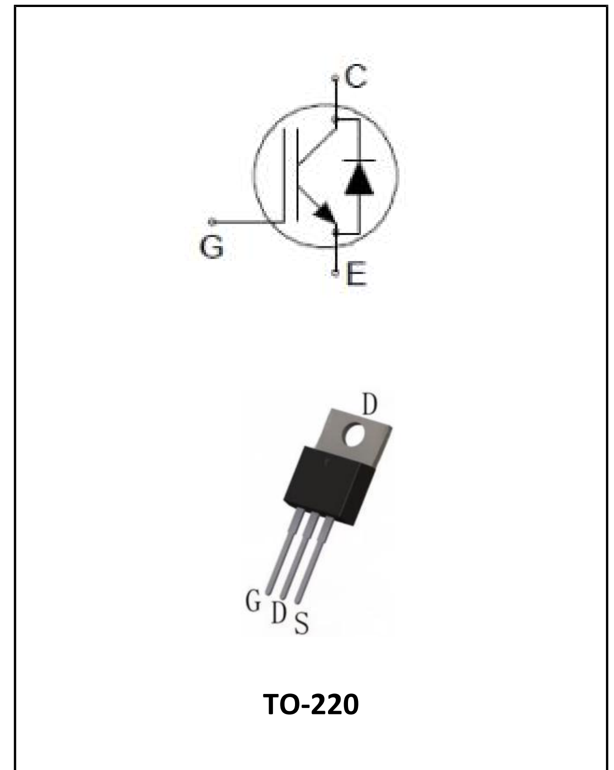
MLG20T65FUL

Description

MLG20T65FUL is obtained by advanced Trench Field Stop (T-FS) technology which is characteristic with low VCE(sat) , optimized switching performance and low gate charge Qg. The IGBT is suitable device for BLDC, UPS, and low VCE(sat) applications.



TO-220

KEY CHARACTERISTICS

Parameter	Value	Unit
V_{CES}	650	V
I_C	20	A
$V_{CE(sat).typ}$	1.55	V

FEATURES

①Fast Switching
②Low VCE(sat)
③Positive temperature coefficient
④Very soft, fast recovery anti-parallel diode
⑤RoHS product

APPLICATIONS

①UPS
②Motor drives
③PFC
④Portable power station

ORDERING INFORMATION

Ordering Codes	Package	Product Code	Packing
MLG20T65FUL	TO-220	MLG20T65FUL	Tube

ABSOLUTE RATINGS

Symbol	Parameter	TO-220	TO-220F	Units
V_{CES}	Collector-Emitter Voltage	650	650	V
I_C	Collector Current @T_C=25°C	40	40	A
	Collector Current @T_C=100°C	20	20	A
I_{CM}	Pulsed Collector Current, tp limited by T_{Jmax}	80	80	A

I_F	Diode Continuous Forward Current @T_C=25°C	40	40	A
	Diode Continuous Forward Current @T_C=100°C	20	20	A
I_{FM}	Diode Maximum Forward Current, limited by T_{Jmax}	40	40	A
V_{GES}	Gate-Emitter Voltage	±30	±30	V
t_{SC}	Short circuit withstand time VGE=15V, VCC≤400V, Allowed number of short circuits<1000,Times between short circuits: ≥ 1.0s,T_J ≤ 175°C	3.0		us
P_D	Power Dissipation @T_C=25°C	136	39	W
T_{Jmax}, T_{stg}	Operating Junction and Storage Temperature Range	175, −55 to 175		℃
T_L	Maximum Temperature for Soldering	260		℃

Thermal characteristics

Symbol	Parameter	TO-220	TO-220F	Units
$R_{\theta JC}$	Junction-to-Case (IGBT)	1.1	3.8	℃/W
$R_{\theta JC}$	Junction-to-Case (Diode)	2.4	6.8	℃/W
$R_{\theta JA}$	Junction-to-Ambient	62.5	78	℃/W

Electrical Characteristics at TC = 25°C, unless otherwise specified

Static Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
V_{CES}	Collector-Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 250μA	650	--	--	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15V,I_C = 20A T_J=25℃ T_J=125℃ T_J=175℃	-- -- --	1.55 1.80 1.90	1.95 -- --	V
$V_{GE(TH)}$	Gate Threshold Voltage	V_{CE} = V_{GE},I_C = 1mA	5.1	5.8	6.5	V
V_F	Diode Forward Voltage	I_F=10A T_J=25℃ T_J=125℃ T_J=175℃	-- -- --	1.60 1.40 1.30	2.20 -- --	V
V_F	Diode Forward Voltage	I_F=20A T_J=25℃ T_J=125℃ T_J=175℃	-- -- --	1.90 1.75 1.65	2.50 -- --	V
I_{CES}	Collector-Emitter Leakage Current	V_{CE} = 650V, V_{GE} = 0V	--	--	4	μA
$I_{GES(F)}$	Gate-Emitter Leakage Current	V_{GE} = +30V	--	--	200	nA
$I_{GES(R)}$	Gate-Emitter Reverse Leakage	V_{GE} = -30V	--	--	-200	nA

Pulse width tp≤300μs, δ≤2%

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	V_{GE}=0V V_{CE}=25V f =1.0MHz	--	892	--	pF
C_{oss}	Output Capacitance		--	43	--	
C_{rss}	Reverse Transfer Capacitance		--	10	--	
Q_G	Gate charge	V_{CC}=520V I_{CE}=20A V_{GE}=15V	--	44	--	nC
Q_{GE}	Gate-emitter charge		--	13	--	
Q_{GC}	Gate-collector charge		--	18	--	
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits, Times between short circuits: ≥ 1.0s	VGE=15.0V,VCC≤400V, tSC≤3us, TJ≤175℃		110		A

IGBT Switching Characteristics, at TJ=25℃

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	I_C =20A V_{CE} = 400V V_{GE} = 15V R_G =10Ω T_J=25°C Inductive Load	--	15	--	ns
tr	Rise Time		--	24	--	
$t_{d(off)}$	Turn-Off Delay Time		--	75	--	
t_f	Fall Time		--	86	--	
E_{on}	Turn-On Switching Loss		--	0.50	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.27	--	
E_{ts}	Total Switching Loss		--	0.77	--	

IGBT Switching Characteristics, at TJ=175℃

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	I_C =20A V_{CE} = 400V V_{GE} = 15V R_G =10Ω T_J=175°C Inductive Load	--	14	--	ns
tr	Rise Time		--	23	--	
$t_{d(off)}$	Turn-Off Delay Time		--	96	--	
t_f	Fall Time		--	128	--	
E_{on}	Turn-On Switching Loss		--	0.54	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.49	--	
E_{ts}	Total Switching Loss		--	1.03	--	

Diode Characteristics, at TJ=25℃

Symbol	Parameter	Test Conditions	Values			Units
			Mi	Typ.	Max.	

T_{rr}	Reverse Recovery Time	I_F=10A, di/dt=200A/us, T_J=25°C	--	66	--	ns
Q_{rr}	Reverse Recovery Charge		--	182	--	nC
I_{rrm}	Reverse Recovery Current		--	4.5	--	A
T_{rr}	Reverse Recovery Time	I_F=20A, di/dt=200A/us, T_J=25°C	--	75	--	ns
Q_{rr}	Reverse Recovery Charge		--	236	--	nC
I_{rrm}	Reverse Recovery Current		--	5.4	--	A

Diode Characteristics, at TJ=175℃

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	I_F=10A, di/dt=200A/us, T_J=175°C	--	122	--	ns
Q_{rr}	Reverse Recovery Charge		--	690	--	nC
I_{rrm}	Reverse Recovery Current		--	10.0	--	A
T_{rr}	Reverse Recovery Time	I_F=20A, di/dt=200A/us, T_J=175°C	--	150	--	ns
Q_{rr}	Reverse Recovery Charge		--	910	--	nC
I_{rrm}	Reverse Recovery Current		--	11.0	--	A

Characteristics Curves

Figure 1. Forward Bias Safe Operating Area for TO220	Figure 2. Forward Bias Safe Operating Area for TO220F

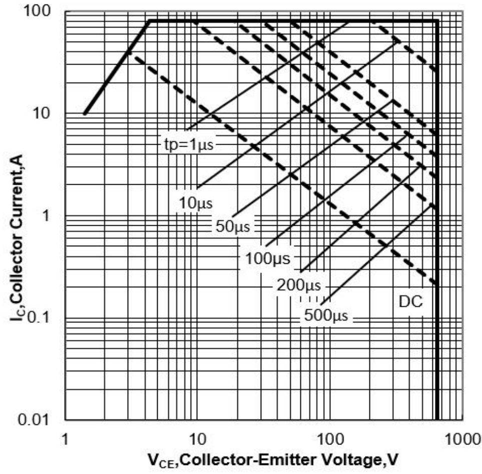
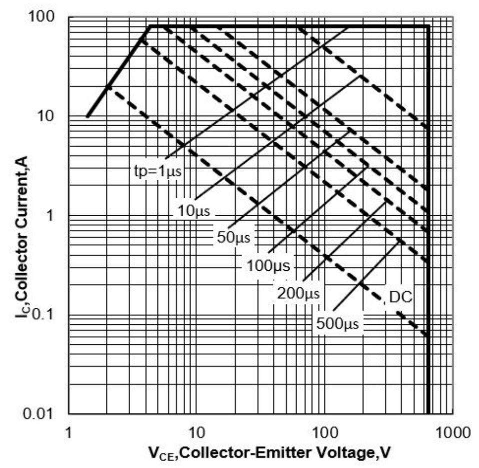

	

Figure 3. Power Dissipation vs Case Temperature for TO220	Figure 4. Power Dissipation vs Case Temperature for TO220F

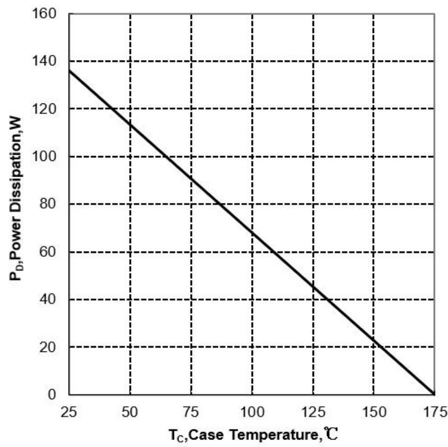
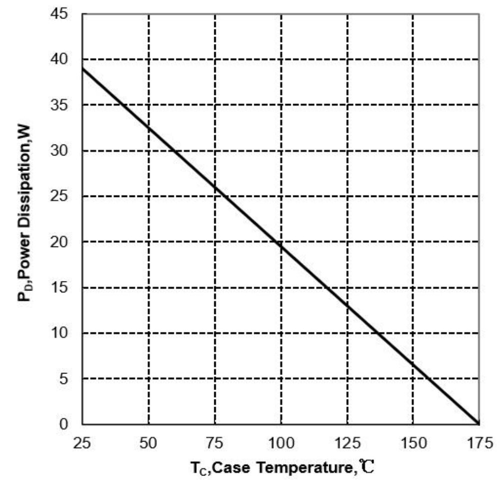

	

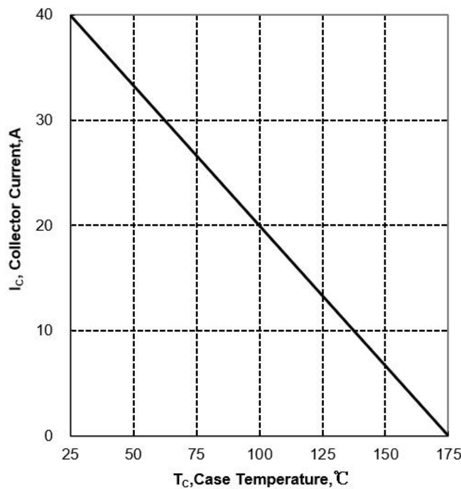
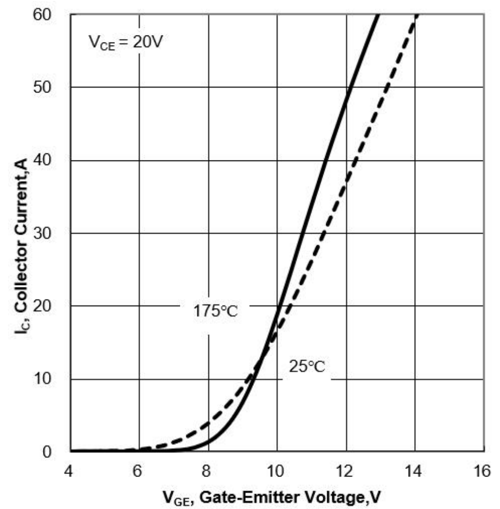
Figure 5. Collector Current vs Case Temperature	Figure 6. Typical Transfer Characteristics
	

Figure 7. Typical Output Characteristics (T_C=25℃)

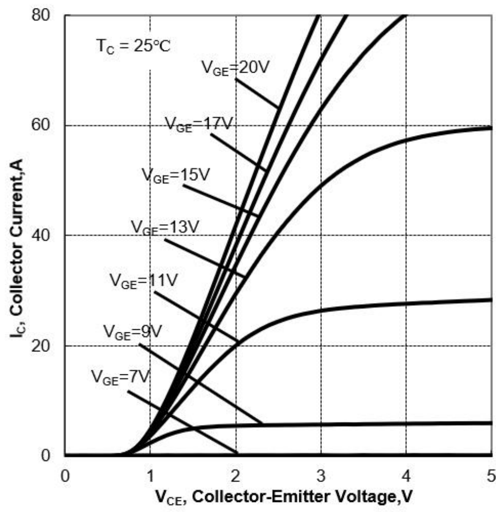


Figure 8. Typical Output Characteristics (T_C=175℃)

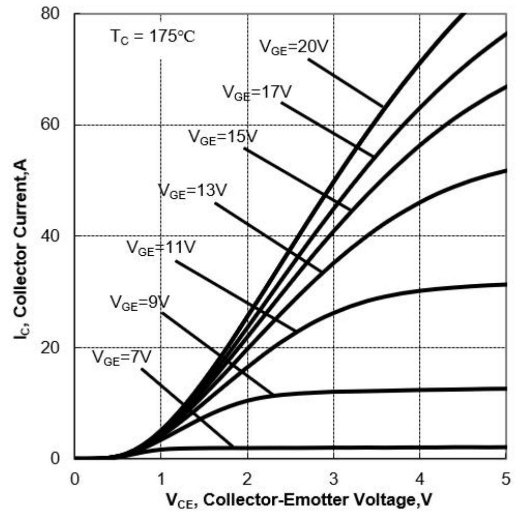


Figure 9. Typical Collector-Emitter Saturation Voltage vs Case Temperature

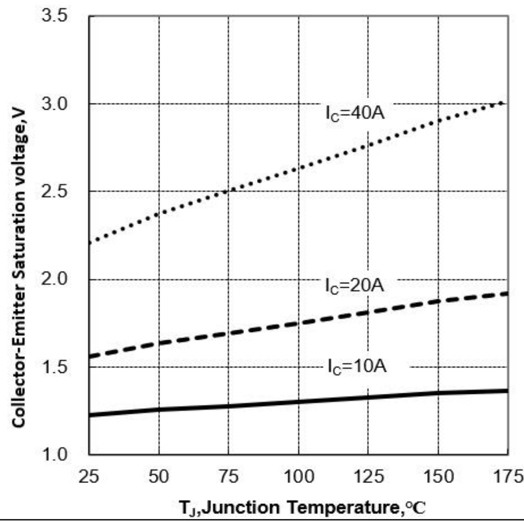


Figure 10. Typical Gate-Emitter Threshold Voltage vs Case Temperature

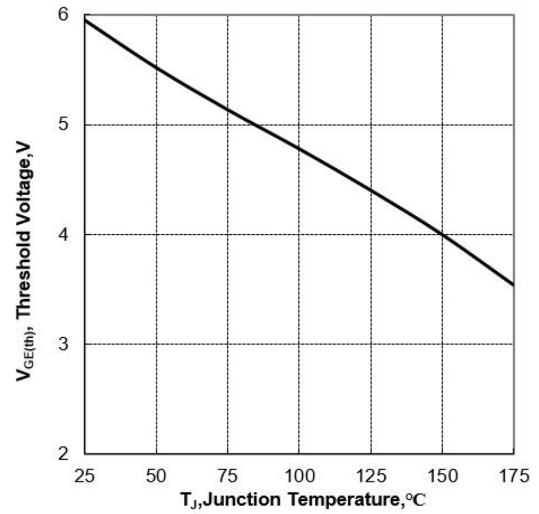


Figure 11. Typical Switching Times vs Gate Resistor (T_J=25℃, Vce=400V, Vge=15/0V, Ic=20A)

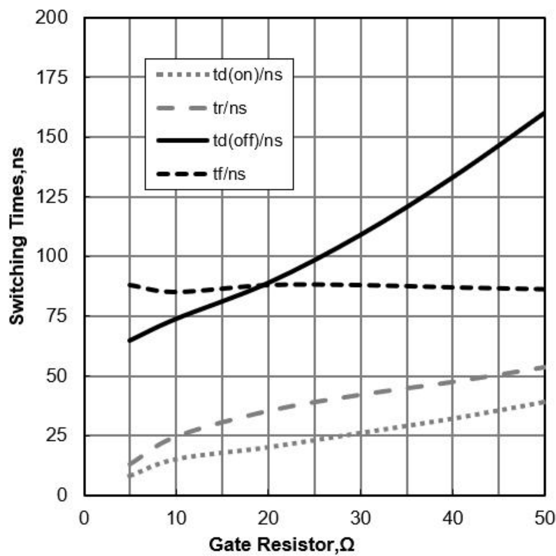


Figure 12. Typical Switching Energy vs Gate Resistor (T_J=25℃, Vce=400V, Vge=15/0V, Ic=20A)

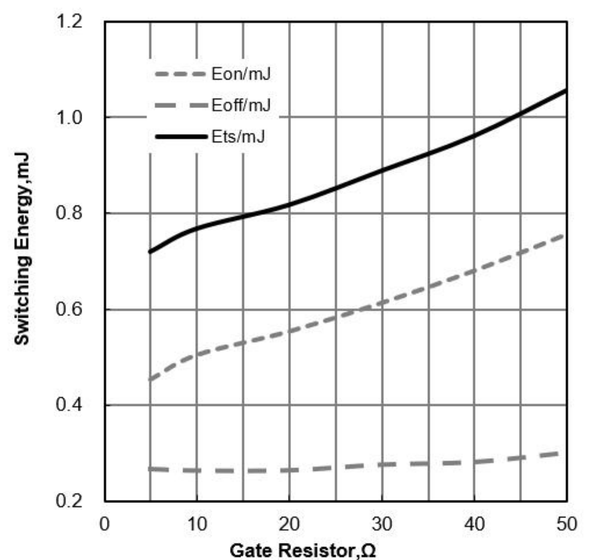


Figure 13. Typical Switching Times vs Case Temperature (Vce=400V, Vge=15/0V, Ic=20A)

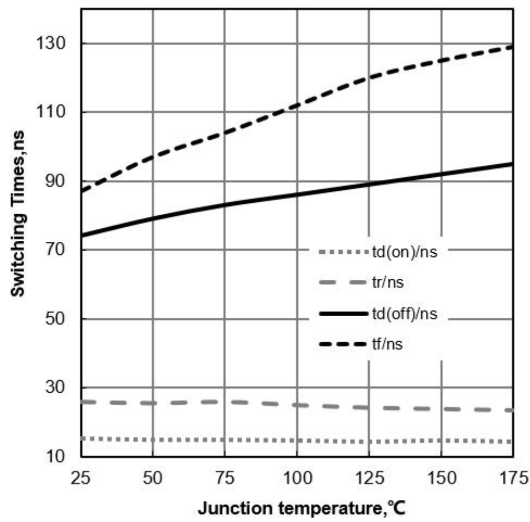


Figure 14. Typical Switching Energy vs Case Temperature (Vce=400V, Vge=15/0V, Ic=20A)

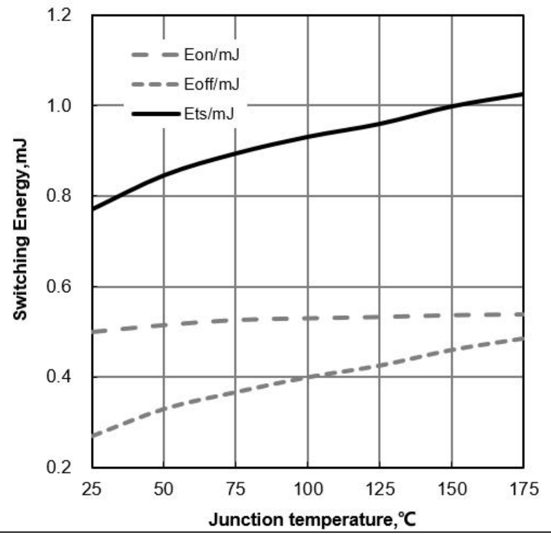


Figure 15. Typical Switching Times vs Collector Current (Tc=25℃, Vce=400V, Vge=15/0V)

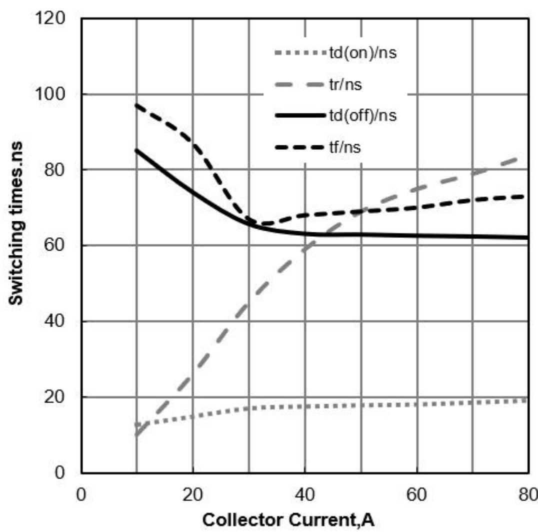


Figure 16. Typical Switching Energy vs Collector Current (Tc=25℃, Vce=400V, Vge=15/0V)

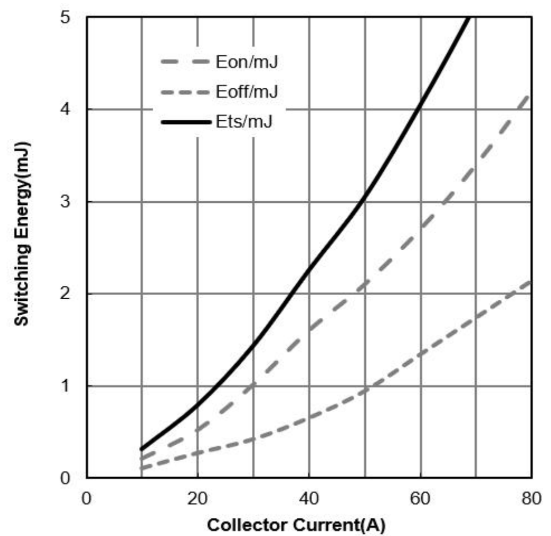


Figure 17. Typical Switching Times vs V_{CE} (Tc=25℃, Vge=15/0V, Ic=20A)

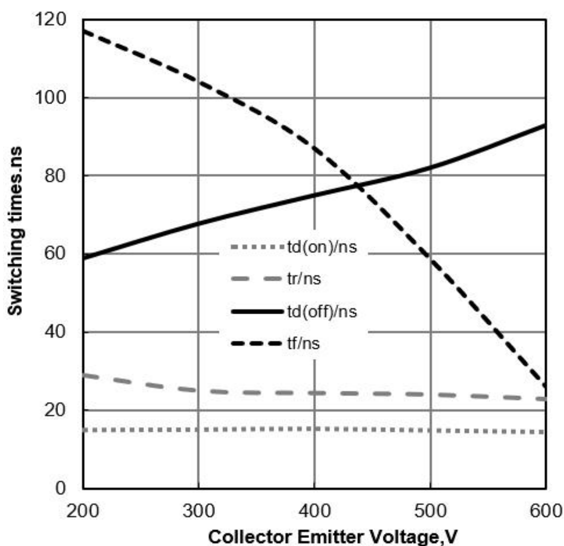


Figure 18. Typical Switching Energy vs vs V_{CE} (Tc=25℃, Vge=15/0V, Ic=20A)

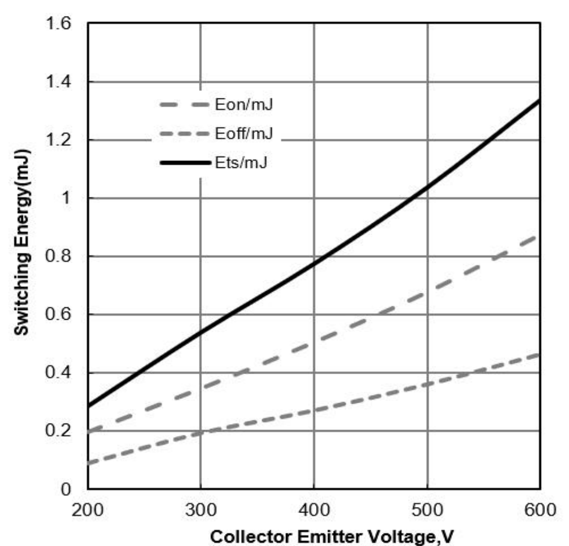


Figure 19. Typical Gate Charge	Figure 20. Typical Capacitance vs Collector- Emitter Voltage

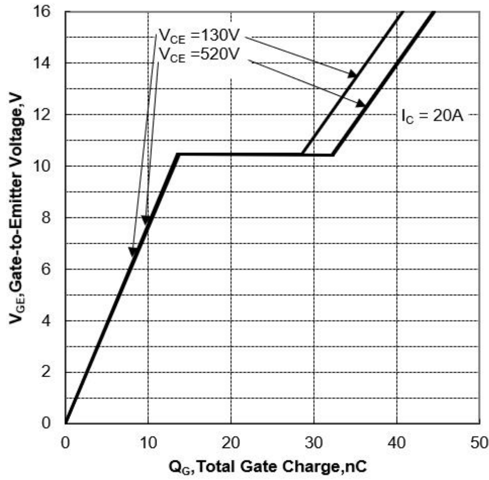
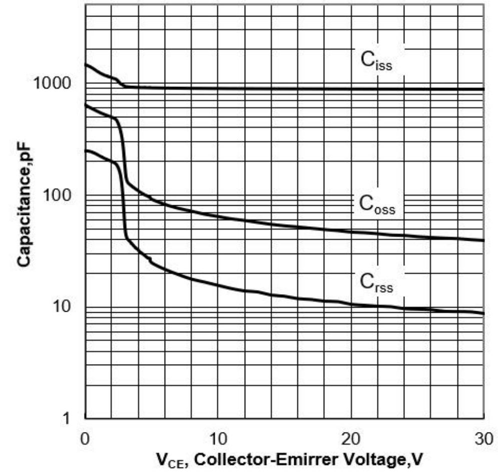

	

Figure 21. IGBT Transient Thermal Impedance vs Pulse Width(TO220)	**Figure 22. IGBT Transient Thermal Impedance vs Pulse Width(TO220F)**

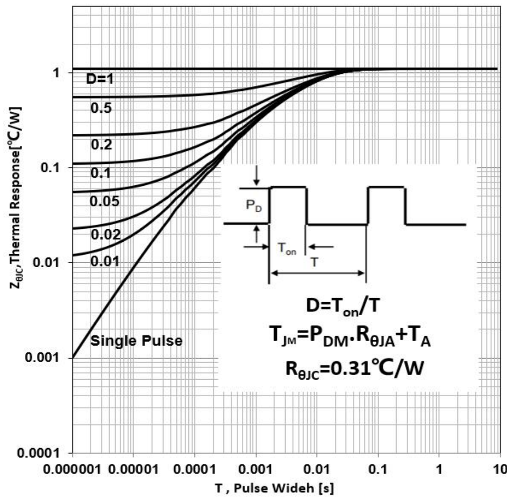
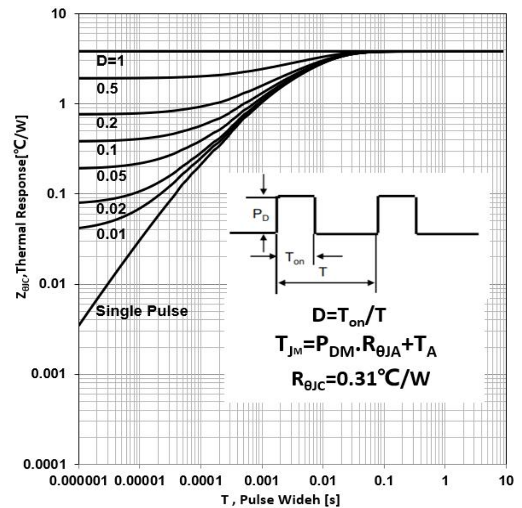

	

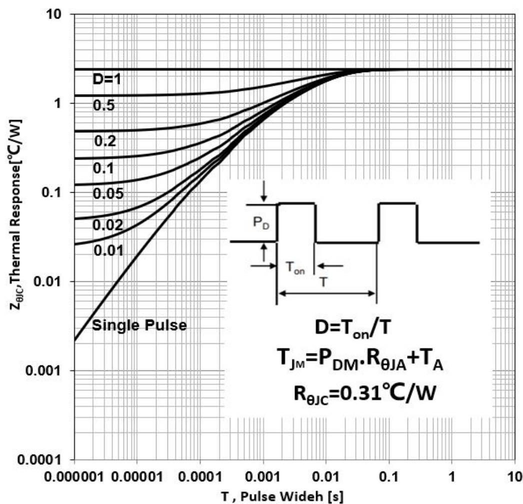
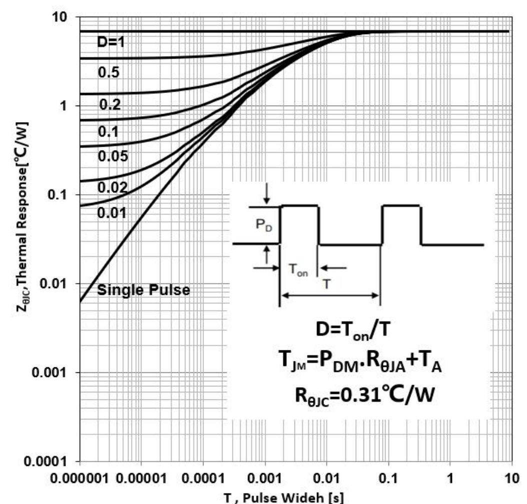
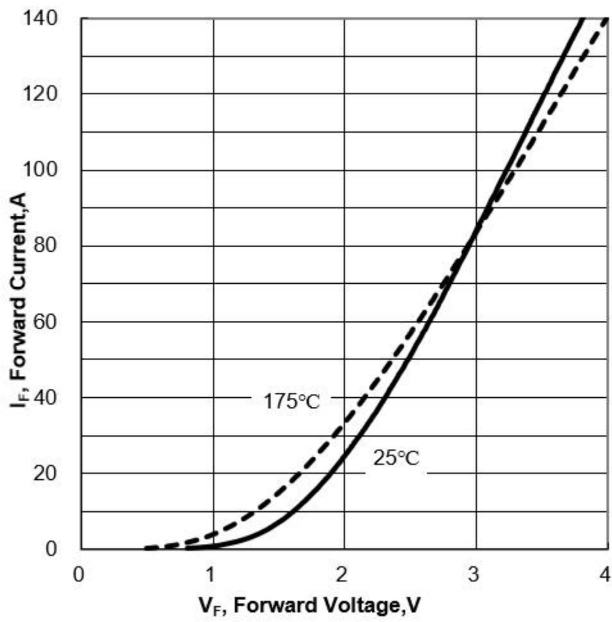
Figure 23. Diode Transient Thermal Impedance vs Pulse Width(TO220)	**Figure 24. Diode Transient Thermal Impedance vs Pulse Width(TO220F)**
	

Figure 25. Typical Diode Forward Current vs Forward Voltage



Test Circuit and Waveform

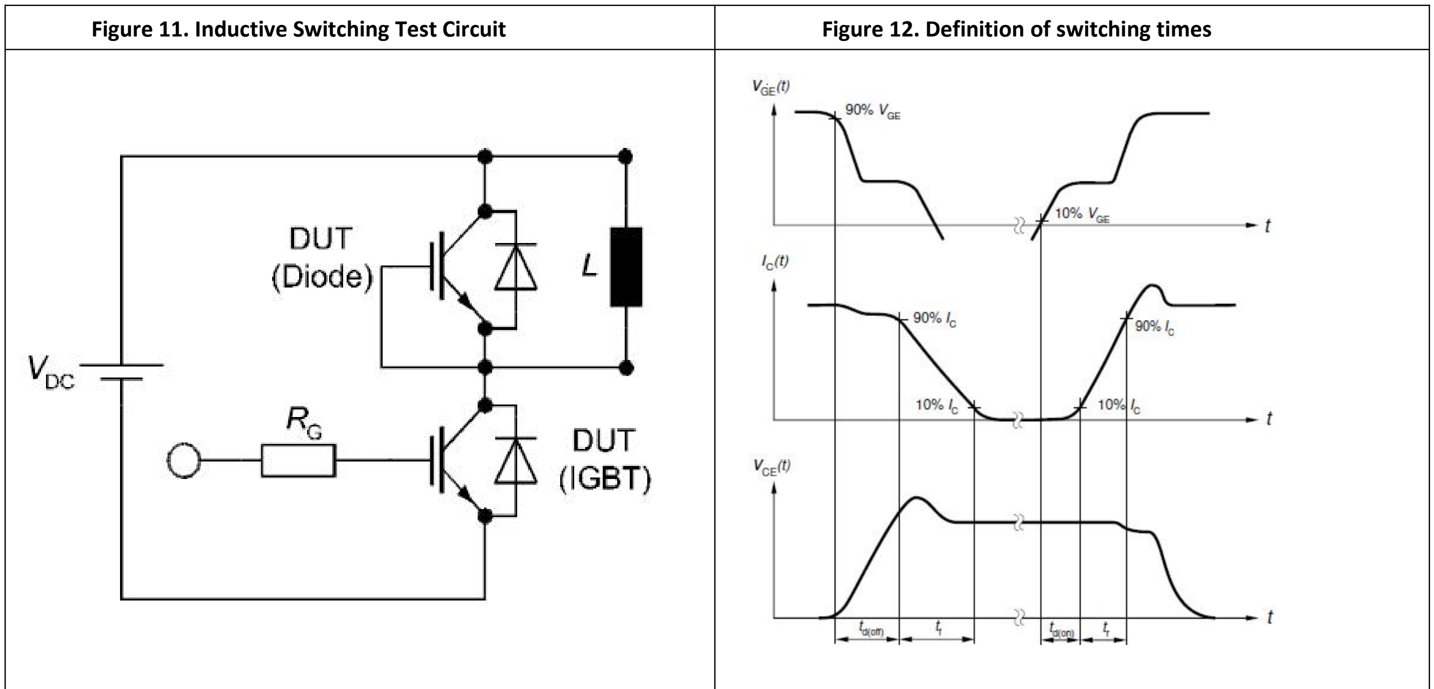


Figure 11. Inductive Switching Test Circuit

Figure 12. Definition of switching times

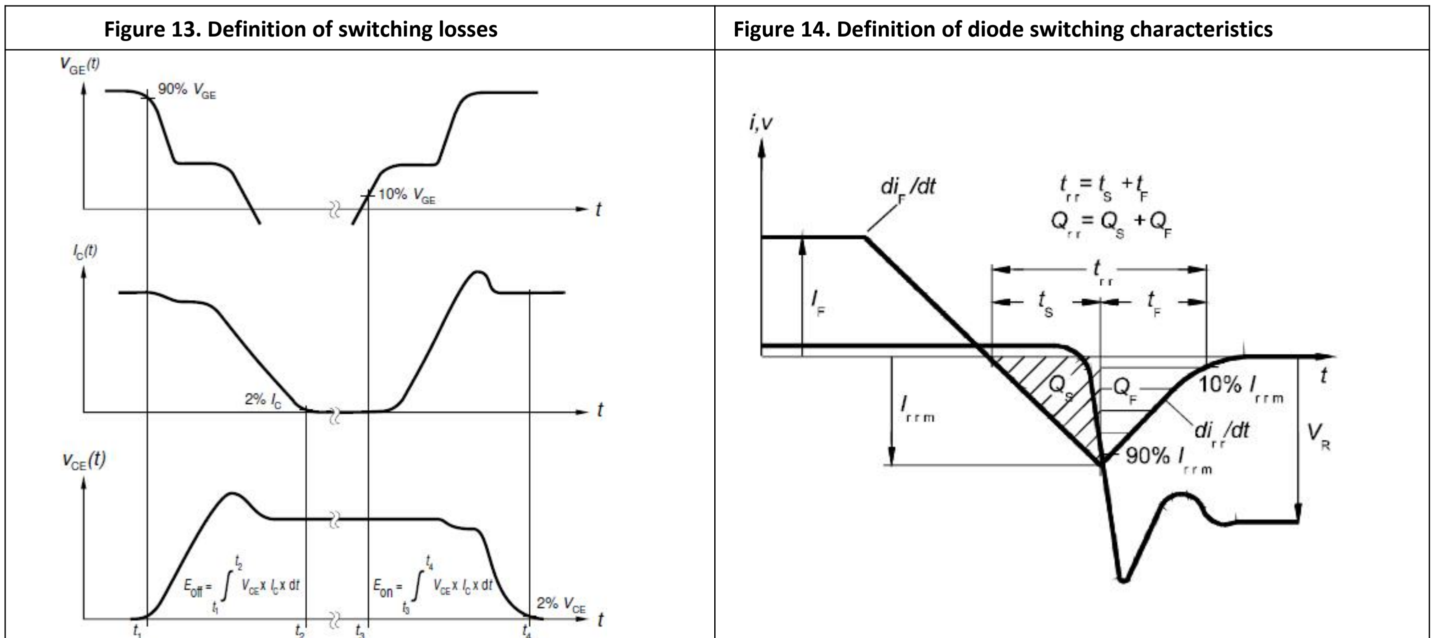
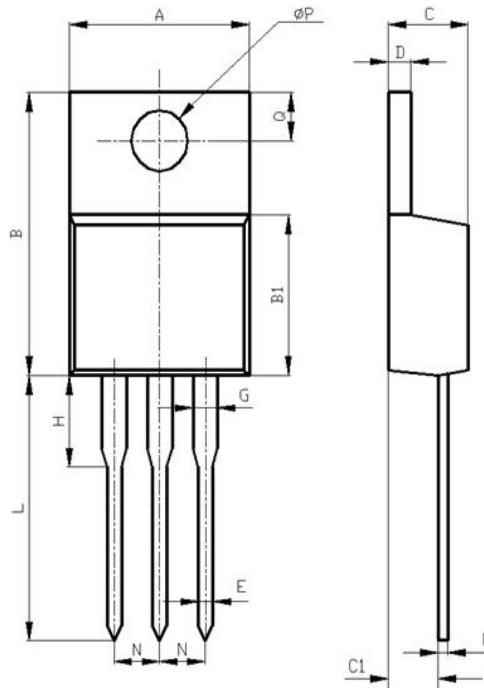


Figure 13. Definition of switching losses

Figure 14. Definition of diode switching characteristics

Package Description



Items	Values(mm)	
	MIN	MAX
A	9.60	10.6
B	15.0	16.0
B1	8.90	9.50
C	4.30	4.80
C1	2.30	3.10
D	1.20	1.40
E	0.70	0.90
F	0.30	0.60
G	1.17	1.37
H	2.70	3.80
L	12.6	14.8
N	2.34	2.74
Q	2.40	3.00
ϕp	3.50	3.90

TO-220 Package

NOTE:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. MOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. Shenzhen Minos reserves the right to make changes in this specification sheet and is subject to change withoutprior notice.

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