Engineering Sample Information
MODULE ASSEMBLY
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HM211

OM5428 Demonstration Board

INTEGRATED ELECTRONIC SOLUTIONS
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AUSTRALIA

OM5428 Demonstration Board HM211

CONTENTS

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1 FEATURES

- Adjustable proportional range
- Adjustable hysteresis
- Adjustable firing burst repetition time
- Adjustable pulse width
- Supplied from the mains
- Provides supply for external temperature bridge
- Low supply current, low dissipation

2 GENERAL DESCRIPTION

The HM211 is a general purpose triac control module based on the OM5428 General Purpose Triggering Integrated Circuit. The HM211 has been designed to allow for demonstration of the various capabilities of the OM5428 which include phase control, soft start, phase control with soft start and time- proportional temperature control. The variety of control applications can be satisfied by the choice of position and value of components on a printed circuit board assembly. The module is capable of being configured for heating or cooling applications. For example, the zero crossing switching of a resistive load, or for the control of inductive loads such as a motor.

The use of the OM5428 General Purpose triggering IC provides improved accuracy, and improved reliabilty over mechanical solutions.

3 QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
V_{SUP}	AC supply voltage	(note 1)	216	230	253	V
I_{SUP}	control supply current	controller only	–	3	–	mA
I_{LOAD}	load current	(note 2)	–	–	6	A
T_{stg}	storage temperature range		–25	–	+85	°C
T_{amb}	operating ambient temperature range	in free air	0	–	+45	°C

Note

1. The operating voltage range can be set to any desired ac range by selection of power supply resistors. Application circuits are easily designed for 100-120 V, or even an extended voltage range such as 100 to 250 V.
2. The HM211 heatsink will permit load currents of up to 6 Amps if it is mounted with a reasonably free flow of air across the heatsink surface. Load currents up to 10 Amps may be used with additional heat dissipating capability, together with triac temperature measurement in situ to demonstrate that under worst case ambient temperatures the triac junction temperature remains within ratings.

4 FUNCTIONAL OVERVIEW

The HM211 electronic control module provides a general purpose core control module for triac control of a variety of applications. It has provision for a large number of component options to be used allowing a wide range of possible user requirements to be covered through the selection and placement of a few components which are customised for each specific application.

Some applications of the HM211 are described in this specification. These and other applications can be addressed by adding the required components to the basic HM211 uncommitted module. Less common functions (for example use at another mains voltage) can also be easily accommodated by choice of the components used.

The HM211 consists of the basic HM211 printed circuit board already assembled with some of the surface mount and other key common parts, providing a basic module which can be more easily customized to whichever circuit a designer might wish to assemble, than by starting with the unpopulated bare board.

The applications of the HM211 which have been mentioned in this specification provide examples of successful designs for typical applications, as well as providing examples of the design process.

In a normal application the core HM211 unit (without the customizing resistors) is made up into a finished product by adding readily available axial lead resistors. This has been chosen as the preferred custom assembly method, rather than having a design based on surface mount components which can be difficult for an inexperienced person to use.

4.1 Technical background

The HM211 contains a zero-crossing triac driver OM5428 (IC1) for electronically controlling a load, and in its most common applications provides motor speed control or light dimmer function by varying the phase of mains. The load function may be either heating or cooling (e.g. a hot water heating element, room heater, fan or motor for evaporative cooling) and this load may be resistive or inductive in nature, meaning the HM211 can satisfy a wide variety of possible appliactions where temperature control or phase control is desired. The necessary changes to suit each load, and to set the switching temperatures or conditions required, are made by selection and placement of additional components (mainly axial leaded resistors) on the generic HM211 control module.

The HM211 module is already assembled with an OM5428 IC, the timing & supply capacitors and a setting potentiometer. Before a functioning module can be completed several questions need to be answered, resistor values calculated, then these components together with the chosen triac are soldered in place to complete the module.

For a detailed description of the functioning of the OM5428 integrated circuit refer to the Data Sheet “OM5428 General purpose triggering circuit”.

5 IMPORTANT ELECTRICAL SAFETY WARNING

The HM211 circuit is connected to the mains electrical supply and operates at voltages which need to be protected by proper enclosure and protective covering. While it has been designed to conform to relevant Australian and overseas Standards (such as AS3300 and AS3313), it should only be used in a manner that ensures the appliance in which they are used complies with all relevant safety and other requirements.

The board must be mounted with non-conductive clips, and positioned such that the minimum creepage distances from the circuit assembly to earth, and between high voltage points is not transgressed.

The NTC element is electrically live and connected to the mains, and must therefore be electrically insulated. Also creepage distances must be maintained for all live parts in the circuit and its wiring, especially with respect to the NTC thermistor.

It should be noted that there are Mains Voltages on the circuit board. Adequate labelling should be attached to warn service personnel, and others, that this danger exists.

The control board assembly must be mounted, preferably with the heatsink vertical, with sufficient free air flow across its surface to prevent the heat dissipated in a number of critical components from causing an unacceptable rise in the ambient temperature.

The board should be mounted in a place that is clean and dry at all times, not subject to condensation or the accumulation of dust and other contaminants.

6 RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
V_{SUP}	AC supply voltage	(note 1)	216	230	253	V
I_{SUP}	control supply current	controller only	–	7	–	mA
I_{LOAD}	load current	(note 2)	–	–	6	A
$I_{STARTUP}$	startup surge load current	(5 seconds maximum)	–	–	16	A
T_{stg}	storage temperature range		–25	–	+85	°C
T_{amb}	operating ambient temperature range	in free air	0	–	+45	°C

Note

1. The operating voltage range can be set to any desired ac range by selection of power supply resistors. Application circuits are easily designed for 100-120 V, or even an extended voltage range such as 100 to 250 V.
2. The HM211 heatsink will permit load currents of up to 6 Amps if it is mounted with a reasonably free flow of air across the heatsink surface. Load currents up to 10 Amps may be used with additional heat dissipating capability, together with temperature measurement in situ to demonstrate that under worst case ambient temperatures the triac junction temperature remains within its published ratings. These current ratings are suited to the triac commonly used in samples, the BT139X-600E, other loads may be better suited to design with another triac which will require different peak current ratings.

7 HM211 GENERIC UNCOMMITTED MODULE

7.1 Description

On the uncommitted assembly the surface mount and the common through-the-board components are already assembled.

The components which will adapt the HM211 to a specific function and operating temperature are not included.

In Table 1 below the parts list of the HM211 is given. This parts list only includes those parts which are common to all applications of the module. Application specific parts lists are given in the relevant application sections.

Figure 1 then follows, which shows the PCB connections and layout for the general HM211 module. These diagrams include all possible component placements on the module, where achievement of a specific application of the module would only require placement of the relevant parts. Application specific PCB layouts and application schematic diagrams follow in the relevant sections.

Figure 2 shows an overall schematic layout for the HM211 module which again includes all possible components for the different applications. This is a schematic representation of the PCB layout.

Most of the components shown on the PCB diagrams are axial leaded components which can be hand formed and soldered in place using a normal soldering iron and solder.

Table 1 Parts list for the HM211 uncommitted module

PART	VALUE	DESCRIPTION
PCB	HM211	printed circuit board
R21	47 R	resistor, carbon composition 0.6 W
C3	100 nF, 250 Vac	capacitor, mains rated, radial, Class X2
IC1	OM5428	integrated circuit
TR1	BT139X-600E	triac
Heatsink		aluminium folded heatsink
Grease		white thermal grease (smear)
Clip		spring mounting clip for the triac
Mounts	2 off	nylon mounting clips
Plug		2 pin pcb mounting plug for NTC
Plug		4 pos 10 mm pitch mains connector
Socket		4 pos screw mount socket for mains/load
Pot shaft		clip-in potentiometer shaft

7.2 Generic Module PCB Layout Showing all Possible Components

Dimensions: 104 x 95 mm.
Height (including the heatsink) 36 mm.

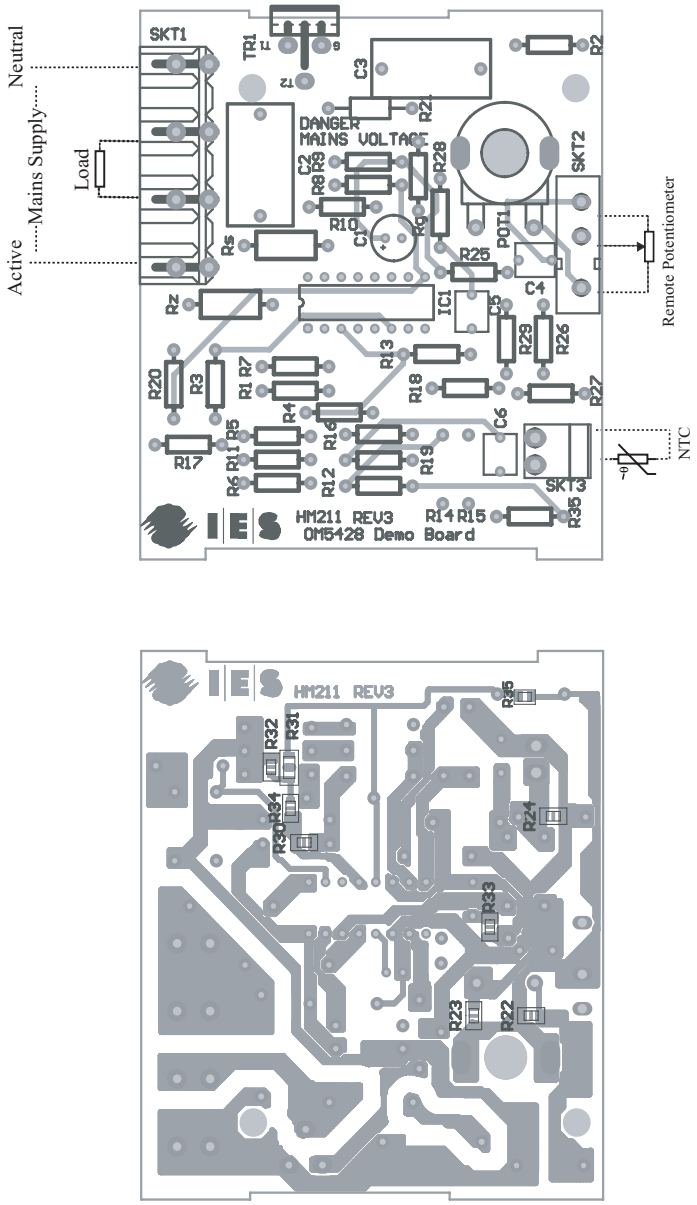

Fig.0 HM211 PCB connections and layout

7.3 Generic Module Circuit Diagram Showing all Possible Components

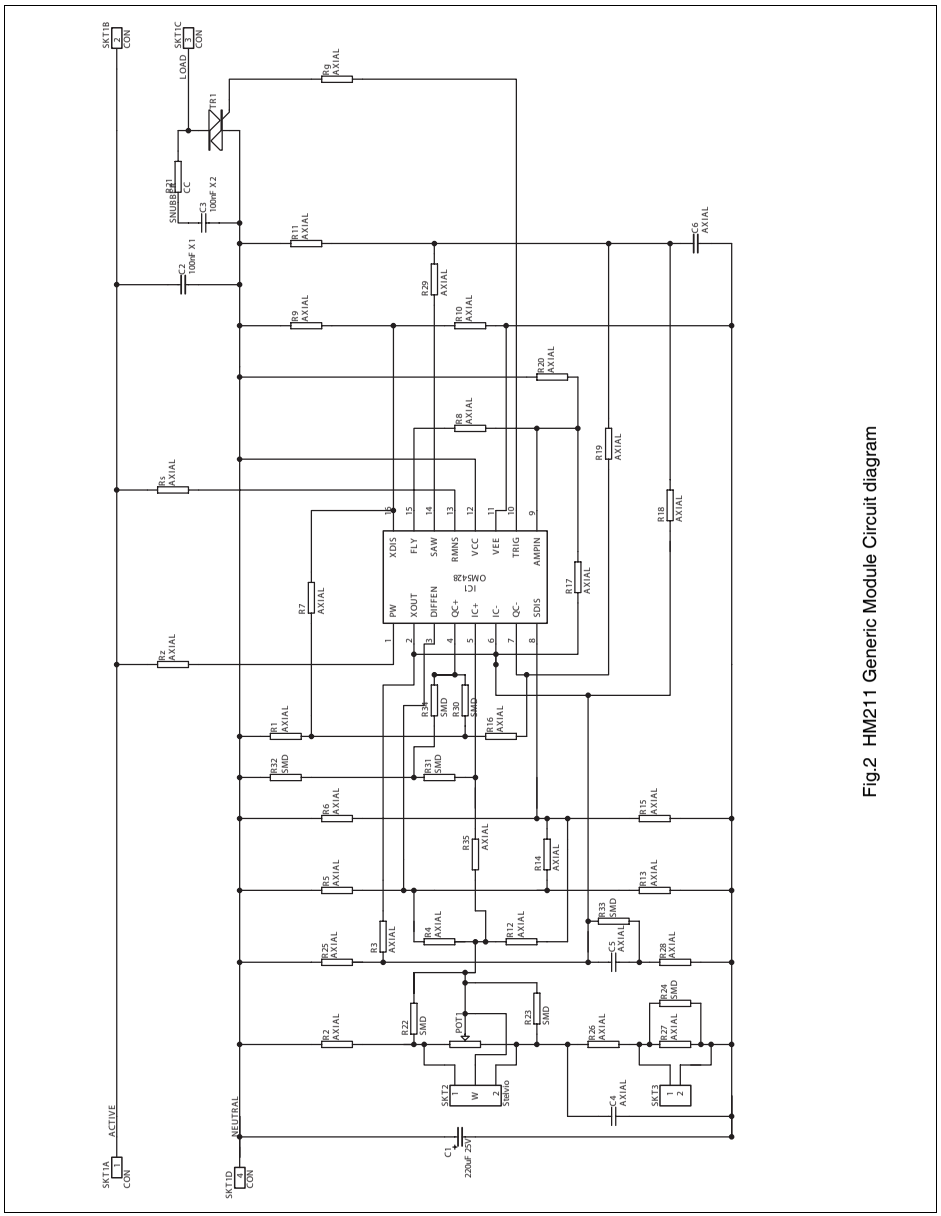

Fig.2 HM211 Generic Module Circuit diagram

8 HM211 SINGLE-PHASE CONTROL APPLICATION MODULE

8.1 Description

The following section outlines components needed to set up the HM211 to achieve the phase control application of the OM5428 IC. Components that are common to this and other applications are included in the uncommitted module and will not need to be added.

This application has a variety of uses such as motor speed control or a light dimmer control.

This circuit provides duty cycle adjustment range from 0% to 100%. 230 V. 0.6 A minimum load current.

Table 2 below, shows the parts list for those parts required to set up the phase control application. This parts list does not include those parts provided on the uncommitted board.

Most of these components are axial leaded components which can be hand formed and soldered in place using a normal soldering iron and electronic solder.

Table 2 Possible components required for the phase control application of the HM211 module, with typical component values

PART	TYP. VALUE	DESCRIPTION
Rz	1 M	Resistor, axial, 1%, high voltage
Rs	100 k	Resistor, axial, 1%, power, 1 W
Rg	680 R	Resistor, axial, 1%, metal film
R2	120 k	Resistor, axial, 1%, metal film
R3	zero ohm link	Resistor, axial, standard metal film
R8	zero ohm link	Resistor, axial, standard metal film
R10	zero ohm link	Resistor, axial, standard metal film
R11	300 k	Resistor, axial, 1%, metal film
R13	1 M	Resistor, axial, 1%, metal film
R15	zero ohm link	Resistor, axial, standard metal film
R19	zero ohm link	Resistor, axial, standard metal film
R22	zero ohm link	Resistor, standard, SMD chip, 0805
R24	zero ohm link	Resistor, standard, SMD chip, 0805
R25	150 k	Resistor, axial, 1%, metal film
R26	4.7 k	Resistor, axial, 1%, metal film
R28	zero ohm link	Resistor, axial, standard metal film
R29	zero ohm link	Resistor, axial, standard metal film
POT1	100 k	Potentiometer, linear
C1	220 uF, 25V	Capacitor, ELCO, radial
C5	100nF	Capacitor, radial
C6	4.7nF	Capacitor, radial

8.2 Phase Control Application Module Connections and Layout

Dimensions: 104 x 95 mm.
Height (including the heatsink) 36 mm.

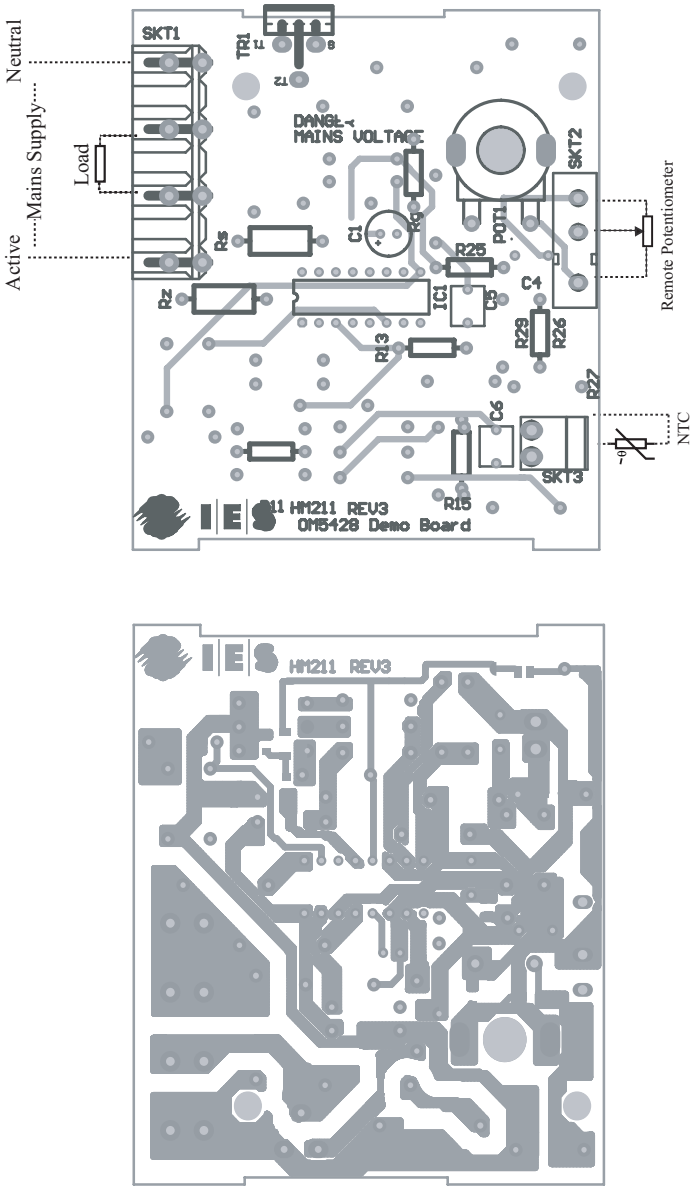

Fig.3 HM211 phase control application, PCB connections and layout

8.3 Phase Control Application Module Block Diagram

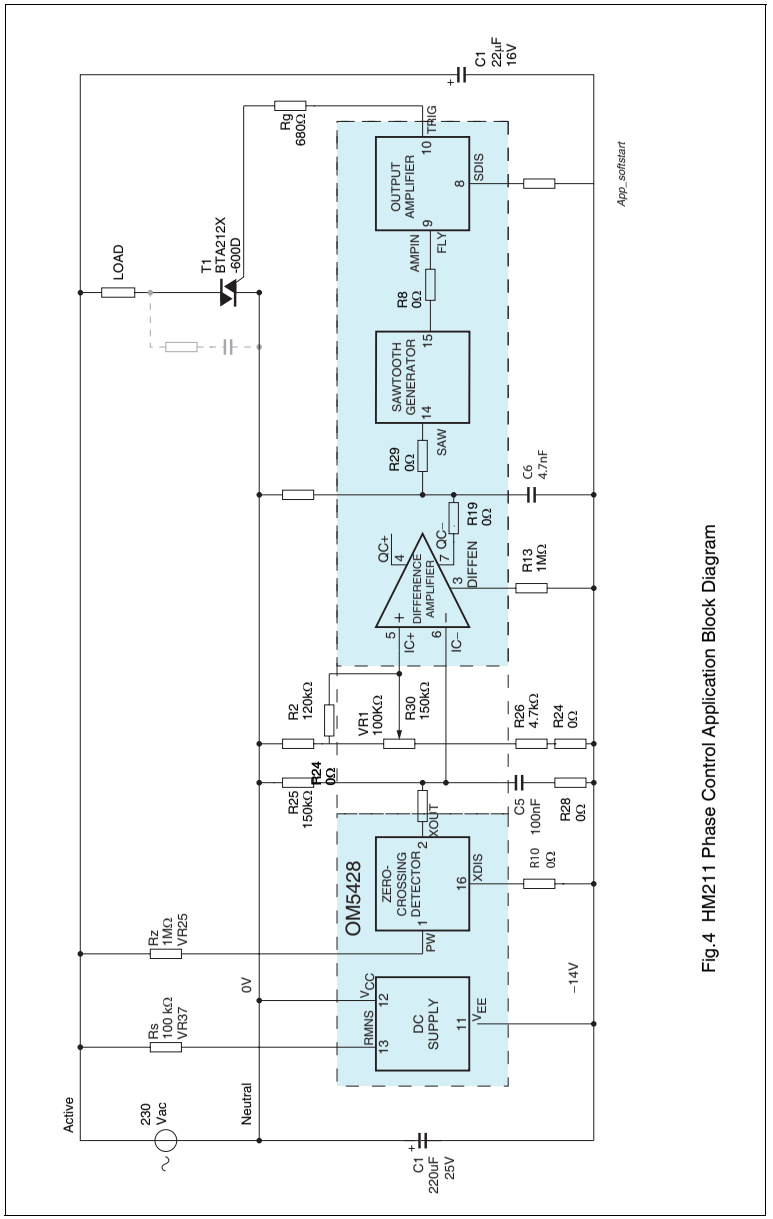

Fig.4 HM211 Phase Control Application Block Diagram

9 HM211 SOFT START CONTROL APPLICATION MODULE

9.1 Description

The following section outlines components needed to set up the HM211 to achieve the soft start control application of the OM5428 IC. Components that are common to this and other applications are included in the uncommitted module and will not need to be added.

This application has a variety of uses such as motor speed control or a light dimmer control.

This soft start function minimises the input current by reducing the peak current that is required when the device is switched on.

Table 2 below, shows the parts list for those parts required to set up the phase control application. This parts list does not include those parts provided on the uncommitted board.

Most of these components are axial leaded components which can be hand formed and soldered in place using a normal soldering iron and electronic solder.

Table 3 Possible components required for the soft start control application of the HM211 module, with typical component values

PART	TYP. VALUE	DESCRIPTION
Rz	1 M	Resistor, axial, 1%, high voltage
Rs	100 k	Resistor, axial, 1%, power, 1 W
R11	300 k	Resistor, axial, 1%, metal film
R13	1 M	Resistor, axial, 1%, metal film
R25	150 k	Resistor, axial, 1%, metal film
R26	4.7 k	Resistor, axial, 1%, metal film
POT1	100 k	Potentiometer, linear
C1	220 uF, 25V	Capacitor, ELCO, radial
C5	100nF	Capacitor, radial
C6	4.7nF	Capacitor, radial
C7	10uF	Capacitor, standard, SMD chip, 1206

9.2 Soft Start Application Module Connections and Layout

Dimensions: 104 x 95 mm.
Height (including the heatsink) 36 mm.

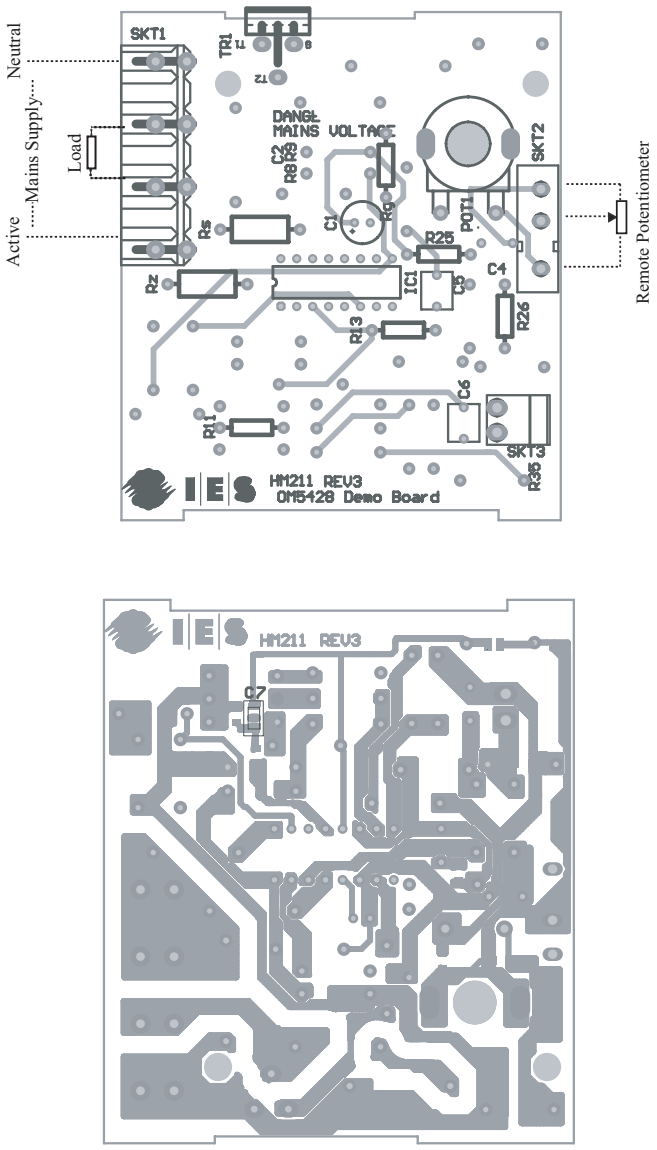

Fig.5 HM211 soft start application, PCB connections and layout

9.3 Soft Start Application Module Block Diagram

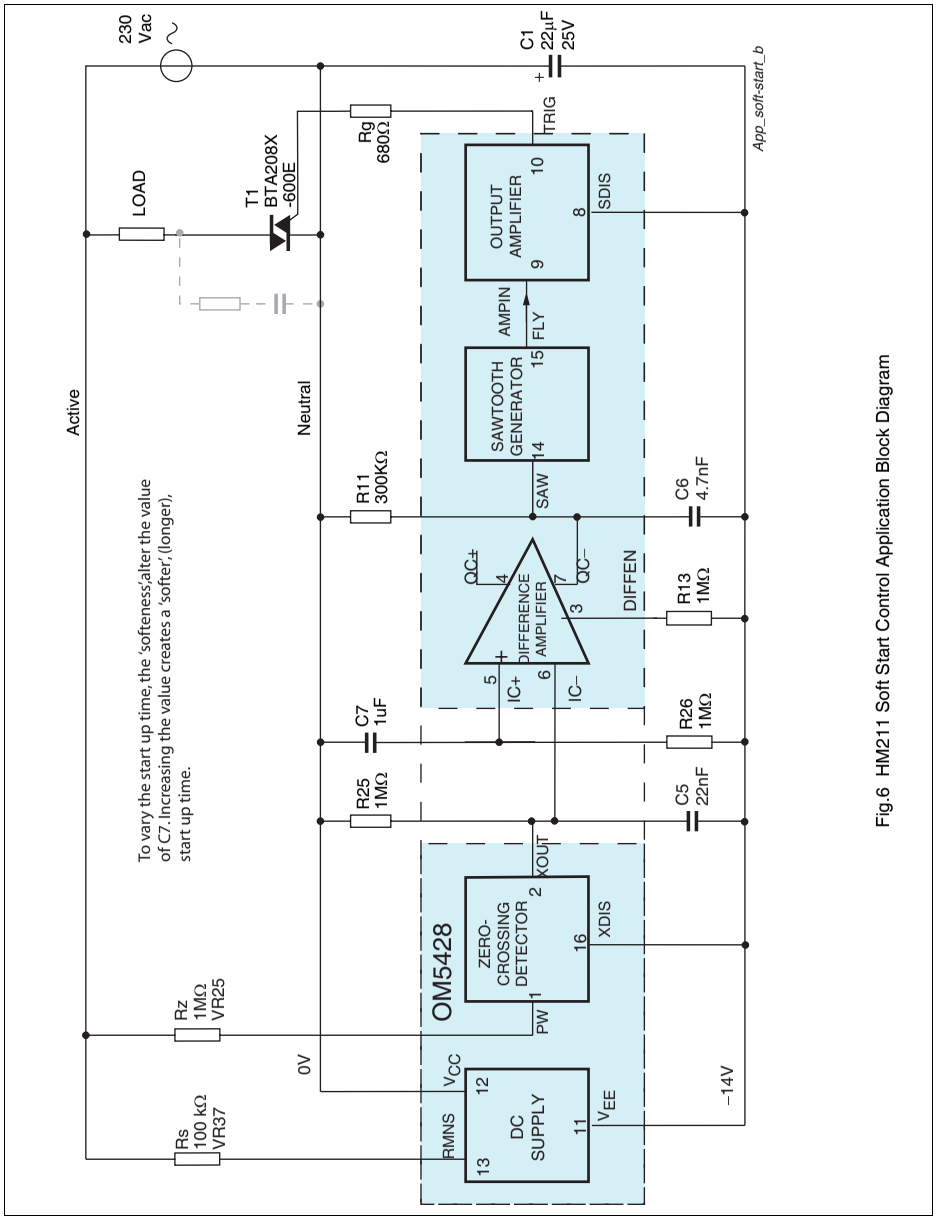

Fig.6 HM211 Soft Start Control Application Block Diagram

10 HM211 PHASE CONTROL(WITH SOFT START) APPLICATION MODULE

10.1 Description

The following section outlines components needed to set up the HM211 to achieve the phase control(with soft start) application of the OM5428 IC. Components that are common to this and other applications are included in the uncommitted module and will not need to be added.

This application has a variety of uses such as motor speed control or a light dimmer control.

This circuit provides duty cycle adjustment range from 0% to 100%. 230 V. 0.6 A minimum load current.It also provides soft start function to limit the current when initiallly swithched on.

Table 2 below, shows the parts list for those parts required to set up the phase control application. This parts list does not include those parts provided on the uncommitted board.

Most of these components are axial leaded components which can be hand formed and soldered in place using a normal soldering iron and electronic solder.

Table 4 Possible components required for the phase control(with soft start) application of the HM211 module, with typical component values

PART	TYP. VALUE	DESCRIPTION
Rz	1 M	Resistor, axial, 1%, high voltage
Rs	100 k	Resistor, axial, 1%, power, 1 W
Rg	680 R	Resistor, axial, 1%, metal film
R11	300 k	Resistor, axial, 1%, metal film
R13	1 M	Resistor, axial, 1%, metal film
R19	zero ohm link	Resistor, axial, standard metal film
R25	150 k	Resistor, axial, 1%, metal film
R26	4.7 k	Resistor, axial, 1%, metal film
R35	150 k	Resistor, standard, SMD chip, 0805
POT1	100 k	Potentiometer, linear
C1	220 uF, 25V	Capacitor, ELCO, radial
C5	100nF	Capacitor, radial
C6	4.7nF	Capacitor, radial
C7	10uF	Capacitor,standard, SMD chip, 1206

10.2 Phase Control(with soft start) Application Module Connections and Layout

Dimensions: 104 x 95 mm.
Height (including the heatsink) 36 mm.

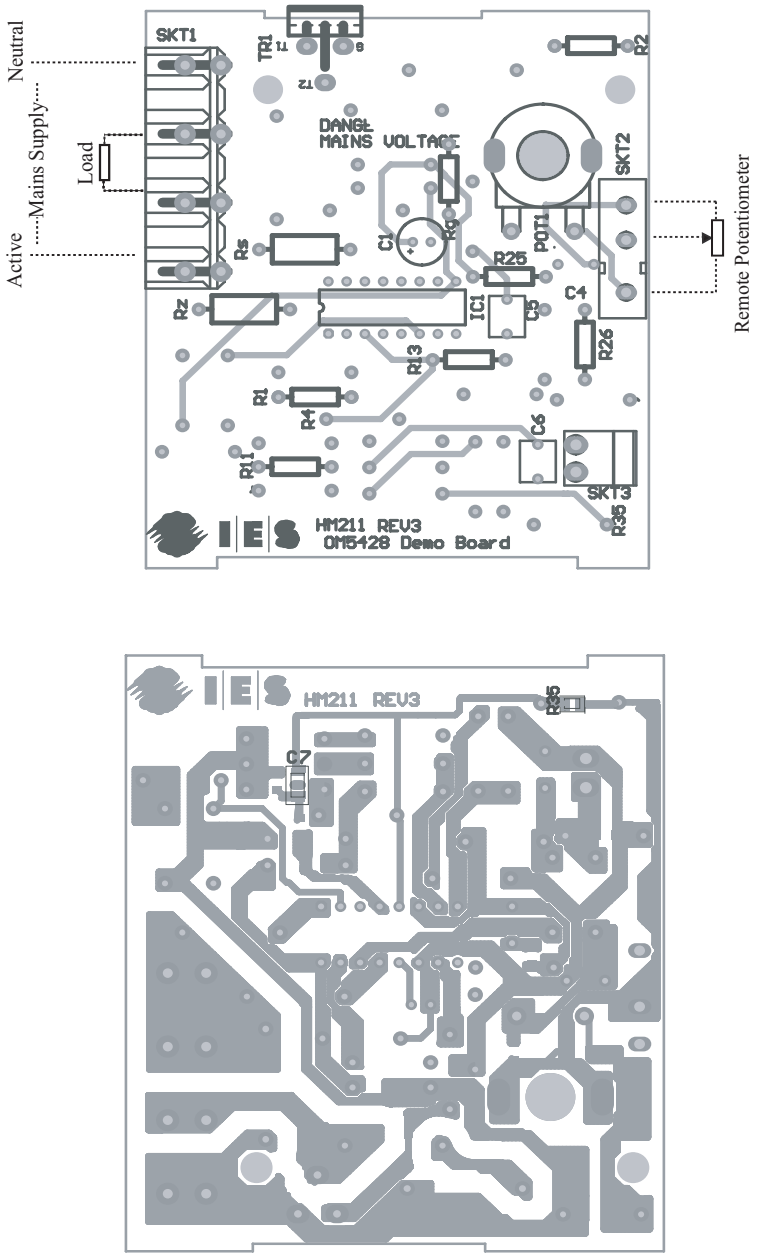

Fig.7 HM211Phase Control with soft start control application, PCB connections and layout

10.3 Phase Control(with soft start Application Module Block Diagram

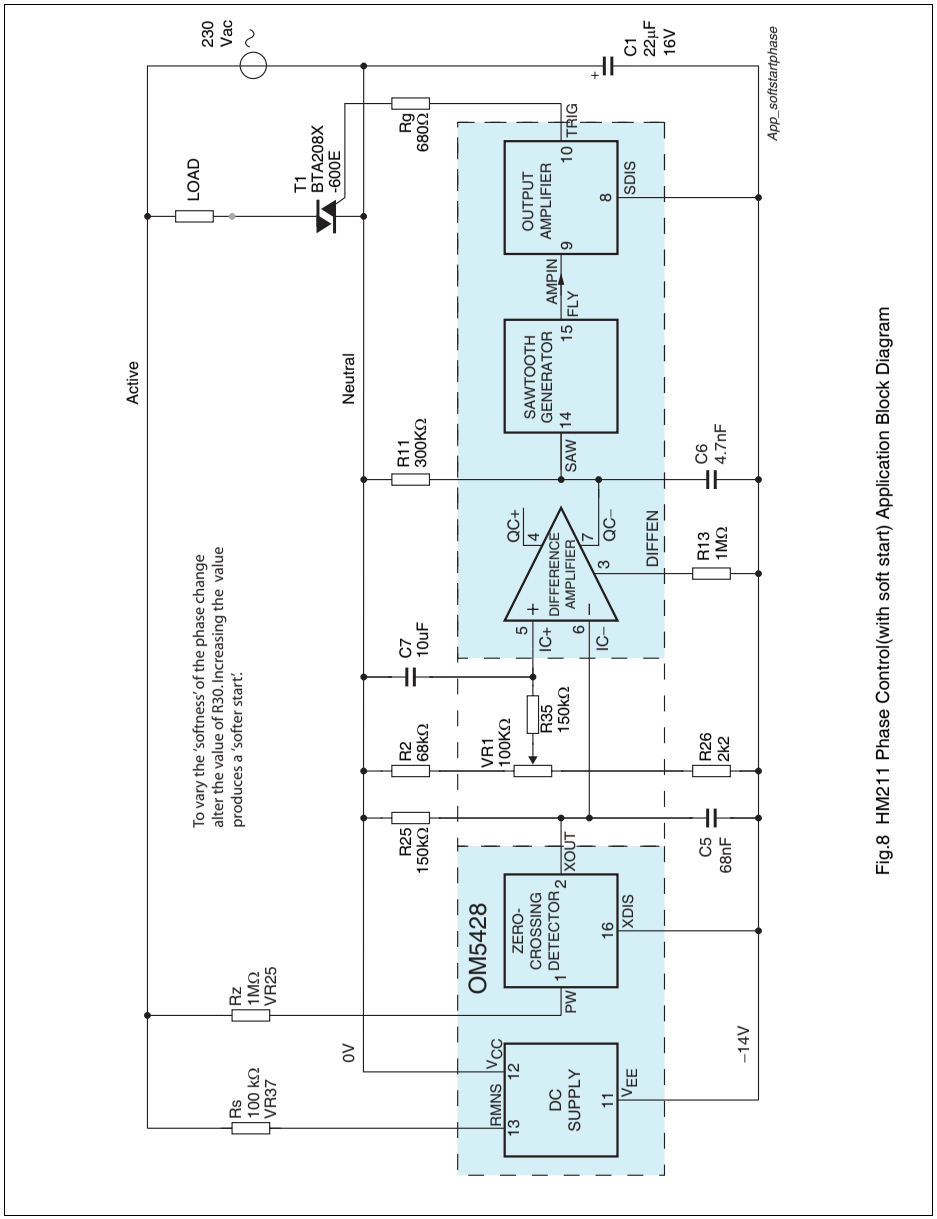

Fig.8 HM211 Phase Control(with soft start) Application Block Diagram

11 HM211 TIME PROPORTIONAL TEMPERATURE CONTROL APPLICATION MODULE

11.1 Description

The following section outlines components needed to set up the HM211 to achieve the time propertional temperature control of the OM5428 IC. Components that are common to this and other applications are included in the uncommitted module and will not need to be added.

This application might have a variety of uses for temperature control applications, such as water bed, room heater, hot water service or boiling water thermostats.

This circuit provides temperature cut-in range 30º to 70ºC.
230 V. 0.6 A minimum load current.
Cycle frequency at mid setting 0.2 Hz

Table 3 below, shows the parts list for those parts required to set up the temperature control appliction. This parts list will give the approximate temperature range shown above. Component values could be altered from those shown in this section to achieve any number of control ranges.This parts list does not include those parts provided on the uncommitted board.

Most of these components are axial leaded components which can be hand formed and soldered in place using a normal soldering iron and electronic solder.

Tolerances for these components are listed at 1% as these will ensure tighter temperature control when an accurate temperature range is paramount.

Table 5 Possible components required for the time proportional temperature control application of the HM211 module, with typical component values

PART	TYP. VALUE	DESCRIPTION
Rz	1 M	Resistor, axial, 1%, high voltage
Rs	82 k	Resistor, axial, 1%, power, 1 W
Rg	680 R	Resistor, axial, 1%, metal film
R1	1 M	Resistor, axial, 1%, metal film
R2	75 k	Resistor, axial, 1%, metal film
R7	zero ohm link	Resistor, axial, standard metal film
R11	750 k	Resistor, axial, 1%, metal film
R14	1 M	Resistor, axial, 1%, metal film
R16	zero ohm link	Resistor, axial, 1%, metal film
R17	zero ohm link	Resistor, axial, standard metal film
R18	1 M	Resistor, axial, 1%, metal film
R23	zero ohm link	Resistor, standard, SMD chip, 0805
R25	1.5 M	Resistor, axial, 1%, metal film
R26	zero ohm linkM	Resistor, axial, 1%, metal film
R28	1 M	Resistor, axial, 1%, metal film
R29	zero ohm link	Resistor, axial, standard metal film
R31	3.3 M	Resistor, standard, SMD chip, 0805
R32	330 k	Resistor, standard, SMD chip, 0805
R33	zero ohm link	Resistor, standard, SMD chip, 0805
R34	zero ohm link	Resistor, standard, SMD chip, 0805
C1	100 uF, 25V	Capacitor, ELCO, radial
C6	22 uF, 25V	Capacitor, ELCO, radial
POT1	220 k	Potentiometer, linear
NTC	200 k	NTC temperature sensor

11.2 Time Proportional Temperature Control Application Module - Connections and Layout

Dimensions: 104 x 95 mm.
Height (including the heatsink) 36 mm.

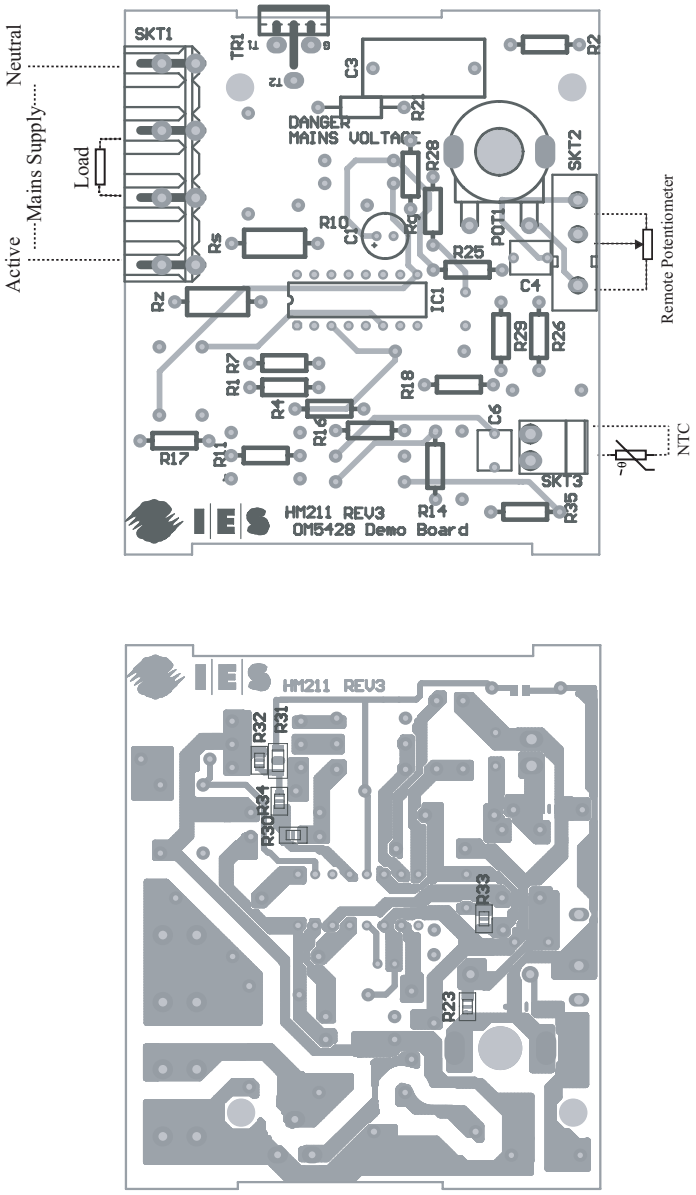

Fig.9 HM211 time proportional temperature control application, PCB connections and layout

11.3 Time Proportional Temperature Control Module - Block Diagram

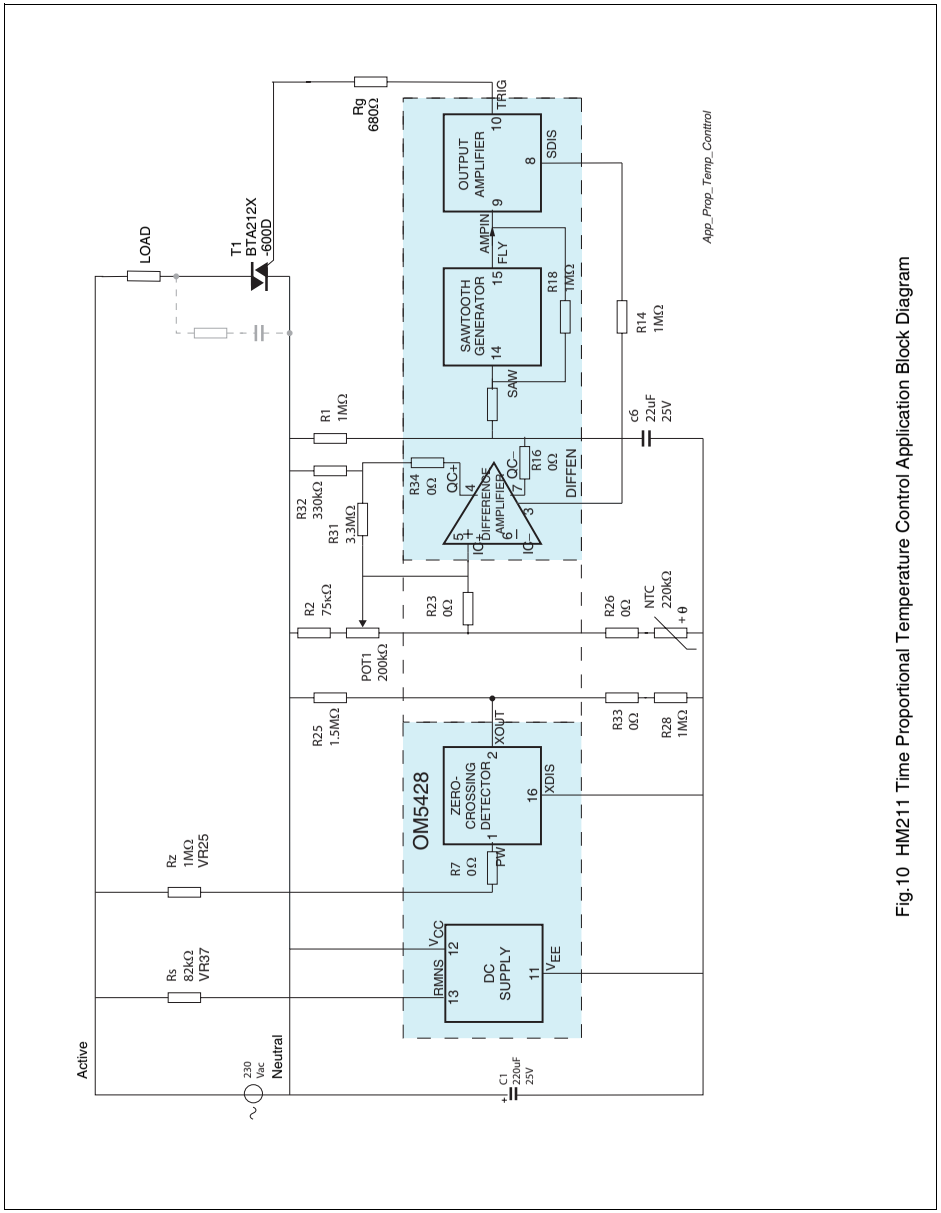

Fig.10 HM211 Time Proportional Temperature Control Application Block Diagram

12 DEFINITIONS

Data sheet status	
Engineering sample information	This contains draft information describing an engineering sample provided to demonstrate possible function and feasibility.Engineering samples have no guarantee that they will perform as described in all details.
Objective specification	This data sheet contains target or goal specifications for product development. Engineering samples have no guarantee that they will function as described in all details.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later. Products to this data may not yet have been fully tested, and their performance fully documented.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

13 IES INFORMATION

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