SGM2080xQ
Automotive 500mA, Fast Transient Response, Low Noise and High Accuracy LDO with Power-Good

GENERAL DESCRIPTION

The SGM2080xQ is a CMOS, fast transient response, low noise and high accuracy linear regulator. It is capable of supplying 500mA output current with typical dropout voltage of only 80mV. The operating input voltage range is from 1.5V to 5.5V. The fixed output voltage range is from 0.8V to 4.2V and adjustable output voltage range is from 0.55V to 5.0V.

Other features include an open-drain power-good (PG) output, logic-controlled shutdown mode, current limit and thermal shutdown protection. The SGM2080xQ has automatic discharge function to quickly discharge V_{OUT} in the disabled status.

This device is AEC-Q100 qualified (Automotive Electronics Council (AEC) standard Q100 Grade 1) and it is suitable for automotive applications.

The SGM2080xQ is available in Green TDFN-2×2-6DL and TDFN-3×3-8KL packages. It operates over an ambient temperature range of -40℃ to +125℃.

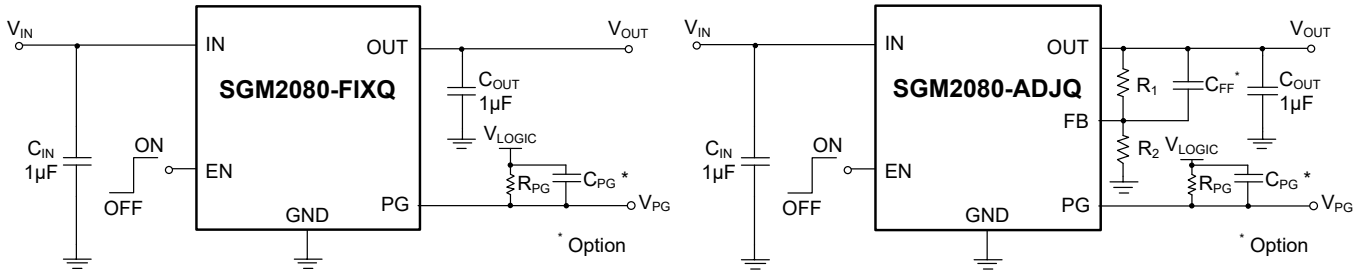
FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  Device Temperature Grade 1
  T_A = -40℃ to +125℃
- **Operating Input Voltage Range: 1.5V to 5.5V**
- **Fixed Output from 0.8V to 4.2V**
- **Adjustable Output from 0.55V to 5.0V**
- **500mA Output Current**
- **Output Voltage Accuracy: ±1% at +25℃**
- **Quiescent Current: 85μA (TYP)**
- **Low Dropout Voltage:**
  80mV (TYP) at 500mA, V_{OUT} = 5V
- **Current Limiting and Thermal Protection**
- **Excellent Load and Line Transient Responses**
- **With Output Automatic Discharge**
- **UVLO with Hysteresis**
- **Support Power-Good Indicator Function**
- **Stable with Small Case Size Ceramic Capacitors**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TDFN-2×2-6DL and TDFN-3×3-8KL Packages**

APPLICATIONS

General Purpose Automotive & Industrial
Automotive Entertainment System

TYPICAL APPLICATION CIRCUITS



Fixed Output Voltage Version **Adjustable Output Voltage Version**

Figure 1. Typical Application Circuits

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2080-0.8Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-0.8QTGC6G/TR	1QI XXXX	Tape and Reel, 3000
SGM2080-0.9Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-0.9QTGC6G/TR	1QJ XXXX	Tape and Reel, 3000
SGM2080-1.0Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-1.0QTGC6G/TR	1QK XXXX	Tape and Reel, 3000
SGM2080-1.05Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-1.05QTGC6G/TR	1QL XXXX	Tape and Reel, 3000
SGM2080-1.1Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-1.1QTGC6G/TR	1QM XXXX	Tape and Reel, 3000
SGM2080-1.2Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-1.2QTGC6G/TR	1QN XXXX	Tape and Reel, 3000
SGM2080-1.5Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-1.5QTGC6G/TR	1QO XXXX	Tape and Reel, 3000
SGM2080-1.8Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-1.8QTGC6G/TR	1QP XXXX	Tape and Reel, 3000
SGM2080-2.5Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-2.5QTGC6G/TR	1QQ XXXX	Tape and Reel, 3000
SGM2080-2.8Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-2.8QTGC6G/TR	1QR XXXX	Tape and Reel, 3000
SGM2080-3.0Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-3.0QTGC6G/TR	1QS XXXX	Tape and Reel, 3000
SGM2080-3.3Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-3.3QTGC6G/TR	1QT XXXX	Tape and Reel, 3000
SGM2080-4.2Q	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-4.2QTGC6G/TR	1QU XXXX	Tape and Reel, 3000
SGM2080-ADJQ	TDFN-2×2-6DL	-40℃ to +125℃ (T_A)	SGM2080-ADJQTGC6G/TR	1QV XXXX	Tape and Reel, 3000

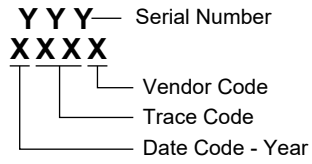
PACKAGE/ORDERING INFORMATION (continued)

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2080-0.8Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-0.8QTHW8G/TR	1QWTHW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-0.9Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-0.9QTHW8G/TR	1QXTHW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-1.0Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-1.0QTHW8G/TR	1QYTHW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-1.05Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-1.05QTHW8G/TR	1QZTHW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-1.1Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-1.1QTHW8G/TR	1R0THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-1.2Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-1.2QTHW8G/TR	1R1THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-1.5Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-1.5QTHW8G/TR	1R2THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-1.8Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-1.8QTHW8G/TR	1R3THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-2.5Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-2.5QTHW8G/TR	1R4THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-2.8Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-2.8QTHW8G/TR	1R5THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-3.0Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-3.0QTHW8G/TR	1R6THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-3.3Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-3.3QTHW8G/TR	1R7THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-4.2Q	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-4.2QTHW8G/TR	1R8THW XXXXX XX#XX	Tape and Reel, 4000
SGM2080-ADJQ	TDFN-3×3-8KL	-40℃ to +125℃ (T_A)	SGM2080-ADJQTHW8G/TR	1R9THW XXXXX XX#XX	Tape and Reel, 4000

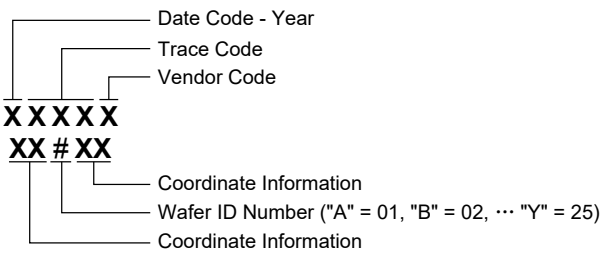
MARKING INFORMATION

NOTE: XXXX = Date Code, Trace Code and Vendor Code. XXXXX = Date Code, Trace Code and Vendor Code. XX#XX = Coordinate Information and Wafer ID Number.

TDFN-2×2-6DL



TDFN-3×3-8KL



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 to GND ..... -0.3V to 6V
OUT to GND ..... -0.3V to (V_{IN} + 0.3V)
EN, PG to GND..... -0.3V to 6V
Power-Good Current..... ±12mA
Package Thermal Resistance
TDFN-2×2-6DL, θ_{JA}..... 59.2℃/W
TDFN-2×2-6DL, θ_{JB}..... 26.6℃/W
TDFN-2×2-6DL, $\theta_{JC(TOP)}$..... 71.4℃/W
TDFN-2×2-6DL, $\theta_{JC(BOT)}$..... 8.6℃/W
TDFN-3×3-8KL, θ_{JA}..... 45.7℃/W
TDFN-3×3-8KL, θ_{JB}..... 21.1℃/W
TDFN-3×3-8KL, $\theta_{JC(TOP)}$..... 47.1℃/W
TDFN-3×3-8KL, $\theta_{JC(BOT)}$..... 8.2℃/W
Junction Temperature .....+150℃
Storage Temperature Range.....-65℃ to +150℃
Lead Temperature (Soldering, 10s) .....+260℃
ESD Susceptibility (1) (2)
HBM.....±8000V
CDM .....±1000V

1. For human body model (HBM), all pins comply with AEC-Q100-002 specification.

2. For charged device model (CDM), all pins comply with AEC-Q100-011 specification.

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range .....1.5V to 5.5V
Enable Input Voltage Range .....0V to 5.5V
Power-Good Voltage Range .....0V to 5.5V
Power-Good Current.....±10mA
Input Effective Capacitance, C_{IN} ..... 0.5μF (MIN)
Output Effective Capacitance, C_{OUT} .....0.5μF to 220μF
Operating Ambient Temperature Range.....-40℃ to +125℃
Operating Junction Temperature Range.....-40℃ to +150℃

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

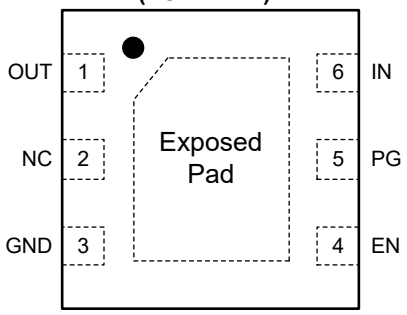
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

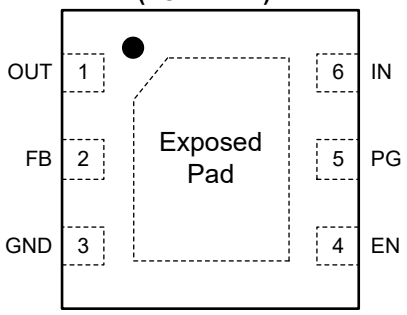
PIN CONFIGURATIONS

SGM2080-FIXQ
(TOP VIEW)



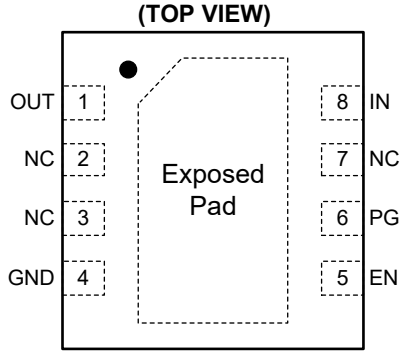
TDFN-2×2-6DL

SGM2080-ADJQ
(TOP VIEW)



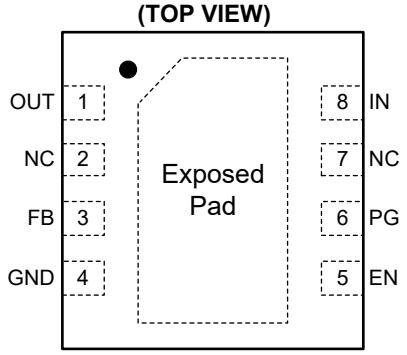
TDFN-2×2-6DL

SGM2080-FIXQ
(TOP VIEW)



TDFN-3×3-8KL

SGM2080-ADJQ
(TOP VIEW)



TDFN-3×3-8KL

PIN DESCRIPTION

PIN		NAME	FUNCTION
TDFN-2×2-6DL	TDFN-3×3-8KL		
1	1	OUT	Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 0.5μF to 220μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin.
2	3	NC	No Connection (fixed voltage version only).
		FB	Feedback Pin (adjustable voltage version only). Connect this pin to the midpoint of an external resistor divider to adjust the output voltage. Place the resistors as close as possible to this pin.
3	4	GND	Ground.
4	5	EN	Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator.
5	6	PG	Open-Drain Power-Good Output Pin. An open-drain output and active high when the output voltage reaches the target voltage.
6	8	IN	Input Supply Voltage Pin. It is recommended to use a 1μF or larger ceramic capacitor from IN pin to ground to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to IN pin.
—	2, 7	NC	No Connection.
Exposed Pad	Exposed Pad	—	Exposed Pad. Connect it to GND internally. Connect it to a large ground plane to maximize thermal performance. This pad is not an electrical connection point.

FUNCTIONAL BLOCK DIAGRAMS

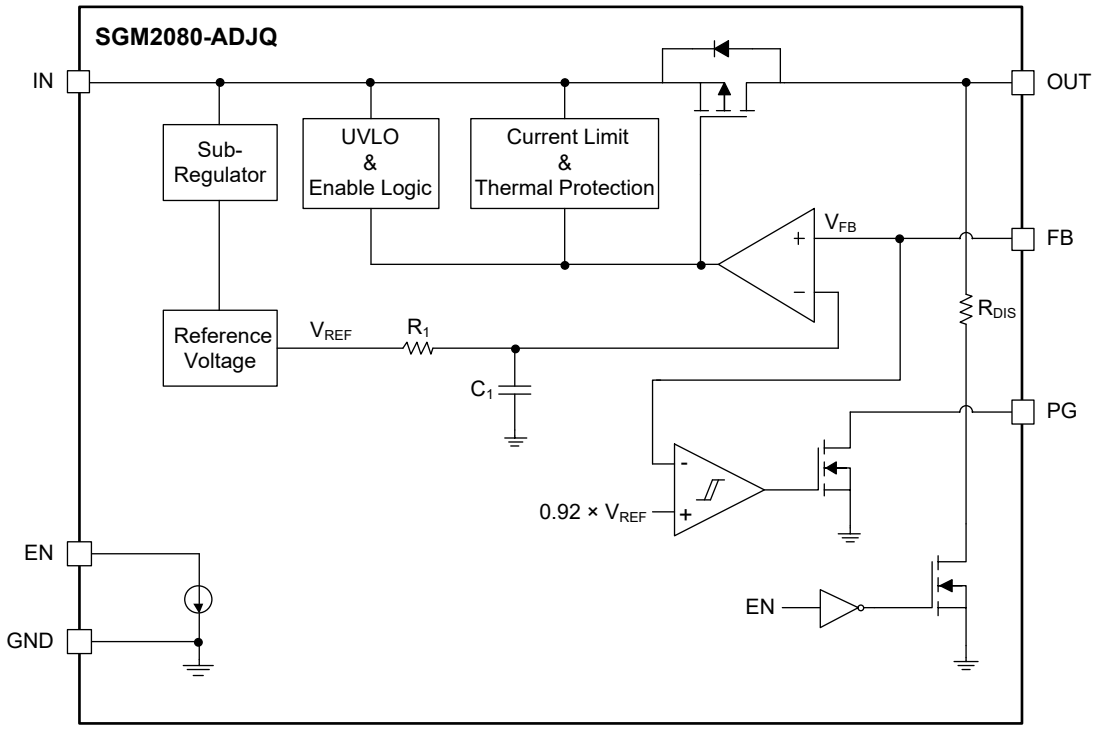


Figure 2. Block Diagram for Adjustable Output Version

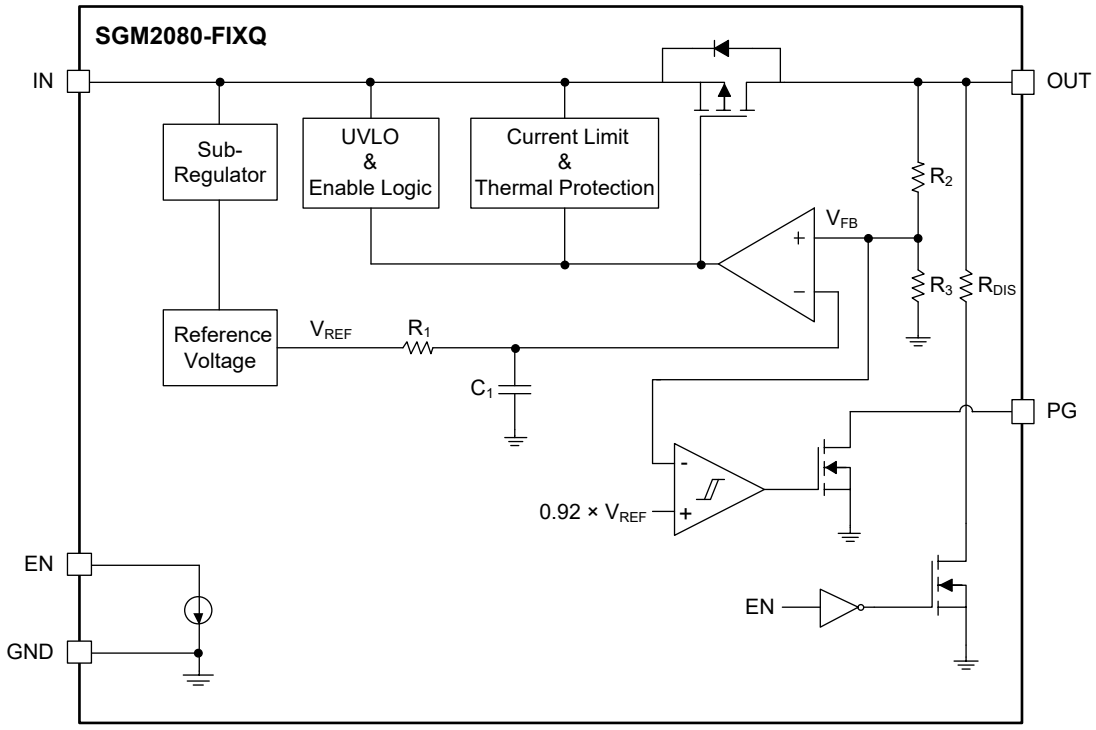


Figure 3. Block Diagram for Fixed Output Version

ELECTRICAL CHARACTERISTICS

(V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = -40℃ to +125℃ (1), typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Supply Voltage Range	V_{IN}			1.5		5.5	V
Output Voltage Range	V_{OUT}	SGM2080-FIXQ		0.8		4.2	V
		SGM2080-ADJQ		0.55		5	
Feedback Voltage	V_{FB}	V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) to 5.5V, I_{OUT} = 10mA	T_J = +25℃	0.5445	0.55	0.5555	V
			T_J = -40℃ to +125℃	0.5401	0.55	0.5599	
Output Voltage Accuracy	V_{OUT}	V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) to 5.5V, I_{OUT} = 10mA	T_J = +25℃	-1		+1	%
			T_J = -40℃ to +125℃	-1.8		+1.8	
FB Pin Input Current	I_{FB}				1	50	nA
Under-Voltage Lockout	V_{UVLO}	V_{IN} rising			1.31	1.45	V
		V_{IN} falling		1.15	1.29		
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) to 5.5V, I_{OUT} = 0.1mA			0.009	0.2	%/V
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{OUT} \times V_{OUT}}$	V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 2V (whichever is greater), I_{OUT} = 0.1mA to 500mA			0.0004	0.003	%/mA
Dropout Voltage	V_{DROP}	I_{OUT} = 500mA, when V_{OUT} falls to 95% × $V_{OUT(NOM)}$	$V_{OUT(NOM)}$ = 3.3V		95	170	mV
			$V_{OUT(NOM)}$ = 5V		80	130	
Output Current Limit	I_{LIMIT}	V_{IN} = V_{OUT} + 2V, V_{OUT} = 90% × $V_{OUT(NOM)}$		500	950		mA
Short-Circuit Current Limit	I_{SHORT}	V_{IN} = $V_{OUT(NOM)}$ + 2V, V_{OUT} = 0V			290		mA
Quiescent Current	I_Q	I_{OUT} = 0mA	T_J = -40℃ to +85℃		85	300	μA
			T_J = -40℃ to +125℃		85	800	
Shutdown Current	I_{SHDN}	V_{EN} = 0V			0.22	5	μA
Enable Threshold Voltage	V_{IH}	EN input voltage high		1		5.5	V
	V_{IL}	EN input voltage low		0		0.4	
Enable Input Current	I_{EN}	V_{EN} = 0V, V_{IN} = 5.5V			20	500	nA
		V_{EN} = 5.5V, V_{IN} = 5.5V			150	1000	nA
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V, V_{IN} = 5.5V			100		Ω
Turn-On Time	t_{ON}	$V_{OUT(NOM)}$ = 3.3V, from assertion of V_{EN} to V_{OUT} = 90% × $V_{OUT(NOM)}$			540	1000	μs
PG High Threshold	PG_{HTH}	V_{OUT} increasing		86	92	98	$\%V_{FB}$
PG Low Threshold	PG_{LTH}	V_{OUT} decreasing		84	90	96	$\%V_{FB}$
PG Pin Low-Level Output Voltage	$V_{PG(LO)}$	V_{IN} ≥ 1.5V, I_{SINK} = 2mA			230	400	mV
PG Pin Leakage Current	$I_{PG(LKG)}$	V_{OUT} > PG_{HTH}, V_{PG} = 5.5V			20	1000	nA
PG Delay Time Rising	t_{PGDH}	Time from 92% × V_{OUT} to 20% of PG, V_{IN} = 5.5V			6		ms
PG Delay Time Falling	t_{PGDL}	Time from 90% × V_{OUT} to 80% of PG, V_{IN} = 5.5V			10		μs
Power Supply Rejection Ratio	PSRR	$V_{OUT(NOM)}$ = 3.3V, V_{IN} = 4.3V, Ripple 0.2V_{P-P}, I_{OUT} = 50mA, C_{OUT} = 2.2μF	f = 1kHz		60		dB
			f = 100kHz		41		
			f = 1MHz		37		

ELECTRICAL CHARACTERISTICS (continued)

(V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = -40℃ to +125℃ (1), typical values are at T_J = +25℃, unless otherwise noted.)

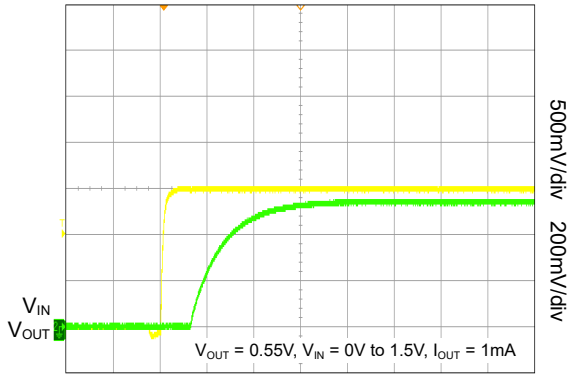
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Voltage Noise	e_n	$V_{OUT(NOM)}$ = 0.55V, C_{OUT} = 2.2μF, f = 10Hz to 100kHz	I_{OUT} = 1mA		24		μV_{RMS}
			I_{OUT} = 500mA		16		
		$V_{OUT(NOM)}$ = 3.3V, C_{OUT} = 2.2μF, f = 10Hz to 100kHz	I_{OUT} = 1mA		70		
			I_{OUT} = 500mA		67		
Thermal Shutdown Temperature	T_{SHDN}	T_J rising			165		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}	Hysteresis			20		℃

NOTE: 1. Tested under pulse load conditions, so $T_J \approx T_A$.

TYPICAL PERFORMANCE CHARACTERISTICS

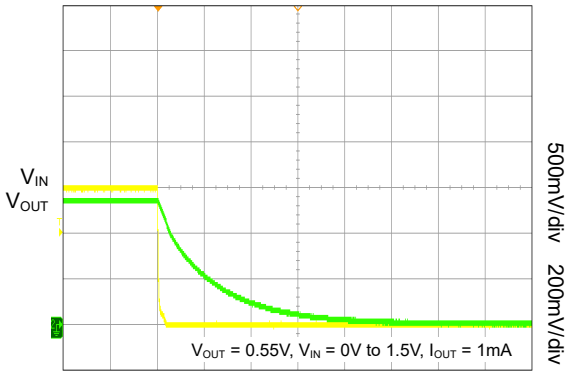
V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = +25℃, unless otherwise noted.

V_{IN} Power-On Time



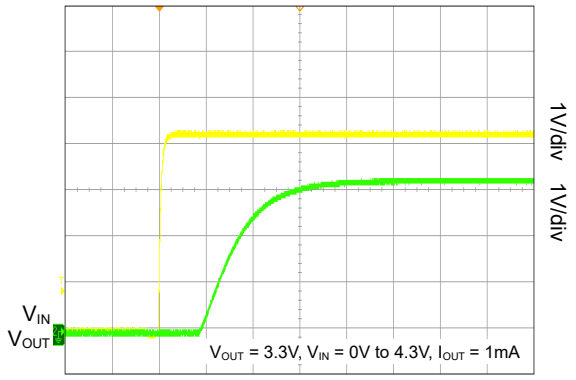
Time (200μs/div)

V_{IN} Power-Off Time



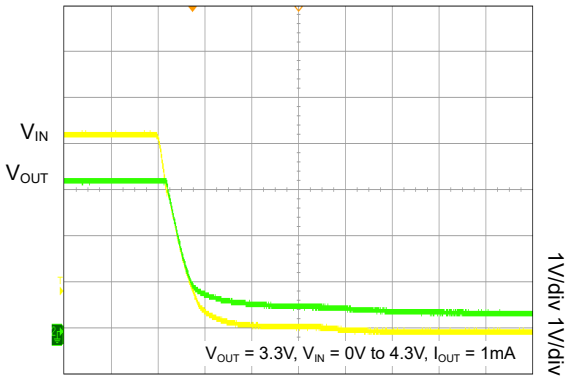
Time (500μs/div)

V_{IN} Power-On Time



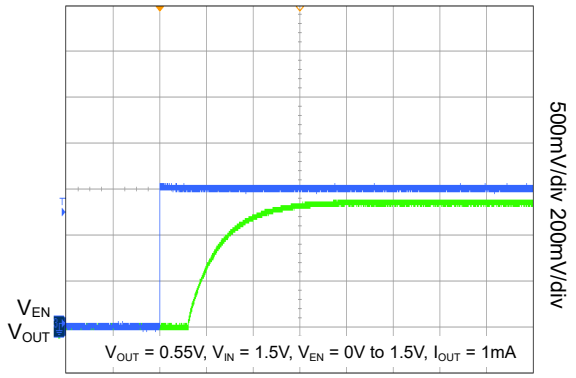
Time (200μs/div)

V_{IN} Power-Off Time



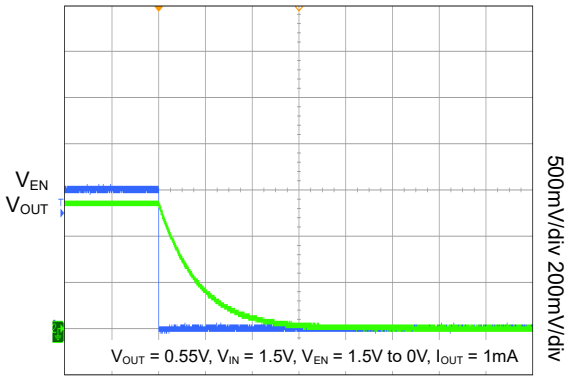
Time (20μs/div)

Enable Turn-On Response



Time (200μs/div)

Enable Turn-Off Response

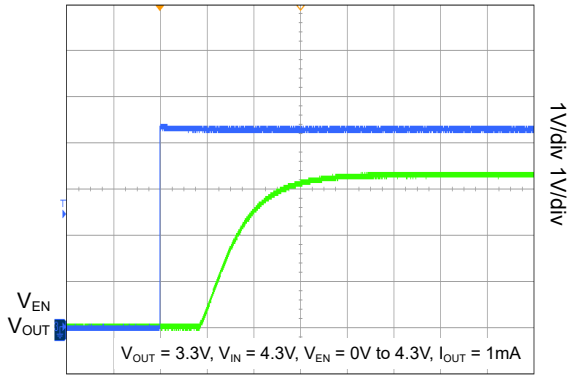


Time (200μs/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

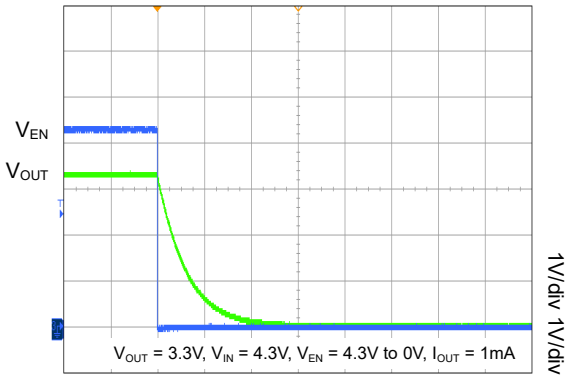
V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = +25℃, unless otherwise noted.

Enable Turn-On Response



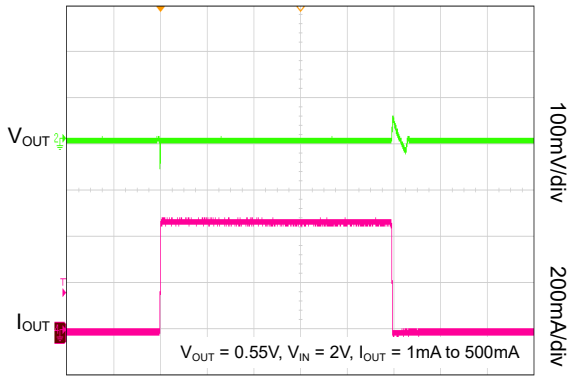
Time (200μs/div)

Enable Turn-Off Response



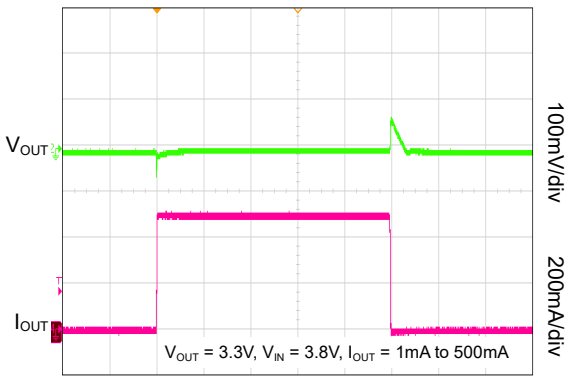
Time (200μs/div)

Load Transient Response



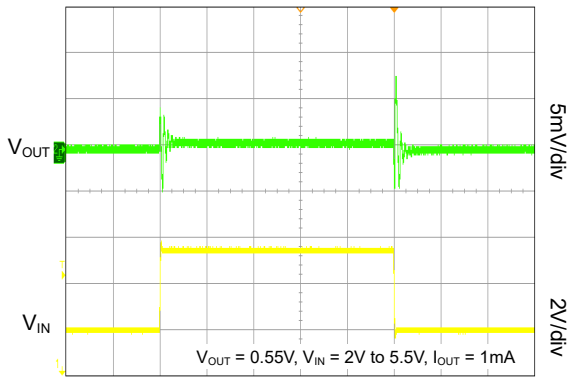
Time (200μs/div)

Load Transient Response



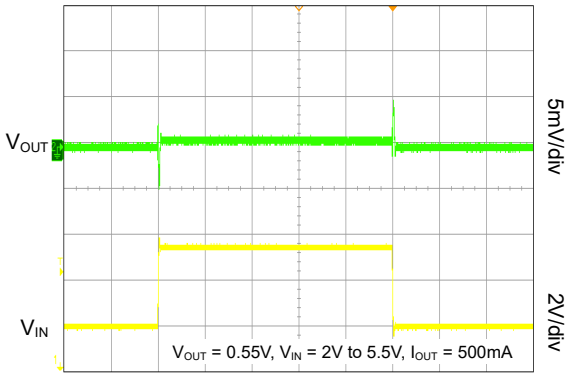
Time (200μs/div)

Line Transient Response



Time (200μs/div)

Line Transient Response

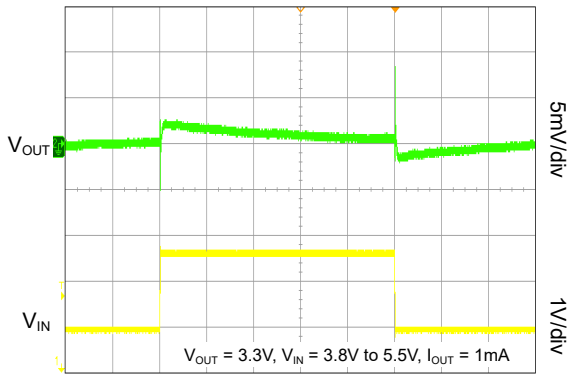


Time (200μs/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

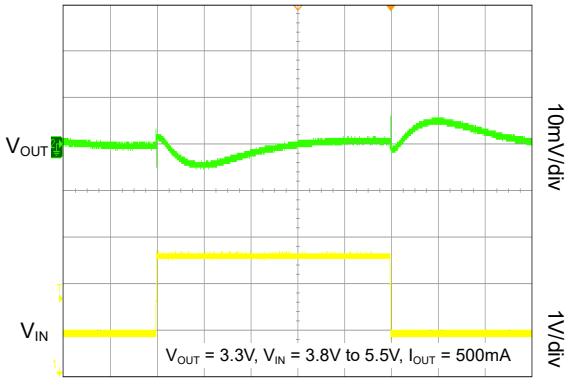
V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = +25℃, unless otherwise noted.

Line Transient Response



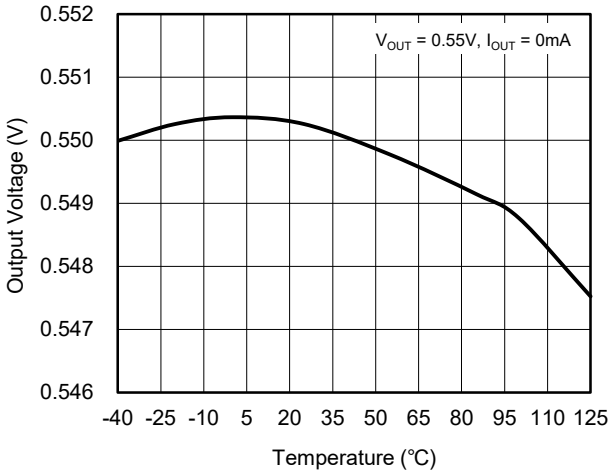
Time (2ms/div)

Line Transient Response

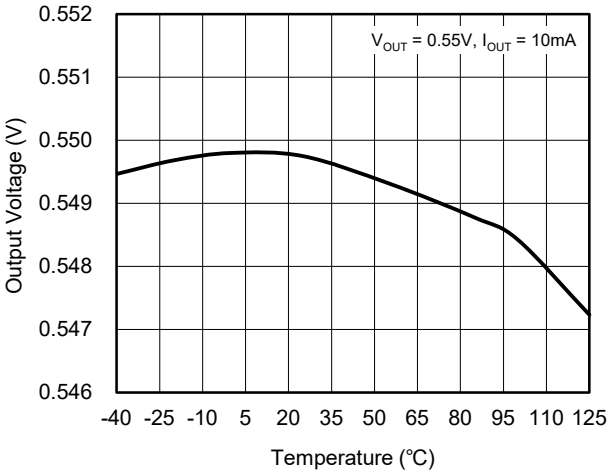


Time (10ms/div)

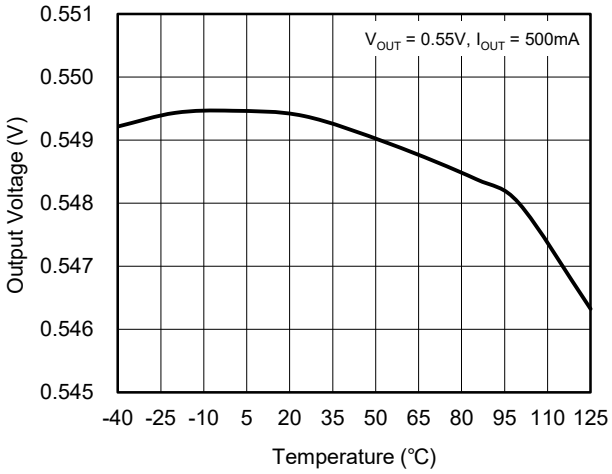
Output Voltage vs. Temperature



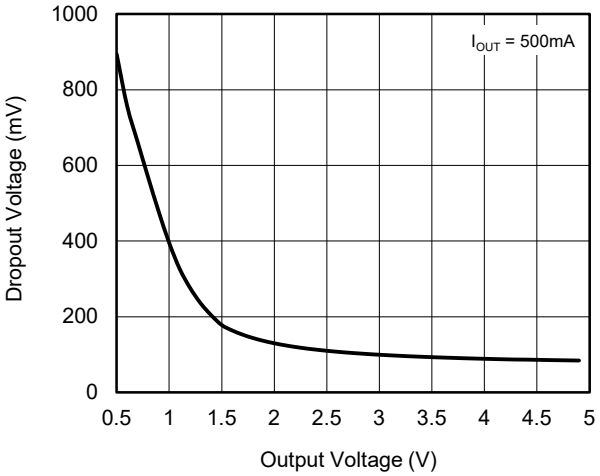
Output Voltage vs. Temperature



Output Voltage vs. Temperature



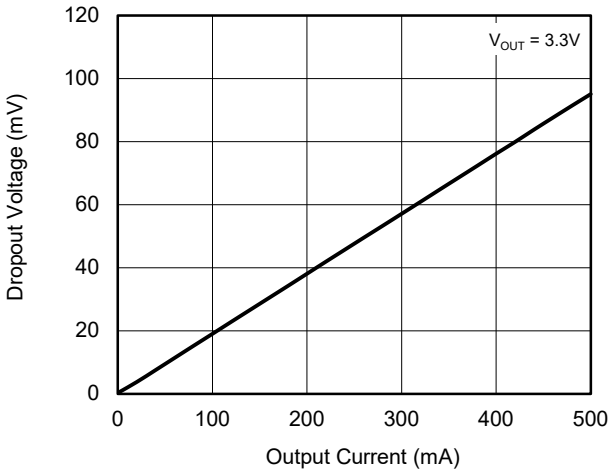
Dropout Voltage vs. Output Voltage



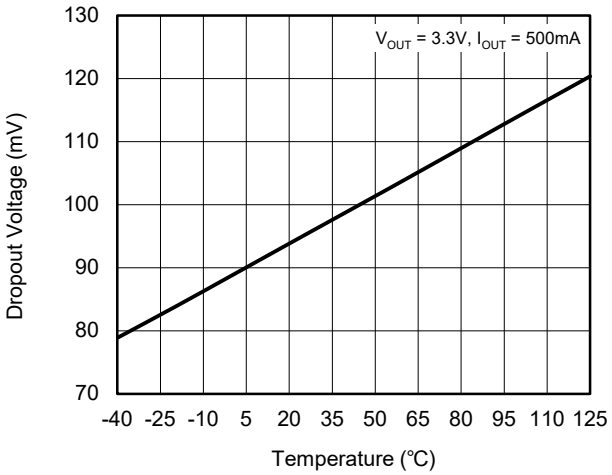
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = +25℃, unless otherwise noted.

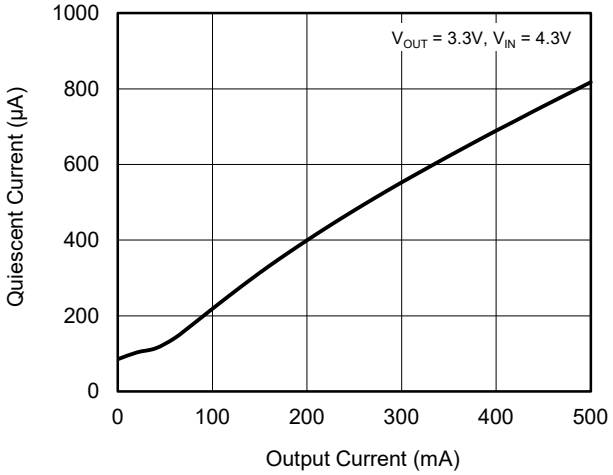
Dropout Voltage vs. Output Current



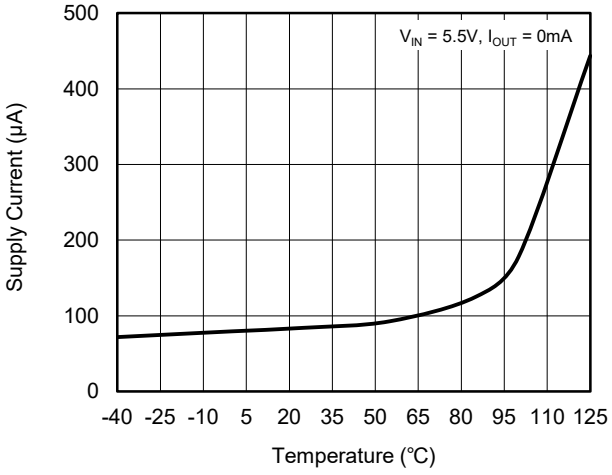
Dropout Voltage vs. Temperature



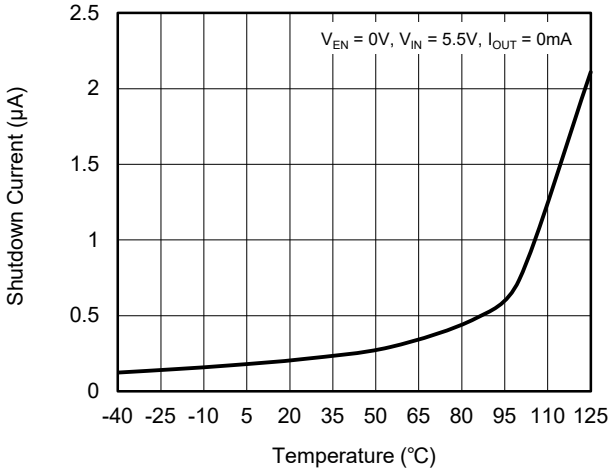
Quiescent Current vs. Output Current



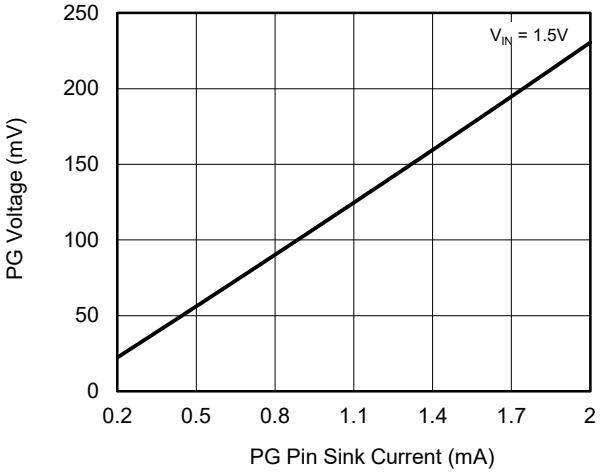
Supply Current vs. Temperature



Shutdown Current vs. Temperature



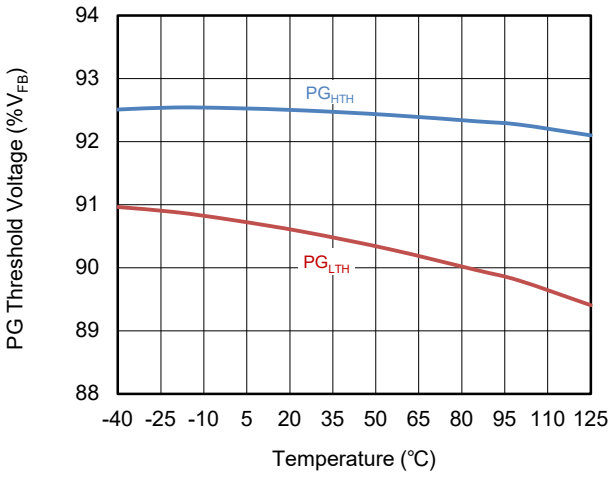
PG Voltage vs. PG Pin Sink Current



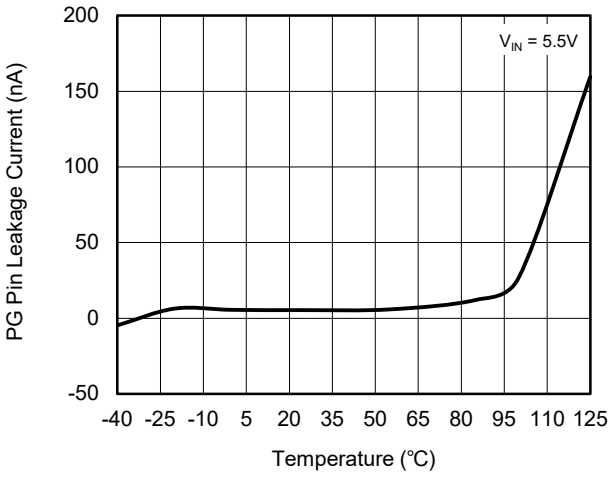
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = +25℃, unless otherwise noted.

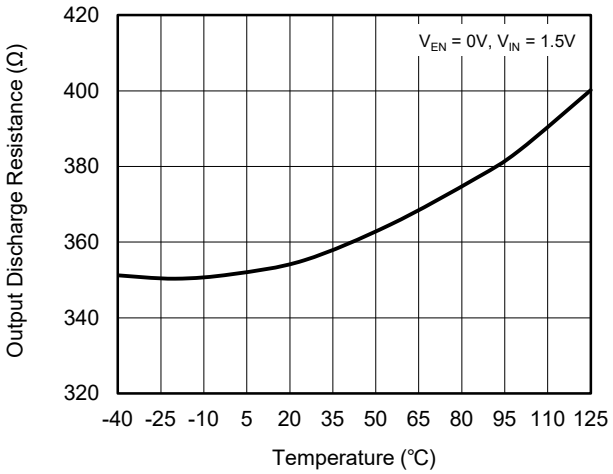
PG Threshold Voltage vs. Temperature



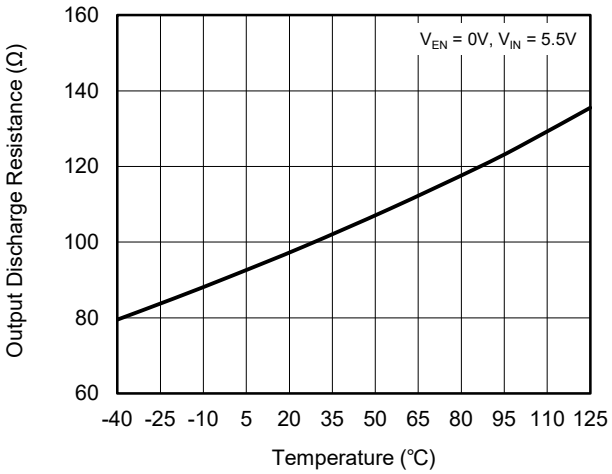
PG Pin Leakage Current vs. Temperature



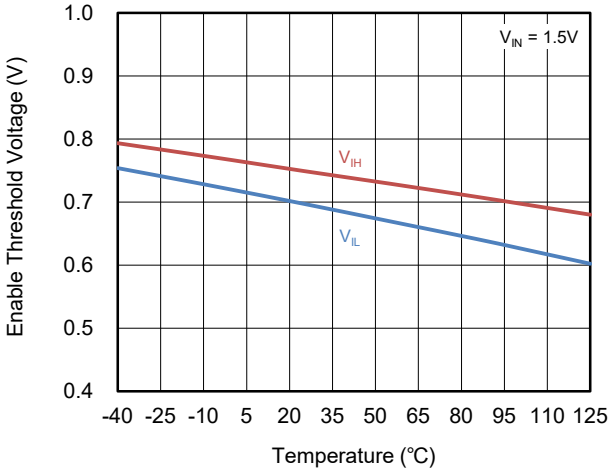
Output Discharge Resistance vs. Temperature



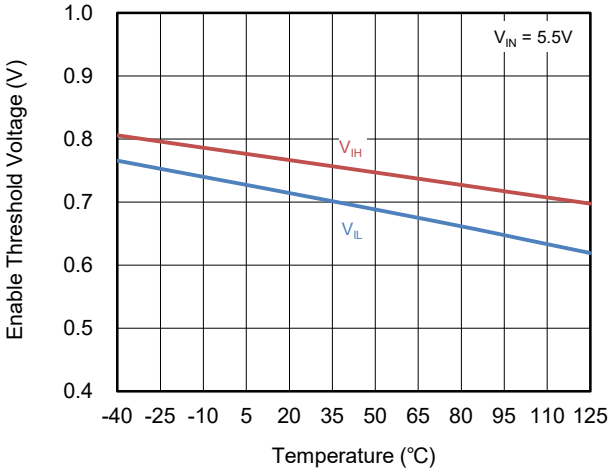
Output Discharge Resistance vs. Temperature



Enable Threshold Voltage vs. Temperature



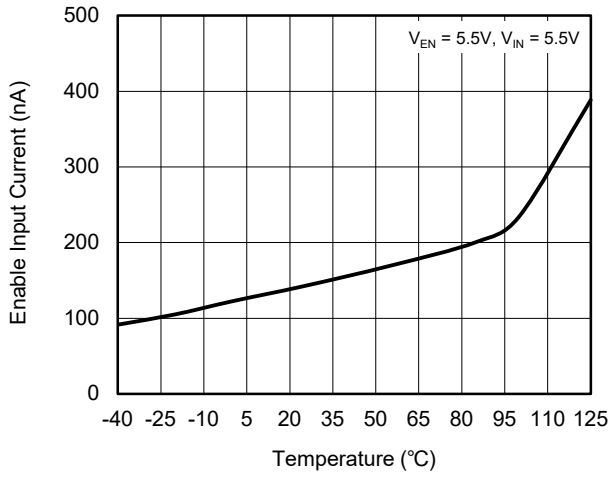
Enable Threshold Voltage vs. Temperature



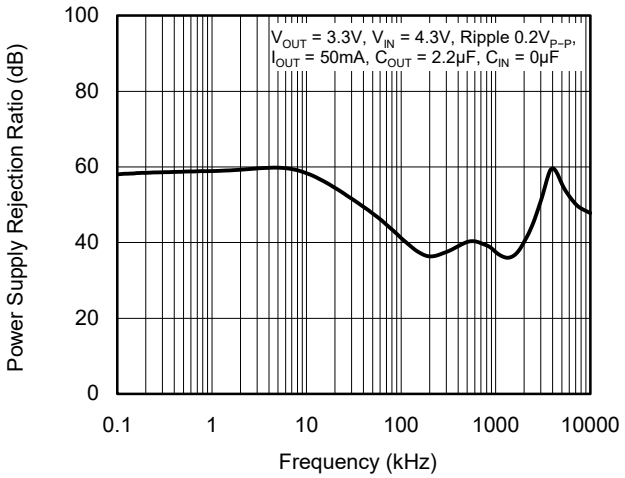
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 1.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = 1μF, C_{OUT} = 1μF, C_{FF} = 0nF, T_J = +25℃, unless otherwise noted.

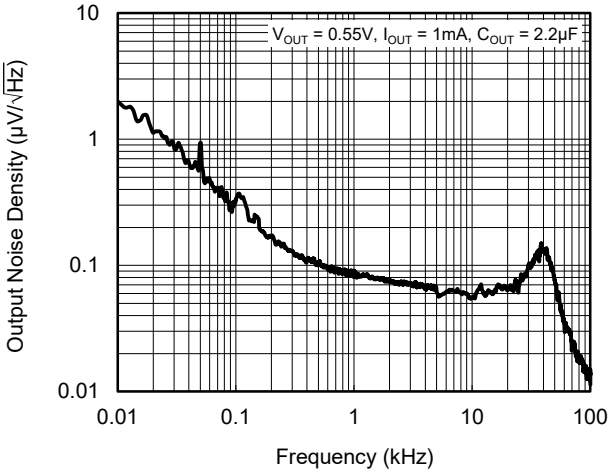
Enable Input Current vs. Temperature



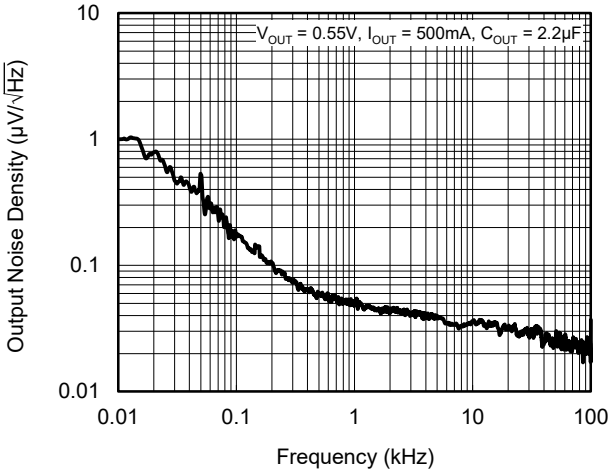
Power Supply Rejection Ratio vs. Frequency



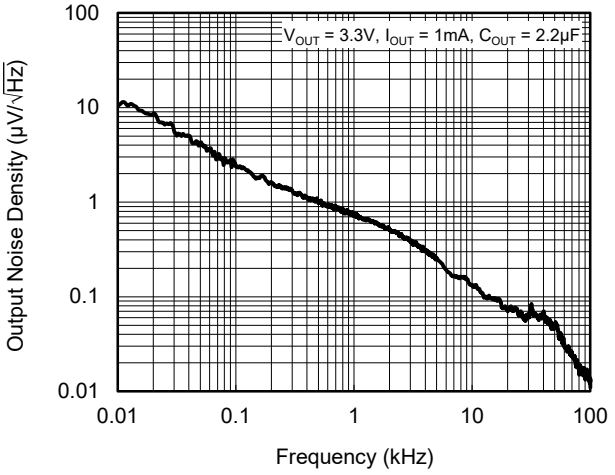
Output Noise Density vs. Frequency



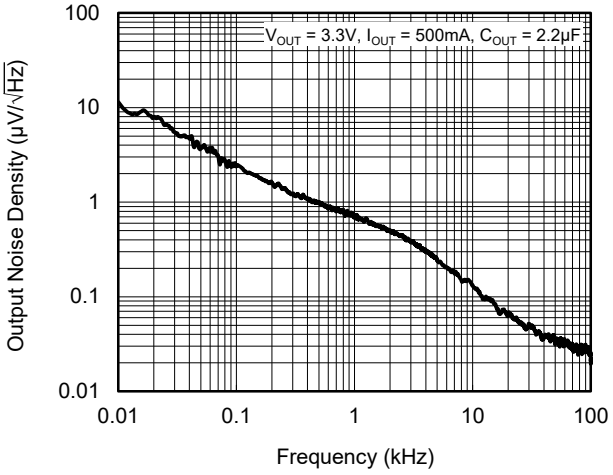
Output Noise Density vs. Frequency



Output Noise Density vs. Frequency



Output Noise Density vs. Frequency



APPLICATION INFORMATION

The SGM2080xQ is a low noise and low dropout LDO and provides 500mA output current. These features make the device a reliable solution to solve many challenging problems in the generation of clean and accurate power supply. The high performance also makes the SGM2080xQ useful in a variety of applications. The SGM2080xQ provides protection functions for output overload and overheating.

The SGM2080xQ provides an EN pin as an external chip enable control to enable/disable the device. When the regulator is in shutdown state, the shutdown current consumes as low as 0.22μA (TYP).

Input Capacitor Selection (C_{IN})

The input decoupling capacitor should be placed as close as possible to the IN pin to ensure the device stability. 1μF or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance.

When V_{IN} is required to provide large current instantaneously, a large effective input capacitor is required. Multiple input capacitors can limit the input tracking inductance. Adding more input capacitors is available to restrict the ringing and to keep it below the device absolute maximum ratings. For C_{OUT} with larger capacitance, it is recommended to choose the larger capacitance C_{IN}.

Output Capacitor Selection (C_{OUT})

One or more output capacitors are required to maintain the stability of the LDO, and the output capacitors should be placed as close as possible to the OUT pin. In addition, in order to obtain the best transient performance, it is recommended to use X7R and X5R ceramic capacitors as output capacitors. Ceramic capacitors have low equivalent series resistance (ESR), excellent temperature and DC bias characteristics. However, it cannot be ignored that the effective capacitance of ceramic capacitors is affected by temperature, DC bias and package size.

For example, Figure 4 shows the capacitance and DC bias and temperature characteristics of 0805, 10V, 10μF±10%, X7R capacitor. Therefore, it is necessary to evaluate whether the effective capacitance of the output capacitor can meet the stability requirements of the LDO in practical applications. In general, a capacitor in higher voltage rating and a larger package exhibits better stability, and the effective capacitance can be obtained from the manufacturer datasheet.

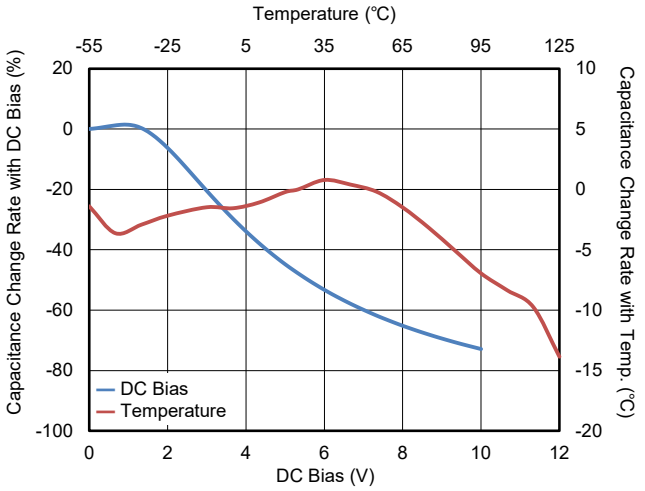


Figure 4. Capacitance vs. DC Bias and Temperature Characteristics

The SGM2080xQ requires a minimum effective capacitance of 0.5μF for C_{OUT} to ensure stability. Additionally, C_{OUT} with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

Adjustable Regulator

The output voltage of the SGM2080-ADJQ can be adjusted from 0.55V to 5.0V. The FB pin will be connected to two external resistors as shown in Figure 5. The output voltage is determined by the following equation:

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R_1}{R_2}\right) \quad (1)$$

where:

V_{OUT} is output voltage and V_{FB} is the internal voltage reference, V_{FB} = 0.55V.

One parallel capacitor (C_{FF}) with R_1 can be used to improve the PSRR, increase the transient response and reduce the output noise. The resistance range of R_2 is recommended to be between 5kΩ and 130kΩ.

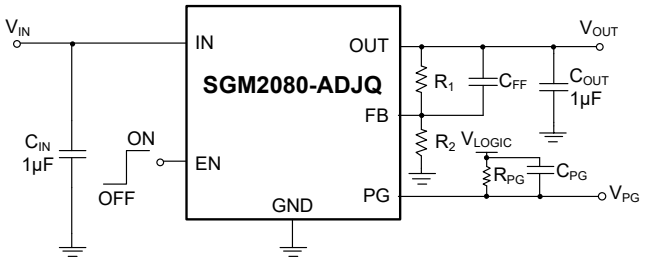


Figure 5. Adjustable Output Voltage Application

APPLICATION INFORMATION (continued)

Enable Operation

The SGM2080xQ uses the EN pin to enable/disable the device and to deactivate/activate the output automatic discharge function.

When the EN pin voltage is lower than 0.4V, the device is in shutdown state. There is no current flowing from IN to OUT pins. In this state, the automatic discharge transistor is active to discharge the output voltage through a 100Ω (TYP) resistor and the PG output is pulled down.

When the EN pin voltage is higher than 1.0V, the device is in active state. The output voltage is regulated to the expected value and the automatic discharge transistor is turned off.

Under-Voltage Lockout (UVLO)

The UVLO circuit monitors the input voltage to prevent the device from turning on before V_{IN} rises above the V_{UVLO} threshold. The UVLO circuit responds quickly to glitches on the IN pin and attempts to disable the output of the device if any of these rails collapses. The local input capacitance prevents severe brownouts in most applications. When the SGM2080xQ enters UVLO, the PG output is pulled down.

Power-Good Function

The SGM2080xQ features PG function for monitoring the feedback voltage, so as to reflect the state of the output voltage. When the output voltage is lower than PG_{LTH}, the PG pin open-drain engages and pulls the PG pin close to GND. When the output voltage is higher than PG_{HTH}, the PG pin is indicated as high impedance. Connecting the PG pin to an external power supply via a pull-up resistor enables any downstream device to receive a power-good valid logic signal for sequencing. The resistance range of the pull-up resistor is recommended to be between 10kΩ and 100kΩ.

When an external feed-forward capacitor (C_{FF}) is added in application, the total LDO startup time constant increases by approximately $3 \times R_1 \times C_{FF}$.

If the Power-Good (PG) output time constant remains unchanged, the PG signal may not accurately indicate whether V_{OUT} has reached the expected voltage. To ensure a valid PG output, the following design configurations must be implemented to match the time constants.

Add a PG delay capacitor (C_{PG}) and connect C_{PG} in parallel with the PG pull-up resistor (R_{PG}) refer to Figure 5. Ensure the following condition is met:

$$3 \times R_{PG} \times C_{PG} \geq 3 \times R_1 \times C_{FF} \quad (2)$$

Figure 6 shows the differences in PG signals when C_{FF} and C_{PG} are added. In Figure 6, t_{REF} is the time that takes for the V_{FB} voltage to rise from 0V to 92% × V_{REF}, t_{CFF} is the startup time contributed by C_{FF}.

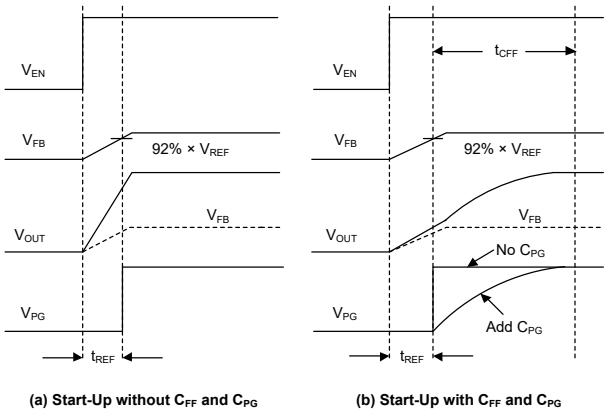


Figure 6. Typical Power-Good Timing Diagram

The PG output is pulled down when the SGM2080xQ is in one of the following states, including disabled, thermal shutdown and UVLO.

Output Current Limit Protection

When overload events happen, the output current is internally limited to 950mA (TYP). When the OUT pin is shorted to ground, the output current is internally limited to 290mA (TYP).

Thermal Shutdown

When the die temperature exceeds the threshold value of thermal shutdown, the SGM2080xQ will be in shutdown state and it will remain in this state until the die temperature decreases to +145℃. When the device enters thermal shutdown, the PG output is pulled low.

Power Dissipation (P_D)

Power dissipation (P_D) of the SGM2080xQ can be calculated by the equation $P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$. The maximum allowable power dissipation ($P_{D(MAX)}$) of the SGM2080xQ is affected by many factors, including the difference between junction temperature and ambient temperature ($T_{J(MAX)} - T_A$), package thermal resistance from the junction to the ambient environment (θ_{JA}), the rate of ambient airflow and PCB layout. $P_{D(MAX)}$ can be approximated by the following equation:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA} \quad (3)$$

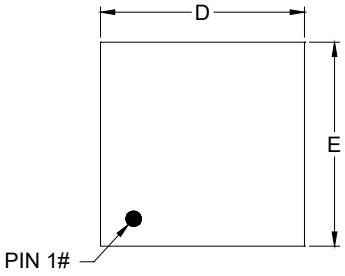
REVISION HISTORY

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

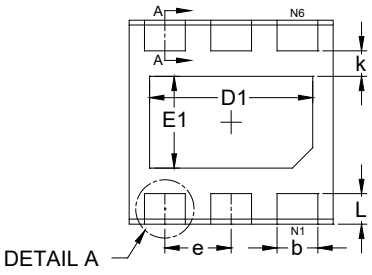
Changes from Original to REV.A (JUNE 2025)	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

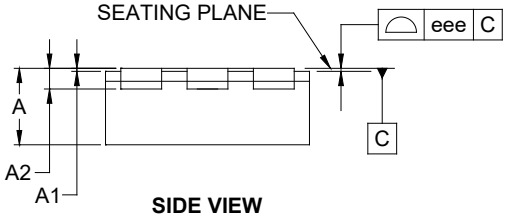
TDFN-2×2-6DL



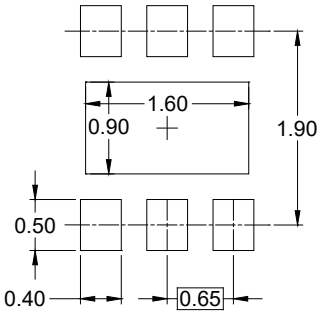
TOP VIEW



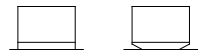
BOTTOM VIEW



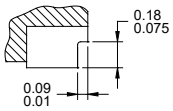
SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



DETAIL A
ALTERNATE TERMINAL CONSTRUCTION



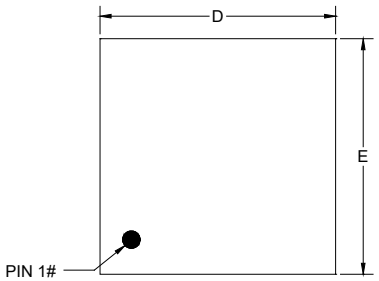
SECTION A-A
TERMINAL CROSS SECTION

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.700	-	0.800
A1	0.000	-	0.050
A2		0.203 REF	
b	0.350	-	0.450
D	1.900	-	2.100
E	1.900	-	2.100
D1	1.500	-	1.700
E1	0.800	-	1.000
e		0.650 BSC	
L	0.250	-	0.350
k		0.250 REF	
eee		0.080	

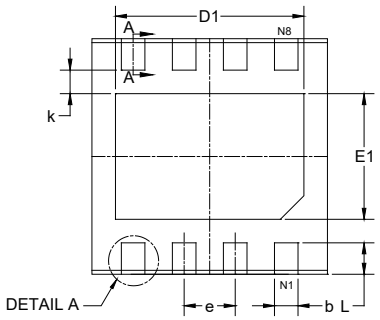
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

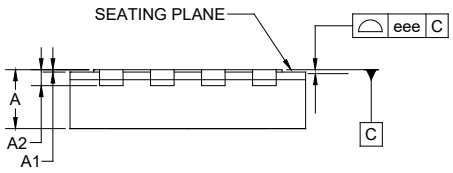
TDFN-3×3-8KL



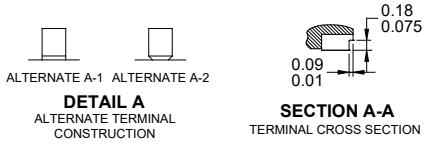
TOP VIEW



BOTTOM VIEW

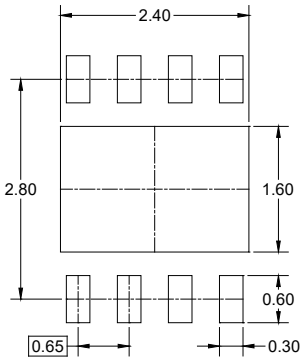


SIDE VIEW



DETAIL A
ALTERNATE TERMINAL CONSTRUCTION

SECTION A-A
TERMINAL CROSS SECTION



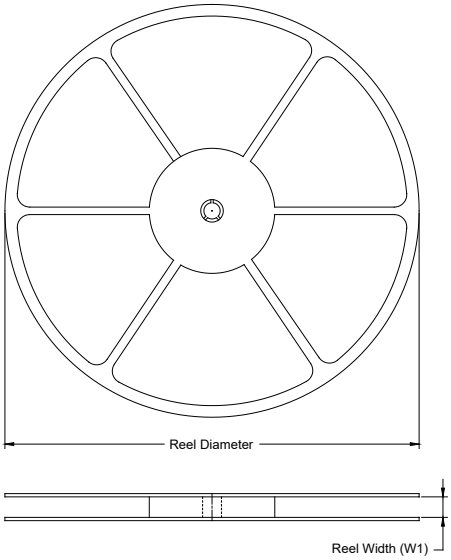
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.700	-	0.800
A1	0.000	-	0.050
A2	0.203 REF		
b	0.250	-	0.350
D	2.900	-	3.100
D1	2.300	-	2.500
E	2.900	-	3.100
E1	1.500	-	1.700
e	0.650 BSC		
k	0.300 REF		
L	0.300	-	0.500
eee	0.080		

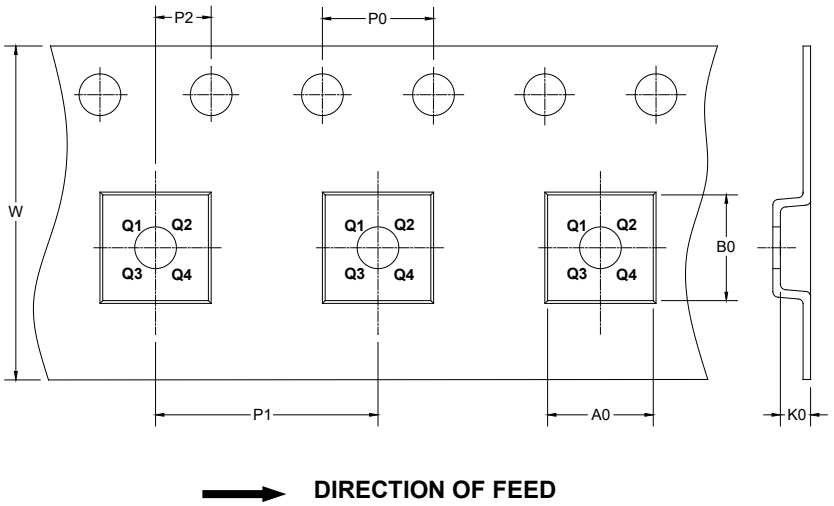
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



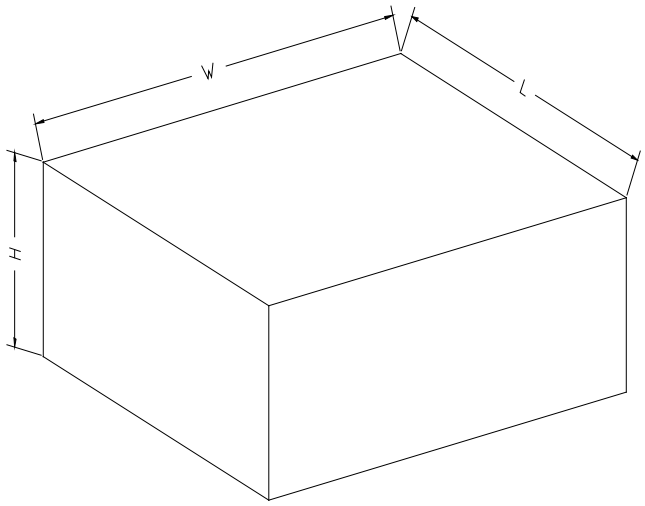
NOTE: The picture is only for reference. Please make the object as the standard.

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-2×2-6DL	7"	9.5	2.30	2.30	1.10	4.0	4.0	2.0	8.0	Q2
TDFN-3×3-8KL	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
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

DD0002