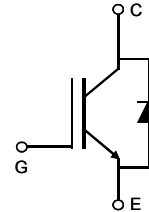
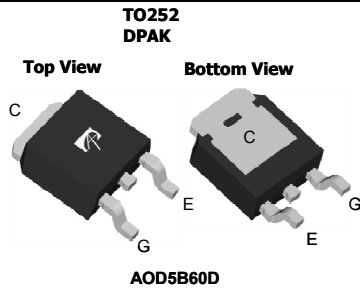


General Description

The Alpha IGBT™ line of products offers best-in-class performance in conduction and switching losses, with robust short circuit capability. They are designed for ease of paralleling, minimal gate spike under high dV/dt conditions and resistance to oscillations. The co-packaged soft diode is optimized to minimize losses in motor control applications.

Product Summary

| | |
|------------------------------------------|-------|
| V_{CE} | 600V |
| I_C ($T_C=100^\circ\text{C}$) | 5A |
| $V_{CE(sat)}$ ($T_C=25^\circ\text{C}$) | 1.55V |



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

| Parameter | Symbol | AOD5B60D | Units |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------|------------------|
| Collector-Emitter Voltage | V_{CE} | 600 | V |
| Gate-Emitter Voltage | V_{GE} | ± 20 | V |
| Continuous Collector Current ^A | I_C | $T_C=25^\circ\text{C}$ | 23 |
| | | $T_C=100^\circ\text{C}$ | 10 |
| Pulsed Collector Current, Limited by T_{Jmax} | I_{CM} | 20 | A |
| Turn off SOA, $V_{CE} \leq 600\text{V}$, Limited by T_{Jmax} | I_{LM} | 20 | A |
| Continuous Diode Forward Current | I_F | $T_C=25^\circ\text{C}$ | 10 |
| | | $T_C=100^\circ\text{C}$ | 5 |
| Diode Pulsed Current, Limited by T_{Jmax} | I_{FM} | 20 | A |
| Short circuit withstanding time $V_{GE} = 15\text{V}$, $V_{CE} \leq 400\text{V}$, delay between short circuits $\geq 1.0\text{s}$, $T_C=25^\circ\text{C}$ | t_{SC} | 10 | μs |
| Power Dissipation | P_D | $T_C=25^\circ\text{C}$ | 54.4 |
| | | $T_C=100^\circ\text{C}$ | 21.7 |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ |
| Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | T_L | 300 | $^\circ\text{C}$ |

Thermal Characteristics

| Parameter | Symbol | AOD5B60D | Units |
|--------------------------------|-----------------|----------|--------------------|
| Maximum Junction-to-Ambient | $R_{\theta JA}$ | 55 | $^\circ\text{C/W}$ |
| Maximum IGBT Junction-to-Case | $R_{\theta JC}$ | 2.3 | $^\circ\text{C/W}$ |
| Maximum Diode Junction-to-Case | $R_{\theta JC}$ | 3 | $^\circ\text{C/W}$ |

Note A: I_C limited by package limitation

Electrical Characteristics (T_J=25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units | |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------|------|------|-------|----|
| STATIC PARAMETERS | | | | | | | |
| BV_{CES} | Collector-Emitter Breakdown Voltage | $I_C=1mA, V_{GE}=0V, T_J=25^\circ C$ | 600 | - | - | V | |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}=15V, I_C=5A$ | $T_J=25^\circ C$ | - | 1.55 | 1.8 | V |
| | | | $T_J=125^\circ C$ | - | 1.78 | - | |
| | | | $T_J=150^\circ C$ | - | 1.85 | - | |
| V_F | Diode Forward Voltage | $V_{GE}=0V, I_C=5A$ | $T_J=25^\circ C$ | - | 1.46 | 1.75 | V |
| | | | $T_J=125^\circ C$ | - | 1.36 | - | |
| | | | $T_J=150^\circ C$ | - | 1.3 | - | |
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $V_{CE}=V_{GE}, I_C=1mA$ | - | 6 | - | V | |
| I_{CES} | Zero Gate Voltage Collector Current | $V_{CE}=600V, V_{GE}=0V$ | $T_J=25^\circ C$ | - | - | 10 | μA |
| | | | $T_J=125^\circ C$ | - | - | 100 | |
| | | | $T_J=150^\circ C$ | - | - | 500 | |
| I_{GES} | Gate-Emitter Leakage Current | $V_{CE}=0V, V_{GE}=\pm 20V$ | - | - | ±100 | nA | |
| g_{FS} | Forward Transconductance | $V_{CE}=20V, I_C=5A$ | - | 2.3 | - | S | |
| DYNAMIC PARAMETERS | | | | | | | |
| C_{ies} | Input Capacitance | $V_{GE}=0V, V_{CE}=25V, f=1MHz$ | - | 367 | - | pF | |
| C_{oes} | Output Capacitance | | - | 34 | - | pF | |
| C_{res} | Reverse Transfer Capacitance | | - | 1.47 | - | pF | |
| Q_g | Total Gate Charge | $V_{GE}=15V, V_{CE}=480V, I_C=5A$ | - | 9.4 | - | nC | |
| Q_{ge} | Gate to Emitter Charge | | - | 3.15 | - | nC | |
| Q_{gc} | Gate to Collector Charge | | - | 3.6 | - | nC | |
| $I_{C(SC)}$ | Short circuit collector current, Max. 1000 short circuits, Delay between short circuits ≥ 1.0s | $V_{GE}=15V, V_{CE}=400V, R_G=60\Omega$ | - | 21 | - | A | |
| R_g | Gate Resistance | $V_{GE}=0V, V_{CE}=0V, f=1MHz$ | - | 3 | - | Ω | |
| SWITCHING PARAMETERS, (Load Inductive, T_J=25°C) | | | | | | | |
| $t_{D(on)}$ | Turn-On Delay Time | $T_J=25^\circ C$ $V_{GE}=15V, V_{CE}=400V, I_C=5A,$ $R_G=60\Omega,$ Parasitic Inductance=75nH | - | 12 | - | ns | |
| t_r | Turn-On Rise Time | | - | 15 | - | ns | |
| $t_{D(off)}$ | Turn-Off Delay Time | | - | 82 | - | ns | |
| t_f | Turn-Off Fall Time | | - | 10 | - | ns | |
| E_{on} | Turn-On Energy | | - | 0.14 | - | mJ | |
| E_{off} | Turn-Off Energy | | - | 0.04 | - | mJ | |
| E_{total} | Total Switching Energy | | - | 0.18 | - | mJ | |
| t_{rr} | Diode Reverse Recovery Time | | $T_J=25^\circ C$ | - | 98 | - | ns |
| Q_{rr} | Diode Reverse Recovery Charge | | $I_F=5A, di/dt=200A/\mu s, V_{CE}=400V$ | - | 0.23 | - | μC |
| I_{rm} | Diode Peak Reverse Recovery Current | | | - | 4.4 | - | A |
| SWITCHING PARAMETERS, (Load Inductive, T_J=150°C) | | | | | | | |
| $t_{D(on)}$ | Turn-On DelayTime | $T_J=150^\circ C$ $V_{GE}=15V, V_{CE}=400V, I_C=5A,$ $R_G=60\Omega,$ Parasitic Inductance=75nH | - | 11 | - | ns | |
| t_r | Turn-On Rise Time | | - | 16 | - | ns | |
| $t_{D(off)}$ | Turn-Off Delay Time | | - | 110 | - | ns | |
| t_f | Turn-Off Fall Time | | - | 14 | - | ns | |
| E_{on} | Turn-On Energy | | - | 0.18 | - | mJ | |
| E_{off} | Turn-Off Energy | | - | 0.08 | - | mJ | |
| E_{total} | Total Switching Energy | | - | 0.26 | - | mJ | |
| t_{rr} | Diode Reverse Recovery Time | | $T_J=150^\circ C$ | - | 166 | - | ns |
| Q_{rr} | Diode Reverse Recovery Charge | | $I_F=5A, di/dt=200A/\mu s, V_{CE}=400V$ | - | 0.4 | - | μC |
| I_{rm} | Diode Peak Reverse Recovery Current | | | - | 5.2 | - | A |

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

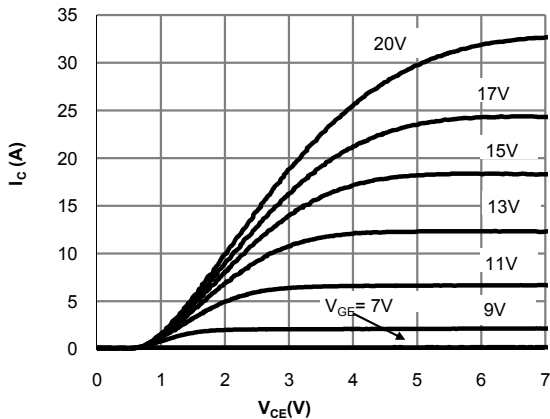


Fig 1: Output Characteristic
($T_j=25^\circ\text{C}$)

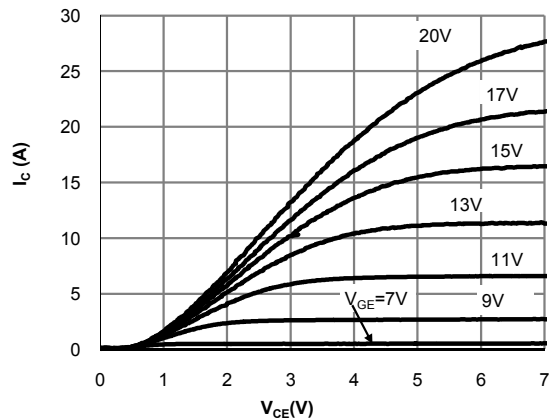


Fig 2: Output Characteristic
($T_j=150^\circ\text{C}$)

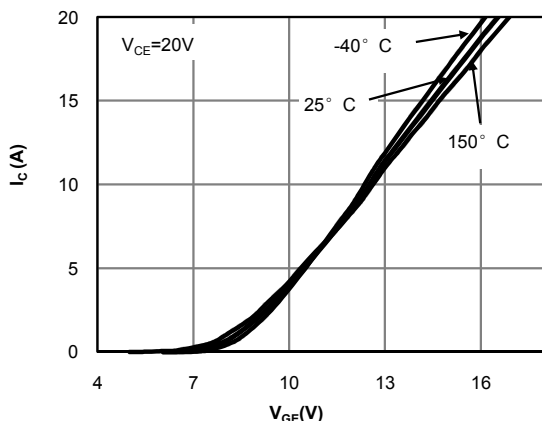


Fig 3: Transfer Characteristic

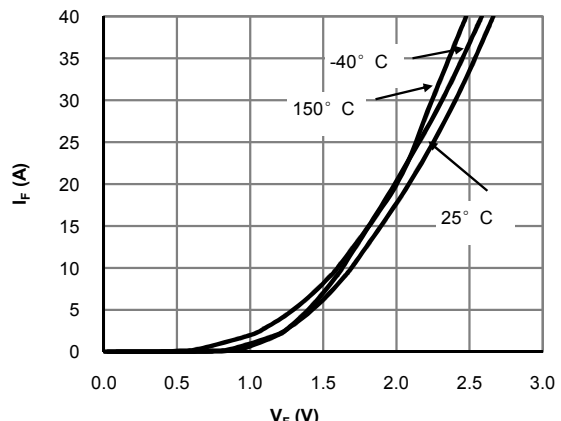


Fig 4: Diode Characteristic

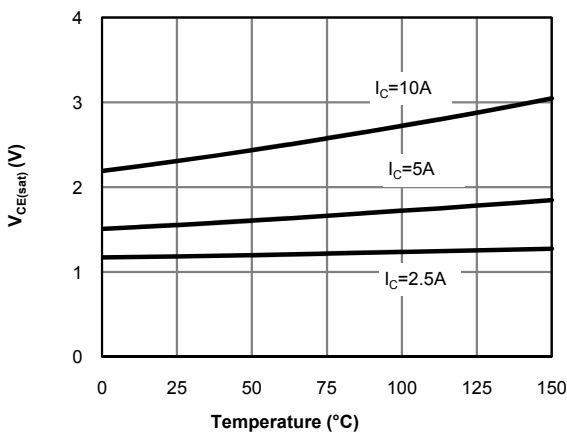


Fig 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

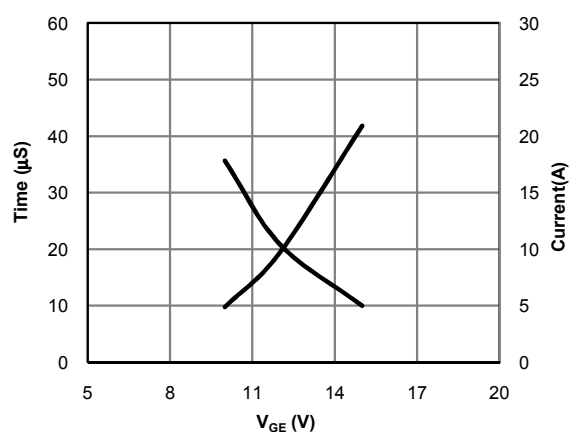


Fig 6: V_{GE} vs. Short Circuit Time
($V_{CE}=400V, T_C=25^\circ\text{C}$)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

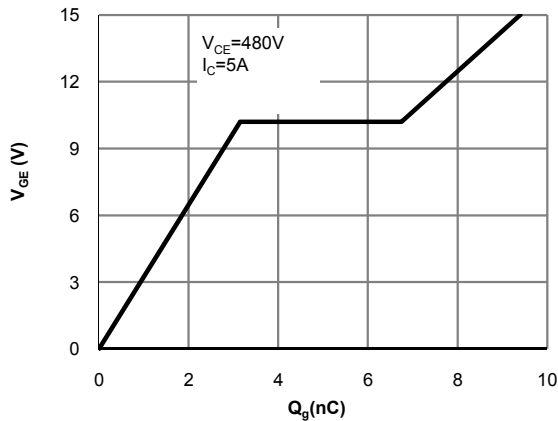


Fig 7: Gate-Charge Characteristics

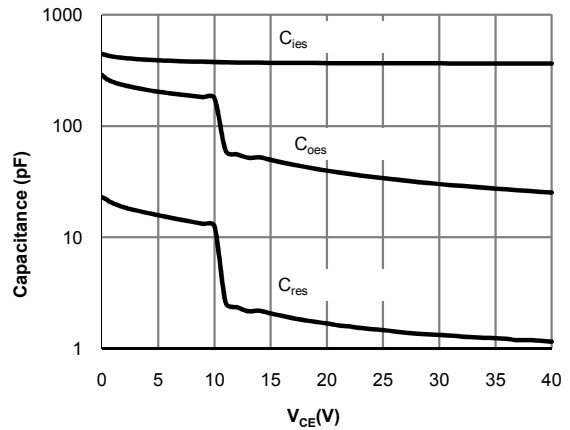


Fig 8: Capacitance Characteristic

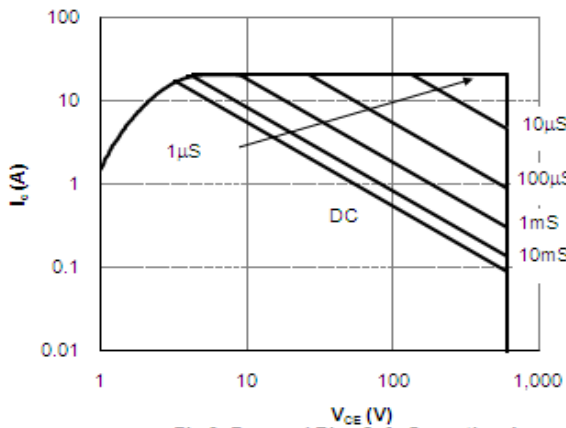


Fig 9: Forward Bias Safe Operating Area
($T_C = 25^\circ\text{C}, V_{GE} = 15\text{V}$)

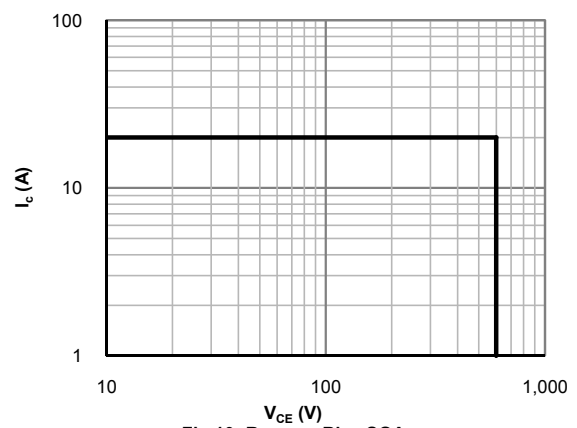


Fig 10: Reverse Bias SOA
($T_J = 150^\circ\text{C}, V_{GE} = 15\text{V}$)

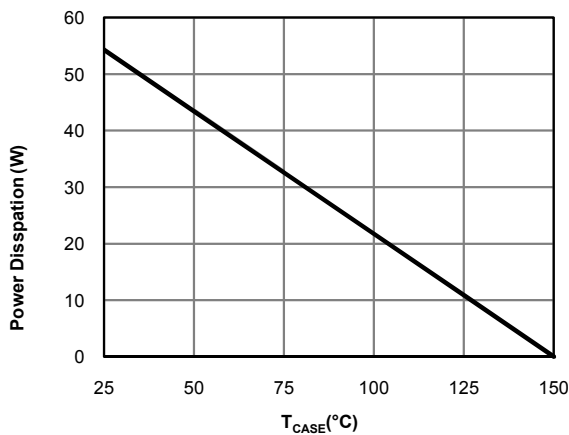


Fig 11: Power Dissipation as a Function of Case

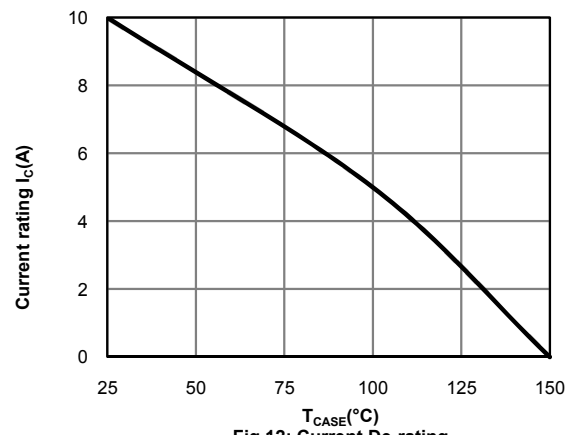


Fig 12: Current De-rating

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

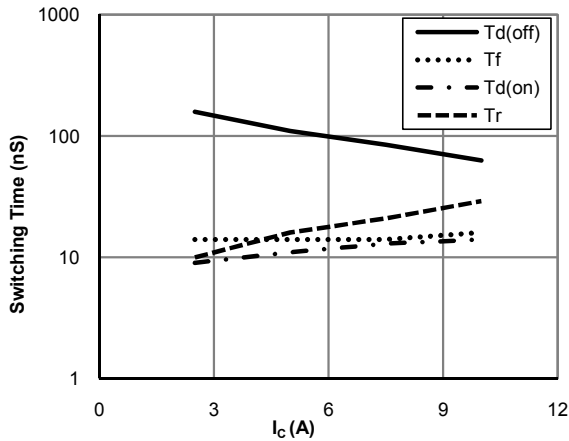


Figure 13: Switching Time vs. I_C
($T_J=150^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, R_g=60\Omega$)

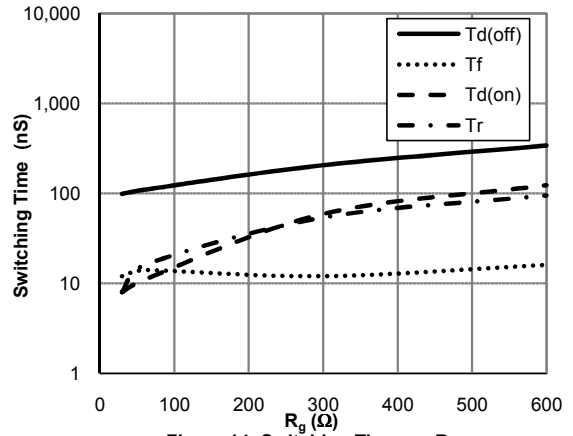


Figure 14: Switching Time vs. R_g
($T_J=150^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=5\text{A}$)

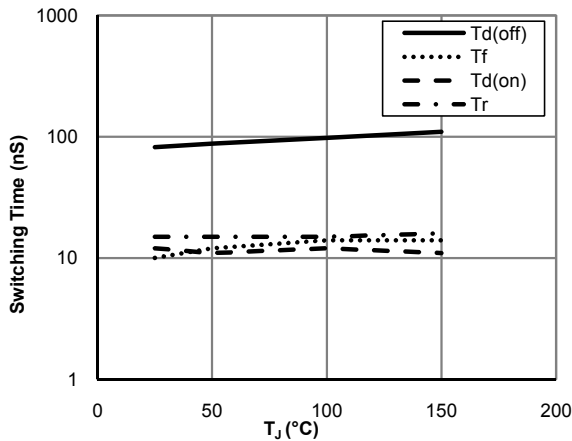


Figure 15: Switching Time vs. T_J
($V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=5\text{A}, R_g=60\Omega$)

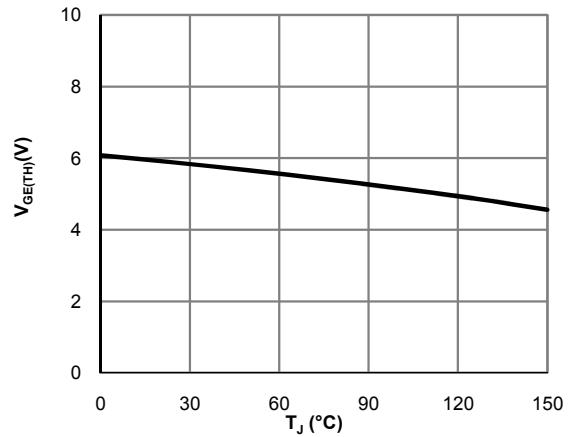


Figure 16: $V_{GE(TH)}$ vs. T_J

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

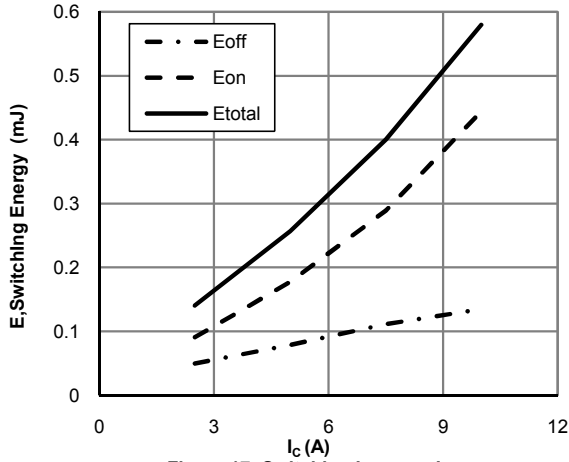


Figure 17: Switching Loss vs. I_C
($T_J=150^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, R_g=60\Omega$)

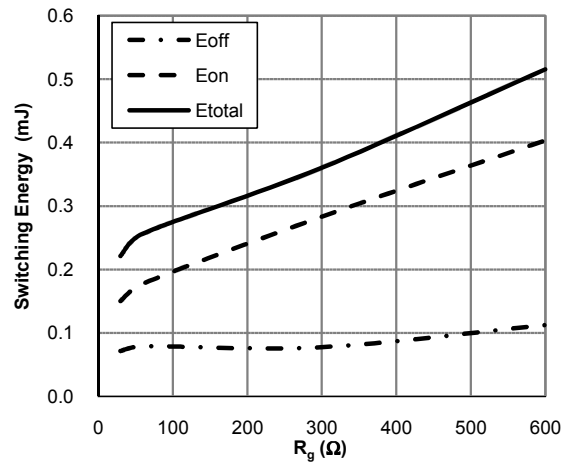


Figure 18: Switching Loss vs. R_g
($T_J=150^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=5\text{A}$)

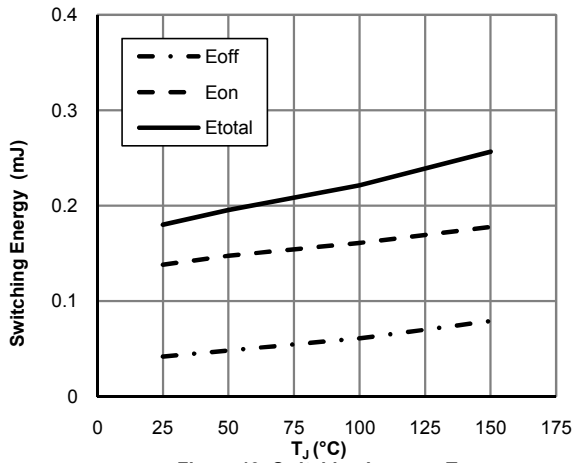


Figure 19: Switching Loss vs. T_J
($V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=5\text{A}, R_g=60\Omega$)

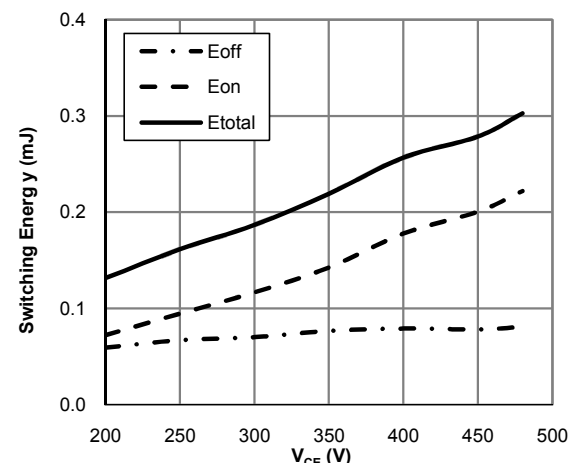


Figure 20: Switching Loss vs. V_{CE}
($T_J=150^\circ\text{C}, V_{GE}=15\text{V}, I_C=5\text{A}, R_g=60\Omega$)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

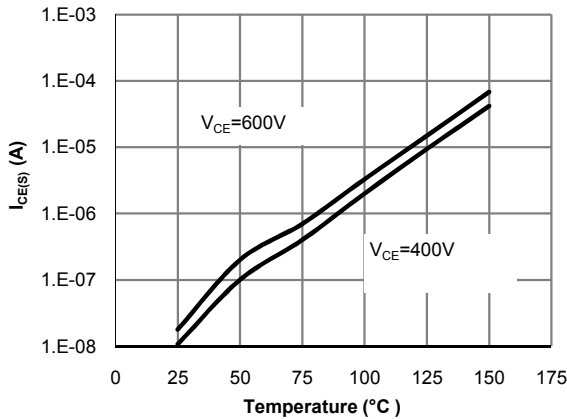


Fig 21: Reverse Leakage Current vs. Junction Temperature

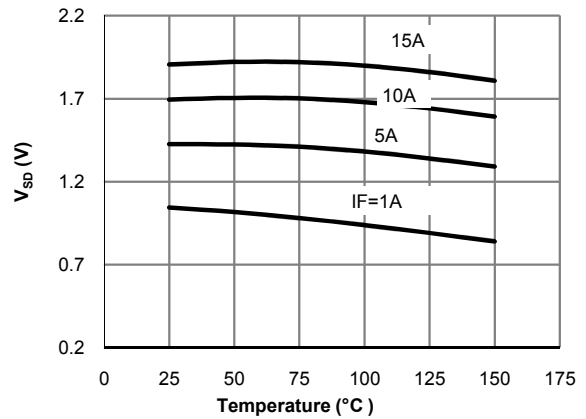


Fig 22: Diode Forward Voltage vs. Junction Temperature

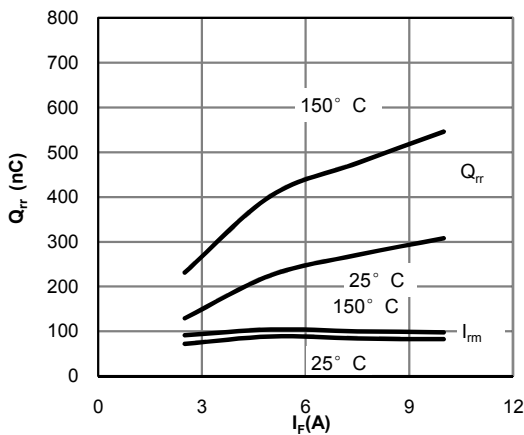


Fig 23: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

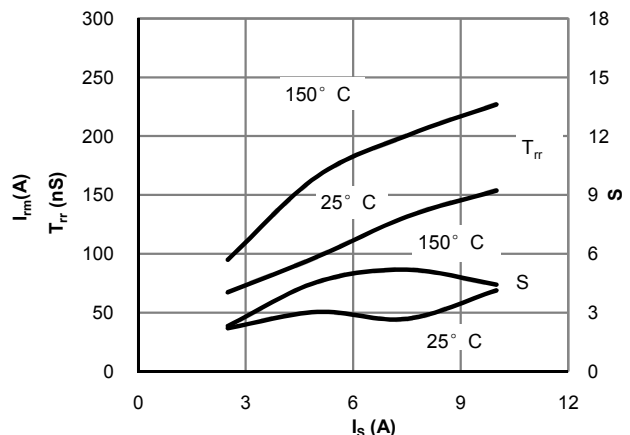


Fig 24: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

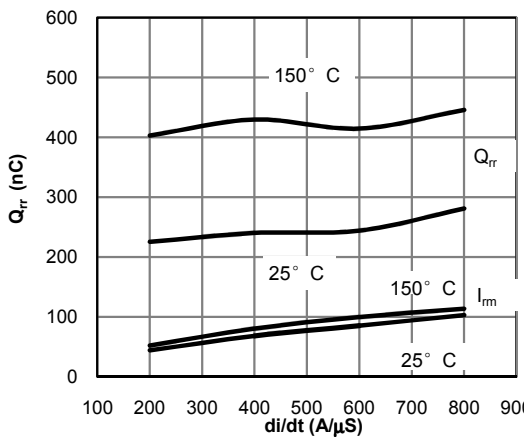


Fig 25: Diode Reverse Recovery Charge and Peak Current vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=5A$)

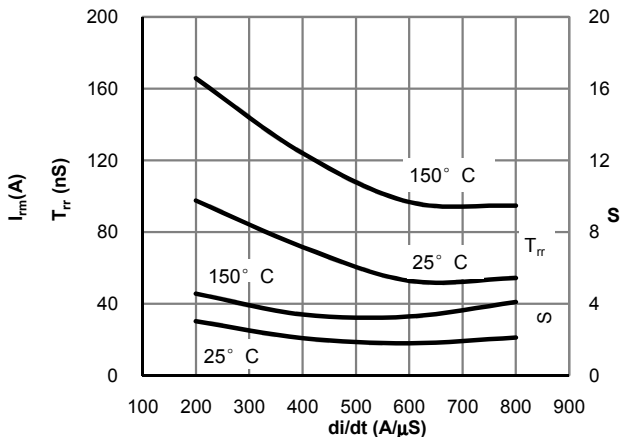


Fig 26: Diode Reverse Recovery Time and Softness Factor vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=5A$)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

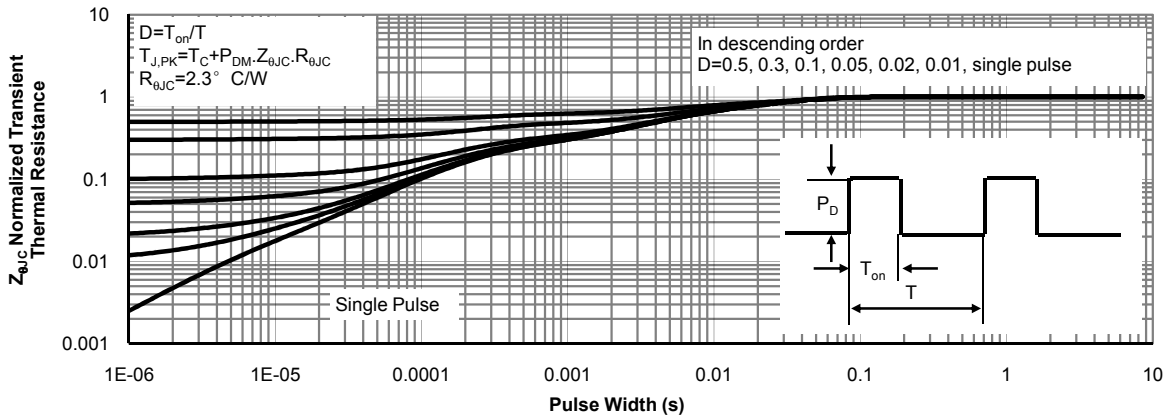


Figure 27: Normalized Maximum Transient Thermal Impedance for IGBT

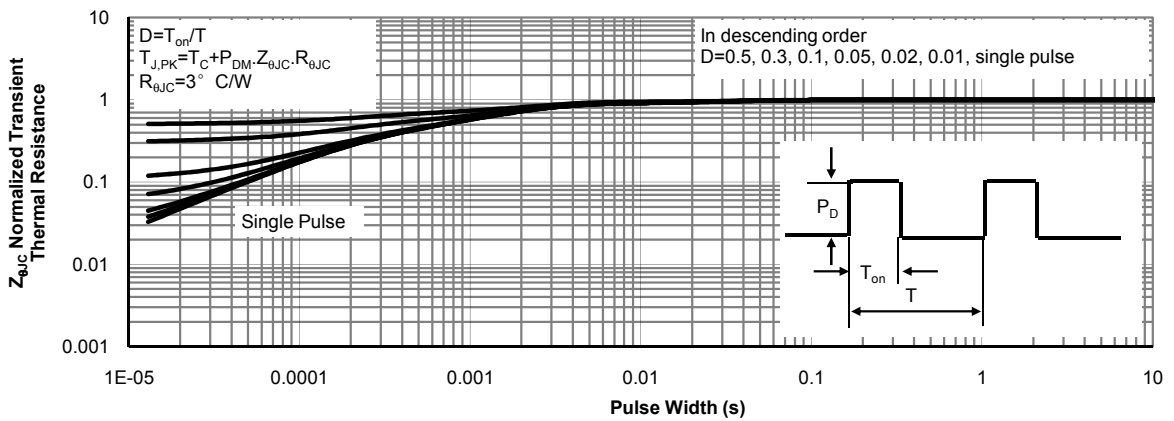
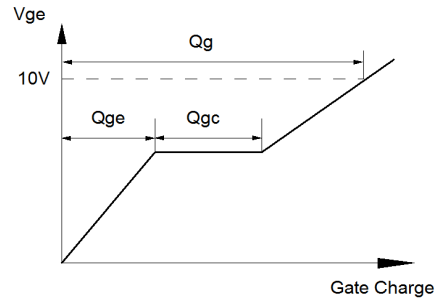
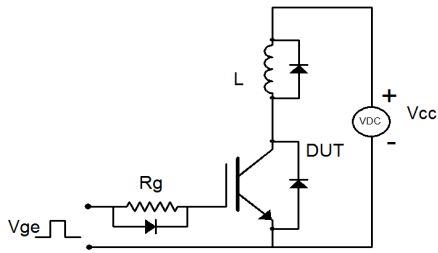
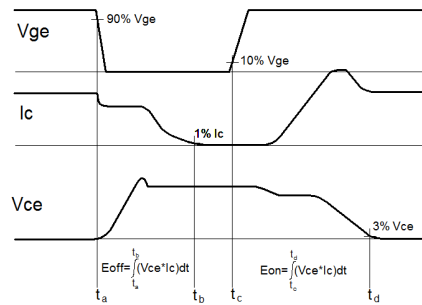
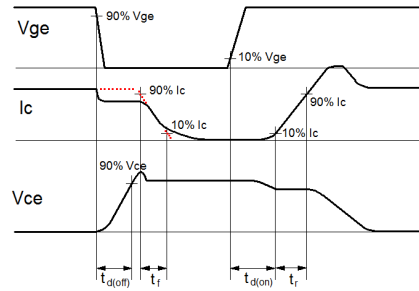
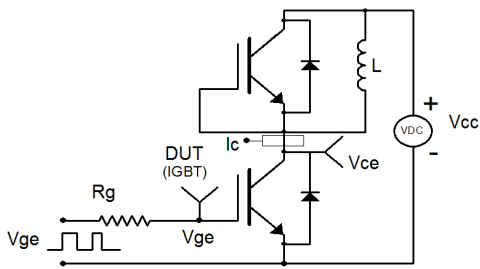


Figure 28: Normalized Maximum Transient Thermal Impedance for Diode

Gate Charge Test Circuit & Waveform



Inductive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

