

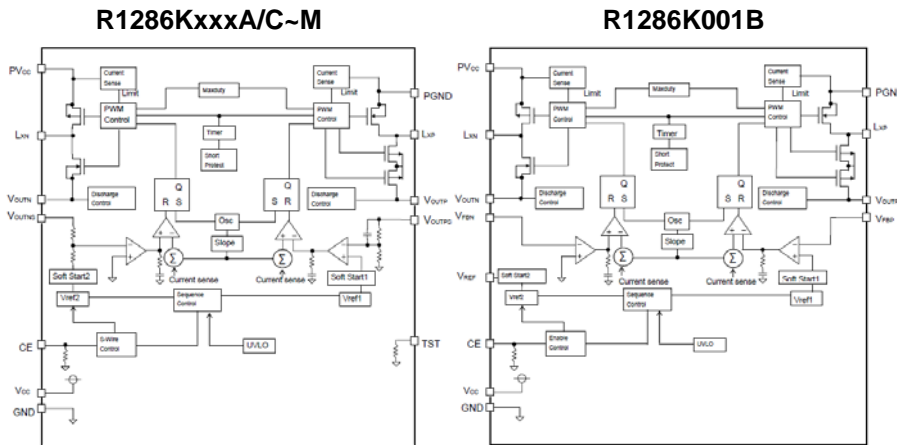
## PWM Step-up/Inverting DC/DC Converter for AMOLED/LCD with synchronous rectifier

The R1286K Series are CMOS-based PWM step-up/inverting DC/DC converters featuring 250mA×2 output current with synchronous rectifier. R1286K includes a soft start circuit, an under-voltage lockout circuit (UVLO), a latch protection circuit, a thermal shutdown circuit, and a shutdown circuit. By simply using two inductors and three capacitors as external components, a high-efficiency step-up/inverting DC/DC converter can be easily configured. R1286K is available in two types: R1286K001B is the type to which the output voltage ( $V_{OUTP}$  and  $V_{OUTN}$ ) can be adjusted by external resistors. R1286KxxxA/C-M are the type to which the step-up output voltage ( $V_{OUTP}$ ) is internally fixed and the inverting output voltage ( $V_{OUTN}$ ) can be adjusted dynamically by the single wire interface. The R1286K has a sequenced start up. After the CE pin is enabled, the step-up output is starting up followed by the inverting output after a delay time. As for shutdown, both outputs will be turned off by the auto-discharge function. R1286K is used for applications such as LCD and AMOLED displays.

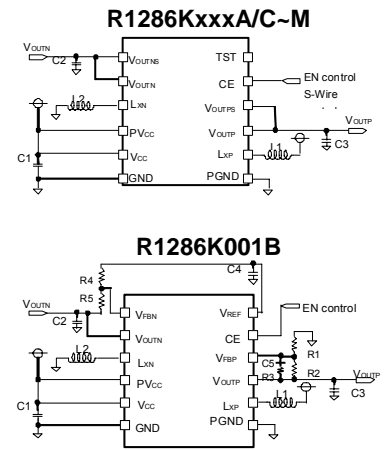
### FEATURES

- Supply Current ( $I_{CC}$ ) .....Typ. 1.2mA ( $V_{CC}=4.8V$ , In non-switching)
- Standby Current ( $I_{standby}$ ) .....Max. 5 $\mu$ A ( $V_{CC}=V_{LXP}=4.8V$ , CE="L")
- Input Voltage Range ( $V_{IN}$ ) .....2.3V to 4.8V
- Step-up Output Voltage ( $V_{OUTP}$ ) .....4.6V to 5.8V (internally fixed),  
Externally adjustable ( $V_{FB}$ : 1V) (001B)
- Inverting Output Voltage ( $V_{OUTN}$ ) .....-2.0V to -6.0V (internally fixed),  
Externally adjustable ( $V_{FB}$ : 0V) (001B) ,  
Dynamically adjustable output voltage with single wire interface.
- Feedback Voltage Accuracy .....Step-up:  $\pm 9mV$  (Except B),  $\pm 15mV$  (B)  
Inverting:  $\pm 70mV$  (Except B) ,  $\pm 25mV$  (B)
- Output Current ( $I_{OUT}$ ) ..... Step-up:250mA, Inverting:250mA
- Oscillator Frequency ( $f_{osc}$ ) ..... 1.75MHz
- Maximum Duty Cycle (Maxduty) ..... Step-up: Typ. 85% , Inverting: Typ. 90%
- UVLO Detect Voltage ( $V_{UVLO}$ ) ..... Typ. 2.05V
- Soft Start Time ( $t_{SSP}$ ) ..... Step-up: Typ. 2.4ms, Inverting: Typ. 2.8ms(B)
- Coil-current Limit Circuit ..... Step-up: Typ. 1A, Inverting: Typ. 1.5A
- Latch Protection Circuit ..... Delay time for protection Typ. 16ms
- Auto-Discharge function
- Thermal Shutdown Circuit ..... Stops at 150°C
- Package ..... DFN(PLP)2730-12

### BLOCK DIAGRAM



### TYPICAL APPLICATION



### SELECTION GUIDES

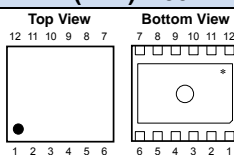
| Halogen Free | Package         | Q'ty per Reel | Part No.       |
|--------------|-----------------|---------------|----------------|
| H/F          | DFN(PLP)2730-12 | 5,000 pcs     | R1286Kxxx\$-TR |
|              |                 |               | R1286K001\$-TR |

\*) R1286Kxxx does not exist. For information about the versions, Please contact us.

xxx : Serial number to specify a combination of the  $V_{OUTP}$  voltage and  $V_{OUTN}$  preset value. The externally adjustable output voltage type is (001).  
\$ : Specify designation method of  $V_{OUTP}$  and  $V_{OUTN}$  settings.  
(A/C to M\*)  $V_{OUTP}$  voltage and  $V_{OUTN}$  preset value are internally fixed.  
 $V_{OUTN}$  voltage can be adjusted dynamically by the single wire interface.  
(B)  $V_{OUTP}$  and  $V_{OUTN}$  are externally adjusted.

### PACKAGE

#### DFN(PLP)2730-12



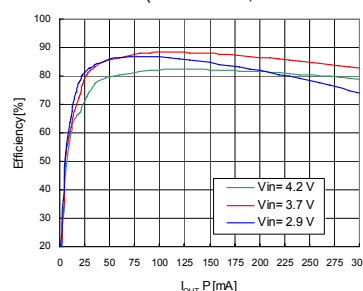
|   | xxA/C~M     | 001B      |    | xxA/C~M     | 001B      |
|---|-------------|-----------|----|-------------|-----------|
| 1 | $V_{OUTNS}$ | $V_{FBN}$ | 7  | PGND        |           |
| 2 | $V_{OUTN}$  |           | 8  | LXP         |           |
| 3 | LXN         |           | 9  | $V_{OUTP}$  |           |
| 4 | PVCC        |           | 10 | $V_{OUTPS}$ | $V_{FBP}$ |
| 5 | $V_{CC}$    |           | 11 | CE          |           |
| 6 | GND         |           | 12 | TST         | $V_{REF}$ |

\*) The tab is substrate level (GND).

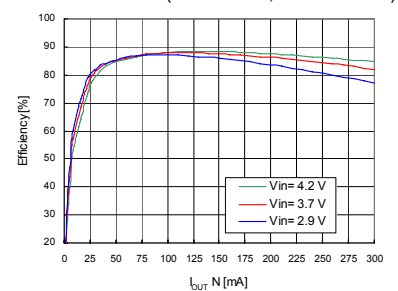
### TYPICAL CHARACTERISTICS

#### R1286Kxxxx Efficiency vs. Output Current

( $V_{OUTP}=4.6V$ ,  $V_{OUTN}= -4.9V$ )



( $V_{OUTP}=5.4V$ ,  $V_{OUTN}= -5.4V$ )



### APPLICATIONS

• Power source for AMOLED and LCD

• Power source for hand-held equipment

## Comparison of Step-up/Inverting DC/DC Converters

| Product Name                         |           | R1286K Series   | R1285L Series (Limited)  | R1283K Series   |
|--------------------------------------|-----------|---|--|---|
| Application                          |           | AMOLED / LCD  | ←  | AMOLED / LCD / CCD  |
| Control                              |           | PWM(Step-up), PWM (Inverting)   | ←  | ←   |
| Rectifier                            |           | Synchronous Rectifier   | Diode Rectifier  | ←   |
| Supply Current<br>(In non-switching) |           | Typ. 1.2mA  | Typ. 350μA   | Typ. 250μA (300kHz)<br>Typ. 300μA (700kHz)<br>Typ. 350μA (1.4MHz)   |
| Input Voltage Range                  |           | 2.3V to 4.8V  | ←  | 2.5V to 5.5V  |
| Output Voltage Range                 | Step-up   | 4.6V to 5.8V or<br>Ext. adjustable between 4.6V and 5.8V (001B)   | 4.6V, 4.8V, 5.0V   | Ext. adjustable up to 20V   |
|                                      | Inverting | -2.0V to -6.0V or<br>Ext. adjustable between -2.0V and -6.0V(001B),<br>Dynamically adjustable inverting voltage<br>with single wire interface. (V <sub>OUTN</sub> ) | -2.0V to -6.0V or<br>Ext. adjustable up to -6.0V (B)               | Ext. adjustable up to V <sub>DD</sub> -20V                          |
| Oscillator Frequency                 |           | Typ. 1.75MHz  | Typ. 1.4MHz  | Typ. 300kHz (A),<br>Typ. 700kHz (B),<br>Typ. 1.4MHz (C)             |
| Maximum Duty Cycle                   |           | Step-up Typ. 85%<br>Inverting Typ. 90%  | ←  | Step-up Typ. 91%<br>Inverting Typ. 91%                              |
| Delay time for<br>latch protection   |           | Typ. 16ms   | Typ. 50ms  | ←   |
| UVLO Detect Voltage                  |           | Typ. 2.05V  | ←  | Typ. 2.15V  |
| Soft Start Time                      |           | Step-up Typ. 2.4ms<br>Inverting Typ. 2.8ms (B)  | Step-up Typ. 4.5ms<br>Inverting Typ. 4.5ms                         | ←   |
| Lx Current limit                     | Step-up   | Typ. 1.0A   | ←  | Typ. 1.5A   |
|                                      | Inverting | Typ. 1.5A   | ←  | Typ. 1.5A   |
| Package                              |           | DFN(PLP)2730-12   | DFN2730-12   | DFN(PLP)2730-12   |
| Others                               |           | Auto-Discharge function,<br>Sequence Control,<br>Shutdown Function,<br>Thermal Shutdown Circuit   | Auto-Discharge function,<br>Sequence Control,<br>Shutdown Function | Auto-Discharge function<br>(Inverting output),<br>Sequence Control, |

## RICOH COMPANY, LTD. Electronic Devices Company



■ Ricoh presented with the Japan Management Quality Award for 1999.  
Ricoh continually strives to promote customer satisfaction, and shares the achievements of its management quality improvement program with people and society.



■ Ricoh awarded ISO 14001 certification.  
The Ricoh Group was awarded ISO 14001 certification, which is an international standard for environmental management systems, at both its domestic and overseas production facilities. Our current aim is to obtain ISO 14001 certification for all of our business offices.



Ricoh completed the organization of the Lead-free production for all of our products. After Apr. 1, 2006, we will ship out the lead free products only.  
Thus, all products that will be shipped from now on comply with RoHS Directive.

<http://www.ricoh.com/LSI/>

**RICOH COMPANY, LTD.**  
Electronic Devices Company  
● Higashi-Shinagawa Office (International Sales)  
3-32-3, Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-8655, Japan  
Phone: +81-3-5479-2857 Fax: +81-3-5479-0502