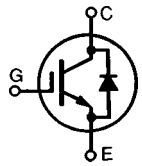
IXYS

Not for new designs

		V_{CES}	I_{C25}	$V_{CE(sat)}$
Low $V_{CE(sat)}$ IGBT with Diode	**IXSH 20 N60U1**	**600 V**	**40 A**	**2.5 V**
High Speed IGBT with Diode	**IXSH 20 N60AU1**	**600 V**	**40 A**	**3.0 V**

Combi Packs

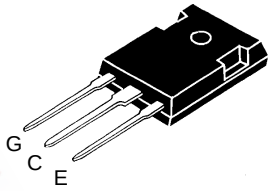
Short Circuit SOA Capability



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	40	A
I_{C90}	T_C = 90°C	20	A
I_{CM}	T_C = 25°C, 1 ms	80	A
SSOA (RBSOA)	V_{GE}= 15 V, T_J = 125°C, R_G = 82 Ω Clamped inductive load, L = 100 µH	I_{CM} = 40 @ 0.8 V_{CES}	A
t_{SC} **(SCSOA)**	V_{GE}= 15 V, V_{CE} = 360 V, T_J = 125°C R_G = 82 Ω, non repetitive	10	µs
P_C	T_C = 25°C	150	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
M_d	Mounting torque	1.13/10	Nm/lb.in.
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	°C

Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
BV_{CES}	I_C = 1.75 mA, V_{GE} = 0 V		600			V
$V_{GE(th)}$	I_C = 1.5 mA, V_{CE} = V_{GE}		3.5		6.5	V
I_{CES}	V_{CE} = 0.8 • V_{CES} V_{GE} = 0 V	T_J = 25°C T_J = 125°C			500 8	µA mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±100	nA
$V_{CE(sat)}$	I_C = I_{C90}, V_{GE} = 15 V	20N60U1 20N60AU1			2.5 3.0	V V

TO-247 AD



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

Features

- International standard package JEDEC TO-247 AD
- High frequency IGBT with guaranteed Short Circuit SOA capability
- IGBT and anti-parallel FRED in one package
- 2nd generation HDMOS™ process
- Low $V_{CE(sat)}$
  - for low on-state conduction losses
- MOS Gate turn-on
  - drive simplicity

Applications

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

Advantages

- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost
- High power density

91770D (4/96)

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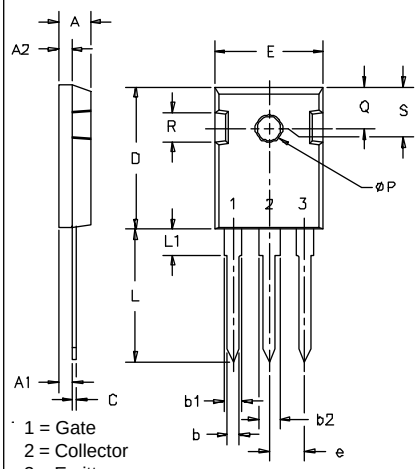
Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	$I_C = I_{C90}$; V_{CE} = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 %	6	7		S
$I_{C(on)}$	V_{GE} = 15 V, V_{CE} = 10 V		65		A
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		1800		pF
C_{oes}			250		pF
C_{res}			45		pF
Q_g	$I_C = I_{C90}$, V_{GE} = 15 V, V_{CE} = 0.5 V_{CES}		90	120	nC
Q_{ge}			40	55	nC
Q_{gc}			65	80	nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		100		ns
t_{ri}	$I_C = I_{C90}$, V_{GE} = 15 V,		200		ns
$t_{d(off)}$	L = 100 µH, V_{CE} = 0.8 V_{CES},		450		ns
t_{fi}	R_G = 39 Ω	20N60U1			ns
	Remarks: Switching times may increase for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G	20N60AU1	350		ns
E_{off}			2.5		mJ
$t_{d(on)}$	**Inductive load, T_J = 125°C**		100		ns
t_{ri}	$I_C = I_{C90}$, V_{GE} = 15 V,		200		ns
E_{on}	L = 100 µH		1		mJ
$t_{d(off)}$	V_{CE} = 0.8 V_{CES}, R_G = 39 Ω			1000	ns
t_{fi}	Remarks: Switching times may increase for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G	20N60U1		1000	ns
		20N60AU1		600	ns
E_{off}		20N60U1	9		mJ
		20N60AU1	3	5	mJ
R_{thJC}				0.83	K/W
R_{thCK}			0.25		K/W

TO-247 AD Outline



1 = Gate
2 = Collector
3 = Emitter
Tab = Collector

SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.185	.209	4.7	5.3
A_1	.087	.102	2.2	2.54
A_2	.059	.098	2.2	2.6
b	.040	.055	1.0	1.4
b_1	.065	.084	1.65	2.13
b_2	.113	.123	2.87	3.12
C	.016	.031	.4	.8
D	.819	.845	20.80	21.46
E	.610	.640	15.75	16.26
e	.215 BSC		5.45 BSC	
L	.780	.800	19.81	20.32
L1		.177		4.50
øP	.140	.144	3.55	3.65
Q	.212	.244	5.4	6.2
R	.170	.216	4.32	5.49
S	.242 BSC		6.15 BSC	

Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	$I_F = I_{C90}$, V_{GE} = 0 V, Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %			1.6	V
I_{RM}	$I_F = I_{C90}$, V_{GE} = 0 V, -di_F/dt = 240 A/µs		10		A
t_{rr}	V_R = 360 V T_J = 125°C		150		ns
	I_F = 1 A; -di/dt = 100 A/µs; V_R = 30 V T_J = 25°C		35	50	ns
R_{thJC}				1	K/W

Fig. 1 Saturation Characteristics

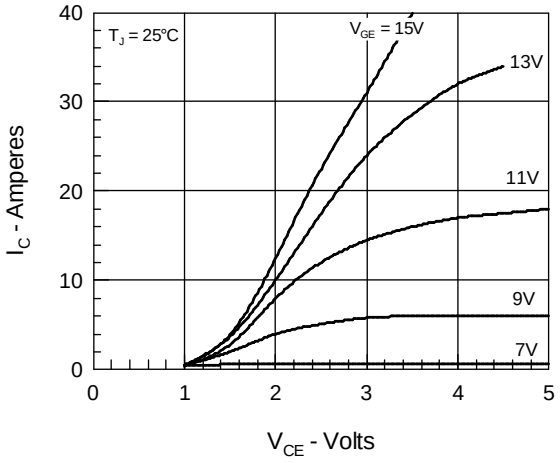


Fig. 2 Output Characterstics

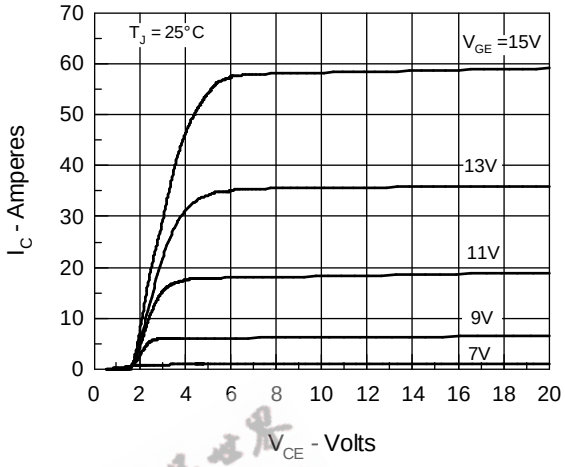


Fig. 3 Collector-Emitter Voltage vs. Gate-Emitter Voltage

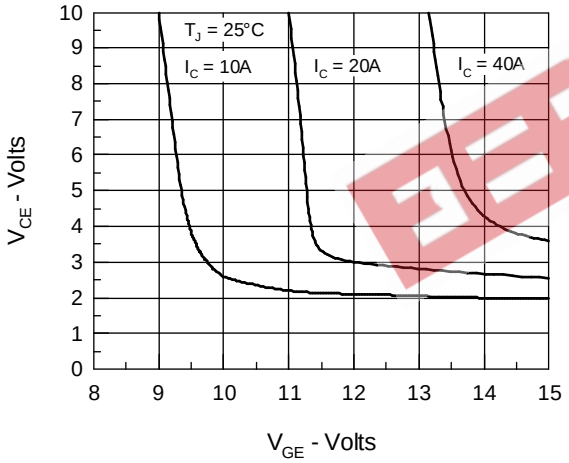


Fig. 4 Temperature Dependence of Output Saturation Voltage

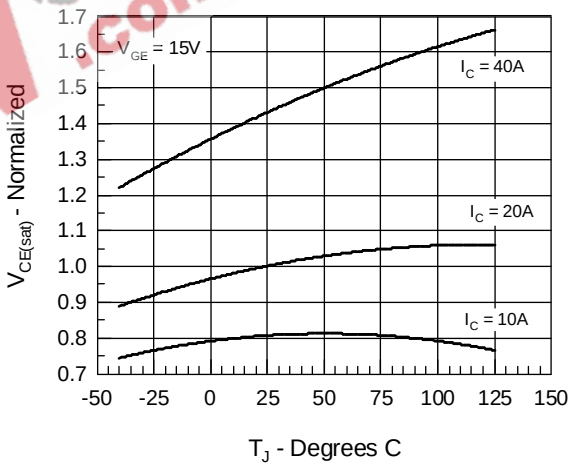


Fig. 5 Input Admittance

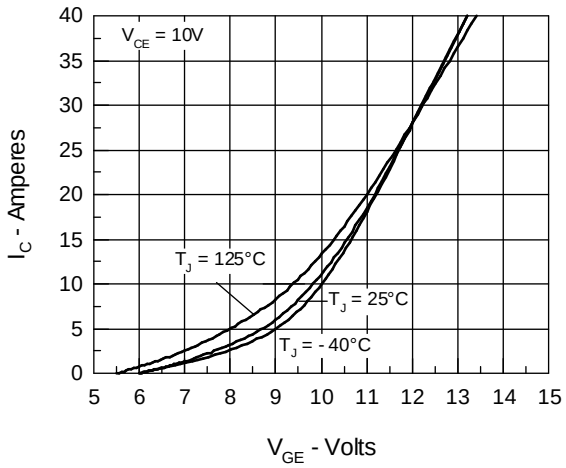


Fig. 6 Temperature Dependence of Breakdown and Threshold Volt.

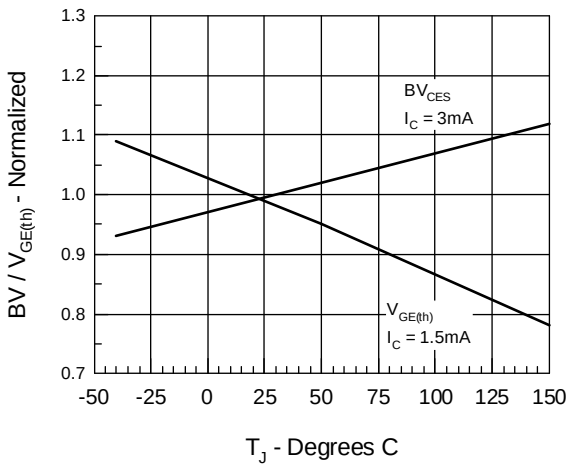


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Fig.7 Turn-Off Energy per Pulse and Fall Time on Collector Current

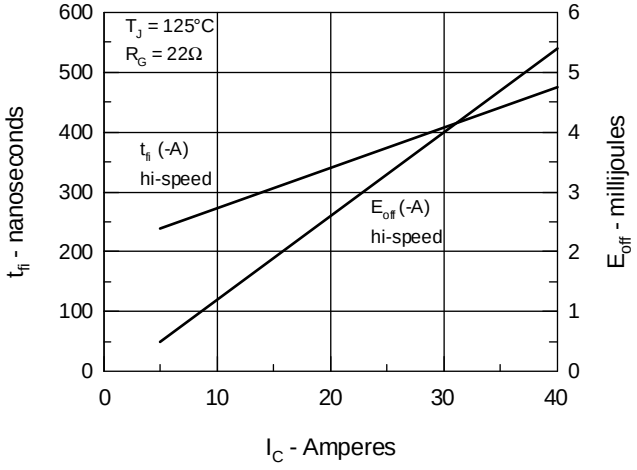

Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on R_G

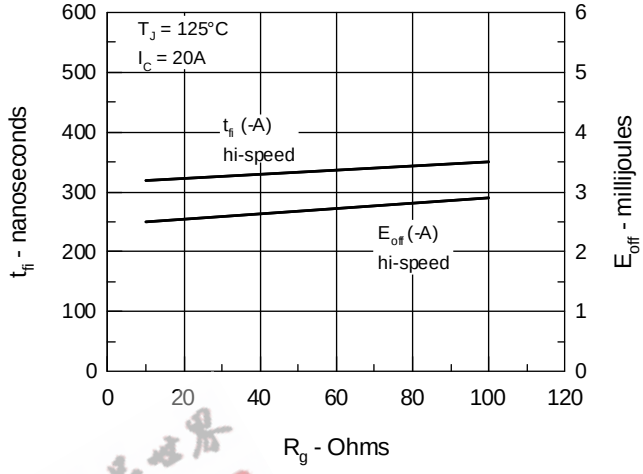

Fig.9 Gate Charge Characteristic Curve

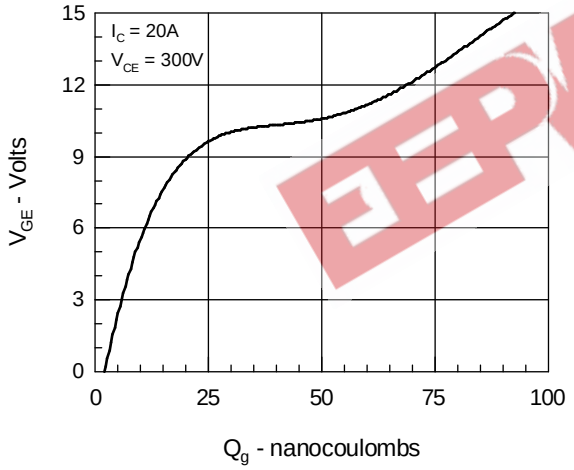

Fig.10 Turn-Off Safe Operating Area

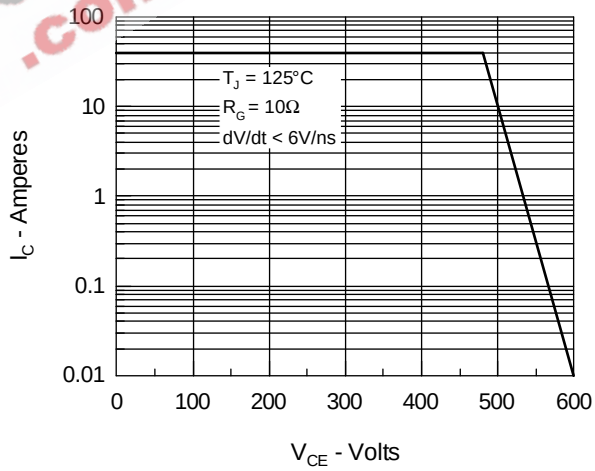

Fig.11 Transient Thermal Impedance

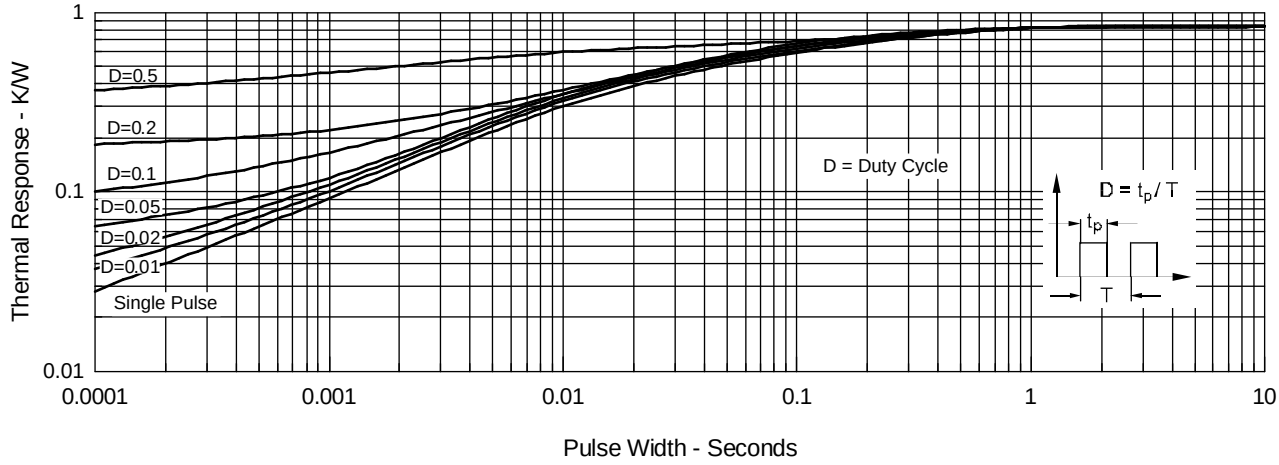

Fig.12 Maximum Forward Voltage Drop Recovery Time t_{fr}

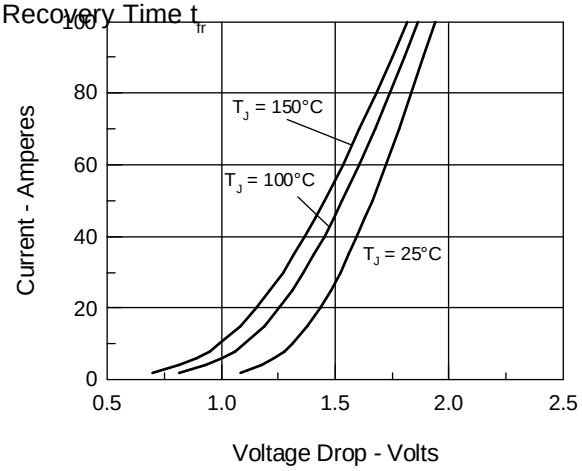

Fig.13 Peak Forward Voltage V_{FR} and Forward

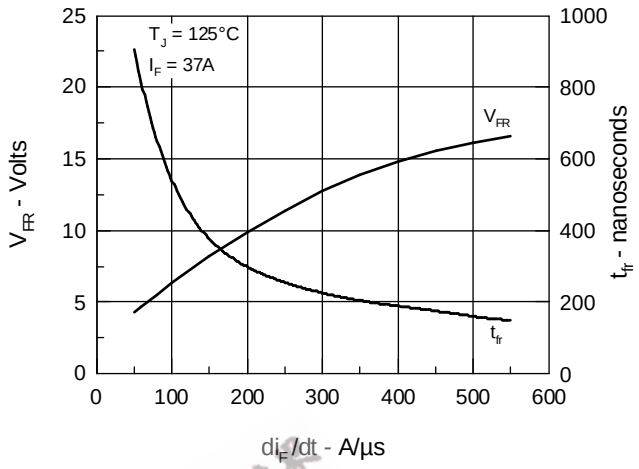

Fig.14 Junction Temperature Dependence off I_{RM} and Q_r

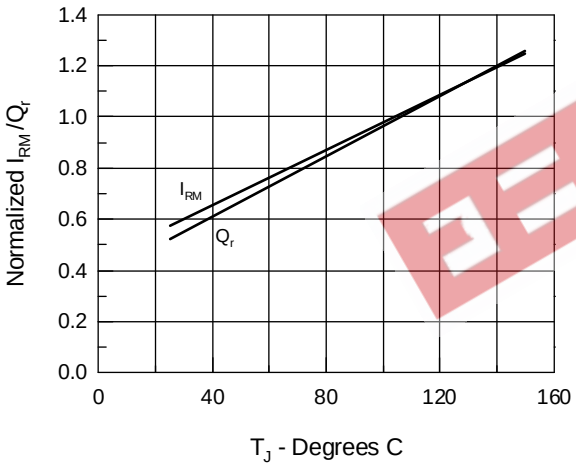

Fig.15 Reverse Recovery Chargee

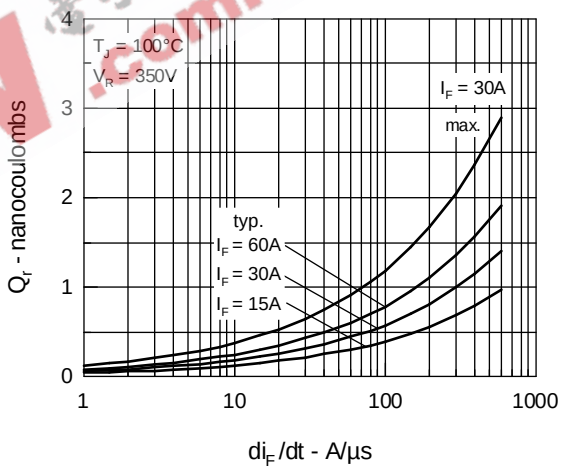

Fig.16 Peak Reverse Recovery Current

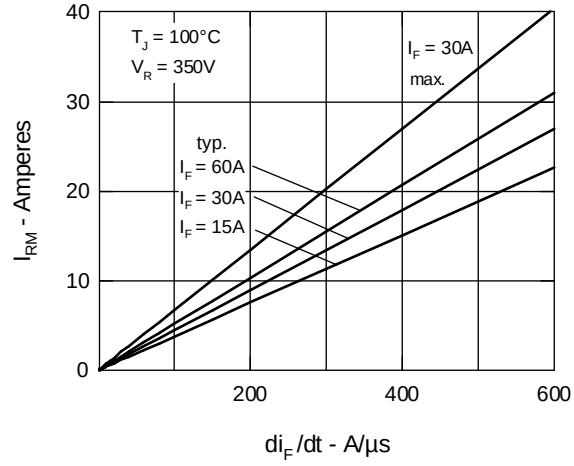

Fig.17 Reverse Recovery Time

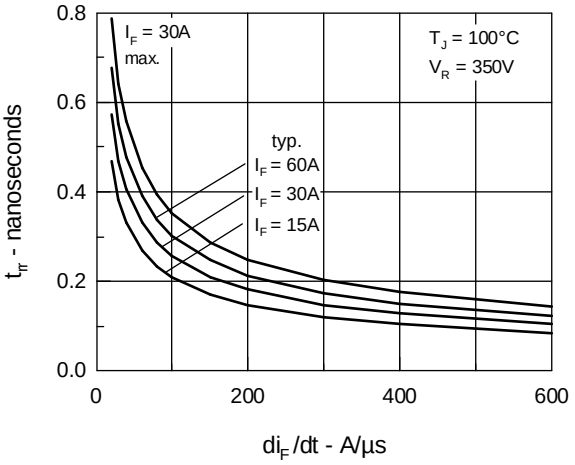

Fig.18 Diode Transient Thermal resistance junction to case