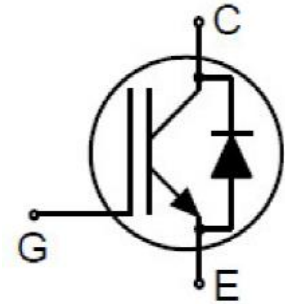


Features

- High breakdown voltage to 1200V for improved reliability
- Trench-stop technology offering:
 - Very tight parameter distribution
 - High ruggedness, temperature stable behavior
 - Short circuit withstand time: 10μs
 - LOW $V_{CE(SAT)}$
 - Easy parallel switching capability due to positive temperature coefficient in $V_{CE(SAT)}$
- Enhanced avalanche capability
- RoHS compliant with Halogen-free
- Qualified to AEC-Q101 Standards

HF

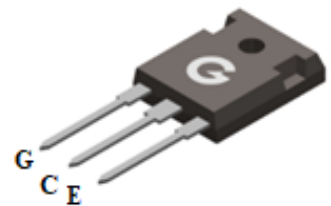


Applications

- Frequency converters
- Motor Drive

Mechanical Data

- Case: TO-247
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208



TO-247

Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
TGKU40N120ET2	TO-247	30 pcs / Tube	KU40N120ET2

Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-to-Emitter Voltage	V_{CES}	1200	V
Gate-Emitter Voltage	V_{GES}	± 20	V
DC Collector Current ($T_C = 25^\circ\text{C}$, limited by maximum T_J)	I_C	80	A
DC Collector Current ($T_C = 100^\circ\text{C}$, limited by maximum T_J)		40	A
Diode Continuous Forward Current ($T_C = 25^\circ\text{C}$, limited by maximum T_J)	I_F	80	A
Diode Continuous Forward Current ($T_C = 100^\circ\text{C}$, limited by maximum T_J)		40	A
Pulsed Collector Current (Pulse width limited by maximum T_J , $V_{GE} = 15\text{V}$)	I_{CM}	160	A
Pulsed Source-Drain Current (Pulse width limited by maximum T_J)	I_{FM}	160	A
Short Circuit Withstand Time ($V_{GE} = 15\text{V}$, $V_{CE} \leq 600\text{V}$)	T_{SC}	10	μs
Soldering Temperature, Wave Soldering 1.6mm (0.063in.) from case for 10s	T_{sold}	260	$^\circ\text{C}$
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	500	W
Operating Junction Temperature Range	T_J	$-55 \sim +175$	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	$-55 \sim +150$	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Case, IGBT (bottom)	$R_{\theta JC}$	-	0.22	0.23	°C/W
Thermal Resistance Junction-to-Case, Diode (bottom)		-	0.43	0.48	°C/W
Thermal Resistance Junction-to-Case, (top)	$R_{\theta JC}$	-	-	15	°C/W
Thermal Resistance Junction-to-Air	$R_{\theta JA}$	-	-	40	°C/W

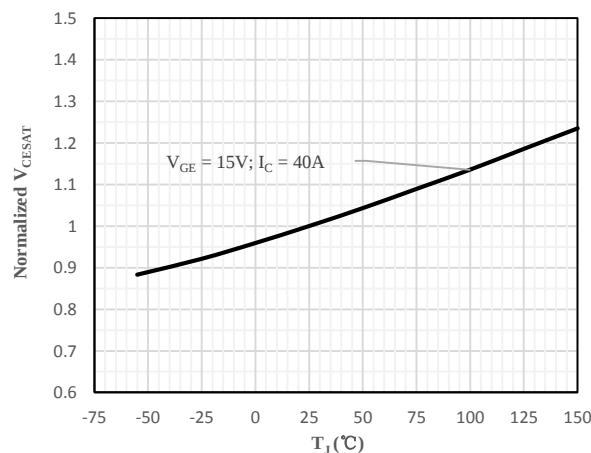
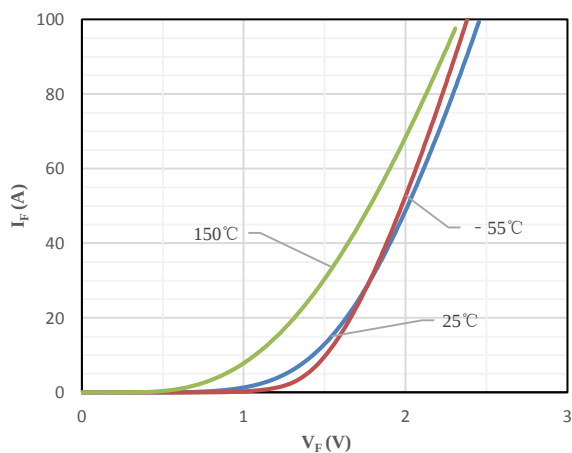
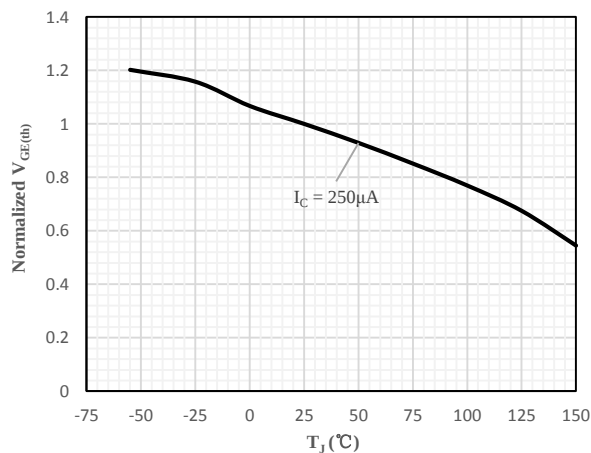
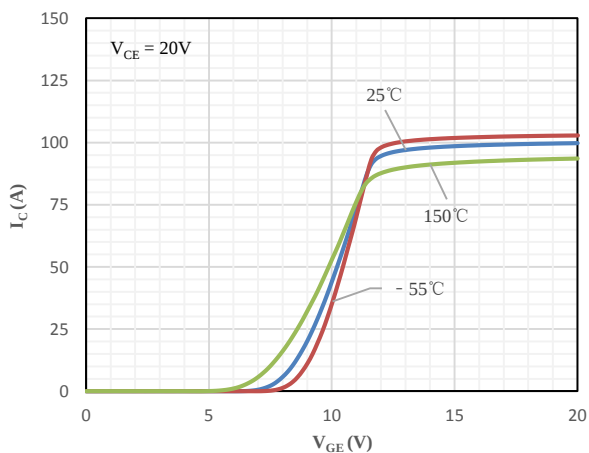
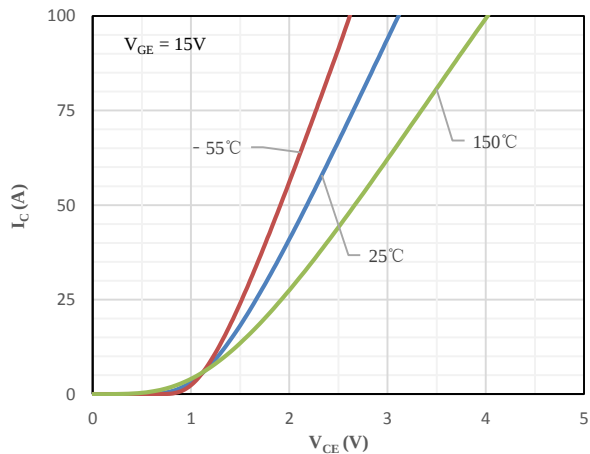
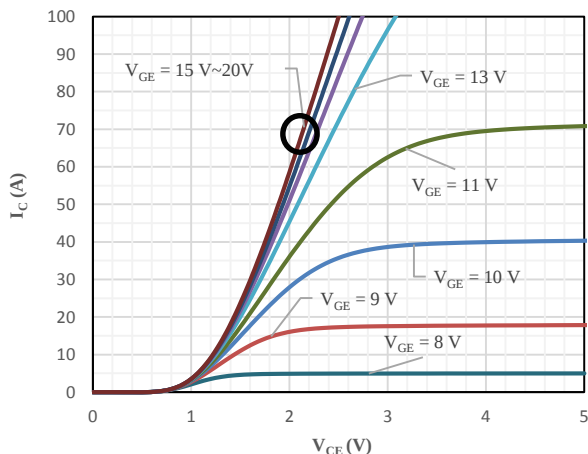
Electrical Characteristics of the IGBT (@ $T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	1200	-	-	V
I_{CES}	Collector-Emitter Leakage Current	$V_{CE} = 1200V, V_{GE} = 0V, T_J = 25^\circ\text{C}$	-	-	250	μA
		$V_{CE} = 1200V, V_{GE} = 0V, T_J = 150^\circ\text{C}$	-	-	2500	μA
I_{GES}	Gate to Emitter Leakage Current	$V_{GE} = \pm 20V, V_{CE} = 0V$	-	-	± 100	nA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15V, I_C = 40A, T_J = 25^\circ\text{C}$	-	1.8	2.2	V
		$V_{GE} = 15V, I_C = 40A, T_J = 150^\circ\text{C}$	-	2.2	-	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 250\mu A$	4	5.2	6	V
g_{fs}	Transconductance	$V_{CE} = 20V, I_C = 15A$	-	15	-	S
R_G	Gate Resistance	$V_{GE} = 0V, f = 1\text{MHz}$	0.5	1.3	3	Ω
Dynamic Characteristics						
Q_G	Total Gate-Charge	$V_{CC} = 960V, V_{GE} = 15V, I_C = 40A$	-	255	-	nC
C_{ies}	Input Capacitance	$V_{CE} = 30V$	-	6017	-	pF
C_{oes}	Output Capacitance	$V_{GE} = 0V$	-	171	-	
C_{res}	Reverse Transfer Capacitance	$f = 1\text{MHz}$	-	84	-	
$I_{C(SC)}$	Short Circuit Collector Current	$V_{GE} = 15V, t_{SC} \leq 10\mu s$ $V_{CC} = 600V, T_J = 25^\circ\text{C}$	-	280	-	A
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	$V_{CE} = 600V$ $V_{GE} = 15V$ $I_C = 40A$ $R_G = 10\Omega$ $T_J = 25^\circ\text{C}$	-	75	-	ns
t_r	Turn-on Rise Time		-	97	-	
$t_{d(off)}$	Turn-Off Delay Time		-	219	-	
t_f	Turn-Off Fall Time		-	172	-	
E_{on}	Turn-On Switching Loss		-	3.28	-	mJ
E_{off}	Turn-Off Switching Loss		-	2.06	-	

Electrical Characteristics of the Diode (@ $T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Dynamic Characteristics						
V_{FM}	Diode Forward Voltage	$I_F = 40\text{A}$, $V_{GE} = 0\text{V}$	-	1.89	-	V
t_{rr}	Reverse recovery time	$V_{GS} = 0\text{V}$, $I_F = 40\text{A}$ $di/dt = 300\text{A}/\mu\text{s}$	-	109	-	ns
Q_{rr}	Reverse recovery charge		-	423	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	7.4	-	A

Ratings and Characteristics Curves (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)



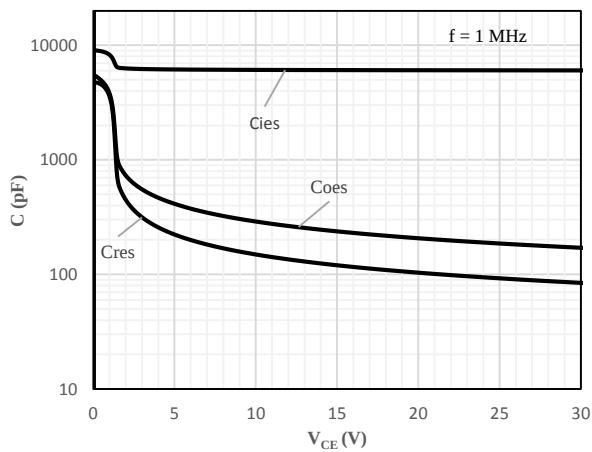


Fig 7 Capacitance Characteristics

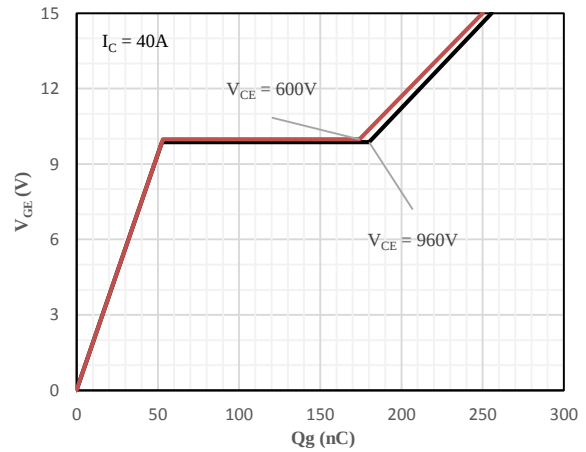


Fig 8 Gate-Charge Characteristics

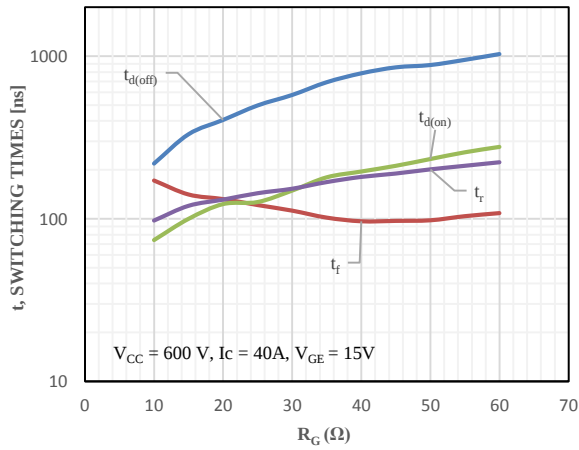


Fig 9 Switching Times vs. Gate Resistor

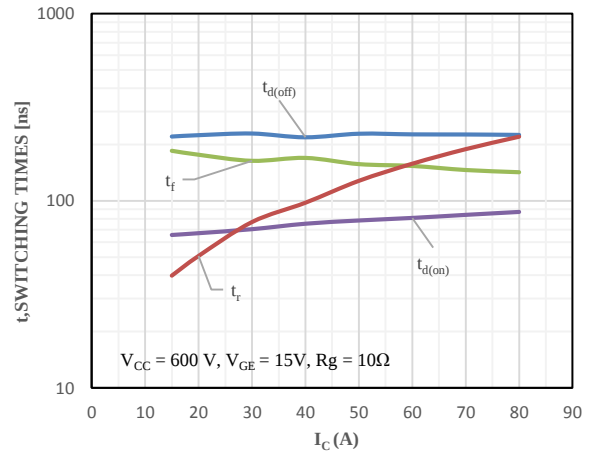


Fig 10 Switching Times vs. Collector Current

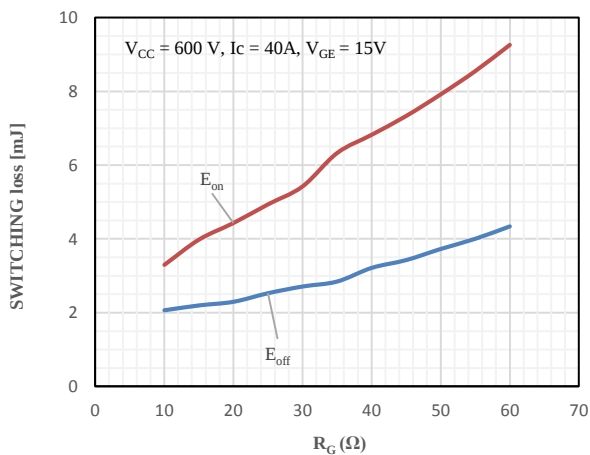


Fig 11 Switching Loss vs. Gate Resistor

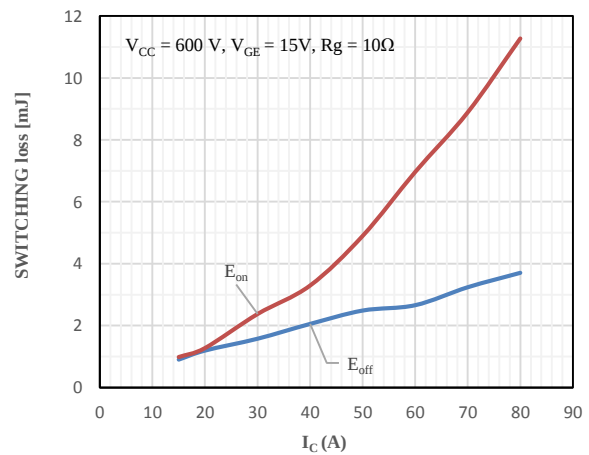


Fig 12 Switching Loss vs. Collector Current

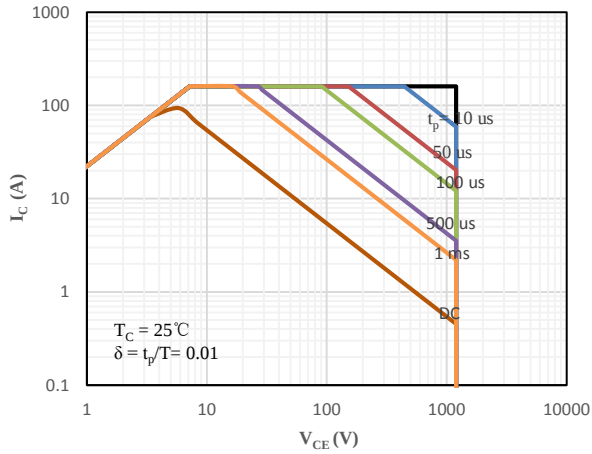


Fig 13 SOA characteristics

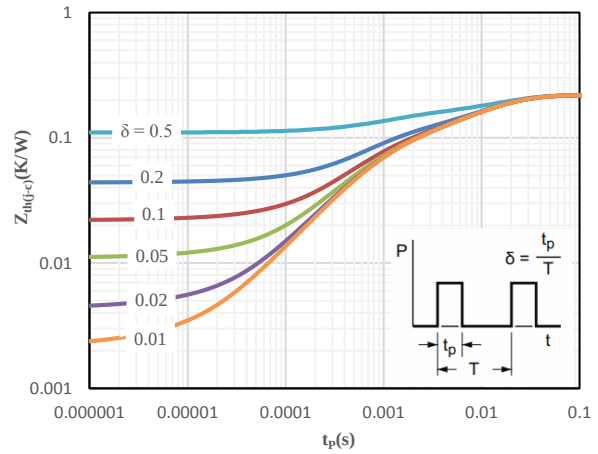
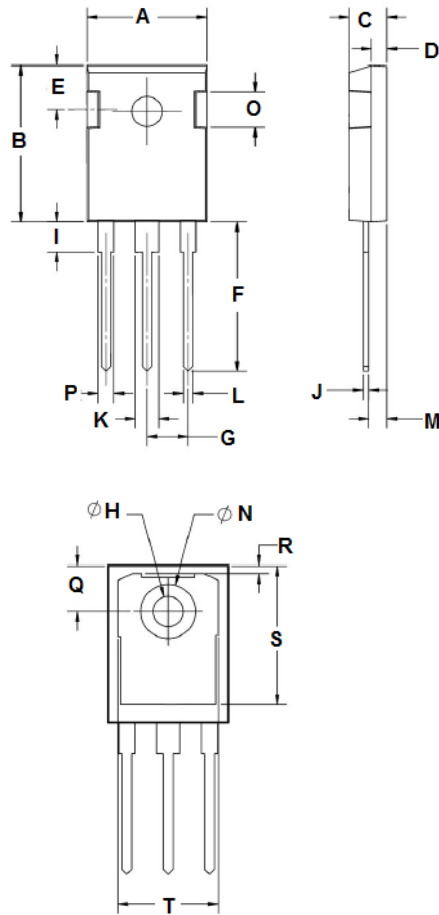


Fig 14 Maximum transient thermal impedance

Package Outline Dimensions (Unit: mm)



TO-247		
Dimension	Min.	Max.
A	15.50	16.10
B	20.70	21.30
C	4.70	5.30
D	1.80	2.20
E	5.20	5.80
F	19.70	20.30
G	5.20	5.60
H	3.30	3.70
I	3.90	4.30
J	0.50	0.70
K	2.80	3.20
L	1.00	1.40
M	2.20	2.60
N	7.00	7.20
O	4.90	5.30
P	1.80	2.20
Q	5.70	5.90
R	0.80	1.20
S	17.00	17.80
T	13.60	14.20