

## 600V 60A FieldStop Trench IGBT

### Description

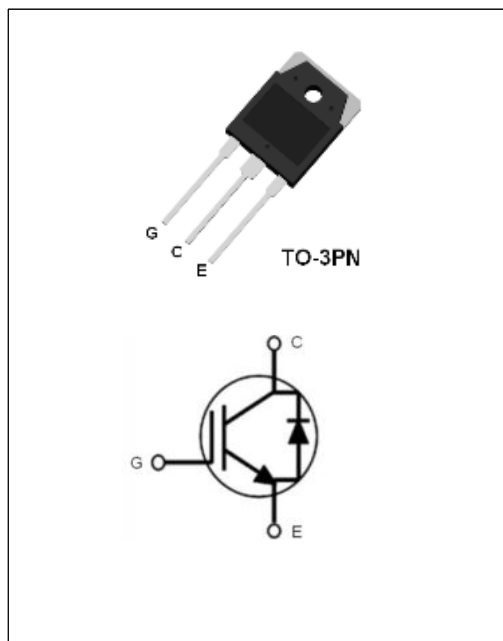
The device is designed by advanced FieldStop Trench technology process. This IGBT offer low  $V_{CE(sat)}$ , high speed switching performance and excellent quality for application such as PFC, UPS, Welder, PV Inverter and other switching applications.

### Features

- FieldStop Trench Technology, Positive temperature coefficient
- $V_{CE(sat)}=1.80V@I_C=60A$
- $t_{rr}=63ns$  (typ.)
- High Speed Switching & Low Power Loss
- High Input Impedance

### Applications

- PFC, UPS, Welder, PV Inverter



### Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit	
$V_{CES}$	Collector to Emitter Voltage	600	V	
$V_{GES}$	Gate to Emitter Voltage	$\pm 20$	V	
$I_C$	Collector Current	$T_C=25^\circ C$	120	A
		$T_C=100^\circ C$	60	A
$I_{CM}$	Pulsed Collector Current	180	A	
$I_F$	Diode Continuous Forward Current	$T_C=100^\circ C$	60	A
$I_{FM}$	Diode Maximum Forward Current	120	A	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ C$	310	W
		$T_C=125^\circ C$	104	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	0.48	$^\circ C/W$
$R_{th(J-C)}$ (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 @ $T_C=25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE}=0V, I_C=250\mu A$	600	-	-	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=60A, V_{GE}=15V$	-	1.80	2.10	V
		$I_C=60A, V_{GE}=15V, T_C=125\text{ }^\circ\text{C}$	-	2.15	-	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE}=V_{GE}, I_C=250\mu A$	4.6	5.3	6.0	V
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{CE}=V_{CES}, V_{GE}=0V$	-	-	5	$\mu A$
$I_{GES}$	Gate to Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0V$	-	-	$\pm 250$	nA

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=60A$	-	2.1	2.4	V
		$I_F=60A, T_C=125\text{ }^\circ\text{C}$	-	1.95	-	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F=60A, di/dt=-210A/\mu s$	-	63	-	ns
$I_{rr}$	Diode Peak Reverse Recovery Current		-	7.5	-	A
$Q_{rr}$	Diode Reverse Recovery Charge		-	450	-	nC

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
$t_{d(on)}$	Turn-on Delay Time	$I_C=60A, V_{CC}=400V, V_{GE}=15V, R_G=7\Omega, \text{Inductive Load}, T_C=25\text{ }^\circ\text{C}$	-	34.5	-	ns	
$t_r$	Rising Time		-	21.8	-	ns	
$t_{d(off)}$	Turn-off Delay Time		-	118.2	-	ns	
$t_f$	Falling Time		-	18.0	-	ns	
$E_{on}$	Turn-on Switching Loss		-	1.32	-	mJ	
$E_{off}$	Turn-off Switching Loss		-	0.86	-	mJ	
$E_{ts}$	Total Switching Loss		-	2.18	-	mJ	
$t_{d(on)}$	Turn-on Delay Time		$I_C=60A, V_{CC}=400V, V_{GE}=15V, R_G=7\Omega, \text{Inductive Load}, T_C=125\text{ }^\circ\text{C}$	-	34.5	-	ns
$t_r$	Rising Time			-	24.0	-	ns
$t_{d(off)}$	Turn-off Delay Time			-	129.9	-	ns
$t_f$	Falling Time	-		21.3	-	ns	
$E_{on}$	Turn-on Switching Loss	-		1.86	-	mJ	
$E_{off}$	Turn-off Switching Loss	-		0.82	-	mJ	
$E_{ts}$	Total Switching Loss	-		2.68	-	mJ	
$C_{ies}$	Input Capacitance	$V_{GE}=0V, V_{CE}=25V, f=1.0MHz$		-	2405	-	pF
$C_{res}$	Reverse Transfer Capacitance			-	66	-	pF
$C_{oes}$	Output Capacitance			-	289	-	pF
$Q_g$	Total Gate Charge	$I_C=60A, V_{CE}=400V, V_{GE}=15V$	-	98	-	nC	
$Q_{ge}$	Gate to Emitter Charge		-	22	-	nC	
$Q_{gc}$	Gate to Collector Charge		-	50	-	nC	
$t_{sc}$	Short Circuit With stand Time	$V_{CC}=400V, V_{GE}=15V$	5	-	-	us	

**Typical Performance Characteristics**

Fig. 1. Typical Output Characteristics

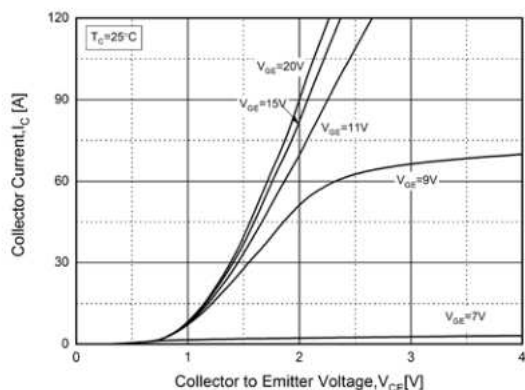


Fig. 2. Typical Saturation Voltage Characteristics

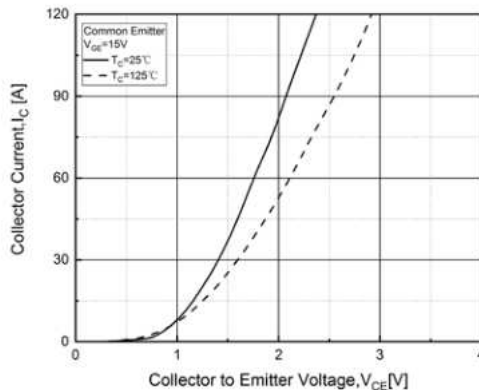


Fig. 3. Typical Saturation Voltage vs.  $T_C$

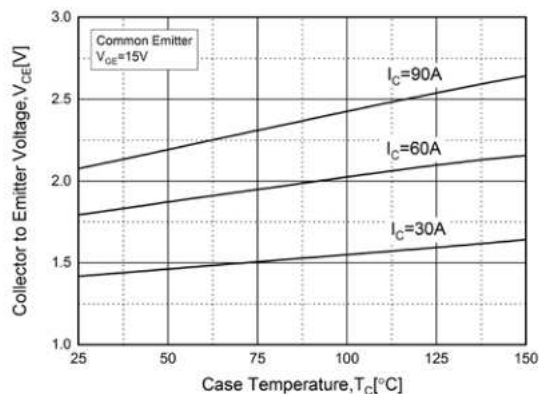


Fig. 4. Diode Forward Characteristics

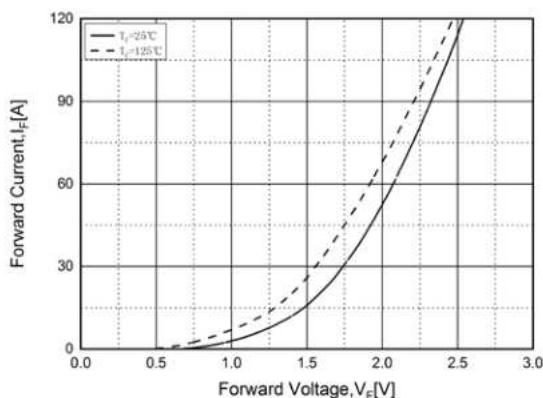


Fig. 5. Typical Capacitance Characteristics

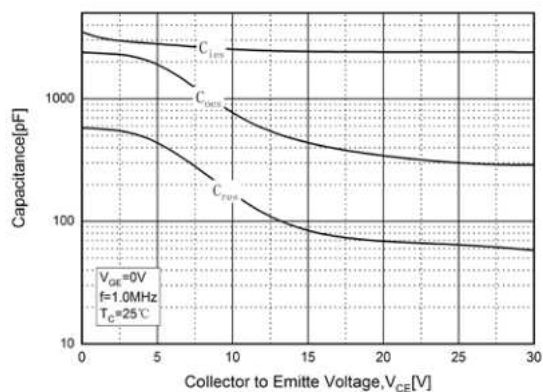
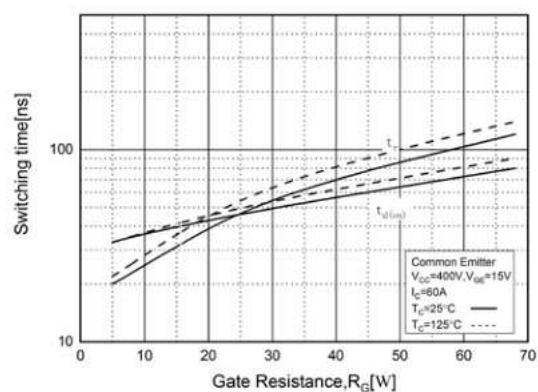


Fig. 6. Turn-on Characteristics vs.  $R_G$



**Typical Performance Characteristics**

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

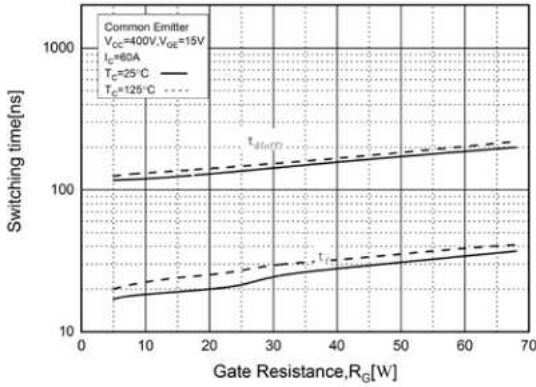


Fig. 8. Switching Loss vs.  $R_G$

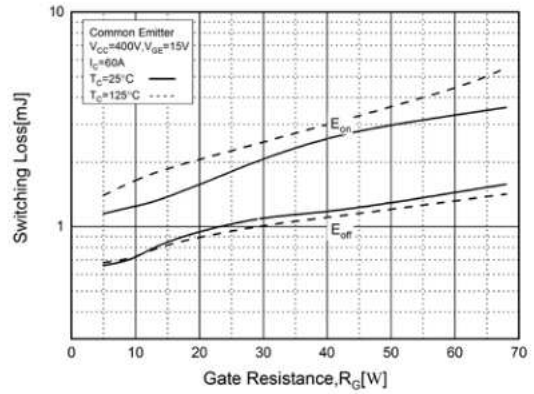


Fig. 9. Turn-on Characteristics vs.  $I_C$

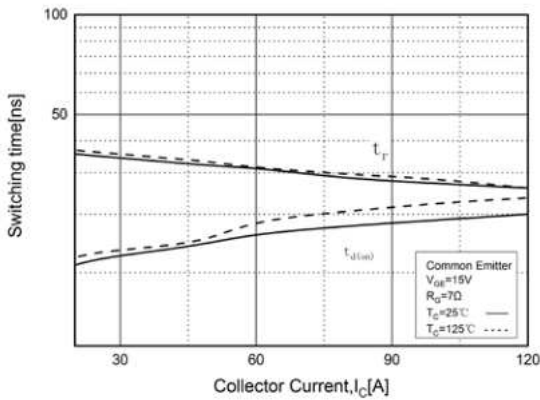


Fig. 10. Turn-off Characteristics vs.  $I_C$

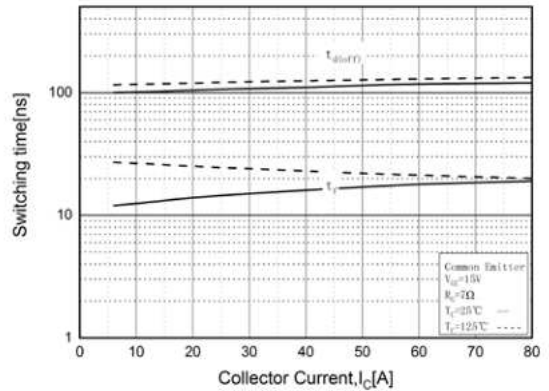
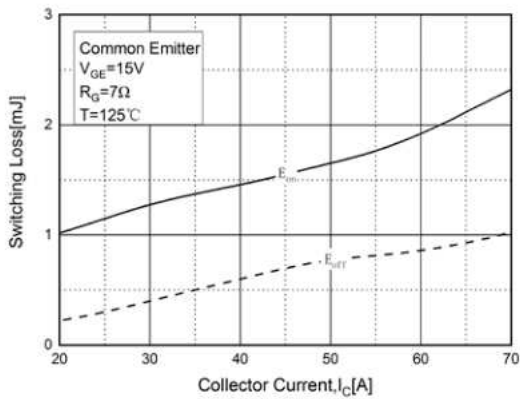


Fig. 11. Switching Loss vs.  $I_C$



**Package Dimensions**

**TO-3PN**

(Dimensions in Millimeters)

