

# MIP713

## Silicon MOS IC

### ■ Features

- Five protective functions (over-current, over-voltage, short-circuit load, over heat, ESD) built-in.
- Heat which goes up when load short-circuits is controlled.
- Although it is a small package, it has resistance of low heat. (When mounted in a substrate.)
- Driving directly from CMOS (microcomputer) is possible.

### ■ Applications

- For automotive electric equipment

### ■ Absolute Maximum Ratings

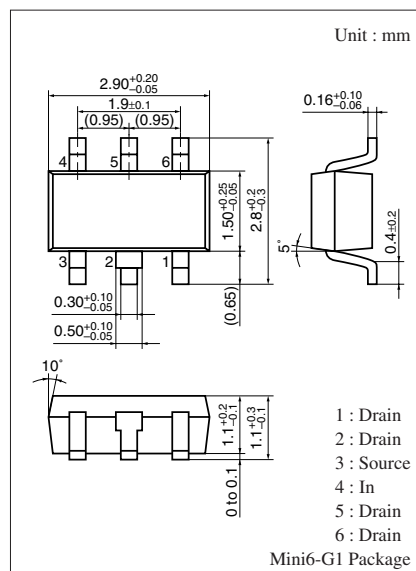
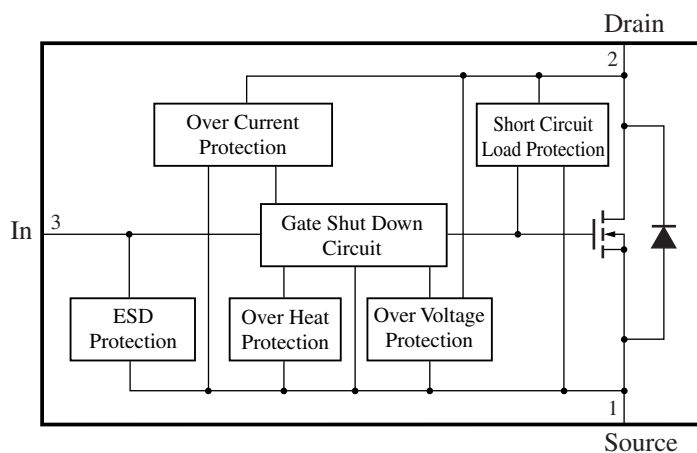
Parameter	Symbol	Rating	Unit
Drain-source voltage	$V_{DS}$	- 0.5 to +40	V
Output peak current	$I_{OP}$	3.0	A
Output current	$I_O$	1.0	A
Input voltage	$V_{IN}$	- 0.5 to +6.0	V
Input current	$I_{IN}$	$\pm 2$	mA
Drain clamp energy <sup>*1</sup>	$E_{CLP}$	17	mJ
Power dissipation 1 <sup>*2</sup>	$P_{D1}$	0.2	W
Power dissipation 2 <sup>*3</sup>	$P_{D2}$	0.8	W
Channel temperature	$T_{ch}$	-40 to +150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

Note) \*1 :  $L = 10 \text{ mH}$ ,  $I_L = 1.84 \text{ A}$ ,  $V_{DD} = 20 \text{ V}$  1 pulse,  $T_C = 25^\circ\text{C}$

\*2 : Single unit

\*3 : Mounting on the PCB (40 mm<sup>2</sup>, Thick 1.7 mm Glass epoxy substrate)  
( $T_a = 25^\circ\text{C}$ )

### ■ Block Diagram



Marking Symbol: MA

### ■ Electrical Characteristics $T_C = 25^\circ\text{C} \pm 3^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-source ON resistance	$R_{DS(on)}$	$V_{IN} = 5\text{ V}, I_{DS} = 1\text{ A}$		0.55	0.8	$\Omega$
Drain-source voltage	$V_{DS(on)}$	$V_{IN} = 5\text{ V}, I_{DS} = 1\text{ A}$		0.55	0.8	V
Drain clamp voltage	$V_{DS(CL P)}$	$V_{IN} = 0\text{ V}, I_{DS} = 3\text{ mA}$	40	52	65	V
Drain-source cutoff current 1	$I_{DS(off)1}$	$V_{IN} = 0\text{ V}, V_{DS} = 12\text{ V}$		27	50	$\mu\text{A}$
Drain-source cutoff current 2	$I_{DS(off)2}$	$V_{IN} = 0\text{ V}, V_{DS} = 16\text{ V}$		36	68	
Drain-source cutoff current 3	$I_{DS(off)3}$	$V_{IN} = 0\text{ V}, V_{DS} = 30\text{ V}$		79	170	
Input voltage high-level	$V_{IN(H)}$	$I_{DS} = 1\text{ A}$	4			V
Input voltage low-level	$V_{IN(L)}$	$I_{DS} = 1\text{ mA}$			0.8	V
Input current (normal)	$I_{IN(on)}$	$V_{IN} = 5\text{ V}, V_{DS} = 0\text{ V}$		0.2	0.3	mA
Input current (act on protection) *	$I_{IN(PROT)}$	$V_{IN} = 5\text{ V}$		0.6	0.9	mA
Over current protection limit	$I_{OCP}$	$V_{IN} = 5\text{ V}$	2.0	3.0		A
Short circuit load protection limit	$V_{DS(SHT)}$	$V_{IN} = 5\text{ V}$	2.0	4.0		V
Input voltage of act on protection	$V_{IN(PROT)}$		3.9	6.0		V

- Note) 1. At on-state when drain voltage exceeds the "Short circuit load protection voltage", output current begin to oscillate.  
 2. When drain voltage exceeds the "Drain clamp voltage" output MOS turn on, so drain voltage are clamped before the drain-source junction become breakdown.  
 3. \*: State of short circuit laod protection and over heat protection (Designed guarantee).

### ■ Electrical Characteristics (Reference value: Non guarantee value)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Over heat protection temperature	$T_{SHD}$	$V_{IN} = 5\text{ V}$	150	190		$^\circ\text{C}$
Turn-on time	$t_{ON}$	$V_{DD} = 30\text{ V}, R_L = 30\text{ }\Omega$ $I_{DS} = 1\text{ A}, V_{IN} = 5\text{ V}$		4		$\mu\text{s}$
Turn-off time	$t_{OFF}$			7		

- Note) If the chip temperature exceeds the "Over heat protection temperature", output current is shut down. And if the chip cool down, the protection will operate automatically again.

### ■ Electrical Characteristics $T_C = -40^\circ\text{C}$ to $125^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-source ON resistance	$R_{DS(on)}$	$V_{IN} = 5\text{ V}, I_{DS} = 1\text{ A}$			1.6	$\Omega$
Drain-source voltage	$V_{DS(on)}$	$V_{IN} = 5\text{ V}, I_{DS} = 1\text{ A}$			1.6	V
Drain clamp voltage	$V_{DS(CL P)}$	$V_{IN} = 0\text{ V}, I_{DS} = 3\text{ mA}$	40		65	V
Drain-source cutoff current 1	$I_{DS(off)1}$	$V_{IN} = 0\text{ V}, V_{DS} = 12\text{ V}$			100	$\mu\text{A}$
Drain-source cutoff current 2	$I_{DS(off)2}$	$V_{IN} = 0\text{ V}, V_{DS} = 16\text{ V}$			136	
Drain-source cutoff current 3	$I_{DS(off)3}$	$V_{IN} = 0\text{ V}, V_{DS} = 30\text{ V}$			340	
Input voltage high-level	$V_{IN(H)}$	$I_{DS} = 1\text{ A}$	4.3			V
Input voltage low-level	$V_{IN(L)}$	$I_{DS} = 1\text{ mA}$			0.8	V
Input current (normal)	$I_{IN(on)}$	$V_{IN} = 5\text{ V}, V_{DS} = 0\text{ V}$			0.45	mA
Input current (act on protection)	$I_{IN(PROT)}$	$V_{IN} = 5\text{ V}$			1.2	mA
Over current protection limit	$I_{OCP}$	$V_{IN} = 5\text{ V}$	1.15			A
Short circuit load protection limit	$V_{DS(SHT)}$	$V_{IN} = 5\text{ V}$	1.6			V
Input voltage of act on protection	$V_{IN(PROT)}$		4.0	6.0		V

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