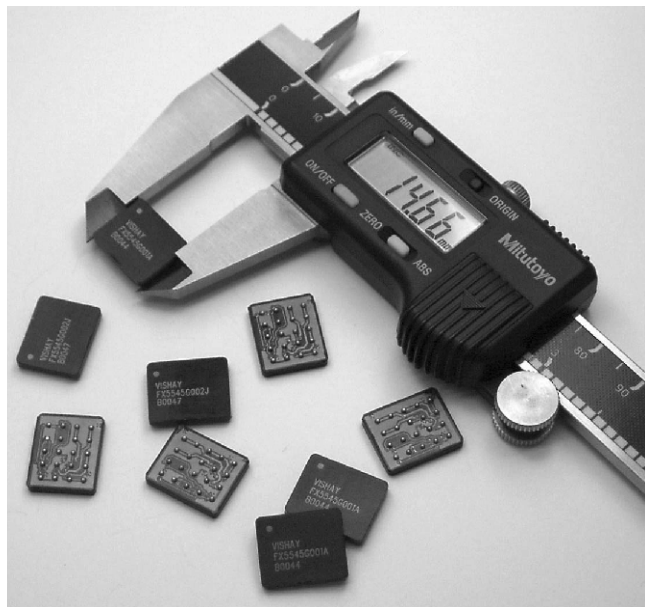


## The Smallest and Low Profile 0.9V to 4.5V\*\*, 4A with 570W/in<sup>3</sup> Power Density Efficiency up to 95% DC/DC Buck Converter



### FEATURES

- Fully integrated DC/DC converter
- High efficiency over large load range
- 100% duty cycle
- Power density - more than 570W/inch<sup>3</sup>
- 1μA shutdown current
- 2.5V to 6V input range (1Li+ and 3-cell NiCd or NiMH cells)
- 0.9V to 4.5V output voltage
- Programmable PWM/PSM controls
- Low output ripple
- BGA construction
- Temperature range: - 40°C to + 85°C
- No external components needed
- Output power 15W
- Maximum current 4A
- Low profile
- UL recognized component E250930

\*\* Note: For higher output voltage please consult factory at [FunctionPAK@Vishay.com](mailto:FunctionPAK@Vishay.com)



The DC/DC converter is a programmable topology synchronized Buck converter for today's continuous changing portable electronic market. The DC/DC converter provides flexibility of utilizing various battery configurations and chemistries such as NiCd, NiMH, or Li+ with an input voltage range of 2.5V to 6V. An additional flexibility is provided with topology programmability to power multiple loads such as power amplifiers, microcontrollers, or baseband logic IC's. For ultra-high efficiency, converters are designed to operate in synchronous rectified PWM mode under full load while transforming into externally controlled pulse-skipping mode (PSM) under light load.

The DC/DC converter is available in 20-ports BGA package. In order to satisfy the stringent ambient temperature requirements, the DC/DC converter is designed to handle the industrial temperature range of - 40°C to + 85°C.

### APPLICATION

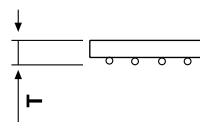
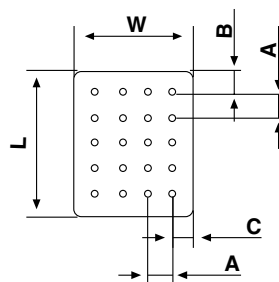
- Cordless phones, PDA's and others
- Supply voltage source for low-voltage chip sets
- Point of Load (POL) applications such as drivers for FPGA's, microprocessors, DSP's amplifiers, etc.
- Portable computers
- Battery back-up supplies
- Cameras

### ORDERING INFORMATION

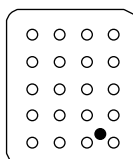
|                                                                                                                                                                              |           |             |             |                          |                          |                          |                          |                          |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|-------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                                                                                                                                                              | <b>FX</b> | <b>5545</b> | <b>G108</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FUNCTION                                                                                                                                                                     |           |             |             |                          |                          |                          |                          |                          |                          |
| SIZE                                                                                                                                                                         |           |             |             |                          |                          |                          |                          |                          |                          |
| CIRCUIT IDENTIFIER                                                                                                                                                           |           |             |             |                          |                          |                          |                          |                          |                          |
| OUTPUT VOLTAGE - Output Voltage-Example: 2.7V should be written as 2V7 as the V indicates the decimal point, or ADJ for adjustable version - self selectable output voltage. |           |             |             |                          |                          |                          |                          |                          |                          |
| PACKAGING - B1 = 10pcs in bulk; B5 = 50pcs in bulk; T1 = 13" reel; T2 = 7" reel.                                                                                             |           |             |             |                          |                          |                          |                          |                          |                          |
| For lead (Pb)-free solder please add E2 suffix. Leave blank for regular SnPb.                                                                                                |           |             |             |                          |                          |                          |                          |                          |                          |

\* Pb containing terminations are not RoHS compliant, exemptions may apply

| DIMENSIONS in inches [millimeters] |                                         |
|------------------------------------|-----------------------------------------|
| L                                  | $0.58 \pm 0.01$<br>[14.7 $\pm$ 0.25]    |
| W                                  | $0.48 \pm 0.01$<br>[12.2 $\pm$ 0.25]    |
| A                                  | $0.1 \pm 0.01$<br>[2.54 $\pm$ 0.25]     |
| B                                  | $0.09 \pm 0.01$<br>[2.29 $\pm$ 0.25]    |
| C                                  | $0.09 \pm 0.01$<br>[2.27 $\pm$ 0.25]    |
| T                                  | 0.126 max<br>[3.2 max]                  |
| Ball Diameter                      | $0.03 \pm 0.001$<br>[0.762 $\pm$ 0.025] |



## BOTTOM SIDE



Note:

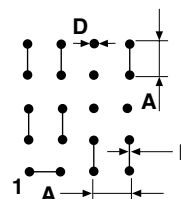
\* Pin Description application note is available at  
[www.vishay.com/doc?10116](http://www.vishay.com/doc?10116)

\*\* If not used must be connected to Vin.

## PIN CONFIGURATION\*

| PIN    | CONNECTION      |
|--------|-----------------|
| 1, 2   | $\overline{SD}$ |
| 3, 7   | SYNC**          |
| 4, 8   | N/C             |
| 5, 9   | Vin             |
| 6, 10  | PWM/PSM         |
| 11, 12 | N/C             |
| 13, 17 | GND             |
| 14, 18 | Vout            |
| 15, 19 | N/C             |
| 16, 20 | GND             |

| RECOMMENDED PAD PATTERN in inches [millimeters] |                                      |                                      |
|-------------------------------------------------|--------------------------------------|--------------------------------------|
| A                                               | D                                    | F                                    |
| $0.1 \pm 0.01$<br>[2.54 $\pm$ 0.25]             | $0.03 \pm 0.001$<br>[0.8 $\pm$ 0.02] | $0.02 \pm 0.001$<br>[0.5 $\pm$ 0.02] |



## TAPE AND REEL

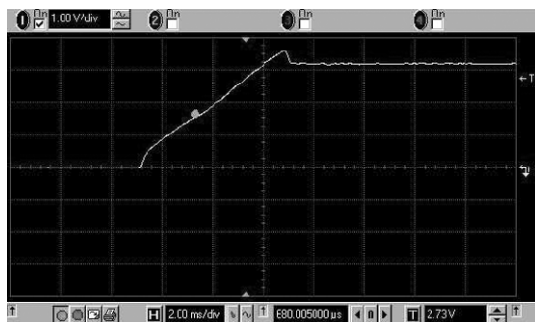
See Tape and Reel Information - Type B



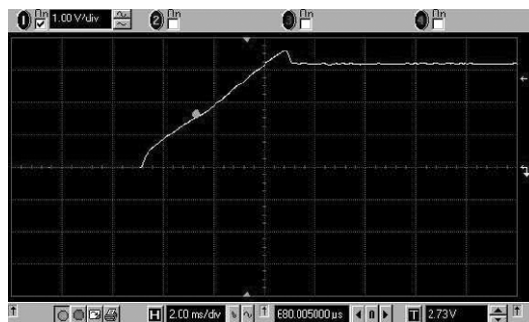
| STANDARD ELECTRICAL SPECIFICATIONS                      |                     |                                        |                      |            |       |
|---------------------------------------------------------|---------------------|----------------------------------------|----------------------|------------|-------|
| PARAMETER                                               | UNIT                | CONDITION                              | MIN                  | TYP        | MAX   |
| <b>Input</b>                                            |                     |                                        |                      |            |       |
| Voltage Range                                           | V <sub>DC</sub>     |                                        | 2.5                  |            | 6     |
| Quiescent Current                                       | μA                  | $\overline{\text{PSM}}$ mode           |                      | 200        |       |
| Soft Start Time                                         | ms                  | T <sub>SS</sub>                        |                      | 6          |       |
| <b>SD, PWM/<math>\overline{\text{PSM}}</math>, SYNC</b> |                     |                                        |                      |            |       |
| Logic High                                              | V                   | V <sub>H</sub>                         | 2.4                  |            |       |
| Logic Low                                               | V                   | V <sub>L</sub>                         |                      |            | 0.8   |
| Normal Mode                                             | μA                  | I <sub>DD</sub>                        |                      |            | 750   |
| $\overline{\text{PSM}}$ Mode                            | μA                  | I <sub>DD</sub>                        |                      |            | 250   |
| Shutdown Mode                                           | μA                  | I <sub>DD</sub>                        |                      |            | 1     |
| Shutdown Time                                           | ms                  | T <sub>SS</sub>                        |                      | 5.5        |       |
| <b>Insulation</b>                                       |                     |                                        |                      |            |       |
| Test Voltage                                            | V <sub>AC</sub>     | 60Hz 60sec                             | 750                  |            |       |
| Resistance                                              | Ω                   | V <sub>ISO</sub> = 500 V <sub>DC</sub> | 1 x 10 <sup>11</sup> |            |       |
| Leakage Current                                         | nA                  | V <sub>ISO</sub> = 500 V <sub>DC</sub> |                      |            | 5     |
| <b>Output</b>                                           |                     |                                        |                      |            |       |
| Power                                                   | W                   |                                        |                      | 15         |       |
| Voltage                                                 | V <sub>DC</sub>     |                                        |                      | 0.9 to 4.5 |       |
| Voltage Tolerance                                       | %                   | at 25 °C Ambient Temperature           | - 3                  |            | +3    |
| Temp. Coefficient                                       | %/°C                |                                        |                      |            | 0.03  |
| Ripple and Noise                                        | mVpp                | DC to 20 MHz                           |                      | 65         |       |
| <b>General</b>                                          |                     |                                        |                      |            |       |
| Package Weight                                          | gr.                 |                                        |                      |            | 1.5   |
| <b>Oscillator</b>                                       |                     |                                        |                      |            |       |
| Frequency                                               | KHz                 |                                        |                      | 400        |       |
| SYNC Range                                              |                     | F <sub>SYNC</sub> /F <sub>OSC</sub>    | 1.2                  |            | 1.5   |
| <b>Temperature</b>                                      |                     |                                        |                      |            |       |
| Operation                                               | °C                  |                                        | - 40                 |            | + 85  |
| Storage                                                 | °C                  |                                        | - 55                 |            | + 125 |
| Operating Junction                                      | °C                  | T <sub>J</sub>                         |                      | 150        |       |
| Thermal Impedance                                       | °C/W <sub>D</sub> * | Q <sub>JA</sub>                        |                      | 82         |       |

\*Note: W<sub>D</sub> = Power Dissipated

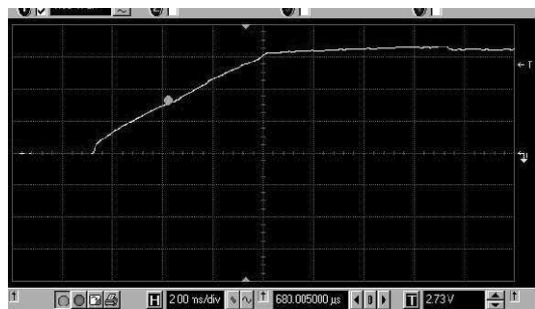
## Rise Time



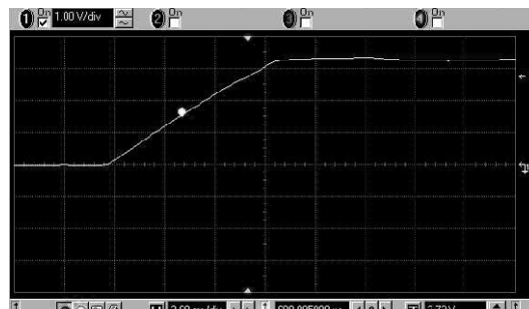
Rise Time (PWM mode): Vin = 6V; Vout = 3.3V; Iout = 4A



Fall Time (PWM mode): Vin = 6V; Vout = 3.3V; Iout = 1A

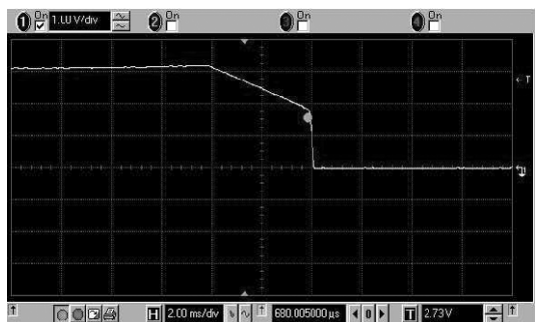


Rise Time (PWM mode): Vin = 4V; Vout = 3.3V; Iout = 4A

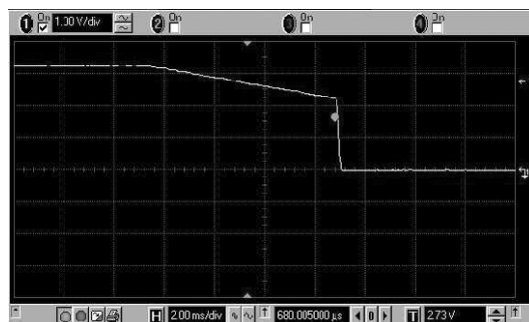


Fall Time (PWM mode): Vin = 4V; Vout = 3.3V; Iout = 1A

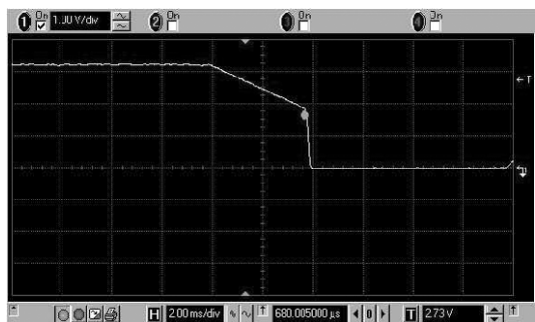
## Fall Time



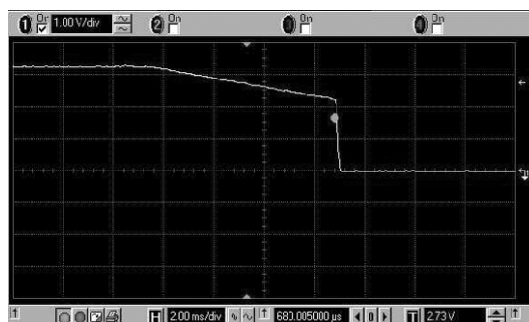
Fall Time (PWM mode): Vin = 4V; Vout = 3.3V; Iout = 4A



Fall Time (PWM mode): Vin = 4V; Vout = 3.3V; Iout = 1A



Fall Time (PWM mode): Vin = 4V; Vout = 3.3V; Iout = 4A

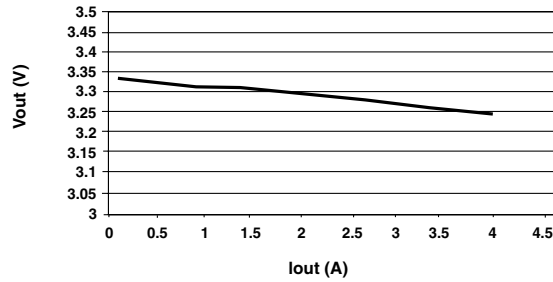


Fall Time (PWM mode): Vin = 4V; Vout = 3.3V; Iout = 1A

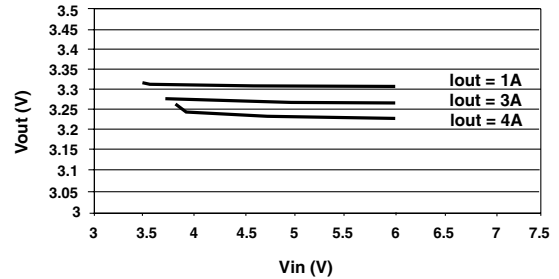


**PWM Mode**

**Vout Vs. Iout\***  
Vin = 4V

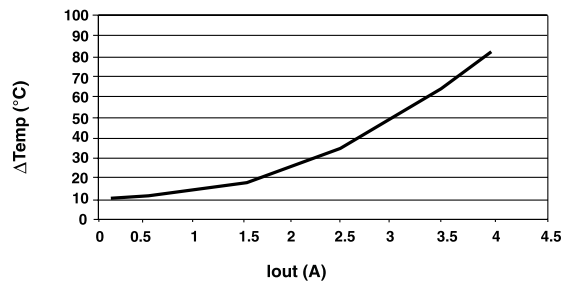


**Vout Vs. Vin\***

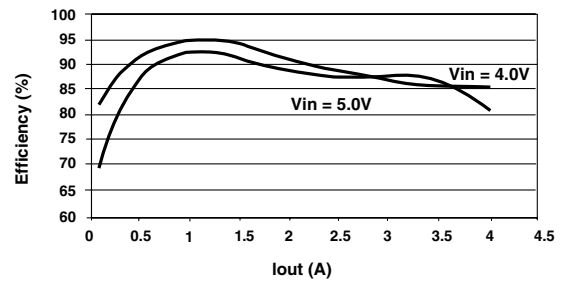


**Temp Vs. Iout\***

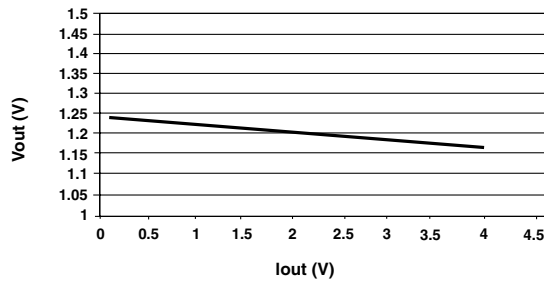
Above 25°C Ambient Temperature Vin = 6.0V; Vout = 3.3V



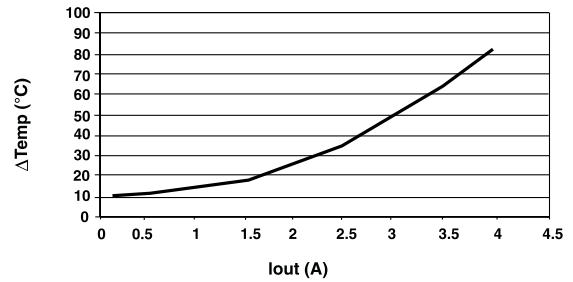
**Efficiency Vs. Iout\*Vs. Vin\***  
Vout = 3.3V



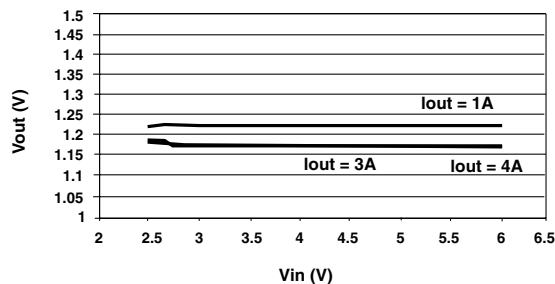
**Vout Vs Iout\***  
Vin = 4V



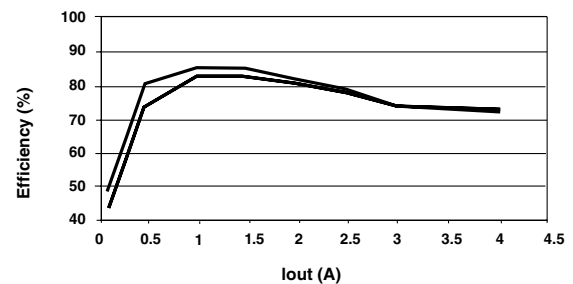
**Temp Vs. Iout\***  
Above 25°C Ambient Temperature Vin = 6.0V;  
Vout = 1.2V



**Vout Vs. Vin\***



**Efficiency Vs. Iout\***  
Vout = 1.2V

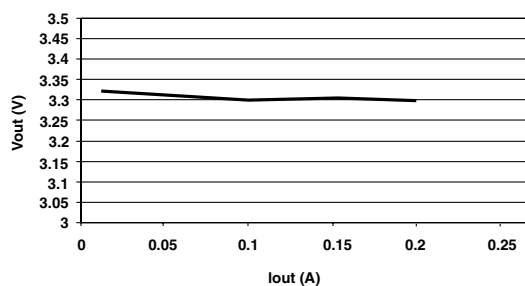


\*Note: Measurements were taken with Power supply: ZUP 20-40 from Nemic Lambda; Electronic load: 6063B from Agilent; Multimeter: Fluke 45 from Fluke and 34401 digital multimeter from Agilent; Scope: Infiniium 54815A from Agilent.

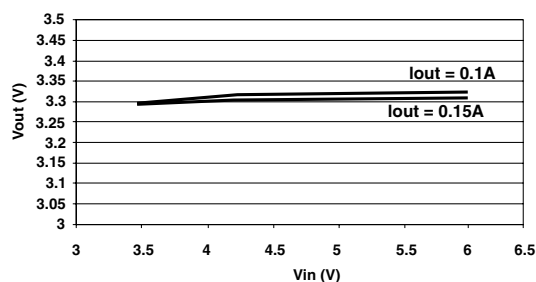
**PSM MODE**

**Vout Vs. Iout\***

Vin = 4V

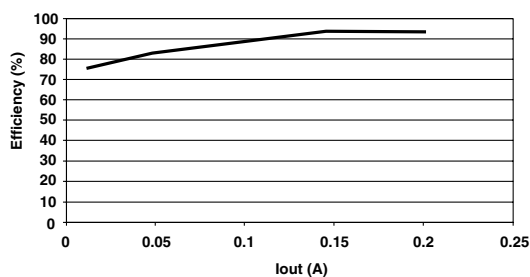


**Vout Vs. Vin\***



**Efficiency Vs. Iout\*\* \***

Vin = 4.0V; Vout = 3.3V



\*Note: Measurements were taken with Power supply: ZUP 20-40 from Nemic Lambda; Electronic load: 6063B from Agilent; Multimeter: Fluke 45 from Fluke and 34401 digital multimeter from Agilent; Scope: Infiniium 54815A from Agilent.



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