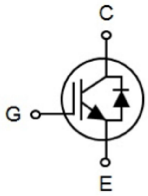
Feature

- High ruggedness for motor control
- VCE(sat) positive temperature coefficient
- Very soft, fast recovery anti-parallel diode
- Low EMI
- Maximum junction temperature 175°C

TO-220F



Applications

- Inverter for motor control

Maximum Ratings

Parameter		Symbol	Rating	Unit
Collector-emitter voltage		V_{CE}	650	V
DC collector current, limited by T_{vjmax}	Tc=25℃	I_C	30	A
	Tc=100℃		15	
Pulsed collector current, tp limited by T_{jvjmax}		I_{Cpuls}	60	A
Diode forward current, limited by T_{vjmax}	Tc=25℃	I_F	30	A
	Tc=100℃		15	
Gate-emitter voltage		V_{GE}	±20V	V
Diode pulsed current, t_p limited by T_{vjmax}		I_{Fpuls}	60	A
Power dissipation（TO-220F）		P_D	48	W
Short circuit withstand time VCC ≤ 360V, VGE =15V, T_{vj} =150°C		tsc	5	μs
Operating Junction temperature range		T_{vj}	-40~175	°C
Storage temperature range		T_{stg}	-55~150	°C

Electrical Characteristics (Tvj = 25°C unless otherwise specified)

Static Characteristics

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=2mA		650	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=15A	Tj=25℃	-	1.65	2.00	V
			Tj=150℃	-	1.90	-	V
Diode forward voltage	V_F	V_{GE}=0V, I_F=15A	Tj=25℃	-	1.85	2.30	V
			Tj=150℃	-	1.95	-	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.5mA, V_{CE}=V_{GE}		4.5	5.5	6.5	V
Zero gate voltage	I_{CES}	V_{CE}=650V, V_{GE}=0V	Tj=25℃	-	-	20	μA

collector current		Tj=150℃	-	-	4	mA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	±100	nA

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	Cies	V_{CE}=25V V_{GE}=0V f=1MHz	–	1129	-	pF
Output capacitance	Coes		–	57	-	
Reverse transfer capacitance	Cres		–	31	-	
Total gate charge	Qg	V_{CE}=520V, I_C=15A V_{GE}=15V	–	61	-	nC
Gate-emitter charge	Qge		–	11	-	nC
Gate-collector charge	Qgc		–	35	-	nC

Switching Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Turn-on delay time	td(on)	V_{GE} = 15V, V_{CC} = 400V, I_C = 15A, R_G = 10Ω, T_{vj} = 25°C Inductive Load	-	19	-	nS
Rise time	t_r		-	27	-	
Turn-off delay time	td(off)		-	128	-	
Fall time	t_f		-	32	-	
Turn-on switching energy	Eon		-	270	-	μJ
Turn-off switching energy	Eoff		-	86	-	
Total switching energy	Ets		-	356	-	
Turn-on delay time	td(on)	V_{GE} = 15V, Vs_{CC} = 400V, I_C = 15A, R_G = 10Ω, T_{vj} = 175°C Inductive Load	-	17	-	nS
Rise time	t_r		-	29	-	
Turn-off delay time	td(off)		-	150	-	
Fall time	t_f		-	130	-	
Turn-on switching energy	Eon		-	342	-	μJ
Turn-off switching energy	Eoff		-	288	-	

Total switching energy	Ets		-	630	-	
Reverse recovery time	trr	T_j=25℃ I_F=15A di_F/dt=200A/μs	-	150	-	nS
Reverse recovery charge	Qrr		-	390	-	nC
Reverse recovery current	Irrm		-	5.2	-	A
Reverse recovery time	trr	T_j=175℃ I_F=15A di_F/dt=200A/μs	-	207	-	nS
Reverse recovery charge	Qrr		-	631	-	nC
Reverse recovery current	Irrm		-	6.1	-	A

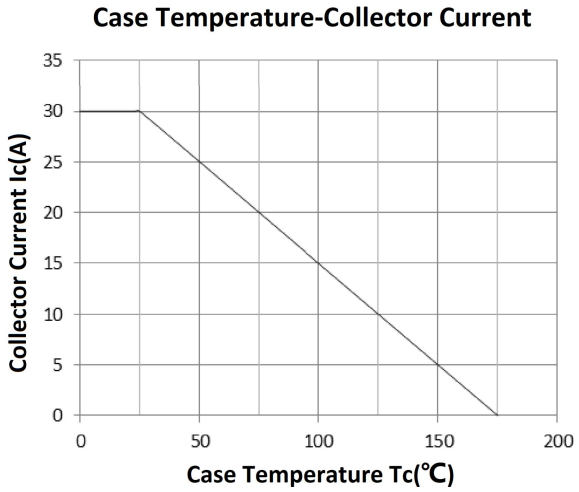
Thermal Characteristics

Parameter	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{th(j-a)}$	62	°C/W
Thermal resistance junction-to-case for IGBT	$R_{th(j-c)}$	3.1	
Thermal resistance junction-to-case for Diode	$R_{th(j-a)}$	5.2	

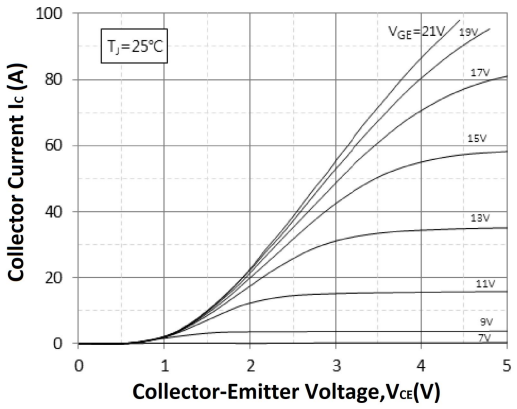
Order Message

Order codes	Package	Packaging
MSG15T65HPT1	TO-220F	Tube

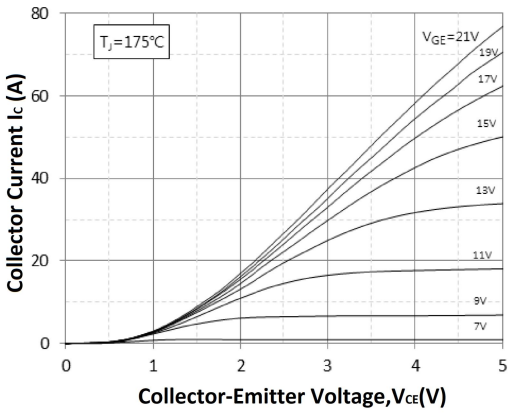
Electrical Characteristics



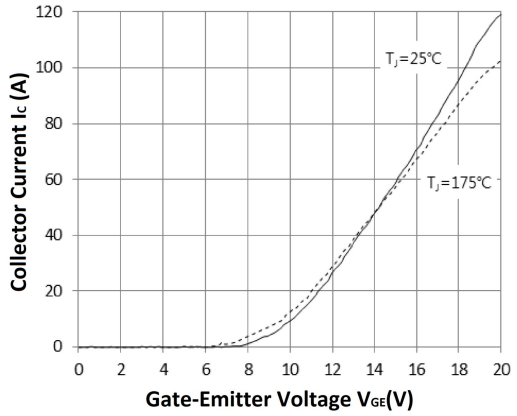
Typical Output Characteristics(TJ=25℃)



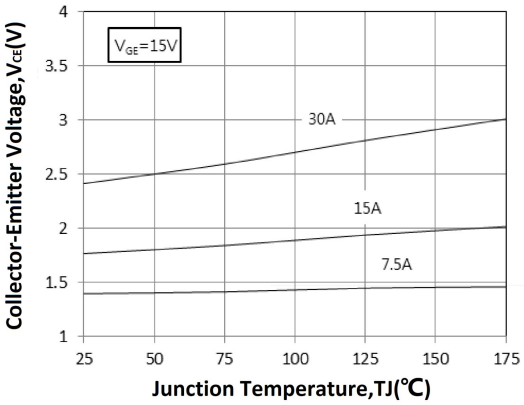
Typical Output Characteristics(TJ=175℃)



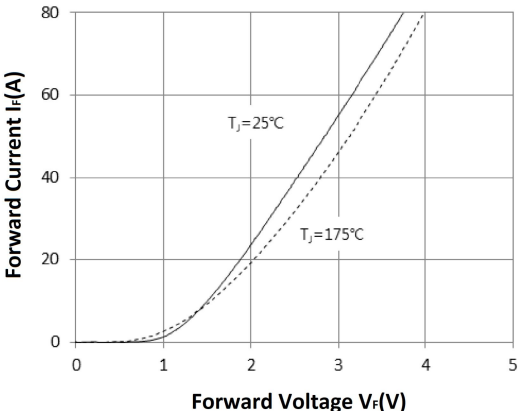
Typical Transfer Characteristics



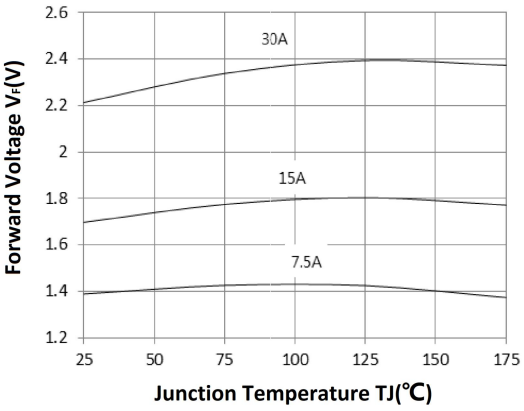
Typical Collector-Emitter Saturation Voltage-Junction Temperature



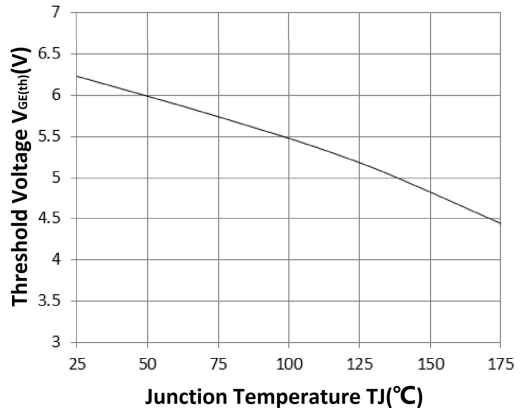
Diode Forward Characteristics



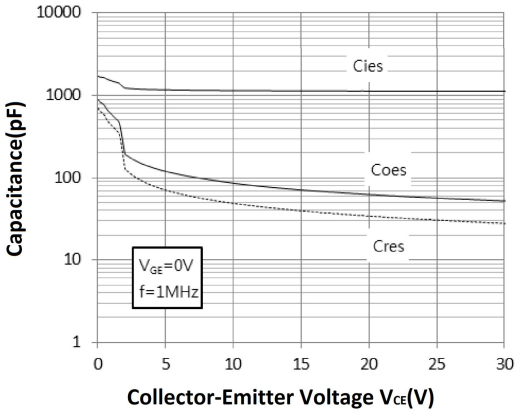
Diode Forward-Junction Temperature



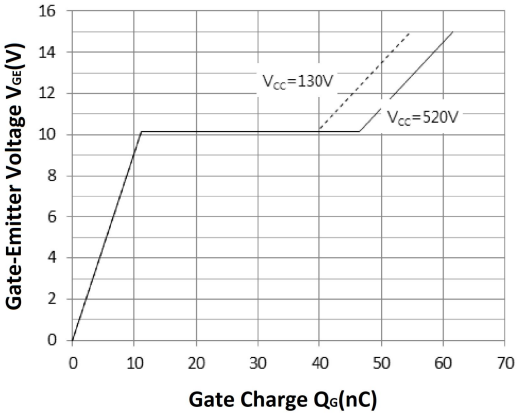
Threshold Voltage-Junction Temperature



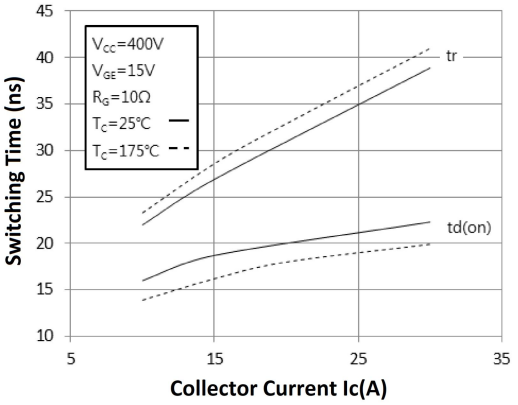
Typical Capacitance



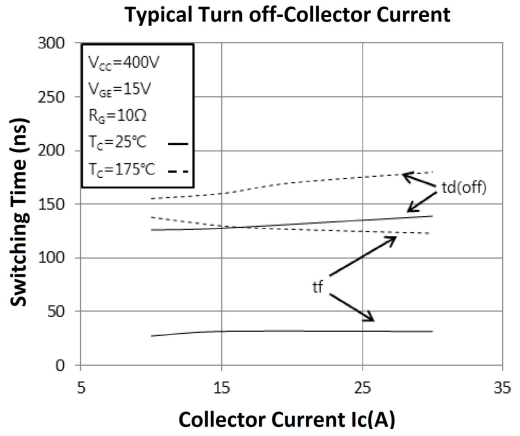
Typical Gate Charge



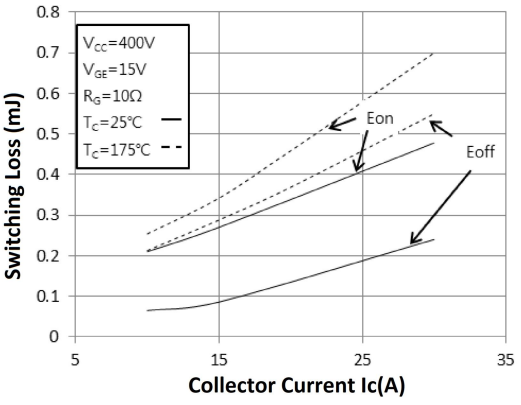
Typical Turn on-Collector Curren



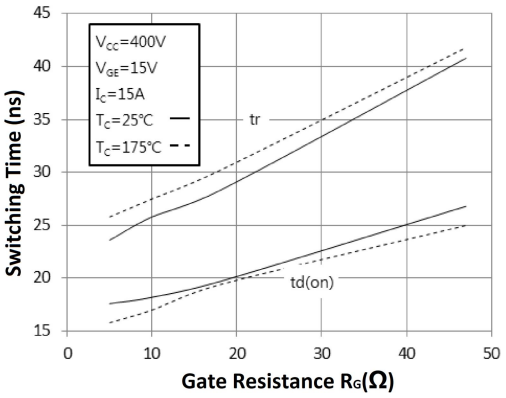
Typical Turn off-Collector Current



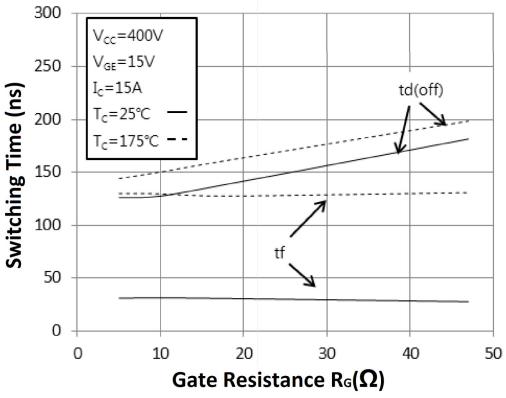
Switching Loss-Collector Current



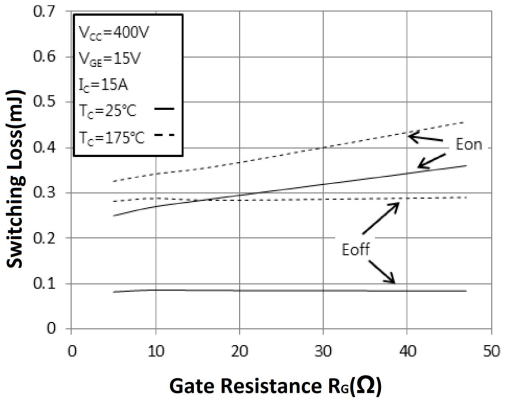
Turn on Characteristics-Gate Resistance



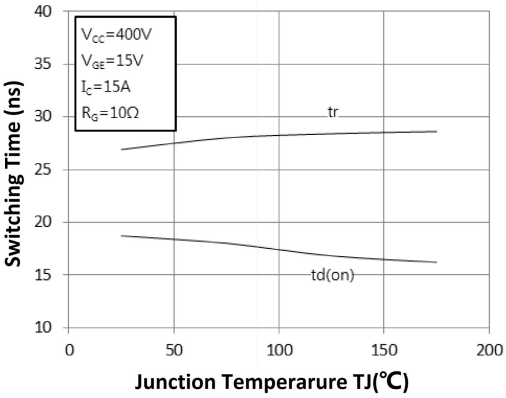
Turn off Characteristics-Gate Resistance



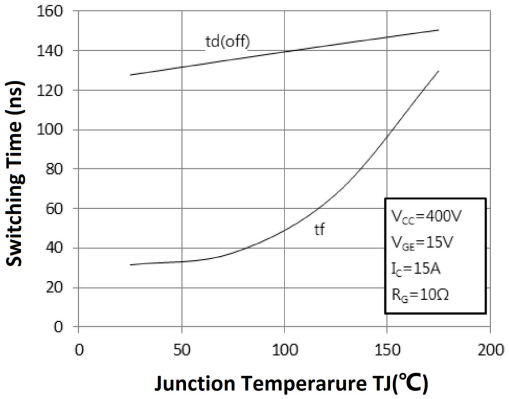
Switching Loss-Gate Resistance



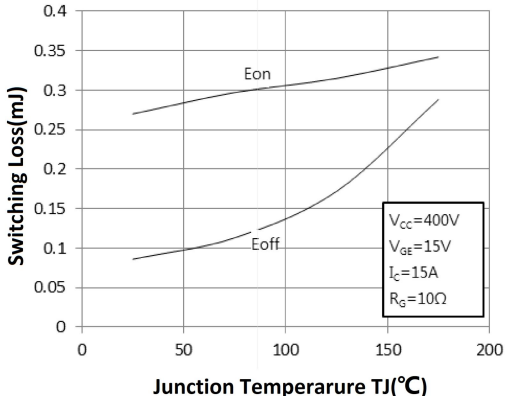
Turn on Characteristics-Junction Temperature



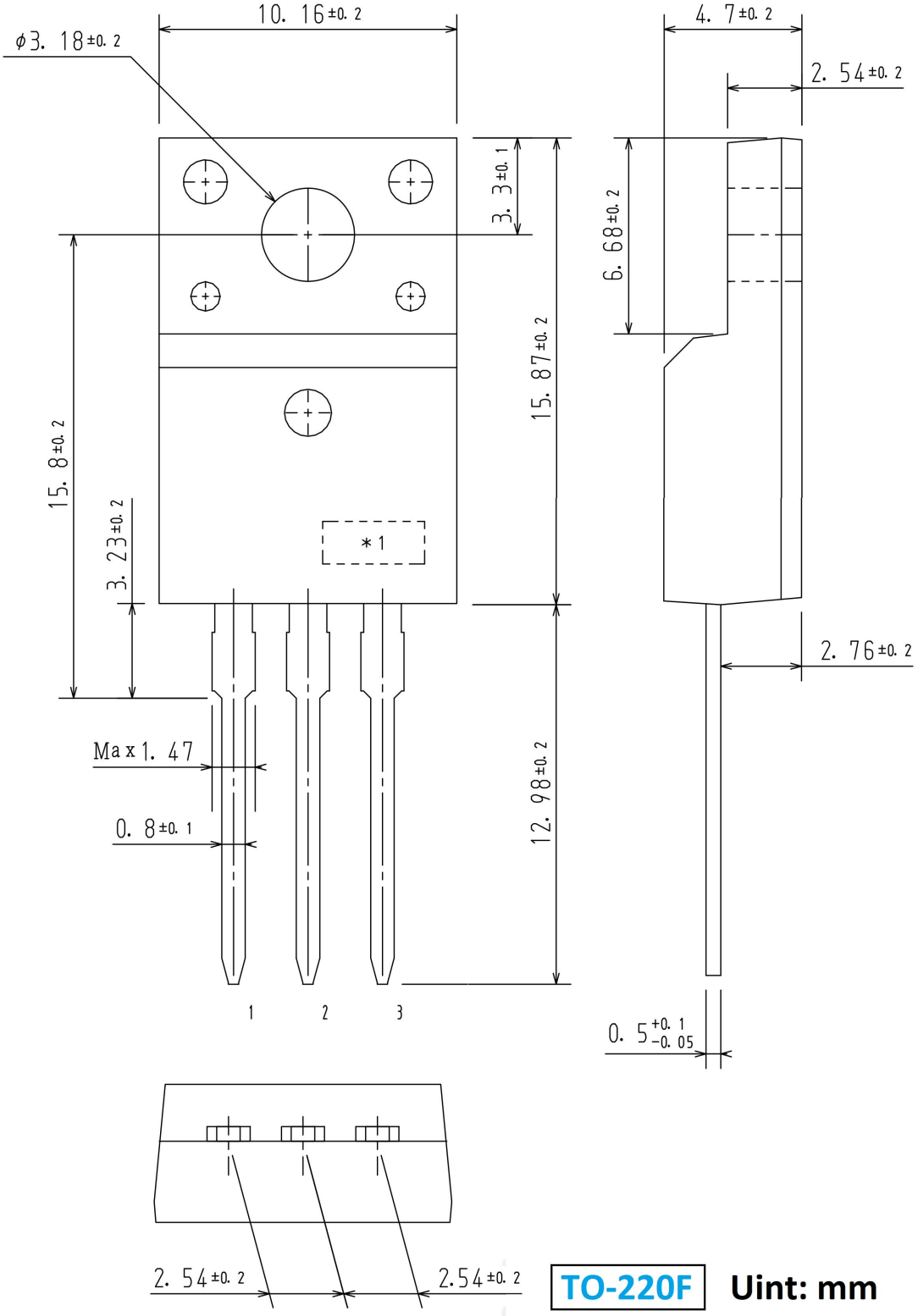
Turn off Characteristics
-Junction Temperature



Switching Loss-Junction Temperature



Package outline dimension



TO-220F **Uint: mm**