

**N-Ch 20V Fast Switching MOSFETs**

- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent Cdv/dt effect decline
- ★ Advanced high cell density Trench technology

**Product Summary**

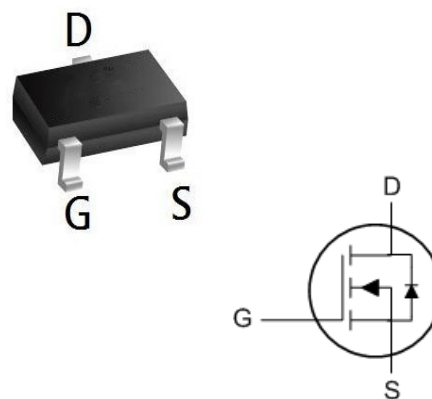


BVDSS	RDSON	ID
20V	35 mΩ	3A

**Description**

The 2302A is the high cell density trenched N-ch MOSFETs, which provides excellent RDSON and efficiency for most of the small power switching and load switch applications. The 2302A meet the RoHS and Green Product requirement with full function reliability approved.

**Pin Configuration**



**Absolute Maximum Ratings**

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D@T_A=25^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	3	A
$I_D@T_A=70^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	1.5	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	12	A
$P_D@T_A=25^\circ C$	Total Power Dissipation <sup>3</sup>	1.05	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$

**Thermal Data**

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-ambient <sup>1</sup>	---	112	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	---	$^\circ C/W$

**Electrical Characteristics**
 $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 16\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 10\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.45	-	1.1	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 4.5\text{ V}, I_D = 3.5\text{ A}$	--	35	45	m $\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 2.0\text{ A}$	-	46	57	

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	180	-	pF
$C_{oss}$	Output Capacitance		--	37	-	pF
$C_{rss}$	Reverse Transfer Capacitance		--	34	-	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 5\text{ V}, V_{DS} = 10\text{ V}, I_D = 3\text{ A},$ $R_G = 6\text{ }\Omega, R_L = 2.7\text{ }\Omega$	--	4.5	--	ns
$t_r$	Turn-On Rise Time		--	31	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	12	--	ns
$t_f$	Turn-Off Fall Time		--	4.0	--	ns
$Q_g$	Total Gate Charge	$V_{DS} = 10\text{ V}, I_D = 3\text{ A},$ $V_{GS} = 5\text{ V}$	--	6.23	--	nC
$Q_{gs}$	Gate-Source Charge		--	6	--	nC
$Q_{gd}$	Gate-Drain Charge		--	0.5	--	nC

**Drain-Source Diode Characteristics and Maximum Ratings**

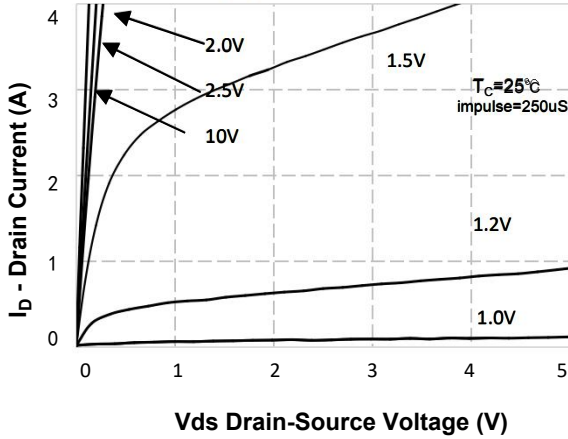
$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	3.5	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	10.5	A
$V_{SD}$	Drain to Source Diode Forward Voltage, $V_{GS} = 0\text{ V}, I_{SD} = 3.5\text{ A}, T_J = 25^\circ\text{C}$	--	--	1.2	V

**Notes:**

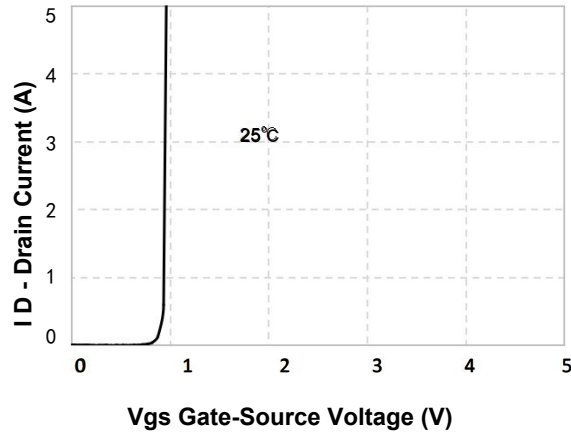
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Device mounted on FR-4 PCB, 1inch x 0.85inch x 0.062 inch
3. Pulse Test: Pulse Width $\leq$ 300 $\mu\text{s}$ , Duty Cycle $\leq$ 0.5%

**Typical Performance Characteristics**

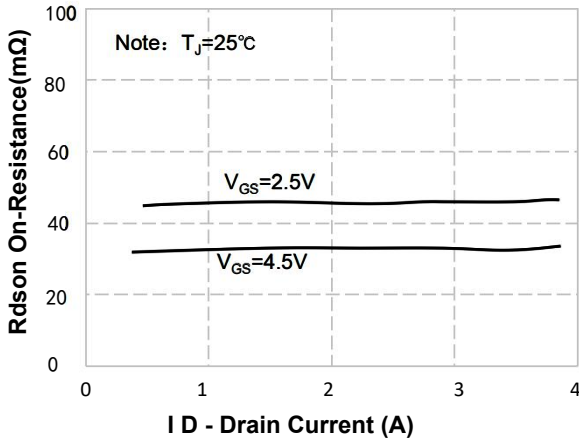
**N- Channel Typical Characteristics**



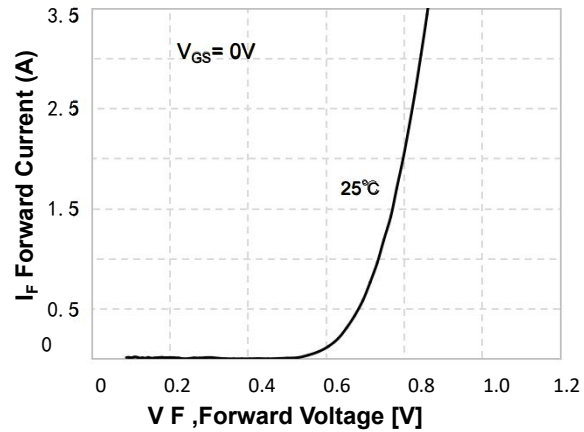
**Figure 1. On-Region Characteristics**



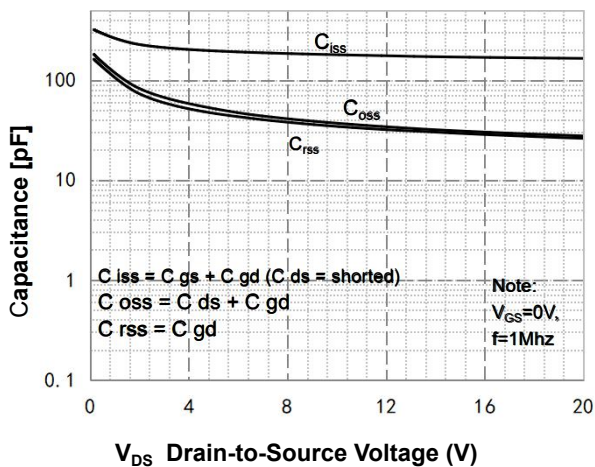
**Figure 2. Transfer Characteristics**



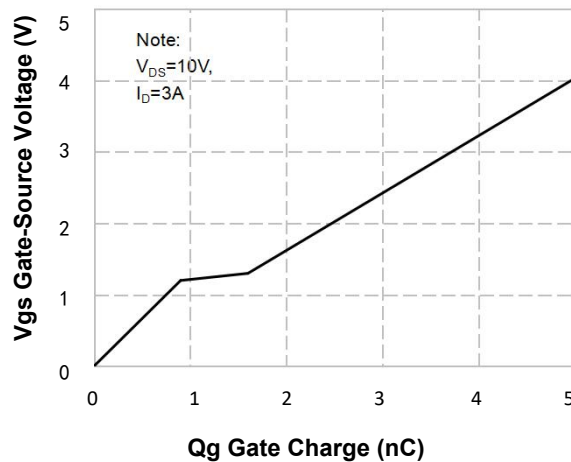
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

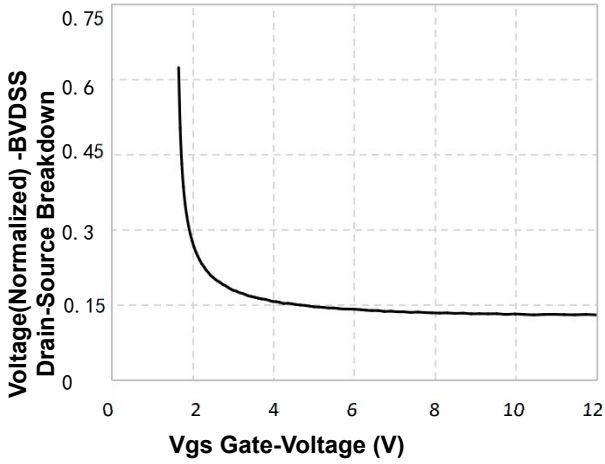


**Figure 5. Capacitance Characteristics**

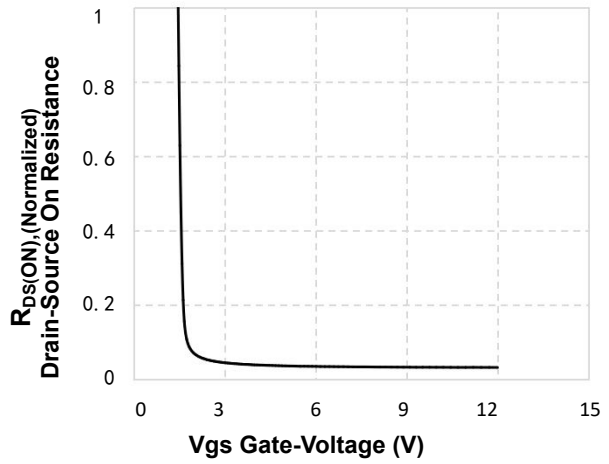


**Figure 6. Gate Charge Characteristics**

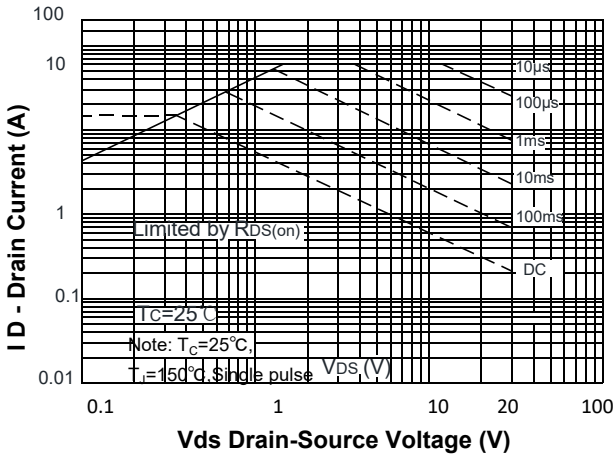
**N- Channel Typical Characteristics** (Continued)



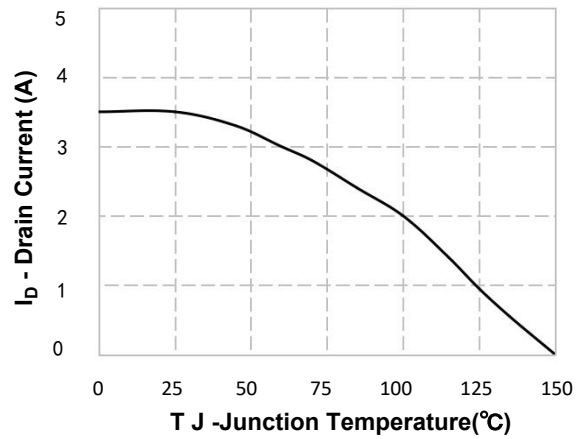
**Figure 7. Breakdown Voltage Variation vs Gate-Voltage**



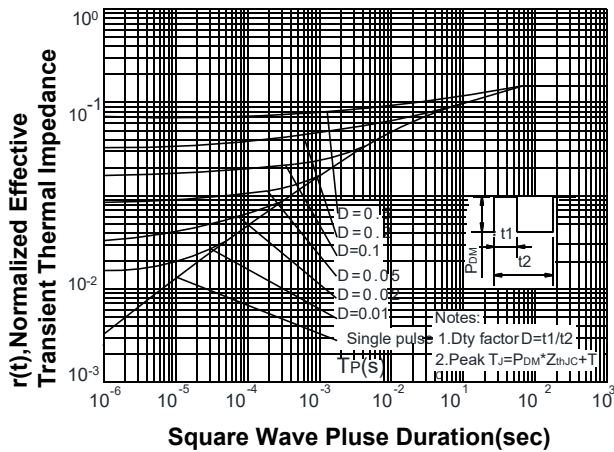
**Figure 8. On-Resistance Variation vs Gate Voltage**



**Figure 9. Maximum Safe Operating Area**

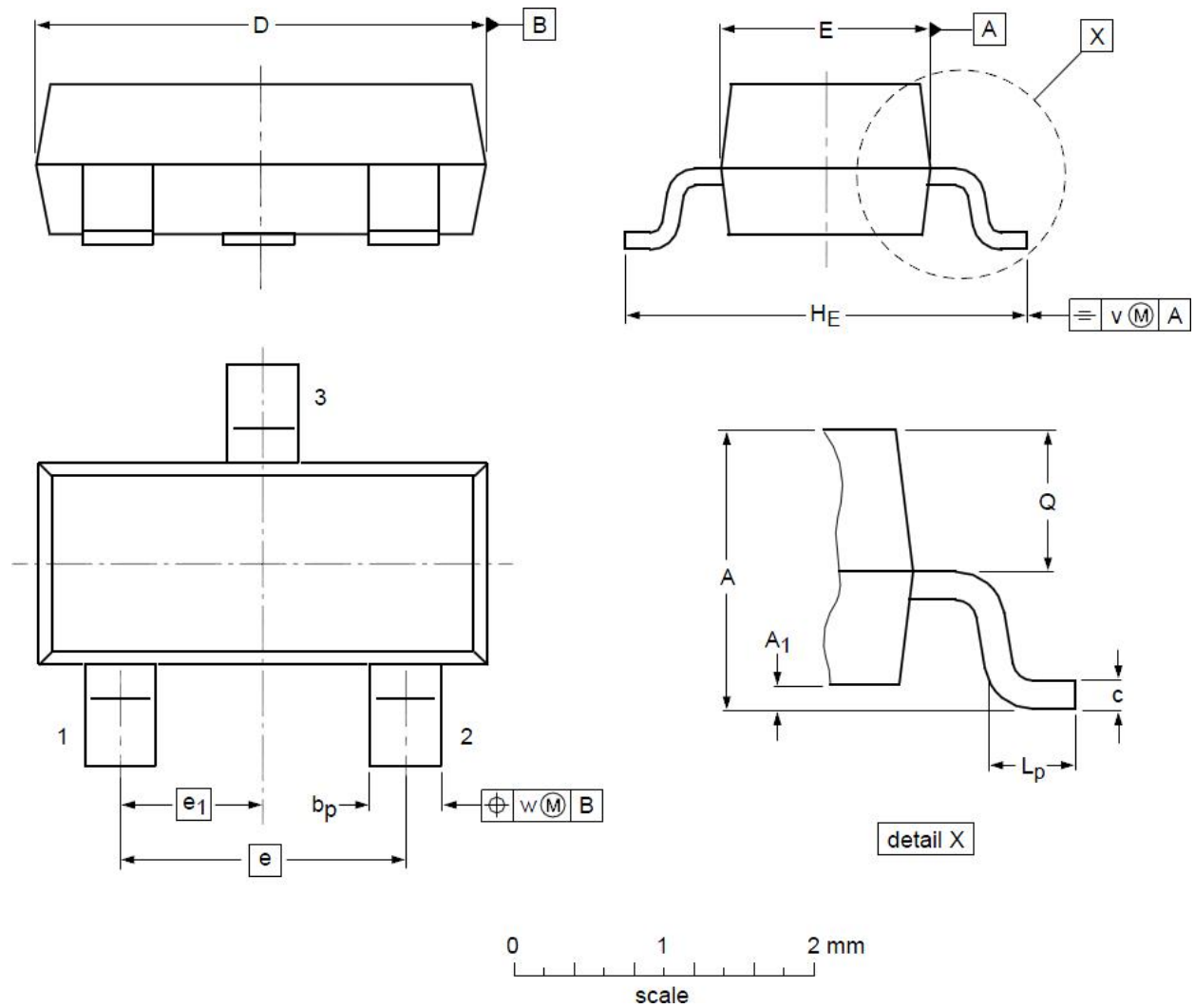


**Figure 10. Maximum PContinuous Drain Current vs Case Temperature**



**Figure 11. Transient Thermal Response Curve**

**Mechanical Data**



**DIMENSIONS** ( unit : mm )

Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	0.90	1.01	1.15	A <sub>1</sub>	0.01	0.05	0.10
b <sub>p</sub>	0.30	0.42	0.50	c	0.08	0.13	0.15
D	2.80	2.92	3.00	E	1.20	1.33	1.40
e	--	1.90	--	e <sub>1</sub>	--	0.95	--
H <sub>E</sub>	2.25	2.40	2.55	L <sub>p</sub>	0.30	0.42	0.50
Q	0.45	0.49	0.55	v	--	0.20	--
w	--	0.10	--				