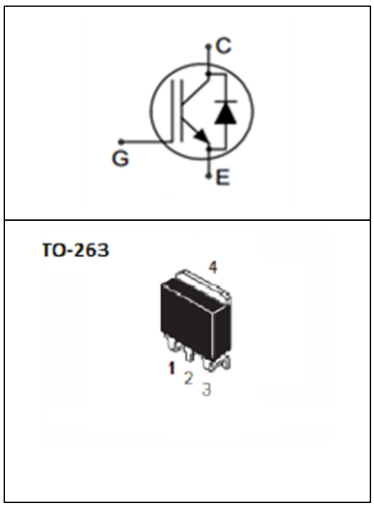
佳恩半导体
JIAENSEMI

# JNG15T60KS

## IGBT

## Features




- 600V,15A
- $V_{CE(sat)(typ.)}$=1.8V@$V_{GE}$=15V,$I_C$=15A
- 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 | ± 20 | V |
| $I_C$ | Continuous Collector Current ( $T_C$=25℃) | 30 | A |
| | Continuous Collector Current ( $T_C$=100℃) | 15 | A |
| $I_{CM}$ | Pulsed Collector Current (Note 1) | 45 | A |
| $I_F$ | Diode Continuous Forward Current ( $T_C$=100℃) | 15 | A |
| $I_{FM}$ | Diode Maximum Forward Current (Note 1) | 45 | A |
| $t_{sc}$ | Short Circuit Withstand Time | 10 | us |
| $P_D$ | Maximum Power Dissipation ( $T_C$=25℃) | 105 | W |
| | Maximum Power Dissipation ( $T_C$=100℃) | 40 | W |
| $T_J$ | Operating Junction Temperature Range | -55 to +150 | ℃ |
| $T_{STG}$ | Storage Temperature Range | -55 to +150 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for IGBT | 1.2 | ℃/ W |
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for Diode | 2.5 | ℃/ W |
| $R_{th\ j\text{-}a}$ | Thermal Resistance, Junction to Ambient | 65 | ℃/ W |

## Electrical Characteristics ($T_C$=25℃ unless otherwise noted )

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $V_{GE}$= 0V, $I_C$= 250uA | 600 | - | - | V |
| $I_{CES}$ | Collector-Emitter Leakage Current | $V_{CE}$= 600V, $V_{GE}$= 0V | - | - | 100 | uA |
| $I_{GES}$ | Gate Leakage Current, Forward | $V_{GE}$=20V, $V_{CE}$= 0V | - | - | 100 | nA |
| | Gate Leakage Current, Reverse | $V_{GE}$= -20V, $V_{CE}$= 0V | - | - | -100 | nA |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$= $V_{CE}$, $I_C$= 250uA | 4.5 | - | 6.5 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$= 15A | - | 1.8 | 2.2 | V |
| Qg | Total Gate Charge | $V_{CC}$=400V<br>$V_{GE}$=15V<br>$I_C$=15A | - | 70 | | nC |
| Qge | Gate-Emitter Charge | | - | 23 | | nC |
| Qgc | Gate-Collector Charge | | - | 24 | | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$=400V<br>$V_{GE}$=15V<br>$I_C$=15A<br>$R_G$=10Ω<br>Inductive Load 500uH<br>$T_C$=25 ℃ | - | 21 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 20 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 89 | - | ns |
| $t_f$ | Turn-off Fall Time | | - | 57 | - | ns |
| Eon | Turn-on Switching Loss | | - | 0.327 | - | mJ |
| Eoff | Turn-off Switching Loss | | - | 0.234 | - | mJ |
| Ets | Total Switching Loss | | - | 0.562 | - | mJ |
| Cies | Input Capacitance | $V_{CE}$=30V<br>$V_{GE}$=0V<br>f = 1MHz | - | 634 | - | pF |
| Coes | Output Capacitance | | - | 84 | - | pF |
| Cres | Reverse Transfer Capacitance | | - | 48 | - | pF |

## Electrical Characteristics of Diode ($T_C$=25℃ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$=15A | - | 1.45 | 1.9 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $V_{CE}$ = 300V<br>$I_F$= 15A<br>dIF/dt = 500A/us | - | 115 | | ns |
| $I_{rr}$ | Diode peak Reverse Recovery Current | | - | 13 | | A |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | - | 620 | | nC |

**Notes:**

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

## Typical Performance Characteristics

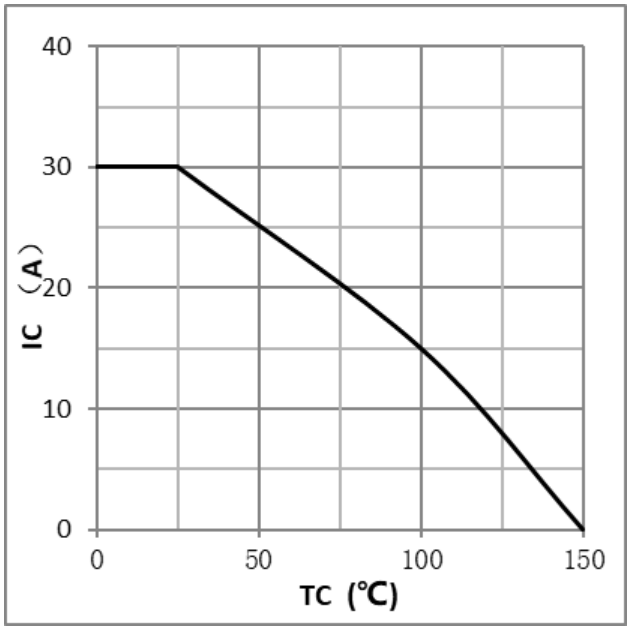



Figure 1. maximum DC collector current VS. case temperature

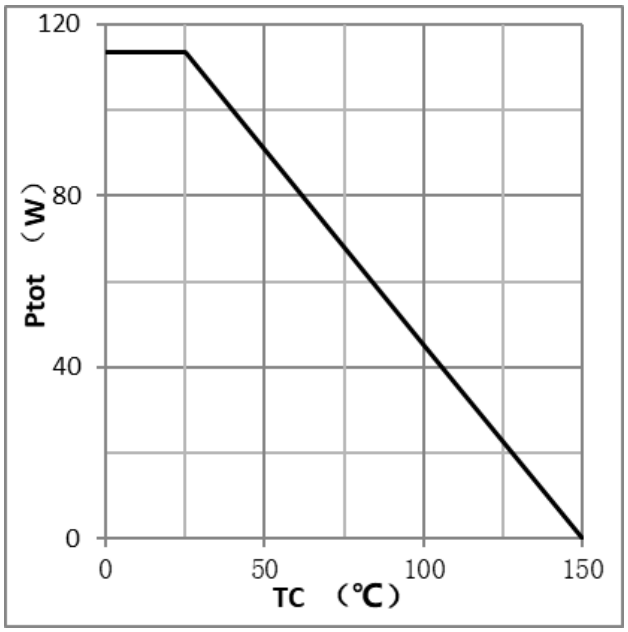



Figure 2. Power dissipation VS. case temperature

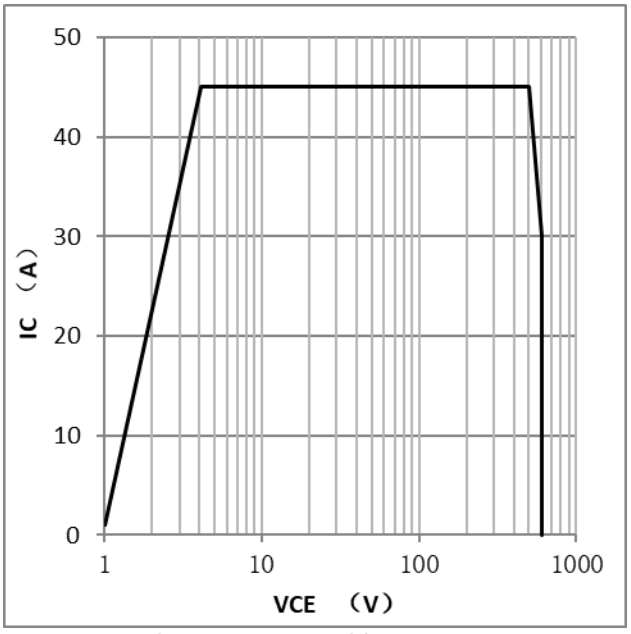



Figure 3. reverse bias SOA, Tj=125℃,Vge=15V

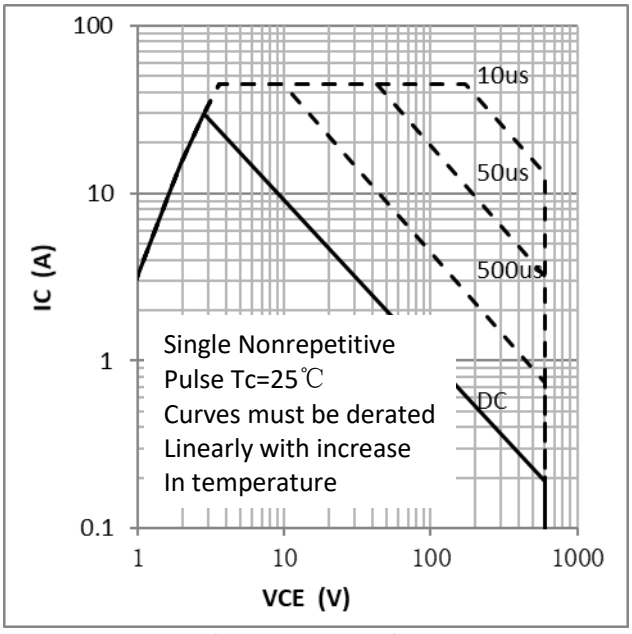



Figure 4. forward SOA Tc=25℃ Tj≤150℃

## Typical Performance Characteristics

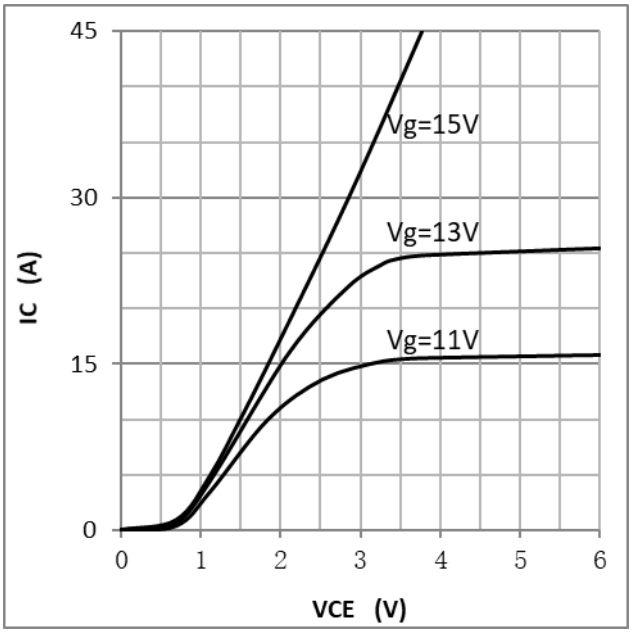



Figure 5. typical output characteristics

Tc=25℃ tp=300us

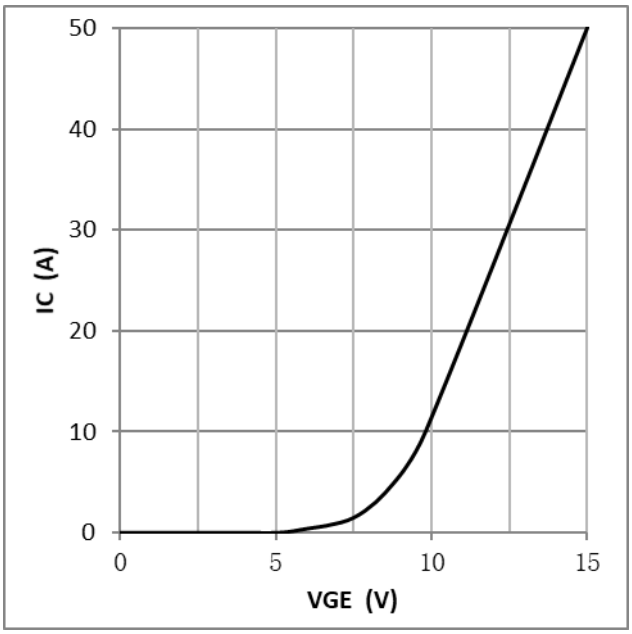



Figure 6. transfer characteristics

Tc=25℃ VCE=20V

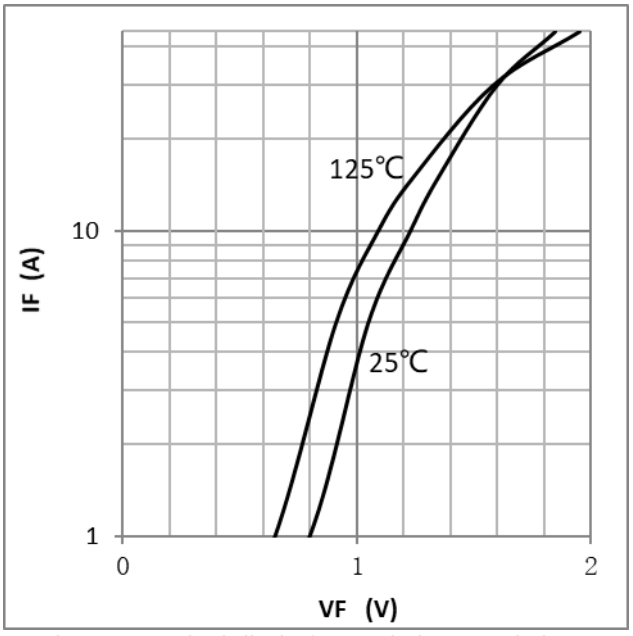



Figure 7. typical diode forward characteristics

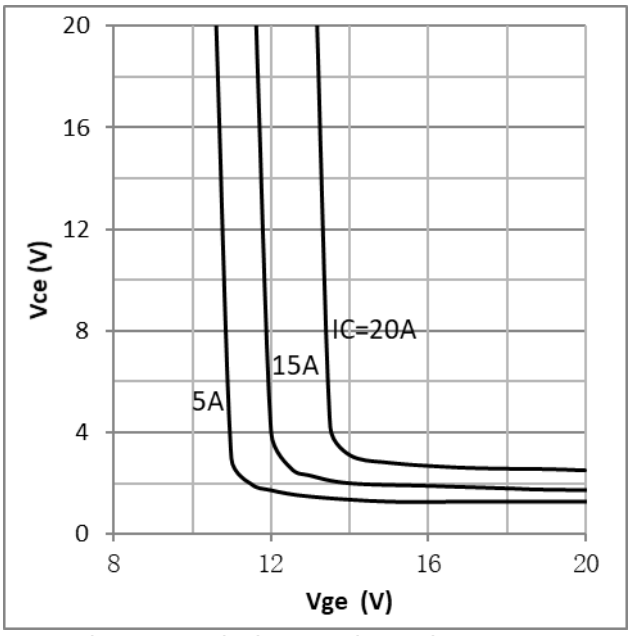



Figure 8. typical Saturation Voltage vs. Vge

Tc=25℃

## Typical Performance Characteristics

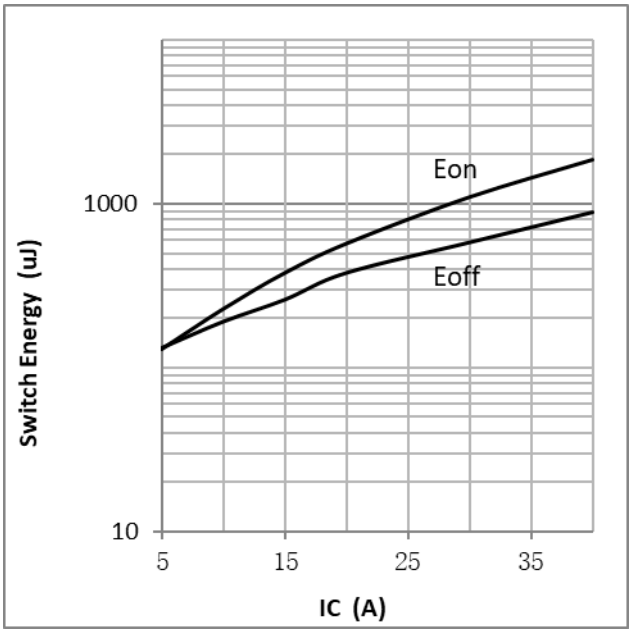



Figure 9. switch energy loss vs.Ic Tc=25℃

Tc=25℃ L=500uH Vcc=400V Vge=15V Rg=20Ω

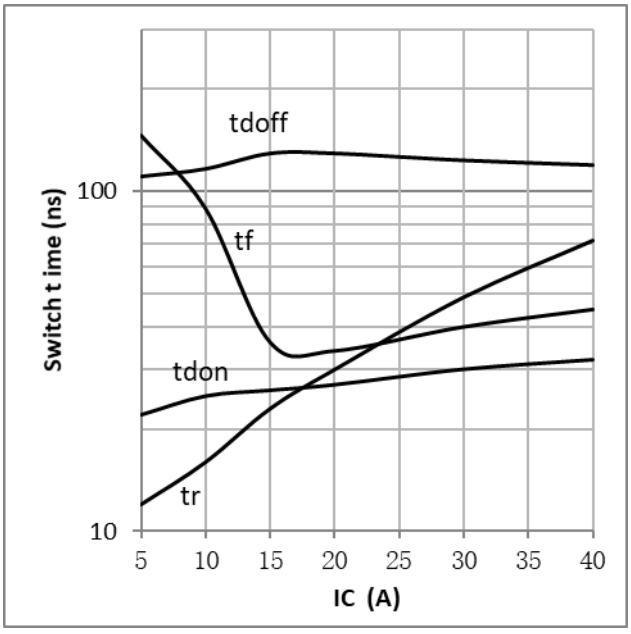



Figure 10. typical switch time vs. Ic Tc=25℃

L=500uH Vcc=400V Vge=15V Rg=20Ω

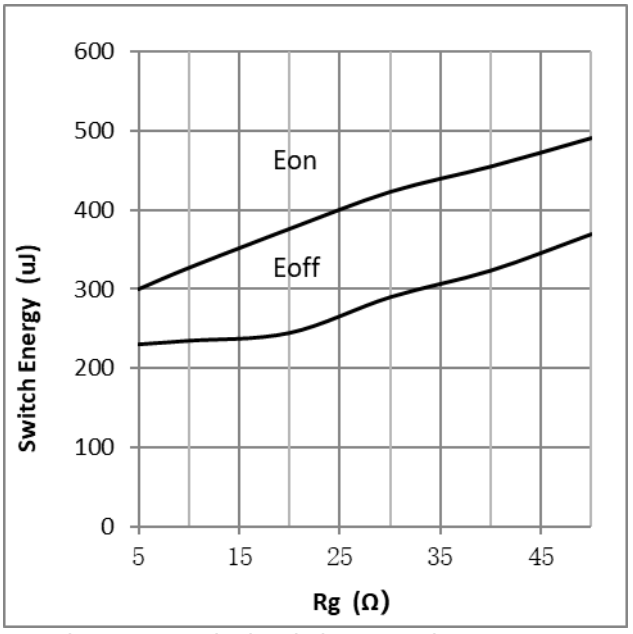



Figure 11. typical switch energy loss vs. Rg

Tc=25℃ L=500uH Vcc=400V Vge=15V Ic=15A

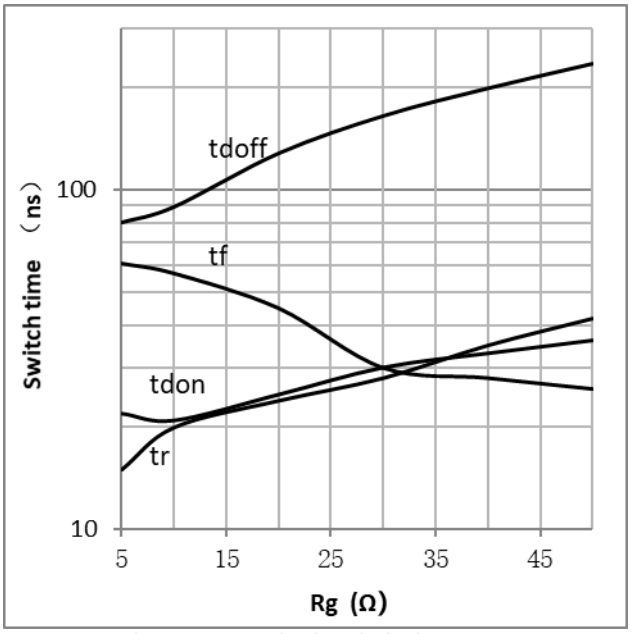



Figure 12. typical switch time vs. Rg

Tc=25℃ L=500uH Vcc=400V Vge=15V Ic=15A

## Typical Performance Characteristics

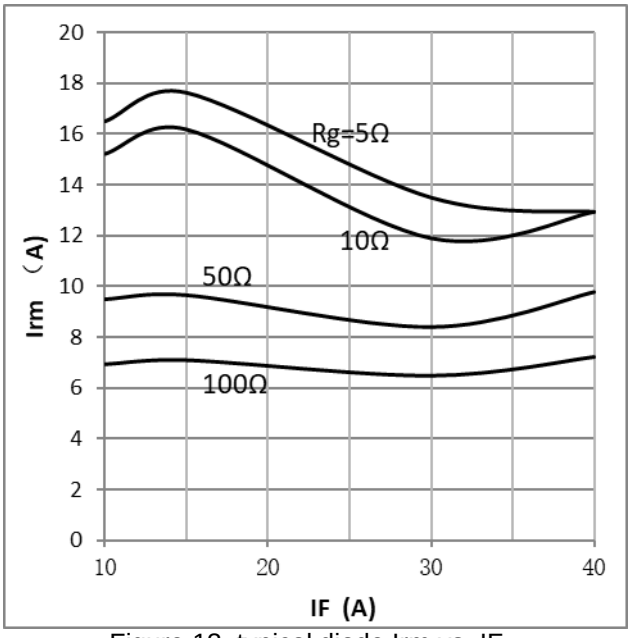



Figure 13. typical diode Irm vs. IF

Tc=25℃ Vcc=300V Vge=15V

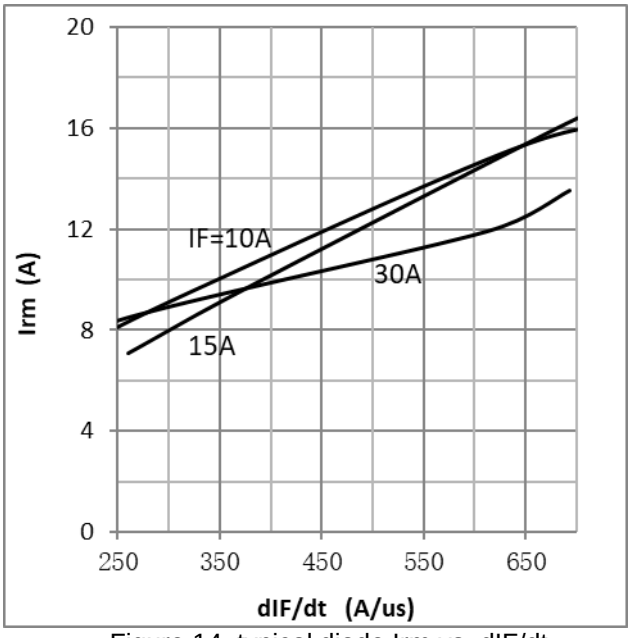



Figure 14. typical diode Irm vs. dIF/dt

Tc=25℃ Vcc=300V Vge=15V

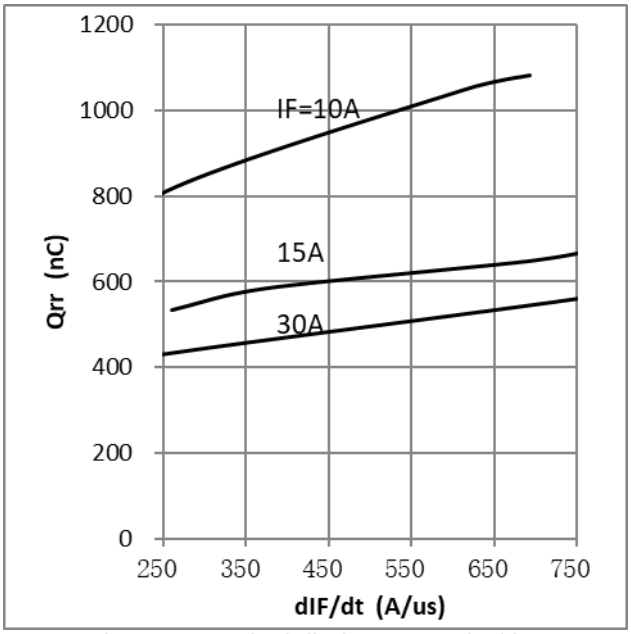



Figure 15. typical diode Qrr vs. dIF/dt

Tc=25℃ Vcc=300V Vge=15V

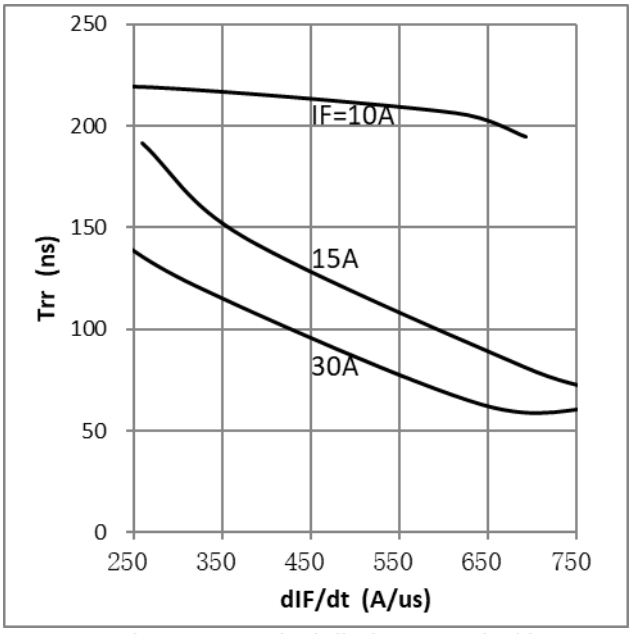



Figure 16. typical diode trr vs. dIF/dt

Tc=25℃ Vcc=300V Vge=15V

## Typical Performance Characteristics

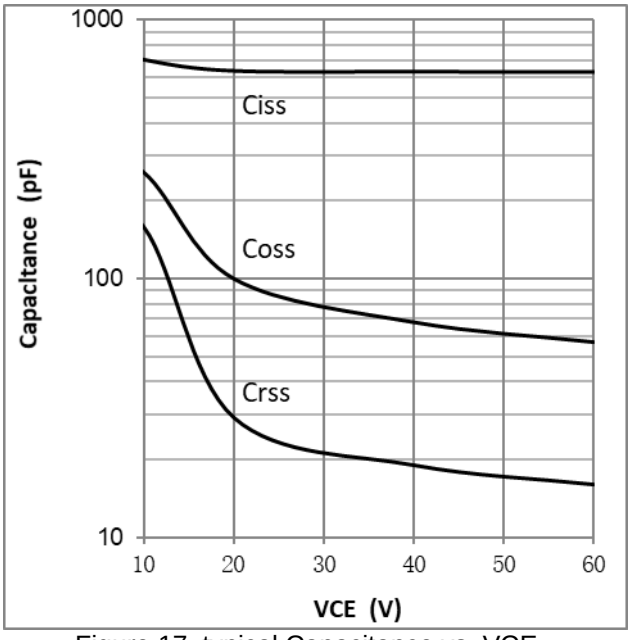



Figure 17. typical Capacitance vs. VCE

Tc=25℃ f=1MHz Vge=0V

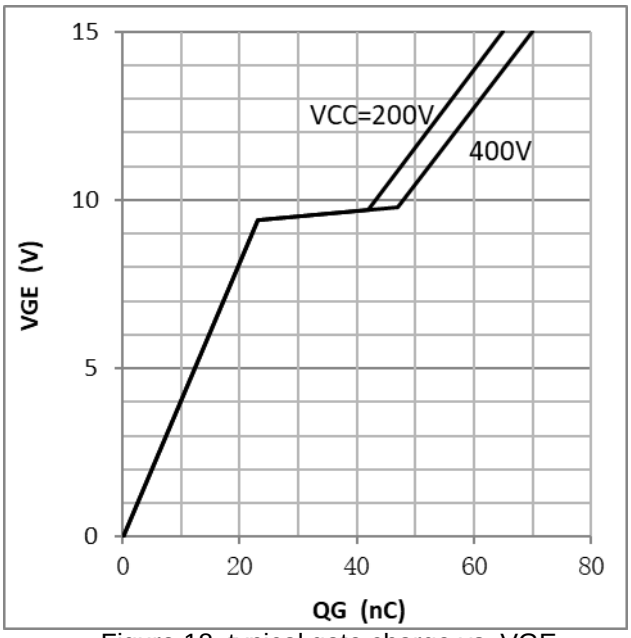



Figure 18. typical gate charge vs. VGE

Tc=25℃ Ic=15A

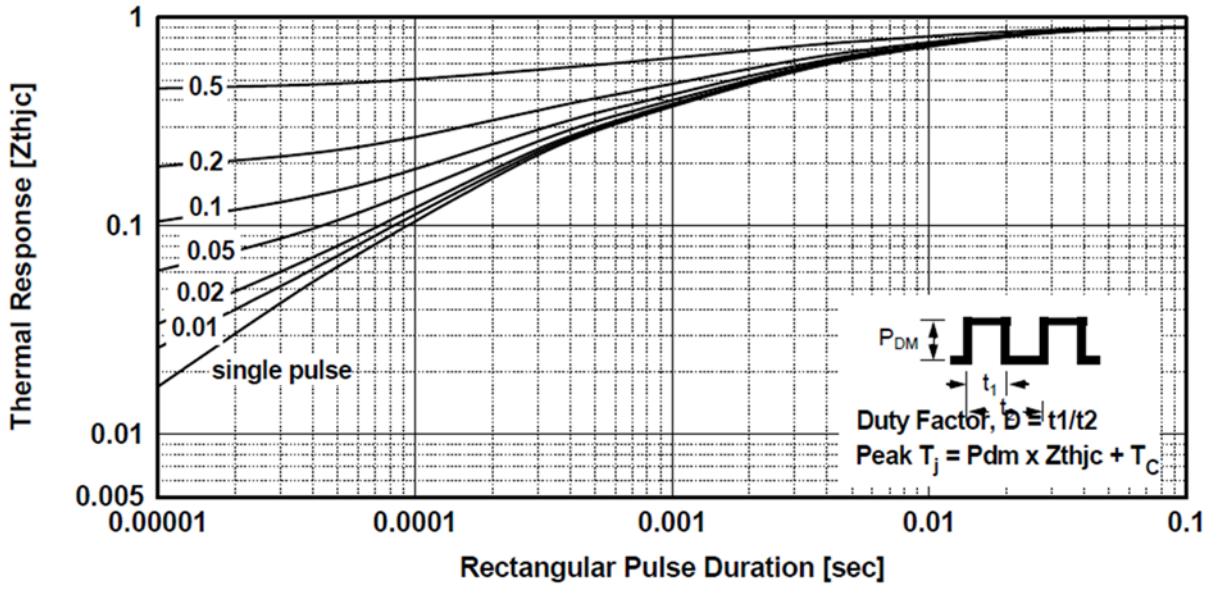
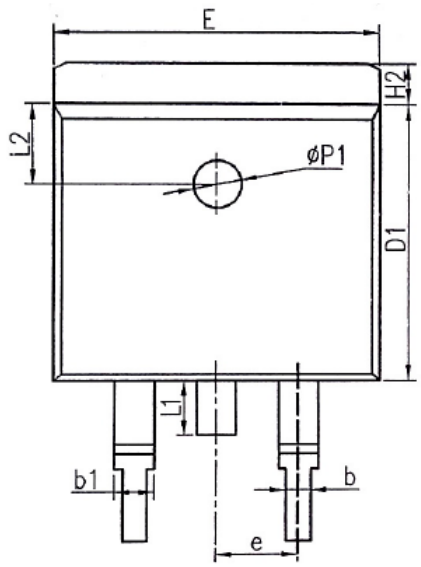
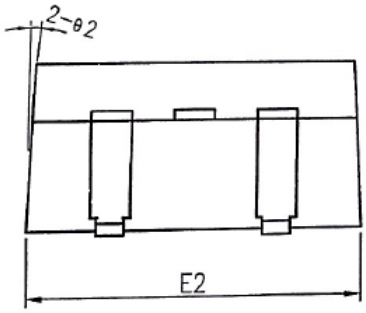
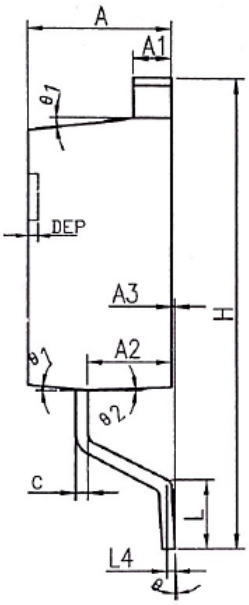



Figure19. normalized transient thermal impedance, junction-to-case

## Mechanical Dimensions




| SYMBOL | MM | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.40 | 4.57 | 4.70 |
| A1 | 1.22 | 1.27 | 1.32 |
| A2 | 2.59 | 2.69 | 2.79 |
| A3 | 0.00 | 0.10 | 0.20 |
| b | 0.77 | 0.813 | 0.90 |
| b1 | 1.20 | 1.27 | 1.36 |
| c | 0.34 | 0.381 | 0.47 |
| D1 | 8.60 | 8.70 | 8.80 |
| E | 10.00 | 10.16 | 10.26 |
| E2 | 10.00 | 10.10 | 10.20 |
| e | 2.54 BSC | | |
| H | 14.70 | 15.10 | 15.50 |
| H2 | 1.17 | 1.27 | 1.40 |
| L | 2.00 | 2.30 | 2.60 |
| L1 | 1.45 | 1.55 | 1.70 |
| L2 | 2.5 REF | | |
| L4 | 0.25 BSC | | |
| θ | 0° | 5° | 8° |
| θ1 | 5° | 7° | 9° |
| θ2 | 1° | 3° | 5° |
| ΦP1 | 1.40 | 1.50 | 1.60 |
| DEP | 0.05 | 0.10 | 0.20 |

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