

P-Channel Enhancement Mode Power MOSFET

Description

The TF4099 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

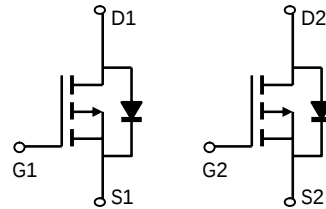
General Features

$$V_{DS} = -40V, I_D = -7.0A$$

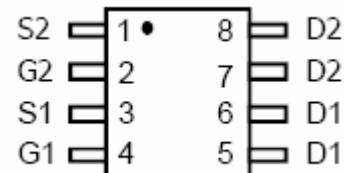
$$R_{DS(ON)typ} = 32m\Omega @ V_{GS} = -10V$$

$$R_{DS(ON)typ} = 43m\Omega @ V_{GS} = -4.5V$$

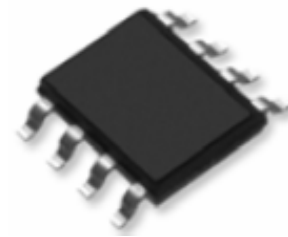
- High power and current handling capability
- Lead free product is acquired
- Surface mount package



Schematic diagram



Marking and pin assignment



SOP-8 top view

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted					
Parameter		Symbol	Maximum	Units	
Drain-Source Voltage		V_{DS}	-40	V	
Gate-Source Voltage		V_{GS}	± 20	V	
Continuous Drain Current ^A	$T_A=25^\circ\text{C}$	I_D	-7.0	A	
Pulsed Drain Current ^B		I_{DM}	-25		
Power Dissipation ^A	$T_A=25^\circ\text{C}$	P_D	2.0	W	
	$T_A=70^\circ\text{C}$		1.0		
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	$^\circ\text{C}$	

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	51	68	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	Steady-State		61	115	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	45	55	$^\circ\text{C/W}$

Electrical Characteristics ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-40			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-40\text{V}$, $V_{GS}=0\text{V}$			-100	nA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.1	-1.7	-2.5	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-4.5\text{V}$, $V_{DS}=-5\text{V}$	-20			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$, $I_D=-7.0\text{A}$		32	39	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$, $I_D=-5.5\text{A}$		43	55	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-7\text{A}$	15			S
V_{SD}	Diode Forward Voltage	$I_S=-7\text{A}$, $V_{GS}=0\text{V}$		-0.82	-1	V
I_S	Maximum Body-Diode Continuous Current				-7.0	A

DYNAMIC PARAMETERS

C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-20\text{V}$, $f=1\text{MHz}$		1021		pF
C_{oss}	Output Capacitance			63.6		pF
C_{rss}	Reverse Transfer Capacitance			48.6		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		4.7		Ω

SWITCHING PARAMETERS

$Q_g(10\text{V})$	Total Gate Charge (10V)	$V_{GS}=-10\text{V}$, $V_{DS}=-20\text{V}$, $I_D=-7\text{A}$		26.5		nC
$Q_g(4.5\text{V})$	Total Gate Charge (4.5V)			19.3		nC
Q_{gs}	Gate Source Charge			2.5		nC
Q_{gd}	Gate Drain Charge			5.5		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$, $V_{DS}=-20\text{V}$, $I_D=-7\text{A}$, $R_{GEN}=10\Omega$		13.0		ns
t_r	Turn-On Rise Time			16.0		ns
$t_{D(off)}$	Turn-Off DelayTime			180		ns
t_f	Turn-Off Fall Time			86.0		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-7\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		34.0		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-7\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		35.0		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}\text{C}$. The value in any given application depends on the user's specific board design. The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.

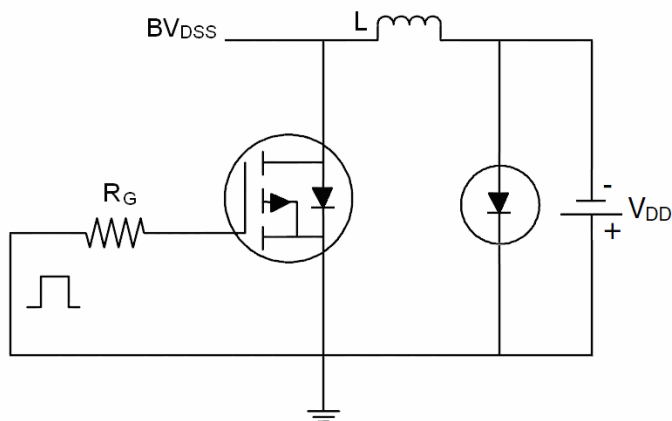
D: The static characteristics in Figures 1 to 6,12,14 are obtained using 80 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}\text{C}$. The SOA curve provides a single pulse rating.

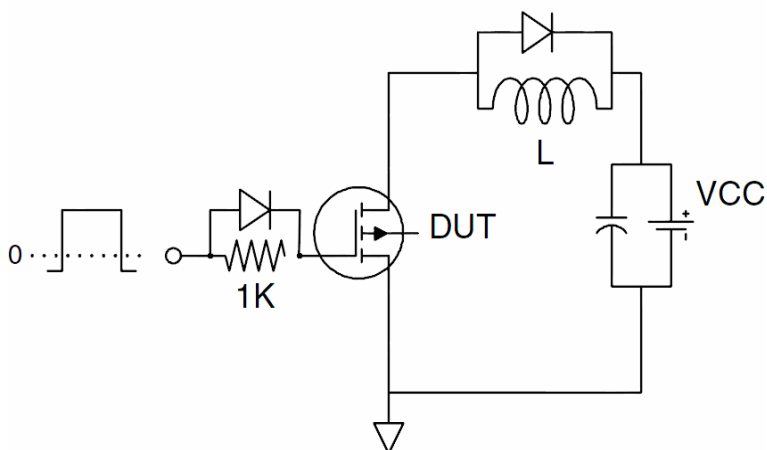
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Test Circuit

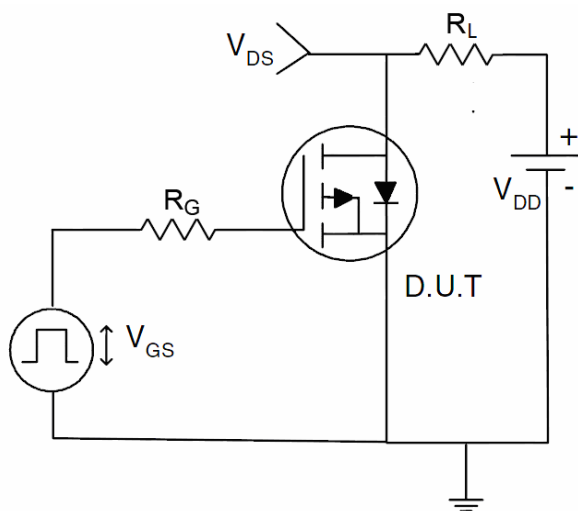
1) E_{AS} Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical And Thermal Characteristics (Curves)

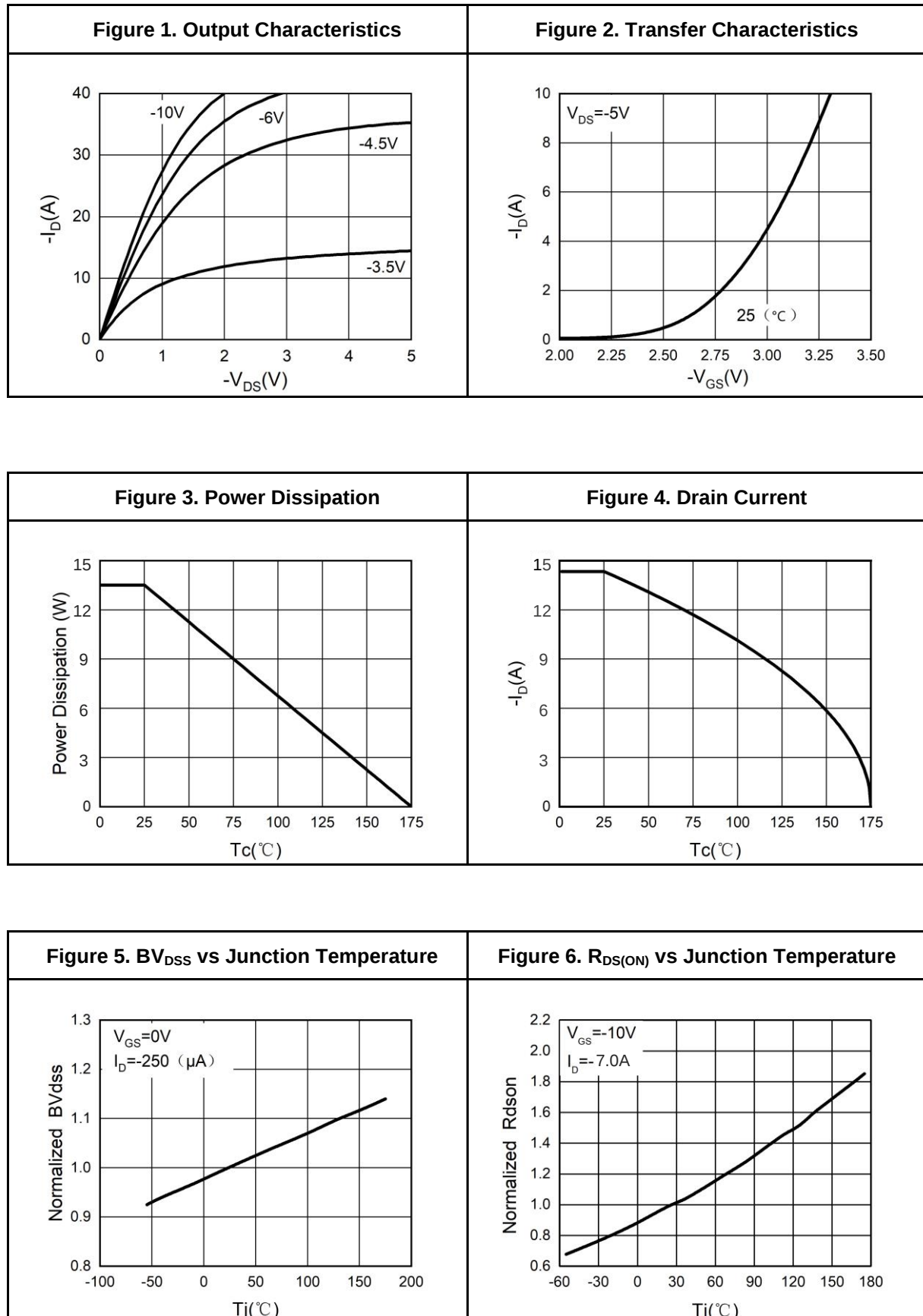


Figure 7. Gate Charge Waveforms

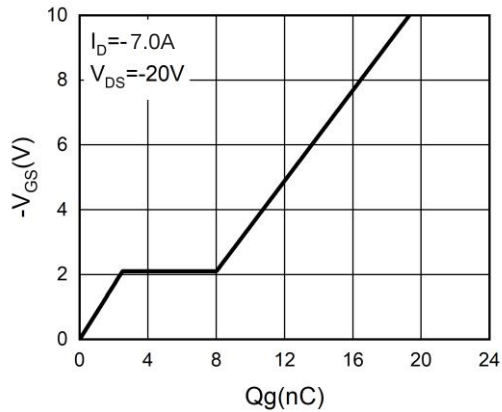


Figure 8. Capacitance

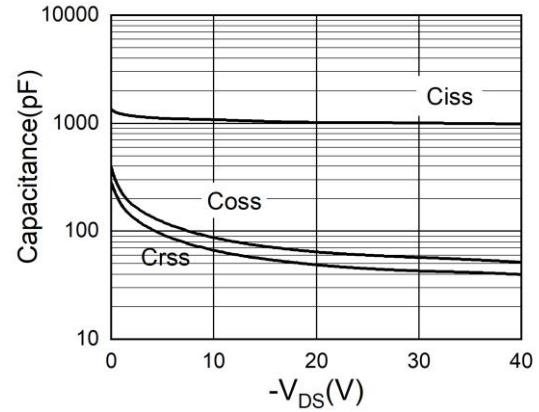


Figure 9. Body-Diode Characteristics

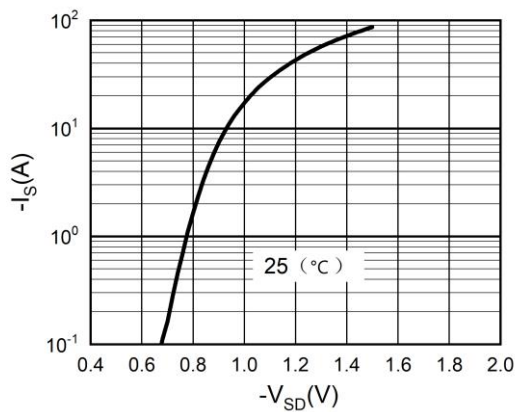
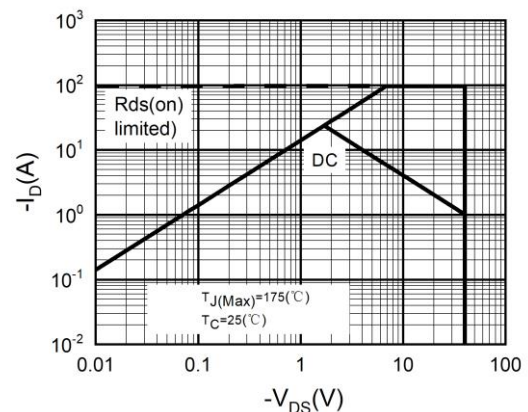
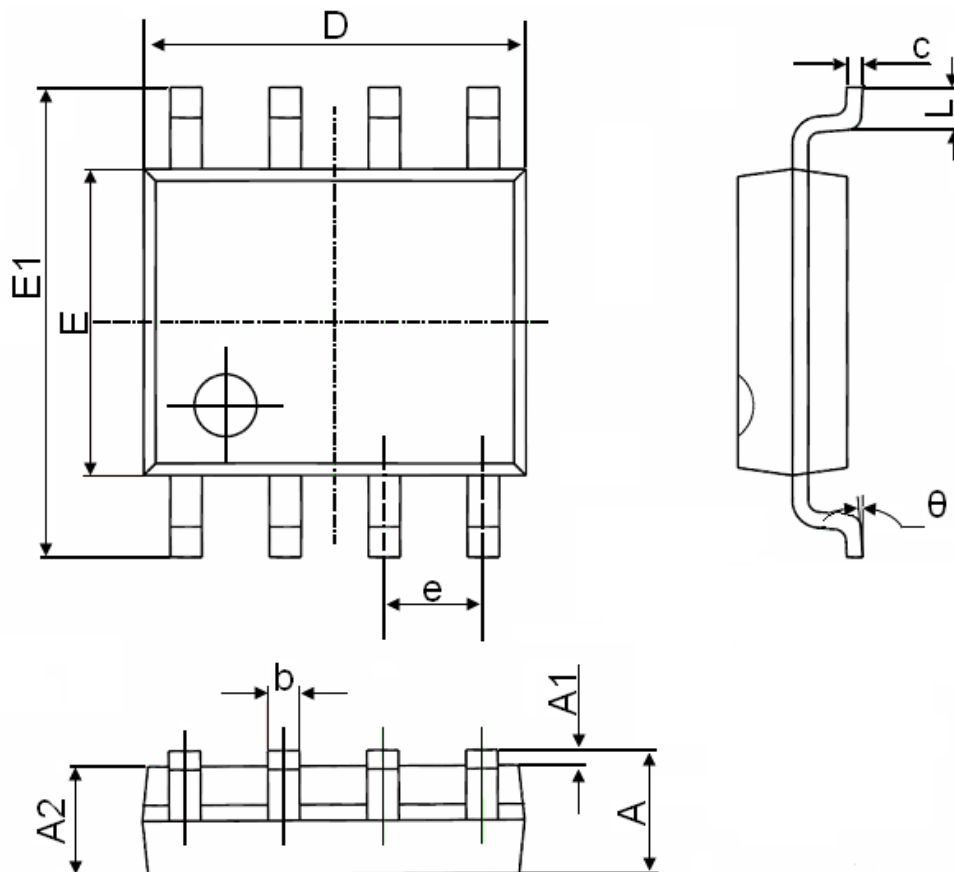


Figure 10. Maximum Safe Operating Area



SOP-8 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°