

1. Features

- $V_{CE(sat)}=1.91V(\text{typ.})@V_{GE}=15V, T_{vj}=25^{\circ}C$
- Low $V_{CE(sat)}$
- Fast Switching
- High Ruggedness
- Short-Circuit Rated

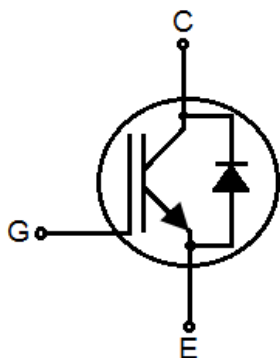
2. Applications

- Solar Inverters
- Uninterrupted Power Supply
- Industrial Inductive Heating
- Energy Storage

3. Pin configuration



TO-247



Pin	Function
1	G
2	C
3	E

4. Ordering information

Part Number	Package	Brand
KGM40N120AI	TO-247	KIA

5. Maximum ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$	V_{CE}	1200	V
DC collector current, limited by $T_{vjmax} T_C = 25^{\circ}\text{C}$	I_C	80	A
DC collector current, limited by $T_{vjmax} T_C = 100^{\circ}\text{C}$		40	A
Pulsed collector current, tp limited by T_{vjmax}	I_{Cpuls}	160	A
Turn off safe operating area $V_{CE} \leq 600\text{V}$, $T_{vj} \leq 150^{\circ}\text{C}$, $tp = 1\mu\text{s}$	-	TBD	A
Diode forward current, limited by $T_{vjmax} T_C = 25^{\circ}\text{C}$	I_F	40	A
Diode forward current, limited by $T_{vjmax} T_C = 100^{\circ}\text{C}$		40	A
Diode pulsed current, tp limited by T_{vjmax}	I_{Fpuls}	80	A
Gate-emitter voltage	V_{GE}	± 20	V
Transient Gate-emitter voltage	V_{GE}	± 30	V
Short circuit withstand time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 400\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 150^{\circ}\text{C}$	t_{SC}	-	μs
Power dissipation $T_C = 25^{\circ}\text{C}$	P_{tot}	575	W
Power dissipation $T_C = 100^{\circ}\text{C}$		290	W
Operating junction temperature	$T_{vj(OP)}$	-40 to +175	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-40 to +150	$^{\circ}\text{C}$
Soldering temperature, wave soldering 1.6mm(0.063in.) from case for 10s	-	260	$^{\circ}\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	-	Nm

Maximum Ratings For optimum lifetime and reliability, 397 recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

6. Thermal characteristics

Parameter	Symbol	Rating		Unit
		Min.	Max.	
IGBT Thermal Resistance, Junction-Case	$R_{\theta(J-C)}$	-	0.26	°C/W
Diode Thermal Resistance, Junction-Case	$R_{\theta(J-C)}$	-	0.45	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta(J-A)}$	-	TBD	°C/W

7. Electrical characteristics

($T_{vj}=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	1200	-	-	V
Collector-emitter breakdown voltage		$V_{GE}=0V, I_C=1mA$	1200	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE}=15V, I_C=60A, T_{vj}=25^{\circ}\text{C}$	-	1.91	2.30	V
		$V_{GE}=15V, I_C=60A, T_{vj}=150^{\circ}\text{C}$	-	2.36	-	V
Diode forward voltage	V_F	$V_{GE}=0V, I_F=60A, T_{vj}=25^{\circ}\text{C}$	-	2.0	2.5	V
		$V_{GE}=0V, I_F=60A, T_{vj}=150^{\circ}\text{C}$	-	1.74	-	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_C=250\mu A$	4.5	5.1	5.7	V
Zero gate voltage collector current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_{vj}=25^{\circ}\text{C}$	-	-	250	μA
		$V_{CE}=650V, V_{GE}=0V, T_{vj}=150^{\circ}\text{C}$	-	-	TBD	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$	-	-	600	nA
Transconductance	g_{fs}	$V_{CE}=20V, I_C=60A$	-	27	-	S

($T_{vj}=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic Characteristic						
Input capacitance	C_{ies}	$V_{CE}=30\text{V}, V_{GE}=0\text{V},$ $f=1\text{MHZ}$	-	2500	-	pF
Output capacitance	C_{oes}		-	200	-	pF
Reverse transfer capacitance	C_{res}		-	100	-	pF
Gate charge	Q_G	$V_{CC}=520\text{V}, I_C=60\text{A},$ $V_{GE}=15\text{V}$	-	120	-	nC
IGBT Characteristic, at $T_{vj}=25^{\circ}\text{C}$						
Turn-on delay time	$t_{d(on)}$	$V_{CC}=600\text{V}, I_C=60\text{A},$ $V_{GE}=0.0/15\text{V}, R_g=12\Omega$	-	15	-	nS
Rise time	t_r		-	70	-	nS
Turn-off delay time	$t_{d(off)}$		-	145	-	nS
Fall time	t_f		-	82	-	nS
Turn-on energy	E_{on}		-	3.48	-	mJ
Turn-off energy	E_{off}		-	1.47	-	mJ
Total switching energy	E_{ts}		-	TBC	-	mJ
Diode reverse recovery time	t_{rr}	$I_F=40\text{A}, V_R=600\text{V},$ $di/dt=400\text{A}/\mu\text{s}$	-	450	-	nS
Diode reverse recovery charge	Q_{rr}		-	2.57	-	μC
Diode peak reverse recovery current	I_{rrm}		-	13	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	TBC	-	$\text{A}/\mu\text{s}$

8. Test circuits and waveforms

Fig. 1 Typical output characteristics

($T_J = 25^\circ\text{C}$, $t_p = 250 \mu\text{s}$)

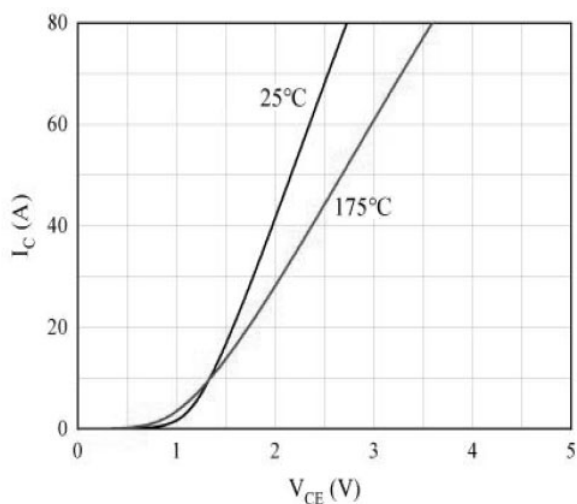


Fig. 2 Typical output characteristics

($T_J = 175^\circ\text{C}$, $t_p = 250 \mu\text{s}$)

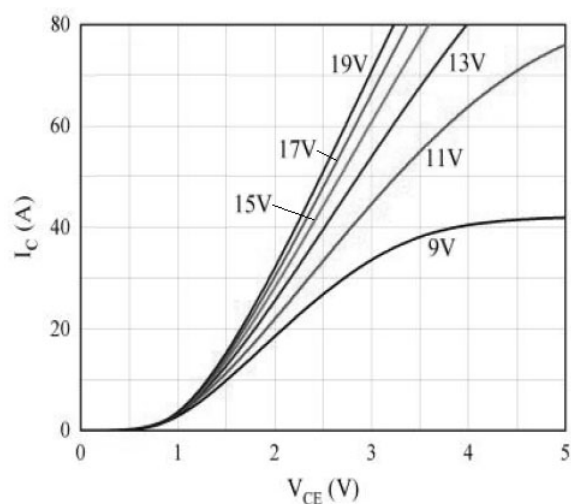


Fig. 3 Typical transfer characteristics

($V_{CE} = 20 \text{ V}$, $t_p = 250 \mu\text{s}$)

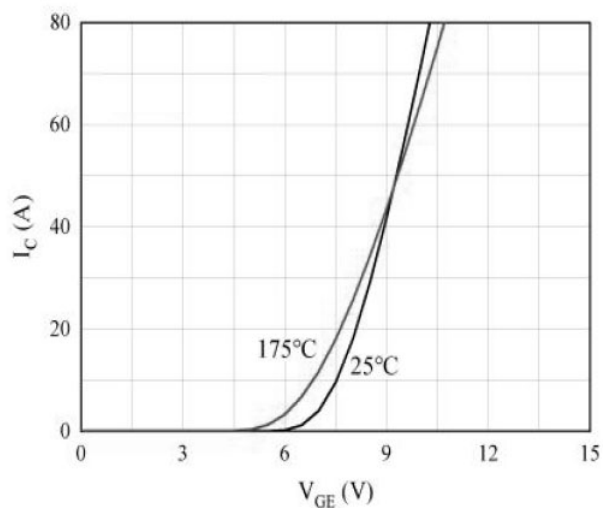
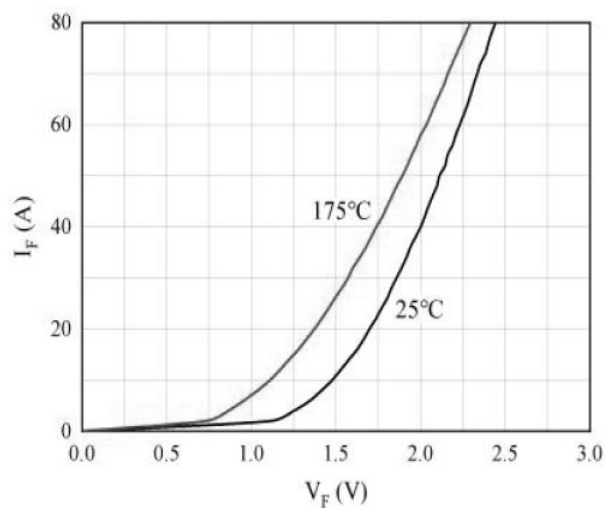
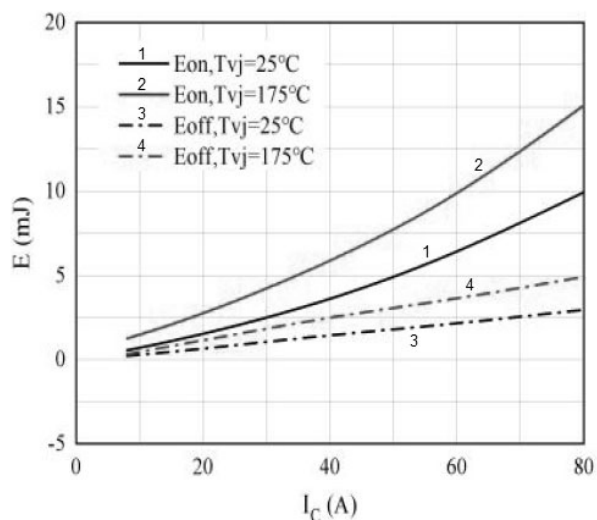


Fig. 4 Forward characteristic of Diode

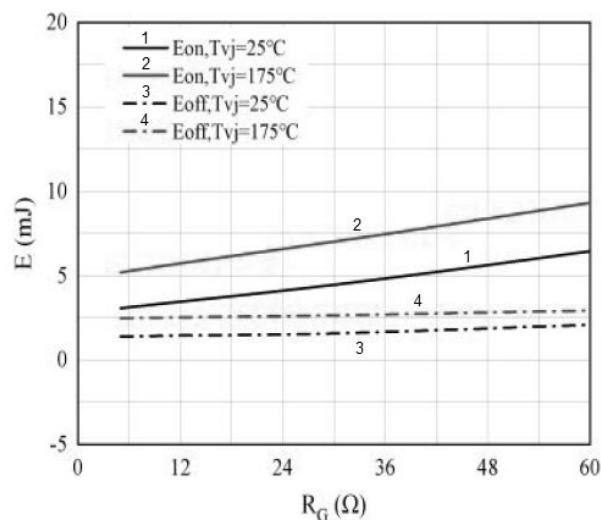
$Z_{thJC} = f(t)$



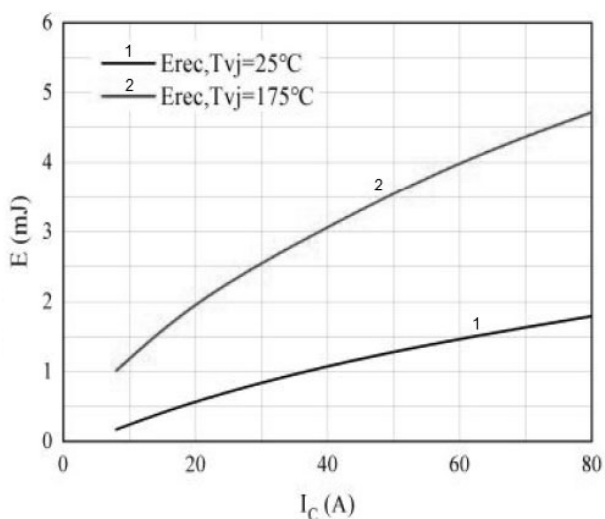
**Fig. 5 Switching losses of IGBT $V_{GE}=\pm 15V$,
 $R_{Gon}=12\Omega$, $R_{Goff}=12\Omega$, $V_{CE}=600V$**



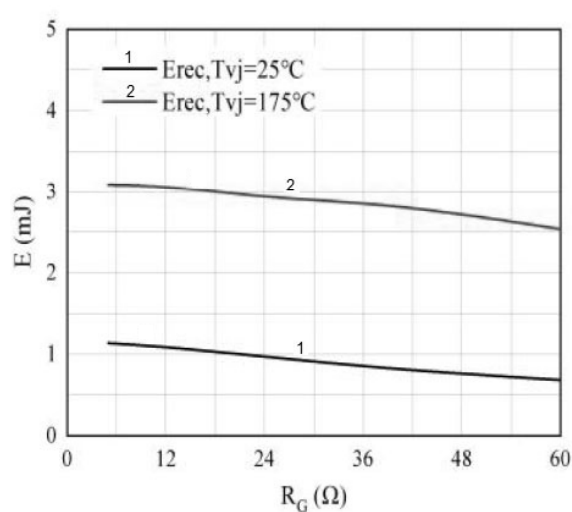
**Fig. 6 Switching losses of IGBT $V_{GE}=\pm 15V$,
 $I_C=40A$, $V_{CE}=600V$**



**Fig. 7 Switching losses of Diode $R_{Gon}=12\Omega$
 $V_{CE}=600V$**



**Fig. 8 Switching losses of Diode $I_F=40A$
 $V_{CE}=600V$**



**Fig. 9 Typical Capacitance characteristic
 $T_C = 25^\circ C$**

