

## Features

- Trench LV MOSFET Technology
- Excellent Package for Heat Dissipation
- Moisture Sensitivity Level 1
- Halogen Free. "Green" Device (Note1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant<sup>(Note2)</sup> ("P" Suffix Designates RoHS Compliant. See Ordering Information)

## Maximum Ratings

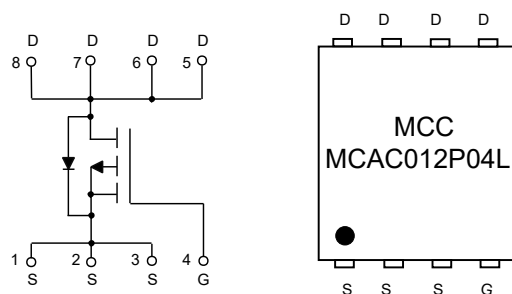
- Operating Junction Temperature Range : -55°C to +150°C
- Storage Temperature Range: -55°C to +150°C
- Thermal Resistance: 50°C/W Junction to Ambient<sup>(Note3)</sup>
- Thermal Resistance: 1.6°C/W Junction to Case

| Parameter                                        | Symbol   | Rating | Unit |
|--------------------------------------------------|----------|--------|------|
| Drain-Source Voltage                             | $V_{DS}$ | -40    | V    |
| Gate-Source Voltage                              | $V_{GS}$ | ±20    | V    |
| Continuous Drain Current                         | $I_D$    | -55    | A    |
|                                                  |          | -34    |      |
| Pulsed Drain Current <sup>(Note4)</sup>          | $I_{DM}$ | -220   | A    |
| Total Power Dissipation <sup>(Note5)</sup>       | $P_D$    | 78     | W    |
| Single Pulse Avalanche Energy <sup>(Note6)</sup> | $E_{AS}$ | 132    | mJ   |

Note:

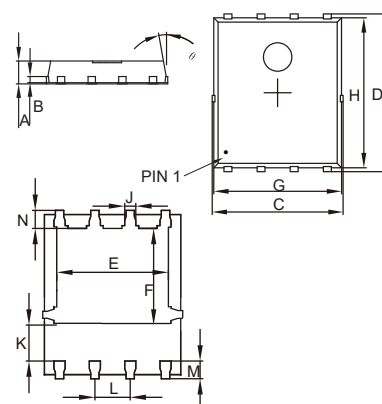
1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. High Temperature Solder Exemption Applied, see EU Directive Annex 7(a)-I.
3. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$ .
4. Repetitive rating; pulse width limited by max. junction temperature.
5.  $P_D$  is based on max. junction temperature, using junction-case thermal resistance.
6.  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = -20\text{V}$ ,  $V_{GS} = -10\text{V}$ ,  $R_G = 25\Omega$ ,  $L = 0.5\text{mH}$ .

## Internal Structure and Marking Code



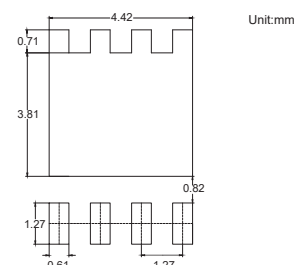
## P-CHANNEL MOSFET

### DFN5060



| DIM | INCHES |       | MM    |      | NOTE |
|-----|--------|-------|-------|------|------|
|     | MIN    | MAX   | MIN   | MAX  |      |
| A   | 0.031  | 0.047 | 0.80  | 1.20 |      |
| B   | 0.010  |       | 0.254 |      | TYP. |
| C   | 0.193  | 0.222 | 4.90  | 5.64 |      |
| D   | 0.232  | 0.250 | 5.90  | 6.35 |      |
| E   | 0.148  | 0.167 | 3.75  | 4.25 |      |
| F   | 0.126  | 0.154 | 3.20  | 3.92 |      |
| G   | 0.189  | 0.213 | 4.80  | 5.40 |      |
| H   | 0.222  | 0.239 | 5.65  | 6.06 |      |
| K   | 0.045  | 0.059 | 1.15  | 1.50 |      |
| J   | 0.012  | 0.020 | 0.30  | 0.50 |      |
| L   | 0.046  | 0.054 | 1.17  | 1.37 |      |
| M   | 0.012  | 0.028 | 0.30  | 0.71 |      |
| N   | 0.016  | 0.028 | 0.40  | 0.71 |      |

### Suggested Solder Pad Layout

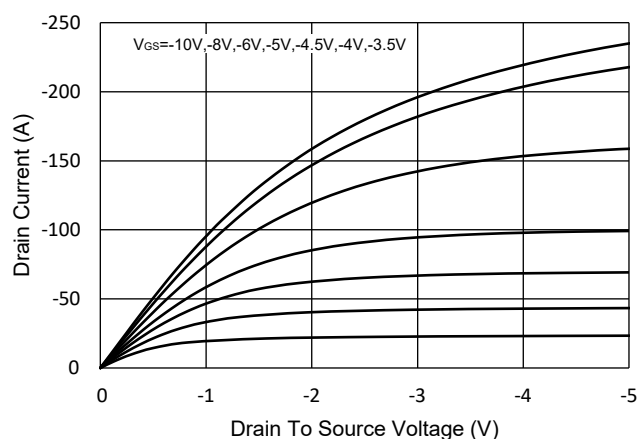


**Electrical Characteristics @ 25°C (Unless Otherwise Specified)**

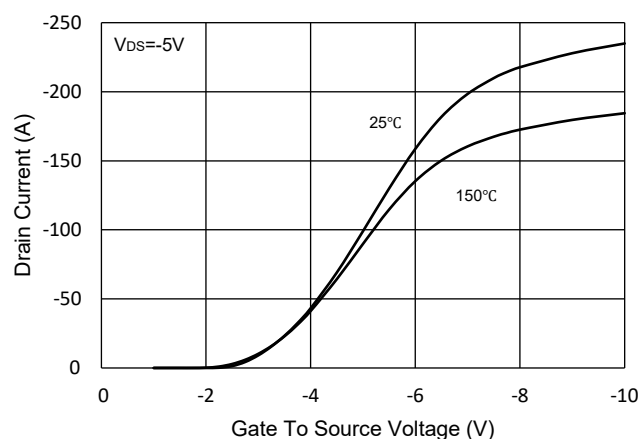
| Parameter                       | Symbol        | Test Conditions                                      | Min  | Typ  | Max       | Unit       |
|---------------------------------|---------------|------------------------------------------------------|------|------|-----------|------------|
| Static Characteristics          |               |                                                      |      |      |           |            |
| Drain-Source Breakdown Voltage  | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=-250\mu A$                           | -40  |      |           | V          |
| Gate-Source Leakage Current     | $I_{GSS}$     | $V_{DS}=0V, V_{GS}=\pm 20V$                          |      |      | $\pm 100$ | nA         |
| Zero Gate Voltage Drain Current | $I_{DSS}$     | $V_{DS}=-40V, V_{GS}=0V$                             |      |      | -1        | $\mu A$    |
| Gate-Threshold Voltage          | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=-250\mu A$                       | -1.0 | -1.7 | -2.5      | V          |
| Drain-Source On-Resistance      | $R_{DS(on)}$  | $V_{GS}=-10V, I_D=-20A$                              |      | 9.7  | 12        | m $\Omega$ |
|                                 |               | $V_{GS}=-4.5V, I_D=-20A$                             |      | 17   | 25        |            |
| Gate Resistance                 | $R_g$         | f=1 MHz, Open drain                                  |      | 5.9  |           | $\Omega$   |
| Diode Characteristics           |               |                                                      |      |      |           |            |
| Continuous Body Diode Current   | $I_S$         |                                                      |      |      | -55       | A          |
| Diode Forward Voltage           | $V_{SD}$      | $V_{GS}=0V, I_S=-20A$                                |      |      | -1.2      | V          |
| Reverse Recovery Time           | $t_{rr}$      | $I_F=-20A, dI_F/dt=100A/\mu s$                       |      | 26   |           | ns         |
| Reverse Recovery Charge         | $Q_{rr}$      |                                                      |      | 26.3 |           | nC         |
| Dynamic Characteristics         |               |                                                      |      |      |           |            |
| Input Capacitance               | $C_{iss}$     | $V_{DS}=-20V, V_{GS}=0V, f=1MHz$                     |      | 2604 |           | pF         |
| Output Capacitance              | $C_{oss}$     |                                                      |      | 265  |           |            |
| Reverse Transfer Capacitance    | $C_{rss}$     |                                                      |      | 243  |           |            |
| Total Gate Charge               | $Q_g$         | $V_{DS}=-20V, V_{GS}=-10V, I_D=-20A$                 |      | 55.8 |           | nC         |
| Gate-Source Charge              | $Q_{gs}$      |                                                      |      | 10.6 |           |            |
| Gate-Drain Charge               | $Q_{gd}$      |                                                      |      | 10.3 |           |            |
| Turn-On Delay Time              | $t_{d(on)}$   | $V_{DD}=-20V, V_{GS}=-10V, R_G=3\Omega, I_{DS}=-20A$ |      | 11   |           | ns         |
| Turn-On Rise Time               | $t_r$         |                                                      |      | 38   |           |            |
| Turn-Off Delay Time             | $t_{d(off)}$  |                                                      |      | 73   |           |            |
| Turn-Off Fall Time              | $t_f$         |                                                      |      | 48   |           |            |

## Curve Characteristics

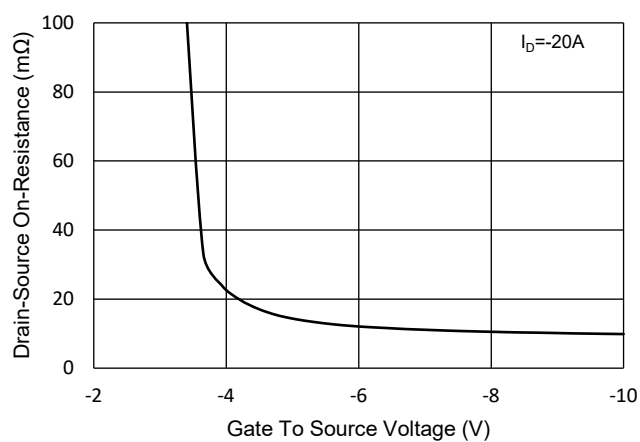
**Fig.1 - Typical Output Characteristics**



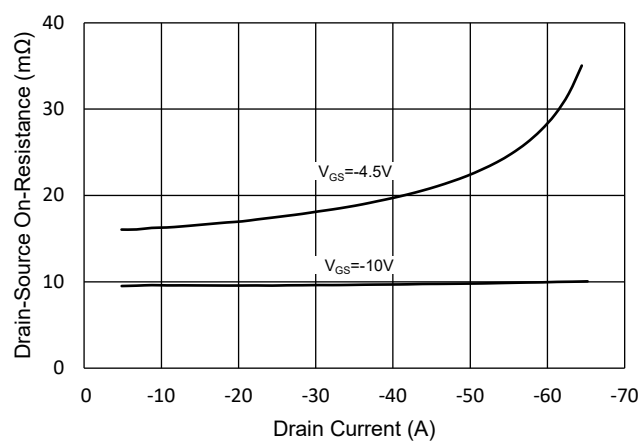
**Fig.2 - Transfer Characteristics**



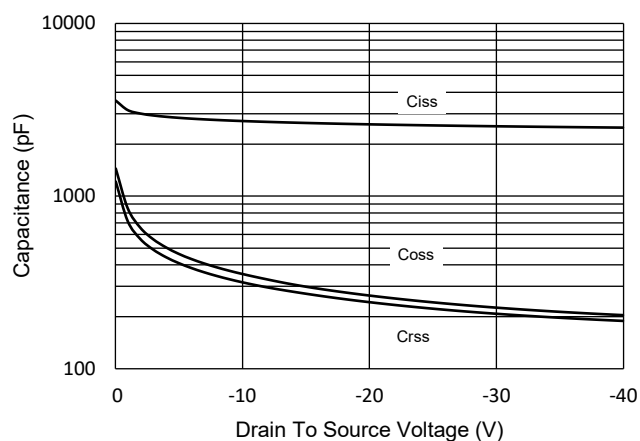
**Fig.3 -  $R_{DS(ON)}$  -  $V_{GS}$**



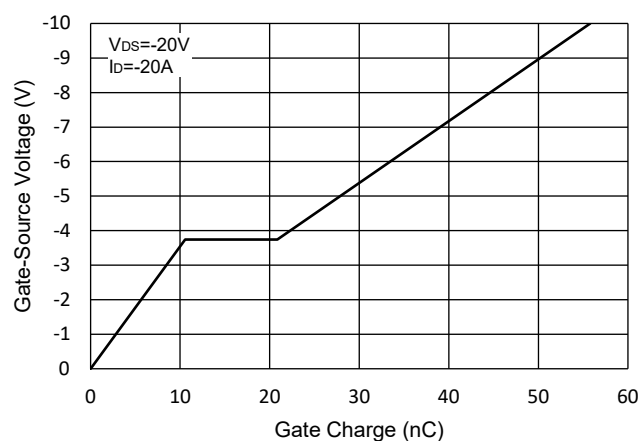
**Fig.4 -  $R_{DS(ON)}$  -  $I_D$**



**Fig.5 - Capacitance Characteristics**

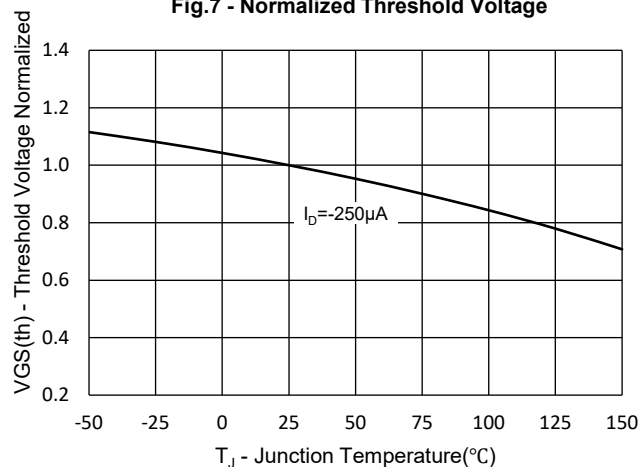


**Fig.6 - Gate Charge**

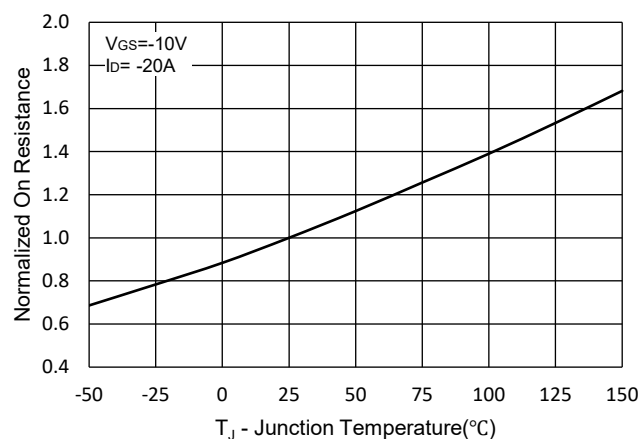


## Curve Characteristics

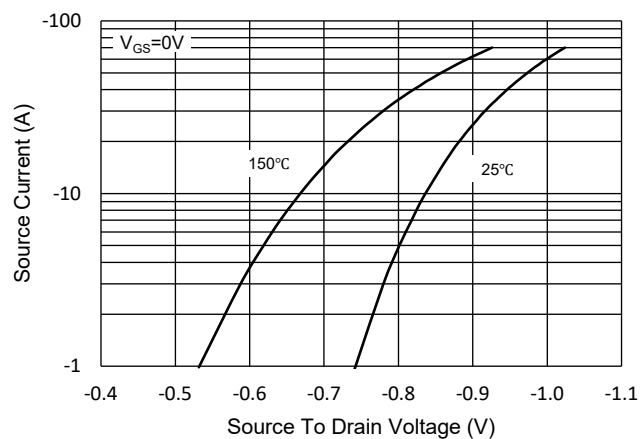
**Fig.7 - Normalized Threshold Voltage**



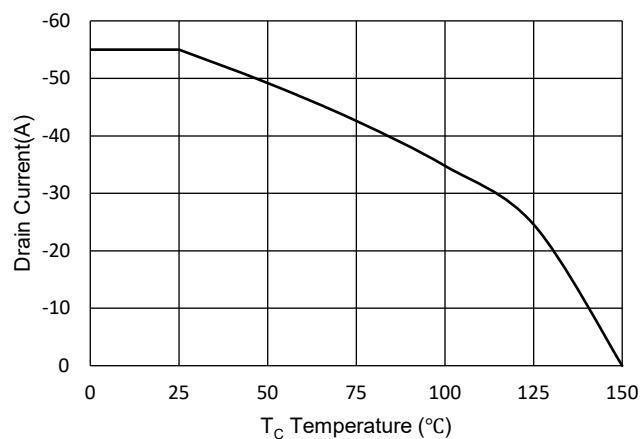
**Fig.8 - Normalized On Resistance Characteristics**



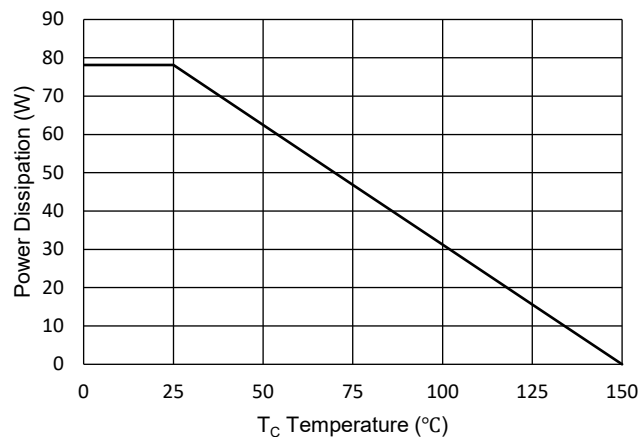
**Fig.9 -  $I_S$  -  $V_{SD}$**



**Fig.10 - Drain Current**



**Fig.11 - PD Dissipation**



## Curve Characteristics

Fig. 12 - Safe Operation Area

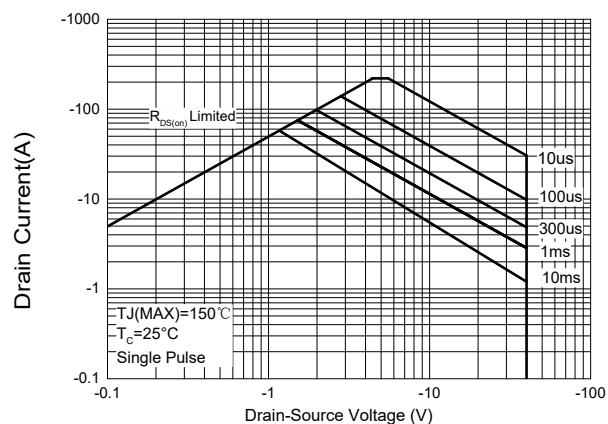
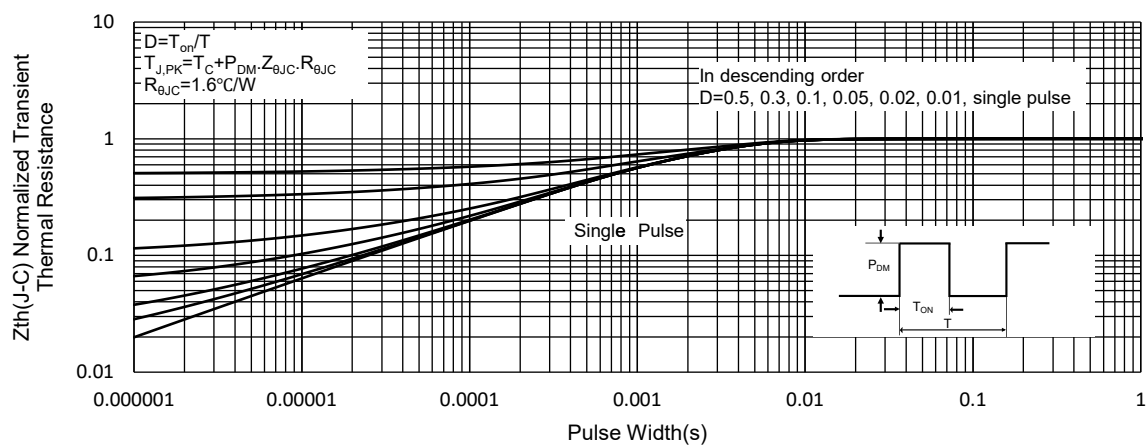


Fig.13 - Normalized Transient Thermal Impedance



## Ordering Information

| Device         | Packing               |
|----------------|-----------------------|
| Part Number-TP | Tape&Reel: 5Kpcs/Reel |

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