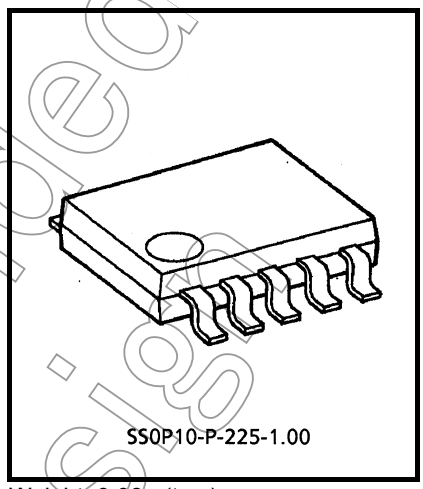
TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

TPD1018F

High-side Power Switch for Motors, Solenoids, and Lamp Drivers

The TPD1018F is a monolithic power IC for high-side switches. The IC has a vertical MOS FET output that can be directly driven from a CMOS or TTL logic circuit (e.g., an MPU). The device is equipped with intelligent self-protection and diagnostic functions.

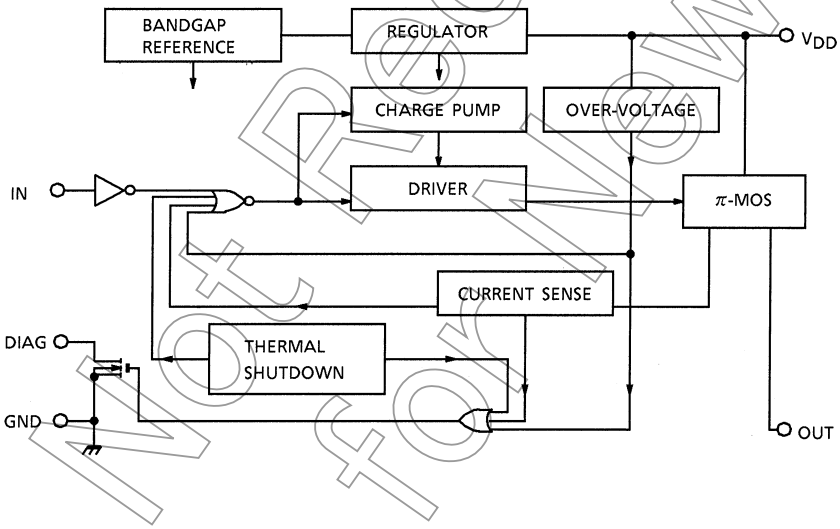


Weight: 0.08g (typ.)

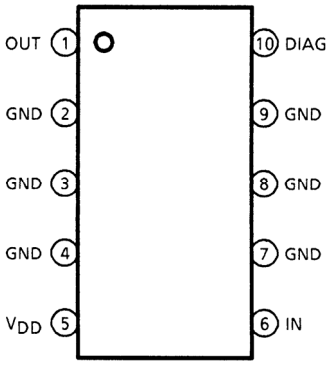
Features

- A monolithic power IC with a new structure combining a control block (Bi-CMOS) and a vertical power MOS FET (π-MOS) on a single chip
- One side of load can be grounded to a high-side switch
- Can directly drive a power load from a microprocessor.
- Built-in protection against overvoltage, thermal shutdown, and load short-circuiting
- Incorporates a diagnosis function that allows diagnosis output to be read externally in the event of load short-circuiting, overvoltage, or overheating.
- Low on-resistance : $R_{DS\ (ON)}$ = 0.8Ω (max)
- Low operating current : I_{DD} = 120μA (typ.) (@V_{DD} = 13.2V, V_{IN} = 0V)
- 10-pin SSOP package for surface mounting

Block Diagram

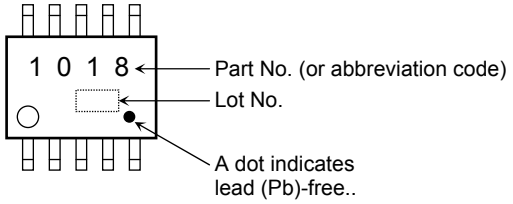


Pin Assignment (top view)



Note: Due to its MOS structure, this product is sensitive to static electricity.

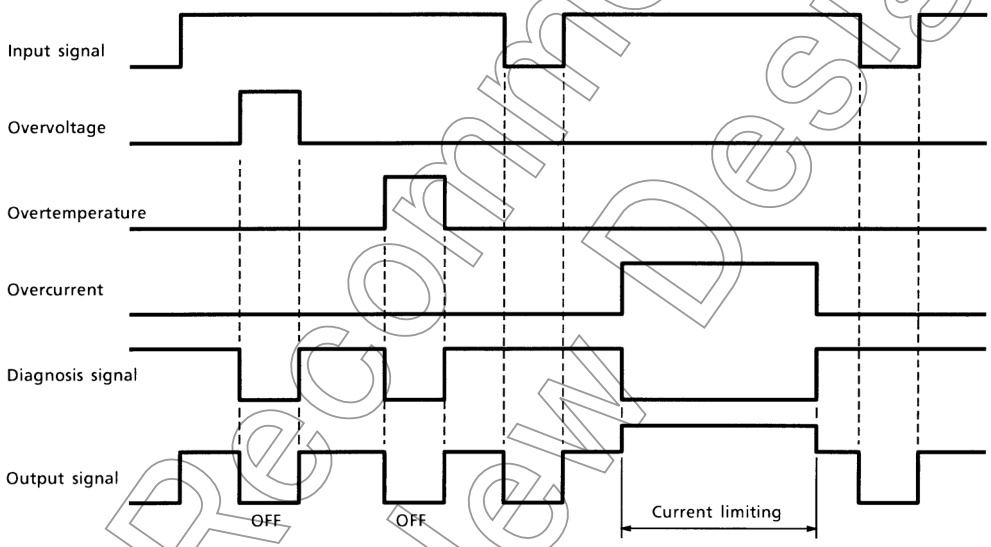
Marking



Pin Description

Pin No.	Symbol	Function
1	OUT	Output pin. When the load is short-circuited and current in excess of the detection current (0.5A min) flows to the output pin, the current limiter operates to protect the IC.
2, 3, 4	GND	Ground pins.
5	V_{DD}	Power pin. Incorporates an overvoltage protection function which turns off the output when the voltage applied exceeds 25V (min). Protects IC and load. Incorporates 2V (typ.) hysteresis.
6	IN	Input is CMOS-compatible, with pull-down resistor connected. Even if the input is open, output will not accidentally turn on.
7, 8, 9	GND	Ground pins.
10	DIAG	Self-diagnosis detection pin. Goes low when overcurrent, overheating, or overvoltage is detected. n-channel open drain.

Timing Chart



Truth Table

Input Signal	Output Signal	Diagnosis Output	State
H	H	H	Normal
L	L	H	
H	L	L	Overcurrent
L	L	H	
H	L	L	Overtemperature
L	L	H	
H	L	L	Overvoltage
L	L	H	

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source Voltage		V_{DS}	60	V
Supply Voltage	DC	$V_{DD\ (1)}$	25	V
	Pulse	$V_{DD\ (2)}$	60 (Rs = 1Ω, τ = 250ms)	V
Input Voltage	DC	$V_{IN\ (1)}$	-0.5~25	V
	Pulse	$V_{IN\ (2)}$	$V_{DD\ (1)}$ + 1.5 (t = 100ms)	V
Output Current		I_O	0.5	A
Input Current		I_{IN}	±10	mA
Power Dissipation		P_D	300	mW
Operating Temperature		T_{opr}	-40~125	°C
Junction Temperature		T_j	150	°C
Storage Temperature		T_{stg}	-55~150	°C

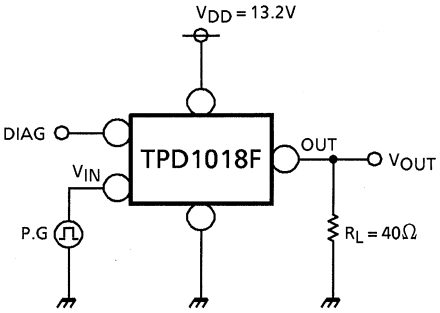
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

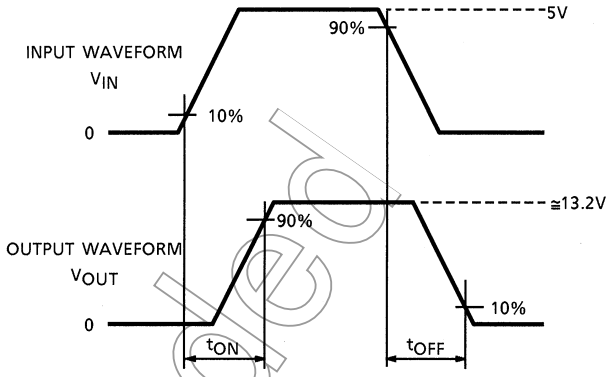
Electrical Characteristics (Tj = -40~125°C)

Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Operating Supply Voltage		$V_{DD\ (opr)}$	—	—	5	12	25	V
Supply Current		$I_{DD\ (1)}$	—	V_{DD} = 13.2V, V_{IN} = 0V, Tj = 85°C	—	120	300	μA
		$I_{DD\ (2)}$		V_{DD} = 13.2V, V_{IN} = 5V	—	1	1.5	mA
Input Voltage		V_{IH}	—	V_{DD} = 13.2V, I_O = 300mA	3.5	—	—	V
		V_{IL}	—	V_{DD} = 13.2V, I_O = 100μA	—	—	1.5	V
Input Current		$I_{IN\ (1)}$	—	V_{DD} = 13.2V, V_{IN} = 5V	—	10	100	μA
		$I_{IN\ (2)}$		V_{DD} = 13.2V, V_{IN} = 0V	-0.2	—	0.2	μA
On-voltage		$V_{DS\ (ON)}$	—	V_{DD} = 13.2V, I_O = 300mA, Tj = 25°C	—	0.21	0.24	V
On-resistance		$R_{DS\ (ON)(1)}$	—	V_{DD} = 13.2V, I_O = 300mA, Tj = 25°C	—	0.7	0.8	Ω
		$R_{DS\ (ON)(2)}$		V_{DD} = 13.2V, I_O = 300mA, Tj = -40~85°C	—	—	1.2	Ω
Diagnosis Output Voltage	“L” Level	V_{DL}	—	V_{DD} = 13.2V, I_{DL} = 1mA	—	—	0.4	V
Diagnosis Output Current	“H” Level	I_{DH}	—	V_{DD} = 25V, I_{DH} = 25V	—	—	10	μA
Output Leakage Current		I_{OL}	—	V_{DD} = 25V, V_{IN} = 0V	—	—	100	μA
Overcurrent Protection		I_S	—	V_{DD} = 13.2V, T_j = 25°C	0.5	—	3	A
Thermal Shutdown	Temperature	T_S	—	—	150	160	200	°C
	Hysteresis	ΔT_S			—	20	50	°C
Overvoltage Protection	Voltage	V_{DDS}	—	—	25	—	—	V
	Hysteresis	ΔV_{DDS}		—	—	2	7	V
Switching Time		t_{ON}	1	V_{DD} = 13.2V, R_L = 40Ω, T_j = 25°C	—	50	—	μs
		t_{OFF}			—	10	—	μs

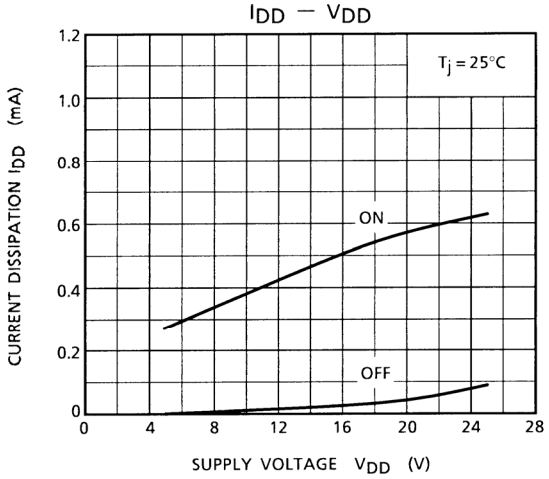
Test Circuit 1

Switching Time

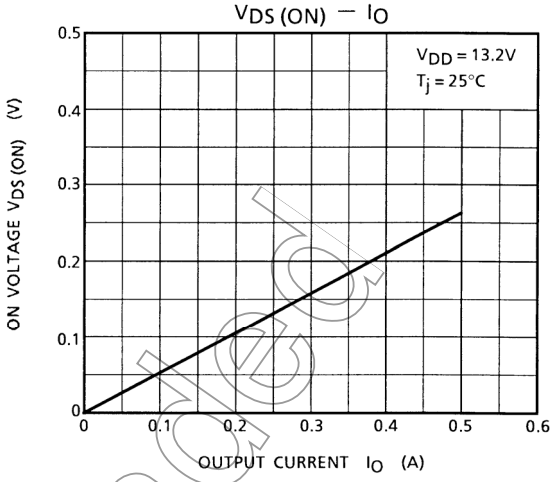




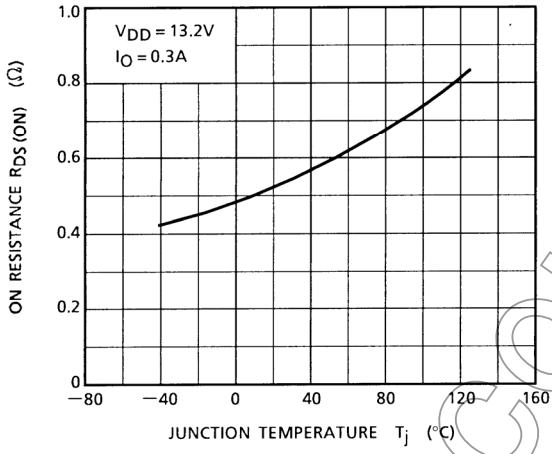
I_{DD} – V_{DD}



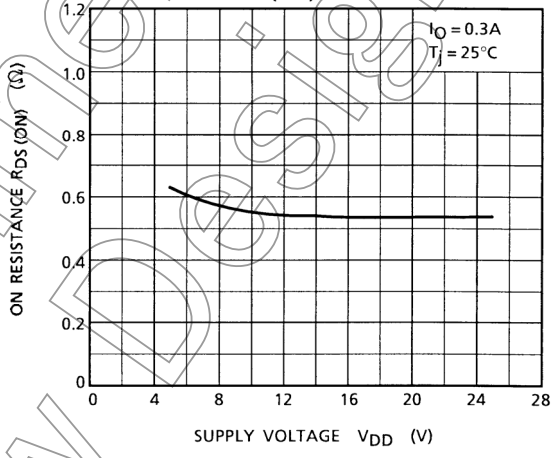
$V_{DS\ (ON)}$ – I_O



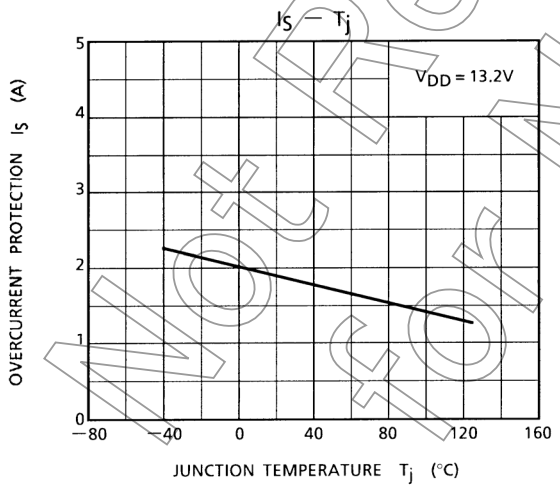
$R_{DS\ (ON)}$ – T_j



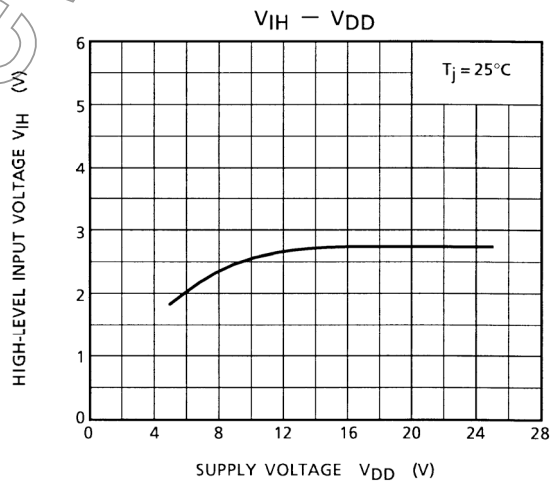
$R_{DS\ (ON)}$ – V_{DD}

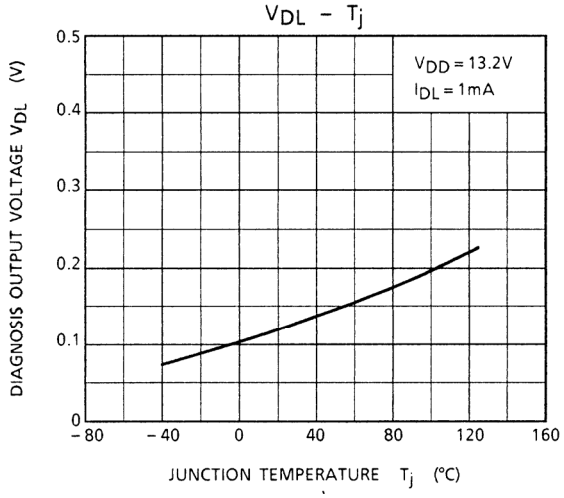


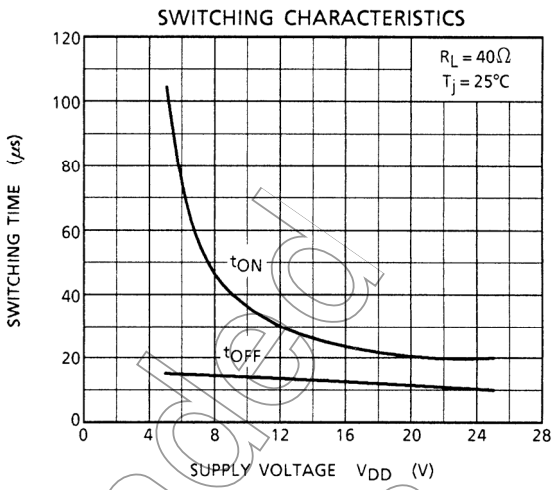
I_S – T_j

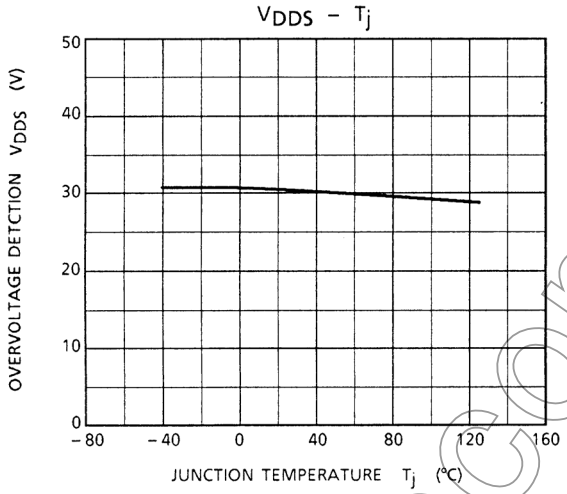


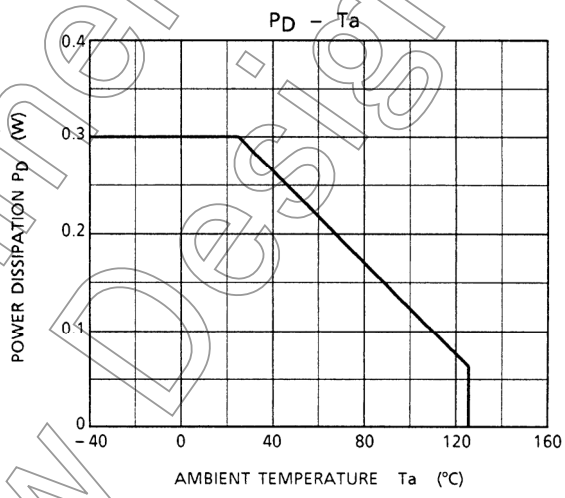
V_{IH} – V_{DD}









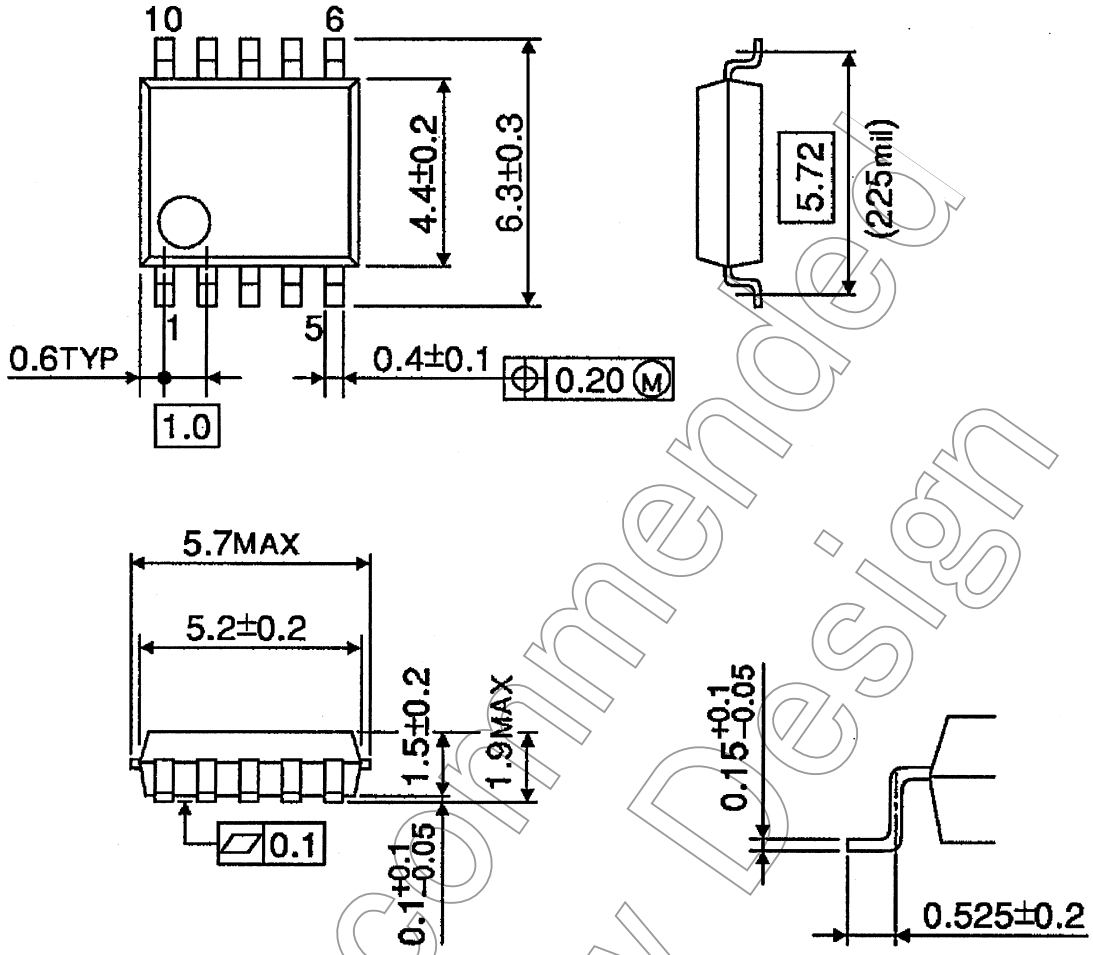


Precaution:

1. Since there is no built-in protection against reverse connection of batteries, etc., provide such protection using external circuits.
2. Since this IC does not include a negative bias protection circuit for the output pin, connect a freewheeling diode (FWD) between OUT and GND when negative bias is applied to the output pin.

Package Dimensions

SSOP10-P-225-1.00 Unit : mm



Weight: 0.08g (typ.)

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20070701-EN GENERAL

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