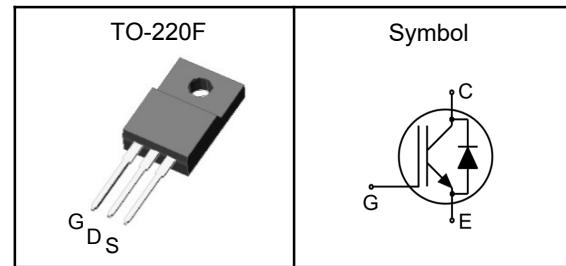


650V/10A Field Stop Trench IGBT
Features

- Trench FS II Technology
- Very low $V_{CE(sat)}$
- High speed switching
- ROHS Compliant

Applications

- Inverter welding machine
- Motor drives
- UPS

Pin Description


V_{CES}	650	V
$V_{CE(sat)-Typ}$	1.4	V
I_C	10	A

Absolute Maximum Ratings ($T_C=25^\circ\text{C}$, Unless Otherwise Noted)

Parameter	Symbol	Rating	Units
Collector-Emitter Voltage	V_{CES}	650	V
Gate- Emitter Voltage	V_{GES}	± 30	V
Collector Current ¹	I_C	15	A
Collector Current ¹	I_C	10	A
Pulsed Collector Current ²	I_{CM}	20	A
Diode Continuous Forward Current	I_F	20	A
Diode Continuous Forward Current	I_F	10	A
Diode Pulsed Forward Current	I_{FM}	24	A
Power Dissipation	P_D	32	W
Power Dissipation	P_D	16	W
Storage Temperature Range	T_{STG}	-55 to 150	$^\circ\text{C}$
Operating Junction Temperature Range	T_J	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	---	65	$^\circ\text{C/W}$
Thermal Resistance Junction to case for IGBT	$R_{\theta JC}$	---	4.6	$^\circ\text{C/W}$
Thermal Resistance Junction to case for Diode	$R_{\theta JCD}$	---	5.6	$^\circ\text{C/W}$



650V/10A Field Stop Trench IGBT

Electrical Characteristics (T_J=25°C, unless otherwise noted)

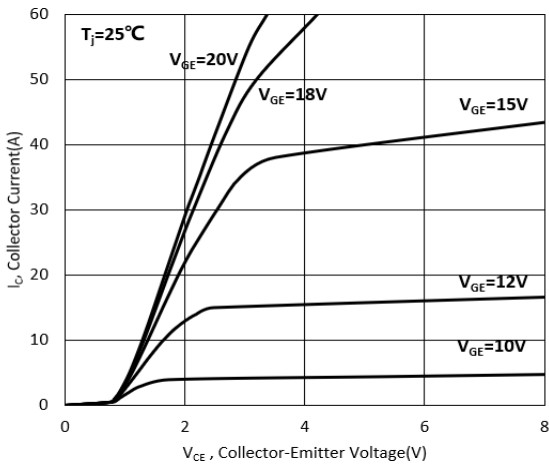
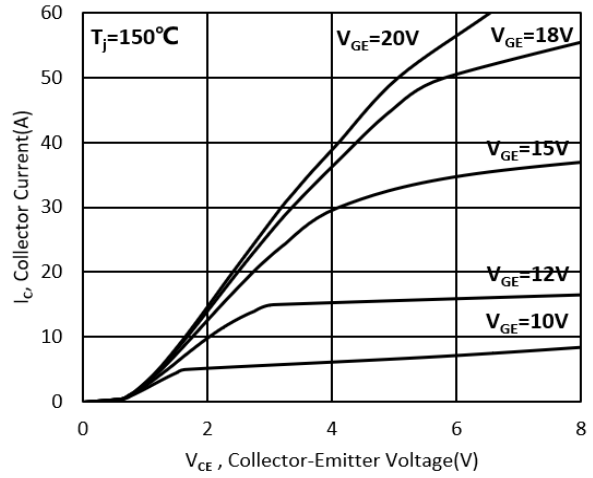
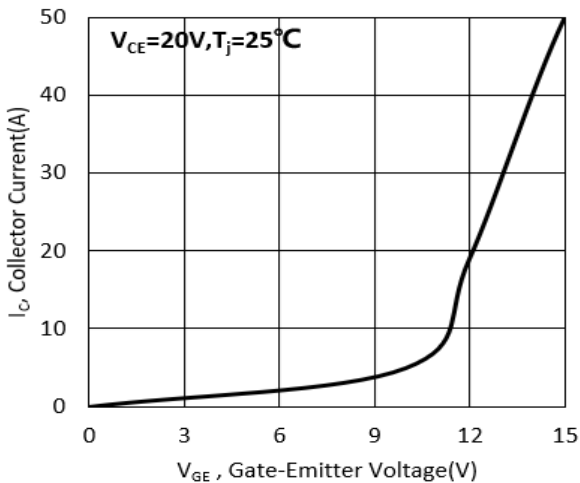
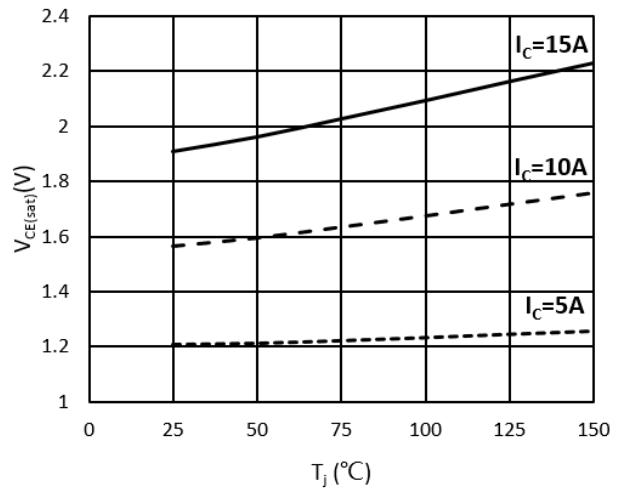
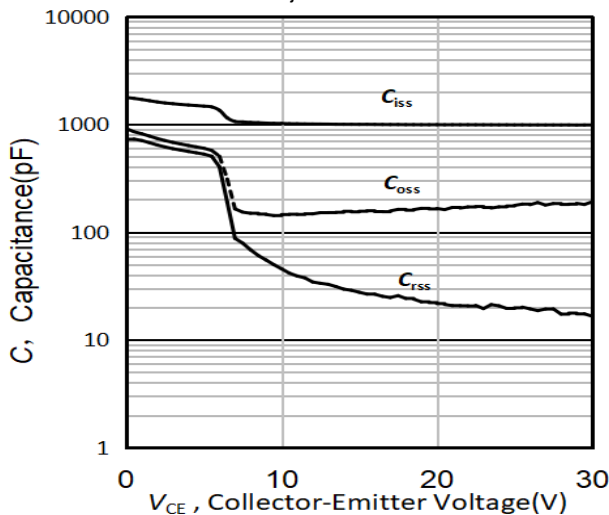
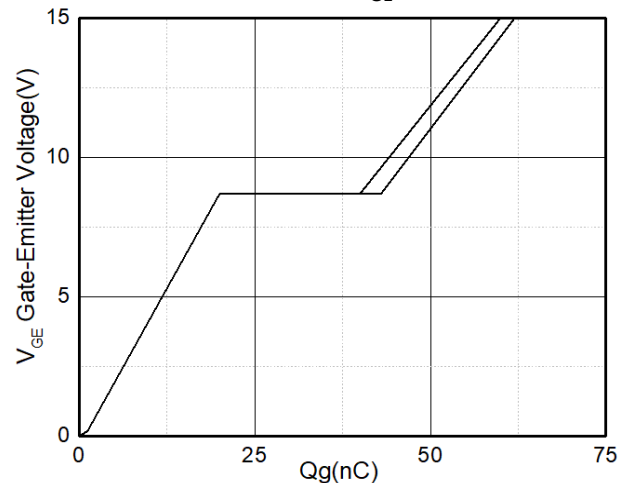
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	V _{(BR)CES}	V _{GE} =0V, I _C =0.25mA	650	---	---	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} =15V, I _C =10A, T _J =25°C	---	1.4	1.8	V
		V _{GE} =15V, I _C =10A, T _J =125°C	---	1.65	---	V
Gate Threshold Voltage	V _{GE(th)}	V _{CE} =V _{GE} , I _C =150uA	4.5	---	6.5	V
Collector-Emitter Leakage Current	I _{CES}	V _{CE} =650V, V _{GE} =0V, T _J =25°C	---	---	0.01	mA
		V _{CE} =650V, V _{GE} =0V, T _J =150°C	---	---	1	mA
Gate to Emitter Leakage Current	I _{GES}	V _{GE} =20V, V _{CE} =0V	---	---	250	nA
Total Gate Charge	Q _g	V _{CC} =300V, V _{GE} =15V, I _C =10A	---	58	---	nC
Gate to Emitter Charge	Q _{ge}		---	---	---	nC
Gate to Collector Charge	Q _{gc}		---	---	---	nC
Turn-On Delay Time	t _{d(ON)}	V _{CE} =400V, V _{GE} =0/15V, R _G =10Ω, I _C =10A, T _J =25°C Inductive Load	---	47	---	ns
Rise Time	t _r		---	28	---	
Turn-Off Delay Time	t _{d(off)}		---	103	---	
Fall Time	t _f		---	80	---	mJ
Turn-On Switching Loss	E _{on}		---	0.17	---	
Turn-Off Switching Loss	E _{off}		---	0.20	---	
Total Switching Loss	E _{ts}	---	0.37	---		
Input Capacitance	C _{ies}	V _{CE} =25V, V _{GE} =0V, f=1MHz	---	1000	---	pF
Output Capacitance	C _{oes}		---	45	---	
Reverse Transfer Capacitance	C _{res}		---	16	---	

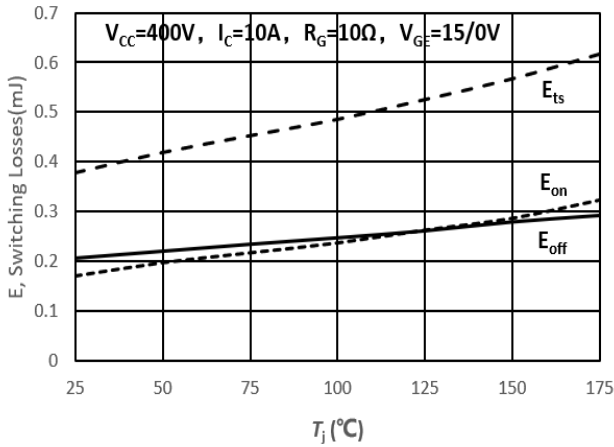
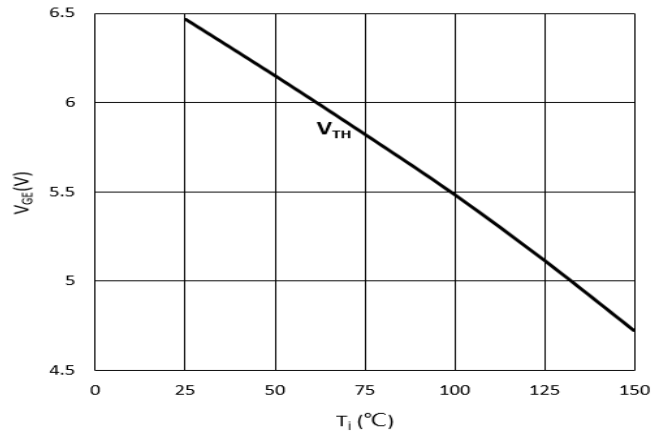
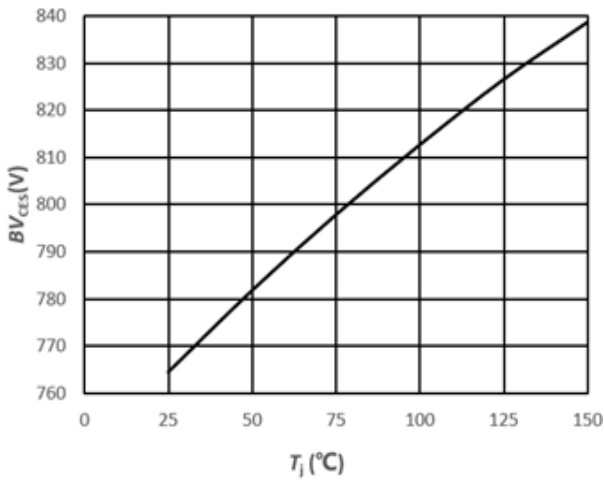
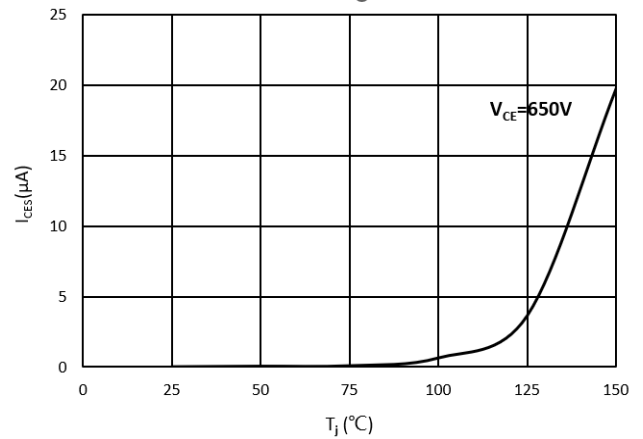
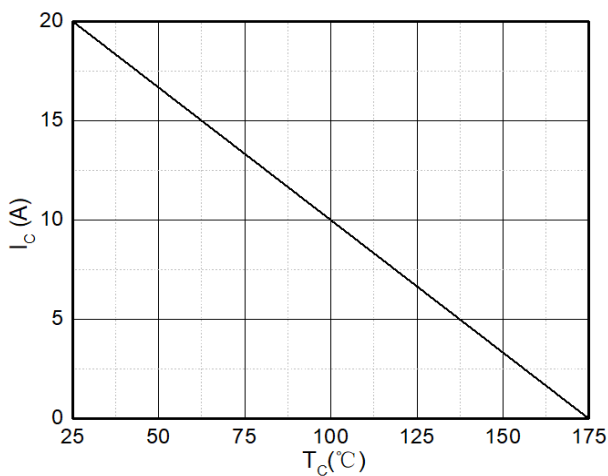
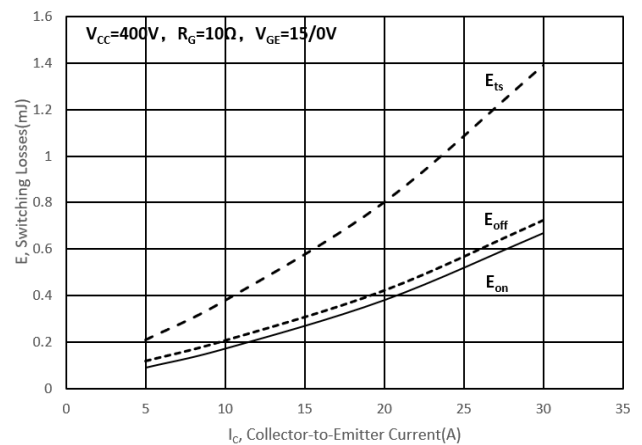
Drain-Source Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V _F	V _{GE} =0V, I _F =10A, T _J =25°C	---	1.65	1.95	V
Reverse Recovery Time	t _{rr}	I _F =10A, V _{CC} =400V, di/dt=350A/μs, T _J =25°C	---	66	---	nS
Reverse Recovery Charge	Q _{rr}		---	0.23	---	uC
Diode Peak Reverse Recovery Current	I _{rrm}		---	5.55	---	A

Note:

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%

650V/10A Field Stop Trench IGBT
Typical Characteristics

Figure 1. Typical output characteristic
 $(T_j = 25^\circ\text{C})$

Figure 2. Typical output characteristic
 $(T_j = 150^\circ\text{C})$

Figure 3. Typical transfer characteristic
 $(T_j = 25^\circ\text{C})$

Figure 4. V_{CESAT} as a function of junction temperature
 $(V_{GE} = 15\text{V})$

Figure 5. Capacitance characteristic
 $(V_{GE} = 0\text{V}, f = 1\text{MHz})$

Figure 6. Typical gate charge
 $(I_C = 10\text{A})$

650V/10A Field Stop Trench IGBT

Figure 7. E_{on} , E_{off} as a function of junction temperature

Figure 8. V_{TH} as a function of junction temperature ($I_{CE}=250\mu A$)

Figure 9. BV as a function of junction temperature ($I_{CE}=250\mu A$)

Figure 10. I_{CES} leakage current as a function of junction temperature

Figure 11. Collector current as a function of case temperature ($V_{GE}\geq 15V$, $T_j\leq 175^\circ C$)

Figure 12. E_{on} , E_{off} as a function of I_C ($T_j=25^\circ C$)

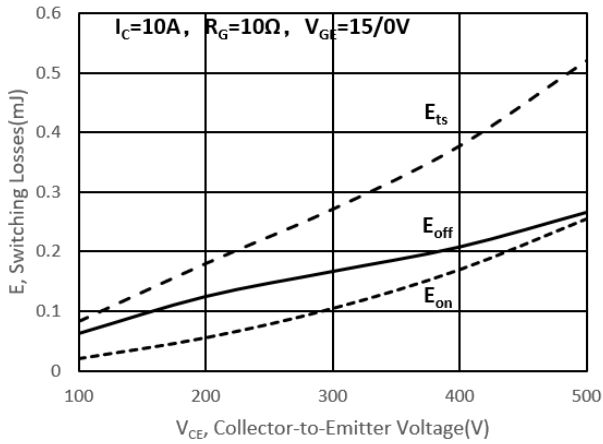
650V/10A Field Stop Trench IGBT


Figure 13. E_{on}, E_{off} as a function of V_{CE} ($T_j=25^\circ C$)

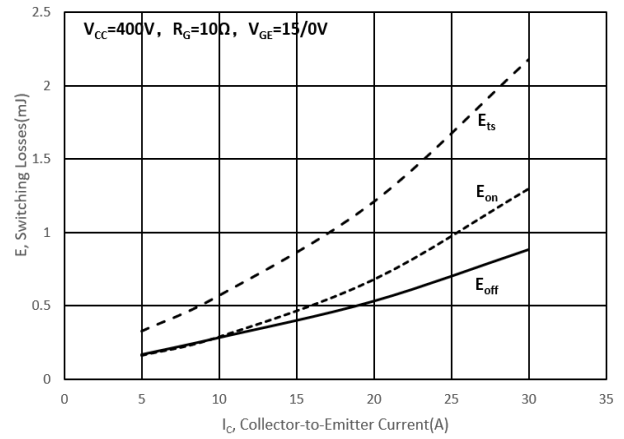


Figure 14. E_{on}, E_{off} as a function of I_C ($T_j=150^\circ C$)

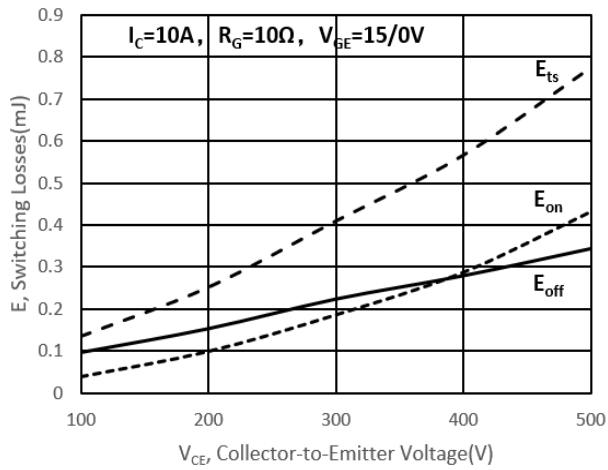
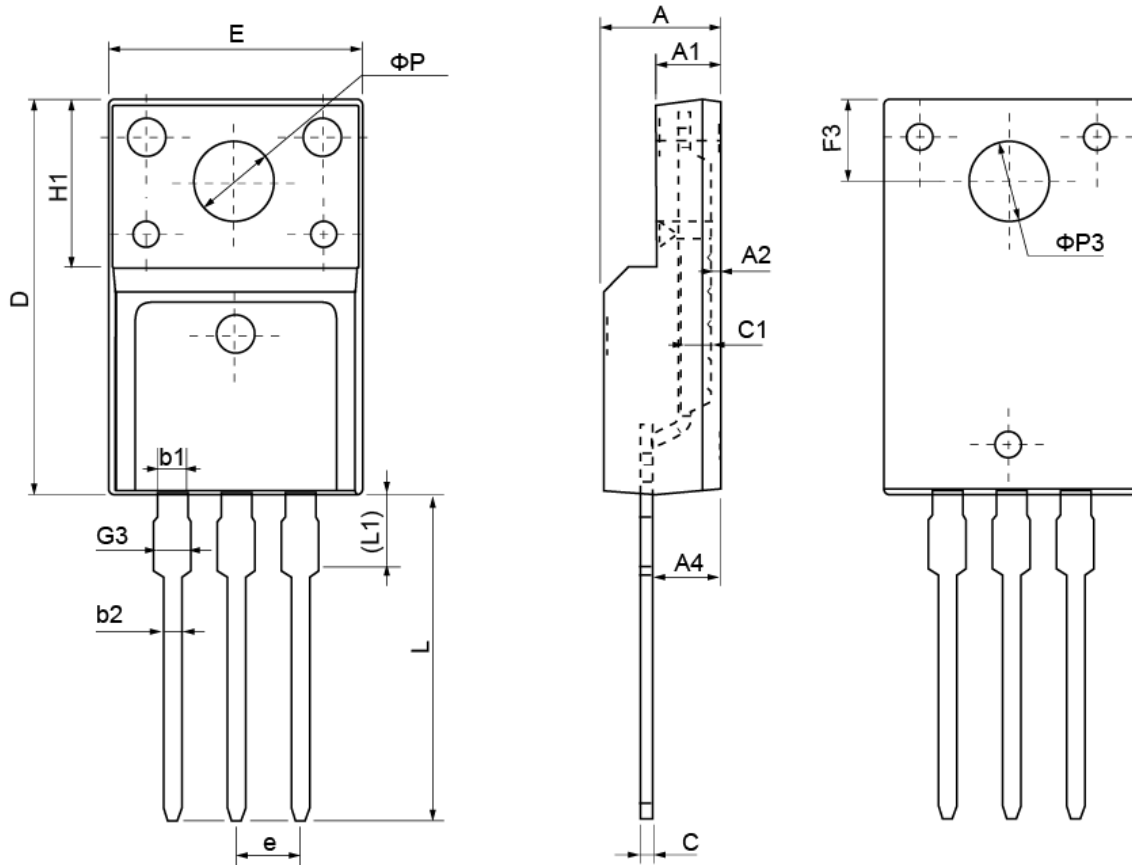


Figure 15. E_{on}, E_{off} as a function of V_{CE} ($T_j=150^\circ C$)

650V/10A Field Stop Trench IGBT
TO-220F Package Outline Dimensions


Symbol	Dimensions (unit:mm)			Symbol	Dimensions (unit:mm)		
	Min	Typ	Max		Min	Typ	Max
A	4.40	4.70	5.00	H1	6.70 REF		
A1	2.30	2.55	2.80	L	12.30	12.98	13.30
A2	0.30	0.50	0.70	L1	2.95	3.10	3.50
A4	2.45	2.80	3.05	ϕP	3.03	3.20	3.50
c	0.30	0.50	0.70	$\phi P3$	3.15	3.45	3.65
c1	1.20	1.30	1.40	b1	1.10	1.30	1.45
D	15.40	15.90	16.40	b2	0.60	0.80	1.00
E	9.86	10.16	10.46	F3	3.05	3.30	3.55
e	2.54 BSC			G3	1.15	1.35	1.55