

### Features

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

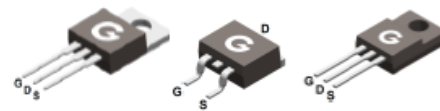
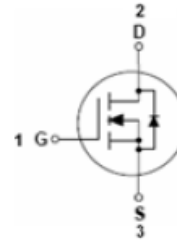
**HF**

### 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
AKS65R190	TO-220AB	50 pcs / Tube	SJM65R190
AKS65R190B	TO-263	50 pcs / Tube or 800 pcs / Tape & Reel	SJM65R190B
AKS65R190F	ITO-220AB	50 pcs / Tube	SJM65R190F

### Maximum Ratings (@ T<sub>C</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V <sub>DSS</sub>	650	V
Gate-to-Source Voltage	V <sub>GSS</sub>	±30	V
Continuous Drain Current (T <sub>C</sub> = 25°C)	I <sub>D</sub>	21	A
Continuous Drain Current (T <sub>C</sub> = 100°C)		13	A
Pulsed Drain Current (t <sub>p</sub> = 10μs, T <sub>C</sub> = 25°C)	I <sub>DM</sub>	84	A
Single Pulse Avalanche Energy <sup>1,2</sup>	E <sub>AS</sub>	400	mJ
Power Dissipation (TO-220AB, T <sub>C</sub> = 25°C)	P <sub>D</sub>	208	W
Power Dissipation (TO-263, T <sub>C</sub> = 25°C)		208	W
Power Dissipation (ITO-220AB, T <sub>C</sub> = 25°C)		36	W
Operating Junction Temperature Range	T <sub>J</sub>	-55 ~ +150	°C
Storage Temperature Range	T <sub>STG</sub>	-55 ~ +150	°C

## Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Case (TO-220AB, TO-263)	R <sub>θJC</sub>	-	0.5	0.6	°C/W
Thermal Resistance Junction-to-Case (ITO-220AB)		-	2.9	3.5	°C/W
Thermal Resistance Junction-to-Air (TO-220AB, TO-263)	R <sub>θJA</sub>	-	-	62	°C/W
Thermal Resistance Junction-to-Air (ITO-220AB)		-	-	75	°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 <sup>1</sup>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 10A	-	0.15	0.19	Ω
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.5	3.0	4.5	V
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> = 0V, f = 1MHz	-	8.1	-	Ω
<b>Dynamic Characteristics</b>						
C <sub>ISS</sub>	Input Capacitance	V <sub>GS</sub> = 0V	-	1292	-	pF
C <sub>OSS</sub>	Output Capacitance	V <sub>DS</sub> = 40V	-	107	-	
C <sub>RSS</sub>	Reverse Transfer Capacitance	f = 250kHz	-	0.7	-	
<b>Switching Characteristics</b>						
t <sub>d(ON)</sub>	Turn-on Delay Time <sup>3</sup>	V <sub>DD</sub> = 400V V <sub>GS</sub> = 10V I <sub>D</sub> = 8.5A R <sub>G</sub> = 10Ω	-	15	-	ns
t <sub>r</sub>	Turn-on Rise Time <sup>3</sup>		-	11	-	
t <sub>d(OFF)</sub>	Turn-Off Delay Time <sup>3</sup>		-	71	-	
t <sub>f</sub>	Turn-Off Fall Time <sup>3</sup>		-	11	-	
Q <sub>G</sub>	Total Gate-Charge	V <sub>DD</sub> = 520V	-	35	-	nC
Q <sub>GS</sub>	Gate to Source Charge	V <sub>GS</sub> = 10V	-	7.5	-	
Q <sub>GD</sub>	Gate to Drain (Miller) Charge	I <sub>D</sub> = 11A	-	18	-	
<b>Source-Drain Diode Characteristics</b>						
V <sub>SD</sub>	Diode Forward Voltage <sup>1</sup>	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> = 10A, V <sub>R</sub> = 400V	-	310	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt = 100A/μs	-	3.8	-	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)

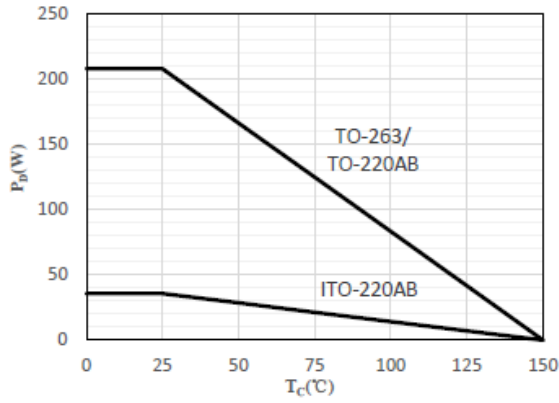


Fig 1 Power Dissipation

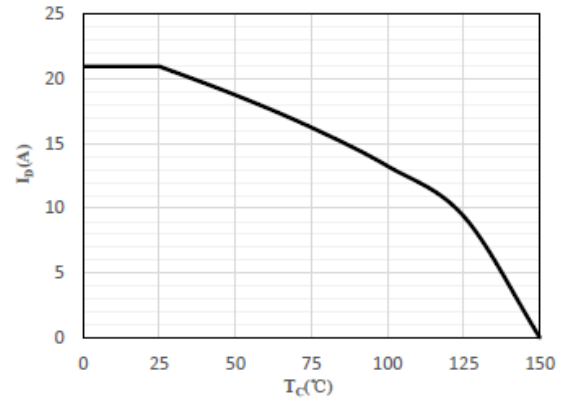


Fig 2 Drain Current

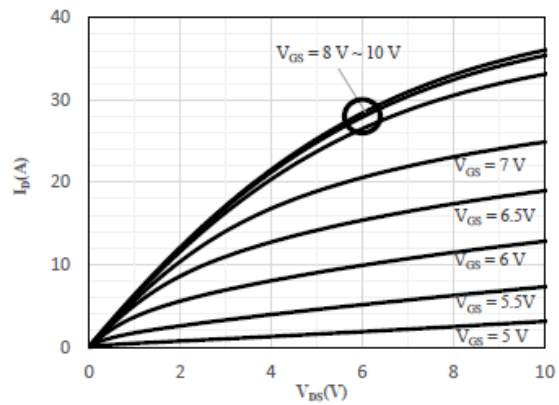


Fig 3 Typical Output Characteristics

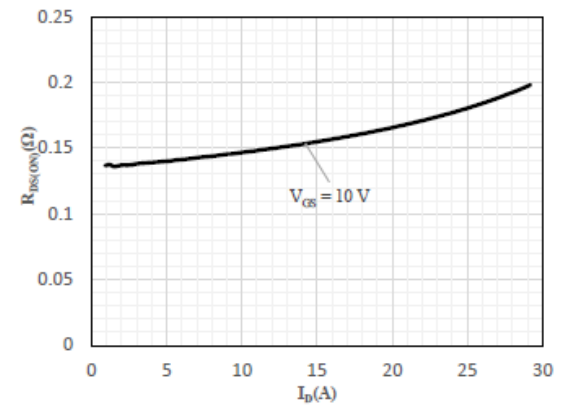


Fig 4 On-Resistance vs. Drain Current and Gate Voltage

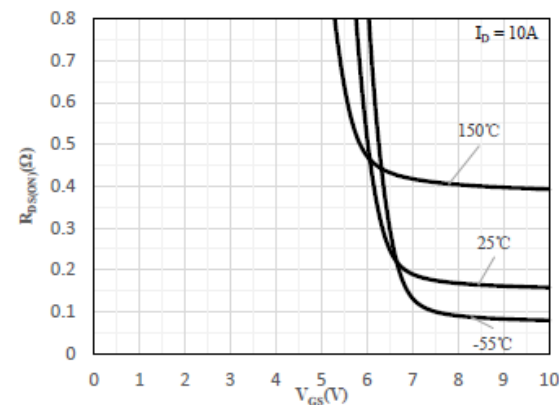


Fig 5 On-Resistance vs. Gate-Source Voltage

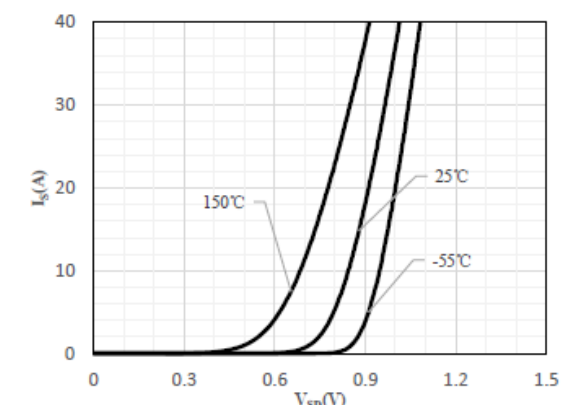


Fig 6 Body-Diode Characteristics

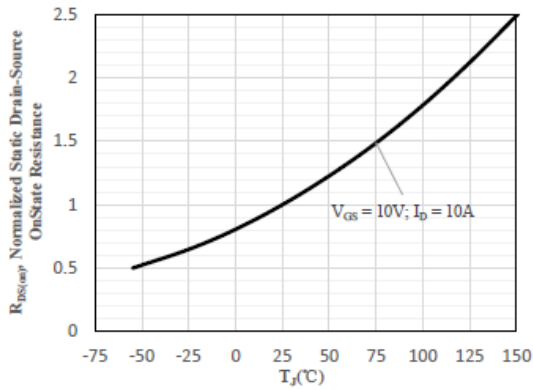


Fig 7 Normalized On-Resistance vs. Junction Temperature

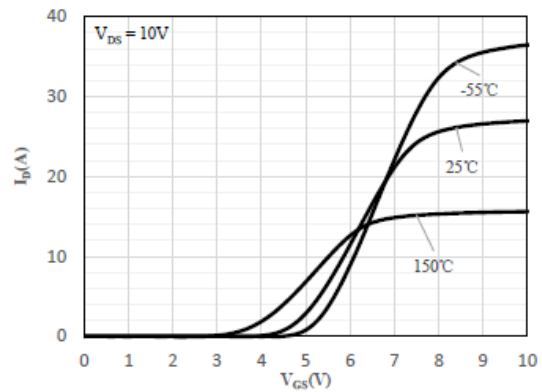


Fig 8 Transfer Characteristics

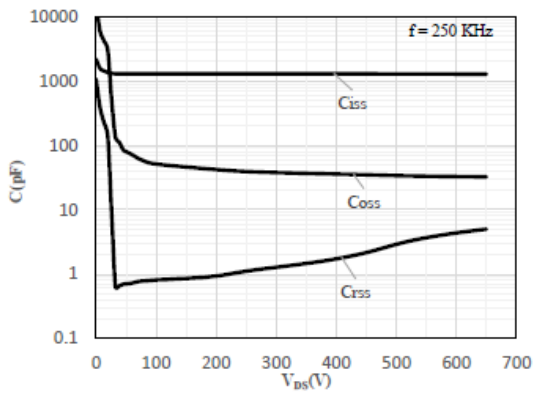


Fig 9 Capacitance Characteristics

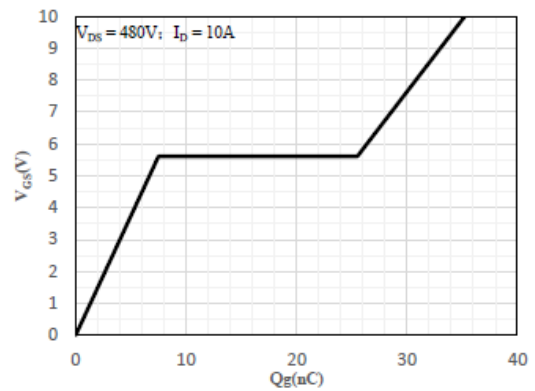


Fig 10 Gate-Charge Characteristics

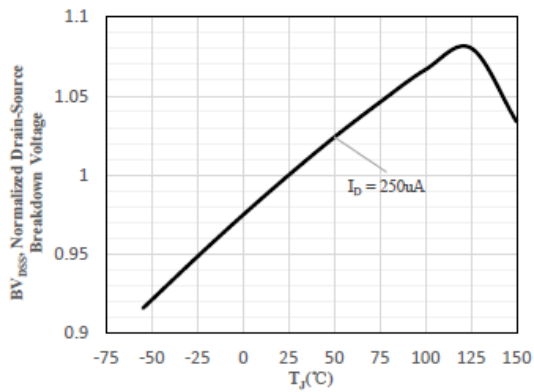


Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

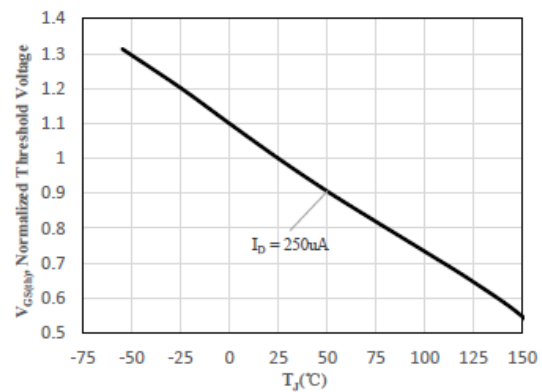


Fig 12 Normalized  $V_{GS(th)}$  vs. Junction Temperature

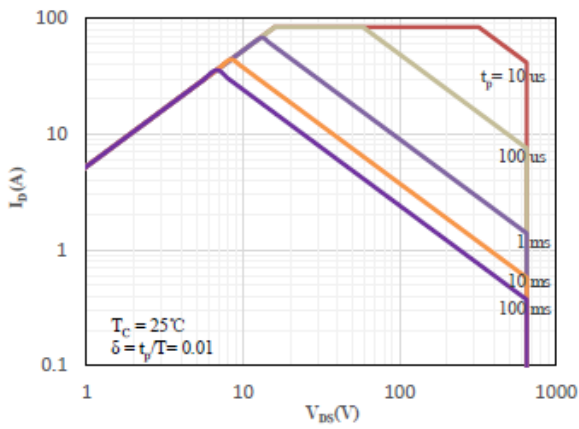


Fig 13 Safe Operation Area (TO-220AB / TO-263)

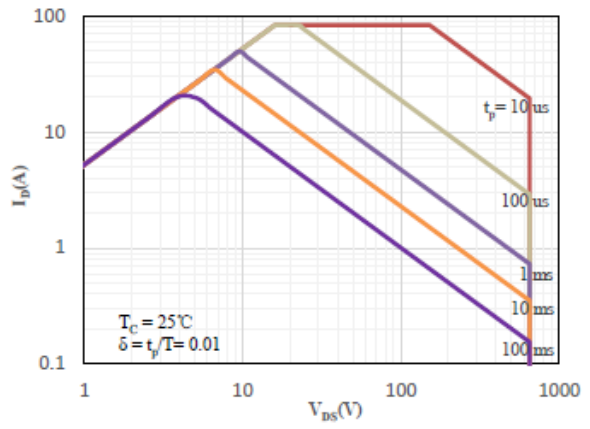


Fig 14 Safe Operation Area (ITO-220AB)

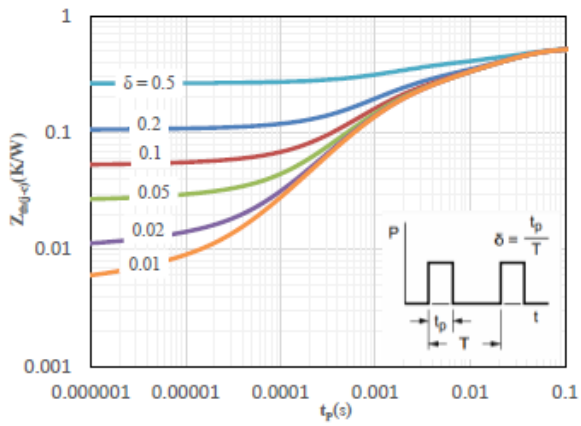


Fig 15 Maximum transient thermal impedance (TO-220AB / TO-263)

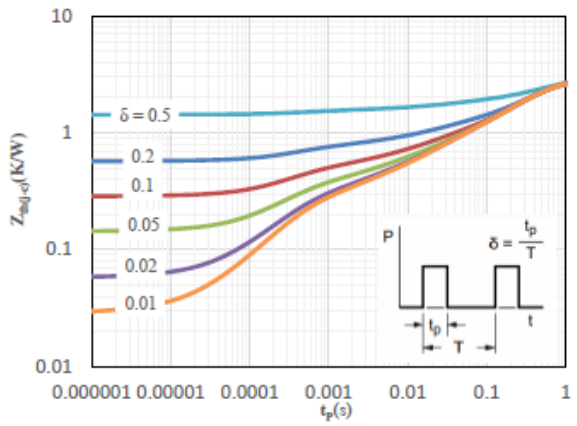
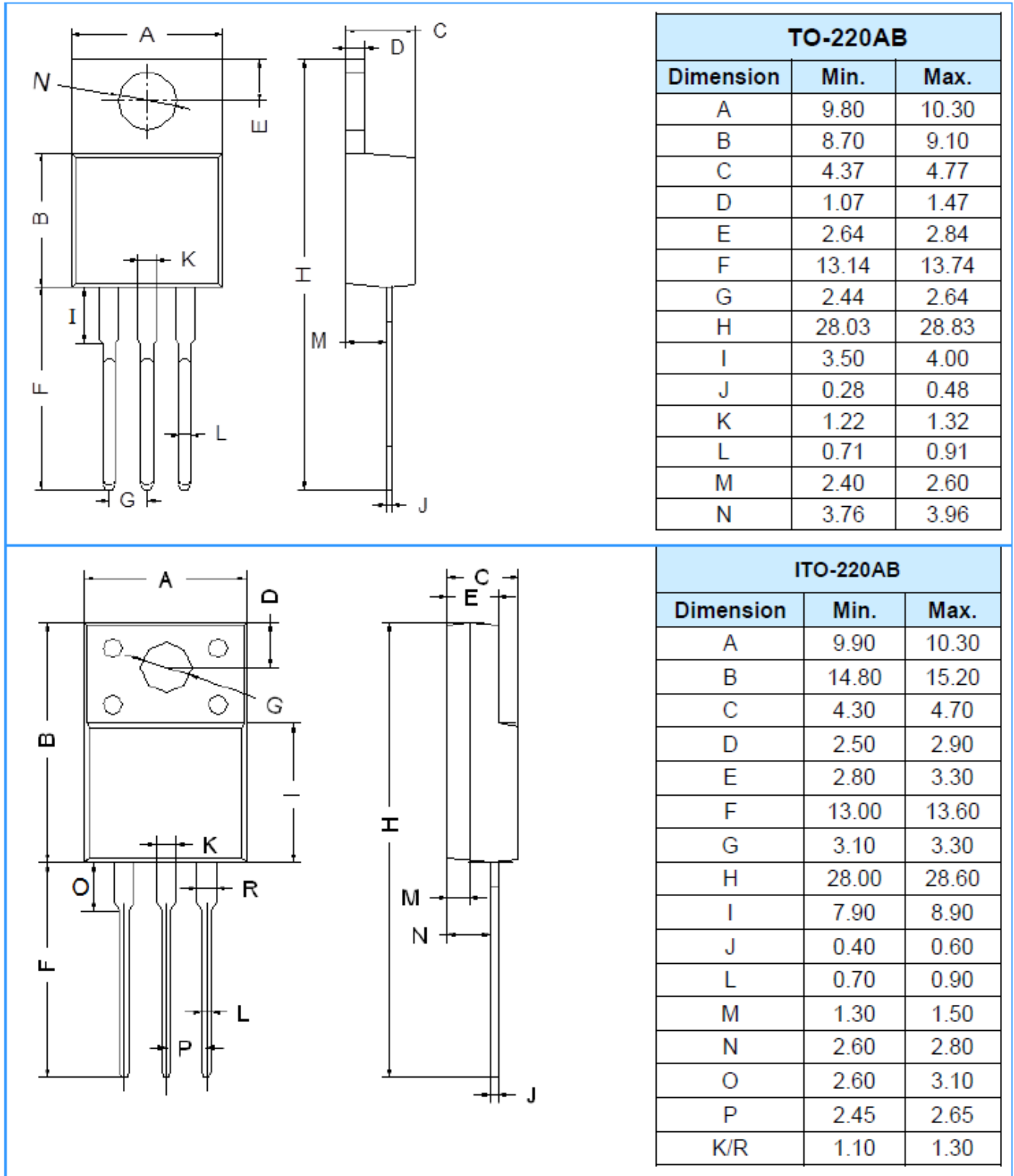
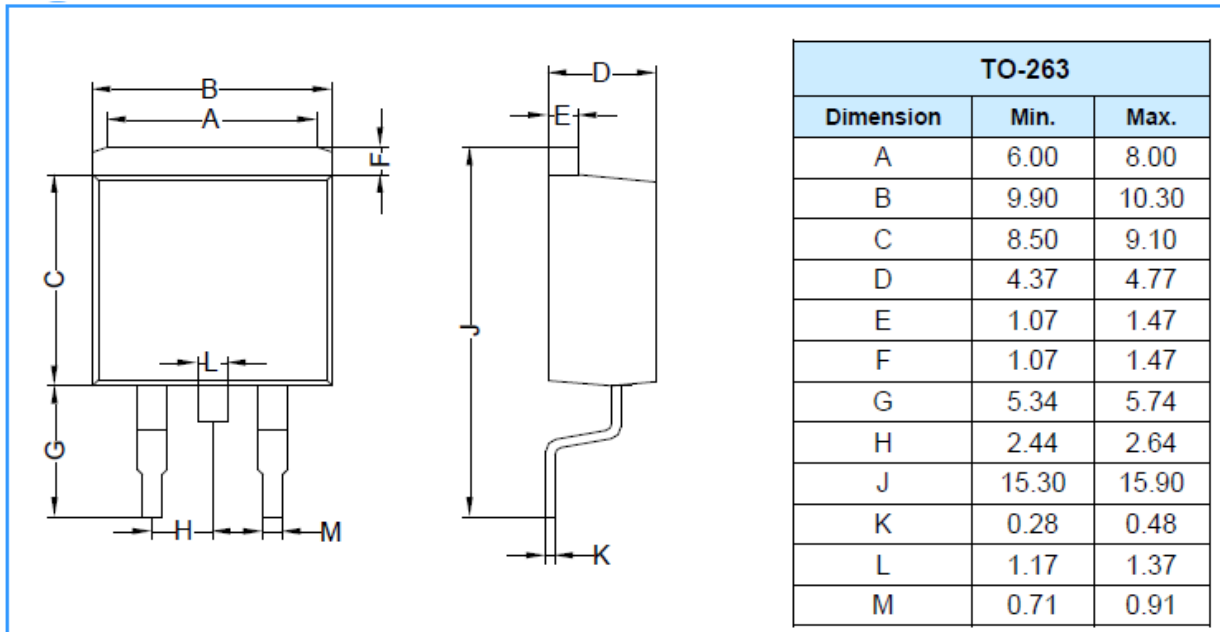
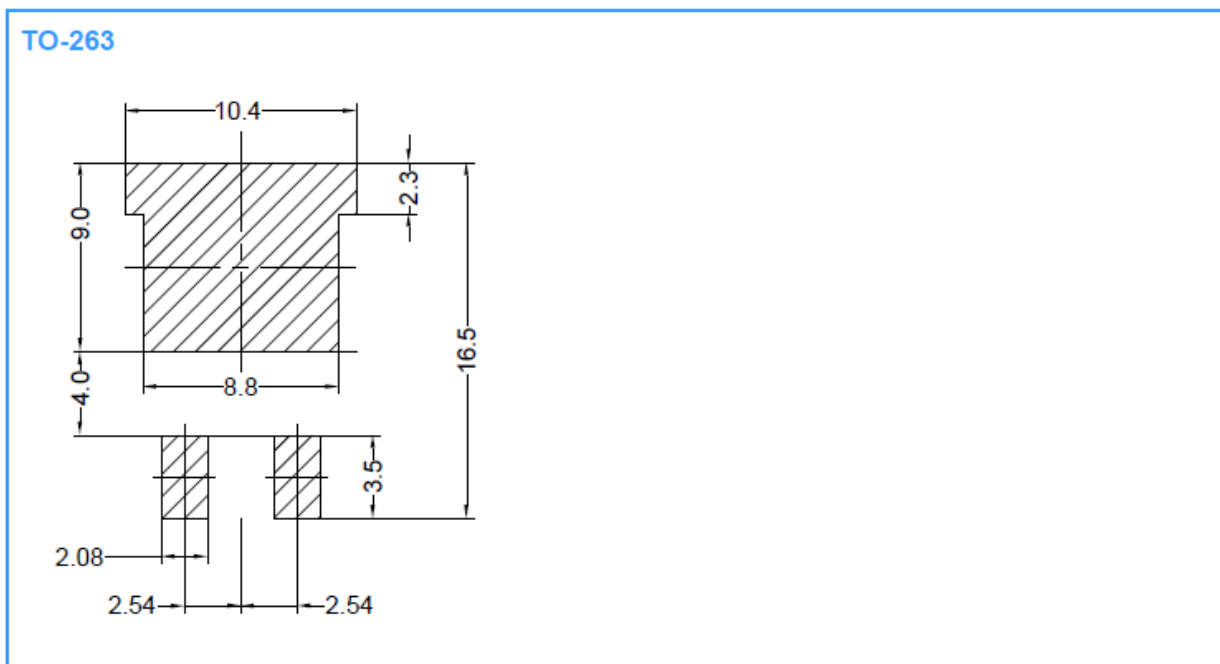


Fig 16 Maximum transient thermal impedance (ITO-220AB)

**Package Outline Dimensions** (Unit: mm)




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



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