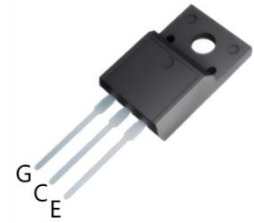
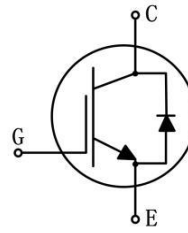


Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	30	A
$V_{CE(sat)}$	1.69	V



TO-220F

Features

- Positive temperature coefficient.
- Fast Switching
- LOW $V_{CE(sat)}$
- Reliable and Rugged

Applications

- Motor drives
- Air Condition
- Inverters

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	± 30	V
Continuous collector current($T_C=25^\circ C$)	I_C	60	A
Continuous collector current($T_C=100^\circ C$)		30	A
Pulsed collector current, tp limited by T_{vjmax}	I_{CM}	90	A
Diode continuous forward current($T_C=25^\circ C$)	I_F	60	A
Diode continuous forward current($T_C=100^\circ C$)		30	A
Diode maximum current, tp limited by T_{vjmax}	I_{FM}	90	A
Operating junction temperature range	T_{vj}	-55 to+175	$^\circ C$
Storage temperature range	T_{Stg}	-55 to+175	$^\circ C$

Thermal Characteristics

Parameter	Symbol	Value		Unit
		Typ	Max.	
Thermal resistance,junction to case for IGBT	$R_{th(j-c)}$	-	0.83	$^\circ C/W$
Thermal resistance,junction to case for Diode	$R_{th(j-c)}$	-	0.65	$^\circ C/W$
Thermal resistance,junction to ambient	$R_{th(j-a)}$	-	40	$^\circ C/W$

Electrical Characteristics of IGBT ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)
Static characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	$B_{V_{CES}}$	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V
Collector-emitter leakage current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$	-	-	10	μA
Gate leakage current, forward	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	± 200	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1mA$	4.3	5.3	6.3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=30A$	-	1.69	2	V
		$V_{GE}=15V, I_C=30A, T_{vj}=125^{\circ}\text{C}$	-	1.9	-	V
		$V_{GE}=15V, I_C=30A, T_{vj}=175^{\circ}\text{C}$	-	2.05	-	V

Dynamic Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{ies}	$V_{CE}=25V$	-	1853	-	pF
Output capacitance	C_{oes}	$V_{GE}=0V$	-	72	-	pF
Reverse transfer capacitance	C_{res}	$f=1MHz$	-	55	-	pF
Total gate charge	Q_g	$V_{CC}=520V$	-	98	-	nC
Gate-Emitter Charge	Q_{ge}	$V_{GE}=15V$	-	18	-	nC
Gate-Collector Charge	Q_{gc}	$I_C=30A$	-	47	-	nC
Short circuit collector current Max.1000 short circuits, times between short circuits: $\geq 1.0s$	$t_{(SC)}$	$V_{GE}=15V$ $V_{CC}\leq 400V$ $T_{J}\leq 175^{\circ}\text{C}$	-	8	-	μs

Switching Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V$ $V_{GE}=15V$ $I_C=30A$ $R_G=5\Omega$ Inductive load	-	16	-	ns
Rise time	t_r		-	46	-	ns
Turn-off delay time	$t_{d(off)}$		-	72	-	ns
Fall time	t_f		-	80	-	ns
Turn-on energy	E_{on}		-	0.52	-	mJ
Turn-off energy	E_{off}		-	0.77	-	mJ
Total switching energy	E_{ts}		-	1.29	-	mJ
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V$	-	18	-	ns
Rise time	t_r	$V_{GE}=15V$	-	54	-	ns

Turn-off delay time	$t_{d(off)}$	$I_C=30A$ $R_G=5\Omega$ Inductive load $T_{vj}=175^\circ C$	-	90	-	ns
Fall time	t_f		-	75	-	ns
Turn-on energy	E_{on}		-	0.97	-	mJ
Turn-off energy	E_{off}		-	1.36	-	mJ
Total switching energy	E_{ts}		-	2.33	-	mJ

Diode Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F=30A$	-	2	2.3	V
		$I_F=30A$ $T_{vj}=125^\circ C$	-	1.7	-	V
		$I_F=30A$ $T_{vj}=175^\circ C$	-	1.5	-	V
Diode reverse recovery time	t_{rr}	$I_F=30A$ $diF/dt=-200A/\mu s$	-	48	-	ns
Diode peak reverse recovery current	Q_{rr}		-	80	-	nC
Diode reverse recovery charge	I_{rrm}		-	5.1	-	A
Diode reverse recovery time	t_{rr}	$I_F=30A$ $diF/dt=-200A/\mu s$ $T_{vj}=175^\circ C$	-	39	-	ns
Diode peak reverse recovery current	Q_{rr}		-	127	-	nC
Diode reverse recovery charge	I_{rrm}		-	8.5	-	A

Typical Characteristics

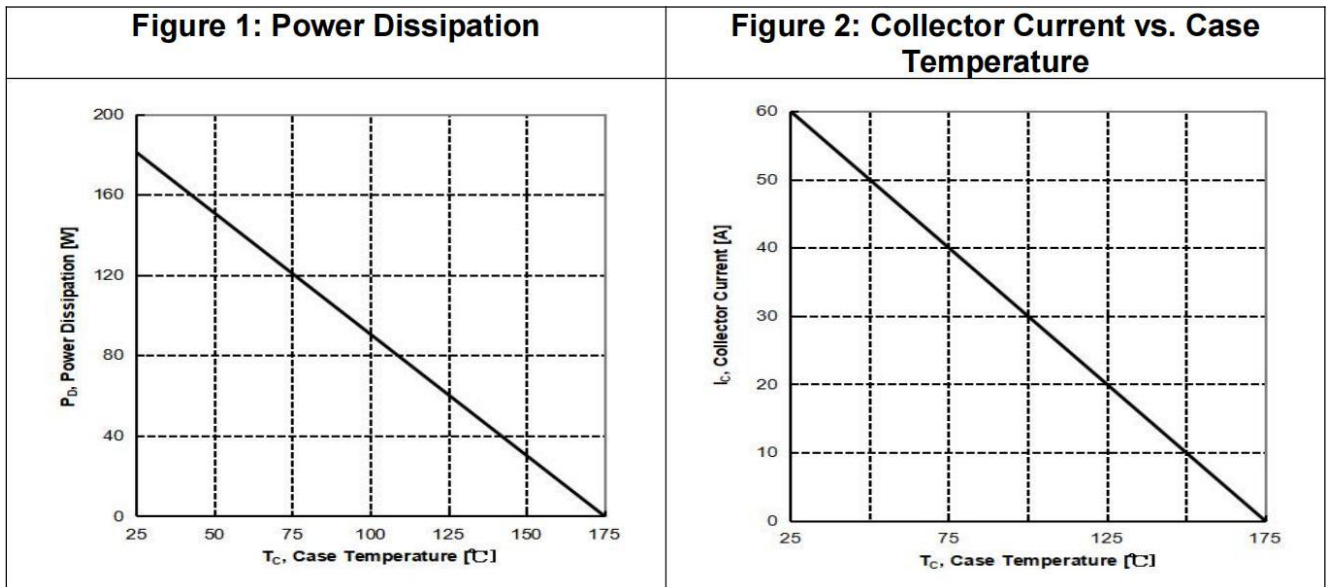


Figure 3: Safe Operation Area

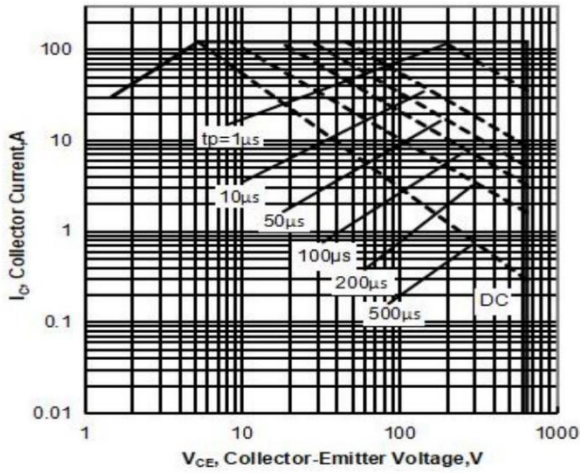


Figure 4: Typical Transfer Characteristics

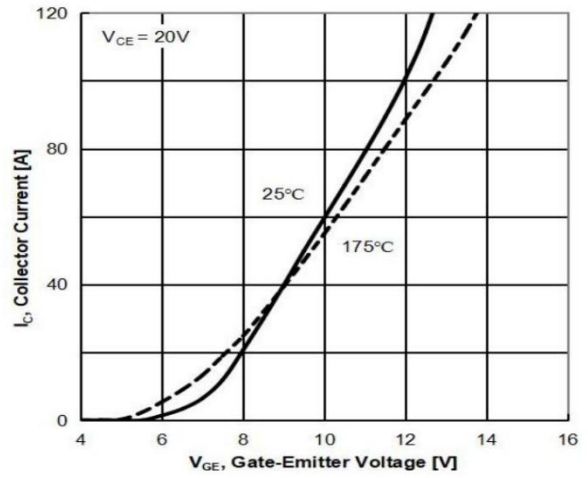


Figure 5: Typical Output Characteristics

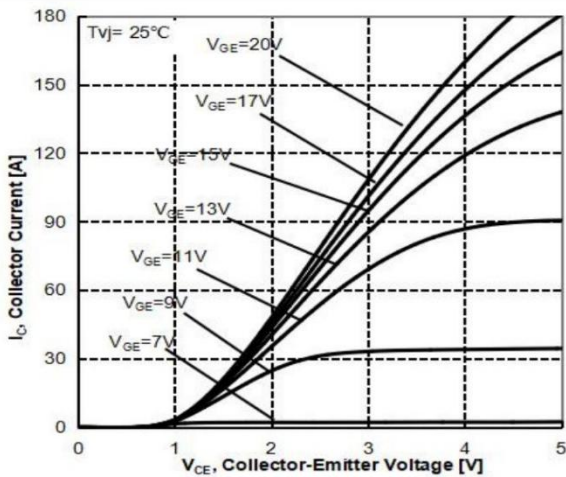


Figure 6: Typical Output Characteristics

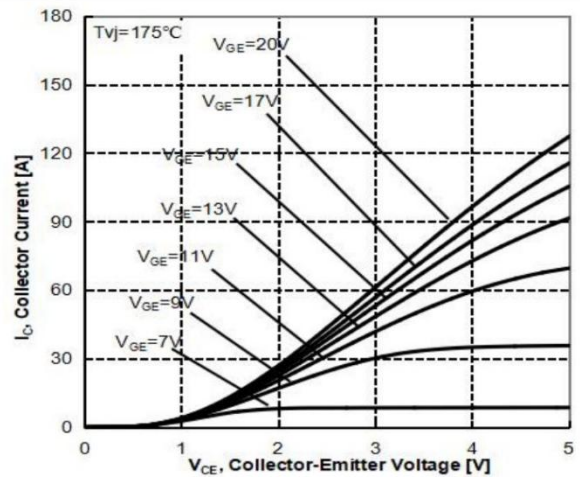


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

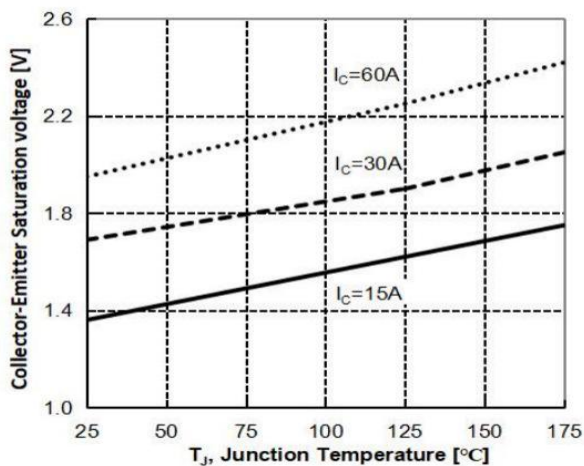


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

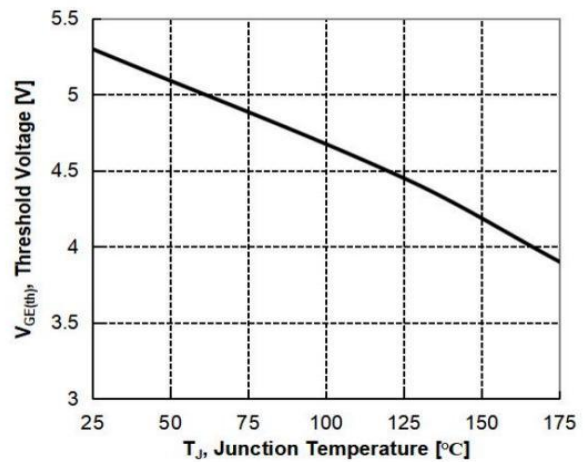


Figure 11: Typical Switching Times vs. Junction Temperature ($V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=30A$)

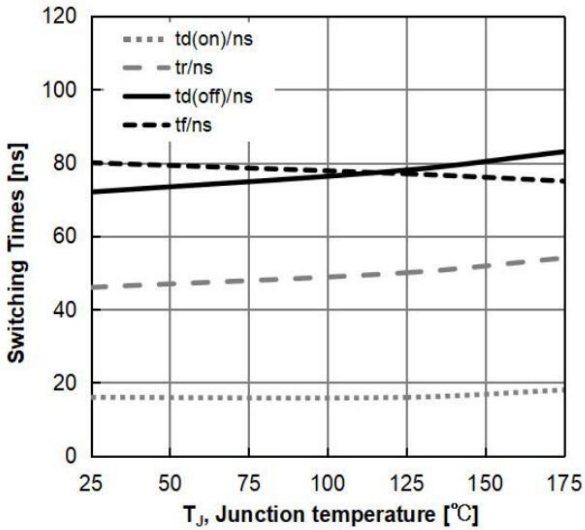


Figure 12: Typical Switching Energy vs. Junction Temperature ($V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=30A$)

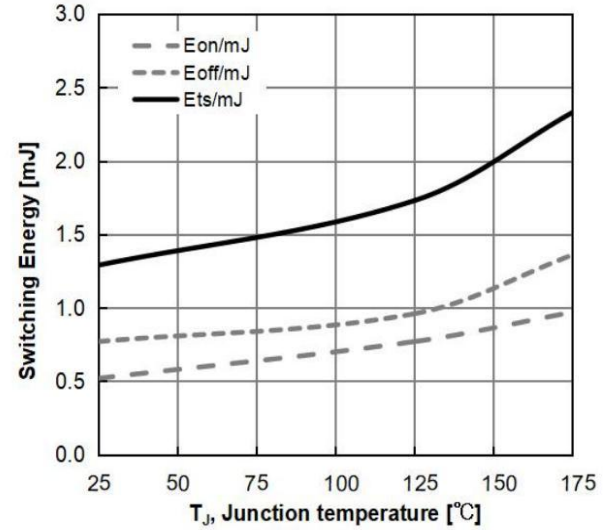


Figure 13: Typical Switching Times vs. Collector Current ($T_J=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$)

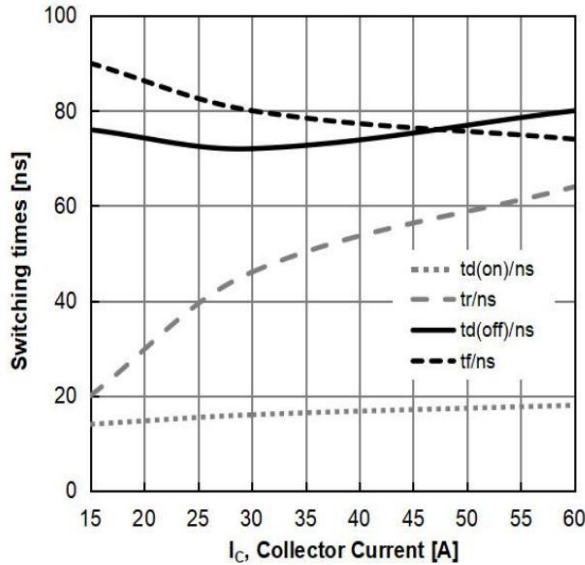


Figure 14: Typical Switching Energy vs. Collector Current ($T_J=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$)

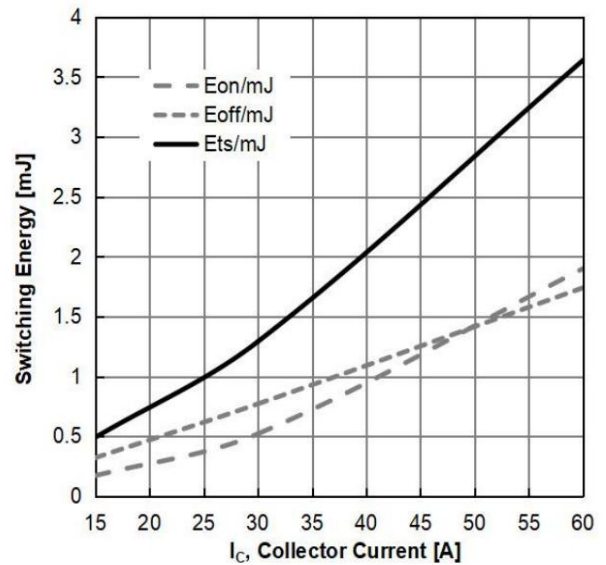


Figure 15: Typical Switching Times vs. VCE ($T_J=25^\circ\text{C}, V_{GE}=15/0\text{V}, I_C=30\text{A}$)

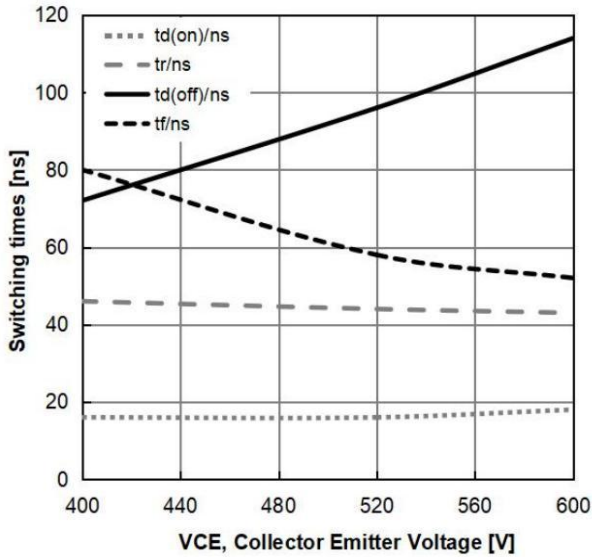


Figure 16: Typical Switching Energy vs. VCE ($T_J=25^\circ\text{C}, V_{GE}=15/0\text{V}, I_C=30\text{A}$)

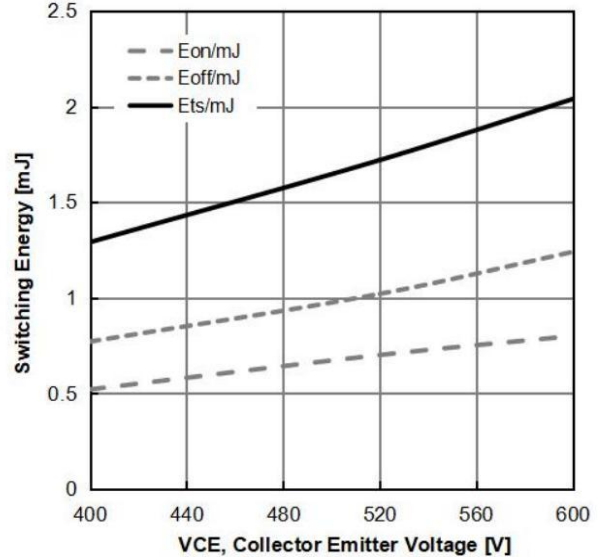


Figure 17: Typical Gate Charge

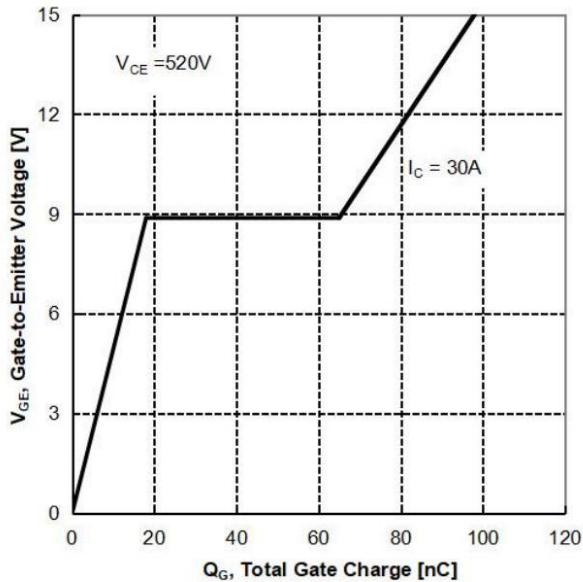


Figure 18: Typical Capacitance vs. Collector- Emitter Voltage

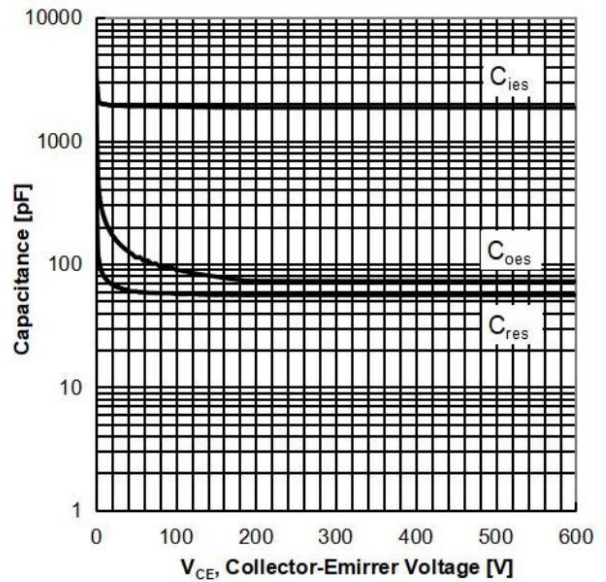


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

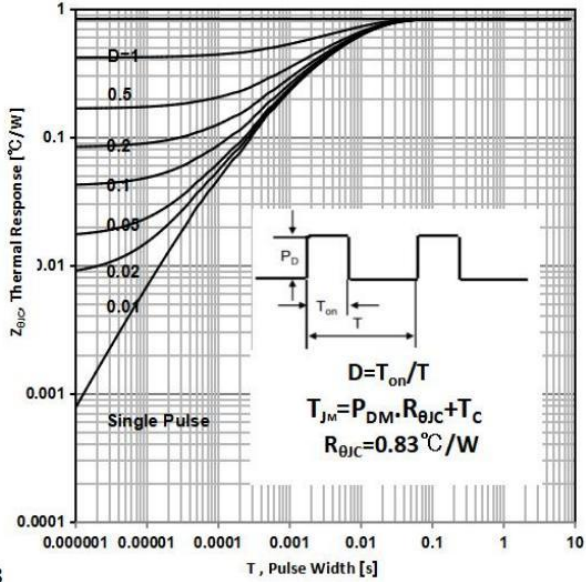


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

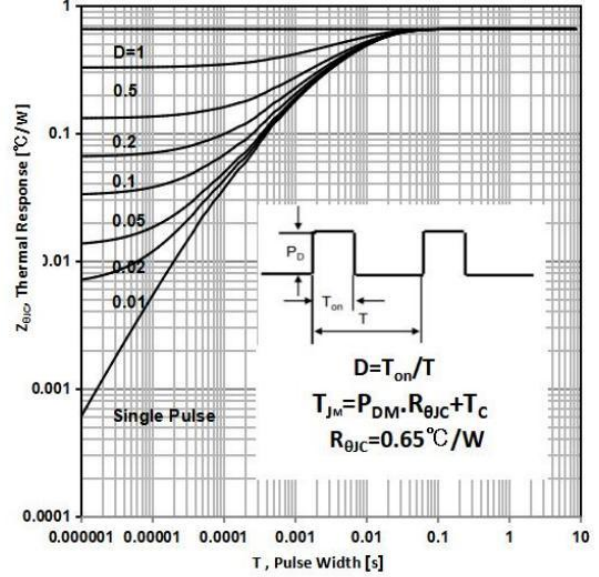
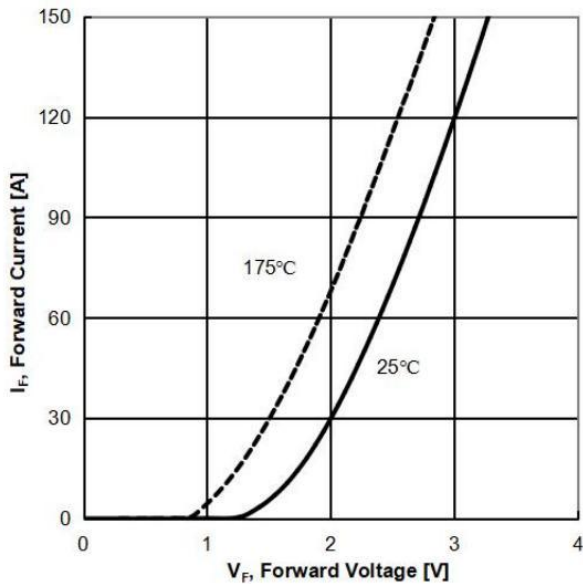
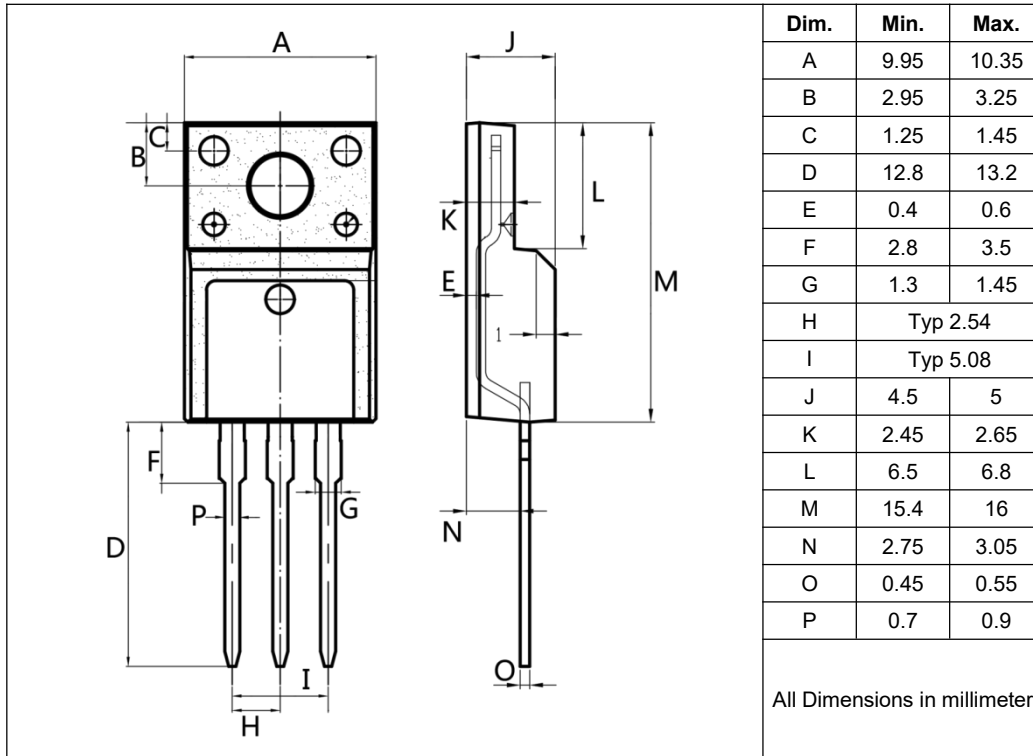


Figure 21: Typical Diode Forward Current vs. Forward Voltage



Package Outlines (Unit: mm)

TO-220F



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