

TO-220-5L

**TO-263-5L
(D²PAK)**

**TO-252-5L
(DPAK)**

Pin Definition:

1. Input
2. Reset Output
3. Ground
4. Reset Delay
5. Output

General Description

This device is a 5V low-drop fixed-voltage regulator. The maximum input voltage is 42V (65V, ≤ 400 ms). Up to an input voltage of 26V and for an output current up to 550mA it regulates the output voltage within a 2% accuracy. The short circuit protection limits the output current of more than 650mA. The device incorporates over voltage protection and temperature protection that disables the circuit at un-permissibly high temperatures.

Features

- Output Voltage tolerance $\pm 2\%$
- Low-drop Voltage
- Integrated Over Temperature Protection
- Reverse Polarity Protection
- Input Voltage up to 42V
- Over Voltage Protection up to 65V (≤ 400 mS)
- Short-Circuit Proof
- Suitable for use in Automotive Electronics
- Wide Temperature Range
- Adjustable Reset Time
- ESD Protection > 4KV

Ordering Information

Part No.	Package	Packing
TS4270CZ550 C0	TO-220-5L	50pcs / Tube
TS4270CM550 RN	TO-263-5L	800pcs / 13" Reel
TS4270CP550 RO	TO-252-5L	2.5kpcs / 13" Reel

Absolute Maximum Rating ($T_J = -40 \sim 150^\circ\text{C}$)

Parameter	Symbol	Limit	Unit
Input Voltage	V_I	42	V
Input Voltage ($t \leq 400$ mS)	V_I	65	V
Operating Input Voltage Range	V_I	6 to 42	V
Reset Output Voltage	V_R	-0.3 to 7	V
Reset Delay Voltage	V_D	-0.3 to 7	V
Output Voltage	V_O	-1.0 to 16	V
Ground Current	I_{GND}	-0.5	A
Storage Temperature Range	T_{ST}	-50 to +150	$^\circ\text{C}$
Junction Temperature Range	T_J	-40 to +150	$^\circ\text{C}$

Thermal Information

Parameter		Symbol	Maximum	Unit
Thermal Resistance* (Junction to Case)	TO-263-5L	$R_{\theta_{JC}}$	3	K/W
	$t < 1$ mS	$Z_{\theta_{JC}}$	2	
Thermal Resistance* (Junction to Ambient)	TO-263-5L	$R_{\theta_{JA}}$	65	K/W

Electrical Specifications ($V_{IN}=13.5V$, $-40^{\circ}C \leq T_J \leq 150^{\circ}C$, unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$5mA \leq I_Q \leq 550mA$, $6V \leq V_I \leq 26V$	4.90	5	5.10	V
Output Voltage	V_{OUT}	$I_Q \leq 300mA$: $26V \leq V_I \leq 36V$	4.90	5	5.10	V
Output Current Limit	I_{Qmax}	$V_O = 0V$	650	850	--	mA
Current Consumption ($I_q = I_I - I_O$)	I_q	$I_O = 5mA$,	--	1	1.5	mA
Current Consumption ($I_q = I_I - I_O$)	I_q	$I_O = 550mA$,	--	55	75	mA
Current Consumption ($I_q = I_I - I_O$)	I_q	$I_O = 550mA$, $V_I = 5V$	--	70	90	mA
Dropout Voltage (Note 1)	V_{DR}	$I_O = 550mA$	--	350	700	mV
Load Regulation	REG_{LOAD}	$I_O = 5 \sim 550mA$, $V_I = 6V$	--	25	50	mV
Line Regulation	REG_{LINE}	$I_O = 5mA$, $V_I = 6 \sim 26V$	--	12	25	mV
Power Supply Ripple Rejection	PSRR	$f=100Hz$, $V_r = 0.5V_{SS}$	--	54	--	dB

Reset Generator

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Switching Threshold	V_{RT}		4.5	4.65	4.8	V
Reset High Voltage	V_{ROH}		4.5	--	--	V
Reset Low Voltage (Note 2)	V_{ROL}	$R_{intern} = 30k\Omega$, $1V \leq V_O \leq 4.5V$	--	60	--	mV
Reset Low Voltage	V_{ROL}	$I_R = 3mA$, $V_O = 4.4V$	--	200	400	mV
Reset Pull-up	R	Internally Connected to Output	18	30	46	k Ω
Lower Reset Timing Threshold	V_{DRL}	$V_O < V_{RT}$	0.2	0.45	0.8	V
Charge Current	I_d	$V_D = 1V$	8	14	25	μA
Upper Timing Threshold	V_{DU}		1.4	1.8	2.3	V
Delay Time	td	$C_D = 100nF$	--	13	--	ms
Reset Reaction Time	t_{RR}	$C_D = 100nF$	--	--	3	μs

Over Voltage Protection

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Turn-off Voltage	$V_{L,OV}$		42	44	46	V

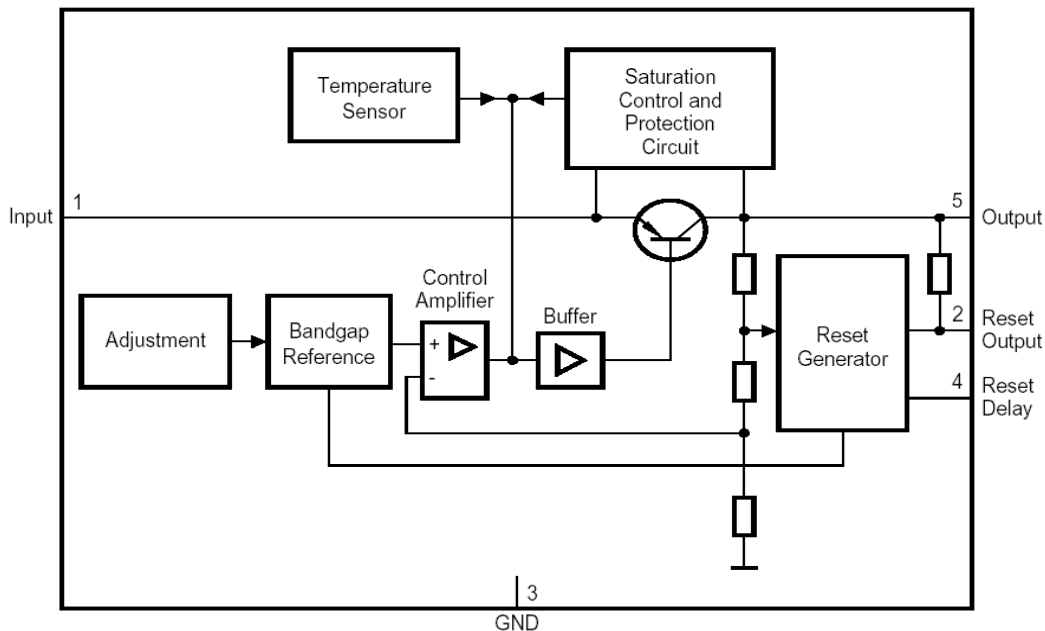
Note:

- Drop voltage = $V_{IN} - V_{OUT}$ (measured when the output voltage has dropped 100 mV from the nominal value obtained at 13.5 V input)
- Reset peak is always lower than 1.0 V.

Pin Definitions and Functions

Pin	Symbol	Function
1	Input	Block to ground directly on the IC with ceramic capacitor
2	Reset Output	The open collector output is connected to the 5 V output via an integrated resistor of 30 k Ω
3	GND	Internally connected to heatsink
4	Reset Delay	Connect a capacitor to ground for delay time adjustment
5	Output	5V, block to ground with 22 mF capacitor ESR, < 3W

Block Diagram



Application Description

The IC regulates an input voltage in the range of $5.5V < V_I < 36V$ to $V_{Onom} = 5.0V$. Up to 26V it produces a regulated output current of more than 550mA. Above 26V the save-operating-area protection allows operation up to 36V with a regulated output current of more than 300mA. Over voltage protection limits operation at 42V. The over voltage protection hysteresis restores operation if the input voltage has dropped below 36V. A reset signal is generated for an output voltage of $V_O < 4.5V$. The delay for power-on reset can be set externally with a capacitor.

Design Notes for External Components

An input capacitor C_I is necessary for compensation of line influences. The resonant circuit consisting of lead inductance and input capacitance can be damped by a resistor of approx. 1Ω W in series with C_I . An output capacitor C_O is necessary for the stability of the regulating circuit. Stability is guaranteed at values of $C_O \geq 22\mu F$ and ESR of $< 3\Omega$.

Circuit Description

The control amplifier compares a reference voltage, which is kept highly accurate by resistance adjustment, to a voltage that is proportional to the output voltage and drives the base of a series transistor via a buffer. Saturation control as a function of the load current prevents any over-saturation of the power element. If the output voltage decreases below 4.5V, an external capacitor C_D on pin 4 (Reset Delay) will be discharged by the reset generator. If the voltage on this capacitor drops below V_{DLR} , a reset signal is generated on pin 2 (Reset Output), i.e. reset output is set low. If the output voltage rises above 4.5V, C_D will be charged with constant current. After the power-on-reset time the voltage on the capacitor reaches V_{DU} and the reset output will be set high again. The value of the power-on-reset time can be set within a wide range depending of the capacitance of C_D .

The IC also incorporate a number of internal circuits for protection against:

- Overload
- Over Voltage
- Over temperature
- Reverse Polarity



Reset Timing

The power-on reset delay time is defined by the charging time of an external capacitor C_D which can be calculated as follows:

$$C_D = (\Delta t \times I_{D,C}) / \Delta V$$

C_D = Delay capacitors

Definitions: Δt = Reset delay Time t_{rd}

$I_{D,C}$ = Charge current, typical 14uA

ΔV = V_{DU} , typical 1.8V

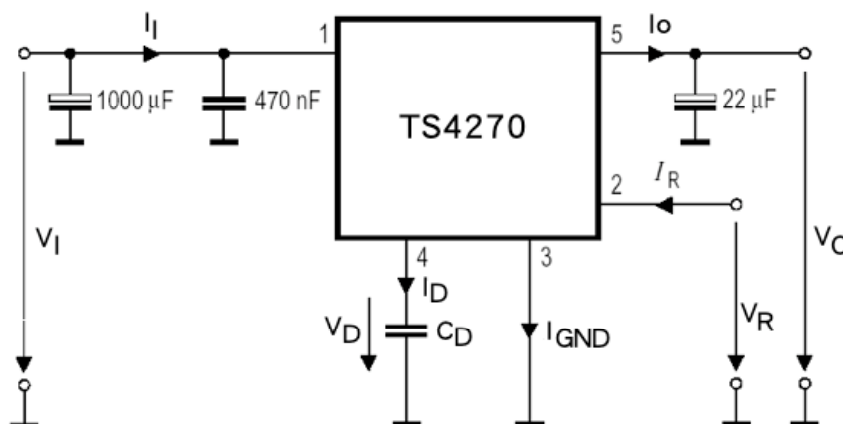
V_{DU} = Upper reset timing threshold at C_D for reset delay time

$$t_{rd} = \Delta V \times C_D / I_{D,C}$$

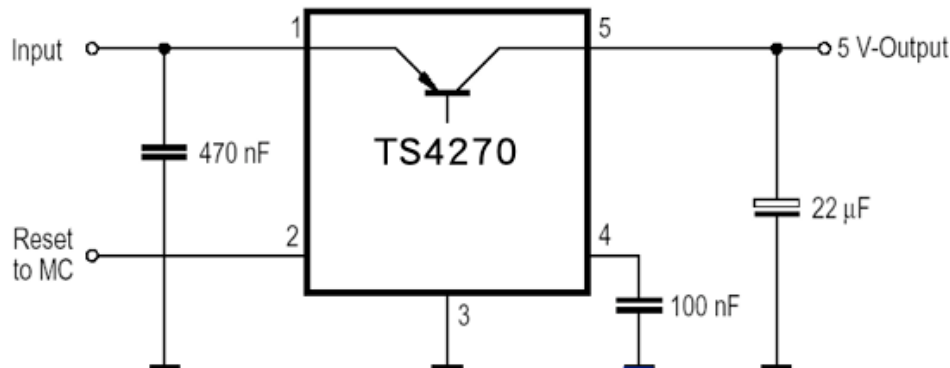
The reset reaction time t_{rr} is the time it takes the voltage regulator to set the reset out LOW after the output voltage has dropped below the reset threshold. It is typical 1uS for delay capacitor of 47nF. For other values for C_D the reaction time can be estimated using the following equation:

$$t_{rr} \approx 20s/F \times C_D$$

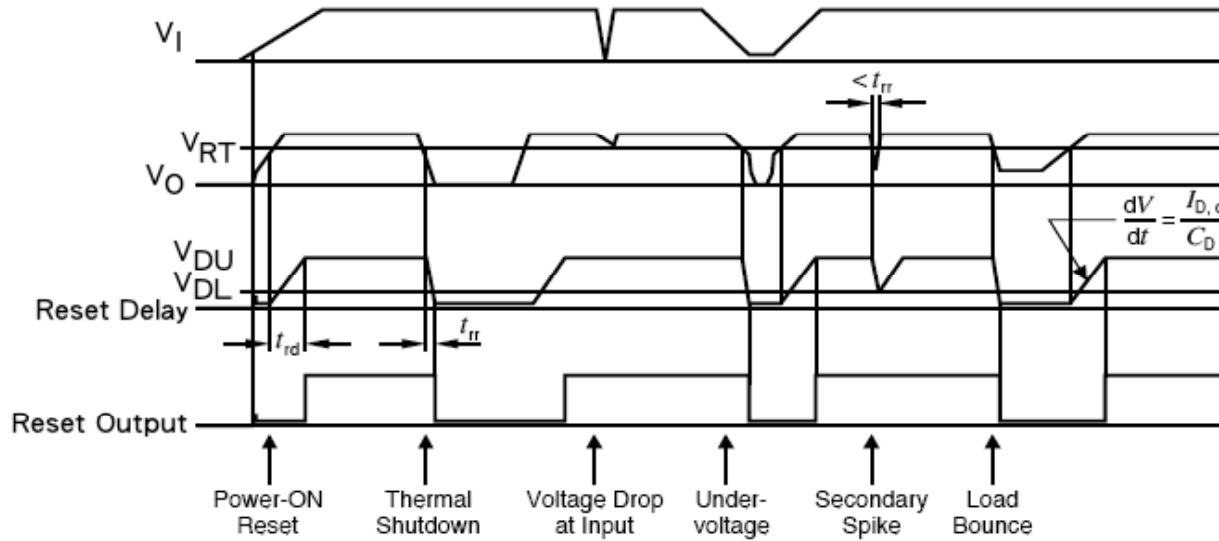
Test Circuit



Application Circuit



Reset Time Response



Electrical Characteristics Curve

FIGURE 1 – Line Regulation

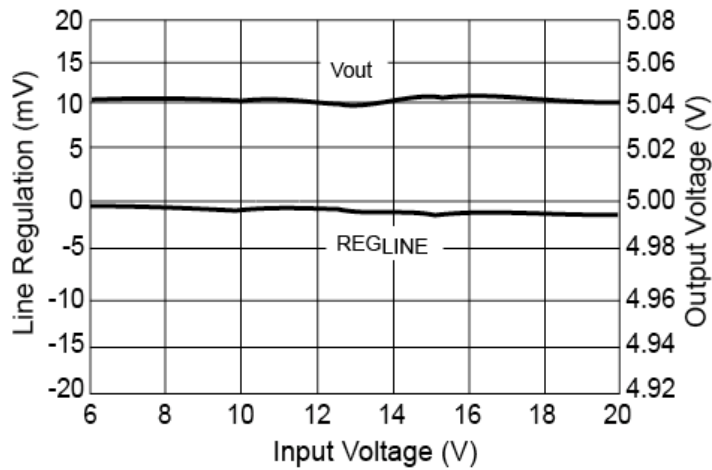


FIGURE 2 – Load Regulation

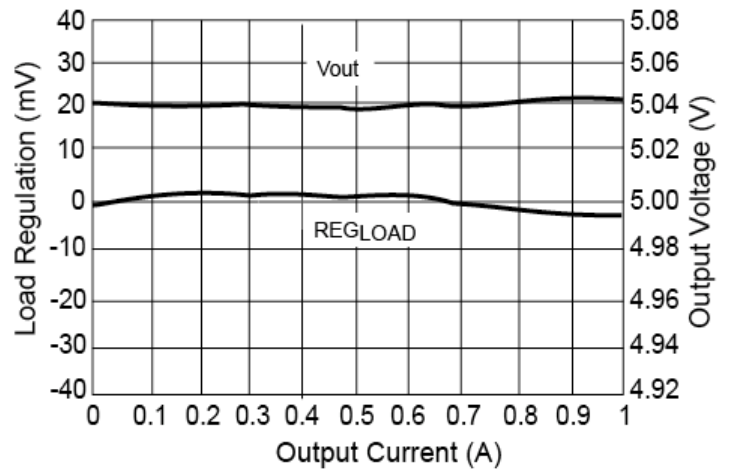


FIGURE 3 – Current Consumption vs. Input Voltage

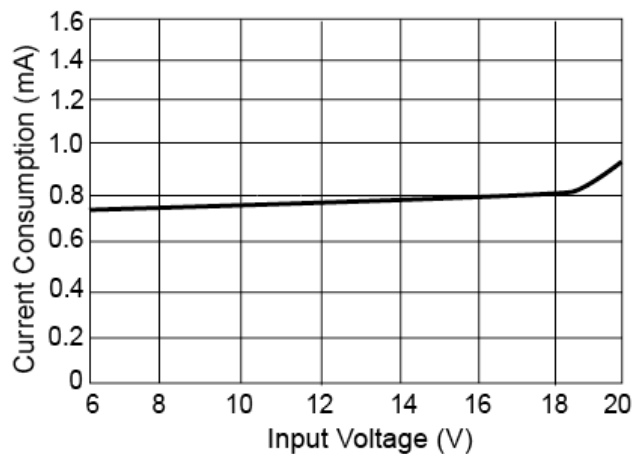
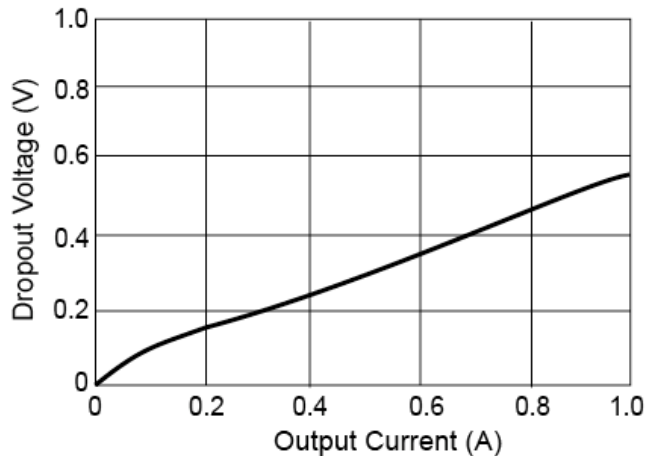
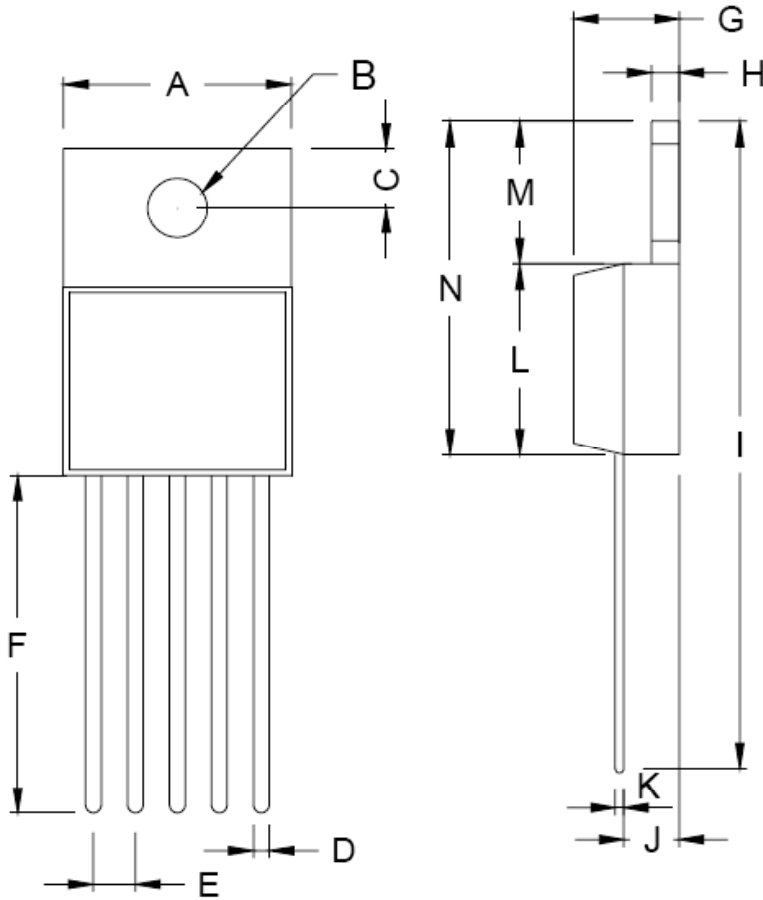


FIGURE 4 – Dropout Voltage

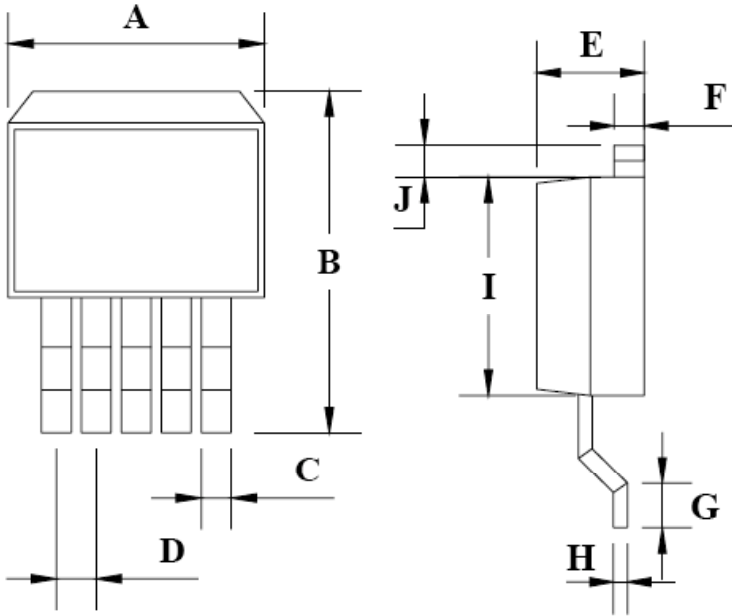


TO-220-5L Mechanical Drawing



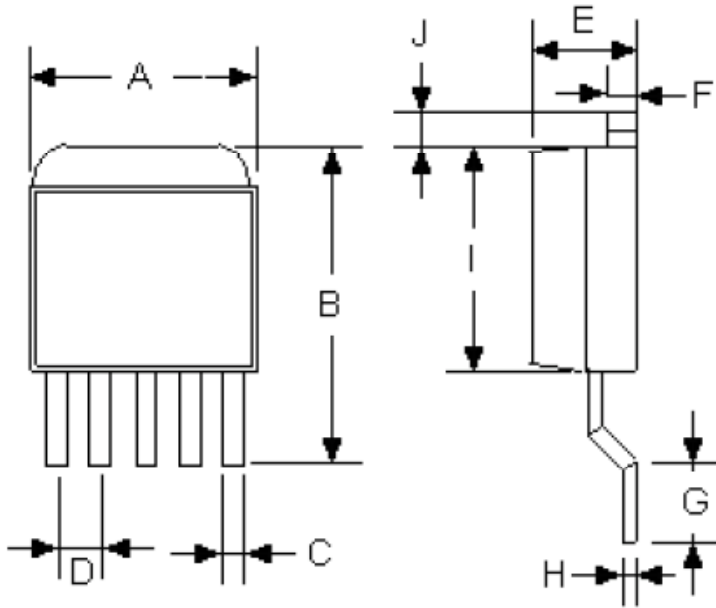
TO-220-5L DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.00	10.50	0.394	0.413
B	3.240	4.440	0.128	0.175
C	2.440	2.940	0.096	0.116
D	0.260	1.020	0.010	0.040
E	1.570	1.830	0.062	0.072
F	13.31	14.13	0.524	0.556
G	4.475	5.225	0.176	0.206
H	1.170	1.370	0.046	0.054
I	27.60	29.44	1.087	1.159
J	2.175	2.925	0.086	0.115
K	0.297	0.477	0.012	0.019
L	8.280	8.800	0.326	0.346
M	6.010	6.510	0.237	0.256
N	14.29	15.31	0.563	0.603

TO-263-5L Mechanical Drawing



DIM	TO-263-5L DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.220	10.260	0.402	0.404
B	14.600	15.870	0.575	0.625
C	0.750	0.770	0.030	0.030
D	1.573	1.827	0.062	0.072
E	4.560	4.570	0.179	0.180
F	1.240	1.270	0.049	0.050
G	2.280	2.790	0.090	0.110
H	0.280	0.320	0.011	0.013
I	8.240	8.280	0.324	0.326
J	1.540	1.800	0.060	0.071

TO-252-5L Mechanical Drawing



DIM	TO-252-5L DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX.
A	6.350	6.730	0.250	0.265
B	9.080	10.440	0.357	0.411
C	0.460	0.640	0.018	0.025
D	1.27BSC		0.05BSC	
E	2.19	2.380	0.086	0.094
F	0.460	0.570	0.018	0.022
G	1.400	1.780	0.055	0.070
H	0.460	0.570	0.018	0.022
I	5.34	5.550	0.210	0.219
J	1.520	2.030	0.060	0.080

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