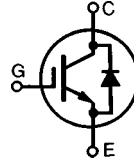


# IGBT with Diode

# IXSK 50N60AU1

## Combi Pack

## Short Circuit SOA Capability



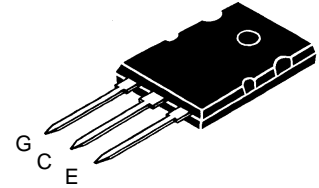
$$V_{CES} = 600 \text{ V}$$

$$I_{C25} = 75 \text{ A}$$

$$V_{CE(sat)} = 2.7 \text{ V}$$

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$	600	V
$V_{CGR}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GE} = 1 \text{ M}\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$ , limited by leads	75	A
$I_{C90}$	$T_C = 90^\circ\text{C}$	50	A
$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1 ms	200	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15 \text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 22 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
<b><math>t_{SC}</math> (SCSOA)</b>	$V_{GE} = 15 \text{ V}$ , $V_{CE} = 360 \text{ V}$ , $T_J = 125^\circ\text{C}$ $R_G = 22 \Omega$ , non repetitive	10	$\mu\text{s}$
$P_c$	$T_C = 25^\circ\text{C}$	300	W
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
$M_d$	Mounting torque	0.9/6	Nm/lb.in.
<b>Weight</b>		10	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

### TO-264 AA



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

### Features

- International standard package JEDEC TO-264 AA
- Guaranteed Short Circuit SOA capability
- High frequency IGBT and anti-parallel FRED in one package
- 2nd generation HDMOS™ process
- 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
- 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

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$BV_{CES}$	$I_C = 3 \text{ mA}$ , $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 4 \text{ mA}$ , $V_{CE} = V_{GE}$	4		V
$I_{CES}$	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ : 750 $\mu\text{A}$ $T_J = 125^\circ\text{C}$ : 15 mA
$I_{GES}$	$V_{CE} = 0 \text{ V}$ , $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$ , $V_{GE} = 15 \text{ V}$			2.7 V

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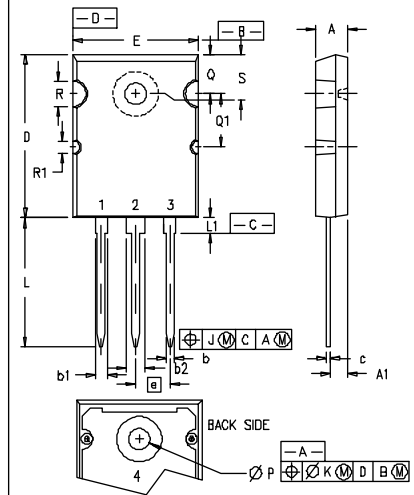
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Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$g_{fs}$	$I_C = I_{C90}$ ; $V_{CE} = 10\text{ V}$ , Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $\leq 2\%$	20	23	S
$Q_g$	$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5\ V_{CES}$		190	250 nC
$Q_{ge}$			45	60 nC
$Q_{gc}$			88	120 nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b>		70	ns
$t_{ri}$	$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\ \mu\text{H}$ , $V_{CE} = 0.8\ V_{CES}$ , $R_G = 2.7\ \Omega$		220	ns
$t_{d(off)}$			200	ns
$t_{fi}$	Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$		400	600 ns
$E_{off}$			6	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b>		70	ns
$t_{ri}$	$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\ \mu\text{H}$ , $V_{CE} = 0.8\ V_{CES}$ , $R_G = 2.7\ \Omega$		230	ns
$E_{on}$			4.5	mJ
$t_{d(off)}$	Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$		340	ns
$t_{fi}$			400	ns
$E_{off}$			7	mJ
$R_{thJC}$				0.42 K/W
$R_{thCK}$		0.15		K/W

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_F$	$I_F = I_{C90}$ , $V_{GE} = 0\text{ V}$ , Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$			1.8 V
$I_{RM}$	$I_F = I_{C90}$ , $V_{GE} = 0\text{ V}$ , $-di_F/dt = 480\text{ A}/\mu\text{s}$ $V_R = 360\text{ V}$ $T_J = 125^\circ\text{C}$ $I_F = 1\text{ A}$ ; $-di/dt = 200\text{ A}/\mu\text{s}$ ; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		19	33 A
$t_{tr}$			175	ns
			35	50 ns
$R_{thJC}$				0.75 K/W

**TO-264 AA Outline**


SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.185	.209	4.70	5.31
A1	.102	.118	2.59	3.00
b	.037	.055	0.94	1.40
b1	.087	.102	2.21	2.59
b2	.110	.126	2.79	3.20
c	.017	.029	0.43	0.74
D	1.007	1.047	25.58	26.59
E	.760	.799	19.30	20.29
e	.215 BSC		5.46 BSC	
J	.000	.010	0.00	0.25
K	.000	.010	0.00	0.25
L	.779	.842	19.79	21.39
L1	.087	.102	2.21	2.59
$\varnothing P$	.122	.138	3.10	3.51
Q	.240	.256	6.10	6.50
Q1	.330	.346	8.38	8.79
$\varnothing R$	.155	.187	3.94	4.75
$\varnothing R1$	.085	.093	2.16	2.36
S	.243	.253	6.17	6.43

- 1 - GATE
- 2, 4 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)

IXYS MOSFETs and IGBTs are covered by one of the following U.S. patents: 4,835,592 4,881,108 5,017,508 5,049,961 5,187,117 5,486,715  
4,850,072 4,931,844 5,034,796 5,063,307 5,237,481 5,381,025

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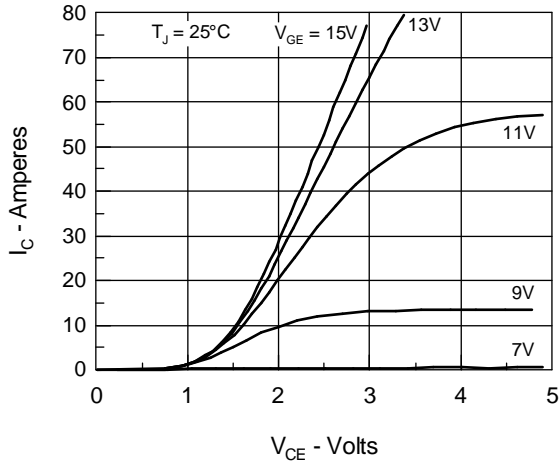
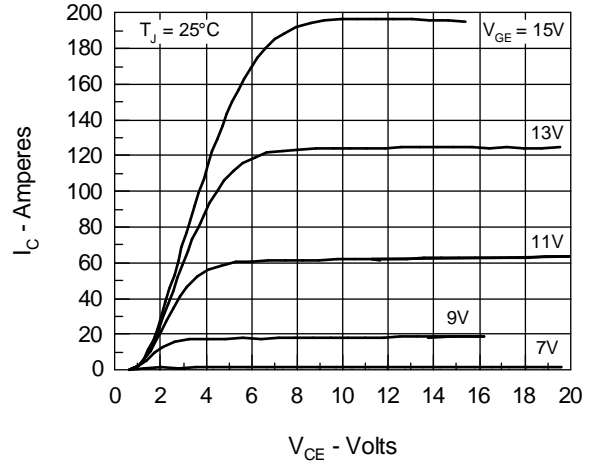
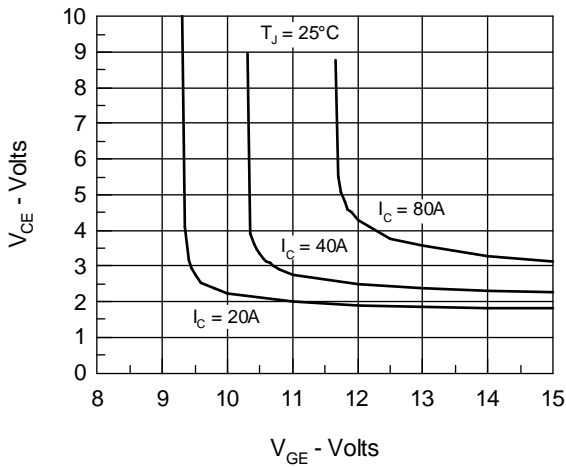
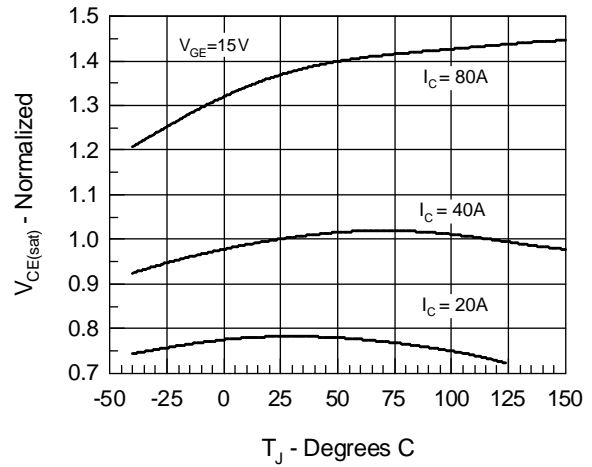
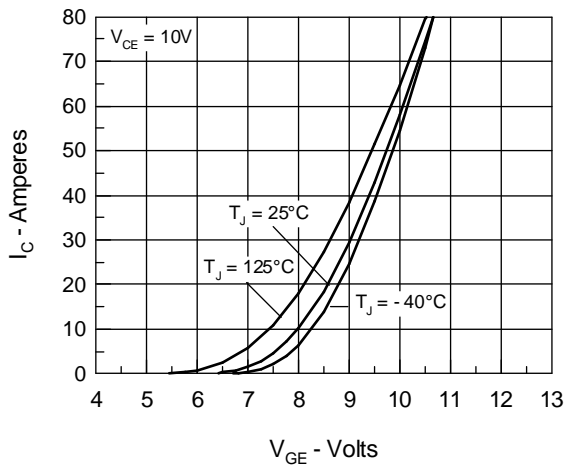
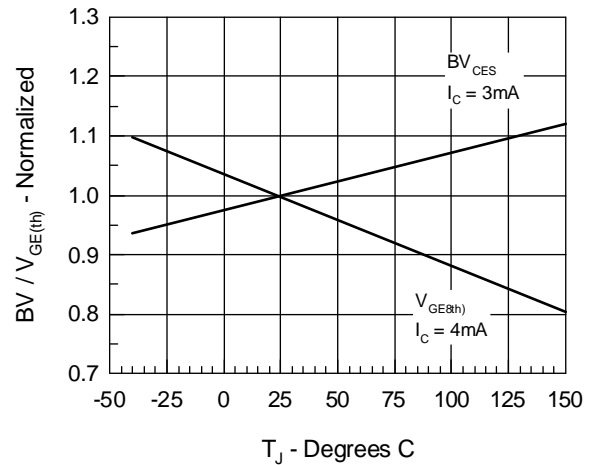
**Fig. 1 Saturation Characteristics**

**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**

**Fig. 6 Temperature Dependence of Breakdown and Threshold Voltage**


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

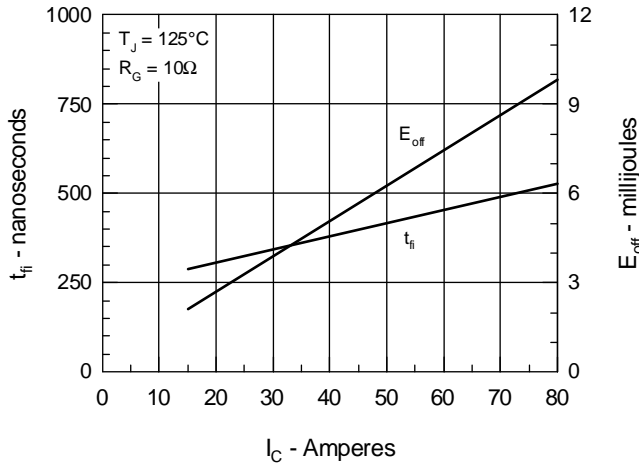


Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on R\_G

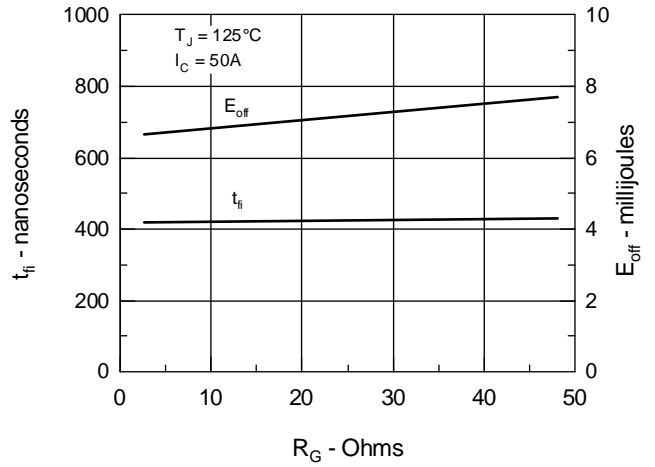


Fig.9 Gate Charge Characteristic Curve

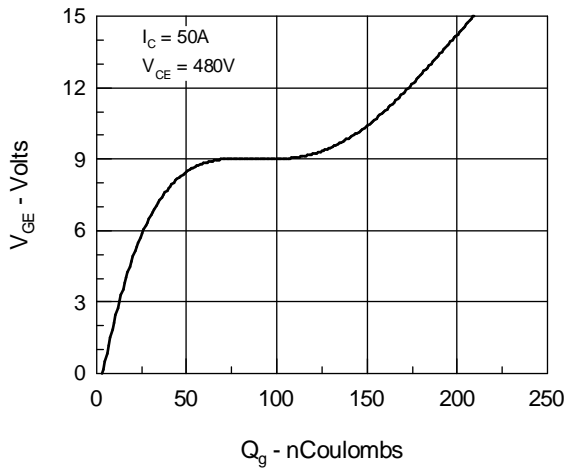


Fig.10 Turn-Off Safe Operating Area

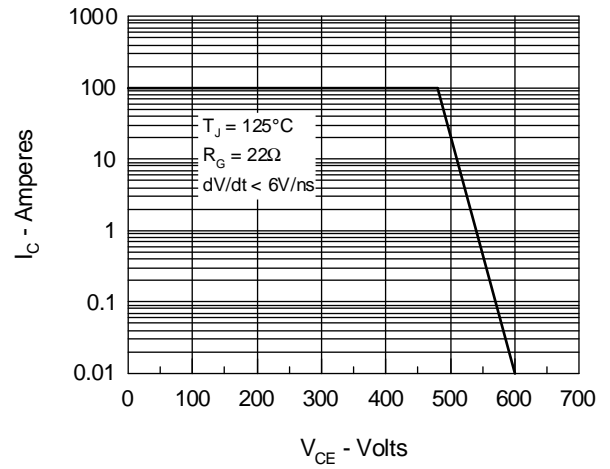
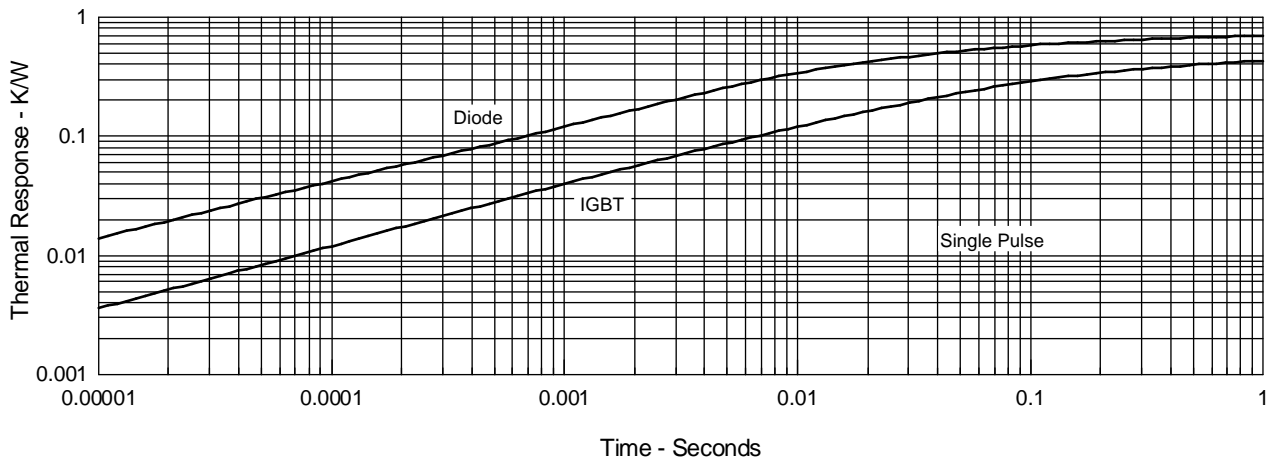


Fig.11 Transient Thermal Impedance



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Fig.12 Typical Forward Voltage Drop

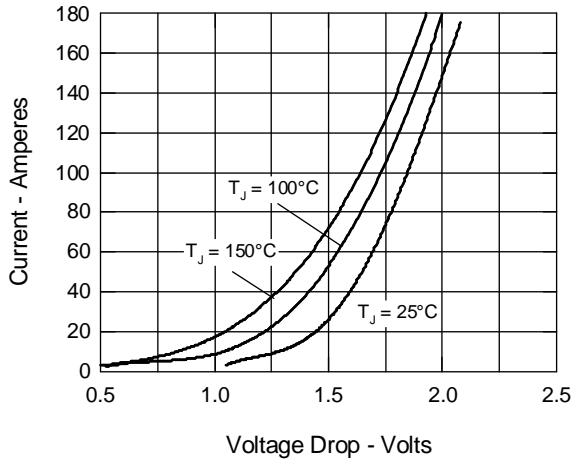


Fig.13 Peak Forward Voltage  $V_{FR}$  and Forward Recovery Time  $t_{fr}$

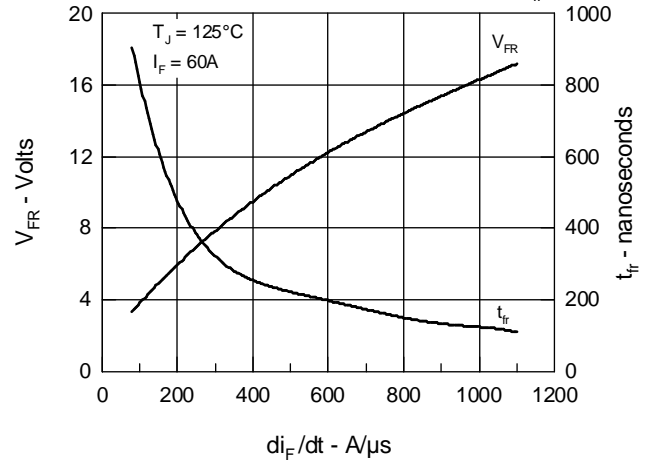


Fig.14 Junction Temperature Dependence of  $I_{RM}$  and  $Q_r$

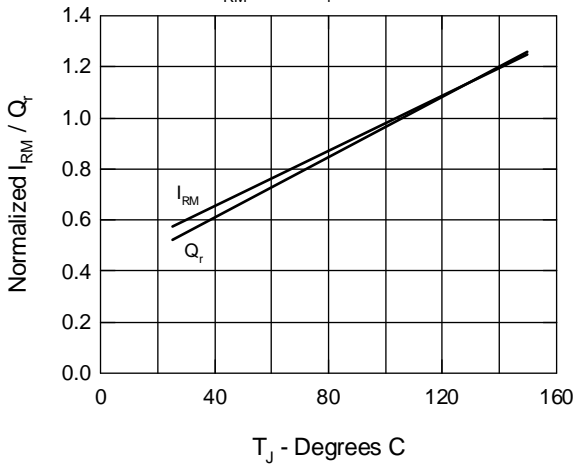


Fig.15 Reverse Recovery Charge

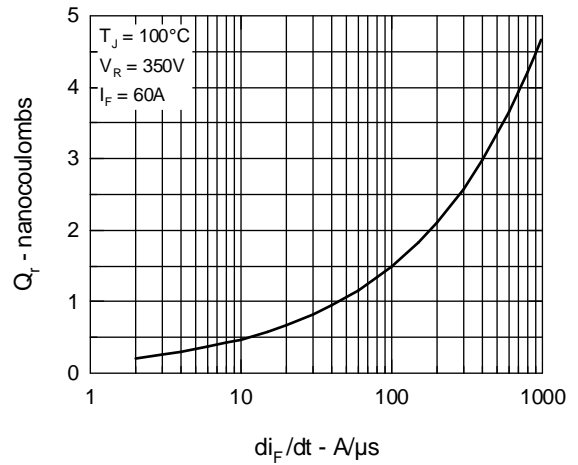


Fig.16 Peak Reverse Recovery Current

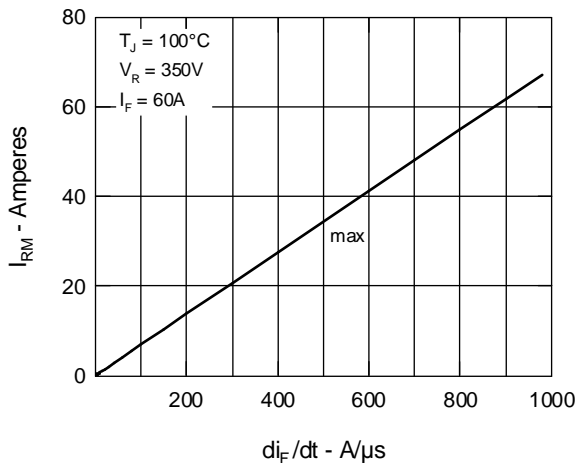
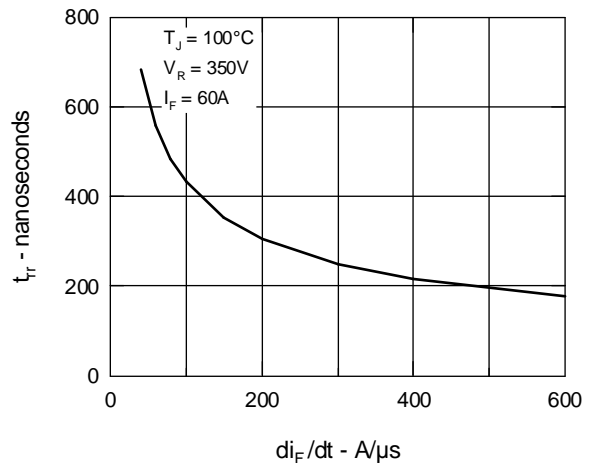


Fig.17 Reverse Recovery Time



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