

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

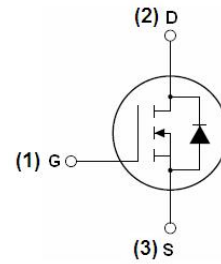
The VCRR6080ED uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

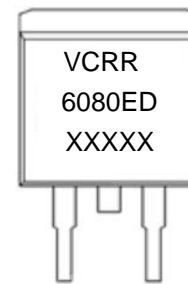
- $V_{DS} = 60V, I_D = 80A$   
 $R_{DS(ON)} < 6.9m\Omega @ V_{GS} = 10V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation

### Application

- PWM
- Load Switching



Schematic diagram



Marking and pin assignment



TO-263-2L top view

### Package Marking and Ordering Information

| Device Marking | Device | Device Package |
|----------------|--------|----------------|
| VCRR6080ED     |        | TO-263-2L      |

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Parameter  | Symbol             | Limit      | Unit          |
|--|--------------------|------------|---------------|
| Drain-Source Voltage                             | $V_{DS}$           | 60         | V             |
| Gate-Source Voltage                              | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                         | $I_D$              | 80         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )  | $I_D(100^\circ C)$ | 56.5       | A             |
| Pulsed Drain Current                             | $I_{DM}$           | 320        | A             |
| Maximum Power Dissipation                        | $P_D$              | 110        | W             |
| Derating factor                                  |                    | 0.73       | W/ $^\circ C$ |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$           | 390        | mJ            |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|   |                 |      |               |
|---|-----------------|------|---------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>    | $R_{\theta JC}$ | 1.36 | $^{\circ}C/W$ |
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 60   | $^{\circ}C/W$ |

## Electrical Characteristics ( $T_C=25^{\circ}C$ unless otherwise noted)

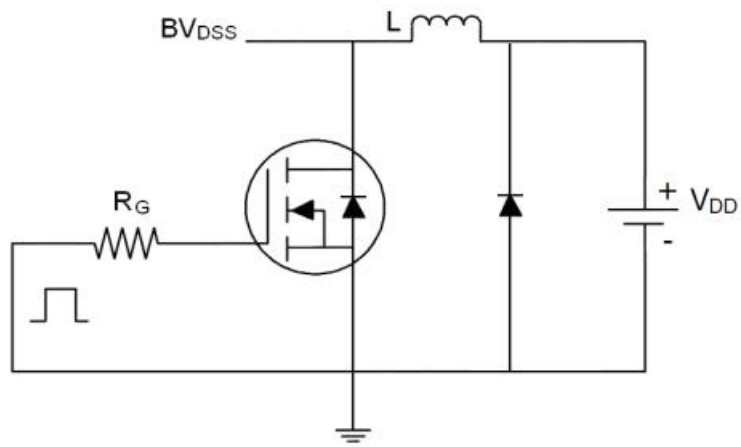
| Parameter  | Symbol       | Condition  | Min | Typ  | Max       | Unit       |
|--|--------------|--|-----|------|-----------|------------|
| <b>Off Characteristics</b>                           |              |  |     |      |           |            |
| Drain-Source Breakdown Voltage                       | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$  | 60  | -    | -         | V          |
| Zero Gate Voltage Drain Current                      | $I_{DSS}$    | $V_{DS}=60V, V_{GS}=0V$  | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                            | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$  | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> <sup>(Note 3)</sup>        |              |  |     |      |           |            |
| Gate Threshold Voltage                               | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$  | 2   | 2.8  | 4         | V          |
| Drain-Source On-State Resistance                     | $R_{DS(on)}$ | $V_{GS}=10V, I_D=20A$  | -   | 6    | 6.9       | m $\Omega$ |
| Forward Transconductance                             | $g_{FS}$     | $V_{DS}=5V, I_D=20A$   | 20  | -    | -         | S          |
| <b>Dynamic Characteristics</b> <sup>(Note 4)</sup>   |              |  |     |      |           |            |
| Input Capacitance                                    | $C_{iss}$    | $V_{DS}=30V, V_{GS}=0V,$<br>$F=1.0MHz$                                     | -   | 4000 | -         | PF         |
| Output Capacitance                                   | $C_{oss}$    |  | -   | 290  | -         | PF         |
| Reverse Transfer Capacitance                         | $C_{rss}$    |  | -   | 210  | -         | PF         |
| <b>Switching Characteristics</b> <sup>(Note 4)</sup> |              |  |     |      |           |            |
| Turn-on Delay Time                                   | $t_{d(on)}$  | $V_{DD}=30V, R_L=1\Omega$<br>$V_{GS}=10V, R_G=3\Omega$                     | -   | 8.5  | -         | nS         |
| Turn-on Rise Time                                    | $t_r$        |  | -   | 7    | -         | nS         |
| Turn-Off Delay Time                                  | $t_{d(off)}$ |  | -   | 40   | -         | nS         |
| Turn-Off Fall Time                                   | $t_f$        |  | -   | 15   | -         | nS         |
| Total Gate Charge                                    | $Q_g$        | $V_{DS}=30V, I_D=20A,$<br>$V_{GS}=10V$                                     | -   | 90   | -         | nC         |
| Gate-Source Charge                                   | $Q_{gs}$     |  | -   | 9    | -         | nC         |
| Gate-Drain Charge                                    | $Q_{gd}$     |  | -   | 18   | -         | nC         |
| <b>Drain-Source Diode Characteristics</b>            |              |  |     |      |           |            |
| Diode Forward Voltage <sup>(Note 3)</sup>            | $V_{SD}$     | $V_{GS}=0V, I_S=20A$   | -   | -    | 1.2       | V          |
| Diode Forward Current <sup>(Note 2)</sup>            | $I_S$        |  | -   | -    | 80        | A          |
| Reverse Recovery Time                                | $t_{rr}$     | $T_J = 25^{\circ}C, I_F = 20A$<br>$di/dt = 100A/\mu s$ <sup>(Note 3)</sup> | -   | 32   | -         | nS         |
| Reverse Recovery Charge                              | $Q_{rr}$     |  | -   | 45   | -         | nC         |
| Forward Turn-On Time                                 | $t_{on}$     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)       |     |      |           |            |

### Notes:

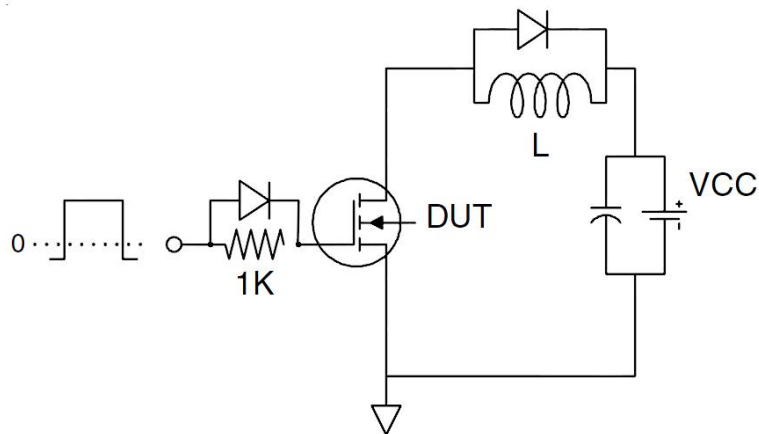
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition :  $T_J=25^{\circ}C, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$

**Test circuit**

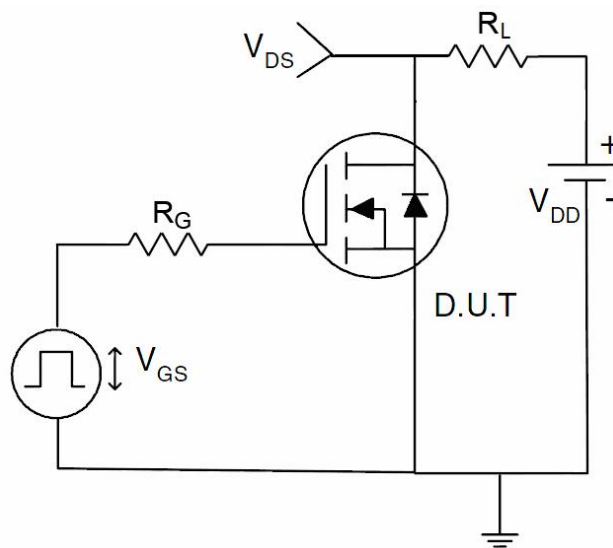
**1)  $E_{AS}$  Test Circuit**



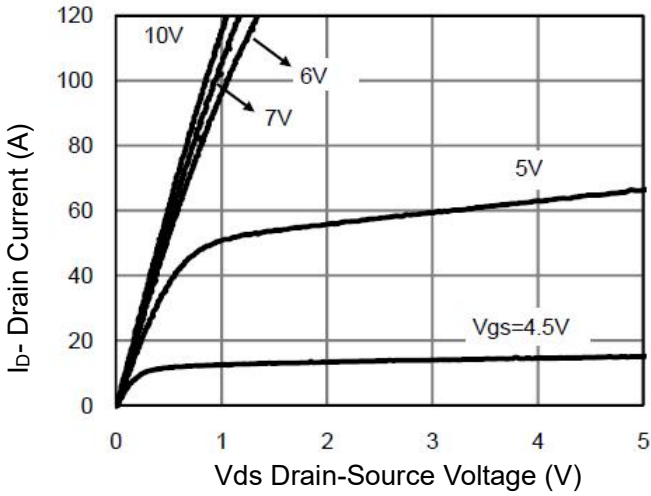
**2) Gate Charge Test Circuit**



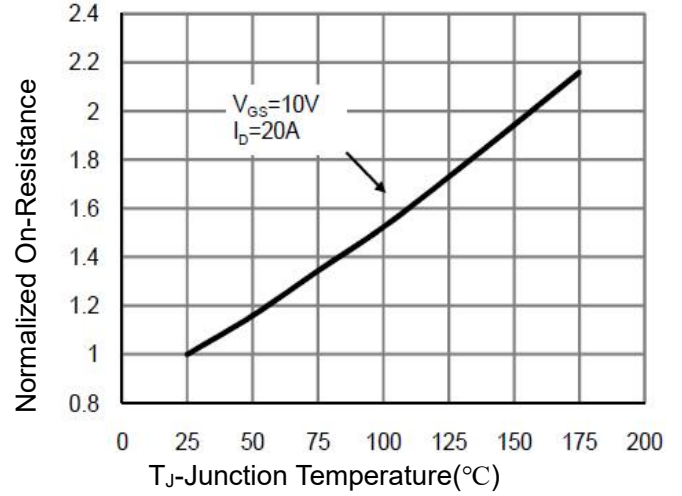
**3) Switch Time Test Circuit**



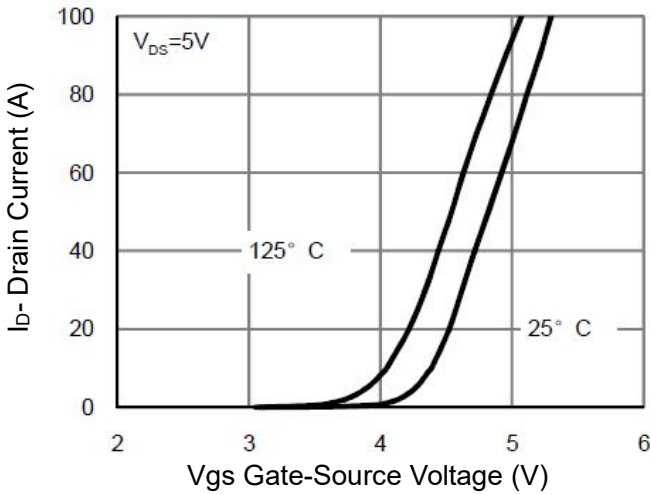
**Typical Electrical and Thermal Characteristics (Curves)**



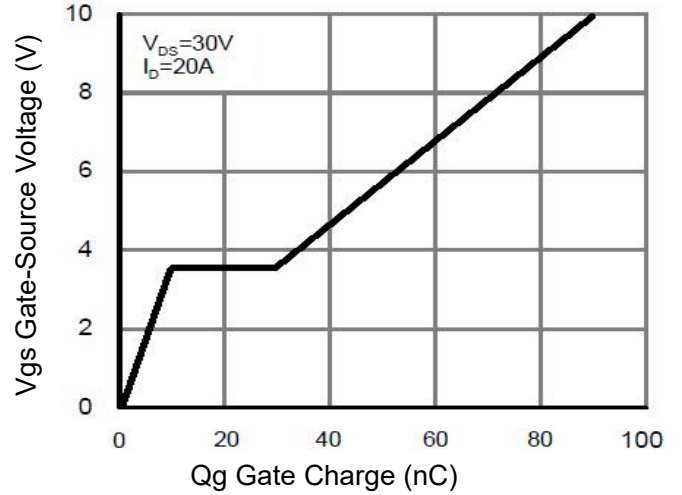
**Figure 1 Output Characteristics**



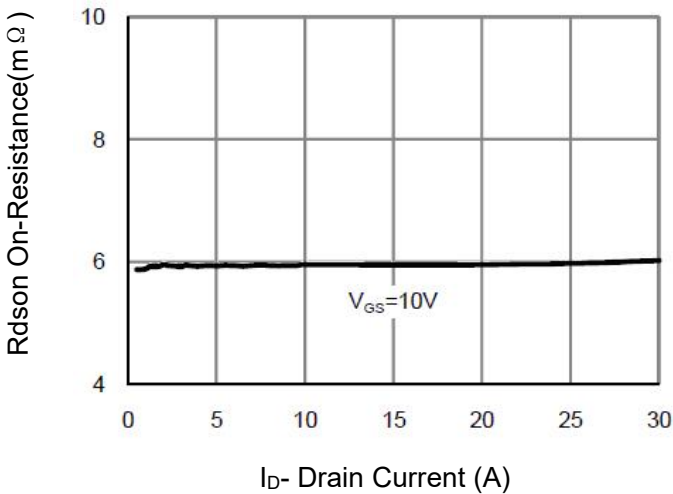
**Figure 4 Rds(on)-Junction Temperature**



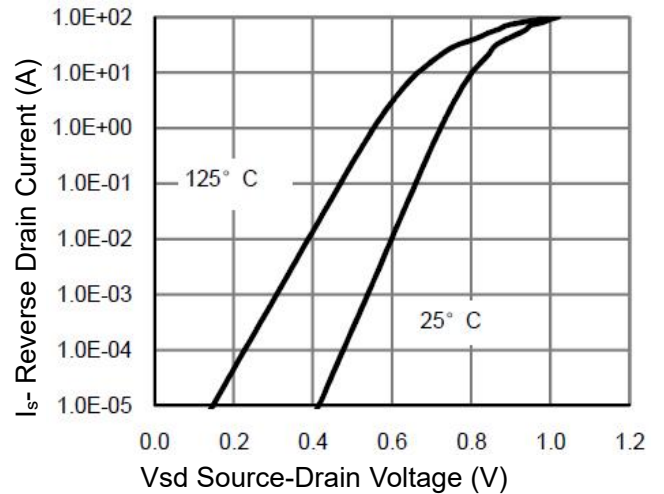
**Figure 2 Transfer Characteristics**



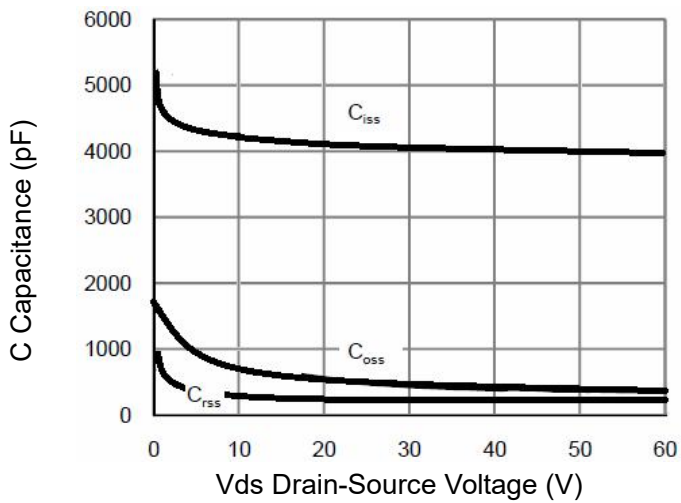
**Figure 5 Gate Charge**



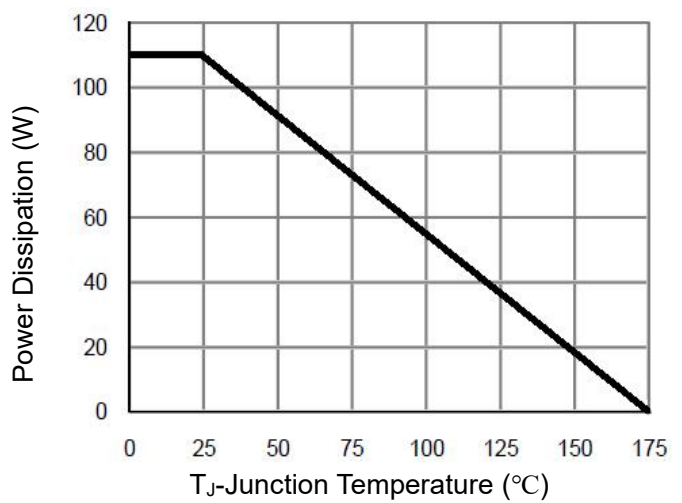
**Figure 3 Rds(on)- Drain Current**



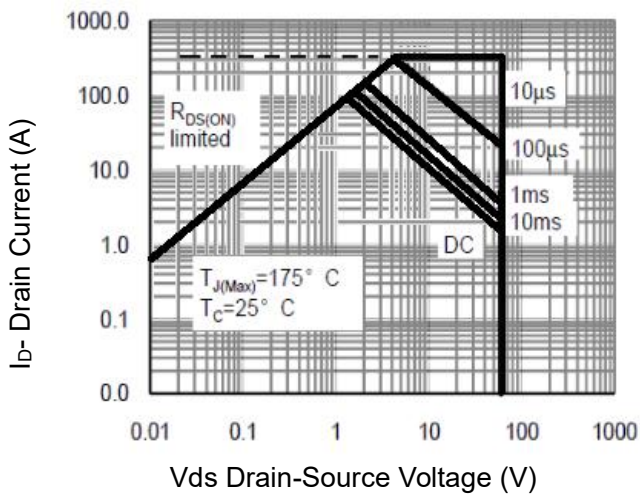
**Figure 6 Source- Drain Diode Forward**



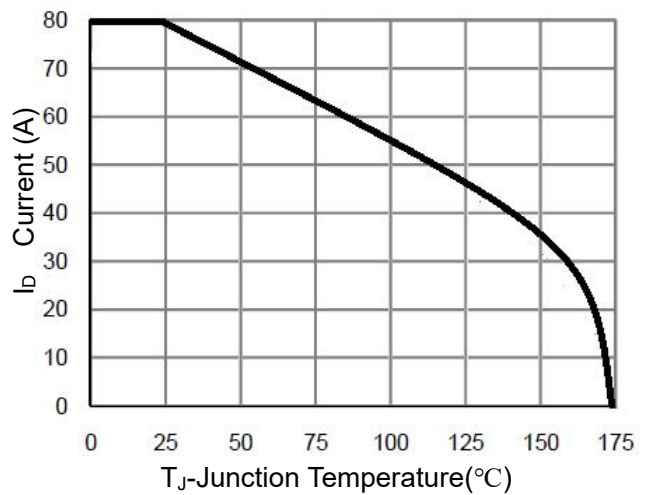
**Figure 7 Capacitance vs Vds**



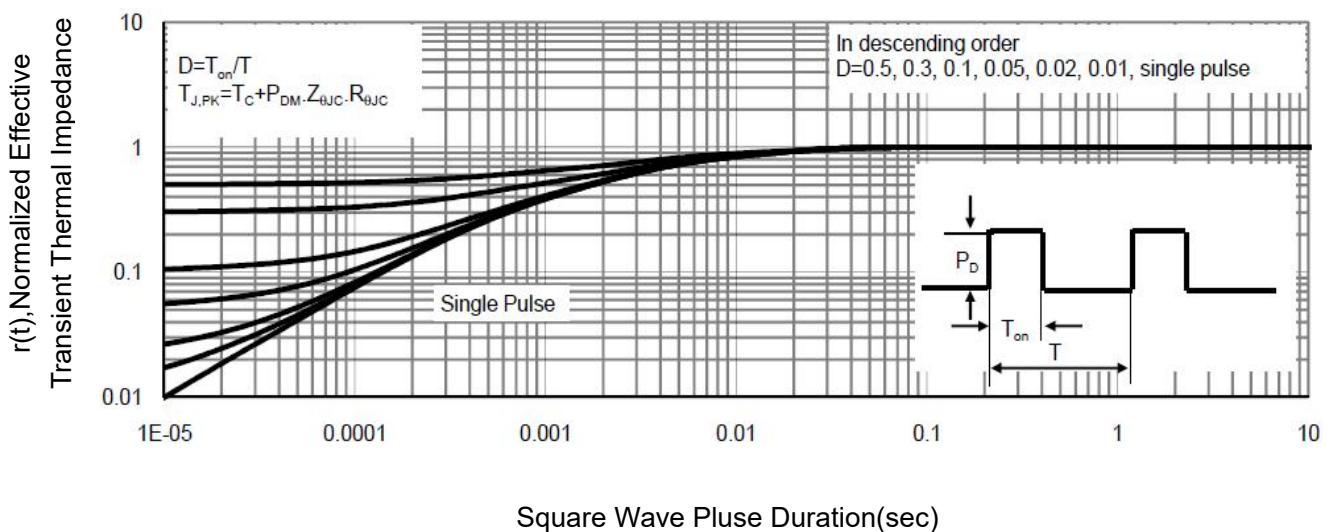
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**



**Figure 10 ID Current- Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**



## Attention

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