

features

- Low Dropout Voltage Regulator, 1.2-V
- 150-mA Load Current Capability
- Power Okay (POK) Function
- Load Independent, Low Ground Current, 150- μ A
- Current Limiting
- Thermal Shutdown
- Low Sleep State Current (Off Mode)
- Fast Transient Response
- Low Variation Due to Load and Line Regulation
- Output Stable With Low ESR Capacitors
- TTL Logic Controlled Enable Input

applications

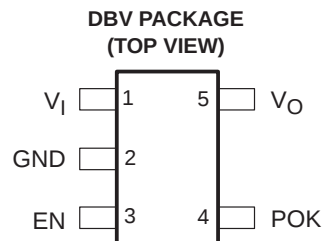
- Processor Powerup Sequencing
- Palmtop Computers, Laptops, and Notebooks

description

The SN105125 is a low dropout voltage regulator with an output tolerance of $\pm 2\%$ over the operating range. The device is optimized for low noise applications and has a low quiescent current (enable < 0.8 V). The device has a low dropout voltage at full load (150 mA). The power okay function monitors the output voltage and indicates when an error occurs in the system (active low). In the event of an output fault such as overcurrent, thermal shutdown, or dropout, the power okay output is pulled low (open drain).

The SN105125 has a fast transient response recovery capability in the event of load transition from heavy load to light load. The device also minimizes overshoot during this condition. During power down, the output capacitor and load are de-energized through the internal active shutdown clamp, which is turned on when the device is disabled.

The SN105125 requires a small output capacitor for stability with low ESR. An input capacitor is not required unless the bulk ac capacitor is placed away from the device or the power supply is a battery. In this situation, a 1- μ F capacitor is recommended for the application. Low ESR ceramic capacitors may be used with the device to reduce board space in power applications, a key concern in hand-held wireless devices.



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 **TEXAS
INSTRUMENTS**

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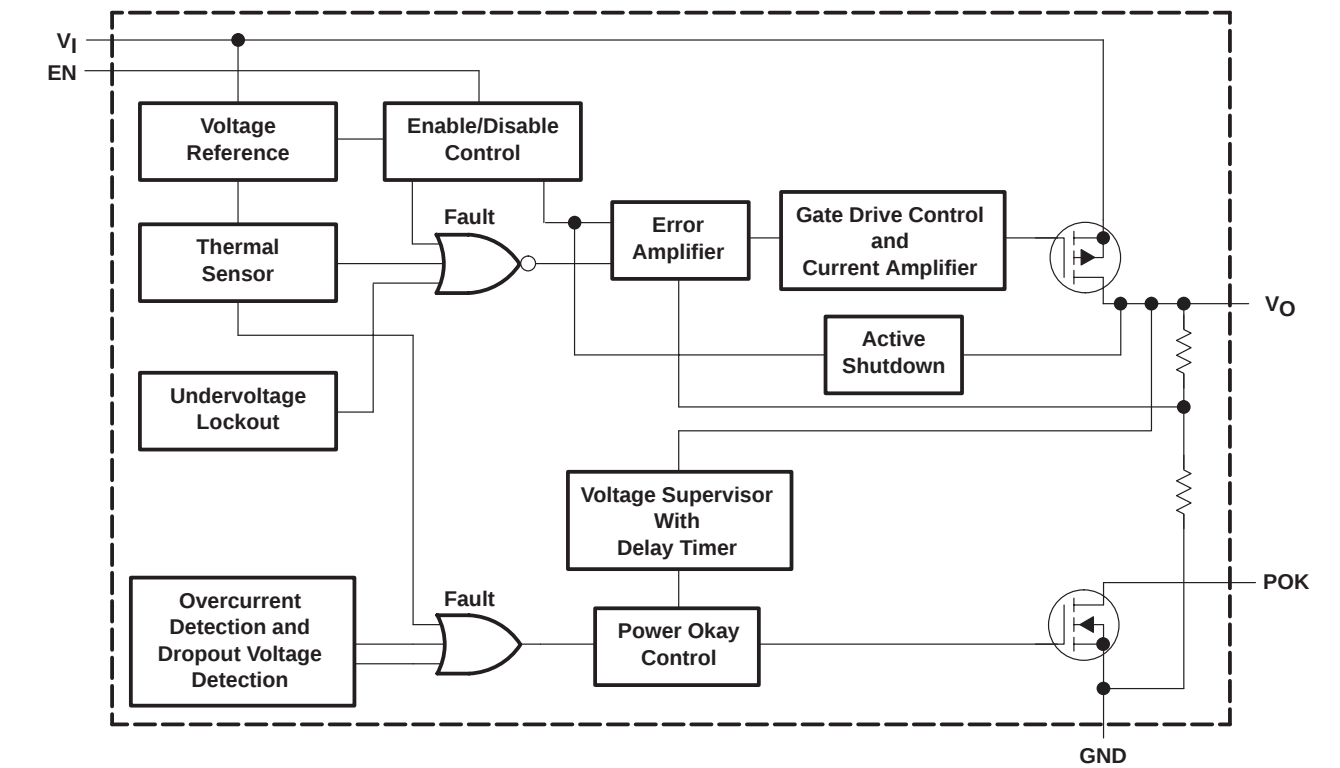
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SN105125

150-mA LOW DROPOUT REGULATOR WITH POK

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functional block diagram



Terminal Functions			
TERMINAL NAME	NO.	I/O	DESCRIPTION
EN	3	I	Enable/shutdown input (active high)
GND	2	I	Ground
POK	4	I	Power okay indicator
VI	1	I	Input supply voltage
VO	5	O	Output voltage

absolute maximum ratings over operating free-air temperature (unless otherwise noted)[†]

Main input voltage range, V_I (see Notes 1 and 2)	0 V to 7 V
Enable input voltage range, $V_{(EN)}$ (see Notes 1 and 2)	0 V – V_I
Power okay output voltage range $V_{(POK)}$, (see Notes 1 and 2)	0 V – V_I
Regulated output current limit, I_O	400 mA
Continuous power dissipation, P_D , $T_A = 25^\circ\text{C}$	0.5 W
Electrostatic discharge susceptibility, $V_{(HBMESE)}$, (see Note 3)	2 kV
Junction temperature, T_J	150°C
Storage temperature range, T_{Stg}	–55°C to 150°C
Lead temperature (soldering, 10 sec)	260°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values are with respect to GND.
 2. Absolute negative voltage on these terminals should not go below –0.5 V.
 3. The human body model is a 100-pF capacitor discharged through a 1.5-k Ω resistor into each terminal. Devices are ESD sensitive. Handling precautions are recommended.

recommended operating conditions

	MIN	TYP	MAX	UNIT
Main input voltage, V_I (see Notes 1 and 2)	3		5.25	V
Enable input voltage, $V_{(EN)}$ (see Notes 1 and 2)	0		V_I	V
Power okay voltage, $V_{(POK)}$ (see Notes 1 and 2)	0		V_I	V
Operating ambient temperature, T_A	0		70	°C

- NOTES:
1. All voltage values are with respect to GND.
 2. Absolute negative voltage on these terminals should not go below –0.5 V.

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electrical characteristics, $T_A = 25^\circ\text{C}$, $V_I = 5\text{ V}$, $V_{(EN)} = V_I$, $I_O = 100\text{ }\mu\text{A}$, $C_L = 1\text{ }\mu\text{F}$ (unless otherwise noted)

regulator V_O

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNITS
V_O	Output voltage	$I_O = 25\text{ mA}$		1.2		V
	Output voltage accuracy	$I_O = 0$	-1%		1%	
		$I_O = 50\text{ mA}$, $T_A = 0^\circ\text{C}$ to 70°C (see Note 4)	-2%		2%	
I_Q	Quiescent supply current	$V_{(EN)} \leq 0.8\text{ V}$		1		μA
$I_{(GND)}$	Ground terminal current (see Note 5)	$I_O = 0$		150		μA
		$I_O = 150\text{ mA}$		150		
I_L	Output load current		150			mA
$I_{(Limit)}$	Output current limit	$V_O = 0$	160	300		mA
$\Delta V_{(LNR)}$	Line regulation	$V_I = 3\text{ V}$ to 5.25 V		10		mV
$\Delta V_{(LDR)}$	Load regulation	$I_O = 0.1\text{ mA}$ to 150 mA , See Note 6		2%	3%	
$V_I - V_O$	Dropout voltage	$I_O = 100\text{ }\mu\text{A}$		1		V
		$I_O = 150\text{ mA}$		1		
C_L	Load capacitance	ESR and capacitance tradeoffs		1		μF
$I_{(REV)}$	Reverse output current on V_I	$V_I = \text{GND}$, $V_O = \text{regulated voltage}$			50	μA

NOTES: 4. Assured by design, not tested in production.

5. Ground terminal current is the regulator quiescent current drawn from the supply to support the load current.

6. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Devices are tested for load regulation in the load range from 0.1 mA to 150 mA.

enable input

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNITS
V_{IL}	Regulated shutdown	$V_I = 3\text{ V}$ to 5.25 V regulated shutdown			0.8	V
V_{IH}	Regulated enabled	$V_I = 3\text{ V}$ to 5.25 V regulated enabled	2			V
$I_{(EN)}$	Enable input current	Shutdown, $V_{IL} \leq 0.8\text{ V}$		0.01		μA
		Enabled, $V_{IH} \geq 2\text{ V}$		0.01		
	Resistance discharge	$V_{(EN)} \leq 0.8\text{ V}$		500		Ω

thermal protection (see Note 4)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNITS
$T_{(SD)}$	Thermal shutdown			165		$^\circ\text{C}$
$T_{(SDHYS)}$	Hysteresis			15		$^\circ\text{C}$

NOTE 4: Assured by design, not tested in production.

power okay (see Note 7)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNITS
$V_{(POKLO)}$	Low threshold	Output falls % of V_O (power NOT okay)	85%			
$V_{(POKTH)}$	High threshold	Output reaches % of V_O , starts delay timer (power okay)			90%	
V_{OL}	V_O out of regulation	Fault condition, $I_{OL} = 100\text{ }\mu\text{A}$			0.4	V
I_{lkg}	Leakage current	$V_I = 5\text{ V}$			1	μA

NOTE 7: Power okay is a function of the output voltage being 5% lower than the specified range. The function is a detection of one of the following: over current, over temperature, or dropout.



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switching characteristics (see Note 4), $T_A = 25^\circ\text{C}$, $V_I = 5\text{ V}$, $V_{(EN)} = V_I$, $I_O = 100\text{ }\mu\text{A}$, $C_L = 1\text{ }\mu\text{F}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power up overshoot	Maximum voltage overshoot allowed on output during powerup		1%		
$t_{(\text{STEP})}$	Output transient time limit		5		μs
	Output transient voltage limit		1%		
$I_{(\text{SR})}$	Load step current slew rate		10		$\text{mA}/\mu\text{s}$
t_r	Power up rise time		50		μs
t_f	Power down fall time		60		μs
$t_d(\text{POK})$	Power okay delay time		2.5		ms

NOTE 4: Assured by design, not tested in production.

thermal resistance

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$R_{\theta\text{JC}}$	Thermal impedance, junction-to-case		145		$^\circ\text{C}/\text{W}$
$R_{\theta\text{JA}}$	Thermal impedance, junction-to-ambient		235		$^\circ\text{C}/\text{W}$



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PARAMETER MEASUREMENT INFORMATION

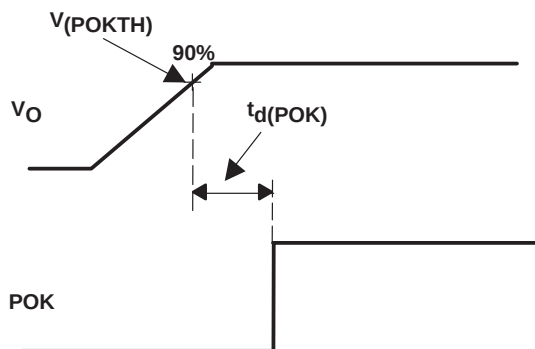


Figure 1. Power Okay Timing During Power Up

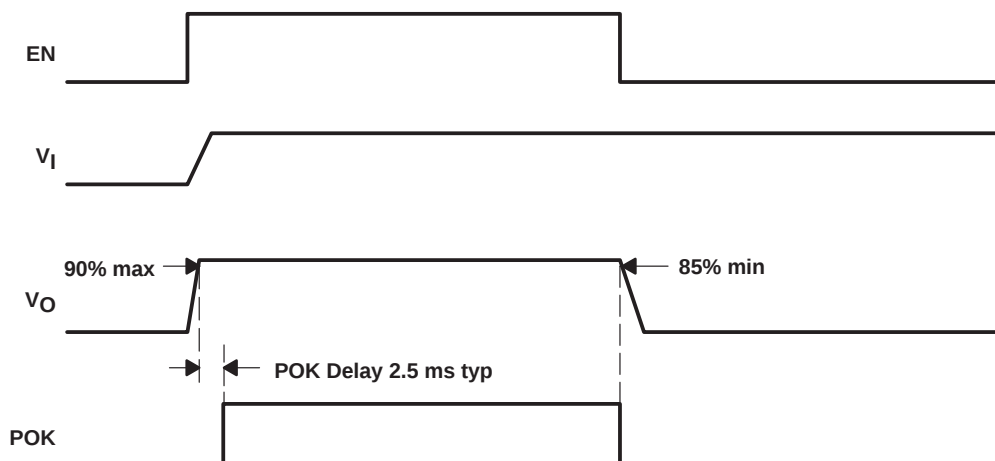


Figure 2. Power Okay Delay Timing and Output Voltage Supervisory

TYPICAL CHARACTERISTICS

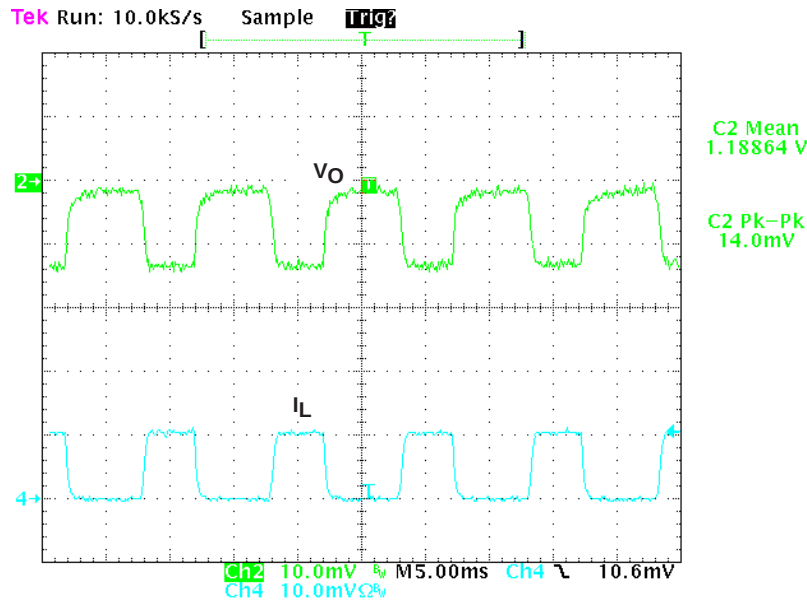


Figure 3. Load Regulation, 50-mA Dynamic Load Step ($V_I = 3$ V)

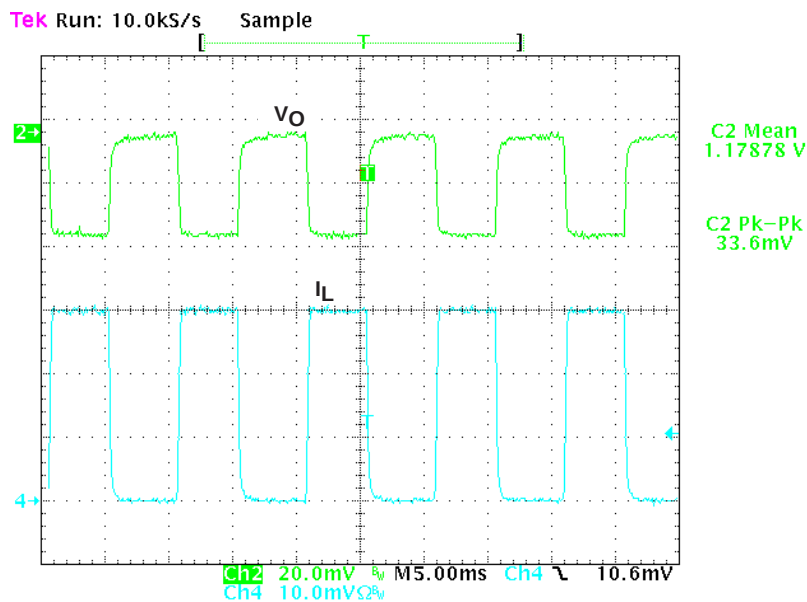


Figure 4. Load Regulation, 150-mA Dynamic Load Step ($V_I = 3$ V)

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TYPICAL CHARACTERISTICS

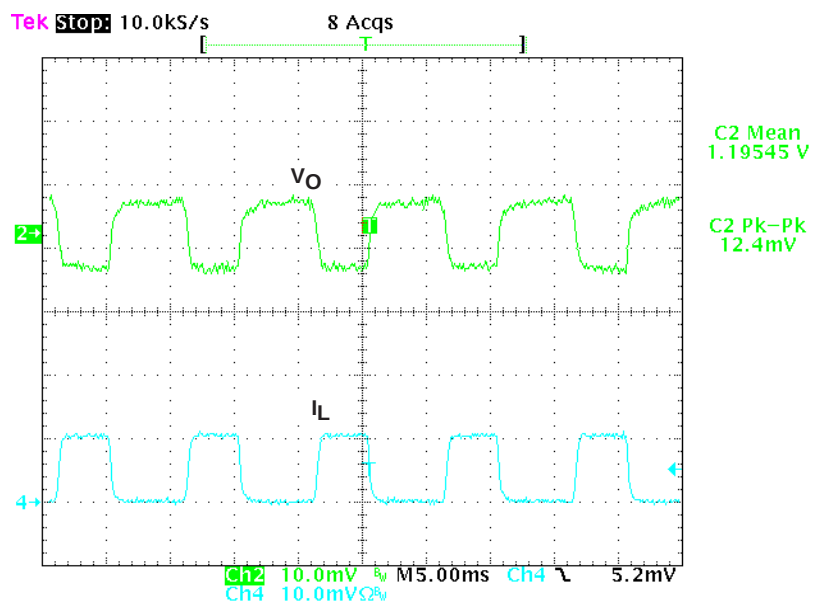


Figure 5. Load Regulation, 50-mA Dynamic Load Step ($V_I = 5$ V)

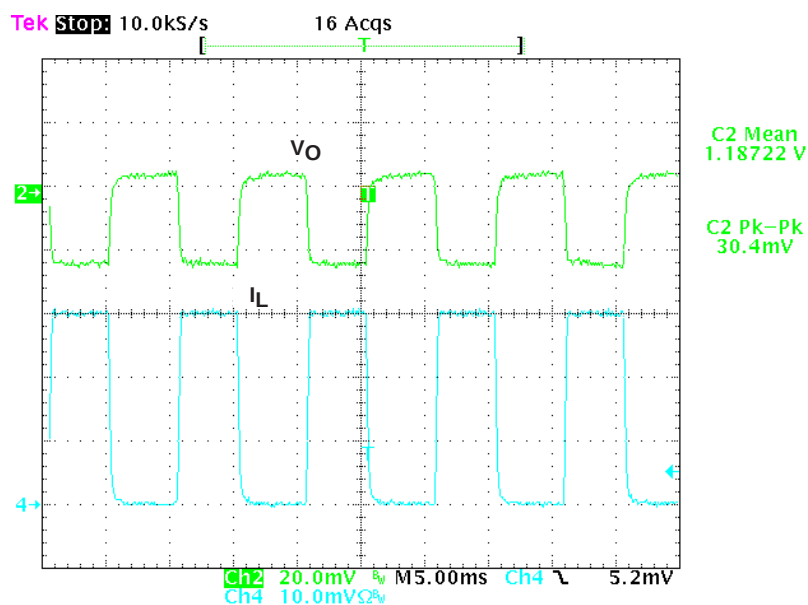


Figure 6. Load Regulation, 150-mA Dynamic Load Step ($V_I = 5$ V)

TYPICAL CHARACTERISTICS

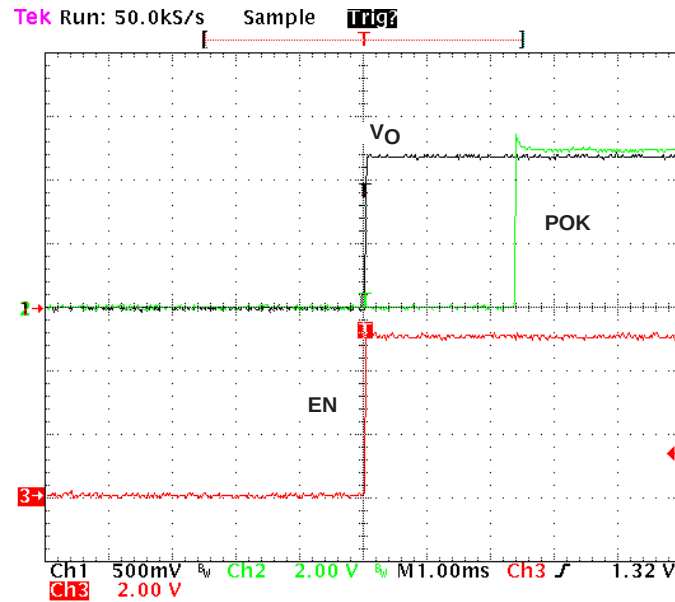


Figure 7. Power Okay Delay During Power Up Condition

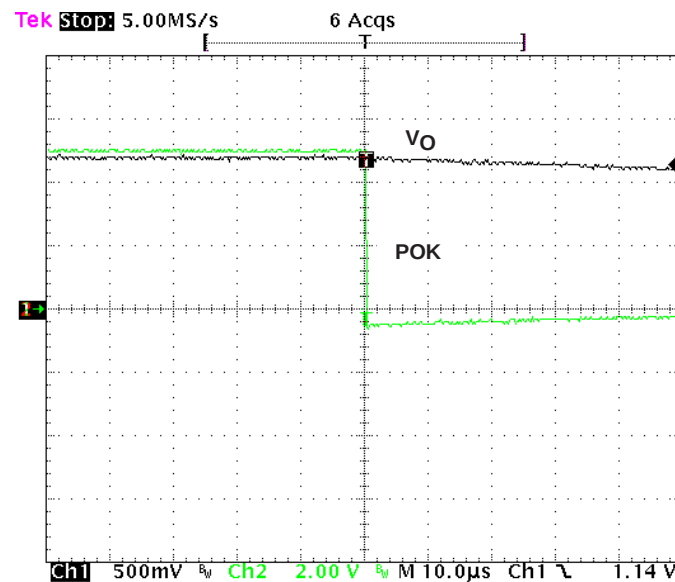


Figure 8. Power Okay Delay During Power Down Condition

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THERMAL INFORMATION

The SN105125 is designed to provide a continuous load current of 150 mA when the maximum power dissipation of the package is not exceeded in the application. To determine the maximum power dissipation of the package, use the junction-to-ambient thermal resistance of the device. The basic equation is as follows:

Maximum power dissipation (W)

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / R_{\theta JA} \text{ (maximum power dissipation limit)}$$

Where:

$T_{J(MAX)}$ is the maximum junction temperature of the die (less than 150°C, minimum thermal shutdown)

T_A is the operating ambient temperature

$R_{\theta JA}$ is the thermal resistance and is layout dependent

The recommended minimum footprint offers a $R_{\theta JA}$ of 235°C/W.

To determine the actual power dissipation of the regulator, use the following equation:

$$P_D = (V_I - V_O) I_O + V_I I_{(GND)} \text{ (Watts)}$$

Power dissipation resulting from quiescent current is negligible. When the power dissipation is excessive, the thermal protection circuit is triggered.

APPLICATION INFORMATION

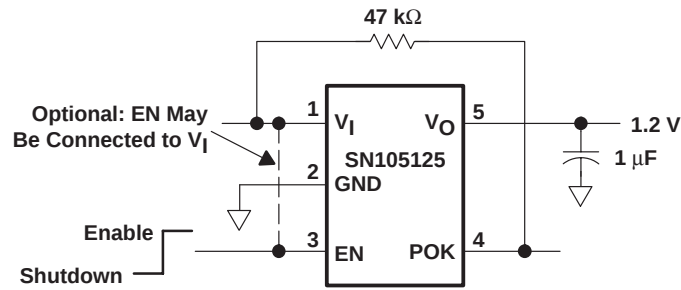


Figure 9. Typical Application Schematic

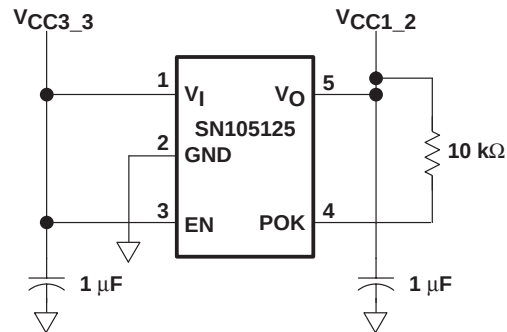


Figure 10. Typical Application For Processor VID Code Power Sequencing Schematic

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN105125DBVR	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	SBAI
SN105125DBVR.B	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	SBAI
SN105125DBVRG4	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	SBAI

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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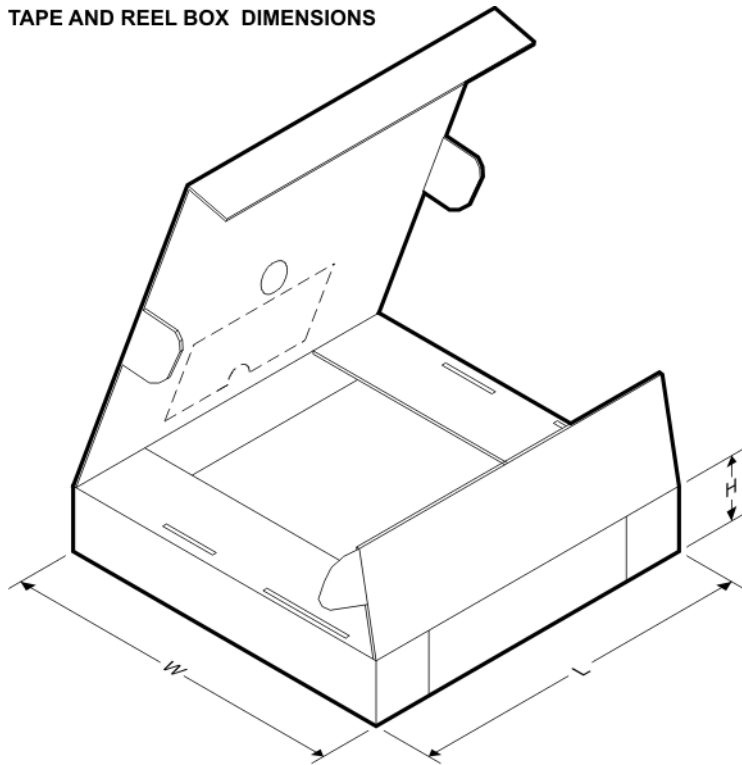
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TAPE AND REEL INFORMATION


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN105125DBVR	SOT-23	DBV	5	3000	178.0	9.0	3.3	3.2	1.4	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN105125DBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0

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