		186		
Delay Time	t_D	SS = open		83		μs
		SS = V_{BIAS}		92		
		SS = GND		109		
Fall Time	t_{FALL}	SS = open		7		μs
Turn-Off Time	t_{OFF}	SS = open		16		μs

TIMING REQUIREMENTS

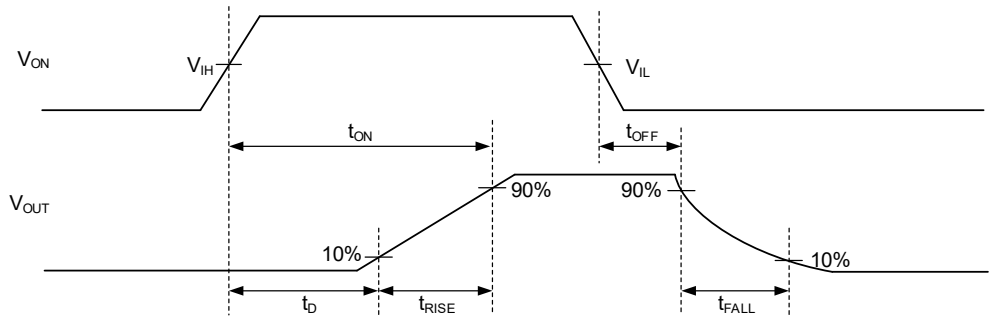


Figure 2. Timing Diagram

FUNCTIONAL BLOCK DIAGRAM

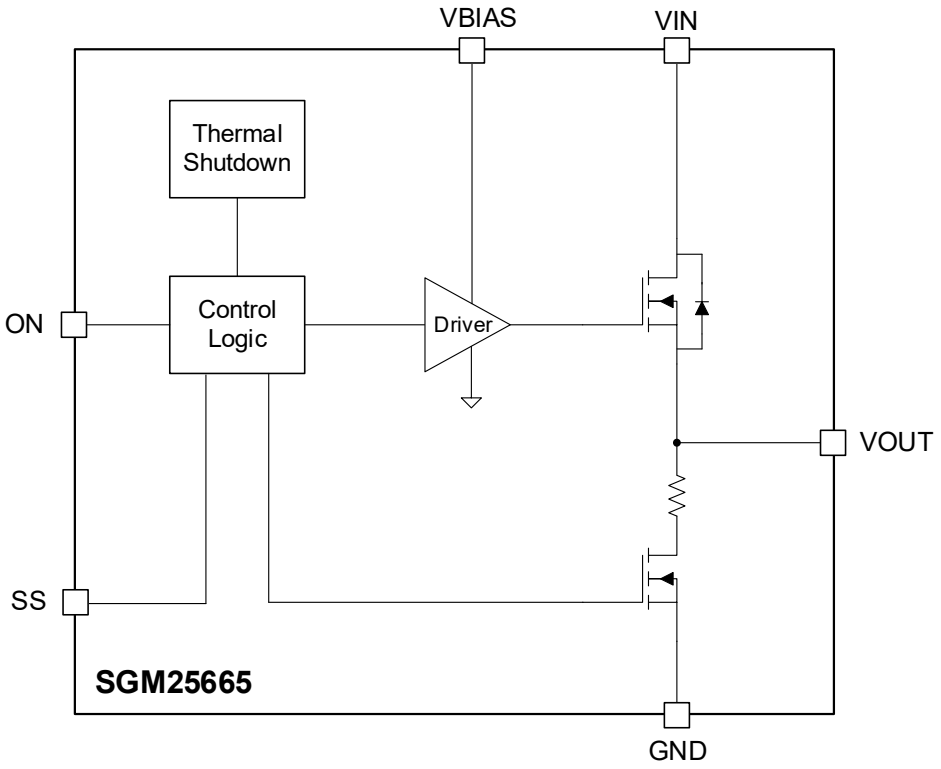
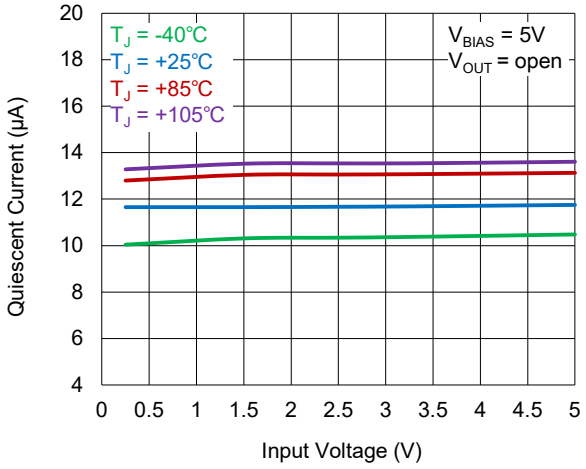


Figure 3. Block Diagram

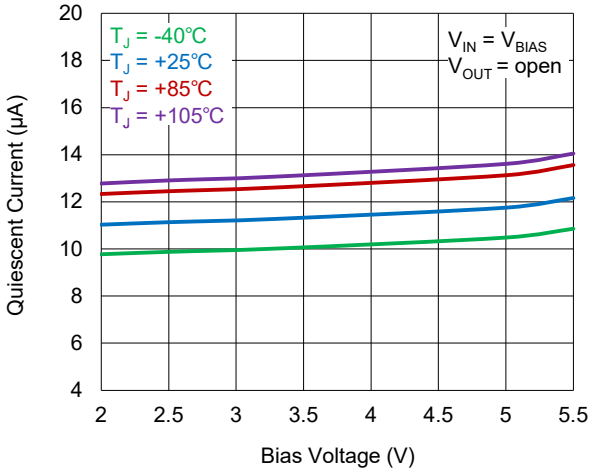
TYPICAL PERFORMANCE CHARACTERISTICS

T_J = +25℃, unless otherwise noted.

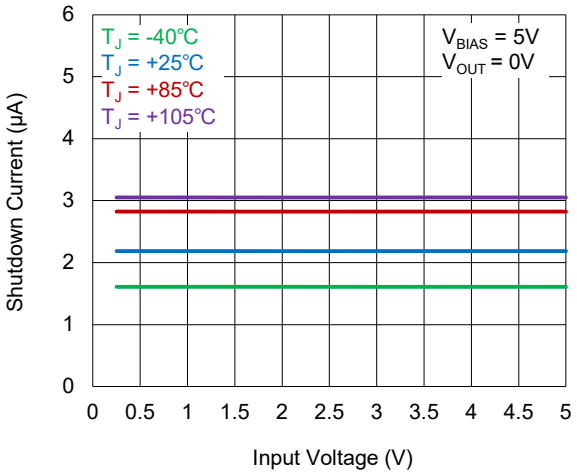
Quiescent Current vs. Input Voltage



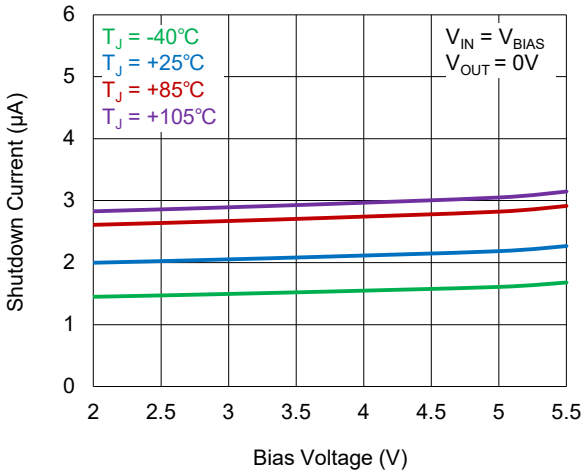
Quiescent Current vs. Bias Voltage



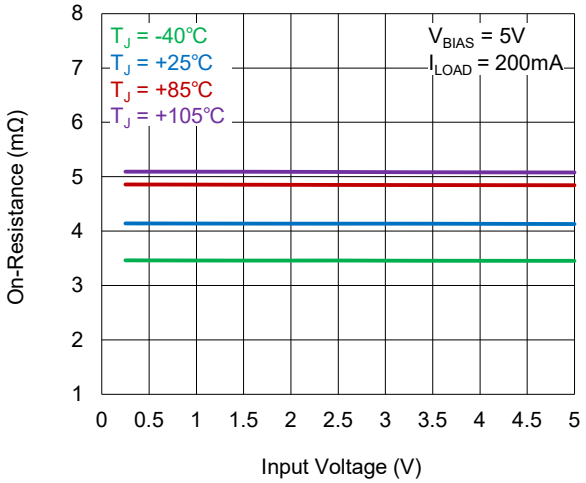
VBIAS Shutdown Current vs. Input Voltage



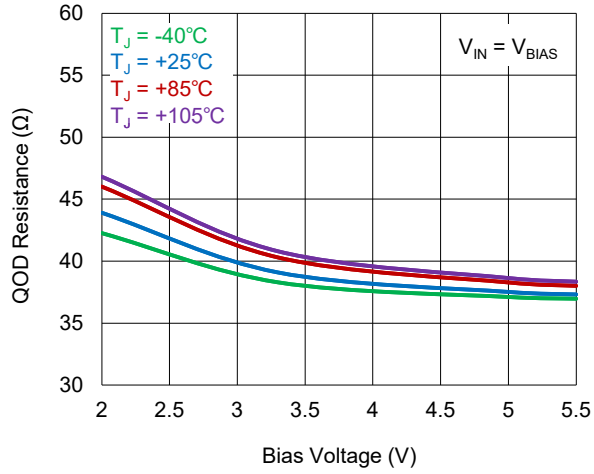
VBIAS Shutdown Current vs. Bias Voltage



On-Resistance vs. Input Voltage



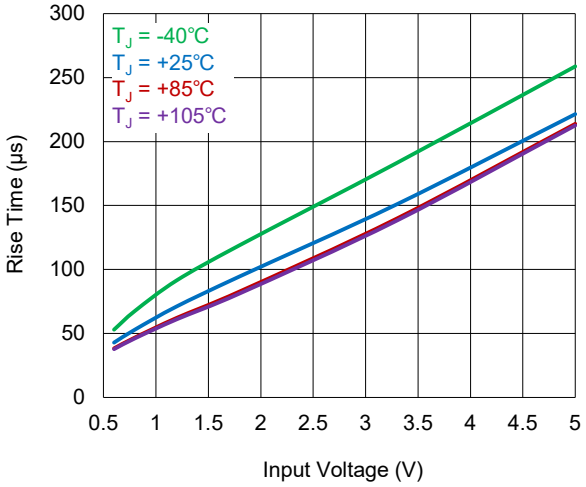
QOD Resistance vs. Bias Voltage



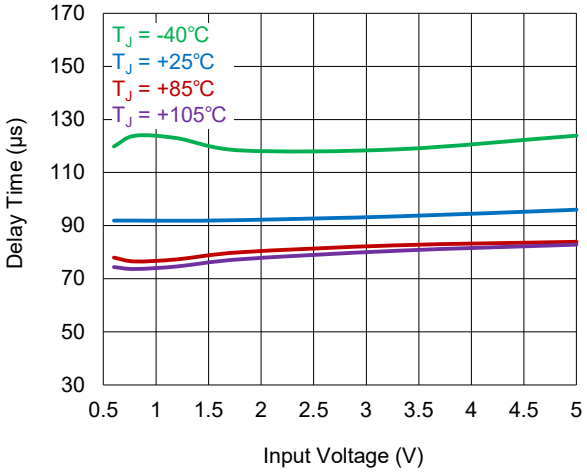
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

V_{BIAS} = 5V, C_L = 0.1μF, SS = floating, T_J = +25℃, unless otherwise noted.

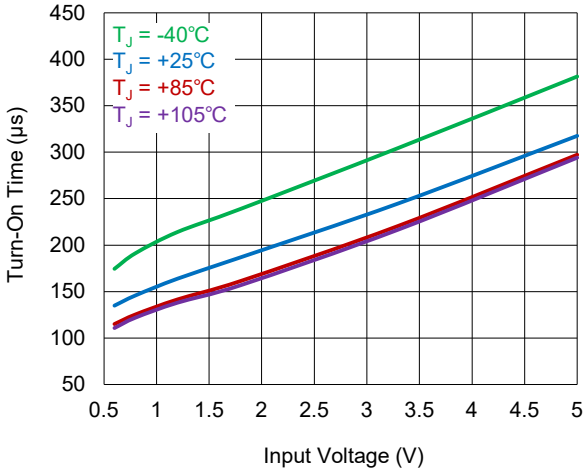
Rise Time vs. Input Voltage



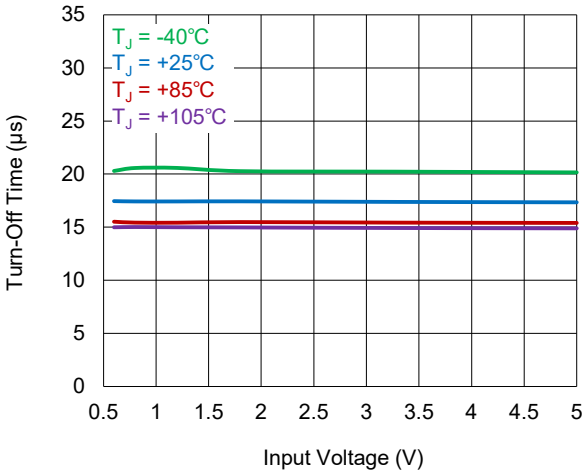
Delay Time vs. Input Voltage



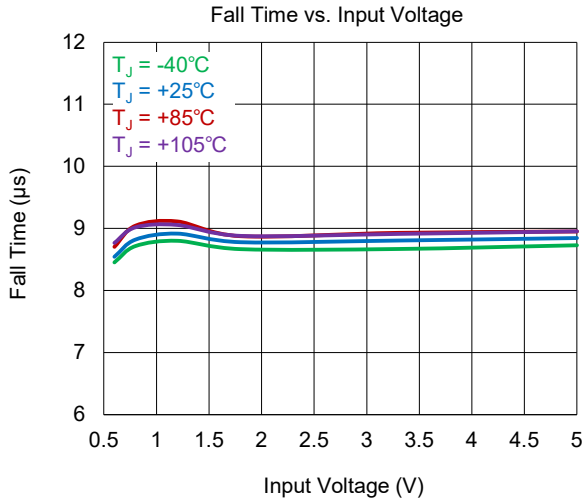
Turn-On Time vs. Input Voltage



Turn-Off Time vs. Input Voltage



Fall Time vs. Input Voltage



DETAILED DESCRIPTION

Overview

The SGM25665 is a 5.5V, integrated N-MOSFET, single-channel load switch. It can support a 10A maximum continuous load current and be enabled by the ON pin. The configurable rise time can be used to avoid inrush current. The device also has the fixed quick output discharge function to remove the remaining energy from the output when the switch is disabled.

The SGM25665 is highly integrated. Using the device can reduce the PCB area and the BOM count greatly, even the cost.

V_{IN} and V_{BIAS} Voltage Range

When V_{IN} < V_{BIAS}, the device gets the best R_{DSON} performance. If V_{IN} > V_{BIAS}, the device will show a larger R_{DSON} than the value in the electrical characteristics table even though it still work. Ensure that V_{IN} and V_{BIAS} are set to appropriate values, otherwise performance will not be guaranteed.

Control Pin

There is a control pin ON to turn on or turn off the corresponding N-MOSFET. When the ON pin is driven high, the switch will be turned on, and when the ON pin is driven low, the switch will be turned off. The ON pin is compatible with standard GPIO logic level threshold, such as 0.7V or higher GPIO voltage.

Adjustable Slew Rate

The SS pin is a tri-state pin whose three slew rates are set according to its pin connection. This pin supports three states: left floating, pulled high, or connected to GND. The floating state is defined as an effective resistance to GND or other pins exceeding 10MΩ.

Thermal Shutdown

Thermal shutdown protects the device from excessive temperature and can recovery automatically. When die temperature exceeds +170℃ (TYP), the MOSFET will be shut down and remained off until die temperature drops below +150℃ (TYP).

Device Functional Modes

The following table summarizes the device functional modes.

ON	Fault Condition	VOUT State
L	None	QOD to GND
H	None	Connected to VIN
H	Thermal shutdown	QOD to GND

APPLICATION INFORMATION

Typical Application

This example illustrates how to use the SGM25665 device in details to limit inrush current within the requirement.

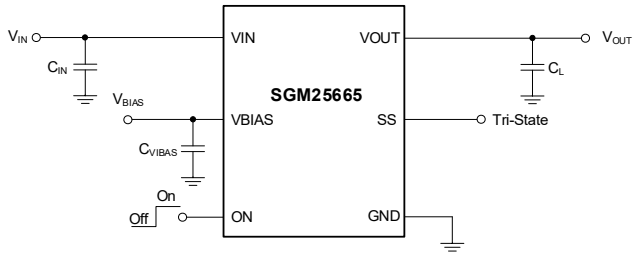


Figure 4. Typical Application Schematic

Design Requirements

Table 1 shows the SGM25665 design parameters.

Table 1. Design Parameters

Design Parameter	Value
V_{BIAS} Voltage (V_{BIAS})	3.3V
Input Voltage (V_{IN})	3.3V
Load Capacitance (C_L)	470μF
Maximum Acceptable Inrush Current (I_{INRUSH})	1.2A

Inrush Current

When the switch is enabled, the C_L must be charged from 0V to 3.3V (set value). This process causes the inrush current, and it can be calculated by Equation 1.

$$I_{INRUSH} = C_L \times dV_{OUT}/dt \quad (1)$$

Where:

C_L is the output capacitance.

dV_{OUT} is the rising change value of V_{OUT} after the device is enabled.

dt is the rise time taken by the device to increase V_{OUT} after the device is enabled.

The rise time of the V_{OUT} can be programmed. This function is used to control the inrush current during turn-on. The design requirements and inrush current equation can be used to calculate the appropriate rise time. See Equation 2.

$$1.2A = 470\mu F \times (3.3V \times 80\%)/dt \quad (2)$$

$$dt = 1034\mu s \quad (3)$$

In order to ensure that the inrush current is less than 1.2A, an appropriate SS pin connection should be selected to produce a rise time more than 1034μs. Setting the SS pin to a high logic level selects a rise time of 1143μs, thereby constraining the inrush current to a level below 1.2A.

Input Capacitor (C_{IN})

Turning on the N-MOSFET to charge load capacitor will generate inrush current, which may cause the V_{IN} to drop. In order to prevent the drop, a capacitor must be placed between the VIN and GND pin. Usually, a 1μF input capacitor (C_{IN}) placed close to the pins is sufficient. However, higher capacitance values could further reduce the voltage drop. So, larger C_{IN} can be used to reduce the voltage drop in high current applications. It should be noted that if the input parasitic situation is poor, it is recommended to use a larger input capacitor.

Output Capacitor (C_L)

A 0.1μF output capacitor (C_L) should be placed between VOUT and GND, and it should be close to the device pins. This capacitor will prevent parasitic board inductances from forcing VOUT below GND when the switch is turned off.

VBIAS Capacitor (C_{VBIAS})

It is recommended to place a 0.1μF capacitor (C_{VBIAS}) close to the VBIAS pin. This capacitor between VBIAS and GND is employed to stabilize the VBIAS supply voltage and mitigate the influence of low-frequency noise. Moreover, if the VBIAS supply environment has the poor parasitic situation, a larger capacitor is required.

APPLICATION INFORMATION (continued)

Layout Guidelines

Careful layout is always important to ensure good performance and stable operation to any kind of load switch.

- All high-current traces (VIN and VOUT) can be as short as possible to optimize parasitic parameters.
- Locate the input and output capacitors as close as possible to the device.
- Choose wide traces for VIN, VOUT and GND. It is recommended to use ground copper pour. Special attention should be paid to that size and number of via must be enough for a given current.

Thermal Considerations

Assuming a given ambient temperature and package thermal resistance, the maximum allowable power dissipation is calculated by:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{\theta_{JA}} \quad (4)$$

where:

$P_{D(MAX)}$ is the maximum power dissipation.

$T_{J(MAX)}$ is the maximum operating junction temperature.

T_A is the operating ambient temperature.

θ_{JA} is the package thermal resistance.

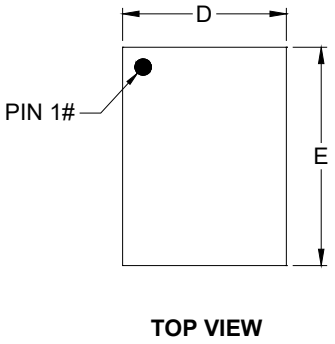
REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

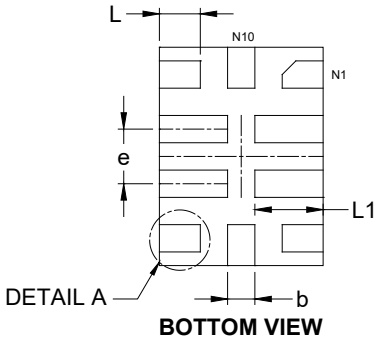
Changes from Original to REV.A (MARCH 2026)	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

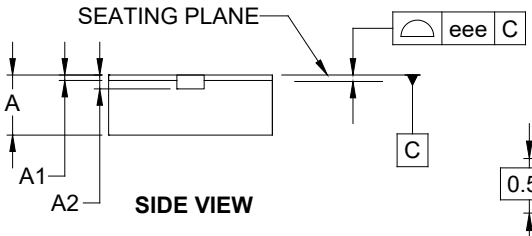
UTQFN-1.5×2-10L



TOP VIEW

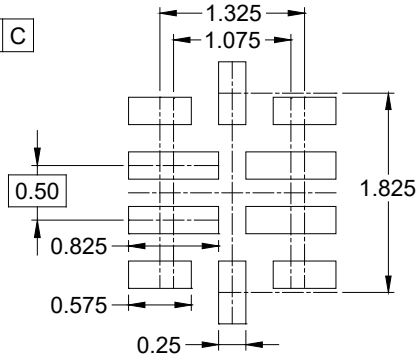


BOTTOM VIEW



SIDE VIEW

DETAIL A
ALTERNATE TERMINAL CONSTRUCTION



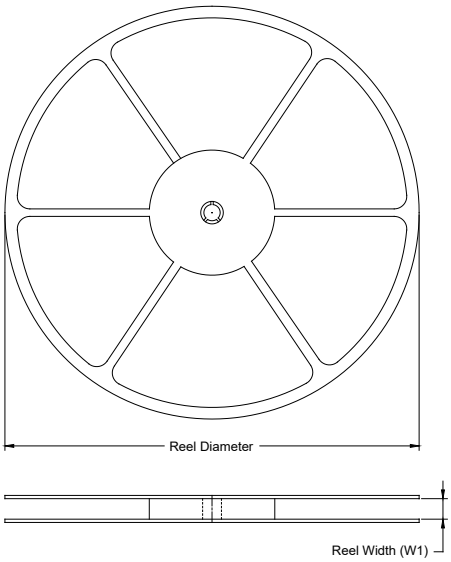
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.500	-	0.600
A1	0.000	-	0.050
A2	0.127 REF		
b	0.200	-	0.300
D	1.400	-	1.600
E	1.900	-	2.100
e	0.500 BSC		
L	0.275	-	0.475
L1	0.525	-	0.725
eee	0.080		

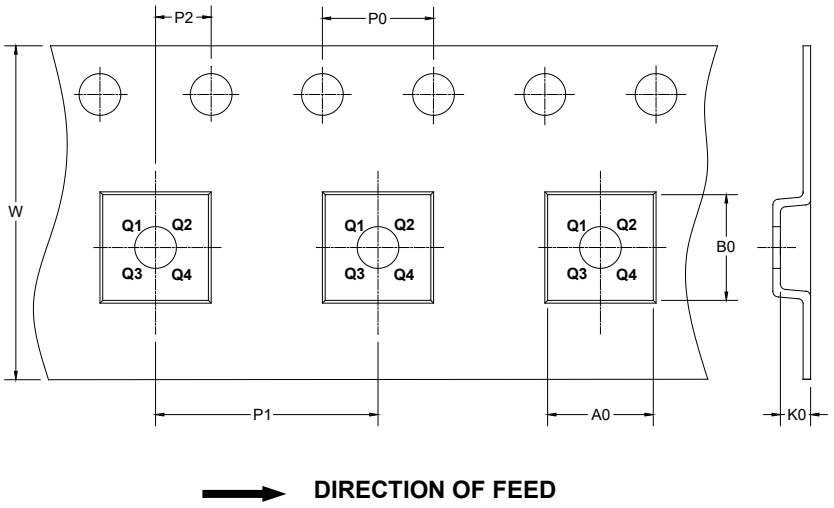
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



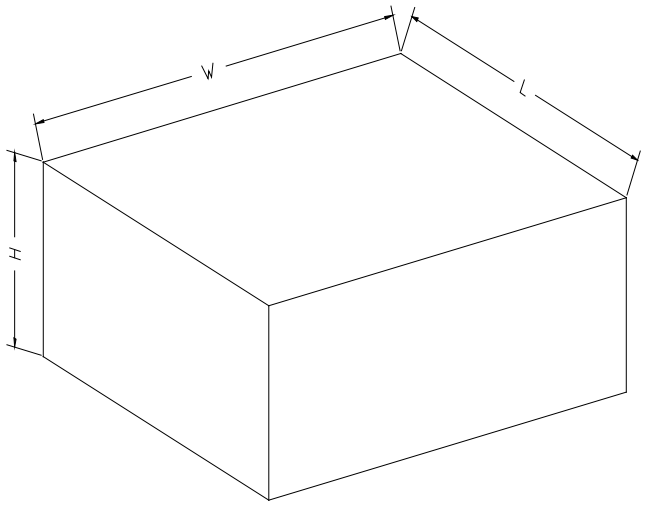
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
UTQFN-1.5×2-10L	7"	9.5	1.75	2.30	0.75	4.0	4.0	2.0	8.0	Q1

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18

DD0002