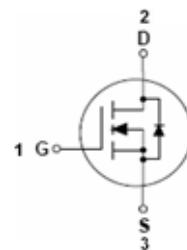


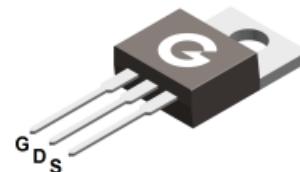
## Features

- Very low FOM  $R_{DS(on)} \times Q_G$
- Very high commutation ruggedness



## APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Power Factor Correction (PFC)
- Uninterruptible Power Supply (UPS)



## Mechanical Data

- Case: TO-220AB
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208

**TO-220AB**

## Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
SJ65R190	TO-220AB	50 pcs / Tube	SJ65R190

## Maximum Ratings (@ $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	650	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Continuous Drain Current ( $T_c = 25^\circ\text{C}$ ) <sup>*1</sup>	$I_D$	21	A
Continuous Drain Current ( $T_c = 125^\circ\text{C}$ ) <sup>*1</sup>		12	A
Pulsed Drain Current ( $T_c = 25^\circ\text{C}$ )	$I_{DM}$	60	A
Single Pulse Avalanche Energy <sup>*2</sup>	$E_{AS}$	500	mJ

## Thermal Characteristics

Parameter	Symbol	Value	Unit
Power Dissipation ( $T_c = 25^\circ\text{C}$ )	$P_D$	151	W
Thermal Resistance Junction-to-Air ( $T_c = 25^\circ\text{C}$ )	$R_{\theta JA}$	62	$^\circ\text{C}/\text{W}$
Thermal Resistance Junction-to-Case ( $T_c = 25^\circ\text{C}$ )	$R_{\theta JC}$	0.82	$^\circ\text{C}/\text{W}$
Operating Junction Temperature Range	$T_J$	-55 ~ +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0\text{V}$ , $I_{\text{D}} = 250\mu\text{A}$	650	-	-	V
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 650\text{V}$ , $V_{\text{GS}} = 0\text{V}$	-	-	1	$\mu\text{A}$
$I_{\text{GSS}}$	Gate-Body Leakage Current	$V_{\text{GS}} = \pm 30\text{V}$ , $V_{\text{DS}} = 0\text{V}$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$R_{\text{DS(ON)}}$	Static Drain-Source On-resistance	$V_{\text{GS}} = 10\text{V}$ , $I_{\text{D}} = 7.3\text{A}$	-	-	0.19	$\Omega$
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\mu\text{A}$	2.0	-	4.0	V
$R_{\text{G}}$	Gate resistance	$V_{\text{DD}} = 0$ , $V_{\text{GS}} = 0$ , $f = 1\text{MHz}$	-	18	-	$\Omega$
<b>Dynamic Characteristics</b>						
$C_{\text{iss}}$	Input Capacitance	$V_{\text{GS}} = 0\text{V}$ $V_{\text{DS}} = 50\text{V}$ $f = 250\text{KHz}$	-	1610	-	pF
$C_{\text{oss}}$	Output Capacitance		-	70	-	
$C_{\text{rss}}$	Reverse Transfer Capacitance		-	0.74	-	
<b>Switching Characteristics</b>						
$t_{\text{d(ON)}}$	Turn-on Delay Time	$V_{\text{DD}} = 400\text{V}$ $V_{\text{GS}} = 10\text{V}$ $I_{\text{D}} = 10\text{A}$	-	25.6	-	ns
$t_{\text{r}}$	Turn-on Rise Time		-	34.6	-	
$t_{\text{d(OFF)}}$	Turn-Off Delay Time		-	120	-	
$t_{\text{f}}$	Turn-Off Fall Time		-	29.8	-	
$Q_{\text{G}}$	Total Gate-Charge	$V_{\text{DS}} = 480\text{V}$ $V_{\text{GS}} = 10\text{V}$ $I_{\text{D}} = 10\text{A}$	-	44	-	nC
$Q_{\text{GS}}$	Gate to Source Charge		-	5.7	-	
$Q_{\text{GD}}$	Gate to Drain (Miller) Charge		-	17	-	
<b>Source-Drain Diode Characteristics</b>						
$V_{\text{SD}}$	Diode Forward Voltage	$I_{\text{F}} = 10\text{A}$ , $V_{\text{GS}} = 0\text{V}$	-	0.84	-	V
$I_{\text{s}}$	Diode Continuous Forward Current	$T_{\text{C}} = 25^\circ\text{C}$	-	-	20	A
$I_{\text{SM}}$	Pulsed Source-Drain Current <sup>2</sup>		-	-	45	A
$t_{\text{rr}}$	Reverse Recovery Time	$I_{\text{F}} = 8\text{A}$ , $V_{\text{R}} = 400\text{V}$ $dI_{\text{F}}/dt = 100\text{ A}/\mu\text{s}$	-	290	-	ns
$Q_{\text{rr}}$	Reverse Recovery Charge		-	4	-	$\mu\text{C}$

Notes:

1. Pulse width  $t_{\text{p}}$  limited by  $T_{\text{J (Max.)}}$
2.  $V_{\text{DD}} = 50\text{V}$ ,  $I_{\text{D}} = 4.5\text{A}$ ,  $R_{\text{G}} = 25\Omega$ , Starting  $T_{\text{J}} = 25^\circ\text{C}$

### Ratings and Characteristics Curves (@ $T_J = 25^\circ\text{C}$ unless otherwise specified)

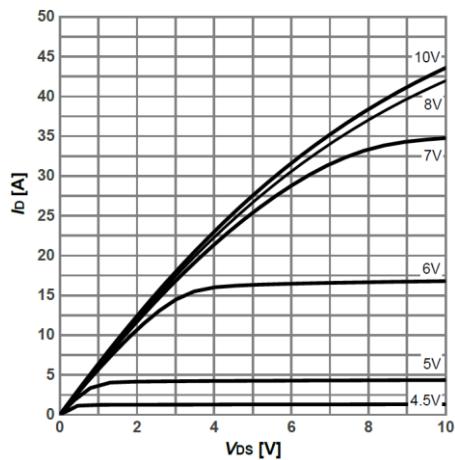


Fig 1 Typical Output Characteristics

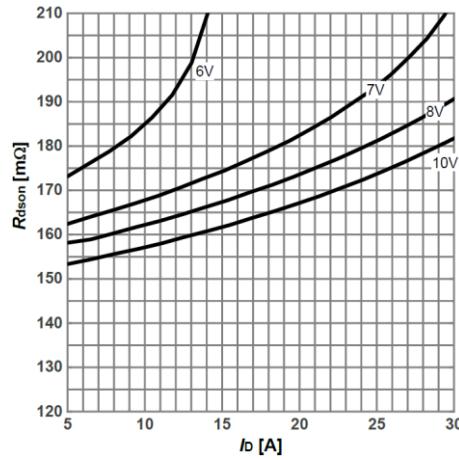


Fig 2 On-Resistance vs. Drain Current and Gate Voltage

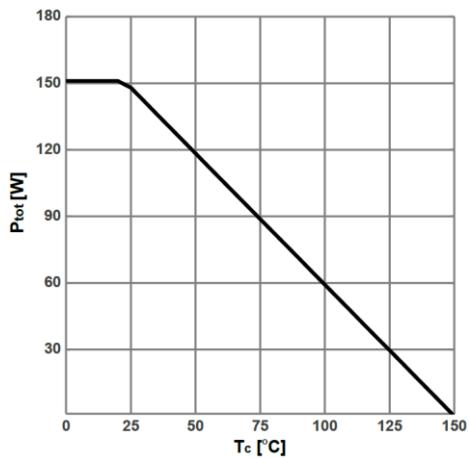


Fig 3 Power Dissipation vs. Case Temperature

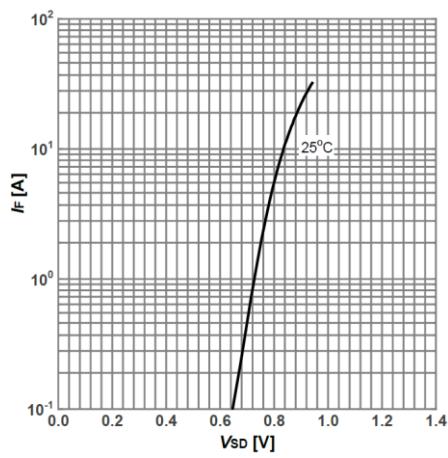


Fig 4 Body-Diode Characteristics

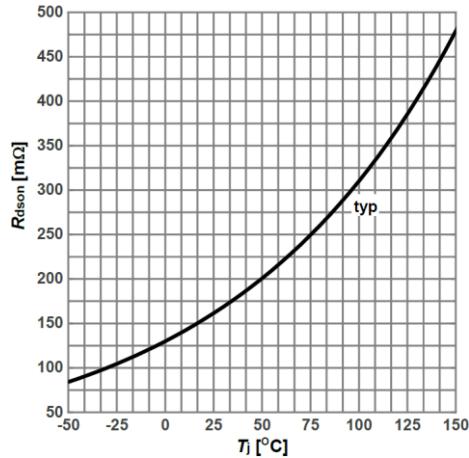


Fig 5 On-Resistance vs. Junction Temperature

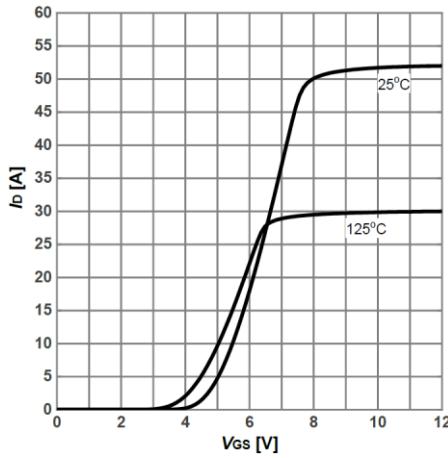


Fig 6 Transfer Characteristics

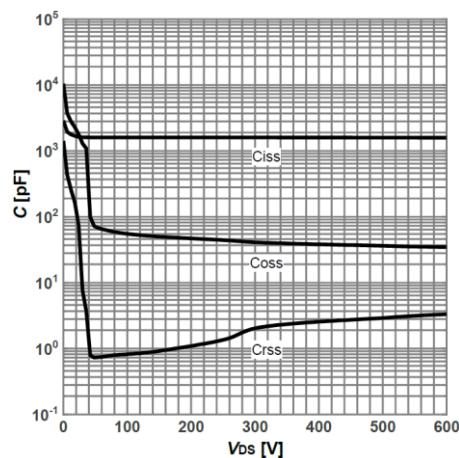


Fig 7 Capacitance Characteristics

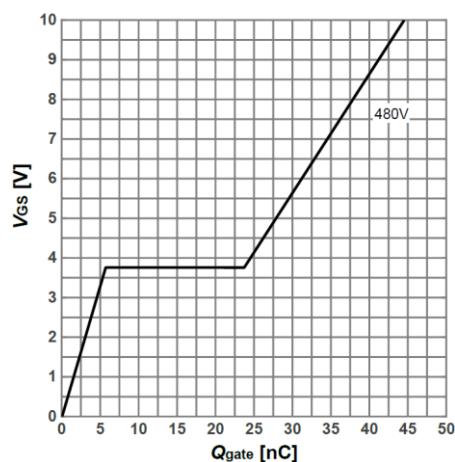


Fig 8 Gate-Charge Characteristics

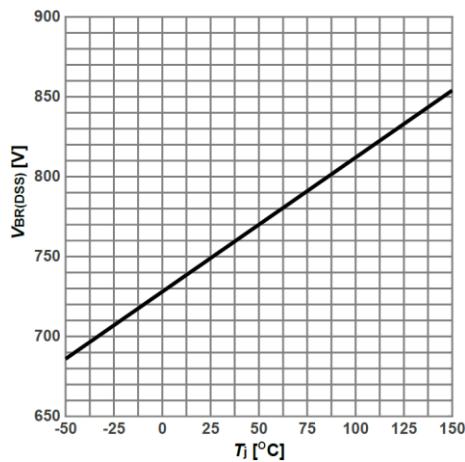


Fig 9 Breakdown Voltage vs. Junction Temperature

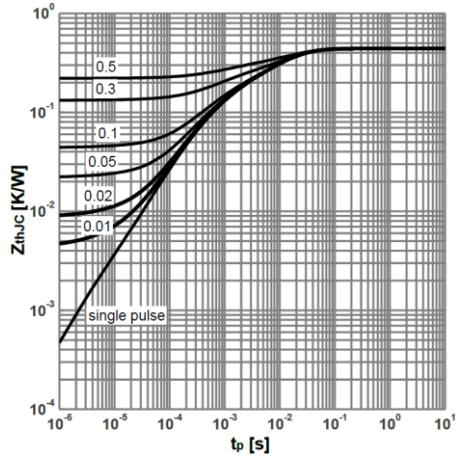


Fig 10 Transient Thermal Resistance

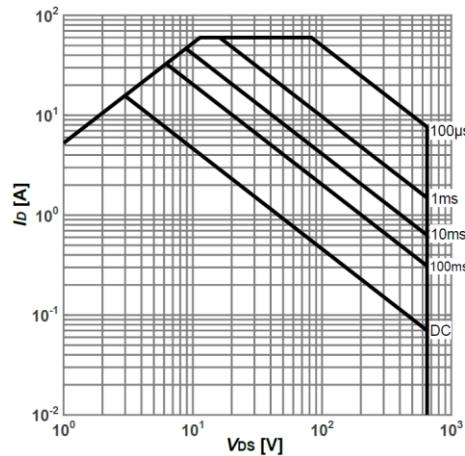
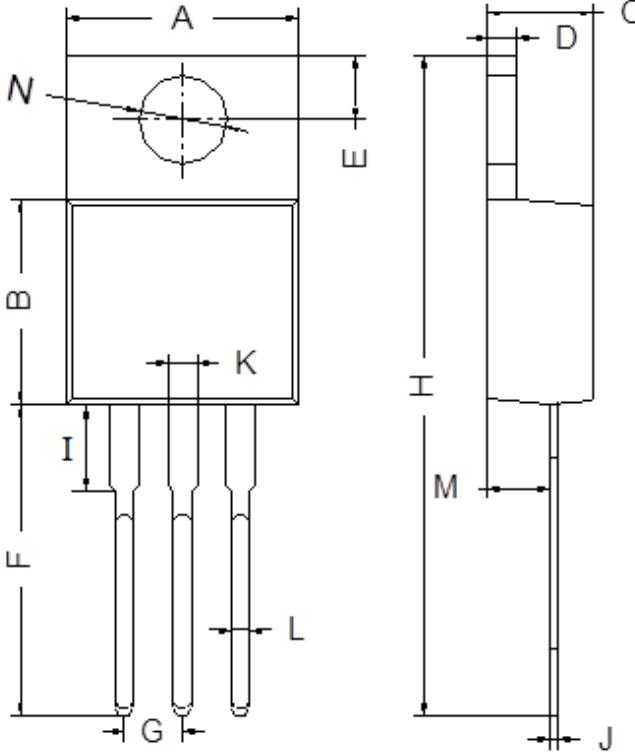


Fig 11 Safe Operation Area

### Package Outline Dimensions (Unit: mm)



The diagram illustrates the TO-220AB package outline with two views: a top view and a side view. The top view shows the lead pitch (A), total width (B), height (C), and lead thickness (D). The side view shows the lead height (E), total height (F), lead thickness (G), lead spacing (H), lead width (I), lead gap (J), lead length (K), lead thickness (L), and lead gap (M). Reference points N and W are also indicated.

TO-220AB		
Dimension	Min.	Max.
A	9.80	10.30
B	8.70	9.10
C	4.37	4.77
D	1.07	1.47
E	2.64	2.84
F	13.14	13.74
G	2.44	2.64
H	28.03	28.83
I	3.50	4.00
J	0.28	0.48
K	1.22	1.32
L	0.71	0.91
M	2.40	2.60
N	3.76	3.96

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