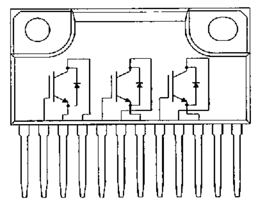
IXYS

Three Independent IGBT with Diode in Power SIP

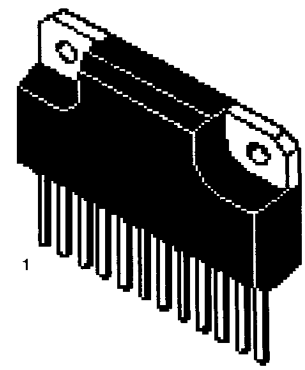
IXGB 16N60U3

V_{CES} = 600 V
I_{C25} = 16 A
$V_{CE(sat)}$ = 2.5 V



Advanced data

Power SIP



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	16	A
I_{C60}	T_C = 60°C	12	A
I_{C90}	T_C = 90°C	8	A
I_{CM}	T_C = 25°C, 1 ms	32	A
SSOA (RBSOA)	V_{GE}= 15 V, T_{VJ} = 125°C, R_G = 150 Ω Clamped inductive load, L = 300 µH	I_{CM} = 16 @ 0.8 V_{CES}	A
t_{SC}	V_{CE}= 0.6 V_{CES}, V_{GE} = 12 V R_G = 150 Ω, T_J = 90°C	3	µs
P_C	T_C = 25°C, IGBT	42	W
P_D	T_C = 25°C, Diode	25	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
T_L	3.2 mm (0.126 in) from case for 5 s	260	°C
V_{ISOL}	50/60 Hz, RMS voltage t = 1 min I_{ISOL} ≤ 1 mA t = 1 s	2500 3000	V~ V~
Weight		6	g

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
BV_{CES}	I_C = 750 µA, V_{GE} = 0 V	600			V
$V_{GE(th)}$	I_C = 500 µA, V_{GE} = V_{GE}	2.5		5.5	V
I_{CES}	V_{CE} = 0.8 • V_{CES} T_J = 25°C V_{GE} = 0 V T_J = 125°C			260 2.5	µA mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V			±100	nA
$V_{CE(sat)}$	I_C = I_{C60}, V_{GE} = 15 V			2.5	V

Data according to a single IGBT/FRED unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions.

Features

- Three high frequency IGBT/FRED diode pairs in a single-inline package
  - only two packages required for three-phase control
- Isolated base plate, isolation voltage 3000 V~
- Low $V_{CE(sat)}$
  - for minimum on-state conduction losses
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
  - soft recovery with low I_{RM}

Applications

- AC motor speed control
- DC servo and robot drives
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies
- DC choppers

Advantages

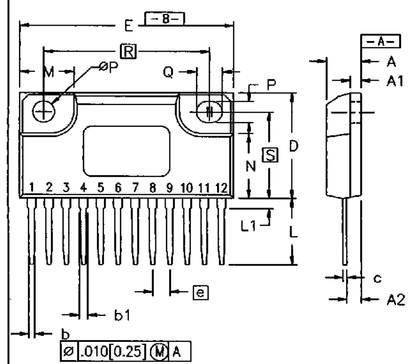
- Saves space (six devices in one package)
- Easy to mount
- Reduces assembly time and cost

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	$I_C = I_{C60}$; V_{CE} = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 %	4	8		S
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		750		pF
C_{oes}			125		pF
C_{res}			30		pF
Q_g	$I_C = I_{C60}$, V_{GE} = 15 V, V_{CE} = 0.5 V_{CES}		50	70	nC
Q_{ge}			15	25	nC
Q_{gc}			25	45	nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		100		ns
t_{ri}	$I_C = I_{C60}$, V_{GE} = 15 V, L = 300 µH		200		ns
$t_{d(off)}$	$R_G = R_{off}$ = 150 Ω		900		ns
t_{fi}	Remarks: Switching times may increase		360		ns
E_{off}	for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G		0.6		mJ
$t_{d(on)}$	**Inductive load, T_J = 125°C**		100		ns
t_{ri}	$I_C = I_{C60}$, V_{GE} = 15 V, L = 300 µH		200		ns
$t_{d(off)}$	$R_G = R_{off}$ = 150 Ω		900	1500	ns
t_{fi}	Remarks: Switching times may increase for		570	1000	ns
t_c	V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or		670		ns
E_{off}	increased R_G		1.4		mJ
R_{thJC}				3	K/W
R_{thCK}			0.25		K/W

Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
I_{RRM}	$V_R = V_{RRM}$		5		µA
	V_R = 0.8 V_{RRM}, T_J = 125°C		0.75		mA
V_F	$I_F = I_{C60}$, V_{GE} = 0 V, Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %			1.75	V
I_{RM}	$I_F = I_{C60}$, V_{GE} = 0 V, -di_F/dt = 64 A/µs		2.5		A
t_{rr}	V_R = 360 V, T_J = 125°C		165		ns
	I_F = 1 A; -di/dt = 50 A/µs; V_R = 30 V, T_J = 25°C		35	50	ns
R_{thJC}				5	K/W

Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.196	.205	4.98	5.20
A1	.058	.072	1.48	1.82
A2	.082	.091	2.09	2.31
b	.027	.039	0.69	0.99
b1	.027	.040	0.69	1.01
c	.015	.028	0.38	0.71
D	.622	.638	15.80	16.20
E	1.230	1.250	31.30	31.70
e	.100 BSC		2.54 BSC	
L	.380	.435	9.66	11.04
L1	.140	.160	3.56	4.06
M	.290	.305	7.37	7.74
N	.380	.410	9.66	10.41
P	.122	.130	3.10	3.30
Q	.145	.154	3.69	3.91
R	.960 BSC		24.38 BSC	
S	.512 BSC		13.00 BSC	

Pin description

1, 11, 12 = No connection
2, 3, 4 = IGBT with FRED
2 = Gate, 3 = Emitter, 4 = Collector
5, 6, 7 = IGBT with FRED
5 = Gate, 6 = Collector, 7 = Emitter
8, 9, 10 = IGBT with FRED
8 = Gate, 9 = Collector, 10 = Emitter

Fig. 1. Saturation Characteristics

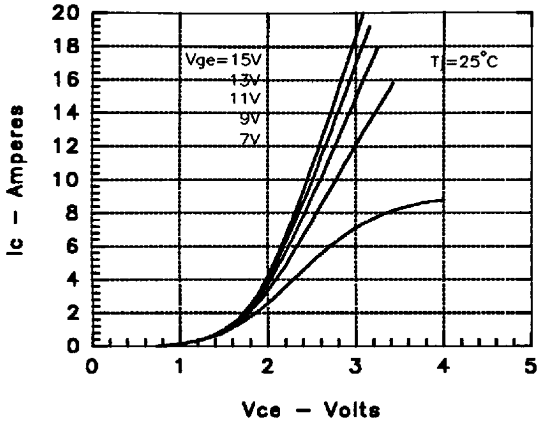


Fig. 2. Output Characteristics

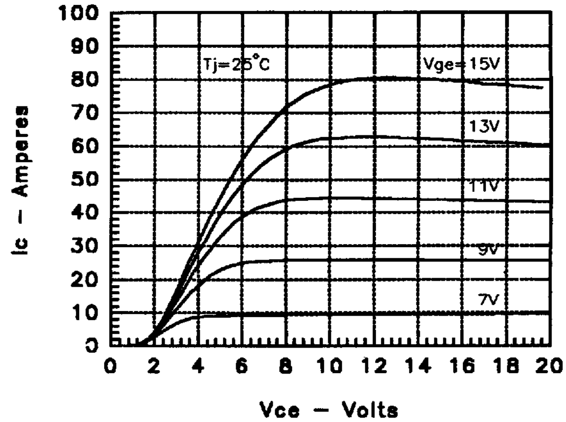


Fig. 3. Collector-Emitter Voltage vs. Gate-Emitter Voltage

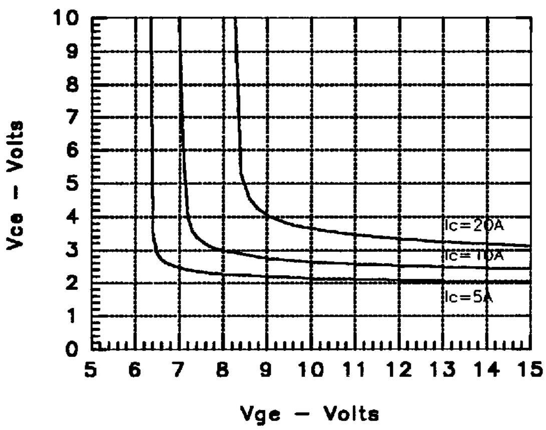


Fig. 4. Temperature Dependence of Output Saturation Voltage

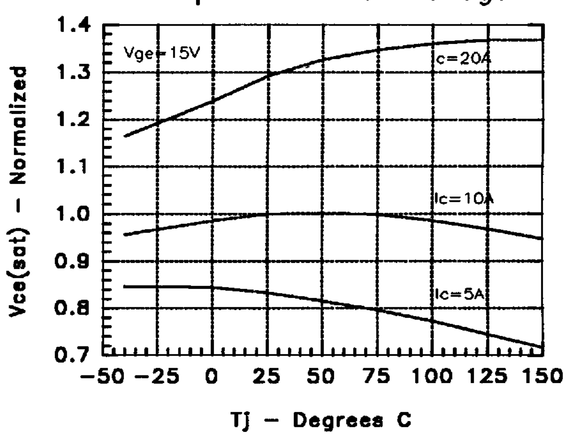
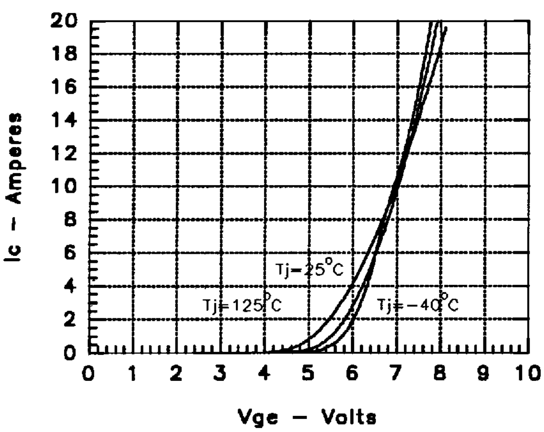


Fig. 5. Input Admittance



G 3 600V-1

Fig. 6. Temperature Dependence of Breakdown and Threshold Voltage

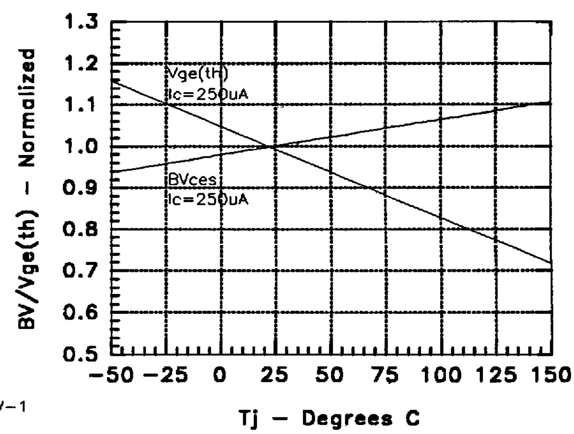


Fig. 7. Gate Charge

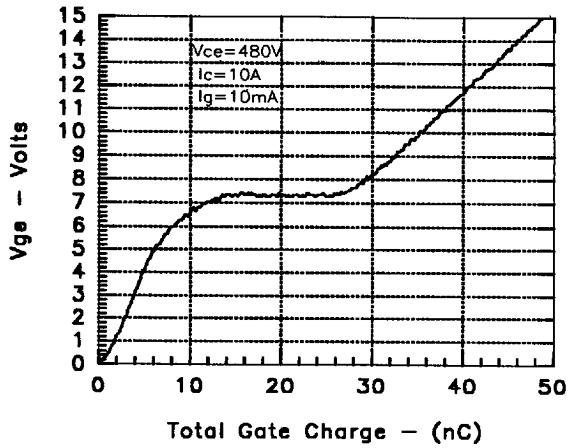


Fig. 8. Turn-Off Safe Operating Area

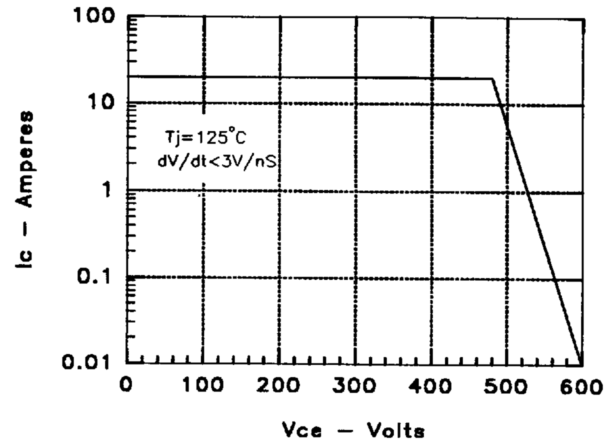


Fig. 9. Capacitance Curves

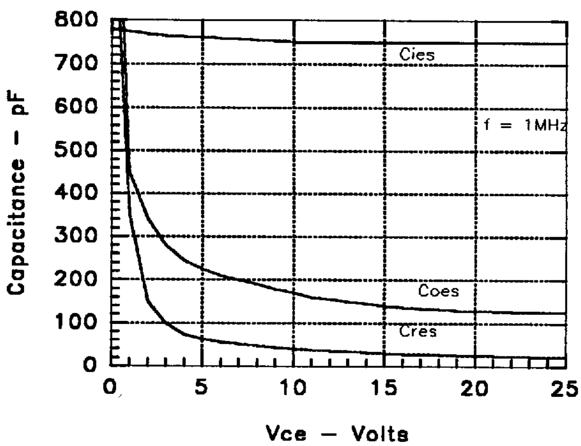
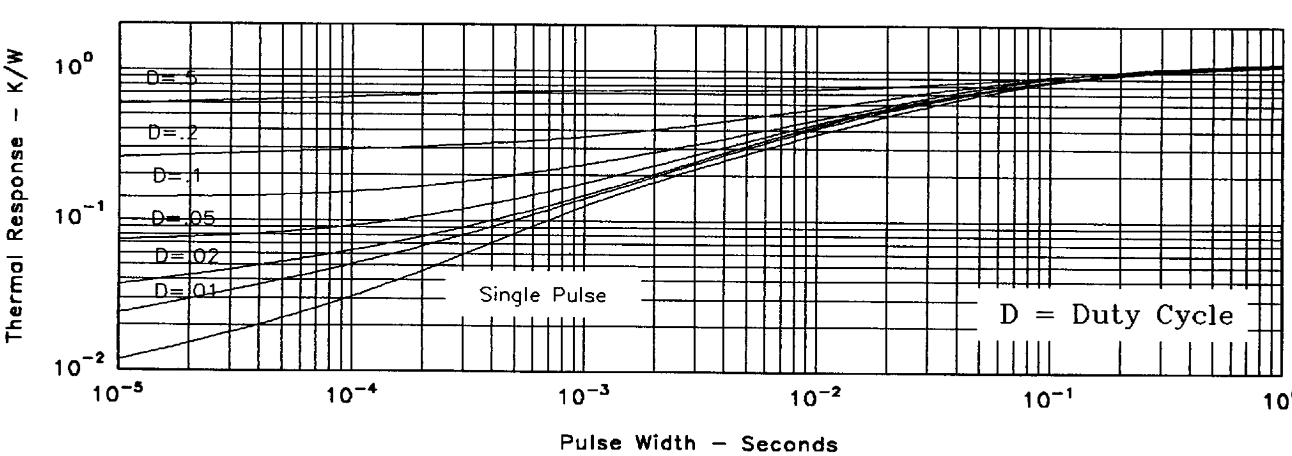


Figure 10. Transient Thermal Impedance



G 3 60-2

Fig. 12. Maximum Forward Voltage Drop

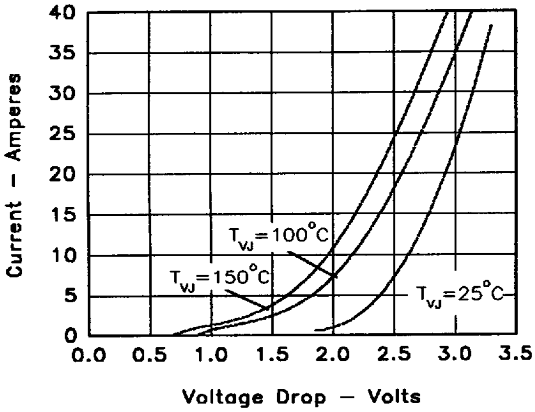


Fig. 13. Peak Forward Voltage V_{FR} and Forward Recovery Time t_{FR}.

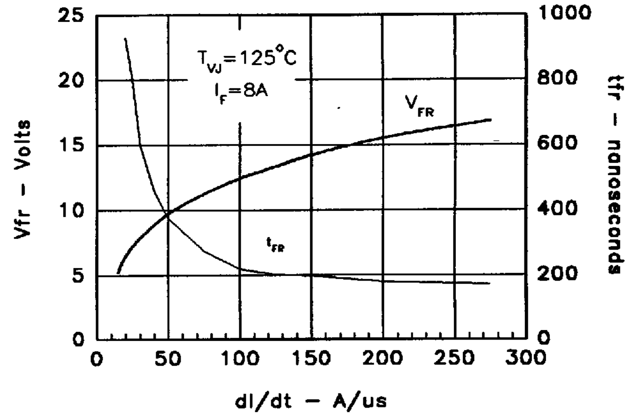


Fig. 14. Junction Temperature Dependence of I_{RM} and Q_R.

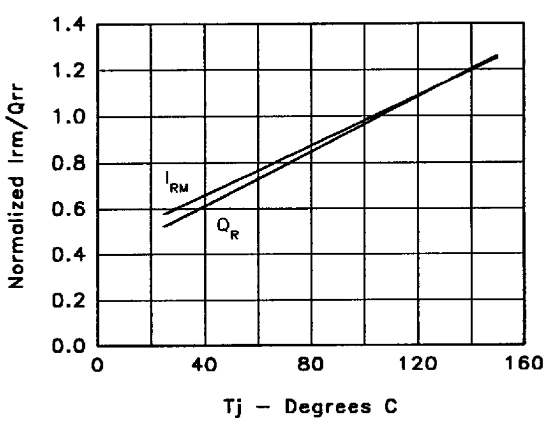


Fig. 15. Maximum Reverse Recovery Charge

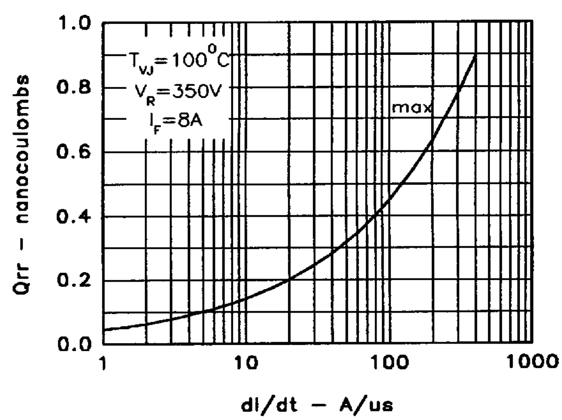


Figure 16. Peak Reverse Recovery Current.

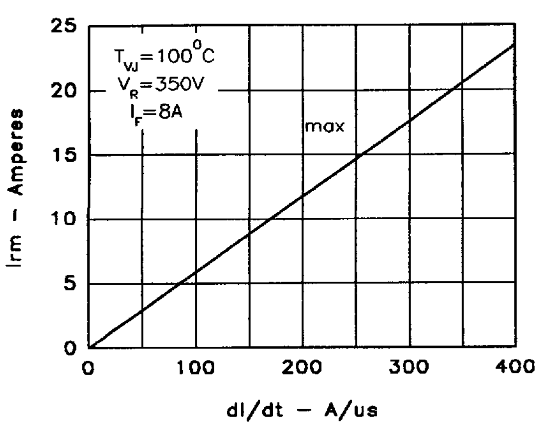


Fig. 17. Maximum Reverse Recovery Time.