

HIGH SIDE SMART POWER SOLID STATE RELAY

ADVANCE DATA

TYPE	V _{DSS}	R _{DS(on)}	I _{OUT}	V _{CC}
VN220	60 V	0.05 Ω	28 A	60 V

- OUTPUT CURRENT (CONTINUOUS): 28A @ T_c=25°C
- THERMAL SHUT-DOWN
- UNDER VOLTAGE SHUT-DOWN
- OPEN DRAIN DIAGNOSTIC OUTPUT
- VERY LOW STAND-BY POWER DISSIPATION

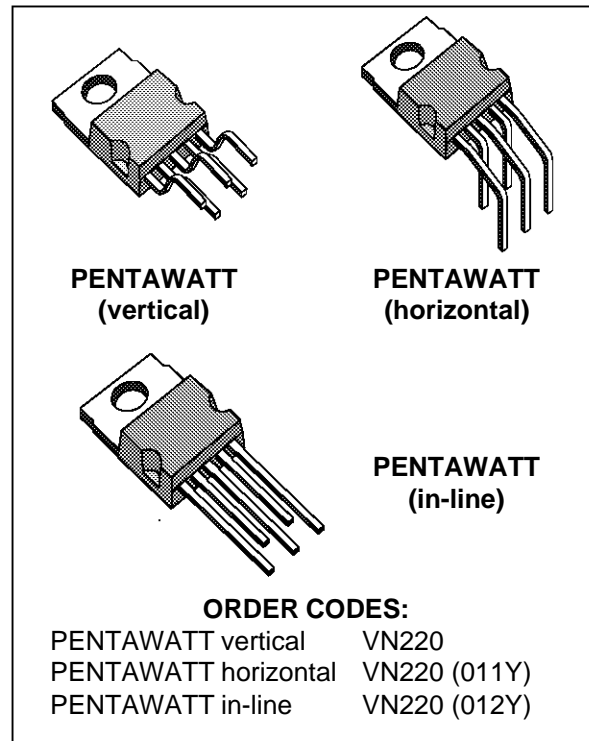
DESCRIPTION

The VN220 is a monolithic device made using SGS-THOMSON Vertical Intelligent Power Technology, intended for driving resistive or inductive loads with one side grounded.

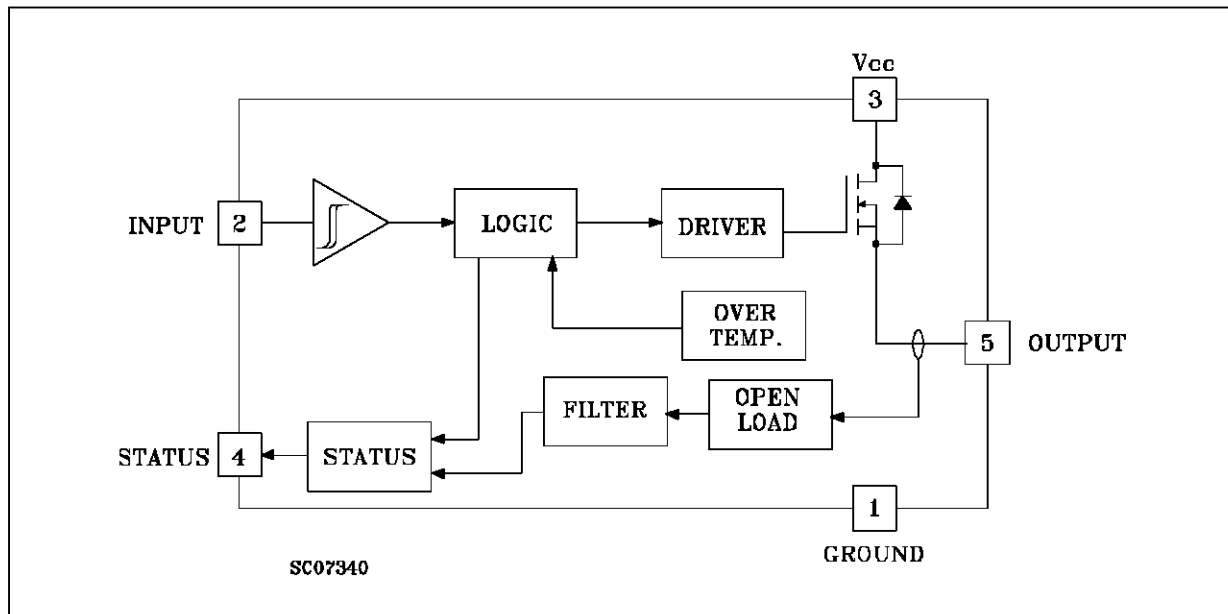
Built-in thermal shut-down protects the chip from over temperature and short circuit.

The input control is 5V logic level compatible.

The open drain diagnostic output indicates open circuit (no load) and over temperature status.



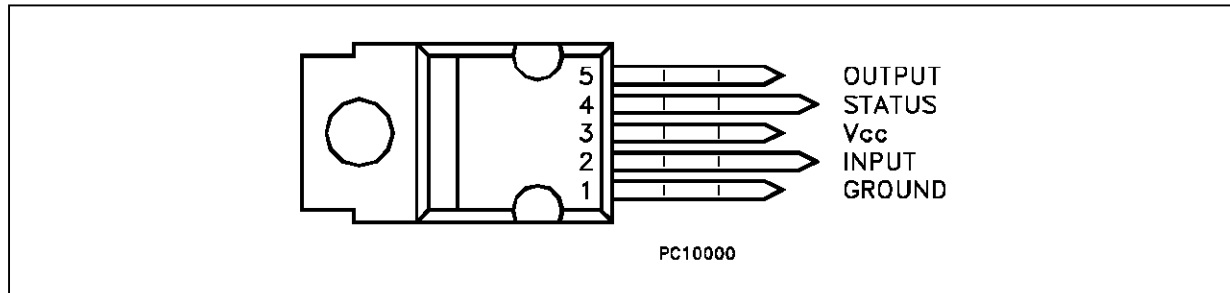
BLOCK DIAGRAM



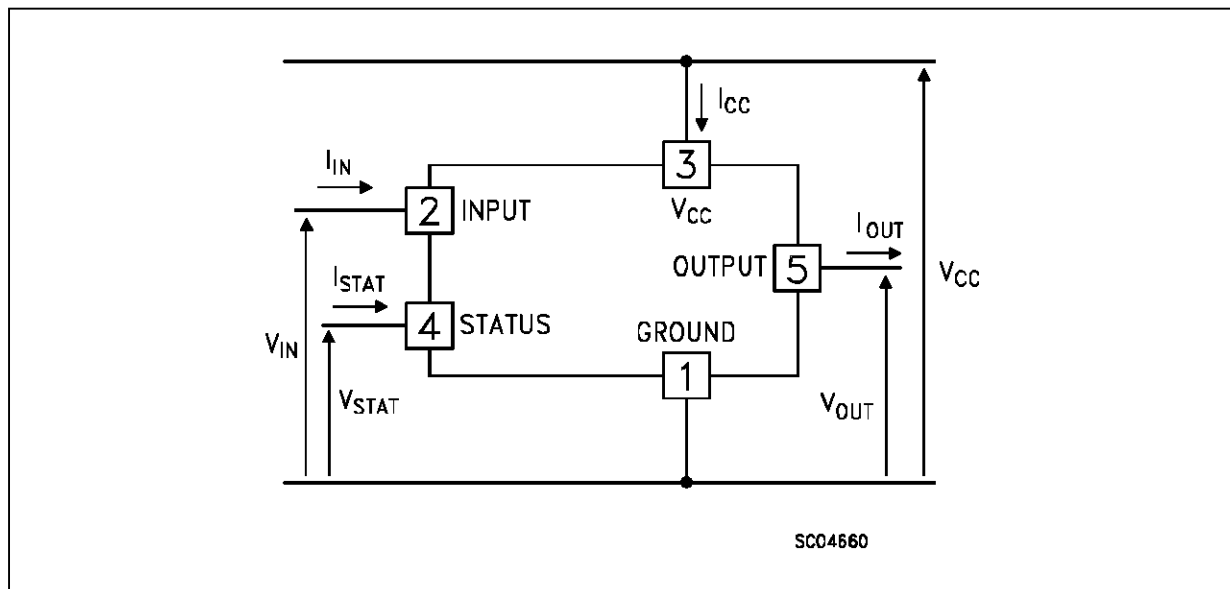
ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	60	V
V_{dsOFF}	Drain-Source Voltage (OFF STATE)	60	V
V_{ds}	Drain-Source Voltage (Output Shorted to Ground)	30	V
I_{OUT}	Output Current (cont.)	28	A
I_R	Reverse Output Current	-28	A
I_{IN}	Input Current	± 10	mA
V_{in}	Input Voltage	35	V
V_{diag}	Status Output Voltage	35	V
$-V_{CC}$	Reverse Supply Voltage	-4	V
I_{STAT}	Status Current	± 10	mA
V_{ESD}	Electrostatic Discharge (1.5 k Ω , 100 pF)	2000	V
P_{tot}	Power Dissipation at $T_c \leq 25$ °C	60	W
T_j	Junction Operating Temperature	-40 to 150	°C
T_{stg}	Storage Temperature	-55 to 150	°C

CONNECTION DIAGRAM



CURRENT AND VOLTAGE CONVENTIONS



THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.08	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	60	$^{\circ}C/W$

ELECTRICAL CHARACTERISTICS ($V_{CC} = 13 V$; $-40 \leq T_j \leq 125 ^{\circ}C$ unless otherwise specified)**POWER**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage		12		30	V
R_{on}	On State Resistance	$I_{OUT} = 3.5 A$ $I_{OUT} = 100 mA$ $T_j = 25 ^{\circ}C$			0.05 1.33	Ω Ω
I_s	Supply Current	Off State On State $T_j = 25 ^{\circ}C$ On State $T_j = 100 ^{\circ}C$			1 8 6	mA mA mA

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time Of Output Current	$I_{OUT} = 3.5 A$ Resistive Load Input Rise Time $< 0.1 \mu s$ $T_j = 25 ^{\circ}C$		20		μs
t_r	Rise Time Of Output Current	$I_{OUT} = 3.5 A$ Resistive Load Input Rise Time $< 0.1 \mu s$ $T_j = 25 ^{\circ}C$		200		μs
$t_{d(off)}$	Turn-off Delay Time Of Output Current	$I_{OUT} = 3.5 A$ Resistive Load Input Rise Time $< 0.1 \mu s$ $T_j = 25 ^{\circ}C$		30		μs
t_f	Fall Time Of Output Current	$I_{OUT} = 3.5 A$ Resistive Load Input Rise Time $< 0.1 \mu s$ $T_j = 25 ^{\circ}C$		5		μs

LOGIC INPUT

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{IL}	Input Low Level Voltage				1.5	V
V_{IH}	Input High Level Voltage		6			V
$V_{I(hyst.)}$	Input Hysteresis Voltage			1		V
I_{IN}	Input Current	$V_{IN} = 5 V$			600	μA
V_{ICL}	Input Clamp Voltage	$I_{IN} = 1 mA$	31	36		V

PROTECTIONS AND DIAGNOSTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{diag}	Diagnostic Output Voltage	$I_{sink} = 5 mA$ (Fault Condition)		0.9	2.5	V
I_{diag}	Diagnostic Output Leakage Current	$V_{diag} = 30 V$			100	μA
I_{OL}	Open Load Current Level		3	9	20	mA

ELECTRICAL CHARACTERISTICS (continued)
PROTECTION AND DIAGNOSTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{ol}	Open Load Filtering Time		1		10	ms
T_{TSD}	Thermal Shut-down Temperature		150			°C
T_R	Reset Temperature		125			°C
V_{diagCL}	Diagnostic Input Clamp Voltage	$I_{IN} = 1 \text{ mA}$	31	36		V

(*) The V_{IH} is internally clamped at 6V about. It is possible to connect this pin to an higher voltage via an external resistor calculated to not exceed 10 mA at the input pin.

(•) Status determination > 100 μs after the switching edge.

FUNCTIONAL DESCRIPTION

The VN220 provides protection against a short circuit on the output and senses the output current to detect an open load. When one of these two faults is detected the diagnostic output is taken low.

OPEN LOAD DETECTION

When the device is first turned on, only the auxiliary DMOS device is turned on. If the load current remains below 9mA (typical), the open load signal is active and the diagnostic output is low. When the load current goes above 9 mA the open load detection becomes inactive and the diagnostic goes high. When the load current exceeds 300 mA, the main DMOS (50 m Ω) turns on. When the load current drops below 240 mA, the main DMOS is turned off but no open load signal is generated and the auxiliary DMOS is still turned on. If the load current drops below 9mA, again the open load signal is generated and the diagnostic output goes low.

NOTE: When an open load defect appears (or disappears) the state of the diagnostic output change only after the filtering time (t_{ol}). SEE open load waveforms diagrams.

SHORT CIRCUIT PROTECTION

Short circuit protection is achieved using the fast response of the thermal shut circuit. The only current limitation in this condition is the saturation current of the DMOS devices and the external wiring resistance. Under this condition the device can survive a short circuit up to 30V across DMOS devices.

THERMAL PROTECTION

The device is internally protected against over temperature by the thermal protection circuit. When the device junction temperature exceeds the protect limit, the output is latched off. To turn on the output again, the input signal must be taken low to reset the latch, then high again to turn on the output. If the junction temperature has not yet cooled below the lower limit set by the thermal sensing hysteresis, the device will remain latched off.

TRUTH TABLE

	INPUT	OUTPUT	DIAGNOSTIC
Normal Operation	L	L	H
	H	H	H
Open Circuit (No Load)	H	H	L (*)
Over-temperature	H	L	L

(*): with filtering operation

Figure 1: Waveforms

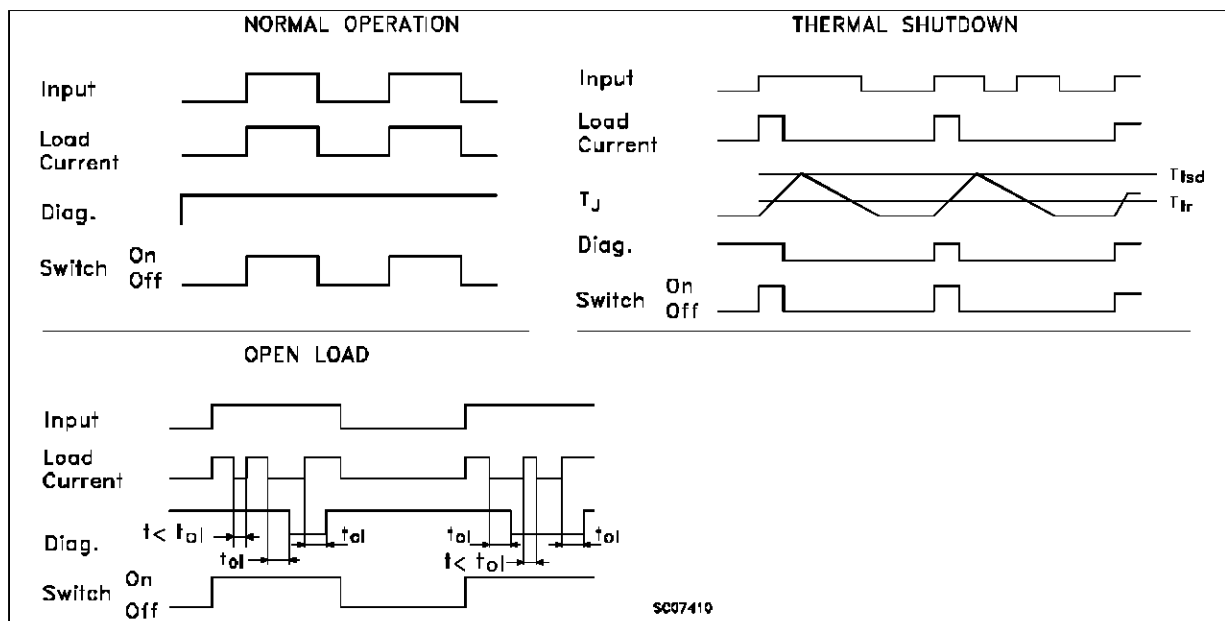


Figure 2: Over Current Test Circuit

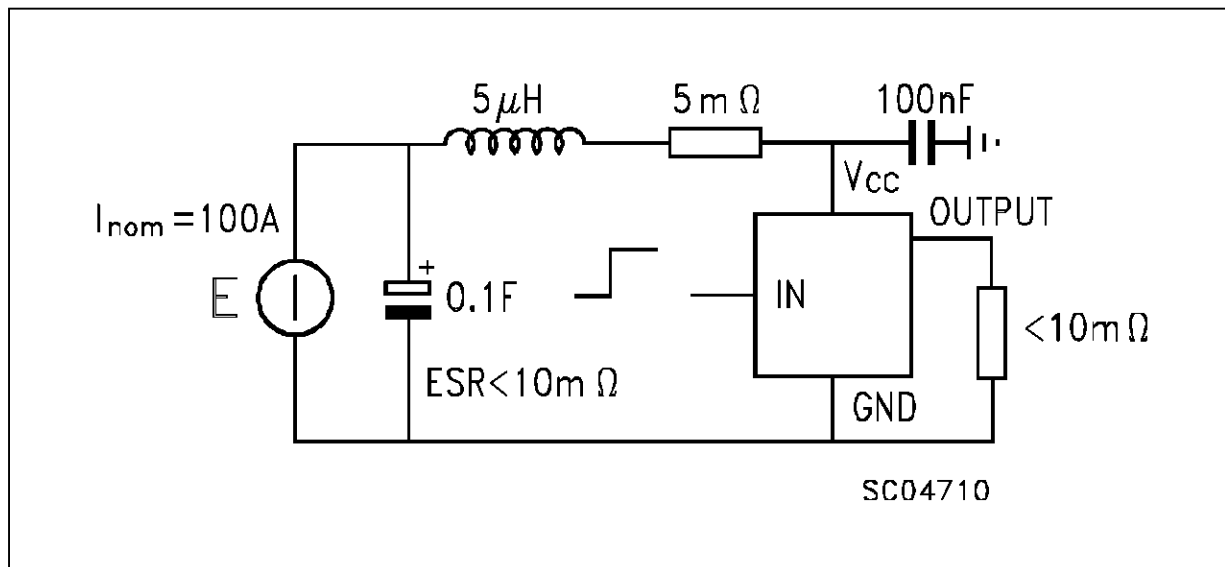


Figure 3: Typical Application Circuit With A Schottky Diode For Reverse Supply Protection

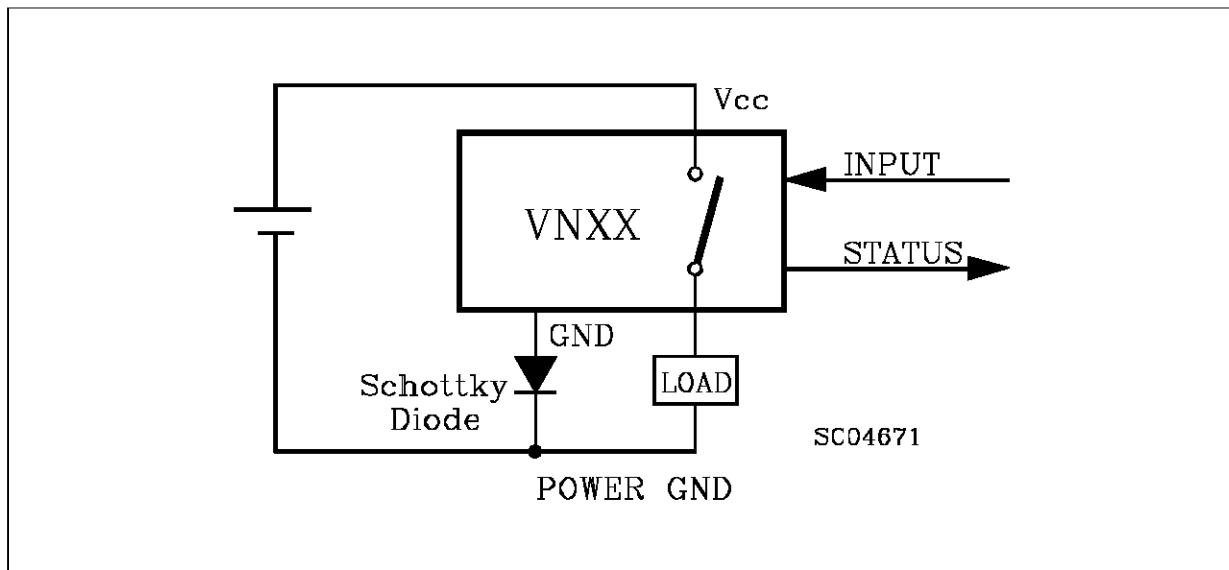
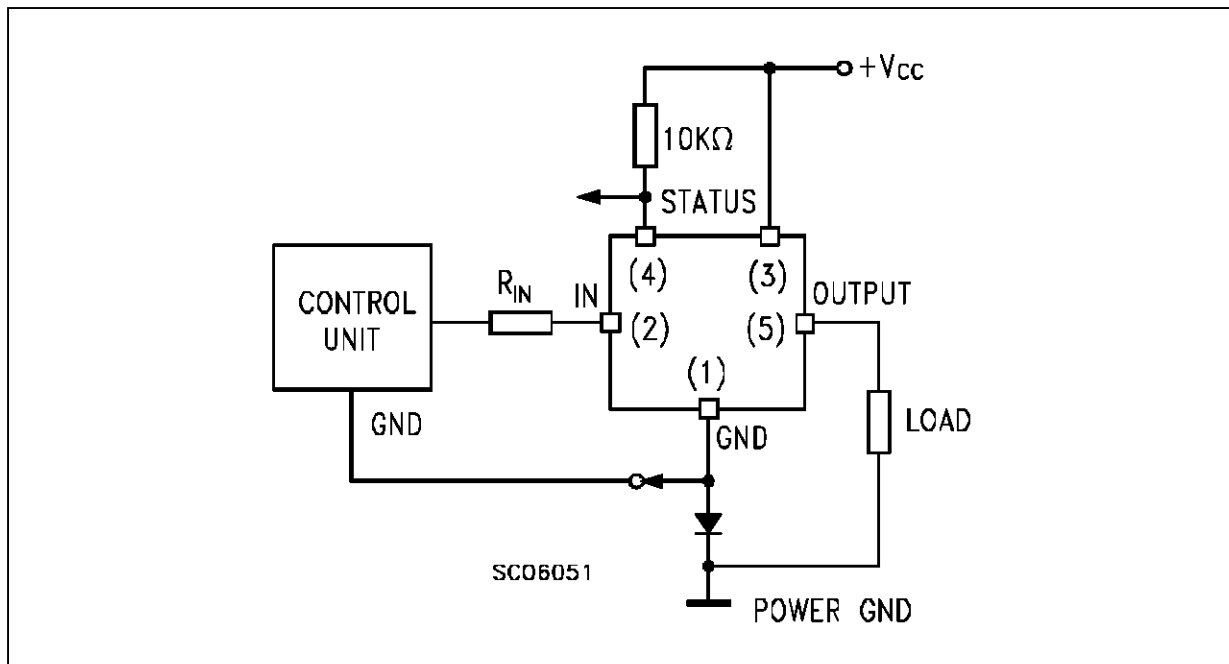
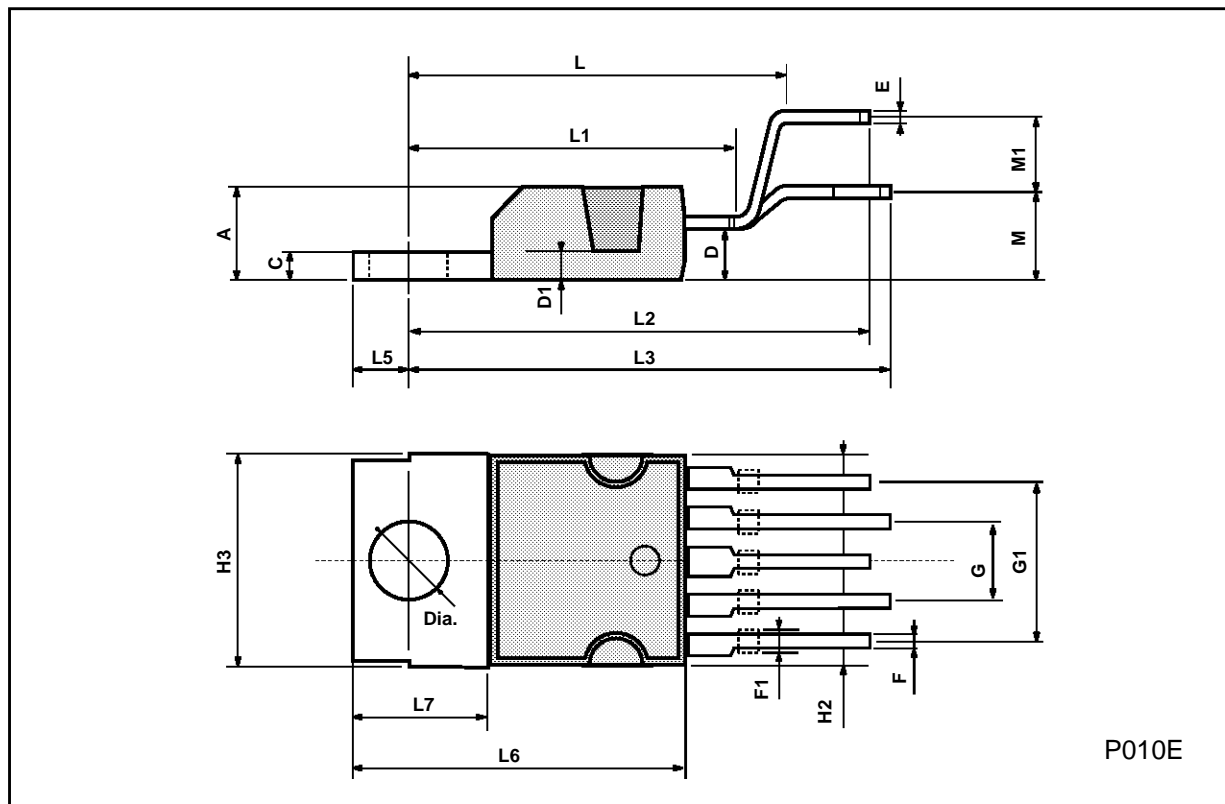


Figure 4: Typical Application Circuit With Separate Signal Ground



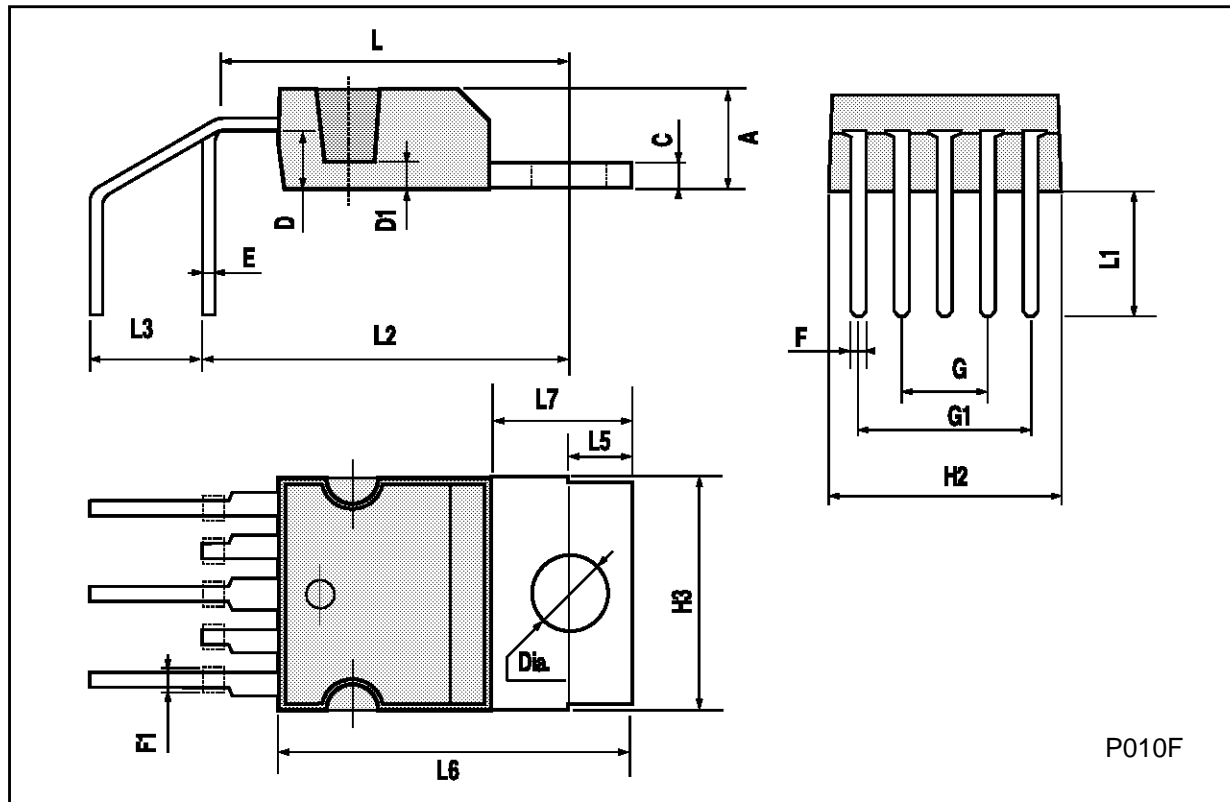
Pentawatt (vertical) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.8		1.05	0.031		0.041
F1	1		1.4	0.039		0.055
G	3.2	3.4	3.6	0.126	0.134	0.142
G1	6.6	6.8	7	0.260	0.268	0.276
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L		17.85			0.703	
L1		15.75			0.620	
L2		21.4			0.843	
L3		22.5			0.886	
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
M		4.5			0.177	
M1		4			0.157	
Dia	3.65		3.85	0.144		0.152



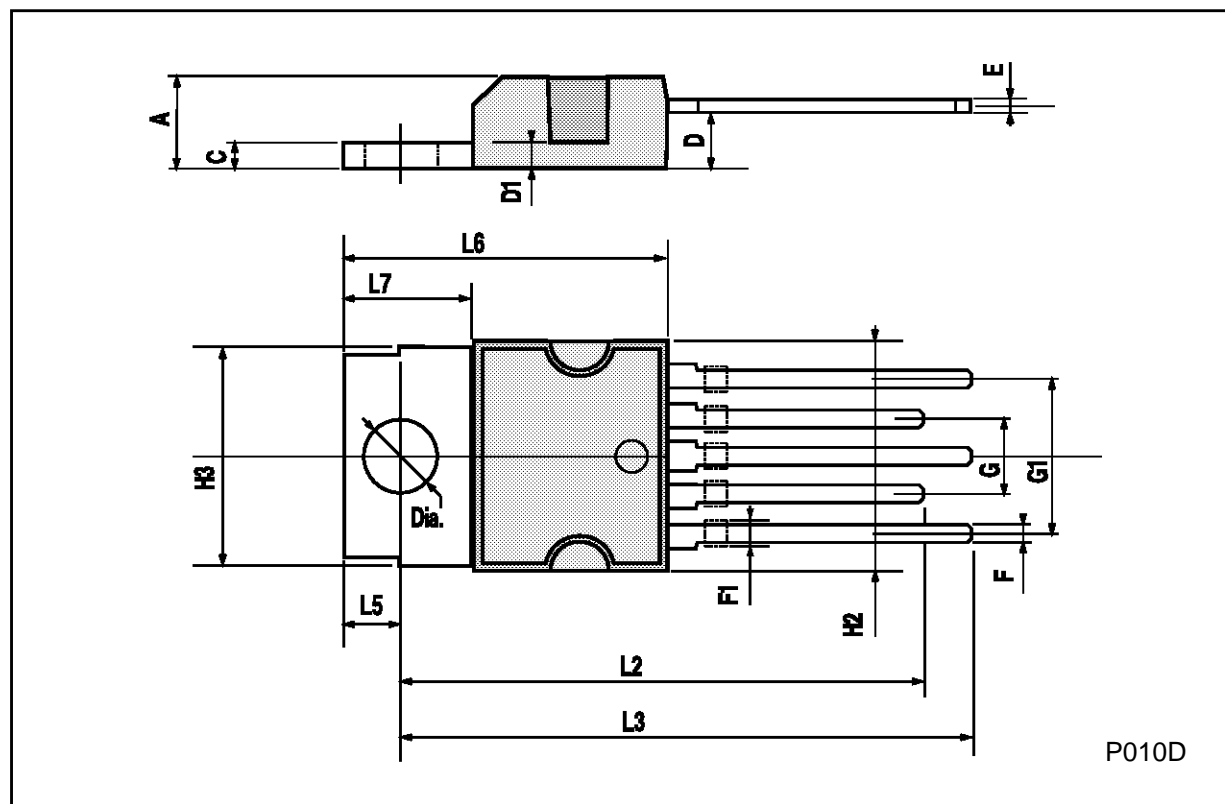
Pentawatt (horizontal) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.8		1.05	0.031		0.041
F1	1		1.4	0.039		0.055
G	3.2	3.4	3.6	0.126	0.134	0.142
G1	6.6	6.8	7	0.260	0.268	0.276
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L	14.2		15	0.559		0.590
L1	5.7		6.2			0.244
L2	14.6		15.2			0.598
L3	3.5		4.1	0.137		0.161
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
Dia	3.65		3.85	0.144		0.152



Pentawatt (In-Line) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.8		1.05	0.031		0.041
F1	1		1.4	0.039		0.055
G	3.2	3.4	3.6	0.126	0.134	0.142
G1	6.6	6.8	7	0.260	0.268	0.276
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L2	23.05	23.4	23.8	0.907	0.921	0.937
L3	25.3	25.65	26.1	0.996	1.010	1.028
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
Dia	3.65		3.85	0.144		0.152



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