NIS1050

Protection Interface Circuit for PMICs with Integrated OVP Control

The NIS1050 is a protection IC targeted at the latest generation of PMICs from the leading mobile phone and UMPC chipset vendors. It includes a highly stable low-current LDO and a low impedance power N-Channel MOSFET.

The LDO provides a low current, five volt supply to the PMIC, and the NFET is the external pass element for the OVIC circuit. These stages combine with the internal PMIC to protect the charging circuit from low-impedance overvoltage conditions that can occur from either the AC/DC or USB supply.

The NIS1050 is available in the low−profile 6-lead 2x2mm WDFN6 surface mount package.

Features

- Lower Power Dissipation and Higher Efficiency vs. Zener Shunt Regulator
- LDO Highly Stable across Temperature, Operates Without Bypass Capacitors
- Wide 3-30 V Power Supply Voltage Input Range
- Low−Profile (0.75mm) 6-Lead 2x2mm WDFN6 Package
- This is a Pb−Free Device

Typical Applications

- Power Interface for New Generation PMICs from Leading Mobile Phone and UMPC Chipset Vendors

ON Semiconductor®

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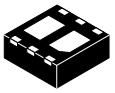


WDFN6, 2x2
CASE 506AN

MARKING DIAGRAMS

PM = Specific Device Code
M = Date Code

ORDERING INFORMATION

Device	Package	Shipping†
NIS1050MNTBG	WDFN6 (Pb−Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

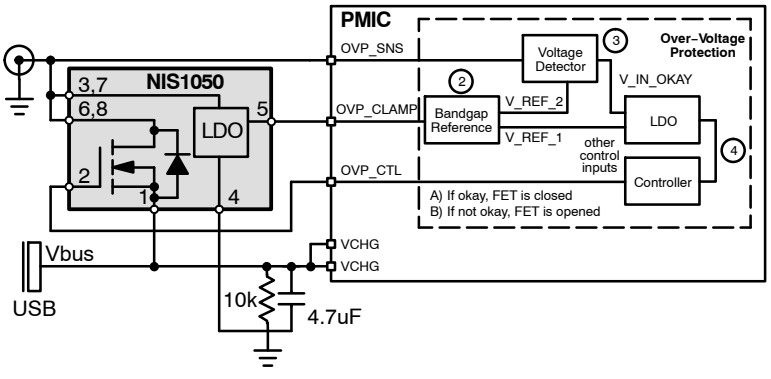


Figure 1. Typical Application

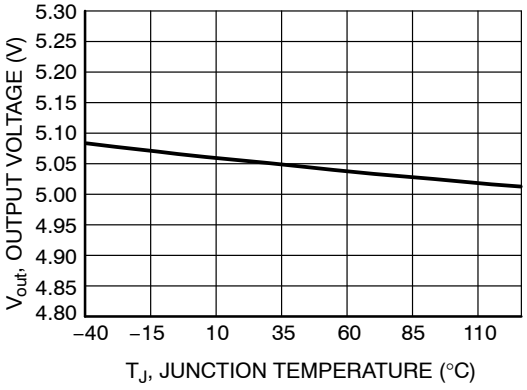


Figure 2. Output Voltage Variation with Temperature

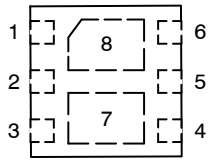


Figure 3. Pin Assignment

Table 1. FUNCTIONAL PIN DESCRIPTION

Pin	Function	Description
1	Source	This is the source of the power FET and connects to the PMIC pin of the same name.
2	Gate	This pin is the gate of the FET switch.
3, 7	Vin	Positive input voltage to the device.
4	Ground	Negative input voltage to the device. This is used as the internal reference for the IC.
5	Vout	This is the output of the internal LDO. It passes the input voltage through to the output and clamps that voltage if it exceeds the regulation limit.
6, 8	Drain	Positive input voltage to the device.

Table 2. MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage, Operating, Steady-State (OVP_sense to Gnd)	V_{in}	-0.3 to 30	V
Gate-to-Source Voltage	V_{GS}	±8	V
Drain Current, Peak (10 μs pulse)	I_{Dpk}	20	A
Drain Current, Continuous (Note 1, Steady-State) T_A = 25°C T_A = 85°C	I_D	 3.7 2.7	A
Total Power Dissipation @ T_A = 25°C (Note 1, 2)	P_{max}	750	mW
Operating Temperature Range	T_J	-40 to 125	°C
Non-operating Temperature Range	T_J	-55 to 150	°C
Maximum Lead Temperature for Soldering Purposes	T_L	260	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm^2, 2 oz Cu.
2. Dual die operation (equally−heated).

Table 3. THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
SINGLE DIE OPERATION (SELF-HEATED)			
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	83	°C/W
Junction-to-Ambient – Steady State Min Pad (Note 4)	$R_{\theta JA}$	177	
Junction-to-Ambient – t ≤ 5 s (Note 3)	$R_{\theta JA}$	54	
DUAL DIE OPERATION (EQUALLY-HEATED)			
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	58	°C/W
Junction-to-Ambient – Steady State Min Pad (Note 4)	$R_{\theta JA}$	133	
Junction-to-Ambient – t ≤ 5 s (Note 3)	$R_{\theta JA}$	40	

3. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
4. Surface Mounted on FR4 Board using the minimum recommended pad size (30 mm^2, 2 oz Cu).

Table 4. ELECTRICAL CHARACTERISTICS (Unless otherwise noted: Vcc (OVP_sense) = 5.0 V, T_J = 25°C)

Characteristics	Symbol	Min	Typ	Max	Unit
POWER FET					
Zero Gate Voltage Drain Current (V_{DS} = 24 V_{dc}, V_{GS} = 0 V) T_J = 85°C	I_{DSS}			1.0 10	μA
Gate-to-Source Leakage Current (V_{DS} = 0 V, V_{GS} = ±8 V)	I_{GSS}			100	nA
Gate Threshold Voltage (V_{GS} = V_{DS}, I_D = 250 μA)	$V_{GS(th)}$	0.4	0.7	1.0	V
Negative Gate Threshold Temperature Coefficent	$V_{GS(th)}/T_J$		2.8		mV/°C
Drain-to-Source On-Resistance (Note 5) V_{GS} = 4.5 V, I_D = 2.0 A V_{GS} = 2.5 V, I_D = 2.0 A	$R_{DS(on)}$		 47 56	 70 90	mΩ
Forward Transconductance (V_{DS} = 5 V, I_D = 2.0 A)	g_{FS}		4.5		S
Input Capacitance (V_{DS} = 15 V_{dc}, V_{GS} = 0 V_{dc}, f = 1 MHz)	C_{ISS}		427		pF
Output Capacitance (V_{DS} = 15 V_{dc}, V_{GS} = 0 V_{dc}, f = 1 MHz)	C_{OSS}		51		pF
Reverse Transfer Capacitance (V_{DS} = 15 V_{dc}, V_{GS} = 0 V_{dc}, f = 1 MHz)	C_{RSS}		32		pF
LDO (Unless otherwise noted, T_J = 25°C, Vin = 5.0 V)					
Regulated Output Voltage (Vcc = 5.5 V Io = 1 mA)	Vout	4.6	5.0	5.3	V
Response to Input Transient (Vin 0 to 30 volts, <1 μs rise time, 5.0 kΩ resistive load, Note 6) Time for signal above 5.5 volts Peak Voltage	 t_{pulse} Vpk		 	 5.0 9.0	 μs V
Headroom (Vin – Vout, Iout = 1.2 mA, Vin = 4.6 V)	V_{head}			150	mV
Headroom (Vin – Vout, Iout = 10 mA, Vin = 4.8 V, T_J = -40 to 125°C)	V_{head}			1000	mV
TOTAL DEVICE					
Input Bias Current	I_{bias}		110	850	μA
Minimum Operating Voltage	V_{in-min}			3.0	V

5. Pulse test: Pulse width 300 μs, duty cycle 2%.
6. Guaranteed by design.

TYPICAL PERFORMANCE CURVES

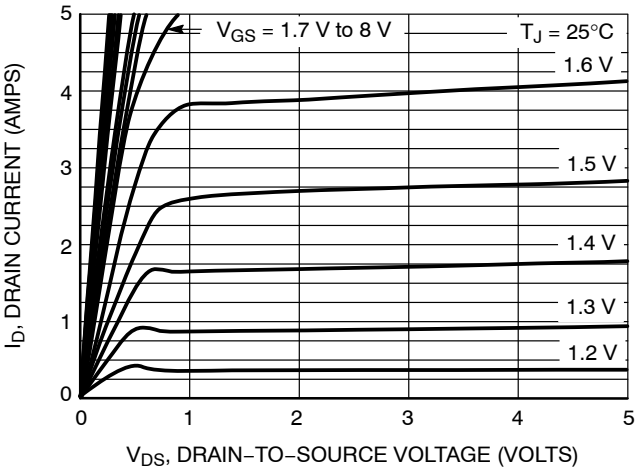


Figure 4. On−Region Characteristics

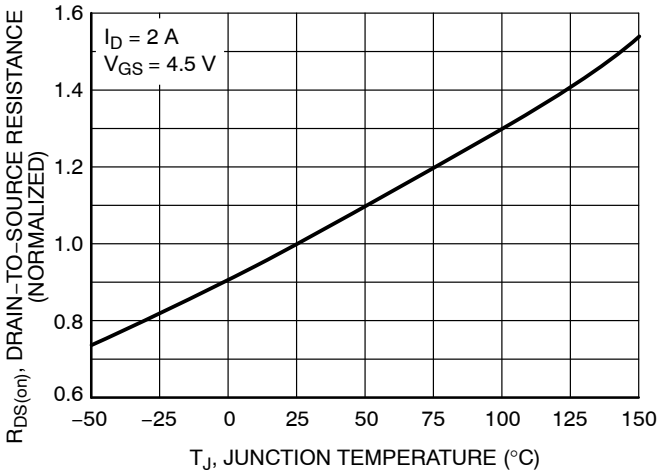


Figure 5. On−Resistance Variation with Temperature

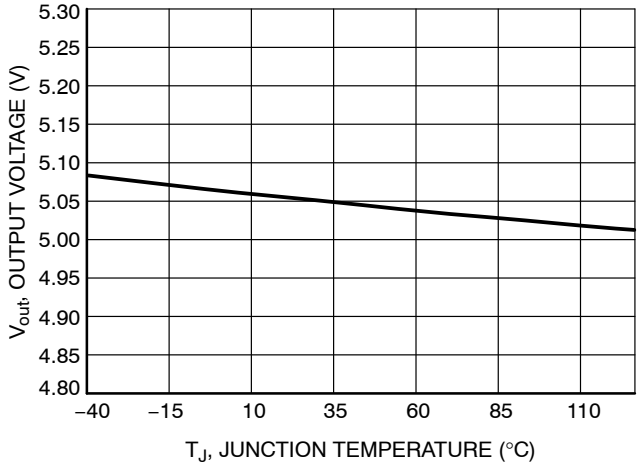


Figure 6. Output Voltage Variation with Temperature

Mounting Considerations

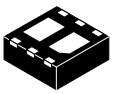
The LDO and MOSFET are both attached to thermal pads to provide a low impedance path for the heat generated in these devices. Both of these pads should have a solid connection to as much board copper area as possible in order to maintain a low operating temperature. The main purpose of both of these pads is for thermal connections, not electrical connections.

Pad 7 is the input voltage for the LDO. It is electrically connected to the Vcc pin. This connection is optional and will have a negligible difference in the electrical performance of the chip due to the current into the LDO.

Pad 8 is the drain of the power MOSFET. This pad will also have a low electrical impedance. Either pad 8, pad 6 or both may be used for electrical connections. The total impedance of the FET will not vary significantly since pad 6 is part of the lead-frame and therefore connected to pad 8 by a metal path on the lead frame. The majority of the package impedance comes from the resistance between the source and pin 1, since this is connected by bond wires.

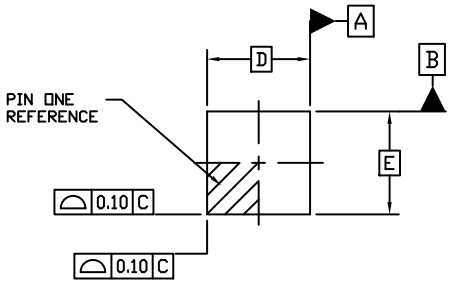
Bypass Capacitors

The LDO has been designed to operate in a stable mode without bypass capacitors; however, it is recommended to use a low ESR capacitor if fast, ac transients or other switching type currents will be present. Typically, a value of 1 to 10 nF is adequate for an output bypass capacitor. A 1 nF capacitor may be added to the input if the input source is noisy or if it has a high ac impedance due to long trace lengths.



WDFN6 2x2, 0.65P
CASE 506AN
ISSUE H

DATE 25 JAN 2022

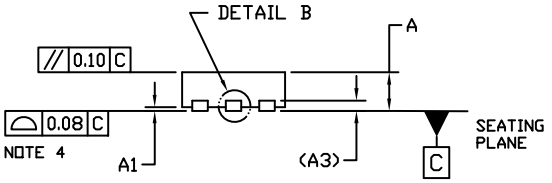


TOP VIEW

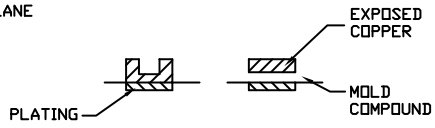
DETAIL A
OPTIONAL CONSTRUCTIONS

NOTES:

1. DIMENSIONING AND TOLERANCING PER. ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.

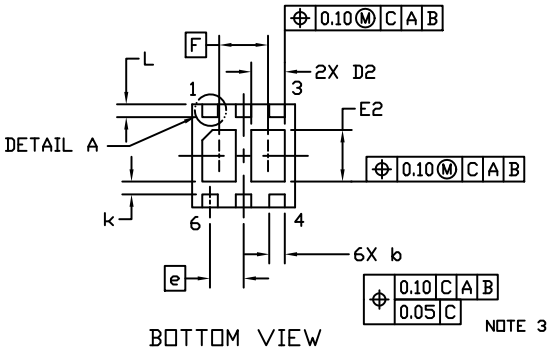


SIDE VIEW

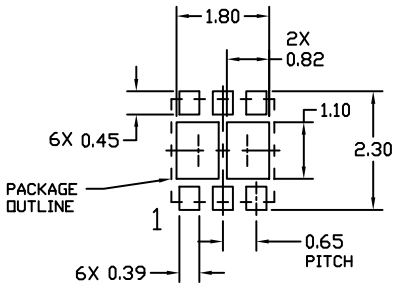


DETAIL B
OPTIONAL CONSTRUCTIONS

DIM	MILLIMETERS	
	MIN.	MAX.
A	0.70	0.80
A1	0.00	0.05
A3	0.20 REF	
b	0.25	0.35
D	2.00 BSC	
D2	0.57	0.77
E	2.00 BSC	
E2	0.90	1.10
e	0.65 BSC	
F	0.95 BSC	
k	0.25 REF	
L	0.20	0.30
L1	---	0.10



BOTTOM VIEW



RECOMMENDED
MOUNTING FOOTPRINT
SOLDERMASK DEFINED

GENERIC
MARKING DIAGRAM*

XX = Specific Device Code
M = Date Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

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DESCRIPTION:	**WDFN6 2x2, 0.65P**	**PAGE 1 OF 1**

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