SP6265

Dual Low-Dropout CMOS Voltage Regulator

Features

- Very Low Dropout Voltage
- Guaranteed 150mA for Each Output
- Accurate to Within 1.5% for Both Outputs
- Typical 70 µA Quiescent Current
- Over-Temperature Shutdown
- Current Limiting
- Noise Reduction Bypass Cap
- Power-Saving Shutdown Mode
- Available in Lead Free, RoHS Compliant Packaging: 6Pin TSOT-26 & 8Pin DFN



TSOT-26
Top View

Applications

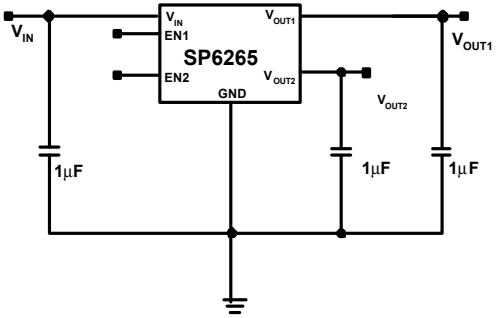
- Cellular Phones
- Palm / Notebook
- Battery Powered Equipment
- Handheld Devices

General Description

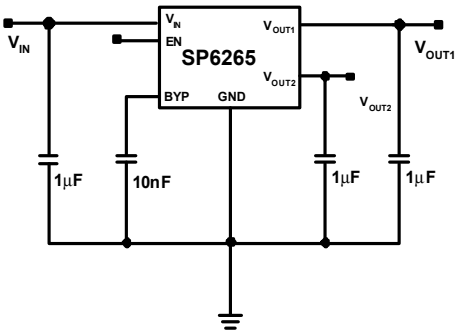
The SP6265 dual, low dropout, linear regulators operate up to 5.5V input and deliver up to 150mA / 150mA output current per regulator. It has a bypass pin option which allows users to decouple the bandgap reference for reducing the output noise. Low dropout voltage and low quiescent current(70µA typ.) make them ideal for battery powered applications. The SP6265 is available with a wide variety of standard voltage options and can be trimmed to 1.5% accuracy. For protection purposes, SP6265 has a thermal shutdown feature to prevent device failure under the "worst" operating conditions.

Typical Applications

SP6265 without Bypass



SP6265 with Bypass



© 2007 Sipex Corporation

Absolute Maximum Ratings

Parameter	Maximum	Unit
Input Voltage	6	V
Output Current	P_D / [$2V_{IN}$-(V_{OUT1}+V_{OUT2})]	mA
Output Voltage	GND-0.3 to V_{IN}+0.3	V
ESD Classification	C*	

Caution: Stress above the listed absolute maximum rating may cause permanent damage to the device.
* HBM C: 4000V+

Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Ambient Temperature Range	T_A	-40 to +85	°C
Junction Temperature Range	T_J	-40 to +125	°C

Thermal Information

Parameter	Package	Die Attach	Symbol	Maximum	Unit
Thermal Resistance* (Junction to Case)	TSOT-26	Conductive Epoxy	θ_{JC}	81	°C / W
	DFN-8 (3mmx3mmx0.6mm)			17	
Thermal Resistance (Junction to Ambient)	TSOT-26		θ_{JA}	260	
	DFN-8 (3mmx3mmx0.6mm)			125	
Internal Power Dissipation	TSOT-26		P_D	400	mW
	DFN-8 (3mmx3mmx0.6mm)			800	
Maximum Junction Temperature				150	°C
Solder Iron (10 Sec)**				350	°C

* Measure θ_{JC} on center of molding compound if IC has no tab.
** MIL-STD-202G 210F

© 2007 Sipex Corporation

Unless specified: T_J=25°C, V_{IN}=Higher V_{OUT}+1V, I_{OUT1}=I_{OUT2}=1mA, C_{IN}=C_{OUT}=1.0µF, V_{EN1}=V_{EN2}=V_{IN}
Typical values are at T_J=25°C

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
IN							
Input Supply Voltage	V_{IN}			Note1		5.5	V
Quiescent Current	I_Q				70	160	µA
OUT1, OUT2							
Output Voltage	V_O	I_{OUT}=1mA		-1.5	V_{OUT}	1.5	%
		0mA<I_{OUT}<=150mA, V_{OUT}+1V<V_{IN}<5.5V	T_J = 0°C to +125°C	-2		2	
Line Regulation	REG_{LINE}	V_{OUT}+1V<V_{IN}<5.5V, I_{OUT}=1mA	T_J=25°C	-0.2		0.2	%/V
			T_J=-40°C to +125°C	-0.25		0.25	
Load Regulation	REG_{LOAD}	1mA<I_{OUT}	T_J = 0°C to +125°C	-0.005	±0.0025	0.005	%/mA
Dropout Voltage	V_{DROP}	I_{OUT1}=I_{OUT2}=150mA, V_O=$V_{O(NOM)}$-2%, $V_{O(NOM)}$<2.5V	T_J= 0°C to +125°C			350	mV
		I_{OUT1}=I_{OUT2}=150mA, V_O=$V_{O(NOM)}$-2%, $V_{O(NOM)}$>=2.5V				300	mV
Current Limit	I_{LIM}			180		600	mA
Short Circuit Current	I_{SC}	Each Channel			200	350	
Ripple Rejection	PSRR	f=100Hz, C_{BYP}=10nF, I_{OUT}=1mA			55		dB
		f=1kHz, C_{BYP}=10nF, I_{OUT}=1mA			55		
		f=10kHz, C_{BYP}=10nF, I_{OUT}=1mA			48		
Output Voltage Noise	e_n	f=1kHz to 100kHz, C_{BYP}=10nF, C_{OUT}=1µF			550		µVRMS
		f=1kHz to 100kHz, C_{BYP}=10nF, C_{OUT}=1µF			5.5		µV/√Hz
EN1, EN2							
Enable Input Threshold	V_{EH}	V_{IN}=2.4V to 5.5V	T_J=-40°C to +125°C	2.4			V
	V_{EL}	V_{IN}=2.4V to 5.5V				0.4	V
EN Input Bias Current	I_{EL}	V_{IN}=5.0V	EN=0V	-1	0.5	1	µA
	I_{EH}		EN=5V				
Shutdown Current	I_{SHDN}	V_{IN}=5.0V, EN1=EN2=0V			0.3	1	
BYP							
Start-Up Rise Time		C_{BYP}=10nF			1.25		ms
Over Temperature Protection							
Over Temperature Shutdown	OTS				150		°C
Over Temperature Hysteresis	OTH				20		°C

Note1: $V_{IN(min)}$ = V_{OUT2} + $V_{Dropout}$

 © 2007 Sipex Corporation

SP6265A, B -- TSOT-26 package with Bypass

Pin Number	Pin Name	Description
1	V_{OUT2}	Regulator 2 Output. Sources up to 150mA continuous current. Bypass with a 1µF (< 0.5Ω typ ESR) capacitor to GND.
2	GND	Ground. This pin also functions as heatsink. Solder to a large pad or the circuit-board ground plane to maximize thermal dissipation.
3	BYP	Reference Noise Bypass. Bypass with a low leakage 10nF ceramic capacitor for reduced noise at both outputs.
4	EN	Shutdown control input, active low. Tie this pin to or above 2.4V to enable the device. Tie this pin to or below 0.4V to turn off the device.
5	V_{IN}	Regulator Input. Supply voltage can range from [V_{OUT2} + 1V] to 5.5V. This input also supplies the on-chip reference. Bypass with 1µF to GND.
6	V_{OUT1}	Regulator 1 Output. Sources up to 150mA continuous current. Bypass with a 1µF (< 0.5Ω typ ESR) capacitor to GND.

SP6265F, G, H, J, K -- TSOT-26 package without Bypass

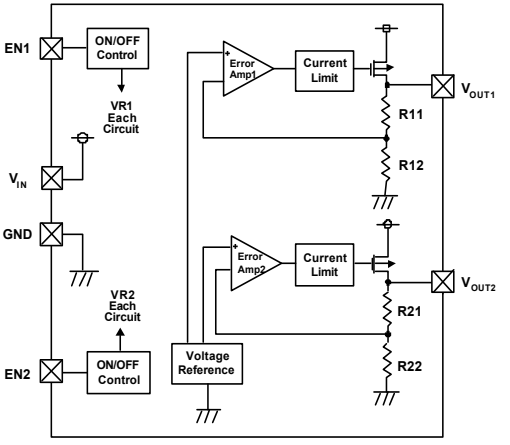
Pin Number	Pin Name	Description
1	V_{OUT2}	Regulator 2 Output. Sources up to 150mA continuous current. Bypass with a 1µF (< 0.5Ω typ ESR) capacitor to GND.
2	GND	Ground. This pin also functions as heatsink. Solder to a large pad or the circuit-board ground plane to maximize thermal dissipation.
3	EN1	Shutdown 1 control input, active low. Tie this pin to or above 2.4V to enable the device. Tie this pin to or below 0.4V to turn off the device.
4	EN2	Shutdown 2 control input, active low. Tie this pin to or above 2.4V to enable the device. Tie this pin to or below 0.4V to turn off the device.
5	V_{IN}	Regulator Input. Supply voltage can range from [V_{OUT2}+1V] to 5.5V. This input also supplies the on-chip reference. Bypass with 1µF to GND.
6	V_{OUT1}	Regulator 1 Output. Sources up to 150mA continuous current. Bypass with a 1µF (< 0.5Ω typ ESR) capacitor to GND.

 © 2007 Sipex Corporation

SP6265L, M -- DFN package without Bypass

Pin Number	Pin Name	Description
1	V_{IN}	Regulator Input. Supply voltage can range from [V_{OUT2}+$V_{DROPOUT}$] to 5.5V. This input also supplies the on-chip reference. Bypass with 1μF to GND.
2	EN1	Shutdown 1 control input, active low. Tie this pin to or above 2.4V to enable the device. Tie this pin to or below 0.4V to turn off the device.
3	EN2	Shutdown 2 control input, active low. Tie this pin to or above 2.4V to enable the device. Tie this pin to or below 0.4V to turn off the device.
4	NC	Not Connected
5	GND	Ground. This pin also functions as heatsink. Solder to a large pad or the circuit-board ground plane to maximize thermal dissipation.
6	NC	Not Connected
7	V_{OUT2}	Regulator 2 Output. Sources up to 150mA continuous current. Bypass with a 1μF (< 0.5Ohm typical ESR) capacitor to GND.
8	V_{OUT1}	Regulator 1 Output. Sources up to 150mA continuous current. Bypass with a 1μF (< 0.5Ohm typical ESR) capacitor to GND.

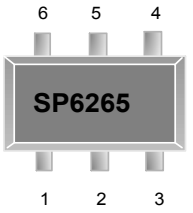
Functional Block Diagram



 © 2007 Sipex Corporation

Pin Configurations

TSOT-26
Top View

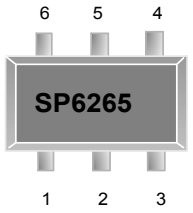


SP6265AEK1
SP6265BEK1

1. V_{OUT2}
2. GND
3. BYP
4. EN
5. V_{IN}
6. V_{OUT1}

*** Die Attach:**
Conductive Epoxy

TSOT-26
Top View

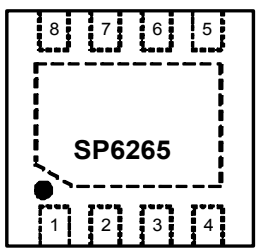


SP6265FEK1
SP6265GEK1
SP6265HEK1
SP6265JEK1
SP6265KEK1

1. V_{OUT2}
2. GND
3. EN1
4. EN2
5. V_{IN}
6. V_{OUT1}

*** Die Attach:**
Conductive Epoxy

DFN-8
(3mmx3mmx0.6mm)
Top View



SP6265LER1
SP6265MER1

1. V_{IN}
2. EN1
3. EN2
4. NC
5. GND
6. NC
7. V_{OUT2}
8. V_{OUT1}

*** Die Attach:**
Conductive Epoxy

Note:
The area enclosed by dashed line represents the Exposed Pad -- connect to GND.

© 2007 Sipex Corporation

Detailed Description

The SP6265 is low-dropout, low quiescent-current linear regulator designed primarily for battery-powered applications. These parts are available with preset output voltage ranging from 1.8V to 3.3V, and the parts can supply loads up to 150mA.

Shutdown

SP6265A & SP6265B

The SP6265A and SP6265B have a single shutdown control input(EN). Drive EN low to shut down both outputs, reducing supply current to 0.3μA. Connect EN to a logic-high, or IN, for normal operation.

SP6265F-SP6265M

The SP6265F-SP6265M have independent shutdown control inputs (EN1 and EN2). Drive EN1 low to shutdown V_{OUT1}. Drive EN2 low to shut down V_{OUT2}. Drive both EN1 and EN2 low to shut down the entire chip, reducing supply current to 0.3μA. Connect both EN1 and EN2 to a logic-high, or IN, for normal operation.

Internal P-Channel Pass Transistor

The SP6265 features two 1Ω P-Channel MOSFET pass transistors. A P-Channel MOSEFT provides several advantages over similar designs using PNP pass transistors, including longer battery life. It requires no base drive, which reduces quiescent current significantly. The SP6265 only consumes 70μA of quiescent current whether in dropout, light-load, or heavy-load applications.

Current Limit

The SP6265 contains two independent current limiters, one for each regulator, which monitor and control the pass transistor's gate voltage, limiting the guaranteed maximum output current to 180mA minimum. The output can be shorted to ground for an indefinite time without damaging the part.

Thermal-Overload Protection

Thermal -overload protection limits total power dissipation in the SP6265. When the junction temperature exceeds T_J=150°C, the thermal sensor signals the shutdown logic, turning off the pass transistor and allowing the IC to cool.

Application Information

Capacitor Selection and Regulator Stability

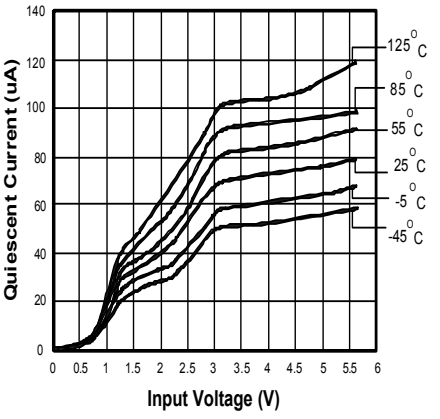
Use a 1μF capacitor on the SP6265 input and a 1μF capacitor on the outputs. Larger input capacitor values and lower ESRs provide better supply noise rejection and line transient response.

PSRR and Operation from Sources Other than Batteries

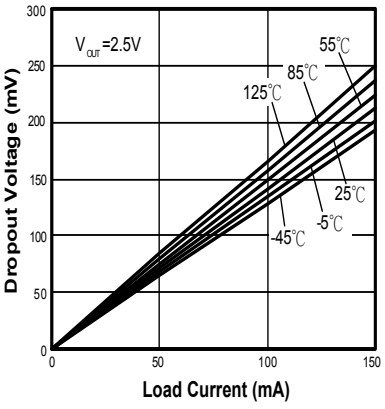
The SP6265 is designed to deliver low dropout voltages and low quiescent current in battery powered systems. Power-supply rejection is 54dB at low frequencies. (See the PSRR vs. Frequency graph)

© 2007 Sipex Corporation

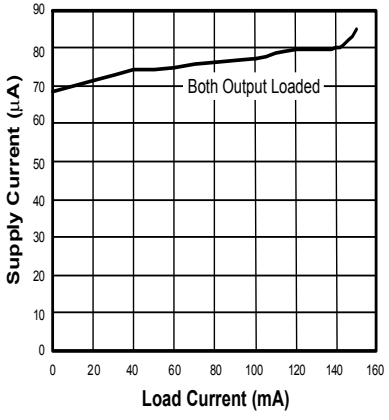
Quiescent Current vs Input Voltage



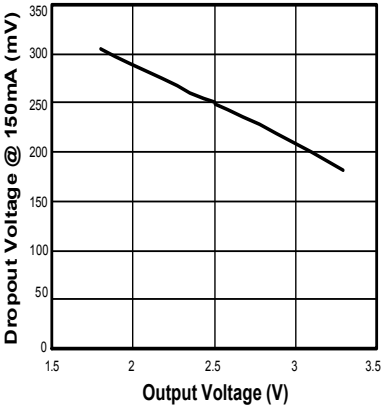
Dropout Voltage vs Load Current



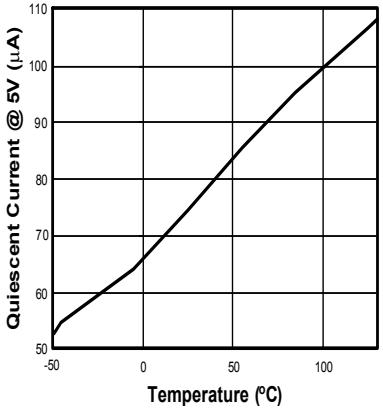
Supply Current vs. Load current



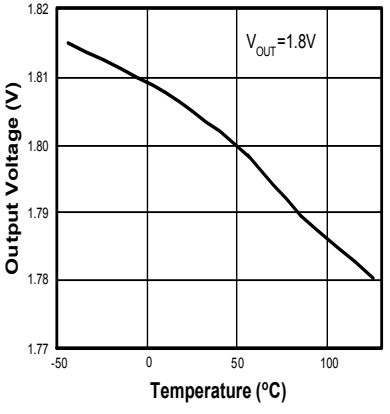
Dropout Voltage vs Output Voltage



Quiescent Current vs Temperature

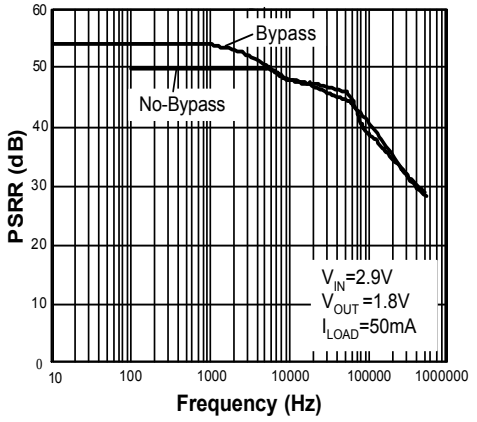


Output Voltage vs Temperature

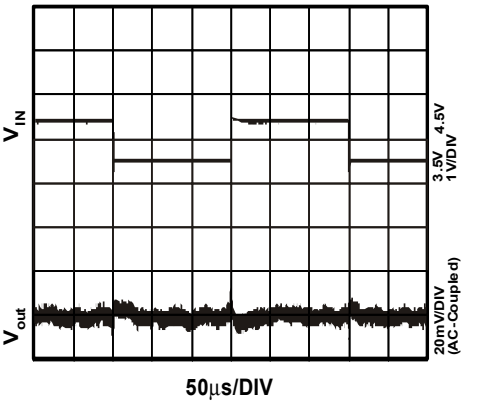


 © 2007 Sipex Corporation

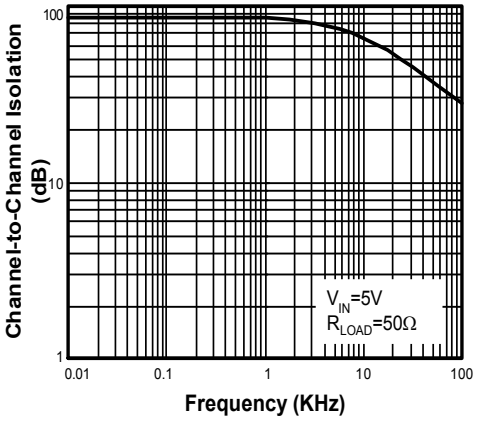
PSRR vs. Frequency



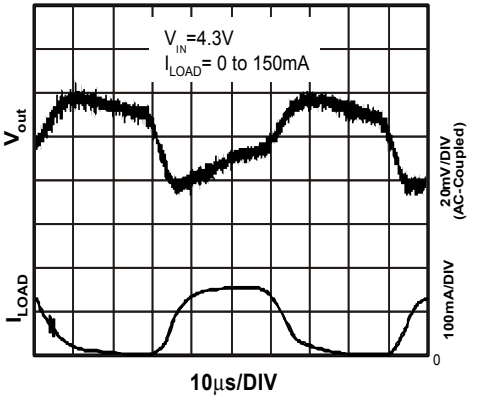
Line Transient



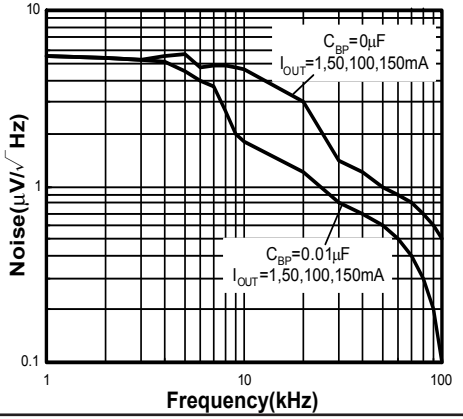
Channel-to-Channel Isolation vs Frequency



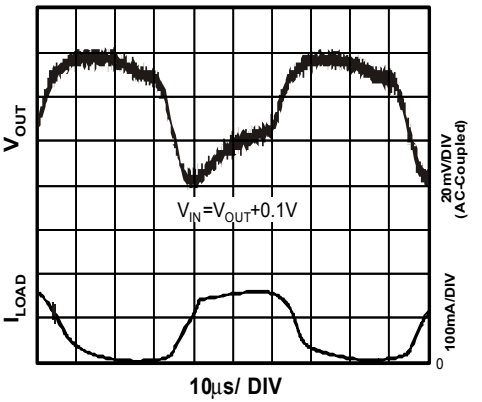
Load Transient



Output Noise Spectral Density

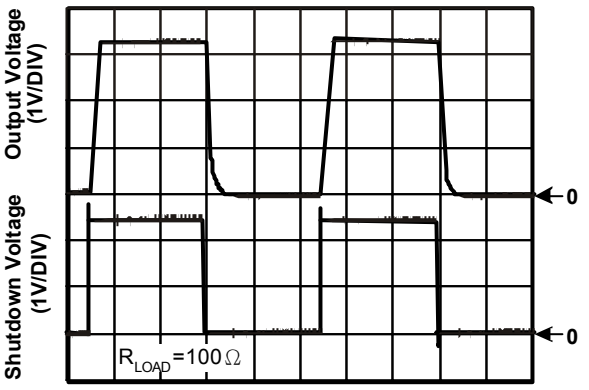


Load Transient Near Dropout



 © 2007 Sipex Corporation

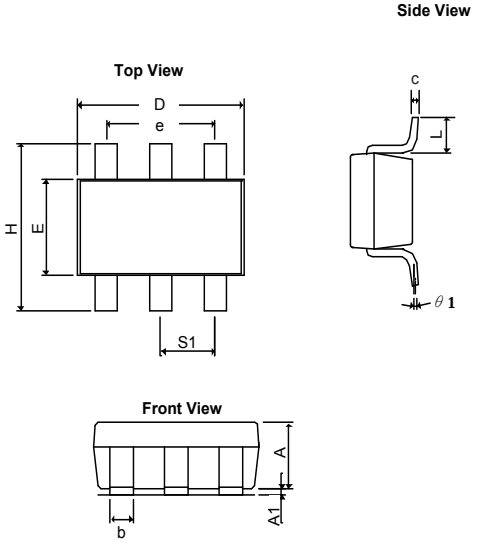
Shutdown Response



 © 2007 Sipex Corporation

• Package Dimensions

TSOT-26

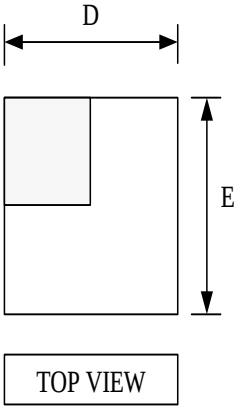


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
$A+A_1$	0.90	1.25	0.0354	0.0492
b	0.30	0.50	0.0118	0.0197
c	0.09	0.25	0.0035	0.0098
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.40	3.00	0.09449	0.11811
L	0.35BSC		0.0138BSC	
θ1	0^o	10^o	0^o	10^o
S_1	0.95BSC		0.0374BSC	

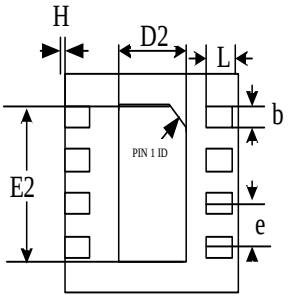
 © 2007 Sipex Corporation

• Package Dimensions

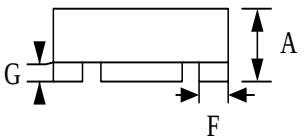
DFN-8 (3mmx3mmx0.6mm)



TOP VIEW



BOTTOM VIEW



SIDE VIEW

SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.550	0.650	0.022	0.026
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
F	0.550 TYP.		0.220 TYP.	
e	0.650 TYP.		0.026 TYP.	
D2	1.500 TYP.		0.059 TYP.	
E2	2.400 TYP.		0.094 TYP.	
b	0.200	0.300	0.0079	0.012
L	0.450	0.550	0.018	0.022
G	0.010	0.090	0.0004	0.004
H	0.000	0.050	0.000	0.002

© 2007 Sipex Corporation

Part Number	Voltage	Pin3/ Pin4 Trait	Voltage Accuracy	Operating Temperature Range	Package	Marking*	Packing Quantity
SP6265AEK1-L/TR	V1=1.8V V2=2.5V	Bypass/ Enable	1.5%	-40ºC to +85ºC	TSOT-26	X9WW	3,000 Tape & Reel
SP6265BEK1-L/TR	V1=1.8V V2=2.8V	Bypass/ Enable	1.5%	-40ºC to +85ºC	TSOT-26	Y9WW	3,000 Tape & Reel
SP6265FEK1-L/TR	V1=1.8V V2=2.5V	Dual Enable	1.5%	-40ºC to +85ºC	TSOT-26	DAWW	3,000 Tape & Reel
SP6265GEK1-L/TR	V1=1.8V V2=2.8V	Dual Enable	1.5%	-40ºC to +85ºC	TSOT-26	EAWW	3,000 Tape & Reel
SP6265HEK1-L/TR	V1=1.8V V2=3.3V	Dual Enable	1.5%	-40ºC to +85ºC	TSOT-26	FAWW	3,000 Tape & Reel
SP6265JEK1-L/TR	V1=2.85V V2=2.85V	Dual Enable	1.5%	-40ºC to +85ºC	TSOT-26	GAWW	3,000 Tape & Reel
SP6265KEK1-L/TR	V1=3.0V V2=3.0V	Dual Enable	1.5%	-40ºC to +85ºC	TSOT-26	HAWW	3,000 Tape & Reel
SP6265LER-L/TR	V1=1.8V V2=2.5V	Dual Enable	1.5%	-40ºC to +85ºC	DFN8	6265LEWWX	1,000 Tape & Reel
SP6265MER-L/TR	V1=1.8V V2=2.8V	Dual Enable	1.5%	-40ºC to +85ºC	DFN8	6265MEWWX	1,000 Tape & Reel

*Note: “WW” = Product Work Week, “X” = 1st Alpha of Lot Number

Sipex Corporation

Headquarters and Sales Office
233 South Hillview Drive
Milpitas, CA 95035
TEL: (408) 934-7500
FAX: (408) 935-7600

Sipex Corporation reserves the right to make changes to any products described herein. Sipex does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights nor the rights of others.