

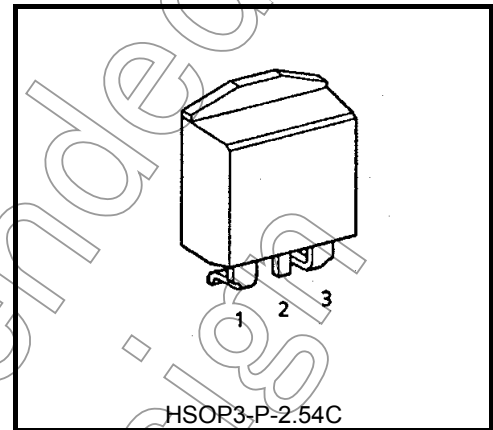
TPD1031AF

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 MOSFET, and the input can be directly driven from CMOS or TTL logic (e.g., an MPU). The TPD1031AF provides intelligent protection functions.

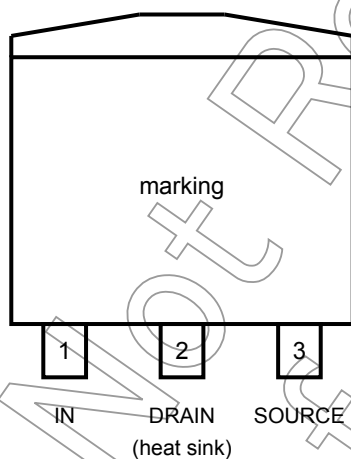
Features

- 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: $R_{DS(ON)} = 65\text{m}\Omega$ (max) (@ $V_{IN} = 5\text{ V}$, $I_D = 4\text{ A}$, $T_{ch} = 25^\circ\text{C}$)
- Low leakage current: $I_{DSS} = 100\text{ }\mu\text{A}$ (max) (@ $V_{IN} = 0\text{ V}$, $V_{DS} = 40\text{ V}$, $T_{ch} = 25^\circ\text{C}$)
- Housed in "TO-220SM" package and supplied in embossed carrier tape.

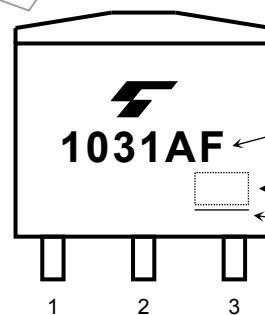


Weight: 1.5 g (typ.)

Pin Assignment



Marking



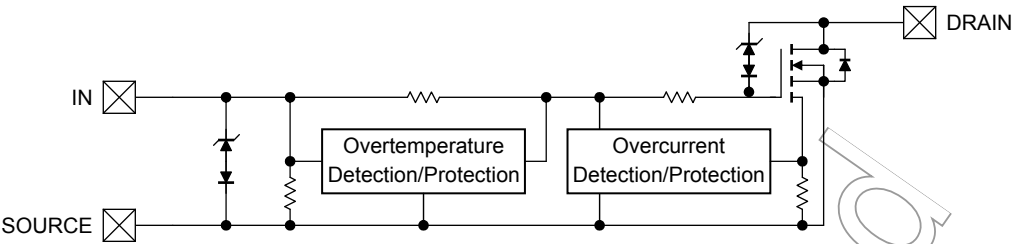
Part No. (or abbreviation code)

Lot No.

A line indicates Lead (Pb) -Free Finish

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

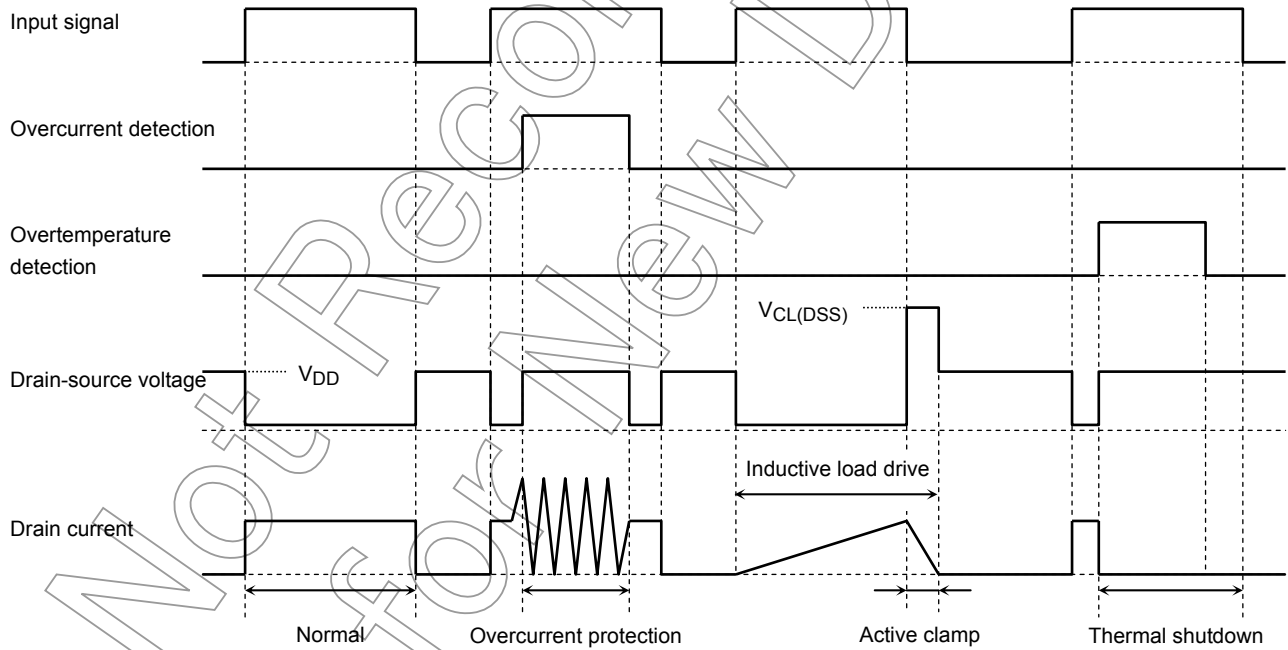
Block Diagram



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

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	$T_c = 25^{\circ}\text{C}$	$P_{D(1)}$	50	W
	$T_a = 25^{\circ}\text{C}$	$P_{D(2)}$	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	$^{\circ}\text{C}$
Channel temperature		T_{ch}	150	$^{\circ}\text{C}$
Storage temperature		T_{stg}	-55 to 150	$^{\circ}\text{C}$

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

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	$^{\circ}\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	83.3	$^{\circ}\text{C/W}$

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

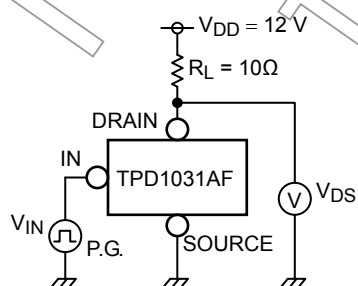
Electrical Characteristics (T_{ch} = -40 to 110°C)

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} = 12 V, 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} = 5 V	8	15	-	A
Overtemperature detection	T _{OT}	-	V _{IN} = 5 V	-	160	-	°C

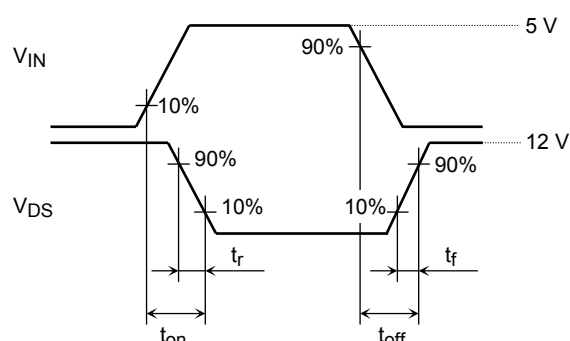
Test Circuit 1

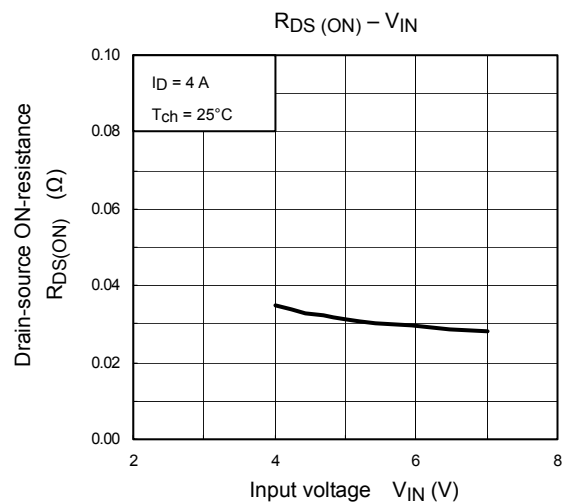
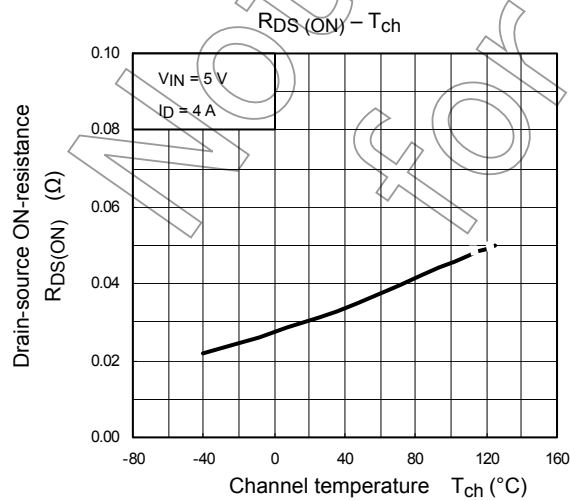
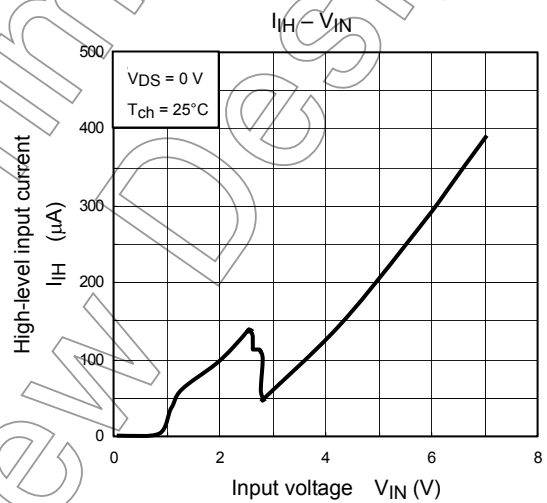
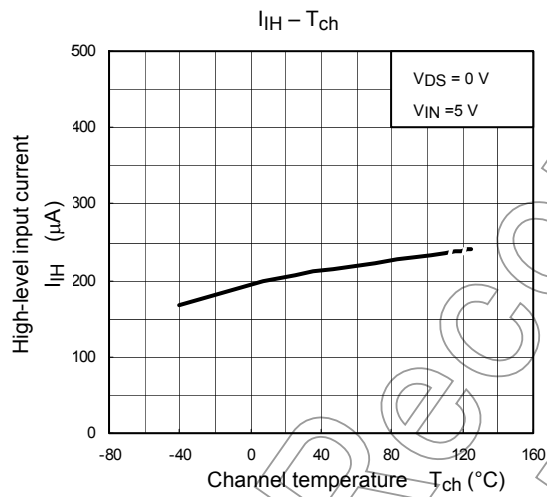
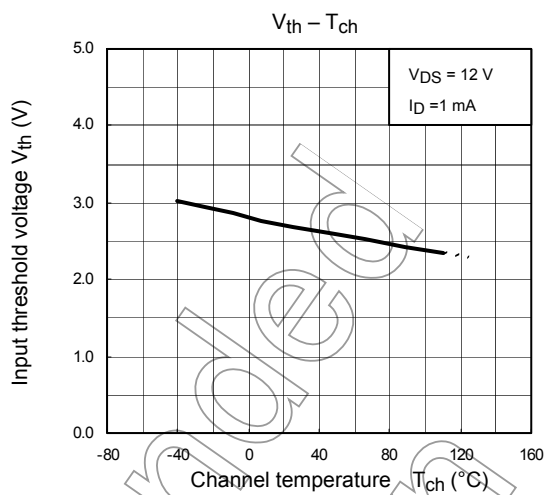
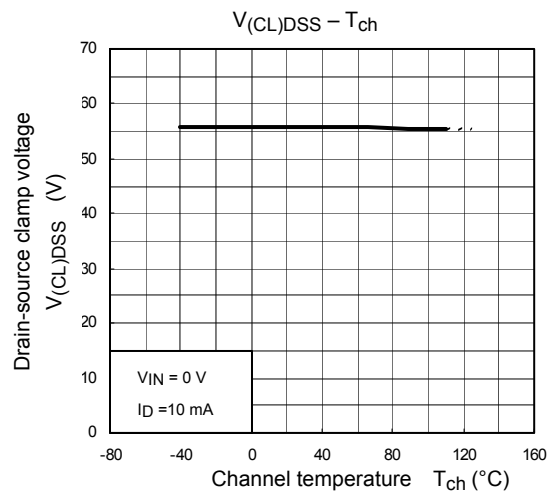
Switching times measuring circuit

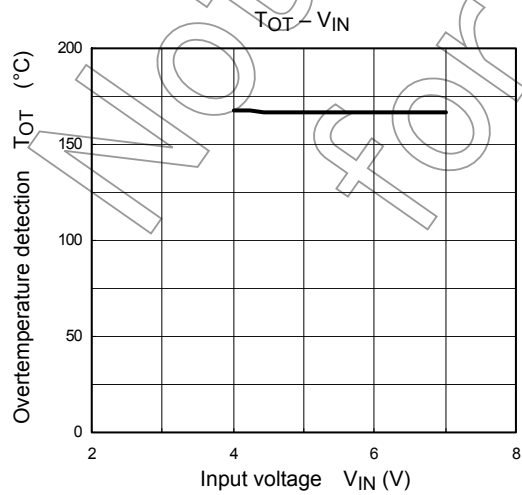
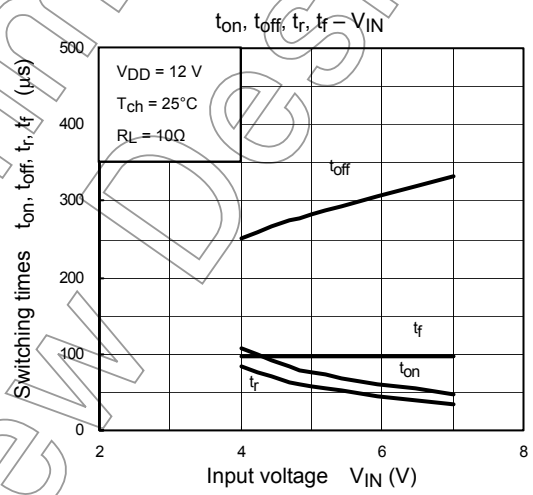
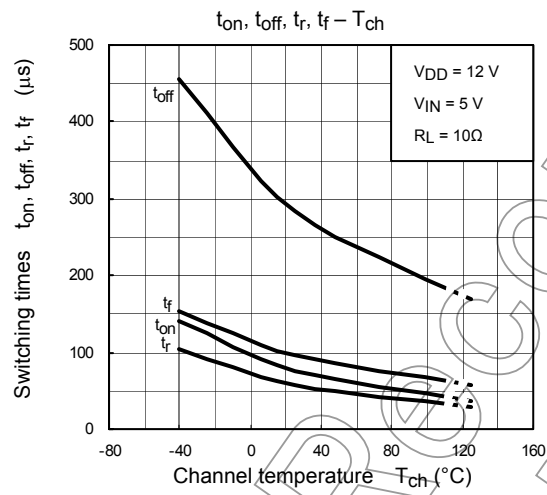
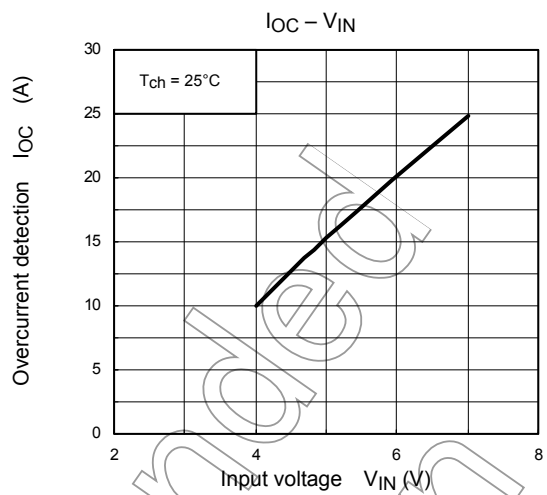
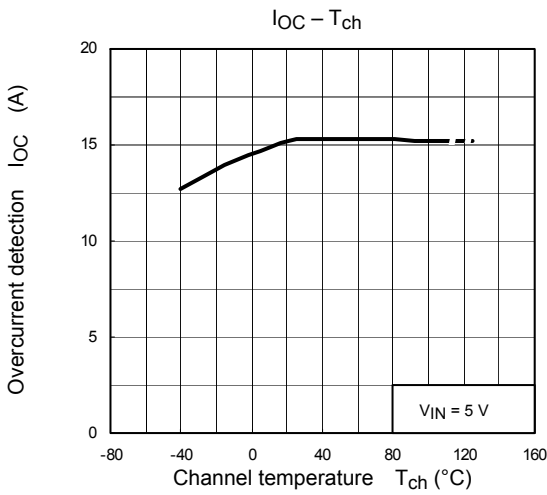
Test circuit

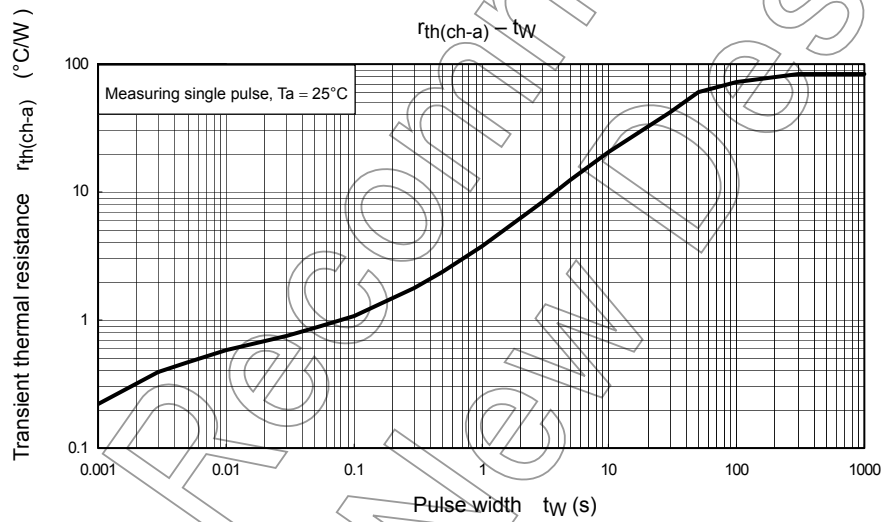
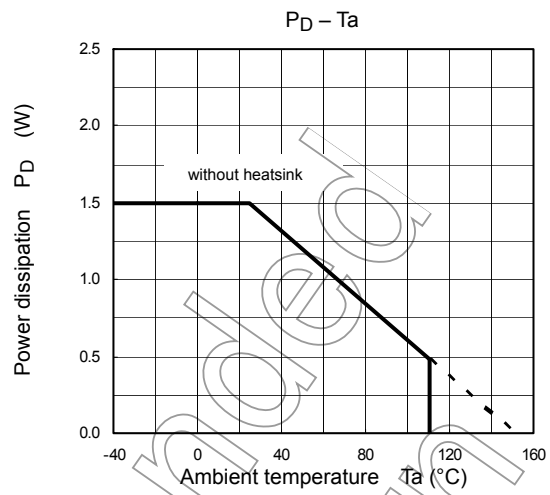
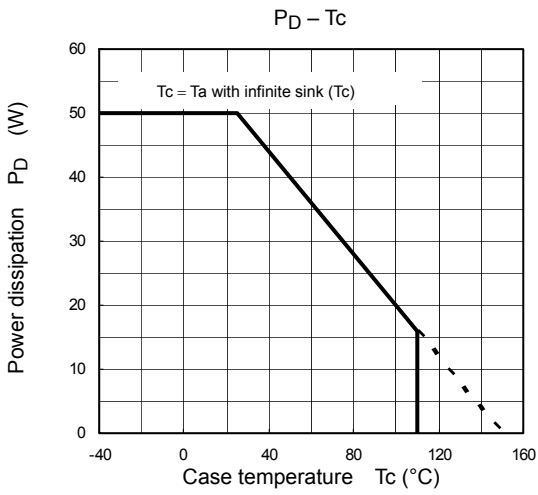


Measured waveforms





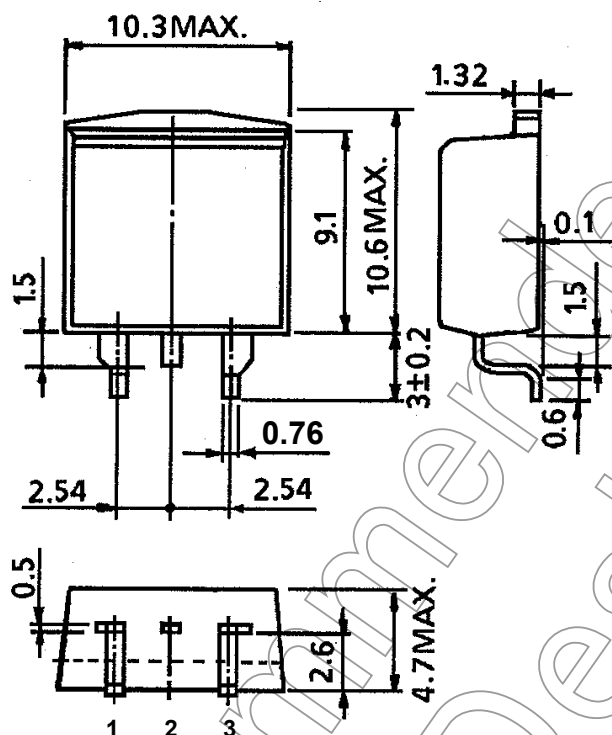




Package Dimensions

HSOP3-P-2.54C

Unit: mm



Weight: 1.5 g (typ.)

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20070701-EN GENERAL

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