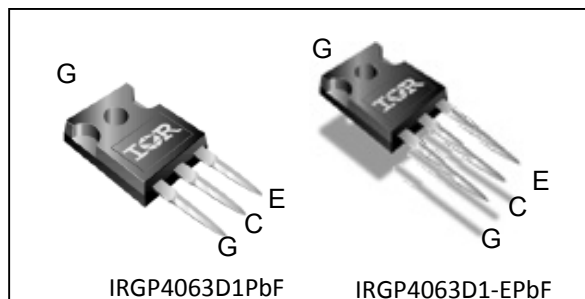
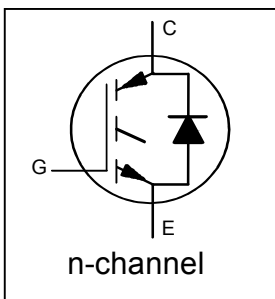


$V_{CES} = 600V$
$I_C = 60A, T_C = 100^\circ C$
$t_{SC} \geq 5\mu s, T_{J(max)} = 175^\circ C$
$V_{CE(ON)} \text{ typ.} = 1.65V @ I_C = 48A$

**Insulated Gate Bipolar Transistor with Ultrafast Soft Recovery Diode**



G	C	E
Gate	Collector	Emitter

- Applications
- Industrial Motor Drive
  - Inverters
  - UPS
  - Welding

Features	Benefits
Low $V_{CE(ON)}$ and switching losses	High efficiency in a wide range of applications and switching frequencies
Square RBSOA and maximum junction temperature $175^\circ C$	Improved reliability due to rugged hard switching performance and higher power capability
Positive $V_{CE(ON)}$ temperature coefficient	Excellent current sharing in parallel operation
$5\mu s$ short circuit SOA	Enables short circuit protection scheme
Lead-free, RoHS compliant	Environmentally friendly

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRGP4063D1PbF	TO-247AC	Tube	25	IRGP4063D1PbF
IRGP4063D1-EPbF	TO-247AD	Tube	25	IRGP4063D1-EPbF

**Absolute Maximum Ratings**

Parameter	Max.	Units
$V_{CES}$ Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$ Continuous Collector Current	100	A
$I_C @ T_C = 100^\circ C$ Continuous Collector Current	60	
$I_{CM}$ Pulse Collector Current, $V_{GE} = 15V$	200	
$I_{LM}$ Clamped Inductive Load Current, $V_{GE} = 20V$ ①	192	
$I_F @ T_C = 25^\circ C$ Diode Continuous Forward Current	30	
$I_F @ T_C = 100^\circ C$ Diode Continuous Forward Current	15	
$I_{FM}$ Diode Maximum Forward Current ①	120	V
$V_{GE}$ Continuous Gate-to-Emitter Voltage	$\pm 20$	
	Transient Gate-to-Emitter Voltage	$\pm 30$
$P_D @ T_C = 25^\circ C$ Maximum Power Dissipation	330	W
$P_D @ T_C = 100^\circ C$ Maximum Power Dissipation	170	
$T_J$ Operating Junction and	-40 to +175	$^\circ C$
$T_{STG}$ Storage Temperature Range		
	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) ②	—	—	0.45	$^\circ C/W$
$R_{\theta JC}$ (Diode) Thermal Resistance Junction-to-Case-(each Diode) ②	—	—	2.4	
$R_{\theta CS}$ Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.24	—	
$R_{\theta JA}$ Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	—	40	

**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

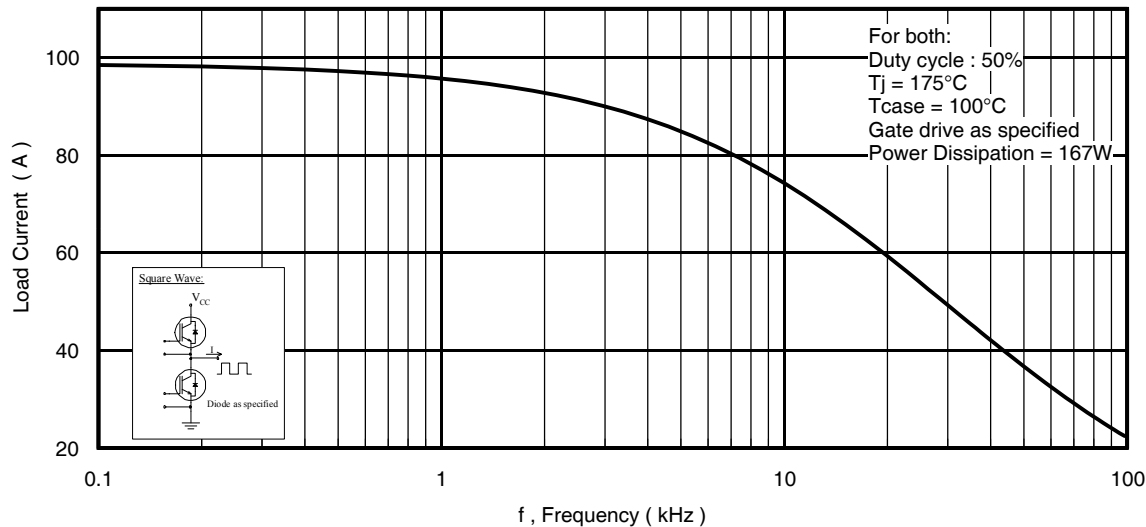
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 100μA ③
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Breakdown Voltage	—	0.3	—	V/°C	V <sub>GE</sub> =0V, I <sub>C</sub> =1mA (25°C-175°C)
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	1.65	2.14	V	I <sub>C</sub> = 48A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 25°C I <sub>C</sub> = 48A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 175°C
		—	2.05	—		
V <sub>GE(th)</sub>	Gate Threshold Voltage	4.0	—	6.5	V	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1.4mA
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	Threshold Voltage temp. coefficient	—	-21	—	mV/°C	V <sub>CE</sub> =V <sub>GE</sub> , I <sub>C</sub> =1.4mA (25°C-175°C)
g <sub>fe</sub>	Forward Transconductance	—	32	—	S	V <sub>CE</sub> = 50V, I <sub>C</sub> = 48A, PW = 20μs
I <sub>CES</sub>	Collector-to-Emitter Leakage Current	—	1.0	200	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 175°C
		—	850	—		
V <sub>FM</sub>	Diode Forward Voltage Drop	—	1.9	2.4	V	I <sub>F</sub> = 8A I <sub>F</sub> = 8A, T <sub>J</sub> = 175°C
		—	1.2	—		
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

**Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

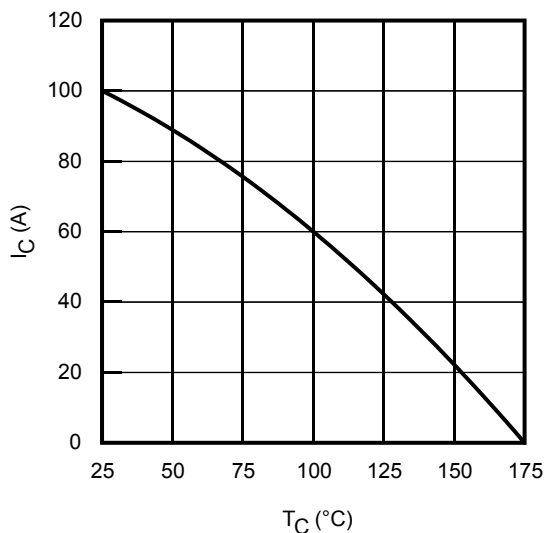
	Parameter	Min.	Typ.	Max.④	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	100	150	nC	I <sub>C</sub> = 48A V <sub>GE</sub> = 15V V <sub>CC</sub> = 400V
Q <sub>ge</sub>	Gate-to-Emitter Charge (turn-on)	—	25	40		
Q <sub>gc</sub>	Gate-to-Collector Charge (turn-on)	—	40	60		
E <sub>on</sub>	Turn-On Switching Loss	—	1.4	2.3	mJ	I <sub>C</sub> = 48A, V <sub>CC</sub> = 400V, V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω, L = 485μH, T <sub>J</sub> = 25°C Energy losses include tail & diode reverse recovery ⑤⑥
E <sub>off</sub>	Turn-Off Switching Loss	—	1.1	2.0		
E <sub>total</sub>	Total Switching Loss	—	2.5	4.3		
t <sub>d(on)</sub>	Turn-On delay time	—	60	80	ns	Energy losses include tail & diode reverse recovery ⑤⑥
t <sub>r</sub>	Rise time	—	50	70		
t <sub>d(off)</sub>	Turn-Off delay time	—	160	185		
t <sub>f</sub>	Fall time	—	30	50		
E <sub>on</sub>	Turn-On Switching Loss	—	2.0	—	mJ	I <sub>C</sub> = 48A, V <sub>CC</sub> = 400V, V <sub>GE</sub> =15V R <sub>G</sub> =10Ω, L= 485μH, T <sub>J</sub> = 175°C Energy losses include tail & diode reverse recovery ⑤⑥
E <sub>off</sub>	Turn-Off Switching Loss	—	1.5	—		
E <sub>total</sub>	Total Switching Loss	—	3.5	—		
t <sub>d(on)</sub>	Turn-On delay time	—	50	—	ns	Energy losses include tail & diode reverse recovery ⑤⑥
t <sub>r</sub>	Rise time	—	55	—		
t <sub>d(off)</sub>	Turn-Off delay time	—	165	—		
t <sub>f</sub>	Fall time	—	55	—		
C <sub>ies</sub>	Input Capacitance	—	2900	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V f = 1.0Mhz
C <sub>oes</sub>	Output Capacitance	—	200	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	90	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T <sub>J</sub> = 175°C, I <sub>C</sub> = 192A V <sub>CC</sub> = 480V, V <sub>p</sub> ≤ 600V R <sub>g</sub> = 50Ω, V <sub>GE</sub> = +20V to 0V
SCSOA	Short Circuit Safe Operating Area	5	—	—	μs	V <sub>CC</sub> = 400V, V <sub>p</sub> ≤ 600V R <sub>g</sub> = 50Ω, V <sub>GE</sub> = +15V to 0V
E <sub>rec</sub>	Reverse Recovery Energy of the Diode	—	245	—	μJ	T <sub>J</sub> = 175°C
t <sub>rr</sub>	Diode Reverse Recovery Time	—	80	—	ns	V <sub>CC</sub> = 400V, I <sub>F</sub> = 48A
I <sub>rr</sub>	Peak Reverse Recovery Current	—	20	—	A	V <sub>GE</sub> = 15V, R <sub>g</sub> = 10Ω, L = 485μH

**Notes:**

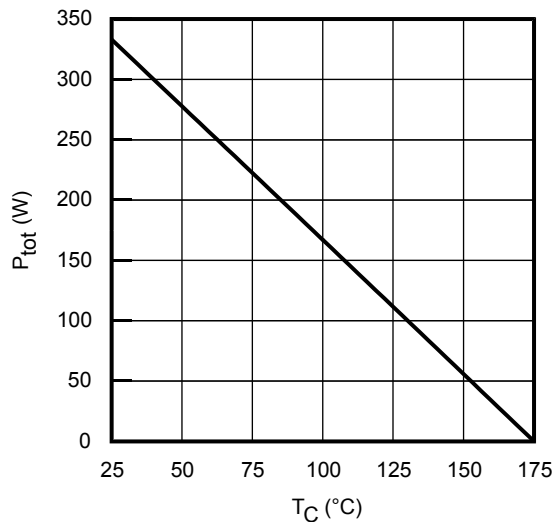
- ① V<sub>CC</sub> = 80% (V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 50μH, R<sub>G</sub> = 50Ω.
- ② R<sub>θ</sub> is measured at T<sub>J</sub> of approximately 90°C.
- ③ Refer to AN-1086 for guidelines for measuring V<sub>(BR)CES</sub> safely.
- ④ Maximum limits are based on statistical sample size characterization.
- ⑤ Pulse width limited by max. junction temperature.
- ⑥ Values influenced by parasitic L and C in measurement.



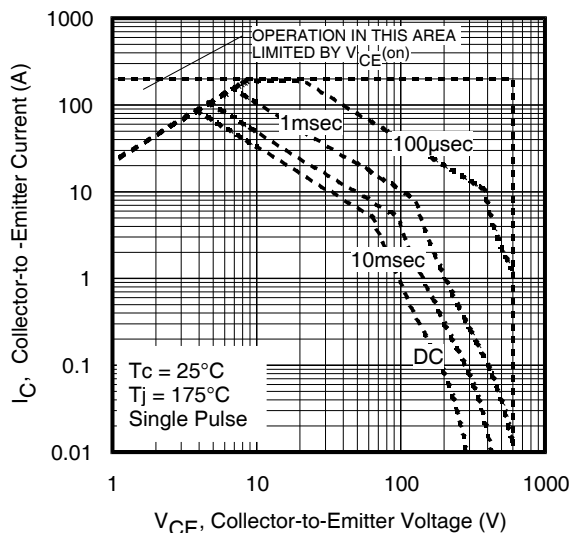
**Fig. 1 - Typical Load Current vs. Frequency**  
(Load Current =  $I_{RMS}$  of fundamental)



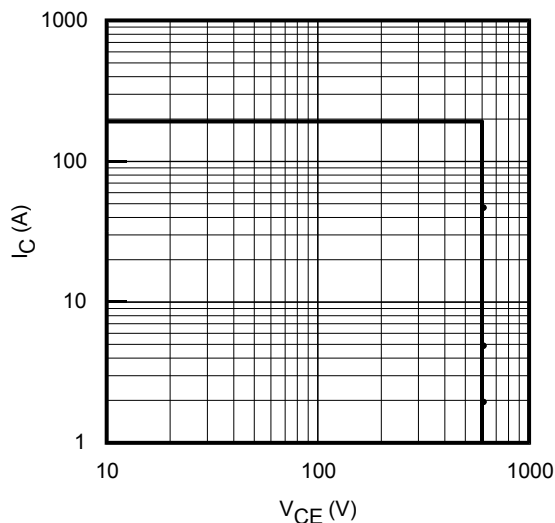
**Fig. 2 - Maximum DC Collector Current vs.**



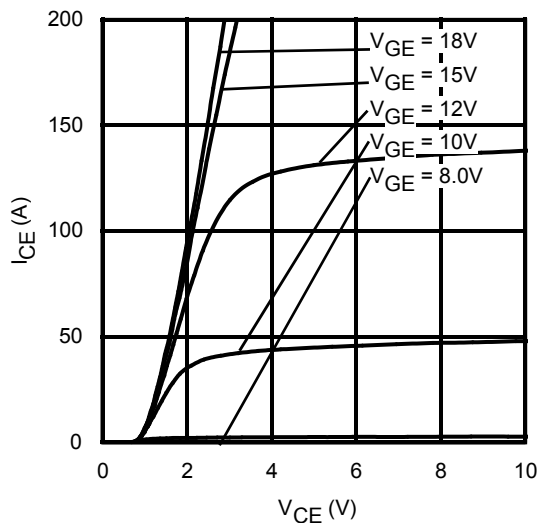
**Fig. 3 - Power Dissipation vs. Case Temperature**



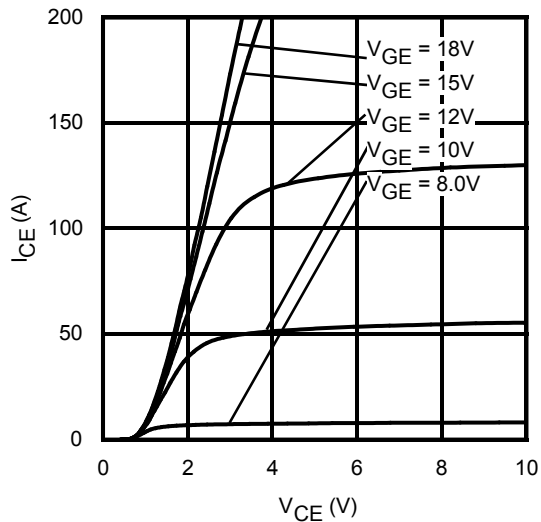
**Fig. 4 - Forward SOA**  
 $T_C = 25^\circ\text{C}$ ,  $T_J @ 175^\circ\text{C}$ ;  $V_{GE} = 15\text{V}$



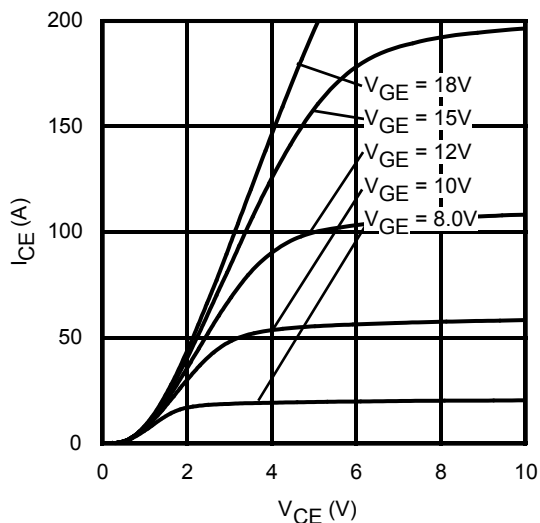
**Fig. 5 - Reverse Bias SOA**  
 $T_J = 175^\circ\text{C}$ ;  $V_{GE} = 20\text{V}$



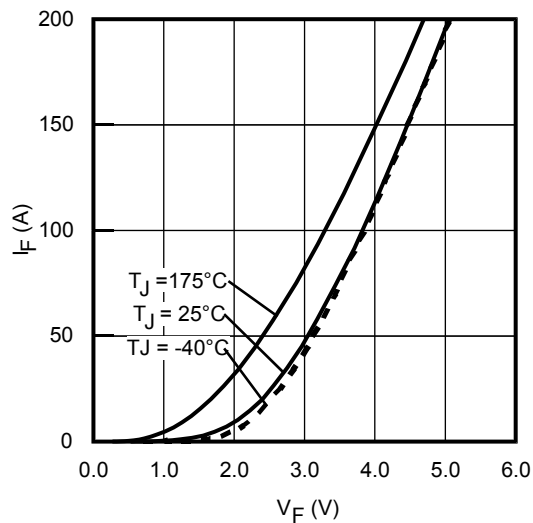
**Fig. 6** - Typ. IGBT Output Characteristics  
 $T_J = -40^\circ\text{C}$ ;  $t_p = 20\mu\text{s}$



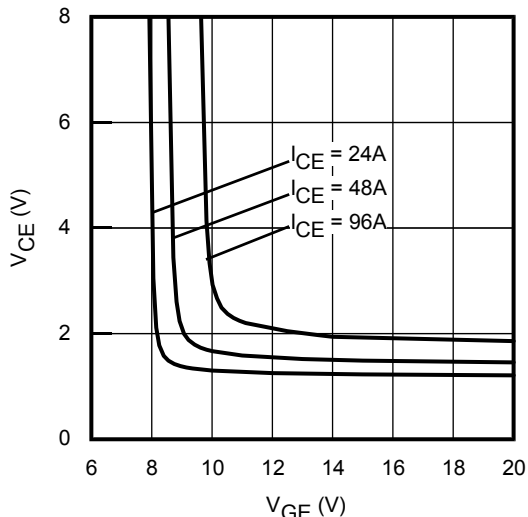
**Fig. 7** - Typ. IGBT Output Characteristics  
 $T_J = 25^\circ\text{C}$ ;  $t_p = 20\mu\text{s}$



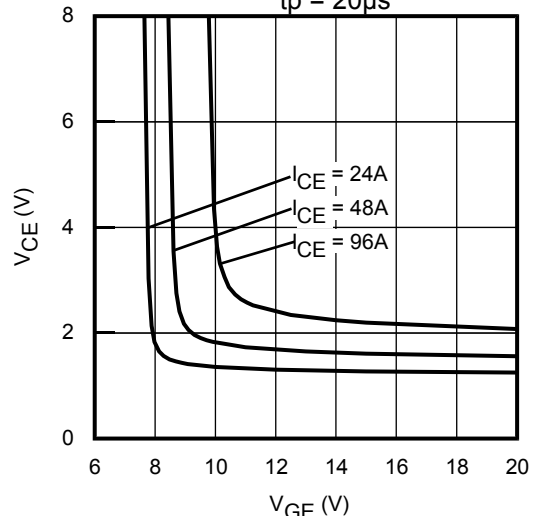
**Fig. 8** - Typ. IGBT Output Characteristics  
 $T_J = 175^\circ\text{C}$ ;  $t_p = 20\mu\text{s}$



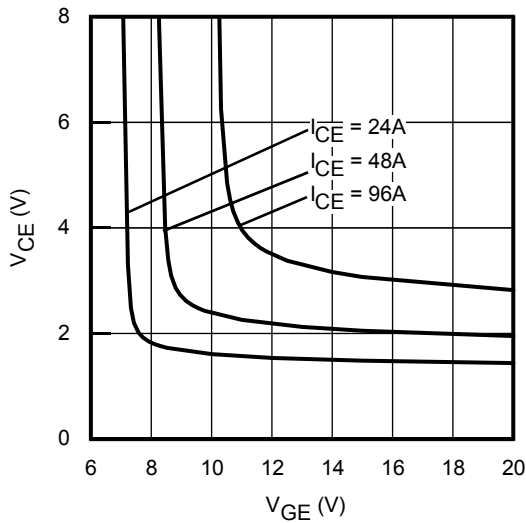
**Fig. 9** - Typ. Diode Forward Characteristics  
 $t_p = 20\mu\text{s}$



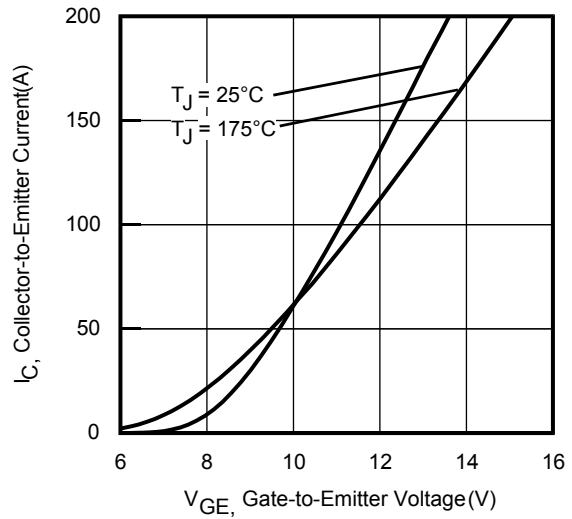
**Fig. 10** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = -40^\circ\text{C}$



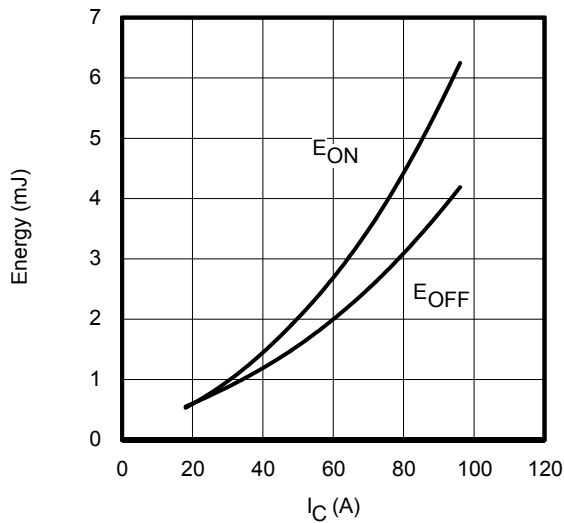
**Fig. 111** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 25^\circ\text{C}$



**Fig. 12** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 175^\circ\text{C}$

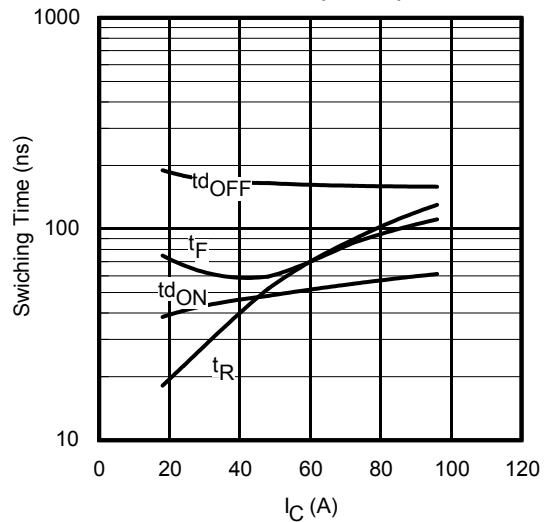


**Fig. 13** - Typ. Transfer Characteristics  
 $V_{CE} = 50\text{V}; t_p = 20\mu\text{s}$



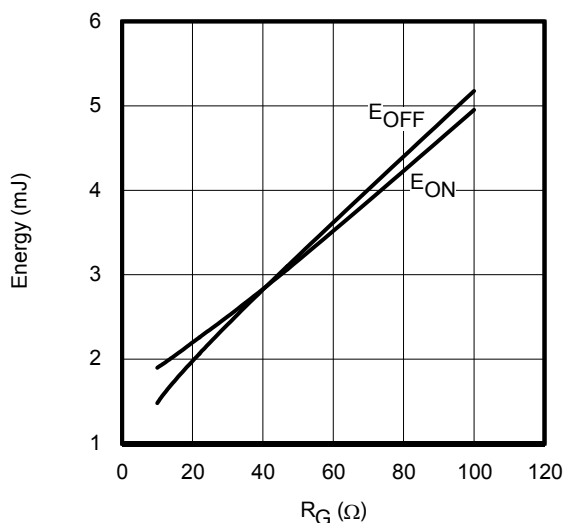
**Fig. 14** - Typ. Energy Loss vs.  $I_C$

$T_J = 175^\circ\text{C}; L = 485\mu\text{H}; V_{CE} = 400\text{V}, R_G = 10\Omega; V_{GE} = 15\text{V}$



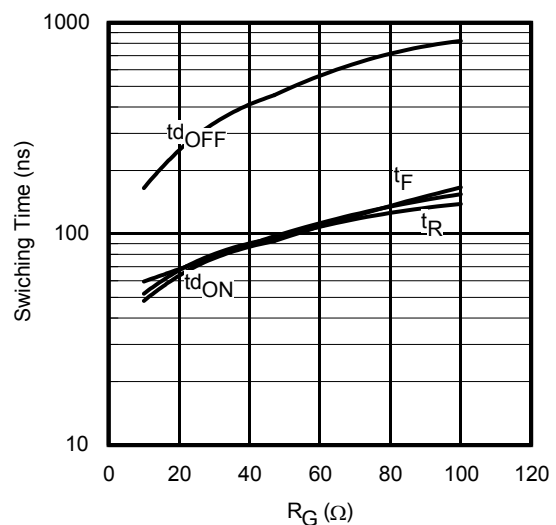
**Fig. 15** - Typ. Switching Time vs.  $I_C$

$T_J = 175^\circ\text{C}; L = 485\mu\text{H}; V_{CE} = 400\text{V}, R_G = 10\Omega; V_{GE} = 15\text{V}$



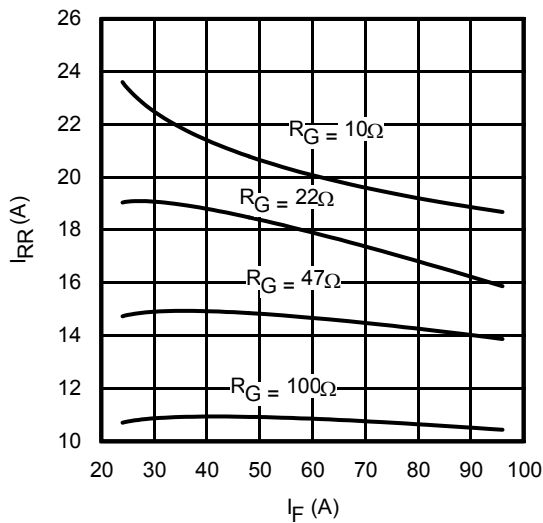
**Fig. 16** - Typ. Energy Loss vs.  $R_G$

$T_J = 175^\circ\text{C}; L = 485\mu\text{H}; V_{CE} = 400\text{V}, I_{CE} = 48\text{A}; V_{GE} = 15\text{V}$

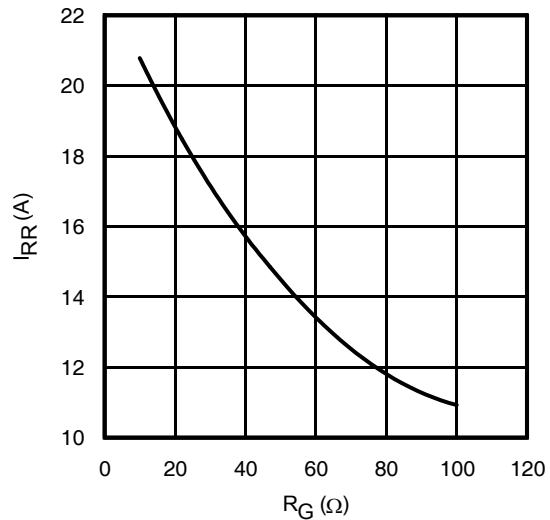


**Fig. 17** - Typ. Switching Time vs.  $R_G$

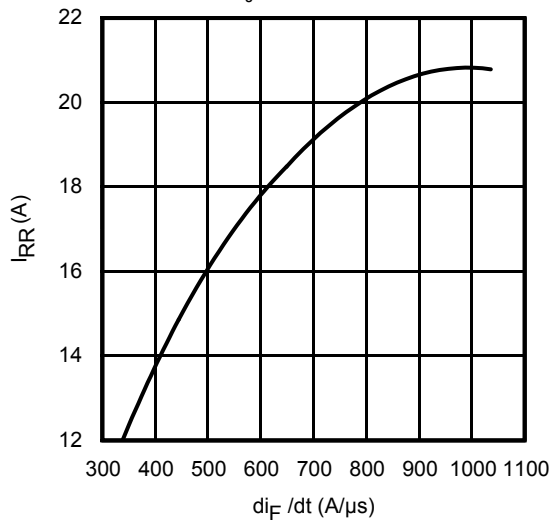
$T_J = 175^\circ\text{C}; L = 485\mu\text{H}; V_{CE} = 400\text{V}, I_{CE} = 48\text{A}; V_{GE} = 15\text{V}$



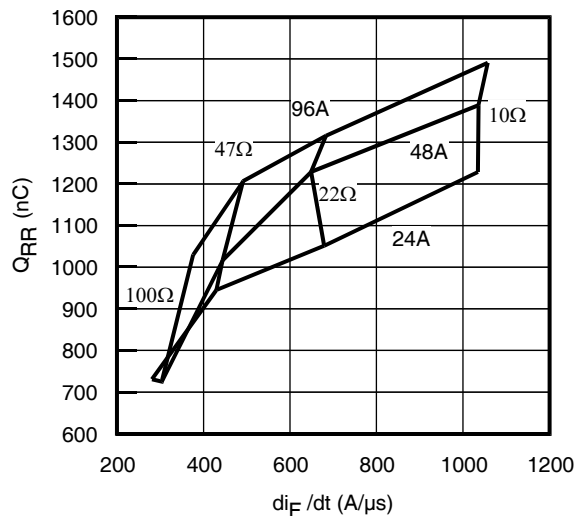
**Fig. 18** - Typ. Diode  $I_{RR}$  vs.  $I_F$   
 $T_J = 175^\circ\text{C}$



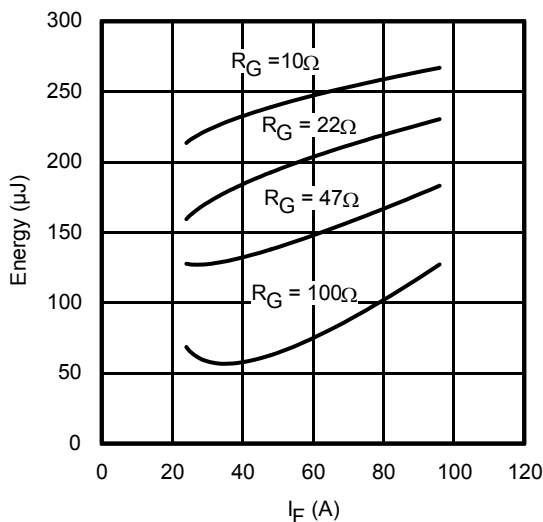
**Fig. 19** - Typ. Diode  $I_{RR}$  vs.  $R_G$   
 $T_J = 175^\circ\text{C}$



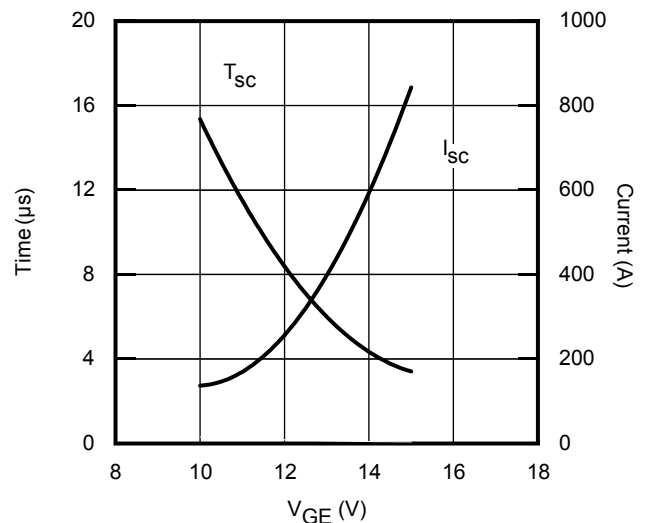
**Fig. 20** - Typ. Diode  $I_{RR}$  vs.  $di_F/dt$   
 $V_{CC} = 400\text{V}; V_{GE} = 15\text{V}; I_F = 48\text{A}; T_J = 175^\circ\text{C}$



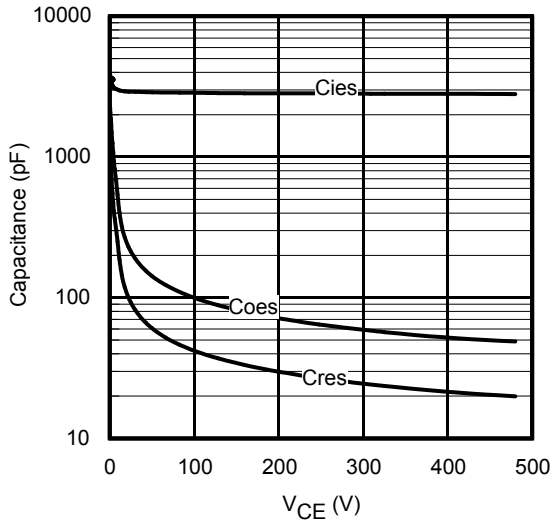
**Fig. 21** - Typ. Diode  $Q_{RR}$  vs.  $di_F/dt$   
 $V_{CC} = 400\text{V}; V_{GE} = 15\text{V}; T_J = 175^\circ\text{C}$



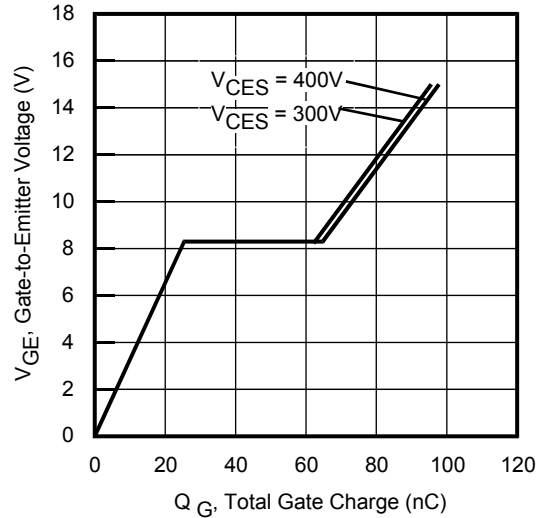
**Fig. 22** - Typ. Diode  $E_{RR}$  vs.  $I_F$   
 $T_J = 175^\circ\text{C}$



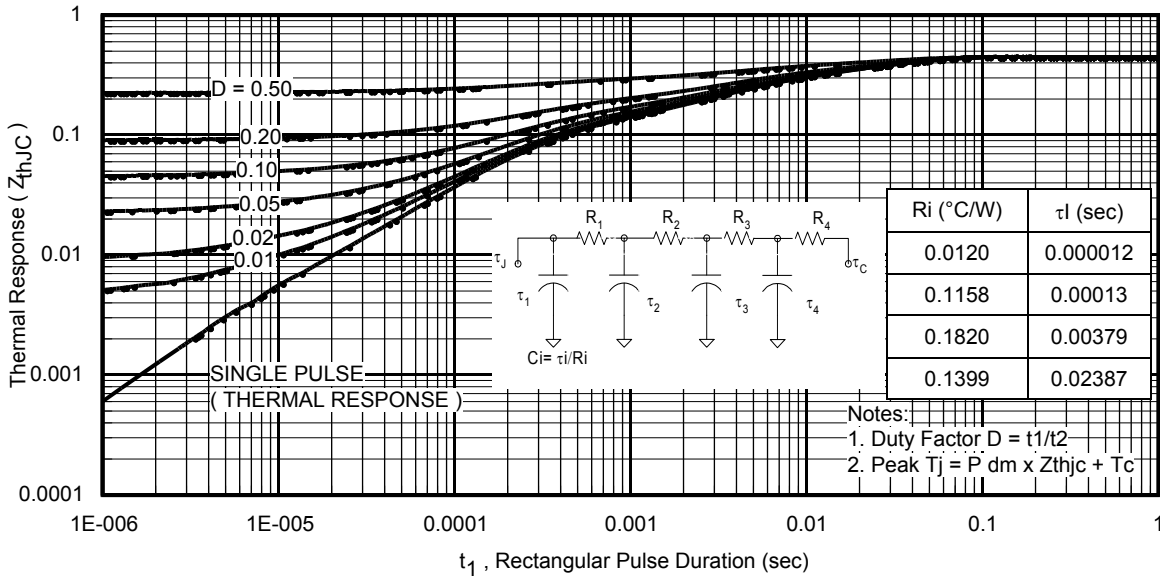
**Fig. 23** -  $V_{GE}$  vs. Short Circuit Time  
 $V_{CC} = 400\text{V}; T_C = 25^\circ\text{C}$



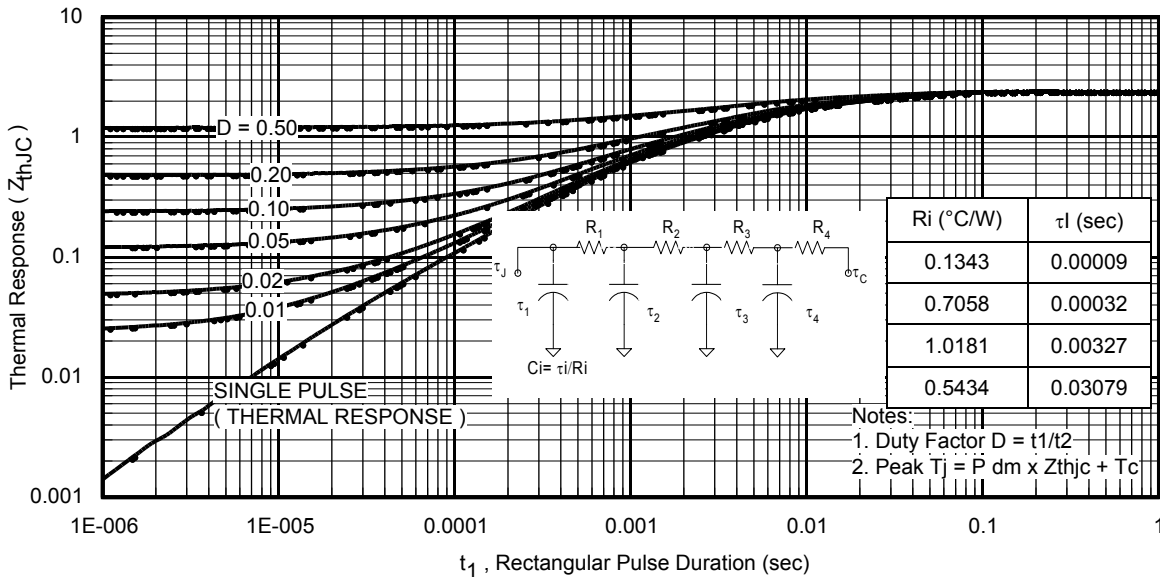
**Fig. 24** - Typ. Capacitance vs.  $V_{CE}$   
 $V_{GE} = 0V$ ;  $f = 1MHz$



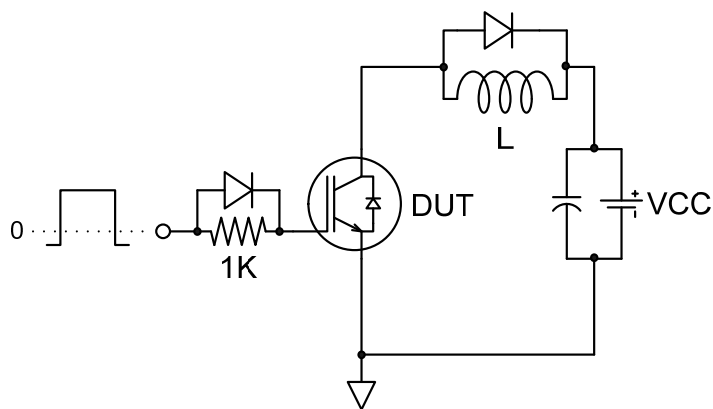
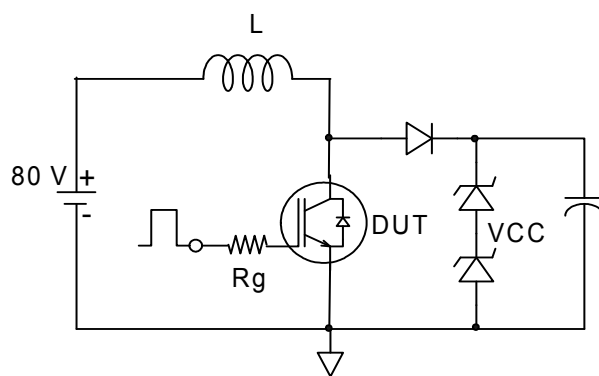
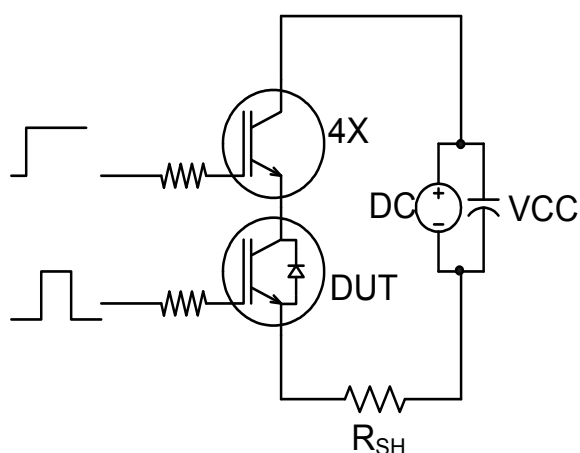
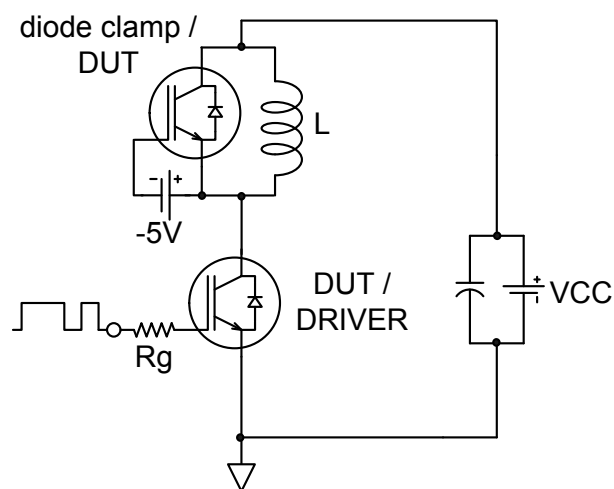
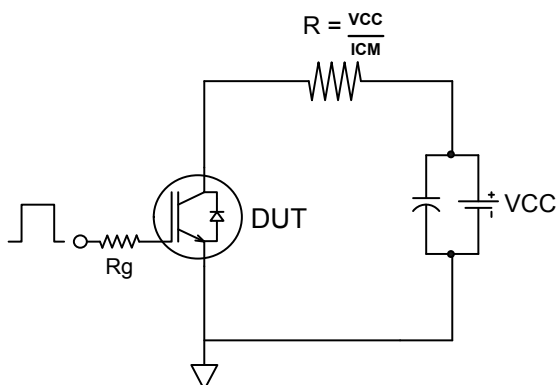
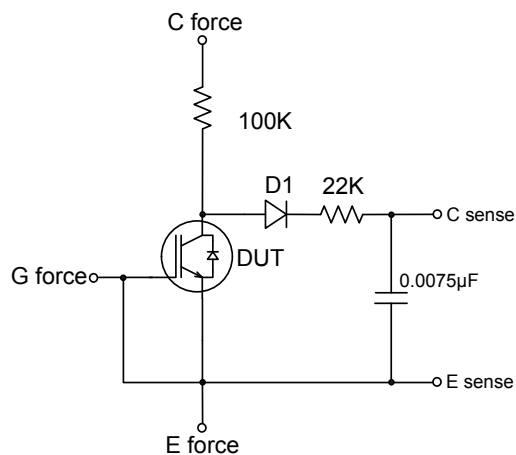
**Fig. 25** - Typical Gate Charge vs.  $V_{GE}$   
 $I_{CE} = 48A$



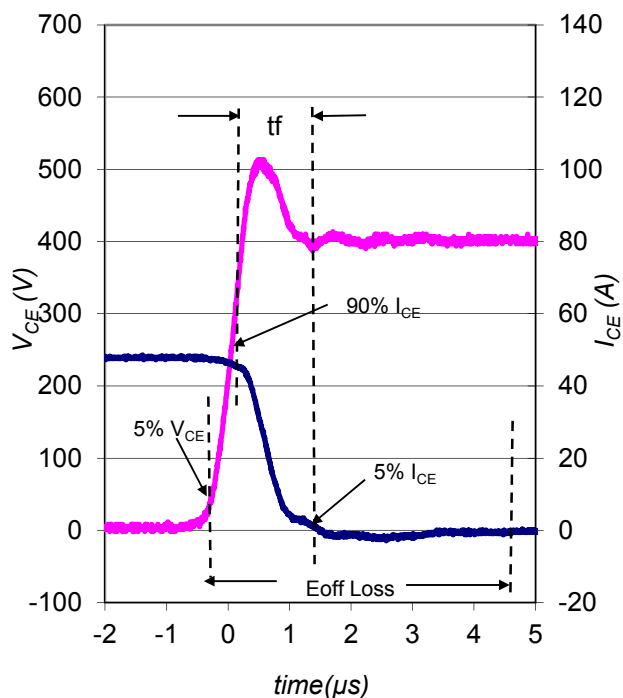
**Fig. 27.** Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)



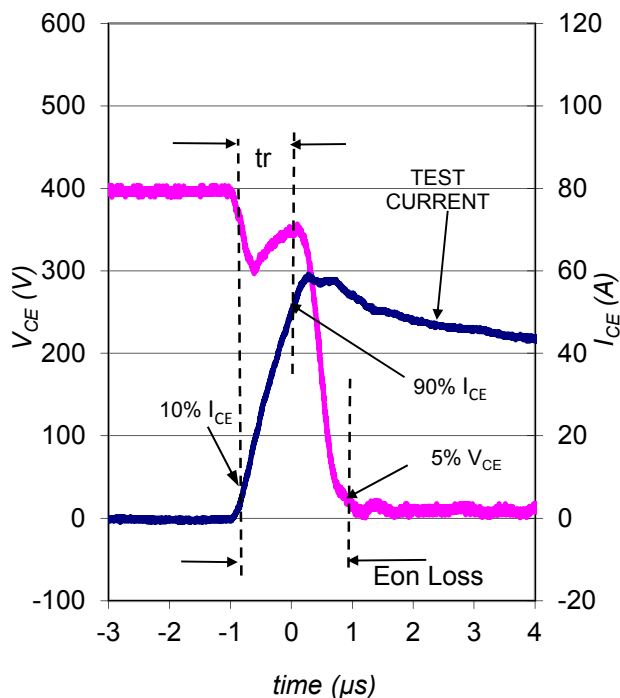
**Fig. 28.** Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)


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

**Fig.C.T.2 - RBSOA Circuit**

**Fig.C.T.3 - S.C. SOA Circuit**

**Fig.C.T.4 - Switching Loss Circuit**

**Fig.C.T.5 - Resistive Load Circuit**

**Fig.C.T.6 - BVCES Filter Circuit**

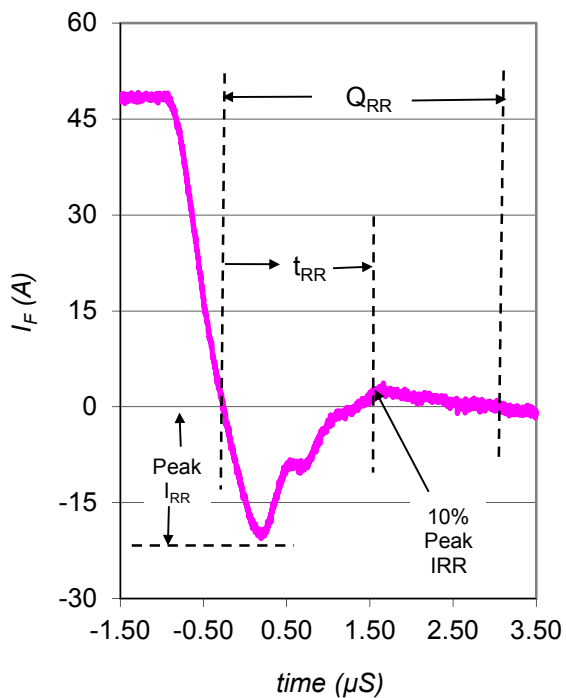




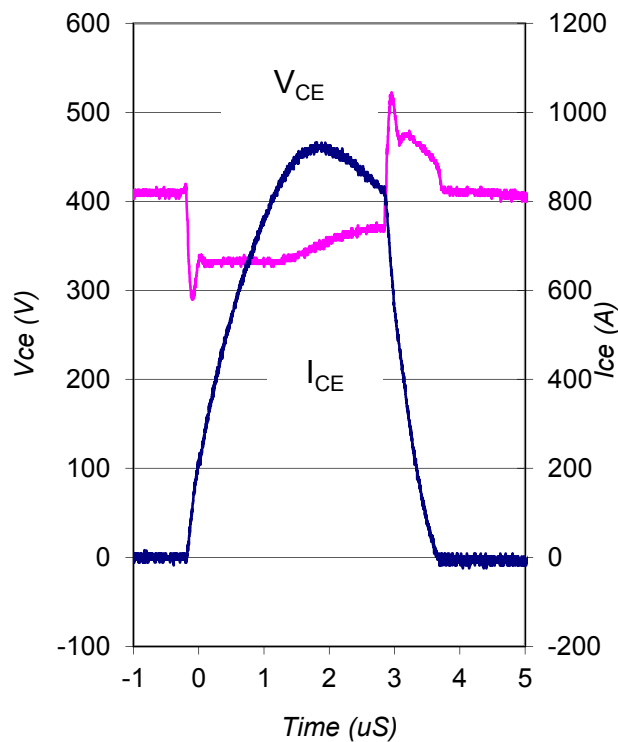
**Fig. WF1** - Typ. Turn-off Loss Waveform  
@  $T_J = 175^\circ\text{C}$  using Fig. CT.4



**Fig. WF2** - Typ. Turn-on Loss Waveform  
@  $T_J = 175^\circ\text{C}$  using Fig. CT.4



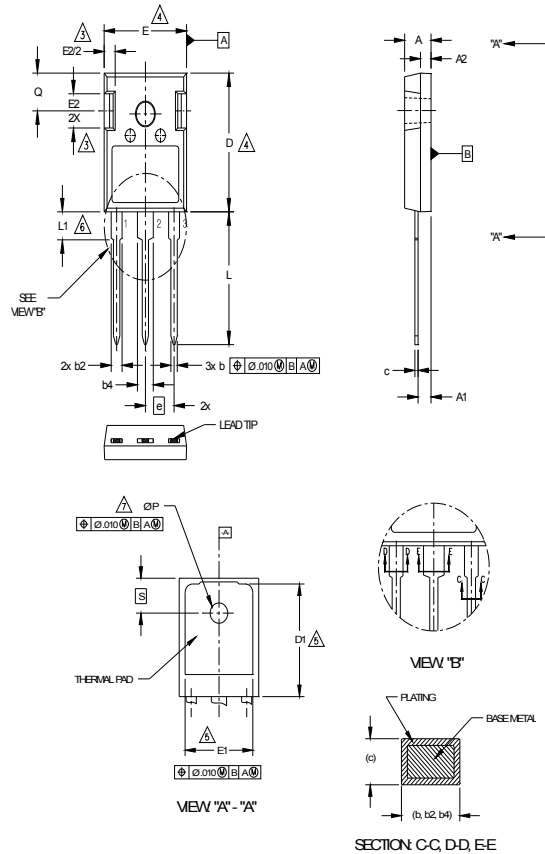
**Fig. WF3** - Typ. Diode Recovery Waveform  
@  $T_J = 175^\circ\text{C}$  using Fig. CT.4



**Fig. WF4** - Typ. S.C. Waveform  
@  $T_J = 25^\circ\text{C}$  using Fig. CT.3

## TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	.190	.204	4.83	5.20	
A1	.090	.100	2.29	2.54	
A2	.075	.085	1.91	2.16	
b	.042	.052	1.07	1.33	
b2	.075	.094	1.91	2.41	
b4	.113	.133	2.87	3.38	
c	.022	.026	0.55	0.68	
D	.819	.830	20.80	21.10	4
D1	.640	.694	16.25	17.65	5
E	.620	.635	15.75	16.13	4
E1	.512	.570	13.00	14.50	
E2	.145	.196	3.68	5.00	
e	.215 Typical		5.45 Typical		
L	.780	.800	19.80	20.32	
L1	.161	.173	4.10	4.40	
∅ P	.138	.143	3.51	3.65	
Q	.216	.236	5.49	6.00	
S	.238	.248	6.04	6.30	

### 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

### NOTES:

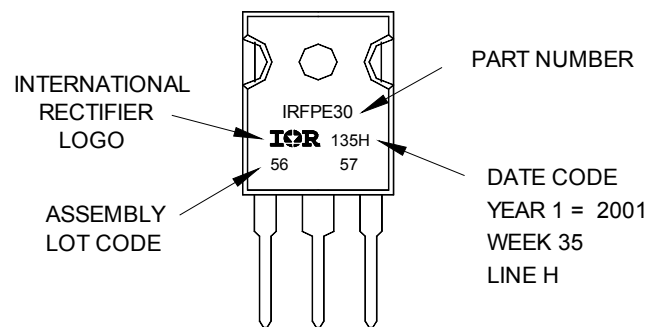
- 1 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
- 2 DIMENSIONS ARE SHOWN IN INCHES AND MILLIMETERS.
- 3 CONTOUR OF SLOT OPTIONAL.
- 4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE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

## TO-247AC Part Marking Information

Notes: This part marking information applies to devices produced after 02/26/2001

EXAMPLE: THIS IS AN IRFPE30 WITH ASSEMBLY LOT CODE 5657 ASSEMBLED ON WW 35, 2001 IN THE ASSEMBLY LINE "H"

Note: "P" in assembly line position indicates "Lead-Free"



TO-247AC 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/>



**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>	Industrial (per JEDEC JESD47F) <sup>††</sup>	
<b>Moisture Sensitivity Level</b>	TO-247AC	N/A
	TO-247AD	
<b>RoHS Compliant</b>	Yes	

† Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/product-info/reliability/>

†† Applicable version of JEDEC standard at the time of product release.

Data and specifications subject to change without notice.

International  
 Rectifier

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单击下面可查看定价，库存，交付和生命周期等信息

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