

AUIRGP35B60PD-E

WARP2 SERIES IGBT WITH ULTRAFAST SOFT RECOVERY DIODE

Features

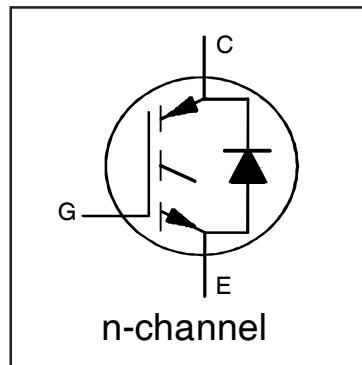
- NPT Technology, Positive Temperature Coefficient
- Lower $V_{CE}(\text{SAT})$
- Lower Parasitic Capacitances
- Minimal Tail Current
- HEXFRED Ultra Fast Soft-Recovery Co-Pack Diode
- Tighter Distribution of Parameters
- Higher Reliability
- Lead-Free, RoHS Compliant
- Automotive Qualified*

Applications

- PFC and ZVS SMPS Circuits
- DC/DC Converter Charger

Benefits

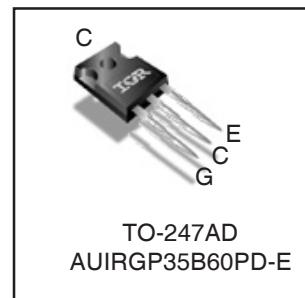
- Parallel Operation for Higher Current Applications
- Lower Conduction Losses and Switching Losses
- Higher Switching Frequency up to 150KHz



$V_{CES} = 600\text{V}$
 $V_{CE(\text{on})} \text{ typ.} = 1.85\text{V}$
@ $V_{GE} = 15\text{V}$ $I_C = 22\text{A}$

Equivalent MOSFET Parameters^①

$R_{CE(\text{on})} \text{ typ.} = 84\text{m}\Omega$
 $I_D \text{ (FET equivalent)} = 35\text{A}$



G	C	E
Gate	Collector	Emitter

Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (T_A) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ\text{C}$	Continuous Collector Current	60	A
$I_C @ T_C = 100^\circ\text{C}$	Continuous Collector Current	34	
I_{CM}	Pulse Collector Current (Ref. Fig. C.T.4)	120	
I_{LM}	Clamped Inductive Load Current ^②	120	
$I_F @ T_C = 25^\circ\text{C}$	Diode Continuous Forward Current	40	
$I_F @ T_C = 100^\circ\text{C}$	Diode Continuous Forward Current	15	
I_{FRM}	Maximum Repetitive Forward Current ^③	60	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	308	W
$P_D @ T_C = 100^\circ\text{C}$	Maximum Power Dissipation	123	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting Torque, 6-32 or M3 Screw	10 lbf·in (1.1 N·m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$ (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT)	—	—	0.41	°C/W
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode)	—	—	1.7	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.50	—	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	—	40	
	Weight	—	6.0 (0.21)	—	g (oz)

*Qualification standards can be found at <http://www.irf.com/>

Qualification Information[†]

Qualification Level	Automotive (per AEC-Q101) ^{††}	
	Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level	TO-247	MSL1
ESD	Machine Model	Class M4 (425V) ^{†††} AEC-Q101-002
	Human Body Model	Class H2 (4000V) ^{†††} AEC-Q101-001
	Charged Device Model	Class C5 (1125V) ^{†††} AEC-Q101-005
RoHS Compliant	Yes	

[†] Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

^{††} Exceptions to AEC-Q101 requirements are noted in the qualification report.

^{†††} Highest passing voltage

AUIRGP35B60PD-E

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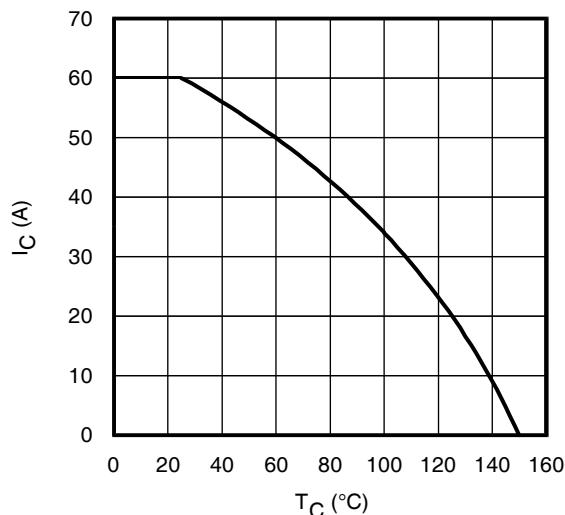


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

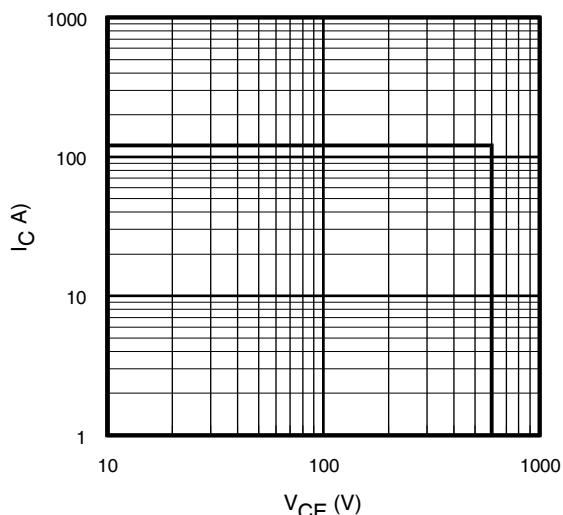


Fig. 3 - Reverse Bias SOA
 $T_J = 150^\circ\text{C}$; $V_{GE} = 15\text{V}$

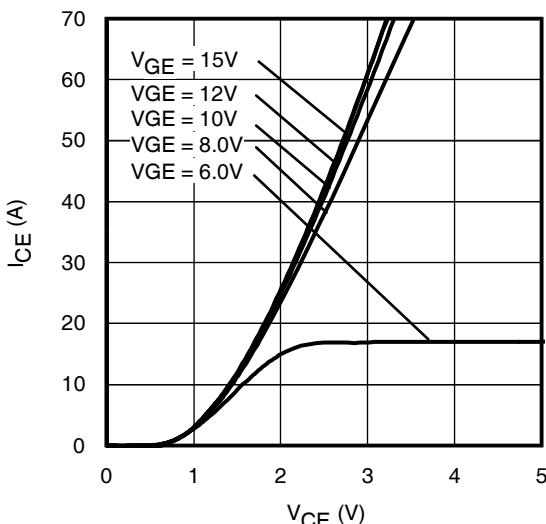


Fig. 5 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 80\mu\text{s}$

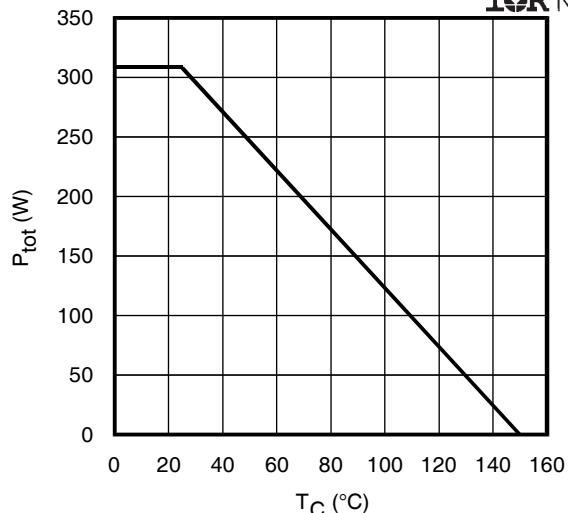


Fig. 2 - Power Dissipation vs. Case Temperature

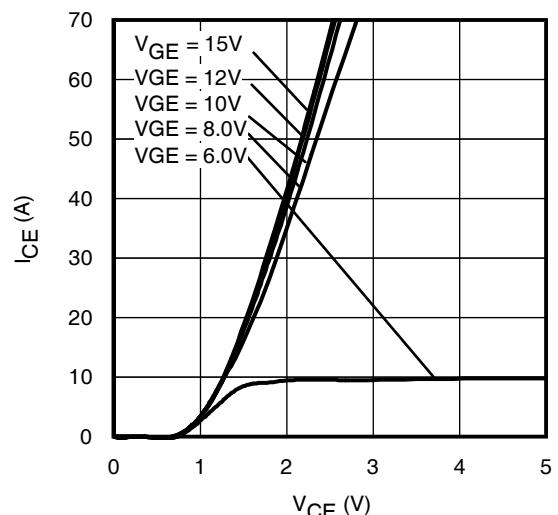


Fig. 4 - Typ. IGBT Output Characteristics
 $T_J = -40^\circ\text{C}$; $t_p = 80\mu\text{s}$

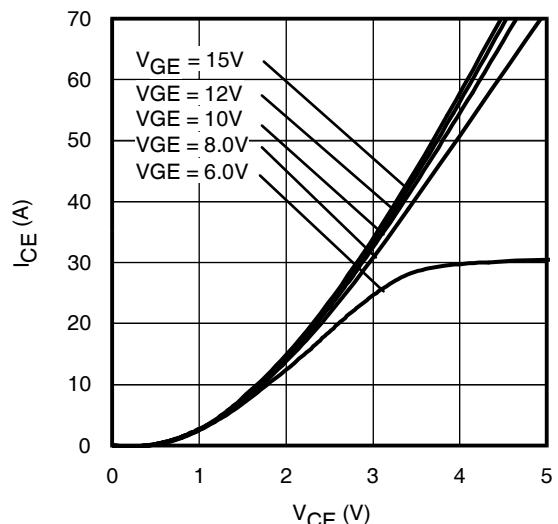


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = 125^\circ\text{C}$; $t_p = 80\mu\text{s}$

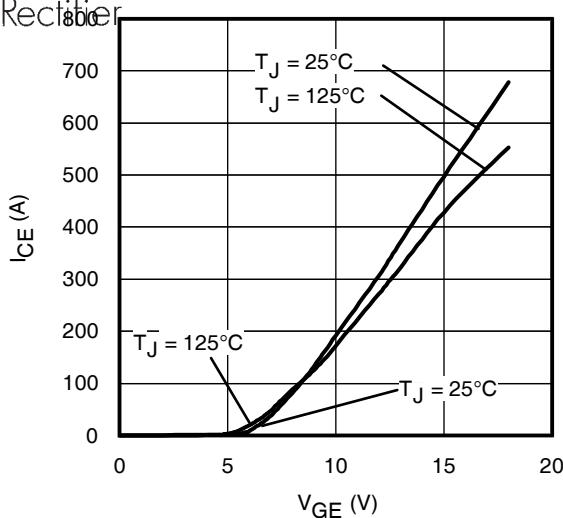


Fig. 7 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$

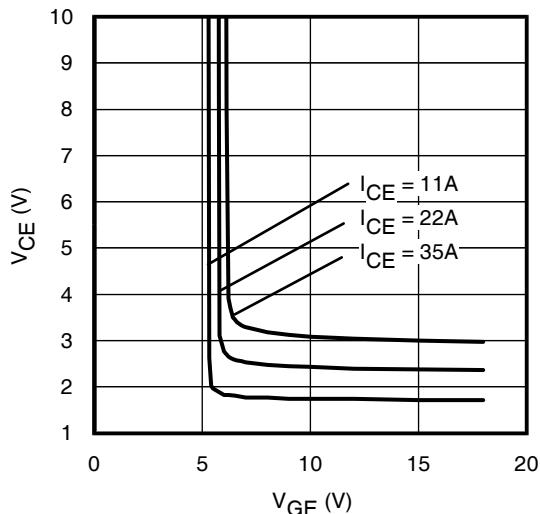


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = 125^\circ\text{C}$

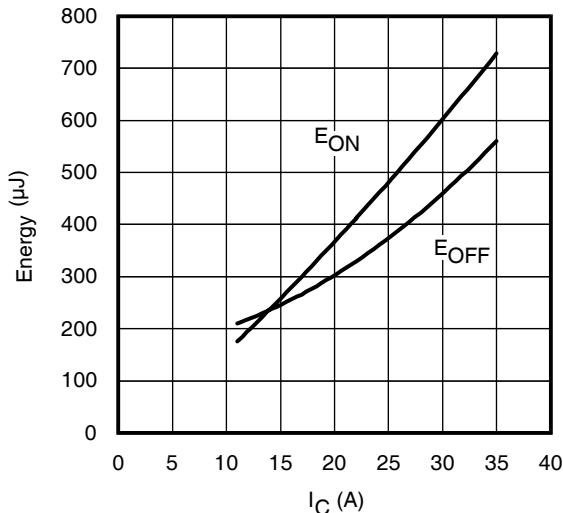


Fig. 11 - Typ. Energy Loss vs. I_C
 $T_J = 125^\circ\text{C}$; $L = 200\mu\text{H}$; $V_{CE} = 390\text{V}$, $R_G = 3.3\Omega$; $V_{GE} = 15\text{V}$.
www.irf.com
Diode clamp used: 30ETH06 (See C.T.3)

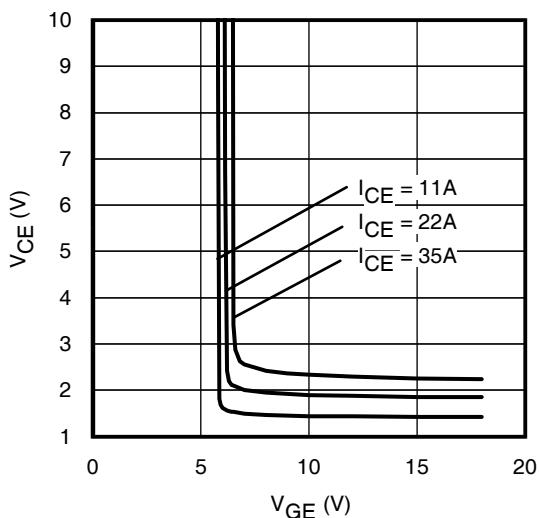


Fig. 8 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

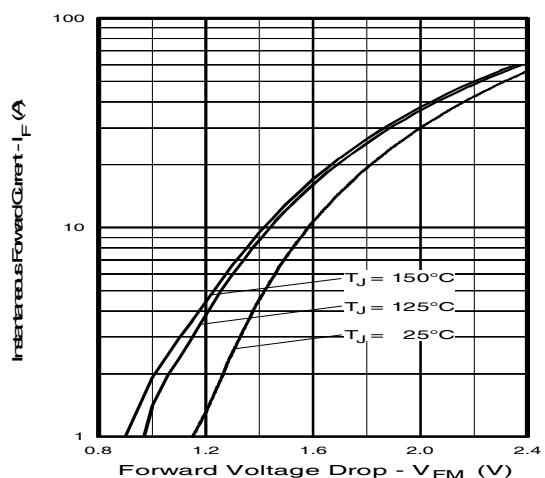


Fig. 10 - Typ. Diode Forward Characteristics
 $t_p = 80\mu\text{s}$

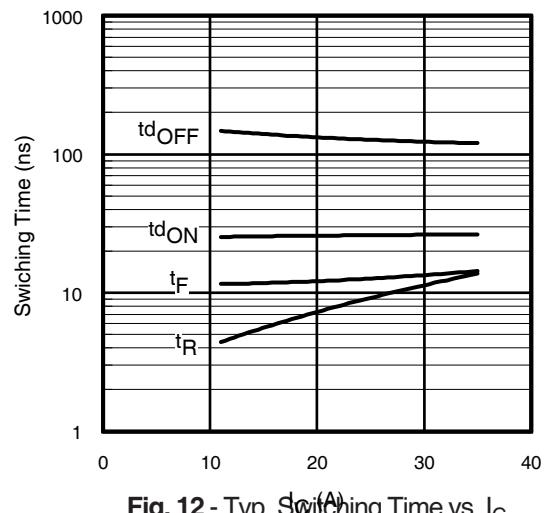


Fig. 12 - Typ. Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$; $L = 200\mu\text{H}$; $V_{CE} = 390\text{V}$, $R_G = 3.3\Omega$; $V_{GE} = 15\text{V}$.
Diode clamp used: 30ETH06 (See C.T.3)

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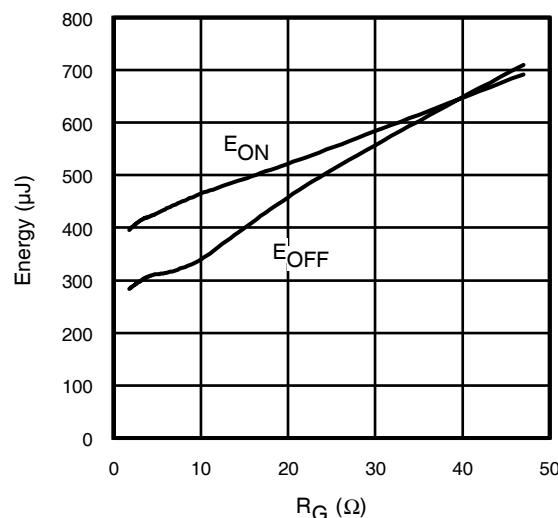


Fig. 13 - Typ. Energy Loss vs. R_G

$T_J = 125^\circ\text{C}$; $L = 200\mu\text{H}$; $V_{CE} = 390\text{V}$, $I_{CE} = 22\text{A}$; $V_{GE} = 15\text{V}$
Diode clamp used: 30ETH06 (See C.T.3)

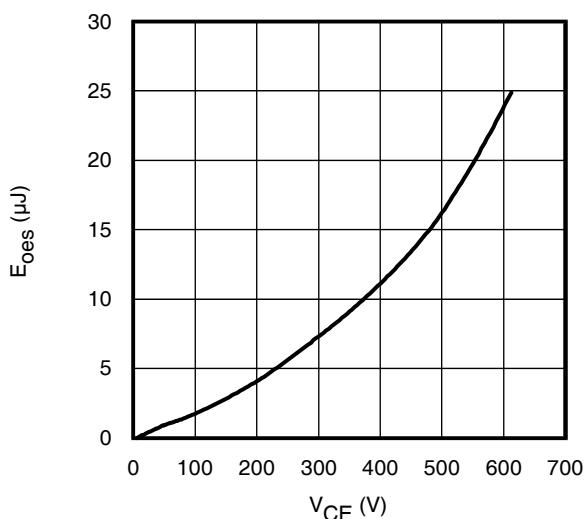


Fig. 15- Typ. Output Capacitance Stored Energy vs. V_{CE}

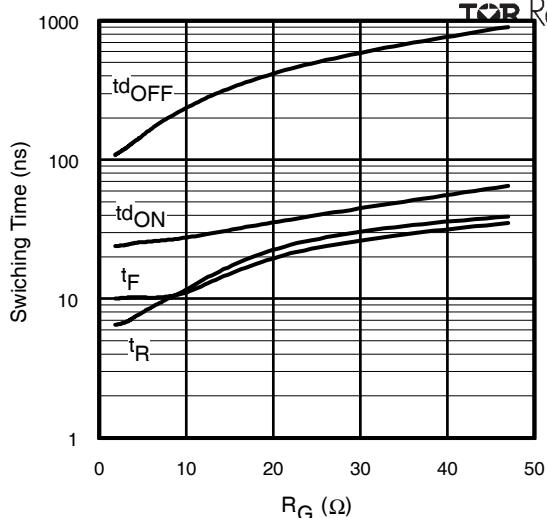


Fig. 14 - Typ. Switching Time vs. R_G

$T_J = 125^\circ\text{C}$; $L = 200\mu\text{H}$; $V_{CE} = 390\text{V}$, $I_{CE} = 22\text{A}$; $V_{GE} = 15\text{V}$
Diode clamp used: 30ETH06 (See C.T.3)

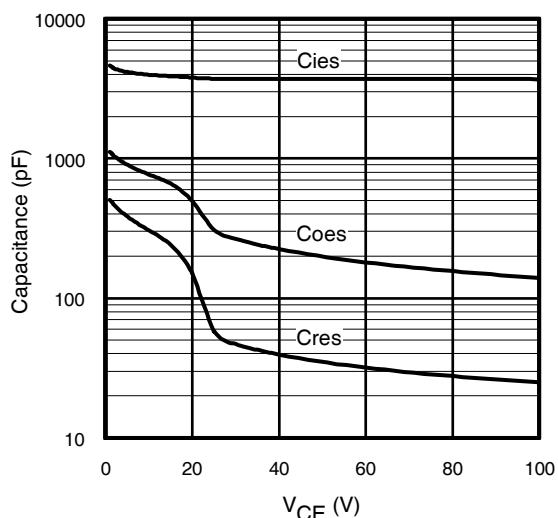


Fig. 16- Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0\text{V}$; $f = 1\text{MHz}$

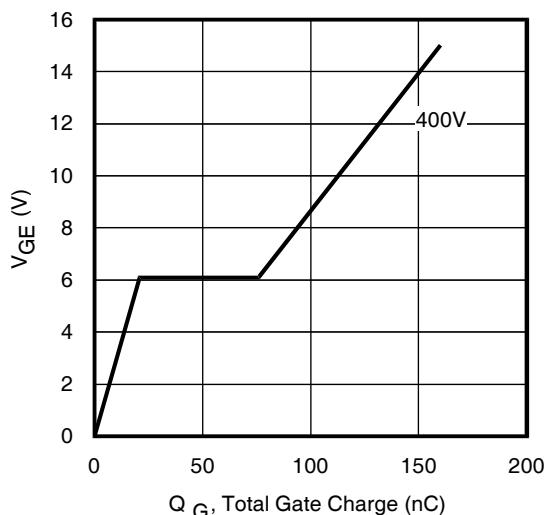


Fig. 17 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 22\text{A}$

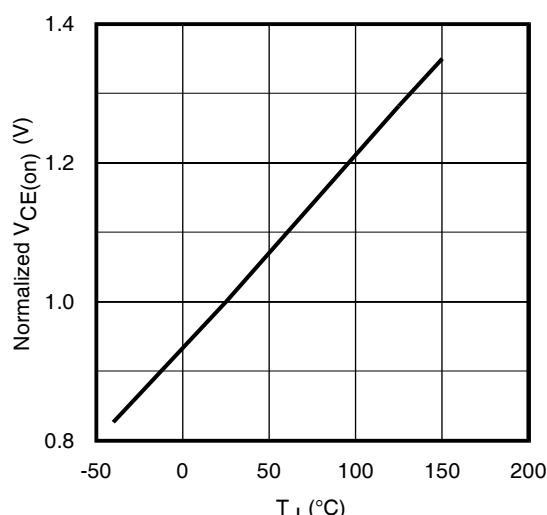


Fig. 18 - Normalized Typ. $V_{CE(on)}$ vs. Junction Temperature
 $I_C = 22\text{A}$, $V_{GE} = 15\text{V}$

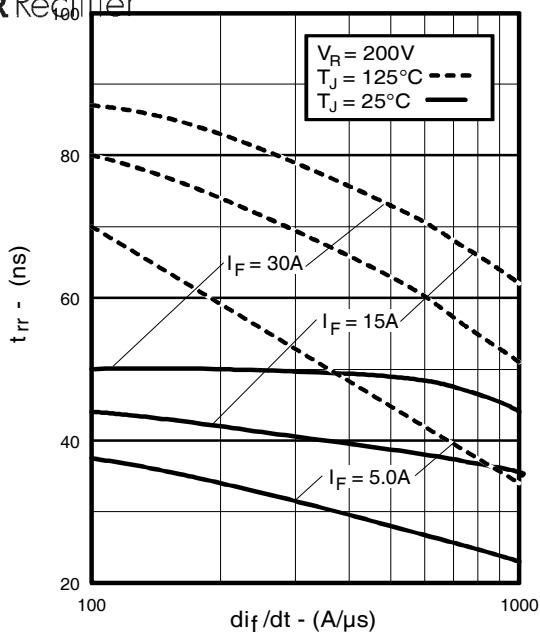


Fig. 19 - Typical Reverse Recovery vs. di_f/dt

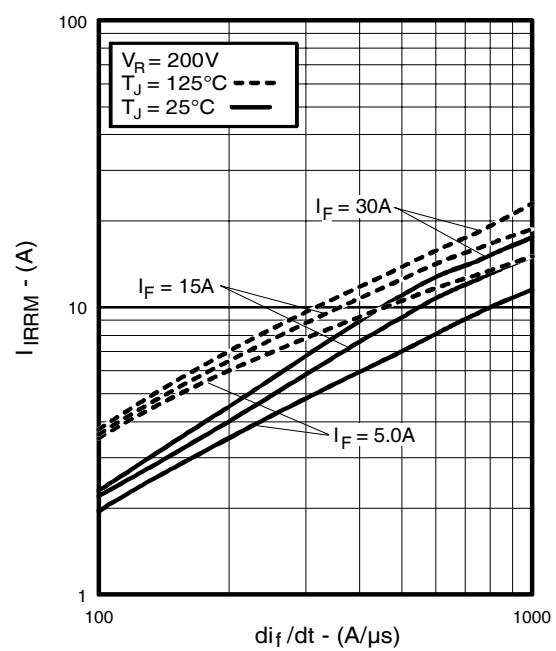


Fig. 20 - Typical Recovery Current vs. di_f/dt

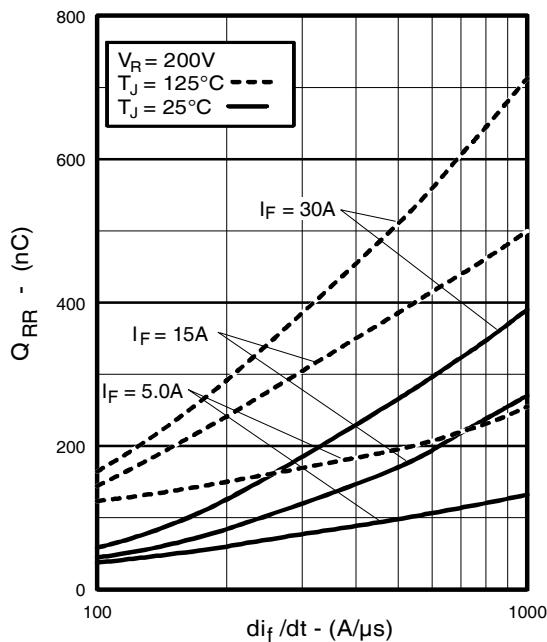


Fig. 21 - Typical Stored Charge vs. di_f/dt

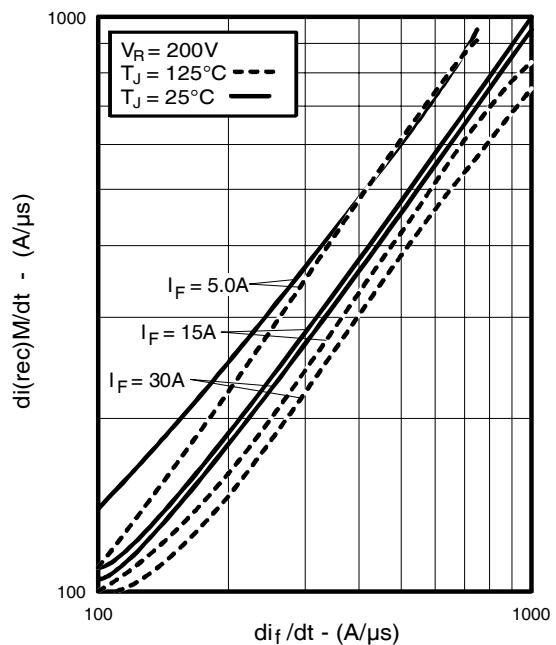
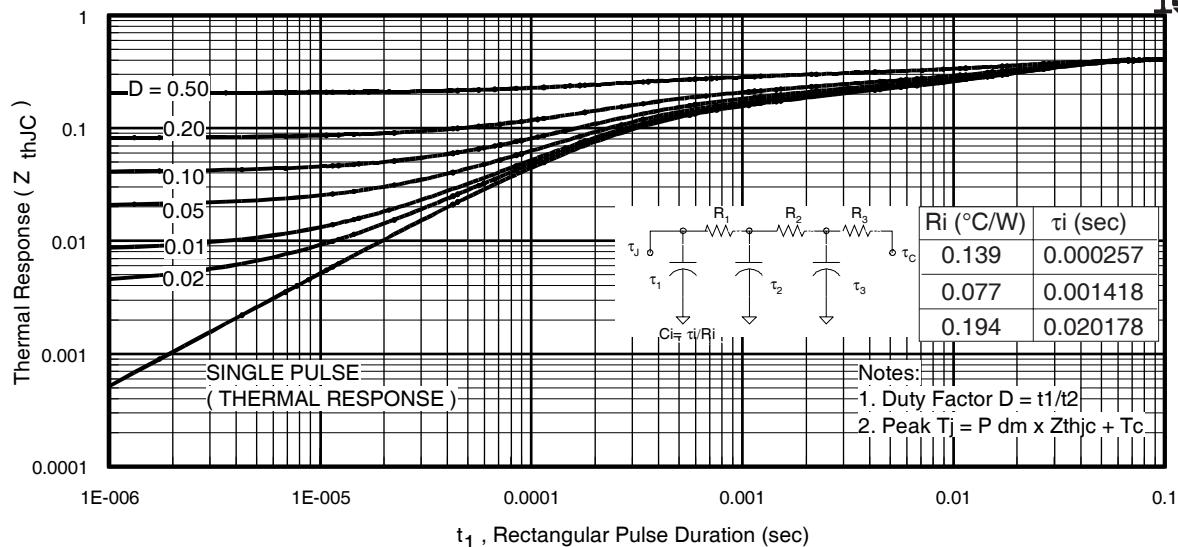
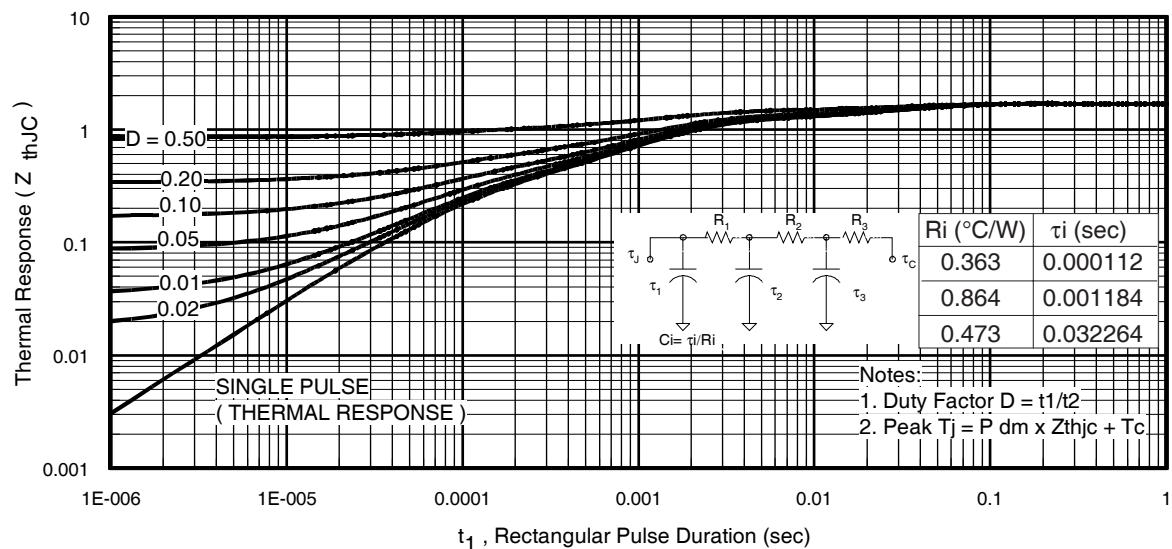


Fig. 22 - Typical $di_{(rec)}M/dt$ vs. di_f/dt ,

**Fig 23.** Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)**Fig. 24.** Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

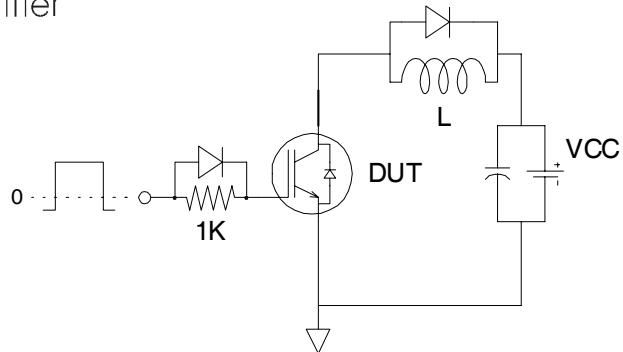


Fig.C.T.1 - Gate Charge Circuit (turn-off)

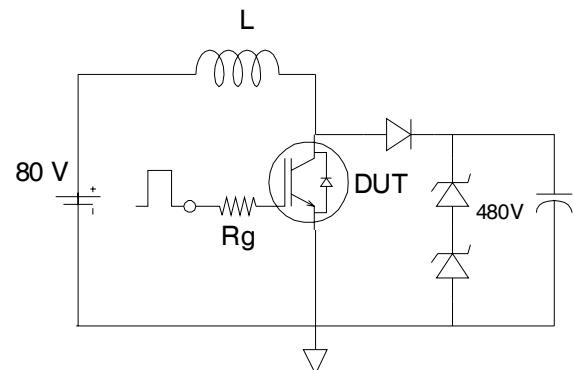


Fig.C.T.2 - RBSOA Circuit

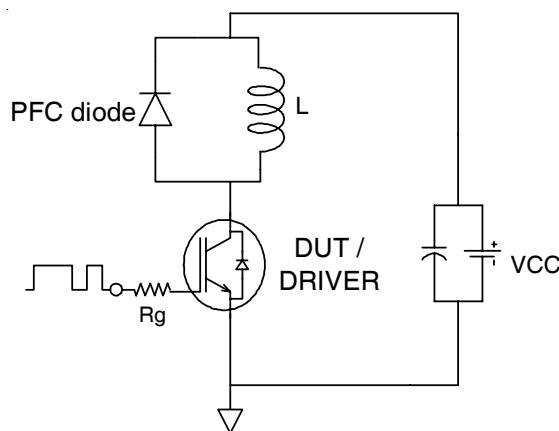


Fig.C.T.3 - Switching Loss Circuit

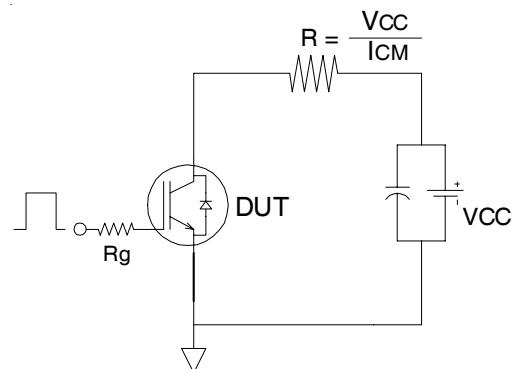


Fig.C.T.4 - Resistive Load Circuit

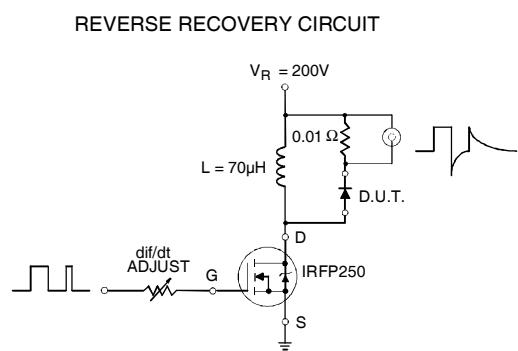


Fig. C.T.5 - Reverse Recovery Parameter Test Circuit

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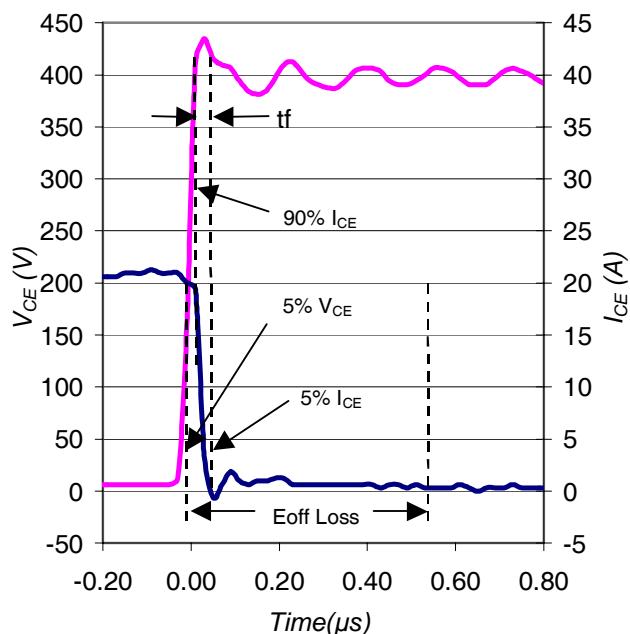


Fig. WF1 - Typ. Turn-off Loss Waveform
@ $T_J = 25^\circ\text{C}$ using Fig. CT.3

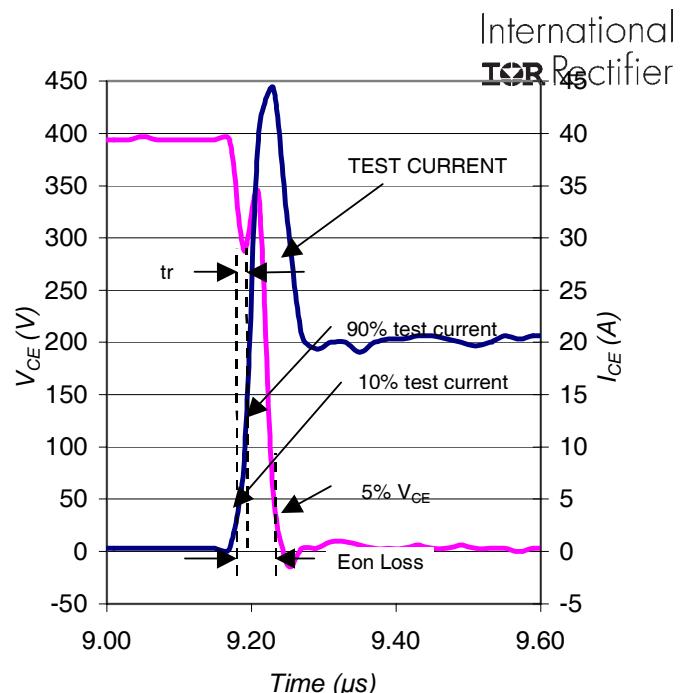
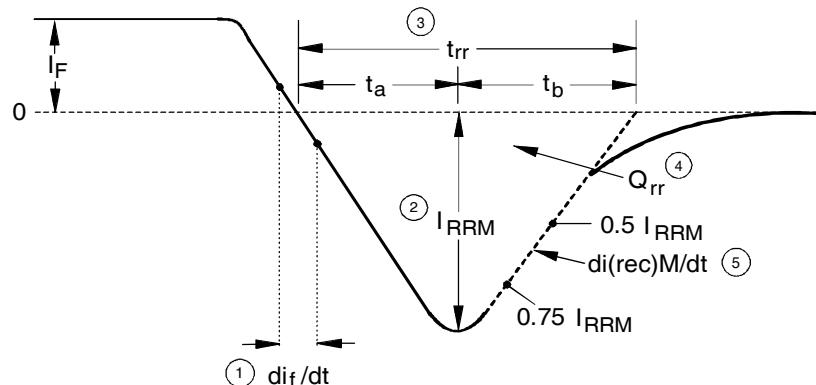


Fig. WF2 - Typ. Turn-on Loss Waveform
@ $T_J = 25^\circ\text{C}$ using Fig. CT.3



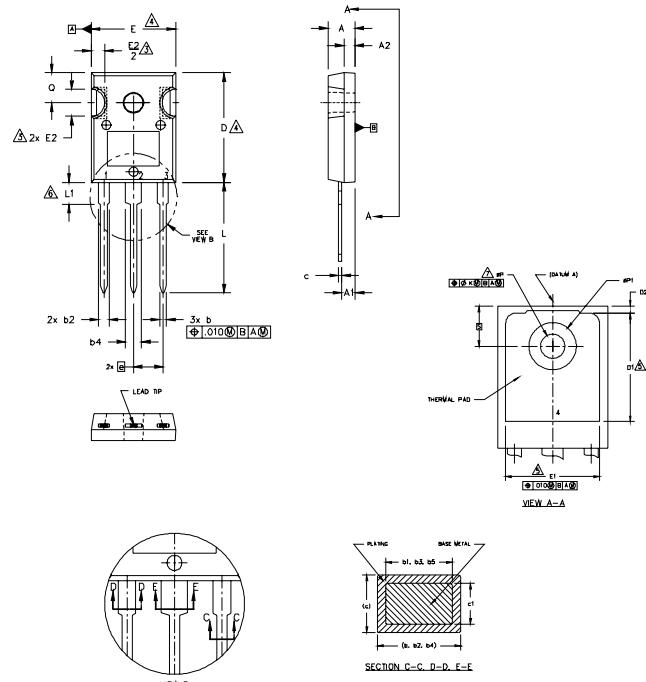
1. di_f/dt - Rate of change of current through zero crossing
2. I_{RRM} - Peak reverse recovery current
3. t_{rr} - Reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through $0.75 I_{RRM}$ and $0.50 I_{RRM}$ extrapolated to zero current

4. Q_{rr} - Area under curve defined by t_{rr} and I_{RRM}
 5. $\text{di}(\text{rec})M/dt$ - Peak rate of change of current during t_b portion of t_{rr}
- $$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

Fig. WF3 - Reverse Recovery Waveform and Definitions

TO-247AD Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN INCHES.
3. CONTOUR OF SLOT OPTIONAL.
4. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
6. LEAD FINISH UNCONTROLLED IN L1.
7. ØP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AD.

SYMBOL	DIMENSIONS			NOTES
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	.183	.209	4.65	5.31
A1	.087	.102	2.21	2.59
A2	.059	.098	1.50	2.49
b	.039	.055	0.99	1.40
b1	.039	.053	0.99	1.35
b2	.065	.094	1.65	2.39
b3	.065	.092	1.65	2.34
b4	.102	.135	2.59	3.43
b5	.102	.133	2.59	3.38
c	.015	.035	0.38	0.89
c1	.015	.033	0.38	0.84
D	.776	.815	19.71	20.70
D1	.515	—	13.08	—
D2	.020	.053	0.51	1.35
E	.602	.625	15.29	15.87
E1	.530	—	13.46	—
E2	.178	.216	4.52	5.49
e	.215 BSC		5.46 BSC	
Øk	.010		0.25	
L	.780	.827	19.57	21.00
L1	.146	.169	3.71	4.29
ØP	.140	.144	3.56	3.66
ØP1	—	.291	—	7.39
Q	.209	.224	5.31	5.69
S	.217 BSC		5.51 BSC	

LEAD ASSIGNMENTS

HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

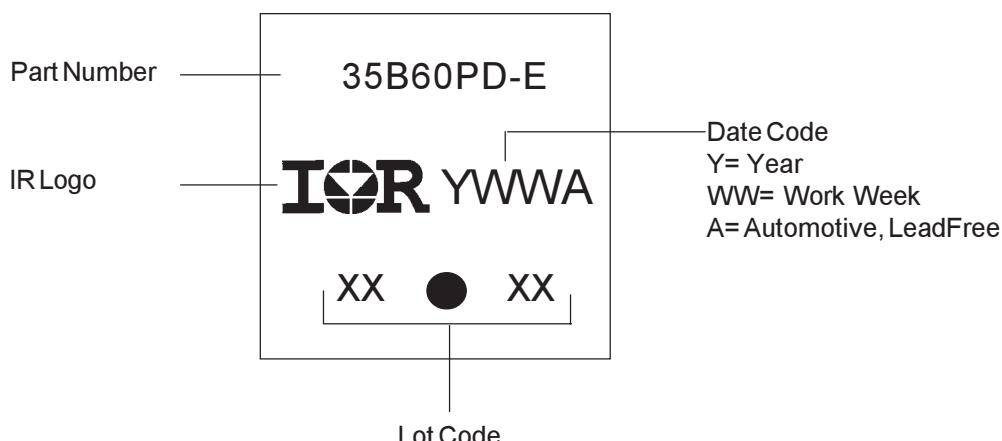
IGBTs, CoPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- Emitter
- 4.- COLLECTOR

DIODES

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

TO-247AD Part Marking Information



TO-247AD package is not recommended for Surface Mount Application.

Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRGP35B60PD-E	TO-247	Tube	25	AUIRGP35B60PD-E

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<http://www.irf.com/technical-info/>

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- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помочь разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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