

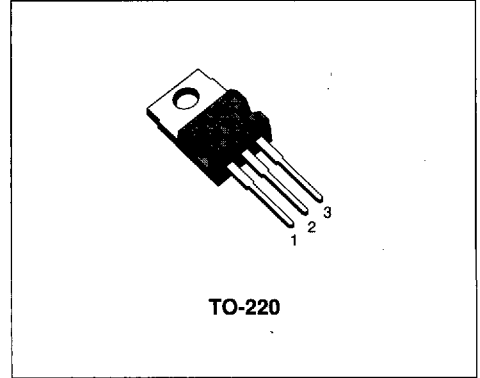
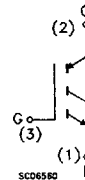
## ISOLATED GATE BIPOLAR TRANSISTOR (IGBT)

PRELIMINARY DATA

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- VERY LOW ON-VOLTAGE DROP  $V_{CE(SAT)}$
- HIGH RELIABILITY LEVEL
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT

**APPLICATIONS:**

- AUTOMOTIVE IGNITION
- LIGHT DIMMER
- S.M.P.S. SOFT START


**INTERNAL SCHEMATIC DIAGRAM**

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{GE} = 0$ )	500	V
$V_{CER}$	Collector-Emitter Voltage ( $R_{GE} = 20 \text{ k}\Omega$ )	500	V
$V_{GE}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current (continuous) at $T_c = 25^\circ\text{C}$	20	A
$I_C$	Collector Current (continuous) at $T_c = 100^\circ\text{C}$	10	A
$I_{CM}(\bullet)$	Collector Current (pulsed)	100	A
$P_{tot}$	Total Dissipation at $T_c = 25^\circ\text{C}$	100	W
	Derating Factor	0.8	W/ $^\circ\text{C}$
$T_{stg}$	Storage Temperature	-65 to 150	$^\circ\text{C}$
$T_j$	Max. Operating Junction Temperature	150	$^\circ\text{C}$

(•) Pulse width limited by safe operating area

## THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-Case	Max	1.25	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-Ambient	Max	62.5	°C/W
$R_{thc-h}$	Thermal Resistance Case-Heatsink	Max	0.1	°C/W

ELECTRICAL CHARACTERISTICS ( $T_j = 25\text{ °C}$  unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$I_C = 250\ \mu\text{A}$ $V_{GE} = 0$	500			V
$I_{CES}$	Collector Cut-off Current ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating}$ $V_{CE} = \text{Max Rating} \times 0.8$ $T_j = 125\text{ °C}$			250 1	$\mu\text{A}$ mA
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{ V}$ $V_{CE} = 0$			100	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ $I_C = 250\ \mu\text{A}$	2		4	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{ V}$ $I_C = 10\text{ A}$ $V_{GE} = 15\text{ V}$ $I_C = 10\text{ A}$ $T_j = 100\text{ °C}$		1.85 1.75		V V

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 20\text{ V}$ $I_C = 10\text{ A}$	2.5	6		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GE} = 0$		900 90 30	1250 140 42	pF pF pF
$Q_g$	Gate Charge	$V_{CE} = 400\text{ V}$ $V_{GE} = 15\text{ V}$ $I_C = 10\text{ A}$		55		nC

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Time Rise Time	$I_C = 10\text{ A}$ $V_{CC} = 400\text{ V}$ $V_{GE} = 15\text{ V}$ $R_{GE} = 100\ \Omega$		35 100	50 150	ns ns
$di_c/dt$	Turn-on Current Slope	$I_C = 10\text{ A}$ $V_{CC} = 400\text{ V}$ $V_{GE} = 15\text{ V}$ $R_{GE} = 100\ \Omega$ $T_j = 100\text{ °C}$		220		A/ms
$E_{on}$	Turn-on Switching Losses	$I_C = 10\text{ A}$ $V_{CC} = 400\text{ V}$ $V_{GE} = 15\text{ V}$ $R_{GE} = 100\ \Omega$ $T_j = 100\text{ °C}$		185	220	$\mu\text{J}$
$V_{CE(350ms)}$	Collector-Emitter Dynamic Voltage	$I_C = 10\text{ A}$ $V_{CC} = 400\text{ V}$ $V_{GE} = 15\text{ V}$ $R_{GE} = 100\ \Omega$ $T_j = 100\text{ °C}$			7	V
$V_{CE(610ms)}$	Collector-Emitter Dynamic Voltage	$I_C = 10\text{ A}$ $V_{CC} = 400\text{ V}$ $V_{GE} = 15\text{ V}$ $R_{GE} = 100\ \Omega$ $T_j = 100\text{ °C}$			4	V

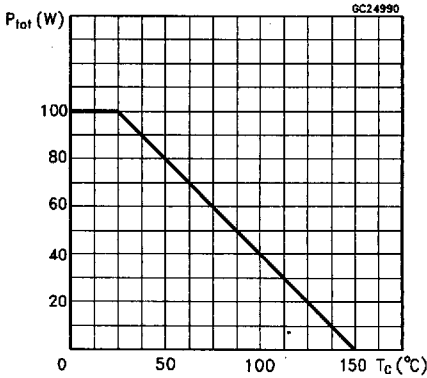
**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING OFF**

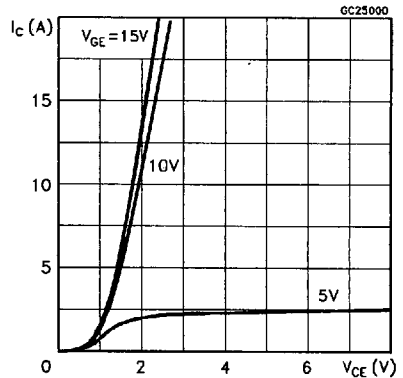
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 400\text{ V}$ $I_C = 10\text{ A}$ $R_{GE} = 100\ \Omega$ $V_{GE} = 15\text{ V}$		1500		ns
$t_{r(Voff)}$	Off Voltage Rise Time			170		ns
$t_f$	Fall Time			1000		ns
$E_{off(**)}$	Turn-off Switching Loss			2.2	3.25	mJ
$t_c$	Cross-Over Time	$V_{CC} = 400\text{ V}$ $I_C = 10\text{ A}$ $R_{GE} = 100\ \Omega$ $V_{GE} = 15\text{ V}$ $T_j = 100\ ^\circ\text{C}$		2600		ns
$t_{r(Voff)}$	Off Voltage Rise Time			190		ns
$t_f$	Fall Time			2000		ns
$E_{off(**)}$	Turn-off Switching Loss			3.8	4.8	mJ

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %  
 (\*\*) Losses include also the tail (Jedec Standardization)

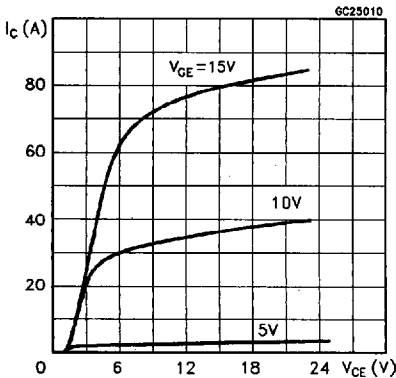
**Derating Curves**



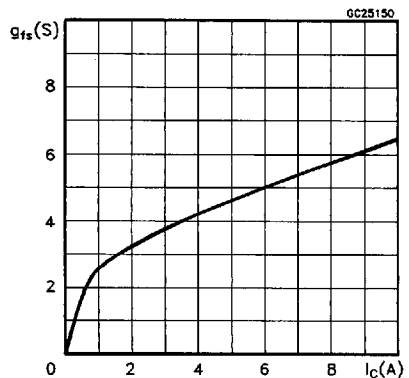
**Output Characteristics**



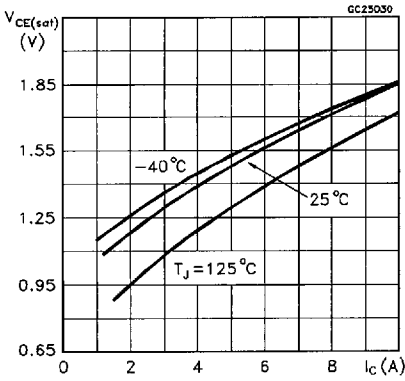
**Output Characteristics**



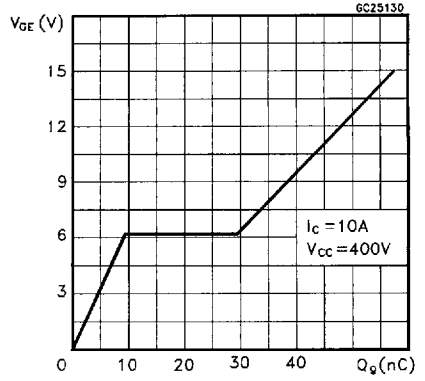
**Transconductance**



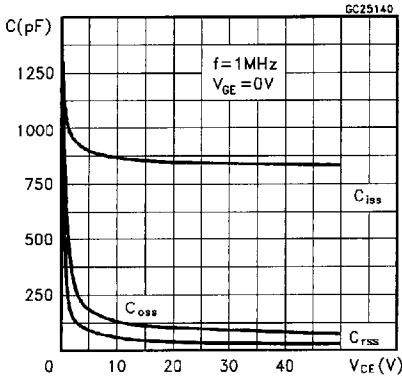
Static Collector-Emitter On Voltage



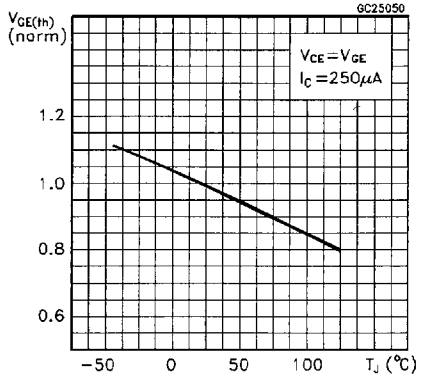
Gate Charge vs Gate-Emitter Voltage



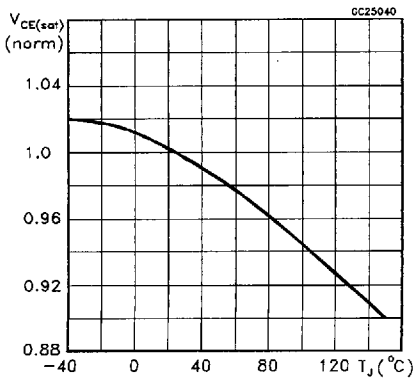
Capacitance Variation



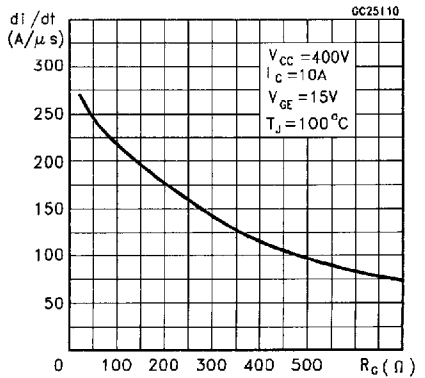
Normalized Gate Threshold Voltage vs Temperature



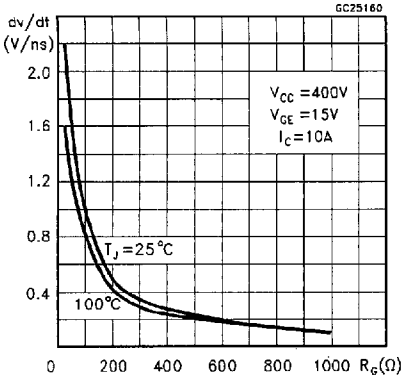
Normalized On Voltage vs Temperature



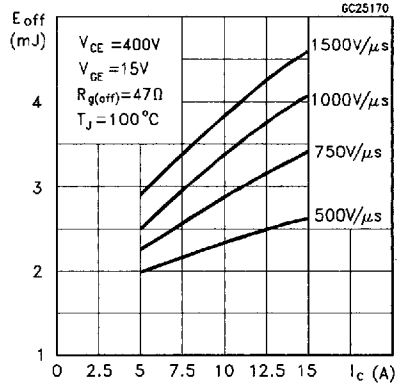
Turn On Current Slope vs Gate-Emitter Resistance



Turn Off Voltage Slope vs Gate-Emitter Resistance



Off Losses vs  $dv/dt$



Off Losses vs Junction Temperature and Supply Voltage

