

**TOSHIBA**

**TPD1031F**

TOSHIBA INTELLIGENT POWER DEVICE SILICON MONOLITHIC POWER MOS INTEGRATED CIRCUIT

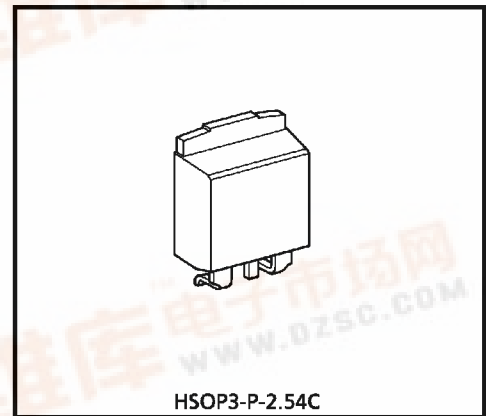
# TPD1031F

## LOW-SIDE POWER SWITCH FOR MOTORS, SOLENOIDS, AND LAMP DRIVERS

TPD1031F is a monolithic power IC for low-side switches. The TPD1031F has a vertical MOSFET output with logic level input. The TPD1031F features current limiting for over current protection, thermal shutdown for over temperature protection and Drain voltage clamping for over voltage protection.

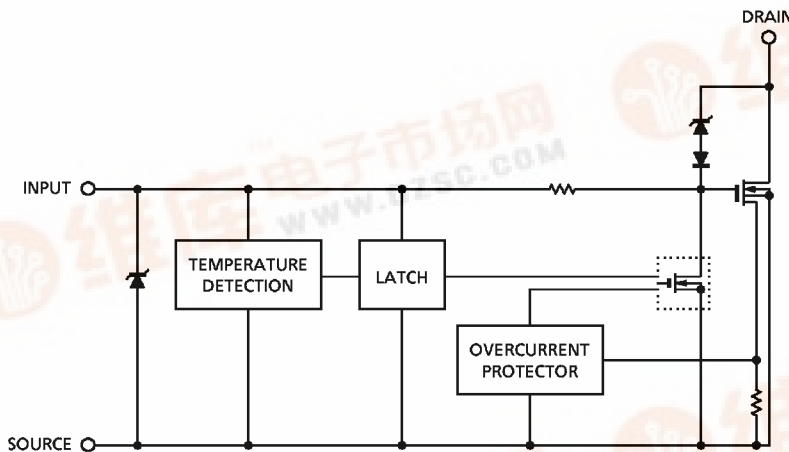
### FEATURES

- Monolithic power IC with a new structure combining a control block with a vertical power MOSFET (L<sup>2</sup>-π-MOS) on a single chip.
- logic level input enables driving power loads directly from CMOS or TTL logic circuit.
- Built-in protection against over voltage, over current, and over temperature.
- Low ON-resistance : R<sub>DS (ON)</sub> = 65 mΩ (Max) (@V<sub>IN</sub> = 5 V, T<sub>ch</sub> = 25°C)



Weight : 1.5 g (Typ.)

### BLOCK DIAGRAM

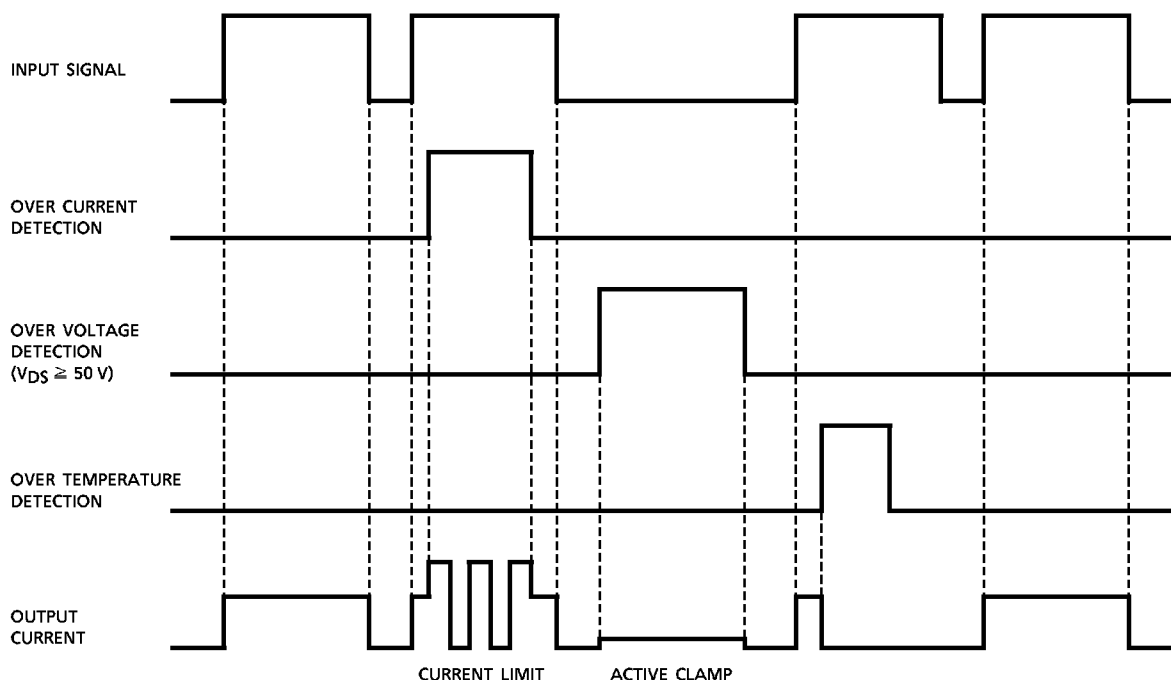


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**TIMING CHART**



**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-Source Voltage		V <sub>DS</sub>	50	V
Drain Current		I <sub>D</sub>	Internally Limited	A
Input Voltage		V <sub>IN</sub>	0~7	V
Power Dissipation	T <sub>c</sub> = 25°C	P <sub>D</sub> (1)	50	W
	T <sub>a</sub> = 25°C	P <sub>D</sub> (2)	1.3	W
Single Pulse Avalanche Energy*		E <sub>AS</sub>	1190	mJ
Avalanche Current		I <sub>AR</sub>	11	A
Channel Temperature		T <sub>ch</sub>	150	°C
Storage Temperature Range		T <sub>stg</sub>	- 55~150	°C

**THERMAL CHARACTERISTICS**

CHARACTERISTIC	SYMBOL	MAX.	UNIT
Thermal Resistance, Channel to Case	R <sub>th</sub> (ch-c)	2.5	°C / W
Thermal Resistance, Channel to Ambient	R <sub>th</sub> (ch-a)	96.1	°C / W

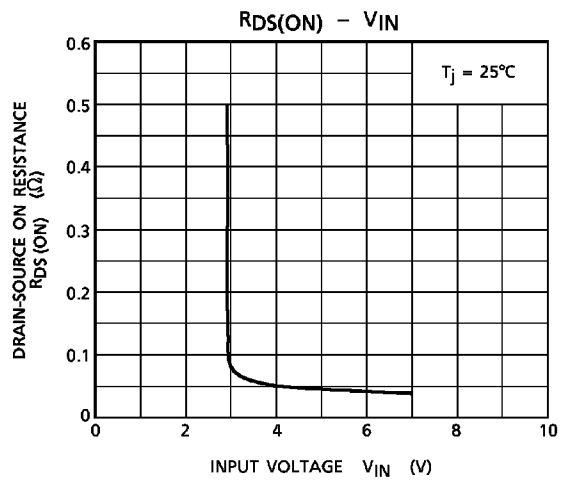
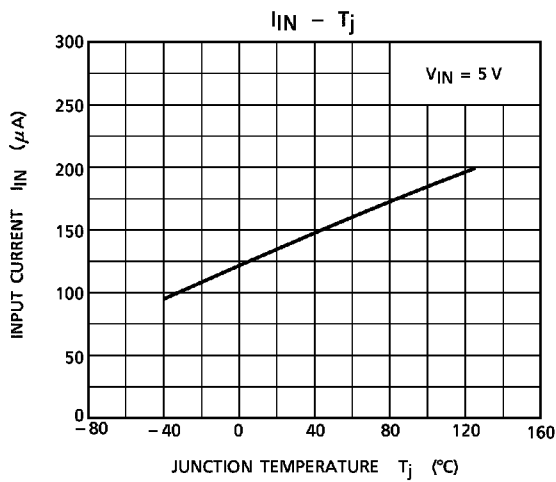
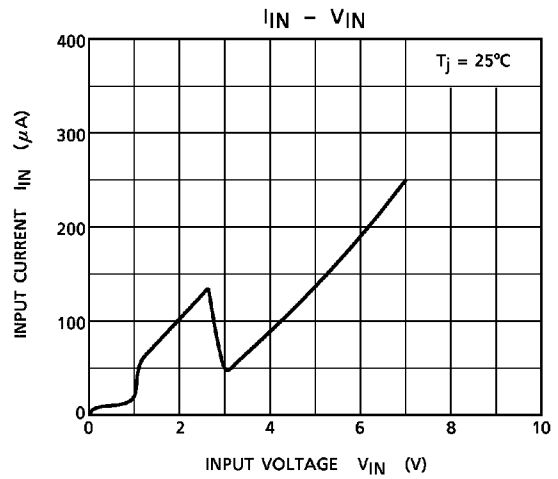
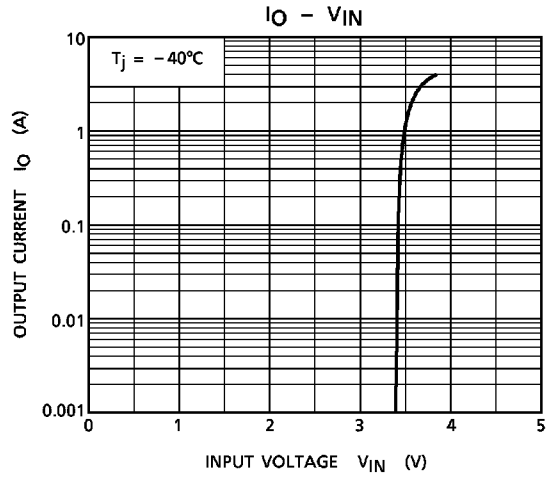
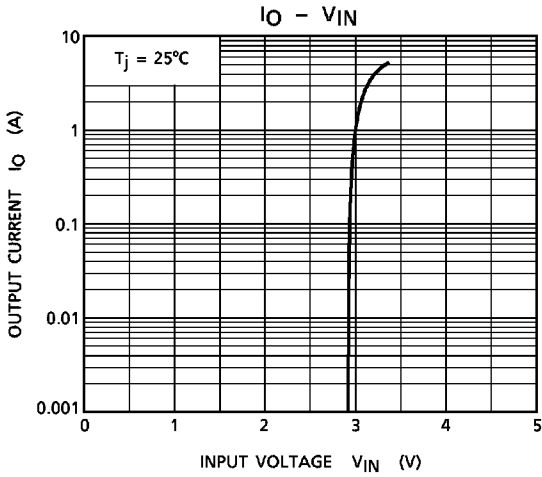
(Note) : \*Avalanche Energy (Single pulse) TEST CONDITION  
 V<sub>DD</sub> = 12 V, T<sub>ch</sub> = 25°C, L = 19.7 mH, I<sub>AR</sub> = 11 A  
 Repetitive rating ; Avalanche Energy Limited by maximum junction temperature.

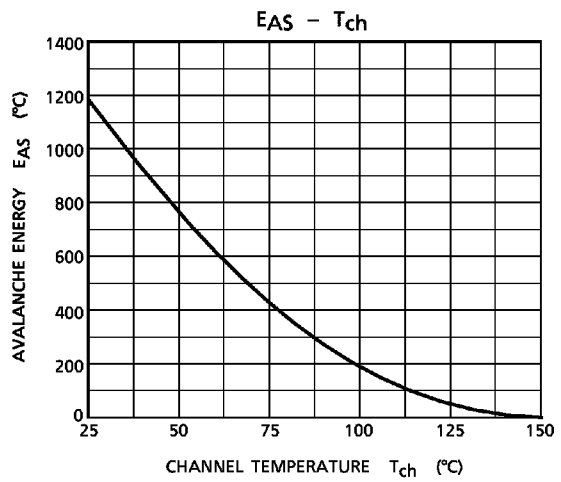
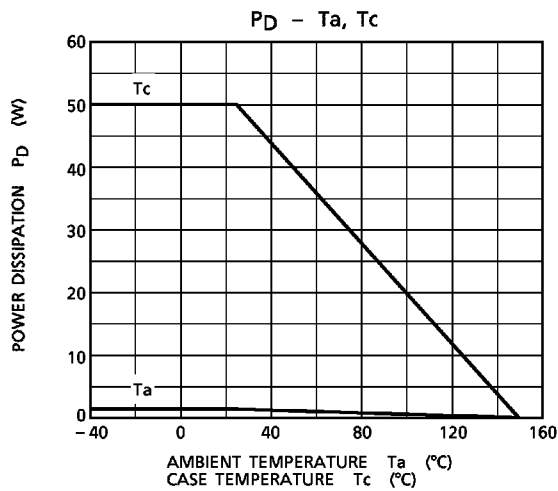
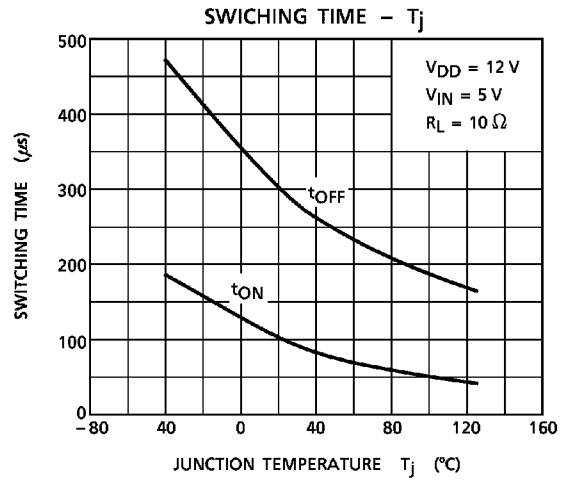
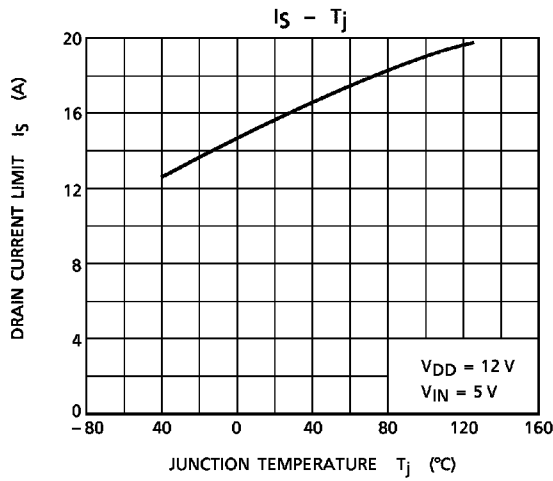
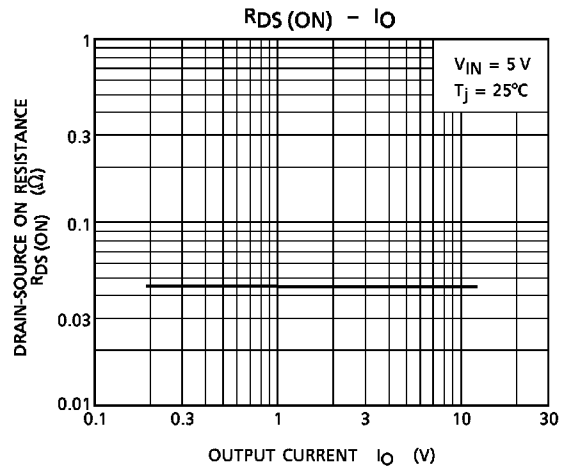
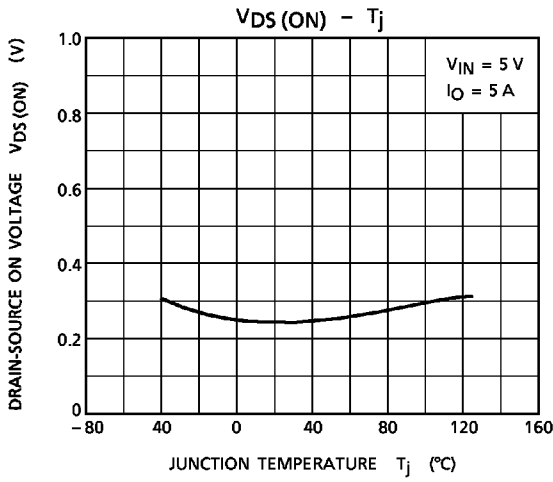
ELECTRICAL CHARACTERISTICS ( $T_j = 25^\circ\text{C}$ )

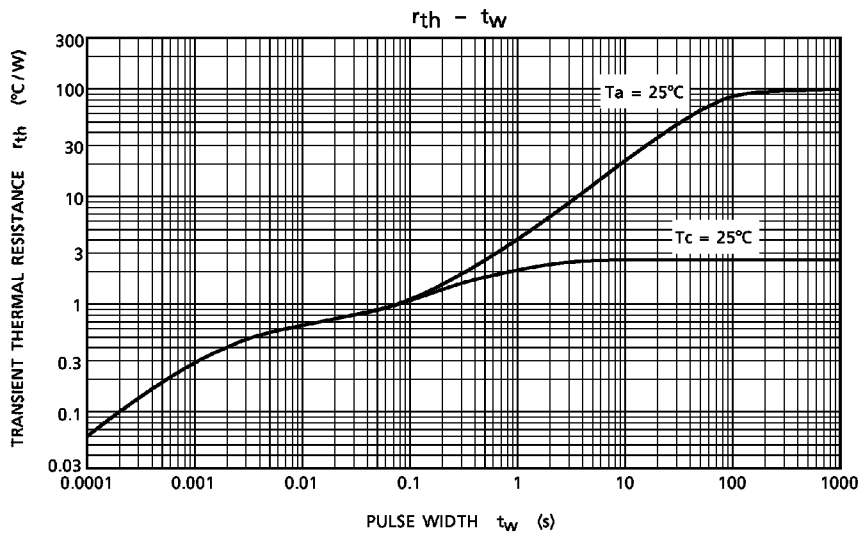
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Current		$I_{IN}$	$V_{IN} = 5\text{ V}, V_{DS} = 0\text{ V}$	—	—	500	$\mu\text{A}$
Drain Cut-Off Current		$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{IN} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source Breakdown Voltage		$V_{(CL)DSS}$	$I_D = 10\text{ mA}, V_{IN} = 0\text{ V}$	50	—	—	V
Operating Supply Voltage		$V_{DD(opr)}$				20	V
Drain-Source ON Resistance		$R_{DS(ON)}$	$V_{IN} = 5\text{ V}, I_D = 4\text{ A}$	—	0.045	0.065	$\Omega$
Switching Time	Rise Time	$t_r$	$V_{IN} = 0\text{ V} / +5\text{ V}, V_{DD} = 12\text{ V}$ $R_L = 10\ \Omega$	—	70	—	$\mu\text{s}$
	Turn-on Time	$t_{on}$		—	100	250	
	Fall Time	$t_f$		—	120	—	
	Turn-off Time	$t_{off}$		—	300	450	
Input Threshold Voltage		$V_{th}$	$V_{DS} = 12\text{ V}, I_D = 1\text{ mA}$	2	3	3.5	V
Protection Supply Voltage		$V_{IN(P)}$		4	—	—	V
Drain Current Limit		$I_{OC}$	$V_{IN} = 5\text{ V}$	11	15	—	A
Over Temperature Shutdown		$T_{OT}$	$V_{IN} = 5\text{ V}$	—	160	—	$^\circ\text{C}$
Diode Forward Voltage		$V_{DSF}$	$I_F = 25\text{ A}, V_{IN} = 0\text{ V}$	—	—	1.8	V

ELECTRICAL CHARACTERISTICS ( $T_j = -40\sim 110^\circ\text{C}$ )

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Current		$I_{IN}$	$V_{IN} = 5\text{ V}, V_{DS} = 0\text{ V}$	—	—	750	$\mu\text{A}$
Drain Cut-Off Current		$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{IN} = 0\text{ V}$	—	—	100	$\mu\text{A}$
Drain-source Breakdown Voltage		$V_{(CL)DSS}$	$I_D = 10\text{ mA}, V_{IN} = 0\text{ V}$	48	—	—	V
Operating Supply Voltage		$V_{DD(opr)}$				20	V
Drain-Source ON Resistance		$R_{DS(ON)}$	$V_{IN} = 5\text{ V}, I_D = 4\text{ A}$	—	0.045	0.095	$\Omega$
Switching Time	Rise Time	$t_r$	$V_{IN} = 0\text{ V} / +5\text{ V}, V_{DD} = 12\text{ V}$ $R_L = 10\ \Omega$	—	70	—	$\mu\text{s}$
	Turn-on Time	$t_{on}$		—	100	400	
	Fall Time	$t_f$		—	120	—	
	Turn-off Time	$t_{off}$		—	300	700	
Input Threshold Voltage		$V_{th}$	$V_{DS} = 12\text{ V}, I_D = 1\text{ mA}$	1.5	3	4	V
Protection Supply Voltage		$V_{IN(P)}$		4	—	—	V
Drain Current Limit		$I_{OC}$	$V_{IN} = 5\text{ V}$	11	15	—	A
Over Temperature Shutdown		$T_{OT}$	$V_{IN} = 5\text{ V}$	—	160	—	$^\circ\text{C}$

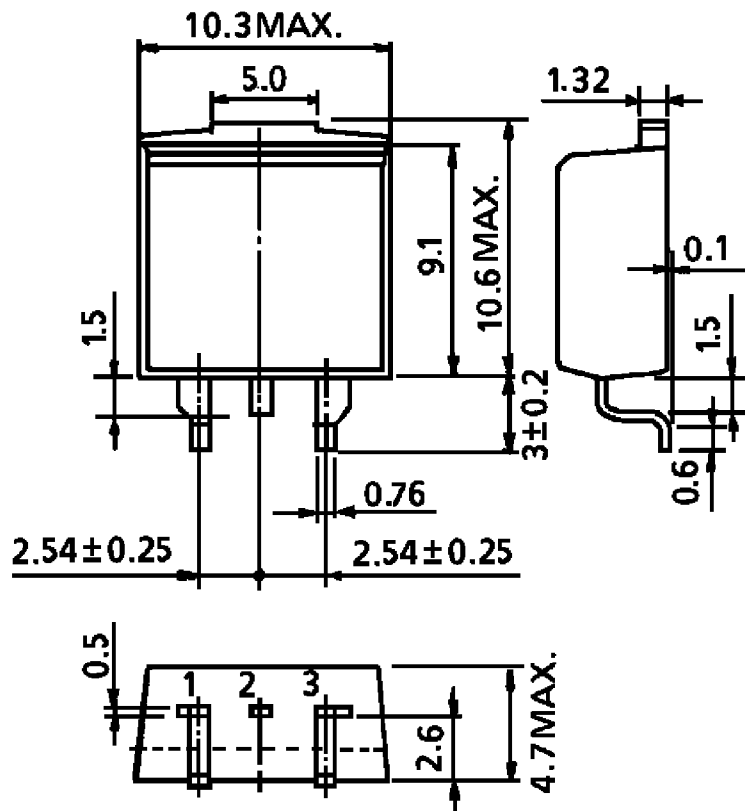






OUTLINE DRAWING  
HSOP3-P-2.54C

Unit : mm



Weight : 1.5 g (Typ.)