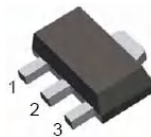


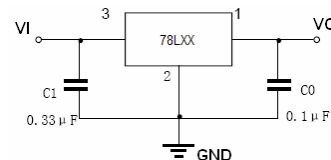
Features

- Wide range of available, fixed output voltage.
- Low cost.
- Internal short-circuit current limiting.
- Internal thermal overload protection.
- No external components required.
- Complementary negative regulators offered

78LXX



SOT-89



Absolute Maximum Ratings ($T_c = 25^\circ\text{C}$)

Symbol	Parameter	Value	Units
V_I	Input voltage(3.3V-9V) (10V-15V) (18V-24V)	30	V
		35	
		40	
I_{CM}	Maximum output current	150	mA
P_D	Power dissipation	500	mW
T_{OPR}	Operating junction temperature	0 to +125	$^\circ\text{C}$
T_J, T_{stg}	Storage temperature range	-40 to +150	$^\circ\text{C}$

Electrical Characteristics

($V_{IN}=10\text{V}, I_O=40\text{mA}, 0^\circ\text{C} < T_J < 125^\circ\text{C}, C_I=0.33\mu\text{F}, C_O=0.1\mu\text{F}$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L05			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ\text{C}$ $7\text{V} \leq V_I \leq 20\text{V}, I_O=1\text{mA}-40\text{mA}$ $V_I=10\text{V}, I_O=1\text{mA}-70\text{mA}$	4.8 4.75 4.75	5.0	5.2 5.25 5.25	V
Load regulation	Reg_{load}	$T_J=25^\circ\text{C}, I_O=1\text{mA}-100\text{mA}$ $T_J=25^\circ\text{C}, I_O=1\text{mA}-40\text{mA}$		11 5	60 30	mV
Line regulation	Reg_{line}	$7\text{V} \leq V_I \leq 20\text{V}, T_J=25^\circ\text{C}$ $8\text{V} \leq V_I \leq 20\text{V}, T_J=25^\circ\text{C}$		55 45	150 100	mV
Input Bias Current	I_{IB}	$T_J=25^\circ\text{C}$ $T_J=125^\circ\text{C}$		3.8	6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$8\text{V} \leq V_I \leq 20\text{V}$ $1\text{mA} \leq I_O \leq 40\text{mA}$			1.5 0.1	mA
Output noise voltage	V_N	$10\text{Hz} \leq f \leq 100\text{KHz}$		40		μV
Ripple rejection	RR	$I_O=40\text{mA}, 8\text{V} \leq V_I \leq 18\text{V}, f=120\text{Hz}$ $T_J=25^\circ\text{C}$	41	49		dB
Dropout voltage	$V_I - V_O$	$T_J=25^\circ\text{C}$		1.7		V

Electrical Characteristics

($V_{IN}=10V, I_O=40mA, 0^{\circ}C < T_J < 125^{\circ}C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L33			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^{\circ}C$ $5.3V \leq V_i \leq 20V, I_O=1mA-40mA$ $V_i=8.3V, I_O=1mA-70mA$	3.168 3.135 3.135	3.3	3.432 3.465 3.465	V
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-40mA$			60 30	mV
Line regulation	Reg_{line}	$5.3V \leq V_i \leq 20V, T_J=25^{\circ}C$ $6.3V \leq V_i \leq 20V, T_J=25^{\circ}C$			150 100	mV
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$			6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$6.3V \leq V_i \leq 20V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz$		40		μV
Ripple rejection	RR	$I_O=40mA, 6.3V \leq V_i \leq 16.3V$ $f=120Hz, T_J=25^{\circ}C$	41	49		dB
Dropout voltage	V_i-V_O	$T_J=25^{\circ}C$		1.7		V

($V_{IN}=12V, I_O=40mA, 0^{\circ}C < T_J < 125^{\circ}C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L06			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^{\circ}C$ $V_i=8.5V-20V, I_O=1mA-40mA$ $V_i=8.5V, I_O=1mA-70mA$	5.75 5.7 5.7	6.0	6.25 6.3 6.3	V
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-70mA$		12.8 5.8	80 40	mV
Line regulation	Reg_{line}	$8.5V \leq V_i \leq 20V, T_J=25^{\circ}C$ $9V \leq V_i \leq 20V, T_J=25^{\circ}C$		64 54	175 125	mV
Input Bias Current	I_{IB}	$T_J=25^{\circ}C, V_{IN}=12V, I_O=40mA$ $T_J=125^{\circ}C, V_{IN}=12V, I_O=40mA$		3.9	5.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$9V \leq V_i \leq 20V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz$		40		$\mu V/V_O$
Ripple rejection	RR	$I_O=40mA, 10V \leq V_i \leq 20V, f=120Hz,$ $T_J=25^{\circ}C$	40	46		dB
Dropout voltage	V_D	$T_J=25^{\circ}C$		1.7		V

Electrical Characteristics

ELECTRICAL CHARACTERISTICS

($V_I=14V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1Mf$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L08			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $10.5V \leq V_I \leq 23V, I_O=1mA-40mA$ $V_I=14V, I_O=1mA-70mA$	7.7 7.6 7.6	8.0	8.3 8.4 8.4	V
Load regulation	Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$		15 8.0	80 40	mV
Line regulation	Reg_{line}	$10.5V \leq V_I \leq 23V, T_J=25^\circ C$ $11V \leq V_I \leq 23V, T_J=25^\circ C$		20 12	175 125	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$		3	6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$11V \leq V_I \leq 23V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	V_N	$T_A=25^\circ C, 10Hz \leq f \leq 100KHz$		60		μV
Ripple rejection	RR	$I_O=40mA, 12V \leq V_I \leq 23V, f=120Hz, T_J=25^\circ C$	37	57		dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$		1.7		V

($V_I=15V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L09			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=11.5V-24V, I_O=1mA-40mA$ $V_I=15V, I_O=1mA-70mA$	8.6 8.5 8.5	9.0	9.4 9.5 9.5	V
Load regulation	Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$		15 8.0	90 40	mV
Line regulation	Reg_{line}	$11.5V \leq V_I \leq 24V, T_J=25^\circ C$ $12V \leq V_I \leq 24V, T_J=25^\circ C$		20 12	175 125	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$		3.0	6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$11V \leq V_I \leq 23V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	V_N	$T_A=25^\circ C, 10Hz \leq f \leq 100KHz$		60		μV
Ripple rejection	RR	$I_O=40mA, 13V \leq V_I \leq 24V, f=120Hz, T_J=25^\circ C$	37	57		dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$		1.7		V

Electrical Characteristics

($V_I=19V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu f$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L12			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=14.5V-27V, I_O=1mA-40mA$ $V_I=19V, I_O=1mA-70mA$	11.5 11.4 11.4	12	12.5 12.6 12.6	V
Load regulation	Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$		20 10	100 50	mV
Line regulation	Reg_{line}	$14.5V \leq V_I \leq 27V, T_J=25^\circ C$ $16V \leq V_I \leq 27V, T_J=25^\circ C$		120 100	250 200	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$		4.2	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$16V \leq V_I \leq 27V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$		80		μV
Ripple rejection	RR	$I_O=40mA, 15V \leq V_I \leq 25V, f=120Hz,$ $T_J=25^\circ C$	37	42		dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$		1.7		V

($V_{IS}=23V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu f$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L15			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=17.5V-30V, I_O=1mA-40mA$ $V_I=23V, I_O=1mA-70mA$	14.4 14.25 14.25	15	15.6 15.75 15.75	V
Load regulation	ΔReg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$		25 12	150 75	mV
Line regulation	ΔReg_{line}	$17.5V \leq V_I \leq 30V, T_J=25^\circ C$ $20V \leq V_I \leq 30V, T_J=25^\circ C$		130 110	300 250	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$		4.4	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$20V \leq V_I \leq 30V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$		90		μV
Ripple rejection	RR	$I_O=40mA, 18.5V \leq V_I \leq 28.5V,$ $f=120Hz, T_J=25^\circ C$	34	39		dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$		1.7		V

Electrical Characteristics

($V_I=27V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L18			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=20.7V-33V, I_O=1mA-40mA$ $V_I=27V, I_O=1mA-70mA$	17.3 17.1 17.1	18	18.7 18.9 18.9	V
Load regulation	Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$		30 15	170 85	mV
Line regulation	Reg_{line}	$20.7V \leq V_I \leq 33V, T_J=25^\circ C$ $21V \leq V_I \leq 33V, T_J=25^\circ C$		45 35	325 275	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$		3.1	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$21V \leq V_I \leq 33V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$		150		μV
Ripple rejection	RR	$I_O=40mA, 23V \leq V_I \leq 33V, f=120Hz,$ $T_J=25^\circ C$	33	48		dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$		1.7		V

($V_{IS}=33V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L24			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=27V-38V, I_O=1mA-40mA$ $V_I=27V-33V, I_O=1mA-70mA$	23 22.8 22.8	24	25 25.2 25.2	V
Load regulation	ΔReg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$		40 20	200 100	mV
Line regulation	ΔReg_{line}	$27.5V \leq V_I \leq 38V, T_J=25^\circ C$ $28V \leq V_I \leq 38V, T_J=25^\circ C$		35 30	350 300	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$		3.1	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$28V \leq V_I \leq 38V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$		200		μV
Ripple rejection	RR	$I_O=40mA, 29V \leq V_I \leq 35V,$ $f=120Hz, T_J=25^\circ C$	31	45		dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$		1.7		V

RATING AND CHARACTERISTIC CURVES

Figure 1. Dropout Characteristics

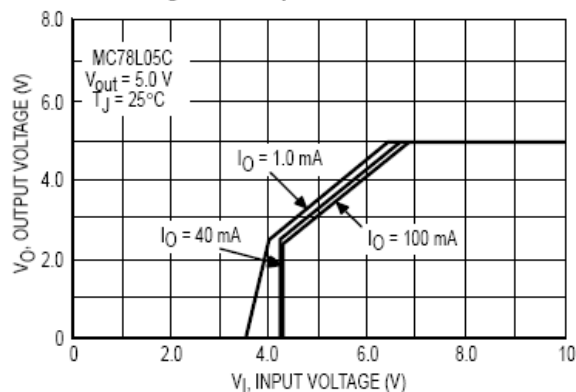


Figure 2. Dropout Voltage versus Junction Temperature

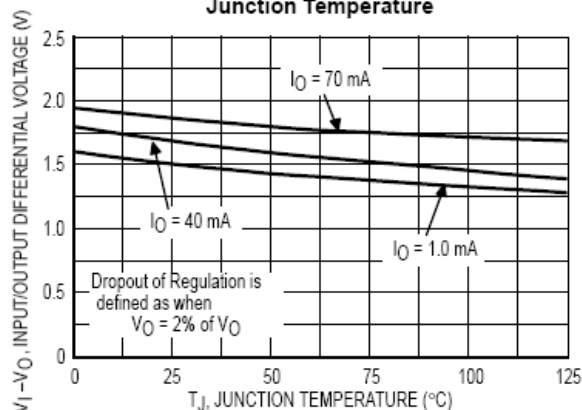


Figure 3. Input Bias Current versus Ambient Temperature

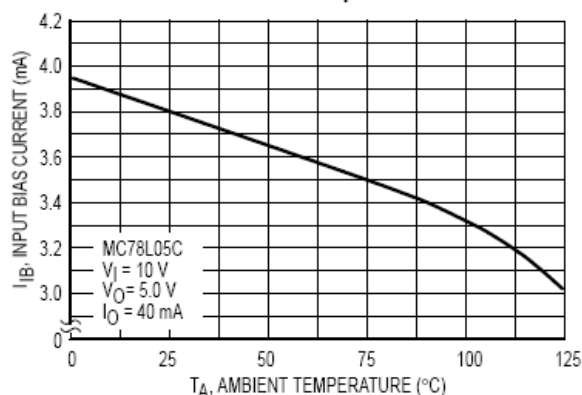


Figure 4. Input Bias Current versus Input Voltage

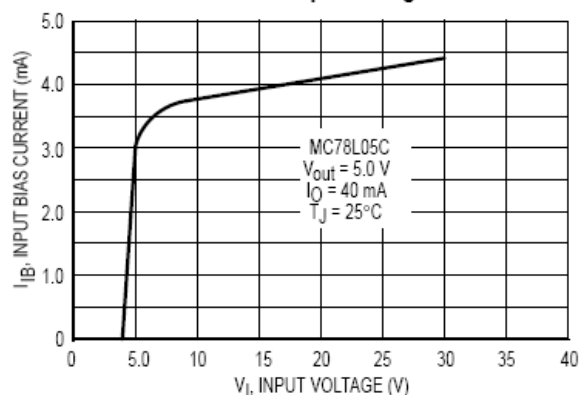


Figure 5. Maximum Average Power Dissipation versus Ambient Temperature – TO-92 Type Package

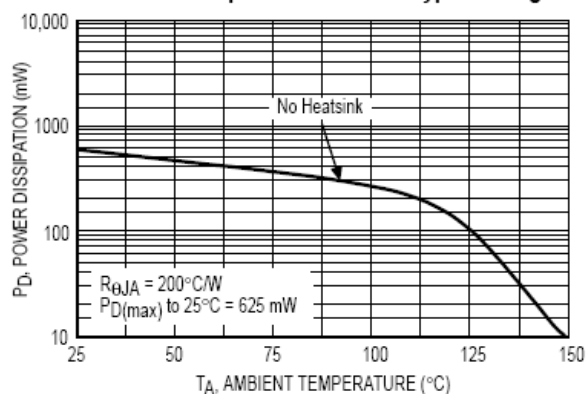
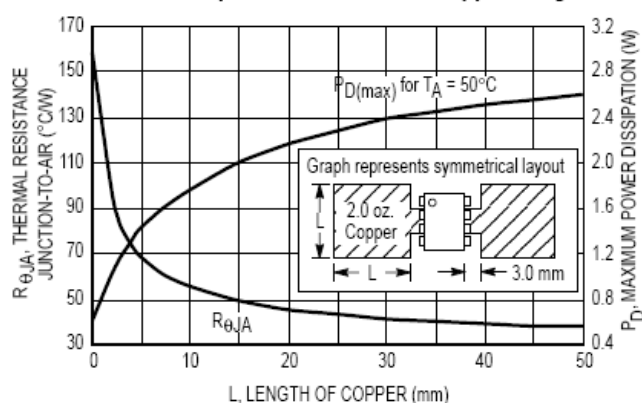
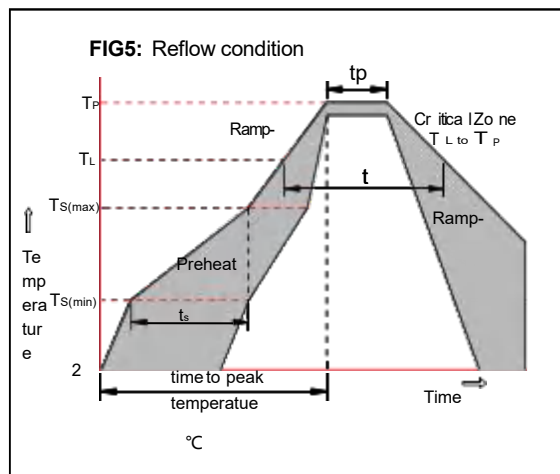


Figure 6. SOP-8 Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

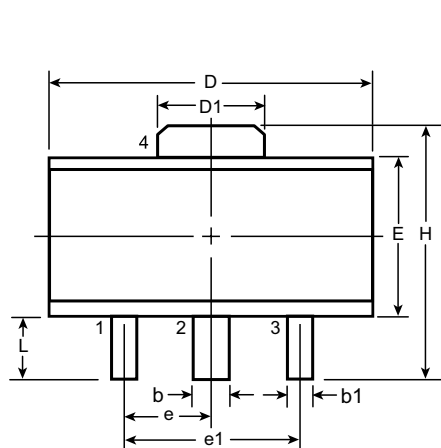


Soldering parameters

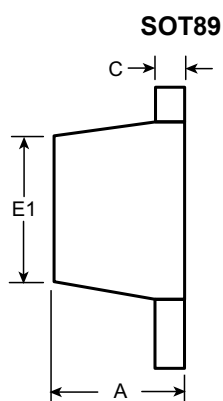
Reflow Condition		Pb-Free assembly (see as below)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150°C
	-Temperature Max($T_{s(max)}$)	+200°C
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3°C/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217°C
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_P)		+260(+0/-5)°C
Time within 5°C of actual Peak Temp (t_p)		30 secs. Max
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp (T_P)		8 min. Max
Do not exceed		+260°C



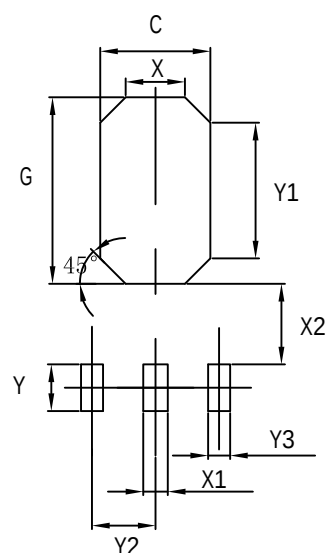
Package Dimensions & Suggested Pad Layout



Top View



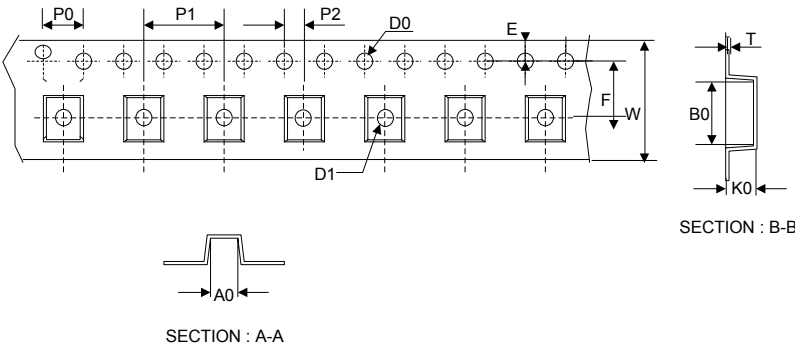
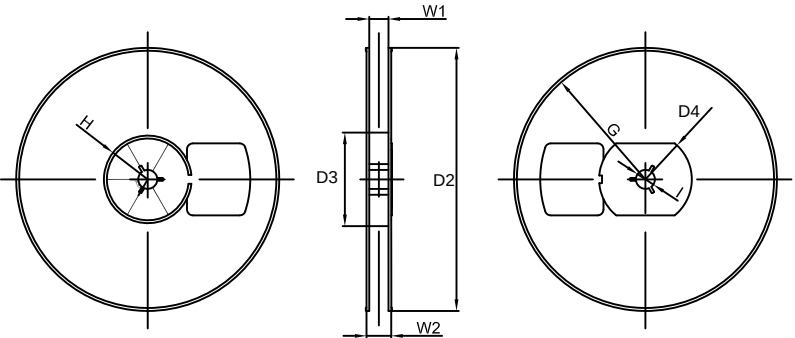
Side View



Symbol		A	b	b1	C	D	D1	E	E1	e	e1	H	L
Dimensions (mm)	MIN	1.40	0.44	0.36	0.3	4.40	1.50	2.29	2.00†	1.50 BSC	3.00 BSC	3.94	0.89
	NOM	-	-	-	-	-	-	-	-			-	-
	MAX	1.60	0.56	0.48	0.5	4.60	1.75	2.60	2.29			-	-

Dimensions	Value (in mm)
C	2.50
G	3.60
X	1.40
X1	0.90
X2	0.90
Y	1.40
Y1	2.60
Y2	1.50
Y3	0.90

Soldering parameters

Tape		Symbol	Dimension (mm)
		P0	4.00±0.20
		P1	8.00±0.20
		P2	2.00±0.20
		D0	1.60±0.20
		D1	1.60±0.20
		E	1.75±0.20
		F	7.50±0.15
		W	16.00±0.20
		A0	6.30±0.20
		B0	8.25±0.20
		K0	2.60±0.20
		T	0.23±0.10
		D2	180.0±5.0
		D3	60Min.
13" Reel		D4	R32.0±2.0
		G	R86.5±2.0
		H	R30.0±2.0
		I	13.0±2.0
		W1	13.20±2.0
		W2	16.50±2.0
		Quantity: 1000PCS	