

High speed switching series fifth generation

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$	V_{CE}	650	V
DC collector current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ $T_c = 100^{\circ}\text{C}$	I_C	74.0 46.0	A
Pulsed collector current, t_p limited by $T_{vjmax}^{1)}$	I_{Cpuls}	120.0	A
Turn off safe operating area $V_{CE} \leq 650\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p = 1\mu\text{s}^{1)}$	-	120.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ $T_c = 100^{\circ}\text{C}$	I_F	37.0 22.0	A
Diode pulsed current, t_p limited by $T_{vjmax}^{1)}$	I_{Fpuls}	120.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	V_{GE}	± 20 ± 30	V
Power dissipation $T_c = 25^{\circ}\text{C}$ Power dissipation $T_c = 100^{\circ}\text{C}$	P_{tot}	250.0 125.0	W
Operating junction temperature	T_{vj}	-40...+175	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-55...+150	$^{\circ}\text{C}$
Soldering temperature, reflow soldering (MSL1 according to JEDEC J-STA-020)		260	$^{\circ}\text{C}$

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

 R_{th} Characteristics

IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.60	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		-	-	1.80	K/W
Thermal resistance, min. footprint junction - ambient	$R_{th(j-a)}$		-	-	65	K/W
Thermal resistance, 6cm ² Cu on PCB junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

¹⁾ Defined by design. Not subject to production test.

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Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{V}, I_C = 0.20\text{mA}$	650	-	-	V
Collector-emitter saturation voltage	V_{CESat}	$V_{GE} = 15.0\text{V}, I_C = 40.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	-	1.65	2.10	V
			-	1.85	-	
			-	1.95	-	
Diode forward voltage	V_F	$V_{GE} = 0\text{V}, I_F = 20.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	-	1.45	1.80	V
			-	1.40	-	
			-	1.40	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.40\text{mA}, V_{CE} = V_{GE}$	3.2	4.0	4.8	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 650\text{V}, V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	-	-	40	μA
			-	1000	-	
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20\text{V}, I_C = 40.0\text{A}$	-	40.0	-	S

Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Input capacitance	C_{ies}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	2500	-	pF
Output capacitance	C_{oes}		-	50	-	
Reverse transfer capacitance	C_{res}		-	9	-	
Gate charge	Q_G	$V_{CC} = 520\text{V}, I_C = 40.0\text{A},$ $V_{GE} = 15\text{V}$	-	90.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	7.0	-	nH

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT Characteristic, at $T_{vj} = 25^{\circ}\text{C}$

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 400\text{V}, I_C = 20.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 15.0\Omega, R_{G(off)} = 15.0\Omega,$ $L_{\sigma} = 30\text{nH}, C_{\sigma} = 30\text{pF}$ L_{σ}, C_{σ} from Fig. E Energy losses include "tail" and diode reverse recovery.	-	21	-	ns
Rise time	t_r		-	21	-	ns
Turn-off delay time	$t_{d(off)}$		-	158	-	ns
Fall time	t_f		-	15	-	ns
Turn-on energy	E_{on}		-	0.41	-	mJ
Turn-off energy	E_{off}		-	0.12	-	mJ
Total switching energy	E_{ts}		-	0.53	-	mJ