# MOSFET – Power, Single, N-Channel

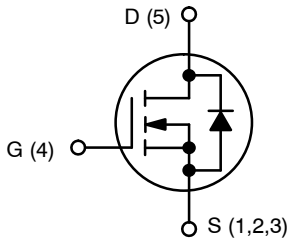
## 60 V, 4.7 mΩ, 93 A

# NTMFS5C646NL

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 60 V | 4.7 mΩ @ 10 V | 93 A |
| | 6.3 mΩ @ 4.5 V | |

### Features

- Small Footprint (5x6 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low $Q_G$ and Capacitance to Minimize Driver Losses
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant




**N−CHANNEL MOSFET**

### MAXIMUM RATINGS ($T_J$ = 25°C unless otherwise noted)

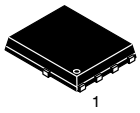
| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 60 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3) | Steady State | $T_C$ = 25°C | $I_D$ | 93 | A |
| | | $T_C$ = 100°C | | 65 | |
| Power Dissipation $R_{\theta JC}$ (Note 1) | | $T_C$ = 25°C | $P_D$ | 79 | W |
| | | $T_C$ = 100°C | | 40 | |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3) | Steady State | $T_A$ = 25°C | $I_D$ | 20 | A |
| | | $T_A$ = 100°C | | 14 | |
| Power Dissipation $R_{\theta JA}$ (Notes 1 & 2) | | $T_A$ = 25°C | $P_D$ | 3.7 | W |
| | | $T_A$ = 100°C | | 1.8 | |
| Pulsed Drain Current | $T_A$ = 25°C, $t_p$ = 10 μs | | $I_{DM}$ | 750 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{stg}$ | −55 to +175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 100 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($I_{L(pk)}$ = 5 A) | | | $E_{AS}$ | 185 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL RESISTANCE MAXIMUM RATINGS

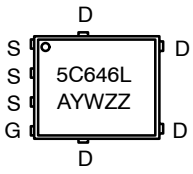
| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case − Steady State | $R_{\theta JC}$ | 1.9 | °C/W |
| Junction−to−Ambient − Steady State (Note 2) | $R_{\theta JA}$ | 41 | |

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface−mounted on FR4 board using a 650 $mm^2$, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.




**DFN5**
**(SO−8FL)**
**CASE 488AA**
**STYLE 1**

### MARKING DIAGRAM




5C646L = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

NOTE: Some of the device on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.

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**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 μA | | 60 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 15.5 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 60 V | $T_J$ = 25 °C | | | 10 | μA |
| | | | $T_J$ = 125°C | | | 250 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = 20 V | | | | 100 | nA |
| **ON CHARACTERISTICS** (Note 4) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 80 μA | | 1.2 | | 2.0 | V |
| Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | −4.9 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V | $I_D$ = 50 A | | 3.8 | 4.7 | mΩ |
| | | $V_{GS}$ = 4.5 V | $I_D$ = 50 A | | 5.0 | 6.3 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 15 V, $I_D$ = 50 A | | | 105 | | S |
| **CHARGES, CAPACITANCES & GATE RESISTANCE** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 25 V | | | 2164 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 900 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 17 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 30 V; $I_D$ = 25 A | | | 15.7 | | nC |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 30 V; $I_D$ = 25 A | | | 33.7 | | |
| Threshold Gate Charge | $Q_{G(TH)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 30 V; $I_D$ = 25 A | | | 1.5 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 5.6 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 5.1 | | |
| Plateau Voltage | $V_{GP}$ | | | | 2.8 | | V |
| **SWITCHING CHARACTERISTICS** (Note 5) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 30 V, $I_D$ = 25 A, $R_G$ = 2.5 Ω | | | 10.4 | | ns |
| Rise Time | $t_r$ | | | | 14.9 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 23.6 | | |
| Fall Time | $t_f$ | | | | 5.1 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 50 A | $T_J$ = 25°C | | 0.88 | 1.2 | V |
| | | | $T_J$ = 125°C | | 0.78 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, dIS/dt = 100 A/μs, $I_S$ = 50 A | | | 40.9 | | ns |
| Charge Time | $t_a$ | | | | 20.8 | | |
| Discharge Time | $t_b$ | | | | 20.1 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 32 | | nC |

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperatures.

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.



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## TYPICAL CHARACTERISTICS

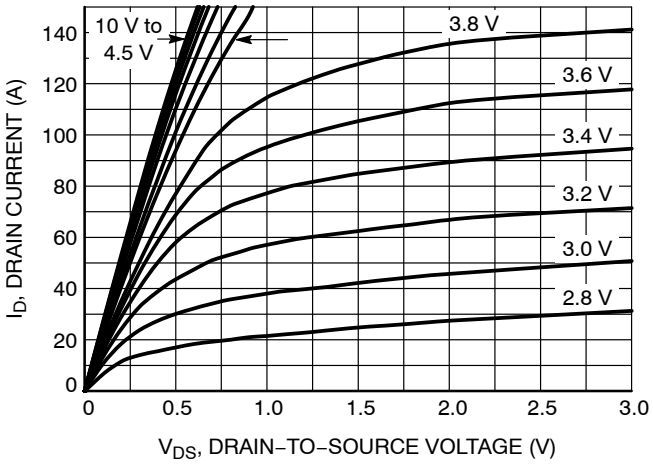



**Figure 1. On−Region Characteristics**

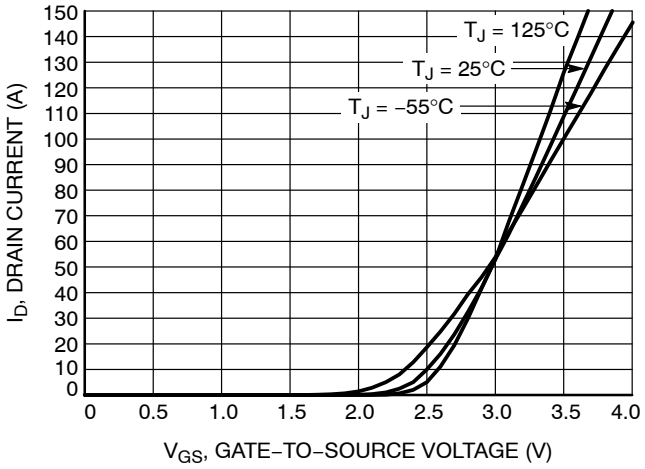



**Figure 2. Transfer Characteristics**

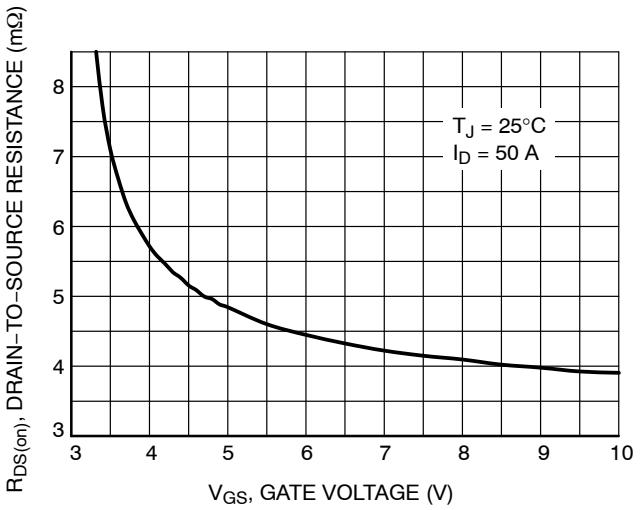



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

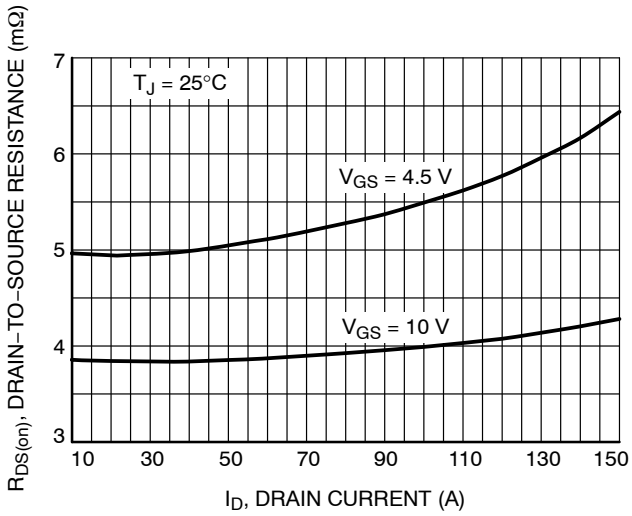



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

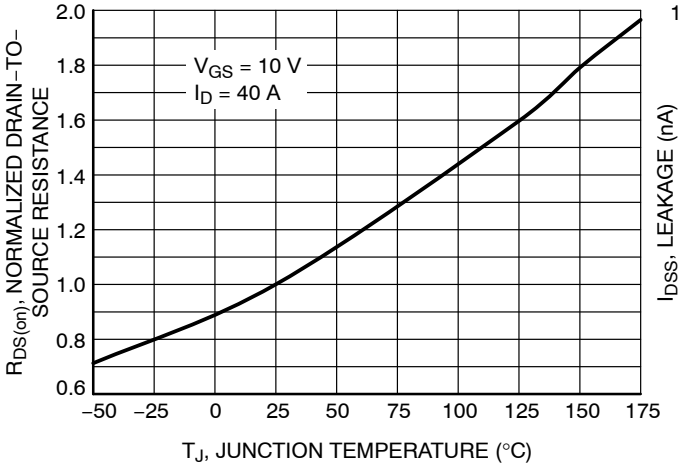



**Figure 5. On−Resistance Variation with Temperature**

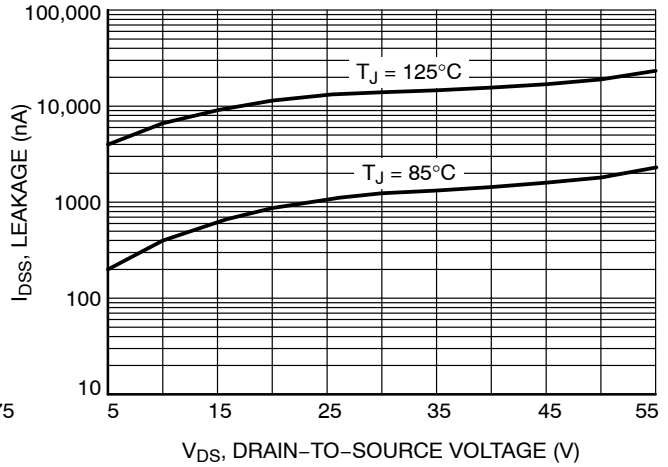



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**



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## TYPICAL CHARACTERISTICS

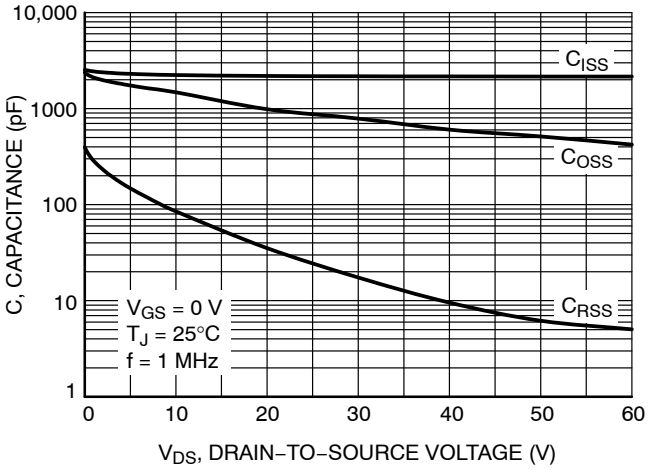



**Figure 7. Capacitance Variation**

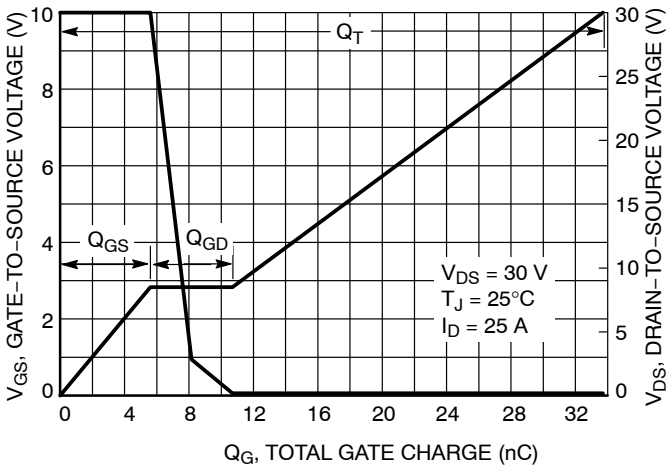



**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

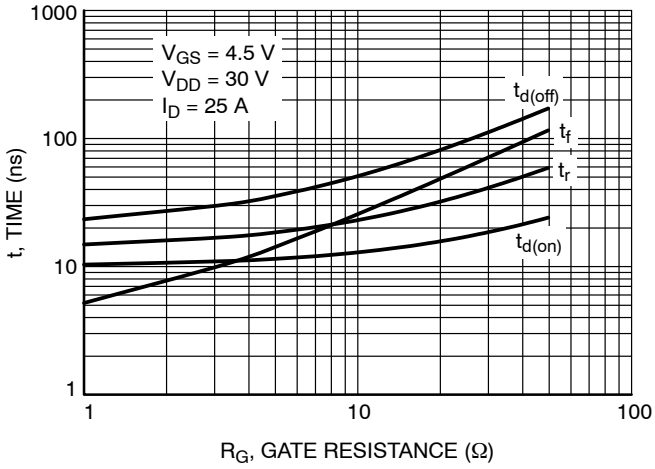



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

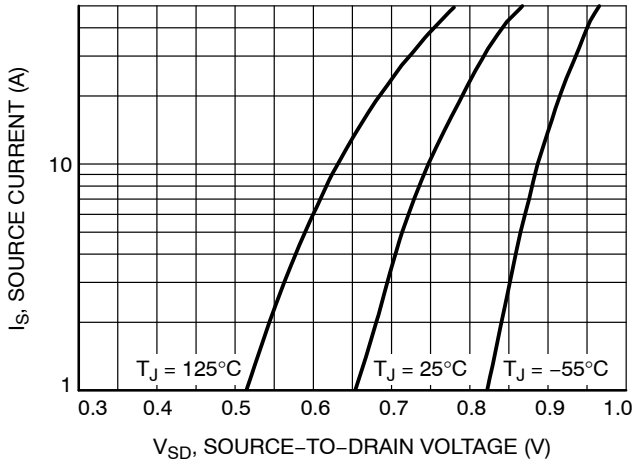



**Figure 10. Diode Forward Voltage vs. Current**

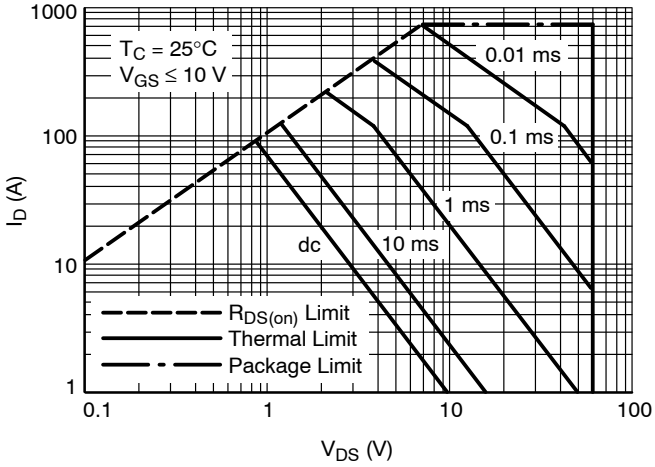



**Figure 11. Safe Operating Area**

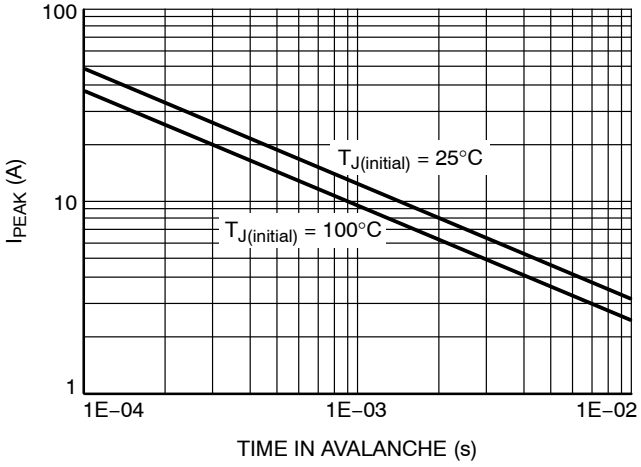



**Figure 12. $I_{PEAK}$ vs. Time in Avalanche**



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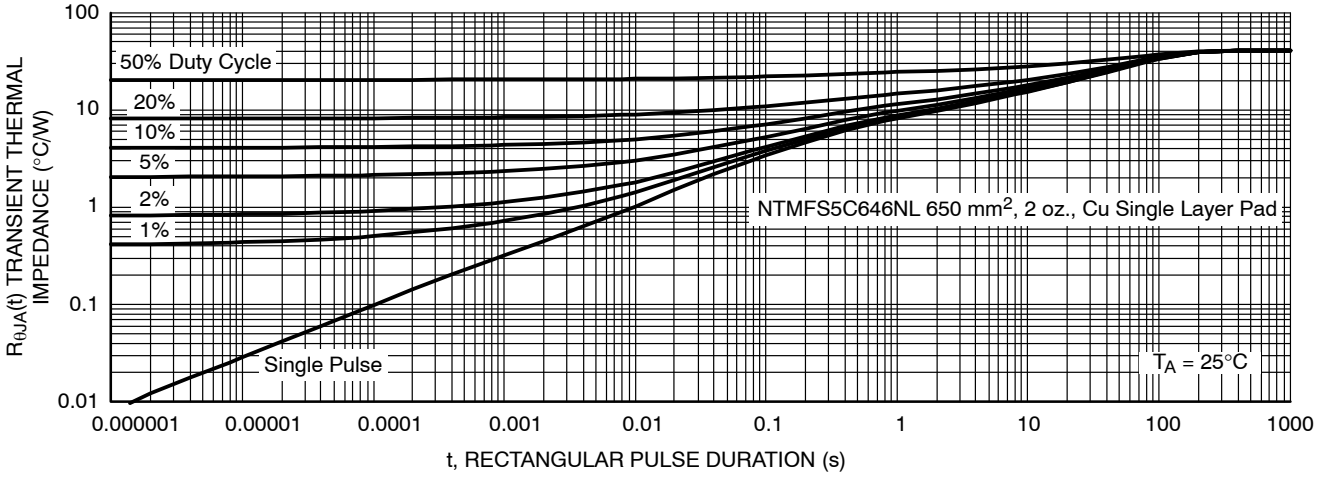



**Figure 13. Thermal Response**

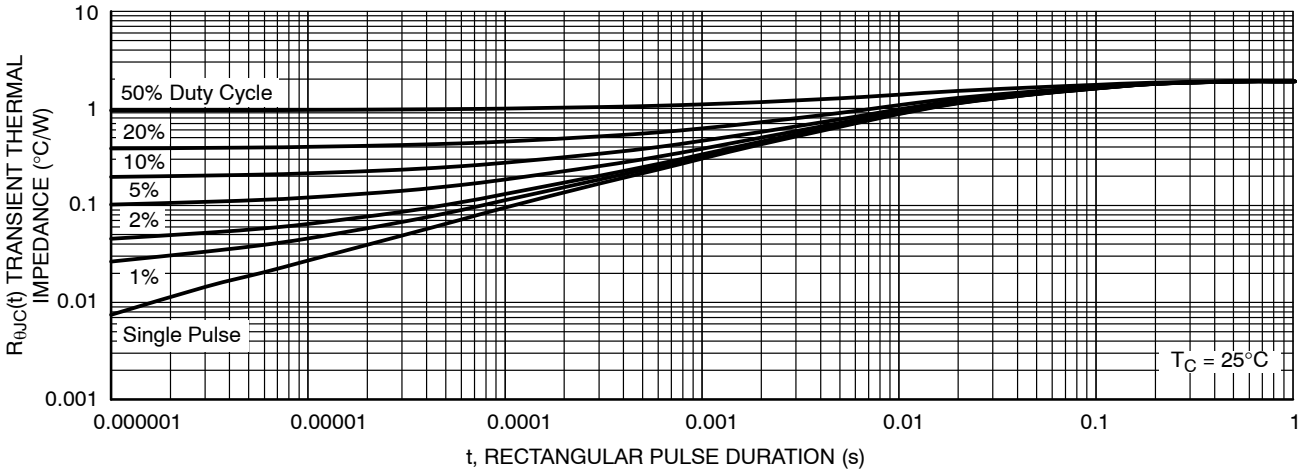



**Figure 14. Thermal Response**

## ORDERING INFORMATION

| Device | Marking | Package | Shipping† |
|---|---|---|---|
| NTMFS5C646NLT1G | 5C646L | DFN5<br>(Pb−Free) | 1500 / Tape & Reel |

**DISCONTINUED** (Note 6)

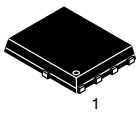
| | | | |
|---|---|---|---|
| NTMFS5C646NLT3G | 5C645L | DFN5<br>(Pb−Free) | 1500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

6. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.



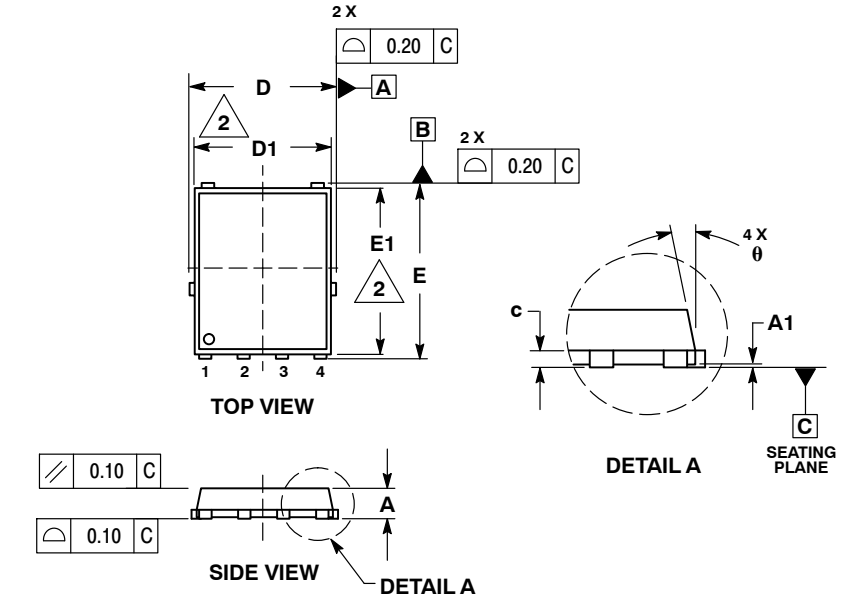
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**SCALE 2:1**

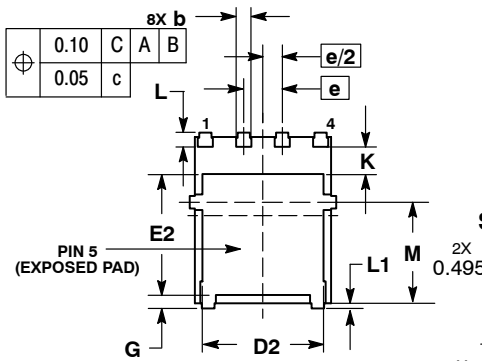
**DFN5 5x6, 1.27P**
**(SO−8FL)**
CASE 488AA
ISSUE N

DATE 25 JUN 2018

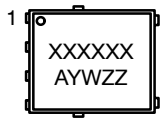



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| | MILLIMETERS | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | ––– | 0.05 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.23 | 0.28 | 0.33 |
| D | 5.00 | 5.15 | 5.30 |
| D1 | 4.70 | 4.90 | 5.10 |
| D2 | 3.80 | 4.00 | 4.20 |
| E | 6.00 | 6.15 | 6.30 |
| E1 | 5.70 | 5.90 | 6.10 |
| E2 | 3.45 | 3.65 | 3.85 |
| e | 1.27 BSC | | |
| G | 0.51 | 0.575 | 0.71 |
| K | 1.20 | 1.35 | 1.50 |
| L | 0.51 | 0.575 | 0.71 |
| L1 | 0.125 REF | | |
| M | 3.00 | 3.40 | 3.80 |
| θ | 0 ° | ––– | 12 ° |



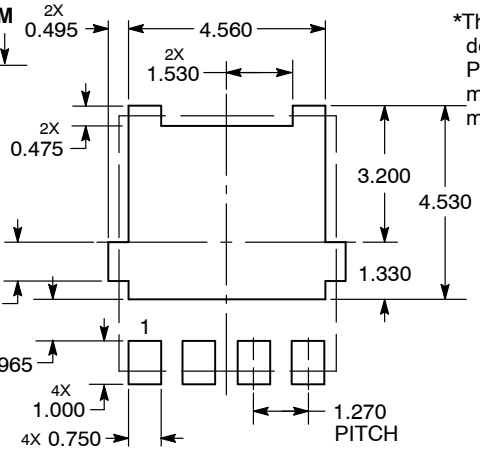

**GENERIC MARKING DIAGRAM***




XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present. Some products may not follow the Generic Marking.

**RECOMMENDED SOLDERING FOOTPRINT***




DIMENSIONS: MILLIMETERS

STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN

STYLE 2:
PIN 1. ANODE
2. ANODE
3. ANODE
4. NO CONNECT
5. CATHODE

*For additional information on our Pb−Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

| | | | |
|---|---|---|---|
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| **DESCRIPTION:** | **DFN5 5x6, 1.27P (SO−8FL)** | | **PAGE 1 OF 1** |

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**ONLINE SUPPORT**: www.onsemi.com/support
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ENTEGRECİ

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# Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

### Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

**www.entegreci.com**

### Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

**Kategorilere göz atın**

### Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

**Üreticileri görün**

### Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

**Teklif isteyin**

**www.entegreci.com** | **destek@entegreci.com** | **0850 305 90 34**

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Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.