

# High Voltage, High Frequency, BiMOSFET™ Monolithic Bipolar MOS Transistor

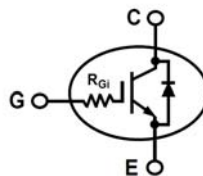
## IXBL60N360

$$V_{CES} = 3600V$$

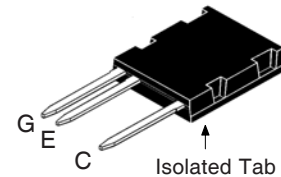
$$I_{C110} = 36A$$

$$V_{CE(sat)} \leq 3.4V$$

(Electrically Isolated Tab)



ISOPLUS i5-Pak™



G = Gate      C = Collector  
E = Emitter

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$	3600	V
$V_{CGR}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GE} = 1M\Omega$	3600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$	92	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	36	A
$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1ms	720	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15V$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 4.7\Omega$ Clamped Inductive Load	$I_{CM} = 480$ $V_{CES} \leq 1500$	A V
<b><math>T_{SC}</math></b> <b>(SCSOA)</b>	$V_{GE} = 15V$ , $T_J = 125^\circ\text{C}$ , $R_G = 52\Omega$ , $V_{CE} = 1500V$ , Non-Repetitive	10	$\mu\text{s}$
$P_C$	$T_C = 25^\circ\text{C}$	417	W
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering	300	$^\circ\text{C}$
$T_{SOLD}$	Plastic Body for 10s	260	$^\circ\text{C}$
$F_C$	Mounting Force with Clip	30..170 / 7..36	N/lb
$V_{ISOL}$	50/60Hz, 5 Seconds	4000	V~
<b>Weight</b>		8	g

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 4000V~ Electrical Isolation
- High Blocking Voltage
- High Frequency Operation

### Advantages

- Low Gate Drive Requirement
- High Power Density

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- Uninterruptible Power Supplies (UPS)
- Laser Generators
- Capacitor Discharge Circuits
- AC Switches

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$BV_{CES}$	$I_C = 250\mu\text{A}$ , $V_{GE} = 0V$	3600		V
$V_{GE(th)}$	$I_C = 250\mu\text{A}$ , $V_{CE} = V_{GE}$	3.0		5.0 V
$I_{CES}$	$V_{CE} = 3000V$ , $V_{GE} = 0V$ Note 2, $T_J = 100^\circ\text{C}$		125	25 $\mu\text{A}$ $\mu\text{A}$
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 200$ nA
$V_{CE(SAT)}$	$I_C = 60A$ , $V_{GE} = 15V$ , Note 1 $T_J = 125^\circ\text{C}$		2.8 3.4	V V

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 60\text{A}, V_{CE} = 10\text{V}$ , Note 1	37	62	S
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		8140	pF
$C_{oes}$			367	pF
$C_{res}$			174	pF
$R_{Gi}$	Integrated Gate Input Resistance		5.0	$\Omega$
$Q_{g(on)}$	$I_C = 60\text{A}, V_{GE} = 15\text{V}, V_{CE} = 1000\text{V}$		450	nC
$Q_{ge}$			52	nC
$Q_{gc}$			187	nC
$t_{d(on)}$	<b>Resistive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 60\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 960\text{V}, R_G = 4.7\Omega$		50	ns
$t_r$			300	ns
$t_{d(off)}$			340	ns
$t_f$			910	ns
$t_{d(on)}$	<b>Resistive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 60\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 960\text{V}, R_G = 4.7\Omega$		56	ns
$t_r$			674	ns
$t_{d(off)}$			370	ns
$t_f$			1025	ns
$R_{thJC}$				0.30 $^\circ\text{C/W}$
$R_{thCS}$		0.15		$^\circ\text{C/W}$

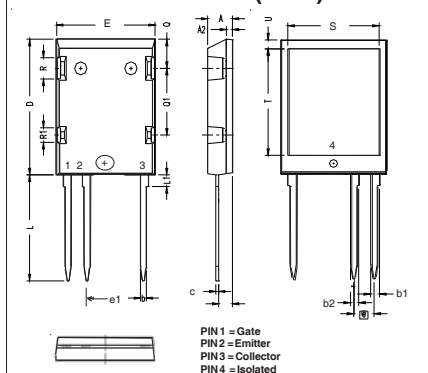
## Reverse Diode

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$V_F$	$I_F = 60\text{A}, V_{GE} = 0\text{V}$ , Note 1			5.0 V
$t_{rr}$	$I_F = 30\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 150\text{A}/\mu\text{s}$ $V_R = 100\text{V}, V_{GE} = 0\text{V}$		1.95	$\mu\text{s}$
$I_{RM}$			78	A
$Q_{RM}$			75.7	$\mu\text{C}$

## Notes:

1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Device must be heatsunk for high-temperature leakage current measurements to avoid thermal runaway.

## ISOPLUS i5-Pak™ HV (IXBL) Outline



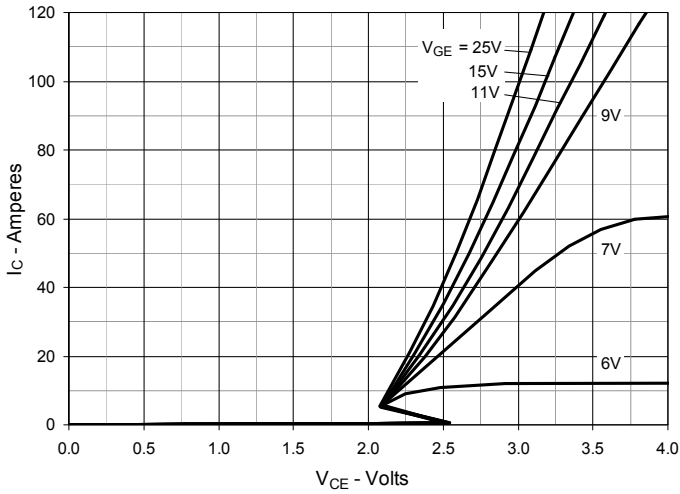
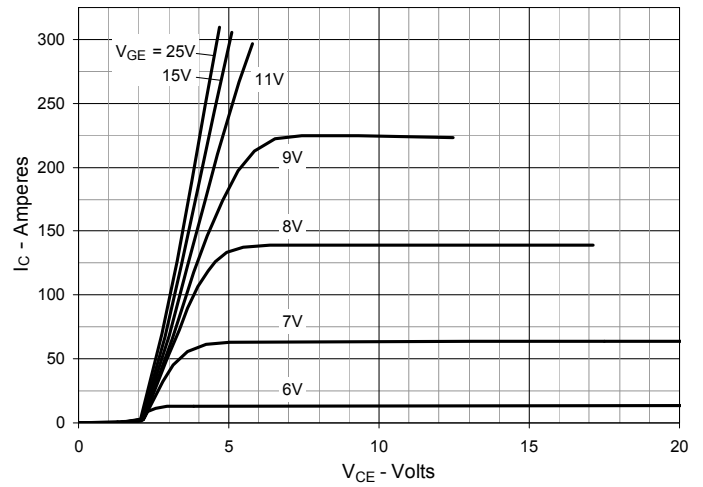
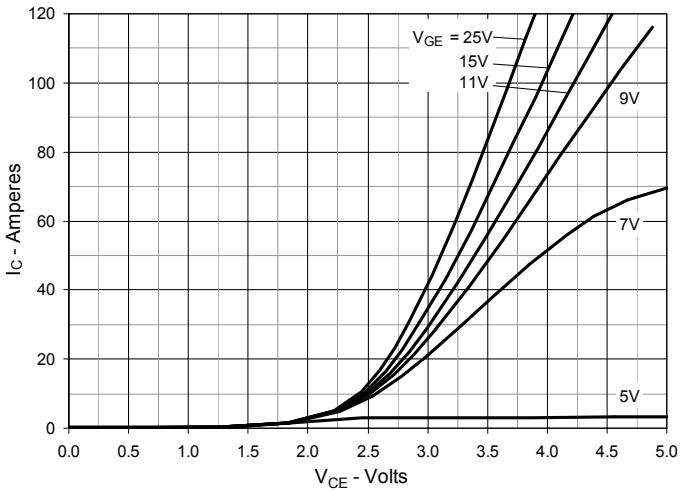
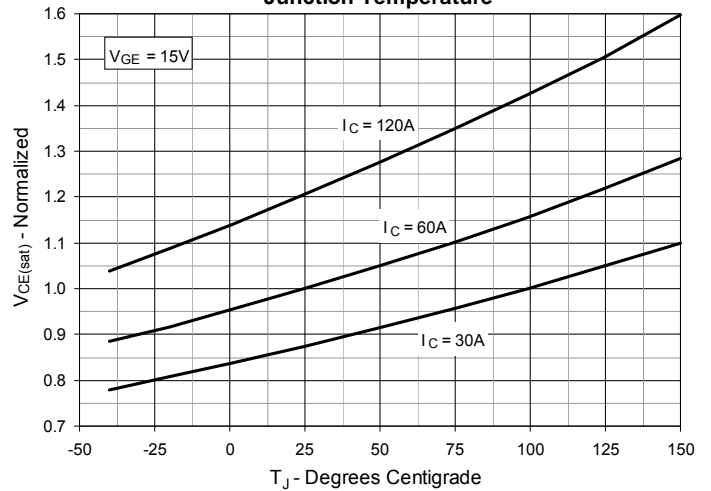
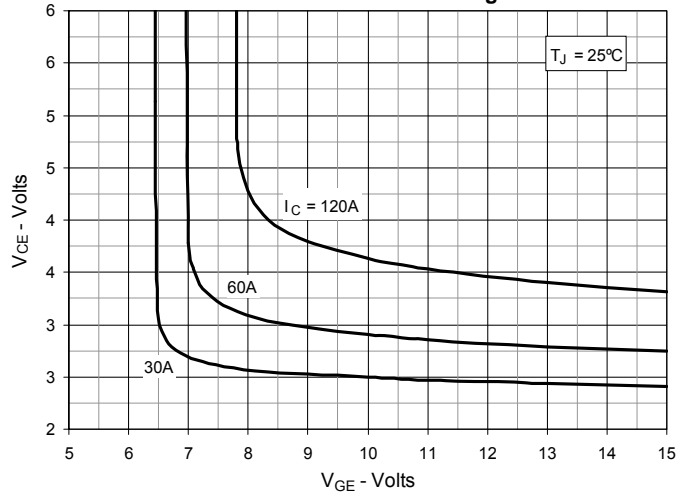
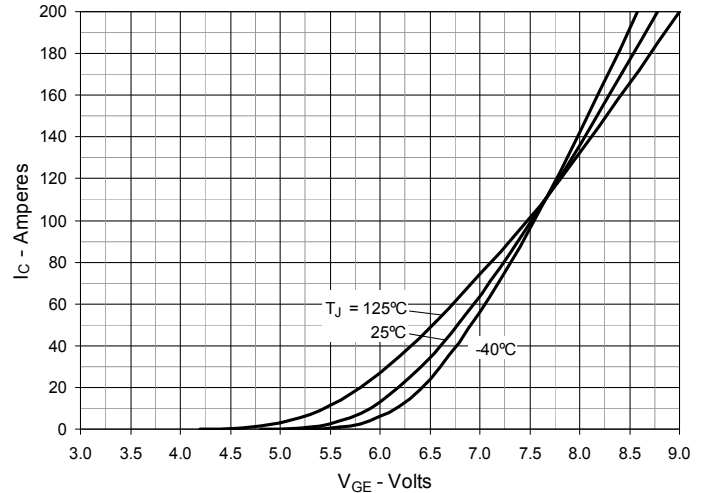
SYM	INCHES		MILLIMETER	
	MIN	MAX	MIN	MAX
A	0.190	0.205	4.83	5.21
A1	0.102	0.118	2.59	3.00
A2	0.046	0.055	1.17	1.40
b	0.045	0.055	1.14	1.40
b1	0.063	0.072	1.60	1.83
b2	0.058	0.068	1.47	1.73
c	0.020	0.029	0.51	0.74
D	1.020	1.040	25.91	26.42
E	0.770	0.799	19.56	20.29
e	0.150 BSC 3.81 BSC			
e1	0.450 BSC 11.43 BSC			
L	0.780	0.820	19.81	20.83
L1	0.080	0.102	2.03	2.59
Q	0.210	0.235	5.33	5.97
Q1	0.490	0.513	12.45	13.03
R	0.150	0.180	3.81	4.57
R1	0.100	0.130	2.54	3.30
S	0.668	0.690	16.97	17.53
T	0.801	0.821	20.34	20.85
U	0.065	0.080	1.65	2.03

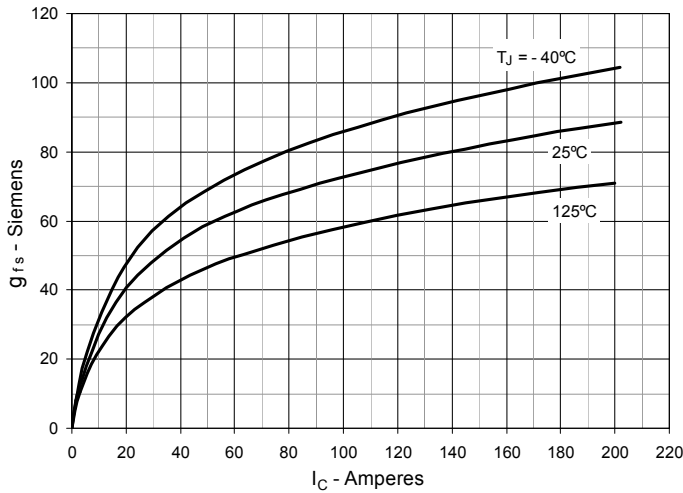
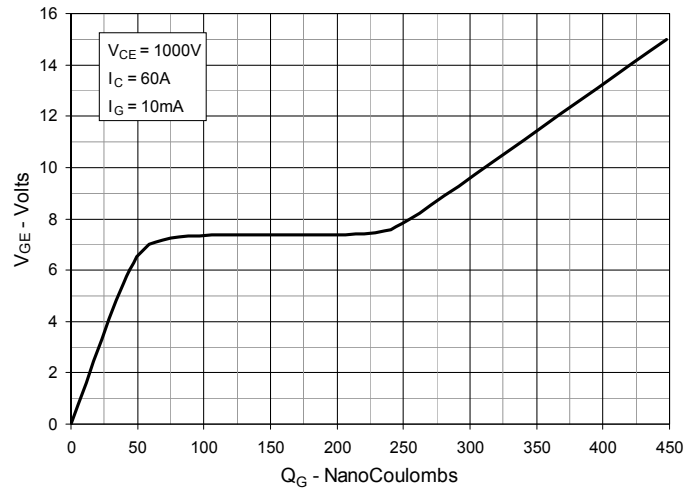
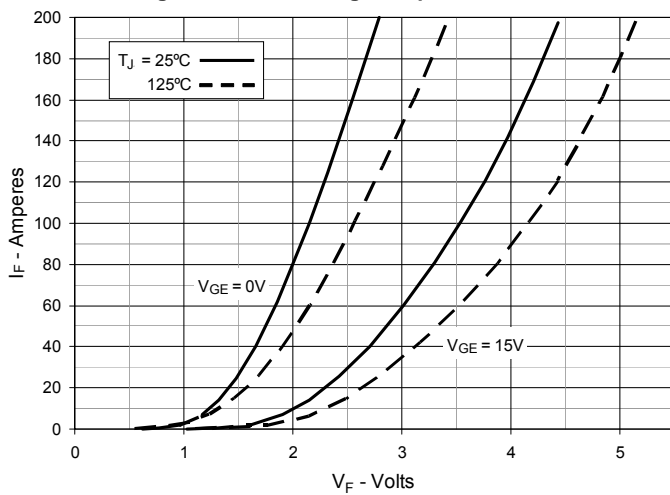
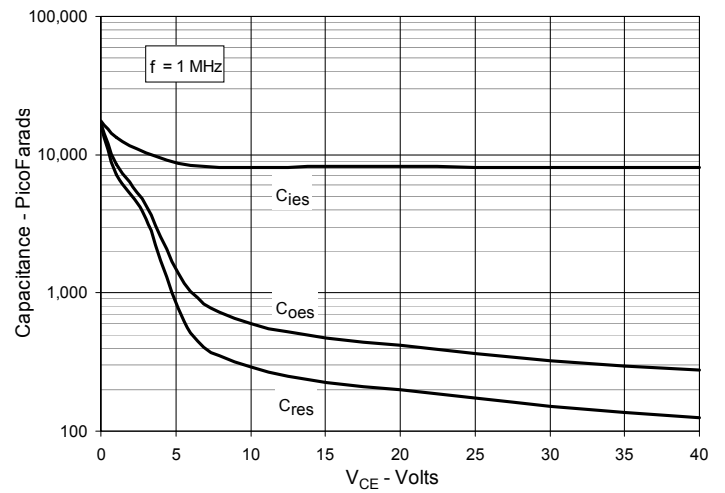
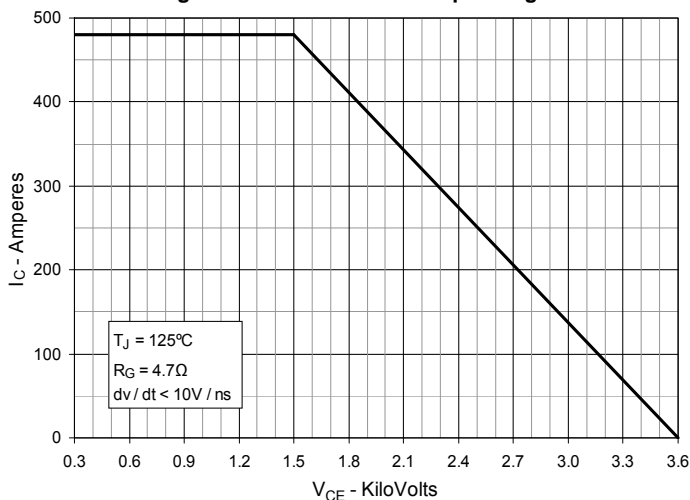
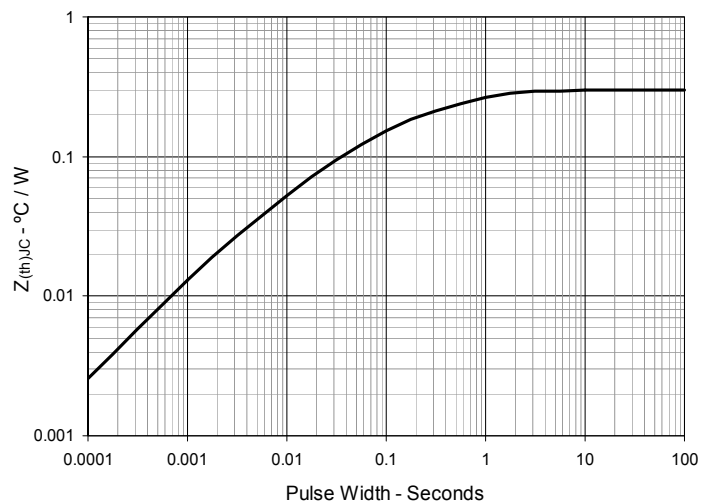
## ADVANCETECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

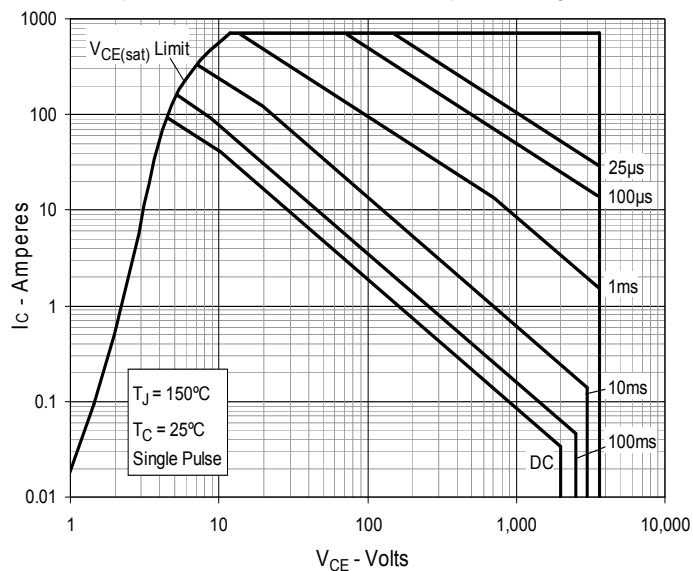
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IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:	4,835,592	4,931,844	5,049,961	5,237,481	6,162,665	6,404,065 B1	6,683,344	6,727,585	7,005,734 B2	7,157,338B2
	4,860,072	5,017,508	5,063,307	5,381,025	6,259,123 B1	6,534,343	6,710,405 B2	6,759,692	7,063,975 B2	
	4,881,106	5,034,796	5,187,117	5,486,715	6,306,728 B1	6,583,505	6,710,463	6,771,478 B2	7,071,537	

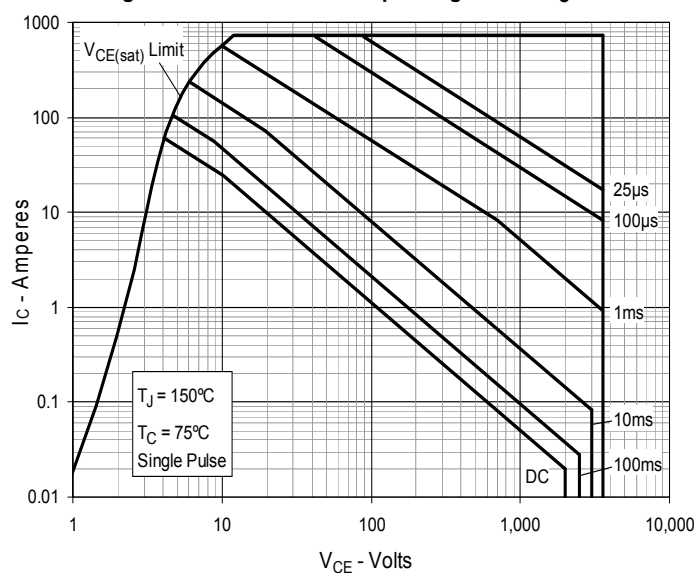
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$** 

**Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature**

**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

**Fig. 6. Input Admittance**


**Fig. 7. Transconductance**

**Fig. 8. Gate Charge**

**Fig. 9. Forward Voltage Drop of Intrinsic Diode**

**Fig. 10. Capacitance**

**Fig. 11. Reverse-Bias Safe Operating Area**

**Fig. 12. Maximum Transient Thermal Impedance**


**Fig. 13. Forward-Bias Safe Operating Area @  $T_C = 25^\circ\text{C}$**



**Fig. 14. Forward-Bias Safe Operating Area @  $T_C = 75^\circ\text{C}$**





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