



STGP7NB60HD STGP7NB60HDFP

N-CHANNEL 7A - 600V TO-220/FP PowerMESH™ IGBT

| TYPE | V _{CES} | V _{CE(sat)} | I _C |
|---------------|------------------|----------------------|----------------|
| STGP7NB60HD | 600 V | < 2.8 V | 7 A |
| STGP7NB60HDFP | 600 V | < 2.8 V | 7 A |

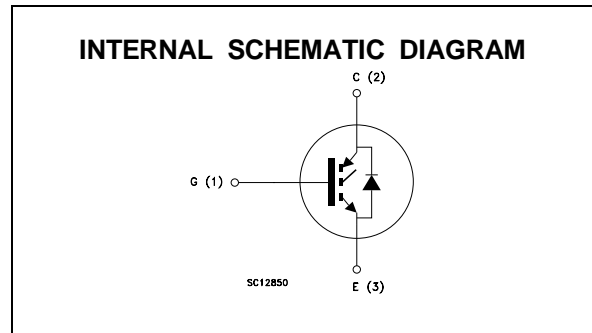
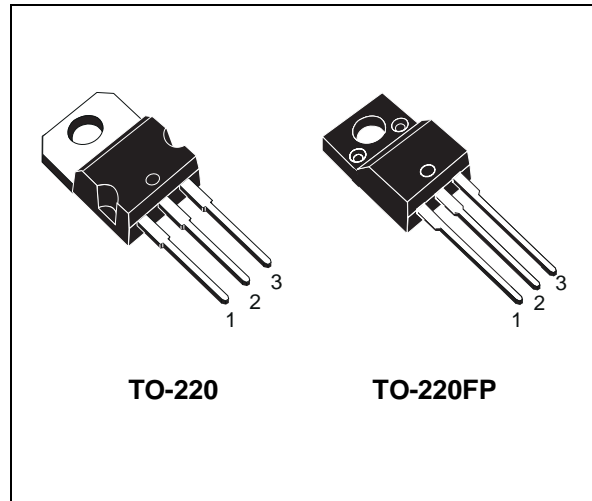
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{cesat})
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "H" identifies a family optimized to achieve very low switching times for high frequency applications (<120kHz).

APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---------------------|---|-------------|---------------|------|
| | | STGP7NB60HD | STGP7NB60HDFP | |
| V _{CES} | Collector-Emitter Voltage (V _{GS} = 0) | 600 | 600 | V |
| V _{GE} | Gate-Emitter Voltage | ± 20 | ± 20 | V |
| I _C | Collector Current (continuous) at T _c = 25 °C | 14 | 13 | A |
| I _C | Collector Current (continuous) at T _c = 100 °C | 7 | 6 | A |
| I _{CM} (●) | Collector Current (pulsed) | 56 | 56 | A |
| P _{tot} | Total Dissipation at T _c = 25 °C | 80 | 35 | W |
| | Derating Factor | 0.64 | 0.28 | W/°C |
| T _{stg} | Storage Temperature | -65 to 150 | | °C |
| T _j | Max. Operating Junction Temperature | 150 | | °C |

(●) Pulse width limited by safe operating area

STGP7NB60HD/FP

THERMAL DATA

| | | | TO-220 | TO-220FP | |
|-----------------------|-------------------------------------|-----|--------|----------|------|
| R _{thj-case} | Thermal Resistance Junction-case | Max | 1.56 | 3.57 | °C/W |
| R _{thj-amb} | Thermal Resistance Junction-ambient | Max | 62.5 | | °C/W |
| R _{thc-sink} | Thermal Resistance Case-sink | Typ | 0.5 | | °C/W |

ELECTRICAL CHARACTERISTICS (T_j = 25 °C unless otherwise specified)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|--|---|------|------|-------------|----------|
| V _{BR(CES)} | Collector-Emitter Breakdown Voltage | I _C = 250 μA V _{GE} = 0 | 600 | | | V |
| I _{CES} | Collector cut-off (V _{GE} = 0) | V _{CE} = Max Rating T _j = 25 °C V _{CE} = Max Rating T _j = 125 °C | | | 250 2000 | μA μA |
| I _{GES} | Gate-Emitter Leakage Current (V _{CE} = 0) | V _{GE} = ± 20 V V _{CE} = 0 | | | ± 100 | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|--------------------------------------|--|------|------------|------|--------|
| V _{GE(th)} | Gate Threshold Voltage | V _{CE} = V _{GE} I _C = 250 μA | 3 | | 5 | V |
| V _{CE(SAT)} | Collector-Emitter Saturation Voltage | V _{GE} = 15 V I _C = 7 A V _{GE} = 15 V I _C = 7 A T _j = 125 °C | | 2.3 1.9 | 2.8 | V V |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|---|---|-----------------|-------------------|-----------------|----------------|
| g _{fs} | Forward Transconductance | V _{CE} = 25 V I _C = 7 A | 3.5 | 5 | | S |
| C _{ies} C _{oes} C _{res} | Input Capacitance Output Capacitance Reverse Transfer Capacitance | V _{CE} = 25 V f = 1 MHz V _{GE} = 0 | 390 45 10 | 560 68 15 | 730 90 20 | pF pF pF |
| Q _G Q _{GE} Q _{GC} | Total Gate Charge Gate-Emitter Charge Gate-Collector Charge | V _{CE} = 480 V I _C = 7 A V _{GE} = 15 V | | 42 7.9 17.6 | 55 | nC nC nC |
| I _{CL} | Latching Current | V _{clamp} = 480 V R _G = 10 Ω T _j = 150 °C | 28 | | | A |

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|--------------------------|--|------|----------|------|----------|
| t _{d(on)} t _r | Delay Time Rise Time | V _{CC} = 480 V I _C = 7 A V _{GE} = 15 V R _G = 10 Ω | | 15 48 | | ns ns |
| (di/dt) _{on} | Turn-on Current Slope | V _{CC} = 480 V I _C = 7 A R _G = 10 Ω V _{GE} = 15 V | | 160 | | A/μs |
| E _{on(∅)} | Turn-on Switching Losses | T _j = 125 °C | | 185 | | μJ |

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

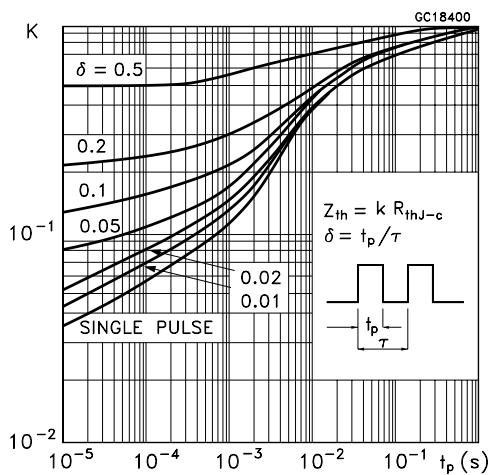
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------|---|------|------|------|---------------|
| t_c | Cross-Over Time | $V_{CC} = 480\text{ V}$ $R_{GE} = 10\ \Omega$ $I_C = 7\text{ A}$ $V_{GE} = 15\text{ V}$ | | 85 | | ns |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 20 | | ns |
| $t_{d(off)}$ | Delay Time | | | 75 | | ns |
| t_f | Fall Time | | | 70 | | ns |
| $E_{off(**)}$ | Turn-off Switching Loss | | | | 85 | |
| $E_{ts(\circ)}$ | Total Switching Loss | | | 235 | | μJ |
| t_c | Cross-Over Time | $V_{CC} = 480\text{ V}$ $R_{GE} = 10\ \Omega$ $T_j = 125\text{ }^\circ\text{C}$ $I_C = 7\text{ A}$ $V_{GE} = 15\text{ V}$ | | 150 | | ns |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 50 | | ns |
| $t_{d(off)}$ | Delay Time | | | 110 | | ns |
| t_f | Fall Time | | | 110 | | ns |
| $E_{off(**)}$ | Turn-off Switching Loss | | | | 220 | |
| $E_{ts(\circ)}$ | Total Switching Loss | | | 405 | | μJ |

COLLECTOR-EMITTER DIODE

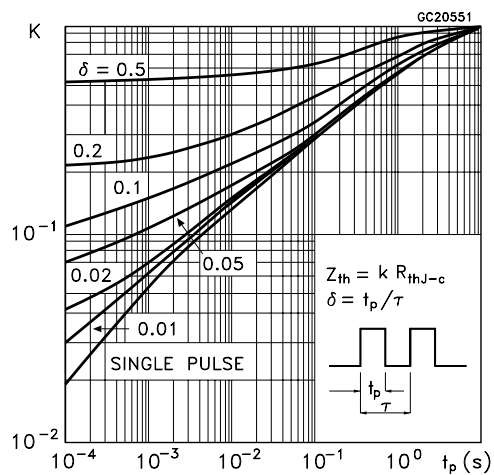
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------------|------|--------|
| I_f | Forward Current | | | | 7 | A |
| I_{fm} | Forward Current pulsed | | | | 56 | A |
| V_f | Forward On-Voltage | $I_f = 7\text{ A}$ $I_f = 7\text{ A}$ $T_j = 125\text{ }^\circ\text{C}$ | | 1.6 1.4 | 2.0 | V V |
| t_{rr} | Reverse Recovery Time | $I_f = 7\text{ A}$ $dI/dt = 100\text{ A}/\mu\text{S}$ $V_R = 200\text{ V}$ $T_j = 125\text{ }^\circ\text{C}$ | | 100 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | 180 | | nC |
| I_{rrm} | Reverse Recovery Current | | | 3.6 | | A |

- (●) Pulse width limited by max. junction temperature
- (○) Include recovery losses on the STTA506 freewheeling diode
- (*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
- (**) Losses Include Also The Tail (Jedec Standardization)

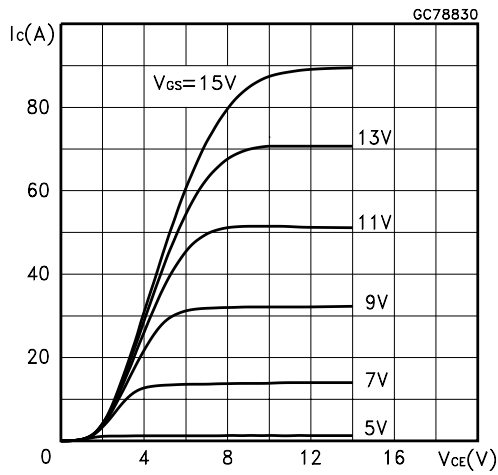
Thermal Impedance For TO-220



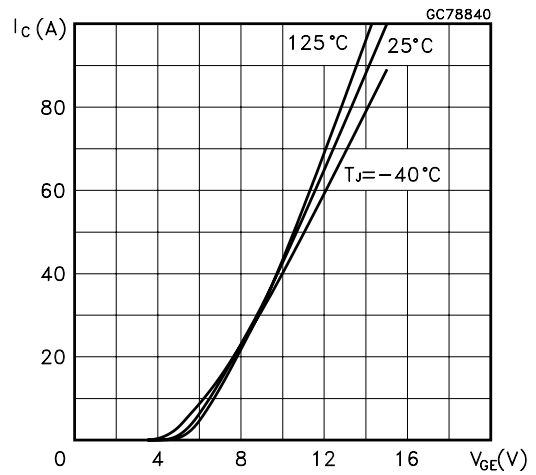
Thermal Impedance For TO-220FP



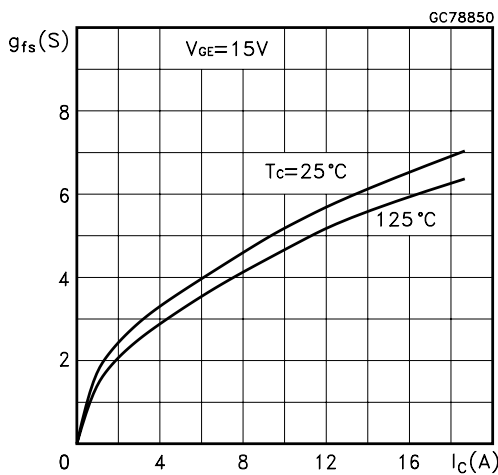
Output Characteristics



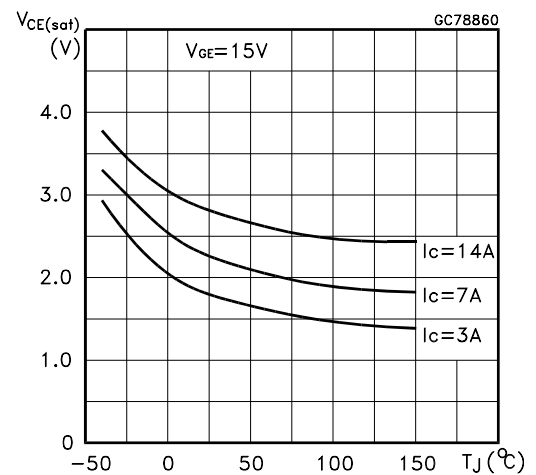
Transfer Characteristics



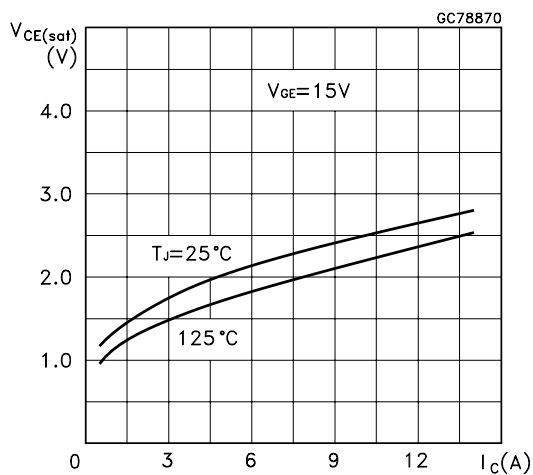
Transconductance



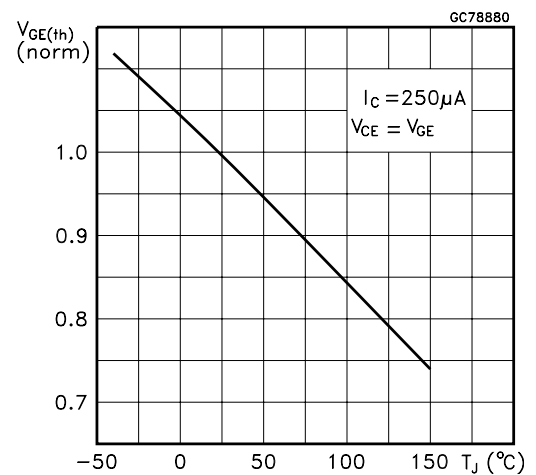
Collector-Emitter On Voltage vs Temperature



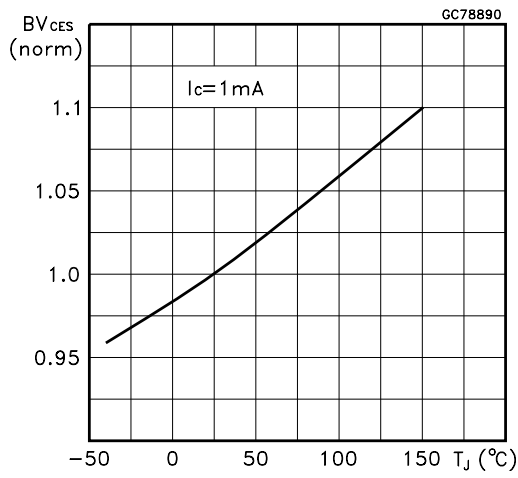
Collector-Emitter On Voltage vs Collector Current



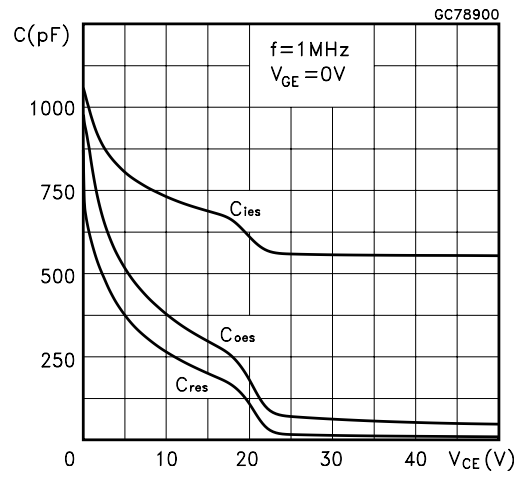
Gate Threshold vs Temperature



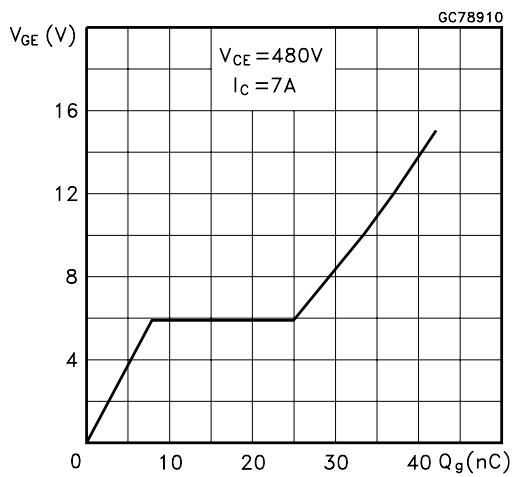
Normalized Breakdown Voltage vs Temperature



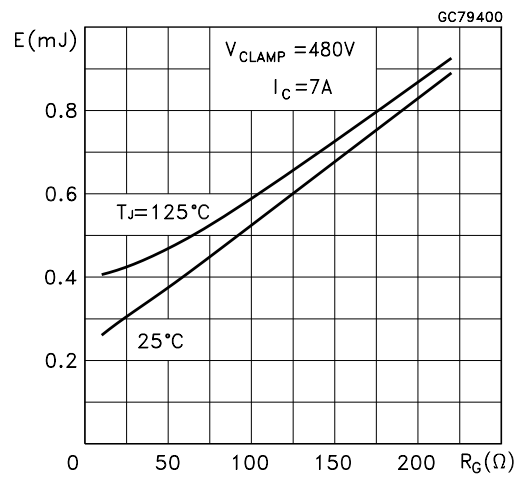
Capacitance Variations



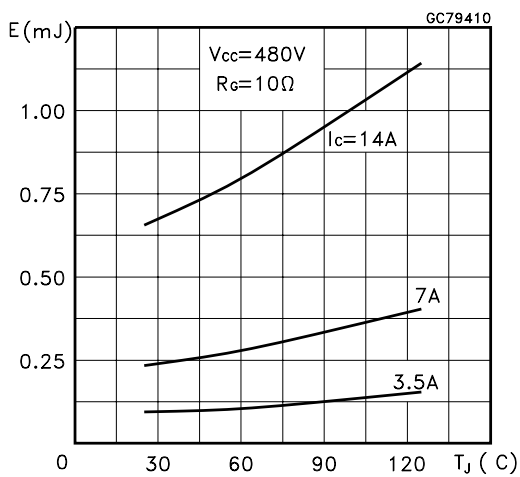
Gate Charge vs Gate-Emitter Voltage



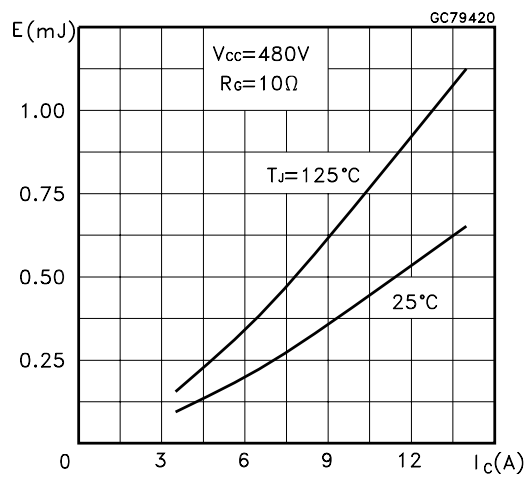
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature

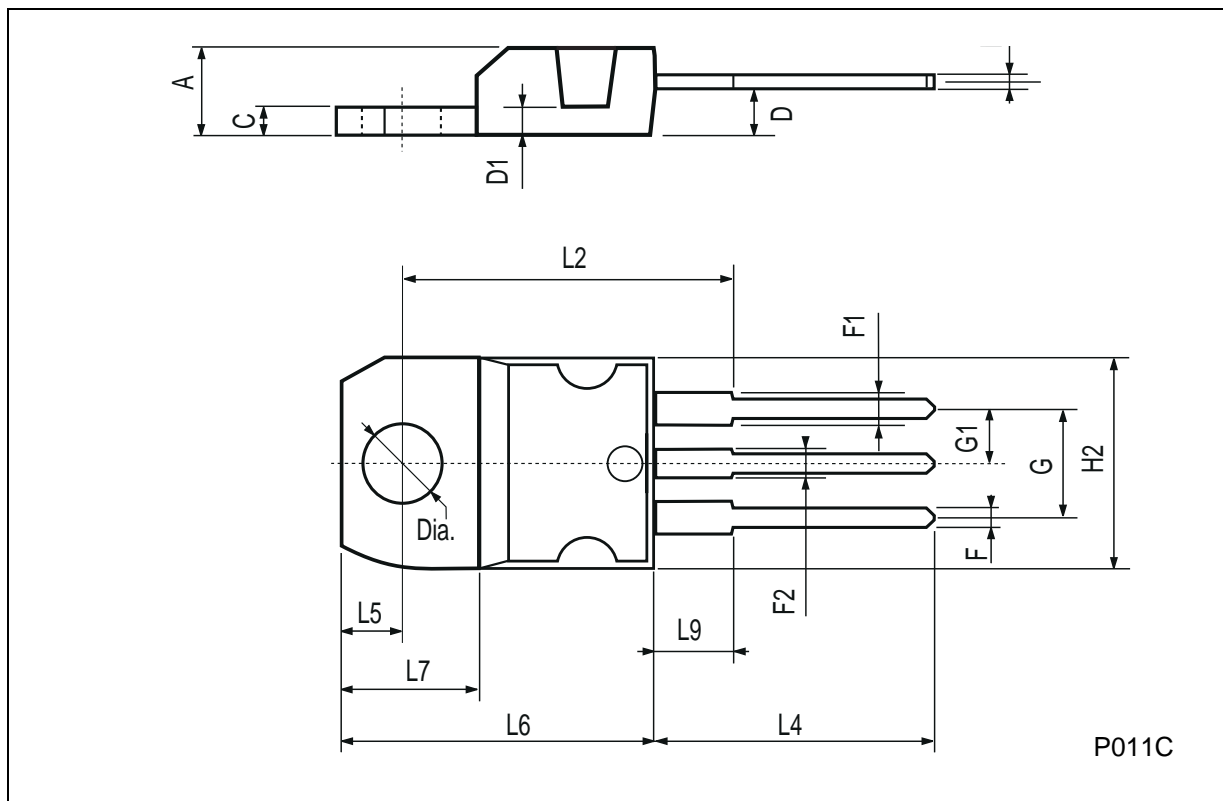


Total Switching Losses vs Collector Current



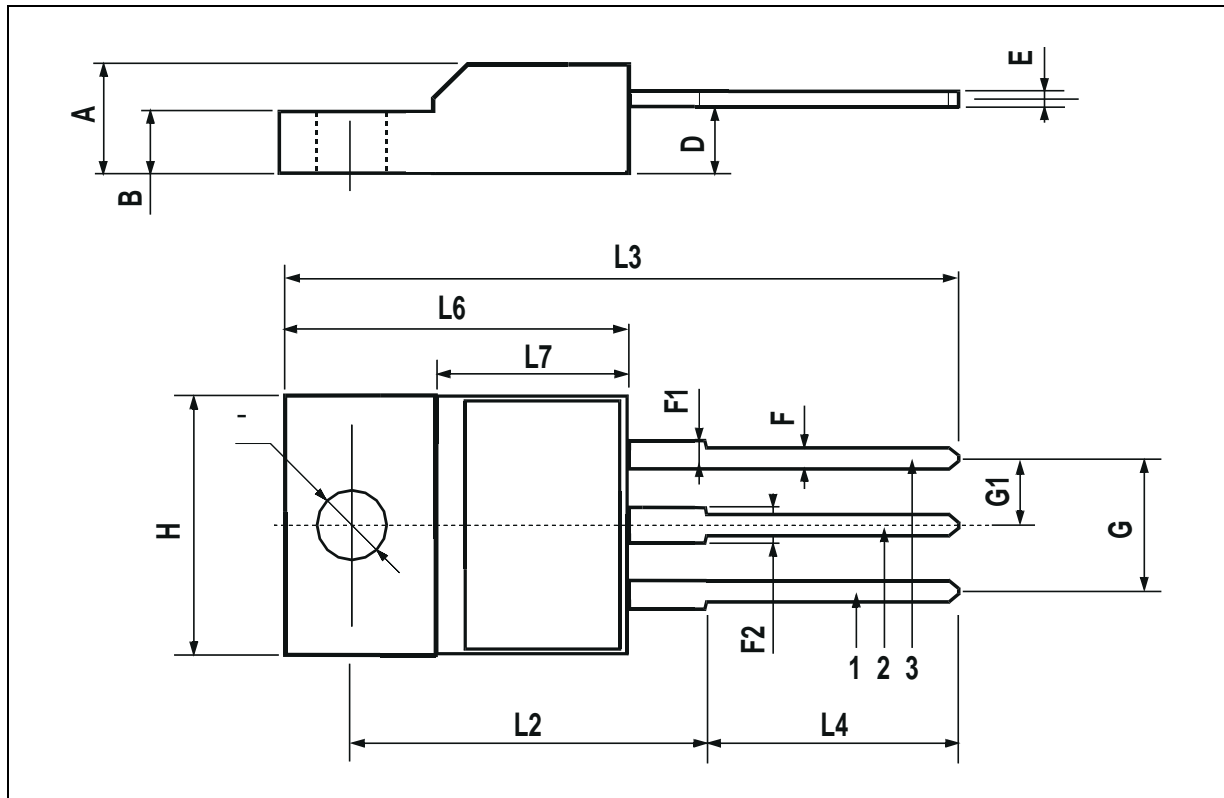
TO-220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| L9 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |



TO-220FP MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| B | 2.5 | | 2.7 | 0.098 | | 0.106 |
| D | 2.5 | | 2.75 | 0.098 | | 0.108 |
| E | 0.45 | | 0.7 | 0.017 | | 0.027 |
| F | 0.75 | | 1 | 0.030 | | 0.039 |
| F1 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| F2 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| G | 4.95 | | 5.2 | 0.195 | | 0.204 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H | 10 | | 10.4 | 0.393 | | 0.409 |
| L2 | | 16 | | | 0.630 | |
| L3 | 28.6 | | 30.6 | 1.126 | | 1.204 |
| L4 | 9.8 | | 10.6 | 0.385 | | 0.417 |
| L6 | 15.9 | | 16.4 | 0.626 | | 0.645 |
| L7 | 9 | | 9.3 | 0.354 | | 0.366 |
| Ø | 3 | | 3.2 | 0.118 | | 0.126 |



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