

Features

- High breakdown voltage to 650V for improved reliability
- Max junction temperature 175°C
- Short Circuit Rated
- Very low saturation voltage
- Soft current turn-off waveforms

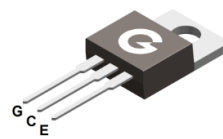
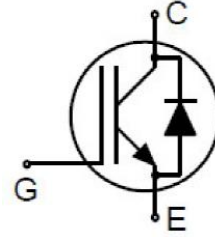
HF

Applications

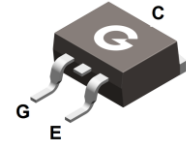
- Soft switching applications
- Air conditioning
- Motor drive inverter

Mechanical Data

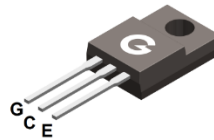
- Case: TO-220AB, TO-263, ITO-220AB
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208



TO-220AB



TO-263



ITO-220AB

Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
GKP20N65EH3	TO-220AB	50 pcs / Tube	KP20N65EH3
GKB20N65EH3	TO-263	50 pcs / Tube or 800 pcs / Tape & Reel	KB20N65EH3
GKF20N65EH3	ITO-220AB	50 pcs / Tube	KF20N65EH3

Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-to-Emitter Voltage	V _{CES}	650	V
Gate-Emitter Voltage	V _{GES}	±20	V
DC Collector Current (T _C = 25°C, limited by maximum T _J)	I _C	40	A
DC Collector Current (T _C = 100°C, limited by maximum T _J)		20	A
Diode Continuous Forward Current (T _C = 25°C, limited by maximum T _J)	I _F	40	A
Diode Continuous Forward Current (T _C = 100°C, limited by maximum T _J)		20	A
Pulsed Collector Current (Pulse width limited by maximum T _J , V _{GE} = 15V)	I _{CM}	60	A
Short Circuit Withstand Time (V _{GE} = 15V, V _{CE} ≤ 400V)	T _{SC}	5	μs
Soldering Temperature, Wave Soldering 1.6mm (0.063in.) from Case for 10s	T _{sold}	260	°C

Thermal Characteristics

Parameter	Symbol	Value	Unit
Power Dissipation (TO-220AB, T _C = 25°C)	P _D	125	W
Power Dissipation (TO-263, T _C = 25°C)		125	W
Power Dissipation (ITO-220AB, T _C = 25°C)		30.6	W
Thermal Resistance Junction-to-Case, IGBT(TO-220AB, TO-263)	R _{θJC}	1.2	°C/W
Thermal Resistance Junction-to-Case, IGBT (ITO-220AB)		4.9	°C/W
Thermal Resistance Junction-to-Case, Diode (TO-220AB, TO-263)		2.38	°C/W
Thermal Resistance Junction-to-Case, Diode (ITO-220AB)		5.8	°C/W
Thermal Resistance Junction-to-Air (TO-220AB, TO-263)	R _{θJA}	62.5	°C/W
Thermal Resistance Junction-to-Air (ITO-220AB)		62.5	°C/W
Operating Junction Temperature Range	T _J	-40 ~ +175	°C
Storage Temperature Range	T _{STG}	-55 ~ +175	°C

Electrical Characteristics of the IGBT (@ T_J = 25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
V _{(BR)CES}	Collector-Emitter Breakdown Voltage	V _{GE} = 0V, I _C = 1mA	650	-	-	V
I _{CES}	Collector-Emitter Leakage Current	V _{CE} = 650V, V _{GE} = 0V	-	-	40	μA
I _{GES}	Gate to Emitter Leakage Current	V _{GE} = ±20V, V _{CE} = 0V	-	-	±200	nA
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} = 15V, I _C = 20A	-	1.95	2.25	V
V _{GE(th)}	Gate Threshold Voltage	V _{CE} = V _{GE} , I _C = 250μA	4.4	5.4	6.4	V
g _{fs}	Transconductance	V _{CE} = 20V, I _C = 15A	-	10	-	S
Dynamic Characteristics						
Q _G	Total Gate-Charge	V _{CC} = 520V, V _{GE} = 15V, I _C = 20A	-	45	-	nC
C _{ies}	Input Capacitance	V _{CE} = 25V V _{GE} = 0V f = 1MHz	-	1050	-	pF
C _{oes}	Output Capacitance		-	50	-	
C _{res}	Reverse Transfer Capacitance		-	20	-	
I _{C(SC)}	Short Circuit Collector Current	V _{GE} = 15V, t _{sc} ≤ 5μs V _{CC} = 400V, T _J = 25°C	-	150	-	A
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{CE} = 400V V _{GE} = 0/15V I _C = 20A R _G = 20Ω T _J = 25°C	-	20	-	ns
t _r	Turn-on Rise Time		-	40	-	
t _{d(off)}	Turn-Off Delay Time		-	60	-	
t _f	Turn-Off Fall Time		-	75	-	
E _{on}	Turn-On Switching Loss	T _J = 25°C	-	0.47	-	mJ
E _{off}	Turn-Off Switching Loss		-	0.10	-	

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Dynamic Characteristics						
V_{FM}	Diode Forward Voltage	$I_F = 20\text{A}, V_{GE} = 0\text{V}$	-	1.9	-	V
t_{rr}	Reverse recovery time	$V_R = 300\text{V}, I_F = 15\text{A}$ $di/dt = 200\text{A}/\mu\text{s}$	-	50	-	ns
Q_{rr}	Reverse recovery charge		-	83	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	4	-	A

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

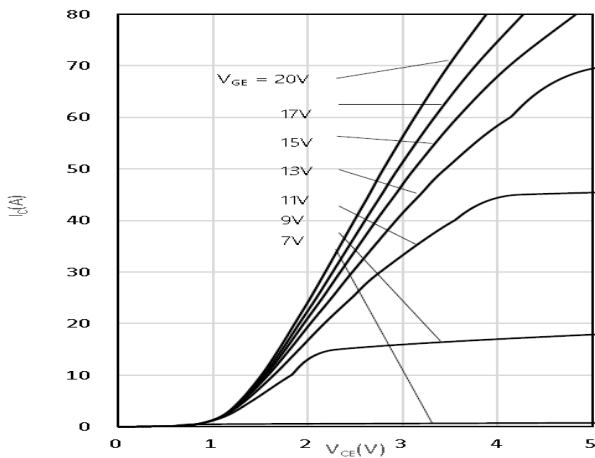


Fig 1 Typical Output Characteristics

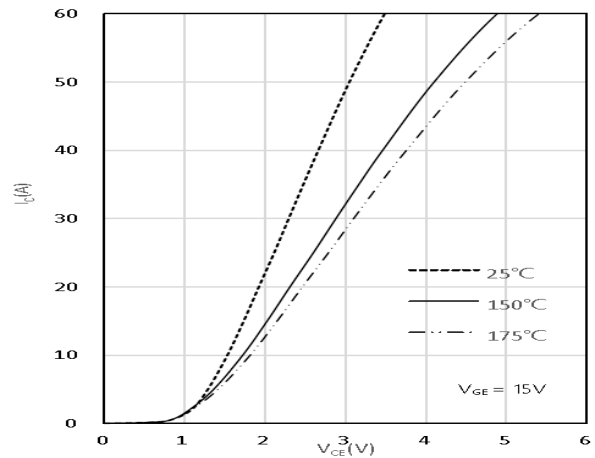


Fig 2 Saturation Voltage Characteristics

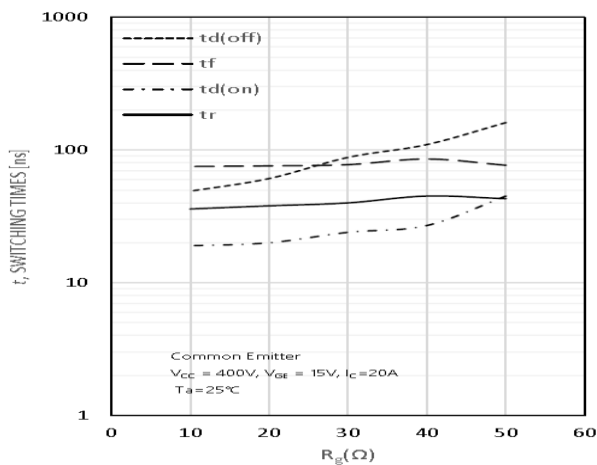


Fig 3 Switching Times vs. Gate Resistor

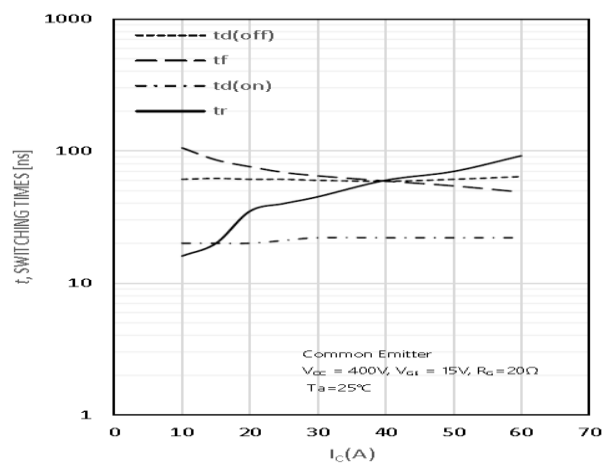


Fig 4 Switching Times vs. Collector Current

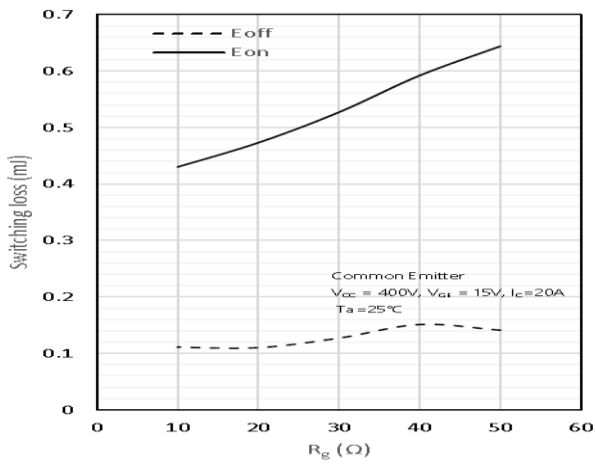


Fig 5 Switching Loss vs. Gate Resistor

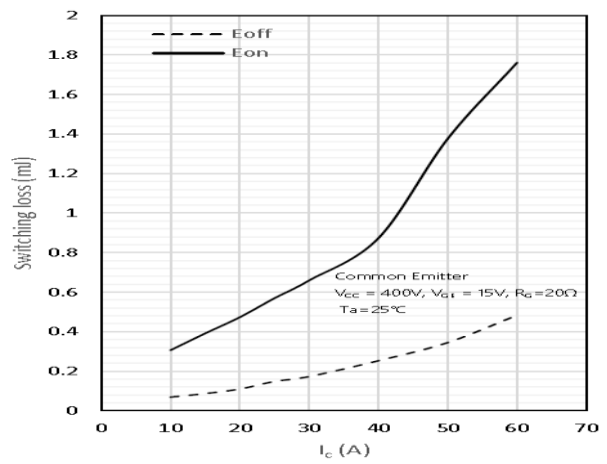


Fig 6 Switching Loss vs. Collector Current

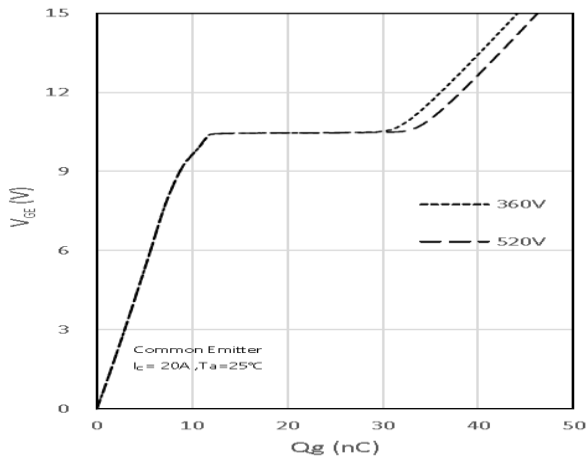


Fig 7 Gate-Charge Characteristics

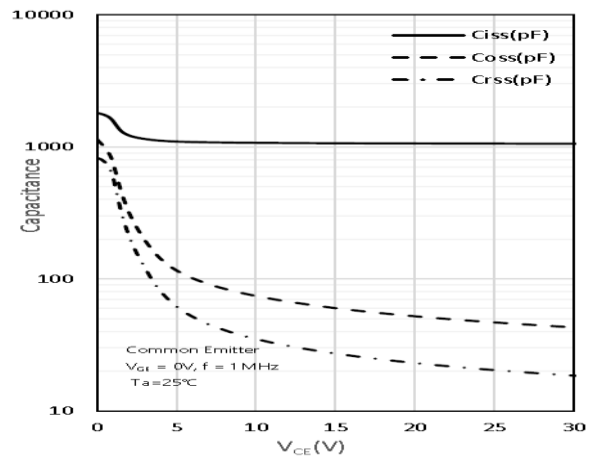


Fig 8 Capacitance Characteristics

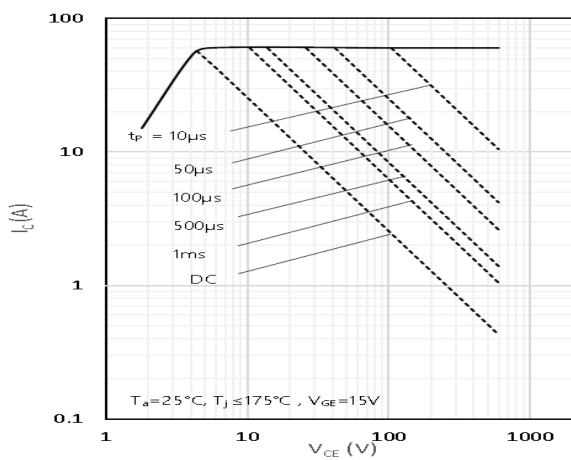


Fig 9 FBSOA Characteristics (ITO-220AB)

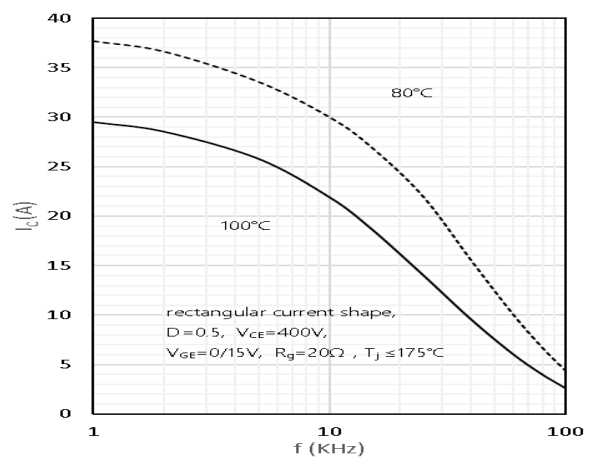


Fig 10 Load Current vs. Frequency (ITO-220AB)

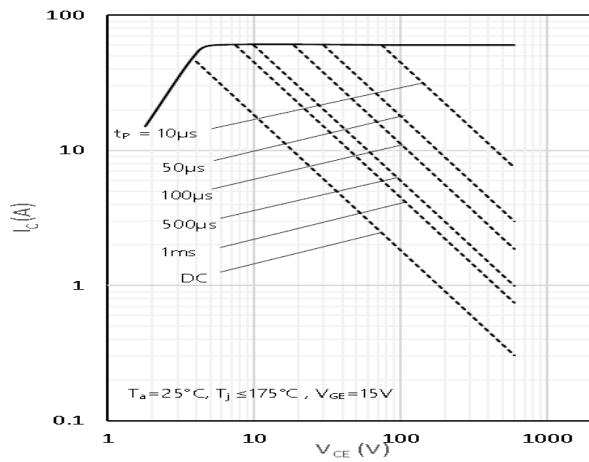


Fig 11 FBSOA Characteristics (TO-220AB/TO-263)

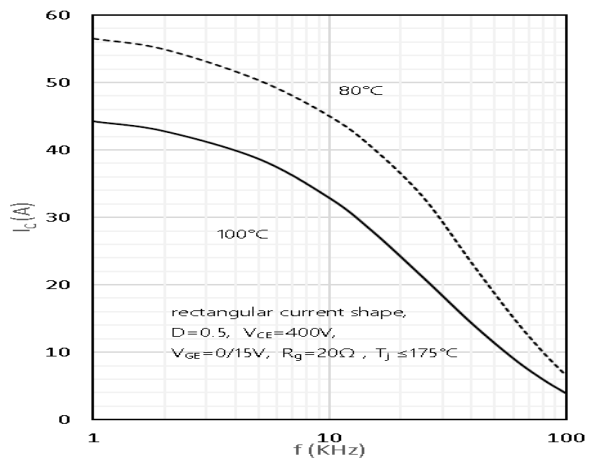
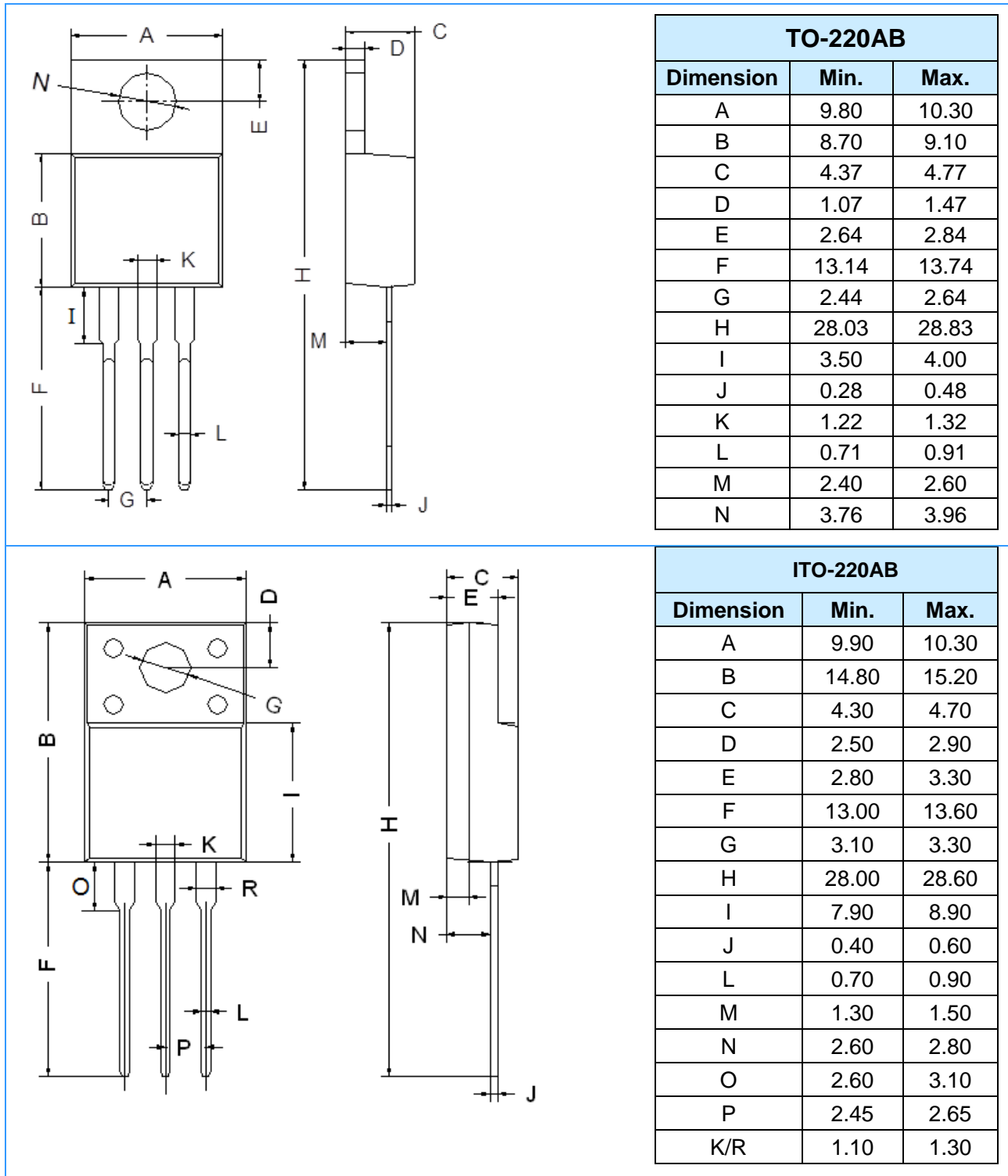
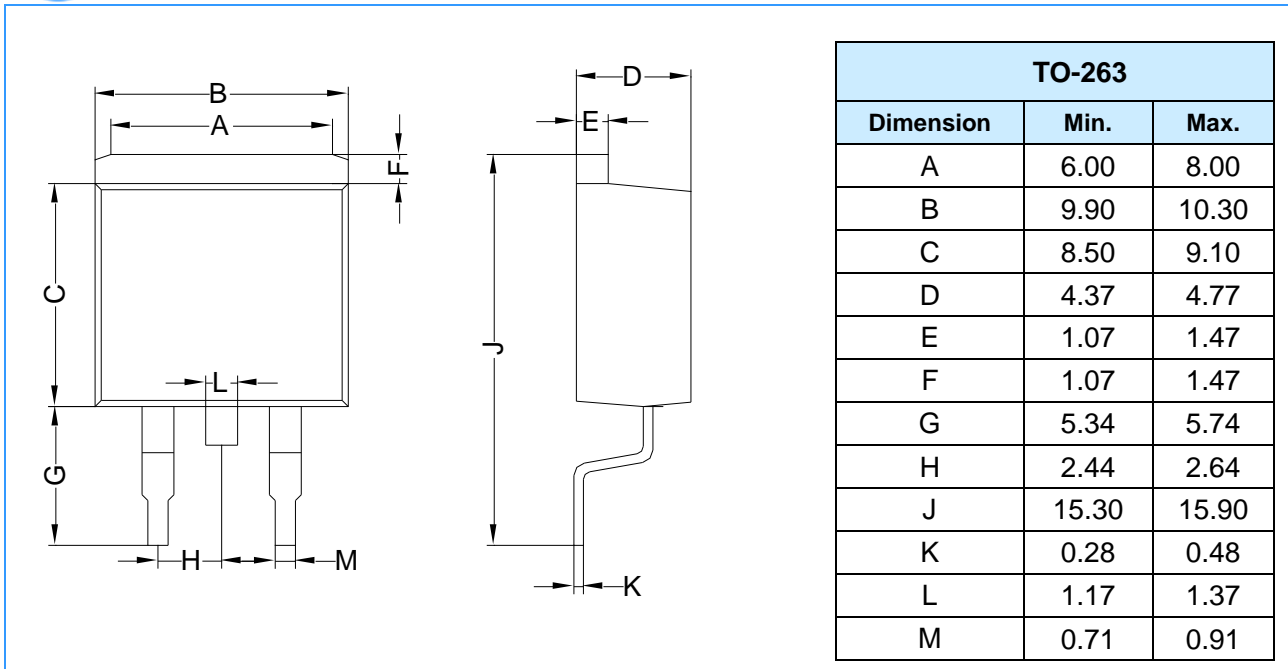


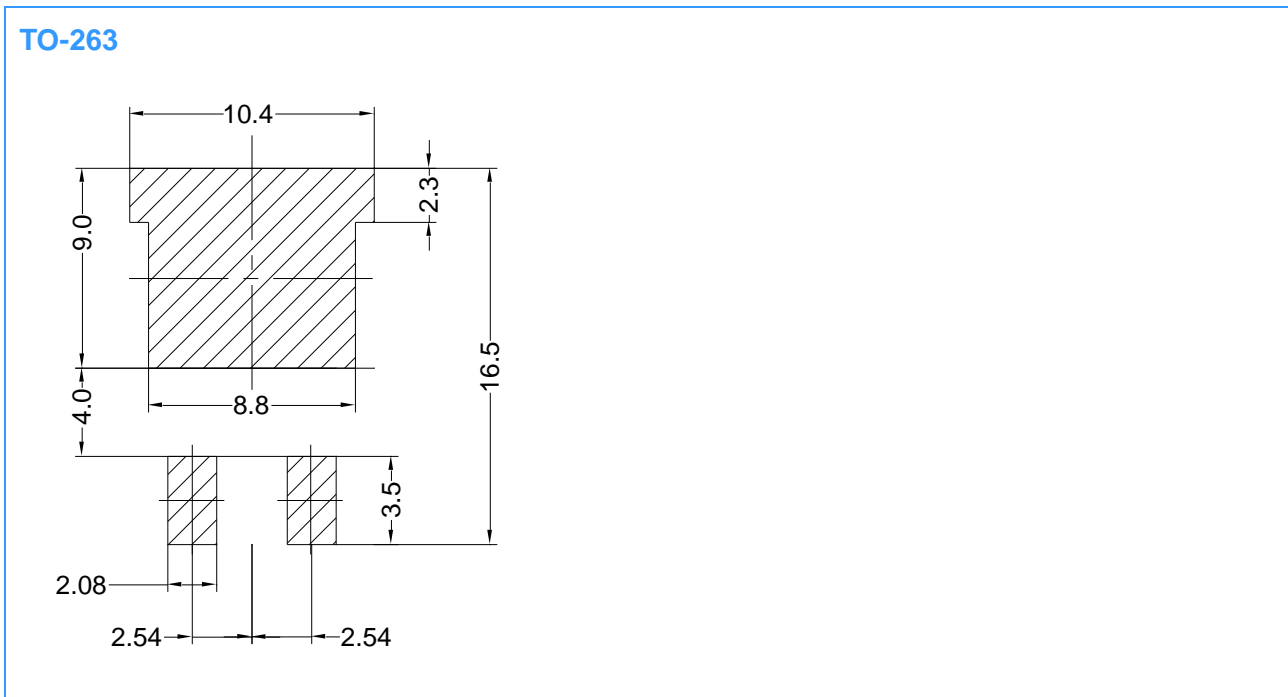
Fig 12 Load Current vs. Frequency
(TO-220AB/TO-263)

Package Outline Dimensions (Unit: mm)





Mounting Pad Layout (Unit: mm)



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