Figure 2. Block Diagram

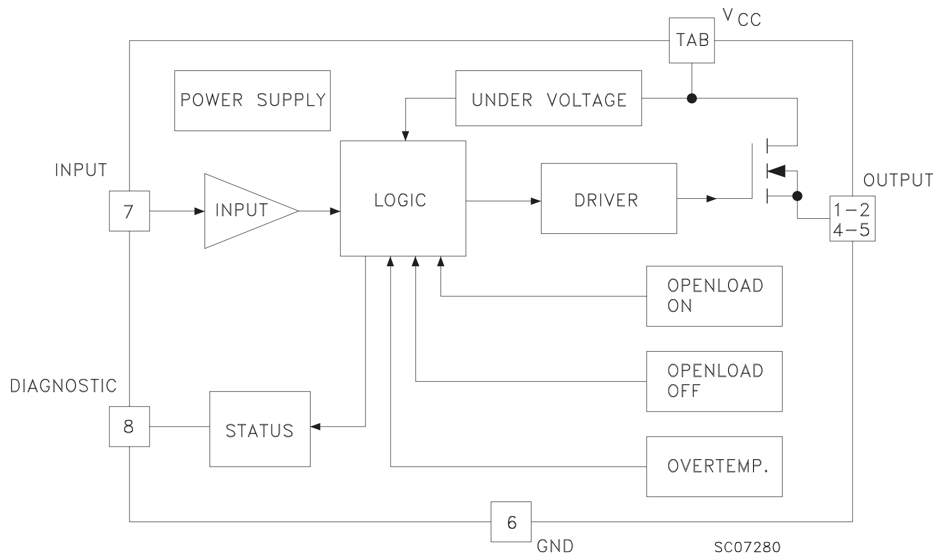


Table 3. Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	40	V
I_{OUT}	Output Current (cont.) at T_c = 85 °C	20	A
I_{OUT}(RMS)	RMS Output Current at T_c = 85 °C	20	A
I_R	Reverse Output Current at T_c = 85 °C (f > 1Hz)	–20	A
I_{IN}	Input Current	±10	mA
$-V_{CC}$	Reverse Supply Voltage	–4	V
I_{STAT}	Status Current	±10	mA
V_{ESD}	Electrostatic Discharge (1.5 kΩ, 100 pF)	2000	V
P_{tot}	Power Dissipation at T_c = 25 °C	82	W
T_j	Junction Operating Temperature	-40 to 150	°C
T_{stg}	Storage Temperature	-55 to 150	°C

Figure 3. Connection Diagrams

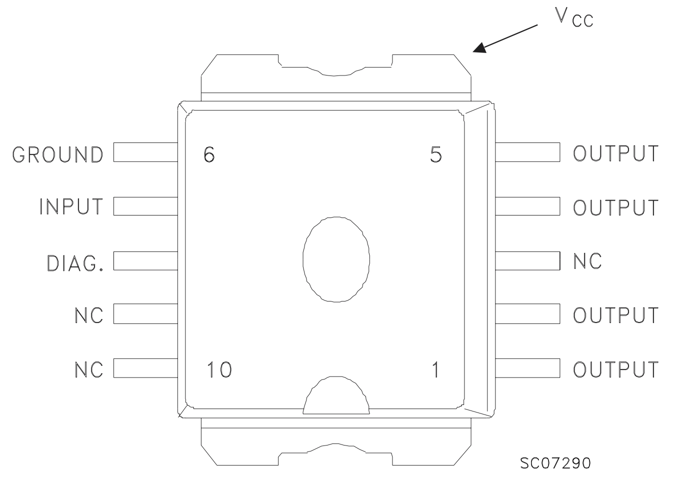


Figure 4. Current and Voltage Conventions

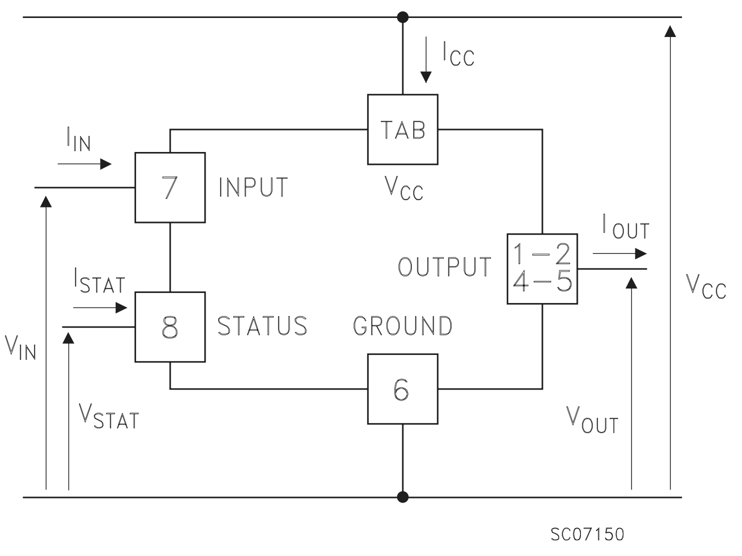


Table 4. Thermal Data

Symbol	Parameter		Value	Unit
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.5	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient (1)	Max	50	°C/W

Note: 1. When mounted using minimum recommended pad size on FR-4 board.

ELECTRICAL CHARACTERISTICS
(8 < V_{CC} < 16 V; -40 ≤ T_j ≤ 125 °C unless otherwise specified)

Table 5. Power

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage		6	13	26	V
I_n(2)	Nominal Current	T_c = 85 °C; $V_{DS(on)}$ ≤ 0.5; V_{CC} = 13 V	5.6		8.8	A
R_{on}	On State Resistance	I_{OUT} = In; V_{CC} = 13 V; T_j = 25 °C	0.038		0.06	Ω
I_S	Supply Current	Off State; V_{CC} = 13 V; T_j ≥ 25 °C		25	50	μA
$V_{DS(MAX)}$	Maximum Voltage Drop	I_{OUT} = 20 A; V_{CC} = 13 V; T_c = 85 °C	1		1.8	V
R_j	Output to GND Internal Impedance	T_j = 25 °C	5	10	20	KΩ

Note: 2. In= Nominal current according to ISO definition for high side automotive switch. The Nominal Current is the current at T_c = 85 °C for battery voltage of 13V which produces a voltage drop of 0.5 V.

Table 6. Switching

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$(3)	Turn-on Delay Time Of Output Current	R_{load} = 1.6 Ω	5	50	500	μs
t_r(3)	Rise Time Of Output Current	R_{load} = 1.6 Ω	40	100	680	μs
$t_{d(off)}$(3)	Turn-off Delay Time Of Output Current	R_{load} = 1.6 Ω	10	100	500	μs
t_f(3)	Fall Time Of Output Current	R_{load} = 1.6 Ω	40	100	680	μs
$(di/dt)_{on}$	Turn-on Current Slope	R_{load} = 1.6 Ω; V_{CC} = 13 V	0.008		0.1	A/μs
$(di/dt)_{off}$	Turn-off Current Slope	R_{load} = 1.6 Ω; V_{CC} = 13 V	0.008		0.1	A/μs
V_{demag}	Inductive Load Clamp Voltage	R_{load} = 1.6 Ω; L = 1 mH	–24	–18	–14	V

Note: 3. See Switching Time Waveforms.

Table 7. 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		3.5		Note 4	V
$V_{I(hyst)}$	Input Hysteresis Voltage		0.2	1	1.5	V
I_{IN}	Input Current	V_{IN} = 5 V; T_j = 25 °C			100	μA
V_{ICL}	Input Clamp Voltage	I_{IN} = 10 mA I_{IN} = –10 mA	5	6 –0.7	7	V V

Note: 4. 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.

ELECTRICAL CHARACTERISTICS (cont'd)

Table 8. Protection and Diagnostics (cont'd)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{STAT}	Status Voltage Output Low	I_{STAT} = 1.6 mA			0.4	V
V_{USD}	Under Voltage Shut Down		3.5	5	6	V
V_{SCL}	Status Clamp Voltage	I_{STAT} = 10 mA I_{STAT} = –10 mA	5	6 –0.7	7	V V
T_{TSD}	Thermal Shut-down Temperature		140	160	180	°C
$T_{SD(hyst.)}$	Thermal Shut-down Hysteresis			15	50	°C
T_R	Reset Temperature		125			°C
V_{OL} (5)	Open Voltage Level	Off-State	2.5	3.8	5	V
I_{OL}	Open Load Current Level	On-State	0.15		0.85	A
t_{povl} (6)	Status Delay			5	10	µs
t_{pol} (6)	Status Delay		50	400	2500	µs

Note: 5. $I_{OL(off)} = (V_{CC} - V_{OL})/R_{OL}$ (see figure 5).
6. t_{povl} t_{pol}: ISO definition (see figure 6).

Figure 5. Note 5 relevant figure

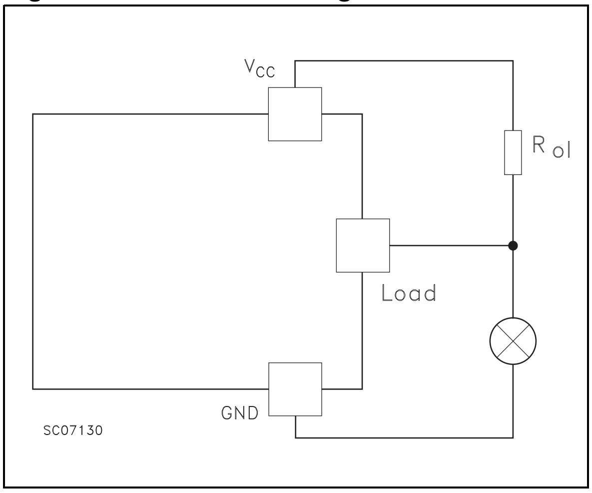


Figure 6. Note 6 relevant figure

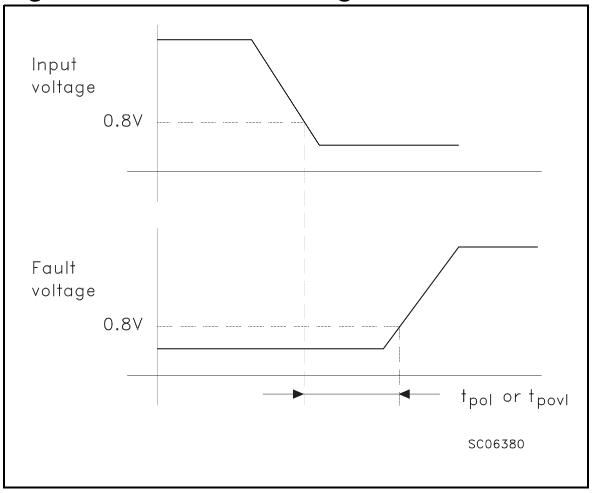
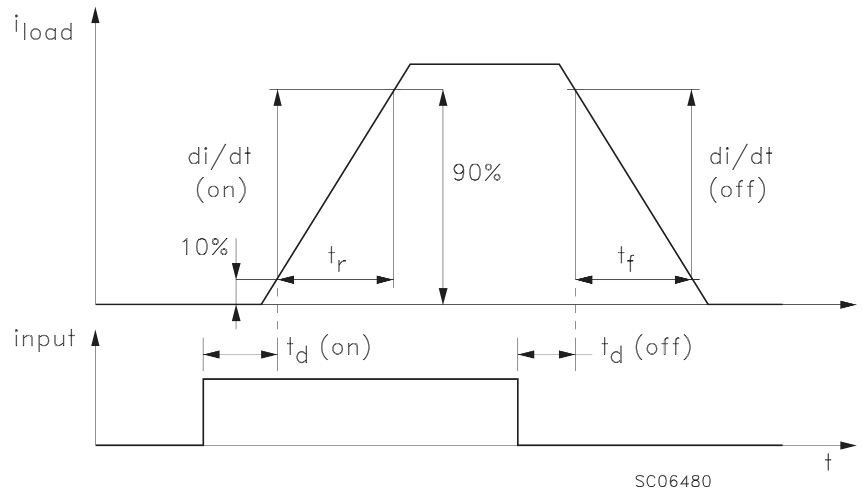


Figure 7. Switching Time Waveforms



FUNCTIONAL DESCRIPTION

The device has a diagnostic output which indicates open load in on-state, open load in off-state, over temperature conditions and stuck-on to V_{CC}.

From the falling edge of the input signal, the status output, initially low to signal a fault condition (overtemperature or open load on-state), will go back to a high state with a different delay in case of overtemperature (tpovl) and in case of open load (tpol) respectively. This feature allows to discriminate the nature of the detected fault. To protect the device against short circuit and over current condition, the thermal protection turns the integrated Power MOS off at a minimum junction temperature of 140 °C. When this temperature returns to 125°C the switch is automatically turned on again. In short circuit the protection reacts with virtually no delay, the sensor being located inside the Power MOS area. An internal function of the devices ensures the fast demagnetization of inductive loads with a typical voltage (V_{demag}) of -18V. This function allows to greatly reduces the power dissipation according to the formula:

$P_{dem} = 0.5 \bullet L_{load} \bullet (I_{load})^2 \bullet [(V_{CC}+V_{demag})/V_{demag}] \bullet f$

where f = switching frequency and

V_{demag} = demagnetization voltage

The maximum inductance which causes the chip temperature to reach the shut-down temperature in a specified thermal environment is a function of the load current for a fixed V_{CC}, V_{demag} and f according to the above formula. In this device if the GND pin is disconnected, with V_{CC} not exceeding 16V, it will switch off.

PROTECTING THE DEVICE AGAINST REVERSE BATTERY

The simplest way to protect the device against a continuous reverse battery voltage (-26V) is to insert a Schottky diode between pin 1 (GND) and ground, as shown in the typical application circuit (Figure 10).

The consequences of the voltage drop across this diode are as follows:

– If the input is pulled to power GND, a negative voltage of $-V_f$ is seen by the device. (V_{IL}, V_{IH} thresholds and V_{STAT} are increased by V_f with respect to power GND).
– The undervoltage shutdown level is increa- sed by V_f.

If there is no need for the control unit to handle external analog signals referred to the power GND, the best approach is to connect the reference potential of the control unit to node [1] (see application circuit in Figure 10), which becomes the common signal GND for the whole control board avoiding shift of V_{IH}, V_{IL} and V_{STAT}. This solution allows the use of a standard diode.

Table 9. Truth Table

	Input	Output	Diagnostic
Normal Operation	L H	L H	H H
Over-temperature	X	L	L
Under-voltage	X	L	H
Short load to V_{CC}	H L	H H	L L
Open Circuit	H L	H L	L L(7)

Note: 7. With an additional external resistor.

Figure 8. Waveforms

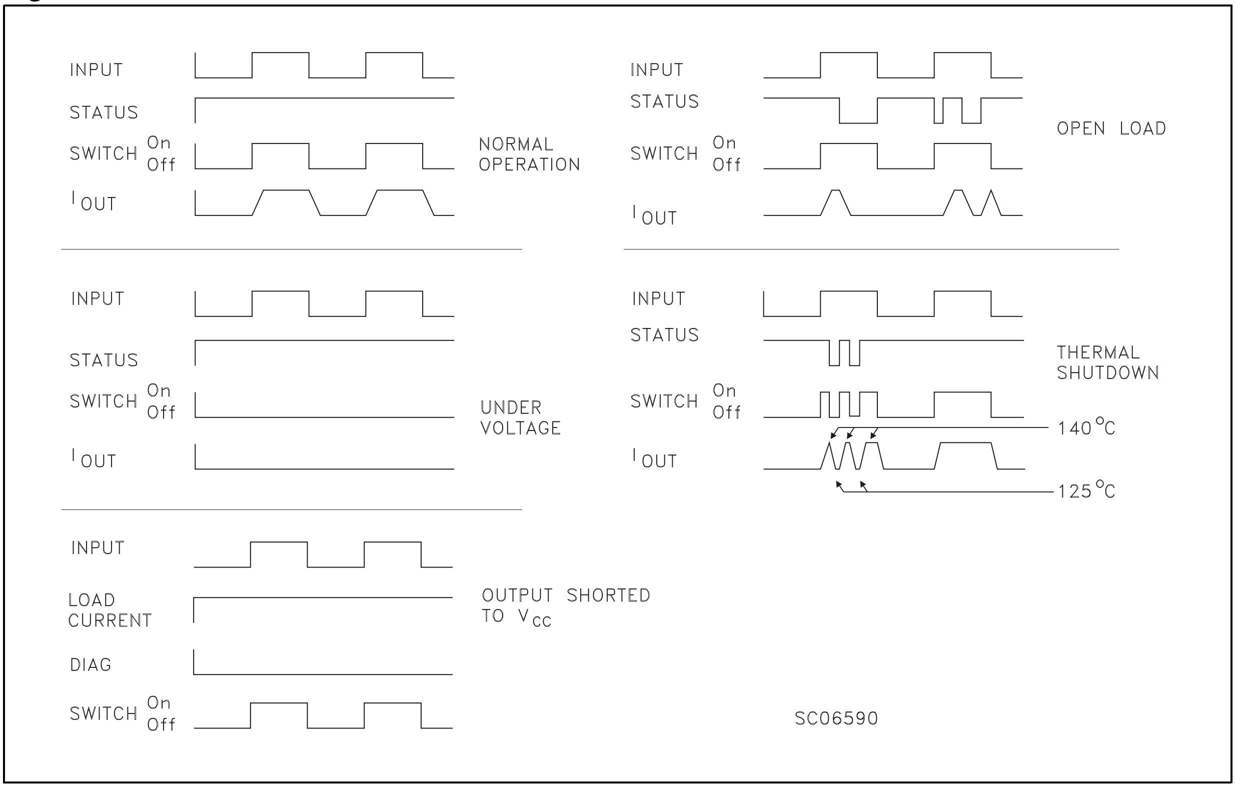


Figure 9. Over Current Test Circuit

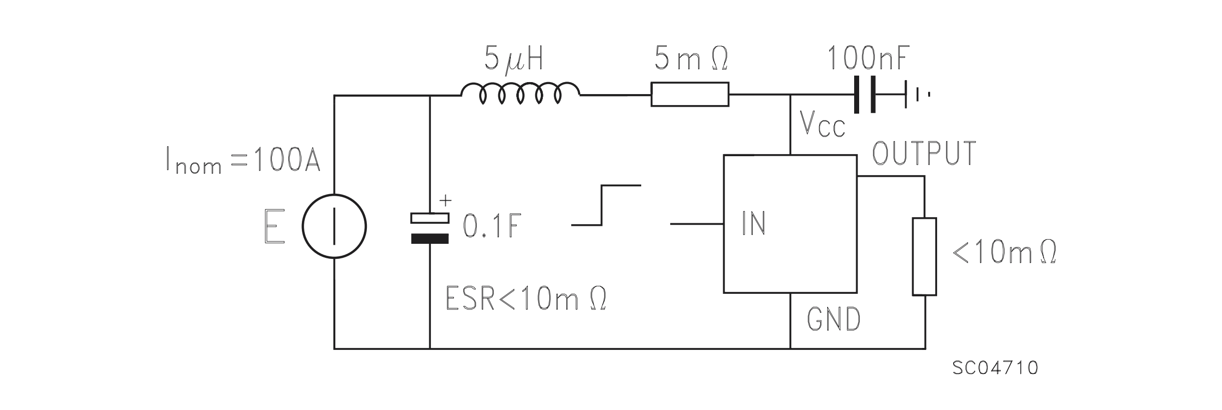


Figure 10. Typical Application Circuit With A Schottky Diode For Reverse Supply Protection

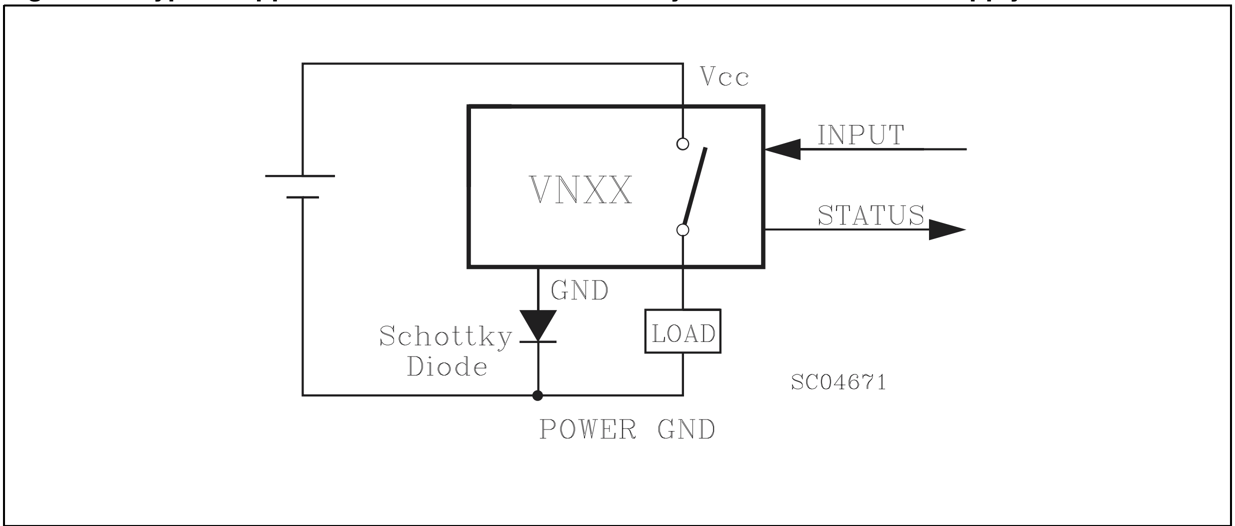
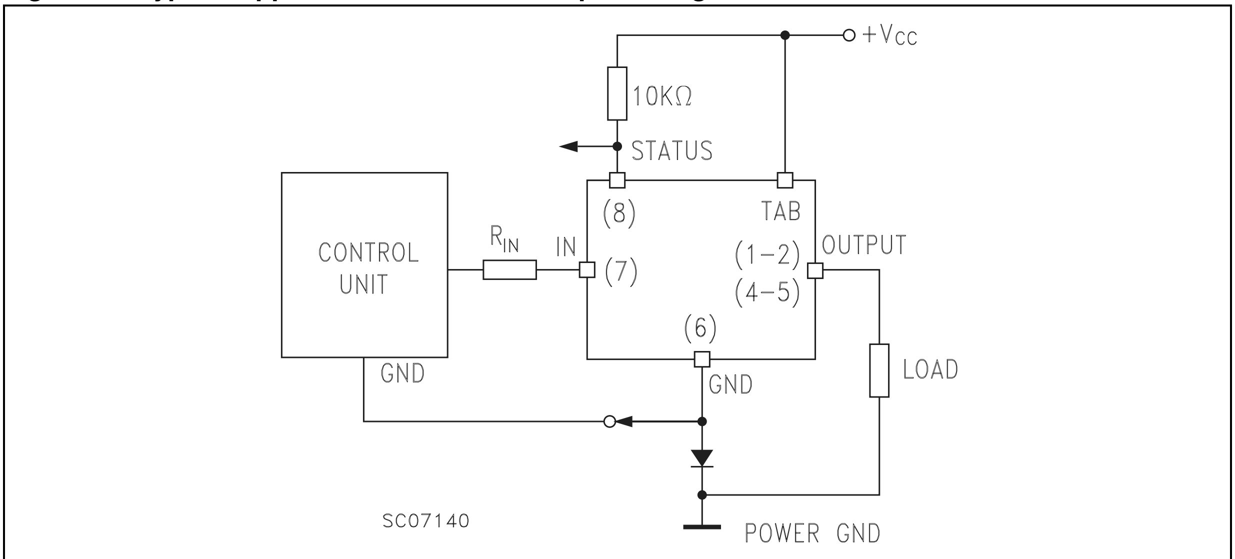


Figure 11. Typical Application Circuit With Separate Signal Ground



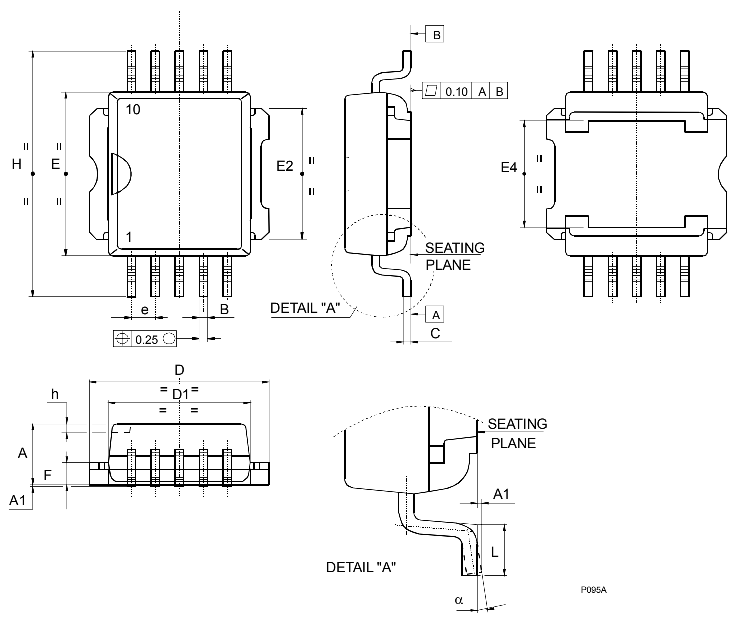
PACKAGE MECHANICAL

Table 10. Power SO-10 Mechanical Data

Symbol	millimeters		
	Min	Typ	Max
A	3.35		3.65
A (8)	3.4		3.6
A1	0.00		0.10
B	0.40		0.60
B (8)	0.37		0.53
C	0.35		0.55
C (8)	0.23		0.32
D	9.40		9.60
D1	7.40		7.60
E	9.30		9.50
E2	7.20		7.60
E2 (8)	7.30		7.50
E4	5.90		6.10
E4 (8)	5.90		6.30
e		1.27	
F	1.25		1.35
F (8)	1.20		1.40
H	13.80		14.40
H (8)	13.85		14.35
h		0.50	
L	1.20		1.80
F (8)	0.80		1.10
a	0º		8º
α (8)	2º		8º

Note: 8. Muar only POA P013P.

Figure 12. Power SO-10 Package Dimensions



Note: Drawing is not to scale.

2 Revision history

Table 1. Document revision history

Date	Revision	Changes
12-Mar-1988	1	Initial release.
18-Jun-2004	2	Stylesheet update.
23-Sep-2013	3	Updated Disclaimer