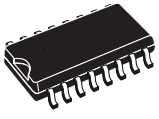
ST2054

CURRENT LIMITED POWER DISTRIBUTION SWITCHES

- 80mΩ HIGH-SIDE MOSFET SWITCH
- 500mA CONTINUOUS CURRENT PER CHANNEL
- INDEPENDENT THERMAL AND SHORT-CIRCUIT PROTECTION WITH OVERCURRENT LOGIC OUTPUT
- OPERATING RANGE FROM 2.7V TO 5.5V
- CMOS- AND TTL-COMPATIBLE ENABLE INPUTS
- 10 ms OC_N FAULT BLANKING
- 2.5ms TYPICAL RISE TIME
- UNDERVOLTAGE LOCKOUT
- 20µA MAXIMUM STANDBY SUPPLY CURRENT
- AMBIENT TEMPERATURE RANGE, 0°C TO 85°C
- ESD PROTECTION



SOP

DESCRIPTION

The ST2054 power distribution switches is intended for application where heavy capacitive loads and short circuits are likely to be encountered. These devices incorporate 80mΩ N-channel MOSFET high-side power switches for power-distribution systems that require multiple powers switches in a single package. Each switch is controlled by an independent logic enable input. Gate drive is provided by an internal charge pump designed to control the power-switch rise times and fall times to minimize current surges during switching. The charge pump requires no external components and allows operation from supplies as low as 2.7 V.

When the output load exceeds the current-limit threshold or a short is present, these devices limit the output current to a safe level by switching into a constant-current mode, pulling the overcurrent ($\overline{OCx}$) logic output low. A 10ms deglitching circuit provides fault-blanking feature, preventing the OC_N pin to be asserted during hot-insertion or short spikes of overcurrent conditions.

When continuous heavy overloads and short circuits increase the power dissipation in the switch, causing the junction temperature to rise, a thermal protection circuit shuts off the switch to prevent damage. Recovery from a thermal shutdown is automatic once the device has cooled sufficiently. Internal circuitry ensures the switch remains off until valid input voltage is present. These power-distribution switches are designed to current limit at 0.9 A.

Table 1: Order Codes

Type	Temperature Range	Package	Comments
ST2054BD	-40 to 85 °C	SO-16 (Tube)	50parts per tube / 40tube per box
ST2054BDR	-40 to 85 °C	SO-16 (Tape & Reel)	2500 parts per reel

Figure 1: Pin Configuration

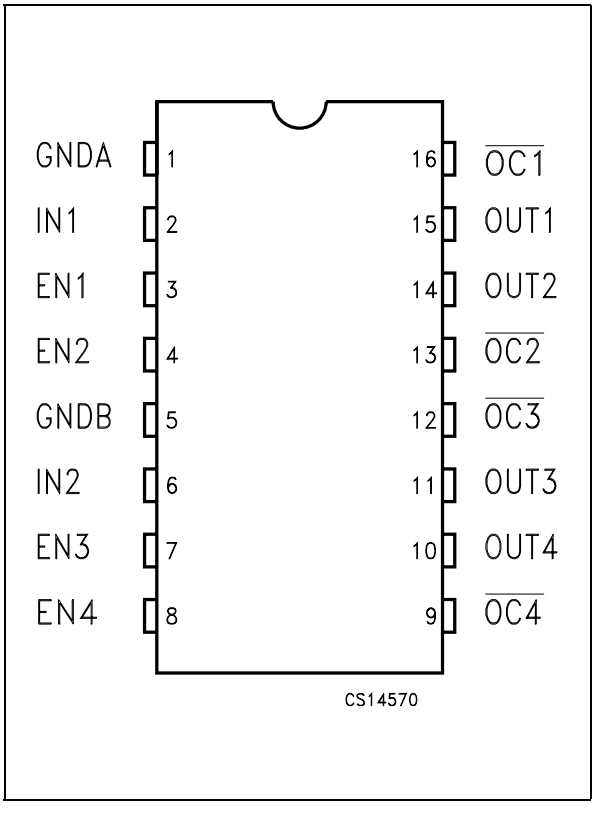


Table 2: Pin Description

Pln N°	Symbol	Name And Function
1	GNDA	Ground
2	IN1	Input Voltage
3	EN1	Enable Input. Logic High Turns On Power Switch IN-OUT1
4	EN2	Enable Input. Logic High Turns On Power Switch IN-OUT2
5	GNDB	Ground
6	IN2	Input Voltage
7	EN3	Enable Input. Logic High Turns On Power Switch IN-OUT3
8	EN4	Enable Input. Logic High Turns On Power Switch IN-OUT4
9	$\overline{OC4}$	Overcurrent. Logic Output Active Low IN-OUT4
10	OUT4	Power Switch Output
11	OUT3	Power Switch Output
12	$\overline{OC3}$	Overcurrent. Logic Output Active Low IN-OUT3
13	$\overline{OC2}$	Overcurrent. Logic Output Active Low IN-OUT2
14	OUT2	Power Switch Output
15	OUT1	Power Switch Output
16	$\overline{OC1}$	Overcurrent. Logic Output Active Low IN-OUT1

Table 3: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_I	Input Voltage Range (Note 1)	-0.3 to 6	V
V_O	Output Voltage Range (Note 1)	-0.3 to (V_I +0.3)	V
V_{IENX}	Input Voltage Range	-0.3 to 6	V
I_O	Continuous Output Current	Internally Limited	
ESD	Electrostatic Discharge	2	kV
T_J	Operating Junction Temperature	-40 to 125	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.
Note1: All voltage are referred to GND

Table 4: Recommended Operating Condition

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_I	Input Voltage Range (Note 1)	2.7		5.5	V
V_O	Output Voltage Range (Note 1)	0		5.5	V
I_O	Continuous Output Current (Per Switch)	0		500	mA

Figure 2: Block Diagram

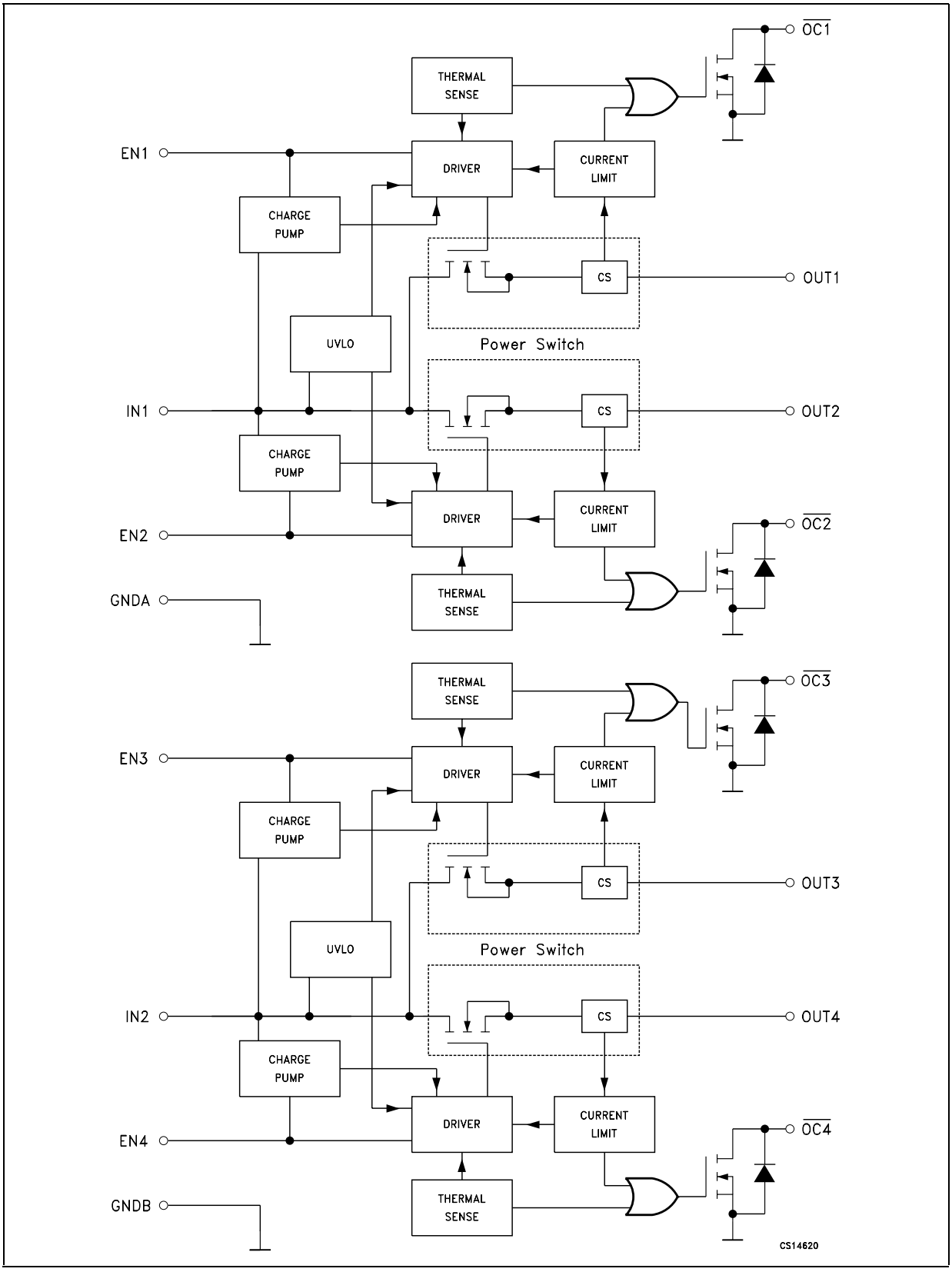


Table 5: Power Switch Electrical Characteristics (V_I = 5.5V, I_O = rated current, V_{IEN} =V_I, T_J = 25°C, unless otherwise specified.) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{DS(ON)}$	Static Drain-Source ON-State Resistance	V_I =5V I_O = 0.5A		80	100	mΩ
		V_I =5V I_O = 0.5A T_J=85°C		90	120	
		V_I =5V I_O = 0.5A T_J=125°C		100	135	
		V_I =3.3V I_O = 0.5A		90	125	
		V_I =3.3V I_O = 0.5A T_J=85°C		110	145	
		V_I =3.3V I_O = 0.5A T_J=125°C		120	160	
t_r	Output Rise Time	V_I =5.5V R_L=10Ω C_L=1µF		2.5		ms
		V_I =2.7V R_L=10Ω C_L=1µF		3		
t_f	Output Fall Time	V_I =5.5V R_L=10Ω C_L=1µF		0.3		ms
		V_I =2.7V R_L=10Ω C_L=1µF		0.2		

Table 6: Enable Input ENx Characteristics (V_I = 5.5V, I_O = rated current, V_{IEN} =V_I, T_J = 25°C, unless otherwise specified.) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{IH}	High level Input Voltage	V_I =2.7V to 5.5V	2			V
V_{IL}	Low level Input Voltage	V_I =4.5V to 5.5V			0.8	V
		V_I =2.7V to 4.5V			0.4	
I_I	Input Current	V_{IENX} = V_I or 0V	-0.5		0.5	µA
t_{on}	Turn-on Time	R_L=10Ω C_L=100µF			20	ms
t_{off}	Turn-off Time	R_L=10Ω C_L=100µF			40	ms

Table 7: Current Limit Characteristics (V_I = 5.5V, I_O = rated current, V_{IEN} =V_I, T_J = 25°C, unless otherwise specified.) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{OS}	Short Circuit Output Current	V_I =5V, OUT connected to GND, device enabled into short circuit	0.7	1	1.3	A

Table 8: Supply Current Characteristics (V_I = 5.5V, I_O = rated current, V_{IEN} =V_I, T_J = 25°C, unless otherwise specified.) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SOL}	Current Low Level Output	V_{IENX} = 0, No Load,		0.05	2	µA
		V_{IENX} = 0, No Load, T_J=-40 to 125°C			20	
I_{SOH}	Current Low High Output	V_{IENX} = V_I, No Load,		140	180	µA
		V_{IENX} = V_I, No Load, T_J=-40 to 125°C			200	
I_L	Output Leakage Current	V_{IENX} = 0, Output Connected to GND, T_J=-40 to 125°C			20	µA

Table 9: Undervoltage Characteristics (V_I = 5.5V, I_O = rated current, V_{IEN} =V_I, T_J = 25°C, unless otherwise specified.) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{IL}	Low Level Input Voltage		2		2.5	V
V_{HYS}	Hysteresys			100		mV

Table 10: Overcurrent ($\overline{OC}$) Characteristics (V_I = 5.5V, I_O = rated current, V_{IEN} =V_I, T_J = 25°C, unless otherwise specified.) (See Note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SINK}	Sink Current	V_O =5V	10			mA
V_O	Output Low Voltage	I_O =5mA			0.5	V
I_{OFF}	OFF-State Current	V_O =5V V_O =3.3V			1	µA
T_{FB}	Fault-Blanking period	V_I =5.5V, T_J=25°C (See Note 2 and 3)	2	10		ms

Note 1: Pulse testing techniques maintain junction temperature close to ambient temperature: thermal effect must be takes into account separately.
Note 2: Specified by design, not production tested.
Note 3: Guaranteed by design.

Figure 3: Test Circuit

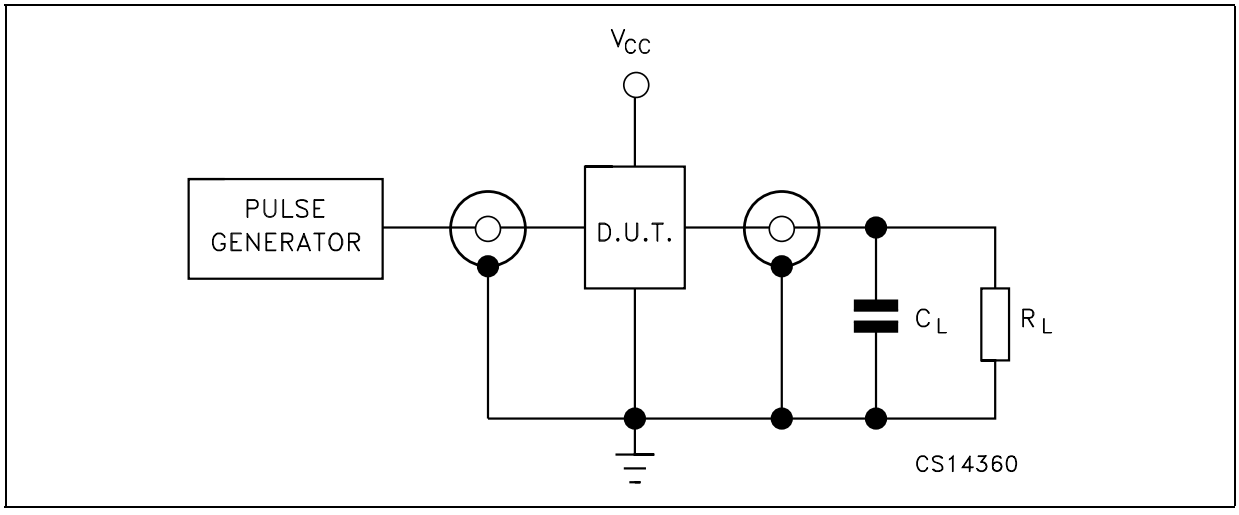
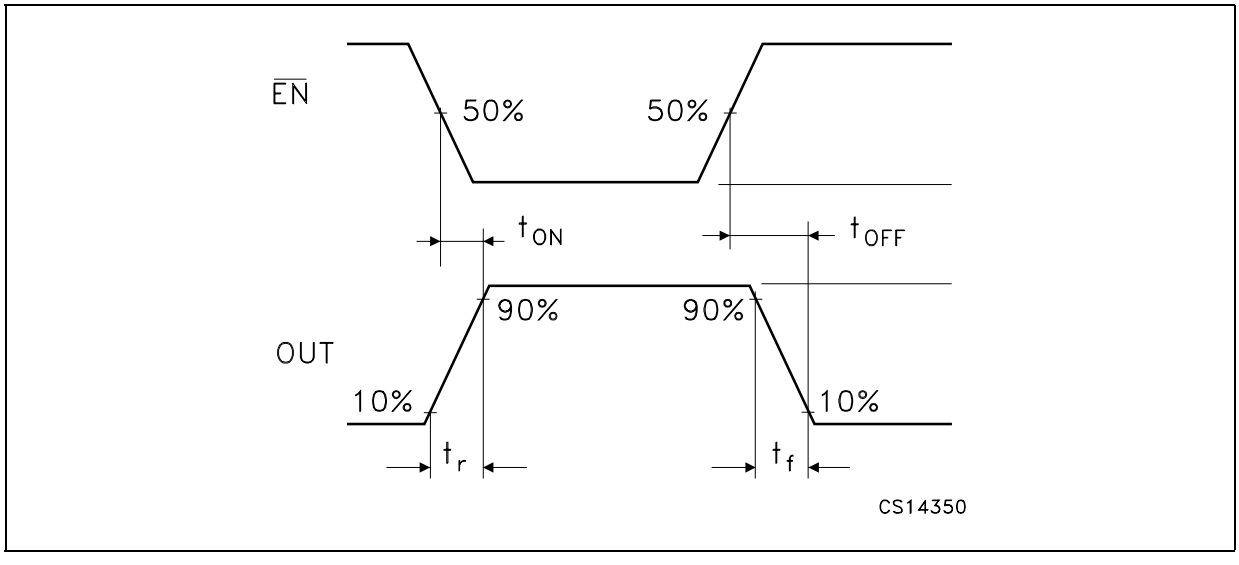
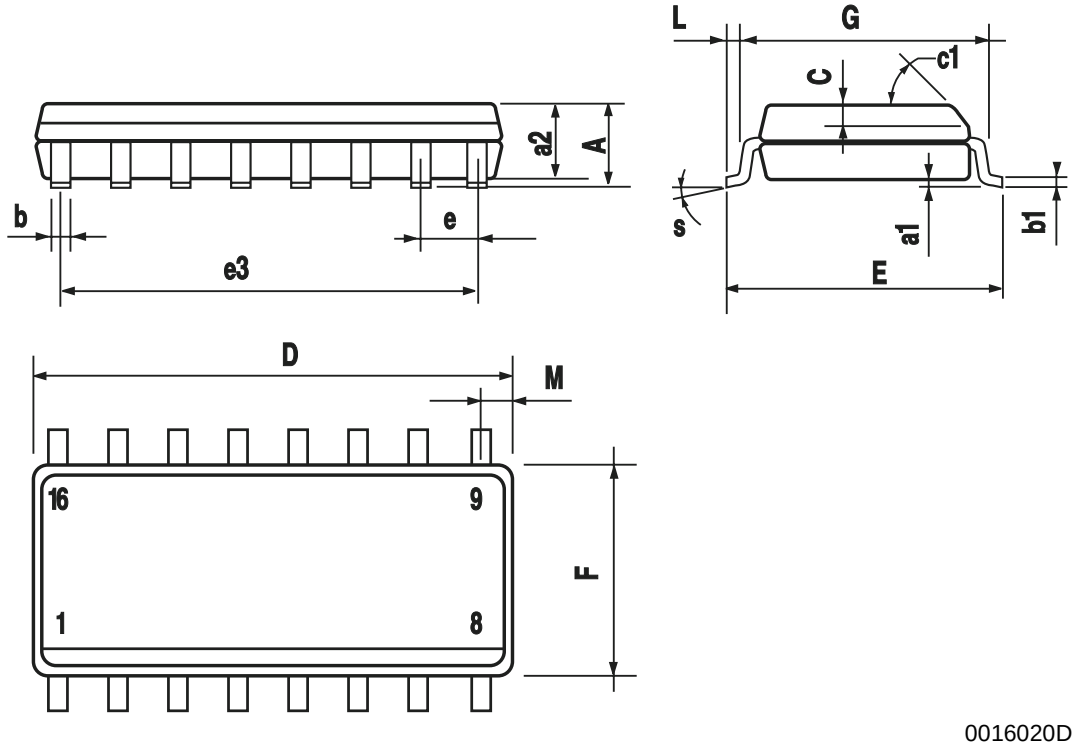


Figure 4: Waveform - Propagation Delays (f=1MHz; 50% duty cycle)



SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



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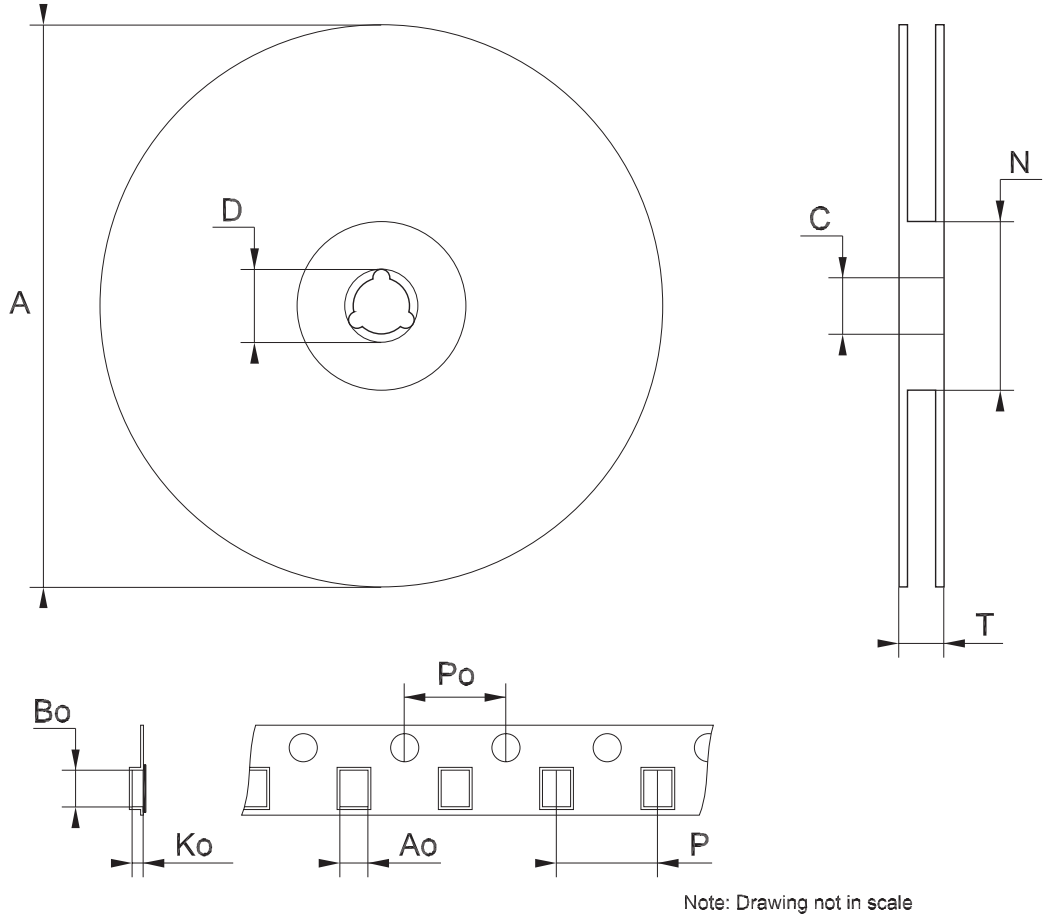
Tape & Reel SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Note: Drawing not in scale

Table 11: Revision History

Date	Revision	Description of Changes
28-Oct-2004	2	Maturity Change.
13-Jul-2005	3	Add bullet on pag. 1, add paragraph in the description on pag. 1 and add row T_{FB} on Table 10.