

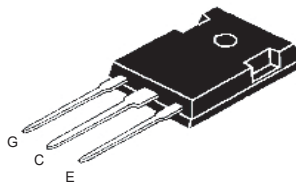
## 650V 50A Insulated Gate Bipolar Transistors

### FEATURES

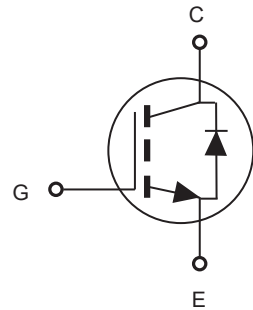
- $V_{CES} = 650V$ ,  $I_C = 50A$  ( $T_C=100^\circ C$ ) .
- Trench Gate and Field Stop Processes IGBT .
- Low  $V_{CE(sat)}$  and High Switching Speed .
- Positive  $V_{CE(sat)}$  Temperature Coefficient .
- 10us of Short-circuit Withstand Time .
- Soft and Fast Recover Antiparallel Diode .

### APPLICATIONS

- Uninterruptible Power Supplies .
- Solar Converters, Welding Machine.
- Motor Drives .



TO-247



### ABSOLUTE MAXIMUM VALUES $T_C = 25^\circ C$ unless otherwise noted

Parameter	Symbol	Limit	Units
Collector-to-Emitter Breakdown Voltage	$V_{CES}$	650	V
Gate-to-Emitter Voltage	$V_{GE}$	$\pm 30$	V
Continuous Collector Current @ $T_C = 25^\circ C$ @ $T_C = 100^\circ C$	$I_C$	100	A
		50	A
Pulsed Collector Current , tp limited by Tjmax	$I_{CM}$	150	A
Diode Continuous Forward Current @ $T_C = 25^\circ C$ @ $T_C = 100^\circ C$	$I_F$	100	A
		50	A
Diode Maximum Forward Current	$I_{FM}$	150	A
Power Dissipation@ $T_C=25^\circ C$ @ $T_C=100^\circ C$	$P_D$	278	W
		111	W
Operating Junction Temperature	$T_J$	-55 to 150	$^\circ C$
Storage Temperature Range	$T_{STG}$	-55 to 150	$^\circ C$
Maximum Temperature for Soldering	$T_L$	260	$^\circ C$

### Thermal Characteristics

Parameter	Symbol	Limit	Units
Thermal Resistance, Junction-to-Case for IGBT	$R_{\theta JC}$	0.45	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	40	$^\circ C/W$

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Units	
Collector-Emitter Breakdown Voltage	$BV_{CES}$	$V_{GE} = 0V, I_C = 1mA$	650			V	
Zero Gate Voltage Collector Current	$I_{CES}$	$V_{CE} = 650V, V_{GE} = 0V$			1	$\mu A$	
Gate Body Leakage Current, Forward	$I_{GESF}$	$V_{GE} = 30V, V_{CE} = 0V$			200	nA	
Gate Body Leakage Current, Reverse	$I_{GESR}$	$V_{GE} = -30V, V_{CE} = 0V$			-200	nA	
Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 1mA$	4.5		6.5	V	
Collector-Emitter saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C = 50A$		1.75	2.35	V	
Input Capacitance	$C_{ies}$	$V_{CE} = 25V, V_{GE} = 0V,$ $f = 1MHz$		5030		pF	
Output Capacitance	$C_{oes}$			175		pF	
Reverse Transfer Capacitance	$C_{res}$			80		pF	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 400V, I_C = 50A,$ $V_{GE} = 15V, R_{GEN} = 5\Omega$ Inductive Load $T_C = 25^\circ\text{C}$		70		ns	
Turn-On Rise Time	$t_r$			82		ns	
Turn-Off Delay Time	$t_{d(off)}$			220		ns	
Turn-Off Fall Time	$t_f$			43		ns	
Turn-On Switching Loss	$E_{on}$			2		mJ	
Turn-Off Switching Loss	$E_{off}$			1.1		mJ	
Total Switching Loss	$E_{ts}$			3.1		mJ	
Total Gate Charge	$Q_g$		$V_{CC} = 480V, I_C = 50A,$ $V_{GE} = 15V$		175		nC
Gate-Emitter Charge	$Q_{ge}$				42		nC
Gate-Collector Charge	$Q_{gc}$				77		nC

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Diode Forward Voltage	$V_F$	$I_F = 50A$		1.5	2	V
Diode Reverse Recovery Time	$t_{rr}$	$I_F = 50A$ $dI_F / dt = 100A / \mu s$		69		ns
Diode peak Reverse Recovery Current	$I_{rr}$			14		A
Diode Reverse Recovery Charge	$Q_{rr}$			0.5		$\mu C$

**Notes :**

a. Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$  .

## TYPICAL PERFORMANCE CHARACTERISTICS

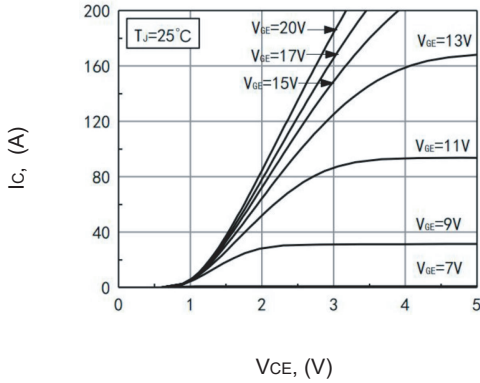


Figure 1. Output Characteristics

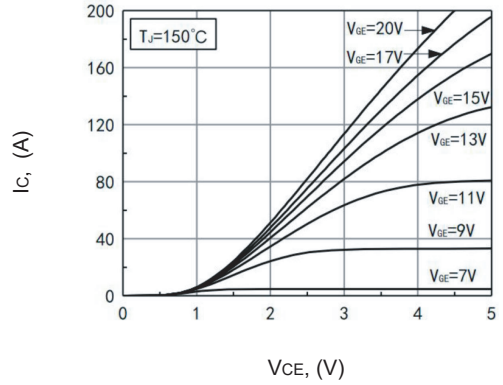


Figure 2. Output Characteristics

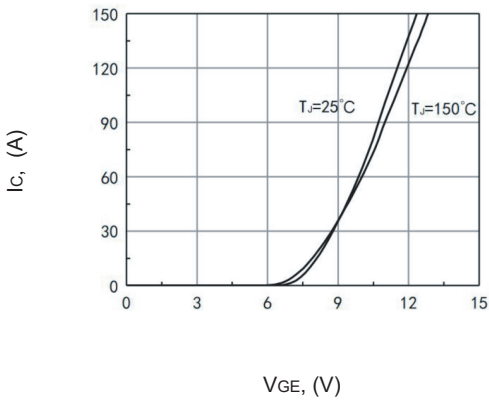


Figure 3. Typical Transfer Characteristics

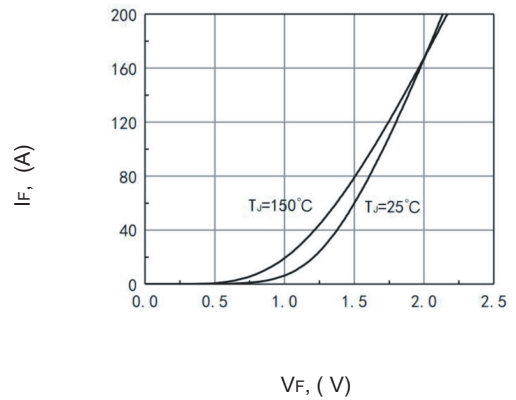


Figure 4. Saturation Voltage vs Tc Characteristics

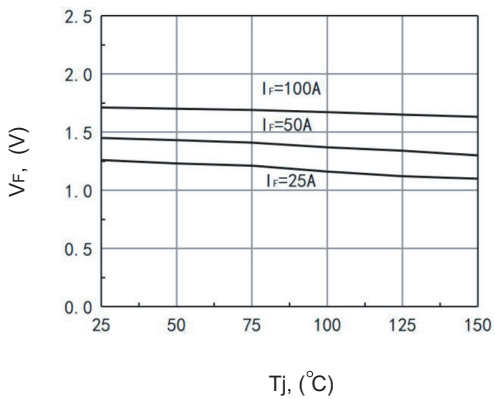


Figure 5. Forward Voltage vs Junction Temperature

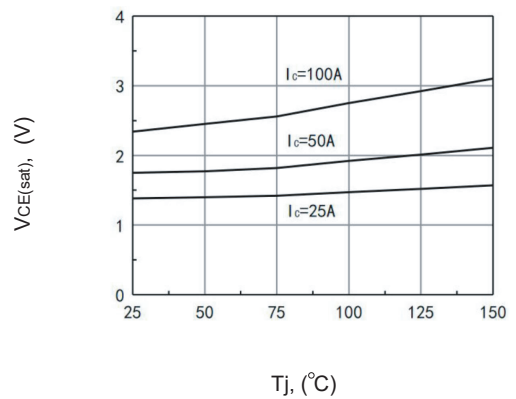


Figure 6. Typical  $V_{CE(sat)}$  vs  $T_J$  Characteristics

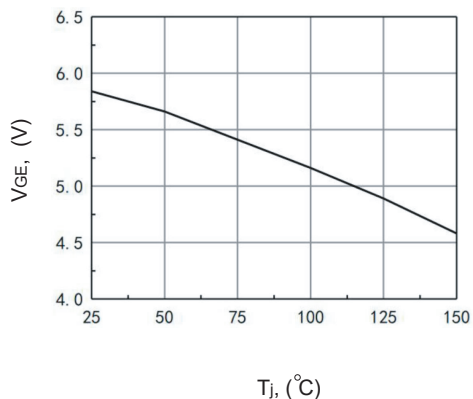


Figure 7.  $V_{GE(th)}$  vs  $T_J$  Characteristics

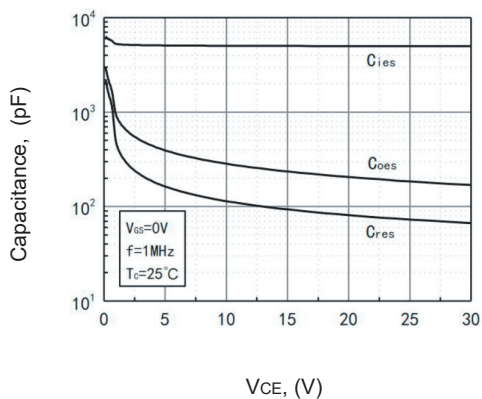


Figure 8. Capacitance Characteristics

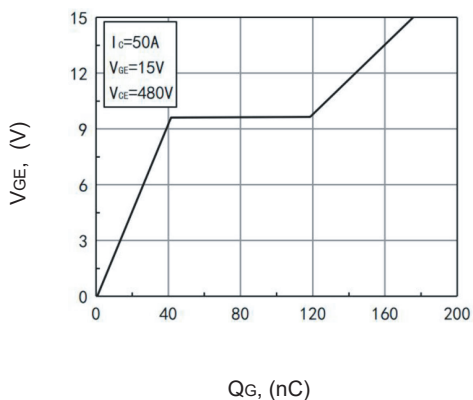


Figure 9. Gate Charge Wave Form

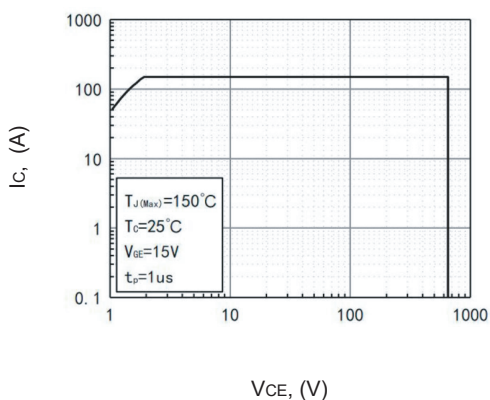


Figure 10. Forward Bias Safe Operating Area

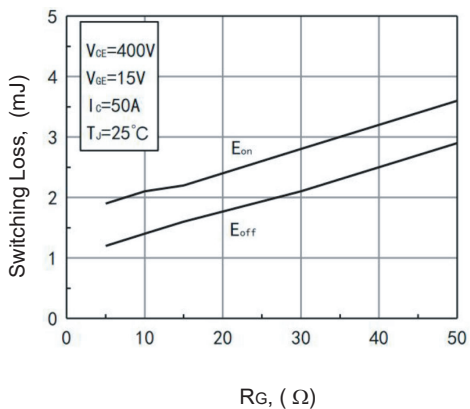


Figure 11. Switching Loss vs Gate Resistances

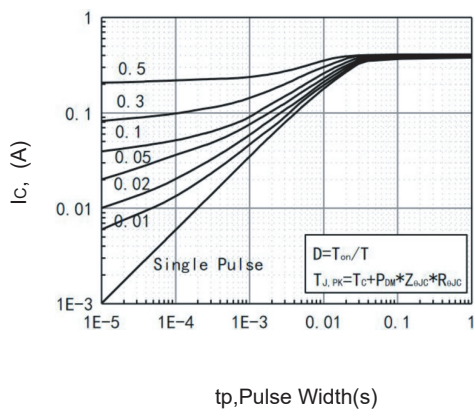
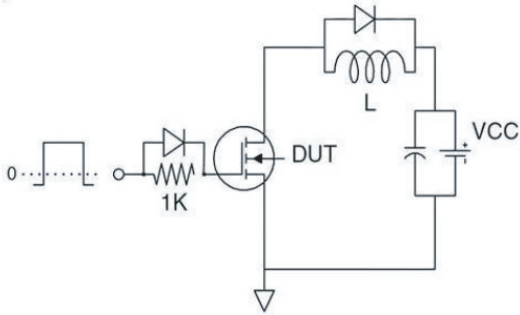


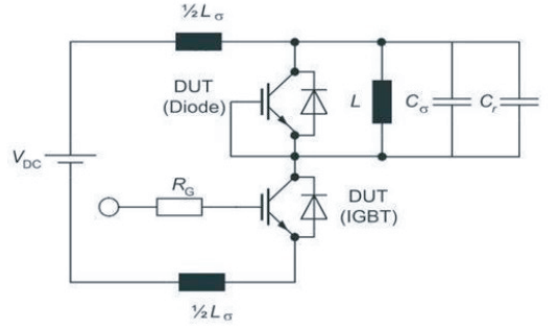
Figure 12. Transient Thermal Resistances



## TEST CIRCUIT

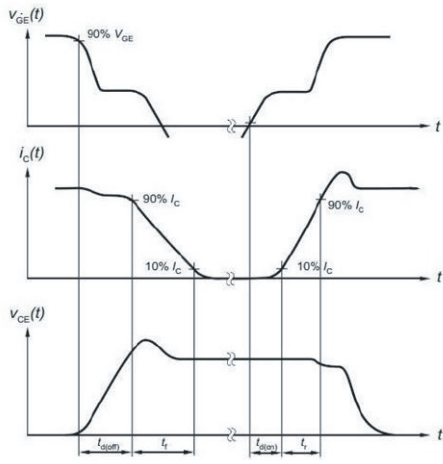


Gate Charge Test Circuit

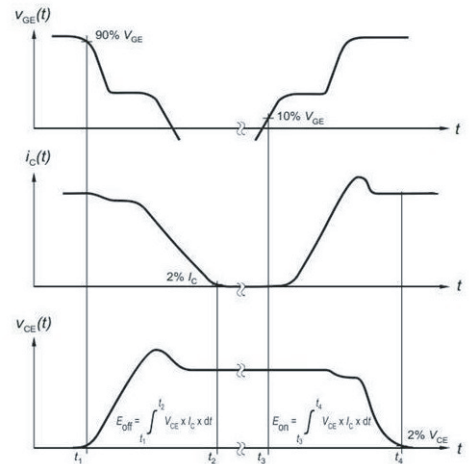


Switch Time Test Circuit

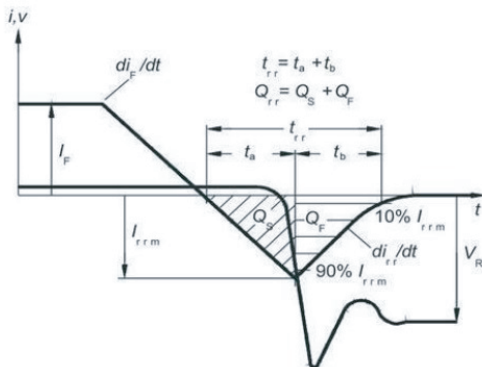
## SWITCHING CHARACTERISTICS



Definition of switching times



Definition of switching losses



Definition of diode switching characteristics