

TPD1039S

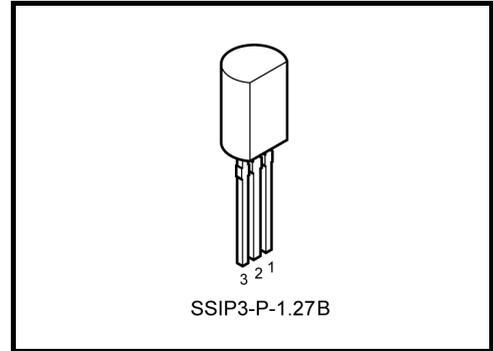
Low-Side Switch for Motor, Solenoid and Lamp Drive

TPD1039S is a monolithic power IC for low-side switch.

The IC has a vertical MOSFET output which can be directly driven from a CMOS or TTL logic circuit (e.g., an MPU). The IC offers intelligent self-protection functions.

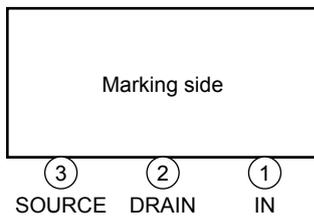
Features

- A monolithic power IC with a new structure combining a control block and a vertical power MOSFET (π -MOS) on a single chip.
- Can directly drive a power load from a CMOS or TTL logic.
- Built-in protection circuits against overvoltage, overheat, and overcurrent.
- Low ON-resistance: $R_{DS(ON)} = 0.25 \Omega$ (max) (@ $V_{IN} = 5 V, T_{ch} = 25^\circ C$)
- Package TO-92 (MOD) can be packed in tape.

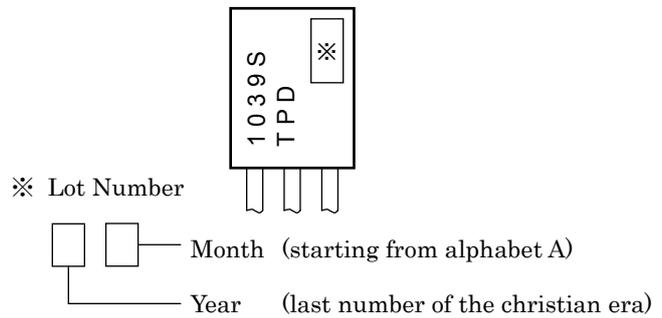


Weight: 0.36 g (typ.)

Pin Assignment

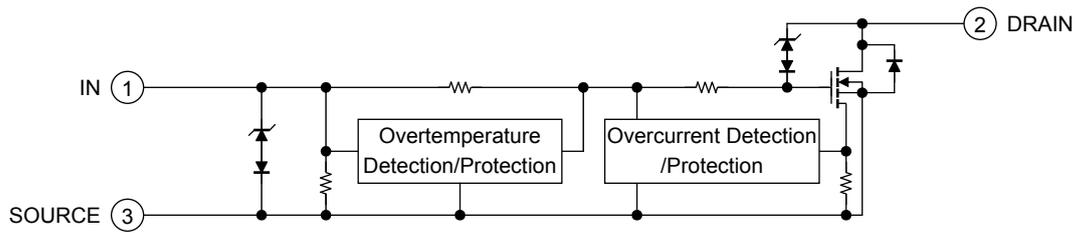


Marking



That because of its MOS structure, this product is sensitive to static electricity.

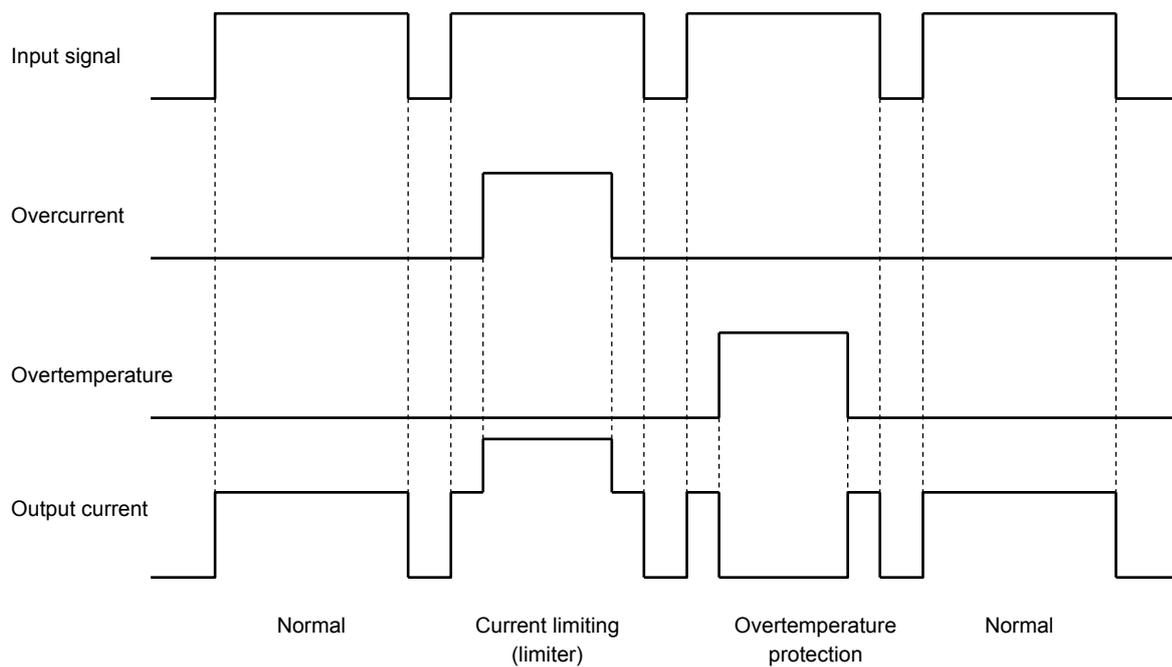
Block Diagram



Pin Description

Pin No.	Symbol	Pin Description
1	IN	Input pin. This pin is connected to a pull-down resistor internally, so that even when input wiring is open-circuited, output can never be turned on inadvertently.
2	DRAIN	Output pin. The current limit for output current is 5 A (typ.) when excessive current flow into a device because of in-rush current and short load of a lamp.
3	SOURCE	Ground pin.

Timing Chart



Truth Table

V_{IN}	V_{DRAIN}	State
L	H	Normal
H	L	
L	H	Overcurrent
H	L	
L	H	Overtemperature
H	H	

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DS} (DC)	45	V
Drain current	I_D (DC)	1.5	A
Input voltage	V_{IN}	-0.5~6	V
Power dissipation ($T_a = 25^\circ\text{C}$)	P_D	0.9	W
Single pulse active clamp capability (Note 1)	E_{AS}	20	mJ
Active clamp current	I_{AR}	1.5	A
Repetitive active clamp capability (Note 2)	E_{AR}	0.09	mJ
Operating temperature	T_{opr}	-40~85	$^\circ\text{C}$
Channel temperature	T_{ch}	150 (Note 3)	$^\circ\text{C}$
Storage temperature range	T_{stg}	-55~150	$^\circ\text{C}$

Note 1: Active clamp capability (single pulse) test condition
 $V_{DD} = 25\text{ V}$, Starting $T_{ch} = 25^\circ\text{C}$, $L = 10\text{ mH}$, $I_{AR} = 1.5\text{ A}$, $R_G = 25\ \Omega$

Note 2: Repetitive rating; pulse width limited by maximum channel temperature.

Note 3: Overtemperature protection will work when the channel temperature exceeds 125°C .
 Be sure to operate the device in such a way that the channel temperature does not exceed 125°C .

Note 4: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	139	$^\circ\text{C/W}$

Electrical Characteristics (T_{ch} = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Drain-source clamp voltage	V _{(CL) DSS}	—	V _{IN} = 0 V, I _D = 1 mA	45	—	—	V
High level input voltage	V _{IH}	—	V _{DS} = 10~40 V, I _D ≥ 1 A	3.5	—	6	V
Low level input voltage	V _{IL}	—	V _{DS} = 10~40 V, I _D ≤ 10 μA	—	—	0.8	V
Drain cut-off current	I _{DSS}	—	V _{IN} = 0 V, V _{DS} = 40 V	—	—	10	μA
Input current	I _{IN}	—	V _{IN} = 5 V, at normal operation	—	—	400	μA
Drain-source on resistance	R _{DS (ON)}	—	V _{IN} = 5 V, I _D = 1 A	—	—	0.25	Ω
Thermal shutdown (Note 4)	T _S	—	V _{IN} = 5 V	125	—	—	°C
Overcurrent protection	I _S	—	V _{IN} = 5 V	—	5	—	A
Switching time	t _{ON}	1	V _{DD} = 24 V, V _{IN} = 5 V, R _L = 24 Ω	—	15	—	μs
	t _{OFF}			—	45	—	
Source-drain diode forward voltage	V _{DSF}	—	I _F = 1.5 A	—	0.9	1.8	V

Note 4: Overtemperature protection will work when the channel temperature exceeds 125°C.

Be sure to operate the device in such a way that the channel temperature does not exceed 125°C.

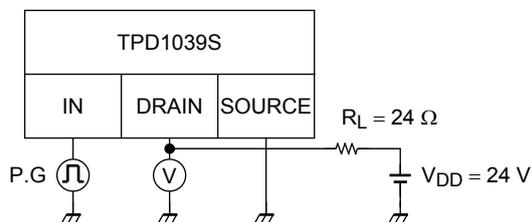
The overtemperature protection function protects a device from destruction.

Once started, however, this function will operate continuously; device reliability is not guaranteed while the function is in operation.

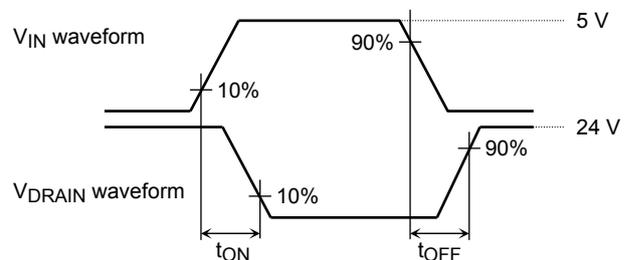
Test Circuit 1

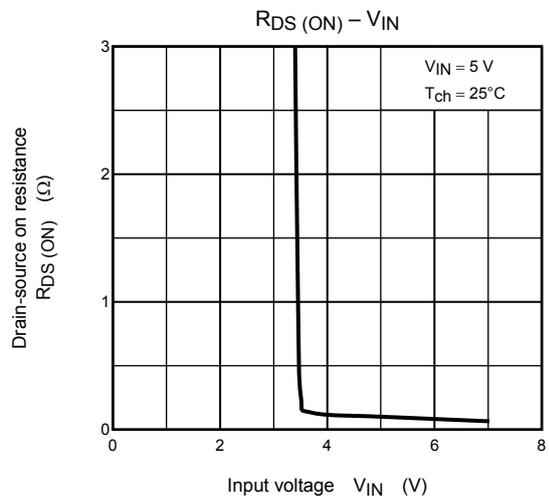
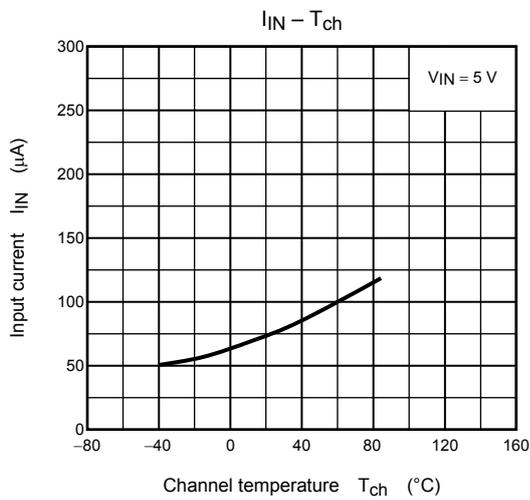
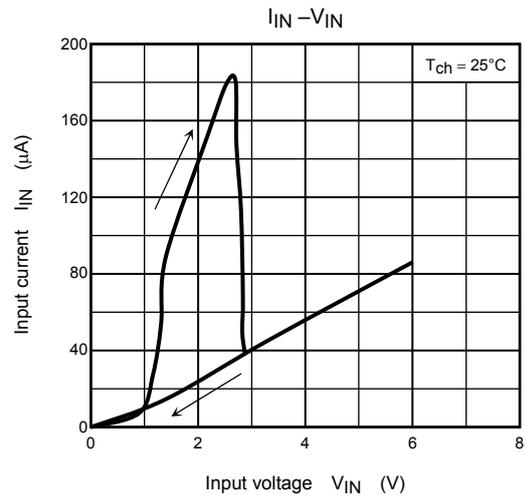
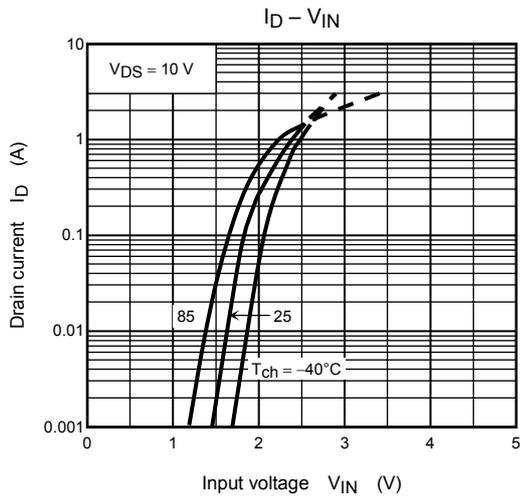
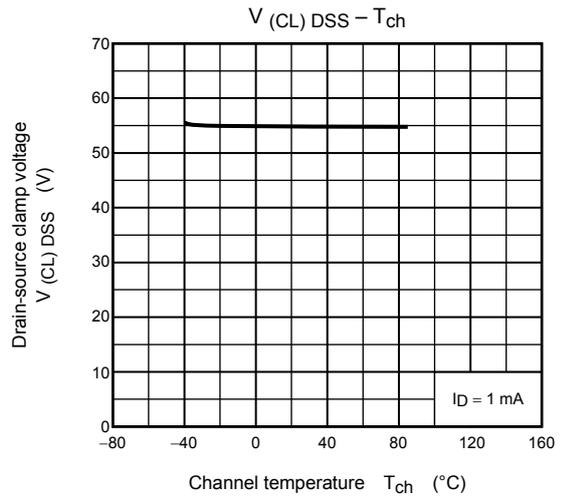
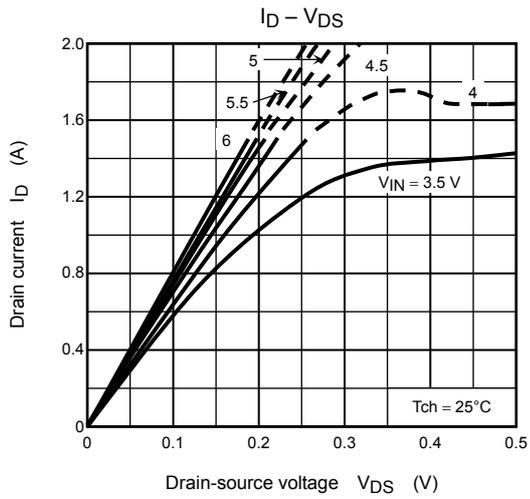
Switching time measuring circuit

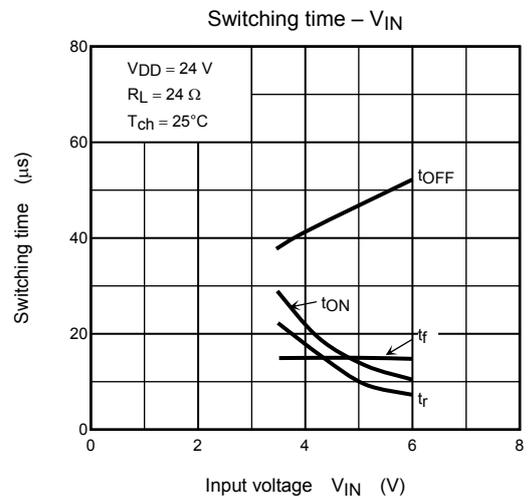
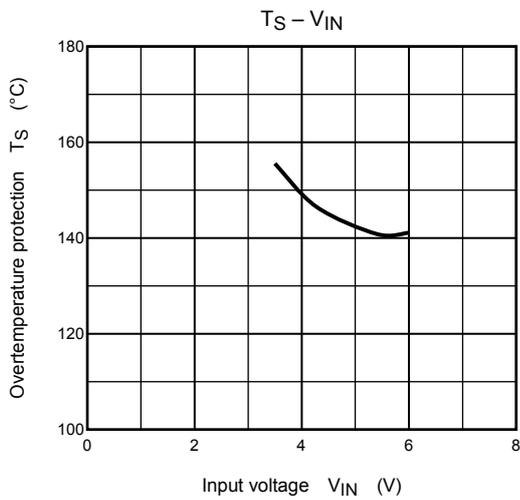
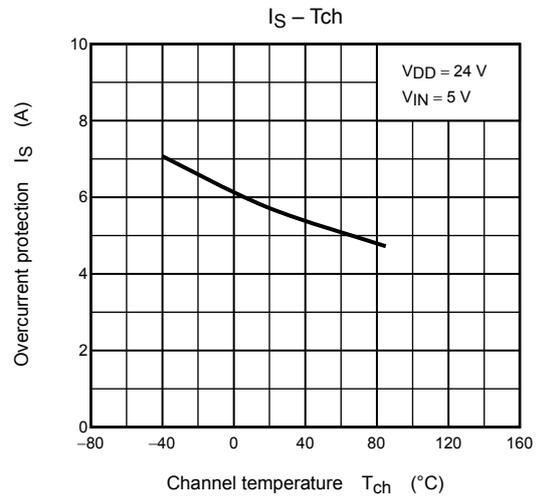
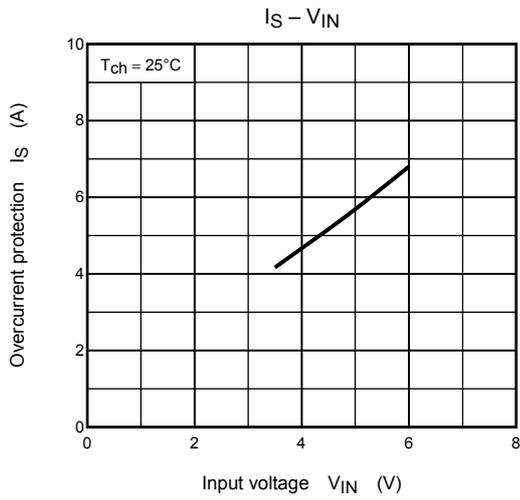
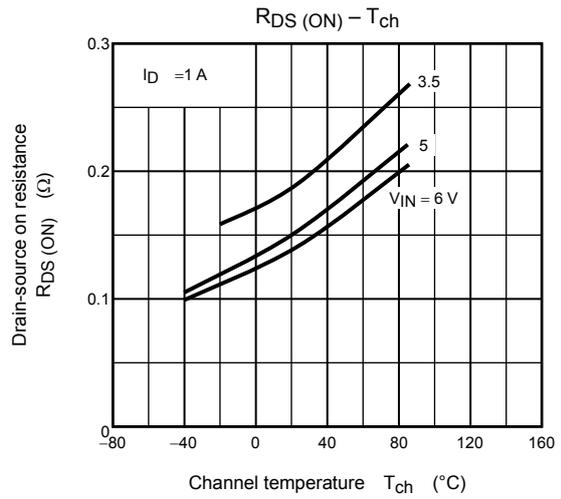
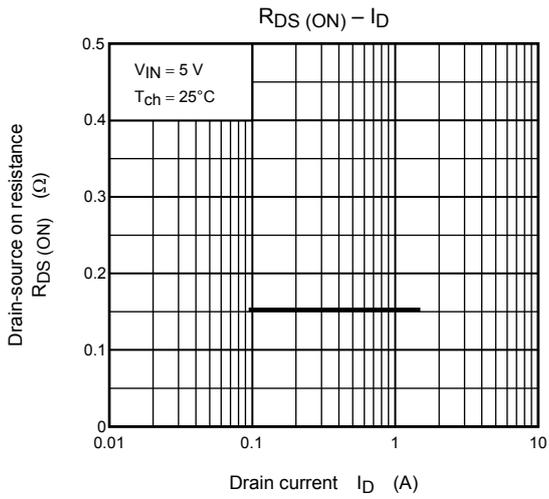
Test circuit

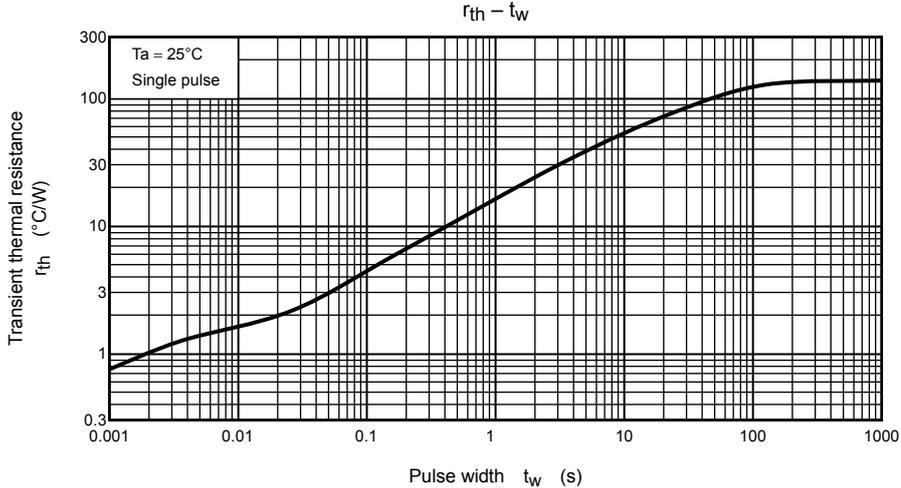
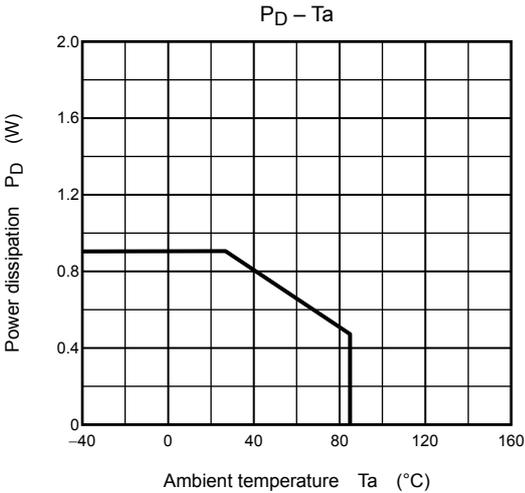


Measured waveforms





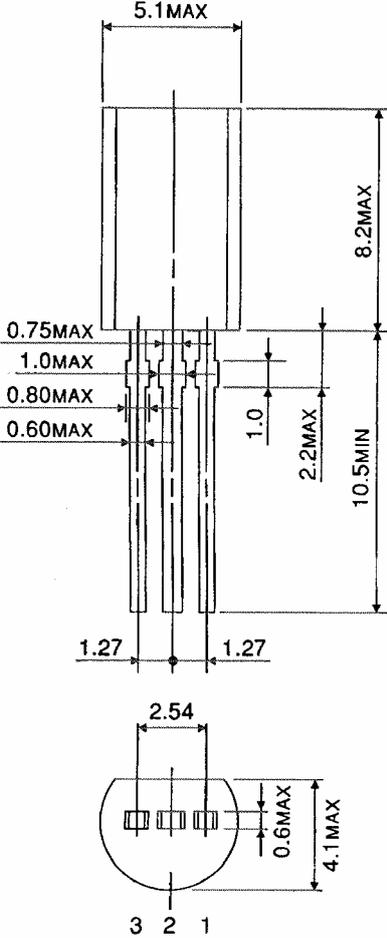




Package Dimensions

SSIP3-P-1.27B

Unit : mm



Weight: 0.36 g (typ.)

RESTRICTIONS ON PRODUCT USE

20070701-EN

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