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Mini catalog

Toshiba's circuit protection solutions and switch solutions

Importance of circuit protection

Circuit protection is an essential element of electronic circuit design. Inadequate circuit protection can damage circuits or peripheral devices. As a result, circuit protection is increasingly important for the delivery of high-quality products.

Toshiba's circuit protection solutions

Toshiba's circuit protection solutions offer high quality and reliability, and can accommodate a wide range of circuits.

Various protection functions are designed to prevent damage from overvoltage, overcurrent, short-circuit, overheating, inrush current, ESD, etc.

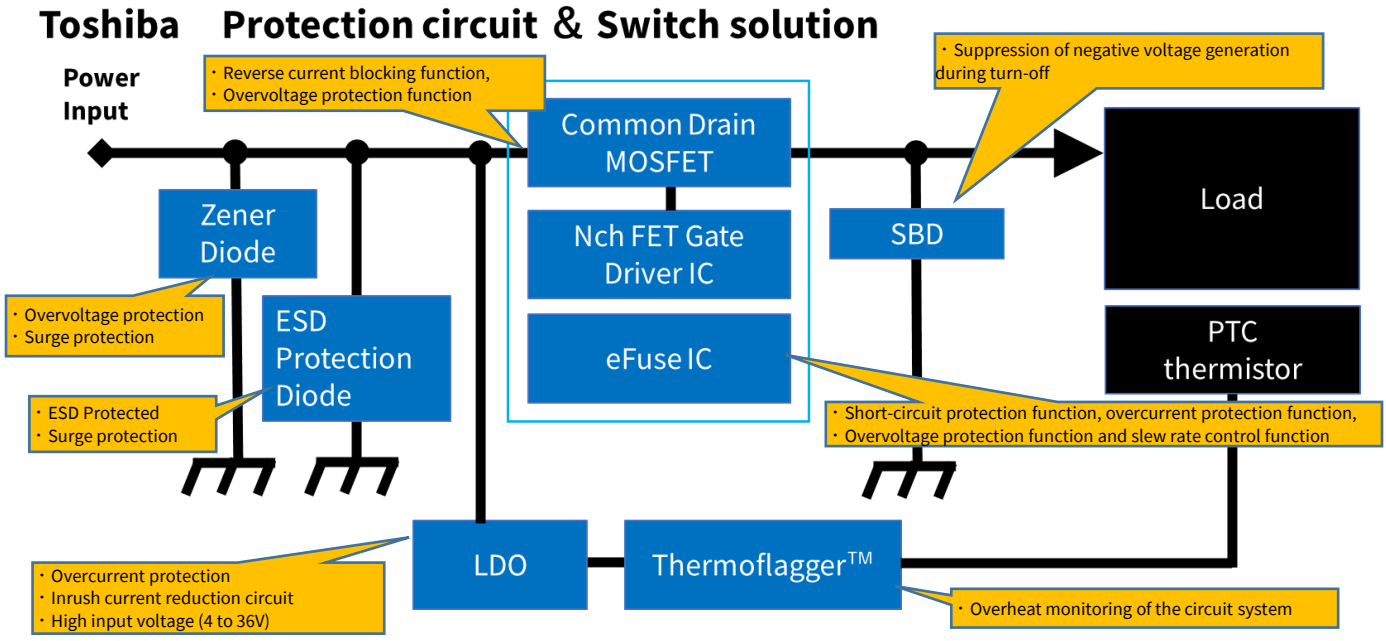
In addition, Toshiba's proprietary discrete and IC technologies are used to develop the semiconductor components that make up Toshiba's protection solutions.

Toshiba's semiconductor product line covers a wide range of protection functions. Its small package sizes make it easy to place components, save design time and effort.

Example circuit protection solution

The following are typical protection solutions composed of Toshiba's semiconductor products. This is a combined solution of a "common drain MOSFET + gate driver IC" with a reverse current protection function and an overvoltage protection function while achieving a low RON.

Toshiba‘s protection solutions also include the eFuse IC, which provides superior protection functions such as short circuit protection, overcurrent protection, overvoltage protection and slew rate control. The Thermoflagger™ IC uses a PTC thermistor (*) to detect overheating of loads. Zener diodes, ESD protection diodes and Schottky barrier diodes (SBD) are also included to enhance the above protection functions.



*A thermistor is an element whose electrical resistance value changes as the temperature changes. PTC thermistors behave such that electric resistivity increases as the temperature rises.

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Key features that are ideal for various protection solutions

- ✓ Ultra-low R_{ON} common-drain MOSFET
- ✓ Nch MOSFET gate driver IC with selectable OVP thresholds
- ✓ Zener diode with high power package US2H
- ✓ eFuse IC with abundant protection functions such as short-circuit protection

Main applications that require protection solutions

Notebook PCs, mobile devices, home appliances, industrial devices, consumer devices, IoT, wearable devices, USB power supplies

Parts list for each product

Chip LGA 6pin(TCSP6A-172101)	Chip LGA 10pin(TCSPAC-153001)	Chip LGA 14pin(TCSPED-302701)
		

Common-drain MOSFET

Product Number	Structure	V_{SSS} ※	V_{GSS} ※	I_S ※	$R_{SS(ON)}$ (typ) Vgs=3.8V	$R_{SS(ON)}$ (typ) Vgs=4.5V	Package
		(V)	(V)	(A)	(mΩ)	(mΩ)	
SSM6N951L	N-channel Common drain	12	±8	8	4.6	4.4	Chip LGA 6pin (TCSP6A-172101) (2.14x1.67x0.11mm)
SSM10N954L		12	±8	13.5	2.2	2.1	Chip LGA 10pin (TCSPAC-153001) (2.98x1.49x 0.11mm)
SSM14N956L		12	±8	19	1.1	1.0	Chip LGA 14pin (TCSPED-302701) (3.00x2.74x0.085mm)

※Absolute maximum rating

WCSP6E


Nch FET gate driver IC

Product Number	Overvoltage protection OVLO(Over Voltage Lock Out) detected Threshold voltage Falling min/max	Gate drive-voltage V_{GS} (typ)	Recommended input-voltage V_{IN}	External N-ch MOSFET Recommended Ratings	Package
	(V)	(V)	(V)	(V)	
TCK420G	26.5/28.5	10	24	VDSS:40/30 VGSS:±20	WCSP6G (1.2x0.8x0.55mm)
TCK421G	22.34/24.05		20	VDSS:30/25 VGSS:±20	
TCK422G	13.61/14.91		12	VDSS:30/25 VGSS:±20	
TCK423G	13.61/14.91	5.6	12	VDSS:25/20 VGSS:±8/10/12	
TCK424G	10.35/11.47		9	VDSS:20/12 VGSS:±8/10/12	
TCK425G	5.76/6.87		5	VDSS:12 VGSS:±8	

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Thermoflager ™ (Overheat Monitoring IC)

ESV

Product Number	Operating voltage range (V_{DD})	PTCO Output current (I_{PTCO}) (typ)	PTC thermistor selection (25℃)	FLAG hold function	FLAG signal-out (PTCGOOD)	Package
	(V)	(μA)	(Ω)			
TCTH021AE	1.7～5.5	10	470 to 940	-	Push-pull	ESV (SOT-553) (1.6x1.6x0.55 mm)
TCTH021BE					Open drain	
TCTH022BE				✓ Yes		

Zener diode

US2H

Product Number	Zener-voltage V_Z	Measuring current I_Z	Dynamic Resistor R_{DYN} (typ)	Clamp-voltage V_C (typ)	Pin-to-pin capacitance C_t (typ)	Package
	(V)	(mA)	(Ω)	(V)	(pF)	
CUHZ5V6	5.3～6.0	10	0.02	5.7	860	US2H (SOD-323HE) (2.5x1.4x0.60mm)
CUHZ6V2	5.8～6.6		0.02	6.1	735	
CUHZ6V8	6.4～7.2		0.014	7.2	585	
CUHZ8V2	7.7～8.7		0.035	8.5	450	
CUHZ12V	11.4～12.6		0.13	13.6	280	
CUHZ16V	15.3～17.1		0.085	17	210	
CUHZ20V	18.8～21.2		0.13	20.6	180	
CUHZ24V	22.8～25.6		0.14	25.5	150	
CUHZ30V	28.0～32.0		0.21	33.8	125	
CUHZ36V	34.0～38.0	9	0.39	41.2	105	

ESD protective diode

SL2

Product Number	Structure	V_{RWM} (max)	C_t @0V (typ)	R_{DYN} (Typ)	V_C (typ) @I_{TLP}16A	V_{ESD} (Min) @IEC61000-4-2 (contact-discharge)	Package
		(V)	(pF)	(Ω)	(V)	(kV)	
DF2B5M4ASL	Both directions	3.6	0.15	0.7	20	±16	SL2 (SOD-962) (0.62x0.32x0.3mm)
DF2B6M4ASL		5.5	0.15	0.7	20	±15	
DF2B12M4SL		11.0	0.2	0.65	27.0	±15	
DF2B20M4SL		18.5	0.2	0.2	27.6	±15	
DF2B26M4SL		24.0	0.2	0.2	31.5	±15	

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Schottky barrier diode (SBD)

US2H

Product Number	Maximum rating		Electrical Characteristics			Package
	V_R (V)	I_O (A)	V_F (V) (Typ) @I_F=1A	V_F (V) (Typ) @I_F=2A	I_R (μA) (Max.)	
CUHS20S30	30	2.0	0.28	0.34	500 @V_R =30V	US2H (SOD-323HE) (2.5x1.4x0.60 mm)
CUHS15S30	30	1.5	0.33	0.37@1.5A	500 @V_R =30V	
CUHS20S40	40	2.0	0.32	0.40	300 @V_R =40V	
CUHS15S40	40	1.5	0.38	0.45@1.5A	200 @V_R =40V	
CUHS20F30	30	2.0	0.35	0.40	60 @V_R =30V	
CUHS15F30	30	1.5	0.42	0.46@1.5A	50 @V_R =30V	
CUHS20F40	40	2.0	0.38	0.47	60 @V_R =40V	
CUHS15F40	40	1.5	0.49	0.57	50 @V_R =40V	

LDO

SMV

Product Number	Input voltage range (V)	Output current (mA)	Output voltage (V)	Output voltage tolerance @10 mA	I_{BON} (Typ) (μA)	Operating temperature range (°C)	Package
TCR1HF18B	4～36	150	1.8	±1%	1	-40～125	SMV (SOT23-5) (2.9x2.8x1.1 mm)
TCR1HF33B			3.3				
TCR1HF50B			5.0				

eFuse IC

WSON10 | WSON10B

Product name	Electrical/Switching Characteristics				Additional functions						Package
	V_{IN} (V) (min)	V_{IN} (V) (max)	R_{ON} (mΩ) (Typ)	I_Q (mA) (Typ)	OAD	RCB	OVC/OVP	OCL	Return operation	FLAG	
TCKE800NA	4.4	18	28	0.49	Y	Option (OFF)	N	0.5A-5A Adjustable	Auto-retry	N	WSON10B (3.0x3.0x0.75 mm)
TCKE805NA				0.46			6.04V OVC				
TCKE812NA				0.49			15.1V OVC				
TCKE800NL				0.49			N		Latched		
TCKE805NL				0.46			6.04V OVC				
TCKE812NL				0.49			15.1V OVC				
TCKE712BNL		13.2	53	0.69	N	Y (OFF)	Adjustable OVP	0.51A-3.65A Adjustable		Y	WSON10 (3.0x3.0x0.75 mm)

OAD: Output auto-discharge, RCB: Reverse current protection, OVC: Overvoltage protection (clamping), OVP: Overvoltage protection (shutdown), OCL: Overcurrent protection (limit)

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