

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
60V	4.5mΩ@10V	110A

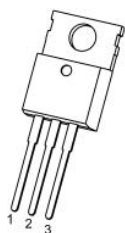
Feature

- Fast Switching
- Low Gate Charge and Rdson
- Low Reverse transfer capacitances
- 100% Single Pulse avalanche energy Test

Applications

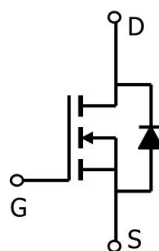
- Charger
- Battery management
- Power Switching application

Package

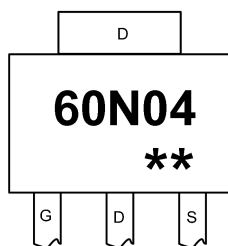


TO-220-3L-C(1:G 2:D 3:S)

Circuit diagram



Marking



60N04 : Product code
****** : Week code

**Absolute maximum ratings (Ta=25°C unless otherwise noted)**

Parameter	Symbol	Rating	Unit
Drain source voltage	V_{DS}	60	V
Gate source voltage	V_{GS}	± 25	V
Continuous drain current(Tc=25°C)	I_D	110	A
Pulsed drain current	I_{DM}	440	A
Continuous diode forward current(Tc=25°C)	I_S	56	A
Power dissipation(Tc=25°C)	P_D	180	W
Single pulsed avalanche energy1)	E_{AS}	784	mJ
Thermal resistance, junction-case	$R_{\theta JC}$	0.69	°C/W
Operation and storage temperature	T_{stg}, T_j	-55 to 150	°C

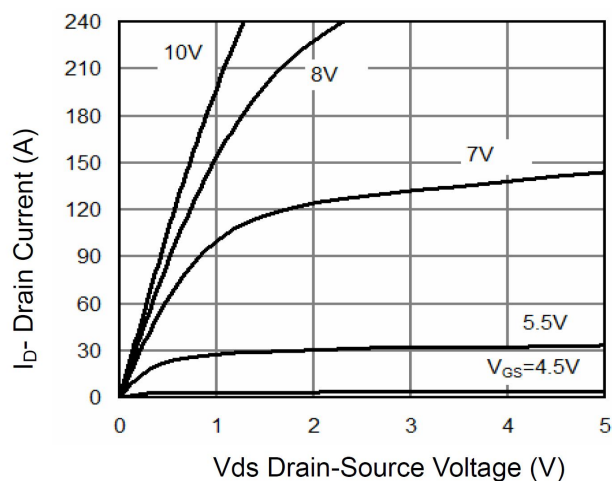
Electrical characteristics (Ta=25°C, unless otherwise noted)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D = 250\mu A, V_{GS} = 0V$	60	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	3	4	
Drain Cut-Off Current	I_{DSS}	$V_{DS} = 48V, V_{GS} = 0V$	-	-	1	μA
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	± 0.1	
Drain-Source ON Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 30A$	-	4.5	6	m Ω
Dynamic CharacteristicsReverse						
Total Gate Charge	Q_g	$V_{DS} = 30V, I_D = 20A, V_{GS} = 10V$	-	96	-	nC
Gate-Source Charge	Q_{gs}		-	22	-	
Gate-Drain Charge	Q_{gd}		-	28	-	
Input Capacitance	C_{iss}	$V_{DS} = 30V, V_{GS} = 0V, f = 1.0MHz$	-	5250	-	pF
Output Capacitance	C_{oss}		-	510	-	
Transfer Capacitance	C_{rss}		-	310	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10V, V_{DS} = 30V, I_D = 30A, R_G = 2.5\Omega$	-	21	-	ns
Rise Time	t_r		-	12	-	
Turn-Off Delay Time	$t_{d(off)}$		-	56	-	
Fall Time	t_f		-	18	-	
Drain-Source Body Diode Characteristics						
Source-Drain Diode Forward Voltage	V_{SD}	$I_S = 1A, V_{GS} = 0V$	-	-	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 50A, dl/dt = 100A/\mu s$	-	35	-	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	67	-	nC

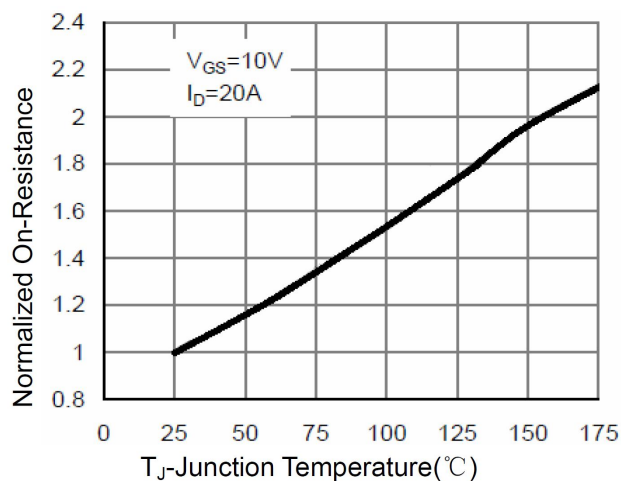
Note:

1.EAS condition : $T_j = 25^\circ C, V_{DD} = 30V, V_G = 10V, L = 0.5mH, R_g = 25\Omega$

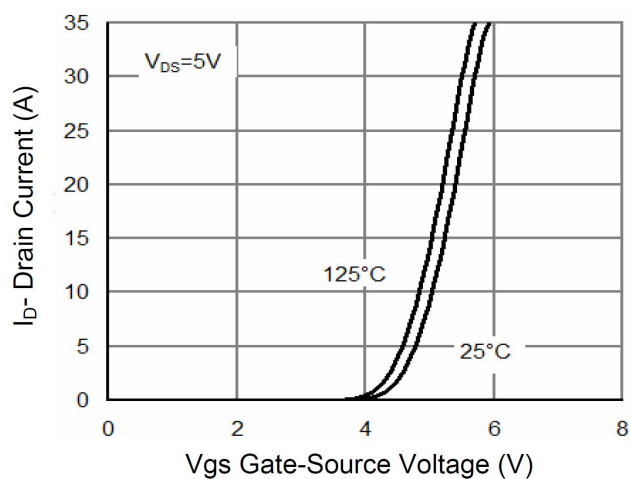
Typical Characteristics



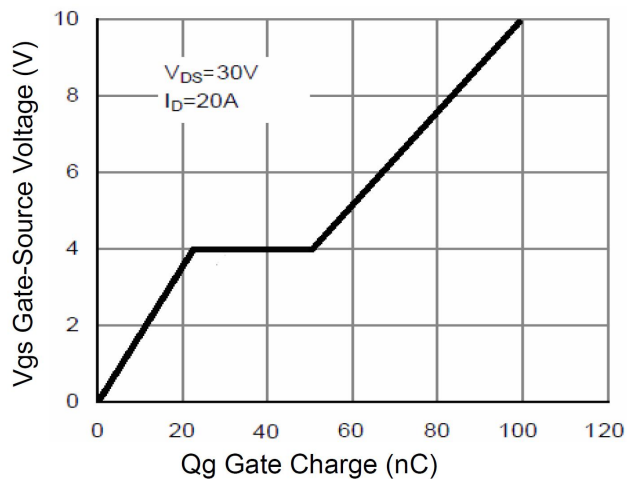
Output Characteristics



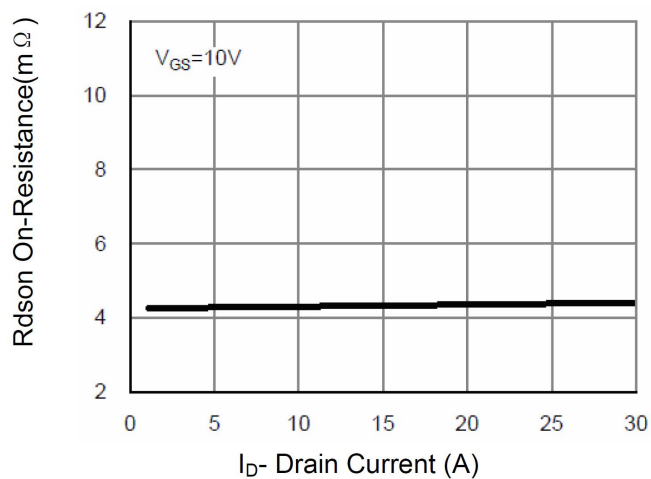
Rdson-Junction Temperature



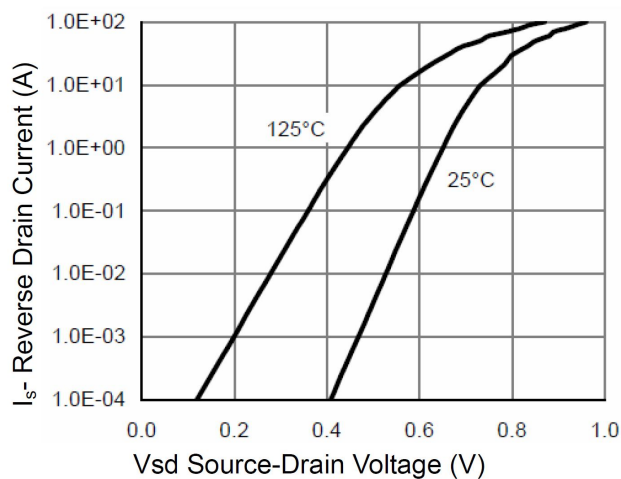
Transfer Characteristics



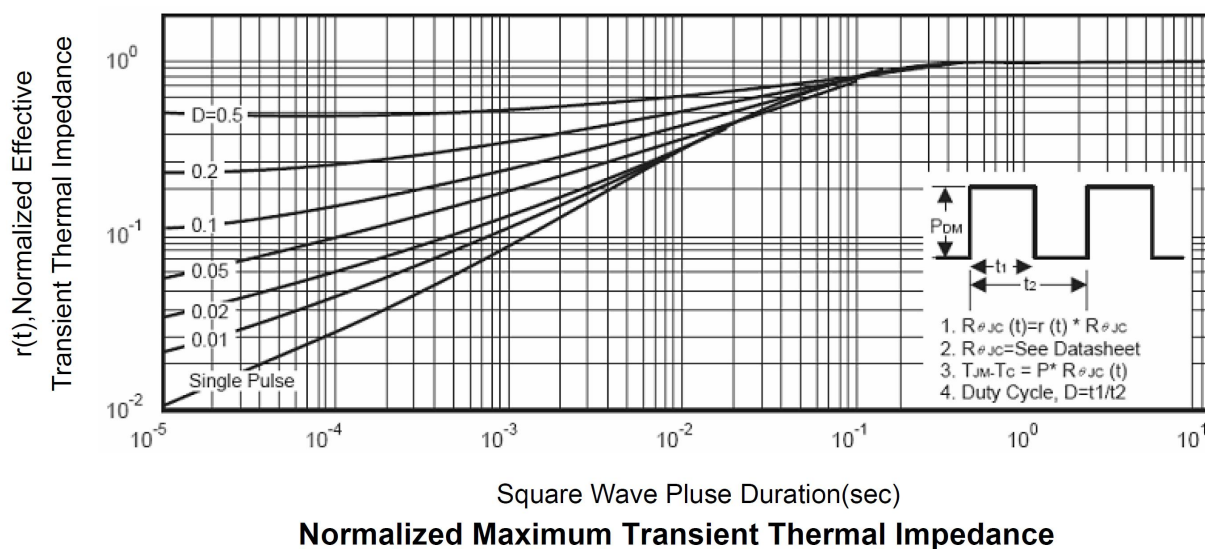
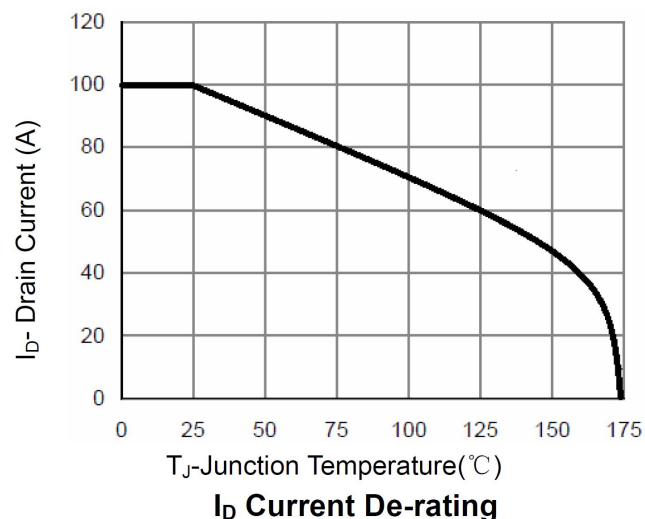
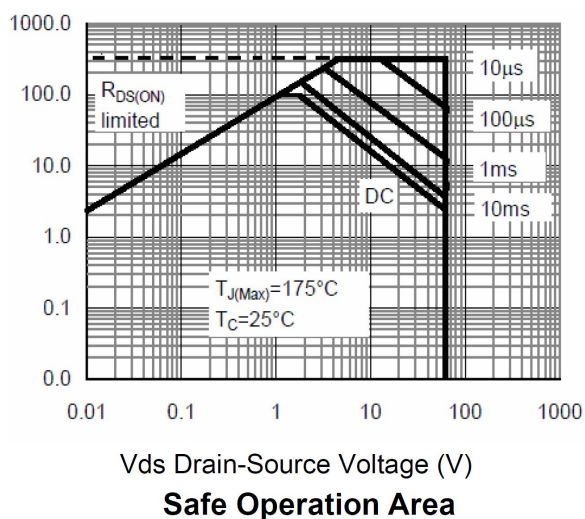
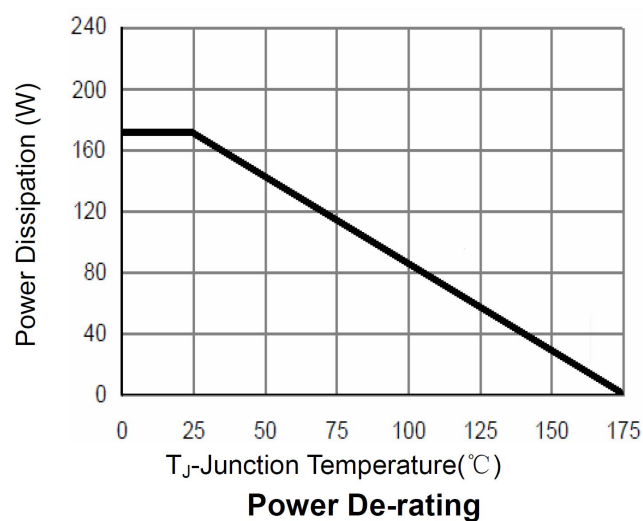
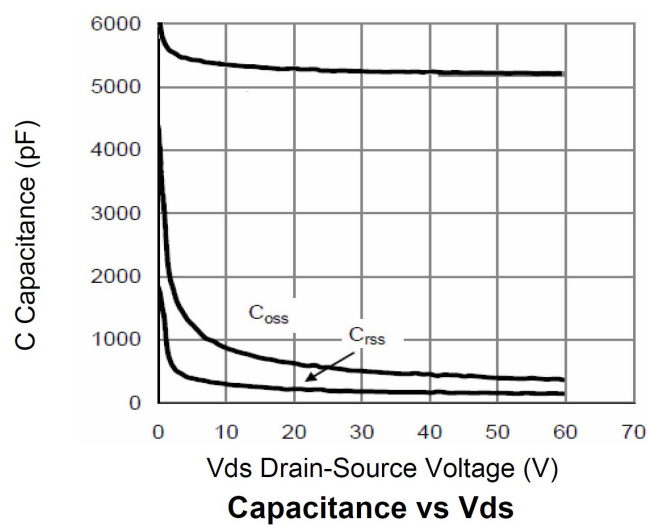
Gate Charge



Rdson- Drain Current

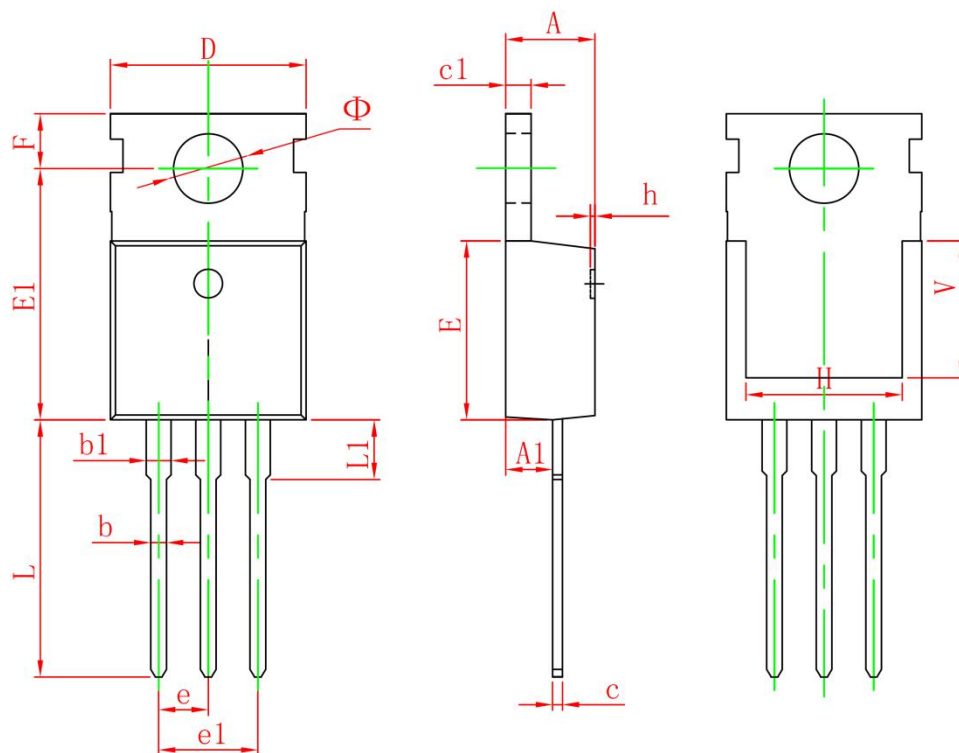


Source- Drain Diode Forward





TO-220-3L-C Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.950	9.750	0.352	0.384
E1	12.650	13.050	0.498	0.514
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	6.900 REF.		0.276 REF.	
Φ	3.400	3.800	0.134	0.150