

## PWM SWITCHER CONTROLLER & 7.5A LOW DROPOUT REGULATOR COMBO PATENT PENDING

### FEATURES

- The US2075 eliminates the need for a separate switching controller IC
- Minimum part count allows lower system cost
- Fixed 3.30V/7.5A LDO on board
- On board MOSFET driver
- Fastest transient response of any controller method. ( 0 to 100% Duty Cycle in 100 nS )
- 1% internal voltage reference
- Internal Thermal shutdown
- Internal Under Voltage Lockout protects MOSFET during start-up

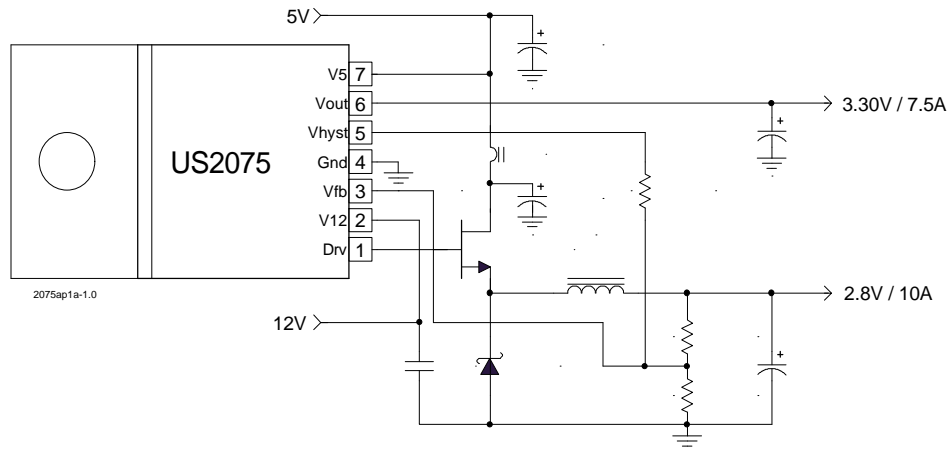
### APPLICATIONS

- Dual supply low voltage processor applications, such as: P55C™, CYRIX M2™, POWER PC™ and AMD

### DESCRIPTION

The US2075 is a dual function IC combining a switching controller and a 7.5A low dropout regulator all in a compact 7 pin TO220 and TO263 surface mount packages providing a total solution for dual supply processor applications such as an Intel P55C™, AMD K6™, as well as Cyrix 6X86L™ and the M2™ processors. Typically in these applications a dual supply regulator converts 5V to 3.3V for I/O supply and a jumper programmable supply of 2.8V to 3.5V for CORE supply. The linear regulator portion in the US2075 is a fixed 3.30V output and has a minimum of 7.5A current capability designed to provide ample current for most applications while the switching regulator controller uses the 5V supply to power the controller and the 12V supply to drive the power MOSFET, allowing a low cost N-MOS switch to be used. The IC also includes an error comparator for fastest transient response, a precise voltage reference for setting the output voltage as well as a direct drive of the MOSFET for the minimum part count.

### TYPICAL APPLICATION



Typical application of US2075 in a flexible mother board designed for Intel P55™, P54™ AMD K5, K6™ as well as Cyrix M1™ and M2™ applications.

Notes: P54C, P55C are trade marks of Intel Corp. K5 & K6 are trade marks of AMD corp. Cyrix 6X86L, M1, M2 are trade marks of Cyrix Corp. Power PC is trade mark of IBM Corp.

### PACKAGE ORDER INFORMATION

T <sub>j</sub> (°C)	7 PIN PLASTIC TO220 (T)	7 PIN PLASTIC TO263 (M)
0 TO 125	US2075CT	US2075CM

# US2075

## ABSOLUTE MAXIMUM RATINGS

12V Supply Voltage .....	14V
5V Supply Voltage .....	7V
LDO Power Dissipation .....	Internally Limited
FB Pin Voltage.....	-0.3V to 5V
Storage Temperature Range .....	-65 TO 150°C
Operating Junction Temperature .....	0 TO 150°C

## PACKAGE INFORMATION

7 PIN PLASTIC TO220 (T)	7 PIN PLASTIC TO263 (M)
<p>FRONT VIEW</p> <p><math>\theta_{JT}=2.7^{\circ}\text{C/W}</math>   <math>\theta_{JA}=60^{\circ}\text{C/W}</math></p>	<p>FRONT VIEW</p> <p><math>\theta_{JA}=35^{\circ}\text{C/W}</math> for 1" Square pad</p>

## ELECTRICAL SPECIFICATIONS

Unless otherwise specified the following specification applies over,  $V_5=5\text{V}$ ,  $V_{12}=12\text{V}$ , and  $T_j=0$  to  $125^{\circ}\text{C}$ . Low duty cycle pulse testing are used which keeps junction and case temperatures equal to the ambient temperature.

### LDO Section

PARAMETER	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT}$	$I_o=0\text{mA}$		3.400		V
Line Regulation		$I_o=0\text{mA}$ , $4.75 < V_5 < 6\text{V}$			0.2	%
Load Regulation (note 1)		$0\text{A} < I_o < 7.5\text{A}$			0.5	%
Maximum Output Current	$I_{MAX}$	$dV_o=0.995 \cdot V_{OUT}$	7.5			A
Thermal Regulation		30 mS Pulse, $V_5=5\text{V}$		0.01	0.02	%/W
Ripple Rejection		$f=120\text{HZ}$ , $C_o=25\mu\text{F}$ Tan $I_o=1\text{A}$		70		dB

### Switching Controller Section

PARAMETER	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
F.B Voltage Initial Accuracy	Vfb	$T_j=25^{\circ}\text{C}$	1.237	1.250	1.262	V
F.B Voltage Total Variation	Vfb	Includes Temp & line, 4.75 to 5.25V	1.225	1.250	1.275	V
F.B Input Bias Current	I <sub>fb</sub>	Vfb=1.25V	-2		+2	uA
Min On Time		Vfb is sq wave with 300 ns on time and 2 uS off time	400	600	800	nS
Min Off Time		Vfb is sq wave with 300 ns off time and 2 uS on time	400	600	800	nS
Vhyst pin output-HI		$I_{source}=500\mu\text{A}$ , Vfb=1.5V	11			V
Vhyst pin output-LO		$I_{sink}=500\mu\text{A}$ , Vfb=1V			1	V
Supply Current	I <sub>cc</sub>	Vfb=1V		10		mA
Maximum Duty Cycle	D <sub>max</sub>	Vfb=1V			100	%
Minimum Duty Cycle	D <sub>min</sub>	Vfb=1.5V	0			%
Gate Drive Rise/Fall Time	V <sub>gate</sub>	Load=IRL3303		70		nS

**Note 1 :** Low duty cycle pulse testing with Kelvin connections are required in order to maintain accurate data.

PIN DESCRIPTIONS

PIN #	PIN SYMBOL	PIN DESCRIPTION
3	Vfb	A resistor divider from this pin to the output of the switching regulator and ground sets the core supply voltage.
6	Vout	The output of the linear regulator. A minimum of a 10uF capacitor must be connected from this pin to ground to insure stability. This voltage is set at 3.30V typ.
7	V5	The input pin of the regulator. Typically a large storage capacitor is connected from this pin to ground to insure that the input voltage does not sag below the minimum drop out voltage during the load transient response. This pin must always be 1.3V higher than Vout in order for the device to regulate properly.
4	Gnd	This pin is connected to the IC substrate and must be connected to the lowest potential in the system. It is also connected to the Tab of the package. A high frequency capacitor must be connected from V12 to this pin to insure proper operation.
1	Drv	The PWM output of the switching controller. This pin is a totem pole drive that is connected to the gate of the power MOSFET. A resistor may be placed from this pin to the gate in order to reduce switching noise.
5	Vhyst	A resistor is connected from this pin to the Vfb pin to set the output ripple voltage. See application note for more details.
2	V12	This pin is connected to the 12V supply voltage A high frequency cap must be connected from this pin to the GND pin of the IC.

BLOCK DIAGRAM

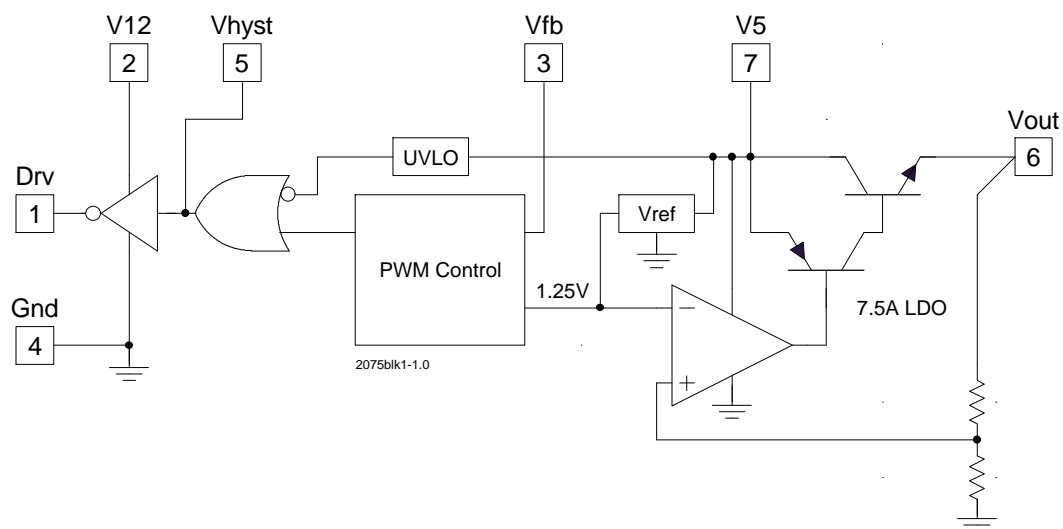


Figure 1 - Simplified block diagram of the US2075

# US2075

## TYPICAL APPLICATION

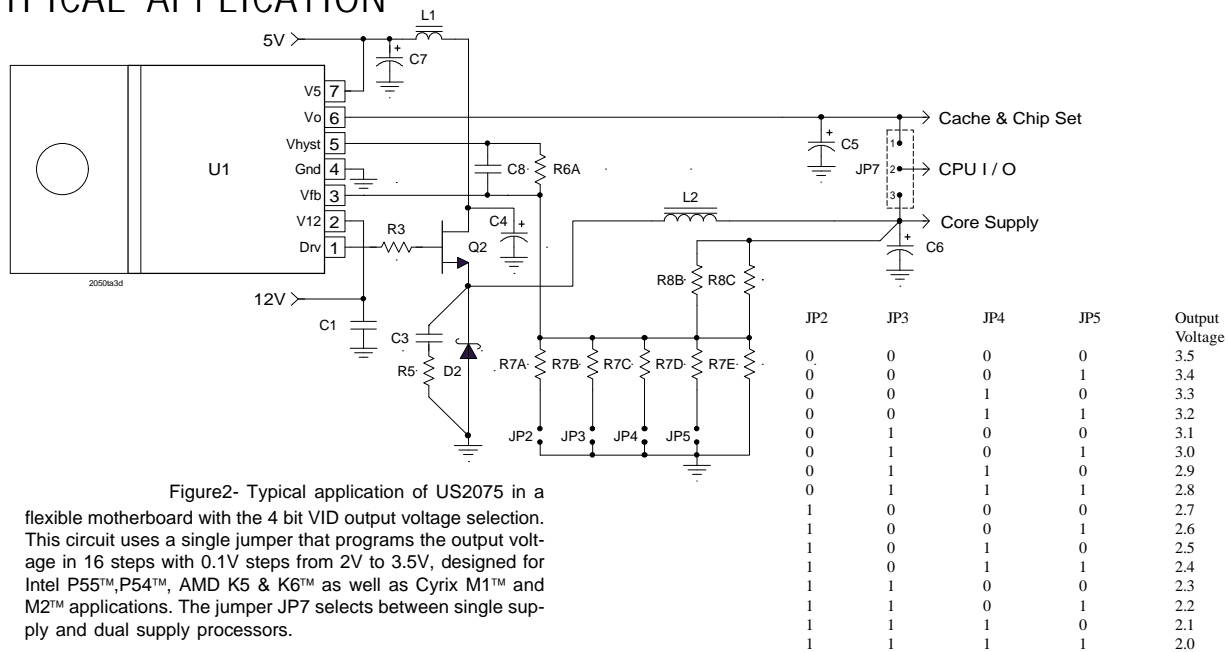


Figure2- Typical application of US2075 in a flexible motherboard with the 4 bit VID output voltage selection. This circuit uses a single jumper that programs the output voltage in 16 steps with 0.1V steps from 2V to 3.5V, designed for Intel P55™, P54™, AMD K5 & K6™ as well as Cyrix M1™ and M2™ applications. The jumper JP7 selects between single supply and dual supply processors.

Ref Desig	Description	Qty	Part #	Manufacturer
U1	LDO/Switcher IC	1	US2075CT (TO220) US2075CM (TO263) (note 1)	Unisem
Q2	MOSFET	1	IRL3303 (TO220) IRL3103S (TO263) (note 1)	International Rectifier
D2	Schottky Diode	1	MBR1045CT (TO220) MBRB1545CT (TO263) (note1)	Motorola
L2	Inductor	1	Core:T50-18,L=4 uH Turns: 10T, 18 AWG	Micro Metal (core)
L1	Inductor	1	L=2 uH	
R3	Resistor	1	22 ohm,5%, SMT 1206 size	
R5	Resistor	1	10 ohm, 5%, SMT 1206 size	
R8C	Resistor	1	806 ohm,1%, SMT 0805 size	
R8B	Resistor	1	90.9 kohm,1%, SMT 0805 size	
R7A	Resistor	1	1.24 kohm,1%, SMT 0805 size	
R7B	Resistor	1	2.49 kohm,1%, SMT 0805 size	
R7C	Resistor	1	4.99 kohm,1%, SMT 0805 size	
R7D	Resistor	1	10 kohm,1%, SMT 0805 size	
R7E	Resistor	1	1.30 kohm,1%, SMT 0805 size	
R6A	Resistor	1	324 kohm,1%, SMT 0805 size	
C8	Resistor	1	10pF,Ceramic, SMT 0805 size	
C1	Capacitor	1	1 uF,Ceramic, SMT 0805 size, Z5U	
C7	Capacitor	1	EEUFA1A681L, 680uF,10V, Elect	Panasonic
C3	Capacitor	1	470pF,Ceramic, SMT 0805 size	
C4	Capacitor	1	6MV1500GX, 1500uF,6.3V, Elect	Sanyo
C5	Capacitor	1	EEUFA1A681L, 680uF,10V, Elect	Panasonic
C6	Capacitor	4	6MV1500GX, 1500uF,6.3V, Elect	Sanyo
HS1	Heat Sink	1	For MOSFET , 577002	Aavid
HS2	Heat Sink	1	For Schottky Diode , 577002	Aavid
HS3	Heat Sink	1	For US2075 , 507222 (I/O Load Current<5A) 576602 (I/O Load Current< 3.5A)	Aavid

Note 1: For the applications where it is desirable to eliminate the heat sink, the US2075CM for U1 when load current is less than 1.5A, the IRL3103S for Q2 and MBR1545CT for D1 in TO263 packages with minimum of 1" square copper pad can be used.