

3A BiCMOS Very Low Dropout Regulators

PRODUCTION DATA SHEET

DESCRIPTION

The LX8630 family are positive very low dropout regulators. They are designed to provide a power supply for very low headroom applications, such as 3.3V – 2.5V.

BiCMOS technology allows an effective series pass element resistance, $R_{DS(ON)}$ of 150mΩ resulting in a typical dropout voltage of 450mV at 3A.

Low Quiescent Current and Logic-Controlled Shutdown help conserve battery life and increase system efficiency. Typical quiescent current is under 400μA irrespective of load current, while the

Shutdown current is only 10μA. The device will enter shutdown mode when the SHDN pin is pulled low.

Thermal and Short-Circuit Current Limiting: the LX8630 limits the current when the output is shorted, protecting the sensitive load circuits. The device will also turn off if the junction temperature exceeds 150°

Available in Popular TO-220 and TO-263 Power Packages: adjustable versions have five leads, and fixed output voltage devices are supplied in three lead packages.

IMPORTANT: For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

KEY FEATURES

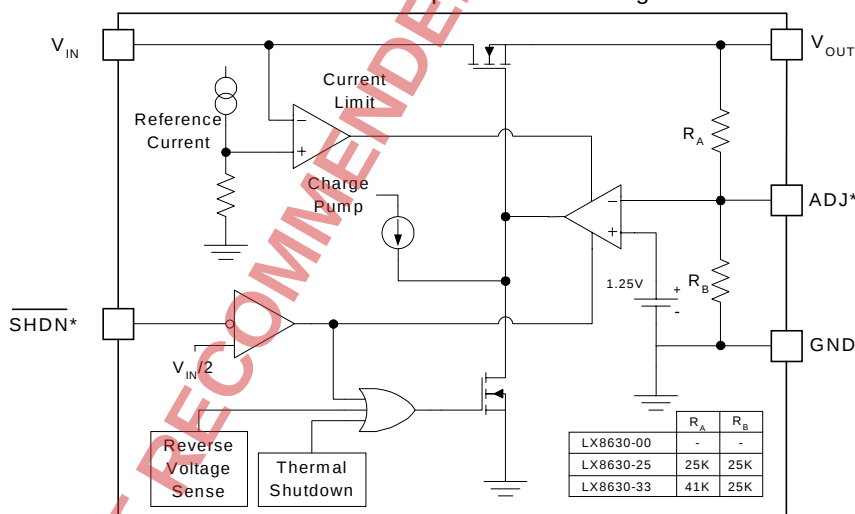
- Dropout Voltage Typically 450mV at 3A and 50mV at 10mA
- Low Quiescent Current, Typically Under 400μA, irrespective of Load
- Shutdown Current 10μA
- Adjustable Output Version in 5-Pin TO-220 & TO-263 Packages
- Low Reverse Leakage Current
- Short-Circuit and Thermal Shutdown Protection

APPLICATIONS/BENEFITS

- 3.3V & 2.5V Supplies for Memory, Microprocessors, Clock Circuits, Etc.
- Portable Equipment

PRODUCT HIGHLIGHT

LX8630-xx Simplified Block Diagram



* Adjustable 5 lead version only

PACKAGE ORDER INFO

T _A (°C)	Output Voltage	P	Plastic TO-220 3-Pin	P	Plastic TO-220 5-Pin	DD	Plastic TO-263 3-Pin	DD	Plastic TO-263 5-Pin
0 to 125	3.3		LX8630-33CP		-		LX8630-33CDD		-
	2.5		LX8630-25CP		-		LX8630-25CDD		-
	ADJ(00)		-		LX8630-00CP		-		LX8630-00CDD

Note: Available in Tape & Reel.

Append the letter "T" to the part number. (i.e. LX8630-33CDDT)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (V_{IN})	6.5V
SHDN Pin	-0.3V to $V_{IN} + 0.3V$
Operating Junction Temperature	
Plastic (P & DD Packages)	150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering, 10 seconds)	300°C

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

THERMAL DATA
P PLASTIC TO-220 3-PIN

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.1°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W

P PLASTIC TO-220 5-PIN

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.1°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W

DD PLASTIC TO-263 3-PIN

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.1°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W

DD PLASTIC TO-263 5-PIN

THERMAL RESISTANCE-JUNCTION TO TAB, θ_{JT}	2.1°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	60°C/W

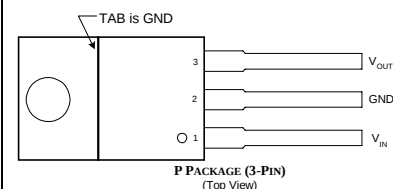
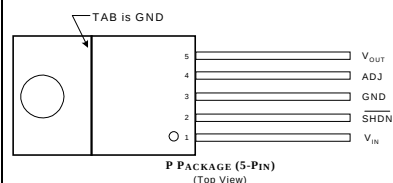
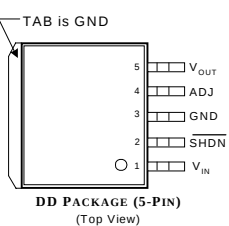
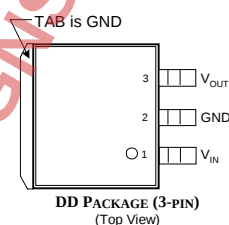
Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.

The θ_{JA} numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

- θ_{JA} can be improved with package soldered to 0.5IN² copper area over backside ground plane or internal power plane. θ_{JA} can vary from 20°C/W to > 40°C/W depending on mounting technique. See table below for thermal resistance guidelines.

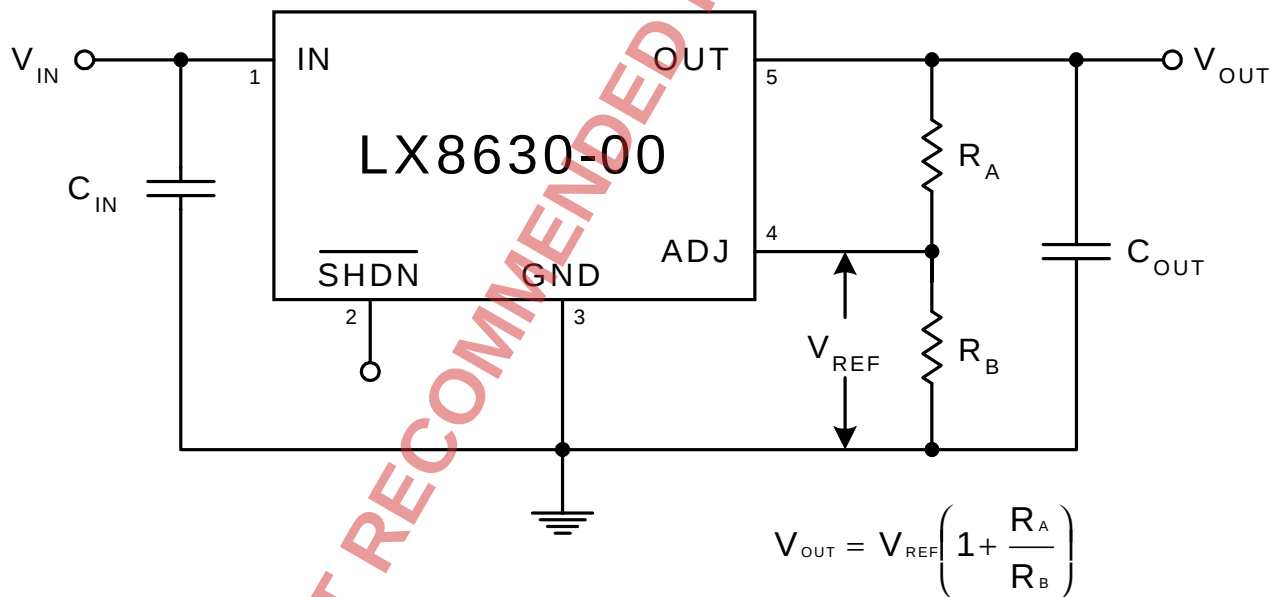
Copper Area (Topside)*	Copper Area (Backside)*	Board Area	Thermal Resistance (θ_{JA})
2.5 sq" (1613mm ²)	2.5 sq" (1613mm ²)	2.5 sq" (1613mm ²)	25°C/W
1.0 sq" (645 mm ²)	2.5 sq" (1613mm ²)	2.5 sq" (1613mm ²)	27°C/W
0.17 sq" (110 mm ²)	2.5 sq" (1613mm ²)	2.5 sq" (1613mm ²)	35°C/W

*Tab of device attached to topside copper

PACKAGE PIN OUT


FUNCTIONAL PIN DESCRIPTION

PIN NAME	DESCRIPTION
V _{IN}	Positive supply input for the regulator. Bypass to GND with at least 2.2μF of low ESR, ESL capacitance if supply source is further than 1 inch from the device.
V _{OUT}	Output for the regulator. It is recommended to bypass to GND with at least 10μF although this is not required for regulation, rather it is needed for transient response. Size your output capacitor to meet the transient loading requirement. If you have a very dynamic load, a larger capacitor will improve the response to these load steps.
GND	Reference ground. The input and output bypass capacitors should be connected to this pin. The tab on the TO-220 and TO-263 packages along with the ground pin are also used for heatsinking the device.
ADJ	Feedback pin for the regulator. For the LX8630-00, the output voltage can be set by two external resistors with the following relationship: $V_{OUT} = 1.25V * (1 + R_A/R_B)$ where R _A is the resistor connected between V _{OUT} and ADJ, R _B is the resistor connected between ADJ and GND pin.
$\overline{\text{SHDN}}$	Shutdown pin. For the LX8630-00, this pin has a threshold of about V _{IN} /2, it should be actively pulled high to enable the regulator. This can be accomplished with a resistive pull-up. When low, it turns off the regulator and puts the device in a low current shutdown state.

TYPICAL APPLICATION

FIGURE 1 – Typical Application

RECOMMENDED OPERATING CONDITIONS
RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
INPUT VOLTAGE	V_{IN}	3.0		5.5	V
LOAD CURRENT (WITH ADEQUATE HEATSINKING)		0.01		3	A
INPUT CAPACITOR (V_{IN} TO GND)		10	100		μF
OUTPUT CAPACITOR (V_{OUT} TO GND)		22	220*		μF

* Size your output capacitor to meet the transient loading requirement. If you have a very dynamic load, a larger capacitor will improve the response to these load steps (see charts 2&3)

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, the following specifications apply over the operating ambient temperatures for the LX8630-xxC with $0^{\circ}C \leq T_A \leq 125^{\circ}C$; $V_{IN} = V_{OUT} + 1.5V$; $I_{OUT} = 10mA$; $C_{IN} = 10\mu F$; $C_{OUT} = 22\mu F$; $T_J = T_A$. Test conditions: Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Symbol	Test Conditions	LX8630-xx			Units
			Min	Typ	Max	
LX8630-33 FIXED 3.3V, 3A						
Output Voltage	V _{OUT}	T _J = 25°C	3.25	3.3	3.35	V
		Over Temperature	3.22		3.38	
Line Regulation	V _{REG}	V _{IN} = 3.9V to 5.5V		2	8	mV
Load Regulation	I _{REG}	I _{OUT} = 10mA to 3 A		18	40	mV
Dropout Voltage (V _{DO} = V _{IN} - V _{OUT})	V _{DO}	I _{OUT} = 3A, ΔV _{OUT} = -1%		0.4	0.6	V
		I _{OUT} = 1.5A, ΔV _{OUT} = -1%		0.3	0.4	
		I _{OUT} = 10mA, ΔV _{OUT} = -1%		0.05	0.15	
Short Circuit Current	I _{SC}	V _{OUT} = 0V		5	6.5	A
Quiescent Current	I _Q	I _{OUT} = 10mA to 3A		400	600	μA
Reverse Leakage Current	I _{REV}	0V < V _{IN} < V _{OUT} , V _{OUT} < 3.4V (at V _{OUT})		50	650	μA
		0V < V _{IN} < V _{OUT} , V _{OUT} < 3.4V (at V _{IN})	-50	0		mA
LX8630-25 FIXED 2.5V, 3A						
Output Voltage	V _{OUT}	T _J = 25°C	2.46	2.5	2.54	V
		Over Temperature	2.44	2.5	2.56	
Line Regulation	V _{REG}	V _{IN} = 3.1V to 5.5V		2	6	mV
Load Regulation	I _{REG}	I _{OUT} = 10mA to 3 A		14	30	mV
Dropout Voltage (V _{DO} = V _{IN} - V _{OUT})	V _{DO}	I _{OUT} = 3A, ΔV _{OUT} = -1%, T _J = 85°C		0.4	0.6	V
		I _{OUT} = 1.5A, ΔV _{OUT} = -1%, T _J = 85°C		0.3	0.45	
		I _{OUT} = 10mA, ΔV _{OUT} = -1%		0.05	0.15	
Short Circuit Current	I _{SC}	V _{OUT} = 0V		5	6.5	A
Quiescent Current	I _Q	I _{OUT} = 10mA to 3A		400	600	μA
Reverse Leakage Current	I _{REV}	0V < V _{IN} < V _{OUT} , V _{OUT} < 2.6V (at V _{OUT})		50	650	μA
		0V < V _{IN} < V _{OUT} , V _{OUT} < 2.6V (at V _{IN})	-50	0		mA

ELECTRICAL CHARACTERISTICS (CONTINUED)

Parameter	Symbol	Test Conditions	LX8630-xx			Units
			Min	Typ	Max	
LX8630-00 ADJUSTABLE OUTPUT, 3A						
Reference Voltage	V _{REF}	T _J = 25°C	1.23	1.25	1.27	V
		Over Temperature	1.22	1.25	1.28	
Line Regulation	V _{REG}	V _{IN} = (V _O + 0.6V) to 5.5V @ ADJ Pin (Note 1)		2	4	mV
Load Regulation	I _{REG}	I _{OUT} = 10mA to 3A @ ADJ Pin		7	15	mV
Dropout Voltage	V _{DO}	I _{OUT} = 3A, ΔV _{OUT} = -1%, T _J = 85°C		0.4	0.6	V
		I _{OUT} = 1.5A, ΔV _{OUT} = -1%, T _J = 85°C		0.3	0.45	
		I _{OUT} = 10mA, ΔV _{OUT} = -1%		0.05	0.15	
Short Circuit Current	I _{SC}	V _{OUT} = 0V		5	6.5	A
Quiescent Current	I _Q	I _{OUT} = 10mA to 3A		400	600	μA
Quiescent Current in Shutdown		V _{IN} = 4.8V; V _{SHDN} <0.8V		1	40	
Reverse Leakage Current	I _{REV}	0V < V _{IN} < V _{OUT} , V _{OUT} < 5.5V (at V _{OUT})		50	650	μA
		0V < V _{IN} < V _{OUT} , V _{OUT} < 5.5V (at V _{IN})	-50	0		mA
Bias Current at ADJ Pin	I _{BIAS}			100		nA
Shutdown Threshold	V _{SHDN}	V _{SHDN} falling	0.8	(V _{IN} /2)		V
		V _{SHDN} rising		(V _{IN} /2)		
SHDN Bias Current	I _{SHDN}	V _{SHDN} < 0.8V		-2		μA
		V _{SHDN} = 3V		-1		

Note 1: V_{IN} min. $\geq 3\text{V}$.

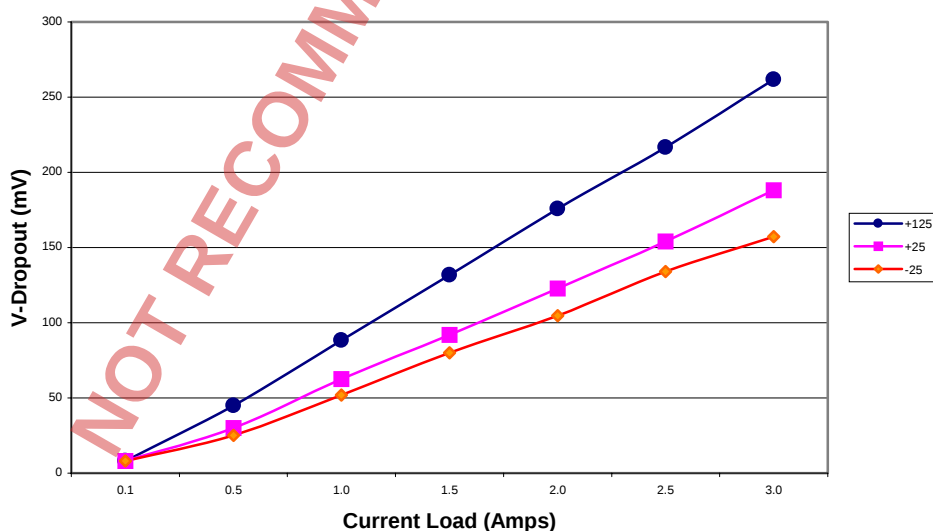
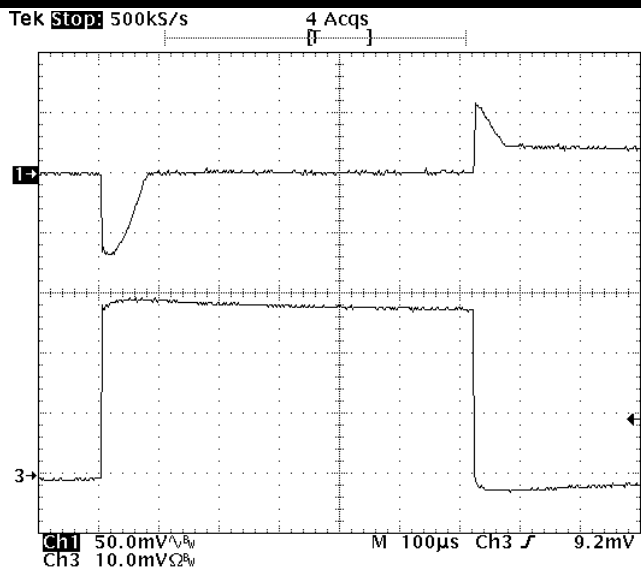
DROPOUT VOLTAGE VS. OUTPUT CURRENT


CHART 1 – Dropout Voltage vs. Output Current (Typical – LX8630-33CCD)

TRANSIENT RESPONSE



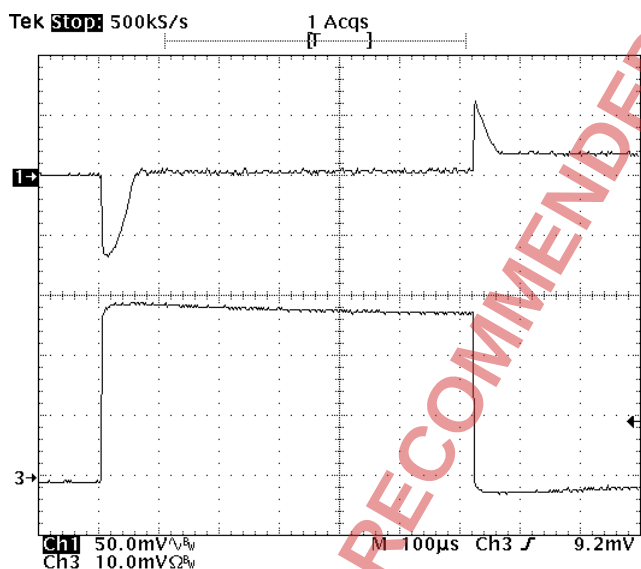
$V_{IN} = 3.3V$

CHAN 1 (TOP TRACE): V_{OUT} 50mV/DIV at 2.5VDC

CHAN 3 (LOWER TRACE): I_{OUT} 1A/DIV with 10mA preload current

Input Cap: 1 6MVGX 1500µF Sanyo Cap

Output Caps: 2 6MVGX 1500µF Sanyo Cap



$V_{IN} = 5.0V$

CHAN 1 (TOP TRACE): V_{OUT} 50mV/DIV at 2.5VDC

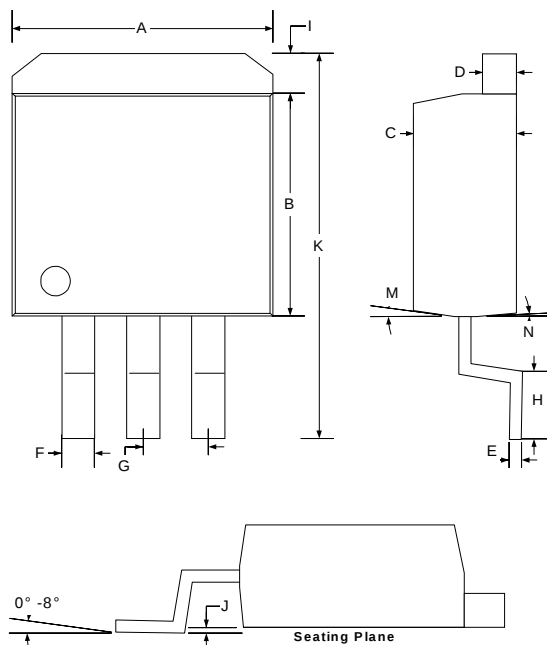
CHAN 3 (LOWER TRACE): I_{OUT} 1A/DIV with 10mA preload current

Input Cap: 1 6MVGX 1500µF Sanyo Cap

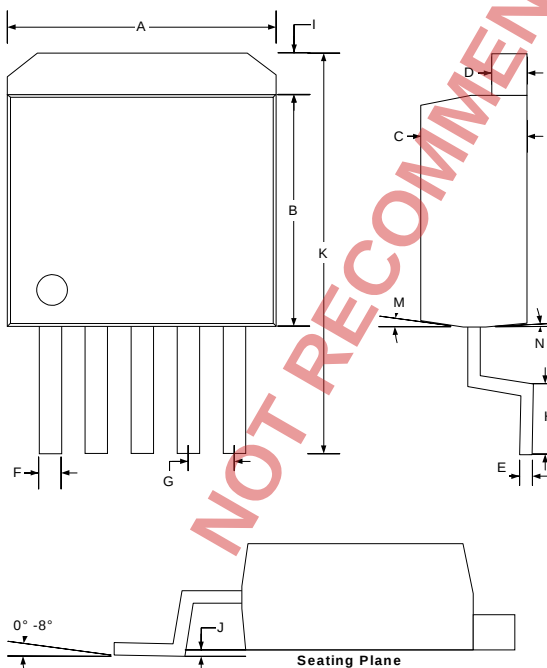
Output Caps: 2 6MVGX 1500µF Sanyo Cap

CHART 2 & 3 — LX8630-00CCD Transient Response

Note: Adjustable Resistors 10K Ohms Each

MECHANICAL DIMENSIONS
DD 3-Pin Plastic TO-263


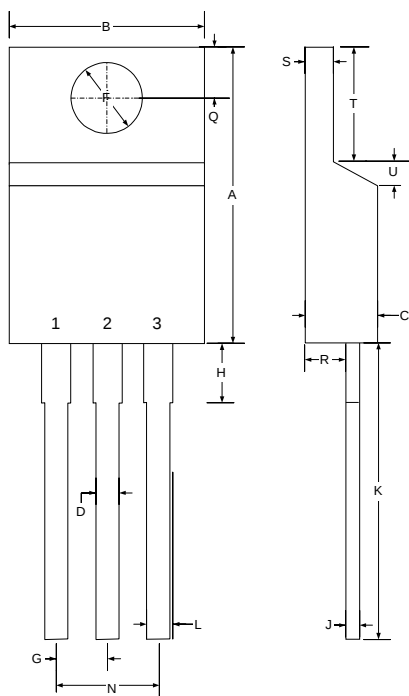
Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.03	10.67	0.395	0.420
B	8.51	9.17	0.335	0.361
C	4.19	4.59	0.165	0.181
D	1.14	1.40	0.045	0.055
E	0.330	0.51	0.013	0.020
F	1.19	1.34	0.047	0.053
G	2.41	2.66	0.095	0.104
H	2.29	2.79	0.090	0.110
I	—	1.65	—	0.065
J	0	0.25	0	0.010
K	14.60	15.87	0.575	0.625
M	7°		7°	
N	3°		3°	

DD 5-Pin Plastic TO-263


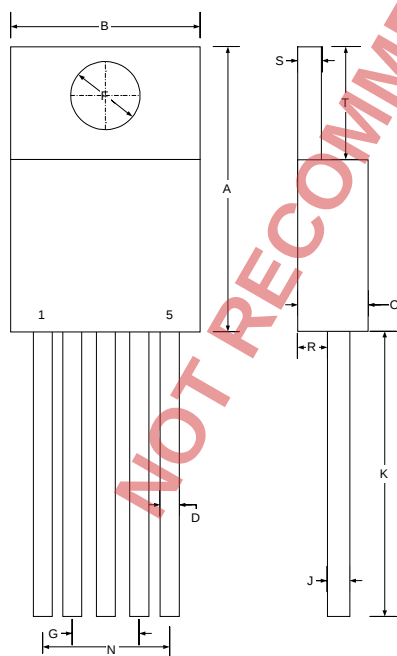
Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.03	10.67	0.395	0.420
B	8.51	9.17	0.335	0.361
C	4.19	4.59	0.165	0.181
D	1.14	1.40	0.045	0.055
E	0.330	0.51	0.013	0.020
F	0.74	0.89	0.029	0.035
G	1.57	1.83	0.062	0.072
H	2.29	2.79	0.090	0.110
I	—	1.65	—	0.065
J	0	0.25	0	0.010
K	14.60	15.87	0.575	0.625
M	7°		7°	
N	3°		3°	

Note:

- Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

MECHANICAL DIMENSIONS
P 3-Pin Plastic TO-220


Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.22	15.88	0.560	0.625
B	9.65	10.67	0.380	0.420
C	3.56	4.83	0.140	0.190
D	0.51	1.14	0.020	0.045
F	3.53	4.09	0.139	0.161
G	2.54 BSC		0.100 BSC	
H		6.35		0.250
J	0.30	1.14	0.012	0.045
K	12.70	14.73	0.500	0.580
L	1.14	1.27	0.045	0.050
N	5.08 TYP		0.200 TYP	
Q	2.54	3.05	0.100	0.120
R	2.03	2.92	0.080	0.115
S	1.14	1.40	0.045	0.055
T	5.84	6.86	0.230	0.270
U	0.508	1.14	0.020	0.045

P 5-Pin Plastic TO-220


Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.23	16.51	0.560	0.650
B	9.66	10.66	0.380	0.420
C	3.56	4.82	0.140	0.190
D	0.46	0.89	0.018	0.035
F	3.56	4.06	0.140	0.160
G	3.40		0.134	
J	0.31	1.14	0.012	0.045
K	12.70	14.73	0.500	0.580
N	6.80 TYP		0.268 TYP	
R	2.04	2.92	0.080	0.115
S	1.14	1.39	0.045	0.055
T	5.85	6.85	0.230	0.270

Note:

- Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

NOTES

NOT RECOMMENDED FOR NEW DESIGNS

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