

DFN5x6-8L Plastic-Encapsulate MOSFETS

TW60N04EF N-Channel Enhancement Mode MOSFET

$BV_{DS} = 40V$, $I_D = 60A$

$R_{DS(ON)}$ TYP = $6.8m\Omega$ @ $V_{GS} = 10V$

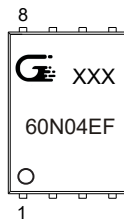
Features

- Improved dv/dt capability
- Fast switching
- Low On-Resistance
- Green Device Available

Application

- Switching Application Systems
- On Board power for server
- Synchronous rectification

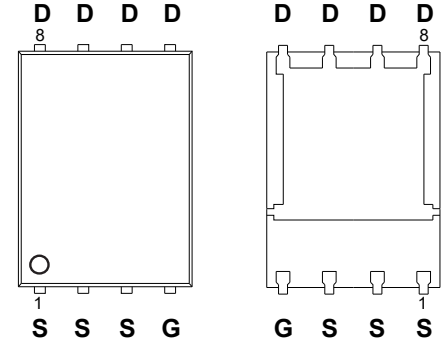
MARKING



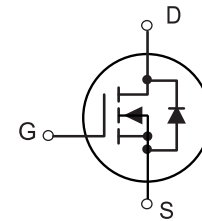
60N04EF= Device code
XXX= YW code (Trace Code Marking)
Solid dot = Pin1 indicator

DFN5x6-8L

RoHS
COMPLIANT



Equivalent circuit



Absolute Maximum Ratings (TA=25°C unless otherwise noted)

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V _{DS}	40	V
Gate-Source Voltage		V _{GS}	± 20	V
Drain Current-Continuous	T _C =25°C	I _D	60	A
Drain Current-Continuous	T _C =100°C		44	A
Drain Current-Pulsed (Note1)		I _{DM}	280	A
Power Dissipation	T _C =25°C	P _D	72	W
Power Dissipation-Derate above 25°C			0.58	W/°C
Junction Temperature and Storage Temperature Range		T _J & T _{stg}	-55 to 150	°C
Thermal Resistance From Junction to Ambient		R _{ΘJA}	62	°C/W
Thermal Resistance From Junction to Case		R _{ΘJC}	1.73	°C/W

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V, T_J=25^{\circ}C$	-	-	1	μA
		$V_{DS}=32V, V_{GS}=0V, T_J=85^{\circ}C$	-	-	10	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.6	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=15A$	-	6.8	9.0	m Ω
		$V_{GS}=4.5V, I_D=8A$	-	10	13	m Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$	-	1278	2200	pF
Output Capacitance	C_{oss}		-	135	250	pF
Reverse Transfer Capacitance	C_{rss}		-	87	170	pF
Gate resistance	R_g	$V_{GS}=0V, V_{DS}=0V, F=1.0MHz$	-	2.2	-	Ω
Switching Characteristics						
Turn-on Delay Time (Note2, 3)	$t_{d(on)}$	$V_{DD}=15V, I_D=1A$ $V_{GS}=10V, R_G=3.3\Omega$	-	13.2	25	nS
Turn-on Rise Time (Note2, 3)	t_r		-	2.2	5	nS
Turn-Off Delay Time (Note2, 3)	$t_{d(off)}$		-	72	130	nS
Turn-Off Fall Time (Note2, 3)	t_f		-	4.5	10	nS
Total Gate Charge (Note2, 3)	Q_g	$V_{DS}=-30V, I_D=-10A,$ $V_{GS}=-10V$	-	19.7	30	nC
Gate-Source Charge (Note2, 3)	Q_{gs}		-	2.8	4.2	nC
Gate-Drain Charge (Note2, 3)	Q_{gd}		-	5.1	7.6	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	$V_{GS}=0V, I_S=1.0A$	-	-	1.0	V
Diode continous forward current	I_S	$V_G=V_D=0V$, Force Current	-	-	60	A
Diode pulse current	I_{SM}		-	-	140	A
Body Diode Reverse Recovery Time	T_{rr}	$IF=5.0A$, $dI/dt=100A/\mu s$	-	17	-	nS
Body Diode Reverse RecoveryCharge	Q_{rr}		-	2.8	-	nC

Notes:

- 1.Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=39A, R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$.
- 3.The data tested by pulsed, Pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.
- 4.Switching characteristics are independent of operating junction temperatures.

Typical Electrical and Thermal Characteristics

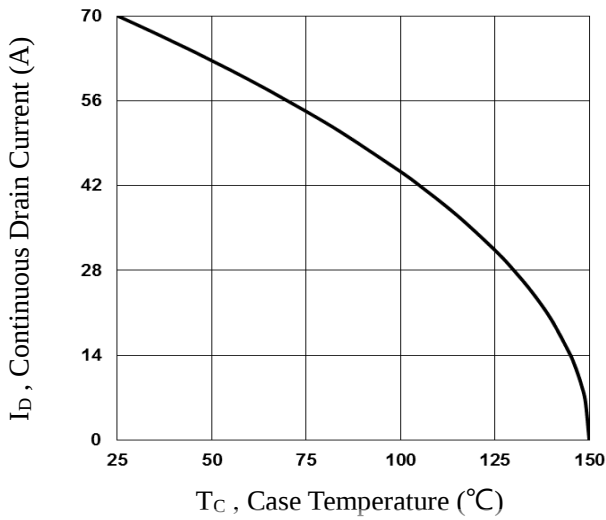


Fig.1 Continuous Drain Current vs. T_C

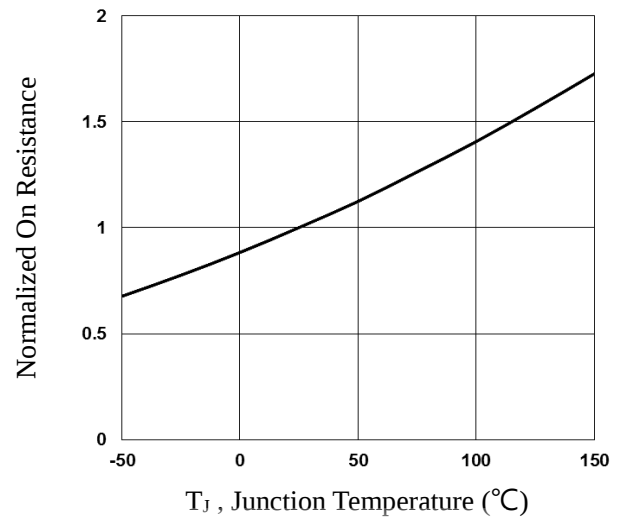


Fig.2 Normalized $R_{DS(on)}$ vs. T_J

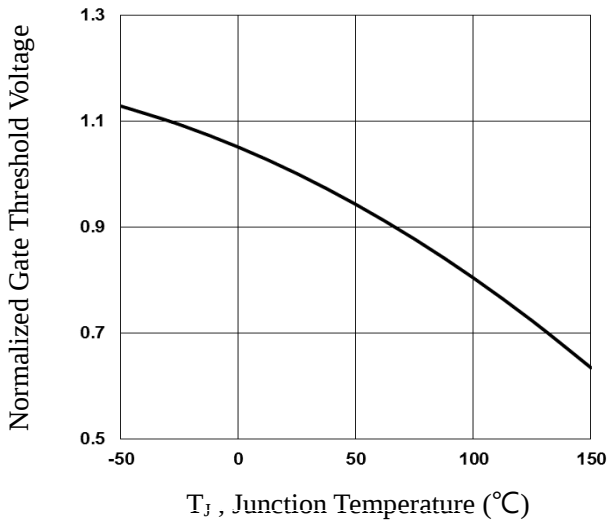


Fig.3 Normalized V_{th} vs. T_J

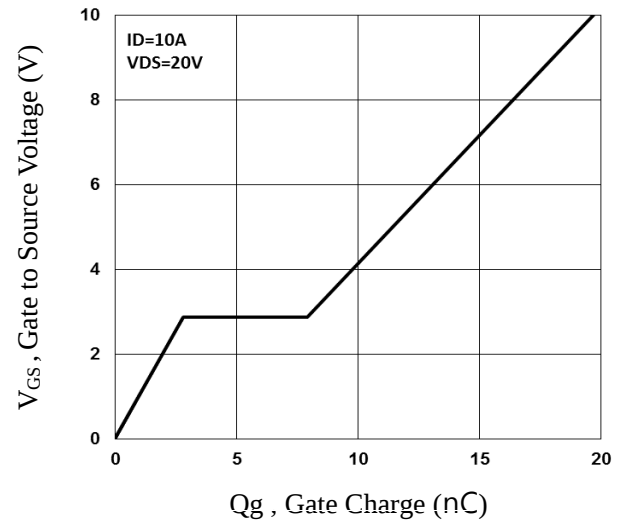


Fig.4 Gate Charge Waveform

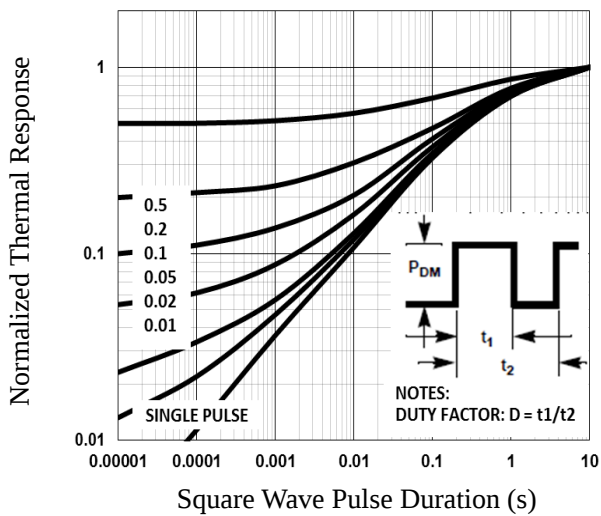


Fig.5 Normalized Transient Impedance

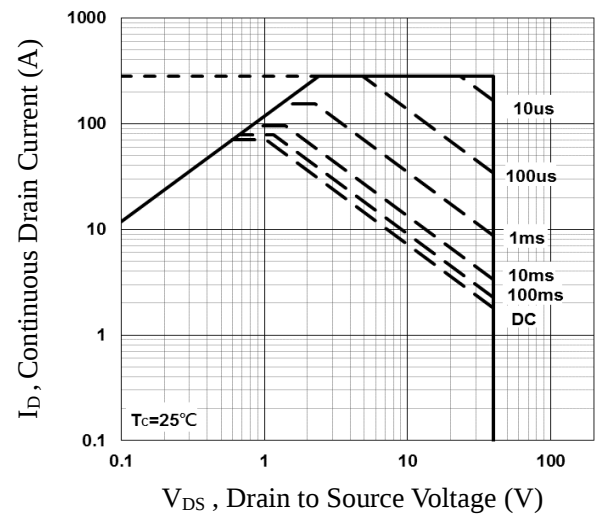


Fig.6 Maximum Safe Operation Area

Typical Electrical and Thermal Characteristics

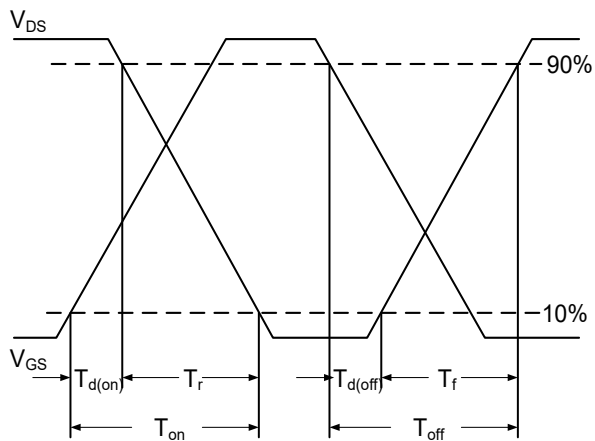
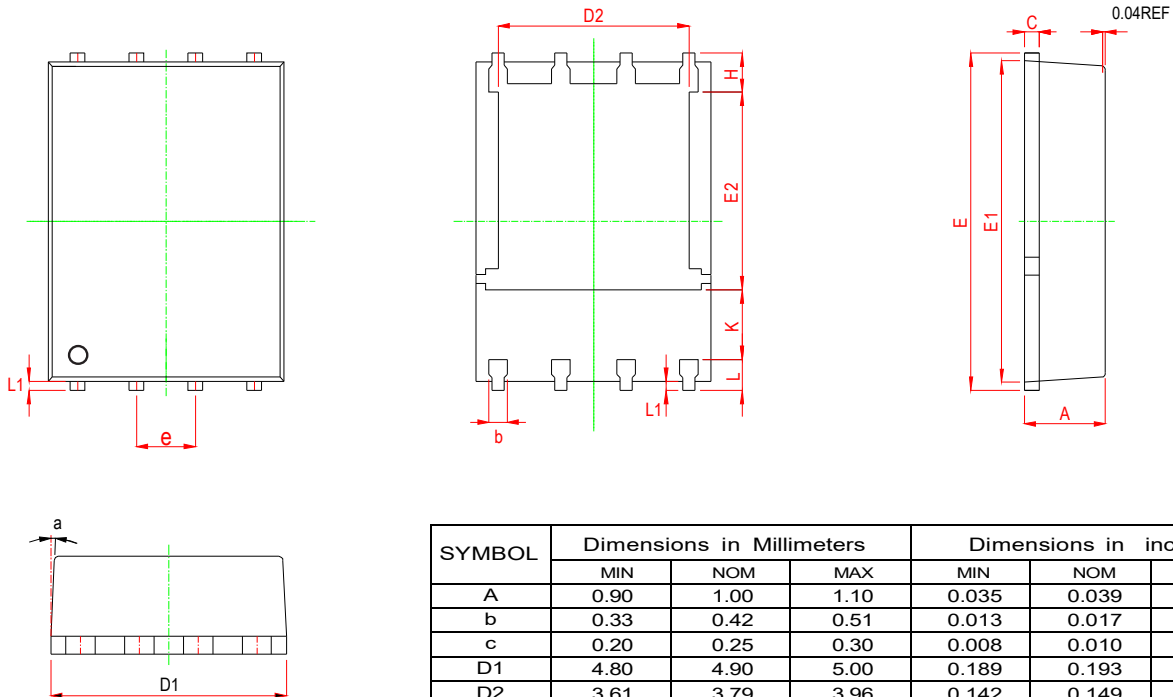


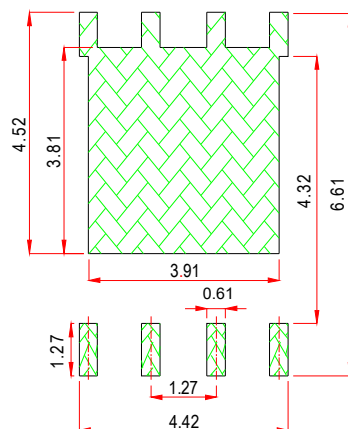
Fig.7 Switching Time Waveform

DFN5x6-8L Package Outline Dimensions



SYMBOL	Dimensions in Millimeters			Dimensions in inches		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.90	1.00	1.10	0.035	0.039	0.043
b	0.33	0.42	0.51	0.013	0.017	0.020
c	0.20	0.25	0.30	0.008	0.010	0.012
D1	4.80	4.90	5.00	0.189	0.193	0.197
D2	3.61	3.79	3.96	0.142	0.149	0.156
E	5.90	6.00	6.10	0.232	0.236	0.240
E1	5.65	5.75	5.85	0.222	0.226	0.230
E2	3.38	3.58	3.78	0.133	0.141	0.149
e	1.27 BSC			0.005 BSC		
H	0.41	0.51	0.61	0.016	0.020	0.024
k	1.10			0.043		
L	0.51	0.61	0.71	0.020	0.024	0.028
L1	0.06	0.13	0.20	0.002	0.005	0.008
a	0°		12°	0°		12°

Suggested Pad Layout



Note:

1. Controlling dimension: in/millimeters.
2. General tolerance: $\pm 0.05\text{mm}$.
3. The pad layout is for reference purposes only.