

Smart Quad Low-Side Switch

Features

- Shorted circuit protection
- Overtemperature protection
- Overvoltage protection
- Open Load Detection
- Direct parallel control of the inputs
- Inputs high or low active programmable
- General fault flag
- Very low standby quiescent current
- Compatible with 3V microcontrollers
- **Electrostatic discharge (ESD) protection**

Product Summary

Supply voltage	V_S	4.5 – 32	V
Drain source voltage	$V_{DS(AZ)max}$	60	V
On resistance	R_{ON}	1.7	Ω
Output current(each)	$I_{D(NOM)}$	350	mA
	(individ.)	500	mA



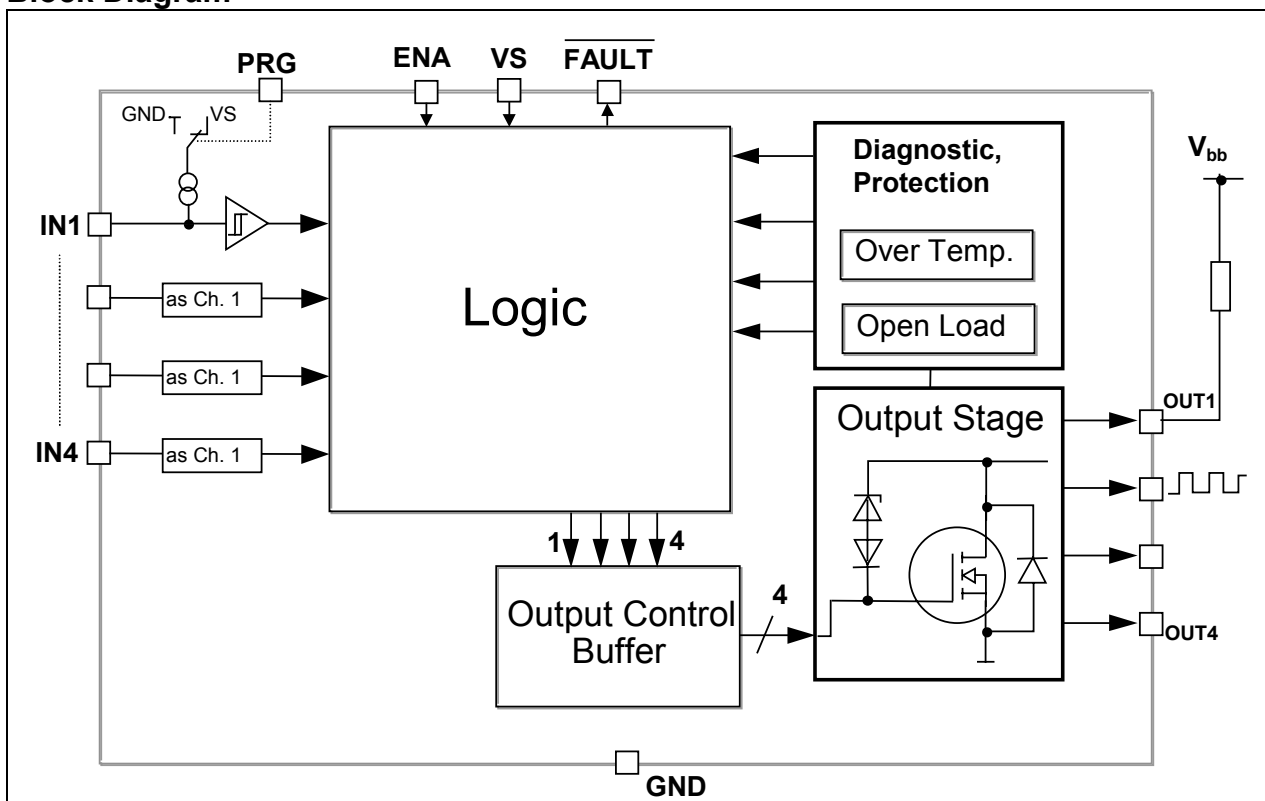
Application

- μC compatible power switch for 12 V applications
- Switch for automotive and industrial systems
- Line, relay or lamp driver

General description

Quad channel Low-Side Switch in Smart Power Technology (SPT) with four separate inputs and four open drain DMOS output stages. The TLE 6225 G is protected by embedded protection functions and designed for automotive and industrial applications, to drive lines, lamps and relays.

Block Diagram



Pin Description

Pin	Symbol	Function
1	IN1	Input Channel 1
2	IN2	Input Channel 2
3	FAULT	General Fault Flag
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	VS	Supply Voltage
9	IN3	Input Channel 3
10	IN4	Input Channel 4
11	ENA	Enable for all channels/Standby
12	OUT4	Power Output channel 4
13	OUT3	Power Output channel 3
14	GND	Ground
15	GND	Ground
16	GND	Ground
17	GND	Ground
18	OUT2	Power Output channel 2
19	OUT1	Power Output channel 1
20	PRG	Program (inputs high or low active)

Pin Configuration (Top view)

IN1	1●	20	PRG
IN2	2	19	OUT1
FAULT	3	18	OUT2
GND	4	17	GND
GND	5	16	GND
GND	6	15	GND
GND	7	14	GND
VS	8	13	OUT3
IN3	9	12	OUT4
IN4	10	11	ENA

P-DSO-20-6

Maximum Ratings for $T_j = -40^{\circ}\text{C}$ to 150°C

Parameter	Symbol	Values	Unit
Supply Voltage	V_S	-0.3 ... +40	V
Continuous Drain Source Voltage (OUT1...OUT4)	V_{DS}	-0.7 ... +45	V
Input Voltage, IN1 - IN4	V_{IN}	- 0.3 ... + 7	V
Input Voltage, PRG, ENA	V_{IN}	- 0.3 ... + 40	V
Output Load Dump Protection $V_{Load\ Dump} = U_P + U_S$; $U_P = 13.5\text{ V}$ With Automotive Relay Load $R_L = 70\ \Omega$ $R_l^{1)} = 2\ \Omega$; $t_d = 400\text{ms}$; IN = low or high	$V_{Load\ Dump}^{2)}$	75	V
FAULT Output Voltage	V_{Fault}	- 0.3 ... + 40	V
Operating Temperature Range	T_j	- 40 ... + 150	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	- 55 ... + 150	
Output Current per Channel (see electrical characteristics)	$I_{D(lim)}$	$I_{D(lim)\ min}$	A
Output Clamping Energy $I_D = 0.2\text{ A}$	E_{AS}	10	mJ
Power Dissipation (DC) @ $T_A = 25\ ^{\circ}\text{C}$ (on PCB 6 cm^2 cooling area)	P_{tot}	2.5	W
Electrostatic Discharge Voltage (Human Body Model) according to MIL STD 883D, method 3015.7 and EOS/ESD assn. standard S5.1 - 1993	V_{ESD}	2000	V
DIN Humidity Category, DIN 40 040		E	
IEC Climatic Category, DIN IEC 68-1		40/150/56	
Thermal Resistance			
junction - pin	R_{thJP}	23	K/W
junction - ambient @ min. footprint	R_{thJA}	80	
junction - ambient @ 6 cm^2 cooling area	R_{thJA}	45	

¹⁾ R_l = internal resistance of the load dump test pulse generator LD200

²⁾ $V_{LoadDump}$ is setup without DUT connected to the generator per ISO 7637-1 and DIN 40 839.

Electrical Characteristics

Parameter and Conditions $V_S = 4.5$ to 32 V ; $T_J = -40$ °C to $+150$ °C (unless otherwise specified)	Symbol	Values			Unit
		min	typ	max	

1. Power Supply

Supply Voltage	V_S	4.5		32	V
Supply Current (ENA = H, Outputs ON)	$I_{S(ON)}$		1	2	mA
Supply Current in Standby Mode (ENA = L)	$I_{S(stby)}$			10	μ A

2. Power Outputs

ON Resistance $V_S \geq 6$ V ; $I_D = 300$ mA	$T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$	$R_{DS(ON)}$		1.7 3	2 3.6	Ω
Output Clamping Voltage	Output OFF	$V_{DS(AZ)}$	45	50	60	V
Current Limit		$I_{D(lim)}$	500	750	1000	mA
Output Leakage Current	$V_{ENA} = L$	$I_{D(lkg)}$			5	μ A
Turn-On Time	$I_D = 200$ mA, resistive load	t_{ON}		5	10	μ s
Turn-Off Time	$I_D = 200$ mA, resistive load	t_{OFF}		5	10	μ s

3. Digital Inputs (IN1 – IN4, ENA, PRG)

Input Low Voltage (IN1 – IN4, PRG)		V_{INL}	- 0.3		1	V
Input Low Voltage (ENA)		V_{INL}	- 0.3		0.8	V
Input High Voltage		V_{INH}	2.0			V
Input Voltage Hysteresis (IN1 – IN4, PRG)		V_{INHys}	50	100		mV
Input Voltage Hysteresis (ENA)		V_{INHys}	20	100		mV
Input Pull Up Current (IN1...IN4) @ PRG = L, $V_{IN} = 0$ V		$I_{IN(1..4)PU}$	20	50	100	μ A
Input Pull Down Current (IN1...IN4) @ PRG = H, $V_{IN} < V_S$; $V_{IN} < 6$		$I_{IN(1..4)PD}$	20	50	100	μ A
PRG, ENA Pull Down Current	$V_{IN} = 5$ V	$I_{IN(PRG,ENA)}$	20	50	100	μ A
PRG, ENA Pull Down Current	$V_{IN} = 14$ V	$I_{IN(PRG,ENA)}$			200	μ A

4. Digital Output ($\overline{\text{FAULT}}$)

$\overline{\text{FAULT}}$ Output Low Voltage	$I_{\text{FAULT}} = 1.6$ mA	V_{FAULTL}			0.4	V
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5. Diagnostic Functions

Open Load/Short to Ground Detection Voltage		$V_{DS(OL)}$	$0.4 \cdot V_S$	$0.5 \cdot V_S$	$0.6 \cdot V_S$	V
Output Pull Down Current		$I_{PD(OL)}$	20	50	200	μ A
Fault Delay Time; $V_S = 12$ V		$t_{d(\text{fault})}$	50	100	200	μ s
Overtemperature Shutdown Threshold		$T_{th(sd)}$	170		200	$^\circ\text{C}$
Hysteresis		T_{hys}		10		K

Diagnostic Table

Operating Condition	Enable Input	Program Input	Control Input	Power Output	Diagnostic Output
	ENA	PRG	IN	OUT	FAULT
Standby	L	X	X	OFF	H
Normal function	H	L	L	ON	L
	H	L	H	OFF	L
	H	H	L	OFF	H
	H	H	H	ON	H
Overtemperature	H	L	L	OFF *	H
	H	H	H	OFF *	L
Open load or short to ground	H	L	L	ON	L
	H	L	H	OFF	H
	H	H	L	OFF	L
	H	H	H	ON	H

X = not relevant

*selective thermal shutdown for each channel at overtemperature

Fault Distinction

Open load/short to ground is recognised in OFF-state. Overtemperature as a result of an overload or short to battery can only arise in ON-state. If there is only one fault at a time, it is possible to distinguish which channel is affected with which fault.

Typical electrical Characteristics

Drain-Source on-resistance

$$R_{DS(ON)} = f(T_j) ; V_s = 5V$$

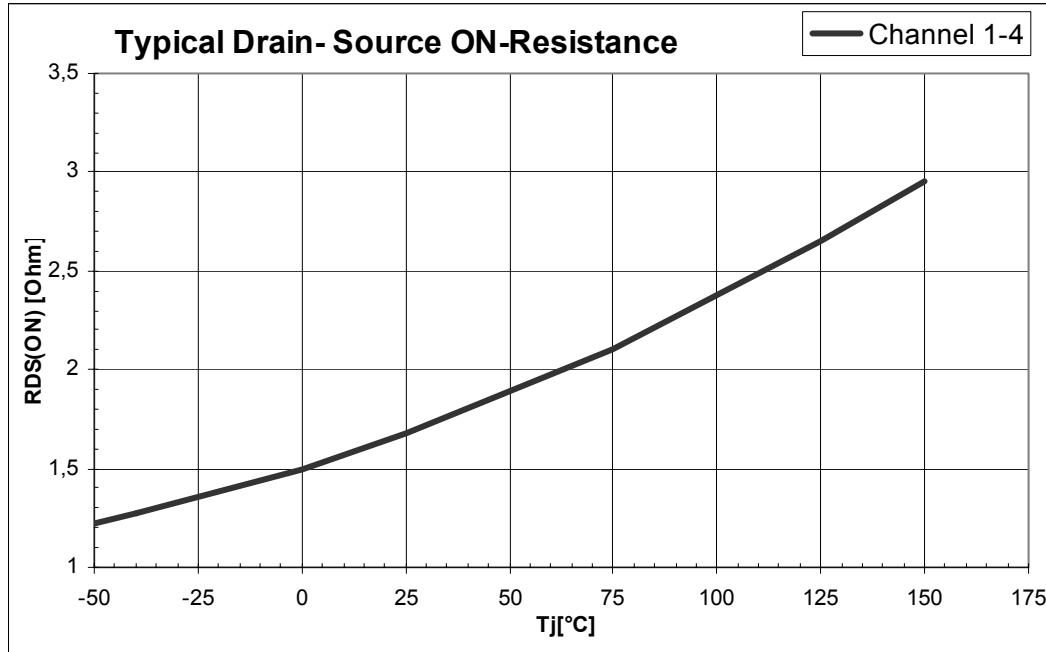


Figure 6 : Typical ON Resistance versus Junction-Temperature
Channel 1-4

Output Clamping Voltage

$$V_{DS(AZ)} = f(T_j) ; V_s = 5V$$

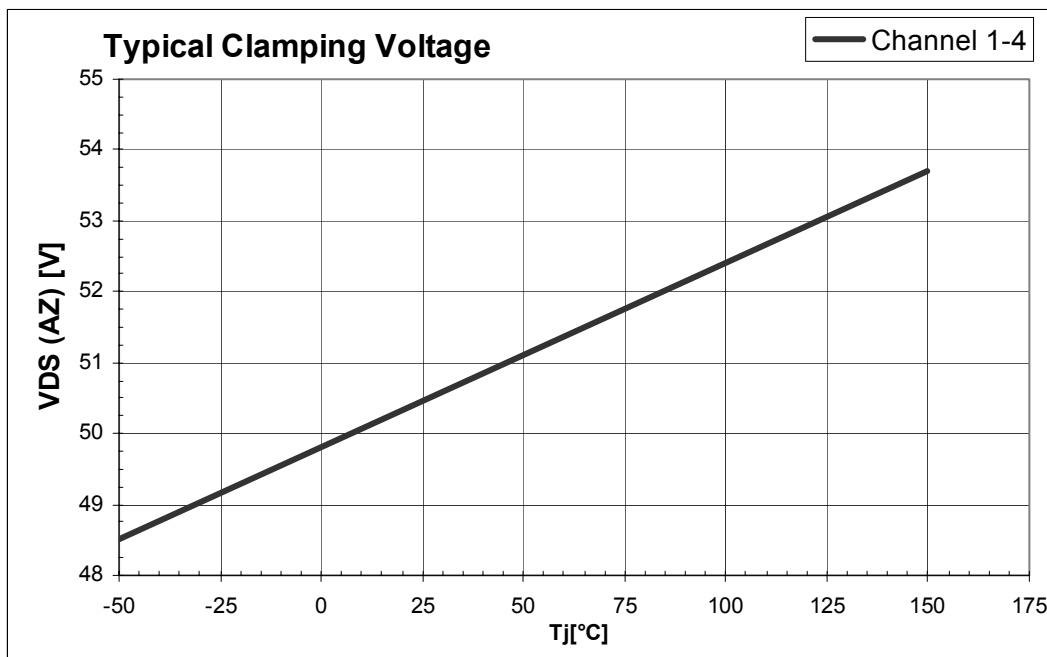
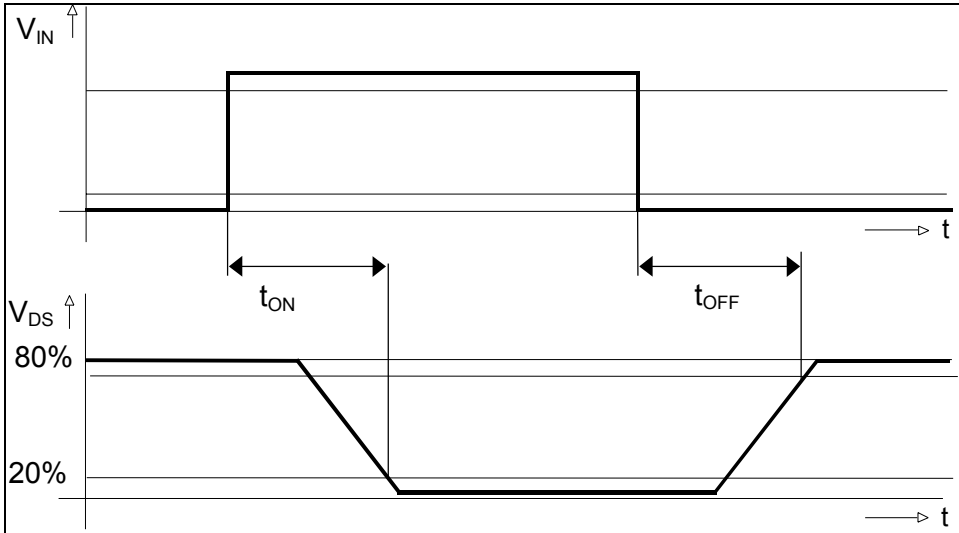


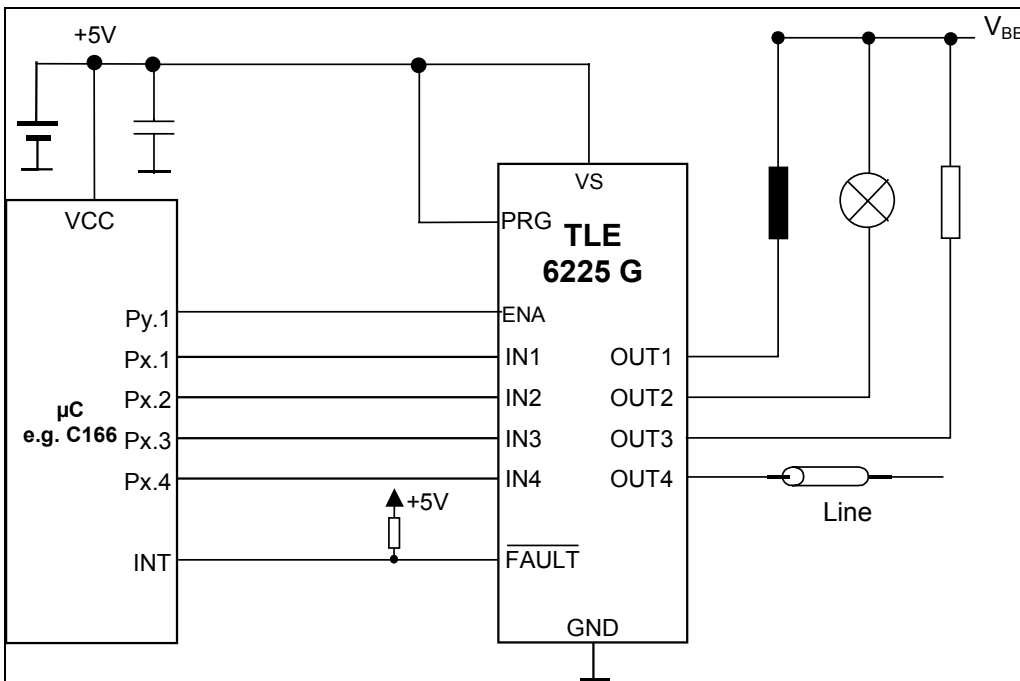
Figure 7 : Typical Clamp Voltage versus Junction-Temperature
Channel 1-4

Timing Diagrams

Power Outputs



Application Circuit



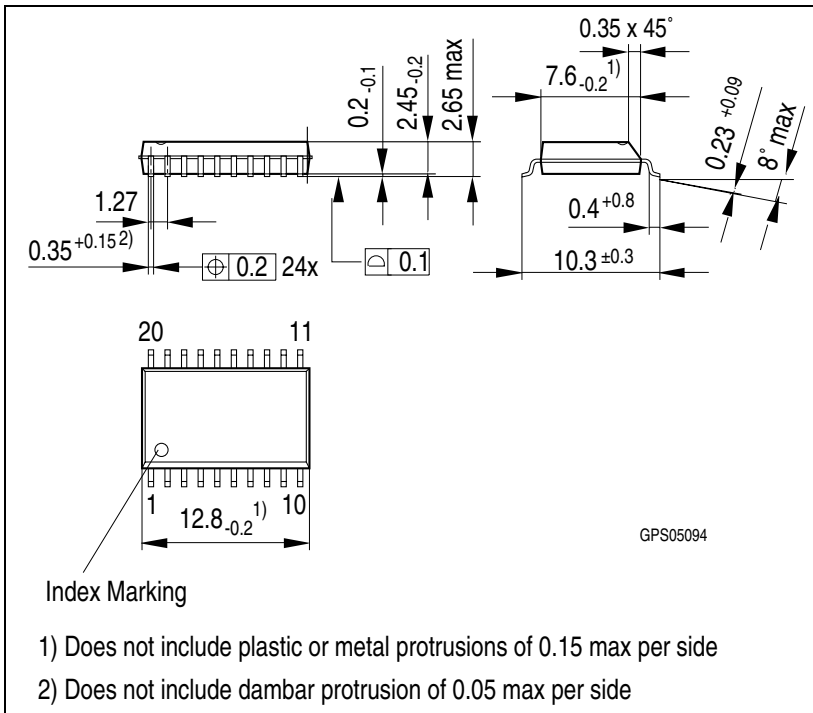
Package and ordering code

all dimensions in mm

P - DSO - 20 - 6

Ordering code

TLE 6225 G	Q 67006 A9373
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