



### SUPER LOW ON RESISTANCE/LOW VOLTAGE 1A LDO REGULATOR

#### DESCRIPTION

The UTC **LR9273** is a typical LDO (linear regulator) with features of super low dropout, 1A output current capability, and -3mV typical load regulation at 1A.

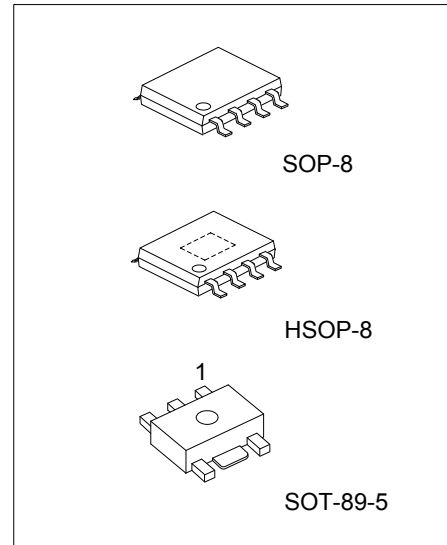
During operation of the UTC **LR9273**, the dropout voltage is very low and the response of line transient and load transient are very well.

Internally, there're many functions of UTC **LR9273** which can be seen in the block figure. There are a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit, and a chip enable circuit in each UTC **LR9273**.

The UTC **LR9273** can be used as an ideal of the power supply for hand-held communication equipment, such as: power source for portable communication equipment, power source for electrical appliances, for example, cameras, VCRs and camcorders and power source for battery-powered equipment.

#### FEATURES

- \* Ultra Supply Current: 60 $\mu$ A (Typ.)
- \* Standby Mode: 0.1 $\mu$ A (Typ.)
- \* Very Low Dropout Voltage: 0.18V (Typ.)  
@ $I_{OUT}=1A, V_{OUT}=2.85V$
- \* Ripple Rejection: 70dB (Typ.)  
@ $f=1kHz, V_{OUT}=2.85V$
- \* Temperature-Drift Coefficient of Output Voltage:  $\pm 100ppm/^{\circ}C$  (Typ.)
- \* Well Line Regulation: 0.02%/V (Typ.)
- \* Output Voltage Accuracy:  $\pm 1.5%$  (Typ.)
- \* Internal Fold Back Protection Circuit: 250mA (Typ.) @ short mode
- \*  $C_{IN}=C_{OUT}=4.7\mu F$  or more (Ceramic capacitors) are recommended to be used with this IC



### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
LR9273xL-xx-AB5-R	LR9273xG-xx-AB5-R	SOT-89-5	Tape Reel
LR9273xL-xx-S08-R	LR9273xG-xx-S08-R	SOP-8	Tape Reel
LR9273xL-xx-SH2-R	LR9273xG-xx-SH2-R	HSOP-8	Tape Reel

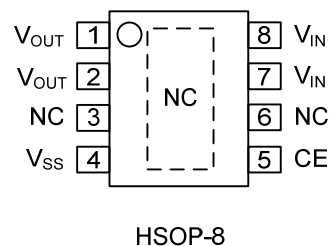
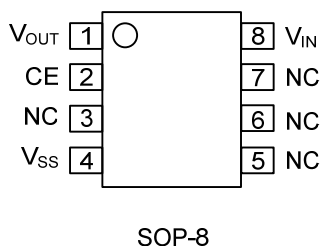
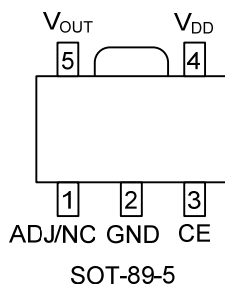
Notes: 1. x: The auto discharge function at off state are options as follows.  
 2. xx: Output Voltage, refer to Marking Information.

<p>LR9273xG-xx-AB5-R</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Output Voltage Code</li> <li>(4) Green Package</li> <li>(5) Active</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) AB5: SOT-89-5, S08: SOP-8, SH2: HSOP-8</li> <li>(3) xx: refer to Marking Information</li> <li>(4) G: Halogen Free and Lead Free, L: Lead Free</li> <li>(5) B: without auto discharge function at off state D: with auto discharge function at off state</li> </ul>
---	---

### MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-89-5	28: 2.8V 33: 3.3V 35: 3.5V AD: ADJ	<p>                         Date Code ← [ ] [ ] [ ] [ ] → Voltage Code (XX)                          Active Code ← [ ] [ ] [ ] [ ] → LR9273 [ ] [ ] → L: Lead Free                          G: Halogen Free                     </p>
SOP-8 HSOP-8		<p>                         Active Code ← [ ] [ ] [ ] [ ] → UTC [ ] [ ] [ ] [ ] → Date Code                          Voltage Code ← [ ] [ ] [ ] [ ] → LR9273 [ ] [ ] → Lot Code                          L: Lead Free                          G: Halogen Free                     </p>

### ■ PIN CONFIGURATION



### ■ PIN DESCRIPTION

#### SOT-89-5

PIN NO.	PIN NAME	DESCRIPTION
1	ADJ	ADJUST Pin (For Adjustable Version)
	NC	No Connection (For Fixed Version)
2	GND	Ground Pin
3	CE	Chip Enable Pin. Active when this Pin is high
4	V <sub>IN</sub>	Input Pin
5	V <sub>OUT</sub>	Output Pin

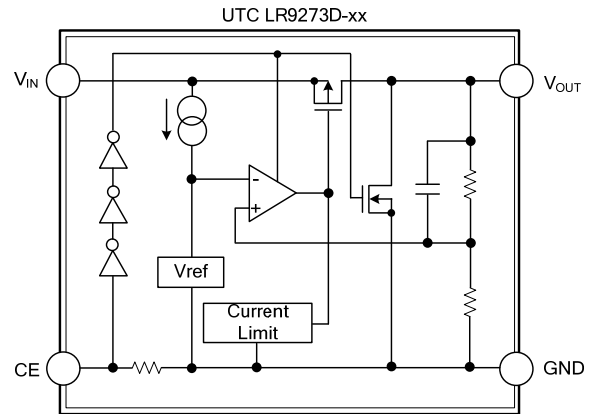
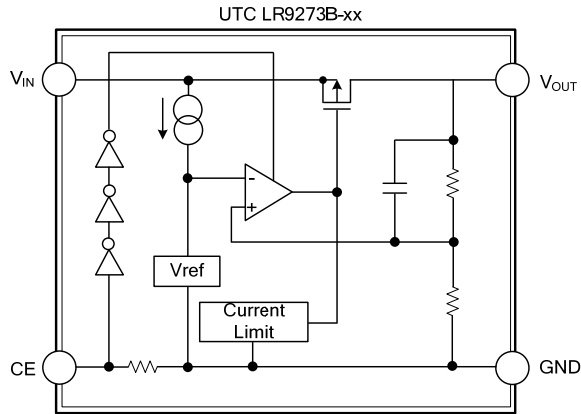
PIN NO.		PIN NAME	DESCRIPTION
SOP-8	HSOP-8		
1	1, 2	V <sub>OUT</sub>	Output Pin
2	5	CE	Chip Enable Pin. Active when this Pin is high
3, 5, 6, 7	3, 6	NC	No connection (Note)
4	4	V <sub>SS</sub>	GND Pin
8	7, 8	V <sub>IN</sub>	Input Pin
-	Exposed Pad	NC	Thermal pad

Note: The NC pin is electrically open.

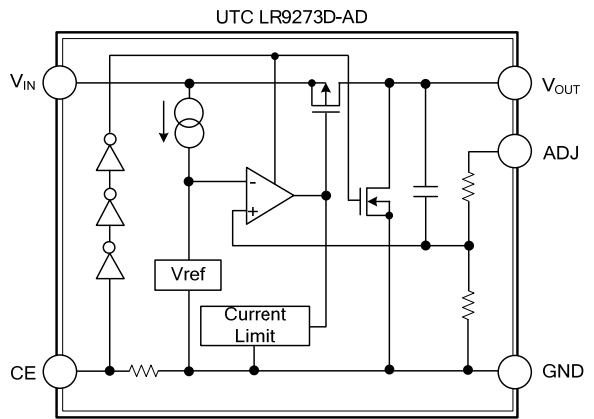
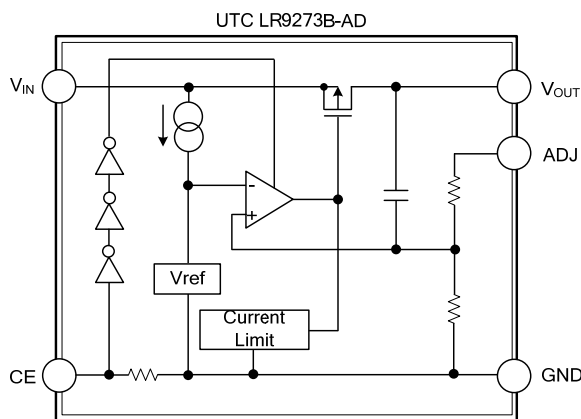
The NC pin can be connected to V<sub>IN</sub> or V<sub>SS</sub>.

### ■ BLOCK DIAGRAM

#### For Fixed Version



#### For Adjustable Version



### ■ ABSOLUTE MAXIMUM RATING

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage		$V_{IN}$	6.5	V
Input Voltage (CE Pin)		$V_{CE}$	6.5	V
Output Voltage		$V_{OUT}$	$V_{IN}+0.3$	V
Power Dissipation	SOT-89-5	$P_D$	550	mW
	SOP-8		700	mW
	HSOP-8			mW
Operating Temperature		$T_{OPT}$	-40 ~ +85	°C
Storage Temperature		$T_{STG}$	-55 ~ +125	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ ELECTRICAL CHARACTERISTICS

#### LR9273B/D-xx (Fixed Output Voltage Type)

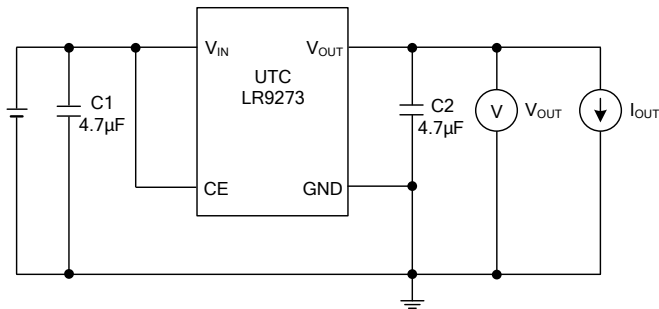
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Input Voltage	$V_{IN}$				6.0	V	
Supply Current	$I_{SS}$	$V_{IN}-V_{OUT}=1.0V, V_{CE}=V_{IN}, I_{OUT}=0A$		60	100	$\mu A$	
Standby Current	$I_{standby}$	$V_{IN}=6.0V, V_{CE}=0V$		0.1	1.0	$\mu A$	
Output Voltage	$V_{OUT}$	$V_{IN}-V_{OUT}=1.0V, I_{OUT}=100mA$	$V_{OUT}>1.5V$	$\times 0.98$	$\times 1.02$	V	
			$V_{OUT}\leq 1.5V$	-30	+30	mV	
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	$V_{IN}-V_{OUT}=0.3V, 1mA\leq I_{OUT}\leq 300mA$ , If $V_{OUT}\leq 1.1V$ , then $V_{IN}=1.4V$		-15	-2	15	mV
		$V_{IN}-V_{OUT}=0.3V, 1mA\leq I_{OUT}\leq 1A$ , If $V_{OUT}\leq 1.1V$ , then $V_{IN}=1.7V$			-3		mV
Dropout Voltage ( $T_{OPT}=25^\circ C$ )	$V_{DIF}$	$I_{OUT}=300mA, 2.8\leq V_{OUT}$		0.15		V	
		$I_{OUT}=1A, 2.8\leq V_{OUT}$		0.45		V	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$I_{OUT}=100mA, V_{OUT}+0.5V\leq V_{IN}\leq 6.0V$ , If $V_{OUT}\leq 0.9V, 1.4V\leq V_{IN}\leq 6.0V$		0.05	0.20	%/V	
Ripple Rejection	RR	$f=1kHz (V_{OUT}\leq 4.0V)$		70		dB	
		$f=1kHz (V_{OUT}>4.0V)$ Ripple 0.5Vp-p, $V_{IN}-V_{OUT}=1.0V, I_{OUT}=100mA$ , If $V_{OUT}\leq 1.2V, V_{IN}-V_{OUT}=1.5V, I_{OUT}=100mA$		60		dB	
Output Voltage Temperature Coefficient	$\frac{\Delta V_{OUT}}{\Delta T_{OPT}}$	$I_{OUT}=100mA, -40^\circ C\leq T_{OPT}\leq 85^\circ C$		$\pm 100$		ppm/°C	
Output Current	$I_{LIM}$	$V_{IN}-V_{OUT}=1.0V$	1			A	
Short Current Limit	$I_{SC}$	$V_{OUT}=0V$		250		mA	
Pull-Down Resistance for CE Pin	$R_{PD}$			5.0		M $\Omega$	
CE Input Voltage	High	$V_{CEH}$	1.2		6.0	V	
	Low	$V_{CEL}$	0		0.4	V	
Thermal Shutdown Detector Threshold Temperature	$T_{TSD}$	Junction temperature		150		°C	

## ■ ELECTRICAL CHARACTERISTICS

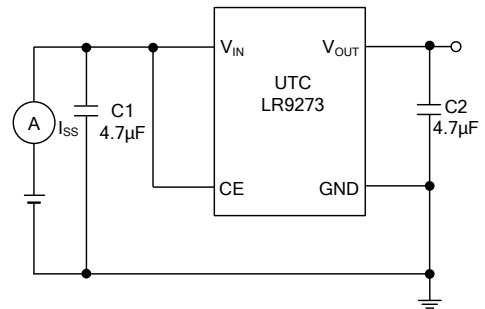
### LR9273B/D-xx (Adjustable Output Voltage Type)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	$V_{IN}$		1.4		6.0	V
Supply Current	$I_{SS}$	$V_{OUT}=V_{ADJ}$ , $V_{IN}=2.0$ , $V_{CE}=V_{IN}$		60	100	$\mu$ A
Standby Current	$I_{standby}$	$V_{IN}=6.0V$ , $V_{CE}=0V$		0.1	1.0	$\mu$ A
Reference Voltage for Adjustable Voltage Regulator	$V_{OUT}$	$V_{OUT}=V_{ADJ}$ , $V_{IN}=2.0V$ , $I_{OUT}=100mA$	1.176	1.200	1.224	V
Output Voltage Range	$RV_{OUT}$		1.0		$V_{IN}$	V
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	$V_{IN}=1.4V$ , $1mA \leq I_{OUT} \leq 300mA$	-15	-2	15	mV
		$V_{IN}=1.7V$ , $1mA \leq I_{OUT} \leq 1A$		-3		mV
Dropout Voltage	$V_{DIF}$	$V_{OUT}=V_{ADJ}$ $I_{OUT}=300mA$ $I_{OUT}=1A$		0.70		V
				0.56		V
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$V_{OUT}=V_{ADJ}$ , $I_{OUT}=100mA$ , $1.5V \leq V_{IN} \leq 6.0V$		0.05	0.20	%/V
Ripple Rejection	RR	$f=1kHz$ Ripple $0.5V_{p-p}$ , $V_{OUT}=V_{ADJ}$ , $V_{IN}=2.5V$ , $I_{OUT}=100mA$		70		dB
Output Voltage Temperature Coefficient	$\frac{\Delta V_{OUT}}{\Delta T_{OPT}}$	$I_{OUT}=100mA$ , $-40^{\circ}C \leq T_{OPT} \leq 85^{\circ}C$		$\pm 100$		ppm/ $^{\circ}C$
Output Current	$I_{LIM}$	$V_{OUT}=V_{ADJ}$ , $V_{IN}=2.0$	1			A
Short Current Limit	$I_{SC}$	$V_{OUT}=V_{ADJ}=0V$		250		mA
Pull-Down Resistance for CE Pin	$R_{PD}$			5.0		M $\Omega$
CE Input Voltage	High	$V_{CEH}$	1.2		6.0	V
	Low	$V_{CEL}$	0		0.4	V
Thermal Shutdown Detector Threshold Temperature	$T_{TSD}$	Junction temperature		150		$^{\circ}C$

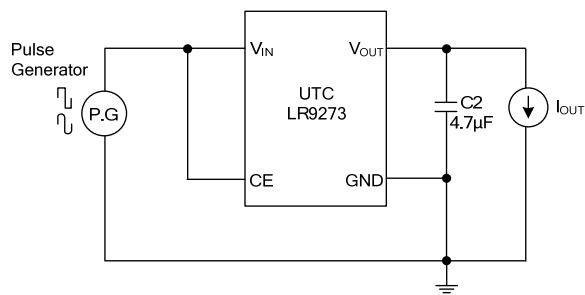
### ■ TEST CIRCUIT



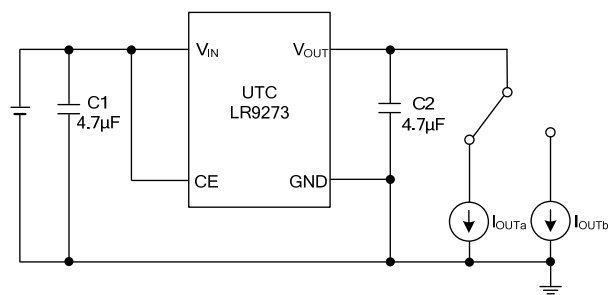
Basic Test Circuit



Test Circuit for Supply Current

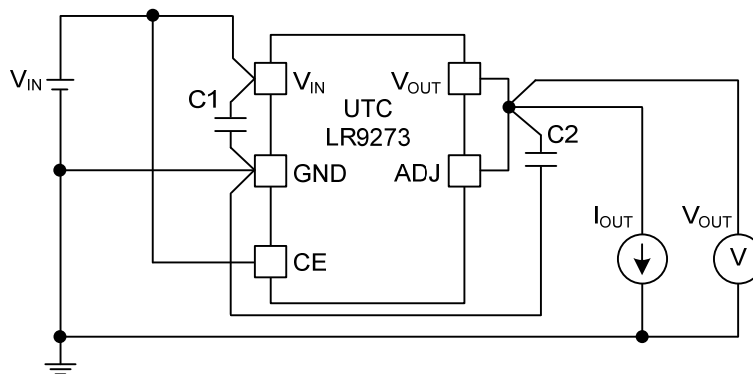
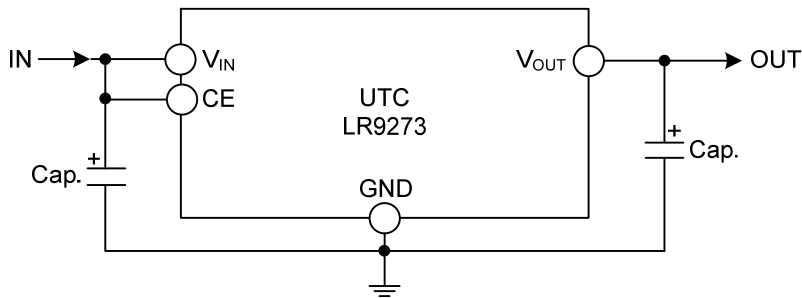


Test Circuit for Ripple Rejection



Test Circuit for Load Transient Response

■ TYPICAL APPLICATION CIRCUIT



Example of the Typical Application of UTC LR9273 (Fixed Output Type)

**Phase Compensation**

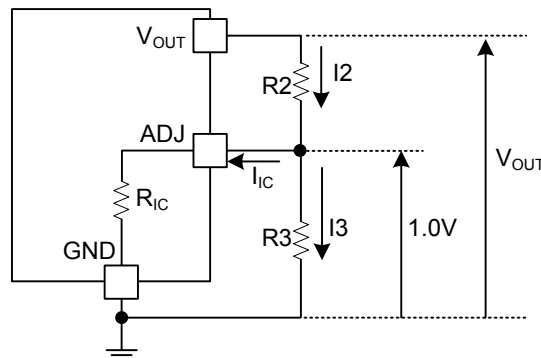
In these ICs, phase compensation is made with the output capacitor for securing stable operation even if the load current is varied. For this purpose, use as much as a capacitor as C2. Recommendation value is as follows:

**Mounting on PCB**

Make  $V_{DD}$  and GND lines sufficient. If their impedance is high, a current flows, the noise picked up or unstable operation may result. Further use a  $4.7\mu\text{F}$  or more value capacitor between  $V_{DD}$  pin and GND pin as close as possible.

Set an Output capacitor between  $V_{OUT}$  pin and GND pin for phase compensation as close as possible.

**Technical Notes on Output Voltage Setting of Adjustable Output type**





■ TYPICAL APPLICATION CIRCUIT(Cont.)

The Output Voltage may be adjustable for any output voltage between its 1.0V reference and its  $V_{DD}$  setting level. An external pair of resistors is required, as shown above.

The complete equation for the output voltage is described step by step as follows;

$$I_2 = I_{IC} + I_3 \dots\dots\dots (1)$$

$$I_3 = 1.0/R_3 \dots\dots\dots (2)$$

Thus,

$$I_2 = I_{IC} + 1.0/R_3 \dots\dots\dots (3)$$

Therefore,

$$V_{OUT} = 1.0 + R_2 \times I_2 \dots\dots\dots (4)$$

Put Equation (3) into Equation (4), then

$$\begin{aligned} V_{OUT} &= 1.0 + R_2(I_{IC} + 1.0/R_3) \\ &= 1.0(1 + R_2/R_3) + R_2 \times I_{IC} \dots\dots\dots (5) \end{aligned}$$

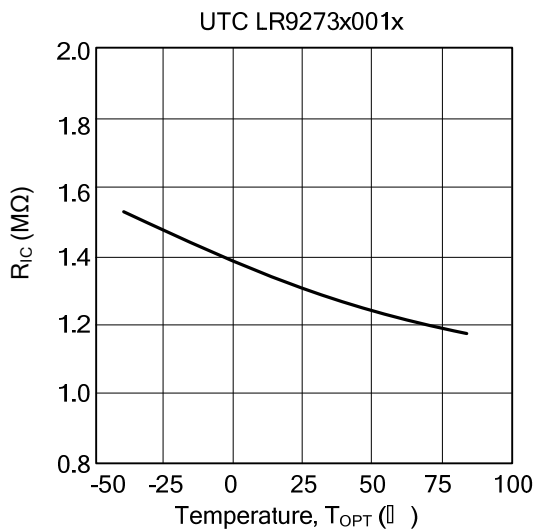
In 2nd term, or  $R_2 \times I_{IC}$  will produce an error in  $V_{OUT}$ .

In Equation (5),

$$I_{IC} = 1.0/R_{IC} \dots\dots\dots (6)$$

$$\begin{aligned} R_2 \times I_{IC} &= R_2 \times 1.0/R_{IC} \\ &= 1.0 \times R_2/R_{IC} \dots\dots\dots (7) \end{aligned}$$

For better accuracy, choosing  $R_2 \ll R_{IC}$  reduces this error.



The graph is a typical characteristic , please evaluate the circuit with an actual condition.

UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. UTC reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.