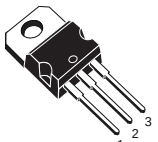
VN1160/ VN1160-1/ VN1160T

DIRECTION INDICATOR DRIVER FOR MOTORBIKE

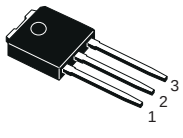
TARGET SPECIFICATION

TYPE	$R_{DS(on)}$	I_{lim}	V_{CC}
VN1160 VN1160-1 VN1160T	0.08 Ω	12 A	40 V

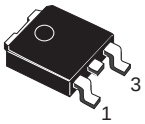
- COMPLETE DIRECTION INDICATOR IN A 3 PIN PACKAGE
- REQUIRES ONLY ONE EXTERNAL CAPACITOR TO SET FLASHING FREQUENCY
- DOUBLE FREQUENCY FLASHING IN LOW LOAD CONDITIONS
- CYCLE BY CYCLE OVERTEMPERATURE SHUTDOWN
- REVERSE BATTERY PROTECTION



TO-220



TO251 (IPAK)



TO252 (DPAK)

ORDER CODES

TO-252 (DPAK)	VN1160
TO-251 (IPAK)	VN1160-1
TO-220	VN1160T

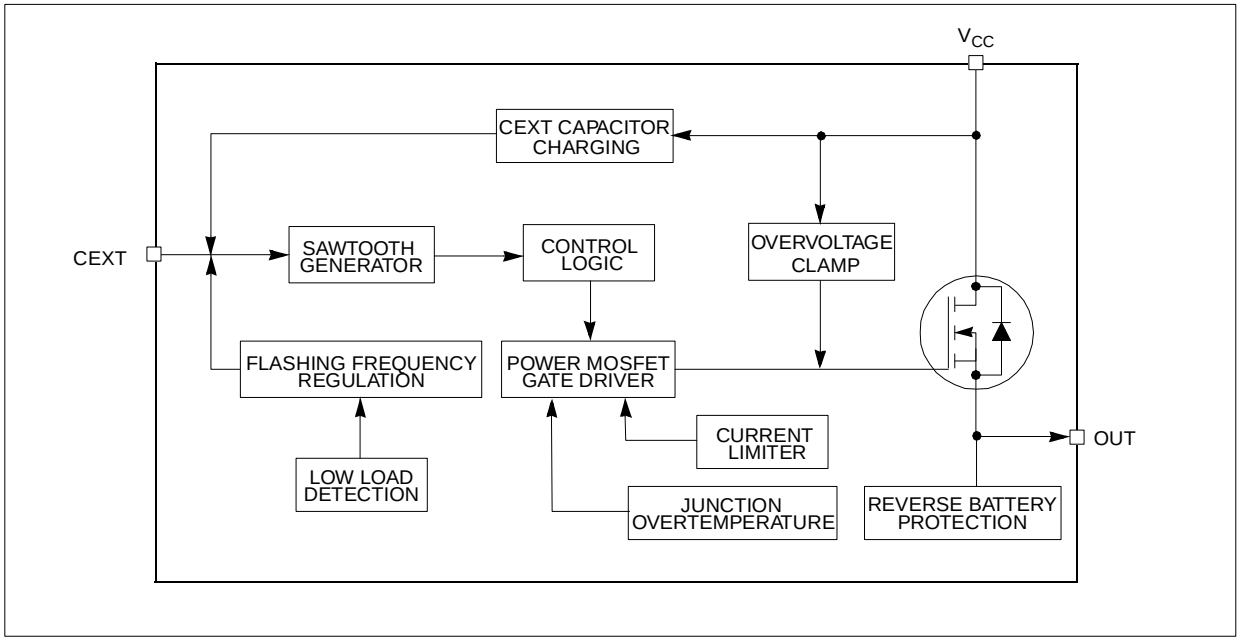
DESCRIPTION

The VN1160, VN1160-1, VN1160T are a monolithic device made by using STMicroelectronics VIPower technology, intended for building a complete flashing unit for two wheel vehicles. The device is connected between the battery positive terminal (V_{CC} pin) and a mechanical switch to the right and/or left bulbs. As soon as the series switch connects the OUT pin to the bulbs, the device begins to turn on/off with a 50% duty cycle.

An external low voltage capacitor (220µF, 10V) connected between the CEXT pin and the OUT pin stores energy for powering the device during the ON phase and sets the flashing frequency.

When a low load is detected (output current lower than I_{df}), flashing frequency is automatically doubled.

BLOCK DIAGRAM



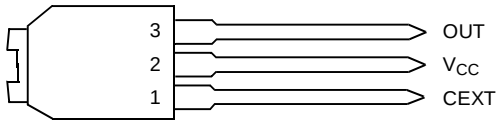
ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value			Unit
		TO-220	IPAK	DPAK	
V_{CC}	DC Supply Voltage	40			V
V_{dd}	CEXT Capacitor Voltage	6.5			V
I_D	Maximum DC drain Current	Internally Limited			A
$- I_D$	Reverse DC Output Current	- 5			A
V_{esd}	Electrostatic Discharge (R=1.5KΩ; C=100 pF)	2000			V
P_{tot}	Power Dissipation T_C = 25 °C	55	45	45	W
T_j	Junction Operating Temperature	Internally Limited			°C
T_{stg}	Storage Temperature	- 55 to 150			°C

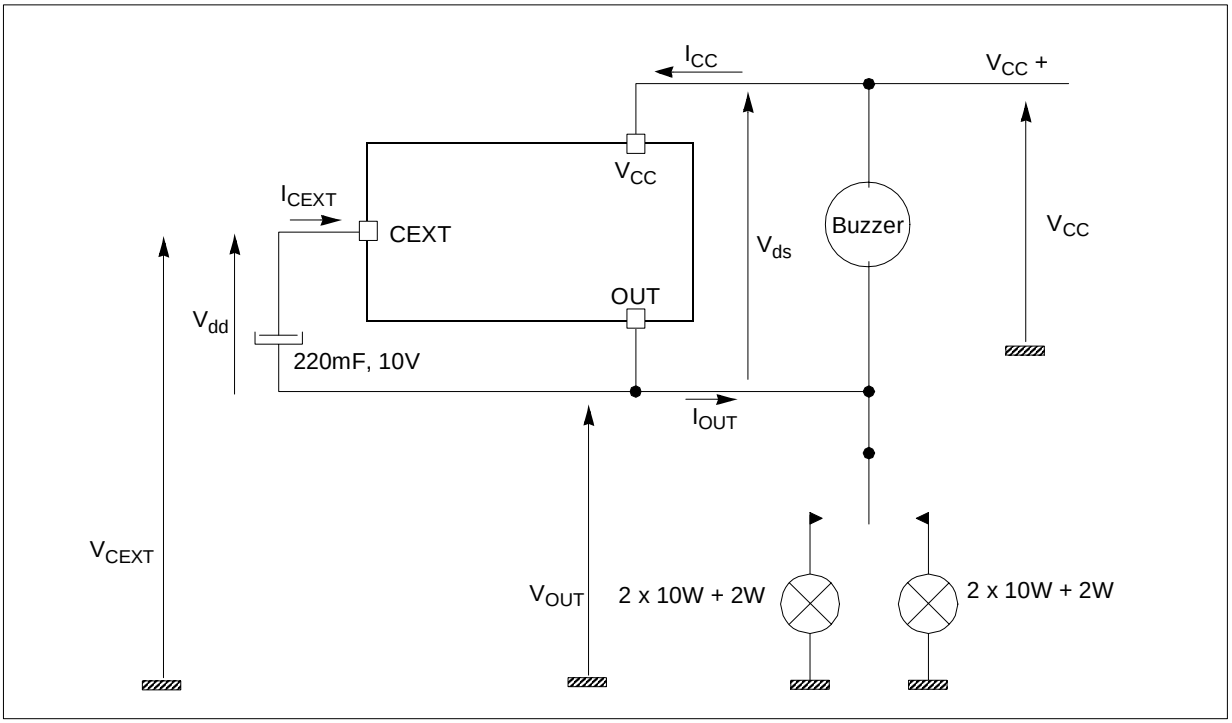
THERMAL DATA

Symbol	Parameter		Value			Unit
			TO-220	IPAK	DPAK	
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	2.2	3.33	3.33	°C/W
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	Max	60	100	100	°C/W

CONNECTION DIAGRAM (TOP VIEW)



CURRENT AND VOLTAGE CONVENTIONS



ELECTRICAL CHARACTERISTICS (9V<V_{CC}<16V; -20°C<T_j<85°C unless otherwise specified)

POWER

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{clamp}	V_{DS} Clamp Voltage	I_{OUT}=1.6A	40	45	50	V
I_{CEXT}	Supply Current from CEXT Pin	V_{DS}=0V; V_{dd}=5V; T_j=25 °C	810	880	950	µA
V_{ddcl}	CEXT Clamp Voltage	I_{CEXT}=2mA; V_{DS}=0V	TBD	7.2	TBD	V
V_{ddrcl}	CEXT Reverse Clamp Voltage	I_{CEXT}=-2mA; V_{DS}=0V	-1.0		-0.3	V
R_{ON}	On State Resistance	V_{dd}=5V; I_{OUT}=1.6A; T_j=25 °C			0.08	Ω

SWITCHING (V_{CC}=V_{en}=13.5V)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$dI/dt_{(on)}$	Turn-on Current Slope	R_{LOAD}=8Ω		0.02		A/µs
$dI/dt_{(off)}$	Turn-off Current Slope	R_{LOAD}=8Ω		0.02		A/µs

DYNAMIC PARAMETERS

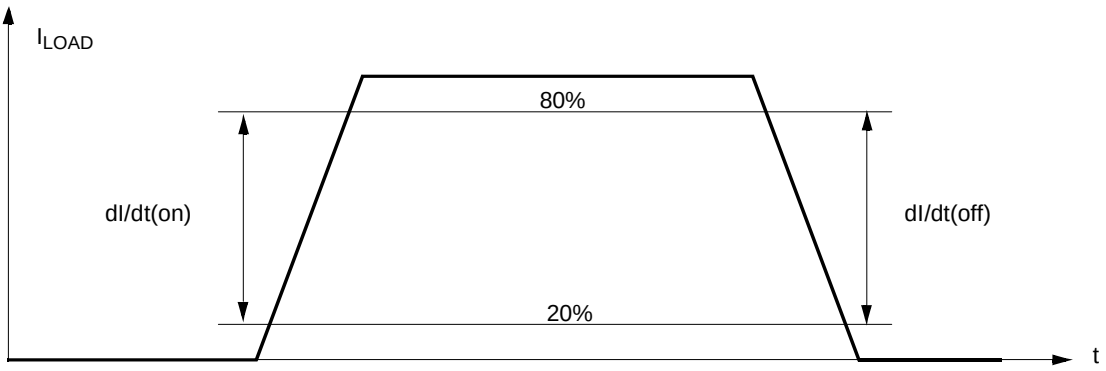
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
f_{osc}	Self Oscillating Frequency	V_{CC}=13.5V; 220µF between CEXT and OUT; R_{LOAD}=8Ω	1.08	1.33	1.58	Hz
V_{ch}	Sawtooth High Level between CEXT and OUT	V_{CC}=13.5V		6		V
V_{cl}	Sawtooth Low Level between CEXT and OUT	V_{CC}=13.5V		4.5		V

PROTECTIONS

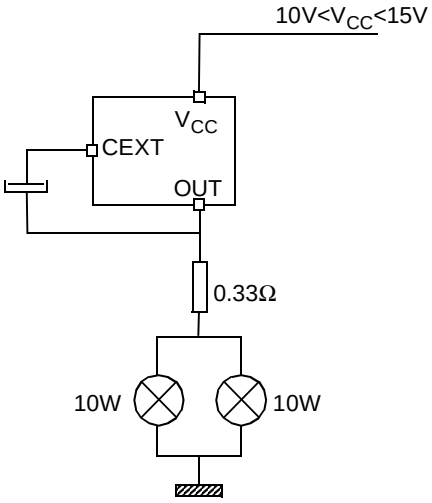
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_{lim}	Drain Current Limit	V_{dd}=5V; V_{DS}=13.5V		12		A
T_{jsh}	Overtemperature Shutdown		125			°C
T_{jrs}	Overtemperature Reset		100			°C
I_{df1}	Double Frequency Flashing Threshold	V_{CC}=9.5V (*)	816	940	1066	mA
I_{df2}	Double Frequency Flashing Threshold	V_{CC}=15.5V (*)	1062	1240	1417	mA

(*) See double frequency test configuration

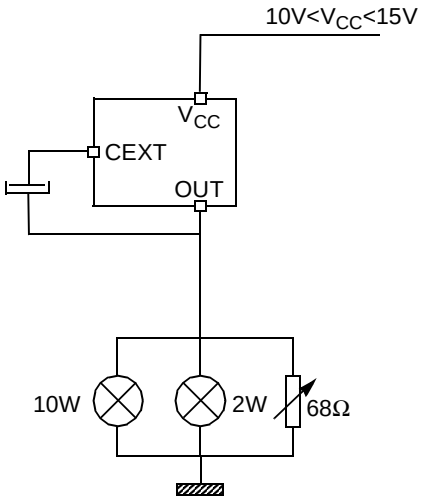
SWITCHING CHARACTERISTICS



DOUBLE FREQUENCY TEST CONFIGURATION



Test1: no defect, minimum load.
The VN1160 must oscillate at f=F_{osc}.



Test2: defect, maximum load.
The VN1160 must oscillate at f=2 x F_{osc}.

FUNCTIONAL DESCRIPTION

1) Normal operation (see Fig.1)
When a nominal load (higher than a 20W bulb) is connected to the OUT pin, the device oscillates by charging the CEXT capacitor up to the threshold voltage V_{ch} quickly, and then slowly discharging CEXT to the threshold voltage V_{cl} by a constant current I_{CEXT}.
The self oscillating frequency of the device is determined by the relation :

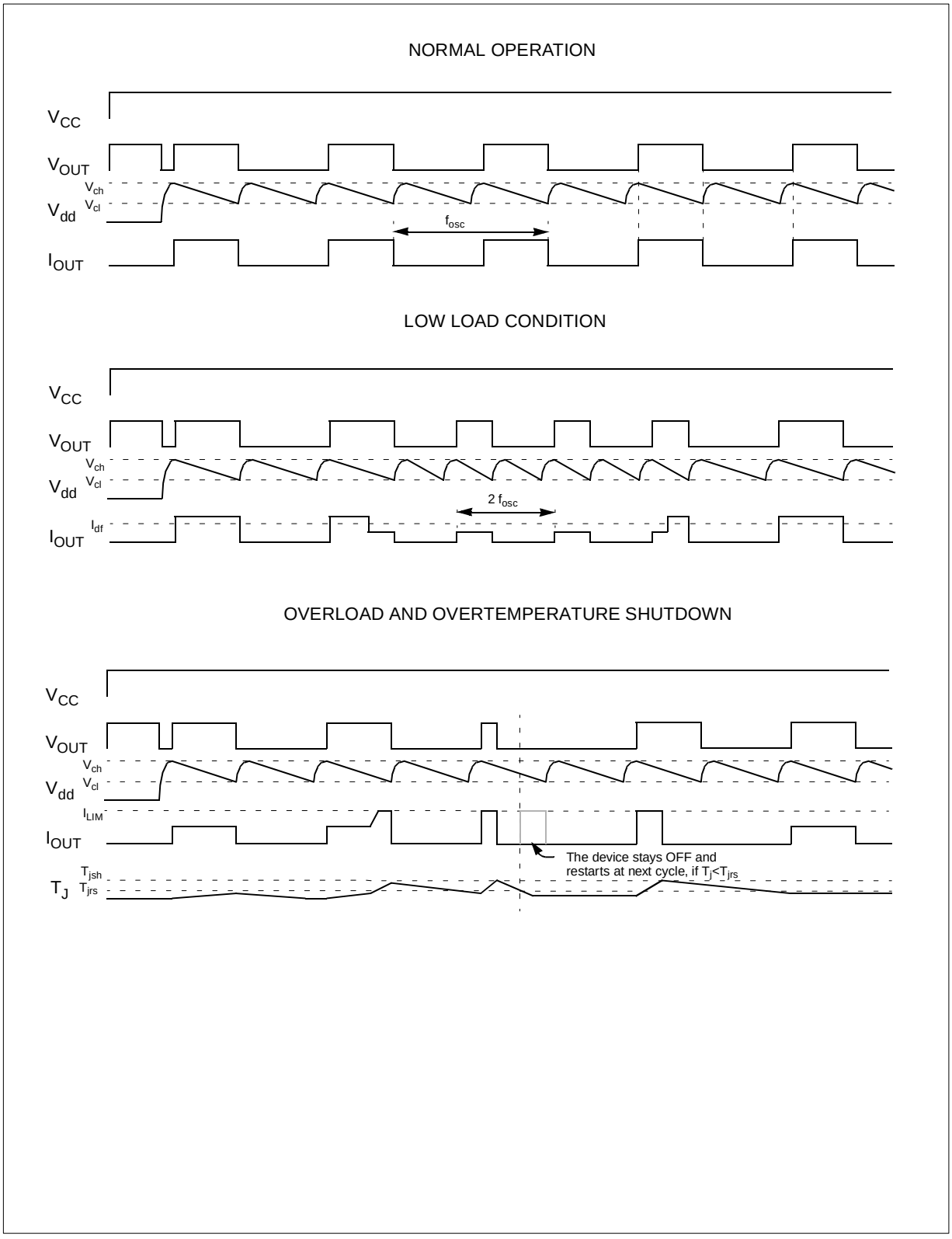
$$fosc = \frac{Icext}{2 \times Cext \times (Vch - Vcl)}$$

The duty cycle is close to 50%.

2) Low load condition (see Fig.1)
If the load is lower than the load of a 14W bulb, the device will detect the low load at the end of the ON phase, and will double the oscillating frequency.

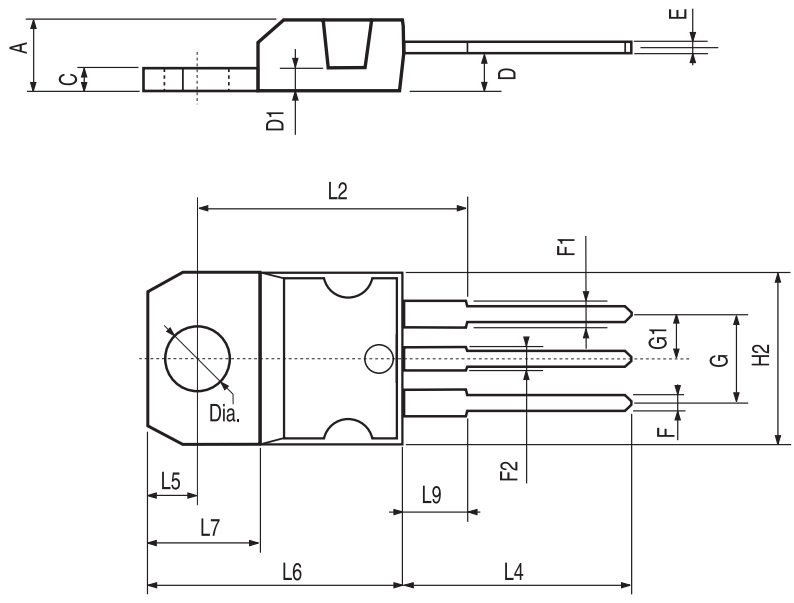
3) Overload and overtemperature shutdown (see Fig.1)
In the case of a short circuit of the load, the output current I_{OUT} is limited to the I_{LIM} value.
If the junction temperature becomes too hot ($T_j > T_{jsh}$), the device turns off, and waits for the next cycle to turn on providing that the junction temperature has cooled to below T_{jrs}.

Figure1: Waveforms



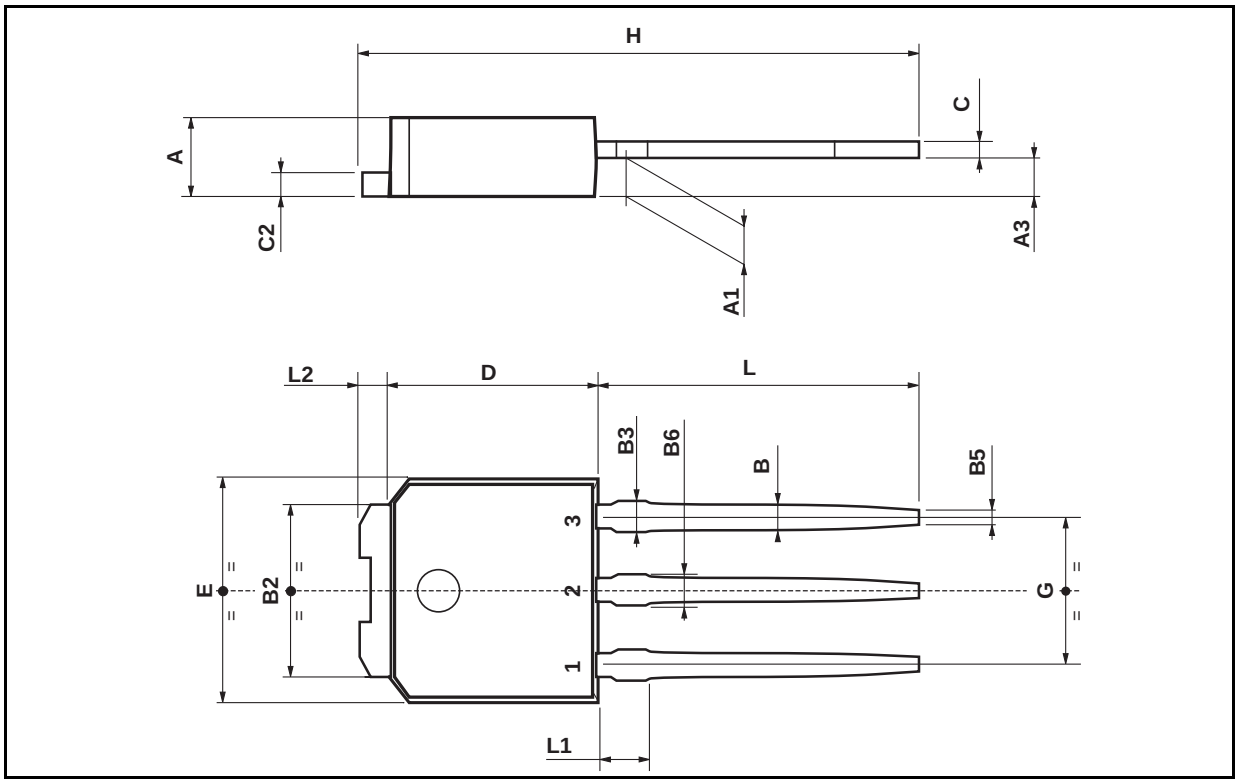
TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137	0.154	
DIA.	3.75		3.85	0.147		0.151



TO-251 (IPAK) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



TO-252 (DPAK) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
B2	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L2		0.8			0.031	
L4	0.6		1	0.023		0.039