

## GENERAL DESCRIPTION

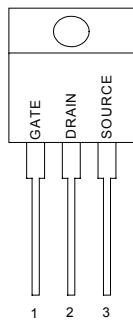
This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

## FEATURES

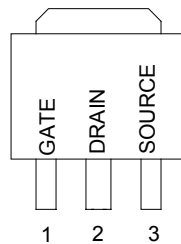
- ◆ Robust High Voltage Termination
- ◆ Avalanche Energy Specified
- ◆ Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- ◆ Diode is Characterized for Use in Bridge Circuits
- ◆  $I_{DSS}$  and  $V_{DS(on)}$  Specified at Elevated Temperature

## PIN CONFIGURATION

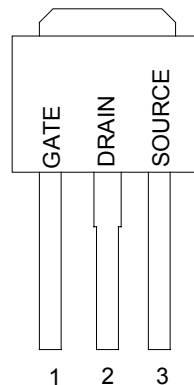
TO-220/TO-220FP  
Front View



TO-252  
Front View

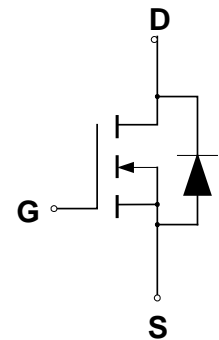


TO-251  
Front View



## SYMBOL

N-Channel MOSFET



## ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain to Current — Continuous	$I_D$	2.0	A
— Pulsed	$I_{DM}$	9.0	
Gate-to-Source Voltage — Continue	$V_{GS}$	$\pm 20$	V
— Non-repetitive	$V_{GSM}$	$\pm 40$	V
Total Power Dissipation	$P_D$	50	W
Derate above 25°C		0.4	W/°C
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy — $T_J = 25^\circ\text{C}$ ( $V_{DD} = 100\text{V}$ , $V_{GS} = 10\text{V}$ , $I_L = 2\text{A}$ , $L = 10\text{mH}$ , $R_G = 25\Omega$ )	$E_{AS}$	20	mJ
Thermal Resistance — Junction to Case	$\theta_{JC}$	1.0	°C/W
— Junction to Ambient	$\theta_{JA}$	62.5	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	°C

### ORDERING INFORMATION

Part Number	Package
CMT02N60N251	TO-251
CMT02N60N252	TO-252
CMT02N60N220	TO-220
CMT02N60N220FP	TO-220 Full Package
CMT02N60GN251*	TO-251
CMT02N60GN252*	TO-252
CMT02N60GN220*	TO-220
CMT02N60GN220FP*	TO-220 Full Package

\*Note: G : Suffix for Pb Free Product

### ELECTRICAL CHARACTERISTICS

Unless otherwise specified,  $T_J = 25^\circ\text{C}$ .

		CMT02N60			
Characteristic	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$ )	$V_{(BR)DSS}$	600			V
Drain-Source Leakage Current ( $V_{DS} = 600\text{ V}$ , $V_{GS} = 0\text{ V}$ ) ( $V_{DS} = 480\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125^\circ\text{C}$ )	$I_{DSS}$			0.25 1.0	mA
Gate-Source Leakage Current-Forward ( $V_{gsf} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ )	$I_{GSSF}$			100	nA
Gate-Source Leakage Current-Reverse ( $V_{gsr} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ )	$I_{GSSR}$			100	nA
Gate Threshold Voltage ( $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$ )	$V_{GS(th)}$	2.0	3.1	4.0	V
Static Drain-Source On-Resistance ( $V_{GS} = 10\text{ V}$ , $I_D = 1.0\text{ A}$ ) *	$R_{DS(on)}$		3.3	4.4	$\Omega$
Drain-Source On-Voltage ( $V_{GS} = 10\text{ V}$ ) ( $I_D = 2.0\text{ A}$ )	$V_{DS(on)}$			8.8	V
Forward Transconductance ( $V_{DS} \geq 50\text{ V}$ , $I_D = 1.0\text{ A}$ ) *	$g_{FS}$	1.0			mhos
Input Capacitance	$(V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	435		pF
Output Capacitance		$C_{oss}$	56		pF
Reverse Transfer Capacitance		$C_{rss}$	9.2		pF
Turn-On Delay Time	$(V_{DD} = 300\text{ V}$ , $I_D = 2.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 18\Omega$ ) *	$t_{d(on)}$	12		ns
Rise Time		$t_r$	21		ns
Turn-Off Delay Time		$t_{d(off)}$	30		ns
Fall Time		$t_f$	24		ns
Total Gate Charge	$(V_{DS} = 400\text{ V}$ , $I_D = 2.0\text{ A}$ , $V_{GS} = 10\text{ V}$ )*	$Q_g$	13	22	nC
Gate-Source Charge		$Q_{gs}$	2.0		nC
Gate-Drain Charge		$Q_{gd}$	6.0		nC
Internal Drain Inductance (Measured from the drain lead 0.25" from package to center of die)	$L_D$		4.5		nH
Internal Drain Inductance (Measured from the source lead 0.25" from package to source bond pad)	$L_S$		7.5		nH
<b>SOURCE-DRAIN DIODE CHARACTERISTICS</b>					
Forward On-Voltage(1)	$(I_S = 2.0\text{ A}$ , $V_{GS} = 0\text{ V}$ , $d_i/d_t = 100\text{ A}/\mu\text{s}$ )	$V_{SD}$	1.0	1.6	V
Forward Turn-On Time		$t_{on}$	**		ns
Reverse Recovery Time		$t_{rr}$	340		ns

\* Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$

\*\* Negligible, Dominated by circuit inductance

### TYPICAL ELECTRICAL CHARACTERISTICS

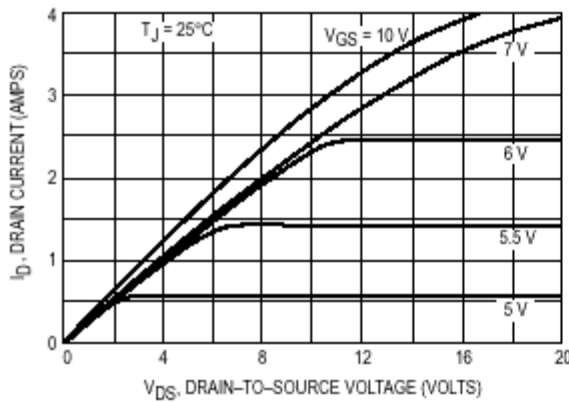


Figure 1. On-Region Characteristics

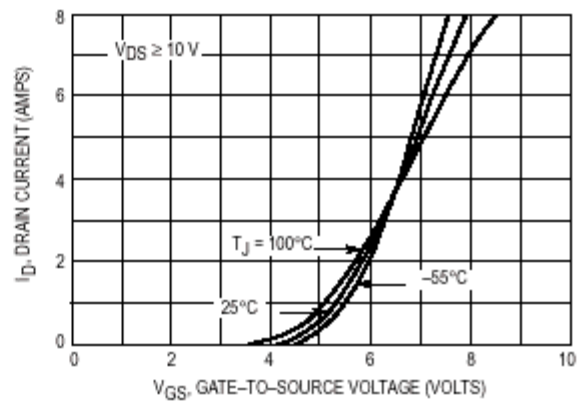


Figure 2. Transfer Characteristics

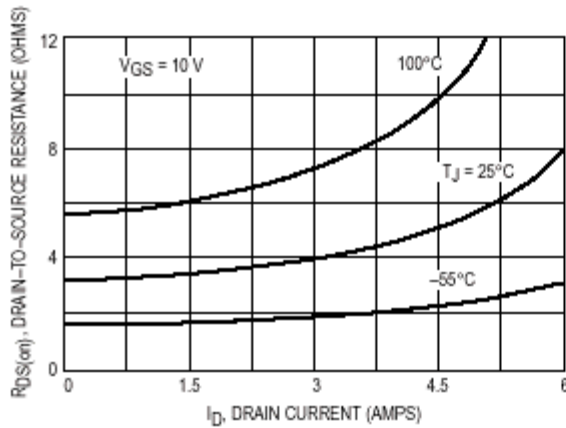


Figure 3. On-Resistance versus Drain Current and Temperature

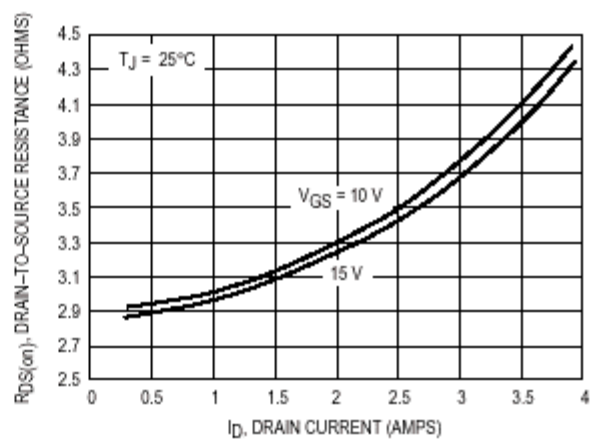


Figure 4. On-Resistance versus Drain Current and Gate Voltage

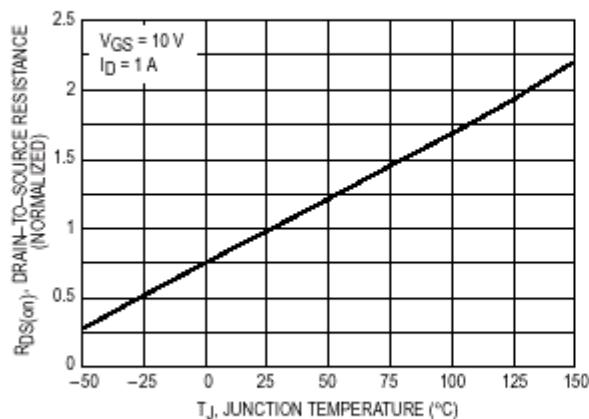


Figure 5. On-Resistance Variation with Temperature

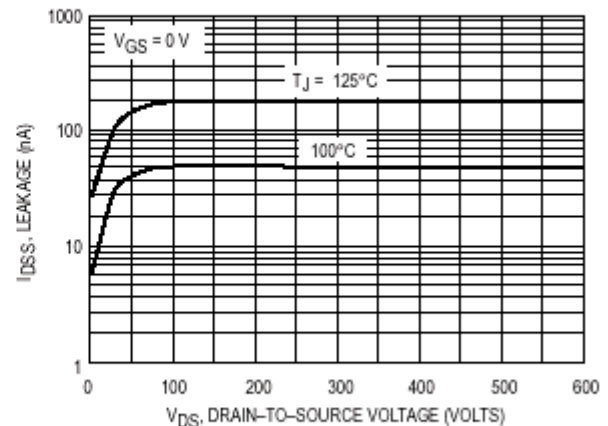
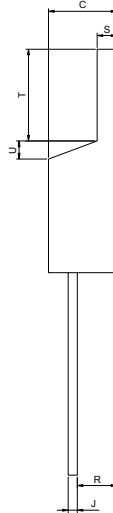
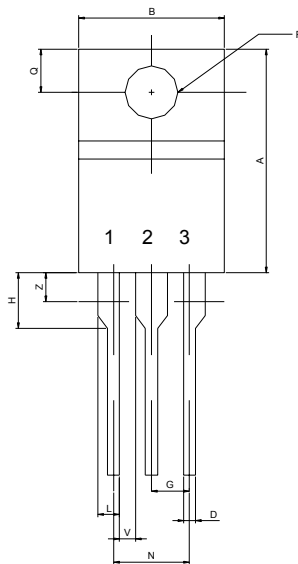


Figure 6. Drain-To-Source Leakage Current versus Voltage

### PACKAGE DIMENSION

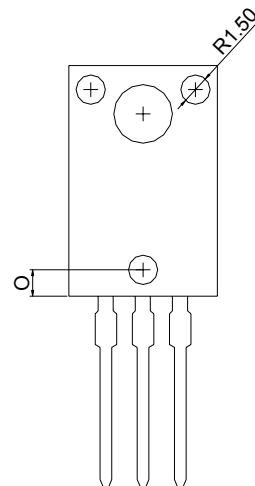
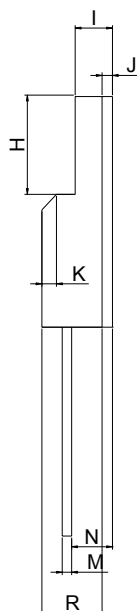
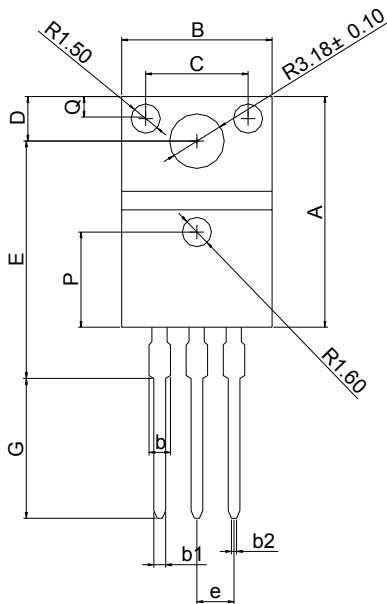
TO-220



PIN 1: GATE  
PIN 2: DRAIN  
PIN 3: SOURCE

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	14.48	---	15.75	0.570	---	0.620
B	9.66	---	10.28	0.380	---	0.405
C	4.07	---	4.82	0.160	---	0.190
D	0.64	---	0.88	0.025	---	0.035
F	3.61	---	3.73	0.142	---	0.147
G	2.42	---	2.66	0.095	---	0.105
H	2.80	---	3.93	0.110	---	0.155
J	0.46	---	0.64	0.018	---	0.025
K	12.70	---	14.27	0.500	---	0.562
L	1.15	---	1.52	0.045	---	0.060
N	4.83	---	5.33	0.190	---	0.210
Q	2.54	---	3.04	0.100	---	0.120
R	2.04	---	2.79	0.080	---	0.110
S	1.15	---	1.39	0.045	---	0.055
T	5.97	---	6.47	0.235	---	0.255
U	0.00	---	1.27	0.000	---	0.050
V	1.15	---	---	0.045	---	---
Z	---	---	2.04	---	---	0.080

TO-220FP

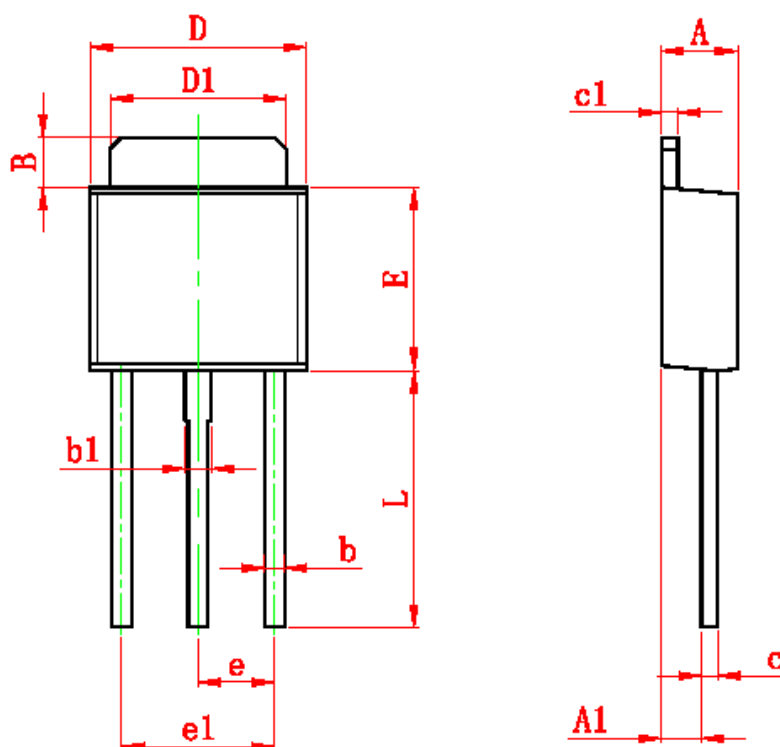


SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	15.67	---	16.07	0.617	---	0.633
B	9.96	---	10.36	0.392	---	0.408
C	---	7.00	---	---	0.275	---
D	3.20	---	3.40	0.126	---	0.134
E	15.60	---	16.00	0.614	---	0.630
G	9.45	---	10.05	0.372	---	0.396
H	6.48	---	6.88	0.255	---	0.279
I	2.34	---	2.74	0.092	---	0.108
J	---	0.70	---	---	0.028	---
K	---	1.00	---	---	0.039	---
M	0.45	---	0.60	0.018	---	0.024
N	2.56	---	2.96	0.101	---	0.117
O	---	1.80	---	---	0.071	---
P	---	6.50	---	---	0.256	---
Q	---	1.50	---	---	0.059	---
R	4.50	---	4.90	0.177	---	0.193
b	---	---	1.47	---	---	0.058
b1	0.70	---	0.90	0.028	---	0.035
b2	0.25	---	0.45	0.010	---	0.018
e	---	2.54	---	---	0.100	---

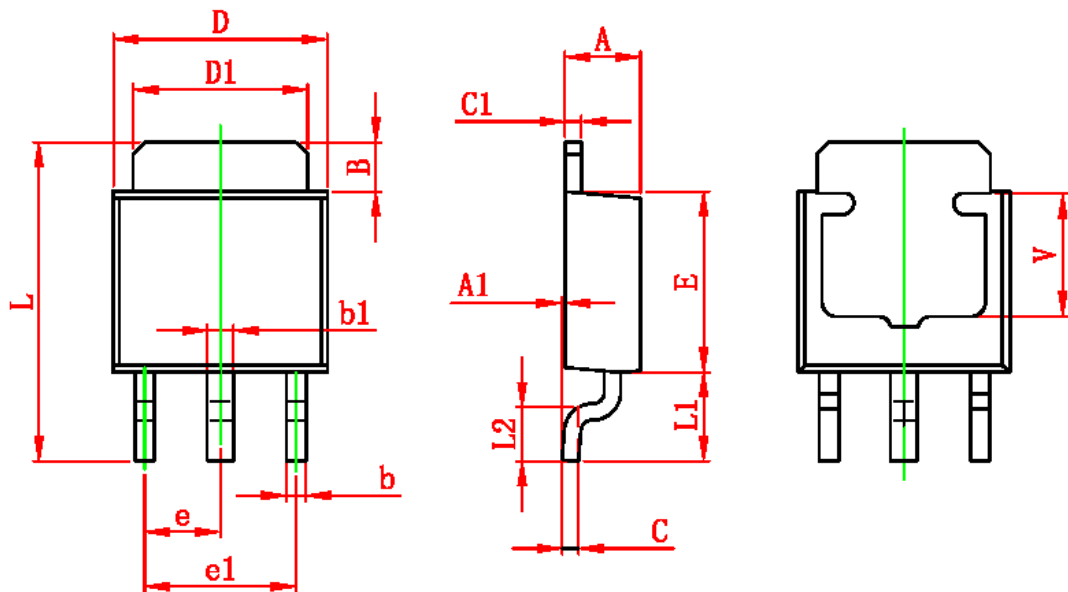
Front View

Side View

Back View

**PACKAGE DIMENSION**
**TO-251**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	1.020	1.270	0.040	0.050
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300 TYP		0.091 TYP	
e1	4.500	4.700	0.177	0.185
L	7.500	7.900	0.295	0.311

**PACKAGE DIMENSION****TO-252**

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300 TYP		0.091 TYP	
e1	4.500	4.700	0.177	0.185
L	9.500	9.900	0.374	0.390
L1	2.550	2.900	0.100	0.114
L2	1.400	1.780	0.055	0.070
V	3.80 REF		0.150 REF	

## IMPORTANT NOTICE

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