

GENERAL DESCRIPTION

The SGM8435-2 is a current feedback, differential wide-band PLC driver, which consists of dual, high voltage, low noise and high slew rate amplifiers. The high crest factor signals can be driven by the device with very low distortion levels in the power meter. These features make SGM8435-2 very suitable for power meter wide-band PLC applications. In order to avoid line surges caused by lightning, very reliable protection measures are taken at the output pins of the driver.

The SGM8435-2 can operate from 5V to 26V single supply. And it maintains wide bandwidth and high linearity over the whole full-scale range of power supply.

A disable control (DIS) pin is used to control the operation modes of the device. When DIS pin is high or floating, SGM8435-2 is in power-down mode. When DIS pin is low, SGM8435-2 is in full-power working mode.

The SGM8435-2 is available in a Green TQFN-4×4-24L package. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- Current Feedback Amplifier A and B
- Supply Voltage Range: 5V to 26V
- Supply Current: 18.5mA (TYP)
- Power-Down Current: 30µA (TYP)
- Low Input Voltage Noise Density: 10nV/√Hz
- Input Offset Voltage: 13mV (MAX)
- High Slew Rate for Differential Signal: 800V/µs
- Amplifier A and B are Stable at Gain ≥ 2
- Output Over-Voltage Protection and Voltage Clamping Protection
- Output Current-Limit Protection
- Over-Temperature Protection
- Disable Control Pins for Low-Power Design
- -40°C to +85°C Operating Temperature Range
- Available in a Green TQFN-4×4-24L Package

APPLICATIONS

Wide-Band, Power Line Communications (PLC)

TYPICAL APPLICATION

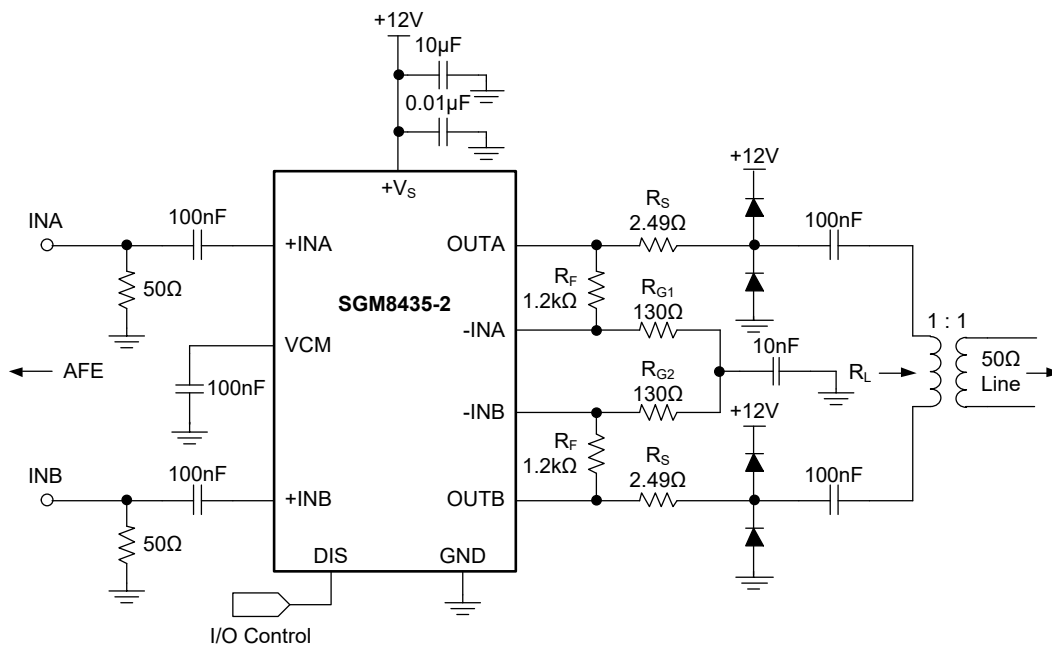


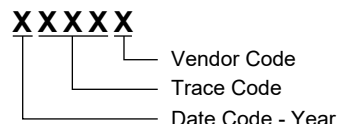
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8435-2	TQFN-4x4-24L	-40°C to +85°C	SGM8435-2YTQF24G/TR	0IR YTQF24 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

- Supply Voltage, +V_S to GND -0.3V to 32V
- Driver V_{IN} Voltage GND to +V_S
- DIS Voltage to GND -0.3V to 5.5V
- Power Dissipation, P_D @ T_A = +25°C
 - TQFN-4x4-24L 3.7W
- Package Thermal Resistance
 - TQFN-4x4-24L, θ_{JA} 33.6°C/W
 - TQFN-4x4-24L, θ_{JB} 12.6°C/W
 - TQFN-4x4-24L, θ_{JC (TOP)} 30.8°C/W
 - TQFN-4x4-24L, θ_{JC (BOT)} 6.5°C/W
- Junction Temperature +150°C
- Storage Temperature Range -65°C to +150°C
- Lead Temperature (Soldering, 10s) +260°C
- ESD Susceptibility
 - HBM 4000V
 - CDM 1000V

RECOMMENDED OPERATING CONDITIONS

- Operating Temperature Range -40°C to +85°C

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.

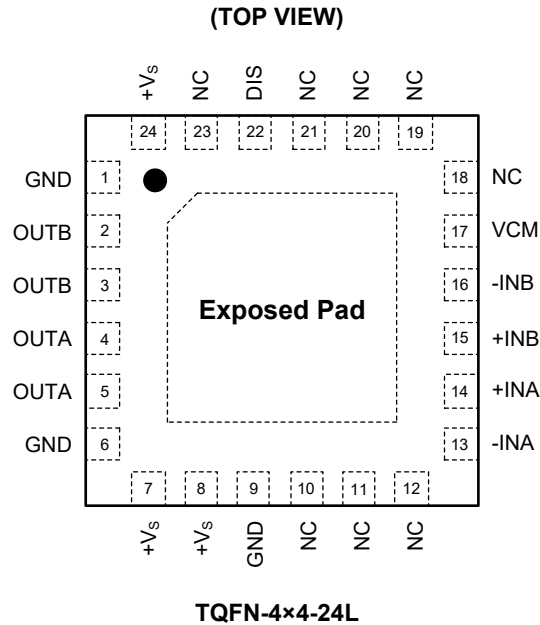
ESD SENSITIVITY CAUTION

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	FUNCTION
1, 6, 9	GND	Ground. The GND pin must be connected with external ground.
2, 3	OUTB	Output of Amplifier B.
4, 5	OUTA	Output of Amplifier A.
7, 8, 24	+Vs	Single Power Supply for Amplifiers. (Power supply range: 5V to 26V)
10-12, 18-21, 23	NC	No Internal Connection.
13	-INA	Inverting Input of Amplifier A.
14	+INA	Non-Inverting Input of Amplifier A.
15	+INB	Non-Inverting Input of Amplifier B.
16	-INB	Inverting Input of Amplifier B.
17	VCM	Output Common Mode Bias.
22	DIS	Disable Control Pin. The SGM8435-2 is in power-down (disabled) mode if the DIS pin is high or floating. When DIS pin is low, SGM8435-2 is in full-power mode.
Exposed Pad	Exposed Pad	Must be connected to GND for optimal thermal performance. Connecting to other pins is not allowed.

ELECTRICAL CHARACTERISTICS

($V_S = 5V$ to $24V$, $R_F = 1.2k\Omega$, $R_{L-DIFF} = 50\Omega$ and $A_V = 10$, Full = $-40^\circ C$ to $+85^\circ C$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Power Supply							
Operating Voltage Range	V_S		Full	5		26	V
Positive Supply Current	$+I_S$ (Full-Power)	All outputs at 0V	+25°C		18.5	22	mA
			Full			28	
Negative Supply Current	$-I_S$ (Full-Power)	All outputs at 0V	+25°C	-22	-18.5		mA
			Full	-28			
Positive Supply Current	$+I_S$ (Power-Down)	All outputs at 0V, $V_{DIS} = 3.3V$	+25°C		30	50	μA
			Full			70	
Negative Supply Current	$-I_S$ (Power-Down)	All outputs at 0V, $V_{DIS} = 3.3V$	+25°C	-50	-30		μA
			Full	-70			
Power Supply Rejections to Differential Output (Input Referred)	PSRR		+25°C	76	90		dB
			Full	72			
Power Supply Rejections to Common Mode Output (Output Referred)	PSRR		+25°C	53	63		dB
			Full	48			
Input Characteristics							
Input Offset Voltage	V_{OS}		+25°C		5	13	mV
			Full			19	
Input Offset Voltage Mismatch	ΔV_{OS}		+25°C		2	15	mV
			Full			17	
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$		Full		0.1		mV/°C
Non-Inverting Input Bias Current	$+I_B$		+25°C		35	70	nA
			Full			90	
Non-Inverting Input Bias Current Drift	$\Delta I_B/\Delta T$		Full		0.18		nA/°C
Transimpedance ⁽¹⁾	R_{OL}		+25°C		18		MΩ
Input High Voltage	V_{IH}	DIS input	+25°C	2			V
			Full	2.4			
Input Low Voltage	V_{IL}	DIS input	+25°C			0.8	V
			Full			0.5	
Input Pin Current	I_{IH}	DIS input, $V_{DIS} = 3.3V$	Full		2	5	μA
	I_{IL}	DIS input, $V_{DIS} = 0V$	Full	-4	-2		
Differential Input Resistance ⁽¹⁾	Z_{IN}		+25°C		6		kΩ

NOTE: 1. Specified by design.

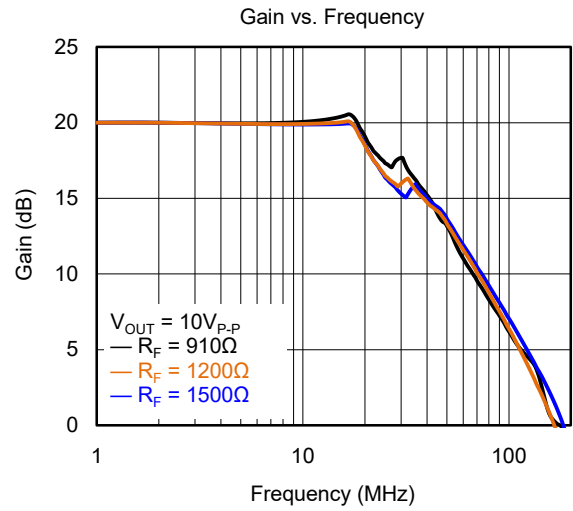
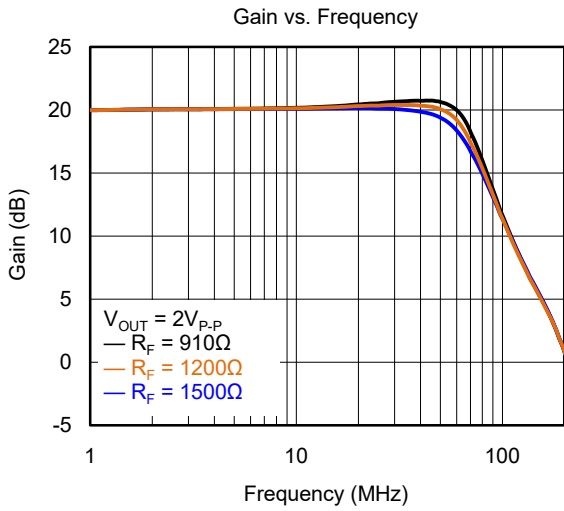
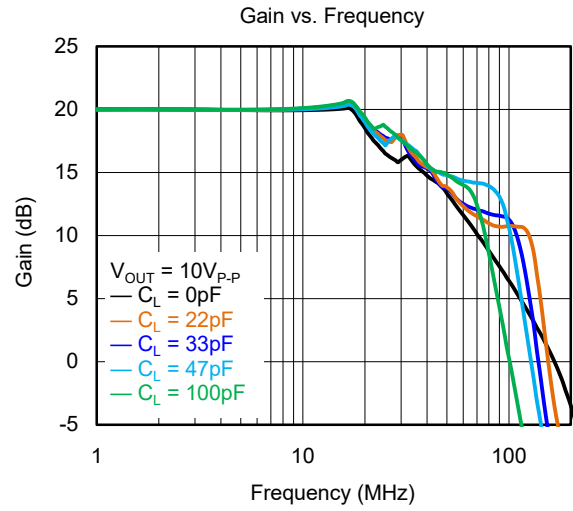
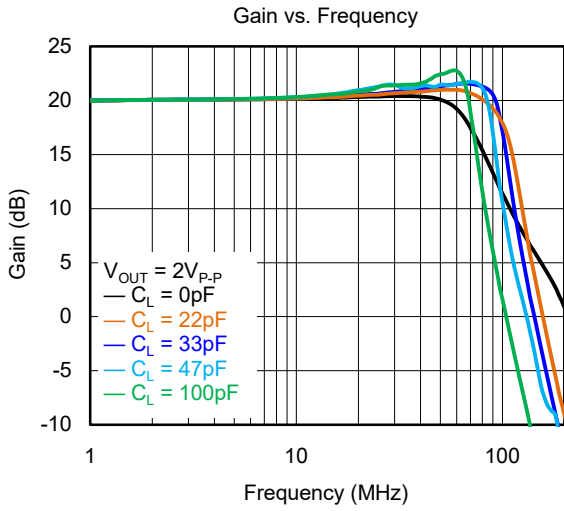
ELECTRICAL CHARACTERISTICS (continued)

($V_S = 5V$ to $24V$, $R_F = 1.2k\Omega$, $R_{L-DIFF} = 50\Omega$ and $A_V = 10$, Full = $-40^\circ C$ to $+85^\circ C$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Output Characteristics							
Loaded Output Swing	V_{OUT}	$V_S = 24V$, $R_L = \text{open}$	$+25^\circ C$		22		V
		$V_S = 24V$, $R_{L-DIFF} = 100\Omega$	$+25^\circ C$		19		
		$V_S = 24V$, $R_{L-DIFF} = 50\Omega$	$+25^\circ C$	17.8	18.5		
Output Short-Circuit Current	I_{OUT}	$V_S = 24V$, $R_L = 10\Omega$	$+25^\circ C$		± 0.5		A
Output Clamping Current			$+25^\circ C$		1.2		A
Dynamic Performance							
-3dB Small-Signal Bandwidth	BW	$V_S = 12V$, $V_{OUT} = 2V_{P-P}$	$+25^\circ C$		60		MHz
2nd Harmonic Distortion	HD2	$V_S = 12V$, $f_C = 500kHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-82		dBc
		$V_S = 12V$, $f_C = 700kHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-80		
		$V_S = 12V$, $f_C = 1MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-80		
		$V_S = 12V$, $f_C = 2MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-77		
		$V_S = 12V$, $f_C = 3MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-76		
		$V_S = 12V$, $f_C = 10MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-67		
3rd Harmonic Distortion	HD3	$V_S = 12V$, $f_C = 500kHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-62		dBc
		$V_S = 12V$, $f_C = 700kHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-60		
		$V_S = 12V$, $f_C = 1MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-56		
		$V_S = 12V$, $f_C = 2MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-50		
		$V_S = 12V$, $f_C = 3MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-47		
		$V_S = 12V$, $f_C = 10MHz$, $V_{OUT} = 2V_{P-P-DIFF}$	$+25^\circ C$		-37		
Slew Rate (Differential Signal)	SR	$V_{OUT} = 16V_{P-P-DIFF}$	$+25^\circ C$		800		V/ μs
Turn On/Off Time	t_{EN}	From disable to enable time	$+25^\circ C$		18		μs
	t_{DIS}	From enable to disable time	$+25^\circ C$		0.5		
Noise							
Input Voltage Noise Density	e_n	$f = 1MHz$	$+25^\circ C$		10		nV/ \sqrt{Hz}
Non-Inverting Input Current Noise Density at each of the Two Inputs ⁽¹⁾	$+i_n$	$f = 1MHz$	$+25^\circ C$		2.5		pA/ \sqrt{Hz}
Inverting Input Current Noise Density at each of the Two Inputs ⁽¹⁾	$-i_n$	$f = 1MHz$	$+25^\circ C$		40		pA/ \sqrt{Hz}
Over-Temperature Protection							
Over-Temperature Protection					150		$^\circ C$
Over-Temperature Protection Hysteresis					20		$^\circ C$

NOTE: 1. Specified by design.

TYPICAL PERFORMANCE CHARACTERISTICS



FUNCTIONAL BLOCK DIAGRAM

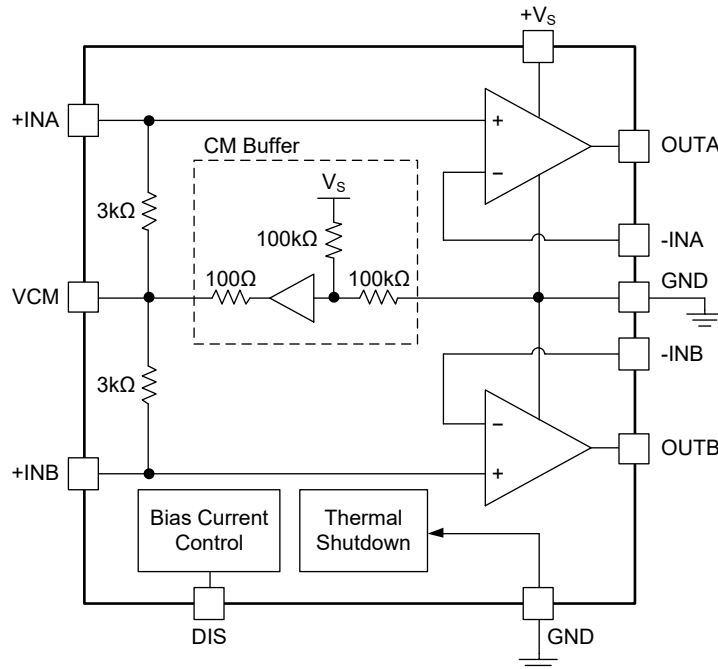


Figure 2. Block Diagram

APPLICATION INFORMATION

Figure 1 shows a typical application circuit for SGM8435-2 as a PLC driver. The full PLC power level is provided since the driver output stage has been sized. The transformer turns ratio will determine the actual peak value of output voltages and currents.

Power Control Function

The SGM8435-2 supports power control operation. Its supply current is controlled by the digital inputs DIS. DIS pin is pulled high internally. The device immediately enters power-down mode when DIS pin is floating.

The truth table of the SGM8435-2 is shown in Table 1.

Table 1. Working Modes of SGM8435-2

DIS Pin	Operation
0	Full-Power Working Mode.
1	Power-Down Mode.
Floating	Power-Down Mode.

APPLICATION INFORMATION (continued)

Breakdown Supply Voltage

If the PLC driver is being used in an application that is part of a regulated power grid, the ability to withstand a supply voltage that is higher than the recommended voltage is important to ensure robustness.

In order to estimate the margin beyond the maximum supply voltage, several randomly selected samples are tested to show the robustness of SGM8435-2.

Figure 4 shows the configuration of this test. The SGM8435-2 is tested by manually increasing the supply voltage in 1V steps while simultaneously recording the supply current. This operation is performed from 5V until internal device is breakdown. Five samples are subjected to this test, and the results are shown in Figure 3.

A second test is done by using the same configuration shown in Figure 4. One sample is tested at a supply voltage of 42V for a duration of 168 hours. The initial and final values of the supply current are recorded. No significant increase in the supply current is observed

and there are no signs of abnormal behavior or damage to the device.

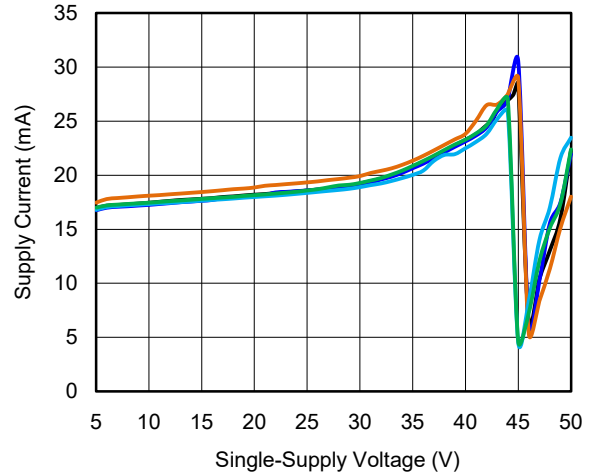


Figure 3. Supply Current vs. Single-Supply Voltage

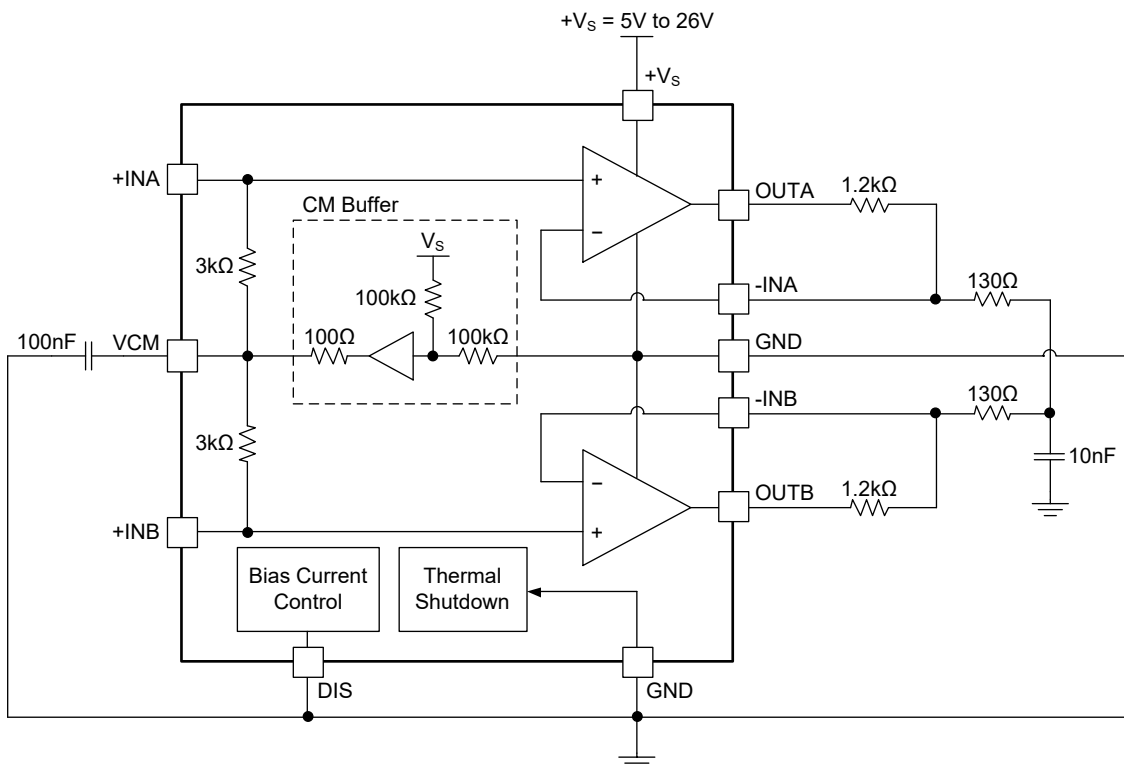


Figure 4. Breakdown Supply Voltage Test Configuration

REVISION HISTORY

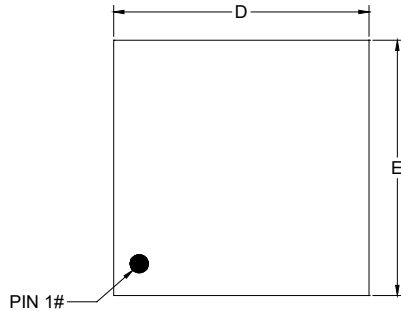
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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

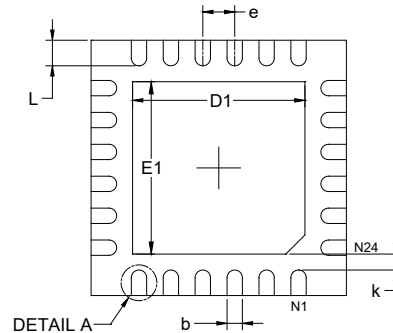
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

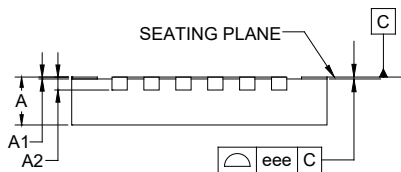
TQFN-4×4-24L



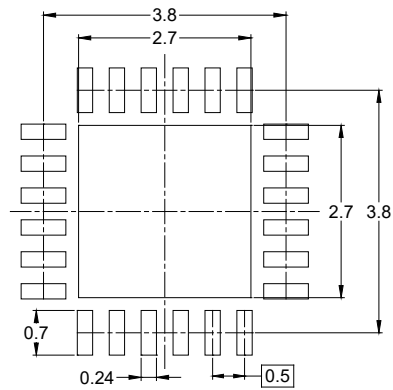
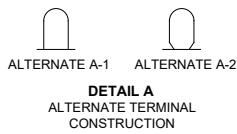
TOP VIEW



BOTTOM VIEW



SIDE VIEW



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	0.180	-	0.300
D	3.900	-	4.100
E	3.900	-	4.100
D1	2.600	-	2.800
E1	2.600	-	2.800
e	0.500 BSC		
k	0.200 MIN		
L	0.300	-	0.500
eee	0.080		

NOTE: This drawing is subject to change without notice.

PACKAGE INFORMATION

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
TQFN-4×4-24L	13"	12.4	4.30	4.30	1.10	4.0	8.0	2.0	12.0	Q2

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PACKAGE INFORMATION

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