

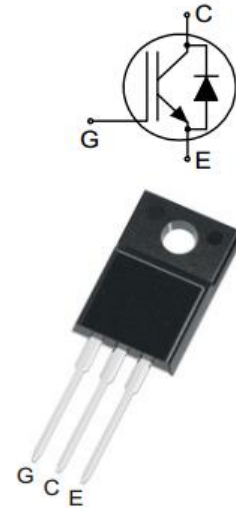
## IGBT

### Features

- 600V,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 IH (induction heating),UPS, general inverter and other soft switching applications.



### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$V_{CES}$	Collector-Emitter Voltage	600	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)	40	A
$I_F$	Diode Continuous Forward Current ( $T_C=100^\circ C$ )	20	A
$I_{FM}$	Diode Maximum Forward Current (Note 1)	40	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	65	$^\circ C/W$

**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	$V_{GE}=0V, I_C=250\mu A$	600	-	-	V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{CE}=600V, V_{GE}=0V$	-	-	100	$\mu A$
$I_{GES}$	Gate Leakage Current, Forward	$V_{GE}=30V, V_{CE}=0V$	-	-	100	nA
	Gate Leakage Current, Reverse	$V_{GE}=-30V, V_{CE}=0V$	-	-	-100	nA
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=250\mu A$	4.5	-	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=20A$	-	2.0	2.35	V
$Q_g$	Total Gate Charge	$V_{CC}=480V$ $V_{GE}=15V$ $I_C=20A$	-	34.5		nC
$Q_{ge}$	Gate-Emitter Charge		-	11.5		nC
$Q_{gc}$	Gate-Collector Charge		-	20.6		nC
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=400V$ $V_{GE}=15V$ $I_C=20A$ $R_G=15\Omega$ Inductive Load $T_C=25^\circ\text{C}$	-	29	-	ns
$t_r$	Turn-on Rise Time		-	75	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	68	-	ns
$t_f$	Turn-off Fall Time		-	67	-	ns
$E_{on}$	Turn-on Switching Loss		-	0.96	-	mJ
$E_{off}$	Turn-off Switching Loss		-	0.40	-	mJ
$E_{ts}$	Total Switching Loss		-	1.36	-	mJ
$C_{ies}$	Input Capacitance		$V_{CE}=25V$	-	800	-
$C_{oes}$	Output Capacitance	$V_{GE}=0V$	-	47.5	-	pF
$C_{res}$	Reverse Transfer Capacitance	$f=1\text{MHz}$	-	15.1	-	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	$I_F=20A$	-	1.43	2.45	V
$t_{rr}$	Diode Reverse Recovery Time	$V_{CE}=400V$	-	72		ns
$I_{rr}$	Diode peak Reverse Recovery Current	$I_F=20A$	-	14.6		A
$Q_{rr}$	Diode Reverse Recovery Charge	$R_g=15\Omega$	-	600		nC

**Notes:**

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

## Typical Performance Characteristic

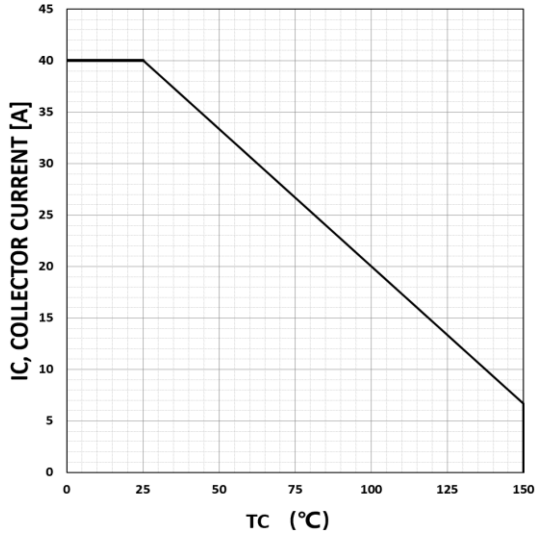


Figure 1. Maximum DC collector current VS. case temperature

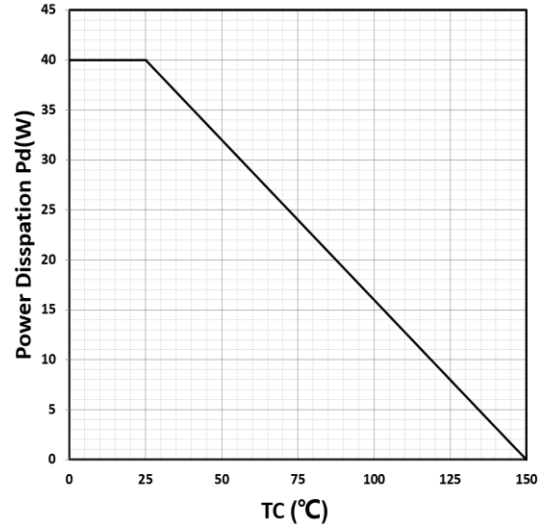


Figure 2. Power dissipation VS. case temperature

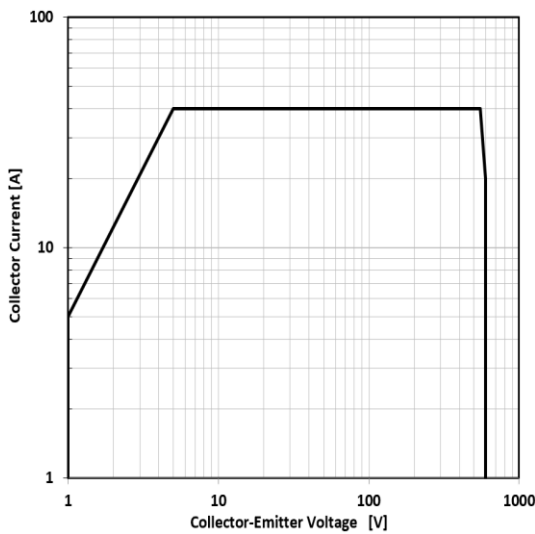


Figure 3. Reverse bias SOA,  $T_j=125^{\circ}\text{C}$ ,  $V_{ge}=15\text{V}$

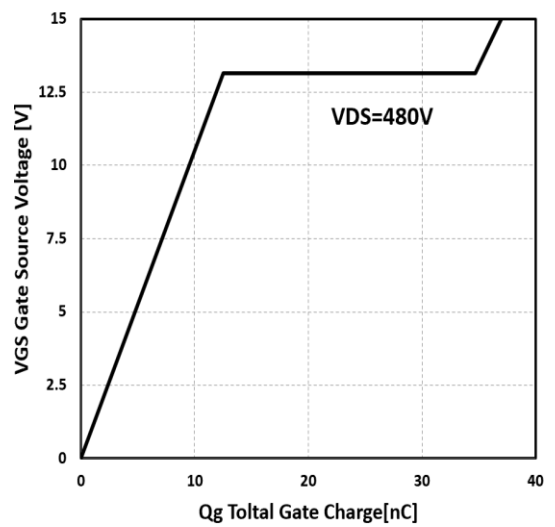


Figure 18: Typical gate charge VS.  $V_{GS}$ ,  $I_C=20\text{A}$

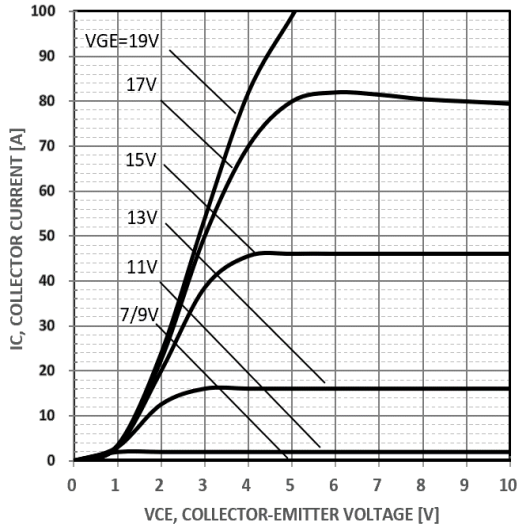


Figure 5. Typical output characteristics  
 $t_p=300\mu s$   $T_c=25^\circ C$

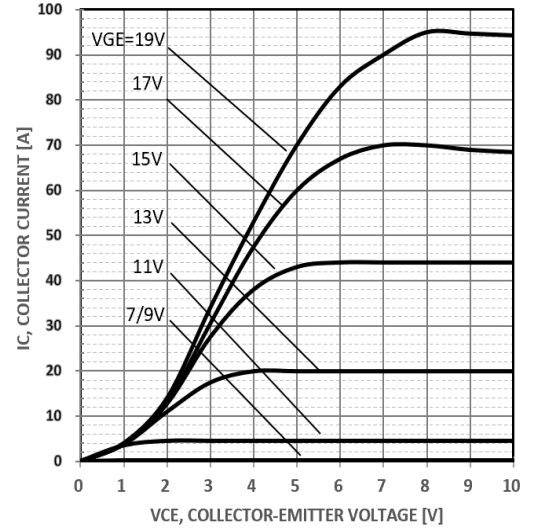


Figure 6. Typical output characteristics  
 $t_p=300\mu s$   $T_c=150^\circ C$

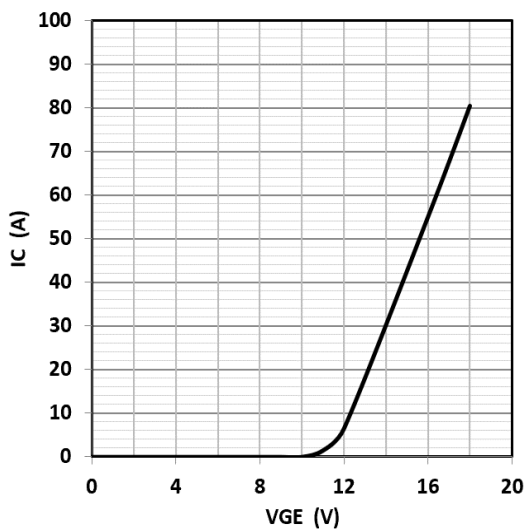


Figure 7. Typical gate threshold voltage

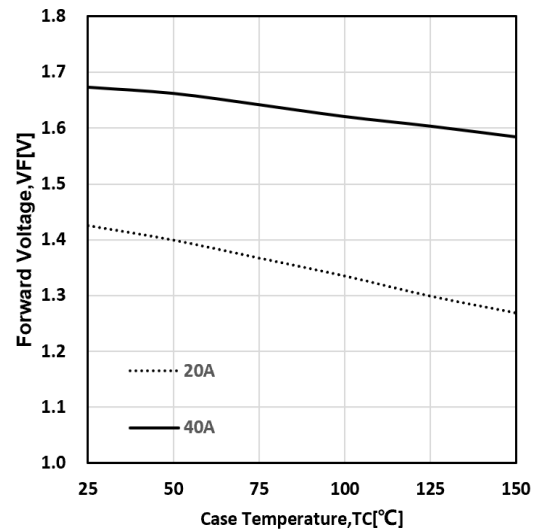


Figure 8. Typical forward voltage vs  $T_c$

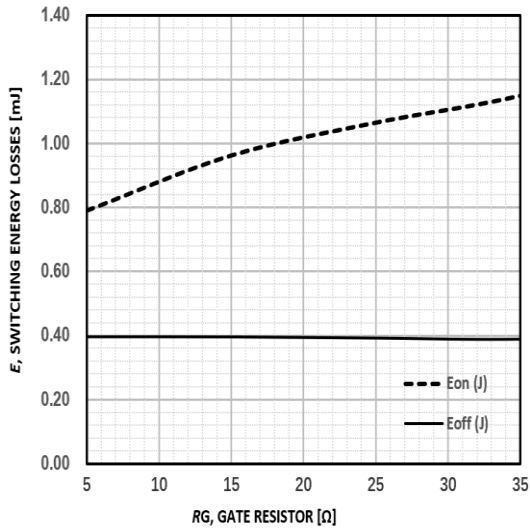


Figure9: Typical energy loss VS. Rg, TC=25°C,  
VCE=400V, VGE=15V, IC=20A

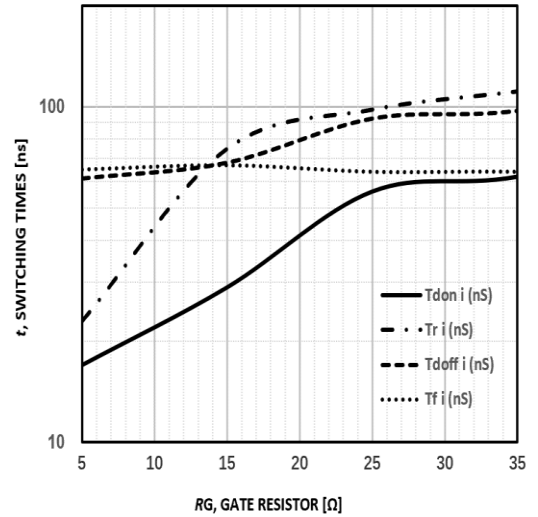


Figure10: Typical switching time VS. Rg, TC=25°C,  
VCE=400V, VGE=15V, IC=20A

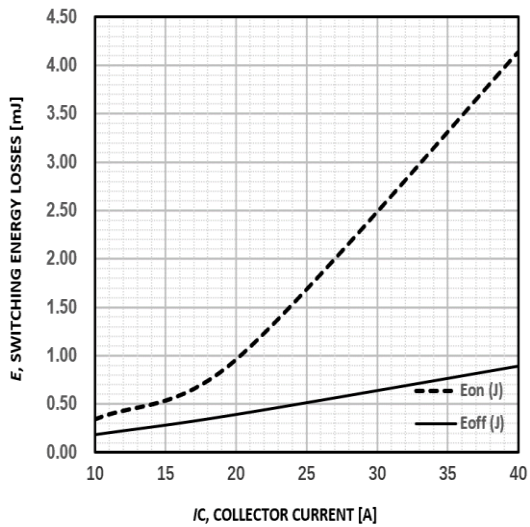


Figure11: Typical energy loss VS. IC, TC=25°C,  
VCE=400V, VGE=15V, RG=15Ω

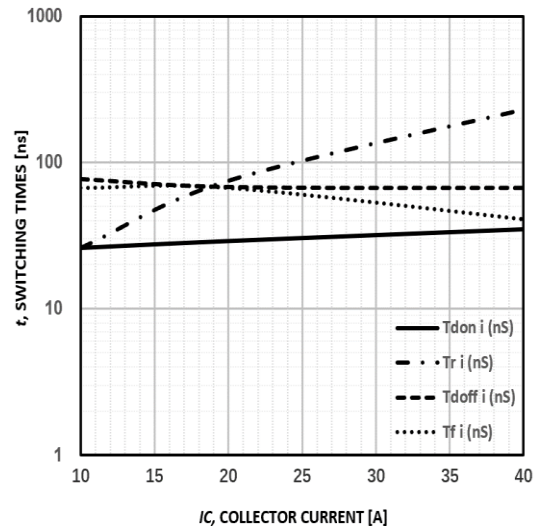


Figure12: Typical switching time VS. IC, TC=25°C,  
VCE=400V, VGE=15V, RG=15Ω

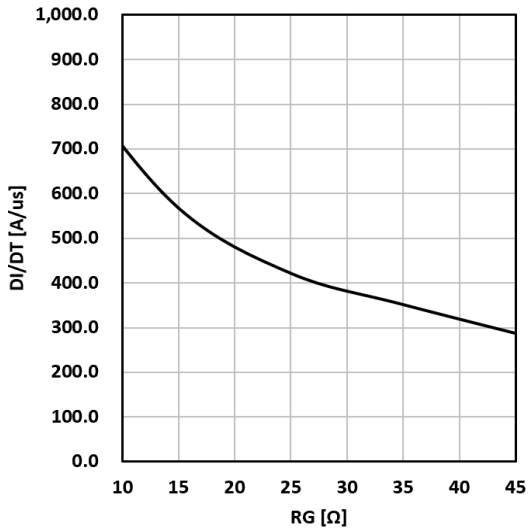


Figure 13. Typical diode di/dt vs rg Tc=25°C  
VCE=400V VGE=15V IF=20A

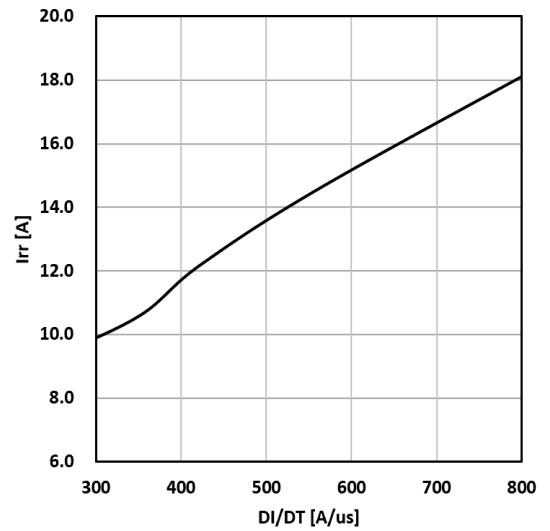


Figure 14. Typical diode Irr vs di/dt Tc=25°C  
VCE=400V VGE=15V IF=20A

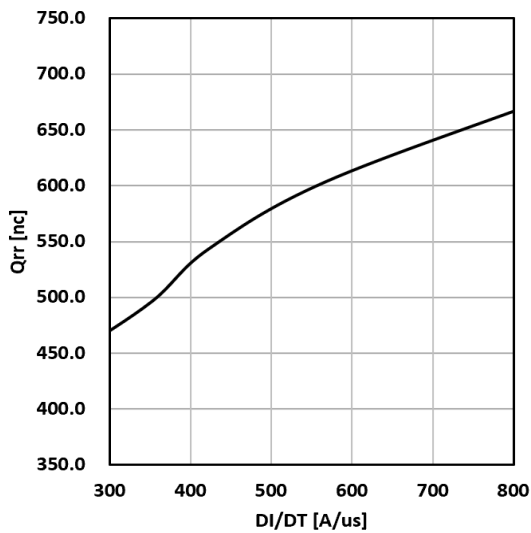


Figure 15. Typical diode Qrr vs di/dt Tc=25°C  
VCE=400V VGE=15V IF=20A

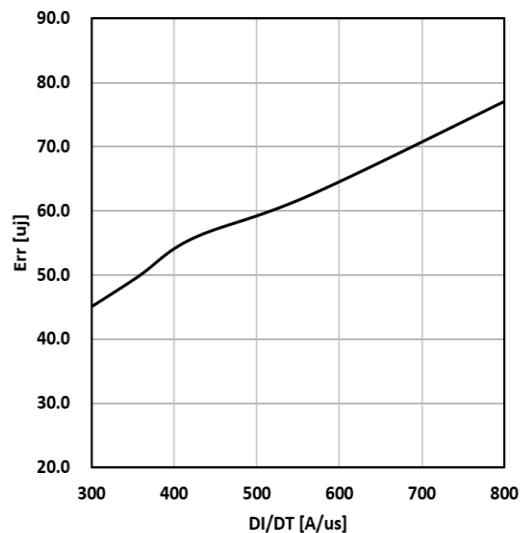


Figure 16. Typical diode Err vs di/dt Tc=25°C  
VCC=400V VGE=15V IF=20A

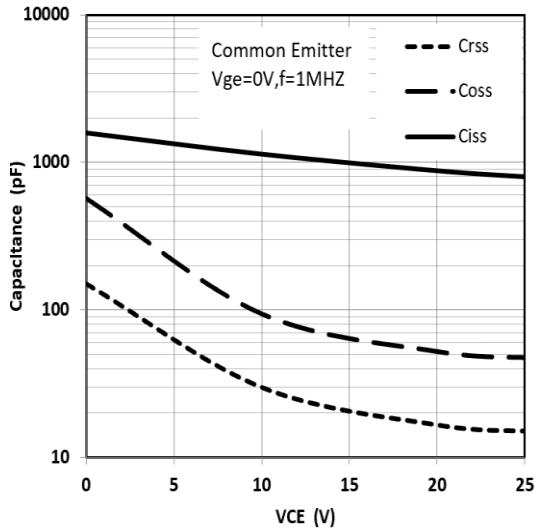


Figure17:Typical capacitance VS. VCE,  
VGE=0V,f=1MHz

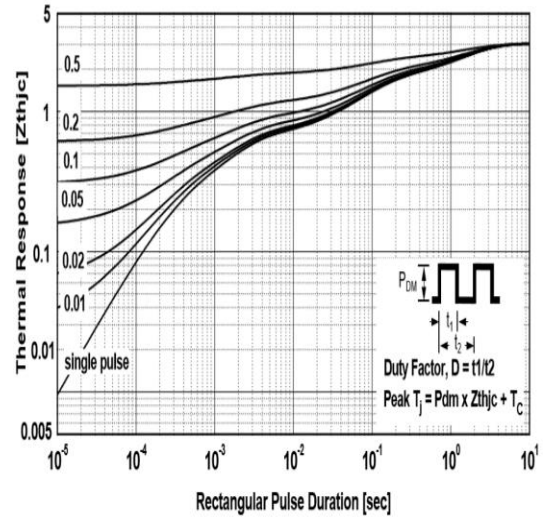
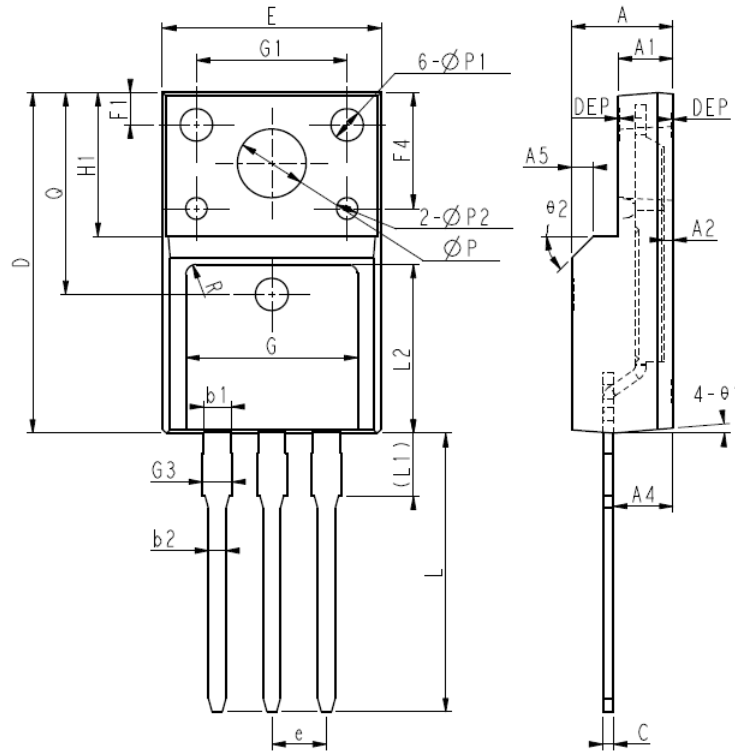


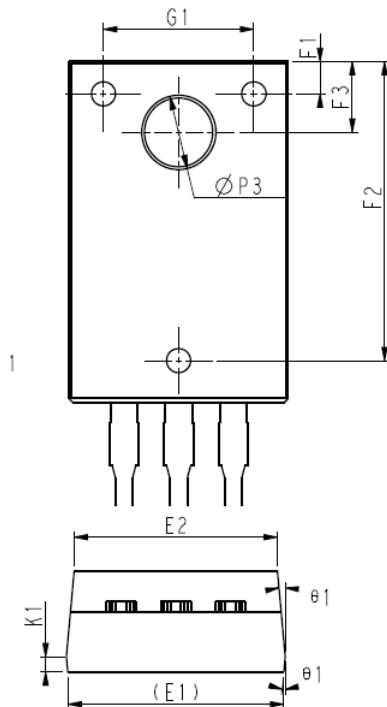
Figure18. normalized transient thermal impedance,  
junction-to-case

## Mechanical Dimensions



COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
E	10.00	10.16	10.32
E1	9.91	10.04	10.14
E2	9.36	9.46	9.56
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.43	-	0.48
A4	2.66	2.76	2.86
A5	1.00REF		
c	0.45	0.50	0.60
D	15.67	15.87	16.07
q	9.40REF		
H1	6.70REF		
e	2.54BSC		
ØP	3.18REF		
L	12.78	12.98	13.18
L1	2.83	2.93	3.03
L2	7.70	7.80	7.90
ØP1	1.40	1.50	1.60
ØP2	0.95	1.00	1.05
ØP3	3.45REF		
Ø1	3°	5°	7°
Ø2	-	45°	-
DEP	0.05	0.10	0.15
F1	1.00	1.50	2.00
F2	13.80	13.90	14.00
F3	3.20	3.30	3.40
F4	5.30	5.40	5.50
G	7.80	8.00	8.20
G1	6.90	7.00	7.10
G3	1.25	1.35	1.45
b1	1.23	1.28	1.38
b2	0.75	0.80	0.90
K1	0.65	0.70	0.75
R	0.50REF		





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