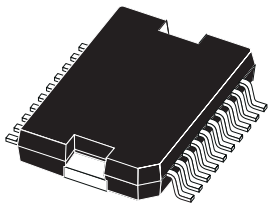
SGS-THOMSON MICROELECTRONICS

VN450

THREE CHANNELS HIGH SIDE SMART SOLID STATE RELAY

TYPE	Channel	$R_{DS(on)}$	I_{OUT}	V_{CC}
VN450	1 & 2 3	40 m Ω 300 m Ω	10 A 2 A	36 V 36 V



Power SO-20 TM

- OUTPUT CURRENT (CONTINUOUS):
  10 A (CHANNEL 1,2) @ T_C = 25 ^{o} C
  2 A (CHANNEL 3) @ T_C = 25 ^{o} C
- 5 V LOGIC LEVEL COMPATIBLE INPUTS
- UNDER VOLTAGE SHUT-DOWN
- OVER VOLTAGE SHUT-DOWN
- THERMAL SHUT-DOWN
- OPEN DRAIN DIAGNOSTIC OUTPUTS
- VERY LOW STAND-BY POWER DISSIPATION

DESCRIPTION

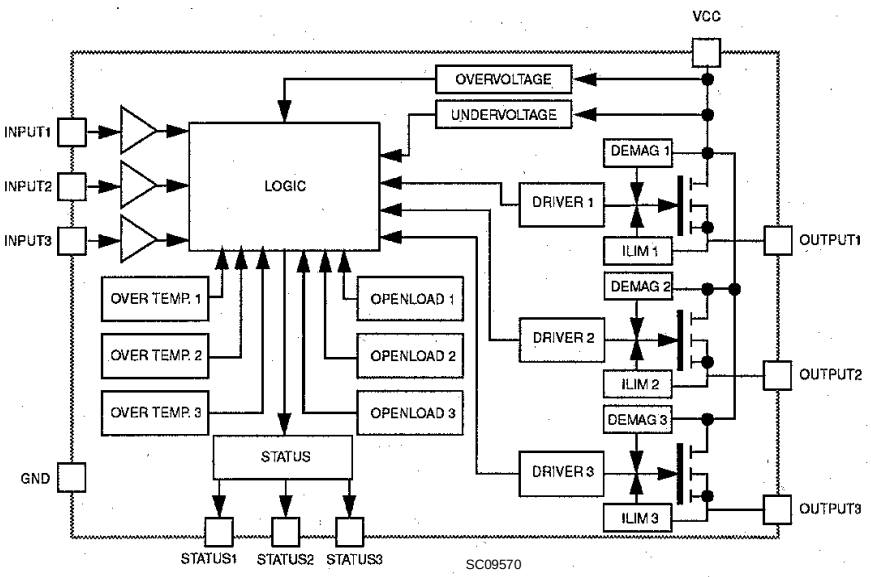
The VN450 is a monolithic device made using SGS-THOMSON Vertical Intelligent Power Technology, intended for driving resistive or inductive loads with one side connected to ground. This device has three independant channels and three diagnostics.

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

The control inputs are 5V CMOS logic level compatible.

The open drain diagnostic outputs indicate short circuit (no load) and overtemperature status.

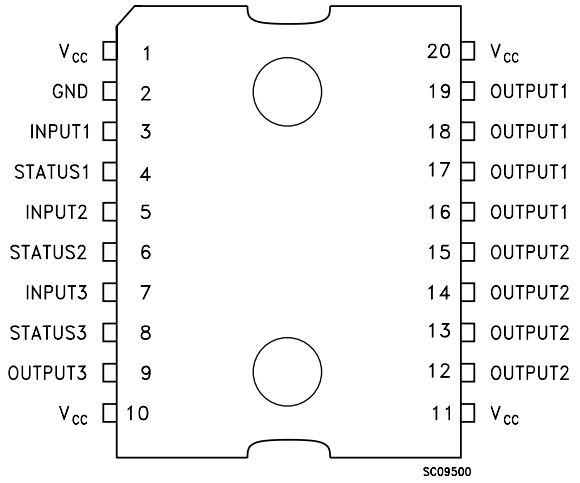
BLOCK DIAGRAM



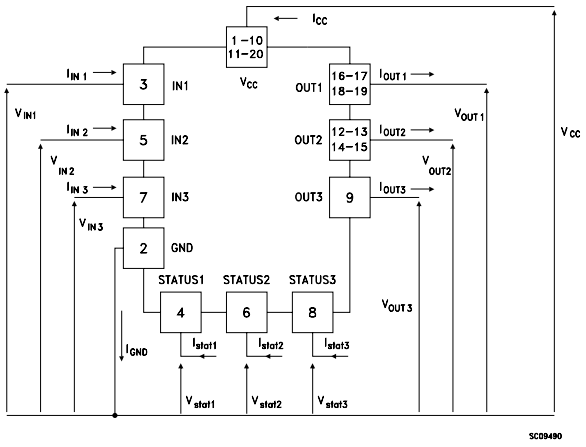
ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage (continuous)	45	V
$-V_{CC}$	Reverse Supply Voltage (continuous)	-0.3	V
$-I_{gnd}$	Reverse Ground Current	-200	mA
$I_{OUT\ 1,2}$	Output Current (continuous), channels 1, 2	10	A
$I_{OUT\ 3}$	Output Current (continuous), channel 3	2.5	A
$I_{R\ 1,2}$	Reverse Output Current (continuous) channels 1, 2	-10	A
$I_{R\ 3}$	Reverse Output Current (continuous) channel 3	-2.5	A
$I_{IN\ 1,2,3}$	Input Current	±10	mA
$I_{STAT\ 1,2,3}$	Status Output Current	±10	mA
V_{ESD}	Electrostatic Discharge (R=1.5 kΩ, C=100 pF)	2000	V
P_{tot}	Power Dissipation at $T_c \leq 25\ ^oC$	95	W
T_j	Junction Operating Temperature	-40 to 150	^oC
T_{stg}	Storage Temperature	-55 to 150	^oC

CONNECTION DIAGRAM



CURRENT AND VOLTAGE CONVENTIONS



ELECTRICAL TRANSIENTS REQUIREMENTS

ISO T/R 7637/1 Test Pulse	TEST LEVELS				
	I	II	III	IV	Delays and Impedance
1	-25 V	-50 V	-75 V	-100 V	2 ms, 10 Ω
2	+25 V	+50 V	+75 V	+100 V	0.2 ms, 10 Ω
3a	-25 V	-50 V	-100 V	-150 V	0.1 µs, 50 Ω
3b	+25 V	+50 V	+75 V	+100 V	0.1 µs, 50 Ω
4	-4 V	-5 V	-6 V	-7 V	100 ms, 0.01 Ω
5	+26.5 V	+46.5 V	+66.5 V	+86.5 V	400 ms, 2 Ω

ISO T/R 7637/1 Test Pulse	TEST LEVELS RESULTS				
	I	II	III	IV	
1	C	C	C	C	
2	C	C	C	C	
3a	C	C	C	C	
3b	C	C	C	C	
4	C	C	C	C	
5	C	E	E	E	

(With a series resistor ≥ 1 KΩ in input and status pins).

CLASS	CONTENTS
C	All function of the device are performed as designed after exposure to disturbance.
E	One or more functions of the device is not performed as designed after exposure and cannot be returned to proper operation without replacing the device.

THERMAL DATA

$R_{thj\text{-}case}$	Thermal Resistance Junction-case (1)	Max	1.3	°C/W
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	Max	50	°C/W

ELECTRICAL CHARACTERISTICS (V_{CC} = 13 V; -40 °C < T_j < 125 °C unless otherwise specified)

POWER

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Operating Supply Voltage		5.5	13	36	V
V_{usd}	Under Voltage Shut-Down		3	4	5.5	V
V_{ov}	Overvoltage Shut-Down		36	39	45	V
R_{on}	On State Resistance	$I_{OUT\ 1,2}$ = 2 A T_j = 25 °C $I_{OUT\ 1,2}$ = 2 A $I_{OUT\ 3}$ = 0.5 A T_j = 25 °C $I_{OUT\ 3}$ = 0.5 A			40 75 300 540	mΩ mΩ mΩ mΩ
I_S	Supply Current	Off state T_{case} = 25 °C On state		30 4.2	60 10	µA mA

LOGIC INPUT (Channel1,2,3)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{IL}	Input Low Level Voltage	(*)			1.5	V
V_{IH}	Input High Level Voltage (see note 1)	(*)	3.5			V
$V_{I(hyst.)}$	Input Hysteresis Voltage		0.2	0.85	1.5	V
I_{IN}	Input Current	V_{IN} = 5 V T_{case} = 25 °C			100	µA
V_{ICL}	Input Clamp Voltage	I_{IN} = 10 mA I_{IN} = -10 mA	5	6 -0.7	7	V V

(*) : The input voltage is internally clamped at 6 V about. It is possible to connect this pin to an higher voltage via an external resistor provided the input current does not exceed 10 mA.

SWITCHING (V_{CC} = 13 V; T_j = 25 °C; input rise time < 0.1µs)

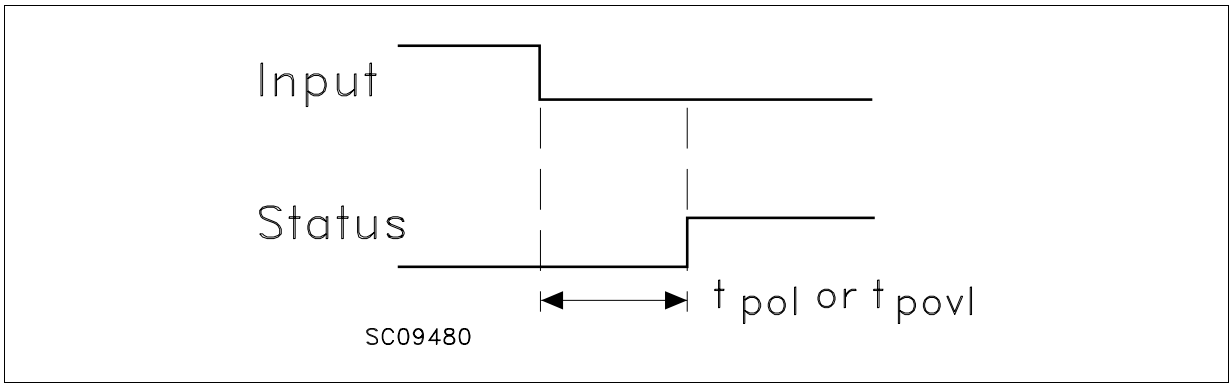
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time Of Output Current	R_1 = 6.5 Ω Channels 1,2 R_1 = 26 Ω Channels 3	10 2	40 20	140 70	µs µs
t_r	Rise Time Of Output Current	R_1 = 6.5 Ω Channels 1,2 R_1 = 26 Ω Channels 3	32 8	150 20	300 60	µs µs
$t_{d(off)}$	Turn-off Delay Time Of Output Current	R_1 = 6.5 Ω Channels 1,2 R_1 = 26 Ω Channels 3	120 30	300 75	600 150	µs µs
t_f	Fall Time Of Output Current	R_1 = 6.5 Ω Channels 1,2 R_1 = 26 Ω Channels 3	32 8	80 20	160 50	µs µs
$di/dt_{(on)}$	Turn-on Current Slope	R_1 = 6.5 Ω Channels 1,2 R_1 = 26 Ω Channels 3		0.02 0.02	0.05 0.05	A/µs A/µs
$di/dt_{(off)}$	Turn-off Current Slope	R_1 = 6.5 Ω Channels 1,2 R_1 = 26 Ω Channels 3		0.02 0.02	0.05 0.05	A/µs A/µs

ELECTRICAL CHARACTERISTICS (continued)
PROTECTIONS AND DIAGNOSTICS

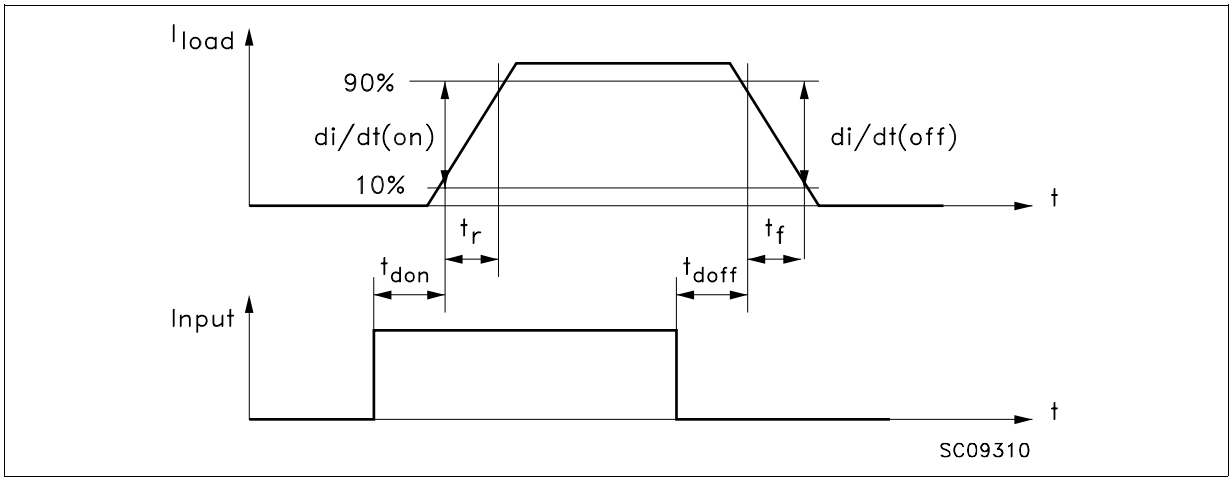
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
T_{TSD}	Thermal Shut-down Temperature		150	170	190	°C
T_{TR}	Thermal Reset Temperature		135			°C
T_{RSD} (HYST)	Thermal Hysteresis		5	15	30	°C
V_{ENOL}	Output Voltage Authorizing Openload Detection	$8V \le V_{CC} \le 36V$	5.2	6.6	8	V
I_{OL}	Open Load Current Level	Channels 1,2 $8V \le V_{CC} \le 18V$ Channels 3 $8V \le V_{CC} \le 30V$	100 5	450 50	800 100	mA mA
I_{OV}	Over Current	$R_1 \le 10\ m\Omega$ channels 1,2 $R_1 \le 10\ m\Omega$ channel 3	10 2	18 3.5		A A
I_{AV}	Average Current in Short Circuit	$R_1 \le 10\ m\Omega$ $T_{Case} = 85°C$ channels 1,2 channel 3		 3.4 2		 A A
$V_{STAT1,2,3}$	Status Output Voltage	I_{STAT} = 1.6 mA (Fault Condition)			0.4	V
$V_{SCL1,2,3}$	Status Clamp Voltage	I_{STAT} = 10 mA I_{STAT} = -10 mA	5.5	6 -0.7	7	V V
t_{POL}	Status Delay	(*) (see figure 1)	50	300	950	µs
t_{POVL}	Status Delay	(*) (see figure 1)			10	µs
V_{DEMAG}	Turn-off Output Clamp Voltage	I_{OUT1} = 2 A L = 1 mH V_{IN1} = 0 I_{OUT2} = 2 A L = 1 mH V_{IN2} = 0 I_{OUT3} = 0.5 A L = 1 mH V_{IN3} = 0	V_{CC}-45	V_{CC}-50	V_{CC}-55	V

(*) ISO definitions T_{POL} = Status delay in case of open load conditions
T_{POVL} = Status delay in case of over load conditions

FIGURE 1



SWITCHING PARAMETERS TEST CONDITIONS

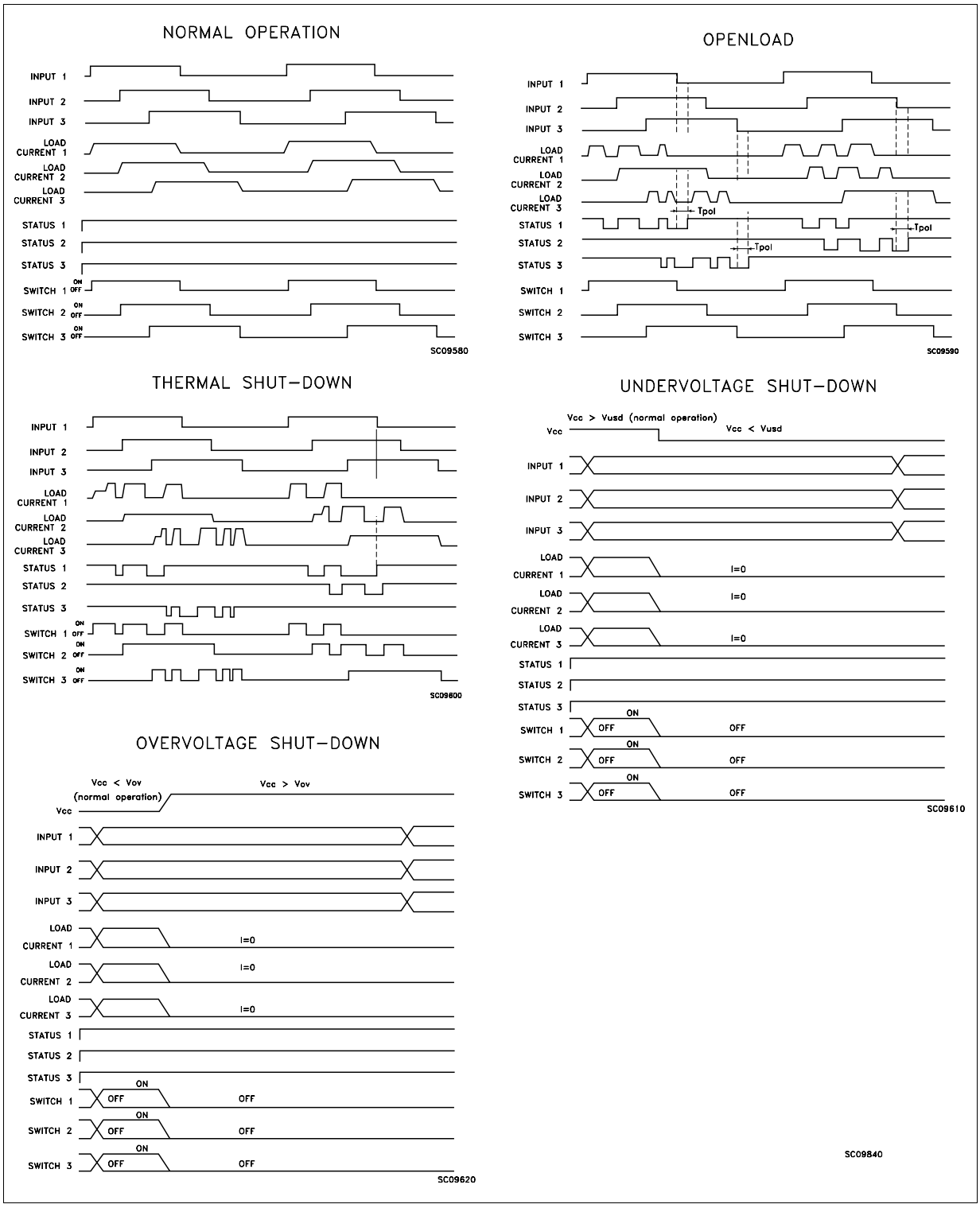


TRUTH TABLE (Channels 1,2,3)

Conditions	INPUT	OUTPUT	STATUS
Normal Operation	L H	L H	H H
Over-voltage	X	L	H
Under-voltage	X	L	H
Thermal shut-down	H	L	L
Open load	H	H	L

H = high level, L= low level, X= unspecified

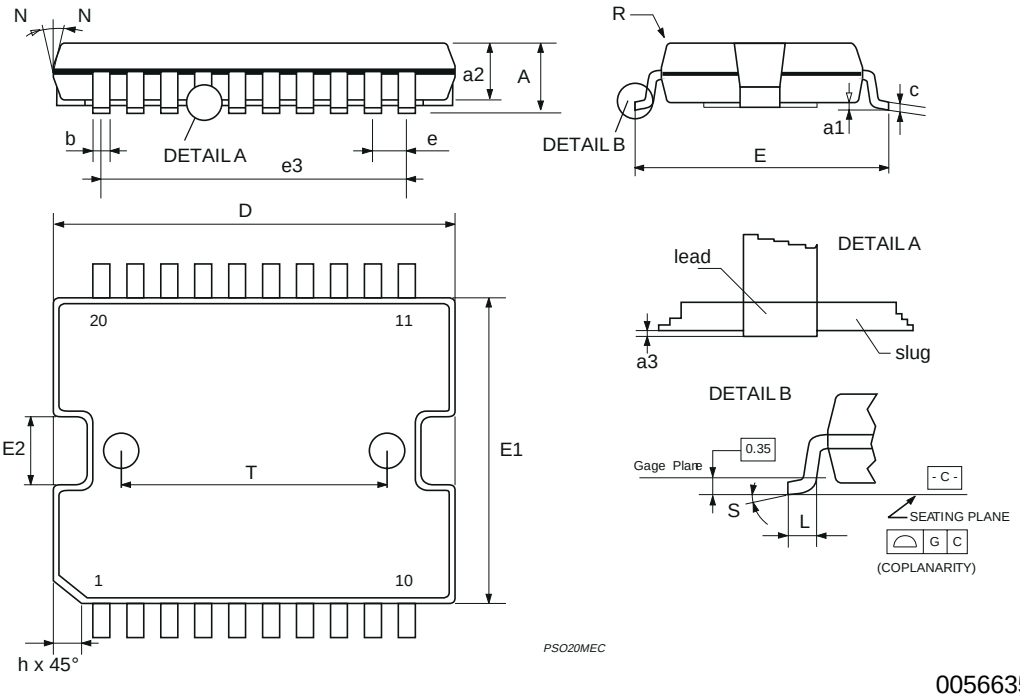
FIGURE 2: Switching Waveforms



PowerSO-20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			3.60			0.1417
a1	0.10		0.30	0.0039		0.0118
a2			3.30			0.1299
a3	0		0.10	0		0.0039
b	0.40		0.53	0.0157		0.0209
c	0.23		0.32	0.009		0.0126
D (1)	15.80		16.00	0.6220		0.6299
E	13.90		14.50	0.5472		0.570
e		1.27			0.050	
e3		11.43			0.450	
E1 (1)	10.90		11.10	0.4291		0.437
E2			2.90			0.1141
G	0		0.10	0		0.0039
h			1.10			0.0433
L	0.80		1.10	0.0314		0.0433
N	10^o (max.)					
S	8^o (max.)					
T		10.0			0.3937	

(1) "D and E1" do not include mold flash or protusions
- Mold flash or protusions shall not exceed 0.15mm (0.006")



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