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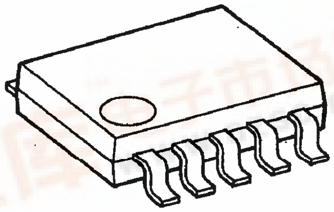
TOSHIBA INTELLIGENT POWER DEVICE SILICON MONOLITHIC POWER MOS INTEGRATED CIRCUIT

TPD1018F

HIGH-SIDE POWER SWITCH for MOTORS, SOLENOIDS, and LAMP DRIVERS

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



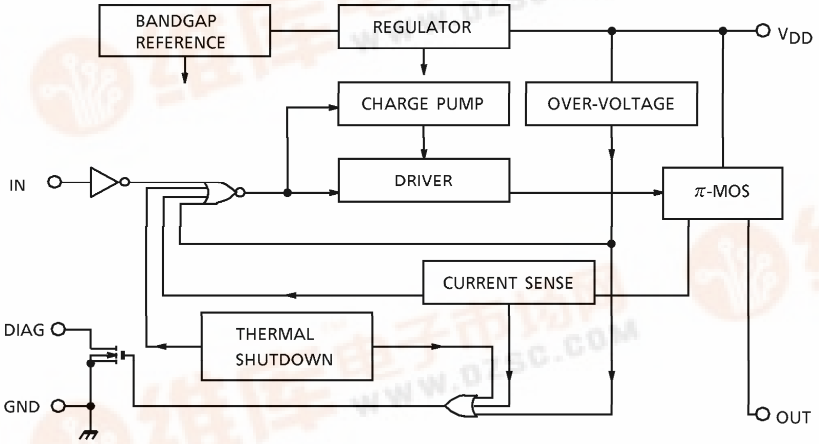
SSOP10-P-225-1.00

Weight : 0.08g (Typ.)

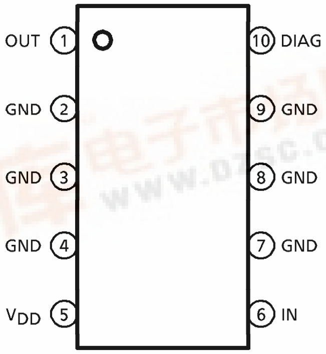
FEATURES

- 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, overheating, and load short circuiting
- Incorporates a diagnosis function that allows diagnosis output to be read externally at load short circuiting, overvoltage, or overheating.
- Low on resistance : $R_{DS\,(ON)} = 0.8\Omega$ (Max)
- Low operating current: $I_{DD} = 120\mu A$ (Typ.), @ $V_{DD} = 13.2V$, $V_{IN} = 0$
- 10-pin SSOP package for surface mounting.

BLOCK DIAGRAM



PIN ASSIGNMENT



(TOP VIEW)

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

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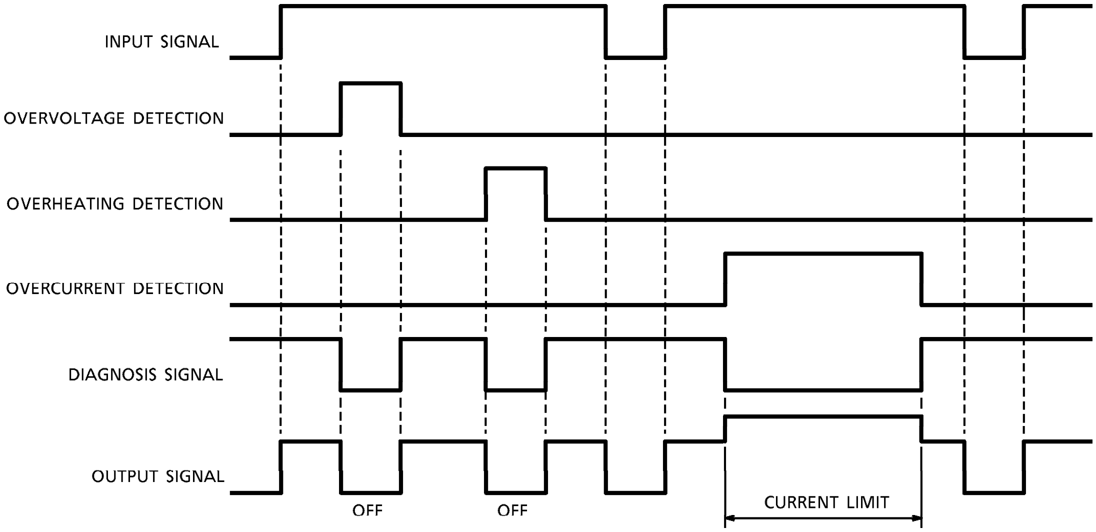
PIN DESCRIPTION

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	Load short circuited
L	L	H	
H	L	L	Overheating
L	L	H	
H	L	L	Overvoltage
L	L	H	

MAXIMUM RATINGS (Ta = 25°C)

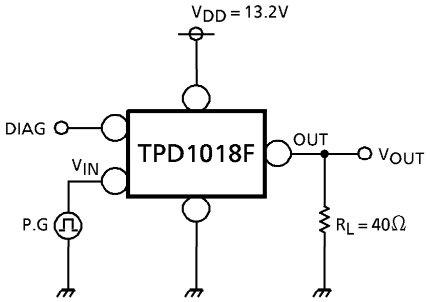
CHARACTERISTIC		SYMBOL	RATING	UNIT
Drain-source Voltage		V_{DS}	60	V
Supply Voltage	DC	$V_{DD\ (1)}$	25	V
	Pulse	$V_{DD\ (2)}$	60 ($Rs = 1\Omega$, $\tau = 250ms$)	V
Input Voltage	DC	$V_{IN\ (1)}$	−0.5~25	V
	Pulse	$V_{IN\ (2)}$	$V_{DD\ (1)} + 1.5$ (t = 100ms)	V
Output Current		I_O	0.5	A
Input Current		I_{IN}	±10	mA
Power Dissipation	Ta = 25°C	P_D	300	mW
Operating Temperature		T_{opr}	−40~125	°C
Junction Temperature		Tj	150	°C
Storage Temperature		T_{stg}	−55~150	°C

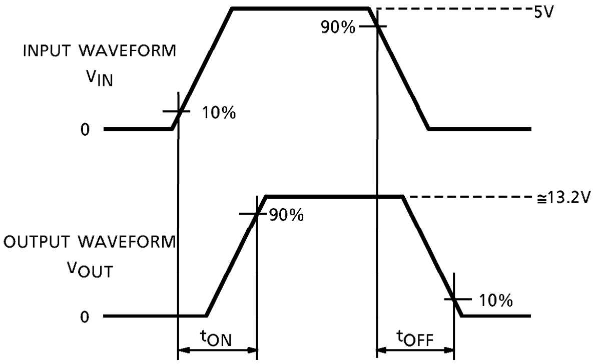
ELECTRICAL CHARACTERISTICS (Tj = −40~125°C)

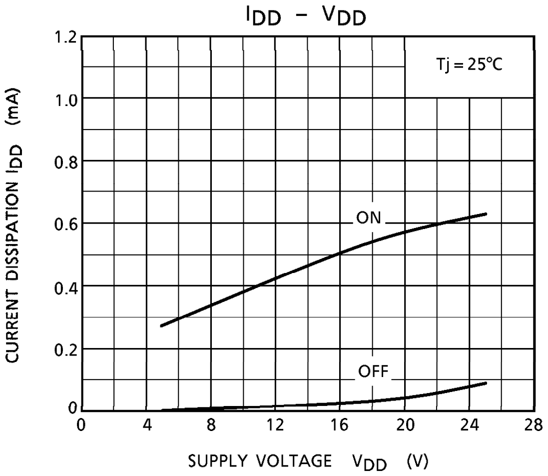
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Operating Supply Voltag		$V_{DD\ (OPR)}$	—	—	5	12	25	V
Current Dissipation		$I_{DD\ (1)}$	—	$V_{DD} = 13.2V$, $V_{IN} = 0$, $Tj = 85°C$	—	120	300	μA
		$I_{DD\ (2)}$		$V_{DD} = 13.2V$, $V_{IN} = 5V$	—	1	1.5	mA
Input Voltage		V_{IH}	—	$V_{DD} = 13.2V$, $I_O = 300mA$	3.5	—	—	V
		V_{IL}	—	$V_{DD} = 13.2V$, $I_O = 100\mu A$	—	—	1.5	V
Input Current		$I_{IN\ (1)}$	—	$V_{DD} = 13.2V$, $V_{IN} = 5V$	—	10	100	μA
		$I_{IN\ (2)}$		$V_{DD} = 13.2V$, $V_{IN} = 0$	−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
		$R_{DS(ON)(2)}$		$V_{DD} = 13.2V$, $I_O = 300mA$, $Tj = -40\sim 85°C$	—	—	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}	—	$V_{DD} = 25V$, $V_{IN} = 0$	—	—	100	μA
Overcurrent Protection		I_S	—	$V_{DD} = 13.2V$, $Tj = 25°C$	0.5	—	3	A
Overheating Protection	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	$V_{DD} = 13.2V$, $R_L = 40\Omega$ $Tj = 25°C$	—	50	—	μs
		t_{OFF}			—	10	—	μs

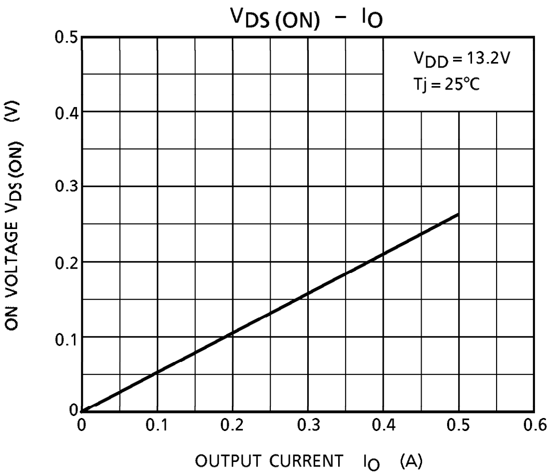
TEST CIRCUIT 1

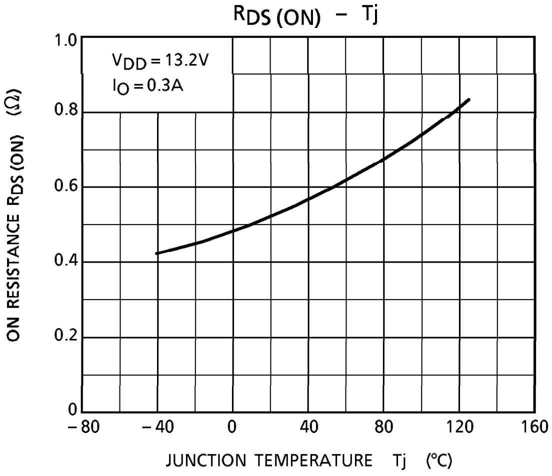
Switching Time

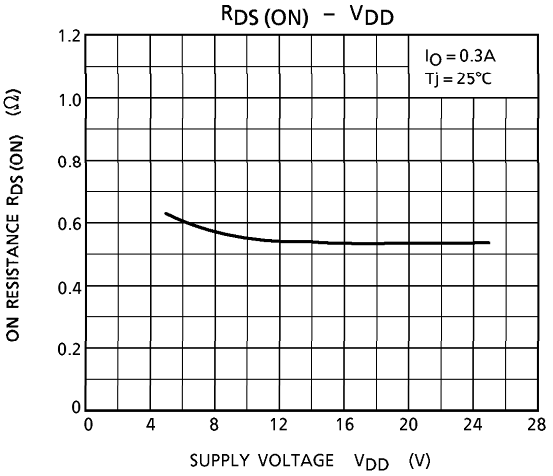


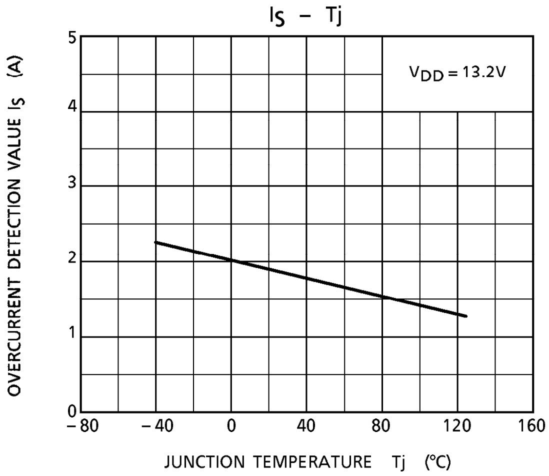


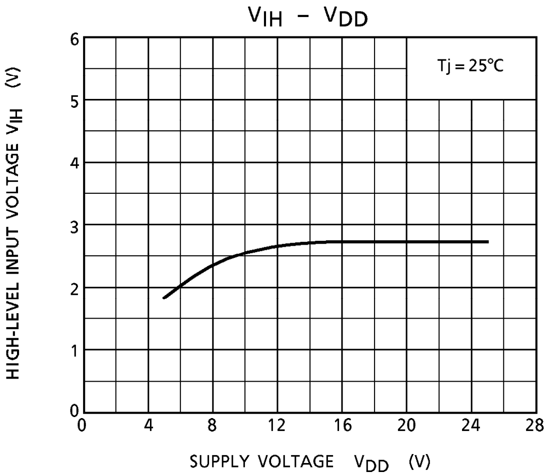

I_{DD} – V_{DD}
Tj = 25°C
ON
OFF
CURRENT DISSIPATION I_{DD} (mA)
0
0.2
0.4
0.6
0.8
1.0
1.2
0
4
8
12
16
20
24
28
SUPPLY VOLTAGE V_{DD} (V)

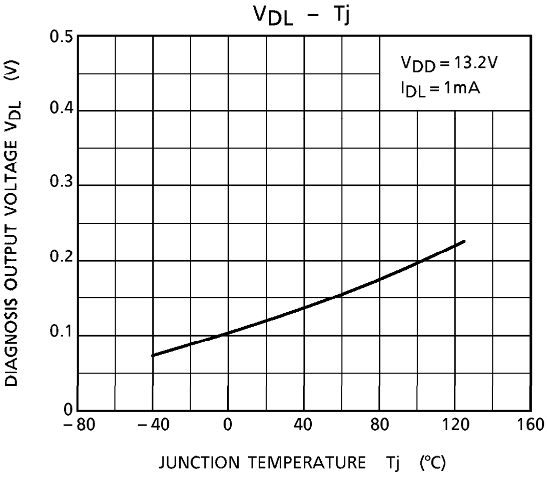

$V_{DS(ON)}$ – I_O
V_{DD} = 13.2V
Tj = 25°C
ON VOLTAGE $V_{DS(ON)}$ (V)
0
0.1
0.2
0.3
0.4
0.5
0
0.1
0.2
0.3
0.4
0.5
0.6
OUTPUT CURRENT I_O (A)

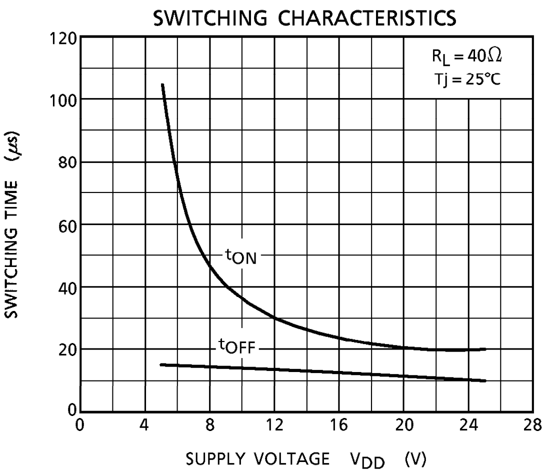

$R_{DS(ON)}$ – Tj
V_{DD} = 13.2V
I_O = 0.3A
ON RESISTANCE $R_{DS(ON)}$ (Ω)
0
0.2
0.4
0.6
0.8
1.0
– 80
– 40
0
40
80
120
160
JUNCTION TEMPERATURE Tj (°C)

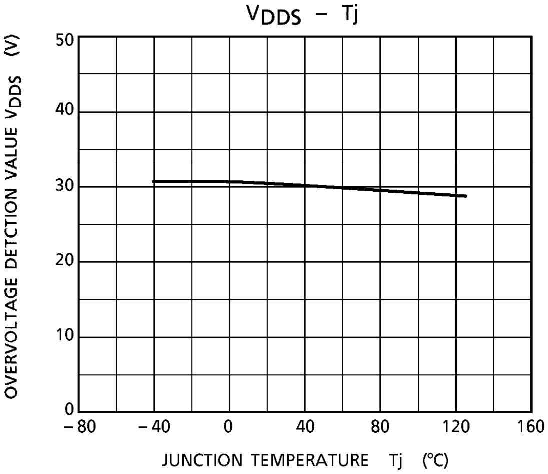

$R_{DS(ON)}$ – V_{DD}
I_O = 0.3A
Tj = 25°C
ON RESISTANCE $R_{DS(ON)}$ (Ω)
0
0.2
0.4
0.6
0.8
1.0
1.2
0
4
8
12
16
20
24
28
SUPPLY VOLTAGE V_{DD} (V)

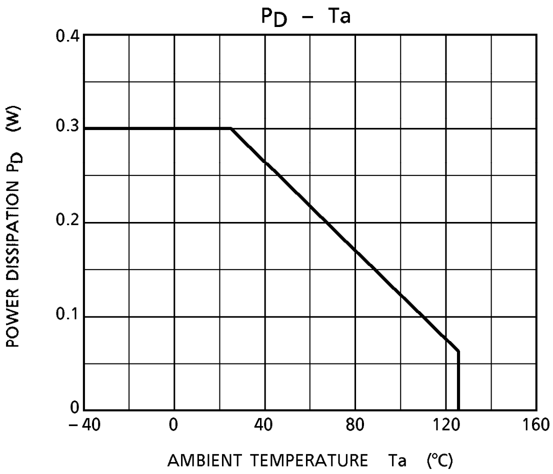

I_S – Tj
V_{DD} = 13.2V
OVERCURRENT DETECTION VALUE I_S (A)
0
1
2
3
4
5
– 80
– 40
0
40
80
120
160
JUNCTION TEMPERATURE Tj (°C)


V_{IH} – V_{DD}
Tj = 25°C
HIGH-LEVEL INPUT VOLTAGE V_{IH} (V)
0
1
2
3
4
5
6
0
4
8
12
16
20
24
28
SUPPLY VOLTAGE V_{DD} (V)









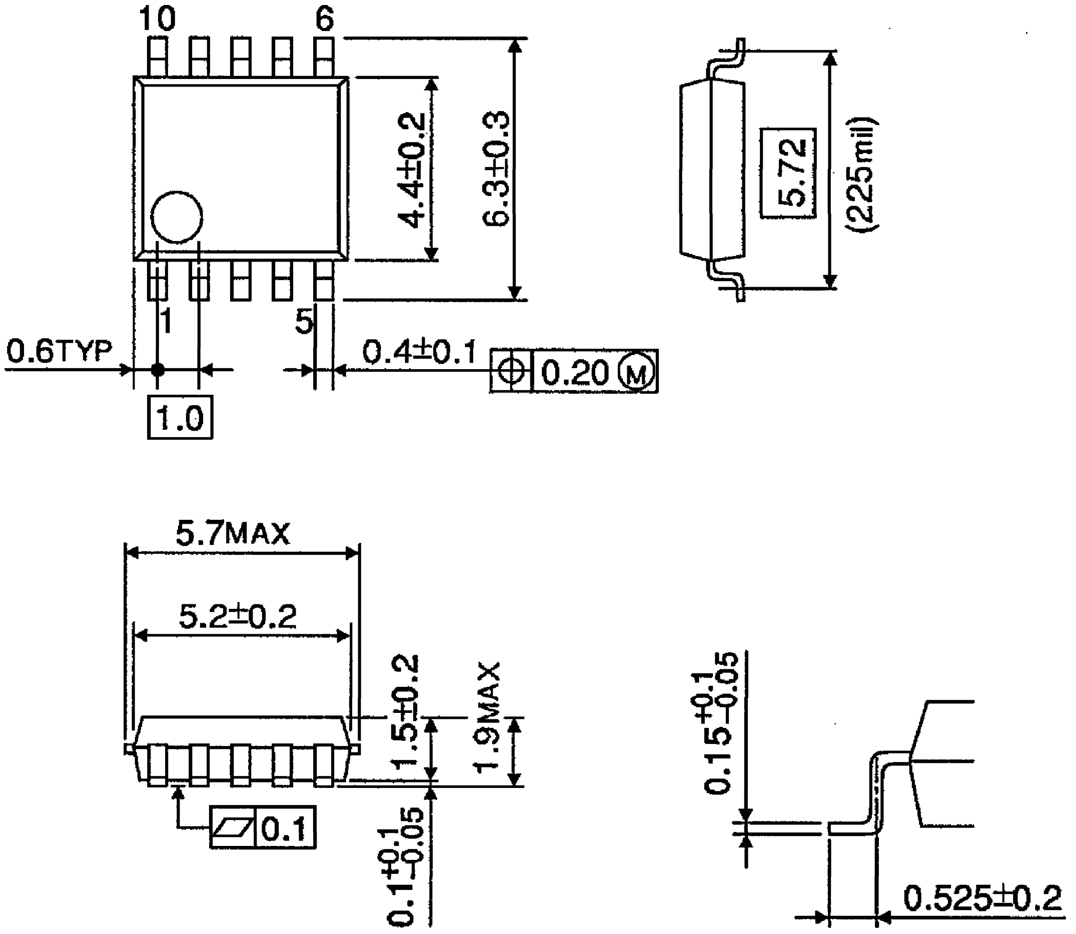
PRECAUTION:

1. Since protection for, for example, reverse connection of the battery is not incorporated, provide protection using external circuits.
2. Since a negative bias protection circuit for the output pin is not incorporated, when negative bias is applied to the output pin, connect a freewheeling diode (FWD) between OUT and GND.

OUTLINE DRAWING

SSOP10-P-225-1.00

Unit : mm



Weight : 0.08g (Typ.)