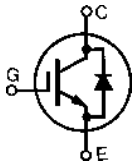
IXYS

Low $V_{CE(sat)}$ IGBT with Diode
ISOPLUS247™
(Electrically Isolated Back Surface)

IXGR 60N60U1

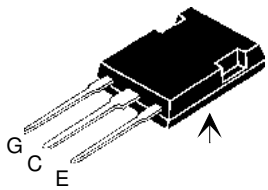
V_{CES} = 600 V
I_{C25} = 75 A
$V_{CE(sat)}$ = 1.7 V

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	75	A
I_{C100}	T_C = 90°C	60	A
I_{CM}	T_C = 25°C, 1 ms	200	A
SSOA (RBSOA)	V_{GE} = 15 V, T_{VJ} = 125°C, R_G = 10 Ω Clamped inductive load; V_{CL} = 0.8 V_{CES}	I_{CM} = 100	A
P_C	T_C = 25°C	300	W
T_J		-55 ..+ 150	°C
T_{JM}		150	°C
T_{stg}		-55...+ 150	°C
T_L	1.6 mm (0.062 in.) from case for 10 s	300	°C
V_{ISOL}	50/60Hz, RMS, t = 1minute, leads-to tab	2500	V
Weight		5	g

ISOPLUS247™



Isolated back surface*

G = Gate, C = Collector,
E = Emitter, TAB = Collector

* Patent pending

Features

- Silicon chip on Direct-Copper-Bond substrate
  - High power dissipation
  - Isolated mounting surface
  - 2500V electrical isolation
- Low collector to tab capacitance (<25pF)
- Rugged polysilicon gate cell structure
- Fast intrinsic Rectifier
- Low $V_{CE(sat)}$ IGBT and standard diode for minimum on-state conduction losses
- MOS Gate turn-on for drive simplicity

Applications

- Solid state relays
- Capacitor discharge circuits
- High power ignition circuits

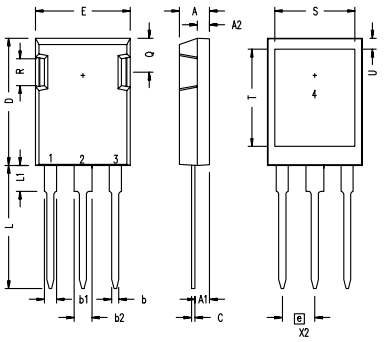
Advantages

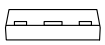
- Space savings (two devices in one package)
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
BV_{CES}	I_C = 1 mA, V_{GE} = 0 V		600			V
$V_{GE(th)}$	I_C = 250 μA, V_{CE} = V_{GE}		2.5		5.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			250	μA
	V_{GE} = 0 V	T_J = 150°C			2	mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±100	nA
$V_{CE(sat)}$	I_C = I_{C100}, V_{GE} = 15 V				1.7	V

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	$I_C = I_{C100}$; V_{CE} = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 %	30	40		S
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		4000		pF
C_{oes}			340		pF
C_{res}			100		pF
Q_g	$I_C = I_{C100}$, V_{GE} = 15 V, V_{CE} = 0.5 V_{CES}		200		nC
Q_{ge}			35		nC
Q_{gc}			80		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		50		ns
t_{ri}	$I_C = I_{C100}$, V_{GE} = 15 V, L = 100 µH,		200		ns
$t_{d(off)}$	V_{CE} = 0.8 V_{CES}, $R_G = R_{off}$ = 2.7 Ω		600	800	ns
t_{fi}	Remarks: Switching times may increase		500	700	ns
E_{off}	for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G		16		mJ
$t_{d(on)}$	**Inductive load, T_J = 125°C**		50		ns
t_{ri}	$I_C = I_{C100}$, V_{GE} = 15 V, L = 100 µH		240		ns
$t_{d(off)}$	V_{CE} = 0.8 V_{CES}, $R_G = R_{off}$ = 2.7 Ω		1000		ns
t_{fi}	Remarks: Switching times may increase		1000		ns
E_{off}	for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G		26		mJ
R_{thJC}				0.5	K/W
R_{thCK}			0.15		K/W

ISOPLUS 247 (IXGR) OUTLINE





1 Gate, 2 Drain (Collector)
3 Source (Emitter)
4 no connection

Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.83	5.21	.190	.205
A_1	2.29	2.54	.090	.100
A_2	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b_1	1.91	2.13	.075	.084
b_2	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45 BSC		.215 BSC	
L	19.81	20.32	.780	.800
L1	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190
S	13.21	13.72	.520	.540
T	15.75	16.26	.620	.640
U	1.65	3.03	.065	.080

Reverse Diode

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	$I_F = I_{C100}$, V_{GE} = 0 V, Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %			2.2	V
R_{thJC}				1.0	K/W

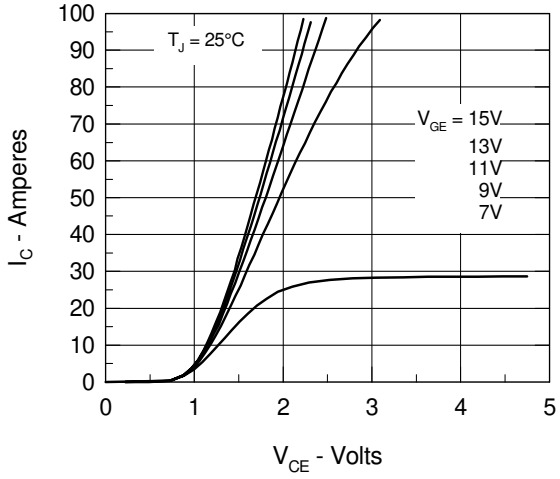


Figure 1. Saturation Voltage Characteristics

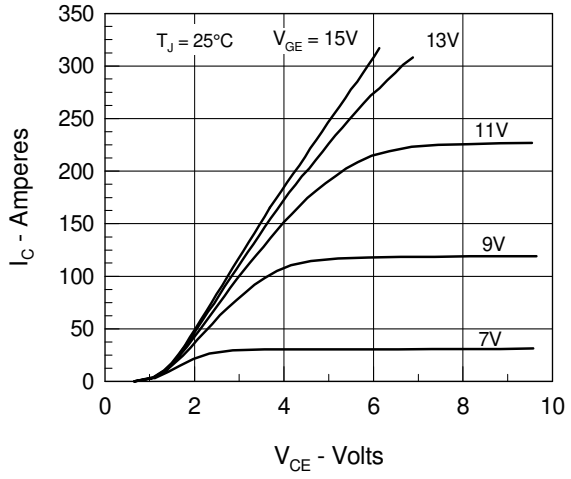


Figure 2. Extended Output Characteristics

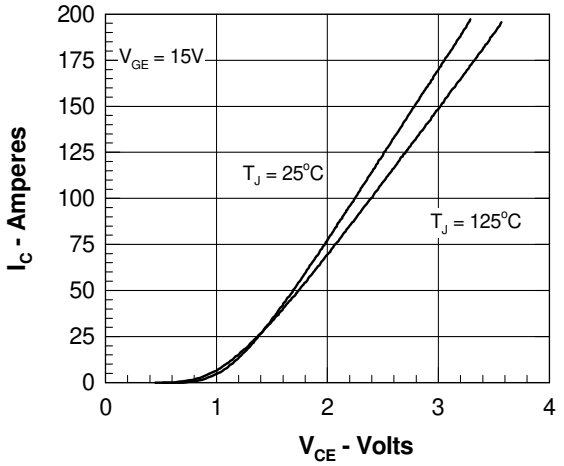


Figure 3. Saturation Voltage Characteristics

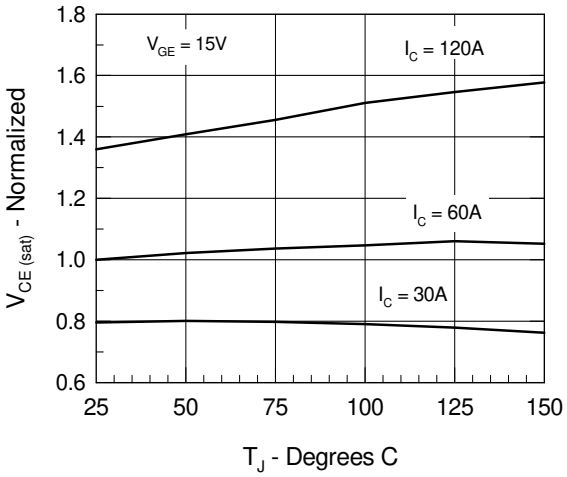


Figure 4. Temperature Dependence of $V_{CE(sat)}$

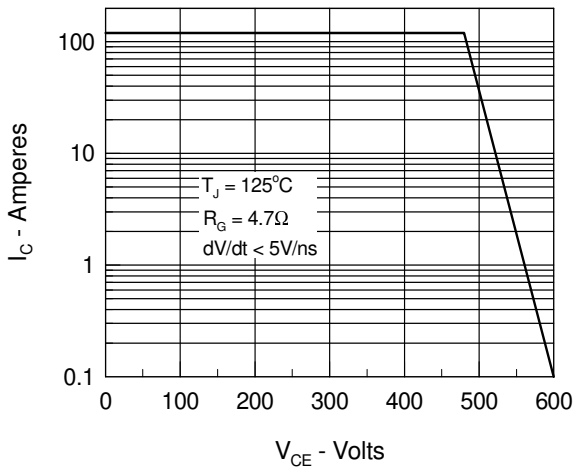


Figure 5. Admittance Curves

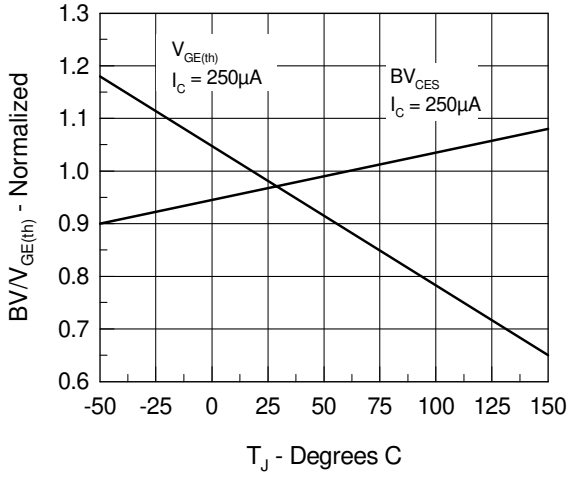


Figure 6. Capacitance Curves

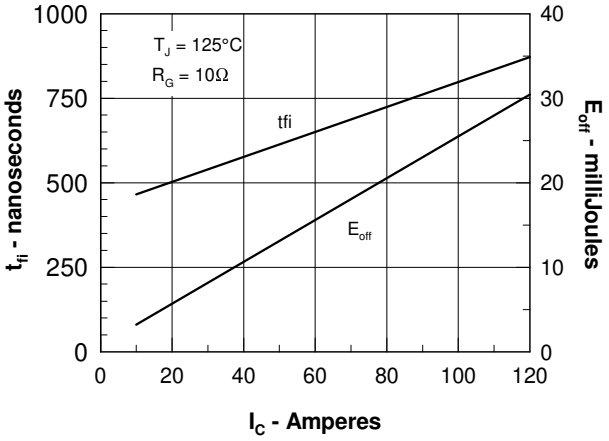


Figure 7. Dependence of E_{ON} and E_{OFF} on I_C.

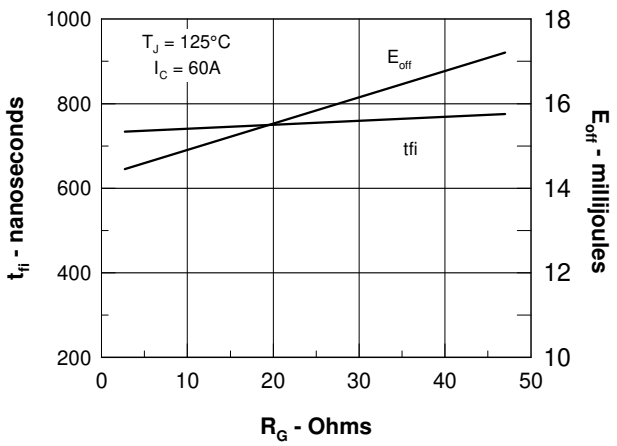


Figure 8. Dependence of E_{ON} and E_{OFF} on R_G.

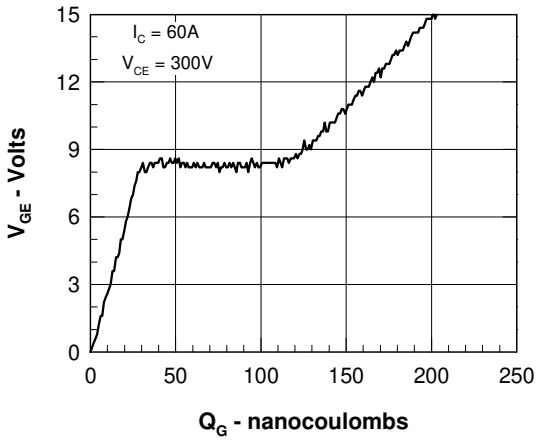


Figure 9. Gate Charge

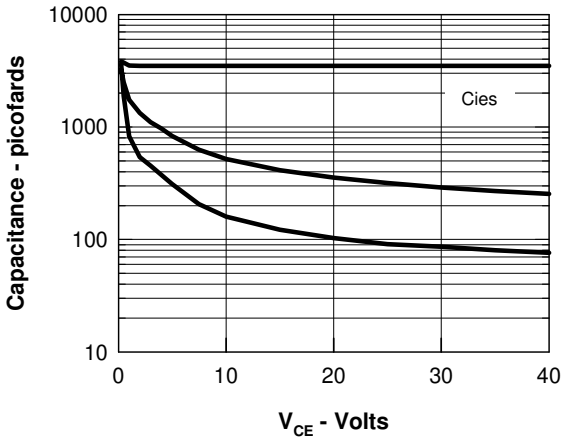


Figure 10. Turn-off Safe Operating Area

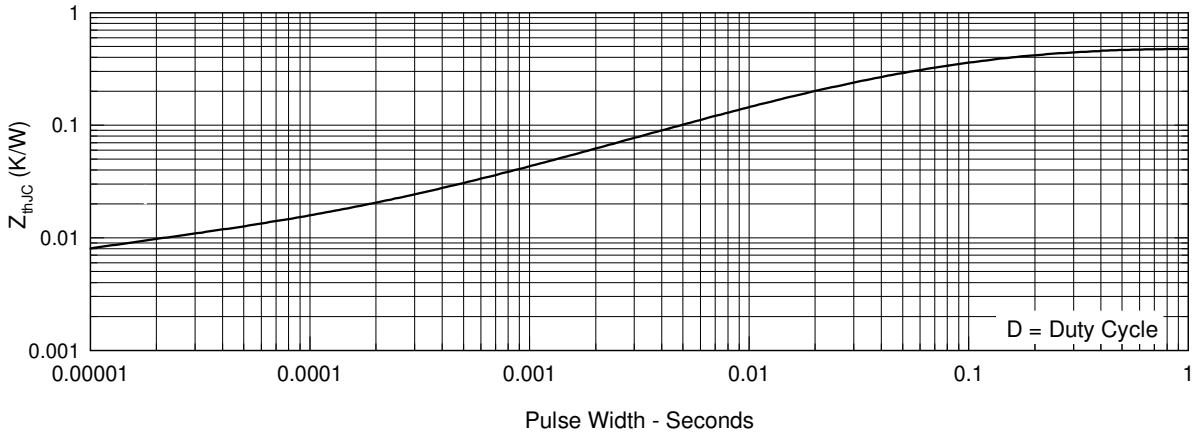


Figure 11. IGBT Transient Thermal Resistance

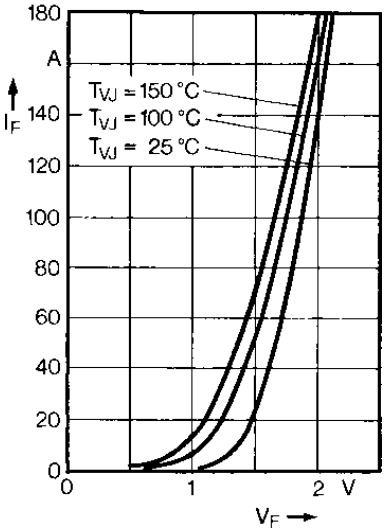


Fig. 12 Forward current versus voltage drop.

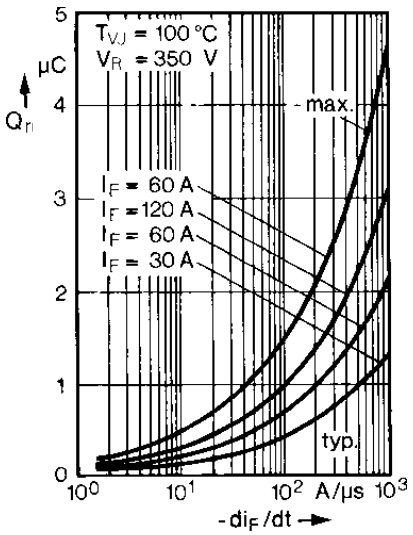


Fig. 13 Recovery charge versus $-di_F/dt$.

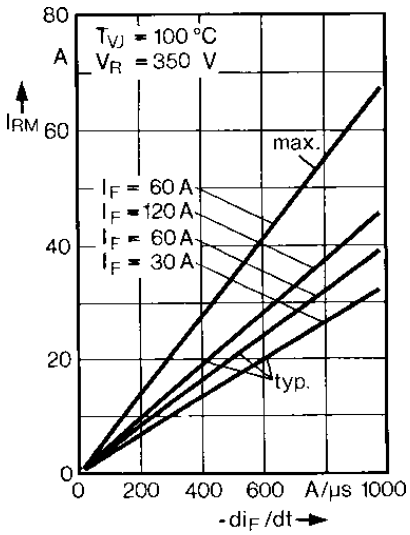


Fig. 14 Peak reverse current versus $-di_F/dt$.

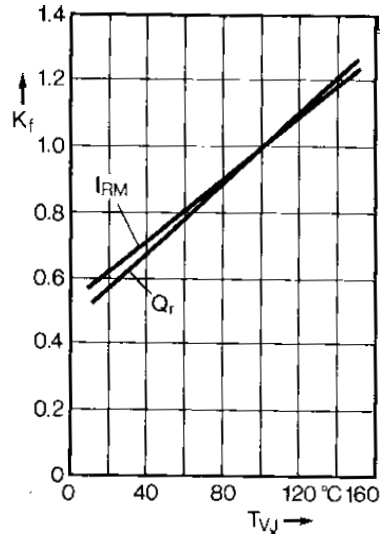


Fig. 15. Dynamic parameters versus junction temperature.

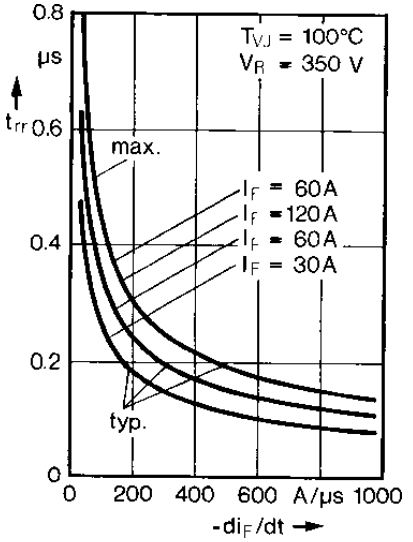


Fig. 16 Recovery time versus $-di_F/dt$.

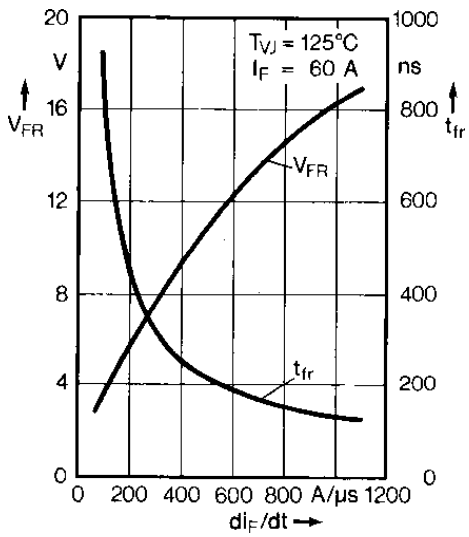


Fig. 17 Peak forward voltage vs. di_F/dt.

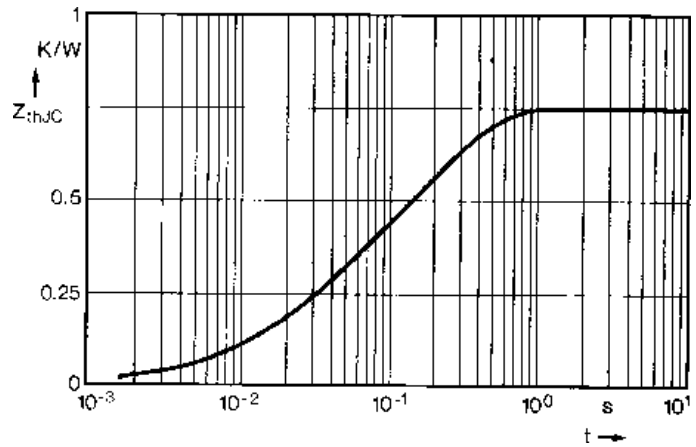


Fig. 18 Transient thermal impedance junction to case.