



## P-Channel Enhancement Mode Field Effect Transistor

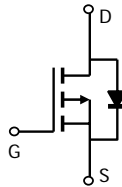
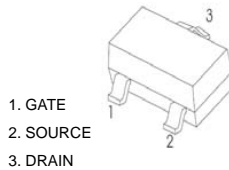
### General Description

The BC3401 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications. *Standard product BC3401 is Pb-free (meets ROHS & Sony 259 specifications). BC3401L is a Green Product ordering option. BC3401 and BC3401L are electrically identical.*

### Features

$V_{DS}$  (V) = -30V  
 $I_D$  = -4.2 A ( $V_{GS}$  = -10V)  
 $R_{DS(ON)}$  < 60m $\Omega$  ( $V_{GS}$  = -10V)  
 $R_{DS(ON)}$  < 65m $\Omega$  ( $V_{GS}$  = -4.5V)  
 $R_{DS(ON)}$  < 120m $\Omega$  ( $V_{GS}$  = -2.5V)

### SOT-23



### MARKING: 3401

#### Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Continuous Drain Current <sup>A</sup>	$T_A=25^\circ\text{C}$	-4.2	A
	$T_A=70^\circ\text{C}$	-3.5	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	-30	
Power Dissipation <sup>A</sup>	$T_A=25^\circ\text{C}$	1.4	W
	$T_A=70^\circ\text{C}$	1	
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 <sup>A</sup>	$R_{\theta JA}$	65	90	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	85	125
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	43	60	$^\circ\text{C/W}$



## BC3401

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$	-30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-24\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 12\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$	-0.7	-1	-1.3	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-5\text{V}$	-25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$ , $I_D=-4.2\text{A}$ $T_J=125^\circ\text{C}$		42	60	m $\Omega$
		$V_{GS}=-4.5\text{V}$ , $I_D=-4\text{A}$		53	65	
		$V_{GS}=-2.5\text{V}$ , $I_D=-1\text{A}$		80	120	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-5\text{A}$	7	11		S
$V_{SD}$	Diode Forward Voltage	$I_S=-1\text{A}$ , $V_{GS}=0\text{V}$		-0.75	-1	V
$I_S$	Maximum Body-Diode Continuous Current				-2.2	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$		954		pF
$C_{oss}$	Output Capacitance			115		pF
$C_{rss}$	Reverse Transfer Capacitance			77		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		6		$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	Total Gate Charge	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-4\text{A}$		9.4		nC
$Q_{gs}$	Gate Source Charge			2		nC
$Q_{gd}$	Gate Drain Charge			3		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=3.6\Omega$ , $R_{GEN}=6\Omega$		6.3		ns
$t_r$	Turn-On Rise Time			3.2		ns
$t_{D(off)}$	Turn-Off DelayTime			38.2		ns
$t_f$	Turn-Off Fall Time			12		ns
$t_{rr}$	Body Diode Reverse Recovery Time		$I_F=-4\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		20.2	
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-4\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		11.2		nC

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> 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  $t_s \leq 10\text{s}$  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 $\mu\text{s}$  pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in<sup>2</sup> 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.

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

## BC3401

### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

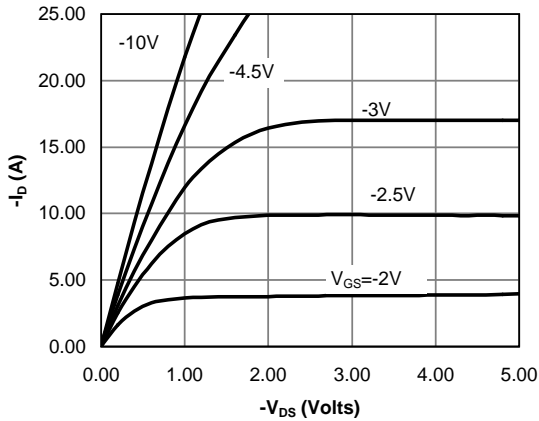


Fig 1: On-Region Characteristics

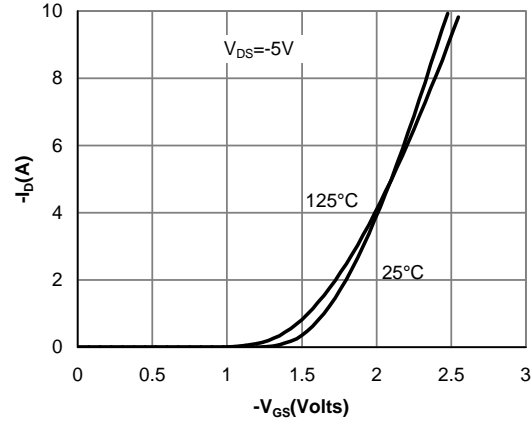


Figure 2: Transfer Characteristics

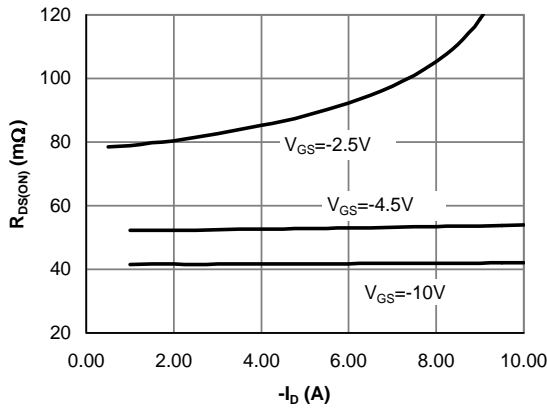


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

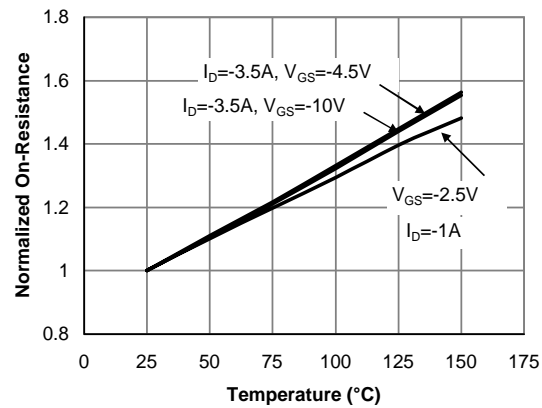


Figure 4: On-Resistance vs. Junction Temperature

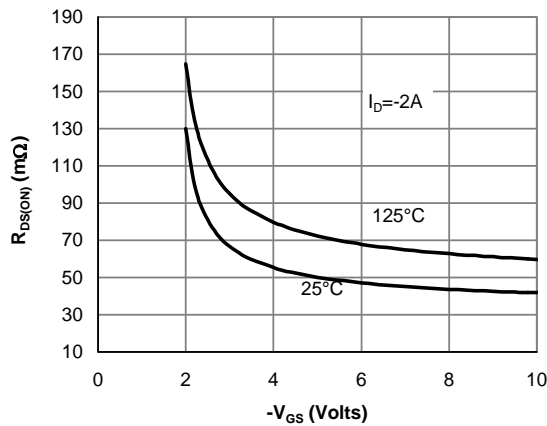


Figure 5: On-Resistance vs. Gate-Source Voltage

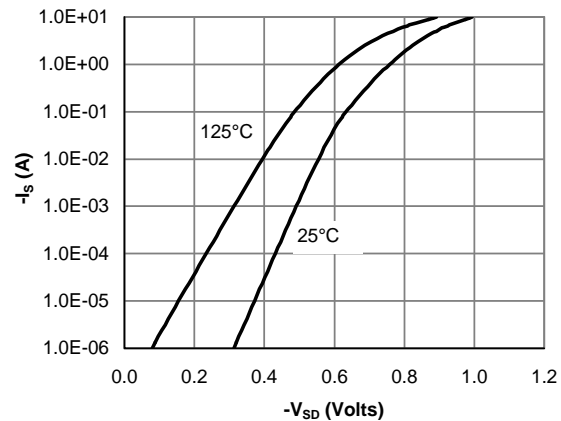


Figure 6: Body-Diode Characteristics

## BC3401

### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

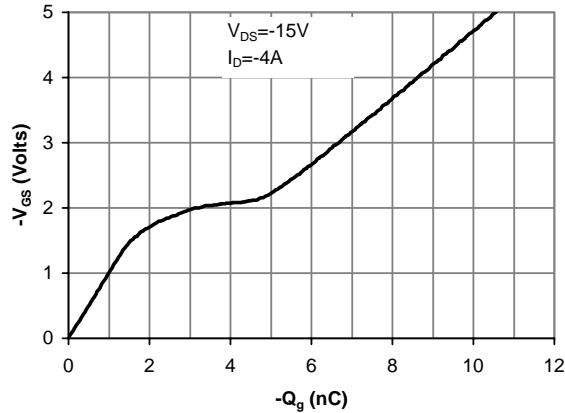


Figure 7: Gate-Charge Characteristics

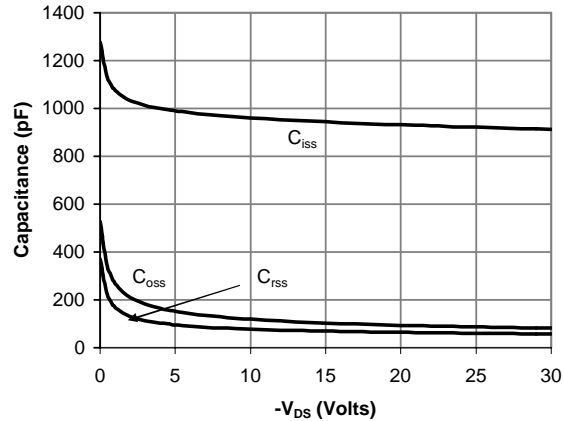


Figure 8: Capacitance Characteristics

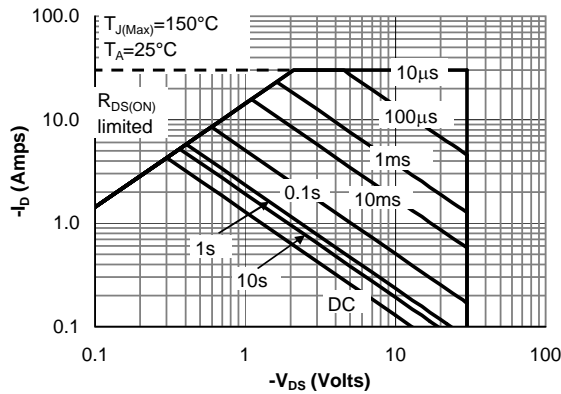


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

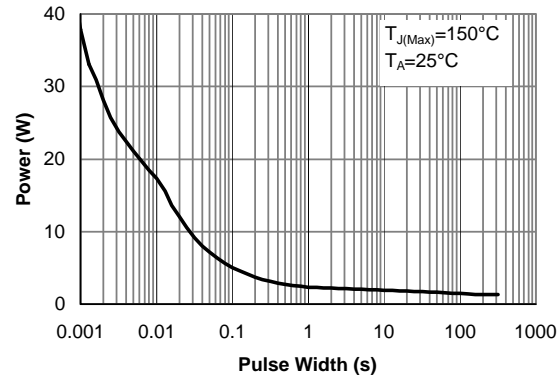


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

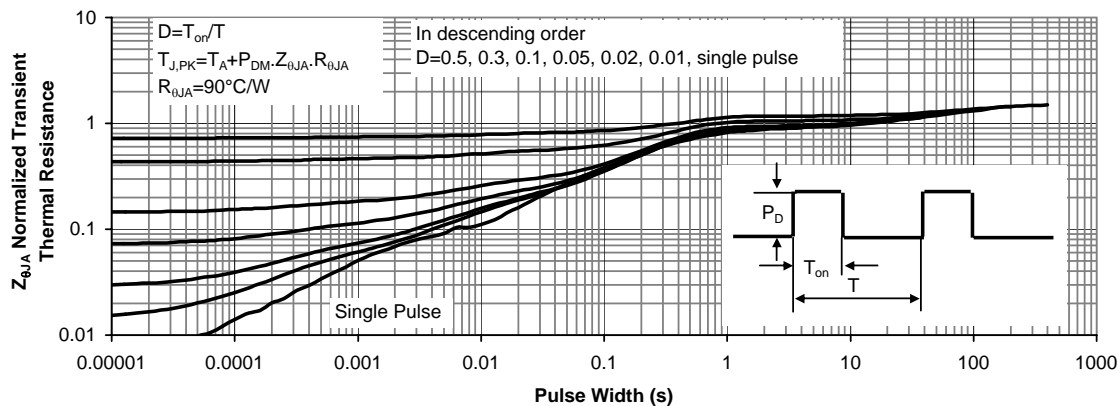


Figure 11: Normalized Maximum Transient Thermal Impedance