

THREE-TERMINAL POSITIVE REGULATOR

LM78LXX Series



TO-92

TO-92
Plastic Package
RoHS compliant

GENERAL DESCRIPTIONS:

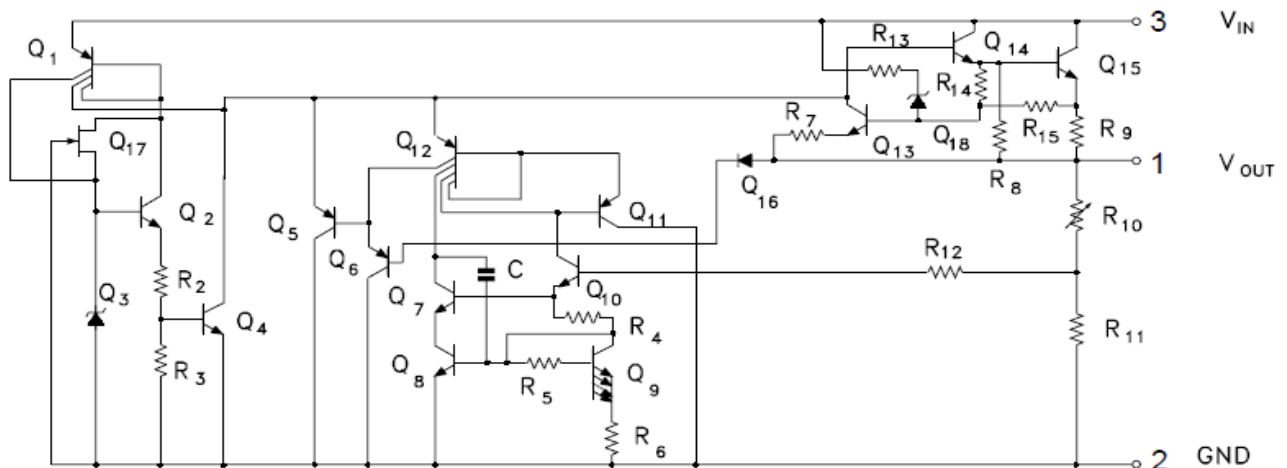
The LM78LXX series of three-terminal positive regulators employ internal current limiting and thermal shutdown, making them essentially indestructible. If adequate heat-sink is provided, they can deliver up to 100 mA output current. They are intended as fixed voltage regulators in a wide range of applications including local or on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power pass elements to make high-current voltage regulators. The LM78LXX series used as Zener diode/resistor combination replacement, offers an effective output impedance improvement of typically two orders of magnitude, along with lower quiescent current and lower noise.

FEATURES:

1. Output current upto 100 mA
2. Output Voltage 3.3; 5; 6; 8; 9; 10; 12; 15; 18; 20; 24V
3. Thermal overload protection.
4. Short circuit protection.
5. No external components required.
6. This product is available in AEC-Q101 Compliant and PPAP Capable also.

Note: For AEC-Q101 compliant products, please use suffix -AQ in the part number while ordering.

SCHEMATIC DIAGRAM





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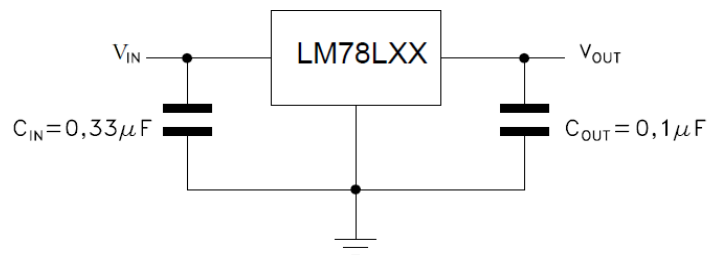
ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C Unless otherwise specified)

PARAMETER		SYMBOL	VALUE	UNIT
DC Input Voltage	V _O = 3.3 to 9 V	V _I	30	V
	V _O = 12 to 15 V		35	
	V _O = 18 to 24 V		40	
Output Current		I _O	100	mA
Lead Temperature 1.6mm (1/16inch) from		T _{stg}	-40 to +150	°C
Operating Junction Temperature Range		T _{op}	-40 to +125	°C

Thermal Resistance

Thermal Resistance Junction to Ambient	R _{th(j-a)}	200	°C/W
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TEST CIRCUIT





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ELECTRICAL CHARACTERISTICS OF LM78L33 (refer to the test circuit, $V_I = 8.3V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	3.168	3.3	3.432	V
		$I_O = 1mA$ to 40mA, $V_I = 5.3V$ to 20V,	3.135	--	3.465	V
		$I_O = 1mA$ to 70mA, $V_I = 8.3V$,	3.135	--	3.465	V
Line Regulation	ΔV_O	$V_I = 5.3V$ to 20V, $T_j = 25^\circ C$	--	--	150	mV
		$V_I = 6.3V$ to 20V, $T_j = 25^\circ C$	--	--	100	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_j = 25^\circ C$	--	--	60	mV
		$I_O = 1mA$ to 40mA, $T_j = 25^\circ C$	--	--	30	mV
Quiescent Current	I_Q	$T_j = 25^\circ C$	--	--	6.0	mA
		$T_j = 125^\circ C$	--	--	5.5	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 6.3V$ to 20V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_j = 25^\circ C$	--	40	--	μV
Supply Voltage Rejection	SVR	$V_I = 6.3$ to 16.3V, $f = 120Hz$, $I_O = 40mA$, $T_j = 25^\circ C$	41	49	--	dB
Dropout Voltage	V_d		--	1.7	--	V

ELECTRICAL CHARACTERISTICS OF LM78L05 (refer to the test circuit, $V_I = 10V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	4.80	5.0	5.20	V
		$I_O = 1mA$ to 40mA, $V_I = 7V$ to 20V,	4.75	--	5.25	V
		$I_O = 1mA$ to 70mA, $V_I = 10V$,	4.75	--	5.25	V
Line Regulation	ΔV_O	$V_I = 7V$ to 20V, $T_j = 25^\circ C$	--	--	150	mV
		$V_I = 8V$ to 20V, $T_j = 25^\circ C$	--	--	100	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_j = 25^\circ C$	--	--	60	mV
		$I_O = 1mA$ to 40mA, $T_j = 25^\circ C$	--	--	30	mV
Quiescent Current	I_Q	$T_j = 25^\circ C$	--	--	6.0	mA
		$T_j = 125^\circ C$	--	--	5.5	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 8V$ to 20V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_j = 25^\circ C$	--	40	--	μV
Supply Voltage Rejection	SVR	$V_I = 8$ to 18V, $f = 120Hz$, $I_O = 40mA$, $T_j = 25^\circ C$	41	49	--	dB
Dropout Voltage	V_d		--	1.7	--	V



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ELECTRICAL CHARACTERISTICS OF LM78L06 (refer to the test circuit, $V_I = 10V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	5.76	6.0	6.24	V
		$I_O = 1mA$ to 40mA, $V_I = 8.5V$ to 20V,	5.70	--	6.30	V
		$I_O = 1mA$ to 70mA, $V_I = 12V$,	5.70	--	6.30	V
Line Regulation	ΔV_O	$V_I = 8.5V$ to 20V, $T_J = 25^\circ C$	--	--	150	mV
		$V_I = 9V$ to 20V, $T_J = 25^\circ C$	--	--	100	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	60	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	30	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6.0	mA
		$T_J = 125^\circ C$	--	--	5.5	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 9V$ to 20V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	50	--	μV
Supply Voltage Rejection	SVR	$V_I = 9$ to 20V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	39	46	--	dB
Dropout Voltage	V_d		--	1.7	--	V

ELECTRICAL CHARACTERISTICS OF LM78L08 (refer to the test circuit, $V_I = 14V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	7.68	8.0	8.32	V
		$I_O = 1mA$ to 40mA, $V_I = 10.5V$ to 23V,	7.60	--	8.40	V
		$I_O = 1mA$ to 70mA, $V_I = 14V$,	7.60	--	8.40	V
Line Regulation	ΔV_O	$V_I = 10.5V$ to 23V, $T_J = 25^\circ C$	--	--	175	mV
		$V_I = 11V$ to 23V, $T_J = 25^\circ C$	--	--	125	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	80	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	40	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6.0	mA
		$T_J = 125^\circ C$	--	--	5.5	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 11V$ to 23V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	60	--	μV
Supply Voltage Rejection	SVR	$V_I = 12$ to 23V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	37	45	--	dB
Dropout Voltage	V_d		--	1.7	--	V



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ELECTRICAL CHARACTERISTICS OF LM78L09 (refer to the test circuit, $V_I = 15V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	8.68	9.0	9.36	V
		$I_O = 1mA$ to 40mA, $V_I = 11.5V$ to 23V,	8.55	--	9.45	V
		$I_O = 1mA$ to 70mA, $V_I = 15V$,	8.55	--	9.45	V
Line Regulation	ΔV_O	$V_I = 11.5V$ to 23V, $T_J = 25^\circ C$	--	--	225	mV
		$V_I = 12V$ to 23V, $T_J = 25^\circ C$	--	--	150	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	80	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	40	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6.0	mA
		$T_J = 125^\circ C$	--	--	5.5	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 12V$ to 23V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	70	--	μV
Supply Voltage Rejection	SVR	$V_I = 12$ to 23V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	37	44	--	dB
Dropout Voltage	V_d		--	1.7	--	V

ELECTRICAL CHARACTERISTICS OF LM78L10 (refer to the test circuit, $V_I = 16V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	9.6	10	10.4	V
		$I_O = 1mA$ to 40mA, $V_I = 12.5V$ to 23V,	9.5	--	10.5	V
		$I_O = 1mA$ to 70mA, $V_I = 16V$,	9.5	--	10.5	V
Line Regulation	ΔV_O	$V_I = 12.5V$ to 23V, $T_J = 25^\circ C$	--	--	230	mV
		$V_I = 13V$ to 23V, $T_J = 25^\circ C$	--	--	170	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	80	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	40	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6	mA
		$T_J = 125^\circ C$	--	--	5.5	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 13V$ to 23V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	60	--	μV
Supply Voltage Rejection	SVR	$V_I = 14$ to 23V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	37	45	--	dB
Dropout Voltage	V_d		--	1.7	--	V



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ELECTRICAL CHARACTERISTICS OF LM78L12 (refer to the test circuit, $V_I = 15V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C			12.5	V
		$I_O = 1mA$ to 40mA, $V_I = 14.5V$ to 23V,		--	12.6	V
		$I_O = 1mA$ to 70mA, $V_I = 19V$,		--	12.6	V
Line Regulation	ΔV_O	$V_I = 14.5V$ to 27V, $T_J = 25^\circ C$	--	--	250	mV
		$V_I = 16V$ to 27V, $T_J = 25^\circ C$	--	--	200	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	100	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	50	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6.5	mA
		$T_J = 125^\circ C$	--	--	6	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 16V$ to 27V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	80	--	μV
Supply Voltage Rejection	SVR	$V_I = 15$ to 25V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	37	42	--	dB
Dropout Voltage	V_d		--	1.7	--	V

ELECTRICAL CHARACTERISTICS OF LM78L15 (refer to the test circuit, $V_I = 19V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	14.4	15	15.6	V
		$I_O = 1mA$ to 40mA, $V_I = 17V$ to 30V,	14.25	--	15.75	V
		$I_O = 1mA$ to 70mA, $V_I = 23V$,	14.25	--	15.75	V
Line Regulation	ΔV_O	$V_I = 17.5V$ to 30V, $T_J = 25^\circ C$	--	--	300	mV
		$V_I = 20V$ to 30V, $T_J = 25^\circ C$	--	--	250	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	150	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	75	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6.5	mA
		$T_J = 125^\circ C$	--	--	6	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 20V$ to 30V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	90	--	μV
Supply Voltage Rejection	SVR	$V_I = 18.5$ to 228.5V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	34	39	--	dB
Dropout Voltage	V_d		--	1.7	--	V



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ELECTRICAL CHARACTERISTICS OF LM78L18 (refer to the test circuit, $V_I = 27V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	17.3	18	18.7	V
		$I_O = 1mA$ to 40mA, $V_I = 22V$ to 33V,	17.1	--	18.9	V
		$I_O = 1mA$ to 70mA, $V_I = 27V$,	17.1	--	18.9	V
Line Regulation	ΔV_O	$V_I = 22V$ to 33V, $T_J = 25^\circ C$	--	--	320	mV
		$V_I = 22V$ to 33V, $T_J = 25^\circ C$	--	--	270	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	170	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	85	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6.5	mA
		$T_J = 125^\circ C$	--	--	6	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 23V$ to 33V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	120	--	μV
Supply Voltage Rejection	SVR	$V_I = 23V$ to 33V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	33	38	--	dB
Dropout Voltage	V_d		--	1.7	--	V

ELECTRICAL CHARACTERISTICS OF LM78L20 (refer to the test circuit, $V_I = 29V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	19.2	20	20.8	V
		$I_O = 1mA$ to 40mA, $V_I = 24V$ to 33V,	19	--	21	V
		$I_O = 1mA$ to 70mA, $V_I = 29V$,	19	--	21	V
Line Regulation	ΔV_O	$V_I = 22.5$ to 34 V, $T_J = 25^\circ C$	--	--	330	mV
		$V_I = 24V$ to 34V, $T_J = 25^\circ C$	--	--	280	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to 100mA, $T_J = 25^\circ C$	--	--	180	mV
		$I_O = 1mA$ to 40mA, $T_J = 25^\circ C$	--	--	90	mV
Quiescent Current	I_Q	$T_J = 25^\circ C$	--	--	6.5	mA
		$T_J = 125^\circ C$	--	--	6	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to 40mA	--	--	0.1	mA
		$V_I = 25V$ to 33V	--	--	1.5	mA
Output Noise Voltage	eN	B = 10Hz to 100KHz, $T_J = 25^\circ C$	--	120	--	μV
Supply Voltage Rejection	SVR	$V_I = 25$ to 35V, $V_f = 120Hz$, $I_O = 40mA$, $T_J = 25^\circ C$	32	38	--	dB
Dropout Voltage	V_d		--	1.7	--	V



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ELECTRICAL CHARACTERISTICS OF LM78L24 (refer to the test circuit, $V_I = 27V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Output Voltage	V_O	25°C	23	24	25	V
		$I_O = 1mA$ to $40mA$, $V_I = 27$ to $38V$,	22.8	--	25.2	V
		$I_O = 1mA$ to $70mA$, $V_I = 33V$,	22.8	--	25.2	V
Line Regulation	ΔV_O	$V_I = 27$ to $38V$, $T_j = 25^\circ C$	--	--	350	mV
		$V_I = 28$ to $38V$, $T_j = 25^\circ C$	--	--	300	mV
Load Regulation	ΔV_O	$I_O = 1mA$ to $100mA$, $T_j = 25^\circ C$	--	--	200	mV
		$I_O = 1mA$ to $40mA$, $T_j = 25^\circ C$	--	--	100	mV
Quiescent Current	I_Q	$T_j = 25^\circ C$	--	--	6.5	mA
		$T_j = 125^\circ C$	--	--	6	mA
Quiescent Current Change	ΔI_d	$I_O = 1mA$ to $40mA$	--	--	0.1	mA
		$V_I = 28$ to $38V$, $T_j = 25^\circ C$	--	--	1.5	mA
Output Noise Voltage	eN	$B = 10Hz$ to $100KHz$, $T_j = 25^\circ C$	--	200	--	μV
Supply Voltage Rejection	SVR	$V_I = 23$ to $33V$, $V_f = 120Hz$, $I_O = 40mA$, $T_j = 25^\circ C$	31	37	--	dB
Dropout Voltage	V_d		--	1.7	--	V

Typical Characteristics Curves

Fig. 1. LM78L05/12 Output Voltage vs Ambient Temperature

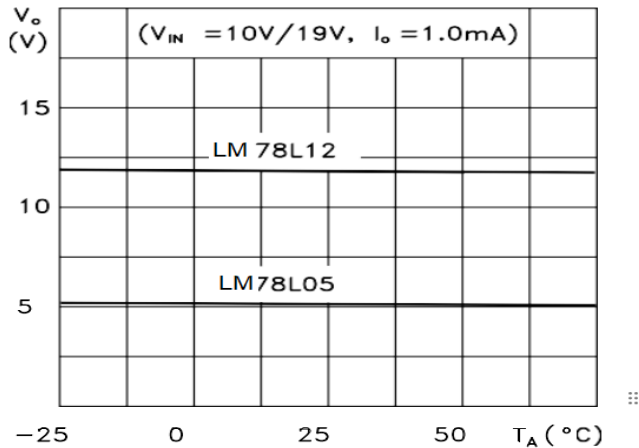


Fig. 4. LM78L05/12 Quiescent Current vs Output Current

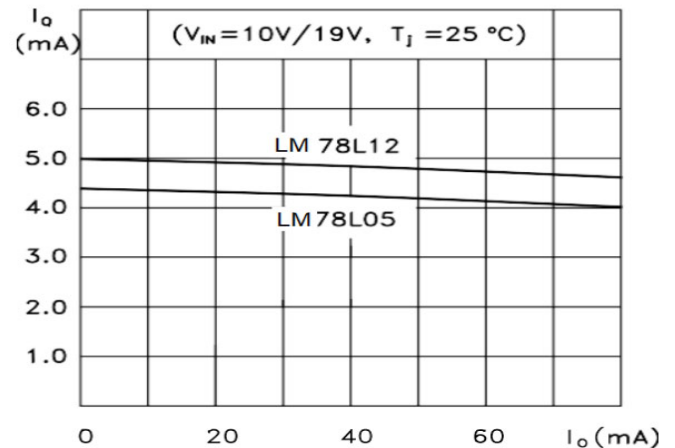


Fig. 2. LM78L05/12/24 Load Characteristics

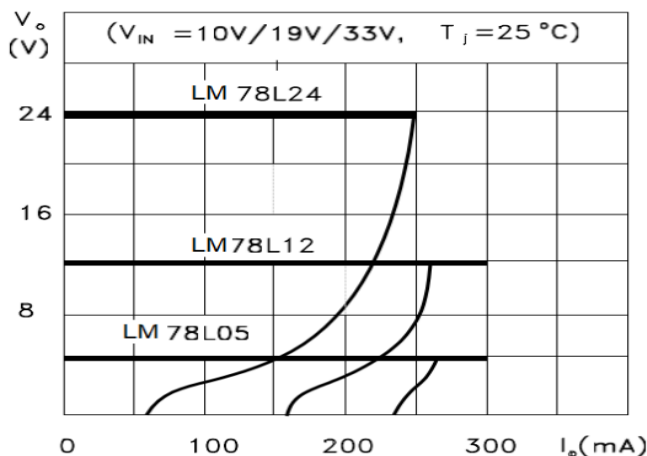


Fig. 5. LM78L05 Quiescent Current vs Input Voltage

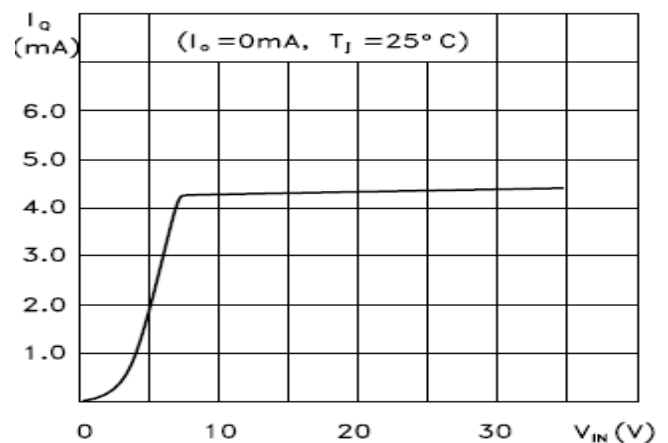


Fig. 3. LM78L05/12/24 Thermal Shutdown

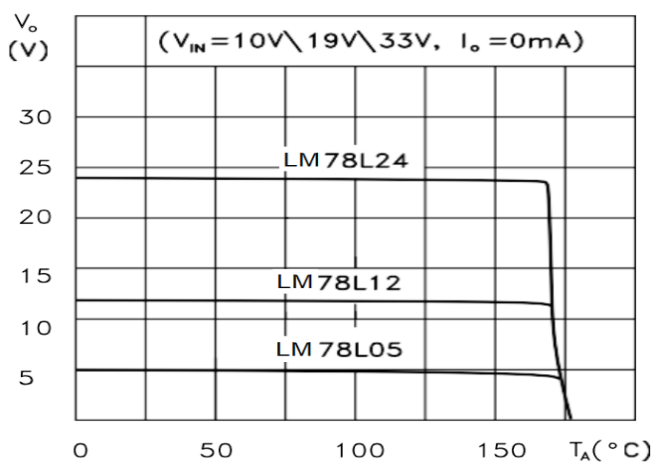
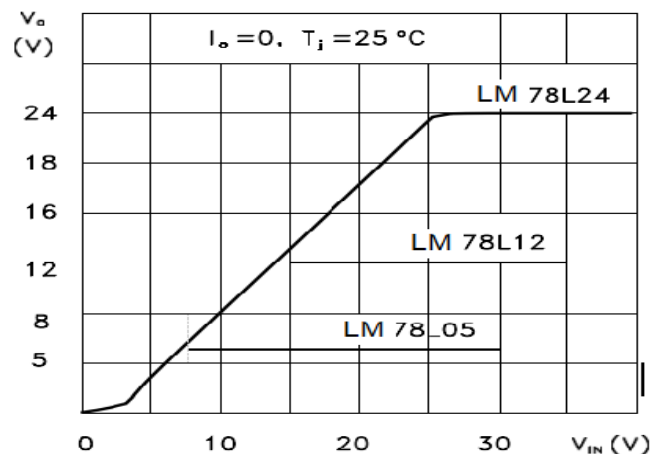


Fig. 6. LM78L05/12/24 Output Characteristics



Typical Characteristics Curves

Fig. 7. LM78L05/12/24 Ripple Rejection

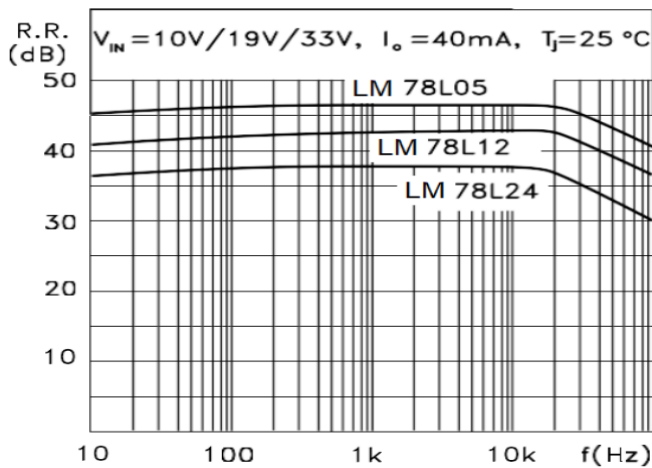


Fig. 8. LM78L05 Dropout Characteristics

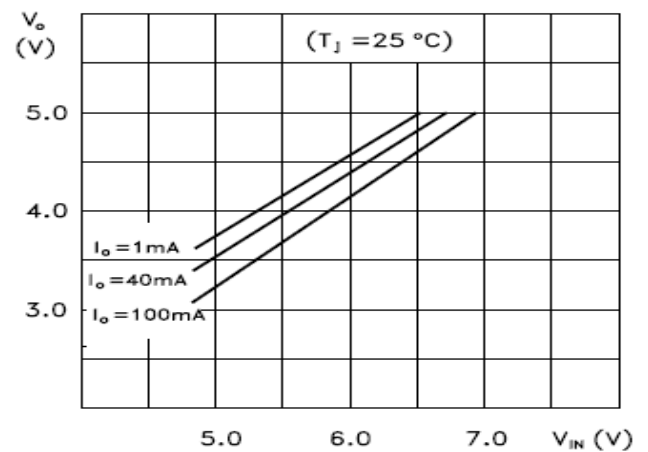
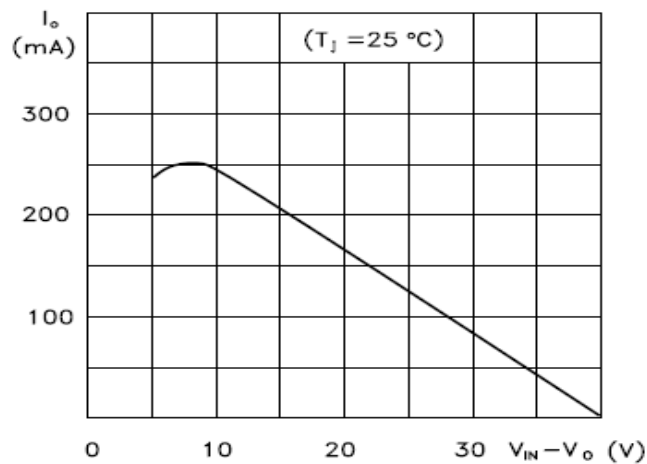


Fig. 9. LM78LXX Series Short Circuit Output Current



TYPICAL APPLICATIONS

Fig. 10. High Output Current Short Circuit Protected

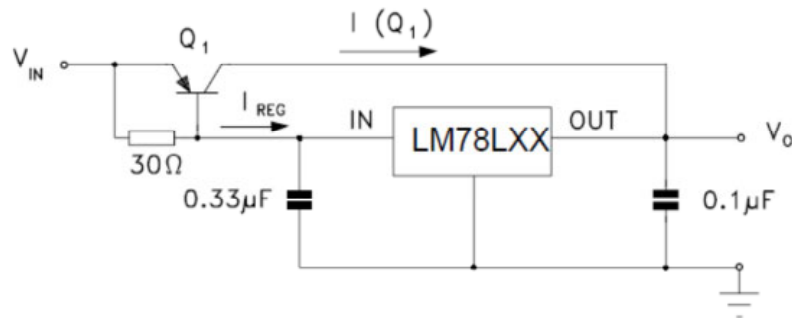


Fig. 11. Edit Boost Circuit

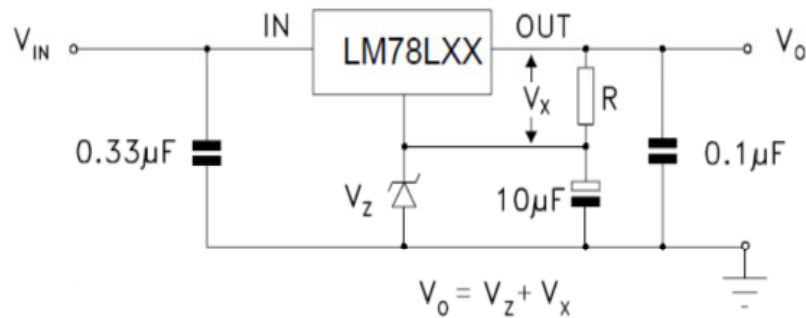


Fig. 12. Current Regulator

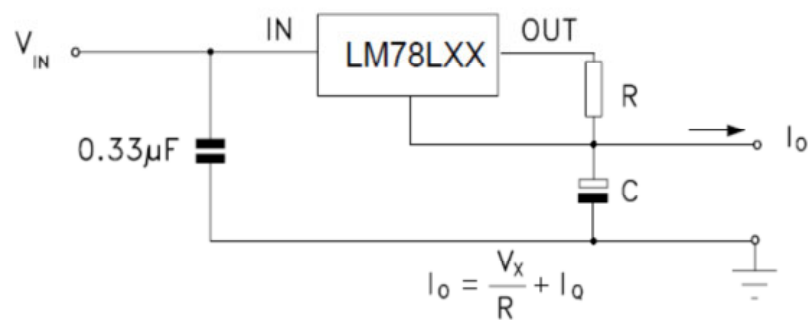
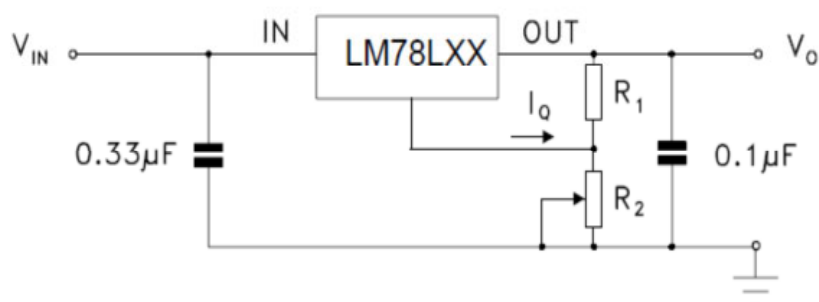
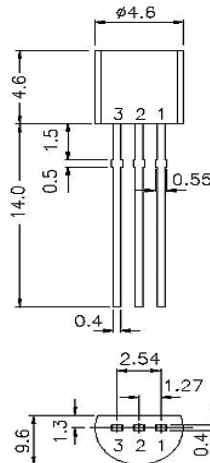


Fig. 13. Adjustable Output Regulator



Package Details

TO-92 Plastic Package



All Dimensions are in mm

Pin Configuration

1. Input
2. Ground
3. Output

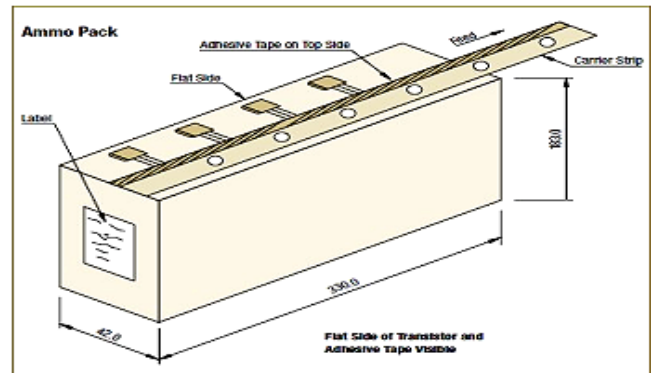
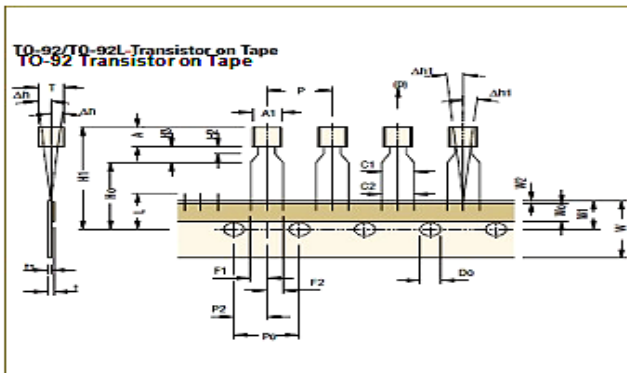
Packing details of TO-92

Packaging Specifications . . .

T & A: Tape and Ammo Pack; T & R: Tape and Reel; Bulk: Loose in Poly Bags; Tube: Tube and Carton; K: 1,000

Package / Case Type	Packaging Type	Std. Packing		Inner Carton		Outer Carton		
		Qty	Qty	Size L x W x H (cm)	Gross Weight (Kg)	Qty	Size L x W x H (cm)	Gross Weight (Kg)
TO-92	Bulk	1,000	5K	19 x 19 x 8	1.1	80K	43 x 40 x 35	20.0
	T & A	2,000	2K	32 x 4.5 x 20	0.7	40K	43 x 40 x 35	15.2

TO-92 and Tape and Ammo Packaging





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Tape Specifications

		T0-92			
Item description	Symbol	Min	Nom	Max	Tol
Body width	A1	4.45		5.20	
Body height	A	4.32		5.33	
Body thickness	T	3.18		4.19	
Pitch of component ^{Cr}	P		12.7		±1.0
Feed hole pitch ^{§1}	Po		12.7		±0.3
Feed hole center to component centre ^{§2}	P2		6.35		±0.4
Comp. alignment, Side view ^{§3}	Dh		0	1.0	
Comp. alignment, Front view ^{§3}	Dh1		0	1.3	
Tape width ^{Cr}	W		18		±0.5
Hold down tape width ^{Cr}	Wo		6		±0.2
Hole position	W1		9		+0.7 -0.5
Hold-down tape position	W2	0.0		0.7	
Lead wire clinch height	Ho		16		±0.5
Component height	H1			24.0	
Length of snapped leads	L			11.0	
Feed hole diameter ^{Cr}	Do		4		±0.2
Total tape thickness ^{§4}	t			1.2	
Lead-to-lead distance ^{Cr}	F1, F2	2.4		2.7	
Stand off	H2	0.45		1.45	
Clinch height	H3			3.0	
Lead parallelism ^{Cr}	C1-C2			0.22	
Pull-out force	(p)	6N			

Taping Specification

- Maximum alignment deviation between leads not to be greater than 0.20 mm.
- Maximum non-cumulative variation between tape feed holes shall not exceed 1 mm in 20 pitches.
- Hold down tape not to exceed beyond the edge(s) carrier tape and there shall be no exposure of adhesive.
- No more than 3 consecutive missing components is permitted.
- A tape trailer, having at least three feed holes is required after the last component.
- Splices shall not interfere with the sprocket feed holes.

§1 Cumulative pitch error 1.0 mm/20 pitch.

§2 To be measured at bottom of clinch.

§3 At top of body.

§4 t1 = 0.3 – 0.6 mm

Cr Critical Dimension.

Recommended Reflow Solder Profiles

The recommended reflow solder profiles for Pb and Pb-free devices are shown below.

Figure 1 shows the recommended solder profile for devices that have Pb-free terminal plating, and where a Pb-free solder is used.

Figure 2 shows the recommended solder profile for devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with a leaded solder.

Figure 1

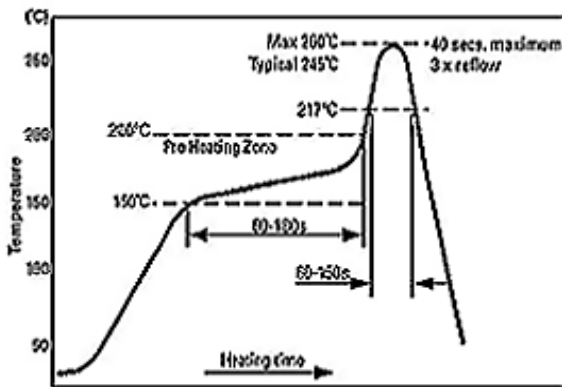
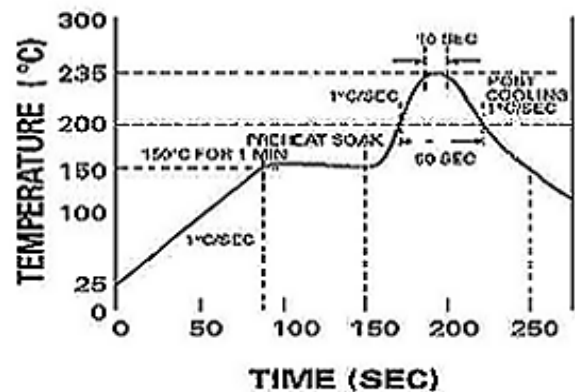


Figure 2

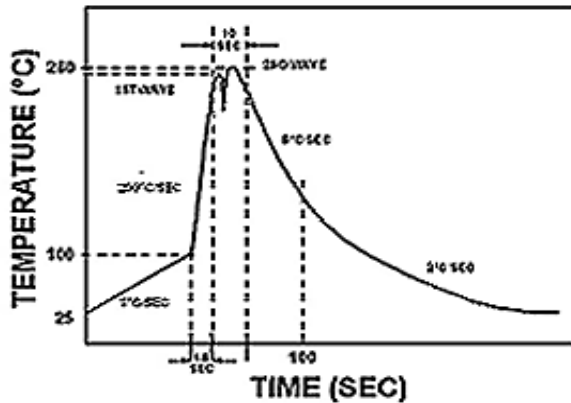


Reflow profiles in tabular form

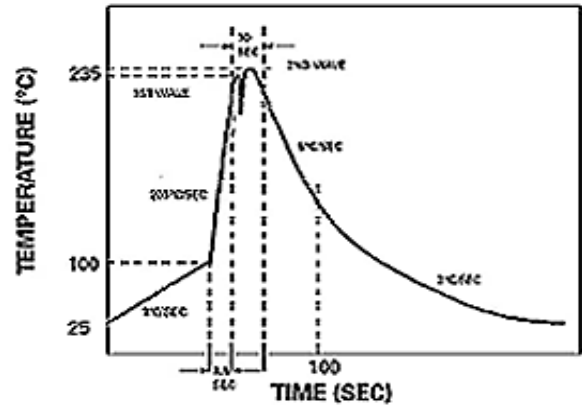
Profile Feature	Sn-Pb System	Pb-Free System
Average Ramp-Up Rate	~3°C/second	~3°C/second
Preheat – Temperature Range – Time	150-170°C 60-180 seconds	150-200°C 60-180 seconds
Time maintained above: – Temperature – Time	200°C 30-50 seconds	217°C 60-150 seconds
Peak Temperature	235°C	260°C max.
Time within +0 -5°C of actual Peak	10 seconds	40 seconds
Ramp-Down Rate	3°C/second max.	6°C/second max.

Recommended Wave Solder Profiles

The Recommended solder Profile For Devices with Pb-free terminal plating where a Pb-free solder is used



The Recommended solder Profile For Devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with leaded solder



Wave Profiles in Tabular Form

Profile Feature	Sn-Pb System	Pb-Free System
Average Ramp-Up Rate	~200°C/second	~200°C/second
Heating rate during preheat	Typical 1-2, Max 4°C/sec	Typical 1-2, Max 4°C/Sec
Final preheat Temperature	Within 125°C of Solder Temp	Within 125°C of Solder Temp
Peak Temperature	235°C	260°C max.
Time within +0 -5°C of actual Peak	10 seconds	10 seconds
Ramp-Down Rate	5°C/second max.	5°C/second max



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Recommended Product Storage Environment for Discrete Semiconductor Devices

This storage environment assumes that the Diodes and transistors are packed properly inside the original packing supplied by CDIL.

- Temperature 5 °C to 30 °C
- Humidity between 40 to 70 %RH
- Air should be clean.
- Avoid harmful gas or dust.
- Avoid outdoor exposure or storage in areas subject to rain or water spraying .
- Avoid storage in areas subject to corrosive gas or dust. Product shall not be stored in areas exposed to direct sunlight.
- Avoid rapid change of temperature.
- Avoid condensation.
- Mechanical stress such as vibration and impact shall be avoided.
- The product shall not be placed directly on the floor.
- The product shall be stored on a plane area. They should not be turned upside down.
- They should not be placed against the wall.

Shelf Life of CDIL Products

The shelf life of products is the period from product manufacture to shipment to customers. The product can be unconditionally shipped within this period. The period is defined as 2 years.

If products are stored longer than the shelf life of 2 years the products shall be subjected to quality check as per CDIL quality procedure.

The products are further warranted for another one year after the date of shipment subject to the above conditions in CDIL original packing.

Floor Life of CDIL Products and MSL Level

When the products are opened from the original packing, the floor life will start.

For this, the following JEDEC table may be referred:

JEDEC MSL Level		
Level	Time	Condition
1	Unlimited	≤30 °C / 85% RH
2	1 Year	≤30 °C / 60% RH
2a	4 Weeks	≤30 °C / 60% RH
3	168 Hours	≤30 °C / 60% RH
4	72 Hours	≤30 °C / 60% RH
5	48 Hours	≤30 °C / 60% RH
5a	24 Hours	≤30 °C / 60% RH
6	Time on Label(TOL)	≤30 °C / 60% RH



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Component Disposal Instructions

1. CDIL Semiconductor Devices are RoHS compliant, customers are requested to please dispose as per prevailing Environmental Legislation of their Country.
2. In Europe, please dispose as per EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).

Disclaimer

The product information and the selection guides facilitate selection of the CDIL's Semiconductor Device(s) best suited for application in your product(s) as per your requirement. It is recommended that you completely review our Data Sheet(s) so as to confirm that the Device(s) meet functionality parameters for your application. The information furnished in the Data Sheet and on the CDIL Web Site/CD are believed to be accurate and reliable. CDIL however, does not assume responsibility for inaccuracies or incomplete information. Furthermore, CDIL does not assume liability whatsoever, arising out of the application or use of any CDIL product; neither does it convey any license under its patent rights nor rights of others. These products are not designed for use in life saving/support appliances or systems. CDIL customers selling these products (either as individual Semiconductor Devices or incorporated in their end products), in any life saving/support appliances or systems or applications do so at their own risk and CDIL will not be responsible for any damages resulting from such sale(s).

CDIL strives for continuous improvement and reserves the right to change the specifications of its products without prior notice.



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