SGM25006
Power Distribution Switch with Precision Adjustable Current Limit

GENERAL DESCRIPTION

The SGM25006 is a single channel power distribution switch. The switch operates from a wide range of 2.5V to 6.5V supply voltage, and is controlled by the nEN/EN pin. The rise time and fall time of the device are controlled internally to avoid inrush current.

An integrated charge pump biases the N-MOSFET switch in order to achieve a low switch R_{DSON}. This device provides the adjustable current limit threshold between 500mA and 5A through the R_{ILIM}. If the load current is higher than the current limit threshold, the device will limit the output current to a safe level and enter into constant-current mode. Fault conditions such as over-current and over-temperature are indicated by the nFAULT pin.

The SGM25006 is available in a Green TDFN-3×3-8FL package.

FEATURES

- **Input Voltage Range: 2.5V to 6.5V**
- **For USB Current Limit Requirements**
- **Adjustable Current Limit: 500mA to 5A**
- **±5% Current Limit Accuracy at 4.5A**
- **Fast Over-Current Response: 3.5μs (TYP)**
- **On-Resistance: 20mΩ (TYP)**
- **Supply Current: 115μA (TYP)**
- **Built-in Soft-Start**
- **Enable Pin Options**
  - **SGM25006A: Active-High**
  - **SGM25006B: Active-Low**
- **15kV [(1)] and 8kV System-Level ESD Capable**

APPLICATIONS

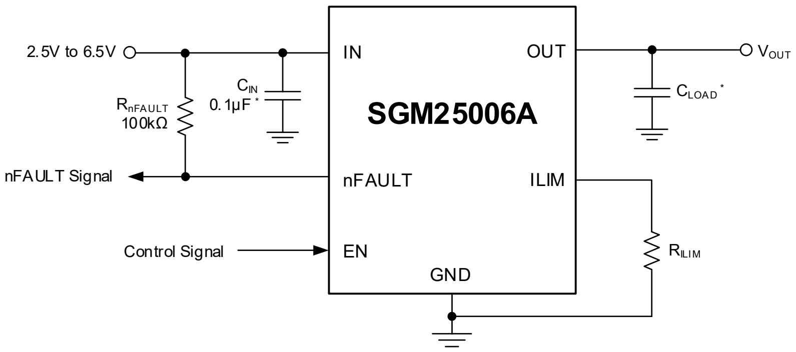
USB Ports and Hubs

Digital TVs

IP Camera

Server or PC

TYPICAL APPLICATION



NOTE: *. In the case of short-circuit, the lead is relatively long, or the input capacitor parasitic inductance is relatively large, the resonance may cause V_{IN} overshoot or burning die, it is recommended that the input capacitance is above 10μF, the output capacitance is above 1μF.

Figure 1. Typical Application Circuit

NOTE: 1. C_{IN} = 1μF.

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM25006A	TDFN-3×3-8FL	-40℃ to +125℃	SGM25006AXTHA8G/TR	SGM 0KPTHA XXXXX	Tape and Reel, 4000
SGM25006B	TDFN-3×3-8FL	-40℃ to +125℃	SGM25006BXTHA8G/TR	SGM 0DBTHA XXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

XXXXX
- Vendor Code
- Trace Code
- Date Code - Year

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

IN, OUT, EN/nEN, ILIM and nFAULT Pins........... -0.3V to 7V
Voltage from IN to OUT .... -7V to 7V
Continuous Output Current .... Internally limited
Continuous nFAULT Sink Current 25mA
ILIM Source Current .... Internally limited
Junction Temperature .... +150℃
Storage Temperature Range .... -65℃ to +150℃
Lead Temperature (Soldering, 10s) .... +260℃
ESD Susceptibility
HBM 4kV
CDM 1kV
Air Gap Discharge on IN Pin (IEC 61000-4-2) (1) 15kV
Contact Discharge on IN Pin (IEC 61000-4-2) 8kV

NOTE: 1. C_{IN} = 1μF.

RECOMMENDED OPERATING CONDITIONS

Input Voltage, IN .... 2.5V to 6.5V
Enable Voltage, V_{nEN}/V_{EN} .... 0V to 6.5V
Continuous Output Current (OUT Pin), I_{OUT} .... 0A to 5A
Continuous nFAULT Sink Current .... 0mA to 10mA
Recommended Resistor Limit, R_{ILIM} .... 20kΩ to 187kΩ
Operating Junction Temperature Range ...... -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

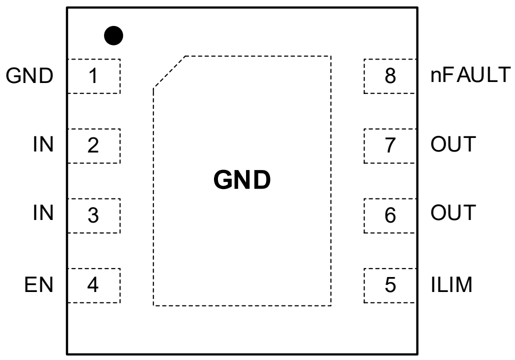
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

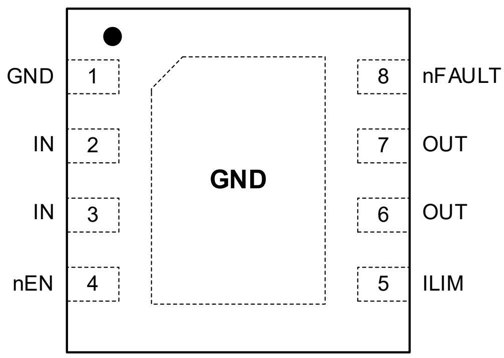
PIN CONFIGURATION

SGM25006A (TOP VIEW)



TDFN-3×3-8FL

SGM25006B (TOP VIEW)



TDFN-3×3-8FL

PIN DESCRIPTION

PIN	NAME		FUNCTION
	SGM25006A	SGM25006B	
1	GND	GND	GND.
2, 3	IN	IN	Switch Input. A 0.1μF or larger ceramic capacitor needs to be added between IN pin and GND.
4	EN	-	Enable Input. Logic high to enable the device.
	-	nEN	Enable Input. Logic low to enable the device.
5	ILIM	ILIM	Adjustable Current Limit Pin. External resistor (20kΩ ≤ R_{ILIM} ≤ 187kΩ) used to set current limit threshold.
6, 7	OUT	OUT	Switch Output.
8	nFAULT	nFAULT	Alert Output Pin. Fault conditions (over-current or over-temperature condition) are indicated by the nFAULT pin.
Exposed Pad	GND	GND	Used for heat dissipation for the chip. Connect the thermal pad (internally connected to GND) to the outside GND.

ELECTRICAL CHARACTERISTICS

(T_J = -40℃ to +125℃, V_{nEN} = 0V or V_{EN} = V_{IN}, typical values are at T_J = +25℃, unless otherwise noted.) [1]

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Power Switch						
Static Drain-Source On-Resistance	R_{DSON}	T_J = +25℃		20	26	mΩ
		T_J = -40℃ to +125℃			35	
Enable Pin Turn-Off/Turn-On Threshold			0.66		1.1	V
Enable Input Hysteresis [2]				40		mV
Input Current	I_{EN}	V_{nEN} = 0V or 6.5V, V_{nEN} = 0V or 6.5V	-0.5		0.5	μA
Current Limit Threshold (Maximum DC Output Current I_{OUT} Delivered to Load) and Short-Circuit Current, OUT Connected to GND	I_{OS}	R_{ILIM} = 24.9kΩ	4240	4420	4640	mA
		R_{ILIM} = 61.9kΩ	1650	1800	1955	
		R_{ILIM} = 100kΩ	1000	1130	1280	
Supply Current, Low-Level Output	I_{IN_OFF}	V_{IN} = 6.5V, no load on OUT, V_{nEN} = 6.5V or V_{EN} = 0V		0.6	3	μA
Supply Current, High-Level Output	I_{IN_ON}	V_{IN} = 6.5V, no load on OUT		115	180	μA
Reverse Leakage Current	I_{REV}	V_{OUT} = 6.5V, V_{IN} = 0V, T_J = +25℃		0.1	2	μA
IN Pin Low-Level Input Voltage	V_{IN_UVLO}	V_{IN} rising		2.4	2.49	V
IN Pin UVLO Hysteresis [2]	V_{IN_HYS}			60		mV
nFAULT Flag						
nFAULT Pin Output Low Voltage	V_{OL}	I_{nFAULT} = 1mA		66	110	mV
Off-State Leakage		V_{nFAULT} = 5.5V			1	μA
nFAULT Deglitch		nFAULT assertion or deassertion due to over-current condition	7	11	16.5	ms
Thermal Shutdown						
Thermal Shutdown Threshold	OTSD-2			155		℃
Thermal Shutdown Threshold in Current Limit	OTSD-1			135		℃
Hysteresis [2]	T_{HYS}			20		℃

SWITCHING CHARACTERISTICS

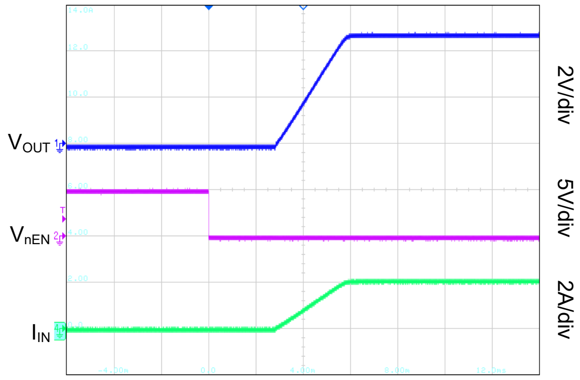
(T_J = -40℃ to +125℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Rise Time, Output	t_R	C_L = 1μF, R_L = 100Ω, (see Figure 3)	V_{IN} = 6.5V	1.5	3	5	ms
			V_{IN} = 2.5V	0.5	1	2	
Fall Time, Output	t_F	C_L = 1μF, R_L = 100Ω, (see Figure 3)	V_{IN} = 6.5V	0.1	0.2	0.4	ms
			V_{IN} = 2.5V	0.1	0.2	0.4	
Turn-On Time	t_{ON}	C_L = 1μF, R_L = 100Ω, (see Figure 3)				10	ms
Turn-Off Time	t_{OFF}	C_L = 1μF, R_L= 100Ω, (see Figure 3)				5	ms
Response Time to Short-Circuit [2]	t_{IOS}	V_{IN} = 5V (see Figure 4)			3.5		μs

NOTES:
1. The pulse testing techniques keep T_J close to T_A and thermal effects must be considered separately.
2. Guaranteed by design.

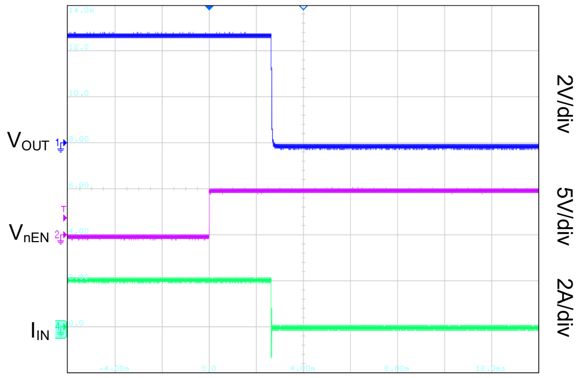
TYPICAL PERFORMANCE CHARACTERISTICS

Turn-On Delay and Rise Time



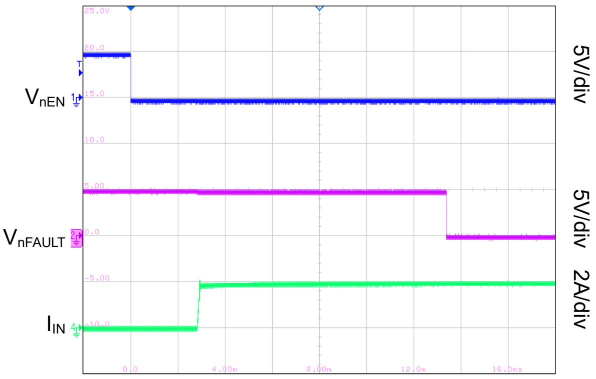
Time (2ms/div)

Turn-Off Delay and Fall Time



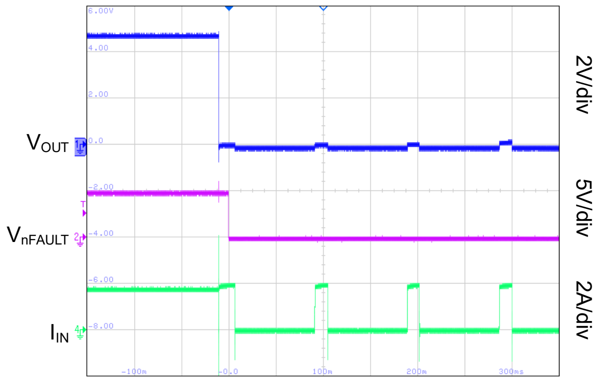
Time (2ms/div)

Device Enabled into Short-Circuit



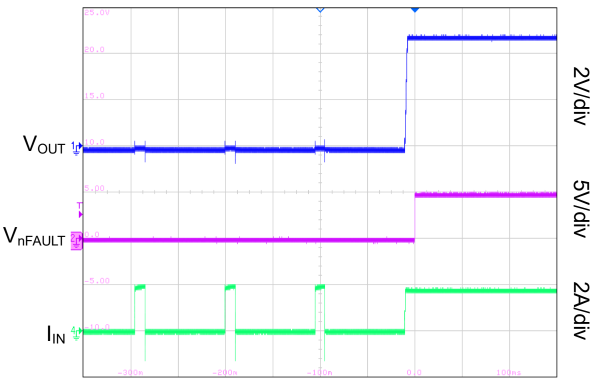
Time (2ms/div)

Full-Load to Short-Circuit Transient Response



Time (50ms/div)

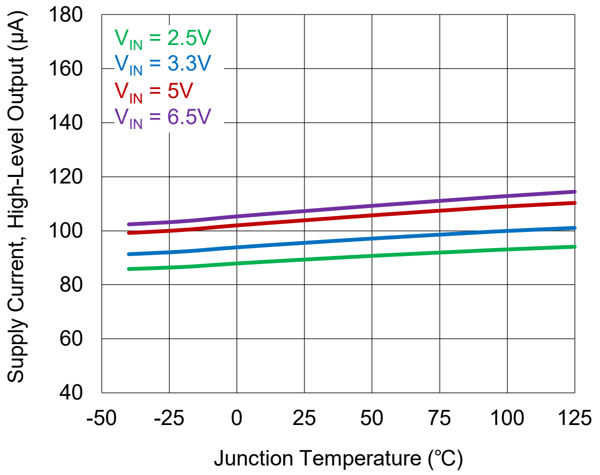
Short-Circuit to Full-Load Recovery Response



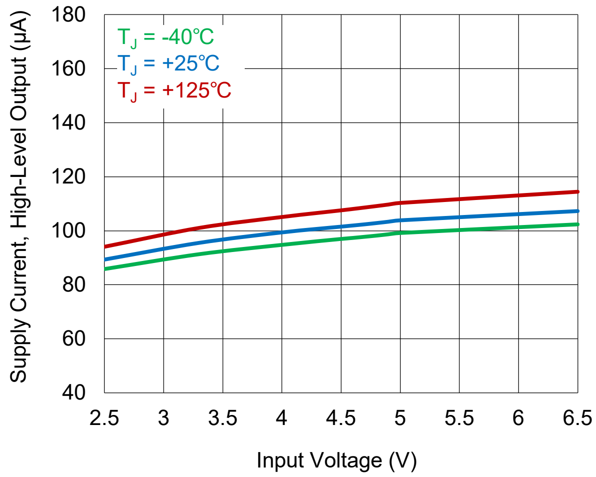
Time (50ms/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

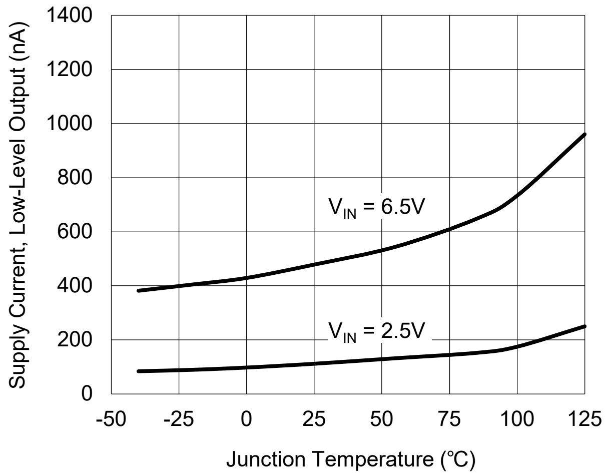
Supply Current, High-Level Output vs. Junction Temperature



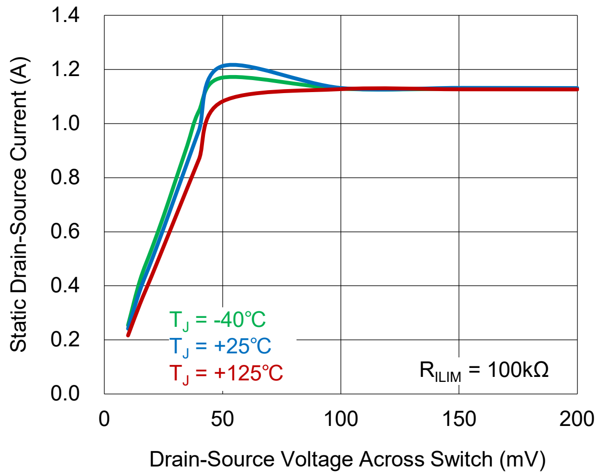
Supply Current, High-Level Output vs. Input Voltage



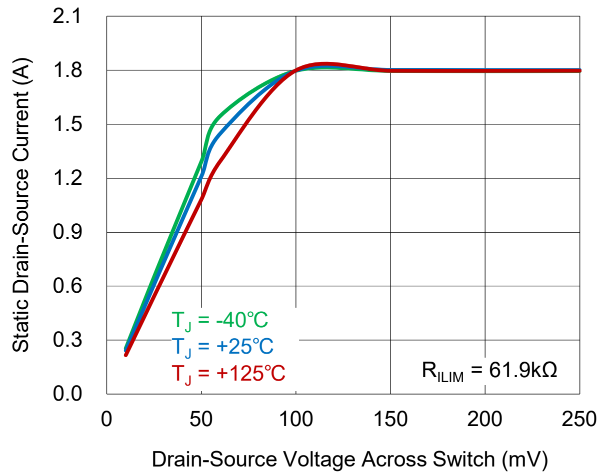
Supply Current, Low-Level Output vs. Junction Temperature



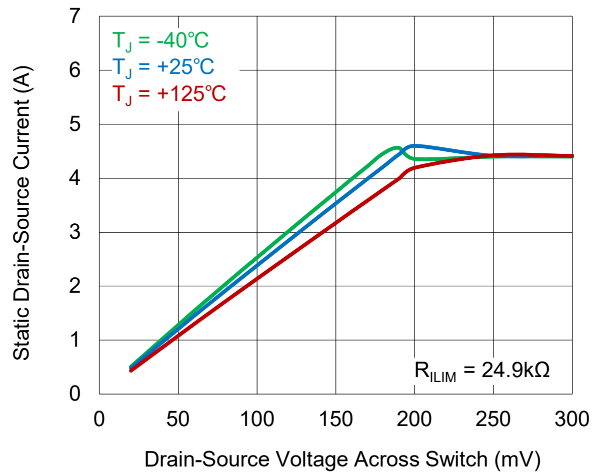
Static Drain-Source Current vs. Drain-Source Voltage Across Switch



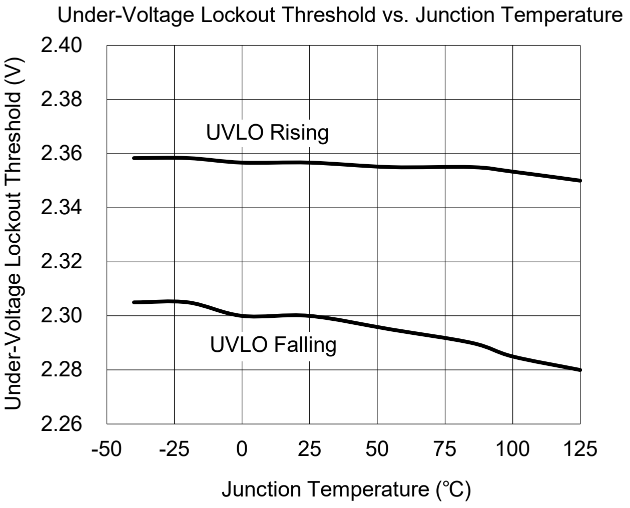
Static Drain-Source Current vs. Drain-Source Voltage Across Switch

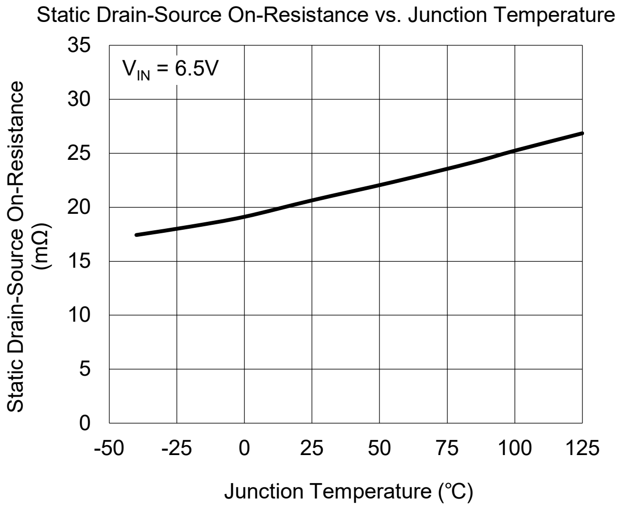


Static Drain-Source Current vs. Drain-Source Voltage Across Switch



TYPICAL PERFORMANCE CHARACTERISTICS (continued)





PARAMETER MEASUREMENT INFORMATION

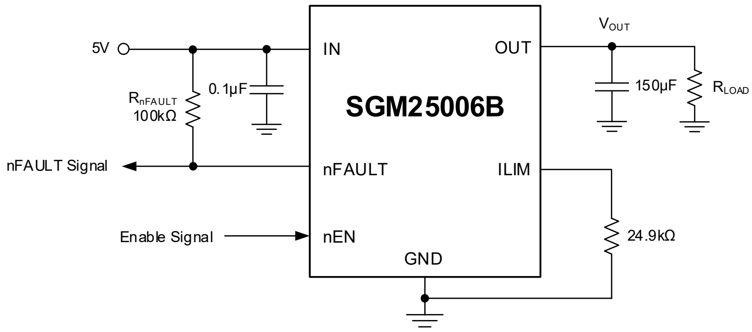


Figure 2. Typical Characteristics Reference Schematic

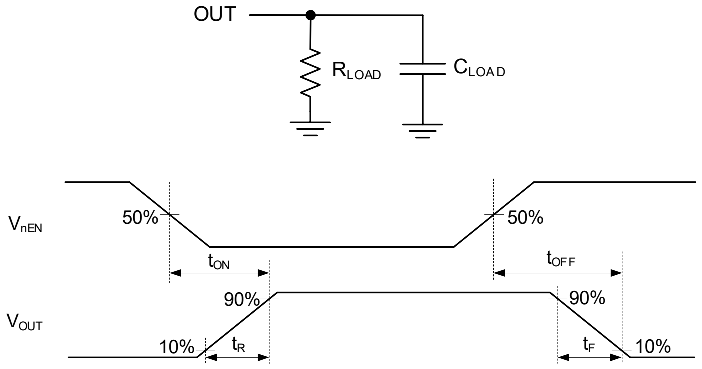


Figure 3. Test Circuit and Voltage Waveforms

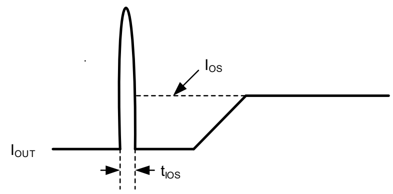


Figure 4. Response Time to Short-Circuit Waveform

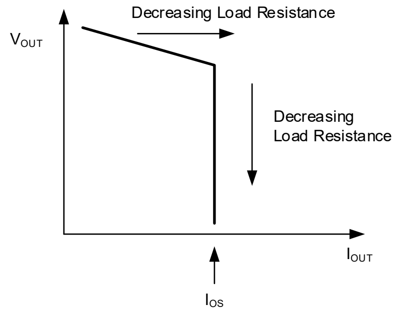


Figure 5. Output Voltage vs. Current Limit Threshold

FUNCTIONAL BLOCK DIAGRAM

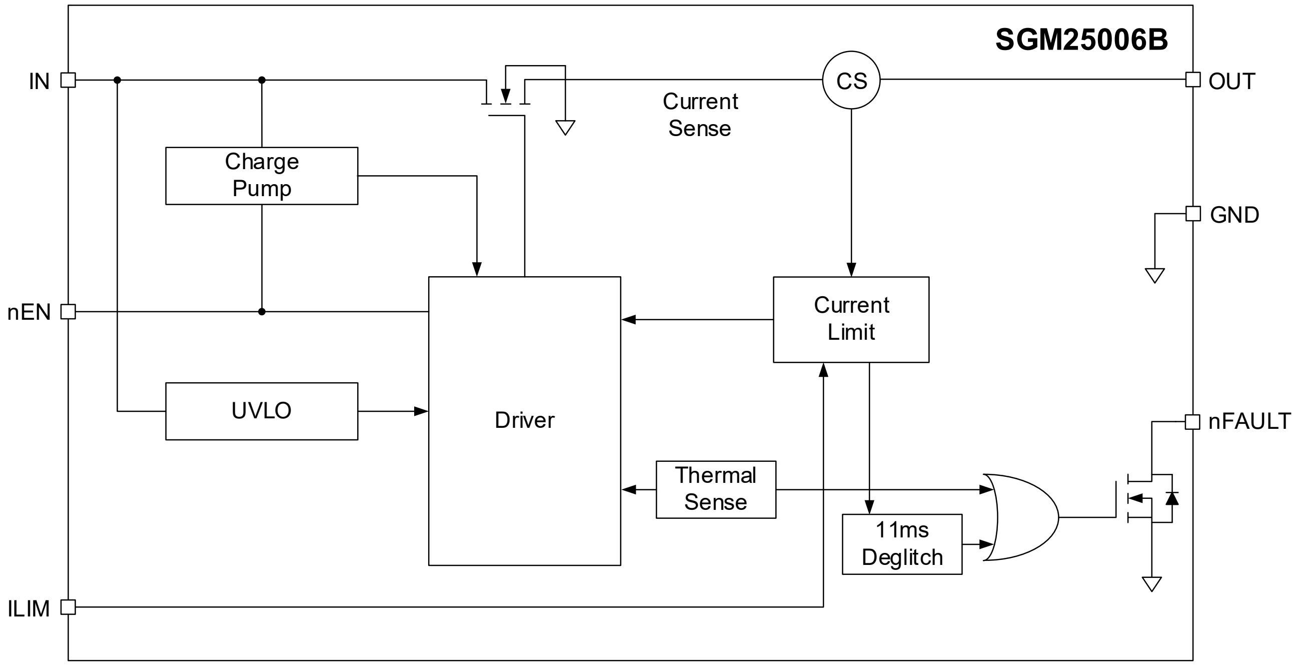


Figure 6. Block Diagram

DETAILED DESCRIPTION

Overview

The SGM25006 is an N-MOSFET power switch with current limit function. It has the adjustable current limit threshold from 0.5A to 5A with an external resistor. To drive the built-in MOSFET, a charge pump and gate driver is used. The charge pump supplies voltage for the driving circuit and lifts the MOSFET gate voltage above the source voltage. The charge pump can work well even the input voltage is down to 2.5V and very small supply current is needed. The gate driver determines the MOSFET gate voltage and rising and falling times of the output to avoid the large current and voltage spikes. Consequently, an internal soft-start is realized.

The SGM25006 has a configurable current limit (I_{OS}) in case of over-current and short-circuit conditions. To limit the output current, the voltage of the charge pump driving N-MOSFET decreases, causing N-MOSFET to operate in the linear region, which leads to the drop of the output voltage because the MOSFET is not completely enhanced.

Over-Current Conditions

The SGM25006 limits the output current to I_{OS} under short-circuit or over-current condition. Once an over-current event occurs, the output current is constant while the output voltage decreases correspondingly. There are two possible conditions of over-current.

The first condition is that a short-circuit or an over-current condition appears before the power-up process. In this case, the output voltage is limited to almost zero potential and the output current starts to ramp up to $I_{OS.}$ The output current keeps its value at I_{OS} unless no over-current condition is detected or a new thermal cycle begins.

The second condition is that a short-circuit or an over-current condition suddenly appears when the device is in the normal operation. Within the time t_{IOS} depicted in Figure 4, the current sense amplifier is overdriven and the N-MOSFET is closed. The current sense amplifier recovers and the output current increases linearly to I_{OS}. The output current keeps its value at I_{OS} unless no over-current condition is detected or a new thermal cycle begins.

If a short-circuit or an overload condition exists for a long time to activate thermal protection, the SGM25006 thermal cycles. The device will be shut off when the junction temperature (T_J) is higher than +135℃ and will not recover until T_J is lower than +115℃. The SGM25006 keeps thermal cycling unless the over-current condition is eliminated.

nFAULT Response

The SGM25006 uses the nFAULT as a fault flag to monitor the over-current or over-temperature condition. The nFAULT is an open-drain pin and is active low once a fault condition occurs. When the false condition is removed, the device returns to normal operation again. A built-in delay deglitch circuit is adopted to avoid the false nFAULT report for over-current condition (11ms, TYP). As a result, the nFAULT will not be asserted under normal condition such as starting with a large capacitive load. The nFAULT signal is not deglitched when entering the over-temperature condition but deglitched when exiting the over-temperature condition, which effectively avoids the nFAULT oscillation under over-temperature condition.

Under-Voltage Lockout (UVLO)

The under-voltage lockout (UVLO) circuit shuts off the N-MOSFET unless the input voltage exceeds the UVLO positive threshold. An internal hysteresis prevents the undesired restart for the input drop in the power on progress.

Enable (nEN or EN)

The enable pin controls the N-MOSFET and supply current. For SGM25006B, when nEN is low, the driver, control circuits and power switch is activated. When nEN is high, the device is shut off and the supply current is less than 3μA. The nEN pin is compatible with TTL and CMOS logic levels.

DETAILED DESCRIPTION (continued)

Thermal Sense

The SGM25006 uses two independent thermal circuits for self-protection, monitors the operating temperature of the power switch, and stops operation when T_J exceeds the recommended operating conditions. Note that the device keeps the output current constant under over-current conditions, which increases the voltage drop across the power switch. Due to the power dissipation increases linearly with the increase of the voltage drop across the power switch, T_J rises a lot under an over-current condition. The first thermal sensor (OTSD-1), will turn off the power switch once the device temperature is higher than +135℃ in a current limit status. After the device temperature drops to +115℃, the power switch will be turned on again.

The second thermal sensor (OTSD-2) will turn off the power switch once the device temperature is higher than +155℃ no matter the device is in a current limit status or not. After the device temperature drops to +135℃, the power switch will be turned on again.

The SGM25006 remains in thermal cycles unless the over-temperature condition is removed.

APPLICATION INFORMATION

The SGM25006 is an accurate load switch suitable for large capacitor load or shorted output. In the following, a typical design for the input and output capacitor and current limit resistor is given. Moreover, how to realize an auto-retry and two-level current limit circuits is also provided as advanced application examples.

Current Limit Power Distribution Switch

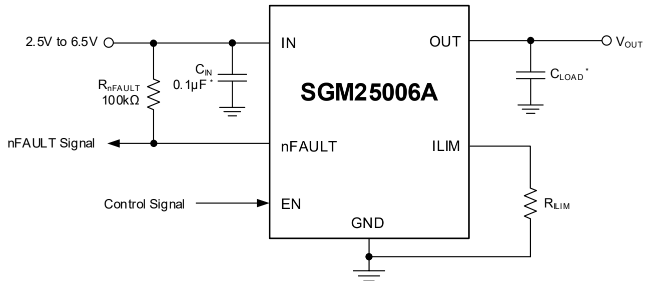


Figure 7. Typical Current Limit Application

Design Requirements

For this example, use the parameters listed in Table 1 as the input parameters.

Table 1. Design Parameters

Parameter	Value
Input Voltage	5V
Output Voltage	5V
Above a Minimum Current Limit	3000mA
Below a Maximum Current Limit	5000mA

Input and Output Capacitance

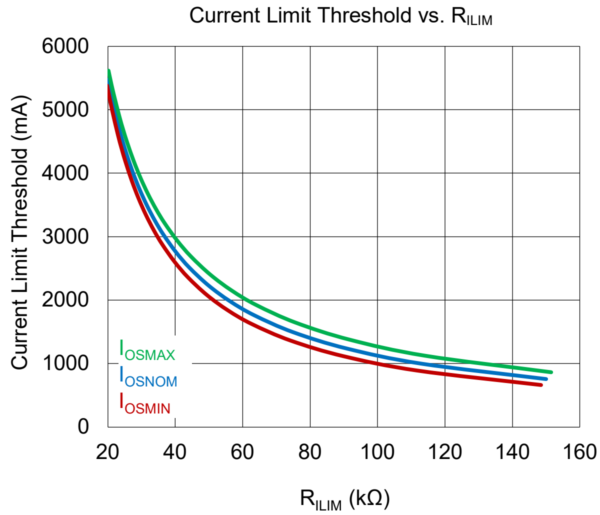
Adding capacitors to the input and output is beneficial to the system device, but the actual capacitor needs to be optimized for more concrete condition. A 0.1μF ceramic capacitor is recommended to be placed as close as possible to the device input pin to suppress the rings caused by the source variations. A larger capacitor is needed to reduce the large overshoot that may exceed the absolute maximum voltage caused by heavy transients especially in bench testing with long and inductive cables.

Generally, the output capacitor is not required. However, if a large transient current condition is considered, a large electrolytic capacitor is recommended on the output pin.

Adjustable Current Limit

The SGM25006 changes the current limit threshold through an external resistor (R_{ILIM}). The current limit threshold is proportional to the current sourced out of the ILIM pin. The device provides a controlled voltage on the ILIM pin through the internal regulation loop. In order to guarantee the ILIM loop stability, choose a resistor with 1% resolution within the range of 20kΩ ~ 187kΩ. To ensure that the current limit completely falls into the defined range, the resistor tolerance should be taken into consideration seriously. The formula of current limit threshold is approximated in Equation 1 and some specific settings can be found in Electrical Characteristics section. Because the parasitic parameters may affect the current limit threshold accuracy, please route the traces of R_{ILIM} as close to the chip as possible.

$$I_{OSMAX}(mA) = \frac{91622V}{R_{ILIM}^{0.929}k\Omega}$$
$$I_{OSNOM}(mA) = \frac{103669V}{R_{ILIM}^{0.982}k\Omega}$$
$$I_{OSMIN}(mA) = \frac{119620V}{R_{ILIM}^{1.039}k\Omega} \quad (1)$$



APPLICATION INFORMATION (continued)

Designing Above a $I_{OS(MIN)}$

In some cases, a minimum current limit is required. In this example, a current of 3A is planned to be transferred to the output. Obviously, now the minimum current limit threshold is 3000mA. Equation 2 depicts how to use I_{OS} to choose a suitable R_{ILIM}.

$$\begin{aligned} I_{OSMIN}(mA) &= 3000mA \\ I_{OSMIN}(mA) &= \frac{119620V}{R_{ILIM}{}^{1.039}k\Omega} \\ R_{ILIM}(k\Omega) &= \left(\frac{119620V}{I_{OSMIN}mA}\right)^{\frac{1}{1.039}} \\ R_{ILIM}(k\Omega) &= 34.7k\Omega \end{aligned} \tag{2}$$

Choose the resistor of 1% resolution that is closest to the value calculated from Equation 2 and get the result of R_{ILIM} = 34.8kΩ. Hence, the requirement of minimum current limit of 3000mA is met. Then, we need to calculate the maximum current limit with I_{OS}, R_{ILIM} that has been calculated in Equation 2.

$$\begin{aligned} R_{ILIM}(k\Omega) &= 34.8k\Omega \\ I_{OSMAX}(mA) &= \frac{91622V}{R_{ILIM}{}^{0.929}k\Omega} \\ I_{OSMAX}(mA) &= \frac{91622V}{34.8^{0.929}k\Omega} \\ I_{OSMAX}(mA) &= 3387mA \end{aligned} \tag{3}$$

Here, the maximum current limit is 3387mA.

Designing Below a $I_{OS(MAX)}$

In some applications, a maximum current limit is required. For instance, limit the upper current to 5000mA to protect an upstream power supply. Choose a resistor for R_{ILIM} with I_{OS}.

$$\begin{aligned} I_{OSMAX}(mA) &= 5000mA \\ I_{OSMAX}(mA) &= \frac{91622V}{R_{ILIM}{}^{0.929}k\Omega} \\ R_{ILIM}(k\Omega) &= \left(\frac{91622V}{I_{OSMAX}mA}\right)^{\frac{1}{0.929}} \\ R_{ILIM}(k\Omega) &= 22.8k\Omega \end{aligned} \tag{4}$$

Choose the resistor of 1% resolution that is closest to the value calculated from Equation 4 and get the result of R_{ILIM} = 22.6kΩ. Hence, the requirement of maximum current limit of 5000mA is met. Then, we need to calculate the maximum current limit with I_{OS}, R_{LIM} has been calculated in Equation 4.

$$\begin{aligned} R_{ILIM}(k\Omega) &= 22.6k\Omega \\ I_{OSMIN}(mA) &= \frac{119620V}{R_{ILIM}{}^{1.039}k\Omega} \\ I_{OSMIN}(mA) &= \frac{119620V}{22.6^{1.039}k\Omega} \\ I_{OSMIN}(mA) &= 4687mA \end{aligned} \tag{5}$$

Here, the minimum current limit is 4687mA.

Resistor Tolerance Accounting

The analysis above is dedicated for the device performance alone on the basis of an exact resistor of R_{ILIM}. However, resistors are manufactured in a large amount of quantity that falls in the range of the upper limit and the lower limit around the marked nominal value. Hence, the resistance variation deeply influences the current limit threshold in a system scale. Table 2 shows how the 1% resistor variation affects the actual value of the current limit threshold. When higher precision for the current limit threshold is required, select a 0.5% or even 0.1% resistor for R_{ILIM} instead.

APPLICATION INFORMATION (continued)

Table 2. Common R_{ILIM} Resistor Selections

Desired Nominal Current Limit (mA)	Ideal Resistor (kΩ)	Closest 1% Resistor (kΩ)	Resistor Bounds (kΩ)		I_{OS} Actual Limits (mA)		
			1% Low	1% High	Min	Nom	Max
750	151.3	150	148.5	151.5	663	756	864
1000	112.9	113	111.9	114.1	890	999	1124
1250	89.9	90.9	90	91.8	1115	1237	1376
1500	74.7	75	74.3	75.8	1362	1494	1645
1750	63.8	63.4	62.8	64	1622	1762	1922
2000	55.7	56.2	55.6	56.8	1838	1983	2150
2250	49.4	49.9	49.4	50.4	2080	2229	2401
2500	44.4	44.2	43.8	44.6	2359	2511	2688
2750	40.3	40.2	39.8	40.6	2603	2756	2935
3000	36.9	36.5	36.1	36.9	2878	3030	3211
3250	34.0	34	33.7	34.3	3098	3249	3430
3500	31.5	31.6	31.3	31.9	3343	3491	3671
3750	29.4	29.4	29.1	29.7	3604	3747	3925
4000	27.5	27.4	27.1	27.7	3877	4016	4191
4250	25.9	25.5	25.2	25.8	4178	4309	4480
4500	24.4	24.3	24.1	24.5	4392	4518	4686
4750	23.1	23.2	23	23.4	4609	4729	4892
5000	21.9	21.5	21.3	21.7	4988	5096	5250
5250	20.9	20.5	20.3	20.7	5241	5340	5487
5500	19.9	20	19.8	20.2	5377	5471	5615

Auto-Retry Function

In some applications, the device is temporarily closed in face of an over-current condition but restarts after a programmable delay time. This auto-retry function is realized by an external resistor and capacitor. Once a fault event occurs, the nFAULT pin turns high and then pulls low the EN pin (SGM25006A). The auto-retry delay time is set by the RC time constant of the external resistor and capacitor mentioned above. The device keeps this cycle unless the fault event is cleared. Equation 6 gives the formula of the auto-retry delay time.

$$t_{BR} = -R_{nFAULT} \times C_{RETRY} \times LN\left(1 - V_{EN}/(V_{IN} - V_{OL})\right) + t_{nFAULT} \quad (6)$$

where:

V_{EN} is the EN pin typical threshold voltage.

V_{IN} is the input voltage.

V_{OL} is the nFAULT pin typical saturation voltage.

t_{nFAULT} is the internal nFAULT typical deglitch time.

Equation 7 presents the formula of the retry duty cycle and hence the average current is equal to the product of the retry duty cycle and I_{OS}.

$$D = t_{nFAULT}/(t_{nFAULT} + t_{BR}) \quad (7)$$

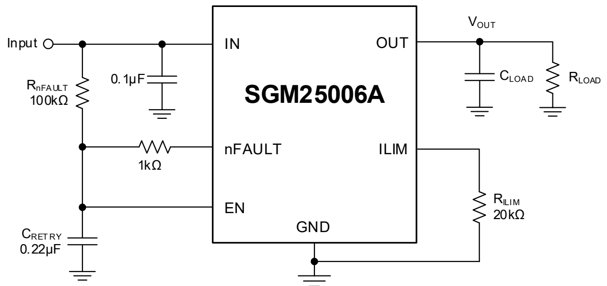


Figure 8. Auto-Retry Function

APPLICATION INFORMATION (continued)

In some applications, the auto-retry function is needed and at the same time the EN pin is controlled with an outside signal. As shown in Figure 9, an external control signal drives EN through R_{nFAULT} and retains the auto-retry ability. The auto-retry time-out period is set by the RC time constant of the external resistor and capacitor (R_{nFAULT} and C_{RETRY}).

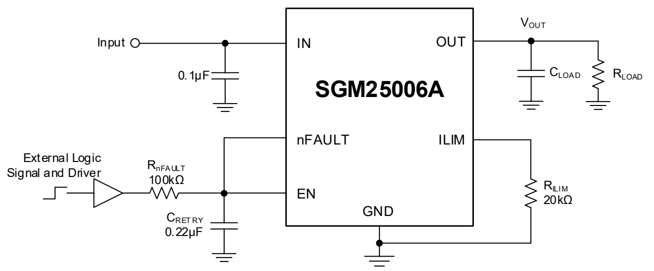


Figure 9. Auto-Retry with External EN Signal

Two-Level Current Limit Circuit

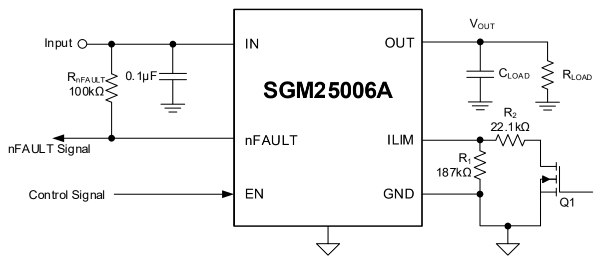


Figure 10. Two-Level Current Limit Circuit

In some applications, different current limit thresholds should be revised according to the outside conditions. In Figure 10, the SGM25006 is controlled externally with a two-level current limit circuit. The resistance between ILIM pin and GND pins determines the current limit. A MOSFET Q1 is adopted here to change the resistance between ILIM pin and GND pins. For more current limit thresholds, take more combinations of MOSFETs and resistors to change the resistance between ILIM pin and GND pin.

NOTE: no external signal is permitted to be directly applied to ILIM pin.

Application Curve

As shown in Figure 11, the I_{LOAD} is set at 5A, programmed by the R_{ILIM} (22.1kΩ). The I_{LOAD} steps from about 4.9A to 5.2A. The internal nFAULT timer runs, and after 11ms, the nFAULT becomes low and the current continues to be regulated at about 5A. Due to the high power consumption inside the device, thermal cycling occurs.

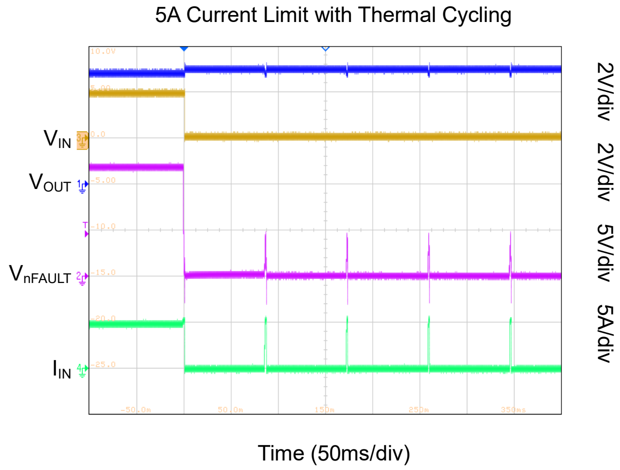


Figure 11. 5A Current Limit with Thermal Cycling

As shown in Figure 12, the I_{LOAD} is set at 604mA, programmed by the R_{ILIM} (187kΩ). The I_{LOAD} steps from about 560mA to 620mA. The internal nFAULT timer runs, and after 11ms, the nFAULT becomes low and the current continues to be regulated at about 580mA.

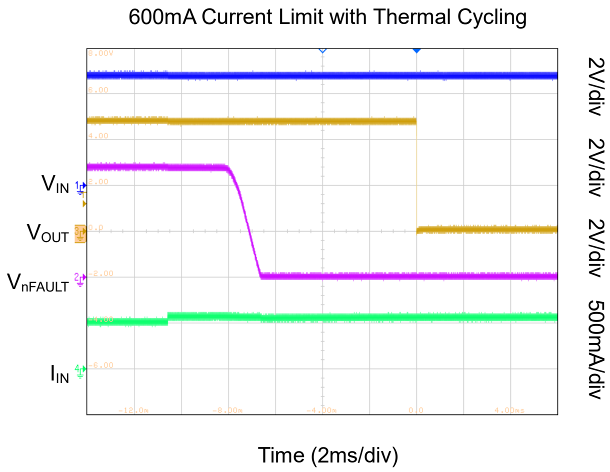


Figure 12. 600mA Current Limit with Thermal Cycling

APPLICATION INFORMATION (continued)

Power Supply Recommendations

The input range of SGM25006 is from 2.5V to 6.5V. It is recommended to use a 3.3V or 5V power supply with 10% tolerance. Keep in mind that the maximum current that the power supply can provide must be higher than I_{OS}.

Layout Guidelines

- It is recommended to place a 100nF capacitor as close to the IN pin as possible with low-inductance trace.
- It is recommended to place a large electrolytic capacitor and a 100nF MLCC capacitor between the output and GND if high inrush current is considered on the output.
- In order to reduce the parasitic parameters and increase the accuracy of user-defined current limit threshold, route R_{ILIM} as close to the device as possible.
- The thermal pad of SGM25006 should be connected to the PCB ground plane with wide and short copper traces.

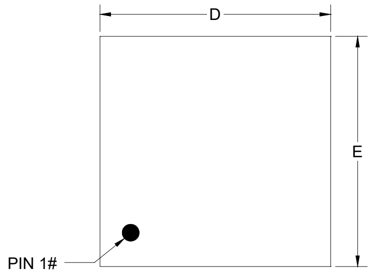
REVISION HISTORY

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

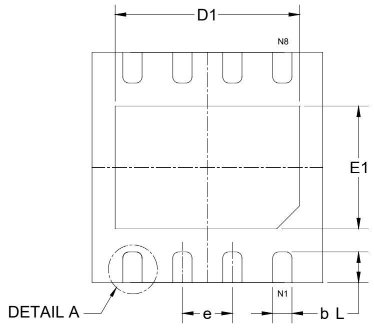
Changes from Original (NOVEMBER 2023) to REV.A	**Page**
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

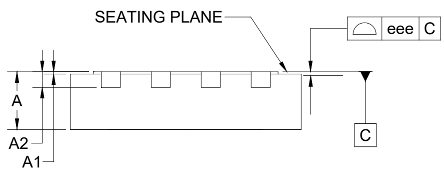
TDFN-3×3-8FL



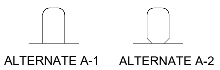
TOP VIEW



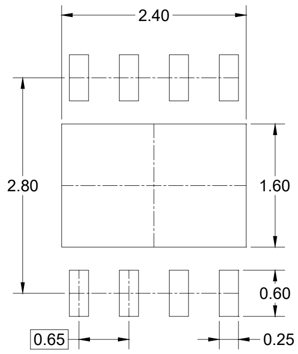
BOTTOM VIEW



SIDE VIEW



DETAIL A
ALTERNATE TERMINAL CONSTRUCTION



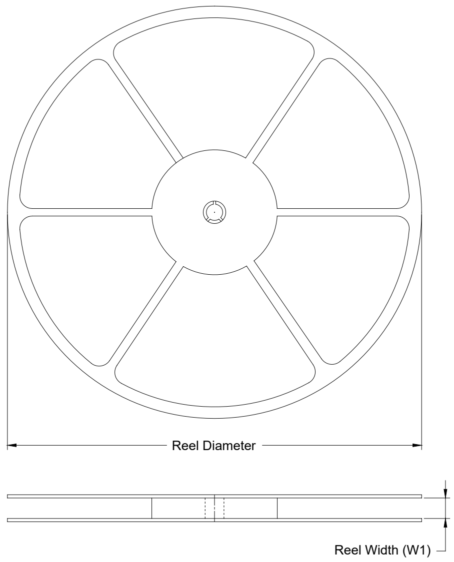
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.700	-	0.800
A1	0.000	-	0.050
A2	0.203 REF		
b	0.200	-	0.300
D	2.900	-	3.100
D1	2.300	-	2.500
E	2.900	-	3.100
E1	1.500	-	1.700
e	0.650 BSC		
L	0.300	-	0.500
eee	0.080		

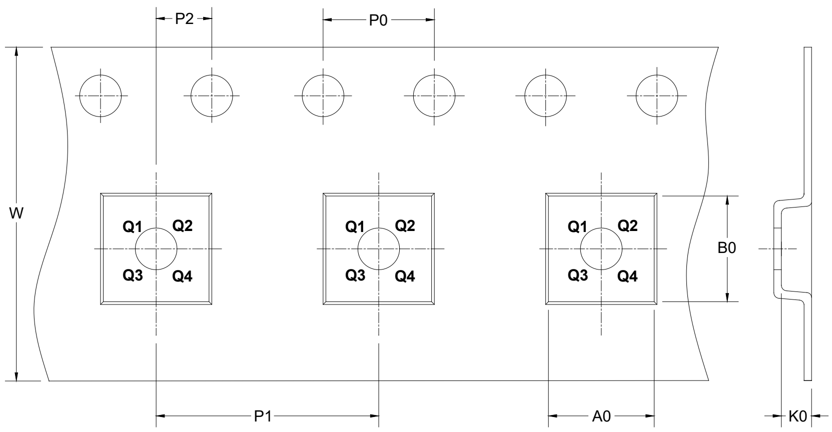
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



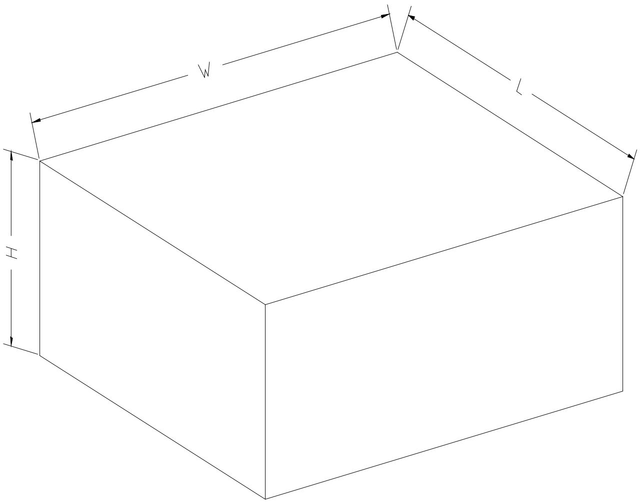
NOTE: The picture is only for reference. Please make the object as the standard.

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
TDFN-3×3-8FL	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q2

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
13″	386	280	370	5

DD0002