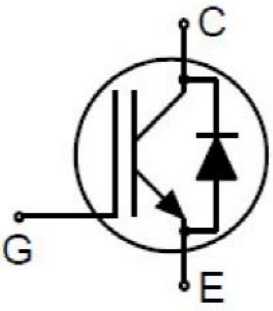
Trench FS IGBT with Full Rated Diode

GKU40N65F5

Features

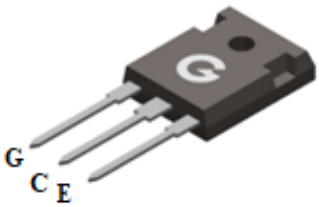
HF

- High breakdown voltage to 650V for improved reliability
- Trench-stop technology offering:
  - High speed switching
  - High ruggedness, temperature stable behavior
  - 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



Applications

- Uninterruptible power supplies
- Solar inverter



TO-247

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

Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
GKU40N65F5	TO-247	30 pcs / Tube	KU40N65F5

Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-to-Emitter Voltage	V_{CES}	650	V
Gate-Emitter Voltage	V_{GES}	±20	V
DC Collector Current (T_C = 25°C, limited by maximum T_J)	I_C	70	A
DC Collector Current (T_C = 100°C, limited by maximum T_J)		40	A
Diode Continuous Forward Current (T_C = 25°C, limited by maximum T_J)	I_F	70	A
Diode Continuous Forward Current (T_C = 100°C, limited by maximum T_J)		40	A
Pulsed Collector Current (Pulse width limited by maximum T_J, V_{GE} = 15V)	I_{CM}	160	A
Pulsed Source-Drain Current (Pulse width limited by maximum T_J)	I_{FM}	160	A
Soldering Temperature, Wave Soldering 1.6mm (0.063in.) from case for 10s	T_{sold}	260	°C
Power Dissipation (T_C = 25°C)	P_D	250	W
Operating Junction Temperature Range	T_J	-55 ~ +175	°C
Storage Temperature Range	T_{STG}	-55 ~ +175	°C

Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Case, IGBT	$R_{\theta JC}$	-	-	0.6	°C/W
Thermal Resistance Junction-to-Case, Diode		-	-	0.65	°C/W
Thermal Resistance Junction-to-Air	$R_{\theta JA}$	-	-	40	°C/W

Electrical Characteristics of the IGBT (@ T_J = 25°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 = 250μA	650	-	-	V
I_{CES}	Collector-Emitter Leakage Current	V_{CE} = 650V, V_{GE} = 0V	-	-	40	μA
I_{GES}	Gate to Emitter Leakage Current	V_{GE} = ±20V, V_{CE} = 0V	-	-	±100	nA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15V, I_C = 40A, T_J = 25°C	-	1.6	2.1	V
		V_{GE} = 15V, I_C = 40A, T_J = 175°C	-	1.95	-	V
$V_{GE(th)}$	Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 250μA	3.2	4.0	4.8	V
g_{fs}	Transconductance	V_{CE} = 15V, I_C = 40A	-	55	-	S
Dynamic Characteristics						
Q_G	Total Gate-Charge	V_{CC} = 520V, V_{GE} = 15V, I_C = 40A	-	57	-	nC
C_{ies}	Input Capacitance	V_{CE} = 25V V_{GE} = 0V f = 1MHz	-	1520	-	pF
C_{oes}	Output Capacitance		-	110	-	
C_{res}	Reverse Transfer Capacitance		-	11	-	
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{CE} = 400V V_{GE} = 15V I_C = 40A R_G = 15Ω T_J = 25°C	-	26	-	ns
t_r	Turn-on Rise Time		-	28	-	
$t_{d(off)}$	Turn-Off Delay Time		-	136	-	
t_f	Turn-Off Fall Time		-	34	-	
E_{on}	Turn-On Switching Loss		-	0.9	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.43	-	

Electrical Characteristics of the Diode (@ T_J = 25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Dynamic Characteristics						
V_{FM}	Diode Forward Voltage	I_F = 40A, V_{GE} = 0V	-	1.8	-	V
t_{rr}	Reverse recovery time	V_{GS} = 0V, I_F = 40A di/dt = 400A/μs	-	56	-	ns
Q_{rr}	Reverse recovery charge		-	270	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	8	-	A

Ratings and Characteristics Curves (@ T_A = 25°C unless otherwise specified)

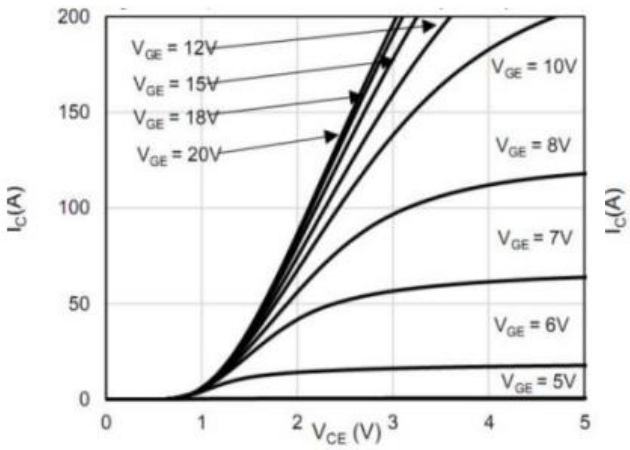


Fig 1 Typical Output Characteristics (25°C)

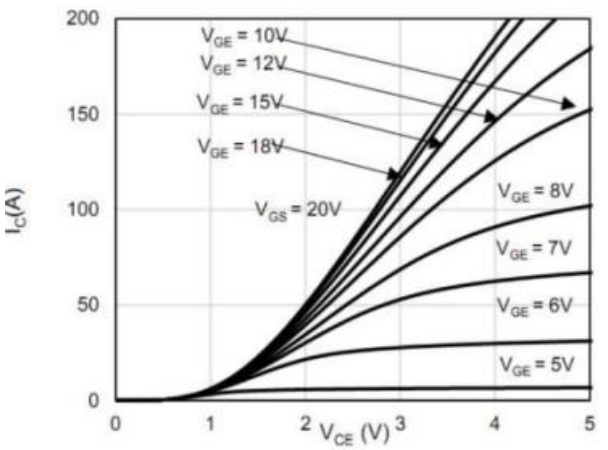


Fig 2 Typical Output Characteristics (150°C)

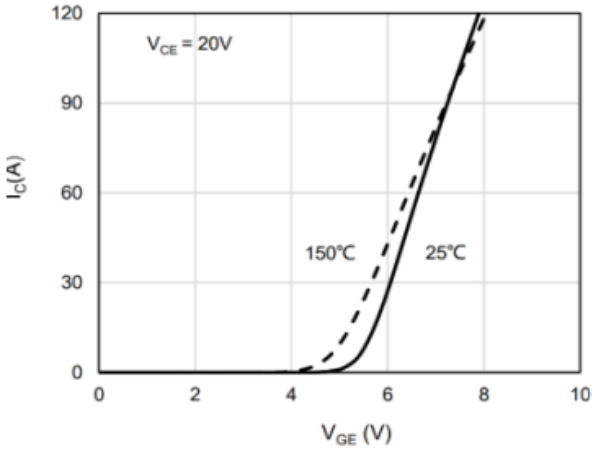


Fig 3 Transfer Characteristics

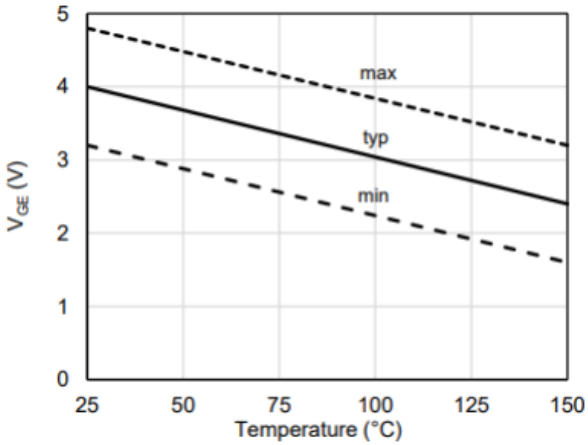


Fig 4 $V_{GE(th)}$ vs. Junction Temperature

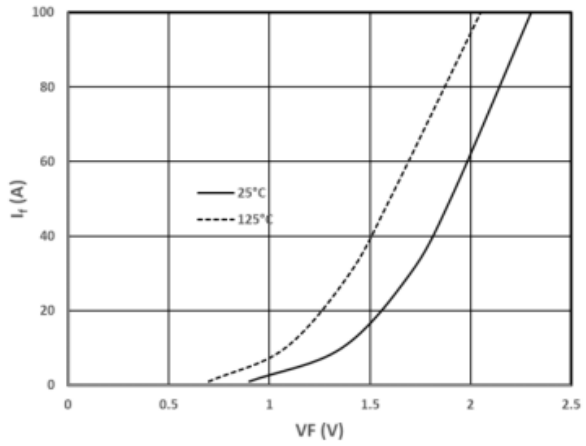


Fig 5 Body-Diode Characteristics

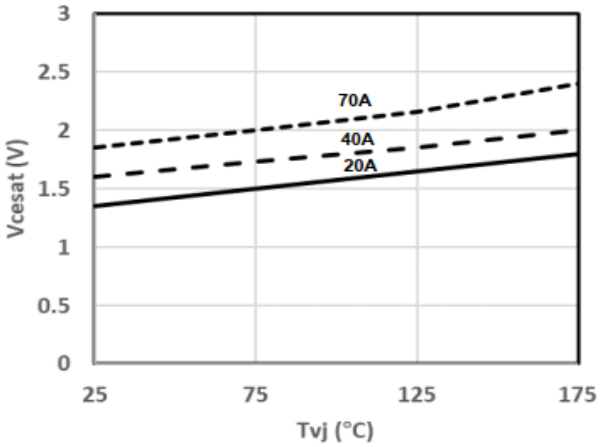


Fig 6 Normalized Collector-Emitter Saturation Voltage vs. Junction Temperature

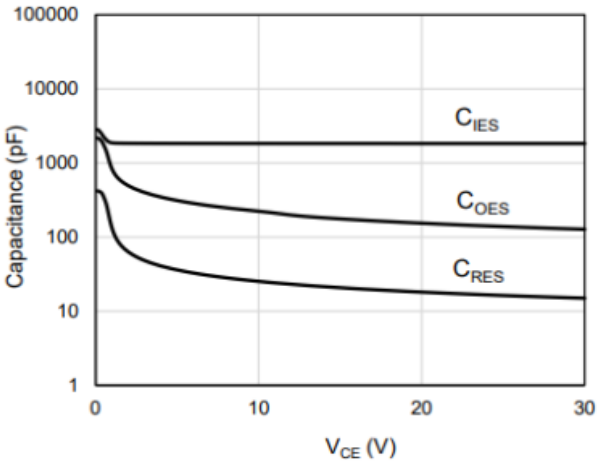


Fig 7 Capacitance Characteristics

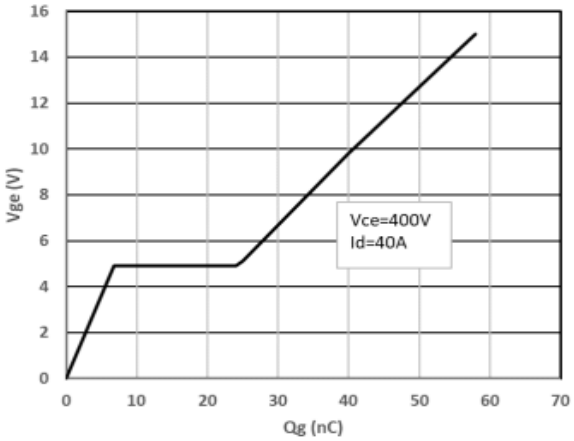


Fig 8 Gate-Charge Characteristics

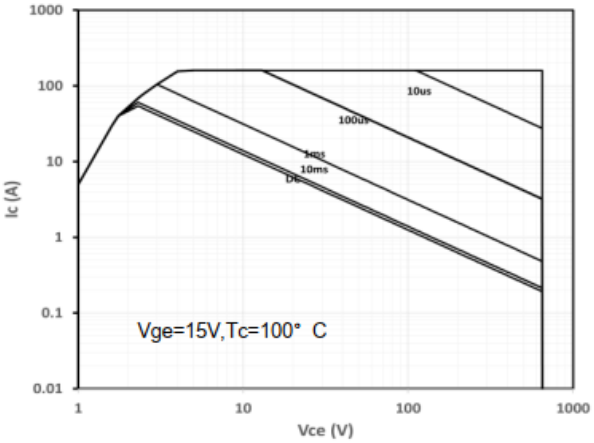


Fig 9 SOA characteristics

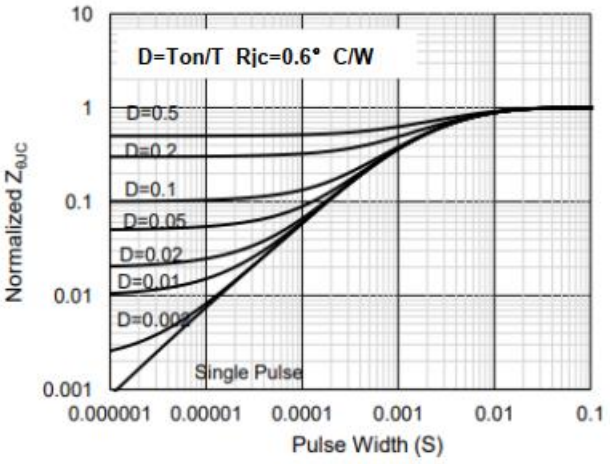
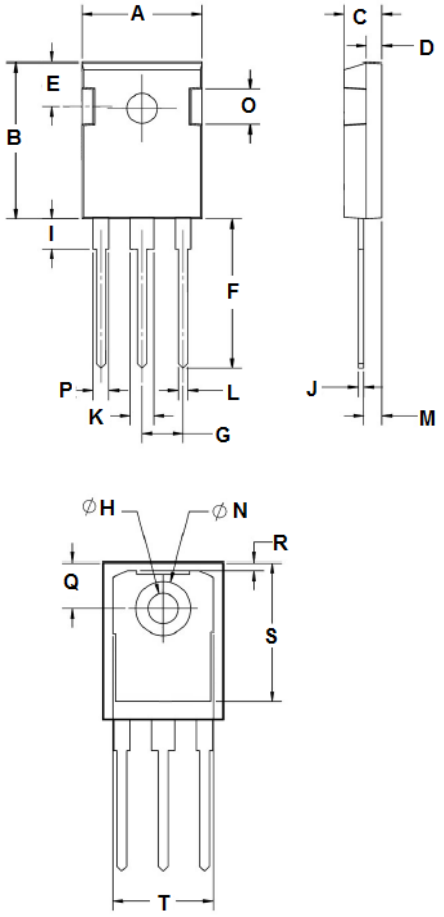


Fig 10 Maximum transient thermal impedance

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