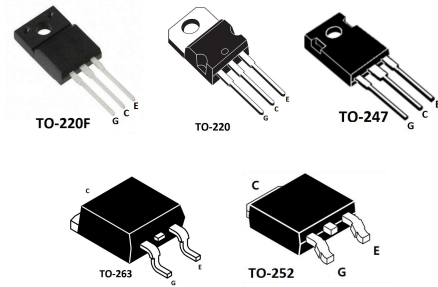


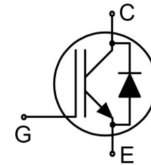
Features

- Low gate charge
- Trench FS Technology,
- saturation voltage: $V_{CE(sat)}$,
typ = 1.6V, $I_C=20A$ and $T_C=25^\circ C$
- RoHS product



Applications

- General purpose inverters
- UPS



Absolute Ratings ($T_C=25^\circ C$)

Parameter	Symbol		MSG20T65FQS	MSG20T65FQT/E/D	MSG20T65FQC	Unit
Collector-Emitter Voltage	Vces		650			V
Gate-Emitter Voltage	V _{GES}		±20			V
Collector Current-continuous	I _C	T _C =25℃	40			A
		T _C =100℃	20			A
Collector Current-pulse(note 1)	I _{CM}		80			A
Diode RMS forward current	I _F	T _C =25℃	40			A
		T _C =100℃	20			A
Surge non repetitive forward current tp=10ms sinusoidal	I _{FSM}		80			A
Short Circuit withstand time	t _{sc}		10			μs
Short Circuit Current	I _{SC}		90			A
Power Dissipation (TC=25℃)	P _D		35	156	162	W
Operating Temperature Range	T _J		-40~+175			℃
Storage Temperature Range	T _{STG}		-55~+150			℃
Maximum Lead Temperature for Soldering Purposes	T _L		300			℃

*Collector current limited by maximum Junction temperature

Thermal Characteristic

Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
Off-Characteristics						
Collector-Emitter Voltage	BV_{CES}	$I_C=500\mu A, V_{GE}=0V$	650	-	-	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_C=25^{\circ}C$	-		10	μA
Gate-body leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$	-	-	± 200	nA
On-Characteristics						
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_c=250uA$	4.5	-	6.5	V
Collector-Emitter saturation Voltage	V_{CESAT}	$V_{GE}=15V, I_c=20A, T_C=25^{\circ}C$	-	1.6	2.0	V
		$T_c=125^{\circ}C$		1.75	2.15	
		$T_C=175^{\circ}C$		1.9	2.3	
Short Collector current	$I_c(sc)$	$V_{GE}=15V$ $V_{CE}=360V$ tsc< 10us $T_c\leq 25^{\circ}C$		116.7		A
Dynamic Characteristics						
Input capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1.0MHz, T_C=25^{\circ}C$	-	1500	-	pF
Output capacitance	C_{oes}		-	128	-	pF
Reverse transfer capacitance	C_{res}		-	28.7	-	pF
Switching Characteristics						
Turn-On delay time	$t_{d(on)}$	$V_{CE}=400V, I_c=20A, R_G=10\Omega, V_{GE}=15V$ $T_c=25^{\circ}C$ Inductive Load	-	16	-	ns
Turn-On rise time	t_r		-	56	-	ns
Turn-off delay time	$t_{d(off)}$		-	52	-	ns
Turn-off Fall time	t_f		-	82	-	ns
Turn-on energy	E_{on}		-	0.79	-	mJ
Turn-off energy	E_{off}		-	0.3	-	mJ
Total switching Energy	E_{total}		-	1.09	-	mJ
Turn-On delay time	$t_d(on)$	$V_{CE}=400V, I_c=20A, R_G=10\Omega, V_{GE}=15V$ $T_c=175^{\circ}C$ Inductive Load	-	14	-	ns
Turn-On rise time	t_r		-	54	-	ns
Turn-off delay time	$t_d(off)$		-	76	-	ns
Turn-off Fall time	t_f		-	146	-	ns

Turn-on energy	E_{on}		-	0.8	-	mJ
Turn-off energy	E_{off}		-	0.49	-	mJ
Total switching Energy	E_{total}		-	1.3	-	mJ
Total Gate Charge	Q_g	VCE=400V, Ic=20A RG=10Ω, VGE=15V TC=25°C (note3,4)	-	43.9	-	nC
Gate to emitter charge	Q_{ge}		-	10.0	-	
Gate to collector charge	Q_{gc}		-	18.9	-	
Gate resistance	R_g	f=1MHz, open collector	-	1.8	-	Ω
Anti-Parallel Diode Characteristics and Maximum Ratings						
Diode Forward Voltage	V_F	VGE=0V, IF=20A. TC=25°C	-	1.4	-	V
		TC=125°C	-	1.2	-	V
		TC=175°C	-	1.0	-	V
Diode Reverse recovery time	t_{rr}	VGE=0V, IF=20A dl=dt=100A/us (note 4) TC=25°C	-	254	-	ns
Reverse recovery charge	Q_{rr}		-	347	-	nC
Diode Reverse recovery Current	I_{rrm}		-	2.7	-	A
Diode Reverse recovery time	t_{rr}	VGE=0V, IF=20A dl=dt=100A/us (note 4) TC=175°C	-	429	-	ns
Reverse recovery charge	Q_{rr}		-	1010	-	nC
Diode Reverse recovery Current	I_{rrm}		-	4	-	A

Thermal Characteristics

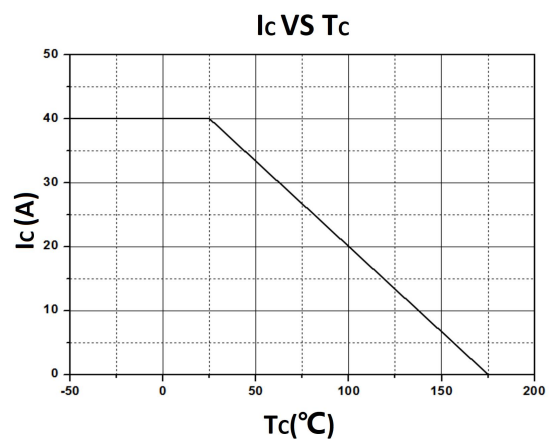
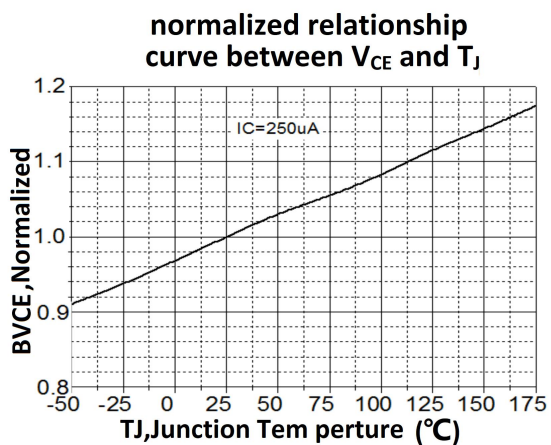
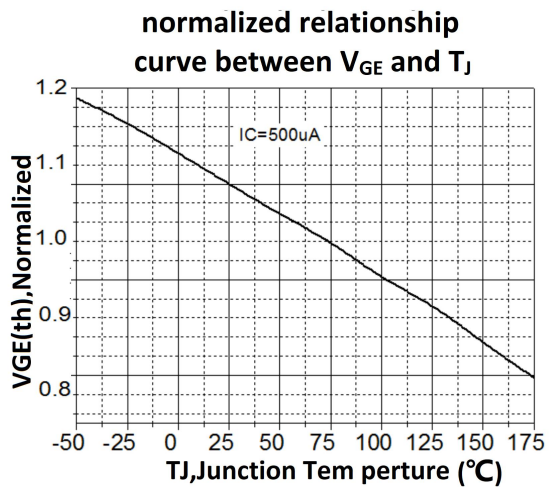
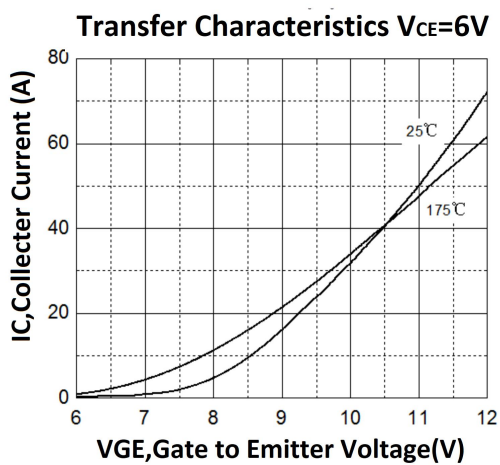
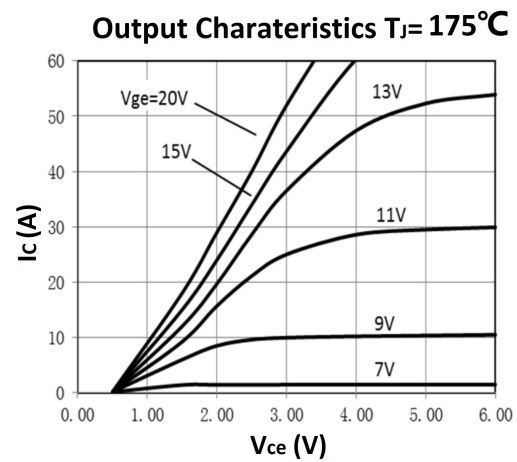
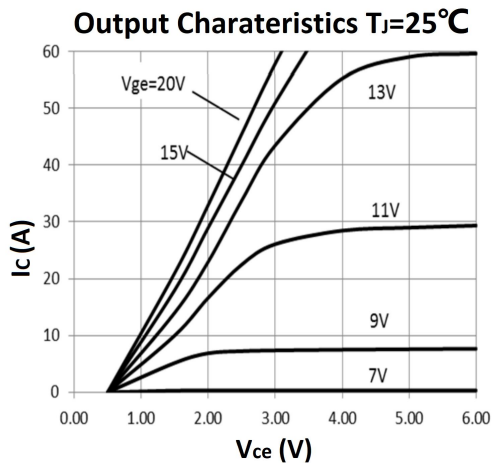
Parameter	Symbol	MSG20T65FQS	MSG20T65FQT/E/D	MSG20T65FQC	Unit
IGBT Thermal Resistance, Junction to Case	$R_{th(j-c)}$	3.57	0.77	0.77	°C/W
FRD Thermal Resistance, Junction to Case	$R_{th(j-c)}$	7.7	2.05	2.05	°C/W
Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	62.5	62.5	33.8	°C/W

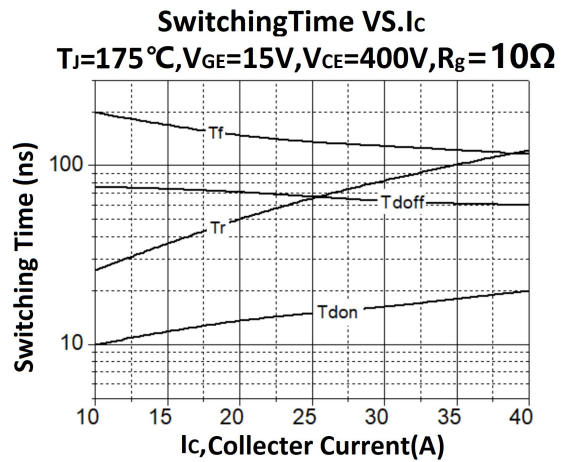
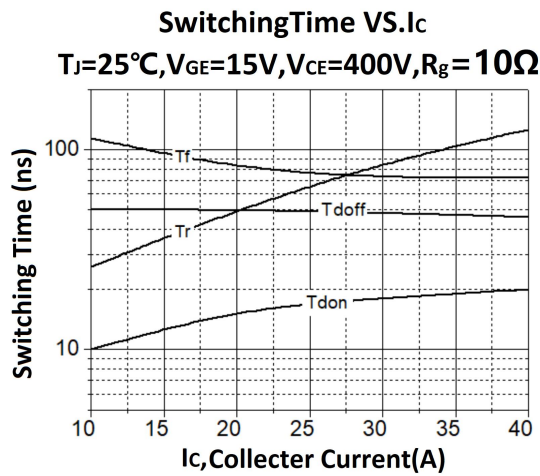
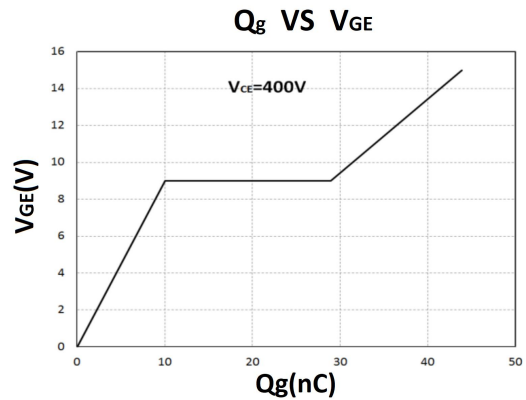
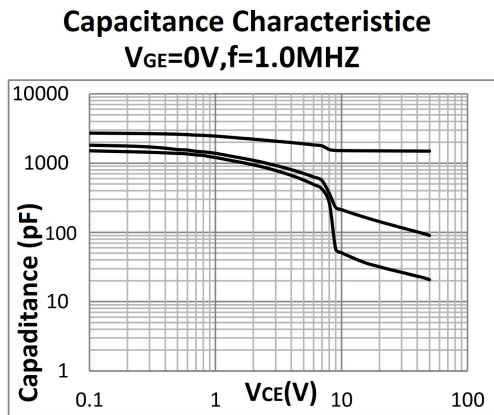
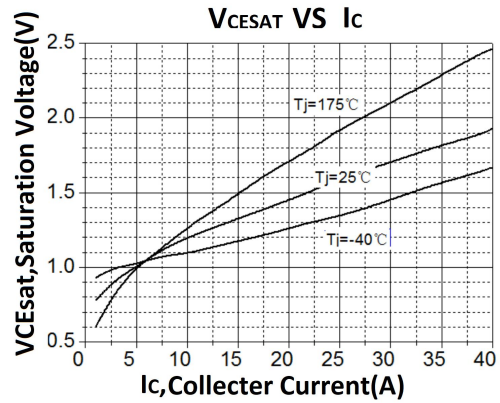
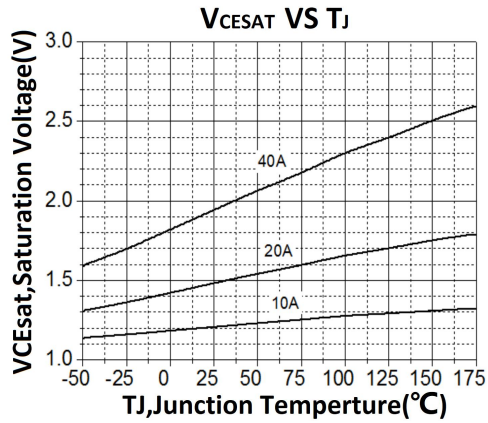
Order Message

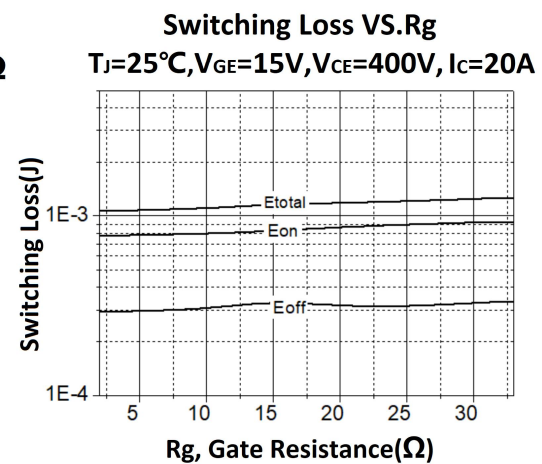
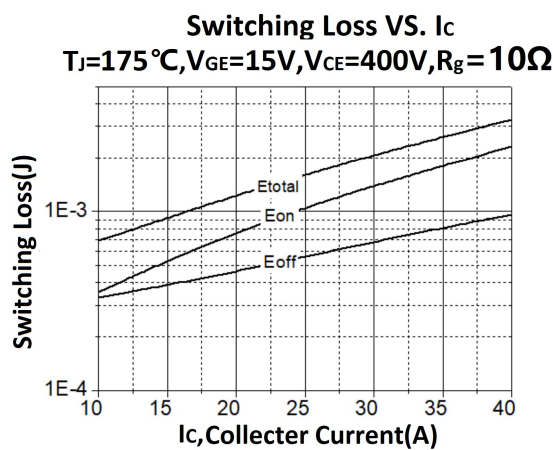
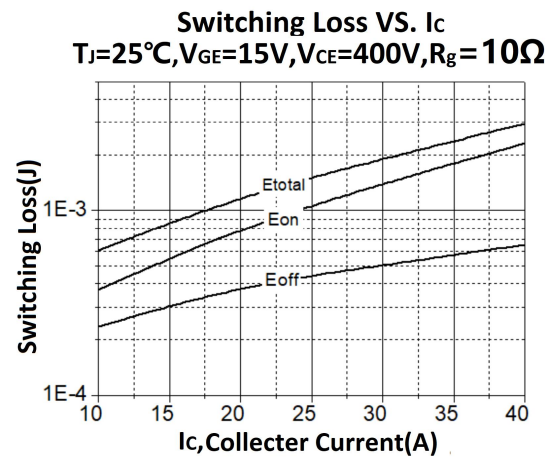
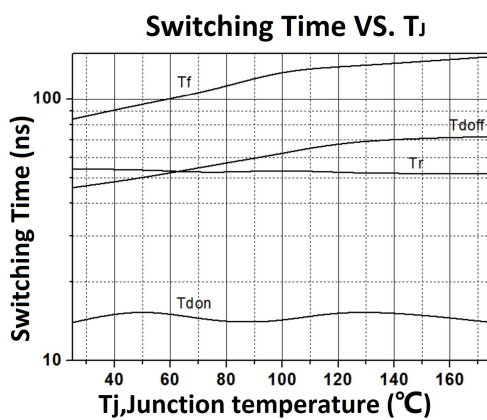
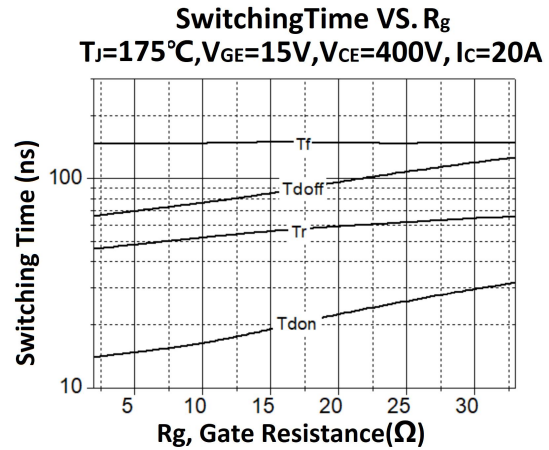
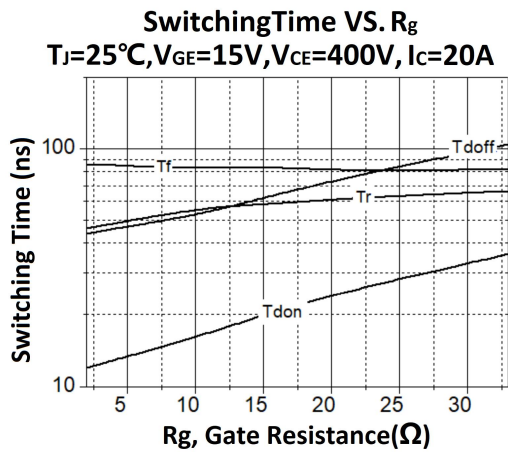
Order codes	Package	Packaging
MSG20T65FQS	TO-220F	Tube
MSG20T65FQT	TO-220	Tube

MSG20T65FQC	TO-247	Tube
MSG20T65FQE	TO-263	
MSG20T65FQD	TO-252	

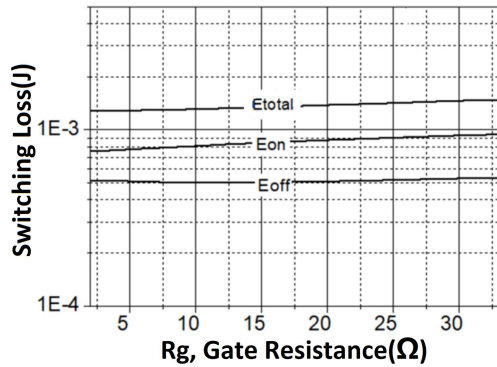
Electrical Characteristics(curves)



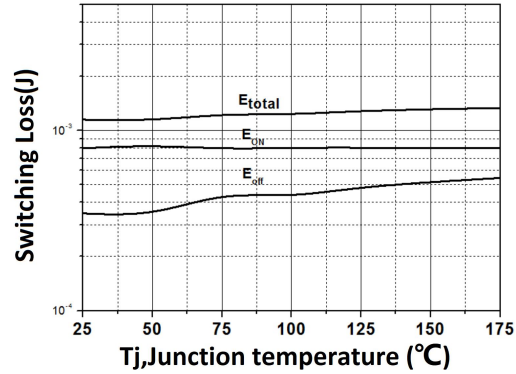




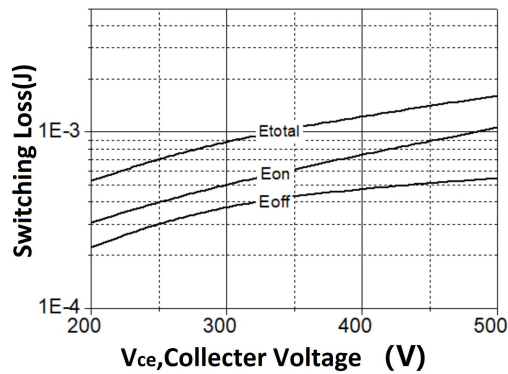
Switching Loss VS. R_g
 $T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=20\text{A}$



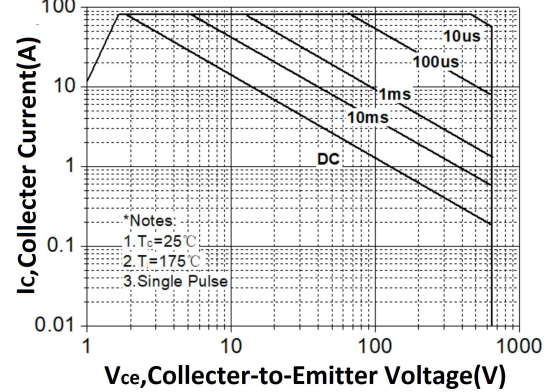
Switching Loss VS. T_J
 $V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=20\text{A}, R_g=10\Omega$



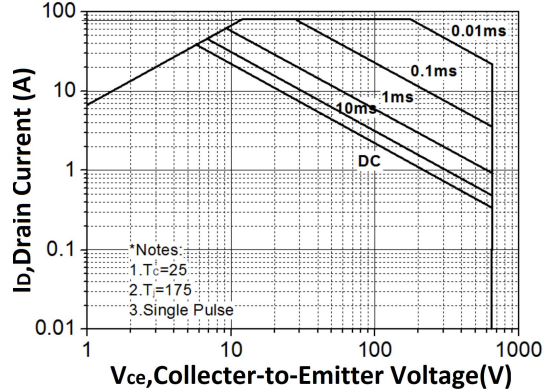
Switching Loss VS. $V_{CE(V)}$
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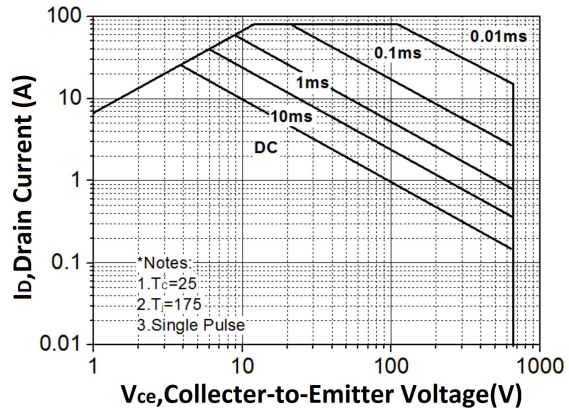
Safe Operating Area TO-247

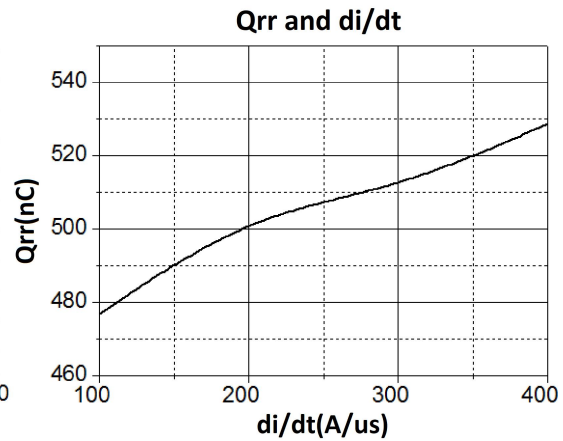
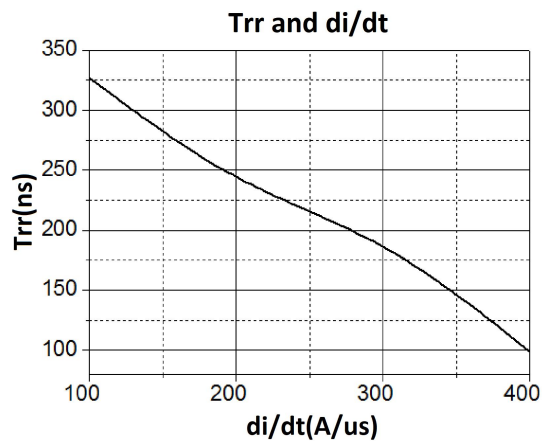
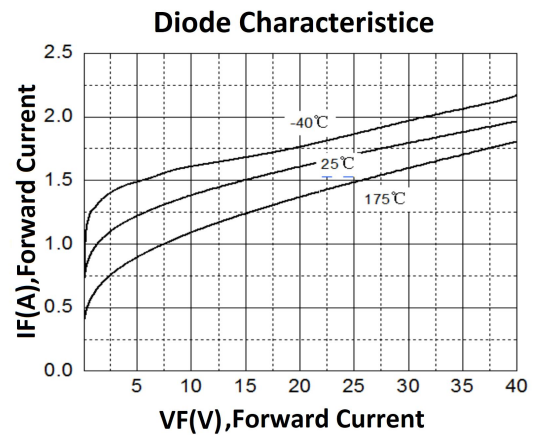
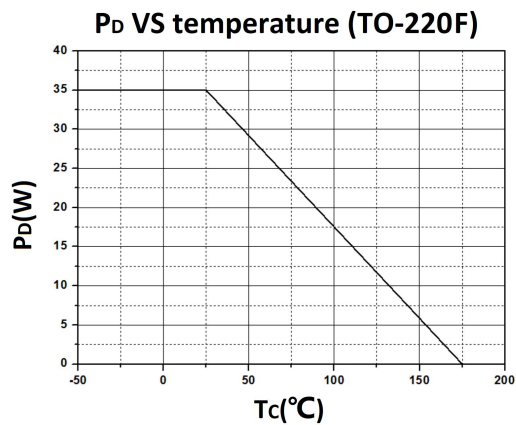
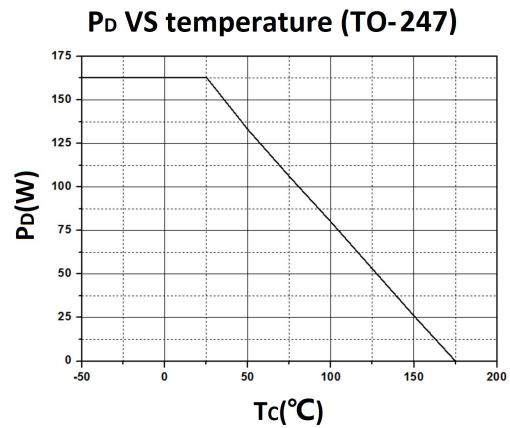
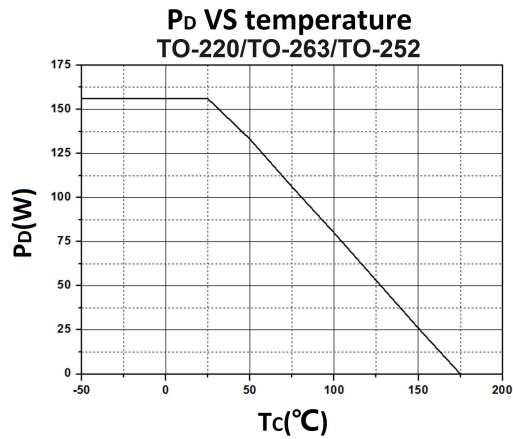


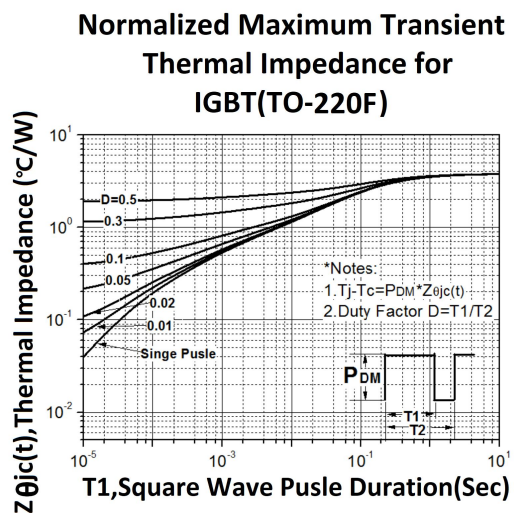
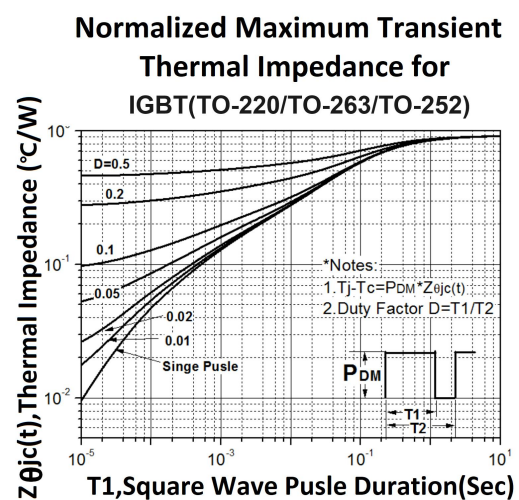
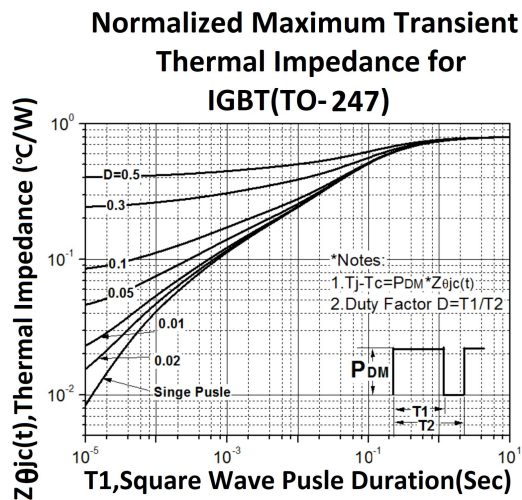
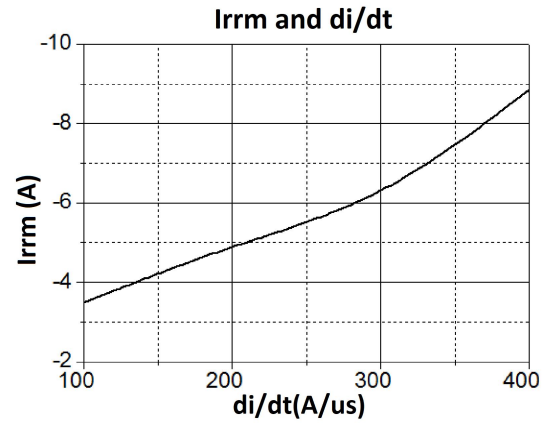
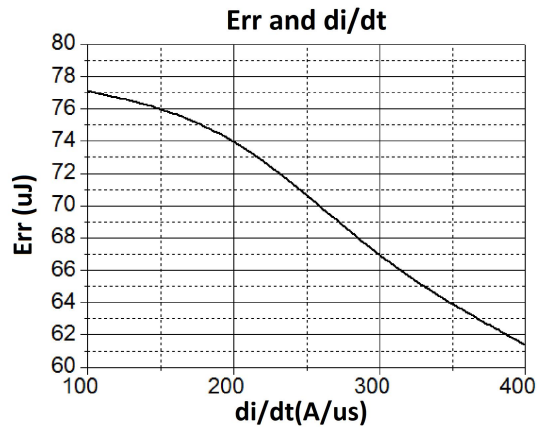
**Safe Operating Area
 TO-220/TO-263/TO-252**



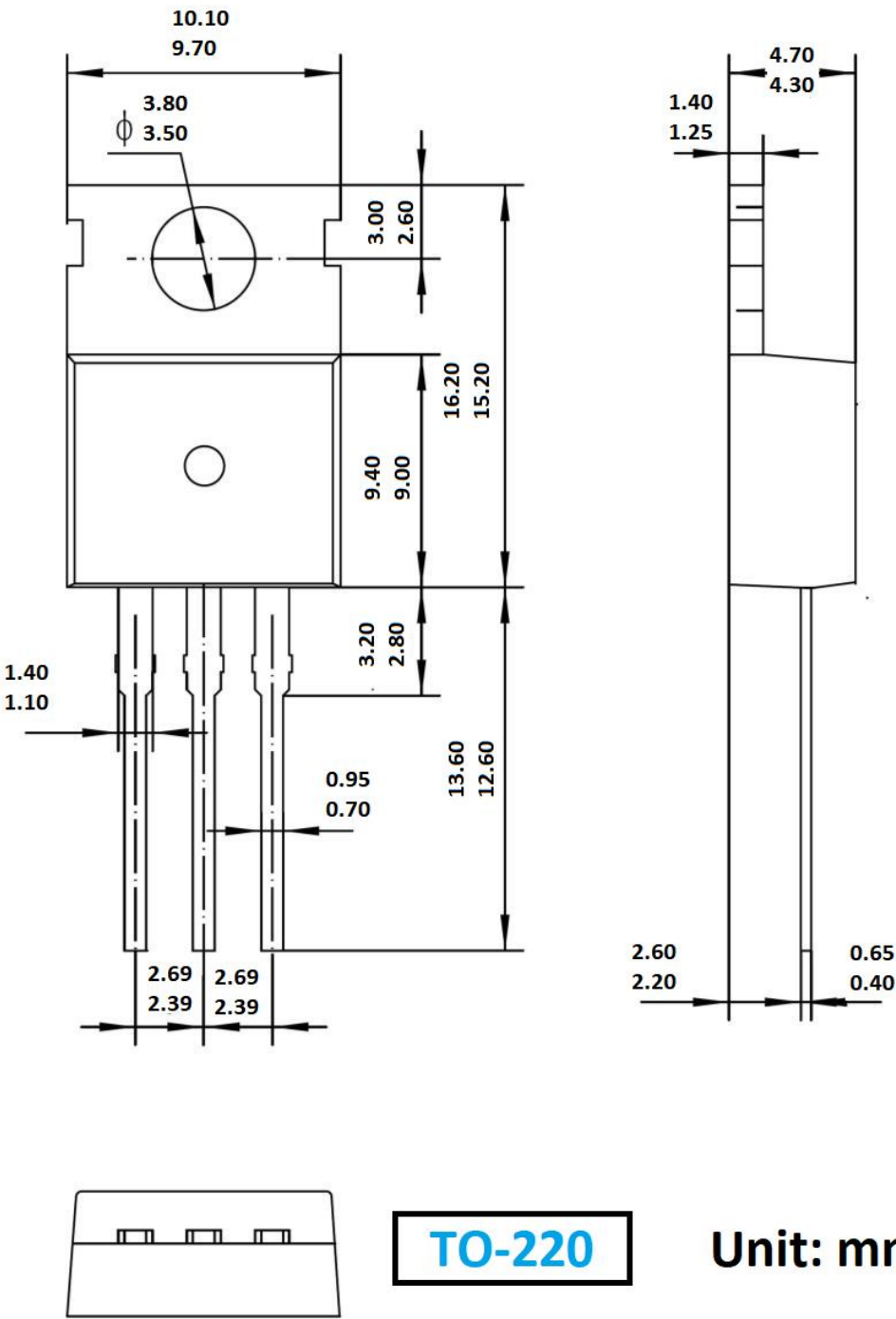
Safe Operating Area TO-220F

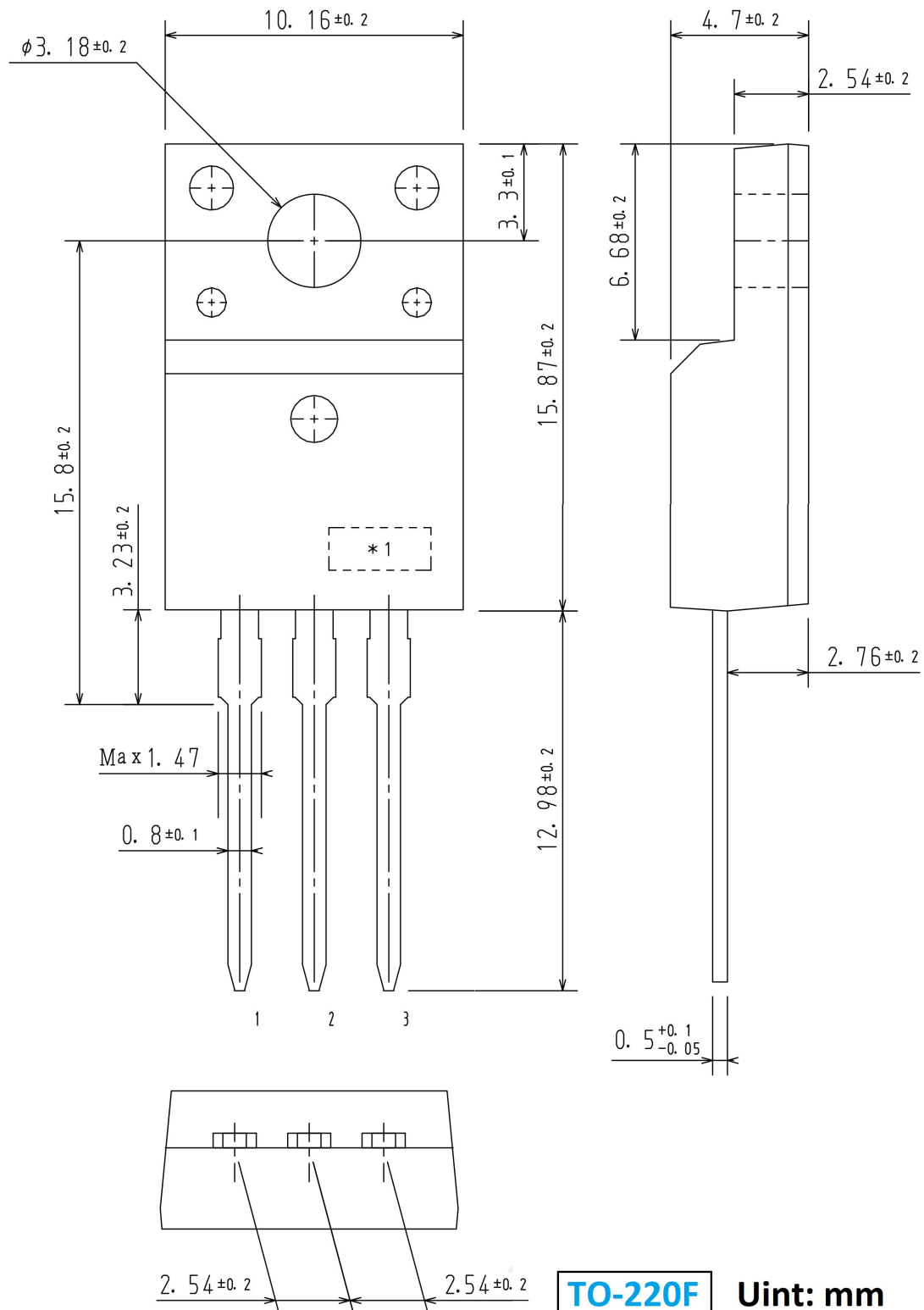


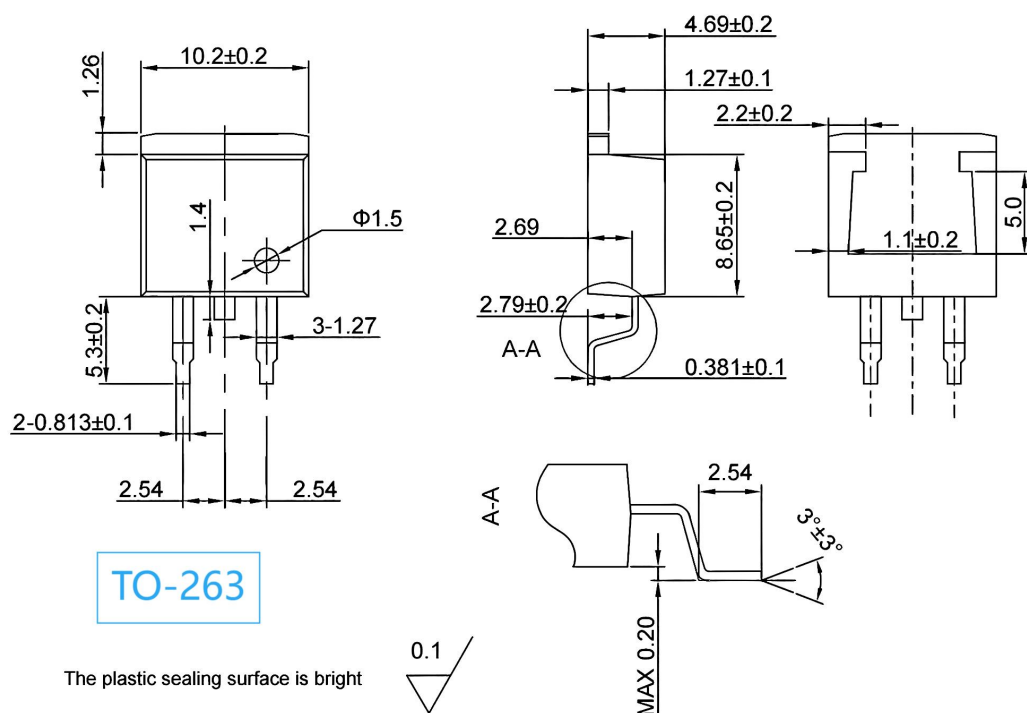
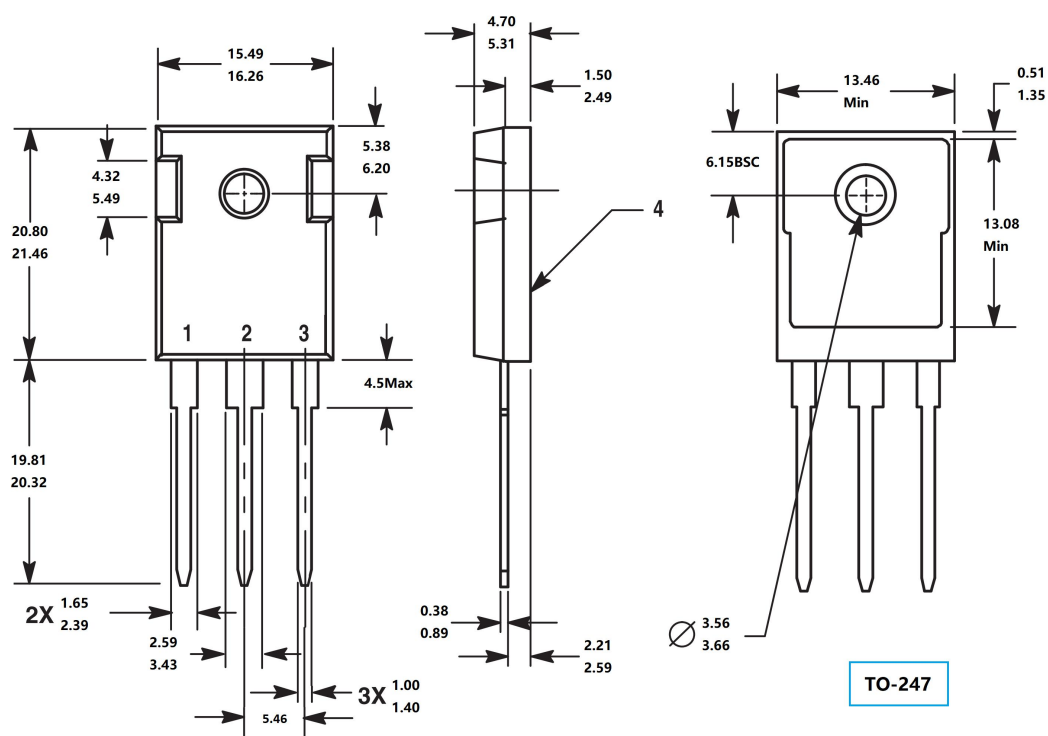




Package Mechanical DATA







Notes:

1. Unmarked tolerance $\pm 0.15\text{mm}$; unmarked $R < 0.15\text{mm}$
2. The resin body is not allowed to have defects, shrinkage holes, cracks, bubbles and other harmful defects
3. The drawing indicates that the leg has reinforcement
4. Unit : mm

