

Pulse Width Modulation Circuit

MB3759

Integrated Circuit

DATASHEET

OEM – Fujitsu

Source: Fujitsu Databook 1983

**FUJITSU
MICROELECTRONICS**

**MB3759
MB3760**

**PULSE WIDTH MODULATION
CONTROL CIRCUIT**

DESCRIPTION

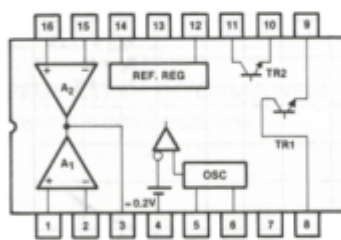
The MB3759 and MB3760 are complete pulse-width modulation control systems on a single monolithic chip. Both circuits provide an internal 5.00V reference, two or-connected amplifiers, externally timed (or synchronized) oscillator and control ramp generator. Both circuits provide for either push-pull or single-ended mode of operation with external control of dead-band. The MB3760 additionally provides steering control and an on-chip 39V zener diode.

The two NPN output transistors have uncommitted emitters and collectors that can be used to either sink or source up to 200mA each.

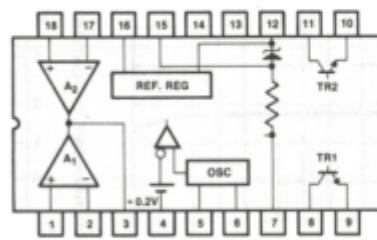
FEATURES

- Complete pulse-width-modulation system with power control circuit.
- Either push-pull or single-ended mode of operation
- On chip voltage reference
- Uncommitted output drivers
- Master or slave oscillator control
- Adjustable dead-band
- Dual error amplifiers
- Externally controlled output steering (MB3760 only)
- 39V Zener (MB3760 only)
- Compatible with TL494 & TL495

MB3759

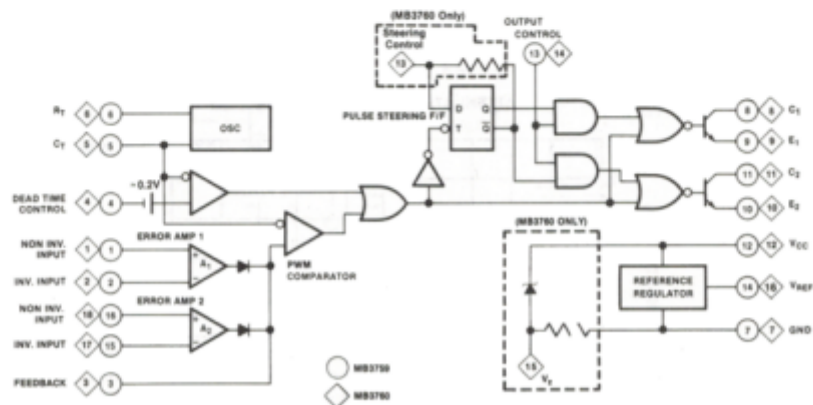


MB3760



Dual in-line Package
(Top view)

MB3759/MB3760 BLOCK DIAGRAM



MB3759/MB3760

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Value	Unit
Supply Voltage	V_{CC}	41	V
Collector Output Voltage	V_{CE}	41	V
Collector Output Current	I_{CE}	250	mA
Amplifier Input Voltage	V_{IN}	$V_{CC} + 0.3$	V
Continuous Total Dissipation	P_D	800 ($T_A \leq 25^\circ\text{C}$)	mW
		800 ($T_A \leq 60^\circ\text{C}$)	
Storage Temperatures	T_{STG}	-55 ~ +150	$^\circ\text{C}$
Operating Temperature	T_{OP}	-20 to +85	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	7	15	40	V
Collector Output Voltage	V_{CE}	—	—	32	V
Collector Output Current (each transistor)	I_{CE}	5	100	200	mA
Amplifier Input Voltage	V_{IN}	-0.3	—	$V_{CC} - 2$	V
Current into Feedback Terminal	$I_{f.b.}$	—	—	0.3	mA
Reference Section Output Current	I_{REF}	—	5	10	mA
Timing resistor	R_T	1.8	30	500	$\text{K}\Omega$
Timing capacitor	C_T	470	1000	1×10^6	pF
Oscillator frequency	f_{osc}	1	40	300	kHz
Operating temperature	T_{OP}	-20	25	85	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Reference Section

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_{REF}	$I_O = 1 \text{ mA}$	4.75	5.0	5.25	V
Input regulation	$\Delta V_{R(LINE)}$	$V_{CC} = 7\text{V to } 40\text{V}$	—	2	25	mV
Output regulation	$\Delta V_{R(Load)}$	$I_{REF} = 1\text{mA to } 10\text{mA}$	—	-1	-15	mV
Output Voltage change with temperature	—	$T_A = -20 \text{ to } 85$	—	± 200	± 750	$\mu\text{V}/^\circ\text{C}$
Short circuit output current	$I_{REF(S.C.)}$	$V_{REF} = 0, T_A = 25^\circ\text{C}$	15	40	—	mA

Oscillator Section

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Frequency	f_{osc}	$R_T = 30 \text{ K}\Omega, C_T = 1000\text{pF}$	36	40	44	KHz
Standard deviation of frequency		$R_T = 30 \text{ K}\Omega, C_T = 1000\text{pf}$	—	± 3	—	%
Frequency change with voltage		$V_{CC} = 7\text{V to } 40\text{V}$	—	± 0.1	—	%
Frequency change with temperature		$T_A = -20 \text{ to } 85$	—	± 0.01	± 0.03	$\%/^\circ\text{C}$

MB3759/MB3760**Dead Time Control Section**

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Input bias current	I_D	$0 \leq V_I \leq 5.25V$	—	-2	-10	μA
Maximum duty cycle each output		$V_I = 0$	40	45	—	%
Input threshold voltage	zero duty cycle	V_{DO}	—	3.0	3.3	V
	Maximum duty cycle	V_{DM}	0	—	—	V

Error-Amplifier Section

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Input offset voltage	V_{IO}	$V_{O(pin\ 3)} = 2.5V$	—	± 2	± 10	mV
Input offset current	I_{IO}	$V_{O(pin\ 3)} = 2.5V$	—	± 25	± 250	nA
Input bias current	I_I	$V_{O(pin\ 3)} = 2.5V$	—	-0.2	-1.0	μA
Common mode input voltage range	V_{CM}	$7V \leq V_{CC} \leq 40V$	-0.3 to $V_{CC} - 2$	—	—	V
Open-loop voltage amplification	A_V	$0.5V \leq V_O \leq 3.5V$	70	95	—	dB
Common-mode rejection ratio	$CMRR$	$V_{CC} = 40V$	65	80	—	dB
Output current	sink	$-5V \leq V_{ID} \leq -15mV$	0.3	0.7	—	mA
	source	$15mV \leq V_{ID} \leq 5V$	-2	-10	—	mA

Output Section

Item	Symbol	Test Conditions	Min	Typ	Max	Unit	
Collector off-state current	I_{CO}	$V_{CE} = 40V, V_{CC} = 40V$	—	—	100	μA	
Emitter off-state current		$V_{CC} = V_C = 40V, V_E = 0$	—	—	-100	μA	
Collector Emitter Saturation Voltage	common emitter	$V_{SAT(C)}$	$V_E = 0, I_C = 200mA$	—	1.1	1.3	V
	emitter follower	$V_{SAT(E)}$	$V_C = 15V, I_E = -200mA$	—	1.5	2.5	V
Output control input current		$V_I = V_{REF}$	—	1.3	3.5	mA	

PWM Comparator Section

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Input threshold voltage	V_{TH}	Zero duty cycle	—	4	4.5	V
Input sink current (Pin 3)		$V_{O(pin\ 3)} = 0.7V$	0.3	0.7	—	mA

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Total Device

Item	Symbol	Test Conditions	Typ	Max	Unit
Standby supply current	I_{CCQ}	Voltage at Pin 6 = V_{REF} , All Other inputs and outputs are open, $V_{CC} = 15V$	7	12	mA
Average supply current	I_{CC}	Voltage at Pin 4 = 2V, see test circuit	8		mA

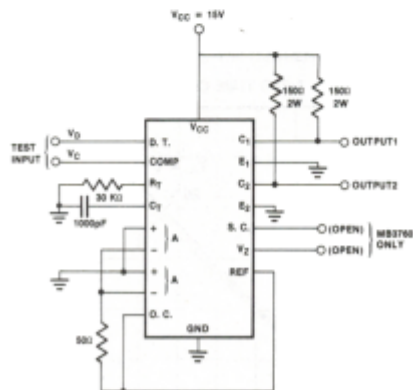
MB3760 Only

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Steering control input current		$V_I = 0.4V$	—	—	-200	μA
		$V_I = 2.4V$	—	—	400	μA
Zener-diode breakdown voltage	V_Z	$V_{CC} = 41V, I_Z = 1mA$	—	39	—	V
Zener-diode sink current	I_Z	$V_{(pin 15)} = 1V$	—	0.3	—	mA

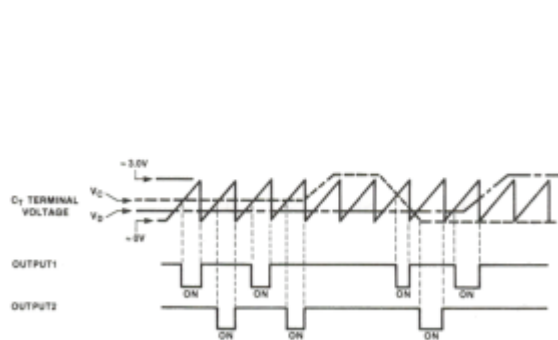
SWITCHING CHARACTERISTICS

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Output voltage rise time	Common Emitter Configuration	$R_L = 68\Omega$	—	100	200	ns
Output voltage rise time	Emitter Follower Configuration	$R_L = 68\Omega$	—	100	200	ns

TEST CIRCUIT



VOLTAGE WAVEFORMS



MB3759/MB3760

OSCILLATOR FREQUENCY

$$f_{osc} = \frac{1.2}{R_T \cdot C_T}$$

R_T : K Ω
 C_T : μ F
 f_{osc} : KHz

FUNCTION TABLE

Output Control (Mode)	Input		Output Function
	Steering Control (MB3760 Only)		
GND	Open		Single-ended or parallel output
V _{REF}	Open		Push-pull operation
V _{REF}	V _I < 0.4V		PWM Output at Output 1
V _{REF}	V _I > 2.4V		PWM Output at Output 2

TYPICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)

