

# MOTOROLA SEMICONDUCTOR TECHNICAL DATA

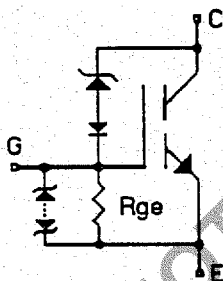
Advanced information

**SMARTDISCRETE™**

## Integrally Clamped, N-Channel IGBT

This Logic Level Insulated Bipolar Transistor (IGBT) features Gate-Emitter ESD protection, Gate-Collectorover-Voltage Protection from **SMARTDISCRETE™** monolithic circuitry for usage as an **Ignition Coil Driver**.

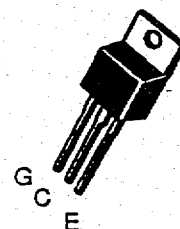
- Temperature compensated Gate-Drain clamp limits stress applied to load
- Integrated ESD diode protection
- Low Threshold Voltage to Interface Power Loads to Logic or Microprocessors
- Low Saturation Voltage
- High Pulsed Current Capability



**MGP20N40CL**

**20 AMPERE  
VOLTAGE CLAMPED  
N-CHANNEL IGBT**

**Vce(ON) = 1.8 Volts  
400Volts (Clamped)**



**CASE 221A-04  
TO-220AB**

### MAXIMUM RATINGS

| Rating                                           | Symbol   | Value       | Unit  |
|--------------------------------------------------|----------|-------------|-------|
| Collector-Emitter Voltage                        | VCEO     | Clamped     | Vdc   |
| Collector-Gate Voltage                           | VCGR     | Clamped     | Vdc   |
| Gate-Emitter Voltage                             | VGE      | Clamped     | Vdc   |
| Collector Current - Continuous                   | IC       | 20          | Amps  |
|                                                  | ICM      | 60          | Amps  |
| Reverse Collector Current - pulse width < 100 μs | ICR      | 12          | Amps  |
| Power Dissipation - @ TC= 25 C (TO-220)          | PD       | 150         | Watts |
| Electrostatic Voltage - Gate to Emitter          | ESD      | 3.5         | kV    |
| Operating and Storage Junction Temperature Range | TJ, Tstg | - 55 to 175 | °C    |

### THERMAL CHARACTERISTICS

|                                                                                  |      |      |      |
|----------------------------------------------------------------------------------|------|------|------|
| Thermal Resistance, Junction to Case (TO-220)                                    | RθJC | 1    | °C/W |
| Thermal Resistance, Junction to Ambient                                          | RθJA | 62.5 | °C/W |
| Maximum Lead Temperature for Soldering Purposes,<br>1/8" from case for 5 seconds | TI   | 275  | °C   |



# MGP20N40CL

## UNCLAMPED INDUCTIVE SWITCHING CHARACTERISTIC

Single Pulse Collector to Emitter Avalanche Energy

@ Starting  $T_J = 25^\circ\text{C}$

@ Starting  $T_J = 150^\circ\text{C}$

|     |     |    |
|-----|-----|----|
| Eas | 550 | mJ |
|     | 150 | mJ |

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ Unless otherwise noted)

| Characteristic                                                                                                              | Symbol            | Min  | Typical | Max  | Unit          |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------|------|---------|------|---------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                  |                   |      |         |      |               |
| Clamp Voltage ( $I_{\text{Clamp}} = 10\text{ mA}$ )<br>( $T_J = -40$ to $150^\circ\text{C}$ )                               | $BV_{\text{ces}}$ | 380  | 405     | 440  | Vdc           |
| Zero Gate Voltage Collector Current<br>( $V_{\text{ce}} = 300\text{ V}$ , $V_{\text{ge}} = 0$ , $T_J = 125^\circ\text{C}$ ) | $I_{\text{ces}}$  | ---  | ---     | 1    | mA            |
| ( $V_{\text{ce}} = 15\text{ V}$ , $V_{\text{ge}} = 0$ , $T_J = 125^\circ\text{C}$ )                                         |                   | ---  | ---     | 200  | $\mu\text{A}$ |
| Resistance Gate-to-Emitter<br>( $T_J = -40$ to $150^\circ\text{C}$ )                                                        | $R_{\text{ge}}$   | 10 k | 16 k    | 30 k | $\Omega$      |
| Gate-Emitter Breakdown Voltage $I_{\text{g}} = 2\text{ mA}$                                                                 | $BV_{\text{geo}}$ | 11   | 13      | 15   | V             |
| Collector-Emitter Reverse Leakage $V_{\text{ce}} = -15\text{ V}$<br>( $T_J = -40$ to $150^\circ\text{C}$ )                  | $I_{\text{eco}}$  | ---  | 8       | 100  | mA            |
| Collector-Emitter Reverse Breakdown Voltage $I_{\text{e}} = 75\text{ mA}$                                                   | $BV_{\text{cer}}$ | 26   | 40      | 120  | V             |

## ON CHARACTERISTICS

|                                                                                                                                                                                                      |                     |           |                   |                   |             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------|-------------------|-------------------|-------------|
| Gate Threshold Voltage<br>( $V_{\text{ce}} = V_{\text{ge}}$ , $I_{\text{c}} = 1\text{ mA}$ )<br>( $V_{\text{ce}} = V_{\text{ge}}$ , $I_{\text{c}} = 1\text{ mA}$ , $T_J = 150^\circ\text{C}$ )       | $V_{\text{ge(th)}}$ | 1<br>0.75 | 1.7<br>---        | 2.4<br>1.8        | V<br>V      |
| Collector-Emitter On-Voltage ( $V_{\text{ge}} = 5\text{ V}$ )<br>( $I_{\text{c}} = 5\text{ A}$ )<br>( $I_{\text{c}} = 10\text{ A}$ )<br>( $I_{\text{c}} = 10\text{ A}$ , $T_J = 150^\circ\text{C}$ ) | $V_{\text{ce(on)}}$ |           | 1.1<br>1.4<br>1.4 | 1.4<br>1.9<br>1.8 | V<br>V<br>V |
| Forward Transconductance<br>( $V_{\text{ce}} > 50\text{ V}$ , $I_{\text{c}} = 10\text{ A}$ )                                                                                                         | $g_{\text{FS}}$     | 10        | 16                | ---               | S           |

## DYNAMIC CHARACTERISTICS

|                                                                                                   |                  |     |      |     |    |
|---------------------------------------------------------------------------------------------------|------------------|-----|------|-----|----|
| Input Capacitance ( $V_{\text{cc}} = 25\text{ V}$ ,<br>$V_{\text{ge}} = 0$ , $f = 1\text{ MHz}$ ) | $C_{\text{iss}}$ | --- | 2800 | --- | pF |
| Output Capacitance                                                                                | $C_{\text{oss}}$ | --- | 200  | --- | pF |
| Transfer Capacitance                                                                              | $C_{\text{rss}}$ | --- | 25   | --- | pF |

## SWITCHING CHARACTERISTICS

|                                                                                                                          |                 |     |    |     |    |
|--------------------------------------------------------------------------------------------------------------------------|-----------------|-----|----|-----|----|
| Total Gate Charge ( $V_{\text{cc}} = 280\text{ V}$ ,<br>$V_{\text{ge}} = 5\text{ V}$ ,<br>$I_{\text{c}} = 20\text{ A}$ ) | $Q_{\text{g}}$  | --- | 45 | 80  | nC |
| Gate-Emitter Charge                                                                                                      | $Q_{\text{gs}}$ | --- | 8  | --- | nC |
| Gate-Collector Charge                                                                                                    | $Q_{\text{gd}}$ | --- | 20 | --- | nC |

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