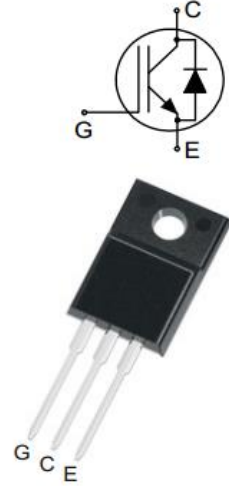


## IGBT

### Features

- 650V,20A
- $V_{CE(sat)(typ.)}=2.0V@V_{GE}=15V,I_C=20A$
- High speed switching
- Higher system efficiency
- Soft current turn-off waveforms
- Square RBSOA



### General Description

JIAEN Trench IGBTs offer lower losses and higher energy efficiency for application such as Motor control, general inverter and other soft switching applications.

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$V_{CES}$	Collector-Emitter Voltage	650	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 30$	V
$I_C$	Continuous Collector Current ( $T_C=25^\circ C$ )	40	A
	Continuous Collector Current ( $T_C=100^\circ C$ )	20	A
$I_{CM}$	Pulsed Collector Current (Note 1)	60	A
$I_F$	Diode Continuous Forward Current ( $T_C=100^\circ C$ )	20	A
$I_{FM}$	Diode Maximum Forward Current (Note 1)	60	A
$t_{sc}$	Short Circuit Withstand Time	10	us
$P_D$	Maximum Power Dissipation ( $T_C=25^\circ C$ )	40	W
	Maximum Power Dissipation ( $T_C=100^\circ C$ )	16	W
$T_J$	Operating Junction Temperature Range	-55 to +150	$^\circ C$
$T_{STG}$	Storage Temperature Range	-55 to +150	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	Max.	Units
$R_{th\ j-c}$	Thermal Resistance, Junction to case for IGBT	3.125	$^\circ C/W$
$R_{th\ j-c}$	Thermal Resistance, Junction to case for Diode	3.8	$^\circ C/W$
$R_{th\ j-a}$	Thermal Resistance, Junction to Ambient	62.5	$^\circ C/W$

**Electrical Characteristics** ( $T_C=25^\circ\text{C}$  unless otherwise noted )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{CE}=650V, V_{GE}=0V$	-	-	100	$\mu A$
$I_{GES}$	Gate Leakage Current, Forward	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	$\pm 100$	nA
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=250\mu A$	5.1	-	6.9	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=20A$	-	2.0	2.5	V
$Q_g$	Total Gate Charge	$V_{CC}=480V$ $V_{GE}=15V$ $I_C=20A$	-	271		nC
$Q_{ge}$	Gate-Emitter Charge		-	70		nC
$Q_{gc}$	Gate-Collector Charge		-	131		nC
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=400V$ $V_{GE}=15V$ $I_C=20A$ $R_G=15\Omega$ Inductive Load $T_C=25^\circ\text{C}$	-	17	-	ns
$t_r$	Turn-on Rise Time		-	31	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	71	-	ns
$t_f$	Turn-off Fall Time		-	99	-	ns
$E_{on}$	Turn-on Switching Loss		-	0.46	-	mJ
$E_{off}$	Turn-off Switching Loss		-	0.41	-	mJ
$E_{ts}$	Total Switching Loss	-	0.87	-	mJ	
$C_{ies}$	Input Capacitance	$V_{CE}=25V$	-	831	-	pF
$C_{oes}$	Output Capacitance	$V_{GE}=0V$	-	50	-	pF
$C_{res}$	Reverse Transfer Capacitance	$f=1\text{MHz}$	-	7.5	-	pF

**Electrical Characteristics of Diode** ( $T_C=25^\circ\text{C}$  unless otherwise noted )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F=20A$	-	1.5	3.0	V
$t_{rr}$	Diode Reverse Recovery Time	$V_{CE}=400V$ $I_F=20A$ $R_G=15\Omega$	-	110		ns
$I_{rr}$	Diode peak Reverse Recovery Current		-	16.6		A
$Q_{rr}$	Diode Reverse Recovery Charge		-	736		nC

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature

## Typical Performance Characteristics

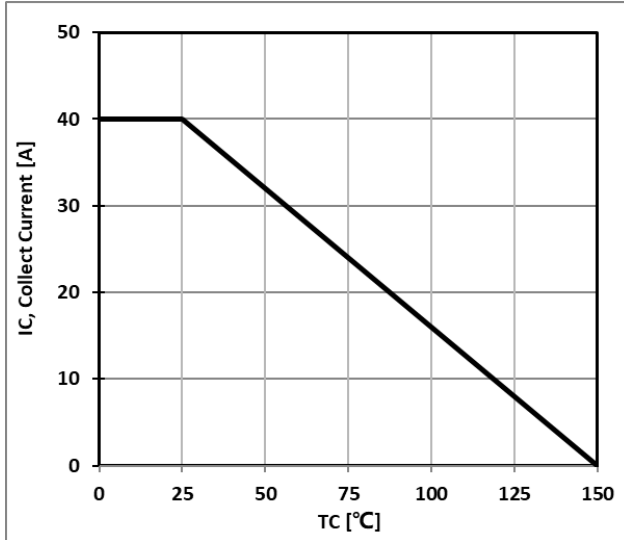


Figure 1: Maximum DC Collector Current VS. case temperature

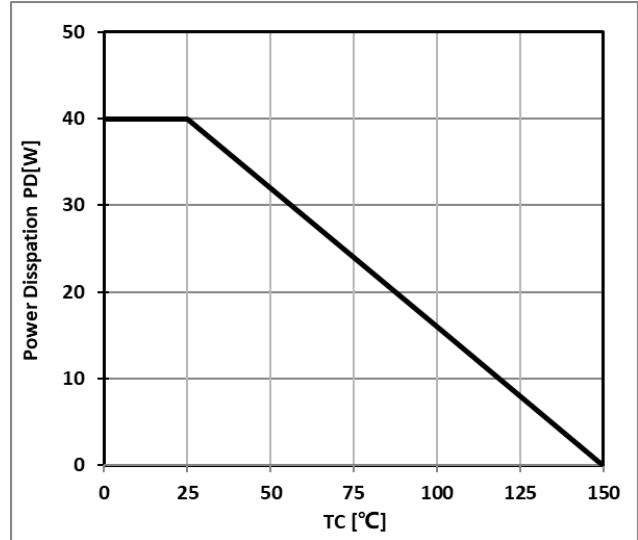


Figure 2: Power Dissipation VS. Case Temperature

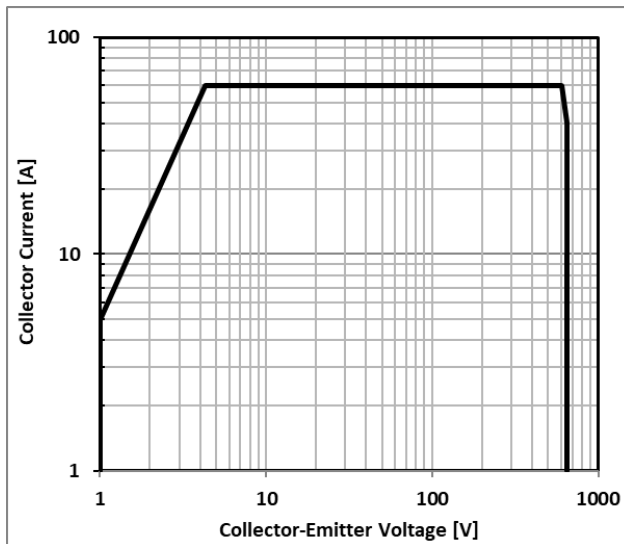


Figure 3: Reverse Bias SOA, TJ=125°C, VGE=15V

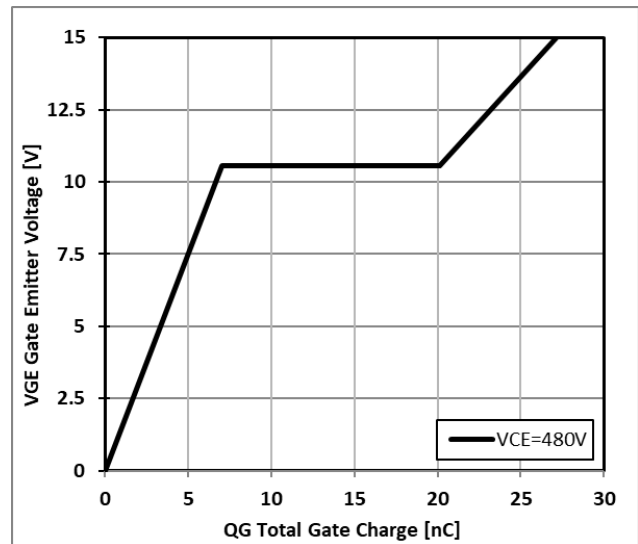


Figure 4: Typical Gate charge VS. VGE, IC=20A

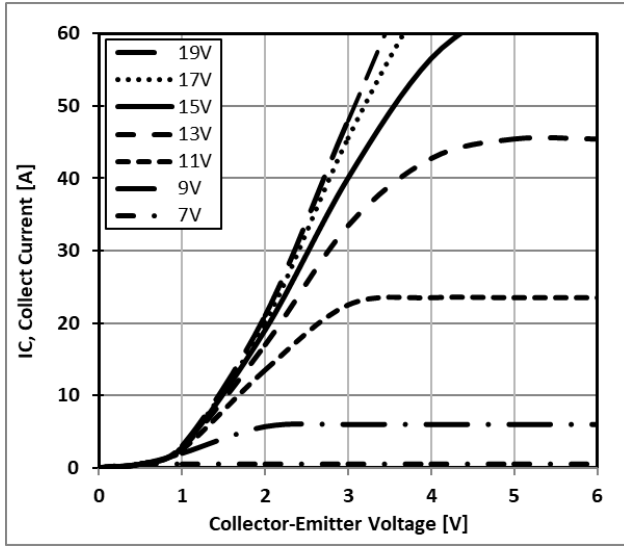


Figure 5: Typical IGBT Output characteristics,  
TC=25°C;tp=300us

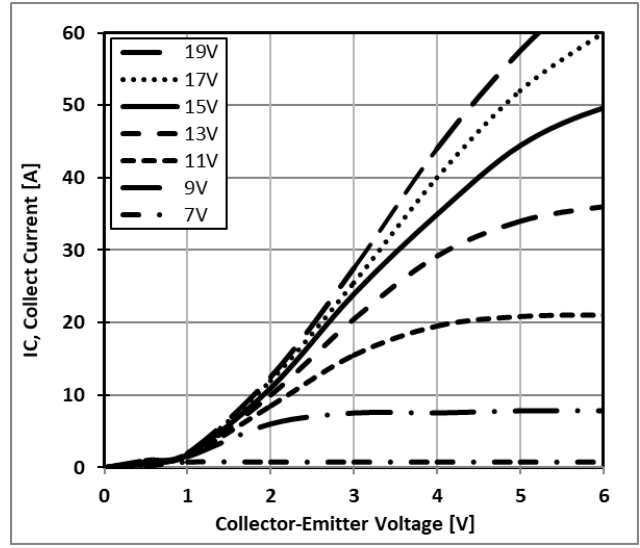


Figure 6: Typical IGBT Output characteristics,  
TC=150°C;tp=300us

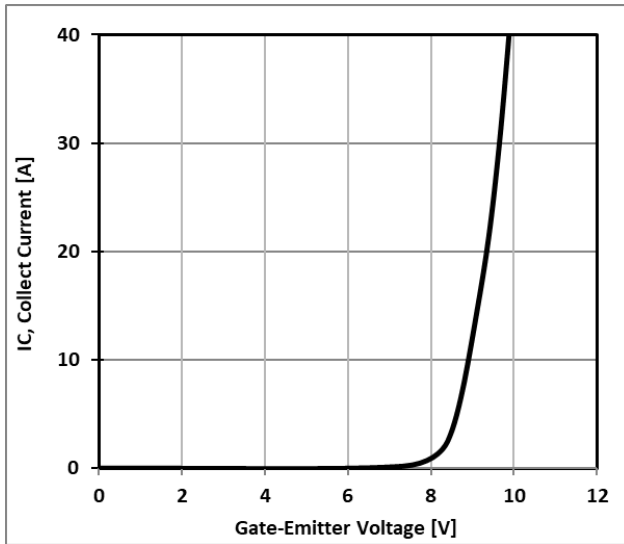


Figure 7: Typical Gate Threshold Voltage

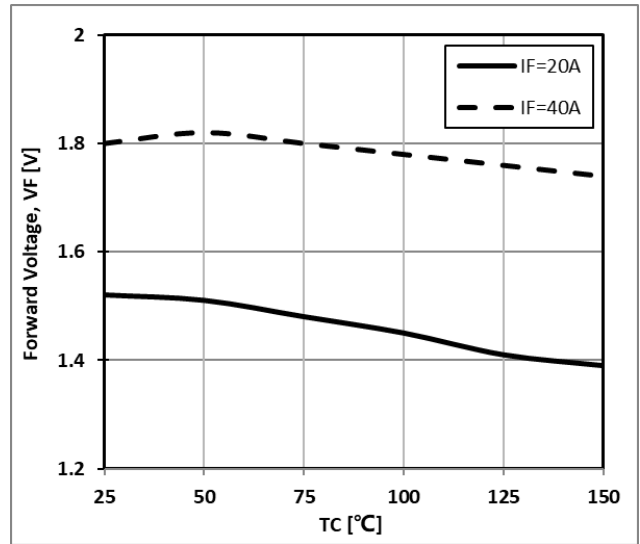


Figure 8: Typical Forward Voltage vs IF

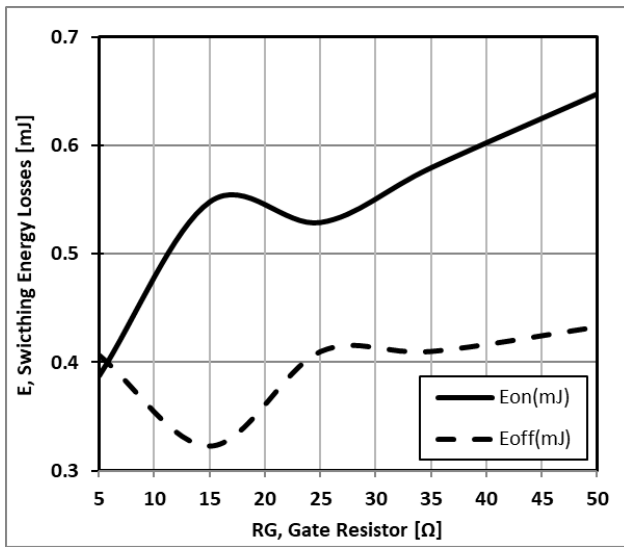


Figure 9: Typical Energy Loss VS. RG, TC=25°C,  
L=200uH, VCE=400V, VGE=15V, IC=20A

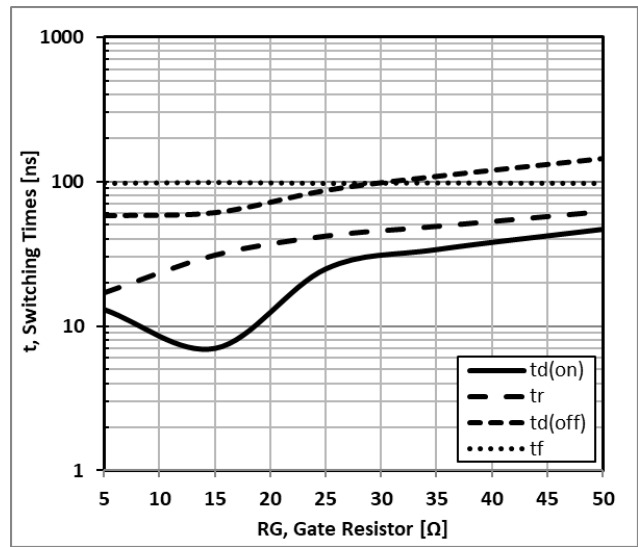


Figure 10: Typical Switching Time VS. RG, TC=25°C,  
L=200uH, VCE=400V, VGE=15V, IC=20A

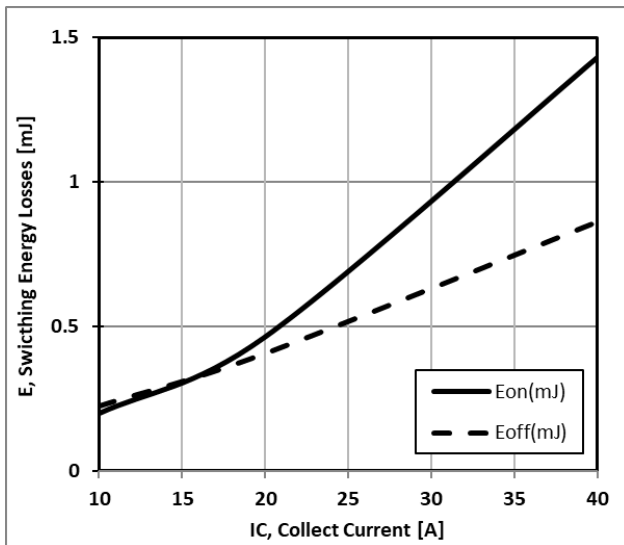


Figure 11: Typical Energy Loss VS. IC, TC=25°C,  
L=200uH, VCE=400V, VGE=15V, RG=15Ω

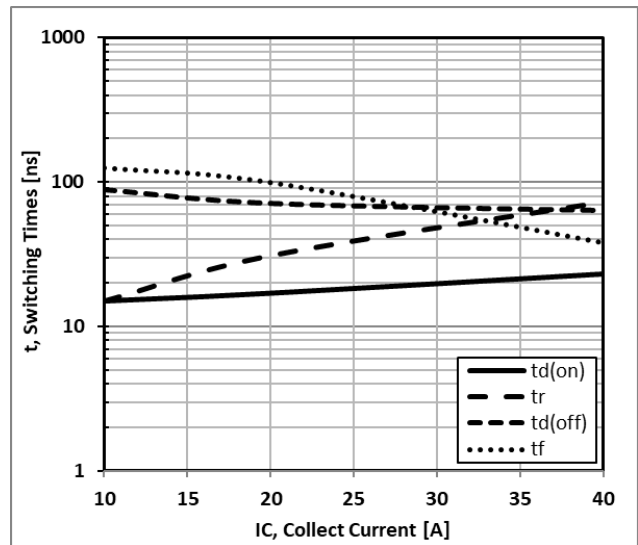


Figure 12: Typical Switching Time VS. IC, TC=25°C,  
L=200uH, VCE=400V, VGE=15V, RG=15Ω

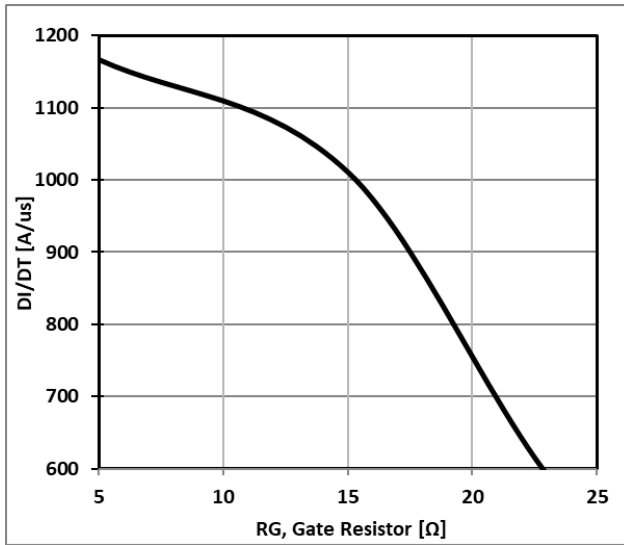


Figure 13: Typical Diode DI/DT VS. RG, TC=25°C  
VCC=400V, VGE=15V, IF=20A

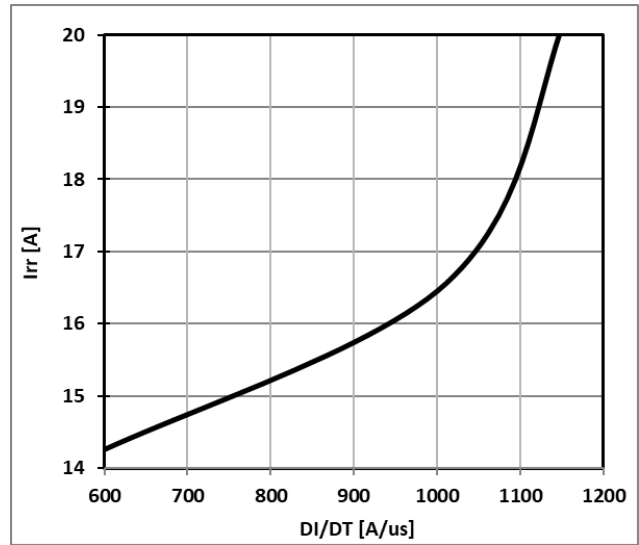


Figure 14: Typical Diode IRR VS. DI/DT, TC=25°C  
VCC=400V, VGE=15V, IF=20A

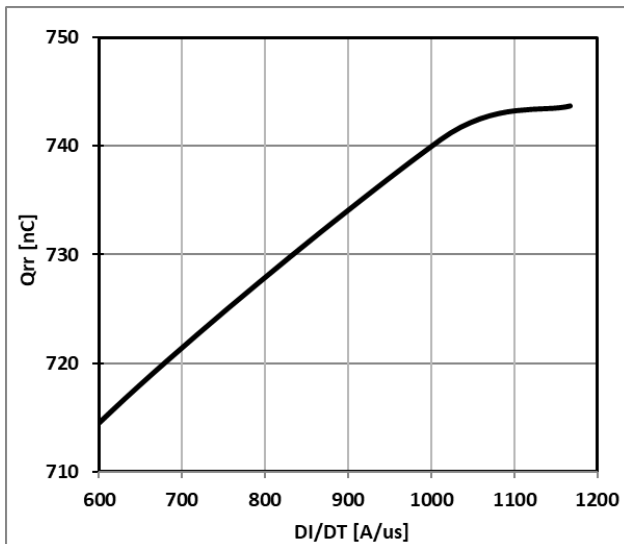


Figure 15: Typical Diode Qrr VS. DI/DT, TC=25°C  
VCC=400V, VGE=15V, IF=20A

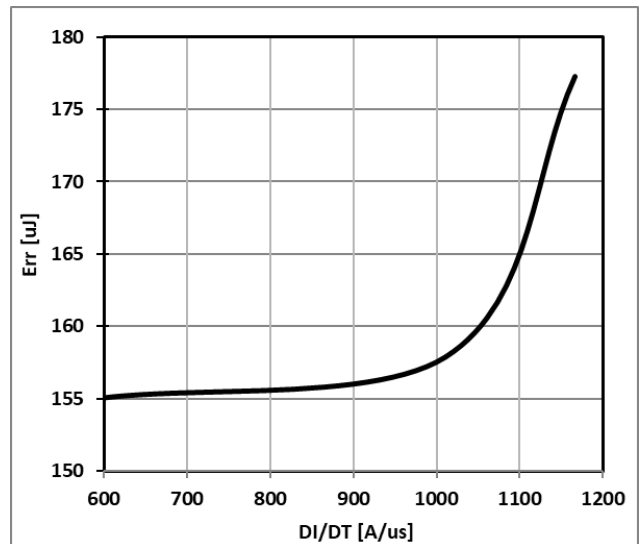


Figure 16: Typical Diode Err VS. DI/DT, TC=25°C  
VCC=400V, VGE=15V, IF=20A

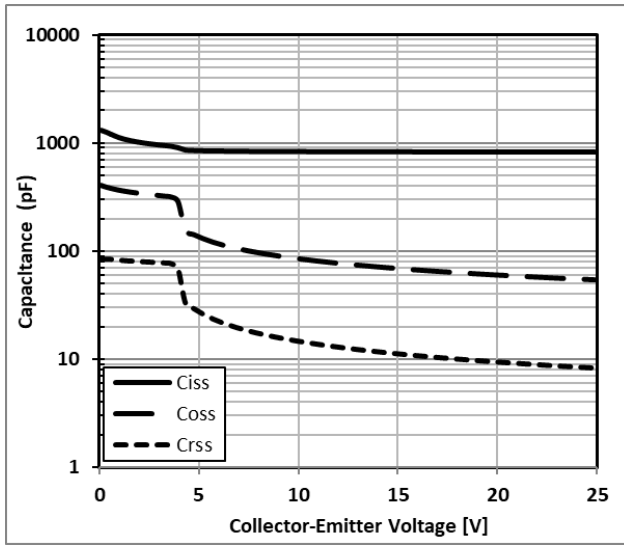


Figure 17: Typical Capacitance VS. VCE,  
VGE=0V, f=1MHz

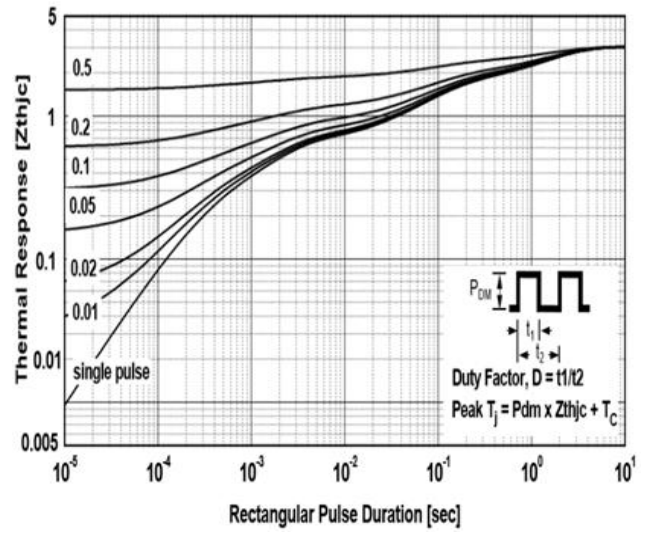
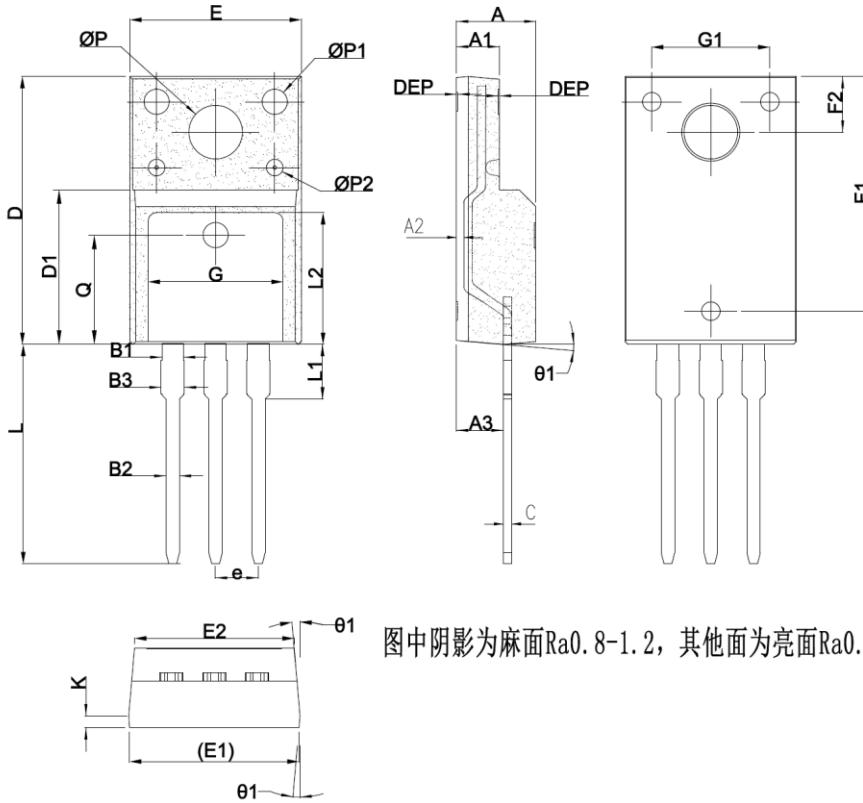


Figure 18: Normalized transient thermal impedance  
junction-to-case

TO-220F PACKAGE OUTLINE



图中阴影为麻面Ra0.8-1.2，其他面为亮面Ra0.2-0.4

COMMON DIMENSIONS			
SYMBOL	mm		
	MIN	NOM	MAX
*A	4.50	4.70	4.90
*A1	2.34	2.54	2.74
*A2	0.38	0.43	0.48
*A3	2.66	2.76	2.86
B1	1.23	1.28	1.33
*B2	0.75	0.80	0.85
*B3	1.28	-	1.43
*C	0.45	0.50	0.60
*D	15.67	15.87	16.07
*D1	9.04	9.12	9.20
*e	2.49	2.54	2.59
*E	10.00	10.16	10.32
E1	9.94	10.04	10.14
E2	9.36	9.46	9.56
F1	13.80	13.90	14.00
*F2	3.20	3.30	3.40
G	7.80	8.00	8.20
G1	6.90	7.00	7.10
K	0.65	0.70	0.75
*L	12.78	12.98	13.18
*L1	3.13	3.23	3.33
L2	7.70	7.80	7.90
Q	6.5REF		
*φP	3.08	-	3.48
φP1	1.40	1.50	1.60
φP2	0.95	1.00	1.05
*θ1	3°	5°	7°
DEP	0.05	0.10	0.15

带\*为检验尺寸



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