

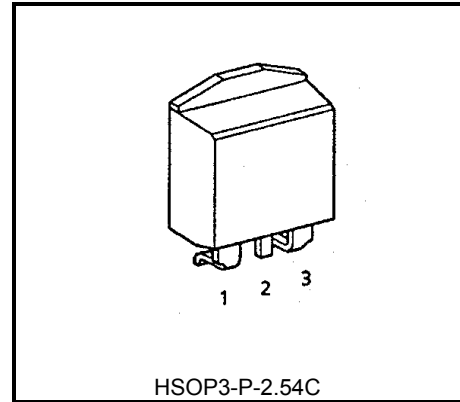
TPD1031AF

Low-Side Power Switch for Motor, Solenoid and Lamp Drivers

The TPD1031AF is a monolithic power IC intended for low-side load switching applications. The output has a vertical power MOSFET, and the input can be directly driven from CMOS or TTL logic (e.g., an MPU). The TPD1031AF provides intelligent protection functions.

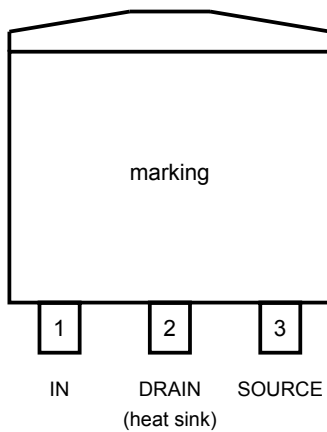
Features

- A structure that incorporates control circuitry and a vertical power MOSFET on a single chip.
- Can be directly driven from a microprocessor, a CMOS logic IC, etc.
- Overvoltage, overtemperature and overcurrent protections
- Low ON-resistance: $R_{DS(ON)} = 65m\Omega$ (max) (@ $V_{IN} = 5V$, $I_D = 4A$, $T_{ch} = 25^\circ C$)
- Low leakage current: $I_{DSS} = 100\mu A$ (max) (@ $V_{IN} = 0V$, $V_{DS} = 40V$, $T_{ch} = 25^\circ C$)
- Housed in "TO-220SM" package and supplied in embossed carrier tape.

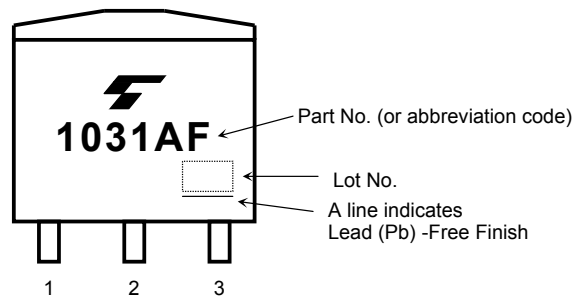


Weight: 1.5 g (typ.)

Pin Assignment

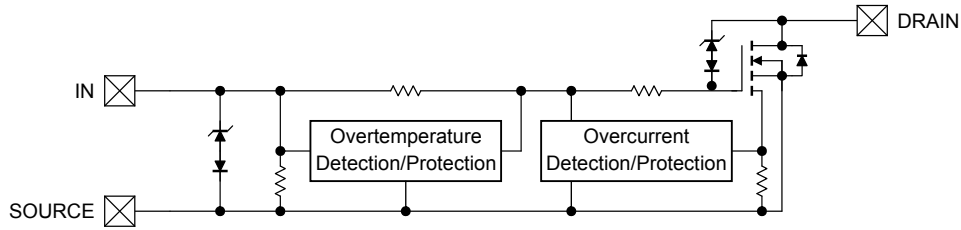


Marking



Note: This product has a MOS structure and is sensitive to electrostatic discharge.

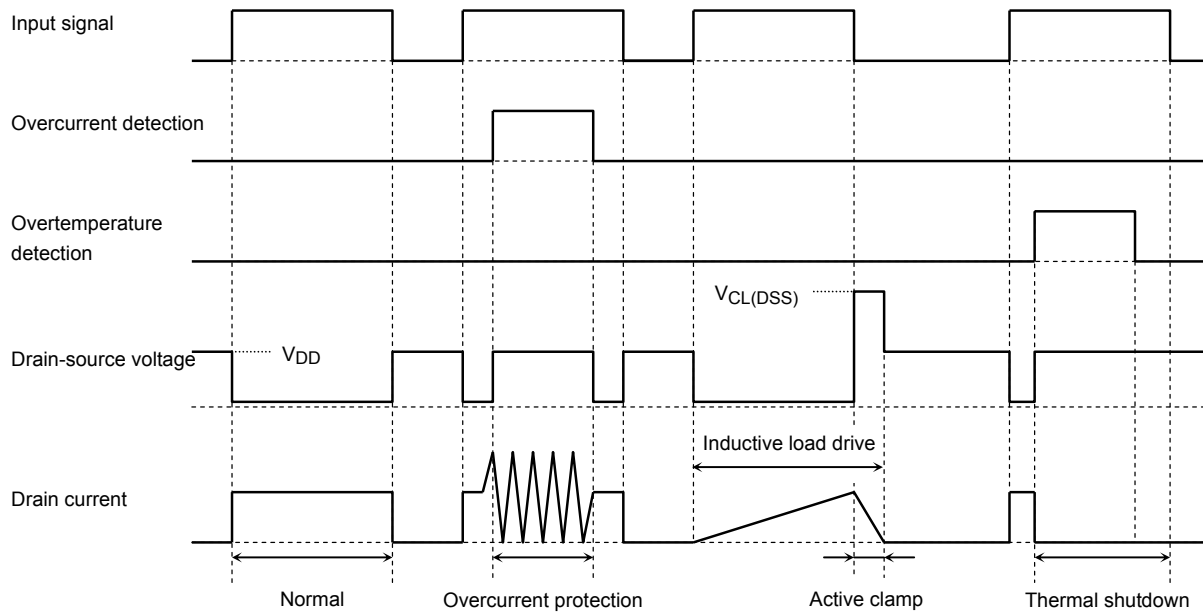
Block Diagram



Pin Description

Pin No.	Symbol	Pin Description
1	IN	Input pin. This pin is connected to a pull-down resistor internally, so that even if the input is open-circuited, the output never turns on inadvertently.
2	DRAIN	Drain pin. When a load short-circuit causes an overcurrent (8 A min) to flow into a device, the output automatically turns on and off repeatedly.
3	SOURCE	Source (ground) pin.

Timing Chart



Truth Table

V _{IN}	V _{DS}	Output State	Operating State
L	H	Off	Normal
H	L	On	
L	H	Off	Load short-circuited
H	H	Current limiting (switching)	
L	H	Off	Overtemperature
H	H	Off	

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit	
Drain-source voltage	V _{DS}	50	V	
Drain current	I _D	Internally limited	A	
Input voltage	V _{IN}	-0.3 to 7	V	
Power dissipation	T _c = 25°C	P _{D(1)}	50	W
	T _a = 25°C	P _{D(2)}	1.5	
Single pulse active clamp capability (Note 1)	E _{AS}	1110	mJ	
Active clamp current	I _{AR}	8	A	
Repetitive active clamp capability (Note 2)	E _{AR}	5	mJ	
Operating temperature	T _{opr}	-40 to 110	°C	
Channel temperature	T _{ch}	150	°C	
Storage temperature	T _{stg}	-55 to 150	°C	

Note 1: Active clamp capability (single pulse) test condition
V_{DD} = 25 V, T_{ch} = 25°C(initial), L = 20 mH, I_{AR} = 8 A, R_G = 25 Ω

Note 2: Repetitive rating: Pulse width limited by maximum channel temperature

Note 3: 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 case	R _{th(ch-c)}	2.5	°C/W
Thermal resistance, channel to ambient	R _{th(ch-a)}	83.3	°C/W

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

Characteristics	Symbol	Test circuit	Test condition	Min	Typ.	Max	Unit
Operating supply voltage range	V _{DD(opr)}	-	-	-	-	18	V
High-level input current	I _{IH}	-	V _{IN} = 5 V, V _{DS} = 0 V	-	-	500	μA
Drain cut-off current	I _{DSS}	-	V _{DS} = 40 V, V _{IN} = 0 V	-	-	100	μA
Drain-source clamp voltage	V _{(CL)DSS}	-	I _D = 10 mA, V _{IN} = 0 V	50	-	-	V
Drain-source ON-resistance	R _{DS(ON)}	-	V _{IN} = 5 V, I _D = 4 A	-	0.045	0.065	Ω
Switching times	Rise time	t _r	V _{IN} = +5 V/-0 V V _{DD} = 12 V R _L = 10 Ω	-	70	-	μs
	Turn on time	t _{on}		-	100	250	
	Fall time	t _f		-	120	-	
	Turn off time	t _{off}		-	300	450	
Input threshold voltage	V _{th}	-	V _{DS} = 12 V, I _D = 1 mA	2	3	3.5	V
Protective circuit operation input voltage range	V _{IN(P)}	-	-	4	-	-	V
Overcurrent detection	I _{OC}	-	V _{IN} = 5 V	8	15	-	A
Overtemperature detection	T _{OT}	-	V _{IN} = 5 V	-	160	-	°C
Drain-source diode forward voltage	V _{DSF}	-	I _{DR} = 8 A, V _{IN} = 0 V	-	-	1.8	V

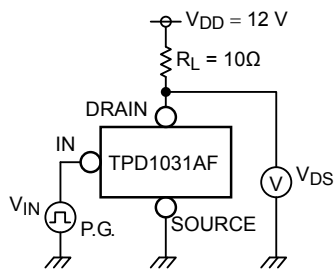
Electrical Characteristics (T_{ch} = -40 to 110°C)

Characteristics	Symbol	Test circuit	Test condition	Min	Typ.	Max	Unit
Operating supply voltage range	V _{DD(opr)}	-	-	-	-	18	V
High-level input current	I _{IH}	-	V _{IN} = 5 V, V _{DS} = 0 V	-	-	750	μA
Drain cut-off current	I _{DSS}	-	V _{DS} = 40 V, V _{IN} = 0 V	-	-	100	μA
Drain-source clamp voltage	V _{(CL)DSS}	-	I _D = 10 mA, V _{IN} = 0 V	48	-	-	V
Drain-source ON-resistance	R _{DS(ON)}	-	V _{IN} = 5 V, I _D = 4 A	-	0.045	0.095	Ω
Switching times	Rise time	t _r	V _{IN} = +5 V/-0 V V _{DD} = 12 V R _L = 10 Ω	-	70	-	μs
	Turn on time	t _{on}		-	100	400	
	Fall time	t _f		-	120	-	
	Turn off time	t _{off}		-	300	700	
Input threshold voltage	V _{th}	-	V _{DS} = 12V, I _D = 1 mA	1.5	3	4	V
Protective circuit operation input voltage range	V _{IN(P)}	-	-	4	-	-	V
Overcurrent detection	I _{OC}	-	V _{IN} = 5V	8	15	-	A
Overtemperature detection	T _{OT}	-	V _{IN} = 5V	-	160	-	°C

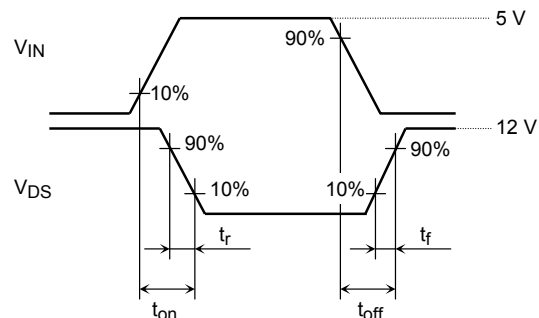
Test Circuit 1

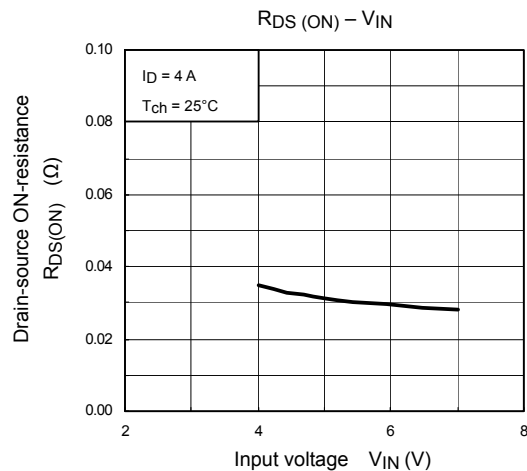
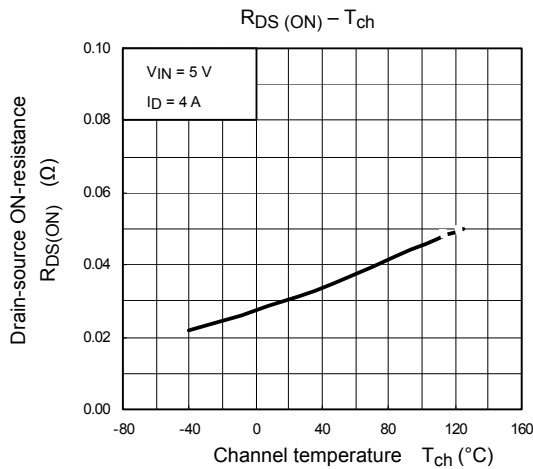
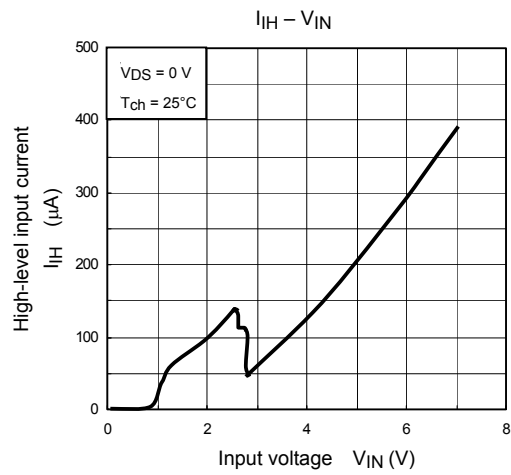
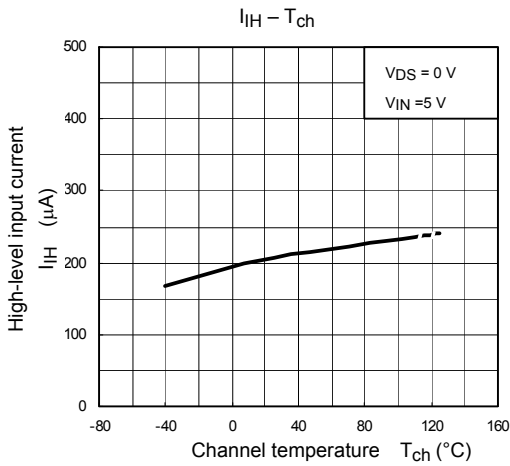
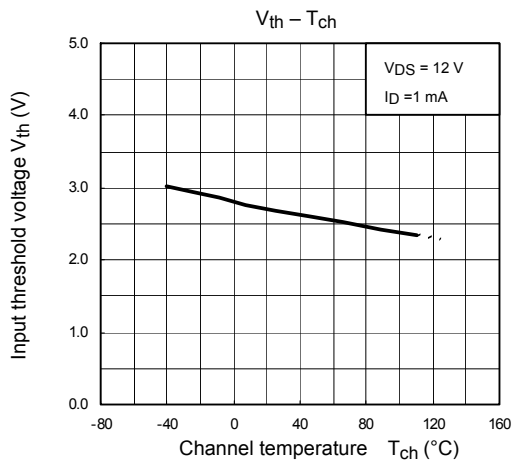
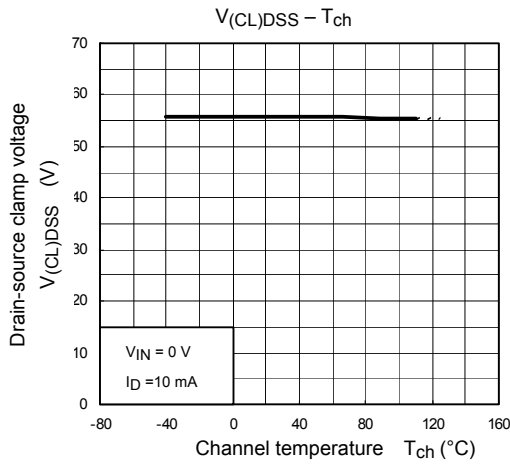
Switching times measuring circuit

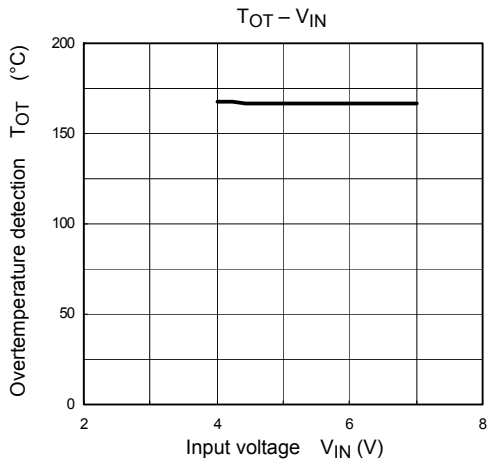
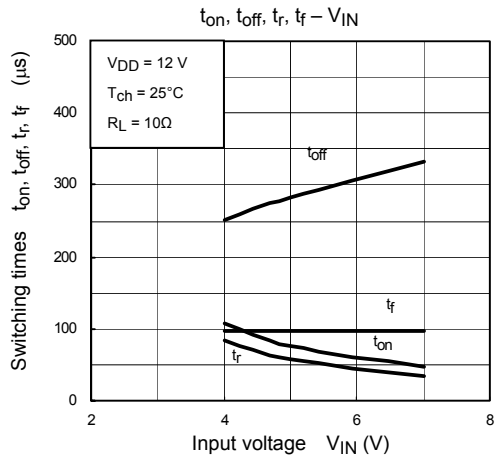
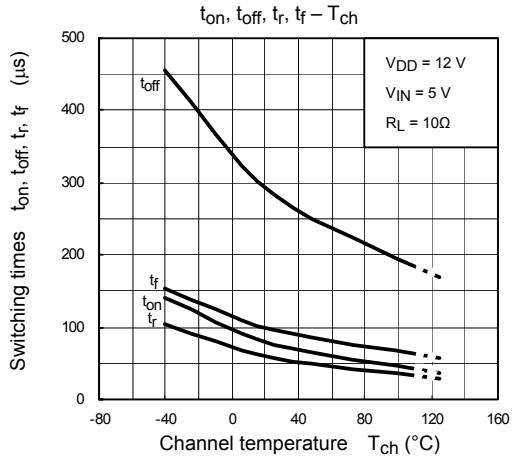
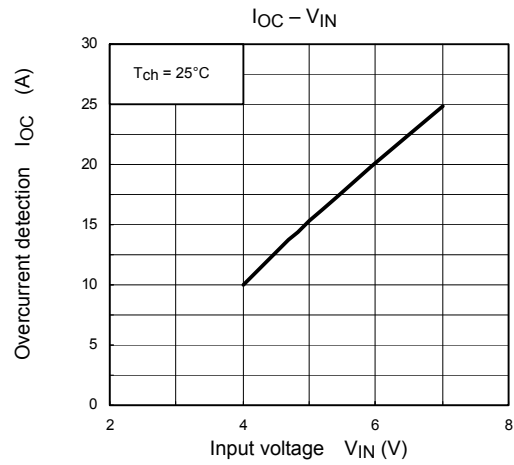
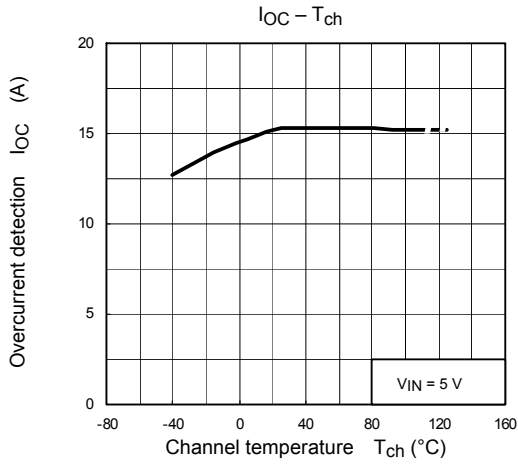
Test circuit

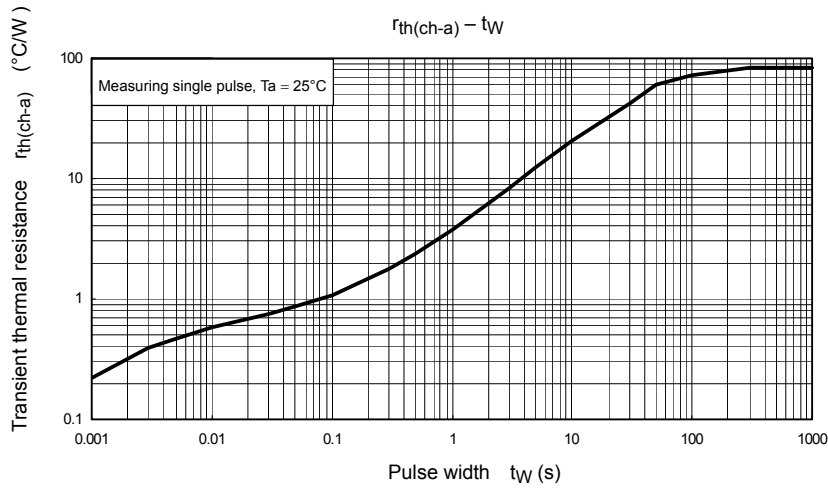
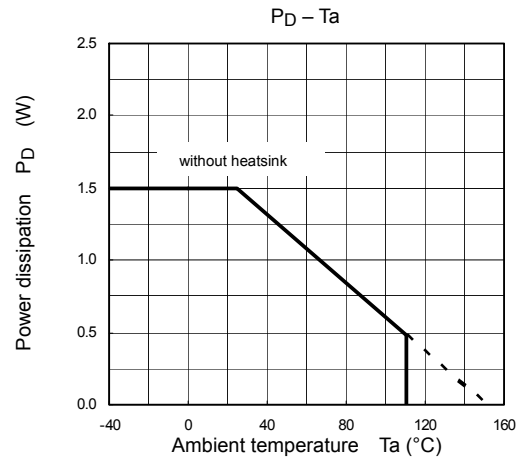
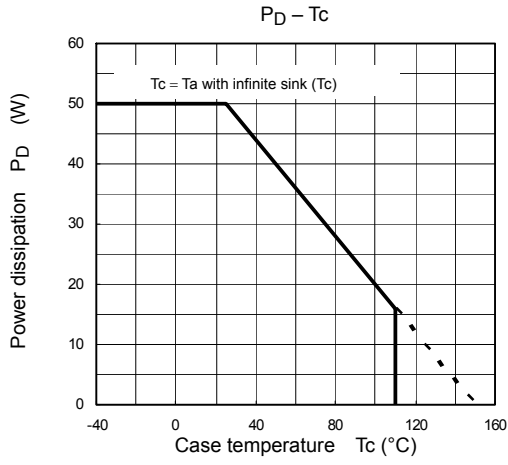


Measured waveforms





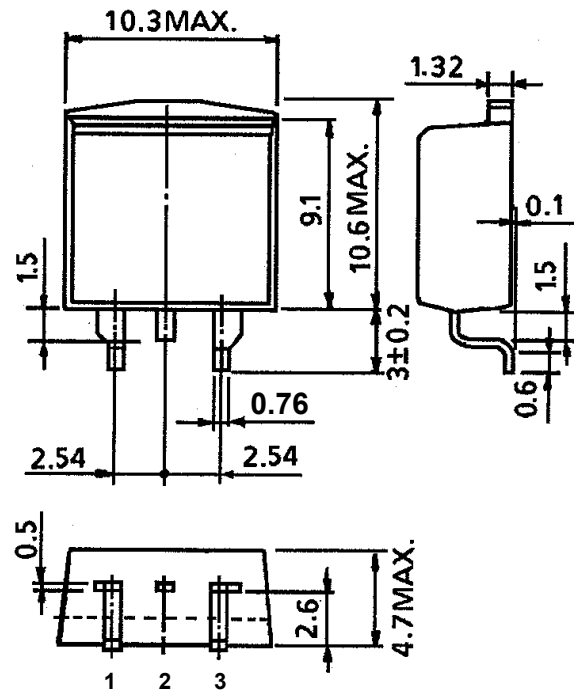




Package Dimensions

HSOP3-P-2.54C

Unit: mm



Weight: 1.5 g (typ.)

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20070701-EN GENERAL

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