

### Features

- Low power loss by high speed switching and low on-resistance
- Excellent thermal behavior
- HBM: JESD22-A114-B: 1B
- Product validation acc. JEDEC Standard

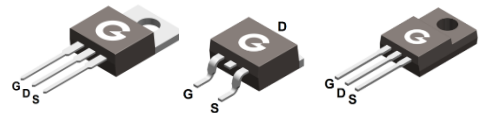
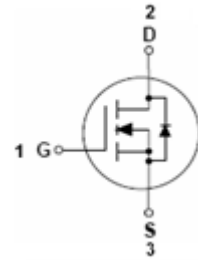
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### APPLICATIONS

- PFC power supply stages
- Solar inverter
- Telecom
- Server
- UPS

### Mechanical Data

- Case: TO-220AB, TO-263, ITO-220AB
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208



TO-220AB

TO-263

ITO-220AB

### Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
SJ65R190	TO-220AB	50 pcs / Tube	SJ65R190
SJ65R190B	TO-263	50 pcs / Tube or 800 pcs / Tape & Reel	SJ65R190B
SJ65R190F	ITO-220AB	50 pcs / Tube	SJ65R190F

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	650	V
Gate-to-Source Voltage	$V_{GSS}$	$\pm 30$	V
Continuous Drain Current ( $T_C = 25^\circ\text{C}$ )	$I_D$	21	A
Continuous Drain Current ( $T_C = 100^\circ\text{C}$ )		13.2	A
Pulsed Drain Current ( $t_p = 10\mu\text{s}$ , $T_C = 25^\circ\text{C}$ )	$I_{DM}$	84	A
Single Pulse Avalanche Energy <sup>2</sup>	$E_{AS}$	500	mJ
Power Dissipation (TO-220AB, $T_C = 25^\circ\text{C}$ )	$P_D$	208	W
Power Dissipation (TO-263, $T_C = 25^\circ\text{C}$ )		208	W
Power Dissipation (ITO-220AB, $T_C = 25^\circ\text{C}$ )		36	W
Operating Junction Temperature Range	$T_J$	-55 ~ +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

### Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Case (TO-220AB, TO-263)	R <sub>θJC</sub>	-	0.41	0.6	°C/W
Thermal Resistance Junction-to-Case (ITO-220AB)		-	3.1	3.5	°C/W
Thermal Resistance Junction-to-Air (TO-220AB, TO-263)	R <sub>θJA</sub>	-	-	50	°C/W
Thermal Resistance Junction-to-Air (ITO-220AB)		-	-	62.5	°C/W

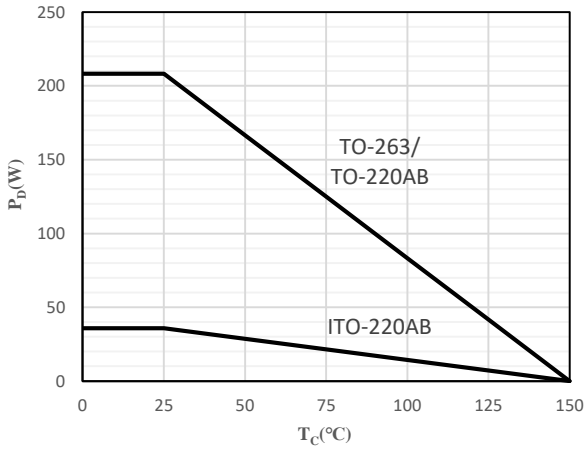
### Electrical Characteristics (@ T<sub>A</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
V <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	650	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V	-	-	1	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V	-	-	±100	nA
<b>On Characteristics</b>						
R <sub>DS(ON)</sub>	Drain-Source On-resistance *1	V <sub>GS</sub> = 10V, I <sub>D</sub> = 10A	-	0.14	0.19	Ω
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2	3	4	V
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> = 0V, f = 1MHz	-	4.4	-	Ω
<b>Dynamic Characteristics</b>						
C <sub>ISS</sub>	Input Capacitance	V <sub>GS</sub> = 0V V <sub>DS</sub> = 40V f = 250kHz	-	1579	-	pF
C <sub>OSS</sub>	Output Capacitance		-	111	-	
C <sub>RSS</sub>	Reverse Transfer Capacitance		-	4	-	
<b>Switching Characteristics</b>						
t <sub>d(ON)</sub>	Turn-on Delay Time *3	V <sub>DD</sub> = 400V V <sub>GS</sub> = 10V I <sub>D</sub> = 7A	-	64	-	ns
t <sub>r</sub>	Turn-on Rise Time *3		-	16	-	
t <sub>d(OFF)</sub>	Turn-Off Delay Time *3		-	55	-	
t <sub>f</sub>	Turn-Off Fall Time *3		-	14	-	
Q <sub>G</sub>	Total Gate-Charge	V <sub>DD</sub> = 520V V <sub>GS</sub> = 10V I <sub>D</sub> = 10A	-	39	-	nC
Q <sub>GS</sub>	Gate to Source Charge		-	5	-	
Q <sub>GD</sub>	Gate to Drain (Miller) Charge		-	14	-	
<b>Source-Drain Diode Characteristics</b>						
V <sub>SD</sub>	Diode Forward Voltage *1	I <sub>SD</sub> = 10A, V <sub>GS</sub> = 0V	-	0.84	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 1A, V <sub>R</sub> = 400V	-	138	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt = 100A/μs	-	0.79	-	μC

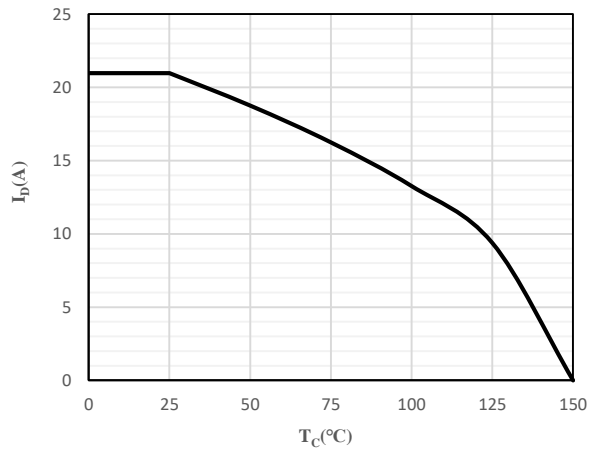
Notes:

- The data tested by pulsed, pulse width ≤ 300μs, duty cycle ≤ 2%
- The E<sub>AS</sub> data shows Max. rating. The test condition is V<sub>DD</sub> = 100V, V<sub>GS</sub> = 15V, L = 50mH
- Guaranteed by design, not subject to production

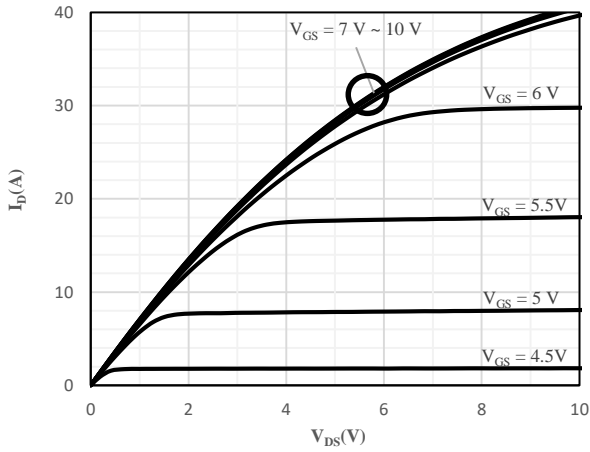
**Ratings and Characteristics Curves** (@  $T_A = 25^\circ\text{C}$  unless otherwise specified)



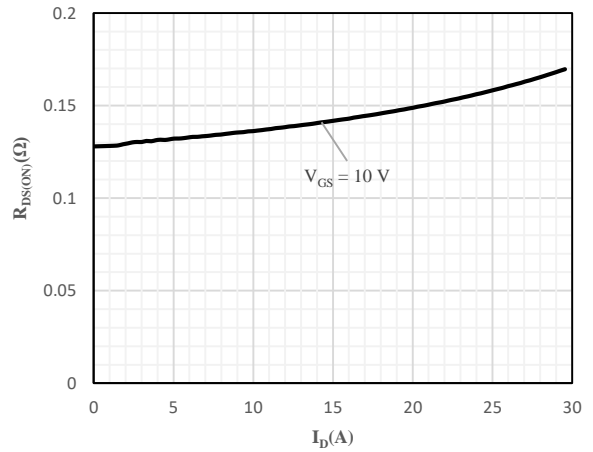
**Fig 1 Power Dissipation**



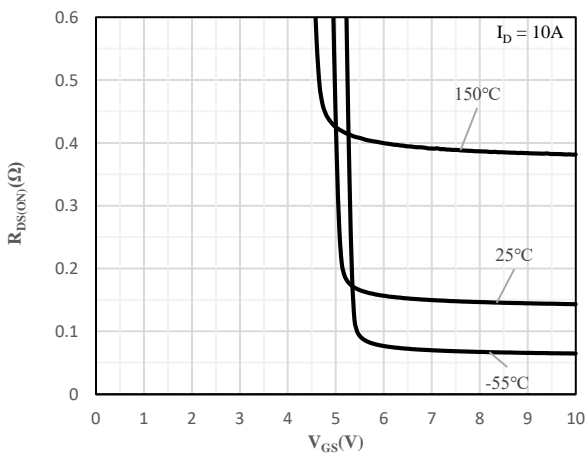
**Fig 2 Drain Current**



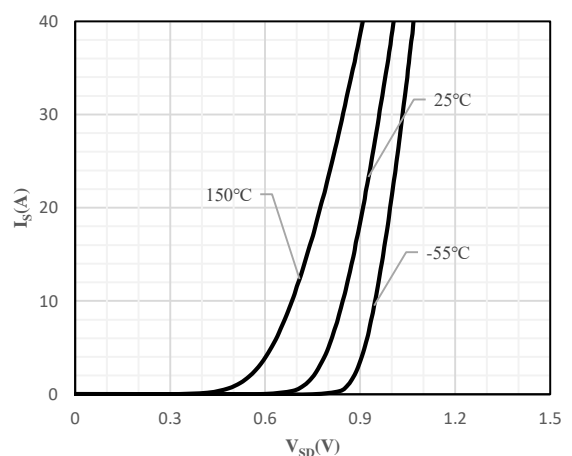
**Fig 3 Typical Output Characteristics**



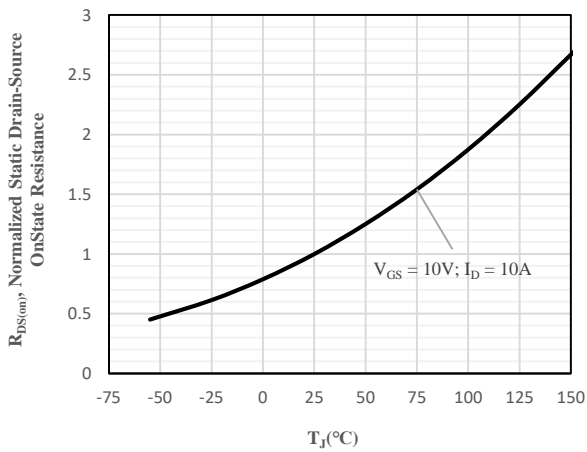
**Fig 4 On-Resistance vs. Drain Current and Gate Voltage**



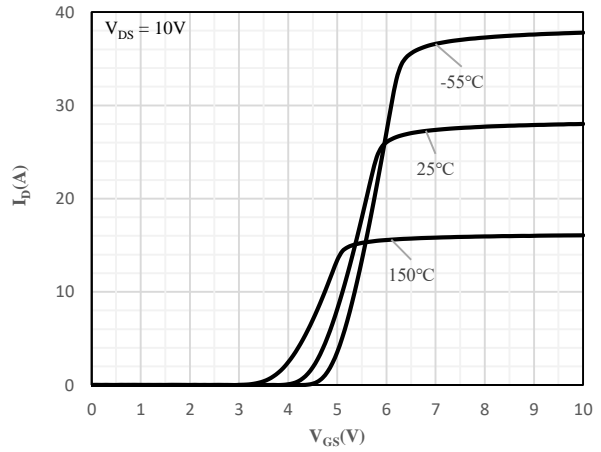
**Fig 5 On-Resistance vs. Gate-Source Voltage**



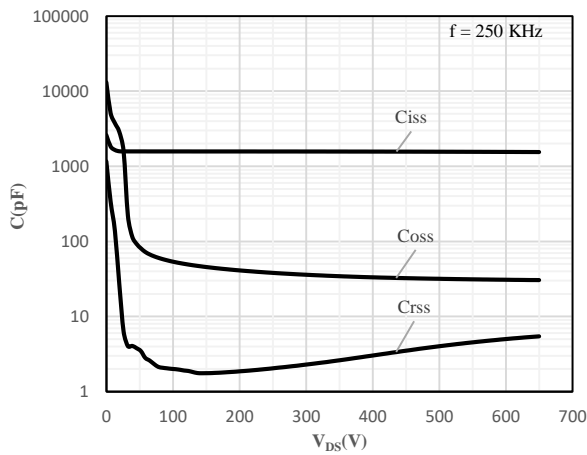
**Fig 6 Body-Diode Characteristics**



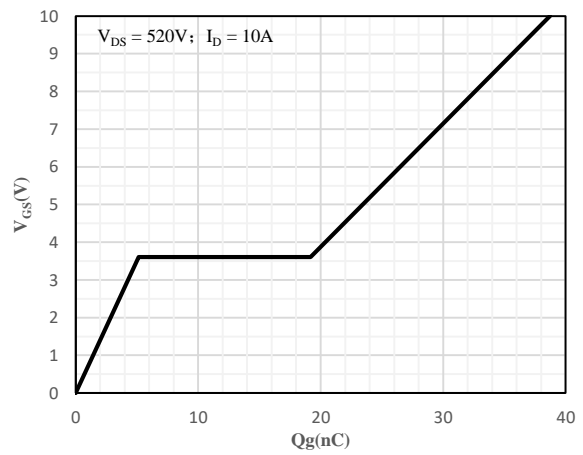
**Fig 7 Normalized On-Resistance vs. Junction Temperature**



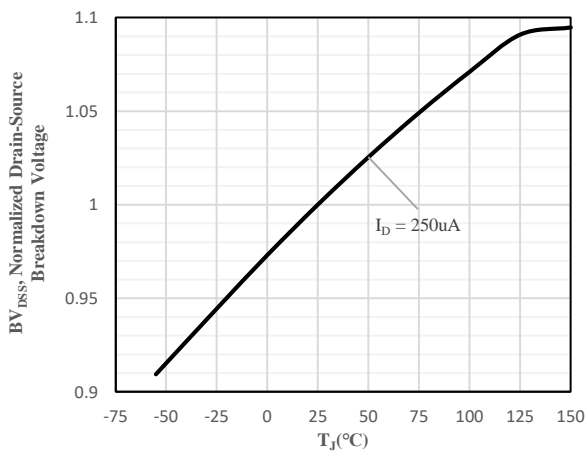
**Fig 8 Transfer Characteristics**



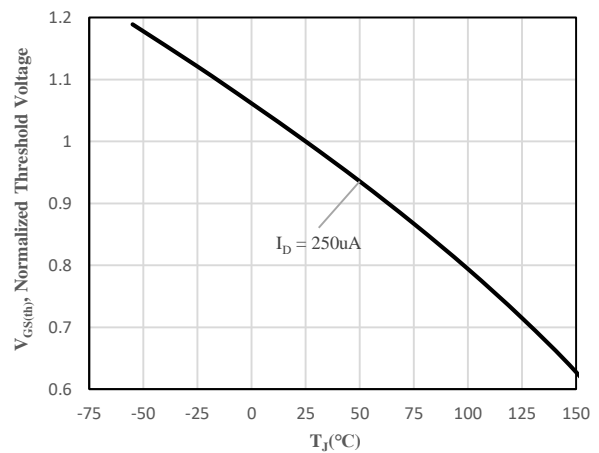
**Fig 9 Capacitance Characteristics**



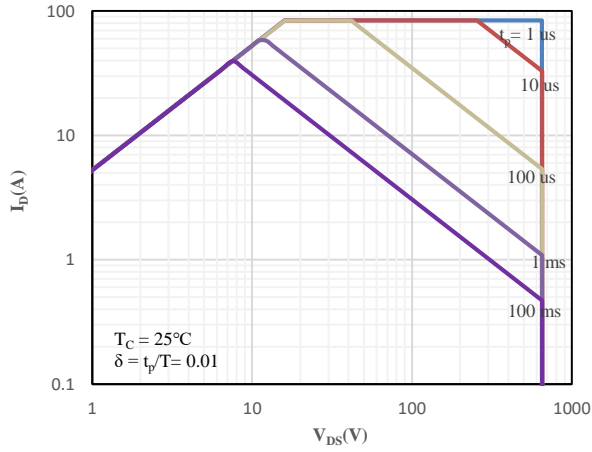
**Fig 10 Gate-Charge Characteristics**



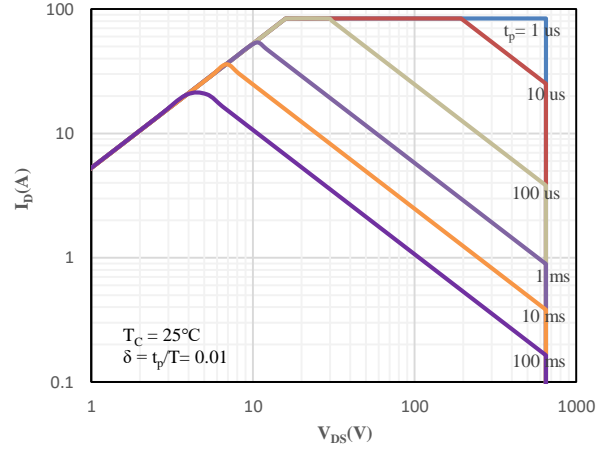
**Fig 11 Normalized Breakdown Voltage vs. Junction Temperature**



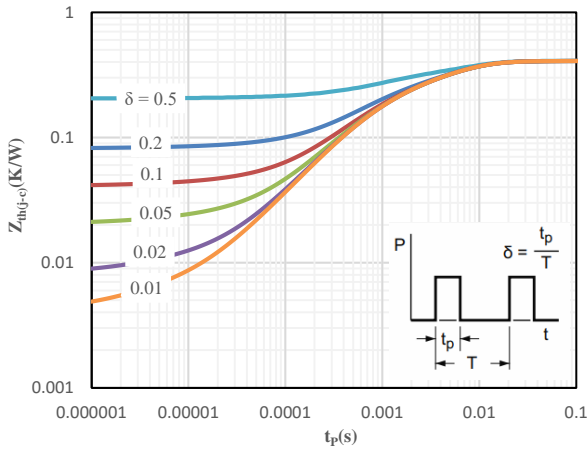
**Fig 12 Normalized  $V_{GS(th)}$  vs. Junction Temperature**



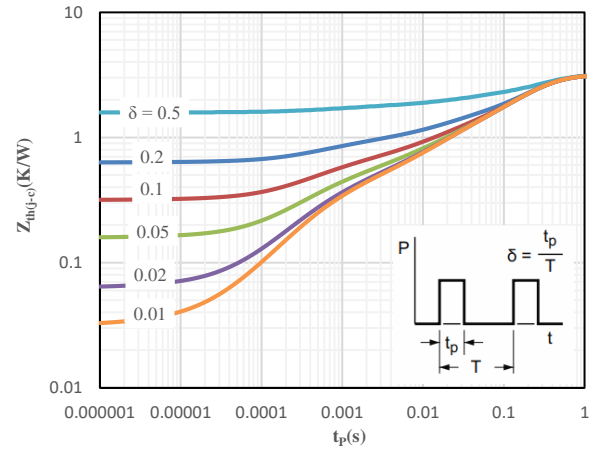
**Fig 13 Safe Operation Area (TO-220AB / TO-263)**



**Fig 14 Safe Operation Area (ITO-220AB)**

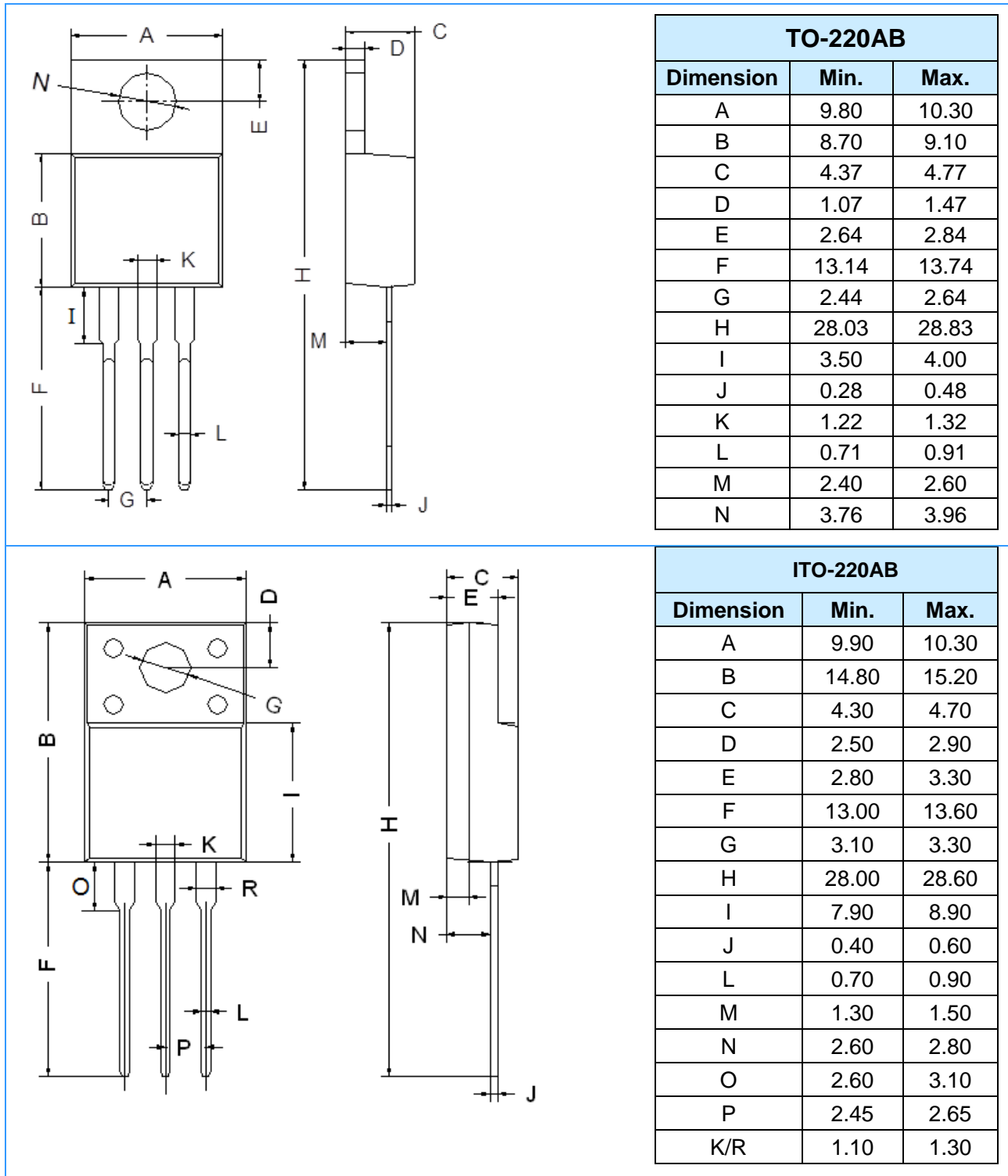


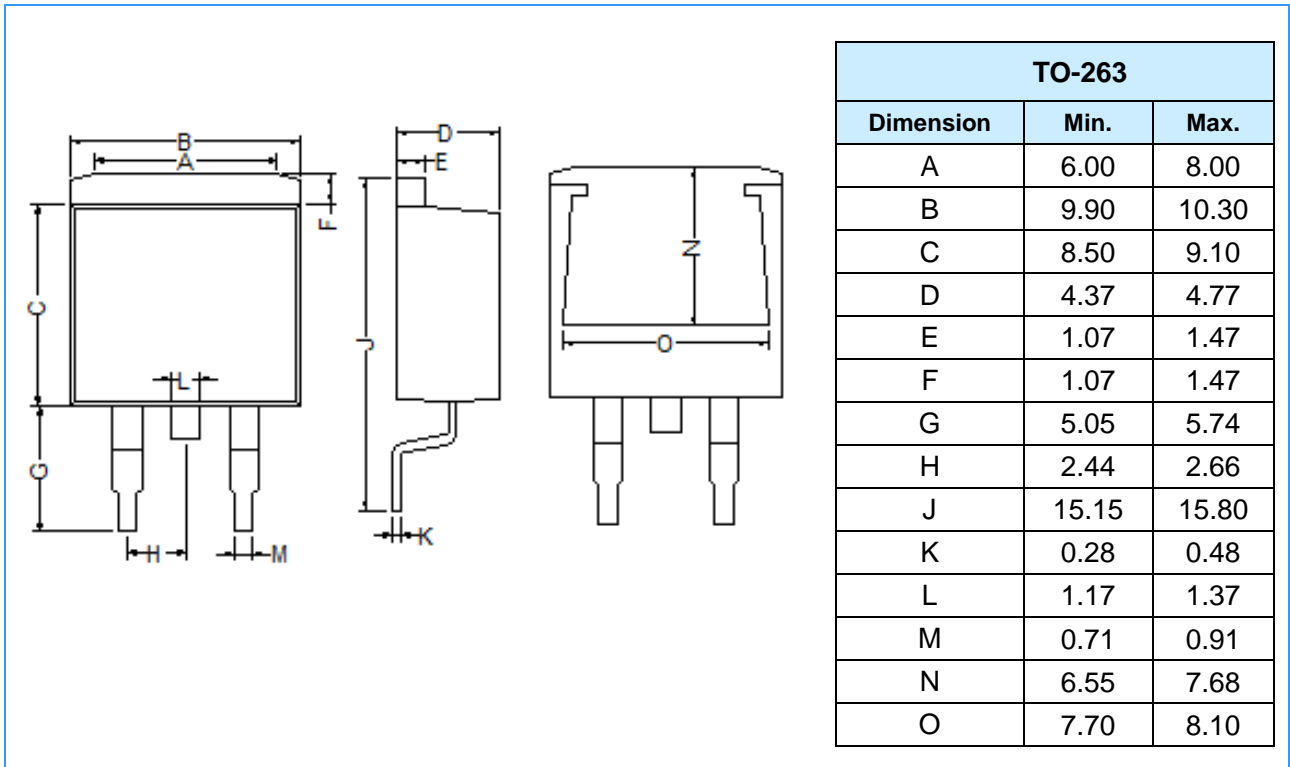
**Fig 15 Maximum transient thermal impedance (TO-220AB / TO-263)**



**Fig 16 Maximum transient thermal impedance (ITO-220AB)**

### Package Outline Dimensions (Unit: mm)





**Mounting Pad Layout** (Unit: mm)

