

Features

- Low power loss by high speed switching and low on-resistance
- Excellent thermal behavior
- Ultra high ruggedness
- HBM: JESD22-A114-B: 2
- Product validation acc. JEDEC Standard

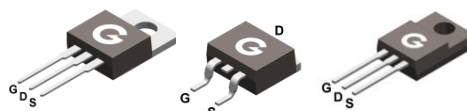
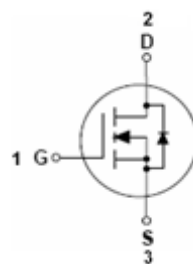
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Applications

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

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
SJM60R099	TO-220AB	50 pcs / Tube	SJM60R099
SJM60R099B	TO-263	50 pcs / Tube or 800 pcs / Tape & Reel	SJM60R099B
SJM60R099F	ITO-220AB	50 pcs / Tube	SJM60R099F

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	600	V
Gate-to-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current ($T_C = 25^\circ\text{C}$)	I_D	38	A
Continuous Drain Current ($T_C = 100^\circ\text{C}$)		24	A
Pulsed Drain Current ($t_p = 10\mu\text{s}$, $T_C = 25^\circ\text{C}$)	I_{DM}	152	A
Single Pulse Avalanche Energy ^{*2}	E_{AS}	500	mJ
Power Dissipation (TO-220AB, $T_C = 25^\circ\text{C}$)	P_D	250	W
Power Dissipation (TO-263, $T_C = 25^\circ\text{C}$)		250	W
Power Dissipation (ITO-220AB, $T_C = 25^\circ\text{C}$)		45	W
Operating Junction Temperature Range	T_J	$-55 \sim +150$	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	$-55 \sim +150$	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Case (TO-220AB, TO-263)	$R_{\theta JC}$	-	0.3	0.5	$^{\circ}\text{C/W}$
Thermal Resistance Junction-to-Case (ITO-220AB)		-	2.2	2.8	$^{\circ}\text{C/W}$
Thermal Resistance Junction-to-Air (TO-220AB, TO-263)	$R_{\theta JA}$	-	-	50	$^{\circ}\text{C/W}$
Thermal Resistance Junction-to-Air (ITO-220AB)		-	-	62	$^{\circ}\text{C/W}$

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
V _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA	600	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600V, V _{GS} = 0V	-	-	1	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} = ±30V, V _{DS} = 0V	-	-	±100	nA
On Characteristics						
R _{DS(ON)}	Drain-Source On-resistance *1	V _{GS} = 10V, I _D = 19A	-	88	99	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2.5	3.5	4.5	V
R _G	Gate Resistance	V _{GS} = 0V, f = 1MHz	-	1.7	-	Ω
Dynamic Characteristics						
C _{ISS}	Input Capacitance	V _{GS} = 0V	-	2176	-	pF
C _{OSS}	Output Capacitance	V _{DS} = 40V	-	182	-	
C _{RSS}	Reverse Transfer Capacitance	f = 250kHz	-	0.8	-	
Switching Characteristics						
t _{d(ON)}	Turn-on Delay Time	V _{DD} = 400V	-	26	-	ns
t _r	Turn-on Rise Time	V _{GS} = 15V	-	51	-	
t _{d(OFF)}	Turn-Off Delay Time	I _D = 19A	-	64	-	
t _f	Turn-Off Fall Time	R _G = 3.3Ω	-	22	-	
Q _G	Total Gate-Charge	V _{DD} = 400V	-	80	-	nC
Q _{GS}	Gate to Source Charge	V _{GS} = 10V	-	7	-	
Q _{GD}	Gate to Drain (Miller) Charge	I _D = 19A	-	23	-	
Source-Drain Diode Characteristics						
V _{SD}	Diode Forward Voltage *1	I _{SD} = 19A, V _{GS} = 0V	-	0.9	1.2	V
t _{rr}	Reverse Recovery Time	I _F = 19A, V _R = 400V	-	450	-	ns
Q _{rr}	Reverse Recovery Charge	di/dt = 100 A/μs	-	7.2	-	μC

Notes:

- The data tested by pulsed, pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
- The E_{AS} data shows Max. rating. The test condition is $V_{DD} = 100\text{V}, V_{GS} = 15\text{V}, L = 10\text{mH}$

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

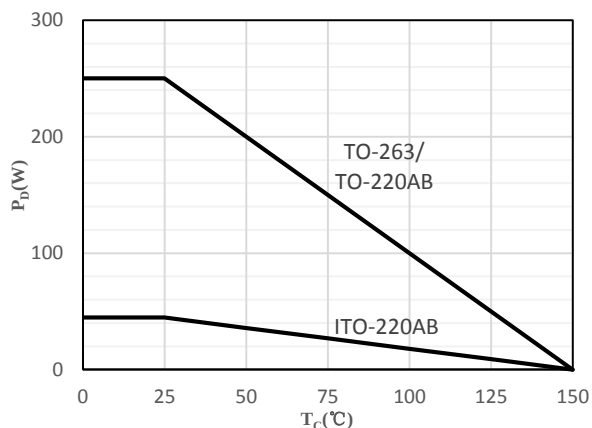


Fig 1 Power Dissipation

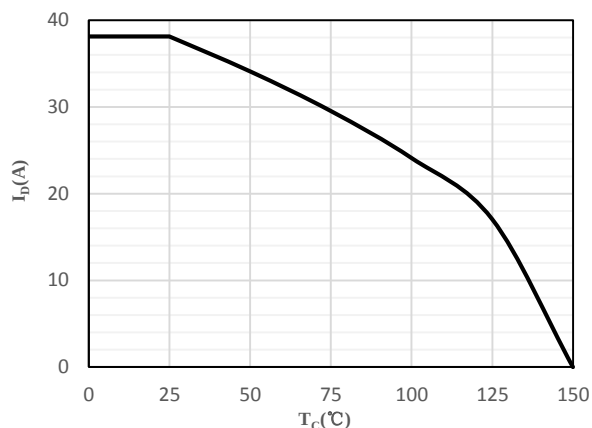


Fig 2 Drain Current

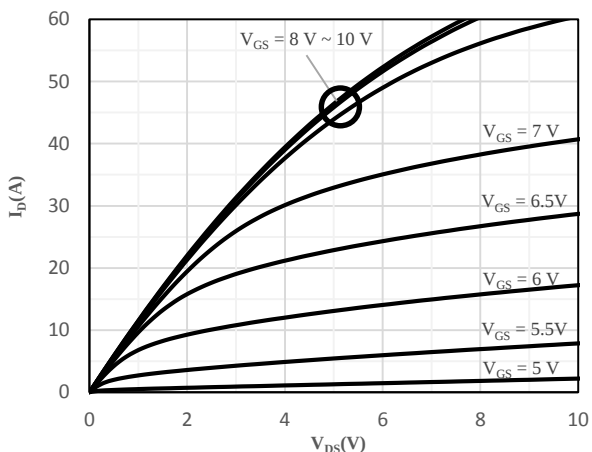


Fig 3 Typical Output Characteristics

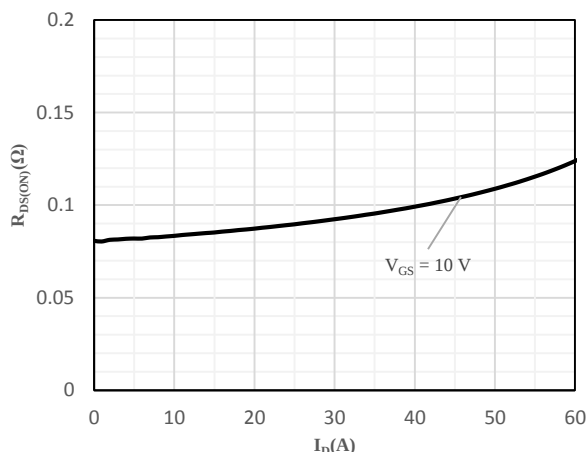


Fig 4 On-Resistance vs. Drain Current
and Gate Voltage

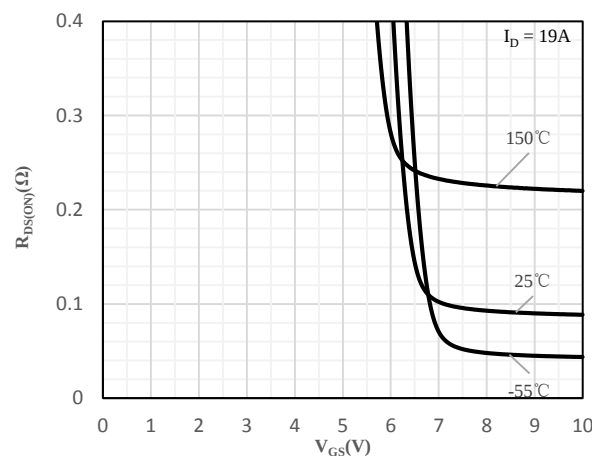


Fig 5 On-Resistance vs. Gate-Source Voltage

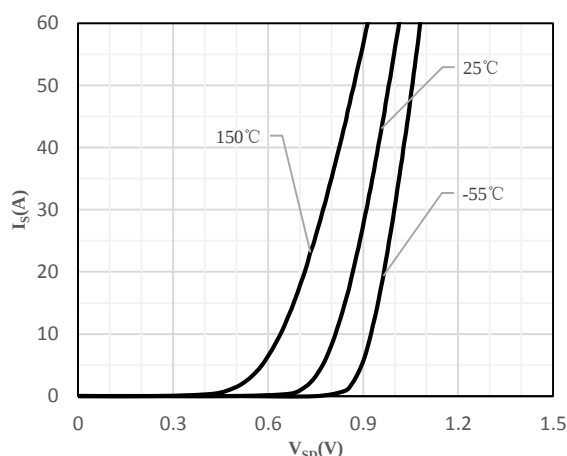


Fig 6 Body-Diode Characteristics

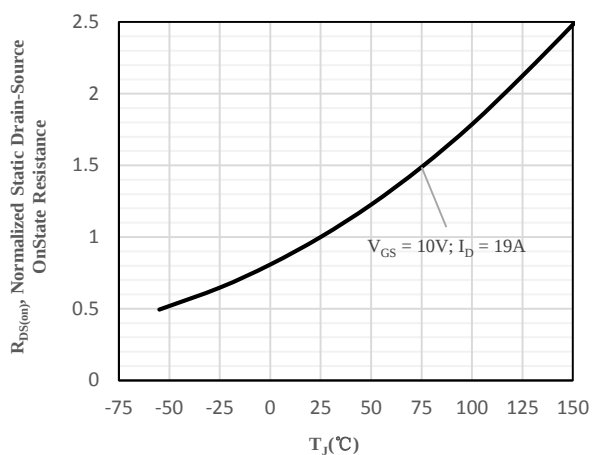


Fig 7 Normalized On-Resistance vs. Junction Temperature

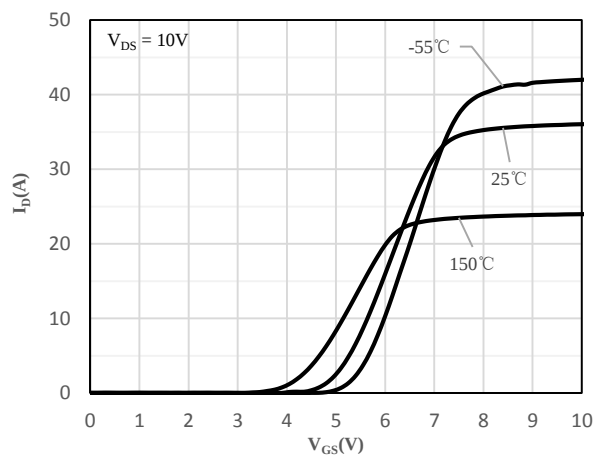


Fig 8 Transfer Characteristics

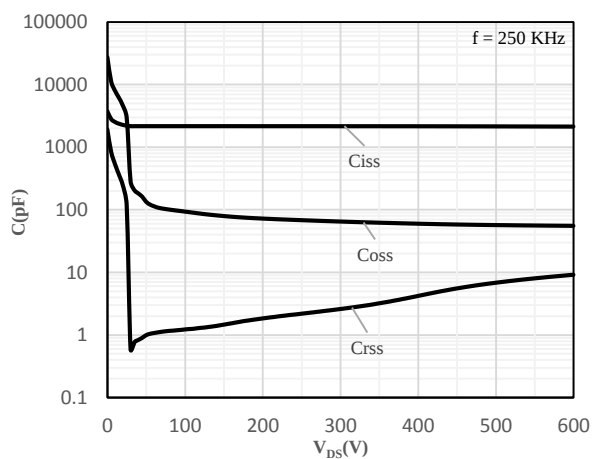


Fig 9 Capacitance Characteristics

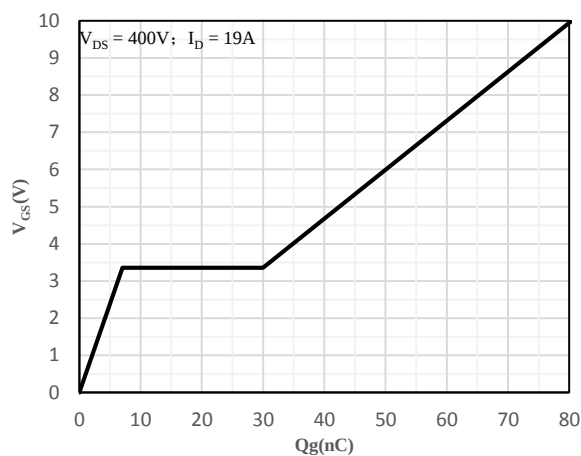


Fig 10 Gate-Charge Characteristics

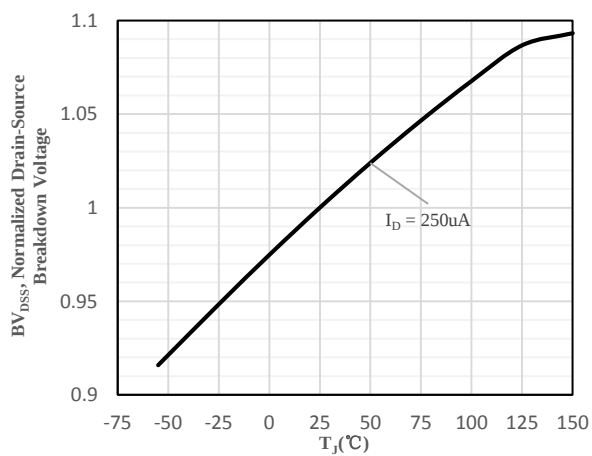


Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

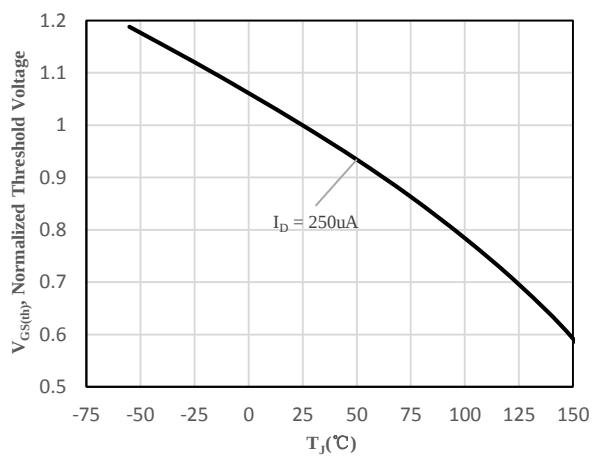


Fig 12 Normalized $V_{GS(th)}$ vs. Junction Temperature

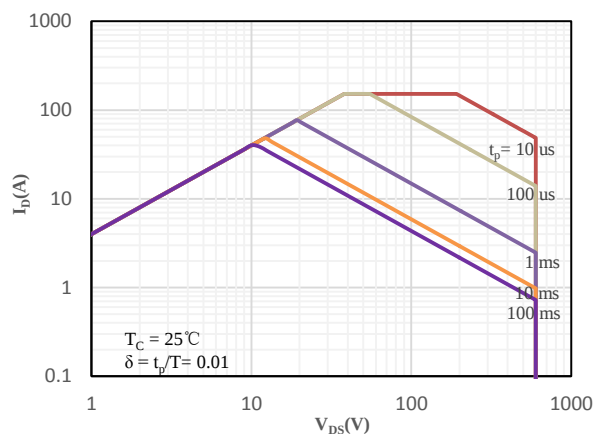


Fig 13 Safe Operation Area (TO-220AB / TO-263)

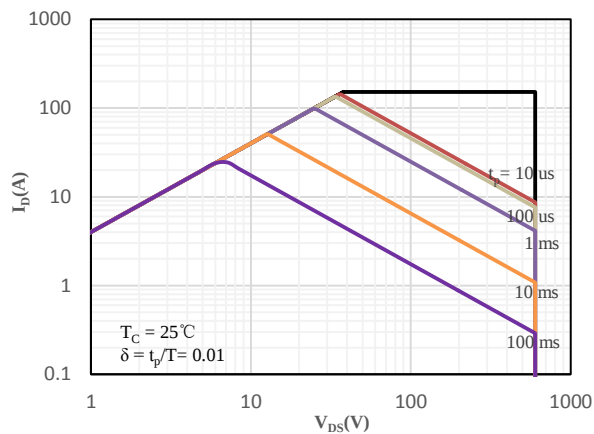


Fig 14 Safe Operation Area (ITO-220AB)

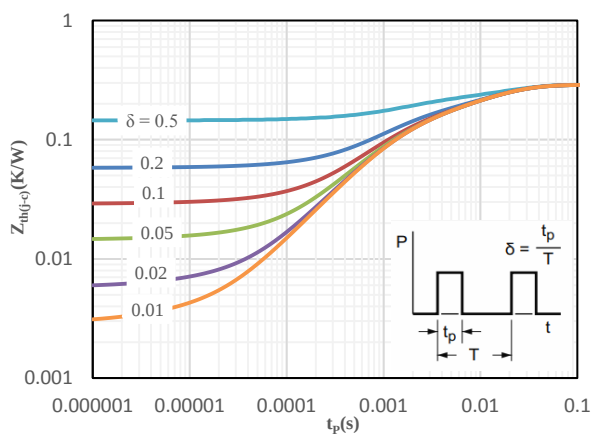


Fig 15 Maximum transient thermal impedance
(TO-220AB / TO-263)

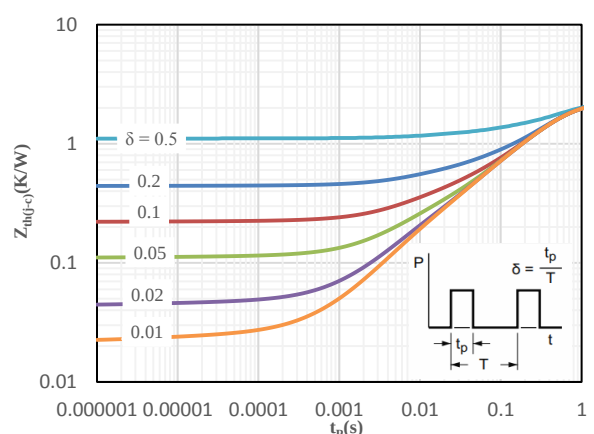
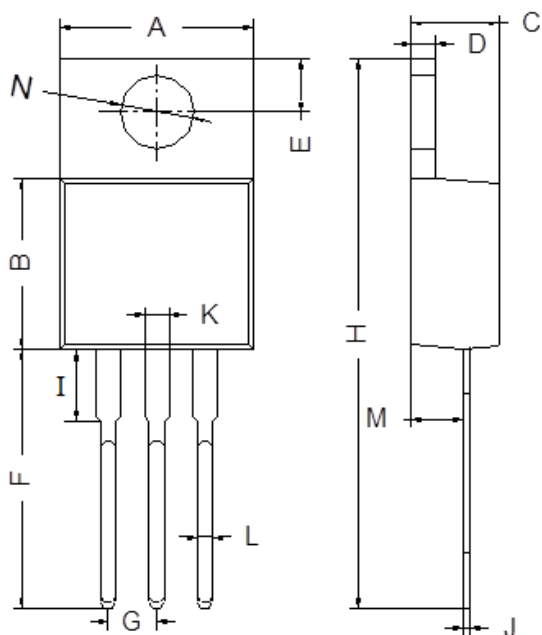
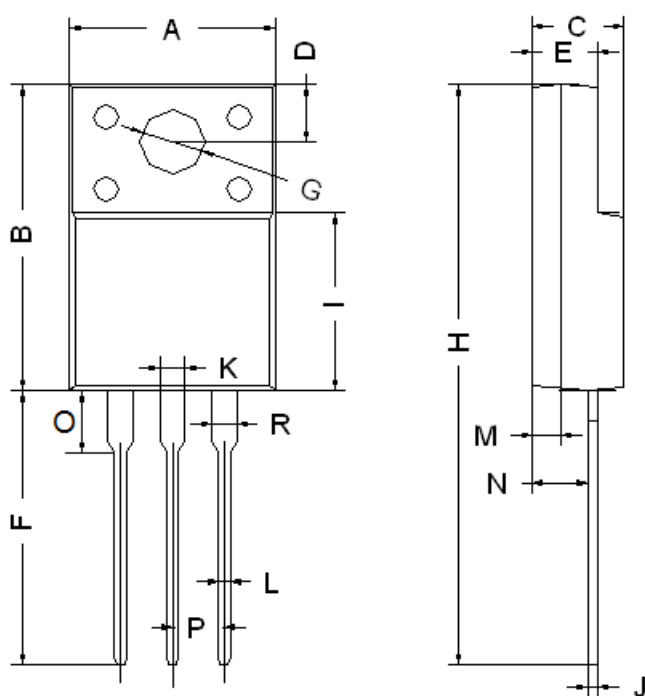


Fig 16 Maximum transient thermal impedance
(ITO-220AB)

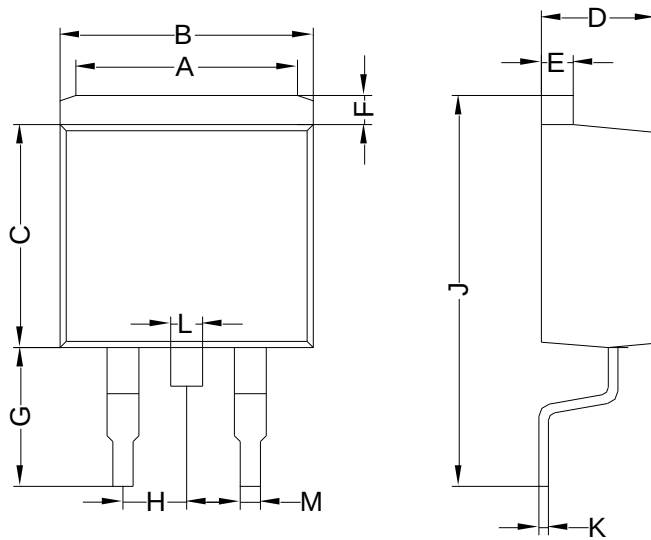
Package Outline Dimensions (Unit: mm)



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



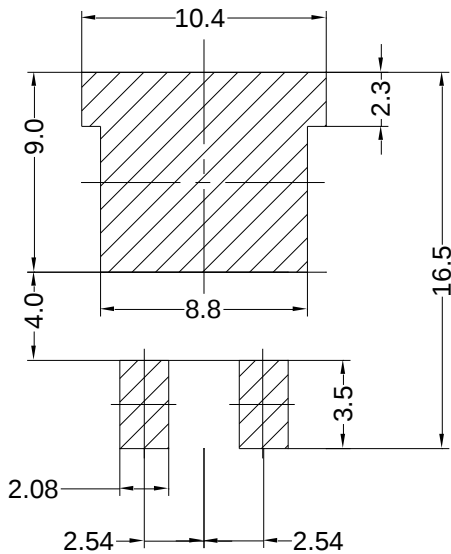
ITO-220AB		
Dimension	Min.	Max.
A	9.90	10.30
B	14.80	15.20
C	4.30	4.70
D	2.50	2.90
E	2.80	3.30
F	13.00	13.60
G	3.10	3.30
H	28.00	28.60
I	7.90	8.90
J	0.40	0.60
L	0.70	0.90
M	1.30	1.50
N	2.60	2.80
O	2.60	3.10
P	2.45	2.65
K/R	1.10	1.30



TO-263		
Dimension	Min.	Max.
A	6.00	8.00
B	9.90	10.30
C	8.50	9.10
D	4.37	4.77
E	1.07	1.47
F	1.07	1.47
G	5.34	5.74
H	2.44	2.64
J	15.30	15.90
K	0.28	0.48
L	1.17	1.37
M	0.71	0.91

Mounting Pad Layout (Unit: mm)

TO-263



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