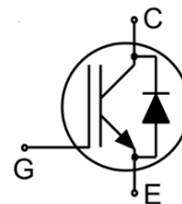
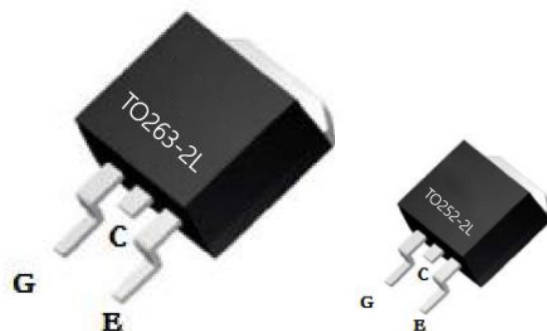


**Trench Field-Stop Technology IGBT**
**YZPST-6H60CX1G3**
**Features**

- 600V, 6A
- $V_{CE(sat)(typ.)} = 1.75V @ V_{GE}=15V, I_C=6A$
- Low  $Q_g$
- Maximum Junction Temperature 175°C
- Pb-free Lead Plating; RoHS Compliant


**Applications**

- Solar Converters
- Uninterrupted Power Supply
- Welding Converters
- Mid to High Range Switching Frequency Converters


**Key Performance and Package Parameters**

| Order codes | $V_{CE}$ | $I_C$ | $V_{CEsat}, T_{vj}=25^{\circ}C$ | $T_{vjmax}$ | Marking   | Package  |
|-------------|----------|-------|---------------------------------|-------------|-----------|----------|
| 60H060CX1R3 | 650V     | 6A    | 1.75V                           | 175°C       | 6H60CX1R3 | TO263-2L |
| 60H060CX1G3 | 650V     | 6A    | 1.75V                           | 175°C       | 6H60CX1G3 | TO252-2L |

**Absolute Maximum Ratings**

| Symbol    | Parameter   | Value      | Unit |
|-----------|---|------------|------|
| $V_{CES}$ | Collector-Emitter Voltage                           | 600        | V    |
| $V_{GES}$ | Gate-Emitter Voltage                                | $\pm 20$   | V    |
| $I_C$     | Continuous Collector Current ( $T_C=25^{\circ}C$ )  | 12         | A    |
|           | Continuous Collector Current ( $T_C=100^{\circ}C$ ) | 6          | A    |
| $I_{CM}$  | Pulsed Collector Current (Note 1)                   | 18         | A    |
| $P_D$     | Maximum Power Dissipation ( $T_C=25^{\circ}C$ )     | 89         | W    |
|           | Maximum Power Dissipation ( $T_C=100^{\circ}C$ )    | 44         | W    |
| $T_J$     | Operating Junction Temperature Range                | -40 to 175 | °C   |
| $T_{STG}$ | Storage Temperature Range                           | -55 to 150 | °C   |

**Thermal Data**

| Symbol          | Parameter                                      | Conditioins | Max. | Unit |
|-----------------|--|-------------|------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case for IGBT  |             | 1.68 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case for Diode |             | 2.6  | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient        | TO263-2L    | 62   | °C/W |
|                 |  | TO252-2L    | 80   | °C/W |

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

| Symbol        | Parameter                            | Conditions  | Min.   | Typ. | Max. | Unit    |    |
|---------------|--------------------------------------|---|--|------|------|---------|----|
| $BV_{CES}$    | Collector-Emitter Breakdown Voltage  | $V_{GE}=0V, I_c=200\mu A$   | 600  | ---  | ---  | V       |    |
| $I_{CES}$     | Collector-Emitter Leakage Current    | $V_{CE}=600V, V_{GE}=0V$  | ---  | ---  | 40   | $\mu A$ |    |
| $I_{GES}$     | 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               | $V_{GE}=V_{CE}, I_c=200\mu A$   | 3.2  | 3.9  | 4.8  | V       |    |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}=15V, I_c=6A, T_j=25^\circ\text{C}$  | ---  | 1.75 | 2.10 | V       |    |
|               |                                      | $V_{GE}=15V, I_c=6A, T_j=150^\circ\text{C}$   | ---  | 2.05 | ---  | V       |    |
| $Q_G$         | Total Gate Charge                    | $V_{CC}=400V$   | ---  | 11.5 | ---  | nC      |    |
| $Q_{GE}$      | Gate-Emitter Charge                  | $V_{GE}=15V$  | ---  | 3.5  | ---  | nC      |    |
| $Q_{GC}$      | Gate-Collector Charge                | $I_c=6A$  | ---  | 3.5  | ---  | nC      |    |
| $t_{d(on)}$   | Turn-on Delay Time                   | $V_{CC}=400V$<br>$V_{GE}=\pm 15V$<br>$I_c=6A$<br>$R_G=10\Omega$<br>Inductive Load<br>$T_C=25^\circ\text{C}$ | ---  | 12   | ---  | ns      |    |
| $t_r$         | Turn-on Rise Time                    |   | ---  | 6    | ---  | ns      |    |
| $t_{d(off)}$  | Turn-off Delay Time                  |   | ---  | 14   | ---  | ns      |    |
| $t_f$         | Turn-off Fall Time                   |   | ---  | 154  | ---  | ns      |    |
| $E_{on}$      | Turn-on Switching Loss               |   | ---  | 91   | ---  | $\mu J$ |    |
| $E_{off}$     | Turn-off Switching Loss              |   | ---  | 95   | ---  | $\mu J$ |    |
| $E_{ts}$      | Total Switching Loss                 |   | ---  | 186  | ---  | $\mu J$ |    |
| $t_{d(on)}$   | Turn-on Delay Time                   |   | $V_{CC}=400V$<br>$V_{GE}=\pm 15V$<br>$I_c=6A$<br>$R_G=10\Omega$<br>Inductive Load<br>$T_C=150^\circ\text{C}$ |      | 3    |         | ns |
| $t_r$         | Turn-on Rise Time                    |   |  |      | 6    |         | ns |
| $t_{d(off)}$  | Turn-off Delay Time                  |   |  |      | 18   |         | ns |
| $t_f$         | Turn-off Fall Time                   |   |  | 214  |      | ns      |    |
| $E_{on}$      | Turn-on Switching Loss               |   |  | 48   |      | $\mu J$ |    |
| $E_{off}$     | Turn-off Switching Loss              |   |  | 211  |      | $\mu J$ |    |
| $E_{ts}$      | Total Switching Loss                 |   |  | 259  |      | $\mu J$ |    |
| $C_{ies}$     | Input Capacitance                    | $V_{CE}=25V$  |  | ---  | 313  | ---     | pF |
| $C_{oes}$     | Output Capacitance                   | $V_{GE}=0V$   | ---  | 34   | ---  | pF      |    |
| $C_{res}$     | Reverse Transfer Capacitance         | $f=1\text{MHz}$   | ---  | 5    | ---  | pF      |    |
| SCSOA         | Short Circuit Safe Operation Area    | $V_{GE}=15V, V_{CC}\leq 400V,$<br>$T_{J,start}\leq 25^\circ\text{C}$  | 9  | ---  | ---  | $\mu S$ |    |

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

| Symbol   | Parameter                           | Conditions                                 | Min. | Typ. | Max. | Unit |
|----------|-------------------------------------|--|------|------|------|------|
| $V_F$    | Diode Forward Voltage               | $I_F=6\text{A}, T_j=25^\circ\text{C}$      | ---  | 1.37 | 2.10 | V    |
|          |                                     | $I_F=6\text{A}, T_j=150^\circ\text{C}$     | ---  | 1.20 |      | V    |
| $t_{rr}$ | Diode Reverse Recovery Time         | $V_R=400\text{V}$                          | ---  | 46.5 | ---  | ns   |
| $I_{rr}$ | Diode peak Reverse Recovery Current | $I_F=6\text{A}$<br>$di_F/dt=20\text{A/us}$ | ---  | 0.35 | ---  | A    |
| $Q_{rr}$ | Diode Reverse Recovery Charge       | $T_C=25^\circ\text{C}$                     | ---  | 8.5  | ---  | nC   |
| $t_{rr}$ | Diode Reverse Recovery Time         | $V_R=400\text{V}$                          | ---  | 230  | ---  | ns   |
| $I_{rr}$ | Diode peak Reverse Recovery Current | $I_F=6\text{A}$<br>$di_F/dt=20\text{A/us}$ | ---  | 1    | ---  | A    |
| $Q_{rr}$ | Diode Reverse Recovery Charge       | $T_C=150^\circ\text{C}$                    | ---  | 115  | ---  | uC   |

Note1: Repetitive rating, pulse width limited by maximum junction temperature

Typical Characteristics

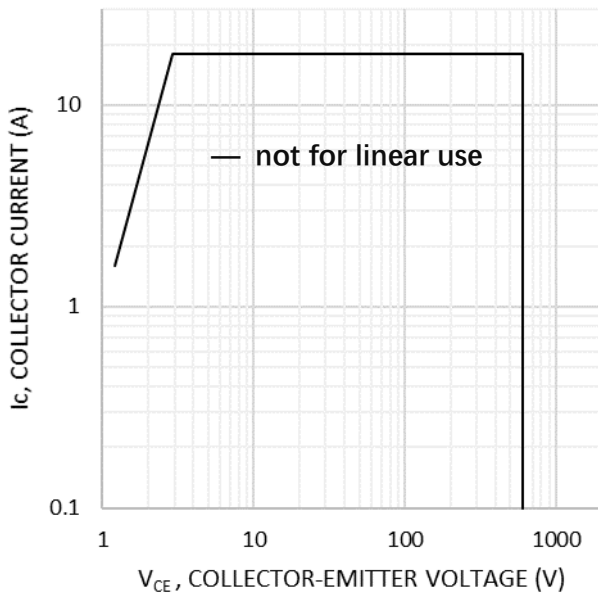


Fig. 1 Forward bias safe operating area (D=0,  $T_c=25^\circ\text{C}$ ,  $T_{vj}\leq 175^\circ\text{C}$ ;  $V_{GE}=15\text{V}$ )

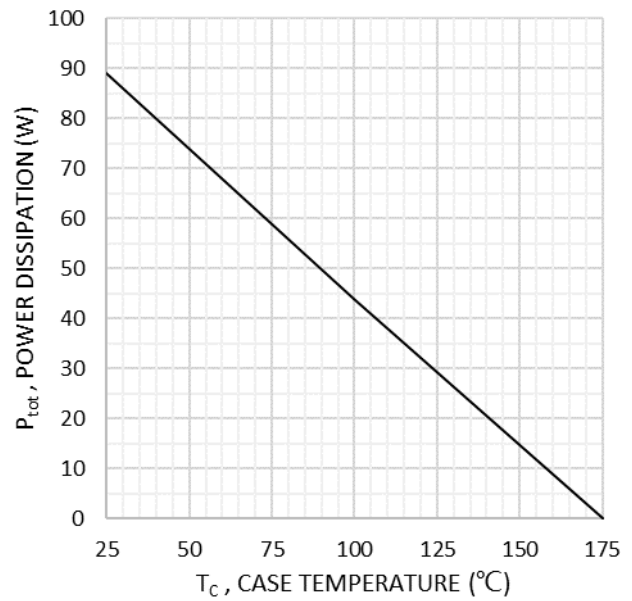


Fig. 2 Power dissipation as a function of case temperature ( $T_{vj}\leq 175^\circ\text{C}$ )

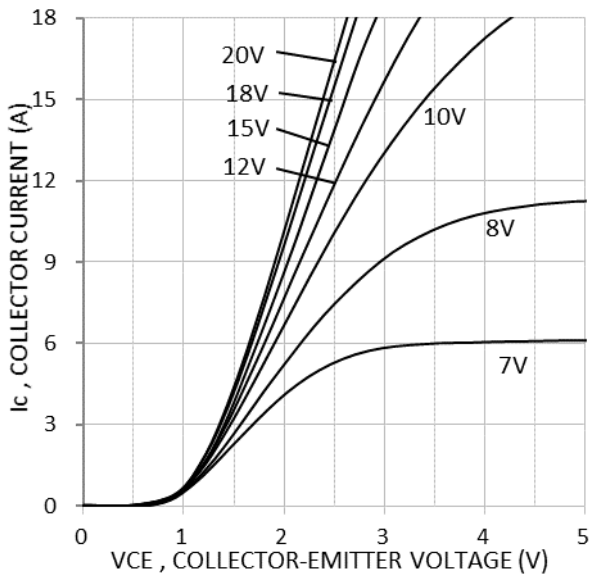


Fig. 3 Typical output characteristic ( $T_{vj}=25^\circ\text{C}$ )

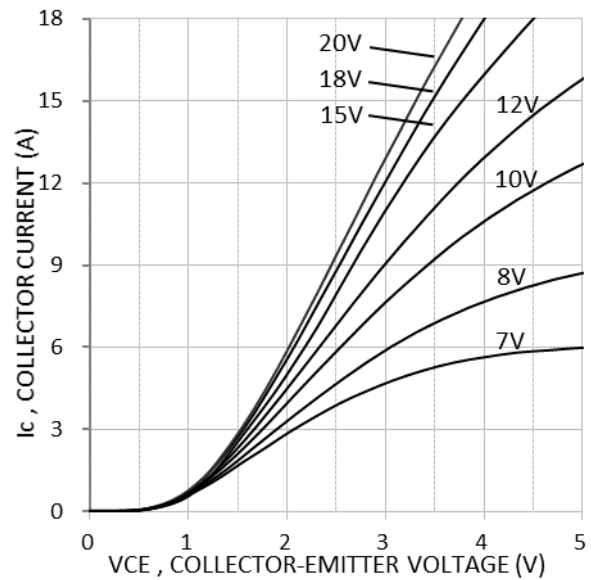


Fig. 4 Typical output characteristic ( $T_{vj}=150^\circ\text{C}$ )

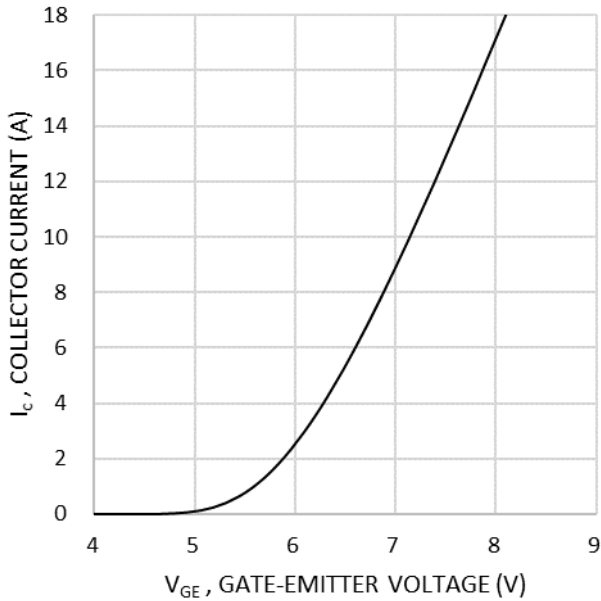


Fig. 5 Typical transfer characteristics ( $V_{CE}=10V$ )

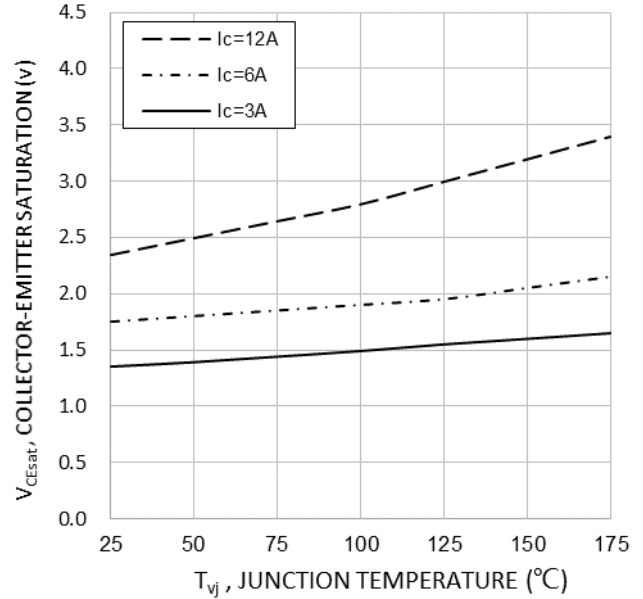


Fig. 6 Typical collector-emitter saturation voltage as a function of junction temperature ( $V_{GE}=15V$ )

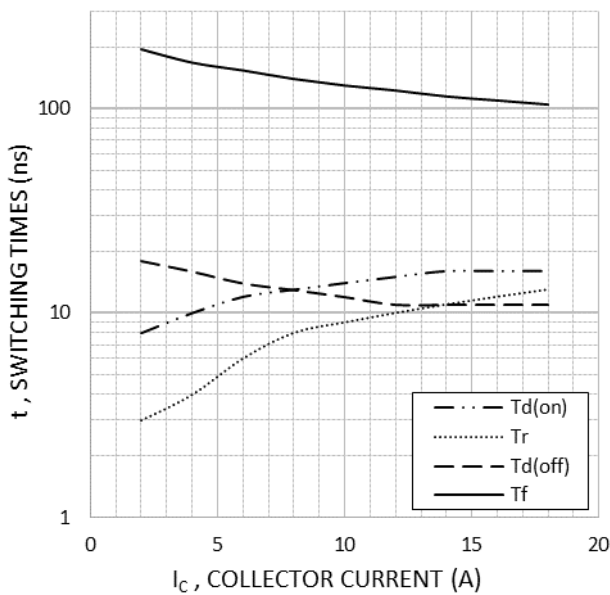


Fig. 7 Typical switching times as a function of collector current (inductive load,  $T_{yj}=25^{\circ}C$ ,  $V_{CE}=400V$ ,  $V_{GE}=15/0V$ ,  $r_G=10\Omega$ )

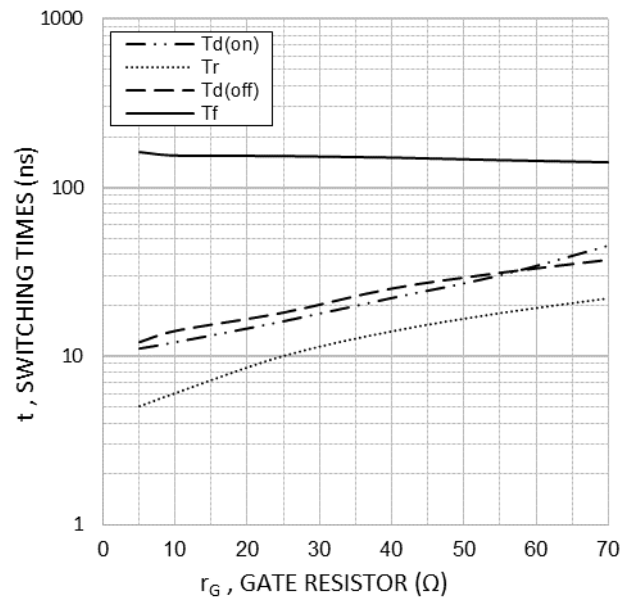


Fig. 8 Typical switching times as a function of gate resistor (inductive load,  $T_{yj}=25^{\circ}C$ ,  $V_{CE}=400V$ ,  $V_{GE}=15/0V$ ,  $I_C=6A$ )

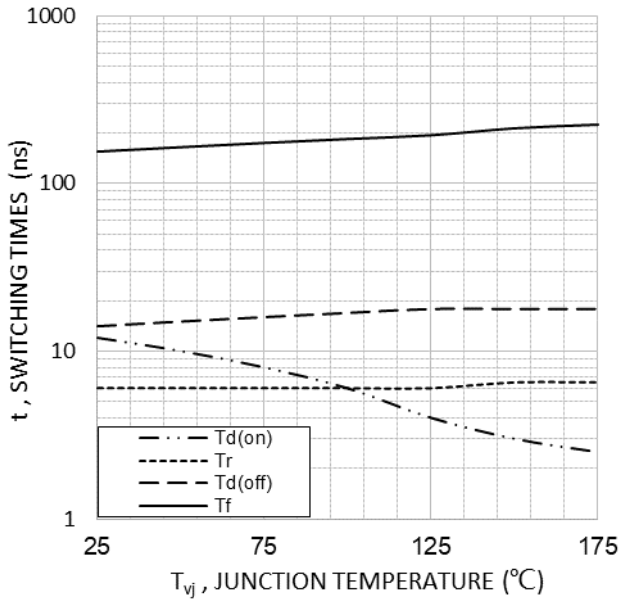


Fig. 9 Typical switching times as a function of junction temperature (inductive load,  $V_{CE}=400V$ ,  $V_{GE}=15/0V$ ,  $I_C=6A$ ,  $r_G=10\Omega$ )

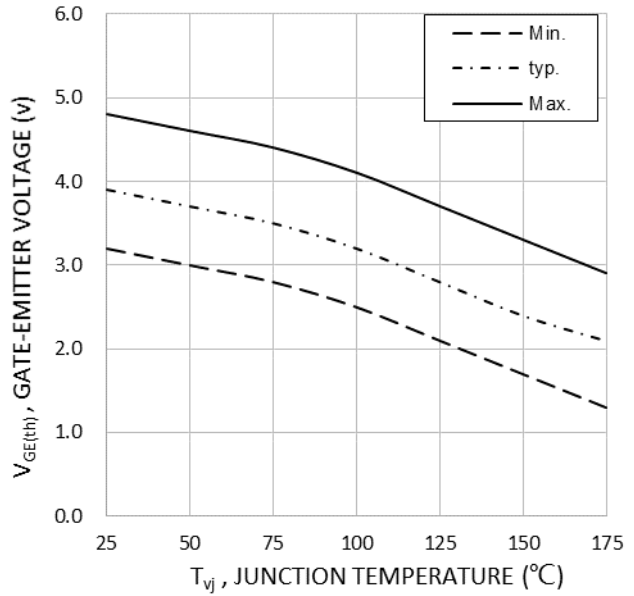


Fig. 10 Gate-emitter threshold voltage as a function of junction temperature ( $I_C=0.2mA$ )

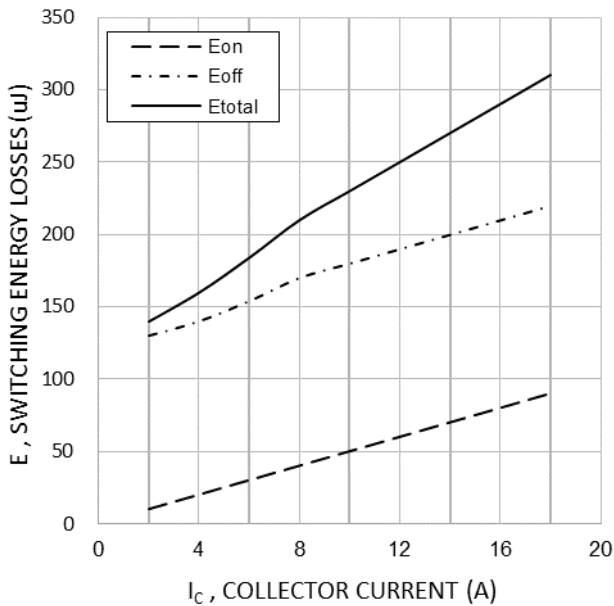


Fig. 11 Typical switching energy losses as a function of collector current (inductive load,  $T_{vj}=25^\circ C$ ,  $V_{CE}=400V$ ,  $V_{GE}=15/0V$ ,  $r_G=10\Omega$ )

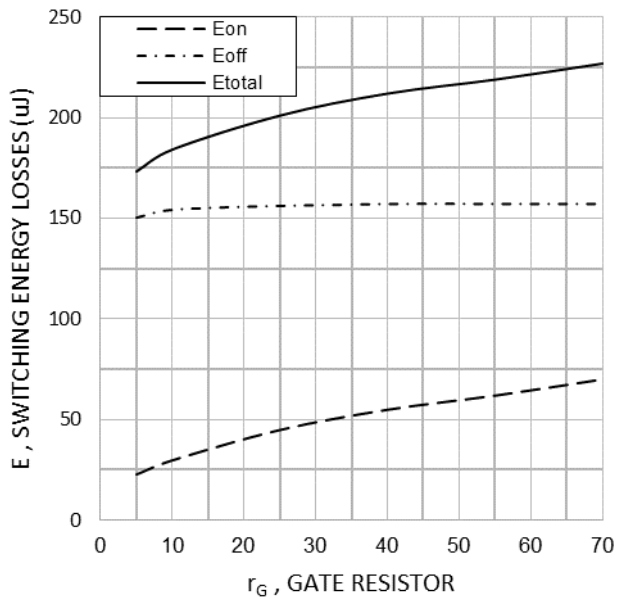


Fig. 12 Typical switching energy losses as a function of gate resistor (inductive load,  $T_{vj}=25^\circ C$ ,  $V_{CE}=400V$ ,  $V_{GE}=15/0V$ ,  $I_C=6A$ )



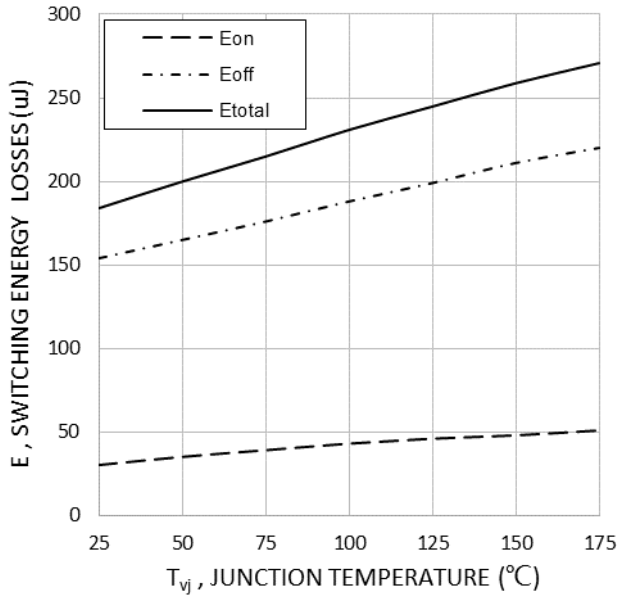


Fig. 13 Typical switching energy losses as a function of junction temperature (inductive load,  $V_{CE}=600V$ ,  $V_{GE}=15/0V$ ,  $I_C=50A$ ,  $r_G=10\Omega$ )

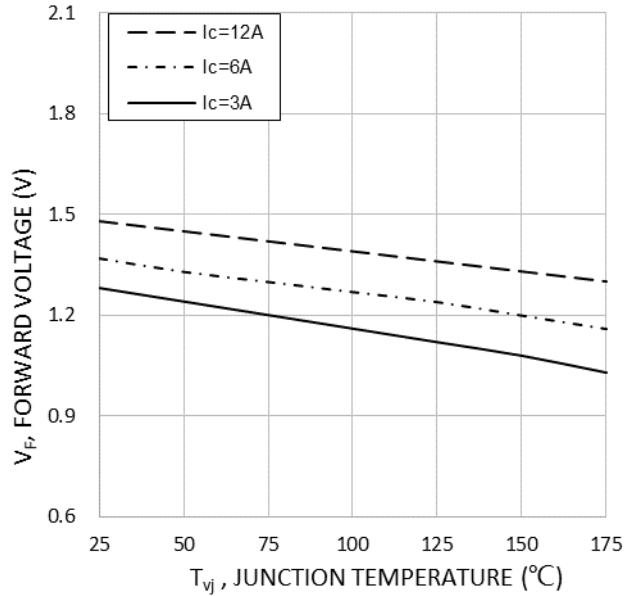


Fig. 14 Typical diode forward voltage as a function of junction temperature

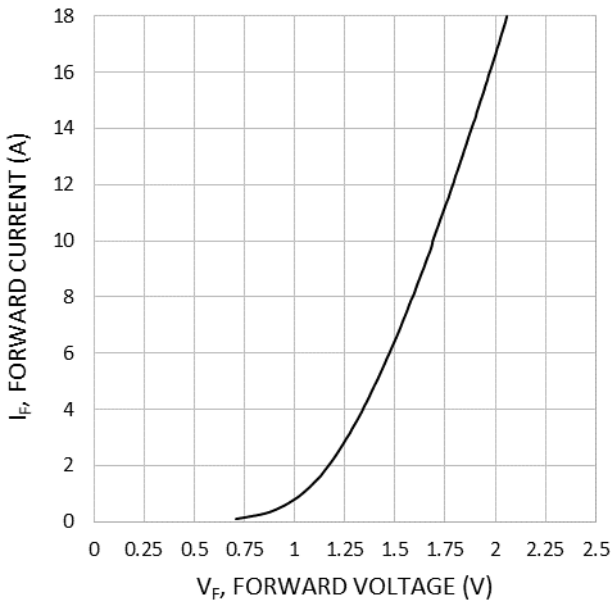


Fig. 15 Typical diode forward current as a function of forward voltage

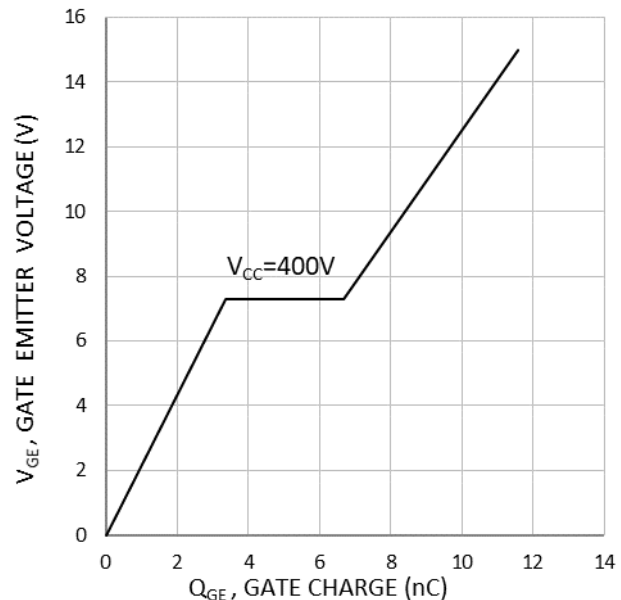


Fig. 16 Typical gate charge ( $I_C=6A$ )

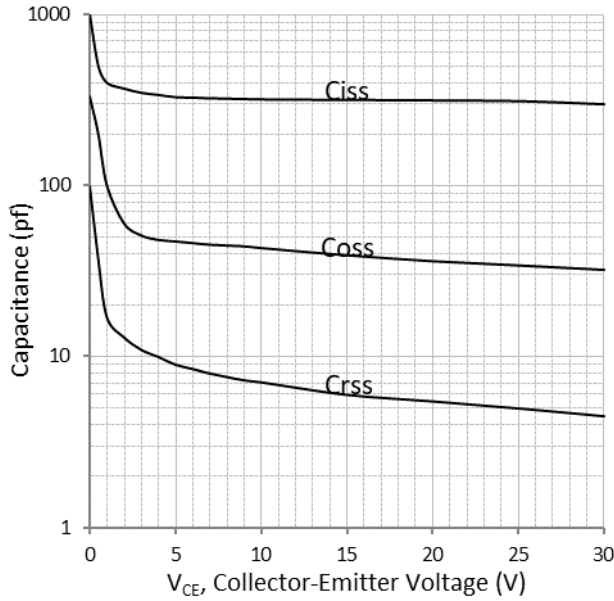


Fig. 17 Typical capacitance as a function of collector-emitter voltage ( $V_{GE}=0V$ ,  $f=1MHz$ )

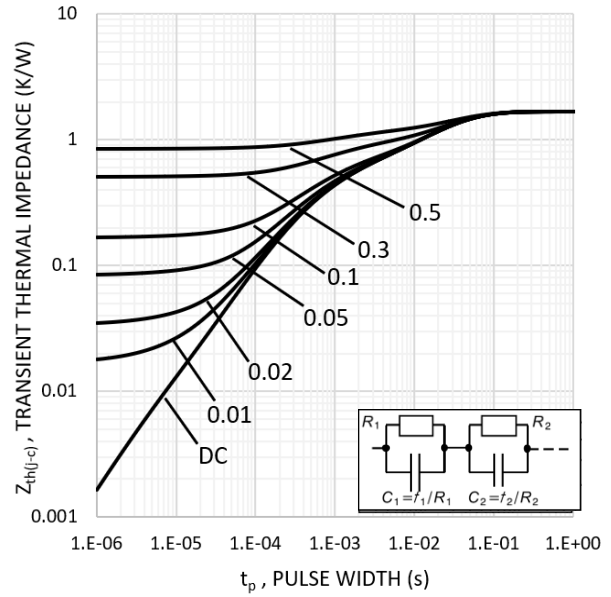


Fig. 18 IGBT transient thermal impedance ( $D=t_p/T$ )

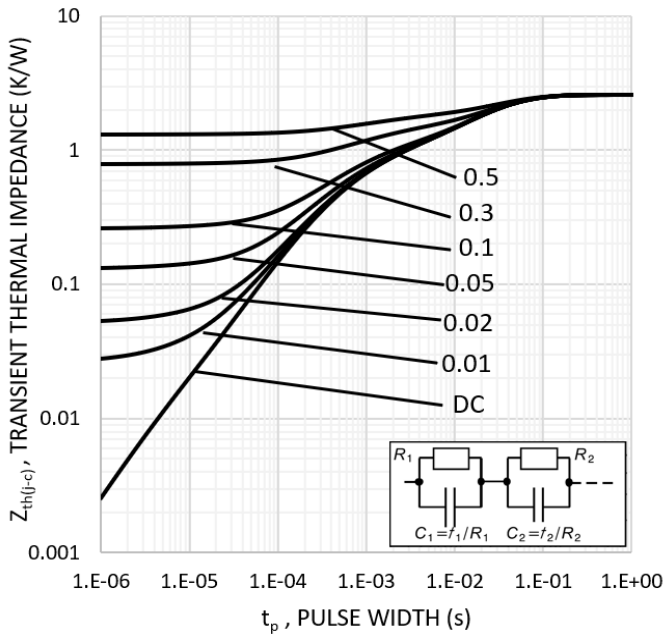
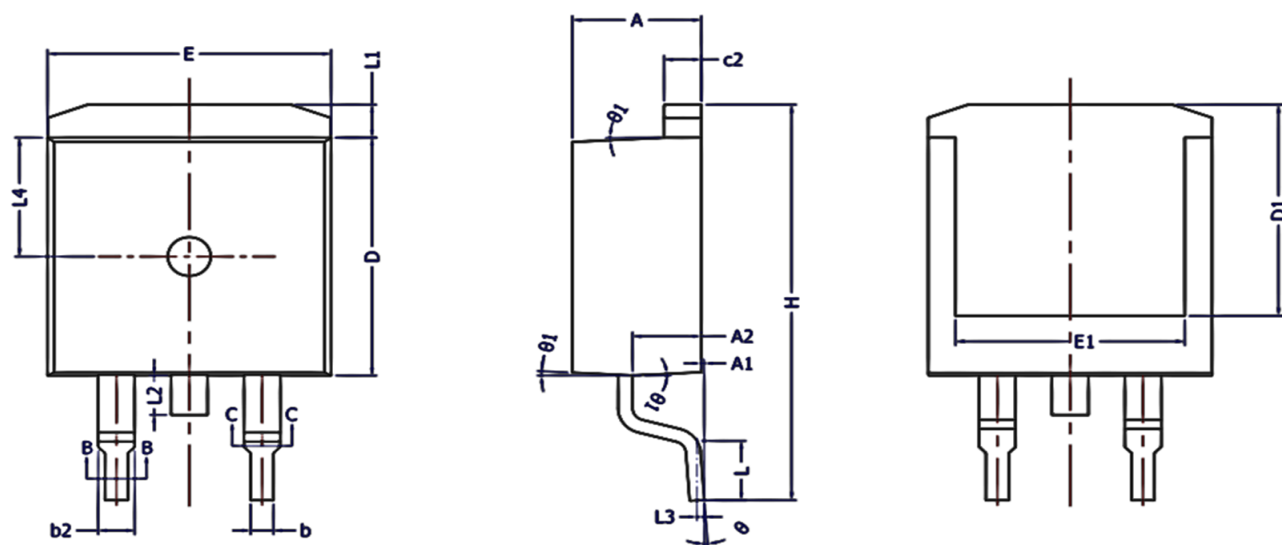


Fig. 19 FRD transient thermal impedance ( $D=t_p/T$ )



**Package Information**

TO-263-2L


**COMMON DIMENSIONS  
(UNITS OF MEASURE =MILLIMETER)**

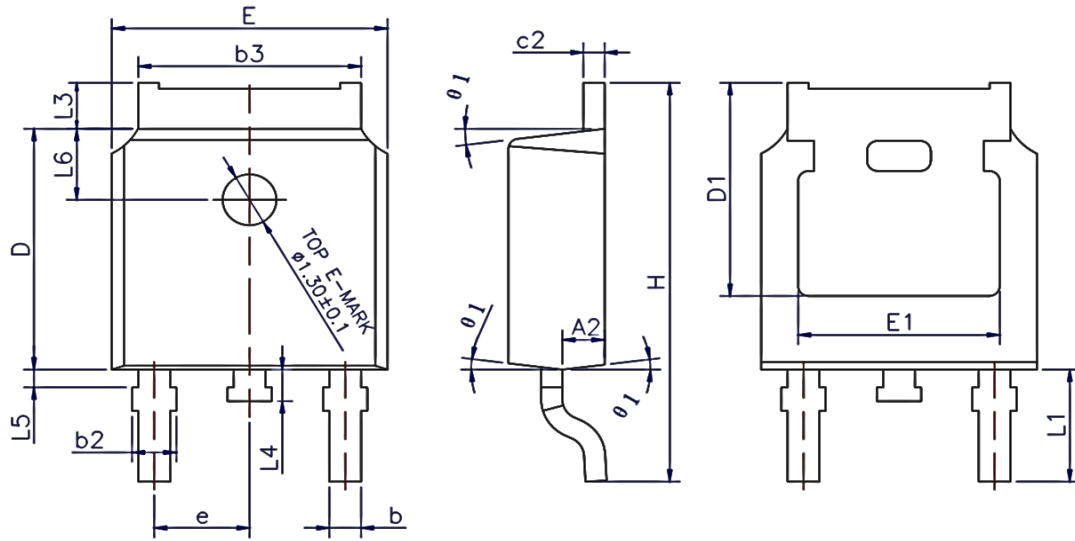
| SYMBOL | MIN      | NOM   | MAX   |
|--------|----------|-------|-------|
| A      | 4.40     | 4.50  | 4.60  |
| A1     | 0        | 0.10  | 0.25  |
| A2     | 2.20     | 2.40  | 2.60  |
| b      | 0.76     | ---   | 0.89  |
| b1     | 0.75     | 0.80  | 0.85  |
| b2     | 1.23     | ---   | 1.37  |
| b3     | 1.22     | 1.27  | 1.32  |
| c      | 0.47     | ---   | 0.60  |
| c1     | 0.46     | 0.51  | 0.56  |
| c2     | 1.25     | 1.30  | 1.35  |
| D      | 9.10     | 9.20  | 9.30  |
| D1     | 8.00     | ---   | ---   |
| E      | 9.80     | 9.90  | 10.00 |
| E1     | 7.80     | ---   | ---   |
| e      | 2.54 BSC |       |       |
| H      | 14.90    | 15.30 | 15.70 |
| L      | 2.00     | 2.30  | 2.60  |
| L1     | 1.17     | 1.27  | 1.40  |
| L2     | ---      | ---   | 1.75  |
| L3     | 0.25BSC  |       |       |
| L4     | 4.60 REF |       |       |
| θ      | 0°       | ---   | 8°    |
| θ1     | 1°       | 3°    | 5°    |

**NOTES:**

 ALL DIMENSIONS REFER TO JEDEC STANDARD TO-263 AB  
 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

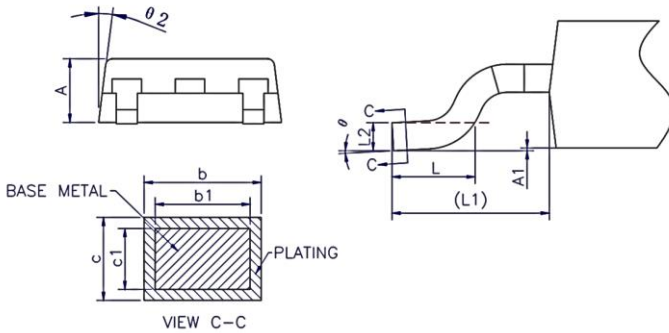
**Package Information**

TO-252-2L



**COMMON DIMENSIONS  
(UNITS OF MEASURE =MILLIMETER)**

| SYMBOL | MIN       | NOM   | MAX   |
|--------|-----------|-------|-------|
| A      | 2.20      | 2.30  | 2.38  |
| A1     | 0         | ---   | 0.10  |
| A2     | 0.90      | 1.01  | 1.10  |
| b      | 0.72      | ---   | 0.85  |
| b1     | 0.71      | 0.76  | 0.81  |
| b2     | 0.72      | ---   | 0.90  |
| b3     | 5.13      | 5.33  | 5.46  |
| c      | 0.47      | ---   | 0.60  |
| c1     | 0.46      | 0.51  | 0.56  |
| c2     | 0.47      | ---   | 0.60  |
| D      | 6.00      | 6.10  | 6.20  |
| D1     | 5.25      | ---   | ---   |
| E      | 6.50      | 6.60  | 6.70  |
| E1     | 4.70      | ---   | ---   |
| e      | 2.186     | 2.286 | 2.386 |
| H      | 9.80      | 10.10 | 10.40 |
| L      | 1.40      | 1.50  | 1.70  |
| L1     | 2.90 REF  |       |       |
| L2     | 0.508 BSC |       |       |
| L3     | 0.90      | ---   | 1.25  |
| L4     | 0.60      | 0.80  | 1.00  |
| L5     | 0.15      | ---   | 0.75  |
| L6     | 1.80 REF  |       |       |
| θ      | 0°        | ---   | 8°    |
| θ1     | 5°        | 7°    | 9°    |
| θ2     | 5°        | 7°    | 9°    |



**NOTES:**  
ALL DIMENSIONS REFER TO JEDEC STANDARD  
TO-252 AA DO NOT INCLUDE MOLD FLASH OR  
PROTRUSIONS

**Revision History**

| Ver. | Date       | Change Notice |
|------|------------|---------------|
| 1.0  | 2021/06/30 | Released      |

