

## 650V 40A FieldStop Trench IGBT

### Features

- FieldStop Trench Technology, Positive temperature coefficient
- $V_{CE(sat)}=2.0V@I_C=40A$
- High Speed Switching & Low Power Loss
- High Input Impedance
- SiC Schottky Barrier Diode

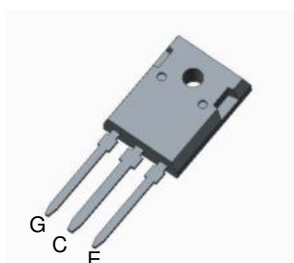
### Description

The device is designed by advanced FieldStop Trench technology process. This IGBT offer low  $V_{CE(sat)}$ , high speed switching performance and excellent quality for application such as PFC,UPS, Welder, PV Inverter and other switching applications.

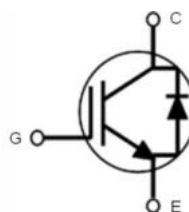
### Applications

- PFC, UPS, Welder, PV Inverter

### Package Type & Internal Circuit



TO-247



### Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit	
$V_{CES}$	Collector to Emitter Voltage	650	V	
$V_{GES}$	Gate to Emitter Voltage	$\pm 20$	V	
$I_C$	Collector Current	$T_C=25^\circ C$	80	A
		$T_C=100^\circ C$	40	A
$I_{CM}$	Pulsed Collector Current	120	A	
$I_F$	Diode Continuous Forward Current	$T_C=100^\circ C$	10	A
$I_{FSM}$	Non-repetitive Peak Surge Current	$T_p=10ms$ , half sine wave	60	A
		$T_p=200us$ , square wave	240	A
$P_D$	Maximum Power Dissipation	$T_C=25^\circ C$	167	W
		$T_C=100^\circ C$	83	W
$T_J$	Operating Junction Temperature Range	-40~+175	$^\circ C$	
$T_{STG}$	Storage Temperature Range	-55~+150	$^\circ C$	

### Thermal Characteristics

Symbol	Parameter	Ratings	Unit
$R_{th(J-C)}$ (IGBT)	Thermal Resistance, Junction to case for IGBT	0.9	$^\circ C/W$
$R_{th(J-C)}$ (Diode)	Thermal Resistance, Junction to case for Diode	1.2	$^\circ C/W$
$R_{th(J-A)}$	Thermal Resistance, Junction to Ambient	40	$^\circ C/W$

## Electrical Characteristics of IGBT @ $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=40A, V_{GE}=15V$	-	2.0	2.6	V
		$I_C=40A, V_{GE}=15V, T_C=150^\circ\text{C}$	-	2.3	-	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE}=V_{GE}, I_C=250\mu A$	4.0	5.3	6.0	V
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{CE}=V_{CES}, V_{GE}=0V$	-	-	1	$\mu A$
$I_{GES}$	Gate to Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0V$	-	-	$\pm 250$	nA

## Electrical Characteristics of Diode @ $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=10A$	-	1.5	1.80	V
		$I_F=10A, T_C=150^\circ\text{C}$	-	1.8	2.2	V
$I_R$	Reverse Leakage Current	$V_R=650V$	-	20	100	$\mu A$
C	Total Capacitance	$V_R=0V, f=1\text{MHz}$	-	490	-	pF
		$V_R=200V, f=1\text{MHz}$	-	50	-	
		$V_R=400V, f=1\text{MHz}$	-	45	-	
$Q_C$	Total Capacitive Charge	$V_R=325V, I_F=10A,$	-	28	-	nC
$t_c$	Switching Time	$di/dt=-200A/\mu s$	-	25	-	ns

## Switching Characteristics @ $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$I_C=40A, V_{CC}=325V, V_{GE}=15V, R_G=10\Omega, \text{Inductive Load}, T_C=25^\circ\text{C}$	-	25.0	-	ns
$t_r$	Rising Time		-	23.0	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	86.1	-	ns
$t_f$	Falling Time		-	18.1	-	ns
$E_{on}$	Turn-on Switching Loss		-	1.30	-	mJ
$E_{off}$	Turn-off Switching Loss		-	0.55	-	mJ
$E_{ts}$	Total Switching Loss		-	1.84	-	mJ
$t_{d(on)}$	Turn-on Delay Time	$I_C=40A, V_{CC}=325V, V_{GE}=15V, R_G=10\Omega, \text{Inductive Load}, T_C=125^\circ\text{C}$	-	24.4	-	ns
$t_r$	Rising Time		-	24.6	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	96.7	-	ns
$t_f$	Falling Time		-	21.5	-	ns
$E_{on}$	Turn-on Switching Loss		-	1.74	-	mJ
$E_{off}$	Turn-off Switching Loss		-	0.71	-	mJ
$E_{ts}$	Total Switching Loss		-	2.56	-	mJ
$C_{ies}$	Input Capacitance	$V_{GE}=0V, V_{CE}=25V, f=1.0\text{MHz}$	-	1685	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	74	-	pF
$C_{oes}$	Output Capacitance		-	48	-	pF
$Q_g$	Total Gate Charge	$I_C=40A, V_{CE}=325V, V_{GE}=15V$	-	161	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	40	-	nC
$Q_{gc}$	Gate to Collector Charge		-	48	-	nC
tsc	Short Circuit With stand Time		$V_{CC}=325V, V_{GE}=15V$	-	10	-

**Typical Performance Characteristics**

Fig. 1. Typical Output Characteristics

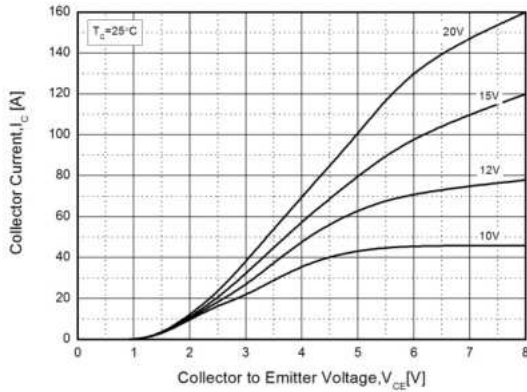


Fig. 2. Typical Saturation Voltage Characteristics

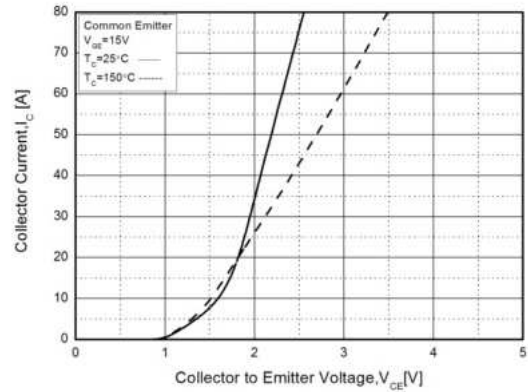


Fig. 3. Typical Saturation Voltage vs.  $T_C$

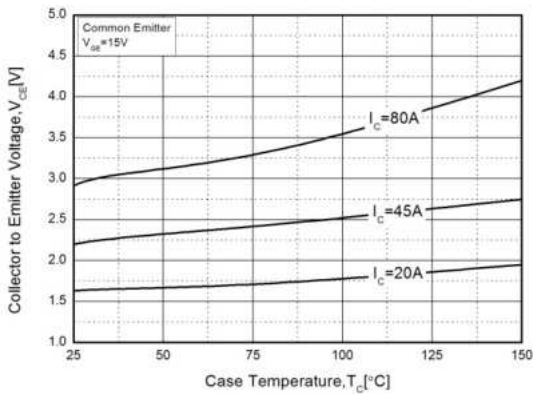


Fig. 4. Diode Forward Characteristics

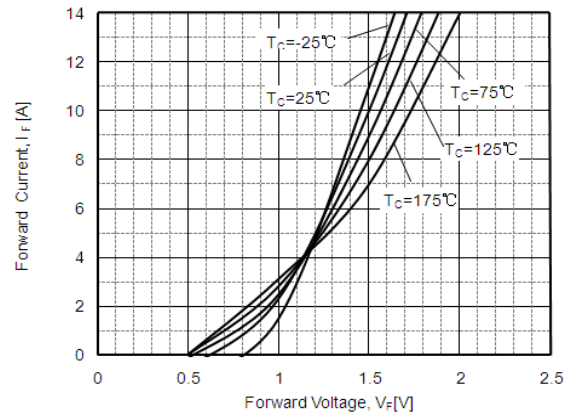


Fig. 5. Typical Capacitance Characteristics

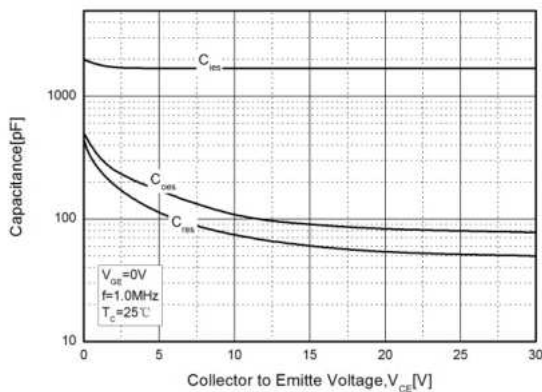
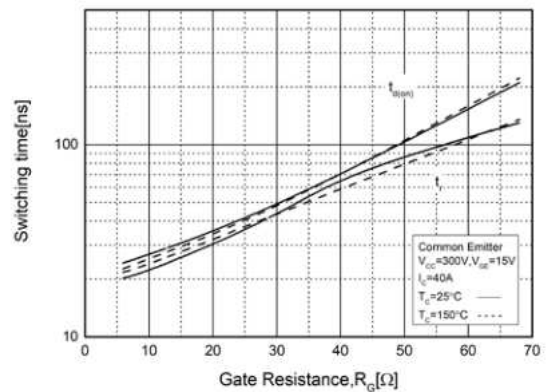


Fig. 6. Turn-on Characteristics vs.  $R_G$



**Typical Performance Characteristics**

Fig. 7. Turn-off Characteristics vs.  $R_G$

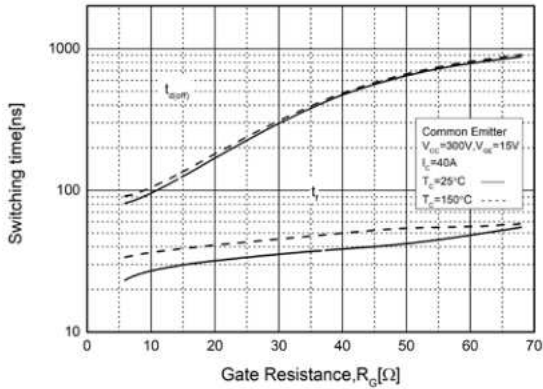


Fig. 8. Switching Loss vs.  $R_G$

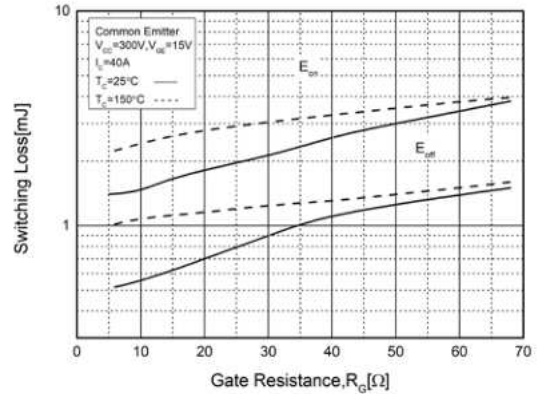


Fig. 9. Turn-on Characteristics vs.  $I_C$

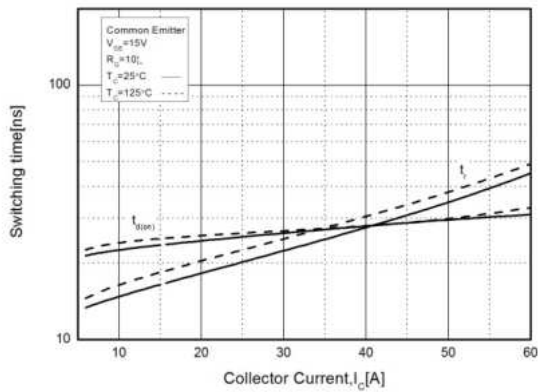


Fig. 10. Turn-off Characteristics vs.  $I_C$

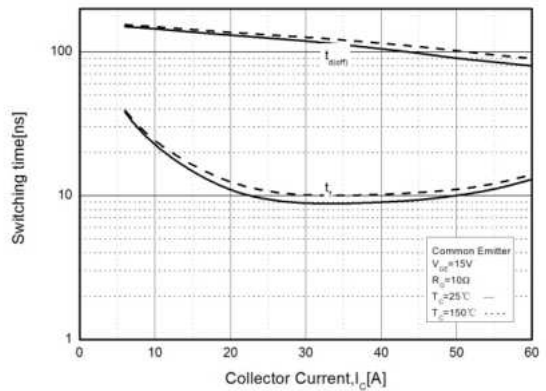
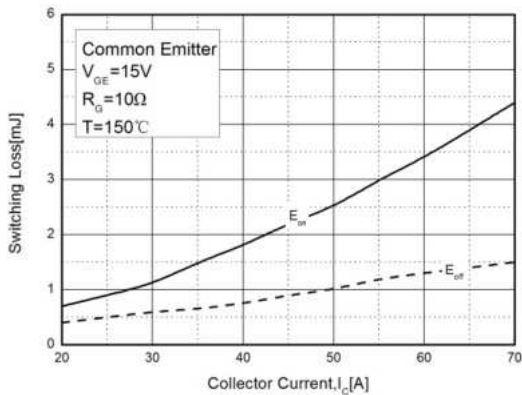


Fig. 11. Switching Loss vs.  $I_C$



**Package Dimensions**

**TO-247**

(Dimensions in Millimeters)

