SGM25660
16V, 50mΩ R_{DSON}, Power Switch with Programmable Soft-Start

GENERAL DESCRIPTION

The SGM25660 is a single-channel line low on-resistance power switch. The device can operate over a wide input voltage range from 2.7V to 16V and is controlled by an active-high enable pin.

Full protection features include programmable soft-start, over-current protection (OCP) and thermal shutdown. A programmable soft-start function is used to set the proper rising time to reduce inrush current caused by large load capacitance.

The SGM25660 is available in a Green SOT-23-5 package.

FEATURES

- **Wide Operating Input Voltage Range: 2.7V to 16V**
- **Low R_{DSON}: 50mΩ at V_{IN} = 12V (TYP)**
- **Low Operation Current: 85μA (TYP)**
- **Low Shutdown Current: 4.7μA (TYP)**
- **Externally Programmable Soft-Start Time**
- **Output Auto Discharge Function**
- **Over-Current Protection**
- **Input Over-Voltage Protection**
- **Thermal Protection**
- **Available in a Green SOT-23-5 Package**

APPLICATIONS

Flat Panel Television and Monitor
Digital Set Top Boxes
Industrial Systems
Distributed Power Systems
Surveillance Systems

SIMPLIFIED SCHEMATIC

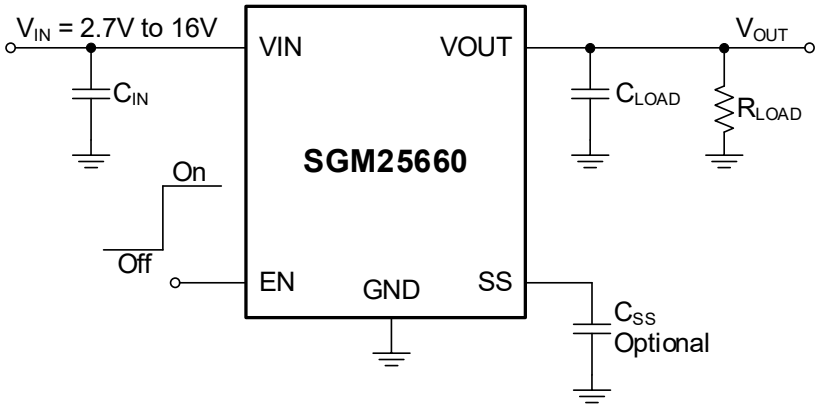


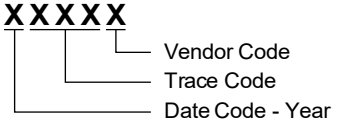
Figure 1. Simplified Schematic

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM25660	SOT-23-5	-40℃ to +125℃	SGM25660XN5G/TR	1TL XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor 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 Supply Voltage Range ..... -0.3V to 20V
VOUT, EN Voltage..... -0.3V to 20V
SS Pin Voltage..... -0.3V to 6V
Package Thermal Resistance
SOT-23-5, θ_{JA} ..... 150.3℃/W
SOT-23-5, θ_{JB} ..... 34.3℃/W
SOT-23-5, θ_{JC} ..... 71.1℃/W
Junction Temperature.....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....+260℃
ESD Susceptibility (1) (2)
HBM.....±2000V
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 Supply Voltage Range .....2.7V to 16V
Operating Junction Temperature .....-40℃ to +125℃

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.

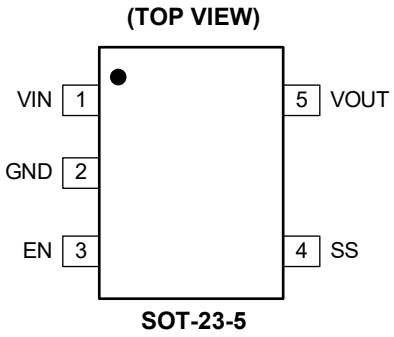
ESD SENSITIVITY CAUTION

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



PIN DESCRIPTION

PIN	NAME	TYPE	FUNCTION
1	VIN	P	Power Supply Pin. Use a low-ESR ceramic capacitor (typically 1μF or larger, X5R or X7R dielectric) between VIN and GND pins close to the device.
2	GND	G	Ground Pin.
3	EN	DI	Enable Pin. Logic-high enables the IC. Logic-low disables the IC and enters micro-power shutdown mode. Do not leave this pin floating.
4	SS	AI	Soft-Start Pin. Set soft-start time by connecting a capacitor to ground. Floating this pin is default soft-start time. The larger the capacitance, the longer soft-start time.
5	VOUT	P	Switch Output Pin. Place a ceramic capacitor (typical 0.1μF) from VOUT pin to Ground.

NOTE: P = power, DI = digital input, AI = analog input.

ELECTRICAL CHARACTERISTICS

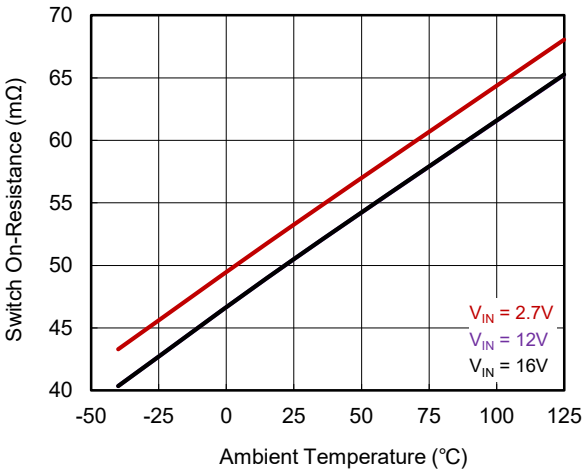
(V_{IN} = 12V, T_J = -40℃ to +125℃, and all typical values are measured at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}		2.7		16	V
UVLO Threshold	V_{UVLO}		2.20	2.40	2.65	V
UVLO Hysteresis	V_{UVLO_HYS}			0.15		V
OVP Threshold	V_{OVP}		16.01	16.8	17.30	V
OVP Hysteresis	V_{OVP_HYS}			0.21		V
Operation Current	I_Q	V_{EN} = 5V, I_{OUT} = 0A		85	140	μA
Shutdown Current	I_{SD}	V_{EN} = 0V		4.7	10	μA
Soft-Start Time	t_{SS}	SS pin is floating		0.12		ms
		C_{SS} = 4.7nF		1		
		C_{SS} = 10nF		2.4		
Switch On-Resistance	R_{DSON}	I_{OUT} = 1A		50	85	mΩ
Switch Current Limit	I_{LIM_SW}	T_J = +25℃	4			A
		T_J = -40℃ to +125℃	3.15			
Output Auto Discharge Current		V_{EN} = 0V	15	30	45	mA
EN Rising Threshold	$V_{EN\_TH\_R}$		0.8	1.0	1.2	V
EN Falling Threshold	$V_{EN\_TH\_F}$		0.7	0.9	1.1	V
EN Hysteresis Voltage	V_{EN_HYS}			0.1		V
Hiccup Cycle Time after Over-Current				1400		ms
Thermal Shutdown Threshold	T_{SD}			145		℃
Thermal Shutdown Hysteresis	T_{HYS}			30		℃

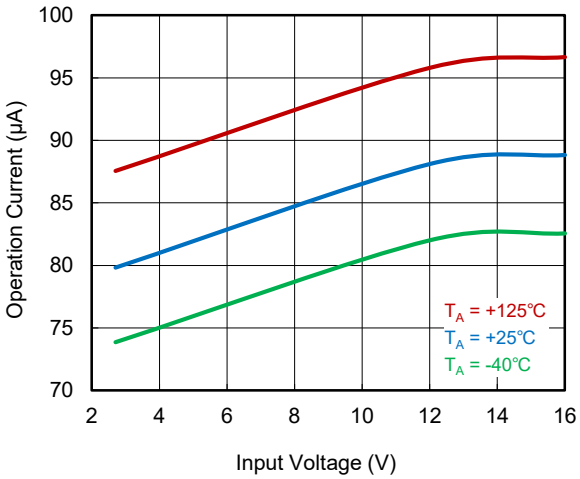
TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN} = 12V and C_{LOAD} = 10μF, unless otherwise noted.

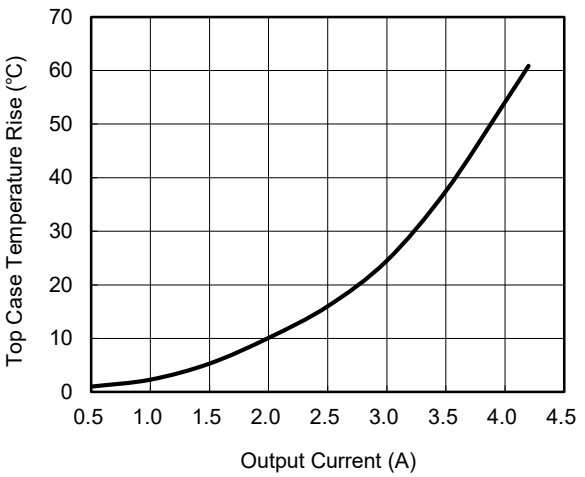
Switch On-Resistance vs. Temperature



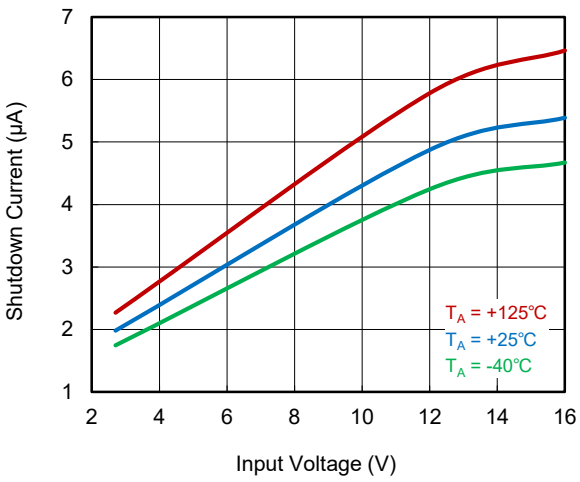
Operation Current vs. Input Voltage



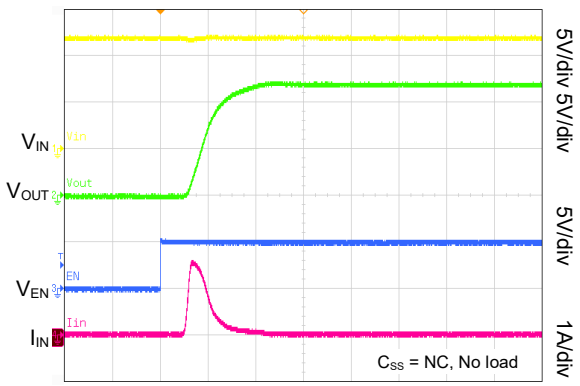
Top Case Temperature Rise vs. Output Current



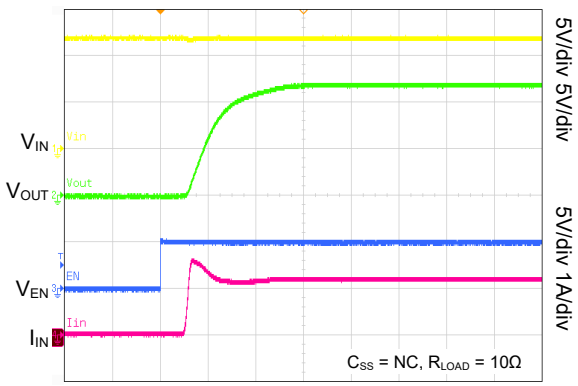
Shutdown Current vs. Input Voltage



Soft-Start



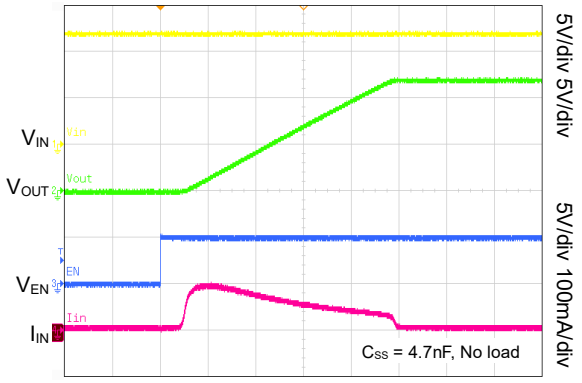
Soft-Start



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

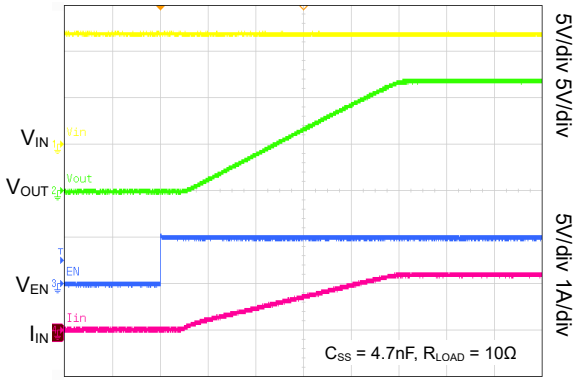
V_{IN} = 12V and C_{LOAD} = 10μF, unless otherwise noted.

Soft-Start



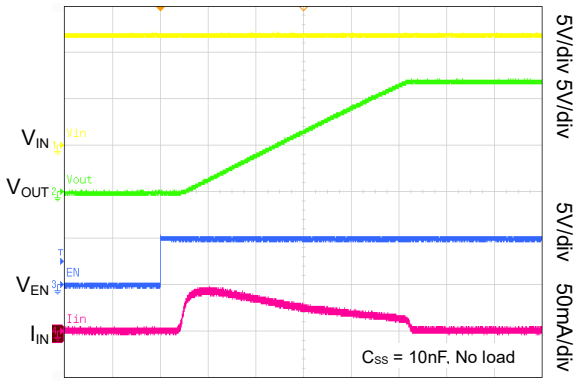
Time (300μs/div)

Soft-Start



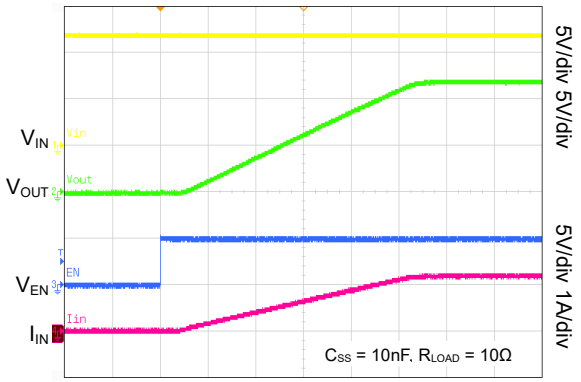
Time (300μs/div)

Soft-Start



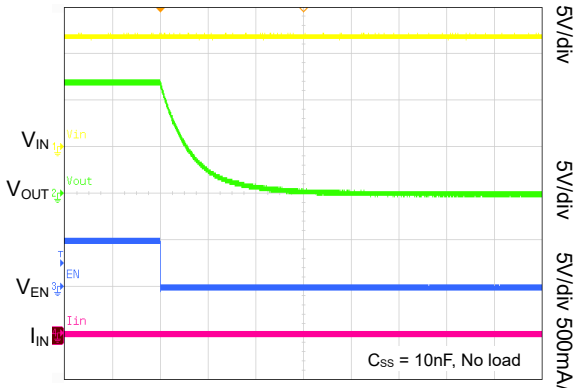
Time (600μs/div)

Soft-Start



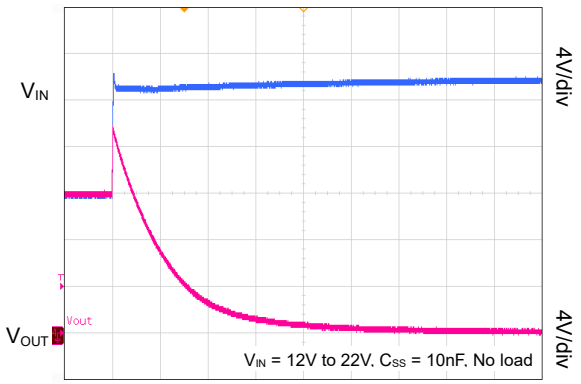
Time (600μs/div)

EN Disable



Time (2ms/div)

Input Over-Voltage Protection



Time (2ms/div)

FUNCTIONAL BLOCK DIAGRAM

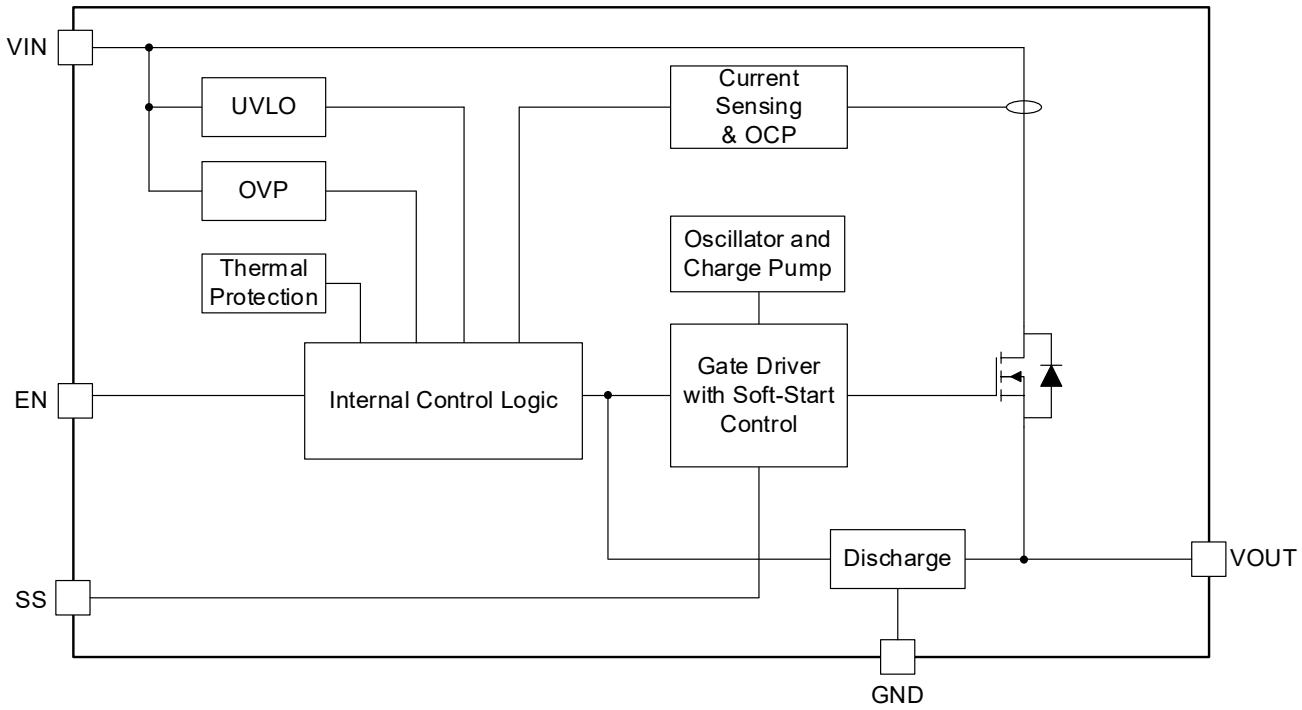


Figure 2. Block Diagram

DETAILED DESCRIPTION

Input Under-Voltage Lockout

The SGM25660 is a single-channel power switch featuring a low on-resistance N-channel MOSFET that minimizes the dropout voltage. It supports an input voltage range from 2.7V to 16V. The device turns on when the EN pin is enabled and the input voltage (V_{IN}) exceeds the under-voltage lockout (UVLO) rising threshold. It turns off when V_{IN} falls below this threshold minus the UVLO hysteresis voltage.

Input Over-Voltage Protection

The SGM25660 features an input over-voltage protection (OVP) function, which prevents the output from high-voltage damage. When the input voltage (V_{IN}) exceeds the fixed OVP threshold (typically 16.8V), the internal MOSFET turns off immediately.

Enable ON/OFF and Auto-Discharge Function

The SGM25660 is controlled by an active-high enable (EN) pin. The internal MOSFET turns on, allowing current to flow from VIN to VOUT, when the input voltage exceeds the UVLO threshold and the EN pin is driven above its rising threshold. Conversely, when EN falls below its falling threshold, the MOSFET turns off and an internal discharge circuit activates, discharging VOUT with a typical current of 30mA.

Programmable Soft-Start Time

The device features a programmable soft-start function to limit inrush current caused by heavy load capacitance by controlling the output voltage rise time. The soft-start duration is set by an external capacitor connected between the SS pin and GND. If the SS pin is left floating, the output voltage (V_{OUT}) will rise with the default minimum soft-start time upon enable.

Over-Current Protection

The device incorporates a current limit function for protection against over-current and output short-circuit conditions. If the current exceeds the preset limit, the internal MOSFET turns off immediately. Following a fixed hiccup cycle, the device automatically attempts to restart. The MOSFET will be turned off again if the fault condition persists.

Thermal Shutdown Protection

The device also includes a thermal shutdown feature to protect it from damage under excessive junction temperature conditions. The internal MOSFET is turned off immediately when the junction temperature exceeds the shutdown threshold and is automatically restored after it cools down by the specified hysteresis value.

APPLICATION INFORMATION

Input and Output Capacitors

An input capacitor is required for the SGM25660 to suppress voltage drops caused by inrush current during turn-on or load transients, and to mitigate voltage spikes during turn-off, especially under over-current protection (OCP) conditions. Typically, a 1μF ceramic capacitor placed close to the VIN pin is sufficient. For high-current applications, a larger input capacitance can be used to better limit these voltage fluctuations.

The capacitor on the output side serves as the load capacitance. A critical design consideration is the capacitance ratio: if the output capacitance exceeds the input capacitance, removing the input power supply may cause V_{OUT} to exceed V_{IN}, leading to a reverse current flow from VOUT to VIN through the MOSFET's body diode. To prevent this reverse current in systems where it is critical, it is recommended to use an input capacitance larger than the output capacitance.

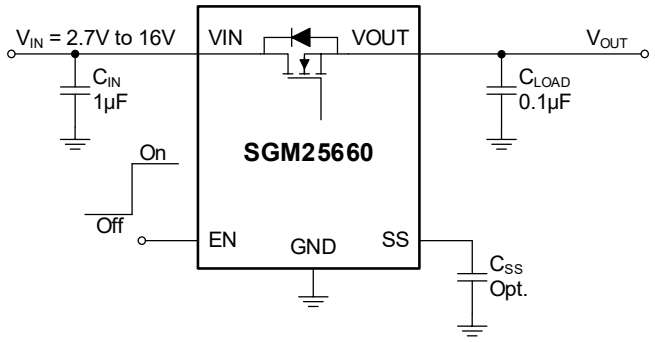


Figure 3. Typical Application Circuit

Programming Soft-Start Capacitor

The capacitor (C_{SS}) connected between the SS pin and ground sets the output voltage slew rate, thereby determining the soft-start time. Leaving the SS pin floating results in the minimum soft-start time, which increases proportionally with the value of C_{SS}. Selecting the appropriate C_{SS} value is critical: an excessively long soft-start time can cause thermal shutdown when charging large output capacitors, due to excessive power dissipation in the MOSFET. Conversely, an excessively short soft-start time may trigger OCP from the high inrush current required by a large output capacitance. Refer to Table 1 for typical soft-start times under various input voltages and C_{SS} values.

Table 1. Soft-Start Time Table (1)

C_{SS}	V_{IN}					
	2.7V	3.3V	5V	9V	12V	16V
NC	77	76	81	78	85	98
1nF	84	88	111	154	211	291
2.2nF	88	112	181	314	433	600
4.7nF	225	274	412	719	980	1361
6.8nF	337	420	620	1165	1450	1994
10nF	480	602	952	1581	2160	3040

NOTE:
1. Soft-Start Time (μs) 10% to 90%, C_{LOAD} = 0.1μF, C_{IN} = 1μF, and I_{OUT} = 0.5A.

Layout Consideration

To ensure the proper operation of the SGM25660, adhere to the following PCB layout guidelines:

1. Power Traces (VIN/VOUT): Keep the VIN and VOUT power traces as short and wide as possible. This minimizes parasitic inductance, thereby reducing input voltage spikes during over-current protection (OCP) events.

2. Input Bypass Capacitor: Bypass the VIN pin to ground with a low-ESR ceramic capacitor (typically 1μF or larger, X5R or X7R dielectric). Place this capacitor as close as possible to the VIN pin to maximize its effectiveness.

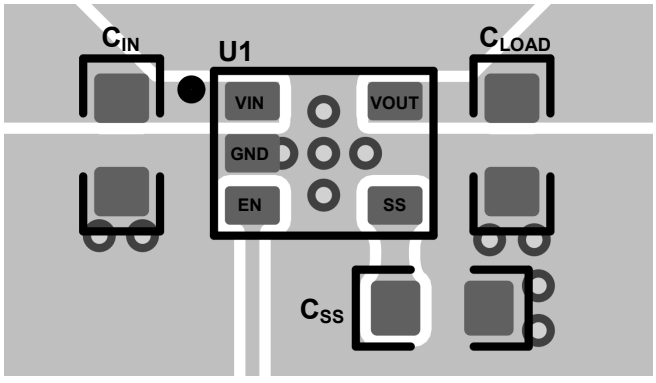


Figure 4. PCB Layout Example

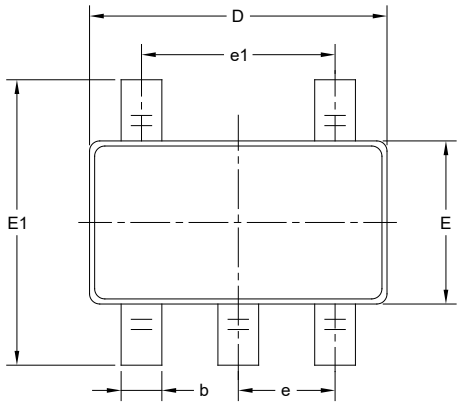
REVISION HISTORY

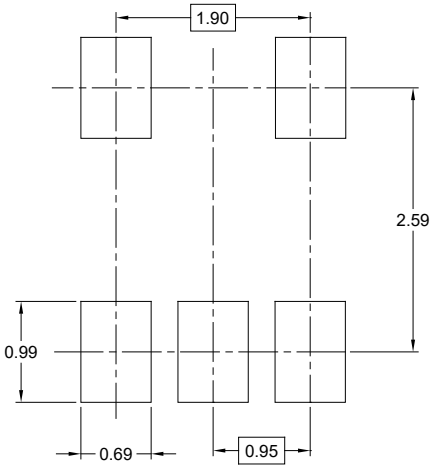
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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

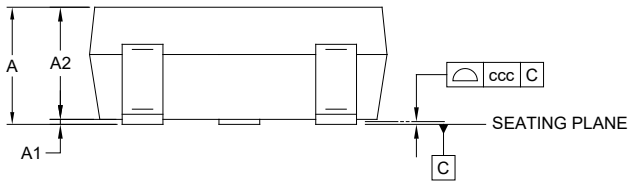
PACKAGE OUTLINE DIMENSIONS

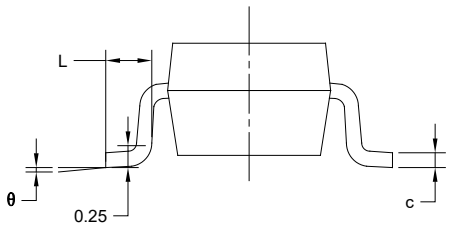
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)



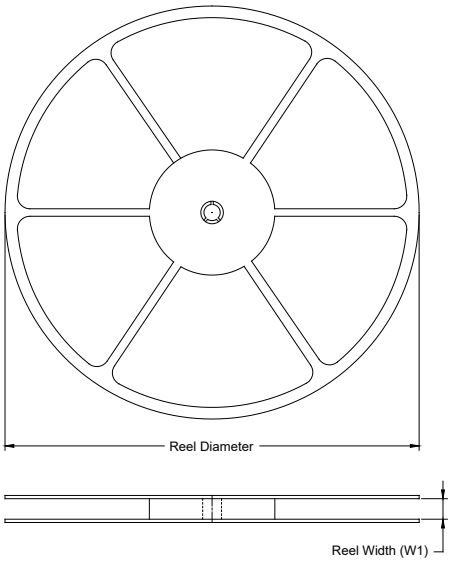


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

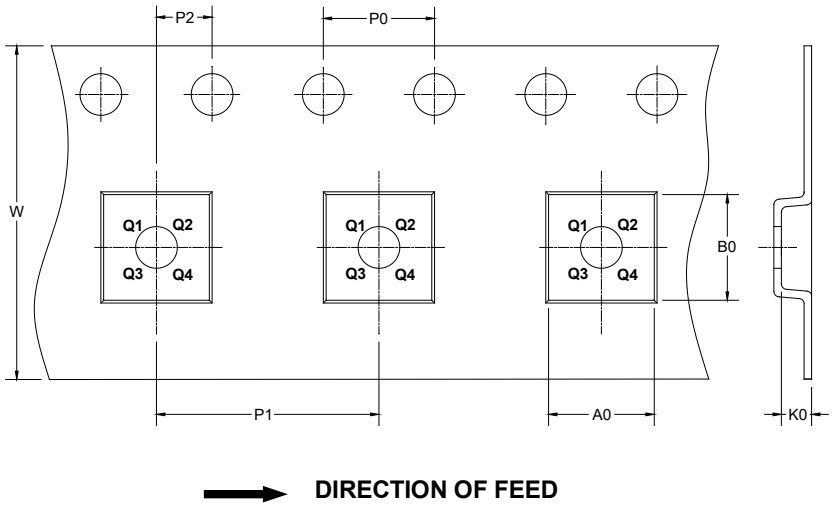
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



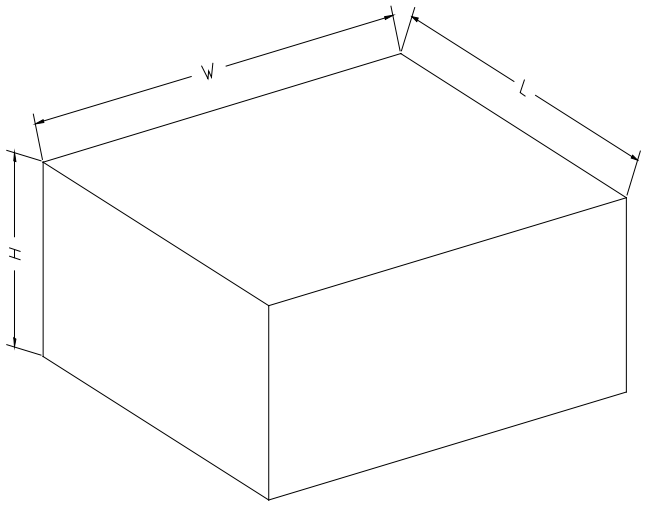
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOT-23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

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